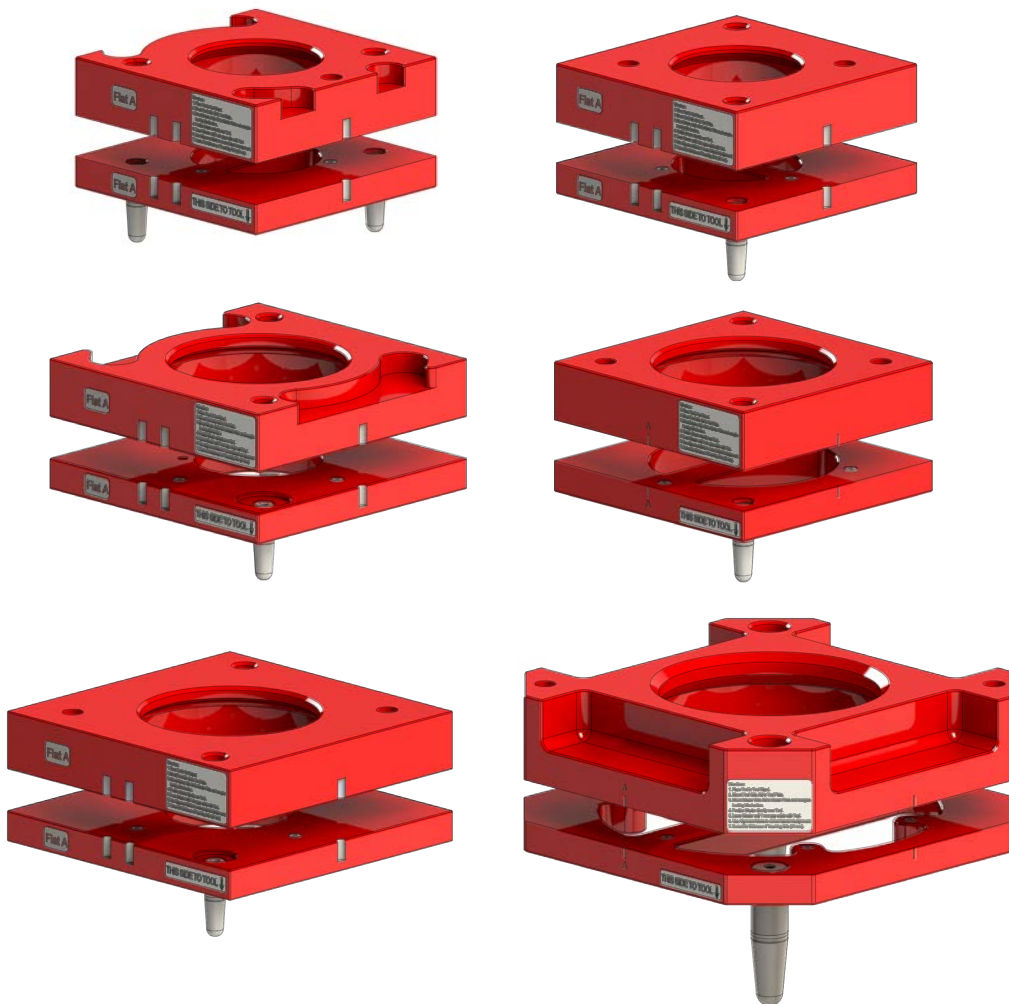




Tool Changer Teaching Aid Assemblies QC-110, QC-160, QC-210, QC-213, QC-310, QC-510, and QC-1210

Manual



Document #: 9610-20-1419

Foreword

This manual contains basic information applicable to all ATI robotic Tool Changers. Certain Tool Changer models have their own manuals that contain more detailed information. Also, additional information about electrical, pneumatic, fluid, high-power and high-current modules and other options are available in other manuals and documents.

Please contact ATI Industrial Automation with any questions concerning your particular model.



CAUTION: This manual describes the function, application, and safety considerations of this product. This manual must be read and understood before any attempt is made to install or operate the product, otherwise damage to the product or unsafe conditions may occur.

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Glossary

Term	Definition
Bearing Race	Hardened steel ring in the Tool Plate that is engaged by the locking balls during the locking process.
End-Effector	Tool used by the robot to perform a particular function.
Locking Mechanism	A pneumatic driven device that draws the Master and Tool plates together and secures the plates in a fail-safe locked condition, until the mechanism is unlocked. The locking mechanism contains the following components: locking balls, cam, ball cage, bearing race, and a pneumatic cylinder.
Master Plate	The half of the Tool Changer that the customer attaches to a robot. The Master plate contains the locking mechanism that couples and secures the Master plate to the Tool plate.
Pick-Up Position	The robot coordinate position at which the Master plate draws the Tool plate into a locked position.
Tool Stand	A fixture that holds Tools that aren't used for a portion of an automated process.
Tool Plate	The half of the Tool Changer to which the customer attaches various tools or end-effectors.
No-Touch™	An ATI Tool Changer design feature that allows the Master plate and Tool plate to couple without physical contact prior to locking.

1. Safety

The safety section describes general safety guidelines to be followed with this product, explanations of the notifications found in this manual, and safety precautions that apply to the product. More specific notifications are imbedded within the sections of the manual where they apply.

1.1 Explanation of Notifications

The following notifications are specific to the product(s) covered by this manual. It is expected that the user heed all notifications from the robot manufacturer and/or the manufacturers of other components used in the installation.



DANGER: Notification of information or instructions that if not followed will result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.



WARNING: Notification of information or instructions that if not followed could result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.



CAUTION: Notification of information or instructions that if not followed could result in moderate injury or will cause damage to equipment. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.

NOTICE: Notification of specific information or instructions about maintaining, operating, installing, or setting up the product that if not followed could result in damage to equipment. The notification can emphasize, but is not limited to: specific grease types, best operating practices, and maintenance tips.

1.2 General Safety Guidelines

Prior to purchase and installation, the customer should verify that the Tool Changer selected is rated for the maximum loads and moments expected during operation. Refer to product specifications section in each module of this manual or contact ATI for assistance. Particular attention should be paid to dynamic loads caused by robot acceleration and deceleration. These forces can be many times the value of static forces in high acceleration or deceleration situations.

The customer is responsible for ensuring that the area between the Master and Tool sides is clear of foreign objects during mating and subsequent coupling. Failure to do so may result in serious injury to personnel.



DANGER: The gap between the Master and Tool sides is a pinch point. All personnel should be prevented from placing any part of their body or clothing in the gap, especially during actuation of the locking mechanism.

The customer is responsible for understanding the function of the Tool Changer and implementing the proper fasteners and/or software to operate the Tool Changer safely. The Tool Changer should be controlled such that there is no chance of locking or unlocking in a position that would endanger personnel and/or equipment. If the Tool Changer is specified with Lock/Unlock (L/U) and Ready-to-Lock (RTL) sensing capability, the status should be monitored and interlocks applied to prevent injury to personnel and equipment.

All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of electrical and pneumatic lines must minimize the possibility of stress/strain, kinking, rupture, etc. Failure of critical electrical or pneumatic lines to function properly may result in injury to personnel and equipment.

All electrical power, pneumatic and fluid circuits should be disconnected during servicing.

1.3 Safety Precautions



WARNING: Remove all temporary protective materials (caps, plugs, tape, etc.) on locking face of Tool Changer and modules prior to operation. Failure to do so will result in damage to Tool Changers, modules, and end-of-arm tooling and could cause injury to personnel.



WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (e.g. electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.



WARNING: During operation, the area between the Master and Tool must be kept clear. Failure to keep area clear will result in damage to Tool Changer, modules, or end-of-arm tooling and could cause injury to personnel.



WARNING: The Tool Changer is only to be used for intended applications and applications approved by the manufacturer. Using the Tool Changer in applications other than intended will result in damage to Tool Changer, modules, or end-of-arm tooling and could cause injury to personnel.



