

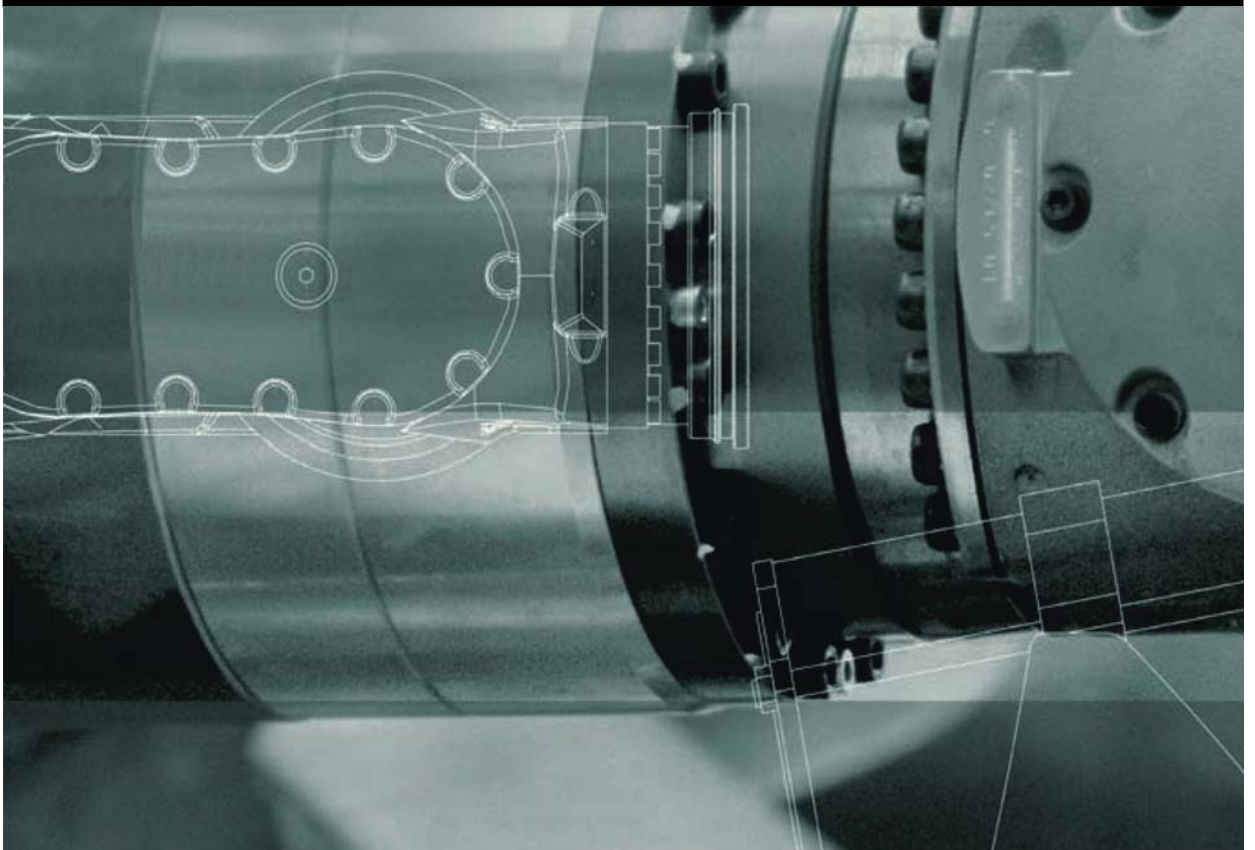


Robots

KUKA Roboter GmbH

KR 500 FORTEC

With F and C Variants
Specification



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Version: Spez KR 500 FORTEC V5



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Other functions not described in this documentation may be operable in the controller. The user has no claims to these functions, however, in the case of a replacement or service work.

We have checked the content of this documentation for conformity with the hardware and software described. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. The information in this documentation is checked on a regular basis, however, and necessary corrections will be incorporated in the subsequent edition.

Subject to technical alterations without an effect on the function.

Translation of the original documentation

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1 Introduction

1.1 Industrial robot documentation

The industrial robot documentation consists of the following parts:


- Documentation for the manipulator
- Documentation for the robot controller
- Operating and programming instructions for the System Software
- Instructions for options and accessories
- Parts catalog on storage medium


Each of these sets of instructions is a separate document.


1.2 Representation of warnings and notes


Safety


These warnings are relevant to safety and **must** be observed.

 **DANGER** These warnings mean that it is certain or highly probable that death or severe injuries **will** occur, if no precautions are taken.


 **WARNING** These warnings mean that death or severe injuries **may** occur, if no precautions are taken.

 **CAUTION** These warnings mean that minor injuries **may** occur, if no precautions are taken.

 **NOTICE** These warnings mean that damage to property **may** occur, if no precautions are taken.


 These warnings contain references to safety-relevant information or general safety measures.
These warnings do not refer to individual hazards or individual precautionary measures.

This warning draws attention to procedures which serve to prevent or remedy emergencies or malfunctions:

 **SAFETY INSTRUCTIONS** Procedures marked with this warning **must** be followed exactly.

Notices

These notices serve to make your work easier or contain references to further information.

 Tip to make your work easier or reference to further information.

1.3 Terms used

| Term | Description |
|-------------------|--|
| Axis range | Range of each axis, in degrees, within which it may move. The axis ranges are defined in the software and must not be changed. |
| Stopping distance | Stopping distance = reaction distance + braking distance The stopping distance is part of the danger zone. |
| Workspace | The robot is allowed to move within its workspace. The workspace is derived from the individual axis ranges. |
| Manipulator | The robot arm and the associated electrical installations |
| smartPAD | Teach pendant for the KR C4 The smartPAD has all the operator control and display functions required for operating and programming the manipulator. |

2 Purpose

2.1 Target group

This documentation is aimed at users with the following knowledge and skills:

- Advanced knowledge of mechanical engineering
- Advanced knowledge of electrical and electronic systems
- Knowledge of the robot controller system



For optimal use of our products, we recommend that our customers take part in a course of training at KUKA College. Information about the training program can be found at www.kuka.com or can be obtained directly from our subsidiaries.

2.2 Intended use

Use The industrial robot is intended for handling tools and fixtures, or for processing or transferring components or products. Use is only permitted under the specified environmental conditions.

Misuse Any use or application deviating from the intended use is deemed to be misuse and is not allowed. This includes e.g.:

- Transportation of persons and animals
- Use as a climbing aid
- Operation outside the permissible operating parameters
- Use in potentially explosive environments
- Use in underground mining

NOTICE

Changing the structure of the manipulator, e.g. by drilling holes, etc., can result in damage to the components. This is considered improper use and leads to loss of guarantee and liability entitlements.

NOTICE

Deviations from the operating conditions specified in the technical data or the use of special functions or applications can lead to premature wear. KUKA Roboter GmbH must be consulted.



The robot system is an integral part of a complete system and may only be operated in a CE-compliant system.

3 Product description

3.1 Overview of the robot system

The robot system consists of the following components:

- Robot
- Robot controller
- smartPAD teach pendant
- Connecting cables
- Software
- Options, accessories

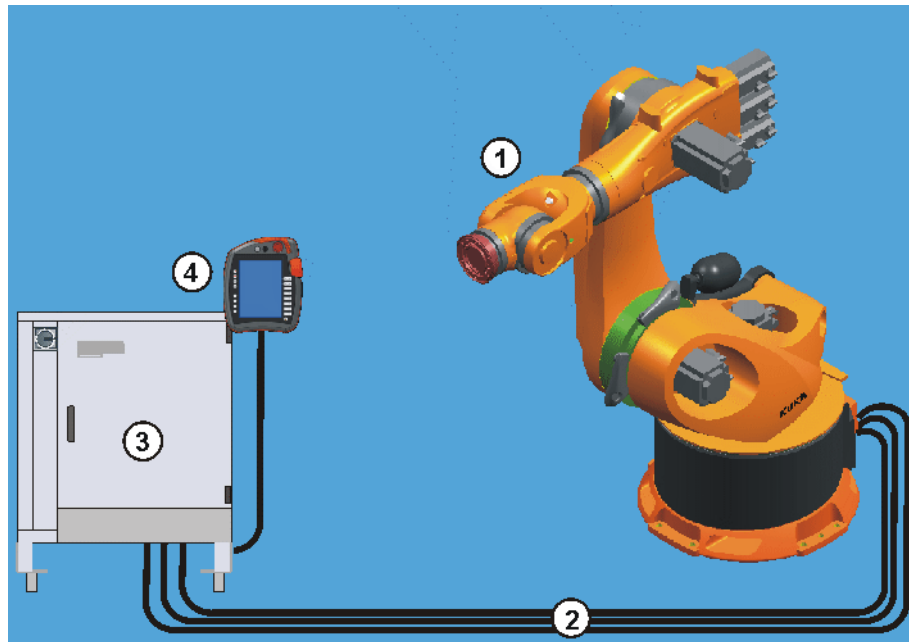


Fig. 3-1: Example of a robot system

- | | | | |
|---|-------------------|---|------------------------|
| 1 | Robot | 3 | Robot controller |
| 2 | Connecting cables | 4 | smartPAD teach pendant |

3.2 Description of the robot

Overview

The robot is designed as a 6-axis jointed-arm kinematic system. The structural components of the robot are made of light alloy and iron castings. The axes are driven by AC servomotors. A hydropneumatic counterbalancing system is used to equalize the load moment about axis 2.

The robot consists of the following principal components:

- In-line wrist
- Arm
- Link arm
- Rotating column
- Base frame
- Counterbalancing system
- Electrical installations

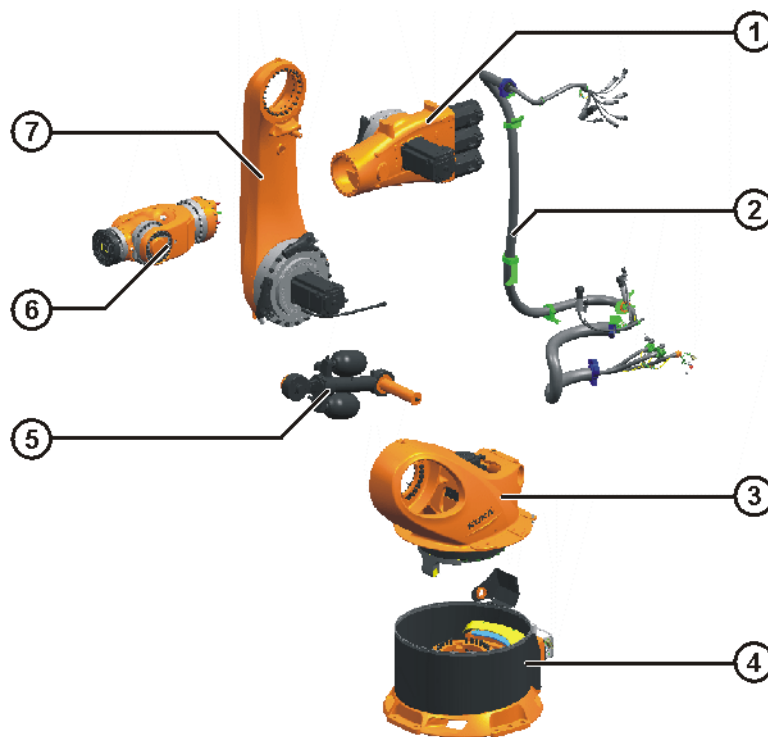


Fig. 3-2: Principal components

- | | | | |
|---|--------------------------|---|-------------------------|
| 1 | Arm | 5 | Counterbalancing system |
| 2 | Electrical installations | 6 | In-line wrist |
| 3 | Rotating column | 7 | Link arm |
| 4 | Base frame | | |

In-line wrist

The robot is fitted with a 3-axis in-line wrist for a rated payload of 360 kg. The in-line wrist comprises axes 4, 5 and 6. It is driven by three AC servomotors installed at the rear end of the arm via drive shafts. The motor unit consists of brushless AC servomotors with a permanent-magnet single-disk brake and hollow-shaft resolver, both integrated. The permanent-magnet single-disk brakes perform a holding function when the servomotor is at rest and contribute to the braking of the respective axis in the event of short-circuit braking (e.g. if one or more of the enabling switches is released while in Test mode). Short-circuit braking must not be used to stop the robot under normal circumstances. The gear units of the in-line wrist are supplied with oil from three separate oil chambers.

If the permissible turning range of a wrist axis is exceeded, the robot is switched off by means of software limit switches. The turning range of A5 is mechanically limited by end stops.

The in-line wrist forms an exchangeable unit with a standardized mechanical interface to the arm.

The assembly also has a gauge mount with a gauge cartridge, through which the mechanical zero of the axis can be determined by means of an electronic probe (accessory) and transferred to the controller.

The in-line wrist variant "F" is available for operating conditions involving greater mechanical and thermal stress.

Arm

The arm is the link between the in-line wrist and the link arm. It houses the motors of the wrist axes A4, A5 and A6, as well as motor A3. The arm is driven by an AC servomotor via a gear unit that is installed between the arm and the link arm. The maximum permissible swivel range is limited by mechanical limit

stops with a buffer function in the positive and negative directions in addition to the software limit switches.

The arm variant “F” is available for operating conditions involving greater mechanical and thermal stress. The arms of the F variants are pressurized to prevent penetration of moisture and dust.

| | |
|---------------------------------|--|
| Link arm | The link arm is the assembly located between the arm and the rotating column. It is mounted on one side of the rotating column via a gear unit. The motor unit consists of a brushless AC servomotor with a permanent-magnet single-disk brake and hollow-shaft resolver, both integrated. The permanent-magnet single-disk brake performs a holding function when the servomotor is at rest and contributes to the braking of the respective axis in the event of short-circuit braking (e.g. if one or more of the enabling switches is released while in Test mode). Short-circuit braking must not be used to stop the robot under normal circumstances. During motion about axis 2, the link arm moves about the stationary rotating column. The usable software swivel range is limited by mechanical limit stops with a buffer function in the positive and negative directions in addition to the software limit switches. |
| Rotating column | The rotating column houses the motors of axes 1 and 2. The rotational motion of axis 1 is performed by the rotating column. It is screwed to the base frame via the gear unit of axis 1. Inside the rotating column is a brushless AC servomotor with a permanent-magnet single-disk brake and hollow-shaft resolver, both integrated, for driving axis 1. The permanent-magnet single-disk brake performs a holding function when the servomotor is at rest and contributes to the braking of the respective axis in the event of short-circuit braking (e.g. if one or more of the enabling switches is released while in Test mode). Short-circuit braking must not be used to stop the robot under normal circumstances. The counterbearing for the counterbalancing system is integrated into the rear of the rotating column housing. |
| Base frame | The base frame is the base of the robot. It is screwed to the mounting base. The interfaces for the electrical installations and the energy supply systems (accessory) are housed in the base frame. The base frame and rotating column are connected via the gear unit of axis 1. The flexible tube for the electrical installations and the energy supply system is accommodated in the base frame. |
| Counterbalancing system | The counterbalancing system is an assembly installed between the rotating column and the link arm. This assembly minimizes the torques generated about axis 2 when the robot is moving or stationary. A closed, hydropneumatic system is used. The system consists of two accumulators, a hydraulic cylinder with associated hoses, a pressure gauge and a bursting disc as a safety element to protect against overload. The accumulators correspond to category III, fluid group 2, of the Pressure Equipment Directive. Different variants of the counterbalancing system are used for floor and ceiling-mounted robots and for the F variants. The mode of operation is reversed for ceiling-mounted robots, i.e. the piston rod pushes against the link arm. |
| Electrical installations | The electrical installations include all the supply and control cables for the motors of axes 1 to 6. All the connections on the motors are screwed plug-and-socket connections. The assembly consists of the cable set, the multi-function housing (MFH) and the RDC box. The interface for the connecting cables is located at the back of the base frame. The motor and control cables are connected here via plug-in connections. The control and motor cables are routed from the RDC box and the multi-function housing to the motors (XM and XP connectors). |
| Options | The robot can be fitted and operated with various options, e.g. working range limitation. The options are described in separate documentation. |

4 Technical data

4.1 Technical data, overview

The technical data for the individual robot types can be found in the following sections:

| Robot | Technical data |
|------------------|--|
| KR 500 R2830 | <ul style="list-style-type: none"> ■ Technical data (>>> 4.2 "Technical data, KR 500 R2830" Page 16) ■ Supplementary loads (>>> 4.10 "Supplementary load" Page 68) ■ Plates and labels (>>> 4.11 "Plates and labels" Page 69) ■ Stopping distances and times (>>> 4.12.3 "Stopping distances and times, KR 500 R2830 (with F and C variants)" Page 74) |
| KR 500 R2830 F | <ul style="list-style-type: none"> ■ Technical data (>>> 4.3 "Technical data, KR 500 R2830 F" Page 23) ■ Supplementary loads (>>> 4.10 "Supplementary load" Page 68) ■ Plates and labels (>>> 4.11 "Plates and labels" Page 69) ■ Stopping distances and times (>>> 4.12.3 "Stopping distances and times, KR 500 R2830 (with F and C variants)" Page 74) |
| KR 500 R2830 C | <ul style="list-style-type: none"> ■ Technical data (>>> 4.4 "Technical data, KR 500 R2830 C" Page 29) ■ Supplementary loads (>>> 4.10 "Supplementary load" Page 68) ■ Plates and labels (>>> 4.11 "Plates and labels" Page 69) ■ Stopping distances and times (>>> 4.12.3 "Stopping distances and times, KR 500 R2830 (with F and C variants)" Page 74) |
| KR 500 R2830 C-F | <ul style="list-style-type: none"> ■ Technical data (>>> 4.5 "Technical data, KR 500 R2830 C-F" Page 36) ■ Supplementary loads (>>> 4.10 "Supplementary load" Page 68) ■ Plates and labels (>>> 4.11 "Plates and labels" Page 69) ■ Stopping distances and times (>>> 4.12.3 "Stopping distances and times, KR 500 R2830 (with F and C variants)" Page 74) |

| Robot | Technical data |
|----------------|---|
| KR 420 R3080 | <ul style="list-style-type: none"> ■ Technical data (>>> 4.6 "Technical data, KR 420 R3080" Page 43) ■ Supplementary loads (>>> 4.10 "Supplementary load" Page 68) ■ Plates and labels (>>> 4.11 "Plates and labels" Page 69) ■ Stopping distances and times (>>> 4.12.4 "Stopping distances and times, KR 420 R3080 (with F variant)" Page 79) |
| KR 420 R3080 F | <ul style="list-style-type: none"> ■ Technical data (>>> 4.7 "Technical data, KR 420 R3080 F" Page 49) ■ Supplementary loads (>>> 4.10 "Supplementary load" Page 68) ■ Plates and labels (>>> 4.11 "Plates and labels" Page 69) ■ Stopping distances and times (>>> 4.12.4 "Stopping distances and times, KR 420 R3080 (with F variant)" Page 79) |
| KR 340 R3330 | <ul style="list-style-type: none"> ■ Technical data (>>> 4.8 "Technical data, KR 340 R3330" Page 56) ■ Supplementary loads (>>> 4.10 "Supplementary load" Page 68) ■ Plates and labels (>>> 4.11 "Plates and labels" Page 69) ■ Stopping distances and times (>>> 4.12.5 "Stopping distances and times, KR 340 R3330 (with F variant)" Page 84) |
| KR 340 R3330 F | <ul style="list-style-type: none"> ■ Technical data (>>> 4.9 "Technical data, KR 340 R3330 F" Page 62) ■ Supplementary loads (>>> 4.10 "Supplementary load" Page 68) ■ Plates and labels (>>> 4.11 "Plates and labels" Page 69) ■ Stopping distances and times (>>> 4.12.5 "Stopping distances and times, KR 340 R3330 (with F variant)" Page 84) |

4.2 Technical data, KR 500 R2830

4.2.1 Basic data, KR 500 R2830

Basic data

| | KR 500 R2830 |
|-------------------------------|-------------------|
| Number of axes | 6 |
| Number of controlled axes | 6 |
| Volume of working envelope | 68 m ³ |
| Pose repeatability (ISO 9283) | ± 0.08 mm |
| Weight | approx. 2385 kg |
| Rated payload | 500 kg |

| | KR 500 R2830 |
|----------------------------------|---|
| Maximum reach | 2826 mm |
| Protection rating | IP65 |
| Protection rating, in-line wrist | IP65 |
| Sound level | < 75 dB (A) |
| Mounting position | Floor |
| Footprint | 1050 mm x 1050 mm |
| Permissible angle of inclination | ≤ 5 ° |
| Default color | Base frame: black (RAL 9005); Moving parts: KUKA orange 2567 |
| Controller | KR C4 |
| Transformation name | KR C4: KR500R2830 C4 FLR |

Ambient conditions

| | |
|---|----------------------------------|
| Humidity class (EN 60204) | - |
| Classification of environmental conditions (EN 60721-3-3) | 3K3 |
| Ambient temperature | |
| During operation | 10 °C to 55 °C (283 K to 328 K) |
| During storage/transportation | -40 °C to 60 °C (233 K to 333 K) |



For operation at low temperatures, it may be necessary to warm up the robot.

Connecting cables

| Cable designation | Connector designation | Interface with robot |
|---|-----------------------------|---------------------------------|
| Motor cable | X20.1 - X30.1 | Harting connectors at both ends |
| Motor cable | X20.4 - X30.4 | Harting connectors at both ends |
| Control cable | X21 - X31 | HAN 3A EMC at both ends |
| Ground conductor / equipotential bonding 16 mm ² (optional) | | M8 ring cable lug at both ends |
| Cable lengths | | |
| Standard | 7 m, 15 m, 25 m, 35 m, 50 m | |

For detailed specifications of the connecting cables, see "Description of the connecting cables".

4.2.2 Axis data, KR 500 R2830

Axis data

| Range of motion | |
|--------------------------|----------------|
| A1 | ±185 ° |
| A2 | -130 ° / 20 ° |
| A3 | -100 ° / 144 ° |
| A4 | ±350 ° |
| A5 | ±120 ° |
| A6 | ±350 ° |
| Speed with rated payload | |

| | |
|----|---------|
| A1 | 90 °/s |
| A2 | 80 °/s |
| A3 | 75 °/s |
| A4 | 90 °/s |
| A5 | 83 °/s |
| A6 | 130 °/s |

The direction of motion and the arrangement of the individual axes may be noted from the diagram (>>> Fig. 4-1).

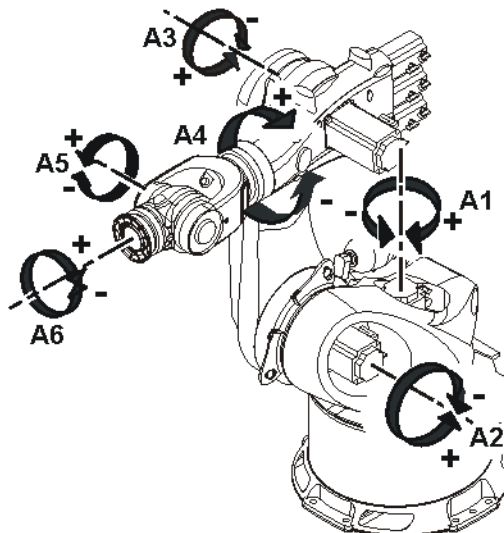


Fig. 4-1: Direction of rotation of robot axes

Mastering position

| Mastering position | |
|--------------------|-------|
| A1 | 0 ° |
| A2 | -90 ° |
| A3 | 90 ° |
| A4 | 0 ° |
| A5 | 0 ° |
| A6 | 0 ° |

Working envelope

The diagrams (>>> Fig. 4-2) and (>>> Fig. 4-3) show the load center of gravity, shape and size of the working envelope.

The reference point for the working envelope is the intersection of axis 4 with axis 5.

Dimensions: mm

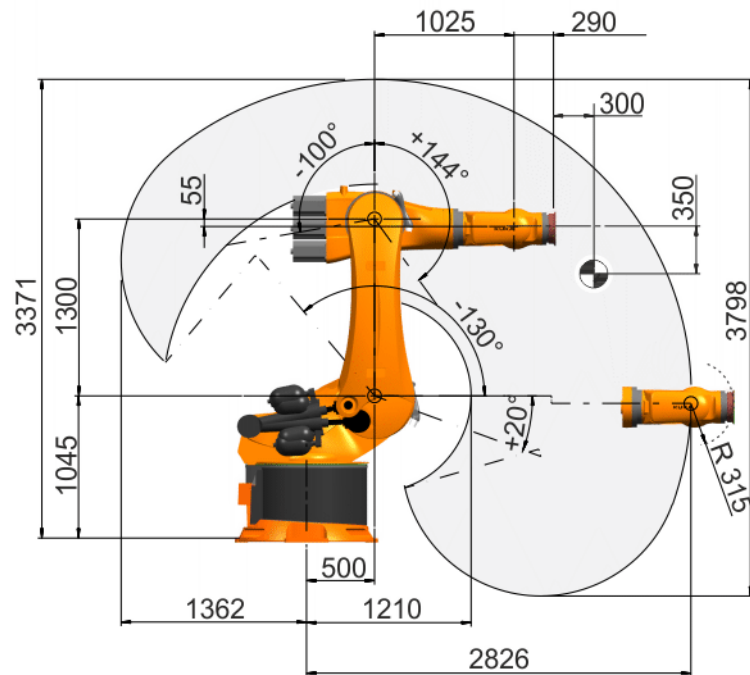


Fig. 4-2: KR 500 R2830 working envelope (with F variant), side view

Dimensions: mm

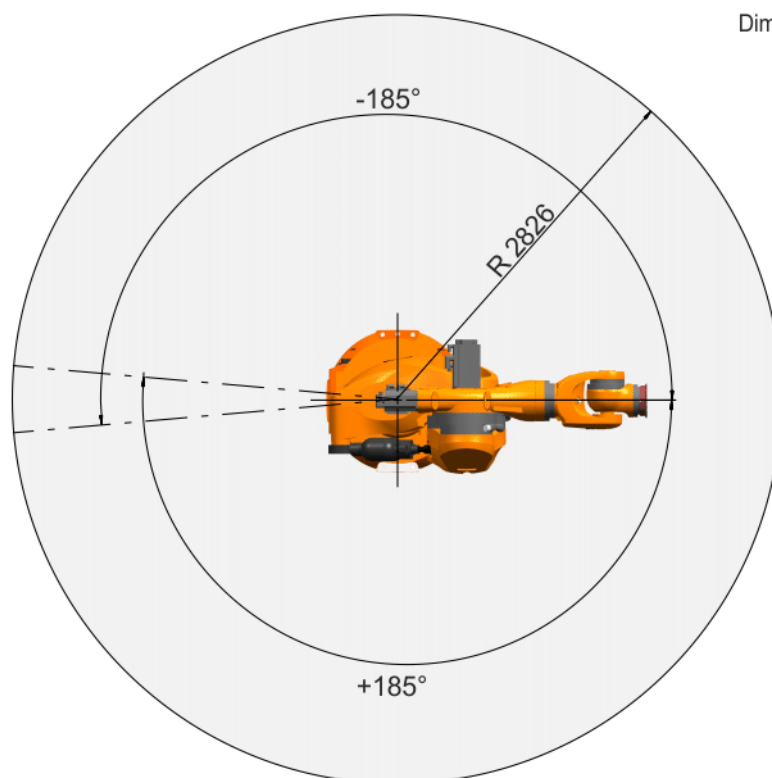


Fig. 4-3: KR 500 R2830 working envelope (with F variant), top view

4.2.3 Payloads, KR 500 R2830

Payloads

| | |
|------------------------------|----------------------|
| Rated payload | 500 kg |
| Rated mass moment of inertia | 250 kgm ² |
| Rated total load | 550 kg |

| | |
|---|--------|
| Rated supplementary load, base frame | 0 kg |
| Maximum supplementary load, base frame | 0 kg |
| Rated supplementary load, rotating column | 0 kg |
| Maximum supplementary load, rotating column | 400 kg |
| Rated supplementary load, link arm | 0 kg |
| Maximum supplementary load, link arm | 100 kg |
| Rated supplementary load, arm | 50 kg |
| Maximum supplementary load, arm | 100 kg |
| Nominal distance to load center of gravity | |
| Lxy | 350 mm |
| Lz | 300 mm |

Load center of gravity

For all payloads, the load center of gravity refers to the distance from the face of the mounting flange on axis 6. Refer to the payload diagram for the nominal distance.

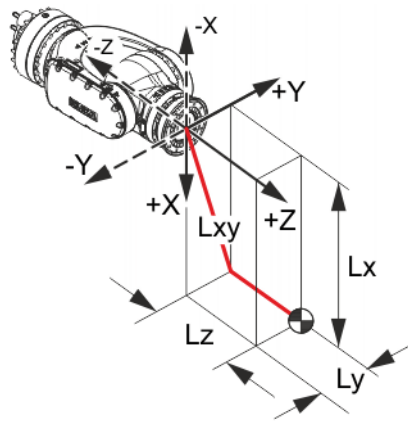


Fig. 4-4: Load center of gravity

Payload diagram

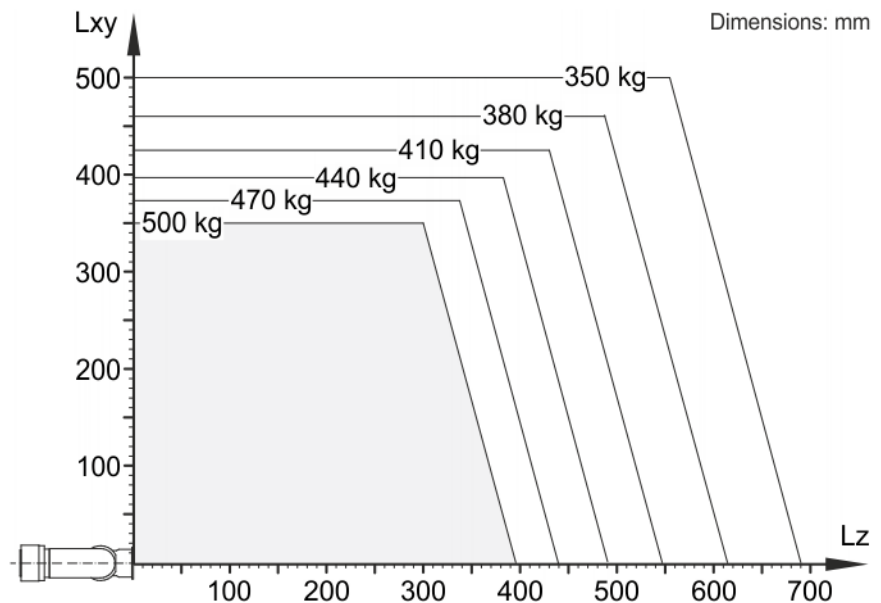


Fig. 4-5: KR 500 FORTEC payload diagram, payload 500 kg

NOTICE

This loading curve corresponds to the maximum load capacity. Both values (payload and mass moment of inertia) must be checked in all cases. Exceeding this capacity will reduce the service life of the robot and overload the motors and the gears; in any such case the KUKA Roboter GmbH must be consulted beforehand.

The values determined here are necessary for planning the robot application. For commissioning the robot, additional input data are required in accordance with the operating and programming instructions of the KUKA System Software.

The mass inertia must be verified using KUKA.Load. It is imperative for the load data to be entered in the robot controller!

In-line wrist

| | |
|--------------------|-----------------------|
| In-line wrist type | ZH500-4 |
| Mounting flange | ISO 9409-1-200-11-M12 |

Mounting flange

| | |
|---------------------|------------------------|
| Screw grade | 12.9 |
| Screw size | M12 |
| Clamping length | 1.5 x nominal diameter |
| Depth of engagement | min. 14 mm, max. 18 mm |
| Locating element | 12 ^{H7} |

The mounting flange is depicted with axis 6 in the zero position (>>> Fig. 4-6) The symbol X_m indicates the position of the locating element (bushing) in the zero position.

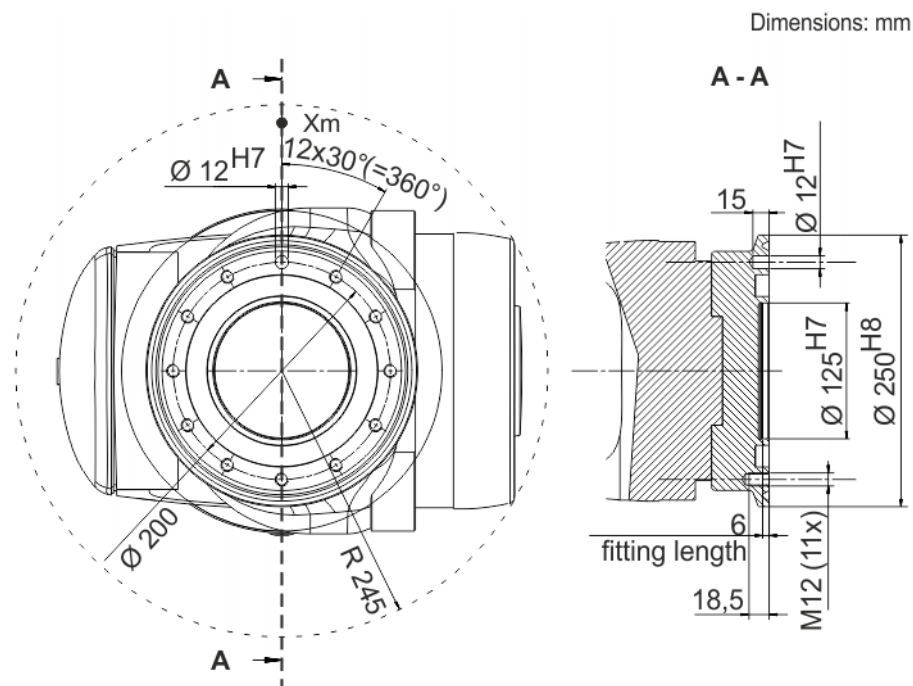


Fig. 4-6: Mounting flange

4.2.4 Loads acting on the foundation, KR 500 R2830

Mounting base loads

The specified forces and moments already include the payload and the inertia force (weight) of the robot.

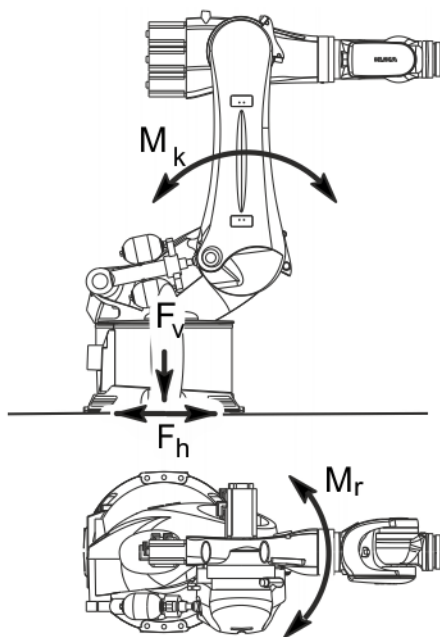


Fig. 4-7: Loads acting on the foundation, floor mounting

| | |
|----------------------------|----------|
| Vertical force $F(v)$ | |
| $F(v)$ normal | 37000 N |
| $F(v)$ max | 40500 N |
| Horizontal force $F(h)$ | |
| $F(h)$ normal | 15900 N |
| $F(h)$ max | 23500 N |
| Tilting moment $M(k)$ | |
| $M(k)$ normal | 58900 Nm |
| $M(k)$ max | 84500 Nm |
| Torque about axis 1 $M(r)$ | |
| $M(r)$ normal | 18500 Nm |
| $M(r)$ max | 45500 Nm |

⚠ WARNING

Normal loads and maximum loads for the foundations are specified in the table.

The maximum loads must be referred to when dimensioning the foundations and must be adhered to for safety reasons. Failure to observe this can result in personal injury and damage to property.

The normal loads are average expected foundation loads. The actual loads are dependent on the program and on the robot loads and may therefore be greater or less than the normal loads.

The supplementary loads (A1 and A2) are not taken into consideration in the calculation of the mounting base load. These supplementary loads must be taken into consideration for F_v .

4.3 Technical data, KR 500 R2830 F


4.3.1 Basic data, KR 500 R2830 F

Basic data

| | KR 500 R2830 F |
|----------------------------------|---|
| Number of axes | 6 |
| Number of controlled axes | 6 |
| Volume of working envelope | 68 m ³ |
| Pose repeatability (ISO 9283) | ± 0.08 mm |
| Weight | approx. 2385 kg |
| Rated payload | 500 kg |
| Maximum reach | 2826 mm |
| Protection rating | IP65 |
| Protection rating, in-line wrist | IP67 |
| Sound level | < 75 dB (A) |
| Mounting position | Floor |
| Footprint | 1050 mm x 1050 mm |
| Permissible angle of inclination | ≤ 5 ° |
| Default color | Base frame: black (RAL 9005); Moving parts: KUKA orange 2567 |
| Controller | KR C4 |
| Transformation name | KR C4: KR500R2830 C4 FLR |

Ambient conditions

| | |
|---|----------------------------------|
| Humidity class (EN 60204) | - |
| Classification of environmental conditions (EN 60721-3-3) | 3K3 |
| Ambient temperature | |
| During operation | 10 °C to 55 °C (283 K to 328 K) |
| During storage/transportation | -40 °C to 60 °C (233 K to 333 K) |

 For operation at low temperatures, it may be necessary to warm up the robot.

