Product specification
Robot stopping distances according to ISO 10218-1
Trace back information:
Workspace Main version a519
Checked in 2023-06-19
Skribenta version 5.5.019
Product specification
Robot stopping distances according to ISO 10218-1

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Revision: Z
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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.

<table>
<thead>
<tr>
<th>Document name</th>
<th>Document ID</th>
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<tr>
<td>Safety manual for robot - Manipulator and IRC5 or OmniCore controller</td>
<td>3HAC031045-001</td>
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<td>Product specifications for the respective robots</td>
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<td>Standard: EN ISO 10218-1, Annex B</td>
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This manual contains all safety instructions from the product manuals for the manipulators and the controllers.

Revisions

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<td>A</td>
<td>Release 14.1.  The following robots are added:  • IRB 120  • IRB 140  • IRB 6700  • IRB 260  • IRB 460  • IRB 660  • IRB 760</td>
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<td>B</td>
<td>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.</td>
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<td>C</td>
<td>Release 15.2.  The following robots are added:  • IRB 2400</td>
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<td>Description</td>
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| 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 17. |
• 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 15.  
• 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. |

Note: Category 0 values are missing for IRB 7600 2.80 m 340 kg.
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<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.  
  • 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. |
| Z        | Release 23B.  
  • The data for the CRB 15000 and IRB 5710/5720 robots is moved to their respective product specification. All documents are available on [www.abb.com/robotics](http://www.abb.com/robotics).  
  The data for new robots is included in their respective product specification. |

Continues on next page
### Overview of this specification

Continued

<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Removed duplicated pages for IRB 1010.</td>
</tr>
</tbody>
</table>
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.

Note

For SCARA robots without brakes on axis 1 and 2, the stopping distances for category 0 stops in actual applications can be longer than those stated in this document because without brakes, it is the friction that will stop the robot (on axes without brakes).

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.

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.

⚠️ CAUTION

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.

⚠️ CAUTION

Follow the safety instructions in the respective product manual for the robot.

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
3 IRB 120

3.1 IRB 120 0.58 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>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 14.

<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

![Graph showing positioning angle (Ph) vs. velocity (v)]
3 IRB 120

3.1 IRB 120 0.58 m 3 kg

Continued
Extension zone 2, stopping distance and stopping time

---

Continues on next page
3 IRB 120

3.1 IRB 120 0.58 m 3 kg

Continued

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 (m=100%, m=66%, m=33%).]
Extension zone 2, stopping distance and stopping time

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

Continued
Extension zone 2, stopping distance and stopping time
3.2 IRB 120T 0.58 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>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>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 14.

<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
3 IRB 120

3.2 IRB 120T 0.58 m 3 kg

Continued

Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for IRB 120T robot.](image)
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 versus velocity](image)

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

![Graph 1: Plot of \( \Phi [^\circ] \) vs. \( v [m/s] \)]

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

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

- Red: \( m=100\% \)
- Green: \( m=66\% \)
- Blue: \( m=33\% \)
3.2 IRB 120T 0.58 m 3 kg

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances for IRB 120T with different mass loads](image1)

![Graph showing stopping times for IRB 120T with different mass loads](image2)

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1](chart1.png)

![Graph 2](chart2.png)
4 IRB 910

4.1 IRB 910 INV 0.35 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>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 14.

<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

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 as functions of speed]

- $P_h [^\circ]$
- $t [s]$
- $v [m/s]$

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

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
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distances and times for different mass ratios and speeds.](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)

Continues on next page
4 IRB 910

4.1 IRB 910INV 0.35 m 3 kg

Continued

Extension zone 1, stopping distance and stopping time

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

- Graph showing $P_h [\text{[\textdegree]}]$ vs. $v \text{[m/s]}$ for different mass percentages $m$.
- Graph showing $t \text{[s]}$ vs. $v \text{[m/s]}$ for different mass percentages $m$.
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>

For definitions of the zones, see Extension zones for articulated robots on page 14.

<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>
Extension zone 1, stopping distance and stopping time

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

\[
\begin{align*}
\phi_1 (\text{rad}) & \quad v \text{ [m/s]} \\
0 & \quad 0.0 \\
20 & \quad 1.0 \\
40 & \quad 1.5 \\
60 & \quad 2.5 \\
& \quad 3.0 \\
& \quad 3.5 \\
& \quad 4.0
\end{align*}
\]

\[
\begin{align*}
t [\text{s}] & \quad v \text{ [m/s]} \\
0.01 & \quad 0.0 \\
0.05 & \quad 0.5 \\
0.10 & \quad 1.0 \\
0.15 & \quad 1.5 \\
0.20 & \quad 2.0 \\
0.25 & \quad 2.5 \\
& \quad 3.0 \\
& \quad 3.5 \\
& \quad 4.0
\end{align*}
\]
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 stopping time for different speeds and masses.](image)
Extension zone 2, stopping distance and stopping time

---

Product specification - Robot stopping distances according to ISO 10218-1
3HAC048645-001 Revision: Z

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Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

\[ P_{hi}[^{\circ}] \]

\[ t [s] \]

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

\[ v [m/s] \]
Extension zone 2, stopping distance and stopping time

- Graph 1: $P_h$ vs. $v$ [$m/s$]
- Graph 2: $t$ vs. $v$ [$m/s$]
4.3 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 14.*

<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 the relationship between speed (v) and angle (\(\phi\)) for different mass loads (m=100%, m=66%, m=33%)]
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1: Ph (°C) vs. v (m/s)]

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

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: Phi (°) vs. v (m/s)]

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

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 for different mass percentages.](image-url)
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: Plot of $P_h$ vs $v$ (with different loading conditions $m=100\%, m=66\%, m=33\%$)
- Graph 2: Plot of $t$ vs $v$ (with different loading conditions $m=100\%, m=66\%, m=33\%$)
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>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 14.

<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
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 for various speeds and mass percentages.](image-url)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) for IRB 910SC with a payload of 0.55 m and 3 kg.](image)

Continues on next page
4 IRB 910

4.4 IRB 910SC 0.55 m 3 kg

Continued

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 for different speeds and mass fractions]

Continued
4 IRB 910

4.4 IRB 910SC 0.55 m 3 kg

Continued

Extension zone 2, stopping distance and stopping time
4.5 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 14.*

<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

![Diagram](image-url)
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 vs. velocity for different load conditions.](image)
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distances for different mass ratios (m=100%, m=66%, m=33%) for various velocities (v) in meters per second (m/s) and stopping times (t) in seconds (s).]
4 IRB 910

4.5 IRB 910SC 0.65 m 3 kg

Continued

Extension zone 1, stopping distance and stopping time

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

![Graph showing stopping distance and time for different load factors](image)
This page is intentionally left blank
5 IRB 920

5.1 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 14.

<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

---

Continued on next page
5 IRB 920

5.1 IRB 920 0.55 m 6 kg

Continued

Category 1, Axis A2

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 vs. speed for different masses (m = 100%, 66%, 33%)](image)

Continued
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

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

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

<table>
<thead>
<tr>
<th>( m )</th>
<th>100%</th>
<th>66%</th>
<th>33%</th>
</tr>
</thead>
<tbody>
<tr>
<td>( s )</td>
<td>ALF</td>
<td>BTF</td>
<td>CTF</td>
</tr>
<tr>
<td>( t )</td>
<td>DLF</td>
<td>ETF</td>
<td>FTF</td>
</tr>
</tbody>
</table>
Extension zone 1, stopping distance and stopping time

---

Continued
Extension zone 2, stopping distance and stopping time

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

- **Graph 1:** Stopping distance (s) vs. speed (v) for different mass fractions (m=100%, m=66%, m=33%).
- **Graph 2:** Stopping time (t) vs. speed (v) for different mass fractions (m=100%, m=66%, m=33%).
5.2 IRB 920 0.65 m 6 kg

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 14.