CAUTION: The Master plate locking mechanism must not be actuated without being mounted to the interface plate. Damage to the Cover Plate and O-ring may result. Always attach the Master plate to the Interface plate prior to attempting any operations.

2. Product Overview

The ATI robot Teaching Aids are to be used with the following ATI No-Touch™ locking Tool Changers: QC-110, QC-160, QC-210, QC-213, QC-310, QC-510, and QC-1210. With the Teaching Aids, a user requires less time to program the robot to pick up and drop off customer tooling and ensure optimal X, Y, and Z alignment. Additionally, teaching Aids help extend the life of the Tool Changer alignment pins and bushings by reducing unnecessary wear. ATI teaching aids have high-contrast alignment marks to aid the user in the set-up process. When positioned, the Master Teaching Aid and Tool Teaching Aid must have a 1 mm clearance between them (refer to [Figure 2.1](#)). This distance will ensure the No-Touch™ Locking zone for the Tool Changer is set correctly. [Figure 2.2](#) is an overview of the different Teaching Aid assemblies. Refer to [Section 8—Drawings](#), for more information.

2.1 Master Teaching Aid

The Master Teaching Aid assembly is a red, anodized aluminum body. The center interior has a tapered feature that engages with the Tool Changer Master plate assembly's locking balls and allows the Master Teaching Aid assembly to lock to the Tool Changer Master plate assembly. Some of the Teaching Aids have holes bored into the Master Teaching Aid plate at the opposite corners of the alignment pin bushings. These holes provide a clearance to avoid activating the RTL sensors, if a user installs a Teaching Aid assembly manually.

2.2 Tool Teaching Aid

The Tool Teaching Aid is a red, anodized aluminum body with hardened steel alignment pins and magnets. Magnets secure the Tool Teaching Aid to the Tool plate's bearing race. The different type of socket flat head cap screws that secure the magnets to the Tool Teaching Aid are called out in [Figure 2.2](#).

Figure 2.1—Master and Tool Teaching Aid Assembly (QC-210 Shown)

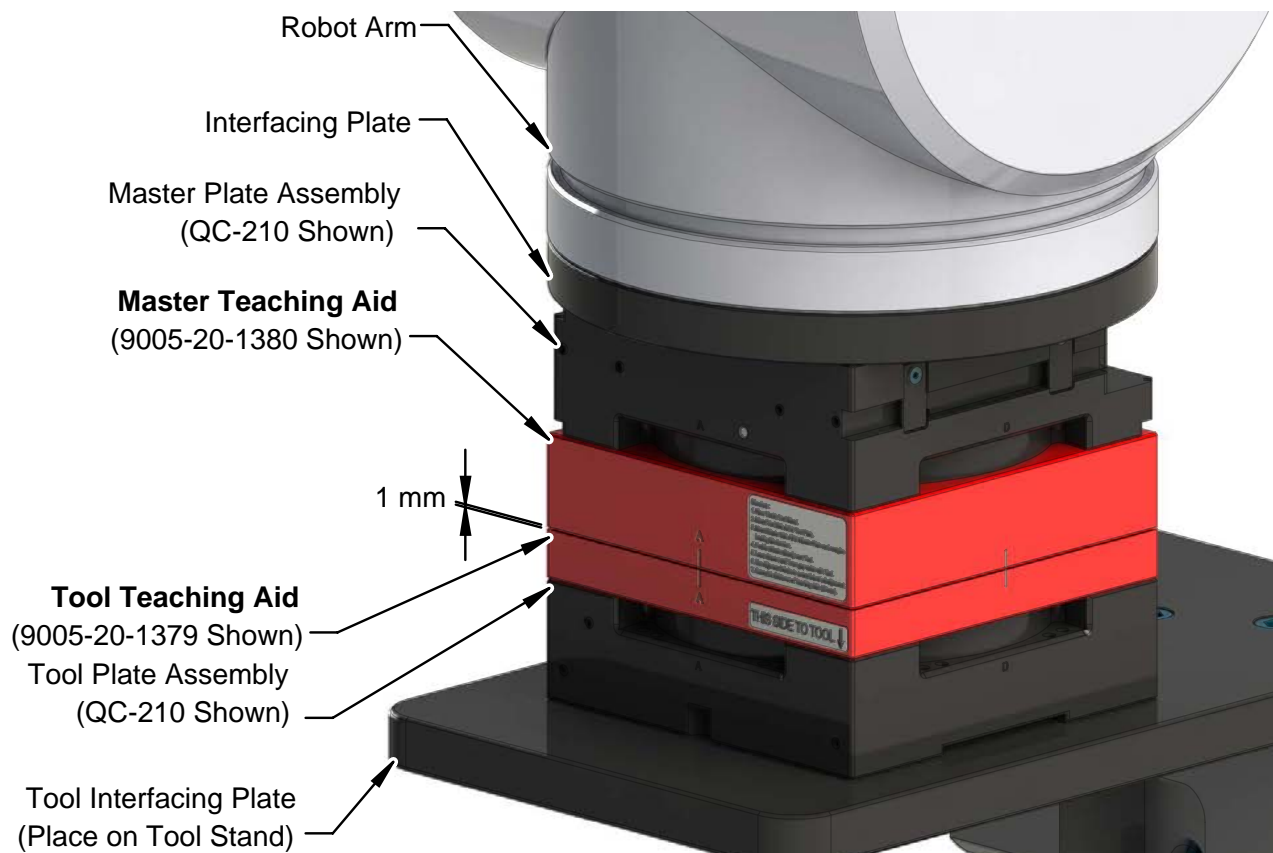
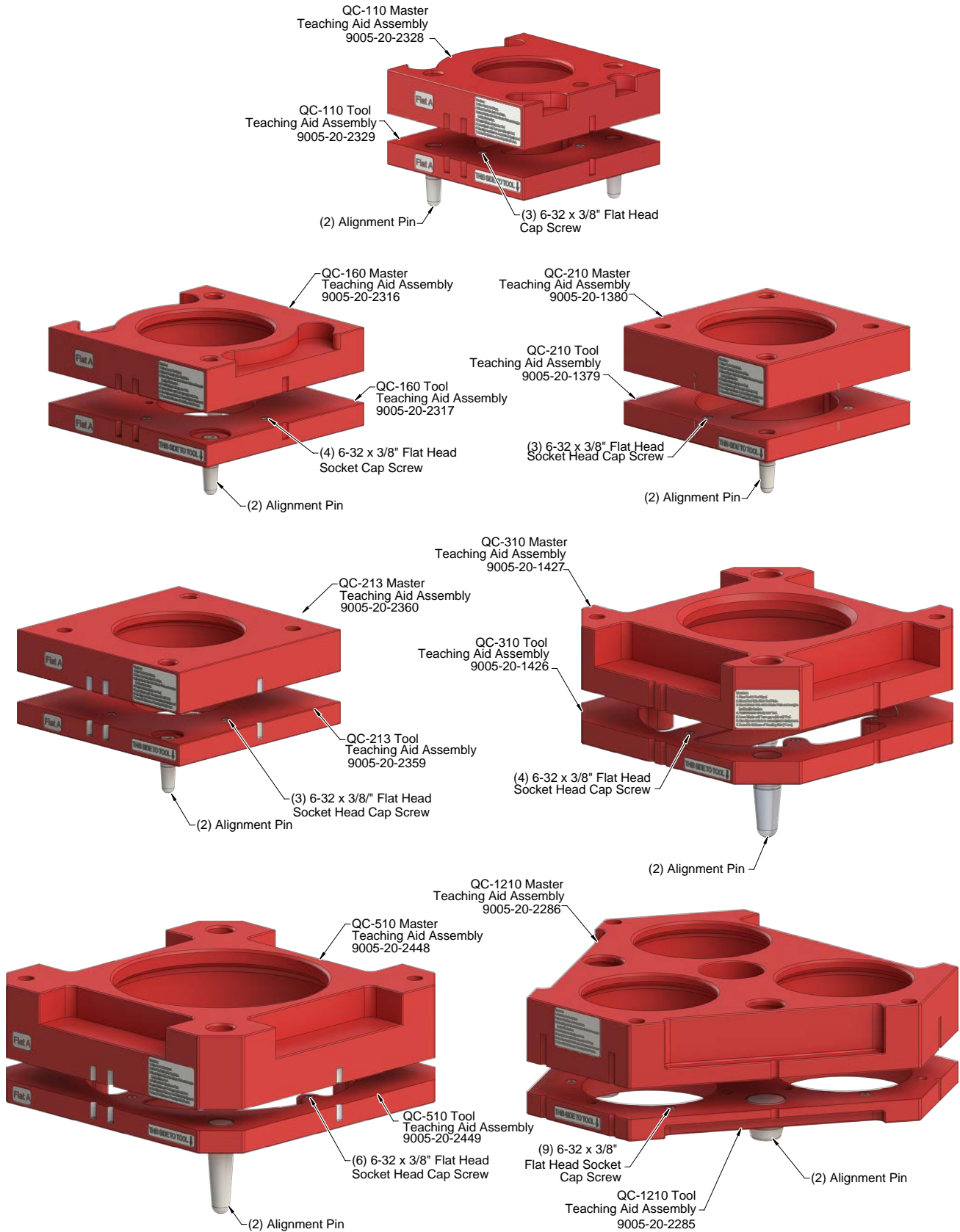


