Product specification

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

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

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

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

- Personnel working with planning of robot systems

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

<table>
<thead>
<tr>
<th>Document name</th>
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<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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| A        | Release 14.1. The following robots are added:  
 IRB 120  
 IRB 140  
 IRB 6700  
 IRB 260  
 IRB 460  
 IRB 660  
 IRB 760 |
| B        | Release 15.1. The following robots are added:  
 IRB 6700 variants  
 IRB 1200  
 IRB 1520  
 IRB 1600  
 Descriptions about the data and measurements are updated. |
| C        | Release 15.2. The following robots are added:  
 IRB 2400 |

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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 |
<p>| M        | Added back IRB 2600, that was accidentally removed from revision L. |</p>
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<td>Added correct graphics for IRB 2600. The graphics used in revisions J to M are not correct.</td>
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| 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. |

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## Overview of this specification

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| AA       | Release 23C.  
           |   The following robots are added:  
           |   - IRB 1510  
           |   The data for the CRB 1100, CRB 1300, IRB 1010, IRB 1100, IRB 1300, IRB 910INV, and IRB 920 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. |
| AB       | Release 24A.  
           |   - Corrected the category 0 stop data for IRB 1600.  
           |   - IRB 120 is phased out from the product offer. |
| AC       | Release 24B.  
           |   - IRB 1410 is phased out from the product offer.  
           |   - IRB 910SC is phased out from the product offer.  
           |   - The stopping data for IRB 1200 OmniCore robots is moved to *Product specification - IRB 1200, 3HAC081417-001*. |
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.

Continues on next page
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.

Continues on next page
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.
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, 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 1200

3.1 IRB 1200 0.7 m 7 kg

Note
This data is applicable for the IRC5 robot. For OmniCore robots, see Product specification - IRB 1200, 3HAC081417-001.

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
3.1 IRB 1200 0.7 m 7 kg

Continued

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

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

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

Extension zone 2, stopping distance and stopping time

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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In the graphs above, the red line represents the maximum stopping distance ($m=100\%$) for different speeds ($v$) according to the ISO 10218-1 standards. The green and blue lines represent lower speeds ($m=66\%$ and $m=33\%$, respectively). The graphs illustrate how the stopping distance increases with speed, with the percentage of maximum speed affecting the stopping distance.

Continued
Extension zone 1, stopping distance and stopping time

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Continued

3 IRB 1200

3.1 IRB 1200 0.7 m 7 kg

Continued
Extension zone 2, stopping distance and stopping time
3.2 IRB 1200 0.7 m 7 kg

Note
This data is applicable for the IRC5 robot. For OmniCore robots, see Product specification - IRB 1200, 3HAC081417-001.

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

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

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

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

![Graph of 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 distances and times for different masses](image-url)
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times for different masses and velocities.]

Continues on next page
Extension zone 2, stopping distance and stopping time
3.3 IRB 1200 0.9 m 5 kg

Note
This data is applicable for the IRC5 robot. For OmniCore robots, see Product specification - IRB 1200, 3HAC081417-001.

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

Continues on next page
3 IRB 1200

3.3 IRB 1200 0.9 m 5 kg

Continued

Extension zone 1, stopping distance and stopping time

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

![Graph](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 IRB 1200 with different mass ratios (m=100%, m=66%, m=33%) at various speeds (v[m/s]) for IRB 1200 0.9 m 5 kg.]

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

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

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

![Graph 2: t vs. v (m/s)]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
3.4 IRB 1200 0.9 m 5 kg

Note

This data is applicable for the IRC5 robot. For OmniCore robots, see Product specification - IRB 1200, 3HAC081417-001.

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 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

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 of stopping distance and time vs. speed]

- $P_h$: stopping distance
- $t$: stopping time
- $v$: speed
- $m$: mass percentage

$m=100\%$, $m=66\%$, $m=33\%$
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. speed for different masses (m=100%, m=66%, m=33%).]
Category 1, Axis 3

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

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

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

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

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

![Graph showing stopping distance and stopping time for IRB 1200](image)

3.4 IRB 1200 0.9 m 5 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>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

Continues on next page
4 IRB 1510

4.1 IRB 1510ID 1.5 m 4 kg

Continued

Extension zone 1, stopping distance and stopping time

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

---

[Graphs showing stopping distance and time vs. speed for different mass conditions]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

![Graph showing stopping distance and stopping time for IRB 1510 in extension zone 1 with different mass loads.]
4 IRB 1510

4.1 IRB 1510ID 1.5 m 4 kg

Continued

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

Extension zone 0, stopping distance and stopping time

![Graph 1: Phi vs. v]

![Graph 2: t vs. v]

Continues on next page
4 IRB 1510

4.1 IRB 1510ID 1.5 m 4 kg

Continued

Extension zone 1, stopping distance and stopping time

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

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

![Graph 1](image1)

![Graph 2](image2)
5 IRB 1520

5.1 IRB 1520ID 1.5 m 4 kg

Category 0

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

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

Category 1, extension zones

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

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

65

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5 IRB 1520

5.1 IRB 1520ID 1.5 m 4 kg

Continued
Extension zone 2, stopping distance and stopping time

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

- **Graph 1**: Stopping distance (\(d_t\)) vs. velocity (\(v\)) for different load weights (100%, 66%, 33%).
  - \(d_t\) is in meters (m).
  - \(v\) is in meters per second (m/s).