<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

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

Continues on next page
Category 1, Axis A2

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

Graphs showing the relationship between velocity (v [m/s]) and stopping distance (Ph [°]) and stopping time (t [s]) for different mass percentages (m = 100%, m = 66%, m = 33%).
Category 1, Axis A3

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 different masses.]

- Top graph: Stopping distance $s$ [m] vs. velocity $v$ [m/s] for masses 100%, 66%, and 33%.
- Bottom graph: Stopping time $t$ [s] vs. velocity $v$ [m/s] for masses 100%, 66%, and 33%.

5.2 IRB 920 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</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 14.

<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&lt;sup&gt;i&lt;/sup&gt;</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>

<sup>i</sup> WCP cannot enter this zone, therefore the diagrams are empty.

Category 1, Axis A1

Extension zone 0, stopping distance and stopping time

[Graph]

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 for different masses](image)

**Note:** Continues on next page
Category 1, Axis A2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) against velocity (v) in meters per second (m/s).]
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 A3

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

![Graph showing stopping distance (s) vs. velocity (v) for different mass percentages: m=100%, m=66%, m=33%.

The graphs display two sets of curves, one for stopping distance (s) and another for stopping time (t). Each set of curves is represented by different lines corresponding to the mass percentages.

Continued on next page.
Extension zone 2, stopping distance and stopping time
5.4 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 14.

<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

![Graph showing stopping distance vs speed for different mass percentages (m=100%, m=66%, m=33%)](image-url)
5 IRB 920

5.4 IRB 920T 0.55 m 6 kg

Continued
Extension zone 2, stopping distance and stopping time

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

Continues on next page
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 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 stopping time for different masses (m=100%, m=66%, m=33%) as a function of velocity (v) in m/s.](image)
Category 1, Axis A3

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

---

```plaintext
5.4 IRB 920T 0.55 m 6 kg

Continued

---
```

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Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time against velocity for different masses.]
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°</td>
<td>0.32</td>
</tr>
<tr>
<td>2</td>
<td>76.35°</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 14.

<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
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 stopping time for different mass fractions (m) vs. velocity (v) for IRB 920 and 920T models.]

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

Continued
Extension zone 2, stopping distance and stopping time

\[ \Phi_i [\degree] \]

\[ t [s] \]

\[ v [m/s] \]
Category 1, Axis A3

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

![Graphs showing stopping distance and time as functions of velocity for different masses.](image-url)
Extension zone 2, stopping distance and stopping time

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

- **s [m]**: Stopping distance
- **v [m/s]**: Velocity
- **t [s]**: Stopping time

Legend:
- \( m=100\% \)
- \( m=66\% \)
- \( m=33\% \)
6 IRB 1010

6.1 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>32.20</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 14.

<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 and time](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 distance and time vs. speed for different weight percentages](image)

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

**Axes**
- **y-axis**: \( P_h \) [°]
- **x-axis**: \( v \) [m/s]
6 IRB 1010

6.1 IRB 1010 0.37 m 1.5 kg

Continued

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

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]

Continued
Extension zone 2, stopping distance and stopping time

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

- **v [m/s]**
- **$P_h$ [°]**
- **$t$ [s]**

*Graph showing stopping distance and time for different mass percentages (m = 100%, m = 66%, m = 33%).*
7 IRB 1100, CRB 1100

7.1 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 14.

<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

![Graph showing stopping distance and time for category 1, Axis 1, extension zone 0]
7.1 IRB 1100, CRB 1100 0.47 m 4 kg

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity with different mass load percentages.]
7 IRB 1100, CRB 1100

7.1 IRB 1100, CRB 1100 0.47 m 4 kg

Continued

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 IRB 1100, CRB 1100](image-url)

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1: Phi vs. v (0.47 m 4 kg)](image1)

![Graph 2: t vs. v (0.47 m 4 kg)](image2)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing Phi (°) vs. v (m/s) for different mass percentages (m=100%, m=66%, m=33%).](image1)

![Graph showing t (s) vs. v (m/s) for different mass percentages (m=100%, m=66%, m=33%).](image2)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for IRB 1100 CRB 1100 at different masses (m=100%, m=66%, m=33%)](image)

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

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

- **Graph 1**: Shows the relationship between $P_H$ [°] and $v$ [m/s] for different load masses (m=100%, m=66%, m=33%).
- **Graph 2**: Demonstrates the relationship between $t_s$ [s] and $v$ [m/s] for the same load masses.

The graphs illustrate how the stopping distance and time vary with velocity and load mass, 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>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 14*.

<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

![Graph showing stopping distances and times for different load factors (m=100%, m=66%, m=33%) for different speeds (v)](image)
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 masses (m=100%, m=66%, m=33%) at various speeds (v) for IRB 1100, CRB 1100. The graphs display the relationship between speed (v) and the stopping angle (θ) or time (t) for different mass percentages.](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time
7 IRB 1100, CRB 1100

7.2 IRB 1100, CRB 1100 0.58 m 4 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 distance and time against speed for different mass fractions.](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph of Phi vs. v]

![Graph of t vs. v]
Extension zone 1, stopping distance and stopping time

Continued
Extension zone 2, stopping distance and stopping time

\[
\begin{align*}
\text{v [m/s]} & \quad \text{Pfo [°]} \\
0.00 & \quad 0.25 & \quad 0.50 & \quad 0.75 & \quad 1.00 & \quad 1.25 & \quad 1.50 & \quad 1.75 \\
0 & \quad 0 & \quad 0 & \quad 0 & \quad 0 & \quad 0 & \quad 0 & \quad 0 \\
80 & \quad 60 & \quad 40 & \quad 20 & \quad 10 & \quad 0 & \quad 0 & \quad 0 \\
\text{m=100%} & \quad \text{m=66%} & \quad \text{m=33%} \\
\end{align*}
\]
8 IRB 1200

8.1 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>37.2</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 14.

<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

![Graph showing stopping distances and times for different masses (m=100%, m=66%, m=33%) against velocity (v) for IRB 1200 robots.](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph of Phi [°] vs v [m/s]](image)

![Graph of t [s] vs v [m/s]](image)
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times for different masses.](image-url)
8 IRB 1200

8.1 IRB 1200 0.7 m 7 kg
Continued

Extension zone 2, stopping distance and stopping time

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

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

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

Continued
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%) at varying speeds (v) in meters per second (m/s).]
8.2 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 14.

<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
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 time for different mass ratios (m=100%, m=66%, m=33%) for different velocities (v)].
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different loads]

Continues on next page
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

![Graphs showing extension zone 2, stopping distance and stopping time with various speeds and masses.](image)
8.3 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 14.

<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

![Graph showing stopping distance and 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

![Graph 1](image1)

![Graph 2](image2)
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 stopping time for IRB 1200 robot.](image-url)
Extension zone 2, stopping distance and stopping time

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

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 masses (m=100%, m=66%, m=33%) for various velocities (v) ranging from 0 to 2.5 m/s.]

