Product specification

Robot stopping distances according to ISO 10218-1
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Overview of this specification

About this specification
This specification contains stopping distances and times for category 0 and category 1 stops, as required by EN ISO 10218-1 Annex B.

Usage
This specification should be used when calculating the safe distance in applying safeguarding devices.

Who should read this manual?
This specification is intended for:

- Personnel working with planning of robot systems

References
Documentation referred to in the manual, is listed in the table below.

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Revision

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| A        | Release 14.1. The following robots are added:  
• IRB 120  
• IRB 140  
• IRB 6700  
• IRB 260  
• IRB 460  
• IRB 660  
• IRB 760 |
| B        | Release 15.1. The following robots are added:  
• IRB 6700 variants  
• IRB 1200  
• IRB 1520  
• IRB 1600  
Descriptions about the data and measurements are updated. |
| C        | Release 15.2. The following robots are added:  
• IRB 2400 |

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|          | • IRB 4400  
          | • IRB 8700  |
|          | **Note**    |
|          | Category 0 values are missing for IRB 7600 2.80 m 340 kg. |

**D** Release 16.1.
The following robots are added:
• New variants for IRB 1600ID
This revision includes the following additions and/or changes:
• A description of how to measure the stopping distance and time for your installation is added, see *Measuring stopping distance and time on page 19.*

**E** Release 16.1.
• Rename of the new variant IRB 1600ID - 6/1.55 to IRB 1660ID - 6/1.55.
• Re-inserted IRB 1600ID-4/1.5 that was missing in the previous revision.

**F** Release 16.2.
• Improved measurements for 4-axis articulated robots.
• Category 0 values are added for IRB 7600 340/2.80.

**G** Release 17.2.
• Updated data for all previously published robots.
• Added information about naming conventions, see *Naming of product variants in this document on page 17.*
• The following robots are added:
  - IRB 360
      **Note**
      For stop category 0, the robot may hit the mechanical stops before the speed is reduced to 0.
  - IRB 6700inv

**H** Release 19A.
The following robots are added:
• IRB 6790
• IRBP K, IRBP L, IRB R

**Note**
Data for IRBP C will be added in a later release.

**J** The following robots are added:
• IRB 910SC

**K** The following robots are added:
• IRBP A, IRBP B, IRBP D
• Corrected names in tables for IRBP R.

**L** The following robots are added:
• IRB 910INV
• IRB 1100
• IRBP C

**M** Added back IRB 2600, that was accidentally removed from revision L.
<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Added correct graphics for IRB 2600. The graphics used in revisions J to M are not correct.</td>
</tr>
</tbody>
</table>
| P        | Release 20C. The category 0 stop data for all IRBP is updated with graphics. The following robots are added:  
  - IRB 1300 |
| Q        | Release 20C. The following robots are added:  
  - IRB 760, 445 kg variant  
  The description about measurement and calculation is updated. |
| R        | Release 21A. The following robots are added:  
  - IRB 390 |
| S        | Release 21B. The following robots are added:  
  - CRB 1100  
  - CRB 15000 |
| T        | Release 21C. The following robots are added:  
  - IRB 920  
  The graphs for IRB 1660ID are corrected. |
| U        | Release 22A. The following robots are added:  
  - IRB 1300-12/1.4  
  - IRB 5710  
  - IRB 5720  
  The robot IRB 260 is removed as it is phased out from the official product offer. |
| V        | Release 22B. The following robots are added:  
  - IRB 365 |
| W        | Release 22C. The following robots are added:  
  - IRB 1010  
  - IRB 920, new variants |
| X        | Release 22D. The following robots are added:  
  - CRB 1300 |
| Y        | Release 23A. The following robots are added:  
  - IRB 365, new variants  
  - The robot IRB 140 is removed as it is phased out from the official product offer.  
  - The robot IRB 6640 is removed as it is phased out from the official product offer. |
1 About the data

Robot stopping distances and times
For articulated and SCARA robots, all measurements and calculations of stopping distances and times are done according to ISO 10218-1, with single axis motion on axes 1, 2, and 3. If more than one axis is used for the movement, then the stopping distance and time can be longer. Normal delays of the hardware and software are taken into account.
For delta robots (parallel arm) the values are based on movement by all axes, as these axes always move together. Only stopping times are presented.
For positioners the values are based on single axis movement.
The stop categories 0 and 1 are according to IEC 60204-1.

Category 0 stops
The stopping distance and time for category 0 stops are simulated using maximum speed, maximum payload, and the arm stretched out to the maximum reach.

Category 1 stops
The stop category 1 data are based on calculations in simulation of worst case scenarios. The data for stop category 1 are verified by measurements.
The simulations and verifications are done with the default value (100%) for the system parameter AccSet. Changing this value will affect the stopping distances and times (only for robots running on versions prior to RobotWare 6.01).

Note
The stop category 1 is a controlled stop and will therefore have less deviation from the programmed path compared with a stop category 0.

Robots
For robots the stopping distance and time for category 1 stop is provided for three arm extensions and three payloads. These variables are 100%, 66%, and 33% of the maximum values for the robot.
The speed and zone data in the simulations are based on TCP0.

Positioners
For positioners the stopping distance and time is provided for three payloads. No extension zones are applicable. The payloads are 100%, 66%, and 33% of the maximum values for the positioner.
Positioners with more than one station are presented with only one station data as the stations are identical.

Loads
The used loads represent the rated load, with rated inertia in the load diagram, maximum cog z, and zero cog x and cog y. No arm load is used. The load diagrams are available in the respective product specification.

Continues on next page
At 66% load and 33% load, the mass and inertia are reduced to 66% and 33% but cog z is the same as for 100% load.

Extension zones for articulated robots

The extension zone for the stop category 1 is based on the wrist center point (WCP). The extension zone limits describe the size of the respective zones. Radius R is measured from the axis-1 center.

<table>
<thead>
<tr>
<th>Zone 0 (Z0)</th>
<th>Zone 1 (Z1)</th>
<th>Zone 2 (Z2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radius (R) is 0-33% of maximum reach of the wrist center point (WCP).</td>
<td>Radius (R) is 33-66% of maximum reach of the wrist center point (WCP).</td>
<td>Radius (R) is 66-100% of maximum reach of the wrist center point (WCP).</td>
</tr>
</tbody>
</table>

Speed

For robots the TCP0 speed is measured in meters per second when the stop is triggered.

For positioners the speed is the angular speed in radians per second.

Stopping distances

The stopping distance is measured in degrees.

Note

The stopping distances are presented as angles. Large angles with TCP0 close to the rotation center do not necessarily correspond to a long stopping distance. Therefore a large stop angle can represent a short TCP stop distance.

Note

The stopping distance for delta robots is measured in meters.

Stopping times

The stopping time is measured in seconds.

Limitations

The stopping distance can vary depending on additional loads on the robot.

The stopping distance for category 0 stops can vary depending on the individual brakes and their friction.

This document includes the robot variants that are part of the official product offer at the time of the release of this revision.
Naming of product variants in this document

The product variants presented in this document are named according to their reach and capacity. This corresponds to their official variant name but there are a few exceptions where the names do not match due to different data sources. For example, IRB 6650S 125/3.5 is listed as IRB 6650S 3.45 m 125 kg.
This page is intentionally left blank
2 Measuring stopping distance and time

Preparations before measuring

For measurement and calculation of overall system stopping performance, see ISO 13855:2010.

The measurement shall be done for the selected stop category. The emergency stop button on the robot controller is configured for stop category 0 on delivery. A risk assessment can conclude the need for another stop category. The stop category can be changed through the system parameter Function (topic Controller, type Safety Run Chain). In case of deviations of the default configuration of stop category 0, then this is detailed in the product specification for the respective manipulator.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
</table>
| The measurement and calculation of overall stopping performance for a robot must be tested with its correct load, speed, and tools, in its actual environment, before the robot is taken into production. 
All load and tool data must be correctly defined (weight, CoG, moment of inertia). The load identification service routine can be used to identify the data. |

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow the safety instructions in the respective product manual for the robot.</td>
</tr>
</tbody>
</table>

Measuring with TuneMaster

The software TuneMaster can be used to measure stopping distances and times for ABB robots. The TuneMaster software contains documentation on how to use it.

1. Download TuneMaster from [www.abb.com/robotics](http://www.abb.com/robotics), section RobotStudio - Downloads - RobotWare Tools and Utilities.
2. Install TuneMaster on a computer. Start the TuneMaster app and select Log Signals.
3. Connect to the robot controller.
4. Define the I/O stop signal to use for measurement, for example, ES1 for emergency stop.
5. Define the signal number to use for measurement, 1298 for axis position. The value is given in radians.
6. Start the logging in TuneMaster.
7. Start the test program on the controller.
8. When the axis has reached maximum speed, press the emergency stop button.
9. In TuneMaster, measure the stopping distance and time.
10. Repeat for all installed emergency stop buttons until the identified hazards due to stopping distance and time for axes have been verified.

Continues on next page
Example from TuneMaster

![Graph showing stopping distance and time](image)

xx1600000386
3 CRB 15000

3.1 CRB 15000 0.95 m 5 kg

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.309</td>
</tr>
<tr>
<td>1</td>
<td>0.309</td>
<td>0.618</td>
</tr>
<tr>
<td>2</td>
<td>0.618</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image-url)
Extension zone 2, stopping distance and stopping time

![Graph 1: Ph vs. v showing stopping distance for different mass percentages.]

![Graph 2: t vs. v showing stopping time for different mass percentages.]

Continues on next page
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph 1: Stopping Distance vs. Velocity](image1)

![Graph 2: Stopping Time vs. Velocity](image2)
Extension zone 2, stopping distance and stopping time
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance and time vs velocity](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time vs. speed for different mass percentages (m=100%, m=66%, m=33%).]
This page is intentionally left blank
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28.9</td>
<td>0.15</td>
</tr>
<tr>
<td>2</td>
<td>32.8</td>
<td>0.17</td>
</tr>
<tr>
<td>3</td>
<td>27.4</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.193</td>
</tr>
<tr>
<td>1</td>
<td>0.193</td>
<td>0.387</td>
</tr>
<tr>
<td>2</td>
<td>0.387</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
4 IRB 120

4.1 IRB 120 0.58 m 3 kg

Continued

Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distances and times for different mass ratios.](image)
Extension zone 1, stopping distance and stopping time

Continued on next page
Extension zone 2, stopping distance and stopping time

- $\Phi_i$ [°]
  - $m=100\%$
  - $m=66\%$
  - $m=33\%$

- $t$ [s]
  - $m=100\%$
  - $m=66\%$
  - $m=33\%$

$P_h = f(v)$

$P_h = f(v)$
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph 1: \( \Phi \) vs. \( v \)]

![Graph 2: \( t \) vs. \( v \)]
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different mass percentages.](image)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses vs. velocity.]
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28.6</td>
<td>0.14</td>
</tr>
<tr>
<td>2</td>
<td>33.2</td>
<td>0.17</td>
</tr>
<tr>
<td>3</td>
<td>27.3</td>
<td>0.12</td>
</tr>
</tbody>
</table>

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.193</td>
</tr>
<tr>
<td>1</td>
<td>0.193</td>
<td>0.387</td>
</tr>
<tr>
<td>2</td>
<td>0.387</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

---

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

Continues on next page
Extension zone 1, stopping distance and stopping time

---

4.2 IRB 120T 0.58 m 3 kg

Continued
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and stopping time for IRB 120T 0.58 m 3 kg](image_url)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>83.25</td>
<td>0.25</td>
</tr>
<tr>
<td>2</td>
<td>103.7</td>
<td>0.27</td>
</tr>
<tr>
<td>3</td>
<td>3.4</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.117</td>
</tr>
<tr>
<td>1</td>
<td>0.117</td>
<td>0.233</td>
</tr>
<tr>
<td>2</td>
<td>0.233</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and load conditions.]
5 IRB 910

5.1 IRB 910 INV 0.35 m 3 kg

Continued

Extension zone 1, stopping distance and stopping time

Continued on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time versus velocity for different mass percentages.]

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) vs velocity (v) in meters per second (m/s).]
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity](image)

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times for different masses (m=100%, m=66%, m=33%) vs. velocity (v) in m/s.](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1](image1.png)

![Graph 2](image2.png)
5.2 IRB 910INV 0.55 m 6 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>46.0</td>
<td>0.22</td>
</tr>
<tr>
<td>2</td>
<td>71.8</td>
<td>0.19</td>
</tr>
<tr>
<td>3</td>
<td>3.95</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.183</td>
</tr>
<tr>
<td>1</td>
<td>0.183</td>
<td>0.367</td>
</tr>
<tr>
<td>2</td>
<td>0.367</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times for different speeds.](image-url)

Continues on next page.
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. speed]

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different masses (m=100%, m=66%, m=33%).]
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different loads and speeds.]

Continued
5 IRB 910

5.2 IRB 910INV 0.55 m 6 kg

Continued

Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for IRB 910INV 0.55 m 6 kg.](image)
5.3 IRB 910SC 0.45 m 3 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42.9</td>
<td>0.21</td>
</tr>
<tr>
<td>2</td>
<td>72.2</td>
<td>0.22</td>
</tr>
<tr>
<td>3</td>
<td>3.98</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.15</td>
</tr>
<tr>
<td>1</td>
<td>0.15</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>0.3</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for category 1, Axis 1.](image)

Continues on next page
5 IRB 910

5.3 IRB 910SC 0.45 m 3 kg

Continued

Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different masses and velocities.](image-url)
5 IRB 910

5.3 IRB 910SC 0.45 m 3 kg

Continued

Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses](image)

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different mass percentages.]

