

# Product specification

## Motor Units and Gear Units

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## **Product specification**

**MU 100, MU 200, MU 300, MU 400  
MTD 250, MTD 500, MTD 750, MTD 2000, MTD 5000  
MID 500, MID 1000**

**Document ID: 3HAC040147-001**

**Revision: G**

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# Overview of this product specification

## About this product specification

This specification describes the performance of the motor units and the gear units in terms of:

- The structure and dimensional prints
- The fulfilment of standards, safety and operating requirements
- The load diagrams, mounting of additional equipment, the motion and reach
- Customer connections
- The specification of variants and options available
- Control equipment
- Safety system

## Usage

Product specifications are used to find data and performance about the product, for example to decide which product to buy. How to handle the product is described in the product manual.

## Users

It is intended for:

- Product managers and product personnel
- Sales and marketing personnel
- Order and customer service personnel

## References

Reference	Document ID
<i>Product specification - Controller IRC5</i> IRC5 with main computer DSQC1000.	3HAC047400-001
<i>Product specification - Controller software IRC5</i> IRC5 with main computer DSQC1000 and RobotWare 5.6x.	3HAC048264-001
<i>Product specification - Controller software IRC5</i> IRC5 with main computer DSQC1000 and RobotWare 6.	3HAC050945-001
<i>Product manual - Motor Units and Gear Units</i>	3HAC040148-001
<i>Circuit diagram - Motor Units and Gear Units</i>	3HAC039887-001
<i>Product specification - Robot user documentation, IRC5 with RobotWare 6</i>	3HAC052355-001

## Revisions

Revision	Description
-	New Product Specification.
A	<ul style="list-style-type: none"> <li>• Load diagram for MID 1000 corrected</li> <li>• Technical data motor units adjusted</li> <li>• Note for ambient temperature added</li> </ul>

*Continues on next page*

Revision	Description
B	<ul style="list-style-type: none"><li>• Dimensions for motor units adjusted</li><li>• Info regarding mounting of Motor Units</li></ul>
C	<ul style="list-style-type: none"><li>• Information regarding mounting holes/screws added</li><li>• Info regarding ordering units added</li><li>• Data iMax for motor units added</li></ul>
D	<ul style="list-style-type: none"><li>• Accuracy for MID units changed</li><li>• The formula for acceleration and deceleration values is corrected, see <a href="#">Dimensioning gear units on page 56</a>.</li><li>• Added information about template configuration files, see <a href="#">Configuration files on page 10</a>, and <a href="#">Technical data on page 20</a>.</li></ul>
E	<ul style="list-style-type: none"><li>• The values for <math>T_{\text{maxgear}}</math> is updated with physical units, see <a href="#">Dimensioning gear units on page 56</a>.</li></ul>
F	<ul style="list-style-type: none"><li>• Color options are added</li><li>• Minor corrections and updates</li></ul>
G	<ul style="list-style-type: none"><li>• Max welding power values added to technical data for MTDs.</li><li>• Measure for MU300 dimension added.</li></ul>



# 1 Description

## 1.1 Motor Units and Gear Units

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### Introduction

This specification provides the characteristics and performance for the new Motor Units and Gear Units. The units are power-operated and function as external axes. They are controlled by drive units mounted in the IRC5 controller or drive modules. The units are designed for optimal performance and to facilitate installation and application.

The Motor Units and Gear Units described in this specification are not tested for compatibility by a configurator when ordering products, due to that these are components to be integrated into systems with a vast amount of possible combinations, both hardware and software-wise, which cannot be foreseen, allowing orders to contain non allowed/invalid configurations. This means, it is possible to place an order either manually or via ordering system containing units that cannot be connected together to obtain a fully functional system.

The motor- and gear units cannot be combined with other standard products from the supplying unit without additional engineering.

The following scenarios will always require a quotation, please contact your local ABB organization:

- If flexible power- and signal cables are required between robot and controller.
- MU & GU combined with track motions (IRBT, RTT) and positioners (IRBP).
- MU & GU used in MultiMove systems.

Kinematic models are not included. Kinematic models for limited combinations of MU & GU can be set up by using the **External Axis Wizard**, which is an add in to RobotStudio.

Kinematic models can also be quoted on request, please contact your local ABB organization.

ABB will not take any functional responsibility for systems ordered.

---

### Operating system

The motor units and gear units are controlled by the IRC5 controller and robot control software, RobotWare. The RobotWare supports every aspect of the system, including the units, such as motion control, development and execution of application programs, communication and so on. For more information, see *Product specification - Controller IRC5 with FlexPendant*.

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### Safety

Safety standards valid for complete robot, manipulator, external units and controller.

*Continues on next page*

# 1 Description

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## 1.1 Motor Units and Gear Units

*Continued*

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### Serial Measurement Box

The SMB box (optional) contains a serial measurement board (with battery backup) and push buttons (optional) for releasing the brakes. The SMB box can be located up to maximum 30meters from the controller and maximum 15meters from the motor units or gear units.

If only one motor unit is used, the SMB board in the manipulator can be used, see [Scenarios on page 11](#), Scenario A.

---

### Brakes

All motors, both in motor units and in gear units, are equipped with electromagnetic brakes. The brakes are "on" when they are not energized. They can be released with push buttons (optional) on the SMB box or by customer installed button at the Motor Unit/Gear Unit.

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### Thermal supervision

The motor units (except MU 100) and gear units are protected from overload, by thermal supervision. Warnings are provided if the motor is close to maximum temperature. The unit will stop if maximum temperature is exceeded. The thermal supervision should be tuned for the environment for optimal efficiency.

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### Limitations

- Can not be combined with IRBP positioners (if needed contact Robotics Sales Support for a quotation).
- *Electronic Position Switches* (EPS) or *SafeMove* is not valid for motor units or gear units.
- IRC5 controller without SMB box allows maximum one motor unit.
- IRC5 controller with SMB box allows maximum 3 motor units or gear units.
- IRC5 drive module with SMB box allows maximum 3 motor units.
- Only motor unit connected to manipulator SMB, option 864-1.
- When using 3rd party motors are PTC functionality (supervision of motor temperature) not available.

---

### How to order

As a basic rule when adding Motor Units or Gear Units to already installed systems, always place a separate order for each system, to secure that correct number of cables/contacts for the controllers are delivered. When adding Motor Units and Gear Units to an existing system, already equipped with external axes, please contact your local ABB Organization.

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### Configuration files

Template configuration files are included in the delivery with the motor units and gear units. The configurations for motor units and gear units can be tuned before running in production to optimize performance.

## 1.2 Scenarios

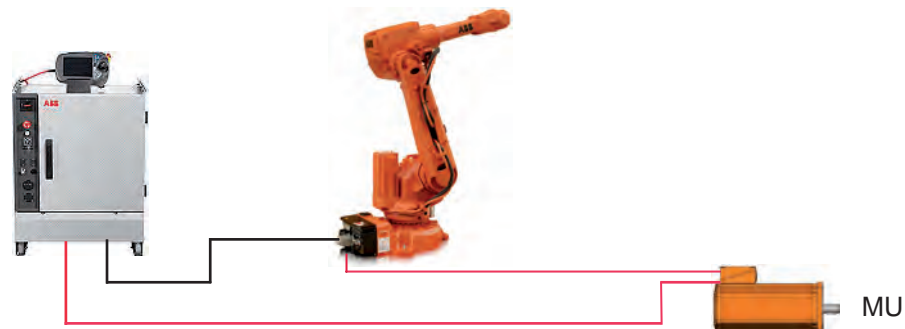
### Introduction

Below are different scenarios described for installation of the units. The axis selector, available as an option inside the controller, allowing to cut the power to the motor units and gear units, will not be shown in the scenarios below.

### Motor units

Scenario A, Lean concept:

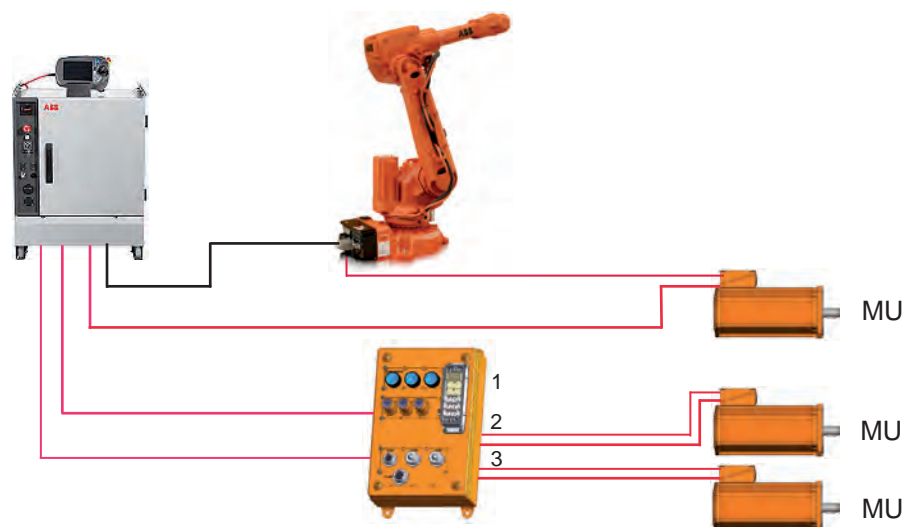
- One motor unit
- No SMB box
- Motor power connected to the IRC5 controller and resolver connected to FB7 at manipulator.



xx1000001187

Scenario B:

- One motor unit connected to the IRC5 controller, according to Lean concept above
- SMB box connected to the IRC5 controller
- Two motor units connected to SMB box



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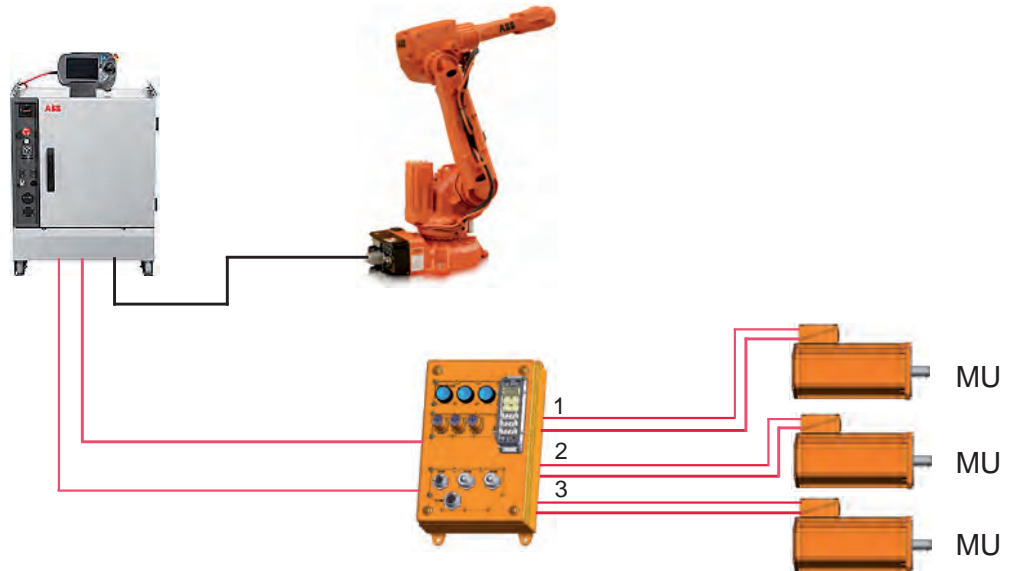
# 1 Description

## 1.2 Scenarios

*Continued*

### Scenario C:

- SMB box connected to the IRC5 controller
- Three motor units connected to one SMB box

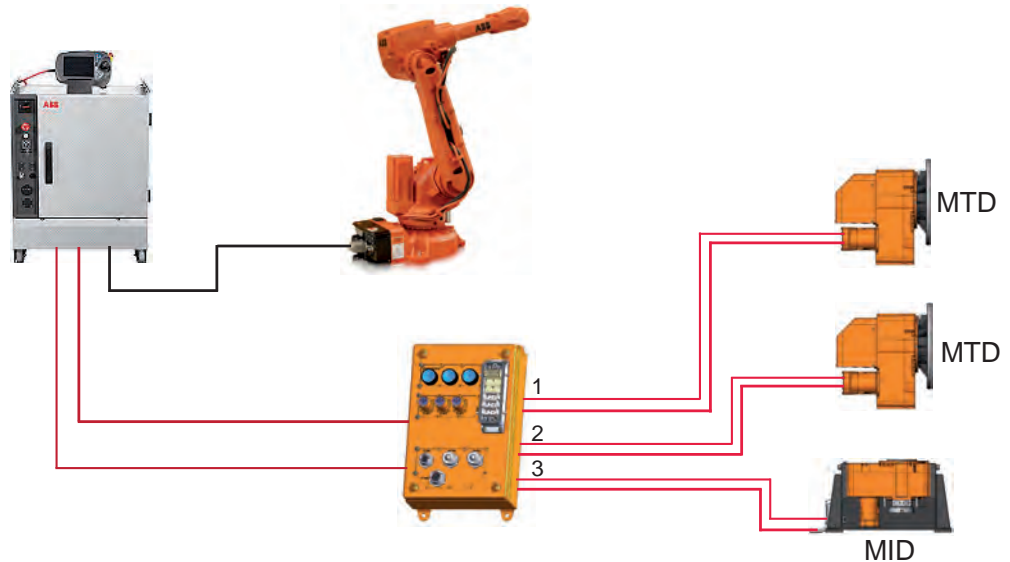


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## Gear units

### Scenario A:

- SMB box connected to the IRC5 controller
- Three gear units connected to one SMB box

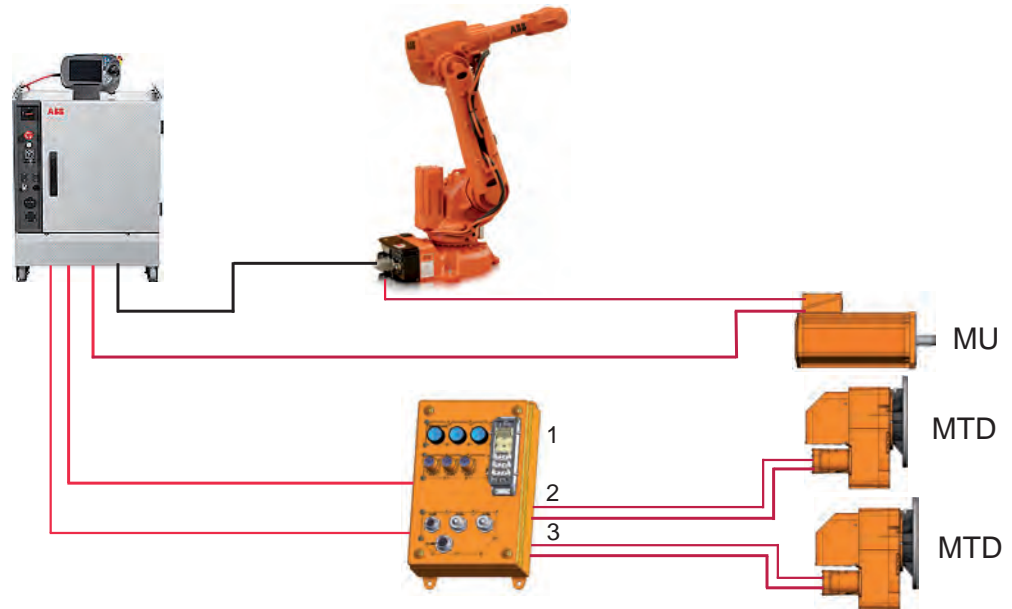


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#### Scenario B:

- One motor unit connected to the IRC5 controller, according to Lean concept
- SMB box connected to the IRC5 controller
- Two gear units connected to one SMB box



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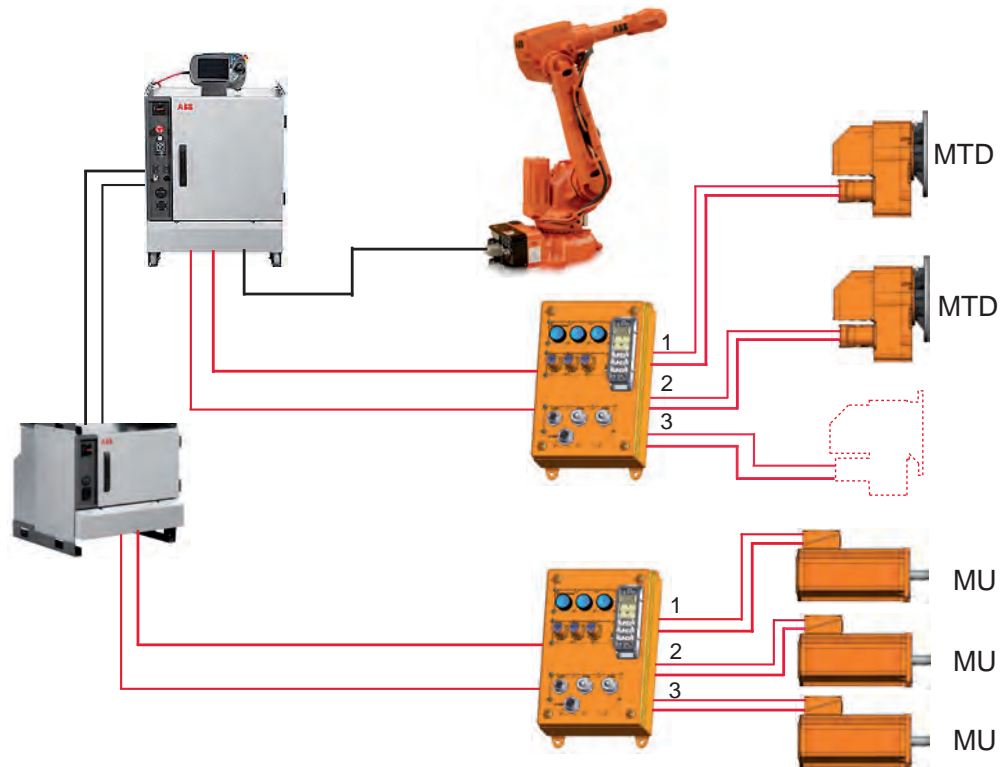
# 1 Description

## 1.2 Scenarios

*Continued*

### Scenario C:

- One SMB box connected to the IRC5 controller
- Two gear units connected to the IRC5 controller, through the SMB box
- One SMB box connected to IRC5 drive module
- Three motor units connected to the IRC5 drive module through the SMB box



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## 1.3 Motor units

### 1.3.1 Introduction

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#### General

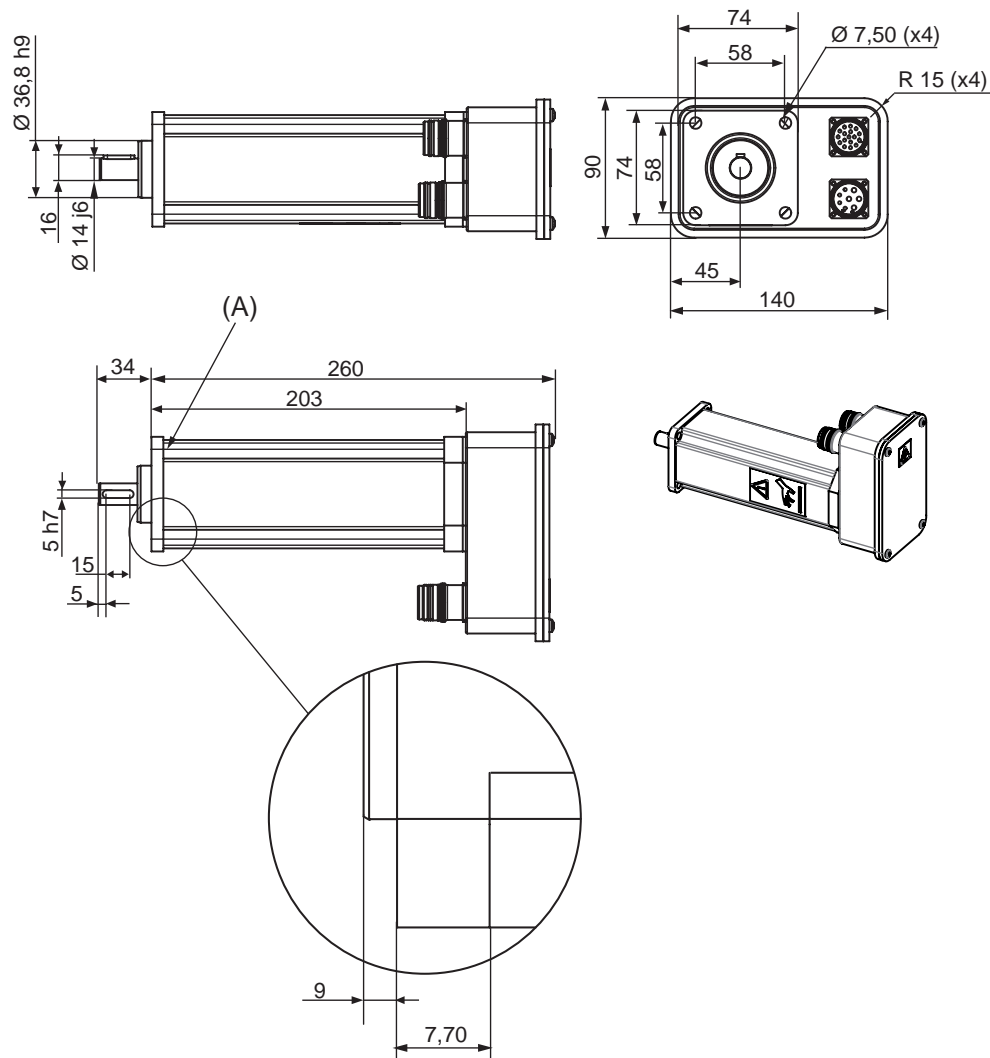
The motor units are intended to be used for peripheral equipment requiring power controlled motors synchronized with the robot movement.