Continued
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 speeds and load factors.](image)

- Top graph: Plot of $P_h$ vs. $v$ for different load factors ($m=100\%, m=66\%, m=33\%$)
- Bottom graph: Plot of $t$ vs. $v$ for different load factors ($m=100\%, m=66\%, m=33\%$)
8.4 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>45.6</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>41.9</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extention zones for articulated robots on page 14.

<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
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

![Graphs showing stopping distance and time for different speeds and mass ratios.](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 fractions m=100%, m=66%, and m=33% against velocity v [m/s].]
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
9 IRB 1300, CRB 1300

9.1 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>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see *Extension zones for articulated robots on page 14.*

<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

<graphical representation>

Continues on next page
9 IRB 1300, CRB 1300

9.1 IRB 1300, CRB 1300 0.9 m 11 kg

Continued

![Graphs showing stopping distances and times for different masses and velocities for extension zone 1.](image)

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 as a function of velocity for different load conditions.](image)

Continued
9 IRB 1300, CRB 1300

9.1 IRB 1300, CRB 1300 0.9 m 11 kg

Continued

Category 1, Axis A2

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

---

**9.1 IRB 1300, CRB 1300 0.9 m 11 kg**

Continued
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

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

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

![Graph 1: \( \Phi_1 \) vs. \( v \) (m/s)](image1)

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

![Graph 2: \( t \) vs. \( v \) (m/s)](image2)

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

\[ P_h [\text{m}] \]
\[ t [\text{s}] \]

- \( m=100\% \)
- \( m=66\% \)
- \( m=33\% \)
9 IRB 1300, CRB 1300

9.2 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 14.

<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
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 of stopping distance and stopping time vs. velocity](image)

- **Ph [°]**
- **t [s]**
- For different mass levels: m=100%, m=66%, m=33%
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 1, Axis A3

Extension zone 0, stopping distance and stopping time

---

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

\[
\begin{align*}
\text{Distance} & \quad \text{Time} \\
\hline
0 & 0 \\
1 & 0.1 \\
2 & 0.2 \\
3 & 0.3 \\
\end{align*}
\]

---

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

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

- Upper graph: Phi [°] vs. v [m/s]
- Lower graph: t [s] vs. v [m/s]
9.3 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 14.

<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

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance vs. speed for different mass ratios](image)

![Graph showing stopping time vs. speed for different mass ratios](image)
Category 1, Axis A2

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 speeds and load factors.

Continues on next page
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 vs. velocity for different mass levels]
Extension zone 2, stopping distance and stopping time

\[ P_\text{hi} [^\circ] \]
\[ v [\text{m/s}] \]
\[ m=100\% \]
\[ m=66\% \]
\[ m=33\% \]

\[ t [\text{s}] \]
\[ v [\text{m/s}] \]
\[ m=100\% \]
\[ m=66\% \]
\[ m=33\% \]
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>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 14.*

<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](image-url)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different mass fractions (m=100%, m=66%, m=33%) against velocity (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 time for different speeds and load conditions.]

Continued
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%) and varying velocities (v) in m/s.]
Category 1, Axis A3
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](image)

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

![Graphs showing stopping distance and time for different speeds and masses.](image-url)
10 IRB 1410

10.1 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 14.

<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

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: Stop angle (φ) vs. Speed (v)](image1)

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

![Graph 2: Stopping time (t) vs. Speed (v)](image2)

- Red line: m = 100%
- Green line: m = 66%
- Blue line: m = 33%
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distances and stopping times for different masses](image-url)

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 time for different masses (m=100%, m=66%, m=33%) against velocity (v) in m/s.](image)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distances and stopping times for different load factors.](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time against velocity](image-url)
Extension zone 2, stopping distance and stopping time
This page is intentionally left blank
11 IRB 1520

11.1 IRB 1520 ID 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 14.

<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

![Graph showing stopping distance vs. velocity for different masses]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

```
<table>
<thead>
<tr>
<th>m</th>
<th>v [m/s]</th>
<th>Ph [°]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>66%</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>33%</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td>3.0</td>
<td>40.0</td>
</tr>
</tbody>
</table>
```

```
<table>
<thead>
<tr>
<th>m</th>
<th>v [m/s]</th>
<th>t [s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>66%</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>33%</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>0.6</td>
</tr>
</tbody>
</table>
```

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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Continued
Extension zone 1, stopping distance and stopping time

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

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

Graphs showing extension zone 2.
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

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

![Graphs showing stopping distance and stopping time for different loads (m=100%, m=66%, m=33%) against velocity (v [m/s]).]
This page is intentionally left blank
12 IRB 1600

12.1 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 14.

<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 time for different speeds]
12 IRB 1600

12.1 IRB 1600 1.2 m 6 kg

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 load conditions]
Category 1, Axis 2

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

---

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

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

![Graph showing stopping distance and time for different load conditions (m=100%, m=66%, m=33%) over varying speeds (v) ranging from 0 to 3 m/s. The graphs display distance (Ph) and time (t) as functions of speed.]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

---

Continued
Extension zone 1, stopping distance and stopping time

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

![Graph showing stopping distances for different mass ratios](image1)

![Graph showing stopping times for different mass ratios](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>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 14.

<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 IRB 1600 robot.]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

![Graph 1: Angle (°) vs. Velocity (m/s)]

![Graph 2: Force (N) vs. Velocity (m/s)]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different masses (m=100%, m=66%, m=33%) at various velocities (v)].
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

- For a load mass of 10 kg, the stopping distance and time increase with higher speeds and load factors.
- The graphs illustrate the relationship between speed (v) in meters per second (m/s) and stopping distance or time (t) in seconds (s), with different load factors (m = 100%, 66%, 33%).

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

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

- **Ph [°]**
  - Red: m=100%
  - Green: m=66%
  - Blue: m=33%

- **t [s]**
  - Red: m=100%
  - Green: m=66%
  - Blue: m=33%

**v [m/s]**

---

12 IRB 1600

12.2 IRB 1600 1.2 m 10 kg

Continued
12.3 IRB 1600 1.45 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>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 14.

<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>0.483</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

[Diagram of stopping distance and 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 loads (m = 100%, m = 66%, m = 33%) at various speeds (v [m/s]).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph of stopping distance vs. velocity]

![Graph of stopping time vs. velocity]

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 for different mass 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

![Graphs showing stopping distance and time as functions of speed for different mass fractions.]
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different masses.](image-url)
12.4 IRB 1600 1.45 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>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 14.*

<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>0.483</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
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 and velocities](image-url)
Category 1, Axis 2

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 masses (m=100%, m=66%, m=33%) against velocity (v) in m/s. The graphs depict the relationship between velocity and stopping distance or stopping time.](image)
Extension zone 2, stopping distance and stopping time

![Graph 1: Phi vs. v (m/s)](image1)

![Graph 2: t vs. v (m/s)](image2)
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 load masses.](image)

Continues on next page
Extension zone 2, stopping distance and stopping time
12.5 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 14.

<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 1: Ph (°C)](image1)

![Graph 2: t [s]](image2)
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time
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 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 stopping time for IRB 1600ID 1.5 m 4 kg.](image)

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

![Graph 1: Stopping Distance (P)](image1)

![Graph 2: Stopping Time (t)](image2)
This page is intentionally left blank
13 IRB 1660

13.1 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 14.