Foundry robots

| | |
|-------------------------------|---|
| Overpressure in the arm | 0.01 MPa (0.1 bar) |
| Compressed air | Free of oil and water |
| Compressed air supply line | Air line in the cable set |
| Air consumption | 0.1 m ³ /h |
| Air line connection | Quick Star push-in fitting for hose PUN-6x1, blue |
| Pressure regulator connection | R 1/8", internal thread |
| Input pressure | 0.1 - 1.2 MPa (1 - 12 bar) |
| Pressure regulator | 0.005 - 0.07 MPa (0.05 - 0.7 bar) |
| Manometer range | 0.0 - 0.1 MPa (0.0 - 1.0 bar) |
| Filter gauge | 25 - 30 µm |
| Thermal loading | 10 s/min at 353 K (180 °C) |
| Resistance | Increased resistance to dust, lubricants, coolants and water vapor. |

| | |
|-----------------------------------|--|
| Special paint finish on wrist | Heat-resistant and heat-reflecting silver paint finish on the in-line wrist. |
| Special paint finish on the robot | Special paint finish on the entire robot, and an additional protective clear coat. |
| Other ambient conditions | KUKA Roboter GmbH must be consulted if the robot is to be used under other ambient conditions. |

Connecting cables

| Cable designation | Connector designation | Interface with robot |
|---|-----------------------|---------------------------------|
| Motor cable | X20.1 - X30.1 | Harting connectors at both ends |
| Motor cable | X20.4 - X30.4 | Harting connectors at both ends |
| Control cable | X21 - X31 | HAN 3A EMC at both ends |
| Ground conductor / equipotential bonding 16 mm ² (optional) | | M8 ring cable lug at both ends |

| | |
|---------------|-----------------------------|
| Cable lengths | |
| Standard | 7 m, 15 m, 25 m, 35 m, 50 m |

For detailed specifications of the connecting cables, see “Description of the connecting cables”.

4.3.2 Axis data, KR 500 R2830 F

Axis data

| Range of motion | |
|--------------------------|----------------|
| A1 | ±185 ° |
| A2 | -130 ° / 20 ° |
| A3 | -100 ° / 144 ° |
| A4 | ±350 ° |
| A5 | ±120 ° |
| A6 | ±350 ° |
| Speed with rated payload | |
| A1 | 90 °/s |
| A2 | 80 °/s |
| A3 | 75 °/s |
| A4 | 90 °/s |
| A5 | 83 °/s |
| A6 | 130 °/s |

The direction of motion and the arrangement of the individual axes may be noted from the diagram (>>> Fig. 4-8).

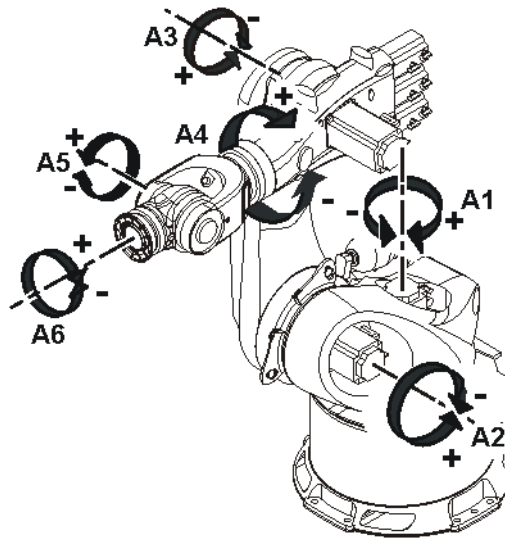


Fig. 4-8: Direction of rotation of robot axes

Mastering position

| Mastering position | |
|--------------------|-------|
| A1 | 0 ° |
| A2 | -90 ° |
| A3 | 90 ° |
| A4 | 0 ° |
| A5 | 0 ° |
| A6 | 0 ° |

Working envelope

The following diagrams (>>> Fig. 4-9) and (>>> Fig. 4-10) show the load center of gravity, shape and size of the working envelope.

The reference point for the working envelope is the intersection of axis 4 with axis 5.

Dimensions: mm

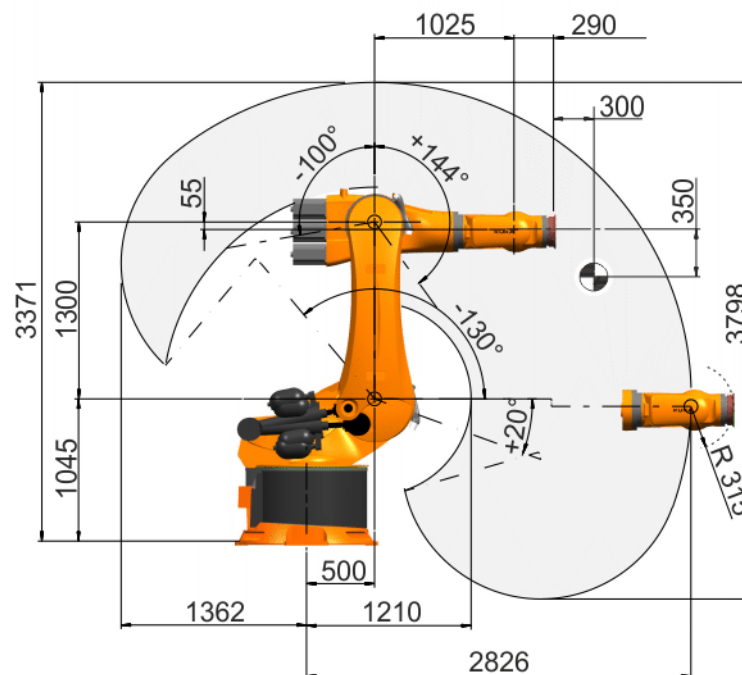


Fig. 4-9: KR 500 R2830 working envelope (with F variant), side view

Dimensions: mm

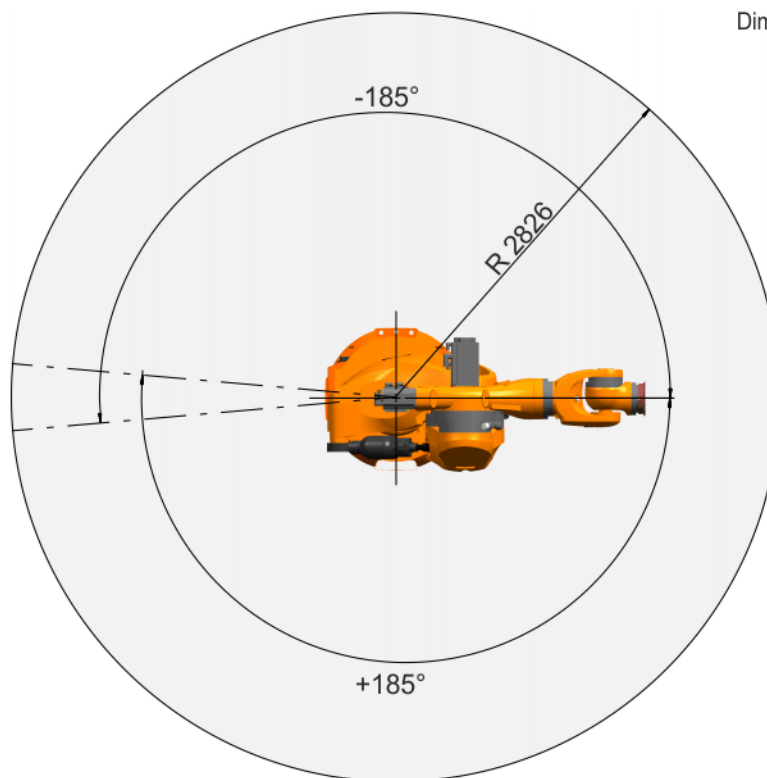


Fig. 4-10: KR 500 R2830 working envelope (with F variant), top view

4.3.3 Payloads, KR 500 R2830 F

Payloads

| | |
|---|----------------------|
| Rated payload | 500 kg |
| Rated mass moment of inertia | 250 kgm ² |
| Rated total load | 550 kg |
| Rated supplementary load, base frame | 0 kg |
| Maximum supplementary load, base frame | 0 kg |
| Rated supplementary load, rotating column | 0 kg |
| Maximum supplementary load, rotating column | 400 kg |
| Rated supplementary load, link arm | 0 kg |
| Maximum supplementary load, link arm | 100 kg |
| Rated supplementary load, arm | 50 kg |
| Maximum supplementary load, arm | 100 kg |
| Nominal distance to load center of gravity | |
| Lxy | 350 mm |
| Lz | 300 mm |

Load center of gravity

For all payloads, the load center of gravity refers to the distance from the face of the mounting flange on axis 6. Refer to the payload diagram for the nominal distance.

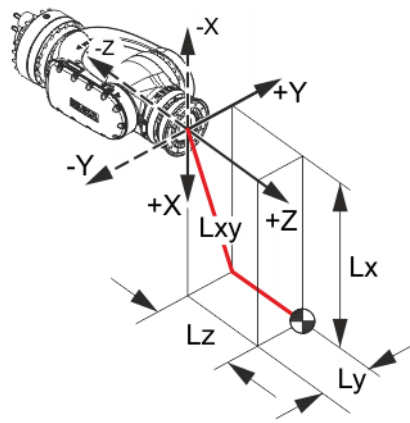


Fig. 4-11: Load center of gravity

Payload diagram

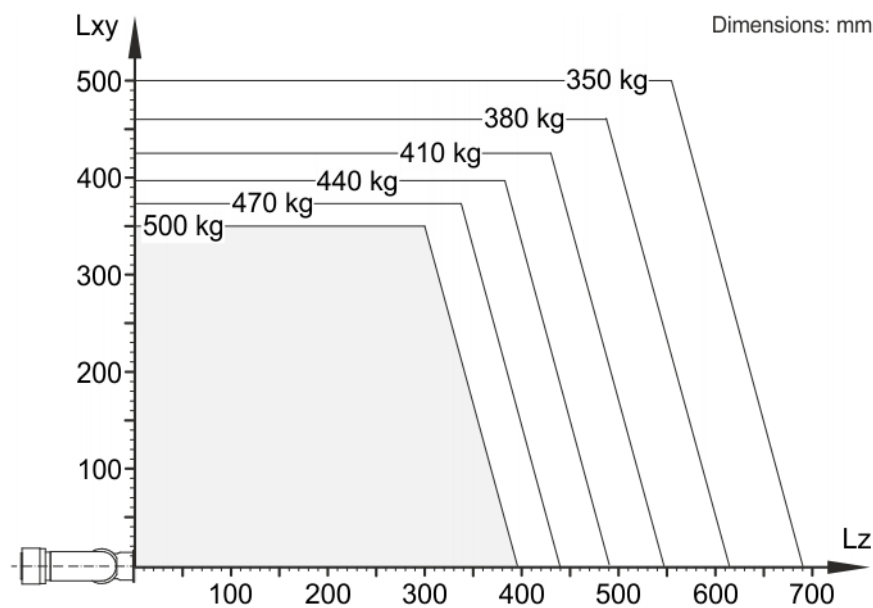


Fig. 4-12: KR 500 FORTEC payload diagram, payload 500 kg

NOTICE

This loading curve corresponds to the maximum load capacity. Both values (payload and mass moment of inertia) must be checked in all cases. Exceeding this capacity will reduce the service life of the robot and overload the motors and the gears; in any such case the KUKA Roboter GmbH must be consulted beforehand.

The values determined here are necessary for planning the robot application. For commissioning the robot, additional input data are required in accordance with the operating and programming instructions of the KUKA System Software.

The mass inertia must be verified using KUKA.Load. It is imperative for the load data to be entered in the robot controller!

In-line wrist

| | |
|--------------------|-----------------------|
| In-line wrist type | ZH500-4F |
| Mounting flange | ISO 9409-1-200-11-M12 |

Mounting flange

| | |
|---------------------|------------------------|
| Screw grade | 12.9 |
| Screw size | M12 |
| Clamping length | 1.5 x nominal diameter |
| Depth of engagement | min. 14 mm, max. 18 mm |
| Locating element | 12 ^{H7} |

The mounting flange is depicted with axis 6 in the zero position (>>> Fig. 4-13) The symbol X_m indicates the position of the locating element (bushing) in the zero position.

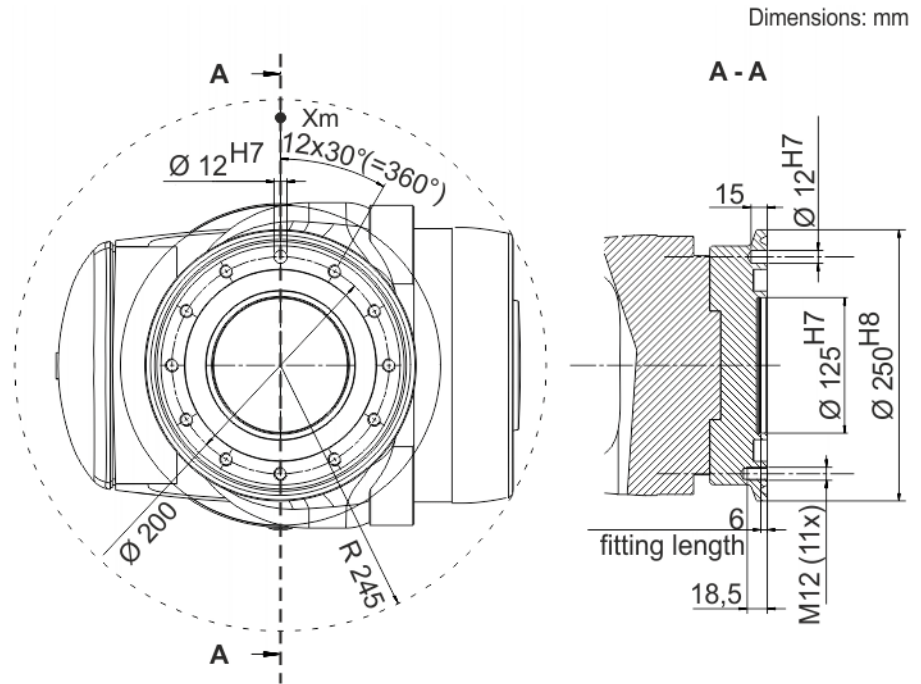


Fig. 4-13: Mounting flange

4.3.4 Loads acting on the foundation, KR 500 R2830 F

Mounting base loads

The specified forces and moments already include the payload and the inertia force (weight) of the robot.

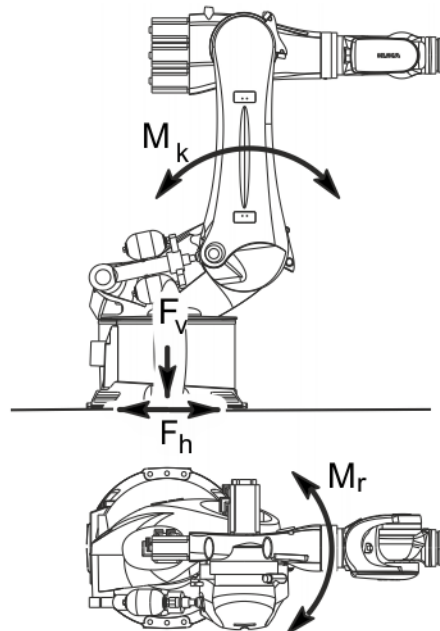


Fig. 4-14: Loads acting on the foundation, floor mounting

| Vertical force F(v) | |
|---------------------|---------|
| F(v normal) | 37000 N |
| F(v max) | 40500 N |

| | |
|--------------------------|----------|
| Horizontal force F(h) | |
| F(h normal) | 15900 N |
| F(h max) | 23500 N |
| Tilting moment M(k) | |
| M(k normal) | 58900 Nm |
| M(k max) | 84500 Nm |
| Torque about axis 1 M(r) | |
| M(r normal) | 18500 Nm |
| M(r max) | 45500 Nm |

⚠ WARNING Normal loads and maximum loads for the foundations are specified in the table.

The maximum loads must be referred to when dimensioning the foundations and must be adhered to for safety reasons. Failure to observe this can result in personal injury and damage to property.

The normal loads are average expected foundation loads. The actual loads are dependent on the program and on the robot loads and may therefore be greater or less than the normal loads.

The supplementary loads (A1 and A2) are not taken into consideration in the calculation of the mounting base load. These supplementary loads must be taken into consideration for F_v .

4.4 Technical data, KR 500 R2830 C

4.4.1 Basic data, KR 500 R2830 C


Basic data

| | KR 500 R2830 C |
|----------------------------------|---|
| Number of axes | 6 |
| Number of controlled axes | 6 |
| Volume of working envelope | 68 m ³ |
| Pose repeatability (ISO 9283) | ± 0.08 mm |
| Weight | approx. 2385 kg |
| Rated payload | 500 kg |
| Maximum reach | 2485 mm |
| Protection rating | IP65 |
| Protection rating, in-line wrist | IP65 |
| Sound level | < 75 dB (A) |
| Mounting position | Ceiling |
| Footprint | 1050 mm x 1050 mm |
| Permissible angle of inclination | ≤ 0 ° |
| Default color | Base frame: black (RAL 9005); Moving parts: KUKA orange 2567 |
| Controller | KR C4 |
| Transformation name | KR C4: KR500R2830 C4 CLG |

Ambient conditions

| | |
|---|-----|
| Humidity class (EN 60204) | - |
| Classification of environmental conditions (EN 60721-3-3) | 3K3 |
| Ambient temperature | |

| | |
|-------------------------------|----------------------------------|
| During operation | 10 °C to 55 °C (283 K to 328 K) |
| During storage/transportation | -40 °C to 60 °C (233 K to 333 K) |

| | |
|---|--|
|  | For operation at low temperatures, it may be necessary to warm up the robot. |
|---|--|

Connecting cables

| Cable designation | Connector designation | Interface with robot |
|---|-----------------------|---------------------------------|
| Motor cable | X20.1 - X30.1 | Harting connectors at both ends |
| Motor cable | X20.4 - X30.4 | Harting connectors at both ends |
| Control cable | X21 - X31 | HAN 3A EMC at both ends |
| Ground conductor / equipotential bonding 16 mm ² (optional) | | M8 ring cable lug at both ends |

| | |
|---------------|-----------------------------|
| Cable lengths | |
| Standard | 7 m, 15 m, 25 m, 35 m, 50 m |

For detailed specifications of the connecting cables, see “Description of the connecting cables”.

4.4.2 Axis data, KR 500 R2830 C

Axis data

| Range of motion | |
|--------------------------|----------------|
| A1 | ±185 ° |
| A2 | -130 ° / 20 ° |
| A3 | -100 ° / 144 ° |
| A4 | ±350 ° |
| A5 | ±120 ° |
| A6 | ±350 ° |
| Speed with rated payload | |
| A1 | 90 °/s |
| A2 | 80 °/s |
| A3 | 75 °/s |
| A4 | 90 °/s |
| A5 | 83 °/s |
| A6 | 130 °/s |

The direction of motion and the arrangement of the individual axes may be noted from the diagram (>>> Fig. 4-15).

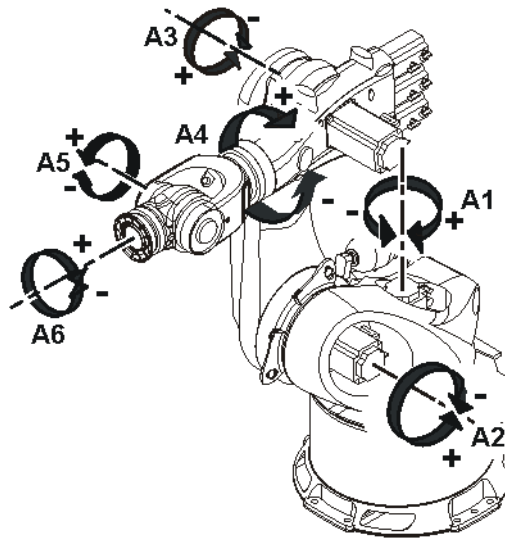


Fig. 4-15: Direction of rotation of robot axes

Mastering position

| Mastering position | |
|--------------------|-------|
| A1 | 0 ° |
| A2 | -90 ° |
| A3 | 90 ° |
| A4 | 0 ° |
| A5 | 0 ° |
| A6 | 0 ° |

Working envelope

The following diagrams (>>> Fig. 4-16) and (>>> Fig. 4-17) show the load center of gravity, shape and size of the working envelope.

The reference point for the working envelope is the intersection of axis 4 with axis 5.

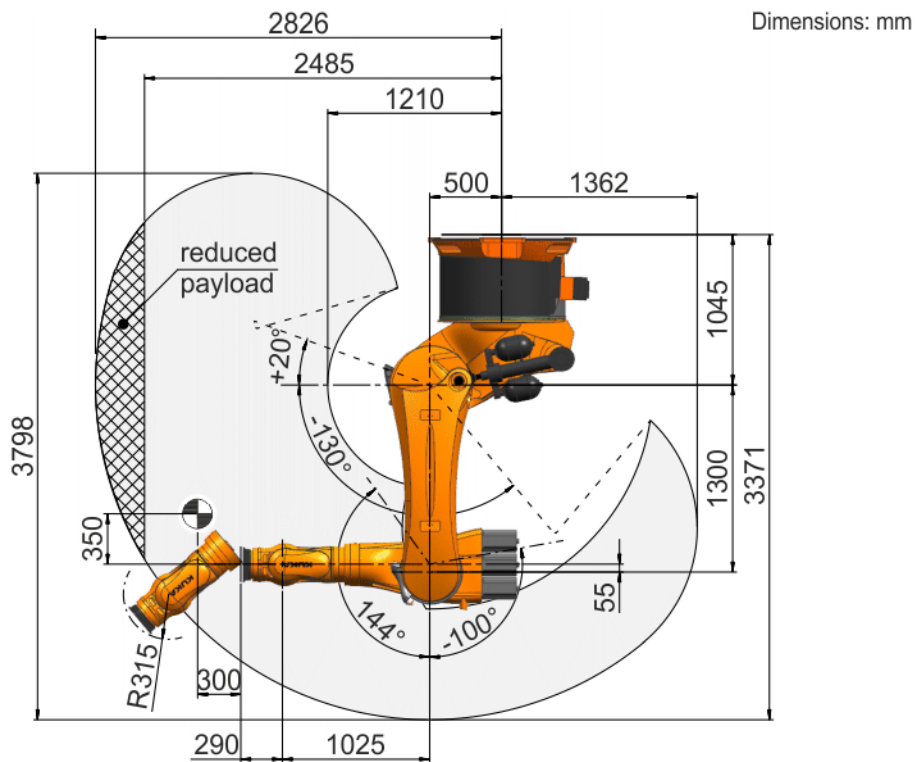


Fig. 4-16: KR 500 R2830 C working envelope (with F variant), side view

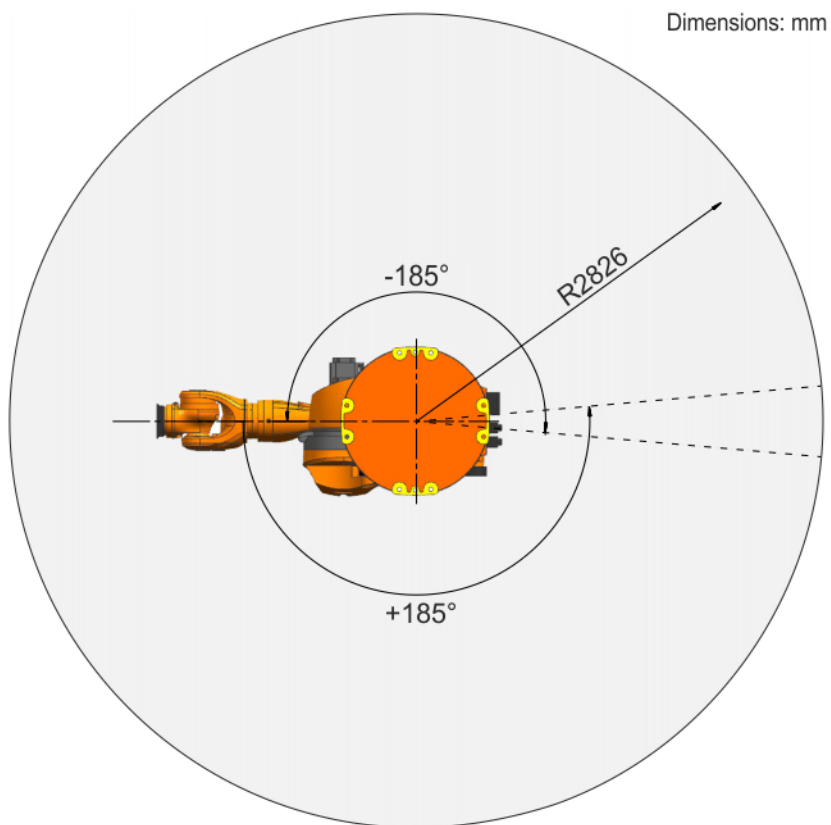


Fig. 4-17: KR 500 R2830 C working envelope (with F variant), top view

4.4.3 Payloads, KR 500 R2830 C

Payloads

| | |
|---|----------------------|
| Rated payload | 500 kg |
| Reduced payload | 360 kg |
| Rated mass moment of inertia | 250 kgm ² |
| Rated total load | 550 kg |
| Rated supplementary load, base frame | 0 kg |
| Maximum supplementary load, base frame | 0 kg |
| Rated supplementary load, rotating column | 0 kg |
| Maximum supplementary load, rotating column | 50 kg |
| Rated supplementary load, link arm | 0 kg |
| Maximum supplementary load, link arm | 50 kg |
| Rated supplementary load, arm | 50 kg |
| Maximum supplementary load, arm | 50 kg |
| Nominal distance to load center of gravity | |
| L _{xy} | 350 mm |
| L _z | 300 mm |

Load center of gravity

For all payloads, the load center of gravity refers to the distance from the face of the mounting flange on axis 6. Refer to the payload diagram for the nominal distance.

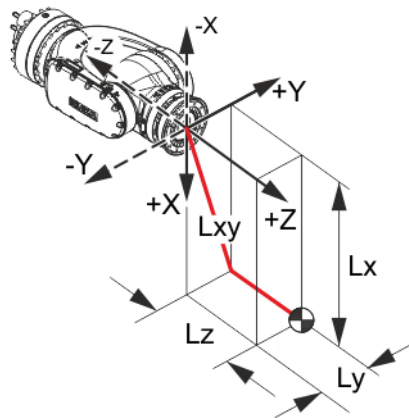


Fig. 4-18: Load center of gravity

Payload diagram

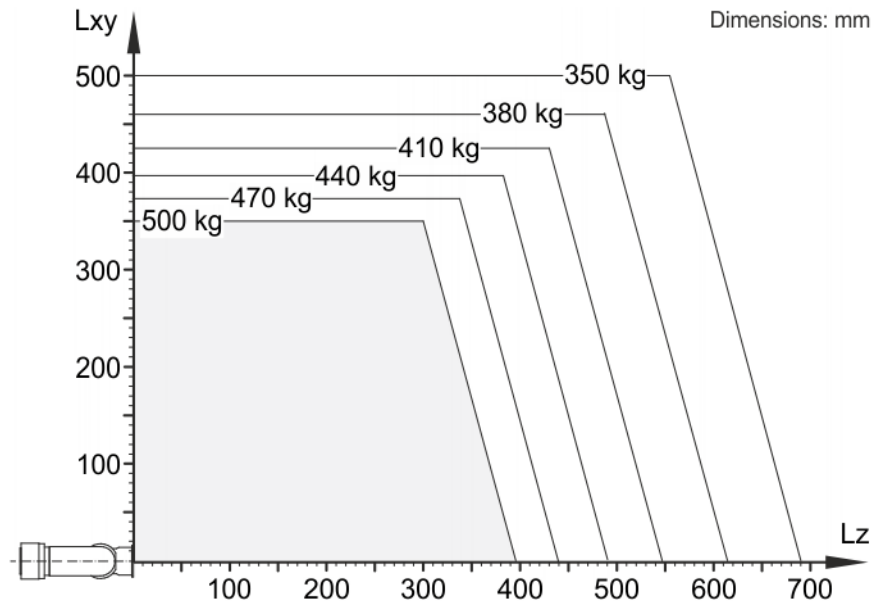


Fig. 4-19: KR 500 FORTEC payload diagram, payload 500 kg

NOTICE This loading curve corresponds to the maximum load capacity. Both values (payload and mass moment of inertia) must be checked in all cases. Exceeding this capacity will reduce the service life of the robot and overload the motors and the gears; in any such case the KUKA Roboter GmbH must be consulted beforehand. The values determined here are necessary for planning the robot application. For commissioning the robot, additional input data are required in accordance with the operating and programming instructions of the KUKA System Software. The mass inertia must be verified using KUKA.Load. It is imperative for the load data to be entered in the robot controller!

In-line wrist

| | |
|--------------------|-----------------------|
| In-line wrist type | ZH500-4 |
| Mounting flange | ISO 9409-1-200-11-M12 |

Mounting flange

| | |
|---------------------|------------------------|
| Screw grade | 12.9 |
| Screw size | M12 |
| Clamping length | 1.5 x nominal diameter |
| Depth of engagement | min. 14 mm, max. 18 mm |
| Locating element | 12 H7 |

The mounting flange is depicted with axis 6 in the zero position (>>> Fig. 4-20) The symbol X_m indicates the position of the locating element (bushing) in the zero position.

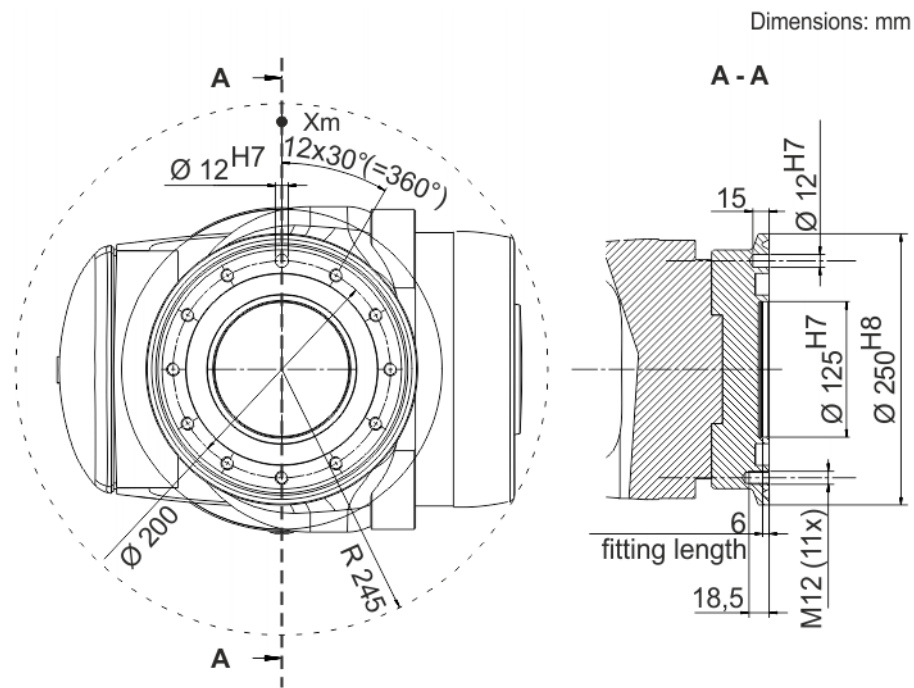


Fig. 4-20: Mounting flange

4.4.4 Loads acting on the foundation, KR 500 R2830 C

Mounting base loads

The specified forces and moments already include the payload and the inertia force (weight) of the robot.

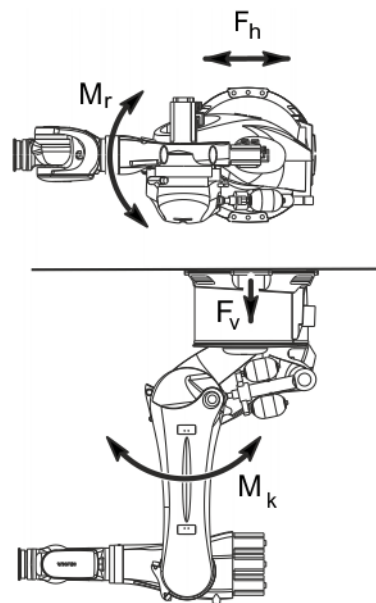


Fig. 4-21: Loads acting on the foundation, ceiling mounting

| | |
|-----------------------|---------|
| Vertical force F(v) | |
| F(v normal) | 37000 N |
| F(v max) | 40500 N |
| Horizontal force F(h) | |
| F(h normal) | 15900 N |
| F(h max) | 23500 N |
| Tilting moment M(k) | |

| | |
|--------------------------|----------|
| M(k normal) | 58900 Nm |
| M(k max) | 84500 Nm |
| Torque about axis 1 M(r) | |
| M(r normal) | 18500 Nm |
| M(r max) | 45500 Nm |



WARNING Normal loads and maximum loads for the foundations are specified in the table. The maximum loads must be referred to when dimensioning the foundations and must be adhered to for safety reasons. Failure to observe this can result in personal injury and damage to property. The normal loads are average expected foundation loads. The actual loads are dependent on the program and on the robot loads and may therefore be greater or less than the normal loads. The supplementary loads (A1 and A2) are not taken into consideration in the calculation of the mounting base load. These supplementary loads must be taken into consideration for F_v .

4.5 Technical data, KR 500 R2830 C-F

4.5.1 Basic data, KR 500 R2830 C-F

Basic data

| | KR 500 R2830 C-F |
|----------------------------------|---|
| Number of axes | 6 |
| Number of controlled axes | 6 |
| Volume of working envelope | 68 m ³ |
| Pose repeatability (ISO 9283) | ± 0.08 mm |
| Weight | approx. 2385 kg |
| Rated payload | 500 kg |
| Maximum reach | 2485 mm |
| Protection rating | IP65 |
| Protection rating, in-line wrist | IP67 |
| Sound level | < 75 dB (A) |
| Mounting position | Ceiling |
| Footprint | 1050 mm x 1050 mm |
| Permissible angle of inclination | ≤ 0 ° |
| Default color | Base frame: black (RAL 9005); Moving parts: KUKA orange 2567 |
| Controller | KR C4 |
| Transformation name | KR C4: KR500R2830 C4 CLG |

Ambient conditions

| | |
|---|----------------------------------|
| Humidity class (EN 60204) | - |
| Classification of environmental conditions (EN 60721-3-3) | 3K3 |
| Ambient temperature | |
| During operation | 10 °C to 55 °C (283 K to 328 K) |
| During storage/transportation | -40 °C to 60 °C (233 K to 333 K) |



For operation at low temperatures, it may be necessary to warm up the robot.

Foundry robots

| | |
|-----------------------------------|--|
| Overpressure in the arm | 0.01 MPa (0.1 bar) |
| Compressed air | Free of oil and water |
| Compressed air supply line | Air line in the cable set |
| Air consumption | 0.1 m ³ /h |
| Air line connection | Quick Star push-in fitting for hose PUN-6x1, blue |
| Pressure regulator connection | R 1/8", internal thread |
| Input pressure | 0.1 - 1.2 MPa (1 - 12 bar) |
| Pressure regulator | 0.005 - 0.07 MPa (0.05 - 0.7 bar) |
| Manometer range | 0.0 - 0.1 MPa (0.0 - 1.0 bar) |
| Filter gauge | 25 - 30 µm |
| Thermal loading | 10 s/min at 353 K (180 °C) |
| Resistance | Increased resistance to dust, lubricants, coolants and water vapor. |
| Special paint finish on wrist | Heat-resistant and heat-reflecting silver paint finish on the in-line wrist. |
| Special paint finish on the robot | Special paint finish on the entire robot, and an additional protective clear coat. |
| Other ambient conditions | KUKA Roboter GmbH must be consulted if the robot is to be used under other ambient conditions. |

Connecting cables

| Cable designation | Connector designation | Interface with robot |
|---|-----------------------|---------------------------------|
| Motor cable | X20.1 - X30.1 | Harting connectors at both ends |
| Motor cable | X20.4 - X30.4 | Harting connectors at both ends |
| Control cable | X21 - X31 | HAN 3A EMC at both ends |
| Ground conductor / equipotential bonding 16 mm ² (optional) | | M8 ring cable lug at both ends |

| Cable lengths | |
|---------------|-----------------------------|
| Standard | 7 m, 15 m, 25 m, 35 m, 50 m |

For detailed specifications of the connecting cables, see "Description of the connecting cables".

4.5.2 Axis data, KR 500 R2830 C-F**Axis data**

| Range of motion | |
|-----------------|----------------|
| A1 | ±185 ° |
| A2 | -130 ° / 20 ° |
| A3 | -100 ° / 144 ° |
| A4 | ±350 ° |
| A5 | ±120 ° |
| A6 | ±350 ° |

| Speed with rated payload | |
|--------------------------|---------|
| A1 | 90 °/s |
| A2 | 80 °/s |
| A3 | 75 °/s |
| A4 | 90 °/s |
| A5 | 83 °/s |
| A6 | 130 °/s |

The direction of motion and the arrangement of the individual axes may be noted from the diagram (>>> Fig. 4-22).