- **Graph 2**: Stopping time (\(t\)) vs. velocity (\(v\)) for different load weights (100%, 66%, 33%).
  - \(t\) is in seconds (s).
  - \(v\) is in meters per second (m/s).
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 masses (m=100%, m=66%, m=33%) against linear velocity (v) in meters per second (m/s).]
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

Continues on next page
5 IRB 1520

5.1 IRB 1520ID 1.5 m 4 kg

Continued

Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass ratios]
Extension zone 2, stopping distance and stopping time

\[ \Phi_h \text{ [°]} \]

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

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

\[ v \text{ [m/s]} \]
This page is intentionally left blank
6 IRB 1600

6.1 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
6 IRB 1600

6.1 IRB 1600 1.2 m 6 kg

Continued

Extension zone 1, stopping distance and stopping time

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

![Graph 1: Phi vs. v]

![Graph 2: t vs. v]

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graphs showing the relationship between speed (v) and stopping distance (\(\Phi\)) and stopping time (t) for different mass percentages (m = 100%, m = 66%, m = 33%).]
Extension zone 1, stopping distance and stopping time

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

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

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
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>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
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1](image1.png)

![Graph 2](image2.png)

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

\[ P_h (\text{m/s}) \]

\[ t (\text{kg}) \]

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

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

Extension zone 0, stopping distance and stopping time

![Graph of stopping distance and time vs. velocity](image)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
6.3 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>
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<tbody>
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<td>0</td>
<td>0.483</td>
</tr>
<tr>
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<td>0.483</td>
<td>0.967</td>
</tr>
<tr>
<td>2</td>
<td>0.967</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

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

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for IRB 1600](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

![Graph 1](attachment:graph1.png)

![Graph 2](attachment:graph2.png)

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

![Graph 1: Plot of $P_{th}$ vs. $v$ for different mass ratios (m=100%, m=66%, m=33%).]

![Graph 2: Plot of $t$ vs. $v$ for different mass ratios (m=100%, m=66%, m=33%).]
Extension zone 2, stopping distance and stopping time

[Graphs showing stopping distance and time as functions of velocity, with different mass loads represented by lines of different styles.]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

- Top graph: 
  - $P_h$ vs. $v$ for $m=100\%$, $m=66\%$, and $m=33\%$
  - $v$ is on the x-axis, $P_h$ is on the y-axis

- Bottom graph: 
  - $t$ vs. $v$ for $m=100\%$, $m=66\%$, and $m=33\%$
  - $v$ is on the x-axis, $t$ is on the y-axis
6.4 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>
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</thead>
<tbody>
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<td>38.5</td>
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<td>29.4</td>
<td>0.22</td>
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</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

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

Continues on next page
6 IRB 1600

6.4 IRB 1600 1.45 m 10 kg
Continued

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: angle (°) vs. velocity (m/s)]

![Graph 2: time (s) vs. velocity (m/s)]
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 mass percentages.](image-url)
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

Continues on next page
Extension zone 2, stopping distance and stopping time
6.5 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>
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<td>32.2</td>
<td>0.25</td>
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<tr>
<td>2</td>
<td>29.1</td>
<td>0.22</td>
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<tr>
<td>3</td>
<td>21.5</td>
<td>0.15</td>
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</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>
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<tr>
<td>1</td>
<td>0.5</td>
<td>1.0</td>
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<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
6.5 IRB 1600ID 1.5 m 4 kg

Continued
Extension zone 2, stopping distance and stopping time

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

Extension zone 0, stopping distance and stopping time

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

[Graphs showing Phi and t as functions of v for different mass loadings (m=100%, m=66%, m=33%)]
Extension zone 2, stopping distance and stopping time
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 mass percentages (m=100%, m=66%, m=33%)]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for different masses (m=100%, m=66%, m=33%) against velocity (v) in meters per second (m/s). The graphs illustrate the relationship between velocity and stopping distance (Ph) and stopping time (t) for IRB 1600 robots.]
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Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29.6</td>
<td>0.22</td>
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<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>
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</thead>
<tbody>
<tr>
<td>0</td>
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<td>0.0</td>
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<tr>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>2</td>
<td>0.0</td>
<td>max reach</td>
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</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

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

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

![Graphs showing stopping distance and stopping time for different mass loadings (m=100%, m=66%, m=33%).]
7.1 IRB 1660ID 1.55 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

\[ P(\theta) [\text{[C]}] \]

\[ t [s] \]

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

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

Continued
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

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

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

![Graph showing stopping distance and stopping time for different load masses (m=100%, m=66%, m=33%) for different speeds (v) in m/s.]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses and speeds.](image)
7.2 IRB 1660ID 1.55 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>29.5</td>
<td>0.22</td>
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<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>
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</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
7 IRB 1660

7.2 IRB 1660ID 1.55 m 6 kg

Continued

Extension zone 1, stopping distance and stopping time

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

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

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

\[
\Phi_i [\degree] \quad m=100\% \\
\Phi_i [\degree] \quad m=66\% \\
\Phi_i [\degree] \quad m=33\%
\]

\[
v [\text{m/s}] \quad 0.0 \quad 0.5 \quad 1.0 \quad 1.5 \quad 2.0 \quad 2.5 \quad 3.0 \quad 3.5 \quad 4.0
\]

\[
t [\text{s}] \quad m=100\% \\
t [\text{s}] \quad m=66\% \\
t [\text{s}] \quad m=33\%
\]

Continued
Extension zone 1, stopping distance and stopping time

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

Continued
Extension zone 2, stopping distance and stopping time

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

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

**ϕ [°]**

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

**t [s]**

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

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

![Graph 1: Plot of $P_h$ vs $v$ for different mass percentages.](image)

![Graph 2: Plot of $t$ vs $v$ for different mass percentages.](image)
Extension zone 2, stopping distance and stopping time

\[ P_h \] vs. \( v \) [m/s]

\[ t \] vs. \( v \) [m/s]

Legend:
- \( m=100\% \)
- \( m=66\% \)
- \( m=33\% \)
8 IRB 2400

8.1 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>
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<td>46.9</td>
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<tr>
<td>2</td>
<td>36.4</td>
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<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>
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<th>wcp max (m)</th>
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</thead>
<tbody>
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<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
Extension zone 2, stopping distance and stopping time

![Graph 1: Plot of $P_h$ vs. $v$]

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

![Graph 2: Plot of $t$ vs. $v$]

- $m=100\%$
- $m=66\%$
- $m=33\%$
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

![Graph showing stopping distance and time for IRB 2400 at 1.5 m and 10 kg load, with graphs for different load percentages (100%, 66%, 33%).]
Extension zone 2, stopping distance and stopping time

![Graph 1: \( P_t [°] \) vs. \( v [m/s] \)]

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

Extension zone 0, stopping distance and stopping time

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

8 IRB 2400

8.1 IRB 2400 1.5 m 10 kg

Continued
Extension zone 1, stopping distance and stopping time

![Graph 1](image1.png)

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

![Graph 1](image1)

![Graph 2](image2)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>53.2</td>
<td>0.61</td>
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<tr>
<td>2</td>
<td>36.1</td>
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</tr>
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<td>3</td>
<td>29.1</td>
<td>0.27</td>
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</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>
<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>
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</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
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%).]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

9.1 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>
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<th>Stop time (s)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>26.6</td>
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<tr>
<td>2</td>
<td>26.9</td>
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<tr>
<td>3</td>
<td>18.2</td>
<td>0.12</td>
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</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>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 0 emergency stop]

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

![Graph 1: φ(v)](image1)

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

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

- $m=100\%$
- $m=66\%$
- $m=33\%$
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 mass ratios.]

