Edition 06/2023

CONFIGURATION MANUAL

SIMOTICS

Linear motors SIMOTICS L-1FN3

For SINAMICS S120

www.siemens.com/drives

SIEMENS

SIMOTICS

Drive technology
1FN3 linear motors

Configuration Manual

06/2023
A5E50685682B AB

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ **DANGER**
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ **WARNING**
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ **CAUTION**
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ **WARNING**
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Digital Industries
Postfach 48 48
90026 NÜRNBERG
GERMANY

A5E50685682B AB
Ⓟ 08/2023 Subject to change

Table of contents

Introduction 1

1.1 About SIMOTICS

Description

SIMOTICS is the Siemens family of electric motors addressing the complete motor spectrum in Digital Industry.

1.2 About this manual

1.2.1 Contents

Description

This Configuration Manual supports you when selecting motors for your application. The Configuration Manual refers to rules and guidelines for configuring motors.

This documentation should be kept in a location where it can be easily accessed and made available to the personnel responsible.

To illustrate possible application areas for our products, typical use cases are listed in this product documentation and in the online help. These are purely exemplary and do not constitute a statement on the suitability of the respective product for applications in specific individual cases. Unless explicitly contractually agreed, Siemens assumes no liability for such suitability. Suitability for a particular application in specific individual cases must be assessed by the user, taking into account all technical, legal, and other requirements on a case-by-case basis. Always observe the descriptions of the technical properties and the relevant constraints of the respective product contained in the product documentation.

Information regarding third-party products

Note

Recommendation relating to third-party products

This document contains recommendations relating to third-party products. Siemens accepts the fundamental suitability of these third-party products.

You can use equivalent products from other manufacturers.

Siemens does not accept any warranty for the properties of third-party products.

1.2.2 Target group

Description

This Configuration Manual addresses:

- Planning engineers
- Design engineers
- Mechanical design engineers

1.2.3 Standard scope

Description

This documentation describes the functionality of the standard scope. This scope may differ from the scope of the functionality of the system that is actually supplied. Please refer to the ordering documentation only for the functionality of the supplied drive system.

Further functions may be executable in the system, which are not explained in this documentation. However, there is no entitlement to these functions in the case of a new delivery or service.

This documentation does not contain all detailed information on all types of the product. Furthermore, this documentation cannot take into consideration every conceivable type of installation, operation and service/maintenance.

The machine manufacturer must document any additions or modifications they make to the product themselves.

1.2.4 Websites of third-party companies

Description

This document may contain hyperlinks to third-party websites. Siemens is not responsible for and shall not be liable for these websites and their content. Siemens has no control over the information which appears on these websites and is not responsible for the content and information provided there. The user bears the risk for their use.

1.3 SIMOTICS documentation

Description

Comprehensive documentation on SIMOTICS, SIMOGEAR and on the SINAMICS converter family are provided in Internet (https://support.industry.siemens.com/cs/ww/en/ps/13204/man).

You can display documents or download them in PDF and HTML5 format.

The documentation is divided into the following categories:

Table 1-1 SIMOTICS / SIMOGEAR / SINAMICS documentation

Information	Documentation class[1)]	Content	Target group
General information	Configuration Manual	Rules, guidelines, and tools for configuring products, systems, and plants. Also contains information on the operating and ambient conditions for hardware and software, the use of functions, as well as on circuit diagrams and terminal diagrams and the installation of software insofar as this is necessary for commissioning.	Planners, configuration engineers
Device information	Installation Instructions	All relevant information on setting up, installing and cabling, as well as the required dimensional drawings and circuit diagrams	Installation personnel, commissioning engineers, service and maintenance personnel
Basic information	Operating instructions	Comprehensive collection of all information necessary for the safe operation of products, plant/system parts and complete plants (IEC 82079)	Machine operators, plant operators
	Compact instructions	Essential contents of the operating instructions in a reduced and condensed form	Machine operators, plant operators
	Product Information	Information that only becomes known shortly before or even after start of delivery and is therefore not included in the associated user documentation	Planners, configuration engineers, technologists, installation personnel, constructors; commissioning engineers, machine operators, programmers, service and maintenance personnel
	Online help	Instructions for configuring, programming, and commissioning	Configuration engineers, programmers, commissioning engineers

1) Not all documentation classes are available for every SIMOTICS / SIMOGEAR / SINAMICS product.

1.4 Service and Support

1.4.1 Siemens Industry Online Support on the Web

Description

The following is available via Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/), among others:

- Product support
- Global forum for information and best practice sharing between users and specialists
- Local contact persons via the contact person database (→ Contact)
- Search for product info
- Important topics at a glance
- FAQs (frequently asked questions)
- Application examples
- Manuals
- Downloads
- Compatibility tool
- Newsletters with information about your products
- Catalogs/brochures

1.4.2 Siemens Industry Online Support on the road

Description

Figure 1-1 "Siemens Industry Online Support" app

The "Industry Online Support" app supports you in the following areas, for example:

- Resolving problems when executing a project
- Troubleshooting when faults develop
- Expanding a system or planning a new system

Furthermore, you have access to the Technical Forum and other articles that our experts have drawn up:

- FAQs
- Application examples
- Manuals
- Certificates
- Product announcements and much more

There is a data matrix code or QR code on the nameplate of your product. Scan the code using the "Industry Online Support" app to obtain technical information about the device.

The app is available for Apple iOS and Android.

See also

App (https://support.industry.siemens.com/cs/ww/en/sc/2067)

1.4.3 Feedback on the technical documentation

Description

We welcome your questions, suggestions, and corrections for this technical documentation. Please use the "Provide feedback" link at the end of the entries in Siemens Industry Online Support.

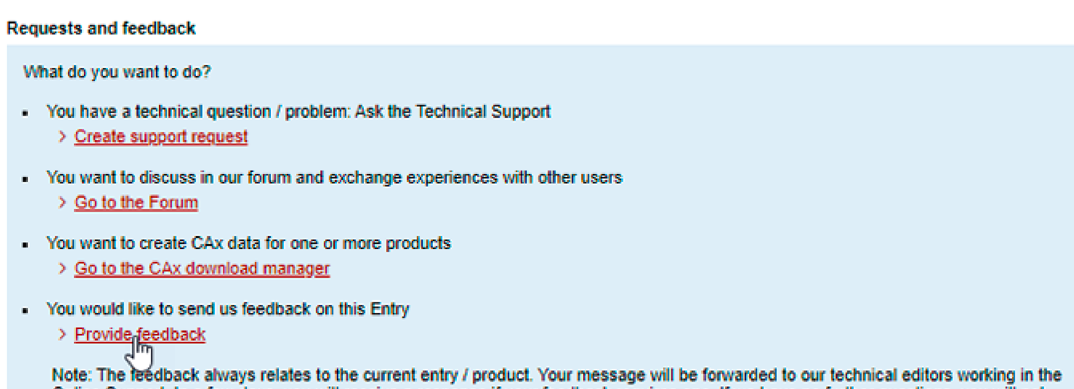


Figure 1-2 Requests and feedback

1.4.4 mySupport documentation

Description

With the "mySupport documentation" web-based system, you can compile your own individual documentation based on Siemens content and adapt this for your own machine documentation.

To start the application, click the "My Documentation" tile on the mySupport homepage (https://support.industry.siemens.com/cs/ww/en/my):

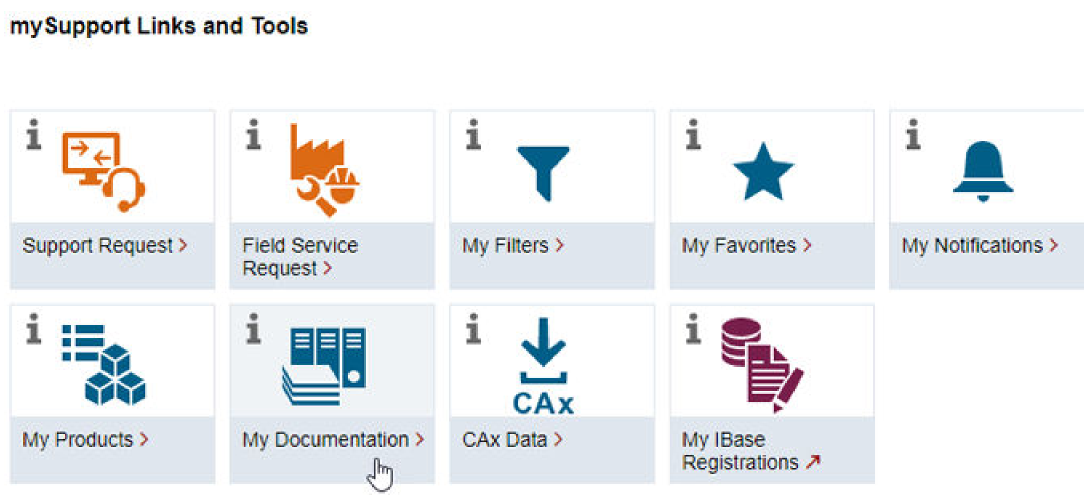


Figure 1-3 mySupport

The configured manual can be exported in the PDF or XML format.

Siemens content that supports the mySupport documentation can be identified by the "Configure" link.

1.4.5 Technical support

Description

Your routes to technical support (https://support.industry.siemens.com/cs/ww/en/sc/4868):

- Support Request (https://www.siemens.com/SupportRequest)
- Contact person database (https://www.automation.siemens.com/aspa_app?lang=en)
- "Industry Online Support" mobile app

The Support Request is the most important input channel for questions relating to products from Siemens Industry. This will assign your request a unique ticket number for tracking purposes. The Support Request offers you:

- Direct access to technical experts
- Recommended solutions for various questions (e.g. FAQs)
- Status tracking of your requests

Technical support also assists you in some cases via remote support (https://support.industry.siemens.com/cs/de/en/view/106665159) to resolve your requests. A Support representative will assist you in diagnosing or resolving the problem through screen transfer.

More information on the Support service packages is available on the Internet via the following address (https://support.industry.siemens.com/cs/ww/en/sc/4869).

You can obtain support on the topics of "Application" and "Mechatronics" at Application & Mechatronic Support Direct Motors (mailto: motor.support.motioncontrol@siemens.com).

1.4.6 Training

Description

SITRAIN – Digital Industry Academy offers a comprehensive range of training courses on Siemens industrial products – directly from the manufacturer, for all industries and use cases, for all knowledge levels from beginner to expert.

More information can be found on the Internet via the following address (https://www.siemens.com/sitrain).

1.5 Important product information

1.5.1 Intended use

⚠ WARNING

Risk of death and material damage as a result of incorrect use

There is a risk of death, serious injury and/or material damage when direct drives or their components are used for a purpose for which they were not intended.

- Only use the motors for industrial or commercial plants and systems.
- Do not install the motors in hazardous zones if the motors have not been expressly and explicitly designed and authorized for this purpose. Carefully observe any special additional notes provided.
- Only use direct drives and their components for applications that Siemens has explicitly specified.
- Protect the motors against dirt and contact with corrosive substances.
- Ensure that the installation conditions comply with the rating plate specifications and the condition specifications contained in this documentation. Where relevant, take into account deviations regarding approvals or country-specific regulations.
- Contact your local sales partner if you have any questions relating to proper and intended use.
- If you wish to use special versions and design versions whose technical details vary from the motors described in this document, then you must contact your local sales partner.

⚠ WARNING

Danger to life for wearers of active implants due to magnetic and electrical fields

Electric motors pose a danger to people with active medical implants, e.g. cardiac stimulators, who come close to the motors.

- If you are affected, stay at a minimum distance of 500 mm from the motors (tripping threshold for static magnetic fields of 0.5 mT according to the Directive 2013/35/EU).

⚠ WARNING

Injury and material damage by not observing machinery directive 2006/42/EC

There is a risk of death, serious injury and/or material damage if machinery directive 2006/42/EC is not carefully observed.

- The products included in the scope of delivery are exclusively designed for installation in a machine. Commissioning is prohibited until it has been fully established that the end product conforms with machinery directive 2006/42/EC.
- Please observe all safety instructions and provide these safety instructions to the end user.

Avoiding violation of protective rights

Carefully observe all national and international license terms when operating direct motors so that no patent rights are violated.

In conjunction with the SINAMICS S120 drive system, the linear motors can be used as a direct drive for the following linear machine applications, for example.
You can use Motor Modules in the "Blocksize", "Booksize" or "Chassis" formats.

Applications for peak load motors

- highly dynamic and flexible machine tools
- Laser machining
- Handling

Applications for continuous load motors

- Oscillating motion (e.g. out-of-center machining)
- Applications with high process forces (e.g. grinding, turning, etc.)
- Vertical axes without weight compensation, quills
- Handling, Cartesian robots

Protective mat with magnetic self-holding function

Use the protective mat with the magnetic self-holding function as mounting or removal aid for secondary sections. The protective mat with magnetic self-holding function protects you and the secondary sections against the consequences of the sudden forces of attraction of the secondary section in the immediate vicinity.

NOTICE

Damage to the protective mat with magnetic self-holding function

If you subject the protective mat with magnetic self-holding function to moisture and/or excessively high storage temperatures, the bonded connection between the foam rubber mat and the metal sheet will be damaged.

- Ensure that the conditions for storage and transport from Chapter "Preparation for use (Page 487)" are complied with for the protective mat with magnetic self-holding function.

NOTICE

No motor operation when the protective mat with magnetic self-holding function is placed down

The motor or the machines can be damaged if you operate the motor with the protective mat placed down on secondary sections.

- Remove the protective mat with magnetic self-holding function before commissioning the motor.

If the original packaging for the secondary sections is not available, then you can use the protection mat as follows:

- For securely placing down secondary sections
- For briefly storing secondary sections outside the machine, e.g. when carrying out repairs and maintenance work

Any other use is not as intended.

The original undamaged packaging is the preferred choice when transporting and storing secondary sections.

Correct packaging offers better protection than the protective mat with magnetic self-holding function against sudden forces of attraction of the secondary section that can occur in the immediate vicinity. Further, when correctly packaged, you are protected against hazardous motion when storing and moving the secondary section.

1.5.2 Reasonably foreseeable misuse

Description

Avoid the following incorrect uses:

- Disregarding safety information and instructions in this manual
- Directly connecting the motor power connection to the line supply
- Directly connecting temperature sensors to the converter
- Untrained or non-authorized personnel working at the motor
- Working on a motor that is not adequately secured
- Handling the motor carelessly or in a deliberately negligent way
- Underestimating the magnetic force of attraction of permanent magnets
- Disregarding safety clearances for persons with pacemakers, implanted defibrillators and/or metal implants
- Underestimating voltages at cable connections caused by induction
- Incorrect commutation setting when installing and replacing the encoder
- Contact with hot surfaces
- Handling the motor without personal protection equipment
- Disregarding any damage
- Using the motor
  - For non-industrial or commercial applications
  - In impermissible environmental conditions
  - In hazardous zones
  - In a dirty state
  - When in contact with aggressive substances
  - With inadequate cooling
- Disregarding data on the rating plate
- Incorrect packaging, storage and/or incorrect transport
- Opening the motor
- Incorrect disposal of the motor

Fundamental safety instructions 2

2.1 General safety instructions

⚠ WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, the following steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check whether the existing auxiliary supply circuits are de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

After you have completed the work, restore the operational readiness in the inverse sequence.

⚠ WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage. Contact with hazardous voltage can result in severe injury or death.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV- (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

⚠ WARNING

Electric shock due to damaged motors or devices

Improper handling of motors or devices can damage them.

Hazardous voltages can be present at the enclosure or at exposed components on damaged motors or devices.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged motors or devices.

⚠ WARNING

Electric shock due to unconnected cable shield

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.

⚠ WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

⚠ WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is in operation can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless it has been explicitly stated that they can be opened in operation.

NOTICE

Property damage due to loose power connections

Insufficient tightening torques or vibration can result in loose power connections. This can result in damage due to fire, device defects or malfunctions.

- Tighten all power connections to the prescribed torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

NOTICE

Damage to equipment due to unsuitable tightening tools.

Unsuitable tightening tools or fastening methods can damage the screws of the equipment.

- Only use screw inserts that exactly match the screw head.
- Tighten the screws with the torque specified in the technical documentation.
- Use a torque wrench or a mechanical precision nut runner with a dynamic torque sensor and speed limitation system.
- Adjust the tools used regularly.

WARNING

Unexpected machine movement caused by radio devices or mobile phones

Using radio devices, cellphones, or mobile WLAN devices in the immediate vicinity of the components can result in equipment malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- Therefore, if you move closer than 20 cm to the components, be sure to switch off radio devices, cellphones or WLAN devices.
- Use the "SIEMENS Industry Online Support App" or a QR code scanner only on equipment that has already been switched off.

WARNING

Unrecognized dangers due to missing or illegible warning labels

Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, where necessary in the national language.
- Replace illegible warning labels.

⚠ WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important Safety instructions for Safety Integrated

If you want to use Safety Integrated functions, you must observe the Safety instructions in the Safety Integrated documentation.

⚠ WARNING

Active implant malfunctions due to electromagnetic fields

Electromagnetic fields (EMF) are generated by the operation of electrical power equipment, such as transformers, converters, or motors. People with pacemakers or implants are at particular risk in the immediate vicinity of this equipment.

- If this affects you, maintain the minimum distance to such equipment that is specified in the "Important product information" chapter.

⚠ WARNING

Active implant malfunctions due to permanent-magnet fields

Even when switched off, electric motors with permanent magnets represent a potential risk for persons with heart pacemakers or implants if they are close to converters/motors.

- If this affects you, maintain the minimum distance to such equipment that is specified in the "Important product information" chapter.
- When transporting or storing permanent-magnet motors always use the original packing materials with the warning labels attached.
- Clearly mark the storage locations with the appropriate warning labels.
- IATA regulations must be observed when transported by air.

WARNING

Injury caused by moving or ejected parts

Contact with moving motor parts or drive output elements and the ejection of loose motor parts (e.g. feather keys) out of the motor enclosure can result in severe injury or death.

- Remove any loose parts or secure them so that they cannot be flung out.
- Do not touch any moving parts.
- Safeguard all moving parts using the appropriate safety guards.

WARNING

Fire due to incorrect operation of the motor

When incorrectly operated and in the case of a fault, the motor can overheat resulting in fire and smoke. This can result in severe injury or death. Further, excessively high temperatures destroy motor components and result in increased failures as well as shorter service lives of motors.

- Operate the motor according to the relevant specifications.
- Only operate the motors in conjunction with effective temperature monitoring.
- Immediately switch off the motor if excessively high temperatures occur.

CAUTION

Burns and thermal damage caused by hot surfaces

Temperatures above 100 °C may occur on the surfaces of motors, converters, and other drive components.

Touching hot surfaces may result in burns. Hot surfaces may damage or destroy temperature sensitive parts.

- Ensure that temperature-sensitive parts do not come into contact with hot surfaces.
- Mount drive components so that they are not accessible during operation.

Measures when maintenance is required:

- Allow drive components to cool off before starting any work.
- Use appropriate personnel protection equipment, e.g. gloves.

2.2 Equipment damage due to electric fields or electrostatic discharge

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE

Equipment damage due to electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

2.3 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens’ products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
https://www.siemens.com/industrialsecurity.

Siemens’ products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer’s exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
https://www.siemens.com/cert.

Further information is provided on the Internet:

Industrial Security Configuration Manual (https://support.industry.siemens.com/cs/ww/en/view/108862708)

WARNING

Unsafe operating states resulting from software manipulation

Software manipulations, e.g. viruses, Trojans, or worms, can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- On completion of commissioning, check all security-related settings.

2.4 Residual risks of power drive systems

When assessing the machine or system-related risk in accordance with the respective local regulations (e.g. EC Machinery Directive), the machine manufacturer or system integrator must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example,
   - Hardware faults and/or software errors in the sensors, control system, actuators, and connections
   - Response times of the control system and of the drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
   - External influences/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures inside and outside the components, including open flames, as well as emissions of light, noise, particles, gases, etc. due to fault conditions, e.g.:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage
   - Short circuits or ground faults in the intermediate DC circuit of the converter

3. Hazardous shock voltages caused by, for example:
   - Component failure
   - Influence during electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly
6. Influence of network-connected and wireless communications systems, e.g. ripple-control transmitters or data communication via the network or mobile radio, WLAN or Bluetooth.
7. Motors for use in potentially explosive areas:
   When moving components such as bearings become worn, this can cause enclosure components to exhibit unexpectedly high temperatures during operation, creating a hazard in areas with a potentially explosive atmosphere.

For more information about the residual risks of the drive system components, see the relevant sections in the technical user documentation.

Description of the motor 3

3.1 Overview

SIMOTICS L-1FN3 linear motors are built-in permanent magnet synchronous motors for linear motion with a modular mounted cooling concept. High precision requirements can be complied with when using the optional primary section precision cooler and/or the optional secondary section cooling. Further, the thermal transfer from the motor to the surrounding machine assembly can be minimized.

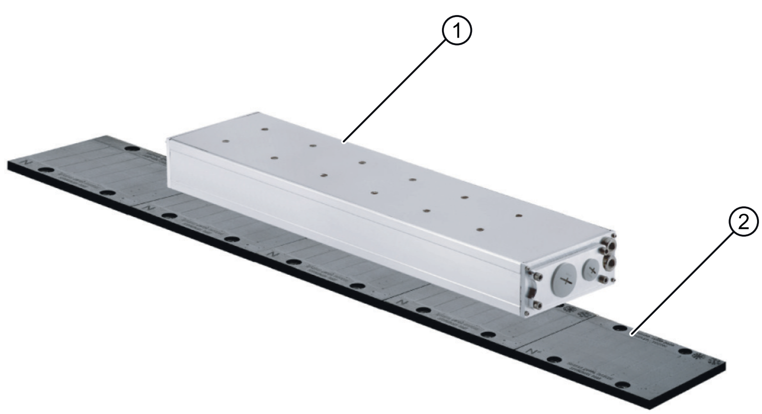
The motor is delivered in components (at least one primary section and secondary sections) and installed directly in the machine.

An encoder is also required for a complete drive unit.

Primary sections connected in series multiply the motor force.

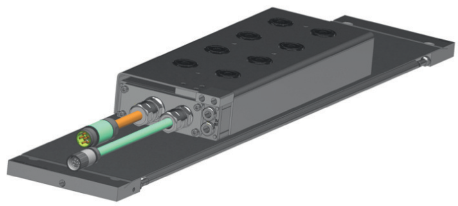
The length of the linear traversing section is obtained from the number of secondary sections linked in series.

The type spectrum encompasses peak and continuous load motors in 7 different sizes (widths) and in up to 5 different lengths.



① Primary section
② Secondary section

Overview of the connection variants



Peak and continuous load motor
with two pre-assembled cables
with/without connector

Peak and continuous load motor
with connection cover for two cables

Peak load motor
with connector cover for one cable
or
with a fixed cable without a connector

General properties of the motors

- High dynamic response
- High forces
- Compact design
- Low sensitivity to corrosive ambient conditions
- As a result of its modular design, the motor can be configured to address the technical requirements. The modularity of the motor is explained in Chapter "Motor components and options (Page 93)".
- The motor is thermally decoupled from the machine using a primary section precision cooler and secondary section cooling, based on the Thermo-Sandwich® principle
- Simple coolant connection
- A continuous optional cover of the secondary section track avoids that particles undesirably collect, especially in the transverse gaps between the secondary sections.
- Simple electrical connection via an integrated connection frame or permanently connected cables

While the peak load motors have high overload capability, the continuous load motors have a rated force with high availability.

1FN3 linear motors can be electrically operated in parallel. You will find information on this in Chapter "Coupled motors (Page 593)".

Additional property of a peak load motor

- Low mass and high overload capability: The motor is suitable for acceleration drive applications.

Additional property of a continuous load motor

- Low mass and high continuous load capability. The motor is suitable for load cycles with continuous acceleration and braking phases and continuous loads, such as forces due to weight or process forces.
- Low force ripple. The motor is suitable for high-precision applications

3.2 Technical features and environmental conditions

3.2.1 Directives and standards

The chapter lists the standards and directives that are applicable for the motor and which the motor complies with.

Standards that are complied with

Note

The standards listed in this manual are not dated.

You can take the currently relevant and valid dates from the Declaration of Conformity.

The motors of the type series SIMOTICS S, SIMOTICS M, SIMOTICS L, SIMOTICS T, SIMOTICS A, called "SIMOTICS motor series" below, fulfill the requirements of the following directives and standards:

- EN 60034-1 - Rotating electrical machines – Dimensioning and operating behavior
- EN 60204-1 - Safety of machinery – Electrical equipment of machines; general requirements

Where applicable, the SIMOTICS motor series are in conformance with the following parts of EN 60034:

Feature	Standard
Degree of protection	EN 60034-5
Cooling [1)]	EN 60034-6
Type of construction	EN 60034-7
Connection designations	EN 60034-8
Noise levels [1)]	EN 60034-9

Feature	Standard
Temperature monitoring	EN 60034-11
Vibration severity grades [1)]	EN 60034-14

1) Standard part, e.g. cannot be used for built-in motors.

Relevant directives

The following directives are relevant for SIMOTICS motors.

European Low-Voltage Directive

SIMOTICS motors comply with the Low-Voltage Directive 2014/35/EU.

European Machinery Directive

SIMOTICS motors do not fall within the scope covered by the Machinery Directive.

However, the use of the products in a typical machine application has been fully assessed for compliance with the main regulations in this directive concerning health and safety.

European EMC Directive

SIMOTICS motors do not fall within the scope covered by the EMC Directive. The products are not considered as devices in the sense of the directive. Installed and operated with a converter, the motor - together with the Power Drive System - must comply with the requirements laid down in the applicable EMC Directive.

European RoHS Directive

The SIMOTICS motor series complies with the Directive 2011/65/EU regarding limiting the use of certain hazardous substances.

European Directive on Waste Electrical and Electronic Equipment (WEEE)

SIMOTICS motors comply with the 2012/19/EU directive on taking back and recycling waste electrical and electronic equipment.

European Directive 2005/32/EC defining requirements for environmentally friendly design of electric motors

The SIMOTICS motor series is not subject to Regulation (EC) No. 640/2009 for implementation of this directive.

European Directive 2009/125/EC defining ecodesign requirements of electric motors and speed controls

The SIMOTICS motor series is not subject to (EU) Regulation 2019/1781 for implementation of this directive.

Eurasian conformity

SIMOTICS motors comply with the requirements of the Russia/Belarus/Kazakhstan (EAC) customs union.

China Compulsory Certification

SIMOTICS motors do not fall within the scope covered by the China Compulsory Certification (CCC).

CCC negative certification (https://support.industry.siemens.com/cs/de/de/view/109769143)

Underwriters Laboratories

SIMOTICS motors are generally in compliance with UL and cUL as components of motor applications, and are appropriately listed.

Specifically developed motors and functions are the exceptions in this case. Here, it is crucial that you carefully observe the content of the quotation and that there is a UL or cUL mark on the rating plate!

Quality systems

Siemens employs a quality management system that meets the requirements of ISO 9001 and ISO 14001.

Certificates for SIMOTICS motors can be downloaded from the Internet at the following link:

Certificates for SIMOTICS motors (https://support.industry.siemens.com/cs/ww/de/ps/13347/cert)

China RoHS

SIMOTICS motors comply with the China RoHS.

You can find more information at:

China-RoHS (https://support.industry.siemens.com/cs/de/de/view/109738670/en)

UKCA - United Kingdom Conformity Assessed

The SIMOTICS motor series satisfies the conformity requirements for England, Wales and Scotland.

3.2.2 Danger from strong magnetic fields

Occurrence of magnetic fields

Motor components with permanent magnets generate very strong magnetic fields. In the no-current condition, the magnetic field strength of the motors comes exclusively from the magnetic fields of components equipped with permanent magnets. Additional electromagnetic fields occur in operation.

Components with permanent magnets

For the linear motors described in this manual, the permanent magnets are in the secondary sections.

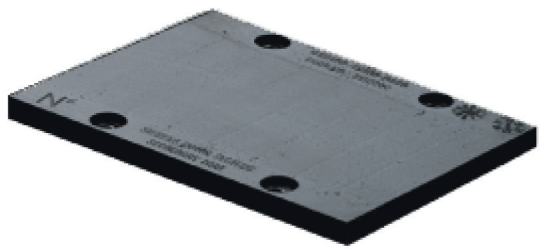


Figure 3-1 Secondary section with permanent magnets

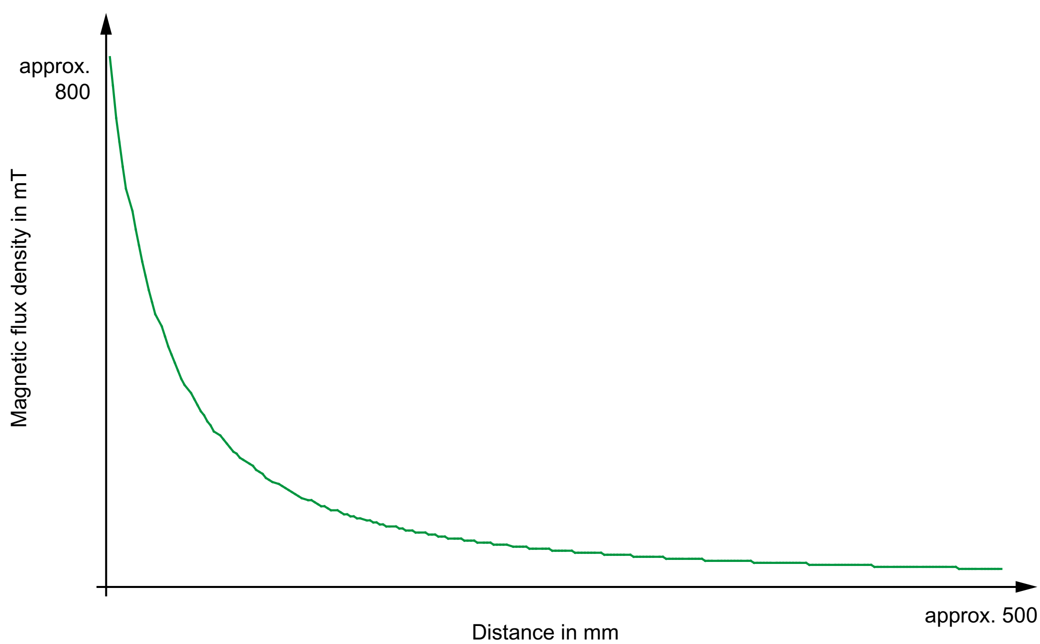


Figure 3-2 Schematic representation of the static magnetic field of a secondary section, depending on distance

Risk to persons as a result of strong magnetic fields

> ⚠ **WARNING**
>
> **Risk of death as a result of permanent magnet fields**
>
> Even when the motor is switched off, the permanent magnets can put people with active medical implants at risk if they are close to the motor.
>
> Examples of active medical implants include: Heart pacemakers, insulin pumps.
>
> - As the affected person, maintain a minimum distance of 500 mm from the permanent magnets (trigger threshold for static magnetic fields of 0.5 mT as per directive 2013/35/EU).

With regard to the effect of strong magnetic fields on people, the DGUV rule 103-013 "Electromagnetic Fields" of the German Social Accident Insurance applies in Germany. This rule specifies all the requirements that must be observed in the workplace. In other countries, the relevant applicable national and local regulations and requirements must be taken into account.

When dealing with magnetic fields, you must consider the requirements of DGUV rule 103-013 of the German Social Accident Insurance.

> ⚠ **CAUTION**
>
> **Handling secondary sections**
>
> The magnetic fields of the secondary sections are permanent. When you come into direct bodily contact with the secondary sections, a static magnetic flux density of 2 T is not exceeded.
>
> - Observe DGUV rule 103-013, § 14 "Systems with high static magnetic fields".

> ⚠ **WARNING**
>
> **Risk of electric shock**
>
> Voltage is induced at the power connections of the primary section each time a primary section moves with respect to a secondary section - and vice versa. If you touch the power connections you may suffer an electric shock.
>
> - Do not touch the power connections.
> - Connect the motor cable ports correctly, or insulate them properly.

⚠ WARNING

Danger of crushing by permanent magnets of the secondary section

The forces of attraction of magnetic secondary sections act on materials that can be magnetized. The forces of attraction increase significantly close to the secondary section. The trigger threshold of 3 mT for a risk of injury due to attraction and projectile effect is reached at a distance of 150 mm (directive 2013/35/EU). Secondary sections and materials that can be magnetized can suddenly slam together unintentionally. Two secondary sections can also unintentionally slam together.

There is a significant risk of crushing when you are close to a secondary section.

Close to the secondary section, the forces of attraction can be several kN - example: Magnetic attractive forces are equivalent to a force of 100 kg, which is sufficient to trap a body part.

- Do not underestimate the strength of the attractive forces, and work very carefully.
- Wear safety gloves.
- The work should be done by at least two people.
- Do not unpack the secondary section until immediately before installation.
- Never unpack several secondary sections at the same time.
- Never place secondary sections next to one another without taking the appropriate precautions.
- Never place any metals on magnetic surfaces and vice versa.
- Never carry any objects made of magnetizable materials (for example watches, steel or iron tools) and/or permanent magnets close to the secondary section! If tools that can be magnetized are nevertheless required, then hold the tool firmly using both hands. Slowly bring the tool to the secondary section.
- Immediately mount the secondary section that has just been unpacked.
- When mounting and removing secondary sections, we recommend that you use protective mats with magnetic self-holding function
- Never remove several secondary sections at the same time.
- Immediately after removal, pack the removed secondary section in the original packaging.
- Always comply with the specified procedure.
- Avoid inadvertently traversing direct drives.
- Keep the following tools at hand to release parts of the body (hand, fingers, foot etc.) trapped between two components:
  - A hammer (about 3 kg) made of solid, non-magnetizable material
  - Two pointed wedges (wedge angle approx. 10° to 15°, minimum height 50 mm) made of solid, non-magnetizable material (e.g. hard wood).

First aid in the case of accidents involving permanent magnets

- Stay calm.
- If the machine is energized, press the emergency stop switch and open the main switch if necessary.
- Administer FIRST AID. Call for further help if required.

- To free jammed parts of the body (e.g. hands, fingers, feet), pull apart components that are clamped together.
  – Do this using the non-magnetic hammer to drive the non-magnetic wedges into the separating rift.
  – Release the jammed body parts.
- If necessary, call the emergency medical service or an emergency physician.

Material damage caused by strong magnetic fields

NOTICE

Data loss caused by strong magnetic fields

If you are close to a secondary section (< 150 mm) any magnetic or electronic data medium as well as electronic devices that you are carrying can be destroyed. For example, credit cards, USB sticks, floppy disks and watches are at risk.

- Do not carry any magnetic/electronic data media and no electronic devices when you are close to a secondary section!

3.2.3 Technical features

Table 3-1 Standard version of the 1FN3 linear motor

Technical feature	Version
Motor type	Permanently excited synchronous linear motor
Type of construction	Individual components
Degree of protection according to DIN EN 60034-5	• Primary section: IP65 • Mounted motor: The degree of protection depends on the machine design and must therefore be realized by the machine manufacturer; minimum requirement: IP23
Cooling method	**Water cooling** • Maximum pressure in the cooling circuit: 10 bar = 1 MPa • Wiring: with G1/8 pipe thread (in compliance with DIN EN ISO 228-1); special connectors are required to connect hoses/pipes
Thermal motor protection	**Temperature sensor in the primary section** • 1x PTC thermistor triplet with response threshold +120 °C (according to DIN 44081/44082) **Evaluation** • According to the SINAMICS S120 Equipment Manual via – Sensor Module SME120/SME125 or – TM120

Technical feature	Version

Temperature monitoring	**Temperature sensor in the primary section**
	• 1FN3xxx-xxxxx-xxx3
	  – 1 x Pt1000 (according to DIN EN 60751)
	• 1FN3xxx-xxxxx-xxx1
	  – Can only be ordered as spare part
	  – 1 x KTY 84 (according to DIN EN 60034-11)
	Evaluation
	• According to the SINAMICS S120 Equipment Manual via
	  – Sensor Module SME120/SME125 or
	  – TM120

2nd rating plate	Enclosed separately
Rating plate for secondary sections	Enclosed separately
Insulating material class of the motor winding according to EN 60034-1	Temperature class 155 (F)
Impulse withstand voltage insulation class according to EN 60034-18-41	IVIC: C
Magnet material	Rare earth material
Connection, electrical	**1FN3050** • Signal and power cables with connectors or open core ends permanently connected to the motor **1FN3100 ... 1FN3900** • Terminal panel with cover integrated in the motor, with metric cable glands for signal and power cables. Additional cover with PG gland for combined cables*) for 1FN3100-xW ... 1FN3900-xW
Encoder system	• Not included in the scope of supply • Selection based on application-specific and converter-specific constraints

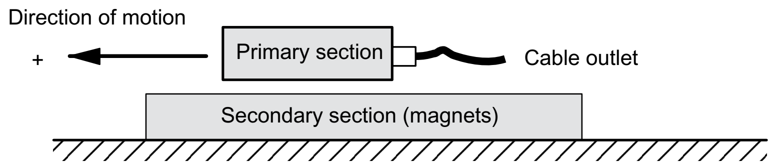
*) Combined cable = power and signal connection in one cable

3.2.4 Direction of motion of the motor

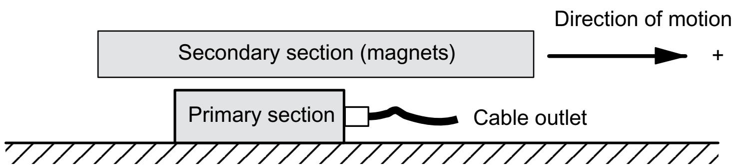
Defining the traversing direction

If the primary section is connected to the terminals of the terminal box with the phase sequence U-V-W and is supplied with current by a three-phase system with a clockwise rotating field, the direction of motion of the primary or secondary section is positive.

1. primary section moveable, secondary section permanently fixed



2. primary section permanently fixed, secondary section movable



3.2.5 Ambient conditions for stationary use

Classify the environmental conditions for stationary use at weather-protected locations according to the standard DIN IEC 60721-3-3. The environmental effects and their limit values are defined in various classes in this standard.

With the exception of environmental parameters "Low air temperature" and "Low air pressure", the motors satisfy climate class 3K3.

Table 3-2 **Ambient conditions are based on climate class 3K3**

Ambient parameter		Unit	Value
a)	Low air temperature	°C	- 5
b)	High air temperature	°C	+ 40
c)	Low relative humidity	%	5
d)	High relative humidity	%	85
e)	Low absolute humidity	g/m^3	1
f)	High absolute humidity	g/m^3	25
g)	Rate of temperature change[1)]	°C/min	0.5
h)	Low air pressure[4)]	kPa	78.4
i)	High air pressure[2)]	kPa	106
j)	Solar radiation (insolation)	W/m^2	700
k)	Thermal radiation	-	-
l)	Air movement[3)]	m/s	1.0
m)	Condensation	-	Not permissible
n)	Wind-driven precipitation (rain, snow, hail, etc.)	-	-

Ambient parameter		Unit	Value
o)	Water (other than rain)	-	See degree of protection
p)	Formation of ice	-	-

[1] Averaged over a period of 5 min

[2] Conditions in mines are not considered.

[3] A cooling system based on natural convection can be disturbed by unforeseen air movements.

[4] The limit value of 78.4 KPa covers altitudes up to 2000 m.

Additional ambient conditions applicable for the motors for stationary use at weather-protected locations according to standard DIN IEC 60721-3-3 include.

Mechanically active ambient conditions	Class 3S1
Mechanical ambient conditions	Class 3M3

Note

Installation instructions

The motors are not suitable for operation

- In salt-laden or corrosive atmospheres
- Outdoors

You can find additional data on the environmental conditions, such as ambient temperatures or conditions for transport and storage of the motors, in the relevant chapters of this documentation.

3.2.6 Scope of delivery

3.2.6.1 Scope of delivery linear motor

Primary section

- Primary section
- One rating plate (attached); additional loose rating plate
- Accessory pack note (safety accessory pack)
- Safety warning instructions (pictograms)
- For the terminal box design: Accessories (mounting accessories) for the terminal box with terminal cover and enclosed information slip with terminal assignments

Secondary section

- Secondary section
- A nameplate included as a separate item
- Accessory pack note (safety accessory pack)
- Safety warning instructions (pictograms)

Note

Nameplates for secondary sections

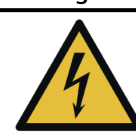
The nameplates for secondary sections are not suitable for applying to a secondary section or to the secondary section cover. Apply the nameplates for secondary sections in a clearly visible position next to the secondary section track or in the vicinity of the motor.

3.2.6.2 Supplied pictograms

Primary sections

To identify hazards, warning signs in the form of permanent adhesive stickers are enclosed with all primary sections in the packaging:

Table 3-3 Warning signs included with primary sections according to BGV A8 and EN ISO 7010 and their meaning

Sign	Meaning	Sign	Meaning
	Warning against hot surface (W017)		Warning against electric voltage (W012)

The following safety instructions are attached at the signal port of the primary section:

Table 3-4 Safety instructions for temperature protection according to BGV A8 and EN ISO 7010 and their significance

Sign	Meaning	Sign	Meaning
	General warning sign (W001)		Observe instruction (M002)

Secondary sections

To identify hazards, warning and prohibition signs in the form of permanent adhesive stickers are enclosed with all secondary sections in the packaging:

Table 3-5 Warning signs according to BGV A8 and EN ISO 7010 included with secondary sections and their meaning

Sign	Meaning	Sign	Meaning
	Warning: strong magnetic field (W006)		Warning: hand injuries (W024)

Table 3-6 Prohibiting signs according to BGV A8 and EN ISO 7010 included with secondary sections and their meaning

Sign	Meaning	Sign	Meaning
	No access for persons with pacemakers or implanted defibrillators (P007)		No access for persons with metal implants (P014)
	No metal objects or watches (P008)		

Note

Applying the stickers

The stickers are not suitable for applying to a secondary section or on the secondary section cover.

- Apply the stickers next to the secondary section track in the vicinity of the motor so that they are clearly visible.

Note

The quality of the label can diminish as result of extreme environmental conditions.

Any danger areas encountered during normal operation and when maintaining and servicing the motor must be identified using clearly visible warning and prohibit signs (pictograms) in the immediate vicinity of the danger (close to the motor). The associated texts must be available in the language of the country in which the product is used.

3.3 Derating factors

For installation altitudes above 2000 m above sea level, reduce the voltage stress of the motors according to table "Factors to reduce the maximum DC link voltage" (reciprocal values from EN 60664-1 Table A. 2).

Table 3-7 Factors to reduce the maximum DC link voltage

Installation altitude above sea level in m up to	Factor
2000	1
3000	0.877
4000	0.775
5000	0.656
6000	0.588
7000	0.513
8000	0.444

Reducing the DC link voltage reduces the converter output voltage. The operating range in the F-v diagram is thus also reduced.

You can find the F-v diagrams in the associated data sheet.

Operation in a vacuum is not permissible due to the low voltage strength and the poor cooling.

3.4 Selection and ordering data

3.4.1 Order designation

The article number is used as the order designation. The article number consists of a combination of letters and numerals. When placing an order, it is sufficient just to specify the unique article number.

The article number consists of three blocks that are separated by hyphens. The first block incorporates seven characters and designates the product family and size of the primary or secondary section. Additional design features are encrypted in the second block, such as length and velocity. The third block is provided for additional data.

Please note that not every theoretical combination is possible.

Note

Availability of primary sections with KTY 84

The primary sections are equipped as standard with Pt1000 temperature sensors for temperature monitoring.

Primary sections with KTY 84 can only be ordered as spare part.

3.4.1.1 Primary sections

Digits in the article number	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
	1	F	N	3	x	x	x	-	x	x	x	x	0	-	0	x	A	x

Electrical machine

Synchronous motor

Linear motor

Type series

Size (width)

Length

Primary section type
N = Primary section for continuous load motors of the 1FN3 product family
W = Primary section for peak load motors of the 1FN3 product family

Velocity $v_{MAX,FMAX}$ in m/s

Electrical connection
A = Terminal panel for a combined cable (power and signal cable in a common cable), not available for continuous load motors
B = Terminal panel for two cables (separate power and signal cables)
E = Motor with two cables and open core ends (separate power and signal cables and permanently connected)
F = Motor with two cables and connectors (separate power and signal cables, permanently connected and assembled)
H = Motor with a combined cable and open core ends (power and signal cable in a shared cable and permanently connected), not available for continuous load motors

Temperature sensors
1 = 1 x PTC triplet 120 °C + 1 x KTY 84
3 = 1 x PTC triplet 120 °C + 1 x Pt1000

3.4.1.2 Secondary sections

Digits in the article number

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	x	x	x	-	4	S	A	x	x	-	0	A	A	0

Size
(like primary section)

Length
4S = Secondary section

Type of construction
A = Standard

Number of poles
00 = 8 pole, standard
12 = 12 pole (1FN3300 and 1FN3450)

Version
as standard

3.4.1.3 Primary section accessories

Precision cooler

Digits in the article number

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	x	x	x	-	x	P	K	x	0	-	0	A	A	0

Size
(like primary section)

Length
(like primary section)

Motor group
0 = Precision cooler for peak load motors of the 1FN3 product family

1 = Precision cooler for continuous load motors of the 1FN3 product family

O rings for precision coolers

Digits in the article number

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	x	x	x	-	0	P	R	0	0	-	0	A	A	0

50 x O rings for precision coolers
- 050 = size 1FN3050 ... 1FN3150
- 300 = size 1FN3300 ... 1FN3900

Hall sensor box

You can mount the Hall sensor box opposite to the connection side of the primary section or on the connection side of the primary section. The standard mounting position is opposite the connection side of the primary section.

Digits in the article number

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	0	0	x	-	0	P	H	0	x	-	0	A	A	0

Size
- 2 = 1FN3050 ... 150, for standard mounting, only lengths 2 and 4
- 3 = 1FN3300 ... 900, for standard mounting, only lengths 2 and 4
- 5 = only standard mounting: 1FN3050 ... 150, lengths 1, 3 and 5
- 6 = only standard mounting: 1FN3300 ... 900, lengths 1, 3 and 5

Cable outlet
- 0 = Straight
- 1 = lateral

Connection cover

For 1FN3 linear motors, all of the connection covers can also be separately ordered.

Positions in the Article No.

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	0	0	x	-	0	P	B	0	x	-	0	x	A	x

Size
2 = 1FN3100 ... 150
3 = 1FN3300 ... 900

Threads for screwed joint
1 = 1 x PG16
2 = 1 x PG21
3 = 1 x PG29
4 = 2 x M20 x 1.5
5 = 1x M20 x 1.5 and 1 x M32 x 1.5

Electrical connection
A = Connection frame for a combination cable (power and signal cables in one common cable)

B = Connection frame for two cables (power and signal cable separate)

Series status, connection cover
0 = Valid for motors, frame size "3" with serial numbers YFF9xxx or YFFOxxx and for all motors, frame size "2"

3 = Valid for motors, frame size "3" from serial number YFFNxxx

Table 3-8 Article numbers for the connection cover

Article No.	Primary section size	Thread for gland	Application
1FN3002-0PB01-0AA0	1FN3100 and 1FN3150	1 x PG16	Only for peak load motors
1FN3003-0PB02-0AAx	1FN3300 to 1FN3900	1 x PG21	Only for peak load motors
1FN3003-0PB03-0AAx	1FN3300 to 1FN3900	1 x PG29	Only for peak load motors
1FN3002-0PB04-0BA0	1FN3100 and 1FN3150	2 x M20 x 1.5	For peak and continuous load motors
1FN3003-0PB04-0BAx	1FN3300 to 1FN3900	2 x M20 x 1.5	For peak and continuous load motors
1FN3003-0PB05-0BAx	1FN3300 to 1FN3900	1 x M20 x 1.5 and 1 x M32 x 1.5	For peak and continuous load motors

Note

Compatibility of the connection cover

Connection covers for 1FN3300 to 1FN3900 with a "0" at the 16th position of the article number are not compatible with primary sections as of a serial number YFFNxxx. Always use the connection cover supplied with the associated seal.

Plug connector

Connector type	Connector size	Article No.
Power connection	1.5	6FX2003-0LA10
Power connection	1	6FX2003-0LA00
Signal connection	M17	6FX2003-0SU07

3.4.1.4 Accessories for the secondary section track

Secondary section end pieces

End pieces with cooling water duct

Digits in the article number

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	x	x	x	-	0	T	x	0	1	-	x	A	A	0

Size
(like primary section/secondary section)

Type of end piece
F = Combi end piece (plug-in connector); not for 1FN3600 ... 900
G = Combi adapter (plug-in connector); not for 1FN3600 ... 900
J = Combi distributor (plug-in connector)

Type of fastening of the continuous cover strip
0 = With wedge and screwed joint
1 = To clamp

End pieces without cooling water duct

Digits in the article number

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	x	x	x	-	0	T	C	0	0	-	x	A	A	0

Size
(like primary section/secondary section)

Type of end piece
C = Cover end piece; not for 1FN3600 ... 900

Type of fastening of the continuous cover strip
0 = With wedge and screwed joint
1 = To clamp

Secondary section cover

Segmented cover

Digits in the article number

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	x	x	x	-	4	T	P	0	0	-	1	A	x	x

Size
(like primary section/secondary section)

Number of secondary sections to be covered
- C5 = 2.5 secondary sections
- D0 = 3 secondary sections
- D5 = 3.5 secondary sections
- E0 = 4 secondary sections
- F0 = 5 secondary sections
- F5 = 5.5 secondary sections, only for 1FN3600 ... 900
- G5 = 6.5 secondary sections, only for 1FN3600 ... 900

Table 3-9 Segmented cover - lengths that can be ordered

1FN3xxx4TP00-1Axx								
Size		**050**	**100**	**150**	**300**	**450**	**600**	**900**
Width in mm		**62**	**92**	**122**	**138**	**184**	**244 +0.2/-0.1**	**338 +0.2/-0.1**
Number secondary sections	**Length code**	**Segmented cover length in mm**						
2.5	C5	300	300	300	460	460	460	460
3	D0	360	360	360	552	552	552	552
3.5	D5	420	420	420	644	644	644	644
4	E0	480	480	480	736	736	736	736
5	F0	600	600	600	920	920	920	920
5.5	F5	-	-	-	-	-	1014	1014
6.5	G5	-	-	-	-	-	1198	1198

Continuous cover strip (metal strip)

Digits in the article number

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	x	x	x	-	0	T	B	0	0	-	1	x	x	0

Size
(like primary section/secondary section)

Number of secondary sections to be covered
Letters stand for numerals:

A	B	C	D	E	F	G	H	J	K
0	1	2	3	4	5	6	7	8	9

Examples:
1 secondary section is coded with AB (minimum number of secondary sections to be covered)
32 secondary sections are coded with DC (maximum number for 1FN3300 ... 900)
50 secondary sections are coded with FA (maximum number for 1FN3050 ... 150)

6002 mm is the maximum length of secondary section cover that can be ordered for 1FN3300 ... 900 *)
6082 mm is the maximum length of secondary section cover that can be ordered for 1FN3050 ... 150 *)

*) Is required to cover the maximum number of secondary sections specified here

Table 3-10 Continuous cover strip - lengths that can be ordered

1FN3xxx0TB00-1xx0								
Size		**050**	**100**	**150**	**300**	**450**	**600**	**900**
Width in mm		**58**	**88**	**118**	**134**	**180**	**240 +/-0.5**	**334 +/-0.5**
Number secondary sections	**Length code**	**Length of the cover band in mm**						
1	AB	202	202	202	298	298	298	298
2	AC	322	322	322	482	482	482	482
3	AD	442	442	442	666	666	666	666
4	AI	562	562	562	850	850	850	850
5	AF	682	682	682	1034	1034	1034	1034
6	AG	802	802	802	1218	1218	1218	1218
7	SH	922	922	922	1402	1402	1402	1402
8	AJ	1042	1042	1042	1586	1586	1586	1586
9	AK	1162	1162	1162	1770	1770	1770	1770
10	BA	1282	1282	1282	1954	1954	1954	1954
11	BB	1402	1402	1402	2138	2138	2138	2138
12	BC	1522	1522	1522	2322	2322	2322	2322
13	BD	1642	1642	1642	2506	2506	2506	2506
14	BI	1762	1762	1762	2690	2690	2690	2690
15	BF	1882	1882	1882	2874	2874	2874	2874
16	BG	2002	2002	2002	3058	3058	3058	3058
17	BH	2122	2122	2122	3242	3242	3242	3242
18	BJ	2242	2242	2242	3426	3426	3426	3426

1FN3xxx0TB00-1xx0								
Size		**050**	**100**	**150**	**300**	**450**	**600**	**900**
Width in mm		**58**	**88**	**118**	**134**	**180**	**240 +/-0.5**	**334 +/-0.5**
Number secondary sections	**Length code**	**Length of the cover band in mm**						
19	BK	2362	2362	2362	3610	3610	3610	3610
20	CA	2482	2482	2482	3794	3794	3794	3794
21	CB	2602	2602	2602	3978	3978	3978	3978
22	CC	2722	2722	2722	4162	4162	4162	4162
23	CD	2842	2842	2842	4346	4346	4346	4346
24	CE	2962	2962	2962	4530	4530	4530	4530
25	CF	3082	3082	3082	4714	4714	4714	4714
26	CG	3202	3202	3202	4898	4898	4898	4898
27	CH	3322	3322	3322	5082	5082	5082	5082
28	CJ	3442	3442	3442	5266	5266	5266	5266
29	CK	3562	3562	3562	5450	5450	5450	5450
30	DO	3682	3682	3682	5634	5634	5634	5634
31	DB	3802	3802	3802	1518	5818	5818	5818
32	DC	3922	3922	3922	6002	6002	6002	6002
33	DD	4042	4042	4042	-	-	-	-
34	DE	4162	4162	4162	-	-	-	-
35	DF	4282	4282	4282	-	-	-	-
36	DG	4402	4402	4402	-	-	-	-
37	DH	4522	4522	4522	-	-	-	-
38	DJ	4642	4642	4642	-	-	-	-
39	DK	4762	4762	4762	-	-	-	-
40	EQ	4882	4882	4882	-	-	-	-
41	EB	5002	5002	5002	-	-	-	-
42	EC	5122	5122	5122	-	-	-	-
43	DR	5242	5242	5242	-	-	-	-
44	EE	5362	5362	5362	-	-	-	-
45	EF	5482	5482	5482	-	-	-	-
46	EU	5602	5602	5602	-	-	-	-
47	EH	5722	5722	5722	-	-	-	-
48	EJ	5842	5842	5842	-	-	-	-
49	EK	5962	5962	5962	-	-	-	-
50	FA	6082	6082	6082	-	-	-	-

Cooling sections

Positions in the Article No.

1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
1	F	N	3	0	0	x	-	0	T	K	0	x	-	1	x	x	Y

Size
- 2 = for 1FN3050 ... 150
- 3 = for 1FN3300 ... 450
- 4 = for 1FN3600
- 5 = for 1FN3900 ... 300 and 450

Connection type
- 2 = Hose nipples at both ends
- 4 = Plug-in couplings at both ends
- 6 = 1FN3050 ... 450: One end, 1 hose nipple - opposite end, 1 plug-in coupling 1FN3600 ... 900: One end, 2 hose nipples - opposite end, 2 plug-in couplings,only available for length AC, intended as right-hand outer cooling profile
- 7 = 1FN3050 ... 450: One end, 1 plug-in coupling - opposite end, 1 hose nippleonly available for length AC, intended as left-hand outer cooling profile

Number of secondary sections to be supplied

Letters stand for numbers:

A	B	C	D	E	F	G	H	J	K	Y
0	1	2	3	4	5	6	7	8	9	0 / 5 *

Examples:
1 secondary section is coded with AB (minimum length of the cooling profiles)
16 secondary sections are coded with BG (maximum number for 1FN3300...900)[1]
24 secondary sections are coded with CE (maximum number for 1FN3050...150)[1]

* 0 = for 1FN3050... 150, 1FN3600, 1FN3900
5 = for 1FN3300... 450

[1] The maximum length of a single-section cooling profile is 3 m. Here, this corresponds to specified number of secondary sections.

Table 3-11 Cooling sections - lengths that can be ordered

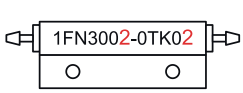
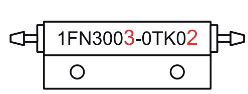
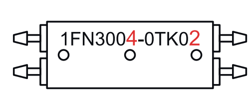
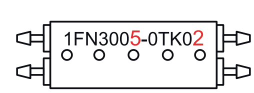
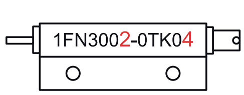
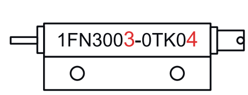
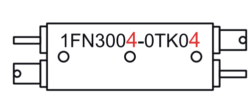
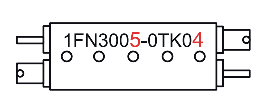
1FN300x-0TK0x-1xx0					
Size		**050, 100, 150**	**300, 450**	**600**	**900**
Number secondary sections	**Length code**	**Length of the cooling section in mm, tolerance -0.5 mm**			
1	AB0	100	164	164	164
1.5 *)	AB5	-	256	-	-
2	AC0	220	348	348	348
3	AD0	340	532	532	532
4	AE0	460	716	716	716
5	AF0	580	900	900	900
6	AG0	700	1084	1084	1084
7	AH0	820	1268	1268	1268

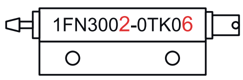
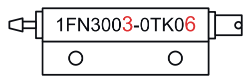
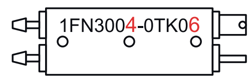
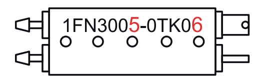
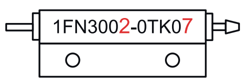
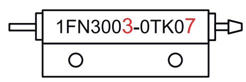
1FN300x-0TK0x-1xx0					
Size		**050, 100, 150**	**300, 450**	**600**	**900**
Number secondary sections	**Length code**	**Length of the cooling section in mm, tolerance -0.5 mm**			
8	AJ0	940	1452	1452	1452
9	AK0	1060	1636	1636	1636
10	BA0	1180	1820	1820	1820
11	BB0	1300	2004	2004	2004
12	BC0	1420	2188	2188	2188
13	BD0	1540	2372	2372	2372
14	BE0	1660	2556	2556	2556
15	BF0	1780	2740	2740	2740
16	BG0	1900	2924	2924	2924
17	BH0	2020	-	-	-
18	BJ0	2140	-	-	-
19	BK0	2260	-	-	-
20	CA0	2380	-	-	-
21	CB0	2500	-	-	-
22	CC0	2620	-	-	-
23	CD0	2740	-	-	-
24	CE0	2860	-	-	-

*) Not for "Type of connection = 2" (hose nipples on both ends)

Overview of cooling profiles

Table 3-12 Cooling profiles - variants and lengths that can be ordered

For sizes **1FN3050** **1FN3100** **1FN3150**	**For sizes** **1FN3300** **1FN3450**	**For sizes** **1FN3600**	**For sizes** **1FN3900**
Lengths: 1 to 24 secondary sections 	Lengths: 1 to 16 secondary sections 	Lengths: 1 to 16 secondary sections 	Lengths: 1 to 16 secondary sections 
Lengths: 1 to 24 secondary sections 	Lengths: 1 to 16 secondary sections 	Lengths: 1 to 16 secondary sections 	Lengths: 1 to 16 secondary sections 

For sizes 1FN3050 1FN3100 1FN3150	For sizes 1FN3300 1FN3450	For sizes 1FN3600	For sizes 1FN3900
Length: only 2 secondary sections  Right-hand outer cooling profile (R)	Length: only 2 secondary sections  Right-hand outer cooling profile (R)	Length: only 2 secondary sections  Outer cooling profile	Length: only 2 secondary sections  Outer cooling profile
Length: only 2 secondary sections  Left-hand outer cooling profile (L)	Length: only 2 secondary sections  Left-hand outer cooling profile (L)		

3.4.1.5 Ordering examples

Ordering example of a peak or continuous load motor

Your local sales partner is available to answer any questions regarding the configuring.

		Peak load motor	Continuous load motor
Component	**Quantity**	**Article No.**	**Article No.**
Primary section	1	1FN3150–3WC00–0BA3	1FN3150–3NC70–0BA3
Primary section precision cooler	1	1FN3150–3PK00–0AA0	1FN3150–3PK10–0AA0
Secondary sections (Length of the secondary section track: 1,440 mm)	12	1FN3150–4SA00–0AA0	
Secondary section cover (continuous cover strip)	1	1FN3150–0TB00–1BC0	
Cooling profiles with plug-type coupling	2	1FN3002–0TK04–1BC0	
Combi distributor	2	1FN3150–0TJ01–0AA0	

Ordering examples of heatsink profiles

In the following ordering examples, the article numbers of the heatsink profile in question is provided directly in the drawings. Your local sales partner is available to answer any questions regarding the configuring cooling sections.

Ordering examples of heatsink profiles with a plug-type coupling and for connection to a combi distributor with a plug-type coupling are shown below. The relevant article numbers for the secondary section end pieces with combi distributors are also shown in the drawings, e.g. 1FN3050-0TJ01-0AA0.

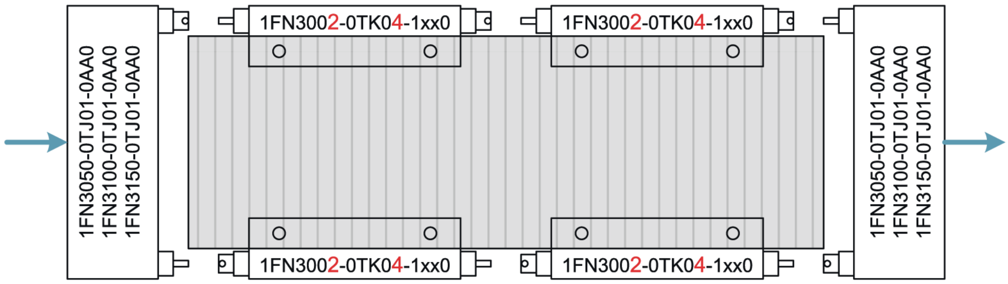


Figure 3-3 Heatsink profiles for secondary section track sizes 1FN3050-4SA00-0AA0, 1FN3100-4SA00-0AA01, 1FN3150-4SA00-0AA0

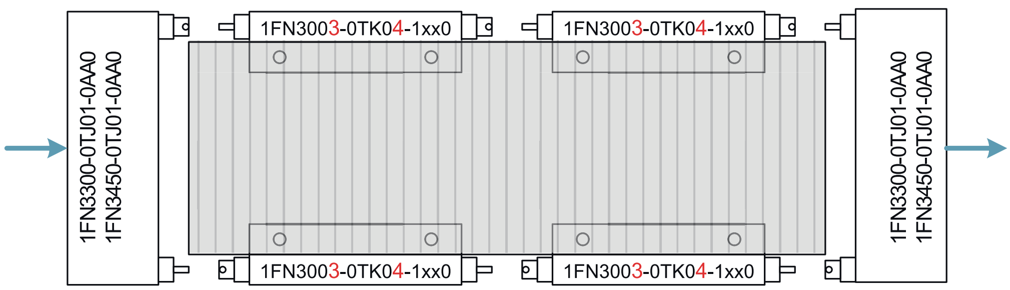


Figure 3-4 Heatsink profiles for secondary section track sizes 1FN3300-4SA00-0AA0, 1FN3450-4SA00-0AA0

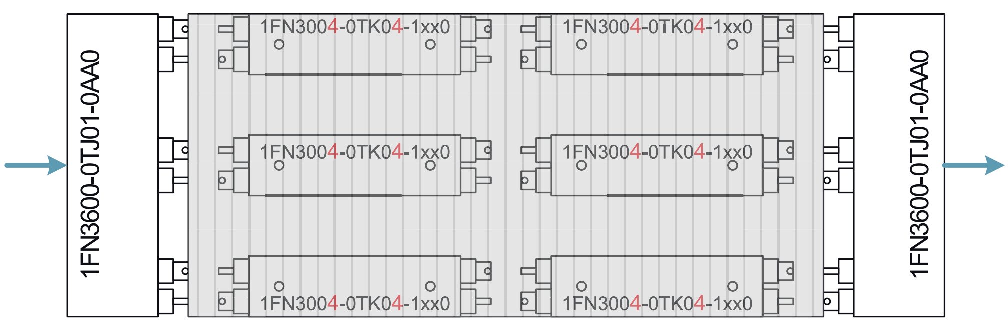


Figure 3-5 Heatsink profiles for secondary section track size 1FN3600-4SA00-0AA0

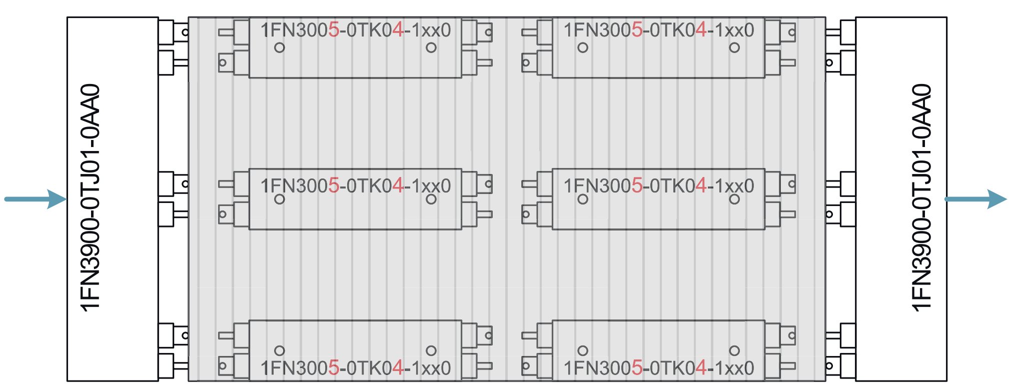


Figure 3-6 Heatsink profiles for secondary section track size 1FN3900-4SA00-0AA0

The following ordering examples show serially connected heatsink profiles that are connected via plug-type couplings. Hose nipples are provided to connect plastic hoses to the outer cooling sections.

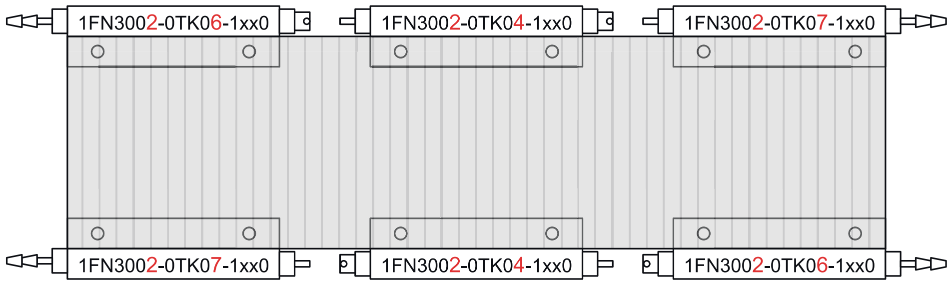


Figure 3-7 Heatsink profiles for secondary section track sizes 1FN3050-4SA00-0AA0, 1FN3100-4SA00-0AA0, 1FN3150-4SA00-0AA0

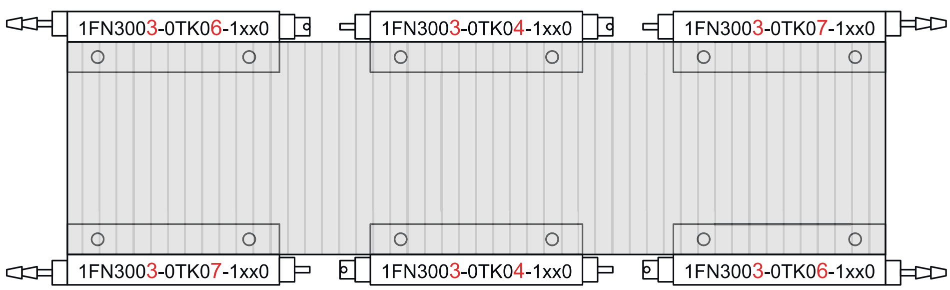


Figure 3-8 Heatsink profiles for secondary section track sizes 1FN3300-4SA00-0AA0, 1FN3450-4SA00-0AA0

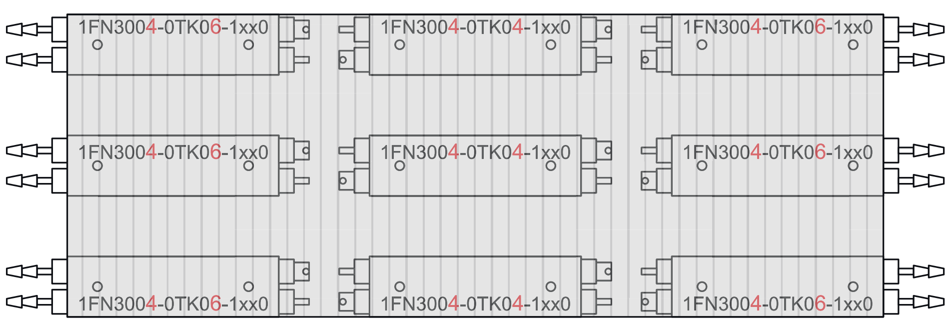


Figure 3-9 Heatsink profiles for secondary section track size 1FN3600-4SA00-0AA0

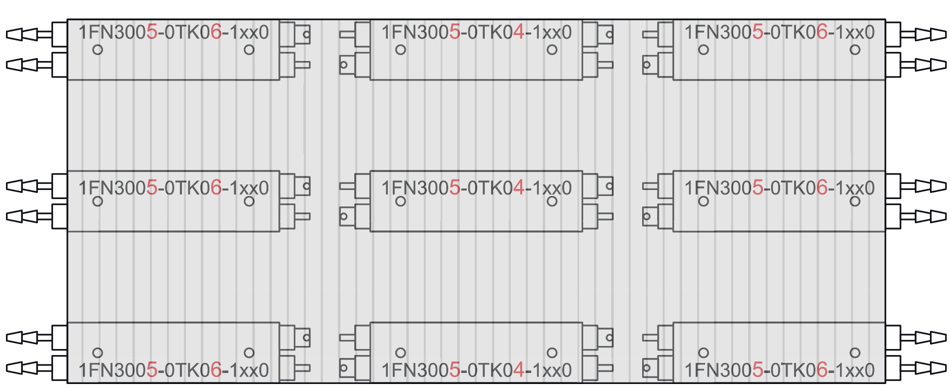


Figure 3-10 Heatsink profiles for secondary section track size 1FN3900-4SA00-0AA0

3.4.2 Selection and ordering data 1FN3

Note

Overview of important motor data

A selection of important motor data and dimensions is provided in this chapter. All of the data sheets are provided in Chapter "Technical data and characteristics (Page 183)" and in Chapter "Assembly drawings/dimension sheets (Page 523)".

Overview of important data of the peak load motors of the 1FN3 product family

The following tables provide an overview of the most important data of the peak load motors of the 1FN3 product family. For the mass and size, models with and without optional precision cooling elements are listed.

Table 3-13 Overview of the most important data of the peak load motors of the 1FN3 product family / Part 1

Article No. Primary section	F_N in N	F_{MAX} in N	I_N in A	I_{MAX} in A	$v_{MAX,FN}$ in m/min	$v_{MAX,FMAX}$ in m/min	$P_{V,N}$ in kW
1FN3050-2WC00-0xAx	200	550	2.72	8.15	408	170	0.275
1FN3100-1WC00-0xAx	200	490	2.44	6.5	335	147	0.269
1FN3100-2WC00-0xAx	450	1100	5.08	13.5	323	148	0.501
1FN3100-2WE00-0xAx	450	1100	8.04	21.4	535	258	0.501
1FN3100-2WJ20-0xAx	450	1100	14.4	38.3	984	488	0.502
1FN3100-3WC00-0xAx	675	1650	7.18	19.1	303	137	0.748
1FN3100-3WE00-0xAx	675	1650	12.1	32.1	534	258	0.749
1FN3100-4WC00-0xAx	900	2200	10.2	27.1	324	148	0.998
1FN3100-4WE00-0xAx	900	2200	16.1	42.9	535	258	0.999
1FN3100-5WC00-0xAx	1120	2750	11	29.5	278	125	1.2
1FN3150-1WC00-0xAx	340	820	3.58	9.54	303	140	0.337
1FN3150-1WE00-0xAx	340	820	6.41	17.1	569	278	0.338
1FN3150-2WC00-0xAx	675	1650	7.16	19.1	306	141	0.671
1FN3150-3WC00-0xAx	1010	2470	10.7	28.6	302	138	1.01
1FN3150-4WC00-0xAx	1350	3300	14.3	38.2	306	141	1.34
1FN3150-5WC00-0xAx	1690	4120	17.9	47.7	306	141	1.67
1FN3300-1WC00-0xAx	610	1720	6.47	20	325	138	0.45
1FN3300-2WB00-0xAx	1220	3450	7.96	24.7	194	76.5	0.85
1FN3300-2WC00-0xAx	1230	3450	12.6	39	322	140	0.852
1FN3300-2WG00-0xAx	1230	3450	32.4	100	868	399	0.812

Article No. Primary section	F_N in N	F_{MAX} in N	I_N in A	I_{MAX} in A	$v_{MAX,FN}$ in m/min	$v_{MAX,FMAX}$ in m/min	$P_{V,N}$ in kW
1FN3300-3WC00-0xAx	1840	5170	19.2	59.5	327	142	1.32
1FN3300-3WG00-0xAx	1840	5170	49.4	153	881	405	1.25
1FN3300-4WB00-0xAx	2450	6900	16	49.4	194	76.7	1.71
1FN3300-4WC00-0xAx	2450	6900	25.3	78.3	323	140	1.71
1FN3450-2WA50-0xAx	1930	5180	8.91	25	120	41	1.47
1FN3450-2WB70-0xAx	1930	5180	16.2	45.4	238	103	1.49
1FN3450-2WC00-0xAx	1930	5180	20	56.2	301	135	1.48
1FN3450-2WD00-0xAx	1930	5180	25	70.2	385	177	1.34
1FN3450-2WE00-0xAx	1930	5180	36.3	102	567	264	1.4
1FN3450-3WA50-0xAx	2900	7760	12.9	38	121	40.5	2.03
1FN3450-3WB00-0xAx	2900	7760	17.9	52.8	179	72.7	1.99
1FN3450-3WB50-0xAx	2900	7760	22.9	67.4	236	102	1.98
1FN3450-3WC00-0xAx	2900	7760	28.3	83.5	298	133	1.97
1FN3450-3WE00-0xAx	2900	7760	51.3	151	561	260	1.86
1FN3450-4WB00-0xAx	3860	10300	23.8	70.1	179	72.9	2.63
1FN3450-4WB50-0xAx	3860	10300	30.3	89.5	236	102	2.62
1FN3450-4WC00-0xAx	3860	10300	37.6	111	298	133	2.6
1FN3450-4WE00-0xAx	3860	10300	68	201	560	261	2.45
1FN3600-2WA50-0xAx	2610	6900	13.2	35.9	128	45.4	2.19
1FN3600-2WB00-0xAx	2610	6900	16.8	45.8	172	69.6	2.18
1FN3600-2WB50-0xAx	2610	6900	22.3	60.7	238	105	2.09
1FN3600-2WC00-0xAx	2610	6900	26.1	70.9	283	128	1.95
1FN3600-3WB00-0xAx	3920	10300	24.8	68.2	171	69.4	3.15
1FN3600-3WB50-0xAx	3920	10300	32.9	90.5	237	104	3.03
1FN3600-3WC00-0xAx	3920	10300	38.4	106	282	128	2.83
1FN3600-4WA30-0xAx	5220	13800	22.3	63.7	112	35.5	3.86
1FN3600-4WB00-0xAx	5220	13800	31.5	90.1	170	68.1	3.82
1FN3600-4WB50-0xAx	5220	13800	41.8	120	234	102	3.67
1FN3600-4WC00-0xAx	5220	13800	48.8	139	279	125	3.42
1FN3600-5WB00-0xAx	6530	17200	42.7	114	171	69.6	5.61
1FN3900-2WB00-0xAx	4050	10300	25.5	70.5	179	78	2.63
1FN3900-2WC00-0xAx	4050	10300	37	102	269	123	2.74
1FN3900-3WB00-0xAx	6080	15500	40.6	114	188	78.7	4.42
1FN3900-4WA50-0xAx	8100	20700	30.7	86.3	98.9	31.1	5.52
1FN3900-4WB00-0xAx	8100	20700	49.7	140	178	77.2	4.98
1FN3900-4WB50-0xAx	8100	20700	61.4	173	222	98.6	5.53
1FN3900-4WC00-0xAx	8100	20700	72	202	266	122	5.19

F_N = rated force, F_{MAX} = maximum force, I_N = rated current, I_{MAX} = maximum current, $v_{MAX,FN}$ = maximum velocity at rated force, $v_{MAX,FMAX}$ = maximum velocity at maximum force, $P_{V,N}$ = power loss at the rated point

Table 3-14 Overview of the most important data of the peak load motors of the 1FN3 product family / Part 2

Article No. Primary section	h_{M3} / h_{M1} in mm	b_P / b_{PK1} in mm	l_P in mm	$l_{P,AKT}$ in mm	m_P / $m_{P,P}$ in kg	l_S in mm	m_S / $m_{S,P}$ in kg
1FN3050-2WC00-0xAx	48.5 / 63.4	67 / 76	255	210	3 / 3.5	120	0.4 / 0.5
1FN3100-1WC00-0xAx	48.5 /	96 /	150	105	2 /	120	0.7 / 0.8
1FN3100-2WC00-0xAx	48.5 / 63.4	96 / 105	255	210	4 / 4.6	120	0.7 / 0.8
1FN3100-2WE00-0xAx	48.5 / 63.4	96 / 105	255	210	4 / 4.6	120	0.7 / 0.8
1FN3100-2WJ20-0xAx	48.5 / 63.4	96 / 105	255	210	4 / 4.6	120	0.7 / 0.8
1FN3100-3WC00-0xAx	48.5 / 63.4	96 / 105	360	315	5.6 / 6.4	120	0.7 / 0.8
1FN3100-3WE00-0xAx	48.5 / 63.4	96 / 105	360	315	5.6 / 6.4	120	0.7 / 0.8
1FN3100-4WC00-0xAx	48.5 / 63.4	96 / 105	465	420	7.4 / 8.5	120	0.7 / 0.8
1FN3100-4WE00-0xAx	48.5 / 63.4	96 / 105	465	420	7.4 / 8.5	120	0.7 / 0.8
1FN3100-5WC00-0xAx	48.5 / 63.4	96 / 105	570	525	9.1 / 10.4	120	0.7 / 0.8
1FN3150-1WC00-0xAx	50.5 /	126 /	150	105	2.9 /	120	1.2 / 1.3
1FN3150-1WE00-0xAx	50.5 /	126 /	150	105	2.9 /	120	1.2 / 1.3
1FN3150-2WC00-0xAx	50.5 / 65.4	126 / 135	255	210	5.3 / 6	120	1.2 / 1.3
1FN3150-3WC00-0xAx	50.5 / 65.4	126 / 135	360	315	7.7 / 8.6	120	1.2 / 1.3
1FN3150-4WC00-0xAx	50.5 / 65.4	126 / 135	465	420	10.4 / 11.6	120	1.2 / 1.3
1FN3150-5WC00-0xAx	50.5 / 65.4	126 / 135	570	525	12.5 / 13.9	120	1.2 / 1.3
1FN3300-1WC00-0xAx	64.1 /	141 /	221	161	6.6 /	184	2.4 / 2.6
1FN3300-2WB00-0xAx	64.1 / 79	141 / 151	382	322	11.5 / 12.5	184	2.4 / 2.6
1FN3300-2WC00-0xAx	64.1 / 79	141 / 151	382	322	11.5 / 12.5	184	2.4 / 2.6
1FN3300-2WG00-0xAx	64.1 / 79	141 / 151	382	322	11.5 / 12.5	184	2.4 / 2.6
1FN3300-3WC00-0xAx	64.1 / 79	141 / 151	543	483	17 / 18.4	184	2.4 / 2.6
1FN3300-3WG00-0xAx	64.1 / 79	141 / 151	543	483	17 / 18.4	184	2.4 / 2.6
1FN3300-4WB00-0xAx	64.1 / 79	141 / 151	704	644	22.2 / 24	184	2.4 / 2.6
1FN3300-4WC00-0xAx	64.1 / 79	141 / 151	704	644	22.2 / 24	184	2.4 / 2.6
1FN3450-2WA50-0xAx	66.1 / 81	188 / 197	382	322	16.5 / 17.7	184	3.8 / 4
1FN3450-2WB70-0xAx	66.1 / 81	188 / 197	382	322	16.5 / 17.7	184	3.8 / 4
1FN3450-2WC00-0xAx	66.1 / 81	188 / 197	382	322	16.5 / 17.7	184	3.8 / 4
1FN3450-2WD00-0xAx	66.1 / 81	188 / 197	382	322	16.5 / 17.7	184	3.8 / 4
1FN3450-2WE00-0xAx	66.1 / 81	188 / 197	382	322	16.5 / 17.7	184	3.8 / 4
1FN3450-3WA50-0xAx	66.1 / 81	188 / 197	543	483	24 / 25.7	184	3.8 / 4
1FN3450-3WB00-0xAx	66.1 / 81	188 / 197	543	483	24 / 25.7	184	3.8 / 4
1FN3450-3WB50-0xAx	66.1 / 81	188 / 197	543	483	24 / 25.7	184	3.8 / 4
1FN3450-3WC00-0xAx	66.1 / 81	188 / 197	543	483	24 / 25.7	184	3.8 / 4
1FN3450-3WE00-0xAx	66.1 / 81	188 / 197	543	483	24 / 25.7	184	3.8 / 4
1FN3450-4WB00-0xAx	66.1 / 81	188 / 197	704	644	31.7 / 33.9	184	3.8 / 4
1FN3450-4WB50-0xAx	66.1 / 81	188 / 197	704	644	31.7 / 33.9	184	3.8 / 4
1FN3450-4WC00-0xAx	66.1 / 81	188 / 197	704	644	31.7 / 33.9	184	3.8 / 4

Article No. Primary section	h_{M3} / h_{M1} in mm	b_P / b_{PK1} in mm	l_P in mm	$l_{P,AKT}$ in mm	m_P / $m_{P,P}$ in kg	l_S in mm	m_S / $m_{S,P}$ in kg
1FN3450-4WE00-0xAx	66.1 / 81	188 / 197	704	644	31.7 / 33.9	184	3.8 / 4
1FN3600-2WA50-0xAx	64.1 / 86	248 / 257	382	322	22.5 / 23.9	184	4.6 / 5
1FN3600-2WB00-0xAx	64.1 / 86	248 / 257	382	322	22.5 / 23.9	184	4.6 / 5
1FN3600-2WB50-0xAx	64.1 / 86	248 / 257	382	322	22.5 / 23.9	184	4.6 / 5
1FN3600-2WC00-0xAx	64.1 / 86	248 / 257	382	322	22.5 / 23.9	184	4.6 / 5
1FN3600-3WB00-0xAx	64.1 / 86	248 / 257	543	483	33.5 / 35.4	184	4.6 / 5
1FN3600-3WB50-0xAx	64.1 / 86	248 / 257	543	483	33.5 / 35.4	184	4.6 / 5
1FN3600-3WC00-0xAx	64.1 / 86	248 / 257	543	483	33.5 / 35.4	184	4.6 / 5
1FN3600-4WA30-0xAx	64.1 / 86	248 / 257	704	644	43 / 45.5	184	4.6 / 5
1FN3600-4WB00-0xAx	64.1 / 86	248 / 257	704	644	43 / 45.5	184	4.6 / 5
1FN3600-4WB50-0xAx	64.1 / 86	248 / 257	704	644	43 / 45.5	184	4.6 / 5
1FN3600-4WC00-0xAx	64.1 / 86	248 / 257	704	644	43 / 45.5	184	4.6 / 5
1FN3600-5WB00-0xAx	64.1 / 86	248 / 257	865	805	56 / 59.1	184	4.6 / 5
1FN3900-2WB00-0xAx	66.1 / 88	342 / 351	382	322	32.2 / 33.7	184	7.5 / 7.9
1FN3900-2WC00-0xAx	66.1 / 88	342 / 351	382	322	32.2 / 33.7	184	7.5 / 7.9
1FN3900-3WB00-0xAx	66.1 / 88	342 / 351	543	483	47.2 / 49.3	184	7.5 / 7.9
1FN3900-4WA50-0xAx	66.1 / 88	342 / 351	704	644	62.7 / 65.4	184	7.5 / 7.9
1FN3900-4WB00-0xAx	66.1 / 88	342 / 351	704	644	62.7 / 65.4	184	7.5 / 7.9
1FN3900-4WB50-0xAx	66.1 / 88	342 / 351	704	644	62.7 / 65.4	184	7.5 / 7.9
1FN3900-4WC00-0xAx	66.1 / 88	342 / 351	704	644	62.7 / 65.4	184	7.5 / 7.9

$\mathbf{h_{M3}}$ = motor height without additional heatsinks, $\mathbf{h_{M1}}$ = motor height with additional heatsinks, $\mathbf{b_P}$ = motor width without precision cooler, $\mathbf{b_{PK1}}$ = motor width with precision cooler, $\mathbf{l_P}$ = length of the primary section (without connection cover), $\mathbf{l_{P,AKT}}$ = magnetically active length of the primary section, $\mathbf{m_P}$ = weight of the primary section, $\mathbf{m_{P,P}}$ = weight of the primary section with precision cooler, $\mathbf{l_S}$ = length of the secondary section, $\mathbf{m_S}$ = weight of the secondary section, $\mathbf{m_{S,P}}$ = weight of the secondary section with cooling profiles

Overview of important data of the peak load motors of the 1FN3 product family

The following tables provide an overview of the most important data of the peak load motors of the 1FN3 product family. For the mass and size, models with and without optional precision cooling elements are listed.

Table 3-15 Overview of the most important data of the peak load motors of the 1FN3 product family / Part 1

Article No. Primary section	F_N in N	F_{MAX} in N	I_N in A	I_{MAX} in A	$v_{MAX,FN}$ in m/min	$v_{MAX,FMAX}$ in m/min	$P_{V,N}$ in kW
1FN3050-2WC00-0xAx	200	550	2.72	8.15	408	170	0.275
1FN3100-1WC00-0xAx	200	490	2.44	6.5	335	147	0.269
1FN3100-2WC00-0xAx	450	1100	5.08	13.5	323	148	0.501
1FN3100-2WE00-0xAx	450	1100	8.04	21.4	535	258	0.501
1FN3100-2WJ20-0xAx	450	1100	14.4	38.3	984	488	0.502
1FN3100-3WC00-0xAx	675	1650	7.18	19.1	303	137	0.748
1FN3100-3WE00-0xAx	675	1650	12.1	32.1	534	258	0.749

Article No. Primary section	F_N in N	F_{MAX} in N	I_N in A	I_{MAX} in A	$v_{MAX,FN}$ in m/min	$v_{MAX,FMAX}$ in m/min	$P_{V,N}$ in kW
1FN3100-4WC00-0xAx	900	2200	10.2	27.1	324	148	0.998
1FN3100-4WE00-0xAx	900	2200	16.1	42.9	535	258	0.999
1FN3100-5WC00-0xAx	1120	2750	11	29.5	278	125	1.2
1FN3150-1WC00-0xAx	340	820	3.58	9.54	303	140	0.337
1FN3150-1WE00-0xAx	340	820	6.41	17.1	569	278	0.338
1FN3150-2WC00-0xAx	675	1650	7.16	19.1	306	141	0.671
1FN3150-3WC00-0xAx	1010	2470	10.7	28.6	302	138	1.01
1FN3150-4WC00-0xAx	1350	3300	14.3	38.2	306	141	1.34
1FN3150-5WC00-0xAx	1690	4120	17.9	47.7	306	141	1.67
1FN3300-1WC00-0xAx	610	1720	6.47	20	325	138	0.45
1FN3300-2WB00-0xAx	1220	3450	7.96	24.7	194	76.5	0.85
1FN3300-2WC00-0xAx	1230	3450	12.6	39	322	140	0.852
1FN3300-2WG00-0xAx	1230	3450	32.4	100	868	399	0.812
1FN3300-3WC00-0xAx	1840	5170	19.2	59.5	327	142	1.32
1FN3300-3WG00-0xAx	1840	5170	49.4	153	881	405	1.25
1FN3300-4WB00-0xAx	2450	6900	16	49.4	194	76.7	1.71
1FN3300-4WC00-0xAx	2450	6900	25.3	78.3	323	140	1.71
1FN3450-2WA50-0xAx	1930	5180	8.91	25	120	41	1.47
1FN3450-2WB70-0xAx	1930	5180	16.2	45.4	238	103	1.49
1FN3450-2WC00-0xAx	1930	5180	20	56.2	301	135	1.48
1FN3450-2WD00-0xAx	1930	5180	25	70.2	385	177	1.34
1FN3450-2WE00-0xAx	1930	5180	36.3	102	567	264	1.4
1FN3450-3WA50-0xAx	2900	7760	12.9	38	121	40.5	2.03
1FN3450-3WB00-0xAx	2900	7760	17.9	52.8	179	72.7	1.99
1FN3450-3WB50-0xAx	2900	7760	22.9	67.4	236	102	1.98
1FN3450-3WC00-0xAx	2900	7760	28.3	83.5	298	133	1.97
1FN3450-3WE00-0xAx	2900	7760	51.3	151	561	260	1.86
1FN3450-4WB00-0xAx	3860	10300	23.8	70.1	179	72.9	2.63
1FN3450-4WB50-0xAx	3860	10300	30.3	89.5	236	102	2.62
1FN3450-4WC00-0xAx	3860	10300	37.6	111	298	133	2.6
1FN3450-4WE00-0xAx	3860	10300	68	201	560	261	2.45
1FN3600-2WA50-0xAx	2610	6900	13.2	35.9	128	45.4	2.19
1FN3600-2WB00-0xAx	2610	6900	16.8	45.8	172	69.6	2.18
1FN3600-2WB50-0xAx	2610	6900	22.3	60.7	238	105	2.09
1FN3600-2WC00-0xAx	2610	6900	26.1	70.9	283	128	1.95
1FN3600-3WB50-0xAx	3910	10300	32.9	90.5	237	104	3.03
1FN3600-3WB00-0xAx	3920	10300	24.8	68.2	171	69.4	3.15
1FN3600-3WC00-0xAx	3920	10300	38.4	106	282	128	2.83
1FN3600-4WA30-0xAx	5220	13800	22.3	63.7	112	35.5	3.86
1FN3600-4WB00-0xAx	5220	13800	31.5	90.1	170	68.1	3.82

Article No. Primary section	F_N in N	F_{MAX} in N	I_N in A	I_{MAX} in A	$v_{MAX,FN}$ in m/min	$v_{MAX,FMAX}$ in m/min	$P_{V,N}$ in kW
1FN3600-4WB50-0xAx	5220	13800	41.8	120	234	102	3.67
1FN3600-4WC00-0xAx	5220	13800	48.8	139	279	125	3.42
1FN3600-5WB00-0xAx	6530	17200	42.7	114	171	69.6	5.61
1FN3900-2WB00-0xAx	4050	10300	25.5	70.5	179	78	2.63
1FN3900-2WC00-0xAx	4050	10300	37	102	269	123	2.74
1FN3900-3WB00-0xAx	6080	15500	40.6	114	188	78.7	4.42
1FN3900-4WA50-0xAx	8100	20700	30.7	86.3	98.9	31.1	5.52
1FN3900-4WB00-0xAx	8100	20700	49.7	140	178	77.2	4.98
1FN3900-4WB50-0xAx	8100	20700	61.4	173	222	98.6	5.53
1FN3900-4WC00-0xAx	8100	20700	72	202	266	122	5.19

F_N = rated force, **F_{MAX}** = maximum force, **I_N** = rated current, **I_{MAX}** = maximum current, **$v_{MAX,FN}$** = maximum velocity at rated force, **$v_{MAX,FMAX}$** = maximum velocity at maximum force, **$P_{V,N}$** = power loss at the rated point

Table 3-16 Overview of the most important data of the peak load motors of the 1FN3 product family / Part 2

Article No. Primary section	h_{M3} / h_{M1} in mm	b_P / b_{PK1} in mm	l_P in mm	$l_{P,AKT}$ in mm	Thread GPG / GM1	m_P / $m_{P,P}$ in kg	l_S in mm	m_S / $m_{S,P}$ in kg
1FN3050-2WC00-0xAx	48.5 / 63.4	67 / 76	255	210		3 / 3.5	120	0.4 / 0.5
1FN3100-1WC00-0xAx	48.5 /	96 /	150	105	PG16 / M20x1.5	2 /	120	0.7 / 0.8
1FN3100-2WC00-0xAx	48.5 / 63.4	96 / 105	255	210		4 / 4.6	120	0.7 / 0.8
1FN3100-2WE00-0xAx	48.5 / 63.4	96 / 105	255	210		4 / 4.6	120	0.7 / 0.8
1FN3100-2WJ20-0xAx	48.5 / 63.4	96 / 105	255	210		4 / 4.6	120	0.7 / 0.8
1FN3100-3WC00-0xAx	48.5 / 63.4	96 / 105	360	315		5.6 / 6.4	120	0.7 / 0.8
1FN3100-3WE00-0xAx	48.5 / 63.4	96 / 105	360	315		5.6 / 6.4	120	0.7 / 0.8
1FN3100-4WC00-0xAx	48.5 / 63.4	96 / 105	465	420		7.4 / 8.5	120	0.7 / 0.8
1FN3100-4WE00-0xAx	48.5 / 63.4	96 / 105	465	420		7.4 / 8.5	120	0.7 / 0.8
1FN3100-5WC00-0xAx	48.5 / 63.4	96 / 105	570	525		9.1 / 10.4	120	0.7 / 0.8
1FN3150-1WC00-0xAx	50.5 /	126 /	150	105		2.9 /	120	1.2 / 1.3
1FN3150-1WE00-0xAx	50.5 /	126 /	150	105		2.9 /	120	1.2 / 1.3
1FN3150-2WC00-0xAx	50.5 / 65.4	126 / 135	255	210		5.3 / 6	120	1.2 / 1.3
1FN3150-3WC00-0xAx	50.5 / 65.4	126 / 135	360	315		7.7 / 8.6	120	1.2 / 1.3
1FN3150-4WC00-0xAx	50.5 / 65.4	126 / 135	465	420		10.4 / 11.6	120	1.2 / 1.3
1FN3150-5WC00-0xAx	50.5 / 65.4	126 / 135	570	525		12.5 / 13.9	120	1.2 / 1.3
1FN3300-1WC00-0xAx	64.1 /	141 /	221	161		6.6 /	184	2.4 / 2.6
1FN3300-2WB00-0xAx	64.1 / 79	141 / 151	382	322		11.5 / 12.5	184	2.4 / 2.6
1FN3300-2WC00-0xAx	64.1 / 79	141 / 151	382	322		11.5 / 12.5	184	2.4 / 2.6
1FN3300-2WG00-0xAx	64.1 / 79	141 / 151	382	322		11.5 / 12.5	184	2.4 / 2.6
1FN3300-3WC00-0xAx	64.1 / 79	141 / 151	543	483		17 / 18.4	184	2.4 / 2.6
1FN3300-3WG00-0xAx	64.1 / 79	141 / 151	543	483		17 / 18.4	184	2.4 / 2.6

Article No. Primary section	h_{M3} / h_{M1} in mm	b_P / b_{PK1} in mm	l_P in mm	$l_{P,AKT}$ in mm	Thread GPG / GM1	m_P / $m_{P,P}$ in kg	l_S in mm	m_S / $m_{S,P}$ in kg
1FN3300-4WB00-0xAx	64.1 / 79	141 / 151	704	644		22.2 / 24	184	2.4 / 2.6
1FN3300-4WC00-0xAx	64.1 / 79	141 / 151	704	644		22.2 / 24	184	2.4 / 2.6
1FN3450-2WA50-0xAx	66.1 / 81	188 / 197	382	322		16.5 / 17.7	184	3.8 / 4
1FN3450-2WB70-0xAx	66.1 / 81	188 / 197	382	322		16.5 / 17.7	184	3.8 / 4
1FN3450-2WC00-0xAx	66.1 / 81	188 / 197	382	322		16.5 / 17.7	184	3.8 / 4
1FN3450-2WD00-0xAx	66.1 / 81	188 / 197	382	322		16.5 / 17.7	184	3.8 / 4
1FN3450-2WE00-0xAx	66.1 / 81	188 / 197	382	322		16.5 / 17.7	184	3.8 / 4
1FN3450-3WA50-0xAx	66.1 / 81	188 / 197	543	483		24 / 25.7	184	3.8 / 4
1FN3450-3WB00-0xAx	66.1 / 81	188 / 197	543	483		24 / 25.7	184	3.8 / 4
1FN3450-3WB50-0xAx	66.1 / 81	188 / 197	543	483		24 / 25.7	184	3.8 / 4
1FN3450-3WC00-0xAx	66.1 / 81	188 / 197	543	483		24 / 25.7	184	3.8 / 4
1FN3450-3WE00-0xAx	66.1 / 81	188 / 197	543	483		24 / 25.7	184	3.8 / 4
1FN3450-4WB00-0xAx	66.1 / 81	188 / 197	704	644		31.7 / 33.9	184	3.8 / 4
1FN3450-4WB50-0xAx	66.1 / 81	188 / 197	704	644		31.7 / 33.9	184	3.8 / 4
1FN3450-4WC00-0xAx	66.1 / 81	188 / 197	704	644		31.7 / 33.9	184	3.8 / 4
1FN3450-4WE00-0xAx	66.1 / 81	188 / 197	704	644		31.7 / 33.9	184	3.8 / 4
1FN3600-2WA50-0xAx	64.1 / 86	248 / 257	382	322		22.5 / 23.9	184	4.6 / 5
1FN3600-2WB00-0xAx	64.1 / 86	248 / 257	382	322		22.5 / 23.9	184	4.6 / 5
1FN3600-2WB50-0xAx	64.1 / 86	248 / 257	382	322		22.5 / 23.9	184	4.6 / 5
1FN3600-2WC00-0xAx	64.1 / 86	248 / 257	382	322		22.5 / 23.9	184	4.6 / 5
1FN3600-3WB50-0xAx	64.1 / 86	248 / 257	543	483		33.5 / 35.4	184	4.6 / 5
1FN3600-3WB00-0xAx	64.1 / 86	248 / 257	543	483		33.5 / 35.4	184	4.6 / 5
1FN3600-3WC00-0xAx	64.1 / 86	248 / 257	543	483		33.5 / 35.4	184	4.6 / 5
1FN3600-4WA30-0xAx	64.1 / 86	248 / 257	704	644		43 / 45.5	184	4.6 / 5
1FN3600-4WB00-0xAx	64.1 / 86	248 / 257	704	644		43 / 45.5	184	4.6 / 5
1FN3600-4WB50-0xAx	64.1 / 86	248 / 257	704	644		43 / 45.5	184	4.6 / 5
1FN3600-4WC00-0xAx	64.1 / 86	248 / 257	704	644		43 / 45.5	184	4.6 / 5
1FN3600-5WB00-0xAx	64.1 / 86	248 / 257	865	805		56 / 59.1	184	4.6 / 5
1FN3900-2WB00-0xAx	66.1 / 88	342 / 351	382	322		32.2 / 33.7	184	7.5 / 7.9
1FN3900-2WC00-0xAx	66.1 / 88	342 / 351	382	322		32.2 / 33.7	184	7.5 / 7.9
1FN3900-3WB00-0xAx	66.1 / 88	342 / 351	543	483		47.2 / 49.3	184	7.5 / 7.9
1FN3900-4WA50-0xAx	66.1 / 88	342 / 351	704	644		62.7 / 65.4	184	7.5 / 7.9
1FN3900-4WB00-0xAx	66.1 / 88	342 / 351	704	644		62.7 / 65.4	184	7.5 / 7.9
1FN3900-4WB50-0xAx	66.1 / 88	342 / 351	704	644		62.7 / 65.4	184	7.5 / 7.9
1FN3900-4WC00-0xAx	66.1 / 88	342 / 351	704	644		62.7 / 65.4	184	7.5 / 7.9

$\mathbf{h_{M3}}$ = Motor height without additional cooler, $\mathbf{h_{M1}}$ = Motor height with additional coolers, $\mathbf{b_P}$ **=** Motor without precision cooler, $\mathbf{b_{PK1}}$ = Motor width with precision cooler, $\mathbf{l_P}$ = Primary section length (without connection cover), $\mathbf{l_{P,AKT}}$ = Active magnetic length of the primary section, thread **GPG** (with extension of the Article No. ...-0AAx) / thread **GM1** (with extension of the Article No. ...-0BAx), $\mathbf{m_P}$ = Primary section weight, $\mathbf{m_{P,P}}$ = Primary section weight with precision cooler, $\mathbf{l_S}$ = Secondary section length, $\mathbf{m_S}$ = Secondary section weight, $\mathbf{m_{S,P}}$ = Secondary section weight with cooling profiles

Overview of important data of the continuous load motors of the 1FN3 product family

The following tables provide an overview of the most important data of the continuous load motors of the 1FN3 product family. For the mass and size, models with and without optional precision cooling elements are listed.

Table 3-17 Overview of the most important data of the continuous load motors of the 1FN3 product family / Part 1

Article No. Primary section	F_N in N	F_{MAX} in N	I_N in A	I_{MAX} in A	$v_{MAX,FN}$ in m/min	$v_{MAX,FMAX}$ in m/min	$P_{V,N}$ in kW
1FN3050-1ND00-0xAx	151	255	2.82	5.86	429	236	0.16
1FN3050-2NB80-0xAx	302	510	2.82	5.86	199	104	0.318
1FN3050-2NE00-0xAx	302	510	5.65	11.7	419	229	0.318
1FN3100-1NC00-0xAx	302	510	2.82	5.86	212	115	0.253
1FN3100-2NC80-0xAx	604	1020	7.96	16.5	300	164	0.503
1FN3100-3NA80-0xAx	905	1530	4.52	9.39	101	49.1	0.755
1FN3100-3NC00-0xAx	905	1530	8.47	17.6	206	111	0.754
1FN3100-4NC80-0xAx	1210	2040	15.9	33.1	296	162	1
1FN3150-1NC20-0xAx	453	766	4.52	9.38	230	127	0.343
1FN3150-2NB80-0xAx	905	1530	7.96	16.5	197	106	0.681
1FN3150-3NB80-0xAx	1360	2300	11.9	24.8	195	105	1.02
1FN3150-3NC70-0xAx	1360	2300	16.9	35.2	284	156	1.02
1FN3150-4NB80-0xAx	1810	3060	15.9	33.1	195	105	1.36
1FN3300-1NC10-0xAx	864	1470	8.12	17.1	228	127	0.508
1FN3300-2NC10-0xAx	1730	2940	16.2	34.1	224	124	1.01
1FN3300-2NH00-0xAx	1730	2940	49.9	105	715	402	1.08
1FN3300-3NB50-0xAx	2590	4400	17.7	37.1	158	85.5	1.52
1FN3300-3NC40-0xAx	2590	4400	27.3	57.4	252	139	1.52
1FN3300-4NB80-0xAx	3460	5870	28.4	59.6	192	105	2.03
1FN3450-1NB50-0xAx	1300	2200	9.1	19.1	169	93.5	0.693
1FN3450-2NB40-0xAx	2590	4400	16.2	34.1	147	80	1.38
1FN3450-2NB80-0xAx	2590	4400	20.4	42.9	188	104	1.39
1FN3450-2NC50-0xAx	2590	4400	28.4	59.6	266	148	1.39
1FN3450-3NA50-0xAx	3890	6600	12.7	26.7	69.9	34.3	2.08
1FN3450-3NB50-0xAx	3890	6600	27.3	57.4	165	90.5	2.07
1FN3450-3NC50-0xAx	3890	6600	42.5	89.5	264	147	2.08
1FN3450-4NB20-0xAx	5190	8810	28.4	59.6	126	67.5	2.77
1FN3450-4NB80-0xAx	5190	8810	40.8	85.8	186	102	2.77
1FN3600-2NB00-0xAx	3460	5870	16.2	34.1	107	56.8	1.86
1FN3600-2NB80-0xAx	3460	5870	28.4	59.6	197	109	1.87
1FN3600-2NE50-0xAx	3460	5870	64.2	135	460	259	2.06
1FN3600-3NB00-0xAx	5190	8810	30.6	64.4	137	74.3	2.8
1FN3600-3NB80-0xAx	5190	8810	42.5	89.5	196	108	2.8
1FN3600-4NA70-0xAx	6920	11700	26.3	55.3	83.5	42.6	3.72

Article No. Primary section	F_N in N	F_{MAX} in N	I_N in A	I_{MAX} in A	$v_{MAX,FN}$ in m/min	$v_{MAX,FMAX}$ in m/min	$P_{V,N}$ in kW
1FN3600-4NB80-0xAx	6920	11700	56.7	119	195	108	3.74
1FN3900-2NB20-0xAx	5190	8810	28.4	59.6	128	69.4	2.65
1FN3900-2NC80-0xAx	5190	8810	64.2	135	304	170	2.89
1FN3900-3NB20-0xAx	7780	13200	42.5	89.5	127	68.9	3.97
1FN3900-4NA50-0xAx	10400	17600	29.3	61.6	59.4	28.2	5.26
1FN3900-4NA80-0xAx	10400	17600	40.8	85.8	87.9	45.6	5.28
1FN3900-4NB20-0xAx	10400	17600	56.7	119	127	68.6	5.29

F_N = rated force, **F_{MAX}** = maximum force, **I_N** = rated current, **I_{MAX}** = maximum current, **$v_{MAX,FN}$** = maximum velocity at rated force, **$v_{MAX,FMAX}$** = maximum velocity at maximum force, **$P_{V,N}$** = power loss at the rated point

Table 3-18 Overview of the most important data of the continuous load motors of the 1FN3 product family / Part 2

Article No. Primary section	h_{M3} / h_{M1} in mm	b_P / b_{PK1} in mm	l_P in mm	$l_{P,AKT}$ in mm	m_P / $m_{P,P}$ in kg	l_S in mm	m_S / $m_{S,P}$ in kg
1FN3050-1ND00-0xAx	59.4 / 74.3	67 / 76	162	117	2.2 / 2.69	120	0.4 / 0.5
1FN3050-2NB80-0xAx	59.4 / 74.3	67 / 76	267	222	3.9 / 4.6	120	0.4 / 0.5
1FN3050-2NE00-0xAx	59.4 / 74.3	67 / 76	267	222	3.9 / 4.6	120	0.4 / 0.5
1FN3100-1NC00-0xAx	59.4 / 74.3	96 / 105	162	117	3 / 3.52	120	0.7 / 0.8
1FN3100-2NC80-0xAx	59.4 / 74.3	96 / 105	267	222	5.4 / 6.19	120	0.7 / 0.8
1FN3100-3NA80-0xAx	59.4 / 74.3	96 / 105	372	327	7.5 / 8.56	120	0.7 / 0.8
1FN3100-3NC00-0xAx	59.4 / 74.3	96 / 105	372	327	7.5 / 8.56	120	0.7 / 0.8
1FN3100-4NC80-0xAx	59.4 / 74.3	96 / 105	477	432	9.9 / 11.2	120	0.7 / 0.8
1FN3150-1NC20-0xAx	61.4 / 76.3	126 / 135	162	117	4 / 4.5	120	1.2 / 1.3
1FN3150-2NB80-0xAx	61.4 / 76.3	126 / 135	267	222	7.3 / 8.15	120	1.2 / 1.3
1FN3150-3NB80-0xAx	61.4 / 76.3	126 / 135	372	327	10.5 / 11.7	120	1.2 / 1.3
1FN3150-3NC70-0xAx	61.4 / 76.3	126 / 135	372	327	10.5 / 11.7	120	1.2 / 1.3
1FN3150-4NB80-0xAx	61.4 / 76.3	126 / 135	477	432	13.9 / 15.3	120	1.2 / 1.3
1FN3300-1NC10-0xAx	78 / 92.9	141 / 151	238	179	8.8 / 9.51	184	2.4 / 2.6
1FN3300-2NC10-0xAx	78 / 92.9	141 / 151	399	340	15.9 / 17	184	2.4 / 2.6
1FN3300-2NH00-0xAx	78 / 92.9	141 / 151	399	340	15.9 / 17	184	2.4 / 2.6
1FN3300-3NB50-0xAx	78 / 92.9	141 / 151	560	501	23 / 24.4	184	2.4 / 2.6
1FN3300-3NC40-0xAx	78 / 92.9	141 / 151	560	501	23 / 24.4	184	2.4 / 2.6
1FN3300-4NB80-0xAx	78 / 92.9	141 / 151	721	662	29.9 / 31.8	184	2.4 / 2.6
1FN3450-1NB50-0xAx	80 / 94.9	188 / 197	238	179	12 / 12.8	184	3.8 / 4
1FN3450-2NB40-0xAx	80 / 94.9	188 / 197	399	340	22.5 / 23.7	184	3.8 / 4
1FN3450-2NB80-0xAx	80 / 94.9	188 / 197	399	340	22.5 / 23.7	184	3.8 / 4
1FN3450-2NC50-0xAx	80 / 94.9	188 / 197	399	340	22.5 / 23.7	184	3.8 / 4
1FN3450-3NA50-0xAx	80 / 94.9	188 / 197	560	501	32.7 / 34.3	184	3.8 / 4
1FN3450-3NB50-0xAx	80 / 94.9	188 / 197	560	501	32.7 / 34.3	184	3.8 / 4
1FN3450-3NC50-0xAx	80 / 94.9	188 / 197	560	501	32.7 / 34.3	184	3.8 / 4

Article No. Primary section	h_{M3} / h_{M1} in mm	b_P / b_{PK1} in mm	l_P in mm	$l_{P,AKT}$ in mm	m_P / $m_{P,P}$ in kg	l_S in mm	m_S / $m_{S,P}$ in kg
1FN3450-4NB20-0xAx	80 / 94.9	188 / 197	721	662	42 / 44	184	3.8 / 4
1FN3450-4NB80-0xAx	80 / 94.9	188 / 197	721	662	42 / 44	184	3.8 / 4
1FN3600-2NB00-0xAx	78 / 99.9	248 / 257	399	340	30.4 / 32	184	4.6 / 5
1FN3600-2NB80-0xAx	78 / 99.9	248 / 257	399	340	30.4 / 32	184	4.6 / 5
1FN3600-2NE50-0xAx	78 / 99.9	248 / 257	399	340	30.4 / 32	184	4.6 / 5
1FN3600-3NB00-0xAx	78 / 99.9	248 / 257	560	501	44.3 / 46.4	184	4.6 / 5
1FN3600-3NB80-0xAx	78 / 99.9	248 / 257	560	501	44.3 / 46.4	184	4.6 / 5
1FN3600-4NA70-0xAx	78 / 99.9	248 / 257	721	662	58.2 / 60.8	184	4.6 / 5
1FN3600-4NB80-0xAx	78 / 99.9	248 / 257	721	662	58.2 / 60.8	184	4.6 / 5
1FN3900-2NB20-0xAx	80 / 102	342 / 351	399	340	43.5 / 45.3	184	7.5 / 7.9
1FN3900-2NC80-0xAx	80 / 102	342 / 351	399	340	43.5 / 45.3	184	7.5 / 7.9
1FN3900-3NB20-0xAx	80 / 102	342 / 351	560	501	63 / 65.5	184	7.5 / 7.9
1FN3900-4NA50-0xAx	80 / 102	342 / 351	721	662	82 / 85.1	184	7.5 / 7.9
1FN3900-4NA80-0xAx	80 / 102	342 / 351	721	662	82 / 85.1	184	7.5 / 7.9
1FN3900-4NB20-0xAx	80 / 102	342 / 351	721	662	82 / 85.1	184	7.5 / 7.9

$\mathbf{h}_{M3}$ = motor height without additional heatsinks, $\mathbf{h}_{M1}$ = motor height with additional heatsinks, $\mathbf{b}_P$ = motor width without precision cooler, $\mathbf{b}_{PK1}$ = motor width with precision cooler, $\mathbf{l}_P$ = length of the primary section (without connection cover), $\mathbf{l}_{P,AKT}$ = magnetically active length of the primary section, $\mathbf{m}_P$ = weight of the primary primary section, $\mathbf{m}_{P,P}$ = weight of the primary section with precision cooler, $\mathbf{l}_S$ = length of the secondary section, $\mathbf{m}_S$ = weight of the secondary section, $\mathbf{m}_{S,P}$ = weight of the secondary section with heatsink profiles

3.5 Rating plate data

Data on the rating plate

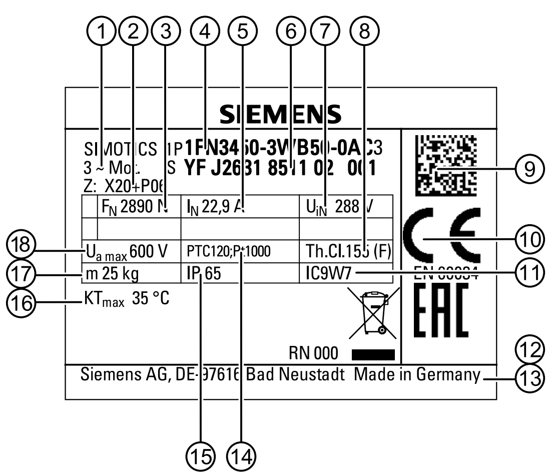


Figure 3-11 Examples of primary section rating plates

Table 3-19 Elements on the primary section rating plate

Item	Description
1	Motor type
2	Options
3	Rated force F_N
4	Article No.
5	Rated current I_N
6	Serial number
7	Induced voltage U_{iN} at rated speed v_N
8	Temperature class
9	2D code, contains the motor data
10	Approvals/conformities
11	Cooling method
12	Motor version
13	Manufacturer
14	Temperature sensors
15	Degree of protection
16	Max. coolant temperature at which the ratings are reached
17	Weight
18	Maximum permissible rms value of the motor terminal voltage $U_{a\ max}$

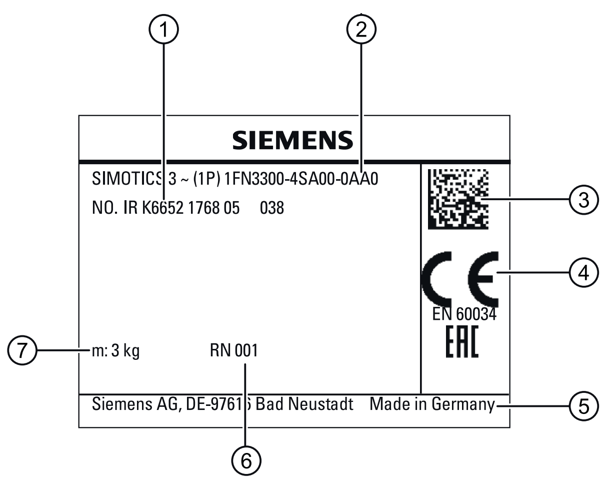


Figure 3-12 Example of a secondary section rating plate

Table 3-20 Elements on the secondary section rating plate

Item	Description
1	Serial number
2	Article No.
3	2D code, contains the data of the secondary section
4	Approvals/conformities

Item	Description
5	Manufacturer
6	Version of secondary section
7	Weight

Mechanical properties

4

4.1 Cooling

The water cooling dissipates the power loss in the primary section.

- Connect the interconnected cooling channels to the cooling circuit of a heat-exchanger unit.

You can find characteristic curves for the pressure drop of the coolant between the flow and return circuit of the coolers as a function of the flow rate in Chapter "Technical data and characteristics".

The rated motor forces specified in the data sheets apply under the following conditions:

- Operation with water cooling with a water flow temperature of 35 °C
- Maximum temperature of the ambient air 40 °C.

NOTICE
Demagnetization of the magnets of the secondary section If the heat dissipated through the secondary section mounting surfaces is not adequate, the secondary section can overheat, which could demagnetize the magnets. • Ensure that the secondary section does not exceed the maximum temperature of 70 °C.

4.1.1 Design of the cooling

Components

The following components are available for cooling the motors of the 1FN3 product family:

- Primary section main cooler
- Primary section precision cooler (optional)
- Secondary section cooling (optional)

These components are structurally separated in motors of the 1FN3 product family. They allow the cooling system to be laid out according to the Thermo-Sandwich® principle.

Details of the heat dissipation

The following figure shows details of the heat dissipation according to the Thermo-Sandwich® principle.

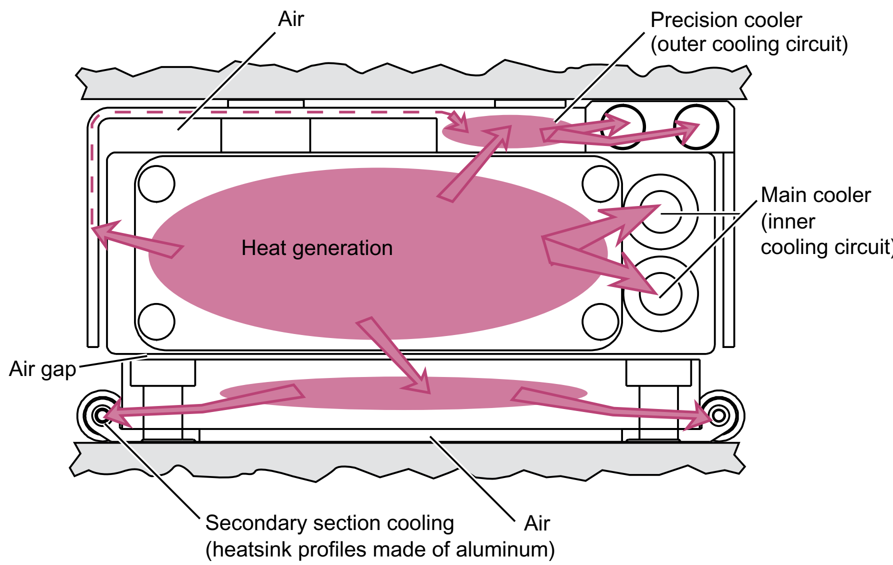


Figure 4-1 Heat dissipation from motors of the 1FN3 product family

Primary section main cooler / cooling of the primary section

The primary section main cooler is directly installed in the primary section. Under rated conditions, the primary section main cooler dissipates 85% to 90% of the power loss arising in the primary section.

The primary section main cooler has no influence on the thermal insulation of the motor from the machine.

Primary section precision cooler / thermal insulation of the primary section

Under rated conditions, the primary section precision cooler dissipates 2 % to 10 % of the total power loss from the primary section. This keeps the temperature rise of the outer surface of the primary section precision cooler over the flow temperature of the primary section precision cooler within a small range of fluctuation. Together with the secondary section cooling, the primary section precision cooler reduces the heat transmission into the connection structure.

The air gap insulates the primary section from the secondary section. On the bolting surface, the optional primary section precision cooler shields the surrounding area from excessively high motor temperatures. Thermo-insulators on the screwed connections and the air chamber located in between reduce heat transfer from the primary section.

The lateral radiation panels of the primary section precision cooler also form air filled spaces. These radiation panels insulate the primary section from the machine structure at the sides.

Under rated conditions, the temperature rise of the outer surface of the primary section precision cooler over the flow temperature is no more than 4 K.

If the primary section precision cooler is not used, the temperatures on the surface of the motor may exceed 100 °C.

Secondary section cooling / thermal insulation of the secondary section

The secondary section cooling dissipates 5% to 8% of the total power loss of the motor under rated conditions.

The standard cooling circuit for the secondary sections comprises heatsink profiles and two combi distributors as secondary section end pieces.

Secondary section cooling is required in the following circumstances:

- Applications where high power losses are transferred into the secondary sections
- Applications, where the machine bed does not ensure that heat is dissipated through the contact surface to the secondary sections

NOTICE
Secondary section cooling is required for large motors
For motors of sizes 1FN3600 and 1FN3900, secondary section cooling is imperative for the proper function of the motors. The large amount of heat transferred from the primary section to the secondary sections cannot be dissipated to the machine bed via the secondary sections' contact surfaces.
• Ensure that secondary section cooling is used for these large motors.

Secondary section cooling components

Cooling sections and secondary sections end pieces are available for cooling the secondary sections of 1FN3 motors.

Heatsink profiles

The heatsink profiles are laid between the machine base and the secondary sections and together with these screwed to the machine base. The following two figures show the resulting cooling system without secondary section end pieces. The blue dotted lines indicate the coolant flow.

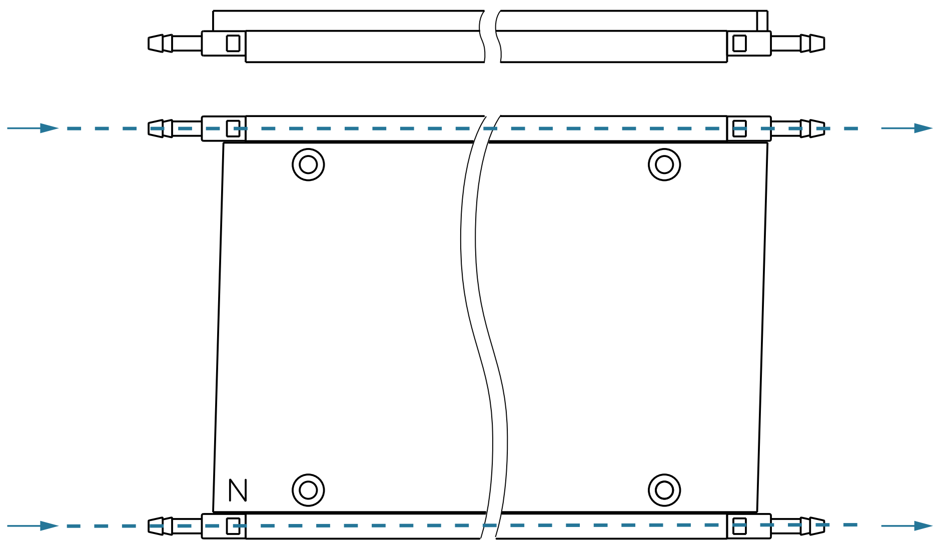


Figure 4-2 Secondary section cooling, comprising cooling sections with hose nipples for motors of sizes 1FN3050 ... 1FN3450 (side view and top view)

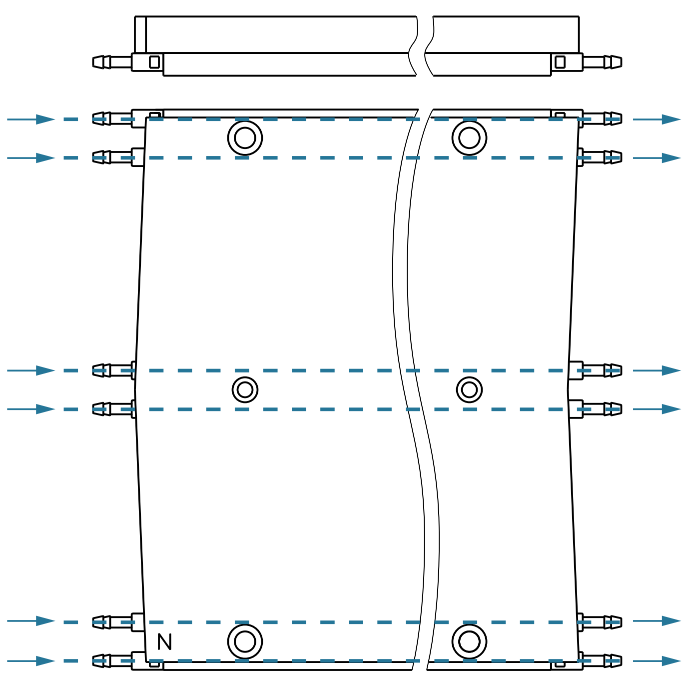


Figure 4-3 Secondary section cooling, comprising cooling sections with hose nipples for motors of sizes 1FN3600 ... 1FN3900 (side view and top view)

For size 1FN3600 and larger, 3 cooling sections with a total of 6 cooling ducts are used. The lateral profiles protrude just a little beyond the secondary section. The middle (additional) heatsink profile is attached by the line of screws in the center of the secondary sections.

The surfaces of the heatsink profiles are thermally optimized. The heat is transferred to the contact area of the secondary section track and from there to the cooling channel. Toward the machine structure, however, the contact area is small, so that the heat transfer is kept at a minimum.

The heatsink profiles are available in lengths up to 3 m.

Secondary section end pieces

The following secondary section end pieces at the start and end of the secondary section track close the cooling circuit and facilitate the cooling medium connection through uniform connectors:

- Combi distributor
- Combi adapter / combi end piece

As standard, combi distributors are used as secondary section end pieces. Secondary section end pieces are available for all sizes. You can use combi adapters / combi end pieces as an alternative for sizes 1FN3050 ... 1FN3450. Cover end pieces are not directly involved in the cooling of the secondary sections.

The following diagrams show the secondary section cooling with different secondary section end piece variants. Secondary section end pieces are shown, where the continuous cover strip for the secondary section track is fixed using a wedge and a screwed joint. There are also secondary section end pieces, where the continuous cover strip is fixed using a clamping element.

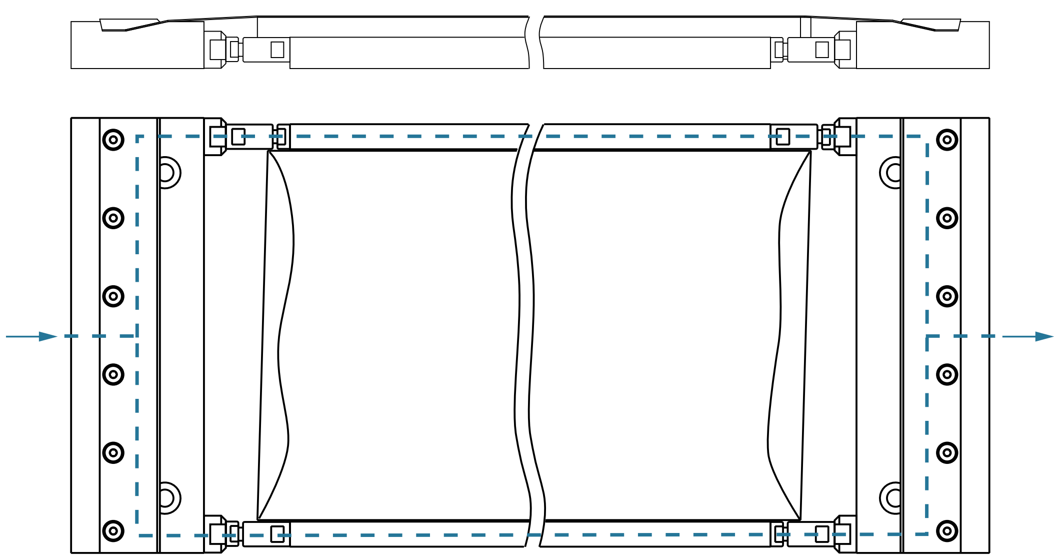


Figure 4-4 Secondary section cooling for motors of sizes 1FN3050 ... 1FN3450 with combi distributors (side and top view)

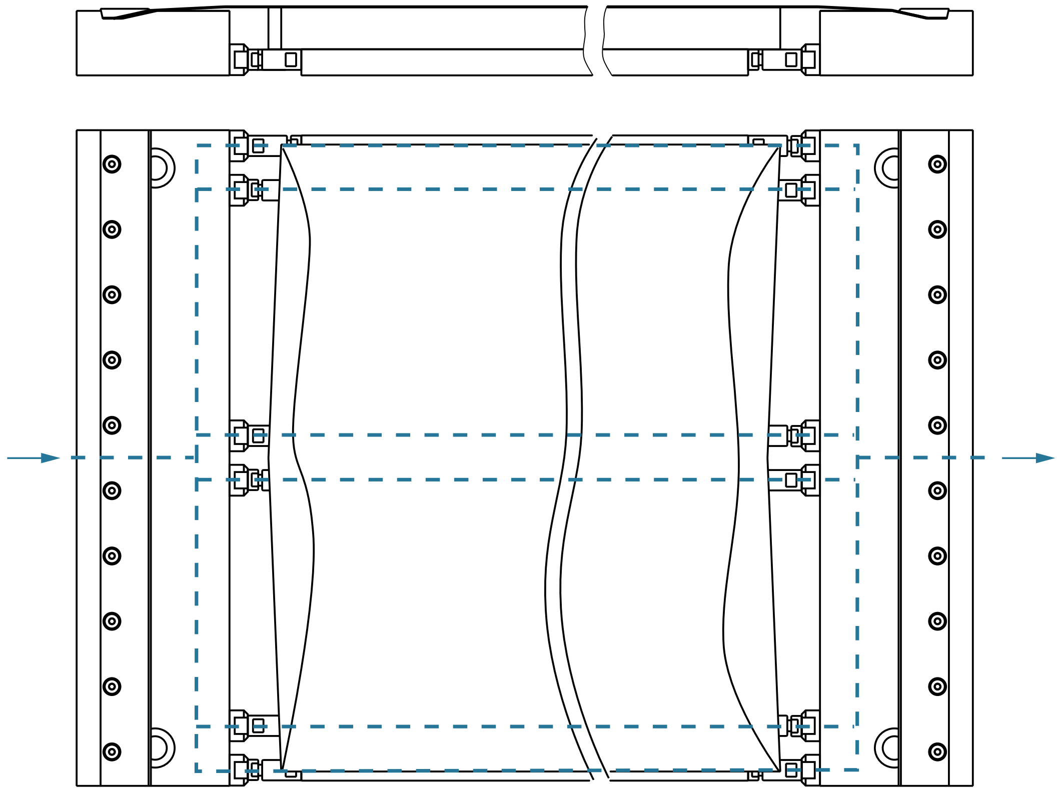


Figure 4-5 Secondary section cooling for motors of sizes 1FN3600 and 1FN3900 with combi distributors (side and top view)

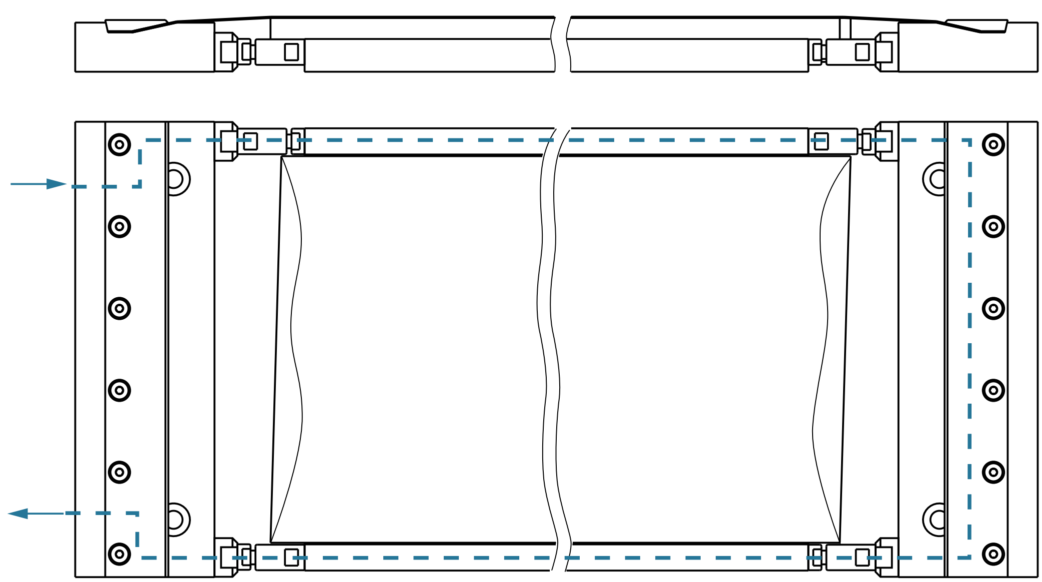


Figure 4-6 Secondary section cooling for motors of sizes 1FN3050 ... 1FN3450 with combi adapter and combi end piece (side and top view)

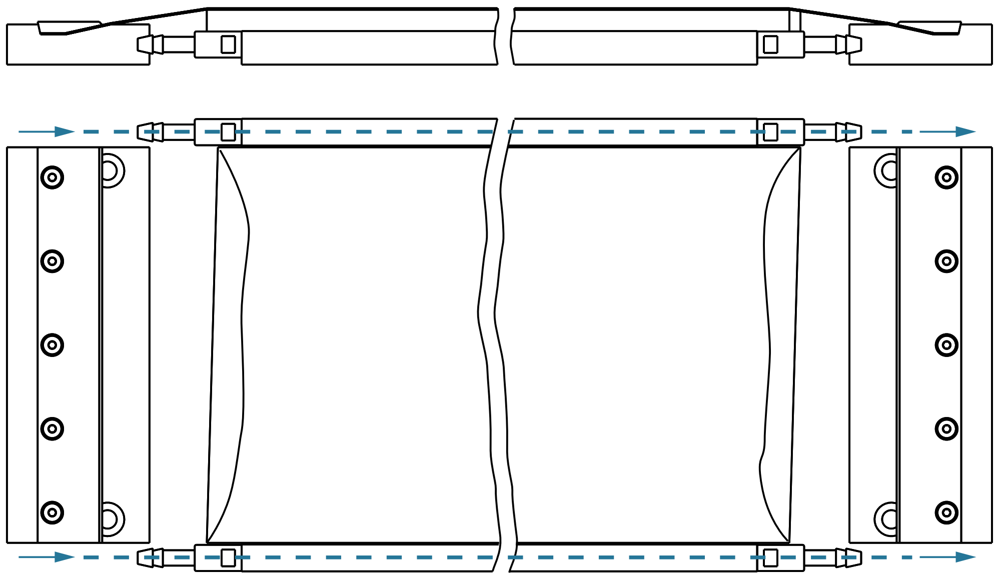


Figure 4-7 Secondary section cooling consisting of cooling sections with hose nipples and cover end pieces on both sides for all motors of sizes 1FN3050 ... 1FN3450 (side and top view)

Note

Pressure drop for combi adapter and end piece

Because of the high pressure drops, only use secondary section cooling with a combi adapter / combi end piece for traversing distances up to a length of approx. 2 m. Check the pressure drop when designing the entire cooling system.

4.1.2 Cooling circuits

Cooling circuit requirements

Avoid algae growth by using suitable chemical agents and opaque water hoses or tubes.

We recommend that the cooling circuits be designed as closed systems. The maximum permissible pressure is 10 bar.

NOTICE
Blocked and clogged cooling circuits Cooling circuits can become blocked and clogged as a result of pollution and longer-term deposits. • We recommend that you use a separate cooling circuit to cool the motors.

- If you use the machine cooling circuits to also cool the motors, you must ensure that the coolant fully complies with the requirements listed in this chapter.
- Also note the maximum non-operational times of cooling circuits corresponding to the coolant manufacturer's data.

Selecting cooling components

When selecting the cooling components to be used, you must consider the following:

- The main cooler is sufficient if the thermal transfer into the machine structure does not have a negative impact on the system.
- If increased demands are placed on the precision of the machine, use of a primary section precision cooler and secondary section cooling according to the Thermo-Sandwich® principle is required.
- If you use primary sections 1FN3600 to 1FN3900, you will definitely need secondary section cooling for heat dissipation of the secondary sections.

Interconnecting cooling circuits

NOTICE

Leaks associated with rigid connections

Rigid connections between the cooling circuits can lead to problems with leaks.

- Use flexible connections (hoses) when interconnecting cooling circuits.

Note

Connecting cooling circuits in parallel

If you connect the cooling circuits of the primary sections in series, coolant at different temperatures will flow through the cooling circuits.

- Connect the primary section cooling circuits in parallel. This ensures that coolant flows through each primary section with the same intake temperature.

Ensure the same pressure drop and an even flow in every primary section.

Influencing variables in this regard are:

- Pipe lengths
- Pipe material
- Pipe cross-section
- Pipe routing
- Regulation of the flow rate

Examples

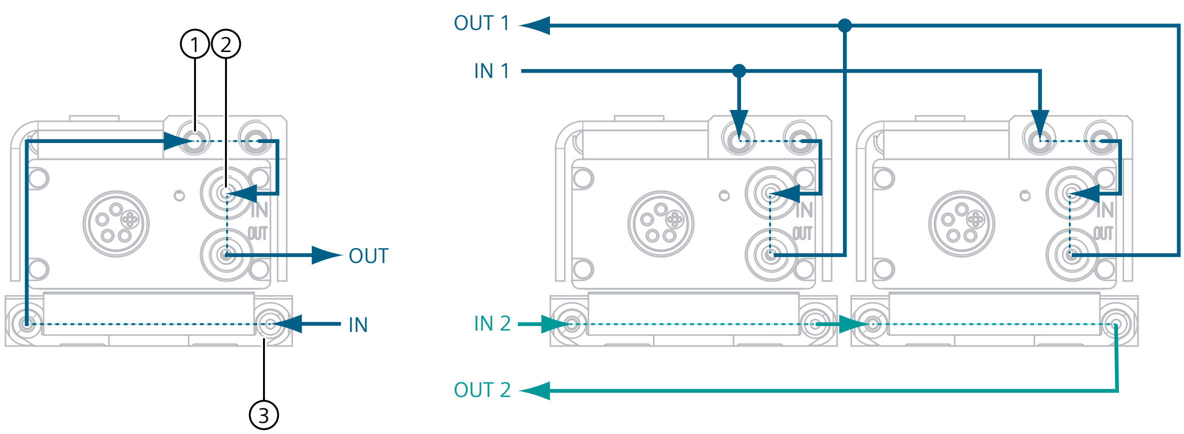
The following diagram shows two schematic examples for interconnecting cooling circuits.

Left-hand part of the diagram:

All of the motor cooling circuits are connected in series.

Right-hand part of the diagram:

For both motors, the cooling circuits of the primary section precision cooler and primary section main cooler are connected in series. These two series circuits are connected in parallel as cooling circuit 1. The secondary section coolers of the two motors are connected in series and form separate cooling circuit 2.



① Primary section precision cooler
② Primary section main cooler
③ Secondary section cooling
═ Coolant ducts outside the motor
┄ Cooling ducts in the motor

Figure 4-8 Examples for interconnecting the cooling circuits

Materials used in the cooling circuits of the linear motors

Table 4-1 Materials used for the cooling system

Precision cooler	Main cooler	Secondary section cooling
1.4301/1.4305; 1.4541; Viton	SF-Cu; 1.4301/1.4305; Viton;	AlMgSi0.5 (anodized); 1.4305; Viton; Delo 5327

NOTICE

Corrosion as a result of unsuitable materials used to connect the cooler

Corrosion damage can occur if you use unsuitable materials to connect to the cooler.

- We recommend that you use brass or stainless steel fittings when connecting the cooler.

Calculating the thermal power that can be dissipated by the cooler

$$Q = \rho \cdot c_p \cdot \dot{V} \cdot \Delta T$$

Average density of the coolant:	ρ	in	kg/m^3
Average specific heat capacity of the coolant:	c_p	in	J/(kg K)
Temperature deviation vis-à-vis the intake temperature:	ΔT	in	K
Volume flow:	$\dot{V}$	in	m^3/s

Coolant intake temperature

NOTICE

Corrosion in the machine

Condensation can lead to corrosion in the machine.

- Select the intake temperatures so that no condensation forms on the surface of the motor. Condensation does not form if the intake temperature T_{VORL} is higher than the ambient temperature or corresponds to the ambient temperature.

The rated motor data refer to operation at a coolant intake temperature of 35 °C. If the intake temperature is different, the continuous motor current changes as shown below.

Note

For a cooler intake temperature of < 35 °C, the possible continuous motor current is greater than the rated current I_N.

Larger cable cross-sections may be required. This means that you must take into account the rated current of the cables.

The following diagram shows the dependency of the relative continuous primary section current $(I_{Primärteil} / I_N) * 100$ on the water intake temperature in the cooling system. Losses due to friction and eddy currents are ignored here.

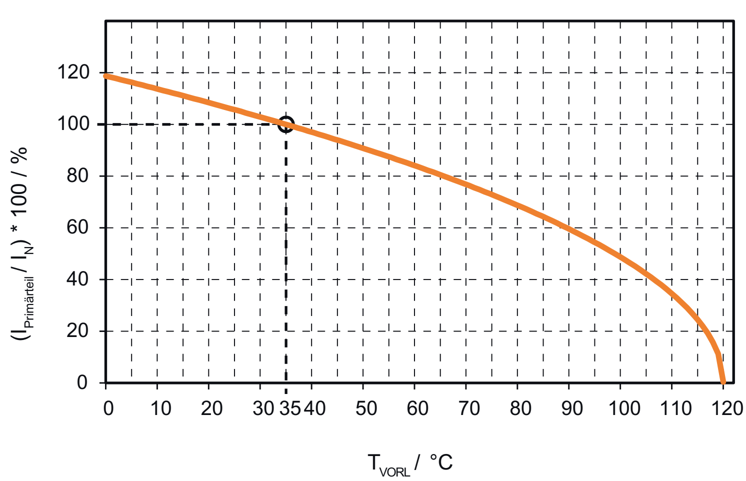


Figure 4-9 Influence of the coolant intake temperature

Heat-exchanger unit

Use a heat-exchanger unit to ensure an flow temperature of 35 °C. Several primary sections can be connected to a heat-exchanger unit. The heat-exchanger units are not included in the scope of delivery.

The cooling capacity is calculated from the sum of the power losses of the connected primary sections. Adapt the pump power to the specified flow and pressure drop of the cooling circuit.

For a list of companies from which you can obtain heat-exchanger units, see the appendix.

Dimensioning the cooling system

The power loss generated in the motor during continuous operation causes a thermal flow to take place. The surrounding machine assembly dissipates a small percentage of this thermal flow. The cooling system coolant dissipates the majority of this thermal flow. The cooling system must dissipate 85 % to 90 % of the power loss that occurs. Dimension the cooling capacity of the cooling system appropriately.

If you operate several primary sections simultaneously on one cooling system, the cooling system must be able to dissipate the sum of the individual power losses.

In continuous duty, only load the motor so much that the effective force of the load cycle F_{eff} does not exceed the rated force F_N.

$$\frac{P_V}{P_{V,N}} = \left(\frac{F_{eff}}{F_N}\right)^2$$

If you cannot determine the actual effective power loss P_V, you can alternatively add the rated power losses $P_{V,N}$ of all the primary sections to be used. The rated power losses $P_{V,N}$ of the primary sections are listed in the data sheets. Dimension the heat-exchanger unit based on the sum of the rated power losses determined $P_{V,N}$.

If the sum of the rated power losses $P_{V,N}$ is greater than the actual rms power loss P_V, then this will lead to an overdimensioning of the cooling system.

The cooling system must be sufficiently powerful to ensure the required coolant pressure even at the maximum volume flow rate.

4.1.3 Coolant

Providing the coolant

The customer must provide the coolant. The motors are designed for water cooling. The water must comply with the requirements corresponding to the corrosion protection agent.

NOTICE
Disintegration of O-rings and hoses
Using oil as coolant can lead to material incompatibilities. O-rings and hoses can disintegrate.
• Use water with anti-corrosion protection as coolant.

Use water with anti-corrosion protection agent

If you use water with corrosion protection agent as coolant, you can avoid scaling and the formation of algae and slime as well as corrosion.

This allows you to avoid the following damage and/or faults, for example:

- Worsening of the heat transfer
- Higher pressure losses due to restricted cross-sections
- Blockage of nozzles, valves, heat exchangers and cooling ducts

General requirements placed on the coolant

The coolant must be pre-cleaned or filtered in order to prevent the cooling circuit from becoming blocked. Formation of ice is not permissible.

Note

The maximum permissible size of particles in the coolant is 100 μm.

Requirements placed on the water

Water, which is used as basis for the coolant must comply as a minimum with the following requirements:

- Chloride concentration: $c < 100$ mg/l
- Sulfate concentration: $c < 100$ mg/l
- $6.5 \leq$ pH value ≤ 9.5

Coordinate additional requirements with the manufacturer of the anti-corrosion agent.

Requirements placed on the corrosion protection agent

The corrosion protection agent must comply with the following requirements:

- Basis is ethylene glycol (also "Ethandiol").
- Water and anticorrosion protection agent do not separate.
- The freezing point of the water used must be reduced down to at least -5 °C.
- The corrosion protection agent used must be compatible with the fittings and hoses of the cooling system as well as the materials used in the motor cooler.

Coordinate these requirements, especially the material compatibility, with the cooling equipment manufacturer and the manufacturer of the corrosion protection agent.

Suitable mixture

- 25 % - 30 % ethylene glycol (= ethanediol)
- The water used contains a maximum of 2 g/l dissolved mineral salt and is largely free from nitrates and phosphates

Recommended manufacturers are listed in the Appendix.

4.2 Degree of protection

NOTICE
Damage to the motor caused by pollution If the area where the motor is installed is polluted and dirty, then the motor can malfunction and clog up. • Keep the area where the motor is installed free of all dirt and pollution.

Primary section

The primary sections satisfy the requirements for IP65 degree of protection in accordance with EN 60529 and EN 60034-5.

Secondary sections

The secondary sections are protected against corrosion to a large degree via structural measures. Ensure that the air gap remains free of chips and other foreign bodies. Provide suitable covers for this. From a distance of 150 mm from the surface of the secondary section, hardly any more ferromagnetic particles are attracted.

Avoid using abrasive or corrosive substances (e.g. acids).

Installed motor

The better the motor installation space is protected against the ingress of foreign particles (especially true for ferromagnetic particles), the longer the motor service life. The space around the motor must be kept free of chips and other foreign bodies.

The degree of protection of the installed motor according to EN 60529 and EN 60034-5 is primarily dictated by the machine construction, but must be at least IP23.

4.3 Vibration response

The vibration response of build-in motors in operation essentially depends on the machine design and the application itself.

As a result of an unfavorable machine design, configuration or system settings, resonance points can be excited, so that vibration severity level A according to EN 6003414 is not reached.

Excessive vibration caused by resonance effects can frequently be avoided by making suitable settings. You can obtain support on the topics of "Application" and "Mechatronics" at AUTOHOTSPOT.

4.4 Noise emission

⚠ WARNING

Hearing damage

Hearing damage may occur if the motor exceeds a sound pressure level of 70 dB (A) due to the type of mounting or pulse frequency.

- Reduce the sound pressure level by implementing sound damping and/or soundproofing measures.

The following components and settings influence the noise levels reached when built-in motors are operational:

- Machine design
- Encoder system
- Bearing
- Controller settings
- Pulse frequency

As a result of unfavorable machine designs, configuration or system settings, measuring surface sound pressure levels of over 70dB (A) can occur. You can obtain support on the topics of "Application" and "Mechatronics" at AUTOHOTSPOT.

4.5 Service and inspection intervals

4.5.1 Safety instructions for maintenance

⚠ WARNING

Risk of injury as a result of inadvertent traversing motion

If, with the motor switched on, you work in the traversing range of the motor, and the motor undesirably moves, this can result in death, injury and/or material damage.

- Always switch off the motor before working in the traversing range of the motor. Ensure that the motor is in a completely no-voltage condition.

⚠ WARNING

Risk of death and crushing as a result of permanent magnet fields

Severe injury and material damage can result if you do not take into consideration the safety instructions relating to the permanent magnet fields of the secondary sections.

- Observe the information in Chapter "Danger from strong magnetic fields (Page 33)".

⚠ WARNING

Danger of crushing by permanent magnets of the secondary section

The forces of attraction of magnetic secondary sections act on materials that can be magnetized. The forces of attraction increase significantly close to the secondary section. The trigger threshold of 3 mT for a risk of injury due to attraction and projectile effect is reached at a distance of 150 mm (directive 2013/35/EU). Secondary sections and materials that can be magnetized can suddenly slam together unintentionally. Two secondary sections can also unintentionally slam together.

There is a significant risk of crushing when you are close to a secondary section.

Close to the secondary section, the forces of attraction can be several kN - example: Magnetic attractive forces are equivalent to a force of 100 kg, which is sufficient to trap a body part.

- Do not underestimate the strength of the attractive forces, and work very carefully.
- Wear safety gloves.
- The work should be done by at least two people.
- Do not unpack the secondary section until immediately before installation.
- Never unpack several secondary sections at the same time.
- Never place secondary sections next to one another without taking the appropriate precautions.
- Never place any metals on magnetic surfaces and vice versa.
- Never carry any objects made of magnetizable materials (for example watches, steel or iron tools) and/or permanent magnets close to the secondary section! If tools that can be magnetized are nevertheless required, then hold the tool firmly using both hands. Slowly bring the tool to the secondary section.
- Immediately mount the secondary section that has just been unpacked.
- When mounting and removing secondary sections, we recommend that you use protective mats with magnetic self-holding function
- Never remove several secondary sections at the same time.
- Immediately after removal, pack the removed secondary section in the original packaging.
- Always comply with the specified procedure.
- Avoid inadvertently traversing direct drives.
- Keep the following tools at hand to release parts of the body (hand, fingers, foot etc.) trapped between two components:
  - A hammer (about 3 kg) made of solid, non-magnetizable material
  - Two pointed wedges (wedge angle approx. 10° to 15°, minimum height 50 mm) made of solid, non-magnetizable material (e.g. hard wood).

⚠ WARNING

Risk of burning when touching hot surfaces

There is a risk of burning when touching hot surfaces immediately after the motor has been operational.

- Wait until the motor has cooled down.

⚠ **WARNING**

Risk of electric shock due to incorrect connection

There is a risk of electric shock if direct drives are incorrectly connected. This can result in death, serious injury, or material damage.

- Motors must always be precisely connected up as described in these instructions.
- Direct connection of the motors to the three-phase supply is not permissible.
- Consult the documentation of the drive system being used.

⚠ **WARNING**

Risk of electric shock

Voltage is induced at the power connections of the primary section each time a primary section moves with respect to a secondary section - and vice versa.

When the motor is switched on, the power connections of the primary section are also live.

If you touch the power connections you may suffer an electric shock.

- Only mount and remove electrical components if you have been qualified to do so.
- Only work on the motor when the system is in a no-voltage condition.
- Do not touch the power connections. Correctly connect the power connections of the primary section or properly insulate the cable connections.
- Do not disconnect the power connection if the primary section is under voltage (live).
- When connecting up, only use power cables intended for the purpose.
- First connect the protective conductor (PE).
- Attach the shield through a large surface area.
- First connect the power cable to the primary section before you connect the power cable to the converter.
- First disconnect the connection to the converter before you disconnect the power connection to the primary section.
- In the final step, disconnect the protective conductor (PE).

⚠ **WARNING**

Risk of electric shock as a result of residual voltages

There is a risk of electric shock if hazardous residual voltages are present at the motor connections. Even after switching off the power supply, active motor parts can have a charge exceeding 60 µC. In addition, even after withdrawing the connector 1 s after switching off the voltage, more than 60 V can be present at the free cable ends.

- Wait for the discharge time to elapse.

⚠ WARNING

Risk of injury when carrying out disassembly work

Risk of death, serious personal injury and/or material damage when carrying out disassembly work.

- When performing disassembly work, observe the information in Chapter "Decommissioning and disposal " in the Operating Instructions "SIMOTICS L-1FN3 Linear Motors."

The motors have been designed for a long service life. Carefully ensure that maintenance work is correctly performed, e.g. removing chips and particles from the air gap.

For safety reasons it is not permissible to repair the motors:

⚠ WARNING

Risk of injury when changing safety-relevant motor properties

Changing safety-relevant motor properties may result in death, serious injury and/or material damage.

Examples of changed safety-relevant motor properties:

Damaged insulation does not protect against arcing. There is a risk of electric shock!

Damaged sealing no longer guarantees protection against shock, ingress of foreign bodies and water, which is specified as IP degree of protection on the rating plate.

Diminished heat dissipation can result in the motor being prematurely shut down and in machine downtime.

- Do not open the motor.

Note

If incorrect changes or corrective maintenance are carried out by you or a third party on the contractual objects, then for these and the consequential damages, no claims can be made against Siemens regarding personal injury or material damage.

Technical Support is available for any questions you might have. Contact data is provided in the introduction.

⚠ CAUTION

Sharp edges and falling objects

Sharp edges can cause cuts and falling objects can injure feet.

- Always wear safety shoes and safety gloves!

4.5.2 Maintenance

Performing maintenance work on the motor

Note

It is essential that you observe the safety information provided in this documentation.

As a result of their inherent principle of operation, linear motors are always wear-free. To ensure that the motor functions properly and remains free of wear, the following maintenance work needs to be carried out:

- Regularly check that the traversing paths are free
- Regularly clean the motor space and remove foreign bodies (e.g. chips)
- Regularly check the condition of the motor components.
- Check the current consumption in the defined test cycle (compare with values of the reference travel)

Intervals between maintenance

Since operating conditions differ greatly, it is not possible to specify intervals between maintenance work.

Indications that maintenance work is required

- Dirt in the motor cabinet
- Distinctive changes in the behavior of the machine
- Unusual sounds emitted by the machine
- Problems with positioning accuracy
- Higher current consumption

4.5.3 Checking the insulation resistance

Notes for checking the insulation resistance

Installation inspection, preventive maintenance and troubleshooting are examples of required checking of the insulation resistance on a machine/system with direct drives or directly on the motors.

> ⚠ **WARNING**
>
> **Risk of electric shock**
>
> If you check the insulation resistance using high voltage, this can damage the motor insulation. There is a risk of death or serious injury if energized parts are touched.
>
> - Only use test equipment that is in compliance with DIN EN 61557-1, DIN EN 61557-2 and DIN EN 61010-1 or the corresponding IEC standards.
> - Check the insulation resistance on the individual motors only according to the following procedure.
> - If a DC voltage > 1000 V or an AC voltage is necessary to test the machine/system, then coordinate this test with your local sales partner.
> - Carefully observe the operating instructions of the test device.

Procedure

1. Interconnect all winding and temperature sensor connections. Check against the PE connection or the motor enclosure with a maximum voltage of 1000 VDC for maximally 60 s.
2. Connect all temperature sensor connections to the PE connection and interconnect all winding connections. Check the winding against the PE connection or the motor enclosure with a maximum voltage of 1000 VDC for maximally 60 s.

❒

Each insulation resistance must be at least 10 MΩ. A lower insulation resistance indicates that the motor insulation is damaged.

> ⚠ **WARNING**
>
> **Risk of death due to electric shock!**
>
> During and immediately after the measurement, in some instances, the terminals are at hazardous voltage levels, which can result in death if touched.
>
> - Never touch the terminals during or immediately after measurement.

4.5.4 Inspection and change intervals for the coolant

Inspection and change intervals for the coolant

You must coordinate inspection and change intervals for the coolant with the manufacturer of the cooling equipment and with the manufacturer of the anti-corrosion agent.

Motor components and options 5

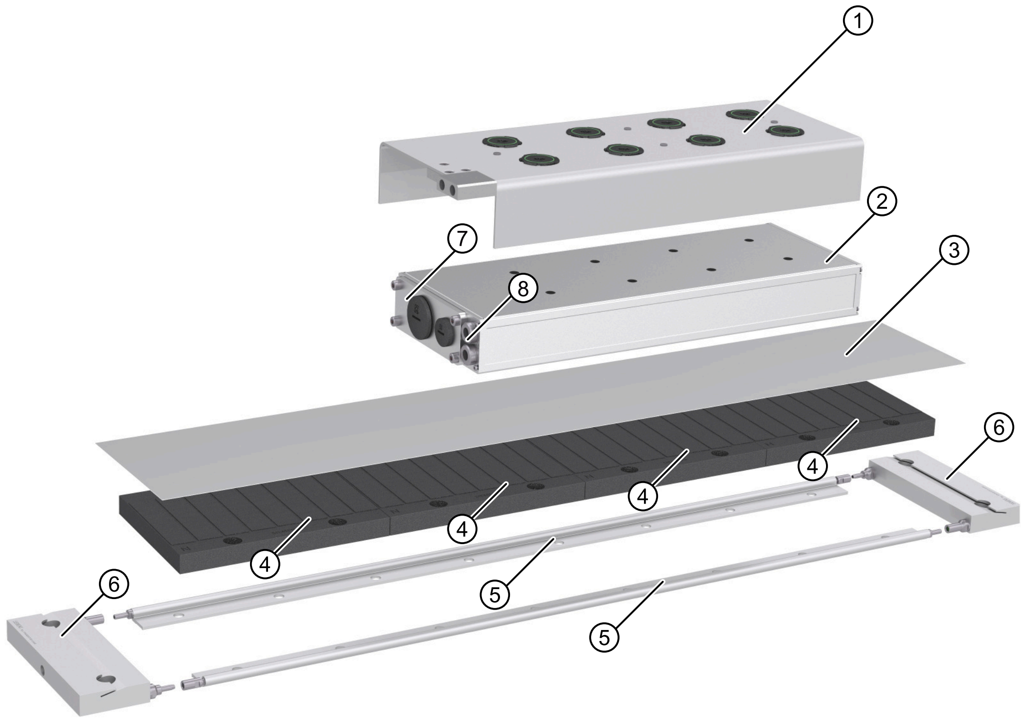
5.1 Motor components

5.1.1 Motor design

Motor components

Motors of the 1FN3 product family consist of the following components:

- Primary section:
  - Basic component of the linear motor
  - With 3-phase winding
  - Integrated main cooler to dissipate the power loss
- Secondary sections:
  - Mounted side-by-side these form the reactive part of the motor
  - Consist of a steel base with attached permanent magnets
  - The casing provides a large degree of protection against corrosion and external effects



① Precision cooler (option)	④ Secondary section	⑦ Connection cover for the electrical connection
② Primary section with main cooler	⑤ Cooling profile with plug coupling (option)	⑧ Main cooler connection
③ Secondary section cover (option), here as continuous cover strip; alternatively as segmented cover	⑥ Secondary section end piece (option)	

Figure 5-1 Components and options of a 1FN3 linear motor

5.1.2 Temperature monitoring and thermal motor protection

5.1.2.1 Temperature monitoring circuits Temp-S and Temp-F

The primary sections are equipped with two subsequently described temperature monitoring circuits - Temp-S and Temp-F.

- Temp-S activates the thermal motor protection when the motor windings are thermally overloaded. In this case the precondition is that Temp-S is correctly connected and evaluated. For a thermal overload, the drive system must bring the motor into a no-current condition.
- Temp-F is used for temperature monitoring and diagnostics during commissioning and in operation.

Both temperature monitoring circuits are independent of one another.

The SME12x Sensor Module or the TM120 Terminal Module evaluates the temperature sensor signals.

You can obtain commissioning information from Technical Support. Contact data is provided in the introduction.

Temp-S

To protect the motor winding against thermal overload, all primary sections are equipped with the following temperature monitoring circuit:

- 1 x PTC 120 °C temperature sensor per phase winding U, V, and W, switching threshold at 120 °C

The three PTC temperature sensors of this temperature monitoring circuit are connected in series to create a PTC triplet.

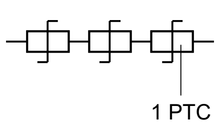


Figure 5-2 PTC triplet

Every phase winding is monitored so that also uneven currents - and therefore the associated different thermal loads of the individual phase windings - are detected. Different thermal loads of the individual phase windings also occur during the subsequent motion or operating states while the motor is simultaneously generating a force:

- Zero velocity (holding)
- Very slow travel (velocity < 0.5 m/min)
- Oscillation (stroke < 1 pole pitch)

Note

Shutdown time

If Temp-S responds, and its response threshold is not undershot again in the meantime, then the drive system must shut down (de-energize) the motor within 2 seconds. This prevents the motor windings from becoming inadmissibly hot.

NOTICE

Motor destroyed as a result of overtemperature

The motor can be destroyed if the motor winding overheats.

- Connect Temp-S.
- Evaluate Temp-S.
- Ensure that the shutdown time is not exceeded.

Note

No temperature monitoring with Temp-S

As a result of their non-linear characteristic, PTC temperature sensors are not suitable for determining the instantaneous temperature.

Temp-F

The Temp-F temperature monitoring circuit comprises an individual temperature sensor. Contrary to Temp-S, this temperature sensor only monitors one phase winding. As a consequence, Temp-F is only used for monitoring the temperature and diagnosing the motor winding temperature.

NOTICE

Motor destroyed as a result of overtemperature

If you use Temp-F for thermal motor protection, then the motor is not adequately protected against destruction as a result of overtemperature.

- Evaluate the Temp-S temperature monitoring circuit to implement thermal motor protection.

Temp-F as KTY 84 or Pt1000

The 16th digit of the order designation on the rating plate of the primary section indicates whether a KTY 84 or a Pt1000 is installed, see Rating plate data (Page 67):

1FN3xxx-xxxxx-xxx1: with KTY 84

1FN3xxx-xxxxx-xxx3: with Pt1000

No direct connection of the temperature monitoring circuits

WARNING

Risk of electric shock if the temperature monitoring circuits are incorrectly connected

In the case of a fault, circuits Temp-S and Temp-F do not provide safe electrical separation with respect to the power circuits.

- Use the TM120 or SME12x to connect temperature monitoring circuits Temp-S and Temp-F. You therefore comply with the directives for safe electrical separation according to DIN EN 61800-5-1 (previously safe electrical separation according to DIN EN 50178).

Correctly connecting temperature sensors

NOTICE

Motor destroyed as a result of overtemperature

The motor can be destroyed as a result of overtemperature if you do not correctly connect the temperature sensors.

- When connecting temperature sensor cables with open conductor ends, pay attention to the correct assignment of conductor colors.

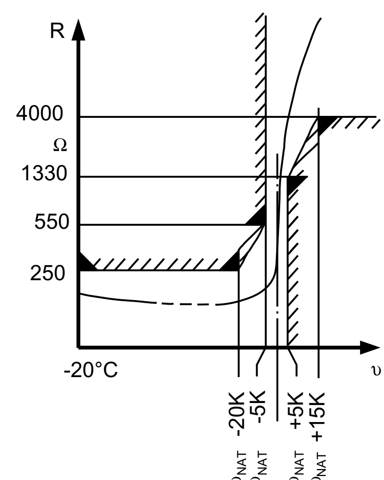
5.1.2.2 Technical features of temperature sensors

Technical features of PTC temperature sensors

Every PTC temperature has a "quasi-switching" characteristic. The resistance suddenly increases in the vicinity of the response threshold (nominal response temperature ϑ_{NAT}).

