* KUKA KR10 series comparion|:

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Robot Company:

Kuka

ABB

Yaskawa

<https://www.motoman.com/en-us/applications/handling>

Universal Robot

<https://www.universal-robots.com/products/ur20-robot/>

JAKA Robot

<https://www.jakarobotics.com/robotic-arms/?gad_source=1&gclid=CjwKCAiAjfyqBhAsEiwA-UdzJBtVpIOL_olDC7WlnygmYD2cz7XoCGfHcxRfk11Cx-ChslNe8Ov4ORoCEQQQAvD_BwE>

Kawasaki

<https://kawasakirobotics.com/applications/material-handling/#:~:text=Robots%20for%20Material%20Handling%20General,1500%20kg%20payload>

Picture for palletizing

A machine with a purple and black arm

Description automatically generated

A robot arm holding boxes

Description automatically generated

# https://www.mokosmart.com/rtls-technologies/

# A table with text on it Description automatically generated

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# 

# Application of Industrial and or Collaborative Robots (Cobots) in Acrylic Bathtub Manufacturing

how the selected robots should be applied to the following processes? what type of commercially available / special purpose robot and end-effectors need to be used or developed?

### Bathtubs Examples:

<https://www.saturn.co.kr/166>

[DARWIN.pdf](https://drive.google.com/file/d/1JPOTZvC4oEBvfbUe9LJU3Y6oY2_Fl76Z/view)

Loading of acrylic sheets into vacuum thermoforming machine:

### How does a Thermal Forming Machine work?

[Vacuum/Thermal Forming Explained](https://www.youtube.com/watch?v=HWX_XxS4zY8)

<https://www.youtube.com/watch?v=wTX0LvewPSI>

https://shzhanshi.en.made-in-china.com/product/lEPYadebqJRz/China-Zs-2520-Manual-Feeding-Thick-Gauge-Thermoforming-Machine-for-Pallet-Luggage-Light-Box-Refrigerator-Bathtub-Appliance-Shell-Lampshade-Turnover-Box.html

Acrylic sheets 5kg

Acrylic Bathtub:75lbs = 34 kg

Selected robots: Articulated Arm Robots / Gantry Robot / Cobot

End-effectors: Vacuum Grippers/ Suction cup

### Robot finding Tools:

FANUC:

<https://www.fanucamerica.com/products/robots/robot-finder-tool>

ABB:

<https://new.abb.com/products/robotics/robots/articulated-robots>

KUKA:

https://www.kuka.com/en-us/products/robotics-systems/industrial-robots

ABB prices:

https://webshop.robotics.abb.com/ca/

### Cobots for loading:

SWIFTI™ CRB 1300

<https://library.e.abb.com/public/6d9d4922a58b4614a799dd22ff1eebb1/SWIFTI_CRB1300-datasheet_.pdf?x-sign=qRJwSLmhjxtyDWnr2N/3AzmM2h9Jl1x4JthBA4LPUWUpz12NO6ctfdrSncQ6GBtx>

KUKA iiwa 14 R820

https://www.kuka.com/-/media/kuka-downloads/imported/8350ff3ca11642998dbdc81dcc2ed44c/0000246833\_en.pdf?rev=1e0b5bbd9e81463ebd57d1468f37b390&hash=1ECF3CD7CF543374A7BF4D802AAED2BF

### 

Controller:

<https://www.kuka.com/en-ca/products/robotics-systems/robot-controllers/kuka-sunrise-cabinet>

YASKAWA HC10DTP

<https://www.motoman.com/getmedia/6bee5ac1-77ed-43da-aa0c-8d3e493d3aea/ds_hc10dtp.pdf.aspx>

UNIVERSAL ROBOTS

UR10e

Controller:

https://www.universal-robots.com/media/1808973/oem-control-box\_tech-sheet\_dec-2019.pdf

### 

### 

### Robots I found for loading SHEET:

KUKA:

KR 10 R1100

<https://www.kuka.com/-/media/kuka-downloads/imported/8350ff3ca11642998dbdc81dcc2ed44c/0000384002_en.pdf?rev=b07956555d7a4d97abd80df43327f921&hash=4E7EF294C1E96A7527D662F6FC5069A8>

FANUC:

LR Mate 200iD/14L

<https://www.fanucamerica.com/docs/default-source/robotics-files/lr-mate-200id-14l-data-sheet.pdf?sfvrsn=16c50329_3>

Controller: R-30iB Plus

<https://www.fanucamerica.com/docs/default-source/robotics-files/fanuc-r-30ib-controller-product-information.pdf>

FANUC LR-10iA/10

<https://www.fanucamerica.com/docs/default-source/robotics-files/fanuc-robot-data-sheets/lr-10ia-data-sheet.pdf>

Controller: R-30iB Plus

<https://www.fanucamerica.com/docs/default-source/robotics-files/fanuc-r-30ib-controller-product-information.pdf>

Controller:

<https://www.kuka.com/en-ca/products/robotics-systems/robot-controllers/kr-c4>

ABB:  
IRB 1300

<https://new.abb.com/products/robotics/robots/articulated-robots/irb-1300>

<https://library.e.abb.com/public/ebdc9e18750f44b3b3b80837e0ab49eb/IRB1300_datashet_20221117_digital.pdf?x-sign=yASygzAFZ7iok3EohLZjSdFU5P7/Fz+viFcmQHIAb0wNoymZ3Gtb9VY5beNCtoLH>

Controller OmniCoreV250XT:

<https://library.e.abb.com/public/93db31d288d24b13b405d04f418bb15a/OmniCoreV250XT_datasheet_20211203_Digital.pdf?x-sign=j3JWtJm5XbmHI9fyYTxRCiD2Zec3VJzUYHqK0qCXIafzucw/nMQKrJoecXGFSBtg>

YASKAWA:

HC10DTP

### <https://www.motoman.com/getmedia/6bee5ac1-77ed-43da-aa0c-8d3e493d3aea/ds_hc10dtp.pdf.aspx>

### Robots found for pelleting (50kg):

A group of yellow robots

Description automatically generated

FANUC CR-35iB Collaborative Robot

<https://www.fanucamerica.com/products/robots/series/collaborative-robot/cr-35ib>

The World’s Strongest Collaborative Robot Gets a Makeover

ideal for tight spaces

<https://www.fanucamerica.com/docs/default-source/robotics-files/robotics-product-information-sheets/cr-35ib-data-sheet.pdf?sfvrsn=9130a283_2>

**FANUC** M-20*i*D/35

<https://www.fanucamerica.com/products/robots/series/m-20/m-20id-35>\

**FANUC** M-710iC/45M

<https://www.fanucamerica.com/products/robots/series/m-710/m-710ic-45m>

FANUC M-710iC/50

https://www.fanucamerica.com/products/robots/series/m-710/m-710ic-50

ABB:

IRB-460

<https://new.abb.com/products/robotics/robots/articulated-robots/irb-460>

**Controller: C90XT**

[**https://library.e.abb.com/public/1e1cccce010b444e92919a3d2c2c359d/3HAC073706%20PM%20OmniCore%20C90XT-en.pdf?x-sign=qetXnHnH4qGJEzDAlN1S3OX2WsGw9kgcNLtxB78T1sjdjystBrsxC8UK9m0hojcV**](https://library.e.abb.com/public/1e1cccce010b444e92919a3d2c2c359d/3HAC073706%20PM%20OmniCore%20C90XT-en.pdf?x-sign=qetXnHnH4qGJEzDAlN1S3OX2WsGw9kgcNLtxB78T1sjdjystBrsxC8UK9m0hojcV)

IRB-5710

https://new.abb.com/products/robotics/robots/articulated-robots/irb-5710

KUKA:

KR 50 R2100

<https://www.kuka.com/-/media/kuka-downloads/imported/8350ff3ca11642998dbdc81dcc2ed44c/0000332115_en.pdf?rev=a1bb651313db412fb51f1a7da1c8e051&hash=548A77006712AC8857123CB72F9231CA>