---

Continued on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses](image-url)
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different mass percentages.](image)
5.4 IRB 910SC 0.55 m 3 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>52.75</td>
<td>0.27</td>
</tr>
<tr>
<td>2</td>
<td>71.9</td>
<td>0.23</td>
</tr>
<tr>
<td>3</td>
<td>3.98</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.183</td>
</tr>
<tr>
<td>1</td>
<td>0.183</td>
<td>0.367</td>
</tr>
<tr>
<td>2</td>
<td>0.367</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different masses](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

Continues on next page
5 IRB 910

5.4 IRB 910SC 0.55 m 3 kg

Continued

Extension zone 1, stopping distance and stopping time

[Graph showing stopping distance and time against velocity]

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different mass values](image)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times for different masses (m=100%, m=66%, m=33%) across various velocities (v) for IRB 910 SC 0.55 m 3 kg.](image-url)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different speeds and mass fractions.]

- Graph 1: $P_h [°C]$ vs. $v [m/s]$
  - Red line: $m=100\%$
  - Green line: $m=66\%$
  - Blue line: $m=33\%$

- Graph 2: $t [s]$ vs. $v [m/s]$
  - Red line: $m=100\%$
  - Green line: $m=66\%$
  - Blue line: $m=33\%$
5.5 IRB 910SC 0.65 m 3 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>49.33</td>
<td>0.29</td>
</tr>
<tr>
<td>2</td>
<td>66.6</td>
<td>0.22</td>
</tr>
<tr>
<td>3</td>
<td>3.98</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.217</td>
</tr>
<tr>
<td>1</td>
<td>0.217</td>
<td>0.433</td>
</tr>
<tr>
<td>2</td>
<td>0.433</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for IRB 910 SC with different masses (m=100%, m=66%, m=33%) at various speeds (v) in meters per second (m/s).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different mass percentages.]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time vs. velocity for different masses]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages.](image)

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

- $P_{ih} \, [^\circ]$ vs. $v \, [\text{m/s}]$
- $t \, [\text{s}]$ vs. $v \, [\text{m/s}]$
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6 IRB 920

6.1 IRB 920 0.55 m 6 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.43°</td>
<td>0.14</td>
</tr>
<tr>
<td>2</td>
<td>42.76°</td>
<td>0.11</td>
</tr>
<tr>
<td>3</td>
<td>0.07 m</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.183</td>
</tr>
<tr>
<td>1</td>
<td>0.183</td>
<td>0.367</td>
</tr>
<tr>
<td>2</td>
<td>0.367</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time with different masses (m=100%, m=66%, m=33%) for various speeds (v [m/s]).]
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) as a function of velocity (v) in meters per second (m/s)].
Extension zone 2, stopping distance and stopping time

\[ \text{v [m/s]} \]

\[ \text{P}_{\text{h}} [\text{°}] \]

\[ \text{f [s]} \]

- m=100%
- m=66%
- m=33%

Continued
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time](image-url)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distances and times for different masses and speeds.](image)
6.2 IRB 920 0.65 m 6 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36.44°</td>
<td>0.17</td>
</tr>
<tr>
<td>2</td>
<td>41.82°</td>
<td>0.11</td>
</tr>
<tr>
<td>3</td>
<td>0.07 m</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.217</td>
</tr>
<tr>
<td>1</td>
<td>0.217</td>
<td>0.433</td>
</tr>
<tr>
<td>2</td>
<td>0.433</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Note

It is not possible to position TCP0 in zone 0 for this variant.

Category 1, Axis A1

Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
6.2 IRB 920 0.65 m 6 kg

Category 1, Axis A2

Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: Distance vs. Speed](image1)

![Graph 2: Time vs. Speed](image2)
Category 1, Axis A3

Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time versus velocity for different mass fractions (m=100%, m=66%, m=33%).](image)
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance vs. velocity]

![Graph of stopping time vs. velocity]
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.14°</td>
<td>0.15</td>
</tr>
<tr>
<td>2</td>
<td>59.28°</td>
<td>0.14</td>
</tr>
<tr>
<td>3</td>
<td>0.0956 m</td>
<td>0.1290</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.15</td>
</tr>
<tr>
<td>1</td>
<td>0.15</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>0.3</td>
<td>max reach</td>
</tr>
</tbody>
</table>

\(^i\) WCP cannot enter this zone, therefore the diagrams are empty.

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

- Top graph: Variations of \( \Phi \) with \( v \) for different mass percentages (m=100%, m=66%, m=33%)
- Bottom graph: Variations of \( t \) with \( v \) for different mass percentages (m=100%, m=66%, m=33%)
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

- Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

- Red line: $m=100\%$
- Green line: $m=66\%$
- Blue line: $m=33\%$

$v$ [m/s] vs. $s$ [m]
$v$ [m/s] vs. $t$ [s]
6.4 IRB 920T 0.55 m 6 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.60°</td>
<td>0.18</td>
</tr>
<tr>
<td>2</td>
<td>59.28°</td>
<td>0.14</td>
</tr>
<tr>
<td>3</td>
<td>0.0956 m</td>
<td>0.1290</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.183</td>
</tr>
<tr>
<td>1</td>
<td>0.183</td>
<td>0.367</td>
</tr>
<tr>
<td>2</td>
<td>0.367</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) at various speeds (v=m/s).]
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different mass ratios (m=100%, m=66%, m=33%) as a function of velocity (v) in meters per second (m/s).]
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass ratios.]

Continued
6 IRB 920

6.4 IRB 920T 0.55 m 6 kg

Continued

Extension zone 2, stopping distance and stopping time
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

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Continues on next page
Extension zone 1, stopping distance and stopping time

Graph 1: Stopping distance $s$ vs. velocity $v$

Graph 2: Stopping time $t$ vs. velocity $v$

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

- **s [m]** vs. **v [m/s]**
- **t [s]** vs. **v [m/s]**

Legend:
- **m=100%**
- **m=66%**
- **m=33%**
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>66.73 m</td>
<td>0.32</td>
</tr>
<tr>
<td>2</td>
<td>76.35 m</td>
<td>0.12</td>
</tr>
<tr>
<td>3</td>
<td>0.0764 m</td>
<td>0.1008</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.217 i</td>
</tr>
<tr>
<td>1</td>
<td>0.217</td>
<td>0.433</td>
</tr>
<tr>
<td>2</td>
<td>0.433</td>
<td>max reach</td>
</tr>
</tbody>
</table>

i WCP cannot enter this zone, therefore the diagrams are empty.

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Continues on next page
Extension zone 2, stopping distance and stopping time

---

Continues on next page
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

---

Continues on next page
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed]

- For m=100%, the stopping distance (s) increases as the velocity (v) increases.
- For m=66% and m=33%, the stopping distances are lower compared to m=100%.
- Similar trend is observed for stopping time (t) as well.

6.5 IRB 920T 0.65 m 6 kg

Continued
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24.71</td>
<td>0.14</td>
</tr>
<tr>
<td>2</td>
<td>32.20</td>
<td>0.19</td>
</tr>
<tr>
<td>3</td>
<td>29.15</td>
<td>0.14</td>
</tr>
</tbody>
</table>

**Category 1, extension zones**

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.123</td>
</tr>
<tr>
<td>1</td>
<td>0.123</td>
<td>0.247</td>
</tr>
<tr>
<td>2</td>
<td>0.247</td>
<td>max reach</td>
</tr>
</tbody>
</table>

**Category 1, Axis A1**

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 1, Axis A1](image)
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance vs. speed for different masses (100%, 66%, 33%)](image1)

![Graph showing stopping time vs. speed for different masses (100%, 66%, 33%)](image2)
Extension zone 1, stopping distance and stopping time

**Graphs showing stopping distance and time for different speeds and load conditions.**

- **Graph 1:** Distance (Ph [m]) vs. Speed (v [m/s])
  - Red line: m=100%
  - Green line: m=66%
  - Blue line: m=33%

- **Graph 2:** Time (t [s]) vs. Speed (v [m/s])
  - Red line: m=100%
  - Green line: m=66%
  - Blue line: m=33%

Continued
7 IRB 1010

7.1 IRB 1010 0.37 m 1.5 kg

Continued

Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distances and times for different masses m=100%, m=66%, m=33%]

Continues on next page
Extension zone 1, stopping distance and stopping time

---

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image-url)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24.71</td>
<td>0.14</td>
</tr>
<tr>
<td>2</td>
<td>32.24</td>
<td>0.19</td>
</tr>
<tr>
<td>3</td>
<td>29.15</td>
<td>0.14</td>
</tr>
</tbody>
</table>

**Category 1, extension zones**

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.123</td>
</tr>
<tr>
<td>1</td>
<td>0.123</td>
<td>0.247</td>
</tr>
<tr>
<td>2</td>
<td>0.247</td>
<td>max reach</td>
</tr>
</tbody>
</table>

**Category 1, Axis A1**

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for IRB 1010](image)

Continued
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different masses](image1.png)

Continued...
Extension zone 1, stopping distance and stopping time

![Graph 1: $P_h$ vs. $v$](image1.png)

- $m=100\%$
- $m=66\%$
- $m=33\%$

![Graph 2: $t$ vs. $v$](image2.png)

- $m=100\%$
- $m=66\%$
- $m=33\%$

Continued
Extension zone 2, stopping distance and stopping time

![Graph of Phi vs. v]

![Graph of t vs. v]

Continues on next page
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass percentages (m=100%, m=66%, m=33%)].
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds with percentage markers.](image-url)
7.3 IRB 1010 0.37 m 1.5 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24.71</td>
<td>0.14</td>
</tr>
<tr>
<td>2</td>
<td>32.15</td>
<td>0.19</td>
</tr>
<tr>
<td>3</td>
<td>29.15</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.123</td>
</tr>
<tr>
<td>1</td>
<td>0.123</td>
<td>0.247</td>
</tr>
<tr>
<td>2</td>
<td>0.247</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance vs. velocity for different loads (m=100%, m=66%, m=33%).]
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continued
7 IRB 1010

7.3 IRB 1010 0.37 m 1.5 kg

Continued

Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and time vs. speed]

Continues on next page
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass percentages (m=100%, m=66%, m=33%).]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times for different masses and speeds.](image-url)
Extension zone 2, stopping distance and stopping time

[Graph showing the relationship between speed (v [m/s]) and stopping time (t [s]) for different mass percentages (m = 100%, m = 66%, m = 33%).]
8 IRB 1100, CRB 1100

8.1 IRB 1100, CRB 1100 0.47 m 4 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56.58</td>
<td>0.27</td>
</tr>
<tr>
<td>2</td>
<td>58.21</td>
<td>0.34</td>
</tr>
<tr>
<td>3</td>
<td>35.91</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.158</td>
</tr>
<tr>
<td>1</td>
<td>0.158</td>
<td>0.317</td>
</tr>
<tr>
<td>2</td>
<td>0.317</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: \( \Phi_f [\text{r}^\circ] \) vs. \( v [\text{m/s}] \)]

- \( m = 100\% \)
- \( m = 66\% \)
- \( m = 33\% \)

![Graph 2: \( t [\text{s}] \) vs. \( v [\text{m/s}] \)]

- \( m = 100\% \)
- \( m = 66\% \)
- \( m = 33\% \)
8 IRB 1100, CRB 1100

8.1 IRB 1100, CRB 1100 0.47 m 4 kg

Continued

Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance vs velocity]

![Graph of stopping time vs velocity]
8 IRB 1100, CRB 1100

8.1 IRB 1100, CRB 1100 0.47 m 4 kg

Continued

Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different weights and velocities.](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

---

Continued
Extension zone 2, stopping distance and stopping time
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>59.09</td>
<td>0.26</td>
</tr>
<tr>
<td>2</td>
<td>55.71</td>
<td>0.3</td>
</tr>
<tr>
<td>3</td>
<td>29.81</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.193</td>
</tr>
<tr>
<td>1</td>
<td>0.193</td>
<td>0.387</td>
</tr>
<tr>
<td>2</td>
<td>0.387</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass ratios (m=100%, m=66%, m=33%)]

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass loads (m=100%, m=66%, m=33%).]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for IRB 1100 and CRB 1100.](image)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times for IRB 1100, CRB 1100](image)

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different masses (m=100%, m=66%, m=33%)](image-url)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.7</td>
<td>0.14</td>
</tr>
<tr>
<td>2</td>
<td>37.2</td>
<td>0.22</td>
</tr>
<tr>
<td>3</td>
<td>37.6</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16*.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.235</td>
</tr>
<tr>
<td>1</td>
<td>0.235</td>
<td>0.469</td>
</tr>
<tr>
<td>2</td>
<td>0.469</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

---

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

---

**9.1 IRB 1200 0.7 m 7 kg**

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different masses (m=100%, m=66%, m=33%)](image-url)
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time against velocity for different masses (100%, 66%, 33%)]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different speeds and load factors]

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses](image-url)

Continued on next page
Extension zone 1, stopping distance and stopping time

![Graph 1: Stopping Distance](image)

![Graph 2: Stopping Time](image)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and loads.](image)
9.2 IRB 1200 0.7 m 7 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.7</td>
<td>0.14</td>
</tr>
<tr>
<td>2</td>
<td>37.1</td>
<td>0.22</td>
</tr>
<tr>
<td>3</td>
<td>37.6</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.235</td>
</tr>
<tr>
<td>1</td>
<td>0.235</td>
<td>0.469</td>
</tr>
<tr>
<td>2</td>
<td>0.469</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses (m = 100%, m = 66%, m = 33%) at various velocities (v)]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

[Graphs showing stopping distances and times for different mass percentages (m=100%, m=66%, m=33%)]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

---

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for IRB 1200 with different masses (100%, 66%, 33%) at various velocities (0.0 to 2.0 m/s).]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance vs. velocity for different masses (m=100%, m=66%, m=33%)]

![Graph showing stopping time vs. velocity for different masses (m=100%, m=66%, m=33%)]

Continued
9.3 IRB 1200 0.9 m 5 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39.1</td>
<td>0.19</td>
</tr>
<tr>
<td>2</td>
<td>45.8</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>42.1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.3</td>
</tr>
<tr>
<td>1</td>
<td>0.3</td>
<td>0.601</td>
</tr>
<tr>
<td>2</td>
<td>0.601</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses (m=100%, m=66%, m=33%) at various speeds (v) in meters per second (m/s)].
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass percentages.](image-url)
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different load fractions](image)

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph](image1)

![Graph](image2)
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity](image-url)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39.1</td>
<td>0.19</td>
</tr>
<tr>
<td>2</td>
<td>45.6</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>41.9</td>
<td>0.2</td>
</tr>
</tbody>
</table>

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.3</td>
</tr>
<tr>
<td>1</td>
<td>0.3</td>
<td>0.601</td>
</tr>
<tr>
<td>2</td>
<td>0.601</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different masses (m=100%, m=66%, m=33%).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1: Stopping Distance vs. Velocity](image1)

![Graph 2: Stopping Time vs. Velocity](image2)

Continued
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass fractions.](image-url)

*Continued on next page*
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

Graph 1: $P_f (\degree)$ vs. $v \text{ [m/s]}$
- $m=100\%$
- $m=66\%$
- $m=33\%$

Graph 2: $t \text{ [s]}$ vs. $v \text{ [m/s]}$
- $m=100\%$
- $m=66\%$
- $m=33\%$
10 IRB 1300, CRB 1300

10.1 IRB 1300, CRB 1300 0.9 m 11 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39.26</td>
<td>0.27</td>
</tr>
<tr>
<td>2</td>
<td>35.23</td>
<td>0.31</td>
</tr>
<tr>
<td>3</td>
<td>52.07</td>
<td>0.30</td>
</tr>
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</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.301</td>
</tr>
<tr>
<td>1</td>
<td>0.301</td>
<td>0.601</td>
</tr>
<tr>
<td>2</td>
<td>0.601</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time against velocity](image)
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) vs. velocity (v) for IRB 1300, CRB 1300.]