PTC temperature sensors have a low thermal capacity - and have good thermal contact with the motor winding. As a consequence, the temperature sensors and the system quickly respond to inadmissibly high motor winding temperatures.

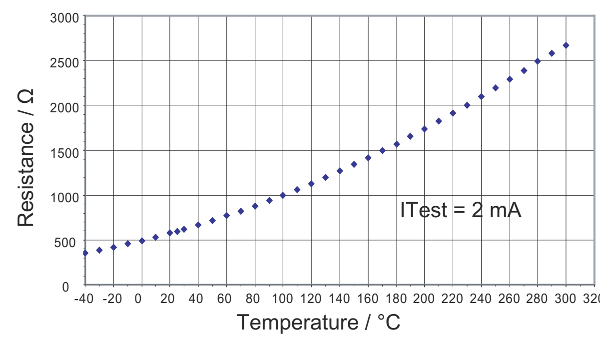
Table 5-1 Technical data of the PTC temperature sensors

Name	Description
Type	PTC triplet acc. to DIN 44082 Individual PTC temperature sensor according to DIN 44081
Response threshold (nominal response temperature ϑ_{NAT})	120 °C ± 5 K
PTC resistance R (20 °C) at the PTC triplet	See the characteristic **if -20 °C < T < ϑ_{NAT} -20 K** R ≤ 3 x 250 Ω R ≤ 750 Ω
Minimum resistance when hot R in the PTC triplet and in the individual PTC temperature sensor	See the characteristic **if T ≤ ϑ_{NAT} – 5 K** R ≤ 3 x 550 Ω R ≤ 1650 Ω **if T > ϑ_{NAT} + 5 K** R ≥ 3 x 1330 Ω R ≥ 3990 Ω **if T > ϑ_{NAT} + 15 K** R ≥ 3 x 4000 Ω R ≥ 12000 Ω
Typical characteristic R(ϑ) of a PTC temperature sensor according to DIN 44081	

Technical features of the KTY 84 temperature sensor

The KTY 84 has a progressive temperature resistance characteristic that is approximately linear. In addition, the KTY 84 has a low thermal capacity and provides good thermal contact with the motor winding. The KTY 84 has a continuous characteristic.

Table 5-2 Technical data of the KTY 84 PTC thermistor

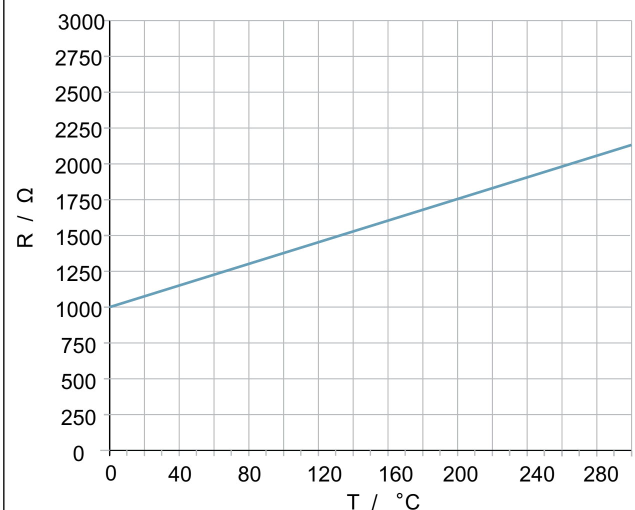
Name	Description
Type	KTY 84 according to EN 60034-11
Transfer range	-40 °C ... +300 °C
Resistance when cold (20 °C)	ca. 580 Ω
Resistance when warm (100 °C)	ca. 1000 Ω
Characteristic of a KTY 84	

Technical features of the Pt1000 temperature sensor

The Pt1000 has a linear temperature resistance characteristic. In addition, the Pt1000 has a low thermal capacity and provides good thermal contact with the motor winding.

Table 5-3 Technical data of the Pt1000 PTC thermistor

Name	Description
Type	Pt1000 according to EN 60751
Transfer range	0 °C ... +300 °C
Resistance when cold (20 °C)	ca. 1080 Ω

Name	Description
Resistance when warm (100 °C)	ca. 1380 Ω
Characteristic of a Pt1000	

System requirements for the Pt1000 temperature sensor

To use the Pt1000 together with the following systems, you will need at least the specified versions:

SINAMICS S120 Firmware V4.8 and V4.7 HF17

SINUMERIK V4.8 as well as V4.7 SP2 HF1 and V4.5 SP6

SIMOTION V4.5 (SINAMICS Integrated Firmware V4.8)

5.1.3 Encoders

Note

Siemens provides the Application & Mechatronic Support Direct Motors service

Contact your local sales partner if you require mechatronic support regarding the following topics:

- Mechanical design of the machine
- Closed-loop control technology to be used
- Resolution and measuring accuracy of the encoder
- Optimum integration of the encoder into the mechanical structure.

Siemens will support you with dimensioning, designing and optimizing your machine by means of measurement-based and computer-based analyses.

You can obtain additional information from your Siemens contacts. You will find the Internet link on "Technical Support" in the "Introduction". You can obtain support on the topics of "Application" and "Mechatronics" at Application & Mechatronic Support Direct Motors (mailto:motor.support.motioncontrol@siemens.com).

Encoder system

In the following, encoder system stands for position measuring systems, position encoders, encoders etc.

The encoder system has a range of different functions:

- Velocity actual value encoder for the velocity control
- Position encoder for closed-loop position control
- Pole position encoder (commutation)

The encoder system is not included in the scope of supply. Due to the wide range of different applications, it is not possible to provide a comprehensive list of suitable encoders here. A certain encoder type can be optimum for one application, but essentially unsuitable for another application.

Absolute position encoders with DRIVE-CLiQ, EnDat interface or incremental position encoders with 1 V_{PP} signal are preferred.

Requirements regarding the encoder

Your choice of encoder essentially depends on the following application and converter-specific conditions:

- Specified maximum velocity
- Specified velocity accuracy
- Specified positioning accuracy and resolution
- pollution level expected
- expected electrical/magnetic interference

- specified ruggedness
- electrical encoder interface

Observe the documentation of the drive system being used and the documentation of the encoder manufacturer.

Encoder systems available in the market use different scanning principles (magnetic, inductive, optical, ...).

In conjunction with this, high-resolution optical or magnetic systems must have a pulse clearance (or a grid spacing) of maximum 0.04 mm on the measuring standard.

Systems that do not have a high resolution (e.g. inductive, magnetic) must be designed to be significantly more rugged and insensitive to pollution. With pulse clearances in the range of approx. 1 mm on the measuring standard, these systems achieve measuring accuracies that are still sufficient to address positioning accuracy specifications for a many applications.

In some instances, encoder systems also internally interpolate the measurement signal. However, when being used on the drive system, this should be avoided as a result of the highly accurate internal interpolation of the measurement signal in the SINAMICS sensor modules.

Depending on the mechanical design of the machine regarding elasticity and natural oscillation, depending on the velocity and grid spacing of the measuring standard, oscillation can be excited and noise
generated.

Using a high-resolution optical measuring system, generally, when compared to other techniques, the best dynamic performance, highest control quality, high noise immunity, precision and low noise can be achieved. Further, excitation of oscillation can be also avoided.

Preconditions to achieve this include:

- The overall mechanical system, including motor and encoder mounting, permits this
- Extremely stiff dynamic machine design to avoid the excitation of low-frequency mechanical oscillation

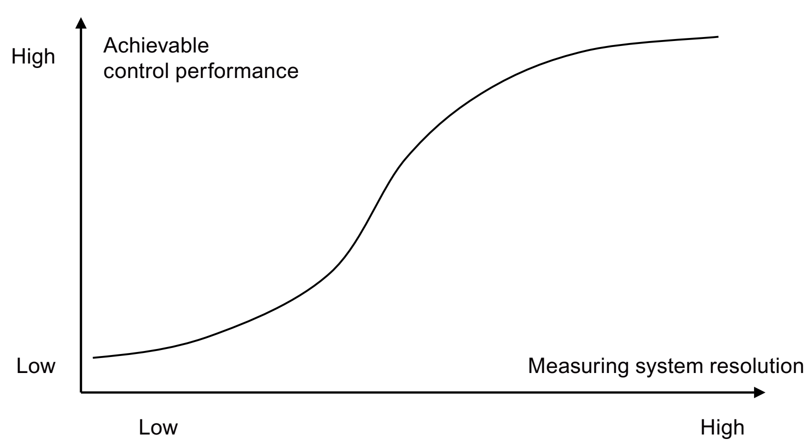


Figure 5-3 Performance-resolution diagram

Note

Siemens does not accept any warranty for the properties/features of third-party products.

⚠ WARNING

Uncontrolled motor motion due to incorrect commutation

Incorrect commutation can result in uncontrolled motor movements.

- Only carry out the work associated with replacing the encoder if you have been appropriately trained.
- When replacing an encoder, ensure the correct commutation setting.

Note

General mechanical conditions

Take into account the permissible velocity, limit frequency of the encoder and Control Unit. When configuring, mounting and adjusting the encoder refer to the appropriate documentation issued by the manufacturer!

Mechanical integration of the encoder

The mechanical integration of an encoder is defined by certain influencing factors, e.g.:

- The requirements specified by the encoder manufacturer (mounting specifications, ambient conditions)
- The closed-motor control (commutation) requires an adequately accurate connection between the motor and encoder without any play
- The closed-loop velocity and position control requires that the encoder is integrated into the mechanical structure with the highest possible stiffness and lowest possible vibration.
- Using the encoder as a position measuring system for the machine precision requires that the encoder is connected as close as possible to the process

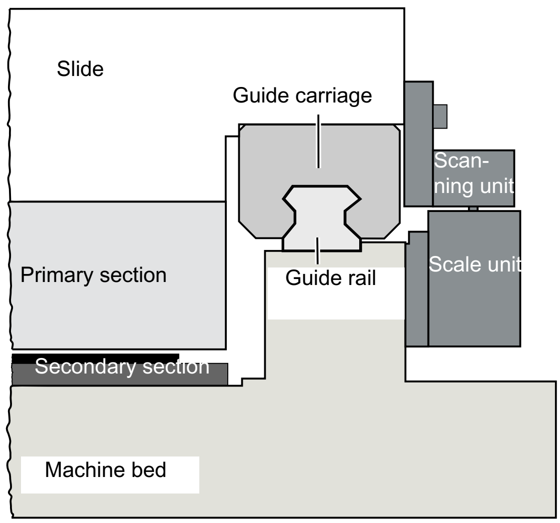
In addition to selecting a suitable encoder, the performance of the machine axis is essentially determined by the integration into the overall mechanical system.

As a consequence, a general recommendation for integrating the encoder cannot be given for all encoder types and axis concepts.

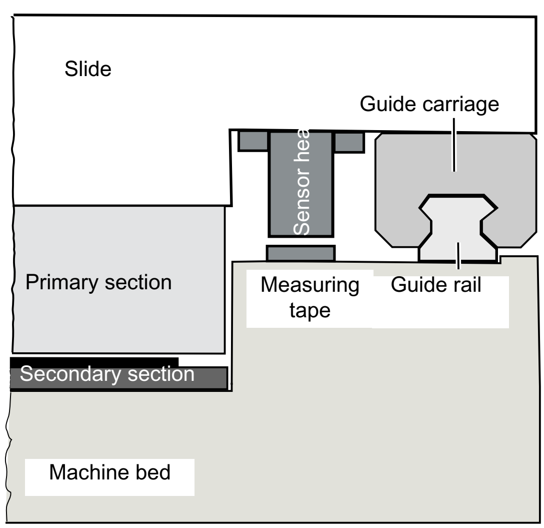
To ensure that the encoder is optimally integrated into the mechanical system, Siemens offers its "Mechatronic Support" service (see Catalog). For additional information, please contact your local Siemens office. You can find the "Technical Support" Internet link in Chapter "Introduction".

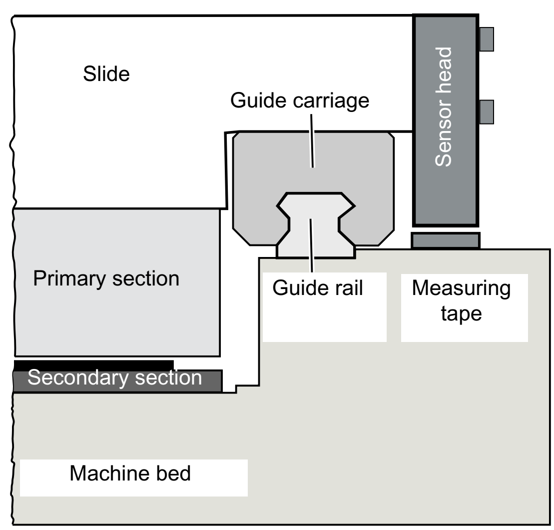
Three options for integrating an encoder are shown as example in the following example.

Schematic examples for a favorable encoder arrangement (examples)



Important integration features:
- short distance between motor and motor encoder
- stiff motor encoder mounting
- no force is introduced between motor and motor encoder





5.1.4 Hall Sensor Box

Use of the Hall sensor box

The Hall sensor box is used in incremental position measuring systems. It measures the motor pole position duirng power-up so that the drive can carry out a reference point approach (coarse synchronization). After the reference point approach, then a changeover can be made to a pole position angle saved in the software (fine synchronization). A Hall sensor box is required for motors for which, due to technical reasons, a software-based detection of the pole position is not possible. The Hall sensor box is also required for large gantry axes with 2 converters and 2 position measuring systems. Pole position identification of the two motors is not always possible due to the rigid coupling and potential twisting.

The Hall sensor must be adjusted to the respective motor and its pole width and be mounted at a certain position with respect to the primary section.

Selection criteria for Hall sensor boxes

The selection of the Hall sensor box depends on:

- the motor type (050...150 or 300...900)
- the length of the motor (1N...2N... or 1W...2W...)
- the location in which the Hall sensor box is fitted (on or opposite the cable outlet side of the primary section)
- the required cable outlet direction (in or perpendicular to the direction of travel)

Hall sensor box mounting types

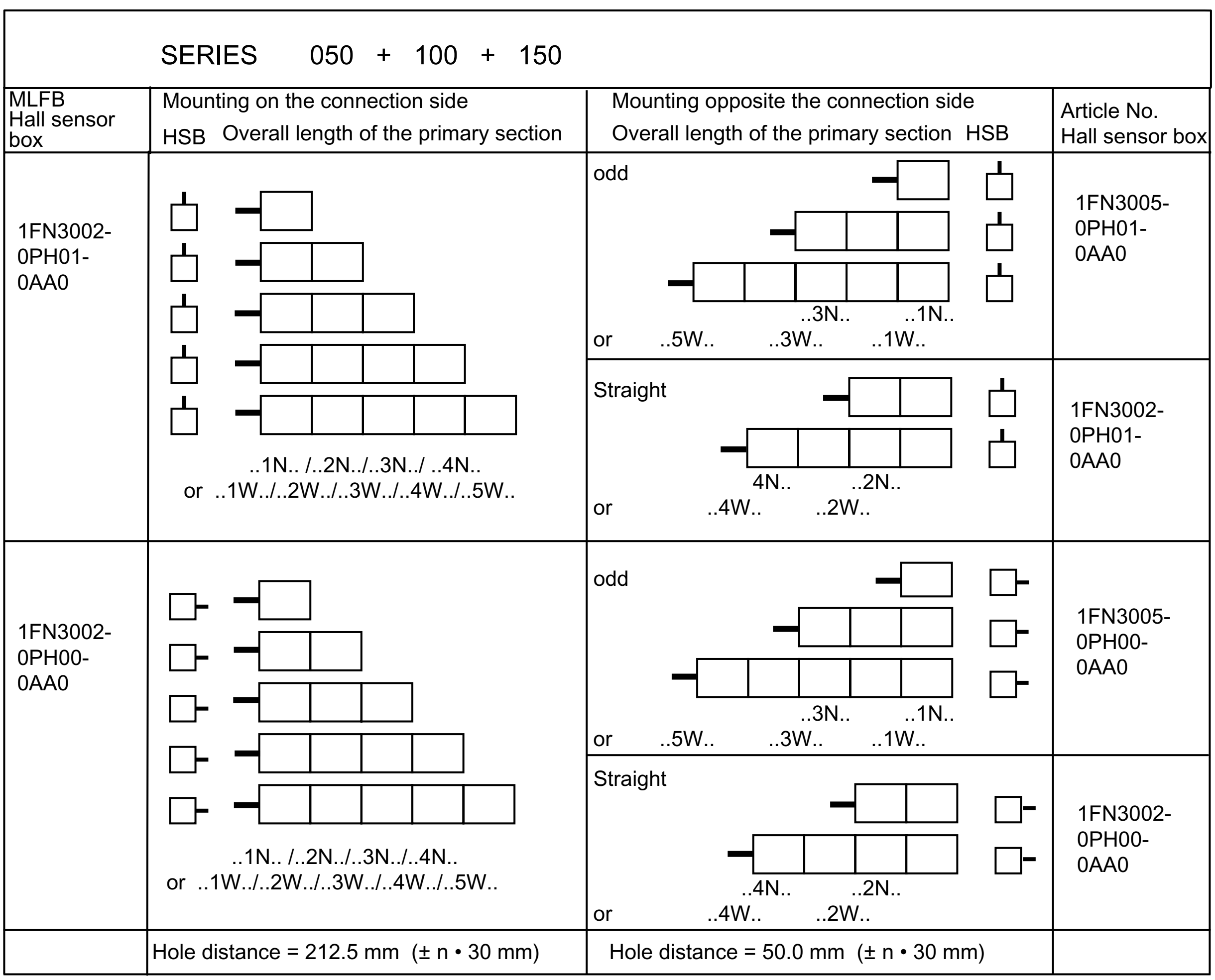


Figure 5-4 Hall sensor box mounting types for models 050 to 150

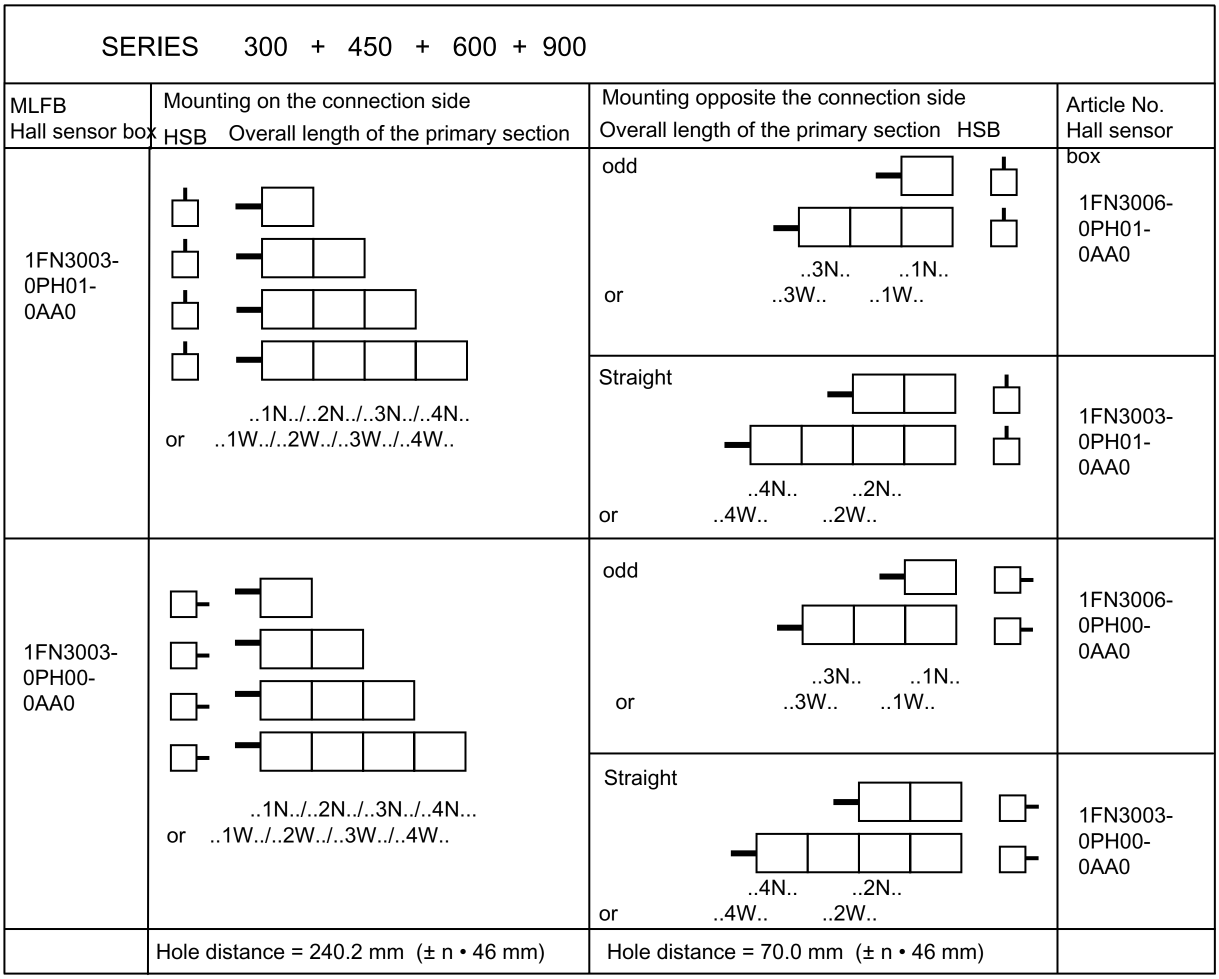


Figure 5-5 Hall sensor box mounting types for models 300 to 900

5.1.5 Braking concepts

> ⚠ **WARNING**
>
> **Uncontrolled motion when malfunctions occur**
>
> Malfunctions can lead to uncontrolled motion of the drive.
>
> - Provide measures so that in the case of a fault, the maximum kinetic energy of the machine slide can be braked.

Possible malfunctions

Malfunctions can occur e.g. for:

- Power failure
- Encoder failure, encoder monitoring responds

- Higher-level control failure (e.g., NCU); bus failure
- Control Unit failure
- Drive fault
- Faults in the NC

Braking and emergency stop concepts

The design and calculation of brake systems depends on the maximum kinetic energy, i.e. on the maximum mass of the machine slide and its maximum velocity. The calculation can therefore only be performed for a specific machine.

To ensure safe braking of the machine slide in the event of faults, adequately dimensioned damping elements and devices must be used at the ends of the traversing paths. If there are several slides on one axis, damping elements and devices must also be mounted between the slides.

In order to reduce the kinetic energy of the slide before it hits the damping elements, the following additional measures can also be applied (including in combinations):

1. Electrical braking using the energy in the DC link:
   Consult the documentation of the drive system being used.
2. Electrical braking by short-circuiting the primary section (corresponds to an armature short-circuit):
   Also see the documentation of the drive system used.
   Disadvantage: The brake force depends on the speed (see the short-circuit braking characteristic in the chapter: "Technical data and characteristics (Page 183)") Short-circuit braking is not suitable to completely brake the slides.
   If electrical braking by short-circuiting the primary section is used, special contactors are required because the currents can be very high. The enable timing for the drive system must be taken into consideration.
3. Mechanical braking via braking elements:
   The braking capacity must be dimensioned as highly as possible so that the slide can be safely braked at maximum kinetic energy.
   Disadvantage: The relatively long response time of the brake control system leads to long, unbraked traversing distances.

We recommend that all three measures be implemented together. Measures (2) and (3) are used as an additional protection here in case Measure (1) fails: The short-circuiting of the primary section works at high velocities first and then the mechanical brake takes effect at lower velocities.

You will find the recommended manufacturers in the appendix.

Use of a holding brake

Due to latching forces, the motors can be pulled into a preferred magnetic position if the motor is no longer supplied with power from the drive. If the drive is already at a standstill, this can cause unexpected movements in up to a half magnetic pole pitch in both directions. To prevent possible damage to the workpiece and/or tool, the use of a holding brake may be appropriate.

Due to the missing mechanical self-locking, a holding brake should be provided in case of inclined or vertical drives without weight compensation so that the drive can be shut down and de-energized in any position.

A holding brake may also be required if:

- The bearing friction does not compensate or exceed the latching forces and unexpected movements result
- Unexpected movements of the drive can lead to damage (e.g. a motor with a large mass also achieves a large kinetic energy)
- Weight-loaded drives must be shut down and de-energized in any position

5.2 Options

The following options exist for motors of the 1FN3 product family:

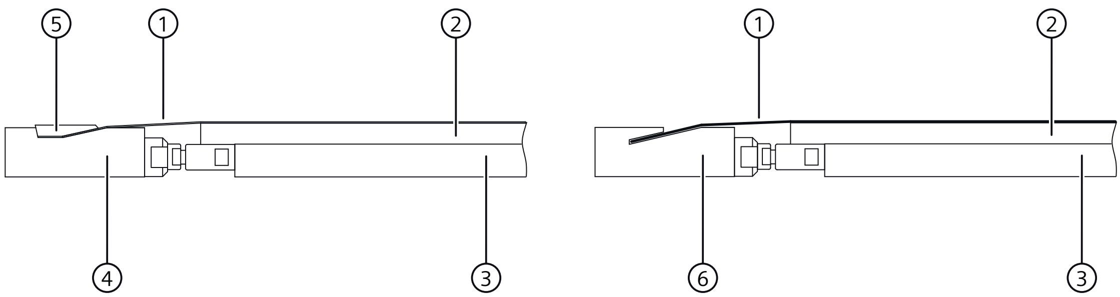
- Precision cooler:
  - Additional cooler to minimize the heat transfer to the machine in accordance with the Thermo-Sandwich® principle
  - Recommended for applications with high precision requirements
- Z option "R01" - O rings for the precision cooler:
  - to increase the degree of protection of the primary section to IP☐7
- Secondary section cover:
  - Mechanical protection for secondary sections
  - Stainless steel plate that can be magnetized (thickness d = 0.4 mm)
  - Adheres to secondary sections
  - Can be removed without tools if worn
  - Available as a continuous cover strip or as a segmented cover with fixed lengths
- Cooling sections with plug-in connection/hose nipple:
  - Secondary section cooling component
  - Aluminum rail sections with integrated cooling channels
  - Are placed under the secondary sections when high machine precision is required
- Secondary section end pieces:
  - Secondary section cooling component
  - Used to hold down the continuous cover for the secondary sections
  - Available in different versions
- Protection mat with yoke function
  - Accessories for 1FN3 secondary sections, e.g. for installation and removal

Secondary section end pieces

Secondary section end pieces are required to fasten the continuous cover strip for secondary sections.

With respect to fastening the cover strip, secondary section end pieces are available in 2 versions as shown in the following diagram:

- Secondary section end piece with wedge and screwed joint
- Secondary section end piece for clamping



① Continuous cover strip for secondary sections	④ Secondary section end piece with wedge and screwed joint
② Secondary section track	⑤ Wedge
③ Heatsink profile	⑥ Secondary section end piece for clamping

Figure 5-6 Secondary section end piece versions (side view)

Further, secondary section end pieces make it easier to connect the coolant as a result of the standard connections used. Combi distributors or combi adapter / combi end pieces close the cooling circuit at the beginning and end of the secondary section track.

As standard, combi distributors are used as secondary section end pieces. Combi distributors are available for all frame sizes. As an alternative, for frame sizes 1FN3050 ... 450, you can also use combi adapters/combi end piece or the cover end pieces.

Overview of the variants

The following secondary section end piece variants are available:

- Combi distributor:
  - Standard solution for using secondary section end pieces
  - Available for all frame sizes
  - Fastens the continuous cover strip for the secondary sections at the beginning and end of the secondary section track
  - Is used to connect and branch the coolant in parallel routes at the beginning of the secondary section track:
    2 cooling sections for 1FN3050 ... 450 or
    3 cooling sections for 1FN3600 ... 900
  - Combines the coolant flow and connects the coolant discharge at the end of the secondary section track.
- Combination adapter/combination end piece:
  - Available for frame sizes 1FN3050 ... 1FN3450
  - Fastens the continuous cover strip for the secondary sections at the beginning and end of the secondary section track
  - Is used to connect the coolant and route the coolant: The connections for the coolant intake and return are provided at the combi adapter. The combination end pieces are required to route the coolant at the other end of the secondary section track.
- Cover end piece:
  - Available for frame sizes 1FN3050 ... 1FN3450
  - Fastens the continuous cover strip for the secondary sections at the beginning and end of the secondary section track

Protective mat with magnetic self-holding function

The protective mat with magnetic self-holding function

- Is an aid when installing or removing secondary sections.
- Is a foam mat reinforced with sheet metal that is placed down on a secondary section.
- Reduces the force of attraction of the permanent magnet fields and therefore the risk of injury when handling secondary sections.
- Can be ordered under Article number 1FN3xxx-4RS00-0AB0 in a package that contains 4 mats.
- Is presently available for frame sizes 1FN3300 and 1FN3450. In this case, the length of the protection mat corresponds to the secondary section length.

You can equip secondary sections, frame size 1FN3600 with 2 adjacent protection mats with Article number 1FN3300-4RS00-0AB0.

You can equip secondary sections, frame size 1FN3900 with 2 adjacent protection mats with Article number 1FN3450-4RS00-0AB0.

Configuration 6

Note

Siemens provides the Application & Mechatronic Support Direct Motors service

Contact your local sales partner if you require mechatronic support regarding the following topics:

- Mechanical design of the machine
- Closed-loop control technology to be used
- Resolution and measuring accuracy of the encoder
- Optimum integration of the encoder into the mechanical structure.

Siemens will support you with dimensioning, designing and optimizing your machine by means of measurement-based and computer-based analyses.

You can obtain additional information from your Siemens contacts. You will find the Internet link on "Technical Support" in the "Introduction". You can obtain support on the topics of "Application" and "Mechatronics" at AUTOHOTSPOT.

6.1 Configuring software

6.1.1 TST engineering tool (TIA-Selection-Tool)

Overview

The TIA-Selection-Tool (TST) engineering tool supports you when dimensioning the hardware and firmware components required for a drive application.

TST supports the following configuration steps:

- Configuring the power supply
- Designing the motor and gearbox, including calculation of mechanical transmission elements
- Configuring the drive components
- Compiling the required accessories
- Selection of the line-side and motor-side power options

The configuration process produces the following results:

- A parts list of components required (Export to Excel)
- Technical specifications of the system

- Characteristic curves
- Comments on system reactions
- Design information of the drive and control components
- Energy considerations of the configured drive systems

You can find additional information that you can download in the Internet at TST (https://support.industry.siemens.com/cs/ww/en/view/109767888).

6.1.2 SINAMICS Startdrive Drive/Commissioning Software

Overview

The SINAMICS Startdrive commissioning tool offers

- Commissioning
- Optimization
- Diagnostics

You can find additional information that you can download in the Internet at SINAMICS Startdrive (https://support.industry.siemens.com/cs/ww/en/view/109794362).

Table 6-1 Article number for the SINAMICS Startdrive commissioning tool

Commissioning tool	Article no. of the DVD
SINAMICS Startdrive V17 German, English, French, Italian, Spanish, Chinese (simplified)	Startdrive Basic V17: 6SL3072-4HA02-0XA0 Startdrive Advanced V17: 6SL3072-4HA02-0XA5 Startdrive Advanced V17 Upgrade: 6SL3072-4HA02-0XE5 Software Update Service (SUS) for Startdrive Advanced: 6SL3072-4AA02-0XL8

6.2 Configuring workflow

Requirements

The selection of a suitable linear motor depends on:

- the peak force, effective force of the duty cycle and static force required for the application
- The desired velocity and acceleration
- The installation space available
- The desired or possible drive arrangement (e.g. single-sided, parallel, or double-sided arrangement)
- The required cooling system

Sequence

As a rule, the motor selection is an iterative process as, especially with high dynamic direct drives, the intrinsic mass of the motor type also determines the required powers. The following figure is a flowchart of this process.

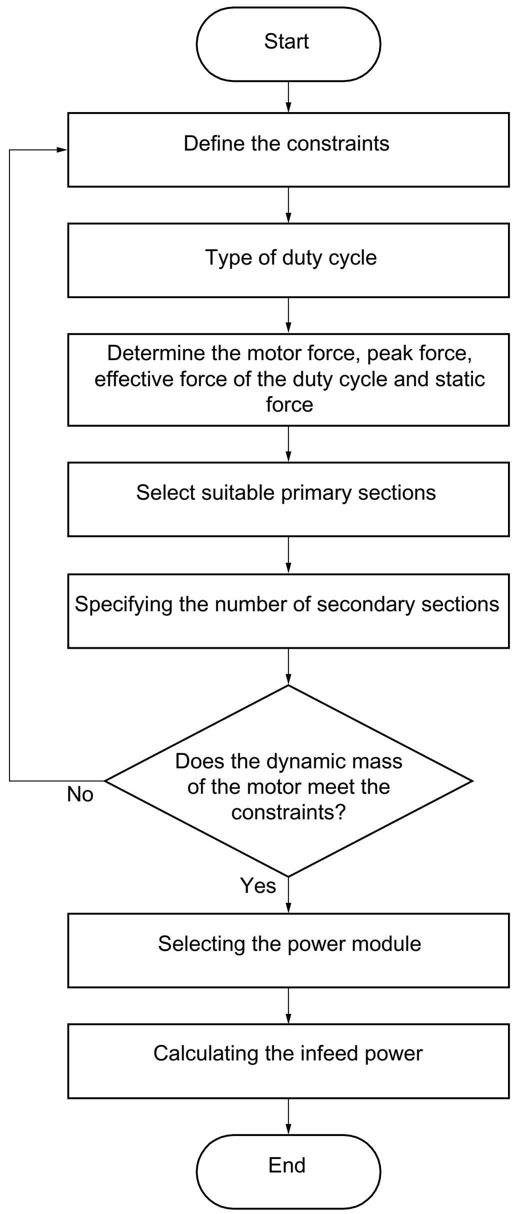


Figure 6-1 Flowchart for the drive configuration

6.2.1 Mechanical boundary conditions

Introduction

The constraints that influence the selection of the motor include:

- Dynamic masses (incl. motor mass)
- Effects of gravitation
- Friction
- Machining forces
- Travel lengths
- The drive configuration

Dynamic masses

All machine parts, equipment in the cable carrier, covers, mounting parts, etc. that the motor has to move, must be included in the calculation of the dynamic mass. The mass of the motor component moved must also be added. As this is not known – the motor still has to be selected – the mass of a motor type that is approximately suitable must be used. If, during the further calculation, it is found that the assumed mass is badly incorrect, an additional iteration step is required for the motor selection.

In contrast to rotary drives with a mechanical gear reduction, all load masses are fully included in the acceleration capacity of the drive for a direct drive.

Gravitation

Every mass is subject to gravity. The motor must thus compensate for part of the gravitational force F_G exerted on the dynamic mass. This component F_g depends on the dynamic mass m, the mounting position of the axis in relation to the Earth's normal (angle α), and any weight compensation used. The following figure shows the forces on the motor due to gravitation for an inclined mounting position. Variable $F_\perp$ is the component of the force of gravity that acts perpendicularly to the inclined axis.

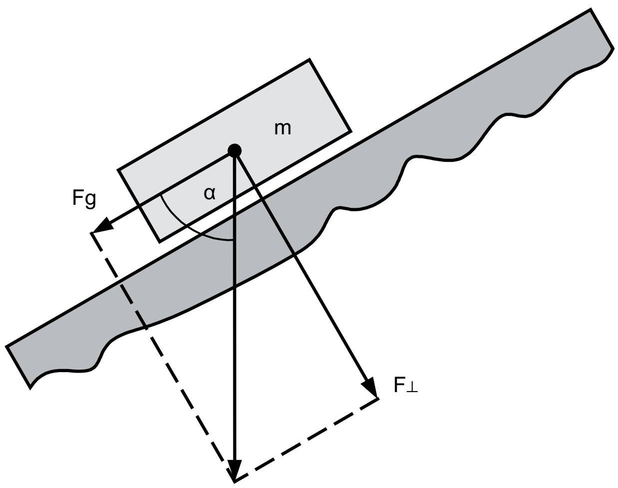


Figure 6-2 Forces on the motor for an inclined mounting position

According to the force components in the above figure, the component of the gravitational force that has to be compensated by the motor is calculated using

$F_g = m \cdot g \cdot \cos \alpha$

with the gravitational acceleration g.

When using a weight compensation, you must consider that the compensation does not automatically amount to 100% and is linked to additional frictional forces and inert masses.

Friction

Friction that impedes the movement of a linear motor occurs between the guide carriage and the guide rail. The corresponding force F_r opposes the direction of motion of the slide.

Essentially, the frictional force F_r consists of a constant component F_{rc} and a component F_{rv} that is proportional to the velocity v :

$F_r = F_{rc} + F_{rv}$

Both components depend on the type of linear guide used and its loading. Loads are also included which, depending on the mechanical design version, especially include the forces due to gravity ($F_\perp$ from the diagram above) and magnetic forces of attraction F_{magn} between the motor components as well as tension forces F_{spann} between the various guide elements. All these forces result in a force F_n that is perpendicular ("normal") to the axis:

$F_n = F_\perp + F_{magn} + F_{spann}$

If you set $F_{rc} = \mu_{rc} \cdot F_n$ and $F_{rv} = \mu_{rv} \cdot v \cdot F_n$, the frictional force will be

$F_r = \mu_{rc} \cdot F_n + \mu_{rv} \cdot v \cdot F_n$

High linear motor velocities can also result in extremely high frictional force values. Note the specifications of the linear guide manufacturer for the calculation of the frictional forces!

The following figure shows a simplified example for the velocity curve and the correspondingly occurring frictional forces in a motor.

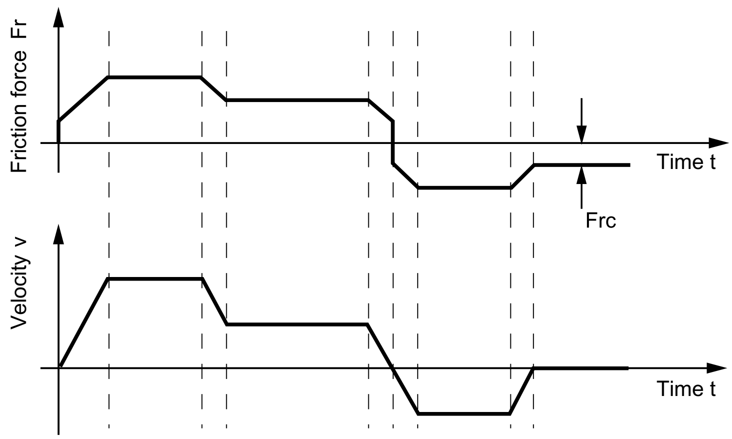


Figure 6-3 Example of frictional forces

6.2.2 Specification of the duty cycle

Uninterrupted duty S1

With uninterrupted duty S1, the motor runs permanently with a constant load. The load period is sufficient to achieve thermal equilibrium.

The rated data is of relevance when dimensioning the motor for uninterrupted duty.

NOTICE
Motor overload An excessively high load can lead to shutdown, or if the temperature sensors are not correctly evaluated, then the motor could be destroyed. • Ensure that the load does not exceed the value I_N specified in the data sheets! • Ensure that the temperature sensors are correctly connected and evaluated.

Short-time duty S2

For short-time duty S2 the load duration is so short that the final thermal state is not reached. The subsequent zero-current break is so long that the motor practically cools down completely.

NOTICE
Motor overload
An excessively high load can lead to shutdown, or if the temperature sensors are not correctly evaluated, then the motor could be destroyed. • Ensure that the load does not exceed the value I_{MAX} specified in the data sheets! • Ensure that the temperature sensors are correctly connected and evaluated.

The motor may only be operated for a limited time $t < t_{MAX}$ with a current $I_N < I_M \leq I_{MAX}$. The time t_{MAX} can be calculated using the following logarithmic formula:

$$t_{MAX} = t_{TH} \cdot \ln\left(\frac{v}{v - 1}\right)$$

with $v = (I_M / I_N)^2$ and thermal time constants t_{TH}.

The thermal time constants, the maximum currents and the rated currents of the motors can be taken from the data sheets.

The above equation is valid under the precondition that the initial temperature of the motor - the intake temperature of the water cooling T_{VORL} corresponds to what is specified in the data sheet.

Example

The 1FN3300-2WC00-0AA1 motor is to be run with maximum current from the cold condition.

- I_{MAX} = 39.2 A, I_N = 12.6 A; this results in v = 9.679
- t_{TH} = 120 s

$$t_{MAX} = 120\ \text{s} \cdot \ln\left(\frac{9.679}{9.679 - 1}\right)$$

$$t_{MAX} \approx 13\ \text{s}$$

The motor can be operated for a maximum of 13 s at maximum current.

Intermittent duty S3

With intermittent duty S3, periods of load time Δt_B with constant current alternate with periods of downtime Δt_S with no current feed. The motor heats up during the load time and then cools down again while at standstill. After a sufficient number of duty cycles with cycle duration $\Delta t_{Spiel} = \Delta t_B + \Delta t_S$, the temperature characteristic oscillates between a constant maximum value T_o and a constant minimum value T_u; see figure below.

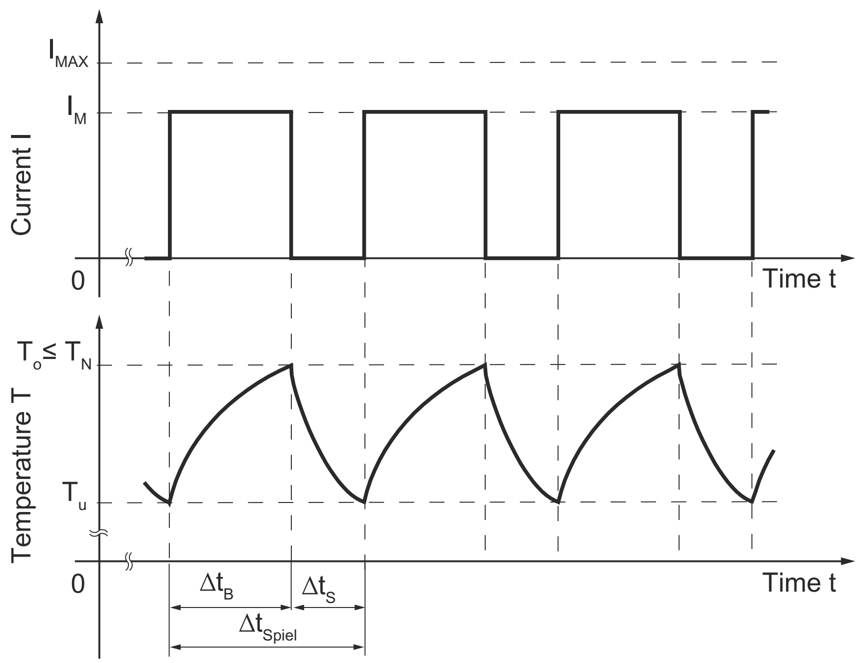


Figure 6-4 Current and temperature characteristic for intermittent duty S3

For currents $I_N < I_M \leq I_{MAX}$, it is not permissible that the rms current exceeds the rated current:

$$I_{eff} = \sqrt{\frac{1}{\Delta t_{Spiel}} (I_M^2 \cdot \Delta t_B)} = I_M \sqrt{\frac{\Delta t_B}{\Delta t_{Spiel}}} < I_N$$

In this case, the cycle duration should not be longer than 10 % of the thermal time constant t_{TH}. If a longer cycle duration is required, then contact your local sales partner.

Example

With a thermal time constant of t_{TH} = 120 s, the maximum permissible cycle duration $\Delta t_{Spiel} = 0.1 \cdot 120$ s = 12 s.

Significance of the duty cycle

In addition to the frictional and gravitational forces, the duty cycle is decisive for the choice of motor. The duty cycle contains information regarding the sequence of motion of the drive axis and the machining forces that occur in the process.

Motion sequence

The motion sequence can be specified as a distance-time diagram, velocity-time diagram or acceleration-time diagram, see following figure.

In accordance with the following relationships:

$$a(t) = \frac{dv}{dt} = \frac{d^2s}{dt^2}$$

the diagrams for the sequence of motion can be converted to one other.

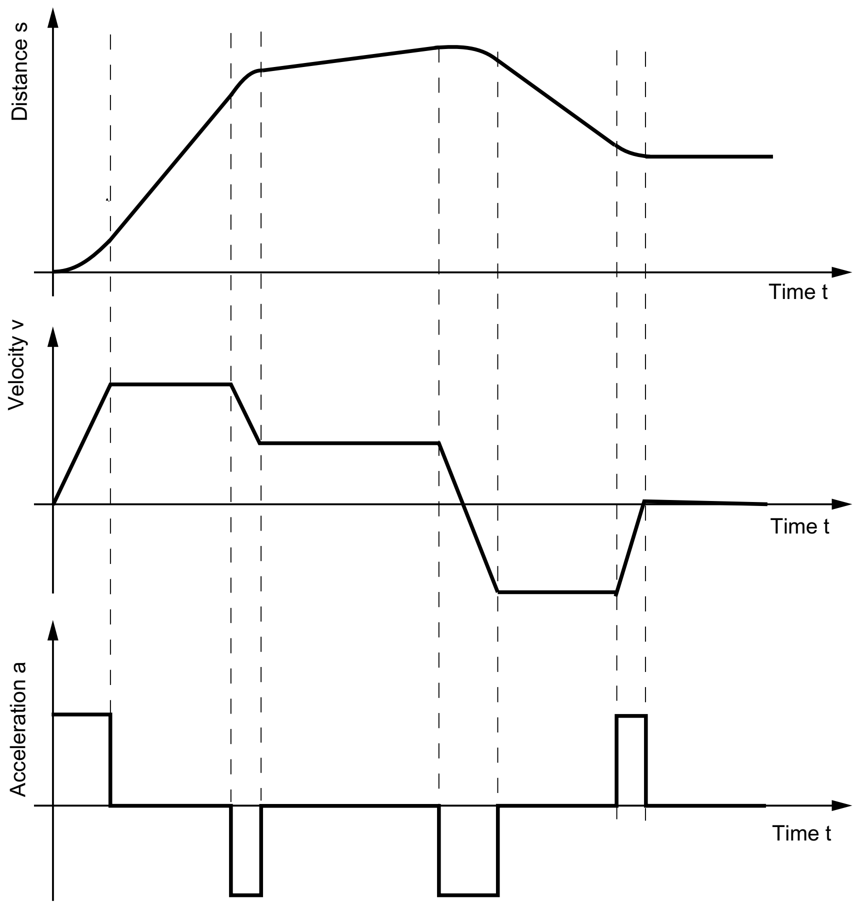


Figure 6-5 Example for the sequence of motion of a linear motor in diagrams

The inertia forces that result from the sequence of motion and that the motor must compensate for, are proportional to the acceleration a and the dynamic mass m:

$F_a = m \cdot a$

They oppose the direction of acceleration.

A *machining force* - time diagram for a motor could look like the following figure. The velocity-time diagram serves as a comparison.

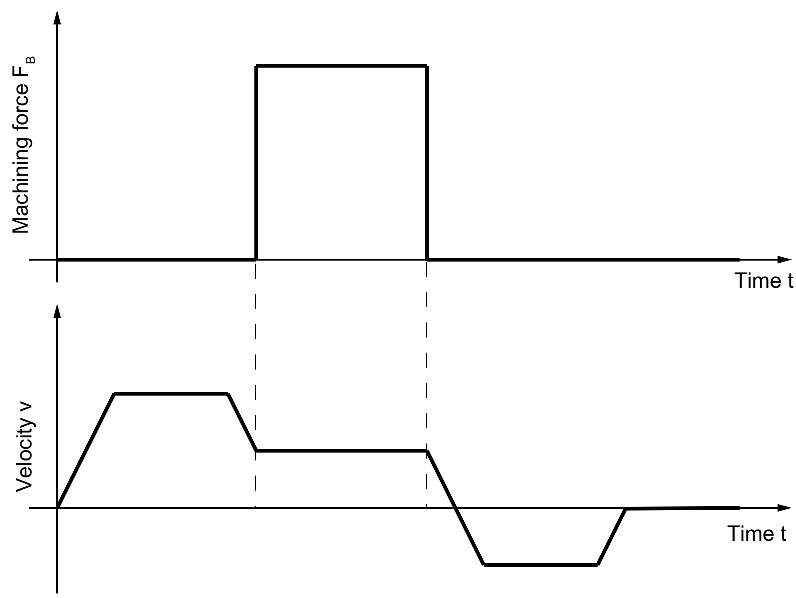


Figure 6-6 Example of a machining force-time diagram

6.2.3 Calculating forces

Determination of the motor force

The force that the motor has to provide consists of the sum of the individual forces at any time. When doing this, you must take into account the signs of the forces.

The following diagram shows an example of the individual forces for a linear motor and the resulting motor force F_M.

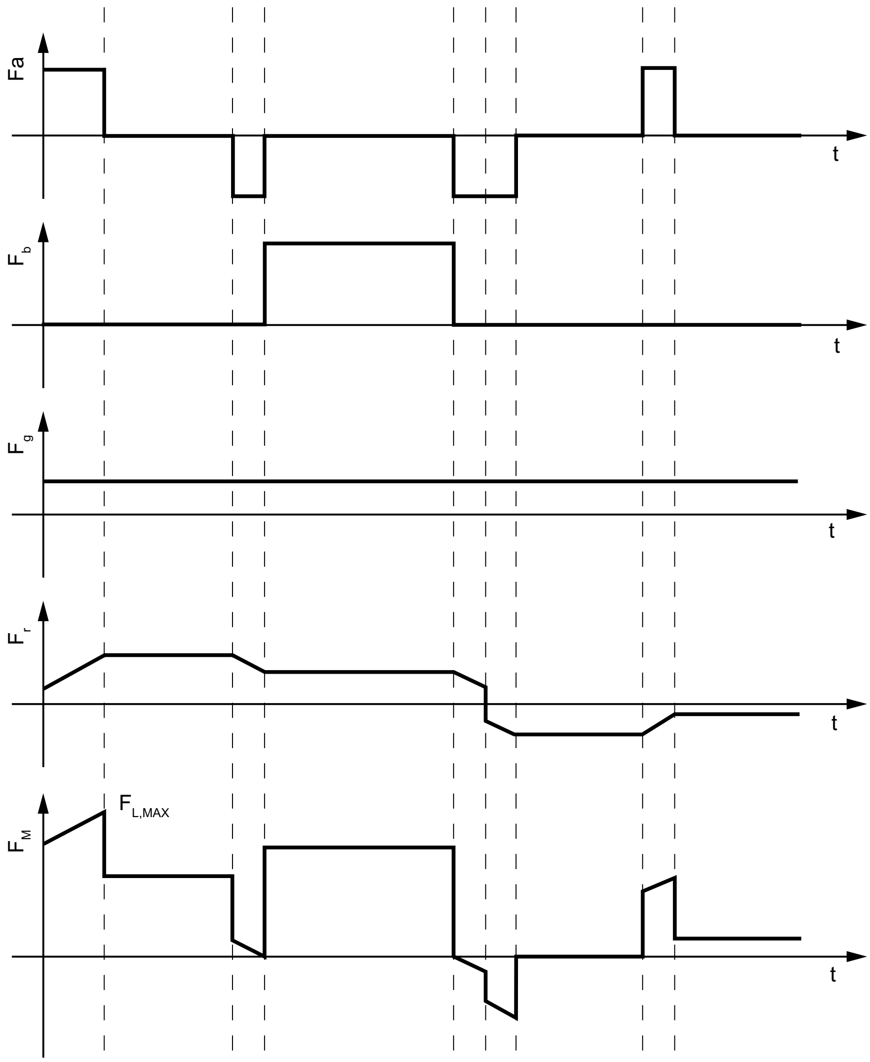


Figure 6-7 Example of the individual forces for a linear motor and the resulting motor force

Determination of the peak force

Peak force $F_{L,MAX}$ can be determined from the diagram above. This force is the maximum force of the duty cycle that the motor must provide.

Calculation of the effective force of the duty cycle

In addition to the peak force, the required effective force of the duty cycle of the motor is decisive for its dimensioning. The *maximum* effective force of the duty cycle of the motor F_{eff} is calculated from the square mean of the motor force over the entire time Δt_{ges} of a sequence of motion and must not exceed the rated force F_N:

$$F_{eff} = \sqrt{\frac{1}{\Delta t_{ges}} \int_0^{\Delta t_{ges}} F^2(t)\, dt} \leq F_N$$

When the motor force is constant over sections, this simplifies the integral for the sum, as shown in the following figure:

$$F_{eff} = \sqrt{\frac{1}{\Delta t_{ges}} \sum F_i^2 \cdot \Delta t_i} = \sqrt{\frac{1}{\Delta t_{ges}} \left(F_1^2 \cdot \Delta t_1 + F_2^2 \cdot \Delta t_2 + F_3^2 \cdot \Delta t_3 + \ldots\right)}$$

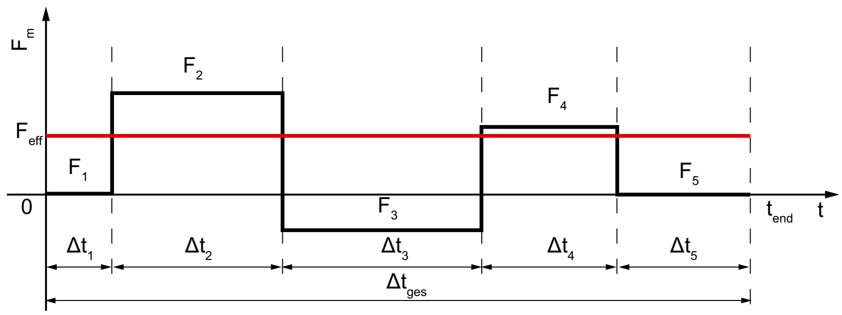


Figure 6-8 Effective force of the duty cycle with motor force constant over sections

The equations stated above apply to calculation of the effective forces. For more precise calculations, you must replace the forces by the corresponding currents, and determine the rms current. You must take into account the effects of motor saturation.

6.2.4 Selection of the primary sections

Requirements relating to the primary section

Whether a primary section can fulfill the requirements from the duty cycle, depends on the following items:

- Rated force F_N of the primary section must be greater than or equal to the calculated value of the effective force of the duty cycle F_{eff}.
- The primary section should have approximately 10% control reserve over the required peak load force $F_{L,MAX}$, in order to avoid undesired limitation effects when control circuits oscillate.
- All required forces can be achieved at the required velocities.
- Overload phases of the duty cycle must not lead to shutdown by the temperature monitoring.

In addition to the requirements from the duty cycle, mechanical installation conditions may influence the choice of motor. The same motor forces may often be generated by different types of primary sections.

If several primary sections are involved in the force generation of the axis, the values for the maximum forces and rated forces of the individual motors must be added. For a gantry axis with uneven distribution of the weight, the distribution of force among the individual motors is not even. In this case, the force requirements on the individual motors must be considered separately.

Motor-velocity-characteristic

The first two items are used for a preselection of the possible primary sections. If some constraints such as the machining forces and frictional forces are not exactly known, it is best to plan with larger margins.

To determine whether a primary section actually fulfills the requirements from the duty cycle, the motor force - velocity characteristic curve, which results from the required sequence of motion and the motor force - time diagram, is required. In this case, only the absolute values for motor force and velocity are decisive, not the directions. All points of the motor force - velocity characteristic curve must be below the force - speed characteristic curve of the primary section that is specified in the data sheets.

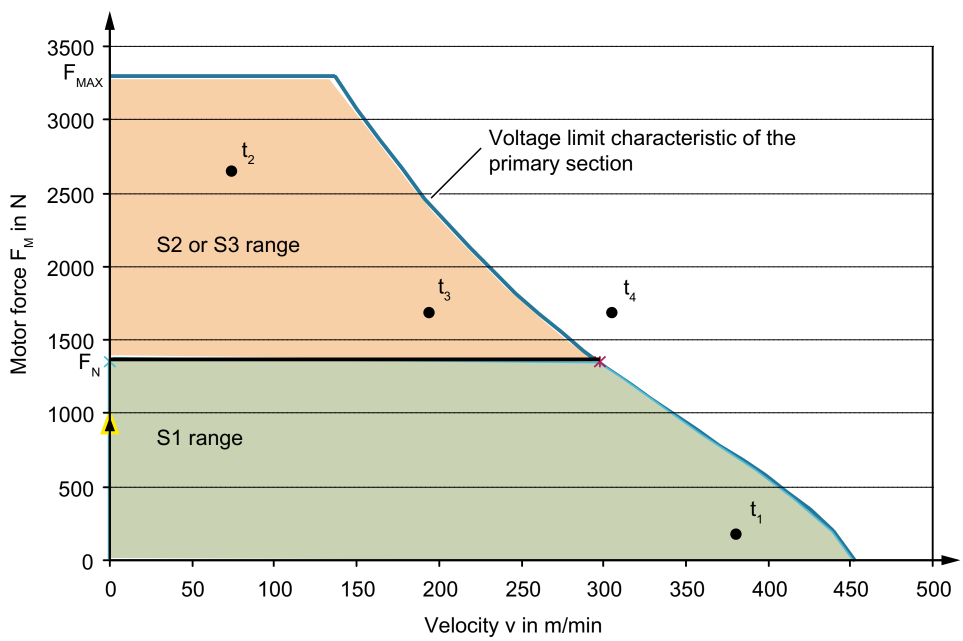


Figure 6-9 Example for points of a motor force - velocity characteristic curve in comparison with the force - velocity characteristic curve of the primary section

As an example, the above figure shows some points of the motor force - velocity characteristic curve at times t_1 ... t_4 in comparison with the force - speed characteristic curve of a primary section:

- t_1: This point is not critical, as it is below the rated force F_N and is also within the voltage limit characteristic of the motor.
- t_2, t_3: These are permissible operating points, as they lie within the voltage limit characteristic of the motor. However, it must be carefully checked whether the motor can be operated at overload for as long as is required for the duty cycle.
- t_4: If such a point occurs, the required motor force cannot be achieved at this velocity. In this case, you must select another primary section at which the point t_4 lies below the force - velocity characteristic curve.

Note

Current does not flow evenly through all phases in all operating states of the motor, e.g.:

- motor stopped but energized, e.g. for:
  - Compensation of a weight
  - Start up against a brake system (damping and impact absorption elements)
- Low velocities (< 0.5 m/min)
- Cyclic traversing distances less than the pole width

With persistent uneven loading, the motor must only be operated at about 70% of the rated force, see F_0* in the data sheets.

For precise dimensioning, please contact your local sales partner.

6.2.5 Specifying the number of secondary sections

Basics

Irrespective of the length, the secondary sections must have the same magnetic track width as the selected primary section. This is guaranteed by making a selection based on the article number The positions of the article number that indicate the motor size must match.

The number of required secondary sections depends on:

- The desired traversing distance
- The drive arrangement

Specifying the total length of the secondary section track

The total length of a secondary section track determines the number of required secondary sections. It depends on the length of the desired traversing distance, the number of primary sections on this secondary section track and, if applicable, the use of a Hall sensor box.

The calculation of the total length of the secondary section track specified here guarantees the maximum motor force over the entire traversing distance.

An individual primary section on the secondary section track

If it is intended that only one primary section should be on the secondary section track, the length of the secondary section track is calculated using the length of the required traversing distance and the magnetically active length of the primary section (see the image below).

Note

The magnetically active length of the primary section without the use of a Hall sensor box ($l_{P,AKT}$) is shorter than when a Hall sensor box is used ($l_{P,AKT,H}$).

The variable $l_{P,AKT}$ is specified in the dimension drawings. The length $l_{P,AKT,H}$ then results from the drawings for the attachment of the Hall sensor box.

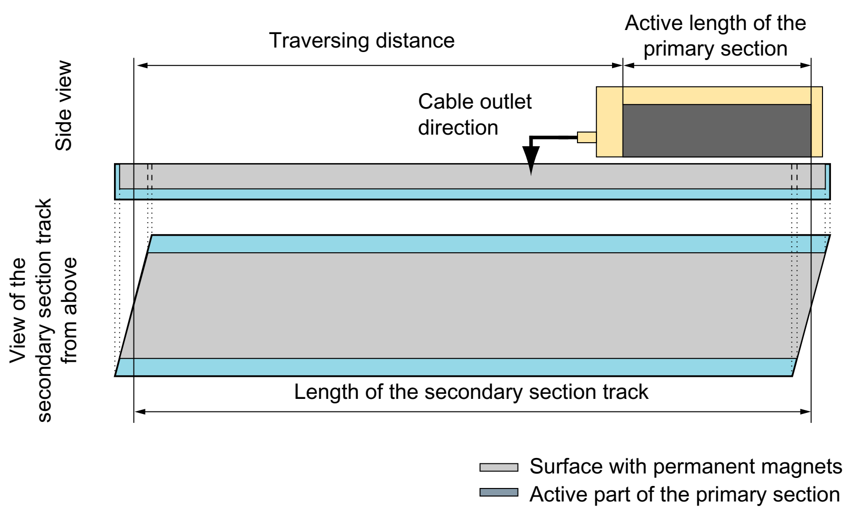


Figure 6-10 Determination of the length of the secondary section track with one primary section

Several primary sections on a secondary section track

If several primary sections are to be mounted on a secondary section track, the required length of the secondary section increases by the active length of the additional primary sections and the distances between them, see the figure below:

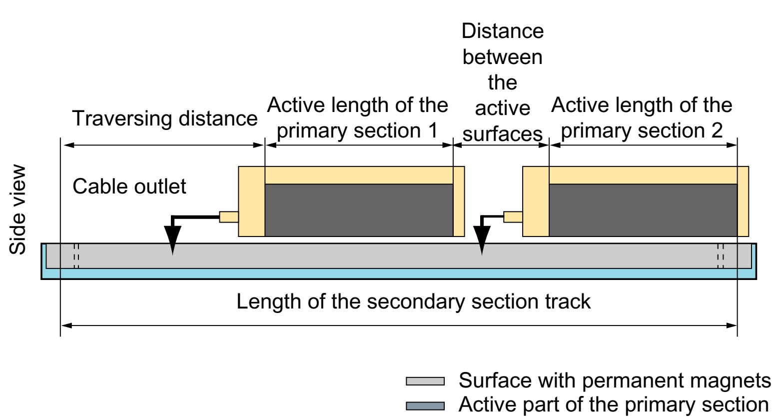


Figure 6-11 Determination of the length of the secondary section track with several primary sections

If the various primary sections are operated from separate drive systems with separate measuring systems, for example, for gantry or master/slave operation, the distance between the primary sections is limited only by mechanical constraints, such as the length of the connecting plugs and the bending radii of the cables. As long as the primary sections are being electrically operated in parallel on a drive system, the pole position of the two primary sections must be the same. The distance can only accommodate certain values.

Specifying the number of secondary sections

The total required length of the secondary section track is calculated from the individual secondary sections. The available lengths are listed in the motor data.

6.2.6 Operation in the area of reduced magnetic coverage

Fundamentals and information

If the primary section moves beyond the ends of the secondary section track, the motor force is reduced.

The available motor force is almost proportional to the percentage of the surface covered by magnets over the complete magnetically active surface of the primary section. Depending on the extent of the frictional forces in the guides, the motor force of the drive may be too low to independently return to the secondary section track if the degree of coverage is too low. External force is then required to return to the track.

The degree of coverage should not be below 50% in order to ensure that the drive can independently return to the secondary section track.

The phases are unsymmetrically loaded, especially at high speeds in the range of reduced magnetic coverage. This leads to additional heating.

The velocity in areas of reduced magnetic coverage should not exceed 25% of the rated velocity $v_{MAX,FN}$.

The area of reduced magnetic coverage should be used only to approach parking or service positions, but not for machining. When using a Hall sensor box (HSB) for position identification, it must be carefully ensured that when the system is switched on the HSB is located above the magnets of the secondary section track, and the primary section can move as a result of its own force.

The drive is normally operated position-controlled. As the loss of motor force changes the behavior of the control circuit, stable operation can only be achieved when the value of the position controller gain k_V is reduced.

The appropriate k_V value for each case depends on the mechanical design of the respective machine. It can only be determined by tests during commissioning. Searching for a suitable value of k_V should start with 5% of its value for full magnetic coverage.

6.2.7 Checking the dynamic mass

Procedure

The dynamic mass of the motor or the axis is determined at the latest after the secondary sections have been selected. With this data, the assumptions specified as mechanical supplementary conditions can be checked. When the mass of the motor assumed there differs considerably from the actual mass of the motor, a new calculation of the load cycle is required.

6.2.8 Selecting the power module

The required power modules are selected according to the peak and continuous currents that occur in the duty cycle. If several primary sections are operated in parallel on one power module, then the sum values of the continuous and peak currents must be taken into account.

NOTICE

Damaged main insulation

In systems where direct drives are used on controlled infeeds, electrical oscillations can occur with respect to ground potential. These oscillations are, among other things, influenced by:

- The lengths of the cables
- The rating of the infeed/regenerative feedback module
- The type of infeed/regenerative feedback module (particularly when an HFD commutating reactor is already present)
- The number of axes
- The size of the motor
- The winding design of the motor
- The type of line supply
- The place of installation

The oscillations lead to increased voltage loads and may damage the main insulation!

- To dampen the oscillations we recommend the use of the associated Active Interface Module or an HFD reactor with damping resistor. Review the documentation of the drive system being used for details. If you have any questions, please contact your local sales partner.

Note

The corresponding Active Interface Module or the appropriate HFD line reactor must be used to operate the Active Line Module controlled infeed unit.

6.2.9 Calculation of the required infeed

Dimensioning the Active Infeed

Use the drive's power balance to dimension the Active Infeed.

The first important quantity to know is the mechanical power P_{MECH} to be produced. Based on this power value, it is possible to work out the electrical active power P_{Netz} to be drawn from the power system by adding the power loss of the motor $P_{V\,Mot}$, the power loss of the Motor Module $P_{V\,MoMo}$ and the power loss of the Active Infeed $P_{V\,AI}$ to the mechanical power P_{MECH}:

$P_{Netz} = P_{mech} + P_{V\,Mot} + P_{V\,MoMo} + P_{V\,AI}$.

The active power to be drawn from the power system depends on the line voltage U_{Netz}, the line current I_{Netz}, and the line-side power factor $\cos\varphi_{Netz}$ as defined by the relation

$P_{Netz} = \sqrt{3} \bullet U_{Netz} \bullet I_{Netz} \bullet \cos\varphi_{Netz}$.

This is used to calculate the required line current I_{Netz} of the Active Infeed as follows:

$I_{Netz} = P_{Netz} / (\sqrt{3} \bullet U_{Netz} \bullet \cos\varphi_{Netz})$.

If the Active Infeed is operated according to the factory setting, i.e. with a line-side power factor of $\cos\varphi_{Netz} = 1$, so that it draws only pure active power from the supply, the formula can be simplified to

$I_{Netz} = P_{Netz} / (\sqrt{3} \bullet U_{Netz})$.

The Active Infeed must now be selected such that the permissible line current of the Active Infeed is greater than or equal to the required value I_{Netz}.

6.3 Examples

Note

The data used here may deviate from the values specified in Chapter "Technical data and characteristics". This does not affect the configuration procedure, however.

6.3.1 Positioning in a specified time

Predefinitions

In the case of positioning in predefined time, only the end points of the path and the duration of the individual motion sections are predefined.

Objective

An appropriate primary section of the peak and continuous load motors in the 1FN3 product family, the matching secondary sections and the number of required secondary sections are to be found for the following specifications:

The motor is to move on a horizontal axis during time Δt_1 to a specific point s_{MAX}. It is to wait there for time Δt_2 and then return to the starting position. The following figure shows these variables in a distance-time diagram.

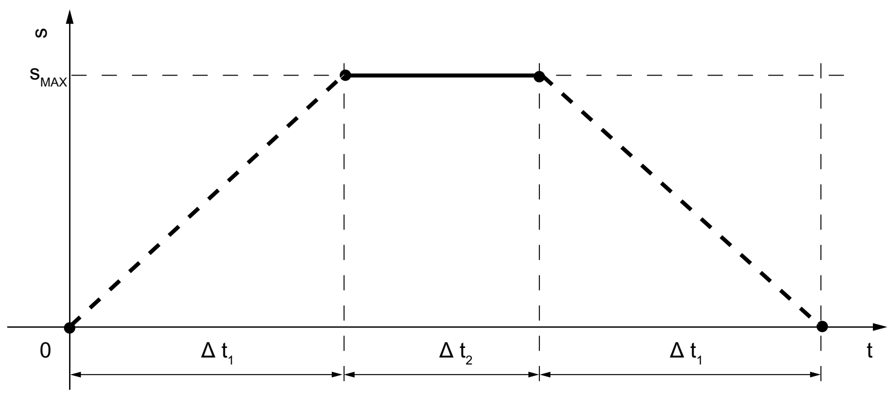


Figure 6-12 Example 1: Representation of the predefined variables in the distance-time diagram

The individual predefined variables are:

Traversing distance	s_{MAX} = 0.26 m
Traversing time	Δt_1 = 0.21 s
Dwell time	Δt_2 = 0.18 s
Mass to be moved (without motor mass)	m = 50 kg
Constant friction	F_r = 100 N
Horizontal axis	F_g = 0

In addition, a power module is to be selected and the maximum infeed power calculated.

Constraints/specification of the duty cycle

Traversing profile - example 1

The form of the traversing profile during time Δt_1 is not explicitly specified. Therefore, a suitable traversing profile must first be specified.

The following example shows a traversing profile that is the simplest to implement: With this profile, only one constant acceleration phase and one constant deceleration phase are required to reach position s_{MAX}, also see the figure below. This type of traversing profile has the shortest positioning times.

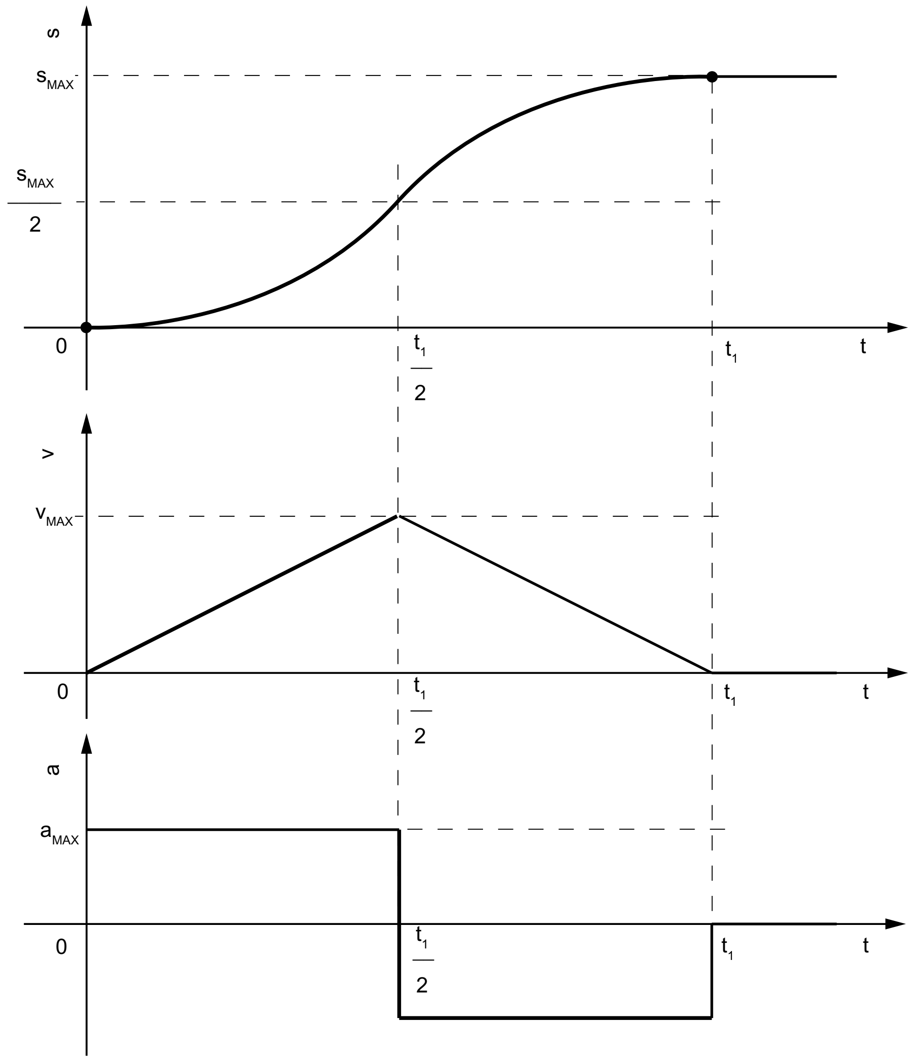


Figure 6-13 Example 1: Motion sequence for the simplest traversing profile

From the specified values, you can calculate how great the maximum velocity and maximum acceleration (deceleration) of the motor must be:

$$\frac{s_{MAX}}{2} = \frac{a_{MAX}}{2} \cdot \left(\frac{t_1}{2}\right)^2 \quad \rightarrow a_{MAX} = s_{MAX} \cdot \left(\frac{2}{t_1}\right)^2$$

$$a_{MAX} = 0.26\ \text{m} \cdot \left(\frac{2}{0.21\ \text{s}}\right)^2 = 23.6\ \text{m/s}^2$$

$$v_{MAX} = a_{MAX} \cdot \frac{t_1}{2} = s_{MAX} \cdot \frac{2}{t_1}$$

$$v_{MAX} = 0.26\ \text{m} \cdot \frac{2}{0.21\ \text{s}} = 2.48\ \text{m/s}$$

Since the force required for this is not yet known, F_{MAX} will be assumed. The value for the maximum velocity v_{MAX} then corresponds with the values listed for $v_{MAX,FMAX}$ in the data sheets. A velocity v_{MAX} = 2.48 m/s = 149 m/min is often above the maximum permissible values $v_{MAX,FMAX}$ for the 1FN3 motors. Therefore, in this example, the traversing profile is to be modified in order to increase the possible selection.

Traversing profile - example 2

Another simple traversing profile that will now be explored here features, in addition to the constant acceleration and constant deceleration, a phase in which the motor is to be run at maximum velocity (see the image below).

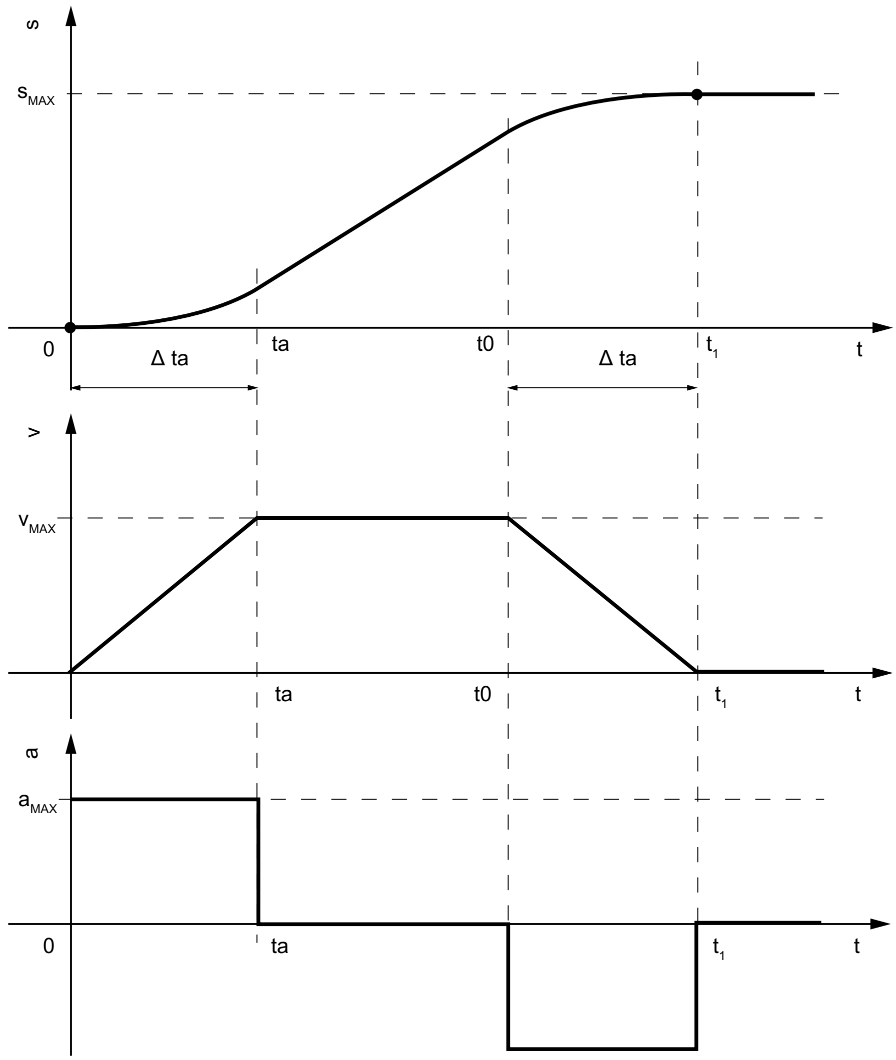


Figure 6-14 Example 1: Modified traversing profile

For the maximum velocity that the motor is to achieve, the following must apply:

$s_{MAX} \leq v_{MAX} \cdot t_1$

Otherwise, the duration of time t_1 will not be long enough to position the motor at s_{MAX}. In the current example, the following must apply for the maximum velocity of the motor:

$v_{MAX} \geq 1.24$ m/s = 74.3 m/min

A higher acceleration a_{MAX} must be used than with the previous profile so that the motor can be positioned in the same time t_1 . At the defined maximum velocity, this acceleration can be calculated:

$$s_{MAX} = 2 \cdot (\frac{a_{MAX}}{2} t_a^2) + (t_1 - 2t_a) v_{MAX} \quad \text{mit } t_a = \frac{v_{MAX}}{a_{MAX}}$$

$$a_{MAX} = \frac{v^2_{MAX}}{v_{MAX} t_1 - s_{MAX}}$$

A primary section can be selected using this data.

Preselection of the primary sections

To avoid restricting the configuration too much, a maximum velocity of **v_{MAX} vMAX = 1.5 m/ s = 90 m/min** is assumed. With this condition for the maximum velocity, only a few primary sections are eliminated from the selection.

This results in **a_{MAX} = 41 m/s²** for the acceleration. The maximum force $F_{L,MAX}$ that the motor must produce during the duty cycle is calculated as follows:

$F_{L,MAX} = m \cdot a + F_r = 50\ kg \cdot 41\ m/s^2 + 100\ N$

$F_{L,MAX}$ = 2150 N

For this example, the following motors are suitable (see motor data sheets):

	Article No.	$v_{MAX, FMAX}$	F_{MAX}	m_{Motor} (with precision cooler)
Peak load motor	1FN3100-4WC00-0BA3	131 m/min	2200 N	8.5 kg
Continuous load motor	1FN3150-3NC70-0BA3	163 m/min	2300 N	11.7 kg

Checking the mechanical constraints

You must now check two points:

- Is the reserve force of the selected primary section also sufficient for the mass of the primary section (which has not yet been taken into account)?
- Is the effective force of the duty cycle F_{eff} below the permissible rated force of the motor F_N?

Calculation of the required maximum force for the selected primary sections

1st iteration step

Peak load motor 1FN3100-4WC00-0BA3	The total mass to be moved m_{ges}: $m_{ges} = m + m_{Motor} = (50 + 8.5)$ kg = 58.5 kg The maximum force that the motor must supply for the duty cycle is: $F_{L,MAX} = m_{ges} \cdot a + F_r = 58.5$ kg · 41 m/s^2 + 100 N $F_{L,MAX}$ = 2499 N
Continuous load motor 1FN3150-3NC70-0BA3	The total mass to be moved m_{ges}: $m_{ges} = m + m_{Motor} = (50 + 11.7)$ kg = 61.7 kg The maximum force that the motor must supply for the duty cycle is: $F_{L,MAX} = m_{ges} \cdot a + F_r = 61.7$ kg · 41 m/s^2 + 100 N $F_{L,MAX}$ = 2630 N

The force of the primary sections previously selected is too low, both for the peak load motor and the continuous load motor. Therefore, a new primary section has to be selected.

2nd iteration step

New, improved motor selection for the example (see motor data sheets):

	Article No.	**$v_{MAX, FMAX}$**	**F_{MAX}**	**m_{Motor} (with precision cooler)**
Peak load motor	1FN3100-5WC00-0BA3 1FN3150-4WC00-0BA3	109 m/min 126 m/min	2750 N 3300 N	10.4 kg 11.4 kg
Continuous load motor	1FN3150-4NB80-0BA3	109 m/min	3060 N	15.3 kg

Peak load motor 1FN3100-5WC00-0BA3 1FN3150-4WC00-0BA3	 m_{ges} = 60.4 kg $F_{L,MAX}$ = 2576 N (no control reserve) m_{ges} = 61.4 kg $F_{L,MAX}$ = 2617 N (10% control reserve present) (calculation uses same approach as in the 1st iterative step)
Continuous load motor 1FN3150-4NB80-0BA3	m_{ges} = 65.3 kg $F_{L,MAX}$ = 2777 N (calculation uses same approach as in the 1st iterative step)

The additional calculations in this example are carried out using the peak load motor 1FN3150-4WC00-0BA3 or the continuous load motor 1FN3150-4NB80-0BA3.

Calculation of the rms force F_{eff} of the duty cycle

The following figure shows the force/time graph for the entire sequence of motion for this example.

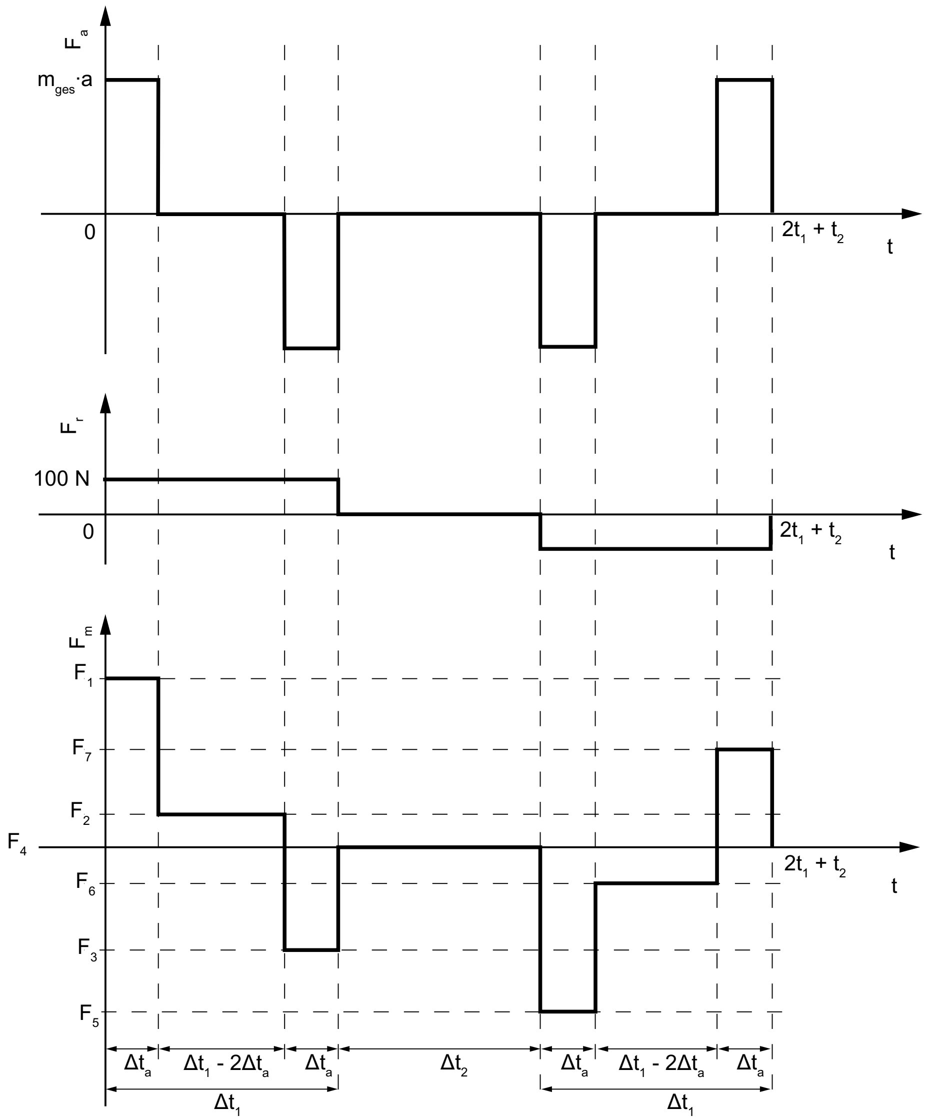


Figure 6-15 Example 1: Force-time diagram of the duty cycle considered

$$F_{eff} = \sqrt{\frac{F_1^2 \Delta t_a + F_2^2(\Delta t_1 - 2\Delta t_a) + F_3^2 \Delta t_a + F_4^2 \Delta t_2 + F_5^2 \Delta t_a + F_6^2(\Delta t_1 - 2\Delta t_a) + F_7^2 \Delta t_a}{2\Delta t_1 + \Delta t_2}}$$

$$t_a = \frac{v_{MAX}}{a_{MAX}} = \frac{1.5 \text{ m/s}}{41 \text{ m/s}^2} = 0.0366 \text{ s}$$

Peak load motor 1FN3150-4WC00-0BA3	$F_1 = m_{ges} \cdot a + F_r = 2617$ N $F_2 = F_r = 100$ N $F_3 = -m_{ges} \cdot a + F_r = -2417$ N $F_4 = 0$ N $F_5 = -m_{ges} \cdot a - F_r = -2617$ N $F_6 = F_4 - F_r = -100$ N $F_7 = m_{ges} \cdot a - F_r = 2417$ N $\Rightarrow F_{eff} = 1246$ N The effective force therefore remains below the permissible value of $F_N = 1350$ N	Travel to position s_{MAX} Dwell time Travel to position s_0
Continuous load motor 1FN3150-4NB80-0BA3	$F_1 = m_{ges} \cdot a + F_r = 2777$ N $F_2 = F_r = 100$ N $F_3 = -m_{ges} \cdot a + F_r = -2577$ N $F_4 = 0$ N $F_5 = -m_{ges} \cdot a - F_r = -2777$ N $F_6 = F_4 - F_r = -100$ N $F_7 = m_{ges} \cdot a - F_r = 2577$ N $\Rightarrow F_{eff} = 1325$ N The effective force therefore remains below the permissible value of $F_N = 1810$ N	Travel to position s_{MAX} Dwell time Travel to position s_0

Final selection of the primary section

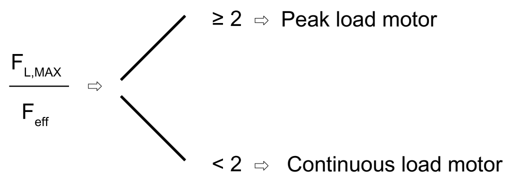
For the example considered here, for a peak load motor, primary section 1FN3150-4WC00-0BA3 is suitable, and for a continuous load motors, primary section 1FN3150-4NB80-0BA3. Which primary section is best suited to the specified duty cycle can be derived from the following summary:

		Values from the data sheet		**Values from the duty cycle**	
Motor	**Article No.**	F_{MAX}	F_N	$F_{L,MAX}$	F_{eff}
Peak load motor	1FN3150-4WC00-0BA3	3300 N	1350 N	2617 N	1246 N
Continuous load motor	1FN3150-4NB80-0BA3	3060 N	1810 N	2773 N	1325 N

Decision-making criteria for the primary section include:

- Size and installation conditions
- Thermal conditions
- Idle times
- Power reserves for peak and continuous loads
- Acceleration and velocity class
- Velocity class
- Converter power module

A rule of thumb for selecting the primary section is as follows:



In this particular example, the quotient $F_{L,max}$ / F_{eff} is equal to 2.1. For peak force $F_{L,MAX}$ of the duty cycle, the peak load motor has sufficient reserves with its maximum force F_{MAX} . The effective force F_{eff} is substantially below the rated force F_N of the continuous load motor.

Without taking other decision-making criteria into account, the **peak load motor 1FN3150-4WC00-0BA3** is the most suitable for the specified duty cycle and is therefore used for the following calculations.

Specifying the number of secondary sections

Type of secondary section

The secondary section suitable for primary section 1FN3150-4WC00-0BA3 is found based on the Article No. It has the order designation 1FN3150-4SA00-0AA0.

Length of the secondary section track and number of secondary sections

$l_{Spur} = l_{P,AKT} + s_{MAX}$

Number = l_{Spur} / l_S

$l_{P,AKT}$ = 420 mm (see motor data sheet 1FN3150-4WC00-0BA3)

l_S = 120 mm (see motor data sheet 1FN3150-4WC00-0BA3)

⇒ l_{Spur} = 420 mm + 260 mm = 680 mm

⇒ **Number of secondary sections = 6**

Selecting the power module

The selected peak load motor has the following data:

F_{MAX} = 3300 N

F_N = 1350 N

I_{MAX} = 38.2 A

I_N = 14.3 A

A suitable power module for this data is selected from the relevant catalog.

Calculating the infeed power

The electrical infeed power is obtained from the mechanical power P_{MECH} and the power loss of the motor $P_{V,Mot}$. The rms values of the motor velocity and motor force resulting from the duty cycle are used as basis for the calculation.

The rms infeed power is estimated as follows:

$$P_{EL} = P_{MECH} + P_{V,Mot}$$

$$P_{EL} = F_{eff} \cdot v_{eff} + 3 \cdot R_{STR}(T_N) \cdot \left(\frac{F_{eff}}{k_{F,20}} \right)^2$$

with

$$R_{STR}(T_N) = R_{STR,20} \, [1 + \alpha \cdot (T_N - 20 \text{ °C})]$$

$$R_{STR}(T_N) = R_{STR,20} \, [1 + 0.00393 \, \frac{1}{K} \cdot (T_N - 20 \text{ °C})]$$

Controlling the unit:

$$P_{EL} / W = \frac{N \cdot m}{s} + \frac{\Omega \cdot N^2 \cdot A^2}{N^2}$$

$$P_{EL} / W = \frac{N \cdot m}{s} + \frac{V \cdot A^2}{A} \quad (1 \text{ W} = 1 \text{ Nm/s} = 1\text{VA})$$

$$P_{EL} / W = W$$

To dimension the infeed (Active Infeed), in addition to the calculated value P_{EL}, the power loss of the Motor Module $P_{v,MoMo}$ and the Active Infeed $P_{V,AI}$ must also be added (see Chapter "Calculation of the required infeed (Page 128)").

6.3.2 Gantry with transverse axis

Machining center with gantry axis

Frequently, an axis design in the form of a gantry is used for machining centers. The center area of the slide of the gantry axis is required as machining space. This means that the gantry is moved using two identical linear motors arranged at the sides.

The two motors are controlled from their own separate drive system - equipped with their own position measuring system (gantry arrangement).

In the simplest scenario, the gantry has a symmetrical design, which means that each motor must accelerate half the mass m_P of the gantry.

In addition, an additional axis (transverse axis moving with the gantry) can be additionally attached to the gantry, whose slides can be moved out of the center position. Depending on the particular operating case, the mass distribution is no longer symmetrical. In this case, the two motors of the gantry have to move different masses.

Depending on how far this transverse axis is moved out of the center position, the slide mass m_S is distributed between both motors of the gantry axis. This means that in addition to half the mass of the gantry, the individual motor also has to move the percentage mass of the transverse axis slide.

It is sufficient to use the most unfavorable scenario when dimensioning the two motors. In this case, the slide of the transverse axis is fully moved to one side. For reasons of simplicity, the maximum possible movement at both sides is assumed to be identical.

The equivalent mass m_{ERSATZ} is calculated from the gantry mass m_P and the slide mass m_S:

$$m_{ERSATZ} = \frac{m_P}{2} + m_S \cdot \left(\frac{1}{2} + \frac{A}{B} \right)$$

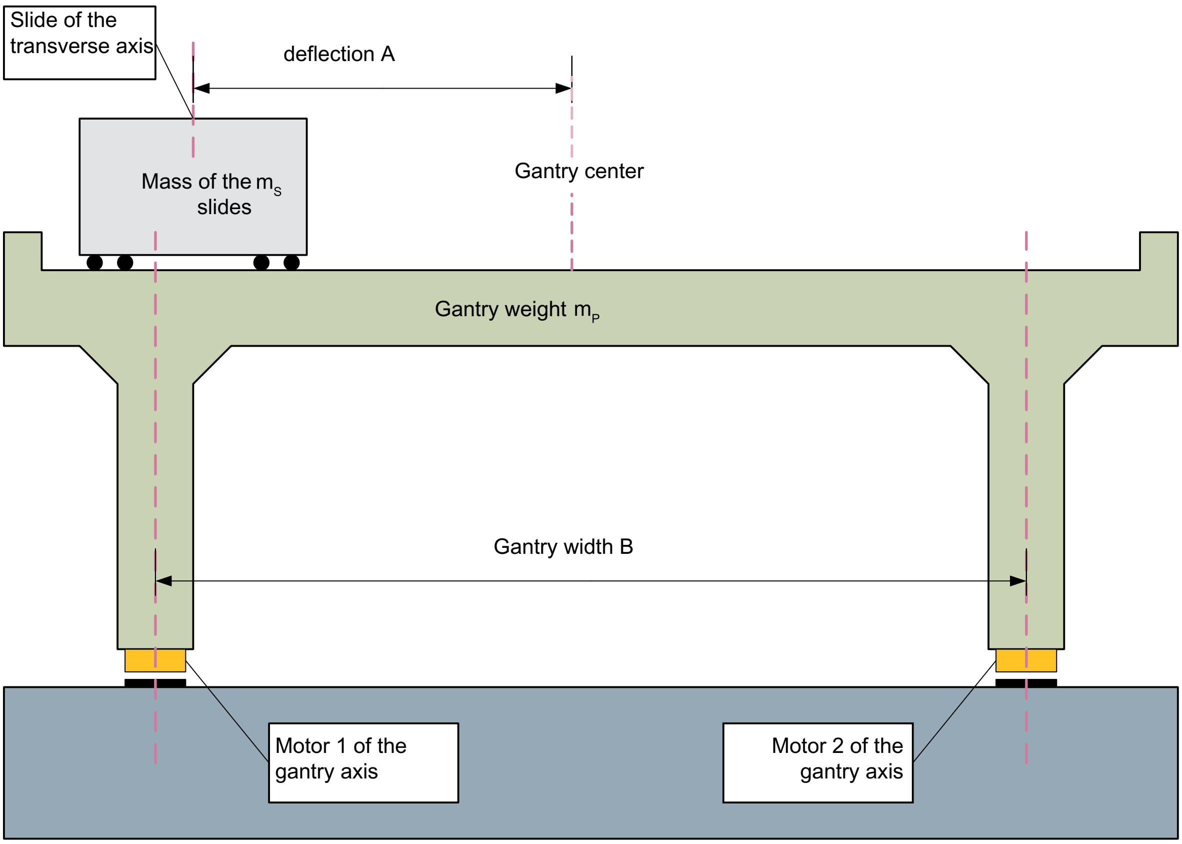


Figure 6-16 Example of a machining center with gantry axis

The drive is now dimensioned based on the equivalent mass - and is only carried out for one motor. The result is also valid for the other motor.

6.3.3 Dimensioning the cooling system

6.3.3.1 Basic information

Individual coolers

Based on the required effective force of the duty cycle F_{eff}, heat $Q_{K,i}$ that must be dissipated by the individual coolers can be calculated first of all. This also corresponds to the cooling capacity $P_{kühl,i}$, which a cooling unit or a heat exchanger must have for the cooling being considered.

$$P_{kühl,i} = Q_{K,i} \approx Q_{K,MAX} \cdot \left(\frac{F_{eff}}{F_N} \right)^2$$

The values for rated force F_N and heat $Q_{K,MAX}$ to be dissipated under full load conditions is obtained from the data sheets.

The volume flow rate is defined; however, the value that is specified in the data sheet tables should be used.

The pressure drop associated with the volume flow rate can be taken from the characteristics for the primary section main cooler as well as for the primary section precision cooler and secondary section cooling.

Temperature rise $\Delta T_{K,i}$ between the flow and return for the individual coolers can be determined for a given volume flow rate

$$\Delta T_{K,i} = \left(\frac{Q_{K,i}}{\rho \cdot c_P \cdot \dot{V}} \right)$$

Variables ρ and c_ρ designate the density or the specific thermal capacity of water as coolant: $\rho = 998\ kg/m^3$, $c_\rho = 4180\ J/(kg \cdot K)$.

Connecting coolers in series

For cooling circuits connected in series, the greatest volume flow rate that results for the individual coolers is the determining value for the entire system:

$\dot{V}_{gesamt} = \max(\dot{V}_1, \dot{V}_2, \dot{V}_3, ...)$

Calculate the individual pressure drops and temperature rises. Calculate the sum for the pressure drop Δp_{gesamt} and the temperature rise ΔT_{gesamt} in each case:

$\Delta p_{gesamt} = \Delta p_{K,1} + \Delta p_{K,2} + \Delta p_{K,3} + ...$

$\Delta T_{gesamt} = \Delta T_{K,1} + \Delta T_{K,2} + \Delta T_{K,3} + ...$

If you are using one cooling unit or heat exchanger for all cooling circuits together, the necessary cooling capacity $P_{kühl}$ is calculated from the individual cooling capacities $P_{kühl}$ as follows:

$P_{kühl} = P_{kühl,1} + P_{kühl,2} + P_{kühl,3} + ... = Q_{K,1} + Q_{K,2} + Q_{K,3} + ...$

6.3.3.2 Example: Dimensioning the cooling

Requirement

A peak load motor with a primary section of the 1FN3300-2WC00 series is to be operated with an effective force of the duty cycle $F_{eff} = 0.8\ F_N$. A primary section main cooler is necessary for this application. The primary section precision cooler and the secondary section cooling system should also be used to prevent heat being transferred to the machine.

The secondary section track is approximately 1.6 m long. There is a coupling point for the heatsink profiles. The flow and return lines of the secondary section cooling system are connected via combi distributors.

The medium flows through the primary section precision cooler, secondary section cooling system and primary section main cooler in that order. To maintain the temperature difference of 4 K between the flow temperature and the surface of the primary section precision cooler, the recommended values from the corresponding data sheet are used.

Data from data sheet:

Volume flow:	$\dot{V}_{gesamt} = 4$ l/min	for all coolers
Pressure drop:	$\Delta p_{P,H} = 0.32$ bar	for main cooler
	$\Delta p_{P,P} = 0.33$ bar	for precision cooler
	$\Delta p_S = 0.09$ bar/m	for heatsink profiles
	$\Delta p_{KV} = 0.42$ bar	for each combi distributor
	$\Delta p_{KS} = 0.31$ bar	for each coupling point
Maximum heat dissipation:	$Q_{P,H,MAX} = 995$ W	for main cooler
	$Q_{P,P,MAX} = 35$ W	for precision cooler
	$Q_{S,MAX} = 93$ W	for secondary section cooling system

Calculating the cooling capacity

Individual cooling circuits

The following results for the individual cooling circuits:

$P_{kühl,P,H} = Q_{P,H} \simeq 995\ W \cdot 0.8^2 = 636.8\ W$

$P_{kühl,P,P} = Q_{P,P} \simeq 35\ W \cdot 0.8^2 = 22.4\ W$

$P_{kühl,S} = Q_S \simeq 93\ W \cdot 0.8^2 = 59.52\ W$

Total cooling

For a heat-exchanger unit that is designed for the complete series configuration, the following must be assumed as a minimum cooling rating:

$P_{kühl,gesamt} = P_{kühl,P,H} + P_{kühl,P,P} + P_{kühl,S} = 636.8\ W + 22.4\ W + 59.52\ W$

$\mathbf{P_{kühl,gesamt} = 718.72\ W}$

Calculating the pressure drop

Pressure drop in the secondary section cooling system

The secondary section cooling comprises a coupling point and two combi distributors. The parallel heatsink profiles for the 1FN3300 have a length of $l_{s\,1}$ = 0.716 m (4 secondary sections) and $l_{s\,2}$ = 0.900 m

(5 secondary sections).

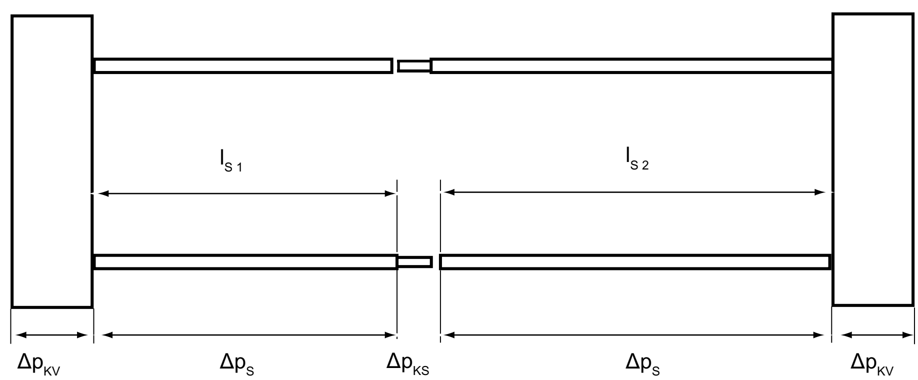


Figure 6-17 Example of a secondary section cooling system

In total, the pressure drop of the secondary section cooling system is:

$\Delta p_{S,ges} = \Delta p_S \cdot l_{S\,1} + \Delta p_S \cdot l_{S\,2} + 2 \cdot \Delta p_{KV} + \Delta p_{KS}$

The result is:

$\Delta p_{S,ges}$ = 0.09 bar/m · 0.176 m +0.09 bar/m · 0.900 m + 2 · 0.42 bar + 0.31 bar

$\Delta p_{S,ges}$ = 1.25 bar

Total cooling

For the total cooling, the following results:

$\Delta p_{gesamt} = \Delta p_{P,H} + \Delta p_{P,P} + \Delta p_{S,ges}$ = 0.32 bar + 0.33 bar + 1.25 bar

Δp_{gesamt} = 1.90 bar

Note

Pressure drop across the water lines on the customer side

For the total pressure drop, the pressure drop across water connections on the customer side caused by the cooling medium pump - combi distributor hoses or valves must also be considered.

Calculating the temperature rise

Individual cooling circuits

The values for the individual cooling circuits are calculated as follows:

$$\Delta T_{P,H} = \frac{636.8\ \text{W}}{998\,\frac{\text{kg}}{\text{m}^3} \cdot 4180\,\frac{\text{J}}{(\text{kg}\cdot\text{K})} \cdot 4\,\frac{\text{l}}{\text{min}}}$$

$$= \frac{636.8\ \frac{\text{J}}{\text{s}}}{998\,\frac{\text{kg}}{\text{m}^3} \cdot 4180\,\frac{\text{J}}{(\text{kg}\cdot\text{K})} \cdot 4 \cdot \frac{10^{-3}\ \text{m}^3}{60\ \text{s}}} = 2.3\ \text{K}$$

$$\Delta T_{P,P} = \frac{22.4\ \text{W}}{998\,\frac{\text{kg}}{\text{m}^3} \cdot 4180\,\frac{\text{J}}{(\text{kg}\cdot\text{K})} \cdot 4\,\frac{\text{l}}{\text{min}}}$$

$$= \frac{22.4\ \frac{\text{J}}{\text{s}}}{998\,\frac{\text{kg}}{\text{m}^3} \cdot 4180\,\frac{\text{J}}{(\text{kg}\cdot\text{K})} \cdot 4 \cdot \frac{10^{-3}\ \text{m}^3}{60\ \text{s}}} = 0.08\ \text{K}$$

$$\Delta T_{S} = \frac{59.52\ \text{W}}{998\,\frac{\text{kg}}{\text{m}^3} \cdot 4180\,\frac{\text{J}}{(\text{kg}\cdot\text{K})} \cdot 4\,\frac{\text{l}}{\text{min}}}$$

$$= \frac{59.52\ \frac{\text{J}}{\text{s}}}{998\,\frac{\text{kg}}{\text{m}^3} \cdot 4180\,\frac{\text{J}}{(\text{kg}\cdot\text{K})} \cdot 4 \cdot \frac{10^{-3}\ \text{m}^3}{60\ \text{s}}} = 0.21\ \text{K}$$

Total cooling

For the total cooling, the following results:

$\Delta T_{gesamt} = \Delta T_{P,H} + \Delta T_{P,P} + \Delta T_{S,ges} = 2.3\ \text{K} + 0.08\ \text{K} + 0.21\ \text{K}$

ΔT_{gesamt} = 2.59 K

Conclusion

For a heat-exchanger unit to be able to cool the motor under the conditions described in this section, it must be dimensioned for about 720 W. The pressure drop is around 3 bar and the temperature difference between the flow and return lines of the cooling system is around 3 K.

Note

Recommended manufacturers

You will find the recommended manufacturers for the heat-exchanger units in the appendix.

6.4 Mounting

6.4.1 Safety instructions for mounting

WARNING

Risk of death and crushing as a result of permanent magnet fields

Severe injury and material damage can result if you do not take into consideration the safety instructions relating to the permanent magnet fields of the secondary sections.

- Observe the information in Chapter "Danger from strong magnetic fields (Page 33)".

⚠ WARNING

Danger of crushing by permanent magnets of the secondary section

The forces of attraction of magnetic secondary sections act on materials that can be magnetized. The forces of attraction increase significantly close to the secondary section. The trigger threshold of 3 mT for a risk of injury due to attraction and projectile effect is reached at a distance of 150 mm (directive 2013/35/EU). Secondary sections and materials that can be magnetized can suddenly slam together unintentionally. Two secondary sections can also unintentionally slam together.

There is a significant risk of crushing when you are close to a secondary section.

Close to the secondary section, the forces of attraction can be several kN - example: Magnetic attractive forces are equivalent to a force of 100 kg, which is sufficient to trap a body part.

- Do not underestimate the strength of the attractive forces, and work very carefully.
- Wear safety gloves.
- The work should be done by at least two people.
- Do not unpack the secondary section until immediately before installation.
- Never unpack several secondary sections at the same time.
- Never place secondary sections next to one another without taking the appropriate precautions.
- Never place any metals on magnetic surfaces and vice versa.
- Never carry any objects made of magnetizable materials (for example watches, steel or iron tools) and/or permanent magnets close to the secondary section! If tools that can be magnetized are nevertheless required, then hold the tool firmly using both hands. Slowly bring the tool to the secondary section.
- Immediately mount the secondary section that has just been unpacked.
- When mounting and removing secondary sections, we recommend that you use protective mats with magnetic self-holding function
- Never remove several secondary sections at the same time.
- Immediately after removal, pack the removed secondary section in the original packaging.
- Always comply with the specified procedure.
- Avoid inadvertently traversing direct drives.
- Keep the following tools at hand to release parts of the body (hand, fingers, foot etc.) trapped between two components:
  - A hammer (about 3 kg) made of solid, non-magnetizable material
  - Two pointed wedges (wedge angle approx. 10° to 15°, minimum height 50 mm) made of solid, non-magnetizable material (e.g. hard wood).

⚠ WARNING

Electric shock caused by defective cables

Defective connecting cables can cause an electric shock and/or material damage, e.g. by fire.

- When installing the motor, make sure that the connecting cables
  - are not damaged,
  - are not under tension,
  - do not come into contact with moving parts.
- Carefully observe the permissible bending radii according to catalog data.
- Do not hold a motor by its cables.
- Do not pull the motor cables.

⚠ WARNING

Risk of electric shock

Voltage is induced at the power connections of the primary section each time a primary section moves with respect to a secondary section - and vice versa.

When the motor is switched on, the power connections of the primary section are also live.

If you touch the power connections you may suffer an electric shock.

- Only mount and remove electrical components if you have been qualified to do so.
- Only work on the motor when the system is in a no-voltage condition.
- Do not touch the power connections. Correctly connect the power connections of the primary section or properly insulate the cable connections.
- Do not disconnect the power connection if the primary section is under voltage (live).
- When connecting up, only use power cables intended for the purpose.
- First connect the protective conductor (PE).
- Attach the shield through a large surface area.
- First connect the power cable to the primary section before you connect the power cable to the converter.
- First disconnect the connection to the converter before you disconnect the power connection to the primary section.
- In the final step, disconnect the protective conductor (PE).

⚠ CAUTION

Sharp edges and falling objects

Sharp edges can cause cuts and falling objects can injure feet.

- Always wear safety shoes and safety gloves!

6.4.2 Mechanical design

Typical installation situation of a linear motor

Linear motors are built-in motors. The following figure shows a typical installation situation.

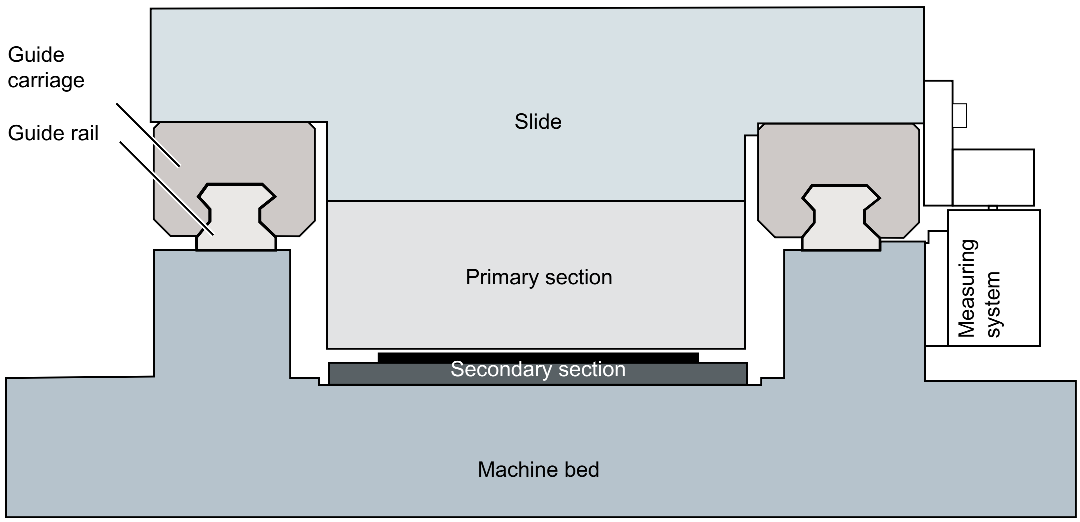


Figure 6-18 Typical installation situation of a single-sided linear motor with moved primary section

Attraction force

The attraction force between the primary section and the secondary section track can be several 10 kN. More details on this force of attraction F_A are provided in the motor data sheet.

NOTICE
Mechanical design A mechanical design that is excessively elastic can have a negative impact on the installed motor. Further, the primary section and secondary section can make direct contact with one another. • Ensure that the mechanical construction has the appropriate degree of stiffness.

As the installation height decreases, the forces of attraction between the primary section and the secondary section track increase significantly.

6.4.3 Specifications for mounting linear motors

Mounting system

When you fasten primary sections and secondary sections on the machine construction, you must observe the following:

- Use screws of property class 10.9.
- Only use new screws that have not been used before.
- Ensure that the correct types of mounting screws are used to fasten the secondary sections:
  - Cylinder head screws with standard head for 1FN3050 to 1FN3150 according to DIN EN ISO 4762 (hexagon socket-head screw) or DIN EN ISO 14579 (hexalobular socket)
  - Cylinder head screws with low head for 1FN3300 to 1FN3900 according to DIN 6912 (hexagon socket-head screw) or DIN EN ISO 14580 (hexalobular socket)
- Ensure that the mounting surfaces are free of oil and grease and are clean and unpainted.
- Comply with the optimal surface roughness depth Rz of the screwing surface. Rz is between 10 and 40 µm.
- Minimize the number of joints. This keeps the settling effect for the material and the screws low.
- Note the presets for the thread depths and screw-in depths in the primary section.
- Tighten the mounting screws using torque control. If you cannot tighten the fixing screws using torque control, at least use a calibrated torque wrench with a short wrench insert. You can increase the load capability of the screwed connection when using a tightening procedure with controlled angle of rotation or yield limits.
  Carefully observe the tightening torques listed in the following table.
- Tighten the screws gradually, with no jerky movements.
- To secure the screws, we recommend a long clamping length lk/d > 5.
  Alternatively, liquid threadlocker can be used or a fixed thread coating (medium strength is adequate) to avoid screw connections from becoming loose. When doing this, carefully observe the changed friction values and the resulting tightening torques

Tightening torques for screws of property class 10.9

Applicable for screws of property class 10.9 Friction value μ_{tot} = 0.1		
M5	**M6**	**M8**
7.6 Nm	13.2 Nm	31.8 Nm

Thread depth and screw-in depths in the primary section

The following drawings schematically illustrate the minimum permissible and maximum screw-in depth of the mounting screws in the screwed-in state, with and without the use of a precision cooler. For selecting the screw length, a **good range** is thus made available to the machine manufacturer.

The selection of the length of the mounting screws while taking all of the design tolerances into consideration is the responsibility of the machine manufacturer.

The machine manufacturer must ensure that the minimum screw-in depth is reached and the maximum screw-in depth is not exceeded.

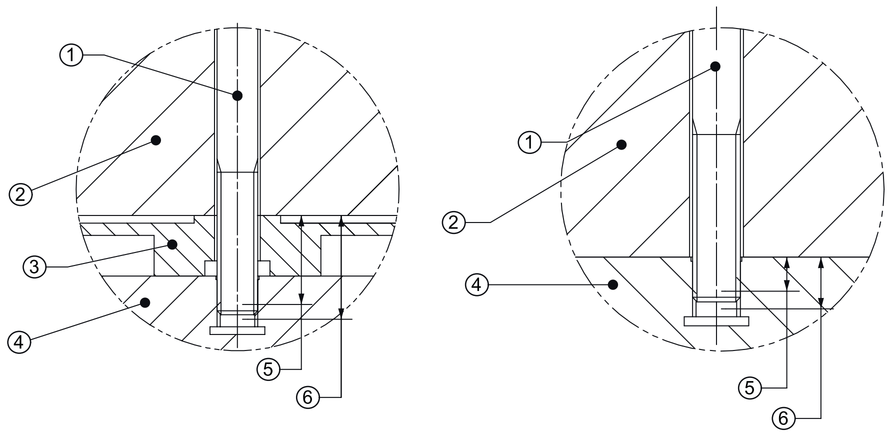


Figure on the left: Primary section with precision cooler, figure on the right: Primary section without precision cooler

① Mounting screw
② Slide
③ Precision cooler
④ Primary section
⑤ - ⑥ The minimum screw-in depth and maximum screw-in depth as shown in the installation drawing of the primary section in the Configuration Manual under ① "Screw-in depth MP"

Figure 6-19 Schematic diagram for the screw-in depths in the primary section

Screw-in depths for the secondary section installation

Minimum permissible screw-in depth

The minimum permissible screw-in depths for the most commonly used materials for a machine bed are listed below. For different materials, you must determine the screw-in depth according to VDI Directive 2230.

Table 6-2 Minimum permissible screw-in depths

Material	Screw-in depth
EN GJL-250	1.4 • d
EN GJL-300	1.3 • d
EN GJS-600-3	0.7 • d
G-ALZN10Si8Mg	2.8 • d
St 37	1.8 • d
St 50	1.3 • d

Maximum screw-in depth

The maximum screw-in depth is at the discretion of the machine manufacturer.

The maximum screw-in depth is specified by the threaded holes in the customers machine bed.

6.4.4 Procedure when installing the motor

Installing a linear motor is subdivided into the following steps:

1. Check the installation height before you install the motor.
2. Clean the mounting surfaces of the motor parts and the machine.
3. Install the primary sections, secondary sections and components.
4. Check the motor installation.

❒

6.4.4.1 Maintaining the installation height

Installation height for motor installation

The following diagram shows the installation height for motor installation. The associated values are specified in the following table.

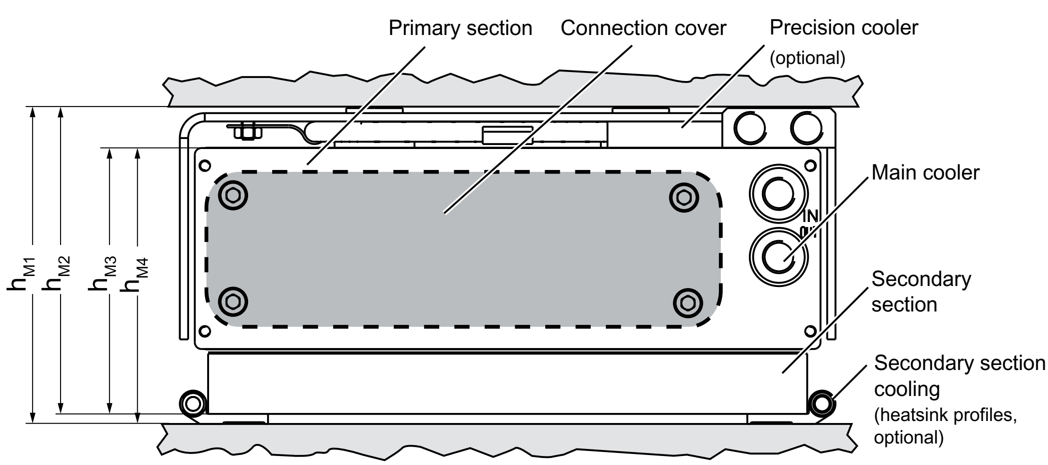


Figure 6-20 Installation height for motor installation

Peak load motor: Installation height

Table 6-3 Installation height for motor installation corresponding to the previous diagram

	Installation height with precision cooler and with secondary section cooler	Installation height with precision cooler and without secondary section cooler	Installation height without precision cooler and without secondary section cooler	Installation height without precision cooler and with secondary section cooler	Tolerance of the installation height
1FN3..-xW	**h_{M1} in mm**	**h_{M2} in mm**	**h_{M3} in mm**	**h_{M4} in mm**	**in mm**
1FN3050 1FN3100	63.4	60.4	48.5	51.1	+0.3
1FN3150	65.4	62.4	50.5	53.5	+0.3
1FN3300	79.0	76.0	64.1	67.1	+0.3
1FN3450	81.0	78.0	66.1	69.1	+0.3
1FN3600	86.0	-- *)	-- *)	74.1	+0.3
1FN3900	88.0	-- *)	-- *)	76.1	+0.3

*) For 1FN3600 and 1FN3900 motors, secondary section cooling is imperative in order that the motors function correctly. The large amount of heat transferred from the primary section to the secondary sections cannot be dissipated to the machine bed via the secondary sections' contact surfaces.

Continuous load motor: Installation height

Table 6-4 Installation height for motor installation corresponding to the previous diagram

	Installation height with precision cooler and with secondary section cooler	Installation height with precision cooler and without secondary section cooler	Installation height without precision cooler and without secondary section cooler	Installation height without precision cooler and with secondary section cooler	Tolerance of the installation height
1FN3..-xN	**h_{M1} in mm**	**h_{M2} in mm**	**h_{M3} in mm**	**h_{M4} in mm**	**in mm**
1FN3050 1FN3100	74.3	71.3	59.4	62.4	+0.3
1FN3150	76.3	73.3	61.4	64.4	+0.3
1FN3300	92.9	89.9	78	81	+0.3
1FN3450	94.9	91.9	80	83	+0.3
1FN3600	99.9	-- *)	-- *)	88	+0.3
1FN3900	101.9	-- *)	-- *)	90	+0.3

*) For 1FN3600 and 1FN3900 motors, secondary section cooling is imperative in order that the motors function correctly. The large amount of heat transferred from the primary section to the secondary sections cannot be dissipated to the machine bed via the secondary sections' contact surfaces.

6.4.4.2 Overview of the installation technique

The following 3 different techniques are possible when installing a linear motor in a machine:

- Motor installation with divided secondary section track
- Motor installation by introducing the slide
- Motor installation by placing down motor components

6.4.4.3 Motor installation with divided secondary section track

WARNING

Risk of crushing when moving the slide (step 3)

If you move the slides with the primary section on the installed secondary section, strong pulling forces briefly occur in the direction of the secondary section track. There is a risk of crushing!

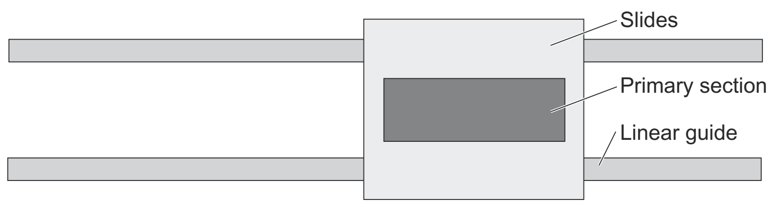
- Make sure that your fingers do not protrude into the danger zone!

Requirements

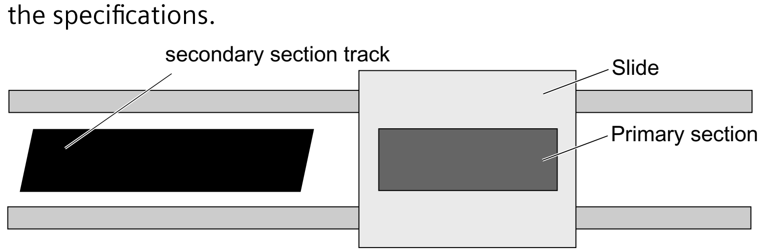
For this type of installation the entire secondary section track must be able to be divided into 2 sections. In this case, the two sections must at least be as long as the slide.

Procedure

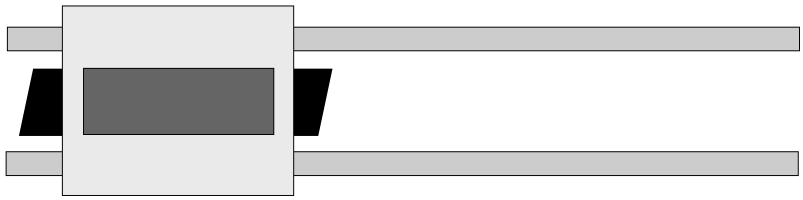
1. Install the slide together with the linear guide and the primary section.



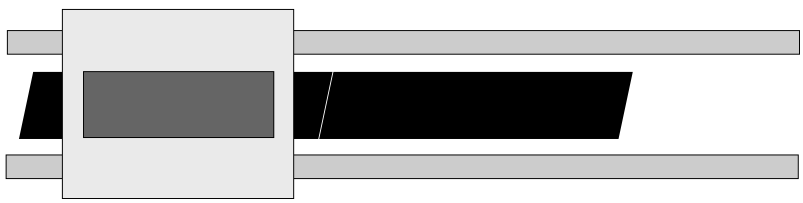
2. Push the slide to one side. Start the installation with the secondary section track on the other side. Proceed as explained in Chapter "Assembling individual motor components (Page 157)". Align the secondary section track. Tighten the mounting screws according to the specifications.



3. Push the slide over the installed secondary section track. The attraction forces are taken up by the linear guides.



4. Install the remaining secondary section track as described in Chapter "Assembling individual motor components (Page 157)". Align the track as well. Tighten the mounting screws according to the specifications.



❒

6.4.4.4 Motor installation through the insertion of the slide

⚠ WARNING

Risk of crushing as result of attractive forces

In this procedure, pulling forces towards the stationary motor component occur. There is a risk of crushing!

- Ensure that the slide plate is guided through the threading unit before the magnetic forces of attraction take effect.
- Make sure that your fingers do not protrude into the danger zone!

Requirements

This type of installation is only intended for setting up motors in a double-sided arrangement. For this type of installation, normally you require a threading fixture provided by the customer.

Procedure

- Slide the movable part of the motor into the stationary housing with the already installed motor parts. See the following figure.

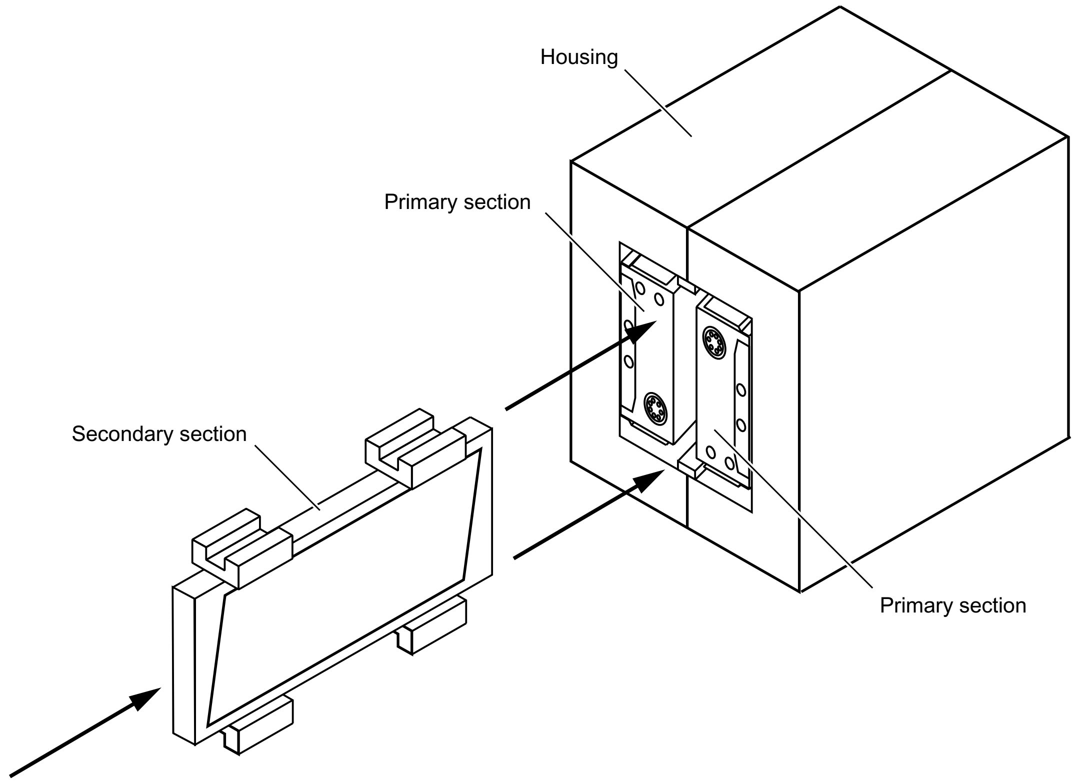


Figure 6-21 Inserting the secondary section for a double-sided motor (similar diagram)

❐

6.4.4.5 Motor installation by placing down motor components

⚠ WARNING

Danger of crushing when placing down the primary section (step 2)

When you place down the primary section on the secondary section track, high forces of attraction (up to 40 kN) act in the direction of the secondary section track. There is a risk of crushing!

- Use a forcing-off fixture that allows the primary section to be lowered in a controlled fashion.
- Make sure that your fingers do not protrude into the danger zone!

NOTICE

Damage to the primary section and secondary section track

If the primary section is located directly on the secondary section track, the two components can only be separated again with considerable effort. This can result in mechanical damage.

- Never place the primary section directly down onto the secondary section track.
- Always place a distance foil manufactured out of non magnetizable material between the primary section and secondary section.

Requirements

If other installation methods are not possible, this complex method is applied.

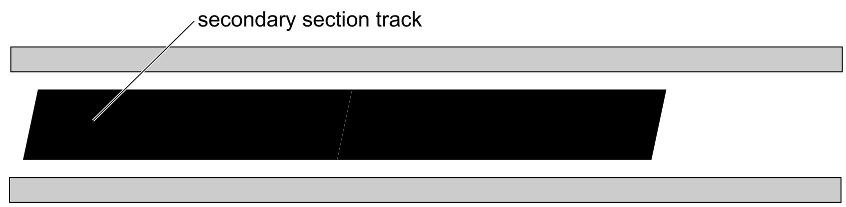
- For this installation technique, a non-magnetic spacer foil must be used between the primary section and secondary section track. This spacer foil prevents the primary section from coming into direct contact with the secondary section track.
  The spacer foil must be thinner than the required air gap. This is necessary to ensure that the spacer foil can be removed at the end of the installation without any effort.
- A forcing-off fixture is required for this installation technique. The forcing-off fixture must ensure that the primary section can be lowered onto the secondary section track (covered with the spacer foil) in a controlled fashion. Further, it must be lowered in parallel with the secondary section track and centered.
  The stiffness of the forcing plate and the length of the forcing-off screws must be dimensioned in such a way that the primary section is held at a height of at least 50 mm before touching down.
  The high forces of attraction must be taken into account with sufficient reserve when dimensioning the screws.

Procedure

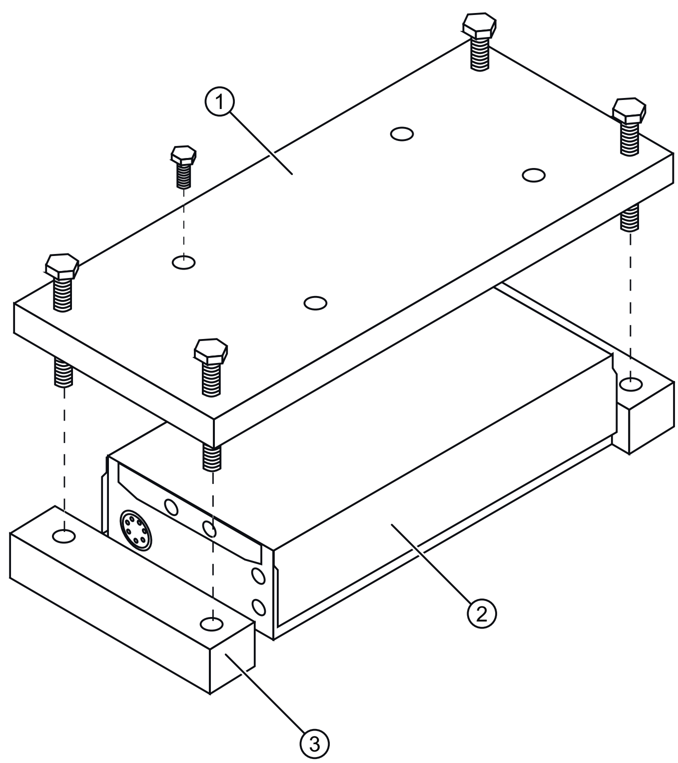
Application example

The secondary section track is shorter than twice the length of the primary section. The primary section together with the slide cannot be shifted to the side far enough so that all of the secondary sections can be easily screwed into place.

1. Install the secondary section track according to Chapter "Assembling individual motor components (Page 157)".



2. Using a forcing-off fixture, place the primary section down onto the secondary section track as follows:

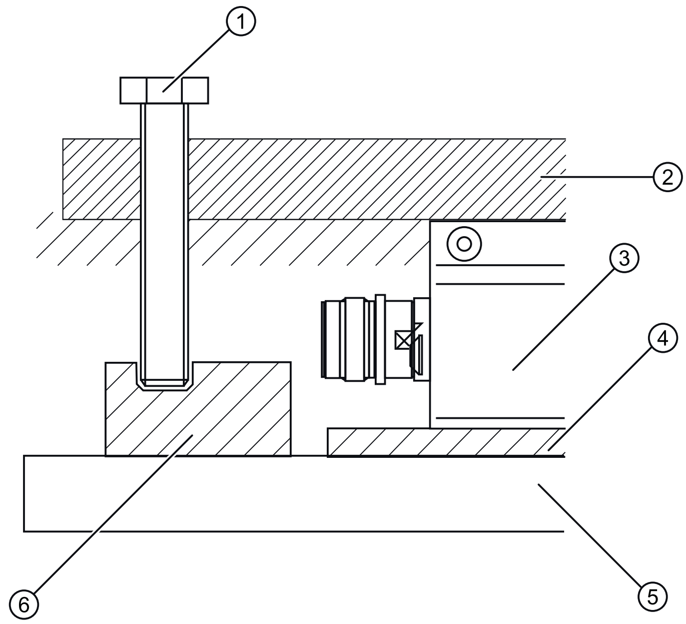


① Forcing plate
② Primary section
③ End support block

Figure 6-22 Forcing assembly

– Mount the primary section on the forcing plate of a forcing assembly. You can use the factory-made mounting holes for this purpose.

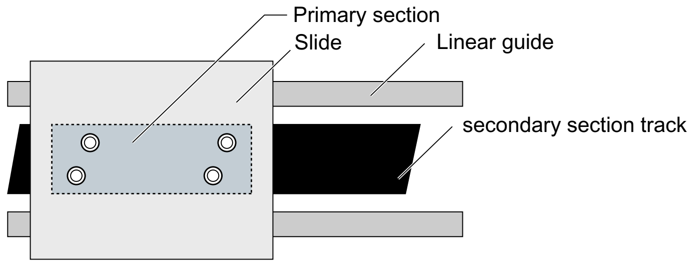
- Screw the jack screws into the forcing plate. Ensure that the jack screws protrude evenly from the forcing plate. There must be a minimum distance of **50 mm** between the non-magnetic counter-bearing blocks and the forcing plate.
- Place a spacer foil between the primary section and the secondary section track.
- Screw back the jack screws in steps to lower the primary section onto the secondary section track, in parallel and centered with it.
- Then completely remove the forcing assembly from the primary section.



①	Jack screw
②	Forcing plate
③	Primary section
④	Spacer foil
⑤	Secondary section
⑥	End support block (aluminum/brass)

3. Installing the primary section on the slide.
   - Secure the slide on the guides.
   - Push the slide over the primary section. When doing this, the mounting holes of the primary section and slide must be fully aligned.
   - The mounting screws are initially screwed through the slide into the primary section and tightened by hand. By uniform and alternating tightening of the mounting screws, the primary section is lifted from the secondary section track.

– Then remove the spacer foil from the air gap without applying any force.



❒

6.4.5 Assembling individual motor components

6.4.5.1 Installing the secondary sections

⚠ WARNING

There is a high risk of crushing fingers etc. when handling unpacked secondary sections!

Secondary sections and materials that can be magnetized can suddenly slam together unintentionally. Two secondary sections can also unintentionally slam together.

- Heed the warning information "Risk of crushing caused by permanent magnets of the secondary section" in Chapter "Safety instructions for mounting (Page 143)".

Procedure

- Place an appropriately sized protective mat with magnetic self-holding function on the secondary section. If necessary, you can cover a secondary section using 2 protection mats placed down next to one another.

Figure 6-23 Protective mats with magnetic self-holding function for secondary sections

- Place the side of the protection mat with the black PU foam over the entire surface of the magnets of the secondary section.
  The protection mat has a metal sheet on its upper side so that it is attracted and held in position by the magnetic force of the secondary section. This weakens the force of attraction of the secondary section. As a consequence, it reduces the risk of crushing due to the secondary section permanent magnets.
- To replace a secondary section, place one protection mat in front of and one behind the secondary section to be replaced.
- Remove the protection mat before you commission the linear motor.

- Use the mounting screws to force-fit the secondary sections to the machine bed. You screw in the optional installable cooling sections together with secondary sections between the secondary sections and the machine bed.

Note

Hole in the machine bed

The shaft of the bolts, which are used to attach the secondary section to the machine base may not reach the thread.

- If necessary, you must lower the relevant hole in the machine bed.

The letter "N" is to be found on each secondary section. Ensure that the letter "N" on each of the secondary sections is pointing in the same direction, as shown in the following figure.

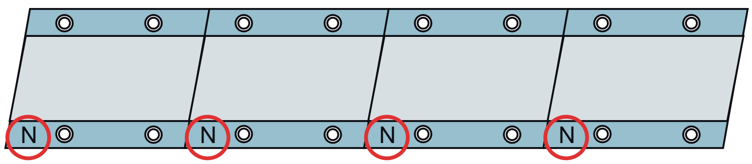


Figure 6-24 Position of the "N" marking on 1FN3 secondary sections

Screw on the secondary sections in the specified sequence as shown in the following diagram.

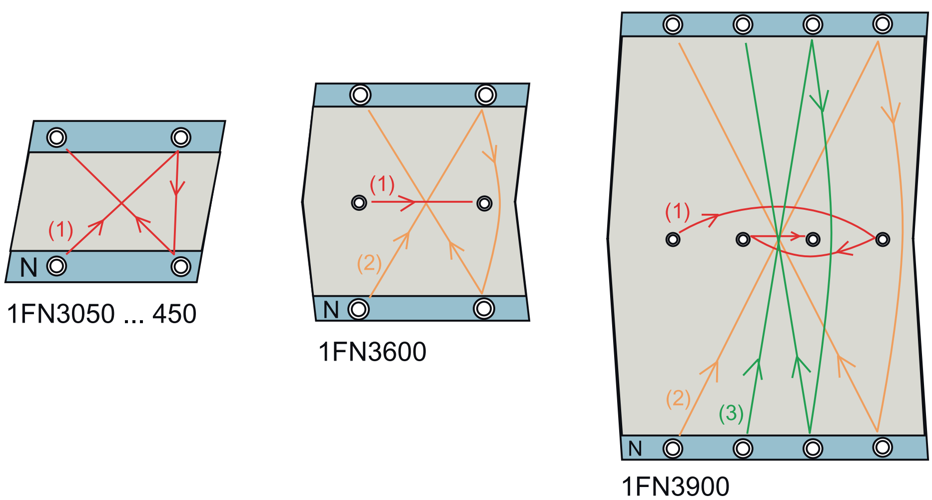


Figure 6-25 Screwed joint sequence of 1FN3 secondary sections

❐

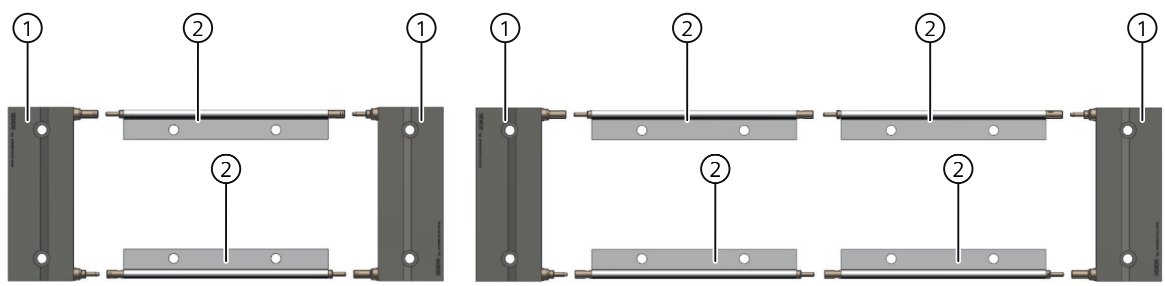
6.4.5.2 Installing the secondary section cooling

NOTICE
Damage to the plug-in connectors for a vertically arranged secondary section track (Step 10)
If you remove the temporary fastening screws too early from the cooling sections, the plug-in connectors may become deformed and thus overstressed. The reason for this is the intrinsic weight of the cooling sections.
• Only remove the screws that you temporarily used to fix the cooling sections step-by-step.

Requirements

If you want to use secondary section cooling, you must install the cooling sections and the secondary section end pieces before installing the secondary sections.

Correctly positioned cooling sections and combi-distributors with plug-in connectors as secondary section end pieces are shown in the following diagram.



① Combi distributor with plug-in connector as secondary section end piece (version to clamp the cover strip)

② Heatsink profile with plug-in connector

Figure 6-26 Position of the heatsink profiles and combi distributors (illustration without fastening screws)

Alternatively, you can use secondary section end pieces with wedges to fasten the cover strip.

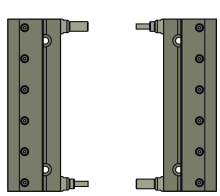


Figure 6-27 Combi distributor with wedge and screwed joint

The fastening screws for the wedges are standard cylinder head screws (hexagon socket-head screw, DIN 7984 M3x6). You can also use fillister-head screws (Phillips head H1, DIN 7985 M3x8). Refer to the following table for the required number of fixing screws.

Table 6-5 Number of mounting screws for the wedge of the secondary section end pieces

	1FN3...						
	050	**100**	**150**	**300**	**450**	**600**	**900**
Combi adapter	4	6	6	6	8	--	--
Combi end piece	4	6	6	6	8	--	--
Combi distributor	4	6	6	6	8	10	14
Cover end piece	2	5	5	6	7	--	--

To fasten the secondary section end pieces, use the same screws as for fastening the secondary sections.

The following work steps are required to mount the cooling sections with plug-in connector:

Procedure

1. This step is only applicable for secondary section end pieces with wedges:
   Before mounting the secondary section end pieces with wedges, you must first remove the wedges to fasten the cover strip.
2. Temporarily, fasten the cooling sections using just a few screws so that all threads in the machine bed are visible. Do not tighten the screws, because you will have to remove them again later.
3. Slide the secondary section end piece No. 1 axially onto the plug-in connectors of the cooling sections.
4. Screw in the mounting screws of the secondary section end piece No. 1. Do not tighten the mounting screws.
5. Slide the secondary section end piece No. 2 axially onto the plug-in connectors of the cooling sections.
6. Screw in the mounting screws of the secondary section end piece No. 2. Do not tighten the mounting screws.
7. Tighten the mounting screws of the secondary section end pieces.
8. Check the cooling circuit for any leaks (pressure check at a maximum of 10 bar).
9. Check whether all of the threads in the machine bed are still visible.
10. Remove the screws that you had temporarily used to fix the cooling sections.
11. Screw the secondary sections together with the heatsink profiles.
12. This step is only applicable for secondary section end pieces with wedges:
    If you do not use the cover strip as a secondary section cover, then mount the wedges of the secondary section end pieces.

❒

6.4.5.3 Installing the secondary section cover

WARNING

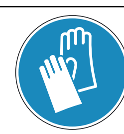
Risk of cutting injuries when handling secondary section covers

Secondary section covers have sharp edges. When delivered, the rolled up cover bands for secondary sections are secured using straps that are under spring tension.

If you cut through these straps, then the rolled up cover bands can suddenly unroll. You can incur cutting injuries at your hands and eyes if you do not wear safety gloves and adequate eye protection.

- Always wear safety gloves when handling secondary section covers
- Always wear suitable eye protection when unpacking cover bands
- Work in pairs where necessary
- Firmly hold the rolled up cover bands when cutting through the straps
- Allow the cover bands to slowly unroll

Table 6-6 Safety pictograms on the packaging for secondary section covers as continuous cover bands

Pictogram	Meaning	Pictogram	Meaning
	Warning against the secondary section cover band suddenly unrolling (Non-standardized warning sign)		Warning against pointed/ sharp object (ISO 7010-W022)
	Use eye protection (ISO 7010-M004)		Use protective gloves (ISO 7010-M009)

The secondary section cover protects the secondary section track. The installation method depends on the type of cover. The following 2 variants are available:

- Continuous cover band
- Segmented cover

NOTICE

Loss of functionality and motor wear due to contamination in the motor compartment

Contamination in the motor compartment can cause the motor to stop functioning or cause wear and tear. The use of scrapers to keep the air gap free is not sufficient and therefore not recommended.

- Use suitable measures to protect the motor compartment from contamination independently of the use of a cover band.

Covering long secondary section tracks with cover bands is more complicated than with segments.

Requirements

On the machine side, always carefully ensure that the linear motor is protected against all types of dirt and pollution. The cover plates of the secondary sections and the stainless steel cover of the primary section towards the air gap serve as protection against dirt and pollution, which cannot be prevented using machine-side shielding.

The cover plates for the secondary sections primarily protect the secondary section surface against being mechanically damaged, for instance, resulting from deposits of dust, sand, metal chips, machine parts etc.

Unprotected secondary sections can be damaged if this dirt or pollution is caught by the primary section or by moving machine parts and is ground or is trapped in the air gap.

The dirt and pollution to be expected in the machine must be taken into consideration when deciding whether a secondary section cover is necessary. When 1FN3 linear motors are installed corresponding to the specifications, then a relatively large air gap is obtained so that small particles of dirt cannot result in any mechanical contact between moved and stationary parts. The length of any cleaning intervals required can be appropriately selected to reflect this. Further, smaller deformations of the machine, as a result of high acceleration levels for example, do not result in any mechanical contact.

The use of cover plates increases the magnetic air gap, and reduces the motor force.

If it is advantageous to install secondary section covers, then you must select the most suitable cover variant (segmented cover or continuous cover band). This can be evaluated based on various criteria.

- Type of dirt/pollution
  - In the case of pointed and sharp-edged pollution, such as metal chips, the continuous cover band is the preferred choice, as it creates a smooth surface without any joints. Metal chips can become lodged in the joints between segmented covers and result in damage. The primary section can press dirt and pollution that can be compressed into the segmented cover joints therefore causing them to lift off. The cover can be shifted if a high degree of friction is created between the primary section and the cover as a result of the dirt and pollution.
  - For occasional exposure to liquids, the segmented cover offers less protection against liquid accumulating between the cover and the secondary sections. It can be advantageous not to use the cover in the case of substances that can attack or penetrate the encapsulation of the secondary sections and damage the magnet material. This allows any liquid to escape and the parts to dry.
- Length of the axis
  - The length of the continuous cover band is limited. Segmented covers can be used to cover any length of secondary section track.
  - When using the continuous cover band, the motor length is extended, even when secondary section cooling is not used, by the mounting areas at the ends of the secondary section track.
- Installation options and installation work involved
  - Installing the continuous cover band is more complex than installing the segmented cover, as it involves flexible and in most cases long sheets of metal. The length of the individual cover segments is limited and is stabilized using lateral edge profiles.
  - As a result of the magnetic force of attraction, the continuous cover band must already be aligned when coming into contact with the secondary sections for the first time. You have to lift it off almost completely if you want to subsequently adjust it. The segmented cover is placed down, and it automatically aligns itself as a result of the lateral edge profiles.
  - If the slides have already been mounted, then the continuous cover band must always be mounted together with the secondary sections, as it is not possible to introduce the cover band between the primary section and secondary section.
  - If the slide length is less than half the length of the secondary section track, then the secondary sections and the covers (both continuous and segmented) must be mounted before installing the slide.

Procedure

Mounting the continuous cover band

The procedure is valid for the following initial situation:

- The secondary section track is at least twice the length of the slide.
- The guides and the slides are mounted together with the primary section.

- The half secondary section track is mounted.
- The slide stands above the range that has no secondary section.

Figure 6-28 Initial situation when mounting the continuous cover band

1. Remove the clamping wedges of the secondary section end pieces and prepare an insertion aid for the cover band.
   Material that cannot be magnetized must be used and the width should approximately correspond to that of the secondary sections (e.g. a wooden board as shown in the diagram above).
2. Position the insertion aid at the end of the secondary section track so that a ramp is created.
3. Unroll the cover band and place it down on the insertion aid.

4. Position the insertion aid so that a clearance of at least 1 cm remains between the cover band and the secondary section track.

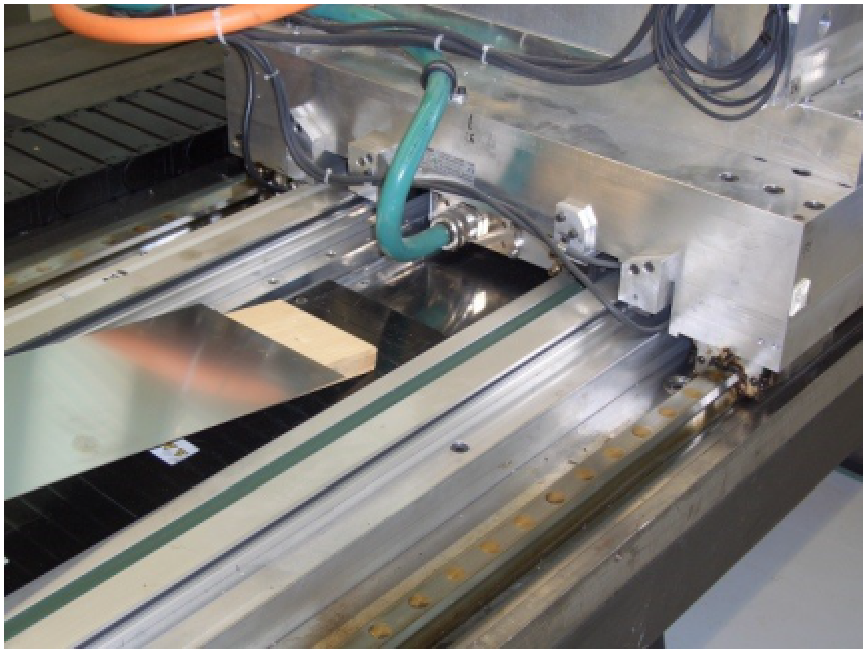


Figure 6-29 Positioning the insertion aid

5. Slide the cover band under the slides until the secondary section end piece is reached.

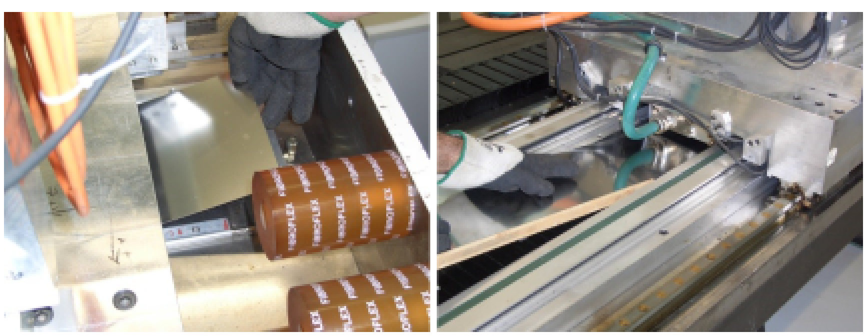


Figure 6-30 Sliding the cover band

6. Place the cover band in the wedge-shaped recess of the secondary section end piece and align it in the traversing direction and at right angles to this, centered with respect to the end piece.
   Some clearance must be left between the end of the cover band and the threaded hole so that the fixing screws of the clamping wedge can be inserted.

7. Place the clamping wedge down and press it into position.

8. Insert the fixing screws and tighten them hand tight.

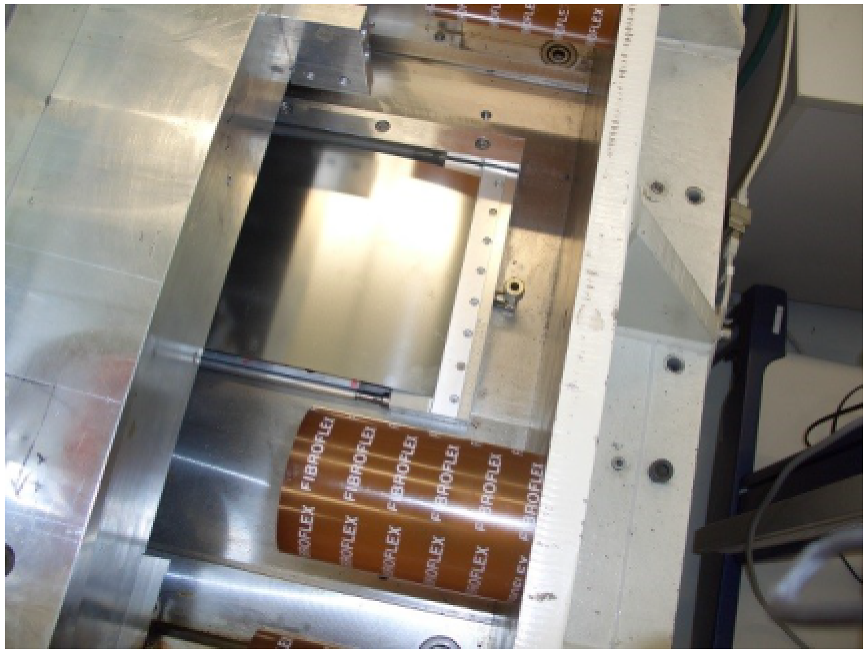


Figure 6-31 Inserting the fixing screws

9. Lift the cover band from the insertion aid and bend it upwards without kinking it.
10. Remove the insertion aid.
11. Slowly place the cover band on the already mounted secondary sections.

12. When coming into contact with the secondary section edge for the first time, align the cover band centered with respect to the secondary section and check that the band is correctly positioned in the secondary section end piece. When placing down on the secondary sections, continuously check the alignment at right angles to the traversing direction. If the cover band significantly deviates from the secondary section track, then it must be lifted and realigned.

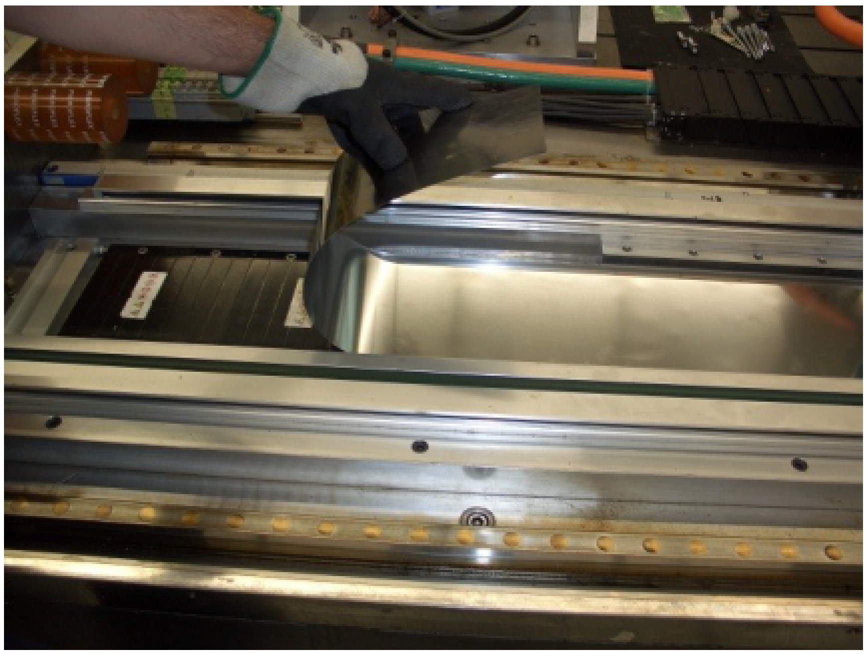


Figure 6-32 Aligning the cover band

13. Place the cover band on the second end piece and check the position in the traversing direction.
    The cover band must be aligned in the traversing direction if the threaded holes for mounting the clamping wedge are covered. In this case, it must be completely lifted off, so that a marking on the cover band at the end of the already mounted parts of the secondary section track (slide side) can be helpful when repositioning.

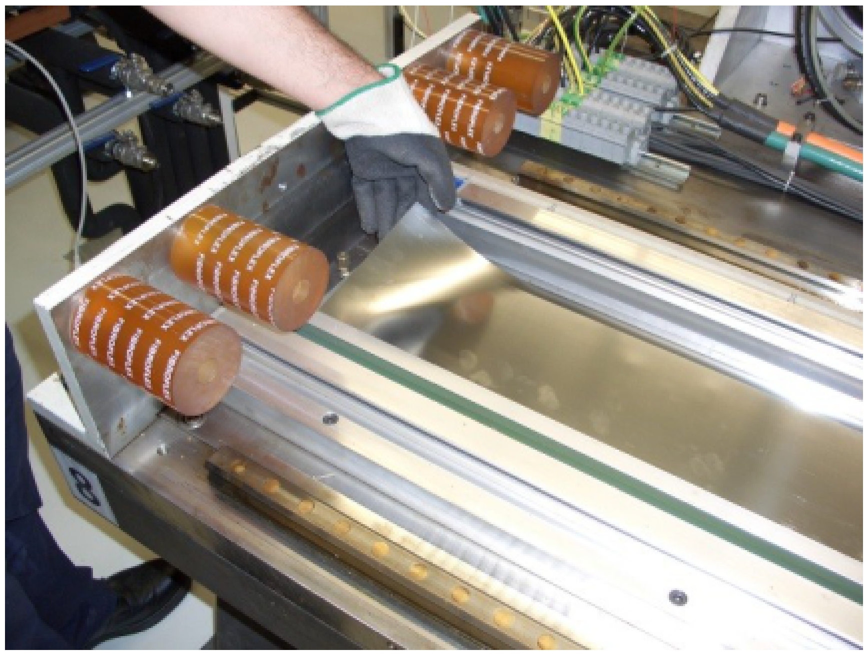


Figure 6-33 Placing the cover band on the second end piece

14. Press in the clamping wedge once you have aligned the cover band.
15. Screw-in the fixing screws and tighten them.

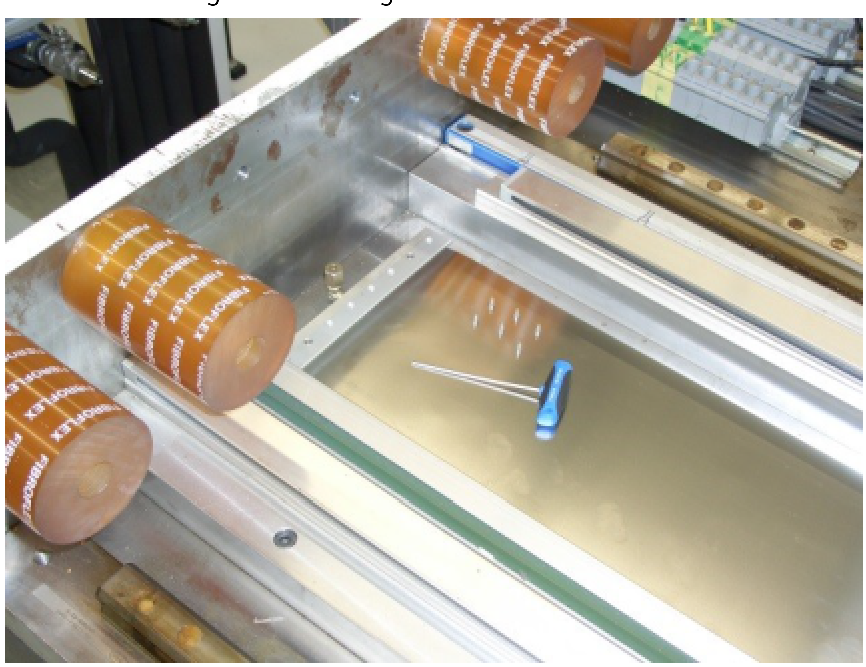


Figure 6-34 Screwing-in the fixing screws

16. Check again that the other end of the cover band is correctly aligned and the threaded holes in the secondary section end piece are not covered, even when the cover band is slightly pulled.
17. Push the slide over the mounted secondary section track to the other end position.
18. Release the cover band at the end without secondary section from the end piece and bend it upwards without kinking it.
19. Fix the cover band and insert a wedge between the secondary sections and cover band to compensate for the force of attraction.

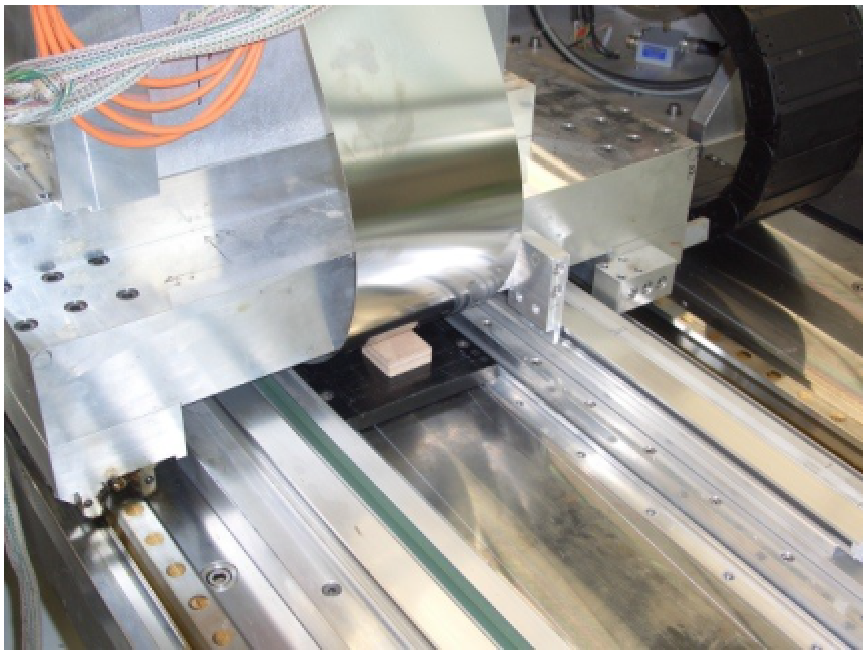


Figure 6-35 Fixing the cover band

20. Mount the remaining secondary sections.

21. Unroll the cover band on the secondary sections, and ensure that it is correctly aligned. Minimum lateral deviations can be corrected.

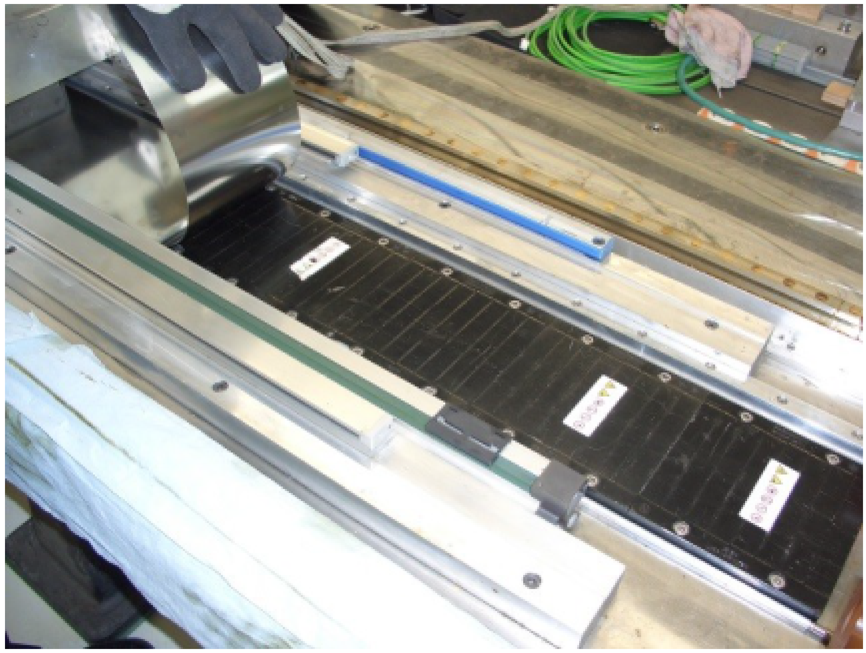


Figure 6-36 Unroll the cover band on the secondary sections

22. Press on the clamping wedge again and screw it tight.

Figure 6-37 Moving up the clamping wedge

Mounting the segmented cover

1. Mount the secondary sections with the slide plate removed.
2. Mount the first segment of the cover as follows:
   Place the end of the first segment starting from the top in a 45° angle, flush to the outer edge of the last secondary section.
   Then lower the segment in alignment with the secondary section track.
   When you sense the magnetic attraction, let loose of the segment.
   The segment generally assumes the correct position on its own.