<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

![Graph 1: Plot of PH vs. v (v in m/s)]

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

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

- Red: m=100%
- Green: m=66%
- Blue: m=33%
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

- Top graph: $\Phi$ vs $v$ (degree vs m/s)
- Bottom graph: $t$ vs $v$ (sec vs m/s)

Legend:
- Red: $m=100\%$
- Green: $m=66\%$
- Blue: $m=33\%$]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing Phi vs v and t vs v for different mass percentages (m=100%, m=66%, m=33%) with v ranging from 0 to 2.5 m/s and Phi and t ranging from 0 to 30 degrees and 0 to 0.3 s respectively.](image-url)
Extension zone 1, stopping distance and stopping time

![Graph of stopping distance and stopping time for IRB 1660 ID 1.55 m 4 kg](image-url)
Extension zone 2, stopping distance and stopping time

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

- Plot 1: Stopping distance $P_h$ vs. velocity $v$
  - Red line: $m=100\%$
  - Green line: $m=66\%$
  - Blue line: $m=33\%$

- Plot 2: Stopping time $t$ vs. velocity $v$
  - Red line: $m=100\%$
  - Green line: $m=66\%$
  - Blue line: $m=33\%$
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>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 14.

<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</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

![Graphs 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

![Graph 1](image1)

![Graph 2](image2)

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

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

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1: \(P_{th}[^{\circ}]\) 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: \(m=33\%\)
Category 1, Axis 3
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 distances and times for different masses (m=100%, m=66%, m=33%) at various velocities (v) in meters per second (m/s).]
14 IRB 2400

14.1 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 14.

<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

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 masses](image)

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 showing stopping distance and time for different mass ratios](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

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

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

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1: Stopping Distance vs Velocity]

- **Graph 1** shows the stopping distance ($d$) plotted against velocity ($v$) for different load factors ($m$) at 10 kg.

![Graph 2: Stopping Time vs Velocity]

- **Graph 2** illustrates the stopping time ($t$) as a function of velocity ($v$) for the same load factors ($m$).

---

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

3HAC048645-001 Revision: Z

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14.2 IRB 2400 1.5 m 16 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>53.2</td>
<td>0.61</td>
</tr>
<tr>
<td>2</td>
<td>36.1</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>29.1</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 14.*

<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

![Diagram of stopping distance and time for category 0 emergency stop]

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

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

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

![Graphs showing stopping distances and times for different loads.](image)

Continued
Extension zone 2, stopping distance and stopping time

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

Continued
Category 1, Axis 3

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

![Graph 1: Stopping distance vs. velocity]

![Graph 2: Stopping time vs. velocity]

Continues on next page
Extension zone 2, stopping distance and stopping time
15 IRB 2600

15.1 IRB 2600 1.65 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>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>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 14.

<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

\[
\begin{align*}
\text{Extension zone 2, stopping distance and stopping time} \\
\begin{align*}
\text{Graph 1: } P_h [\text{T}] & \quad \text{vs. } v [\text{m/s}] \\
\text{Graph 2: } t [\text{s}] & \quad \text{vs. } v [\text{m/s}]
\end{align*}
\end{align*}
\]
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: Ph (°)](image)

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

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

Continued
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

[Graphs showing stopping distance and time vs. velocity for different load conditions.]
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>28.7</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 14.

<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

[Graphs showing stopping distance and time as functions of velocity for different mass loads (m = 100%, 66%, 33%).]

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1: Stopping distance vs. speed]

![Graph 2: Stopping time vs. speed]

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances](image)

![Graph showing stopping times](image)
Extension zone 2, stopping distance and stopping time

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

![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 vs. speed]

*Note: The graph illustrates the stopping distance and time for different speeds and mass percentages.*
15.3 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 14.

<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 vs. speed for different load factors](image)
Continues on next page
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different load scenarios]

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 various speeds and mass percentages.]

Continued
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

![Graphs showing stopping distances and times for different mass fractions (m=100%, m=66%, m=33%) as functions of velocity (v) in meters per second (m/s).]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Graphs showing the relationship between velocity (v [m/s]) and stopping distance (P_h [m]) and stopping time (t [s]) for different mass ratios (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>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 14.

<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
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

Graphs showing the relationship between velocity (v [m/s]) and stopping distance (Φ [°]) and time (t [s]) for different masses (m=100%, m=66%, m=33%).
Extension zone 1, stopping distance and stopping time

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

![Graph](image1)

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

- For **m=100%**, the stopping distance and time increase with velocity.
- For **m=66%** and **m=33%**, the curves are shifted to the right, indicating longer distances and times, especially at higher velocities.
15.5 IRB 2600ID 2.00 m 8 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>31.8</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 14.*

<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

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

[Graphs showing stopping distances and times for different velocities and mass percentages.]
Extension zone 1, stopping distance and stopping time

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

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

![Graphs for stopping distance and stopping time](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
Extension zone 2, stopping distance and stopping time

Graphs showing the relationship between stopping distance and velocity for different mass percentages (m=100%, m=66%, and m=33%).
16 IRB 4400

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 14.

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

[Graph showing stopping distance and time as functions of velocity]

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

![Graph showing Phi (°) and t (s) against v (m/s) for different masses (m=100%, m=66%, m=33%)](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

![Graphs showing stopping distances and times for different velocities and weights.](image-url)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distances and times for different mass percentages.]
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 14.

<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>0.66</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

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

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

Continued
Extension zone 2, stopping distance and stopping time
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

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>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 14*.

<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 1, Axis 1](image)

Continues on next page
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

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%) at various velocities (0.00 to 0.05 m/s).]
Extension zone 2, stopping distance and stopping time

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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

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

Graphs showing the relationship between speed (v [m/s]) and stopping time (t [s]) or stopping distance (Pd [m]) for different masses (m=100%, m=66%, m=33%).
17 IRB 4600

17.1 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 14.*

<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](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

![Graphs showing stopping distances and times for different masses (m=100%, m=66%, m=33%) as a function of velocity (v) in m/s.](image-url)
Category 1, Axis 2

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

- Image of a graph showing the relationship between velocity (v [m/s]) and stopping distance (t [s]) for different load factors (m).
- The graphs are labeled with different load factors: m=100%, m=66%, and m=33%.

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

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distances and stopping times for different masses (m=100%, m=66%, m=33%) at various velocities (v [m/s]).]
Extension zone 1, stopping distance and stopping time

![Graph](image)

**Graph Description:***
- The graph shows the relationship between velocity (v [m/s]) and stopping distance (P̂ [m]) for different mass ratios (m = 100%, m = 66%, m = 33%).
- The red line represents m = 100%, the green line represents m = 66%, and the blue line represents m = 33%.
- The x-axis represents velocity in meters per second (m/s), ranging from 0 to 3.5.
- The y-axis represents stopping distance in meters (m), ranging from 0 to 30.

**Graph 2 Description:***
- The second graph illustrates the relationship between velocity (v [m/s]) and stopping time (t [s]) for different mass ratios.
- The red line represents m = 100%, the green line represents m = 66%, and the blue line represents m = 33%.
- The x-axis represents velocity in meters per second (m/s), ranging from 0 to 3.5.
- The y-axis represents stopping time in seconds (s), ranging from 0 to 0.3.

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

![Graph showing stopping distance and stopping time vs. speed for different mass percentages.](image-url)
17.2 IRB 4600 2.05 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>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 Extension zones for articulated robots on page 14.