Continued
Extension zone 1, stopping distance and stopping time

![Graph 1: ϕ vs. v (°/m/s)]

![Graph 2: t vs. v (s/m/s)]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time versus velocity with different masses (m=100%, m=66%, m=33%)](image)
10.2 IRB 1300, CRB 1300 1.15 m 10 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>53.95</td>
<td>0.37</td>
</tr>
<tr>
<td>2</td>
<td>30.42</td>
<td>0.27</td>
</tr>
<tr>
<td>3</td>
<td>47.77</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16*.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.384</td>
</tr>
<tr>
<td>1</td>
<td>0.384</td>
<td>0.768</td>
</tr>
<tr>
<td>2</td>
<td>0.768</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages (m=100%, m=66%, m=33%) as a function of velocity (v) in m/s.](image)

Continued
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed](image)

---

Continued
Extension zone 1, stopping distance and stopping time

10 IRB 1300, CRB 1300
10.2 IRB 1300, CRB 1300 1.15 m 10 kg
Continued
Extension zone 2, stopping distance and stopping time

---

Product specification - Robot stopping distances according to ISO 10218-1

3HAC048645-001 Revision: Y

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Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

Graph showing the relationship between $v$ [m/s] and two variables, $\Phi$ [°] and $t$ [s], for different values of $m$ (100%, 66%, 33%).
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different masses.]

Continued
Extension zone 2, stopping distance and stopping time
10.3 IRB 1300, CRB 1300 1.4 m 7 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55.25</td>
<td>0.40</td>
</tr>
<tr>
<td>2</td>
<td>33.39</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>35.66</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.467</td>
</tr>
<tr>
<td>1</td>
<td>0.467</td>
<td>0.934</td>
</tr>
<tr>
<td>2</td>
<td>0.934</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

[Graph showing stopping distance and time for different speeds and masses]

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph 1: Phi vs. v]

- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

![Graph 2: t vs. v]

- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

Continues on next page
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds and mass percentages.]

---

Continued
Extension zone 1, stopping distance and stopping time

![Diagram showing stopping distance and stopping time for different loads and velocities for IRB 1300, CRB 1300 with 1.4 m 7 kg configuration.]

Continued
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

---

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and masses.](image)
Extension zone 2, stopping distance and stopping time

![Graph 1](image1.png)

 advantageous

![Graph 2](image2.png)
10.4 IRB 1300 1.4 m 12 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>48.88</td>
<td>0.40</td>
</tr>
<tr>
<td>2</td>
<td>18.53</td>
<td>0.20</td>
</tr>
<tr>
<td>3</td>
<td>21.92</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.467</td>
</tr>
<tr>
<td>1</td>
<td>0.467</td>
<td>0.934</td>
</tr>
<tr>
<td>2</td>
<td>0.934</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

Continues on next page
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times for different masses (m=100%, m=66%, m=33%) for speeds (v) ranging from 0.0 to 4.0 m/s.](image-url)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different load cases (m=100%, m=66%, m=33%).]
Category 1, Axis A3
Extension zone 0, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different masses](image-url)
Extension zone 2, stopping distance and stopping time

---

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11 IRB 1410

11.1 IRB 1410 1.44 m 5 kg

**Category 0**

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26.2</td>
<td>0.34</td>
</tr>
<tr>
<td>2</td>
<td>19.4</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>14.0</td>
<td>0.15</td>
</tr>
</tbody>
</table>

**Category 1, extension zones**

For definitions of the zones, see *Extension zones for articulated robots on page 16*.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.481</td>
</tr>
<tr>
<td>1</td>
<td>0.481</td>
<td>0.962</td>
</tr>
<tr>
<td>2</td>
<td>0.962</td>
<td>max reach</td>
</tr>
</tbody>
</table>

**Category 1, Axis 1**

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time](image)

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continued

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

Cont. on next page.
Extension zone 1, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass values]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time](image)

Continued
Extension zone 1, stopping distance and stopping time

Graph 1: Ph [°] vs. v [m/s] for different masses (m = 100%, 66%, 33%)

Graph 2: t [s] vs. v [m/s] for different masses (m = 100%, 66%, 33%)

Continued
Extension zone 2, stopping distance and stopping time

[Graphs showing stopping distance and time vs. velocity]
12 IRB 1520

12.1 IRB 1520ID 1.5 m 4 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.2</td>
<td>0.22</td>
</tr>
<tr>
<td>2</td>
<td>18.5</td>
<td>0.17</td>
</tr>
<tr>
<td>3</td>
<td>15.0</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td>1</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>1.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different load percentages (100%, 66%, 33%) at various velocities (v [m/s]).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and masses.]

Continues on next page
Category 1, Axis 3
Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times]
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different load factors.][1]

[1]: https://example.com/graphs.png
13 IRB 1600

13.1 IRB 1600 1.2 m 6 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19.7</td>
<td>0.17</td>
</tr>
<tr>
<td>2</td>
<td>16.8</td>
<td>0.12</td>
</tr>
<tr>
<td>3</td>
<td>16.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.408</td>
</tr>
<tr>
<td>1</td>
<td>0.408</td>
<td>0.817</td>
</tr>
<tr>
<td>2</td>
<td>0.817</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

[Graph showing stopping distance and stopping time for category 1, Axis 1]
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages.](image)

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph 1: Stopping Distance vs. Speed](image1)

![Graph 2: Stopping Time vs. Speed](image2)

Continued...
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different load conditions](image-url)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.7</td>
<td>0.17</td>
</tr>
<tr>
<td>2</td>
<td>26.1</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>22.3</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.408</td>
</tr>
<tr>
<td>1</td>
<td>0.408</td>
<td>0.817</td>
</tr>
<tr>
<td>2</td>
<td>0.817</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass values.](image)

**Graph Legend:**
- Red: m=100%
- Green: m=66%
- Blue: m=33%

**Axes:**
- x-axis: v [m/s]
- y-axis: Ph [°] or t [s]

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*Continues on next page*
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

Continued
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different mass ratios (m=100%, m=66%, m=33%) as functions of velocity (v) in meters per second (m/s).]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different masses.](image-url)

Continued on next page.
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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Continues on next page
Extension zone 1, stopping distance and stopping time

![Diagram showing stopping distance and stopping time for different mass values.](image-url)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. speed for different mass ratios (m=100%, m=66%, m=33%) on IRB 1600.](image-url)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23.4</td>
<td>0.2</td>
</tr>
<tr>
<td>2</td>
<td>22.0</td>
<td>0.17</td>
</tr>
<tr>
<td>3</td>
<td>15.8</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>1</td>
<td>0.483</td>
<td>0.967</td>
</tr>
<tr>
<td>2</td>
<td>0.967</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 1, Axis 1]

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity]

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 1, stopping distance and stopping time

Graphs showing the relationship between speed (v [m/s]) and stopping distance (Pth [°]) and time (t [s]) for different mass loads (m=100%, m=66%, m=33%).
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages.](image)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing Phi vs v and t vs v for different masses m=100%, m=66%, and m=33%]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different masses (m=100%, m=66%, m=33%) at different speeds (v)].
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27.9</td>
<td>0.22</td>
</tr>
<tr>
<td>2</td>
<td>30.9</td>
<td>0.25</td>
</tr>
<tr>
<td>3</td>
<td>22.3</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.483</td>
</tr>
<tr>
<td>1</td>
<td>0.483</td>
<td>0.967</td>
</tr>
<tr>
<td>2</td>
<td>0.967</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for Category 1, Axis 1 extension zone 0.](image)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph](image1)

![Graph](image2)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distances and times for different mass loads (m=100%, m=66%, m=33%) vs. speed (v) for IRB 1600.](image)

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances](image1)

![Graph showing stopping times](image2)

Continues on next page
13 IRB 1600

13.4 IRB 1600 1.45 m 10 kg

Continued

Extension zone 2, stopping distance and stopping time
13.5 IRB 1600ID 1.5 m 4 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.2</td>
<td>0.25</td>
</tr>
<tr>
<td>2</td>
<td>29.1</td>
<td>0.22</td>
</tr>
<tr>
<td>3</td>
<td>21.5</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td>1</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>1.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

[Graphs showing stopping distance and time as functions of velocity for different load factors (m=100%, m=66%, m=33%).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph of PH1 vs v for different mass percentages](image1)

![Graph of t vs v for different mass percentages](image2)

Continues on next page
Extension zone 1, stopping distance and stopping time

Graphs showing the relationship between velocity (v [m/s]) and stopping distance (Phi [°]) and stopping time (t [s]) for different mass load scenarios (m=100%, m=66%, m=33%).
Extension zone 2, stopping distance and stopping time

Graphs showing the relationship between speed (v [m/s]) and stopping distance (Ph [m]) or stopping time (t [s]) for different load masses (m = 100%, m = 66%, m = 33%).
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing Ph (°) and t [s] vs. v [m/s] for different mass percentages (m=100%, m=66%, m=33%).]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for IRB 1600 ID 1.5 m 4 kg](image-url)
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and stopping time for IRB 1600](image1)

![Graph of stopping distance and stopping time for IRB 1600](image2)
14 IRB 1660

14.1 IRB 1660ID 1.55 m 4 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29.6</td>
<td>0.22</td>
</tr>
<tr>
<td>2</td>
<td>40.2</td>
<td>0.34</td>
</tr>
<tr>
<td>3</td>
<td>26.8</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 0 emergency stop](image-url)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distances and times for different speeds and load factors.]

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times for different mass percentages (m=100%, m=66%, m=33%) for various speeds (v) ranging from 0 to 2.5 m/s.](image1)

![Graph showing how the stopping distance (P_t) increases with increasing speed (v) for different mass percentages.](image2)
Extension zone 2, stopping distance and stopping time

![Graph](image1)

![Graph](image2)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29.5</td>
<td>0.22</td>
</tr>
<tr>
<td>2</td>
<td>39.5</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>26.6</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

Continued
Extension zone 1, stopping distance and stopping time

![Graph 1: P[\phi] ° vs. v [m/s]]

- Red line: \( m = 100\% \)
- Green dashed line: \( m = 66\% \)
- Blue dotted line: \( m = 33\% \)

![Graph 2: \|\text{[kg]} vs. v [m/s]]

- Red line: \( m = 100\% \)
- Green dashed line: \( m = 66\% \)
- Blue dotted line: \( m = 33\% \)
Extension zone 2, stopping distance and stopping time

[Graphs showing stopping distance and time for different speeds and mass load scenarios.]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass fractions.]

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass loading]

Continues on next page
Extension zone 2, stopping distance and stopping time
15 IRB 2400

15.1 IRB 2400 1.5 m 10 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>46.9</td>
<td>0.51</td>
</tr>
<tr>
<td>2</td>
<td>36.4</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>22.8</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.524</td>
</tr>
<tr>
<td>1</td>
<td>0.524</td>
<td>1.048</td>
</tr>
<tr>
<td>2</td>
<td>1.048</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses](image)

*Continues on next page*
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different masses.](image-url)
Extension zone 2, stopping distance and stopping time

---

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 1, stopping distance and stopping time

---

Continued
Extension zone 2, stopping distance and stopping time
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>53.2</td>
<td>0.61</td>
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<tr>
<td>2</td>
<td>36.1</td>
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<td>3</td>
<td>29.1</td>
<td>0.27</td>
</tr>
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</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.524</td>
</tr>
<tr>
<td>1</td>
<td>0.524</td>
<td>1.048</td>
</tr>
<tr>
<td>2</td>
<td>1.048</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different loads](image)

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times for various mass percentages.]