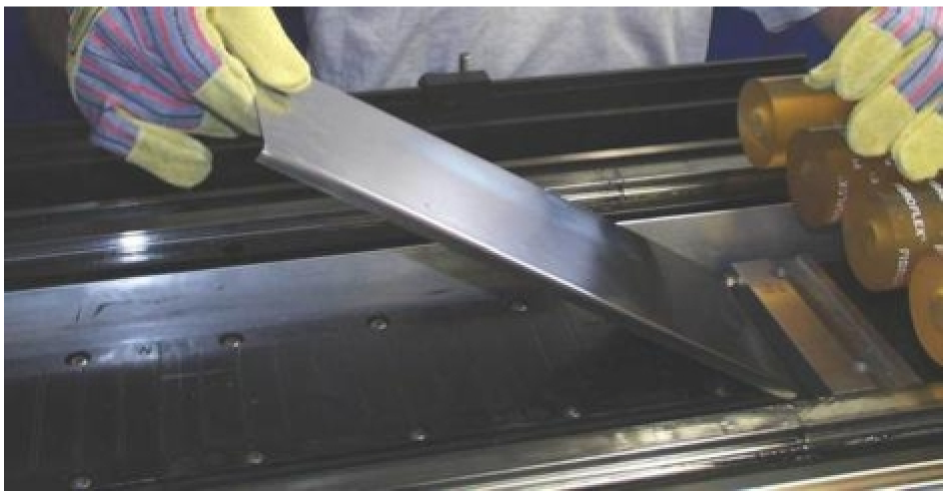


Figure 6-38 Mounting the first segment of the segmented cover

3. Check the correct position:
   If the first segment of the cover extends to the middle of a secondary section, the position is correct.
4. Mount all other segments the same way as the first segment.

Figure 6-39 Mounting an additional segment of the segmented cover

5. Fasten the ends of the first and last segments to the secondary section end pieces.
6. Place the primary section with spacer and forcing assembly on the secondary section track.
7. Mount the slide onto the guide.
8. Align the slide over the mounting holes of the primary section.
9. Remove the primary section from the secondary section track using the forcing assembly.
10. Mount the primary section securely on the slide.

❒

Note

Arranging segments of the cover

If you arrange the butt joints of the cover segments so that they are offset from the butt joints of the secondary sections, the secondary section track will be better protected against dust. The segments of the cover also align better.

This offset is achieved when the cover segments at the ends of the secondary section track have a (n + 0.5) length instead of the integral length of the secondary sections, see the following diagram showing this.

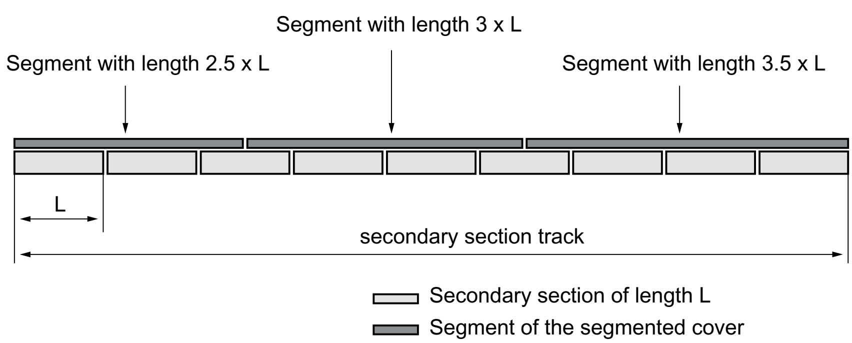


Figure 6-40 Example: Segment position of the segmented secondary section cover

Removing the segmented cover

If you want to remove the segmented secondary section cover, you must raise the segments on one side transversely to the traversing direction as per the following figure.

Figure 6-41 Demounting a segment of the segmented secondary section cover

6.4.5.4 Installing the primary section

NOTICE
Damage to motor components due to incorrect screw-in depths
The primary section can be damaged if the fixing screws are screwed in too deep and prevent an adequate force-locked connection to the machine. Screwed connections can fail in operation if the fixing screws are not screwed in deep enough. Both scenarios damage or destroy motor parts. • Strictly comply with the specifications regarding minimum and maximum permissible screw-in depth.

Procedure

- Screw the primary section to the back of the primary section using the threaded holes to establish a friction-locked connection.

6.4.5.5 Mounting the Hall sensor box

NOTICE
Uncontrolled traversing movements due to incorrect installation of the Hall sensor box
Incorrect installation of the Hall sensor box can lead to uncontrolled traversing movements of the motor. The machine can also become damaged. • Increase the clearance between the primary section and Hall sensor box from a certain minimum clearance only by integer multiples of the pole pair width $2\tau_M$. The count factor N_P is specified in the drawings. The exact dimensions of the Hall sensor box can be found in Chapter "Assembly drawings/dimension sheets (Page 523)".

Note

If several primary sections are operated on one drive system, the master is always to be used as reference for the Hall sensor box.

Procedure

- When mounting the Hall sensor box, you must comply with the appropriate installation drawings regarding its mounting position and orientation with respect to the primary section. The cable outlet direction and position of the Hall sensor within the Hall sensor box are permanently assigned to one another.
- Place the holding fixture for the Hall sensor box so that a clearance of x = 35 mm is maintained between the top edge of the Hall sensor box and the bottom edge of the primary section. See the following figure.

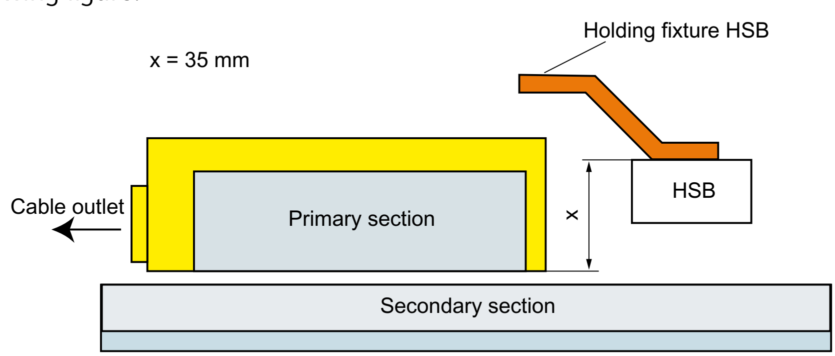


Figure 6-42 Specified dimension for mounting the Hall sensor box (HSB)

❐

The Hall sensor box cable is trailable and is suitable for installation in a cable carrier.

6.4.6 Cooler connection

Connection system

Please note the following for the connection of the cooling system:

- All connections should be flexible (hoses)
- All material used must be resistant to the local environmental conditions
- All materials must be compatible
- Manufacturer's information regarding mounting are to be observed.

6.4.6.1 Primary section cooling connection

Preconditions for the connection

All cooler connections of the primary section main cooler and primary section precision cooler have a G1/8 cylindrical pipe thread according to DIN ISO 228-1. Suitable connectors are required for connecting the hoses.

NOTICE
Never use any used connection parts and components Faulty and used connection parts and components can result in pressure drop and leaks. • Use only new, unused connection parts and components • Check the compatibility of the materials of the parts being connected (including seals) with all other materials in the cooling circuit and with the coolant that is used.

Properties and attributes of the sealants used:

- Viton: resistant to temperature and glycol
- Perbunan: up to water temperatures of 80 °C
- Ethylene-propylene: resistant to temperature and glycol

Note

Recommended manufacturers

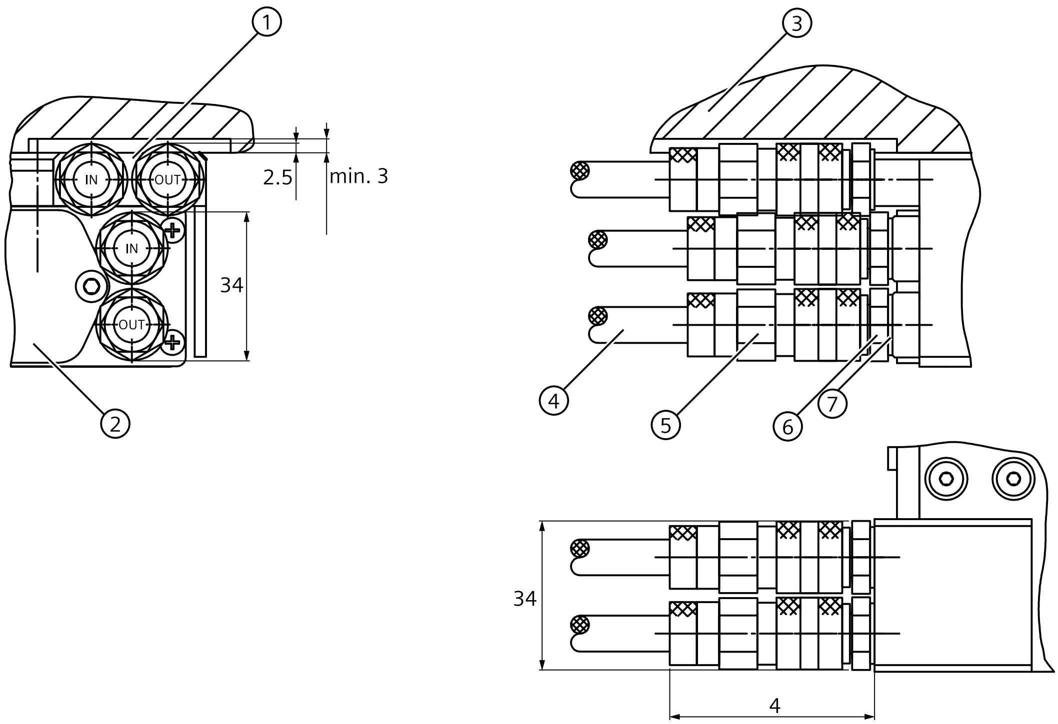
You will find recommended manufacturers for the connecting parts for the cooling in the appendix.

Mounting

The connection parts and components can generally be installed using standard tools.

Recess at the machine slides

If the connection assembly of the primary section in the traversing direction extends beyond the primary section, a recess must be machined at the machine slides as shown in the following diagram. The recess above the cooler connections is required for the use of connecting parts.



① Precision cooler
② Primary section (main cooler)
③ Machine slide
④ Coolant hose
⑤ Quick release coupling 21 KF KO08 MPX (Rectus company)
⑥ Plug-in nipple 21 SF AW10 MPX (Rectus company)
⑦ Sealing ring DIN 7603-A 10x13.5-Cu (or Al)

Figure 6-43 Example of a cooler connection with recess at the machine slides

6.4.6.2 Secondary section cooling connection

Connection options

For motors of the 1FN3 product family, you can use secondary section end pieces for the flow and return lines of the secondary section cooling system.

If the continuous cover for secondary sections is not used, you can also connect the plastic hoses directly to the cooling sections using hose nipples.

Properties of the plastic hose

The plastic hoses must be resistant to the cooling medium, flexible and abrasion resistant.

Note

Recommended manufacturers

You will find the recommended manufacturers for the plastic hoses in the appendix.

Connection via secondary section end pieces

To connect plastic hoses to secondary section end pieces, screwed joints with screwed nipples and reinforcing sleeves can be used. You can attach the plastic hoses over the screwed hose connector nipples with hose clamps.

For this connection, note the maximum outer diameter (12 mm) and the maximum width across corners (width across flats 10) of the screwed joint or the screwed nipple:

If you choose larger screw joints or screwed nipples, you must provide appropriately dimensioned recesses in the screw surface of the secondary section.

You can seal screwed nipples from the end piece in one of the following ways:

- Axially acting O-ring
- Sealing ring
- Thread seal

We recommend the use of conical screwed nipples

Note

Recommended manufacturers

You will find recommended manufacturers for screwed joints with screwed nipples and reinforcing sleeves in the appendix.

Position of the connections for secondary section end pieces

Connect the secondary section cooling via the G1/8 threaded connections. The G1/8 thread connections are located on the front faces of the secondary section end pieces.

For models with combi distributors, the flow is located on one side of the secondary section track and the return on the opposite side, see also the following figure.

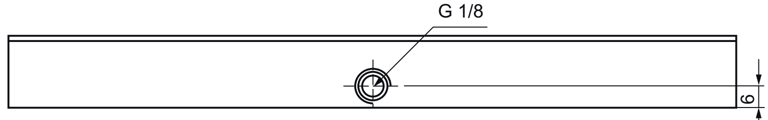


Figure 6-44 Position of the connection elements of the secondary section cooling system with combi distributor (face view)

For variants with combi adapter / combi end piece, the coolant intake and return are located on the combi adapter, see the following figure.

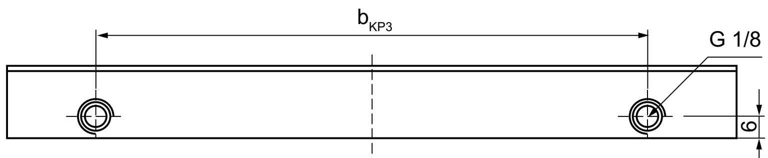


Figure 6-45 Position of the connection elements of the secondary section cooling system with combi adapter (face view)

Table 6-7 Connector dimensions of the secondary section cooling system with combi adapter (available only for 1FN3050 ... 450)

Motor type	b_{KP3} in mm
1FN3050	40
1FN3100	40
1FN3150	100
1FN3300	50
1FN3450	100

Direct connection

To connect plastic hoses directly, you can order cooling sections with hose nipples from Siemens. The inside diameter of the hose must be 5 mm. Connect the hose and the hose connector nipple using a hose clamp.

6.4.7 Checking the work carried out

⚠ WARNING

Risk of electric shock

Voltage is induced at the power connections of the primary section each time a primary section moves with respect to a secondary section - and vice versa. If you touch the power connections you may suffer an electric shock.

- Do not touch the power connections.
- Connect the motor cable ports correctly, or insulate them properly.

6.4.7.1 Smooth running of the slide

Checking the smooth running of the slide

The motor installation must be specially checked for the smooth running of the slide.

- Remove all tools and objects from the traversing range.
- Clean the magnetic surface with a cloth before moving the slide.

If the guidance system is precisely aligned, it must be possible to move the moving part of the motor with a force that remains constant over the entire traversing range. A slight fluctuation in force is permissible. The force fluctuation results from the system-related cogging force of the linear motor.

- If excessive sluggishness results locally, check the installation height and the alignment of the guide system.

Note

Increased shifting force or force ripple

When checking the smooth running of the slide, ensure that the power connections of the motor cable are not connected to the drive. In addition, the power connections must not be "short-circuited". In these cases, a greater shifting force or force ripple occurs.

6.4.7.2 Checking ease of movement in the air gap

Note

Installation height and air gap

The installation height must remain within the specified tolerances over the complete traversing distance.

The correct installation height automatically sets the correct air gap height.

Precisely measuring the air gap height is not possible as a result of the inherent design.

The correct installation height is a precondition to comply with the electrical properties of the motor according to the data sheet.

After installation, check ease of movement in the air gap over the complete length of the secondary section track using a piece of tear-resistant spacer foil that is 0.5 mm thick.

You can find the manufacturer's recommendation for spacer foil in the annex.

Procedure

1. Slide the spacer foil into the air gap between the primary and secondary sections.
   The spacer foil must not jam. It must be easily moveable along the entire length of the air gap by hand with minimal use of force.
2. Slide the primary section over a section of the secondary section track that has not yet been checked. Repeat the check.
3. Repeat this procedure until the entire length of the secondary section track has been checked.

❒

NOTICE
Air gap height is too small
If the check identifies that there is not the appropriate ease of movement in the air gap, then the specified installation height is not complied with or there is an installation error. It is not permissible that the machine is commissioned. • Ensure that the installation height of the machine is within tolerance and the motor has been correctly installed without any errors.

Technical data and characteristics 7

The technical data and characteristics for the 1FN3 linear motors are stated in this chapter. This data collection provides the motor data required for configuration and contains a number of additional data for more detailed calculations for detailed analyses and problem analyses.

Parameters that are used in the drive system for the control of a drive can differ from the data specified here.

Technical data subject to change.

Note

System-specific data refer to the combination of 1FN3 linear motors with SINAMICS S120 drive systems.

Unless otherwise stated, the following constraints apply here:

- The DC link voltage U_{DC} is 600 V, the converter output voltage $U_{a\,max}$ is 425 V
- The motor is water-cooled with the recommended minimum volume flow rate $\dot{V}_{P,H,MIN}$ according to the data sheet and a water flow temperature T_{VORL} of 35 °C
- The rated temperature of the motor winding T_N is 120 °C
- Voltages and currents are specified as rms values.
- Installation altitude of the motors up to 2000 m above sea level.

7.1 Explanations

7.1.1 Explanations of the formula abbreviations

Data sheet contents

The data contained in the data sheets are explained in the following and divided as follows:

- General conditions
- Data at the rated point
- Limit data
- Physical constants
- Primary section main cooler data

- Primary section precision cooler data
- Secondary section cooling data

General conditions

U_{DC}	Converter DC link voltage (direct voltage value). **Comment**: $U_{a\ max}$ is the maximum permissible converter output voltage
T_{VORL}	Maximum flow temperature of the water cooling if the motor is to be utilized up to its rated force F_N.
T_N	Rated temperature of the motor winding

Ratings (S1 duty)

F_N	Rated force of the motor
I_N	Rated current of the motor at rated force F_N
$v_{MAX,\ FN}$	Maximum velocity up to which the motor can deliver the rated force F_N
$P_{V,N}$	Motor power loss at the rated point (F_N,$v_{MAX,FN}$) at the rated temperature T_N. Losses due to friction and eddy currents are ignored. **Comment:** The power loss is calculated using $P_V = 3 \cdot R_{STR}(T) \cdot I^2$. Correspondingly, $P_{V,N}$ is calculated using $P_{V,N} = 3 \cdot R_{STR}(T_N) \cdot I_N^2$.

Limit data

F_{MAX}	Maximum force of the motor (according to data sheet)
$F_{L,MAX}$	Maximum force of the duty cycle that the motor must produce
I_{MAX}	Maximum current of the motor at maximum force F_{MAX}
$v_{MAX,FMAX}$	Maximum velocity up to which the motor can deliver the maximum force F_{MAX}
$P_{EL,MAX}$	Electric power drawn by the motor at point (F_{MAX},$v_{MAX,FMAX}$) at rated temperature T_N. Losses due to friction and eddy currents are ignored. **Comment:** The sum of the output mechanical power P_{MECH} and power loss P_V is the electric power drawn by the motor P_{EL}: $P_{EL} = P_{MECH} + P_V = F \cdot v + 3 \cdot R_{STR}(T) \cdot I^2$ $P_{EL,MAX}$ can be correspondingly calculated: $P_{EL,MAX} = P_{MECH,MAX} + P_{V,MAX} = F_{MAX} \cdot v_{MAX,FMAX} + 3 \cdot R_{STR}(T) \cdot I_{MAX}^2$
F_0^*	Static force: Motor force that can be continuously achieved at standstill **Comment:** F_0* can be approximately calculated from the rated force F_N, while neglecting the influence of motor saturation: $F_0^* \approx \frac{1}{\sqrt{2}} F_N$
I_0*	Stall current of the motor at static force F_0* **Comment:** I_0* can be calculated from the rated current I_N: $I_0^* \approx \frac{1}{\sqrt{2}} I_N$

Physical constants

$k_{F,20}$	Force constant of the motor with a specified installation height and a secondary section temperature of 20 °C. **Comment:** The force constant refers to the linear (lower) section of the motor force-current characteristic.
k_E	Voltage constant for calculating the mutually induced voltage between the phase and the neutral point for the specified installation height.
$k_{M,20}$	Motor constant at a winding temperature of 20 °C. **Comment:** The motor constant k_M can be calculated for other temperatures: $k_M(T) = k_{M,20}[1 + α(T - 20 °C)]$ with the temperature coefficients α = 0.001 1/K for the magnets used.
$R_{STR,20}$	Line resistance of the winding at a winding temperature of 20 °C. **Comment:** The line resistance R_{STR} can be calculated for other temperatures: $R_{STR}(T) = R_{STR,20}[1 + α(T - 20 °C)]$ with the temperature coefficients α = 0.00393 1/K for copper.
L_{STR}	Phase inductance of the winding with specified installation height
F_A	Force of attraction between the primary section and the secondary section for the specified installation height
t_{TH}	Thermal time constant of the motor winding **Comment:** The thermal time constant is obtained from the temperature characteristic in the motor winding for a sudden load with constant current at time t = 0,, see the following figure. After time t_{TH} has elapsed, the motor winding reaches approx. 63 % of its final temperature T_{GRENZ}, if the temperature protection does not respond beforehand.

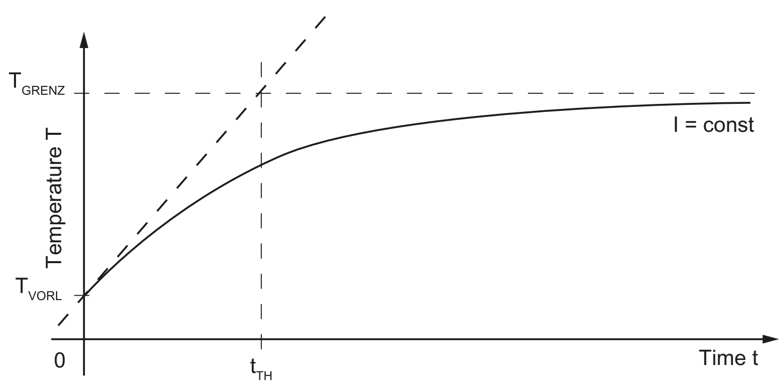


Figure 7-1 Definition of the thermal time constant

$τ_M$	Pole width of the motor, corresponds to the distance between the respective centers of the north and south poles of neighboring magnets on a secondary section.
m_P	Weight of the primary section without precision cooler, fastening screws, plugs, connection cable and coolant.
$m_{P,P}$	Weight of the primary section with precision cooler, but without fastening screws, plugs, connection cable and coolant.
m_S	Mass of a secondary section without mounting screws, cover and optional heatsink profiles
$m_{S,P}$	Weight of a secondary section with cooling sections, but without fastening screws, cover and coolant

Primary section main cooler data

$Q_{P,H,MAX}$	Maximum thermal output dissipated through the main cooler when utilizing rated force F_N and at the rated temperature T_N
$\dot{V}_{P,H,MIN}$	Recommended minimum volume flow rate through the main cooler to achieve the rated force F_N
$\Delta T_{P,H}$	Temperature increase of the coolant between the intake and return of the main cooler at the operating point ($Q_{P,H,MAX}$,$\dot{V}_{P,H,MIN}$)
$\Delta p_{P,H}$	Pressure drop of the coolant between the intake and return lines of the main cooler with flow rate $\dot{V}_{P,H,MIN}$.

Primary section precision cooler data

$Q_{P,P,MAX}$	Maximum thermal output dissipated through the primary section precision cooler when utilizing rated force F_N and at the rated temperature T_N
$\dot{V}_{P,P,MIN}$	Recommended minimum volume flow rate in the primary section precision cooler so that the maximum surface temperature is T_{VORL} + 4 K
$\Delta p_{P,P}$	Pressure drop of the coolant between the intake and return lines of the primary section precision cooler with flow rate $\dot{V}_{P,P,MIN}$.

Secondary section cooling data

$Q_{S,MAX}$	Maximum thermal output dissipated through the secondary section cooling system when the rated force F_N and rated temperature T_N are utilized.
$\dot{V}_{S,MIN}$	Recommended minimum volume flow rate in the secondary section cooling
Δp_S	Pressure drop of the coolant between the intake and return lines of the secondary section cooling for flow rate $\dot{V}_{S,MIN}$ and a reference length of one meter
Δp_{KS}	Pressure drop of the coolant at a connection point of the secondary section cooling **Comment:** For the term "coupling point", see the following figure.

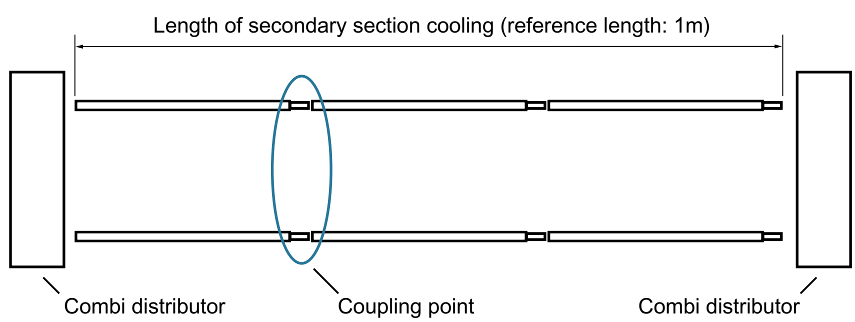


Figure 7-2 Components of the standard secondary section cooling system, schematic

Δp_{KV}	Pressure drop of the coolant in a combi distributor. **Comment:** Usually two combi distributors are used in the secondary section cooling, see the following figure

7.1.2 Explanations of the characteristic curves

Motor force vs. velocity

The diagrams for motor force F_M for each of the motors include three characteristics for various DC link voltages U_{DC} or converter output voltages $U_{a\ max}$. See also the table below "Color coding of F-v characteristics in the diagrams" and the following figure.

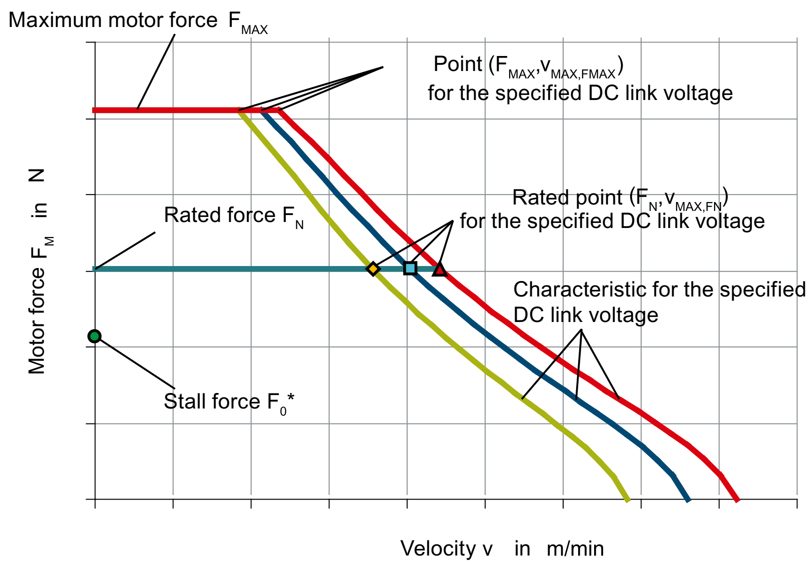


Figure 7-3 Characteristic curve for the motor force F_M versus velocity v, schematic

Table 7-1 Color coding of the F-v characteristics in the diagrams

Color	Resulting DC link voltage U_{DC}	Converter output voltage (rms value) $U_{a\ max}$	Permissible line supply voltage (rms value)	SINAMICS S120 Line Module
red line	634 V	460 V	480 V	Smart Line Module, non-active with regenerative feedback or Basic Line Module, non-active without regenerative feedback
blue line	600 V	425 V	400 V	Active Line Module, active with regenerative feedback
yellow-green line	528 V	380 V	400 V	Smart Line Module, non-active with regenerative feedback or Basic Line Module, non-active without regenerative feedback

Short-circuit braking force vs. velocity

The characteristic curve below shows the short-circuit braking force F_{Br} of the motor as a function of the velocity v by way of example. Any friction that occurs is ignored.

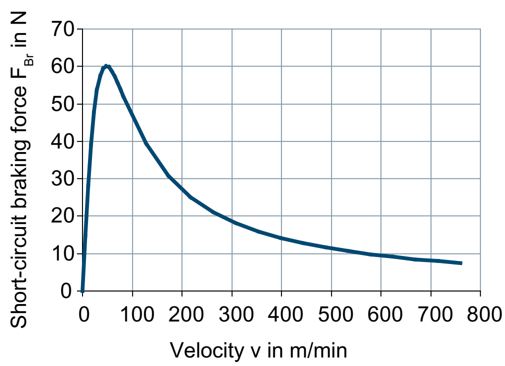


Figure 7-4 Short-circuit braking force F_{Br} versus velocity v, example

Temperature rise of the primary section main cooler versus volume flow rate

The following characteristic curve shows the temperature rise ΔT between the flow and return of the primary section main cooler as a function of the volume flow rate $\dot{V}$ by way of example.

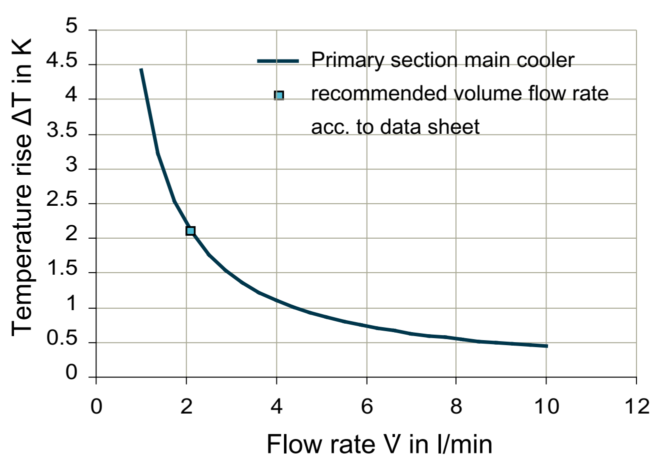


Figure 7-5 Characteristic temperature rise ΔT versus volume flow rate $\dot{V}$ in the primary section main cooler, example

Pressure drop across the coolers with respect to the flow rate

The following characteristic curve shows the pressure drop Δpbetween the flow and return of the primary section main cooler as a function of the volume flow rate V̇ by way of example.

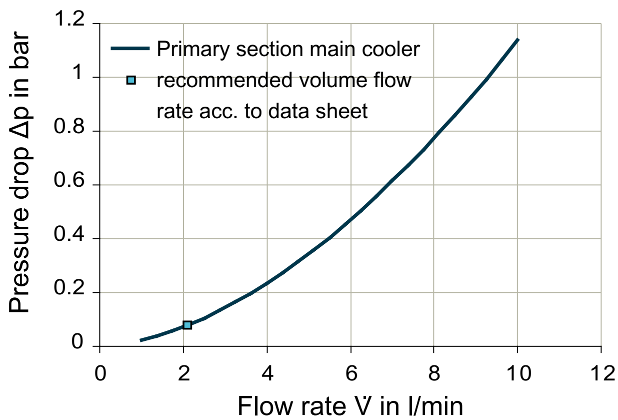


Figure 7-6 Pressure drop Δp versus volume flow rate V̇ for primary section main cooler, example

The following characteristic curve shows the pressure drop Δp between the flow and return of the primary section precision cooler as a function of the volume flow rate V̇ by way of example.

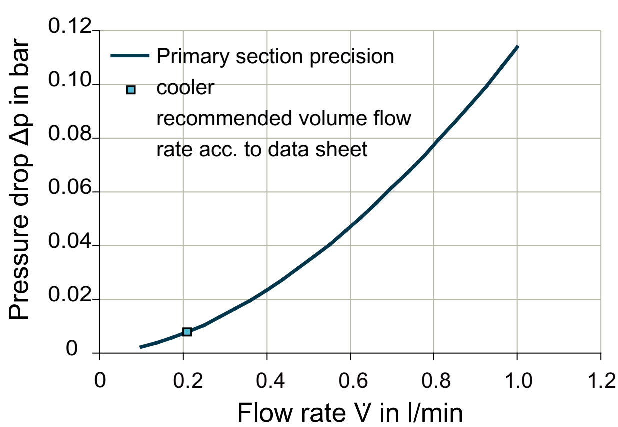


Figure 7-7 Pressure drop Δp versus volume flow rate V̇ for primary section precision cooler, example

The following characteristic curves show the pressure drop Δp between the flow and return of the individual components of the standard secondary section cooling with a combi distributor as a function of the volume flow rate V̇ by way of example.

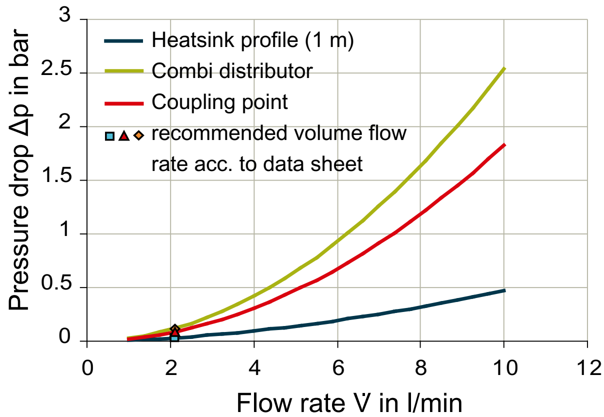


Figure 7-8 Pressure drop Δp versus volume flow rate V̇ for secondary section cooling, example

7.2 Data sheets and characteristics

7.2.1 1FN3050-xxxxx-xxxx

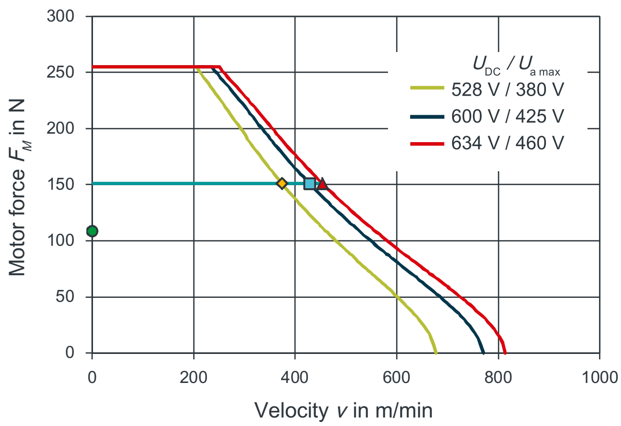
Data sheet of 1FN3050-1ND00-0xAx

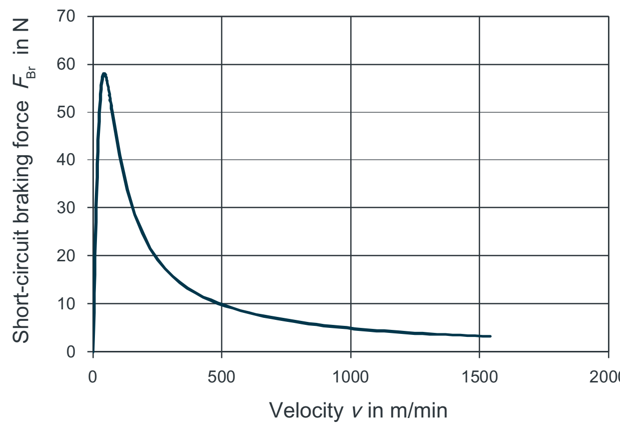
1FN3050-1ND00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	151
Rated current	I_N	A	2.82
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	429
Rated power loss	$P_{V,N}$	kW	0.16
Limit data			
Maximum force	F_{MAX}	N	255
Maximum current	I_{MAX}	A	5.86
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	236
Maximum electric power drawn	$P_{EL,MAX}$	kW	1.69
Static force	F_0*	N	108
Stall current	I_0*	A	2

1FN3050-1ND00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	54.3
Voltage constant	k_E	Vs/m	18.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	14.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	4.8
Phase inductance	L_{STR}	mH	44.9
Attraction force	F_A	N	496
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	2.2
Mass of the primary section with precision cooler	$m_{P,P}$	kg	2.69
Mass of a secondary section	m_S	kg	0.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.142
Recommended minimum volume flow rate	$V_{P,H,MIN}$	l/min	2.1
Temperature increase of the coolant	$\Delta T_{P,H}$	K	0.97
Pressure drop	$\Delta p_{P,H}$	bar	0.359
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.00419
Recommended minimum volume flow rate	$V_{P,P,MIN}$	l/min	2.1
Pressure drop	$\Delta p_{P,P}$	bar	0.0555
Secondary section cooling data			
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.014
Recommended minimum volume flow rate	$V_{S,MIN}$	l/min	2.1
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0286
Pressure drop per combi distributor	Δp_{KV}	bar	0.119
Pressure drop per coupling point	Δp_{KS}	bar	0.0877

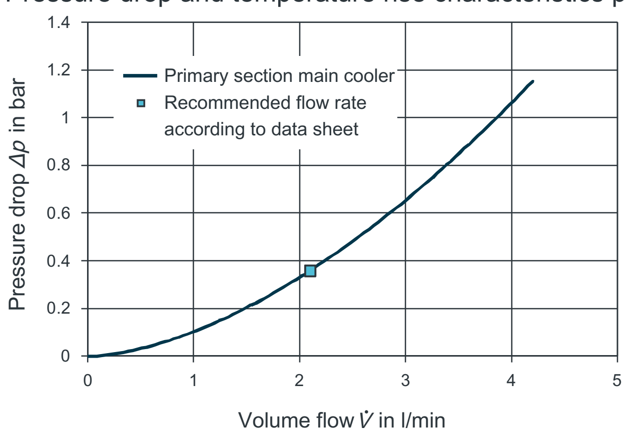
Characteristics of 1FN3050-1ND00-0xAx

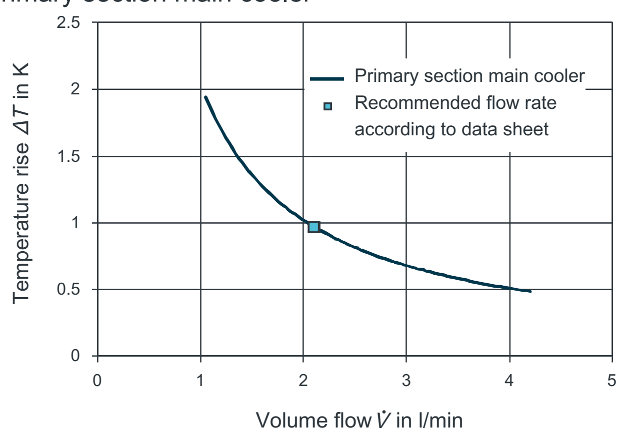
Force characteristics



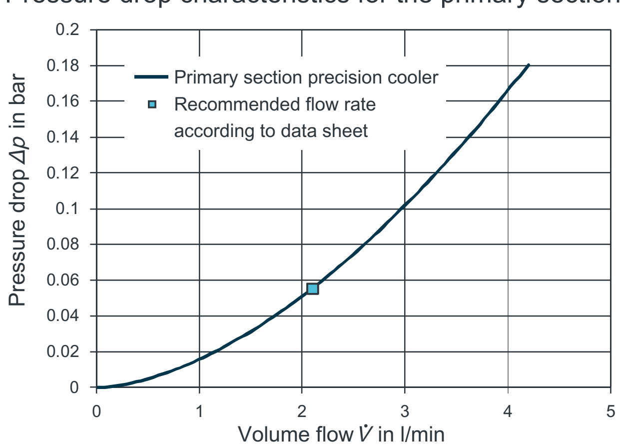


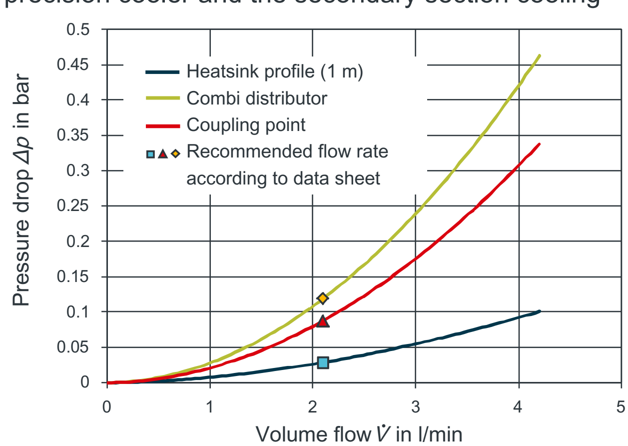
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





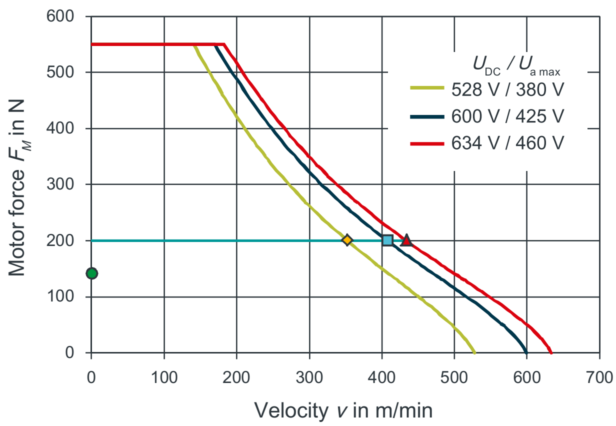
Data sheet of 1FN3050-2WC00-0xAx

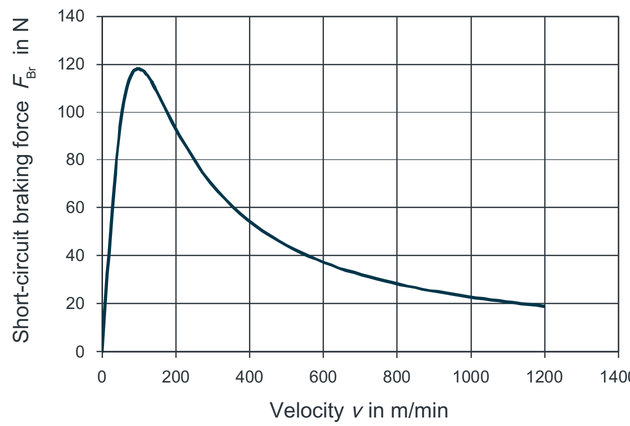
1FN3050-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	200
Rated current	I_N	A	2.72
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	408
Rated power loss	$P_{V,N}$	kW	0.275
Limit data			
Maximum force	F_{MAX}	N	550
Maximum current	I_{MAX}	A	8.15
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	170
Maximum electric power drawn	$P_{EL,MAX}$	kW	4.03
Static force	F_0*	N	141
Stall current	I_0*	A	1.92
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	73.6
Voltage constant	k_E	Vs/m	24.5
Motor constant at 20 °C	$k_{M,20}$	$N/(W)^{0.5}$	14.2
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	8.9
Phase inductance	L_{STR}	mH	36.5
Attraction force	F_A	N	996
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	3
Mass of the primary section with precision cooler	$m_{P,P}$	kg	3.5
Mass of a secondary section	m_S	kg	0.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.245
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.1
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.68
Pressure drop	$\Delta p_{P,H}$	bar	0.637
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0072
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.1
Pressure drop	$\Delta p_{P,P}$	bar	0.0778
Secondary section cooling data			

1FN3050-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0231
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.1
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0286
Pressure drop per combi distributor	Δp_{KV}	bar	0.119
Pressure drop per coupling point	Δp_{KS}	bar	0.0877

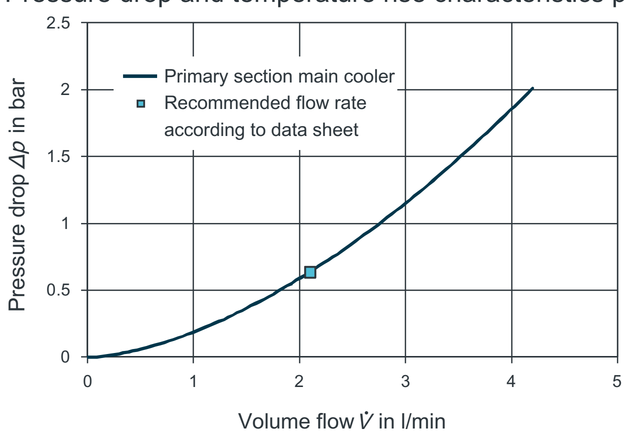
Characteristics of 1FN3050-2WC00-0xAx

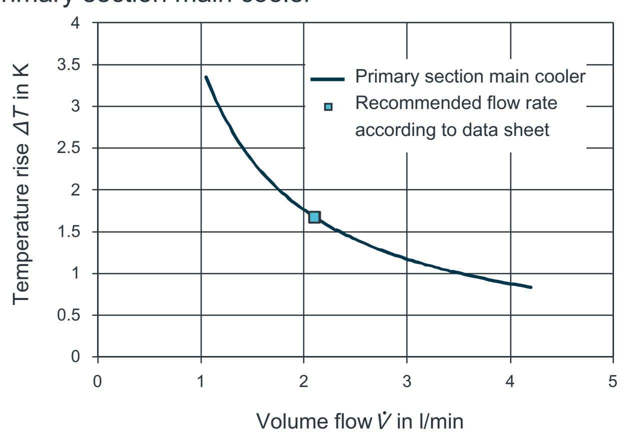
Force characteristics



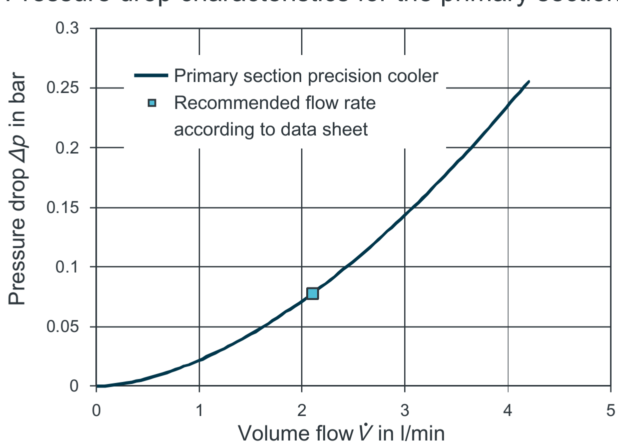


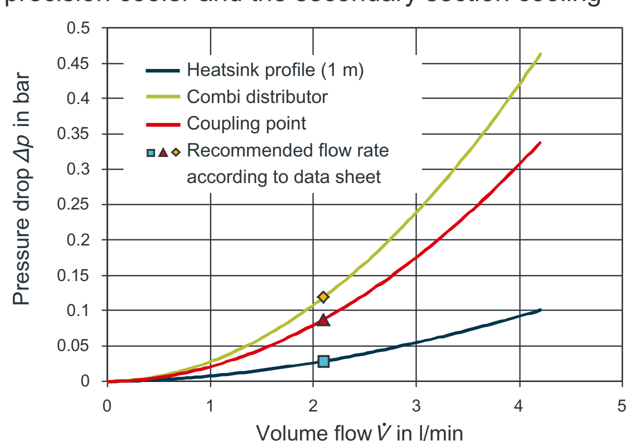
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





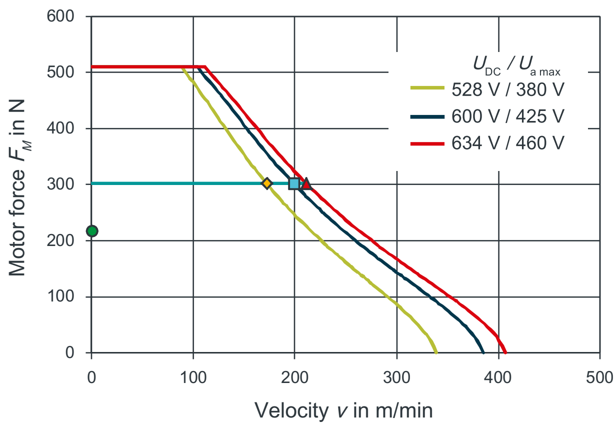
Data sheet of 1FN3050-2NB80-0xAx

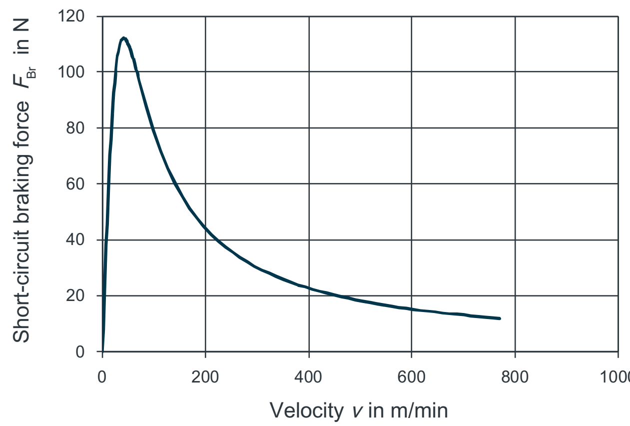
1FN3050-2NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	302
Rated current	I_N	A	2.82
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	199
Rated power loss	$P_{V,N}$	kW	0.318
Limit data			
Maximum force	F_{MAX}	N	510
Maximum current	I_{MAX}	A	5.86
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	104
Maximum electric power drawn	$P_{EL,MAX}$	kW	2.26
Static force	F_0*	N	217
Stall current	I_0*	A	2
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	109
Voltage constant	k_E	Vs/m	36.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	20.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	9.55
Phase inductance	L_{STR}	mH	92.9
Attraction force	F_A	N	992
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	3.9
Mass of the primary section with precision cooler	$m_{P,P}$	kg	4.6
Mass of a secondary section	m_S	kg	0.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.282
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.1
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.93
Pressure drop	$\Delta p_{P,H}$	bar	0.637
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.00833
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.1
Pressure drop	$\Delta p_{P,P}$	bar	0.0772
Secondary section cooling data			

1FN3050-2NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0279
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.1
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0286
Pressure drop per combi distributor	Δp_{KV}	bar	0.119
Pressure drop per coupling point	Δp_{KS}	bar	0.0877

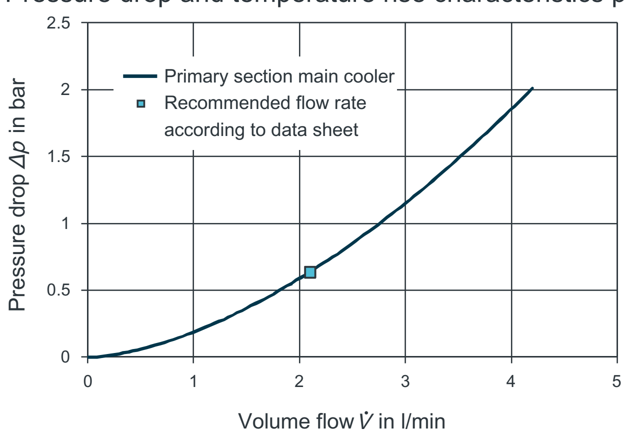
Characteristics of 1FN3050-2NB80-0xAx

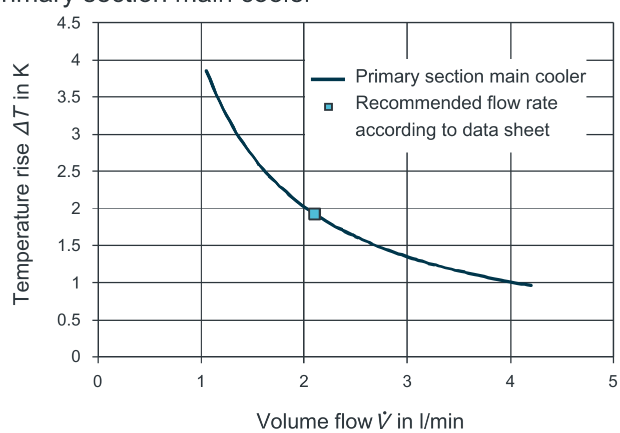
Force characteristics



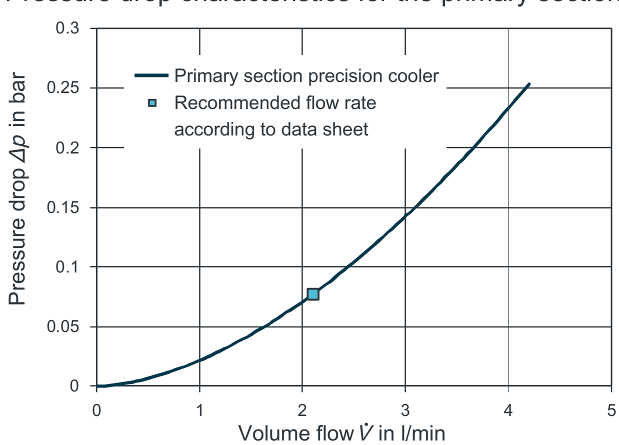


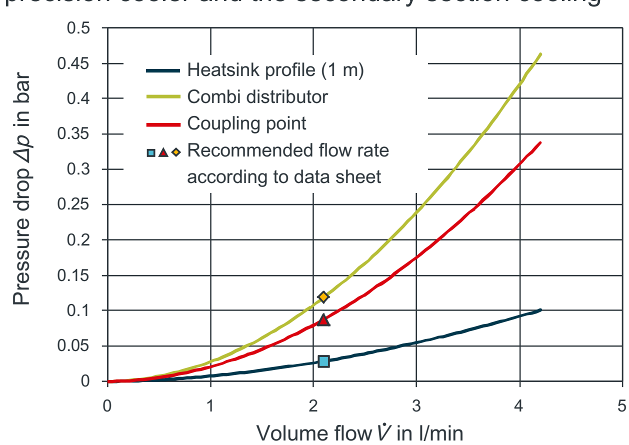
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





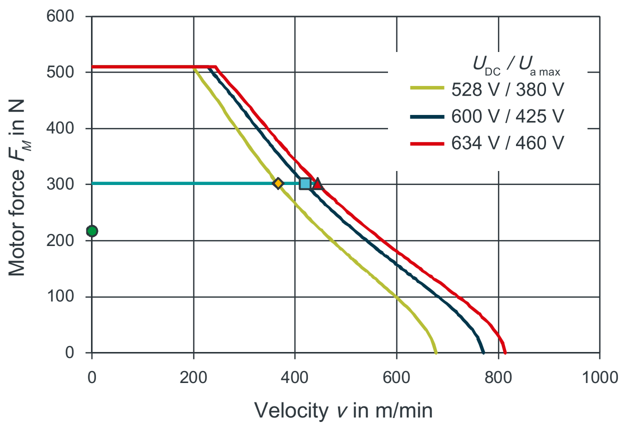
Data sheet of 1FN3050-2NE00-0xAx

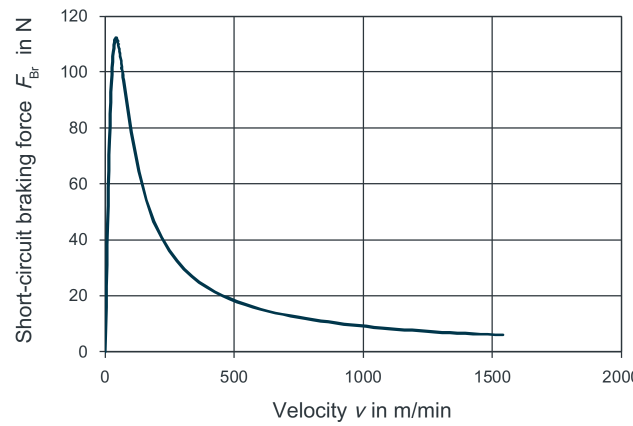
1FN3050-2NE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	302
Rated current	I_N	A	5.65
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	419
Rated power loss	$P_{V,N}$	kW	0.318
Limit data			
Maximum force	F_{MAX}	N	510
Maximum current	I_{MAX}	A	11.7
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	229
Maximum electric power drawn	$P_{EL,MAX}$	kW	3.32
Static force	F_0*	N	217
Stall current	I_0*	A	3.99
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	54.3
Voltage constant	k_E	Vs/m	18.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	20.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	2.39
Phase inductance	L_{STR}	mH	23.2
Attraction force	F_A	N	992
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	3.9
Mass of the primary section with precision cooler	$m_{P,P}$	kg	4.6
Mass of a secondary section	m_S	kg	0.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.282
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.1
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.93
Pressure drop	$\Delta p_{P,H}$	bar	0.637
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.00833
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.1
Pressure drop	$\Delta p_{P,P}$	bar	0.0772
Secondary section cooling data			

1FN3050-2NE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0279
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.1
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0286
Pressure drop per combi distributor	Δp_{KV}	bar	0.119
Pressure drop per coupling point	Δp_{KS}	bar	0.0877

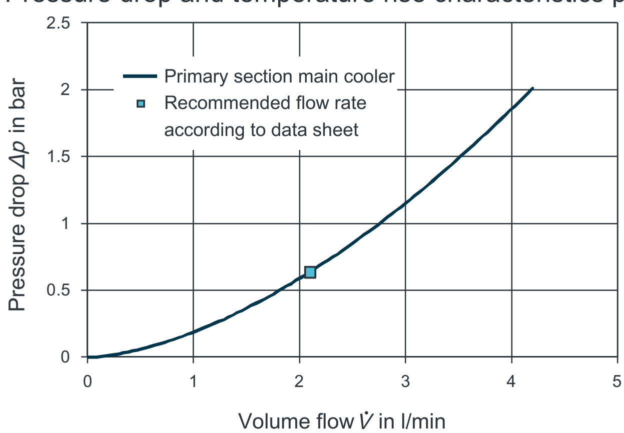
Characteristics of 1FN3050-2NE00-0xAx

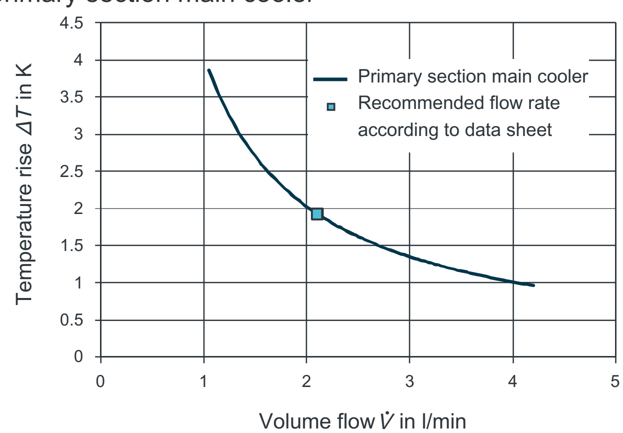
Force characteristics



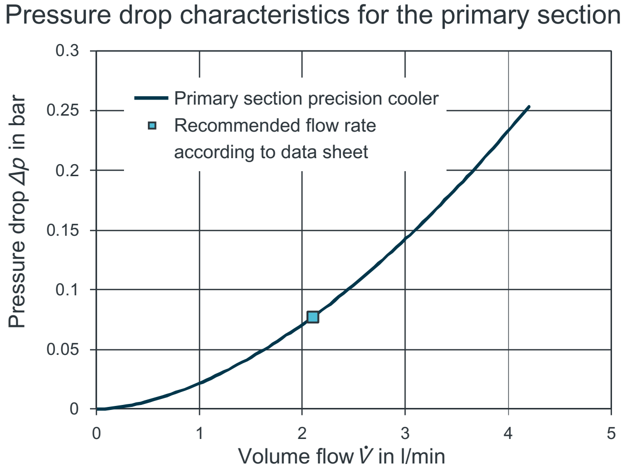


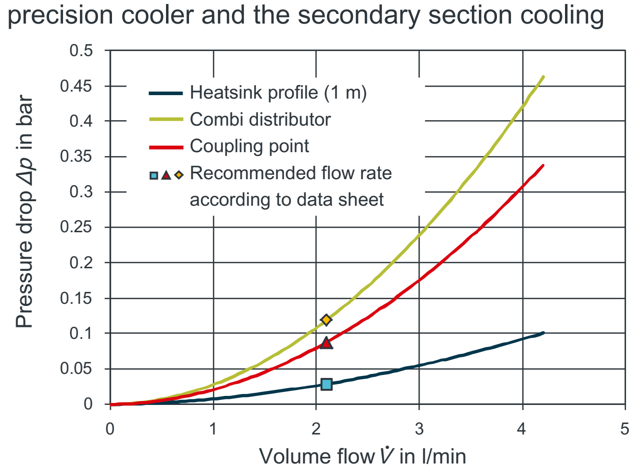
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





7.2.2 1FN3100-xxxxx-xxxx

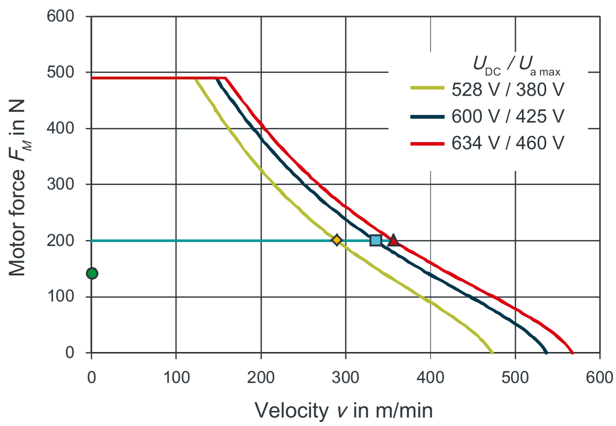
Data sheet of 1FN3100-1WC00-0xAx

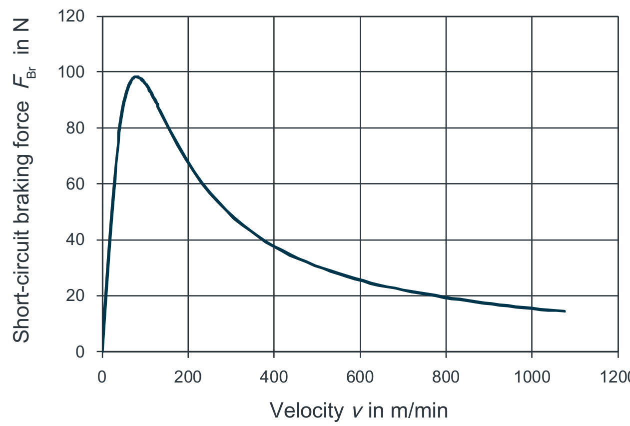
1FN3100-1WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	200
Rated current	I_N	A	2.44
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	335
Rated power loss	$P_{V,N}$	kW	0.269
Limit data			
Maximum force	F_{MAX}	N	490
Maximum current	I_{MAX}	A	6.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	147
Maximum electric power drawn	$P_{EL,MAX}$	kW	3.11
Static force	F_0*	N	141
Stall current	I_0*	A	1.72
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	82
Voltage constant	k_E	Vs/m	27.3
Motor constant at 20 °C	$k_{M,20}$	$N/(W)^{0.5}$	14.4
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	10.8
Phase inductance	L_{STR}	mH	54.5
Attraction force	F_A	N	996
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	2
Mass of the primary section with precision cooler	$m_{P,P}$	kg	---
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.24
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.38
Pressure drop	$\Delta p_{P,H}$	bar	0.571
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	---

1FN3100-1WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	---
Pressure drop	$\Delta p_{P,P}$	bar	---
Secondary section cooling data			
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0226
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

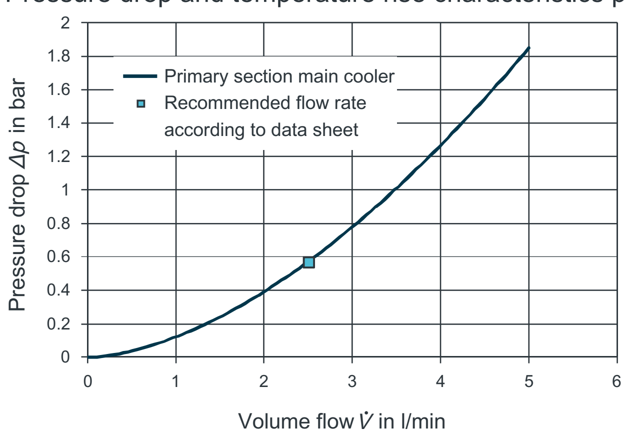
Characteristics for 1FN3100-1WC00-0xAx

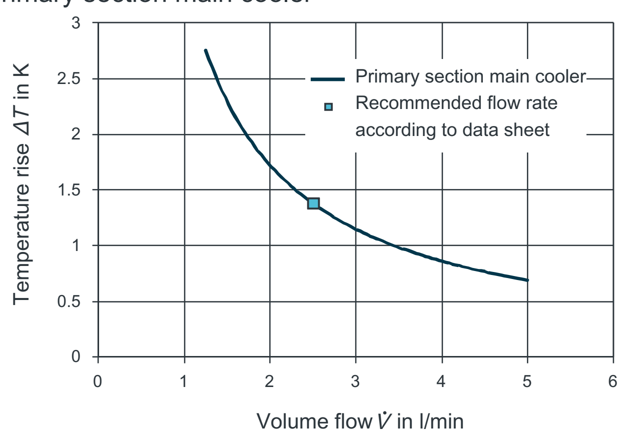
Force characteristics





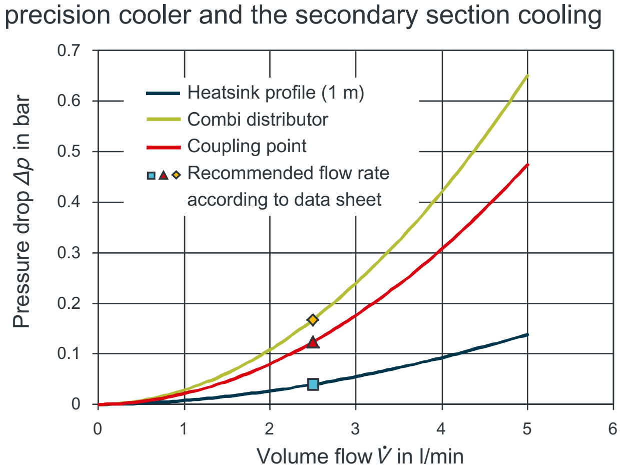
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling

No primary section precision cooler available



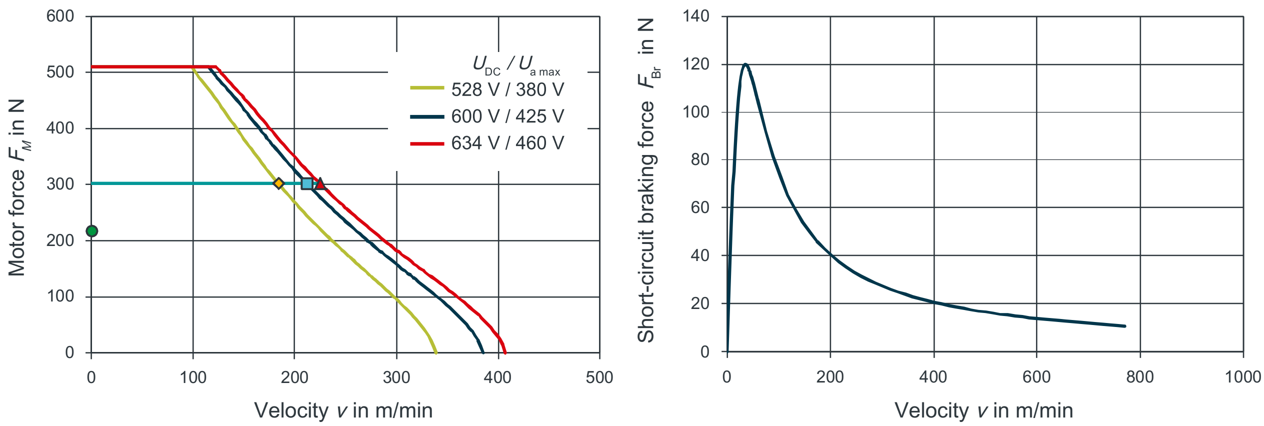
Data sheet of 1FN3100-1NC00-0xAx

1FN3100-1NC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	302
Rated current	I_N	A	2.82
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	212
Rated power loss	$P_{V,N}$	kW	0.253
Limit data			
Maximum force	F_{MAX}	N	510
Maximum current	I_{MAX}	A	5.86
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	115
Maximum electric power drawn	$P_{EL,MAX}$	kW	2.07
Static force	F_0*	N	217
Stall current	I_0*	A	2
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	109
Voltage constant	k_E	Vs/m	36.2
Motor constant at 20 °C	$k_{M,20}$	$N/(W)^{0.5}$	22.8
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	7.58
Phase inductance	L_{STR}	mH	87
Attraction force	F_A	N	992
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	3
Mass of the primary section with precision cooler	$m_{P,P}$	kg	3.52
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.224
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.29
Pressure drop	$\Delta p_{P,H}$	bar	0.571
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.00662
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.0788
Secondary section cooling data			

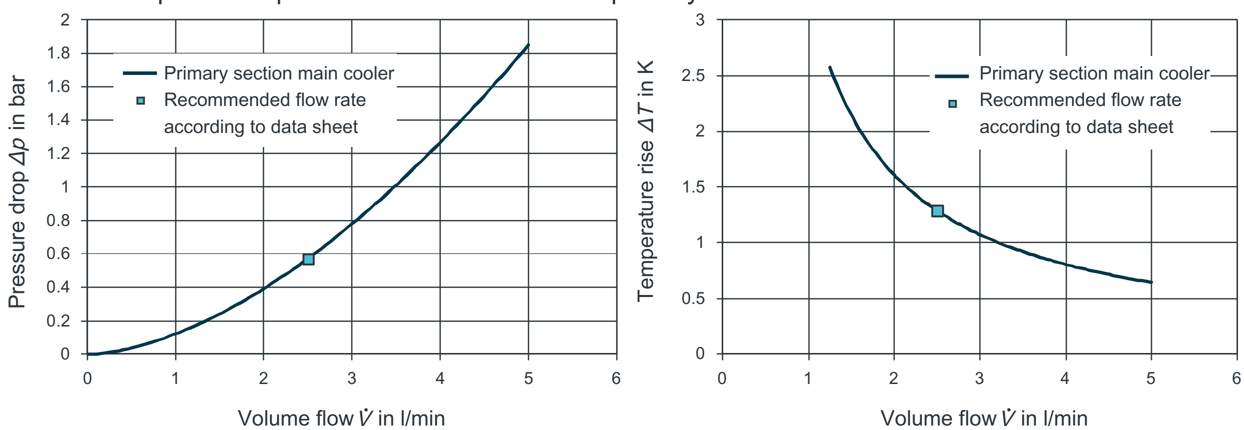
1FN3100-1NC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0222
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

Characteristics of 1FN3100-1NC00-0xAx

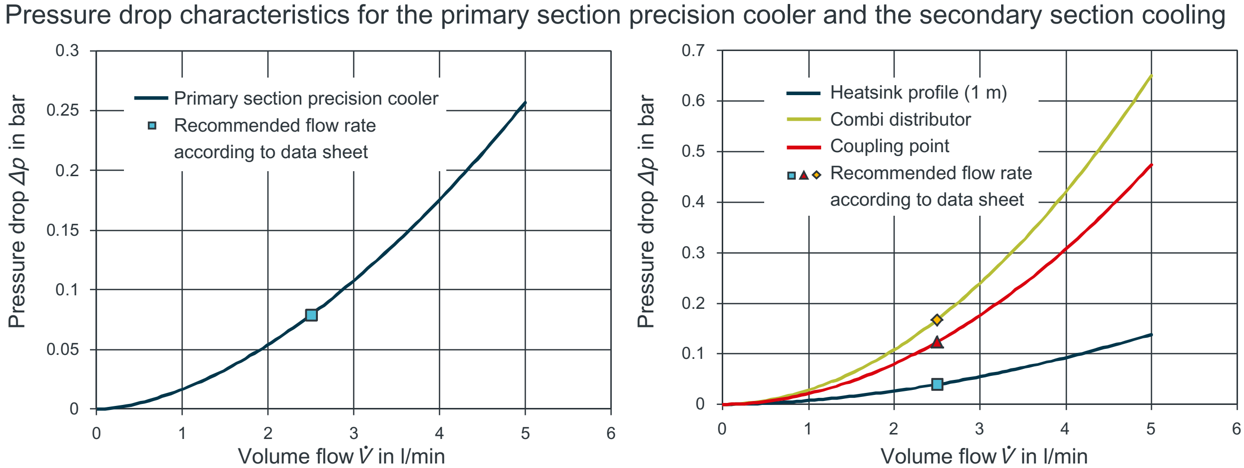
Force characteristics



Pressure drop and temperature rise characteristics primary section main cooler



Pressure drop characteristics for the primary section precision cooler and the secondary section cooling



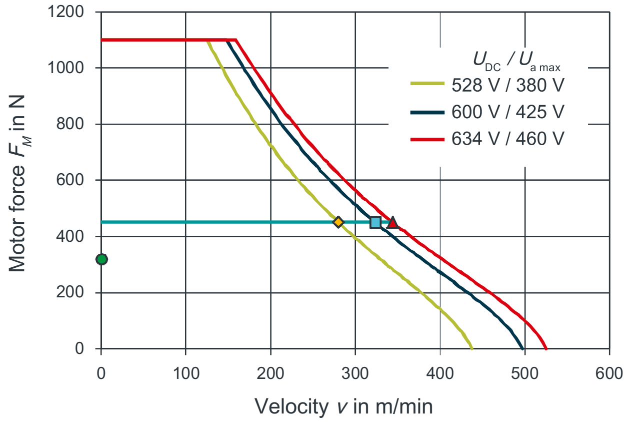
Data sheet of 1FN3100-2WC00-0xAx

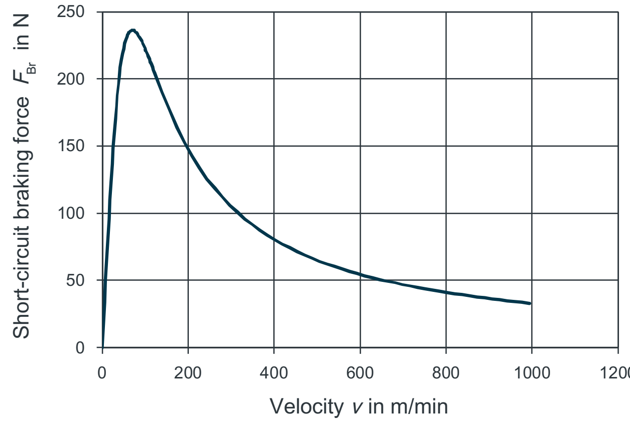
1FN3100-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	450
Rated current	I_N	A	5.08
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	323
Rated power loss	$P_{V,N}$	kW	0.501
Limit data			
Maximum force	F_{MAX}	N	1100
Maximum current	I_{MAX}	A	13.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	148
Maximum electric power drawn	$P_{EL,MAX}$	kW	6.27
Static force	F_0*	N	318
Stall current	I_0*	A	3.59
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	88.7
Voltage constant	k_E	Vs/m	29.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	23.7
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	4.66
Phase inductance	L_{STR}	mH	26.5
Attraction force	F_A	N	1990
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	4.6
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.446
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	2.57
Pressure drop	$\Delta p_{P,H}$	bar	1.03
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0131
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.109
Secondary section cooling data			

1FN3100-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0421
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

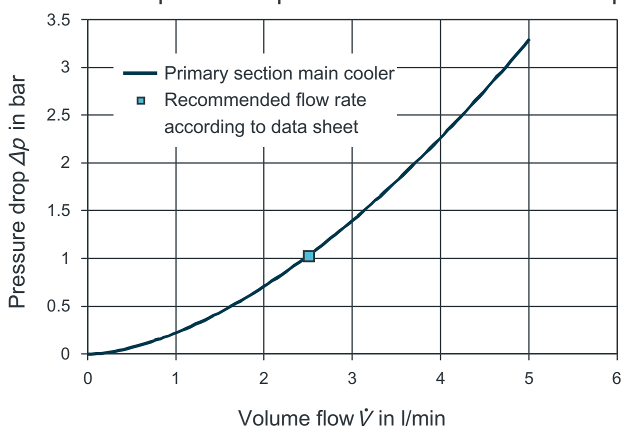
Characteristics for 1FN3100-2WC00-0xAx

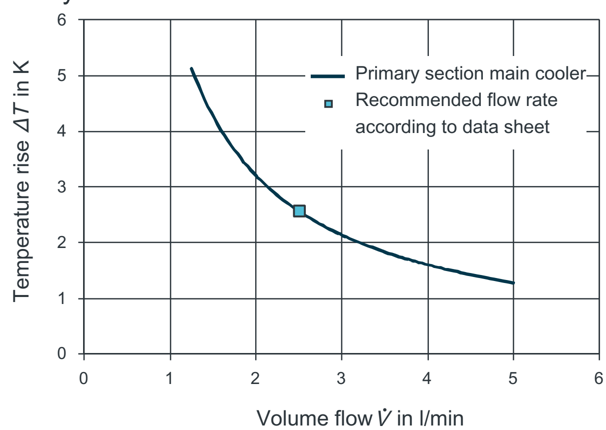
Force characteristics



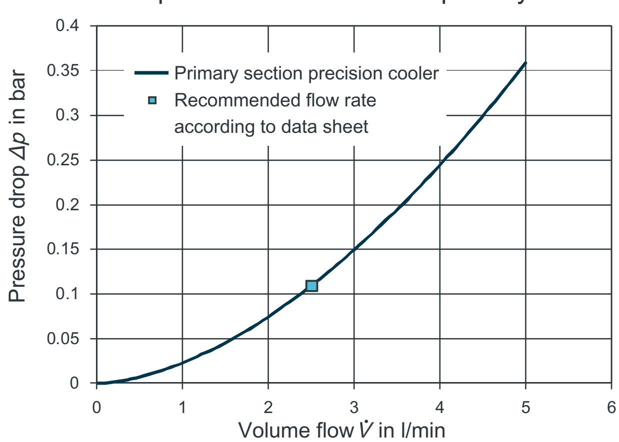


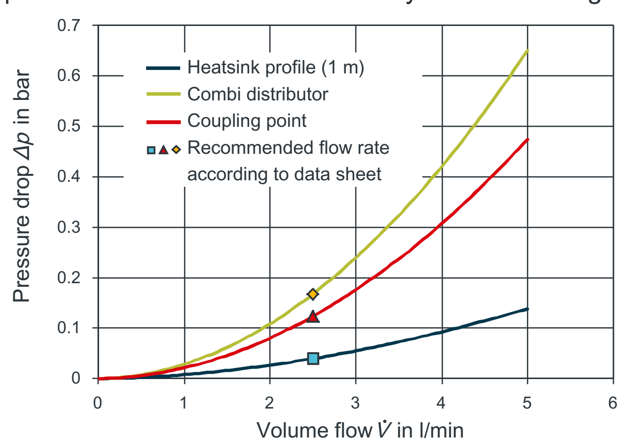
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





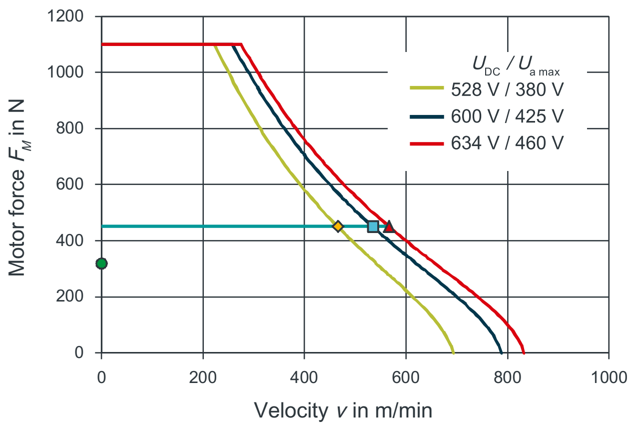
Data sheet of 1FN3100-2WE00-0xAx

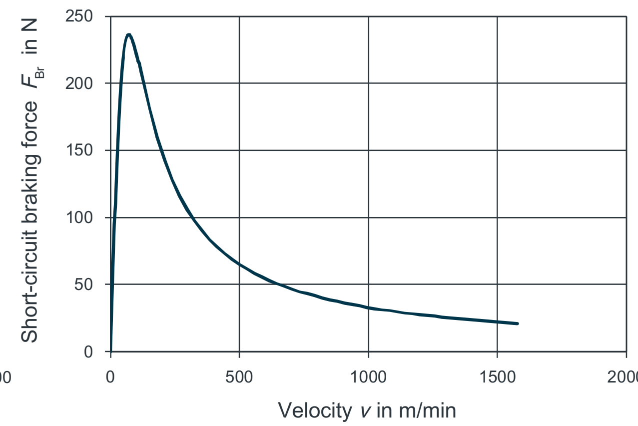
1FN3100-2WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	450
Rated current	I_N	A	8.04
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	535
Rated power loss	$P_{V,N}$	kW	0.501
Limit data			
Maximum force	F_{MAX}	N	1100
Maximum current	I_{MAX}	A	21.4
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	258
Maximum electric power drawn	$P_{EL,MAX}$	kW	8.3
Static force	F_0*	N	318
Stall current	I_0*	A	5.69
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	55.9
Voltage constant	k_E	Vs/m	18.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	23.7
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.85
Phase inductance	L_{STR}	mH	10.5
Attraction force	F_A	N	1990
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	4.6
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.446
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	2.57
Pressure drop	$\Delta p_{P,H}$	bar	1.03
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0131
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.109
Secondary section cooling data			

1FN3100-2WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0421
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

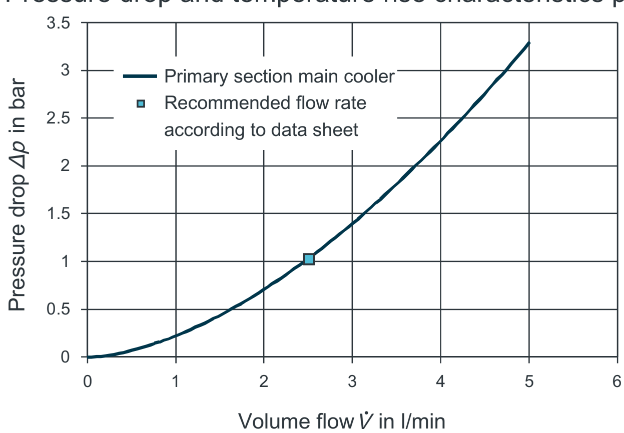
Characteristics for 1FN3100-2WE00-0xAx

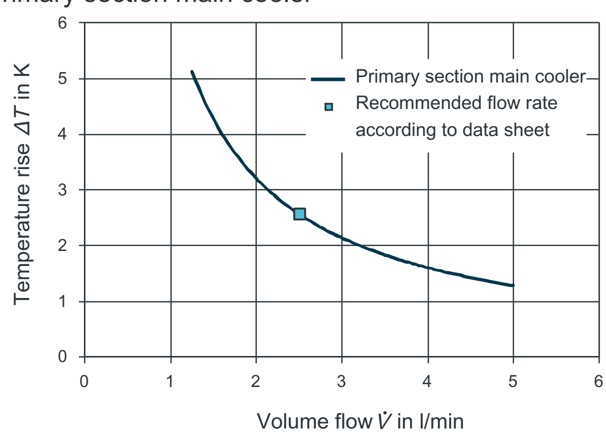
Force characteristics



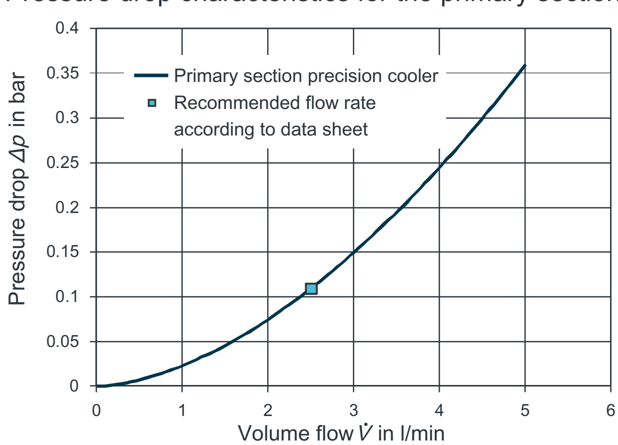


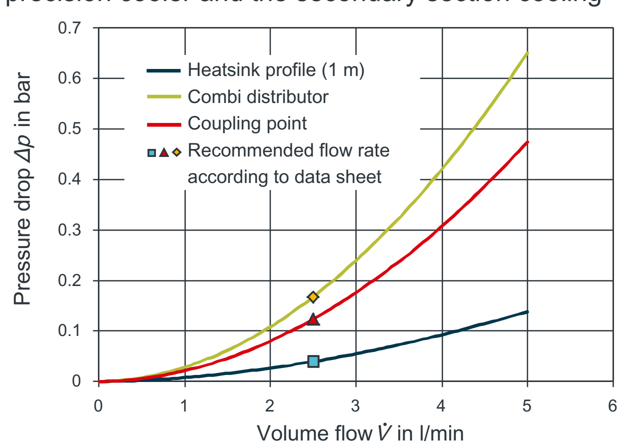
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





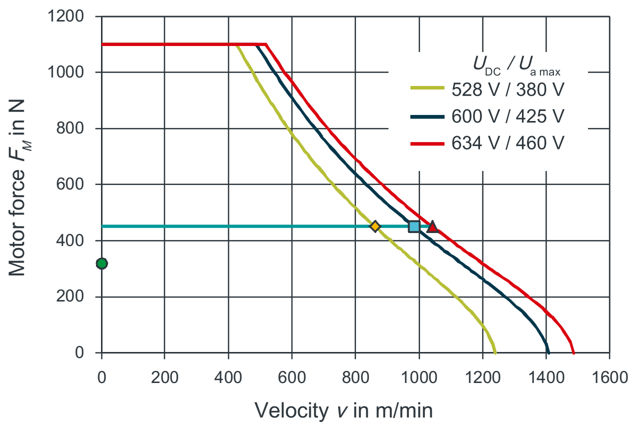
Data sheet of 1FN3100-2WJ20-0xAx

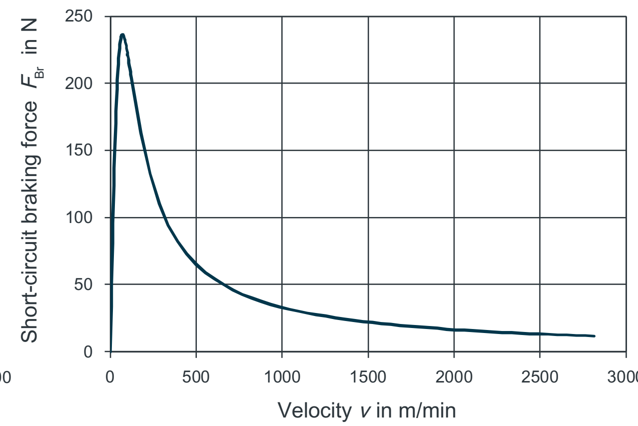
1FN3100-2WJ20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	450
Rated current	I_N	A	14.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	984
Rated power loss	$P_{V,N}$	kW	0.502
Limit data			
Maximum force	F_{MAX}	N	1100
Maximum current	I_{MAX}	A	38.3
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	488
Maximum electric power drawn	$P_{EL,MAX}$	kW	12.5
Static force	F_0*	N	318
Stall current	I_0*	A	10.2
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	31.3
Voltage constant	k_E	Vs/m	10.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	23.7
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.582
Phase inductance	L_{STR}	mH	3.3
Attraction force	F_A	N	1990
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	4.6
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.447
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	2.57
Pressure drop	$\Delta p_{P,H}$	bar	1.03
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0131
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.109
Secondary section cooling data			

1FN3100-2WJ20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0422
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

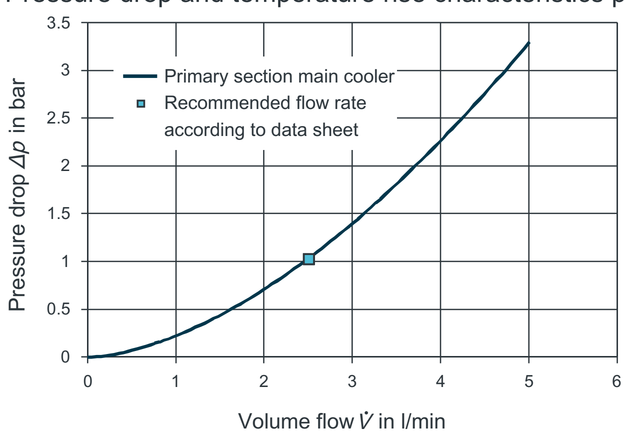
Characteristics for 1FN3100-2WJ20-0xAx

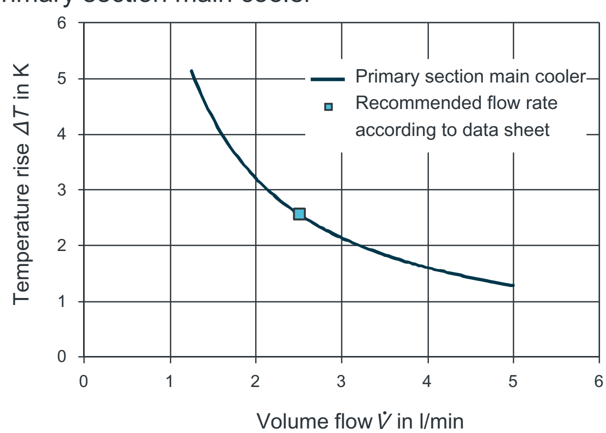
Force characteristics



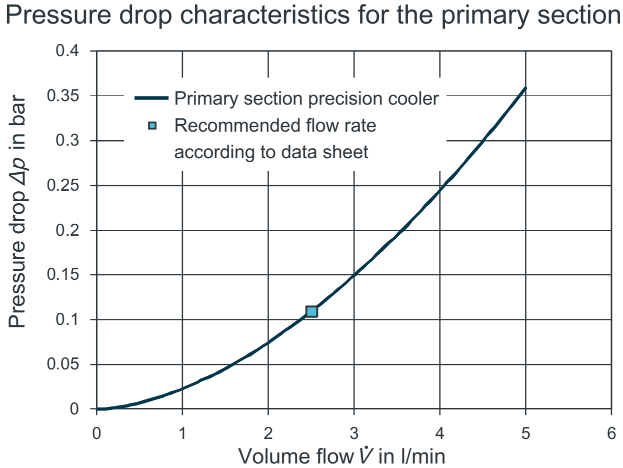


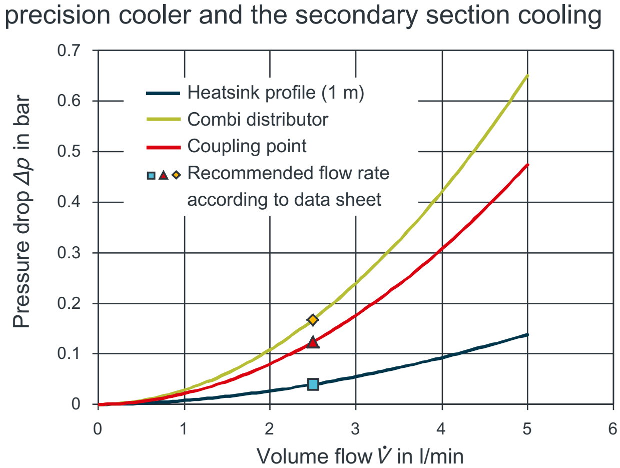
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





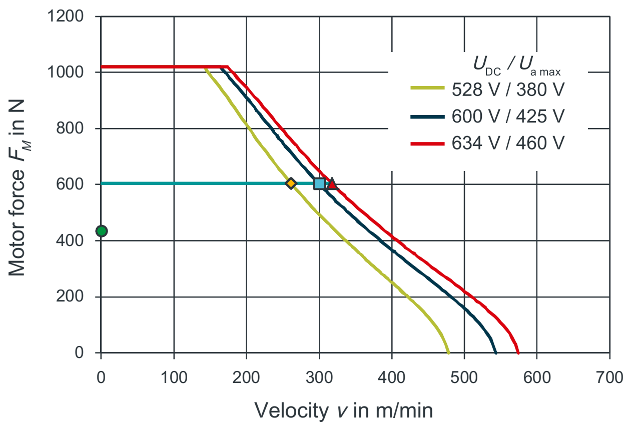
Data sheet of 1FN3100-2NC80-0xAx

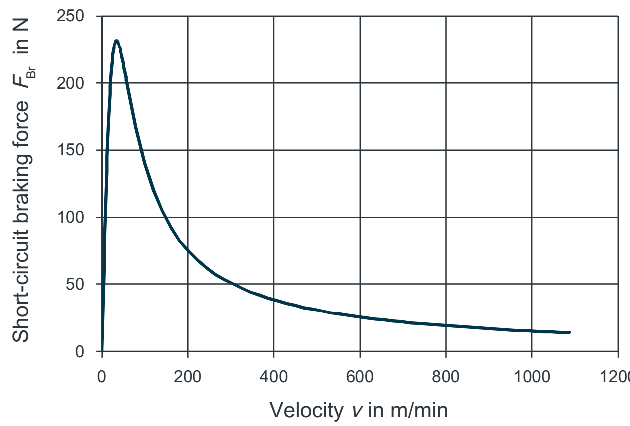
1FN3100-2NC80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	604
Rated current	I_N	A	7.96
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	300
Rated power loss	$P_{V,N}$	kW	0.503
Limit data			
Maximum force	F_{MAX}	N	1020
Maximum current	I_{MAX}	A	16.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	164
Maximum electric power drawn	$P_{EL,MAX}$	kW	4.96
Static force	F_0*	N	433
Stall current	I_0*	A	5.63
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	77.1
Voltage constant	k_E	Vs/m	25.7
Motor constant at 20 °C	$k_{M,20}$	$N/(W)^{0.5}$	32.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.9
Phase inductance	L_{STR}	mH	22.7
Attraction force	F_A	N	1980
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	5.4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	6.19
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.445
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	2.56
Pressure drop	$\Delta p_{P,H}$	bar	1.03
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0132
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.108
Secondary section cooling data			

1FN3100-2NC80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0442
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

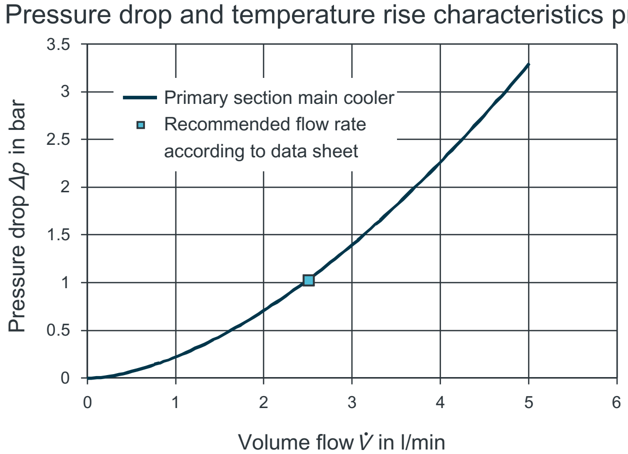
Characteristics for 1FN3100-2NC80-0xAx

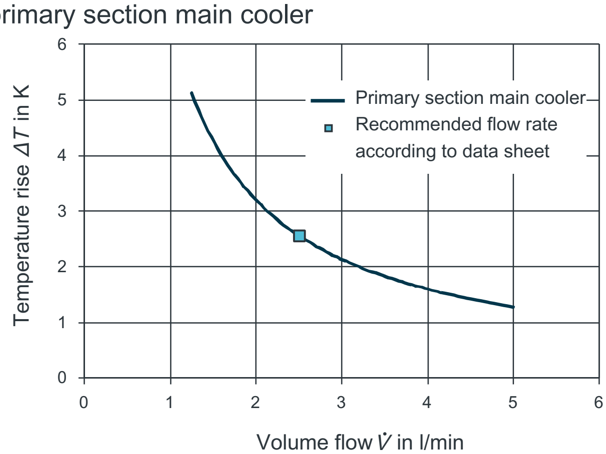
Force characteristics



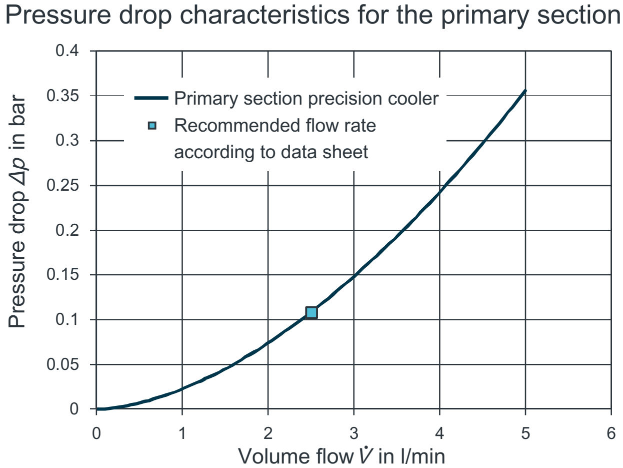


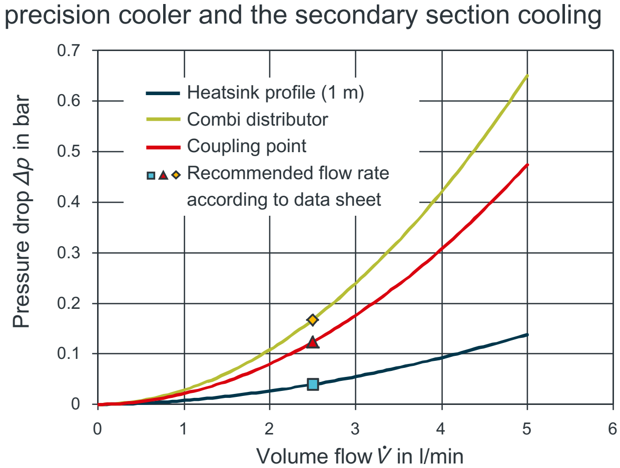
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





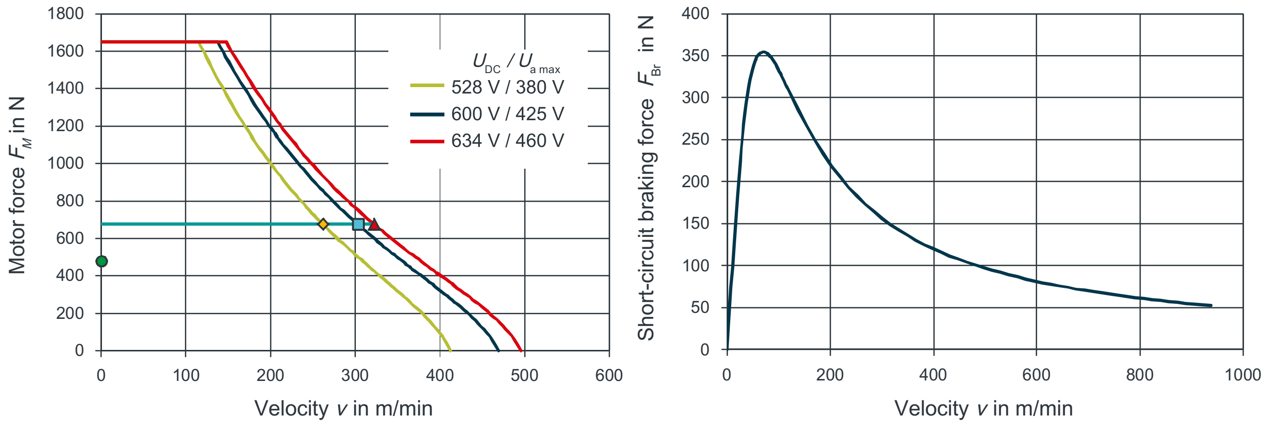
Data sheet of 1FN3100-3WC00-0xAx

1FN3100-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	675
Rated current	I_N	A	7.18
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	303
Rated power loss	$P_{V,N}$	kW	0.748
Limit data			
Maximum force	F_{MAX}	N	1650
Maximum current	I_{MAX}	A	19.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	137
Maximum electric power drawn	$P_{EL,MAX}$	kW	9.09
Static force	F_0*	N	477
Stall current	I_0*	A	5.08
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	94
Voltage constant	k_E	Vs/m	31.3
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	29.1
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	3.47
Phase inductance	L_{STR}	mH	19.9
Attraction force	F_A	N	2990
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	5.6
Mass of the primary section with precision cooler	$m_{P,P}$	kg	6.4
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.666
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.83
Pressure drop	$\Delta p_{P,H}$	bar	1.49
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0196
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.139
Secondary section cooling data			

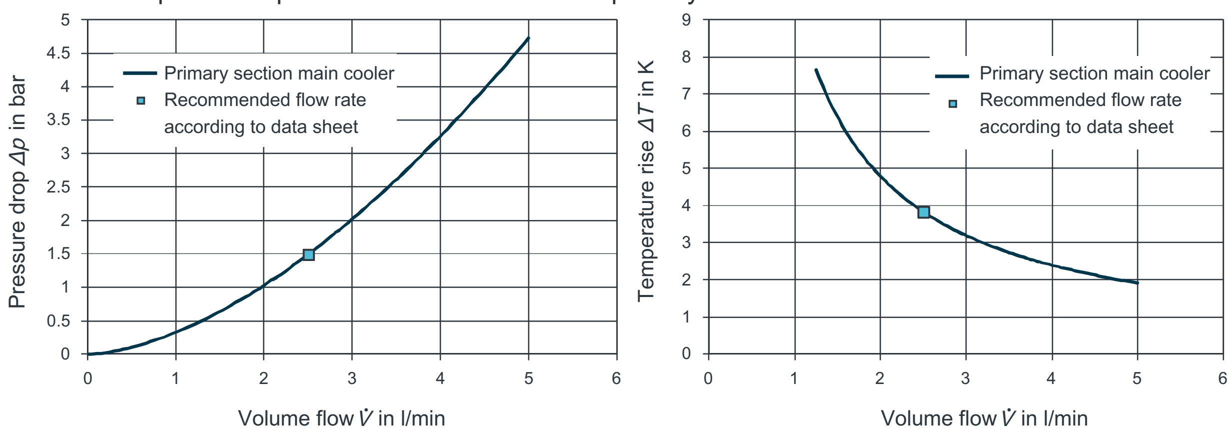
1FN3100-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0629
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

Characteristics for 1FN3100-3WC00-0xAx

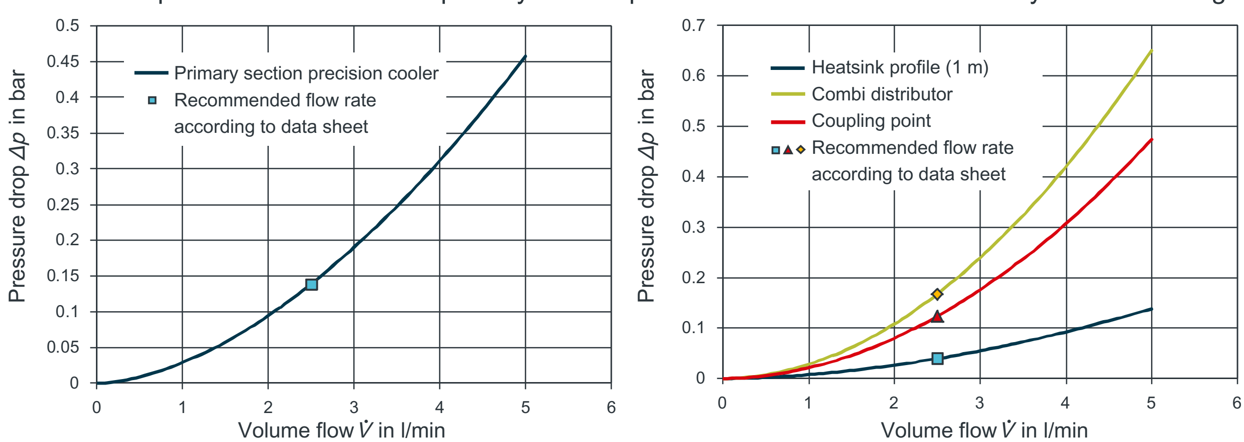
Force characteristics



Pressure drop and temperature rise characteristics primary section main cooler



Pressure drop characteristics for the primary section precision cooler and the secondary section cooling



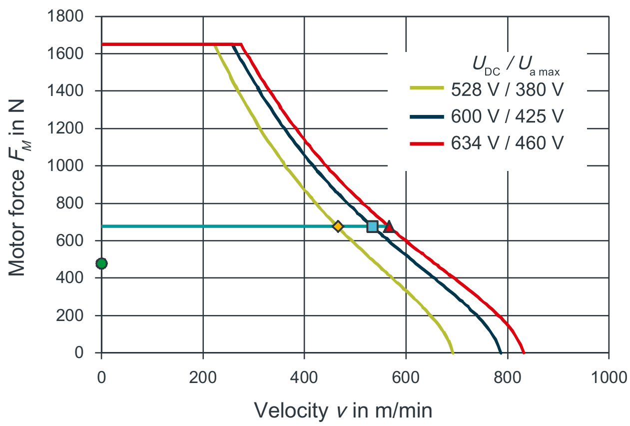
Data sheet of 1FN3100-3WE00-0xAx

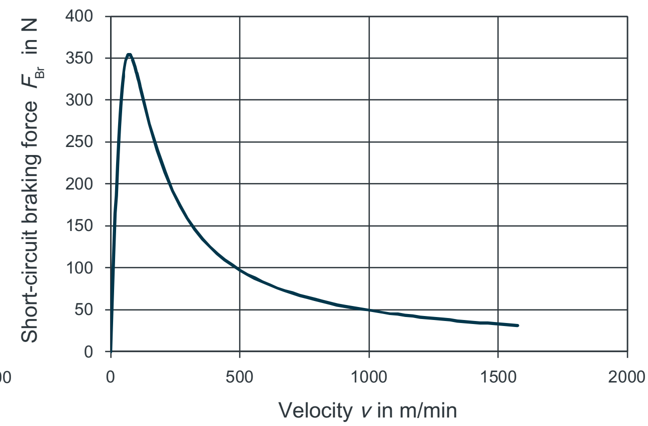
1FN3100-3WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	675
Rated current	I_N	A	12.1
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	534
Rated power loss	$P_{V,N}$	kW	0.749
Limit data			
Maximum force	F_{MAX}	N	1650
Maximum current	I_{MAX}	A	32.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	258
Maximum electric power drawn	$P_{EL,MAX}$	kW	12.4
Static force	F_0*	N	477
Stall current	I_0*	A	8.52
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	56
Voltage constant	k_E	Vs/m	18.7
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	29.1
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.23
Phase inductance	L_{STR}	mH	7.04
Attraction force	F_A	N	2990
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	5.6
Mass of the primary section with precision cooler	$m_{P,P}$	kg	6.4
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.667
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.84
Pressure drop	$\Delta p_{P,H}$	bar	1.49
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0196
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.139
Secondary section cooling data			

1FN3100-3WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0629
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

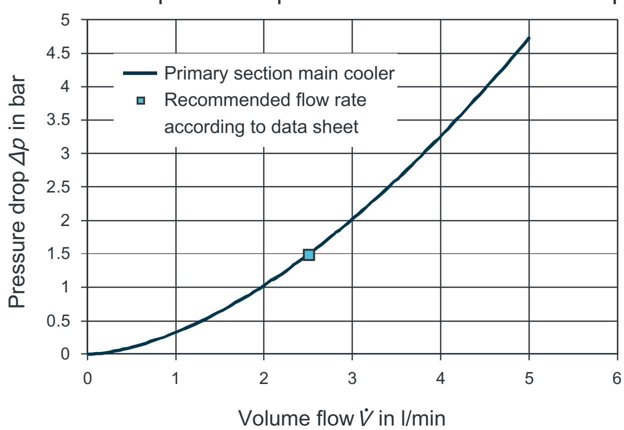
Characteristics for 1FN3100-3WE00-0xAx

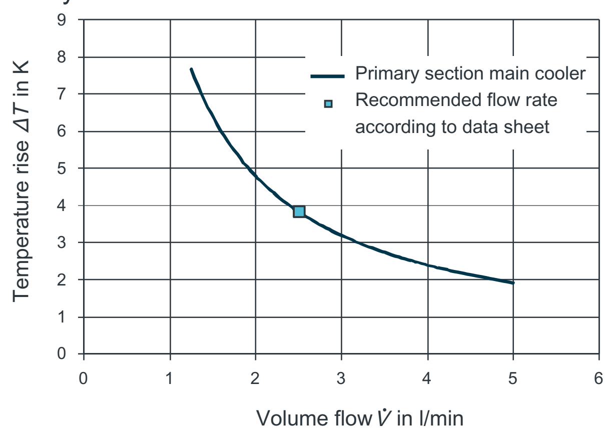
Force characteristics



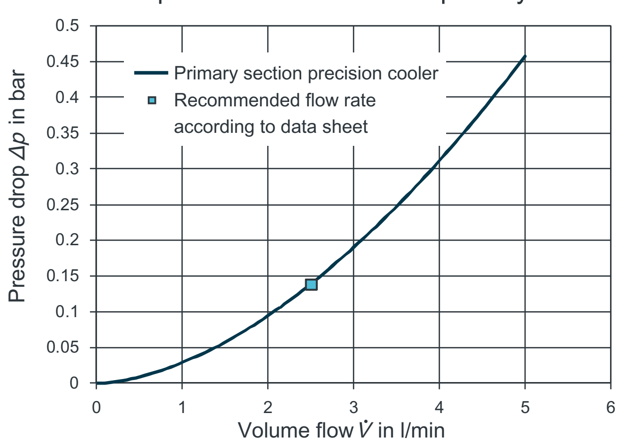


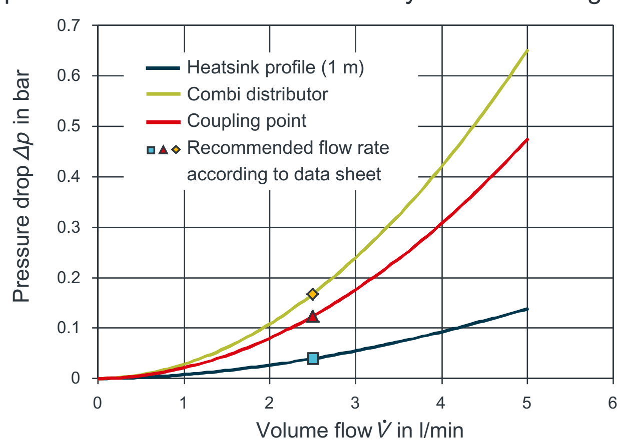
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





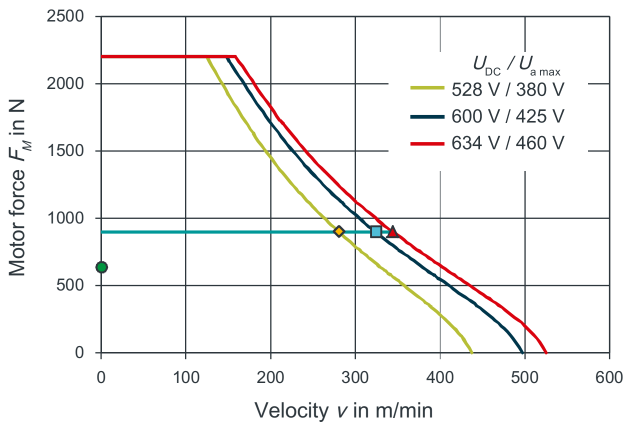
Data sheet of 1FN3100-4WC00-0xAx

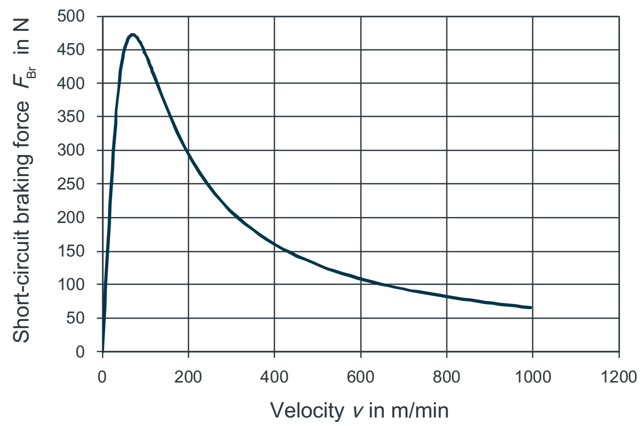
1FN3100-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	900
Rated current	I_N	A	10.2
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	324
Rated power loss	$P_{V,N}$	kW	0.998
Limit data			
Maximum force	F_{MAX}	N	2200
Maximum current	I_{MAX}	A	27.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	148
Maximum electric power drawn	$P_{EL,MAX}$	kW	12.5
Static force	F_0*	N	636
Stall current	I_0*	A	7.18
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	88.7
Voltage constant	k_E	Vs/m	29.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	33.6
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	2.32
Phase inductance	L_{STR}	mH	13.2
Attraction force	F_A	N	3980
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	7.4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	8.5
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.888
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.11
Pressure drop	$\Delta p_{P,H}$	bar	1.95
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0261
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.168
Secondary section cooling data			

1FN3100-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0839
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

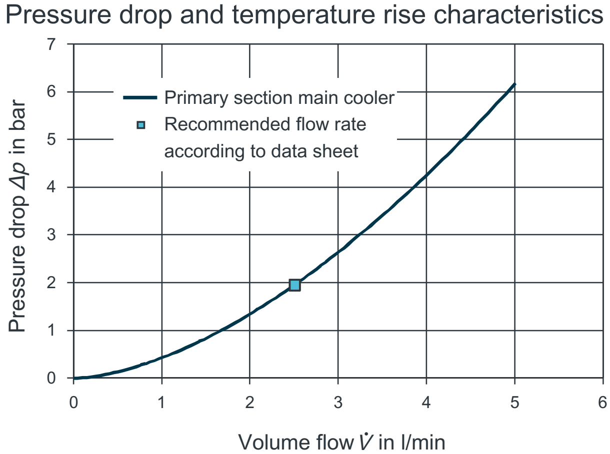
Characteristics for 1FN3100-4WC00-0xAx

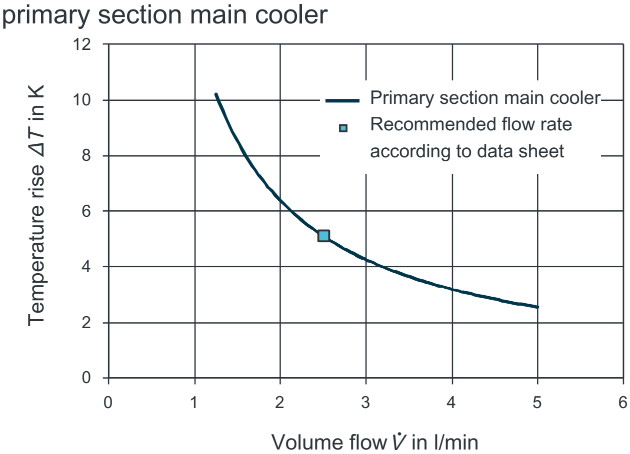
Force characteristics



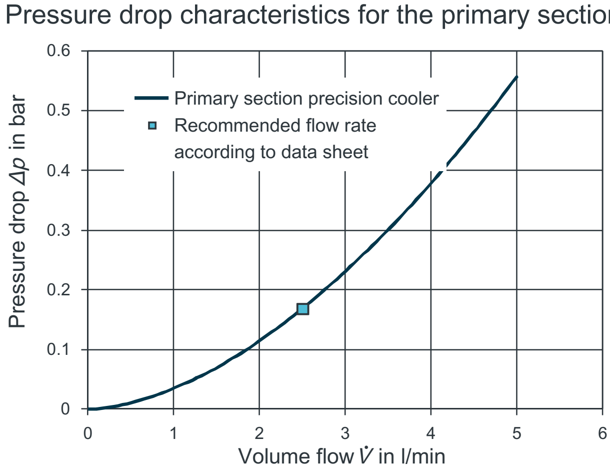


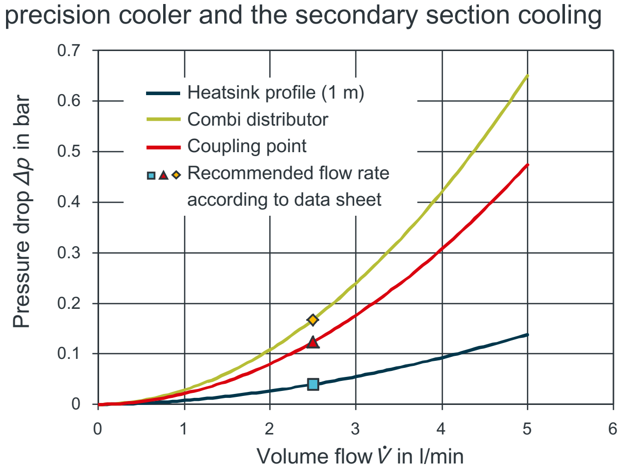
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





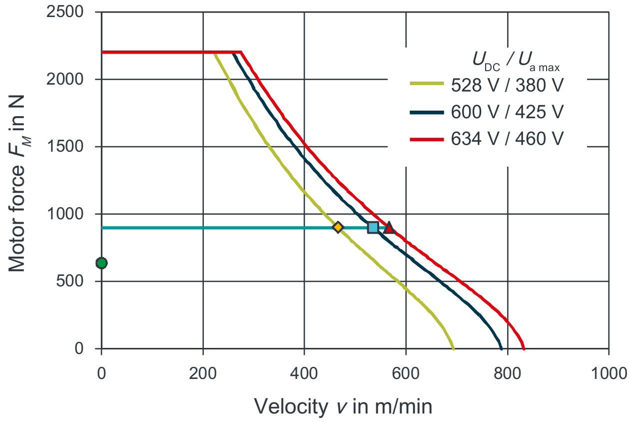
Data sheet of 1FN3100-4WE00-0xAx

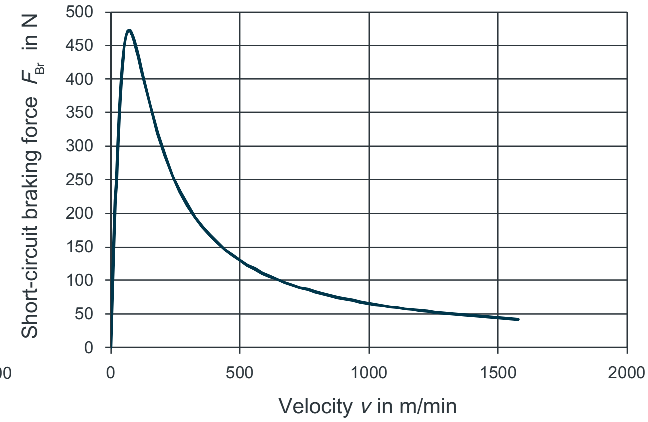
1FN3100-4WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	900
Rated current	I_N	A	16.1
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	535
Rated power loss	$P_{V,N}$	kW	0.999
Limit data			
Maximum force	F_{MAX}	N	2200
Maximum current	I_{MAX}	A	42.9
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	258
Maximum electric power drawn	$P_{EL,MAX}$	kW	16.6
Static force	F_0*	N	636
Stall current	I_0*	A	11.4
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	55.9
Voltage constant	k_E	Vs/m	18.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	33.6
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.924
Phase inductance	L_{STR}	mH	5.27
Attraction force	F_A	N	3980
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	7.4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	8.5
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.889
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.12
Pressure drop	$\Delta p_{P,H}$	bar	1.95
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0262
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.168
Secondary section cooling data			

1FN3100-4WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.084
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

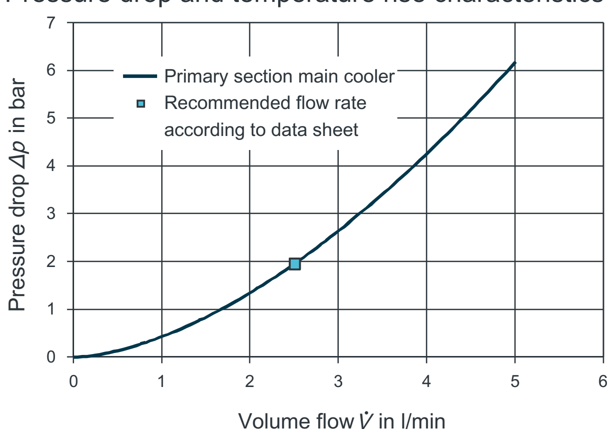
Characteristics for 1FN3100-4WE00-0xAx

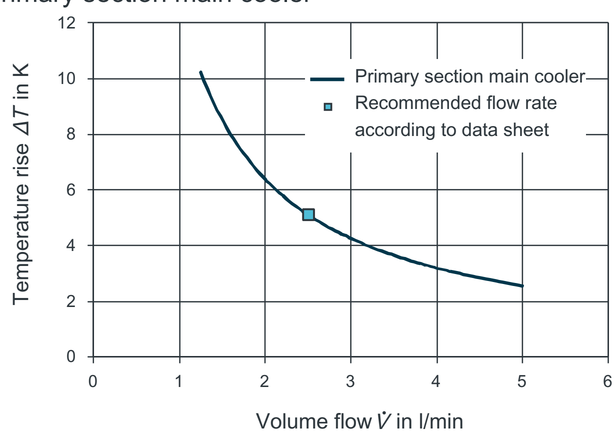
Force characteristics



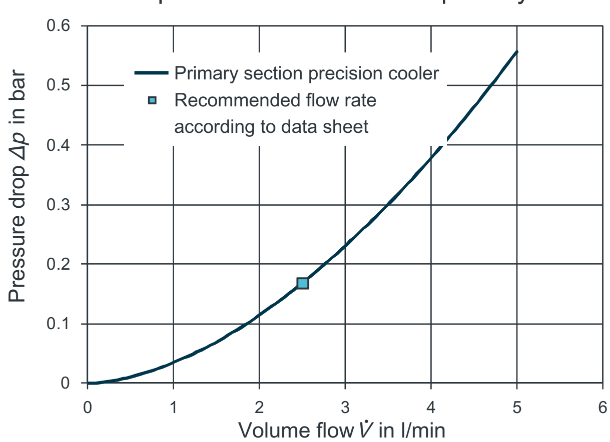


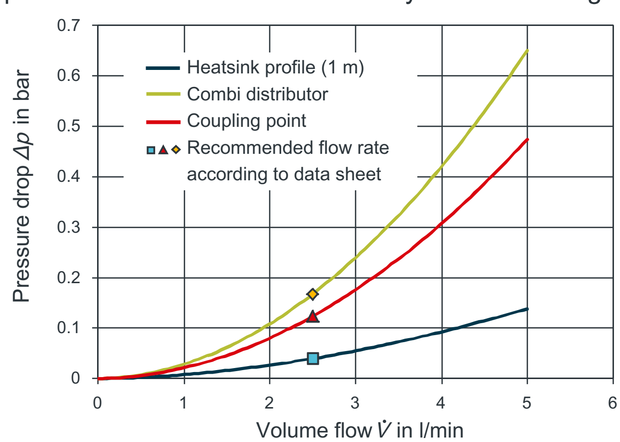
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





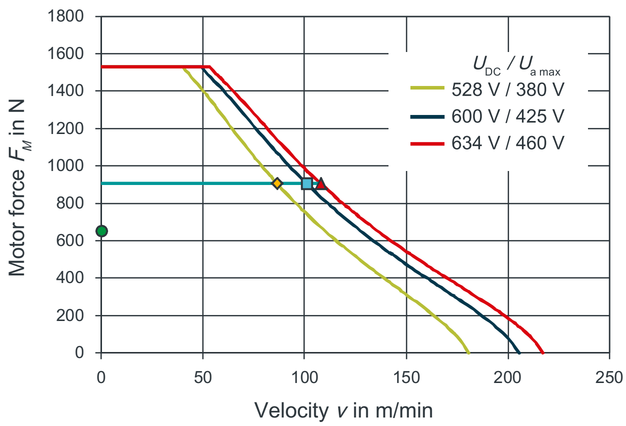
Data sheet of 1FN3100-3NA80-0xAx

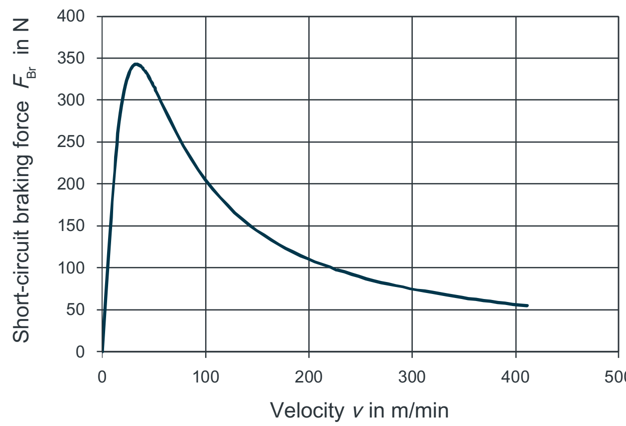
1FN3100-3NA80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	905
Rated current	I_N	A	4.52
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	101
Rated power loss	$P_{V,N}$	kW	0.755
Limit data			
Maximum force	F_{MAX}	N	1530
Maximum current	I_{MAX}	A	9.39
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	49.1
Maximum electric power drawn	$P_{EL,MAX}$	kW	4.51
Static force	F_0*	N	650
Stall current	I_0*	A	3.19
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	204
Voltage constant	k_E	Vs/m	67.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	39.5
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	8.86
Phase inductance	L_{STR}	mH	107
Attraction force	F_A	N	2980
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	7.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	8.56
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.669
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.85
Pressure drop	$\Delta p_{P,H}$	bar	1.49
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0198
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.138
Secondary section cooling data			

1FN3100-3NA80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0663
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

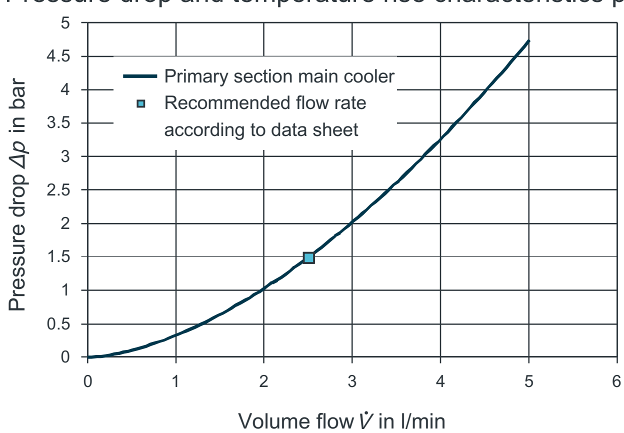
Characteristics of 1FN3100-3NA80-0xAx

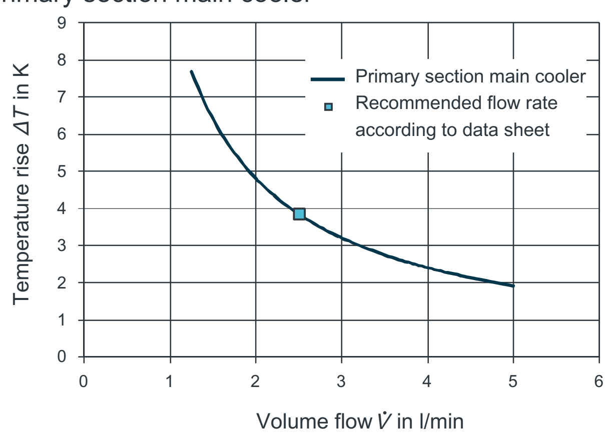
Force characteristics



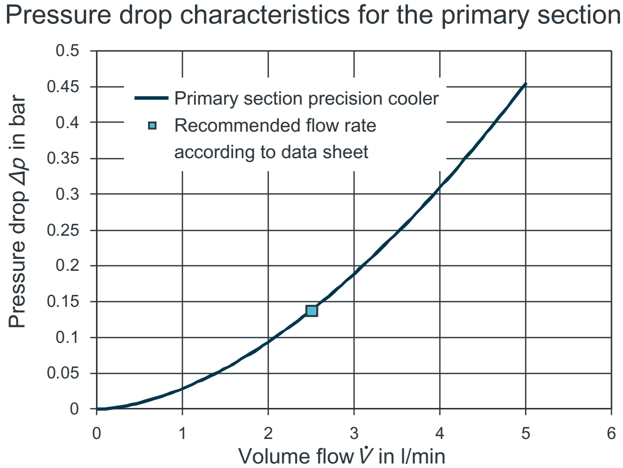


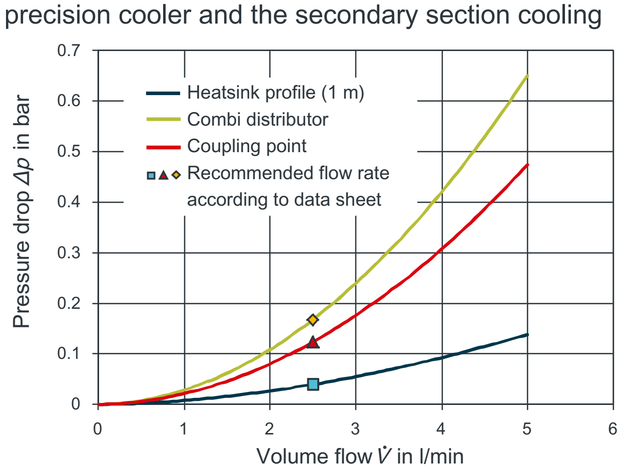
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





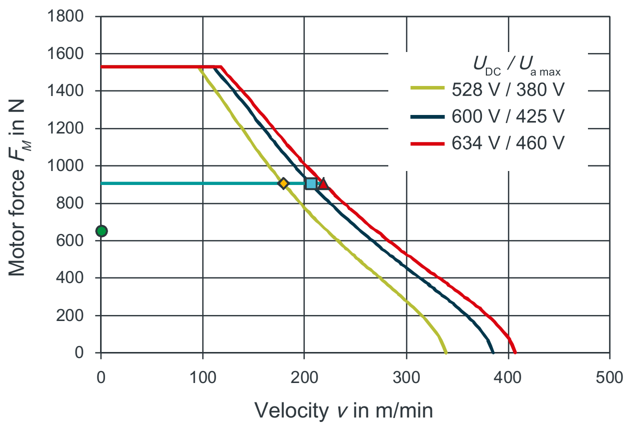
Data sheet of 1FN3100-3NC00-0xAx

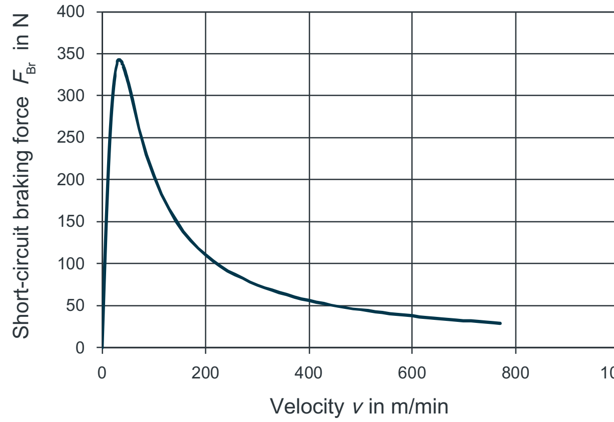
1FN3100-3NC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	905
Rated current	I_N	A	8.47
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	206
Rated power loss	$P_{V,N}$	kW	0.754
Limit data			
Maximum force	F_{MAX}	N	1530
Maximum current	I_{MAX}	A	17.6
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	111
Maximum electric power drawn	$P_{EL,MAX}$	kW	6.08
Static force	F_0*	N	650
Stall current	I_0*	A	5.99
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	109
Voltage constant	k_E	Vs/m	36.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	39.6
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	2.51
Phase inductance	L_{STR}	mH	30.4
Attraction force	F_A	N	2980
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	7.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	8.56
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.668
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.84
Pressure drop	$\Delta p_{P,H}$	bar	1.49
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0198
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.138
Secondary section cooling data			

1FN3100-3NC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0662
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

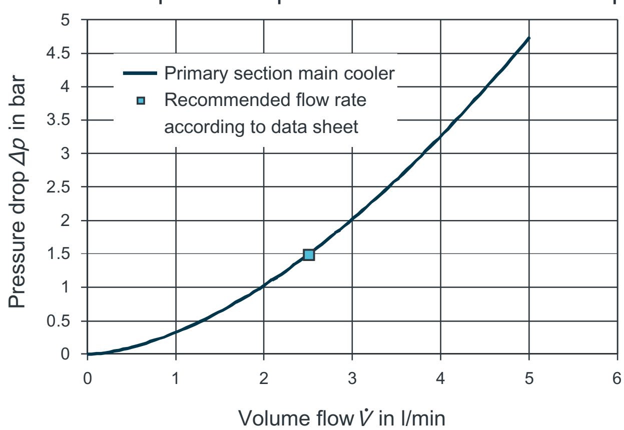
Characteristics for 1FN3100-3NC00-0xAx

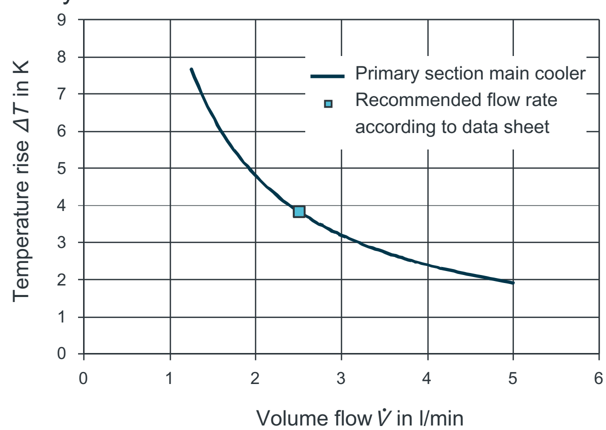
Force characteristics



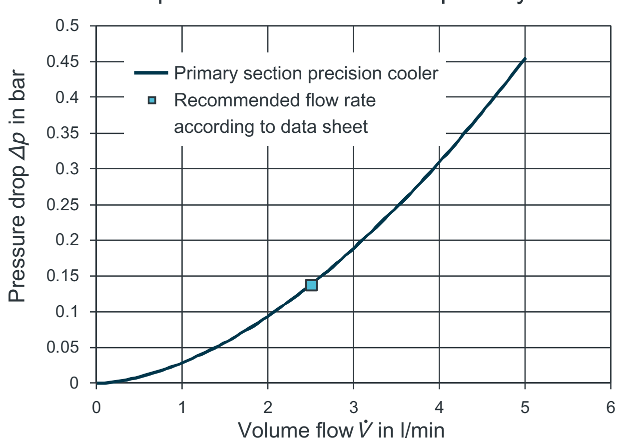


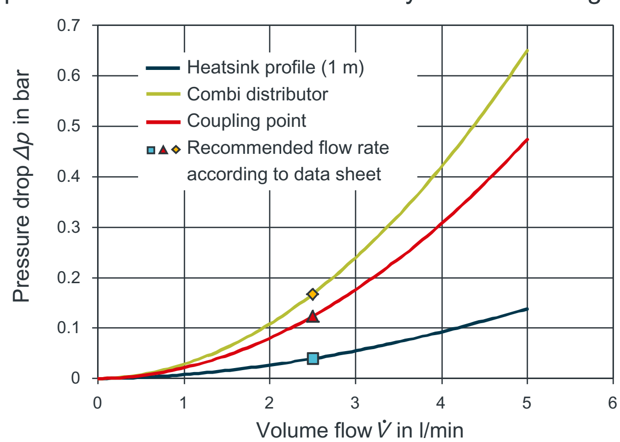
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





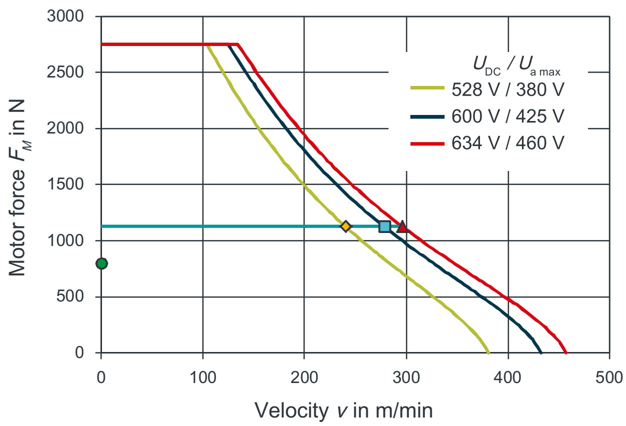
Data sheet of 1FN3100-5WC00-0xAx

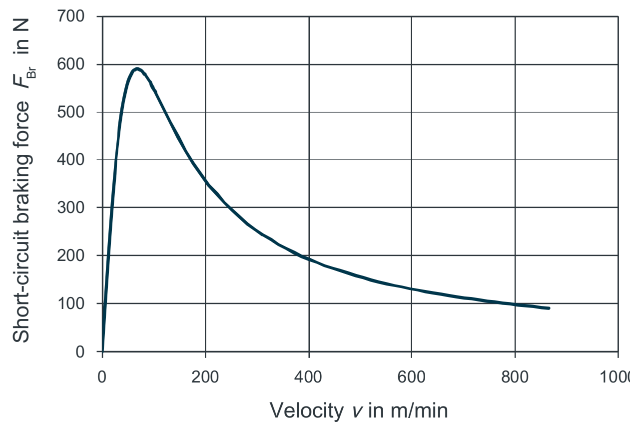
1FN3100-5WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1120
Rated current	I_N	A	11
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	278
Rated power loss	$P_{V,N}$	kW	1.2
Limit data			
Maximum force	F_{MAX}	N	2750
Maximum current	I_{MAX}	A	29.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	125
Maximum electric power drawn	$P_{EL,MAX}$	kW	14.3
Static force	F_0*	N	795
Stall current	I_0*	A	7.81
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	102
Voltage constant	k_E	Vs/m	33.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	38.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	2.36
Phase inductance	L_{STR}	mH	14
Attraction force	F_A	N	4980
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	9.1
Mass of the primary section with precision cooler	$m_{P,P}$	kg	10.4
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.07
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.15
Pressure drop	$\Delta p_{P,H}$	bar	2.41
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0315
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.197
Secondary section cooling data			

1FN3100-5WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.101
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

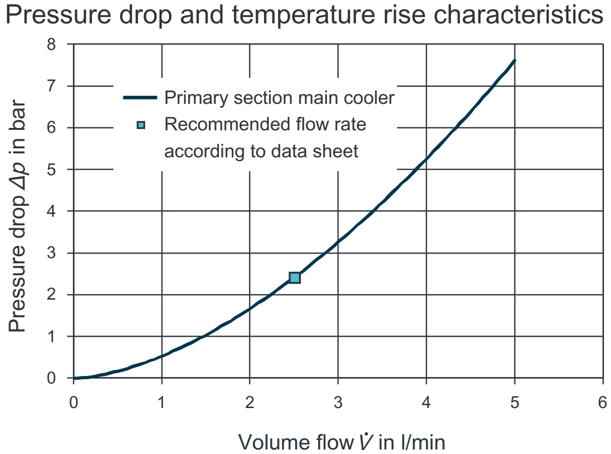
Characteristics for 1FN3100-5WC00-0xAx

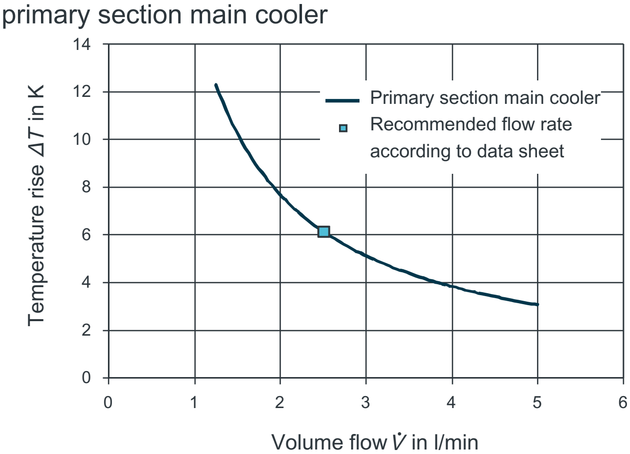
Force characteristics



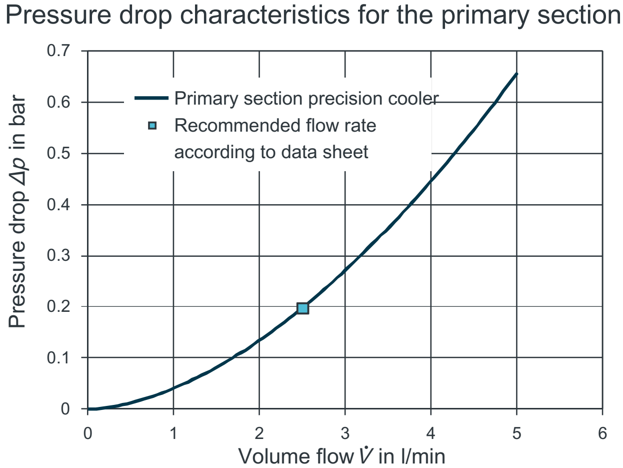


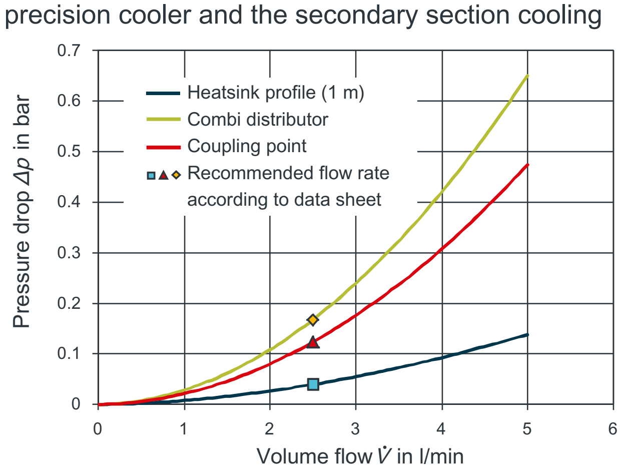
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





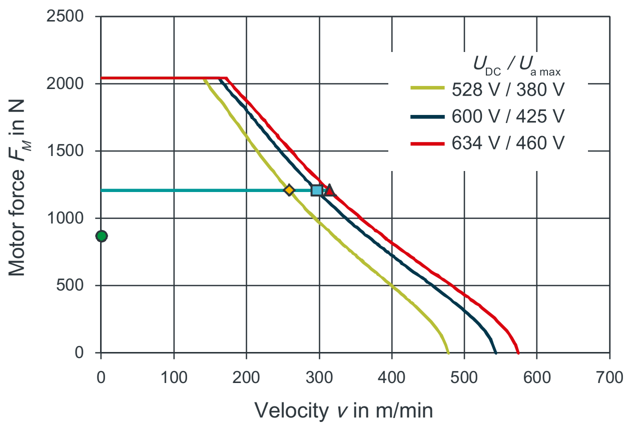
Data sheet of 1FN3100-4NC80-0xAx

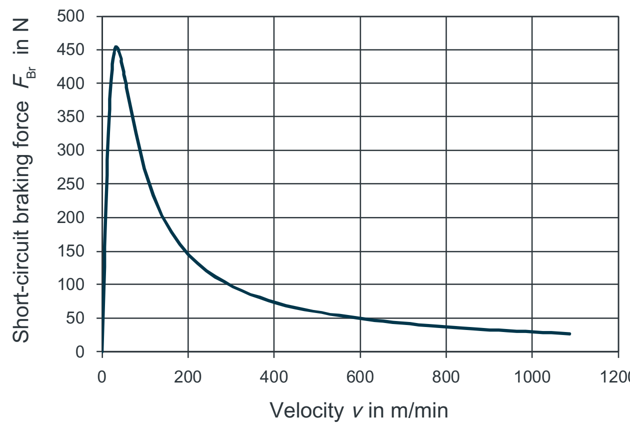
1FN3100-4NC80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1210
Rated current	I_N	A	15.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	296
Rated power loss	$P_{V,N}$	kW	1
Limit data			
Maximum force	F_{MAX}	N	2040
Maximum current	I_{MAX}	A	33.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	162
Maximum electric power drawn	$P_{EL,MAX}$	kW	9.83
Static force	F_0*	N	867
Stall current	I_0*	A	11.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	77.1
Voltage constant	k_E	Vs/m	25.7
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	45.8
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.947
Phase inductance	L_{STR}	mH	11.5
Attraction force	F_A	N	3970
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	9.9
Mass of the primary section with precision cooler	$m_{P,P}$	kg	11.2
Mass of a secondary section	m_S	kg	0.7
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	0.8
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.889
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.11
Pressure drop	$\Delta p_{P,H}$	bar	1.95
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0263
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.5
Pressure drop	$\Delta p_{P,P}$	bar	0.167
Secondary section cooling data			

1FN3100-4NC80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0881
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0393
Pressure drop per combi distributor	Δp_{KV}	bar	0.167
Pressure drop per coupling point	Δp_{KS}	bar	0.123

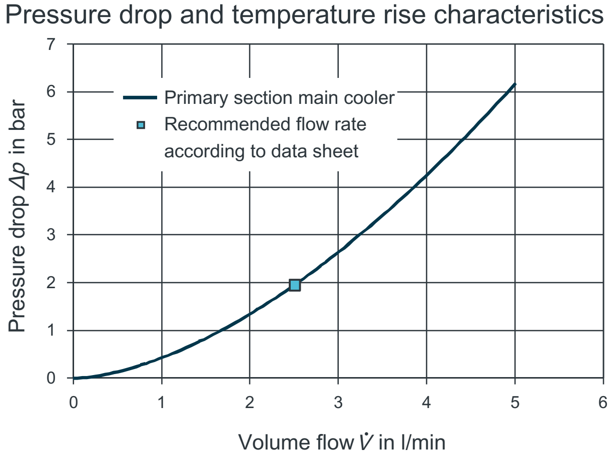
Characteristics for 1FN3100-4NC80-0xAx

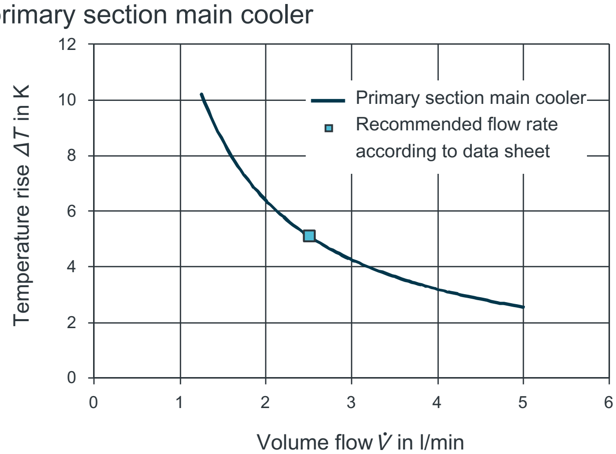
Force characteristics



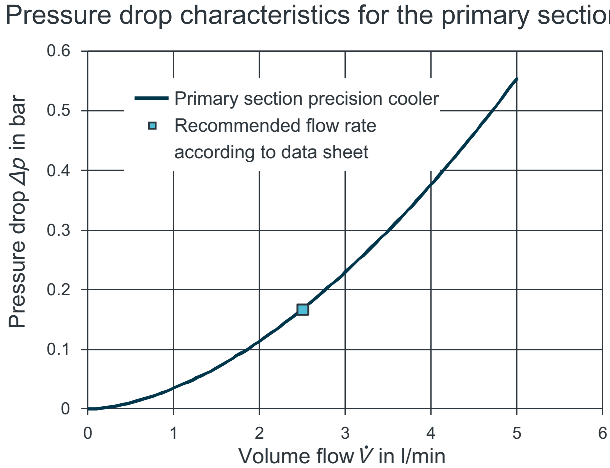


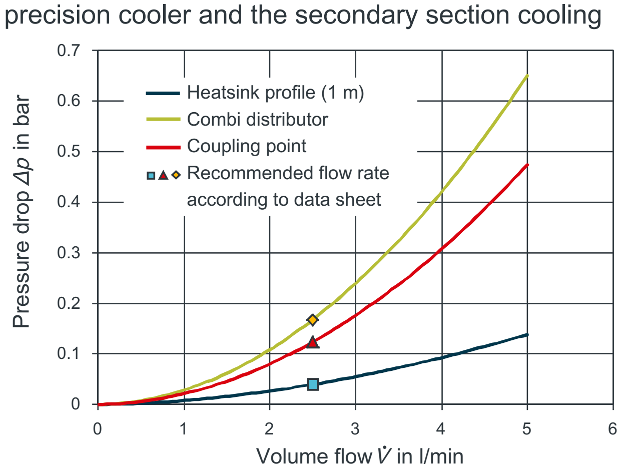
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





7.2.3 1FN3150-xxxxx-xxxx

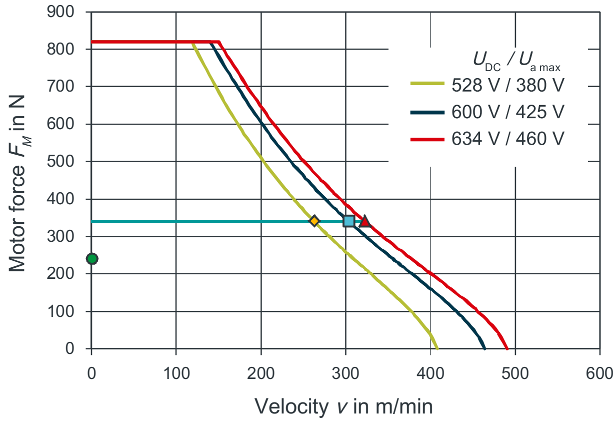
Data sheet of 1FN3150-1WC00-0xAx

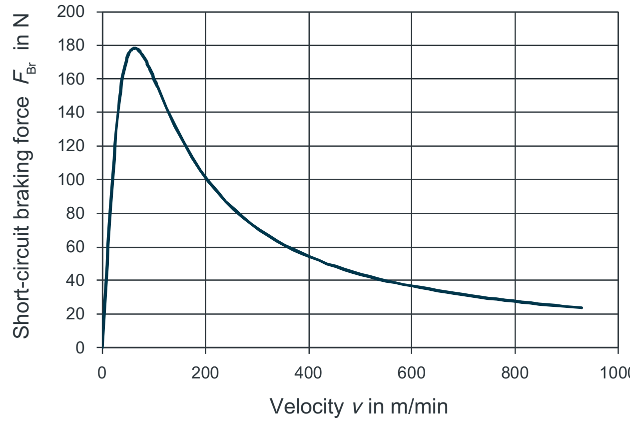
1FN3150-1WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	340
Rated current	I_N	A	3.58
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	303
Rated power loss	$P_{V,N}$	kW	0.337
Limit data			
Maximum force	F_{MAX}	N	820
Maximum current	I_{MAX}	A	9.54
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	140
Maximum electric power drawn	$P_{EL,MAX}$	kW	4.31
Static force	F_0*	N	240
Stall current	I_0*	A	2.53
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	95
Voltage constant	k_E	Vs/m	31.7
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	21.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	6.3
Phase inductance	L_{STR}	mH	40.3
Attraction force	F_A	N	1490
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	2.9
Mass of the primary section with precision cooler	$m_{P,P}$	kg	---
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.3
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.54
Pressure drop	$\Delta p_{P,H}$	bar	0.815
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	---

1FN3150-1WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	---
Pressure drop	$\Delta p_{P,P}$	bar	---
Secondary section cooling data			
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0283
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

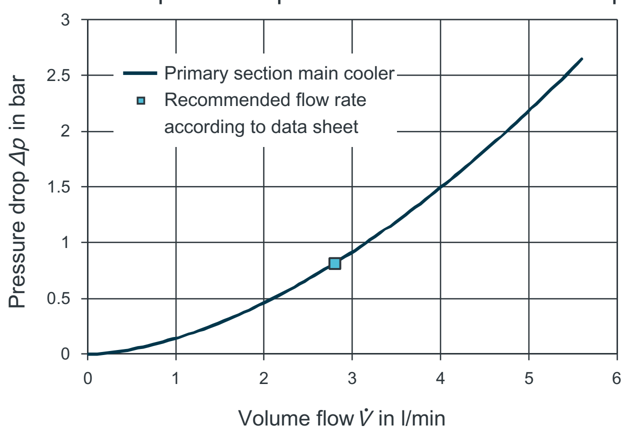
Characteristics for 1FN3150-1WC00-0xAx

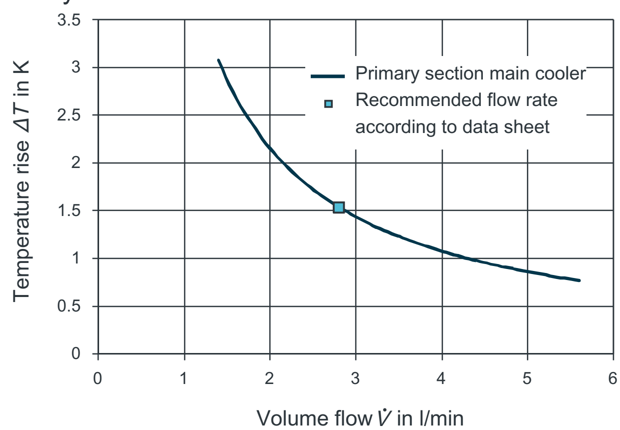
Force characteristics





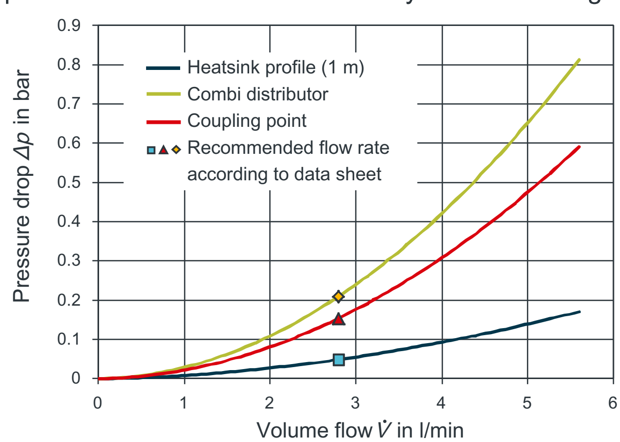
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling

No primary section precision cooler available



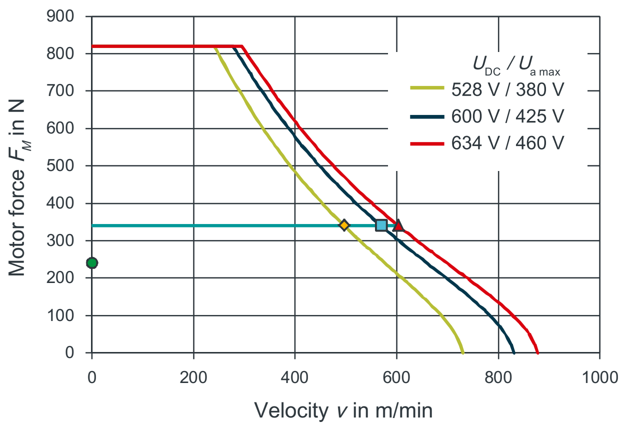
Data sheet of 1FN3150-1WE00-0xAx

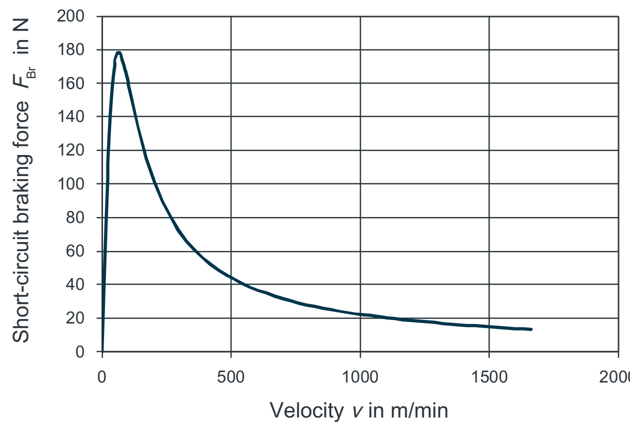
1FN3150-1WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	340
Rated current	I_N	A	6.41
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	569
Rated power loss	$P_{V,N}$	kW	0.338
Limit data			
Maximum force	F_{MAX}	N	820
Maximum current	I_{MAX}	A	17.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	278
Maximum electric power drawn	$P_{EL,MAX}$	kW	6.2
Static force	F_0*	N	240
Stall current	I_0*	A	4.53
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	53.1
Voltage constant	k_E	Vs/m	17.7
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	21.8
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.97
Phase inductance	L_{STR}	mH	12.6
Attraction force	F_A	N	1490
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	2.9
Mass of the primary section with precision cooler	$m_{P,P}$	kg	---
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.301
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.55
Pressure drop	$\Delta p_{P,H}$	bar	0.815
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	---
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	---
Pressure drop	$\Delta p_{P,P}$	bar	---
Secondary section cooling data			

1FN3150-1WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0284
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

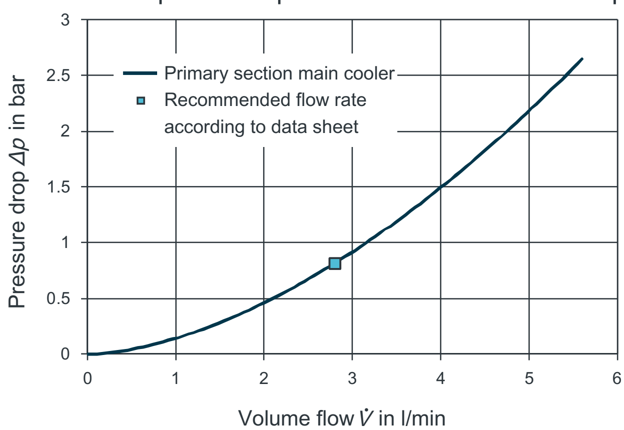
Characteristics for 1FN3150-1WE00-0xAx

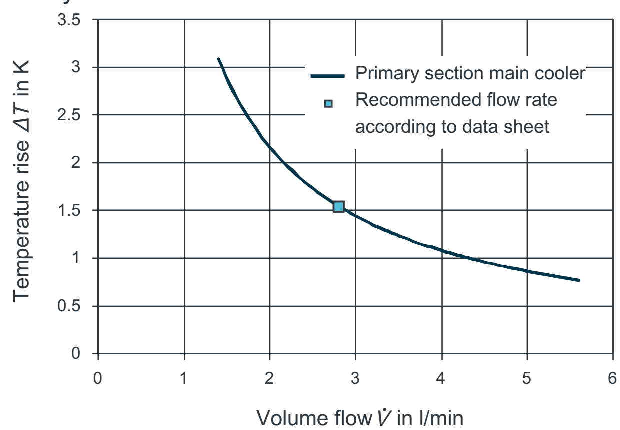
Force characteristics





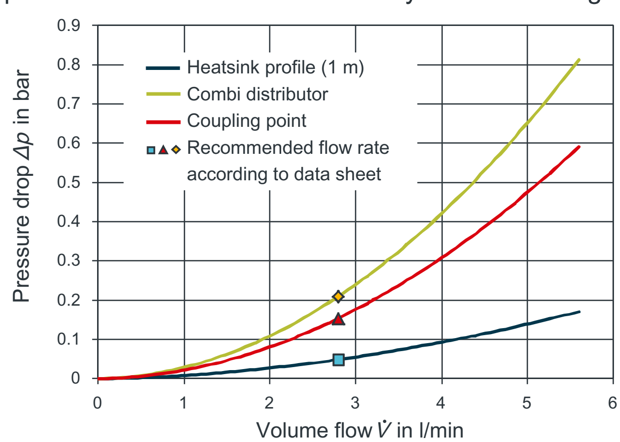
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling

No primary section precision cooler available



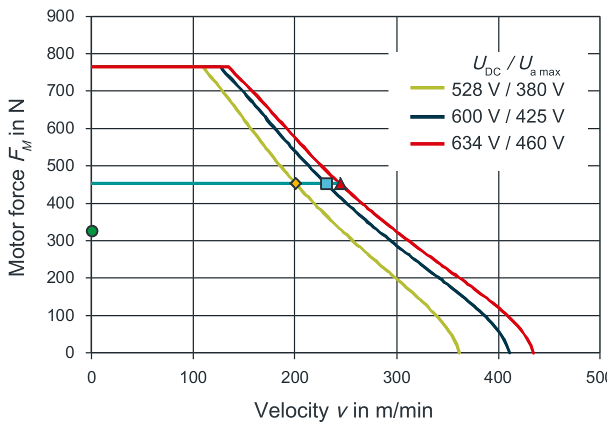
Data sheet of 1FN3150-1NC20-0xAx

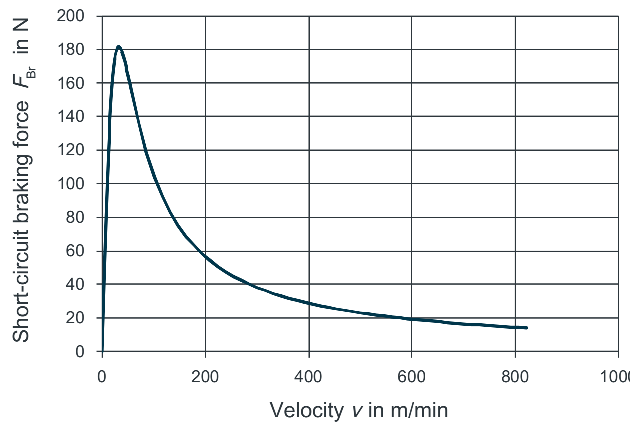
1FN3150-1NC20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	453
Rated current	I_N	A	4.52
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	230
Rated power loss	$P_{V,N}$	kW	0.343
Limit data			
Maximum force	F_{MAX}	N	766
Maximum current	I_{MAX}	A	9.38
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	127
Maximum electric power drawn	$P_{EL,MAX}$	kW	3.09
Static force	F_0*	N	325
Stall current	I_0*	A	3.19
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	102
Voltage constant	k_E	Vs/m	34
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	29.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	4.02
Phase inductance	L_{STR}	mH	50.4
Attraction force	F_A	N	1490
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	4.5
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.304
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.56
Pressure drop	$\Delta p_{P,H}$	bar	0.815
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.00899
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.8
Pressure drop	$\Delta p_{P,P}$	bar	0.101
Secondary section cooling data			

1FN3150-1NC20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0301
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