Robot for palletizing

FANUC PALLETIZING 的 所有robot

<https://www.fanucamerica.com/solutions/applications/palletizing-robots>

FANUC M-410iB/140H

<https://www.fanucamerica.com/products/robots/series/m-410/m-410ib-140h-palletizing-robot>

<https://www.fanucamerica.com/docs/default-source/fanuc-robot-datasheets-new/datasheet-m-410ib-140h.pdf>

Controller: R-30iB Plus

<https://www.fanucamerica.com/docs/default-source/robotics-files/fanuc-r-30ib-controller-product-information.pdf>

KUKA KR 140 R3200-2 PA

<https://www.kuka.com/-/media/kuka-downloads/imported/8350ff3ca11642998dbdc81dcc2ed44c/0000360897_en.pdf?rev=5660e917d9a5426fb31166ee118986d9&hash=A3850BBE5D9177BA1C705540449AB7B8>

Controller: KR C5; KR C4

KR C5

<https://www.kuka.com/-/media/kuka-downloads/imported/87f2706ce77c4318877932fb36f6002d/kuka_kr_c5_en.pdf?rev=ced38276d0f04fd8919989163ae856f6&hash=825B16C6CDA45B3334F2AF2B309657B8>

KR C4:

<https://www.kuka.com/-/media/kuka-downloads/imported/87f2706ce77c4318877932fb36f6002d/kuka_pb_controllers_en.pdf?rev=42930755b6154ac2a3e3fdb9a6141104&hash=807B1F07CCEFC21E261B873DA8079C58>

[ABB IRB 460](https://www.kuka.com/-/media/kuka-downloads/imported/87f2706ce77c4318877932fb36f6002d/kuka_pb_controllers_en.pdf?rev=42930755b6154ac2a3e3fdb9a6141104&hash=807B1F07CCEFC21E261B873DA8079C58)

ABB IRB 460

<https://library.e.abb.com/public/36bc73cb27f3469096831d80edca9860/3HAC039611%20PS%20IRB%20460%20on%20IRC5-en.pdf?x-sign=Npy5ImfBjvjT34VcBVjS3HTvNpUJnncTC0vKaHRPWcMMACUXKB1kjyOP05fR11O1>

<https://www.youtube.com/watch?v=XuUvJXomTmo>

<https://library.e.abb.com/public/31a9d0191b3b43309f3bf15566e89de5/IRB_660_220818_datasheet.pdf?x-sign=32xlHz/pzMfUxfLz8uLMVjlV3YWV569xjJ/MFfhUs+XMcK+2kj/OA8AJwwS1crKG>

**Controller:**

**C90XT**

YASKAWA GP110

[Motoman GP110 Robot for Assembly & Handling | 110.0 kg](https://www.motoman.com/en-us/products/robots/industrial/assembly-handling/gp-series/gp110)

Controller:

YRC-1000

https://www.motoman.com/getmedia/088c71be-0c86-4e63-8ed8-e6666036bf13/YRC1000.pdf.aspx

YASKAWA GP180

<https://www.motoman.com/en-us/products/robots/industrial/assembly-handling/gp-series/gp180>

YASKAWA PL190

<https://www.motoman.com/en-us/products/robots/industrial-robots/packaging-palletizing/pl-series/pl190>

Application #3: automated warehouse for stocking and retrieving different molds (similar to our SIF-400 facility in Smart Manufacturing Hub), molds weigh between 200-300kg (made from steel)

* **List of commercially available Robots/Cobots in the market that can be used in bathtub manufacturing considering the weight and dimensions of different bathtubs available in the market**
* M-900iB/330L

<https://www.fanucamerica.com/products/robots/series/m-900/m-900ib-330l>

* IRB 7600-400

<https://new.abb.com/products/robotics/robots/articulated-robots/irb-7600>

* KR 340 R3330

<https://www.kuka.com/en-ca/products/robotics-systems/industrial-robots/kr-500-fortec>