Figure 2.2—Teaching Aid Assemblies

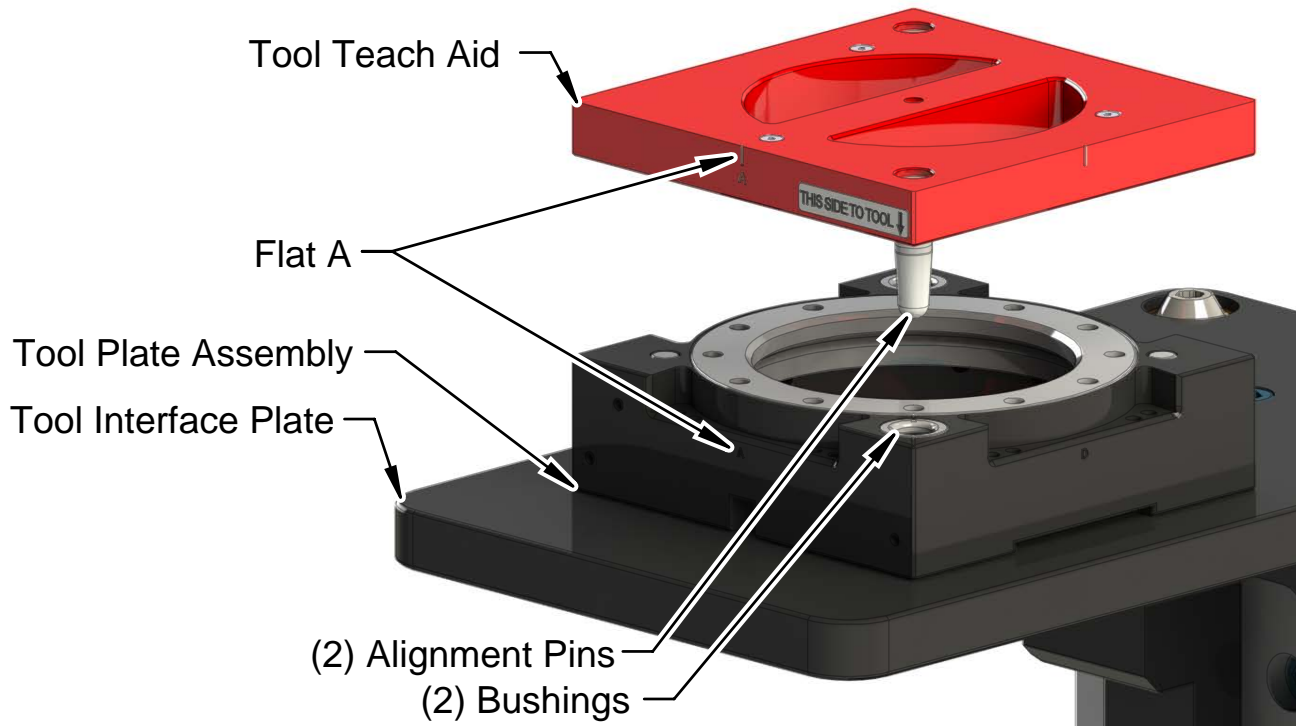


3. Installation and Alignment Procedure

On the Master Teaching Aid, there are labels with abbreviated installation and alignment instructions. To install and align a Teaching Aid, complete the following procedure:

1. Place the Tool plate in the tool stand. Robot programs should be written with the Tool plate resting in the Tool stand.
2. Orient the Tool side Teaching Aid such that the 'A' flat corresponds to the 'A' flat on the Tool plate.
3. Mount the Tool side Teaching Aid over the Tool plate by inserting the alignment pins into the bushings.

Figure 3.1—Tool Teaching Aid Assembly Installation (QC-210 Shown)



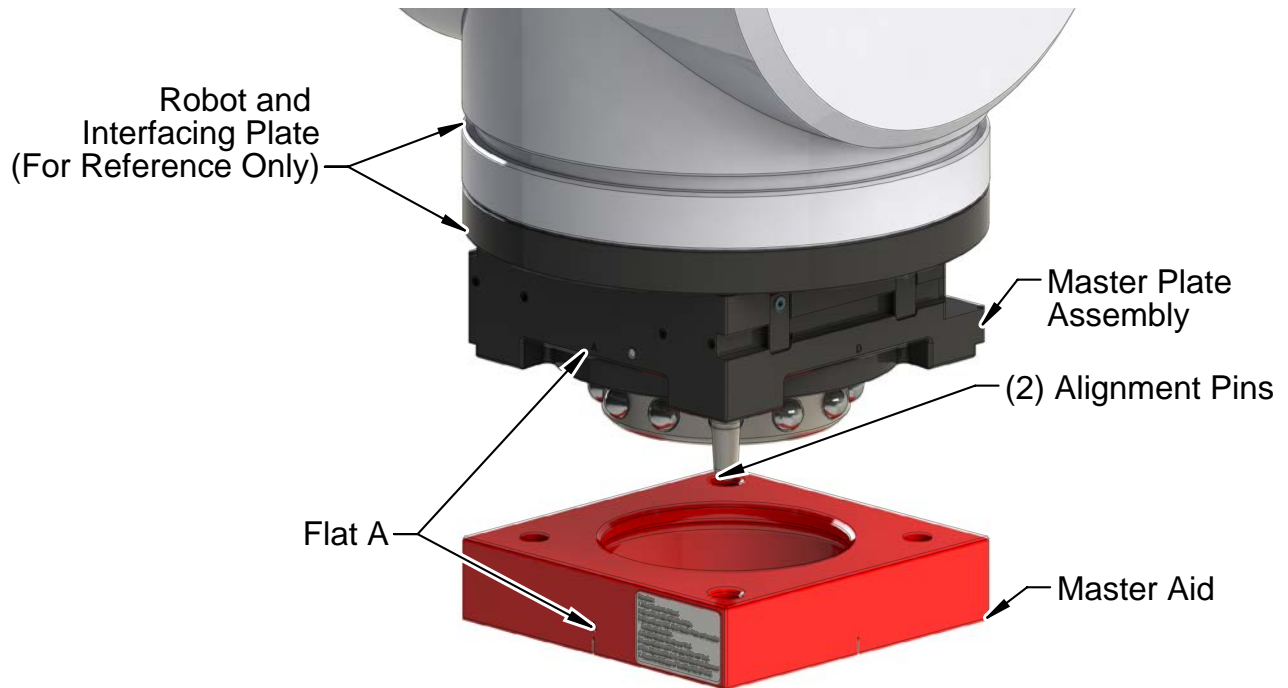
4. Verify the Tool Changer locking mechanism is in the Unlocked position.