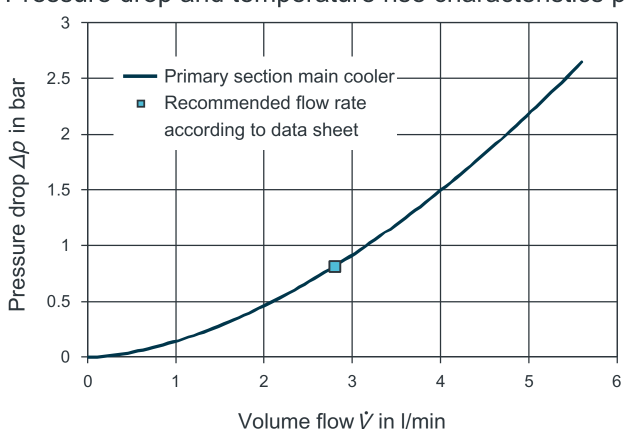
Characteristics for 1FN3150-1NC20-0xAx

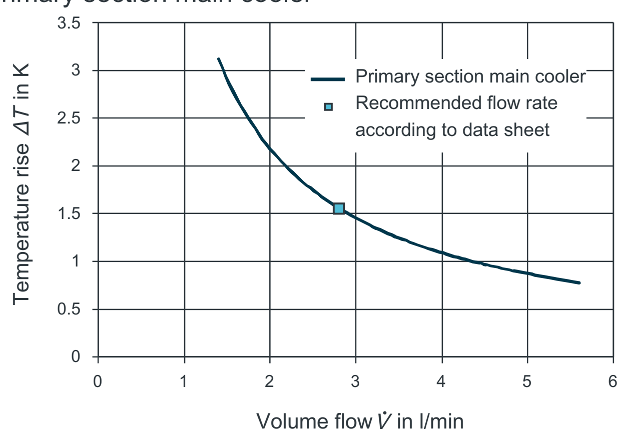
Force characteristics



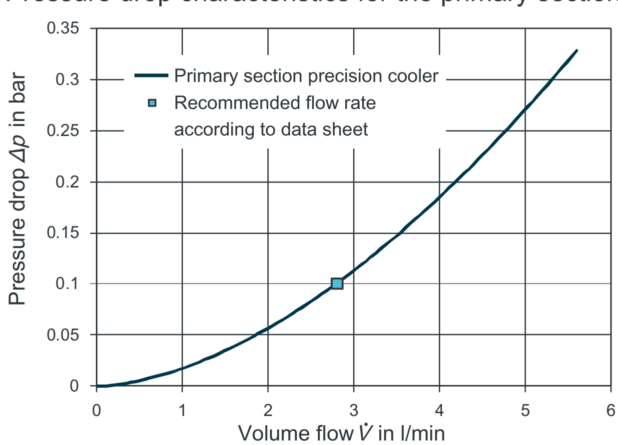


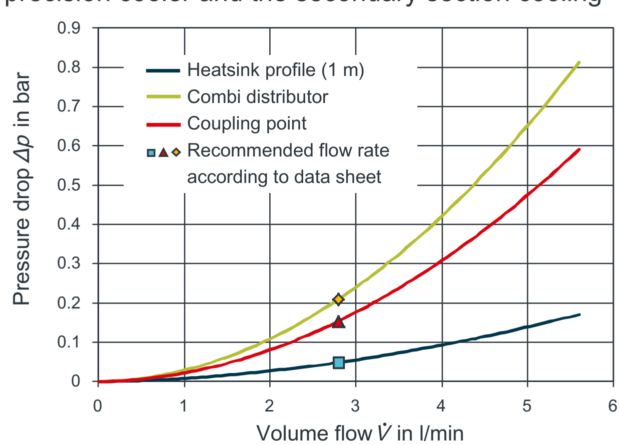
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





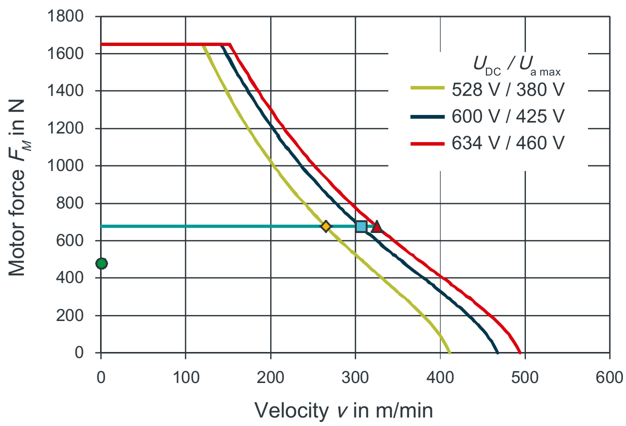
Data sheet of 1FN3150-2WC00-0xAx

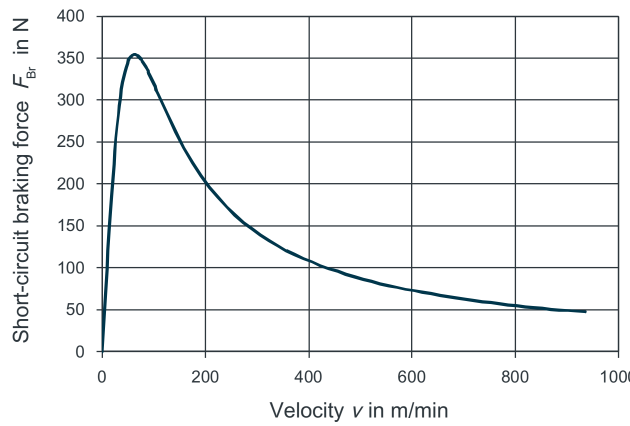
1FN3150-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	675
Rated current	I_N	A	7.16
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	306
Rated power loss	$P_{V,N}$	kW	0.671
Limit data			
Maximum force	F_{MAX}	N	1650
Maximum current	I_{MAX}	A	19.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	141
Maximum electric power drawn	$P_{EL,MAX}$	kW	8.65
Static force	F_0*	N	477
Stall current	I_0*	A	5.06
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	94.3
Voltage constant	k_E	Vs/m	31.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	30.8
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	3.13
Phase inductance	L_{STR}	mH	20
Attraction force	F_A	N	2990
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	5.3
Mass of the primary section with precision cooler	$m_{P,P}$	kg	6
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.597
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.07
Pressure drop	$\Delta p_{P,H}$	bar	1.49
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0176
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.8
Pressure drop	$\Delta p_{P,P}$	bar	0.138
Secondary section cooling data			

1FN3150-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0564
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

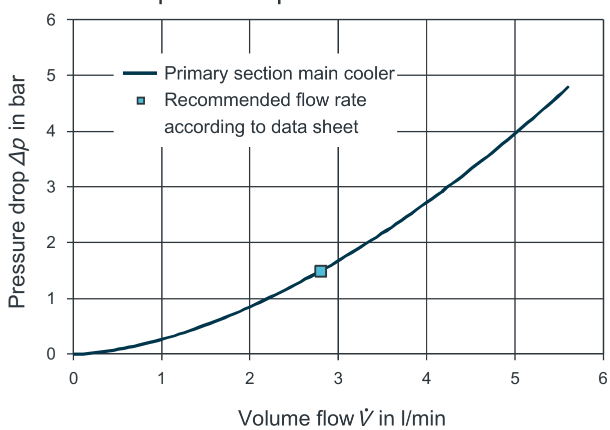
Characteristics for 1FN3150-2WC00-0xAx

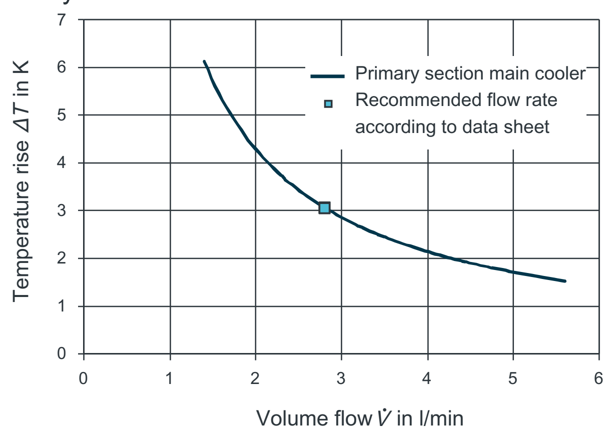
Force characteristics



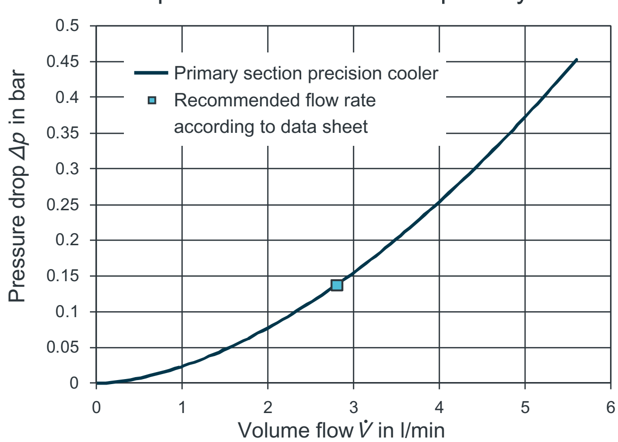


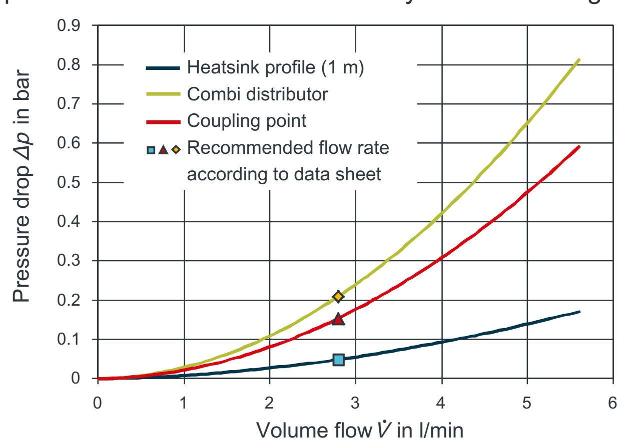
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





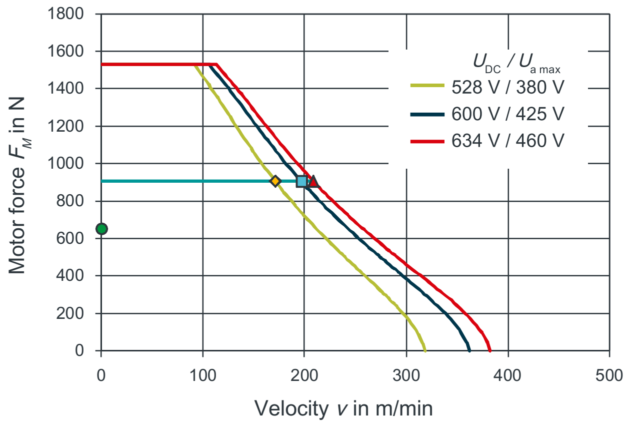
Data sheet of 1FN3150-2NB80-0xAx

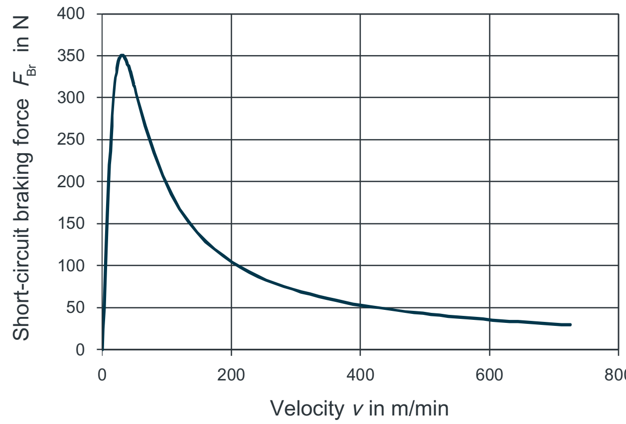
1FN3150-2NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	905
Rated current	I_N	A	7.96
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	197
Rated power loss	$P_{V,N}$	kW	0.681
Limit data			
Maximum force	F_{MAX}	N	1530
Maximum current	I_{MAX}	A	16.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	106
Maximum electric power drawn	$P_{EL,MAX}$	kW	5.66
Static force	F_0*	N	650
Stall current	I_0*	A	5.63
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	116
Voltage constant	k_E	Vs/m	38.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	41.6
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	2.57
Phase inductance	L_{STR}	mH	33.7
Attraction force	F_A	N	2980
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	7.3
Mass of the primary section with precision cooler	$m_{P,P}$	kg	8.15
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.603
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.1
Pressure drop	$\Delta p_{P,H}$	bar	1.49
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0178
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.8
Pressure drop	$\Delta p_{P,P}$	bar	0.137
Secondary section cooling data			

1FN3150-2NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0598
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

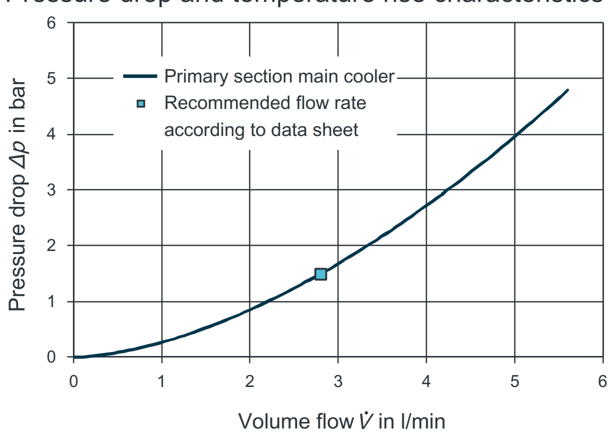
Characteristics for 1FN3150-2NB80-0xAx

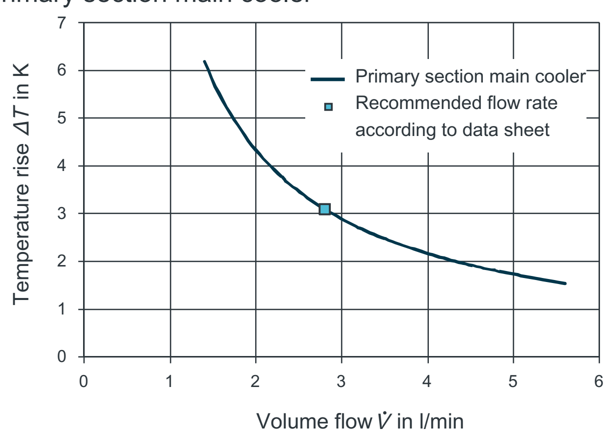
Force characteristics



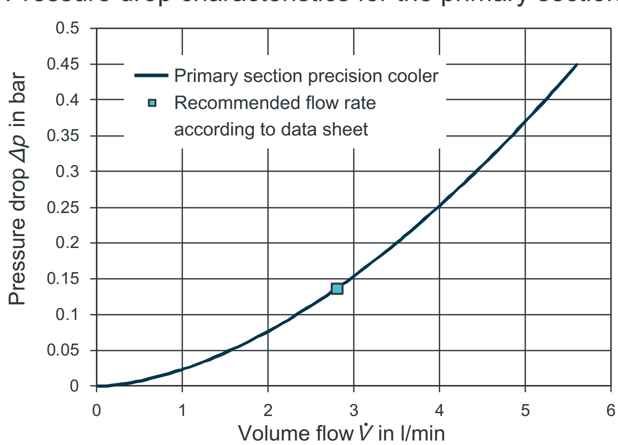


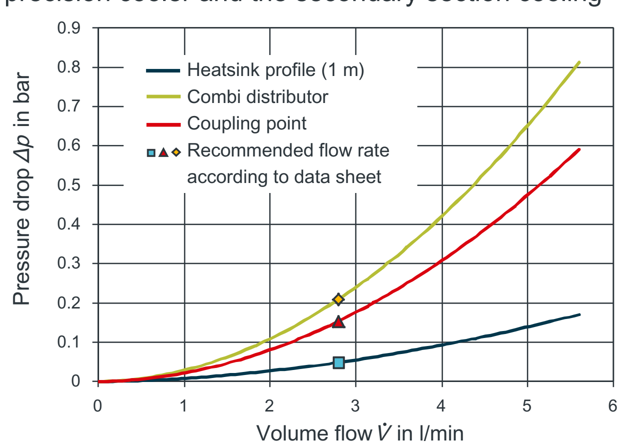
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





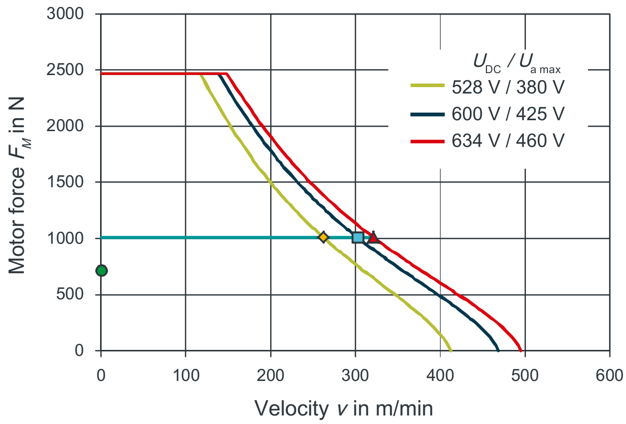
Data sheet of 1FN3150-3WC00-0xAx

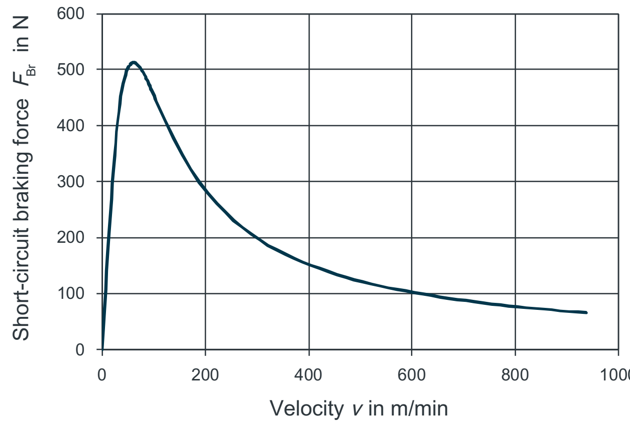
1FN3150-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1010
Rated current	I_N	A	10.7
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	302
Rated power loss	$P_{V,N}$	kW	1.01
Limit data			
Maximum force	F_{MAX}	N	2470
Maximum current	I_{MAX}	A	28.6
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	138
Maximum electric power drawn	$P_{EL,MAX}$	kW	12.8
Static force	F_0*	N	714
Stall current	I_0*	A	7.59
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	94.1
Voltage constant	k_E	Vs/m	31.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	37.6
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	2.09
Phase inductance	L_{STR}	mH	13.7
Attraction force	F_A	N	4480
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	7.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	8.6
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.895
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.6
Pressure drop	$\Delta p_{P,H}$	bar	2.17
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0263
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.8
Pressure drop	$\Delta p_{P,P}$	bar	0.173
Secondary section cooling data			

1FN3150-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0845
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

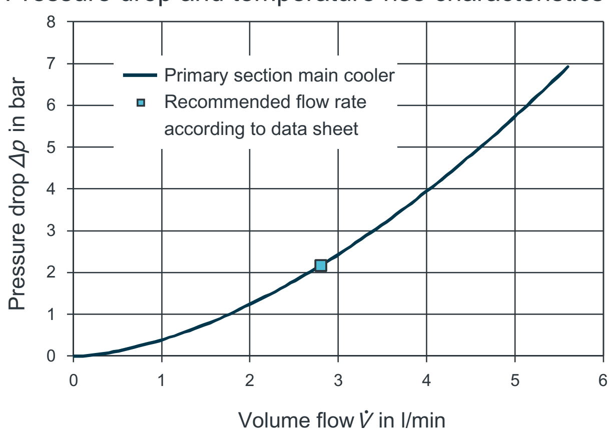
Characteristics for 1FN3150-3WC00-0xAx

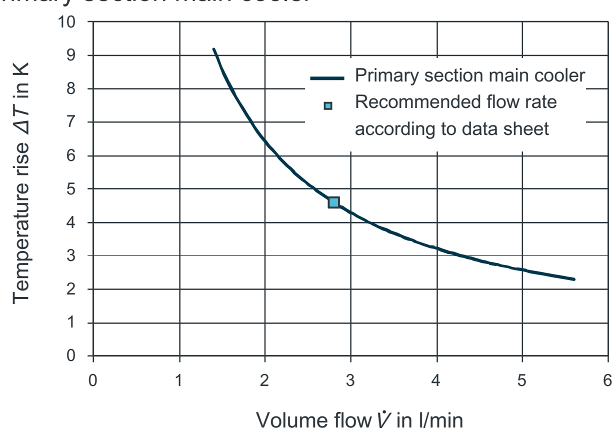
Force characteristics



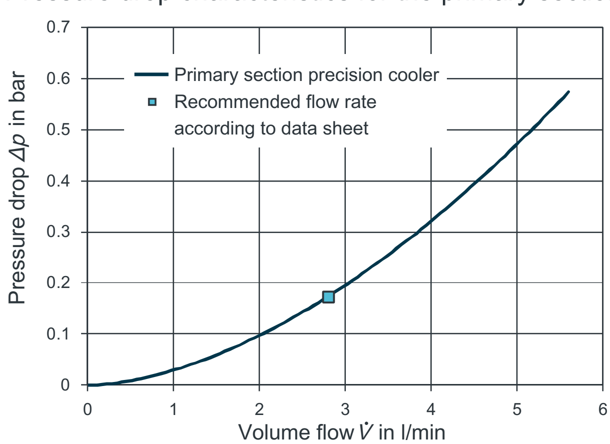


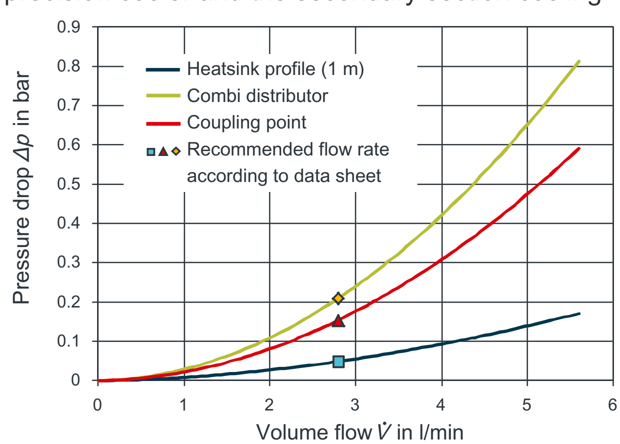
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





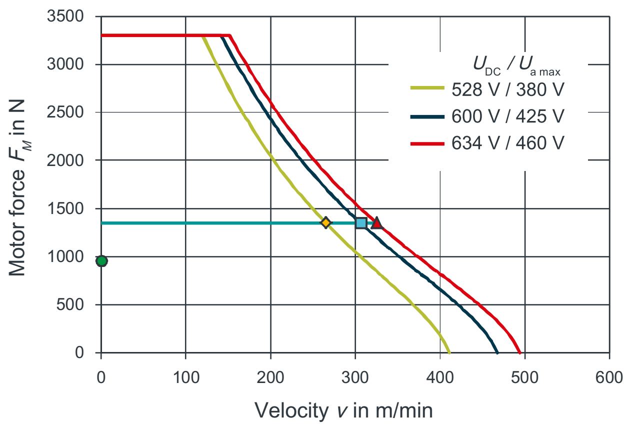
Data sheet of 1FN3150-4WC00-0xAx

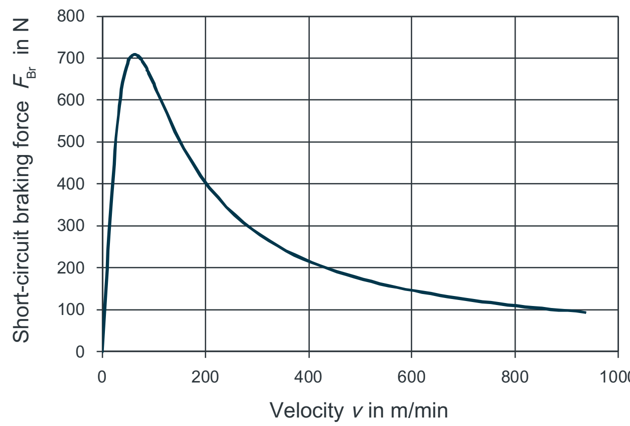
1FN3150-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1350
Rated current	I_N	A	14.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	306
Rated power loss	$P_{V,N}$	kW	1.34
Limit data			
Maximum force	F_{MAX}	N	3300
Maximum current	I_{MAX}	A	38.2
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	141
Maximum electric power drawn	$P_{EL,MAX}$	kW	17.3
Static force	F_0*	N	955
Stall current	I_0*	A	10.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	94.3
Voltage constant	k_E	Vs/m	31.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	43.5
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.56
Phase inductance	L_{STR}	mH	9.99
Attraction force	F_A	N	5980
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	10.4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	11.6
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.19
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.12
Pressure drop	$\Delta p_{P,H}$	bar	2.85
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0351
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.8
Pressure drop	$\Delta p_{P,P}$	bar	0.209
Secondary section cooling data			

1FN3150-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.113
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

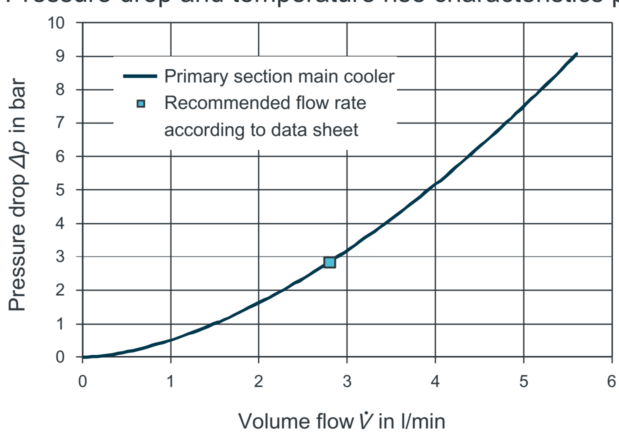
Characteristics for 1FN3150-4WC00-0xAx

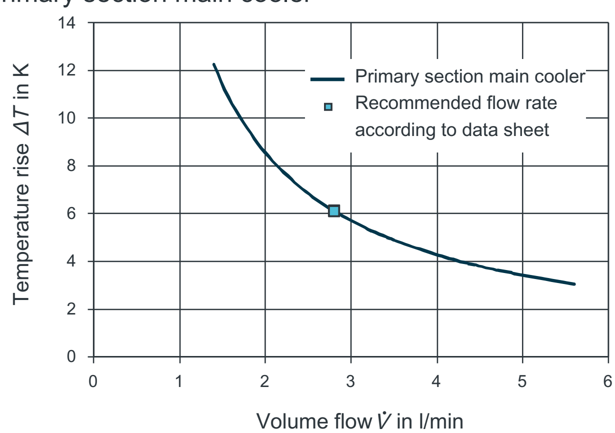
Force characteristics



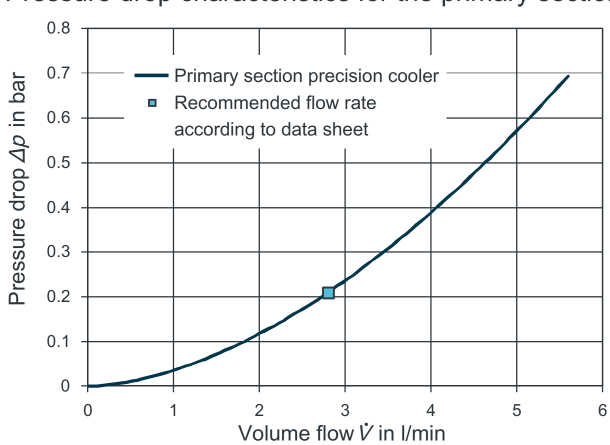


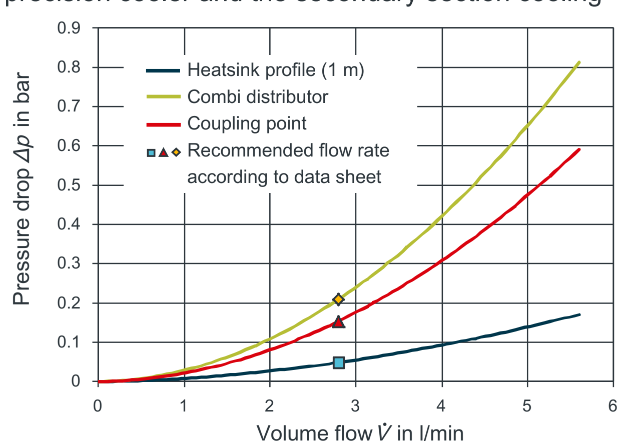
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





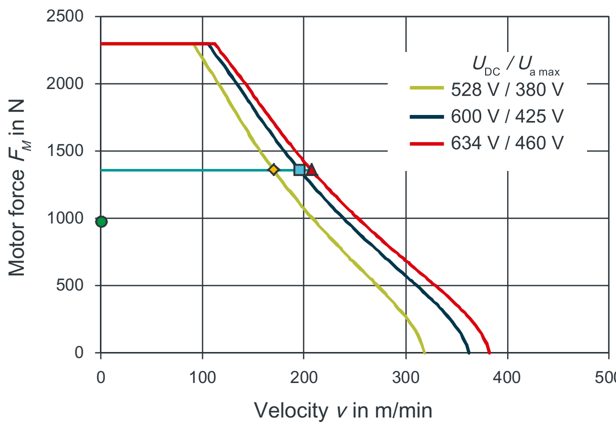
Data sheet of 1FN3150-3NB80-0xAx

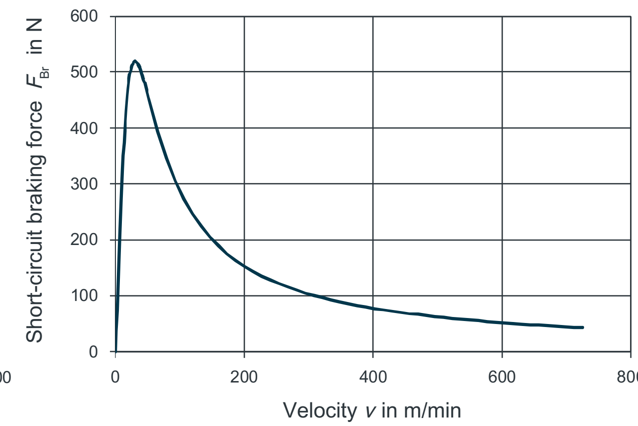
1FN3150-3NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1360
Rated current	I_N	A	11.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	195
Rated power loss	$P_{V,N}$	kW	1.02
Limit data			
Maximum force	F_{MAX}	N	2300
Maximum current	I_{MAX}	A	24.8
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	105
Maximum electric power drawn	$P_{EL,MAX}$	kW	8.44
Static force	F_0*	N	975
Stall current	I_0*	A	8.44
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	116
Voltage constant	k_E	Vs/m	38.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	51
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.71
Phase inductance	L_{STR}	mH	22.7
Attraction force	F_A	N	4460
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	10.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	11.7
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.904
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.64
Pressure drop	$\Delta p_{P,H}$	bar	2.17
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0267
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.8
Pressure drop	$\Delta p_{P,P}$	bar	0.172
Secondary section cooling data			

1FN3150-3NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0896
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

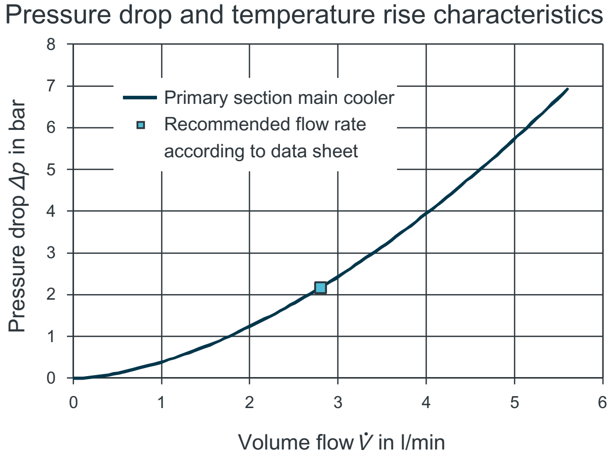
Characteristics for 1FN3150-3NB80-0xAx

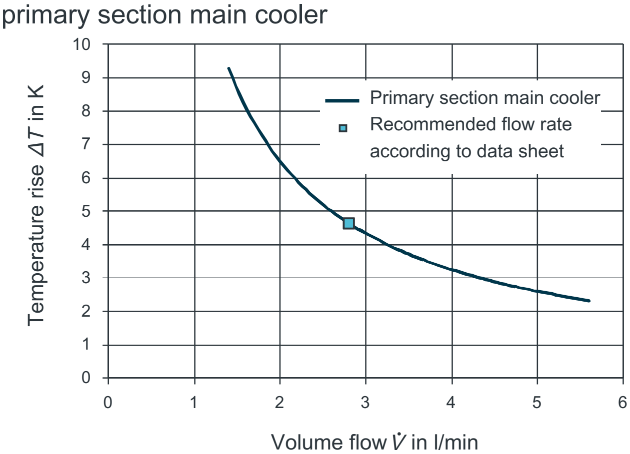
Force characteristics



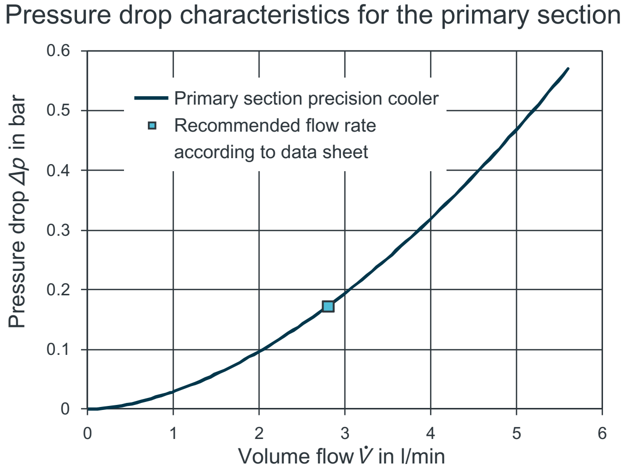


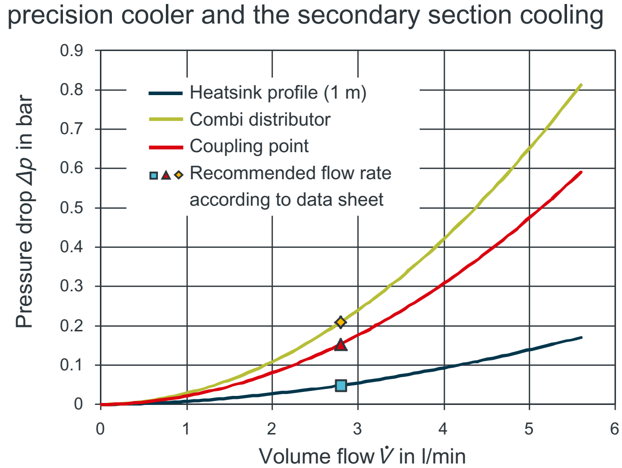
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





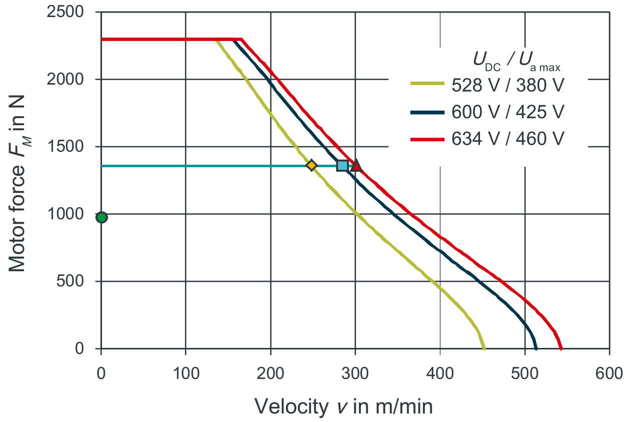
Data sheet of 1FN3150-3NC70-0xAx

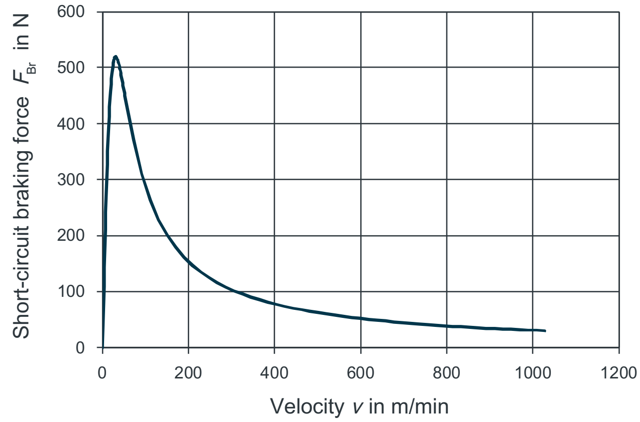
1FN3150-3NC70-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1360
Rated current	I_N	A	16.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	284
Rated power loss	$P_{V,N}$	kW	1.02
Limit data			
Maximum force	F_{MAX}	N	2300
Maximum current	I_{MAX}	A	35.2
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	156
Maximum electric power drawn	$P_{EL,MAX}$	kW	10.4
Static force	F_0*	N	975
Stall current	I_0*	A	12
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	81.5
Voltage constant	k_E	Vs/m	27.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	51
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.853
Phase inductance	L_{STR}	mH	11.3
Attraction force	F_A	N	4460
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	10.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	11.7
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.906
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.65
Pressure drop	$\Delta p_{P,H}$	bar	2.17
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0268
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.8
Pressure drop	$\Delta p_{P,P}$	bar	0.172
Secondary section cooling data			

1FN3150-3NC70-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0898
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

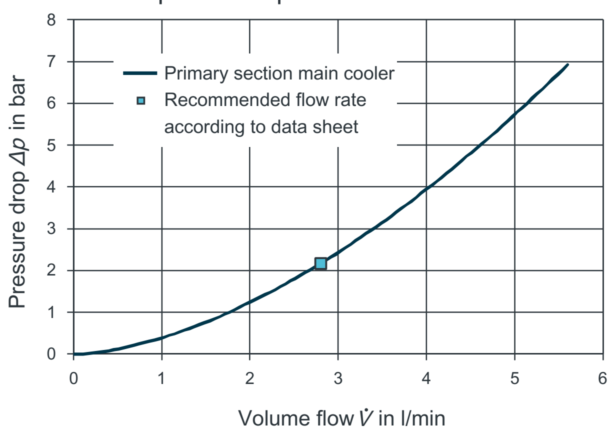
Characteristics for 1FN3150-3NC70-0xAx

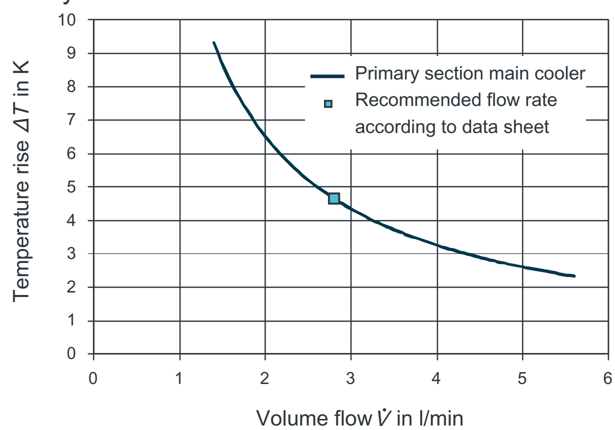
Force characteristics



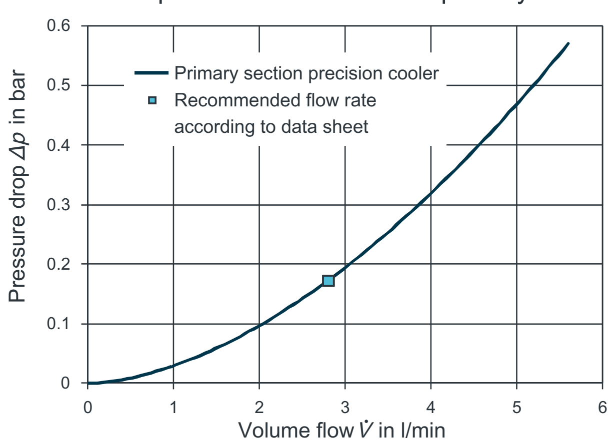


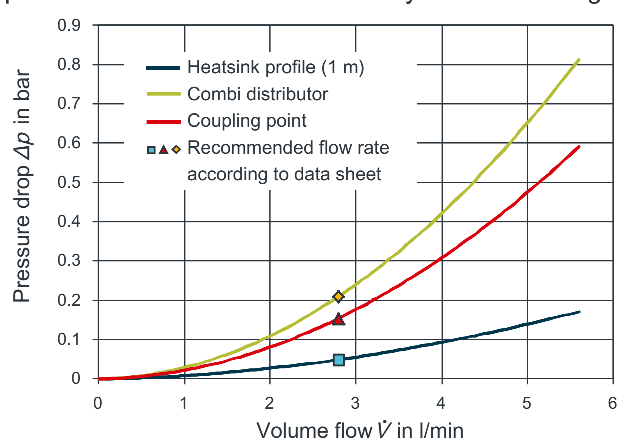
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





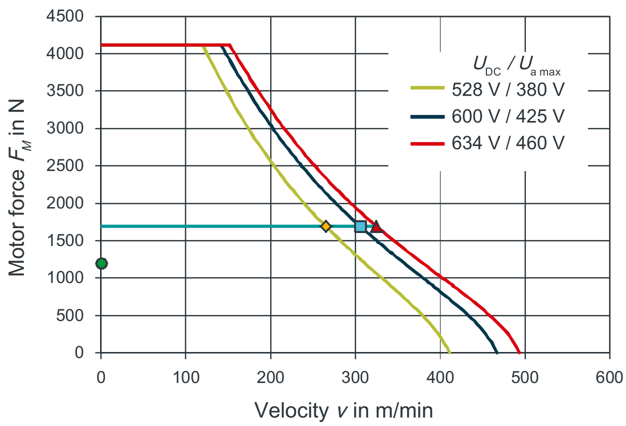
Data sheet of 1FN3150-5WC00-0xAx

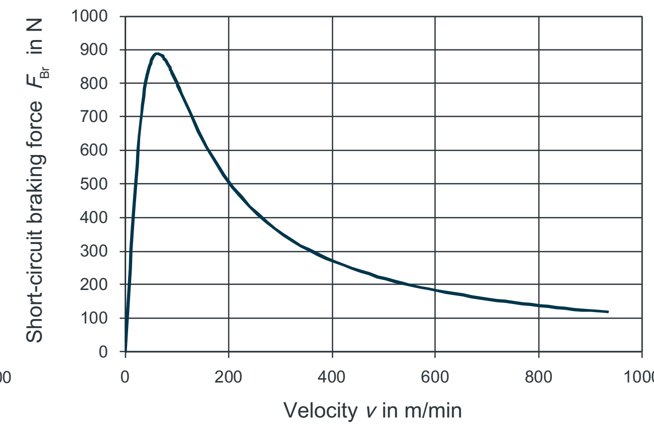
1FN3150-5WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1690
Rated current	I_N	A	17.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	306
Rated power loss	$P_{V,N}$	kW	1.67
Limit data			
Maximum force	F_{MAX}	N	4120
Maximum current	I_{MAX}	A	47.7
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	141
Maximum electric power drawn	$P_{EL,MAX}$	kW	21.6
Static force	F_0*	N	1200
Stall current	I_0*	A	12.7
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	94.4
Voltage constant	k_E	Vs/m	31.5
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	48.8
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.25
Phase inductance	L_{STR}	mH	7.99
Attraction force	F_A	N	7470
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	12.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	13.9
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.49
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	7.65
Pressure drop	$\Delta p_{P,H}$	bar	3.52
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0438
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.8
Pressure drop	$\Delta p_{P,P}$	bar	0.245
Secondary section cooling data			

1FN3150-5WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.141
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

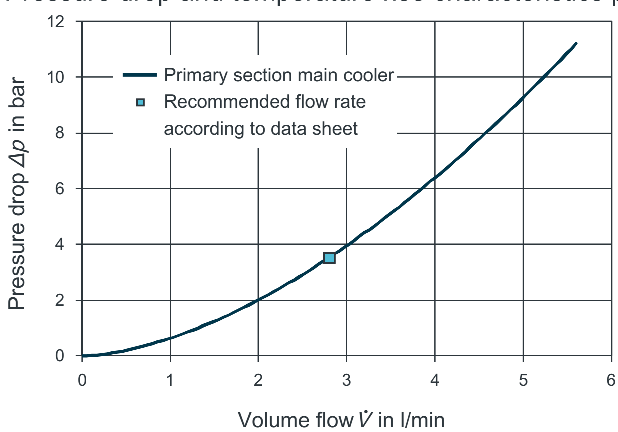
Characteristics for 1FN3150-5WC00-0xAx

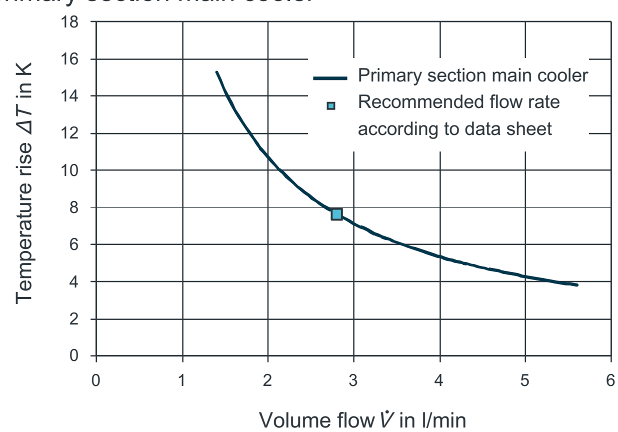
Force characteristics



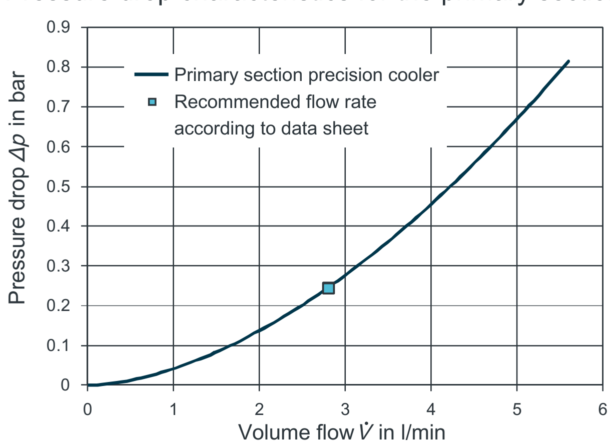


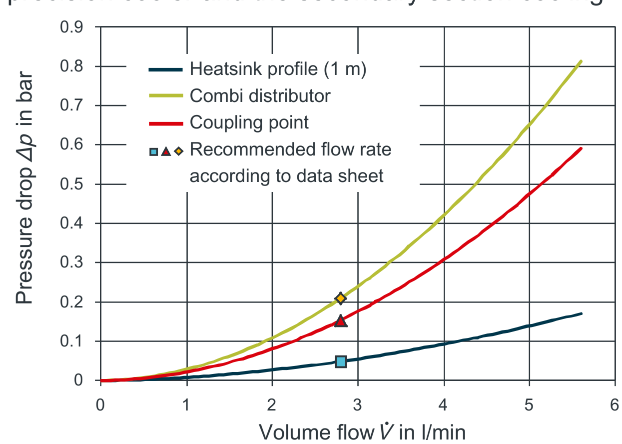
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





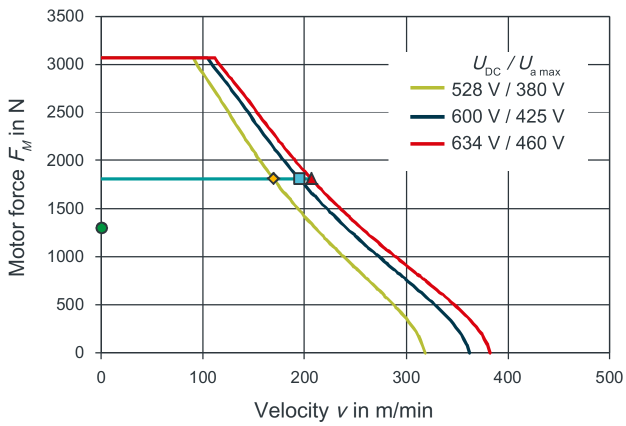
Data sheet of 1FN3150-4NB80-0xAx

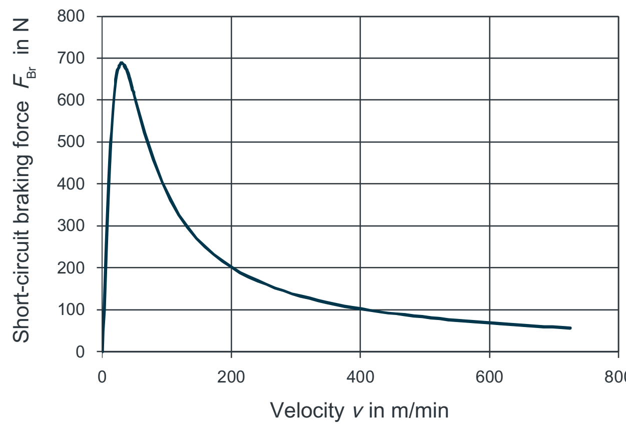
1FN3150-4NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1810
Rated current	I_N	A	15.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	195
Rated power loss	$P_{V,N}$	kW	1.36
Limit data			
Maximum force	F_{MAX}	N	3060
Maximum current	I_{MAX}	A	33.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	105
Maximum electric power drawn	$P_{EL,MAX}$	kW	11.2
Static force	F_0*	N	1300
Stall current	I_0*	A	11.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	116
Voltage constant	k_E	Vs/m	38.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	58.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.28
Phase inductance	L_{STR}	mH	17.1
Attraction force	F_A	N	5950
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	15
Mass of the primary section	m_P	kg	13.9
Mass of the primary section with precision cooler	$m_{P,P}$	kg	15.3
Mass of a secondary section	m_S	kg	1.2
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	1.3
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.2
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	2.8
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.19
Pressure drop	$\Delta p_{P,H}$	bar	2.85
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0356
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	2.8
Pressure drop	$\Delta p_{P,P}$	bar	0.208
Secondary section cooling data			

1FN3150-4NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.119
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	2.8
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0482
Pressure drop per combi distributor	Δp_{KV}	bar	0.209
Pressure drop per coupling point	Δp_{KS}	bar	0.154

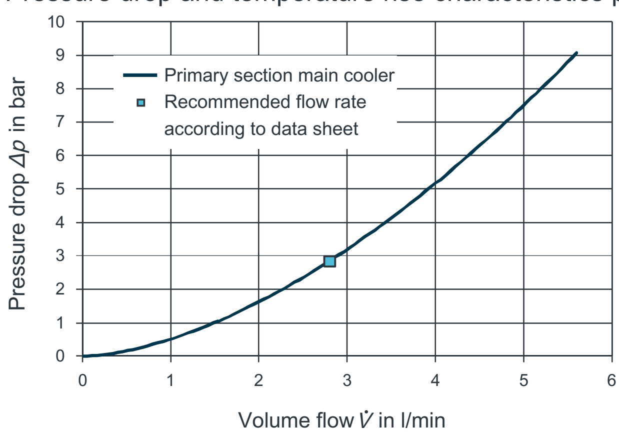
Characteristics for 1FN3150-4NB80-0xAx

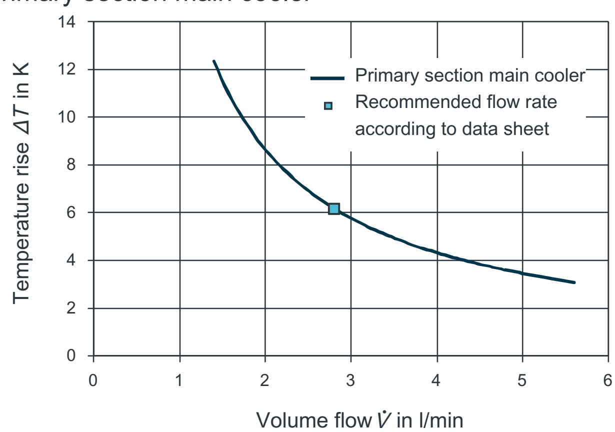
Force characteristics



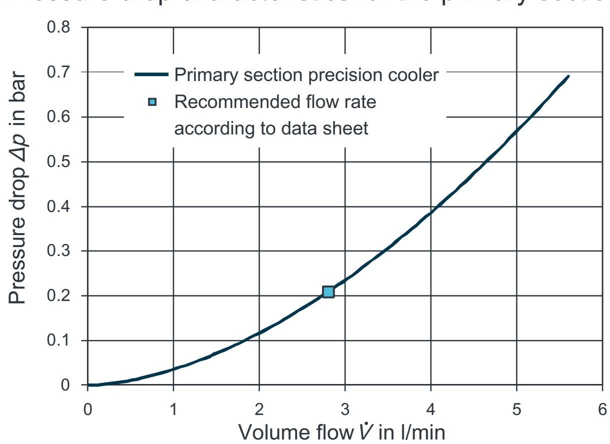


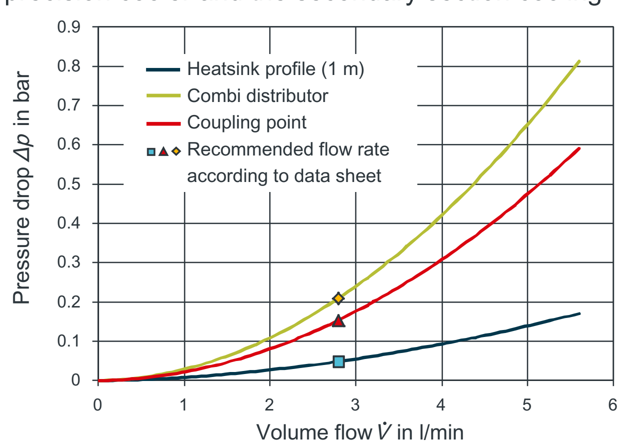
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





7.2.4 1FN3300-xxxxx-xxxx

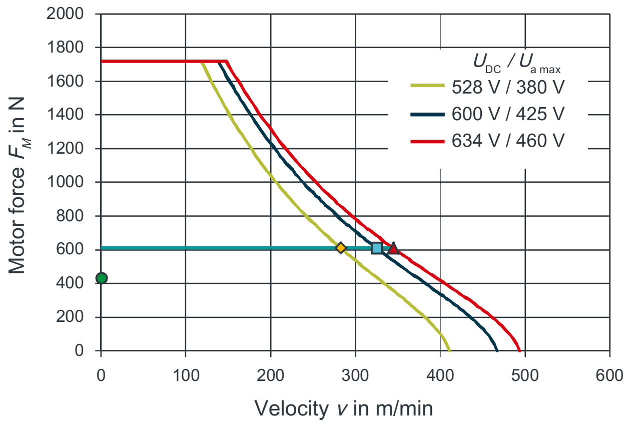
Data sheet of 1FN3300-1WC00-0xAx

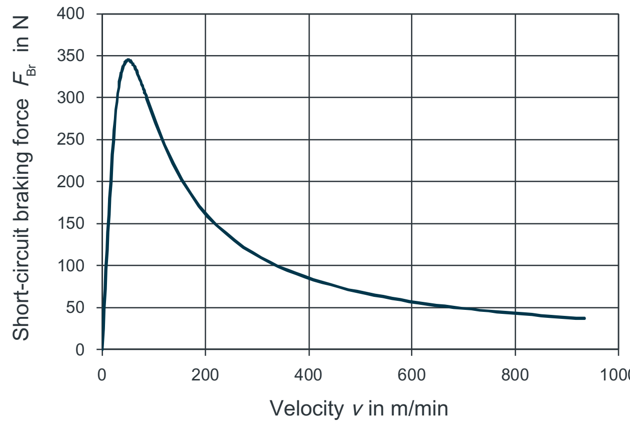
1FN3300-1WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	610
Rated current	I_N	A	6.47
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	325
Rated power loss	$P_{V,N}$	kW	0.45
Limit data			
Maximum force	F_{MAX}	N	1720
Maximum current	I_{MAX}	A	20
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	138
Maximum electric power drawn	$P_{EL,MAX}$	kW	8.27
Static force	F_0*	N	431
Stall current	I_0*	A	4.57
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	94.3
Voltage constant	k_E	Vs/m	31.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	33.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	2.58
Phase inductance	L_{STR}	mH	31.5
Attraction force	F_A	N	2940
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	6.6
Mass of the primary section with precision cooler	$m_{P,P}$	kg	---
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.401
Recommended minimum volume flow rate	$V_{P,H,MIN}$	l/min	3.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.65
Pressure drop	$\Delta p_{P,H}$	bar	0.147
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	---

1FN3300-1WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	---
Pressure drop	$\Delta p_{P,P}$	bar	---
Secondary section cooling data			
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0378
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	3.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0724
Pressure drop per combi distributor	Δp_{KV}	bar	0.324
Pressure drop per coupling point	Δp_{KS}	bar	0.237

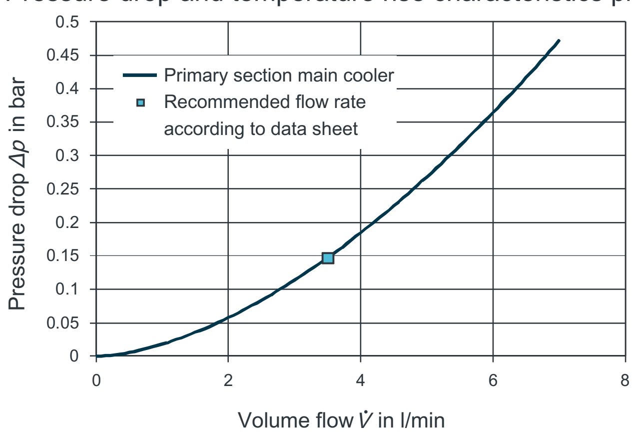
Characteristics for 1FN3300-1WC00-0xAx

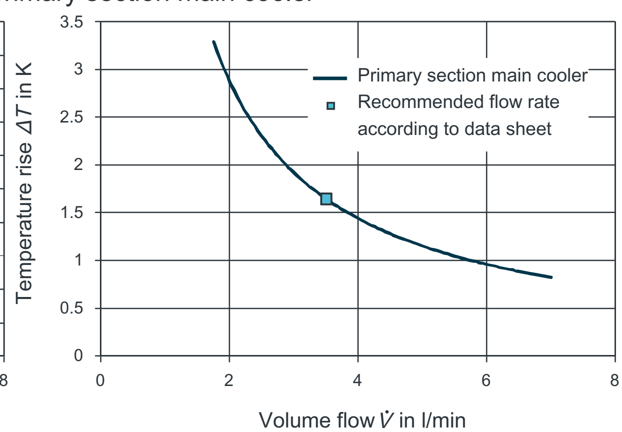
Force characteristics





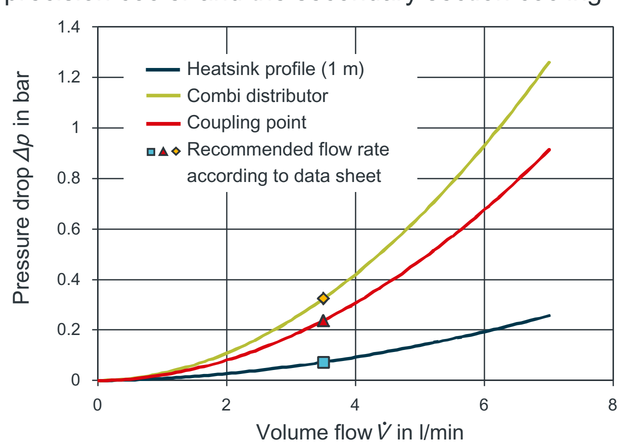
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling

No primary section precision cooler available



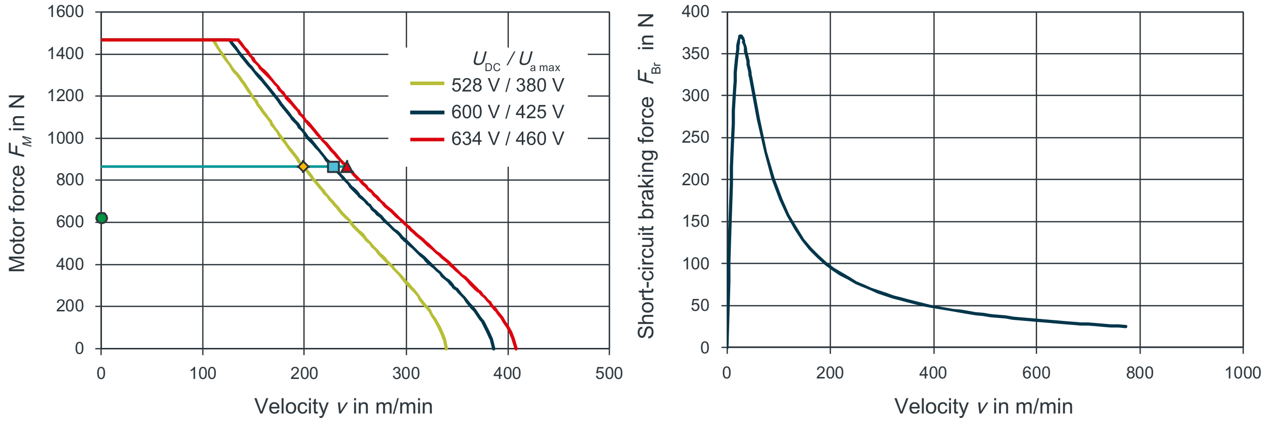
Data sheet of 1FN3300-1NC10-0xAx

1FN3300-1NC10-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	864
Rated current	I_N	A	8.12
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	228
Rated power loss	$P_{V,N}$	kW	0.508
Limit data			
Maximum force	F_{MAX}	N	1470
Maximum current	I_{MAX}	A	17.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	127
Maximum electric power drawn	$P_{EL,MAX}$	kW	5.35
Static force	F_0*	N	621
Stall current	I_0*	A	5.74
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	108
Voltage constant	k_E	Vs/m	36.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	46.1
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.85
Phase inductance	L_{STR}	mH	42.9
Attraction force	F_A	N	2890
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	8.8
Mass of the primary section with precision cooler	$m_{P,P}$	kg	9.51
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.45
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	3.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	1.85
Pressure drop	$\Delta p_{P,H}$	bar	0.147
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0133
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	3.5
Pressure drop	$\Delta p_{P,P}$	bar	0.178
Secondary section cooling data			

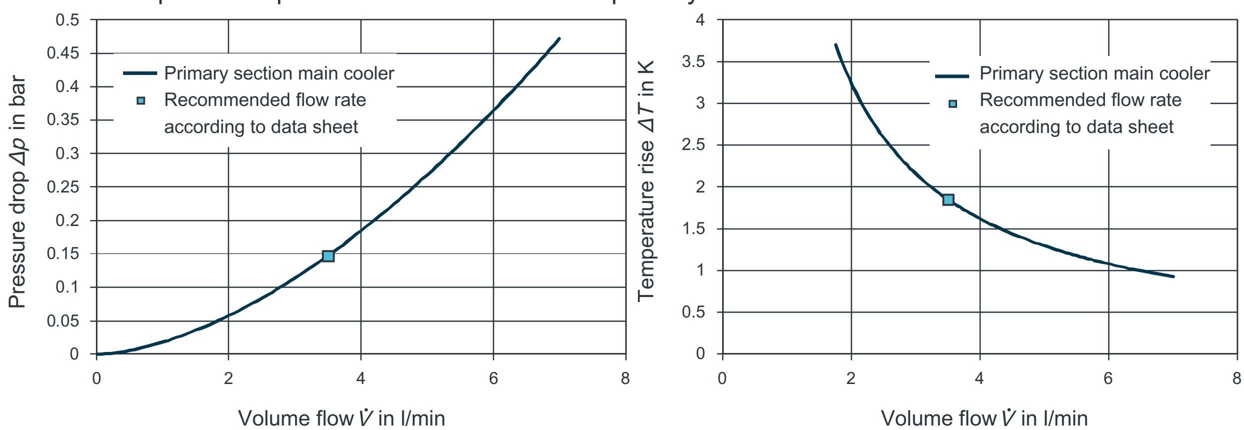
1FN3300-1NC10-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0446
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	3.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0724
Pressure drop per combi distributor	Δp_{KV}	bar	0.324
Pressure drop per coupling point	Δp_{KS}	bar	0.237

Characteristics for 1FN3300-1NC10-0xAx

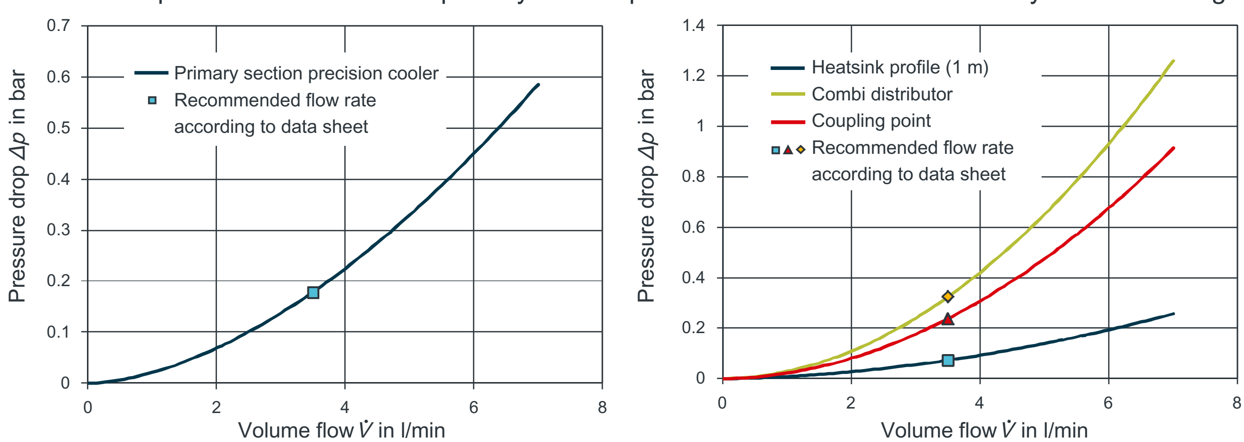
Force characteristics



Pressure drop and temperature rise characteristics primary section main cooler



Pressure drop characteristics for the primary section precision cooler and the secondary section cooling



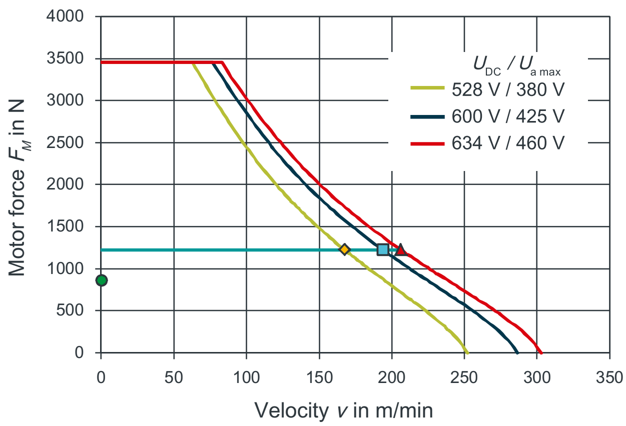
Data sheet of 1FN3300-2WB00-0xAx

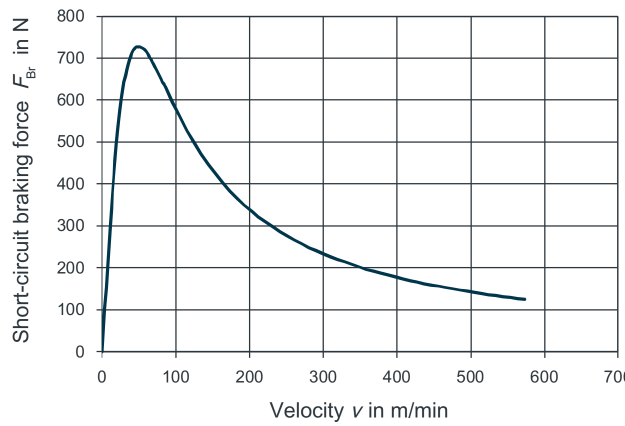
1FN3300-2WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1220
Rated current	I_N	A	7.96
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	194
Rated power loss	$P_{V,N}$	kW	0.85
Limit data			
Maximum force	F_{MAX}	N	3450
Maximum current	I_{MAX}	A	24.7
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	76.5
Maximum electric power drawn	$P_{EL,MAX}$	kW	12.6
Static force	F_0*	N	866
Stall current	I_0*	A	5.63
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	154
Voltage constant	k_E	Vs/m	51.3
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	49.6
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	3.21
Phase inductance	L_{STR}	mH	39.7
Attraction force	F_A	N	5880
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	11.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	12.5
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.757
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	2.72
Pressure drop	$\Delta p_{P,H}$	bar	0.323
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0223
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.33
Secondary section cooling data			

1FN3300-2WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0714
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

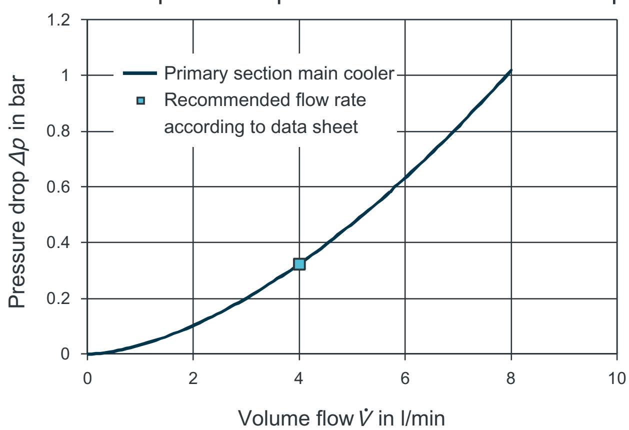
Characteristics for 1FN3300-2WB00-0xAx

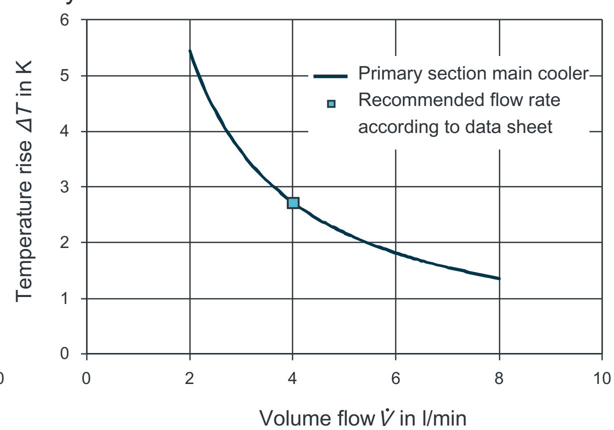
Force characteristics



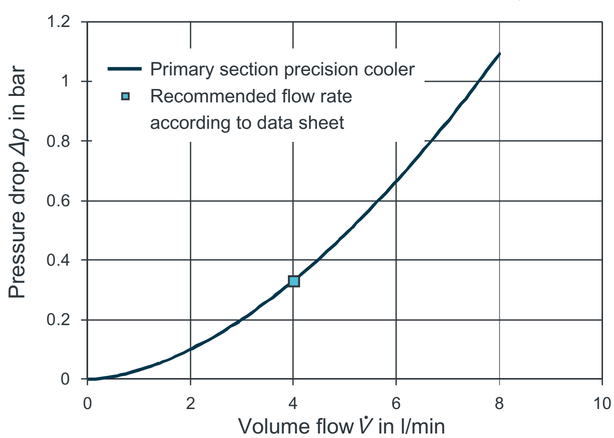


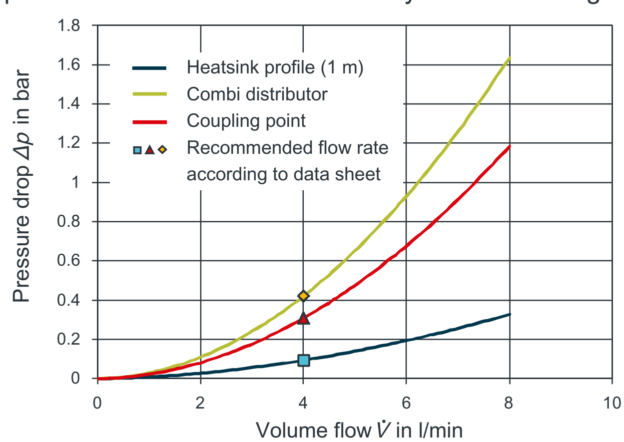
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





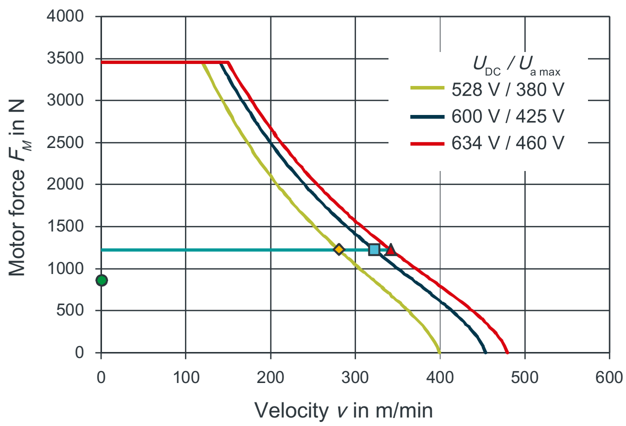
Data sheet of 1FN3300-2WC00-0xAx

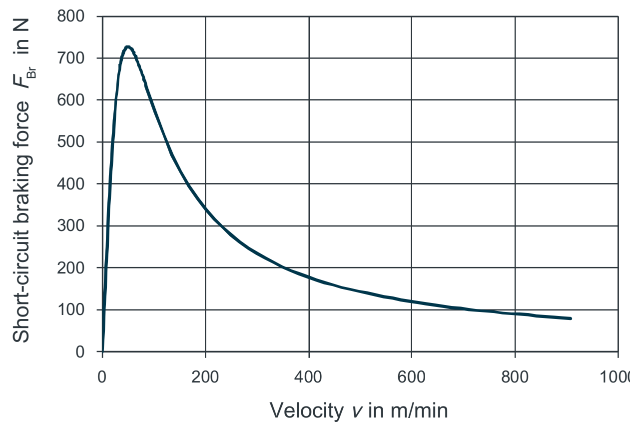
1FN3300-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1230
Rated current	I_N	A	12.6
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	322
Rated power loss	$P_{V,N}$	kW	0.852
Limit data			
Maximum force	F_{MAX}	N	3450
Maximum current	I_{MAX}	A	39
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	140
Maximum electric power drawn	$P_{EL,MAX}$	kW	16.2
Static force	F_0*	N	866
Stall current	I_0*	A	8.92
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	97.2
Voltage constant	k_E	Vs/m	32.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	49.5
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.28
Phase inductance	L_{STR}	mH	15.8
Attraction force	F_A	N	5880
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	11.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	12.5
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.758
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	2.73
Pressure drop	$\Delta p_{P,H}$	bar	0.323
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0223
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.33
Secondary section cooling data			

1FN3300-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0716
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

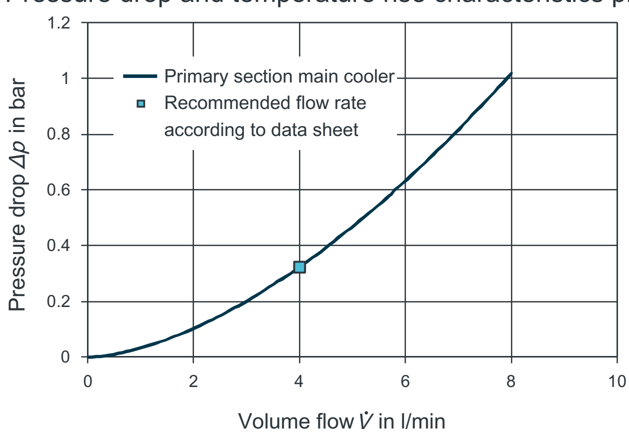
Characteristics for 1FN3300-2WC00-0xAx

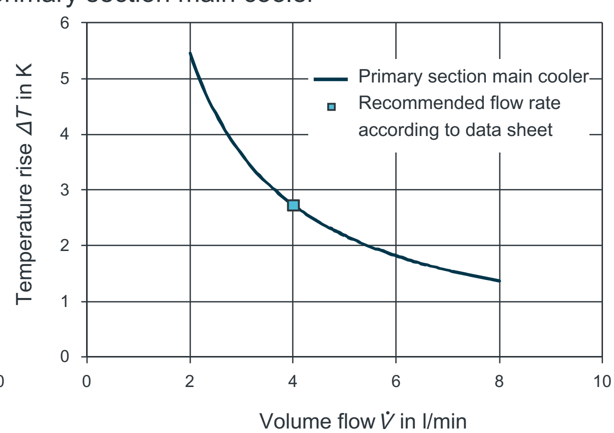
Force characteristics



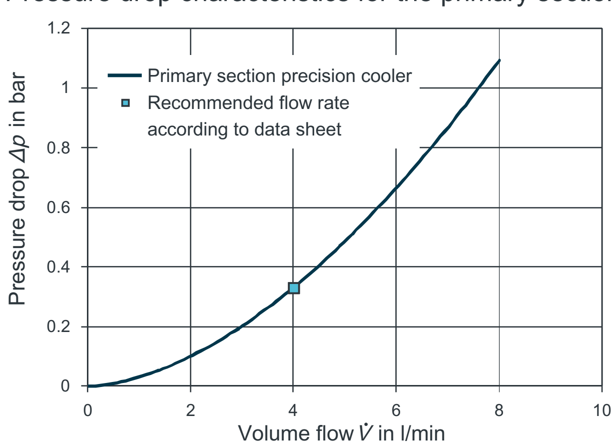


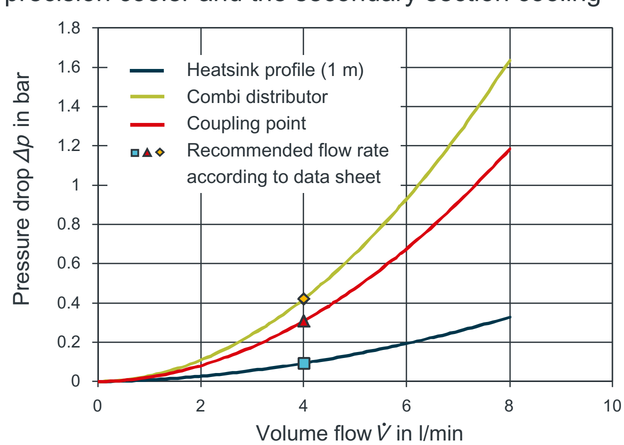
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





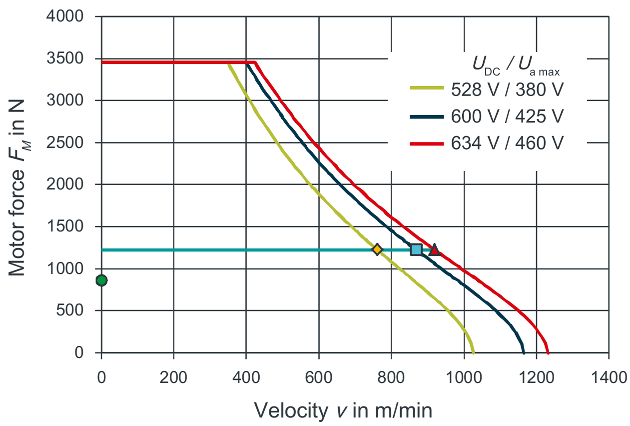
Data sheet of 1FN3300-2WG00-0xAx

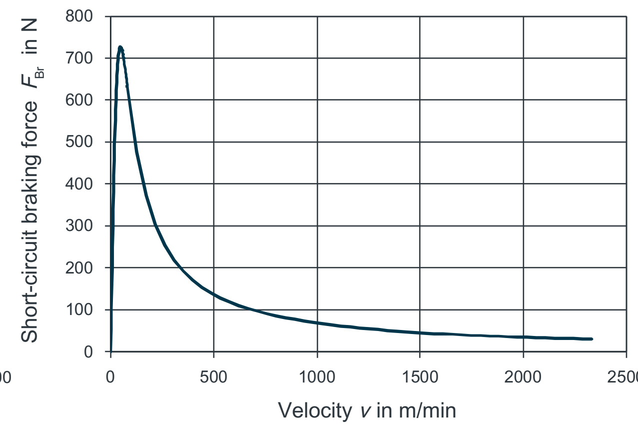
1FN3300-2WG00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1230
Rated current	I_N	A	32.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	868
Rated power loss	$P_{V,N}$	kW	0.812
Limit data			
Maximum force	F_{MAX}	N	3450
Maximum current	I_{MAX}	A	100
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	399
Maximum electric power drawn	$P_{EL,MAX}$	kW	30.8
Static force	F_0*	N	866
Stall current	I_0*	A	22.9
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	37.8
Voltage constant	k_E	Vs/m	12.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	50.7
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.185
Phase inductance	L_{STR}	mH	2.4
Attraction force	F_A	N	5880
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	11.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	12.5
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.723
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	2.6
Pressure drop	$\Delta p_{P,H}$	bar	0.323
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0213
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.33
Secondary section cooling data			

1FN3300-2WG00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0682
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

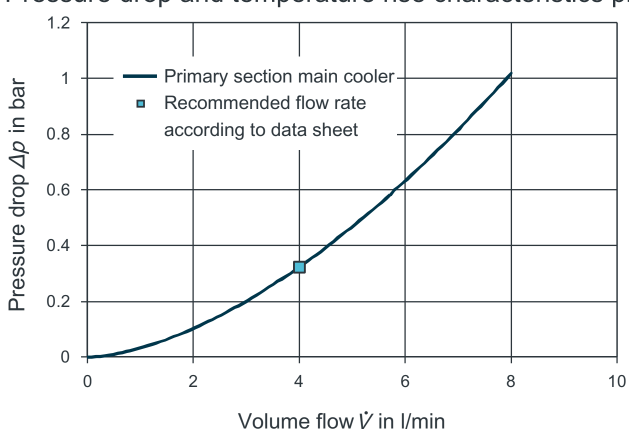
Characteristics for 1FN3300-2WG00-0xAx

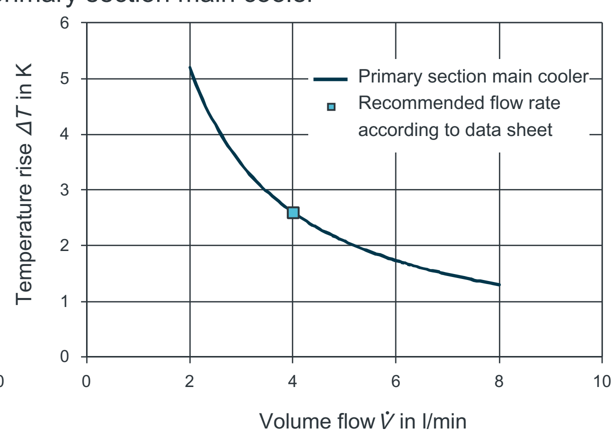
Force characteristics



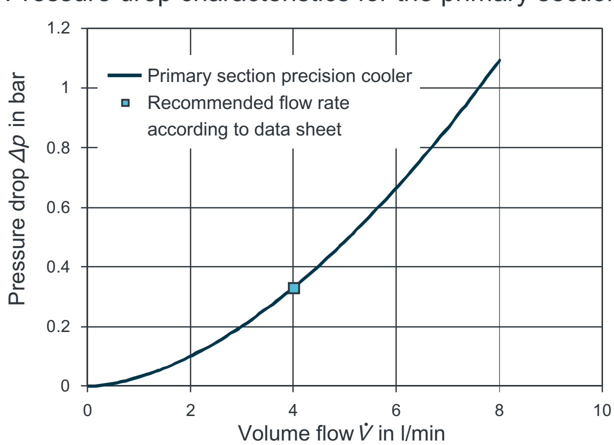


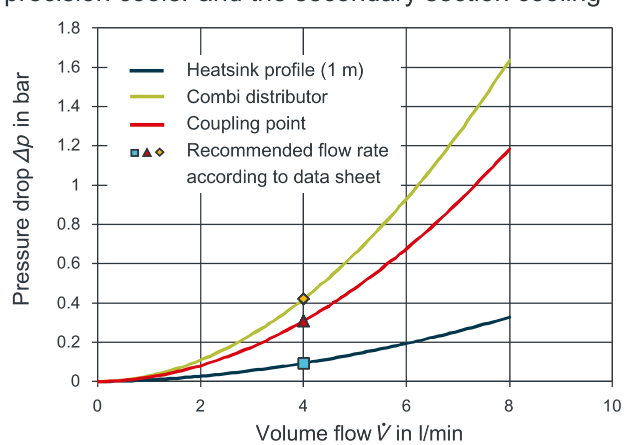
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





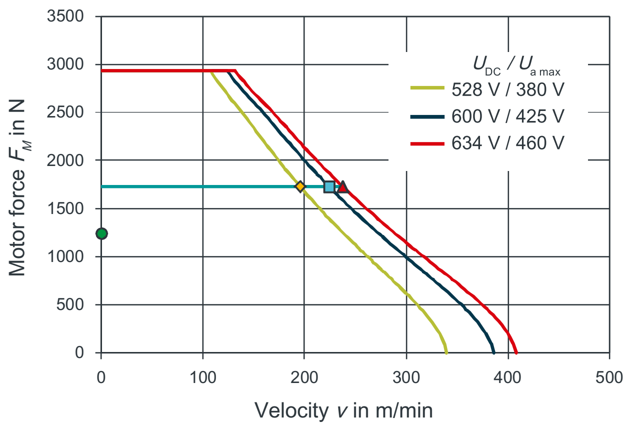
Data sheet of 1FN3300-2NC10-0xAx

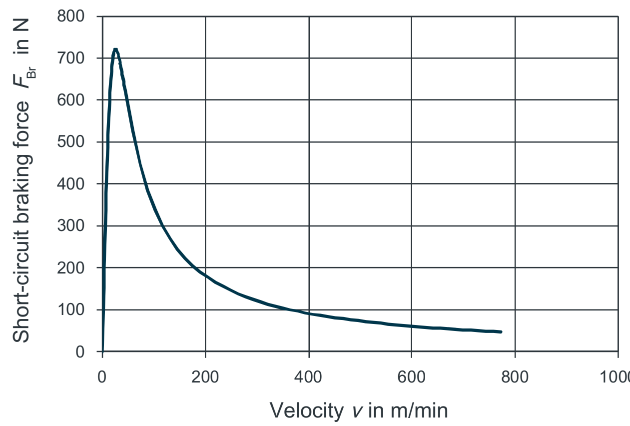
1FN3300-2NC10-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1730
Rated current	I_N	A	16.2
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	224
Rated power loss	$P_{V,N}$	kW	1.01
Limit data			
Maximum force	F_{MAX}	N	2940
Maximum current	I_{MAX}	A	34.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	124
Maximum electric power drawn	$P_{EL,MAX}$	kW	10.5
Static force	F_0*	N	1240
Stall current	I_0*	A	11.5
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	108
Voltage constant	k_E	Vs/m	36.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	65.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.92
Phase inductance	L_{STR}	mH	22.1
Attraction force	F_A	N	5780
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	15.9
Mass of the primary section with precision cooler	$m_{P,P}$	kg	17
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.897
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.23
Pressure drop	$\Delta p_{P,H}$	bar	0.323
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0265
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.327
Secondary section cooling data			

1FN3300-2NC10-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0889
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

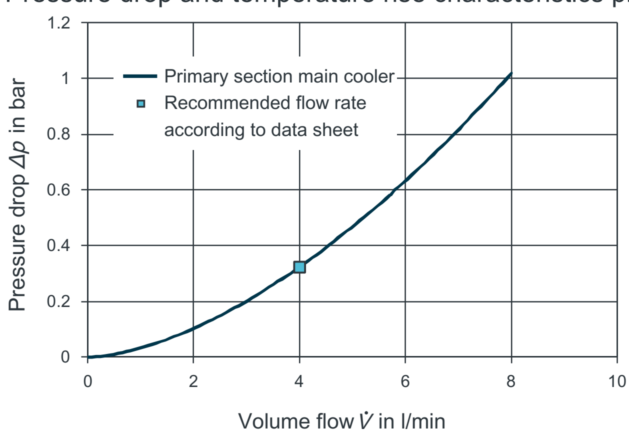
Characteristics for 1FN3300-2NC10-0xAx

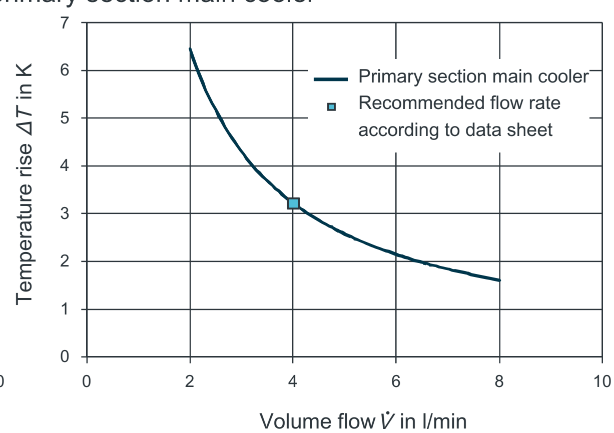
Force characteristics



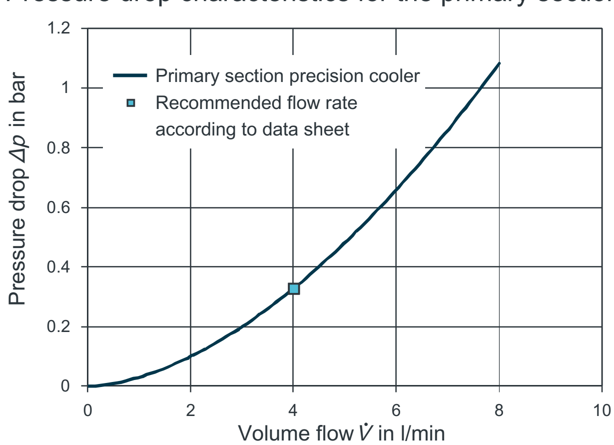


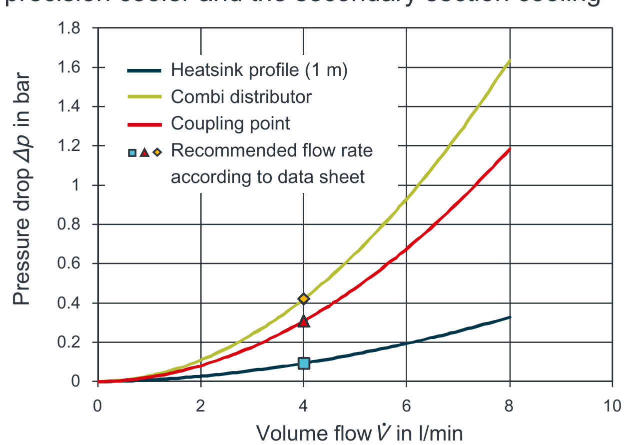
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





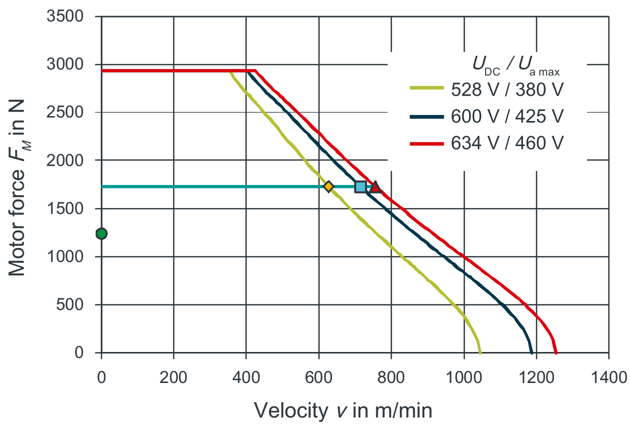
Data sheet of 1FN3300-2NH00-0xAx

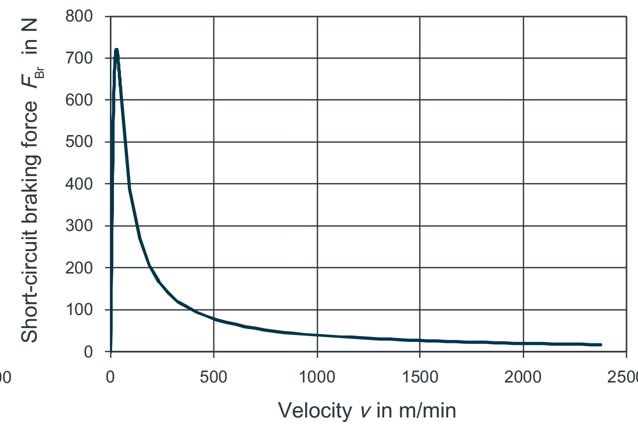
1FN3300-2NH00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1730
Rated current	I_N	A	49.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	715
Rated power loss	$P_{V,N}$	kW	1.08
Limit data			
Maximum force	F_{MAX}	N	2940
Maximum current	I_{MAX}	A	105
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	402
Maximum electric power drawn	$P_{EL,MAX}$	kW	24.5
Static force	F_0*	N	1240
Stall current	I_0*	A	35.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	35.3
Voltage constant	k_E	Vs/m	11.8
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	63.1
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.104
Phase inductance	L_{STR}	mH	2.34
Attraction force	F_A	N	5780
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	15.9
Mass of the primary section with precision cooler	$m_{P,P}$	kg	17
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.961
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.45
Pressure drop	$\Delta p_{P,H}$	bar	0.323
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0284
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.327
Secondary section cooling data			

1FN3300-2NH00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0952
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

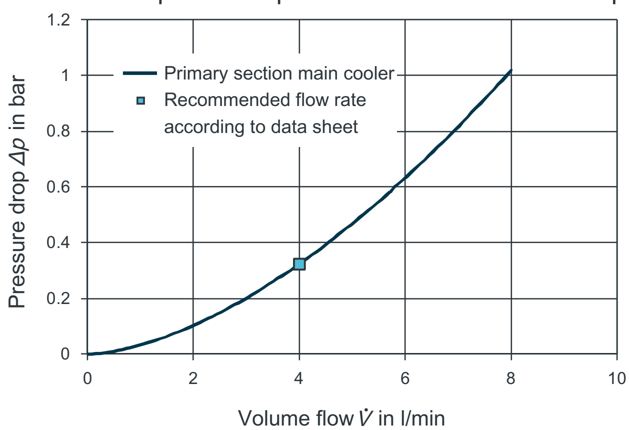
Characteristics of 1FN3300-2NH00-0xAx

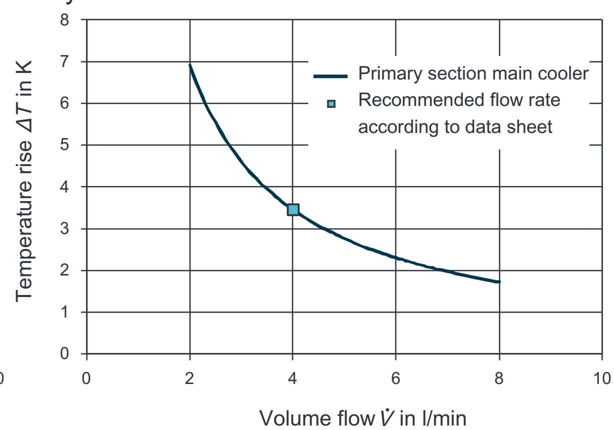
Force characteristics



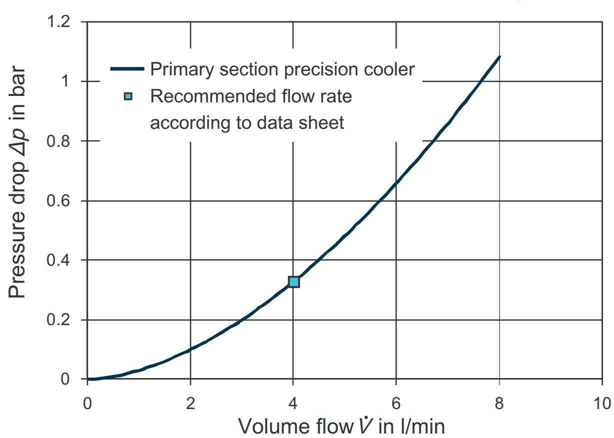


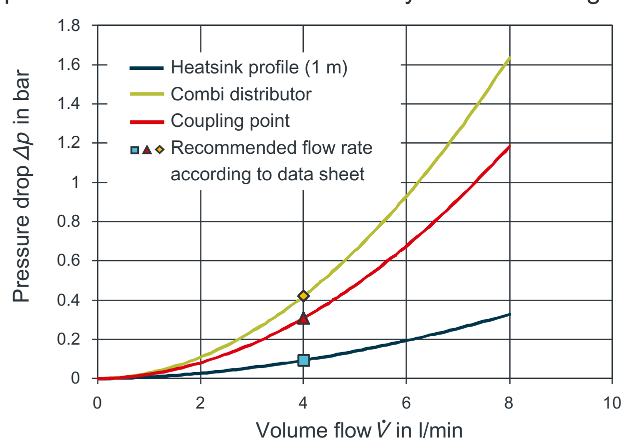
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





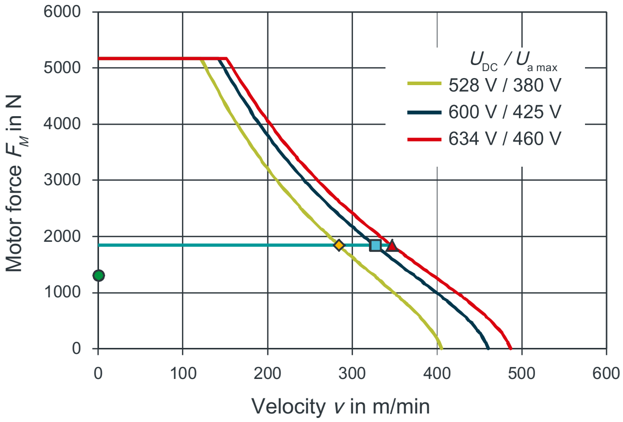
Data sheet of 1FN3300-3WC00-0xAx

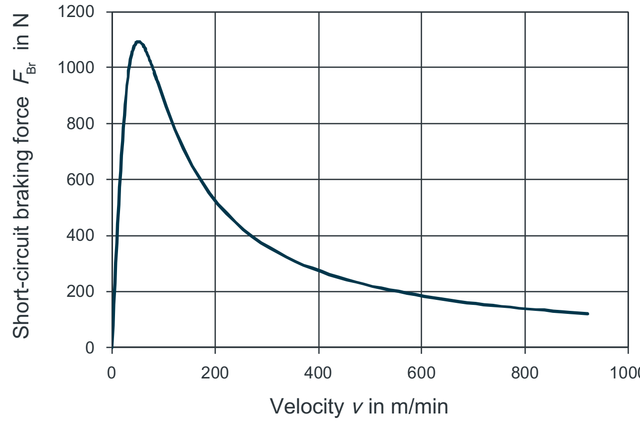
1FN3300-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1840
Rated current	I_N	A	19.2
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	327
Rated power loss	$P_{V,N}$	kW	1.32
Limit data			
Maximum force	F_{MAX}	N	5170
Maximum current	I_{MAX}	A	59.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	142
Maximum electric power drawn	$P_{EL,MAX}$	kW	24.9
Static force	F_0*	N	1300
Stall current	I_0*	A	13.6
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	95.7
Voltage constant	k_E	Vs/m	31.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	59.8
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.854
Phase inductance	L_{STR}	mH	10.2
Attraction force	F_A	N	8820
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	17
Mass of the primary section with precision cooler	$m_{P,P}$	kg	18.4
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.17
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.75
Pressure drop	$\Delta p_{P,H}$	bar	0.56
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0345
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.531
Secondary section cooling data			

1FN3300-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.111
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

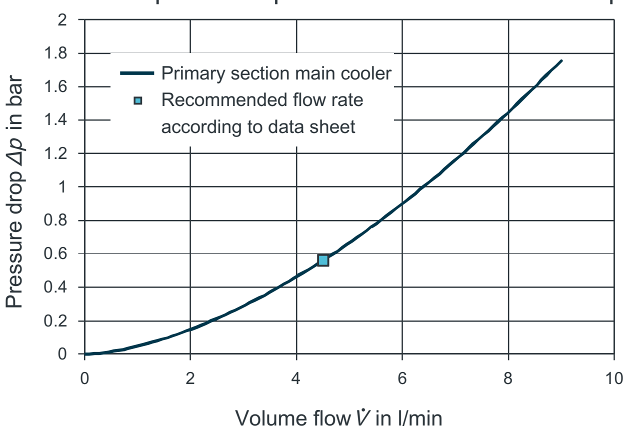
Characteristics for 1FN3300-3WC00-0xAx

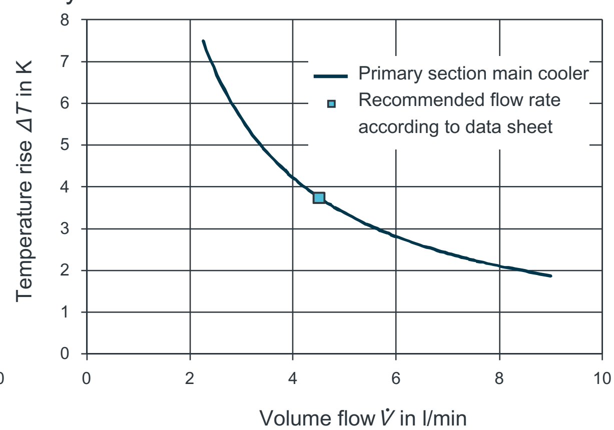
Force characteristics



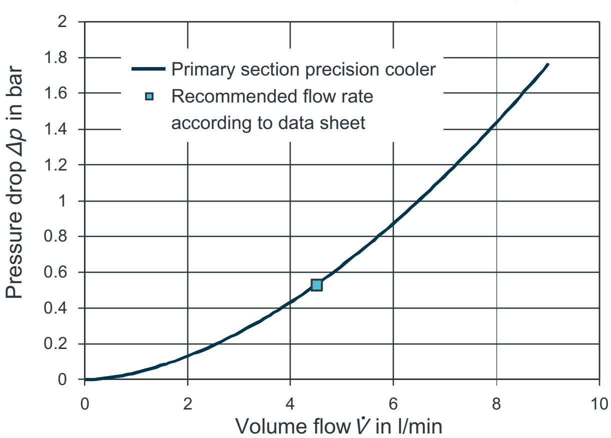


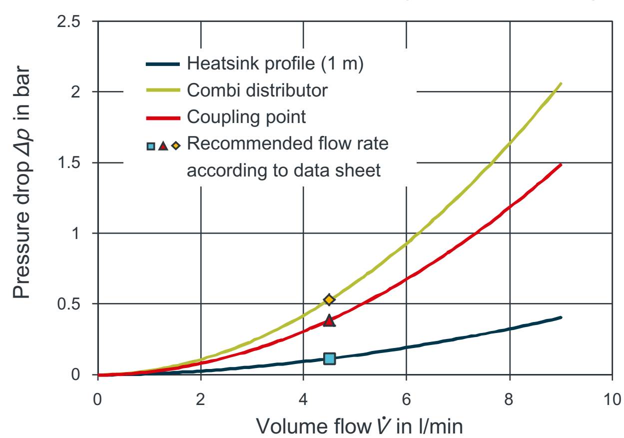
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





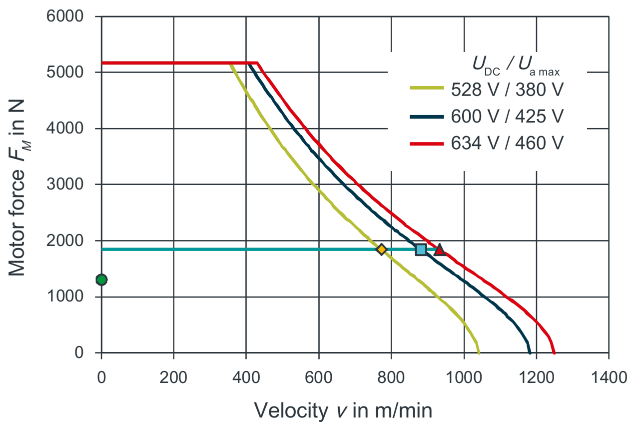
Data sheet of 1FN3300-3WG00-0xAx

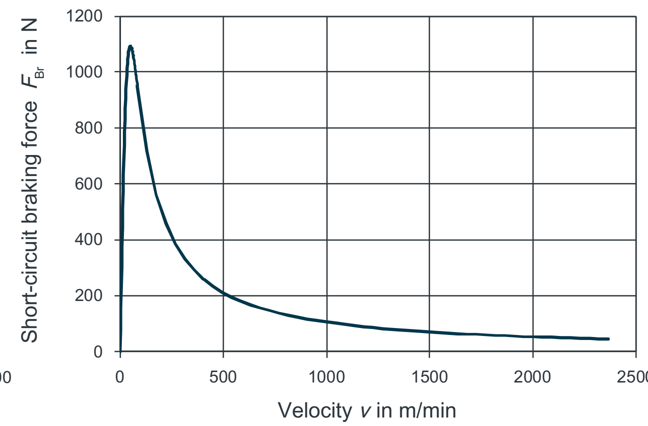
1FN3300-3WG00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1840
Rated current	I_N	A	49.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	881
Rated power loss	$P_{V,N}$	kW	1.25
Limit data			
Maximum force	F_{MAX}	N	5170
Maximum current	I_{MAX}	A	153
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	405
Maximum electric power drawn	$P_{EL,MAX}$	kW	47
Static force	F_0*	N	1300
Stall current	I_0*	A	34.9
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	37.3
Voltage constant	k_E	Vs/m	12.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	61.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.123
Phase inductance	L_{STR}	mH	1.55
Attraction force	F_A	N	8820
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	17
Mass of the primary section with precision cooler	$m_{P,P}$	kg	18.4
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.12
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	3.56
Pressure drop	$\Delta p_{P,H}$	bar	0.56
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0328
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.531
Secondary section cooling data			

1FN3300-3WG00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.105
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

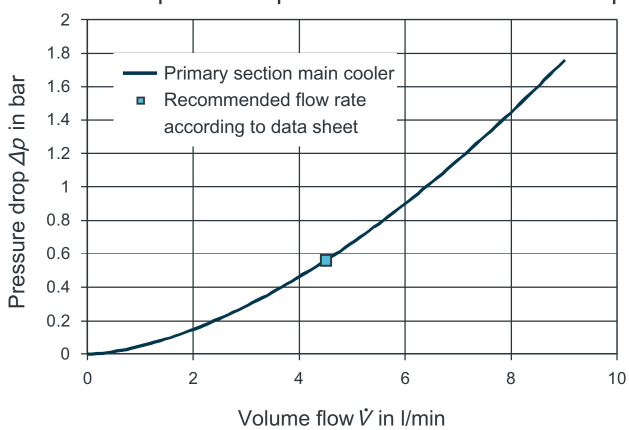
Characteristics for 1FN3300-3WG00-0xAx

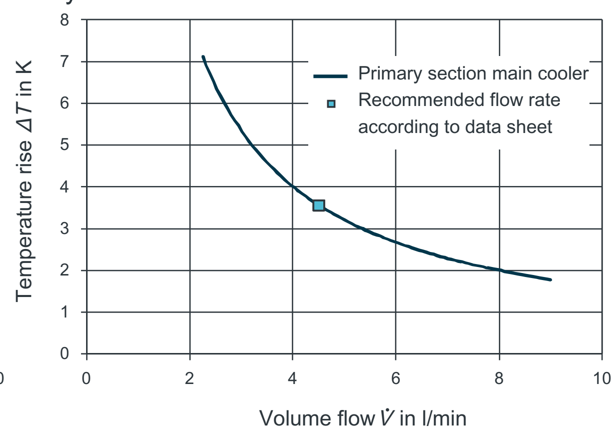
Force characteristics



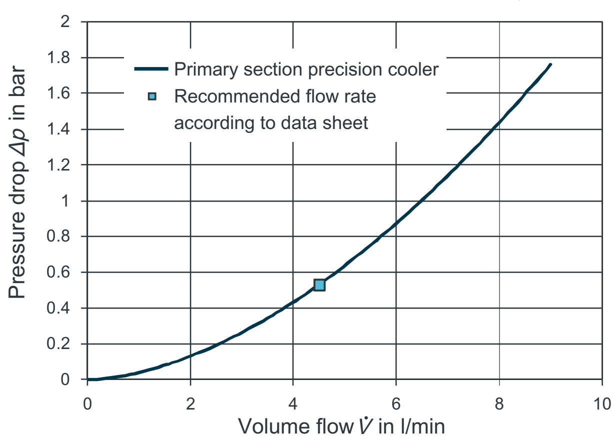


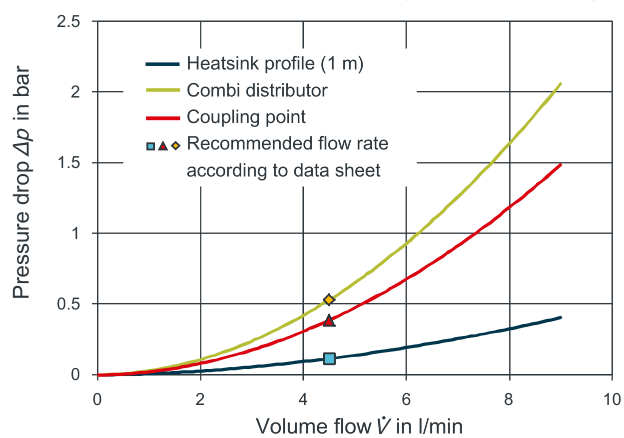
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





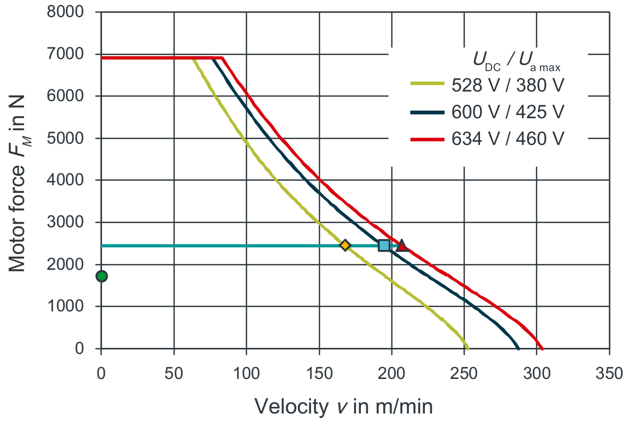
Data sheet of 1FN3300-4WB00-0xAx

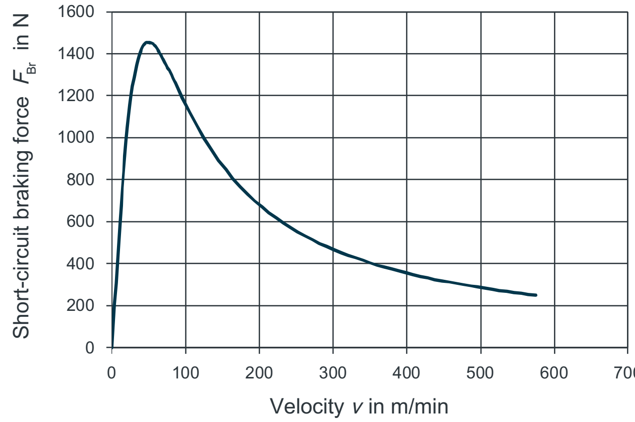
1FN3300-4WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2450
Rated current	I_N	A	16
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	194
Rated power loss	$P_{V,N}$	kW	1.71
Limit data			
Maximum force	F_{MAX}	N	6900
Maximum current	I_{MAX}	A	49.4
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	76.7
Maximum electric power drawn	$P_{EL,MAX}$	kW	25.2
Static force	F_0*	N	1730
Stall current	I_0*	A	11.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	153
Voltage constant	k_E	Vs/m	51.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	70
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.6
Phase inductance	L_{STR}	mH	19.8
Attraction force	F_A	N	11800
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	22.2
Mass of the primary section with precision cooler	$m_{P,P}$	kg	24
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.52
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.37
Pressure drop	$\Delta p_{P,H}$	bar	0.865
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0446
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5
Pressure drop	$\Delta p_{P,P}$	bar	0.789
Secondary section cooling data			

1FN3300-4WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.143
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.138
Pressure drop per combi distributor	Δp_{KV}	bar	0.651
Pressure drop per coupling point	Δp_{KS}	bar	0.474

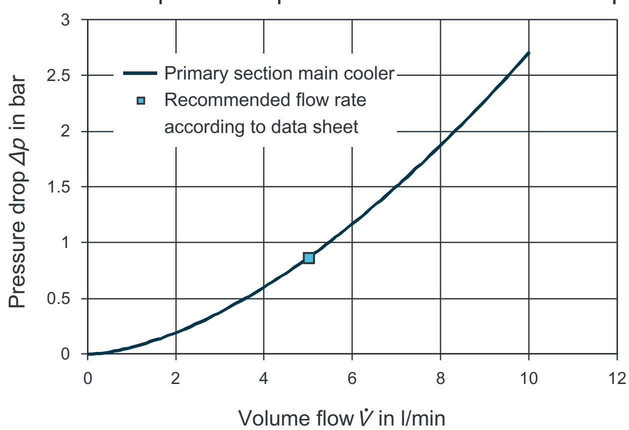
Characteristics for 1FN3300-4WB00-0xAx

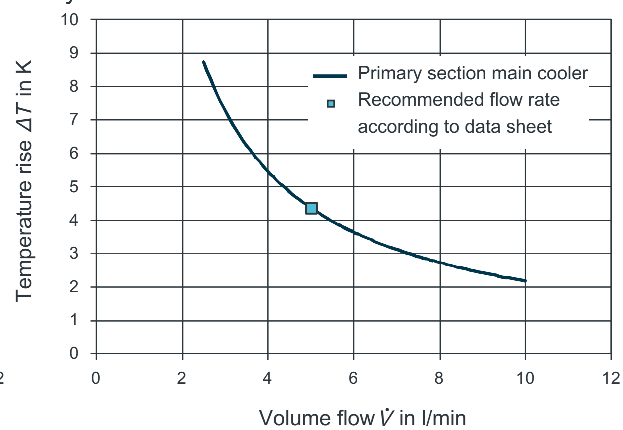
Force characteristics



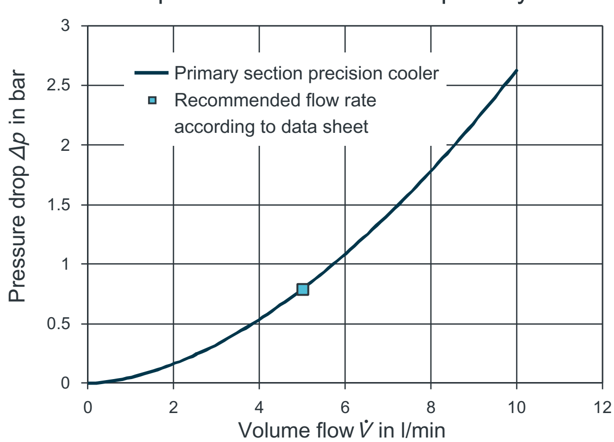


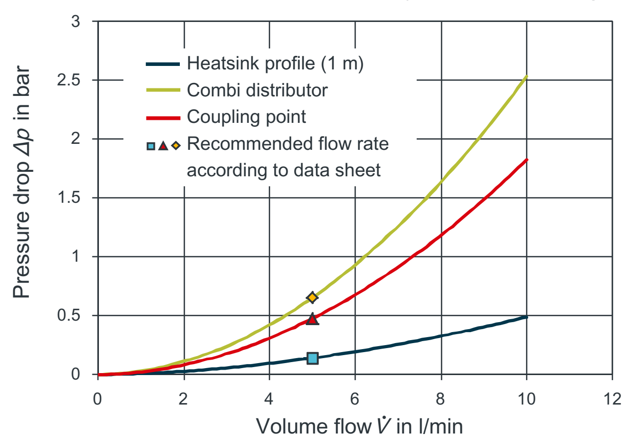
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





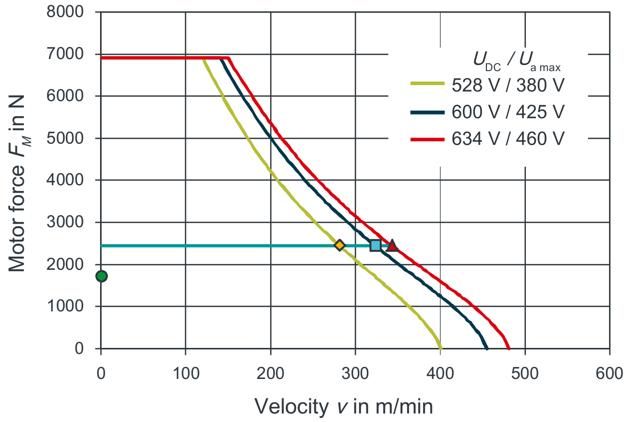
Data sheet of 1FN3300-4WC00-0xAx

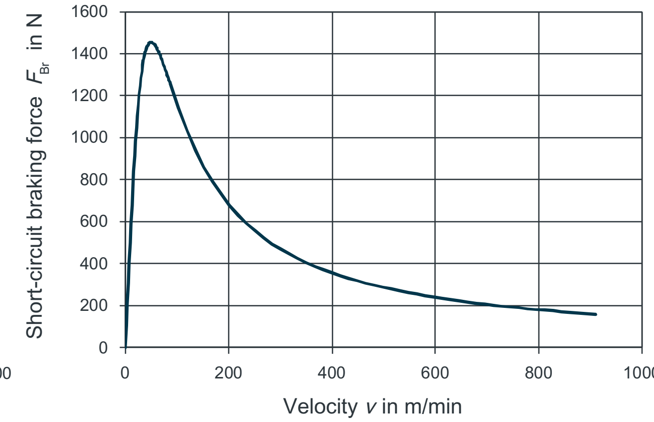
1FN3300-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2450
Rated current	I_N	A	25.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	323
Rated power loss	$P_{V,N}$	kW	1.71
Limit data			
Maximum force	F_{MAX}	N	6900
Maximum current	I_{MAX}	A	78.3
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	140
Maximum electric power drawn	$P_{EL,MAX}$	kW	32.6
Static force	F_0*	N	1730
Stall current	I_0*	A	17.9
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	96.9
Voltage constant	k_E	Vs/m	32.3
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	69.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.64
Phase inductance	L_{STR}	mH	7.87
Attraction force	F_A	N	11800
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	22.2
Mass of the primary section with precision cooler	$m_{P,P}$	kg	24
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.52
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.38
Pressure drop	$\Delta p_{P,H}$	bar	0.865
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0448
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5
Pressure drop	$\Delta p_{P,P}$	bar	0.789
Secondary section cooling data			

1FN3300-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.144
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.138
Pressure drop per combi distributor	Δp_{KV}	bar	0.651
Pressure drop per coupling point	Δp_{KS}	bar	0.474

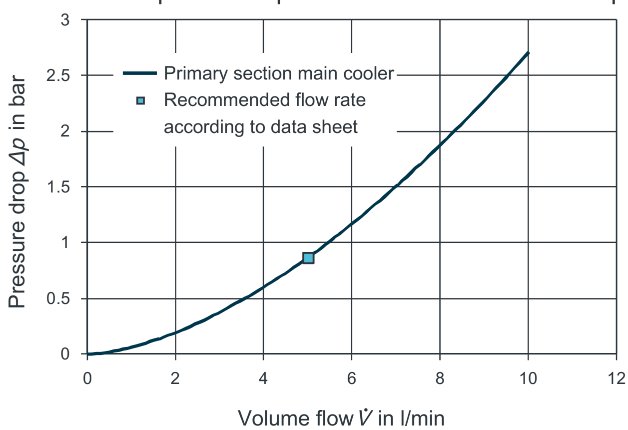
Characteristics for 1FN3300-4WC00-0xAx

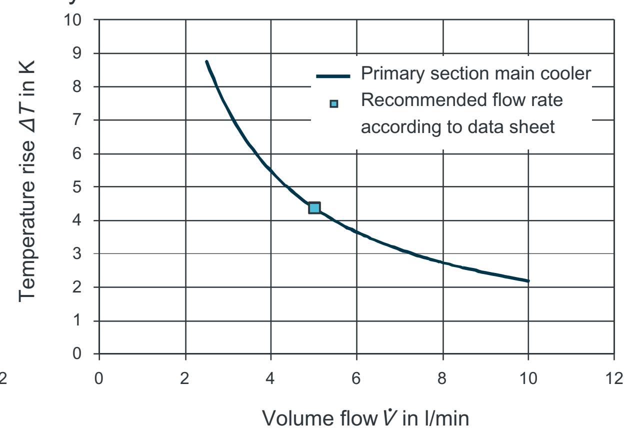
Force characteristics



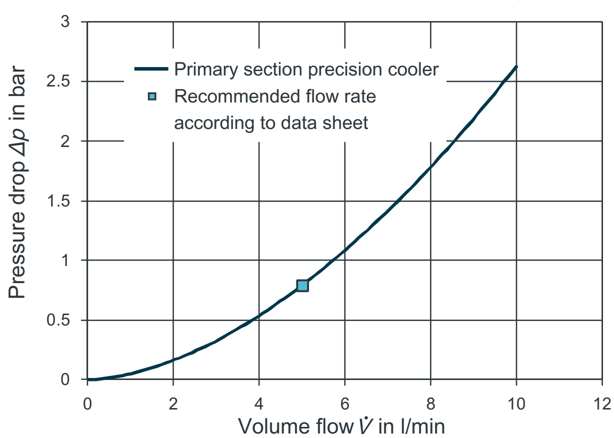


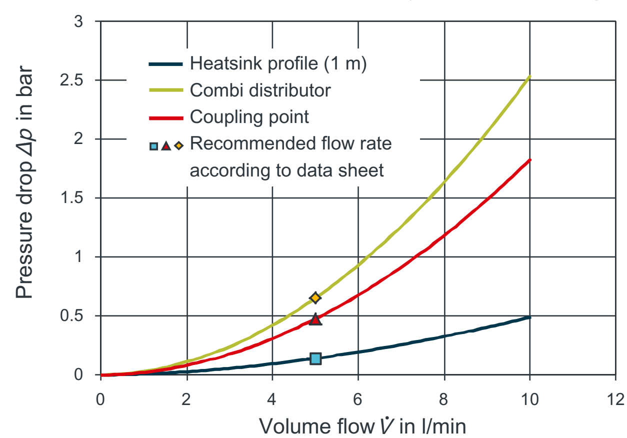
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





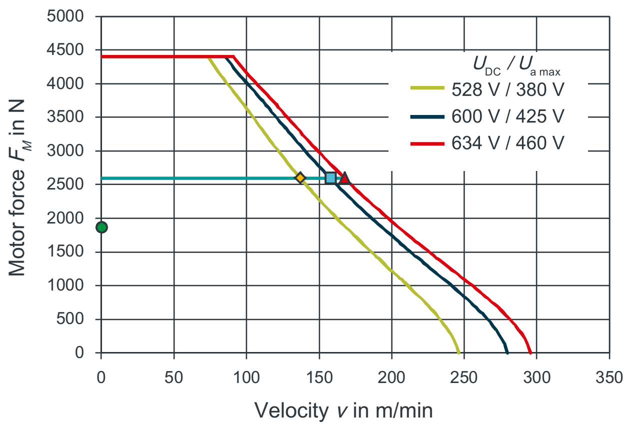
Data sheet of 1FN3300-3NB50-0xAx

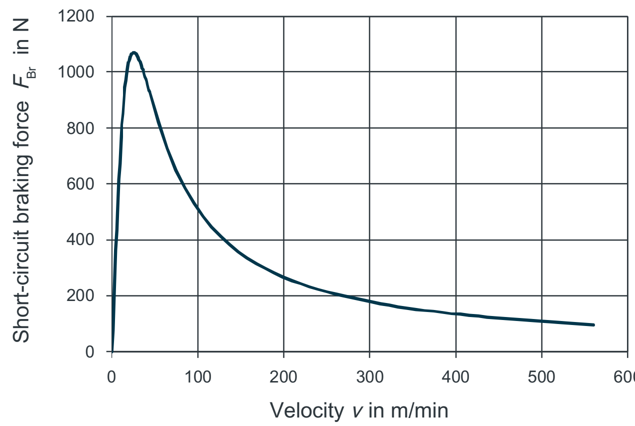
1FN3300-3NB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2590
Rated current	I_N	A	17.7
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	158
Rated power loss	$P_{V,N}$	kW	1.52
Limit data			
Maximum force	F_{MAX}	N	4400
Maximum current	I_{MAX}	A	37.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	85.5
Maximum electric power drawn	$P_{EL,MAX}$	kW	13
Static force	F_0*	N	1860
Stall current	I_0*	A	12.5
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	150
Voltage constant	k_E	Vs/m	49.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	79.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.17
Phase inductance	L_{STR}	mH	28.3
Attraction force	F_A	N	8670
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	23
Mass of the primary section with precision cooler	$m_{P,P}$	kg	24.4
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.35
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.31
Pressure drop	$\Delta p_{P,H}$	bar	0.56
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0399
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.527
Secondary section cooling data			

1FN3300-3NB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.134
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

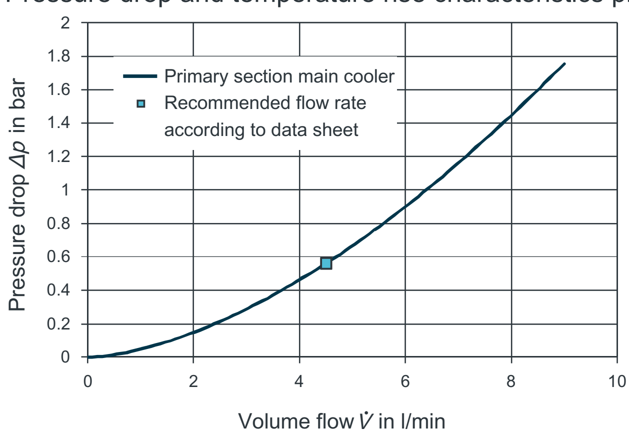
Characteristics for 1FN3300-3NB50-0xAx

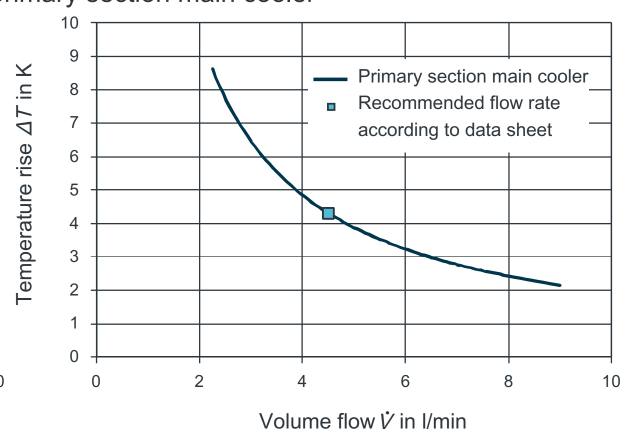
Force characteristics



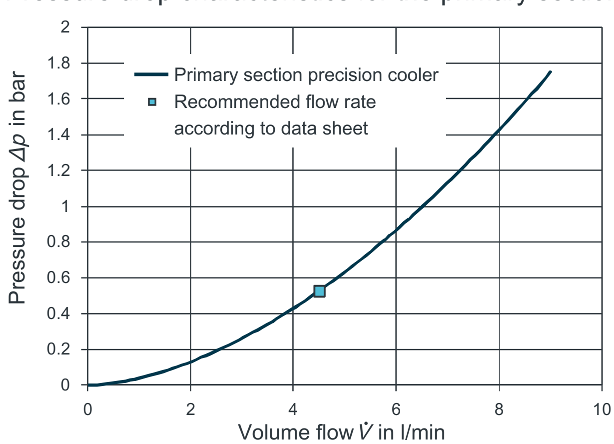


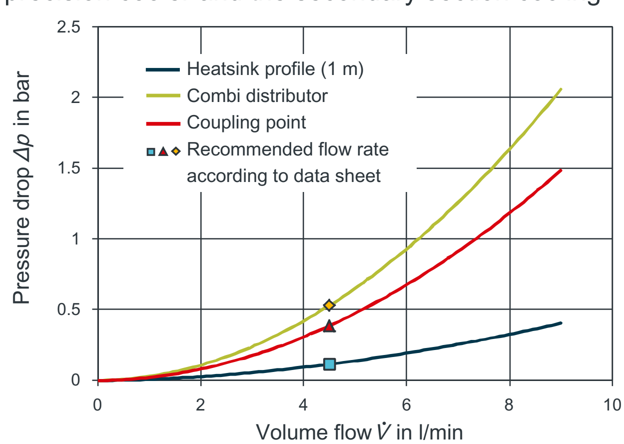
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





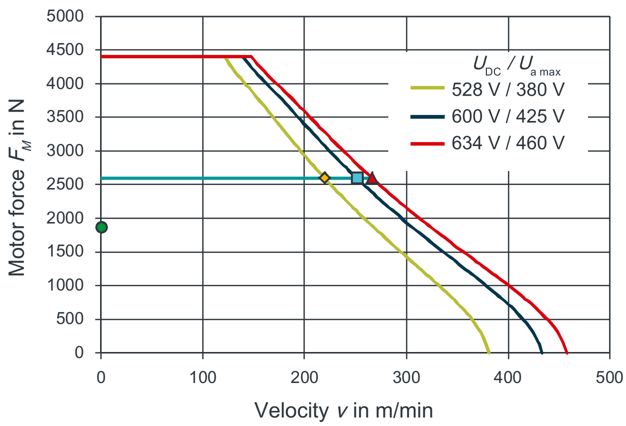
Data sheet of 1FN3300-3NC40-0xAx

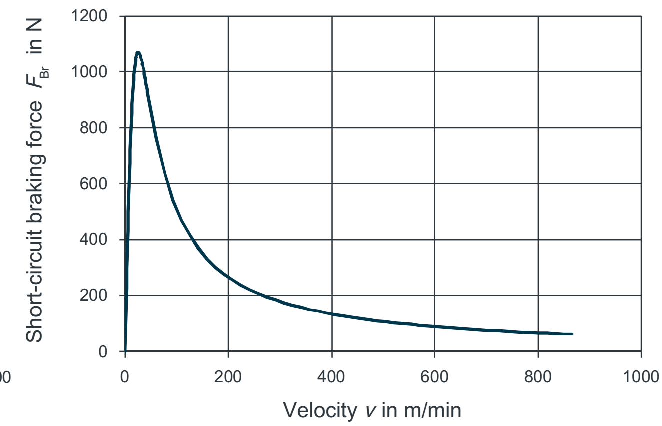
1FN3300-3NC40-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2590
Rated current	I_N	A	27.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	252
Rated power loss	$P_{V,N}$	kW	1.52
Limit data			
Maximum force	F_{MAX}	N	4400
Maximum current	I_{MAX}	A	57.4
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	139
Maximum electric power drawn	$P_{EL,MAX}$	kW	16.9
Static force	F_0*	N	1860
Stall current	I_0*	A	19.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	96.7
Voltage constant	k_E	Vs/m	32.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	80.1
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.486
Phase inductance	L_{STR}	mH	11.8
Attraction force	F_A	N	8670
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	23
Mass of the primary section with precision cooler	$m_{P,P}$	kg	24.4
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.34
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.29
Pressure drop	$\Delta p_{P,H}$	bar	0.56
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0397
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.527
Secondary section cooling data			

1FN3300-3NC40-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.133
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

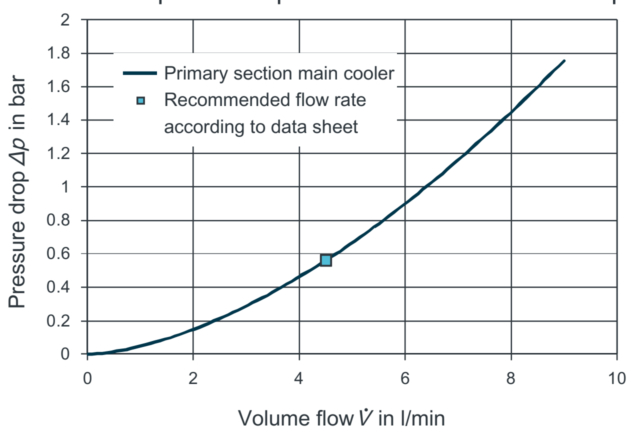
Characteristics for 1FN3300-3NC40-0xAx

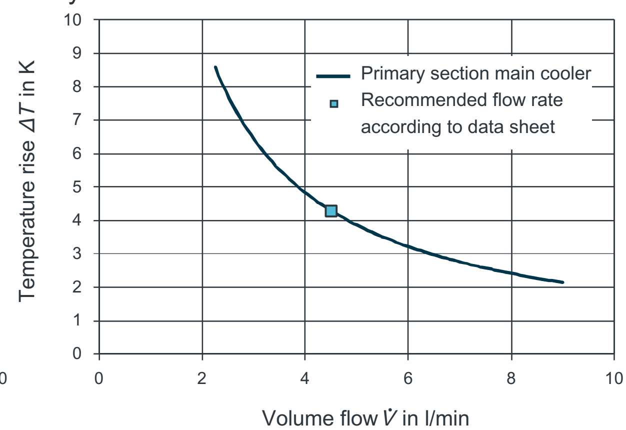
Force characteristics



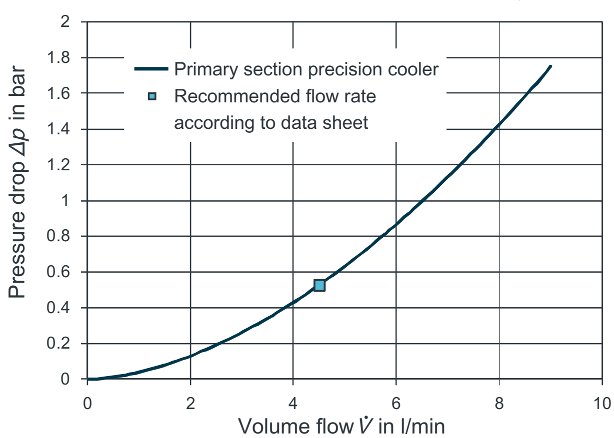


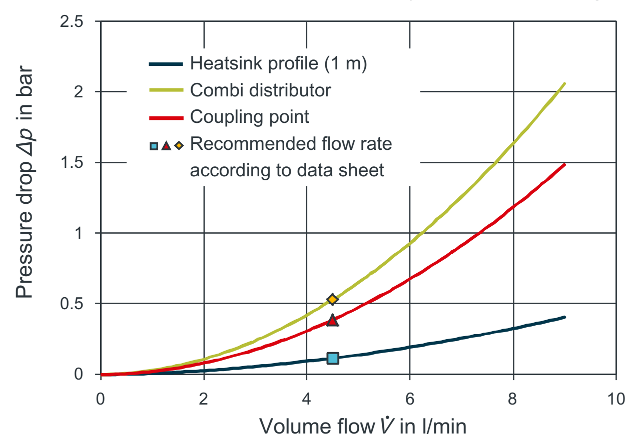
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





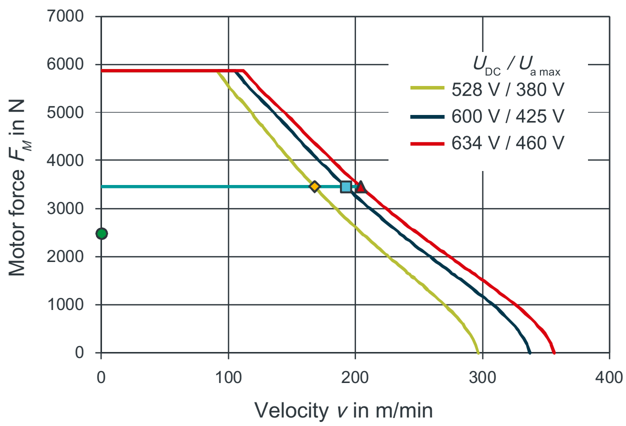
Data sheet of 1FN3300-4NB80-0xAx

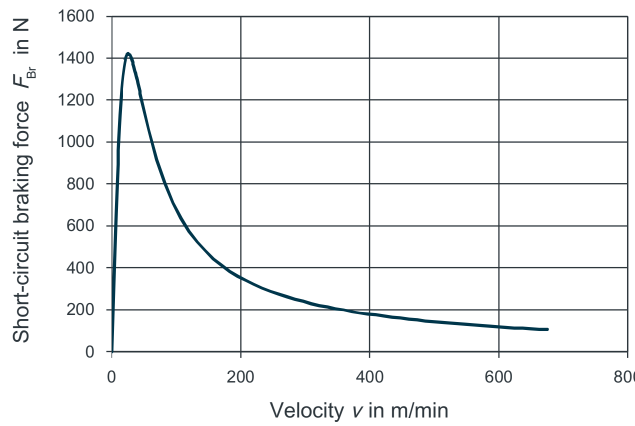
1FN3300-4NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3460
Rated current	I_N	A	28.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	192
Rated power loss	$P_{V,N}$	kW	2.03
Limit data			
Maximum force	F_{MAX}	N	5870
Maximum current	I_{MAX}	A	59.6
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	105
Maximum electric power drawn	$P_{EL,MAX}$	kW	19.3
Static force	F_0*	N	2490
Stall current	I_0*	A	20.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	124
Voltage constant	k_E	Vs/m	41.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	92.2
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.605
Phase inductance	L_{STR}	mH	14.7
Attraction force	F_A	N	11600
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	29.9
Mass of the primary section with precision cooler	$m_{P,P}$	kg	31.8
Mass of a secondary section	m_S	kg	2.4
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	2.6
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.8
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.18
Pressure drop	$\Delta p_{P,H}$	bar	0.865
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0533
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5
Pressure drop	$\Delta p_{P,P}$	bar	0.784
Secondary section cooling data			

1FN3300-4NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.179
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.138
Pressure drop per combi distributor	Δp_{KV}	bar	0.651
Pressure drop per coupling point	Δp_{KS}	bar	0.474

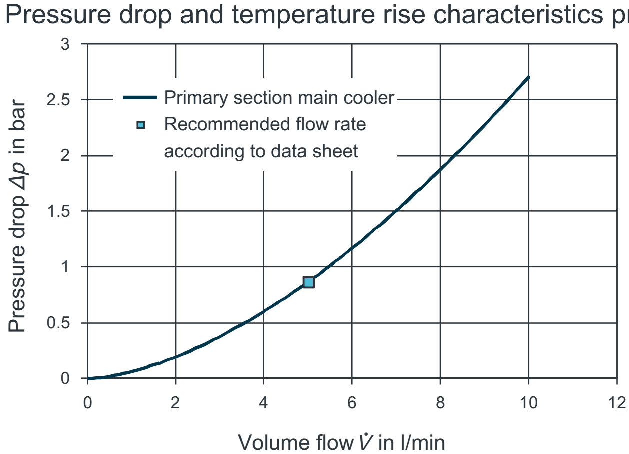
Characteristics for 1FN3300-4NB80-0xAx

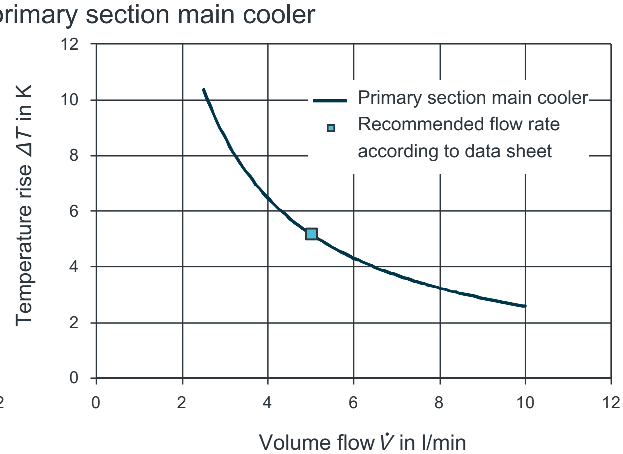
Force characteristics



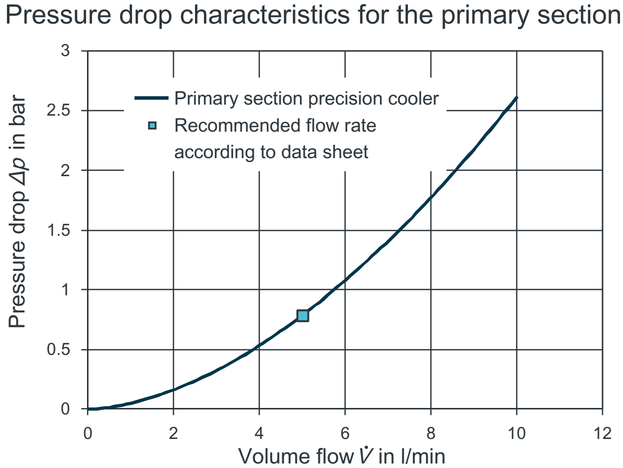


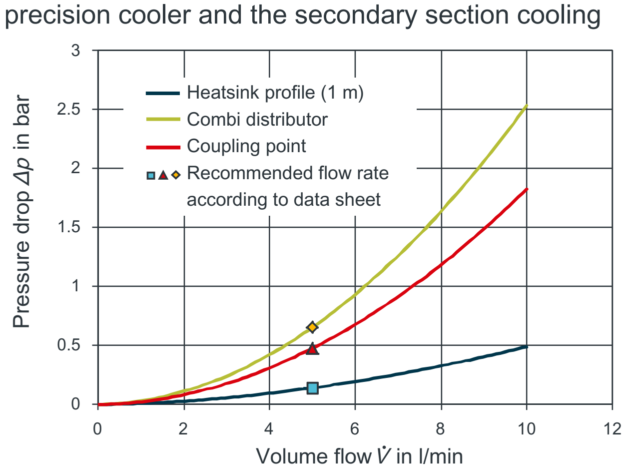
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





7.2.5 1FN3450-xxxxx-xxxx

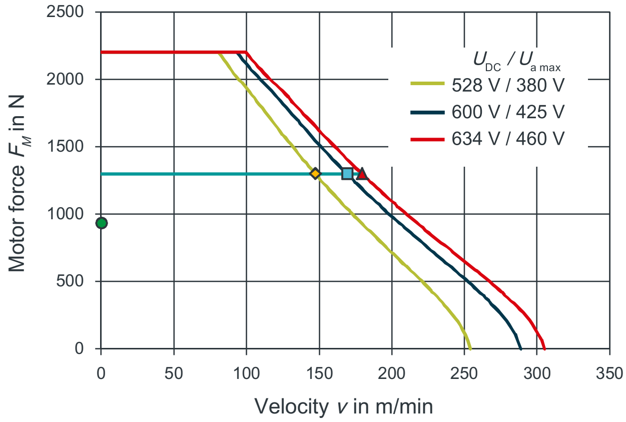
Data sheet of 1FN3450-1NB50-0xAx

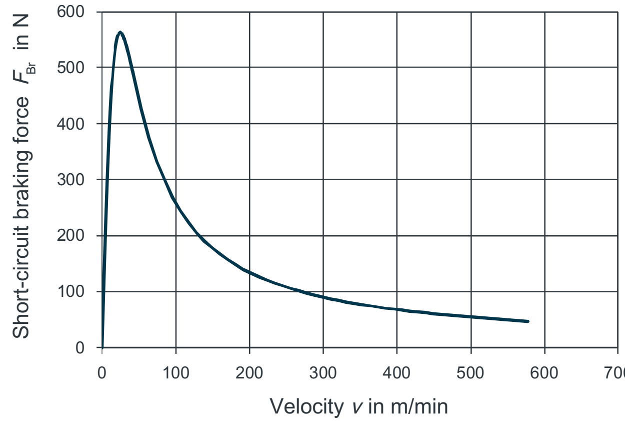
1FN3450-1NB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1300
Rated current	I_N	A	9.1
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	169
Rated power loss	$P_{V,N}$	kW	0.693
Limit data			
Maximum force	F_{MAX}	N	2200
Maximum current	I_{MAX}	A	19.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	93.5
Maximum electric power drawn	$P_{EL,MAX}$	kW	6.49
Static force	F_0*	N	932
Stall current	I_0*	A	6.44
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	145
Voltage constant	k_E	Vs/m	48.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	59.2
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	2
Phase inductance	L_{STR}	mH	50.6
Attraction force	F_A	N	4340
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	12
Mass of the primary section with precision cooler	$m_{P,P}$	kg	12.8
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	0.614
Recommended minimum volume flow rate	$V_{P,H,MIN}$	l/min	3.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	2.52
Pressure drop	$\Delta p_{P,H}$	bar	0.166
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0182

1FN3450-1NB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	3.5
Pressure drop	$\Delta p_{P,P}$	bar	0.19
Secondary section cooling data			
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.0609
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	3.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0724
Pressure drop per combi distributor	Δp_{KV}	bar	0.324
Pressure drop per coupling point	Δp_{KS}	bar	0.237

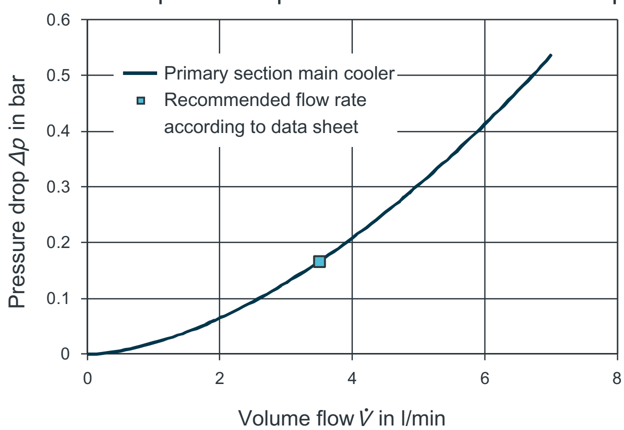
Characteristics of 1FN3450-1NB50-0xAx

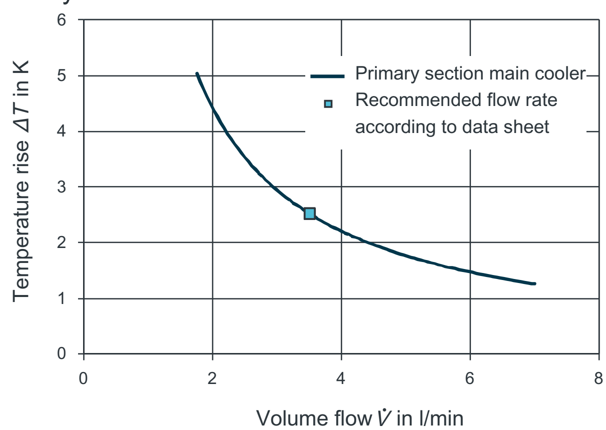
Force characteristics



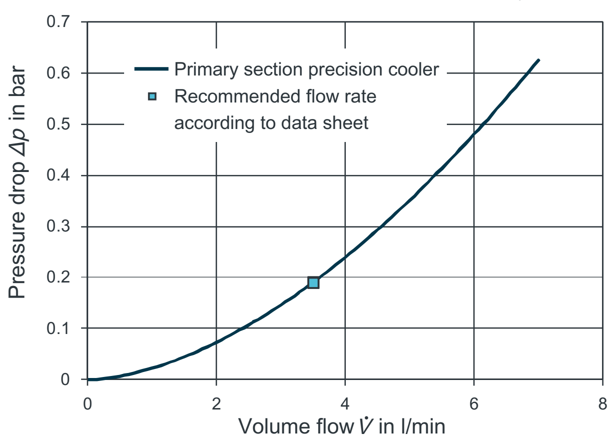


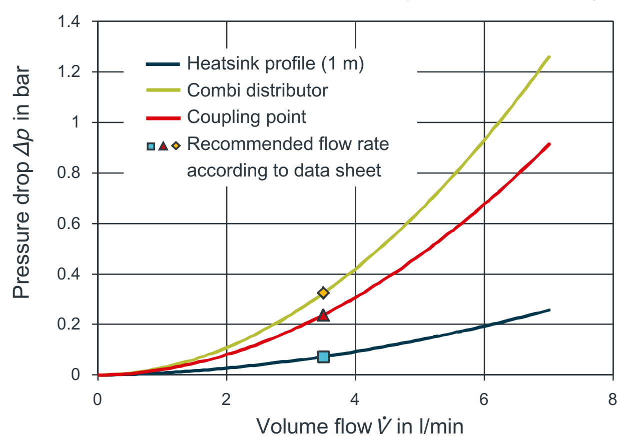
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





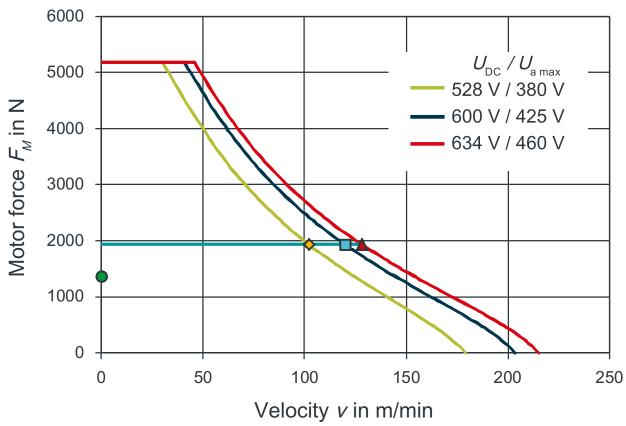
Data sheet of 1FN3450-2WA50-0xAx

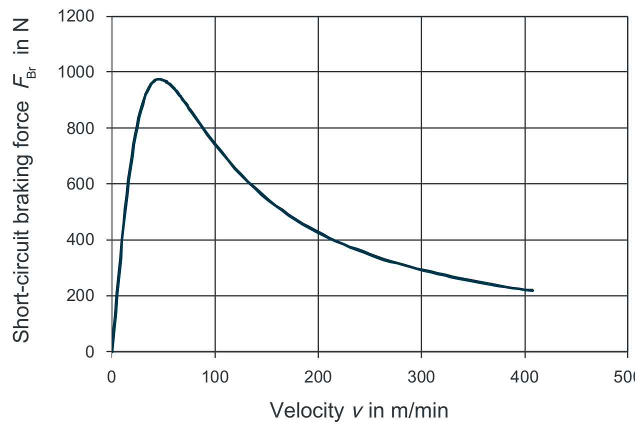
1FN3450-2WA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1930
Rated current	I_N	A	8.91
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	120
Rated power loss	$P_{V,N}$	kW	1.47
Limit data			
Maximum force	F_{MAX}	N	5180
Maximum current	I_{MAX}	A	25
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	41
Maximum electric power drawn	$P_{EL,MAX}$	kW	15.1
Static force	F_0*	N	1360
Stall current	I_0*	A	6.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	216
Voltage constant	k_E	Vs/m	72.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	59.5
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	4.42
Phase inductance	L_{STR}	mH	58.7
Attraction force	F_A	N	8820
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	16.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	17.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.31
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.69
Pressure drop	$\Delta p_{P,H}$	bar	0.371
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0384
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.345
Secondary section cooling data			

1FN3450-2WA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.123
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

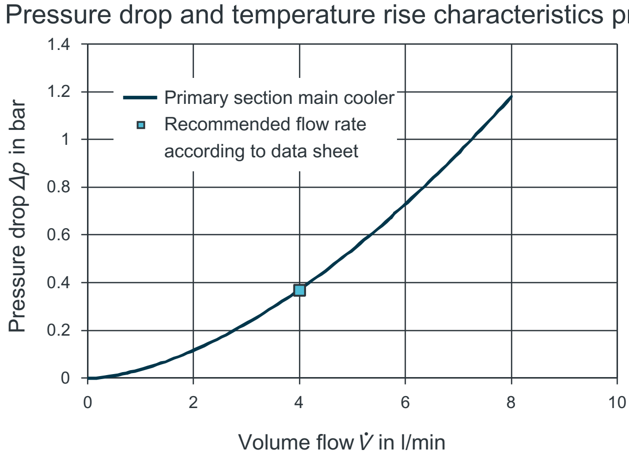
Characteristics for 1FN3450-2WA50-0xAx

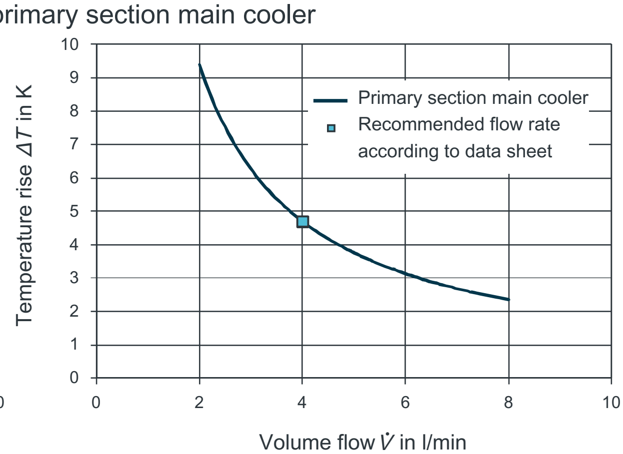
Force characteristics



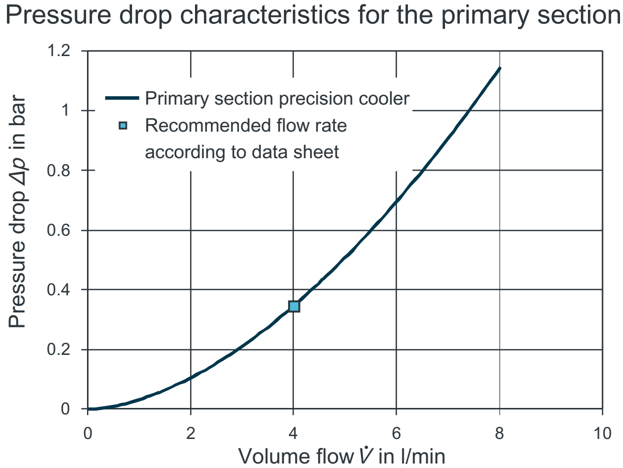


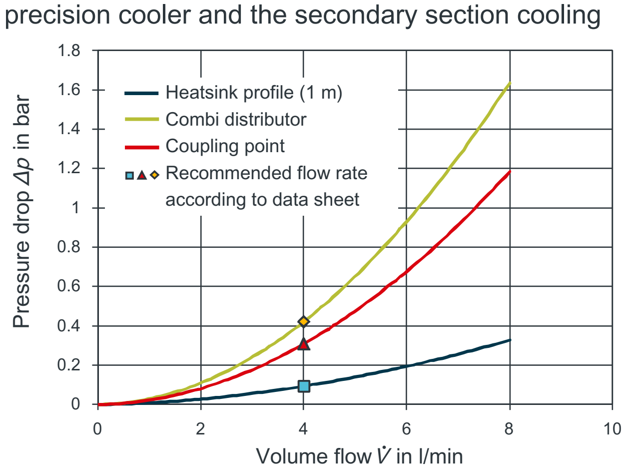
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





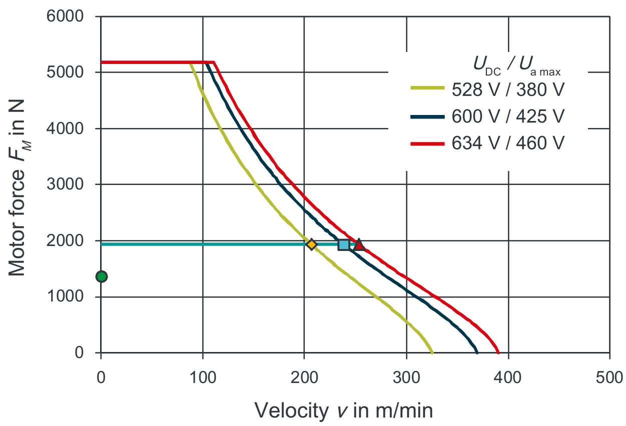
Data sheet of 1FN3450-2WB70-0xAx

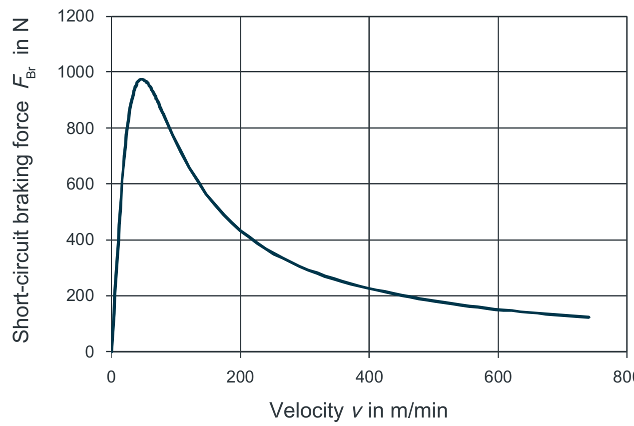
1FN3450-2WB70-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1930
Rated current	I_N	A	16.2
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	238
Rated power loss	$P_{V,N}$	kW	1.49
Limit data			
Maximum force	F_{MAX}	N	5180
Maximum current	I_{MAX}	A	45.4
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	103
Maximum electric power drawn	$P_{EL,MAX}$	kW	20.6
Static force	F_0*	N	1360
Stall current	I_0*	A	11.4
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	119
Voltage constant	k_E	Vs/m	39.8
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	59
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.36
Phase inductance	L_{STR}	mH	17.8
Attraction force	F_A	N	8820
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	16.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	17.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.33
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.77
Pressure drop	$\Delta p_{P,H}$	bar	0.371
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0391
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.345
Secondary section cooling data			

1FN3450-2WB70-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.125
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

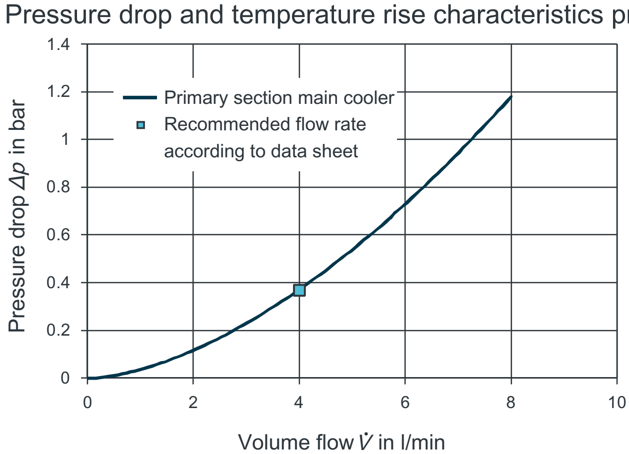
Characteristics for 1FN3450-2WB70-0xAx

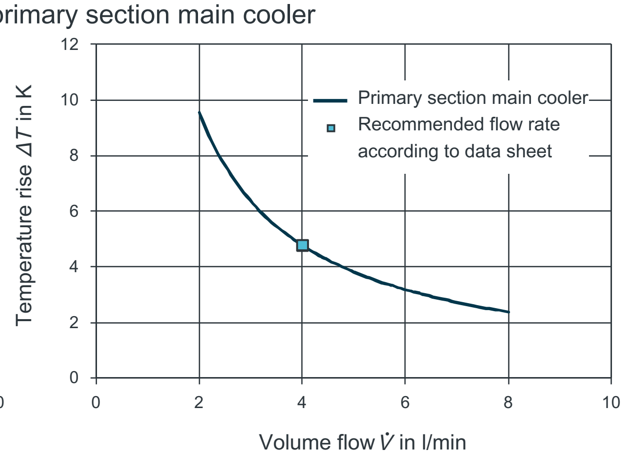
Force characteristics



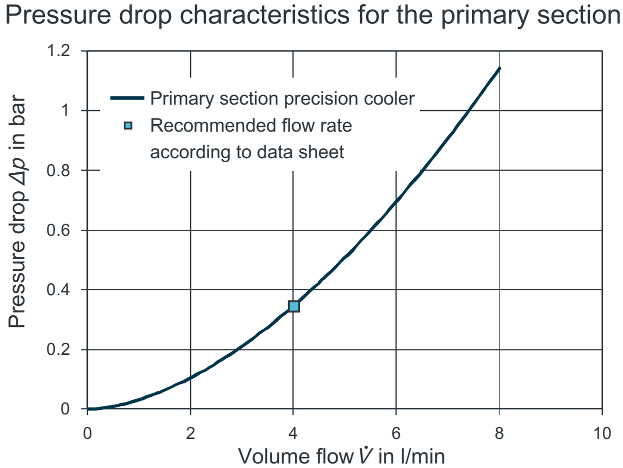


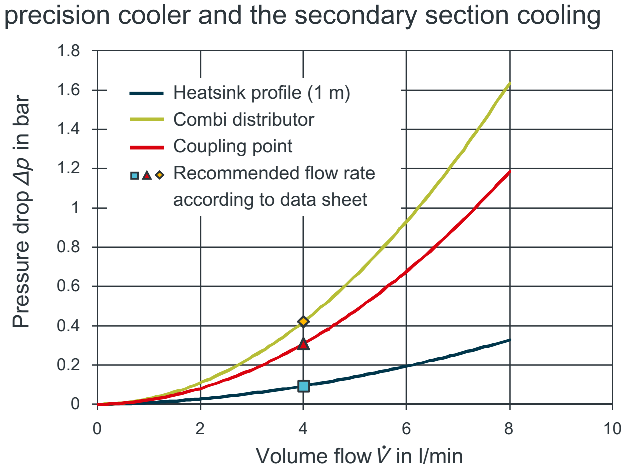
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