* MX350L

<https://kawasakirobotics.com/asia-oceania/products-robots/mx350l/>

* **Tabular comparison of the available Robots/Cobots in terms of the number of DoFs., workspace, payload, speed, and types of IOs available for peripheral devices, programming, ability to work in harsh environments (spraying), precision, repeatability, price, popularity in the North American/European/ Asian markets (after-sale services)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | DOF | Workspace | Payload | Speed (°/s) | IOs | Prog | Harsh Env | Repeat | $ | Popularity |
| M-900iB/330L (FANUC) | 6 | Sphere (max 3203 mm) | 330kg | J1 100, J2 85, J3 85, J4 90, J5 85, J6 165 | Gigabit Ethernet (PROFINet) and high-speed USB 2.0 interfaces (R-30+B Plus controller) | Teaching pendant, demonstration | severe dust and liquid protection,  IP67 | ± 0.1 |  | Many after sale service locations in NA |
| IRB 7600 (ABB) | 6 | Sphere (max 2.55m) | 400kg | J1 75, J2 60, J3 60, J4 100, J5 100, J6 160 | Full PC I/O interface, Ethernet with PROFINet (using the IRC5 controller | RAPID™ (high level programming language) using teach pendant | dust and liquid protection, IP67 | ± 0.1 |  | More than 40 assembly and after sales service locations in NA |
| KR 340 R3330 (KUKA) | 6 | Sphere (max 3326 mm) | 340kg | J1 90, J2 80, J3 75, J4 90, J5 83, J6 130 | 16 I/O, PROFInet, EthernetIP, expansion for PROFIBus (KRC5 controller | KUKA.WorkVisual (teaching using pendant), KUKA.Sim (virtual simulation) | Dust, liquid spray and liquid protection, IP65-IP67 | ± 0.08 |  | Sales location in the US only |
| MX350-L (KAWASAKI) | 6 | Sphere (max 3018mm) | 350kg | J1 80, J2 70, J3 70, J4 80, J5 80, J6 1200 | Ethernet (PROFINet support), RS232, 10 digital I/O, USB2.0, PROFIBus, Bluetooth (F04 controller) | KCONG (virtual simulation), K-ROSET programming tool (using teach pendant) | dust and liquid protection, IP67 | ± 0.1 |  | Very minimal after sales support in NA, mostly Asia and Oceania, parts of Europe and Africa |

Dead Zone

Workspace

Possible warehouse layouts

* Rectangular within the workspace envelope
* Radial within the workspace envelope around the dead zone

This works best for warehouses with square like floor plan as it utilizes most of the warehouse space

We can use transfer units to add an additional degree of freedom (basically rails for robots)

* HiGlyde Max

<https://www.kyrusautomation.com/automation-products/linear-tracks/higlyde-max/>

* STN 4

<https://admex.com.tr/products/stn-4-robot-linear-track/>

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | DOF | Workspace | Payload | Speed | IOs | Prog | Harsh Env | Repeat | $ | Popularity |
| HiGlyde Max | 1 | Spheriod, with length of stroke+2\*max reach of used robot, width of 2\* max reach of robot | 4000kg (robot + robot payload) | 1.5 m/s | Can use the same controller used by the robot of choice | N/A | severe dust and liquid protection,  IP67 | ± 0.1 |  | Head quarter in the UK, serves both Europe and NA |
| STN 4 | 1 | Spheriod, with length of stroke+2\*max reach of used robot, width of 2\* max reach of robot | 4000kg (robot + robot payload) | 2 m/s | Can use the same controller used by the robot of choice | N/A | severe dust and liquid protection,  IP67 | ± 0.01 |  | Serves Europe only |

Workspace

Dead Zone slides along the transfer unit

Possible warehouse layouts

* Rectangular along the side (or both sides) of the work space envelope

This works best for warehouses with long rectangular floor plan as it utilizes most of the warehouse space. The most notable benefit of using the transfer unit is eliminating the dead zone entirely as the robot can reach all points within the work spaces compared to a fixed robot.