DANGER: The gap between the Master and Tool sides are pinch points. Physical contact in these pinch points will result in serious or permanent injury to personnel. Prevent all personnel from placing any body part or clothing in the gap, especially during actuation of the locking mechanism.

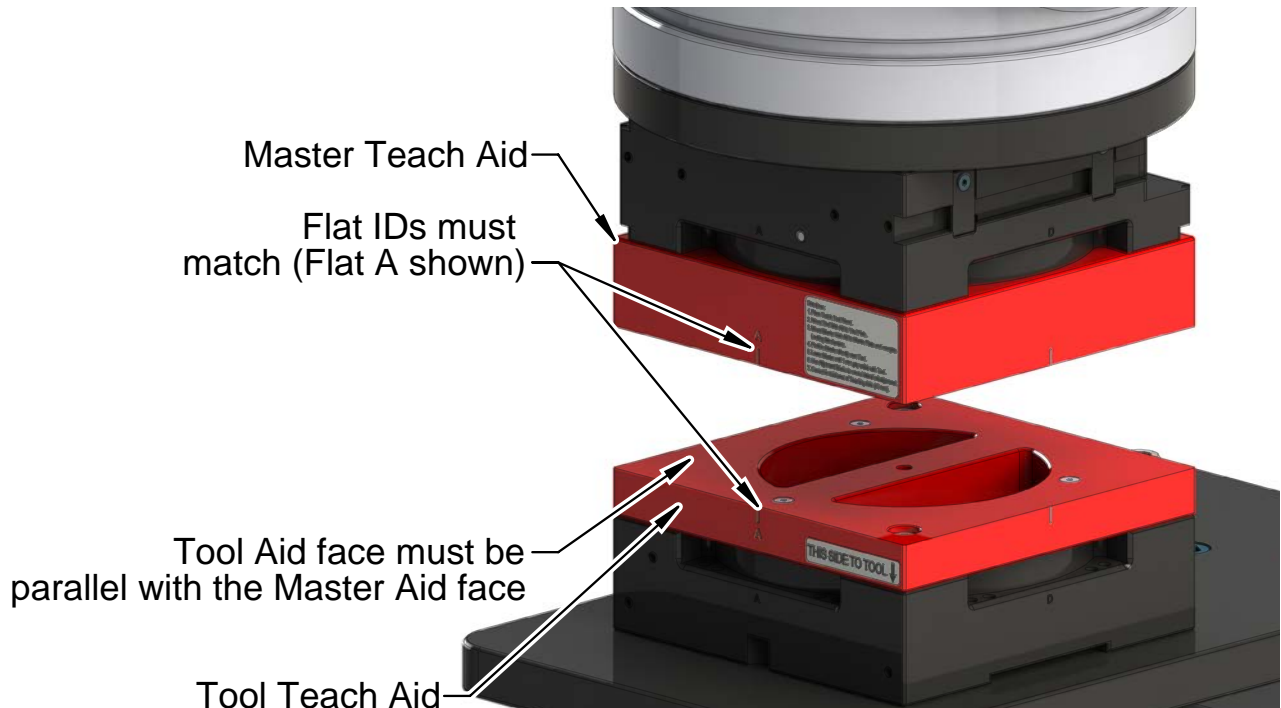
5. Orient the Master side Teaching Aid such that the 'A' flat corresponds to the 'A' flat on the Master plate.
6. Mount the Master side Teaching Aid to the Tool Changer Master plate by inserting the alignment pins into the corresponding holes in the Master side Teaching Aid.
7. Energize the locking mechanism to secure the Master side Teaching Aid in place.

Figure 3.2—Master Teaching Aid Assembly Installation (QC-210 Shown)



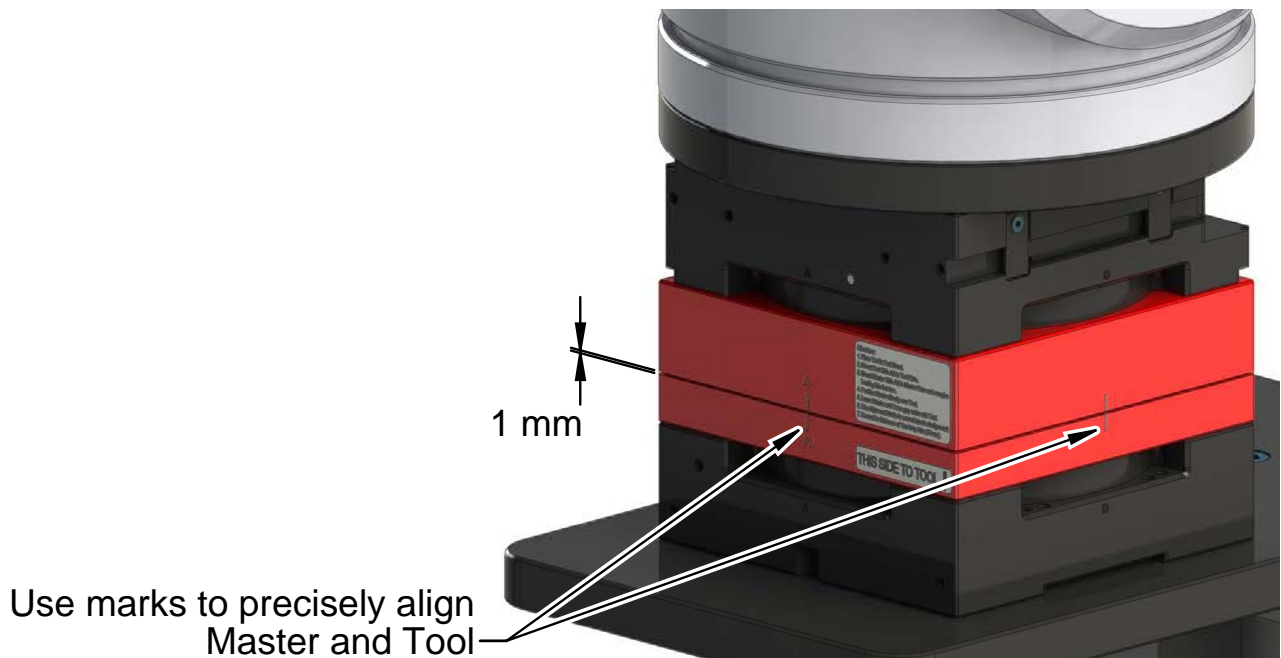
- Position the Master plate directly over and parallel to the Tool plate. Align the Master and Tool flats; for example: the 'A' flat on the Master plate is aligned with the 'A flat' on the Tool plate.

Figure 3.3—Positioning the Master plate towards the Tool plate



- Move the Master plate assembly slowly toward the Tool plate until the Master and Tool side Teaching Aids are 1 mm apart.
- Use the alignment marks to align the Tool side and Master side Teaching Aids.

Figure 3.4—Final Alignment Position of the Teaching Aid Plate Assembly



11. Support the Master side Teaching Aid, and unlock the Tool Changer.
12. Remove the Master and Tool Teaching Aids from the Tool Changer.

NOTICE:

- Refer to the applicable Tool Changer manual for the maximum recommended offsets.
- Depending on the customer application, the pick-up position is not always vertical.

13. Move the Tool Changer Master plate to the Tool plate until the Master plate is in the pick-up position.
14. Record the pick-up position.