Continued
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time as a function of velocity for different mass ratios.](image)
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26.6</td>
<td>0.2</td>
</tr>
<tr>
<td>2</td>
<td>26.9</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>18.2</td>
<td>0.12</td>
</tr>
</tbody>
</table>

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

Continued
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance vs. velocity](image1)

![Graph of stopping time vs. velocity](image2)

Continues on next page
16.1 IRB 2600 1.65 m 12 kg

Continued

Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different mass loads (m=100%, m=66%, m=33%) as a function of velocity (v [m/s]) for IRB 2600.](image)

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different masses (100%, 66%, 33%)](image-url)
Extension zone 2, stopping distance and stopping time

![Graph](image_url)

**Graph 1:**
- **$\phi_h$ [°]** vs **$v$ [m/s]**
- Lines for $m=100\%$, $m=66\%$, and $m=33\%$

**Graph 2:**
- **$t$ [s]** vs **$v$ [m/s]**
- Lines for $m=100\%$, $m=66\%$, and $m=33\%$
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28.7</td>
<td>0.22</td>
</tr>
<tr>
<td>2</td>
<td>30.5</td>
<td>0.25</td>
</tr>
<tr>
<td>3</td>
<td>22.4</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0</td>
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<tr>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time as functions of velocity](image)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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Product specification - Robot stopping distances according to ISO 10218-1

3HAC048645-001 Revision: Y

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. speed for different mass ratios (m=100%, m=66%, m=33%).]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

- For m = 100%
- For m = 66%
- For m = 33%
16.3 IRB 2600 1.85 m 12 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30.3</td>
<td>0.25</td>
</tr>
<tr>
<td>2</td>
<td>30.9</td>
<td>0.25</td>
</tr>
<tr>
<td>3</td>
<td>17.8</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph 1: $P_\text{thi}$ vs. $v$](image1)

- Red line: $m=100\%$
- Green line: $m=66\%$
- Blue line: $m=33\%$

![Graph 2: $t$ vs. $v$](image2)

- Red line: $m=100\%$
- Green line: $m=66\%$
- Blue line: $m=33\%$
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity](image_url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different load conditions (m=100%, m=66%, m=33%).]
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times for different mass percentages (m=100%, m=66%, m=33%) for IRB 2600.](image-url)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance (Ph) vs. velocity (v) for different mass ratios (m=100%, m=66%, m=33%).](image1)

![Graph showing stopping time (t) vs. velocity (v) for different mass ratios (m=100%, m=66%, m=33%).](image2)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33.1</td>
<td>0.27</td>
</tr>
<tr>
<td>2</td>
<td>34.4</td>
<td>0.27</td>
</tr>
<tr>
<td>3</td>
<td>20.7</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.617</td>
</tr>
<tr>
<td>1</td>
<td>0.617</td>
<td>1.233</td>
</tr>
<tr>
<td>2</td>
<td>1.233</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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Product specification - Robot stopping distances according to ISO 10218-1

16.4 IRB 2600ID 1.85 m 15 kg

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different mass percentages.](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds and mass percentages.](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass percentages.]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different load factors]

Continues on next page
Continued

Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass loads (m=100%, m=66%, m=33%) against velocity (v) in meters per second (m/s).]
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31.8</td>
<td>0.27</td>
</tr>
<tr>
<td>2</td>
<td>33.7</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>23.0</td>
<td>0.17</td>
</tr>
</tbody>
</table>

**Category 1, extension zones**

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.667</td>
</tr>
<tr>
<td>1</td>
<td>0.667</td>
<td>1.333</td>
</tr>
<tr>
<td>2</td>
<td>1.333</td>
<td>max reach</td>
</tr>
</tbody>
</table>

**Category 1, Axis 1**

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time versus velocity for different loads and mass ratios.](image)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

Continues on next page
Extension zone 1, stopping distance and stopping time

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Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages in IRB 2600ID 2.00 m 8 kg.](image)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different mass percentages.](image-url)
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and mass fractions.](image-url)
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17.1 IRB 4400 1.95 m 45 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>67.8</td>
<td>0.8</td>
</tr>
<tr>
<td>2</td>
<td>18.8</td>
<td>0.22</td>
</tr>
<tr>
<td>3</td>
<td>18.2</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.661</td>
</tr>
<tr>
<td>1</td>
<td>0.661</td>
<td>1.322</td>
</tr>
<tr>
<td>2</td>
<td>1.322</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Contains on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different mass loads](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and loads. The graphs display two sets of curves, one for \( m = 100\% \) and another for \( m = 66\% \) and \( m = 33\% \).](image)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times for various speeds and load factors.]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different mass ratios](image-url)
17.2 IRB 4400 1.95 m 60 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75.1</td>
<td>0.9</td>
</tr>
<tr>
<td>2</td>
<td>20.2</td>
<td>0.25</td>
</tr>
<tr>
<td>3</td>
<td>20.6</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.661</td>
</tr>
<tr>
<td>1</td>
<td>0.661</td>
<td>1.322</td>
</tr>
<tr>
<td>2</td>
<td>1.322</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) as functions of velocity (v) in m/s. The upper graph represents the angle change (Φh) and the lower graph represents the stopping time (t1) for different velocities.]
Extension zone 2, stopping distance and stopping time

<table>
<thead>
<tr>
<th>v [m/s]</th>
<th>P_h [°]</th>
<th>t [s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.5</td>
<td>10</td>
<td>0.1</td>
</tr>
<tr>
<td>1.0</td>
<td>20</td>
<td>0.2</td>
</tr>
<tr>
<td>1.5</td>
<td>30</td>
<td>0.3</td>
</tr>
<tr>
<td>2.0</td>
<td>40</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Legend:
- m=100%
- m=66%
- m=33%
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph 1: Stopping distance vs. velocity](image1.png)

![Graph 2: Stopping time vs. velocity](image2.png)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time as functions of velocity for different load masses: m=100%, m=66%, m=33%.]

Continued
Extension zone 2, stopping distance and stopping time

Graphs showing the stopping distance and time as functions of velocity for different mass ratios (100%, 66%, 33%).
17.3 IRB 4400 2.6 m 10 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>51.3</td>
<td>0.58</td>
</tr>
<tr>
<td>2</td>
<td>21.1</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>19.0</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different load levels]

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

- Graph 1: $P_h$ vs. $v$ for $m=100\%$, $m=66\%$, and $m=33\%$
- Graph 2: $t$ vs. $v$ for $m=100\%$, $m=66\%$, and $m=33\%$
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph 1: Stopping distance vs. velocity](image1)

![Graph 2: Stopping time vs. velocity](image2)
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

---

**Graph 1:**
- **x-axis:** $v$ [m/s]
- **y-axis:** $\Phi_1$ [°]
- Lines for $m=100\%$, $m=66\%$, $m=33\%$

**Graph 2:**
- **x-axis:** $v$ [m/s]
- **y-axis:** $t$ [s]
- Lines for $m=100\%$, $m=66\%$, $m=33\%$
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance and stopping time vs. velocity]

![Graph of stopping time vs. velocity]

Continued
Extension zone 2, stopping distance and stopping time

Graph 1: Ph [°C] vs. v [m/s]
- m=100%
- m=66%
- m=33%

Graph 2: t [s] vs. v [m/s]
- m=100%
- m=66%
- m=33%
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18 IRB 4600

18.1 IRB 4600 2.05 m 45 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60.5</td>
<td>0.58</td>
</tr>
<tr>
<td>2</td>
<td>37.1</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>25.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.684</td>
</tr>
<tr>
<td>1</td>
<td>0.684</td>
<td>1.367</td>
</tr>
<tr>
<td>2</td>
<td>1.367</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 0 emergency stop at max speed]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1](image1.png)

![Graph 2](image2.png)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

Continued
Extension zone 1, stopping distance and stopping time

Graph 1: 
- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

Graph 2:
- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%
Extension zone 2, stopping distance and stopping time

![Graph 1: Plot of Phi (°) vs. V (m/s)]

![Graph 2: Plot of t [s] vs. V (m/s)]

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different mass ratios](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

Continued
Extension zone 2, stopping distance and stopping time
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>62.9</td>
<td>0.66</td>
</tr>
<tr>
<td>2</td>
<td>40.3</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>32.8</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see \textit{Extension zones for articulated robots on page 16}.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.684</td>
</tr>
<tr>
<td>1</td>
<td>0.684</td>
<td>1.367</td>
</tr>
<tr>
<td>2</td>
<td>1.367</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different load conditions.

The graphs display data points and lines indicating how the stopping distance (Ph) and stopping time (t) vary with speed (v) for different load percentages (m=100%, m=66%, m=33%).

The upper graph shows Ph as a function of v, while the lower graph shows t as a function of v for the same load conditions. The graphs help in understanding the dynamic behavior of the robot under varying load conditions.

Continued on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses.](image)

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

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Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different load factors](image)

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
18.3 IRB 4600 2.50 m 20 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>53.9</td>
<td>0.51</td>
</tr>
<tr>
<td>2</td>
<td>33.9</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>22.2</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.838</td>
</tr>
<tr>
<td>1</td>
<td>0.838</td>
<td>1.675</td>
</tr>
<tr>
<td>2</td>
<td>1.675</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time

![Graph](image)

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) at varying velocities (v) in meters per second (m/s)].

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs velocity](image)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

---

Continued
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>61.7</td>
<td>0.71</td>
</tr>
<tr>
<td>2</td>
<td>41.9</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>30.2</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16*.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.851</td>
</tr>
<tr>
<td>1</td>
<td>0.851</td>
<td>1.701</td>
</tr>
<tr>
<td>2</td>
<td>1.701</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

*Continues on next page*
Extension zone 1, stopping distance and stopping time

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Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

Continues on next page
Continued

Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different load percentages](image)

*Continues on next page*
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

---

Continued
Extension zone 1, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for IRB 4600](image-url)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.6</td>
<td>0.52</td>
</tr>
<tr>
<td>2</td>
<td>27.2</td>
<td>0.39</td>
</tr>
<tr>
<td>3</td>
<td>24.7</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.767</td>
</tr>
<tr>
<td>1</td>
<td>0.767</td>
<td>1.534</td>
</tr>
<tr>
<td>2</td>
<td>1.534</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time](image-url)
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Diagram showing stopping distance and time for different speeds and masses.]

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different load factors (m = 100%, m = 66%, m = 33%).](image)

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph 1: Plot of 0 to 50 P (°) against v (m/s) with lines for m=100%, m=66%, and m=33%]

![Graph 2: Plot of 0 to 0.7 t (s) against v (m/s) with lines for m=100%, m=66%, and m=33%]
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different mass percentages.](image)
Extension zone 1, stopping distance and stopping time

![Graph 1: Stopping Distance vs Velocity](image1)

![Graph 2: Stopping Time vs Velocity](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass loads](image)

- Graph 1: Stopping distance ($P_h$) vs. velocity ($v$) for different mass loads ($m=100\%, m=66\%, m=33\%$)
- Graph 2: Stopping time ($t$) vs. velocity ($v$) for different mass loads ($m=100\%, m=66\%, m=33\%$)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.1</td>
<td>0.54</td>
</tr>
<tr>
<td>2</td>
<td>39.8</td>
<td>0.52</td>
</tr>
<tr>
<td>3</td>
<td>32.1</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.9</td>
</tr>
<tr>
<td>1</td>
<td>0.9</td>
<td>1.801</td>
</tr>
<tr>
<td>2</td>
<td>1.801</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

```
<table>
<thead>
<tr>
<th>Speed (m/s)</th>
<th>Distance (mm)</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>100</td>
<td>0.1</td>
</tr>
<tr>
<td>1.0</td>
<td>200</td>
<td>0.2</td>
</tr>
<tr>
<td>1.5</td>
<td>300</td>
<td>0.3</td>
</tr>
<tr>
<td>2.0</td>
<td>400</td>
<td>0.4</td>
</tr>
<tr>
<td>2.5</td>
<td>500</td>
<td>0.5</td>
</tr>
<tr>
<td>3.0</td>
<td>600</td>
<td>0.6</td>
</tr>
<tr>
<td>3.5</td>
<td>700</td>
<td>0.7</td>
</tr>
<tr>
<td>4.0</td>
<td>800</td>
<td>0.8</td>
</tr>
<tr>
<td>4.5</td>
<td>900</td>
<td>0.9</td>
</tr>
<tr>
<td>5.0</td>
<td>1000</td>
<td>1.0</td>
</tr>
</tbody>
</table>
```

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass scenarios.](image)

Continued
Extension zone 2, stopping distance and stopping time

\[
\begin{align*}
\text{Graph 1: } P_h [\text{m}] & \quad \text{for } v [\text{m/s}] \\
\text{Graph 2: } t [\text{s}] & \quad \text{for } v [\text{m/s}]
\end{align*}
\]

- \( m = 100\% \)
- \( m = 66\% \)
- \( m = 33\% \)
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different loads and speeds.](image)

*Continued on next page*
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different mass percentages](image)

- **$\Phi_v$ [°]** vs **$v$ [m/s]**
  - Red: $m=100\%$
  - Green: $m=66\%$
  - Blue: $m=33\%$

- **$t$ [s]** vs **$v$ [m/s]**
  - Red: $m=100\%$
  - Green: $m=66\%$
  - Blue: $m=33\%$
19.3 IRB 5710 2.30 m 90 kg LID INV

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39.3</td>
<td>0.53</td>
</tr>
<tr>
<td>2</td>
<td>32.2</td>
<td>0.47</td>
</tr>
<tr>
<td>3</td>
<td>28.7</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.767</td>
</tr>
<tr>
<td>1</td>
<td>0.767</td>
<td>1.534</td>
</tr>
<tr>
<td>2</td>
<td>1.534</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

[Graph showing stopping distance and time for different load conditions]

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass percentages.](image-url)
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

Continued
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different loads and speeds.](image-url)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.5</td>
<td>0.53</td>
</tr>
<tr>
<td>2</td>
<td>52.8</td>
<td>0.64</td>
</tr>
<tr>
<td>3</td>
<td>46.7</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.9</td>
</tr>
<tr>
<td>1</td>
<td>0.9</td>
<td>1.801</td>
</tr>
<tr>
<td>2</td>
<td>1.801</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 1, Axis A1]
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

**Diagram:**

- Top diagram: $P_h$ vs. $v$ for $m=100\%$, $m=66\%$, and $m=33\%$.
- Bottom diagram: $t$ vs. $v$ for the same mass percentages.
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

Continued
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times for different load masses (m=100%, m=66%, m=33%) as functions of speed (v in m/s).]
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

---

**Graph 1:**
- **Phi [°]** vs. **v [m/s]**
- Lines represent:
  - Red: m=100%
  - Green: m=66%
  - Blue: m=33%

**Graph 2:**
- **t [s]** vs. **v [m/s]**
- Lines represent:
  - Red: m=100%
  - Green: m=66%
  - Blue: m=33%
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
19.5 IRB 5710 2.30 m 110 kg INV