# 1 Description

## 1.3.2 Dimensions

## 1.3.2 Dimensions

### MU 100



xx1000001206

Rs	Description	Tightening torque [Nm] $\pm 10\%$
A	Mounting screw M 6 (quality 8.8), max. washer $\varnothing 11 \text{ mm}$ .	10

Continues on next page

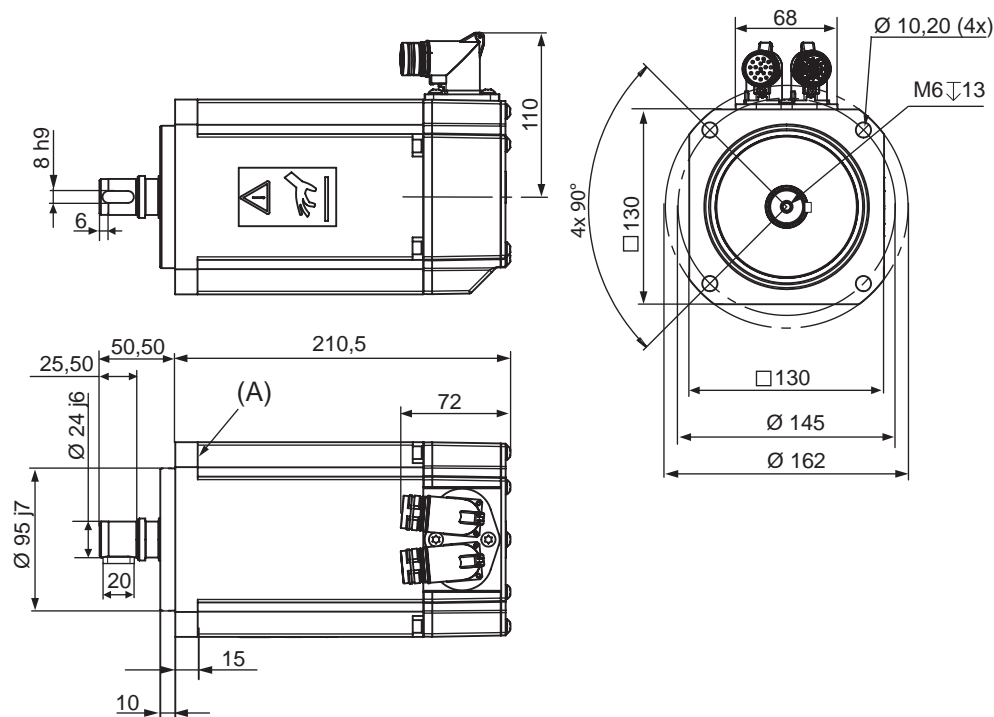


# 1 Description

## 1.3.2 Dimensions

Continued

MU 200



xx1100000099

Rs	Description	Tightening torque [Nm] ±10%
A	<p>The thread in the mounting holes in the motor flange are intended for disassemble of the motor, by removing the fixing screws and inserting a screw to press the motor out. Holes in motor flange M 12, free diameter Ø 10.2 mm.</p> <p>Mounting screw M 8 (quality 8.8), max. washer Ø 17 mm.</p>	24

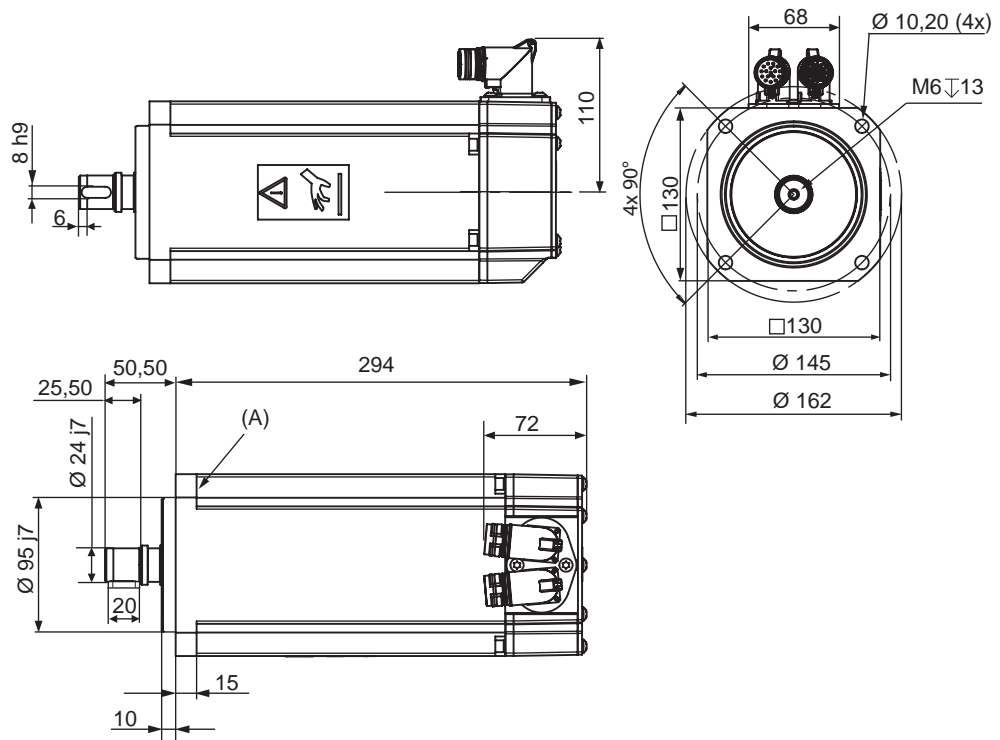
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# 1 Description

## 1.3.2 Dimensions

Continued

### MU 300



xx1100000100

Rs	Description	Tightening torque [Nm] ±10%
A	<p>The thread in the mounting holes in the motor flange are intended for disassemble of the motor, by removing the fixing screws and inserting a screw to press the motor out. Holes in motor flange M 12, free diameter Ø 10.2 mm.</p> <p>Mounting screw M 8 (quality 8.8), max. washer Ø 17 mm.</p>	24

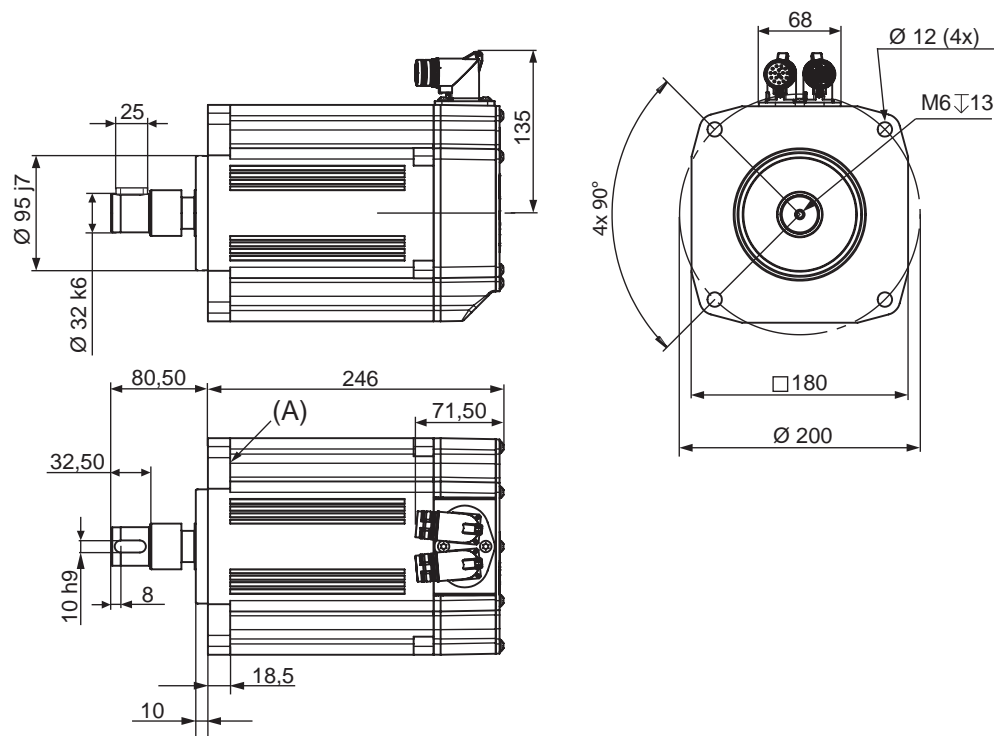
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# 1 Description

## 1.3.2 Dimensions

Continued

### MU 400



xx1100000101

Rs	Description	Tightening torque [Nm] ±10%
A	The thread in the mounting holes in the motor flange are intended for disassemble of the motor, by removing the fixing screws and inserting a screw to press the motor out. Holes in motor flange M 14, free diameter Ø 12 mm. Mounting screw M 10 (quality 8.8), max. washer Ø 22 mm.	47

# 1 Description

## 1.3.3 Technical data

### 1.3.3 Technical data

#### Technical data

The motor units are available in four variants, see table below for technical data.

Parameter	MU 100	MU 200	MU 300	MU 400
Minimum suitable bus voltage in IRC5 (V DC) <sup>i</sup>	275/450	275/450	275/450	275/450
N <sub>nom</sub> : nominal speed (rpm)	3300	5000	5000	4700
N <sub>rms</sub> : speed @ rms torque (rpm)	1650	2000	2000	1880
T <sub>0</sub> : Low speed torque 0 to 10 rpm (Nm) <sup>ii</sup>	1.5	7	17	26
T <sub>rms</sub> : torque @ rms speed (Nm) <sup>ii</sup>	1.4	6.4	12.5	20
T <sub>nom</sub> : torque @nominal speed (Nm) <sup>ii</sup>	1.0	1.0	2.6	10
T <sub>acc</sub> : max dynamic torque (Nm) (Torque absolute max)	4.3	14 <sup>iii</sup>	35 <sup>iv</sup>	50 <sup>v</sup>
K <sub>t</sub> : torque constant (Nm/A) <sup>vi</sup>	0.453	0.76	0.967	1.17
i <sub>Max</sub> (A)	11	30.5	58	68.4
Temp max: max allowed average winding temperature (deg C)	140	140	140	140
Temp amb: allowed ambient temperature (deg C)	0 to +52	0 to +52	0 to +52	0 to +52
J <sub>tot</sub> : total inertia motor unit (kgm <sup>2</sup> )	0.8x10 <sup>-4</sup>	7.5x10 <sup>-4</sup>	16.6x10 <sup>-4</sup>	49.3x10 <sup>-4</sup>
m: mass (kg)	4.4	9	15	27
Sealing class: IP rating acc. to IEC529	IP 67	IP 67	IP 67	IP 67

<sup>i</sup> The minimum suitable DC bus voltage affects the available torque at high speed.

<sup>ii</sup> During normal conditions. If ambient temperature > 40 degrees C, or poor cooling conditions, reductions may apply.

Conversion factor if the ambient temperature is higher than 40 degrees C:

- Ambient temperature = 45 degrees C => 0.97
- Ambient temperature = 52 degrees C => 0.94

<sup>iii</sup> The value in the template configuration file is 7.5. See *Product manual - Motor Units and Gear Units*.

<sup>iv</sup> The value in the template configuration file is 17.5. See *Product manual - Motor Units and Gear Units*.

<sup>v</sup> The value in the template configuration file is 25. See *Product manual - Motor Units and Gear Units*.

<sup>vi</sup> Nominal value. Variations (from +5% to -20%) due to tolerances, winding temperature, and other factors may apply.

Brake data	MU 100	MU 200	MU 300	MU 400
T <sub>brake min</sub> : minimum brake torque (Nm)	0.7	7.3	15	24
T <sub>brake max</sub> : maximum brake torque (Nm)	1.4	17	30	60
Brake voltage: brake voltage requirement (V DC)	24± 10%	24± 10%	24± 10%	24± 10%
Brake power consumption (W)	8	< 22	< 28	< 34
Max inertia: max allowed load inertia at N <sub>nom</sub> (kgm <sup>2</sup> ) <sup>i</sup>	0.0031	0.036	0.036	0.035

<sup>i</sup> Warning! This represents the maximum brake energy that the brake is tested for.

### 1.3.4 Performance diagrams

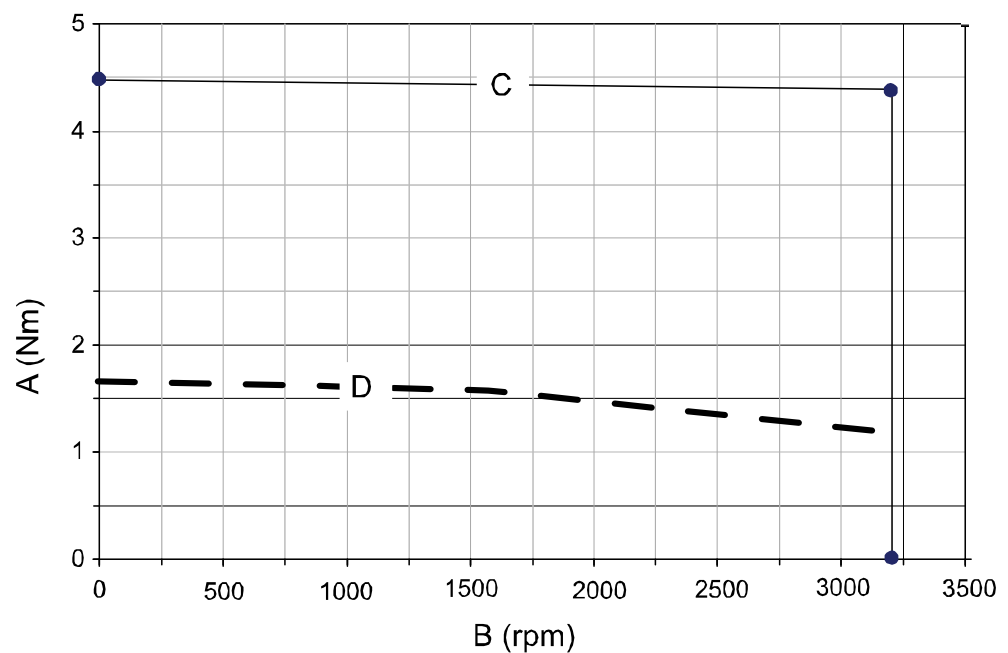
#### Introduction

The following diagrams shows the torque curve for the motor units.

Below is a list of required DC Link for each robot:

Type of DC Link	Robot
High voltage DC Link	IRB 4600, IRB 66X0, IRB 7600
Low voltage DC Link	All other robots

#### MU 100



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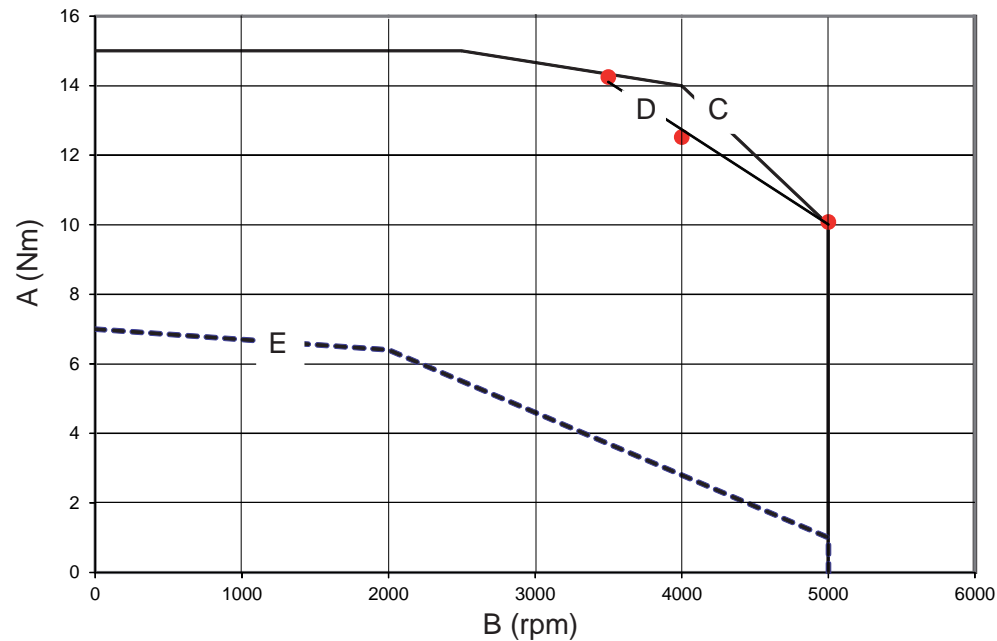
Pos	Description
A	Motor torque
B	Motor speed
C	$T_{acc}$ = torque at acceleration
D	$T_{average}$ = average torque

*Continues on next page*

1 Description

1.3.4 Performance diagrams  
Continued

MU 200

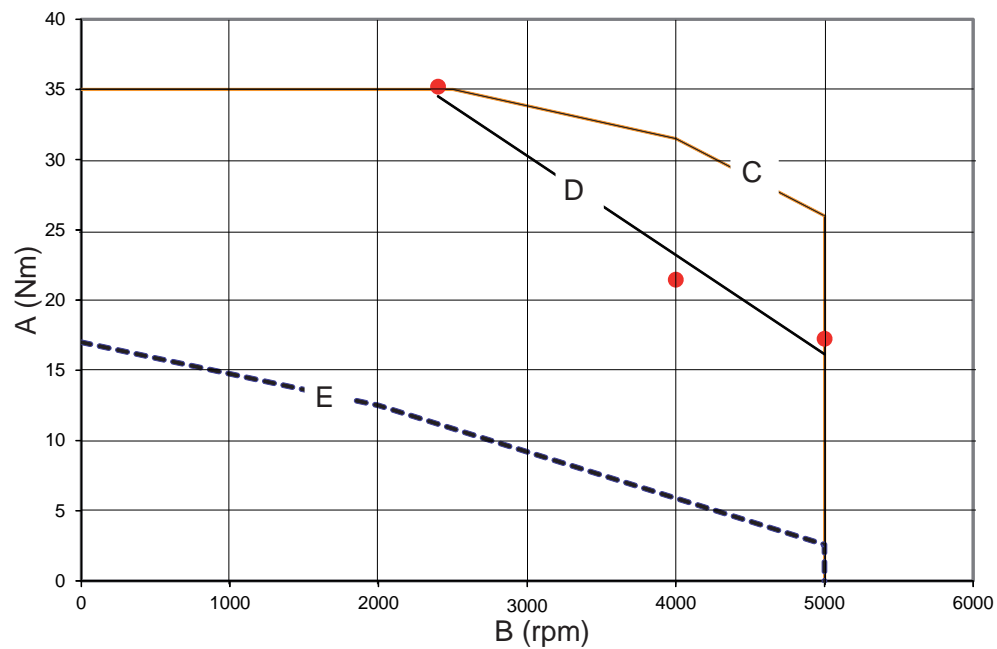


xx1000001220

Pos	Description
A	Motor torque
B	Motor speed
C	T <sub>acc</sub> = torque at acceleration
D	T <sub>acc</sub> = torque at acceleration for low voltage DC-link
E	T <sub>average</sub> = average torque

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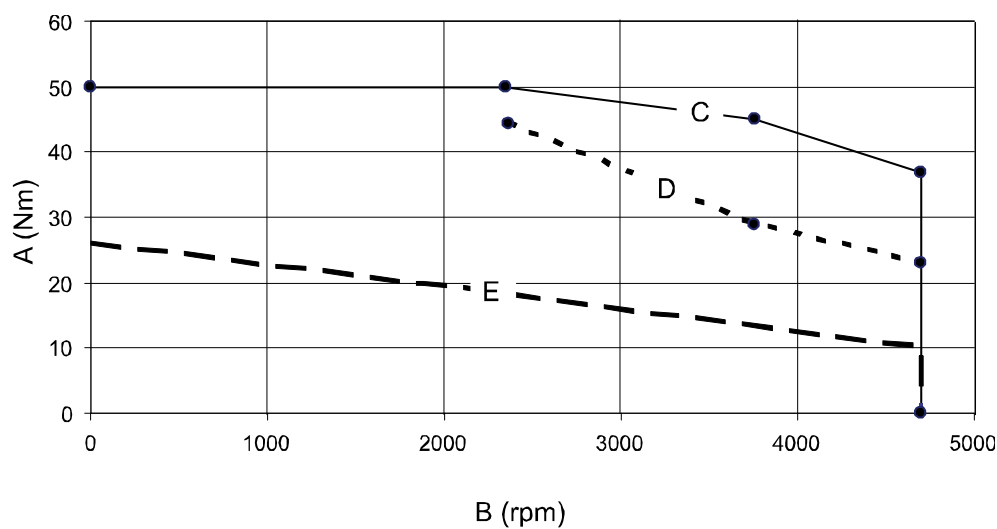
### MU 300



xx1000001221

Pos	Description
A	Motor torque
B	Motor speed
C	$T_{acc}$ = torque at acceleration
D	$T_{average}$ = average torque

### MU 400



xx1000001222

Pos	Description
A	Motor torque

Continues on next page

## 1 Description

---

### 1.3.4 Performance diagrams

*Continued*

Pos	Description
B	Motor speed
C	$T_{acc}$ = torque at acceleration
D	$T_{acc}$ = torque at acceleration for low voltage DC-link
E	$T_{average}$ = average torque



### 1.3.5 Permissible loads at motor shaft

#### Introduction

The following section provides information regarding permissible loads on the output shaft of the motor units. The loads stated here do not apply to installation or assembly. See *Product manual - Motor Units and Gear Units* for instructions.