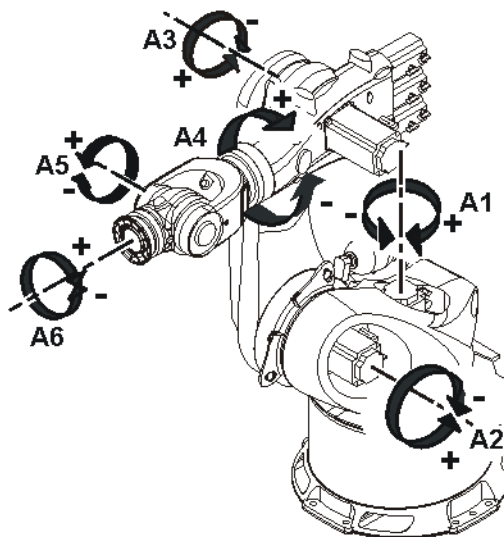


Fig. 4-22: Direction of rotation of robot axes

Mastering position

| Mastering position | |
|--------------------|-------|
| A1 | 0 ° |
| A2 | -90 ° |
| A3 | 90 ° |
| A4 | 0 ° |
| A5 | 0 ° |
| A6 | 0 ° |

Working envelope

The following diagrams (>>> Fig. 4-23) and (>>> Fig. 4-24) show the load center of gravity, shape and size of the working envelope.

The reference point for the working envelope is the intersection of axis 4 with axis 5.

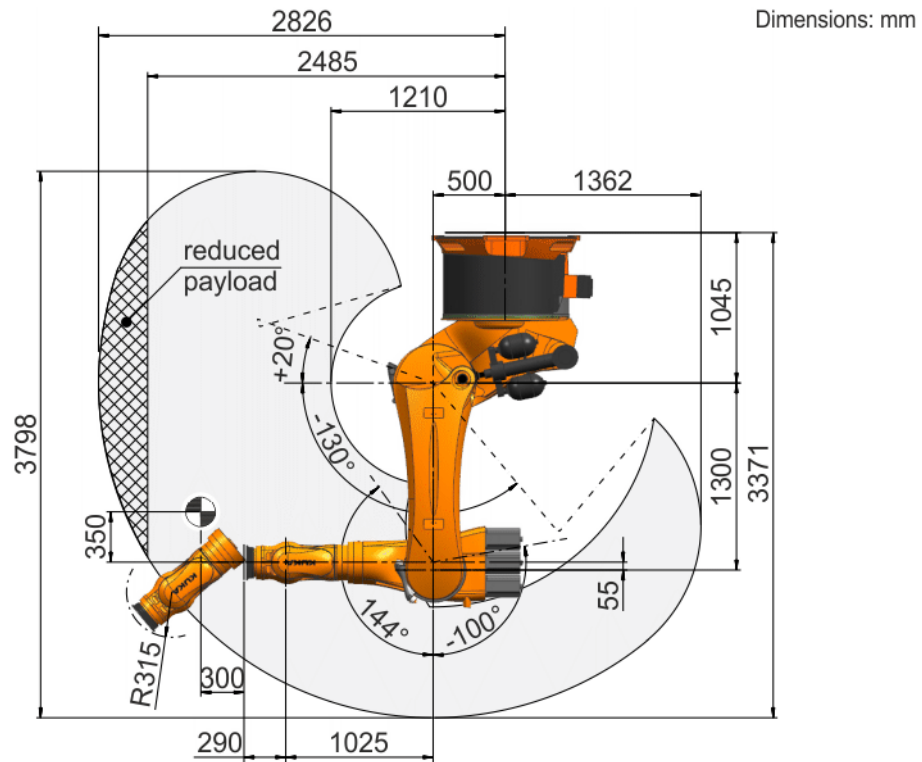


Fig. 4-23: KR 500 R2830 C working envelope (with F variant), side view

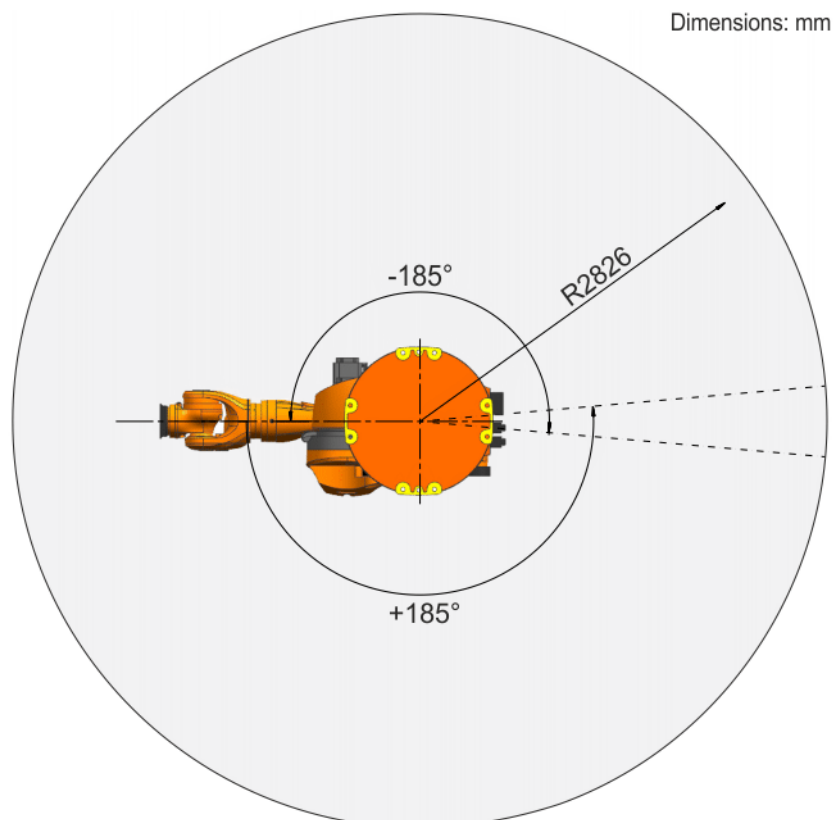


Fig. 4-24: KR 500 R2830 C working envelope (with F variant), top view

4.5.3 Payloads, KR 500 R2830 C-F

Payloads

| | |
|---|----------------------|
| Rated payload | 500 kg |
| Reduced payload | 360 kg |
| Rated mass moment of inertia | 250 kgm ² |
| Rated total load | 550 kg |
| Rated supplementary load, base frame | 0 kg |
| Maximum supplementary load, base frame | 0 kg |
| Rated supplementary load, rotating column | 0 kg |
| Maximum supplementary load, rotating column | 50 kg |
| Rated supplementary load, link arm | 0 kg |
| Maximum supplementary load, link arm | 50 kg |
| Rated supplementary load, arm | 50 kg |
| Maximum supplementary load, arm | 50 kg |
| Nominal distance to load center of gravity | |
| Lxy | 350 mm |
| Lz | 300 mm |

Load center of gravity

For all payloads, the load center of gravity refers to the distance from the face of the mounting flange on axis 6. Refer to the payload diagram for the nominal distance.

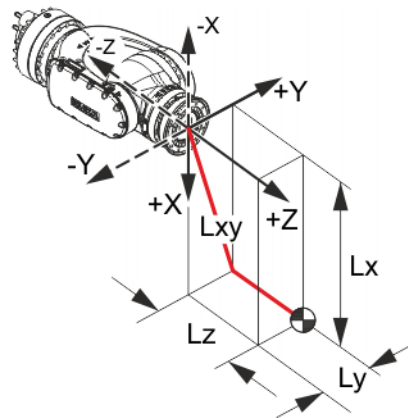


Fig. 4-25: Load center of gravity

Payload diagram

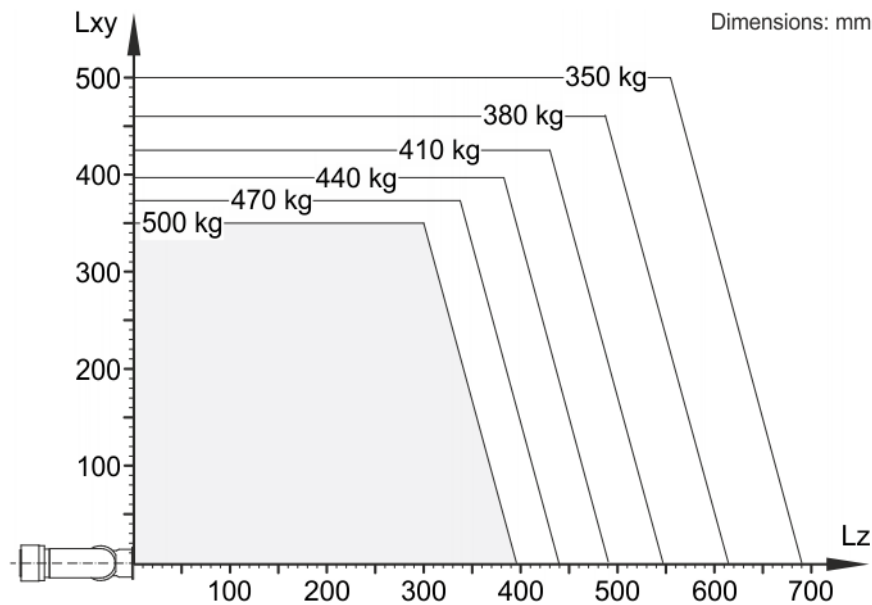


Fig. 4-26: KR 500 FORTEC payload diagram, payload 500 kg

NOTICE

This loading curve corresponds to the maximum load capacity. Both values (payload and mass moment of inertia) must be checked in all cases. Exceeding this capacity will reduce the service life of the robot and overload the motors and the gears; in any such case the KUKA Roboter GmbH must be consulted beforehand. The values determined here are necessary for planning the robot application. For commissioning the robot, additional input data are required in accordance with the operating and programming instructions of the KUKA System Software. The mass inertia must be verified using KUKA.Load. It is imperative for the load data to be entered in the robot controller!

In-line wrist

| | |
|--------------------|-----------------------|
| In-line wrist type | ZH500-4F |
| Mounting flange | ISO 9409-1-200-11-M12 |

Mounting flange

| | |
|---------------------|------------------------|
| Screw grade | 12.9 |
| Screw size | M12 |
| Clamping length | 1.5 x nominal diameter |
| Depth of engagement | min. 14 mm, max. 18 mm |
| Locating element | 12 ^{H7} |

The mounting flange is depicted with axis 6 in the zero position (>>> Fig. 4-27) The symbol X_m indicates the position of the locating element (bushing) in the zero position.

Dimensions: mm

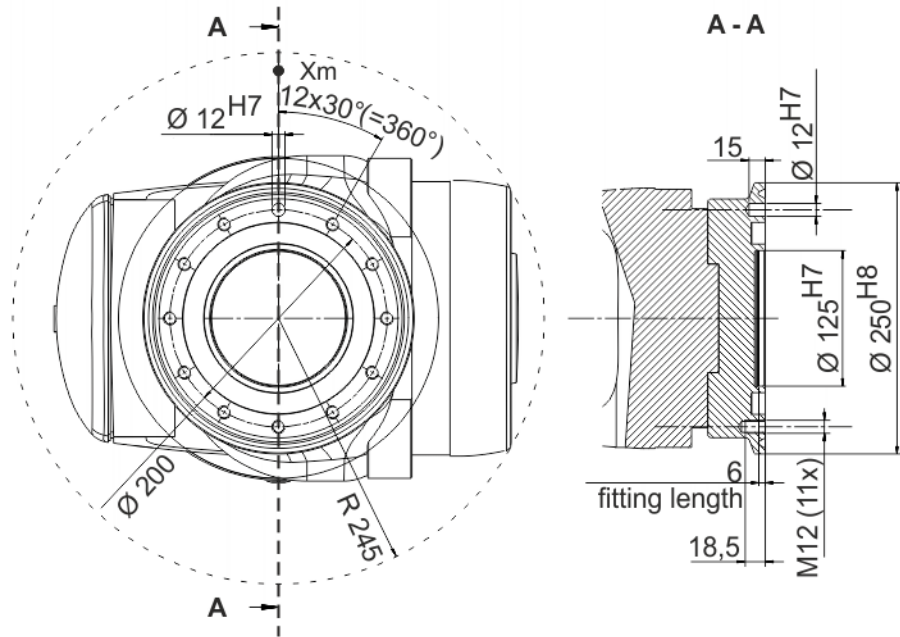


Fig. 4-27: Mounting flange

4.5.4 Loads acting on the foundation, KR 500 R2830 C-F

Mounting base loads

The specified forces and moments already include the payload and the inertia force (weight) of the robot.

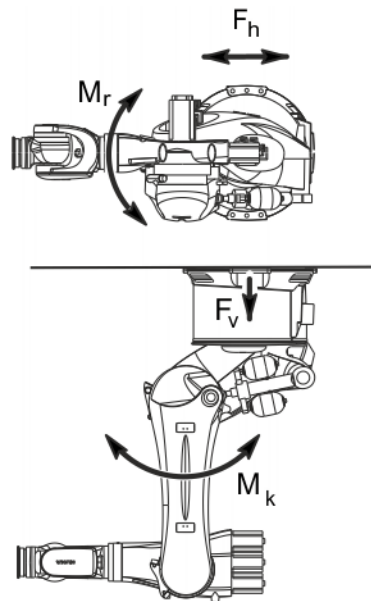



Fig. 4-28: Loads acting on the foundation, ceiling mounting

| | |
|-----------------------|---------|
| Vertical force F(v) | |
| F(v normal) | 37000 N |
| F(v max) | 40500 N |
| Horizontal force F(h) | |
| F(h normal) | 15900 N |
| F(h max) | 23500 N |
| Tilting moment M(k) | |

| | |
|--------------------------|----------|
| M(k normal) | 58900 Nm |
| M(k max) | 84500 Nm |
| Torque about axis 1 M(r) | |
| M(r normal) | 18500 Nm |
| M(r max) | 45500 Nm |

| | |
|--|---|
|  WARNING | Normal loads and maximum loads for the foundations are specified in the table. The maximum loads must be referred to when dimensioning the foundations and must be adhered to for safety reasons. Failure to observe this can result in personal injury and damage to property. The normal loads are average expected foundation loads. The actual loads are dependent on the program and on the robot loads and may therefore be greater or less than the normal loads. The supplementary loads (A1 and A2) are not taken into consideration in the calculation of the mounting base load. These supplementary loads must be taken into consideration for F_v . |
|--|---|

4.6 Technical data, KR 420 R3080


4.6.1 Basic data, KR 420 R3080

Basic data

| | KR 420 R3080 |
|----------------------------------|---|
| Number of axes | 6 |
| Number of controlled axes | 6 |
| Volume of working envelope | 88 m ³ |
| Pose repeatability (ISO 9283) | ± 0.08 mm |
| Weight | approx. 2415 kg |
| Rated payload | 420 kg |
| Maximum reach | 3076 mm |
| Protection rating | IP65 |
| Protection rating, in-line wrist | IP65 |
| Sound level | < 75 dB (A) |
| Mounting position | Floor |
| Footprint | 1050 mm x 1050 mm |
| Permissible angle of inclination | ≤ 5 ° |
| Default color | Base frame: black (RAL 9005); Moving parts: KUKA orange 2567 |
| Controller | KR C4 |
| Transformation name | KR C4: KR420R3080 C4 FLR |

Ambient conditions

| | |
|---|----------------------------------|
| Humidity class (EN 60204) | - |
| Classification of environmental conditions (EN 60721-3-3) | 3K3 |
| Ambient temperature | |
| During operation | 10 °C to 55 °C (283 K to 328 K) |
| During storage/transportation | -40 °C to 60 °C (233 K to 333 K) |

| | |
|---|--|
|  | For operation at low temperatures, it may be necessary to warm up the robot. |
|---|--|

Connecting cables

| Cable designation | Connector designation | Interface with robot |
|---|-----------------------------|---------------------------------|
| Motor cable | X20.1 - X30.1 | Harting connectors at both ends |
| Motor cable | X20.4 - X30.4 | Harting connectors at both ends |
| Control cable | X21 - X31 | HAN 3A EMC at both ends |
| Ground conductor / equipotential bonding 16 mm ² (optional) | | M8 ring cable lug at both ends |
| Cable lengths | | |
| Standard | 7 m, 15 m, 25 m, 35 m, 50 m | |

For detailed specifications of the connecting cables, see "Description of the connecting cables".

4.6.2 Axis data, KR 420 R3080**Axis data**

| Range of motion | |
|--------------------------|----------------|
| A1 | ±185 ° |
| A2 | -130 ° / 20 ° |
| A3 | -100 ° / 144 ° |
| A4 | ±350 ° |
| A5 | ±120 ° |
| A6 | ±350 ° |
| Speed with rated payload | |
| A1 | 90 °/s |
| A2 | 80 °/s |
| A3 | 75 °/s |
| A4 | 90 °/s |
| A5 | 83 °/s |
| A6 | 130 °/s |

The direction of motion and the arrangement of the individual axes may be noted from the diagram (>>> Fig. 4-29).

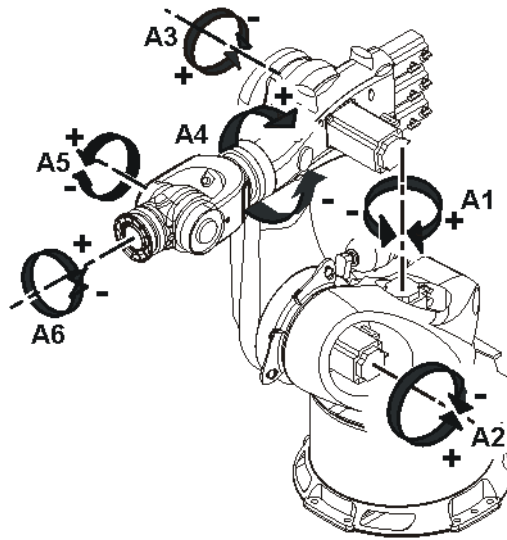


Fig. 4-29: Direction of rotation of robot axes

Mastering position

| Mastering position | |
|--------------------|-------|
| A1 | 0 ° |
| A2 | -90 ° |
| A3 | 90 ° |
| A4 | 0 ° |
| A5 | 0 ° |
| A6 | 0 ° |

Working envelope

The following diagrams (>>> Fig. 4-30) and (>>> Fig. 4-31) show the load center of gravity, shape and size of the working envelope.

The reference point for the working envelope is the intersection of axis 4 with axis 5.

Dimensions: mm

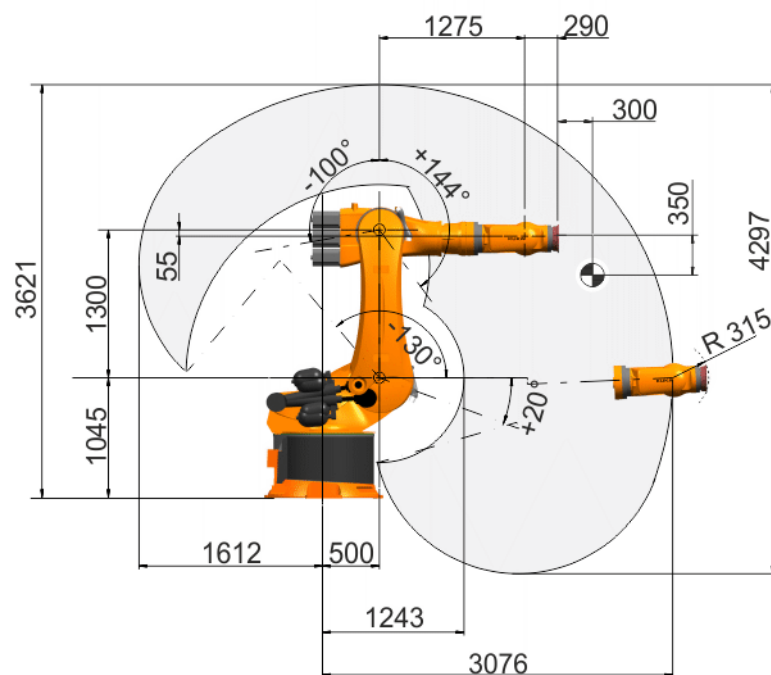


Fig. 4-30: KR 420 R3080 working envelope (with F variant), side view

Dimensions: mm

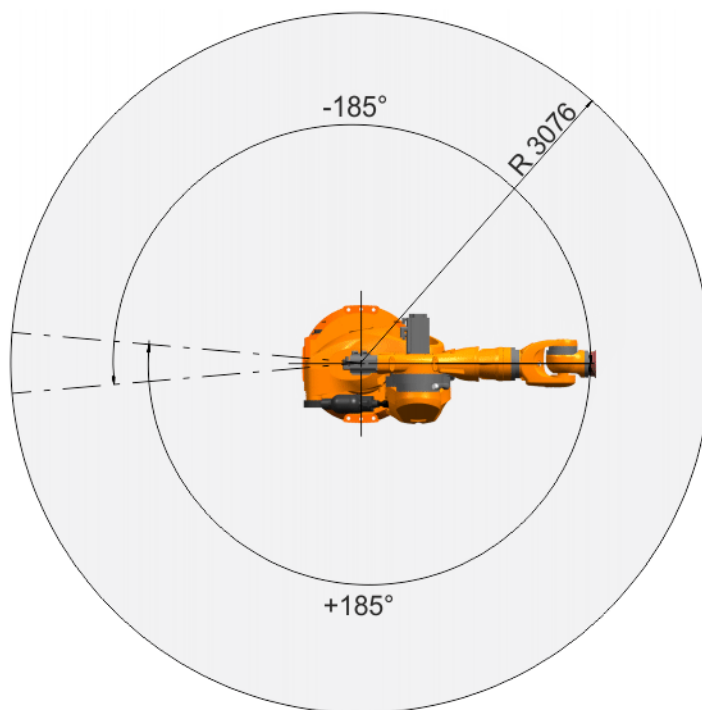


Fig. 4-31: KR 420 R3080 working envelope (with F variant), top view

4.6.3 Payloads, KR 420 R3080

Payloads

| | |
|---|----------------------|
| Rated payload | 420 kg |
| Rated mass moment of inertia | 210 kgm ² |
| Rated total load | 470 kg |
| Rated supplementary load, base frame | 0 kg |
| Maximum supplementary load, base frame | 0 kg |
| Rated supplementary load, rotating column | 0 kg |
| Maximum supplementary load, rotating column | 400 kg |
| Rated supplementary load, link arm | 0 kg |
| Maximum supplementary load, link arm | 100 kg |
| Rated supplementary load, arm | 50 kg |
| Maximum supplementary load, arm | 100 kg |
| Nominal distance to load center of gravity | |
| Lxy | 350 mm |
| Lz | 300 mm |

Load center of gravity

For all payloads, the load center of gravity refers to the distance from the face of the mounting flange on axis 6. Refer to the payload diagram for the nominal distance.

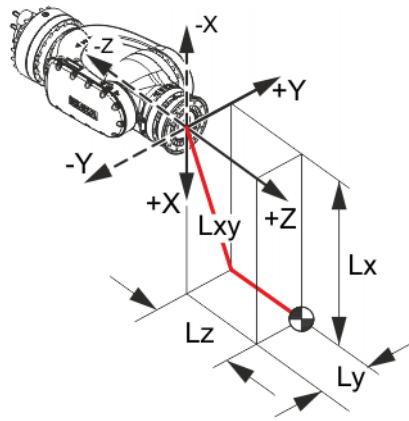


Fig. 4-32: Load center of gravity

Payload diagram

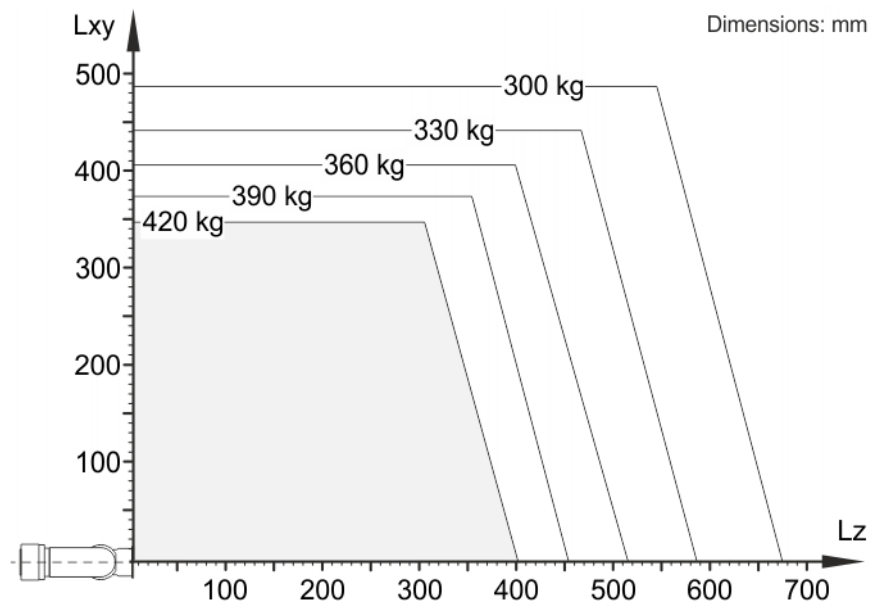


Fig. 4-33: KR 500 FORTEC payload diagram, payload 420 kg

NOTICE

This loading curve corresponds to the maximum load capacity. Both values (payload and mass moment of inertia) must be checked in all cases. Exceeding this capacity will reduce the service life of the robot and overload the motors and the gears; in any such case the KUKA Roboter GmbH must be consulted beforehand.

The values determined here are necessary for planning the robot application. For commissioning the robot, additional input data are required in accordance with the operating and programming instructions of the KUKA System Software.

The mass inertia must be verified using KUKA.Load. It is imperative for the load data to be entered in the robot controller!

In-line wrist

| | |
|--------------------|-----------------------|
| In-line wrist type | ZH500-4 |
| Mounting flange | ISO 9409-1-200-11-M12 |

Mounting flange

| | |
|-----------------|------------------------|
| Screw grade | 12.9 |
| Screw size | M12 |
| Clamping length | 1.5 x nominal diameter |

| | |
|---------------------|------------------------|
| Depth of engagement | min. 14 mm, max. 18 mm |
| Locating element | 12 H7 |

The mounting flange is depicted with axis 6 in the zero position (>>> Fig. 4-34) The symbol X_m indicates the position of the locating element (bushing) in the zero position.

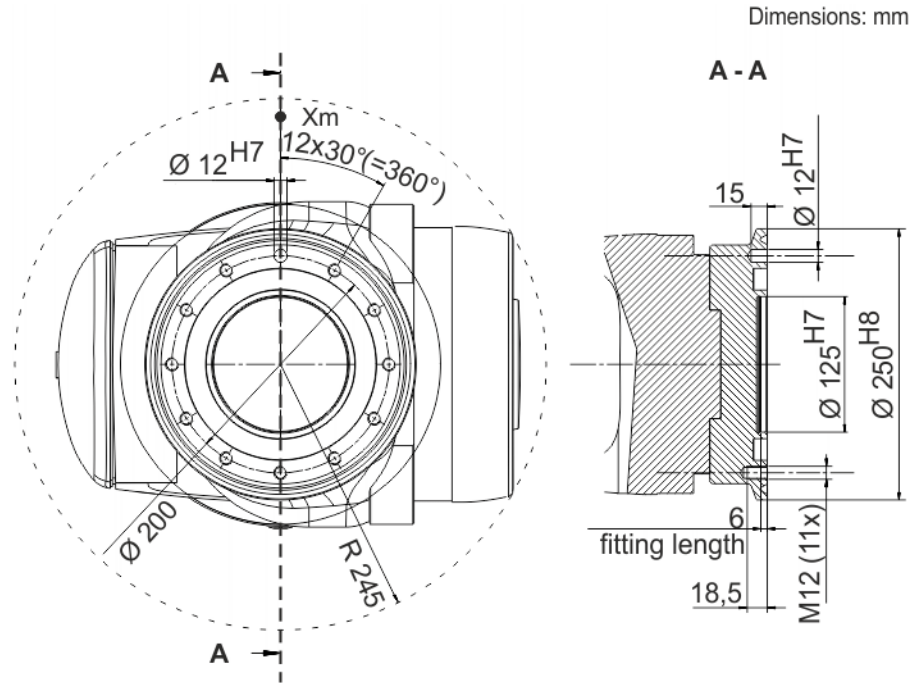


Fig. 4-34: Mounting flange

4.6.4 Loads acting on the foundation, KR 420 R3080

Mounting base loads

The specified forces and moments already include the payload and the inertia force (weight) of the robot.

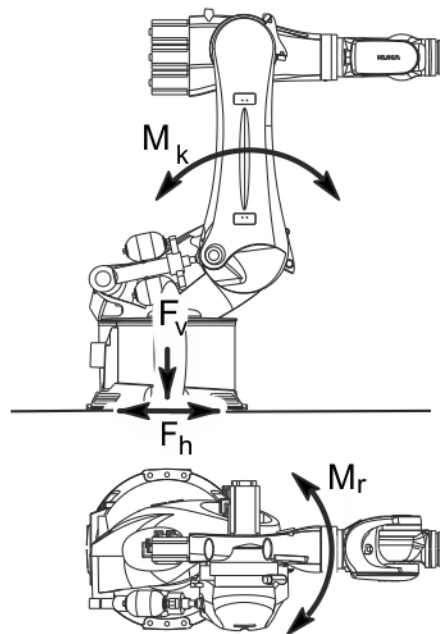


Fig. 4-35: Loads acting on the foundation, floor mounting

| | |
|--------------------------|----------|
| Vertical force F(v) | |
| F(v normal) | 37000 N |
| F(v max) | 40500 N |
| Horizontal force F(h) | |
| F(h normal) | 15900 N |
| F(h max) | 23500 N |
| Tilting moment M(k) | |
| M(k normal) | 58900 Nm |
| M(k max) | 84500 Nm |
| Torque about axis 1 M(r) | |
| M(r normal) | 18500 Nm |
| M(r max) | 45500 Nm |

⚠ WARNING Normal loads and maximum loads for the foundations are specified in the table.

The maximum loads must be referred to when dimensioning the foundations and must be adhered to for safety reasons. Failure to observe this can result in personal injury and damage to property.

The normal loads are average expected foundation loads. The actual loads are dependent on the program and on the robot loads and may therefore be greater or less than the normal loads.

The supplementary loads (A1 and A2) are not taken into consideration in the calculation of the mounting base load. These supplementary loads must be taken into consideration for F_v .

4.7 Technical data, KR 420 R3080 F


4.7.1 Basic data, KR 420 R3080 F

Basic data

| | KR 420 R3080 F |
|----------------------------------|---|
| Number of axes | 6 |
| Number of controlled axes | 6 |
| Volume of working envelope | 88 m ³ |
| Pose repeatability (ISO 9283) | ± 0.08 mm |
| Weight | approx. 2415 kg |
| Rated payload | 420 kg |
| Maximum reach | 3076 mm |
| Protection rating | IP65 |
| Protection rating, in-line wrist | IP67 |
| Sound level | < 75 dB (A) |
| Mounting position | Floor |
| Footprint | 1050 mm x 1050 mm |
| Permissible angle of inclination | ≤ 5 ° |
| Default color | Base frame: black (RAL 9005); Moving parts: KUKA orange 2567 |
| Controller | KR C4 |
| Transformation name | KR C4: KR420R3080 C4 FLR |

Ambient conditions

| | |
|---|----------------------------------|
| Humidity class (EN 60204) | - |
| Classification of environmental conditions (EN 60721-3-3) | 3K3 |
| Ambient temperature | |
| During operation | 10 °C to 55 °C (283 K to 328 K) |
| During storage/transportation | -40 °C to 60 °C (233 K to 333 K) |

| | |
|---|--|
|  | For operation at low temperatures, it may be necessary to warm up the robot. |
|---|--|

Foundry robots

| | |
|-----------------------------------|--|
| Overpressure in the arm | 0.01 MPa (0.1 bar) |
| Compressed air | Free of oil and water |
| Compressed air supply line | Air line in the cable set |
| Air consumption | 0.1 m ³ /h |
| Air line connection | Quick Star push-in fitting for hose PUN-6x1, blue |
| Pressure regulator connection | R 1/8", internal thread |
| Input pressure | 0.1 - 1.2 MPa (1 - 12 bar) |
| Pressure regulator | 0.005 - 0.07 MPa (0.05 - 0.7 bar) |
| Manometer range | 0.0 - 0.1 MPa (0.0 - 1.0 bar) |
| Filter gauge | 25 - 30 µm |
| Thermal loading | 10 s/min at 353 K (180 °C) |
| Resistance | Increased resistance to dust, lubricants, coolants and water vapor. |
| Special paint finish on wrist | Heat-resistant and heat-reflecting silver paint finish on the in-line wrist. |
| Special paint finish on the robot | Special paint finish on the entire robot, and an additional protective clear coat. |
| Other ambient conditions | KUKA Roboter GmbH must be consulted if the robot is to be used under other ambient conditions. |

Connecting cables

| Cable designation | Connector designation | Interface with robot |
|---|-----------------------------|---------------------------------|
| Motor cable | X20.1 - X30.1 | Harting connectors at both ends |
| Motor cable | X20.4 - X30.4 | Harting connectors at both ends |
| Control cable | X21 - X31 | HAN 3A EMC at both ends |
| Ground conductor / equipotential bonding 16 mm ² (optional) | | M8 ring cable lug at both ends |
| Cable lengths | | |
| Standard | 7 m, 15 m, 25 m, 35 m, 50 m | |

For detailed specifications of the connecting cables, see "Description of the connecting cables".

4.7.2 Axis data, KR 420 R3080 F

Axis data

| Range of motion | |
|--------------------------|--------------------------|
| A1 | $\pm 185^\circ$ |
| A2 | $-130^\circ / 20^\circ$ |
| A3 | $-100^\circ / 144^\circ$ |
| A4 | $\pm 350^\circ$ |
| A5 | $\pm 120^\circ$ |
| A6 | $\pm 350^\circ$ |
| Speed with rated payload | |
| A1 | 90 °/s |
| A2 | 80 °/s |
| A3 | 75 °/s |
| A4 | 90 °/s |
| A5 | 83 °/s |
| A6 | 130 °/s |

The direction of motion and the arrangement of the individual axes may be noted from the diagram (>>> Fig. 4-36).

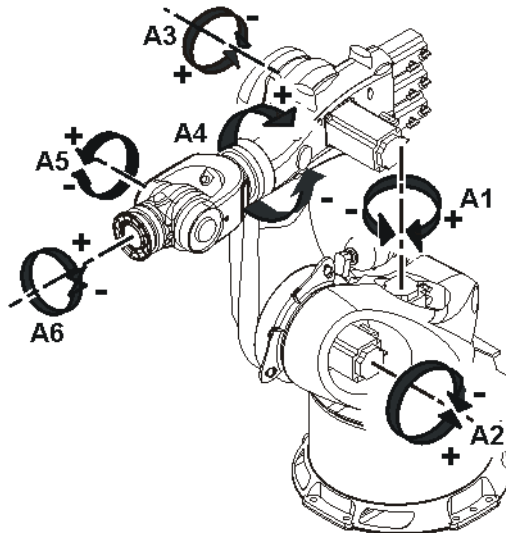


Fig. 4-36: Direction of rotation of robot axes

Mastering position

| Mastering position | |
|--------------------|-------|
| A1 | 0 ° |
| A2 | -90 ° |
| A3 | 90 ° |
| A4 | 0 ° |
| A5 | 0 ° |
| A6 | 0 ° |

Working envelope

The following diagrams (>>> Fig. 4-37) and (>>> Fig. 4-38) show the load center of gravity, shape and size of the working envelope.

The reference point for the working envelope is the intersection of axis 4 with axis 5.