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

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

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

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 for different speeds and mass factors.]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds and load factors (m=100%, m=66%, m=33%).]
9.2 IRB 2600 1.65 m 20 kg

Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
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<tbody>
<tr>
<td>1</td>
<td>28.7</td>
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<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

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

![Graphs showing stopping distance and time vs. speed for IRB 2600 with different load factors.](image-url)

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

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

![Graph showing stopping distance and stopping time for IRB 2600 with different mass ratios (m=100%, m=66%, m=33%)](image)

- **Graph 1**: Plot of \( P_h \) [°C] against \( v \) [m/s]
- **Graph 2**: Plot of \( t \) [s] against \( v \) [m/s]

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

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

\[ P_{h} [\text{m}] \]

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

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

- \( m = 100\% \)
- \( m = 66\% \)
- \( m = 33\% \)
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>30.3</td>
<td>0.25</td>
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<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>
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<tbody>
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<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
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

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

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

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

![Graph of stopping time vs. velocity](image2)
9 IRB 2600

9.3 IRB 2600 1.85 m 12 kg

Continued

Extension zone 2, stopping distance and stopping time

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

Extension zone 0, stopping distance and stopping time

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

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

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

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

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 masses (m=100%, m=66%, m=33%) and velocities (v) for IRB 2600ID 1.85 m 15 kg.]

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

\[ P_h \] vs \[ v \] [m/s]

\[ t \] vs \[ v \] [m/s]

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

\[
\begin{align*}
\text{Ph} [\text{°}] \quad & \text{for } \text{v} [\text{m/s}] \\
\text{t} [\text{s}] \quad & \text{for } \text{v} [\text{m/s}]
\end{align*}
\]

- Red line: \( m = 100\% \)
- Green line: \( m = 66\% \)
- Blue line: \( m = 33\% \)
9 IRB 2600

9.4 IRB 2600ID 1.85 m 15 kg

Continued

Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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Continues on next page

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

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Extension zone 1, stopping distance and stopping time

![Graph 1: Relationship between v [m/s] and P[t [°]]

![Graph 2: Relationship between v [m/s] and t [s]]

Continued
9 IRB 2600

9.4 IRB 2600ID 1.85 m 15 kg

Continued

Extension zone 2, stopping distance and stopping time
9.5 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

![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: Phi vs. v](image1)

![Graph 2: t vs. v](image2)
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time against velocity for different mass values.]

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

![Graph showing stopping distance and time for IRB 2600 ID 2.00 m 8 kg]

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1](image1.png)

![Graph 2](image2.png)
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 1]

![Graph 2]
This page is intentionally left blank
10 IRB 4400

10.1 IRB 4400 1.95 m 45 kg

Category 0

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

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

Category 1, extension zones

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

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcpx min (m)</th>
<th>wcpx 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

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

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 for different masses and velocities.](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

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]

- $P_d [^\circ C]$ vs $v [m/s]$ for $m = 100\%$, $m = 66\%$, and $m = 33\%$
- $t [s]$ vs $v [m/s]$ for $m = 100\%$, $m = 66\%$, and $m = 33\%$
10.2 IRB 4400 1.95 m 60 kg

Category 0

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

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

Category 1, extension zones

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

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

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

Extension zone 0, stopping distance and stopping time

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Continues on next page
10 IRB 4400

10.2 IRB 4400 1.95 m 60 kg

Continued

Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times](image-url)

Continues on next page
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

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

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%) for various speeds (0.0 to 2.0 m/s).]
10.3 IRB 4400 2.6 m 10 kg

Category 0

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

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

Category 1, extension zones

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

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

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

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

**IRB 4400**

**10.3 IRB 4400 2.6 m 10 kg**

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

![Graph 1](image1)

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

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

- $P_{hi} \ [\text{m}]$ for different masses ($m=100\%, m=66\%, m=33\%$)
- $t \ [\text{s}]$ for different masses ($m=100\%, m=66\%, m=33\%$)

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

Continued
Extension zone 1, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Extension zone 2, stopping distance and stopping time
11 IRB 4600

11.1 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 stopping time for IRB 4600](image)

Continues on next page
11 IRB 4600

11.1 IRB 4600 2.05 m 45 kg

Continued

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

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

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

![Graph showing stopping distance and stopping time for different mass percentages (m=100%, m=66%, m=33%) against velocity (v) in meters per second (m/s).]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

![Graph showing stopping distance and time for different mass percentages](image-url)
**Category 0**

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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

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

![Graphs showing 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]

![Graph 2: t vs. v]
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 showing stopping distance and stopping time vs. velocity](image-url)
Extension zone 1, stopping distance and stopping time

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

Graph 1: $P_H$ [°]

Graph 2: $t$ [s]
11.3 IRB 4600 2.50 m 20 kg

Category 0

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

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

Category 1, extension zones

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

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 of Phi vs. v (m/s)]

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

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

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

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

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

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

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

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

Extension zone 0, stopping distance and stopping time

---

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

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

- Top graph: $P_{th}$ vs. $v$ for different mass percentages ($m=100\%$, $m=66\%$, $m=33\%$).
- Bottom graph: $t$ vs. $v$ for the same mass percentages.
Extension zone 2, stopping distance and stopping time

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

- $P_h [^\circ]$ vs. $v [\text{m/s}]$
- $t [\text{s}]$ vs. $v [\text{m/s}]$

Legend:
- $m=100\%$
- $m=66\%$
- $m=33\%$
11.4 IRB 4600

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
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

![Graph](image1)

![Graph](image2)

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

![Graphs showing stopping distances and times for different load scenarios (m=100%, m=66%, m=33%) for IRB 4600 at 2.55 m 40 kg.]