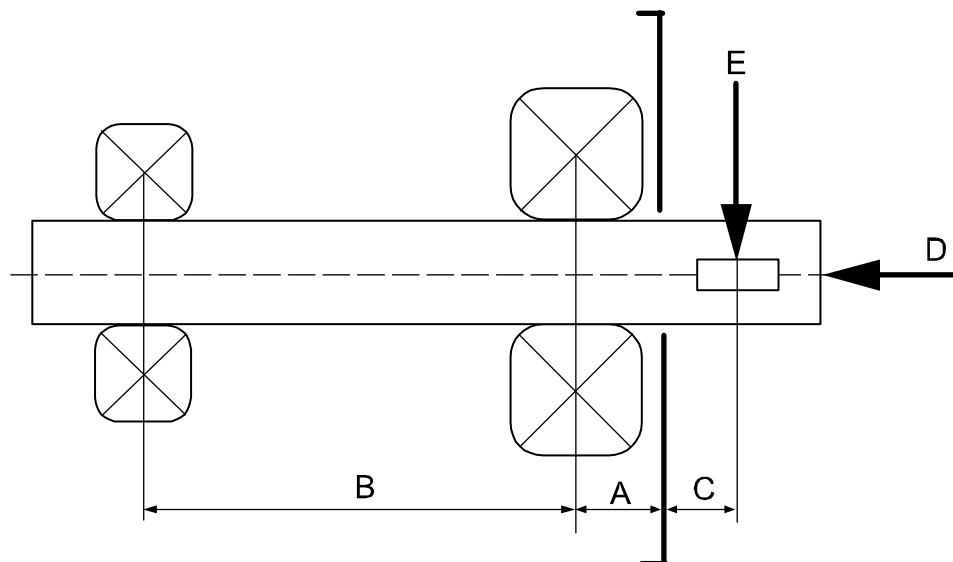
#### Note

Couplings, pulley, and motor pinion (transmission elements) must be assembled using adequate tools. Otherwise the motor shaft can be distorted which damages the resolver. Never use a hammer, as this will damage the equipment.

Grease the shaft after assembly to avoid oxidation.

#### Geometry

The graphic below shows the geometry of the motor.



xx1100000118

Pos	Description
A	Distance between motor flange and bearing load side
B	Distance between bearing load side and bearing non load side
C	Distance between motor flange and center of shaft (wedge on adapter)
D	Axial force
E	Radial force

Motor	Geometry		
	Distance A	Distance B	Distance C
MU 100	11 mm	175.2 mm	21.5 mm
MU 200	12 mm	125 mm	37.5 mm

*Continues on next page*

# 1 Description

## 1.3.5 Permissible loads at motor shaft

*Continued*

Motor	Geometry		
	Distance A	Distance B	Distance C
MU 300	11 mm	208.5 mm	37.5 mm
MU 400	16 mm	174.5 mm	64 mm
Design speed	1650 rpm		
Lifetime	20000 hours		

### Loads

#### Design load

The rating life for design loads are based on the assumption that bearing load and bearing speed is constant. If these vary, the equivalent operating load can be calculated as follows:

$$P = \sqrt[3]{\frac{t_1 \times F_1^3 + t_2 \times F_2^3 + \dots + t_i \times F_i^3}{t_1 + t_2 + \dots + t_i}}$$

	Axial force (N)	Radial force (N)
MU 100 <sup>i</sup>	60	143
MU 200	441	1027
MU 300	441	1132
MU 400	614	1445

<sup>i</sup> Higher loads can be approved, contact your local ABB organization.

#### Peak load

The peak loads are valid when the motor is in normal acceleration or deceleration.

	Axial force (N)	Radial force (N)
MU 100 <sup>i</sup>	125	280
MU 200	881	2053
MU 300	881	2263
MU 400	1228	2889

<sup>i</sup> Higher loads can be approved, contact your local ABB organization.

#### Axial force

The maximum loads for emergency stop are valid for active brake.

	Axial force (N)	Radial force (N)
MU 100	125	280
MU 200	1963	7091
MU 300	1963	7815
MU 400	2825	9976

*Continues on next page*



#### Note

For load cases with combined axial and radial loads please contact your local ABB organization.

## 1 Description

---

### 1.3.6 Using the motor unit in direct contact with gearbox oil/grease

### 1.3.6 Using the motor unit in direct contact with gearbox oil/grease



#### WARNING

Oil leakage into motor unit will cause drastic reduction of brake torque. The rotational seal performance and lifetime must be assured in the customer application.

---

#### Sealing in the front flange

The motor units has a groove in the front flange for an O-ring sealing.

Recommended sealing:

Motor unit	O-ring inner diameter	Cross section diameter
MU 100	37 mm	3 mm
MU 200, MU 300, MU 400	102 mm	3 mm

---

#### Sealing on motor shaft

The motor shaft on MU 200/MU 300/MU 400 has a rotational sealing that is tested and designed for the following environment:

- Lifetime: 16,000 hours @  $n_{rms}$  speed
- Oil temperature:  $< 60^{\circ}\text{C}$
- Gearbox pressure: 0-0.2 bar
- Speed range: 0- $n_{nom}$
- Oil type: Mineral or Polyglycol based



#### Note

The MU 100 motor shaft has a rotational sealing, but should not be used in direct contact with gearbox oil/grease.

## 1.4 Gear units

### 1.4.1 Introduction

---

**General**

The gear units are available in two variants, five MTD and two MID, for handling loads of 250, 500, 750, 1000, 2000 and 5000 kg (including possible fixture). There is a faceplate fitted on the outgoing shaft of the units. The faceplate has plain holes and guide holes for securing fixtures. The drive equipment for the units is placed in the IRC5 controller.

**WARNING**

No current selector is available for gear units. Suitable arrangements for avoiding current through the gear units must be taken in installations for welding.

---

**MID500 and MID1000**

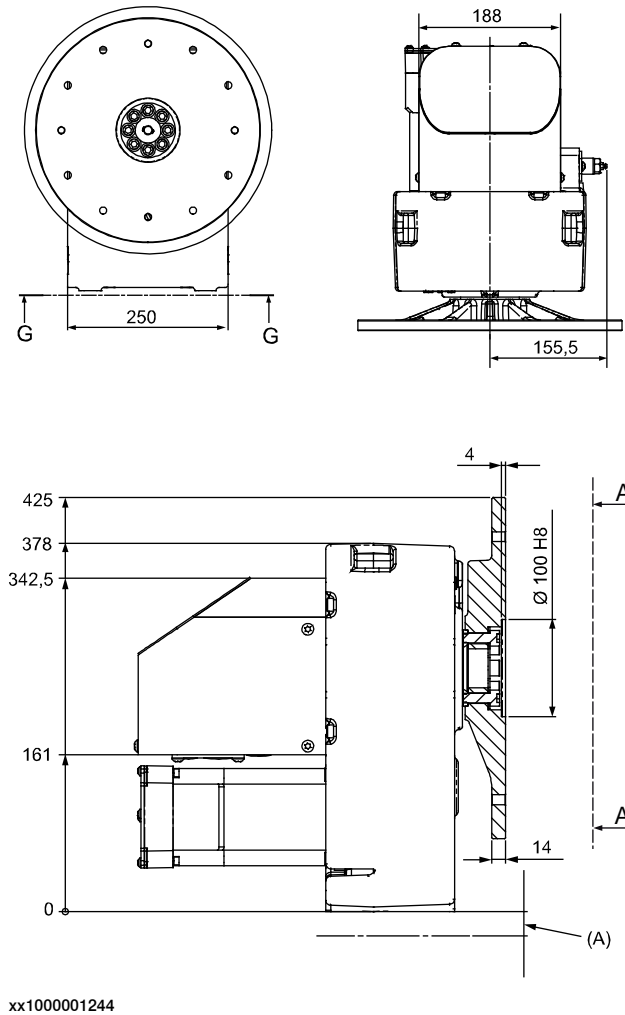
The MID500 and MID1000 gear units are equipped with a position indicator switch, that operates via a cam disc on the outgoing shaft. This gives the possibility to indicate the position of the outgoing shaft. The connection is done via a connection block in the controller. For detailed information, see *Product manual - Motor Units and Gear Units*.

# 1 Description

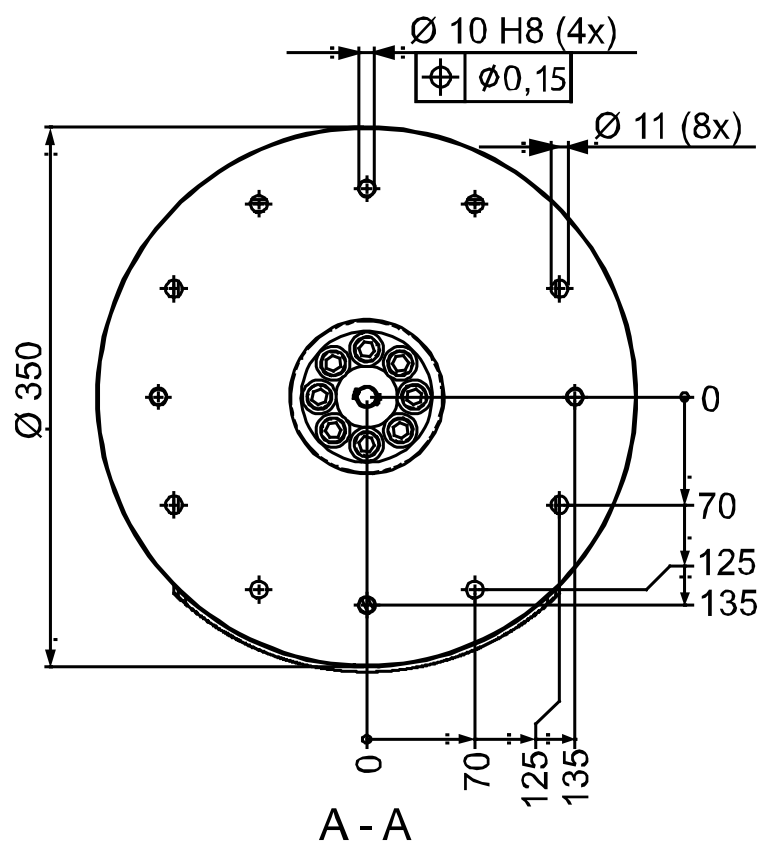
## 1.4.2 Dimensional drawings

### 1.4.2 Dimensional drawings

#### MTD250



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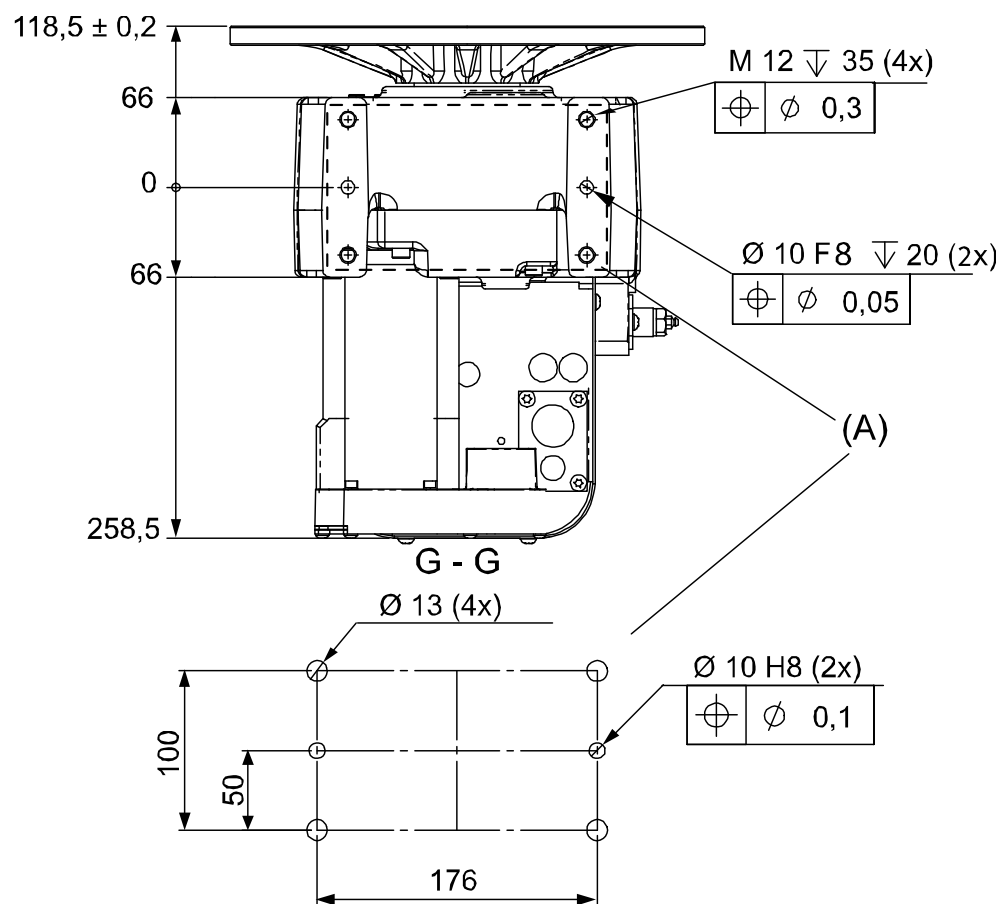
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# 1 Description

## 1.4.2 Dimensional drawings

Continued

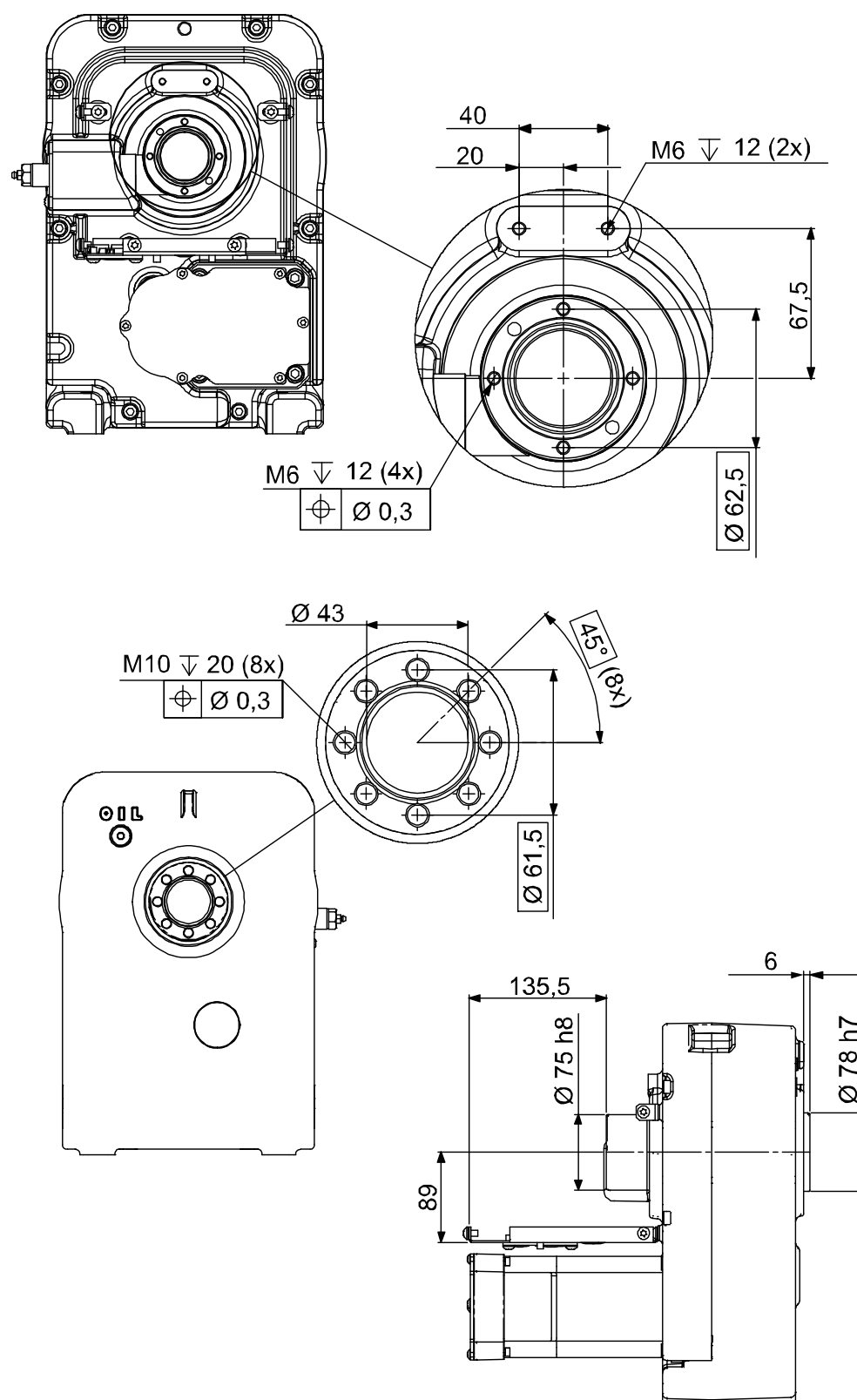


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Pos	Description
A	Hole configuration for mounting base