4. Maintenance



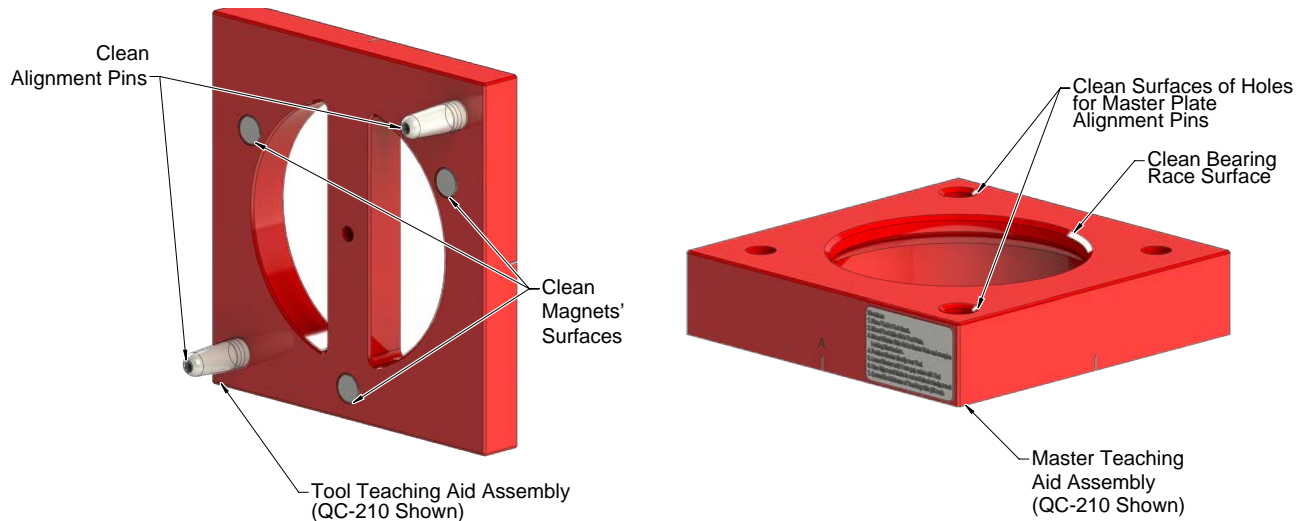
WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (e.g. electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

If the Tool Changer is used in environments susceptible to contamination; for example: welding or deburring applications, limit the exposure of the Tool Changer and Teaching Aid to this environment. Cover idle Tool assemblies and Teaching Aids to prevent debris from settling on the mating surface. Keep the Tool Changer's Master plate assembly exposed to this environment for a short period of time, during the Tool change and down time.

Under normal conditions, no special maintenance is necessary. If needed, inspect and clean the following:

- Inspect the flat head socket head screws in the Tool Teaching Aid to verify that they are tight. If loose, refer to [Section 5.2.1—Adjustment or Installation of Magnets in Tool Teaching Aid Assembly](#).
- Use a clean rag to thoroughly remove existing lubricant and debris from the bearing race and bores for Master Plate Alignment Pins from the Master Teaching Aid. Refer to [Figure 4.1](#).
- Use a clean rag to thoroughly remove any existing lubricant and debris from the alignment pins and magnets. Refer to [Figure 4.1](#).

Figure 4.1—Cleaning of Master and Tool Teaching Aid Assemblies



5. Troubleshooting and Service Procedures

Troubleshooting and service information to help identify symptoms and resolve problems are available in the following sections.



WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (e.g. electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

5.1 Troubleshooting Procedures

Troubleshooting information is in the following table.

Table 5.1—Troubleshooting		
Symptom	Cause	Resolution
Master Teaching Aid plate will not lock with the Tool Changer Master.	The bearing race has debris.	Clean bearing race and aliment pin bushings. Refer to Section 4—Maintenance .
	Refer to applicable Tool Changer or control module.	
Tool Changer Master plate will not unlock and release the Master Teaching Aid plate.	The control module on the Tool Changer has safety features that may not allow the Master plate to unlock.	Refer to the applicable Tool Changer or control module manual
Tool Teaching Aid plate is not secure to the Tool Changer Tool plate.	The surfaces of the Tool Teaching Aid plate have debris.	Clean Tool Teaching Aid assembly surfaces in accordance with Section 4—Maintenance .
	The fasteners that secure the magnets to the Tool Teaching Aid plate are loose.	Tighten fasteners. Refer to Section 5.2.1—Adjustment or Installation of Magnets in Tool Teaching Aid Assembly .

5.2 Service Procedures

Instructions for component replacement and adjustment are in the following section.

5.2.1 Adjustment or Installation of Magnets in Tool Teaching Aid Assembly

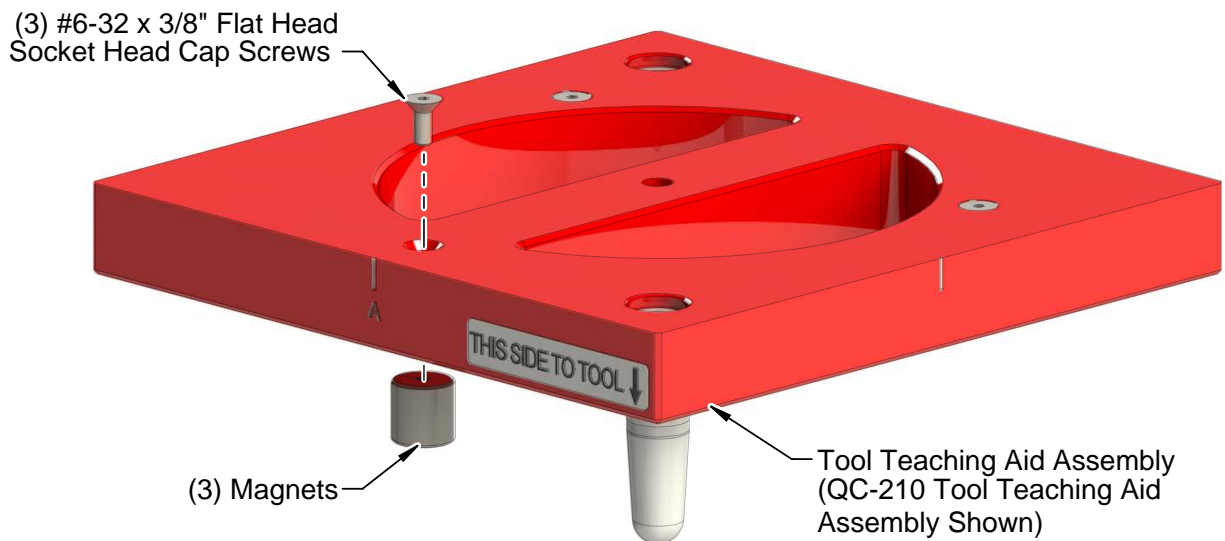
Parts required: Refer to *Section 6.1—Tool Teaching Aid Serviceable Parts*.

Tools required: 5/64" hex key, torque wrench

Supplies required: Loctite Primer 7649® and Loctite 262®

1. Remove the #6-32 x 3/8" socket flat head cap screw(s) in the Tool. Refer to *Figure 5.1*.
2. Remove the existing magnet, if necessary.
3. Place new magnet in the Tool Teaching Aid plate.
4. Apply Loctite Primer 7649® and Loctite 262® to the threads of the #6-32 x 3/8" socket flat head cap screw(s).
5. Using a 5/64" hex key, secure the magnet in the Tool side Teaching Aid with a #6-32 x 3/8" socket flat head cap screw. Tighten to 15 in-lbs (1.69 Nm).