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

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

![Graph showing stopping distance and time vs. speed for IRB 4600]
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

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 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 load masses (m=100%, m=66%, m=33%) as a function of velocity (v) in meters per second (m/s)].

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

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

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

Extension zone 0, stopping distance and stopping time

![Graph 1: Stopping distance vs. velocity for different mass ratios](image1)

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

![Graph showing stopping distance and time against velocity]

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

- Graph 2: t [s] vs. v [m/s]
  - m=100%
  - m=66%
  - m=33%
This page is intentionally left blank
13 IRB 6650
13.1 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

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

\[ P_h \text{ [°]} \]

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

\[ m = 100\% \]
\[ m = 66\% \]
\[ m = 33\% \]
Category 1, Axis 2
Extension zone 0, stopping distance and stopping time

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

![Diagram showing stopping distance and time for different masses (m=100%, m=66%, m=33%) as a function of velocity (v) for IRB 6650S 3.00 m 200 kg.](image-url)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for IRB 6650S 3.00 m 200 kg](image)

Continues on next page
Category 1, Axis 3

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

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Continues on next page
Extension zone 2, stopping distance and stopping time
13.2 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

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

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

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Continued on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

[Graphs showing stopping distances and times for different speeds and mass fractions]
Extension zone 1, stopping distance and stopping time

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

![Graph of stopping distance and stopping time vs. velocity for different mass loads (m=100%, m=66%, m=33%).]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

Continued
Extension zone 1, 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 speed (v [m/s]).]
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different speeds and load factors.

- Top graph: Ph [°] vs. v [m/s]
  - m=100%
  - m=66%
  - m=33%
- Bottom graph: t [s] vs. v [m/s]
  - m=100%
  - m=66%
  - m=33%]
13.3 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

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

Continued 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 1: Ph vs. v (m/s)]

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

Continued
Extension zone 2, stopping distance and stopping time

### Graphs

#### Upper Graph

- $P_{th}$ [°C]
- $v$ [m/s]
- Lines for $m=100\%$, $m=66\%$, and $m=33\%$

#### Lower Graph

- $t$ [s]
- $v$ [m/s]
- Lines for $m=100\%$, $m=66\%$, and $m=33\%$
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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
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 load masses.]

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 1](image1)

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

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

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

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

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

![Graph showing stopping distance and time for different masses and velocites.](image-url)
13.5 IRB 6650S LeanID 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

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
Extension zone 1, stopping distance and stopping time

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

![Graph](image1.png)

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

![Graph showing stopping distance and time vs. speed for IRB 6650 robot](image1)

![Graph showing stopping distance and time vs. speed for IRB 6650 robot](image2)

Continued
Extension zone 2, stopping distance and stopping time

Graph 1: $P_{st}$ vs. $v$
- $m=100\%$
- $m=66\%$
- $m=33\%$

Graph 2: $t_{st}$ vs. $v$
- $m=100\%$
- $m=66\%$
- $m=33\%$
This page is intentionally left blank
Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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

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 depicting stopping distances and times for IRB 6660 robot.](image)

Continued
Category 1, Axis 2

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

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

Continued
Extension zone 2, stopping distance and stopping time

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

![Graph 2: Stopping time (t) vs. velocity (v)](image2)
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 distance and time vs. velocity 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>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

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

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

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

[Graphs showing stopping distance (P) and stopping time (t) vs. velocity (v) for different load factors (m = 100%, m = 66%, m = 33%)]
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

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

- **$P_m [^\circ C]$** vs. **$v [m/s]$**
  - $m=100\%$
  - $m=66\%$
  - $m=33\%$

- **$t [s]$** vs. **$v [m/s]$**
  - $m=100\%$
  - $m=66\%$
  - $m=33\%$

Continued
Extension zone 2, stopping distance and stopping time
14.3 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 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

![Graphs showing Ph and t as functions of v for different mass percentages](image)

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

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

---

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different mass conditions (m=100%, m=66%, m=33%) for varying speeds (v) in meters per second (m/s).]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances for different mass ratios (m=100%, m=66%, m=33%) with respect to velocity (v) in meters per second (m/s)].

- Top graph: Stopping distance $P_h$ against velocity $v$.
- Bottom graph: Stopping time $t$ against velocity $v$.

Continued
Extension zone 2, stopping distance and stopping time

![Graphs showing stopping distance and time for different masses (m=100%, m=66%, m=33%) as functions of velocity (v) in m/s.](image)
This page is intentionally left blank
15 IRB 6700

15.1 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
Extension zone 2, stopping distance and stopping time

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

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

Continued on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

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

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

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

![Graph 2: Plot of $t$ vs. $v$](image2)
15.2 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
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Graph 1: $P_h$ vs. $v$ [m/s]

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

$m=100\%$, $m=66\%$, $m=33\%$
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 against velocity for different mass fractions (m = 100%, m = 66%, m = 33%).]
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time vs. speed for different mass ratios.](image)
Category 1, Axis 3
Extension zone 0, stopping distance and stopping time

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

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

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

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

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

- For $m=100\%$, the stopping distance and time increase sharply with speed.
- For $m=66\%$ and $m=33\%$, the curves are less steep, indicating a reduced impact of speed on stopping distance and time.

---

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15.3 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

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

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

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

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

![Graph showing stopping distance and time vs. speed for different load masses: m=100%, m=66%, m=33%]

Continued
Extension zone 2, stopping distance and stopping time

**Graphs**

- Top graph: \( \Phi \) vs. \( v \) for different values of \( m \) (100%, 66%, 33%)
- Bottom graph: \( t \) vs. \( v \) for different values of \( m \) (100%, 66%, 33%)
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]

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

![Graph showing stopping distance and time vs. speed with different mass percentages.](image1)

![Graph showing another relationship between speed and stopping time.](image2)
Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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
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 stopping time for different mass percentages.]
Extension zone 2, stopping distance and stopping time

![Graph of stopping distance and time vs. speed](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%).]
Extension zone 1, stopping distance and stopping time

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

![Graphs showing stopping distance and time for different speeds and mass percentages.](image-url)
15.5 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>
</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

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

---

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

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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

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

\[ P_h \] [°]
\[ v \] [m/s]
\[ m=100\% \]
\[ m=66\% \]
\[ m=33\% \]

\[ t \] [s]
\[ v \] [m/s]
\[ m=100\% \]
\[ m=66\% \]
\[ m=33\% \]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time vs. velocity for different mass ratios (m=100%, m=66%, m=33%)]
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time
15.6 IRB 6700 3.00 m 245 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>38.8</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>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.989</td>
</tr>
<tr>
<td>1</td>
<td>0.989</td>
<td>1.978</td>
</tr>
<tr>
<td>2</td>
<td>1.978</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

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 against speed for different load conditions.]