Dimensions: mm

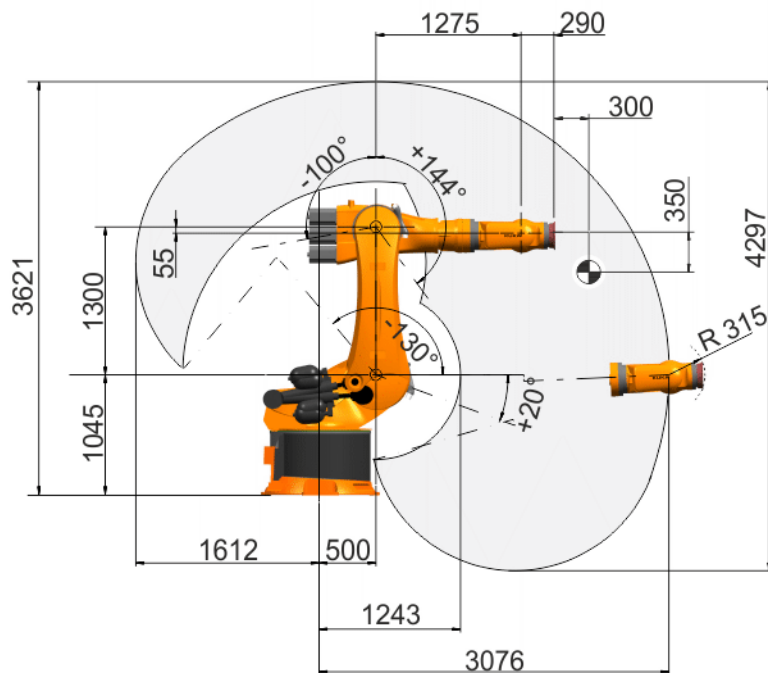


Fig. 4-37: KR 420 R3080 working envelope (with F variant), side view

Dimensions: mm

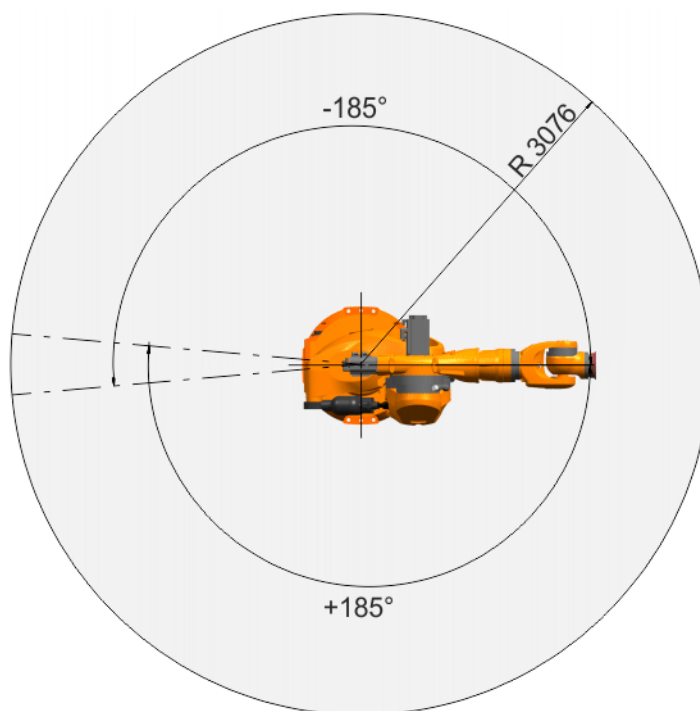


Fig. 4-38: KR 420 R3080 working envelope (with F variant), top view

4.7.3 Payloads, KR 420 R3080 F

Payloads

| | |
|--------------------------------------|----------------------|
| Rated payload | 420 kg |
| Rated mass moment of inertia | 210 kgm ² |
| Rated total load | 470 kg |
| Rated supplementary load, base frame | 0 kg |

| | |
|---|--------|
| Maximum supplementary load, base frame | 0 kg |
| Rated supplementary load, rotating column | 0 kg |
| Maximum supplementary load, rotating column | 400 kg |
| Rated supplementary load, link arm | 0 kg |
| Maximum supplementary load, link arm | 100 kg |
| Rated supplementary load, arm | 50 kg |
| Maximum supplementary load, arm | 100 kg |
| Nominal distance to load center of gravity | |
| Lxy | 350 mm |
| Lz | 300 mm |

Load center of gravity

For all payloads, the load center of gravity refers to the distance from the face of the mounting flange on axis 6. Refer to the payload diagram for the nominal distance.

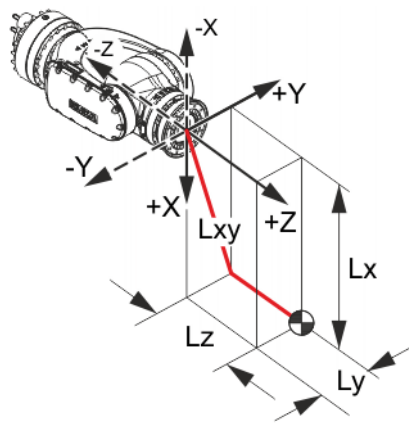


Fig. 4-39: Load center of gravity

Payload diagram

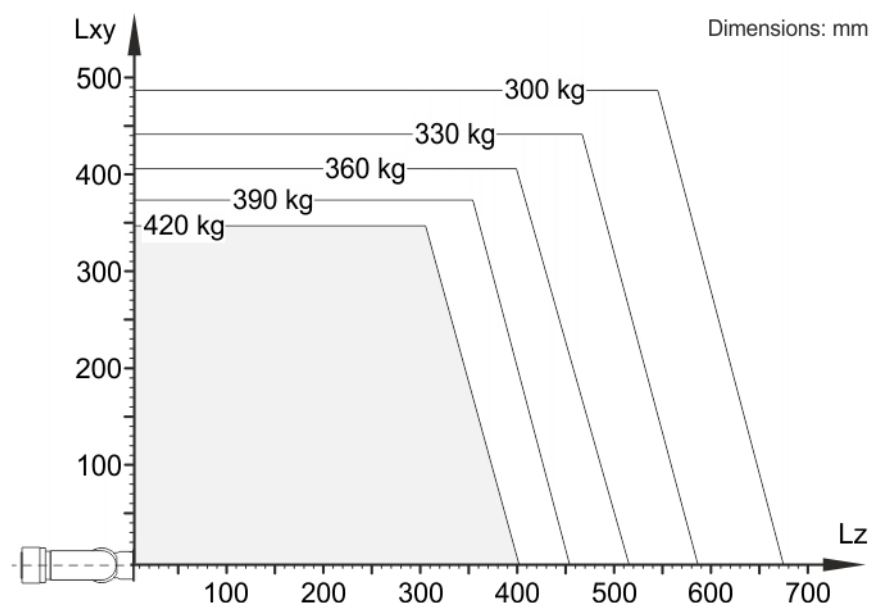


Fig. 4-40: KR 500 FORTEC payload diagram, payload 420 kg

NOTICE This loading curve corresponds to the maximum load capacity. Both values (payload and mass moment of inertia) must be checked in all cases. Exceeding this capacity will reduce the service life of the robot and overload the motors and the gears; in any such case the KUKA Roboter GmbH must be consulted beforehand. The values determined here are necessary for planning the robot application. For commissioning the robot, additional input data are required in accordance with the operating and programming instructions of the KUKA System Software. The mass inertia must be verified using KUKA.Load. It is imperative for the load data to be entered in the robot controller!

In-line wrist

| | |
|--------------------|-----------------------|
| In-line wrist type | ZH500-4F |
| Mounting flange | ISO 9409-1-200-11-M12 |

Mounting flange

| | |
|---------------------|------------------------|
| Screw grade | 12.9 |
| Screw size | M12 |
| Clamping length | 1.5 x nominal diameter |
| Depth of engagement | min. 14 mm, max. 18 mm |
| Locating element | 12 ^{H7} |

The mounting flange is depicted with axis 6 in the zero position (>>> Fig. 4-41) The symbol X_m indicates the position of the locating element (bushing) in the zero position.

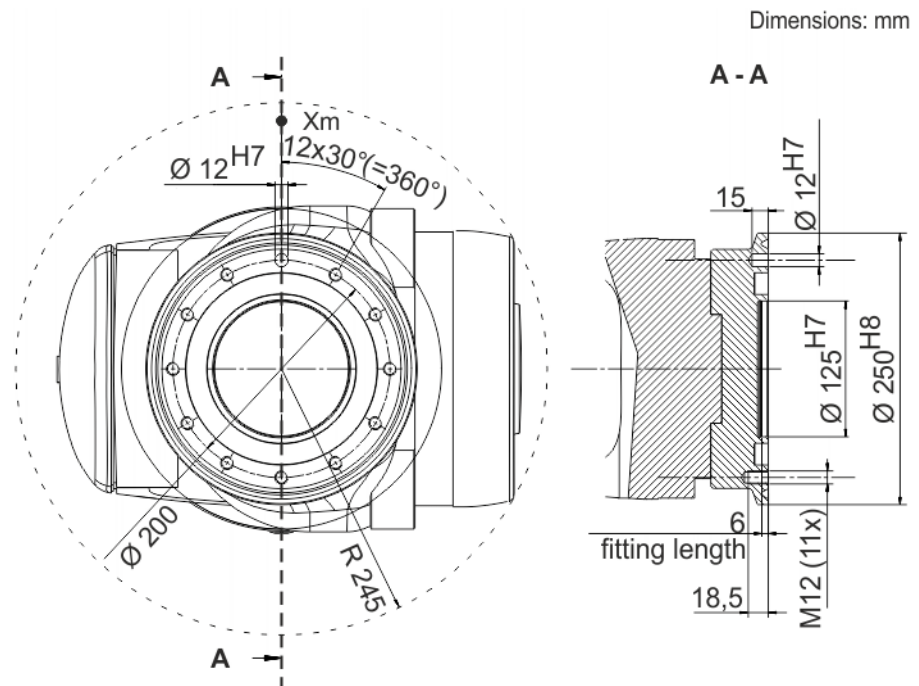


Fig. 4-41: Mounting flange

4.7.4 Loads acting on the foundation, KR 420 R3080 F

Mounting base loads

The specified forces and moments already include the payload and the inertia force (weight) of the robot.

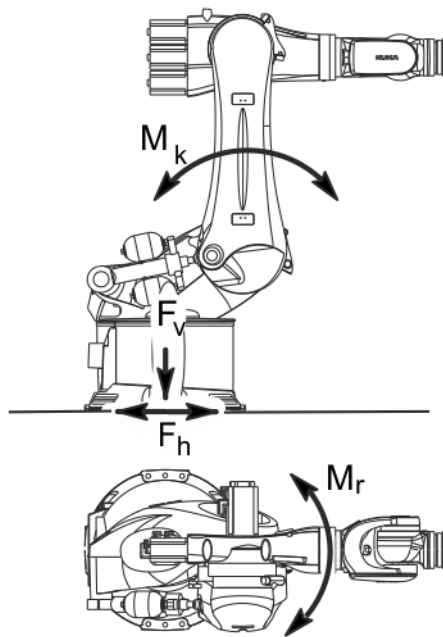


Fig. 4-42: Loads acting on the foundation, floor mounting

| | |
|----------------------------|----------|
| Vertical force $F(v)$ | |
| $F(v)$ normal) | 37000 N |
| $F(v)$ max) | 40500 N |
| Horizontal force $F(h)$ | |
| $F(h)$ normal) | 15900 N |
| $F(h)$ max) | 23500 N |
| Tilting moment $M(k)$ | |
| $M(k)$ normal) | 58900 Nm |
| $M(k)$ max) | 84500 Nm |
| Torque about axis 1 $M(r)$ | |
| $M(r)$ normal) | 18500 Nm |
| $M(r)$ max) | 45500 Nm |

⚠ WARNING Normal loads and maximum loads for the foundations are specified in the table.

The maximum loads must be referred to when dimensioning the foundations and must be adhered to for safety reasons. Failure to observe this can result in personal injury and damage to property.

The normal loads are average expected foundation loads. The actual loads are dependent on the program and on the robot loads and may therefore be greater or less than the normal loads.

The supplementary loads (A1 and A2) are not taken into consideration in the calculation of the mounting base load. These supplementary loads must be taken into consideration for F_v .

4.8 Technical data, KR 340 R3330

4.8.1 Basic data, KR 340 R3330

Basic data

| | KR 340 R3330 |
|----------------------------------|---|
| Number of axes | 6 |
| Number of controlled axes | 6 |
| Volume of working envelope | 114.5 m ³ |
| Pose repeatability (ISO 9283) | ± 0.08 mm |
| Weight | approx. 2421 kg |
| Rated payload | 340 kg |
| Maximum reach | 3326 mm |
| Protection rating | IP65 |
| Protection rating, in-line wrist | IP65 |
| Sound level | < 75 dB (A) |
| Mounting position | Floor |
| Footprint | 1050 mm x 1050 mm |
| Permissible angle of inclination | ≤ 5 ° |
| Default color | Base frame: black (RAL 9005); Moving parts: KUKA orange 2567 |
| Controller | KR C4 |
| Transformation name | KR C4: KR340R3330 C4 FLR |

Ambient conditions

| | |
|---|----------------------------------|
| Humidity class (EN 60204) | - |
| Classification of environmental conditions (EN 60721-3-3) | 3K3 |
| Ambient temperature | |
| During operation | 10 °C to 55 °C (283 K to 328 K) |
| During storage/transportation | -40 °C to 60 °C (233 K to 333 K) |



For operation at low temperatures, it may be necessary to warm up the robot.

Connecting cables

| Cable designation | Connector designation | Interface with robot |
|---|-----------------------|---------------------------------|
| Motor cable | X20.1 - X30.1 | Harting connectors at both ends |
| Motor cable | X20.4 - X30.4 | Harting connectors at both ends |
| Control cable | X21 - X31 | HAN 3A EMC at both ends |
| Ground conductor / equipotential bonding 16 mm ² (optional) | | M8 ring cable lug at both ends |

| | |
|---------------|-----------------------------|
| Cable lengths | |
| Standard | 7 m, 15 m, 25 m, 35 m, 50 m |

For detailed specifications of the connecting cables, see "Description of the connecting cables".

4.8.2 Axis data, KR 340 R3330

Axis data

| Range of motion | |
|--------------------------|--------------------------|
| A1 | $\pm 185^\circ$ |
| A2 | $-130^\circ / 20^\circ$ |
| A3 | $-100^\circ / 144^\circ$ |
| A4 | $\pm 350^\circ$ |
| A5 | $\pm 120^\circ$ |
| A6 | $\pm 350^\circ$ |
| Speed with rated payload | |
| A1 | 90 °/s |
| A2 | 80 °/s |
| A3 | 75 °/s |
| A4 | 90 °/s |
| A5 | 83 °/s |
| A6 | 130 °/s |

The direction of motion and the arrangement of the individual axes may be noted from the diagram (>>> Fig. 4-43).

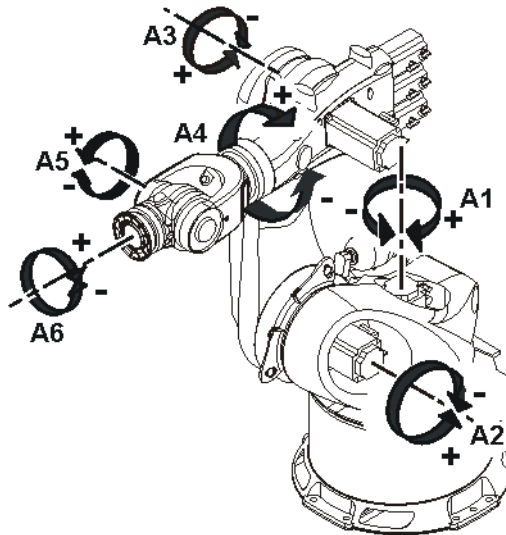


Fig. 4-43: Direction of rotation of robot axes

Mastering position

| Mastering position | |
|--------------------|-------|
| A1 | 0 ° |
| A2 | -90 ° |
| A3 | 90 ° |
| A4 | 0 ° |
| A5 | 0 ° |
| A6 | 0 ° |

Working envelope

The following diagrams (>>> Fig. 4-44) and (>>> Fig. 4-45) show the load center of gravity, shape and size of the working envelope.

The reference point for the working envelope is the intersection of axis 4 with axis 5.

Dimensions: mm

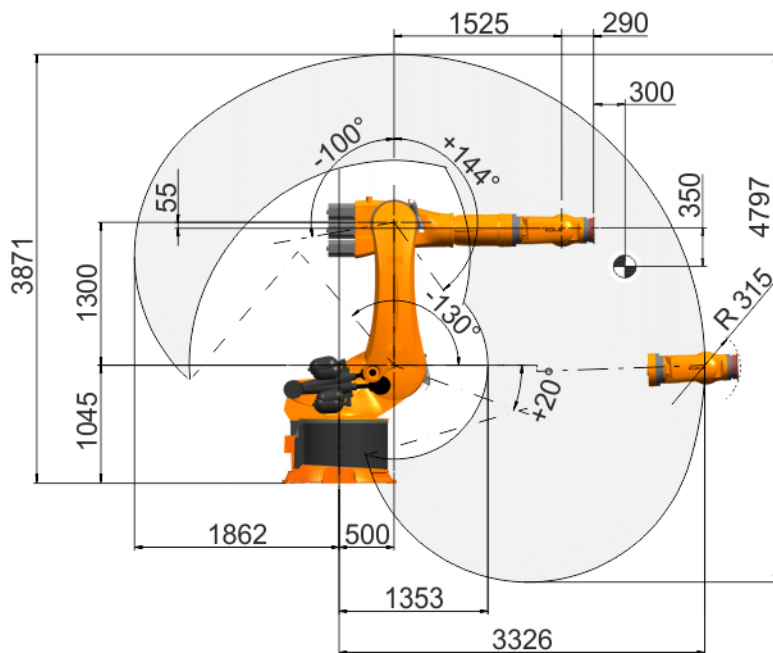


Fig. 4-44: KR 340 R3330 working envelope (with F variant), side view

Dimensions: mm

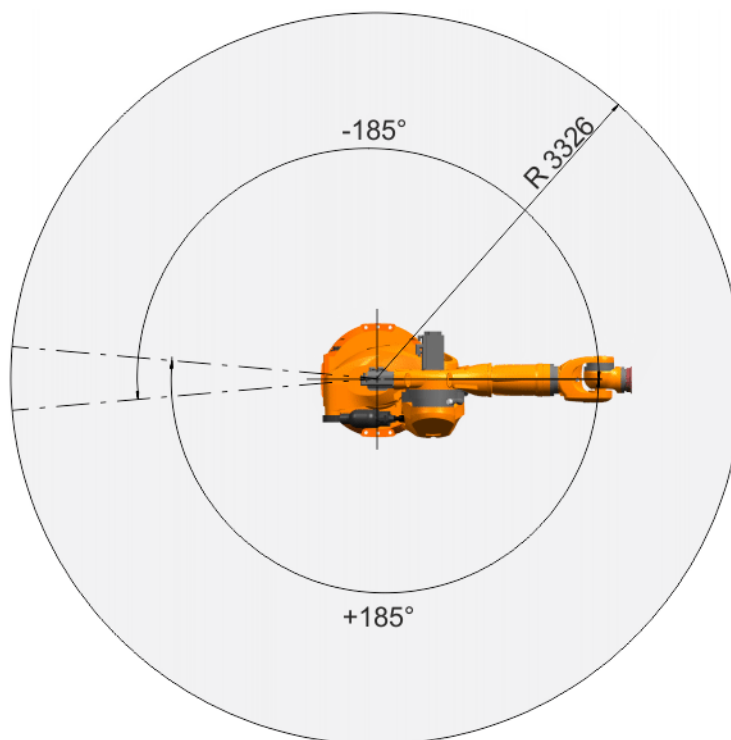


Fig. 4-45: KR 340 R3330 working envelope (with F variant), top view

4.8.3 Payloads, KR 340 R3330

Payloads

| | |
|--------------------------------------|----------------------|
| Rated payload | 340 kg |
| Rated mass moment of inertia | 170 kgm ² |
| Rated total load | 390 kg |
| Rated supplementary load, base frame | 0 kg |

| | |
|---|--------|
| Maximum supplementary load, base frame | 0 kg |
| Rated supplementary load, rotating column | 0 kg |
| Maximum supplementary load, rotating column | 400 kg |
| Rated supplementary load, link arm | 0 kg |
| Maximum supplementary load, link arm | 100 kg |
| Rated supplementary load, arm | 50 kg |
| Maximum supplementary load, arm | 100 kg |
| Nominal distance to load center of gravity | |
| Lxy | 350 mm |
| Lz | 300 mm |

Load center of gravity

For all payloads, the load center of gravity refers to the distance from the face of the mounting flange on axis 6. Refer to the payload diagram for the nominal distance.

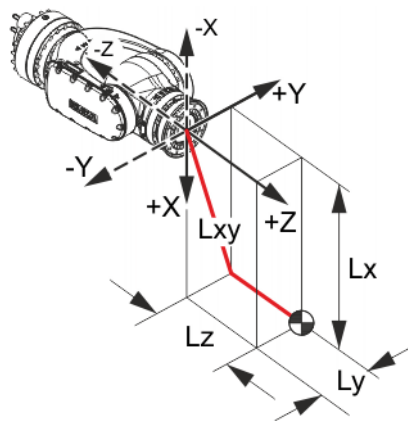


Fig. 4-46: Load center of gravity

Payload diagram

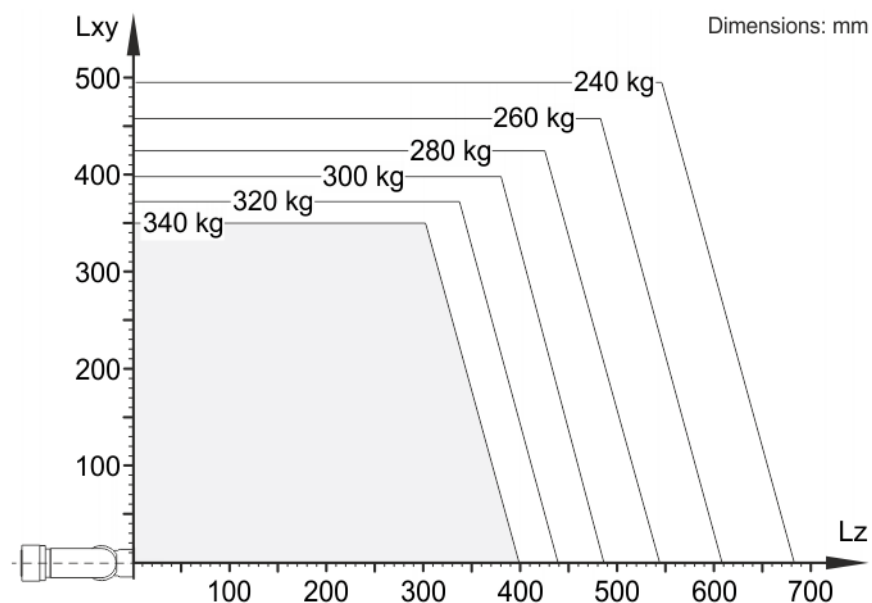


Fig. 4-47: KR 500 FORTEC payload diagram, payload 340 kg

NOTICE This loading curve corresponds to the maximum load capacity. Both values (payload and mass moment of inertia) must be checked in all cases. Exceeding this capacity will reduce the service life of the robot and overload the motors and the gears; in any such case the KUKA Roboter GmbH must be consulted beforehand. The values determined here are necessary for planning the robot application. For commissioning the robot, additional input data are required in accordance with the operating and programming instructions of the KUKA System Software. The mass inertia must be verified using KUKA.Load. It is imperative for the load data to be entered in the robot controller!

In-line wrist

| | |
|--------------------|-----------------------|
| In-line wrist type | ZH500-4 |
| Mounting flange | ISO 9409-1-200-11-M12 |

Mounting flange

| | |
|---------------------|------------------------|
| Screw grade | 12.9 |
| Screw size | M12 |
| Clamping length | 1.5 x nominal diameter |
| Depth of engagement | min. 14 mm, max. 18 mm |
| Locating element | 12 ^{H7} |

The mounting flange is depicted with axis 6 in the zero position (>>> Fig. 4-48) The symbol X_m indicates the position of the locating element (bushing) in the zero position.

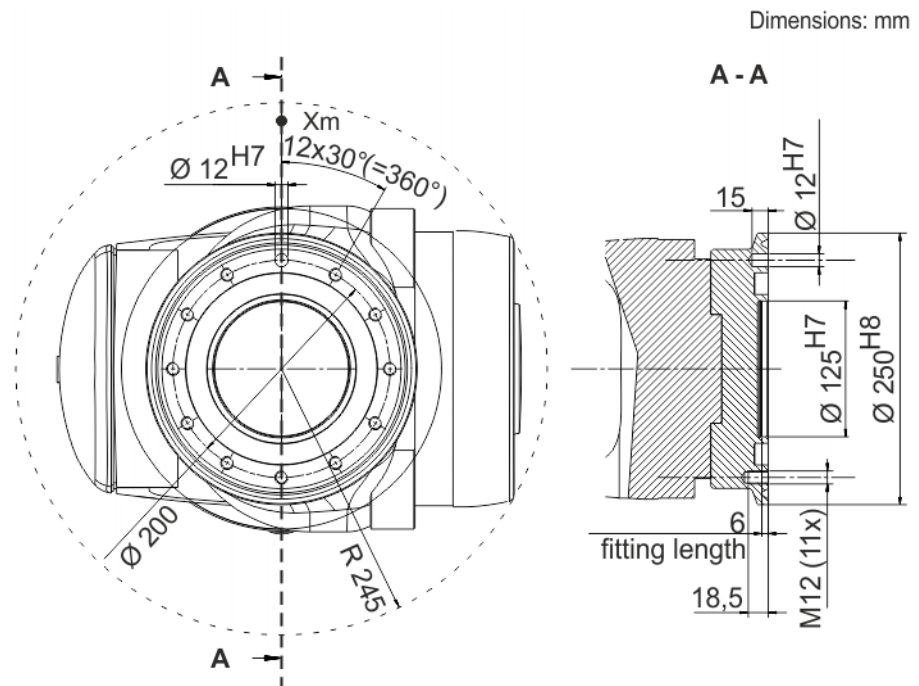


Fig. 4-48: Mounting flange

4.8.4 Loads acting on the foundation, KR 340 R3330

Mounting base loads

The specified forces and moments already include the payload and the inertia force (weight) of the robot.

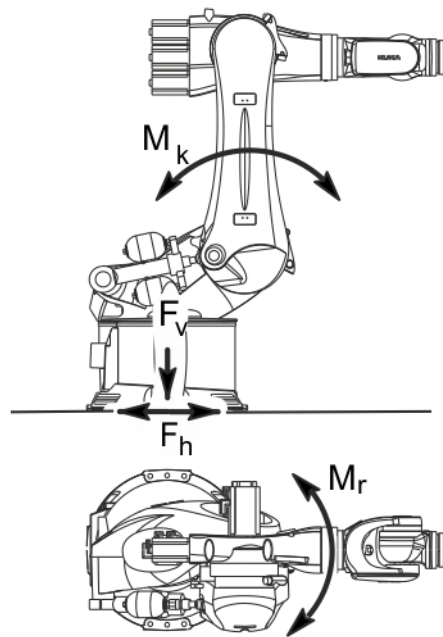


Fig. 4-49: Loads acting on the foundation, floor mounting

| | |
|----------------------------|----------|
| Vertical force $F(v)$ | |
| $F(v)$ normal) | 37000 N |
| $F(v)$ max) | 40500 N |
| Horizontal force $F(h)$ | |
| $F(h)$ normal) | 15900 N |
| $F(h)$ max) | 23500 N |
| Tilting moment $M(k)$ | |
| $M(k)$ normal) | 58900 Nm |
| $M(k)$ max) | 84500 Nm |
| Torque about axis 1 $M(r)$ | |
| $M(r)$ normal) | 18500 Nm |
| $M(r)$ max) | 45500 Nm |

⚠ WARNING Normal loads and maximum loads for the foundations are specified in the table.

The maximum loads must be referred to when dimensioning the foundations and must be adhered to for safety reasons. Failure to observe this can result in personal injury and damage to property.

The normal loads are average expected foundation loads. The actual loads are dependent on the program and on the robot loads and may therefore be greater or less than the normal loads.

The supplementary loads (A1 and A2) are not taken into consideration in the calculation of the mounting base load. These supplementary loads must be taken into consideration for F_v .

4.9 Technical data, KR 340 R3330 F

4.9.1 Basic data, KR 340 R3330 F

Basic data

| | KR 340 R3330 F |
|----------------------------------|---|
| Number of axes | 6 |
| Number of controlled axes | 6 |
| Volume of working envelope | 114.5 m ³ |
| Pose repeatability (ISO 9283) | ± 0.08 mm |
| Weight | approx. 2421 kg |
| Rated payload | 340 kg |
| Maximum reach | 3326 mm |
| Protection rating | IP65 |
| Protection rating, in-line wrist | IP67 |
| Sound level | < 75 dB (A) |
| Mounting position | Floor |
| Footprint | 1050 mm x 1050 mm |
| Permissible angle of inclination | ≤ 5 ° |
| Default color | Base frame: black (RAL 9005); Moving parts: KUKA orange 2567 |
| Controller | KR C4 |
| Transformation name | KR C4: KR340R3330 C4 FLR |

Ambient conditions

| | |
|---|----------------------------------|
| Humidity class (EN 60204) | - |
| Classification of environmental conditions (EN 60721-3-3) | 3K3 |
| Ambient temperature | |
| During operation | 10 °C to 55 °C (283 K to 328 K) |
| During storage/transportation | -40 °C to 60 °C (233 K to 333 K) |



For operation at low temperatures, it may be necessary to warm up the robot.

Foundry robots

| | |
|-------------------------------|---|
| Overpressure in the arm | 0.01 MPa (0.1 bar) |
| Compressed air | Free of oil and water |
| Compressed air supply line | Air line in the cable set |
| Air consumption | 0.1 m ³ /h |
| Air line connection | Quick Star push-in fitting for hose PUN-6x1, blue |
| Pressure regulator connection | R 1/8", internal thread |
| Input pressure | 0.1 - 1.2 MPa (1 - 12 bar) |
| Pressure regulator | 0.005 - 0.07 MPa (0.05 - 0.7 bar) |
| Manometer range | 0.0 - 0.1 MPa (0.0 - 1.0 bar) |
| Filter gauge | 25 - 30 µm |
| Thermal loading | 10 s/min at 353 K (180 °C) |
| Resistance | Increased resistance to dust, lubricants, coolants and water vapor. |

| | |
|-----------------------------------|--|
| Special paint finish on wrist | Heat-resistant and heat-reflecting silver paint finish on the in-line wrist. |
| Special paint finish on the robot | Special paint finish on the entire robot, and an additional protective clear coat. |
| Other ambient conditions | KUKA Roboter GmbH must be consulted if the robot is to be used under other ambient conditions. |

Connecting cables

| Cable designation | Connector designation | Interface with robot |
|---|-----------------------|---------------------------------|
| Motor cable | X20.1 - X30.1 | Harting connectors at both ends |
| Motor cable | X20.4 - X30.4 | Harting connectors at both ends |
| Control cable | X21 - X31 | HAN 3A EMC at both ends |
| Ground conductor / equipotential bonding 16 mm ² (optional) | | M8 ring cable lug at both ends |

| Cable lengths | |
|---------------|-----------------------------|
| Standard | 7 m, 15 m, 25 m, 35 m, 50 m |

For detailed specifications of the connecting cables, see "Description of the connecting cables".

4.9.2 Axis data, KR 340 R3330 F

Axis data

| Range of motion | |
|--------------------------|----------------|
| A1 | ±185 ° |
| A2 | -130 ° / 20 ° |
| A3 | -100 ° / 144 ° |
| A4 | ±350 ° |
| A5 | ±120 ° |
| A6 | ±350 ° |
| Speed with rated payload | |
| A1 | 90 °/s |
| A2 | 80 °/s |
| A3 | 75 °/s |
| A4 | 90 °/s |
| A5 | 83 °/s |
| A6 | 130 °/s |

The direction of motion and the arrangement of the individual axes may be noted from the diagram (>>> Fig. 4-50).

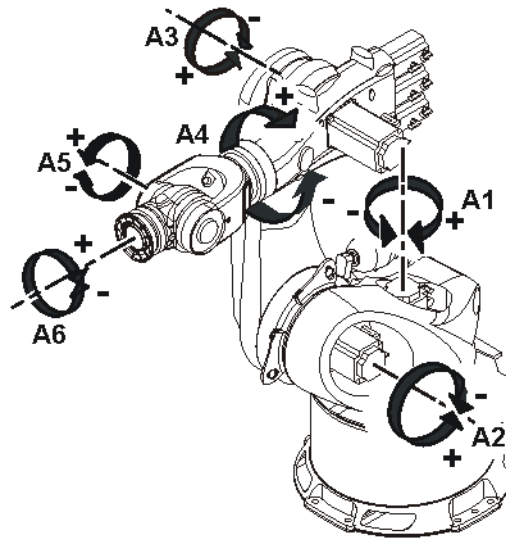


Fig. 4-50: Direction of rotation of robot axes

Mastering position

| Mastering position | |
|--------------------|-------|
| A1 | 0 ° |
| A2 | -90 ° |
| A3 | 90 ° |
| A4 | 0 ° |
| A5 | 0 ° |
| A6 | 0 ° |

Working envelope

The following diagrams (>>> Fig. 4-51) and (>>> Fig. 4-52) show the load center of gravity, shape and size of the working envelope.

The reference point for the working envelope is the intersection of axis 4 with axis 5.

Dimensions: mm

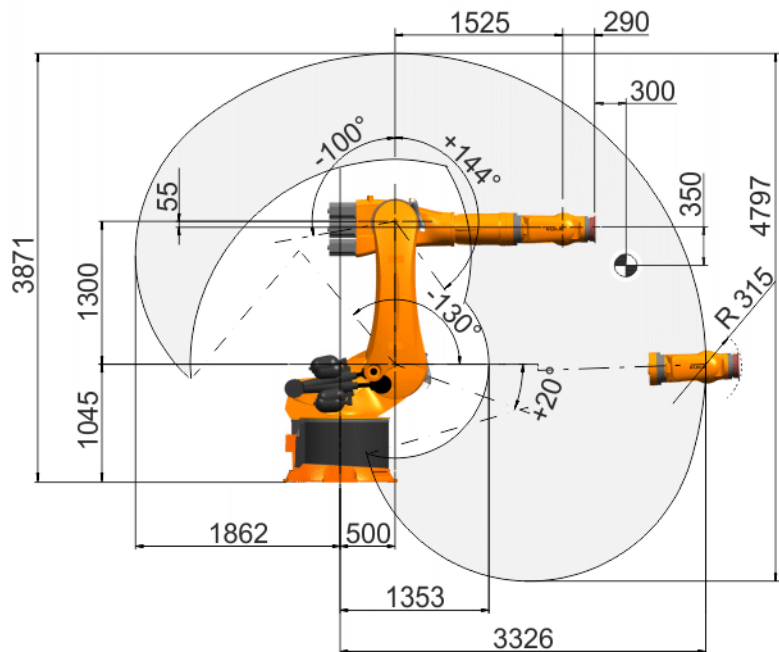


Fig. 4-51: KR 340 R3330 working envelope (with F variant), side view

Dimensions: mm

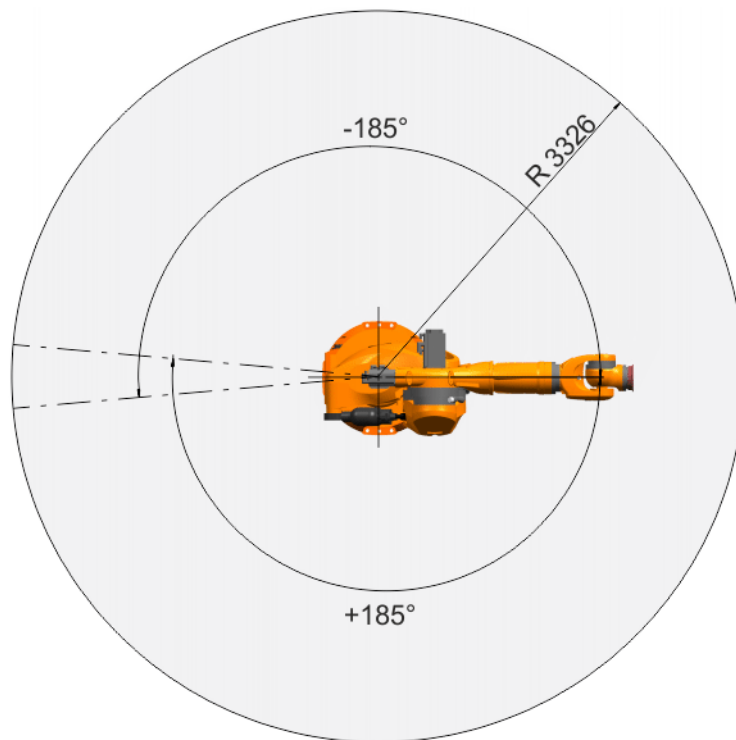


Fig. 4-52: KR 340 R3330 working envelope (with F variant), top view

4.9.3 Payloads, KR 340 R3330 F

Payloads

| | |
|---|----------------------|
| Rated payload | 340 kg |
| Rated mass moment of inertia | 170 kgm ² |
| Rated total load | 390 kg |
| Rated supplementary load, base frame | 0 kg |
| Maximum supplementary load, base frame | 0 kg |
| Rated supplementary load, rotating column | 0 kg |
| Maximum supplementary load, rotating column | 400 kg |
| Rated supplementary load, link arm | 0 kg |
| Maximum supplementary load, link arm | 100 kg |
| Rated supplementary load, arm | 50 kg |
| Maximum supplementary load, arm | 100 kg |
| Nominal distance to load center of gravity | |
| Lxy | 350 mm |
| Lz | 300 mm |

Load center of gravity

For all payloads, the load center of gravity refers to the distance from the face of the mounting flange on axis 6. Refer to the payload diagram for the nominal distance.