Figure 5.1—Adjustment or Installation of Magnets



6. Serviceable Parts

6.1 Tool Teaching Aid Serviceable Parts

Figure 6.1—Tool Teaching Aid Plate (QC-210 Shown)

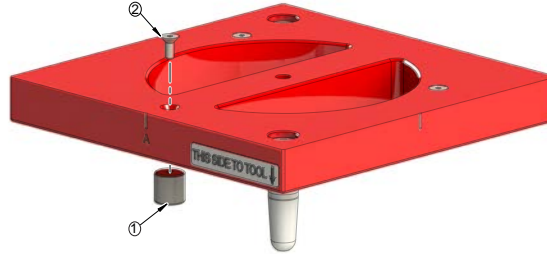


Table 6.1—Tool Teaching Aid Plate			
QC-110, QC-210			
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	3	3710-20-3355	Encased Alinco 5 Magnet 1/2" Dia, 1/2" Thick, 6-32 Hole, 1.4 Pull lbs
2	3	3500-1215037-21	#6-32 x 3/8" Stainless Steel Flat Head Socket Cap Screw
QC-160, QC-213			
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	4	3710-20-3355	Encased Alinco 5 Magnet 1/2" Dia, 1/2" Thick, 6-32 Hole, 1.4 Pull lbs
2	4	3500-1215037-21	#6-32 x 3/8" Stainless Steel Flat Head Socket Cap Screw
QC-310			
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	6	3710-20-3355	Encased Alinco 5 Magnet 1/2" Dia, 1/2" Thick, 6-32 Hole, 1.4 Pull lbs
2	6	3500-1215037-21	#6-32 x 3/8" Stainless Steel Flat Head Socket Cap Screw
QC-510			
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	8	3710-20-3355	Encased Alinco 5 Magnet 1/2" Dia, 1/2" Thick, 6-32 Hole, 1.4 Pull lbs
2	8	3500-1215037-21	#6-32 x 3/8" Stainless Steel Flat Head Socket Cap Screw
QC-1210			
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	9	3710-20-3355	Encased Alinco 5 Magnet 1/2" Dia, 1/2" Thick, 6-32 Hole, 1.4 Pull lbs
2	9	3500-1215037-21	#6-32 x 3/8" Stainless Steel Flat Head Socket Cap Screw

7. Specifications

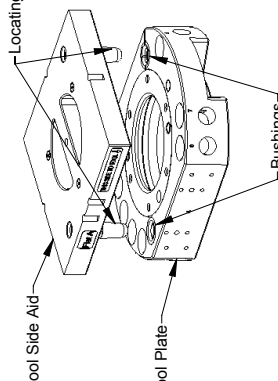
Table 7.1—Teaching Aid Specifications				
Part Number	Description	Material	Weight	Stack Height
9120-110-Teach	QC-110 Teaching Aids	6061-T6 Aluminum	5.9 lb (2.68 kg)	2.2 in (55 mm)
9005-20-2328	QC-110 Master Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9005-20-2329	QC-110 Tool Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9120-160-TEACH	QC-160 Teaching Aids	6061-T6 Aluminum	7 lb (3.18 kg)	2.2 in (55 mm)
9005-20-2316	QC-160 Master Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9005-20-2317	QC-160 Tool Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9120-210-TEACH	QC-210 Teaching Aids	6061-T6 Aluminum	5.5 lb (2.49 kg)	2.2 in (55 mm)
9005-20-1380	QC-210 Master Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9005-20-1379	QC-210 Tool Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9120-213-TEACH	QC-213 Teaching Aids	6061-T6 Aluminum	8.9 lb (4.04 kg)	2.2 in (55 mm)
9005-20-2360	QC-213 Master Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9005-20-2359	QC-213 Tool Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9120-310-TEACH	QC-310 Teaching Aids	6061-T6 Aluminum	12.6 lb (5.72 kg)	2.6 in (66 mm)
9005-20-1427	QC-310 Master Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9005-20-1426	QC-310 Tool Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9120-510-TEACH	QC-510 Teaching Aids	6061-T6 Aluminum	17 lb (7.71 kg)	2.4 in (61 mm)
9005-20-2448	QC-510 Master Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9005-20-2449	QC-510 Tool Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9120-1210-TEACH	QC-1210 Teaching Aids	6061-T6 Aluminum	15.9 lb (7.21 kg)	2.8 in (70 mm)
9005-20-2286	QC-1210 Master Side Teaching Aid	6061-T6 Aluminum	N/A	N/A
9005-20-2285	QC-1210 Tool Side Teaching Aid	6061-T6 Aluminum	N/A	N/A

8. Drawings

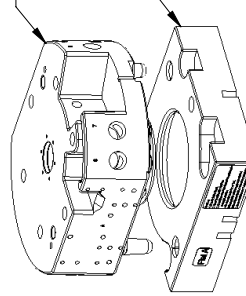
8.1 QC-110 Teaching Aid Assembly

Rev.	Description	Initiator	Date
01	Initial Drawing	DBsh	6/27/2014

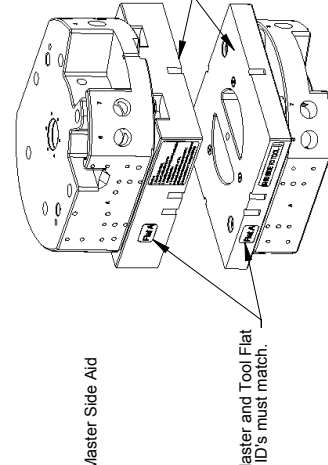
Step 1:
Place the Tool Plate in the Tool Stand. Programs should be entered with the Tool Plate resting in the Tool Stand.



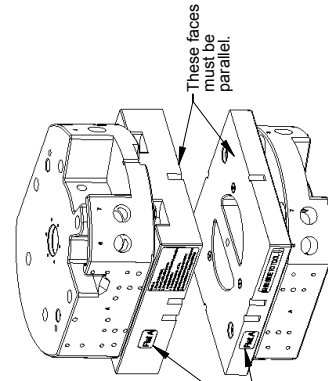
Step 2:
Mount the Tool Side Aid over the Tool Plate by inserting the Locating Pins into the Bushings. Orient the Tool Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Tool Plate.



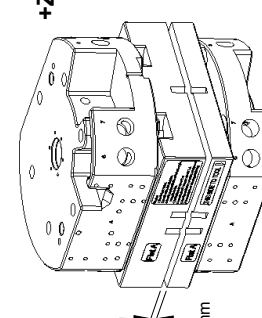
Step 3:
Mount the Master Side Aid to the QC Master Plate ensuring that the taper pins enter the corresponding holes in the Master Side Aid. Orient the Master Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Master Plate. Engage the Locking Mechanism to secure the Master Side Aid in place.



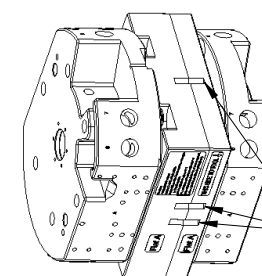
Step 4:
Bring the Master Plate Assembly to a position directly over the Tool Plate Assembly. The Master Plate Assembly's face should be parallel to the Tool Plate Assembly's face. Ensure that the orientation of the Master and Tool assemblies are such that the Flat ID's correspond (i.e. 'A' Master to 'A' Tool, etc.).



Step 5:
Move the Master Plate Assembly slowly downward until the Master and Tool Side Aids are approximately 1mm apart.



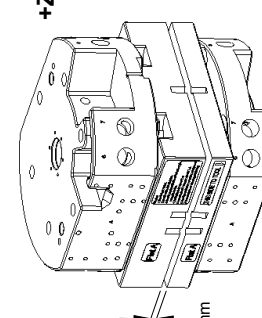
Step 6:
Adjust the position of the robot to correct for any lateral misalignment. Use the Alignment Marks to align the Tool Side and Master Side Aids.




Step 7:
Record the robot coordinates from Step 6. A correction must now be made to the Z coordinate to account for the thickness of the Tool and Master side Teaching Aids. Only in this way can the correct "Pick-up" and "Replacement" coordinates be determined. Perform the following calculation to determine the "Pick-up" and "Replacement" location:

Z "Pick-up" Coordinate = (Z Coordinate from Step 6) - (55mm)

Ensure that the Tool Side and Master Side Alignment Marks are precisely aligned.



NOTES: UNLESS OTHERWISE SPECIFIED,
 DO NOT SCALE DRAWING.
 ALL DIMENSIONS ARE IN MILLIMETERS.