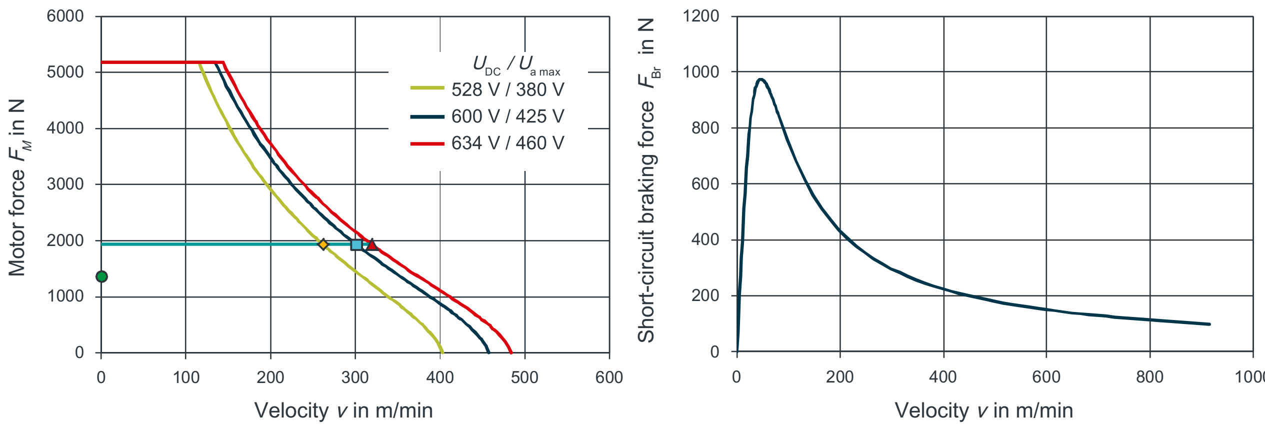
Data sheet of 1FN3450-2WC00-0xAx

1FN3450-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1930
Rated current	I_N	A	20
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	301
Rated power loss	$P_{V,N}$	kW	1.48
Limit data			
Maximum force	F_{MAX}	N	5180
Maximum current	I_{MAX}	A	56.2
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	135
Maximum electric power drawn	$P_{EL,MAX}$	kW	23.3
Static force	F_0*	N	1360
Stall current	I_0*	A	14.2
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	96.3
Voltage constant	k_E	Vs/m	32.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	59.1
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.884
Phase inductance	L_{STR}	mH	11.6
Attraction force	F_A	N	8820
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	16.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	17.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.32
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.75
Pressure drop	$\Delta p_{P,H}$	bar	0.371
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0388
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.345
Secondary section cooling data			

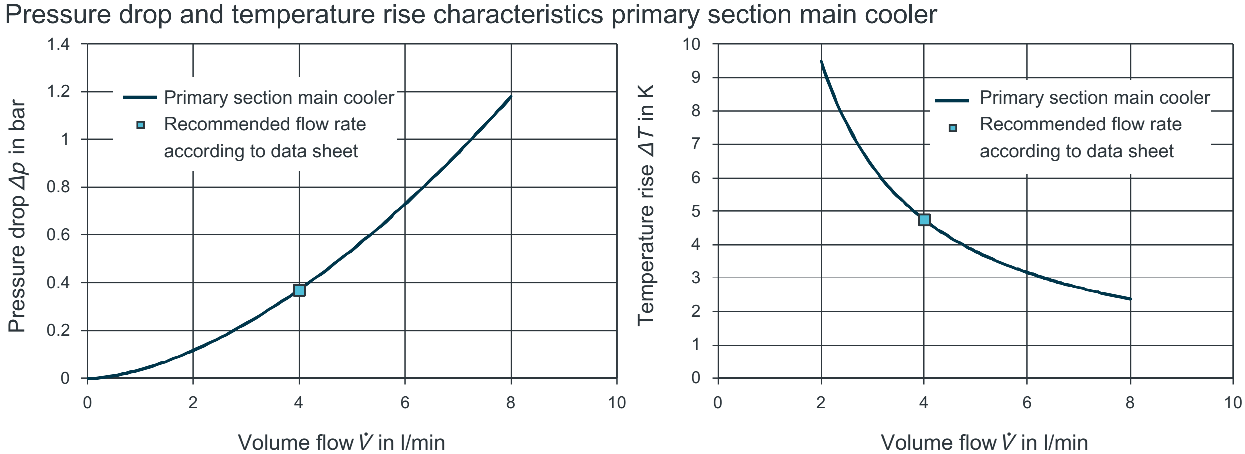
1FN3450-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.125
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

Characteristics for 1FN3450-2WC00-0xAx

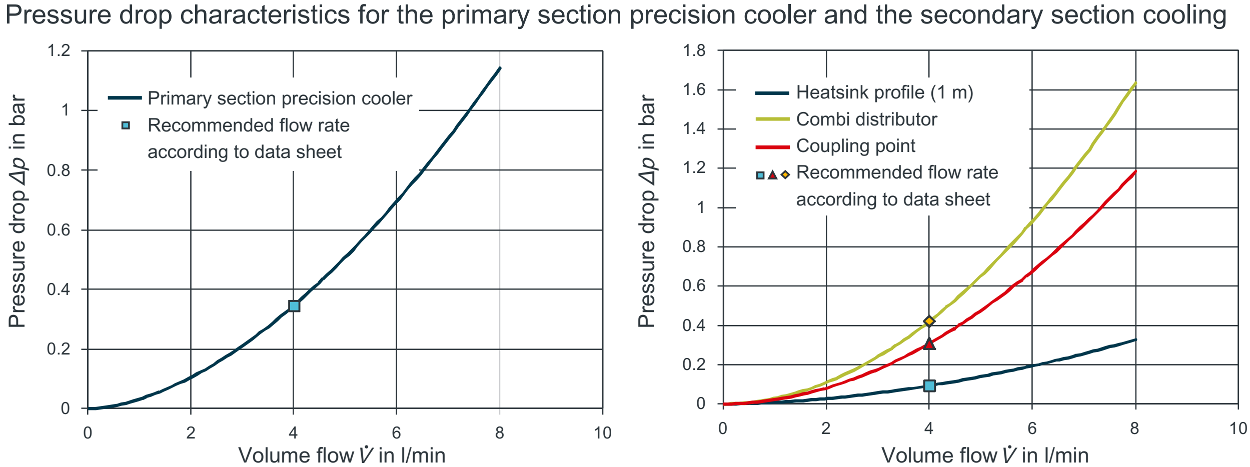
Force characteristics



Pressure drop and temperature rise characteristics primary section main cooler



Pressure drop characteristics for the primary section precision cooler and the secondary section cooling



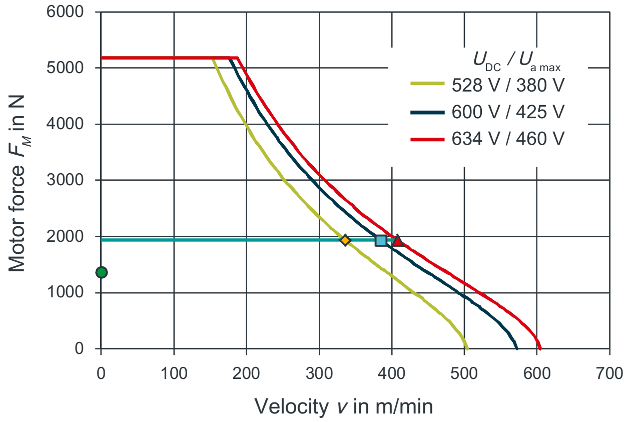
Data sheet of 1FN3450-2WD00-0xAx

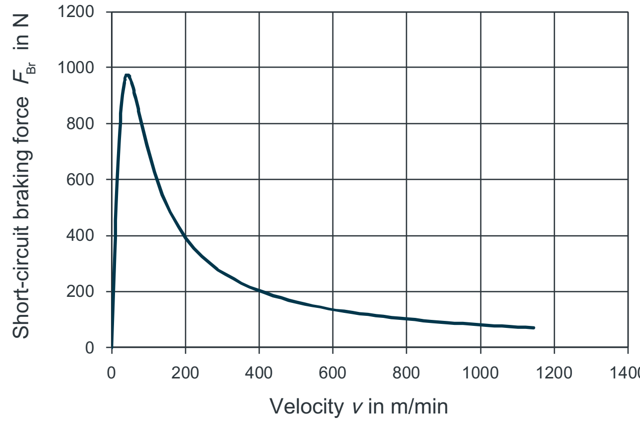
1FN3450-2WD00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1930
Rated current	I_N	A	25
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	385
Rated power loss	$P_{V,N}$	kW	1.34
Limit data			
Maximum force	F_{MAX}	N	5180
Maximum current	I_{MAX}	A	70.2
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	177
Maximum electric power drawn	$P_{EL,MAX}$	kW	25.8
Static force	F_0*	N	1360
Stall current	I_0*	A	17.7
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	77.1
Voltage constant	k_E	Vs/m	25.7
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	62.2
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.512
Phase inductance	L_{STR}	mH	7.43
Attraction force	F_A	N	8820
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	16.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	17.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.19
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.29
Pressure drop	$\Delta p_{P,H}$	bar	0.371
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0351
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.345
Secondary section cooling data			

1FN3450-2WD00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.113
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

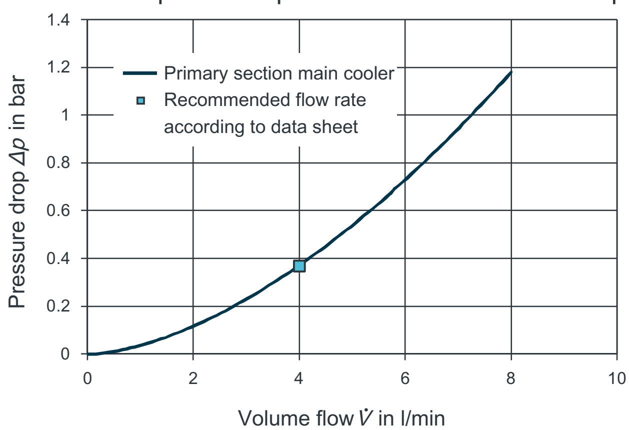
Characteristics for 1FN3450-2WD00-0xAx

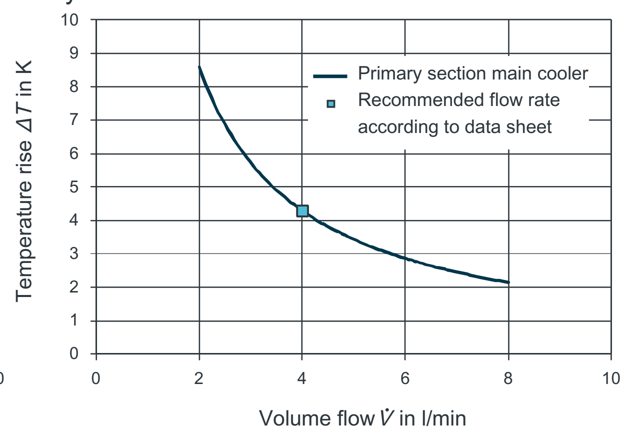
Force characteristics



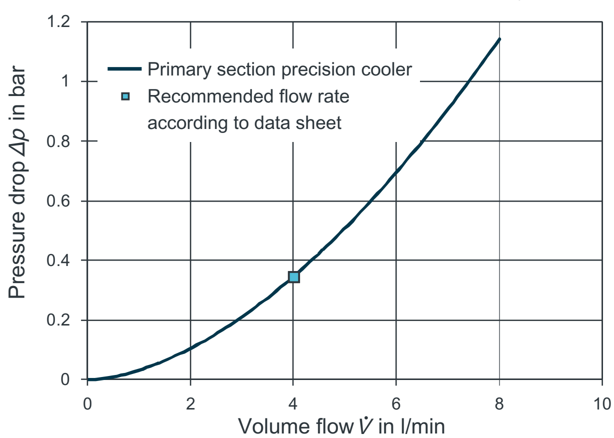


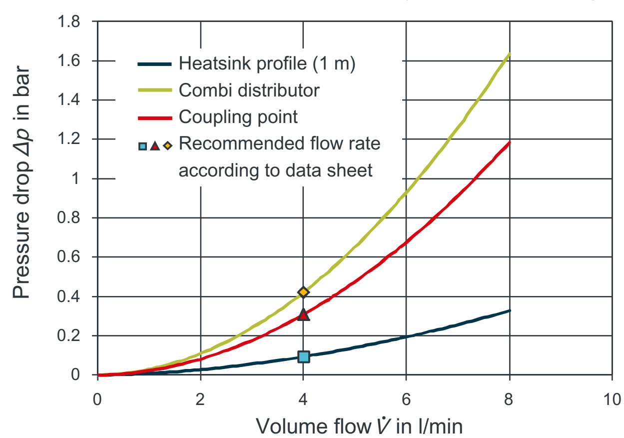
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





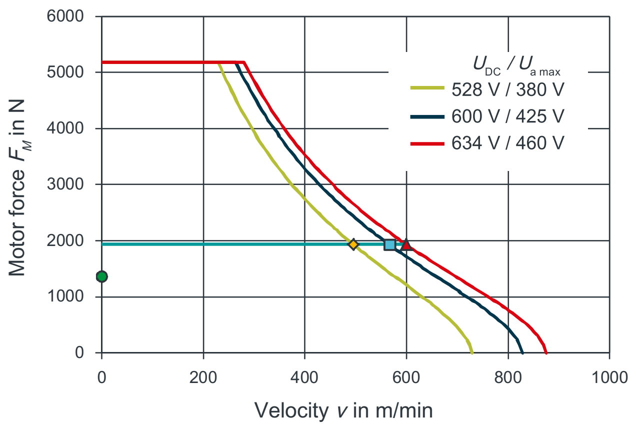
Data sheet of 1FN3450-2WE00-0xAx

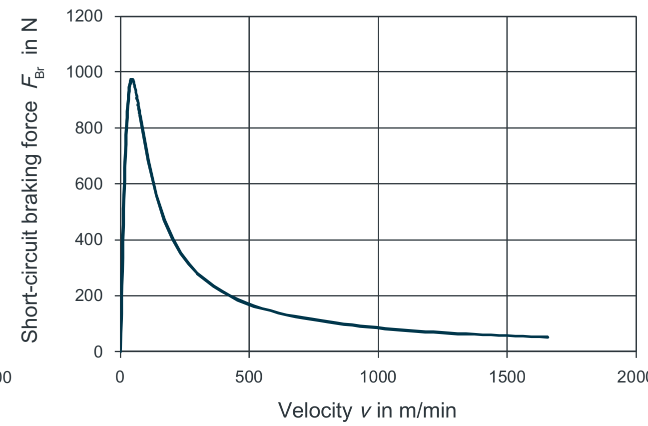
1FN3450-2WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	1930
Rated current	I_N	A	36.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	567
Rated power loss	$P_{V,N}$	kW	1.4
Limit data			
Maximum force	F_{MAX}	N	5180
Maximum current	I_{MAX}	A	102
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	264
Maximum electric power drawn	$P_{EL,MAX}$	kW	33.8
Static force	F_0*	N	1360
Stall current	I_0*	A	25.6
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	53.2
Voltage constant	k_E	Vs/m	17.7
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	60.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.254
Phase inductance	L_{STR}	mH	3.54
Attraction force	F_A	N	8820
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	16.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	17.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.24
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.47
Pressure drop	$\Delta p_{P,H}$	bar	0.371
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0366
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.345
Secondary section cooling data			

1FN3450-2WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.117
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

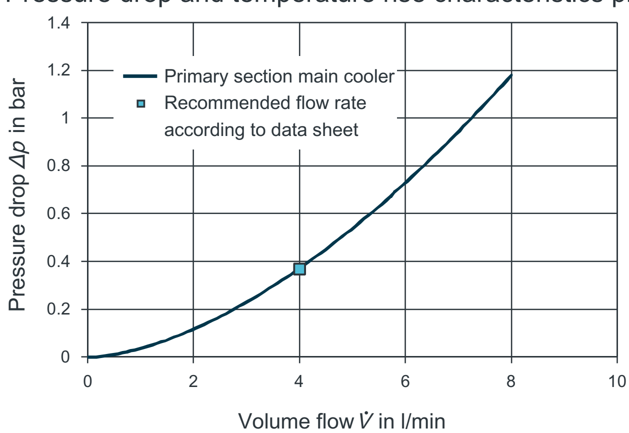
Characteristics for 1FN3450-2WE00-0xAx

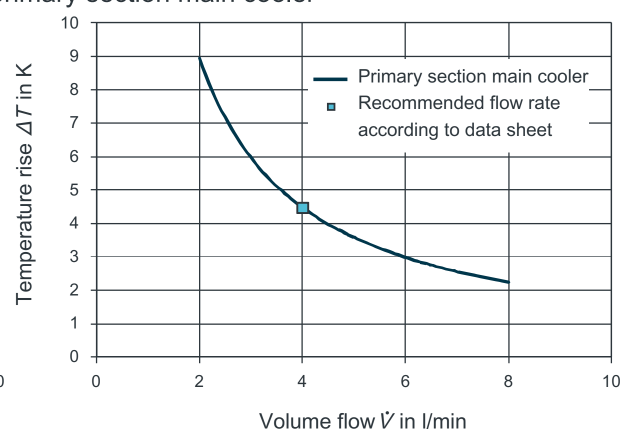
Force characteristics



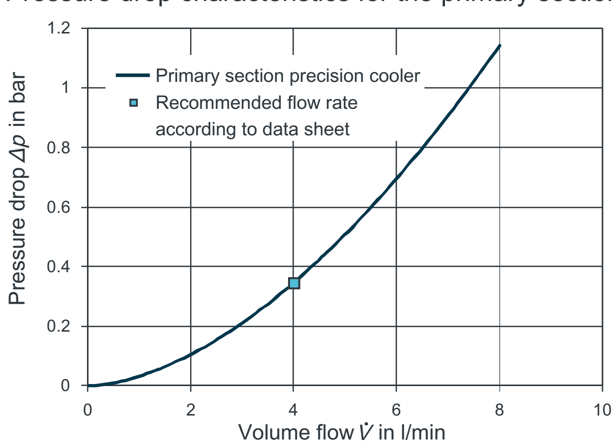


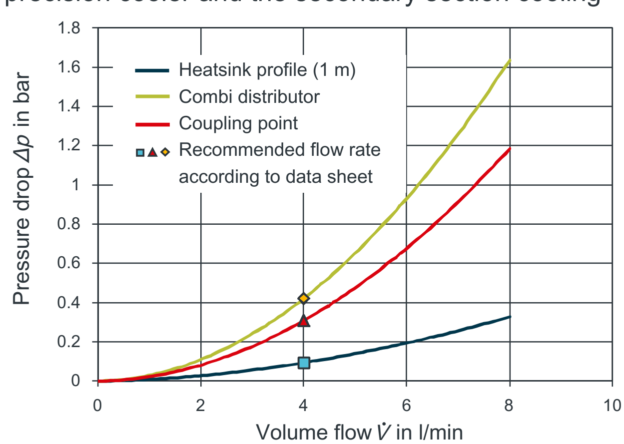
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





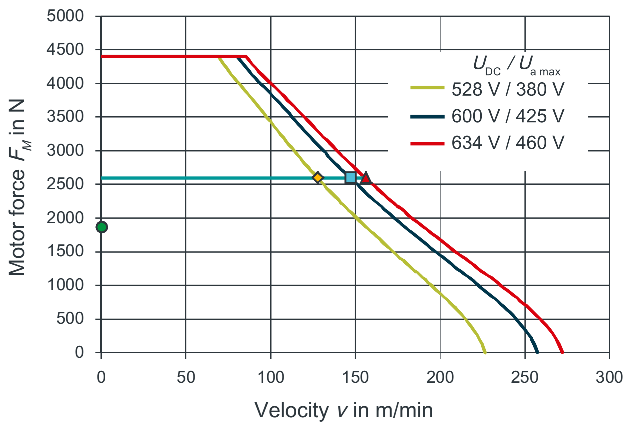
Data sheet of 1FN3450-2NB40-0xAx

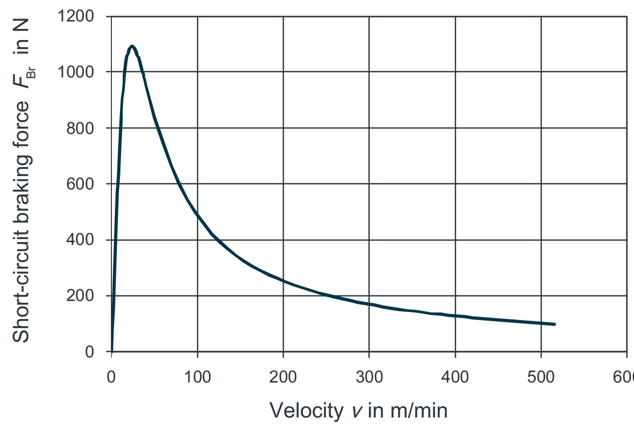
1FN3450-2NB40-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2590
Rated current	I_N	A	16.2
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	147
Rated power loss	$P_{V,N}$	kW	1.38
Limit data			
Maximum force	F_{MAX}	N	4400
Maximum current	I_{MAX}	A	34.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	80
Maximum electric power drawn	$P_{EL,MAX}$	kW	12
Static force	F_0*	N	1860
Stall current	I_0*	A	11.5
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	163
Voltage constant	k_E	Vs/m	54.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	83.8
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.26
Phase inductance	L_{STR}	mH	32.8
Attraction force	F_A	N	8670
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	22.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	23.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.22
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.4
Pressure drop	$\Delta p_{P,H}$	bar	0.371
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0362
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.342
Secondary section cooling data			

1FN3450-2NB40-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.121
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

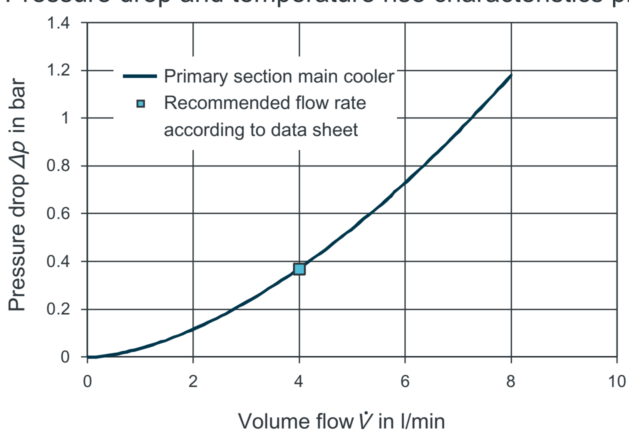
Characteristics for 1FN3450-2NB40-0xAx

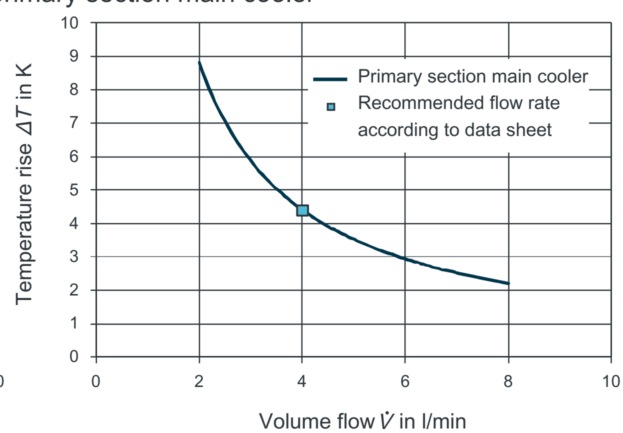
Force characteristics



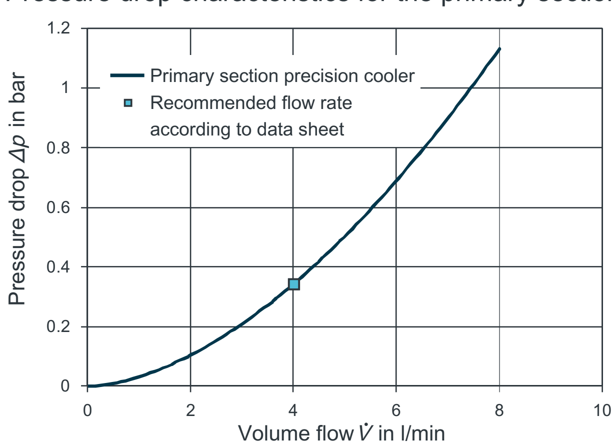


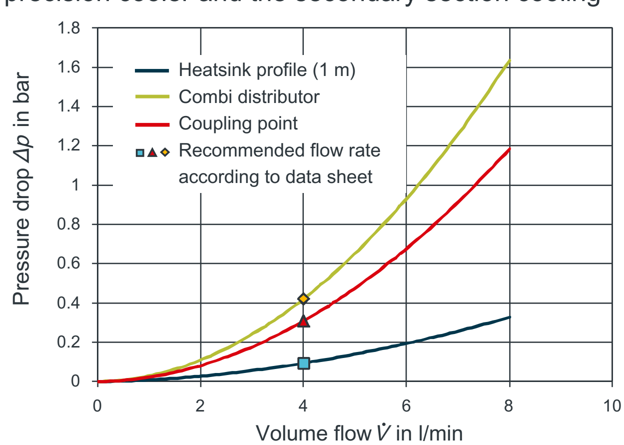
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





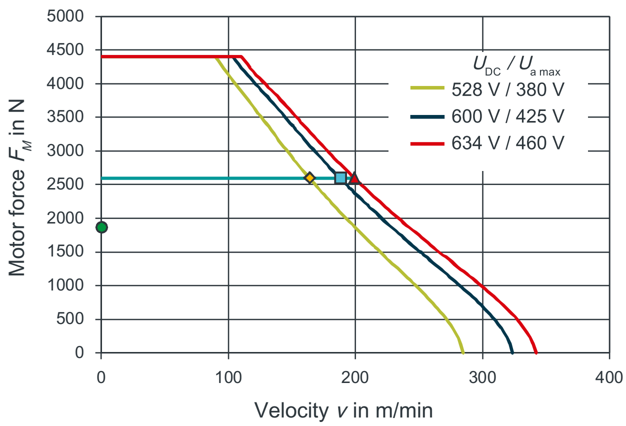
Data sheet of 1FN3450-2NB80-0xAx

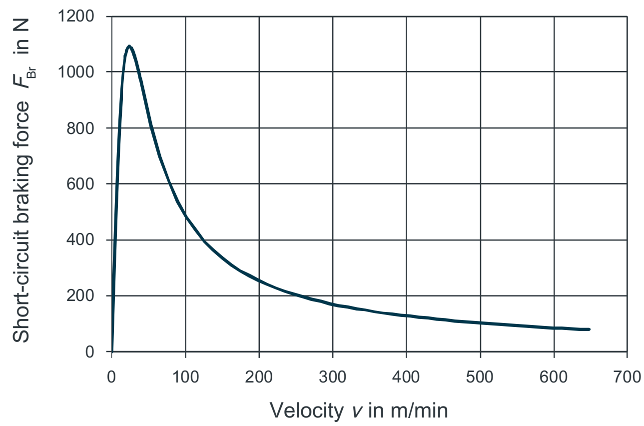
1FN3450-2NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2590
Rated current	I_N	A	20.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	188
Rated power loss	$P_{V,N}$	W	1.39
Limit data			
Maximum force	F_{MAX}	N	4400
Maximum current	I_{MAX}	A	42.9
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	104
Maximum electric power drawn	$P_{EL,MAX}$	W	13.7
Static force	F_0*	N	1860
Stall current	I_0*	A	14.4
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	129
Voltage constant	k_E	Vs/m	43.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	83.6
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.798
Phase inductance	L_{STR}	mH	20.7
Attraction force	F_A	N	8670
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	22.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	23.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	W	1.23
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.42
Pressure drop	$\Delta p_{P,H}$	bar	0.371
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	W	0.0364
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.342
Secondary section cooling data			

1FN3450-2NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	W	0.122
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

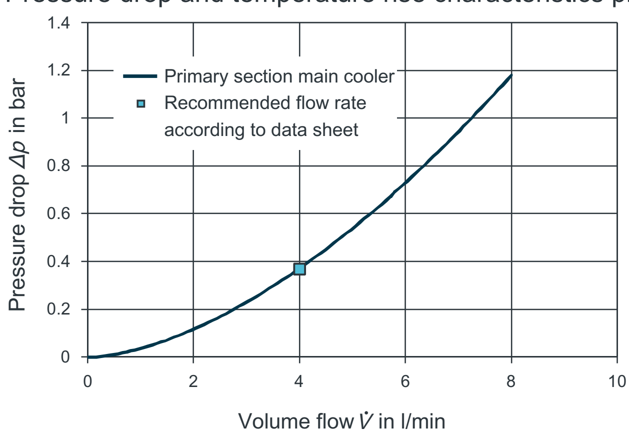
Characteristics for 1FN3450-2NB80-0xAx

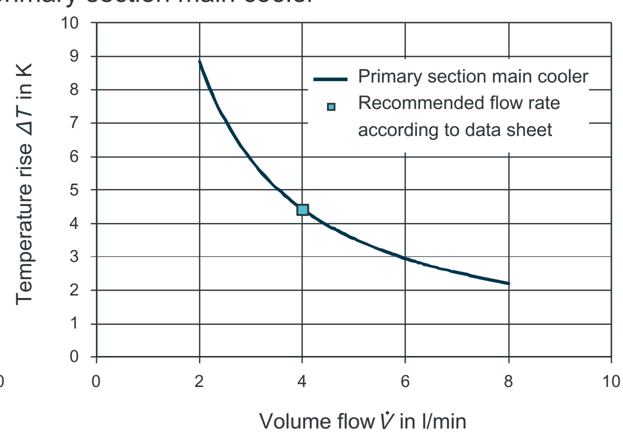
Force characteristics



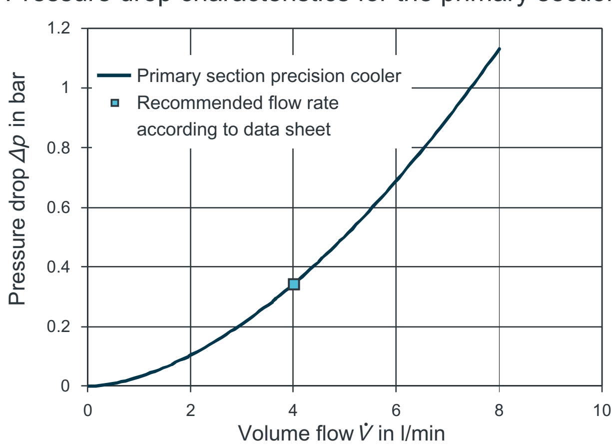


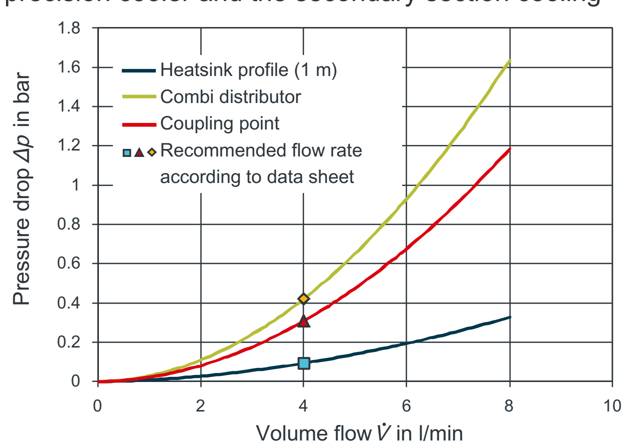
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





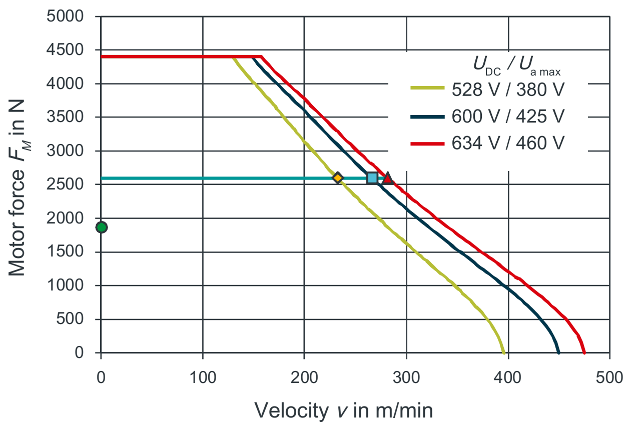
Data sheet of 1FN3450-2NC50-0xAx

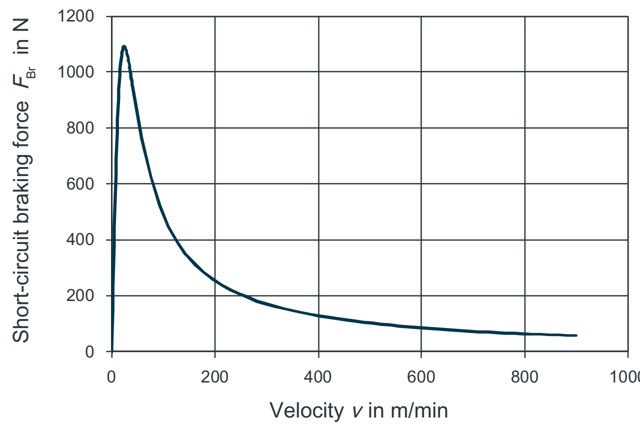
1FN3450-2NC50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2590
Rated current	I_N	A	28.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	266
Rated power loss	$P_{V,N}$	kW	1.39
Limit data			
Maximum force	F_{MAX}	N	4400
Maximum current	I_{MAX}	A	59.6
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	148
Maximum electric power drawn	$P_{EL,MAX}$	kW	17
Static force	F_0*	N	1860
Stall current	I_0*	A	20.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	93.1
Voltage constant	k_E	Vs/m	31
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	83.6
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.414
Phase inductance	L_{STR}	mH	10.7
Attraction force	F_A	N	8670
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	22.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	23.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.23
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4
Temperature increase of the coolant	$\Delta T_{P,H}$	K	4.43
Pressure drop	$\Delta p_{P,H}$	bar	0.371
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0364
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4
Pressure drop	$\Delta p_{P,P}$	bar	0.342
Secondary section cooling data			

1FN3450-2NC50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.122
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0923
Pressure drop per combi distributor	Δp_{KV}	bar	0.42
Pressure drop per coupling point	Δp_{KS}	bar	0.307

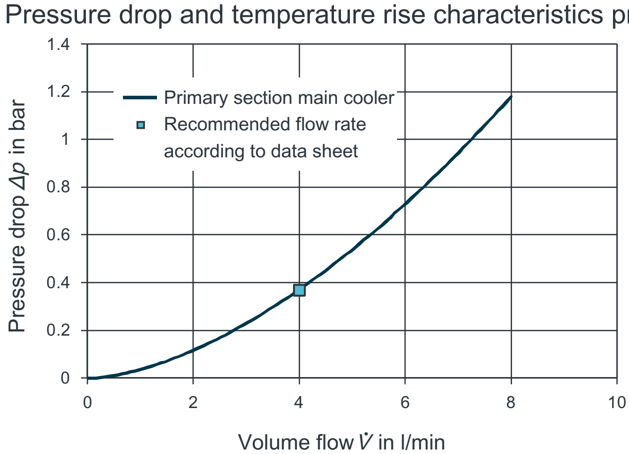
Characteristics for 1FN3450-2NC50-0xAx

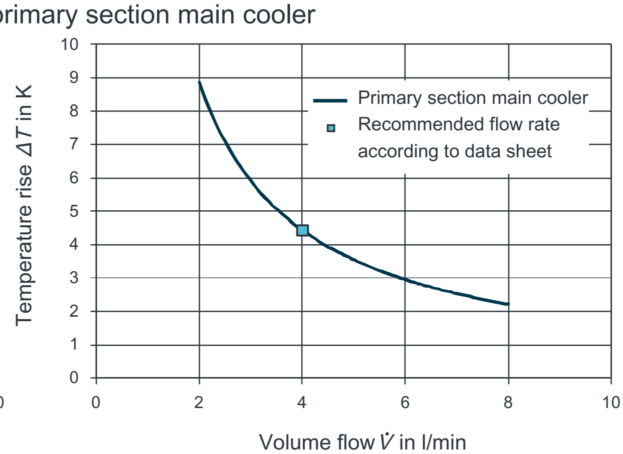
Force characteristics



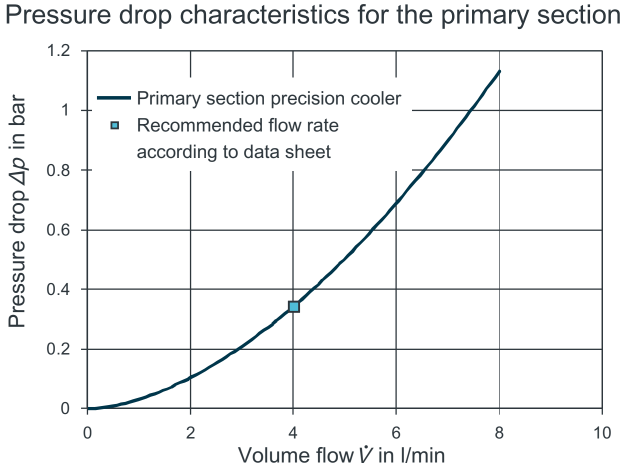


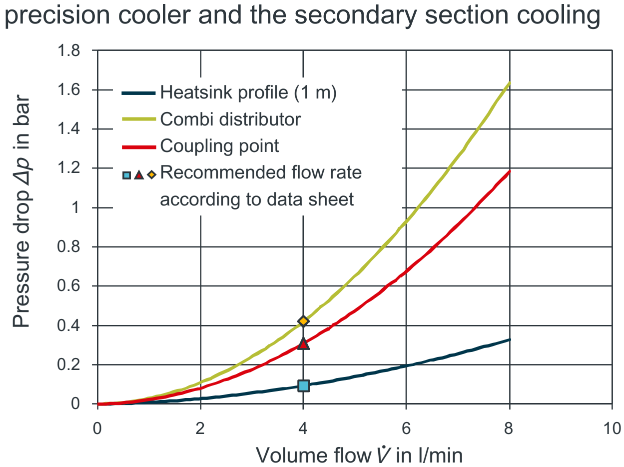
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





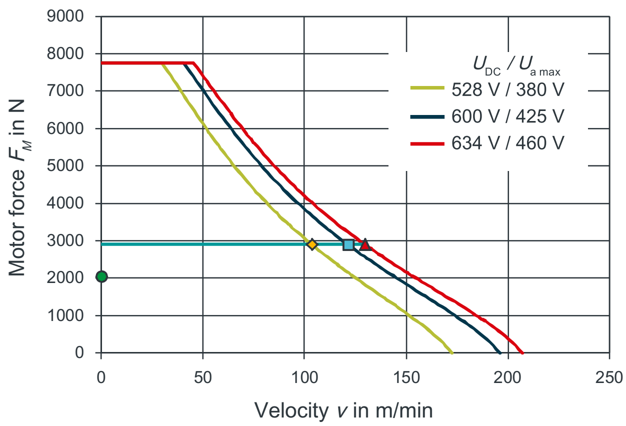
Data sheet of 1FN3450-3WA50-0xAx

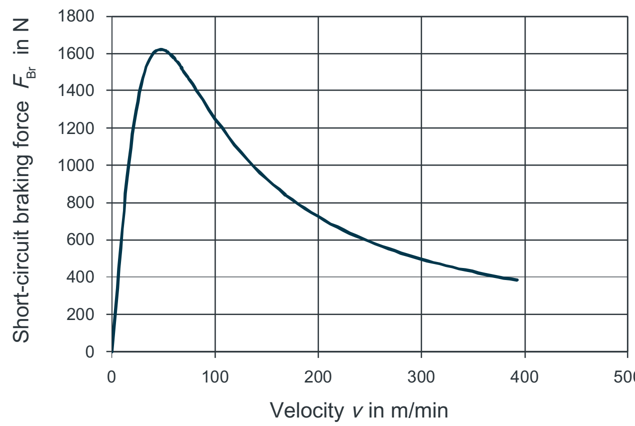
1FN3450-3WA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2900
Rated current	I_N	A	12.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	121
Rated power loss	$P_{V,N}$	kW	2.03
Limit data			
Maximum force	F_{MAX}	N	7760
Maximum current	I_{MAX}	A	38
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	40.5
Maximum electric power drawn	$P_{EL,MAX}$	kW	22.9
Static force	F_0*	N	2050
Stall current	I_0*	A	9.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	225
Voltage constant	k_E	Vs/m	75
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	75.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	2.93
Phase inductance	L_{STR}	mH	38.1
Attraction force	F_A	N	13200
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	24
Mass of the primary section with precision cooler	$m_{P,P}$	kg	25.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.8
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.77
Pressure drop	$\Delta p_{P,H}$	bar	0.648
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0531
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.549
Secondary section cooling data			

1FN3450-3WA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.17
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

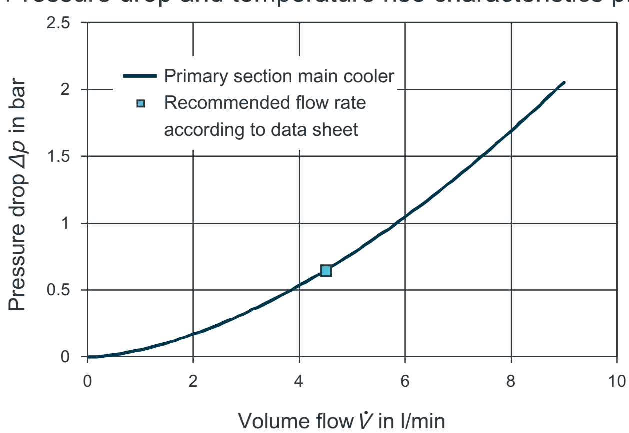
Characteristics for 1FN3450-3WA50-0xAx

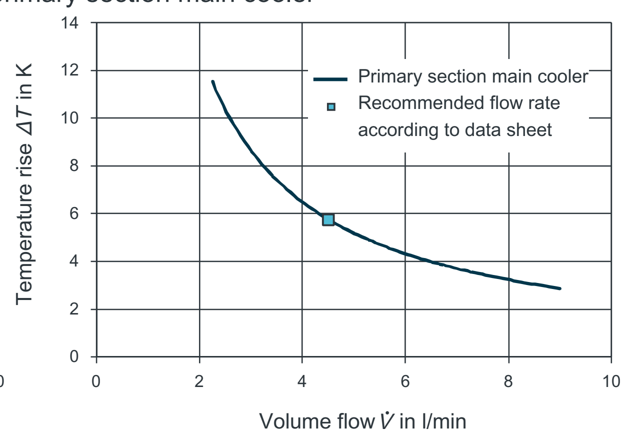
Force characteristics



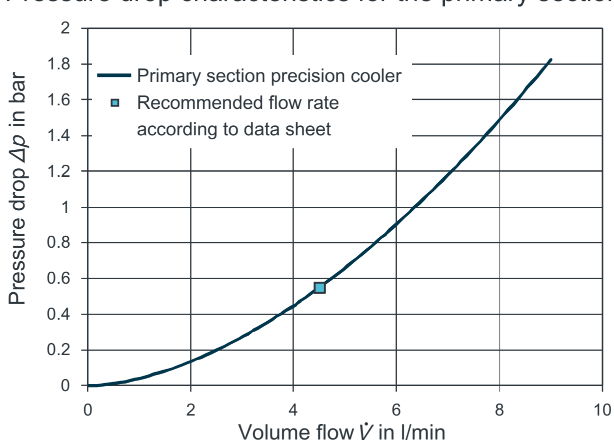


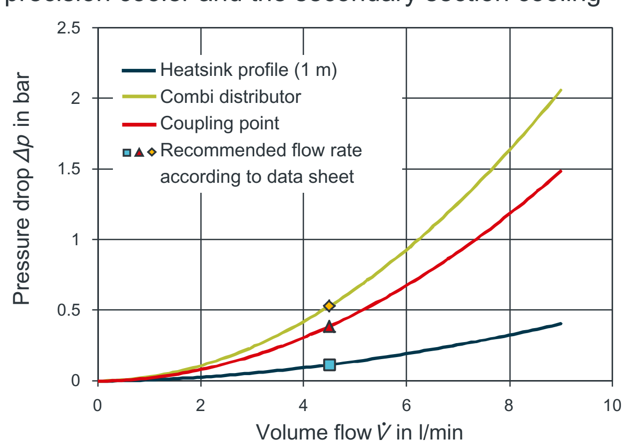
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





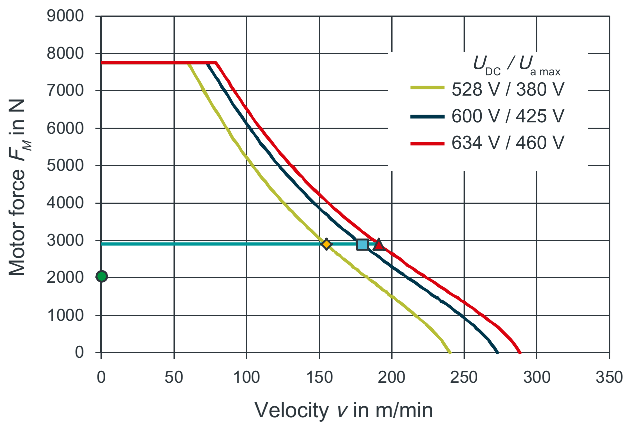
Data sheet of 1FN3450-3WB00-0xAx

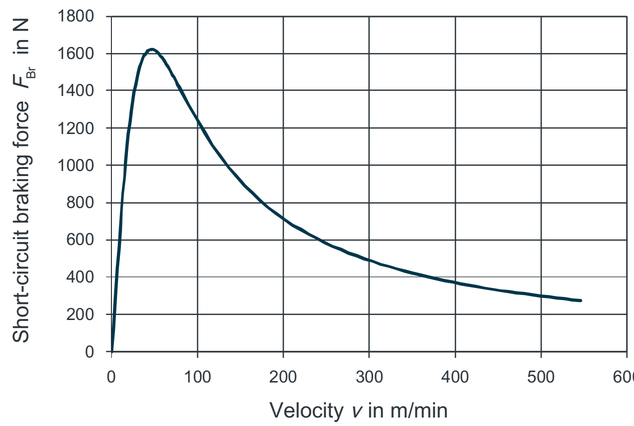
1FN3450-3WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2900
Rated current	I_N	A	17.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	179
Rated power loss	$P_{V,N}$	kW	1.99
Limit data			
Maximum force	F_{MAX}	N	7760
Maximum current	I_{MAX}	A	52.8
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	72.7
Maximum electric power drawn	$P_{EL,MAX}$	kW	26.7
Static force	F_0*	N	2050
Stall current	I_0*	A	12.7
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	162
Voltage constant	k_E	Vs/m	53.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	76.5
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.49
Phase inductance	L_{STR}	mH	19.7
Attraction force	F_A	N	13200
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	24
Mass of the primary section with precision cooler	$m_{P,P}$	kg	25.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.77
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.67
Pressure drop	$\Delta p_{P,H}$	bar	0.648
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0522
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.549
Secondary section cooling data			

1FN3450-3WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.168
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

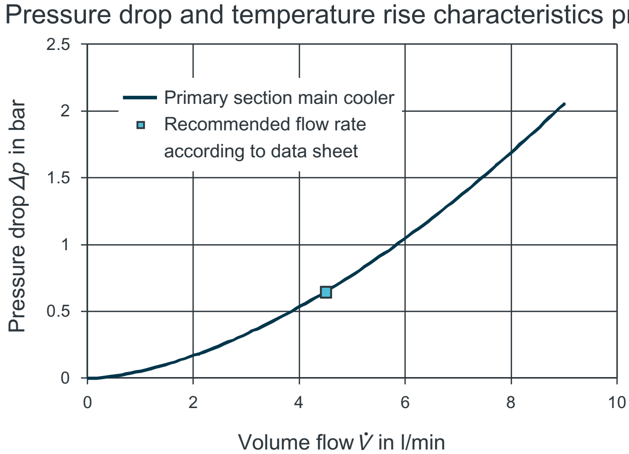
Characteristics for 1FN3450-3WB00-0xAx

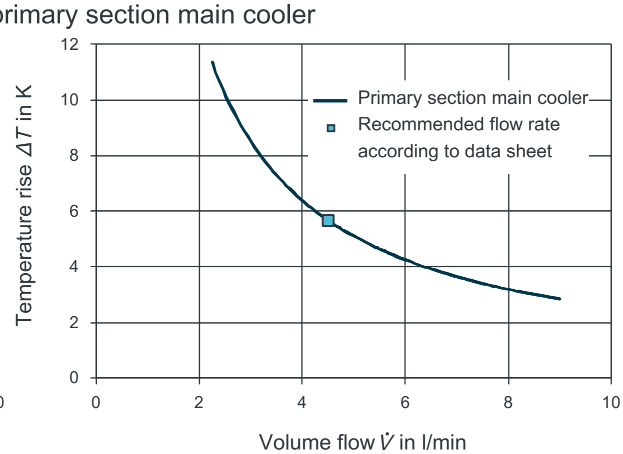
Force characteristics



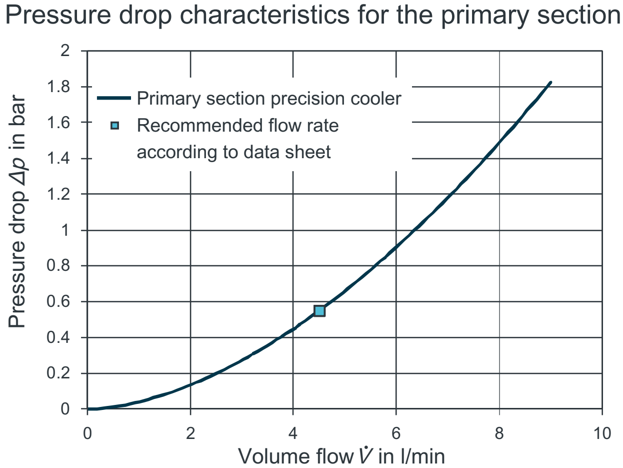


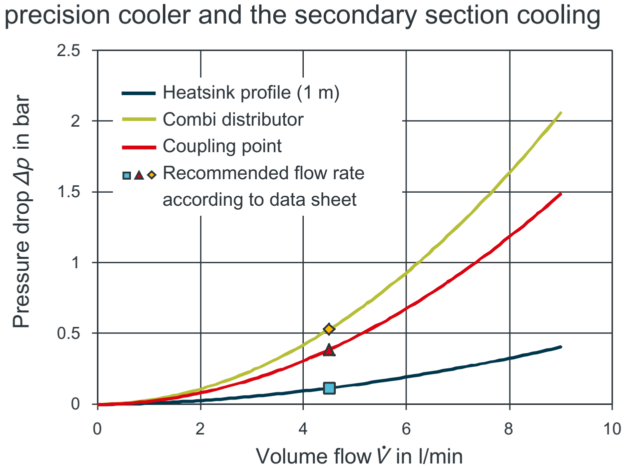
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





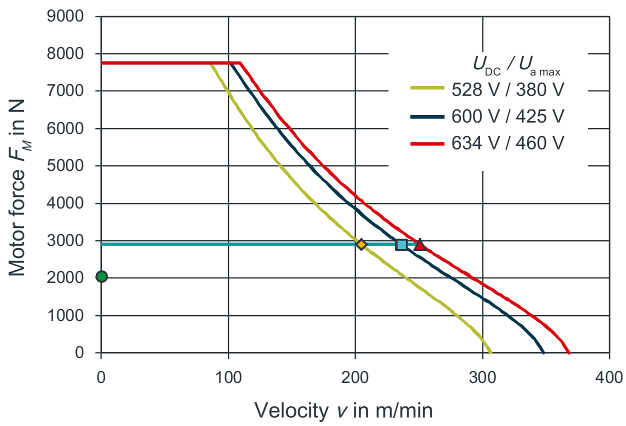
Data sheet of 1FN3450-3WB50-0xAx

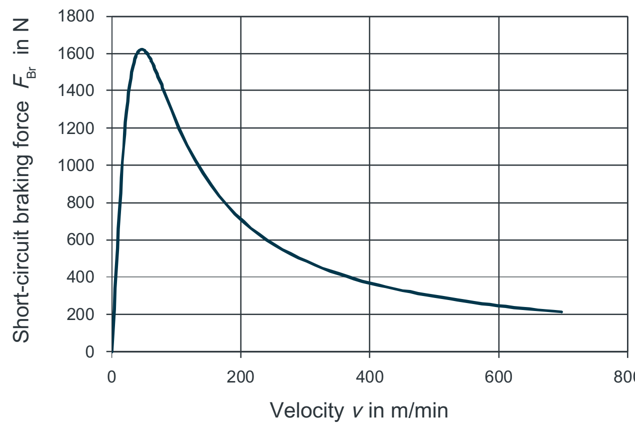
1FN3450-3WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2900
Rated current	I_N	A	22.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	236
Rated power loss	$P_{V,N}$	kW	1.98
Limit data			
Maximum force	F_{MAX}	N	7760
Maximum current	I_{MAX}	A	67.4
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	102
Maximum electric power drawn	$P_{EL,MAX}$	kW	30.4
Static force	F_0*	N	2050
Stall current	I_0*	A	16.2
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	127
Voltage constant	k_E	Vs/m	42.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	76.7
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.908
Phase inductance	L_{STR}	mH	12.1
Attraction force	F_A	N	13200
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	24
Mass of the primary section with precision cooler	$m_{P,P}$	kg	25.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.77
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.64
Pressure drop	$\Delta p_{P,H}$	bar	0.648
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0519
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.549
Secondary section cooling data			

1FN3450-3WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.167
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

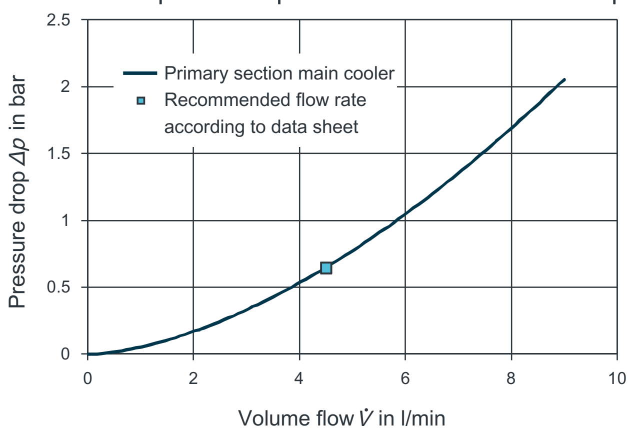
Characteristics for 1FN3450-3WB50-0xAx

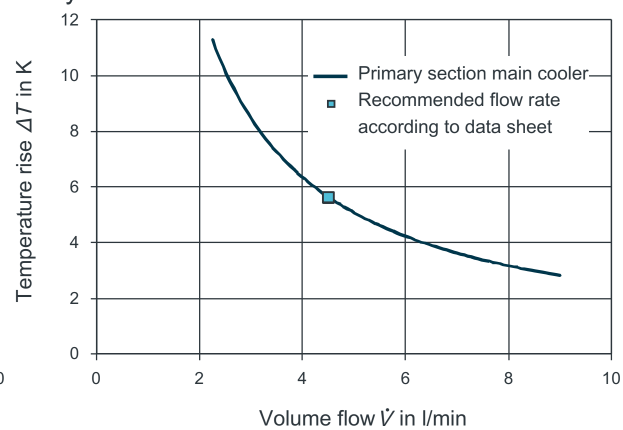
Force characteristics



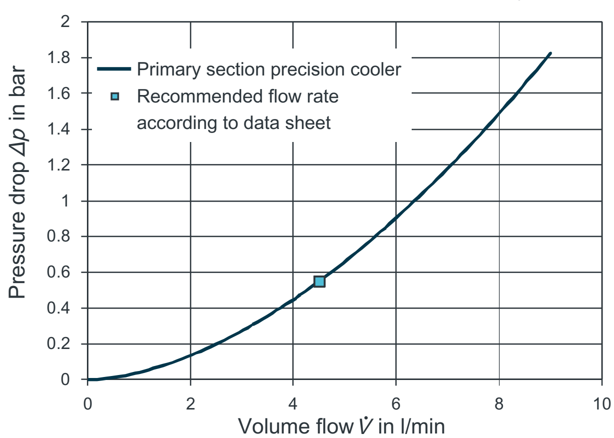


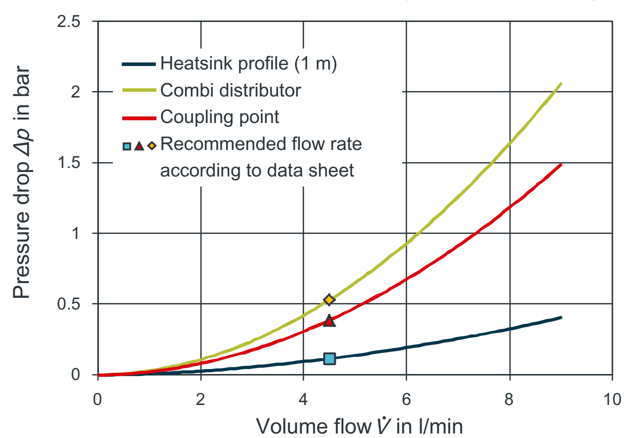
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





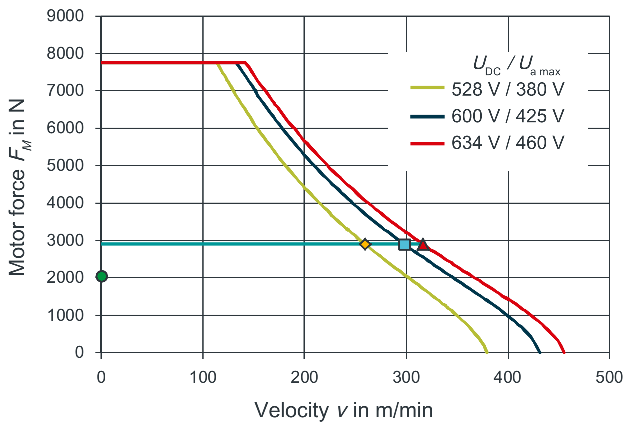
Data sheet of 1FN3450-3WC00-0xAx

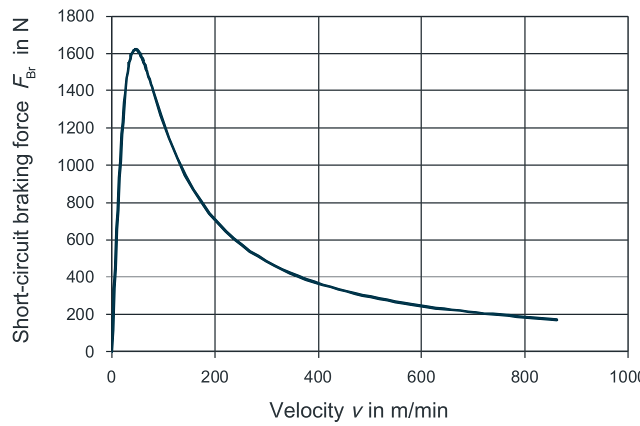
1FN3450-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2900
Rated current	I_N	A	28.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	298
Rated power loss	$P_{V,N}$	kW	1.97
Limit data			
Maximum force	F_{MAX}	N	7760
Maximum current	I_{MAX}	A	83.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	133
Maximum electric power drawn	$P_{EL,MAX}$	kW	34.3
Static force	F_0*	N	2050
Stall current	I_0*	A	20
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	102
Voltage constant	k_E	Vs/m	34.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	76.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.589
Phase inductance	L_{STR}	mH	7.86
Attraction force	F_A	N	13200
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	24
Mass of the primary section with precision cooler	$m_{P,P}$	kg	25.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.75
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.61
Pressure drop	$\Delta p_{P,H}$	bar	0.648
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0516
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.549
Secondary section cooling data			

1FN3450-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.166
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

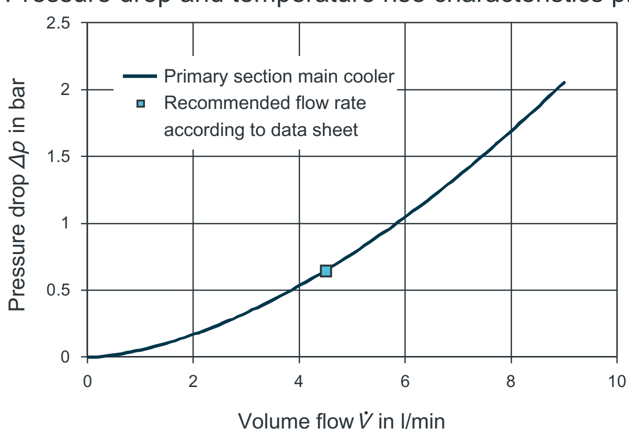
Characteristics for 1FN3450-3WC00-0xAx

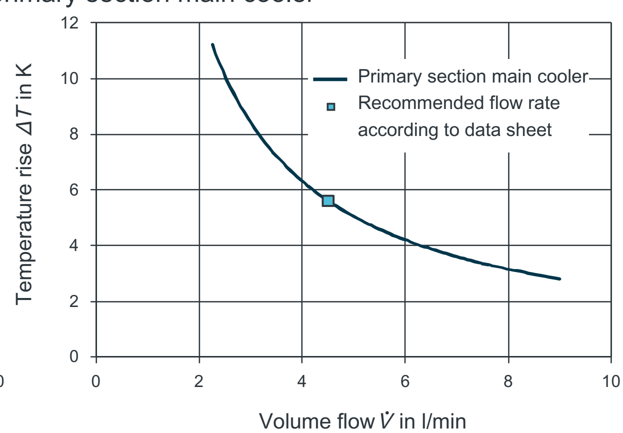
Force characteristics



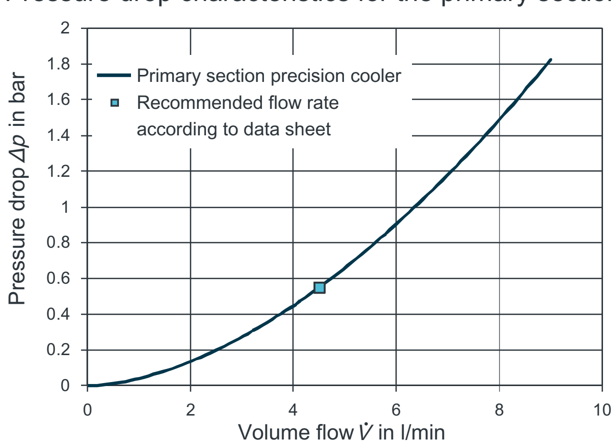


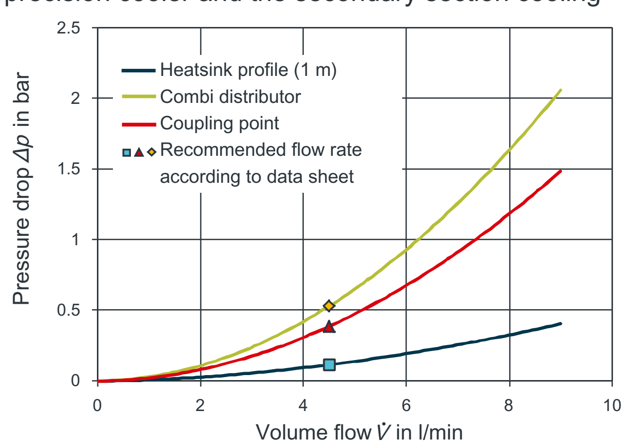
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





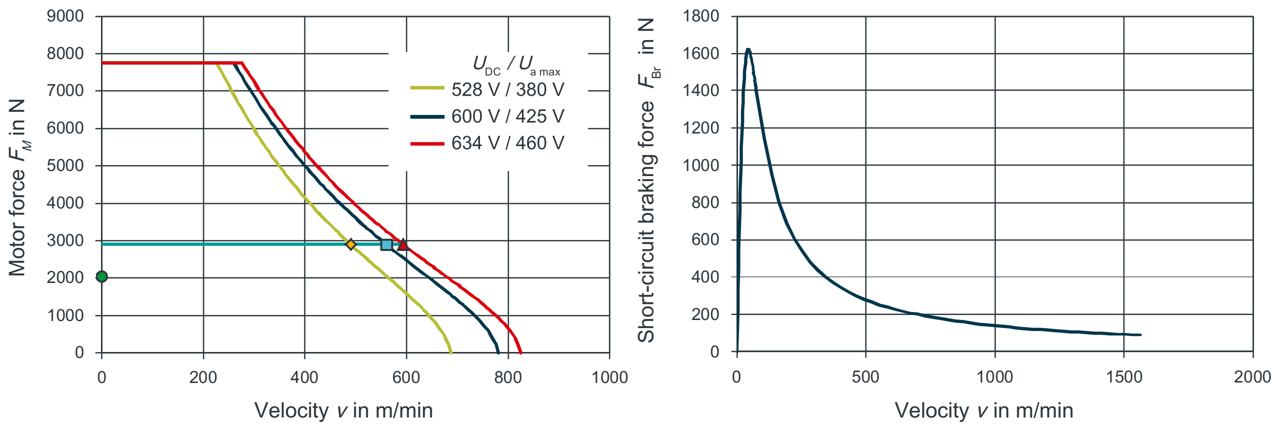
Data sheet of 1FN3450-3WE00-0xAx

1FN3450-3WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2900
Rated current	I_N	A	51.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	561
Rated power loss	$P_{V,N}$	kW	1.86
Limit data			
Maximum force	F_{MAX}	N	7760
Maximum current	I_{MAX}	A	151
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	260
Maximum electric power drawn	$P_{EL,MAX}$	kW	49.8
Static force	F_0*	N	2050
Stall current	I_0*	A	36.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	56.5
Voltage constant	k_E	Vs/m	18.8
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	79.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.169
Phase inductance	L_{STR}	mH	2.4
Attraction force	F_A	N	13200
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	24
Mass of the primary section with precision cooler	$m_{P,P}$	kg	25.7
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.65
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.28
Pressure drop	$\Delta p_{P,H}$	bar	0.648
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0486
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.549
Secondary section cooling data			

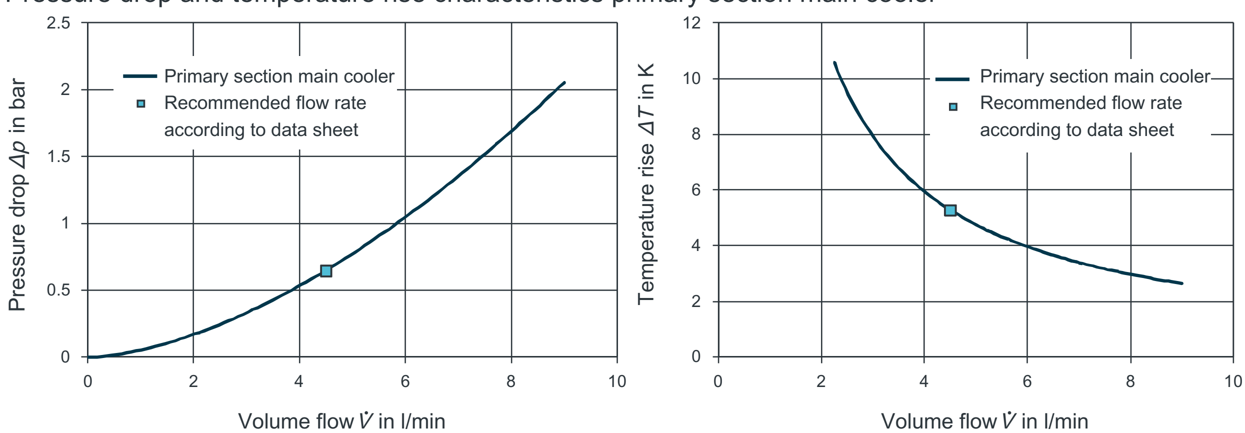
1FN3450-3WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.156
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

Characteristics for 1FN3450-3WE00-0xAx

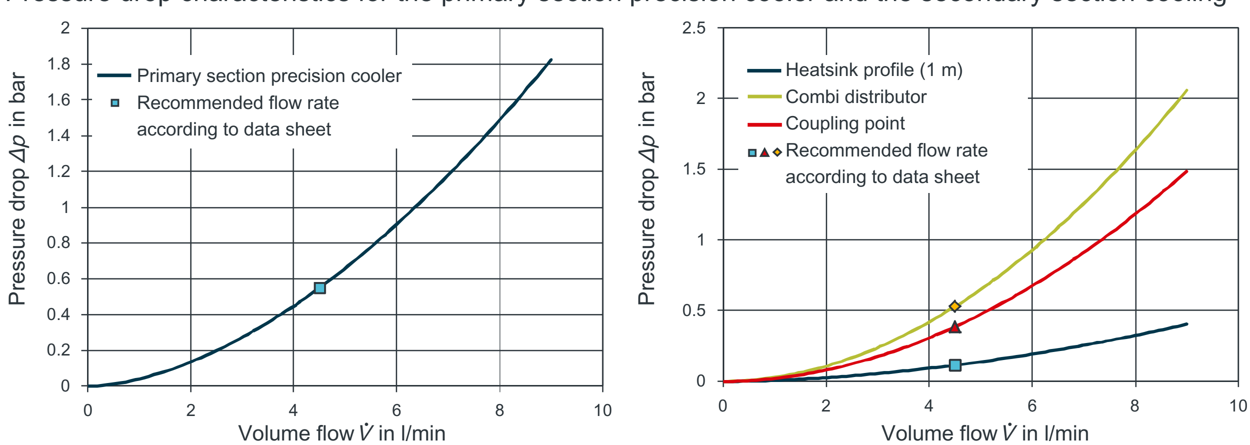
Force characteristics



Pressure drop and temperature rise characteristics primary section main cooler



Pressure drop characteristics for the primary section precision cooler and the secondary section cooling



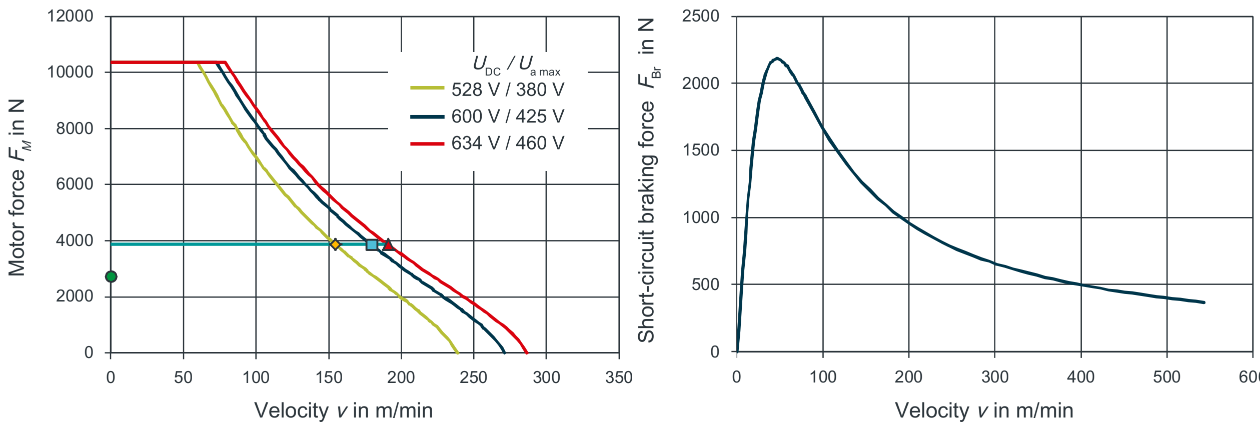
Data sheet of 1FN3450-4WB00-0xAx

1FN3450-4WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3860
Rated current	I_N	A	23.8
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	179
Rated power loss	$P_{V,N}$	kW	2.63
Limit data			
Maximum force	F_{MAX}	N	10300
Maximum current	I_{MAX}	A	70.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	72.9
Maximum electric power drawn	$P_{EL,MAX}$	kW	35.5
Static force	F_0*	N	2730
Stall current	I_0*	A	16.8
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	162
Voltage constant	k_E	Vs/m	54.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	88.8
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.12
Phase inductance	L_{STR}	mH	14.8
Attraction force	F_A	N	17600
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	31.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	33.9
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.34
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.74
Pressure drop	$\Delta p_{P,H}$	bar	1.01
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0689
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5
Pressure drop	$\Delta p_{P,P}$	bar	0.811
Secondary section cooling data			

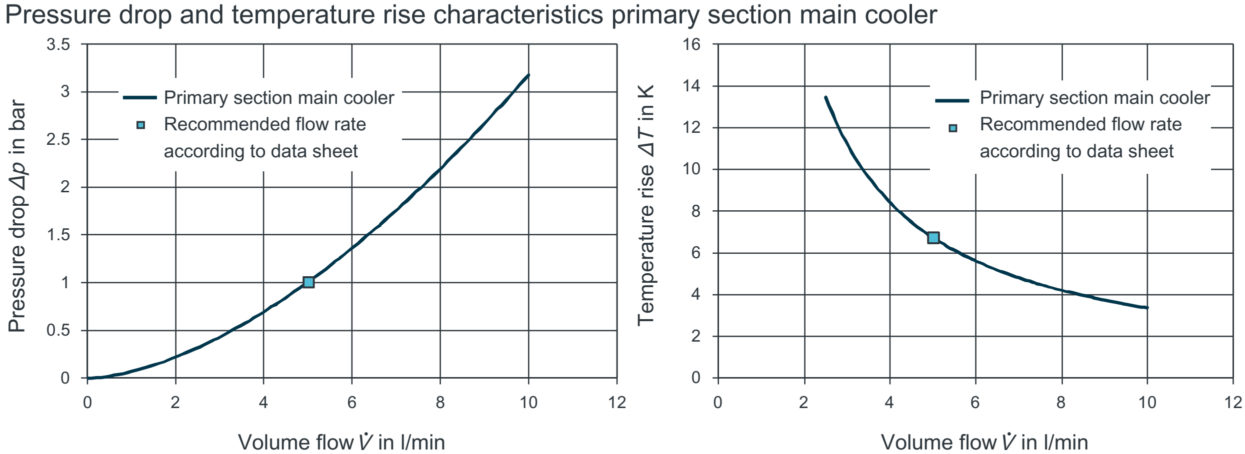
1FN3450-4WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.221
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.138
Pressure drop per combi distributor	Δp_{KV}	bar	0.651
Pressure drop per coupling point	Δp_{KS}	bar	0.474

Characteristics for 1FN3450-4WB00-0xAx

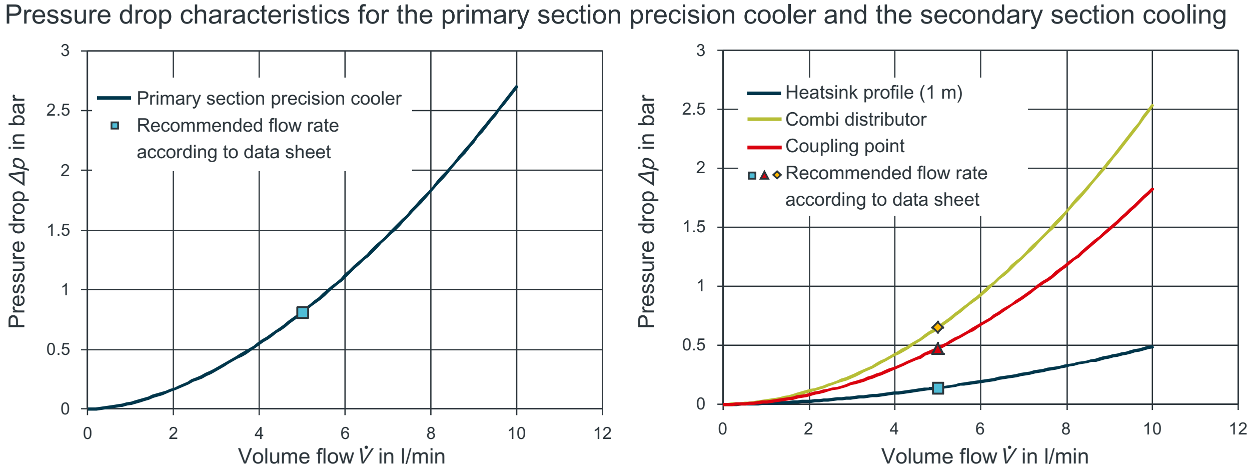
Force characteristics



Pressure drop and temperature rise characteristics primary section main cooler



Pressure drop characteristics for the primary section precision cooler and the secondary section cooling



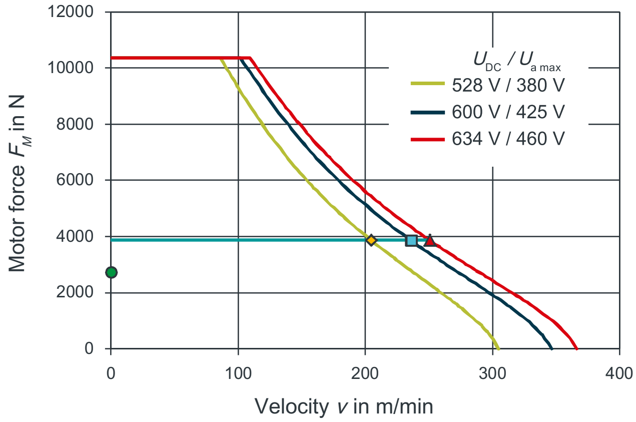
Data sheet of 1FN3450-4WB50-0xAx

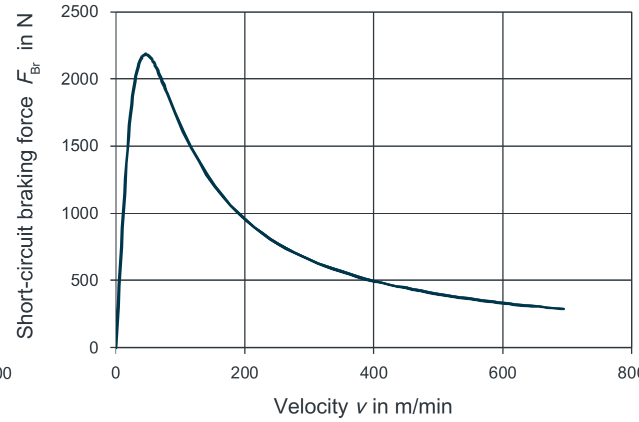
1FN3450-4WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3860
Rated current	I_N	A	30.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	236
Rated power loss	$P_{V,N}$	kW	2.62
Limit data			
Maximum force	F_{MAX}	N	10300
Maximum current	I_{MAX}	A	89.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	102
Maximum electric power drawn	$P_{EL,MAX}$	kW	40.4
Static force	F_0*	N	2730
Stall current	I_0*	A	21.5
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	127
Voltage constant	k_E	Vs/m	42.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	89
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.681
Phase inductance	L_{STR}	mH	9.05
Attraction force	F_A	N	17600
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	31.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	33.9
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.33
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.7
Pressure drop	$\Delta p_{P,H}$	bar	1.01
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0685
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5
Pressure drop	$\Delta p_{P,P}$	bar	0.811
Secondary section cooling data			

1FN3450-4WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.22
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.138
Pressure drop per combi distributor	Δp_{KV}	bar	0.651
Pressure drop per coupling point	Δp_{KS}	bar	0.474

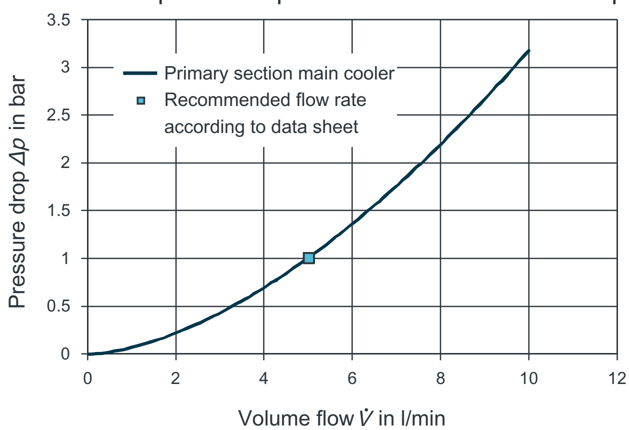
Characteristics for 1FN3450-4WB50-0xAx

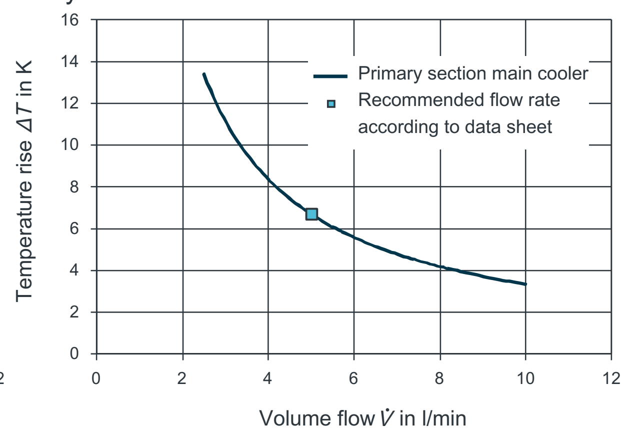
Force characteristics



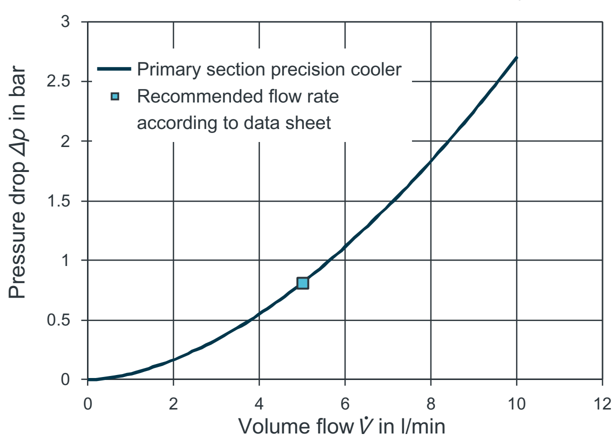


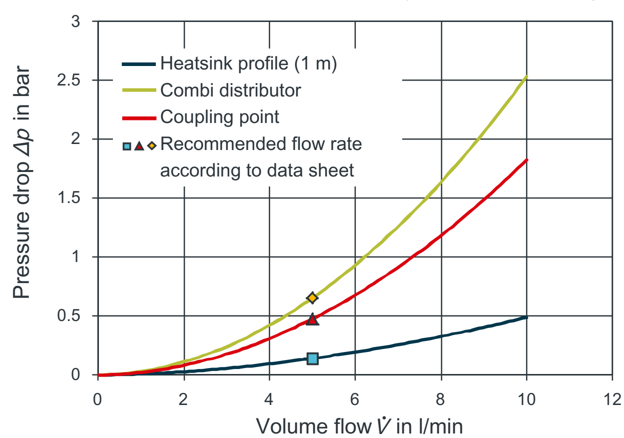
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





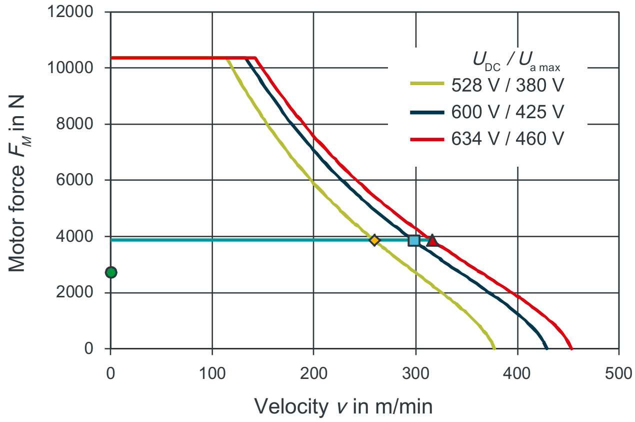
Data sheet of 1FN3450-4WC00-0xAx

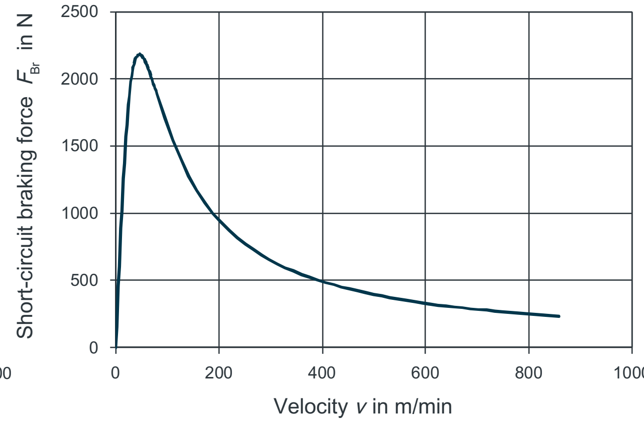
1FN3450-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3860
Rated current	I_N	A	37.6
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	298
Rated power loss	$P_{V,N}$	kW	2.6
Limit data			
Maximum force	F_{MAX}	N	10300
Maximum current	I_{MAX}	A	111
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	133
Maximum electric power drawn	$P_{EL,MAX}$	kW	45.6
Static force	F_0*	N	2730
Stall current	I_0*	A	26.6
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	103
Voltage constant	k_E	Vs/m	34.3
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	89.4
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.441
Phase inductance	L_{STR}	mH	5.91
Attraction force	F_A	N	17600
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	31.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	33.9
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.31
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.65
Pressure drop	$\Delta p_{P,H}$	bar	1.01
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.068
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5
Pressure drop	$\Delta p_{P,P}$	bar	0.811
Secondary section cooling data			

1FN3450-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.218
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.138
Pressure drop per combi distributor	Δp_{KV}	bar	0.651
Pressure drop per coupling point	Δp_{KS}	bar	0.474

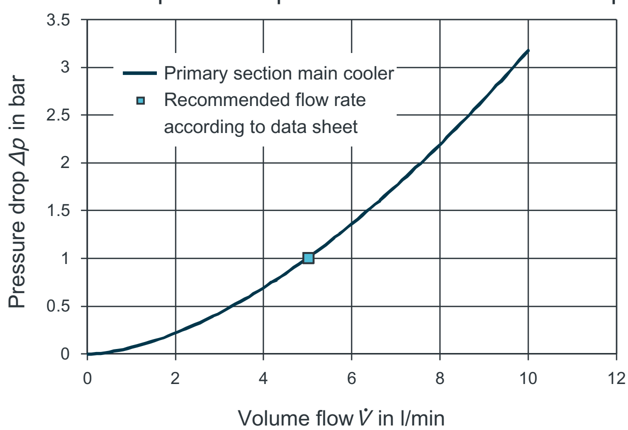
Characteristics for 1FN3450-4WC00-0xAx

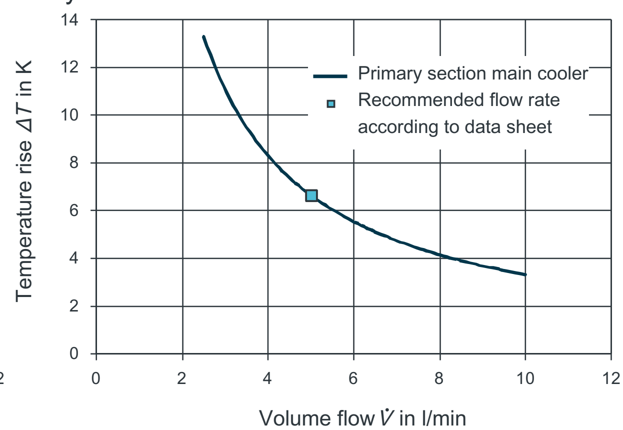
Force characteristics



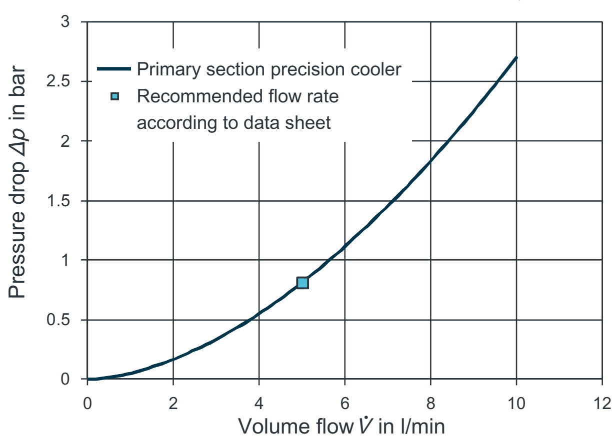


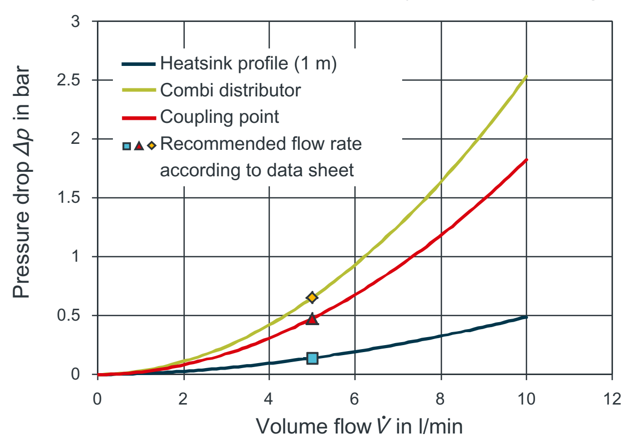
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





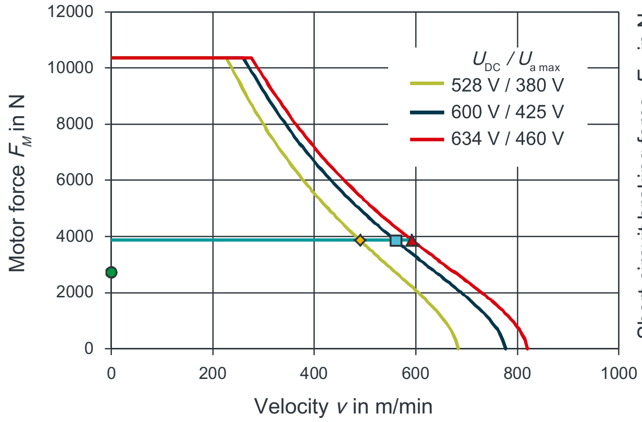
Data sheet of 1FN3450-4WE00-0xAx

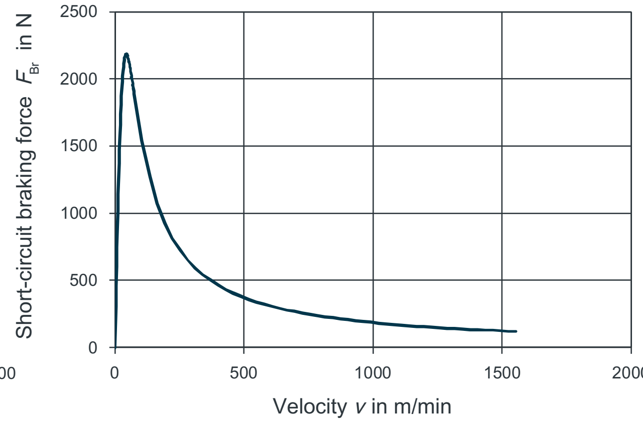
1FN3450-4WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3860
Rated current	I_N	A	68
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	560
Rated power loss	$P_{V,N}$	kW	2.45
Limit data			
Maximum force	F_{MAX}	N	10300
Maximum current	I_{MAX}	A	201
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	261
Maximum electric power drawn	$P_{EL,MAX}$	kW	66.3
Static force	F_0*	N	2730
Stall current	I_0*	A	48.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	56.8
Voltage constant	k_E	Vs/m	18.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	92.1
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.127
Phase inductance	L_{STR}	mH	1.8
Attraction force	F_A	N	17600
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	31.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	33.9
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.18
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.26
Pressure drop	$\Delta p_{P,H}$	bar	1.01
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.064
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5
Pressure drop	$\Delta p_{P,P}$	bar	0.811
Secondary section cooling data			

1FN3450-4WE00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.206
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.138
Pressure drop per combi distributor	Δp_{KV}	bar	0.651
Pressure drop per coupling point	Δp_{KS}	bar	0.474

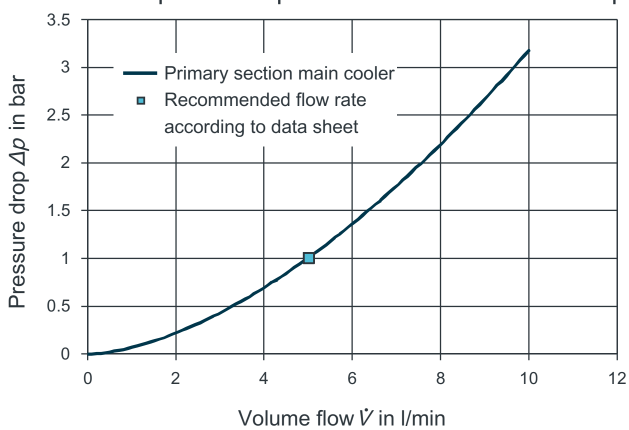
Characteristics for 1FN3450-4WE00-0xAx

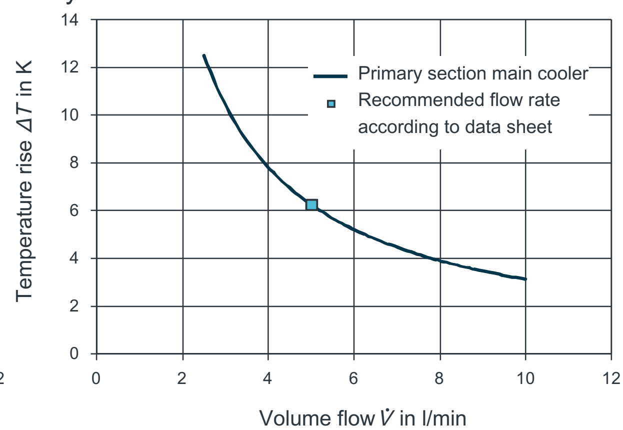
Force characteristics



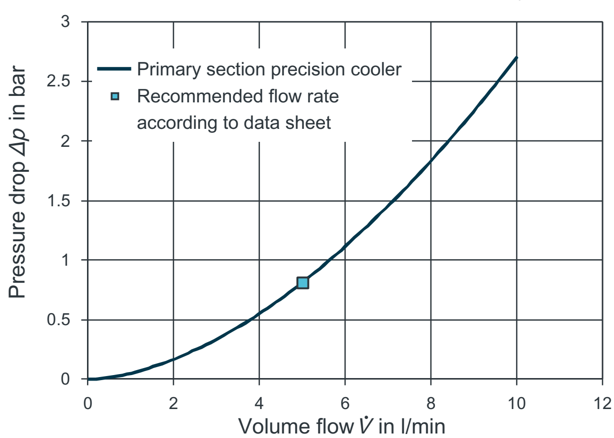


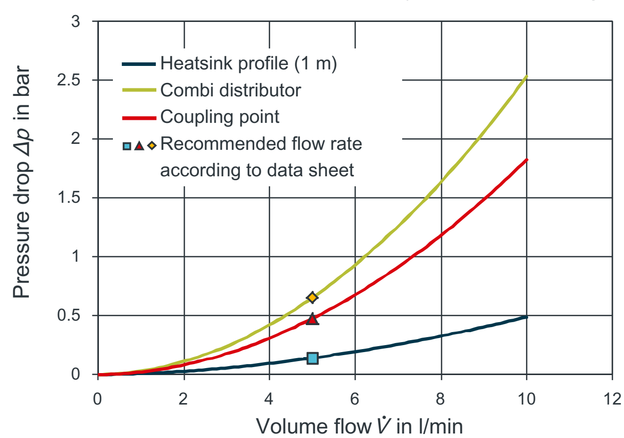
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





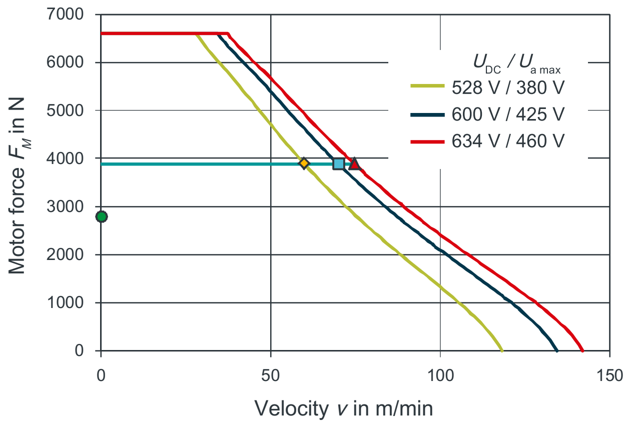
Data sheet of 1FN3450-3NA50-0xAx

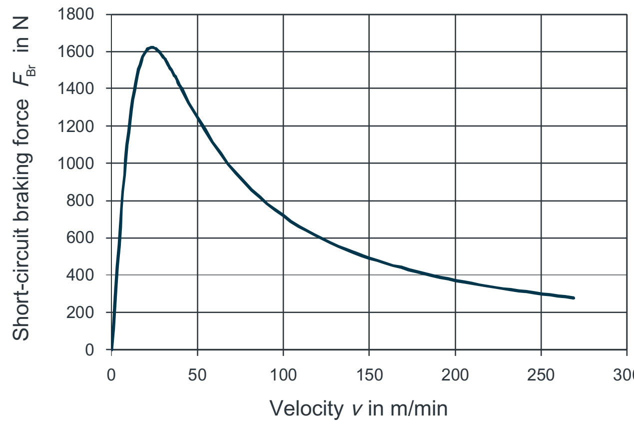
1FN3450-3NA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3890
Rated current	I_N	A	12.7
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	69.9
Rated power loss	$P_{V,N}$	kW	2.08
Limit data			
Maximum force	F_{MAX}	N	6600
Maximum current	I_{MAX}	A	26.7
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	34.3
Maximum electric power drawn	$P_{EL,MAX}$	kW	13
Static force	F_0*	N	2800
Stall current	I_0*	A	8.99
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	312
Voltage constant	k_E	Vs/m	104
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	102
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	3.08
Phase inductance	L_{STR}	mH	81
Attraction force	F_A	N	13000
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	32.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	34.3
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.84
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.9
Pressure drop	$\Delta p_{P,H}$	bar	0.648
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0546
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.546
Secondary section cooling data			

1FN3450-3NA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.183
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

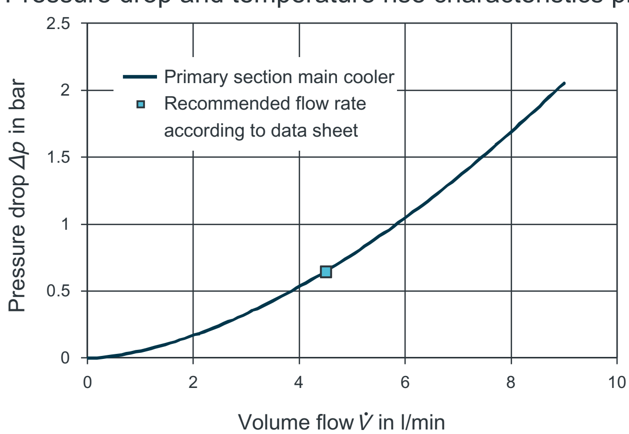
Characteristics of 1FN3450-3NA50-0xAx

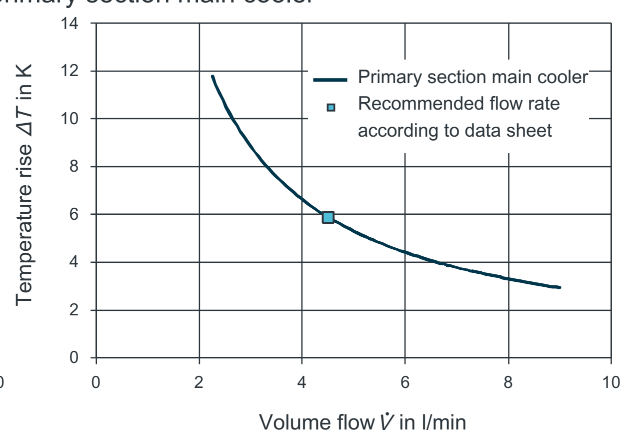
Force characteristics



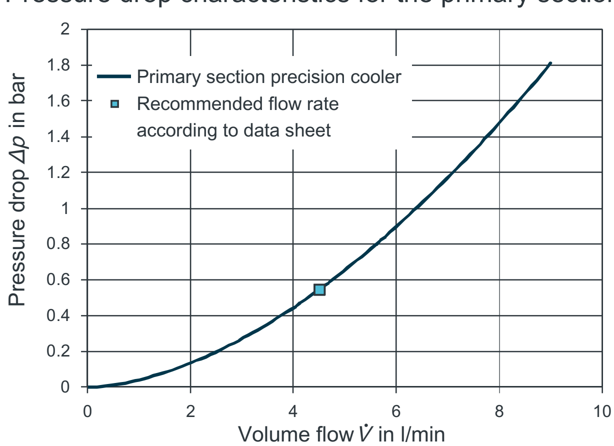


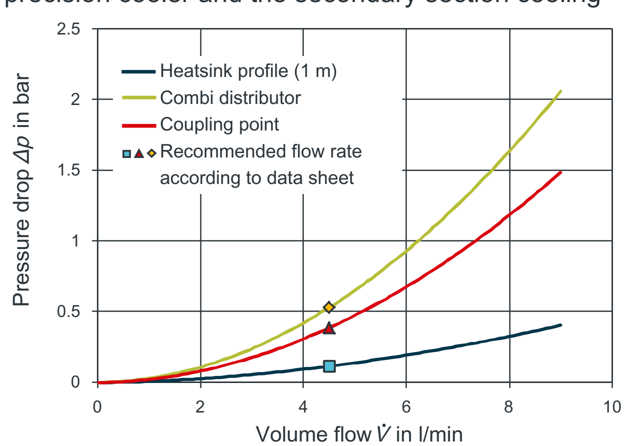
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





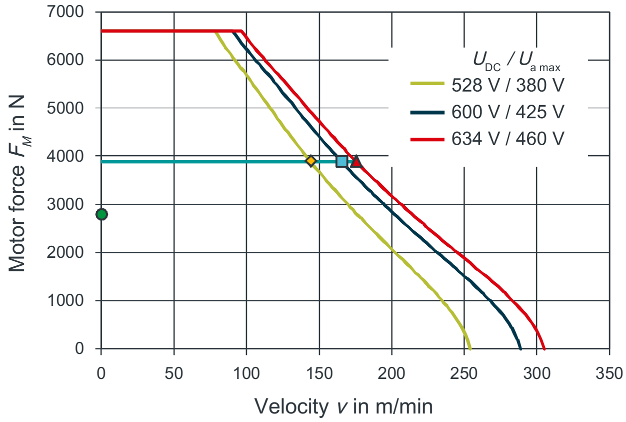
Data sheet of 1FN3450-3NB50-0xAx

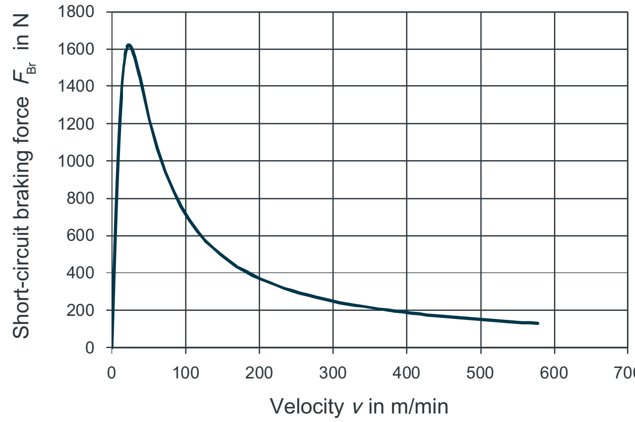
1FN3450-3NB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3890
Rated current	I_N	A	27.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	165
Rated power loss	$P_{V,N}$	kW	2.07
Limit data			
Maximum force	F_{MAX}	N	6600
Maximum current	I_{MAX}	A	57.4
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	90.5
Maximum electric power drawn	$P_{EL,MAX}$	kW	19.1
Static force	F_0*	N	2800
Stall current	I_0*	A	19.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	145
Voltage constant	k_E	Vs/m	48.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	103
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.664
Phase inductance	L_{STR}	mH	17.5
Attraction force	F_A	N	13000
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	32.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	34.3
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.83
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.86
Pressure drop	$\Delta p_{P,H}$	bar	0.648
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0542
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.546
Secondary section cooling data			

1FN3450-3NB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.182
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

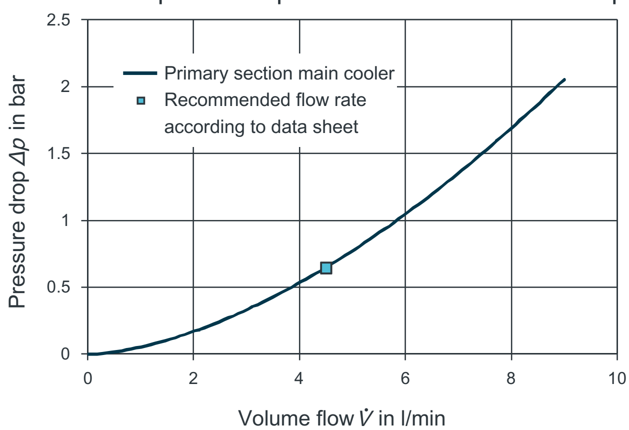
Characteristics for 1FN3450-3NB50-0xAx

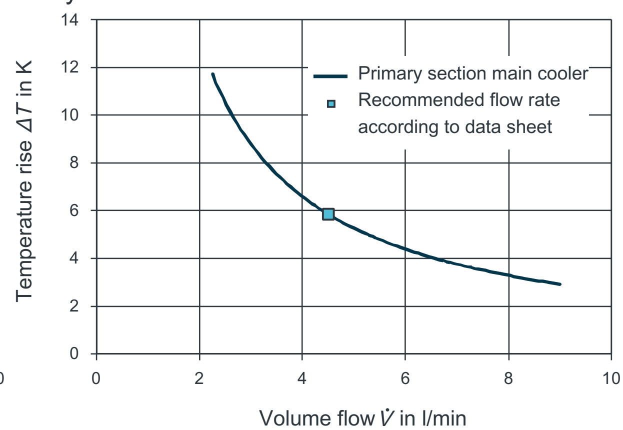
Force characteristics



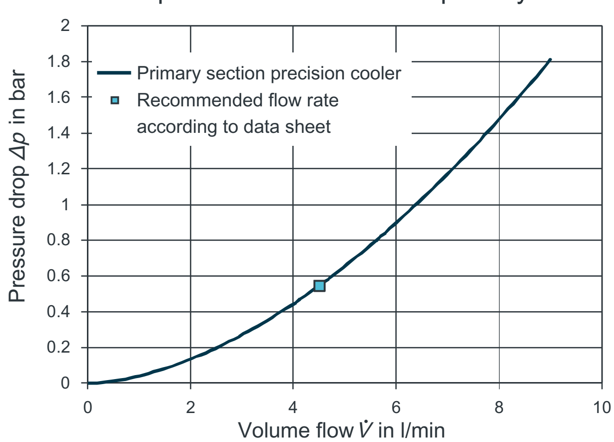


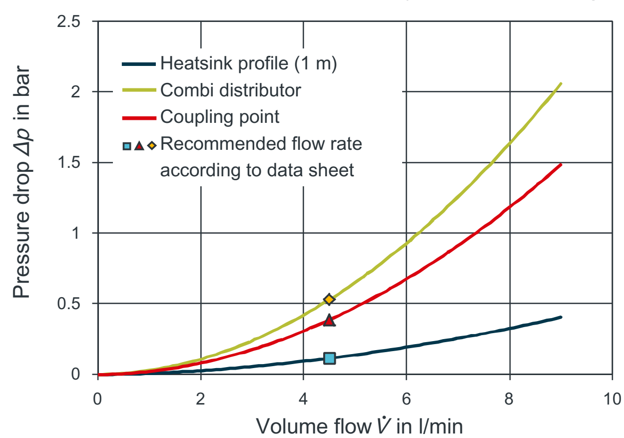
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





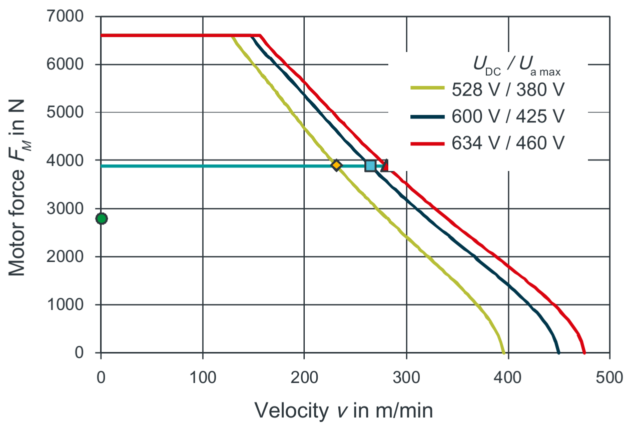
Data sheet of 1FN3450-3NC50-0xAx

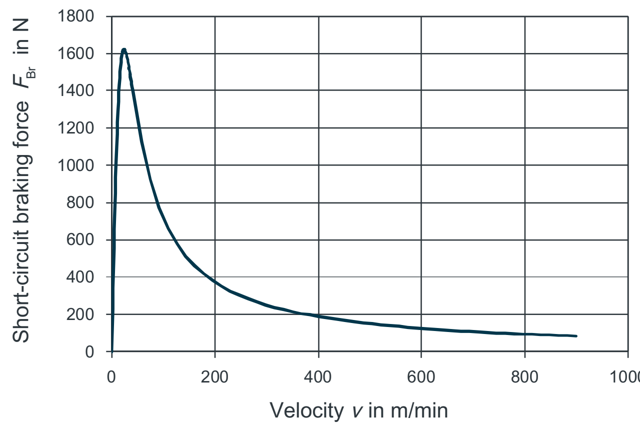
1FN3450-3NC50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3890
Rated current	I_N	A	42.5
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	264
Rated power loss	$P_{V,N}$	kW	2.08
Limit data			
Maximum force	F_{MAX}	N	6600
Maximum current	I_{MAX}	A	89.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	147
Maximum electric power drawn	$P_{EL,MAX}$	kW	25.4
Static force	F_0*	N	2800
Stall current	I_0*	A	30.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	93.1
Voltage constant	k_E	Vs/m	31
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	102
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.275
Phase inductance	L_{STR}	mH	7.23
Attraction force	F_A	N	13000
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	32.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	34.3
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.85
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.9
Pressure drop	$\Delta p_{P,H}$	bar	0.648
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0546
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.546
Secondary section cooling data			

1FN3450-3NC50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.183
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.114
Pressure drop per combi distributor	Δp_{KV}	bar	0.529
Pressure drop per coupling point	Δp_{KS}	bar	0.386

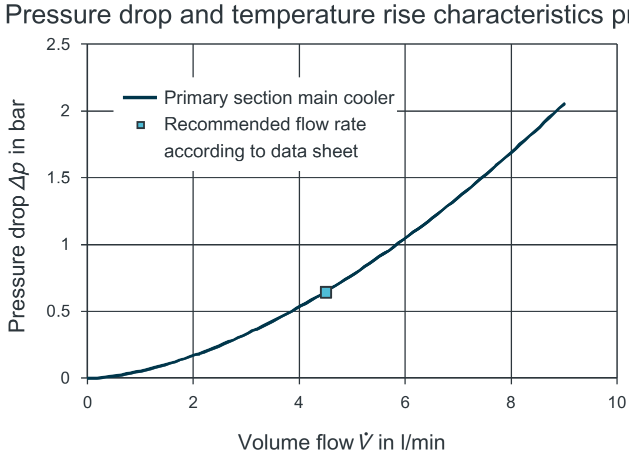
Characteristics for 1FN3450-3NC50-0xAx

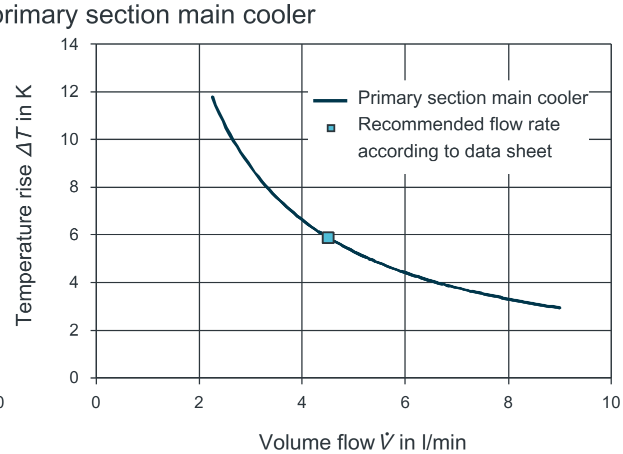
Force characteristics



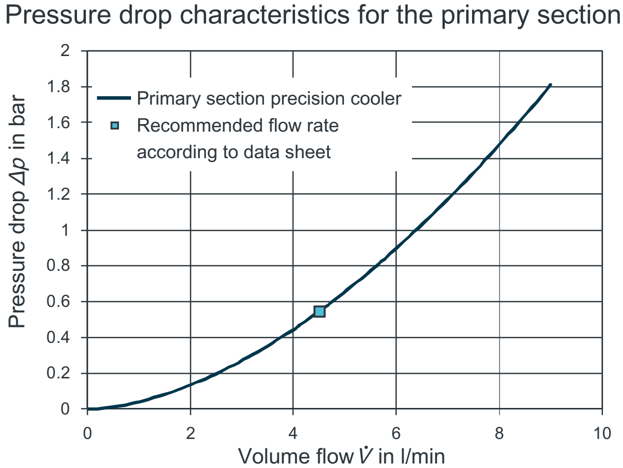


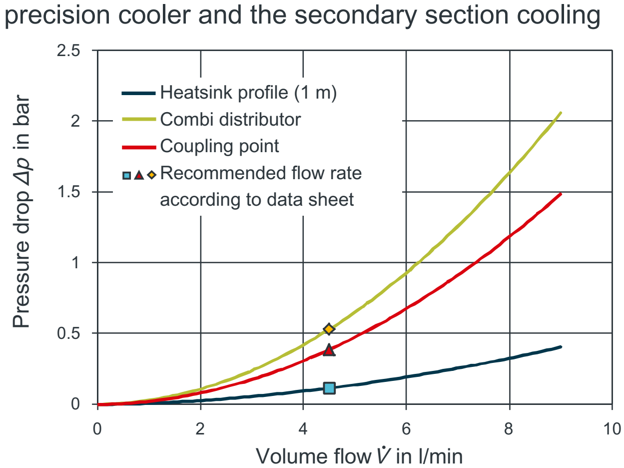
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





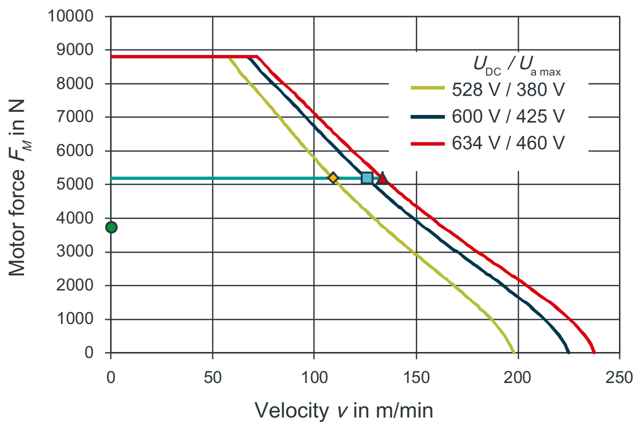
Data sheet of 1FN3450-4NB20-0xAx

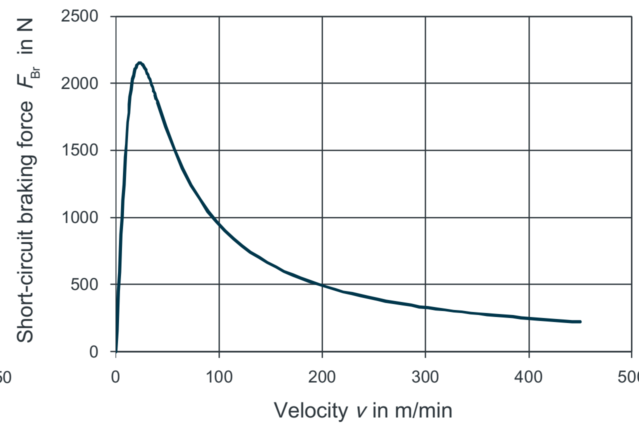
1FN3450-4NB20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5190
Rated current	I_N	A	28.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	126
Rated power loss	$P_{V,N}$	kW	2.77
Limit data			
Maximum force	F_{MAX}	N	8810
Maximum current	I_{MAX}	A	59.6
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	67.5
Maximum electric power drawn	$P_{EL,MAX}$	kW	22.2
Static force	F_0*	N	3730
Stall current	I_0*	A	20.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	186
Voltage constant	k_E	Vs/m	62.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	118
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.825
Phase inductance	L_{STR}	mH	21.8
Attraction force	F_A	N	17300
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	42
Mass of the primary section with precision cooler	$m_{P,P}$	kg	44
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.46
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	7.07
Pressure drop	$\Delta p_{P,H}$	bar	1.01
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0727
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5
Pressure drop	$\Delta p_{P,P}$	bar	0.807
Secondary section cooling data			

1FN3450-4NB20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.244
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.138
Pressure drop per combi distributor	Δp_{KV}	bar	0.651
Pressure drop per coupling point	Δp_{KS}	bar	0.474

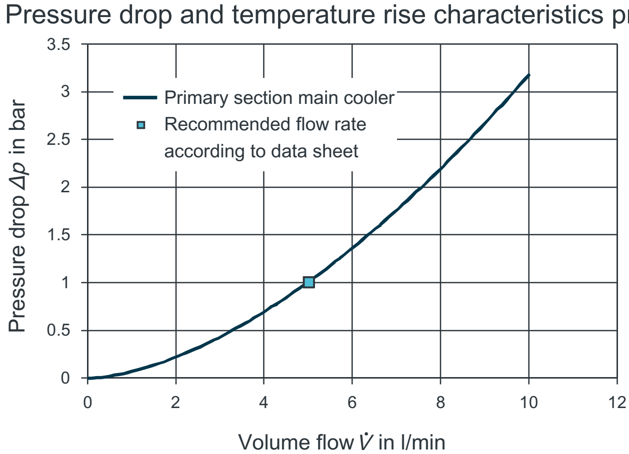
Characteristics of 1FN3450-4NB20-0xAx

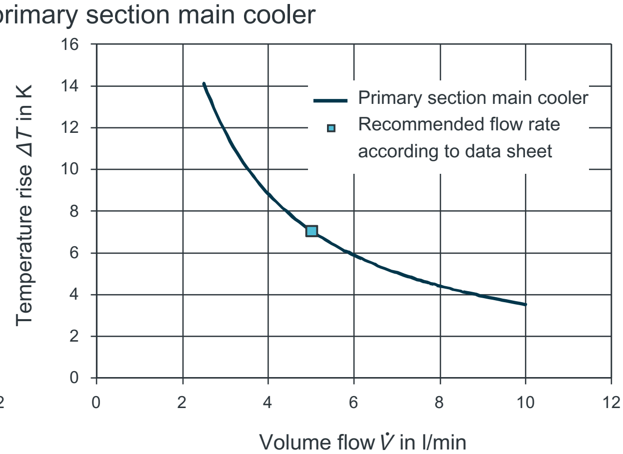
Force characteristics



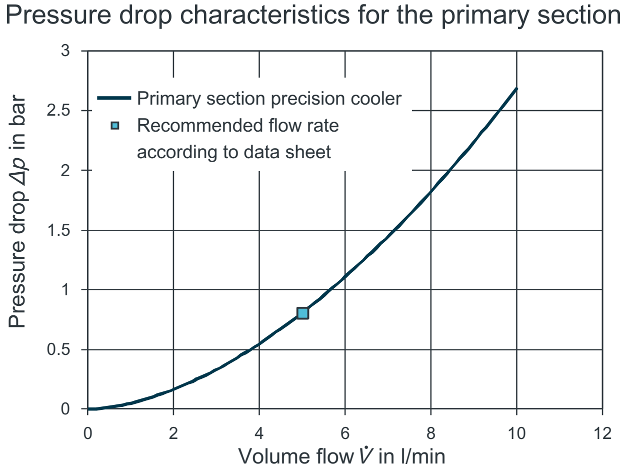


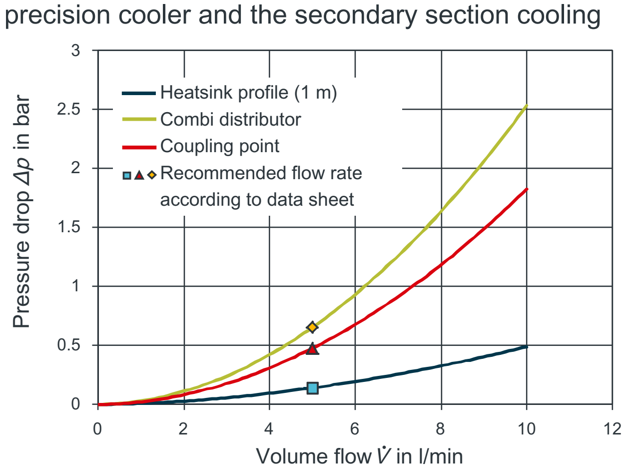
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





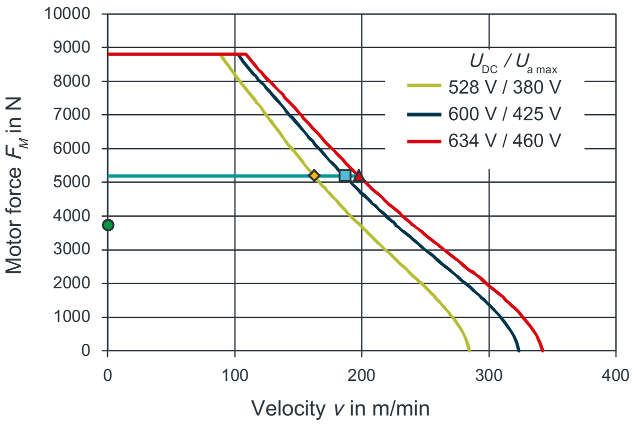
Data sheet of 1FN3450-4NB80-0xAx

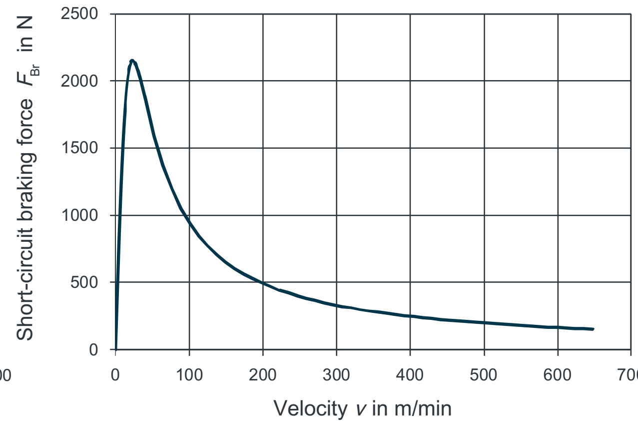
1FN3450-4NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5190
Rated current	I_N	A	40.8
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	186
Rated power loss	$P_{V,N}$	kW	2.77
Limit data			
Maximum force	F_{MAX}	N	8810
Maximum current	I_{MAX}	A	85.8
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	102
Maximum electric power drawn	$P_{EL,MAX}$	kW	27.3
Static force	F_0*	N	3730
Stall current	I_0*	A	28.9
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	129
Voltage constant	k_E	Vs/m	43.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	118
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.398
Phase inductance	L_{STR}	mH	10.5
Attraction force	F_A	N	17300
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	42
Mass of the primary section with precision cooler	$m_{P,P}$	kg	44
Mass of a secondary section	m_S	kg	3.8
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	4
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.46
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	7.06
Pressure drop	$\Delta p_{P,H}$	bar	1.01
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0726
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5
Pressure drop	$\Delta p_{P,P}$	bar	0.807
Secondary section cooling data			

1FN3450-4NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.243
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.138
Pressure drop per combi distributor	Δp_{KV}	bar	0.651
Pressure drop per coupling point	Δp_{KS}	bar	0.474

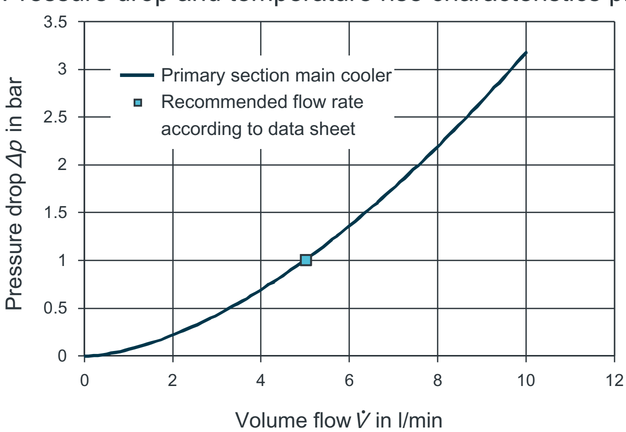
Characteristics for 1FN3450-4NB80-0xAx

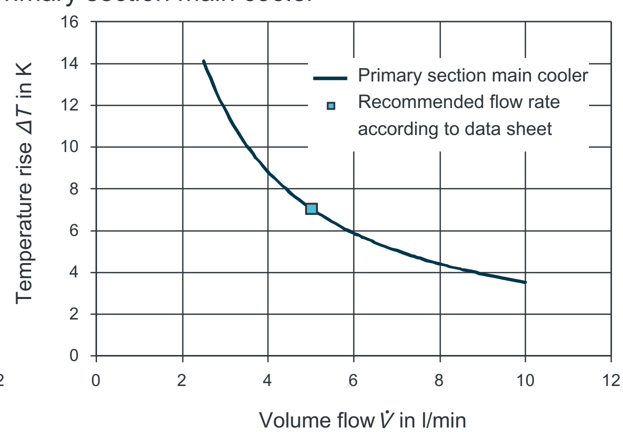
Force characteristics



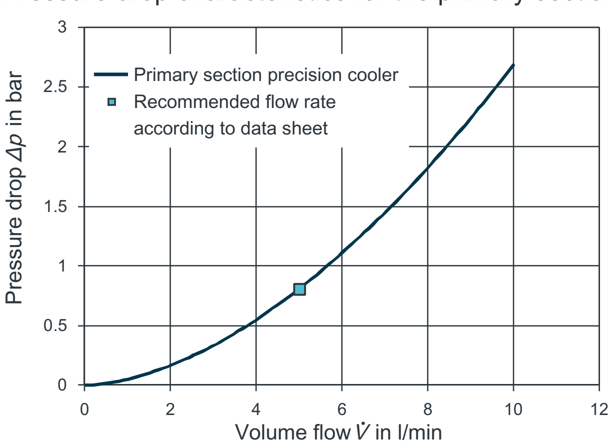


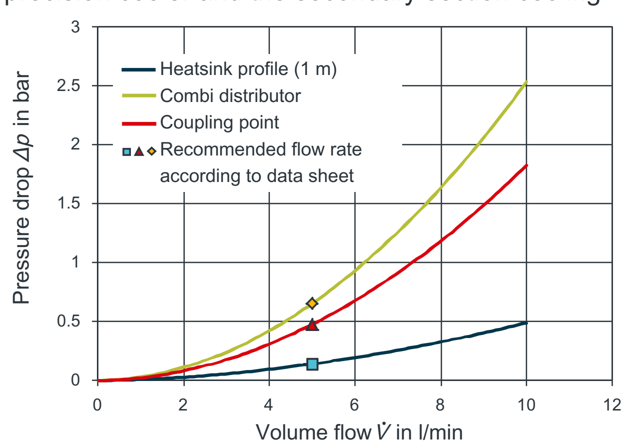
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





7.2.6 1FN3600-xxxxx-xxxx

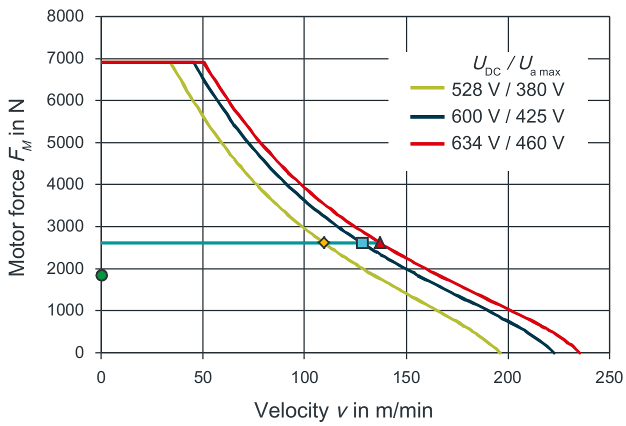
Data sheet of 1FN3600-2WA50-0xAx

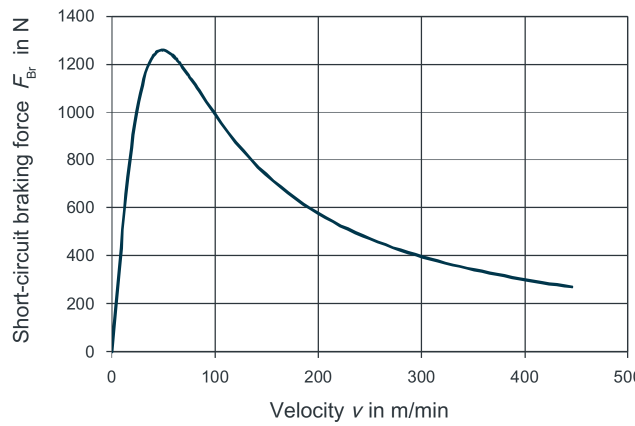
1FN3600-2WA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2610
Rated current	I_N	A	13.2
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	128
Rated power loss	$P_{V,N}$	kW	2.19
Limit data			
Maximum force	F_{MAX}	N	6900
Maximum current	I_{MAX}	A	35.9
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	45.4
Maximum electric power drawn	$P_{EL,MAX}$	kW	21.4
Static force	F_0*	N	1850
Stall current	I_0*	A	9.32
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	198
Voltage constant	k_E	Vs/m	66
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	65.8
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	3.01
Phase inductance	L_{STR}	mH	38
Attraction force	F_A	N	11800
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	22.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	23.9
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.95
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.23
Pressure drop	$\Delta p_{P,H}$	bar	0.506
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0573

1FN3600-2WA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.839
Secondary section cooling data			
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.184
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0165
Pressure drop per combi distributor	Δp_{KV}	bar	0.113
Pressure drop per coupling point	Δp_{KS}	bar	0.12

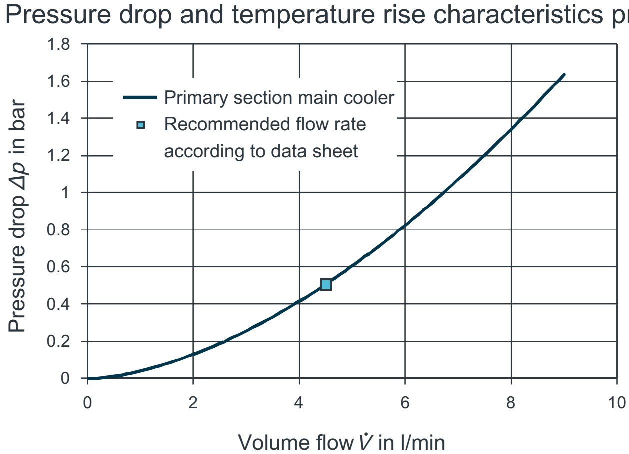
Characteristics for 1FN3600-2WA50-0xAx

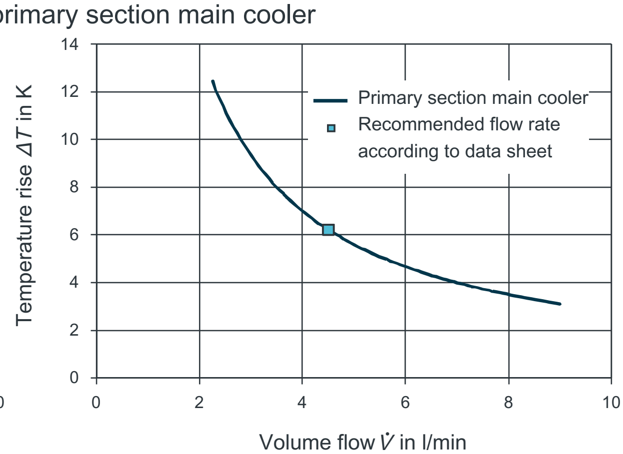
Force characteristics



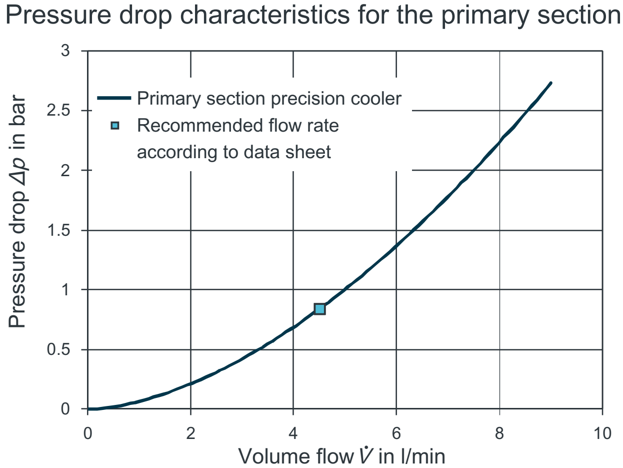


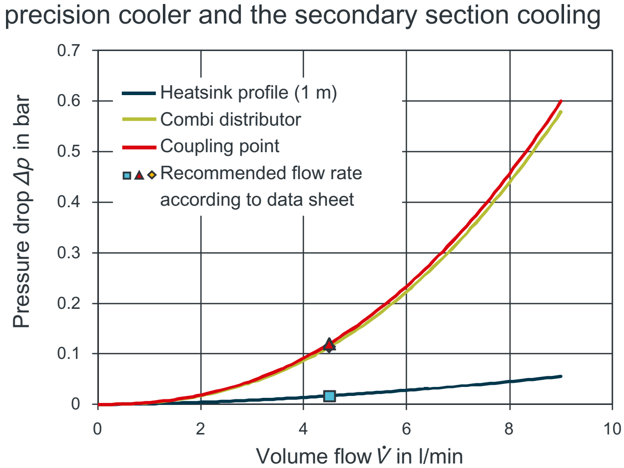
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





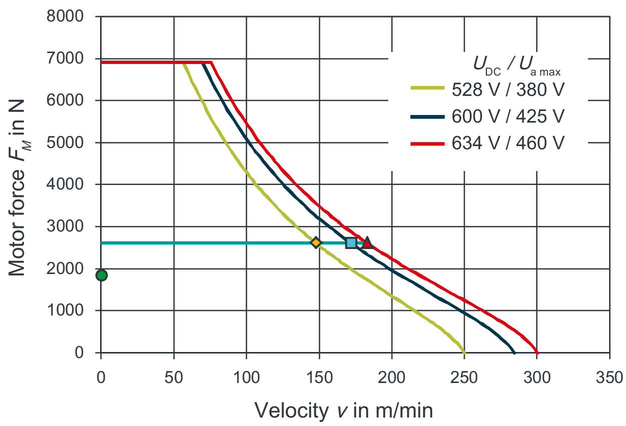
Data sheet of 1FN3600-2WB00-0xAx

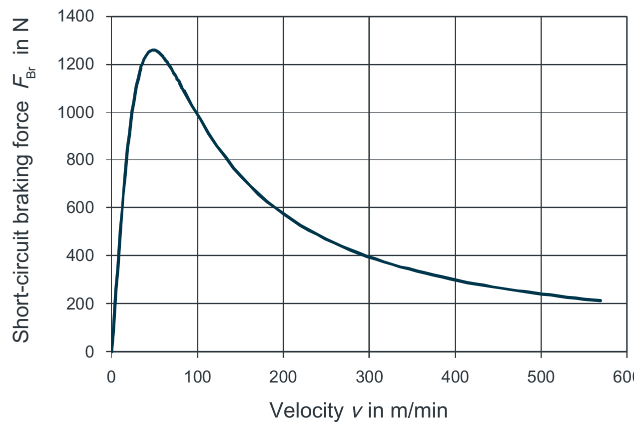
1FN3600-2WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2610
Rated current	I_N	A	16.8
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	172
Rated power loss	$P_{V,N}$	kW	2.18
Limit data			
Maximum force	F_{MAX}	N	6900
Maximum current	I_{MAX}	A	45.8
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	69.6
Maximum electric power drawn	$P_{EL,MAX}$	kW	24.1
Static force	F_0*	N	1850
Stall current	I_0*	A	11.9
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	155
Voltage constant	k_E	Vs/m	51.7
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	66
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.84
Phase inductance	L_{STR}	mH	23.3
Attraction force	F_A	N	11800
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	22.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	23.9
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.94
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.2
Pressure drop	$\Delta p_{P,H}$	bar	0.506
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.057
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.839
Secondary section cooling data			

1FN3600-2WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.183
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0165
Pressure drop per combi distributor	Δp_{KV}	bar	0.113
Pressure drop per coupling point	Δp_{KS}	bar	0.12

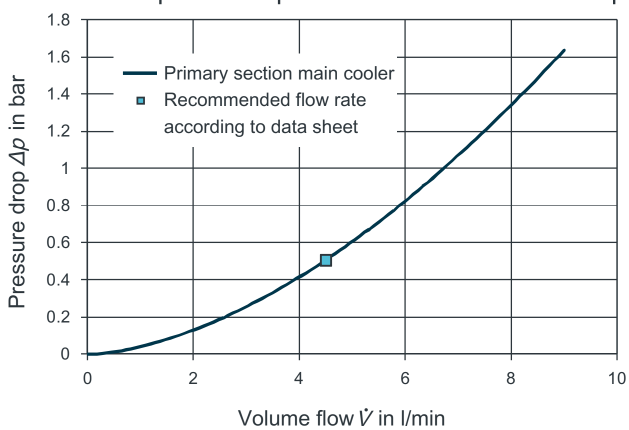
Characteristics for 1FN3600-2WB00-0xAx

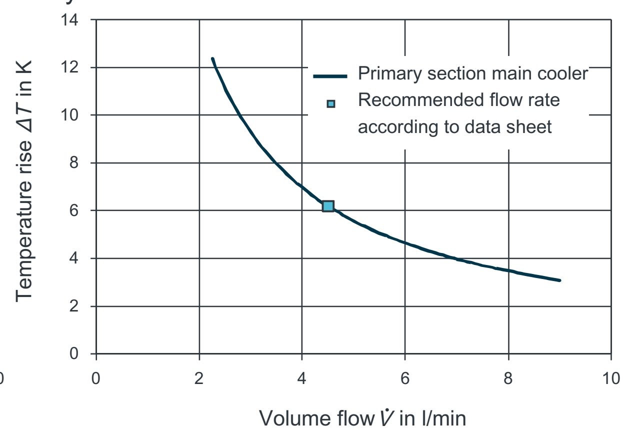
Force characteristics



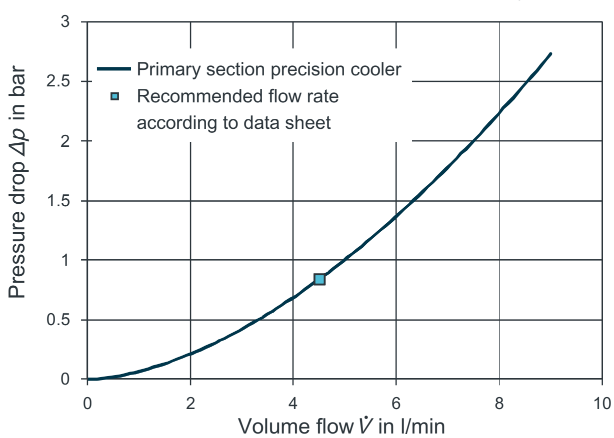


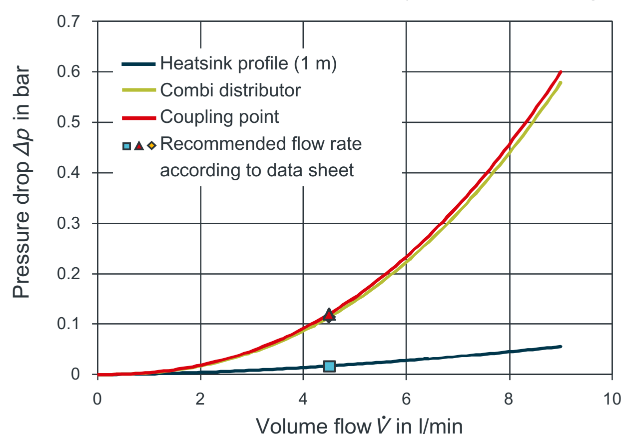
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





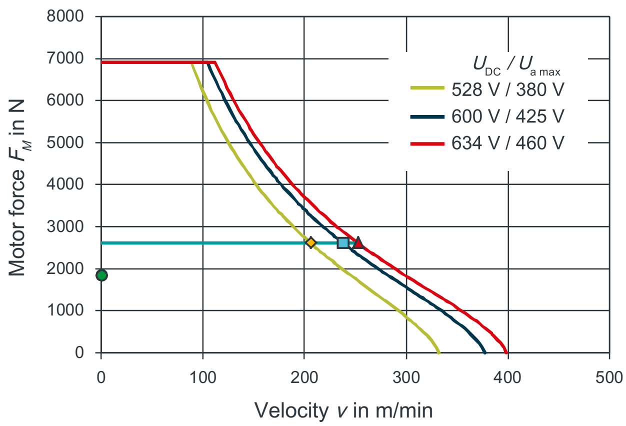
Data sheet of 1FN3600-2WB50-0xAx

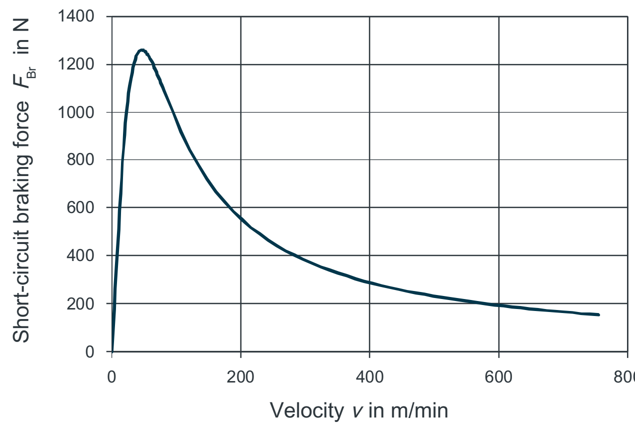
1FN3600-2WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_{N}	°C	120
Data at the rated point			
Rated force	F_{N}	N	2610
Rated current	I_{N}	A	22.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	238
Rated power loss	$P_{V,N}$	kW	2.09
Limit data			
Maximum force	F_{MAX}	N	6900
Maximum current	I_{MAX}	A	60.7
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	105
Maximum electric power drawn	$P_{EL,MAX}$	kW	27.5
Static force	F_{0}*	N	1850
Stall current	I_{0}*	A	15.8
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	117
Voltage constant	k_{E}	Vs/m	38.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	67.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1
Phase inductance	L_{STR}	mH	13.2
Attraction force	F_{A}	N	11800
Thermal time constant	t_{TH}	s	120
Pole width	τ_{M}	mm	23
Mass of the primary section	m_{P}	kg	22.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	23.9
Mass of a secondary section	m_{S}	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.86
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.96
Pressure drop	$\Delta p_{P,H}$	bar	0.506
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0548
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.839
Secondary section cooling data			

1FN3600-2WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.176
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0165
Pressure drop per combi distributor	Δp_{KV}	bar	0.113
Pressure drop per coupling point	Δp_{KS}	bar	0.12

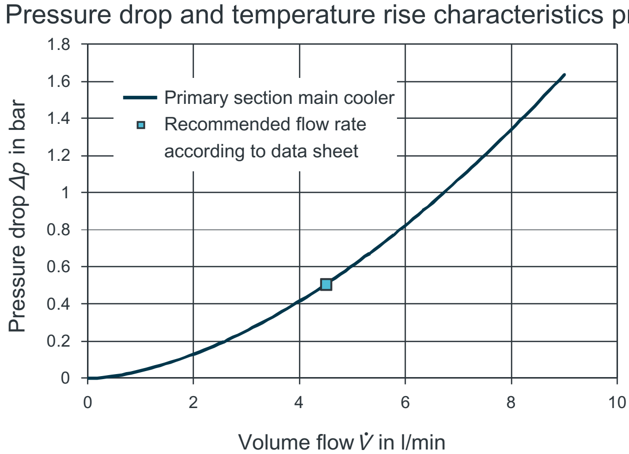
Characteristics of 1FN3600-2WB50-0xAx

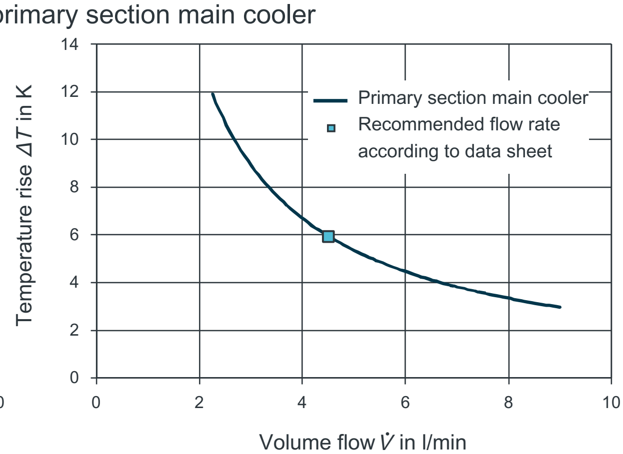
Force characteristics



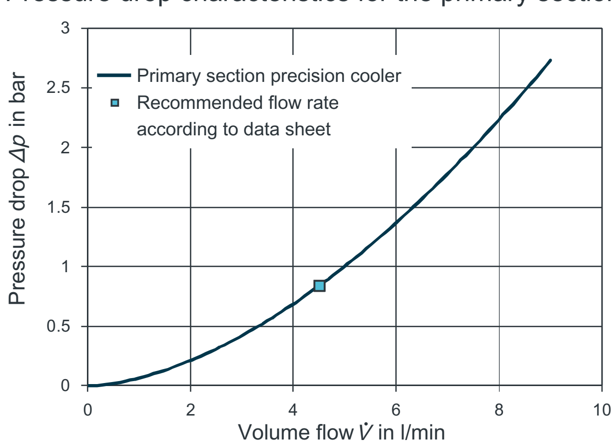


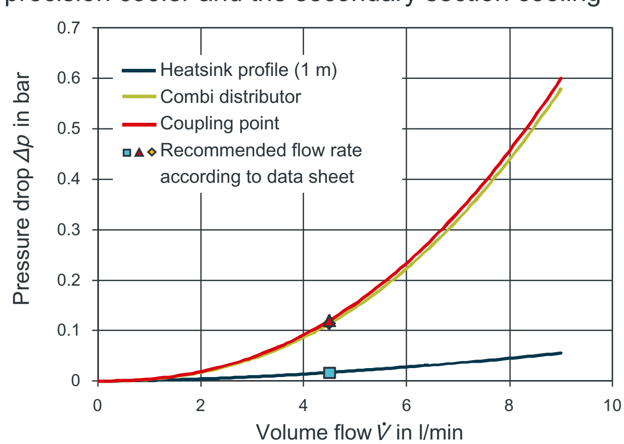
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





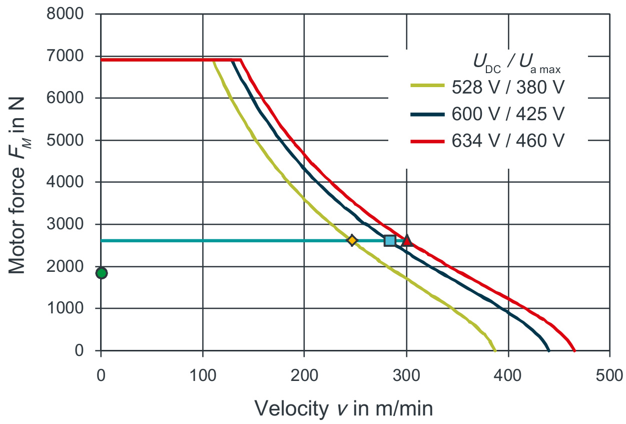
Data sheet of 1FN3600-2WC00-0xAx

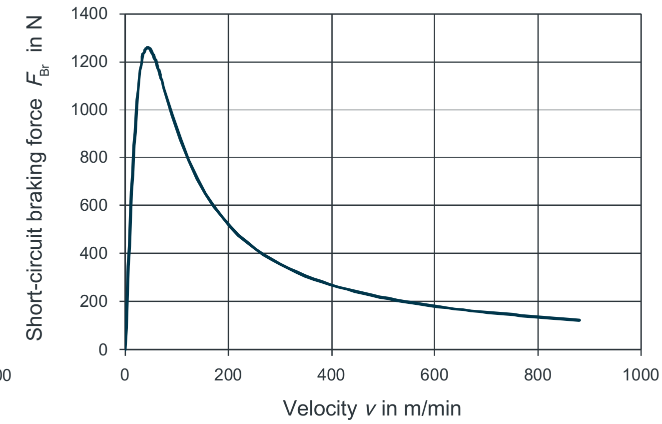
1FN3600-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	2610
Rated current	I_N	A	26.1
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	283
Rated power loss	$P_{V,N}$	kW	1.95
Limit data			
Maximum force	F_{MAX}	N	6900
Maximum current	I_{MAX}	A	70.9
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	128
Maximum electric power drawn	$P_{EL,MAX}$	kW	29.2
Static force	F_0*	N	1850
Stall current	I_0*	A	18.4
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	100
Voltage constant	k_E	Vs/m	33.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	69.7
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.689
Phase inductance	L_{STR}	mH	9.72
Attraction force	F_A	N	11800
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	22.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	23.9
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.74
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.56
Pressure drop	$\Delta p_{P,H}$	bar	0.506
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0511
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.839
Secondary section cooling data			

1FN3600-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.164
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0165
Pressure drop per combi distributor	Δp_{KV}	bar	0.113
Pressure drop per coupling point	Δp_{KS}	bar	0.12

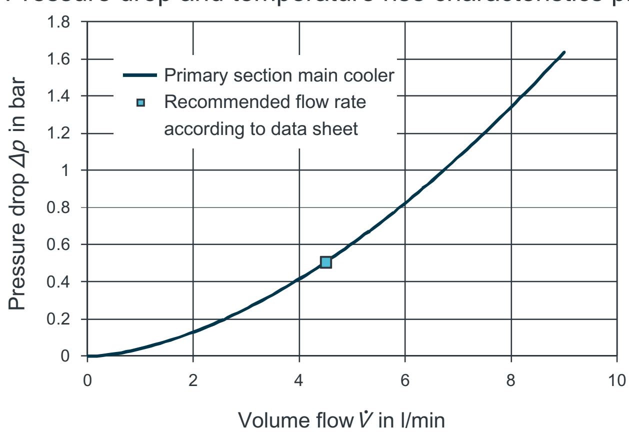
Characteristics of 1FN3600-2WC00-0xAx

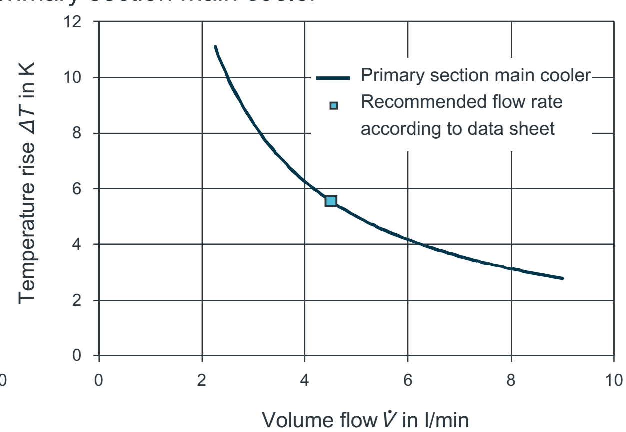
Force characteristics



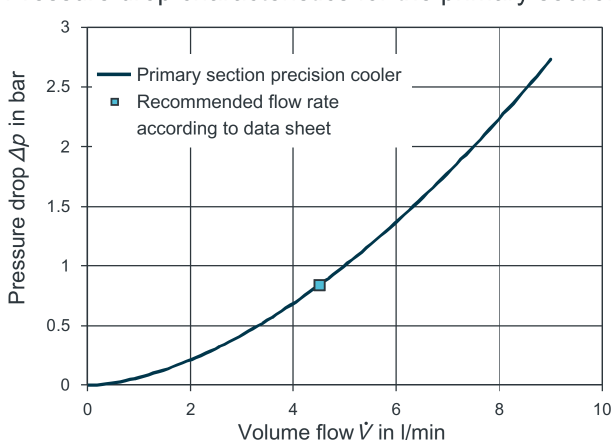


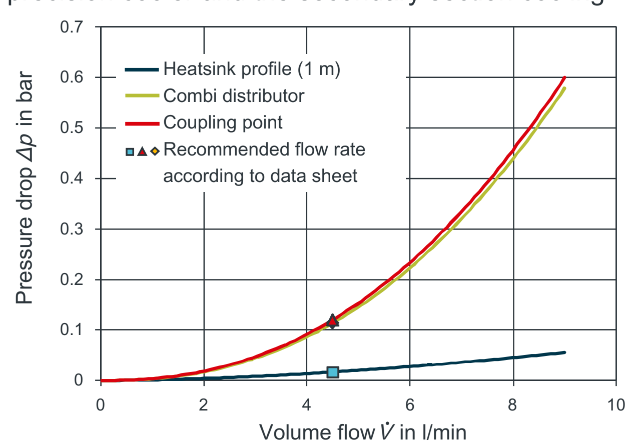
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





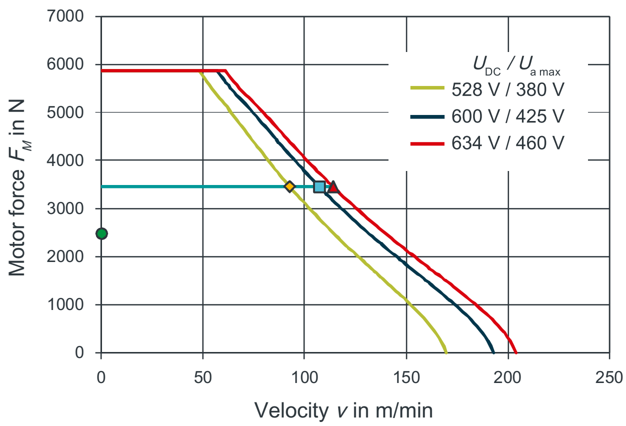
Data sheet of 1FN3600-2NB00-0xAx

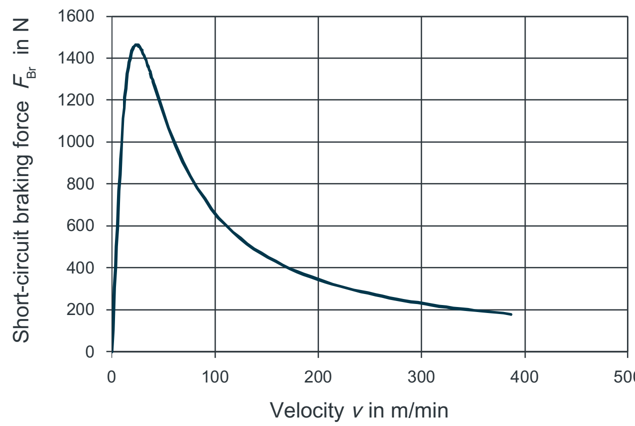
1FN3600-2NB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3460
Rated current	I_N	A	16.2
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	107
Rated power loss	$P_{V,N}$	kW	1.86
Limit data			
Maximum force	F_{MAX}	N	5870
Maximum current	I_{MAX}	A	34.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	56.8
Maximum electric power drawn	$P_{EL,MAX}$	kW	13.8
Static force	F_0*	N	2490
Stall current	I_0*	A	11.5
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	217
Voltage constant	k_E	Vs/m	72.3
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	96.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.69
Phase inductance	L_{STR}	mH	43.5
Attraction force	F_A	N	11600
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	30.4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	32
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.65
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.27
Pressure drop	$\Delta p_{P,H}$	bar	0.489
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0488
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.829
Secondary section cooling data			

1FN3600-2NB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.164
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0165
Pressure drop per combi distributor	Δp_{KV}	bar	0.113
Pressure drop per coupling point	Δp_{KS}	bar	0.12

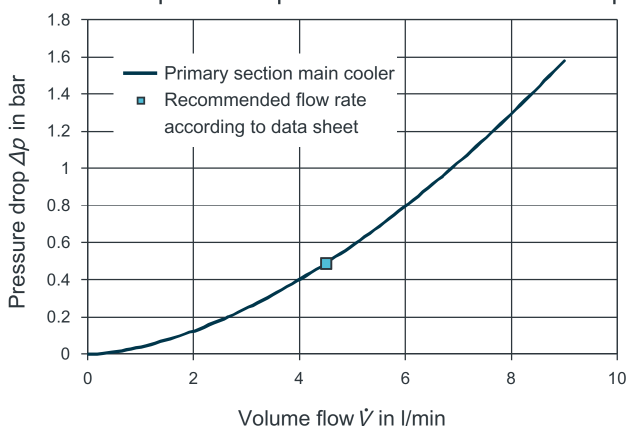
Characteristics of 1FN3600-2NB00-0xAx

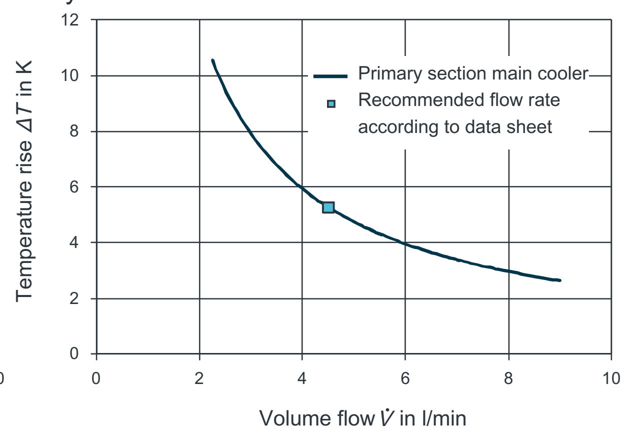
Force characteristics



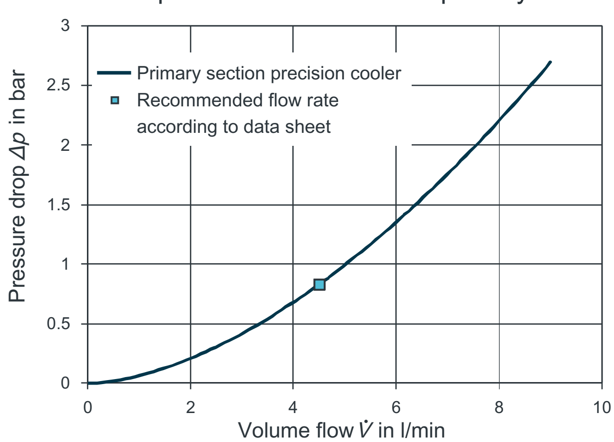


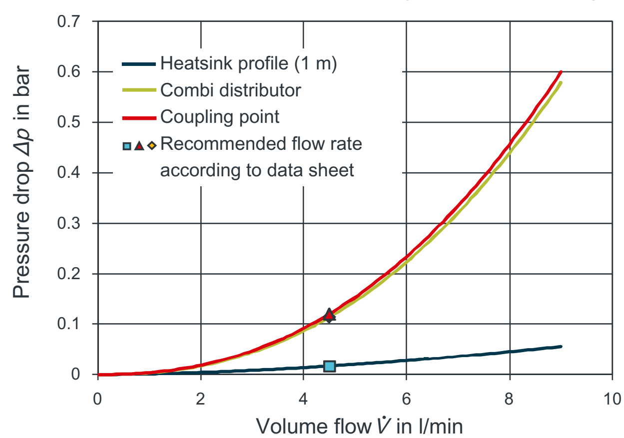
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





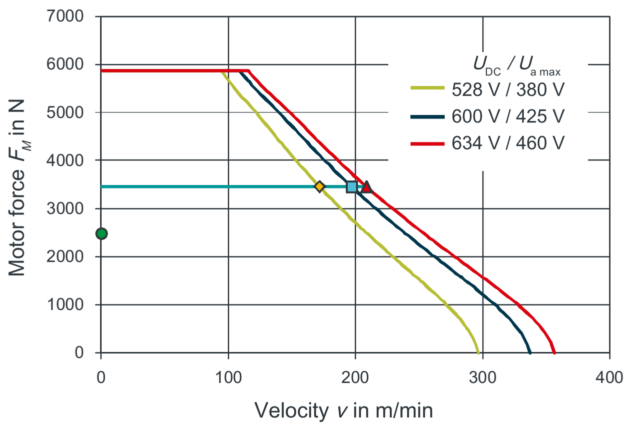
Data sheet of 1FN3600-2NB80-0xAx

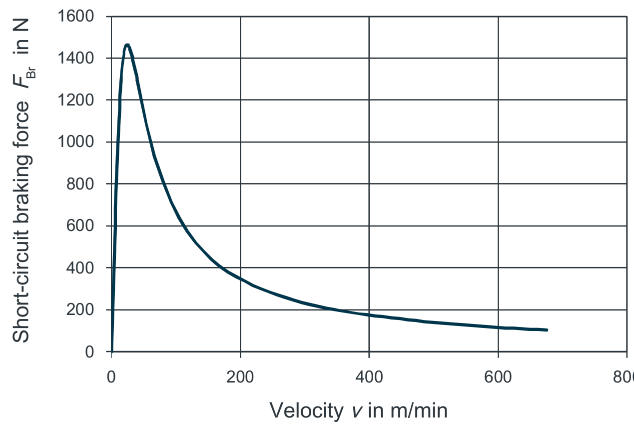
1FN3600-2NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3460
Rated current	I_N	A	28.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	197
Rated power loss	$P_{V,N}$	kW	1.87
Limit data			
Maximum force	F_{MAX}	N	5870
Maximum current	I_{MAX}	A	59.6
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	109
Maximum electric power drawn	$P_{EL,MAX}$	kW	18.9
Static force	F_0*	N	2490
Stall current	I_0*	A	20.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	124
Voltage constant	k_E	Vs/m	41.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	96
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.557
Phase inductance	L_{STR}	mH	14.2
Attraction force	F_A	N	11600
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	30.4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	32
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.66
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.3
Pressure drop	$\Delta p_{P,H}$	bar	0.489
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0491
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.829
Secondary section cooling data			