Continues on next page
Category 1, Axis 2

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

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

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

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

![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
Extension zone 1, stopping distance and stopping time

\[
\begin{align*}
\text{Pr} [\text{m}] & \quad \text{v [m/s]} \\
0 & \quad 0.0 \\
5 & \quad 0.5 \\
10 & \quad 1.0 \\
15 & \quad 1.5 \\
20 & \quad 2.0 \\
25 & \quad 2.5 \\
30 & \quad 3.0 \\
\end{align*}
\]

\[
\begin{align*}
\text{t [s]} & \quad \text{v [m/s]} \\
0 & \quad 0.0 \\
0.1 & \quad 0.5 \\
0.2 & \quad 1.0 \\
0.3 & \quad 1.5 \\
0.4 & \quad 2.0 \\
0.5 & \quad 2.5 \\
0.6 & \quad 3.0 \\
\end{align*}
\]
Extension zone 2, stopping distance and stopping time

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

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

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

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

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

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 of stopping distances and times for different masses (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 as a function of velocity](image)

- **Graph 1:** Plot of $P_t$ vs. $v$ for different values of $m$.
  - Red line: $m=100\%$
  - Green line: $m=66\%$
  - Blue line: $m=33\%$

- **Graph 2:** Plot of $t$ vs. $v$ for different values of $m$.
  - Red line: $m=100\%$
  - Green line: $m=66\%$
  - Blue line: $m=33\%$
15.8 IRB 6700 3.20 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>41.7</td>
<td>0.75</td>
</tr>
<tr>
<td>2</td>
<td>21.3</td>
<td>0.39</td>
</tr>
<tr>
<td>3</td>
<td>15.7</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Category 1, extension zones

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

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

Extension zone 0, stopping distance and stopping time

Continued
Extension zone 1, stopping distance and stopping time
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

![Graphs showing stopping distance and stopping time for different mass ratios (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

![Graph 1: v vs. PHI for different mass ratios](image)

![Graph 2: v vs. t for different mass ratios](image)
Extension zone 2, stopping distance and stopping time
15.9 IRB 6700

**Category 0**

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33.1</td>
<td>0.58</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

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

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 IRB 6700](image)

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

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

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

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

*Continued on next page*
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

Continued
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 speed (v) in m/s. The graphs are labeled Ph (°) and t (s).]
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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
Extension zone 2, stopping distance and stopping time

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

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
Extension zone 2, stopping distance and stopping time

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

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

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

Extension zone 0, stopping distance and stopping time

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

![Graphs showing stopping distance and time vs. velocity for different load factors m]
Extension zone 2, stopping distance and stopping time
15.11 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

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)

![Graph 2](image2)
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)

Continued on next page
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

---

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
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

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
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

![Graph 1](image1)

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

![Graph 1: STOP DISTANCE P (°) vs. V (m/s)]

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

![Graph 2: STOP TIME t (s) vs. V (m/s)]

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

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

![Graph showing stopping distances and times](image)

- **Extension Zone 2**
- **Stopping Distance**
- **Stopping Time**

*Continued*
15.13 IRB 6700LeanID 2.60 m 175 kg

Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36.6</td>
<td>0.58</td>
</tr>
<tr>
<td>2</td>
<td>24.4</td>
<td>0.34</td>
</tr>
<tr>
<td>3</td>
<td>15.7</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 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
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](image)

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

![Graph 1: Plot of $P_{hi}$ vs. $v$ for different $m$ values.]

![Graph 2: Plot of $t$ vs. $v$ for different $m$ values.]

Continued
Extension zone 2, stopping distance and stopping time

Graphs showing the relationship between speed (v [m/s]) and two different variables (Pₜ [°] and t [s]) for different load factors (m = 100%, m = 66%, and m = 33%).
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

![Graph 1](image)

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

![Graph showing stopping distance and time vs. speed for different mass ratios m=100%, m=66%, and m=33% with speed v in m/s and stopping distance Ph in °C and time t in s.](image-url)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph of stopping distances and times](image)

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

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

![Graph of extension zone 2, stopping distance and stopping time](image-url)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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

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 versus speed]

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

- Ph [°C]
- t [s]

Graphs showing stopping distance and time for different masses (m) at various speeds (v).
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 ratios.](Image)
Extension zone 1, stopping distance and stopping time

[Graph of stopping distance and time as functions of speed]

Continued
Extension zone 2, stopping distance and stopping time

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

- \( P_h [\text{°}] \)
- \( t [\text{s}] \)
- \( v [\text{m/s}] \)

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

3HAC048645-001 Revision: AC
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

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

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

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

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

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

- $P_h$ [°] vs. $v$ [m/s]
- $t$ [s] vs. $v$ [m/s]

- $m=100\%$
- $m=66\%$
- $m=33\%$
15.17 IRB 6700LeanID 2.85 m 140 kg

Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.9</td>
<td>0.61</td>
</tr>
<tr>
<td>2</td>
<td>25.0</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>17.7</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

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

<table>
<thead>
<tr>
<th>Zone</th>
<th>wcp min (m)</th>
<th>wcp max (m)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0</td>
<td>0.949</td>
</tr>
<tr>
<td>1</td>
<td>0.949</td>
<td>1.898</td>
</tr>
<tr>
<td>2</td>
<td>1.898</td>
<td>max reach</td>
</tr>
</tbody>
</table>

Category 1, Axis 1

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for category 0 emergency stop at max speed.](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 stopping time for different mass ratios.](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

![Graph 1: Plot of \( P_h \) vs. \( v \)]

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

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

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

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

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time as functions of velocity for different masses.]

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 masses (m=100%, m=66%, m=33%) at various speeds (v) in meters per second (m/s). The graphs depict the relationship between velocity and the two variables, with curves for each mass percentage.]
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>
</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

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 distances and times for different mass loads](image-url)
Extension zone 1, stopping distance and stopping time

![Graphs showing stopping distances and times for different masses (m) at various speeds (v)].