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.5</td>
<td>0.52</td>
</tr>
<tr>
<td>2</td>
<td>27.7</td>
<td>0.40</td>
</tr>
<tr>
<td>3</td>
<td>24.4</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.767</td>
</tr>
<tr>
<td>1</td>
<td>0.767</td>
<td>1.534</td>
</tr>
<tr>
<td>2</td>
<td>1.534</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time](image)
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time
Category 1, Axis A2
Extension zone 0, stopping distance and stopping time

---

```
506 Product specification - Robot stopping distances according to ISO 10218-1
Continues
```

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Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed](image)

---

Continued on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds](image)

Continued
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: Plot of $P_h$ vs. $v$ for different masses (m=100%, m=66%, m=33%)]

![Graph 2: Plot of $t$ vs. $v$ for different masses (m=100%, m=66%, m=33%)]
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.1</td>
<td>0.54</td>
</tr>
<tr>
<td>2</td>
<td>41.5</td>
<td>0.54</td>
</tr>
<tr>
<td>3</td>
<td>32.4</td>
<td>0.42</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.9</td>
</tr>
<tr>
<td>1</td>
<td>0.9</td>
<td>1.801</td>
</tr>
<tr>
<td>2</td>
<td>1.801</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different masses (m=100%, m=66%, m=33%) as a function of speed (v [m/s]).](image)
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity]

Continued
Extension zone 2, stopping distance and stopping time

\[ P_h (\degree) \]

\[ t [s] \]

Continued
Category 1, Axis A3
Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

Continued
Extension zone 2, stopping distance and stopping time
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39.2</td>
<td>0.35</td>
</tr>
<tr>
<td>2</td>
<td>33.9</td>
<td>0.47</td>
</tr>
<tr>
<td>3</td>
<td>28.3</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.767</td>
</tr>
<tr>
<td>1</td>
<td>0.767</td>
<td>1.534</td>
</tr>
<tr>
<td>2</td>
<td>1.534</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different load factors (m=100%, m=66%, m=33%).]
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and mass ratios.](image-url)
Extension zone 1, stopping distance and stopping time

```
\begin{align*}
\text{Extension zone 1, stopping distance and stopping time} \\
\end{align*}
```

![Graphs showing stopping distance and time for different load factors](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity (v [m/s]) for different mass (m) ratios: m=100%, m=66%, m=33%.

The graphs illustrate how the stopping distance and time change with velocity for each mass ratio.

Continued on next page.
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Continued

Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different masses (m=100%, m=66%, m=33%) for v ranging from 0 to 3.5 m/s. The graphs display two sets of data: one for angle (Φ, °) and the other for time (t, s).]
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity]
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.7</td>
<td>0.53</td>
</tr>
<tr>
<td>2</td>
<td>53.2</td>
<td>0.61</td>
</tr>
<tr>
<td>3</td>
<td>46.1</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.9</td>
</tr>
<tr>
<td>1</td>
<td>0.9</td>
<td>1.801</td>
</tr>
<tr>
<td>2</td>
<td>1.801</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

[Graph showing stopping distance and stopping time for different mass percentages (m = 100%, m = 66%, m = 33%) against velocity (v) in m/s.]
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

---

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different mass m values.](chart)

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time against velocity]

Continued
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

---

Continued
Extension zone 2, stopping distance and stopping time
## 20 IRB 5720

### 20.1 IRB 5720 2.60 m 180 kg

**Category 0**

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41.8</td>
<td>0.72</td>
</tr>
<tr>
<td>2</td>
<td>18.6</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>16.7</td>
<td>0.26</td>
</tr>
</tbody>
</table>

**Category 1, extension zones**

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.867</td>
</tr>
<tr>
<td>1</td>
<td>0.867</td>
<td>1.733</td>
</tr>
<tr>
<td>2</td>
<td>1.733</td>
<td>max reach</td>
</tr>
</tbody>
</table>

**Category 1, Axis A1**

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time](image)

*Continues on next page*
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

\[ \text{Stopping Distance} \]

\[ \text{Stopping Time} \]
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass ratios (m=100%, m=66%, m=33%)](image)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass percentages]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed]

- For different load percentages (m = 100%, m = 66%, m = 33%), the graphs illustrate the relationship between speed (v) and stopping distance (Ph) or stopping time (t).

Continued
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different masses (100%, 66%, 33%)](image)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distances and times for different mass loadings (100%, 66%, 33%) vs. speed (v [m/s]).]
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.4</td>
<td>0.70</td>
</tr>
<tr>
<td>2</td>
<td>20.6</td>
<td>0.41</td>
</tr>
<tr>
<td>3</td>
<td>19.7</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>2.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distances and times for different load factors (m=100%, m=66%, m=33%) against velocity (v) in meters per second (m/s).]
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds and load conditions.](image)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance (Ph) and stopping time (t) vs. speed (v) for different mass loads (m).]
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different masses and speeds.](image-url)
Extension zone 2, stopping distance and stopping time
20.3 IRB 5720 2.60 m 155 kg LID INV

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42.6</td>
<td>0.74</td>
</tr>
<tr>
<td>2</td>
<td>22.3</td>
<td>0.42</td>
</tr>
<tr>
<td>3</td>
<td>18.1</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16*.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.867</td>
</tr>
<tr>
<td>1</td>
<td>0.867</td>
<td>1.733</td>
</tr>
<tr>
<td>2</td>
<td>1.733</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 1, Axis A1](image-url)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

\begin{figure}
\centering
\includegraphics[width=\textwidth]{extension_zone_2_stopping_distance}
\caption{Extension zone 2, stopping distance and stopping time for different load factors.}
\end{figure}
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continued on next page
Continued

Extension zone 2, stopping distance and stopping time

![Graph 1: \(P_h [\text{[]} \) vs. \(v [\text{m/s}]\)](image)

- \(m=100\%\)
- \(m=66\%\)
- \(m=33\%\)

![Graph 2: \(t [\text{s}] \) vs. \(v [\text{m/s}]\)](image)

- \(m=100\%\)
- \(m=66\%\)
- \(m=33\%\)
Category 1, Axis A3
Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance vs. velocity for different load masses (m=100%, m=66%, m=33%).]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

<table>
<thead>
<tr>
<th>m</th>
<th>v [m/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>![Graph showing stopping distance and time vs. velocity]</td>
</tr>
<tr>
<td>66%</td>
<td>![Graph showing stopping distance and time vs. velocity]</td>
</tr>
<tr>
<td>33%</td>
<td>![Graph showing stopping distance and time vs. velocity]</td>
</tr>
</tbody>
</table>
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37.23</td>
<td>0.6</td>
</tr>
<tr>
<td>2</td>
<td>24.95</td>
<td>0.4</td>
</tr>
<tr>
<td>3</td>
<td>22.23</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>2.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different mass percentages.]
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity]

Continued
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different velocities.](image-url)
Extension zone 1, stopping distance and stopping time

$P_v [\text{m}]$

$m = 100\%$
$m = 66\%$
$m = 33\%$

$v [\text{m/s}]$

$t [\text{s}]$

$m = 100\%$
$m = 66\%$
$m = 33\%$

$v [\text{m/s}]$

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and mass percentages.]

- Graph 1: \( P_{th} [\text{m}] \) vs. \( v \ [\text{m/s}] \)
  - Red: \( m = 100\% \)
  - Green: \( m = 66\% \)
  - Blue: \( m = 33\% \)

- Graph 2: \( t [\text{s}] \) vs. \( v \ [\text{m/s}] \)
  - Red: \( m = 100\% \)
  - Green: \( m = 66\% \)
  - Blue: \( m = 33\% \)
20.5 IRB 5720 2.60 m 180 kg INV

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41.8</td>
<td>0.73</td>
</tr>
<tr>
<td>2</td>
<td>18.6</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>16.8</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.867</td>
</tr>
<tr>
<td>1</td>
<td>0.867</td>
<td>1.733</td>
</tr>
<tr>
<td>2</td>
<td>1.733</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

---

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different load capacities](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed]

Continued
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different masses (m=100%, m=66%, m=33%) with velocity (v) on the x-axis and time (t) or angle (θ) on the y-axis.](image-url)

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs speed](image1)

![Graph showing another parameter vs speed](image2)

Continues on next page
Extension zone 2, stopping distance and stopping time

- Graph showing $P_h [\text{m}]$ vs. $v [\text{m/s}]$ with curves for $m=100\%$, $m=66\%$, and $m=33\%$.
- Graph showing $t [\text{s}]$ vs. $v [\text{m/s}]$ with curves for $m=100\%$, $m=66\%$, and $m=33\%$. 

Product specification - Robot stopping distances according to ISO 10218-1

20 IRB 5720 2.60 m 180 kg INV

Continued
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.4</td>
<td>0.70</td>
</tr>
<tr>
<td>2</td>
<td>22.8</td>
<td>0.41</td>
</tr>
<tr>
<td>3</td>
<td>19.7</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>2.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different mass ratios.](image)
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

---

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity]

- **P_d [°] vs. v [m/s]**
- **t [s] vs. v [m/s]**

Legend:
- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%
20.7 IRB 5720 2.60 m 155 kg LID

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41.6</td>
<td>0.72</td>
</tr>
<tr>
<td>2</td>
<td>21.6</td>
<td>0.42</td>
</tr>
<tr>
<td>3</td>
<td>18.4</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.867</td>
</tr>
<tr>
<td>1</td>
<td>0.867</td>
<td>1.733</td>
</tr>
<tr>
<td>2</td>
<td>1.733</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graph of stopping distance and time vs velocity](image-url)

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. speed for different load factors (m)](image-url)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.6</td>
<td>0.67</td>
</tr>
<tr>
<td>2</td>
<td>21.4</td>
<td>0.43</td>
</tr>
<tr>
<td>3</td>
<td>20.8</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>2.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

---

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different masses](image1)

Continued...
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time against velocity](image-url)
Category 1, Axis A3
Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continued on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

- $P_{hi}$ (°)
- $t$ (s)
- $m=100\%$
- $m=66\%$
- $m=33\%$

$\text{v [m/s]}$
21 IRB 6620

21.1 IRB 6620 2.20 m 150 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29.1</td>
<td>0.49</td>
</tr>
<tr>
<td>2</td>
<td>25.2</td>
<td>0.44</td>
</tr>
<tr>
<td>3</td>
<td>19.0</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.735</td>
</tr>
<tr>
<td>1</td>
<td>0.735</td>
<td>1.47</td>
</tr>
<tr>
<td>2</td>
<td>1.47</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

[Graph]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different masses (m=100%, m=66%, m=33%)](image)

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different velocities and mass fractions (m=100%, m=66%, m=33%).]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different load masses (m=100%, m=66%, m=33%) vs. speed (v) in m/s. The graphs illustrate the relationship between speed and the stopping distance/ time for various load conditions.]
Extension zone 1, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 2, stopping distance and stopping time

![Diagram showing stopping distance and stopping time for different mass percentages.](image-url)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>51.5</td>
<td>0.95</td>
</tr>
<tr>
<td>2</td>
<td>34.5</td>
<td>0.63</td>
</tr>
<tr>
<td>3</td>
<td>20.0</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.013</td>
</tr>
<tr>
<td>1</td>
<td>1.013</td>
<td>2.026</td>
</tr>
<tr>
<td>2</td>
<td>2.026</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs velocity for different masses (m=100%, m=66%, m=33%)](image)

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different masses (m=100%, m=66%, m=33%) as a function of speed (v) in meters per second (m/s).](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

- For m=100%, the stopping distance and time increase linearly with velocity.
- For m=66%, the curves are slightly lower compared to m=100%.
- For m=33%, the curves are the lowest among the three.

These graphs illustrate the stopping distances and times for different load conditions according to ISO 10218-1.
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>52.8</td>
<td>0.95</td>
</tr>
<tr>
<td>2</td>
<td>33.4</td>
<td>0.61</td>
</tr>
<tr>
<td>3</td>
<td>20.3</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.161</td>
</tr>
<tr>
<td>1</td>
<td>1.161</td>
<td>2.323</td>
</tr>
<tr>
<td>2</td>
<td>2.323</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

[Graph showing the relationship between speed (v [m/s]) and angular position (θ) for different masses (m=100%, m=66%, m=33%)]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different mass ratios](image)

Continued
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different speeds](image)

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds and mass percentages.](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different load capacities (m=100%, m=66%, m=33%).]
Continued

Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different masses](image1)

![Graph showing stopping distance and time for different masses](image2)
22.3 IRB 6650S 3.90 m 90 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>51.2</td>
<td>0.97</td>
</tr>
<tr>
<td>2</td>
<td>37.0</td>
<td>0.68</td>
</tr>
<tr>
<td>3</td>
<td>23.9</td>
<td>0.39</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.311</td>
</tr>
<tr>
<td>1</td>
<td>1.311</td>
<td>2.621</td>
</tr>
<tr>
<td>2</td>
<td>2.621</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: Ph vs. v (m/s)]

![Graph 2: t vs. v (m/s)]

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass loads (m=100%, m=66%, m=33%)]
Extension zone 1, stopping distance and stopping time

[Diagrams showing stopping distance and time for different mass values.]
Extension zone 2, stopping distance and stopping time

![Graph depicting stopping distance and time vs. velocity](image)

Continued
Category 1, Axis 3
Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different mass percentages.](Image)

Continued
Extension zone 2, stopping distance and stopping time
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45.7</td>
<td>0.83</td>
</tr>
<tr>
<td>2</td>
<td>26.2</td>
<td>0.46</td>
</tr>
<tr>
<td>3</td>
<td>13.8</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.013</td>
</tr>
<tr>
<td>1</td>
<td>1.013</td>
<td>2.027</td>
</tr>
<tr>
<td>2</td>
<td>2.027</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

[Graph showing stopping distance and time for different speeds and load factors]
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

$P_h [\text{\degree}]$

$m=100\%$
$m=66\%$
$m=33\%$

$v [\text{m/s}]$

$t [\text{s}]$

$m=100\%$
$m=66\%$
$m=33\%$

$v [\text{m/s}]$

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph]

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
22.5 IRB 6650SLeanID 3.5 m 100 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50.6</td>
<td>0.9</td>
</tr>
<tr>
<td>2</td>
<td>34.9</td>
<td>0.66</td>
</tr>
<tr>
<td>3</td>
<td>20.5</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.162</td>
</tr>
<tr>
<td>1</td>
<td>1.162</td>
<td>2.323</td>
</tr>
<tr>
<td>2</td>
<td>2.323</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time vs. velocity](image-url)

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time against velocity with different mass levels.](image)
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity](image)

- **Above graph**: Distance $d$ in mm as a function of velocity $v$ in m/s for different mass ratios $m$.
- **Below graph**: Time $t$ in s as a function of velocity $v$ in m/s for different mass ratios $m$.