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DRAWN BY: D. Bohle 6/26/2014
 CHECKED BY: K. Zachary 7/17/2014

TITLE: QC-110 Teaching Aids

SCALE: 1:5
 SIZE: B
 DRAWING NUMBER: 9230-20-7747

PROJECT #: 140625-1 SHEET 011

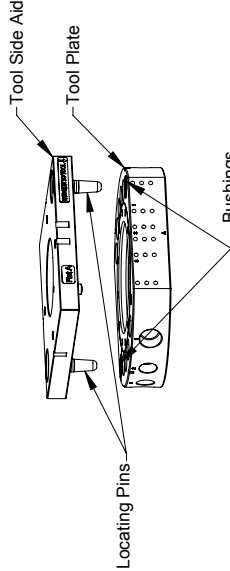
DATE OF PUBLICATION: 6/27/2014

REVISON: 01

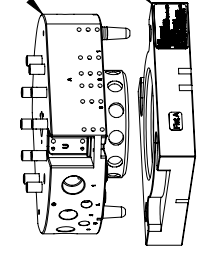
8.2 QC-160 Teaching Aid Assembly

Rev.	Description	Initiator	Date
01	Initial drawing	BVK	7/14/2014
02	Update drawing views	BVK	10/17/2014

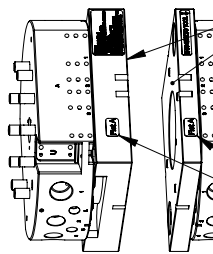
Step 1:
Place the Tool Plate in the Tool Stand. Programs should be written with the Tool Plate resting in the Tool Stand.



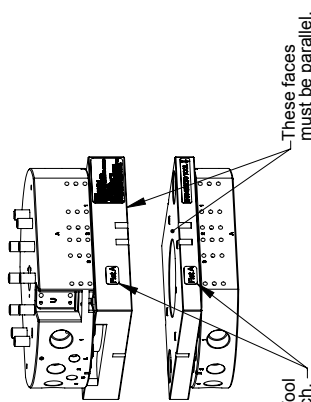
Step 2:
Mount the Tool Side Aid over the Tool Plate by inserting the Locating Pins into the Bushings. Orient the Tool Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Tool Plate.



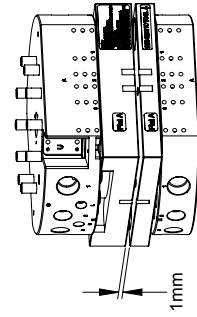
Step 3:
Mount the Master Side Aid to the QC Master Plate ensuring that the Taper Master corresponding holes in the Master Side Aid. Orient the Master Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Master Plate. Energize the Locking Mechanism to secure the Master Side Aid in place.



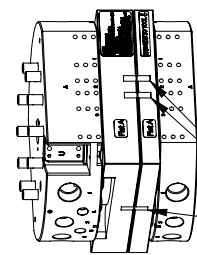
Step 4:
Bring the Master Plate Assembly to a position directly over the Tool Plate Assembly. The Master Plate Assembly Face should be parallel to the Tool Plate Assembly Face. Ensure the orientation of the Master and Tool assemblies is such that the Flat ID's correspond (i.e. 'A' Master to 'A' Tool, etc.).



Step 5:
Move the Master Plate Assembly slowly downward until the Master and Tool Side Aids are approximately 1mm apart.



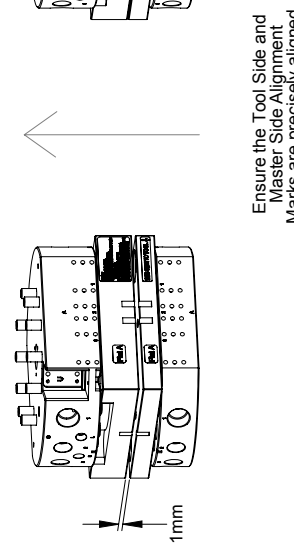
Step 6:
Adjust the position of the robot to correct for any lateral misalignment. Use the Alignment Marks to align the Tool Side and Master Side Aids.




Step 7:
Record the robot coordinates from Step 6. A correction must now be made to the Z coordinate to account for the thickness of the Master and Tool Side Teaching Aids. Only in this way can the correct "Pick-up" and "Replacement" coordinates be determined. Perform the following calculation to determine the "Pick-up" and "Replacement" locations:

Z "Pick-up" Coordinate = (Z Coordinate from Step 6) - 55mm

Ensure the Tool Side and Master Side Alignment Marks are precisely aligned.



NOTES: UNLESS OTHERWISE SPECIFIED:
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3rd ANGLE PROJECTION

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ATI INDUSTRIAL AUTOMATION

DRAWN BY: B. Kendrick 7/14/14
CHECKED BY: M. Gala 7/14/14

TITLE: QC-160 Teaching Aid Customer Drawing

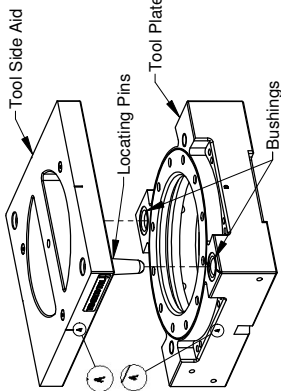
SCALE: 1:4 SIZE: B DRAWING NUMBER: 9230-20-7755 PROJECT #: 140512-1 SHEET 1 OF 1

REVISION: 02

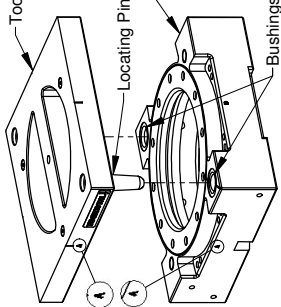
8.3 QC-210 Teaching Aid Assembly

REV.	DESCRIPTION	INITIALS	DATE
01	ISSUED THE SPEC. FOR THE MASTER PLATE AND TOOL SIDE AID.	WB	12/27/2006
02	Alignment fix and modified the spec and location of the holding magnets.	WB	4/2/2007

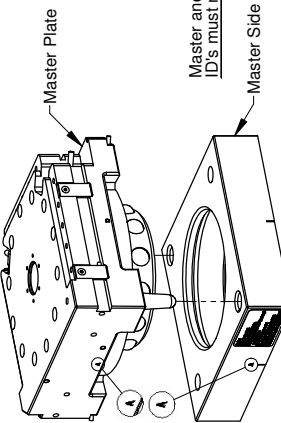
Step 1: Place the Tool Plate in the Tool Stand. Programs should be written with the Tool Plate resting in the Tool Stand.



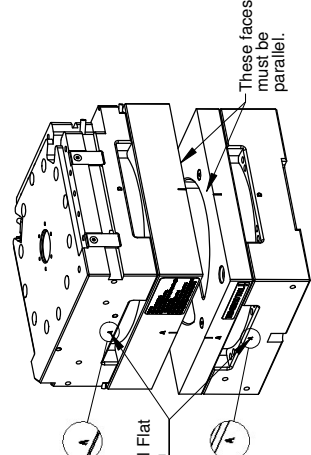
Step 2: Mount the Tool Side Aid over the Tool Plate by inserting the Locating Pins into the Bushings. Orient the Tool Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Tool Plate.



Step 3: Mount the Master Side Aid to the QC Master Plate ensuring that the taper pins enter the corresponding holes in the Master Side Aid. Orient the Master Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Master Plate. Energize the Locking Mechanism to secure the Master Side Aid in place.

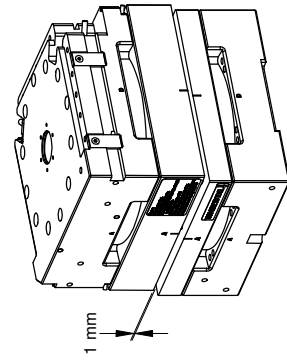


Step 4: Bring the Master Plate Assembly to a position directly over the Tool Plate Assembly. The Master Plate Assembly's face should be parallel to the Tool Plate Assembly's face. Ensure that the orientation of the Master and Tool assemblies are such that the Flat ID's correspond (i.e. 'A' Master to 'A' Tool, etc.).

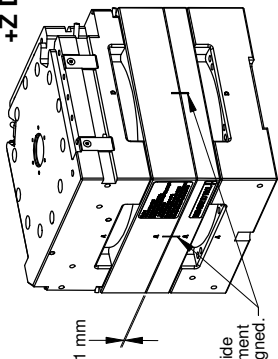


These faces must be parallel.

Step 5: Move the Master Plate Assembly slowly downward until the Master and Tool Side Aids are approximately 1 mm apart.