* **Which Robots/Cobot vendor do we recommend for manufacturing (Decision Matrix)**

For articulated robots

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Workspace (20%) | Payload (10%) | Speed (°/s) (5%) | IOs (10%) | Prog (15%) | Harsh Env (5%) | Repeat (25%) | $ (5%) | Popularity (5%) |
| M-900iB/330L (FANUC) | Sphere (max 3203 mm) | 330kg | J1 100, J2 85, J3 85, J4 90, J5 85, J6 165 | Gigabit Ethernet (PROFINet) and high-speed USB 2.0 interfaces (R-30+B Plus controller) | Teaching pendant, demonstration | severe dust and liquid protection,  IP67 | ± 0.1 |  | Many after sale service locations in NA |
| IRB 7600 (ABB) | Sphere (max 2250 mm) | 400kg | J1 75, J2 60, J3 60, J4 100, J5 100, J6 160 | Full PC I/O interface, Ethernet with PROFINet (using the IRC5 controller | RAPID™ (high level programming language) using teach pendant | dust and liquid protection, IP67 | ± 0.1 |  | More than 40 assembly and after sales service locations in NA |
| KR 340 R3330 (KUKA) | Sphere (max 3326 mm) | 340kg | J1 90, J2 80, J3 75, J4 90, J5 83, J6 130 | 16 I/O, PROFInet, EthernetIP, expansion for PROFIBus (KRC5 controller | KUKA.WorkVisual (teaching using pendant), KUKA.Sim (virtual simulation) | Dust, liquid spray and liquid protection, IP65-IP67 | ± 0.08 |  | Sales location in the US only |
| MX350-L (KAWASAKI) | Sphere (max 3018mm) | 350kg | J1 80, J2 70, J3 70, J4 80, J5 80, J6 120 | Ethernet (PROFINet support), RS232, 10 digital I/O, USB2.0, PROFIBus, Bluetooth (F04 controller) | KCONG (virtual simulation), K-ROSET programming tool (using teach pendant) | dust and liquid protection, IP67 | ± 0.1 |  | Very minimal after sales support in NA, mostly Asia and Oceania, parts of Europe and Africa |

We can see that the Kuka 340 R3330 is the best option for this application as it scored the highest from between all 4 options at 65% matching the important requirements for this application

For 7th axis transfer units

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | DOF | Workspace | Payload | Speed | IOs | Prog | Harsh Env | Repeat | $ | Popularity |
| HiGlyde Max | 1 | Spheriod, with length of stroke+2\*max reach of used robot, width of 2\* max reach of robot | 4000kg (robot + robot payload) | 1.5 m/s | Can use the same controller used by the robot of choice | N/A | severe dust and liquid protection,  IP67 | ± 0.1 |  | Head quarter in the UK, serves both Europe and NA |
| STN 4 | 1 | Spheriod, with length of stroke+2\*max reach of used robot, width of 2\* max reach of robot | 4000kg (robot + robot payload) | 2 m/s | Can use the same controller used by the robot of choice | N/A | severe dust and liquid protection,  IP67 | ± 0.01 |  | Serves Europe and NA |

we can see that the ADMEX STN 4 has a slight edge over the HiGlyde Max in the speed and repeatability criteria making it the preferred option

* **What features of the robots/Cobots do we need to consider when purchasing and deploying them for the current applications?**

For the purpose of this application, it would be the Workspace, Payload, the I/Os available, programming type, and repeatability. We chose these criteria as they affect the efficiency the most. Workspace and Payload affects our ability to store and retrieve the bathtub molds, while I/Os, programming type and repeatability affects our ability to operate the robot efficiently (easy programming, connectivity, etc

Application #4: Loading / retrieving molds from mold warehouse to the vacuum thermoforming machine