*Continued on next page*
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different mass fractions.](image)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time versus speed]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and load weights.](image-url)
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Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21.1</td>
<td>0.32</td>
</tr>
<tr>
<td>2</td>
<td>15.1</td>
<td>0.15</td>
</tr>
<tr>
<td>3</td>
<td>19.6</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.644</td>
</tr>
<tr>
<td>1</td>
<td>0.644</td>
<td>1.289</td>
</tr>
<tr>
<td>2</td>
<td>1.289</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses](image_url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distances and times for different masses (m) against velocity (v)].

Continues on next page
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and load factors.](image-url)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different load factors (m=100%, m=66%, m=33%) against velocity (v) in meters per second (m/s).]
23.2 IRB 6660 3.10 m 130 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39.8</td>
<td>0.61</td>
</tr>
<tr>
<td>2</td>
<td>34.0</td>
<td>0.42</td>
</tr>
<tr>
<td>3</td>
<td>36.6</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.035</td>
</tr>
<tr>
<td>1</td>
<td>1.035</td>
<td>2.071</td>
</tr>
<tr>
<td>2</td>
<td>2.071</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph 1](image1.png)

![Graph 2](image2.png)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

- \( P_{th} \) [°]
- \( t \) [s]
- \( v \) [m/s]

Graphs showing stopping distance and time for different mass percentages (100%, 66%, 33%) against velocity. The graphs illustrate the relationship between velocity and stopping distance/time for IRB 6660 robots. The graphs continue on the next page.
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. speed for different mass ratios.](image)

Continued
Extension zone 1, stopping distance and stopping time

![Diagram showing stopping distance and time for different mass conditions](image-url)

- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass loads](image)

- **v [m/s]**
- **t [s]**
- **P [m]**

Legend:
- **m=100%**
- **m=66%**
- **m=33%**
23.3 IRB 6660 3.35 m 100 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.1</td>
<td>0.63</td>
</tr>
<tr>
<td>2</td>
<td>33.9</td>
<td>0.42</td>
</tr>
<tr>
<td>3</td>
<td>36.5</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.118</td>
</tr>
<tr>
<td>1</td>
<td>1.118</td>
<td>2.235</td>
</tr>
<tr>
<td>2</td>
<td>2.235</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1: Stopping Distance vs Speed](image1)

![Graph 2: Stopping Time vs Speed](image2)
Extension zone 1, stopping distance and stopping time

Continued on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph 1](image)

![Graph 2](image)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass loads (100%, 66%, 33%) for an IRB 6660 robot.](image)
This page is intentionally left blank
24 IRB 6700

24.1 IRB 6700 2.60 m 200 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.8</td>
<td>0.66</td>
</tr>
<tr>
<td>2</td>
<td>25.1</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>19.3</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.867</td>
</tr>
<tr>
<td>1</td>
<td>0.867</td>
<td>1.734</td>
</tr>
<tr>
<td>2</td>
<td>1.734</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for Category 0 emergency stop](image-url)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different mass percentages.](image)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. speed](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different mass load conditions.](image)
Extension zone 2, stopping distance and stopping time

---

**Graph 1:**
- $P_h$ [°C]
- $v$ [m/s]
- M = 100%, M = 66%, M = 33%

---

**Graph 2:**
- $t$ [s]
- $v$ [m/s]
- M = 100%, M = 66%, M = 33%
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass percentages (m) vs. velocity (v) for IRB 6700 2.60 m 200 kg. The graphs display the relationship between velocity and stopping distance or time for m=100%, m=66%, and m=33%.]
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. speed]

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses (m=100%, m=66%, m=33%) and velocities (v) for IRB 6700 robot.](image-url)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.2</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>20.3</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.4</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.883</td>
</tr>
<tr>
<td>1</td>
<td>0.883</td>
<td>1.767</td>
</tr>
<tr>
<td>2</td>
<td>1.767</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different load conditions](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time](image)

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass ratios.](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass loads (m=100%, m=66%, m=33%).]
24.3 IRB 6700 2.70 m 300 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37.4</td>
<td>0.66</td>
</tr>
<tr>
<td>2</td>
<td>21.6</td>
<td>0.39</td>
</tr>
<tr>
<td>3</td>
<td>17.5</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.907</td>
</tr>
<tr>
<td>1</td>
<td>0.907</td>
<td>1.813</td>
</tr>
<tr>
<td>2</td>
<td>1.813</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses vs. velocity.](image-url)

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different mass ratios (m=100%, m=66%, m=33%) as a function of velocity (v) in meters per second (m/s).]
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity]

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distances and times for different masses (m=100%, m=66%, m=33%) vs. velocity (v) for IRB 6700.](image)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed]

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time](image)

- **Ph [°C]**
  - v [m/s]
  - m = 100%
  - m = 66%
  - m = 33%

- **t [s]**
  - v [m/s]
  - m = 100%
  - m = 66%
  - m = 33%
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.0</td>
<td>0.71</td>
</tr>
<tr>
<td>2</td>
<td>20.6</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.1</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.931</td>
</tr>
<tr>
<td>1</td>
<td>0.931</td>
<td>1.863</td>
</tr>
<tr>
<td>2</td>
<td>1.863</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different load factors (m=100%, m=66%, m=33%) vs speed (v) in m/s.](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times for different load factors.](image-url)
Extension zone 2, stopping distance and stopping time

![Graph 1: \( P_h \) vs. \( v \)](image1)

![Graph 2: \( t \) vs. \( v \)](image2)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different masses (m) and velocities (v).]
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity](image-url)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

*Continued*
24.5 IRB 6700 2.85 m 155 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.9</td>
<td>0.66</td>
</tr>
<tr>
<td>2</td>
<td>25.1</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>19.3</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.949</td>
</tr>
<tr>
<td>1</td>
<td>0.949</td>
<td>1.898</td>
</tr>
<tr>
<td>2</td>
<td>1.898</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

Continued
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time

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Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass loads (m=100%, m=66%, m=33%).]
Extension zone 2, stopping distance and stopping time

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Continued

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Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

[Graphs showing Phi and t vs. v for different mass percentages]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses]
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.8</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>21.7</td>
<td>0.39</td>
</tr>
<tr>
<td>3</td>
<td>17.9</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see [Extension zones for articulated robots on page 16](#).

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.989</td>
</tr>
<tr>
<td>1</td>
<td>0.989</td>
<td>1.978</td>
</tr>
<tr>
<td>2</td>
<td>1.978</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph of stopping distance and time](image)
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph 1: Stopping distance (Pf) vs. velocity (v)](image1)

- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

![Graph 2: Stopping time (t) vs. velocity (v)](image2)

- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses](image-url)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different masses](image)

- For $m=100\%$
- For $m=66\%$
- For $m=33\%$

$\Phi_h$ in $[\text{m}]$

$v$ in $[\text{m/s}]$

$t$ in $[\text{s}]$

Continues on next page
Category 1, Axis 3
Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different masses (100%, 66%, 33%).]
Extension zone 2, stopping distance and stopping time
24.7 IRB 6700 3.05 m 175 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.9</td>
<td>0.73</td>
</tr>
<tr>
<td>2</td>
<td>21.1</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>15.6</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.019</td>
</tr>
<tr>
<td>1</td>
<td>1.019</td>
<td>2.037</td>
</tr>
<tr>
<td>2</td>
<td>2.037</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

[Graph showing stopping distance and time for category 1, Axis 1]

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

Continued
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass fractions (m=100%, m=66%, m=33%).]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for IRB 6700](image)

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

---

Continued on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different mass percentages (m=100%, m=66%, m=33%)](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances for different masses](image)

![Graph showing stopping times for different masses](image)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41.7</td>
<td>0.75</td>
</tr>
<tr>
<td>2</td>
<td>21.3</td>
<td>0.39</td>
</tr>
<tr>
<td>3</td>
<td>15.7</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.067</td>
</tr>
<tr>
<td>1</td>
<td>1.067</td>
<td>2.133</td>
</tr>
<tr>
<td>2</td>
<td>2.133</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass percentages.](image1)

![Graph showing stopping distance and stopping time for different mass percentages.](image2)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity](image)

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance and stopping time vs speed](image)

*Continued*
Extension zone 2, stopping distance and stopping time

![Graph 1](image)

Proportionality coefficient $\Phi_h$ vs. speed $v$ for different mass percentages:

- Red line: $m=100\%$
- Green line: $m=66\%$
- Blue line: $m=33\%$

![Graph 2](image)

Stopping time $t$ vs. speed $v$ for different mass percentages:

- Red line: $m=100\%$
- Green line: $m=66\%$
- Blue line: $m=33\%$
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass percentages (m=100%, m=66%, m=33%). The graphs are labeled with 'φ' and 't' on the y-axis and 'v [m/s]' on the x-axis.](image-url)
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs velocity for different mass ratios.]
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33.1</td>
<td>0.58</td>
</tr>
<tr>
<td>2</td>
<td>21.0</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.7</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.872</td>
</tr>
<tr>
<td>1</td>
<td>0.872</td>
<td>1.744</td>
</tr>
<tr>
<td>2</td>
<td>1.744</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time as a function of velocity for different load factors (m=100%, m=66%, m=33%).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distances and times for different masses](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and mass ratios.]

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds and masses.](image-url)

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different masses (m=100%, m=66%, m=33%).]
Extension zone 1, stopping distance and stopping time

![Graph 1: Variation of $P_h$ with $v$ for different mass ratios](image1)

![Graph 2: Variation of $t$ with $v$ for different mass ratios](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed]

- $P_h$ [°C]
- $t$ [s]
- $v$ [m/s]

Legend:
- $m=100\%$
- $m=66\%$
- $m=33\%$
24.10 IRB 6700

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33.1</td>
<td>0.56</td>
</tr>
<tr>
<td>2</td>
<td>21.1</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.6</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.955</td>
</tr>
<tr>
<td>1</td>
<td>0.955</td>
<td>1.909</td>
</tr>
<tr>
<td>2</td>
<td>1.909</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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Product specification - Robot stopping distances according to ISO 10218-1

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different loads](image-url)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and mass ratios.](image-url)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time against velocity]

Continued on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed]

Continues on next page
Extension zone 2, stopping distance and stopping time
24.11 IRB 6700 Inv 2.60 m 300 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.5</td>
<td>0.56</td>
</tr>
<tr>
<td>2</td>
<td>20.3</td>
<td>0.34</td>
</tr>
<tr>
<td>3</td>
<td>13.8</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see **Extension zones for articulated robots on page 16**.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.872</td>
</tr>
<tr>
<td>1</td>
<td>0.872</td>
<td>1.744</td>
</tr>
<tr>
<td>2</td>
<td>1.744</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph](image-url)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing Phi vs. v and t vs. v for different mass percentages.]

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity with different load conditions.]

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass levels (m=100%, m=66%, m=33%) against velocity (v) for IRB 6700 with a payload of 300 kg.]

Continues on next page
Category 1, Axis 3
Extension zone 0, stopping distance and stopping time

![Graph 1: P vh vs v]

![Graph 2: t vh vs v]

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: Phi vs. v](image1)

![Graph 2: t vs. v](image2)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31.4</td>
<td>0.54</td>
</tr>
<tr>
<td>2</td>
<td>20.0</td>
<td>0.34</td>
</tr>
<tr>
<td>3</td>
<td>13.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.955</td>
</tr>
<tr>
<td>1</td>
<td>0.955</td>
<td>1.909</td>
</tr>
<tr>
<td>2</td>
<td>1.909</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different mass percentages]

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses (m=100%, m=66%, m=33%) with velocity (v) in m/s on the x-axis and Phi [°] on the y-axis.]

![Graphs showing stopping distance and time for different masses (m=100%, m=66%, m=33%) with velocity (v) in m/s on the x-axis and t [s] on the y-axis.]

Continued
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses](image)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different load masses (m=100%, m=66%, m=33%).]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and masses.](image)
Extension zone 1, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different speeds and mass ratios.](image-url)
24.13 IRB 6700

LeanID 2.60 m 175 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36.6</td>
<td>0.58</td>
</tr>
<tr>
<td>2</td>
<td>24.4</td>
<td>0.34</td>
</tr>
<tr>
<td>3</td>
<td>15.7</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.867</td>
</tr>
<tr>
<td>1</td>
<td>0.867</td>
<td>1.734</td>
</tr>
<tr>
<td>2</td>
<td>1.734</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed]

- **Graph 1:** Distance (Pd) in meters versus speed (v) in meters per second.
  - Lines represent different masses (m=100%, m=66%, m=33%).

- **Graph 2:** Time (t) in seconds versus speed (v) in meters per second.
  - Lines represent different masses (m=100%, m=66%, m=33%).