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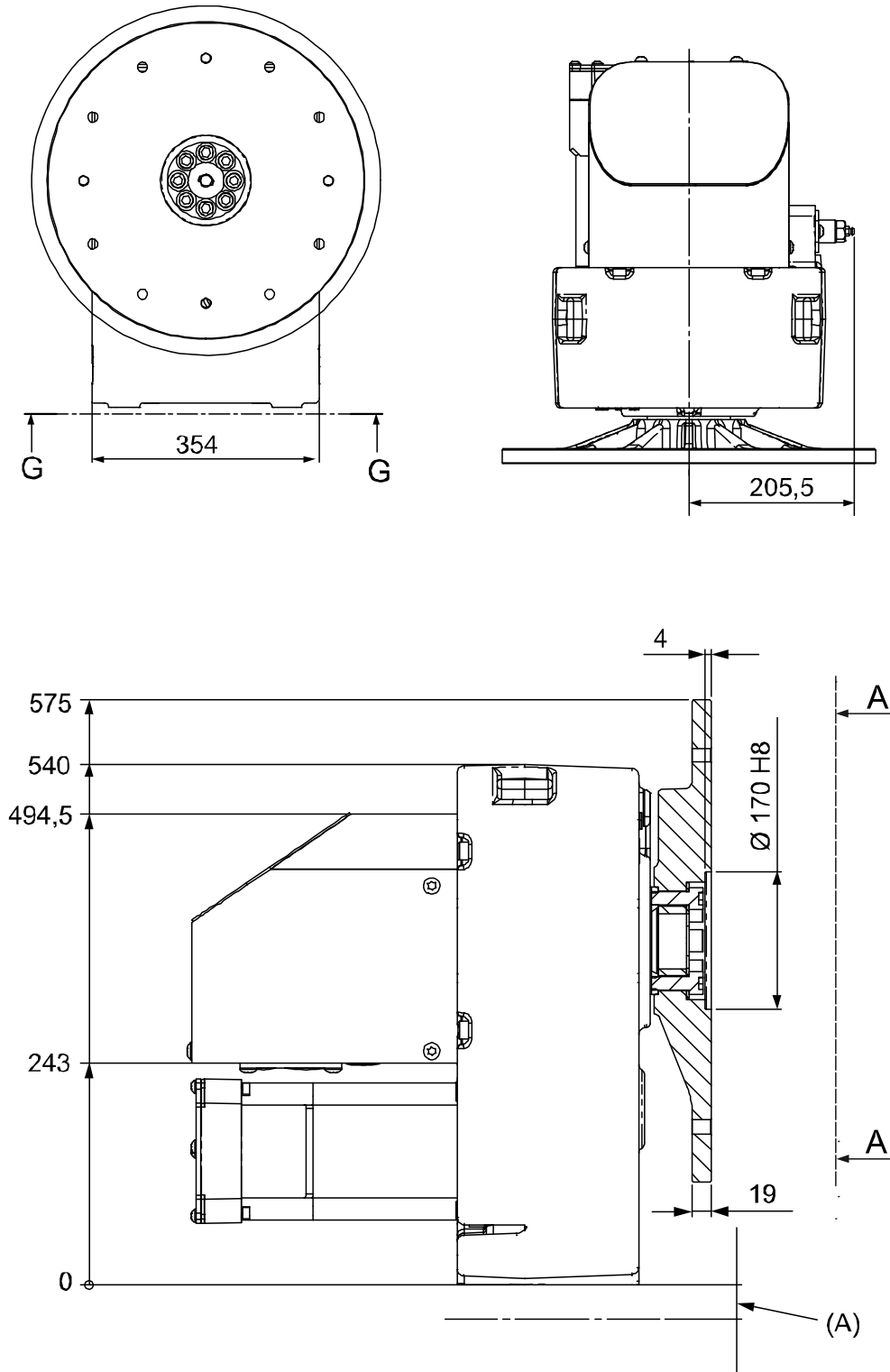
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1 Description