Continued
Extension zone 2, stopping distance and stopping time

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Continued on next page

Product specification - Robot stopping distances according to ISO 10218-1
3HAC048645-001 Revision: AC
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Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

Continued
Extension zone 1, stopping distance and stopping time

[Graphs showing stopping distances and times for different speeds and mass percentages (m=100%, m=66%, m=33%)]

Continued
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and stopping time for various speeds and weight factors (m=100%, m=66%, m=33%) for different velocities (v [m/s]).]
15.19 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. velocity for different percentage values.]

Continues on next page...
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

Continued
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different masses (m=100%, m=66%, m=33%) as a function of velocity (v) in m/s. The graphs display the relationship between velocity and stopping distance, with stopping time also indicated.]
Extension zone 2, stopping distance and stopping time

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

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distances and times for different mass ratios (m=100%, m=66%, m=33%) with varying velocities (v) from 0 to 3 m/s.]

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

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

Continued
Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.6</td>
<td>0.73</td>
</tr>
<tr>
<td>2</td>
<td>20.9</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.7</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 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
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](image)

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

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

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

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

- 
- 

Continued on next page
Category 1, Axis 3

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

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

- Continues on next page
Extension zone 2, stopping distance and stopping time
16 IRB 6790

16.1 IRB 6790 2.65 m 235 kg

Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38.2</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>20.3</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>14.4</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

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

[Graph]

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]

- Graph shows the relationship between velocity (v [m/s]) and stopping distance (P(t) [m]) or stopping time (t [s]) for different mass factors (m=100%, m=66%, m=33%).

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

Continued
Extension zone 1, stopping distance and stopping time

![Graph 1](image1)

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

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

Continued...
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different load factors (m=100%, m=66%, m=33%) as functions of velocity (v [m/s]).]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages (m=100%, m=66%, m=33%) for various speeds (v) in meters per second (m/s). The graphs display the relationship between speed and the parameters P̄h and t, where P̄h is the average stopping distance and t is the stopping time.]
Extension zone 2, stopping distance and stopping time

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

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

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

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

![Graph showing stopping distance and time for different speeds and masses](image-url)
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 (m=100%, m=66%, m=33%) as a function of speed (v) in m/s. The graphs display the relationship between angle of movement (θ) and time (t) for various speeds.](image)
17 IRB 7600

17.1 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>
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<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

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

![Graph 1: Plot of \( P_h \) vs. \( v \)]

\[ P_h \text{ [°]} \]

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

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

Graphs showing stopping distance (\( \Phi \)) and stopping time (\( t \)) as functions of velocity (\( v \)).

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

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

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

Continued
Category 1, Axis 3

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

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

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1](image1.png)

![Graph 2](image2.png)
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

![Graphs showing stopping distance and stopping time for different load conditions (m=100%, m=66%, m=33%)]

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

![Graph showing the relationship between stopping time (t) and speed (v)](image)

![Graph showing the relationship between stopping distance (Ph) and speed (v)](image)
Extension zone 2, stopping distance and stopping time

![Graph 1](image1)

![Graph 2](image2)
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

[Graphs showing stopping distances and times for different speeds and load conditions]
Extension zone 1, stopping distance and stopping time

![Graph 1](image1.png)

![Graph 2](image2.png)
Extension zone 2, stopping distance and stopping time
17.3 IRB 7600 2.80 m 340 kg

Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum 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
Extension zone 2, stopping distance and stopping time

Continues on next page
Category 1, Axis 2

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

**Graph 1:**
- **Axes:** $v$ [m/s] vs. $\Phi_i$ [°]
- **Lines:**
  - Red: $m=100\%$
  - Green: $m=66\%$
  - Blue: $m=33\%$

**Graph 2:**
- **Axes:** $v$ [m/s] vs. $t$ [s]
- **Lines:**
  - Red: $m=100\%$
  - Green: $m=66\%$
  - Blue: $m=33\%$

*Continued 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%) for various velocities (v in m/s).]
Category 1, Axis 3

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

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

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

Legend:
- m=100%
- m=66%
- m=33%
17.4 IRB 7600 3.05 m 325 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>33.0</td>
<td>0.78</td>
</tr>
<tr>
<td>2</td>
<td>9.0</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>8.4</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Category 1, extension zones

For definitions of the zones, see Extension zones for articulated robots on page 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
Category 1, Axis 2

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

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

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

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

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and time for different speeds and loads.](image-url)
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

\[
\begin{align*}
\text{Extension zone 2, stopping distance and stopping time}\\
\text{(Graphs showing stopping distances and times for different masses.)}\\
\end{align*}
\]
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

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

Continues on next page
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

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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)
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 mass loadings.](image-url)

Continued
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

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

Continued
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graph showing stopping distance and stopping time for different mass load percentages (m=100%, m=66%, m=33%) as a function of velocity (v) in meters per second (m/s). The graphs depict increasing distance (\(\Phi\)) and time (\(t\)) with increasing velocity.]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distances and times for different load conditions.](image)

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

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

![Graph 2: \( t [\text{s}] \) vs. \( v [\text{m/s}] \)]
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

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

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

Continued
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

\[ \text{Extension zone 2, stopping distance and stopping time} \]

\[ \text{Continued} \]

\[ \text{Continues on next page} \]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

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

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

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

Continued
Extension zone 2, stopping distance and stopping time

![Graph 1: Phi vs. v with linear increase for different masses](image1)

![Graph 2: t vs. v with linear increase for different masses](image2)
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load. All results are from tests on one moving axis.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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>

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>

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

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

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

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

Continues on next page
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

---

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

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

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

![Graphs showing stopping distance and stopping time for different masses](image-url)
18 IRB 8700

18.1 IRB 8700 3.50 m 800 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>1.31</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

[Diagram of stopping distance and 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](image)

Continued on next page
Category 1, Axis 2

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

\[ \text{Diagram showing stopping distance and time as functions of speed for different masses.} \]
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 stopping time as functions of velocity for different mass percentages (m=100%, m=66%, m=33%).]
Extension zone 2, stopping distance and stopping time

Graphs showing stopping distance and stopping time for different load conditions.
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
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 conditions.](image-url)
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