<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

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 mass ratios.](image)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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Continued on next page
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

Graph 1: Stopping distance (P_t) as a function of velocity (v).
- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%

Graph 2: Stopping time (t) as a function of velocity (v).
- Red line: m=100%
- Green line: m=66%
- Blue line: m=33%
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 of Extension zone 2, stopping distance and stopping time]

- **Graph 1**: $P_H$ vs. $v$ for different mass coefficients ($m=100\%$, $m=66\%$, $m=33\%$).
- **Graph 2**: $t$ vs. $v$ for different mass coefficients ($m=100\%$, $m=66\%$, $m=33\%$).
### 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>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 14.*

<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
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: Phi vs. v](image1)

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

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

**Continued**
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

![Graph showing stopping distance and time vs. speed for different masses.](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>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 14.

<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
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

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

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

Continued
Extension zone 2, stopping distance and stopping time

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

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

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. speed]
Extension zone 2, stopping distance and stopping time

![Graph of stopping distances and times for different speeds and masses.]

The graphs show the relationship between speed (v [m/s]) and stopping distance (Ph [m]) or stopping time (t [s]) for different mass percentages (m = 100%, 66%, 33%). The graphs indicate that at higher speeds, the stopping distance and time increase significantly, especially for higher mass percentages.
18 IRB 6620

18.1 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 14.

<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

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

![Graphs showing stopping distances and times for different masses (m=100%, m=66%, m=33%) as a function of velocity (v).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image1)

![Graph showing more detailed data](image2)
Extension zone 1, stopping distance and stopping time

![Graph 1](image1)

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

---

<table>
<thead>
<tr>
<th>m</th>
<th>m=100%</th>
<th>m=66%</th>
<th>m=33%</th>
</tr>
</thead>
<tbody>
<tr>
<td>v [m/s]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

\[ \Phi_1 [\text{m}] = f(v, m) \]

\[ t [\text{s}] = f(v, m) \]

where:
- \( v \) is the velocity in m/s
- \( m \) is the mass ratio

Continued
Extension zone 1, stopping distance and stopping time

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

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

- **Graph 1**: Distance ($d$) vs. speed ($v$) for $m=100\%$, $m=66\%$, and $m=33\%$.
- **Graph 2**: Time ($t$) vs. speed ($v$) for $m=100\%$, $m=66\%$, and $m=33\%$. 

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

18 IRB 6620

18.1 IRB 6620 2.20 m 150 kg

*Continued*
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19 IRB 6650

19.1 IRB 6650S 3.00 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>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 14.*

<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
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 (m=100%, m=66%, m=33%). The graphs plot velocity (v) against Ph (°) and t (s) for different mass percentages.](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

![Graph showing stopping distance and stopping time for different mass loads (m=100%, m=66%, m=33%) at various speeds (v in m/s).]
Extension zone 2, stopping distance and stopping time

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

The graphs depict the stopping distance (top) and stopping time (bottom) for different masses (m) normalized to 100%, 66%, and 33%. The x-axis represents velocity in m/s, while the y-axis shows distance or time in meters or seconds, respectively.

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)

Continues on next page
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
19.2 IRB 6650S 3.45 m 125 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>52.8</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 14.

<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

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

![Graph showing stopping distance and time for different load factors (m = 100%, m = 66%, m = 33%) vs. velocity (v) for IRB 6650S 3.45 m 125 kg.]

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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**Graphs:**

1. Graph showing Phi [°] vs. v [m/s] for m=100%, m=66%, and m=33%.
2. Graph showing t [s] vs. v [m/s] for m=100%, m=66%, and m=33%.

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

![Graph showing extension zone 1, stopping distance and stopping time.](chart.png)
Extension zone 2, stopping distance and stopping time

[Graphs showing stopping distance and time against velocity]
Category 1, Axis 3

Extension zone 0, 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) in m/s.](image)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
19.3 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 14.

<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

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

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

Continued on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

Graph 1: $P_h$ [°] vs. $v$ [m/s]

Graph 2: $t$ [s] vs. $v$ [m/s]
Extension zone 2, stopping distance and stopping time

\begin{center}
\begin{figure}
\centering
\includegraphics[width=\textwidth]{extension_zone_2_stopping_distance_stopping_time.png}
\caption{Graph showing stopping distance and time against velocity for different masses (m=100%, m=66%, m=33%).}
\end{figure}
\end{center}
19.4 IRB 6650SLeanID 3.0 m 190 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>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 14*.

<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](image-url)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph 1: \(P_{th} \text{ [°]}\) vs. \(v \text{ [m/s]}\)]

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

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

- Red line: \(m=100\%\)
- Green dashed line: \(m=66\%\)
- Blue dotted line: \(m=33\%\)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distances and times for different speeds with varying masses (m=100%, m=66%, m=33%).]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time versus velocity for IRB 6650S LeanID 3.0 m 190 kg](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time against velocity]

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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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

![Graphs showing stopping distance and time vs. velocity for different masses (m=100%, m=66%, m=33%).]
19.5 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 14.*

<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
Extension zone 1, stopping distance and stopping time

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

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 stopping time for different mass ratios](image)

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 vs. velocity]

Continued 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

![Graphs showing stopping distances and times for different mass ratios (m) at varying velocities (v)].

- Upper graph: Stopping angle ($\theta$) vs. velocity ($v$) for different mass ratios (m=100%, m=66%, m=33%).
- Lower graph: Stopping time (t) vs. velocity ($v$) for different mass ratios (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>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 14.*

<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

![Graph](image)
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 load factors](image)

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph of stopping distance and stopping time for different mass loads (m=100%, m=66%, m=33%) vs. velocity.](image)

Continued
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 showing stopping distance and stopping time for different masses (m = 100%, m = 66%, m = 33%) as a function of velocity (v).]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

Continued
Extension zone 1, stopping distance and stopping time

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

Continued
Extension zone 2, stopping distance and stopping time

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

- **Graph 1:** Plots the stopping distance $P_h$ in meters as a function of speed $v$ in meters per second for different load factors: $m=100\%$, $m=66\%$, and $m=33\%$.
- **Graph 2:** Plots the stopping time $t$ in seconds as a function of speed $v$ in meters per second for different load factors: $m=100\%$, $m=66\%$, and $m=33\%$.
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>39.8</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 14.

<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
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

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

![Graph showing stopping distance and time for different speeds and load factors (m=100%, m=66%, m=33%).]
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 time vs. velocity for different mass values (m = 100%, m = 66%, m = 33%).]
Extension zone 2, stopping distance and stopping time
20.3 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 14.

<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

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

Continues on next page
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 stopping time](image-url)

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph of Phi vs v]

![Graph of t vs v]
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 load factors]
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%) against velocity (v) in m/s]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for IRB 6660 robot](image)

Continued
Extension zone 2, stopping distance and stopping time

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

- **Graph 1**: \( P_h \) vs. \( v \) with lines for different masses: m=100%, m=66%, m=33%
- **Graph 2**: \( t \) vs. \( v \) with lines for different masses: m=100%, m=66%, m=33%
This page is intentionally left blank
21 IRB 6700

21.1 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 14.

<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

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

![Graph showing stopping distances and times for different mass loads (m=100%, m=66%, m=33%) at various speeds (v).]
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](image)

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time as functions of velocity](image)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

---

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity](image1)

![Graph showing stopping distance and time vs. velocity](image2)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for IRB 6700 robot](image-url)
21.2 IRB 6700 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 14.