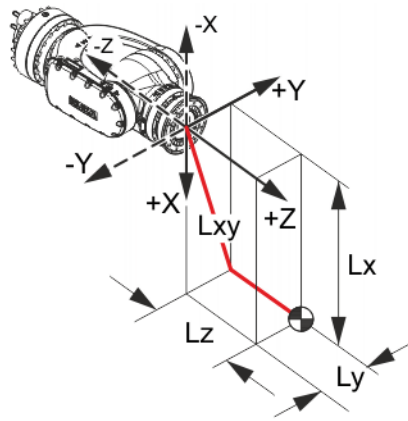


Fig. 4-53: Load center of gravity

Payload diagram

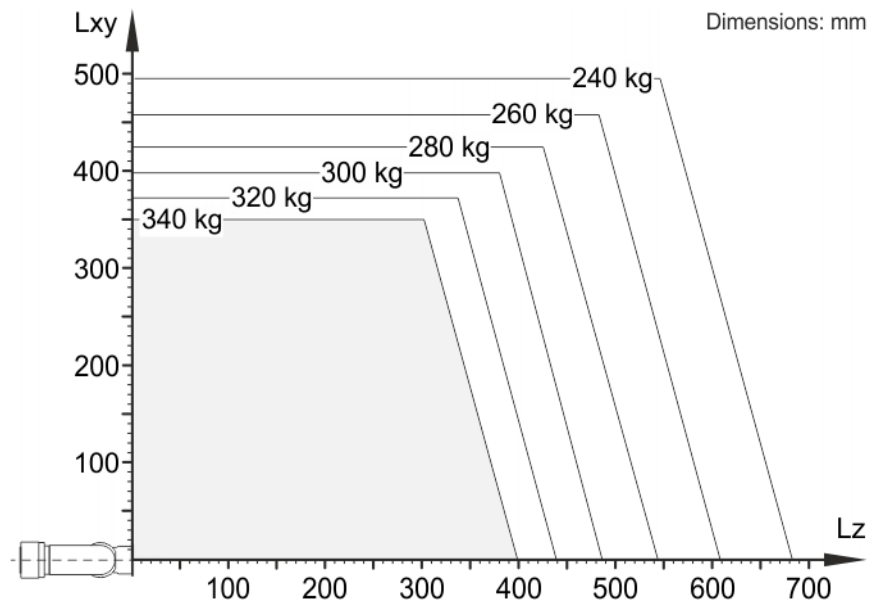


Fig. 4-54: KR 500 FORTEC payload diagram, payload 340 kg

NOTICE This loading curve corresponds to the maximum load capacity. Both values (payload and mass moment of inertia) must be checked in all cases. Exceeding this capacity will reduce the service life of the robot and overload the motors and the gears; in any such case the KUKA Roboter GmbH must be consulted beforehand. The values determined here are necessary for planning the robot application. For commissioning the robot, additional input data are required in accordance with the operating and programming instructions of the KUKA System Software. The mass inertia must be verified using KUKA.Load. It is imperative for the load data to be entered in the robot controller!

In-line wrist

| | |
|--------------------|-----------------------|
| In-line wrist type | ZH500-4F |
| Mounting flange | ISO 9409-1-200-11-M12 |

Mounting flange

| | |
|---------------------|------------------------|
| Screw grade | 12.9 |
| Screw size | M12 |
| Clamping length | 1.5 x nominal diameter |
| Depth of engagement | min. 14 mm, max. 18 mm |
| Locating element | 12 ^{H7} |

The mounting flange is depicted with axis 6 in the zero position (>>> Fig. 4-55) The symbol X_m indicates the position of the locating element (bushing) in the zero position.

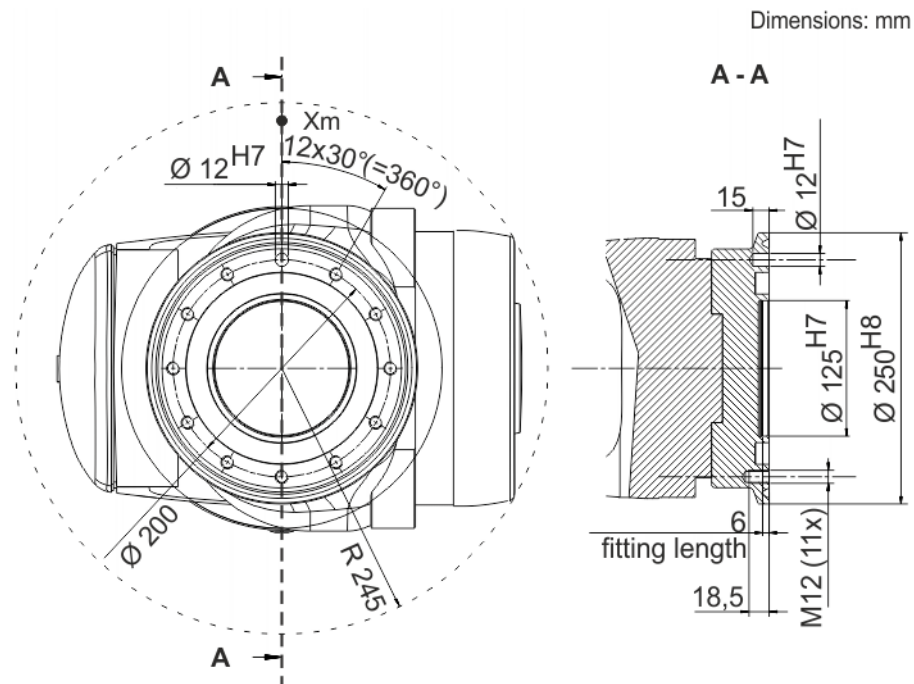


Fig. 4-55: Mounting flange

4.9.4 Loads acting on the foundation, KR 340 R3330 F

Mounting base loads

The specified forces and moments already include the payload and the inertia force (weight) of the robot.

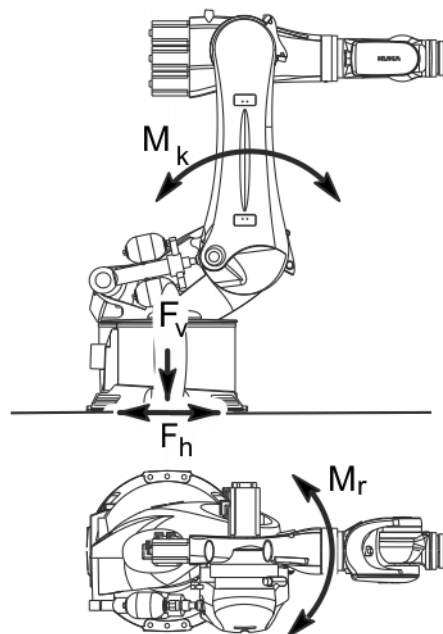


Fig. 4-56: Loads acting on the foundation, floor mounting

| Vertical force $F(v)$ | |
|-----------------------|---------|
| $F(v)$ normal) | 37000 N |
| $F(v)$ max) | 40500 N |

| | |
|--------------------------|----------|
| Horizontal force F(h) | |
| F(h normal) | 15900 N |
| F(h max) | 23500 N |
| Tilting moment M(k) | |
| M(k normal) | 58900 Nm |
| M(k max) | 84500 Nm |
| Torque about axis 1 M(r) | |
| M(r normal) | 18500 Nm |
| M(r max) | 45500 Nm |

⚠ WARNING Normal loads and maximum loads for the foundations are specified in the table. The maximum loads must be referred to when dimensioning the foundations and must be adhered to for safety reasons. Failure to observe this can result in personal injury and damage to property. The normal loads are average expected foundation loads. The actual loads are dependent on the program and on the robot loads and may therefore be greater or less than the normal loads. The supplementary loads (A1 and A2) are not taken into consideration in the calculation of the mounting base load. These supplementary loads must be taken into consideration for F_v .

4.10 Supplementary load

Description

The robot can carry supplementary loads on the arm, on the rotating column and on the link arm. When mounting the supplementary loads, be careful to observe the maximum permissible total load. The dimensions and positions of the installation options can be seen in the following diagram.

Dimensions: mm

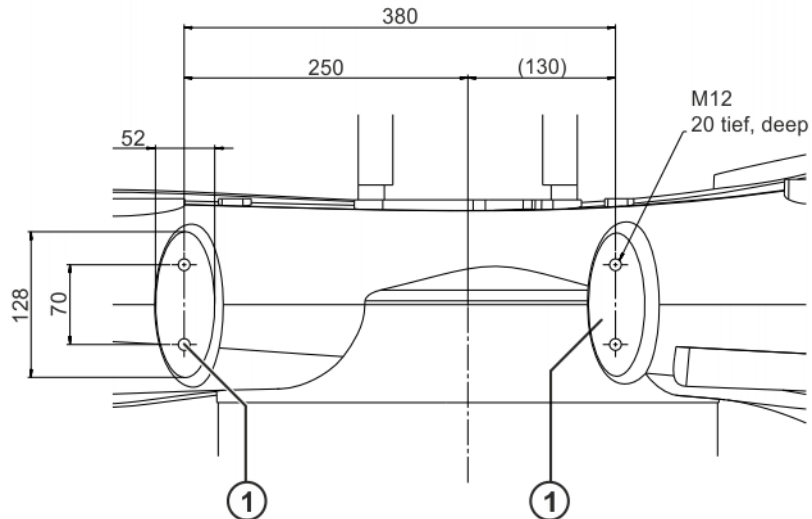


Fig. 4-57: Supplementary load, arm

- 1 Support bracket for supplementary load

Dimensions: mm

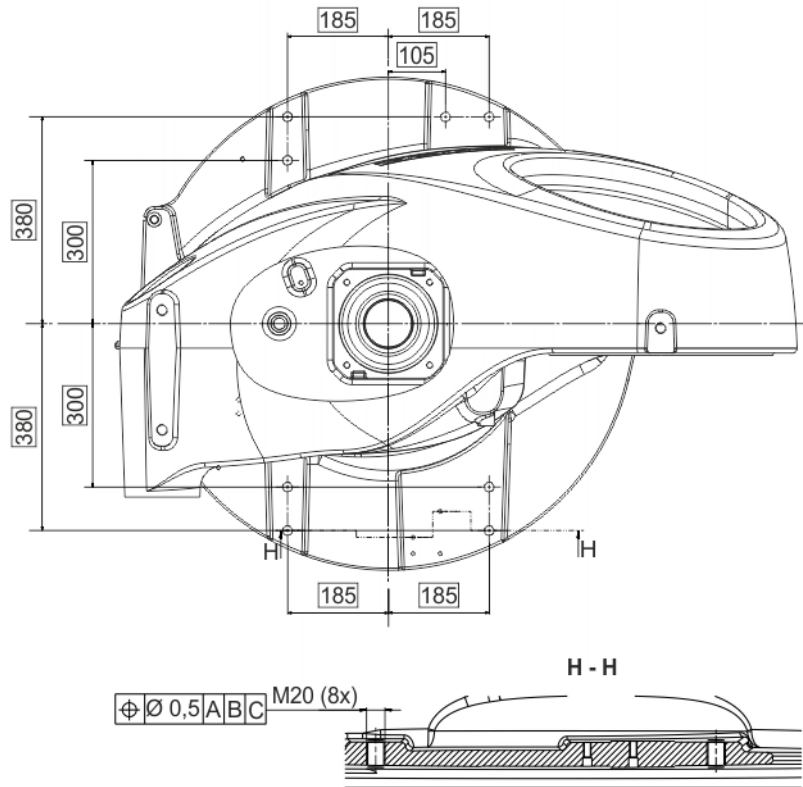


Fig. 4-58: Supplementary load, rotating column

Dimensions: mm

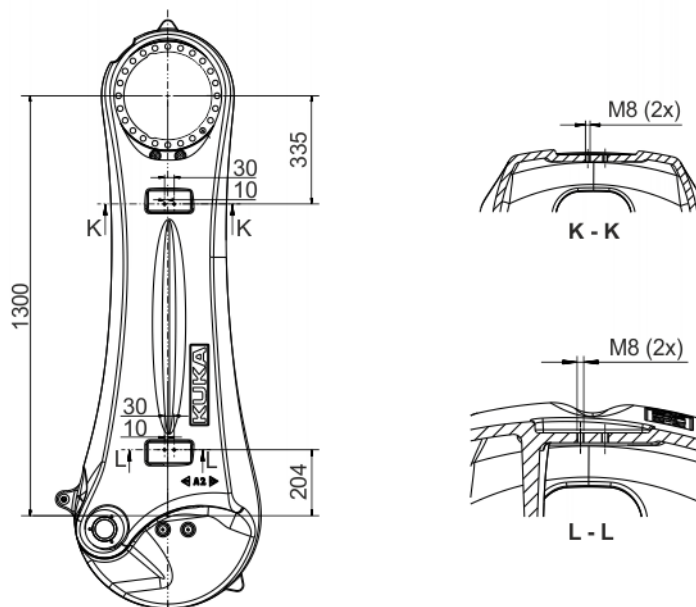


Fig. 4-59: Supplementary load, link arm

4.11 Plates and labels

Plates and labels The following plates and labels are attached to the robot. They must not be removed or rendered illegible. Illegible plates and labels must be replaced.

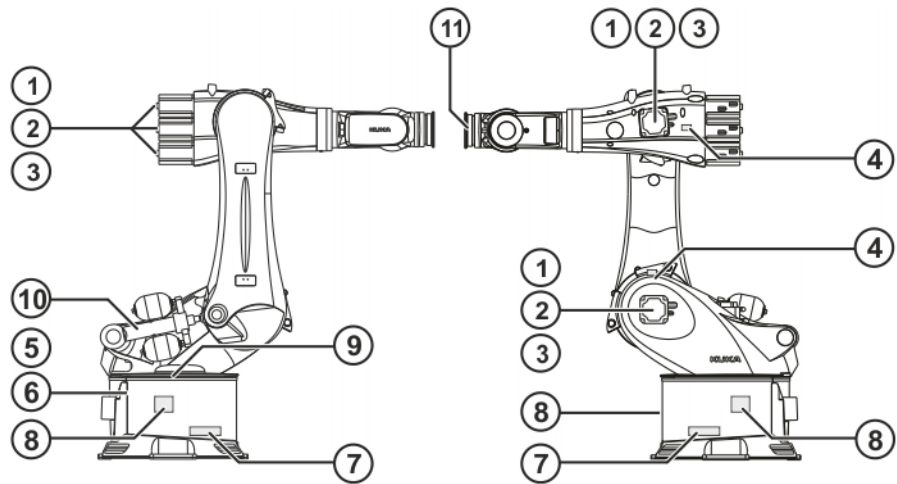



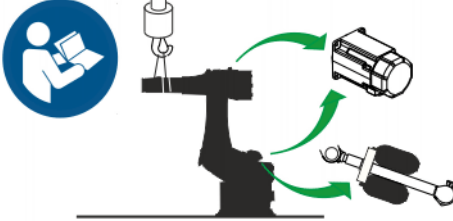




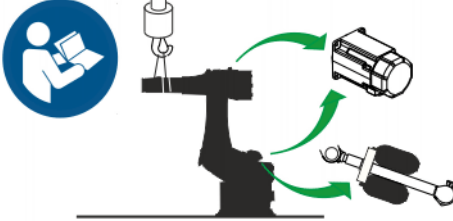




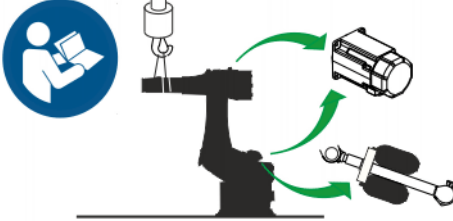



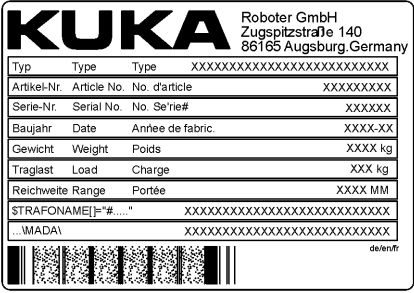
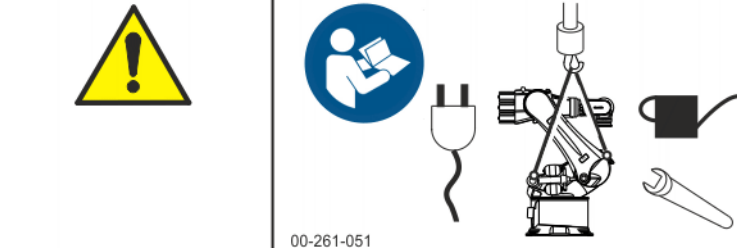

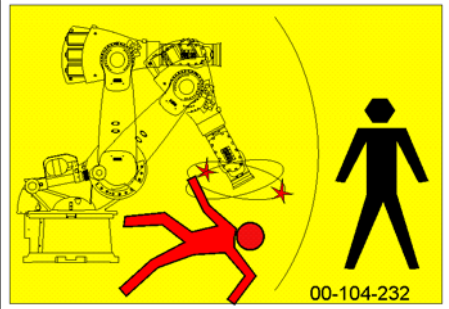

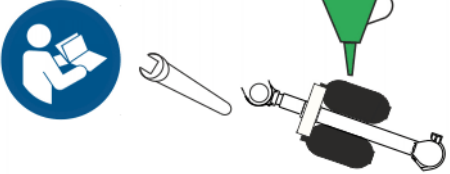

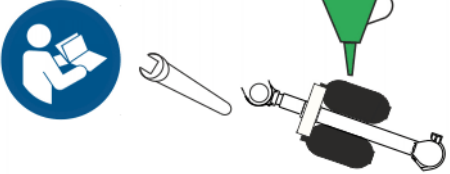

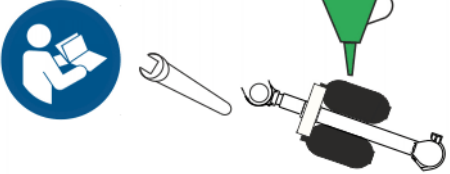


Fig. 4-60: Location of plates and labels

| Item | Description | | | | | | | | |
|---|---|---|--|---|--|---|---|--|--|
| 1 |  <p>High voltage Any improper handling can lead to contact with current-carrying components. Electric shock hazard!</p> | | | | | | | | |
| 2 |  <p>Hot surface During operation of the robot, surface temperatures may be reached that could result in burn injuries. Protective gloves must be worn!</p> | | | | | | | | |
| 3 | <table border="1" data-bbox="647 1308 1430 1827"> <tr> <td data-bbox="647 1308 943 1592">  </td> <td data-bbox="943 1308 1430 1592">  <p>00-261-051</p> </td> </tr> <tr> <td data-bbox="647 1592 943 1671">  <p>CAUTION</p> </td> <td data-bbox="943 1592 1430 1671"> <p>Before removing the motor or counterbalancing system, secure robot axis to prevent it from moving!</p> </td> </tr> <tr> <td data-bbox="647 1671 943 1749">  <p>ATTENTION</p> </td> <td data-bbox="943 1671 1430 1749"> <p>Avant de retirer le moteur ou le système d'équilibrage, protéger l'axe du robot pour éviter tout mouvement!</p> </td> </tr> <tr> <td data-bbox="647 1749 943 1827">  <p>VORSICHT</p> </td> <td data-bbox="943 1749 1430 1827"> <p>Vor Entfernen des Motors oder des Gewichtsausgleichs, Roboterachse gegen Bewegungen sichern!</p> </td> </tr> </table> <p>Secure the axes Before exchanging any motor or counterbalancing system, secure the corresponding axis through safeguarding by suitable means/ devices to protect against possible movement. The axis can move. Risk of crushing!</p> |  |  <p>00-261-051</p> |  <p>CAUTION</p> | <p>Before removing the motor or counterbalancing system, secure robot axis to prevent it from moving!</p> |  <p>ATTENTION</p> | <p>Avant de retirer le moteur ou le système d'équilibrage, protéger l'axe du robot pour éviter tout mouvement!</p> |  <p>VORSICHT</p> | <p>Vor Entfernen des Motors oder des Gewichtsausgleichs, Roboterachse gegen Bewegungen sichern!</p> |
|  |  <p>00-261-051</p> | | | | | | | | |
|  <p>CAUTION</p> | <p>Before removing the motor or counterbalancing system, secure robot axis to prevent it from moving!</p> | | | | | | | | |
|  <p>ATTENTION</p> | <p>Avant de retirer le moteur ou le système d'équilibrage, protéger l'axe du robot pour éviter tout mouvement!</p> | | | | | | | | |
|  <p>VORSICHT</p> | <p>Vor Entfernen des Motors oder des Gewichtsausgleichs, Roboterachse gegen Bewegungen sichern!</p> | | | | | | | | |

| Item | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------|--|------------------|--|--------------------|--|-------------------|---|---------------|------------|-----------|------------|------------|--------|------------------|--|--------------------|--|-------------------|--|-------|---------|----------|------|--------|--------|------------|-------|--------|---------|--------------------|--|--|----------------------------|----------|--|--|----------------------------|
| 4 | <div data-bbox="539 203 986 526" style="border: 1px solid black; padding: 5px;">  <p>KUKA Roboter GmbH Zugspitzstraße 140 86165 Augsburg, Germany</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Typ</td> <td>Type</td> <td>Type</td> <td>XXXXXXXXXXXXXXXXXXXXXXXXXX</td> </tr> <tr> <td>Artikel-Nr.</td> <td>Article No.</td> <td>No. d'article</td> <td>XXXXXXXXXX</td> </tr> <tr> <td>Serie-Nr.</td> <td>Serial No.</td> <td>No. Série#</td> <td>XXXXXX</td> </tr> <tr> <td>Baujahr</td> <td>Date</td> <td>Année de fabric.</td> <td>XXXX-XX</td> </tr> <tr> <td>Gewicht</td> <td>Weight</td> <td>Poids</td> <td>XXXX kg</td> </tr> <tr> <td>Traglast</td> <td>Load</td> <td>Charge</td> <td>XXX kg</td> </tr> <tr> <td>Reichweite</td> <td>Range</td> <td>Portée</td> <td>XXXX MM</td> </tr> <tr> <td colspan="2">STRAFNAME]="#...."</td> <td></td> <td>XXXXXXXXXXXXXXXXXXXXXXXXXX</td> </tr> <tr> <td colspan="2">...WADA]</td> <td></td> <td>XXXXXXXXXXXXXXXXXXXXXXXXXX</td> </tr> </table> </div> <p>Identification plate Content according to Machinery Directive.</p> | Typ | Type | Type | XXXXXXXXXXXXXXXXXXXXXXXXXX | Artikel-Nr. | Article No. | No. d'article | XXXXXXXXXX | Serie-Nr. | Serial No. | No. Série# | XXXXXX | Baujahr | Date | Année de fabric. | XXXX-XX | Gewicht | Weight | Poids | XXXX kg | Traglast | Load | Charge | XXX kg | Reichweite | Range | Portée | XXXX MM | STRAFNAME]="#...." | | | XXXXXXXXXXXXXXXXXXXXXXXXXX | ...WADA] | | | XXXXXXXXXXXXXXXXXXXXXXXXXX |
| Typ | Type | Type | XXXXXXXXXXXXXXXXXXXXXXXXXX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Artikel-Nr. | Article No. | No. d'article | XXXXXXXXXX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Serie-Nr. | Serial No. | No. Série# | XXXXXX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Baujahr | Date | Année de fabric. | XXXX-XX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gewicht | Weight | Poids | XXXX kg | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Traglast | Load | Charge | XXX kg | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reichweite | Range | Portée | XXXX MM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRAFNAME]="#...." | | | XXXXXXXXXXXXXXXXXXXXXXXXXX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ...WADA] | | | XXXXXXXXXXXXXXXXXXXXXXXXXX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | <div data-bbox="539 638 1311 1102" style="border: 1px solid black; padding: 5px;">  <p>00-261-051</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: yellow; text-align: center;">⚠ CAUTION</td> <td>Secure the system before beginning work on the robot. Read and observe the safety instructions!</td> </tr> <tr> <td style="background-color: yellow; text-align: center;">⚠ ATTENTION</td> <td>Bloquer le système avant d'effectuer des travaux sur le robot. Lire et respecter les remarques relatives à la sécurité!</td> </tr> <tr> <td style="background-color: yellow; text-align: center;">⚠ VORSICHT</td> <td>Vor Arbeiten am Roboter, System sichern. Sicherheitshinweise lesen und beachten!</td> </tr> </table> </div> <p>Work on the robot Before start-up, transportation or maintenance, read and follow the assembly and operating instructions.</p> | ⚠ CAUTION | Secure the system before beginning work on the robot. Read and observe the safety instructions! | ⚠ ATTENTION | Bloquer le système avant d'effectuer des travaux sur le robot. Lire et respecter les remarques relatives à la sécurité! | ⚠ VORSICHT | Vor Arbeiten am Roboter, System sichern. Sicherheitshinweise lesen und beachten! | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ⚠ CAUTION | Secure the system before beginning work on the robot. Read and observe the safety instructions! | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ⚠ ATTENTION | Bloquer le système avant d'effectuer des travaux sur le robot. Lire et respecter les remarques relatives à la sécurité! | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ⚠ VORSICHT | Vor Arbeiten am Roboter, System sichern. Sicherheitshinweise lesen und beachten! | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | <div data-bbox="539 1243 1311 1684" style="border: 1px solid black; padding: 5px;">  <p>00-261-051</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>A1</td> <td>A2</td> <td>A3</td> <td>A4</td> <td>A5</td> <td>A6</td> </tr> <tr> <td>0°</td> <td>-130°</td> <td>+130°</td> <td>0°</td> <td>+90°</td> <td>0°</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: yellow; text-align: center;">⚠ CAUTION</td> <td>Move the robot into its transport position before removing the mounting base!</td> </tr> <tr> <td style="background-color: yellow; text-align: center;">⚠ ATTENTION</td> <td>Amener le robot en position de transport avant de défaire la fixation aux fondations!</td> </tr> <tr> <td style="background-color: yellow; text-align: center;">⚠ VORSICHT</td> <td>Roboter vor Lösen der Fundamentbefestigung in Tranportstellung bringen!</td> </tr> </table> </div> <p>Transport position Before loosening the bolts of the mounting base, the robot must be in the transport position as indicated in the table. Risk of toppling!</p> | A1 | A2 | A3 | A4 | A5 | A6 | 0° | -130° | +130° | 0° | +90° | 0° | ⚠ CAUTION | Move the robot into its transport position before removing the mounting base! | ⚠ ATTENTION | Amener le robot en position de transport avant de défaire la fixation aux fondations! | ⚠ VORSICHT | Roboter vor Lösen der Fundamentbefestigung in Tranportstellung bringen! | | | | | | | | | | | | | | | | | | |
| A1 | A2 | A3 | A4 | A5 | A6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0° | -130° | +130° | 0° | +90° | 0° | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ⚠ CAUTION | Move the robot into its transport position before removing the mounting base! | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ⚠ ATTENTION | Amener le robot en position de transport avant de défaire la fixation aux fondations! | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ⚠ VORSICHT | Roboter vor Lösen der Fundamentbefestigung in Tranportstellung bringen! | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Item | Description | | | | | | | | | | | | | | | | | | | | |
|---|--|---|---|-------------------------|--|---------------------------|---|--------------------------|--|-------------------|---------------------|------------|-----------|-----|------------------|-----------------|---------------------|---------------------|-----------|--------------------|--|
| 7 |  <p>Danger zone Entering the danger zone of the robot is prohibited if the robot is in operation or ready for operation. Risk of injury!</p> | | | | | | | | | | | | | | | | | | | | |
| 8 | <table border="1" data-bbox="651 651 1434 1144"> <tr> <td data-bbox="651 651 943 927">  </td> <td data-bbox="943 651 1434 927">  <p>p > 21,8 MPa (218 bar) 00-261-051</p> </td> </tr> <tr> <td data-bbox="651 927 943 1003"> <p>⚠ CAUTION</p> </td> <td data-bbox="943 927 1434 1003"> <p>Counterbalancing system pressurized – read and observe safety instructions before beginning work!</p> </td> </tr> <tr> <td data-bbox="651 1003 943 1079"> <p>⚠ ATTENTION</p> </td> <td data-bbox="943 1003 1434 1079"> <p>Le système d'équilibrage est sous pression, lire et respecter les remarques relatives à la sécurité avant d'effectuer des travaux!</p> </td> </tr> <tr> <td data-bbox="651 1079 943 1144"> <p>⚠ VORSICHT</p> </td> <td data-bbox="943 1079 1434 1144"> <p>Gewichtsausgleich unter Druck, vor Arbeiten Sicherheitshinweise lesen und beachten!</p> </td> </tr> </table> <p>Counterbalancing system The system is pressurized with oil and nitrogen. Read and follow the assembly and operating instructions before commencing work on the counterbalancing system. Risk of injury!</p> |  |  <p>p > 21,8 MPa (218 bar) 00-261-051</p> | <p>⚠ CAUTION</p> | <p>Counterbalancing system pressurized – read and observe safety instructions before beginning work!</p> | <p>⚠ ATTENTION</p> | <p>Le système d'équilibrage est sous pression, lire et respecter les remarques relatives à la sécurité avant d'effectuer des travaux!</p> | <p>⚠ VORSICHT</p> | <p>Gewichtsausgleich unter Druck, vor Arbeiten Sicherheitshinweise lesen und beachten!</p> | | | | | | | | | | | | |
|  |  <p>p > 21,8 MPa (218 bar) 00-261-051</p> | | | | | | | | | | | | | | | | | | | | |
| <p>⚠ CAUTION</p> | <p>Counterbalancing system pressurized – read and observe safety instructions before beginning work!</p> | | | | | | | | | | | | | | | | | | | | |
| <p>⚠ ATTENTION</p> | <p>Le système d'équilibrage est sous pression, lire et respecter les remarques relatives à la sécurité avant d'effectuer des travaux!</p> | | | | | | | | | | | | | | | | | | | | |
| <p>⚠ VORSICHT</p> | <p>Gewichtsausgleich unter Druck, vor Arbeiten Sicherheitshinweise lesen und beachten!</p> | | | | | | | | | | | | | | | | | | | | |
| 9 | <table border="1" data-bbox="651 1332 1107 1608"> <tr> <td>Schrauben</td> <td>M12 Qualität 12.9</td> </tr> <tr> <td>Einschraubtiefe</td> <td>min. 14mm max. 18mm</td> </tr> <tr> <td>Klemmlänge</td> <td>min. 18mm</td> </tr> <tr> <td>Fastening screws</td> <td>M12 quality 12.9</td> </tr> <tr> <td>Engagement length</td> <td>min. 14mm max. 18mm</td> </tr> <tr> <td>Screw grip</td> <td>min. 18mm</td> </tr> <tr> <td>Vis</td> <td>M12 qualité 12.9</td> </tr> <tr> <td>Longueur vissée</td> <td>min. 14mm max. 18mm</td> </tr> <tr> <td>Longueur de serrage</td> <td>min. 18mm</td> </tr> <tr> <td colspan="2" style="text-align: right;">Art.Nr. 00-243-772</td> </tr> </table> <p>Mounting flange on in-line wrist The values specified on this plate apply for the installation of tools on the mounting flange of the wrist and must be observed.</p> | Schrauben | M12 Qualität 12.9 | Einschraubtiefe | min. 14mm max. 18mm | Klemmlänge | min. 18mm | Fastening screws | M12 quality 12.9 | Engagement length | min. 14mm max. 18mm | Screw grip | min. 18mm | Vis | M12 qualité 12.9 | Longueur vissée | min. 14mm max. 18mm | Longueur de serrage | min. 18mm | Art.Nr. 00-243-772 | |
| Schrauben | M12 Qualität 12.9 | | | | | | | | | | | | | | | | | | | | |
| Einschraubtiefe | min. 14mm max. 18mm | | | | | | | | | | | | | | | | | | | | |
| Klemmlänge | min. 18mm | | | | | | | | | | | | | | | | | | | | |
| Fastening screws | M12 quality 12.9 | | | | | | | | | | | | | | | | | | | | |
| Engagement length | min. 14mm max. 18mm | | | | | | | | | | | | | | | | | | | | |
| Screw grip | min. 18mm | | | | | | | | | | | | | | | | | | | | |
| Vis | M12 qualité 12.9 | | | | | | | | | | | | | | | | | | | | |
| Longueur vissée | min. 14mm max. 18mm | | | | | | | | | | | | | | | | | | | | |
| Longueur de serrage | min. 18mm | | | | | | | | | | | | | | | | | | | | |
| Art.Nr. 00-243-772 | | | | | | | | | | | | | | | | | | | | | |

4.12 Stopping distances and times

4.12.1 General information

Information concerning the data:

- The stopping distance is the angle traveled by the robot from the moment the stop signal is triggered until the robot comes to a complete standstill.

- The stopping time is the time that elapses from the moment the stop signal is triggered until the robot comes to a complete standstill.
- The data are given for the main axes A1, A2 and A3. The main axes are the axes with the greatest deflection.
- Superposed axis motions can result in longer stopping distances.
- Stopping distances and stopping times in accordance with DIN EN ISO 10218-1, Annex B.
- Stop categories:
 - Stop category 0 » STOP 0
 - Stop category 1 » STOP 1
according to IEC 60204-1
- The values specified for Stop 0 are guide values determined by means of tests and simulation. They are average values which conform to the requirements of DIN EN ISO 10218-1. The actual stopping distances and stopping times may differ due to internal and external influences on the braking torque. It is therefore advisable to determine the exact stopping distances and stopping times where necessary under the real conditions of the actual robot application.
- Measuring technique
The stopping distances were measured using the robot-internal measuring technique.
- The wear on the brakes varies depending on the operating mode, robot application and the number of STOP 0 triggered. It is therefore advisable to check the stopping distance at least once a year.