*Continued on next page*
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph 1]

- $P_t$ [°C] vs. $v$ [m/s]
- Lines for $m=100\%$, $m=66\%$, and $m=33\%$

![Graph 2]

- $t$ [s] vs. $v$ [m/s]
- Lines for $m=100\%$, $m=66\%$, and $m=33\%$
Extension zone 2, stopping distance and stopping time

![Graph](image)

- $P_h$ [°]
  - $m=100\%$
  - $m=66\%$
  - $m=33\%$

- $t_s$ [s]
  - $m=100\%$
  - $m=66\%$
  - $m=33\%$

$v$ [m/s]

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph 1: \( \Phi \) vs. \( v \)]

- \( \Phi \) in [°]
- \( v \) in [m/s]
- Lines represent different mass percentages: m=100%, m=66%, m=33%

![Graph 2: \( t \) vs. \( v \)]

- \( t \) in [s]
- \( v \) in [m/s]
- Lines represent different mass percentages: m=100%, m=66%, m=33%

*Continued on next page*
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity](image-url)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

- $P_h$ vs. $v$ for different mass percentages ($m=100\%, m=66\%, m=33\%$)
- $t$ vs. $v$ for different mass percentages ($m=100\%, m=66\%, m=33\%$)
24.14 IRB 6700

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35.8</td>
<td>0.63</td>
</tr>
<tr>
<td>2</td>
<td>19.5</td>
<td>0.34</td>
</tr>
<tr>
<td>3</td>
<td>12.3</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.883</td>
</tr>
<tr>
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<td>0.883</td>
<td>1.767</td>
</tr>
<tr>
<td>2</td>
<td>1.767</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image)

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

Continues on next page
Extension zone 1, stopping distance and stopping time

\[ \text{Graph 1: } \Phi_h [^\circ] \text{ vs. } v \text{ [m/s]} \]

\[ \text{Graph 2: } t \text{ [s]} \text{ vs. } v \text{ [m/s]} \]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time vs. velocity]

- **Extension zone 2**: Indicates the area where the stopping distances are measured.
- **Stopping distance and stopping time**: These values are critical for ensuring the safety of the workspace around the robot.

The graphs illustrate how stopping distance and time vary with different loads and velocities, highlighting the importance of understanding these metrics for compliance with ISO 10218-1 standards.
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass percentages](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

- Graph 1: $P_h$ vs. $v$ for $m=100\%$, $m=66\%$, and $m=33\%$
- Graph 2: $t_s$ vs. $v$ for $m=100\%$, $m=66\%$, and $m=33\%$

Continued on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different speeds and masses (m=100%, m=66%, m=33%).]
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35.2</td>
<td>0.61</td>
</tr>
<tr>
<td>2</td>
<td>20.8</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.9</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.907</td>
</tr>
<tr>
<td>1</td>
<td>0.907</td>
<td>1.813</td>
</tr>
<tr>
<td>2</td>
<td>1.813</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for category 1, Axis 1](image)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different mass percentages (m=100%, m=66%, m=33%) at various speeds (v) in m/s.](image)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and masses (m=100%, m=66%, m=33%).]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

Continues on next page
Extension zone 2, stopping distance and stopping time

- Above graph shows the relationship between velocity (v) and stopping distance (P_0) for different mass fractions (m=100%, m=66%, m=33%).
- Below graph shows the relationship between velocity (v) and stopping time (t) for the same mass fractions.

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass percentages.](image)

Continues on next page
Extension zone 2, stopping distance and stopping time

Graph 1: Position [°C] vs. Velocity [m/s]
- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

Graph 2: Time [s] vs. Velocity [m/s]
- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39.0</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>20.3</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>13.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.931</td>
</tr>
<tr>
<td>1</td>
<td>0.931</td>
<td>1.863</td>
</tr>
<tr>
<td>2</td>
<td>1.863</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: Phi vs. v](image1)

![Graph 2: t vs. v](image2)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph 1](image1.png)

![Graph 2](image2.png)
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different masses at various speeds.]

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance and time vs. speed for different mass fractions m=100%, m=66%, m=33%.]
Extension zone 2, stopping distance and stopping time
24.17 IRB 6700 LeanID 2.85 m 140 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.9</td>
<td>0.61</td>
</tr>
<tr>
<td>2</td>
<td>25.0</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>17.7</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.949</td>
</tr>
<tr>
<td>1</td>
<td>0.949</td>
<td>1.898</td>
</tr>
<tr>
<td>2</td>
<td>1.898</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 1, Axis 1](attachment:graph.png)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: Plot of \( P_h [\text{m}] \) vs. \( v [\text{m/s}] \)]

- \( m = 100\% \)
- \( m = 66\% \)
- \( m = 33\% \)

![Graph 2: Plot of \( t [\text{s}] \) vs. \( v [\text{m/s}] \)]

- \( m = 100\% \)
- \( m = 66\% \)
- \( m = 33\% \)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1: Phi vs. v](image1)

![Graph 2: t vs. v](image2)

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity](image)

Continued on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different masses (m=100%, m=66%, m=33%).]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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Continues on next page
Extension zone 1, stopping distance and stopping time

[Graphs showing stopping distance and time vs. velocity for different masses (m=100%, m=66%, m=33%).]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different loads](image)

- **Ph [°]**
  - m=100%
  - m=66%
  - m=33%

- **t [s]**
  - m=100%
  - m=66%
  - m=33%

v [m/s]
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36.6</td>
<td>0.63</td>
</tr>
<tr>
<td>2</td>
<td>20.9</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>16.1</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.989</td>
</tr>
<tr>
<td>1</td>
<td>0.989</td>
<td>1.978</td>
</tr>
<tr>
<td>2</td>
<td>1.978</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses.](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses and speeds.]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image_url)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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**24 IRB 6700**

24.18 IRB 6700 Lean ID 3.00 m 220 kg

Continued
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time
24.19  IRB 6700

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.4</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>20.2</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.2</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.019</td>
</tr>
<tr>
<td>1</td>
<td>1.019</td>
<td>2.037</td>
</tr>
<tr>
<td>2</td>
<td>2.037</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds and load masses (m=100%, m=66%, m=33%)]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different masses (m=100%, m=66%, m=33%)]

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs velocity](image)

Continues on next page
Extension zone 1, stopping distance and stopping time

Graph 1: $P_h$ vs. $v$ for different mass fractions $m$.

Graph 2: $t$ vs. $v$ for different mass fractions $m$. 

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph](image1)

![Graph](image2)

Product specification - Robot stopping distances according to ISO 10218-1

24 IRB 6700

24.19 IRB 6700 LeanID 3.05 m 155 kg

Continued
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.6</td>
<td>0.73</td>
</tr>
<tr>
<td>2</td>
<td>20.9</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.7</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.067</td>
</tr>
<tr>
<td>1</td>
<td>1.067</td>
<td>2.133</td>
</tr>
<tr>
<td>2</td>
<td>2.133</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs velocity for different mass loads](image)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different mass ratios (m=100%, m=66%, m=33%)]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and mass percentages](image)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different load factors (m=100%, m=66%, m=33%) with labels for Phi [°] on the y-axis and v [m/s] on the x-axis.](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distances and times for different mass levels (m=100%, m=66%, m=33%) for varying velocities (v) in meters per second (m/s)].
Extension zone 1, stopping distance and stopping time

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Continues on next page
Extension zone 2, stopping distance and stopping time
25 IRB 6790

25.1 IRB 6790 2.65 m 235 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.2</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>20.3</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.4</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.883</td>
</tr>
<tr>
<td>1</td>
<td>0.883</td>
<td>1.767</td>
</tr>
<tr>
<td>2</td>
<td>1.767</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph of Stopping Distance and Time vs. Velocity]

- **Ph (°)**
- **t (s)**

**Graph Details:**
- **m = 100%**
- **m = 66%**
- **m = 33%**

---

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

25.1 IRB 6790 2.65 m 235 kg

Continued
Extension zone 1, stopping distance and stopping time

---

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different mass percentages associated with various velocities.](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and load rates.](image)

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds and mass percentages (m=100%, m=66%, m=33%)]
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different load conditions.](image)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.0</td>
<td>0.71</td>
</tr>
<tr>
<td>2</td>
<td>20.6</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.1</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.931</td>
</tr>
<tr>
<td>1</td>
<td>0.931</td>
<td>1.863</td>
</tr>
<tr>
<td>2</td>
<td>1.863</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity for IRB 6790](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph of Ph (°) vs. v (m/s)]

- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

![Graph of t [s] vs. v (m/s)]

- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Graph showing stopping distance and time vs. velocity for different mass fractions m.
Extension zone 2, stopping distance and stopping time
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31.6</td>
<td>0.73</td>
</tr>
<tr>
<td>2</td>
<td>13.1</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>9.0</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.85</td>
</tr>
<tr>
<td>1</td>
<td>0.85</td>
<td>1.7</td>
</tr>
<tr>
<td>2</td>
<td>1.7</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continued on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. speed for different mass ratios (m=100%, m=66%, m=33%).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages.]
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different load factors (m = 100%, m = 66%, m = 33%) with respect to velocity (v) in meters per second (m/s).](image)

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: Ph (°) vs. v (m/s)]

![Graph 2: t [s] vs. v (m/s)]
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.6</td>
<td>0.75</td>
</tr>
<tr>
<td>2</td>
<td>9.0</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>7.6</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.85</td>
</tr>
<tr>
<td>1</td>
<td>0.85</td>
<td>1.7</td>
</tr>
<tr>
<td>2</td>
<td>1.7</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different mass percentages](image-url)

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different masses (m) at various speeds (v).]

Continues on next page
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time](image)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time as functions of velocity for different mass ratios.](image)
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity](image)

---

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time against velocity.]
26.3 IRB 7600 2.80 m 340 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31.1</td>
<td>0.71</td>
</tr>
<tr>
<td>2</td>
<td>12.9</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>9.0</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.932</td>
</tr>
<tr>
<td>1</td>
<td>0.932</td>
<td>1.865</td>
</tr>
<tr>
<td>2</td>
<td>1.865</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph](image-url)

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance vs. velocity]

![Graph showing stopping time vs. velocity]

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different mass values](image)

---

Continued
Extension zone 1, stopping distance and stopping time

![Graph 1: Stopping Distance vs. Velocity](image1)

![Graph 2: Stopping Time vs. Velocity](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages.](image)

[Continues on next page]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image-url)
Extension zone 1, stopping distance and stopping time

![Graph 1: Phi vs. v]

![Graph 2: t vs. v]
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different mass load conditions](image-url)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33.0</td>
<td>0.78</td>
</tr>
<tr>
<td>2</td>
<td>9.0</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>8.4</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.015</td>
</tr>
<tr>
<td>1</td>
<td>1.015</td>
<td>2.03</td>
</tr>
<tr>
<td>2</td>
<td>2.03</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

Continued
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses (m=100%, m=66%, m=33%) as a function of velocity (v) for IRB 7600.](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time](image)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

[Graphs showing stopping distance (Ph) and stopping time (t) as functions of speed (v) for m = 100%, m = 66%, and m = 33%.]
Extension zone 2, stopping distance and stopping time
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>47.1</td>
<td>0.85</td>
</tr>
<tr>
<td>2</td>
<td>11.5</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>8.8</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.167</td>
</tr>
<tr>
<td>1</td>
<td>1.167</td>
<td>2.333</td>
</tr>
<tr>
<td>2</td>
<td>2.333</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: Ph vs. v](image1)

![Graph 2: t vs. v](image2)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing Phi vs. v for different mass ratios (m=100%, m=66%, m=33%)]

![Graph showing t vs. v for different mass ratios (m=100%, m=66%, m=33%)]

Continued
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance](image1)

![Graph of stopping time](image2)
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27.5</td>
<td>0.63</td>
</tr>
<tr>
<td>2</td>
<td>10.3</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>6.8</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.85</td>
</tr>
<tr>
<td>1</td>
<td>0.85</td>
<td>1.7</td>
</tr>
<tr>
<td>2</td>
<td>1.7</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 1, Axis 1]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different mass ratios.]

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing Phi vs. v and t vs. v]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different masses](image)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph of $P_{th}$ vs $v$](image1)

![Graph of $t$ vs $v$](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different masses](image1)

![Graph showing stopping distance and time vs. velocity for different masses](image2)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28.3</td>
<td>0.66</td>
</tr>
<tr>
<td>2</td>
<td>10.7</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>7.2</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.932</td>
</tr>
<tr>
<td>1</td>
<td>0.932</td>
<td>1.865</td>
</tr>
<tr>
<td>2</td>
<td>1.865</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass percentages.](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

```
<table>
<thead>
<tr>
<th>v [m/s]</th>
<th>Ph [°]</th>
<th>t [s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>0.5</td>
<td>2.5</td>
<td>0.1</td>
</tr>
<tr>
<td>1.0</td>
<td>5.0</td>
<td>0.2</td>
</tr>
<tr>
<td>1.5</td>
<td>7.5</td>
<td>0.3</td>
</tr>
<tr>
<td>2.0</td>
<td>10.0</td>
<td>0.4</td>
</tr>
<tr>
<td>2.5</td>
<td>12.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>
```

- Ph: Stopping distance
- t: Stopping time
- m: Load factor

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Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity for different mass fractions](graph.png)
Extension zone 1, stopping distance and stopping time

![Graph 1: Stopping distance vs. speed](image1)

![Graph 2: Stopping time vs. speed](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time as a function of velocity for different mass ratios (100%, 66%, 33%).]
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30.1</td>
<td>0.71</td>
</tr>
<tr>
<td>2</td>
<td>8.4</td>
<td>0.27</td>
</tr>
<tr>
<td>3</td>
<td>6.7</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.015</td>
</tr>
<tr>
<td>1</td>
<td>1.015</td>
<td>2.03</td>
</tr>
<tr>
<td>2</td>
<td>2.03</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

---

Cont continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

[Graph showing stopping distance and time vs. speed for different mass percentages (m=100%, m=66%, m=33%)]
Extension zone 2, stopping distance and stopping time

![Graph](image)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

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Continues on next page

Product specification - Robot stopping distances according to ISO 10218-1

Continues on next page
Extension zone 2, stopping distance and stopping time
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44.4</td>
<td>1.31</td>
</tr>
<tr>
<td>2</td>
<td>11.4</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>13.0</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.169</td>
</tr>
<tr>
<td>1</td>
<td>1.169</td>
<td>2.338</td>
</tr>
<tr>
<td>2</td>
<td>2.338</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
27 IRB 8700

27.1 IRB 8700 3.50 m 800 kg

Continued

Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distances and times for different loads and speeds.]