1FN3600-2NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.165
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0165
Pressure drop per combi distributor	Δp_{KV}	bar	0.113
Pressure drop per coupling point	Δp_{KS}	bar	0.12

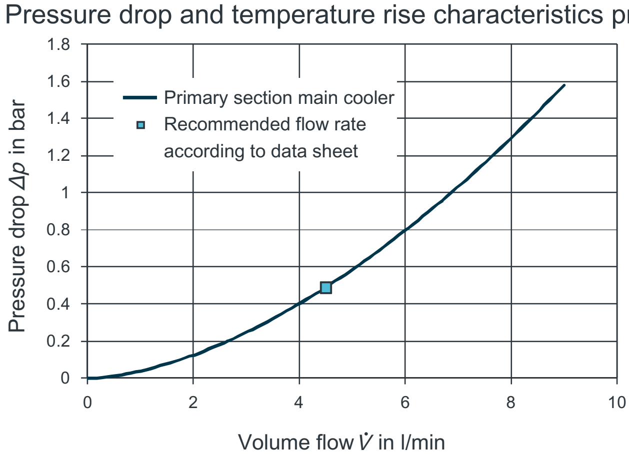
Characteristics for 1FN3600-2NB80-0xAx

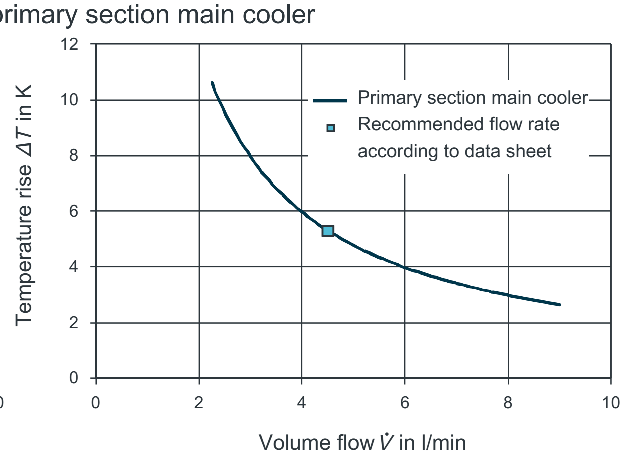
Force characteristics



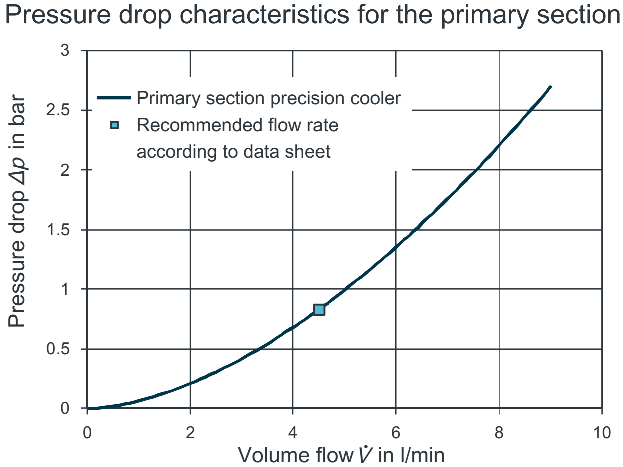


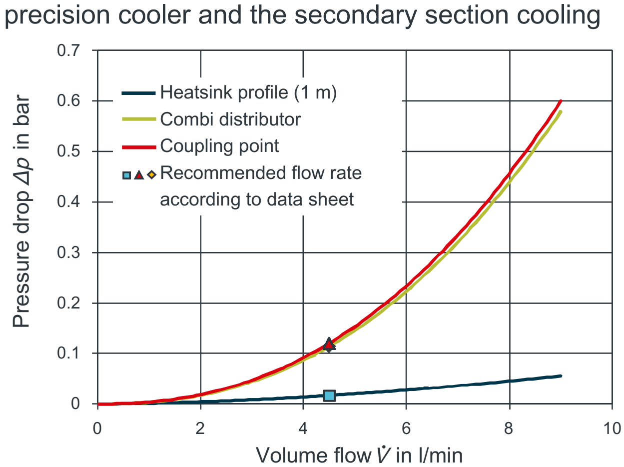
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





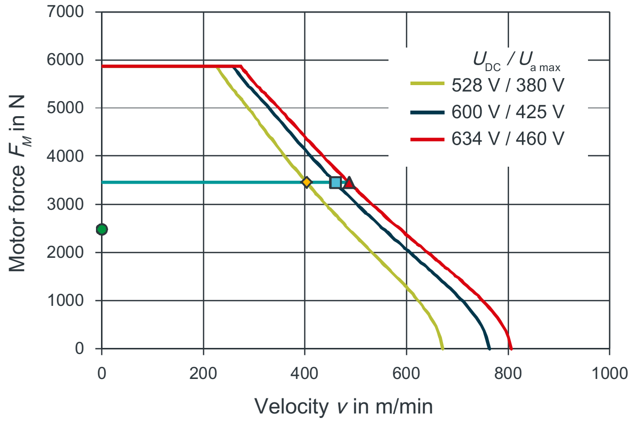
Data sheet of 1FN3600-2NE50-0xAx

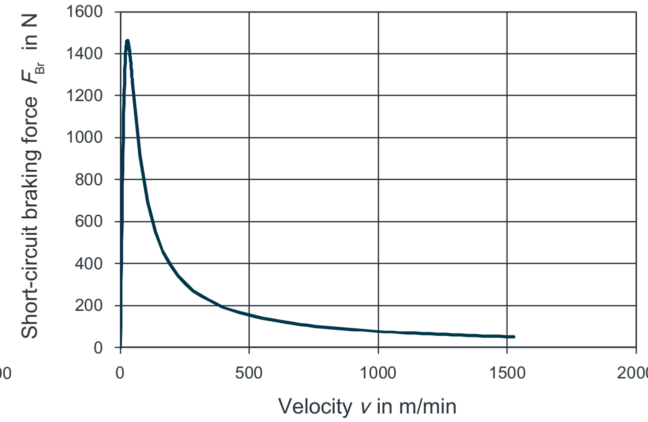
1FN3600-2NE50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3460
Rated current	I_N	A	64.2
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	460
Rated power loss	$P_{V,N}$	kW	2.06
Limit data			
Maximum force	F_{MAX}	N	5870
Maximum current	I_{MAX}	A	135
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	259
Maximum electric power drawn	$P_{EL,MAX}$	kW	34.4
Static force	F_0*	N	2490
Stall current	I_0*	A	45.4
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	54.9
Voltage constant	k_E	Vs/m	18.3
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	91.5
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.12
Phase inductance	L_{STR}	mH	2.78
Attraction force	F_A	N	11600
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	30.4
Mass of the primary section with precision cooler	$m_{P,P}$	kg	32
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	1.83
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	4.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	5.85
Pressure drop	$\Delta p_{P,H}$	bar	0.489
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0541
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	4.5
Pressure drop	$\Delta p_{P,P}$	bar	0.829
Secondary section cooling data			

1FN3600-2NE50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.181
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	4.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0165
Pressure drop per combi distributor	Δp_{KV}	bar	0.113
Pressure drop per coupling point	Δp_{KS}	bar	0.12

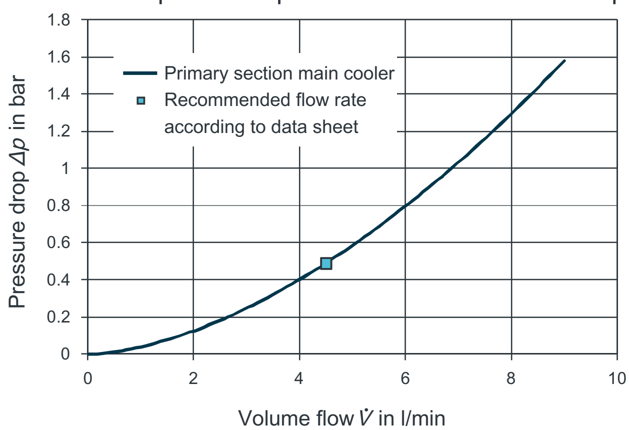
Characteristics of 1FN3600-2NE50-0xAx

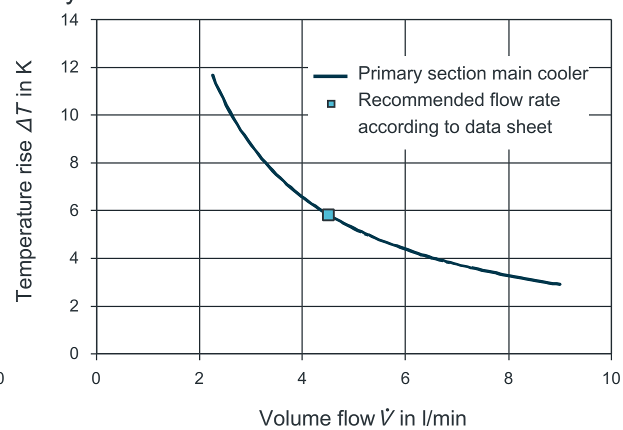
Force characteristics



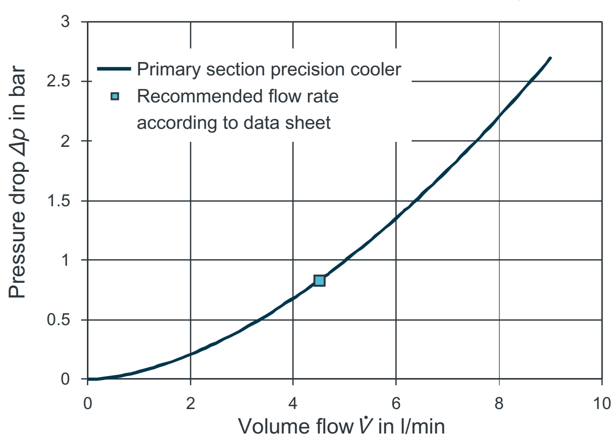


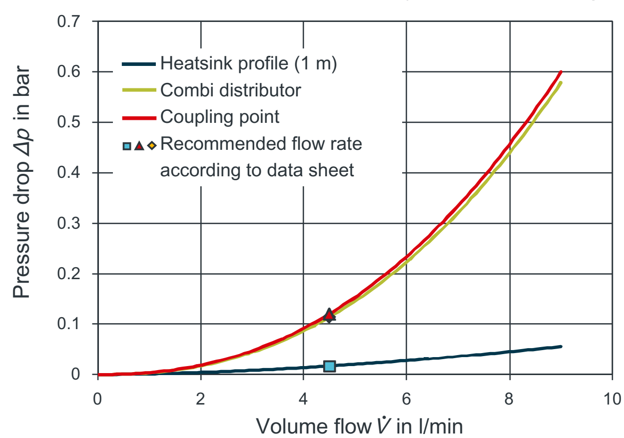
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





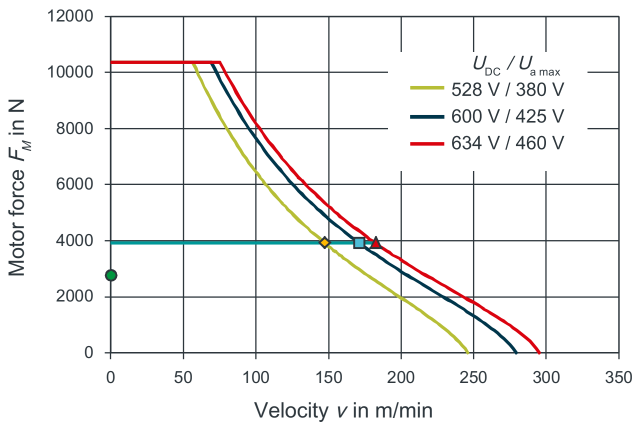
Data sheet of 1FN3600-3WB00-0xAx

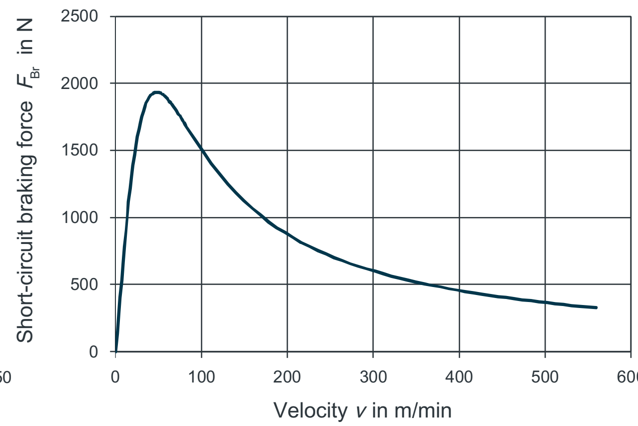
1FN3600-3WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3920
Rated current	I_N	A	24.8
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	171
Rated power loss	$P_{V,N}$	kW	3.15
Limit data			
Maximum force	F_{MAX}	N	10300
Maximum current	I_{MAX}	A	68.2
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	69.4
Maximum electric power drawn	$P_{EL,MAX}$	kW	35.8
Static force	F_0*	N	2770
Stall current	I_0*	A	17.5
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	158
Voltage constant	k_E	Vs/m	52.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	82.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.22
Phase inductance	L_{STR}	mH	15.7
Attraction force	F_A	N	17600
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	33.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	35.4
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.8
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	7.33
Pressure drop	$\Delta p_{P,H}$	bar	1.02
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0825
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5.5
Pressure drop	$\Delta p_{P,P}$	bar	1.54
Secondary section cooling data			

1FN3600-3WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.265
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0234
Pressure drop per combi distributor	Δp_{KV}	bar	0.182
Pressure drop per coupling point	Δp_{KS}	bar	0.191

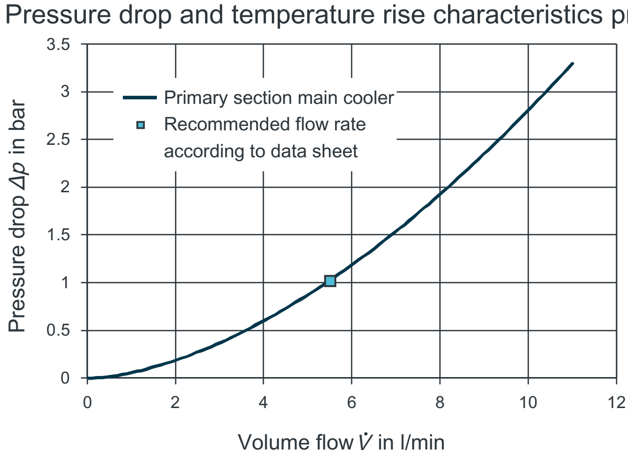
Characteristics for 1FN3600-3WB00-0xAx

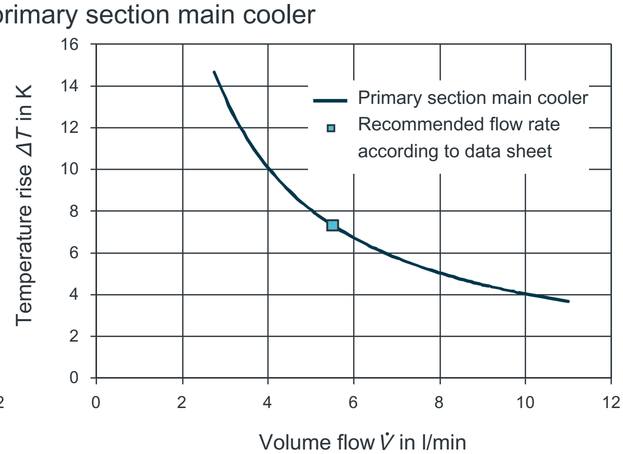
Force characteristics



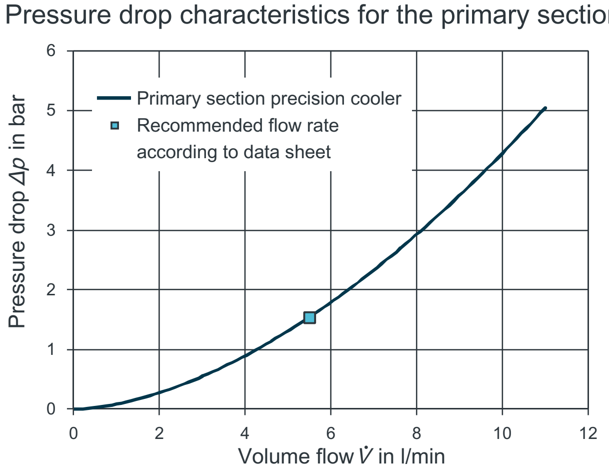


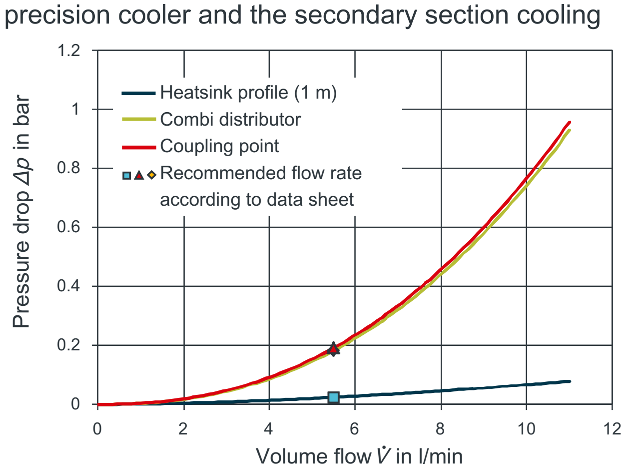
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





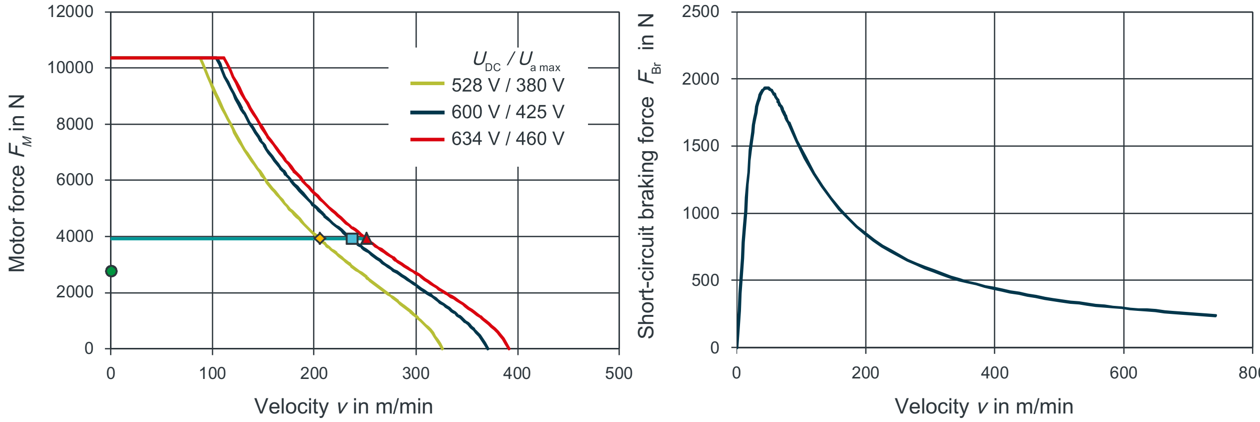
Data sheet of 1FN3600-3WB50-0xAx

1FN3600-3WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3920
Rated current	I_N	A	32.9
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	237
Rated power loss	$P_{V,N}$	kW	3.03
Limit data			
Maximum force	F_{MAX}	N	10300
Maximum current	I_{MAX}	A	90.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	104
Maximum electric power drawn	$P_{EL,MAX}$	kW	40.8
Static force	F_0*	N	2770
Stall current	I_0*	A	23.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	119
Voltage constant	k_E	Vs/m	39.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	83.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.669
Phase inductance	L_{STR}	mH	8.92
Attraction force	F_A	N	17600
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	33.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	35.4
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with cooling profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.7
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	7.05
Pressure drop	$\Delta p_{P,H}$	bar	1.02
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0793
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5.5
Pressure drop	$\Delta p_{P,P}$	bar	1.54
Secondary section cooling data			

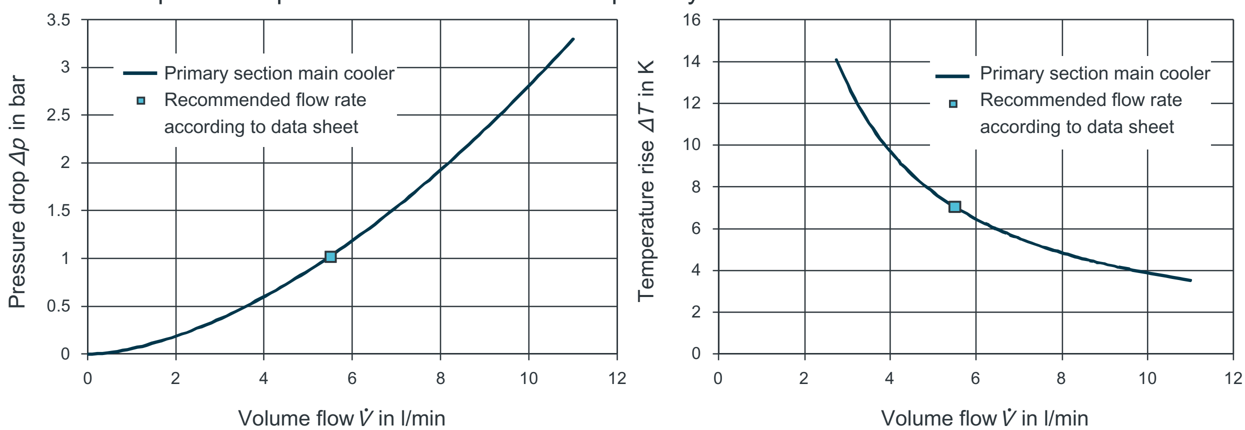
1FN3600-3WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.255
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5.5
Pressure drop per meter of cooling profile	Δp_{S}	bar	0.0234
Pressure drop per combi distributor	Δp_{KV}	bar	0.182
Pressure drop per coupling point	Δp_{KS}	bar	0.191

Characteristics of 1FN3600-3WB50-0xAx

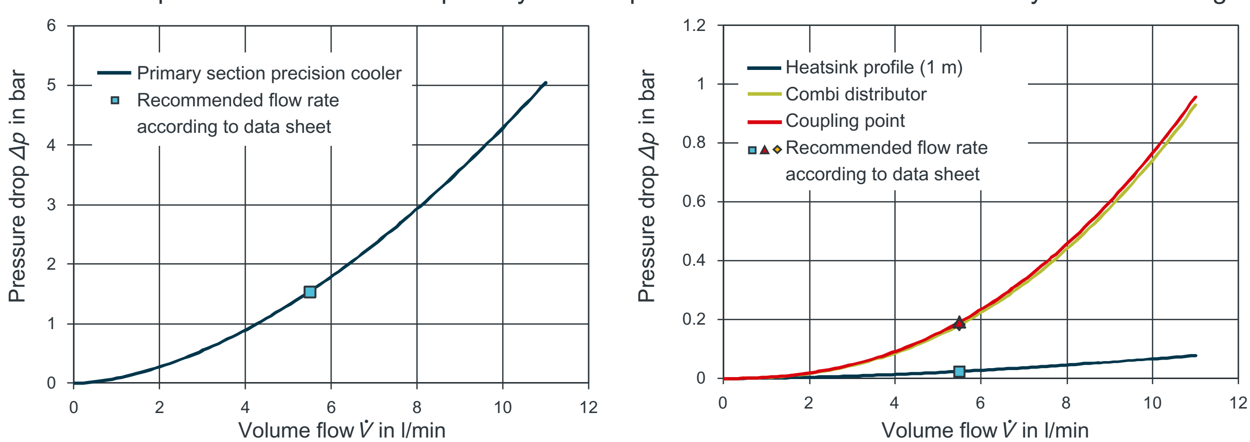
Force characteristics



Pressure drop and temperature rise characteristics primary section main cooler



Pressure drop characteristics for the primary section precision cooler and the secondary section cooling



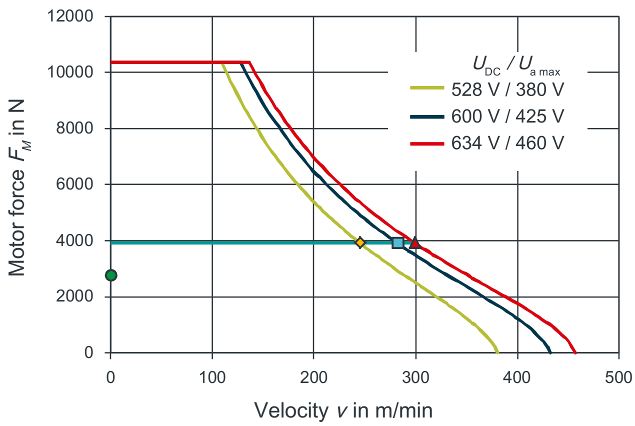
Data sheet of 1FN3600-3WC00-0xAx

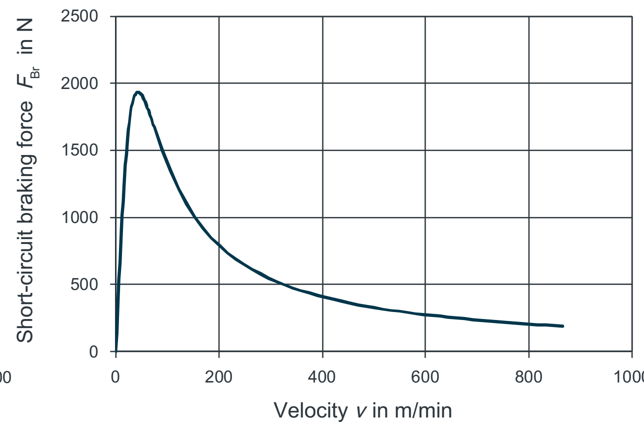
1FN3600-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	3920
Rated current	I_N	A	38.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	282
Rated power loss	$P_{V,N}$	kW	2.83
Limit data			
Maximum force	F_{MAX}	N	10300
Maximum current	I_{MAX}	A	106
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	128
Maximum electric power drawn	$P_{EL,MAX}$	kW	43.4
Static force	F_0*	N	2770
Stall current	I_0*	A	27.2
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	102
Voltage constant	k_E	Vs/m	34
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	86.9
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.458
Phase inductance	L_{STR}	mH	6.55
Attraction force	F_A	N	17600
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	33.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	35.4
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.51
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.58
Pressure drop	$\Delta p_{P,H}$	bar	1.02
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.074
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5.5
Pressure drop	$\Delta p_{P,P}$	bar	1.54
Secondary section cooling data			

1FN3600-3WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.237
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0234
Pressure drop per combi distributor	Δp_{KV}	bar	0.182
Pressure drop per coupling point	Δp_{KS}	bar	0.191

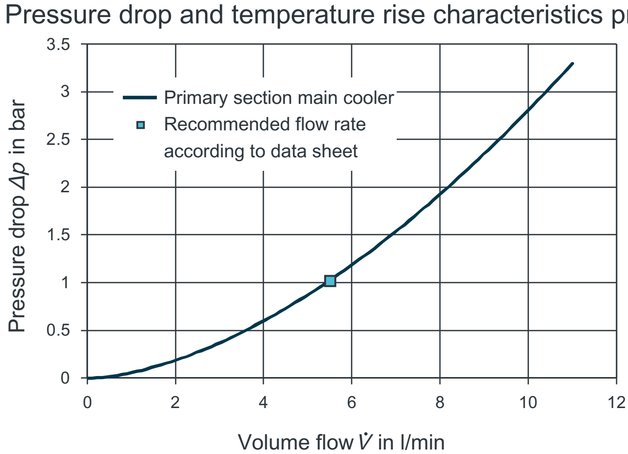
Characteristics for 1FN3600-3WC00-0xAx

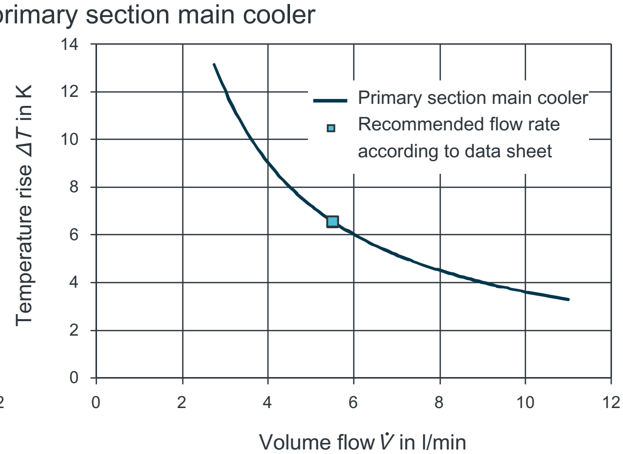
Force characteristics



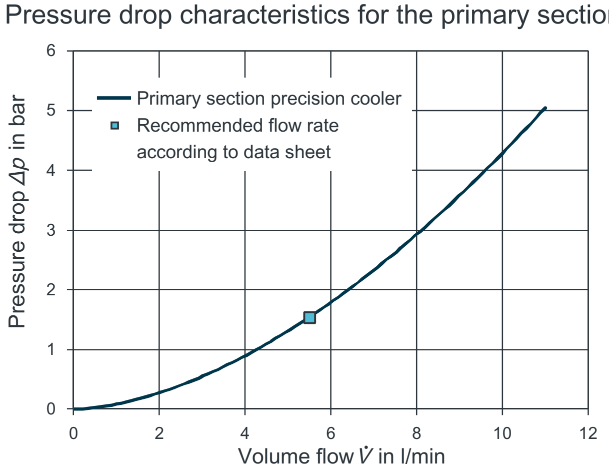


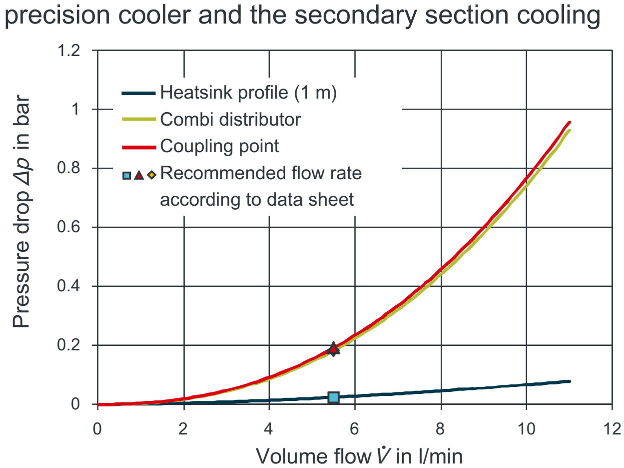
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





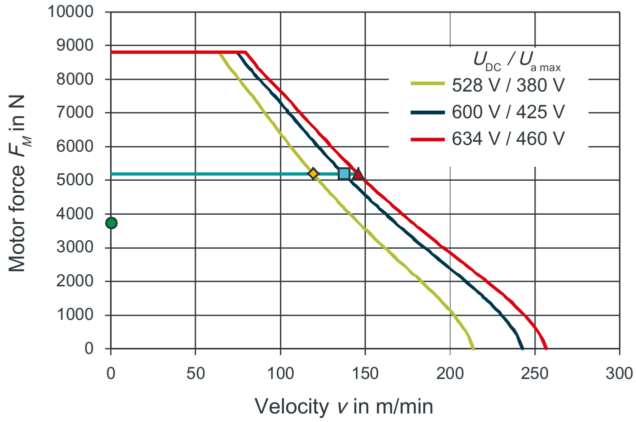
Data sheet of 1FN3600-3NB00-0xAx

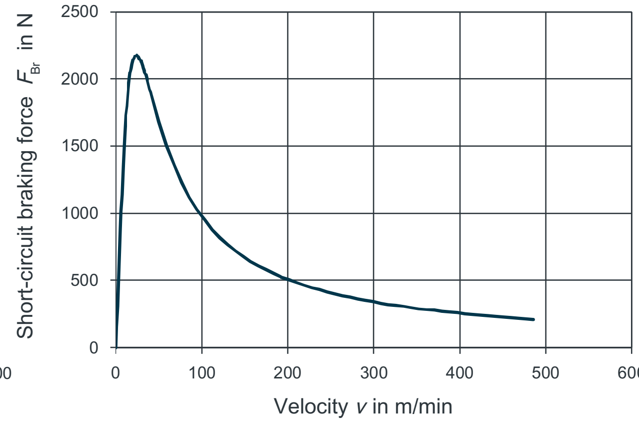
1FN3600-3NB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5190
Rated current	I_N	A	30.6
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	137
Rated power loss	$P_{V,N}$	kW	2.8
Limit data			
Maximum force	F_{MAX}	N	8810
Maximum current	I_{MAX}	A	64.4
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	74.3
Maximum electric power drawn	$P_{EL,MAX}$	kW	23.3
Static force	F_0*	N	3730
Stall current	I_0*	A	21.7
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	173
Voltage constant	k_E	Vs/m	57.5
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	118
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.715
Phase inductance	L_{STR}	mH	18.5
Attraction force	F_A	N	17300
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	44.3
Mass of the primary section with precision cooler	$m_{P,P}$	kg	46.4
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.48
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.49
Pressure drop	$\Delta p_{P,H}$	bar	0.988
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0734
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5.5
Pressure drop	$\Delta p_{P,P}$	bar	1.52
Secondary section cooling data			

1FN3600-3NB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.246
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0234
Pressure drop per combi distributor	Δp_{KV}	bar	0.182
Pressure drop per coupling point	Δp_{KS}	bar	0.191

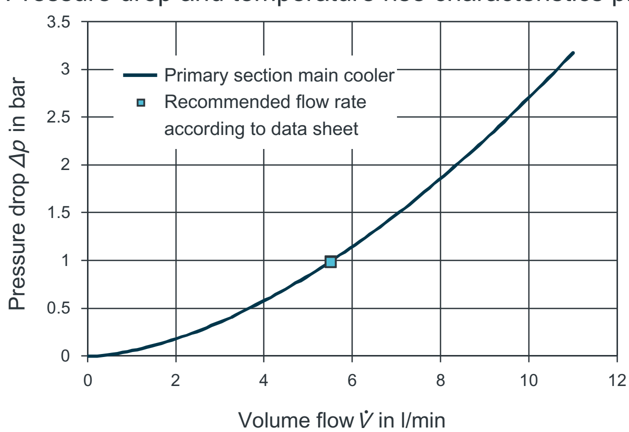
Characteristics of 1FN3600-3NB00-0xAx

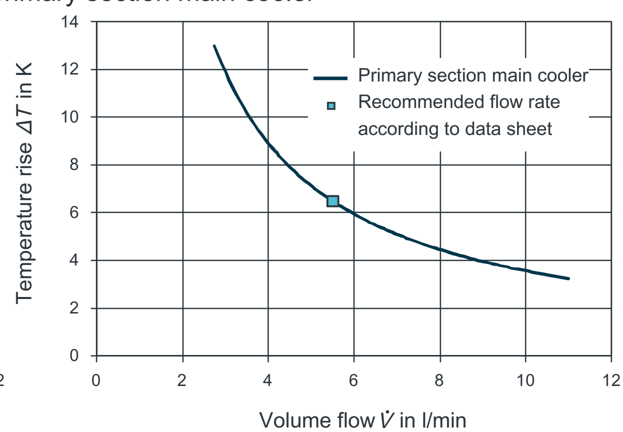
Force characteristics



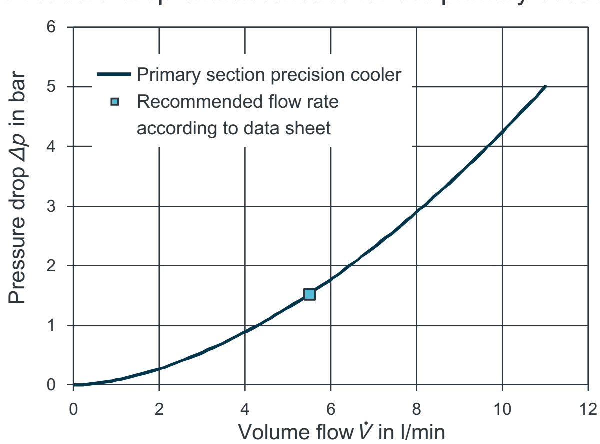


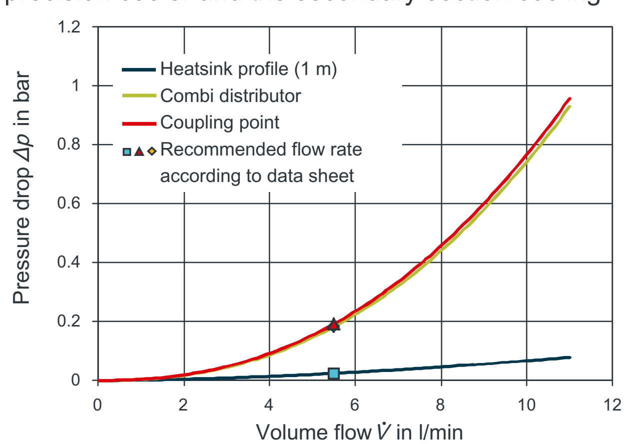
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





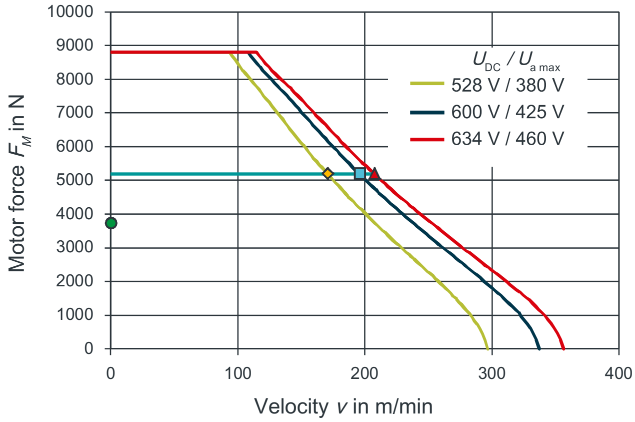
Data sheet of 1FN3600-3NB80-0xAx

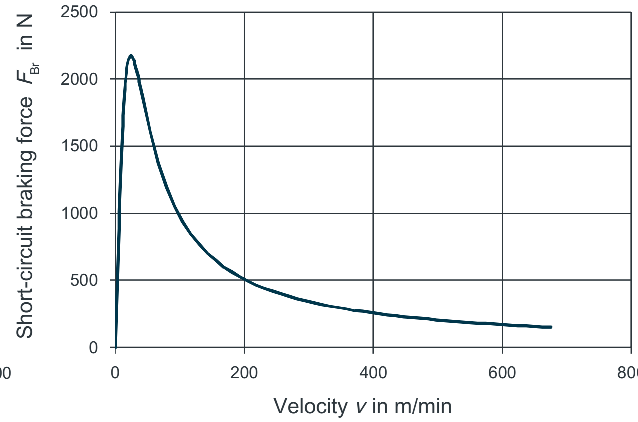
1FN3600-3NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5190
Rated current	I_N	A	42.5
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	196
Rated power loss	$P_{V,N}$	kW	2.8
Limit data			
Maximum force	F_{MAX}	N	8810
Maximum current	I_{MAX}	A	89.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	108
Maximum electric power drawn	$P_{EL,MAX}$	kW	28.2
Static force	F_0*	N	3730
Stall current	I_0*	A	30.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	124
Voltage constant	k_E	Vs/m	41.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	118
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.371
Phase inductance	L_{STR}	mH	9.59
Attraction force	F_A	N	17300
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	44.3
Mass of the primary section with precision cooler	$m_{P,P}$	kg	46.4
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.48
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.5
Pressure drop	$\Delta p_{P,H}$	bar	0.988
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0735
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5.5
Pressure drop	$\Delta p_{P,P}$	bar	1.52
Secondary section cooling data			

1FN3600-3NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.246
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0234
Pressure drop per combi distributor	Δp_{KV}	bar	0.182
Pressure drop per coupling point	Δp_{KS}	bar	0.191

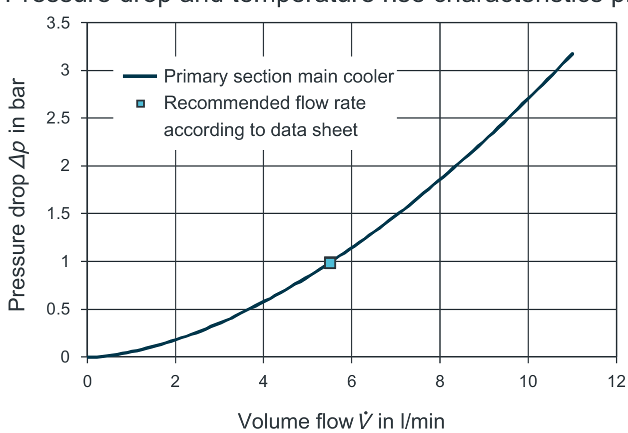
Characteristics for 1FN3600-3NB80-0xAx

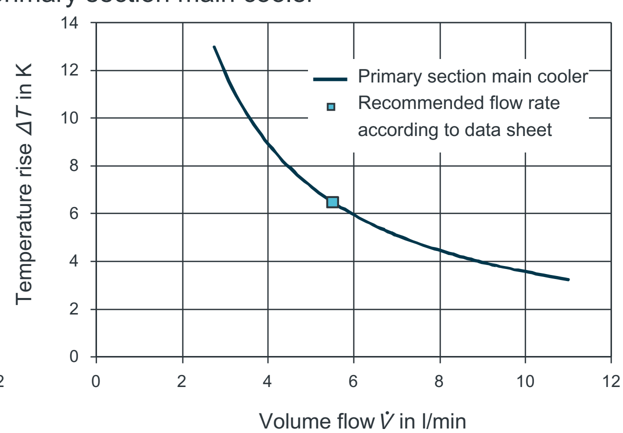
Force characteristics



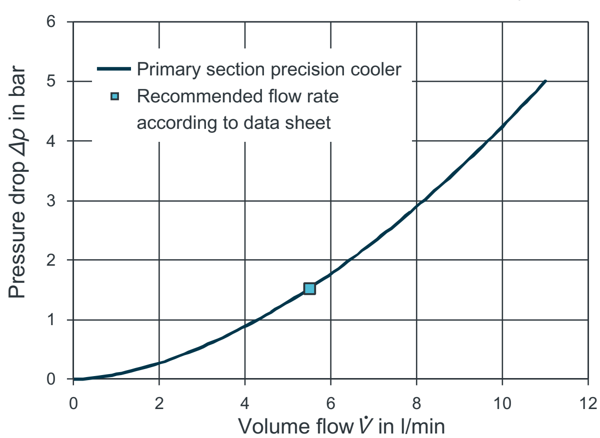


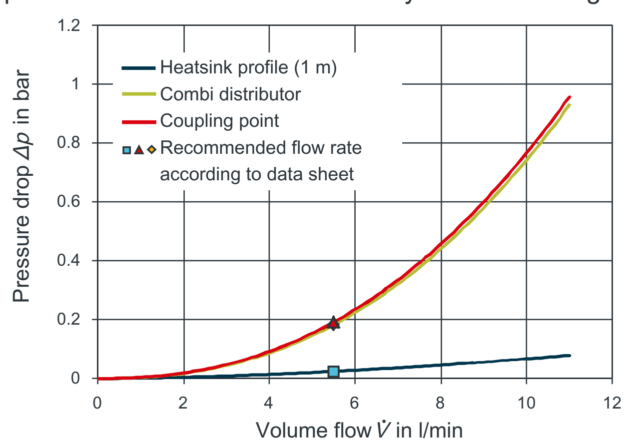
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





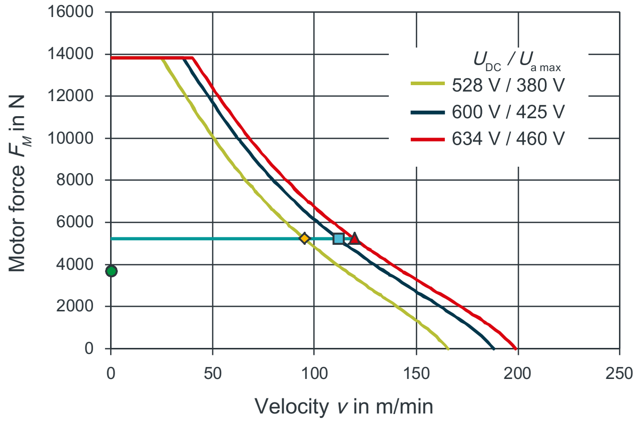
Data sheet of 1FN3600-4WA30-0xAx

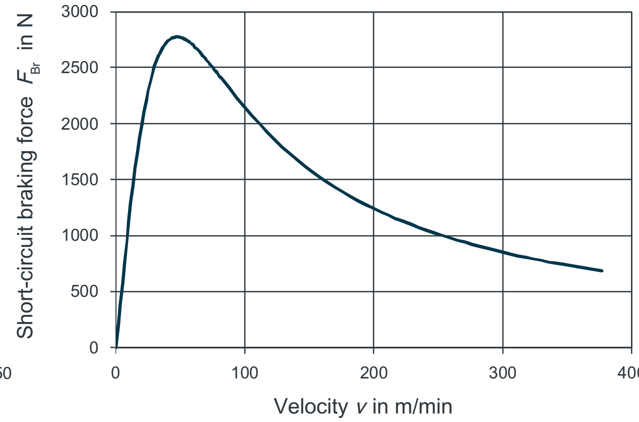
1FN3600-4WA30-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5220
Rated current	I_N	A	22.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	112
Rated power loss	$P_{V,N}$	kW	3.86
Limit data			
Maximum force	F_{MAX}	N	13800
Maximum current	I_{MAX}	A	63.7
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	35.5
Maximum electric power drawn	$P_{EL,MAX}$	kW	39.7
Static force	F_0*	N	3690
Stall current	I_0*	A	15.8
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	234
Voltage constant	k_E	Vs/m	78.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	99.1
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.86
Phase inductance	L_{STR}	mH	24.1
Attraction force	F_A	N	23500
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	43
Mass of the primary section with precision cooler	$m_{P,P}$	kg	45.5
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	3.44
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6
Temperature increase of the coolant	$\Delta T_{P,H}$	K	8.24
Pressure drop	$\Delta p_{P,H}$	bar	1.55
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.101
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6
Pressure drop	$\Delta p_{P,P}$	bar	2.21
Secondary section cooling data			

1FN3600-4WA30-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.325
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0272
Pressure drop per combi distributor	Δp_{KV}	bar	0.223
Pressure drop per coupling point	Δp_{KS}	bar	0.234

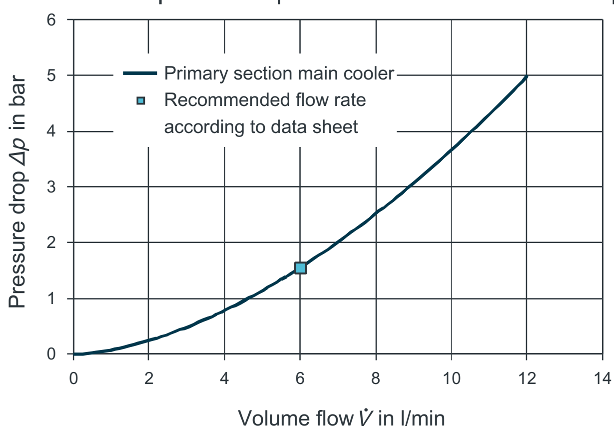
Characteristics for 1FN3600-4WA30-0xAx

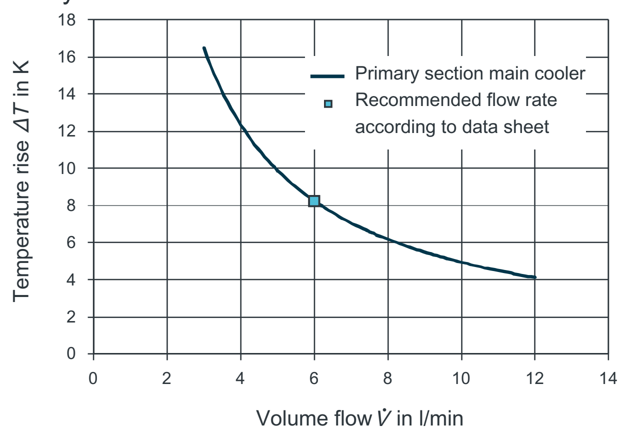
Force characteristics



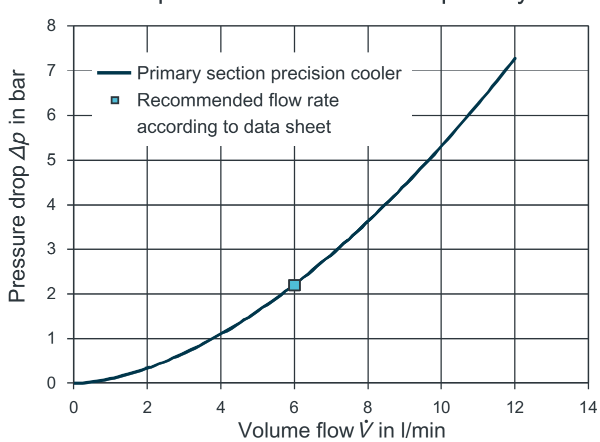


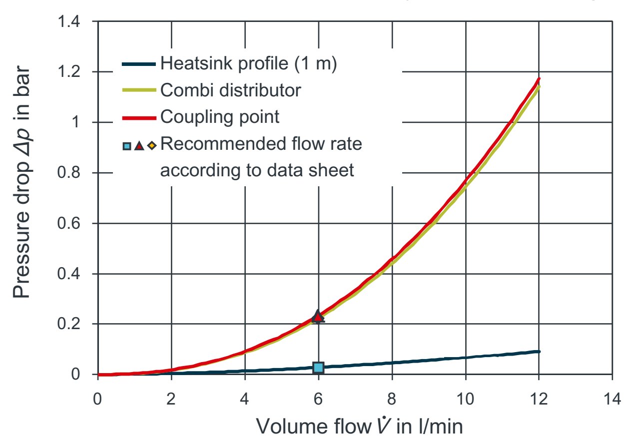
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





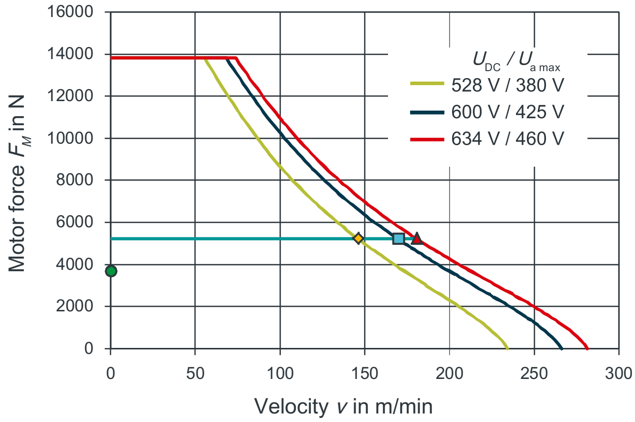
Data sheet of 1FN3600-4WB00-0xAx

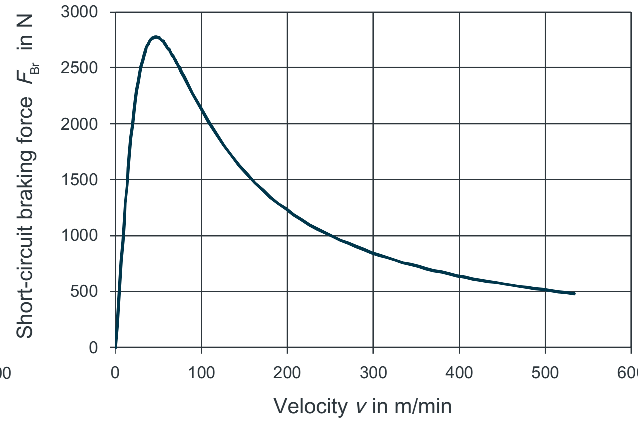
1FN3600-4WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5220
Rated current	I_N	A	31.5
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	170
Rated power loss	$P_{V,N}$	kW	3.82
Limit data			
Maximum force	F_{MAX}	N	13800
Maximum current	I_{MAX}	A	90.1
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	68.1
Maximum electric power drawn	$P_{EL,MAX}$	kW	46.8
Static force	F_0*	N	3690
Stall current	I_0*	A	22.3
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	165
Voltage constant	k_E	Vs/m	55.2
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	99.7
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.918
Phase inductance	L_{STR}	mH	12
Attraction force	F_A	N	23500
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	43
Mass of the primary section with precision cooler	$m_{P,P}$	kg	45.5
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	3.4
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6
Temperature increase of the coolant	$\Delta T_{P,H}$	K	8.14
Pressure drop	$\Delta p_{P,H}$	bar	1.55
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0999
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6
Pressure drop	$\Delta p_{P,P}$	bar	2.21
Secondary section cooling data			

1FN3600-4WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.321
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0272
Pressure drop per combi distributor	Δp_{KV}	bar	0.223
Pressure drop per coupling point	Δp_{KS}	bar	0.234

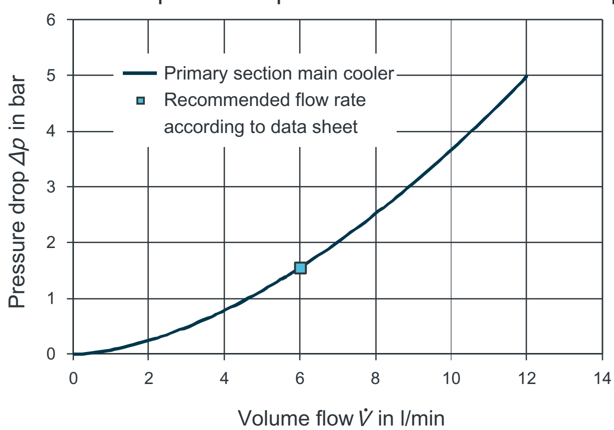
Characteristics for 1FN3600-4WB00-0xAx

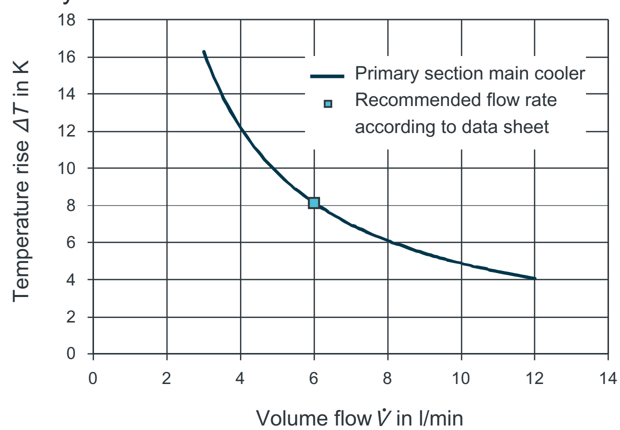
Force characteristics



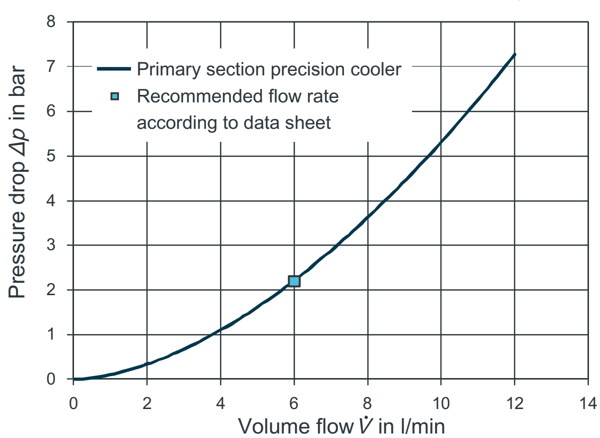


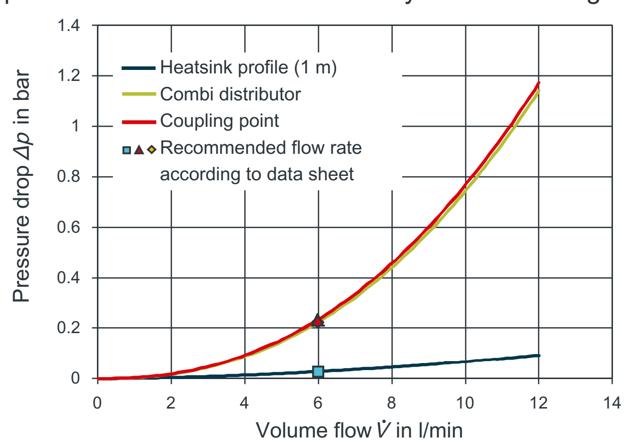
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





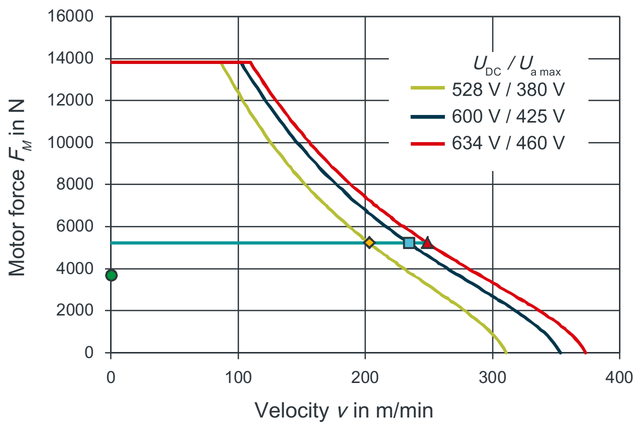
Data sheet of 1FN3600-4WB50-0xAx

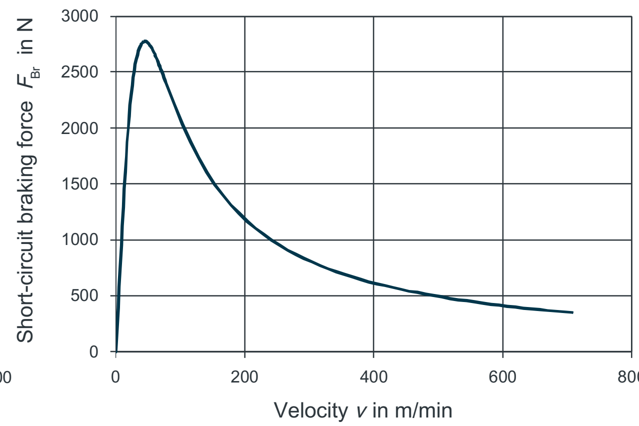
1FN3600-4WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5220
Rated current	I_N	A	41.8
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	234
Rated power loss	$P_{V,N}$	kW	3.67
Limit data			
Maximum force	F_{MAX}	N	13800
Maximum current	I_{MAX}	A	120
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	102
Maximum electric power drawn	$P_{EL,MAX}$	kW	53.4
Static force	F_0*	N	3690
Stall current	I_0*	A	29.6
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	125
Voltage constant	k_E	Vs/m	41.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	102
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.502
Phase inductance	L_{STR}	mH	6.84
Attraction force	F_A	N	23500
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	43
Mass of the primary section with precision cooler	$m_{P,P}$	kg	45.5
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	3.27
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6
Temperature increase of the coolant	$\Delta T_{P,H}$	K	7.83
Pressure drop	$\Delta p_{P,H}$	bar	1.55
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0961
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6
Pressure drop	$\Delta p_{P,P}$	bar	2.21
Secondary section cooling data			

1FN3600-4WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.308
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0272
Pressure drop per combi distributor	Δp_{KV}	bar	0.223
Pressure drop per coupling point	Δp_{KS}	bar	0.234

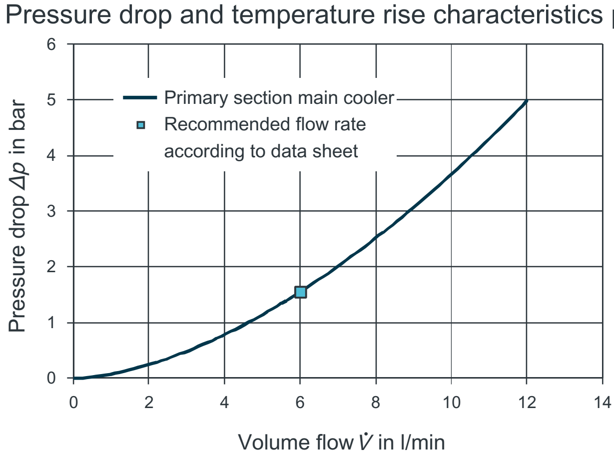
Characteristics for 1FN3600-4WB50-0xAx

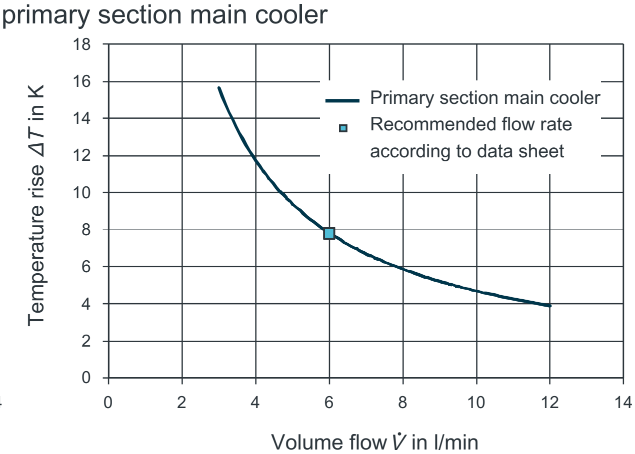
Force characteristics



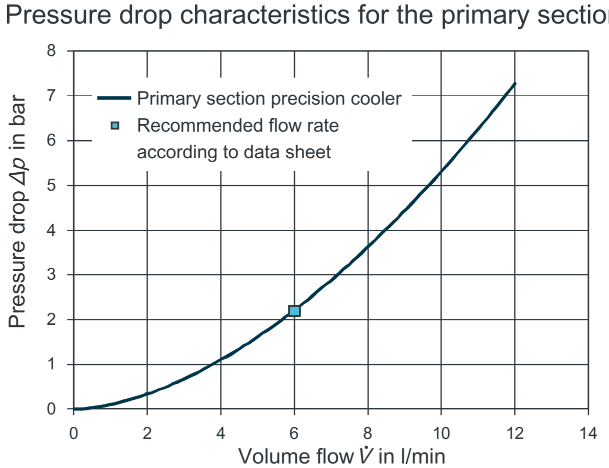


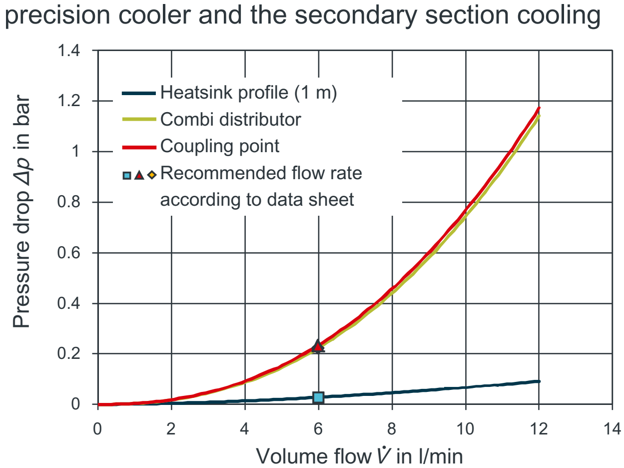
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





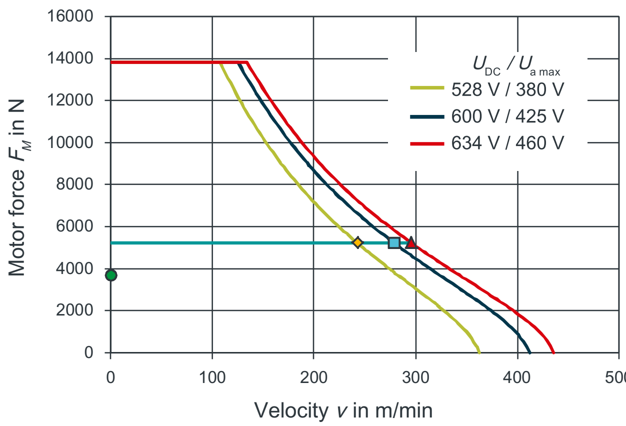
Data sheet of 1FN3600-4WC00-0xAx

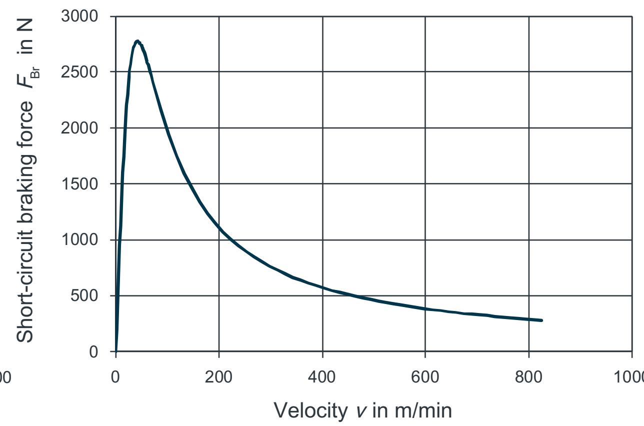
1FN3600-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5220
Rated current	I_N	A	48.8
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	279
Rated power loss	$P_{V,N}$	kW	3.42
Limit data			
Maximum force	F_{MAX}	N	13800
Maximum current	I_{MAX}	A	139
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	125
Maximum electric power drawn	$P_{EL,MAX}$	kW	56.8
Static force	F_0*	N	3690
Stall current	I_0*	A	34.5
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	107
Voltage constant	k_E	Vs/m	35.6
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	105
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.344
Phase inductance	L_{STR}	mH	5.03
Attraction force	F_A	N	23500
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	43
Mass of the primary section with precision cooler	$m_{P,P}$	kg	45.5
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	3.04
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6
Temperature increase of the coolant	$\Delta T_{P,H}$	K	7.3
Pressure drop	$\Delta p_{P,H}$	bar	1.55
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0896
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6
Pressure drop	$\Delta p_{P,P}$	bar	2.21
Secondary section cooling data			

1FN3600-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.287
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0272
Pressure drop per combi distributor	Δp_{KV}	bar	0.223
Pressure drop per coupling point	Δp_{KS}	bar	0.234

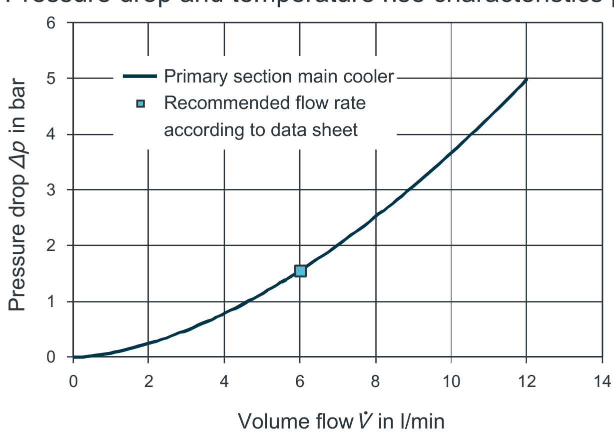
Characteristics for 1FN3600-4WC00-0xAx

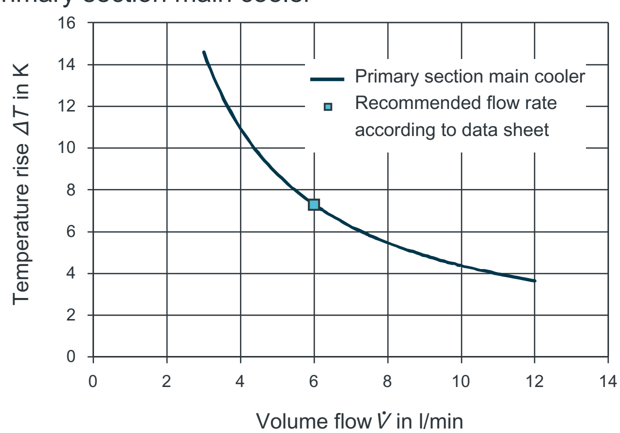
Force characteristics



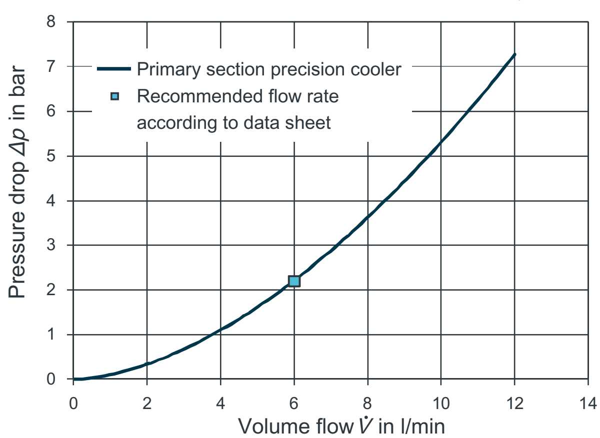


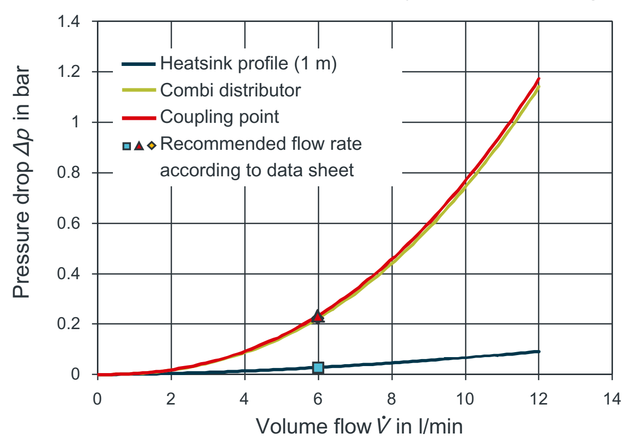
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





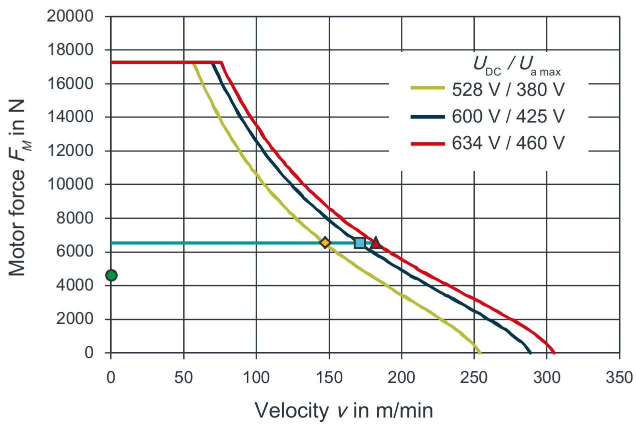
Data sheet of 1FN3600-5WB00-0xAx

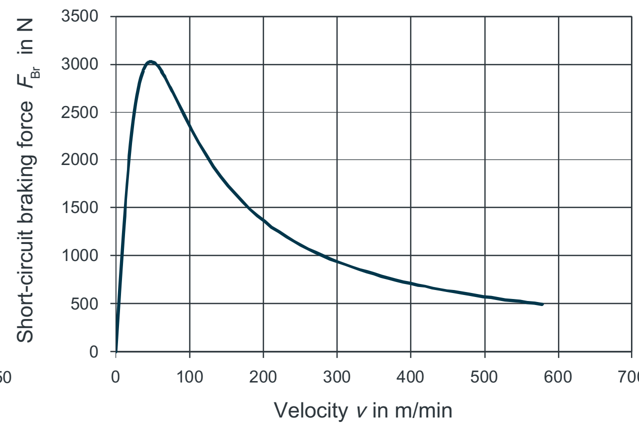
1FN3600-5WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	6530
Rated current	I_N	A	42.7
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	171
Rated power loss	$P_{V,N}$	kW	5.61
Limit data			
Maximum force	F_{MAX}	N	17200
Maximum current	I_{MAX}	A	114
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	69.6
Maximum electric power drawn	$P_{EL,MAX}$	kW	60.2
Static force	F_0*	N	4610
Stall current	I_0*	A	30.2
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	153
Voltage constant	k_E	Vs/m	50.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	103
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.734
Phase inductance	L_{STR}	mH	9.4
Attraction force	F_A	N	29400
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	56
Mass of the primary section with precision cooler	$m_{P,P}$	kg	59.1
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	4.99
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	11
Pressure drop	$\Delta p_{P,H}$	bar	2.19
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.147
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6.5
Pressure drop	$\Delta p_{P,P}$	bar	3.01
Secondary section cooling data			

1FN3600-5WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.471
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0313
Pressure drop per combi distributor	Δp_{KV}	bar	0.269
Pressure drop per coupling point	Δp_{KS}	bar	0.282

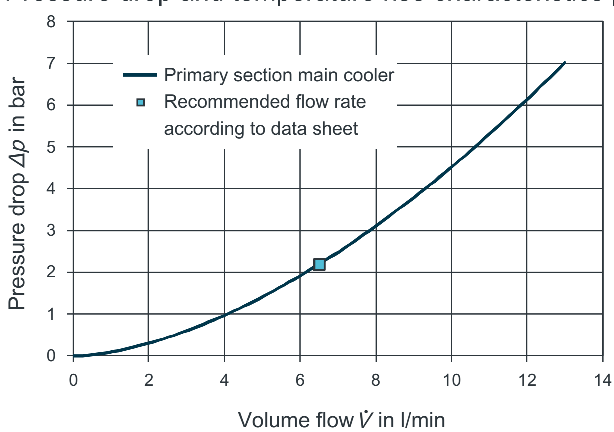
Characteristics of 1FN3600-5WB00-0xAx

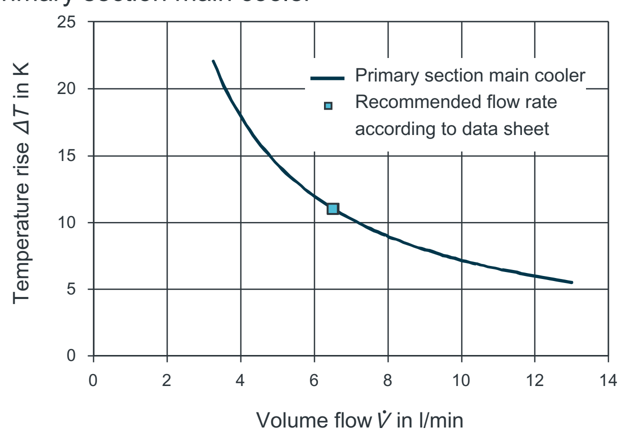
Force characteristics



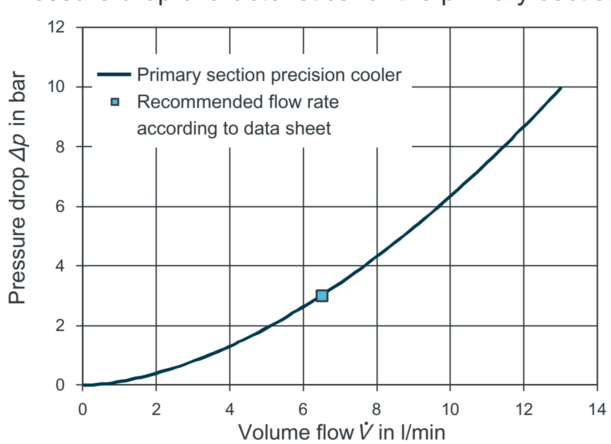


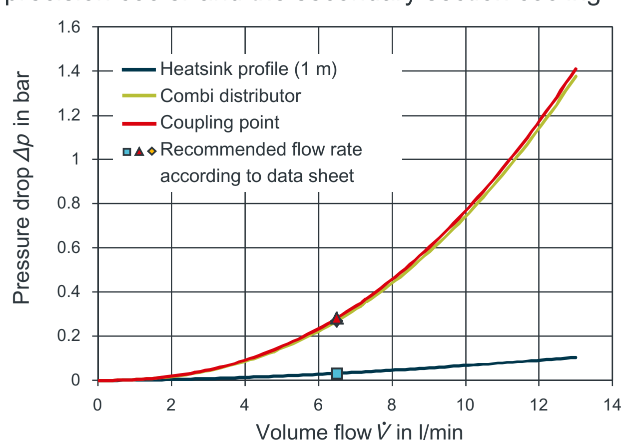
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





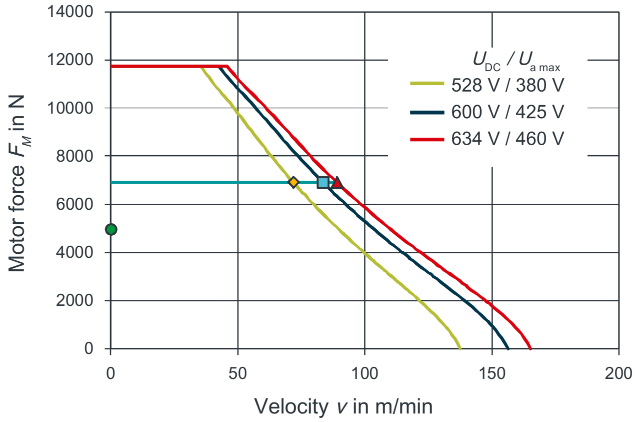
Data sheet of 1FN3600-4NA70-0xAx

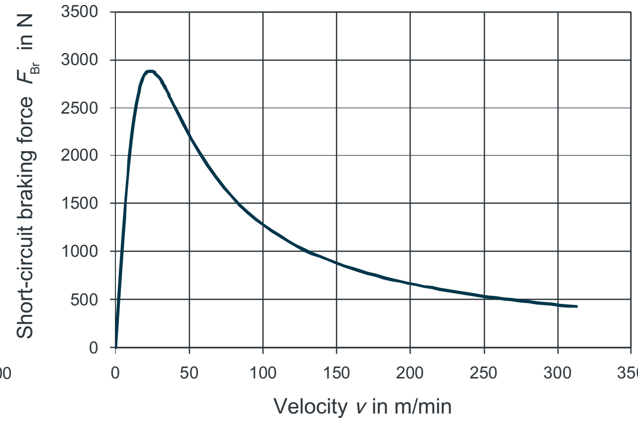
1FN3600-4NA70-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	6920
Rated current	I_N	A	26.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	83.5
Rated power loss	$P_{V,N}$	kW	3.72
Limit data			
Maximum force	F_{MAX}	N	11700
Maximum current	I_{MAX}	A	55.3
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	42.6
Maximum electric power drawn	$P_{EL,MAX}$	kW	24.8
Static force	F_0*	N	4970
Stall current	I_0*	A	18.6
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	268
Voltage constant	k_E	Vs/m	89.3
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	136
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.29
Phase inductance	L_{STR}	mH	33.7
Attraction force	F_A	N	23100
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	58.2
Mass of the primary section with precision cooler	$m_{P,P}$	kg	60.8
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	3.3
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6
Temperature increase of the coolant	$\Delta T_{P,H}$	K	7.9
Pressure drop	$\Delta p_{P,H}$	bar	1.49
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0975
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6
Pressure drop	$\Delta p_{P,P}$	bar	2.19
Secondary section cooling data			

1FN3600-4NA70-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.327
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0272
Pressure drop per combi distributor	Δp_{KV}	bar	0.223
Pressure drop per coupling point	Δp_{KS}	bar	0.234

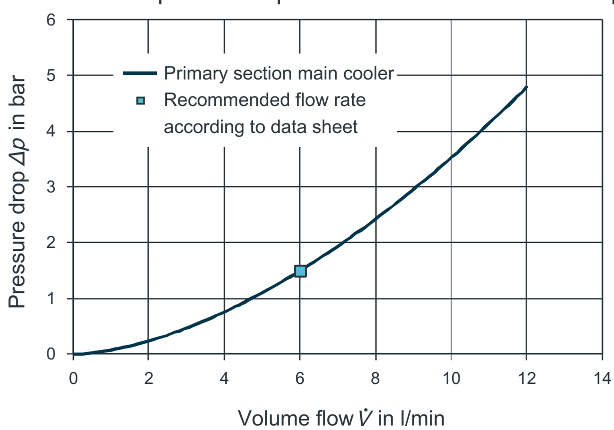
Characteristics for 1FN3600-4NA70-0xAx

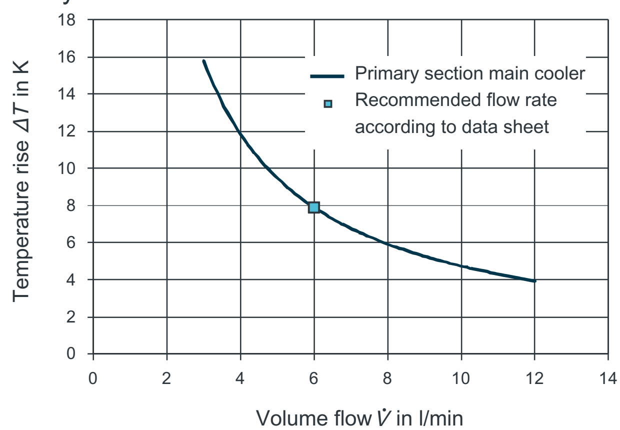
Force characteristics



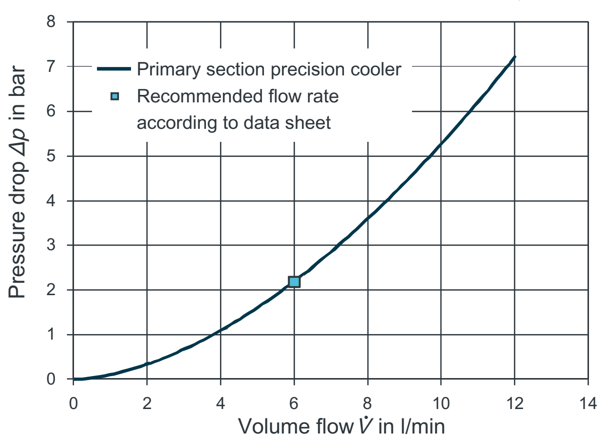


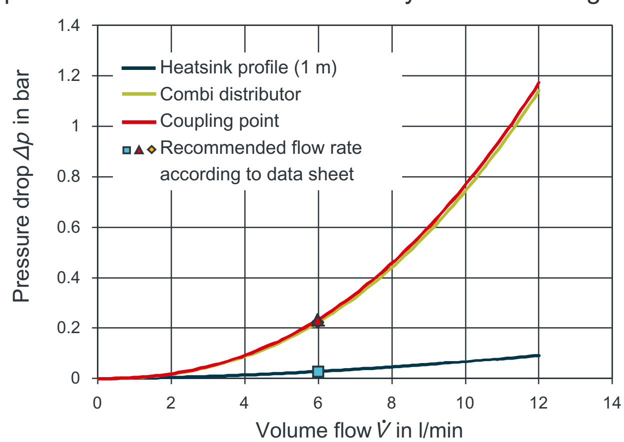
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





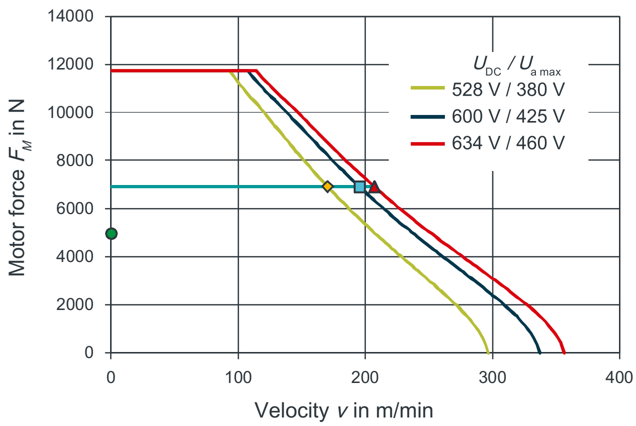
Data sheet of 1FN3600-4NB80-0xAx

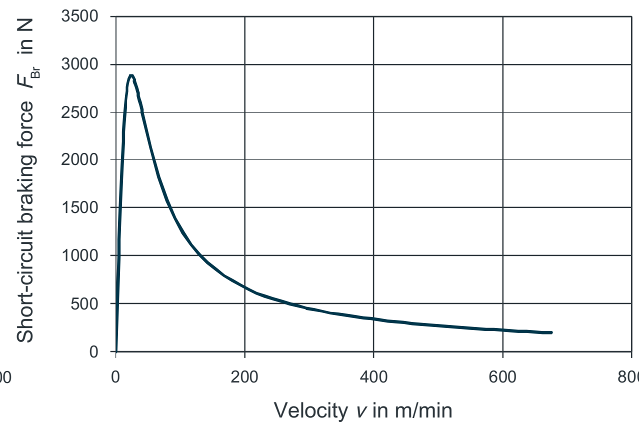
1FN3600-4NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	6920
Rated current	I_N	A	56.7
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	195
Rated power loss	$P_{V,N}$	kW	3.74
Limit data			
Maximum force	F_{MAX}	N	11700
Maximum current	I_{MAX}	A	119
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	108
Maximum electric power drawn	$P_{EL,MAX}$	kW	37.6
Static force	F_0*	N	4970
Stall current	I_0*	A	40.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	124
Voltage constant	k_E	Vs/m	41.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	136
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.278
Phase inductance	L_{STR}	mH	7.23
Attraction force	F_A	N	23100
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	58.2
Mass of the primary section with precision cooler	$m_{P,P}$	kg	60.8
Mass of a secondary section	m_S	kg	4.6
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	5
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	3.31
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6
Temperature increase of the coolant	$\Delta T_{P,H}$	K	7.94
Pressure drop	$\Delta p_{P,H}$	bar	1.49
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0979
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6
Pressure drop	$\Delta p_{P,P}$	bar	2.19
Secondary section cooling data			

1FN3600-4NB80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.328
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0272
Pressure drop per combi distributor	Δp_{KV}	bar	0.223
Pressure drop per coupling point	Δp_{KS}	bar	0.234

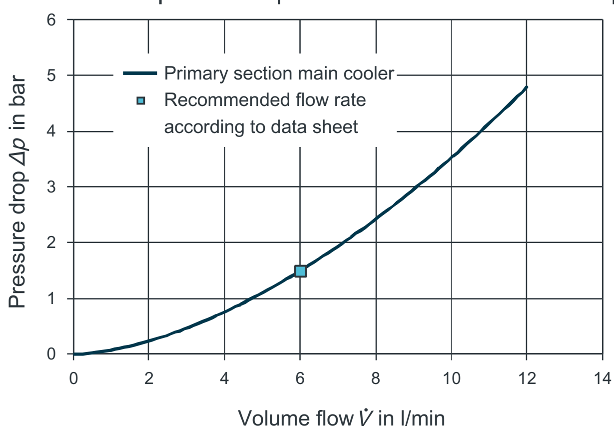
Characteristics for 1FN3600-4NB80-0xAx

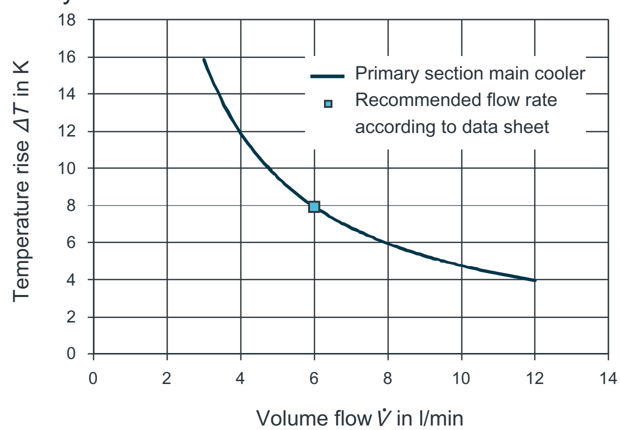
Force characteristics



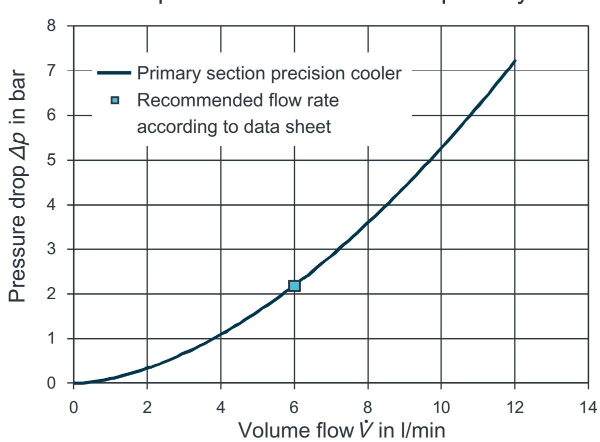


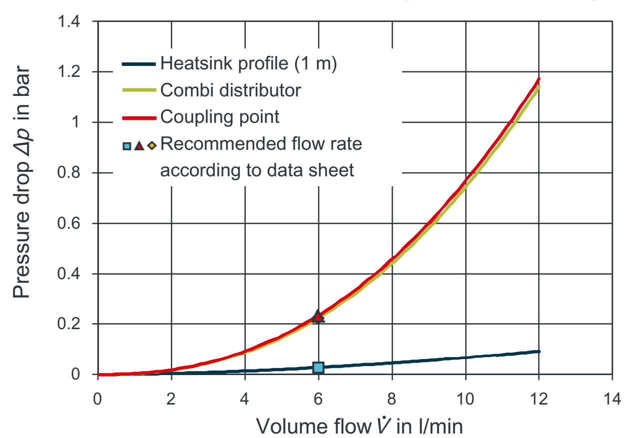
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





7.2.7 1FN3900-xxxxx-xxxx

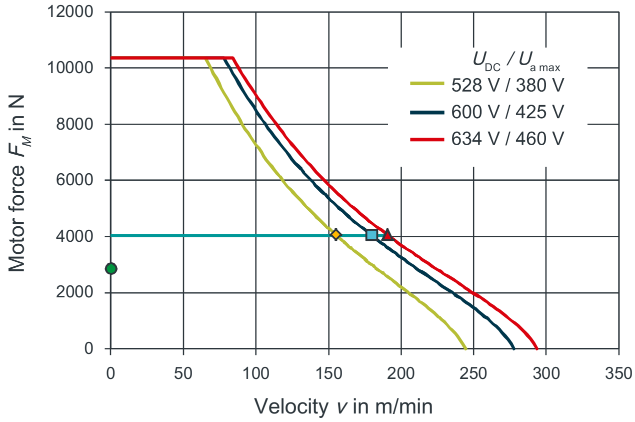
Data sheet of 1FN3900-2WB00-0xAx

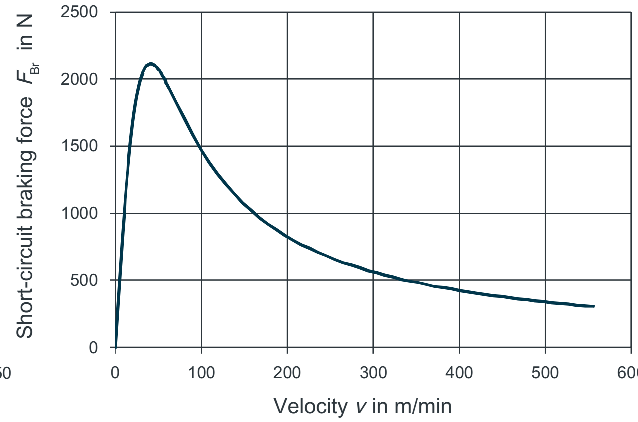
1FN3900-2WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	4050
Rated current	I_N	A	25.5
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	179
Rated power loss	$P_{V,N}$	kW	2.63
Limit data			
Maximum force	F_{MAX}	N	10300
Maximum current	I_{MAX}	A	70.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	78
Maximum electric power drawn	$P_{EL,MAX}$	kW	33.5
Static force	F_0*	N	2860
Stall current	I_0*	A	18
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	159
Voltage constant	k_E	Vs/m	52.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	93.3
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.965
Phase inductance	L_{STR}	mH	14.5
Attraction force	F_A	N	17600
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	32.2
Mass of the primary section with precision cooler	$m_{P,P}$	kg	33.7
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.34
Recommended minimum volume flow rate	$V_{P,H,MIN}$	l/min	5.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.11
Pressure drop	$\Delta p_{P,H}$	bar	0.885
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0687

1FN3900-2WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5.5
Pressure drop	$\Delta p_{P,P}$	bar	1.28
Secondary section cooling data			
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.221
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0234
Pressure drop per combi distributor	Δp_{KV}	bar	0.182
Pressure drop per coupling point	Δp_{KS}	bar	0.191

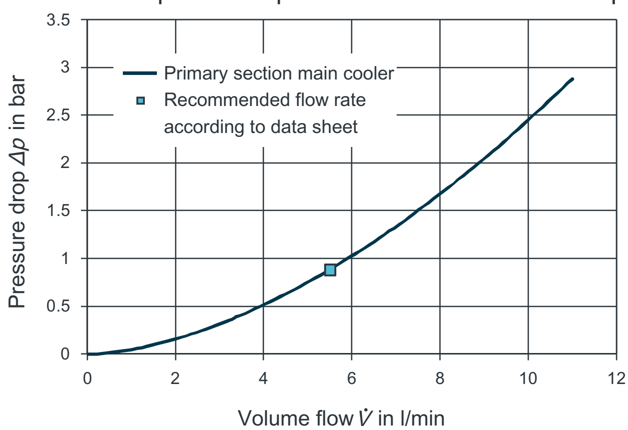
Characteristics for 1FN3900-2WB00-0xAx

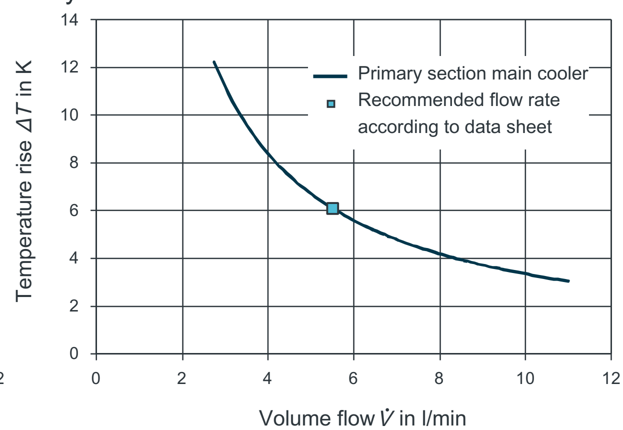
Force characteristics



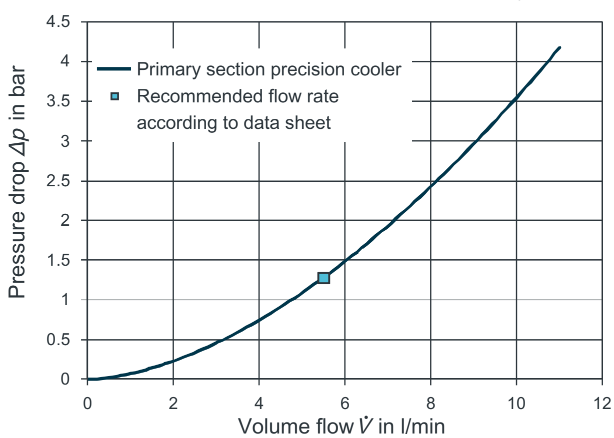


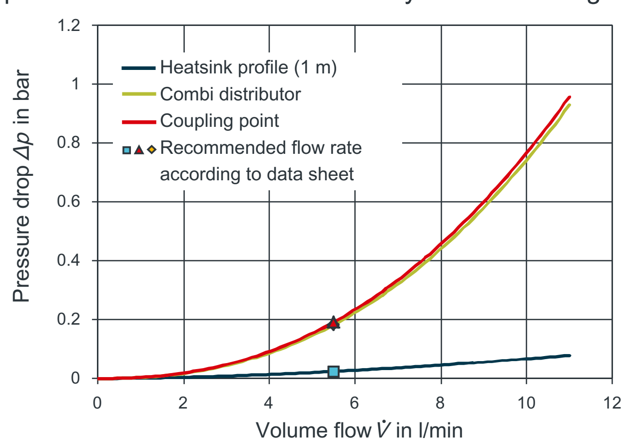
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





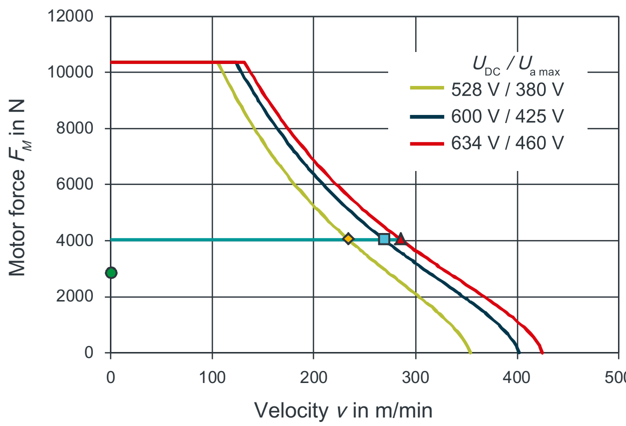
Data sheet of 1FN3900-2WC00-0xAx

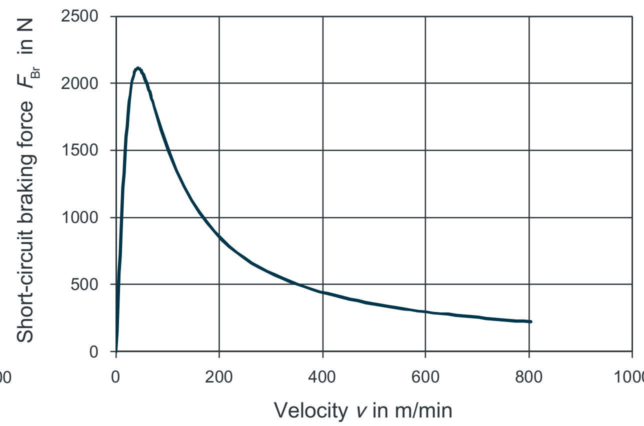
1FN3900-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	4050
Rated current	I_N	A	37
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	269
Rated power loss	$P_{V,N}$	kW	2.74
Limit data			
Maximum force	F_{MAX}	N	10300
Maximum current	I_{MAX}	A	102
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	123
Maximum electric power drawn	$P_{EL,MAX}$	kW	42.2
Static force	F_0*	N	2860
Stall current	I_0*	A	26.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	110
Voltage constant	k_E	Vs/m	36.5
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	91.4
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.48
Phase inductance	L_{STR}	mH	6.94
Attraction force	F_A	N	17600
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	32.2
Mass of the primary section with precision cooler	$m_{P,P}$	kg	33.7
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.44
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.37
Pressure drop	$\Delta p_{P,H}$	bar	0.885
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0716
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5.5
Pressure drop	$\Delta p_{P,P}$	bar	1.28
Secondary section cooling data			

1FN3900-2WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.23
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0234
Pressure drop per combi distributor	Δp_{KV}	bar	0.182
Pressure drop per coupling point	Δp_{KS}	bar	0.191

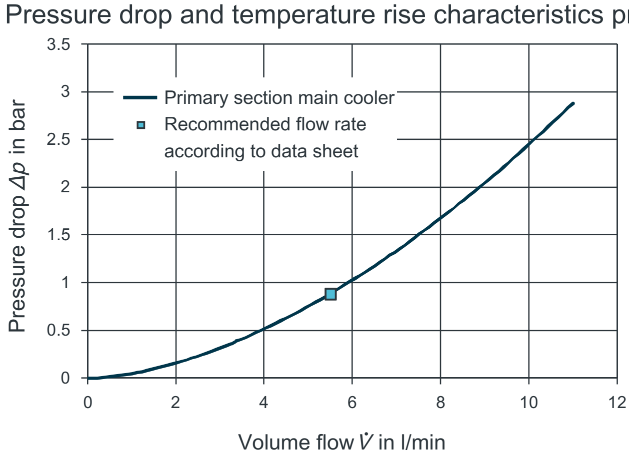
Characteristics for 1FN3900-2WC00-0xAx

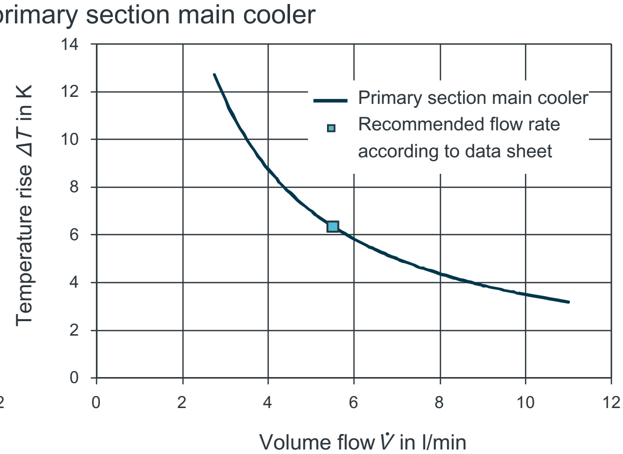
Force characteristics



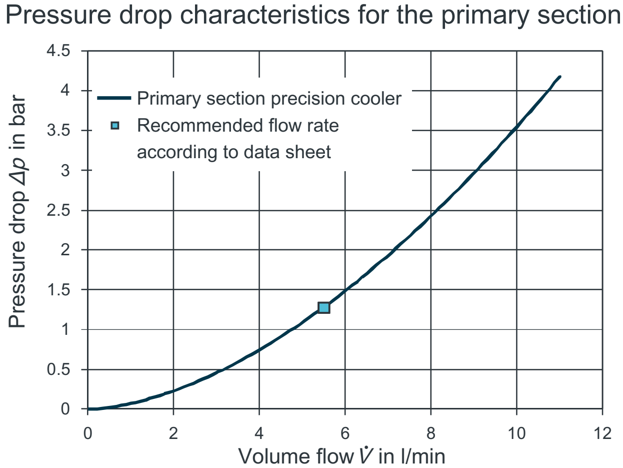


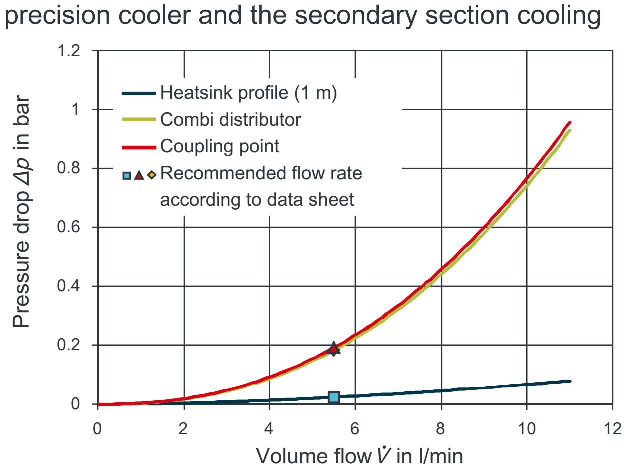
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





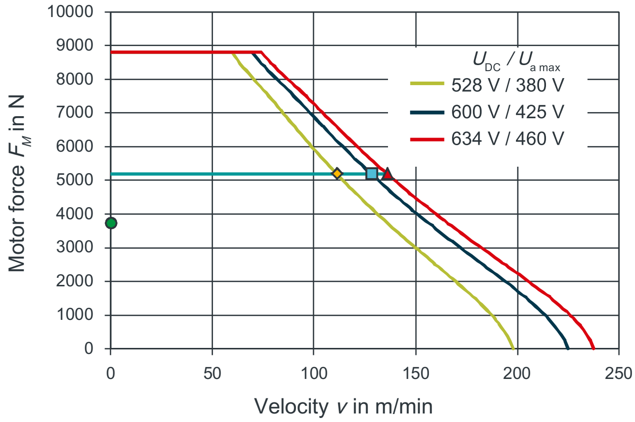
Data sheet of 1FN3900-2NB20-0xAx

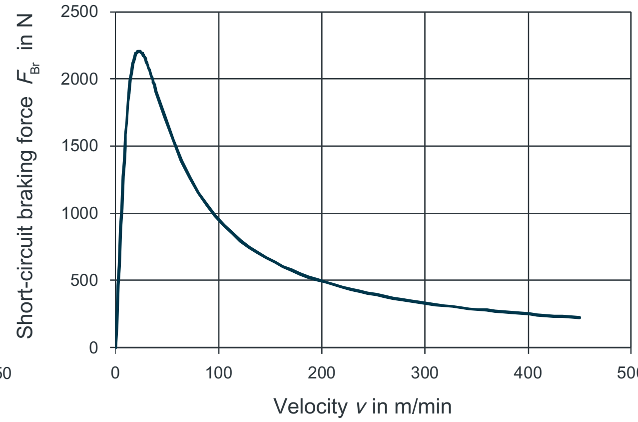
1FN3900-2NB20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5190
Rated current	I_N	A	28.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	128
Rated power loss	$P_{V,N}$	kW	2.65
Limit data			
Maximum force	F_{MAX}	N	8810
Maximum current	I_{MAX}	A	59.6
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	69.4
Maximum electric power drawn	$P_{EL,MAX}$	kW	21.9
Static force	F_0*	N	3730
Stall current	I_0*	A	20.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	186
Voltage constant	k_E	Vs/m	62.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	121
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.787
Phase inductance	L_{STR}	mH	21.2
Attraction force	F_A	N	17300
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	43.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	45.3
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.34
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.13
Pressure drop	$\Delta p_{P,H}$	bar	0.86
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0693
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5.5
Pressure drop	$\Delta p_{P,P}$	bar	1.26
Secondary section cooling data			

1FN3900-2NB20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.232
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0234
Pressure drop per combi distributor	Δp_{KV}	bar	0.182
Pressure drop per coupling point	Δp_{KS}	bar	0.191

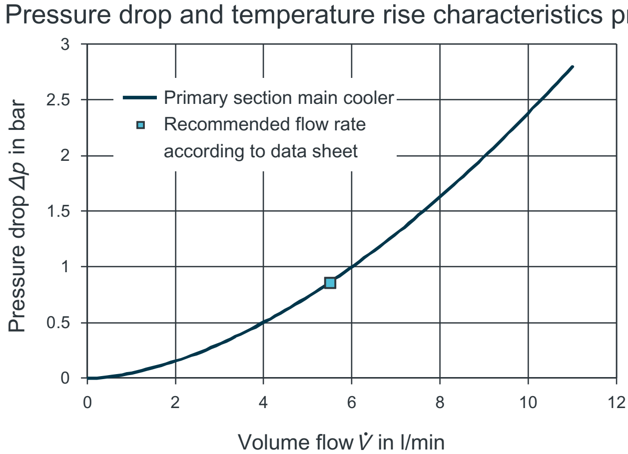
Characteristics for 1FN3900-2NB20-0xAx

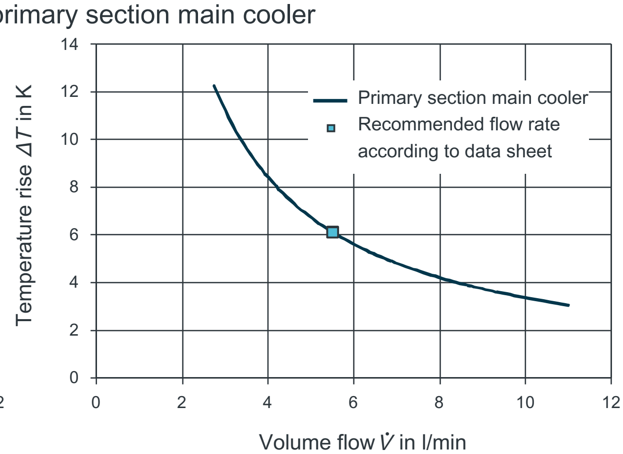
Force characteristics



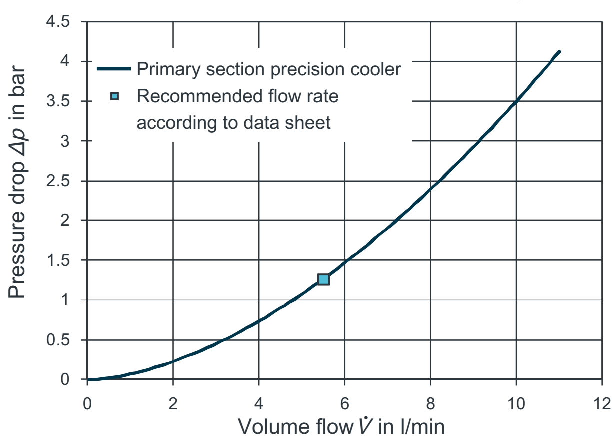


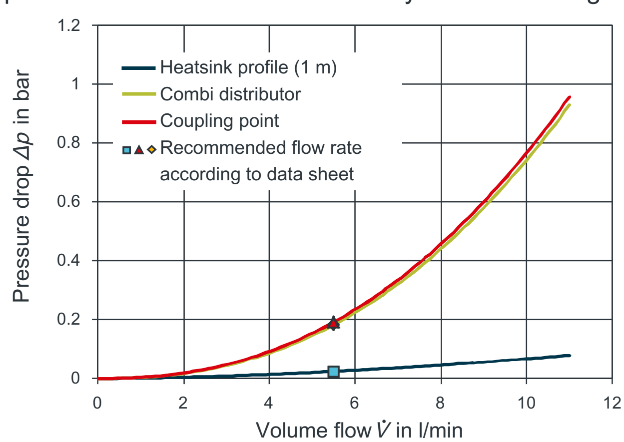
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





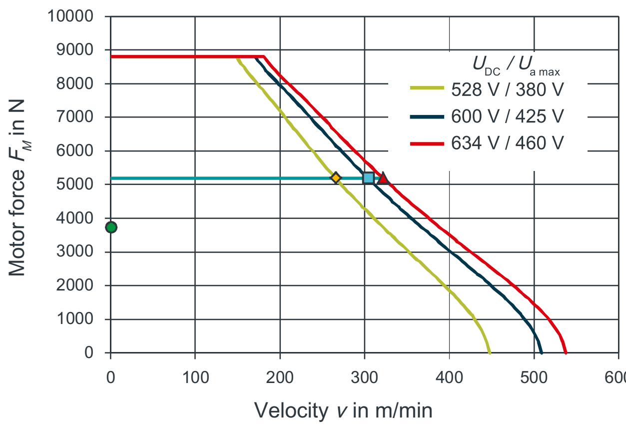
Data sheet of 1FN3900-2NC80-0xAx

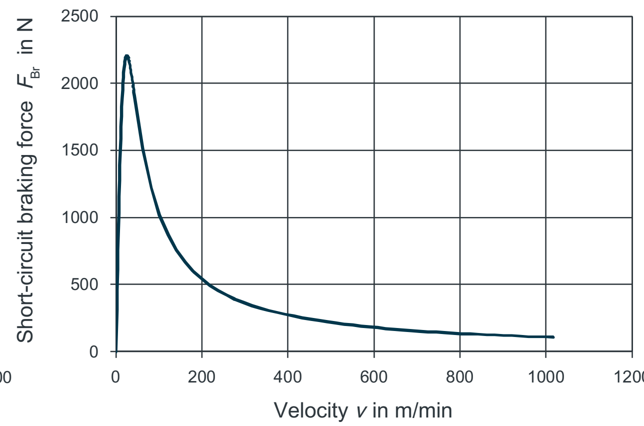
1FN3900-2NC80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	5190
Rated current	I_N	A	64.2
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	304
Rated power loss	$P_{V,N}$	kW	2.89
Limit data			
Maximum force	F_{MAX}	N	8810
Maximum current	I_{MAX}	A	135
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	170
Maximum electric power drawn	$P_{EL,MAX}$	kW	37.8
Static force	F_0*	N	3730
Stall current	I_0*	A	45.4
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	82.3
Voltage constant	k_E	Vs/m	27.4
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	116
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.168
Phase inductance	L_{STR}	mH	4.15
Attraction force	F_A	N	17300
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	43.5
Mass of the primary section with precision cooler	$m_{P,P}$	kg	45.3
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	2.56
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	5.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	6.7
Pressure drop	$\Delta p_{P,H}$	bar	0.86
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.0758
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	5.5
Pressure drop	$\Delta p_{P,P}$	bar	1.26
Secondary section cooling data			

1FN3900-2NC80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.254
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	5.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0234
Pressure drop per combi distributor	Δp_{KV}	bar	0.182
Pressure drop per coupling point	Δp_{KS}	bar	0.191

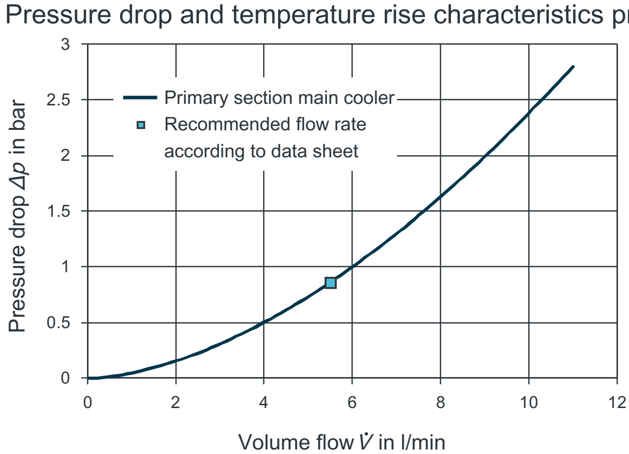
Characteristics of 1FN3900-2NC80-0xAx

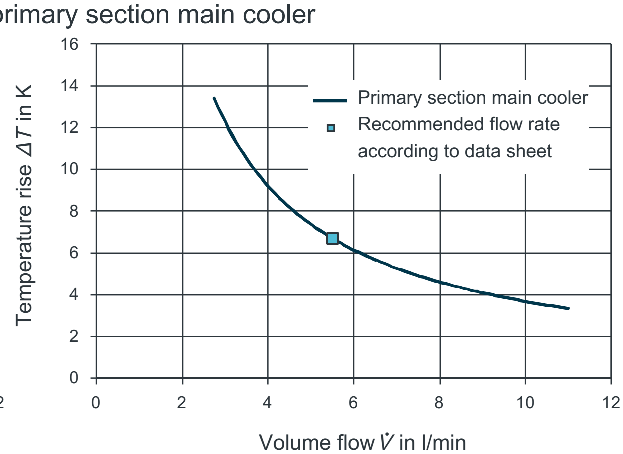
Force characteristics



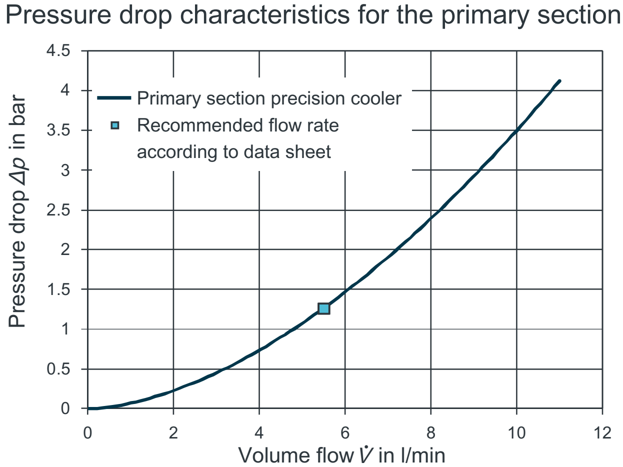


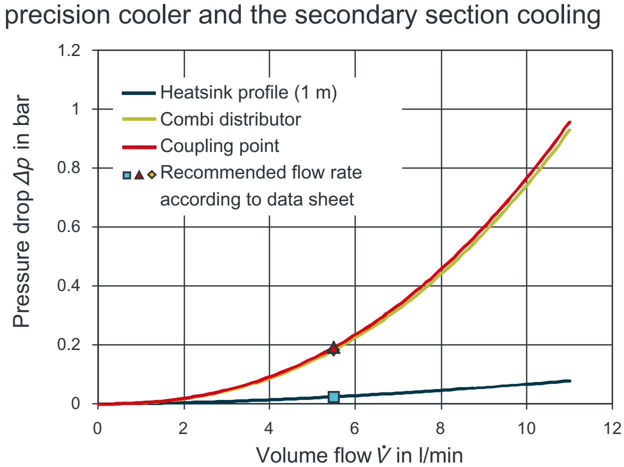
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





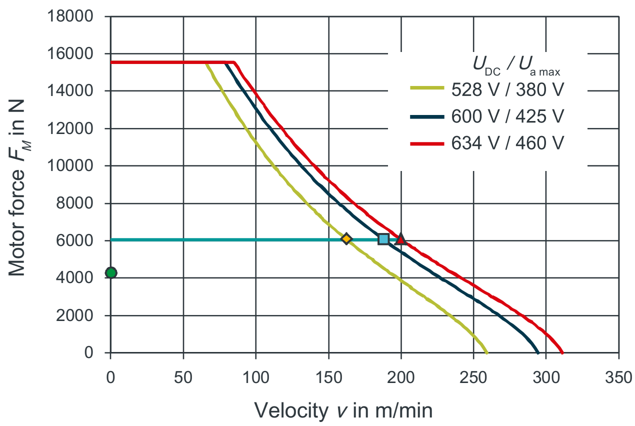
Data sheet of 1FN3900-3WB00-0xAx

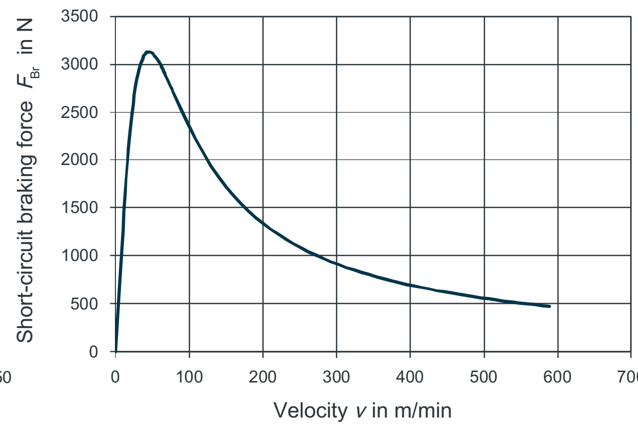
1FN3900-3WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	6080
Rated current	I_N	A	40.6
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	188
Rated power loss	$P_{V,N}$	kW	4.42
Limit data			
Maximum force	F_{MAX}	N	15500
Maximum current	I_{MAX}	A	114
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	78.7
Maximum electric power drawn	$P_{EL,MAX}$	kW	55.3
Static force	F_0*	N	4300
Stall current	I_0*	A	28.7
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	150
Voltage constant	k_E	Vs/m	49.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	108
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.643
Phase inductance	L_{STR}	mH	8.74
Attraction force	F_A	N	26400
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	47.2
Mass of the primary section with precision cooler	$m_{P,P}$	kg	49.3
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	3.93
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6
Temperature increase of the coolant	$\Delta T_{P,H}$	K	9.43
Pressure drop	$\Delta p_{P,H}$	bar	1.49
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.116
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6
Pressure drop	$\Delta p_{P,P}$	bar	1.9
Secondary section cooling data			

1FN3900-3WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.371
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0272
Pressure drop per combi distributor	Δp_{KV}	bar	0.223
Pressure drop per coupling point	Δp_{KS}	bar	0.234

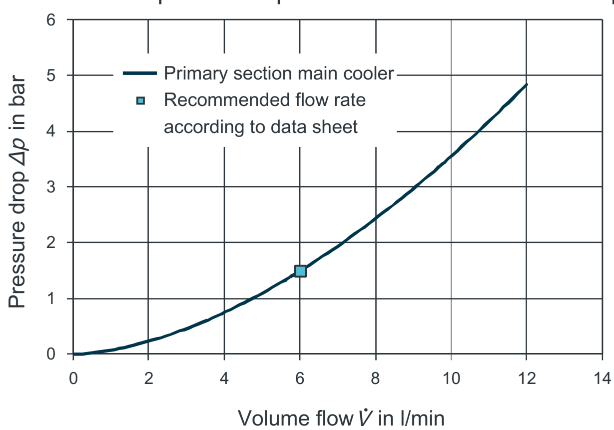
Characteristics for 1FN3900-3WB00-0xAx

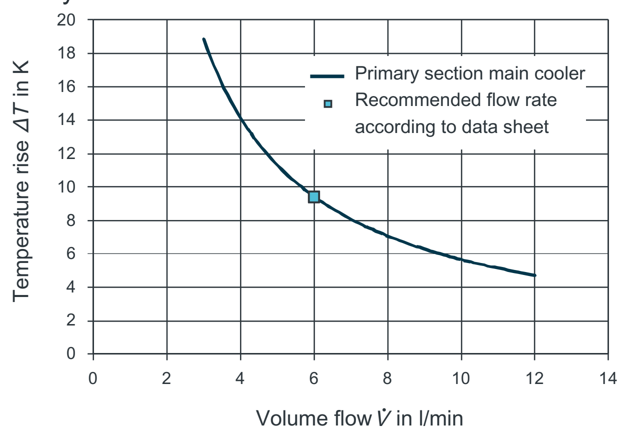
Force characteristics



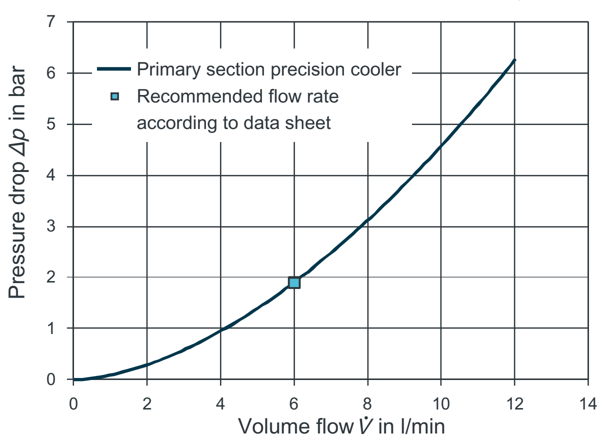


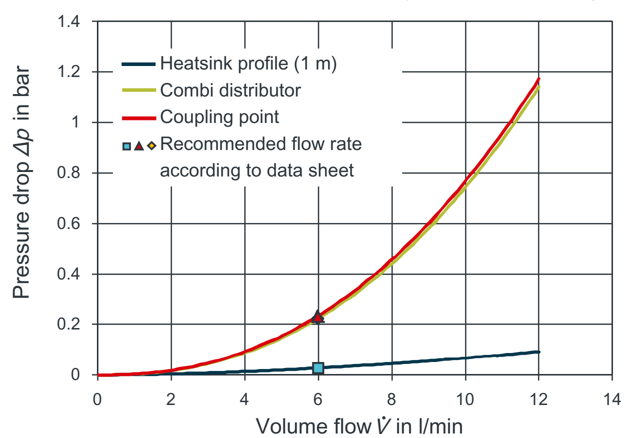
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





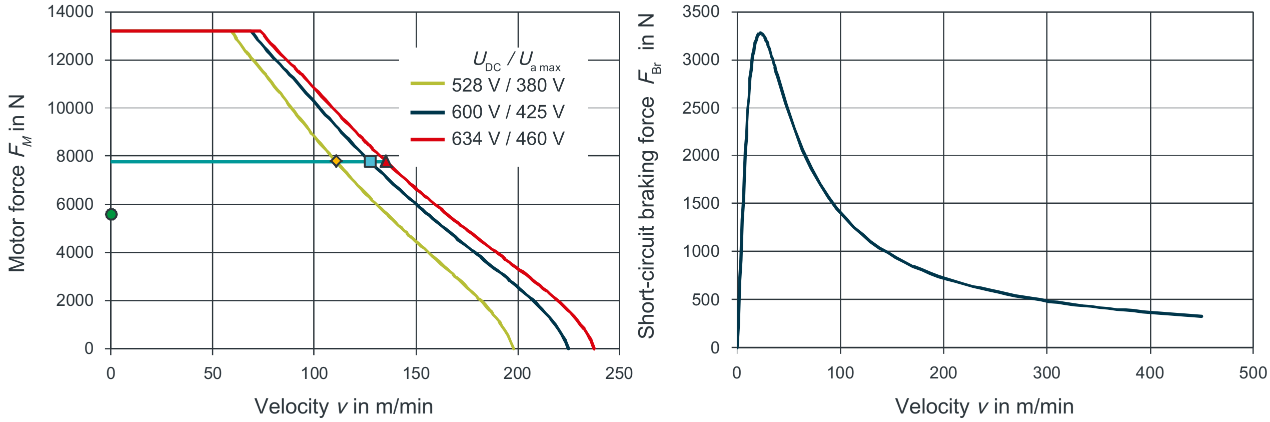
Data sheet of 1FN3900-3NB20-0xAx

1FN3900-3NB20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	7780
Rated current	I_N	A	42.5
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	127
Rated power loss	$P_{V,N}$	kW	3.97
Limit data			
Maximum force	F_{MAX}	N	13200
Maximum current	I_{MAX}	A	89.5
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	68.9
Maximum electric power drawn	$P_{EL,MAX}$	kW	32.7
Static force	F_0*	N	5590
Stall current	I_0*	A	30.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	186
Voltage constant	k_E	Vs/m	62.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	148
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.525
Phase inductance	L_{STR}	mH	14.3
Attraction force	F_A	N	26000
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	63
Mass of the primary section with precision cooler	$m_{P,P}$	kg	65.5
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	3.52
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6
Temperature increase of the coolant	$\Delta T_{P,H}$	K	8.43
Pressure drop	$\Delta p_{P,H}$	bar	1.45
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.104
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6
Pressure drop	$\Delta p_{P,P}$	bar	1.88
Secondary section cooling data			

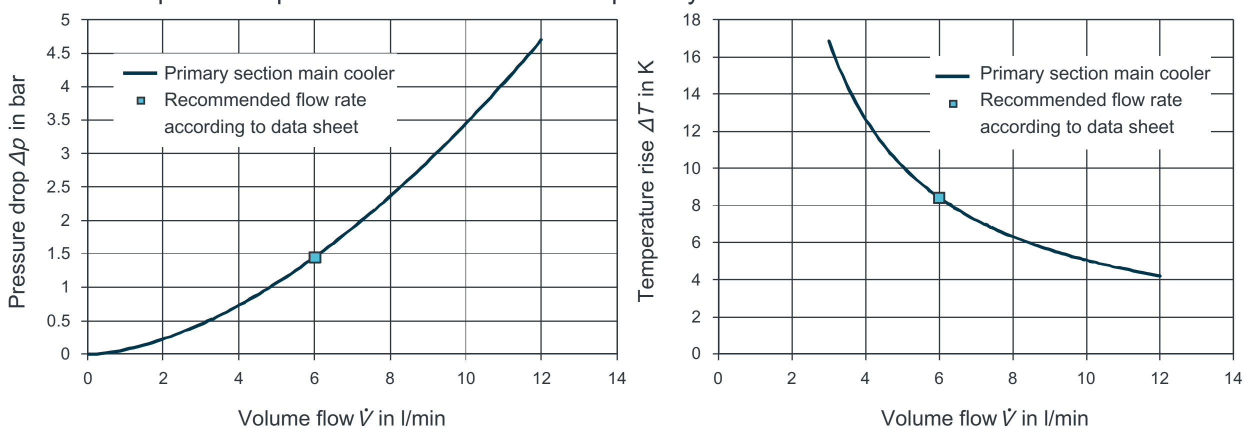
1FN3900-3NB20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.349
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0272
Pressure drop per combi distributor	Δp_{KV}	bar	0.223
Pressure drop per coupling point	Δp_{KS}	bar	0.234

Characteristics for 1FN3900-3NB20-0xAx

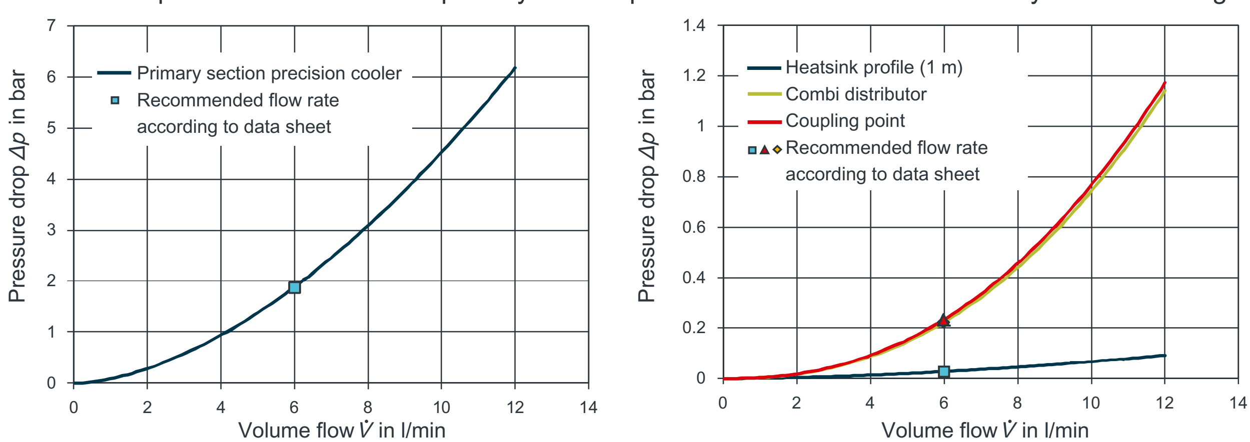
Force characteristics



Pressure drop and temperature rise characteristics primary section main cooler



Pressure drop characteristics for the primary section precision cooler and the secondary section cooling



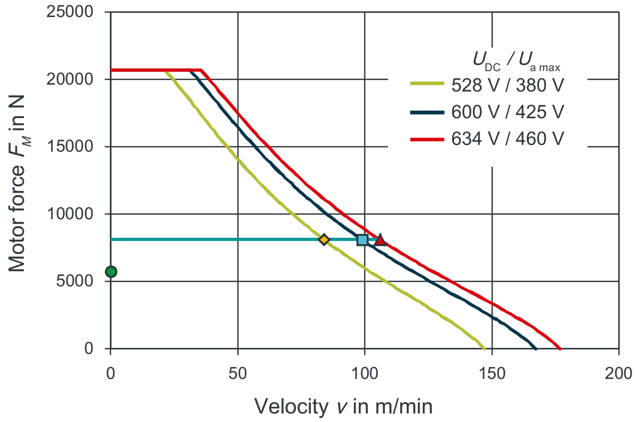
Data sheet of 1FN3900-4WA50-0xAx

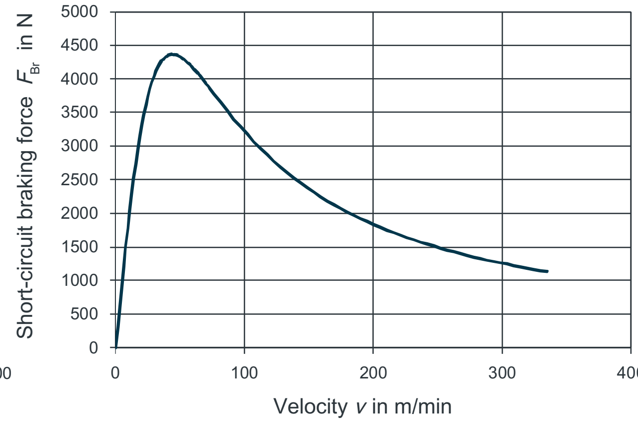
1FN3900-4WA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	8100
Rated current	I_N	A	30.7
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	98.9
Rated power loss	$P_{V,N}$	kW	5.52
Limit data			
Maximum force	F_{MAX}	N	20700
Maximum current	I_{MAX}	A	86.3
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	31.1
Maximum electric power drawn	$P_{EL,MAX}$	kW	54.4
Static force	F_0*	N	5730
Stall current	I_0*	A	21.7
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	264
Voltage constant	k_E	Vs/m	87.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	129
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.4
Phase inductance	L_{STR}	mH	19.4
Attraction force	F_A	N	35300
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	62.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	65.4
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	4.92
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	10.9
Pressure drop	$\Delta p_{P,H}$	bar	2.24
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.145
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6.5
Pressure drop	$\Delta p_{P,P}$	bar	2.66
Secondary section cooling data			

1FN3900-4WA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.464
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0313
Pressure drop per combi distributor	Δp_{KV}	bar	0.269
Pressure drop per coupling point	Δp_{KS}	bar	0.282

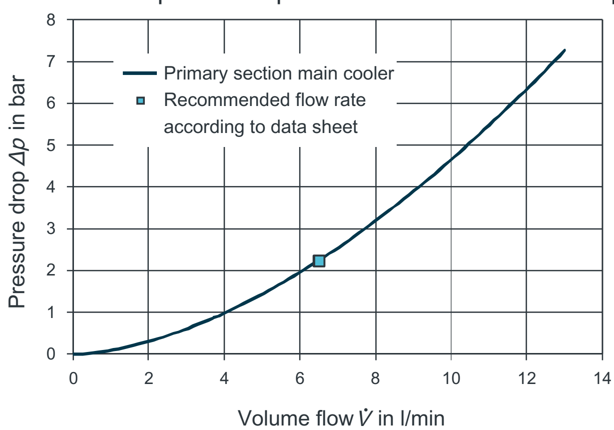
Characteristics of 1FN3900-4WA50-0xAx

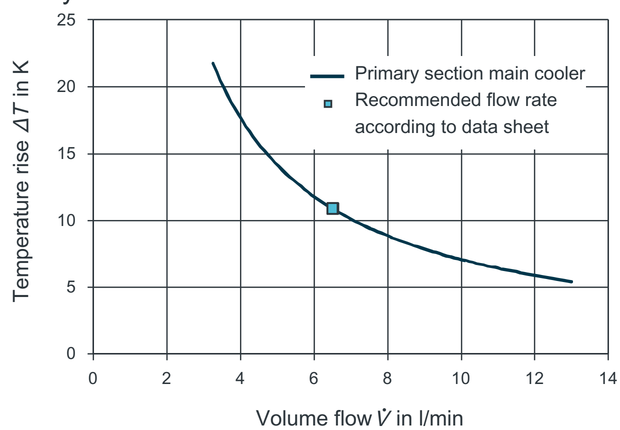
Force characteristics



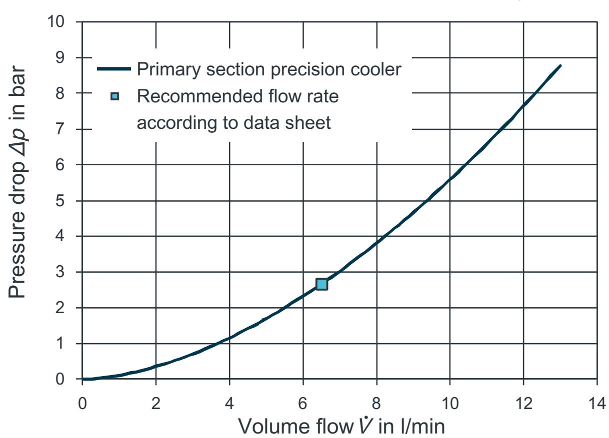


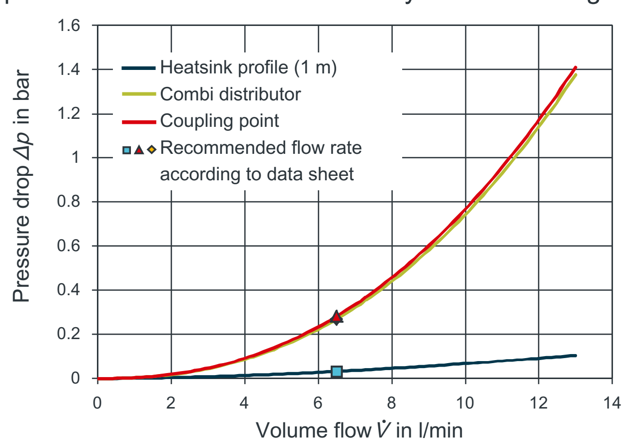
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





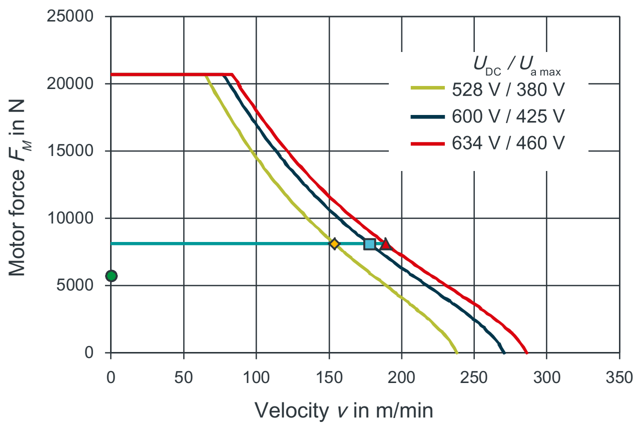
Data sheet of 1FN3900-4WB00-0xAx

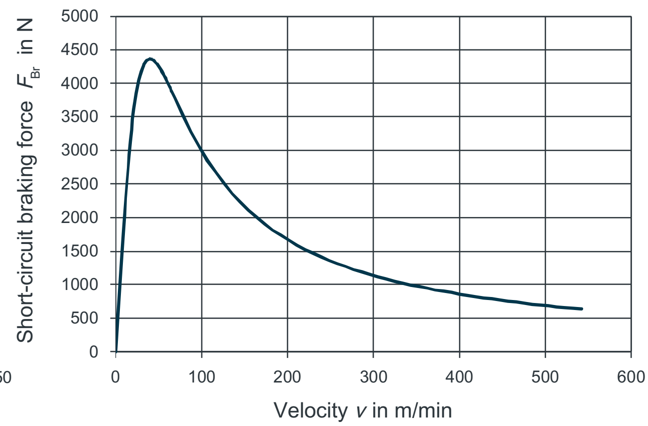
1FN3900-4WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	8100
Rated current	I_N	A	49.7
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	178
Rated power loss	$P_{V,N}$	kW	4.98
Limit data			
Maximum force	F_{MAX}	N	20700
Maximum current	I_{MAX}	A	140
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	77.2
Maximum electric power drawn	$P_{EL,MAX}$	kW	66
Static force	F_0*	N	5730
Stall current	I_0*	A	35.2
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	163
Voltage constant	k_E	Vs/m	54.3
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	135
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.482
Phase inductance	L_{STR}	mH	7.42
Attraction force	F_A	N	35300
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	62.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	65.4
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	4.43
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	9.81
Pressure drop	$\Delta p_{P,H}$	bar	2.24
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.13
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6.5
Pressure drop	$\Delta p_{P,P}$	bar	2.66
Secondary section cooling data			

1FN3900-4WB00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.419
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0313
Pressure drop per combi distributor	Δp_{KV}	bar	0.269
Pressure drop per coupling point	Δp_{KS}	bar	0.282

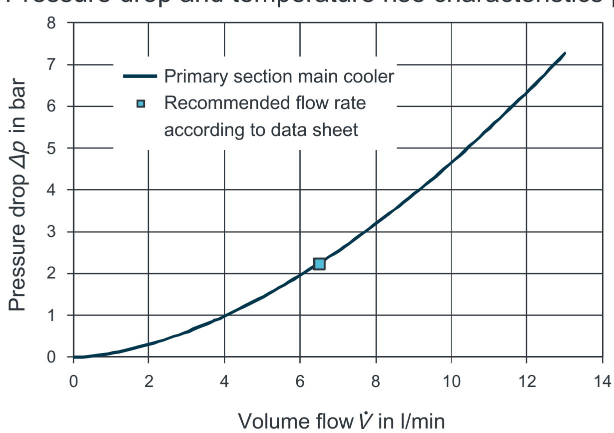
Characteristics for 1FN3900-4WB00-0xAx

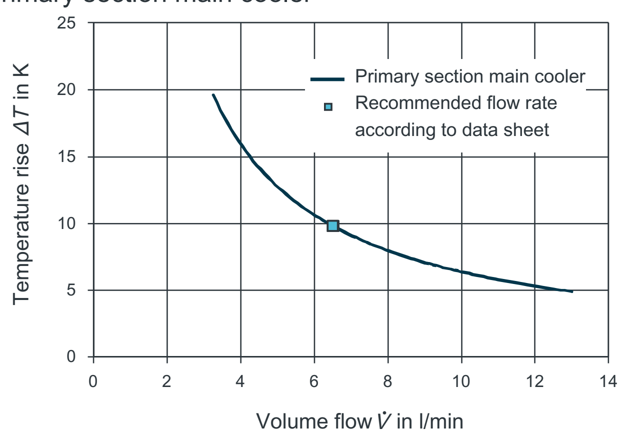
Force characteristics



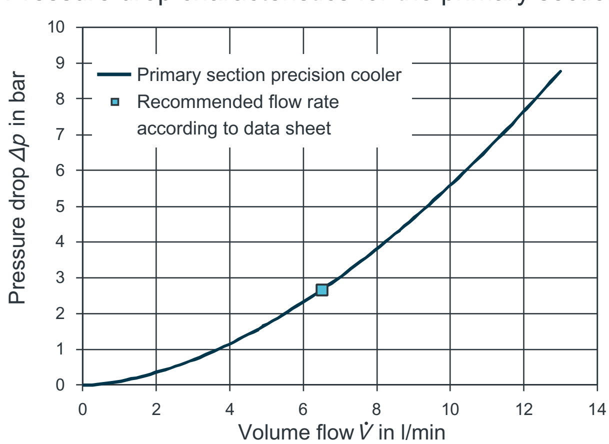


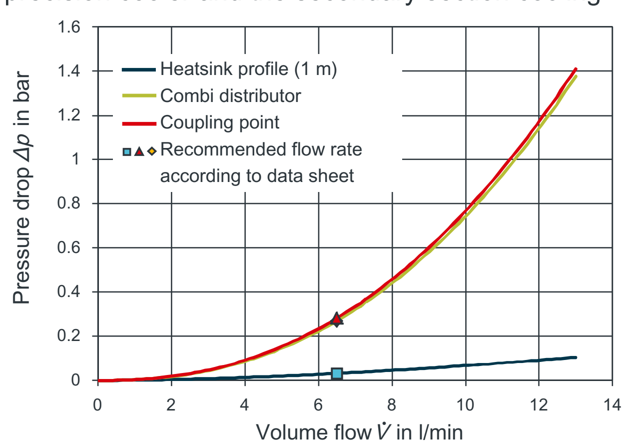
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





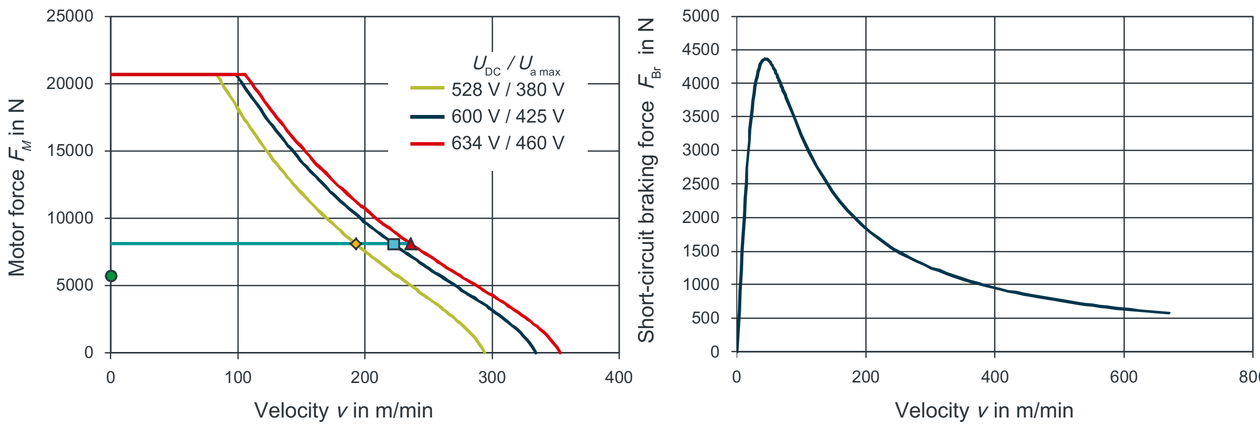
Data sheet of 1FN3900-4WB50-0xAx

1FN3900-4WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	8100
Rated current	I_N	A	61.4
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	222
Rated power loss	$P_{V,N}$	kW	5.53
Limit data			
Maximum force	F_{MAX}	N	20700
Maximum current	I_{MAX}	A	173
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	98.6
Maximum electric power drawn	$P_{EL,MAX}$	kW	77.7
Static force	F_0*	N	5730
Stall current	I_0*	A	43.5
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	132
Voltage constant	k_E	Vs/m	43.9
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	129
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.35
Phase inductance	L_{STR}	mH	4.86
Attraction force	F_A	N	35300
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	62.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	65.4
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	4.92
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	10.9
Pressure drop	$\Delta p_{P,H}$	bar	2.24
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.145
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6.5
Pressure drop	$\Delta p_{P,P}$	bar	2.66
Secondary section cooling data			

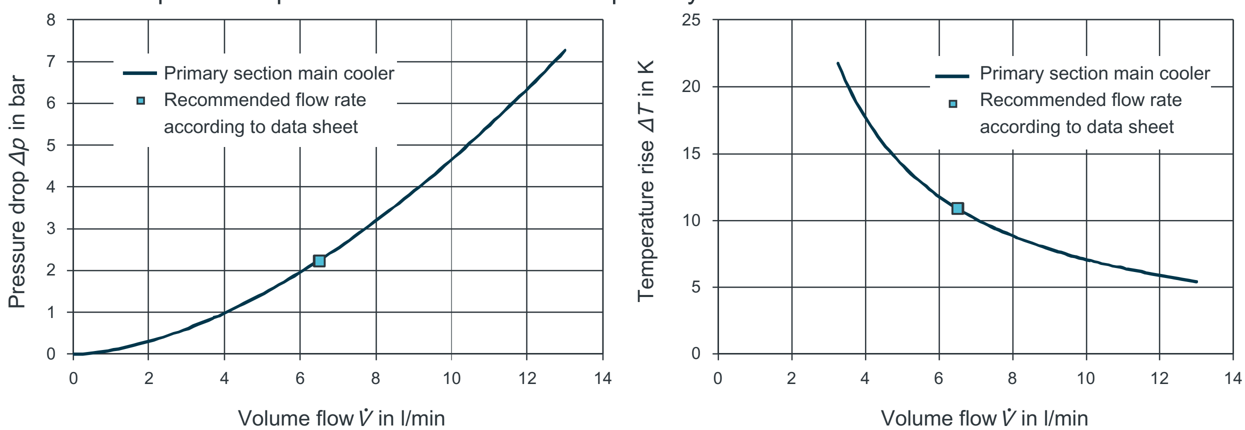
1FN3900-4WB50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.464
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0313
Pressure drop per combi distributor	Δp_{KV}	bar	0.269
Pressure drop per coupling point	Δp_{KS}	bar	0.282

Characteristics for 1FN3900-4WB50-0xAx

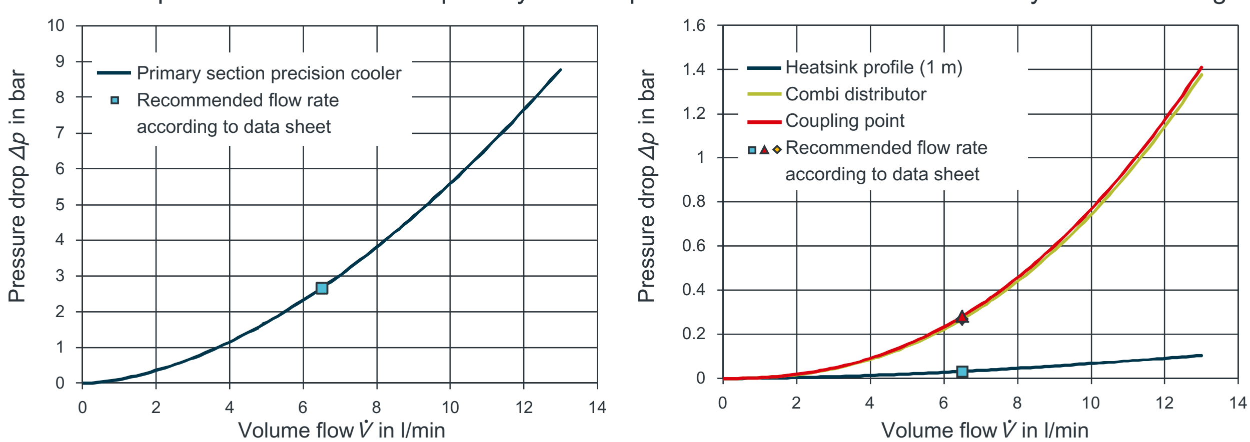
Force characteristics



Pressure drop and temperature rise characteristics primary section main cooler



Pressure drop characteristics for the primary section precision cooler and the secondary section cooling



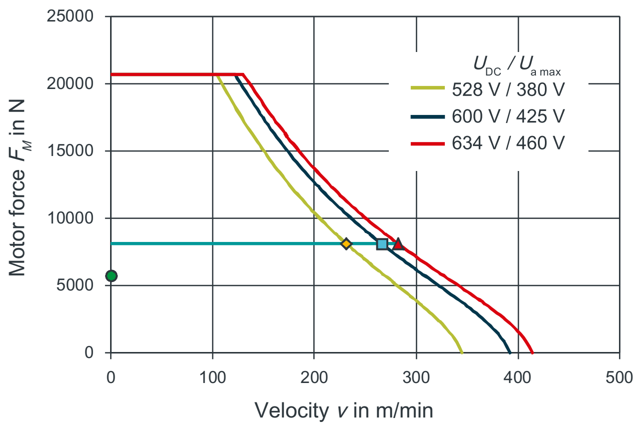
Data sheet of 1FN3900-4WC00-0xAx

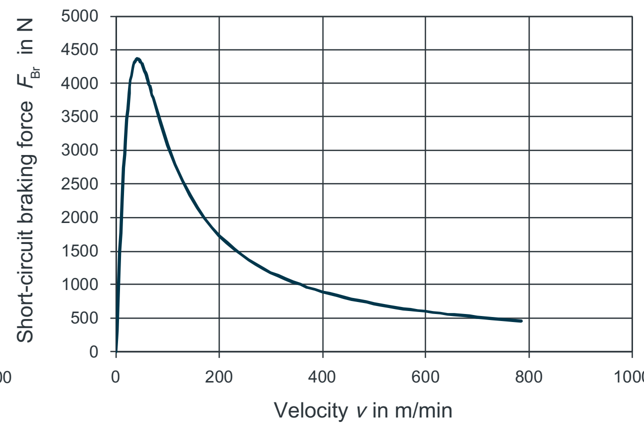
1FN3900-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	8100
Rated current	I_N	A	72
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	266
Rated power loss	$P_{V,N}$	kW	5.19
Limit data			
Maximum force	F_{MAX}	N	20700
Maximum current	I_{MAX}	A	202
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	122
Maximum electric power drawn	$P_{EL,MAX}$	kW	83
Static force	F_0*	N	5730
Stall current	I_0*	A	50.9
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	112
Voltage constant	k_E	Vs/m	37.5
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	133
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.239
Phase inductance	L_{STR}	mH	3.54
Attraction force	F_A	N	35300
Thermal time constant	t_{TH}	s	120
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	62.7
Mass of the primary section with precision cooler	$m_{P,P}$	kg	65.4
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	4.62
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	10.2
Pressure drop	$\Delta p_{P,H}$	bar	2.24
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.136
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6.5
Pressure drop	$\Delta p_{P,P}$	bar	2.66
Secondary section cooling data			

1FN3900-4WC00-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.436
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0313
Pressure drop per combi distributor	Δp_{KV}	bar	0.269
Pressure drop per coupling point	Δp_{KS}	bar	0.282

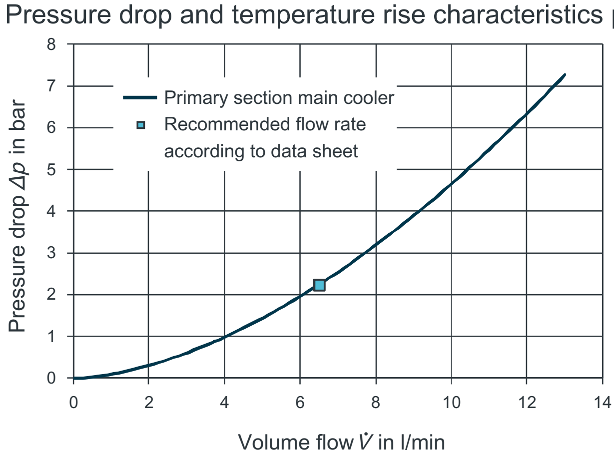
Characteristics for 1FN3900-4WC00-0xAx

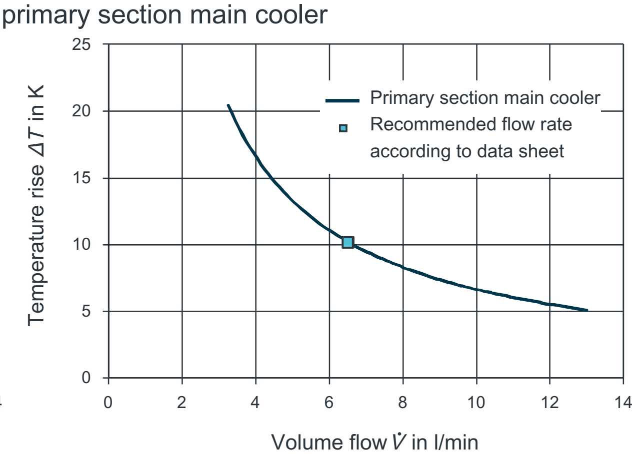
Force characteristics



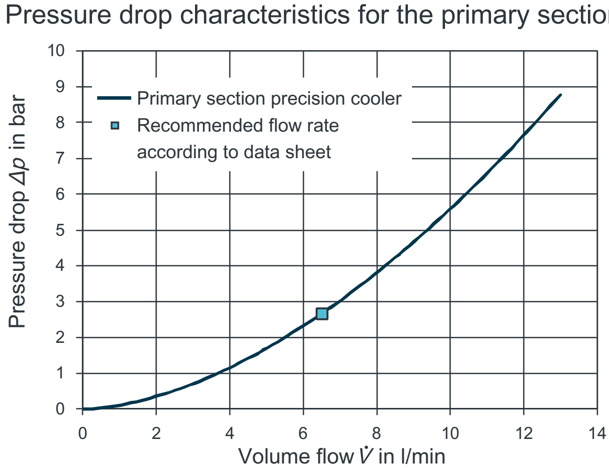


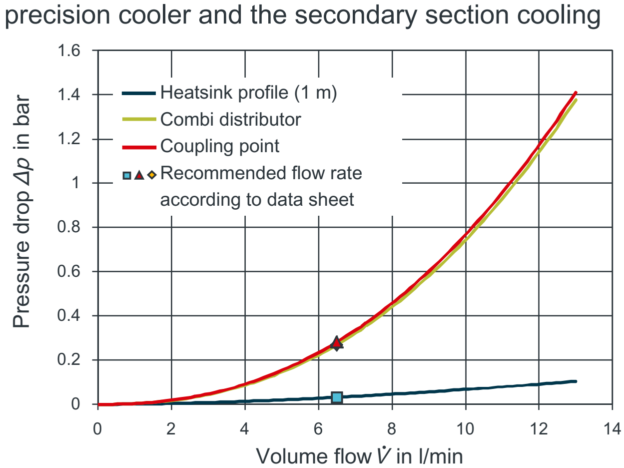
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





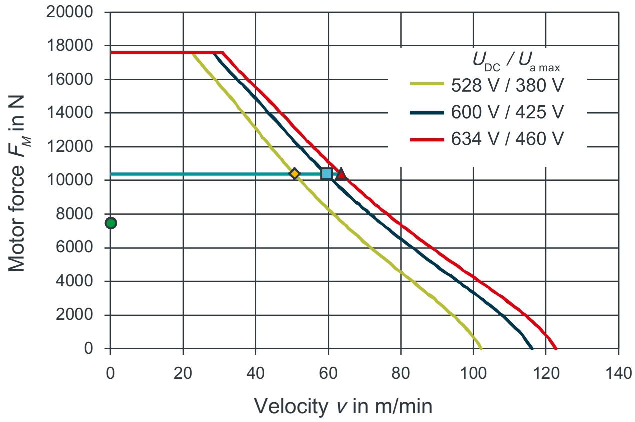
Data sheet of 1FN3900-4NA50-0xAx

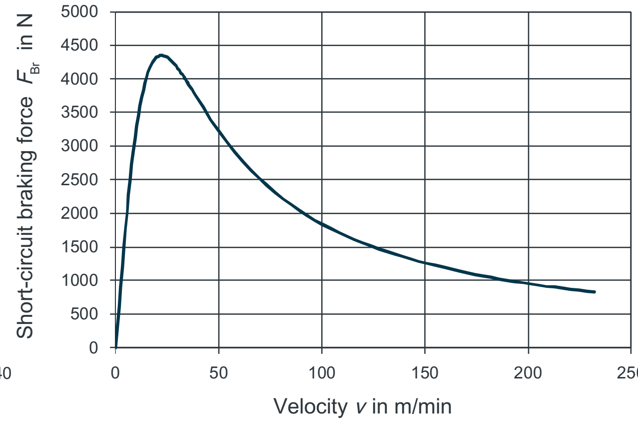
1FN3900-4NA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	10400
Rated current	I_N	A	29.3
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	59.4
Rated power loss	$P_{V,N}$	kW	5.26
Limit data			
Maximum force	F_{MAX}	N	17600
Maximum current	I_{MAX}	A	61.6
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	28.2
Maximum electric power drawn	$P_{EL,MAX}$	kW	31.6
Static force	F_0*	N	7460
Stall current	I_0*	A	20.7
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	361
Voltage constant	k_E	Vs/m	120
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	172
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	1.47
Phase inductance	L_{STR}	mH	40.5
Attraction force	F_A	N	34700
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	82
Mass of the primary section with precision cooler	$m_{P,P}$	kg	85.1
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	4.66
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	10.3
Pressure drop	$\Delta p_{P,H}$	bar	2.17
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.138
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6.5
Pressure drop	$\Delta p_{P,P}$	bar	2.64
Secondary section cooling data			

1FN3900-4NA50-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.462
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6.5
Pressure drop per meter of heatsink profile	Δp_{S}	bar	0.0313
Pressure drop per combi distributor	Δp_{KV}	bar	0.269
Pressure drop per coupling point	Δp_{KS}	bar	0.282

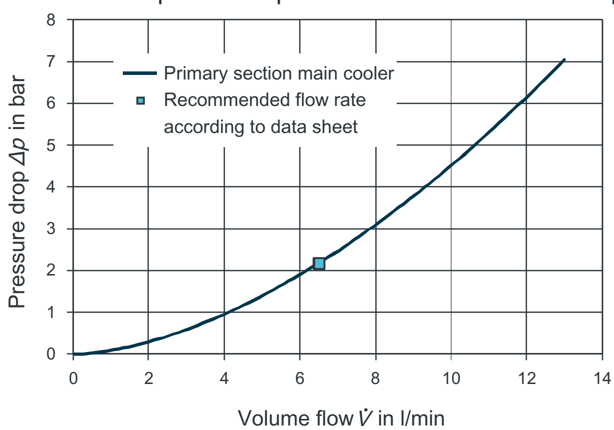
Characteristics for 1FN3900-4NA50-0xAx

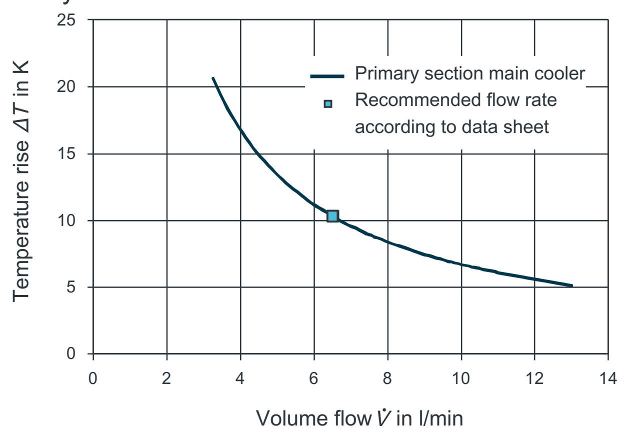
Force characteristics



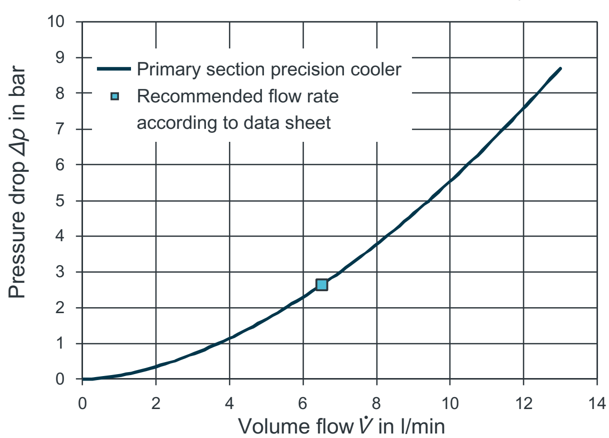


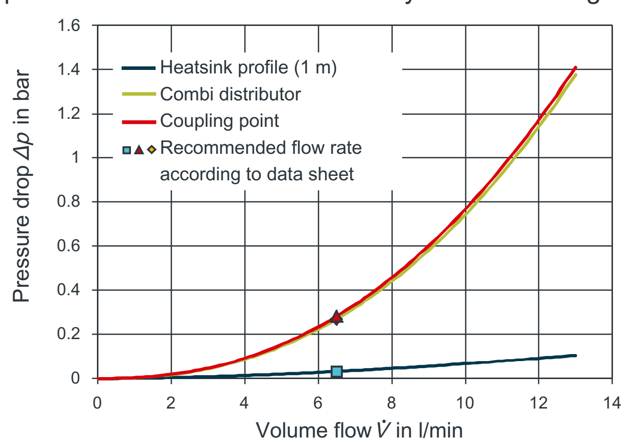
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





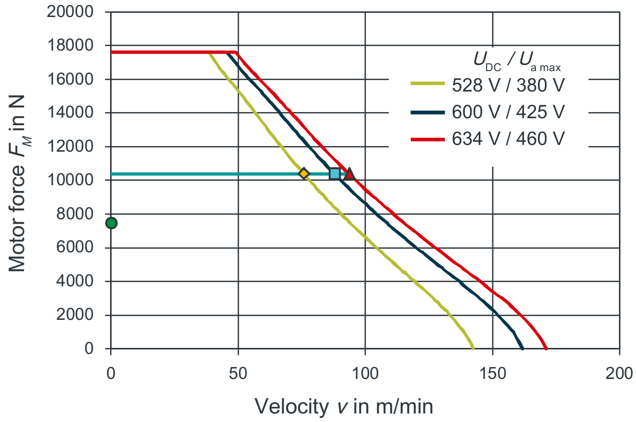
Data sheet of 1FN3900-4NA80-0xAx

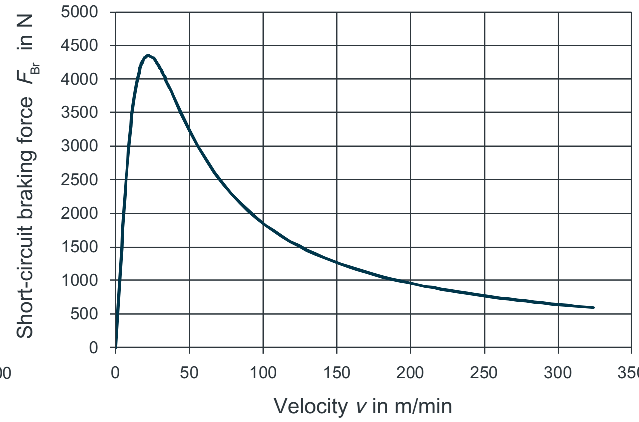
1FN3900-4NA80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	10400
Rated current	I_N	A	40.8
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	87.9
Rated power loss	$P_{V,N}$	kW	5.28
Limit data			
Maximum force	F_{MAX}	N	17600
Maximum current	I_{MAX}	A	85.8
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	45.6
Maximum electric power drawn	$P_{EL,MAX}$	kW	36.8
Static force	F_0*	N	7460
Stall current	I_0*	A	28.9
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	259
Voltage constant	k_E	Vs/m	86.3
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	172
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.759
Phase inductance	L_{STR}	mH	20.8
Attraction force	F_A	N	34700
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	82
Mass of the primary section with precision cooler	$m_{P,P}$	kg	85.1
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	4.68
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	10.4
Pressure drop	$\Delta p_{P,H}$	bar	2.17
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.138
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6.5
Pressure drop	$\Delta p_{P,P}$	bar	2.64
Secondary section cooling data			

1FN3900-4NA80-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.464
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0313
Pressure drop per combi distributor	Δp_{KV}	bar	0.269
Pressure drop per coupling point	Δp_{KS}	bar	0.282

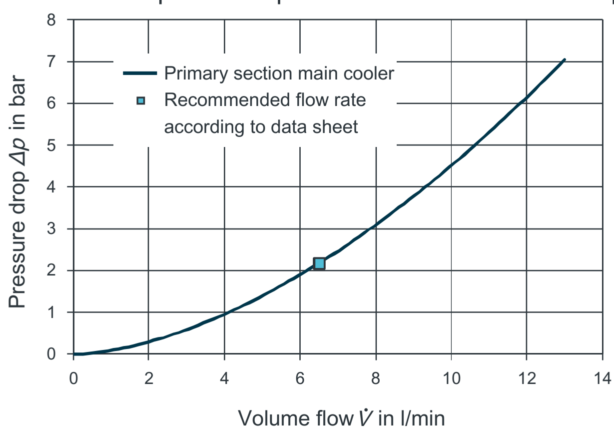
Characteristics of 1FN3900-4NA80-0xAx

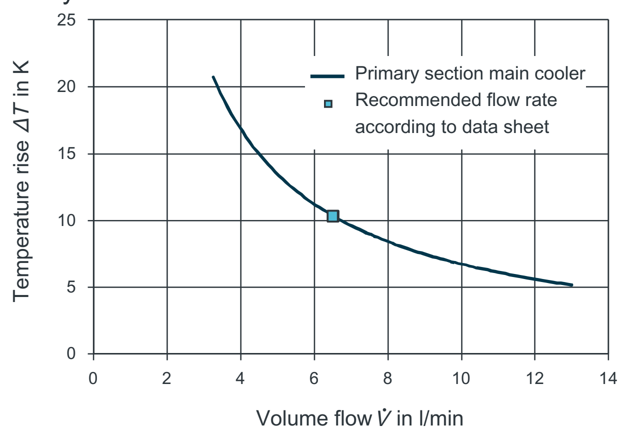
Force characteristics



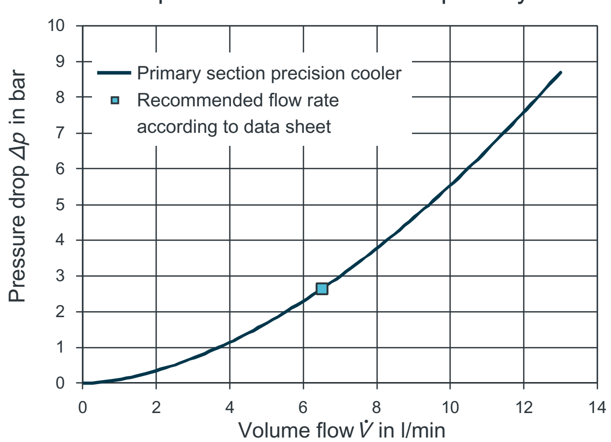


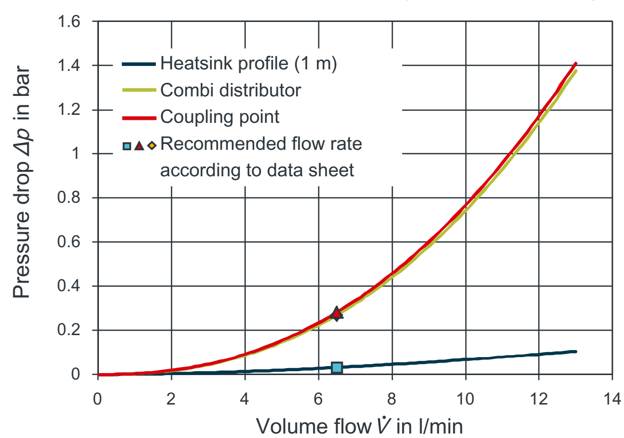
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





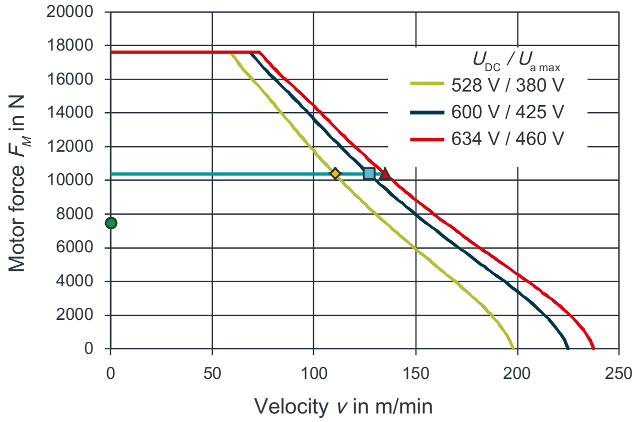
Data sheet of 1FN3900-4NB20-0xAx

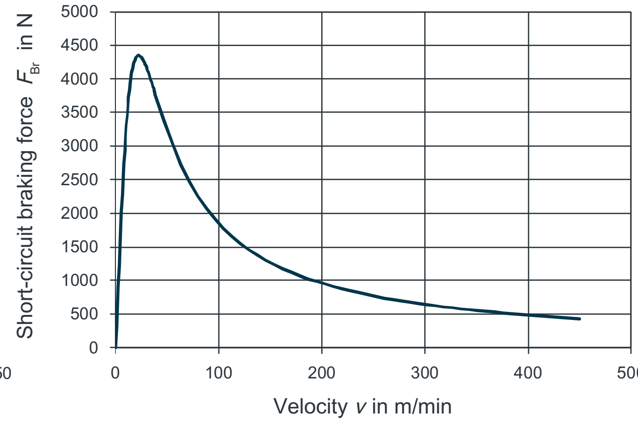
1FN3900-4NB20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
General conditions			
DC-link voltage	U_{DC}	V	600
Water cooling flow temperature	T_{VORL}	°C	35
Rated temperature	T_N	°C	120
Data at the rated point			
Rated force	F_N	N	10400
Rated current	I_N	A	56.7
Maximum velocity at rated force	$v_{MAX,FN}$	m/min	127
Rated power loss	$P_{V,N}$	kW	5.29
Limit data			
Maximum force	F_{MAX}	N	17600
Maximum current	I_{MAX}	A	119
Maximum velocity at maximum force	$v_{MAX,FMAX}$	m/min	68.6
Maximum electric power drawn	$P_{EL,MAX}$	kW	43.5
Static force	F_0*	N	7460
Stall current	I_0*	A	40.1
Physical constants			
Force constant at 20 °C	$k_{F,20}$	N/A	186
Voltage constant	k_E	Vs/m	62.1
Motor constant at 20 °C	$k_{M,20}$	$N/W^{0.5}$	172
Motor winding resistance at 20 °C	$R_{STR,20}$	Ω	0.393
Phase inductance	L_{STR}	mH	10.8
Attraction force	F_A	N	34700
Thermal time constant	t_{TH}	s	180
Pole width	τ_M	mm	23
Mass of the primary section	m_P	kg	82
Mass of the primary section with precision cooler	$m_{P,P}$	kg	85.1
Mass of a secondary section	m_S	kg	7.5
Mass of a secondary section with heatsink profiles	$m_{S,P}$	kg	7.9
Primary section main cooler data			
Maximum dissipated thermal output	$Q_{P,H,MAX}$	kW	4.68
Recommended minimum volume flow rate	$\dot{V}_{P,H,MIN}$	l/min	6.5
Temperature increase of the coolant	$\Delta T_{P,H}$	K	10.4
Pressure drop	$\Delta p_{P,H}$	bar	2.17
Primary section precision cooler data			
Maximum dissipated thermal output	$Q_{P,P,MAX}$	kW	0.139
Recommended minimum volume flow rate	$\dot{V}_{P,P,MIN}$	l/min	6.5
Pressure drop	$\Delta p_{P,P}$	bar	2.64
Secondary section cooling data			

1FN3900-4NB20-0xAx			
Technical data	**Designation**	**Unit**	**Value**
Maximum dissipated thermal output	$Q_{S,MAX}$	kW	0.464
Recommended minimum volume flow rate	$\dot{V}_{S,MIN}$	l/min	6.5
Pressure drop per meter of heatsink profile	Δp_S	bar	0.0313
Pressure drop per combi distributor	Δp_{KV}	bar	0.269
Pressure drop per coupling point	Δp_{KS}	bar	0.282

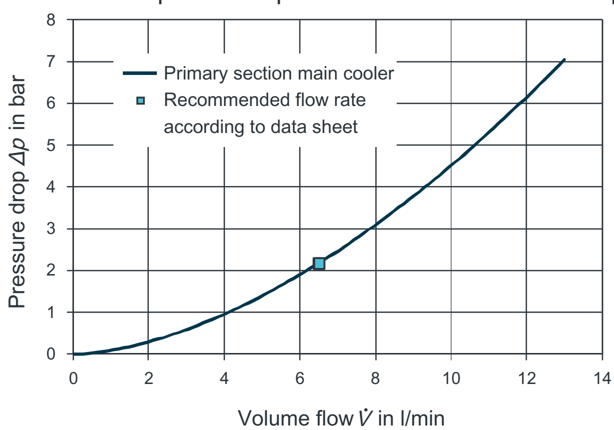
Characteristics for 1FN3900-4NB20-0xAx

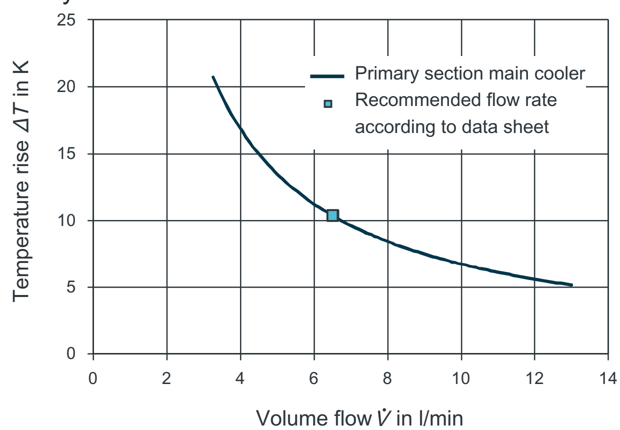
Force characteristics



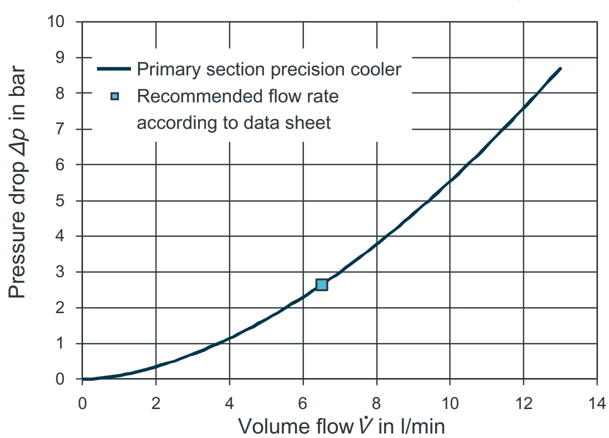


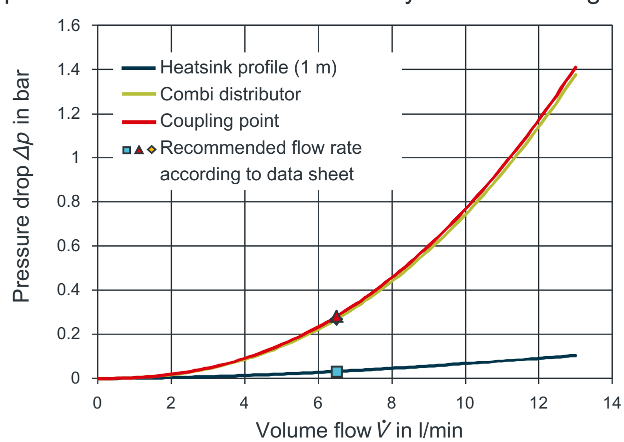
Pressure drop and temperature rise characteristics primary section main cooler





Pressure drop characteristics for the primary section precision cooler and the secondary section cooling





7.2.8 Additional characteristic curves

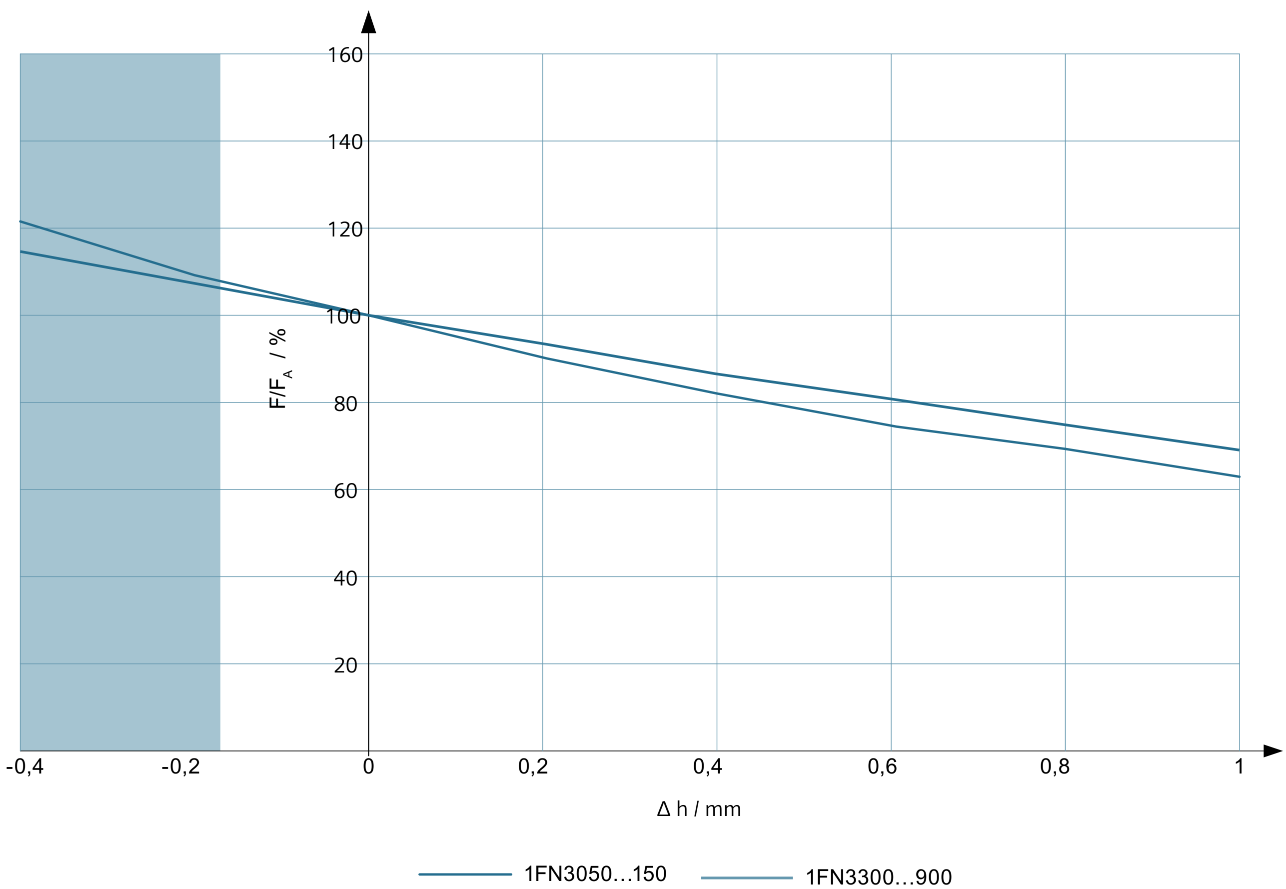
7.2.8.1 Interrelationship between force of attraction and installation height

For the reference installation height h_{M1}, h_{M2}, h_{M3} or h_{M4} the force of attraction F between the primary section and the secondary section track has its rated value F_A according to the data sheet. The reference installation heights are provided in Chapter "Maintaining the installation height (Page 149)".