4.12.2 Terms used

| Term | Description |
|-----------|--|
| m | Mass of the rated load and the supplementary load on the arm. |
| Phi | Angle of rotation (°) about the corresponding axis. This value can be entered in the controller via the KCP/ smartPAD and can be displayed on the KCP/smartPAD. |
| POV | Program override (%) = velocity of the robot motion. This value can be entered in the controller via the KCP/ smartPAD and can be displayed on the KCP/smartPAD. |
| Extension | Distance (l in %) (>>> Fig. 4-61) between axis 1 and the intersection of axes 4 and 5. With parallelogram robots, the distance between axis 1 and the intersection of axis 6 and the mounting flange. |
| KCP | KUKA Control Panel Teach pendant for the KR C2/KR C2 edition2005 The KCP has all the operator control and display functions required for operating and programming the industrial robot. |
| smartPAD | Teach pendant for the KR C4 The smartPAD has all the operator control and display functions required for operating and programming the industrial robot. |

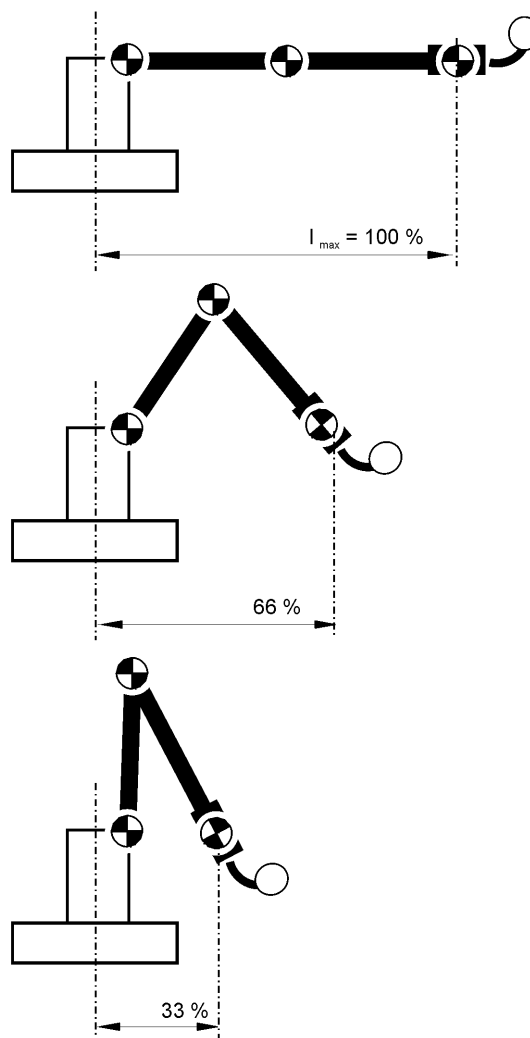


Fig. 4-61: Extension

4.12.3 Stopping distances and times, KR 500 R2830 (with F and C variants)

4.12.3.1 Stopping distances and stopping times for STOP 0, axis 1 to axis 3

The table shows the stopping distances and stopping times after a STOP 0 (category 0 stop) is triggered. The values refer to the following configuration:

- Extension $l = 100\%$
- Program override POV = 100%
- Mass $m =$ maximum load (rated load + supplementary load on arm)

| | Stopping distance (°) | Stopping time (s) |
|--------|-----------------------|-------------------|
| Axis 1 | 23.79 | 0.692 |
| Axis 2 | 30.94 | 0.666 |
| Axis 3 | 19.40 | 0.362 |

4.12.3.2 Stopping distances and stopping times for STOP 1, axis 1

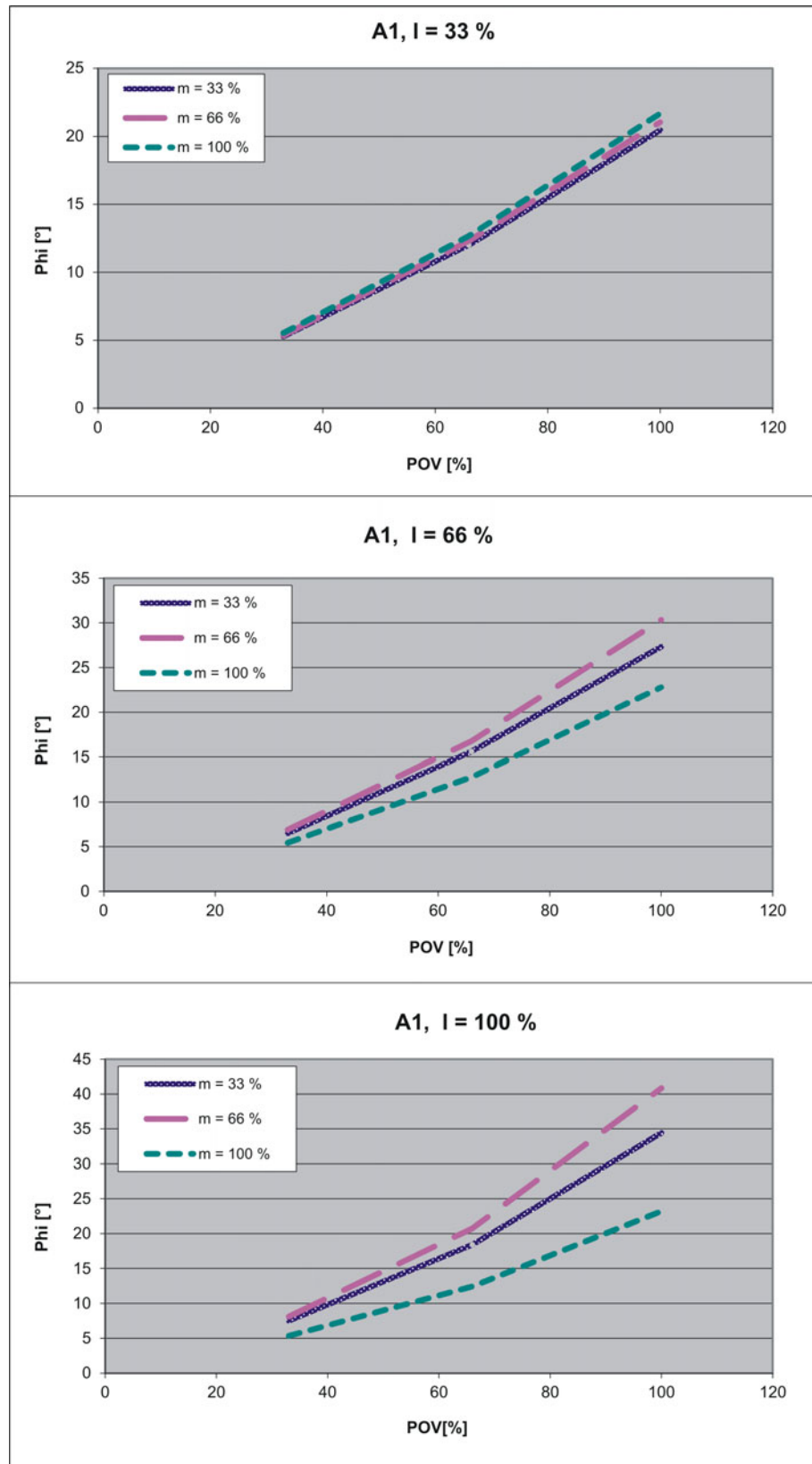


Fig. 4-62: Stopping distances for STOP 1, axis 1

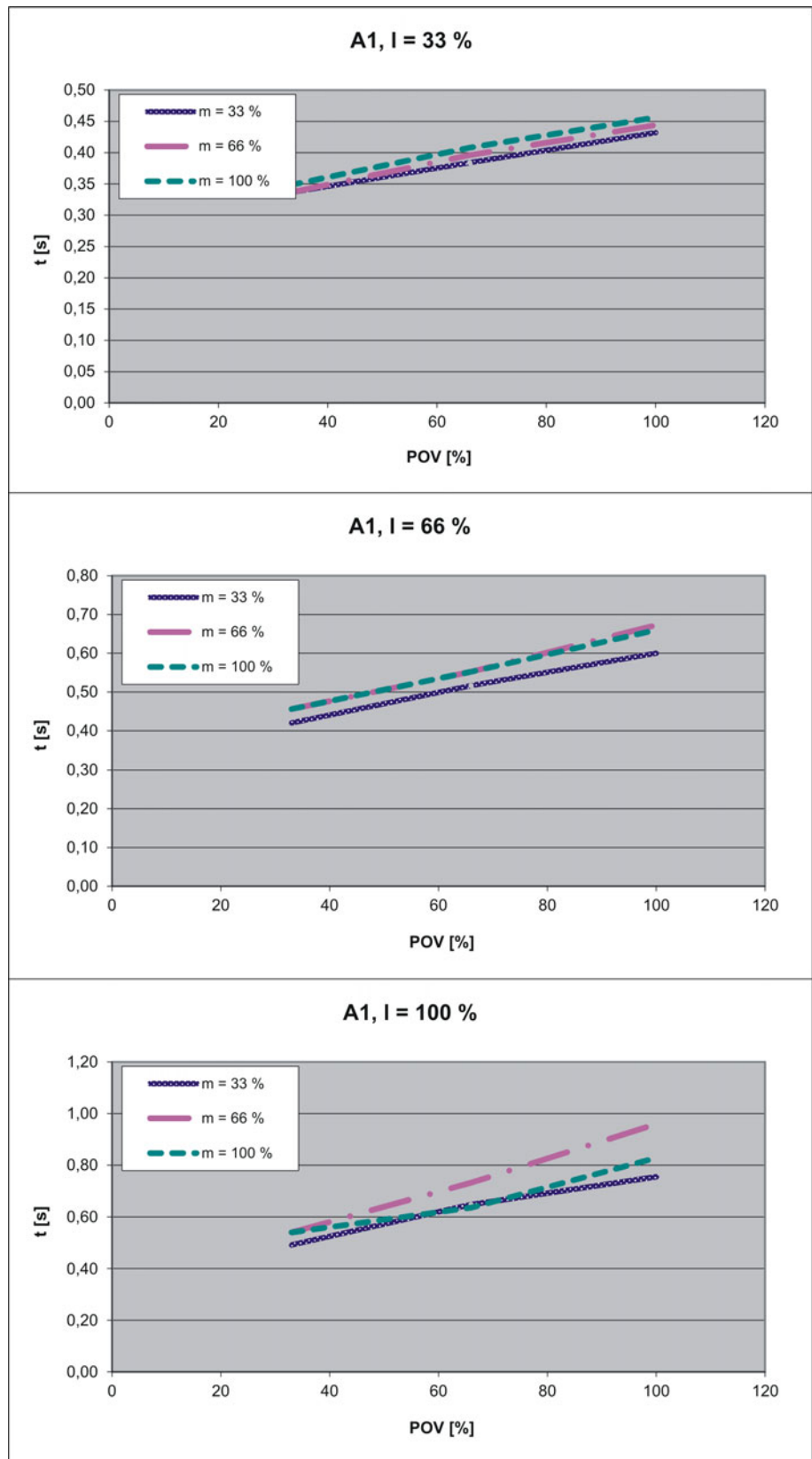


Fig. 4-63: Stopping times for STOP 1, axis 1

4.12.3.3 Stopping distances and stopping times for STOP 1, axis 2

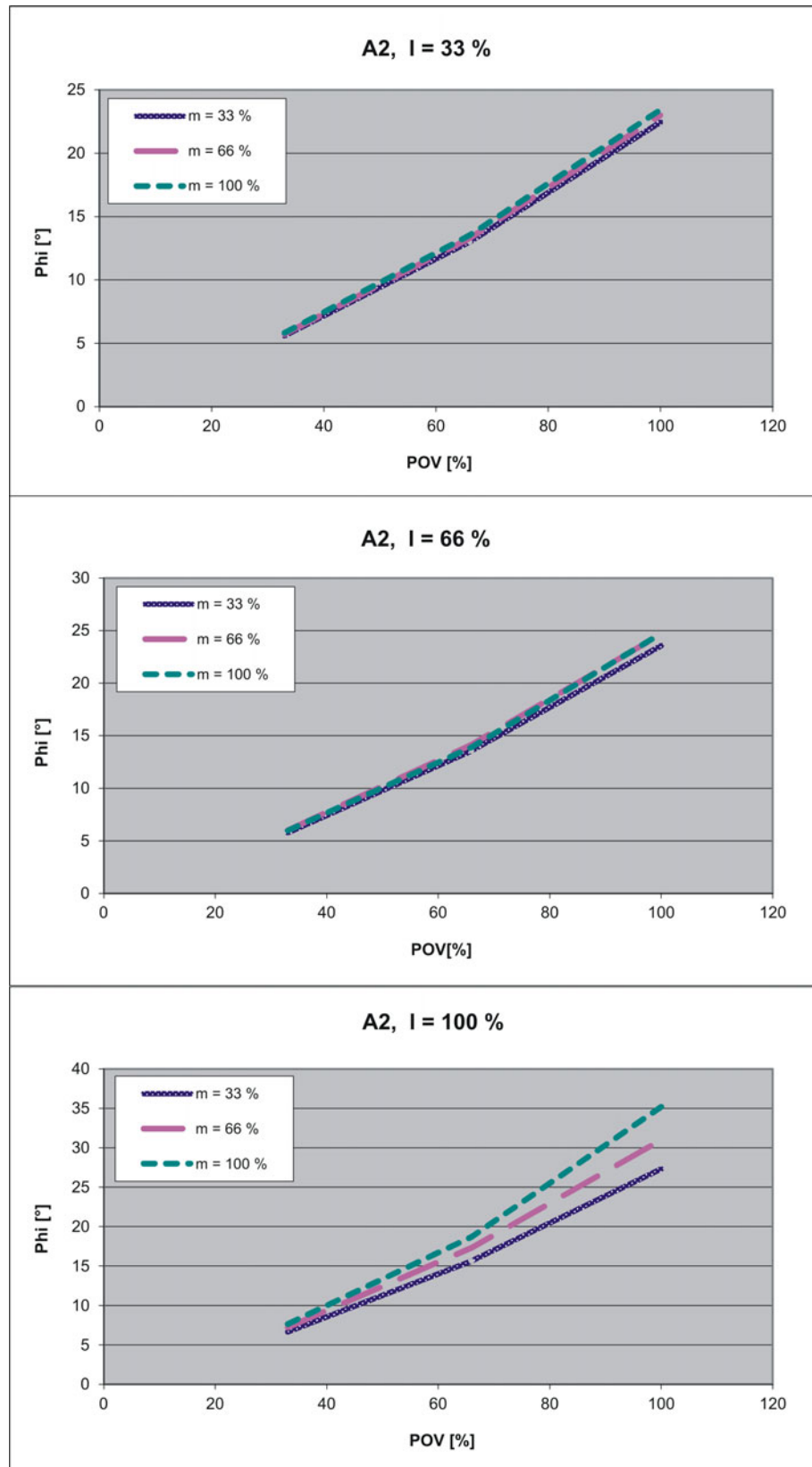


Fig. 4-64: Stopping distances for STOP 1, axis 2

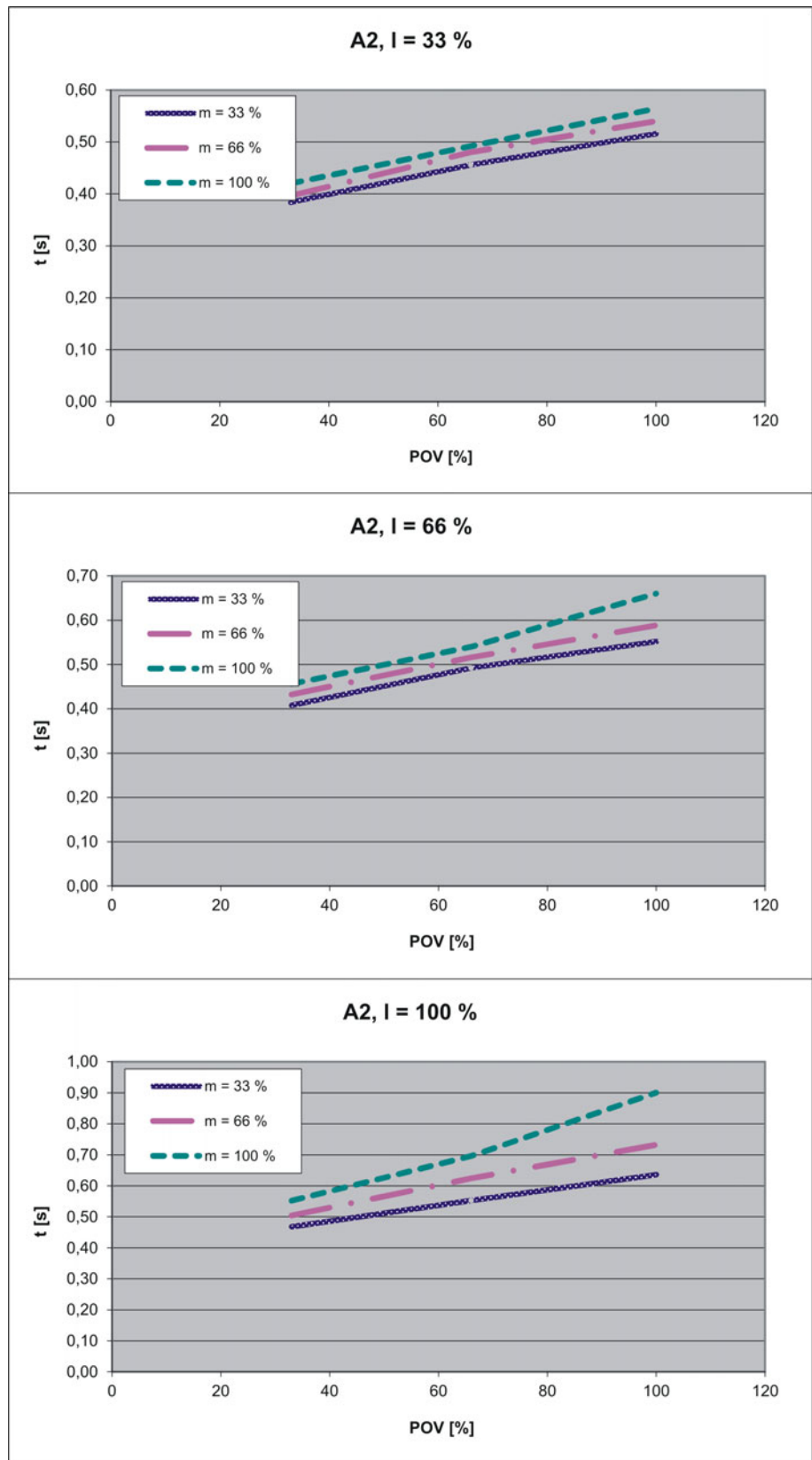


Fig. 4-65: Stopping times for STOP 1, axis 2

4.12.3.4 Stopping distances and stopping times for STOP 1, axis 3

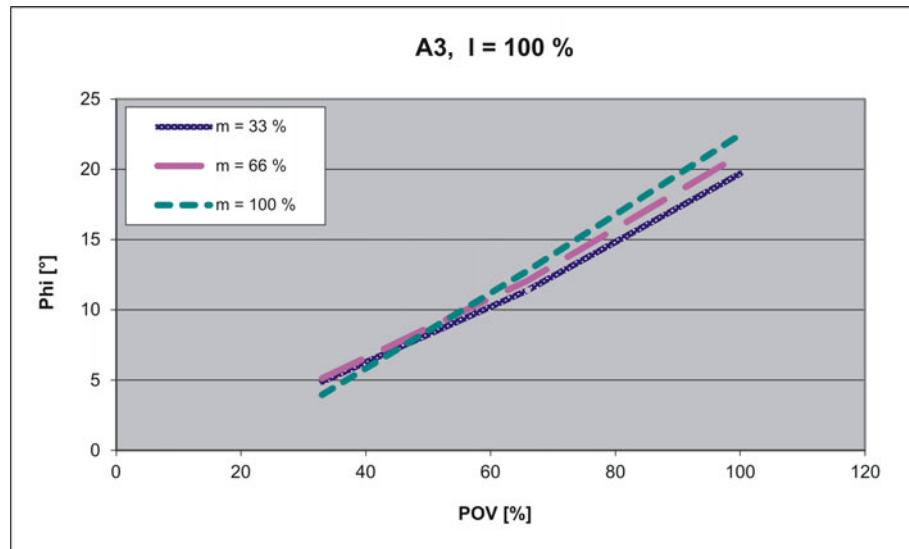


Fig. 4-66: Stopping distances for STOP 1, axis 3

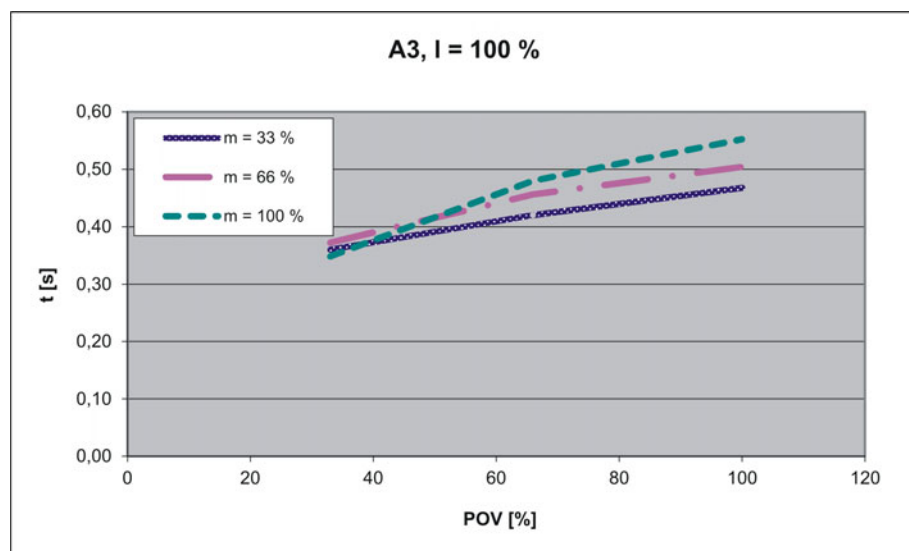


Fig. 4-67: Stopping times for STOP 1, axis 3

4.12.4 Stopping distances and times, KR 420 R3080 (with F variant)

4.12.4.1 Stopping distances and stopping times for STOP 0, axis 1 to axis 3

The table shows the stopping distances and stopping times after a STOP 0 (category 0 stop) is triggered. The values refer to the following configuration:

- Extension l = 100%
- Program override POV = 100%
- Mass m = maximum load (rated load + supplementary load on arm)

| | Stopping distance (°) | Stopping time (s) |
|--------|-----------------------|-------------------|
| Axis 1 | 48.17 | 0.982 |
| Axis 2 | 35.96 | 0.778 |
| Axis 3 | 20.41 | 0.387 |

4.12.4.2 Stopping distances and stopping times for STOP 1, axis 1

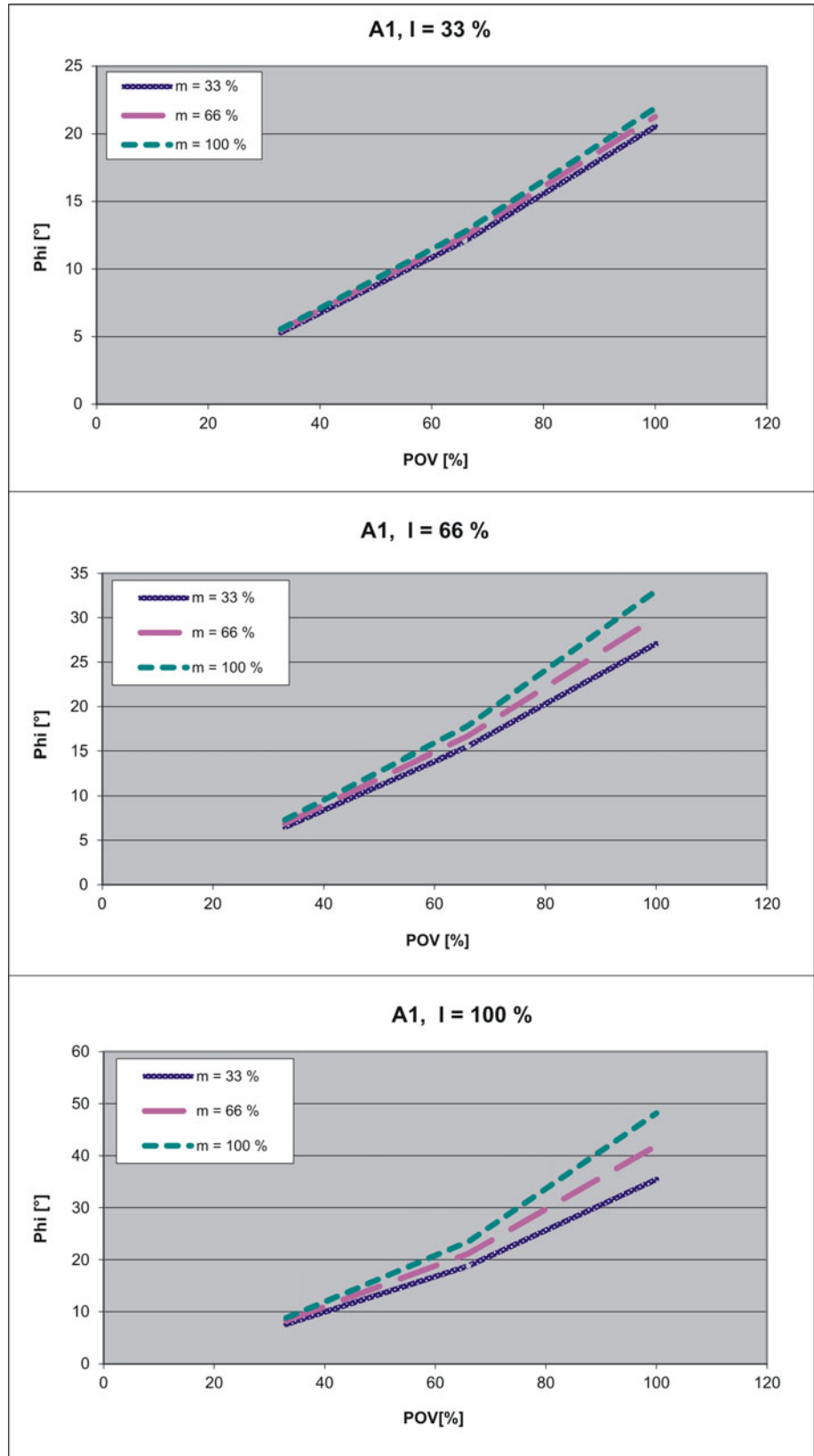


Fig. 4-68: Stopping distances for STOP 1, axis 1

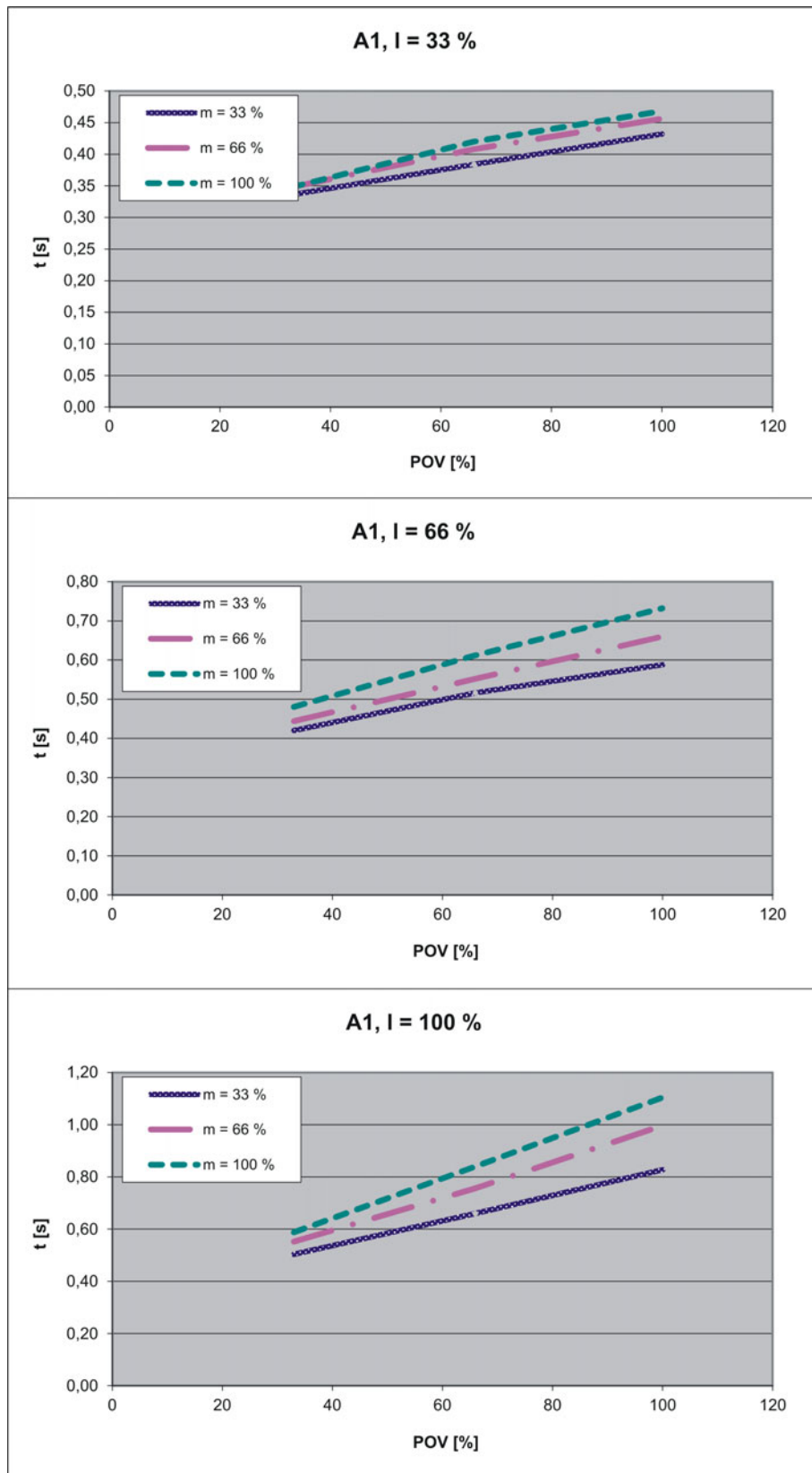


Fig. 4-69: Stopping times for STOP 1, axis 1

4.12.4.3 Stopping distances and stopping times for STOP 1, axis 2

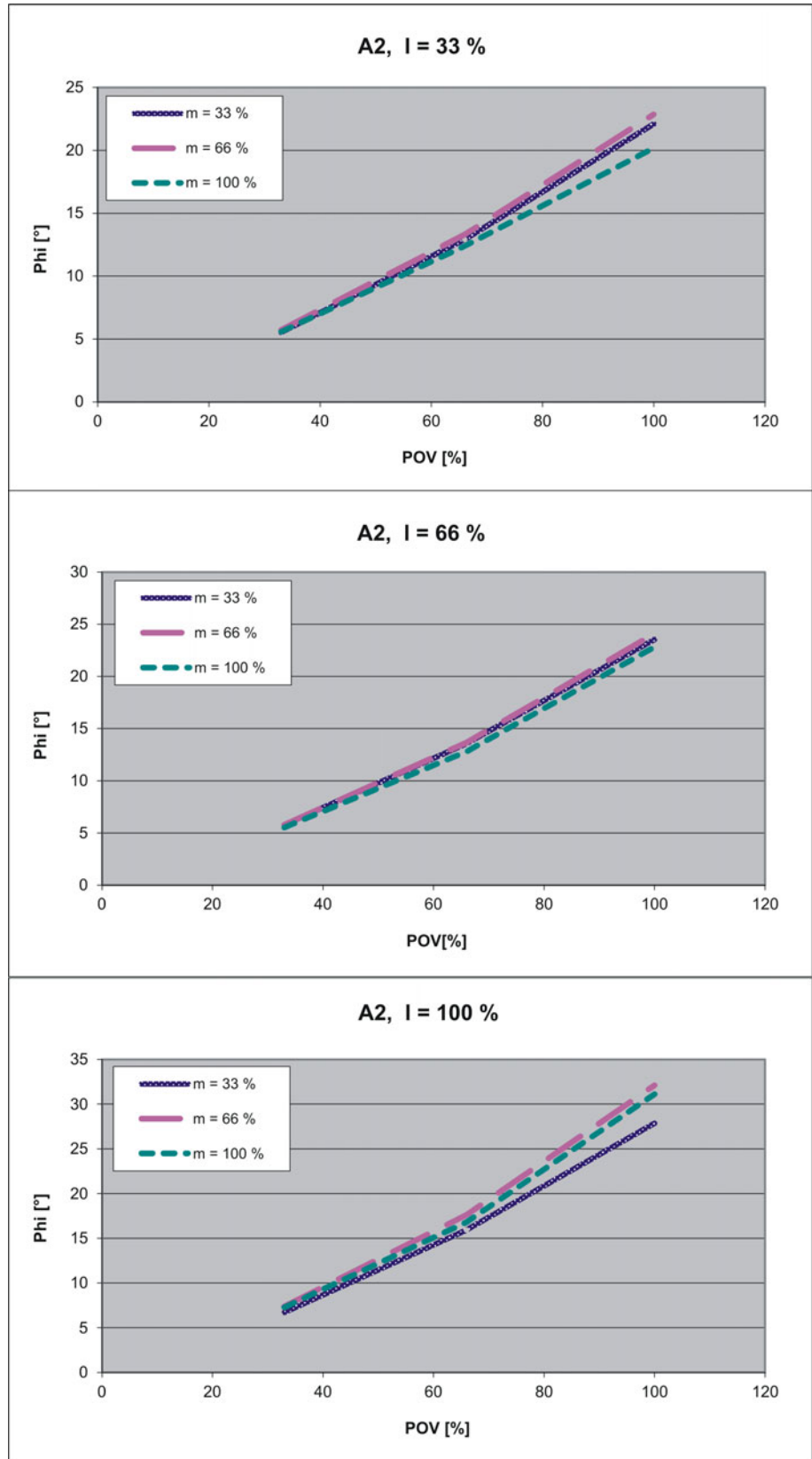


Fig. 4-70: Stopping distances for STOP 1, axis 2

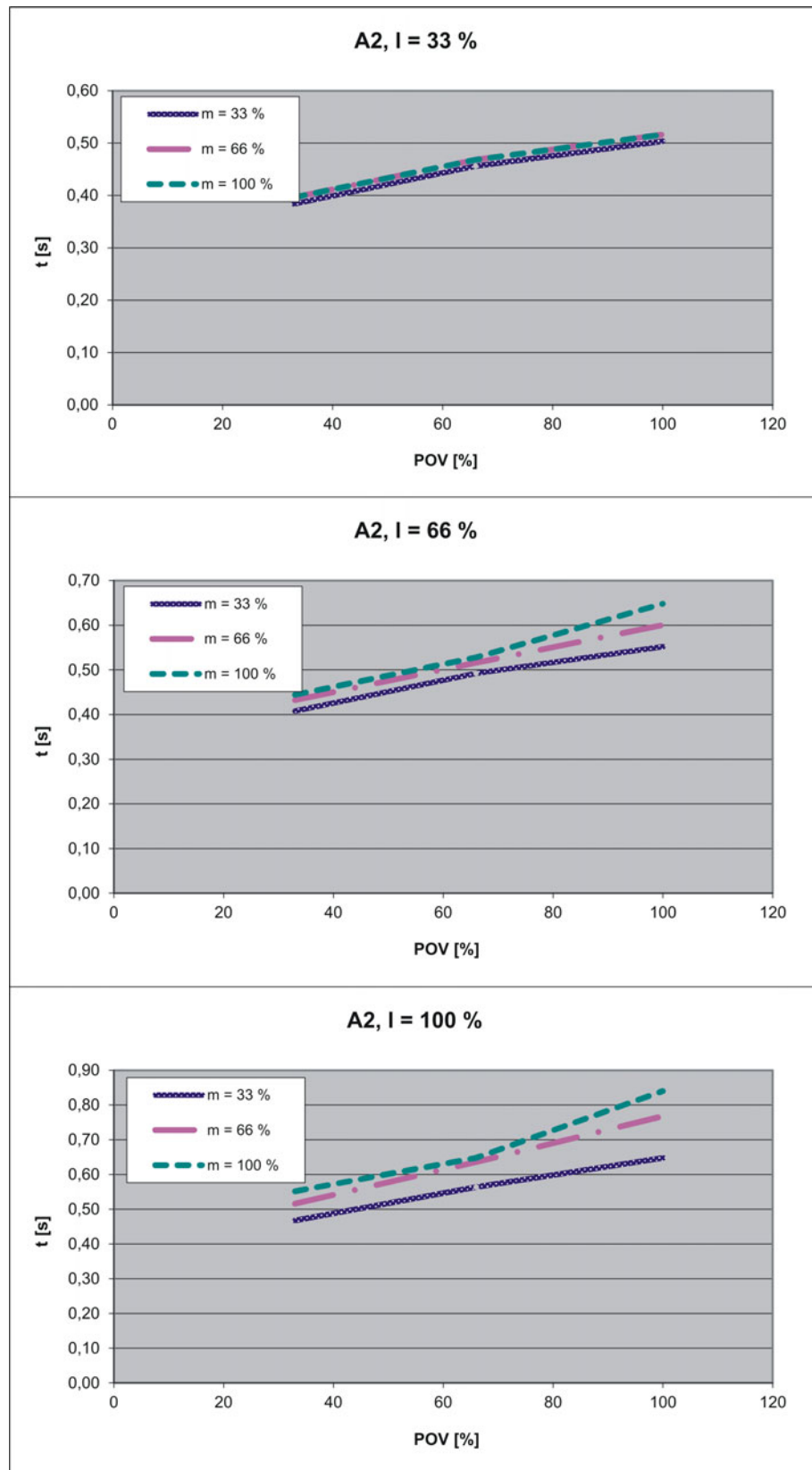


Fig. 4-71: Stopping times for STOP 1, axis 2

4.12.4.4 Stopping distances and stopping times for STOP 1, axis 3

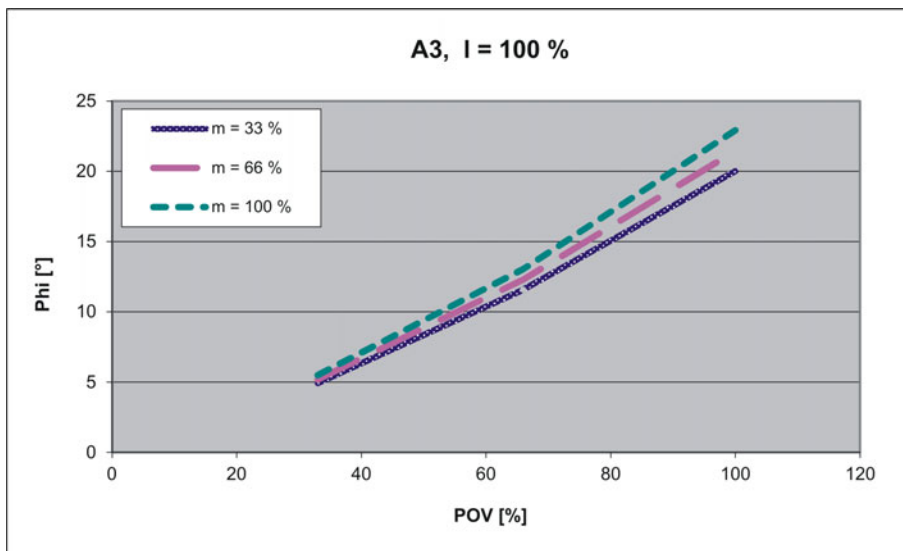


Fig. 4-72: Stopping distances for STOP 1, axis 3

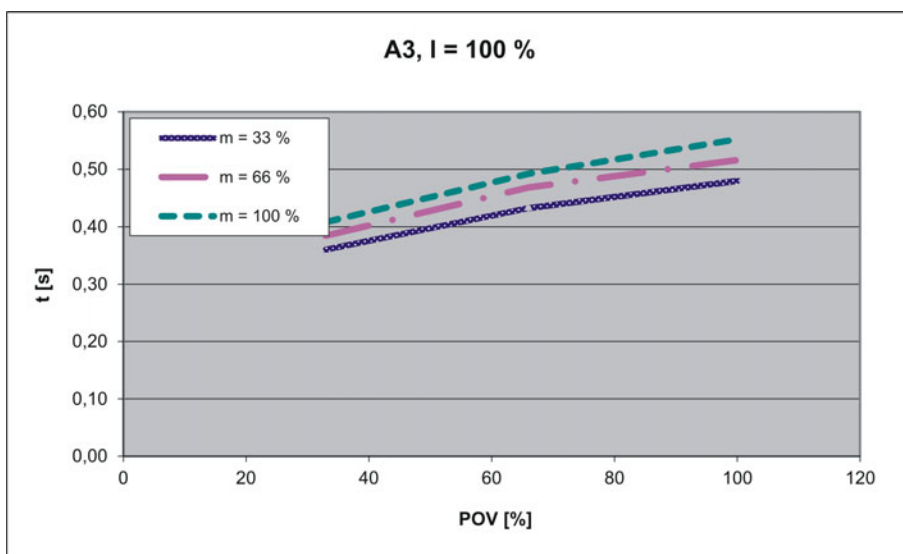


Fig. 4-73: Stopping times for STOP 1, axis 3

4.12.5 Stopping distances and times, KR 340 R3330 (with F variant)

4.12.5.1 Stopping distances and stopping times for STOP 0, axis 1 to axis 3

The table shows the stopping distances and stopping times after a STOP 0 (category 0 stop) is triggered. The values refer to the following configuration:

- Extension I = 100%
- Program override POV = 100%
- Mass m = maximum load (rated load + supplementary load on arm)

| | Stopping distance (°) | Stopping time (s) |
|--------|-----------------------|-------------------|
| Axis 1 | 47.67 | 0.97 |
| Axis 2 | 36.34 | 0.785 |
| Axis 3 | 20.98 | 0.401 |

4.12.5.2 Stopping distances and stopping times for STOP 1, axis 1

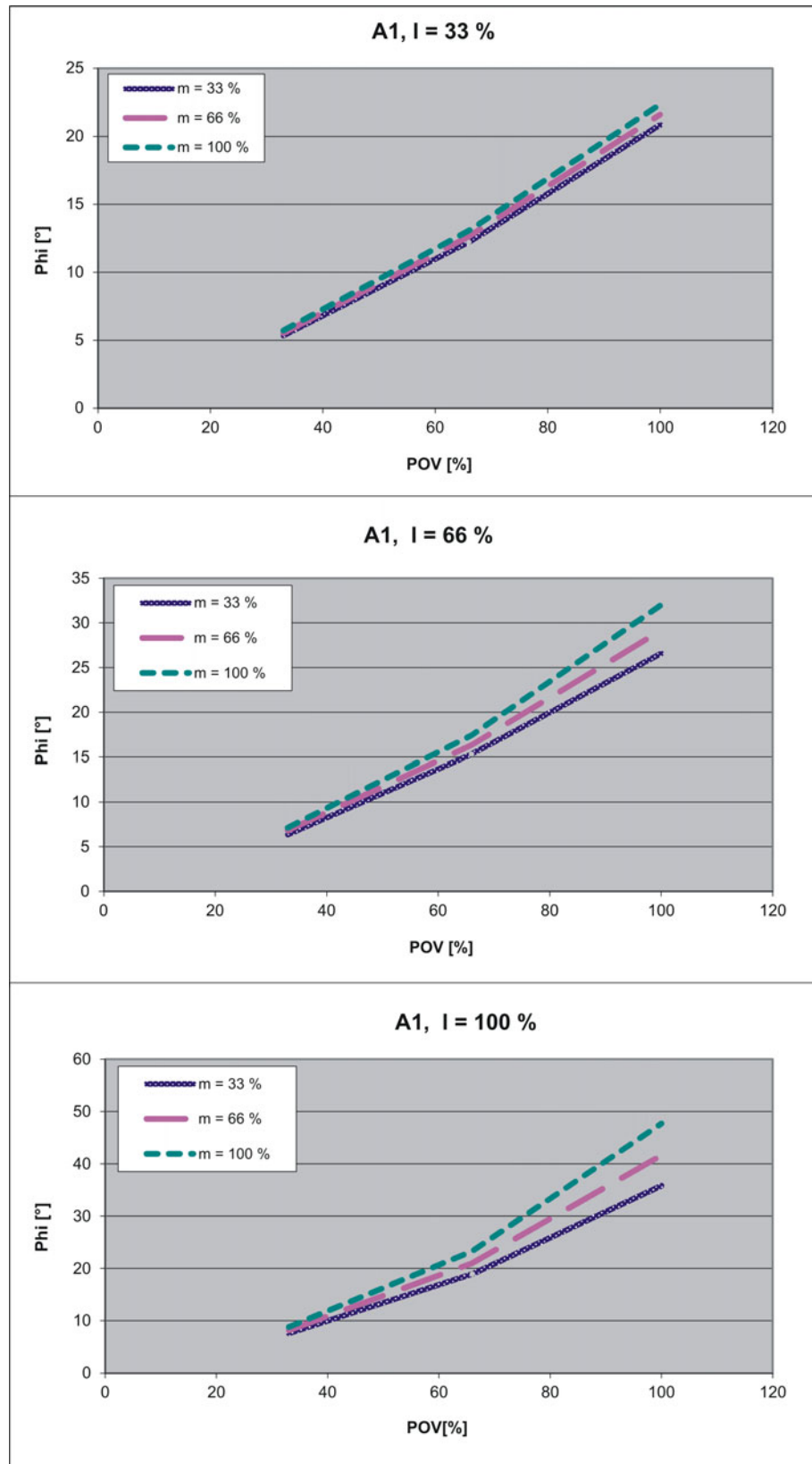


Fig. 4-74: Stopping distances for STOP 1, axis 1

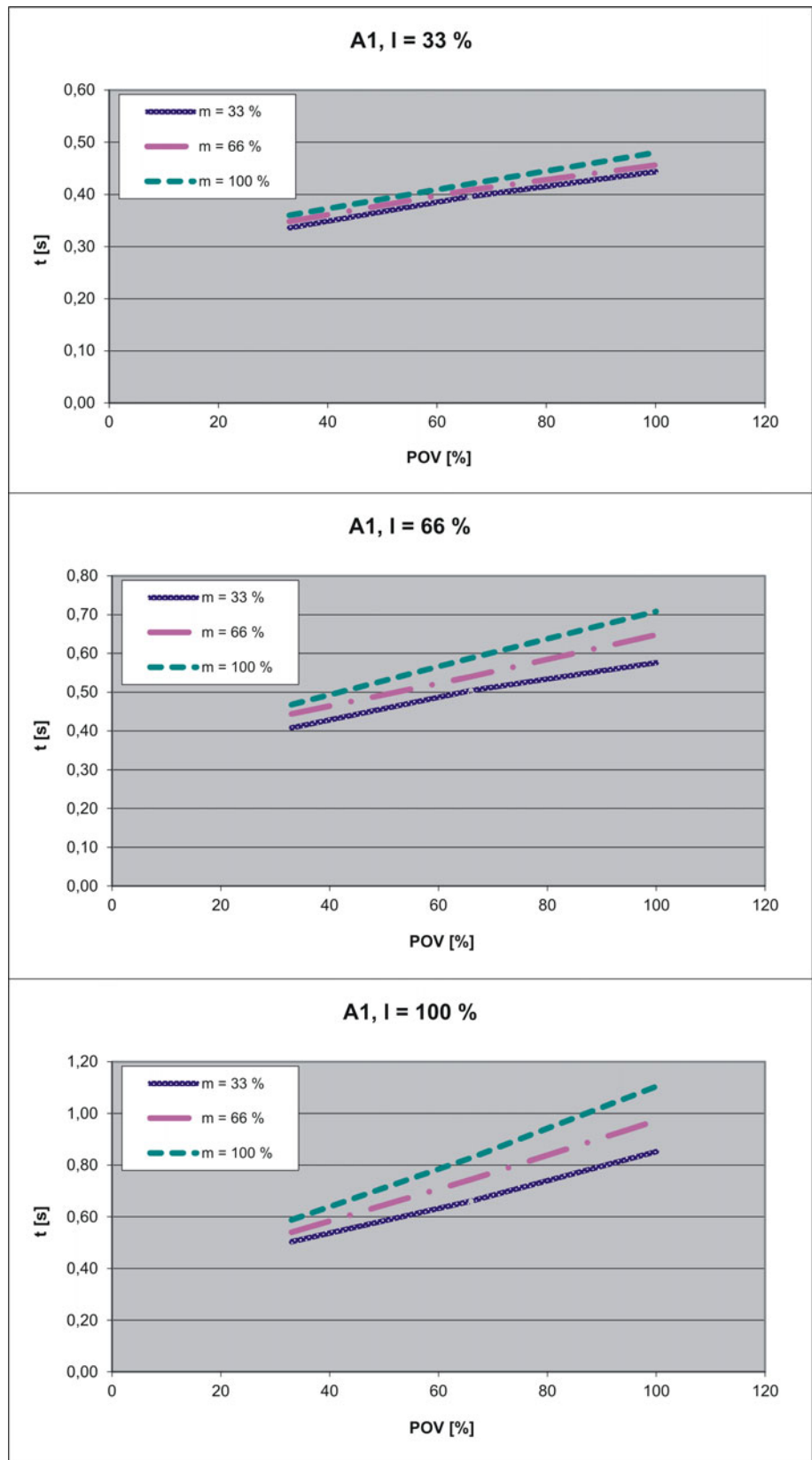


Fig. 4-75: Stopping times for STOP 1, axis 1

4.12.5.3 Stopping distances and stopping times for STOP 1, axis 2

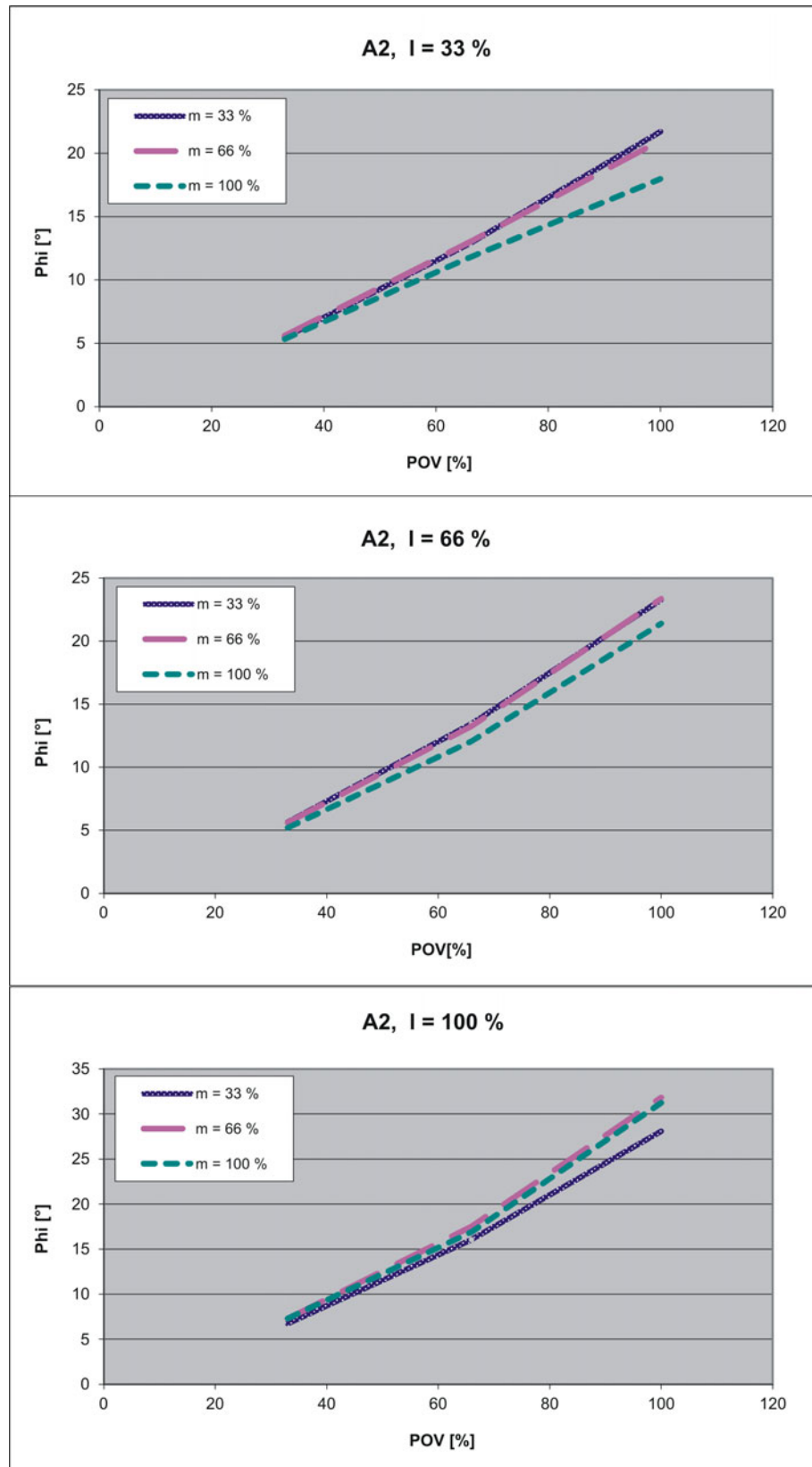


Fig. 4-76: Stopping distances for STOP 1, axis 2

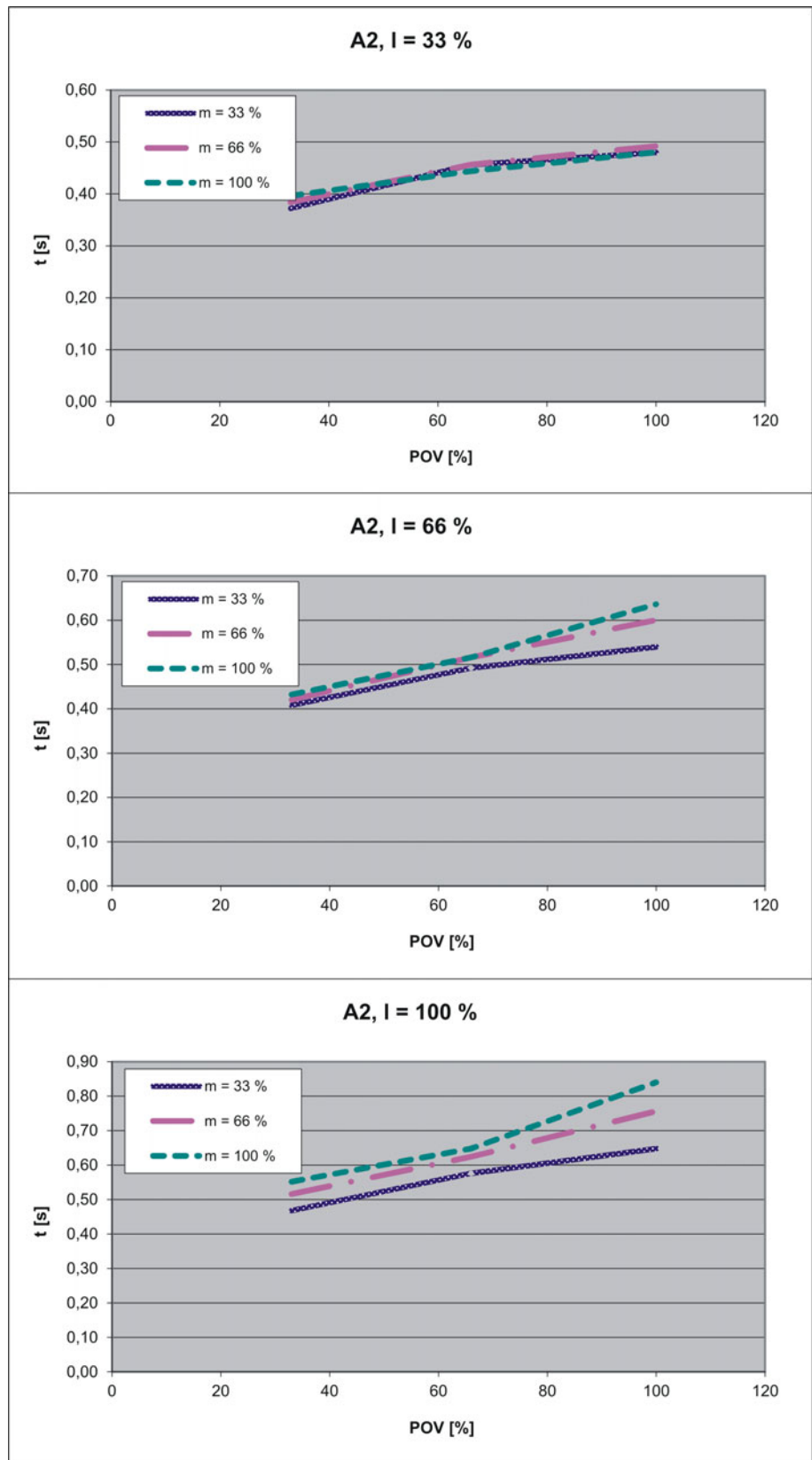


Fig. 4-77: Stopping times for STOP 1, axis 2

4.12.5.4 Stopping distances and stopping times for STOP 1, axis 3

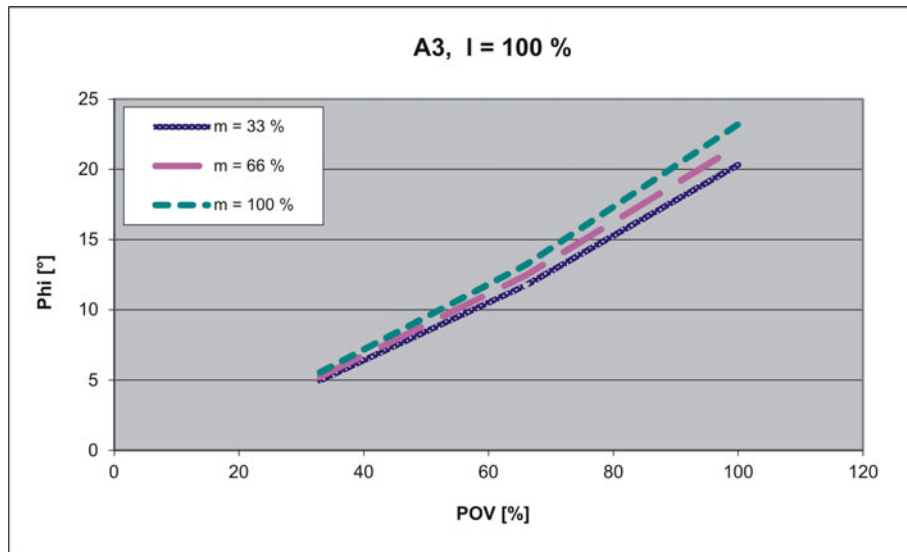


Fig. 4-78: Stopping distances for STOP 1, axis 3

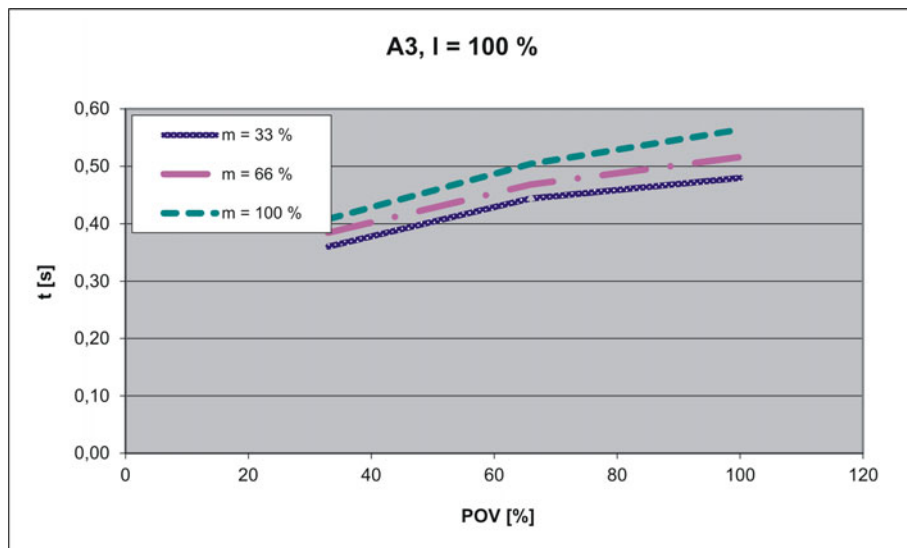


Fig. 4-79: Stopping times for STOP 1, axis 3

5 Safety

5.1 General



■ This “Safety” chapter refers to a mechanical component of an industrial robot.

■ If the mechanical component is used together with a KUKA robot controller, the “Safety” chapter of the operating instructions or assembly instructions of the robot controller must be used!

This contains all the information provided in this “Safety” chapter. It also contains additional safety information relating to the robot controller which must be observed.

■ Where this “Safety” chapter uses the term “industrial robot”, this also refers to the individual mechanical component if applicable.

5.1.1 Liability

The device described in this document is either an industrial robot or a component thereof.

Components of the industrial robot:

- Manipulator
- Robot controller
- Teach pendant
- Connecting cables
- External axes (optional)
e.g. linear unit, turn-tilt table, positioner
- Software
- Options, accessories

The industrial robot is built using state-of-the-art technology and in accordance with the recognized safety rules. Nevertheless, misuse of the industrial robot may constitute a risk to life and limb or cause damage to the industrial robot and to other material property.

The industrial robot may only be used in perfect technical condition in accordance with its designated use and only by safety-conscious persons who are fully aware of the risks involved in its operation. Use of the industrial robot is subject to compliance with this document and with the declaration of incorporation supplied together with the industrial robot. Any functional disorders affecting safety must be rectified immediately.

Safety information

Safety information cannot be held against KUKA Roboter GmbH. Even if all safety instructions are followed, this is not a guarantee that the industrial robot will not cause personal injuries or material damage.

No modifications may be carried out to the industrial robot without the authorization of KUKA Roboter GmbH. Additional components (tools, software, etc.), not supplied by KUKA Roboter GmbH, may be integrated into the industrial robot. The user is liable for any damage these components may cause to the industrial robot or to other material property.

In addition to the Safety chapter, this document contains further safety instructions. These must also be observed.

5.1.2 Intended use of the industrial robot

The industrial robot is intended exclusively for the use designated in the “Purpose” chapter of the operating instructions or assembly instructions.

Any use or application deviating from the intended use is deemed to be misuse and is not allowed. The manufacturer is not liable for any damage resulting from such misuse. The risk lies entirely with the user.

Operation of the industrial robot in accordance with its intended use also requires compliance with the operating and assembly instructions for the individual components, with particular reference to the maintenance specifications.

Misuse

Any use or application deviating from the intended use is deemed to be misuse and is not allowed. This includes e.g.:

- Transportation of persons and animals
- Use as a climbing aid
- Operation outside the specified operating parameters
- Use in potentially explosive environments
- Operation without additional safeguards
- Outdoor operation
- Underground operation

5.1.3 EC declaration of conformity and declaration of incorporation

The industrial robot constitutes partly completed machinery as defined by the EC Machinery Directive. The industrial robot may only be put into operation if the following preconditions are met:

- The industrial robot is integrated into a complete system.
 - or: The industrial robot, together with other machinery, constitutes a complete system.
 - or: All safety functions and safeguards required for operation in the complete machine as defined by the EC Machinery Directive have been added to the industrial robot.
- The complete system complies with the EC Machinery Directive. This has been confirmed by means of an assessment of conformity.

Declaration of conformity

The system integrator must issue a declaration of conformity for the complete system in accordance with the Machinery Directive. The declaration of conformity forms the basis for the CE mark for the system. The industrial robot must always be operated in accordance with the applicable national laws, regulations and standards.

The robot controller is CE certified under the EMC Directive and the Low Voltage Directive.

Declaration of incorporation

The partly completed machinery is supplied with a declaration of incorporation in accordance with Annex II B of the EC Machinery Directive 2006/42/EC. The assembly instructions and a list of essential requirements complied with in accordance with Annex I are integral parts of this declaration of incorporation.

The declaration of incorporation declares that the start-up of the partly completed machinery is not allowed until the partly completed machinery has been incorporated into machinery, or has been assembled with other parts to form machinery, and this machinery complies with the terms of the EC Machinery Directive, and the EC declaration of conformity is present in accordance with Annex II A.

5.1.4 Terms used

| Term | Description |
|--------------------------------------|--|
| Axis range | Range of each axis, in degrees or millimeters, within which it may move. The axis range must be defined for each axis. |
| Stopping distance | Stopping distance = reaction distance + braking distance The stopping distance is part of the danger zone. |
| Workspace | The manipulator is allowed to move within its workspace. The workspace is derived from the individual axis ranges. |
| Operator (User) | The user of the industrial robot can be the management, employer or delegated person responsible for use of the industrial robot. |
| Danger zone | The danger zone consists of the workspace and the stopping distances. |
| Service life | The service life of a safety-relevant component begins at the time of delivery of the component to the customer. The service life is not affected by whether the component is used in a robot controller or elsewhere or not, as safety-relevant components are also subject to aging during storage. |
| KCP | KUKA Control Panel Teach pendant for the KR C2/KR C2 edition2005 The KCP has all the operator control and display functions required for operating and programming the industrial robot. |
| KUKA smartPAD | see "smartPAD" |
| Manipulator | The robot arm and the associated electrical installations |
| Safety zone | The safety zone is situated outside the danger zone. |
| smartPAD | Teach pendant for the KR C4 The smartPAD has all the operator control and display functions required for operating and programming the industrial robot. |
| Stop category 0 | The drives are deactivated immediately and the brakes are applied. The manipulator and any external axes (optional) perform path-oriented braking. Note: This stop category is called STOP 0 in this document. |
| Stop category 1 | The manipulator and any external axes (optional) perform path-maintaining braking. The drives are deactivated after 1 s and the brakes are applied. Note: This stop category is called STOP 1 in this document. |
| Stop category 2 | The drives are not deactivated and the brakes are not applied. The manipulator and any external axes (optional) are braked with a normal braking ramp. Note: This stop category is called STOP 2 in this document. |
| System integrator (plant integrator) | System integrators are people who safely integrate the industrial robot into a complete system and commission it. |
| T1 | Test mode, Manual Reduced Velocity (≤ 250 mm/s) |
| T2 | Test mode, Manual High Velocity (> 250 mm/s permissible) |
| External axis | Motion axis which is not part of the manipulator but which is controlled using the robot controller, e.g. KUKA linear unit, turn-tilt table, Posiflex. |

5.2 Personnel

The following persons or groups of persons are defined for the industrial robot:

- User

- Personnel



All persons working with the industrial robot must have read and understood the industrial robot documentation, including the safety chapter.

User

The user must observe the labor laws and regulations. This includes e.g.:

- The user must comply with his monitoring obligations.
- The user must carry out briefing at defined intervals.

Personnel

Personnel must be instructed, before any work is commenced, in the type of work involved and what exactly it entails as well as any hazards which may exist. Instruction must be carried out regularly. Instruction is also required after particular incidents or technical modifications.

Personnel includes:

- System integrator
- Operators, subdivided into:
 - Start-up, maintenance and service personnel
 - Operating personnel
 - Cleaning personnel



Installation, exchange, adjustment, operation, maintenance and repair must be performed only as specified in the operating or assembly instructions for the relevant component of the industrial robot and only by personnel specially trained for this purpose.

System integrator

The industrial robot is safely integrated into a complete system by the system integrator.

The system integrator is responsible for the following tasks:

- Installing the industrial robot
- Connecting the industrial robot
- Performing risk assessment
- Implementing the required safety functions and safeguards
- Issuing the declaration of conformity
- Attaching the CE mark
- Creating the operating instructions for the complete system

Operator

The operator must meet the following preconditions:

- The operator must be trained for the work to be carried out.
- Work on the industrial robot must only be carried out by qualified personnel. These are people who, due to their specialist training, knowledge and experience, and their familiarization with the relevant standards, are able to assess the work to be carried out and detect any potential hazards.



Work on the electrical and mechanical equipment of the industrial robot may only be carried out by specially trained personnel.

5.3 Workspace, safety zone and danger zone

Workspaces are to be restricted to the necessary minimum size. A workspace must be safeguarded using appropriate safeguards.

The safeguards (e.g. safety gate) must be situated inside the safety zone. In the case of a stop, the manipulator and external axes (optional) are braked and come to a stop within the danger zone.

The danger zone consists of the workspace and the stopping distances of the manipulator and external axes (optional). It must be safeguarded by means of physical safeguards to prevent danger to persons or the risk of material damage.

5.4 Overview of protective equipment

The protective equipment of the mechanical component may include:


- Mechanical end stops
- Mechanical axis range limitation (optional)
- Axis range monitoring (optional)
- Release device (optional)
- Labeling of danger areas

Not all equipment is relevant for every mechanical component.

5.4.1 Mechanical end stops

Depending on the robot variant, the axis ranges of the main and wrist axes of the manipulator are partially limited by mechanical end stops.

Additional mechanical end stops can be installed on the external axes.


 **WARNING** If the manipulator or an external axis hits an obstruction or a mechanical end stop or axis range limitation, the manipulator can no longer be operated safely. The manipulator must be taken out of operation and KUKA Roboter GmbH must be consulted before it is put back into operation .

5.4.2 Mechanical axis range limitation (optional)

Some manipulators can be fitted with mechanical axis range limitation in axes A1 to A3. The adjustable axis range limitation systems restrict the working range to the required minimum. This increases personal safety and protection of the system.

In the case of manipulators that are not designed to be fitted with mechanical axis range limitation, the workspace must be laid out in such a way that there is no danger to persons or material property, even in the absence of mechanical axis range limitation.

If this is not possible, the workspace must be limited by means of photoelectric barriers, photoelectric curtains or obstacles on the system side. There must be no shearing or crushing hazards at the loading and transfer areas.

 This option is not available for all robot models. Information on specific robot models can be obtained from KUKA Roboter GmbH.

5.4.3 Axis range monitoring (optional)

Some manipulators can be fitted with dual-channel axis range monitoring systems in main axes A1 to A3. The positioner axes may be fitted with additional axis range monitoring systems. The safety zone for an axis can be adjusted

and monitored using an axis range monitoring system. This increases personal safety and protection of the system.



This option is not available for the KR C4. This option is not available for all robot models. Information on specific robot models can be obtained from KUKA Roboter GmbH.

5.4.4 Options for moving the manipulator without drive energy



The system user is responsible for ensuring that the training of personnel with regard to the response to emergencies or exceptional situations also includes how the manipulator can be moved without drive energy.

Description

The following options are available for moving the manipulator without drive energy after an accident or malfunction:

- Release device (optional)
The release device can be used for the main axis drive motors and, depending on the robot variant, also for the wrist axis drive motors.
- Brake release device (option)
The brake release device is designed for robot variants whose motors are not freely accessible.
- Moving the wrist axes directly by hand
There is no release device available for the wrist axes of variants in the low payload category. This is not necessary because the wrist axes can be moved directly by hand.



Information about the options available for the various robot models and about how to use them can be found in the assembly and operating instructions for the robot or requested from KUKA Roboter GmbH.

NOTICE

Moving the manipulator without drive energy can damage the motor brakes of the axes concerned. The motor must be replaced if the brake has been damaged. The manipulator may therefore be moved without drive energy only in emergencies, e.g. for rescuing persons.

5.4.5 Labeling on the industrial robot

All plates, labels, symbols and marks constitute safety-relevant parts of the industrial robot. They must not be modified or removed.

Labeling on the industrial robot consists of:

- Identification plates
- Warning signs
- Safety symbols
- Designation labels
- Cable markings
- Rating plates



Further information is contained in the technical data of the operating instructions or assembly instructions of the components of the industrial robot.

5.5 Safety measures

5.5.1 General safety measures

The industrial robot may only be used in perfect technical condition in accordance with its intended use and only by safety-conscious persons. Operator errors can result in personal injury and damage to property.

It is important to be prepared for possible movements of the industrial robot even after the robot controller has been switched off and locked out. Incorrect installation (e.g. overload) or mechanical defects (e.g. brake defect) can cause the manipulator or external axes to sag. If work is to be carried out on a switched-off industrial robot, the manipulator and external axes must first be moved into a position in which they are unable to move on their own, whether the payload is mounted or not. If this is not possible, the manipulator and external axes must be secured by appropriate means.

⚠ DANGER In the absence of operational safety functions and safeguards, the industrial robot can cause personal injury or material damage. If safety functions or safeguards are dismantled or deactivated, the industrial robot may not be operated.

⚠ DANGER Standing underneath the robot arm can cause death or injuries. For this reason, standing underneath the robot arm is prohibited!

⚠ CAUTION The motors reach temperatures during operation which can cause burns to the skin. Contact must be avoided. Appropriate safety precautions must be taken, e.g. protective gloves must be worn.

KCP/smartPAD

The user must ensure that the industrial robot is only operated with the KCP/smartPAD by authorized persons.

If more than one KCP/smartPAD is used in the overall system, it must be ensured that each device is unambiguously assigned to the corresponding industrial robot. They must not be interchanged.

⚠ WARNING The operator must ensure that decoupled KCPs/smartPADs are immediately removed from the system and stored out of sight and reach of personnel working on the industrial robot. This serves to prevent operational and non-operational EMERGENCY STOP devices from becoming interchanged. Failure to observe this precaution may result in death, severe injuries or considerable damage to property.

External keyboard, external mouse

An external keyboard and/or external mouse may only be used if the following conditions are met:

- Start-up or maintenance work is being carried out.
- The drives are switched off.
- There are no persons in the danger zone.

The KCP/smartPAD must not be used as long as an external keyboard and/or external mouse are connected to the control cabinet.

The external keyboard and/or external mouse must be removed from the control cabinet as soon as the start-up or maintenance work is completed or the KCP/smartPAD is connected.

| | |
|----------------------|--|
| Modifications | <p>After modifications to the industrial robot, checks must be carried out to ensure the required safety level. The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety functions must also be tested.</p> <p>New or modified programs must always be tested first in Manual Reduced Velocity mode (T1).</p> <p>After modifications to the industrial robot, existing programs must always be tested first in Manual Reduced Velocity mode (T1). This applies to all components of the industrial robot and includes modifications to the software and configuration settings.</p> |
| Faults | <p>The following tasks must be carried out in the case of faults in the industrial robot:</p> <ul style="list-style-type: none"> ■ Switch off the robot controller and secure it (e.g. with a padlock) to prevent unauthorized persons from switching it on again. ■ Indicate the fault by means of a label with a corresponding warning (tag-out). ■ Keep a record of the faults. ■ Eliminate the fault and carry out a function test. |

5.5.2 Transportation

| | |
|---------------------------------|---|
| Manipulator | <p>The prescribed transport position of the manipulator must be observed. Transportation must be carried out in accordance with the operating instructions or assembly instructions of the robot.</p> <p>Avoid vibrations and impacts during transportation in order to prevent damage to the manipulator.</p> |
| Robot controller | <p>The prescribed transport position of the robot controller must be observed. Transportation must be carried out in accordance with the operating instructions or assembly instructions of the robot controller.</p> <p>Avoid vibrations and impacts during transportation in order to prevent damage to the robot controller.</p> |
| External axis (optional) | <p>The prescribed transport position of the external axis (e.g. KUKA linear unit, turn-tilt table, positioner) must be observed. Transportation must be carried out in accordance with the operating instructions or assembly instructions of the external axis.</p> |

5.5.3 Start-up and recommissioning

Before starting up systems and devices for the first time, a check must be carried out to ensure that the systems and devices are complete and operational, that they can be operated safely and that any damage is detected.

The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety circuits must also be tested.



The passwords for logging onto the KUKA System Software as “Expert” and “Administrator” must be changed before start-up and must only be communicated to authorized personnel.

⚠ WARNING The robot controller is preconfigured for the specific industrial robot. If cables are interchanged, the manipulator and the external axes (optional) may receive incorrect data and can thus cause personal injury or material damage. If a system consists of more than one manipulator, always connect the connecting cables to the manipulators and their corresponding robot controllers.

⚠ If additional components (e.g. cables), which are not part of the scope of supply of KUKA Roboter GmbH, are integrated into the industrial robot, the user is responsible for ensuring that these components do not adversely affect or disable safety functions.

NOTICE If the internal cabinet temperature of the robot controller differs greatly from the ambient temperature, condensation can form, which may cause damage to the electrical components. Do not put the robot controller into operation until the internal temperature of the cabinet has adjusted to the ambient temperature.

Function test

The following tests must be carried out before start-up and recommissioning:
It must be ensured that:

- The industrial robot is correctly installed and fastened in accordance with the specifications in the documentation.
- There is no damage to the robot that could be attributed to external forces. Example: Dents or abrasion that could be caused by an impact or collision.

⚠ WARNING In the case of such damage, the affected components must be exchanged. In particular, the motor and counterbalancing system must be checked carefully. External forces can cause non-visible damage. For example, it can lead to a gradual loss of drive power from the motor, resulting in unintended movements of the manipulator. Death, injuries or considerable damage to property may otherwise result.