Graph 1: Phi (°) vs. v [m/s]
- m=100%
- m=66%
- m=33%

Graph 2: t [s] vs. v [m/s]
- m=100%
- m=66%
- m=33%
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 stopping time for IRB 8700 robot.](image-url)
Extension zone 1, stopping distance and stopping time

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

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

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

$v$ [m/s] vs. $\Delta t$ [s] and $\Delta x$ [m]
18.3 IRB 8700LeanID 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
Extension zone 1, stopping distance and stopping time
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distances and times for different load conditions.](image)

Continued
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

Continued
Extension zone 1, stopping distance and stopping time

Graph 1: Variation of $\Phi_h$ with $v$ for different mass ratios ($m=100\%, m=66\%, m=33\%$)

Graph 2: Variation of $t$ with $v$ for different mass ratios ($m=100\%, m=66\%, m=33\%$)

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

Extension zone 0, stopping distance and stopping time

![Graph showing extension zone 0, stopping distance and stopping time for m=100%, m=66%, and m=33%]

Continued
Extension zone 1, stopping distance and stopping time

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

- **Chart 1:**
  - $\Phi_h$ vs. $v$ (m/s)
  - Lines represent:
    - $m=100\%$
    - $m=66\%$
    - $m=33\%$

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44.4</td>
<td>1.26</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

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

![Graphs showing stopping distance and time versus velocity for different mass fractions.](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

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

- \( \Phi \) for different mass ratios:
  - \( m = 100\% \)
  - \( m = 66\% \)
  - \( m = 33\% \)

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

- \( t \) for different mass ratios:
  - \( m = 100\% \)
  - \( m = 66\% \)
  - \( m = 33\% \)
Extension zone 2, stopping distance and stopping time
Category 1, Axis 3
Extension zone 0, stopping distance and stopping time

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

![Graph showing stopping distance and stopping time for IRB 8700]

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

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

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

$v$ [m/s] on the x-axis and $P$ [°] on the y-axis for the first graph.

$t$ [s] on the y-axis and $v$ [m/s] on the x-axis for the second graph.
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 showing stopping distance and time for category 0](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 for different speeds and mass percentages.]

Continues on next page
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

---

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

![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. The graphs display the relationship between velocity and stopping distance or time for IRB 460 2.4 m 110 kg.]
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%) with velocity (v) in m/s on the x-axis and stopping distance or time (t) in s on the y-axis.](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

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

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

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

![Graph showing stopping distance and time for category 0 emergency stop]
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](image)

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

Continued
Category 1, Axis 2

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

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

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

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

Extension zone 0, stopping distance and stopping time

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

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

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

![Graph of stopping distance vs. velocity]

![Graph of stopping time vs. velocity]

Continued
Extension zone 2, stopping distance and stopping time

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

- **Graph 1:** \( P_h \) [\(^{\circ}\)] 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 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
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 mass fractions (m=100%, m=66%, m=33%).]
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

![Diagram showing stopping distance and stopping time for different mass values (100%, 66%, 33%).](image)
Extension zone 2, stopping distance and stopping time

![Graph showing stopping distance and time for IRB 660 robot with different mass loadings.](image-url)
Category 1, Axis 3

Extension zone 0, 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 in 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. speed](image)

- Extension zone 2
- Stopping distance
- Stopping time
- Graph showing different scenarios for stopping (m=100%, m=66%, m=33%)

continued
Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.7</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

![Graph showing stopping distance and stopping time for different velocities and mass values for Axis A1.](image)
Extension zone 1, stopping distance and stopping time

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

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

![Graph showing stopping distance and stopping time for different mass loads (m=100%, m=66%, m=33%).]
Extension zone 2, stopping distance and stopping time
Category 1, Axis A3

Extension zone 0, stopping distance and stopping time

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

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

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

![Graphs showing stopping distance and stopping time for different load conditions.](image-url)
Category 0

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Distance (degrees)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.2</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
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](image)

*Continued on next page*
Category 1, Axis 2

Extension zone 0, stopping distance and stopping time

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

![Graphs of extension zone 2 showing stopping distance and time vs. velocity for different masses (100%, 66%, 33%)]
Category 1, Axis 3

Extension zone 0, stopping distance and stopping time

![Graphs showing stopping distance and time for different load factors (m=100%, m=66%, m=33%) with varying speeds (0.00 to 2.00 m/s).]
Extension zone 1, stopping distance and stopping time

![Graph showing stopping distance and time for IRB 760](image)

Continued
Extension zone 2, stopping distance and stopping time
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<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

Continues on next page
Category 1, 3AXES

Stopping distance and stopping time
22.2 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

Continues on next page
Category 1, Wash Down

Stopping distance and stopping time

Continues on next page
Category 1, 3AXES

Stopping distance and stopping time
Category 1, Stainless

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>0.65</td>
<td>0.21</td>
</tr>
<tr>
<td>Wash down</td>
<td>0.65</td>
<td>0.21</td>
</tr>
<tr>
<td>3AXES</td>
<td>0.62</td>
<td>0.20</td>
</tr>
<tr>
<td>Stainless</td>
<td>0.64</td>
<td>0.22</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

Continues on next page

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

22 IRB 360

22.3 IRB 360 1.13 m 3 kg

Continued
Category 1, Wash Down

Stopping distance and stopping time
Category 1, 3AXES

Stopping distance and stopping time

```
360_1.13_3_3AXES-11
```

```
360_1._13._3_3AXES-11
```

Continues on next page
Category 1, Stainless

Stopping distance and stopping time
The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.65</td>
<td>0.33</td>
</tr>
</tbody>
</table>
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>0.90</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Continues on next page
Category 1, Standard

Stopping distance and stopping time

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

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.93</td>
<td>0.36</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

[Graph showing stopping distance and stopping time for different mass percentages.]
23 IRB 365

23.1 IRB 365 0.8 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>0.55</td>
<td>0.25</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

![Graph showing stopping distance and time for different mass percentages.](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>0.41</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Continues on next page
Category 1, Standard

Stopping distance and stopping time

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

Continues on next page
Category 1, Standard

Stopping distance and stopping time

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

IRB 390 1.3 m 10 kg

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

IRB 390 1.3 m 10 kg

Graph showing the relationship between stopping time and velocity for different mass percentages (m = 33%, m = 66%, m = 100%).
### Category 0

The following table describes the stopping distance and time for category 0 emergency stop at max speed, with the arm stretched out to the maximum with maximum load.