Depending on the design, the actual installation height can deviate from the reference installation height h_{M1}, h_{M2}, h_{M3} or h_{M4} by height difference Δh.

The force of attraction F depends on this height difference Δh.

The following diagram shows the relative force of attraction F/F_A in % as a function of the height difference Δh.



F/F_A / %	Relative force of attraction as a percentage	Δh	Height difference to the reference installation height h_{M1}, h_{M2}, h_{M3} or h_{M4}
F_A	Force of attraction according to the data sheet		In this range, the primary section is in contact. Operation is not possible.

Figure 7-9 Relative force of attraction F/F_A / % depending on the height difference to the reference installation height Δh

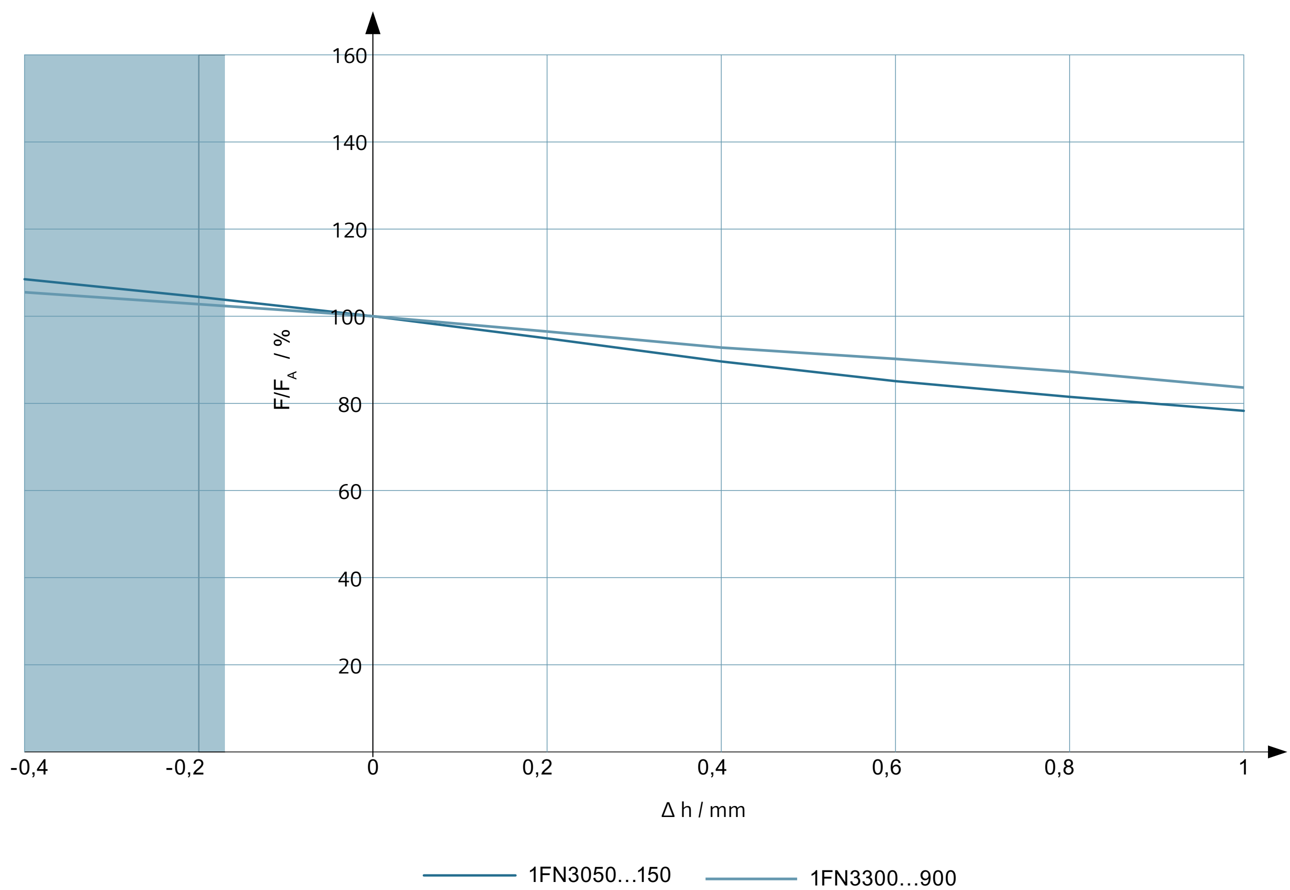
7.2.8.2 Interrelationship between motor force and installation height

For the reference installation height h_{M1}, h_{M2}, h_{M3} or h_{M4} the motor force F has its rated value F_N according to the data sheet. The reference installation heights are provided in Chapter "Maintaining the installation height (Page 149)".

Depending on the design, the actual installation height can deviate from the reference installation height h_{M1}, h_{M2}, h_{M3} or h_{M4} by height difference Δh.

Motor force F depends on this height difference Δh.

The following diagram shows the relative motor force F/F_N in % as a function of the height difference Δh.



F/F_N / %	Relative motor force as a percentage	Δh	Height difference to the reference installation height h_{M1}, h_{M2}, h_{M3} or h_{M4}
F_N	Rated force according to the data sheet	(shaded area)	In this range, the primary section is in contact. Operation is not possible.

Figure 7-10 Relative motor force F/F_N / % depending on the height difference to the reference installation height Δh

Preparation for use

8

⚠ WARNING

Risk of death and crushing as a result of permanent magnet fields

Severe injury and material damage can result if you do not take into consideration the safety instructions relating to the permanent magnet fields of the secondary sections.

- Observe the information in Chapter "Danger from strong magnetic fields (Page 33)".

⚠ WARNING

Incorrect packaging, storage and/or incorrect transport

Risk of death, injury and/or material damage can occur if the devices are packed, stored, or transported incorrectly.

- Always follow the safety instructions for storage and transport.
- When transporting or lifting machines or machine parts with the motors installed, protect the components from moving unintentionally.
- Always correctly and carefully carry out storage, transport and lifting operations.
- Only use suitable devices and equipment that are in perfect condition.
- Only use lifting devices, transport equipment and suspension equipment that comply with the appropriate regulations.
- IATA regulations must be observed when components are transported by air.
- Mark locations where secondary sections are stored with warning and prohibition signs according to the tables in the Chapter "Supplied pictograms".
- Observe the warning instructions on the packaging.
- Always wear safety shoes and safety gloves.
- Take into account the maximum loads that personnel can lift and carry. The motors and their components can weigh more than 13 kg.
- Primary sections and secondary sections must always be transported and stored in the packaged condition.
  - Replace any defective packaging. Correct packaging offers protection against sudden forces of attraction that can occur in the immediate vicinity of a secondary section. Further, when correctly packaged, you are protected against hazardous motion when storing and moving the secondary section.
  - Only use undamaged original packaging.

Note

Original packaging

Keep the packaging of components with permanent magnets where possible!

When reusing the original packaging do not cover safety instructions that are possibly attached. When required, use transparent adhesive tape for the packaging.

WARNING

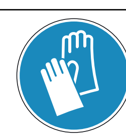
Risk of cutting injuries when handling secondary section covers

Secondary section covers have sharp edges. When delivered, the rolled up cover bands for secondary sections are secured using straps that are under spring tension.

If you cut through these straps, then the rolled up cover bands can suddenly unroll. You can incur cutting injuries at your hands and eyes if you do not wear safety gloves and adequate eye protection.

- Always wear safety gloves when handling secondary section covers
- Always wear suitable eye protection when unpacking cover bands
- Work in pairs where necessary
- Firmly hold the rolled up cover bands when cutting through the straps
- Allow the cover bands to slowly unroll

Table 8-1 Safety pictograms on the packaging for secondary section covers as continuous cover bands

Pictogram	Meaning	Pictogram	Meaning
	Warning against the secondary section cover band suddenly unrolling (Non-standardized warning sign)		Warning against pointed/ sharp object (ISO 7010-W022)
	Use eye protection (ISO 7010-M004)		Use protective gloves (ISO 7010-M009)

8.1 Transporting

Note

UN number for permanent magnets

UN number 2807 is allocated to permit magnets as hazardous item.

When shipping products that contain permanent magnets by sea or road, no additional packaging measures are required for protection against magnetic fields.

8.1.1 Ambient conditions for transportation

Based on DIN EN 60721-3-2 (for transportation)

Table 8-2 Climatic ambient conditions

Lower air temperature limit:	- 15 °C
Upper air temperature limit:	+ 40° C
Lower relative humidity limit:	5 %
Upper relative humidity limit:	85 %
Rate of temperature fluctuations:	Max. 0.5 K/min
Condensation:	Not permissible
Formation of ice:	Not permissible
Transport:	Class 2K2

Transport is only permissible in locations that are fully protected against the weather (in halls or rooms).

Table 8-3 Biological ambient conditions

Transport:	Class 2B1

Table 8-4 Chemical ambient conditions

Transport:	Class 2C1

Table 8-5 Mechanically active ambient conditions

Transport:	Class 2S2

Table 8-6 Mechanical ambient conditions

Transport:	Class 2M2

8.1.2 Packaging specifications for air transportation

When transporting products containing permanent magnets by air, the maximum permissible magnetic field strengths specified by the appropriate IATA Packing Instruction must not be exceeded. Special measures may be required so that these products can be shipped. Above a certain magnetic field strength, shipping requires that you notify the relevant authorities and appropriately label the products.

Note

The magnetic field strengths listed in the following always refer to values for the DC magnetic field specified in IATA packaging instruction 953. If the values change, we will take this into account in the next edition.

Products whose highest field strength exceeds 0.418 A/m, as determined at a distance of 4.6 m from the product, require shipping authorization. This product will only be shipped with previous authorization from the responsible national body of the country from where the product is being shipped (country of origin) and the country where the airfreight company is based. Special measures need to be taken to enable the product to be shipped.

When shipping products whose highest field strength is equal to or greater than 0.418 A/m, as determined at a distance of 2.1 m from the product, you have a duty to notify the relevant authorities and appropriately label the product.

When shipping products whose highest field strength is less than 0.418 A/m, as determined at a distance of 2.1 m from the product, you do not have to notify the relevant authorities and you do not have to label the product.

To achieve mutual optimal weakening of the magnetic fields (magnetic interference fields) the original and individual packaging of two secondary sections must always be stacked on one another in pairs, alternating according to the following diagram. In each case, edge A-B of the lower individual package must be placed on the edge C-D of the upper individual package.

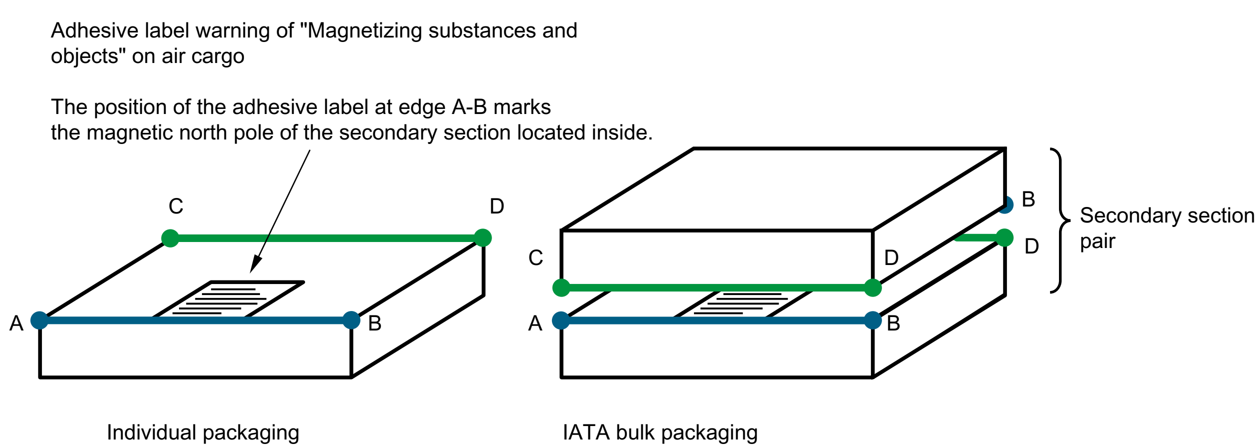


Figure 8-1 Packing for secondary sections and correct stacking

The precondition for correctly stacking two secondary sections is an offset within a secondary section pair of less than 1 cm, which must be guaranteed for the complete duration of the air transport. To achieve this, fix the original individual packaging, e.g. using adhesive packaging tape. When required, use transparent adhesive packaging tape in order not to cover any safety instructions.

If the individual packages with the secondary sections are not stacked pairwise alternating on top of one another, the magnetic fields strengthen one another. If the offset within a secondary section pair is larger than 1 cm during the complete duration of the air transport, then the magnetic fields also strengthen one another.

In bulk packaging, secondary section pairs (each pair stacked alternating, according to the diagram "Packaging for secondary sections and correct stacking") can be arranged as required.

Table 8-7 Packaging specifications for 1FN3xxx-xSxxx-xxxx secondary sections

	not subject to notification and labeling requirements	**subject to notification and labeling requirements**	**subject to authorization**
A single secondary section is packaged in its original individual packaging		X	
Two secondary sections each are packaged in the original individual packaging and correctly stacked in pairs	X [2])		
Secondary sections are packaged in the original individual packaging, and can be arranged as required			X [1])

[1]) If the secondary section is also packed in a ferromagnetic sheet metal case in addition to the original individual packaging, e.g. manufactured out of iron with a thickness of greater than 0.5 mm, then when shipping, you only have to notify the relevant authorities and attach appropriate labels.

[2]) If an offset within a secondary section pair of less than 1 cm cannot be guaranteed for the duration of the complete air transport, then for transportation you have to notify the relevant authorities and attach appropriate labels.

Example 1

Original individual packages with secondary section pairs with the Article number 1FN3xxx-xSxxx-xxxx are correctly stacked in new packaging (bulk packaging). The shipment is not subject to notification and labeling requirements.

Example 2

A maximum of one additional original individual packaging with one secondary section may be added to the new (bulk) packaging from example 1. This individual secondary section can be arbitrarily aligned, a sheet metal case to provide additional shielding is not required. The shipment of the complete new package is then subject to notification and labeling requirements.

8.1.3 Lifting primary sections

NOTICE
Damage to the primary section when incorrectly lifted

Improper use of lifting equipment and slings can lead to permanent deformation and damage to the primary section.

- Always ensure the primary section is horizontal when lifting and transporting it.
- To fasten the suspension ropes for lifting the primary section, use
  - the threaded holes on the top of the primary section
  - Eye bolts acc. to DIN 580
- To lift and transport in a horizontal position, screw in the eye bolts in diagonally opposing threaded holes of the primary section. Choose the threaded holes with the greatest possible distance from one another.
- If the unit must be lifted and transported in a vertical position, you must screw in the eye bolts in adjacent threaded holes directly on a front end of the primary section.
- The locating surfaces of the eye bolts must positioned flat and over the whole surface on the top of the primary section.
- Observe the specifications for thread depths and screw-in depths in the primary section (Specifications for mounting linear motors (Page 147)).
  The values cited in this chapter also apply to the eye bolts.
  If the threaded pins of the eye bolts are too long, you must ensure that the maximum screw-in depth is adhered to, using washers if necessary.
- All of the suspension ropes must be the same length.
  When lifting and transporting in a horizontal position, the taut suspension ropes must form an angle of at least 50° between the rope and the primary section. The center of gravity of the primary section must be centered between the threaded holes that are used and lie vertically under the hook of the crane.
- Two suspension ropes and two eyebolts are sufficient to lift and transport the primary section. The primary section may incline to one side during this, however.
- If you use four suspension ropes and four eye bolts, the load is optimally distributed, which means that a sideward inclination is ruled out.
- The positioning of the primary section with suspension ropes on the provided installation position is not permitted.
- Comply with the specifications laid down in DIN 580.

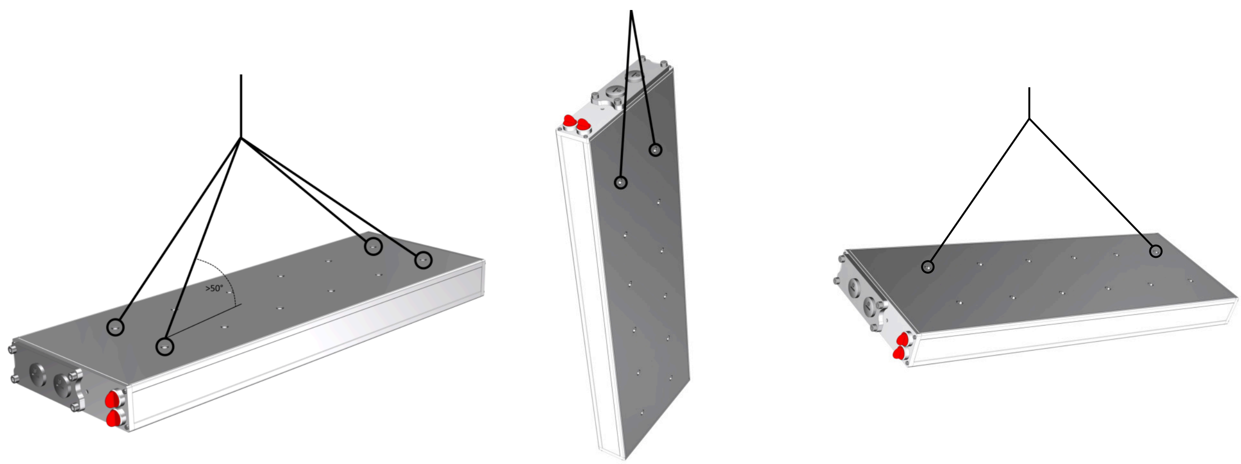


Figure 8-2 Correct lifting of primary sections

8.2 Storage

8.2.1 Ambient conditions for long-term storage

Based on DIN EN 60721-3-1 (for long-term storage)

Table 8-8 Climatic ambient conditions

Lower air temperature limit:	- 5° C (deviates from 3K3)
Upper air temperature limit:	+ 40° C
Lower relative humidity limit:	5 %
Upper relative humidity limit:	85 %
Rate of temperature fluctuations:	Max. 0.5 K/min
Condensation:	Not permissible
Formation of ice:	Not permissible
Long-term storage:	Class 1K3 and class 1Z1 have a different upper relative humidity

Storage is only permissible in locations that are fully protected against the weather (in halls or rooms).

Table 8-9 Biological ambient conditions

Long-term storage:	Class 1B1

Table 8-10 Chemical ambient conditions

Long-term storage:	Class 1C1

Table 8-11 Mechanically active ambient conditions

Long-term storage:	Class 1S2

Table 8-12 Mechanical ambient conditions

Long-term storage:	Class 1M2

8.2.2 Storage in rooms and protection against humidity

Storing indoors

- Apply a preservation agent (e.g. Tectyl) to bare external motor components if this has not already been carried out in the factory.
- Store the motors as described in Section "Ambient conditions for long-term storage". The storage room/area must satisfy the following conditions:
  - Dry
  - Dust-free
  - Free of any vibration
  - Well ventilated
  - Protected against extreme weather conditions
  - The air inside the room or space must be free of any aggressive gases
- Protect the motor against shocks and humidity.
- Make sure that the motor is covered properly.

Protection against humidity

If a dry storage area is not available, then take the following precautions:

- Wrap the motor in humidity-absorbent material. Then wrap it in foil so that it is air tight.
- Include several bags of desiccant in the sealed packaging. Check the desiccant and replace it as required.

- Place a humidity meter in the sealed packaging to indicate the level of air humidity inside it.
- Inspect the motor on a regular basis.

Protecting the cooling system for motors with integrated cooling

Before you store the motor after use, perform the following actions:

- Empty the cooling channels.
- Blow out the cooling ducts with dry, compressed air so that the cooling ducts are completely empty.
- Seal the connections of the cooling system.

9 Electrical connection

NOTICE
Destruction of the motor if it is directly connected to the three-phase line supply
The motor will be destroyed if it is directly connected to the three-phase line supply. • Only operate the motors with the appropriately configured converters.

WARNING

Risk of electric shock due to incorrect connection

If you incorrectly connect the motor this can result in death, serious injury, or extensive material damage. The motors require an impressed sinusoidal current.

- Connect the motor in accordance with the circuit diagram provided in this documentation.
- Refer also to the documentation for the drive system used.

WARNING

Risk of electric shock

Voltage is induced at the power connections of the primary section each time a primary section moves with respect to a secondary section - and vice versa.

When the motor is switched on, the power connections of the primary section are also live.

If you touch the power connections you may suffer an electric shock.

- Only mount and remove electrical components if you have been qualified to do so.
- Only work on the motor when the system is in a no-voltage condition.
- Do not touch the power connections. Correctly connect the power connections of the primary section or properly insulate the cable connections.
- Do not disconnect the power connection if the primary section is under voltage (live).
- When connecting up, only use power cables intended for the purpose.
- First connect the protective conductor (PE).
- Attach the shield through a large surface area.
- First connect the power cable to the primary section before you connect the power cable to the converter.
- First disconnect the connection to the converter before you disconnect the power connection to the primary section.
- In the final step, disconnect the protective conductor (PE).

⚠ WARNING

Electric shock caused by high leakage currents

When touching conductive parts of the machine, high leakage currents can result in an electric shock.

- For high leakage currents, observe the increased requirements placed on the protective conductor. The requirements are laid down in standards DIN EN 61800-5-1 and DIN EN 60204-1.
- For high leakage currents, attach warning symbols to Power Drive System .

⚠ WARNING

Risk of electric shock as a result of residual voltages

There is a risk of electric shock if hazardous residual voltages are present at the motor connections. Even after switching off the power supply, active motor parts can have a charge exceeding 60 μC. In addition, even after withdrawing the connector 1 s after switching off the voltage, more than 60 V can be present at the free cable ends.

- Wait for the discharge time to elapse.

9.1 Permissible line system types

Permissible line system types and voltages

The following table shows the permissible line voltages of TN line supply systems for the motors.

Table 9-1 Permissible line voltages of TN line supply systems, resulting DC link voltages and converter output voltages

Permissible line supply voltage	resulting DC link voltage U_{DC}	Converter output voltage (rms value) $U_{a\ max}$
400 V	600 V (controlled) 528 V (uncontrolled)	425 V (controlled) 380 V (uncontrolled)
480 V	634 V (uncontrolled)	460 V (uncontrolled)

When using the SINAMICS S120 drive system, the motors are always approved for operation on the following line supplies:

- TN line systems with grounded neutral point
- TT line systems with grounded neutral point
- IT line systems

When operated on IT line systems, a protective device should be provided that switches off the drive system in the case of a ground fault.

In operation with a grounded external conductor, an isolating transformer with grounded neutral (secondary side) must be connected between the line supply and the drive system. This protects the winding insulation from excessive stress.

9.2 Motor circuit diagram

The circuit diagram of the primary section looks like this:

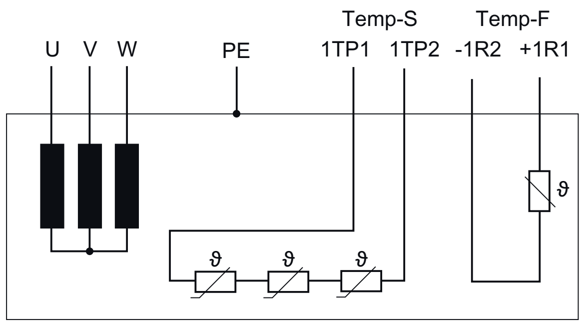


Figure 9-1 Circuit diagram for primary section

9.3 System integration

9.3.1 Drive system

Components

The drive system that feeds a motor comprises an infeed module, a power module and a control module. For the SINAMICS S120 drive system, these modules are called "Line Modules", "Motor Modules" and "Control Units". Line Modules can be regulated with feedback (ALM, Active Line Module), unregulated with feedback (SLM, Smart Line Module), or unregulated without feedback (BLM, Basic Line Module).

To operate several motors simultaneously on a single drive system, either one Motor Module per motor or one Motor Module for several motors can be provided, depending on the application. The appropriate choice of Line Module is primarily determined by the power consumption of the motors used. Other important related factors are the line voltage, regenerative feedback, and the DC-link voltage.

The subsequent diagrams show examples of motors integrated into systems with connection of Temp-S and Temp-F via an SME12x.

To connect an absolute value encoder EnDat with 1 V_{PP}, order designation EnDat01 or EnDat02, or SSI with 1 V_{PP} , you require the SME125.

To connect an incremental encoder (sin/cos 1 V_{PP}), you require the SME120.

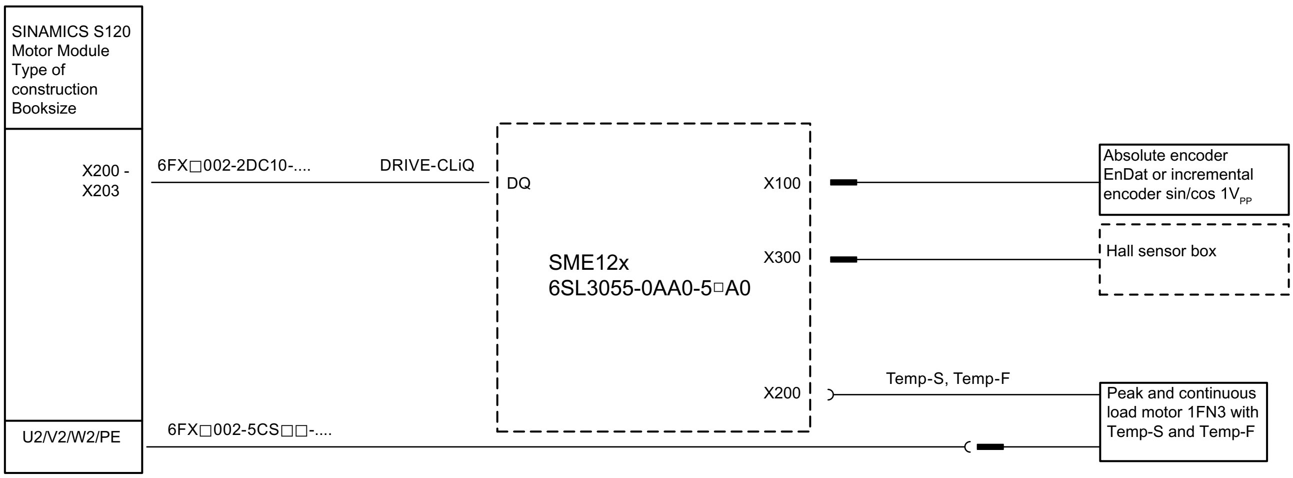


Figure 9-2 System integration with SME12x and separate signal and power cables (example)

The following diagram only applies to peak load motors.

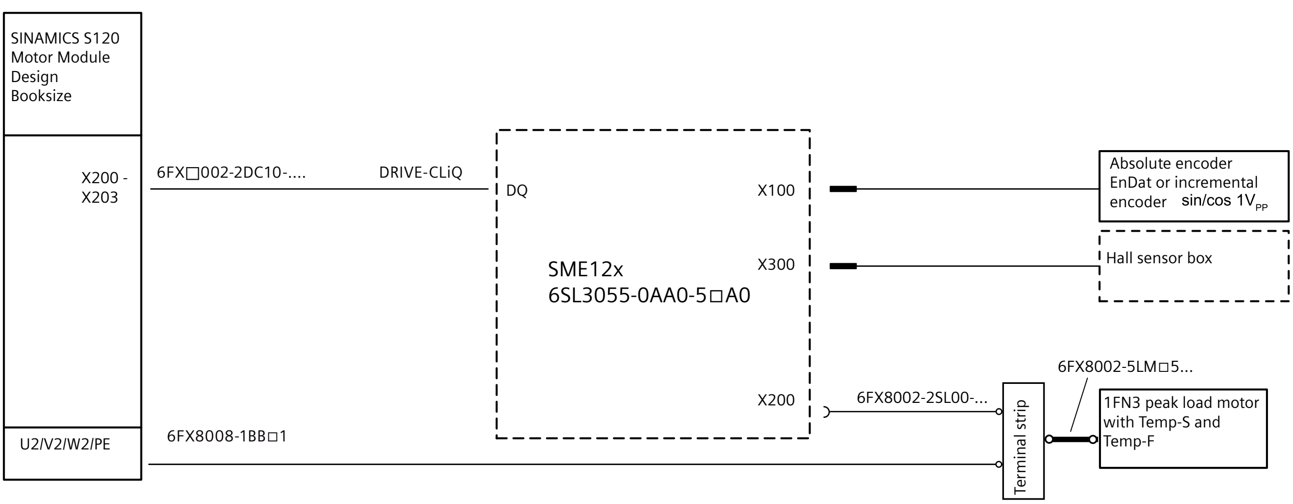


Figure 9-3 System integration with SME12x and combined cable for the signal and power connection (example)

The subsequent diagram shows an example of a motor integrated into a system with Temp-S and Temp-F connected via TM120. An incremental encoder (sin/cos 1 V_{PP}) or absolute encoder (EnDat with 1 V_{PP}, order designation EnDat01 or EnDat02, or SSI with 1 V_{PP}) is connected via SMC20.

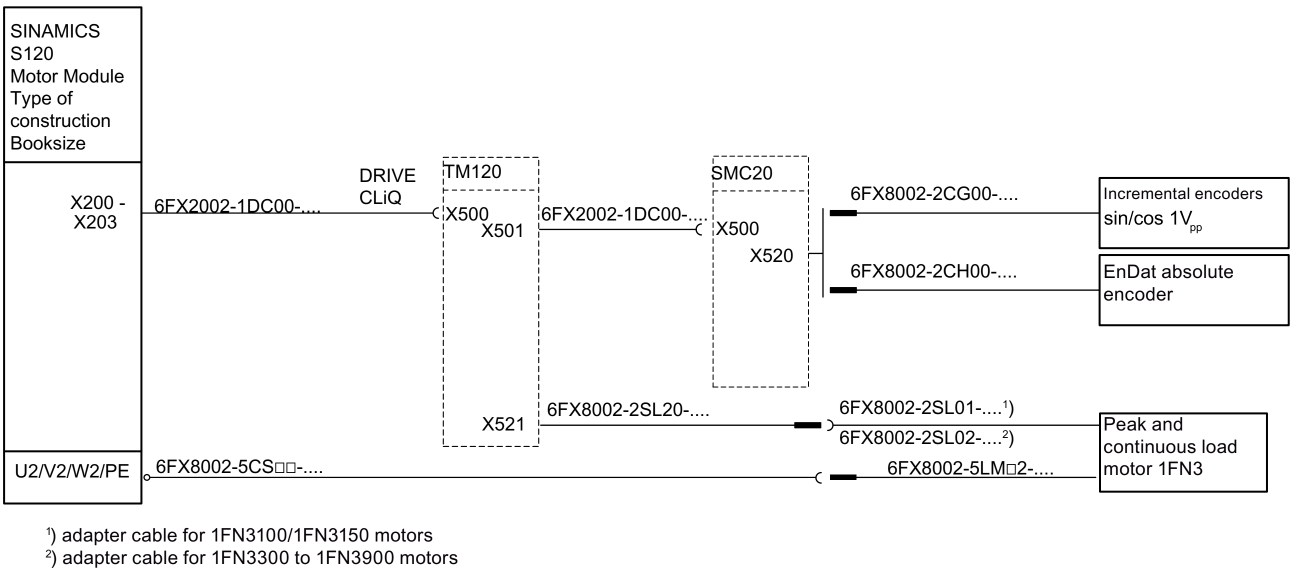


Figure 9-4 System integration with TM120 and SMC20 (example)

The subsequent diagram shows an example of a motor integrated into a system with Temp-S and Temp-F connected via TM120. A DRIVE-CLiQ encoder is connected directly to the TM120.

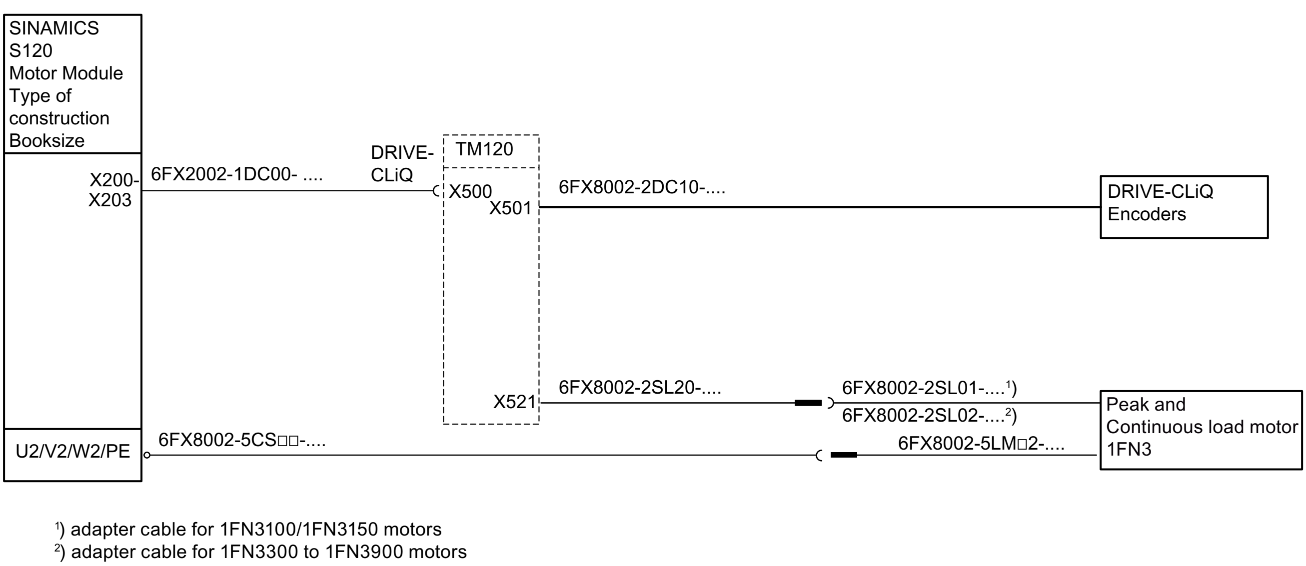


Figure 9-5 System integration with TM120 (example)

Power and signal connection

Only ring cable lugs are suitable for the power and signal connection at the motor end. Only plug connectors with a full thread are suitable for the onward adapter cable. This is the reason that cable extensions, for example, to the converter or to the SME12x, must also have a full thread connectors. SPEED-CONNECT connections are not compatible.

Requirements

- The choice of Motor Module depends on the rated current or the maximum current of the motor.
- The encoder system depends on the application

Note

Read the corresponding documentation about open-loop and closed-loop control systems.

NOTICE

Damaged main insulation

In systems where direct drives are used on controlled infeeds, electrical oscillations can occur with respect to ground potential. These oscillations are, among other things, influenced by:

- The lengths of the cables
- The rating of the infeed/regenerative feedback module
- The type of infeed/regenerative feedback module (particularly when an HFD commutating reactor is already present)
- The number of axes
- The size of the motor
- The winding design of the motor
- The type of line supply
- The place of installation

The oscillations lead to increased voltage loads and may damage the main insulation!

- To dampen the oscillations we recommend the use of the associated Active Interface Module or an HFD reactor with damping resistor. Review the documentation of the drive system being used for details. If you have any questions, please contact your local sales partner.

Note

The corresponding Active Interface Module or the appropriate HFD line reactor must be used to operate the Active Line Module controlled infeed unit.

9.3.2 Sensor Module SME12x

Sensor Module External SME12x is a module to evaluate:

- Incremental encoders with sin/cos 1 V_{PP} interface (SME120)
- Absolute encoders with EnDat interface (SME125)
- Temperature sensors

The temperature sensors in the motor do not have safe electrical separation in order to achieve better thermal contact to the motor winding.

The SME12x evaluates the temperature sensors with safe electrical separation.

Information about the SME12x is provided in the "SINAMICS S120 Control Units and Additional System Components" Equipment Manual.

9.3.3 TM120 Terminal Module

The TM120 Terminal Module is a module for evaluating temperature signals.

The temperature sensors in the motor do not have safe electrical separation in order to achieve better thermal contact to the motor winding.

Terminal Module TM120 evaluates the temperature sensors with safe electrical separation.

Information about the TM120 is provided in the Equipment Manual "SINAMICS S120 Control Units and Additional System Components".

9.3.4 SMC20 Sensor Module

The Sensor Module Cabinet-Mounted SMC20 is a module to evaluate:

- Incremental encoders with sin/cos 1 V_{PP} interface
- Absolute encoders with EnDat 2.1 interface
- Absolute encoders with EnDat 2.2 interface and order designation EnDat01 or EnDat02

Information about the SMC20 is provided in the "SINAMICS S120 Control Units and Additional System Components" Equipment Manual.

9.3.5 SMC40 Sensor Module

The Sensor Module Cabinet-Mounted SMC40 is a module for evaluating:

- Two absolute encoders with EnDat 2.2 interface and order designation EnDat22

Information about the SMC40 is provided in Equipment Manual "SINAMICS S120 Control Units and Additional System Components".

9.3.6 Pin assignments and connection types

The 1FN3050 motors either have a permanently connected combined cable or two separate permanently connected cables for the power connection and the signal connection. These cables are either 0.5 m long with prefabricated connectors (size 1 or M17) or 2 m long with open conductor ends.

The 1FN3100 to 1FN3900 motors are provided with separate cables for the power connection and signal connection. To connect these motors, use the connection cover with metric cable glands directly on the integrated terminal panel.

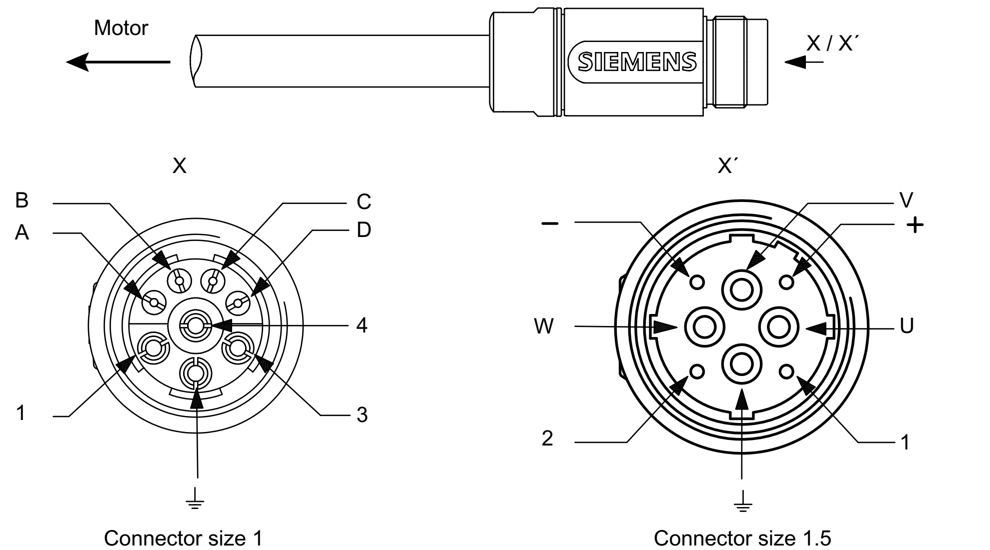
Peak load motors from this series are also available with a combined cable. Connect the combined cable via a connection cover with PG cable gland on the terminal panel.

Separate power and signal cables with their own connectors make electrical connection simpler, for example to a SME12x Sensor Module. You also avoid use of a terminal block.

Combined cable for the power and temperature sensor connection

As standard, this connection variant is only intended for peak load motors; you can retrofit continuous load motors as required. The combined cable has 4 power cores (3 phases and PE) and 2x2 signal cores for the temperature sensors. Connect the combined cable directly at the integrated terminal panel. Use angled ring cable lugs for the ends of the cables.

You will find connection types for connection of temperature sensors and core assignments in Chapter "Signal connection (Page 512)".



Core	Pin
U	1
V	4
W	3
PE	⏚
Temp-S: PTC	A
Temp-S: PTC	B
Temp-F: KTY + or Pt1000	C
Temp-F: KTY - or Pt1000	D

Core	Pin
U	U
V	V
W	W
PE	⏚
Temp-S: PTC	1
Temp-S: PTC	2
Temp-F: KTY + or Pt1000	+
Temp-F: KTY - or Pt1000	-

Figure 9-6 PIN assignments of the plug-in connectors for combined cables

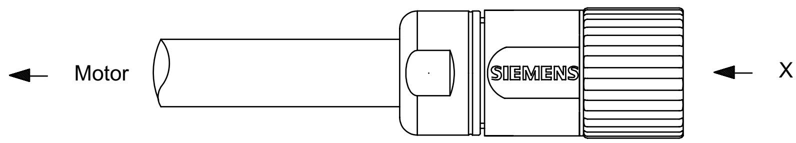
Connect the cables at the motor end with EMC-compliant metallic PG cable glands. This allows cable connections with low bending radii in all directions.

Prefabricated adapter cables 6FX8002-5LMx**0** with straight heavy-gauge threaded joint and connector are available for the MOTION-CONNECT connection system, as are direct cables 6FX8002-5LMx**5** without connector. These cables allow quick connection to the motor using angular ring cable lugs and heavy-gauge threaded joints with an integrated EMC-compliant shield support. You will find the article numbers for these items in the catalog or on the Internet at https://eb.automation.siemens.com using the search term "MOTION-CONNECT".

Separate power and temperature sensor cables

This connection type is standard for peak and continuous load motors. The power cable has 4 power cores (3 phases and PE). The temperature sensor cable has 2x2 signal cores. Connect both cables to the terminal panel. Insert the cables into the terminal panel with two metric cable glands.

You will find connection types for connection of temperature sensors and core assignments in Chapter "Signal connection (Page 512)".



Signal connector size M 17

Core	Pin
Temp-F: KTY - or Pt1000	1
Temp-F: KTY + or Pt1000	2
Temp-S: PTC	3
Temp-S: PTC	4
---	5
---	6
PE	⏚

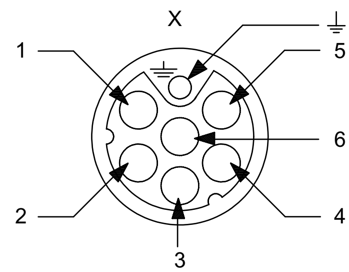
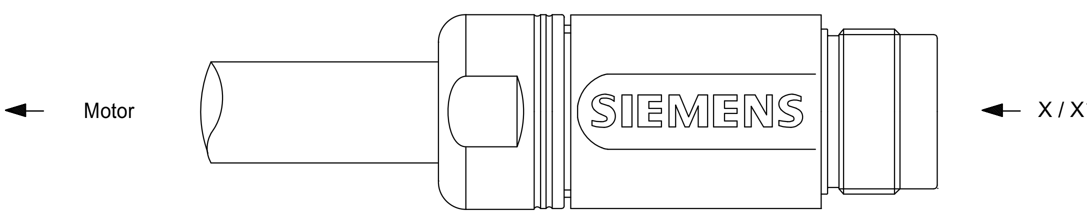
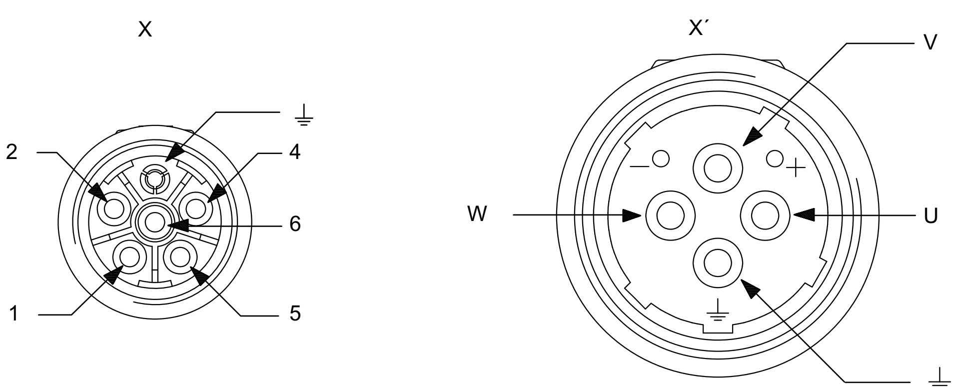


Figure 9-7 PIN assignments of the plug-in connectors for signal cables





Connector size 1

Core	Pin
U	1
V	2
W	6
PE	⏚
---	4
---	5

Connector size 1.5

Core	Pin
U	U
V	V
W	W
PE	⏚
---	+
---	-

Figure 9-8 PIN assignments of the plug-in connectors for power cables

9.3.7 Terminal panel

Terminal panel and connector pin assignment

Note

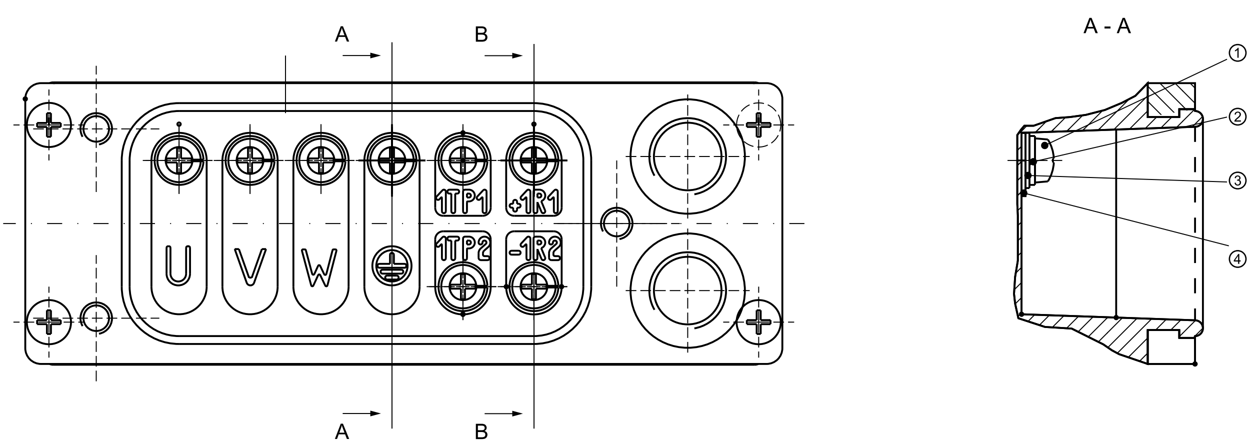
Preassemble the cables before installing

If the primary section is already installed, the terminal panel may be difficult to access.

- Install the cables in the terminal panel before installing the primary section in the machine.

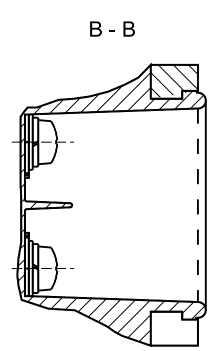
The following figures show the terminal assignment of the terminal panel for various peak load motor types. The terminal panel of peak load and continuous load motors is identical. The only difference is that the dimensions of the casing are larger on the continuous load motor. However, this is of no significance for the electrical connection.

With the EN 60034-8:2002 standard the terminal markings have changed. For the old terminal markings, see Appendix.



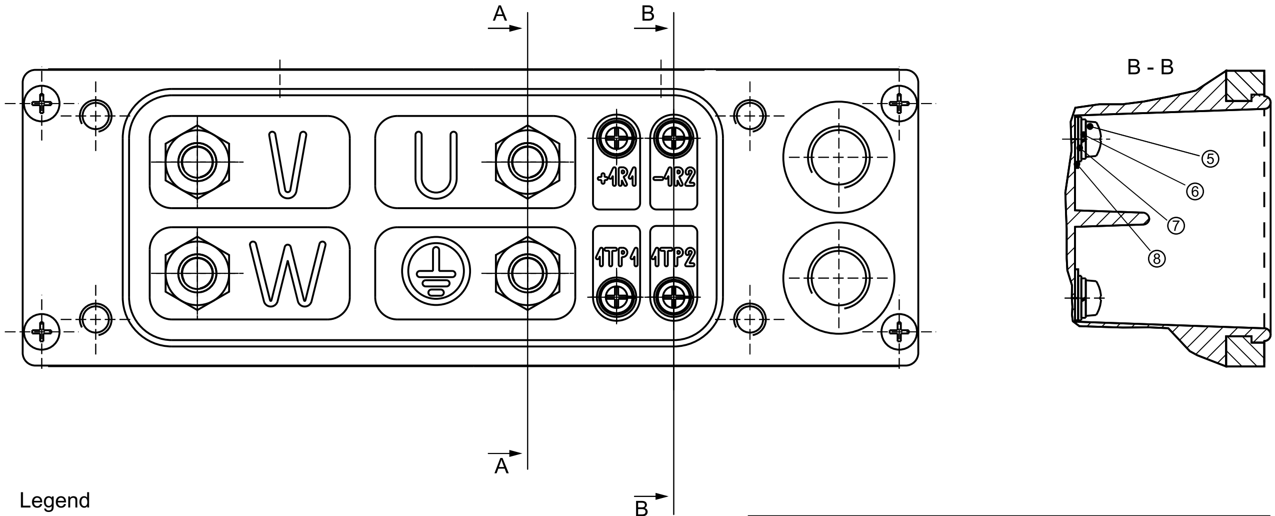
Legend

U	Phase U
V	Phase V
W	Phase W
⏚	Protective conductor terminal PE
1TP1	Temp-S: PTC
1TP2	Temp-S: PTC
+1R1	Temp-F: KTY 84 + or Pt1000
-1R2	Temp-F: KTY 84 - or Pt1000



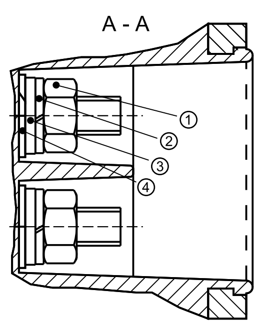
①	Oval-head screw with cross head ISO 7985-M3x10-A2; Tightening torque: 0.6 Nm ... 0.8 Nm
②	Spring lock washer DIN 128-A 3.1-Fst
③	Washer DIN 125-A 3.2-A2
④	e.g. crimp type socket DIN 46234; not included in the scope of supply of the primary section!

Figure 9-9 Terminal panel for the motors 1FN3100 to 1FN3150



Legend

U	Phase U
V	Phase V
W	Phase W
PE	Protective conductor terminal PE
1TP1	Temp-S: PTC
1TP2	Temp-S: PTC
+1R1	Temp-F: KTY 84 + or Pt1000
-1R2	Temp-F: KTY 84 - or Pt1000



①	Nut ISO 4032-M6-A2; Tightening torque: 6 Nm ... 7 Nm
②	Spring lock washer DIN 128-A 6.1-Fst
③	Washer DIN 125-A 6.4-A2
④	e.g. crimp type socket DIN 46234; not included in the scope of supply of the primary section!
⑤	Oval-head screw with cross head ISO 7985-M3x10-A2; Tightening torque: 0.6 Nm ... 0.8 Nm
⑥	Spring lock washer DIN 128-A 3.1-Fst
⑦	Washer DIN 125-A 3.2-A2
⑧	e.g. crimp type socket DIN 46234; not included in the scope of supply of the primary section!

Figure 9-10 Terminal panel for the motors 1FN3300 to 1FN3900

Connection cover

The terminal panel is sealed with degree of protection IP65 using a cover with connection thread. The following figure shows the different connection cover versions and their potential applications.

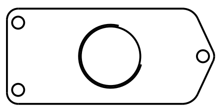
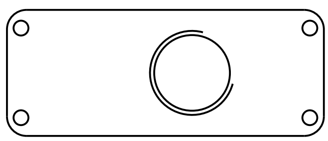
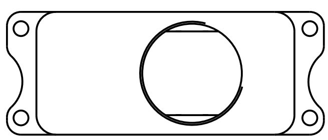
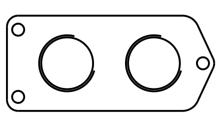
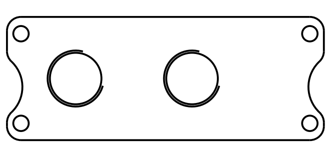
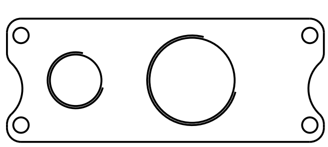
	PG16 screw glandfor 1FN3100 - 150 (1FN3002-0PB01-0AA0)	only for peak load motors
	PG21 screw glandfor 1FN3300 - 900 (1FN3003-0PB02-0AAx)	only for peak load motors
	PG29 screw glandfor 1FN3300 - 900 (1FN3003-0PB03-0AAx)	only for peak load motors
	2x M20x1.5 screwed jointfor 1FN3100 - 150 (1FN3002-0PB04-0BA0)	for peak andContinuous load motors
	2x M20x1.5 screwed jointfor 1FN3300 - 900 (1FN3003-0PB04-0BAx)	for peak andContinuous load motors
	M20x1.5+M32x1.5 screwed glandfor 1FN3300 - 900 (1FN3003-0PB05-0BAx)	for peak andContinuous load motors

Figure 9-11 Connection cover variants

Note

Compatibility of the connection cover

Connection covers for 1FN3300 to 1FN3900 with a "0" at the 16th position of the article number are not compatible with primary sections as of a serial number YFFNxxx. Always use the connection cover supplied with the associated seal.

The screws supplied and the associated tightening torques are listed in the following table.

Table 9-2 Screws supplied for the connection cover and the associated tightening torque

Motor type 1FN3...	Screw in compliance with DIN EN ISO 4762	Tightening torque
100, 150	M4x20–A2	2.2 Nm
300, 450, 600, 900	M5x20–A4	3.4 Nm

Disassembly of the connection cover

NOTICE

Damage to the seal

The seal can be damaged during disassembly of the connection cover.

- When unscrewing the connection cover, take care that the seal stays completely in the groove in the connection cover.
- Carefully remove the seal from the motor if necessary. Then press the seal back into the groove of the connection cover.

9.3.8 Power connection

Connection assignment

Table 9-3 Power connection for linear motor

Converter	Primary section
U2	U
V2	V
W2	W

For information on connecting the power, also refer to the diagrams relating to "System integration". The direction of motion of the primary or secondary section is positive if the primary section is connected to phase sequence U, V, W. See "Direction of motion of the motor (Page 38)".

Number of conductors and cable cross-sections

Cables that are connected to the motor must have four conductors for the power cable / four conductors for the signal cable. The cross-section for each of the signal cable conductors is 0.5 mm^2. The cross-section of the power cable conductors is based on the rated current of the motor. The rated current of the motor must be less than the current carrying capacity of the cable according to DIN EN 60204-1 (laying system C). The table below specifies the maximum permissible rated current of the motor for different cross-sections of the power cable conductors.

Table 9-4 Maximum permissible rated current with different cross-sections of the power cable conductors.

Power cable conductor cross-section	2.5 mm^2	4 mm^2	6 mm^2	10 mm^2	16 mm^2	25 mm^2
Maximum permissible rated current	21 A	28 A	36 A	50 A	66 A	84 A

Note

Connection of large cable cross-sections

Connecting cables with conductor cross-sections of more than 16 mm^2 is not possible at the motor terminal panel. Contact your local sales partner if the rated current of a motor requires power cores with a cross-section of 25 mm^2.

Cable protection when primary sections are connected in parallel

For the following configurations, you require a circuit breaker for each primary section:

- Several primary sections are connected in parallel to one Motor Module.
- The current-carrying capacity of the feeder cable cross-section is less than the rated current of the Motor Module.

Connect all of the primary sections to be connected in parallel to a Motor Module via a circuit breaker.

- Connect phases U, V, W of the primary section in question to the corresponding terminals of the associated circuit breaker:
  U - L1
  V - L2
  W - L3
- Connect phases U, V, W of the Motor Module to the circuit breaker terminals:
  U - T1
  V - T2
  W - T3
- Connect the auxiliary NO contacts of the circuit breaker in series.
- Connect the auxiliary NO contacts to an input on the CU/NCU.
- Connect the auxiliary NO contact to an external drive fault of the drive using BICO technology. This means that when a circuit breaker trips, the complete drive is shut down (OFF2).

- You can also evaluate the auxiliary NO contact of the circuit breaker using the PLC.
- Adjust the circuit breaker to the rated current of the motor feeder cables +10 %.

Avoiding false circuit breaker tripping

At the subsequent link you can find information in the Internet on the topic of "Influence of high-frequency currents on thermal overload releases of circuit breakers (3RV, 3VU) and overload relays (3RU, 3UA)" and "Additional effects that can result in nuisance tripping".

FAQ entry ID 24153083 (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&objid=24153083&nodeid0=20358027&caller=view&lang=de&extranet=standard&viewreg=WW&u=NDAwMDAxNwAA&siteID=cseus)

9.3.9 Signal connection

No direct connection of the temperature monitoring circuits

WARNING

Risk of electric shock if the temperature monitoring circuits are incorrectly connected

In the case of a fault, circuits Temp-S and Temp-F do not provide safe electrical separation with respect to the power circuits.

- Use the TM120 or SME12x to connect temperature monitoring circuits Temp-S and Temp-F. You therefore comply with the directives for safe electrical separation according to DIN EN 61800-5-1 (previously safe electrical separation according to DIN EN 50178).

Correctly connecting temperature sensors

NOTICE

Motor destroyed as a result of overtemperature

The motor can be destroyed as a result of overtemperature if you do not correctly connect the temperature sensors.

- When connecting temperature sensor cables with open conductor ends, pay attention to the correct assignment of conductor colors.

Note

Observe the polarity

Carefully note the polarity when connecting the KTY.

The following shows various connection variants for the temperature sensors. These illustrations apply to the operation of 1FN3 linear motors with the SINAMICS S120 drive system. The IDs A, B or C are used to identify the conductor assignments of the temperature sensor cables in the following tables.

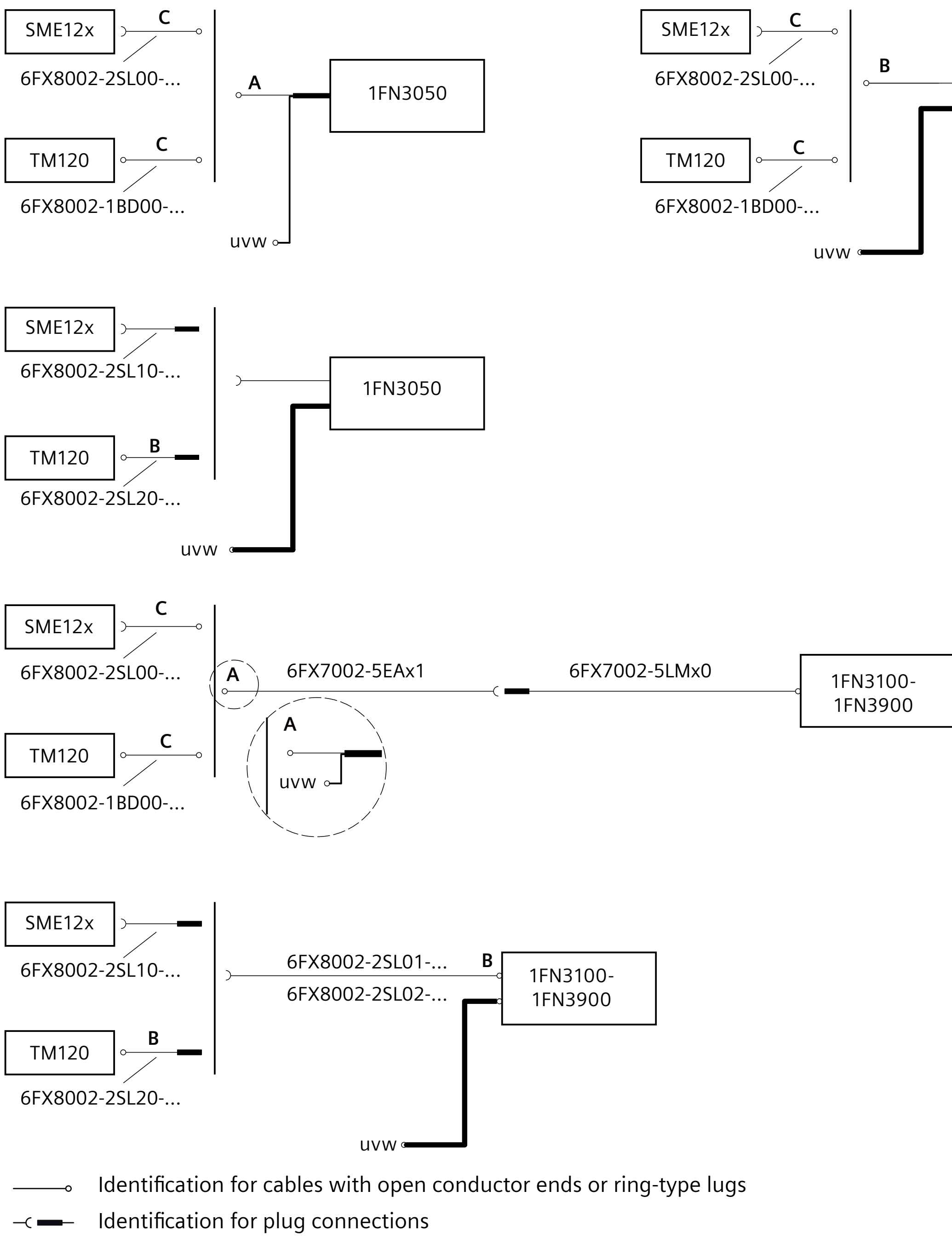


Figure 9-12 Connection variants for temperature sensors for the SINAMICS S120 drive system

Table 9-5 Conductor assignments of the temperature sensor cables - Table A

Conductor color	Interface
White	-1R2: -KTY or Pt1000
black	+1R1: +KTY or Pt1000

Conductor color	Interface
red	1TP1: PTC
Yellow	1TP2: PTC

Is applicable for a permanently connected combination cable with open core ends for 1FN3050 and basis cable 6FX7002-5EAx1-...

Table 9-6 Conductor assignments of the temperature sensor cables - Table B

Conductor color	Interface
White	-1R2: -KTY or Pt1000
Brown	+1R1: +KTY or Pt1000
Green	1TP1: PTC
Yellow	1TP2: PTC

Applies to cable 6FX8002-2SL01-..., 6FX8002-2SL02-..., 6FX8002-2SL20-... and permanently connected sensor cable with open conductor ends for 1FN3050

Table 9-7 Conductor assignments of the temperature sensor cables - Table C

Conductor color	Pin	Sensors
White	1	WH
Brown	2	BN
Green	3	GN
Yellow	4	YE
Gray	5	-
Pink	6	-
Green/yellow	⏚	-

Applies to cable 6FX8002-2SL00-...; the conductor colors also apply for cable 6FX8002-1BD00-... (sold by the meter)

Temperature sensor connection - standard

Connect the signal cable as follows:

- Using a plug connector at the SME12x (Sensor Module External)
- With open cable ends at the TM120

The SME12x or the TM120 is connected to the converter via DRIVE-CLiQ. See the diagrams for "System integration (Page 499)".

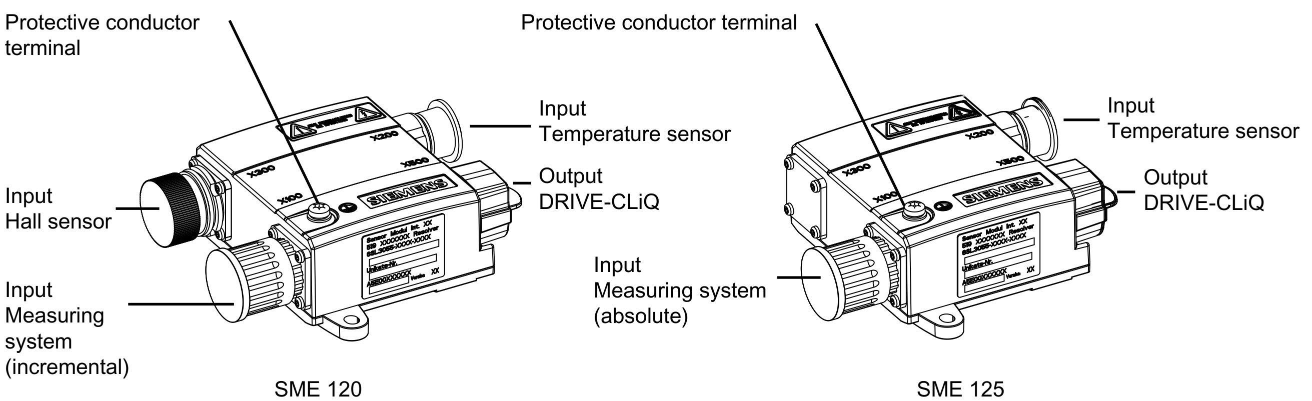
Note

Checking the shutdown circuit

Before commissioning and switching on for the first time, carefully check that the Temp-S temperature monitoring circuit correctly shuts down the system when it responds via the SME12x or the TM120.

The typical characteristic R(ϑ) of a PTC temperature sensor according to DIN 44081 is provided in the Chapter "Technical features of temperature sensors (Page 97)".

Connection of the temperature sensors via SME12x



Pin assignment of the temperature sensor - SME12x interface

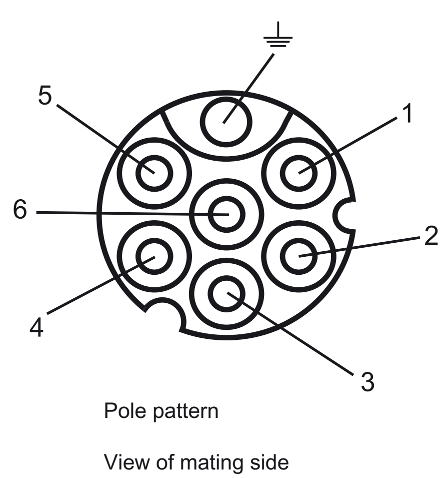


Figure 9-13 Pole layout of the temperature sensor - SME12x interface

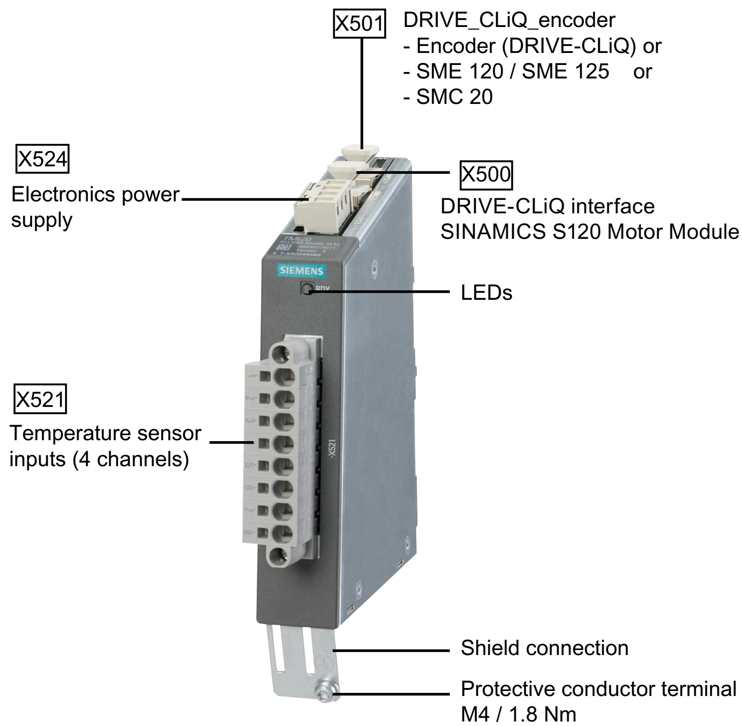
Table 9-8 Pole layout of the temperature sensor - SME12x interface

Conductor assignment for cable 6FX8002-2SL00-	**Pin**	**Sensor contact**
white	1	-1R2: -KTY or Pt1000
brown	2	+1R1: +KTY or Pt1000
green	3	1TP1: PTC
yellow	4	1TP2: PTC
gray	5	-
pink	6	-
green/yellow	⏚	PE

Note

You require a signal connector with Article No. 6FX2003-0SU07 to connect a motor with open core ends to the SME12x.

Connection of the temperature sensors via TM120



The selectable temperature sensors can be freely assigned to the four channels.

Information about the TM120 is provided in Equipment Manual "SINAMICS S120 Control Units and Additional System Components".

Table 9-9 Terminal assignment for the temperature sensor inputs on the TM120 (example)

Conductor assignment for cable 6FX8002-2SL00-	**Terminal**	**Sensor contact**
white	1	-1R2: -KTY or Pt1000
brown	2	+1R1: +KTY or Pt1000
green	3	1TP1: PTC
yellow	4	1TP2: PTC
gray	5	-
pink	6	-
-	7	-
-	8	-
green/yellow	⏚ Protective conductor connection on the shield connection plate	PE

9.3.10 Shielding, grounding, and equipotential bonding

Important notes regarding shielding, grounding and equipotential bonding

The correct installation and connection of the cable shields and protective conductors is of crucial importance, not only for personal safety but also for interference and immunity to a disturbance.

WARNING

Risk of electric shock!

Hazardous touch voltages can be present at unused cores and shields if they have not been grounded or insulated.

- Connect the cable shields to the respective housings through the largest possible surface area. Use suitable clips, clamps or screw couplings to do this.
- Connect unused cores of shielded or unshielded cables and their associated shields to the grounded enclosure potential at one end as minimum.
  Alternatively:
  Insulate conductors and their associated shields that are not used. The insulation must be able to withstand the rated voltage.

Further, unshielded or incorrectly shielded cables can lead to faults in the drive – particularly the encoder – or in external devices, for example.

Electrical charges that are the result of capacitive cross coupling are discharged by connecting the cores and shields.

NOTICE

Device damage as a result of leakage currents for incorrectly connected protective conductor

High leakage currents may damage other devices if the motor protective conductor is not directly connected to the power module.

- Connect the motor protective conductor (PE) directly at the power unit.

NOTICE

Device damage as a result of leakage currents for incorrect shielding

High leakage currents may damage other devices if the motor power cable shield is not directly connected to the power module.

- Connect the power cable shield at the shield connection of the power module.

Note

Apply the EMC installation guideline of the converter manufacturer. For Siemens converters, this is available under document order No. 6FC5297-□AD30-0□P□.

9.3.11 Requirements for the motor supply cables

The selected cables must be able to withstand the mechanical forces caused by high accelerations and speeds. Further, the cables must be suitable for the bending stresses that occur.

NOTICE
Damage to cables Cables subject to high acceleration rates can wear more quickly. The cables permanently connected to the motor cannot be replaced if they are damaged. • Observe the permissible acceleration rates for the cables. • Do not use a cable carrier for the cables permanently attached to the motor.

Because of EMC influence occurring on drive systems, we always recommend that shielded cables are used. See also Chapter "Shielding, grounding, and equipotential bonding (Page 519)".

You will find MOTION-CONNECT cables from the terminal box provided by the customer or extensions for the power and signal connection in the catalog.

Permissible power cable lengths

The permissible length of the power cable between the motor and the Motor Module depends on the rated output current of the Motor Module.

You can find information on the permissible lengths of the motor feeder cables, for example, in the following Equipment Manuals:

- "SINAMICS S120 Booksize Power Units" in the chapter "Maximum cable lengths"
- "SINAMICS S120 Booksize Power Units C/D type" in Chapter "Configuring the cable length"
- "SINAMICS S120 AC Drive" in Chapter "Configuring the cable length"

Permissible signal cable lengths

The permissible signal cable length from the motor to the sensor module depends on the type of signal cable being used.

General notes for routing electric cables

Drives with linear motors are subject to a high dynamic load. It must be ensured that vibration is not transferred to the connectors by suitably routing the cables or by providing strain relief close to the connector (distance < 10 D_{max}). D_{max} is the maximum cable diameter (see Catalog).

Note

Also observe the information in the catalog

Using the cables in the cable carrier

Note

When laying cables, carefully observe the instructions given by the cable carrier manufacturer!

To maximize the service life of the cable carrier and cables, it is not permissible to route cables manufactured from different materials without using spacers in the cable carrier.

The chambers must be filled evenly to ensure that the position of the cables does not change during operation. The cables should be distributed as symmetrically as possible according to their mass and dimensions.

If possible, use only cables with equal diameters in one chamber. Cables with very different outer diameters should be separated by spacers.

The cables must not be fixed in the carrier and must have room to move. It must be possible to move the cables without applying force, in particular in the bending radii of the carrier.

The specified bending radii must be adhered to. The cable fixings must be attached at both ends at an appropriate distance away from the end points of the moving parts in a dead zone.

A tension relief must be installed at least at the ends of the cable carrier. Be sure to mount the cables along the casing without crushing them.

The cables are to be taken off the drum free of twists, i.e. roll the cables off the drum instead of taking them off in loops from the drum flange.

Assembly drawings/dimension sheets

10

The following installation drawings apply to the peak load motor and the continuous load motor. Slight construction differences in the installation diagrams of the two motor designs are not taken into account.

Dimensions can be assigned to the particular motor based on the dimension variables and the associated dimension tables.

The installation drawings show secondary section end pieces with wedge and screwed joint to fasten the continuous cover strip.

There are also secondary section end pieces to clamp the continuous cover strip:

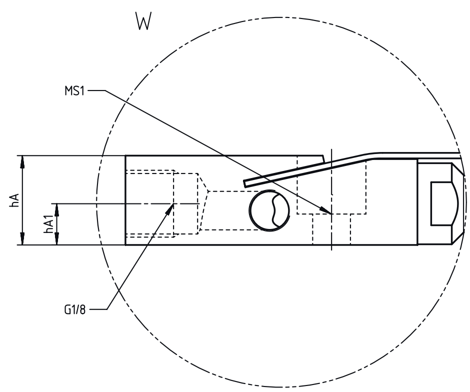


Figure 10-1 Secondary section end pieces to clamp the continuous cover strip

10.1 Position tolerance for mounting holes

Mounting holes

The following diagram shows the position tolerances according to DIN EN ISO 1101 of the mounting holes of the primary section and secondary section track. This information must be available at the user's installation location.

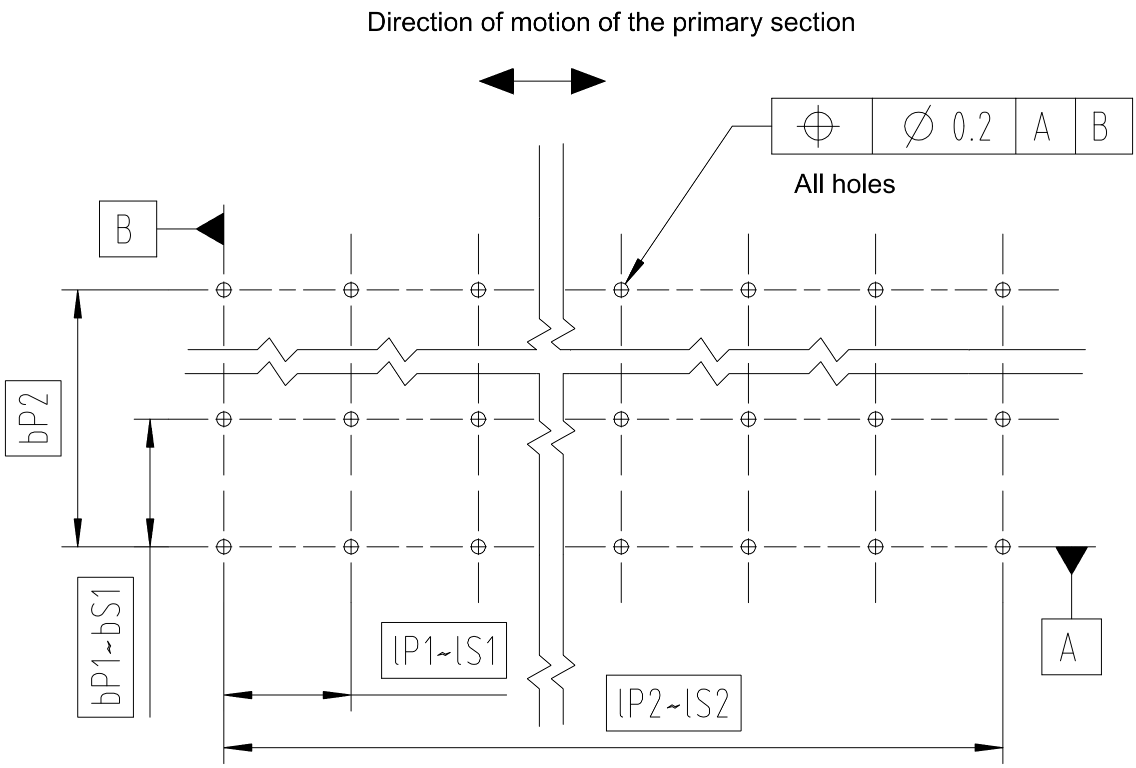


Figure 10-2 Position tolerances for mounting holes

For secondary section tracks larger than 4 m, you must make the hole pattern for the secondary sections according to the position tolerance.

10.2 Installation heights

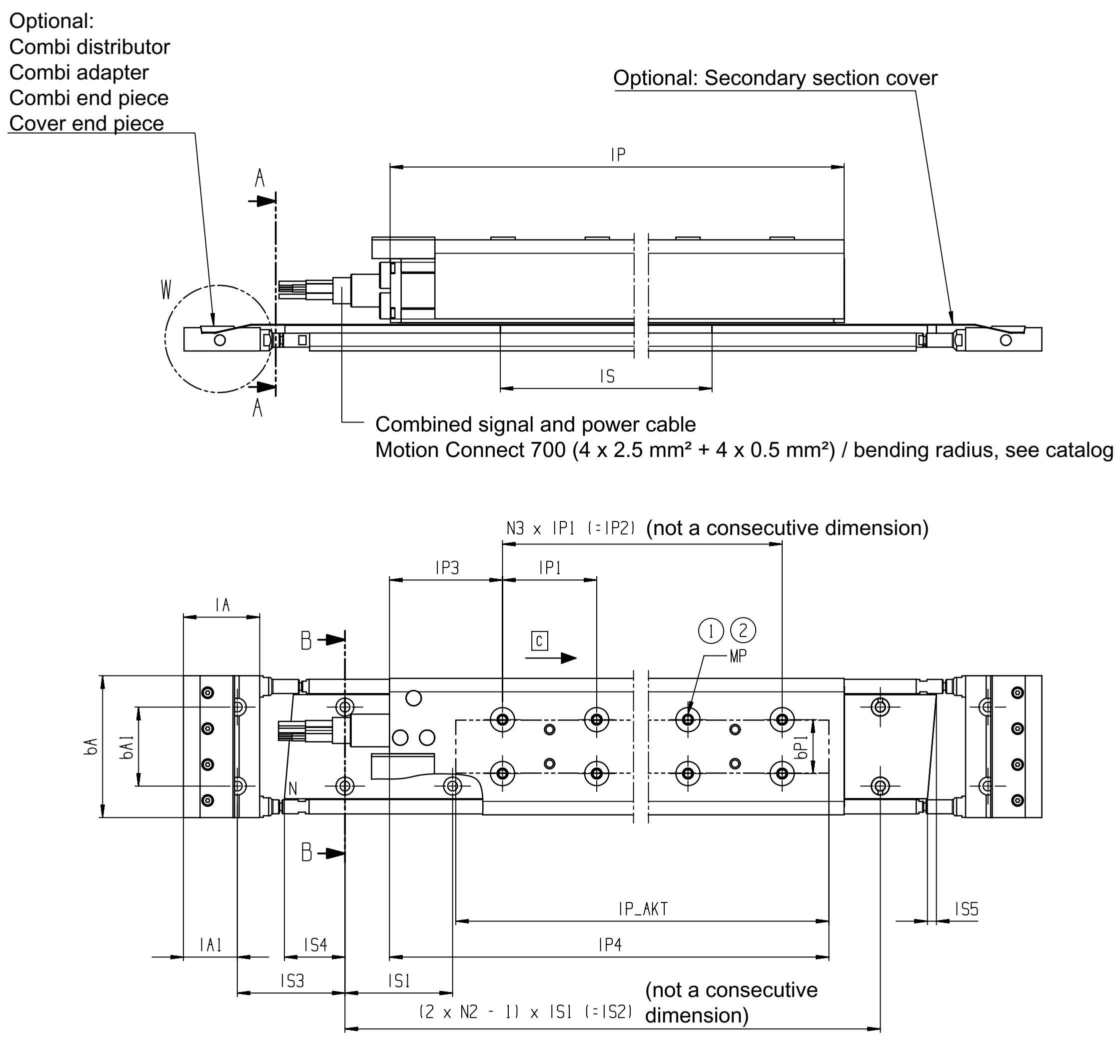
Specifying the installation heights

No individual tolerances are specified for the primary section and the secondary section. The tolerances for the primary and secondary sections are coordinated with the reference installation height of the complete motor. For the design, you therefore only have to consider the tolerances of the installation heights.

You will find detailed data on the installation heights and tolerances in Chapter "Mounting (Page 143)".

10.3 1FN3050, 1FN3100, 1FN3150

10.3.1 Drawings for 1FN3050



N2 = 1, 2, 3,... Number of secondary sections
N3 + 1 = number of hole series (longitudinal)

① screw-in depth MP: 20 +0/-2 (primary section with precision cooler)
② screw-in depth MP: 8 +0/-2 (primary section without precision cooler)
③ if the secondary section cover is not used, then hS1 and hS2 must be reduced by 0.4 mm

For the max. tightening torques of the mounting screws, see Chapter "Specifications of the mounting technology"

Motor pole position: C Direction of motion of the primary section for rotating field direction for positive zero crossover of phase U

Figure 10-3 Installation dimensions for 1FN3050 motor with one cable connection

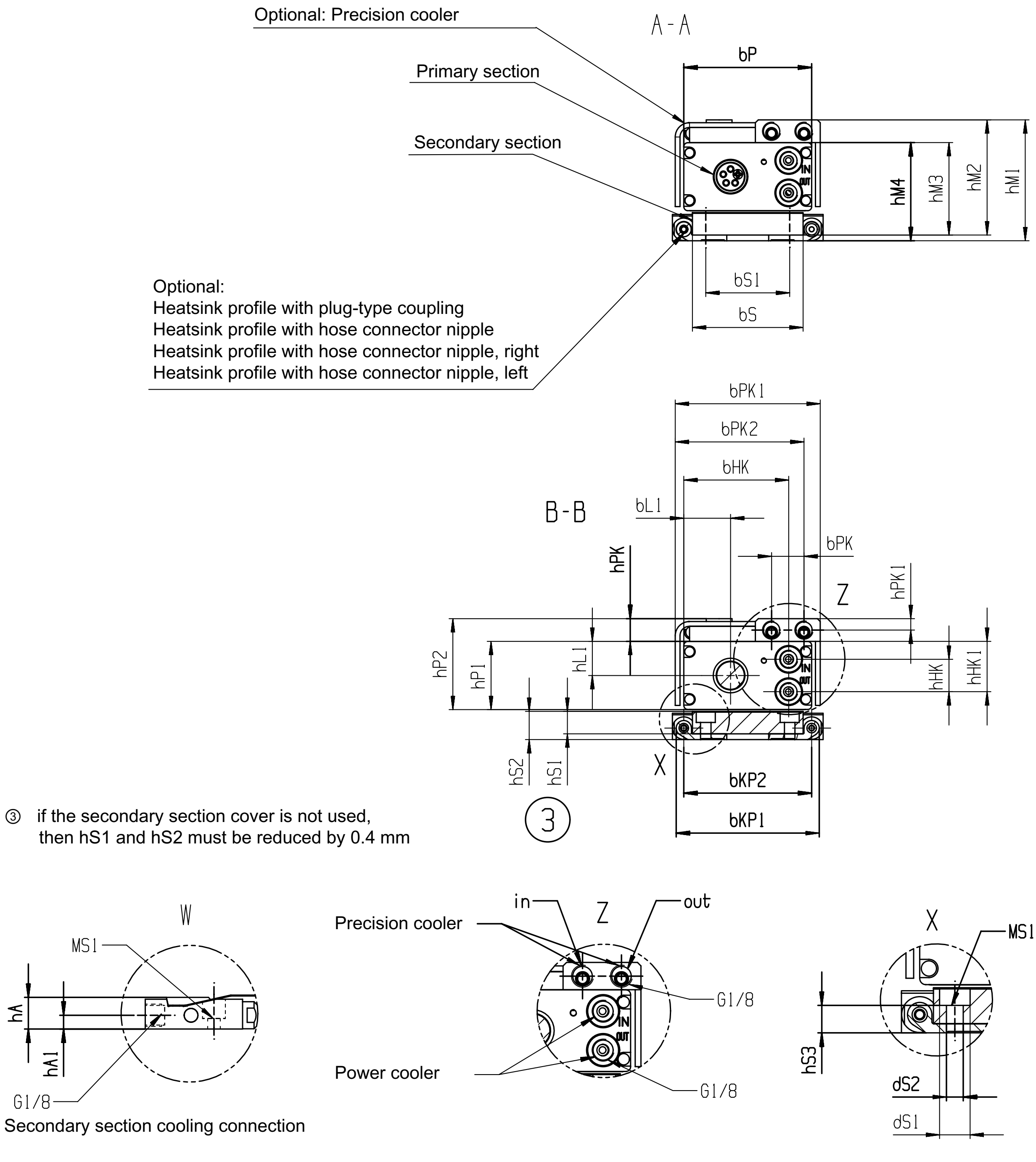
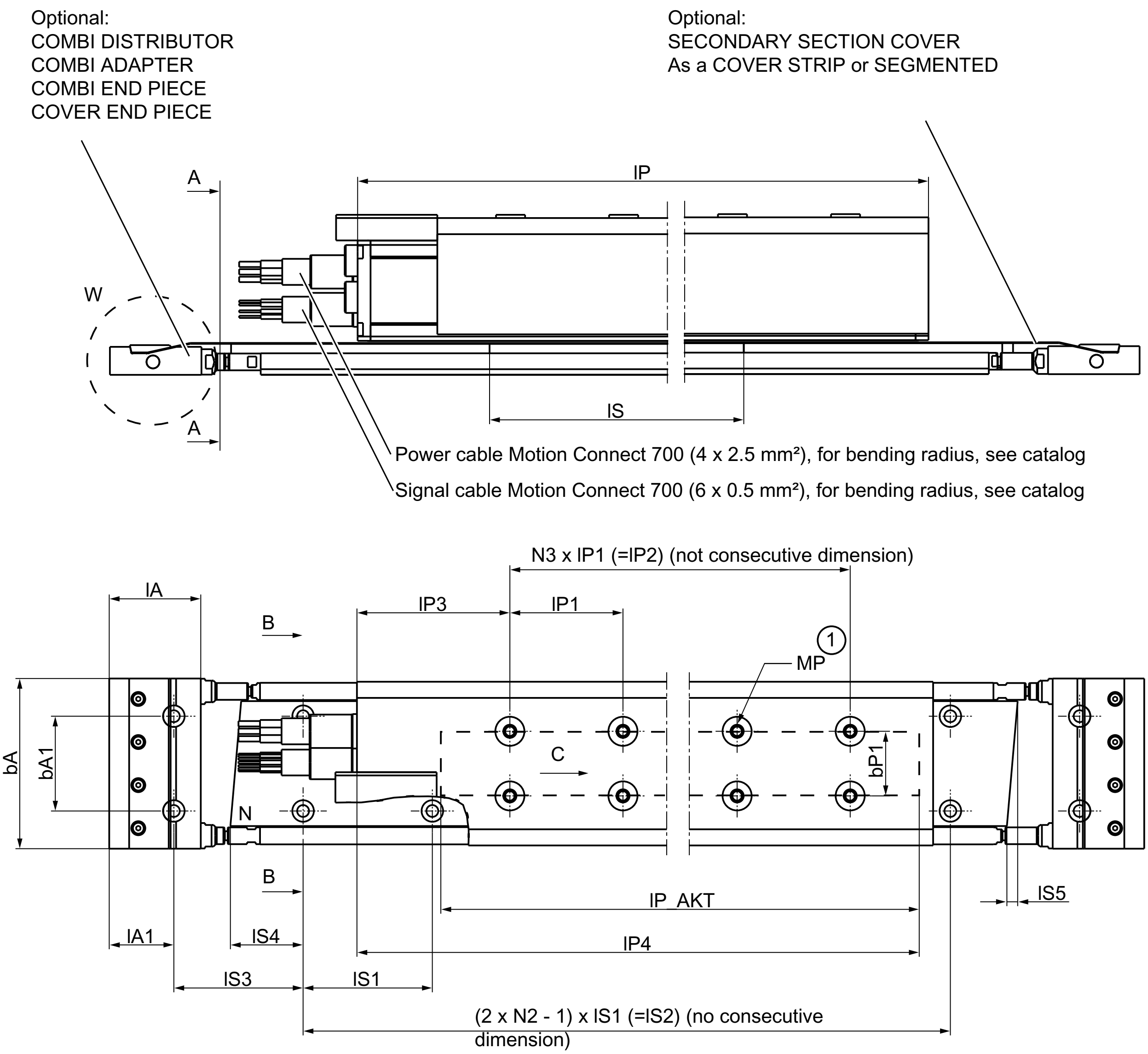


Figure 10-4 Installation dimensions for the 1FN3050 motor with one cable connection (cross sections and details)



N2 = 1,2,3... Number of SECONDARY SECTIONS

N3 +1 = number of hole rows in the longitudinal direction

For the max. tightening torques of the mounting screws, see Chapter "Specifications of the mounting technology".

C → Direction of motion of the PRIMARY SECTION for rotating field direction with zero crossover of phase U

(1) Screw-in depth MP:
$20^{+0/-2}$ mm with precision cooler; $8^{+0/-2}$ mm without precision cooler

Figure 10-5 Installation dimensions for 1FN3050 motors with two cable connections

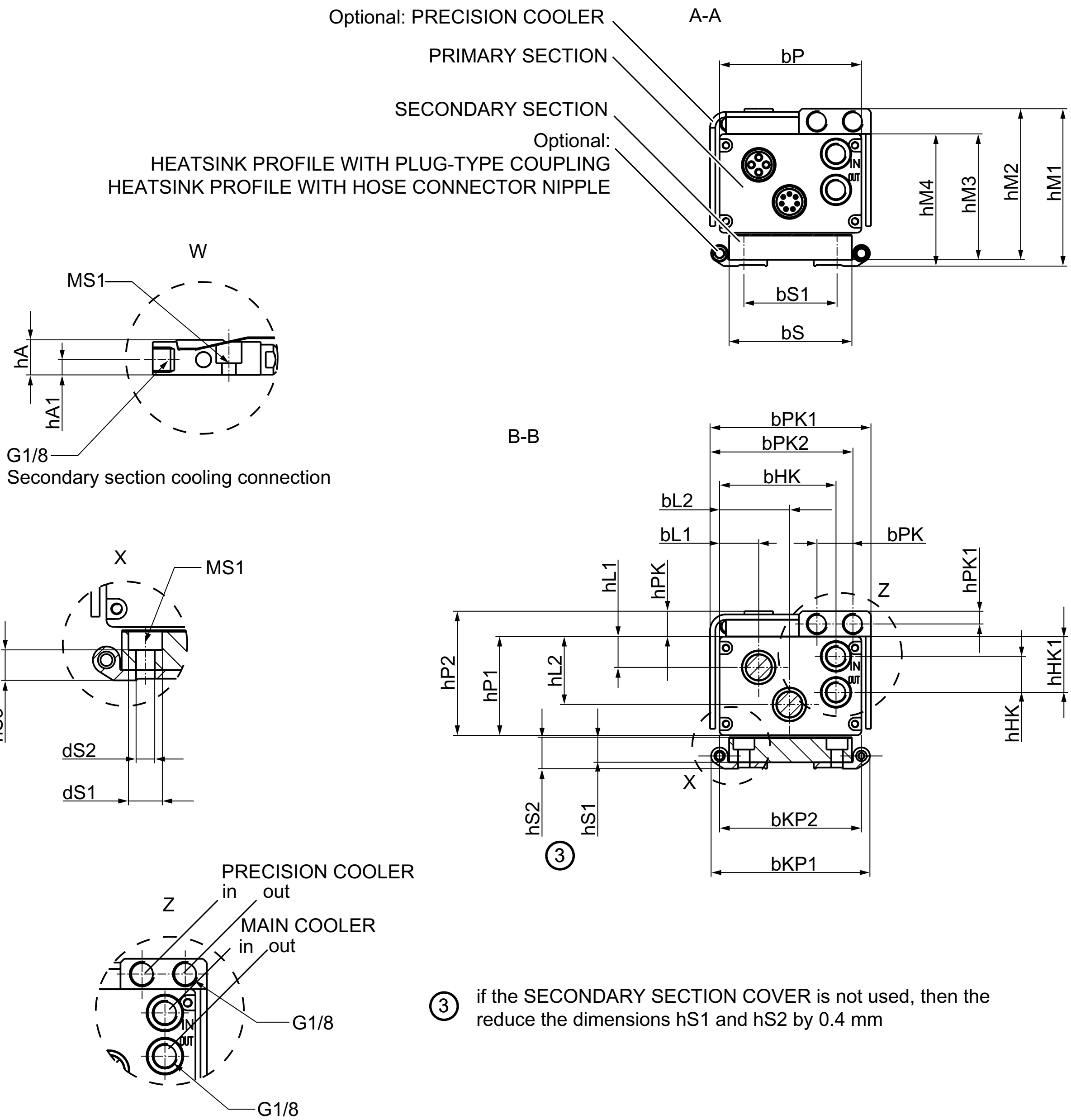


Figure 10-6 Installation dimensions for 1FN3050 motors with two cable connections (cross sections and details)

10.3.2 Dimensions of peak load primary section 1FN3050

Size	Variable	Unit	1FN3050-...				
			1W	2W	3W	4W	5W
Length	lP	mm	–	255	–	–	–
Longitudinal hole pattern	lP1	mm	–	52.5	–	–	–
Total longitudinal hole pattern	lP2	mm	–	157.5	–	–	–
Position 1st hole longitudinal pattern	lP3	mm	–	63	–	–	–
Position of the magnetically active surface	lP4	mm	–	247	–	–	–
Magnetically active length	lP,AKT	mm	–	210	–	–	–
Main cooler connection position (width)	bHK	mm	–	55	–	–	–
Width without precision cooler	bP	mm	–	67	–	–	–
Transverse hole pattern	bP1	mm	–	30	–	–	–
Total transverse hole pattern	bP2	mm	–	–	–	–	–
Precision cooler connector spacing	bPK	mm	–	17	–	–	–
Precision cooler width	bPK1	mm	–	76	–	–	–
Precision cooler connection position	bPK2	mm	–	68	–	–	–
Main cooler connection spacing	hHK	mm	–	17	–	–	–
Main cooler connection position (height)	hHK1	mm	–	26.4	–	–	–
Motor height with additional coolers	hM1	mm	–	63.4	–	–	–
Motor height with precision cooler	hM2	mm	–	60.4	–	–	–
Motor height without additional cooler	hM3	mm	–	48.5	–	–	–
Motor height with heatsink profile without precision cooler	hM4	mm	–	51.5	–	–	–
Height of primary section without precision cooler	hP1	mm	–	35.8	–	–	–
Height of primary section with precision cooler	hP2	mm	–	47.7	–	–	–
Precision cooler height	hPK	mm	–	11.9	–	–	–
Precision cooler connector position (height)	hPK1	mm	–	6	–	–	–
Mounting screw thread	MP		–	M5	–	–	–
Version with one connecting cable (end of the Article No. ...0HAx)							
Cable 1 position (width)	bL1	mm	–	24.5	–	–	–
Cable 1 position (height)	hL1	mm	–	17.9	–	–	–
Version with 2 connecting cables (end of the Article No. . ...0EAx or 0FAx)							
Power cable position L1 (width)	bL1	mm	–	16	–	–	–
Power cable position L1 (height)	hL1	mm	–	11.9	–	–	–
Signal cable position L2 (width)	bL2	mm	–	33	–	–	–
Signal cable position L2 (height)	hL2	mm	–	23.9	–	–	–

10.3.3 Dimensions of continuous load primary sections 1FN3050

Size	Variable	Unit	1FN3050-...				
			1N	2N	3N	4N	5N
Length of primary section	lP	mm	162	267	–	–	–
Longitudinal hole pattern	lP1	mm	52.5	52.5	–	–	–
Total longitudinal hole pattern	lP2	mm	52.5	157.5	–	–	–
Position 1st hole longitudinal pattern	lP3	mm	71	71	–	–	–
Position of the magnetically active surface	lP4	mm	155.6	260.6	–	–	–
Magnetically active length	lP,AKT	mm	116.6	221.6	–	–	–
Main cooler connection position (width)	bHK	mm	55	55	–	–	–
Width without precision cooler	bP	mm	67	67	–	–	–
Transverse hole pattern	bP1	mm	30	30	–	–	–
Power cable position (width)	bL1	mm	18.5	18.5	–	–	–
Signal cable position (width)	bL2	mm	33	33	–	–	–
Precision cooler connector spacing	bPK	mm	17	17	–	–	–
Precision cooler width	bPK1	mm	76	76	–	–	–
Precision cooler connection position	bPK2	mm	67.5	67.5	–	–	–
Main cooler connection spacing	hHK	mm	17	17	–	–	–
Main cooler connection position (height)	hHK1	mm	26.4	26.4	–	–	–
Motor height with additional coolers	hM1	mm	74.3	74.3	–	–	–
Motor height with precision cooler	hM2	mm	71.3	71.3	–	–	–
Motor height without additional cooler	hM3	mm	59.4	59.4	–	–	–
Motor height with heatsink profile without precision cooler	hM4	mm	62.4	62.4	–	–	–
Height of primary section without precision cooler	hP1	mm	46.7	46.7	–	–	–
Height of primary section with precision cooler	hP2	mm	58.6	58.6	–	–	–
Power cable position (height)	hL1	mm	14.6	14.6	–	–	–
Signal cable position (height)	hL2	mm	32.1	32.1	–	–	–
Precision cooler height	hPK	mm	11.9	11.9	–	–	–
Precision cooler connector position (height)	hPK1	mm	6	6	–	–	–
Mounting screw thread	MP		M5	M5	–	–	–

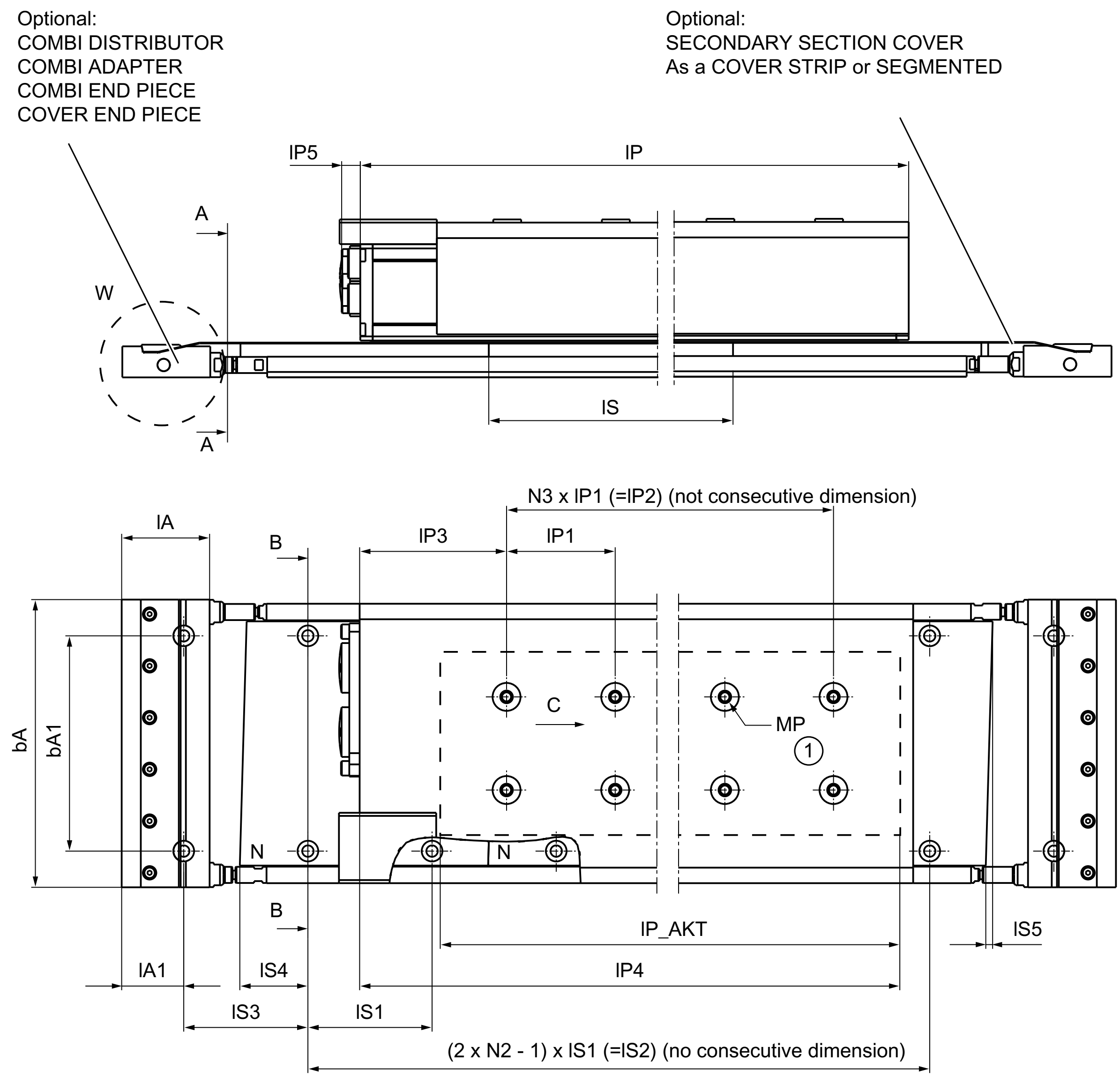
10.3.4 Dimensions of the secondary section of 1FN3050

Size	Variable	Unit	1FN3050-4SAxx
Secondary section length	lS	mm	120
Hole pattern (longitudinal)	lS1	mm	60
Total hole pattern (longitudinal)	lS2	mm	lS1 x (2xN2–1)
Position 1st hole hole pattern (longitudinal)	lS4	mm	31.3
Incline	lS5	mm	5
Width without heatsink profile	bS	mm	58
Hole pattern (transverse)	bS1	mm	44
Width with heatsink profile	bKP1	mm	75
Heatsink profile connector spacing	bKP2	mm	67
Height without heatsink profile with cover	hS1	mm	11.8
Height with heatsink profile with cover	hS2	mm	14.8
Mounting screw clamp length	hS3	mm	9
Screw countersink diameter (outer)	dS1	mm	10
Hole diameter (outer)	dS2	mm	5.5
Hole diameter (inner)	dS3	mm	–
Screw countersink diameter (inner)	dS4	mm	–
Secondary section mounting screws (outside)	MS1	mm	DIN EN ISO 4762 - M5
Secondary section mounting screws (inside)	MS2	mm	–

10.3.5 Dimensions of the secondary section end pieces of 1FN3050

Size	Variable	Unit	1FN3050-0TF00 1FN3050-0TG00 1FN3050-0TJ00	1FN3050-0TC00
Maximum length	lA	mm	42.5	42.5
Hole position (right)	lA1	mm	30	30
Hole distance to secondary section hole	lS3	mm	60	60
Maximum width	bA	mm	79	79
G 1/8 cooler connector position (height)	hA1	mm	6	–
Hole pattern (transverse)	bA1	mm	44	44
maximum height for 1FN3050-0Tx00-0AA0 / 1AA0	hA	mm	13.8 / 13.4	10.8 / 10.4

10.3.6 Drawings for 1FN3100 and 1FN3150



N2 = 1,2,3... Number of SECONDARY SECTIONS

N3 +1 = number of hole rows in the longitudinal direction

For the max. tightening torques of the mounting screws, see Chapter "Specifications of the mounting technology".

C → Direction of motion of the PRIMARY SECTION for rotating field direction with zero crossover of phase U

① Screw-in depth MP:
$20^{+0/-2}$ mm with precision cooler; $8^{+0/-2}$ mm without precision cooler

Figure 10-7 Installation dimensions for the motors 1FN3100 and 1 FN3150

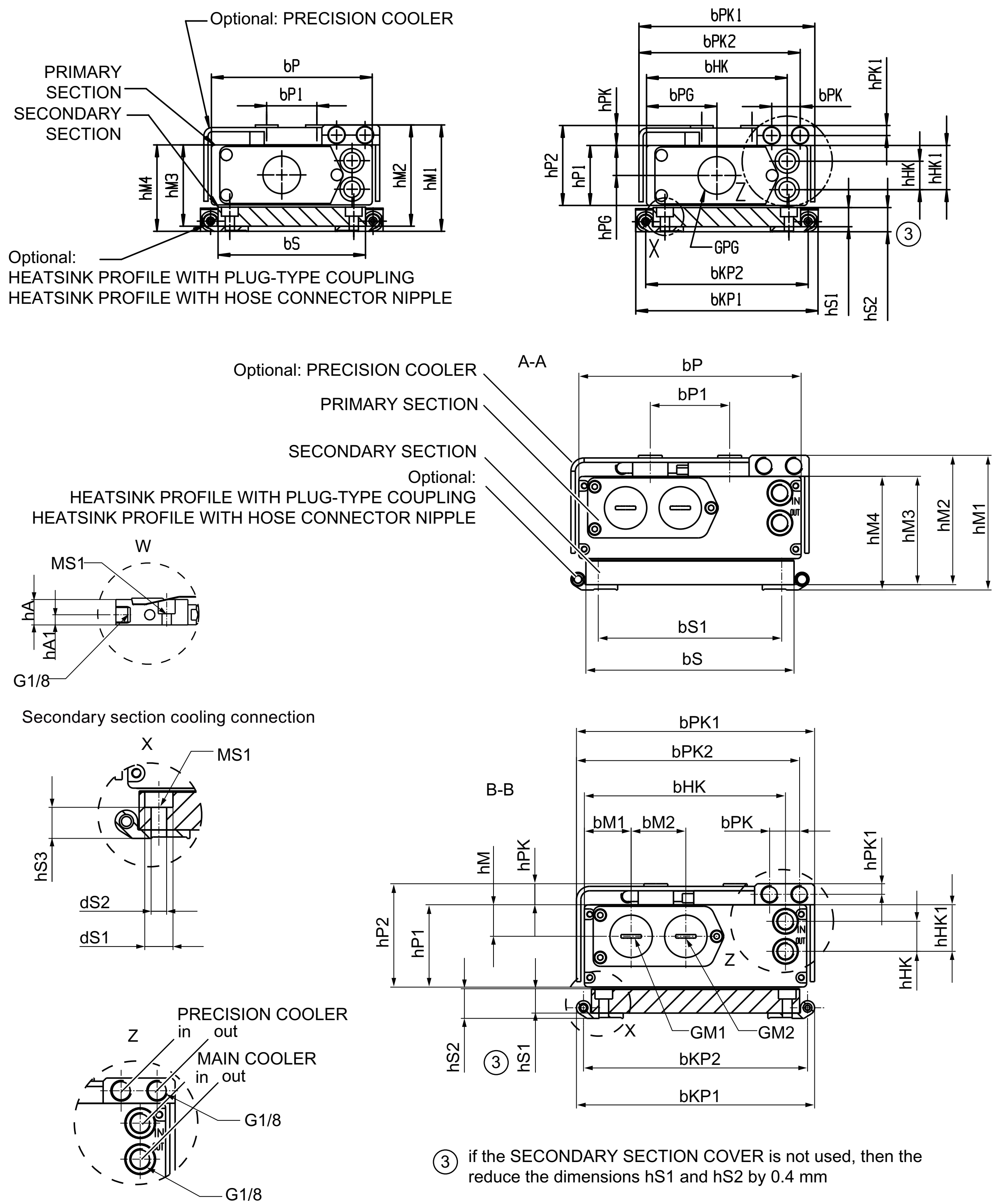


Figure 10-8 Installation dimensions for the motors 1FN3100 and 1FN3150 (cross sections and details)

10.3.7 Dimensions of peak load primary sections 1FN3100

Size	Variable	Unit	1FN3100-...				
			1W	2W	3W	4W	5W
Length without connection cover	lP	mm	150	255	360	465	570
Longitudinal hole pattern	lP1	mm	52.5	52.5	52.5	52.5	52.5
Total longitudinal hole pattern	lP2	mm	52.5	157.5	262.5	367.5	472.5
Position 1st hole longitudinal pattern	lP3	mm	63	63	63	63	63
Position of the magnetically active surface	lP4	mm	142	247	352	457	562
Connection cover length	lP5	mm	9	9	9	9	9
Magnetically active length	lP,AKT	mm	105	210	315	420	525
Main cooler connection position (width)	bHK	mm	84	84	84	84	84
Width without precision cooler	bP	mm	96	96	96	96	96
Transverse hole pattern	bP1	mm	30	30	30	30	30
Total transverse hole pattern	bP2	mm	–	–	–	–	–
Precision cooler connector spacing	bPK	mm	–	17	17	17	17
Precision cooler width	bPK1	mm	–	105	105	105	105
Precision cooler connection position	bPK2	mm	–	97	97	97	97
Main cooler connection spacing	hHK	mm	17	17	17	17	17
Main cooler connection position (height)	hHK1	mm	26.4	26.4	26.4	26.4	26.4
Motor height with additional coolers	hM1	mm	–	63.4	63.4	63.4	63.4
Motor height with precision cooler	hM2	mm	–	60.4	60.4	60.4	60.4
Motor height without additional cooler	hM3	mm	48.5	48.5	48.5	48.5	48.5
Motor height with heatsink profile without precision cooler	hM4	mm	51.5	51.5	51.5	51.5	51.5
Height of primary section without precision cooler	hP1	mm	35.8	35.8	35.8	35.8	35.8
Height of primary section with precision cooler	hP2	mm	–	47.7	47.7	47.7	47.7
Precision cooler height	hPK	mm	–	11.9	11.9	11.9	11.9
Precision cooler connector position (height)	hPK1	mm	–	6	6	6	6
Mounting screw thread	MP		M5	M5	M5	M5	M5
Version with one connecting cable (end of the Article No. ...0AAx)							
PG thread position (width)	bPG	mm	42	42	42	42	42
PG thread position (height)	hPG	mm	17.9	17.9	17.9	17.9	17.9
PG thread diameter	GPG		PG16 1)	PG16 1)	PG16 1)	PG16 1)	PG16 1)
Version with 2 connecting cables (end of the Article No. ...0BAx)							
Thread position (height)	hM	mm	17.9	17.9	17.9	17.9	17.9
Thread 1 position (width)	bM1	mm	26.5	26.5	26.5	26.5	26.5
Thread 2 position (width)	bM2	mm	31	31	31	31	31
Thread 1 diameter	GM1		M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5
Thread 2 diameter	GM2		M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5

[1] Applicable for 1FN3100-1WC00, 1FN3100-2WC00, 1FN3100-2WE00, 1FN3100-2WJ20, 1FN3100-3WC00, 1FN3100-3WE00, 1FN300100-4WC00, 1FN3100-4WE00, 1FN3100-5WC00 motors

10.3.8 Dimensions of the peak load primary sections 1FN3100_with note thread

Size	Variable	Unit	1FN3100-...				
			1W	2W	3W	4W	5W
Length without connection cover	lP	mm	150	255	360	465	570
Longitudinal hole pattern	lP1	mm	52.5	52.5	52.5	52.5	52.5
Total longitudinal hole pattern	lP2	mm	52.5	157.5	262.5	367.5	472.5
Position 1st hole longitudinal pattern	lP3	mm	63	63	63	63	63
Position of the magnetically active surface	lP4	mm	142	247	352	457	562
Connection cover length	lP5	mm	9	9	9	9	9
Magnetically active length	lP,AKT	mm	105	210	315	420	525
Main cooler connection position (width)	bHK	mm	84	84	84	84	84
Width without precision cooler	bP	mm	96	96	96	96	96
Transverse hole pattern	bP1	mm	30	30	30	30	30
Total transverse hole pattern	bP2	mm	–	–	–	–	–
Precision cooler connector spacing	bPK	mm	–	17	17	17	17
Precision cooler width	bPK1	mm	–	105	105	105	105
Precision cooler connection position	bPK2	mm	–	97	97	97	97
Main cooler connection spacing	hHK	mm	17	17	17	17	17
Main cooler connection position (height)	hHK1	mm	26.4	26.4	26.4	26.4	26.4
Motor height with additional coolers	hM1	mm	–	63.4	63.4	63.4	63.4
Motor height with precision cooler	hM2	mm	–	60.4	60.4	60.4	60.4
Motor height without additional cooler	hM3	mm	48.5	48.5	48.5	48.5	48.5
Motor height with cooling profile without precision cooler	hM4	mm	51.5	51.5	51.5	51.5	51.5
Height of primary section without precision cooler	hP1	mm	35.8	35.8	35.8	35.8	35.8
Height of primary section with precision cooler	hP2	mm	–	47.7	47.7	47.7	47.7
Precision cooler height	hPK	mm	–	11.9	11.9	11.9	11.9
Precision cooler connector position (height)	hPK1	mm	–	6	6	6	6
Mounting screw thread	MP		M5	M5	M5	M5	M5
Version with one connecting cable (end of the Article No. ...0AAx)							
PG thread position (width)	bPG	mm	42	42	42	42	42
PG thread position (height)	hPG	mm	17.9	17.9	17.9	17.9	17.9
PG thread diameter	GPG		Assignment, PG thread to the relevant primary section in data table Part 2 in Chapter "Selection and ordering data 1FN3 (Page 58)"				
Version with 2 connecting cables (end of the Article No. ...0BAx)							

Size	Variable	Unit	1FN3100-...				
			1W	2W	3W	4W	5W
Thread position (height)	hM	mm	17.9	17.9	17.9	17.9	17.9
Thread 1 position (width)	bM1	mm	26.5	26.5	26.5	26.5	26.5
Thread 2 position (width)	bM2	mm	31	31	31	31	31
Thread 1 diameter	GM1		Assignment, metric thread to the relevant primary section in data table Part 2 in Chapter "Selection and ordering data 1FN3 (Page 58)"				
Thread 2 diameter	GM2		M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5

10.3.9 Dimensions of continuous load primary sections 1FN3100

Size	Variable	Unit	1FN3100-...				
			1N	**2N**	**3N**	**4N**	**5N**
Length without connection cover	lP	mm	162	267	372	477	–
Longitudinal hole pattern	lP1	mm	52.5	52.5	52.5	52.5	–
Total longitudinal hole pattern	lP2	mm	52.5	157.5	262.5	367.5	–
Position 1st hole longitudinal pattern	lP3	mm	71	71	71	71	–
Position of the magnetically active surface	lP4	mm	155.6	260.6	365.6	470.6	–
Connection cover length	lP5	mm	9	9	9	9	–
Magnetically active length	lP,AKT	mm	116.6	221.6	326.6	431.6	–
Main cooler connection position (width)	bHK	mm	84	84	84	84	–
Width without precision cooler	bP	mm	96	96	96	96	–
Transverse hole pattern	bP1	mm	30	30	30	30	–
Thread 1 position (width)	bM1	mm	26.5	26.5	26.5	26.5	–
Thread 2 position (width)	bM2	mm	31.0	31.0	31.0	31.0	–
Precision cooler connector spacing	bPK	mm	17	17	17	17	–
Precision cooler width	bPK1	mm	105	105	105	105	–
Precision cooler connection position	bPK2	mm	97	97	97	97	–
Main cooler connection spacing	hHK	mm	17	17	17	17	–
Main cooler connection position (height)	hHK1	mm	26.4	26.4	26.4	26.4	–
Motor height with additional coolers	hM1	mm	74.3	74.3	74.3	74.3	–
Motor height with precision cooler	hM2	mm	71.3	71.3	71.3	71.3	–
Motor height without additional cooler	hM3	mm	59.4	59.4	59.4	59.4	–
Motor height with heatsink profile without precision cooler	hM4	mm	62.4	62.4	62.4	62.4	–
Height of primary section without precision cooler	hP1	mm	46.7	46.7	46.7	46.7	–
Height of primary section with precision cooler	hP2	mm	58.6	58.6	58.6	58.6	–
Thread position (height)	hM	mm	17.9	17.9	17.9	17.9	–
Precision cooler height	hPK	mm	11.9	11.9	11.9	11.9	–
Precision cooler connector position (height)	hPK1	mm	6	6	6	6	–
Thread 1 diameter	GM1		M20x1.5	M20x1.5	M20x1.5	M20x1.5	–
Thread 2 diameter	GM2		M20x1.5	M20x1.5	M20x1.5	M20x1.5	–
Mounting screw thread	MP		M5	M5	M5	M5	–

10.3.10 Dimensions of peak load primary sections 1FN3150

Size	Variable	Unit	1FN3150-...				
			1W	2W	3W	4W	5W
Length without connection cover	lP	mm	150	255	360	465	570
Longitudinal hole pattern	lP1	mm	52.5	52.5	52.5	52.5	52.5
Total longitudinal hole pattern	lP2	mm	52.5	157.5	262.5	367.5	472.5
Position 1st hole longitudinal pattern	lP3	mm	63	63	63	63	63
Position of the magnetically active surface	lP4	mm	142	247	352	457	562
Connection cover length	lP5	mm	9	9	9	9	9
Magnetically active length	lP,AKT	mm	105	210	315	420	525
Main cooler connection position (width)	bHK	mm	114	114	114	114	114
Width without precision cooler	bP	mm	126	126	126	126	126
Transverse hole pattern	bP1	mm	45	45	45	45	45
Total transverse hole pattern	bP2	mm	-	–	–	–	–
Precision cooler connector spacing	bPK	mm	17	17	17	17	17
Precision cooler width	bPK1	mm	135	135	135	135	135
Precision cooler connection position	bPK2	mm	127	127	127	127	127
Main cooler connection spacing	hHK	mm	17	17	17	17	17
Main cooler connection position (height)	hHK1	mm	26.4	26.4	26.4	26.4	26.4
Motor height with additional coolers	hM1	mm	65.4	65.4	65.4	65.4	65.4
Motor height with precision cooler	hM2	mm	62.4	62.4	62.4	62.4	62.4
Motor height without additional cooler	hM3	mm	50.5	50.5	50.5	50.5	50.5
Motor height with heatsink profile without precision cooler	hM4	mm	53.5	53.5	53.5	53.5	53.5
Height of primary section without precision cooler	hP1	mm	35.8	35.8	35.8	35.8	35.8
Height of primary section with precision cooler	hP2	mm	47.7	47.7	47.7	47.7	47.7
Precision cooler height	hPK	mm	11.9	11.9	11.9	11.9	11.9
Precision cooler connector position (height)	hPK1	mm	6	6	6	6	6
Mounting screw thread	MP		M5	M5	M5	M5	M5
Version with one connecting cable (end of the Article No. ...0AAx)							
PG thread position (width)	bPG	mm	42	42	42	42	42
PG thread position (height)	hPG	mm	17.9	17.9	17.9	17.9	17.9
PG thread diameter	GPG		PG16 [1)]	PG16 [1)]	PG16 [1)]	PG16 [1)]	PG16 [1)]
Version with 2 connecting cables (end of the Article No. ...0BAx)							
Thread position (height)	hM	mm	17.9	17.9	17.9	17.9	17.9
Thread 1 position (width)	bM1	mm	26.5	26.5	26.5	26.5	26.5
Thread 2 position (width)	bM2	mm	31	31	31	31	31
Thread 1 diameter	GM1		M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5
Thread 2 diameter	GM2		M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5

[1] Applicable for 1FN3150-1WC00, 1FN3150-2WC00, 1FN3150-3WC00, 1FN3150-4WC00, 1FN3150-5WC00, 1FN3150-5WE00 motors

10.3.11 Dimensions of continuous load primary sections 1FN3150

Size	Variable	Unit	1FN3150-...				
			1N	2N	3N	4N	5N
Length without connection cover	lP	mm	162	267	372	477	–
Longitudinal hole pattern	lP1	mm	52.5	52.5	52.5	52.5	–
Total longitudinal hole pattern	lP2	mm	52.5	157.5	262.5	367.5	–
Position 1st hole longitudinal pattern	lP3	mm	71	71	71	71	–
Position of the magnetically active surface	lP4	mm	155.6	260.6	365.6	470.6	–
Connection cover length	lP5	mm	9	9	9	9	–
Magnetically active length	lP,AKT	mm	116.6	221.6	326.6	431.6	–
Main cooler connection position (width)	bHK	mm	114	114	114	114	–
Width without precision cooler	bP	mm	126	126	126	126	–
Transverse hole pattern	bP1	mm	45	45	45	45	–
Thread 1 position (width)	bM1	mm	26.5	26.5	26.5	26.5	–
Thread 2 position (width)	bM2	mm	31.0	31.0	31.0	31.0	–
Precision cooler connector spacing	bPK	mm	17	17	17	17	–
Precision cooler width	bPK1	mm	135	135	135	135	–
Precision cooler connection position	bPK2	mm	127	127	127	127	–
Main cooler connection spacing	hHK	mm	17	17	17	17	–
Main cooler connection position (height)	hHK1	mm	26.4	26.4	26.4	26.4	–
Motor height with additional coolers	hM1	mm	76.3	76.3	76.3	76.3	–
Motor height with precision cooler	hM2	mm	73.3	73.3	73.3	73.3	–
Motor height without additional cooler	hM3	mm	61.4	61.4	61.4	61.4	–
Motor height with heatsink profile without precision cooler	hM4	mm	64.4	64.4	64.4	64.4	–
Height of primary section without precision cooler	hP1	mm	46.7	46.7	46.7	46.7	–
Height of primary section with precision cooler	hP2	mm	58.6	58.6	58.6	58.6	–
Thread position (height)	hM	mm	17.9	17.9	17.9	17.9	–
Precision cooler height	hPK	mm	11.9	11.9	11.9	11.9	–
Precision cooler connector position (height)	hPK1	mm	6	6	6	6	–
Thread 1 diameter	GM1		M20x1.5	M20x1.5	M20x1.5	M20x1.5	–
Thread 2 diameter	GM2		M20x1.5	M20x1.5	M20x1.5	M20x1.5	–
Mounting screw thread	MP		M5	M5	M5	M5	–

10.3.12 Dimensions of the secondary section of 1FN3100

Size	Variable	Unit	1FN3100-4SAxx
Secondary section length	lS	mm	120
Hole pattern (longitudinal)	lS1	mm	60
Total hole pattern (longitudinal)	lS2	mm	lS1 x (2xN2−1)
Position 1st hole hole pattern (longitudinal)	lS4	mm	30.6
Incline	lS5	mm	3.7
Width without heatsink profile	bS	mm	88
Hole pattern (transverse)	bS1	mm	74
Width with heatsink profile	bKP1	mm	105
Heatsink profile connector spacing	bKP2	mm	97
Height without heatsink profile with cover	hS1	mm	11.8
Height with heatsink profile with cover	hS2	mm	14.8
Mounting screw clamp length	hS3	mm	9
Screw countersink diameter (outer)	dS1	mm	10
Hole diameter (outer)	dS2	mm	5.5
Hole diameter (inner)	dS3	mm	–
Screw countersink diameter (inner)	dS4	mm	–
Secondary section mounting screws (outside)	MS1	mm	DIN EN ISO 4762 - M5
Secondary section mounting screws (inside)	MS2	mm	–

10.3.13 Dimensions of the secondary section of 1FN3150

Size	Variable	Unit	1FN3150-4SAxx
Secondary section length	lS	mm	120
Hole pattern (longitudinal)	lS1	mm	60
Total hole pattern (longitudinal)	lS2	mm	lS1 x (2xN2–1)
Position 1st hole hole pattern (longitudinal)	lS4	mm	30.4
Incline	lS5	mm	3.3
Width without heatsink profile	bS	mm	118
Hole pattern (transverse)	bS1	mm	104
Width with heatsink profile	bKP1	mm	135
Heatsink profile connector spacing	bKP2	mm	127
Height without heatsink profile with cover	hS1	mm	13.8
Height with heatsink profile with cover	hS2	mm	16.8
Mounting screw clamp length	hS3	mm	11
Screw countersink diameter (outer)	dS1	mm	10
Hole diameter (outer)	dS2	mm	5.5
Hole diameter (inner)	dS3	mm	–
Screw countersink diameter (inner)	dS4	mm	–
Secondary section mounting screws (outside)	MS1	mm	DIN EN ISO 4762 - M5
Secondary section mounting screws (inside)	MS2	mm	–

10.3.14 Dimensions of the secondary section end pieces of 1FN3100

Size	Variable	Unit	1FN3100-0TF00 1FN3100-0TG00 1FN3100-0TJ00	1FN3100-0TC00
Maximum length	lA	mm	42.5	42.5
Hole position (right)	lA1	mm	30	30
Hole distance to secondary section hole	lS3	mm	60	60
Maximum width	bA	mm	109	109
G 1/8 cooler connector position (height)	hA1	mm	6	–
Hole pattern (transverse)	bA1	mm	74	74
maximum height for 1FN3100-0Tx00-0AA0 / 1AA0	hA	mm	13.8 / 13.4	10.8 / 10.4

10.3.15 Dimensions of the secondary section end pieces of 1FN3150

Size	Variable	Unit	1FN3150-0TF00 1FN3150-0TG00 1FN3150-0TJ00	1FN3150-0TC00
Maximum length	lA	mm	42.5	42.5
Hole position (right)	lA1	mm	30	30
Hole distance to secondary section hole	lS3	mm	60	60
Maximum width	bA	mm	139	139
G 1/8 cooler connector position (height)	hA1	mm	6	–
Hole pattern (transverse)	bA1	mm	104	104
maximum height for 1FN3150-0Tx00-0AA0 / 1AA0	hA	mm	15.8 / 15.4	12.8 / 12.4

10.3.16 Mounting the Hall sensor box

Mounting the Hall sensor box onto the peak load motors 1FN3050 - 1FN3150

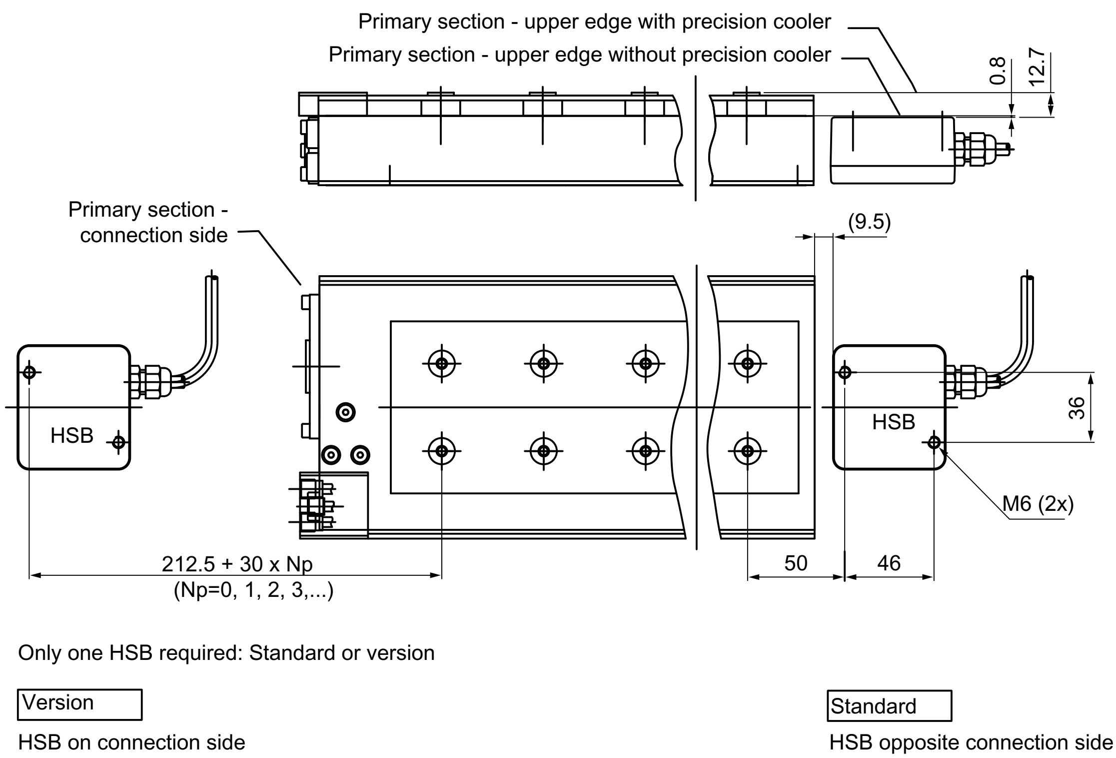


Figure 10-9 Hall sensor box (HSB) with straight cable outlet for motors 1FN3050, 1FN3100 and 1FN3150

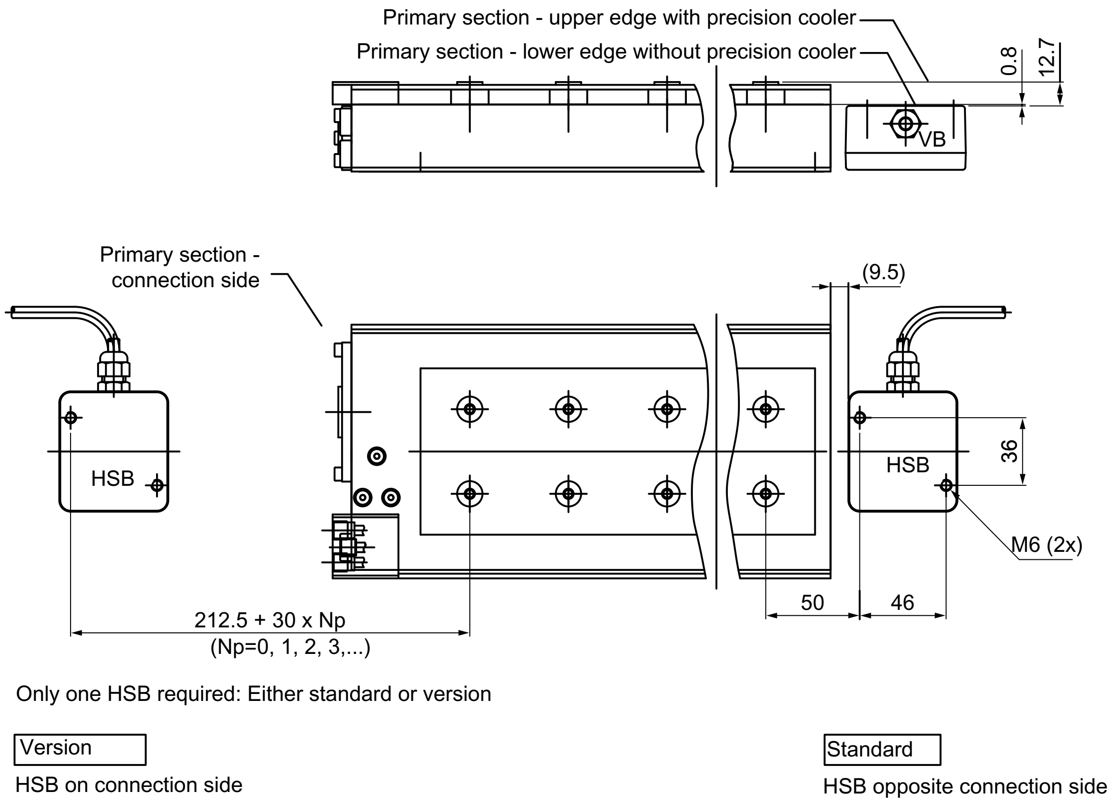


Figure 10-10 Hall sensor box (HSB) with lateral cable outlet for motors 1FN3050, 1FN3100 and 1FN3150

Mounting the Hall sensor box onto the continuous load motors 1FN3050 - 1FN3150

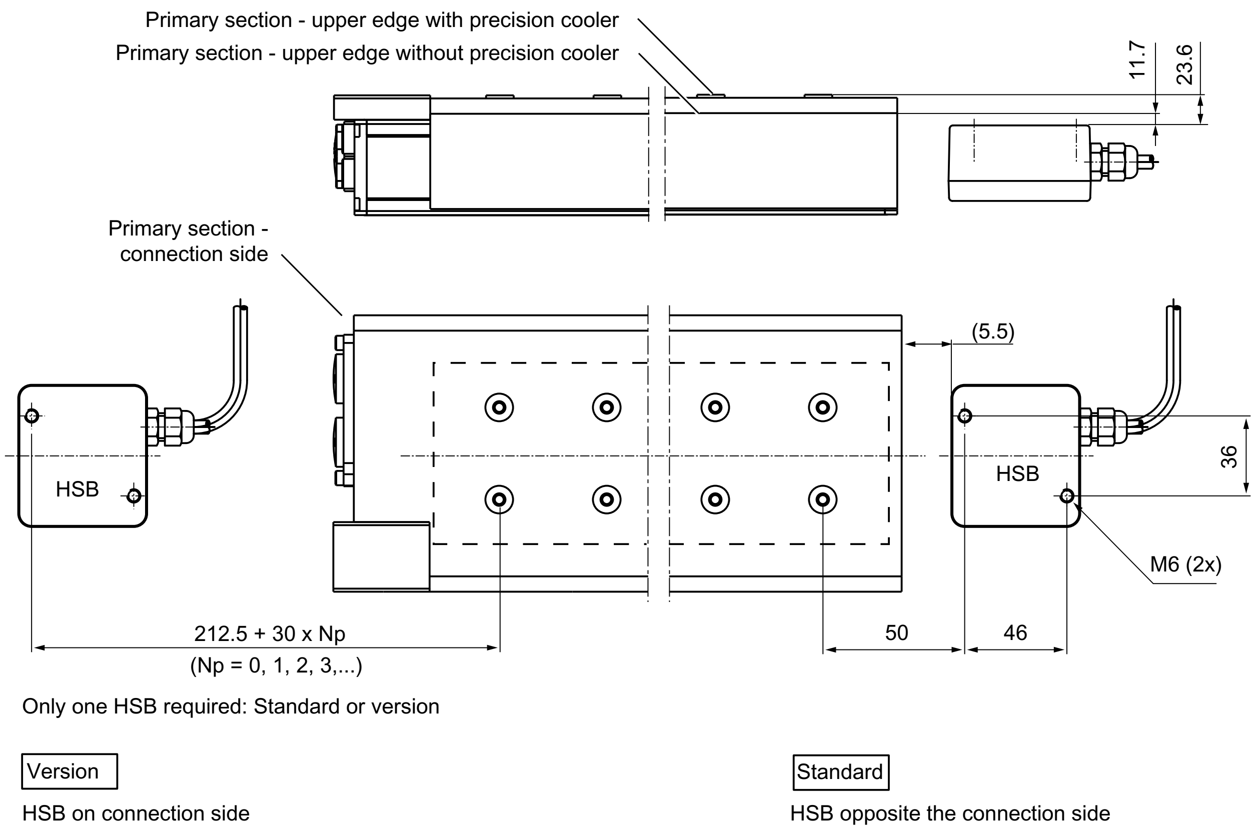


Figure 10-11 Mounting the Hall sensor box (HSB) with straight cable outlet for motors 1FN3050-xN ... 150-xN

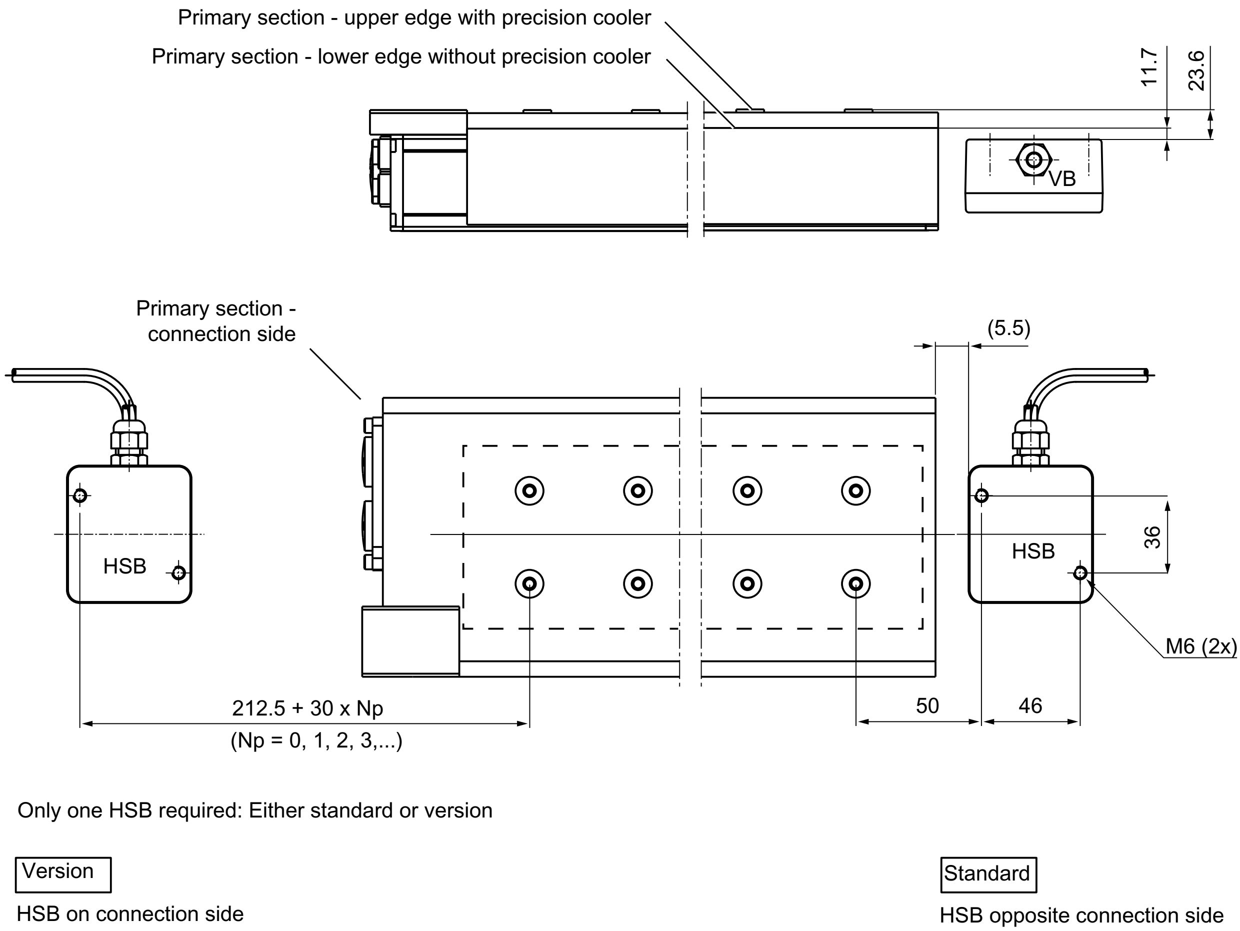
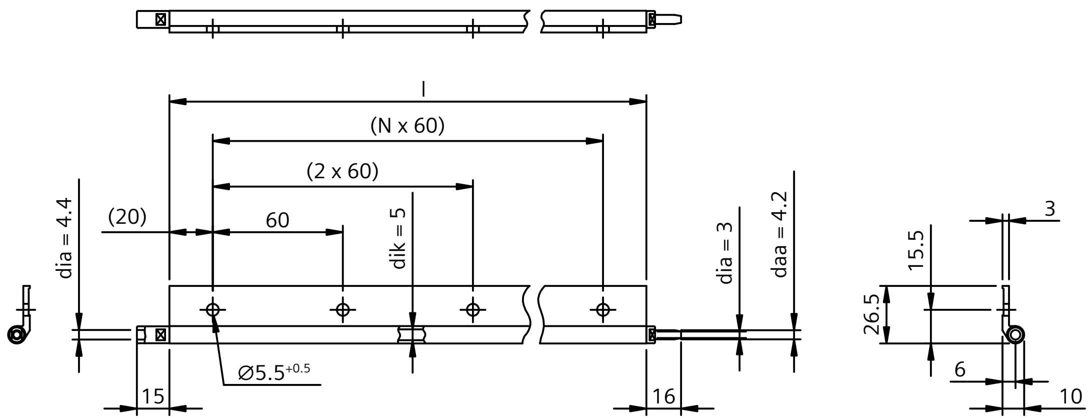


Figure 10-12 Mounting the Hall sensor box (HSB) with lateral cable outlet for motors 1FN3050-xN ... 150-xN

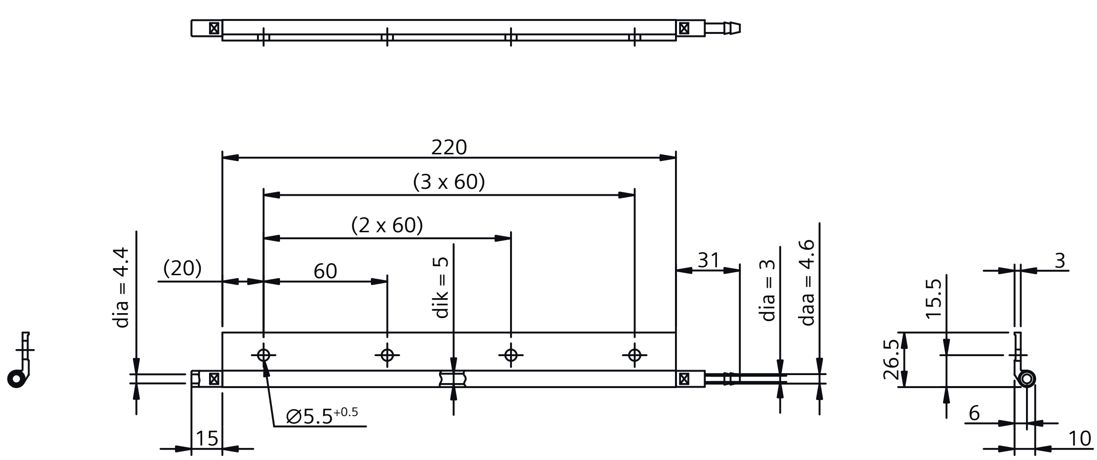
10.3.17 Heatsink profiles



Number of secondary sections	N	l in mm	Weight in g
1	1	100	31.0
2	3	220	59.8
3	5	340	88.6
4	7	460	117.4
...	...	...	...

Coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed!

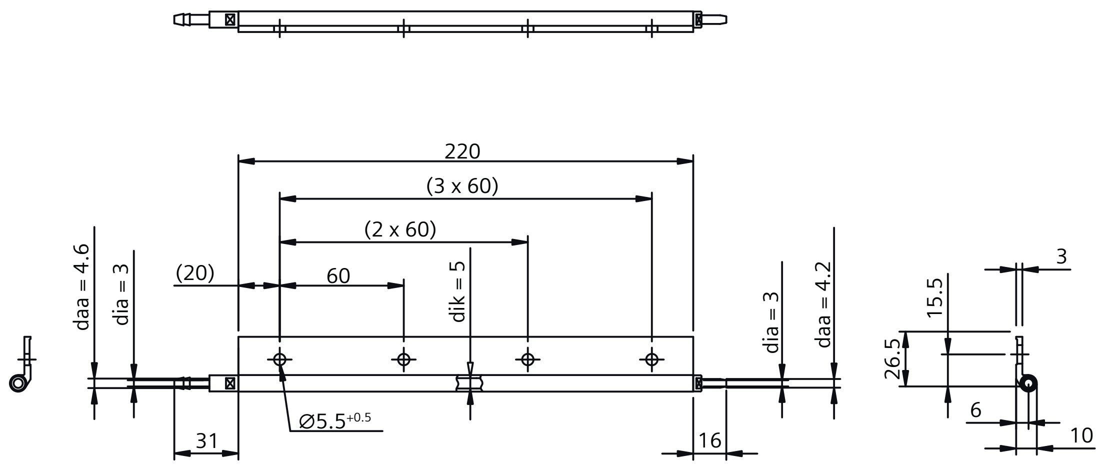
Figure 10-13 Cooling profile with plug-type coupling for motors with sizes 1FN3050, 1FN3100 and 1FN3150



Hose nipple, coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed.