<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]

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

---

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for various speeds and mass percentages.]

Continued
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)
21.3 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 14.

<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

![Chart showing stopping distance and time for category 1, Axis 1](chart.png)
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 vs. speed](image)

The graphs illustrate the stopping distance (De) and stopping time (t) for different mass load conditions (m=100%, m=66%, m=33%) at various speeds (v).

Continued on 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
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](image1)

![Graph showing stopping distance and time for different masses](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>40.0</td>
<td>0.71</td>
</tr>
<tr>
<td>2</td>
<td>20.6</td>
<td>0.37</td>
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<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 14.

<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

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

![Graph showing stopping distance and time as a function of 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](image1)

![Graph 2: Stopping Time](image2)
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 3

Extension zone 0, stopping distance and stopping time

Continued
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
21.5 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 14.

<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>
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<tr>
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<td>0.949</td>
<td>1.898</td>
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<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 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-url)

Continued on next page.
Category 1, Axis 2

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

![Graph showing the relationship between velocity (v) and stopping distance (Phi)].

![Graph showing the relationship between velocity (v) and stopping time (t)].

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

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

- Stopping distance $P_h$ [m] vs. velocity $v$ [m/s]
- Stopping time $t$ [s] vs. 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>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 14.

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
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</thead>
<tbody>
<tr>
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<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
Extension zone 2, stopping distance and stopping time

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

- For mass percentages at 100%, 66%, and 33%, the graphs illustrate how stopping distance and time vary with speed.

Continued on next page.
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1: Stopping distance](image1)

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

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
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different masses (m=100%, m=66%, m=33%) vs velocity (v) for IRB 6700 3.00 m 245 kg.](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>40.9</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 14.

<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

Continued
Extension zone 2, stopping distance and stopping time

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

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

- **Continuous 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

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

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Continues on next page

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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>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>

For definitions of the zones, see Extension zones for articulated robots on page 14.

<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>

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 for different mass percentages.](image-url)
Category 1, Axis 2

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 fractions (m=100%, m=66%, m=33%)](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 for different masses (m=100%, m=66%, m=33%)](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different mass fractions.]
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>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 14.*

<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

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distances and times for different masses (m=100%, m=66%, m=33%) vs. velocity (v) in meters per second (m/s).]
Category 1, Axis 2

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

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

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

![Graph showing stopping distance and time as functions of velocity]

---

Continued
Category 1, Axis 3

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

[Graphs showing stopping distance and time vs. velocity for different mass percentages]
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>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 14.

<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
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]

Continued
Category 1, Axis 2

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

\[ \Phi_t [\text{m}] \]

\[ t [\text{s}] \]

\[ m = 100\% \]
\[ m = 66\% \]
\[ m = 33\% \]

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 for different speeds and masses.]

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

![Graphs showing stopping distance and stopping time for different masses](image-url)
21.11 IRB 6700Inv 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 14.*

<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 showing stopping distance and stopping time for various load percentages](image-url)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity]
Category 1, Axis 2

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 vs. velocity for different mass ratios (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

![Graphs showing stopping distance and stopping time for different load scenarios.](image)
Extension zone 1, stopping distance and stopping time
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>31.4</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 14.*

<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

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

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

- Graphs showing the relationship between velocity (v [m/s]) and stopping distance (P_h [m]) and stopping time (t [s]) for different load factors (m = 100%, 66%, 33%).

Continued 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

![Graphs showing Ph and t vs. v)](image-url)

Continued
Extension zone 2, stopping distance and stopping time
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>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 14.

<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. velocity for different load factors (m=100%, m=66%, m=33%) for IRB 6700 LeanID 2.60 m 175 kg.](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

Graph 1: $P_{th}$ [°C] vs. $v$ [m/s]

Graph 2: $t$ [s] vs. $v$ [m/s] for different mass reductions:
- $m=100\%$
- $m=66\%$
- $m=33\%$
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>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 14.

<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

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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

[Graph showing stopping distance and stopping time for different mass percentages (m=100%, m=66%, m=33%) against velocity (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 vs. velocity for different load conditions.](image)
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 stopping time for different mass percentages (m=100%, m=66%, m=33%) against velocity (v) in m/s.](image)
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>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 14.

<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 distances and times for different weights (m=100%, m=66%, m=33%) at various speeds (v [m/s]).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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Continued
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

![Diagram showing stopping distance and time vs. velocity for different mass loads](image1)

![Diagram showing stopping distance and time vs. velocity for different mass loads](image2)
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 time vs. speed for different mass percentages.]

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different load masses]
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 14.

<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

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

![Graphs showing stopping distance and time for different masses.](Image)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

![Graphs showing stopping distance and stopping time for different mass loadings (m=100%, m=66%, m=33%) at varying speeds (v).]
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
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 14.

<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 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 vs. velocity](image)
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. $v$ [m/s]

Graph 2: $t$ [s] vs. $v$ [m/s]

- $m=100\%$
- $m=66\%$
- $m=33\%$
Category 1, Axis 3

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 masses](image)

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

![Graph showing stopping distance and stopping time for different speeds and mass ratios. The graphs display the relationship between velocity (v [m/s]) and stopping distance (P_2 [m]) or stopping time (t [s]). The curves are labeled for different mass ratios: m=100%, m=66%, and 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>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 14.*

<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>
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<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

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 the relationship between velocity (v) and stopping distance (Ph) and stopping time (t) for different mass (m) values (m=100%, m=66%, m=33%).]

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]

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

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

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

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

- Red line: \( m=100\% \)
- Green line: \( m=66\% \)
- Blue line: \( m=33\% \)
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 vs. velocity]

- For different mass ratios (m=100%, m=66%, m=33%), the graphs illustrate the variation of stopping distance (\(d\)) and stopping time (\(t\)) with velocity (\(v\)), highlighting the impact of mass on stopping efficiency.
Extension zone 2, stopping distance and stopping time
21.19 IRB 6700 LeanID 3.05 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>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 14.

<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

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

Continued
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

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

![Graphs showing stopping distances and times]

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time]

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

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

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

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

- Graph showing stopping distance ($P_f$) vs. velocity ($v$) for different mass fractions ($m=100\%, m=66\%, m=33\%$).
- Graph showing stopping time ($t$) vs. velocity ($v$) for different mass fractions ($m=100\%, m=66\%, m=33\%$).
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>40.6</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 14.

<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

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 speeds and masses]
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: Phi vs. v]

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

![Graph 1: Angular displacement (°) 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 1, Axis 3

Extension zone 0, stopping distance and stopping time

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Continued on next page

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

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Extension zone 1, stopping distance and stopping time

\begin{align*}
\text{Plot 1: } P_h & \text{ vs. } v \\
\text{Plot 2: } t & \text{ vs. } v
\end{align*}

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

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>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 14.

<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 1: \(P_h \,[^\text{C}]\) vs. \(v \,[\text{m/s}]\)](image1)

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

![Graph 2: \(t \,[\text{s}]\) vs. \(v \,[\text{m/s}]\)](image2)

- Red line: \(m=100\%\)
- Green line: \(m=66\%\)
- Blue line: \(m=33\%\)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing Phi and t vs. v]

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. speed]

Continued
Category 1, Axis 3

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

[Graphs showing stopping distance and time as functions of velocity]

Continued
Extension zone 2, stopping distance and stopping time

---

**Graph 1:**
- **$P_h (\degree)$** vs **$v [m/s]$**
- Curves for different load factors ($m=100\%, m=66\%, m=33\%$)

**Graph 2:**
- **$t [s]$** vs **$v [m/s]$**
- Curves for different load factors ($m=100\%, m=66\%, m=33\%$)
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 14.