1.4.2 Dimensional drawings  
Continued

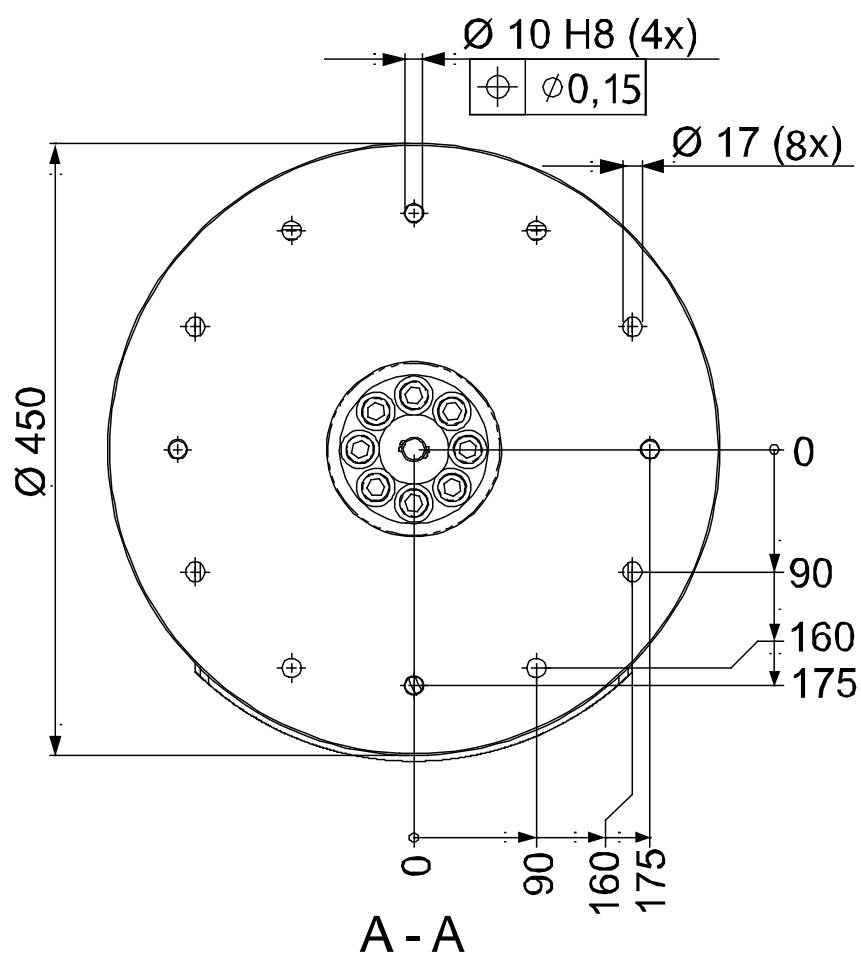
MTD500 and MTD750



xx1000001246

Pos	Description
A	30 mm recommended minimum clamping length

Continues on next page



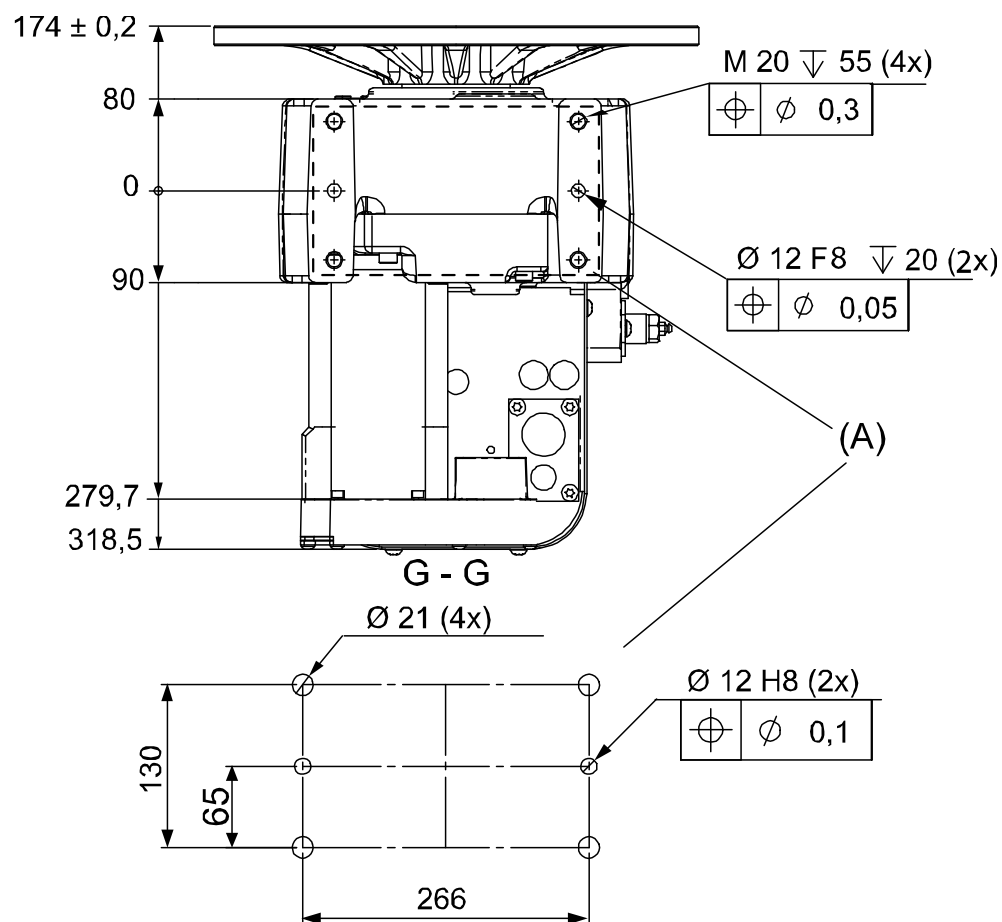
xx1000001245

Continues on next page

# 1 Description

## 1.4.2 Dimensional drawings

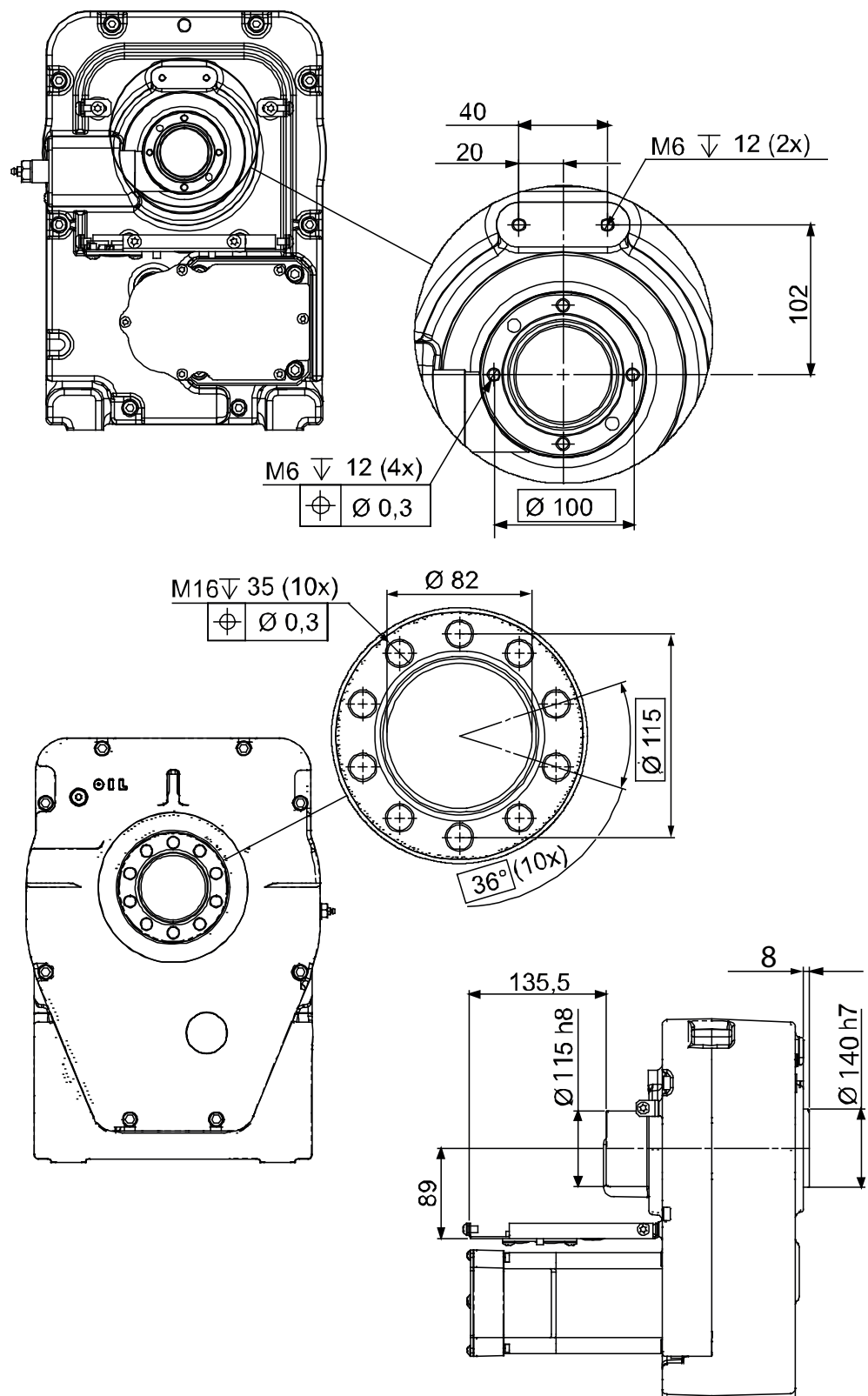
Continued



xx1000000735

Pos	Description
A	Hole configuration for mounting hole

Continues on next page



xx1000000736

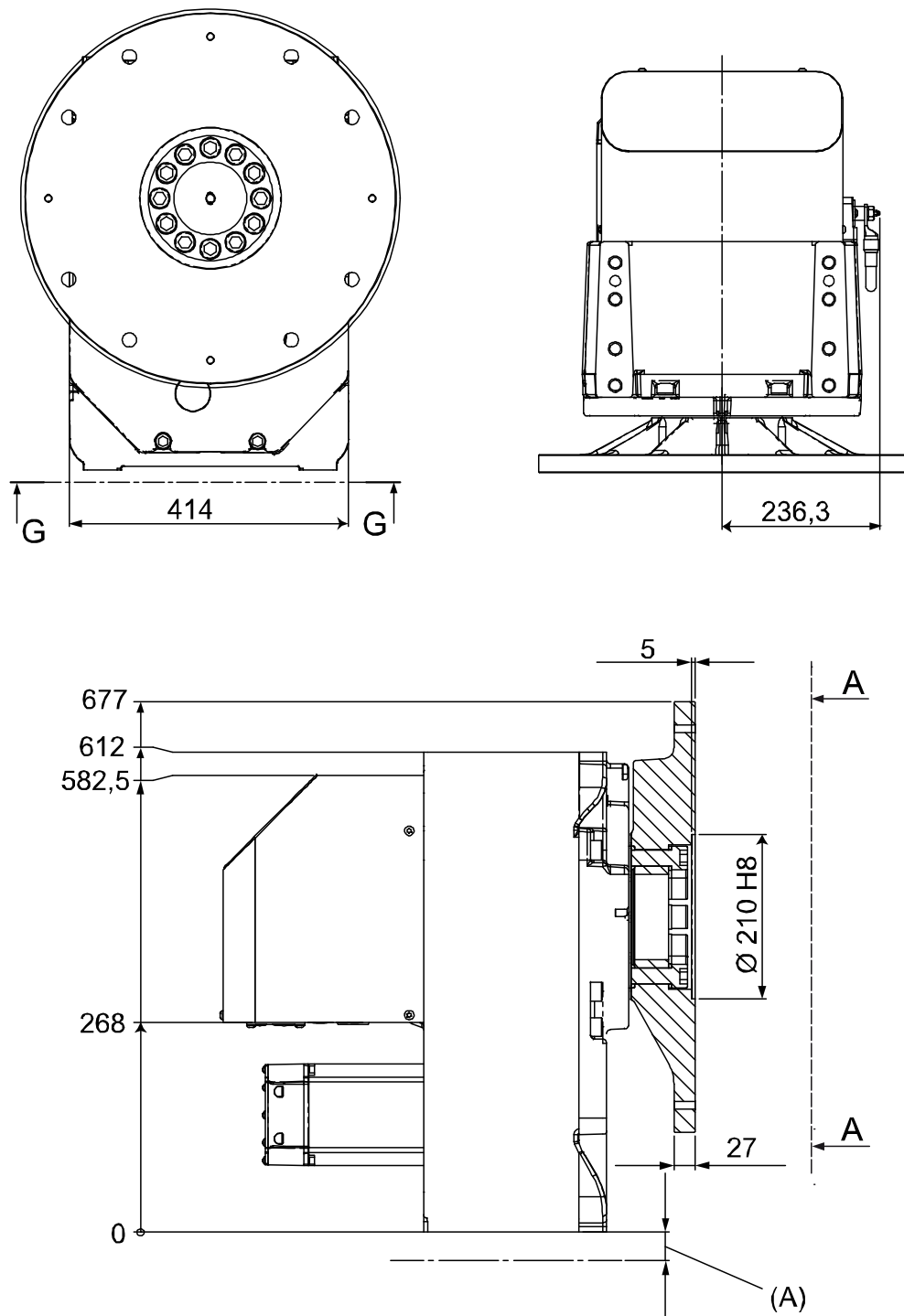
Continues on next page

# 1 Description

## 1.4.2 Dimensional drawings

Continued

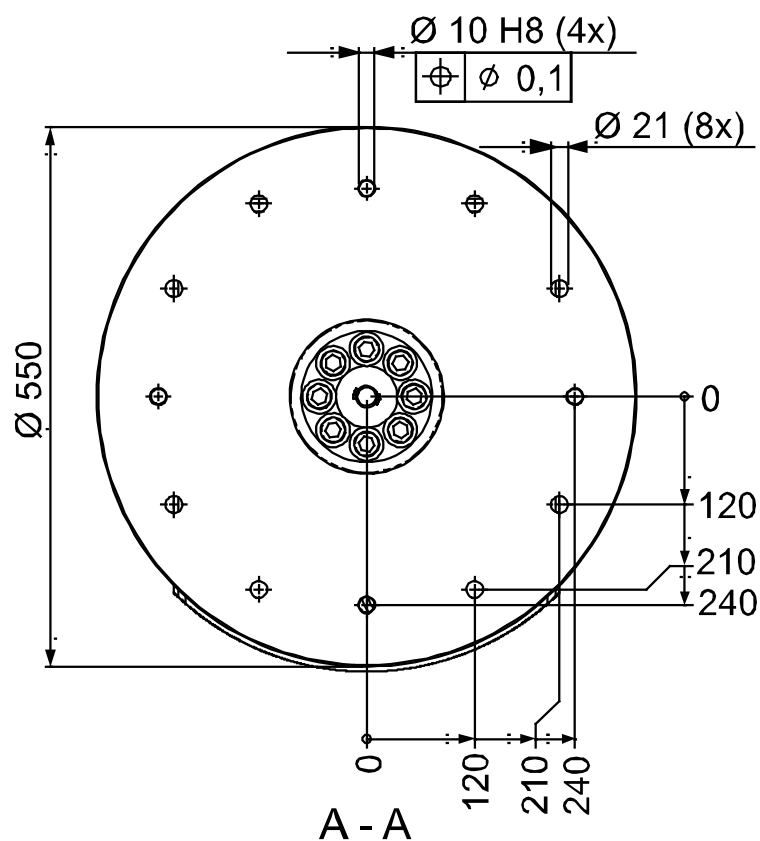
MTD2000



xx1000001248

Pos	Description
A	36 mm recommended minimum clamping length

Continues on next page



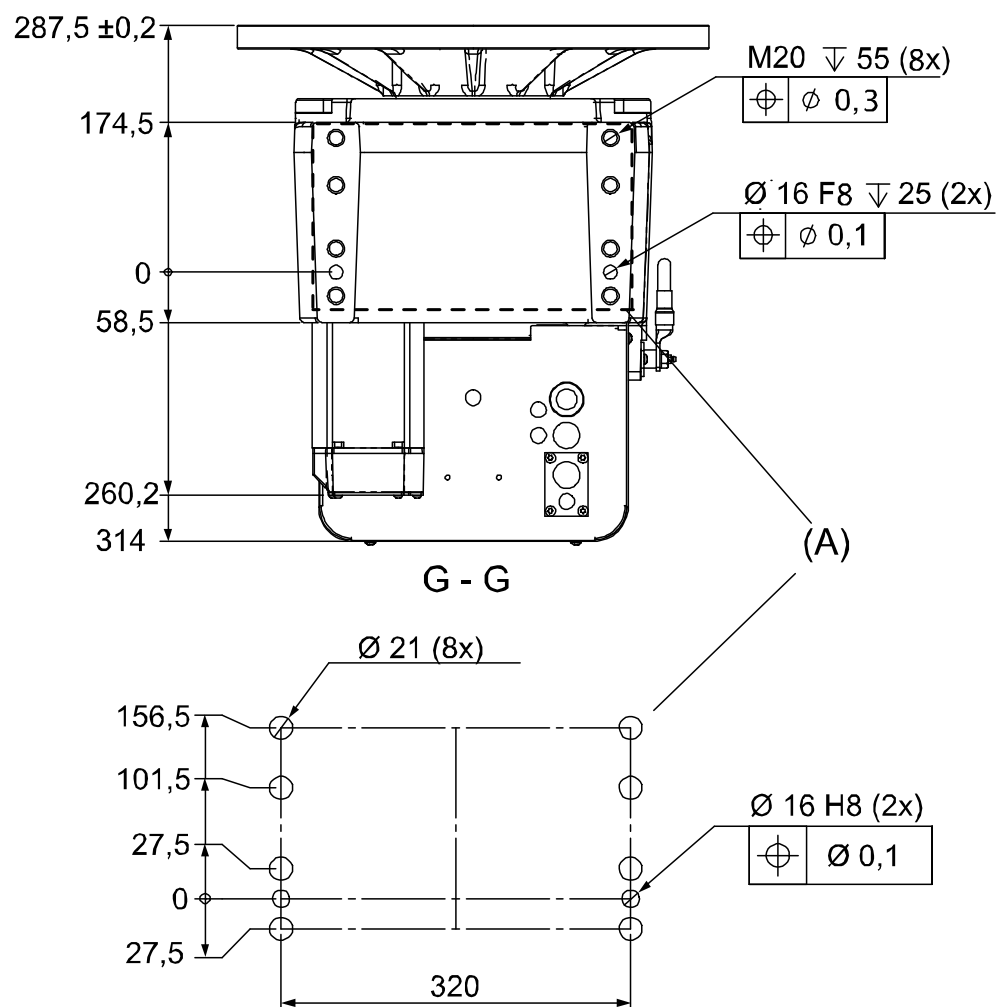
xx1000001247

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# 1 Description

## 1.4.2 Dimensional drawings

Continued

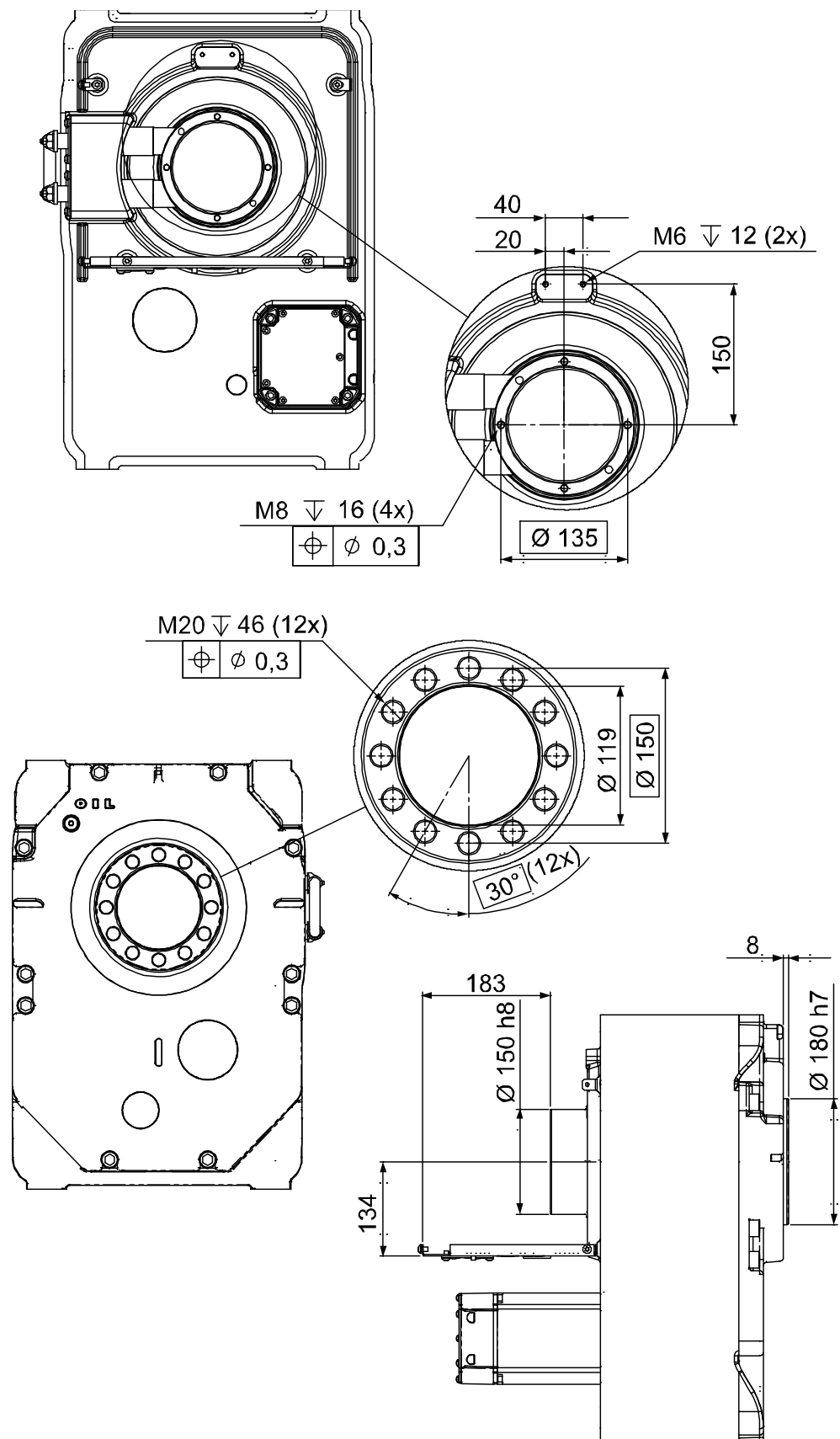


xx1000000740

Pos	Description
A	Hole configuration for mounting base

Continues on next page





xx1000000741

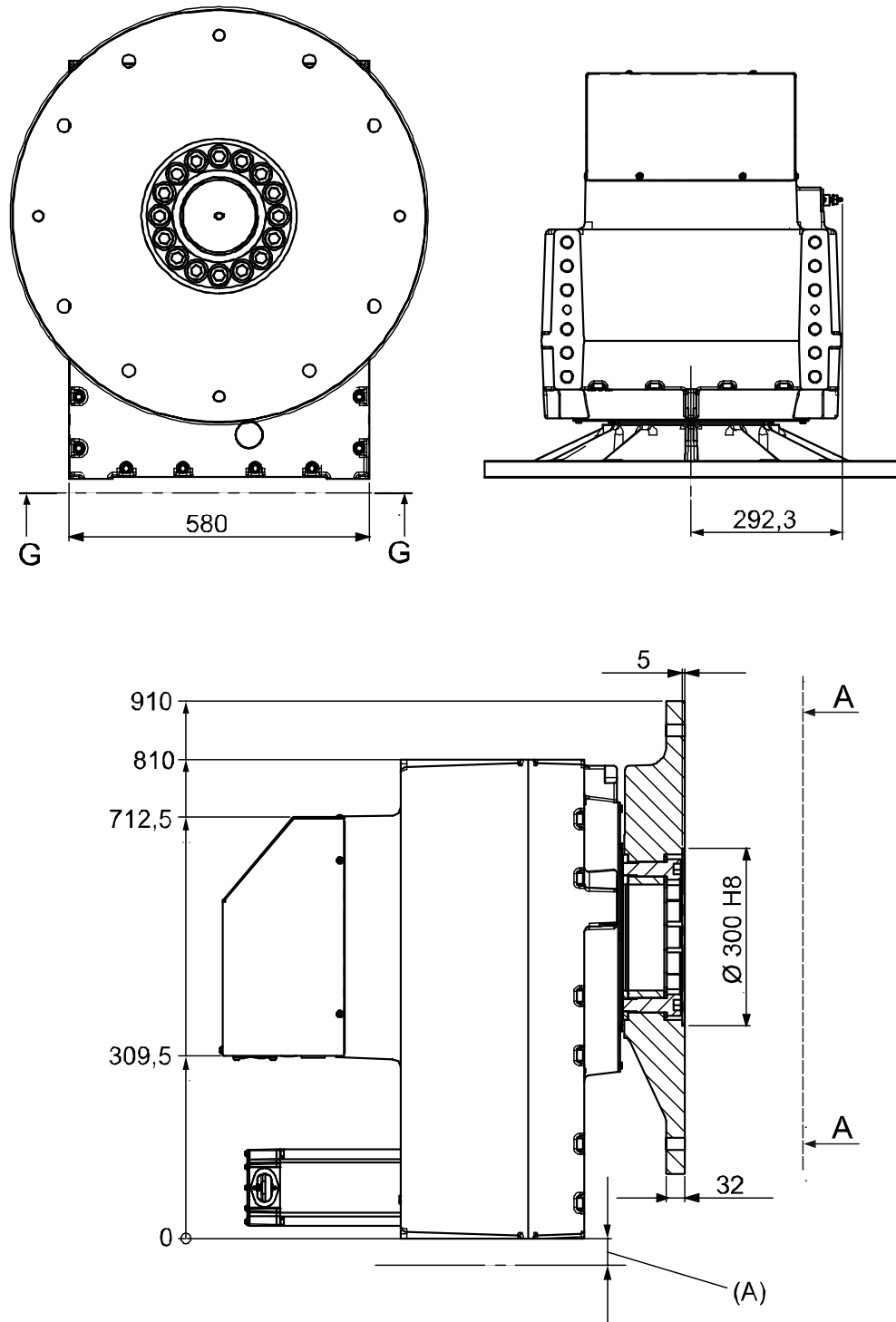
Continues on next page

# 1 Description

## 1.4.2 Dimensional drawings

Continued

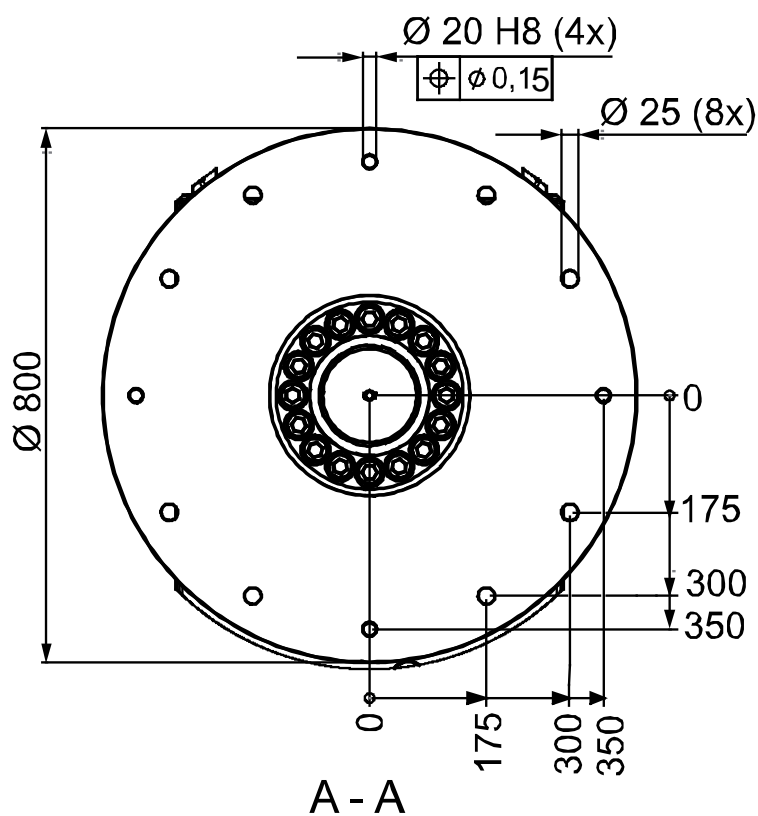
MTD5000



xx1000001250

Pos	Description
A	46 mm recommended minimum clamping length

Continues on next page



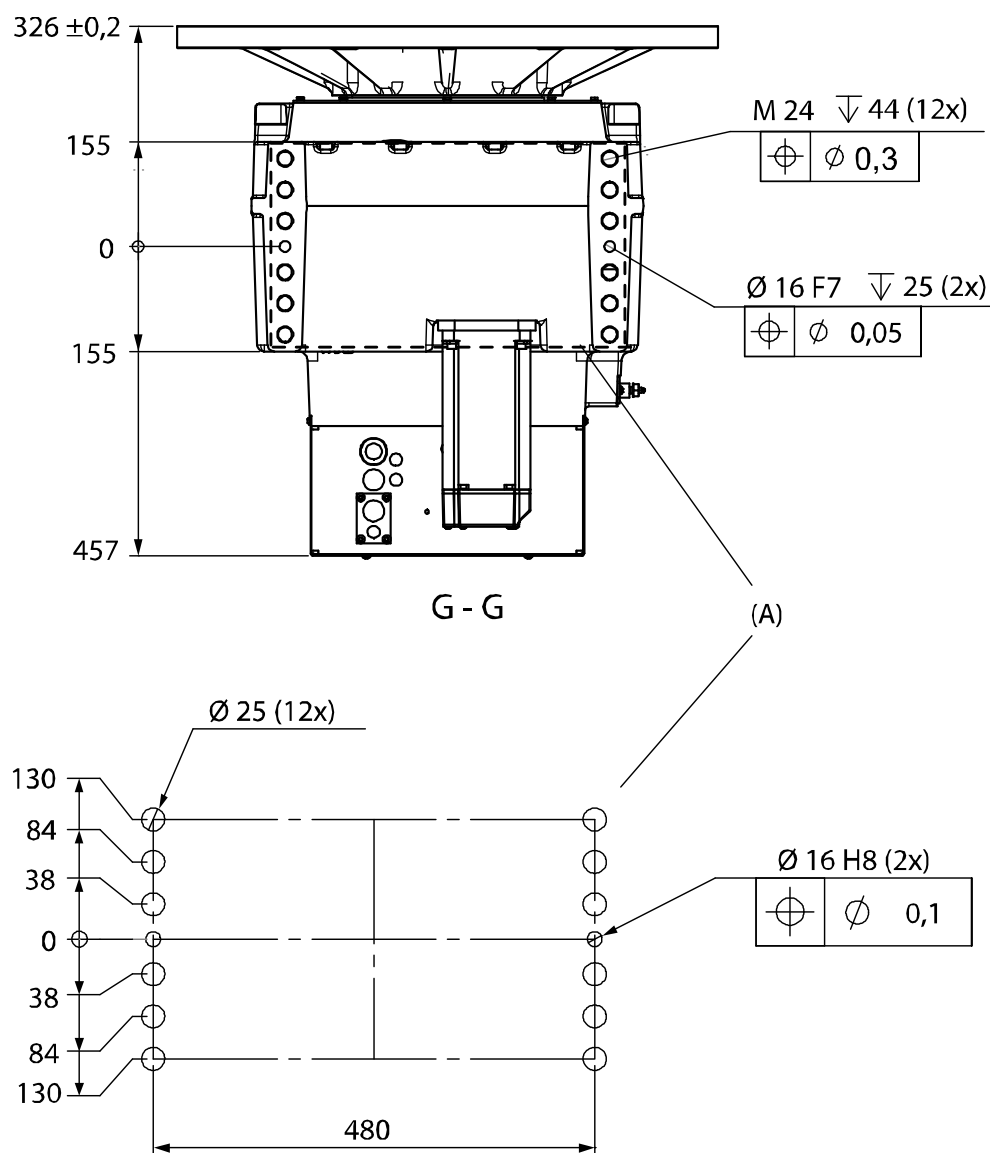
xx1000001249

Continues on next page

# 1 Description

## 1.4.2 Dimensional drawings

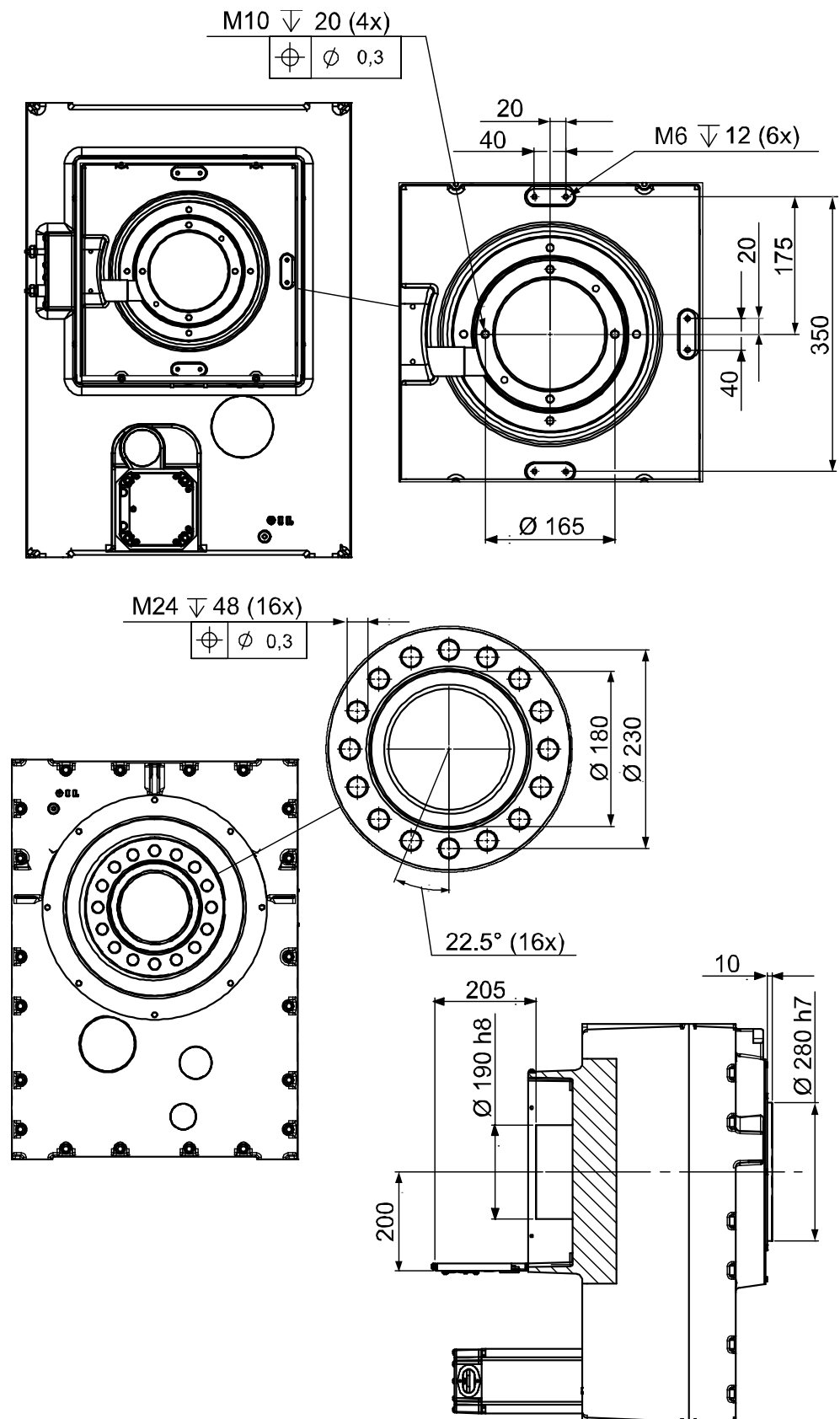
Continued



xx1000000745

Pos	Description
A	Hole configuration for mounting base.