Weight: 59.8 g

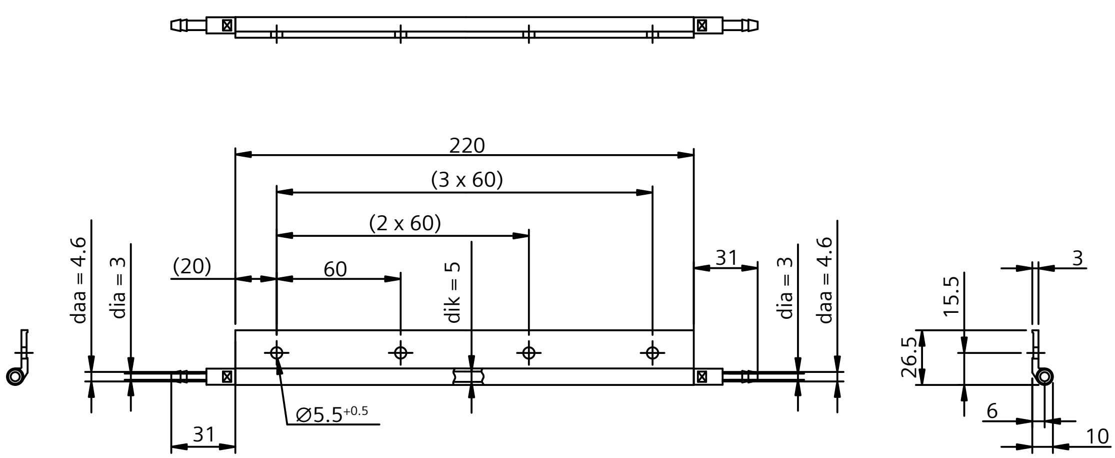
Figure 10-14 Cooling profile with hose nipple R, for motors, sizes 1FN3050, 1FN3100 and 1FN3150, example



Hose nipple, coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed.

Weight: 59.8 g

Figure 10-15 Cooling profile with hose nipple L, for motors, sizes 1FN3050, 1FN3100 and 1FN3150, example



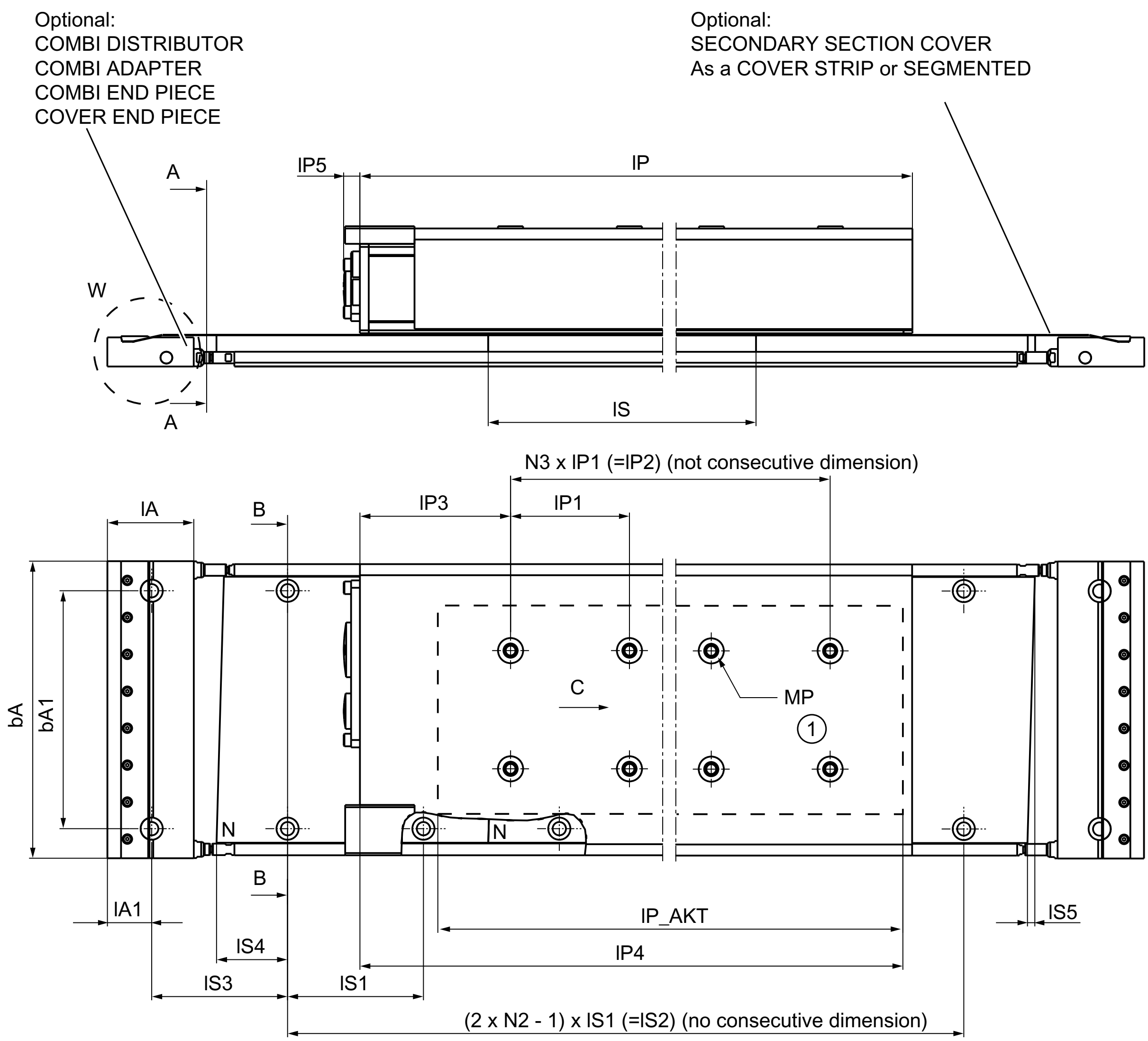
Hose nipple, coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed.

Weight: 59.8 g

Figure 10-16 Cooling profile with hose nipple LR for motor sizes 1FN3050, 1FN3100 and 1FN3150, example

10.4 1FN3300, 1FN3450

10.4.1 Drawings für 1FN3300 and 1FN3450



N2 = 1,2,3... Number of SECONDARY SECTIONS

N3 +1 = number of hole rows in the longitudinal direction

C → Direction of motion of the PRIMARY SECTION for rotating field direction with zero crossover of phase U

① Screw-in depth MP:
$22^{+0/-2}$ mm with precision cooler; $10^{+0/-2}$ mm without precision cooler

For the max. tightening torques of the mounting screws, see Chapter "Specifications of the mounting technology".

Figure 10-17 Installation dimensions for motors 1FN3300 - 1FN3450

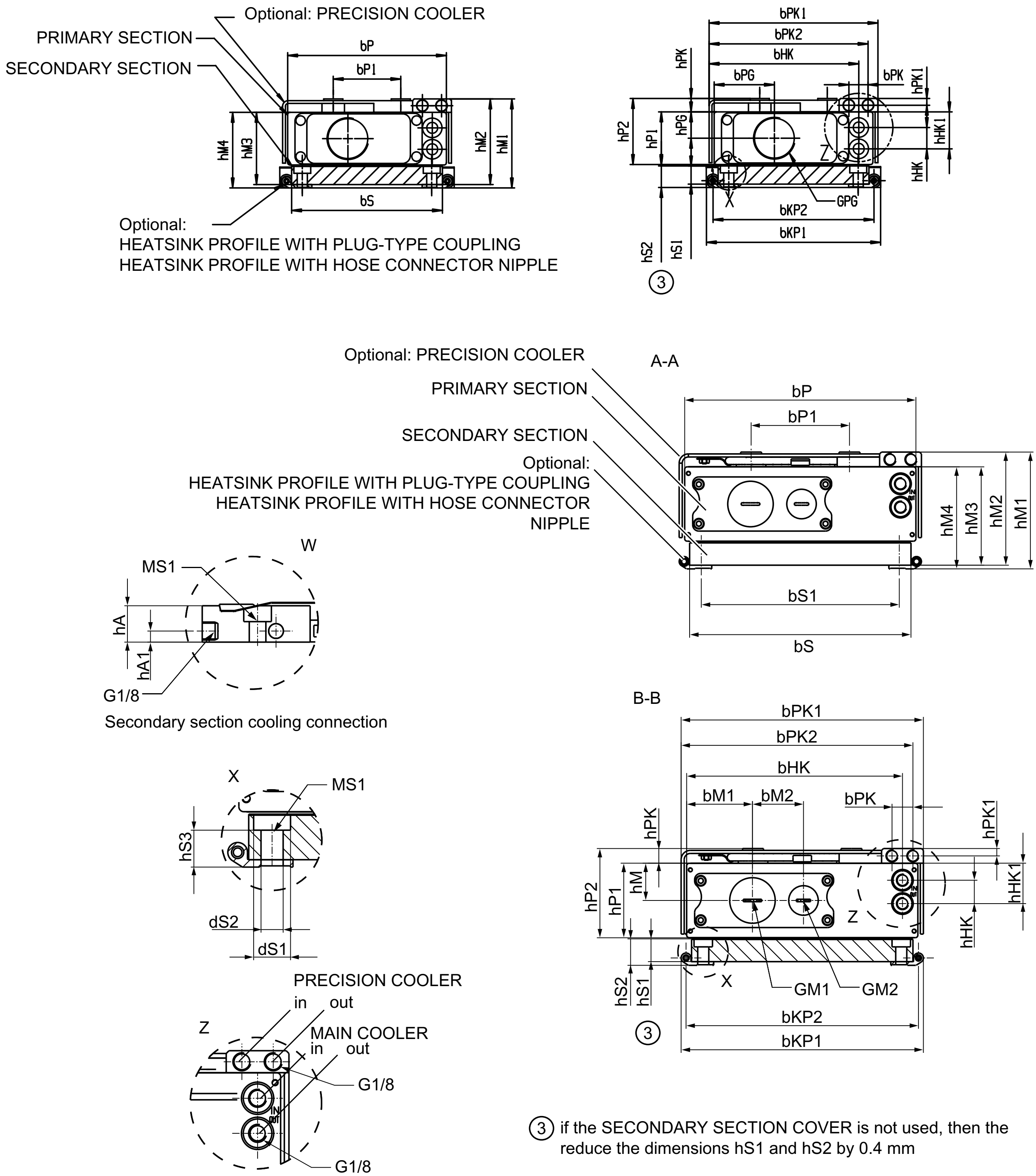


Figure 10-18 Installation dimensions for motors 1FN3300 - 1FN3450 (cross sections and details)

10.4.2 Dimensions of peak load primary sections 1FN3300

Size	Variable	Unit	1FN3300-...				
			1W	2W	3W	4W	5W
Length without connection cover	lP	mm	221	382	543	704	–
Longitudinal hole pattern	lP1	mm	80.5	80.5	80.5	80.5	–
Total longitudinal hole pattern	lP2	mm	80.5	241.5	402.5	563.5	–
Position 1st hole longitudinal pattern	lP3	mm	90	90	90	90	–
Position of the magnetically active surface	lP4	mm	211	372	533	694	–
Connection cover length	lP5	mm	11	11	11 / 28[1)]	11	–
Magnetically active length	lP,AKT	mm	161	322	483	644	–
Main cooler connection position (width)	bHK	mm	128.5	128.5	128.5	128.5	–
Width without precision cooler	bP	mm	141	141	141	141	–
Transverse hole pattern	bP1	mm	60	60	60	60	–
Total transverse hole pattern	bP2	mm	–	–	–	–	–
Precision cooler connector spacing	bPK	mm	–	17	17	17	–
Precision cooler width	bPK1	mm	–	150	150	150	–
Precision cooler connection position	bPK2	mm	–	141.5	141.5	141.5	–
Main cooler connection spacing	hHK	mm	19	19	19	19	–
Main cooler connection position (height)	hHK1	mm	32.9	32.9	32.9	32.9	–
Motor height with additional coolers	hM1	mm	–	79	79	79	–
Motor height with precision cooler	hM2	mm	–	76	76	76	–
Motor height without additional cooler	hM3	mm	64.1	64.1	64.1	64.1	–
Motor height with heatsink profile without precision cooler	hM4	mm	67.1	67.1	67.1	67.1	–
Height of primary section without precision cooler	hP1	mm	46.7	46.7	46.7	46.7	–
Height of primary section with precision cooler	hP2	mm	–	58.6	58.6	58.6	–
Precision cooler height	hPK	mm	–	11.9	11.9	11.9	–
Precision cooler connector position (height)	hPK1	mm	–	6	6	6	–
Mounting screw thread	MP		M8	M8	M8	M8	–
Version with one connecting cable (end of the Article No. ...0AAx)							
PG thread position (width)	bPG	mm	53.5	53.5	53.5	53.5	–
PG thread position (height)	hPG	mm	23.4	23.4	23.4	23.4	–
PG thread diameter	GPG	mm	PG21[1)]	PG21[1)]	PG21[1)] / PG29[2)]	PG21[1)]	–
Version with 2 connecting cables (end of the Article No. ...0BAx)							
Thread position (height)	hM	mm	23.4	23.4	23.4	23.4	–
Thread 1 position (width)	bM1	mm	53.5	53.5	53.5	53.5	–
Thread 2 position (width)	bM2	mm	41.5	41.5	41.5	41.5	–
Thread 1 diameter	GM1		M20x1.5	M20x1.5/ M32x1.5[3)]	M20x1.5/ M32x1.5[3)]	M20x1.5/ M32x1.5[3)]	–
Thread 2 diameter	GM2		M20x1.5	M20x1.5	M20x1.5	M20x1.5	–

[1] Applicable for 1FN3300-1WC00, 1FN3300-2WB00, 1FN3300-2WC00, 1FN3300-2WG00, 1FN3300-3WC00, 1FN3300-4WB00, 1FN300-4WC00 motors; [2] Applicable for the 1FN3300-3WG00 motor; [3] Applicable for 1FN3300-2WG00, 1FN3300-3WG00 and 1FN3300-4WC00 motors

10.4.3 Dimensions of continuous load primary sections 1FN3300

Size	Varia-ble	Unit	1FN3300-...				
			1N	2N	3N	4N	5N
Length without connection cover	lP	mm	238	399	560	721	–
Longitudinal hole pattern	lP1	mm	80.5	80.5	80.5	80.5	–
Total longitudinal hole pattern	lP2	mm	80.5	241.5	402.5	563.5	–
Position 1st hole longitudinal pattern	lP3	mm	102	102	102	102	–
Position of the magnetically active surface	lP4	mm	231.8	392.8	553.8	714.8	–
Connection cover length	lP5	mm	11	11	11	11	–
Magnetically active length	lP,AKT	mm	179	340	501	662	–
Main cooler connection position (width)	bHK	mm	128.5	128.5	128.5	128.5	–
Width without precision cooler	bP	mm	141	141	141	141	–
Transverse hole pattern	bP1	mm	60	60	60	60	–
Thread 1 position (width)	bM1	mm	53.5	53.5	53.5	53.5	–
Thread 2 position (width)	bM2	mm	41.5	41.5	41.5	41.5	–
Precision cooler connector spacing	bPK	mm	17	17	17	17	–
Precision cooler width	bPK1	mm	150	150	150	150	–
Precision cooler connection position	bPK2	mm	141.5	141.5	141.5	141.5	–
Main cooler connection spacing	hHK	mm	19	19	19	19	–
Main cooler connection position (height)	hHK1	mm	32.9	32.9	32.9	32.9	–
Motor height with additional coolers	hM1	mm	92.9	92.9	92.9	92.9	–
Motor height with precision cooler	hM2	mm	89.9	89.9	89.9	89.9	–
Motor height without additional cooler	hM3	mm	78.0	78.0	78.0	78.0	–
Motor height with heatsink profile without precision cooler	hM4	mm	81.0	81.0	81.0	81.0	–
Height of primary section without precision cooler	hP1	mm	60.6	60.6	60.6	60.6	–
Height of primary section with precision cooler	hP2	mm	72.5	72.5	72.5	72.5	–
Thread position (height)	hM	mm	30.3	30.3	30.3	30.3	–
Precision cooler height	hPK	mm	11.9	11.9	11.9	11.9	–
Precision cooler connector position (height)	hPK1	mm	6	6	6	6	–
Thread 1 diameter	GM1		M20x1.5	M20x1.5/ M32x1.5[1)]	M32x1.5/ M20x1.5[2)]	M32x1.5	–
Thread 2 diameter	GM2		M20x1.5	M20x1.5	M20x1.5	M20x1.5	–
Mounting screw thread	MP		M8	M8	M8	M8	–

[1)] Applicable for the 1FN3300-2NH00 motor; [2)] Applicable for the 1FN3300-3NB50 motor

10.4.4 Dimensions of peak load primary sections 1FN3450

Size	Variable	Unit	1FN3450-...				
			1W	2W	3W	4W	5W
Length without connection cover	lP	mm	–	382	543	704	–
Longitudinal hole pattern	lP1	mm	–	80.5	80.5	80.5	–
Total longitudinal hole pattern	lP2	mm	–	241.5	402.5	563.5	–
Position 1st hole longitudinal pattern	lP3	mm	–	90	90	90	–
Position of the magnetically active surface	lP4	mm	–	372	533	694	–
Connection cover length	lP5	mm	–	11	11 / 28*	11 / 28*	–
Magnetically active length	lP,AKT	mm	–	322	483	644	–
Main cooler connection position (width)	bHK	mm	–	175.5	175.5	175.5	–
Width without precision cooler	bP	mm	–	188	188	188	–
Transverse hole pattern	bP1	mm	–	80	80	80	–
Total transverse hole pattern	bP2	mm	–	–	–	–	–
Precision cooler connector spacing	bPK	mm	–	17	17	17	–
Precision cooler width	bPK1	mm	–	197	197	197	–
Precision cooler connection position	bPK2	mm	–	188.5	188.5	188.5	–
Main cooler connection spacing	hHK	mm	–	19	19	19	–
Main cooler connection position (height)	hHK1	mm	–	32.9	32.9	32.9	–
Motor height with additional coolers	hM1	mm	–	81	81	81	–
Motor height with precision cooler	hM2	mm	–	78	78	78	–
Motor height without additional cooler	hM3	mm	–	66.1	66.1	66.1	–
Motor height with heatsink profile without precision cooler	hM4	mm	–	69.1	69.1	69.1	–
Height of primary section without precision cooler	hP1	mm	–	46.7	46.7	46.7	–
Height of primary section with precision cooler	hP2	mm	–	58.6	58.6	58.6	–
Precision cooler height	hPK	mm	–	11.9	11.9	11.9	–
Precision cooler connector position (height)	hPK1	mm	–	6	6	6	–
Mounting screw thread	MP		–	M8	M8	M8	–
Version with one connecting cable (end of the Article No. ...0AAx)							
PG thread position (width)	bPG	mm	–	53.5	53.5	53.5	–
PG thread position (height)	hPG	mm	–	23.4	23.4	23.4	–
PG thread diameter	GPG		–	PG21	PG21 1) / PG29 2)	PG21 1) / PG29 2)	–
Version with 2 connecting cables (end of the Article No. ...0BAx)							
Thread position (height)	hM	mm	–	23.4	23.4	23.4	–
Thread 1 position (width)	bM1	mm	–	53.5	53.5	53.5	–
Thread 2 position (width)	bM2	mm	–	41.5	41.5	41.5	–
Thread 1 diameter	GM1		–	M32x1.5/ M20x1.5 3)	M32x1.5/ M20x1.5 3)	M32x1.5	–
Thread 2 diameter	GM2		–	M20x1.5	M20x1.5	M20x1.5	–

[1] Applicable for motors 1FN3450-2WA50, 1FN3450-2WB00, 1FN3450-2WB70, 1FN3450-2WC00, 1FN3450-2WD00, 1FN3450-3WA50, 1FN3450-3WB00, 1FN3450-3WB50, 1FN3450-3WB60, 1FN3450-3WC00, 1FN3450-4WB00, 1FN3450-4WB00, 1FN3450-4WB50; [2] Applicable for motors 1FN3450-2WE00, 1FN3450-3WE00, 1FN3450-4WC00, 1FN3450-4WE00; [3] Applicable for motors 1FN3450-2WA50, 1FN3450-2WC00, 1FN3450-2WB70, 1FN3450-3WB00 and 1FN3450-3WA50

10.4.5 Dimensions of continuous load primary sections 1FN3450

Size	Variable	Unit	1FN3450-...				
			1N	2N	3N	4N	5N
Length without connection cover	lP	mm	238	399	560	721	–
Longitudinal hole pattern	lP1	mm	80.5	80.5	80.5	80.5	–
Total longitudinal hole pattern	lP2	mm	80.5	241.5	402.5	563.5	–
Position 1st hole longitudinal pattern	lP3	mm	102	102	102	102	–
Position of the magnetically active surface	lP4	mm	231.8	392.8	553.8	714.8	–
Connection cover length	lP5	mm	11	11	11	11	–
Magnetically active length	lP,AKT	mm	179	340	501	662	–
Main cooler connection position (width)	bHK	mm	175.5	175.5	175.5	175.5	–
Width without precision cooler	bP	mm	188	188	188	188	–
Transverse hole pattern	bP1	mm	80	80	80	80	–
Thread 1 position (width)	bM1	mm	53.5	53.5	53.5	53.5	–
Thread 2 position (width)	bM2	mm	41.5	41.5	41.5	41.5	–
Precision cooler connector spacing	bPK	mm	17	17	17	17	–
Precision cooler width	bPK1	mm	197	197	197	197	–
Precision cooler connection position	bPK2	mm	188.5	188.5	188.5	188.5	–
Main cooler connection spacing	hHK	mm	19	19	19	19	–
Main cooler connection position (height)	hHK1	mm	32.9	32.9	32.9	32.9	–
Motor height with additional coolers	hM1	mm	94.9	94.9	94.9	94.9	–
Motor height with precision cooler	hM2	mm	91.9	91.9	91.9	91.9	–
Motor height without additional cooler	hM3	mm	80.0	80.0	80.0	80.0	–
Motor height with heatsink profile without precision cooler	hM4	mm	83.0	83.0	83.0	83.0	–
Height of primary section without precision cooler	hP1	mm	60.6	60.6	60.6	60.6	–
Height of primary section with precision cooler	hP2	mm	72.5	72.5	72.5	72.5	–
Thread position (height)	hM	mm	30.3	30.3	30.3	30.3	–
Precision cooler height	hPK	mm	11.9	11.9	11.9	11.9	–
Precision cooler connector position (height)	hPK1	mm	6	6	6	6	–
Thread 1 diameter	GM1		M20x1.5	M32x1.5/ M20x1.5 [1)]	M32x1.5/ M20x1.5 [1)]	M32x1.5	–
Thread 2 diameter	GM2		M20x1.5	M20x1.5	M20x1.5	M20x1.5	–
Mounting screw thread	MP		M8	M8	M8	M8	–

1) Applicable for motors 1FN3450-2NB40, 1FN3450-2NB80 and 1FN3450-3NA50

10.4.6 Dimensions of the secondary section of 1FN3300

Size	Variable	Unit	1FN3300-4SA00	1FN3300-4SA12
Secondary section length	lS	mm	184	276 max.
Hole pattern (longitudinal)	lS1	mm	92	92
Total hole pattern (longitudinal)	lS2	mm	lS1 x (2xN2–1)	lS1 x (2xN2–1)
Position 1st hole hole pattern (longitudinal)	lS4	mm	49.2	49.2
Incline	lS5	mm	5.6	5.6
Width without heatsink profile	bS	mm	134	134
Hole pattern (transverse)	bS1	mm	115	115
Width with heatsink profile	bKP1	mm	151	151
Heatsink profile connector spacing	bKP2	mm	143	143
Height without heatsink profile with cover	hS1	mm	16.5	16.5
Height with heatsink profile with cover	hS2	mm	19.5	19.5
Mounting screw clamp length	hS3	mm	13	13
Screw countersink diameter (outer)	dS1	mm	15	15
Hole diameter (outer)	dS2	mm	9	9
Hole diameter (inner)	dS3	mm	–	–
Screw countersink diameter (inner)	dS4	mm	–	–
Secondary section mounting screws (outside)	MS1	mm	DIN 6912 - M8	DIN 6912 - M8
Secondary section mounting screws (inside)	MS2	mm	–	–

10.4.7 Dimensions of the secondary section of 1FN3450

Size	Variable	Unit	1FN3450-4SA00	1FN3450-4SA12
Secondary section length	lS	mm	184	276 max.
Hole pattern (longitudinal)	lS1	mm	92	92
Total hole pattern (longitudinal)	lS2	mm	lS1 x (2xN2–1)	lS1 x (2xN2–1)
Position 1st hole hole pattern (longitudinal)	lS4	mm	48.9	48.9
Incline	lS5	mm	5	5
Width without heatsink profile	bS	mm	180	180
Hole pattern (transverse)	bS1	mm	161	161
Width with heatsink profile	bKP1	mm	197	197
Heatsink profile connector spacing	bKP2	mm	189	189
Height without heatsink profile with cover	hS1	mm	18.5	18.5
Height with heatsink profile with cover	hS2	mm	21.5	21.5
Mounting screw clamp length	hS3	mm	15	15
Screw countersink diameter (outer)	dS1	mm	15	15
Hole diameter (outer)	dS2	mm	9	9
Hole diameter (inner)	dS3	mm	–	–
Screw countersink diameter (inner)	dS4	mm	–	–
Secondary section mounting screws (outside)	MS1	mm	DIN 6912 - M8	DIN 6912 - M8
Secondary section mounting screws (inside)	MS2	mm	–	–

10.4.8 Dimensions of the secondary section end pieces of 1FN3300

Size	Variable	Unit	1FN3300-0TF00 1FN3300-0TG00 1FN3300-0TJ00	1FN3300-0TC00
Maximum length	lA	mm	58.5	58.5
Hole position (right)	lA1	mm	30	30
Hole distance to secondary section hole	lS3	mm	92	92
Maximum width	bA	mm	155	155
G 1/8 cooler connector position (height)	hA1	mm	6	–
Hole pattern (transverse)	bA1	mm	115	115
maximum height for 1FN3300-0Tx00-0AA0 / 1AA0	hA	mm	18.5 / 18.1	15.5 / 15.1

10.4.9 Dimensions of the secondary section end pieces of 1FN3450

Size	Variable	Unit	1FN3450-0TF00 1FN3450-0TG00 1FN3450-0TJ00	1FN3450-0TC00
Maximum length	lA	mm	58.5	58.5
Hole position (right)	lA1	mm	30	30
Hole distance to secondary section hole	lS3	mm	92	92
Maximum width	bA	mm	201	201
G 1/8 cooler connector position (height)	hA1	mm	6	–
Hole pattern (transverse)	bA1	mm	161	161
maximum height for 1FN3450-0Tx00-0AA0 / 1AA0	hA	mm	20.5 / 20.1	17.5 / 17.1

10.4.10 Mounting the Hall sensor box

Mounting the Hall sensor box onto the peak load motors 1FN3300 - 1FN3450

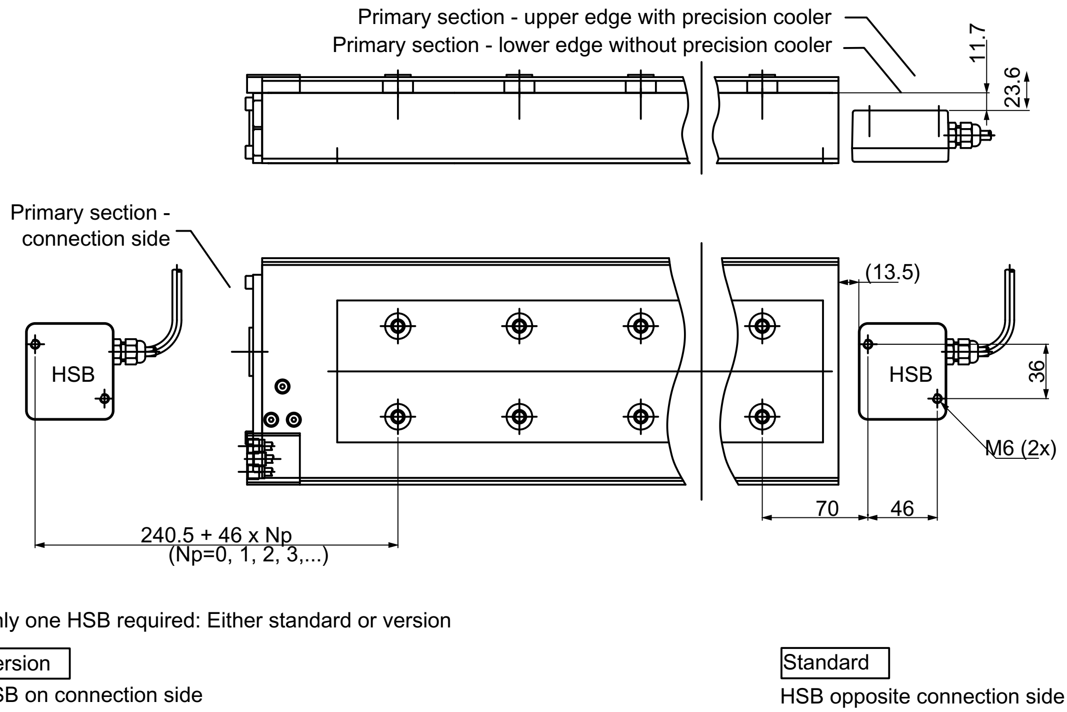


Figure 10-19 Hall sensor box (HSB) with straight cable outlet for motors 1FN3300 and 1FN3450

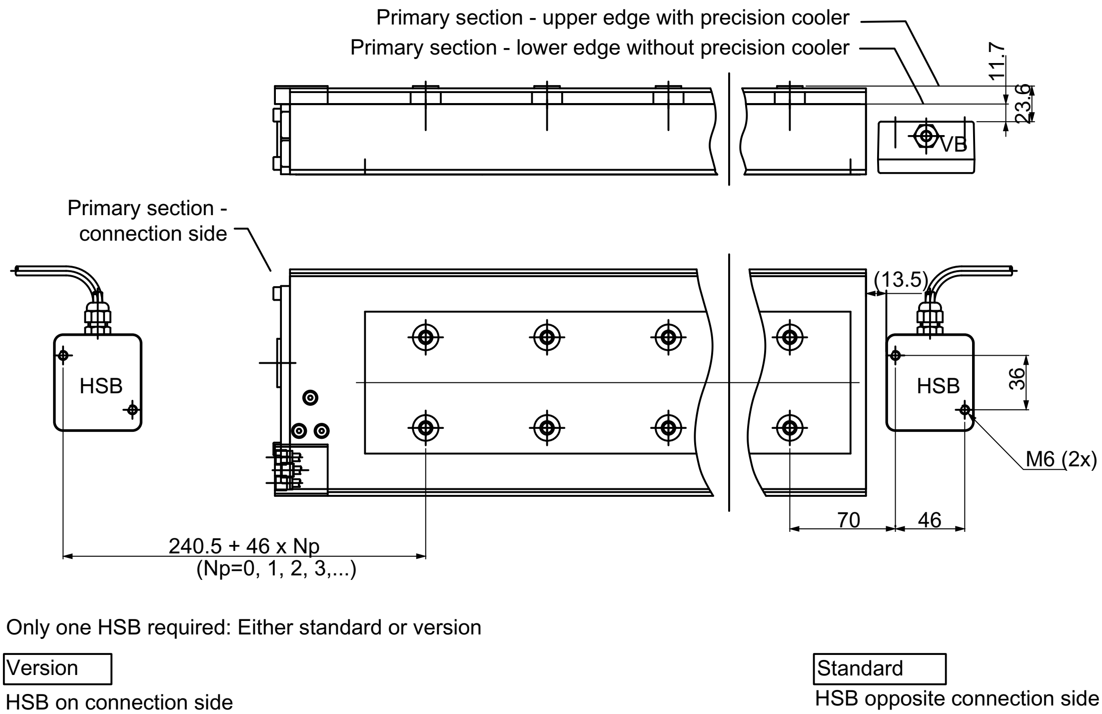


Figure 10-20 Hall sensor box (HSB) with lateral cable outlet for motors 1FN3300 and 1FN3450

Mounting the Hall sensor box onto continuous load motors 1FN3300 - 1FN3450

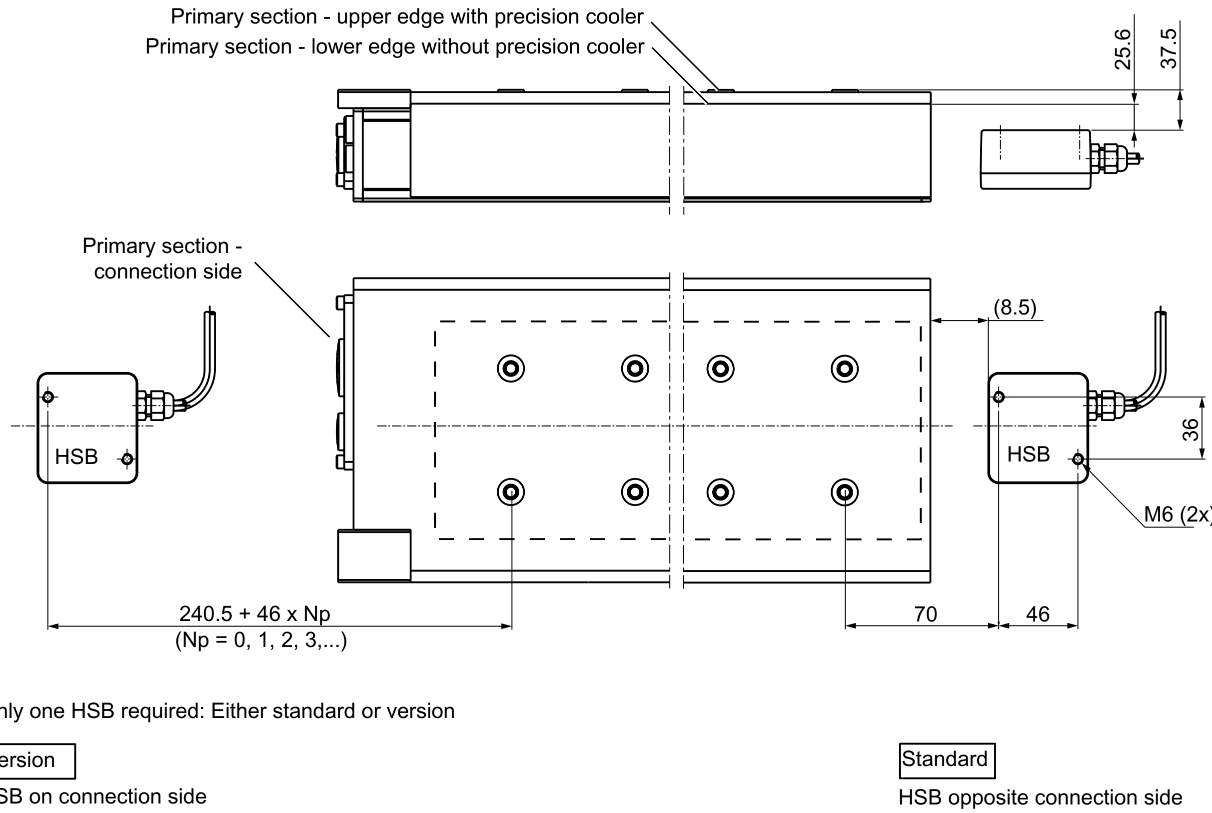


Figure 10-21 Mounting the Hall sensor box (HSB) with straight cable outlet for motors 1FN3300-xN ... 450-xN

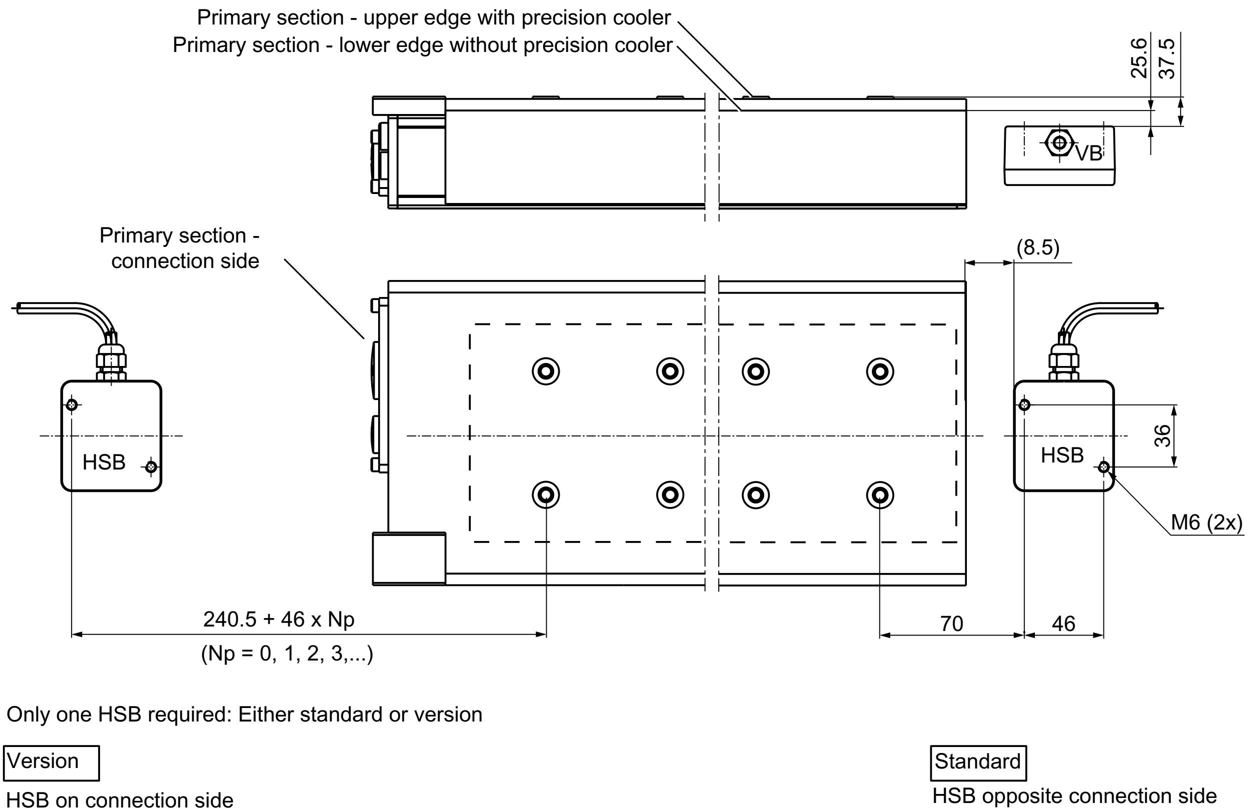
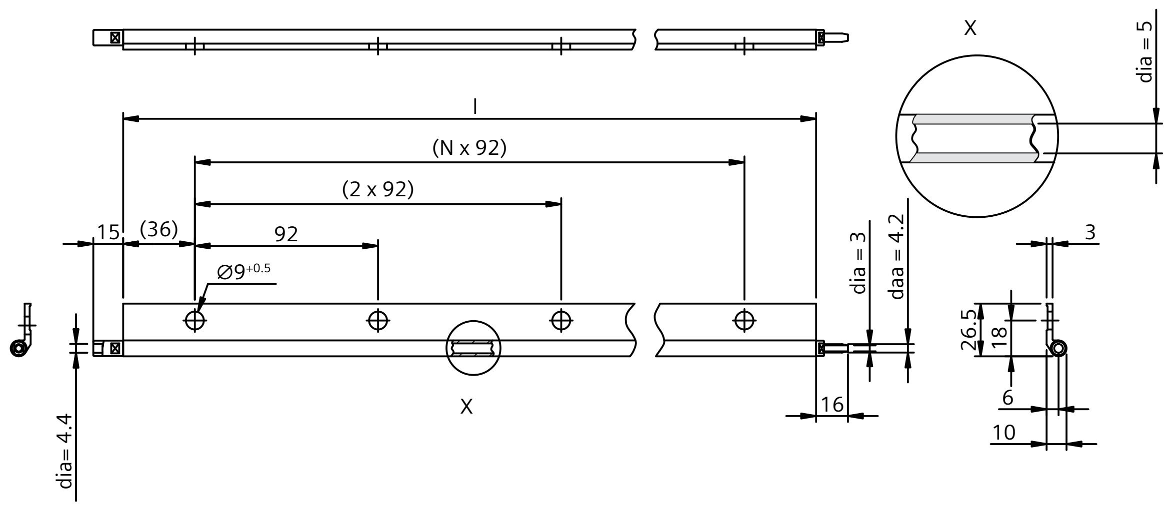


Figure 10-22 Mounting the Hall sensor box (HSB) with lateral cable outlet for motors 1FN3300-xN ... 450-xN

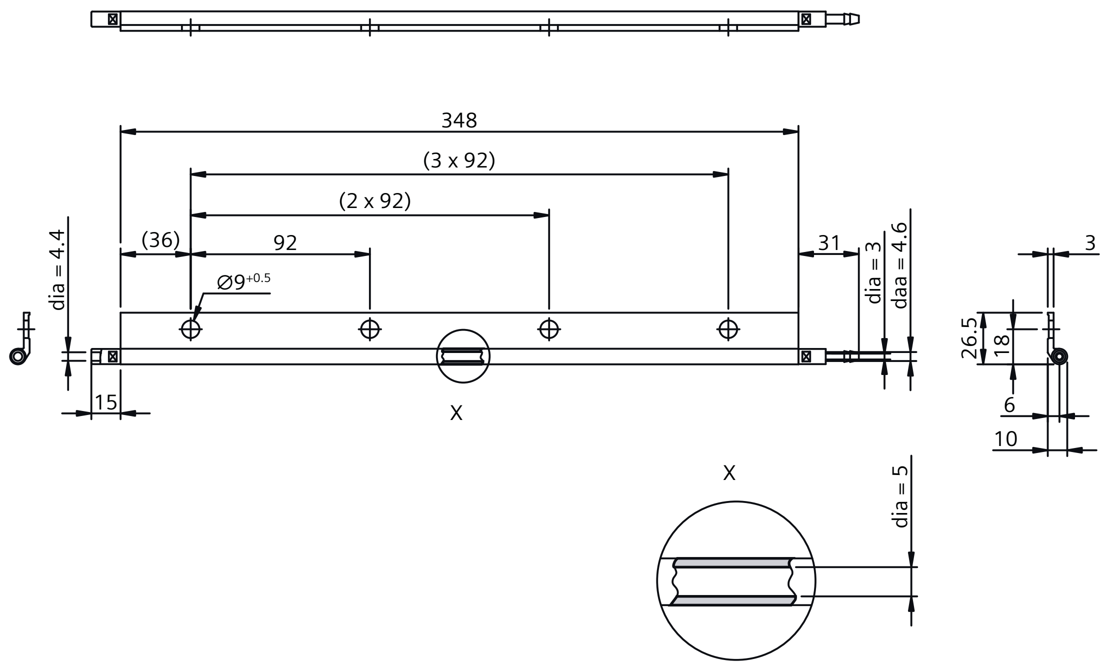
10.4.11 Heatsink profiles



Number of secondary sections	N	l in mm	Weight in g
1	1	164	46.3
2	3	348	90.5
3	5	532	134.7
4	7	716	178.8
5	9	900	223.0
...	...	...	...

Coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed!

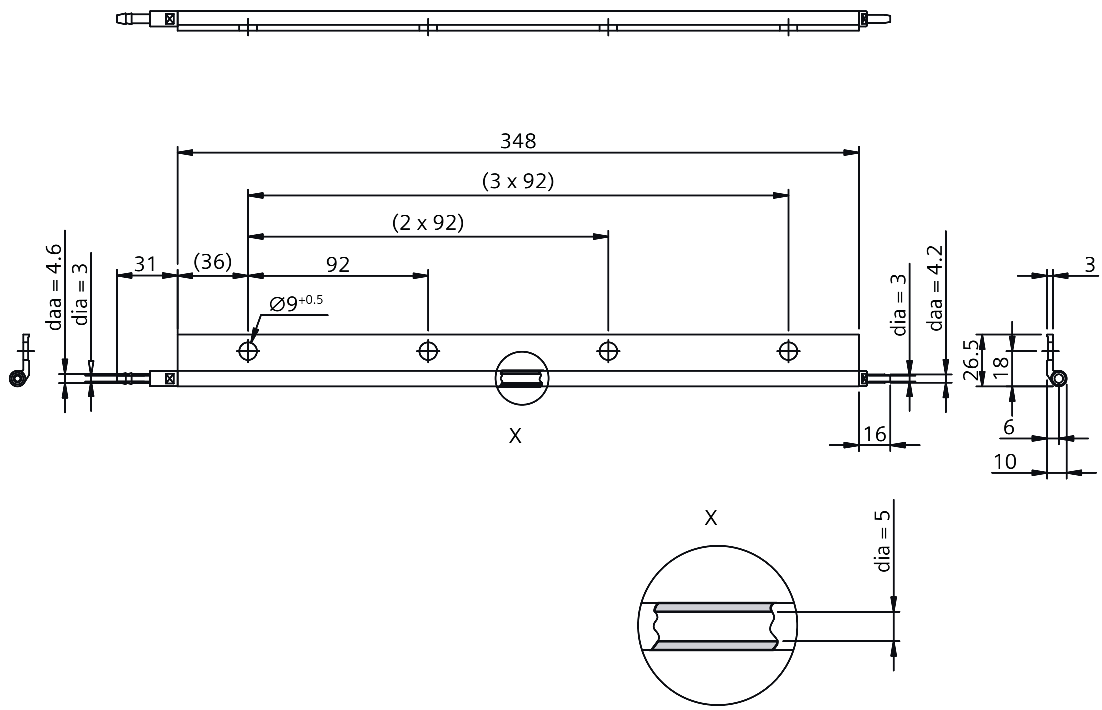
Figure 10-23 Cooling profile with plug-type coupling for motors of sizes 1FN3300 and 1FN3450



Hose nipple, coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed.

Weight: 90.5 g

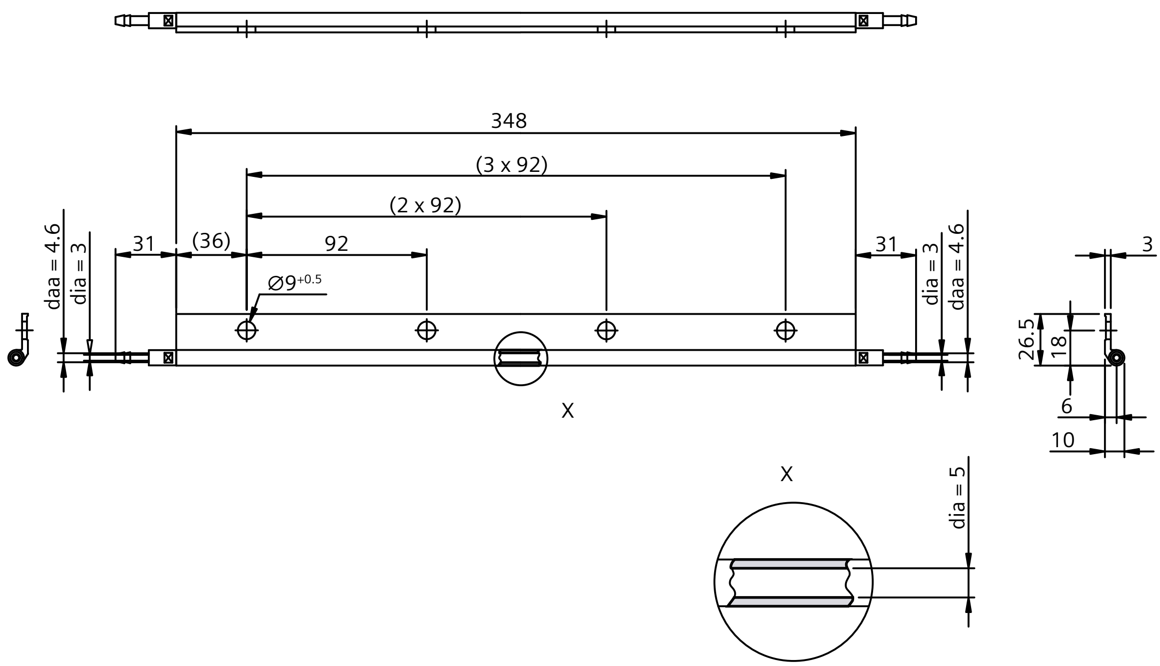
Figure 10-24 Cooling profile with hose nipple R for motors, sizes 1FN3300 and 1FN3450, example



Hose nipple, coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed.

Weight: 90.5 g

Figure 10-25 Cooling profile with hose nipple L for motors, sizes 1FN3300 and 1FN3450, example



Hose nipple, coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed.

Weight: 90.5 g

Figure 10-26 Cooling profile with hose nipple LR for motors, sizes 1FN3300 and 1FN3450, example

10.5 1FN3600

10.5.1 Drawings for 1FN3600

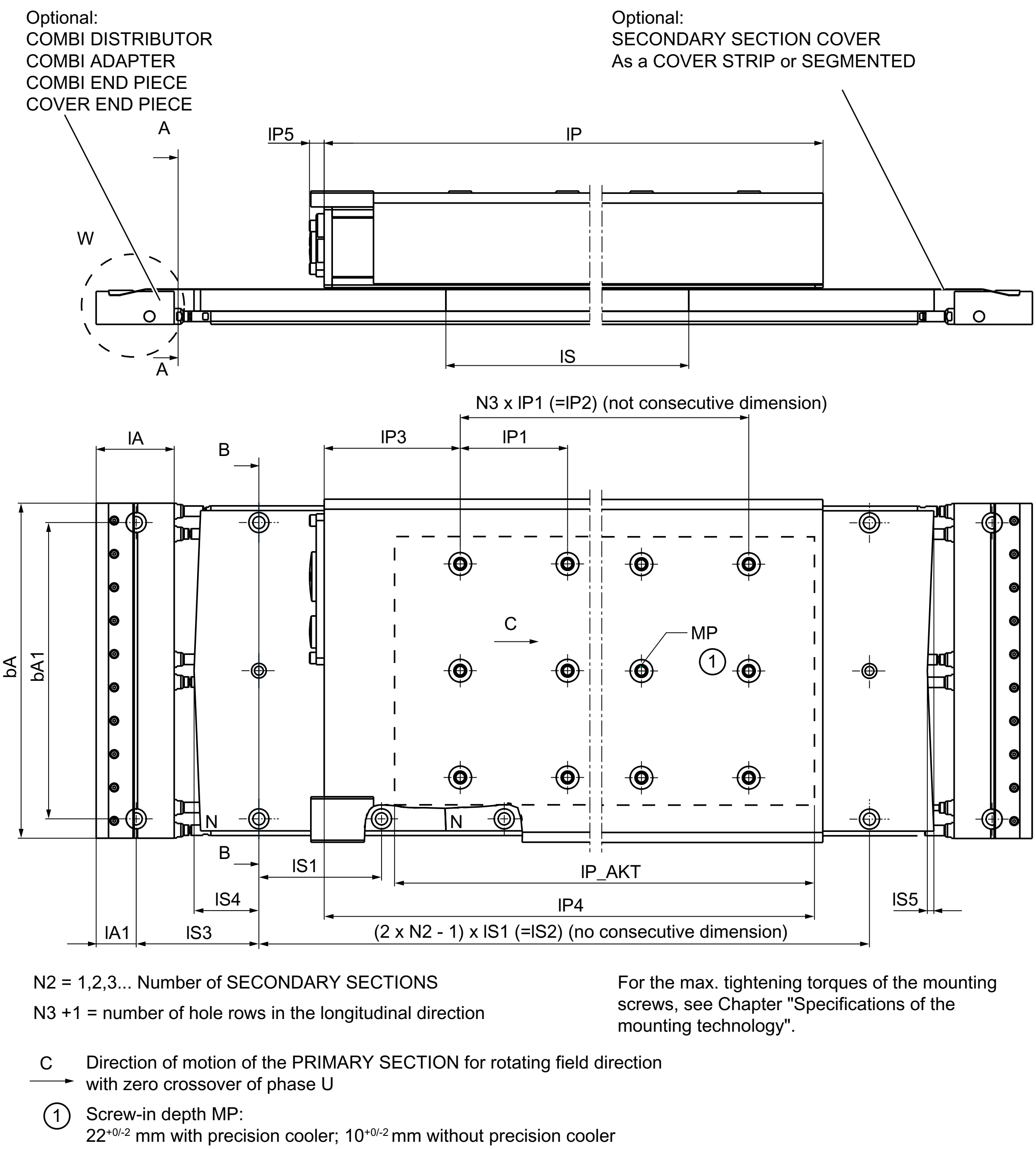


Figure 10-27 Installation dimension of motor 1FN3600

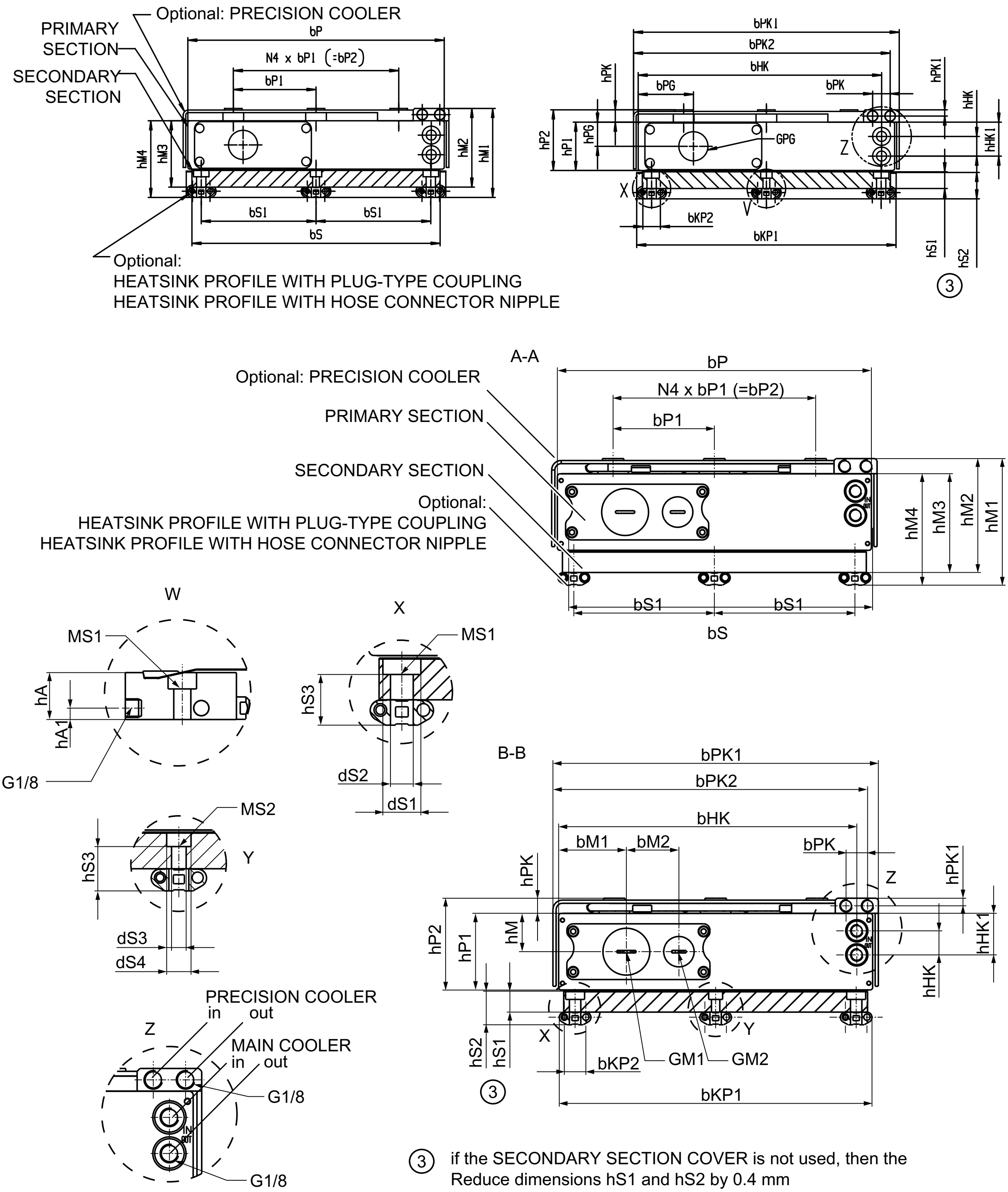


Figure 10-28 Installation diagram of motor 1FN3600 (cross sections and details)

10.5.2 Dimensions of peak load primary sections 1FN3600

Size	Varia-ble	Unit	1FN3600-...				
			1W	2W	3W	4W	5W
Length without connection cover	lP	mm	–	382	543	704	865
Longitudinal hole pattern	lP1	mm	–	80.5	80.5	80.5	80.5
Total longitudinal hole pattern	lP2	mm	–	241.5	402.5	563.5	724.5
Position 1st hole longitudinal pattern	lP3	mm	–	90	90	90	90
Position of the magnetically active surface	lP4	mm	–	372	533	694	855
Connection cover length	lP5	mm	–	11	11	11	11
Magnetically active length	lP,AKT	mm	–	322	483	644	805
Main cooler connection position (width)	bHK	mm	–	235.5	235.5	235.5	235.5
Width without precision cooler	bP	mm	–	248	248	248	248
Transverse hole pattern	bP1	mm	–	80	80	80	80
Total transverse hole pattern	bP2	mm	–	160	160	160	160
Precision cooler connector spacing	bPK	mm	–	17	17	17	17
Precision cooler width	bPK1	mm	–	257	257	257	257
Precision cooler connection position	bPK2	mm	–	248.5	248.5	248.5	248.5
Main cooler connection spacing	hHK	mm	–	19	19	19	19
Main cooler connection position (height)	hHK1	mm	–	32.9	32.9	32.9	32.9
Motor height with additional coolers	hM1	mm	–	86	86	86	86
Motor height with precision cooler	hM2	mm	–	76	76	76	76
Motor height without additional cooler	hM3	mm	–	64.1	64.1	64.1	64.1
Motor height with heatsink profile without precision cooler	hM4	mm	–	74.1	74.1	74.1	74.1
Height of primary section without precision cooler	hP1	mm	–	46.7	46.7	46.7	46.7
Height of primary section with precision cooler	hP2	mm	–	58.6	58.6	58.6	58.6
Precision cooler height	hPK	mm	–	11.9	11.9	11.9	11.9
Precision cooler connector position (height)	hPK1	mm	–	6	6	6	6
Mounting screw thread	MP		–	M8	M8	M8	M8
Version with one connecting cable (end of the Article No. ...0AAx)							
PG thread position (width)	bPG	mm	–	53.5	53.5	53.5	53.5
PG thread position (height)	hPG	mm	–	23.4	23.4	23.4	23.4
PG thread diameter	GPG		–	PG21[1)] / PG29[2)]	PG21[1)]	PG21[1)] / PG29[2)]	PG21[1)] / PG29[2)]
Version with 2 connecting cables (end of the Article No. ..0BAx)							
Thread position (height)	hM	mm	–	23.4	23.4	23.4	23.4
Thread 1 position (width)	bM1	mm	–	53.5	53.5	53.5	53.5
Thread 2 position (width)	bM2	mm	–	41.5	41.5	41.5	41.5
Thread 1 diameter	GM1		–	M32x1.5/ M20x15[3)]	M32x1.5	M32x1.5	M32x1.5
Thread 2 diameter	GM2		–	M20x15	M20x15	M20x15	M20x15

[1] Applicable for motors 1FN3600-2WA50, 1FN3600-2WB00, 1FN3600-2WE00, 1FN3600-3WB00, 1FN3600-4WA30, 1FN3600-4WB00, 1FN3600-4WC00, 1FN3600-4WD30; [2] Applicable for motors 1FN3600-2WE00, 1FN3600-4WB50, 1FN3600-4WC00, 1FN3600-4WD30, 1FN3600-5WB00; [3] Applicable for motors 1FN3600-2WA50 and 1FN3600-2WB00

10.5.3 Dimensions of continuous load primary sections 1FN3600

Size	Varia-ble	Unit	1FN3600-...				
			1N	2N	3N	4N	5N
Length without connection cover	lP	mm	–	399	560	721	–
Longitudinal hole pattern	lP1	mm	–	80.5	80.5	80.5	–
Total longitudinal hole pattern	lP2	mm	–	241.5	402.5	563.5	–
Position 1st hole longitudinal pattern	lP3	mm	–	102	102	102	–
Position of the magnetically active surface	lP4	mm	–	392.8	553.8	714.8	–
Connection cover length	lP5	mm	–	11	11	11	–
Magnetically active length	lP,AKT	mm	–	340	501	662	–
Main cooler connection position (width)	bHK	mm	–	235.5	235.5	235.5	–
Width without precision cooler	bP	mm	–	248	248	248	–
Transverse hole pattern	bP1	mm	–	80	80	80	–
Total transverse hole pattern	bP2	mm	–	160	160	160	–
Thread 1 position (width)	bM1	mm	–	53.5	53.5	53.5	–
Thread 2 position (width)	bM2	mm	–	41.5	41.5	41.5	–
Precision cooler connector spacing	bPK	mm	–	17	17	17	–
Precision cooler width	bPK1	mm	–	257	257	257	–
Precision cooler connection position	bPK2	mm	–	248.5	248.5	248.5	–
Main cooler connection spacing	hHK	mm	–	19	19	19	–
Main cooler connection position (height)	hHK1	mm	–	32.9	32.9	32.9	–
Motor height with additional coolers	hM1	mm	–	99.9	99.9	99.9	–
Motor height with precision cooler	hM2	mm	–	89.9	89.9	89.9	–
Motor height without additional cooler	hM3	mm	–	78.0	78.0	78.0	–
Motor height with heatsink profile without precision cooler	hM4	mm	–	88.0	88.0	88.0	–
Height of primary section without precision cooler	hP1	mm	–	60.6	60.6	60.6	–
Height of primary section with precision cooler	hP2	mm	–	72.5	72.5	72.5	–
Thread position (height)	hM	mm	–	30.3	30.3	30.3	–
Precision cooler height	hPK	mm	–	11.9	11.9	11.9	–
Precision cooler connector position (height)	hPK1	mm	–	6	6	6	–
Thread 1 diameter	GM1		–	M32x1.5/ M20x1.5[1)]	M32x1.5	M32x1.5	–
Thread 2 diameter	GM2		–	M20x1.5	M20x1.5	M20x1.5	–
Mounting screw thread	MP		–	M8	M8	M8	–

1) Applicable for the 1FN3600-2NB00 motor

10.5.4 Dimensions of the secondary section of 1FN3600

Size	Variable	Unit	1FN3600-4SAxx
Secondary section length	lS	mm	184
Hole pattern (longitudinal)	lS1	mm	92
Total hole pattern (longitudinal)	lS2	mm	lS1 x (2xN2–1)
Position 1st hole hole pattern (longitudinal)	lS4	mm	48.6
Incline	lS5	mm	4.9
Width without heatsink profile	bS	mm	240
Hole pattern (transverse)	bS1	mm	111
Width with heatsink profile	bKP1	mm	247
Heatsink profile connector spacing	bKP2	mm	17
Height without heatsink profile with cover	hS1	mm	16.5
Height with heatsink profile with cover	hS2	mm	26.5
Mounting screw clamp length	hS3	mm	20
Screw countersink diameter (outer)	dS1	mm	15
Hole diameter (outer)	dS2	mm	9
Hole diameter (inner)	dS3	mm	6.6
Screw countersink diameter (inner)	dS4	mm	11
Secondary section mounting screws (outside)	MS1	mm	DIN 6912 - M8
Secondary section mounting screws (inside)	MS2	mm	DIN 6912 - M6

10.5.5 Dimensions of the secondary section end pieces of 1FN3600

Size	Variable	Unit	1FN3600-0TJ00
Maximum length	lA	mm	58.5
Hole position (right)	lA1	mm	30
Hole distance to secondary section hole	lS3	mm	92
Maximum width	bA	mm	251
G 1/8 cooler connector position (height)	hA1	mm	66
Hole pattern (transverse)	bA1	mm	222
maximum height for 1FN3600-0TJ00-0AA0 / 1AA0	hA	mm	25.5 / 25.1

10.5.6 Mounting the Hall sensor box

Mounting the Hall sensor onto the peak load motor 1FN3600

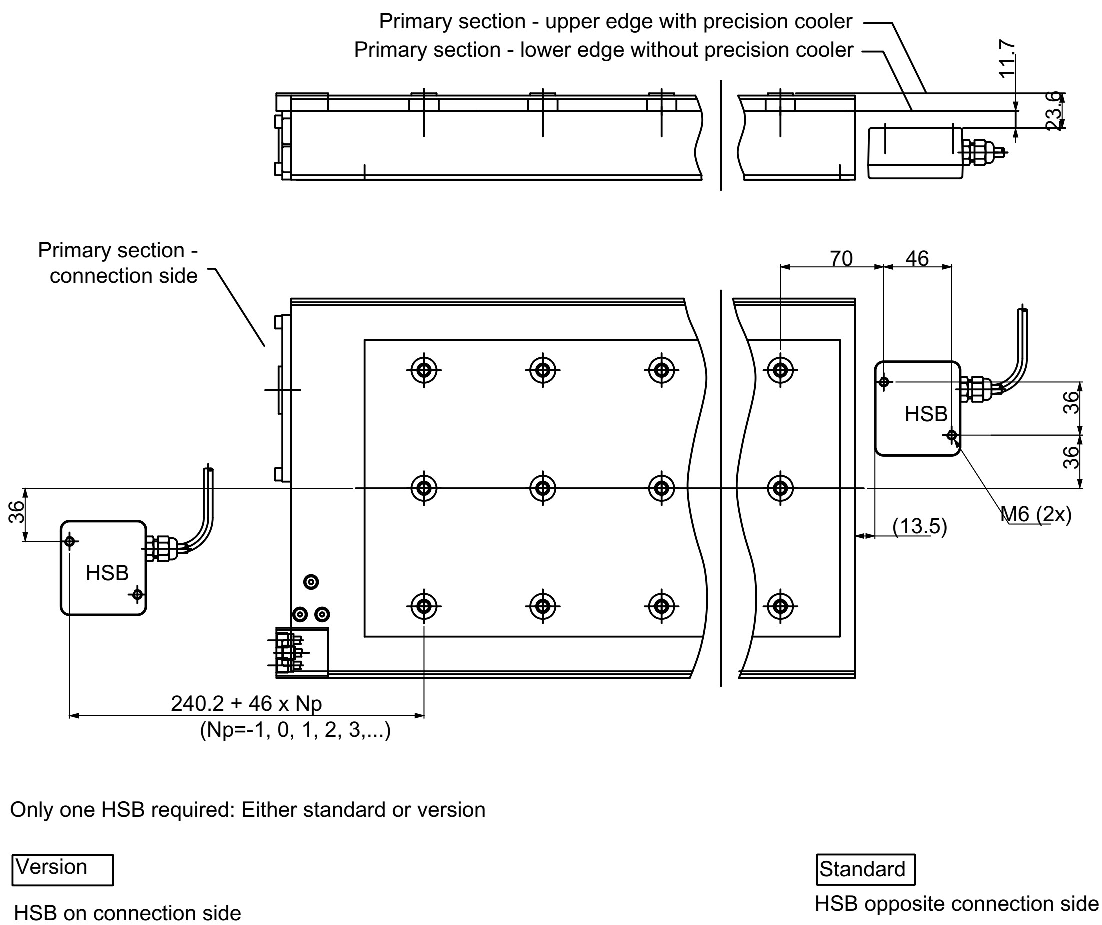


Figure 10-29 Hall sensor box (HSB) with straight cable outlet for 1FN3600 motors

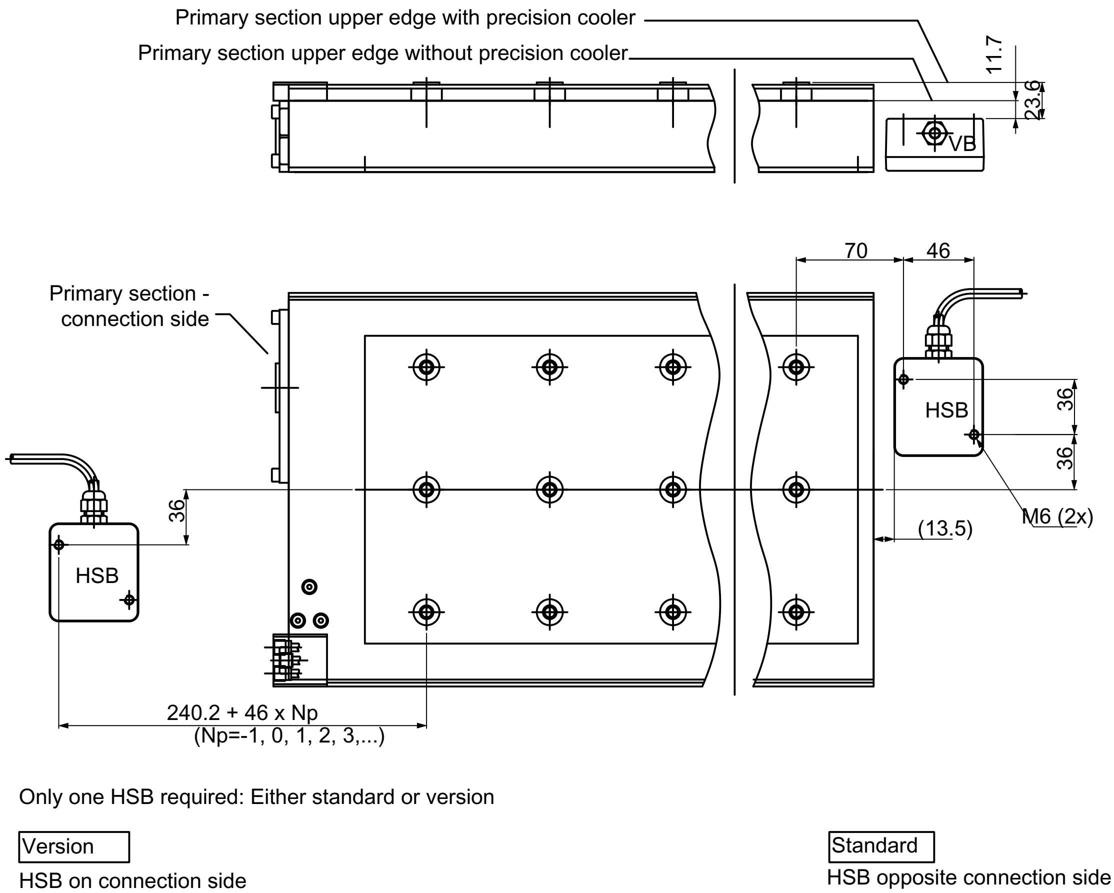


Figure 10-30 Hall sensor box (HSB) with lateral cable outlet for 1FN3600 motors

Mounting the Hall sensor box onto the continuous load motor 1FN3600

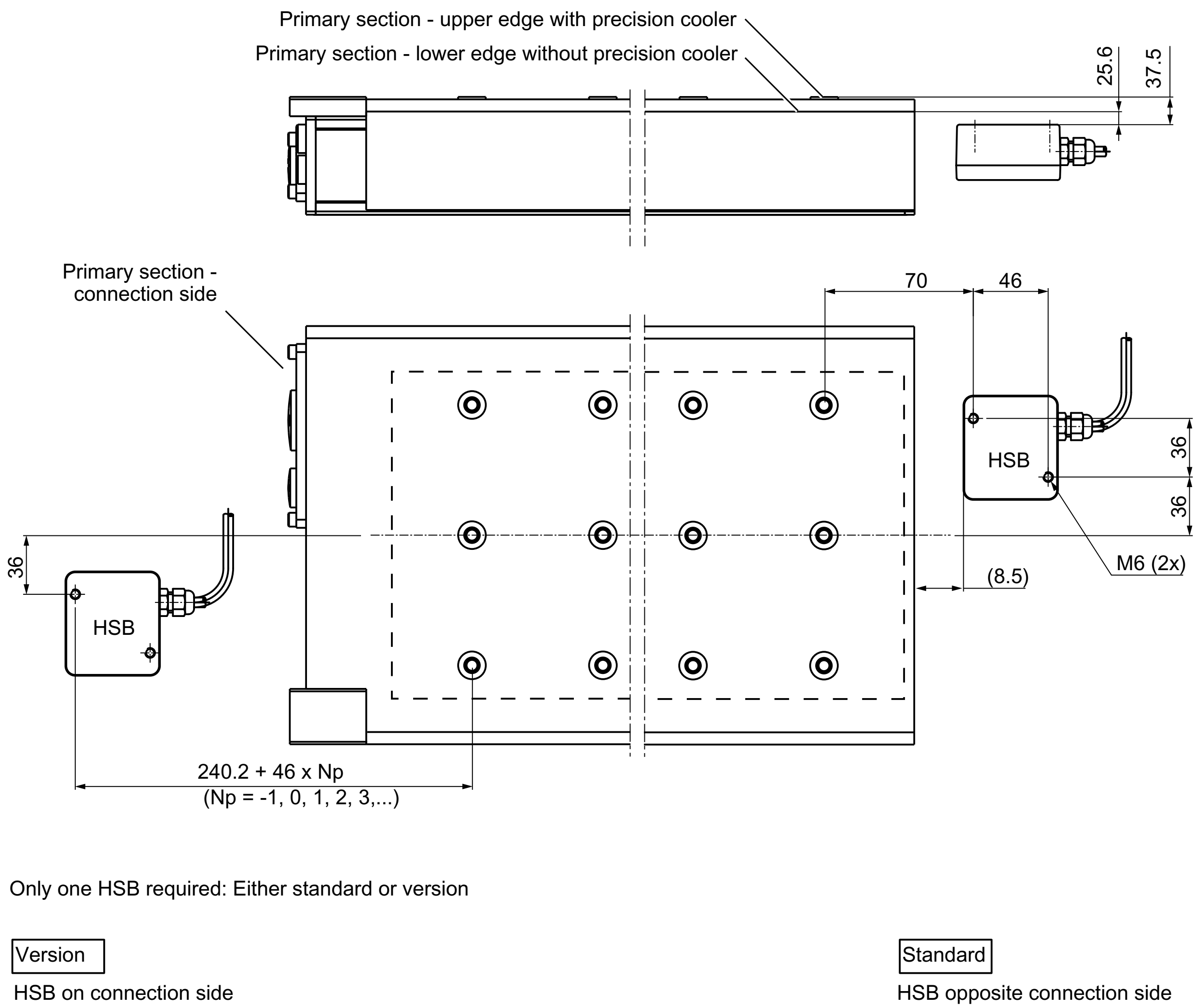


Figure 10-31 Mounting the Hall sensor box (HSB) with straight cable outlet for 1FN3600-xN motors

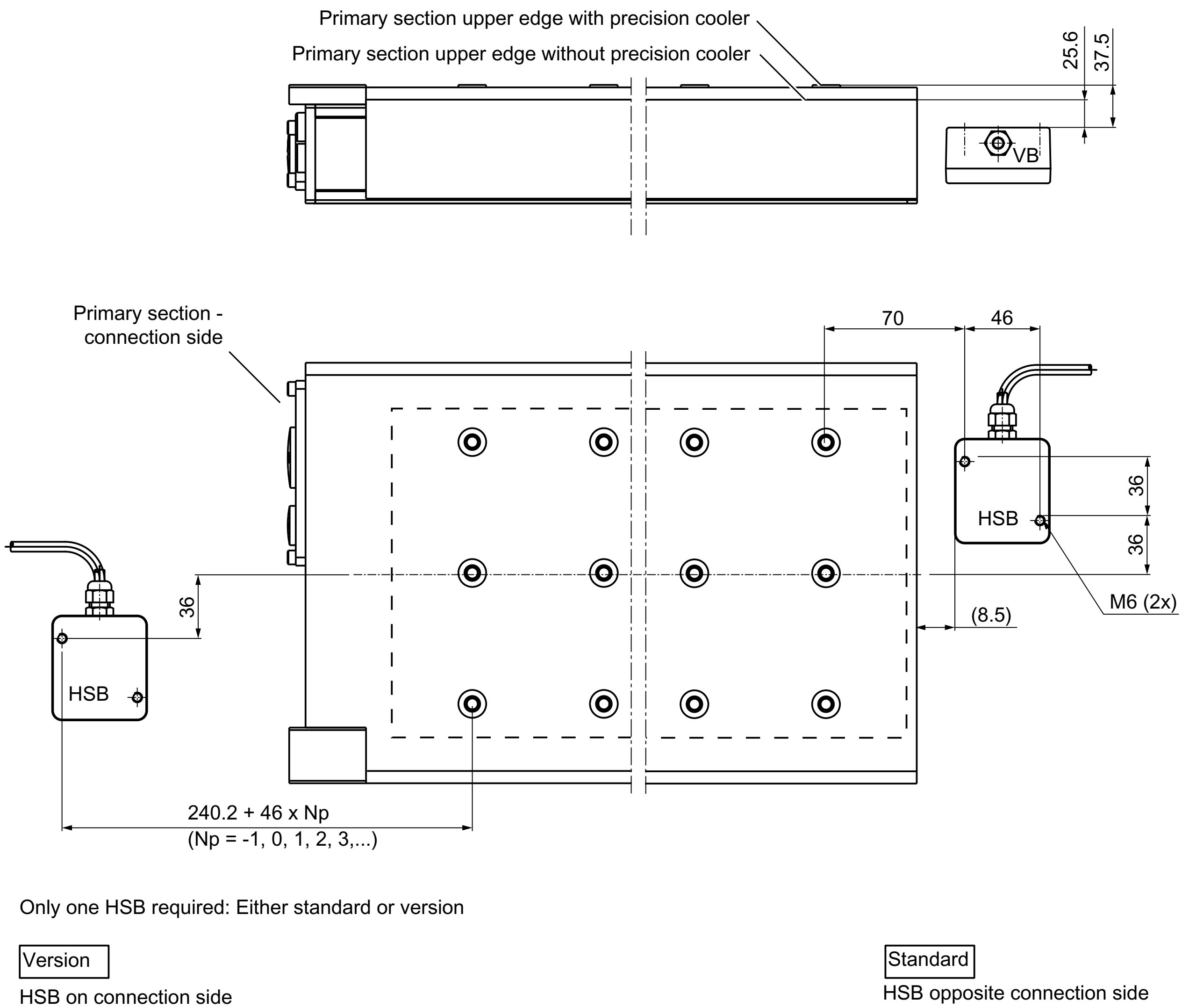
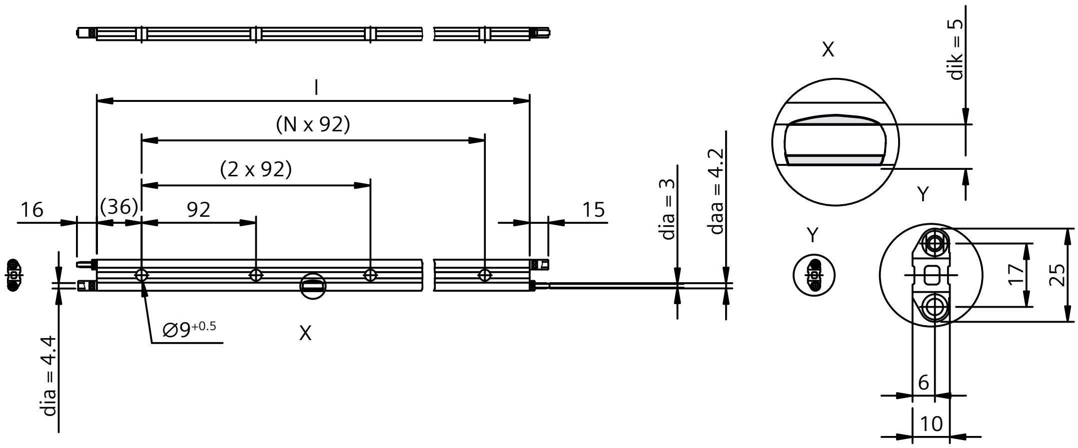


Figure 10-32 Mounting the Hall sensor box (HSB) with lateral cable outlet for 1FN3600-xN motors

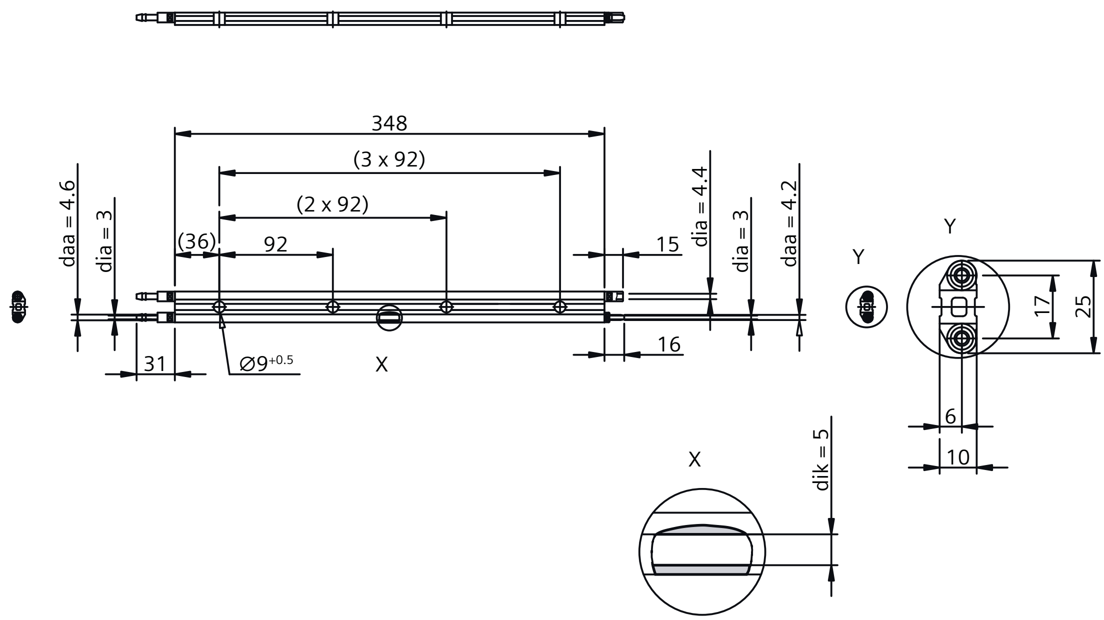
10.5.7 Heatsink profiles



Number of secondary sections	N	l in mm	Weight in g
1	1	164	79.6
2	3	348	153.2
3	5	532	226.8
4	7	716	300.4
5	9	900	374.0
...	...	...	...

Coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed!

Figure 10-33 Heatsink profile with plug-type coupling for motors of size 1FN3600



Hose nipple, coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed!

Weight: 153.2 g

Figure 10-34 Cooling section with hose nipple R/L for motors, sizes 1FN3600, example

10.6 1FN3900

10.6.1 Drawings for 1FN3900

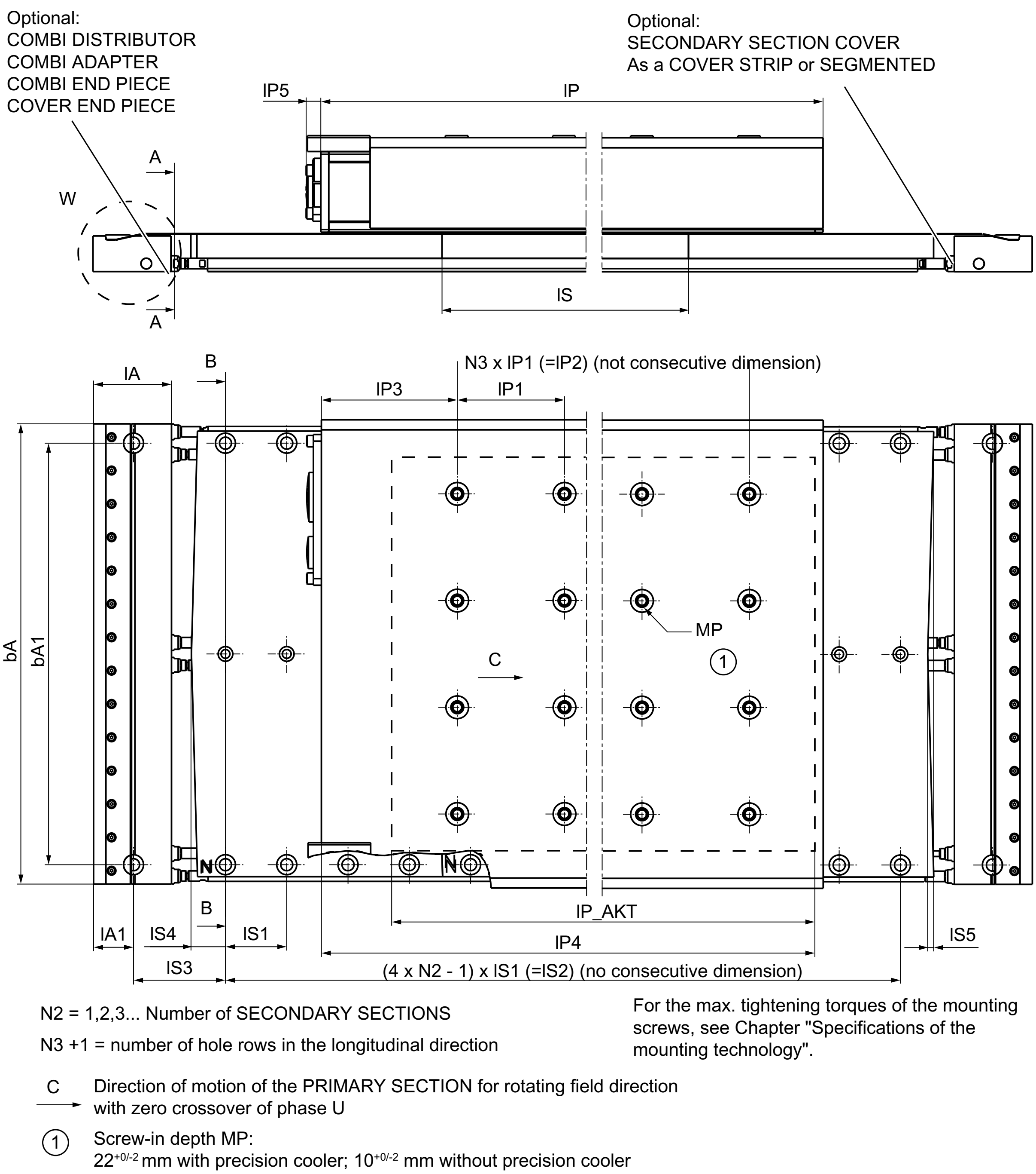


Figure 10-35 Installation dimension of motor 1FN3900

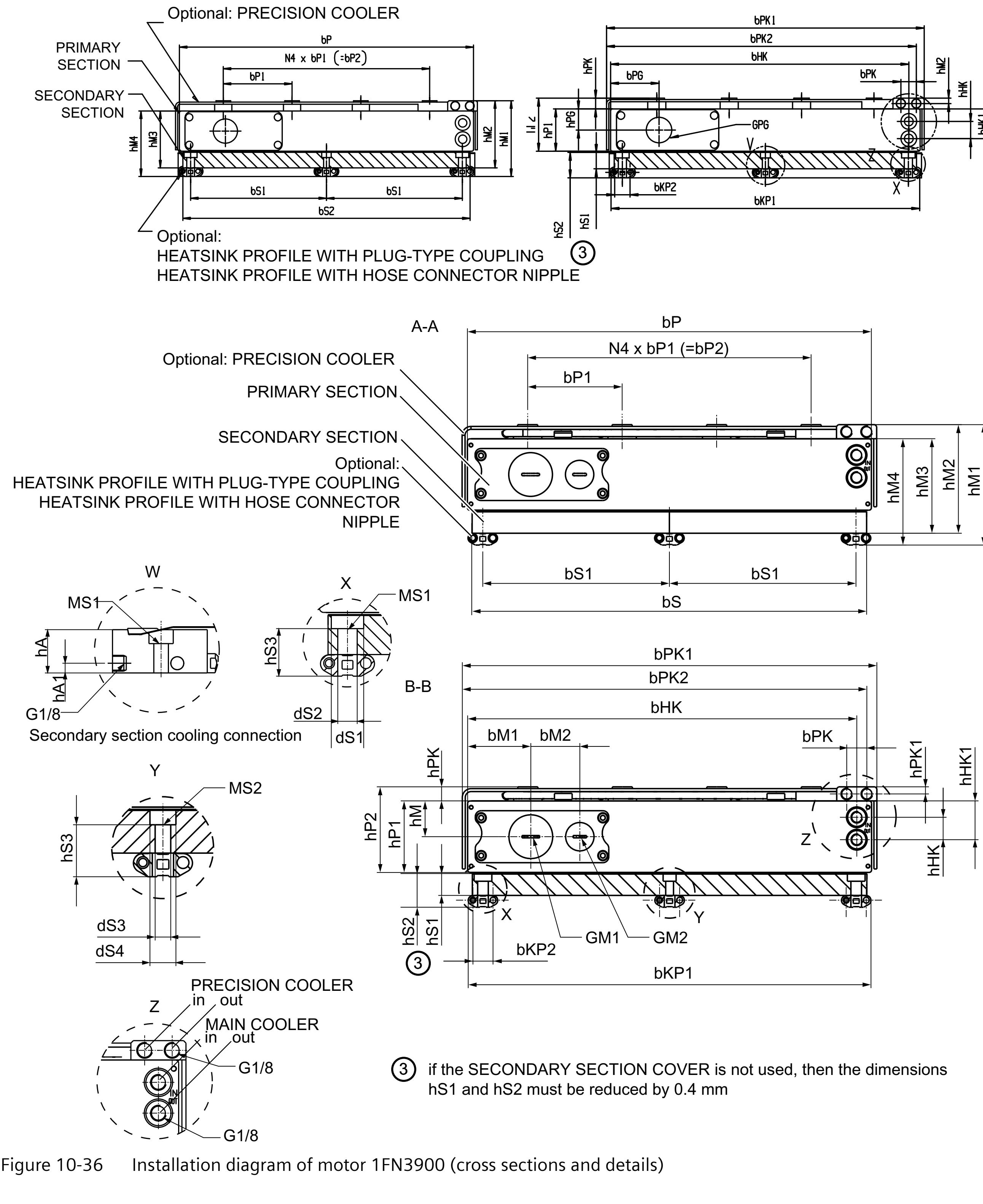


Figure 10-36 Installation diagram of motor 1FN3900 (cross sections and details)

10.6.2 Dimensions of peak load primary sections 1FN3900

Size	Variable	Unit	1FN3900-...				
			1W	2W	3W	4W	5W
Length without connection cover	lP	mm	–	382	543	704	–
Longitudinal hole pattern	lP1	mm	–	80.5	80.5	80.5	–
Total longitudinal hole pattern	lP2	mm	–	241.5	402.5	563.5	–
Position 1st hole longitudinal pattern	lP3	mm	–	90	90	90	–
Position of the magnetically active surface	lP4	mm	–	372	533	694	–
Connection cover length	lP5	mm	–	11	11	11 / 28[1)]	–
Magnetically active length	lP,AKT	mm	–	322	483	644	–
Main cooler connection position (width)	bHK	mm	–	329.5	329.5	329.5	–
Width without precision cooler	bP	mm	–	342	342	342	–
Transverse hole pattern	bP1	mm	–	80	80	80	–
Total transverse hole pattern	bP2	mm	–	240	240	240	–
Precision cooler connector spacing	bPK	mm	–	17	17	17	–
Precision cooler width	bPK1	mm	–	351	351	351	–
Precision cooler connection position	bPK2	mm	–	342.5	342.5	342.5	–
Main cooler connection spacing	hHK	mm	–	19	19	19	–
Main cooler connection position (height)	hHK1	mm	–	32.9	32.9	32.9	–
Motor height with additional coolers	hM1	mm	–	88	88	88	–
Motor height with precision cooler	hM2	mm	–	78	78	78	–
Motor height without additional cooler	hM3	mm	–	66.1	66.1	66.1	–
Motor height with heatsink profile without precision cooler	hM4	mm	–	76.1	76.1	76.1	–
Height of primary section without precision cooler	hP1	mm	–	46.7	46.7	46.7	–
Height of primary section with precision cooler	hP2	mm	–	58.6	58.6	58.6	–
Precision cooler height	hPK	mm	–	11.9	11.9	11.9	–
Precision cooler connector position (height)	hPK1	mm	–	6	6	6	–
Mounting screw thread	MP		–	M8	M8	M8	–
Version with one connecting cable (end of the Article No. ...0AAx)							
PG thread position (width)	bPG	mm	–	53.5	53.5	53.5	–
PG thread position (height)	hPG	mm	–	23.4	23.4	23.4	–
PG thread diameter	GPG		–	PG21[1)]	PG21	PG21[1)] / PG29[2)]	–
Version with 2 connecting cables (end of the Article No. ...0BAx)							
Thread position (height)	hM	mm	–	23.4	23.4	23.4	–
Thread 1 position (width)	bM1	mm	–	53.5	53.5	53.5	–
Thread 2 position (width)	bM2	mm	–	41.5	41.5	41.5	–
Thread 1 diameter	GM1		–	M32x1.5	M32x1.5	M32x1.5	–
Thread 2 diameter	GM2		–	M20x1.5	M20x1.5	M20x1.5	–

[1] Applicable for motors 1FN3900-2WB00, 1FN3900-4WA50;[2]Applicable for motors 1FN3900-2WC00, 1FN3900-3WB00, 1FN3900-4WB00, 1FN3900-4WB50 and 1FN3900-4WC00

10.6.3 Dimensions of continuous load primary sections 1FN3900

Size	Varia-ble	Unit	1FN3900-...				
			1N	2N	3N	4N	5N
Length without connection cover	lP	mm	–	399	560	721	–
Longitudinal hole pattern	lP1	mm	–	80.5	80.5	80.5	–
Total longitudinal hole pattern	lP2	mm	–	241.5	402.5	563.5	–
Position 1st hole longitudinal pattern	lP3	mm	–	102	102	102	–
Position of the magnetically active surface	lP4	mm	–	392.8	553.8	714.8	–
Connection cover length	lP5	mm	–	11	11	11	–
Magnetically active length	lP,AKT	mm	–	340	501	662	–
Main cooler connection position (width)	bHK	mm	–	329.5	329.5	329.5	–
Width without precision cooler	bP	mm	–	342	342	342	–
Transverse hole pattern	bP1	mm	–	80	80	80	–
Total transverse hole pattern	bP2	mm	–	240	240	240	–
Thread 1 position (width)	bM1	mm	–	53.5	53.5	53.5	–
Thread 2 position (width)	bM2	mm	–	41.5	41.5	41.5	–
Precision cooler connector spacing	bPK	mm	–	17	17	17	–
Precision cooler width	bPK1	mm	–	351	351	351	–
Precision cooler connection position	bPK2	mm	–	342.5	342.5	342.5	–
Main cooler connection spacing	hHK	mm	–	19	19	19	–
Main cooler connection position (height)	hHK1	mm	–	32.9	32.9	32.9	–
Motor height with additional coolers	hM1	mm	–	101.9	101.9	101.9	–
Motor height with precision cooler	hM2	mm	–	91.9	91.9	91.9	–
Motor height without additional cooler	hM3	mm	–	80.0	80.0	80.0	–
Motor height with heatsink profile without precision cooler	hM4	mm	–	90.0	90.0	90.0	–
Height of primary section without precision cooler	hP1	mm	–	60.6	60.6	60.6	–
Height of primary section with precision cooler	hP2	mm	–	72.5	72.5	72.5	–
Thread position (height)	hM	mm	–	30.3	30.3	30.3	–
Precision cooler height	hPK	mm	–	11.9	11.9	11.9	–
Precision cooler connector position (height)	hPK1	mm	–	6	6	6	–
Thread 1 diameter	GM1		–	M32x1.5	M32x1.5	M32x1.5	–
Thread 2 diameter	GM2		–	M20x1.5	M20x1.5	M20x1.5	–
Mounting screw thread	MP		–	M8	M8	M8	–

10.6.4 Dimensions of the secondary section of 1FN3900

Size	Variable	Unit	1FN3900-4SAxx
Secondary section length	lS	mm	184
Hole pattern (longitudinal)	lS1	mm	46
Total hole pattern (longitudinal)	lS2	mm	lS1 x (4xN2–1)
Position 1st hole hole pattern (longitudinal)	lS4	mm	25.5
Incline	lS5	mm	4.5
Width without heatsink profile	bS	mm	334
Hole pattern (transverse)	bS1	mm	158
Width with heatsink profile	bKP1	mm	341
Heatsink profile connector spacing	bKP2	mm	17
Height without heatsink profile with cover	hS1	mm	18.5
Height with heatsink profile with cover	hS2	mm	28.5
Mounting screw clamp length	hS3	mm	22
Screw countersink diameter (outer)	dS1	mm	15
Hole diameter (outer)	dS2	mm	9
Hole diameter (inner)	dS3	mm	6.6
Screw countersink diameter (inner)	dS4	mm	11
Secondary section mounting screws (outside)	MS1	mm	DIN 6912 - M8
Secondary section mounting screws (inside)	MS2	mm	DIN 6912 - M6

10.6.5 Dimensions of the secondary section end pieces of 1FN3900

Size	Variable	Unit	1FN3900-0TJ00
Maximum length	lA	mm	58.5
Hole position (right)	lA1	mm	30
Hole distance to secondary section hole	lS3	mm	69
Maximum width	bA	mm	345
G 1/8 cooler connector position (height)	hA1	mm	6
Hole pattern (transverse)	bA1	mm	316
maximum height for 1FN3900-0TJ00-0AA0 / 1AA0	hA	mm	27.5 / 27.1

10.6.6 Mounting the Hall sensor box

Mounting the Hall sensor box onto the peak load motor 1FN3900

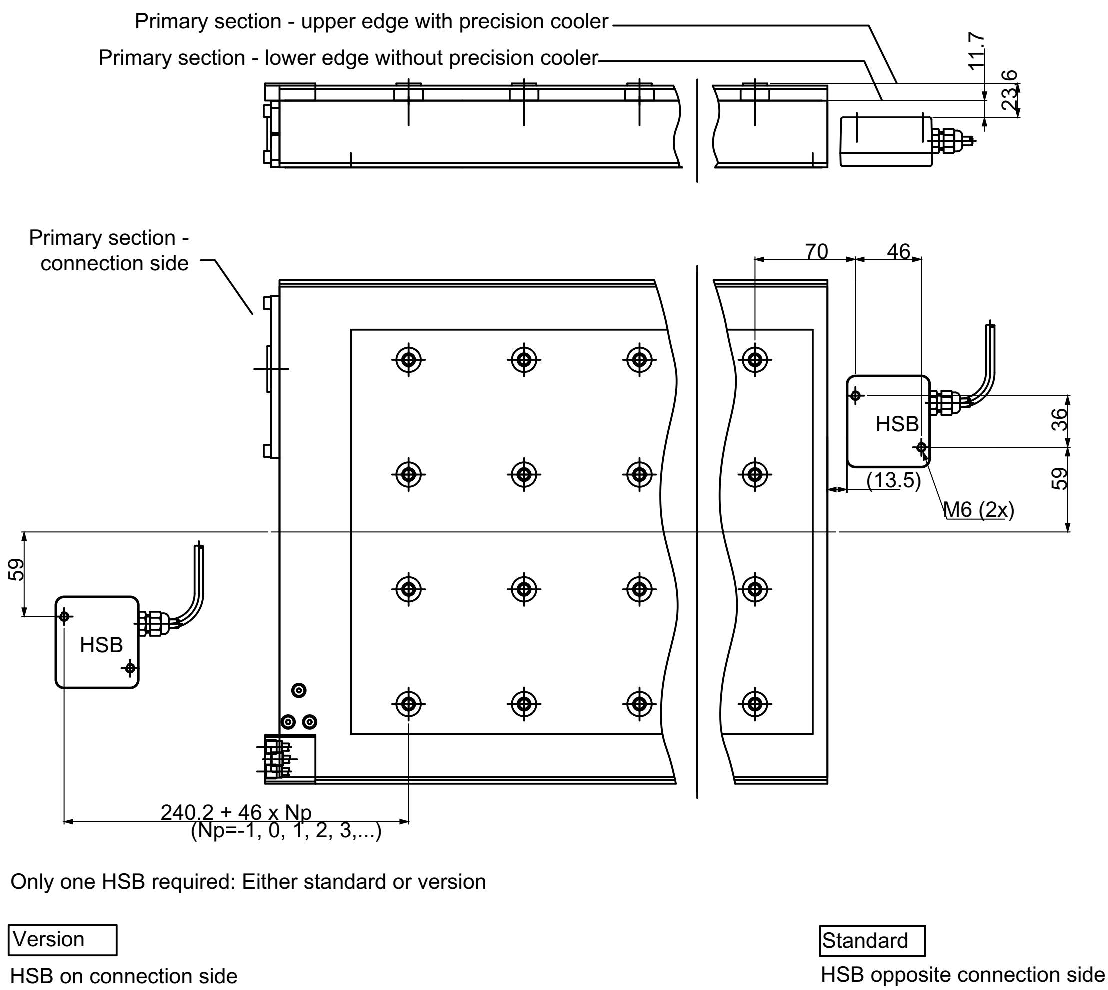


Figure 10-37 Hall sensor box (HSB) with straight cable outlet for 1FN3900 motors

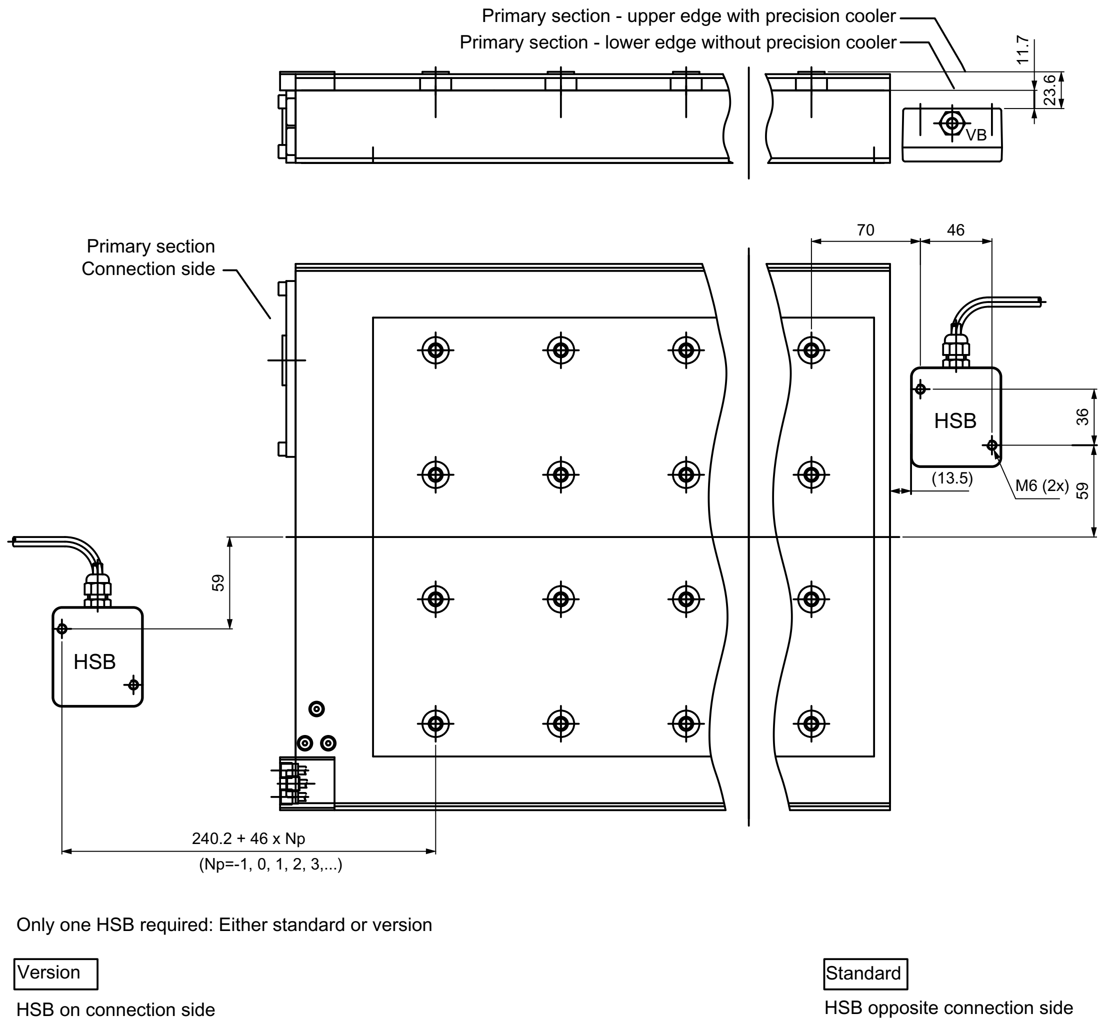


Figure 10-38 Hall sensor box (HSB) with lateral cable outlet for 1FN3900 motors

Mounting the Hall sensor box to the continuous load motor 1FN3900

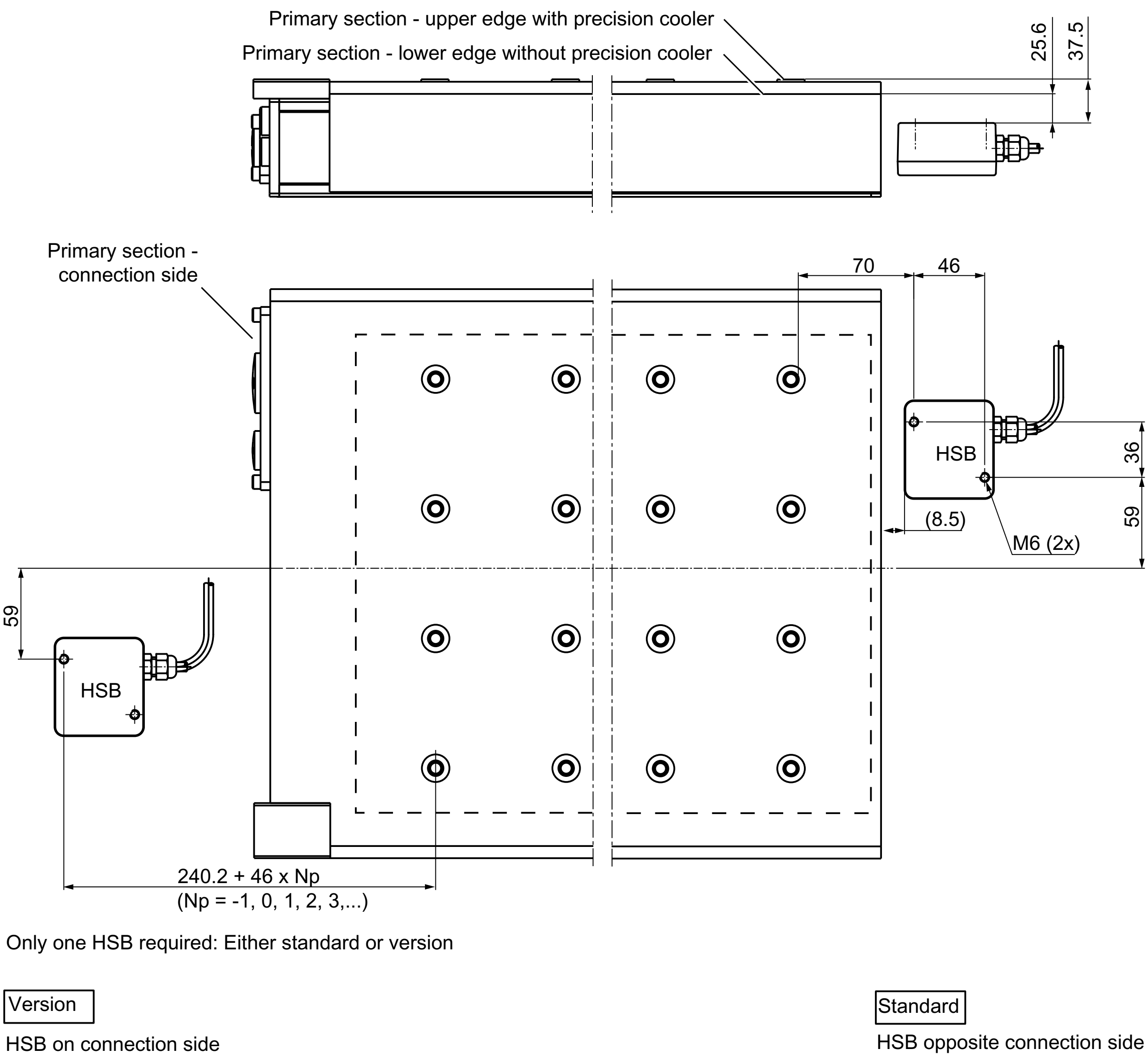


Figure 10-39 Mounting the Hall sensor box (HSB) with straight cable outlet for 1FN3900-xN motors

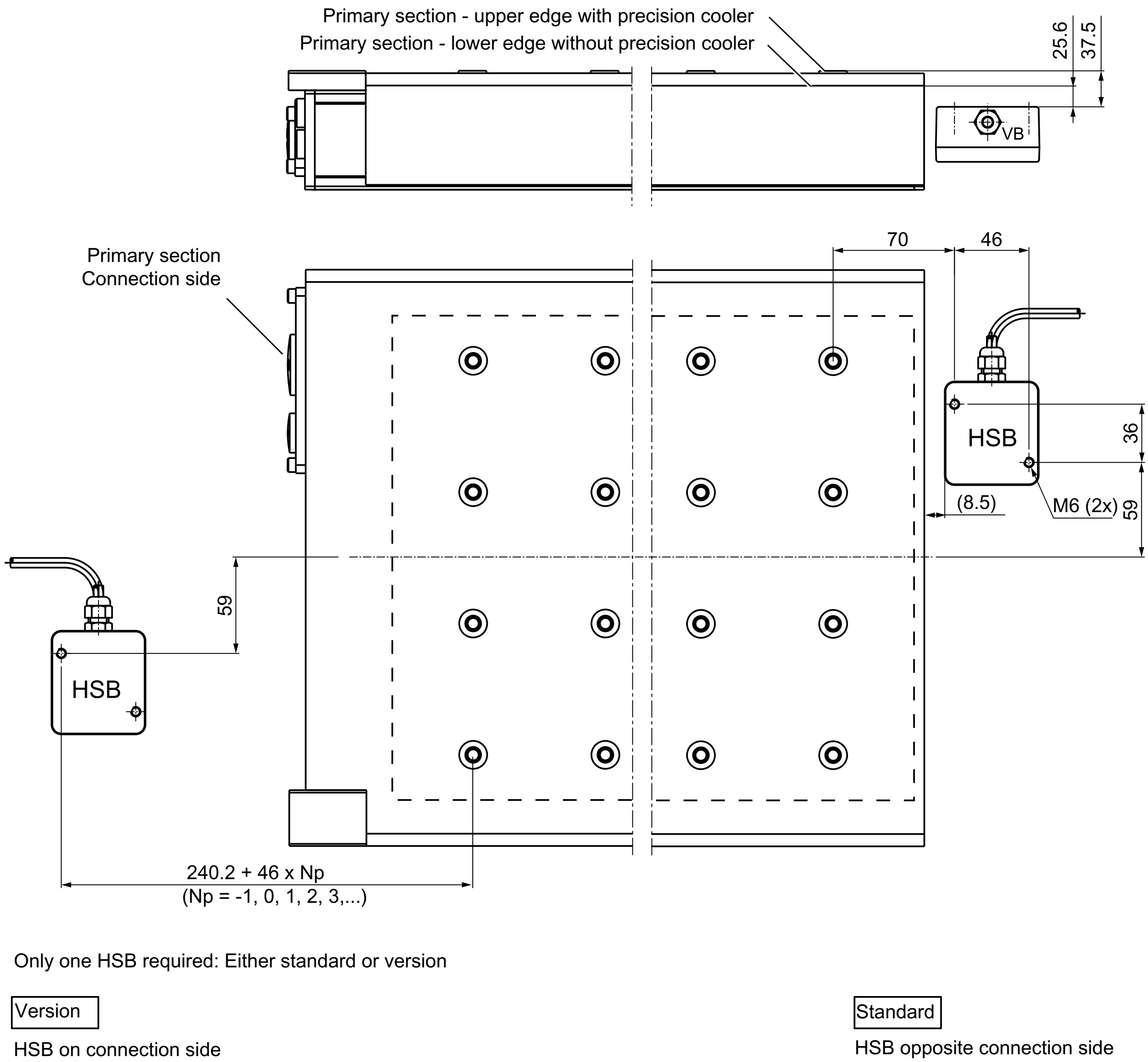
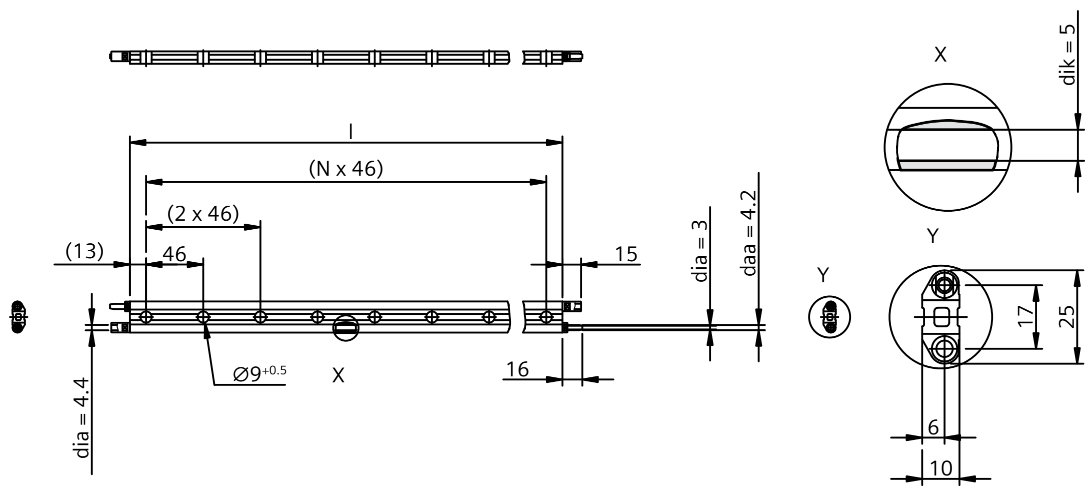


Figure 10-40 Mounting the Hall sensor box (HSB) with lateral cable outlet for 1FN3900-xN motors

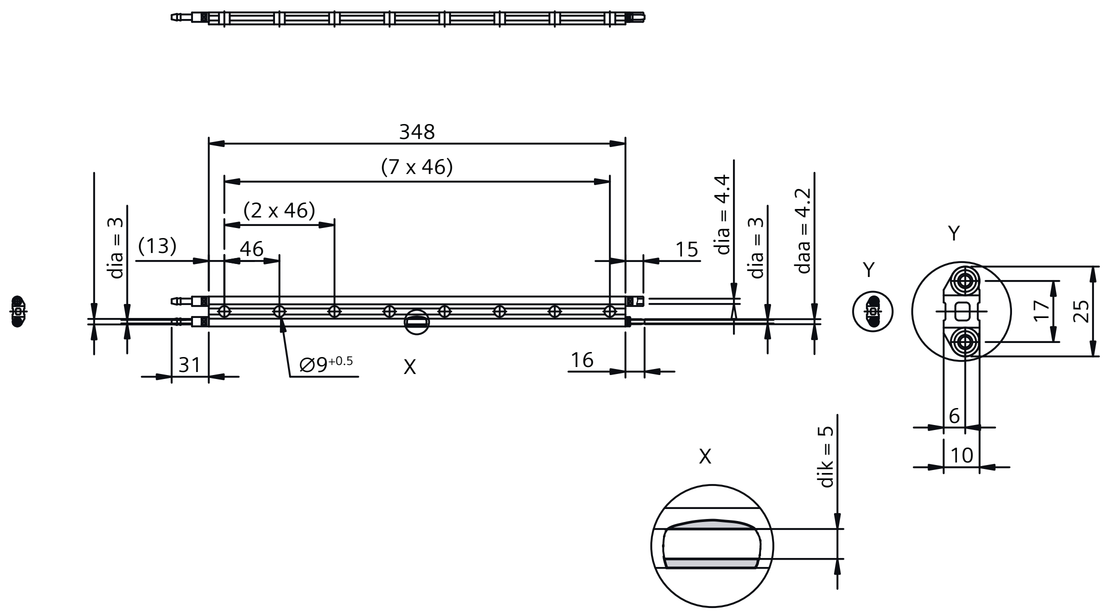
10.6.7 Heatsink profiles



Number of secondary sections	N	l in mm	Weight in g
1	3	164	78.0
2	7	348	149.7
3	11	532	221.5
4	15	716	293.2
5	19	900	365.0
...	...	...	...

Coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed!

Figure 10-41 Heatsink profile with plug-type coupling for motors of size 1FN3900

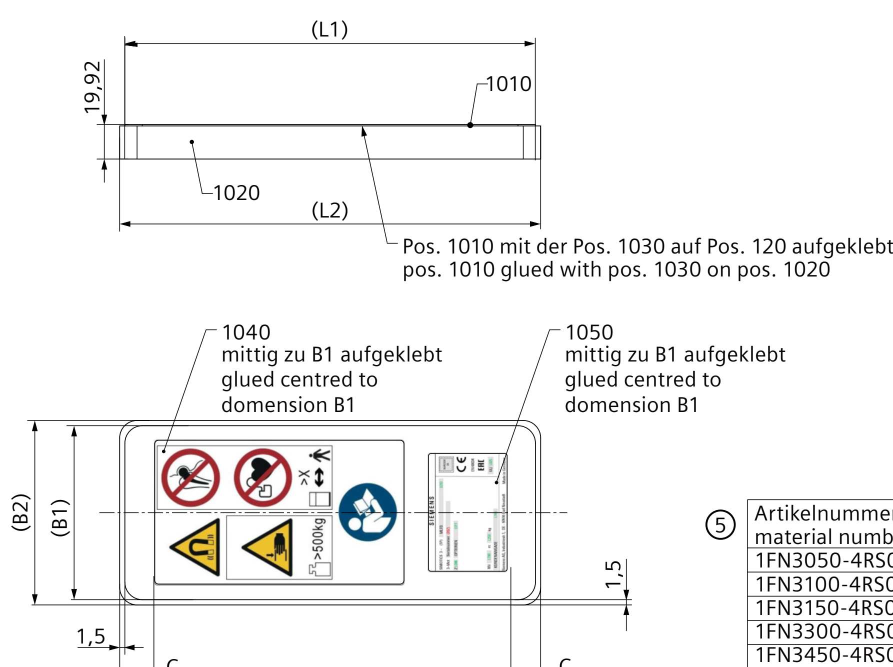


Hose nipple, coupling nipple and coupling socket are assembled using thread sealant and it is not permissible that they are unscrewed!

Weight: 149.7 g

Figure 10-42 Cooling section with hose nipple R/L for motors, sizes 1FN3900, example

10.7 Protective mat with magnetic self-holding function



Artikelnummer material number	L1	L2	B1	B2	C
1FN3050-4RS00-0AA0	118	121	50	53	2 ± 0.5
1FN3100-4RS00-0AA0	118	121	80	83	2 ± 0.5
1FN3150-4RS00-0AA0	118	121	110	113	2 ± 0.5
1FN3300-4RS00-0AA0	180	183	125	128	21 ± 1
1FN3450-4RS00-0AA0	180	183	170	173	21 ± 1

Figure 10-43 Dimension drawing "Protective mat with magnetic self-holding function for 1FN3 secondary sections"

Coupled motors 11

11.1 Operating motors connected to an axis in parallel

If the motor force of an individual motor is not sufficient for the drive application, then distribute the motor force required over 2 or more motors.

Mount the motors on the same slide of an axis. The motors are then mechanically coupled.

You have 2 possible variants for supplying the individual motors:

- Each motor is operated on its own Motor Module with its own encoder or using an appropriate encoder signal splitting. This operation does not represent an electrical parallel connection. The motors only operate together mechanically.
  Options for generating encoder signals are:
  - Several encoders
  - Several measuring heads on one scale
  - Hardware signal splitting
  - Software signal splitting (TEC SERVCOUP)
- All of the motors are connected to the same Motor Modules. In this case, the article numbers of all of the motors involved must be the same. The motors are then electrically connected in parallel, and operate in the parallel mode.

For example, if you require information about optimally engineering or dimensioning drive systems with linear motors operating in parallel, then contact technical support.

Note

Country-specific safety requirements for parallel operation

Country-specific safety requirements and regulations apply when connecting motors in parallel at a Motor Module.

For example, in the US, for special motor protection, carefully comply with the requirements laid down in standards NFPA 70 and NFPA 79.

Notes on parallel operation

The motor power cables must be the same length in order to ensure uniform current distribution.

To operate multiple motors in parallel, you will have to provide space for additional motors and cables. Plan the additional installation space required.

Add the masses of each primary section involved to the total mass of the slide of the axis.

The installation height must be identical for all primary sections.

The primary sections connected in parallel must be coupled with sufficient mechanical rigidity.

The phase position of the EMFs of the primary sections connected in parallel must match. To achieve this, in the installed state, the position of every primary section with respect to the magnet grid of its secondary section must be the same.

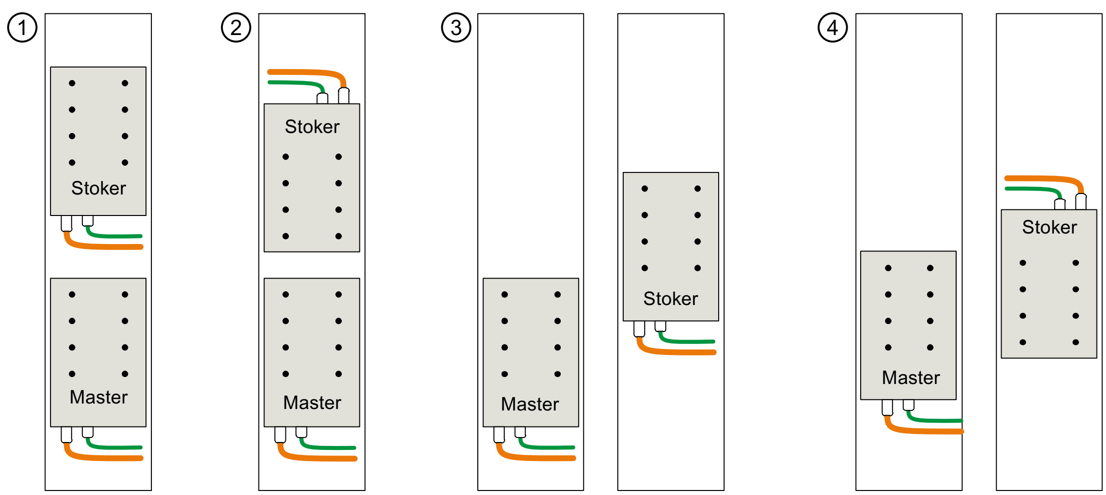
11.2 Master and stoker

Mechanical arrangements

The first motor in an axis is called the "master". The master defines the positive direction of motion of the axis. The second and each additional motor are called "stokers". The following definitions also apply to each additional stoker. Which of the arrangements described below is the preferable solution depends on the space requirement and the cable routing.

You can arrange two primary sections, to be operated electrically connected in parallel, on either a single secondary section track or on two individual secondary section tracks. The cable outlets can run in the same or opposite direction.

As a consequence, the four mechanical arrangements subsequently shown are obtained for the master and stoker:



① **Tandem arrangement:** Master and stoker with the same cable outlet direction on the same secondary section track

② **Janus arrangement:** Master and stoker with opposite cable outlet directions on the same secondary section track

③ **Parallel arrangement:** Master and stoker with the same cable outlet direction on a separate secondary section track

④ **Anti-parallel arrangement:** Master and stoker with opposite cable outlet directions on a separate secondary section track

Note

Requirements of coupled motors

- For parallel operation connected to one motor module: Check the phase angles of the EMFs
- Ensure that there is a sufficiently rigid mechanical coupling.
- Position the motors as close together as possible.
- For gantry applications, the two gantry axes cannot be electrically connected in parallel.

If you connect linear motors in parallel on a shared secondary section track, the primary sections must be positioned with a defined distance between them. This produces matching phase angles of the EMFs.

For separate secondary section tracks, you must also consider the position of the tracks relative to each other.

Check whether the phase angles of the EMFs differ by no more than ±10° (see SINAMICS S120 Commissioning Manual).

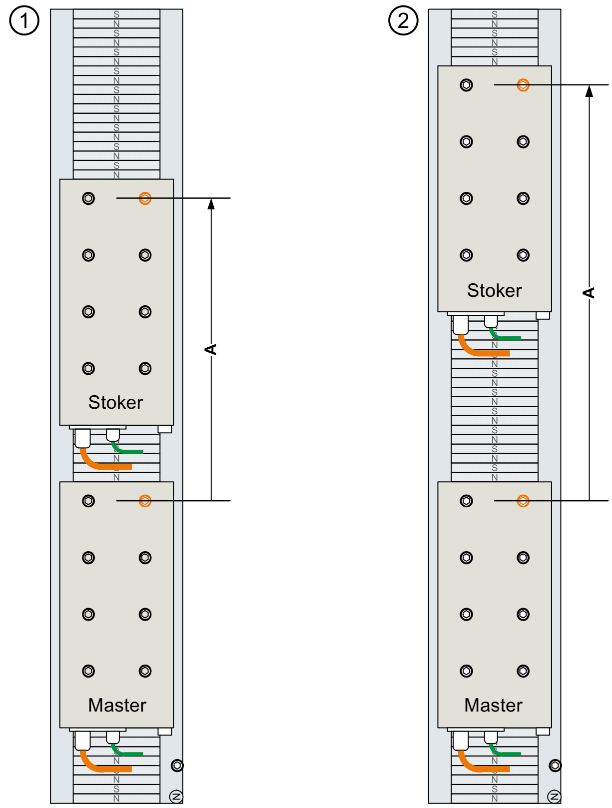
11.2.1 Tandem arrangement

For the tandem arrangement, the distance A between the holes must correspond to an integer positive multiple of the pole pair width.

Note

Offset factors

Offset factors i, i_{MIN} are exclusively integer factors.



A Distance between the reference holes of the primary sections

i Integer offset factor, e.g. 30, 31, 32, ...

i_{MIN} Smallest integer permissible offset factor

τ_M Pole width according to Chapter "Technical data and characteristics (Page 183)"

① **Shortest tandem arrangement:**

Distance A = i_{MIN} x $2\tau_M$

$i = i_{MIN}$

i_{MIN} is large enough to provide enough space for supply cables between the master and stoker.

② **Extended tandem arrangement:**

Distance A = i x $2\tau_M$

$i > i_{MIN}$

Power connection

Table 11-1 Power connection in a tandem arrangement of two primary sections

Motor Module	Master	Stoker
U2	U	U
V2	V	V
W2	W	W

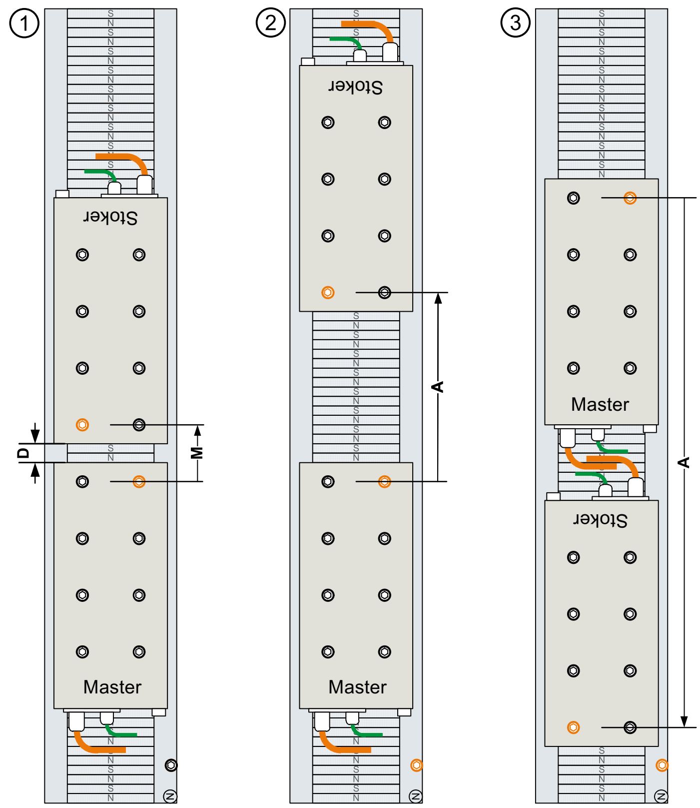
11.2.2 Janus arrangement

The cable outlet of the primary section is opposing. For this reason, two phases must be interchanged on the stoker.

Note

Offset factor

The offset factor i is an integer factor only.



A	Distance between the reference holes of the primary sections

M	Minimum distance between reference holes according to the table below "Minimum distances between master and stoker"

D	Housing distance, distance between the primary section housings

i	Integer offset factor

τ_M	Pole width according to Chapter "Technical data and characteristics (Page 183)"

① **Shortest Janus arrangement:**

i = 0, therefore A = M.

This arrangement permits the shortest distance D between the primary section housings.

② **Extended Janus arrangement:**

i is a positive integer, e.g. 1, 2, 3, ...

Distance A = M + i x $2\tau_M$

③ **Inverse Janus arrangement:**

i is a negative integer, e.g. -1, -2, -3, ...

This arrangement has advantages for cable routing.

Power connection

Table 11-2 Power connection in a Janus arrangement of two primary sections

Motor Module	Master	Stoker
U2	U	U
V2	V	W
W2	W	V

Minimum distances between master and stoker

NOTICE

Phases V and W interchanged

Minimum distance M between the master and stoker when phases V and W are interchanged is stated in the table above.

If a different minimum distance M is required, you must interchange other phases.

- In this case, please contact your local sales partner or "Technical Support". You will find contact data in Chapter "Introduction".

Note

Design differences between peak and continuous load motors

The design differences between peak and continuous load motors result in different distances between housings D and minimum distances M.

Table 11-3 Minimum distances between master and stoker

Primary section type	Same length	Distance between housings D	Minimum distance M
Peak load motor	1FN3050-xW	3.5 mm	72.5 mm
	1FN3100-xW		
	1FN3150-xW		
	1FN3300-xW	10.2 mm	111.2 mm
	1FN3450-xW		
	1FN3600-xW		
	1FN3900-xW		

Primary section type	Same length	Distance between housings D	Minimum distance M
Continuous load motor	1FN3050-xN	25.5 mm	102.5 mm
	1FN3100-xN		
	1FN3150-xN		
	1FN3300-xN	46.2 mm	157.2 mm
	1FN3450-xN		
	1FN3600-xN		
	1FN3900-xN		

11.2.3 Parallel arrangement

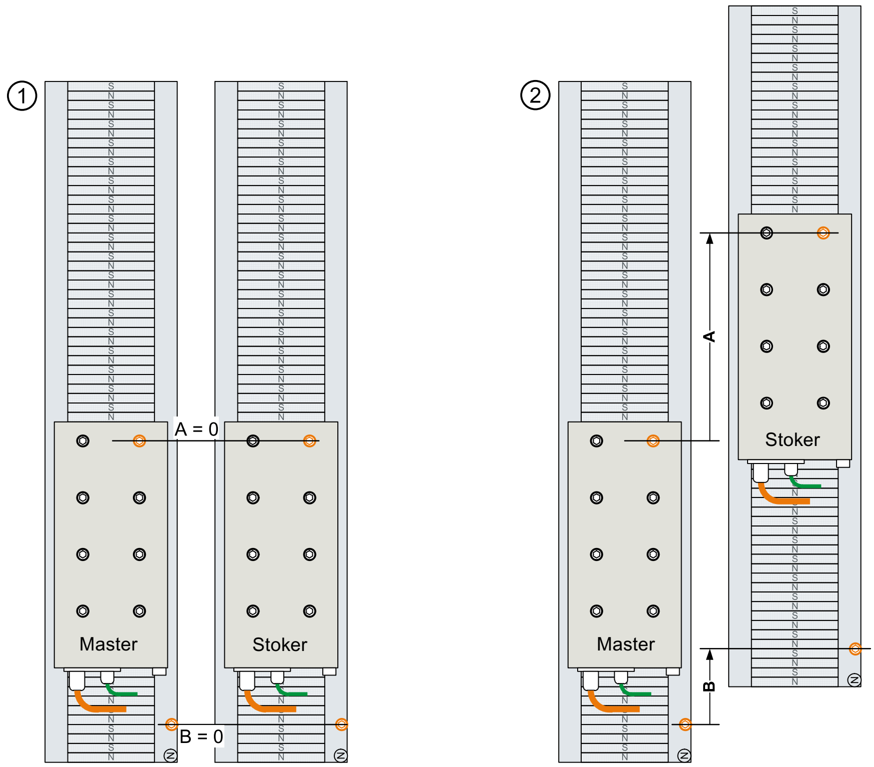
The phase sequence U, V, W of the master and stoker is identical because the cable outlet direction is the same. When the positioning of the master and stoker is correct, the pole layout is identical on the two primary sections.

In the parallel arrangement, you can offset the primary sections by the distance A or the secondary section tracks by the length B, if required.

Note

Offset factor

The offset factor i is an integer factor only.



A	Distance between the reference holes of the primary sections
B	Offset of the secondary sections with respect to one another
i	Integer number offset factor, e.g. -2, -1, 0, 1, 2 ...
τ_M	Pole width according to Chapter "Technical data and characteristics (Page 183)"
①	**Shortest parallel arrangement:** i = 0 and B = 0, resulting in the distance A = 0. This enables the simplest arrangement of the two secondary section tracks.
②	**Extended parallel arrangement:** Distance $A = B + i \times 2\tau_M$

Power connection

Table 11-4 Power connection in a parallel arrangement of two primary sections

Motor Module	Master	Stoker
U2	U	U
V2	V	V
W2	W	W

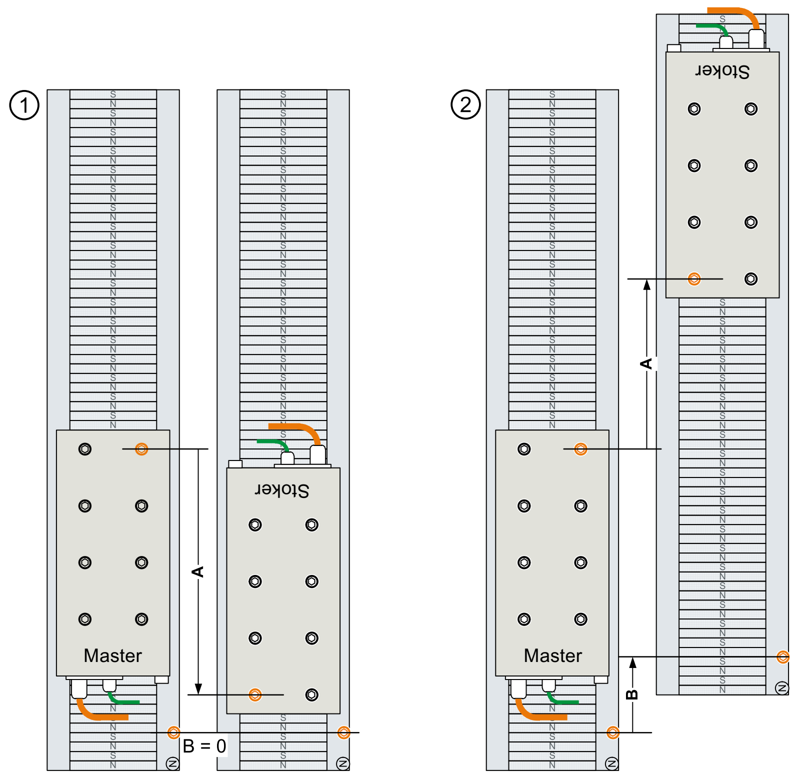
11.2.4 Anti-parallel arrangement

The cable outlet direction of the primary section is opposite. For this reason, two phases must be interchanged for the phase sequence of the master and stoker.

Note

Offset factor

The offset factor i is an integer factor only.



A Distance between the reference holes of the primary sections

B Offset of the secondary sections with respect to one another

M Minimum distance between reference holes according to the table "Minimum distances between master and stoker" in Chapter "Janus arrangement (Page 597)"

i Integer offset factor, e.g. ..., -2, -1, 0, 1, 2, ...

τ_M Pole width (see "Technical data")

① **Shortest anti-parallel arrangement:**

B = 0

i = -1, -2, -3, ...

This arrangement permits a minimum slide length.

Distance A = M + i x 2τ_M

② **Extended anti-parallel arrangement:**

Distance A = M + B + i x 2τ_M

Table 11-5 Constant minimum offset between the master and stoker

Primary section type	Same length	Minimum offset M
Peak load motor	1FN3050-xW	72.5 mm
	1FN3100-xW	
	1FN3150-xW	
	1FN3300-xW	111.2 mm
	1FN3450-xW	
	1FN3600-xW	
	1FN3900-xW	
Continuous load motor	1FN3050-xN	102.5 mm
	1FN3100-xN	
	1FN3150-xN	
	1FN3300-xN	157.2 mm
	1FN3450-xN	
	1FN3600-xN	
	1FN3900-xN	

Power connection

Table 11-6 Power connection in a anti-parallel arrangement of two primary sections

Motor Module	Master	Stoker
U2	U	U
V2	V	W
W2	W	V

NOTICE

Phases V and W interchanged

You will find the minimum distance M between the master and the stoker for interchanging phases V and W in the table in Chapter "Janus arrangement (Page 597)".

If a different minimum distance M is required, you must interchange other phases. Note that the minimum distance M then changes.

- In this case, please contact your local sales partner or "Technical Support". You will find contact data in Chapter "Introduction".

11.2.5 Double-sided arrangement

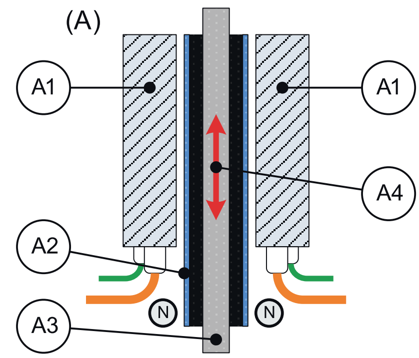
The following versions exist for designing double-sided motors:

Version (A)

The secondary section support is a plate with bolted-on standard secondary section segments.
The support plate can be made of a magnetically active or inactive material (e.g. aluminum, fiberglass reinforced plastic).
Two standard primary sections are energized.

Compared with single-sided:

- More compact design
- Little additional cost for design
- Low mass reduction

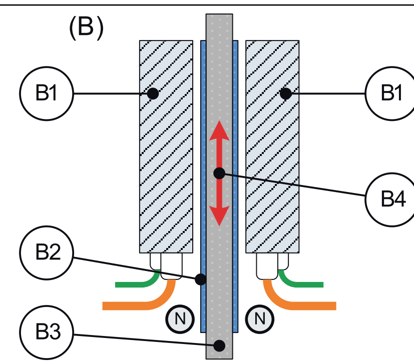


Version (B)

The secondary section support is an especially prepared plate with single magnets stuck on both sides.
The support plate must be made of magnetically active material (iron, steel) for the magnetic return path.
Two standard primary sections are energized.

Compared with single-sided:

- Medium additional cost for design
- Medium mass reduction

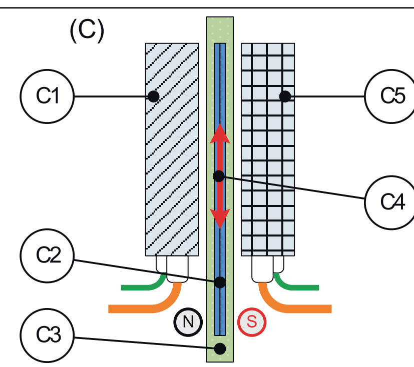


Version (C)

The secondary section carrier is a plate with embedded individual magnets.
The carrier plate must be manufactured out of a magnetically inactive material (e.g. aluminum, GRP).
Current flows through a standard primary section and a primary section with inverse winding (customer-specific).

Compared with single-sided:

- Highest additional cost for design
- Highest mass reduction



A1 = B1 = C1	Primary sections with standard winding	C2	Row of embedded magnets
A2	Bolted-on standard secondary section segments	C3	Secondary section support made of magnetically inactive material
A3	Secondary section support made of magnetically active or inactive material	C5	Primary section with inverse winding
A4 = B4 = C4	Direction of motion	N	Magnet row starts with a north pole
B2	Row of glued-on magnets	S	Magnet row starts with a south pole
B3	Secondary section support made of magnetically active material		

If you are planning different cable outlet directions or offsets for the primary section position or the secondary section track, request support from Application & Mechatronic Support Direct Motors. Contact data is provided in the introduction.

Power connection

Table 11-7 Power connection in a double-sided arrangement of two primary sections

Motor Module	Master	Stoker
U2	U	U
V2	V	V
W2	W	W

Design of the mounting plate

It is your responsibility to manufacture the mounting plate for the application-specific secondary section track. Obtain advice on this from the your local sales partner.

The mounting plate must be rigid enough to transmit the motor forces during operation.

For the magnetic return path in version (B), a support plate is required that is at least 8 mm thick.

In a double-sided arrangement, the forces of attraction theoretically cancel each other out. However, there is generally some asymmetry in the installation heights. This means that approx. 25 % of the attraction force of a motor remain exerted on the support plate. The support plate must not sag as a result.

Configuration

Double-sided motors are mainly configured in the normal way. Only difference: In this case, the dynamic mass is the mass of the secondary section system. This means that the following must be taken into consideration:

- The mass of the secondary sections or the mass of the magnetic material
- The mass of the (special) secondary section covers
- The mass of the mount of the support plate
- The mass of the guide elements
- The mass of the length measuring system

11.3 Connection examples for parallel operation

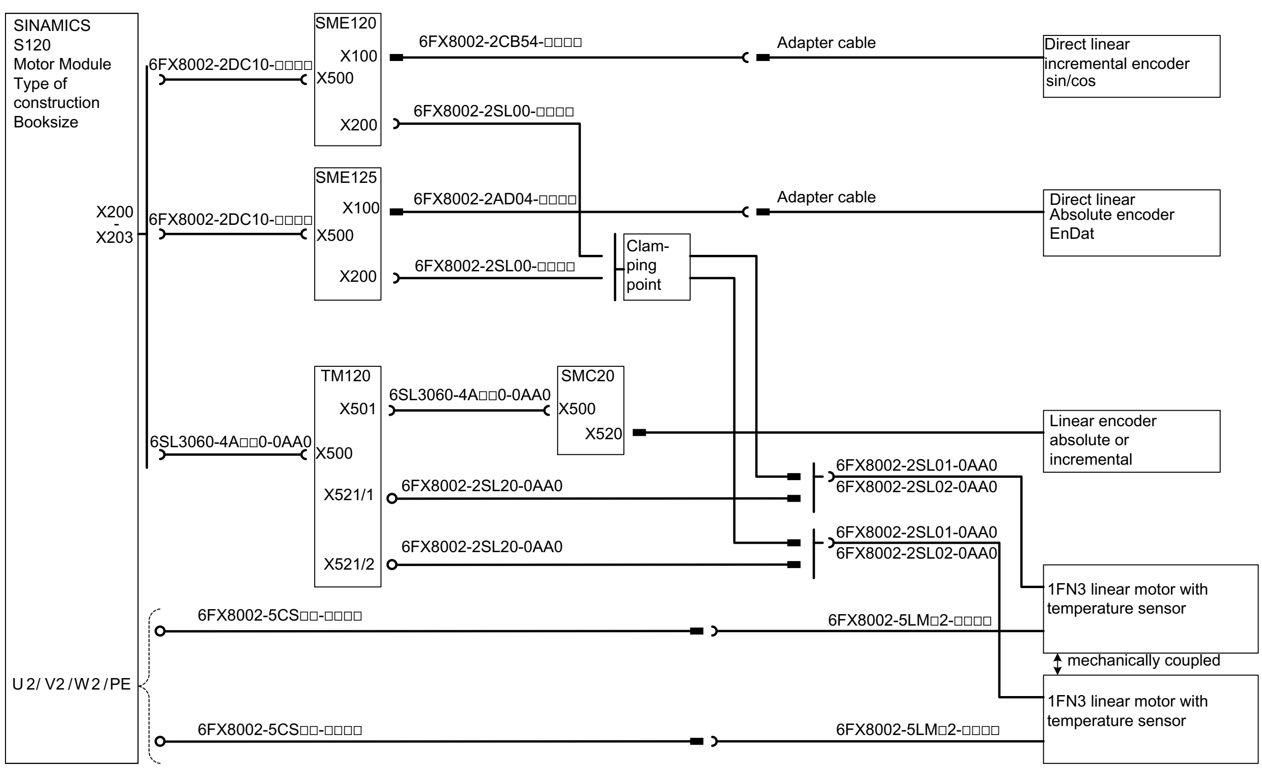
⚠ WARNING

Risk of electric shock!

Hazardous touch voltages can be present at unused cores and shields if they have not been grounded or insulated.

- Refer to the Chapter "Shielding, grounding and equipotential bonding".

System integration for coupled motors



The following connection diagrams show the power and signal connection of two linear motors electrically connected in parallel in a tandem arrangement as an example.

Table 11-8 Power connection when operating two linear motors in a tandem arrangement in parallel

Motor Module	Master	Stoker Tandem arrangement
U2	U	U
V2	V	V
W2	W	W

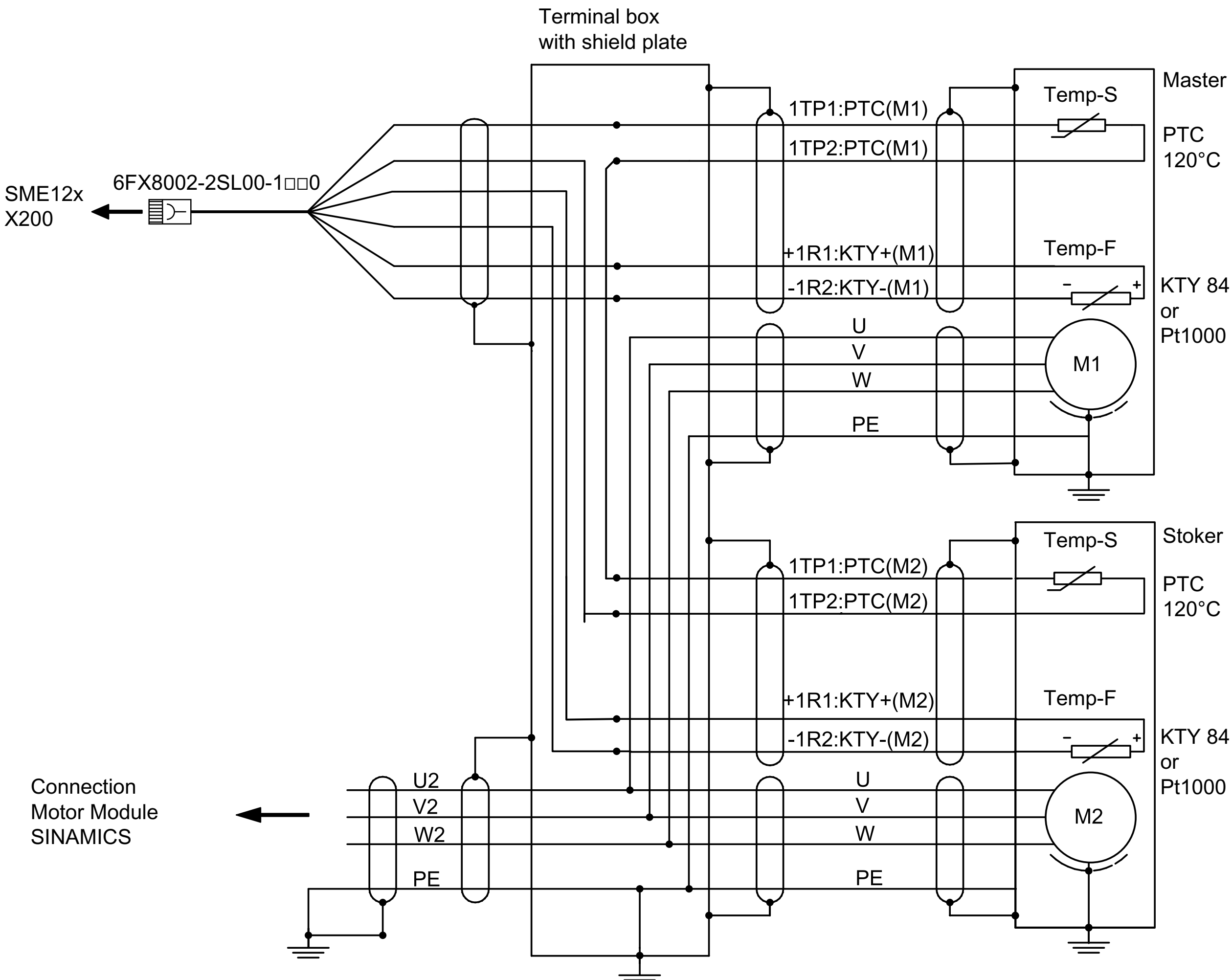


Figure 11-1 Connecting the PTC 120 °C via SME12x

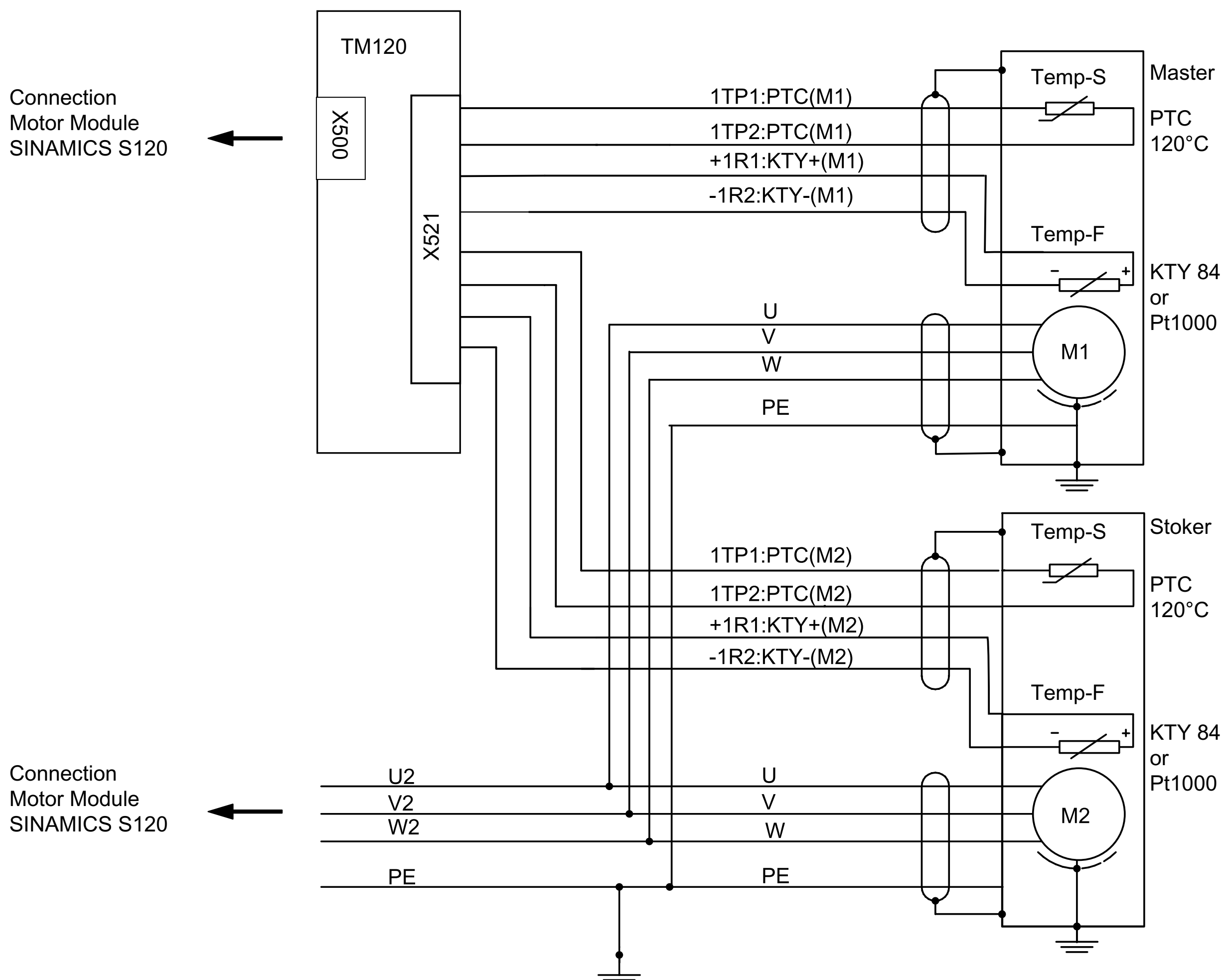


Figure 11-2 Connecting the PTC 120 °C via TM120

Appendix A

A.1 Recommended manufacturers

Information regarding third-party products

Note

Recommendation relating to third-party products

This document contains recommendations relating to third-party products. Siemens accepts the fundamental suitability of these third-party products.

You can use equivalent products from other manufacturers.

Siemens does not accept any warranty for the properties of third-party products.

A.1.1 Supply sources for braking elements

Schaeffler KG	
	Internet address: (https://www.schaeffler.com)

Zimmer GmbH Technische Werkstätten	
	Internet address: (https://www.zimmer-group.com)

A.1.2 Supply sources for cooling systems

Pfannenberg GmbH	
	Internet address: (https://www.pfannenberg.com)

BKW Kälte-Wärme-Versorgungstechnik GmbH	
	Internet address: (https://www.bkw-kuema.de)

Helmut Schimpke Industriekühlanlagen GmbH + Co. KG	
	Internet address: (https://www.schimpke.de)

Hydac International GmbH	
	Internet address: (https://www.hydac.com)

Rittal GmbH & Co. KG	
	Internet address: (https://www.rittal.de)

A.1.3 Supply sources for anti-corrosion agents

TYFOROP CHEMIE GmbH	
Anti-corrosion protection: Tyfocor	Internet address: (https://www.tyfo.de)

Clariant Produkte (Deutschland) GmbH	
Anti-corrosion protection: Antifrogen N	Internet address: (https//:www.clariant.com)

A.1.4 Supply source for connection parts for the cooling

Parker Hannifin GmbH	
	Internet address: (https://www.parker.com)

A.1.5 Supply sources for plastic hoses

Festo AG & Co. KG	
	Internet address: (https://www.festo.com)

Parker Hannifin GmbH	
	Internet address: (https://www.parker.com)

A.1.6 Supply source for screw-in nipples and reinforcing sleeves

Serto GmbH	
	Internet address: (https://www.serto.de)

A.1.7 Supply source for spacer foils

A.1.7.1 Thickness and material of the spacer foil_1FN3

Use spacer foils manufactured out of polyamide PA 6 with a thickness of

- 0.5 mm (with secondary section cover)
- 1.0 mm (without secondary section cover)

SAHLBERG GmbH & Co. KG	
	Internet address: (https://www.sahlberg.de)

A.2 List of abbreviations

BGV	Employer's Liability Insurance Association; binding national health and safety at work regulations in Germany, accident prevention regulations
CE	Conformité Européenne (European Conformity)
DIN	Deutsches Institut für Normung (German standards organization)
EU	European Union
EMF	Electromagnetic fields
EMF	Electromotive force
EMC	Electromagnetic compatibility
EN	European standard
FAQ	Frequently Asked Questions
HFD	High-frequency damping
HSB	Hall sensor box
HW	Hardware
IATA	International Air Transport Association
IEC	International Electrotechnical Commission
ISO	International Standardization Organization
IP	International Protection or Ingress Protection; type of protection für electric devices according to DIN EN 60529
KTY	Temperature sensor with progressive, almost linear characteristic
LU	Length Unit
NC	Numerical control
PTC	Temperature sensor with positive temperature coefficient
PE	Protection Earth (protective conductor)
Pt	Platinum
PELV	Protective extra low voltage
PDS	Power drive system
RoHS	Restriction of (the use of certain) Hazardous Substances

S1	"Uninterrupted duty" mode
S2	"Short-time duty" mode
S3	"Intermittent periodic duty" mode
SMC	Sensor Module Cabinet
SME	Sensor Module External
PLC	Programmable logic controller
SW	Software
SSI	Synchronous Serial Interface
Temp-F	Circuit for monitoring the temperature of the motor winding
Temp-S	Temperature monitoring circuit for switching off the drive at overtemperature
TM	Terminal Module
UL	Underwriters Laboratories
VDE	Association of Electrical Engineering, Electronics and Information Technology (in Germany)
WMS	Position measuring system; incl. WMS: incremental position measuring system; abs. WMS: absolute position measuring system

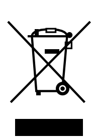
A.3 Environmental compatibility

A.3.1 Environmental compatibility during production

- The packaging material is made primarily from cardboard.
- Energy consumption during production was optimized.
- Production has low emission levels.

A.3.2 Disposal

Recycling and disposal



For environmentally-friendly recycling and disposal of your old device, please contact a company certified for the disposal of waste electrical and electronic equipment, and dispose of the old device as prescribed in the respective country of use.

A.3.2.1 Guidelines for disposal

> ⚠ **WARNING**
>
> **Injury or material damage if not correctly disposed of**
>
> If you do not correctly dispose of direct drives or their components (especially components with permanent magnets), then this can result in death, severe injury and/or material damage.
>
> - Ensure that direct drives and their associated components are correctly disposed of.

Main constituents of a proper disposal procedure

- Complete demagnetization of the components that contain permanent magnets
- Components that are to be recycled should be separated into:
  - Electronics scrap (e.g. encoder electronics, Sensor Modules)
  - Electrical scrap (e.g. motor windings, cables)
  - Scrap iron (e.g. laminated cores)
  - Aluminum
  - Insulating materials
- No mixing with solvents, cold cleaning agents, or residue of paint, for example

A.3.2.2 Disposing of secondary sections

> ⚠ **WARNING**
>
> **Risk of death and crushing as a result of permanent magnet fields**
>
> Severe injury and material damage can result if you do not take into consideration the safety instructions relating to the permanent magnet fields of the secondary sections.
>
> - Observe the information in Chapter "Danger from strong magnetic fields (Page 33)".

Demagnetization of the secondary sections

Disposal companies specialized in demagnetization use special disposal furnaces. The insides of the disposal furnace consist of non-magnetic material.

The secondary sections are put in the furnace in a solid, heat-resistant container (such as a skeleton container) made of non-magnetic material and left in the furnace during the entire demagnetization procedure. The temperature in the furnace must be at least 300° C during a holding time of at least 30 minutes.

Escaping exhaust must be collected and made risk-free without damaging the environment.

A.3.2.3 Disposal of packaging

Packaging materials and disposal

The packaging and packing aids we use contain no problematic materials. With the exception of wooden materials, they can all be recycled and should always be disposed of for reuse. Wooden materials should be burned.

Only recyclable plastics are used as packing aids:

- Code 02 PE-HD (polyethylene)
- Code 04 PE-LD (polyethylene)
- Code 05 PP (polypropylene)
- Code 04 PS (polystyrene)

A.4 Terminal markings according to EN 60034-8:2002

Terminal markings according to EN 60034-8:2002

With the EN 60034-8:2002 standard, the terminal markings for electrical connections have changed. The following table shows the changes that are relevant for the motors described here.

Table A-1 Terminal markings according to EN 60034-8

	KTY 84 or Pt1000 (Temp-F)	**PTC (Temp-S)**
old designation	2T1⊕ / 2T1⊖	1T1 / 1T2
new designation	+1R1 / –1R1	1TP1 / 1TP2

Glossary

Absolute position measuring system

By using several reading tracks, the motor is able to recognize the current position with the absolute position measuring system immediately after switching on. The position is recognized without traversing distance and is transmitted via the serial EnDat interface. The measurement path is limited and more expensive due to the more complex measurement track

Combined cable

Power and signal connection in one cable.

Gantry operation

In gantry operation, the synchronous motion of two motors is implemented via two independent axis drives including position measuring system.

Incremental position measuring system

To determine the position of the motor in the machine using an incremental position measuring system, the motor must travel to a reference point after being switched on. There are several reference points with the distance-coded incremental position measuring system. Higher speeds can be reached if open incremental encoders are used.

Janus arrangement

In a Janus arrangement, the phases V and W must be swapped for the → stoker, so that → master und → stoker run in the same direction. The cable outlets of the motors are located on opposite sides.

Master

The term "Master" describes the first of two motors in an axis fed by a shared power module, which are therefore connected in parallel. → Parallel connection

Parallel connection of motors

The parallel connection of two identical motors to one power module doubles the power available for the drive in comparison with just one such motor. Both motors must have a defined position to one another for synchronous power generation. The motors must be rigidly coupled to one another to guarantee the defined position of the motors relative to one another throughout operation.

Only one position measuring system is required to control the motors.

Primary section

The primary section is the electrically active component of a linear motor. It is usually the moving component.

Secondary section

Unlike the → primary section, a secondary section is not electrically active. The → secondary section track is composed of secondary sections.

Secondary section track

The secondary section track is usually composed of multiple → secondary sections. It is usually the immobile component of a linear motor.

Stoker

The term "Stoker" describes the second of two motors in an axis fed by a shared power module, which are therefore connected in parallel. → Parallel connection

Tandem arrangement

In a tandem arrangement, → Master and → Stoker have the same phase sequence UVW. The cable outlets of the motors are located on the same side.

More information

Siemens:
www.siemens.com/simotics

Industry Online Support (service and support):
www.siemens.com/online-support

Industry Mall:
www.siemens.com/industrymall

Siemens AG
Digital Industries
Motion Control
Postfach 31 80
91050 ERLANGEN
Germany

Scan the QR code for more information about SIMOTICS.