* **List of commercially available Robots/Cobots in the market that can be used in bathtub manufacturing considering the weight and dimensions of different bathtubs available in the market. we can use similar robots as in the previous application as both load and unload heavy bathtub molds, but we can cut costs by choosing slightly smaller robots with lesser payload criteria and reach as we don’t need to reach higher spaces as in the previous application.**
* M-900iB/330L

<https://www.fanucamerica.com/products/robots/series/m-900/m-900ib-330l>

* IRB 6700-300

<https://new.abb.com/products/robotics/robots/articulated-robots/irb-6700>

* KR 300-2 PA

<https://my.kuka.com/s/product/detail/01t1i000001VGy1AAG?language=en_US>

* MX350L

<https://kawasakirobotics.com/asia-oceania/products-robots/mx350l/>

* **Tabular comparison of the available Robots/Cobots in terms of the number of DoFs., workspace, payload, speed, and types of IOs available for peripheral devices, programming, ability to work in harsh environments (spraying), precision, repeatability, price, popularity in the North American/European/ Asian markets (after-sale services)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | DOF | Workspace | Payload | Speed (°/s) | IOs | Prog | Harsh Env | Repeat | $ | Popularity |
| M-900iB/330L (FANUC) | 6 | Sphere (max 3203 mm) | 330kg | J1 100, J2 85, J3 85, J4 90, J5 85, J6 165 | Gigabit Ethernet (PROFINet) and high-speed USB 2.0 interfaces (R-30+B Plus controller) | Teaching pendant, demonstration | severe dust and liquid protection,  IP67 | ± 0.1 |  | Many after sale service locations in NA |
| IRB 6700 (ABB) | 6 | Sphere (max 2700m) | 300kg | J1 100, J2 88, J3 90, J4 140, J5 110, J6 180 | Full PC I/O interface, Ethernet with PROFINet (using the IRC5 controller | RAPID™ (high level programming language) using teach pendant | dust and liquid protection, IP67 | ± 0.1 |  | More than 40 assembly and after sales service locations in NA |
| KR 300 R2700-2 (KUKA) | 6 | Sphere (max 2701 mm) | 300kg | J1 105, J2 101, J3 107, J4 140,  J5 113,  J6 180 | 16 I/O, PROFInet, EthernetIP, expansion for PROFIBus (KRC5 controller | KUKA.WorkVisual (teaching using pendant), KUKA.Sim (virtual simulation) | Dust, liquid spray and liquid protection, IP65-IP67 | ± 0.05 |  | Sales location in the US only |
| MX350-L (KAWASAKI) | 6 | Sphere (max 3018mm) | 350kg | J1 80, J2 70, J3 70, J4 80, J5 80, J6 1200 | Ethernet (PROFINet support), RS232, 10 digital I/O, USB2.0, PROFIBus, Bluetooth (F04 controller) | KCONG (virtual simulation), K-ROSET programming tool (using teach pendant) | dust and liquid protection, IP67 | ± 0.1 |  | Very minimal after sales support in NA, mostly Asia and Oceania, parts of Europe and Africa |