Continues on next page



xx1000000746

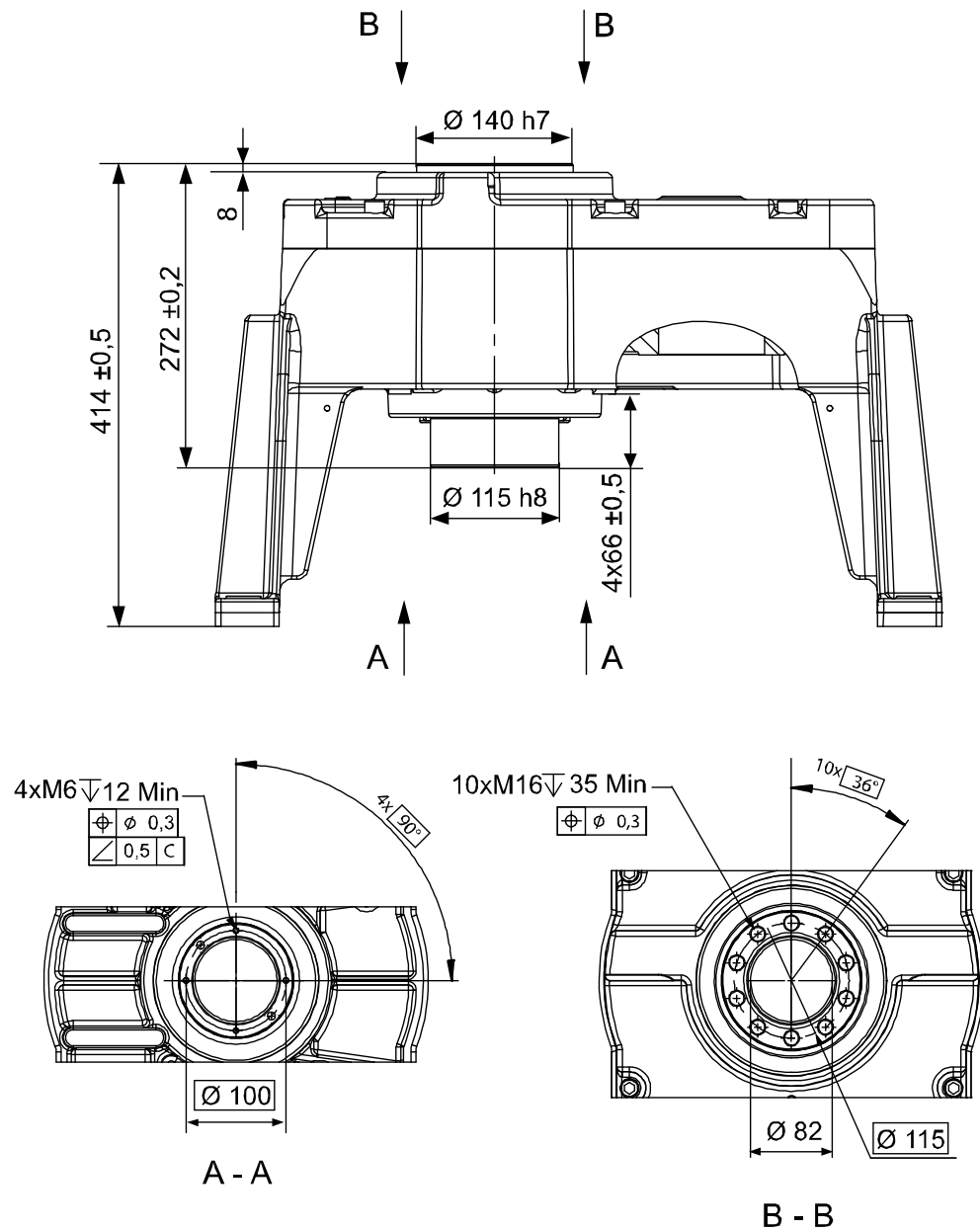
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# 1 Description

## 1.4.2 Dimensional drawings

Continued

MID500

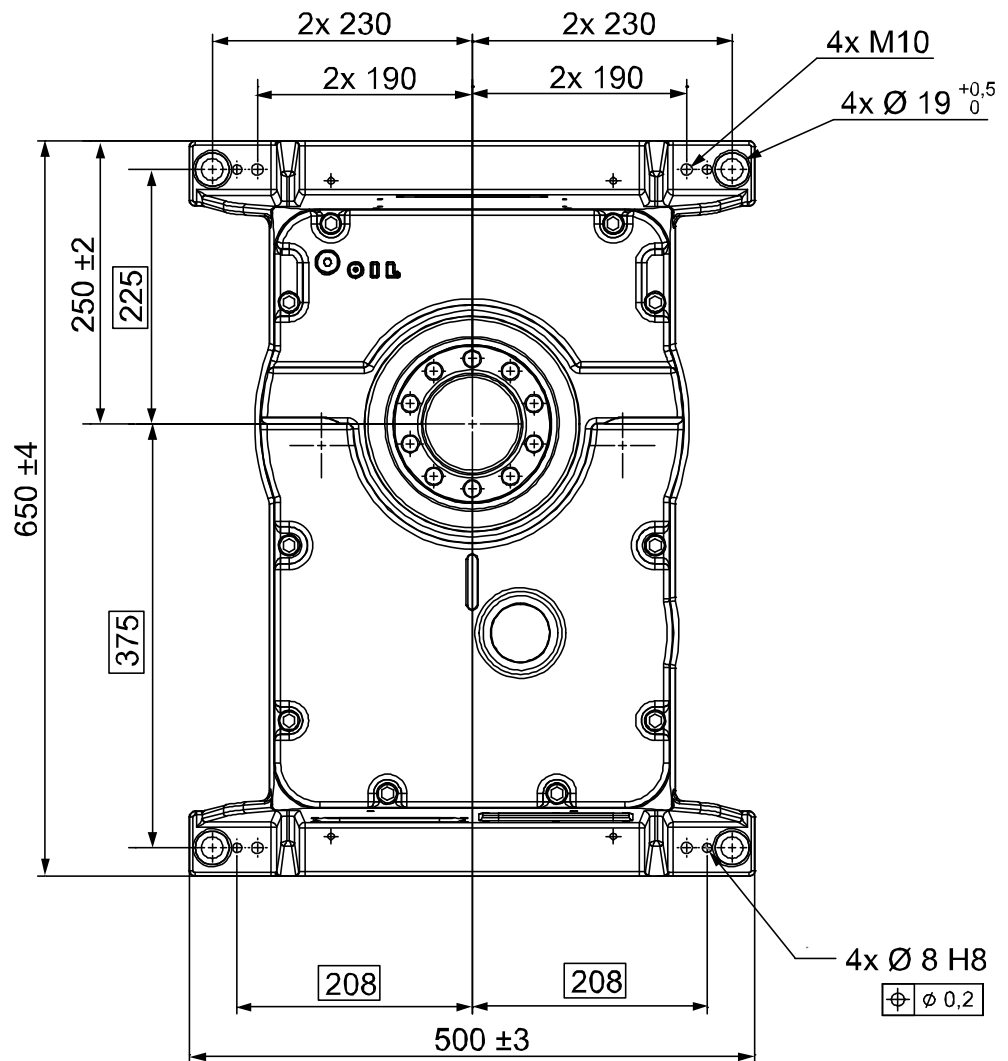


xx1100000001

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# 1 Description

## 1.4.2 Dimensional drawings Continued



xx1100000002

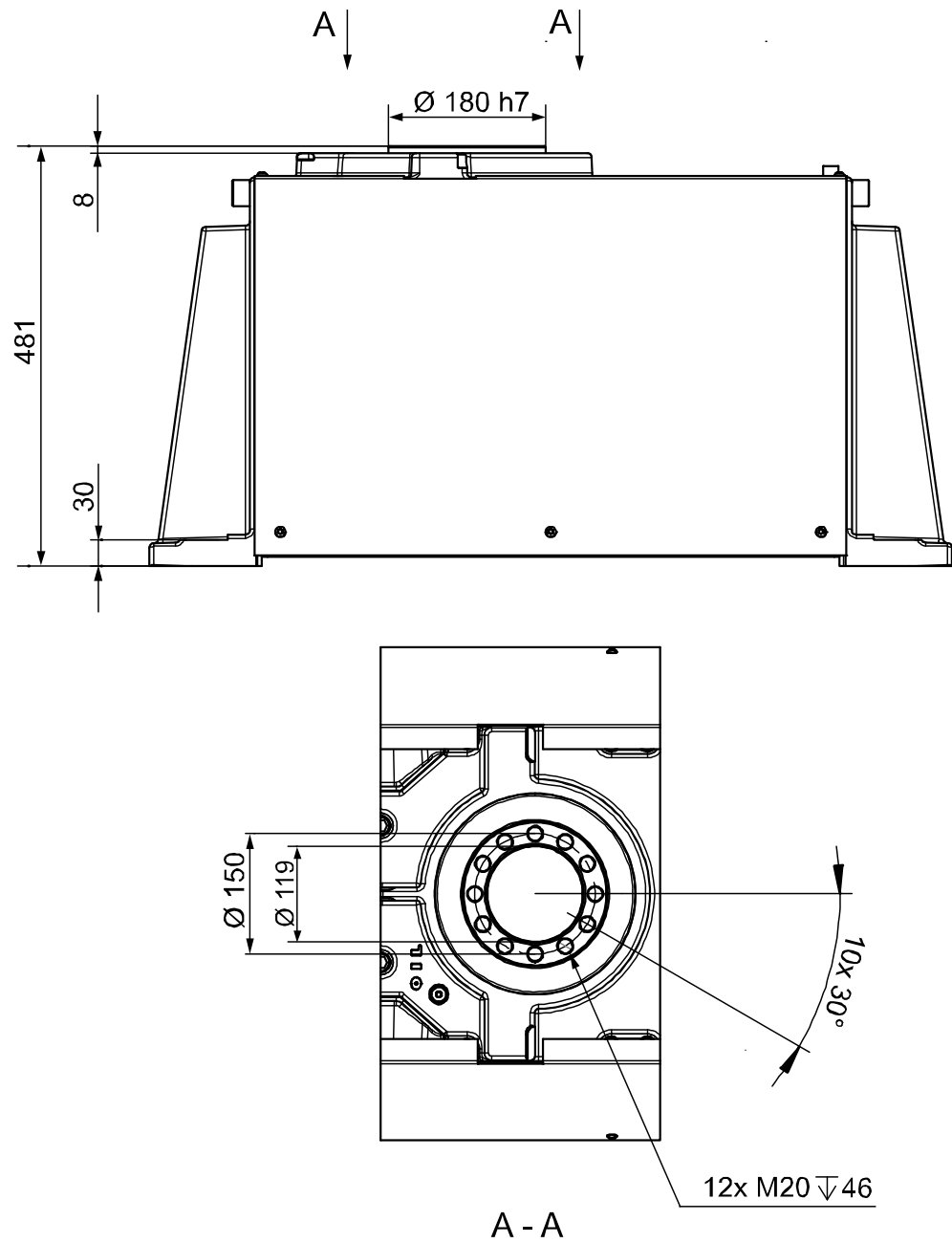
Continues on next page

# 1 Description

## 1.4.2 Dimensional drawings

Continued

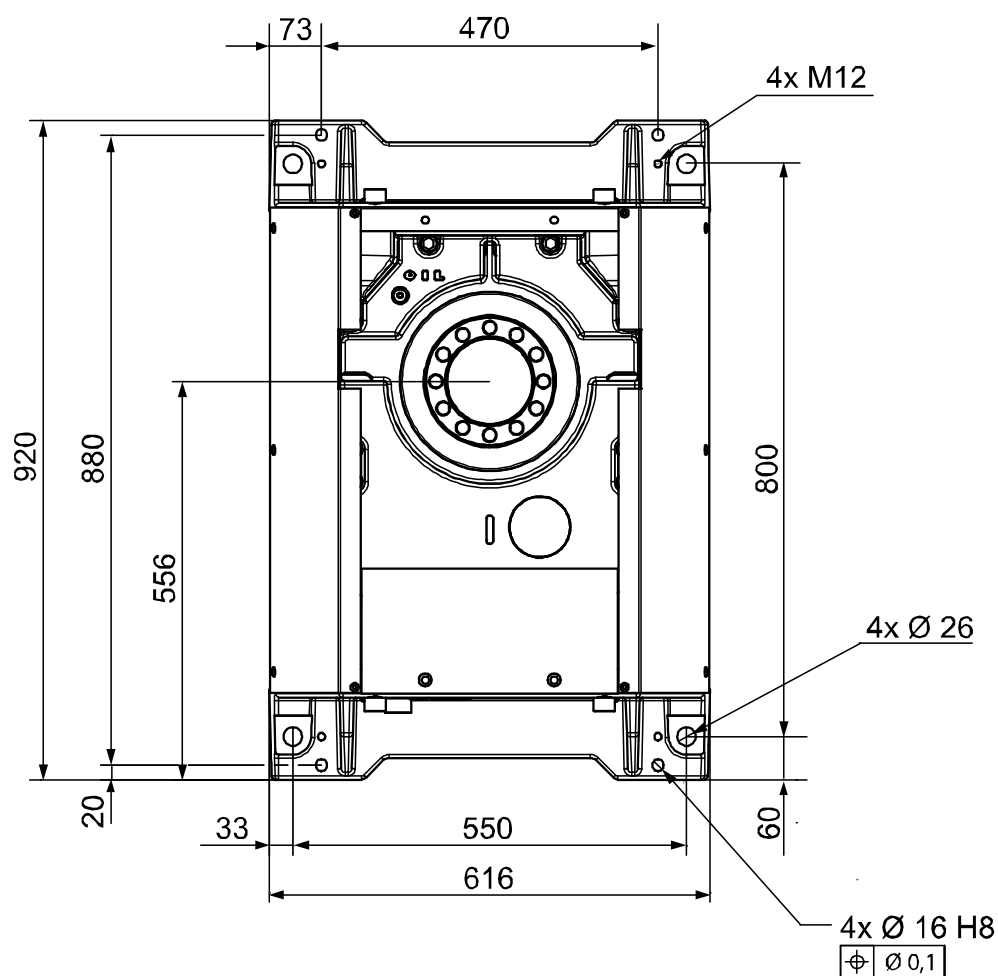
MID1000



xx1100000003

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xx1100000004

# 1 Description

## 1.4.3 Technical data

## 1.4.3 Technical data

### Introduction

The gear units are available in seven variants, see tables below for technical data.

### MTD250, MTD500, MTD750

Technical data	MTD250	MTD500	MTD750
Max. handling capacity	300 kg, see load diagram	600 kg, see load diagram	1000 kg, see load diagram
Max. continuous torque	350 Nm	650 Nm	900 Nm
Center of gravity	See <a href="#">Load diagrams on page 52</a> .		
Max bending moment	650 Nm	3300 Nm	5000 Nm
Positioning time 90 degrees	0.8 -1.2 s	1.0 -1.3 s	1.0 -1.3 s
Positioning time 180 degrees	1.4 -1.9 s	1.5 -2.1 s	1.5 -2.1 s
Positioning time 360 degrees	2.3 -2.7 s	2.7 -3.4 s	2.7 -3.5 s
Repetition accuracy with equal loads and radius 500 mm	±0.05 mm	±0.05 mm	±0.05 mm
Max. speed of rotation	180 deg/s	150 deg/s	150 deg/s
Stop time with an emergency stop	< 0.5 s	< 0.5 s	< 0.5 s
Max welding power, 60% duty cycle	600 Amp	600 Amp	600 Amp
Weight	70 kg	180 kg	180 kg

### MTD 2000, MTD5000

Technical data	MTD2000	MTD5000
Max. handling capacity	2000 kg	5000 kg
Max continuous torque	3800 Nm	9000 Nm
Center of gravity	See <a href="#">Load diagrams on page 52</a> .	
Max bending moment	15,000 Nm	60,000 Nm
Positioning time 90 degrees	1.2 - 2.2 s	2.5 - 3.1 s
Positioning time 180 degrees	2.2 - 3.8 s	4.8 - 5.9 s
Positioning time 360 degrees	4.2 - 5.1 s	9.4 - 10.0 s
Repetition accuracy with equal loads and radius 500 mm	±0.05 mm	±0.05 mm
Max. speed of rotation	90 deg/s	39 deg/s
Stop time with an emergency stop	< 0.6 s	< 0.9 s
Max welding power, 60% duty cycle	2 x 600 Amp	2 x 600 Amp
Weight	340 kg	770 kg

### MID 500, MID1000

Technical data	MID500	MID1000
Max. handling capacity	1300 kg	3300 kg

*Continues on next page*

Technical data	MID500	MID1000
Max continuous torque	1400 Nm	3800 Nm
Max acceleration torque	1950 Nm	5000 Nm
Center of gravity	See <a href="#">Load diagrams on page 52</a> .	
Max bending moment	5000 Nm	15,000 Nm
Positioning time 180 degrees	2.5 - 4.0 s	2.5 - 4.0 s
Repetition accuracy with equal loads and radius 500 mm	±0.07 mm	±0.05 mm
Max. speed of rotation	90 deg/s	90 deg/s
Stop time with an emergency stop	< 0.6 s	< 0.9 s
Weight	170 kg	395 kg

# 1 Description

## 1.4.4 Load diagrams

### 1.4.4 Load diagrams

#### Information



#### WARNING

It is very important to always define correct actual load data and correct payload of the gear unit. Incorrect definitions of load data can result in overloading of the unit.

If incorrect load data and/or loads are outside load diagram is used the following parts can be damaged due to overload:

- motors
- gearboxes
- mechanical structure



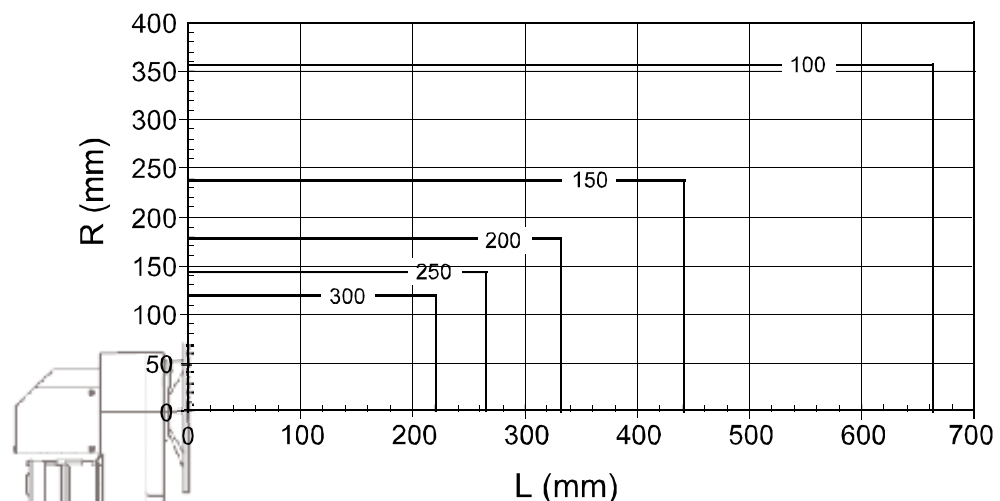
#### WARNING

Gear units running with incorrect load data and/or with loads outside diagram, will not be covered by robot warranty.

#### Introduction

The following load diagrams show the maximum permitted center of gravity displacement from the center of rotation at different loads.