<table>
<thead>
<tr>
<th>Protection type/variant</th>
<th>Distance (meters)</th>
<th>Stop time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.72</td>
<td>0.28</td>
</tr>
</tbody>
</table>
Category 1, Standard

Stopping distance and stopping time

---

**Graph 1:**

- **Title:** IRB 390 1.3 m 15 kg
- **Graph Description:**
  - X-axis: Velocity [m/s]
  - Y-axis: Stop distance [m]
  - Lines represent different mass percentages:
    - m = 33%
    - m = 66%
    - m = 100%

**Graph 2:**

- **Title:** IRB 390 1.3 m 15 kg
- **Graph Description:**
  - X-axis: Velocity [m/s]
  - Y-axis: Stop time [s]
  - Lines represent different mass percentages:
    - m = 33%
    - m = 66%
    - m = 100%
Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

Continues on next page
Category 1, ARM

Stopping distance and stopping time

Continued
Category 1, PLATE

Stopping distance and stopping time

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

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

续前页...
25.2 A500_D1000

Category 0, ARM

Stopping distance and stopping time

Continues on next page
Category 0, PLATE

Stopping distance and stopping time

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Continues on next page
Category 1, ARM

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different conditions.](image)
25.3 A500_D1450

Category 0, ARM

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time
Category 1, ARM

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distances and times for different speeds and distances.](image-url)
25.4 A750_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

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

Continued
Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for A750_D1000 PLATE.](image)
Category 0, ARM

Stopping distance and stopping time
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](image1)

![Diagram](image2)
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

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Category 1, INTERCH

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

![Diagram showing stopping distance and time for different speeds and categories.](image-url)
26.2 B500_D1450

Category 0, INTERCH

Stopping distance and stopping time

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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

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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, ARM

Stopping distance and stopping time
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, ARM

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

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

![Graph showing another parameter vs. speed.](image2)
Category 0, INTERCH

Stopping distance and stopping time

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Category 1, INTERCH

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for different speeds.](image)
27.2 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 time for C1000 IRBP C category 1)](image-url)
Category 0, INTERCH

Stopping distance and stopping time

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Category 0, ARM

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

![Graph 1](image1.png)

![Graph 2](image2.png)

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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

![Graph showing stopping distance and stopping time]

![Graph showing angular speed]
28.2 D300_L1600_D1000

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

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Category 1, INTERCH

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, INTERCH

Stopping distance and stopping time

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Category 0, ARM

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

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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
28.4 D600_L1600_D1200

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, ARM

Stopping distance and stopping time

![Graph 1: Stopping distance vs. angular speed]

![Graph 2: Stopping time vs. angular speed]
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, ARM

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Category 1, PLATE

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Category 0, ARM
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Category 1, INTERCH

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Category 1, ARM

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

![Graphs showing stopping distance and stopping time for different speeds and load conditions.](D600_L2000_D1000 PLATE)
Category 0, INTERCH

Stopping distance and stopping time

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Category 0, ARM

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

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Category 1, INTERCH

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Category 1, ARM

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Category 1, PLATE

Stopping distance and stopping time

![Graph showing stopping distance and stopping time for D600_L2000_D1200](image)

![Graph showing stopping distance and stopping time for D600_L2000_D1200](image)
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

![Graphs showing stopping distance and time for different speeds.](image-url)
29.2 K1000_D1400

Category 0, INTERCH

Stopping distance and stopping time

![Graph showing stopping distances and times for K1000_D1400]

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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
Category 0, INTERCH

Stopping distance and stopping time

- Graph 1: Stopping distance [m] vs. Approach speed [m/s]
- Graph 2: Stopping time [s] vs. Approach speed [m/s]
Category 0, PLATE

Stopping distance and stopping time
Category 1, INTERCH

Stopping distance and stopping time
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

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Category 1, INTERCH

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

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

![Graph showing stopping distances for different categories of robots.](image-url)
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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

![Graph 1](image1)

![Graph 2](image2)
Category 0, PLATE

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time
30.2 L2000

Category 0, PLATE

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time

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

3HAC048645-001 Revision: AC

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30.3 L300

Category 0, PLATE

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
30.4 L5000

Category 0, PLATE

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

![Graph of stopping distance and stopping time for L5000-PLATE]

![Graph of angular speed versus angular position for L5000-PLATE]
30.5 L600

Category 0, PLATE

Stopping distance and stopping time

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Category 1, PLATE

Stopping distance and stopping time

[Diagram of stopping distance and stopping time for IRBP L600]

[Diagram showing the relationship between speed and stopping distance for different mass values]
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Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

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Category 1, INTERCH

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
Category 0, INTERCH

Stopping distance and stopping time
Category 0, PLATE

Stopping distance and stopping time

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Category 1, INTERCH

Stopping distance and stopping time
Category 1, PLATE

Stopping distance and stopping time
31.3 R1000_L2000_D1000

Category 0, INTERCH

Stopping distance and stopping time
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
31.4 R1000_L2000_D1200

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

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

Stopping distance and stopping time

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Continued
Category 1, INTERCH

Stopping distance and stopping time

![Graph of stopping distance vs. velocity for different categories of robots.](image-url)
Category 1, PLATE

Stopping distance and stopping time
31.6 R300_L1600_D1000

Category 0, INTERCH

Stopping distance and stopping time
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
31.7 R600_L1600_D1000

Category 0, INTERCH

Stopping distance and stopping time

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Category 0, PLATE

Stopping distance and stopping time

[Graphs of stopping distance and stopping time for different speeds and distances.]
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 various speeds and distances.]

![Graph showing another perspective of stopping distance and time.]

31 IRBP R
31.7 R600_L1600_D1000

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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

![Graph 1](image1)

![Graph 2](image2)
31.9 R600_L2000_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

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Category 1, PLATE

Stopping distance and stopping time

![Graph: Stopping distance and stopping time](image1)

![Graph: Stopping distance and stopping time](image2)
Category 0, INTERCH

Stopping distance and stopping time

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Stopping distance and stopping time

Category 0, PLATE

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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 showing stopping distance and time for different speeds.](image)

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