* **Which Robots/Cobot vendor do we recommend for manufacturing (Decision Matrix)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Workspace (20%) | Payload (10%) | Speed (°/s) (5%) | IOs (10%) | Prog (15%) | Harsh Env (5%) | Repeat (25%) | $ (5%) | Popularity (5%) |
| M-900iB/330L (FANUC) | Sphere (max 3203 mm) | 330kg | J1 100, J2 85, J3 85, J4 90, J5 85, J6 165 | Gigabit Ethernet (PROFINet) and high-speed USB 2.0 interfaces (R-30+B Plus controller) | Teaching pendant, demonstration | severe dust and liquid protection,  IP67 | ± 0.1 |  | Many after sale service locations in NA |
| IRB 6700 (ABB) | Sphere (max 2701m) | 300kg | J1 100, J2 88, J3 90, J4 140, J5 110, J6 180 | Full PC I/O interface, Ethernet with PROFINet (using the IRC5 controller | RAPID™ (high level programming language) using teach pendant | dust and liquid protection, IP67 | ± 0.1 |  | More than 40 assembly and after sales service locations in NA |
| KR 300 R2700-2 (KUKA) | Sphere (max 2701 mm) | 300kg | J1 105, J2 101, J3 107, J4 140,  J5 113,  J6 180 | 16 I/O, PROFInet, EthernetIP, expansion for PROFIBus (KRC5 controller | KUKA.WorkVisual (teaching using pendant), KUKA.Sim (virtual simulation) | Dust, liquid spray and liquid protection, IP65-IP67 | ± 0.05 |  | Sales location in the US only |
| MX350-L (KAWASAKI) | Sphere (max 3018mm) | 350kg | J1 80, J2 70, J3 70, J4 80, J5 80, J6 120 | Ethernet (PROFINet support), RS232, 10 digital I/O, USB2.0, PROFIBus, Bluetooth (F04 controller) | KCONG (virtual simulation), K-ROSET programming tool (using teach pendant) | dust and liquid protection, IP67 | ± 0.1 |  | Very minimal after sales support in NA, mostly Asia and Oceania, parts of Europe and Africa |

We can see that the Kuka 340 R3330 is the best option for this application as it scored the highest from between all 4 options at 50% matching the important requirements for this application

There is no need for a transfer unit for this application as space utilization isn’t important, we only need to load/unload the mold into/from the thermoforming station

* **What features of the robots/Cobots do we need to consider when purchasing and deploying them for the current applications?**

For the purpose of this application, it would be the Workspace, Payload, the I/Os available, programming type, and repeatability. We chose these criteria as they affect the efficiency the most. Workspace and Payload affects our ability to store and retrieve the bathtub molds, while I/Os, programming type and repeatability affects our ability to operate the robot efficiently (easy programming, connectivity, etc

* **How can Robots/Cobots increases the efficiency, throughput, and productivity, and safety of the above procedures in bathtub manufacturing?**
* Precision and Consistency: Robots exhibit meticulous precision in measurements and the uniform application of materials, thereby ensuring a consistent level of product quality.
* Enhanced Speed: Cobots, characterized by rapid learning capabilities, adeptly undertake repetitive tasks at elevated speeds, consequently augmenting overall production rates.
* Heavy-duty Operations: Robotics technology proves invaluable in executing tasks involving substantial physical exertion, such as the movement of raw materials and finished products. This not only expedites the manufacturing process but also mitigates the potential for workplace injuries.
* Continuous Operation: Robots operate ceaselessly without the need for breaks, contributing to sustained productivity levels around the clock.
* Safety Considerations: Cobots, designed for collaborative work with human counterparts, contribute to a safer working environment by assuming responsibility for hazardous or physically demanding tasks.
* Data Acquisition and Analysis: The incorporation of robotics facilitates real-time data collection during the manufacturing process, furnishing valuable insights for process optimization and ongoing refinement.
* Adaptability: The programmable nature of robots enables seamless transitions between tasks, ensuring adaptability to shifting production demands without significant downtime.
* Quality Assurance: Equipped with advanced sensors and vision systems, robots can discern defects promptly, ensuring that only products meeting stringent quality standards progress along the production line.
* Resource Optimization: Robots exercise precise control over materials and processes, minimizing waste and fostering an environmentally conscientious manufacturing process, thereby yielding cost savings.
* **What is the driving force behind using Robots/Cobots in bathtub manufacturing?**

The integration of Robots and Cobots in bathtub manufacturing is propelled by a collective pursuit of precision, efficiency, and safety. These robotic entities bring unparalleled precision and consistency to production, elevating product quality. Their ability to handle tasks swiftly and continuously boosts throughput, while collaborative robots enhance workplace safety by undertaking hazardous tasks. The 24/7 operation ensures sustained productivity, and their adaptability allows for seamless transitions between tasks. Advanced sensors contribute to real-time quality control, minimizing defects. The resource optimization, reduced labor intensity, and collaborative dynamics between humans and robots further solidify their role in transforming and optimizing the manufacturing process.