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph of stopping distance and time versus velocity](image)

---

*Continues on next page*
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time vs. velocity.](image)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and mass ratios.]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different mass values.](image)

- **Extension zone 2, stopping distance and stopping time**

- **Graphs**
  - Upper graph: Distance $P_h$ in meters ($m$) against velocity $v$ in meters per second ($m/s$)
  - Lower graph: Time $t$ in seconds ($s$) against velocity $v$ in meters per second ($m/s$)

- **Legend**
  - $m=100\%$
  - $m=66\%$
  - $m=33\%$
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44.4</td>
<td>1.33</td>
</tr>
<tr>
<td>2</td>
<td>10.0</td>
<td>0.27</td>
</tr>
<tr>
<td>3</td>
<td>14.4</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.399</td>
</tr>
<tr>
<td>1</td>
<td>1.399</td>
<td>2.798</td>
</tr>
<tr>
<td>2</td>
<td>2.798</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and stopping time](image)

- **Ph [°]**
- **t [s]**

- **m=100%**
- **m=66%**
- **m=33%**

---

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different masses.](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
27.3 IRB 8700 LeanID 3.50 m 630 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44.4</td>
<td>1.19</td>
</tr>
<tr>
<td>2</td>
<td>10.1</td>
<td>0.27</td>
</tr>
<tr>
<td>3</td>
<td>9.6</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.169</td>
</tr>
<tr>
<td>1</td>
<td>1.169</td>
<td>2.338</td>
</tr>
<tr>
<td>2</td>
<td>2.338</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs velocity for different load conditions.]

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity]

Continued
Extension zone 2, stopping distance and stopping time

---

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time as functions of velocity for different mass percentages.]

---

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different load masses.](image)

**Graph:**
- **x-axis:** Velocity (v [m/s])
- **y-axis:** Stopping distance (Pf [m]) and Stopping time (t [s])
- **Legend:**
  - m=100%
  - m=66%
  - m=33%
Extension zone 2, stopping distance and stopping time
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44.4</td>
<td>1.26</td>
</tr>
<tr>
<td>2</td>
<td>9.5</td>
<td>0.25</td>
</tr>
<tr>
<td>3</td>
<td>12.0</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.399</td>
</tr>
<tr>
<td>1</td>
<td>1.399</td>
<td>2.798</td>
</tr>
<tr>
<td>2</td>
<td>2.798</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

[Graphs showing stopping distance and stopping time for different momentum levels (m=100%, m=66%, m=33%)]
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass percentages.]

Continues on next page.
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and masses.](image)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass percentages.](image)

Continues on next page
Extension zone 2, stopping distance and stopping time
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41.5</td>
<td>0.49</td>
</tr>
<tr>
<td>2</td>
<td>14.6</td>
<td>0.17</td>
</tr>
<tr>
<td>3</td>
<td>13.6</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.889</td>
</tr>
<tr>
<td>1</td>
<td>0.889</td>
<td>1.778</td>
</tr>
<tr>
<td>2</td>
<td>1.778</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass percentages.](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass percentages.]

Continues on next page
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass percentages]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image_url)

Continues on next page
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass load conditions.](image-url)
Extension zone 2, stopping distance and stopping time

Graphs showing the relationship between velocity (v [m/s]) and stopping distance (Ph [m]) or stopping time (t [s]) for different mass values (m=100%, m=66%, m=33%).
This page is intentionally left blank
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>64.4</td>
<td>0.9</td>
</tr>
<tr>
<td>2</td>
<td>32.6</td>
<td>0.39</td>
</tr>
<tr>
<td>3</td>
<td>27.0</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 16.*

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.148</td>
</tr>
<tr>
<td>1</td>
<td>1.148</td>
<td>2.297</td>
</tr>
<tr>
<td>2</td>
<td>2.297</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 0 emergency stop](image)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distances and times for different mass load percentages](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) as a function of velocity (v [m/s]).]
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds and mass ratios (m=100%, m=66%, m=33%).]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages (m=100%, m=66%, m=33%) at various speeds (v [m/s]).]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different masses](image-url)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43.1</td>
<td>0.78</td>
</tr>
<tr>
<td>2</td>
<td>23.2</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>21.6</td>
<td>0.32</td>
</tr>
</tbody>
</table>

For definitions of the zones, see Extension zones for articulated robots on page 16.

Category 1, extension zones

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.148</td>
</tr>
<tr>
<td>1</td>
<td>1.148</td>
<td>2.297</td>
</tr>
<tr>
<td>2</td>
<td>2.297</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continues on next page

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Extension zone 2, stopping distance and stopping time
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1: Phi vs. v]

![Graph 2: t vs. v]

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times for different speeds and mass ratios.](image)

Continued
Extension zone 2, stopping distance and stopping time

\[ P_h [°] \]
\[ v [m/s] \]

\[ t [s] \]
\[ v [m/s] \]

- \( m=100\% \)
- \( m=66\% \)
- \( m=33\% \)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different mass values (m=100%, m=66%, m=33%) as a function of velocity (v [m/s]).]
Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.7</td>
<td>0.89</td>
</tr>
<tr>
<td>2</td>
<td>24.4</td>
<td>0.54</td>
</tr>
<tr>
<td>3</td>
<td>26.9</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.17</td>
</tr>
<tr>
<td>1</td>
<td>1.17</td>
<td>2.34</td>
</tr>
<tr>
<td>2</td>
<td>2.34</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

Continues on next page
Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity](image-url)
Category 1, Axis A2
Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and stopping time vs. velocity for different masses](image-url)

Continued
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times for different mass ratios](image)

Continues on next page
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time vs. speed for different mass ratios.]

Continues on next page
Extension zone 1, stopping distance and stopping time

- Graph 1: $P_h [\circ]$ as a function of $v [m/s]$, showing lines for $m=100\%$, $m=66\%$, and $m=33\%$
- Graph 2: $t [s]$ as a function of $v [m/s]$, showing lines for $m=100\%$, $m=66\%$, and $m=33\%$
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed](image)

Product specification - Robot stopping distances according to ISO 10218-1

3HAC048645-001 Revision: Y

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The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.2</td>
<td>0.83</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>26.4</td>
<td>0.49</td>
</tr>
</tbody>
</table>

For definitions of the zones, see Extension zones for articulated robots on page 16.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1.168</td>
</tr>
<tr>
<td>1</td>
<td>1.168</td>
<td>2.337</td>
</tr>
<tr>
<td>2</td>
<td>2.337</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: Stopping distance vs. velocity](image1)

![Graph 2: Stopping time vs. velocity](image2)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass percentages.](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass percentages.]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image-url)

Continued on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance vs. velocity](image1)

![Graph of stopping time vs. velocity](image2)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for IRB 760]

- **Ph [°]**
- **m=100%**
- **m=66%**
- **m=33%**

![Graph showing stopping time for IRB 760]

- **t [s]**
- **m=100%**
- **m=66%**
- **m=33%**
31 IRB 360

31.1 IRB 360 0.8 m 1 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.57</td>
<td>0.18</td>
</tr>
<tr>
<td>Wash down</td>
<td>0.56</td>
<td>0.18</td>
</tr>
<tr>
<td>3AXES</td>
<td>0.57</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Continues on next page
Category 1, Standard

Stopping distance and stopping time

---

Continues on next page
Category 1, Wash Down

Stopping distance and stopping time
Category 1, 3AXES

Stopping distance and stopping time

![Graph showing stopping distance and time for various speeds.](image-url)
31.2 IRB 360 1.13 m 1 kg

## Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.69</td>
<td>0.19</td>
</tr>
<tr>
<td>Wash down</td>
<td>0.69</td>
<td>0.19</td>
</tr>
<tr>
<td>3AXES</td>
<td>0.73</td>
<td>0.18</td>
</tr>
<tr>
<td>Stainless</td>
<td>0.67</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Continues on next page
Category 1, Standard

Stopping distance and stopping time

[Graphs showing stopping distance and stopping time for different speeds]

Continues on next page
Category 1, Wash Down

Stopping distance and stopping time

Continues on next page
Category 1, 3AXES

Stopping distance and stopping time

---

Continues on next page
Category 1, Stainless

Stopping distance and stopping time
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.65</td>
<td>0.21</td>
</tr>
<tr>
<td>Wash down</td>
<td>0.65</td>
<td>0.21</td>
</tr>
<tr>
<td>3AXES</td>
<td>0.62</td>
<td>0.20</td>
</tr>
<tr>
<td>Stainless</td>
<td>0.64</td>
<td>0.22</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

Continues on next page
Category 1, Wash Down

Stopping distance and stopping time

Continues on next page
Category 1, 3AXES

Stopping distance and stopping time

---

Continued on next page
Category 1, Stainless

Stopping distance and stopping time
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.65</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Continues on next page
Category 1, Standard

Stopping distance and stopping time

![Graph showing stopping distance and velocity](image)
31.5 IRB 360 1.6 m 1 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.90</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Continues on next page
Category 1, Standard

Stopping distance and stopping time
31.6 IRB 360 1.6 m 6 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.93</td>
<td>0.36</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds.](image-url)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.55</td>
<td>0.25</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

![Graph showing stopping distance and time for different masses (33%, 66%, 100%) against velocity (v) in meters per second (m/s).]
32.2 IRB 365 1.1 m 1.5 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.41</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Continues on next page
32 IRB 365

32.2 IRB 365 1.1 m 1.5 kg

Continued

Category 1, Standard

Stopping distance and stopping time

![Graph showing stopping distance and stopping time](image)

- **Stop distance [m]**
  - $m = 33\%$
  - $m = 66\%$
  - $m = 100\%$

- **Stop time [s]**
  - $m = 33\%$
  - $m = 66\%$
  - $m = 100\%$

$v [\text{m/s}]$
### Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.73</td>
<td>0.26</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

**Graph 1:**
- **Y-axis:** Stop distance [m]
- **X-axis:** Speed [m/s]
- Lines represent:
  - $m = 33\%$
  - $m = 66\%$
  - $m = 100\%$

**Graph 2:**
- **Y-axis:** Stop time [s]
- **X-axis:** Speed [m/s]
- Lines represent:
  - $m = 33\%$
  - $m = 66\%$
  - $m = 100\%$
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.71</td>
<td>0.29</td>
</tr>
</tbody>
</table>
Category 1, Standard
Stopping distance and stopping time
**Category 0**

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.72</td>
<td>0.28</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time
Category 0, ARM

Stopping distance and stopping time

[Graphs showing stopping distance and time for different speeds and percentages]
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, ARM

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
34.2 A500_D1000

Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time

![Graph of stopping distance vs. speed](image1)

![Graph of stopping time vs. speed](image2)
Category 0, ARM

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, ARM

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
34.4 A750_D1000

Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time

Continued on next page
Category 1, PLATE

Stopping distance and stopping time

![Diagram showing stopping distance and time for different speeds.](image-url)
Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
Category 0, INTERCH

Stopping distance and stopping time
Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time

Continues on next page
Category 1, ARM

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for B250_D1000]

![Graph showing stopping distance and stopping time for B250_D1000]
Category 0, INTERCH

Stopping distance and stopping time
Category 0, ARM

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, ARM

Stopping distance and stopping time

![Diagram showing stopping distance vs. speed for different load conditions.]

![Diagram showing stopping time vs. speed for different load conditions.]

Continues on next page
Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and time for different speeds.](image-url)
Category 0, INTERCH

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time
36.2 C1000

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and categories.](image-url)
Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time

Continues on next page
Category 1, ARM

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
37.2 D300_L1600_D1000

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
37.3 D600_L1600_D1000

Category 0, INTERCH

Stopping distance and stopping time

Continue on next page
Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
37.4 D600_L1600_D1200

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

[Graphs showing stopping distance and stopping time for different speeds and load conditions]

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time

Continued
Category 1, ARM

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
37.5 D600_L2000_D1000

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

![Graph 1: Stopping distance vs. angular speed](image1.png)

![Graph 2: Stopping time vs. angular speed](image2.png)
Category 0, INTERCH

Stopping distance and stopping time
Category 0, ARM

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time

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Continues on next page
Category 1, ARM

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

![Graph showing stopping distances and times for different speeds.](image-url)
Category 1, INTERCH

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

![Graph of stopping distance and stopping time for IRBP K1000_D1200](image1)

![Graph of stopping distance and stopping time for IRBP K1000_D1200](image2)
38.2 K1000_D1400

Category 0, INTERCH

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for K1000_D1400]

![Graph showing stopping distance and stopping time for K1000_D1400 with different conditions]
38.3 K300_D1000

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and time for IRBP K300_D1000](image)
Category 1, INTERCH

Stopping distance and stopping time

[Diagram of stopping distance and stopping time]

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
38.4 K300_D1200

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and time for different speeds.](image-url)
Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
38.6 K600_D1400

Category 0, INTERCH

Stopping distance and stopping time

Contines on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
39 IRBP L

39.1 L1000

Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
39.2 L2000

Category 0, PLATE

Stopping distance and stopping time

[Graphs showing stopping distances and times for L2000]

Continues on next page
Category 1, PLATE

Stopping distance and stopping time

![Graphs showing stopping distance and stopping time for L2000 robot]
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for L300 PLATE.](image)
Category 0, PLATE

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time

Continues on next page
Category 1, PLATE  

Stopping distance and stopping time
Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
40.3 R1000_L2000_D1000

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Category 1, INTERCH

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![Graph 1: Stopping Distance vs. Linear Speed](image1)

![Graph 2: Stopping Distance vs. Angular Speed](image2)
40.5 R300_L1250_D1000

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40.6 R300_L1600_D1000

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Stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different scenarios.](image)
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[Graph showing stopping distance and time for different speeds and conditions]
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