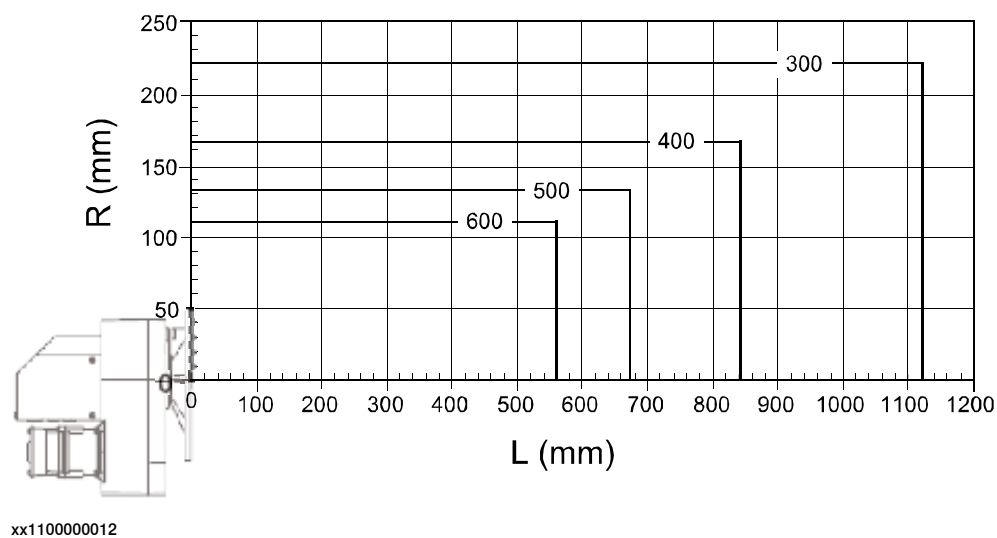
#### MTD250



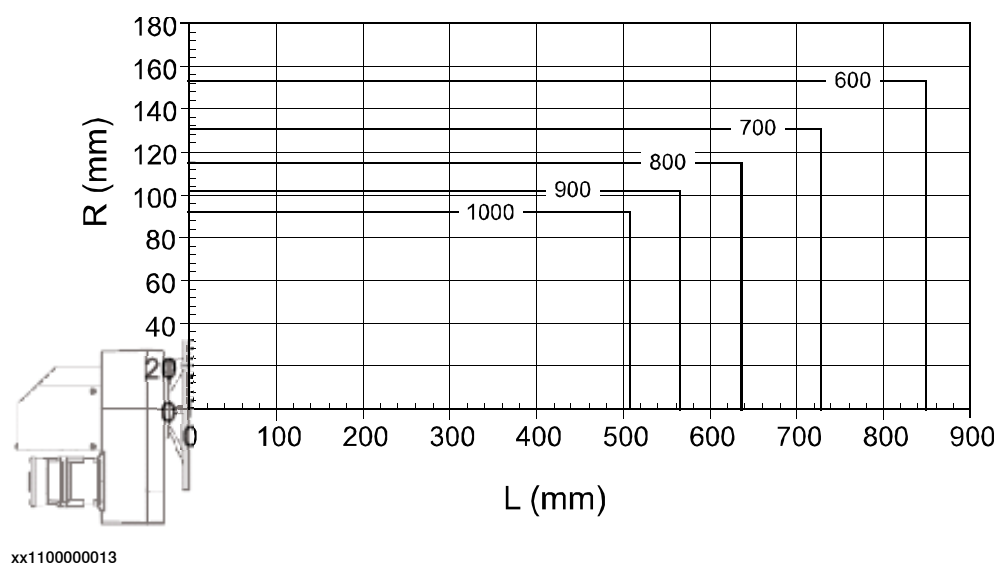
xx1100000011

*Continues on next page*

### MTD500



### MTD750



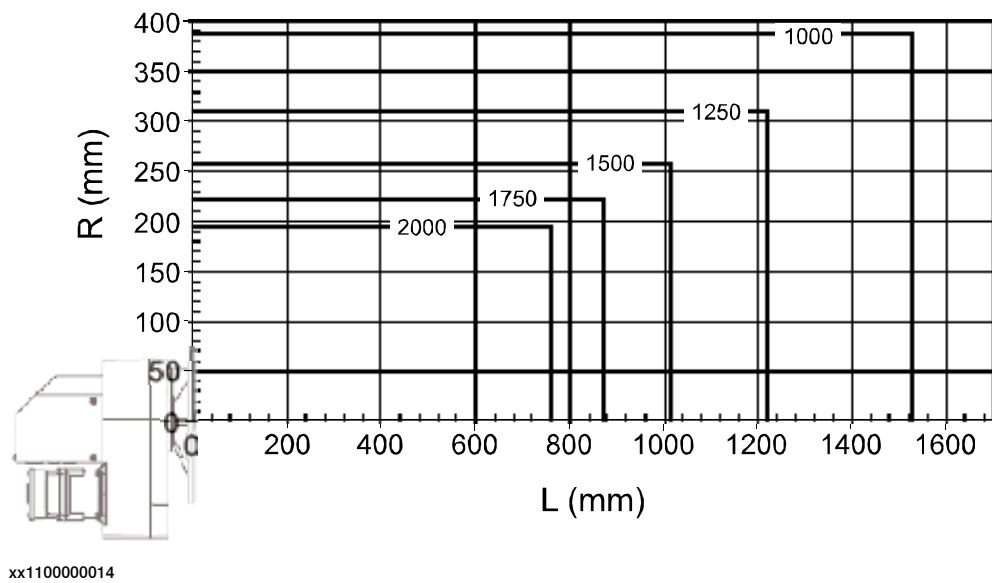
*Continues on next page*

# 1 Description

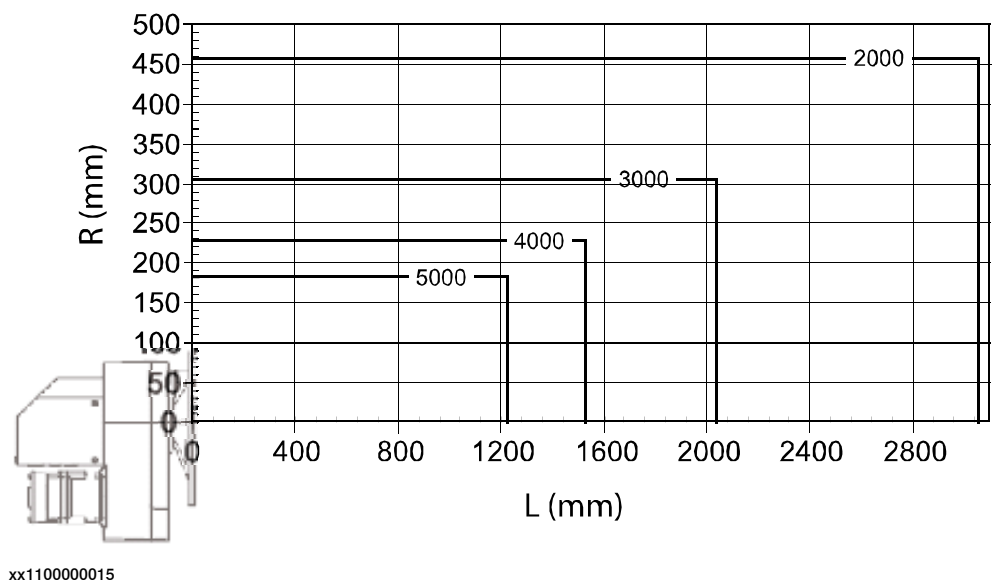
## 1.4.4 Load diagrams

Continued

### MTD2000

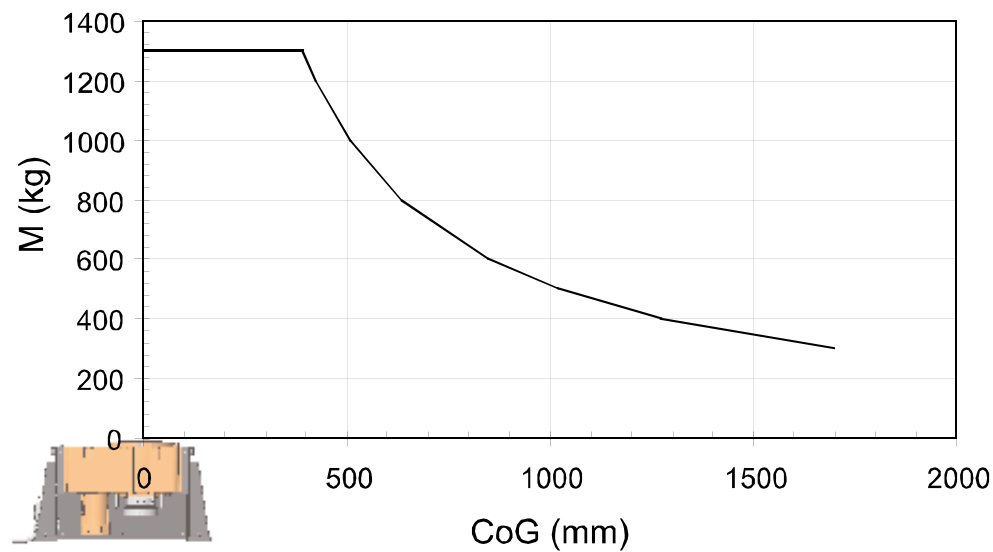


### MTD5000



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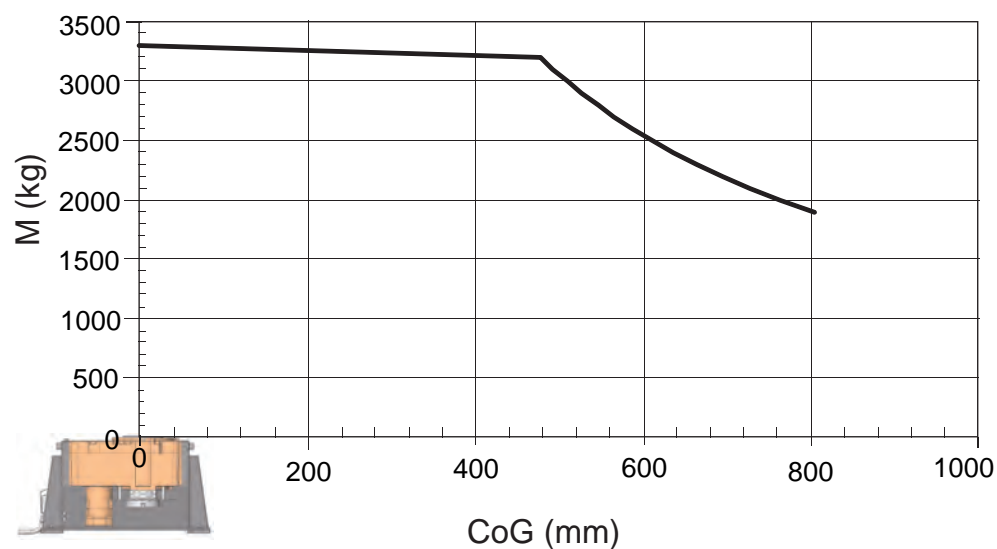
### MID500



xx1000001229

CoG	Center of gravity
-----	-------------------

### MID1000



xx1000001230

CoG	Center of gravity
-----	-------------------

## 1 Description

### 1.4.5 Dimensioning gear units

### 1.4.5 Dimensioning gear units

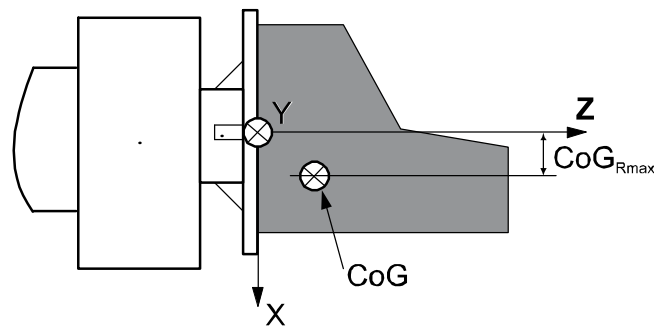
#### Acceleration and deceleration values

To secure that gear units will not run too hard and damage the gear box, the acceleration and deceleration of the axis on the arm side must be calculated.

This calculation will give a maximum value for the system parameters *Nominal Acceleration* and *Nominal Deceleration*. The value can be lowered if the acceleration is too fast, see *Application manual - Additional axes and stand alone controller*.

Do not use values higher than the recommended maximum acceleration, see [Maximum gearbox torques on page 56](#).

$$(T_{\max\text{gear}} - m * g * \text{CoG}_{\text{Rmax}}) / (m * \text{CoG}_{\text{Rmax}}^2 + J_{0z})$$



xx1100000104

$J_{0z}$  is the moment of inertia around the Z axis at the center of gravity (CoG).

$\text{CoG}_{\text{Rmax}}$  is the radial distance in X and Y directions between the Z axis and the center of gravity (CoG).

Define the system parameters *Nominal Acceleration* and *Nominal Deceleration* in the type *Acceleration Data* in the topic *Motion*, based on the calculations.

#### Maximum gearbox torques

Use the  $T_{\max\text{gear}}$  values from the table for the calculation.

Gear unit	$T_{\max\text{gear}}$ (max torque on arm side) (Nm)	Recommended maximum acceleration and deceleration (rad/s <sup>2</sup> )
MTD 250	480	4
MTD 500	1100	3
MTD 750	1950	3
MTD 2000	5000	0.8
MTD 5000	11400	0.5
MID 500	1950	2.4
MID 1000	5000	1.1

#### Related information

Dimensioning of motors is described in *Application manual - Additional axes and stand alone controller*.



## 1.5 SMB box

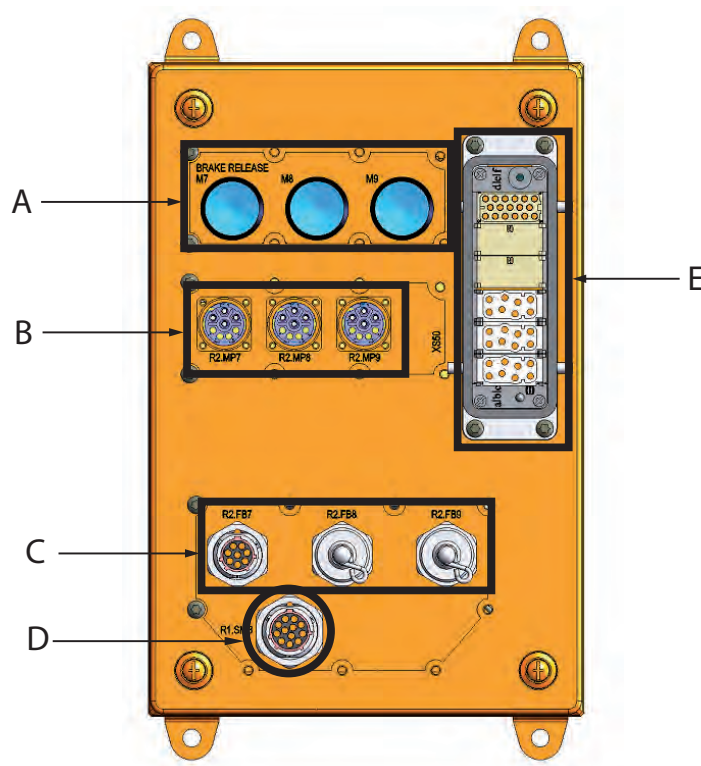
### Introduction

The SMB box allows the connection of three motor units and/or gear units to the IRC5 controller (drive module).

The SMB box can be located 7, 15, or 30 meters from the IRC5 cabinet. Motor units and gear units can be connected to the SMB box through flexible cables with lengths of 3, 7, or 15 meters. The SMB box can be equipped with three brake release buttons (option), one for each unit.

### SMB box

Below is a illustrations of the SMB box.



xx1000001204

Pos	Description
A	Brake release buttons (option)
B	Motor cables to motor units and/or gear units
C	Resolver cables to motor units and/or gear units
D	SMB cable from IRC5 controller
E	Motor cable from IRC5 controller

*Continues on next page*

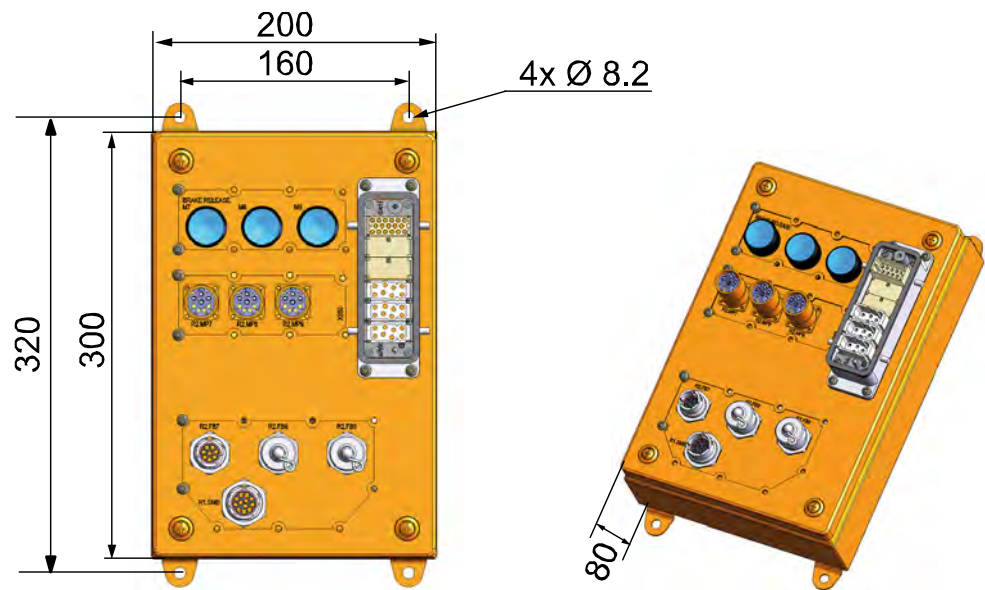
## 1 Description

### 1.5 SMB box

*Continued*

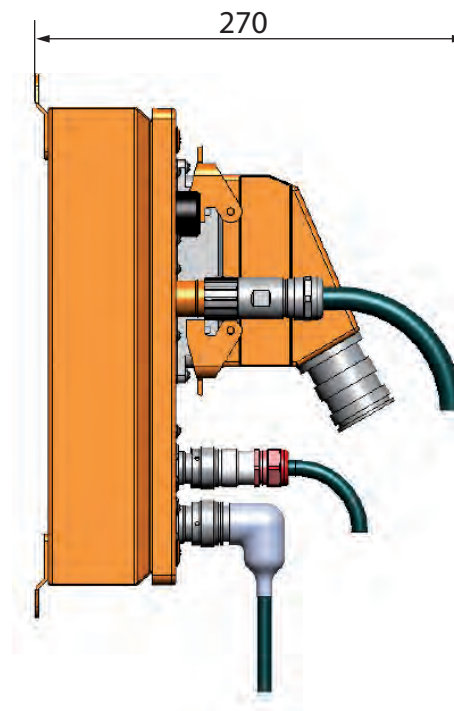
#### SMB box dimensions

The graphic below shows the dimensions of the SMB box.



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Minimum required space in front of the SMB box is shown below.



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## 1.6 Axis selector

---

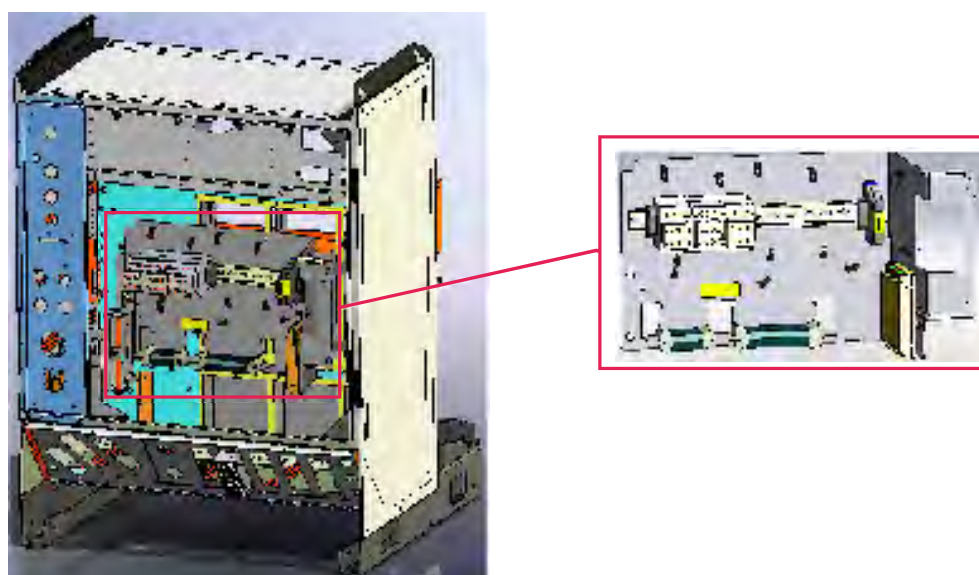
### Introduction

The axis selector is mounted inside the IRC5 controller and makes it possible to cut the power for selected connected external units. To obtain safety for personal to load/unload the work station, the signal *Supervision active relays* in the axis selector must be supervised by external safety equipment.

See the circuit diagram for motor units and gear units, for detailed information.  
See [References on page 7](#).

The function is controlled by instructions in the robot program.