- There are no foreign bodies or loose parts on the industrial robot.
- All required safety equipment is correctly installed and operational.
- The power supply ratings of the industrial robot correspond to the local supply voltage and mains type.
- The ground conductor and the equipotential bonding cable are sufficiently rated and correctly connected.
- The connecting cables are correctly connected and the connectors are locked.

Machine data

It must be ensured that the rating plate on the robot controller has the same machine data as those entered in the declaration of incorporation. The machine data on the rating plate of the manipulator and the external axes (optional) must be entered during start-up.

⚠ WARNING The industrial robot must not be moved if incorrect machine data are loaded. Death, severe injuries or considerable damage to property may otherwise result. The correct machine data must be loaded.

5.5.4 Manual mode

Manual mode is the mode for setup work. Setup work is all the tasks that have to be carried out on the industrial robot to enable automatic operation. Setup work includes:

- Jog mode
- Teaching
- Programming
- Program verification

The following must be taken into consideration in manual mode:

- If the drives are not required, they must be switched off to prevent the manipulator or the external axes (optional) from being moved unintentionally.
- New or modified programs must always be tested first in Manual Reduced Velocity mode (T1).
- The manipulator, tooling or external axes (optional) must never touch or project beyond the safety fence.
- Workpieces, tooling and other objects must not become jammed as a result of the industrial robot motion, nor must they lead to short-circuits or be liable to fall off.
- All setup work must be carried out, where possible, from outside the safeguarded area.

If the setup work has to be carried out inside the safeguarded area, the following must be taken into consideration:

In **Manual Reduced Velocity mode (T1)**:

- If it can be avoided, there must be no other persons inside the safeguarded area.
If it is necessary for there to be several persons inside the safeguarded area, the following must be observed:
 - Each person must have an enabling device.
 - All persons must have an unimpeded view of the industrial robot.
 - Eye-contact between all persons must be possible at all times.
- The operator must be so positioned that he can see into the danger area and get out of harm's way.

In **Manual High Velocity mode (T2)**:

- This mode may only be used if the application requires a test at a velocity higher than possible in T1 mode.
- Teaching and programming are not permissible in this operating mode.
- Before commencing the test, the operator must ensure that the enabling devices are operational.
- The operator must be positioned outside the danger zone.
- There must be no other persons inside the safeguarded area. It is the responsibility of the operator to ensure this.

5.5.5 Automatic mode

Automatic mode is only permissible in compliance with the following safety measures:

- All safety equipment and safeguards are present and operational.
- There are no persons in the system.
- The defined working procedures are adhered to.

If the manipulator or an external axis (optional) comes to a standstill for no apparent reason, the danger zone must not be entered until an EMERGENCY STOP has been triggered.

5.5.6 Maintenance and repair

After maintenance and repair work, checks must be carried out to ensure the required safety level. The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety functions must also be tested.

The purpose of maintenance and repair work is to ensure that the system is kept operational or, in the event of a fault, to return the system to an operational state. Repair work includes troubleshooting in addition to the actual repair itself.

The following safety measures must be carried out when working on the industrial robot:

- Carry out work outside the danger zone. If work inside the danger zone is necessary, the user must define additional safety measures to ensure the safe protection of personnel.
- Switch off the industrial robot and secure it (e.g. with a padlock) to prevent it from being switched on again. If it is necessary to carry out work with the robot controller switched on, the user must define additional safety measures to ensure the safe protection of personnel.
- If it is necessary to carry out work with the robot controller switched on, this may only be done in operating mode T1.
- Label the system with a sign indicating that work is in progress. This sign must remain in place, even during temporary interruptions to the work.
- The EMERGENCY STOP devices must remain active. If safety functions or safeguards are deactivated during maintenance or repair work, they must be reactivated immediately after the work is completed.

DANGER

Before work is commenced on live parts of the robot system, the main switch must be turned off and secured against being switched on again. The system must then be checked to ensure that it is deenergized.

It is not sufficient, before commencing work on live parts, to execute an EMERGENCY STOP or a safety stop, or to switch off the drives, as this does not disconnect the robot system from the mains power supply. Parts remain energized. Death or severe injuries may result.

Faulty components must be replaced using new components with the same article numbers or equivalent components approved by KUKA Roboter GmbH for this purpose.

Cleaning and preventive maintenance work is to be carried out in accordance with the operating instructions.

Robot controller

Even when the robot controller is switched off, parts connected to peripheral devices may still carry voltage. The external power sources must therefore be switched off if work is to be carried out on the robot controller.

The ESD regulations must be adhered to when working on components in the robot controller.

Voltages in excess of 50 V (up to 600 V) can be present in various components for several minutes after the robot controller has been switched off! To prevent life-threatening injuries, no work may be carried out on the industrial robot in this time.

Water and dust must be prevented from entering the robot controller.

Counterbalancing system

Some robot variants are equipped with a hydropneumatic, spring or gas cylinder counterbalancing system.

The hydropneumatic and gas cylinder counterbalancing systems are pressure equipment and, as such, are subject to obligatory equipment monitoring and the provisions of the Pressure Equipment Directive.

The user must comply with the applicable national laws, regulations and standards pertaining to pressure equipment.

Inspection intervals in Germany in accordance with Industrial Safety Order, Sections 14 and 15. Inspection by the user before commissioning at the installation site.

The following safety measures must be carried out when working on the counterbalancing system:

- The manipulator assemblies supported by the counterbalancing systems must be secured.
- Work on the counterbalancing systems must only be carried out by qualified personnel.

Hazardous substances

The following safety measures must be carried out when handling hazardous substances:

- Avoid prolonged and repeated intensive contact with the skin.
- Avoid breathing in oil spray or vapors.
- Clean skin and apply skin cream.



To ensure safe use of our products, we recommend that our customers regularly request up-to-date safety data sheets from the manufacturers of hazardous substances.

5.5.7 Decommissioning, storage and disposal

The industrial robot must be decommissioned, stored and disposed of in accordance with the applicable national laws, regulations and standards.

5.6 Applied norms and regulations

| Name | Definition | Edition |
|------------|---|---------|
| 2006/42/EC | Machinery Directive: Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast) | 2006 |
| 2014/30/EC | EMC Directive: Directive 2014/30/EC of the European Parliament and of the Council of 26 February 2014 on the approximation of the laws of the Member States concerning electromagnetic compatibility This directive is valid from the 20/04/2016 on. | 2014 |

| | | |
|-----------------------|---|------|
| 2004/108/EC | EMC Directive: Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States concerning electromagnetic compatibility This directive is valid until 19/04/2016. | 2004 |
| 2014/68/EC | Pressure Equipment Directive: Directive 2014/68/EC of the European Parliament and of the Council of 15 May 2014 on the approximation of the laws of the Member States concerning pressure equipment (Only applicable for robots with hydropneumatic counterbalancing system.) This directive is valid from the 19/07/2016 on. | 2014 |
| 97/23/EC | Pressure Equipment Directive: Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment (Only applicable for robots with hydropneumatic counterbalancing system.) This directive is valid until 18/07/2016. | 1997 |
| EN ISO 13850 | Safety of machinery: Emergency stop - Principles for design | 2008 |
| EN ISO 13849-1 | Safety of machinery: Safety-related parts of control systems - Part 1: General principles of design | 2008 |
| EN ISO 13849-2 | Safety of machinery: Safety-related parts of control systems - Part 2: Validation | 2012 |
| EN ISO 12100 | Safety of machinery: General principles of design, risk assessment and risk reduction | 2010 |
| EN ISO 10218-1 | Industrial robots – Safety requirements Part 1: Robot Note: Content equivalent to ANSI/RIA R.15.06-2012, Part 1 | 2011 |
| EN 614-1 + A1 | Safety of machinery: Ergonomic design principles - Part 1: Terms and general principles | 2009 |
| EN 61000-6-2 | Electromagnetic compatibility (EMC): Part 6-2: Generic standards; Immunity for industrial environments | 2005 |

| | | |
|--------------------------|---|------|
| EN 61000-6-4 + A1 | Electromagnetic compatibility (EMC): Part 6-4: Generic standards; Emission standard for industrial environments | 2011 |
| EN 60204-1 + A1 | Safety of machinery: Electrical equipment of machines - Part 1: General requirements | 2009 |

6 Planning

6.1 Information for planning

In the planning and design phase, care must be taken regarding the functions or applications to be executed by the kinematic system. The following conditions can lead to premature wear. They necessitate shorter maintenance intervals and/or earlier exchange of components. In addition, the permissible operating parameters specified in the technical data must be taken into account and observed during planning.

- Continuous operation near temperature limits or in abrasive environments
- Continuous operation close to the performance limits, e.g. high rpm of an axis
- High duty cycle of individual axes
- Monotonous motion profiles, e.g. short, frequently recurring axis motions
- Static axis positions, e.g. continuous vertical position of a wrist axis
- External forces (process forces) acting on the robot

If one or more of these conditions are to apply during operation of the kinematic system, KUKA Roboter GmbH must be consulted.

If the robot reaches its corresponding operation limit or if it is operated near the limit for a period of time, the built-in monitoring functions come into effect and the robot is automatically switched off.

This protective function can limit the availability of the robot system.

6.2 Mounting base 175 mm

Description

The mounting base with centering (>>> Fig. 6-1) is used for installation on the floor, i.e. directly on a concrete foundation with a thickness of at least 175 mm.

The mounting base consists of:

- Bedplate
- Chemical anchors (resin-bonded anchors) with Dynamic Set
- Fastening elements

This mounting variant requires a level and smooth surface on a concrete foundation with adequate load bearing capacity. The concrete foundation must be able to accommodate the forces occurring during operation. The minimum dimensions must be observed.

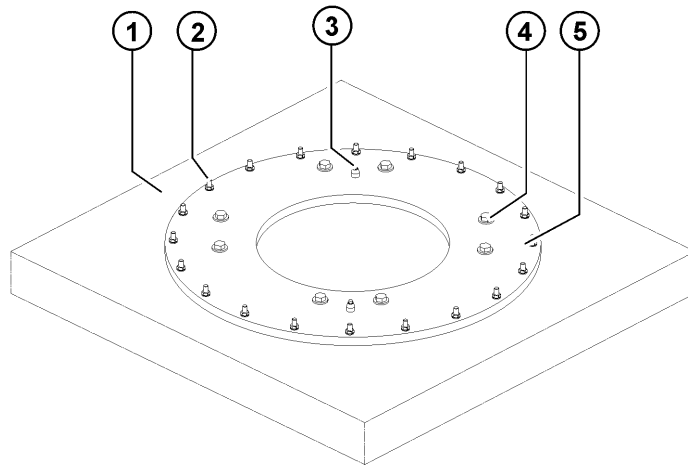


Fig. 6-1: Mounting base 175 mm

- | | | | |
|---|---------------------------------------|---|--------------|
| 1 | Concrete foundation | 4 | Hexagon bolt |
| 2 | Chemical anchor (resin-bonded anchor) | 5 | Bedplate |
| 3 | Pin | | |

Grade of concrete for foundations

When producing foundations from concrete, observe the load-bearing capacity of the ground and the country-specific construction regulations. There must be no layers of insulation or screed between the bedplates and the concrete foundation. The quality of the concrete must meet the requirements of the following standard:

- C20/25 according to DIN EN 206-1:2001/DIN 1045-2:2008

Dimensioned drawing

The following illustration provides all the necessary information on the mounting base, together with the required foundation data.

6.3 Mounting base 200 mm

Description

The mounting base with centering (>>> Fig. 6-4) is used for installation on the floor, i.e. directly on the concrete foundation with a thickness of at least 200 mm.

The mounting base with centering consists of:

- Bedplates
- Chemical anchors
- Fastening elements

This mounting variant requires a level and smooth surface on a concrete foundation with adequate load bearing capacity. The concrete foundation must be able to accommodate the forces occurring during operation. There must be no layers of insulation or screed between the bedplates and the concrete foundation.

The minimum dimensions must be observed.

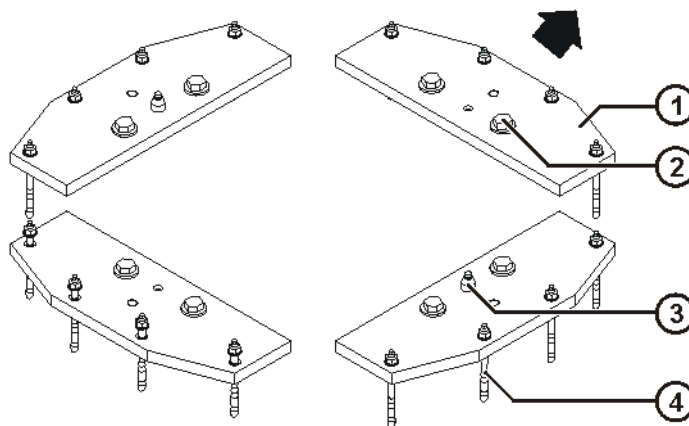


Fig. 6-4: Mounting base 200 mm

- | | |
|----------------|---|
| 1 Bedplate | 3 Pin with Allen screw |
| 2 Hexagon bolt | 4 Resin-bonded anchors with Dynamic Set |

Grade of concrete for foundations

When producing foundations from concrete, observe the load-bearing capacity of the ground and the country-specific construction regulations. There must be no layers of insulation or screed between the bedplates and the concrete foundation. The quality of the concrete must meet the requirements of the following standard:

- C20/25 according to DIN EN 206-1:2001/DIN 1045-2:2008

Dimensioned drawing

The following illustrations provide all the necessary information on the mounting base, together with the required foundation data.

Dimensions: mm

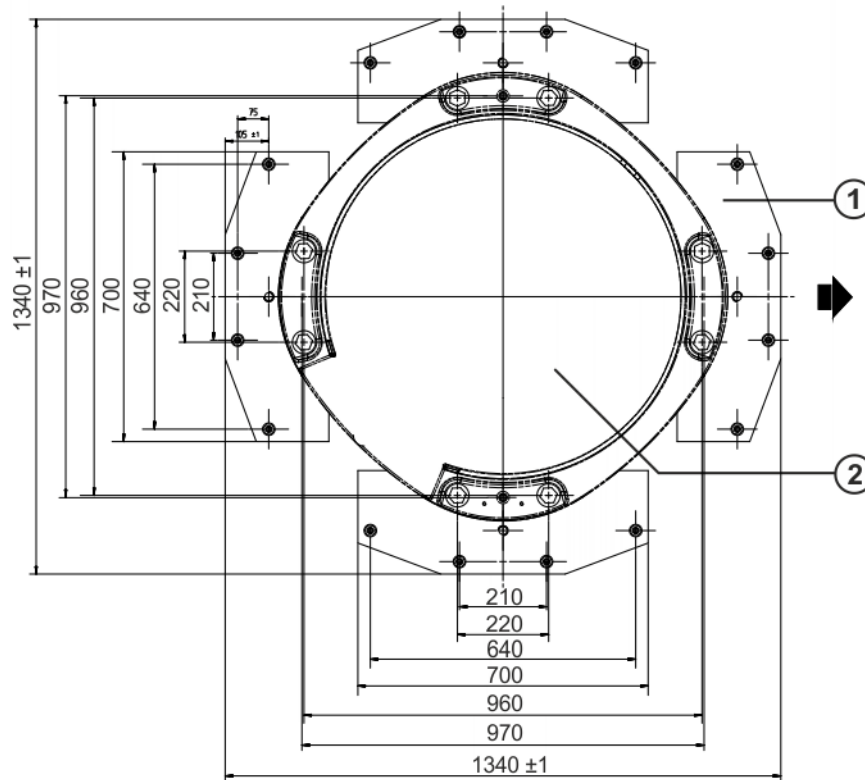


Fig. 6-5: Mounting base 200 mm, dimensioned drawing

- | | | | |
|---|-----------|---|------------|
| 1 | Bedplates | 2 | Base frame |
|---|-----------|---|------------|

To ensure that the anchor forces are safely transmitted to the foundation, observe the dimensions for concrete foundations specified in the following illustration.

Dimensions: mm

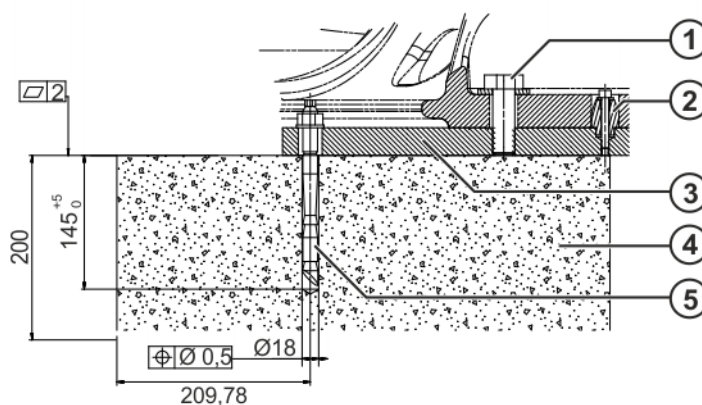


Fig. 6-6: Cross-section of foundation 200 mm

- | | | | |
|---|--------------|---|---------------------|
| 1 | Hexagon bolt | 4 | Concrete foundation |
| 2 | Pin | 5 | Resin-bonded anchor |
| 3 | Bedplate | | |

6.4 Machine frame mounting

Description

The machine frame mounting assembly is used for installation on a steel structure, a booster frame (pedestal) or a KUKA linear unit. This assembly is also used if the base frame is installed in an inverted position, i.e. on the ceiling. It must be ensured that the substructure is able to withstand safely the forces occurring during operation (foundation loads). The following diagram contains all the necessary information that must be observed when preparing the mounting surface (>>> Fig. 6-7).

The machine frame mounting assembly consists of:

- Pins with fasteners
- Hexagon bolts with conical spring washers

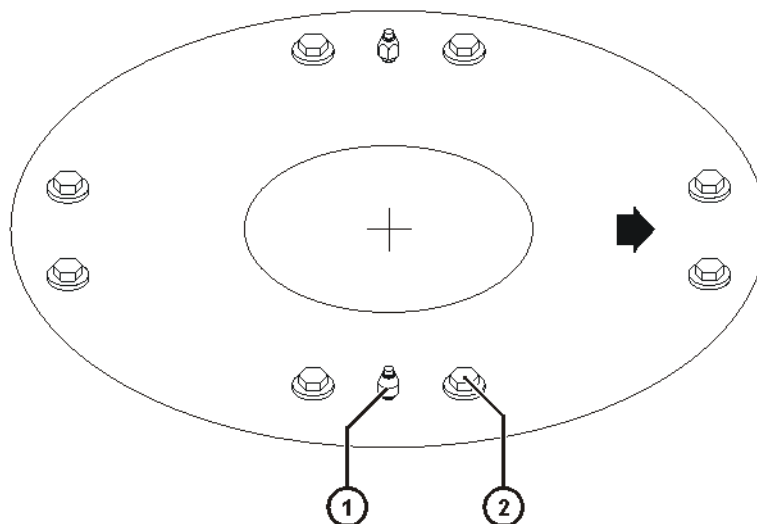


Fig. 6-7: Machine frame mounting

- 1 Pin
- 2 Hexagon bolt

Dimensioned drawing

The following illustrations provide all the necessary information on machine frame mounting, together with the required foundation data.

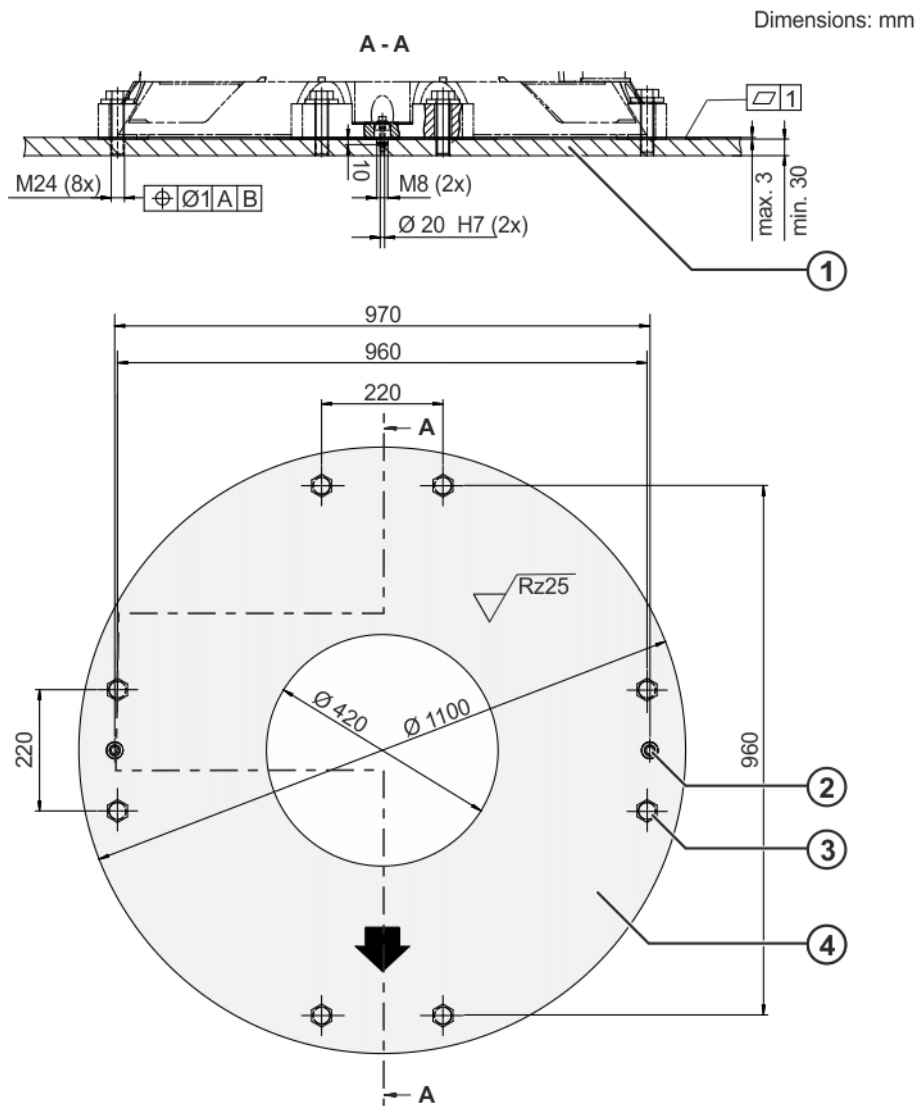


Fig. 6-8: Machine frame mounting, dimensioned drawing

- | | |
|-------------------|---------------------|
| 1 Steel structure | 3 Hexagon bolt (8x) |
| 2 Pins (2x) | 4 Mounting surface |

6.5 Connecting cables and interfaces

Connecting cables

The connecting cables comprise all the cables for transferring energy and signals between the robot and the robot controller. They are connected to the robot junction boxes with connectors. The set of connecting cables comprises:

- Motor cable X20.1 - X30.1
- Motor cable X20.4 - X30.4
- Control cable X21 - X31
- Ground conductor (optional)

Depending on the specification of the robot, various connecting cables are used. Cable lengths of 7 m, 15 m, 25 m, 35 m and 50 m are available. The maximum length of the connecting cables must not exceed 50 m. Thus if the robot is operated on a linear unit which has its own energy supply chain these cables must also be taken into account.



For the connecting cables, a ground conductor is always required to provide a low-resistance connection between the robot and the control cabinet in accordance with DIN EN 60204. The ground conductor is not part of the scope of supply and can be ordered as an option. The connection must be made by the customer. The tapped holes for connecting the ground conductor are located on the base frame of the robot.

The following points must be observed when planning and routing the connecting cables:

- The bending radius for fixed routing must not be less than 150 mm for motor cables and 60 mm for control cables.
- Protect cables against exposure to mechanical stress.
- Route the cables without mechanical stress – no tensile forces on the connectors
- Cables are only to be installed indoors.
- Observe permissible temperature range (fixed installation) of 263 K (-10 °C) to 343 K (+70 °C).
- Route the motor cables and the data cables separately in metal ducts; if necessary, additional measures must be taken to ensure electromagnetic compatibility (EMC).

Interface for energy supply systems

The robot can be equipped with an energy supply system between axis 1 and axis 3 and a second energy supply system between axis 3 and axis 6. The A1 interface required for this is located on the rear of the base frame, the A3 interface is located on the side of the arm and the interface for axis 6 is located on the robot tool. Depending on the application, the interfaces differ in design and scope. They can be equipped e.g. with connections for cables and hoses. Detailed information on the connector pin allocation, threaded unions, etc. is given in separate documentation.

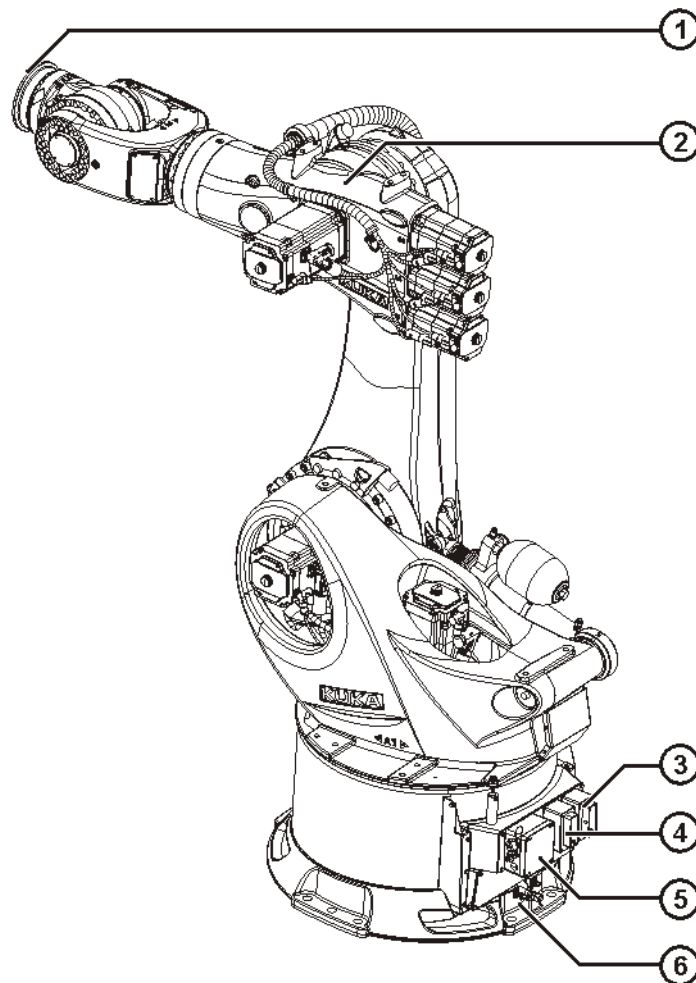


Fig. 6-9: Connecting cables and interfaces

- 1 Interface A6, tool
- 2 Interface A3, arm
- 3 Connection, motor cable X30.4
- 4 Connection, motor cable X30.1
- 5 Connection, control cable X31
- 6 Interface A1, base frame

7 Transportation

7.1 Transporting the robot

Description Move the robot into its transport position each time it is transported. It must be ensured that the robot is stable while it is being transported. The robot must remain in its transport position until it has been fastened in position. Before the robot is lifted, it must be ensured that it is free from obstructions. Remove all transport safeguards, such as nails and screws, in advance. First remove any rust or glue on contact surfaces. Remove any disruptive add-on parts (e.g. energy supply system) before transportation.

Transport position The robot must be in the transport position (>>> Fig. 7-1) before it can be transported. The robot is in the transport position when the axes are in the following positions:

| Axis | A1 | A2 | A3 | A4 | A5 | A6 |
|-------|----|-------|-------|----|------|----|
| Angle | 0° | -130° | +130° | 0° | +90° | 0° |

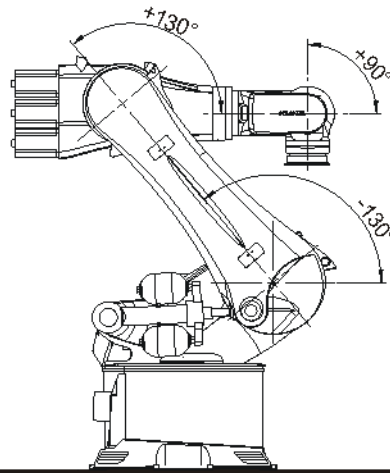


Fig. 7-1: Transport position

Transport dimensions The transport dimensions for the robot can be noted from the following figures. The position of the center of gravity and the weight vary according to the specific configuration. The specified dimensions refer to the robot without equipment.

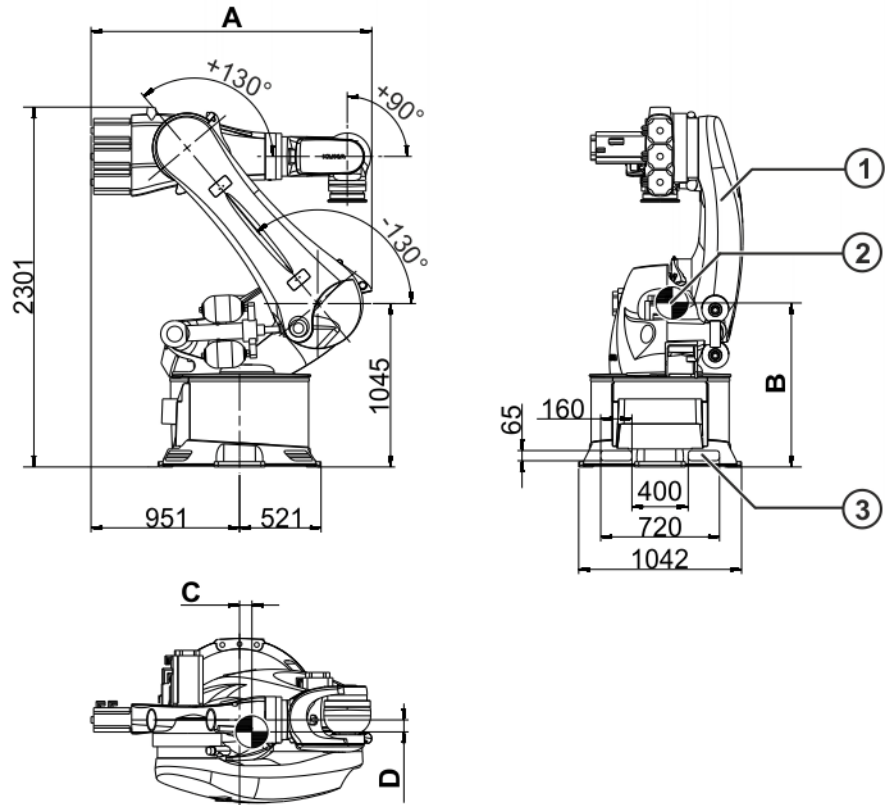


Fig. 7-2: Transport dimensions

- 1 Robot
- 2 Center of gravity
- 3 Fork slots

| Robot | A | B | C | D |
|------------------|----------|----------|--------|-------|
| KR 500 R2830 | 1,803 mm | 1,053 mm | 78 mm | 77 mm |
| KR 500 R2830 F | | | | |
| KR 500 R2830 C | | | | |
| KR 500 R2830 C-F | | | | |
| KR 420 R3080 | 2,040 mm | 1,059 mm | 100 mm | 77 mm |
| KR 420 R3080 F | | | | |
| KR 340 R3330 | 2,290 mm | 1,069 mm | 122 mm | 77 mm |
| KR 340 R3330 F | | | | |

Transportation

The robot can be transported by fork lift truck or using lifting tackle.

WARNING Use of unsuitable handling equipment may result in damage to the robot or injury to persons. Only use authorized handling equipment with a sufficient load-bearing capacity. Only transport the robot in the manner specified here.

Transportation by fork lift truck

For transport by fork lift truck (>>> Fig. 7-3), two fork slots are provided in the base frame. The robot can be picked up by the fork lift truck from the front and rear. The base frame must not be damaged when inserting the forks into the fork slots. The fork lift truck must have a minimum payload capacity of 3,500 kg and an adequate fork length.

Ceiling-mounted robots can only be transported by fork lift truck.

NOTICE Avoid excessive loading of the fork slots through undue inward or outward movement of hydraulically adjustable forks of the fork lift truck. Failure to do so may result in material damage.

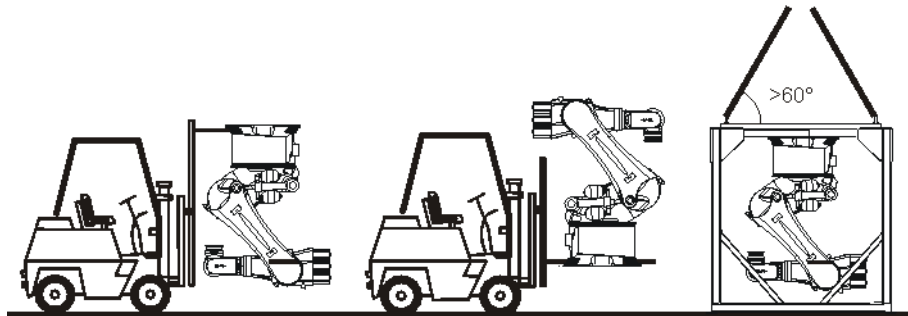


Fig. 7-3: Transportation by fork lift truck

Transportation with lifting tackle

The robot can also be transported using lifting tackle. The robot must be in the transport position.

The lifting tackle must be attached using 3 M20 DIN 580 eyebolts and positioned along the robot as illustrated (>>> Fig. 7-4). The lifting tackle must consist of 3 legs of the following length:

- Length of leg G1: 2020 mm
- Length of leg G2: 2140 mm
- Length of leg G3: 1480 mm

All the legs must be long enough and must be routed in such a way that the robot is not damaged. Installed tools and items of equipment that could be damaged during transportation must be removed.

Installed tools and items of equipment can cause undesirable shifts in the center of gravity, which are liable to cause a collision during transportation. The user shall be liable for any damage to the robot or to other material property resulting from this.

Tools and items of equipment must be removed from a robot before it is exchanged.

WARNING The robot may tip during transportation. Risk of personal injury and damage to property.
If the robot is being transported using lifting tackle, special care must be exercised to prevent it from tipping. Additional safeguarding measures must be taken. It is forbidden to pick up the robot in any other way using a crane!

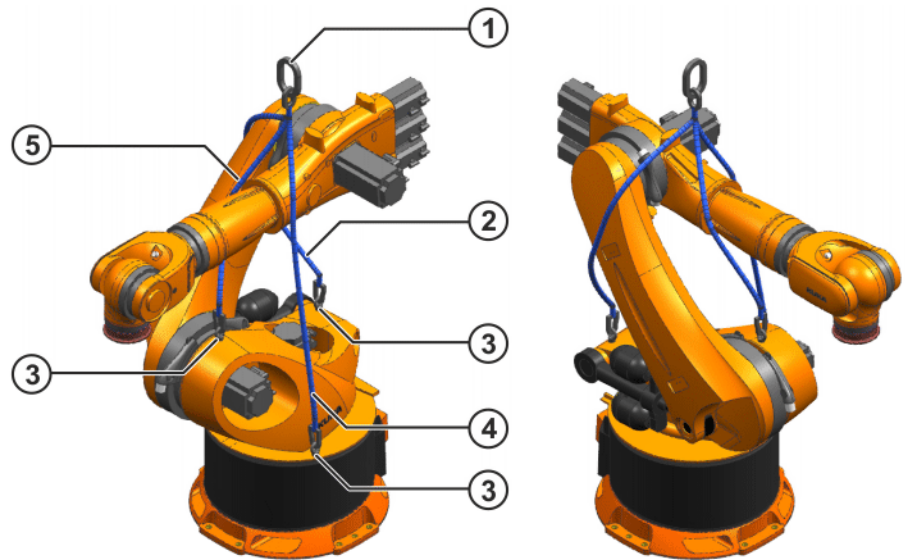


Fig. 7-4: Transportation using lifting tackle

- 1 Lifting tackle assembly
- 2 Leg G1 (length: 2020 mm)
- 3 M20 DIN 580 eyebolt
- 4 Leg G2 (length: 2140 mm)
- 5 Leg G3 (length: 1480 mm)

8 KUKA Service

8.1 Requesting support

| | |
|---------------------|---|
| Introduction | This documentation provides information on operation and operator control, and provides assistance with troubleshooting. For further assistance, please contact your local KUKA subsidiary. |
| Information | <p>The following information is required for processing a support request:</p> <ul style="list-style-type: none"> ■ Description of the problem, including information about the duration and frequency of the fault ■ As comprehensive information as possible about the hardware and software components of the overall system <p>The following list gives an indication of the information which is relevant in many cases:</p> <ul style="list-style-type: none"> ■ Model and serial number of the kinematic system, e.g. the manipulator ■ Model and serial number of the controller ■ Model and serial number of the energy supply system ■ Designation and version of the system software ■ Designations and versions of other software components or modifications ■ Diagnostic package KrcDiag: Additionally for KUKA Sunrise: Existing projects including applications For versions of KUKA System Software older than V8: Archive of the software (KrcDiag is not yet available here.) ■ Application used ■ External axes used |

8.2 KUKA Customer Support

| | |
|---------------------|---|
| Availability | KUKA Customer Support is available in many countries. Please do not hesitate to contact us if you have any questions. |
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