<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

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 2

Extension zone 0, stopping distance and stopping time

![Graph 1: $\Phi$ vs $v$](image1)

$m=100\%$

$m=66\%$

$m=33\%$

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

$m=100\%$

$m=66\%$

$m=33\%$
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds and masses.]
Extension zone 2, stopping distance and stopping time

```
<table>
<thead>
<tr>
<th>v [m/s]</th>
<th>P_h [°C]</th>
<th>t [s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0.2</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>0.4</td>
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<tr>
<td>3</td>
<td>15</td>
<td>0.6</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>1.0</td>
</tr>
</tbody>
</table>
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Continued
Category 1, Axis 3

Extension zone 0, 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 linear velocity (v) in m/s. The graphs depict how the stopping distance (\(\Phi\)) and stopping time (\(t\)) vary with velocity.](image-url)
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses (m = 100%, 66%, 33%) vs. velocity (v) for IRB 6790 2.80 m 205 kg.](image-url)
Extension zone 2, stopping distance and stopping time
23 IRB 7600

23.1 IRB 7600 2.55 m 400 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>31.6</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 14.

<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 Ph vs. v]
 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 IRB 7600](image)

Continued 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

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

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

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

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

![Graph showing stopping distance and time for IRB 7600 with varying mass percentages.](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 1: \( \Phi_i [^\circ] \) vs. \( v \) [m/s]](image1)

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

![Graph 2: \( t \) [s] vs. \( v \) [m/s]](image2)

- \( m = 100\% \)
- \( m = 66\% \)
- \( m = 33\% \)
Extension zone 2, stopping distance and stopping time
23.2 IRB 7600 2.55 m 500 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>32.6</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 14.

<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
Extension zone 2, stopping distance and stopping time

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

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

 guerra del olmecas historia, cultura, arte, y simbolismo.
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

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

![Graph showing stopping distances and times for different mass loads (m=100%, m=66%, m=33%) for a IRB 23.2 7600 robot with a maximum speed of 2.55 m/s and a maximum load of 500 kg.](image)

Continues on next page
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%), the graphs illustrate how stopping distance and time change with velocity.

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>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 14.

<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

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

![Graphs showing stopping distance and stopping time for different load percentages (m=100%, m=66%, m=33%) with speed (v) in m/s on the x-axis and stopping distance (\(\Phi\)) or stopping time (t) on the y-axis.](image)
Extension zone 1, stopping distance and stopping time

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

![Graph 1: Ph vs. v]

![Graph 2: t vs. v]

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

Continued
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-url)
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different payload masses.](image)

---

23 IRB 7600

23.3 IRB 7600 2.80 m 340 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>33.0</td>
<td>0.78</td>
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<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 14.

<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
Extension zone 2, stopping distance and stopping time

![Graph of 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 masses (m=100%, m=66%, m=33%) as a function of speed (v) in meters per second (m/s).]
Extension zone 1, stopping distance and stopping time

\[\Phi_h(\mathbf{v})\]

\[t(\mathbf{v})\]

\[m=100\%\]
\[m=66\%\]
\[m=33\%\]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs speed for different masses]
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
23.5 IRB 7600 3.50 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>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 14.

<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
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

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

Continues on next page.
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph 1: Phi vs. v](image1)

![Graph 2: t vs. v](image2)
Extension zone 1, stopping distance and stopping time

Graph showing the relationship between velocity (v [m/s]) and stopping distance (Ph [m]), and between velocity (v [m/s]) and stopping time (t [s]) for different mass values (m=100%, m=66%, 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>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 14.

<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](image-url)
Extension zone 1, stopping distance and stopping time

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

\[ P_h [\degree] \]

\[ t [\text{s}] \]

\[ v [\text{m/s}] \]
Category 1, Axis 2

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

![Graph](image)

Continued
Extension zone 2, stopping distance and stopping time

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

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

![Graphs showing stopping distances and times for different mass load ratios](image-url)
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 1: $P_H$ vs $v$ for different masses $m=100\%$, $m=66\%$, and $m=33\%$

Graph 2: $t$ vs $v$ for different masses $m=100\%$, $m=66\%$, and $m=33\%$
23.7 IRB 7600 LeanID 2.8 m 320 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>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 14.

<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 1](image1)

![Graph 2](image2)

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

\begin{figure}
\centering
\includegraphics[width=\textwidth]{extension_zone_1_stopping_distance}
\end{figure}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{extension_zone_1_stopping_time}
\end{figure}
Extension zone 2, stopping distance and stopping time

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

![Graph 2: \( t [\text{s}] \) vs. \( v [\text{m/s}] \)]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

![Graphs showing stopping distance and stopping time for IRB 7600 LeanID 2.8 m 320 kg](image)

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 velocities (v) in meters per second (m/s).]
23.8 IRB 7600 LeanID 3.1 m 290 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>30.1</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 14.

<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

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

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

---

Continued
Category 1, Axis 2

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

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

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

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

- $m=100\%$
- $m=66\%$
- $m=33\%$
Extension zone 2, stopping distance and stopping time

[Graphs showing stopping distances and times for different load conditions (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

Graphs showing the relationship between stopping distance and velocity for different mass percentages (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 ($\Phi$ [°]) and time ($t$ [s]) for different load capacities (m = 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>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 14.

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

![Graph 1: Phi vs. v (m/s)](image1)

![Graph 2: t vs. v (m/s)](image2)
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 and time vs velocity]

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

![Graph showing stopping distance and 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 (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 14.

<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

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

![Graph showing stopping distance and stopping time for different load factors](image1)

![Graph showing stopping distance and stopping time for different load factors](image2)
Extension zone 1, stopping distance and stopping time
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 stopping time for IRB 8700 robot]

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time vs. velocity for different mass fractions.](image)
24.3 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 14.

<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

![Graph showing stopping distance vs speed for different loads (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 for different mass percentages.]

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 showing stopping distance and stopping time for different mass percentages.](image-url)
Extension zone 2, stopping distance and stopping time

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

Continued
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 1: Stopping distance (\(\Phi\)) vs. velocity (\(v\))

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

![Graph 2: Stopping time (\(t\)) vs. velocity (\(v\))

- 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>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 14.

<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
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 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

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

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

Graphs showing stopping distances and times for different speeds and masses.

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

\[ P_h [^\circ] \]
\[ t [s] \]

\[ v [m/s] \]

- \( m=100\% \)
- \( m=66\% \)
- \( m=33\% \)
25 IRB 460

25.1 IRB 460 2.4 m 110 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>41.5</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 14.*

<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

![Graph](image)

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. velocity for different mass percentages.](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

Continued
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 showing stopping distance and stopping time for IRB 460, 2.4 m, 110 kg]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

![Graphs showing stopping distance and time vs. velocity for different mass ratios (m=100%, m=66%, m=33%) with IRB 460 robot specifications.](image-url)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass ratios](image1)

![Graph showing stopping distance and stopping time for different mass ratios](image2)
This page is intentionally left blank
26 IRB 660

26.1 IRB 660 3.15 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>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 14.*

<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
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 versus velocity](image-url)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph of stopping distances and times for different mass coefficients.](image)
Extension zone 1, stopping distance and stopping time

---

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

![Graph](image1)

![Graph](image2)
26.2 IRB 660 3.15 m 250 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>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>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 14.

<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

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

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