The location of the axis selector, inside the IRC5 controller is shown below:



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# 1 Description

## 1.7 Cables

## 1.7 Cables

### Introduction

There are three types of cables:

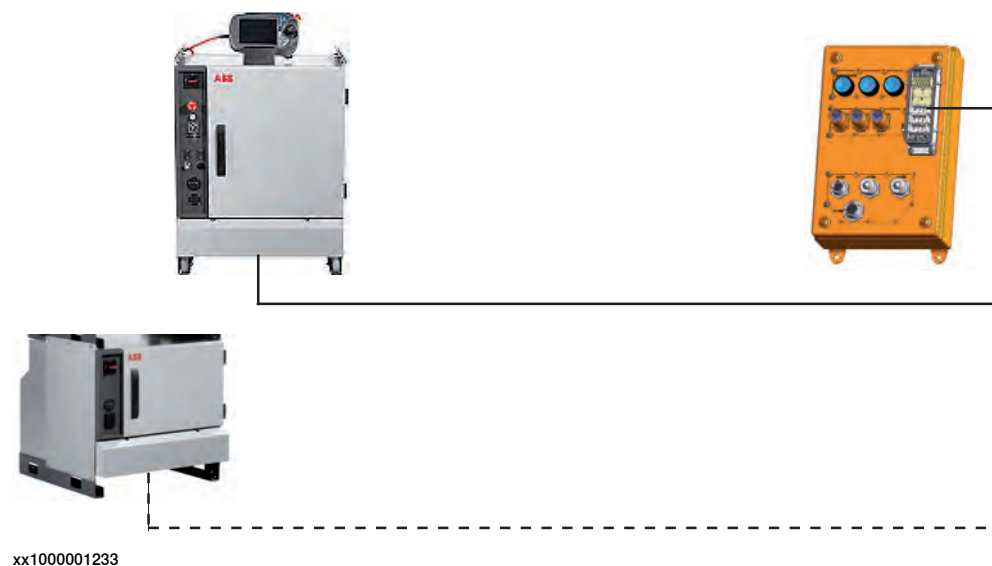
- motor
- SMB
- resolver

Cable	Name	Note
Motor cable	IRC5 - SMB box POW	7, 15 or 30 m, from IRC5 controller or IRC5 drive module to SMB box.
Motor cable	IRC5 - MU POW	7, 15 or 30 m, flex cable from IRC5 controller to motor unit.
Motor cable	SMB box - MU/GU POW	3, 7 or 15 m, flex cable from SMB box to motor unit or gear unit.
SMB cable	IRC5 - SMB box SIGN	3, 7 or 15, from IRC5 controller or IRC5 drive module to SMB box.
Resolver cable	SMB - MU/GU SIGN	3, 7 or 15, flex cable from SMB box to motor unit/gear unit or from IRB to motor unit.

Illustrations below shows the routing of the cables.

### IRC5 - SMB box POW

Option 1314-1 (7 m), 1315-1 (15 m), 1316-1 (30 m).



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## IRC5 - MU POW

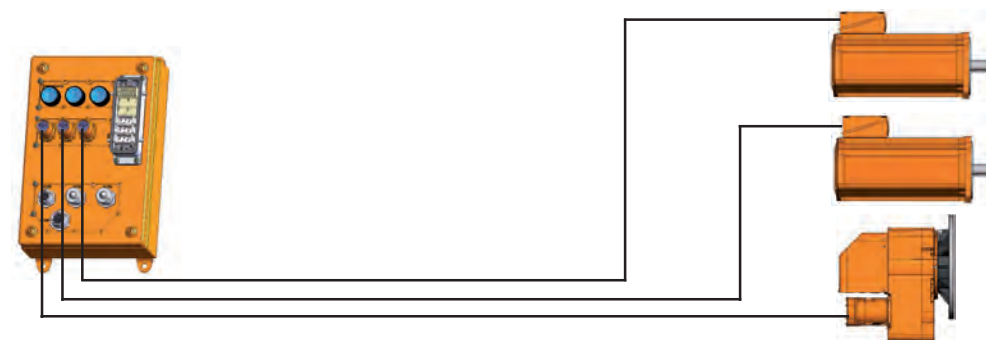
Option 1317-1 (7 m), -2 (15 m), -3 (30 m).



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## SMB box - MU/GU POW

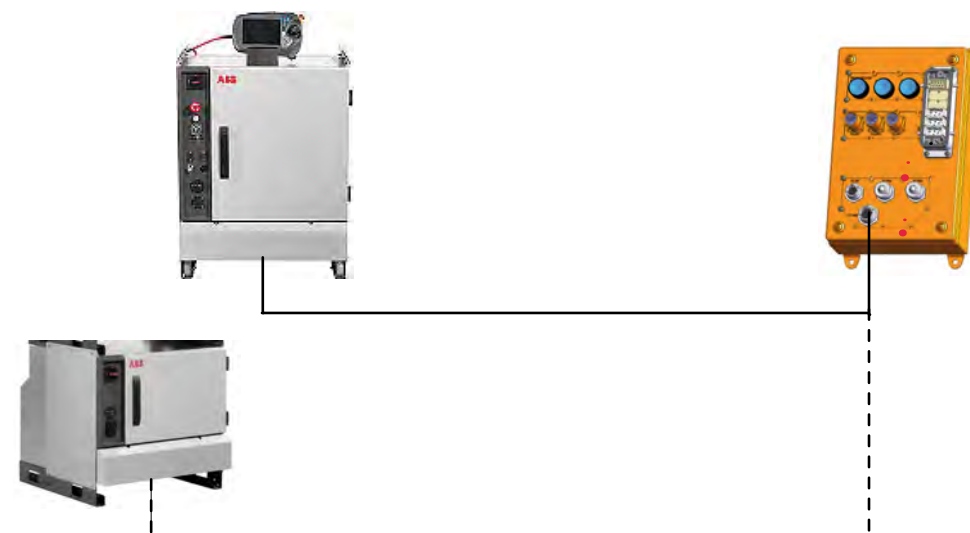
Option 1318-1 (3 m), 1319-1 (7 m), 1320-1 (15 m).



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## IRC5 - SMB box SIGN

Option 1321-1 (7 m), 1322-1 (15 m), 1323-1 (30 m).



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Continues on next page

## 1 Description

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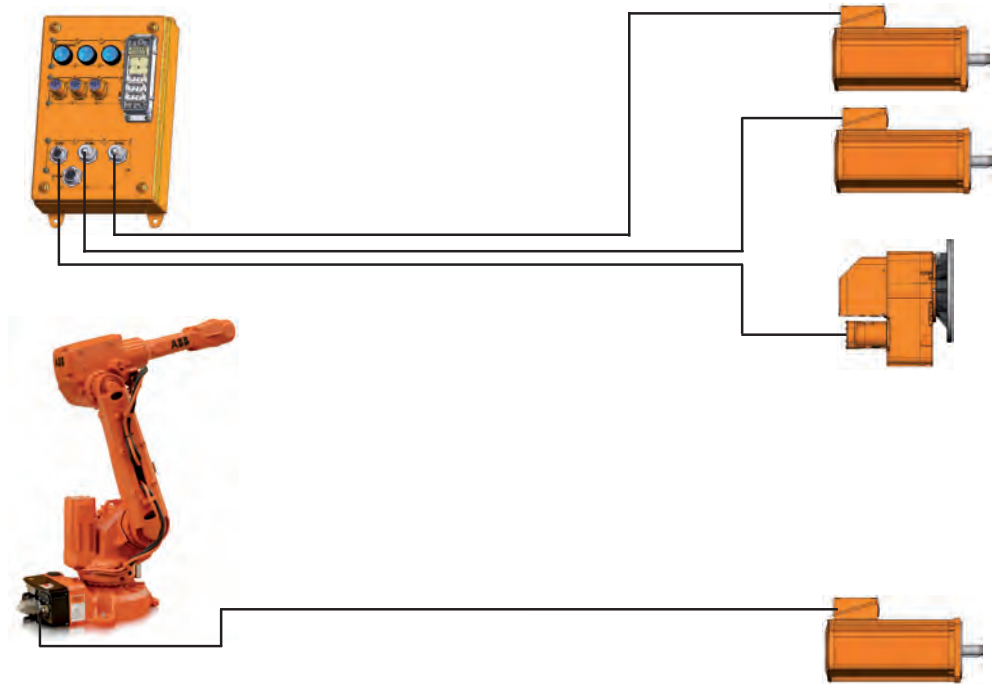
### 1.7 Cables

*Continued*

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#### SMB - MU/GU SIGN

Option 1324-1 (3 m), 1325-1 (7 m), 1326-1 (15 m).



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## 1.8 Applicable safety standards

### Standards, EN ISO

The robot system is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1	Robots for industrial environments - Safety requirements -Part 1 Robot
EN ISO 9787	Robots and robotic devices -- Coordinate systems and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1 <sup>i</sup>	Classification of air cleanliness
EN ISO 13732-1	Ergonomics of the thermal environment - Part 1
EN IEC 61000-6-4 (option 129-1)	EMC, Generic emission
EN IEC 61000-6-2	EMC, Generic immunity
EN IEC 60974-1 <sup>ii</sup>	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10 <sup>ii</sup>	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529	Degrees of protection provided by enclosures (IP code)

<sup>i</sup> Only robots with protection Clean Room.

<sup>ii</sup> Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

### European standards

Standard	Description
EN 614-1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design
EN 953	Safety of machinery - General requirements for the design and construction of fixed and movable guards

# 1 Description

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## 1.9.1 Installation

## 1.9 Installation

### 1.9.1 Installation

---

#### Introduction

Detailed information regarding mechanical installation can be found in *Product manual - Motor Units and Gear Units*.

The system parameter configuration files for the motor units and gear units are included on the RobotWare DVD included in the delivery. The files suit the most common combinations of drive and measuring systems. The parameters can be loaded either via:

- FlexPendant
- RobotStudio

Select suitable files depending on the location of the drive unit and then depending on the size of motor. The parameters are a basis for continued work. It is therefore necessary to configure either the name or the acceleration data, transmission (gear ratio), etc.



## 1.9.2 Operating requirements

### Protection standards

Product	Protection standard IEC60529
MU 100, MU 200, MU 300, MU 400	IP67
MTD 250, MTD 500, MTD 750, MTD 2000, MTD 5000	IP65
MID 500, MID 1000	IP42

### Explosive environments

The motor units and gear units must not be located or operated in an explosive environment.

### Ambient temperature

Description	Standard/Option	Temperature
Motor unit during operation	Standard	+ 5°C (41°F) to + 52°C (126°F)
Gear unit during operation	Standard	+ 5°C <sup>i</sup> (41°F) to + 52°C (126°F)
For short periods (not exceeding 24 hours)	Standard	up to + 70°C (158°F)

<sup>i</sup> At low environmental temperature < 10 degrees C is, as with any other machine, a warm-up phase recommended to be run with the unit. Otherwise there is a risk that the unit stops or run with lower performance due to temperature dependent oil and grease viscosity.

### Relative humidity

Description	Relative humidity
During transportation and storage	Max. 95% at constant temperature
During operation	Max. 95% at constant temperature

## 1 Description

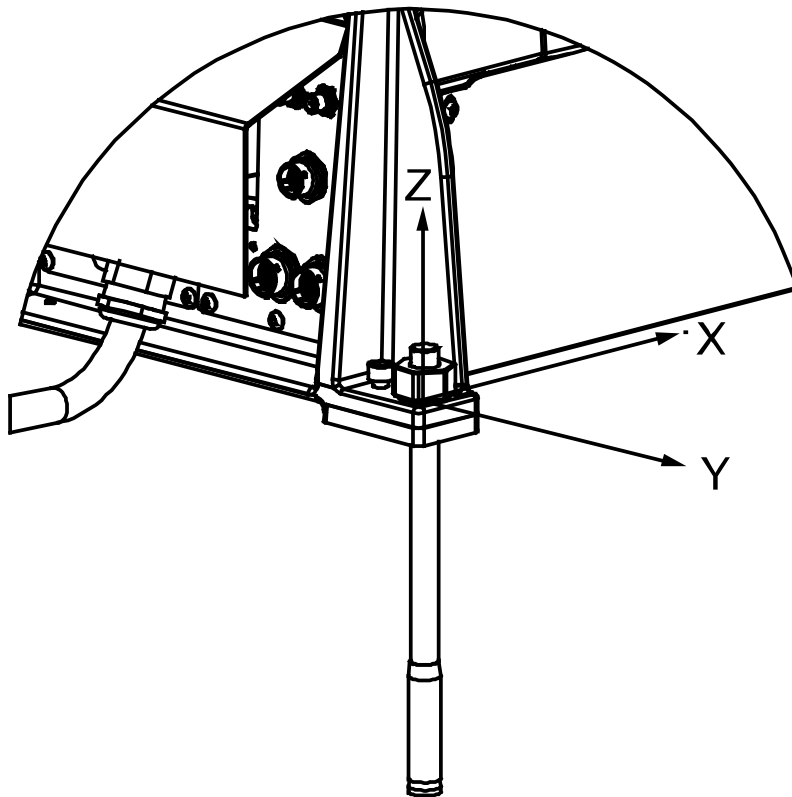
### 1.9.3 On site installation

### 1.9.3 On site installation

#### Forces for MID units

Maximum floor loads in relation to the base coordination system for the MID500 and MID1000 units and indicated per each screw of the base on the unit. See graphic below.

Type	Endurance load in operation (kN)		Max. load at emergency stop (kN)	
	Fxy	Fz (±)	Fxy	Fz (±)
MID500	1.5	6	3	8
MID1000	2.7	15	6.4	22.3



xx1000000764

#### Installation of MID units

It is important to ensure that the floor withstand the forces stated above for MID units.

	MID500	MID1000
Recommended screws	4 x M16	4 x M20
Class	8.8	8.8

*Continues on next page*

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**Installation of MTD units**

It is important to ensure that the frame carrying the MTD unit provides sufficient rigidity and strength to support the loads. For recommended min clamping thickness of frame see [Dimensional drawings on page 30](#).

	MTD250	MTD500	MTD750	MTD2000	MTD5000
Recommended screws	4 x M12	4 x M20	4 x M20	8 x M20	12 x M24
Class	12.9	12.9	12.9	12.9	12.9
Tightening torque (Nm) ±10%	120	550	550	550	950
Min. used threads of screw in the gearbox (mm)	> 29	> 47	> 47	> 50	> 37

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## 2 Variants and options

### 2.1 Introduction to variants and options

---

#### General

The different variants and options for the motor units and gear units are described in the following sections. The same option numbers are used here as in the specification form.

---

#### Related information

For the controller see *Product specification - Controller IRC5*.

For the software options see *Product specification - Controller software IRC5*.

## 2 Variants and options

### 2.2 Motor units and Gear units

### 2.2 Motor units and Gear units



#### Note

If the total quantity of motor units and gear units are more than 3 must a IRC5 drive module be ordered on the specification form for IRC5 controller, for HV, options 751-3, 751-5, and 751-6.

Assembly instructions are included in the cable kit for mounting in the IRC5 drive module. The article number for kit is 3HAC040089-001.

#### Motor units

Option	Description	Type
1300-1	(1-6) Choose quantity	MU 100
1301-1	(1-6) Choose quantity	MU 200
1302-1	(1-6) Choose quantity	MU 300
1303-1	(1-6) Choose quantity	MU 400

#### Gear units

Option	Description	Type
1304-1	(1-3) Choose quantity	MTD 250
1305-1	(1-3) Choose quantity	MTD 500
1306-1	(1-3) Choose quantity	MTD 750
1307-1	(1-3) Choose quantity	MTD 2000
1308-1	(1-3) Choose quantity	MTD 5000
1309-1	(1-3) Choose quantity	MID 500
1310-1	(1-3) Choose quantity	MID 1000

#### SMB box

SMB box to be connected between IRC5 controller/drive module and motor units/gear units, see [Scenarios on page 11](#) for different scenarios and [SMB box on page 57](#) for more detail information.



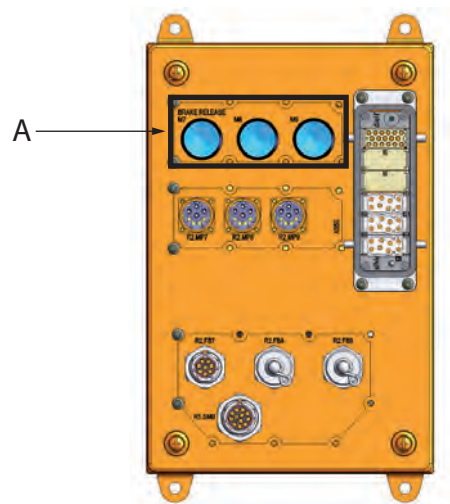
xx1000001217

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#### Brake release buttons

Brake release buttons on SMB box. Possible to select buttons on one or two boxes.

Option	Description	Note
1311-1	(1-2) Choose quantity	Requires: SMB box, option 1312-1. Brake release buttons on one or two SMB box(es)



xx1000001216

#### Axis selector MU/GU

To make it possible to cut power to connected units, for example for safe load/unloading. See [Axis selector on page 59](#).

Option	Description	Note
1313-1	Axis selector	

#### Harness, axis selector

Internal harness to axis selector. To be used when motors from other suppliers or existing ABB motors are to be used. See [Axis selector on page 59](#).

Option	Description	Note
1340-1	(1-2) Choose quantity	

#### Manipulator color

Option	Description	
209-1	ABB Orange Standard	
209-202	ABB Graphite White Standard	Standard color


*Continues on next page*

## 2 Variants and options

### 2.2 Motor units and Gear units

*Continued*

#### Warranty

Option	Type	Description
438-1	Standard warranty	Standard warranty is 12 months from <i>Customer Delivery Date</i> or latest 18 months after <i>Factory Shipment Date</i> , whichever occurs first. Warranty terms and conditions apply.
438-2	Standard warranty + 12 months	Standard warranty extended with 12 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-4	Standard warranty + 18 months	Standard warranty extended with 18 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-5	Standard warranty + 24 months	Standard warranty extended with 24 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-6	Standard warranty + 6 months	Standard warranty extended with 6 months from end date of the standard warranty. Warranty terms and conditions apply.
438-7	Standard warranty + 30 months	Standard warranty extended with 30 months from end date of the standard warranty. Warranty terms and conditions apply.
438-8	Stock warranty	<p>Maximum 6 months postponed start of standard warranty, starting from factory shipment date. Note that no claims will be accepted for warranties that occurred before the end of stock warranty. Standard warranty commences automatically after 6 months from <i>Factory Shipment Date</i> or from activation date of standard warranty in WebConfig.</p> <p> <b>Note</b></p> <p>Special conditions are applicable, see <i>Robotics Warranty Directives</i>.</p>



## 2.3 Cables

### Motor cables

From IRC5 controller or IRC5 drive module to SMB box, see [Cables on page 60](#).  
Maximum total number of selectable cables are 2.

Option	Description	Note
1314-1	(1-2) Choose quantity	IRC5 - SMB box POW 7 m
1315-1	(1-2) Choose quantity	IRC5 - SMB box POW 15 m
1316-1	(1-2) Choose quantity	IRC5 - SMB box POW 30 m

Flex cable from IRC5 controller to motor unit, see [Cables on page 60](#).

Option	Description	Note
1317-1	IRC5 - MU POW 7 m	Max. 1 Motor unit
1317-2	IRC5 - MU POW 15 m	Max. 1 Motor unit
1317-3	IRC5 - MU POW 30 m	Max. 1 Motor unit

Flex cable from SMB box to motor unit or gear unit, see [Cables on page 60](#).  
Maximum total number of selectable cables are 6.

Option	Description	Note
1318-1	(1-6) Choose quantity	SMB box - MU/GU POW 3 m
1319-1	(1-6) Choose quantity	SMB box - MU/GU POW 7 m
1320-1	(1-6) Choose quantity	SMB box - MU/GU POW 15 m

### SMB cables

From IRC5 controller or IRC5 drive module to SMB box, see [Cables on page 60](#).  
Maximum total number of selectable cables are 2.

Option	Description	Note
1321-1	(1-2) Choose quantity	IRC5 - SMB box SIGN 7 m
1322-1	(1-2) Choose quantity	IRC5 - SMB box SIGN 15 m
1323-1	(1-2) Choose quantity	IRC5 - SMB box SIGN 30 m

### Resolver cables

Flex cable from SMB box to motor unit or gear unit or from IRB to motor unit, see [Cables on page 60](#). Maximum total number of selectable cables are 6.

Option	Description	Note
1324-1	(1-6) Choose quantity	SMB - MU/GU SIGN 3 m
1325-1	(1-6) Choose quantity	SMB - MU/GU SIGN 7 m
1326-1	(1-6) Choose quantity	SMB - MU/GU SIGN 15 m

## 2 Variants and options

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### 2.4 Documentation

### 2.4 Documentation

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#### DVD User Documentation

The user documentation describes the manipulator system in detail, including service and safety instructions. All documents are available on the documentation DVD.

Option	Type	Description
808-1	Documentation on DVD	See <i>Product specification - Robot user documentation, IRC5 with RobotWare 5</i> . See <i>Product specification - Robot user documentation, IRC5 with RobotWare 6</i> .

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