The graphs show the relationship between velocity (v [m/s]) and stopping distance (Ph [m]) or stopping time (t [s]). The curves are labeled for different load masses (m=100%, m=66%, m=33%).
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

Graphs showing the relationship between velocity (v [m/s]) and stopping distance (Ph [°]) and stopping time (t [s]) for different masses (m = 100%, 66%, 33%).
27 IRB 760
27.1 IRB 760 3.2 m 445 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>40.7</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 14.

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

[Graph showing stopping distance and stopping time as functions of speed (v [m/s]) and load (m) for IRB 760.]

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 vs. velocity for different mass loads (m=100%, m=66%, m=33%).]

Continues on next page

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

27 IRB 760

27.1 IRB 760 3.2 m 445 kg

Continued...
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 1: Ph vs v](image1)

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

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 14.

<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>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

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

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and load factors (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-url)
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
Extension zone 1, stopping distance and stopping time

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

<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>
Category 1, Standard

Stopping distance and stopping time
Category 1, Wash Down

Stopping distance and stopping time
Category 1, 3AXES

Stopping distance and stopping time
28.2 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>
Category 1, Standard

Stopping distance and stopping time
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

![Graph showing stopping distance and time for different speeds for IRB 360 1.13 m 1 kg.](image)
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

Continued
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
28 IRB 360

28.3 IRB 360 1.13 m 3 kg

Continued

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>
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>0.90</td>
<td>0.22</td>
</tr>
</tbody>
</table>
Category 1, Standard
Stopping distance and stopping time

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

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28.6 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>

Continues on next page
Category 1, Standard

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>0.55</td>
<td>0.25</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

[Graph showing stopping distance and time as functions of velocity for different mass ratios.]
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>
Category 1, Standard

Stopping distance and stopping time

[Diagram showing stopping distance and stopping time as functions of velocity for different mass fractions (m = 33%, m = 66%, m = 100%).]

Continued
29.3 IRB 365 1.3 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>0.73</td>
<td>0.26</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

![Graph showing stop distance and time for different masses and velocities.](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.

<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

![Graph of stopping distance and stopping time for IRB 390 1.3 m 10 kg]

---

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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.

<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>

Continues on next page
Category 1, Standard

Stopping distance and stopping time

---

30.2 IRB 390 1.3 m 15 kg

Continued
Category 0, ARM

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for Category 0, ARM](image)

Continues on next page
Category 0, PLATE

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

![Diagram showing stopping distance and stopping time for A250_D1000]

![Diagram showing another aspect of stopping distance and stopping time for A250_D1000]
31.2 A500_D1000

Category 0, ARM

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

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Category 1, ARM

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

[Graph showing stopping distance vs. speed]

[Graph showing stopping time vs. speed]
Category 0, ARM

Stopping distance and stopping time

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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
Category 0, ARM

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

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Category 1, ARM

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time
Category 0, ARM

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

[Diagram of stopping distance and time graphs for A750_D1450 PLATE]
Category 1, ARM

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time
Category 0, INTERCH

Stopping distance and stopping time
Category 0, ARM

Stopping distance and stopping time

[Graphs showing stopping distance and stopping time for different speeds]

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Category 0, PLATE

Stopping distance and stopping time

![Graphs showing stopping distance and time for different angular speeds and load conditions.](image-url)
Category 1, INTERCH

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time

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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

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Category 0, PLATE

Stopping distance and stopping time

[Graphs showing stopping distance and stopping time for different speeds and conditions]
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 1: Stopping distance vs. speed](image1)

![Graph 2: Stopping time vs. speed](image2)
32.3 B750_D1450

Category 0, INTERCH

Stopping distance and stopping time
Category 0, ARM

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

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

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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
Category 1, INTERCH
Stopping distance and stopping time

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

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942 Product specification - Robot stopping distances according to ISO 10218-1
3HAC048645-001 Revision: Z

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33.2 C1000

Category 0, INTERCH

Stopping distance and stopping time

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Category 1, INTERCH

Stopping distance and stopping time

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

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

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34 IRBP D

34.1 D300_L1250_D1000

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, ARM

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for Category 0, ARM]
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time

![Graph 1]

![Graph 2]
Category 1, ARM

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time
34.2 D300_L1600_D1000

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, ARM

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time

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Continued
Category 1, ARM

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time
34.3 D600_L1600_D1000

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, ARM

Stopping distance and stopping time

![Diagram of stopping distances and times for Category 0, ARM]
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

![Graph showing stopping distance and stopping time for Category 1, PLATE.](image-url)
34.4 D600_L1600_D1200

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
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

![Graph](image1)

![Graph](image2)

Continues on next page
Category 1, ARM

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
34.5 D600_L2000_D1000

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, ARM

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

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Continued
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
34.6 D600_L2000_D1200

Category 0, INTERCH

Stopping distance and stopping time

Continues on next page
Category 0, ARM

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for different scenarios.](image-url)
Category 1, PLATE

Stopping distance and stopping time
Category 0, INTERCH

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

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

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Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and time for IRBP K 35.2 K1000_D1400]
35.3 K300_D1000

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

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Category 1, INTERCH

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

![Graphs showing stopping distance and time for different speeds for the K300_D1000 robot.](image-url)
35.4 K300_D1200

Category 0, INTERCH

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

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

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Category 1, INTERCH

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

![Graph of stopping distance vs. speed]

![Graph of stopping time vs. speed]
Category 0, INTERCH

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and stopping time](image-url)
35.6 K600_D1400

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, INTERCH

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

![Graph 1](K600_D1400-PLATE)

![Graph 2](K600_D5400-PLATE)
Category 0, PLATE

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
36.2 L2000

Category 0, PLATE

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for L2000 PLATE.](image)
36.3 L300

Category 0, PLATE

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time
36.4 L5000

Category 0, PLATE

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and time for different speeds for L5000-PLATE.](image-url)
Category 0, PLATE

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for the L600 robot.](image1)

![Graph showing angular speed vs. angular position for the L600 robot.](image2)
Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

![Graph of stopping distance and stopping time for R1000_L1600_D1000]

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Category 1, INTERCH

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time
Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different models.](image)
Category 1, INTERCH

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time
37.3 R1000_L2000_D1000

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
37.4 R1000_L2000_D1200

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

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Category 1, PLATE

Stopping distance and stopping time

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

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1030 Product specification - Robot stopping distances according to ISO 10218-1

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37.5 R300_L1250_D1000

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
37.6 R300_L1600_D1000

Category 0, INTERCH

Stopping distance and stopping time

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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
37.7 R600_L1600_D1000

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

[Graphs showing stopping distance and time for different speeds and conditions.]
Category 1, INTERCH

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
37.8 R600_L1600_D1200

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time
Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time

37.9 R600_L2000_D1000

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Category 1, PLATE

Stopping distance and stopping time
37.10 R600_L2000_D1200

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

Continued
Category 1, INTERCH

Stopping distance and stopping time

Continues on next page
Category 1, PLATE

Stopping distance and stopping time

![Graph 1](Image1)

![Graph 2](Image2)