Step 6: Adjust the position of the robot to correct for any lateral misalignment. Use the Alignment Marks to align the Tool Side and Master Side Aids.




Ensure that the Tool Side and Master Side Alignment Marks are precisely aligned.

Step 7: Record the robot coordinates from Step 6. A correction must now be made to the Z coordinate to account for the thickness of the Tool and Master Side Teaching Aids. Only in this way can the correct "Pick-up" and "Replacement" coordinates be determined. Perform the following calculation to determine the "Pick-up" and "Replacement" location:

Z "Pick-up" Coordinate = (Z Coordinate from Step 6) - (55 mm)

NOTES: UNLESS OTHERWISE SPECIFIED
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3x ANGLE PROJECTION

ATI INDUSTRIAL AUTOMATION

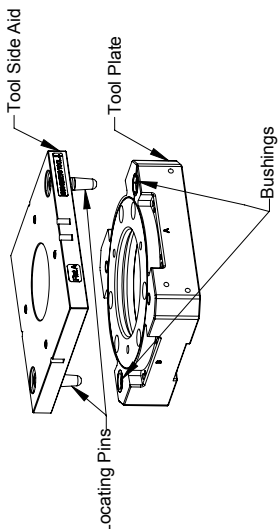
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DRAWN BY: W. Berrocal, 12/22/06	TITLE: QC-210 Alignment Teaching Aids
CHECKED BY: D. Norton, 4/2/07	DRAWING NUMBER: 9230-20-2516-02
WEIGHT (LB): N.A.	SCALE: 1:5
ASSEMBLY REF:	SIZE: B
	DATE: 12/22/06
	SHEET 1 OF 1

8.4 QC-213 Teaching Aid Assembly

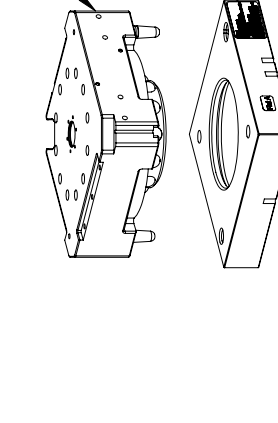
Rev. 01 Description: Initial Drawing	Initiator: RUR Date: 9/12/2014
-----------------------------------------	-----------------------------------

Step 1:
Place the Tool Plate in the Tool Stand. Programs should be written with the Tool Plate resting in the Tool Stand.



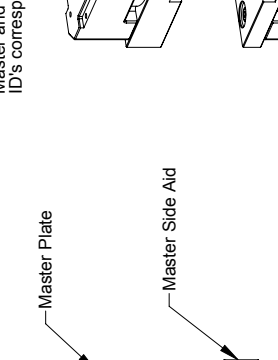
Labels: Locating Pins, Tool Side Aid, Tool Plate, Bushings

Step 2:
Mount the Tool Side Aid over the Tool Plate by inserting the Locating Pins into the Bushings. Orient the Tool Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Tool Plate.

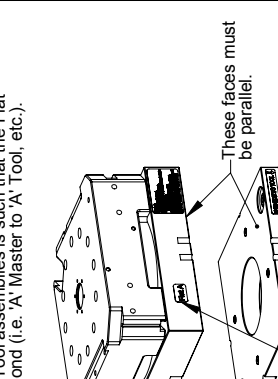


Labels: Master Plate, Master Side Aid

Step 3:
Mount the Master Side Aid to the QC Master Plate ensuring that the Taper Pins enter the corresponding holes in the Master Side Aid. Orient the Master Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Master Plate. Energize the Locking Mechanism to secure the Master Side Aid in place.

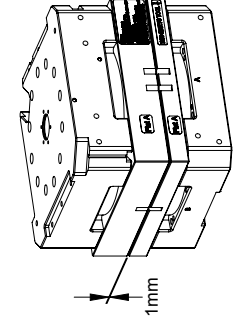


Step 4:
Bring the Master Plate Assembly to a position directly over the Tool Plate Assembly. The Master Plate Assembly Face should be parallel to the Tool Master and Tool Assemblies is such that the Flat ID's correspond (i.e. 'A' Master to 'A' Tool, etc.).



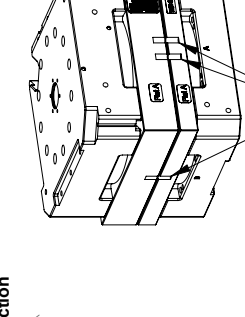
Labels: Master and Tool Flat ID's match. These faces must be parallel.

Step 5:
Move the Master Plate Assembly slowly downward until the Master and Tool Side Aids are approximately 1mm apart.



Label: 1mm

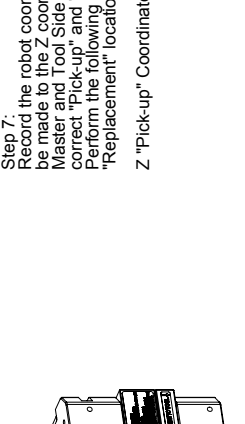
Step 6:
Adjust the position of the robot to correct for any lateral misalignment. Use the Alignment Marks to align the Tool Side and Master Side Aids.



Label: +Z Direction

Step 7:
Record the robot coordinates from Step 6. A correction must now be made to the Z coordinate to account for the thickness of the Master and Tool Side Teaching Aids. Only in this way can the correct "Pick-up" and "Replacement" coordinates be determined. Perform the following calculation to determine the "Pick-up" and "Replacement" locations:
 Z "Pick-up" Coordinate = (Z Coordinate from Step 6) - 55mm

Ensure the Tool Side and Master Side Alignment Marks are precisely aligned.



NOTES: UNLESS OTHERWISE SPECIFIED, DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.

3RD ANGLE PROJECTION

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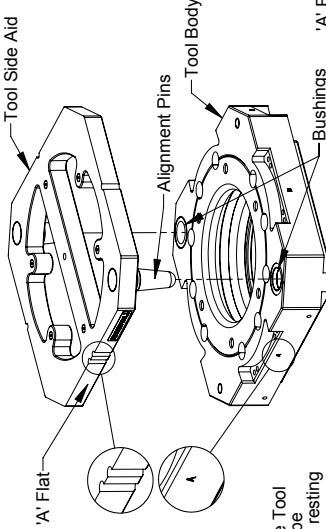
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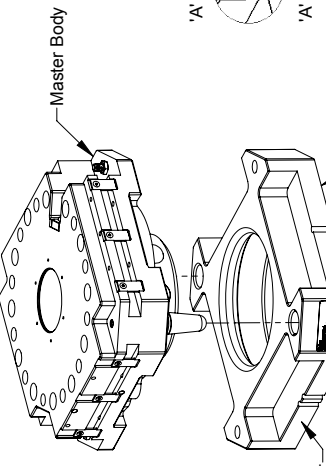
DRAWN BY: R. Raines 9/11/14	TITLE: QC-213 Teaching Aid Customer Drawing	SCALE: 1:4	REVISION: 01
CHECKED BY: D. Norton 10/30/14		SIZE: B	DRAWING NUMBER: 9230-20-7774
PROJECT #: 140827-2	SHEET 1 OF 1		

8.5 QC-310 Teaching Aid Assembly

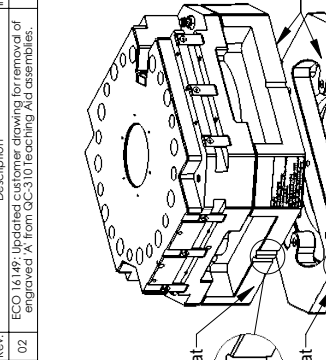
Rev. 02	Description ECO 16.149: Updated customer drawing for removal of engraved 'A' from QC-310 Teaching Aid assemblies.	Initiator TBC	Date 10/9/2017
---------	----------------------------------------------------------------------------------------------------------------------	------------------	-------------------




Step 1: Place the Tool Body in the Tool Stand. Programs should be written with the Tool Plate resting in the Tool Stand.



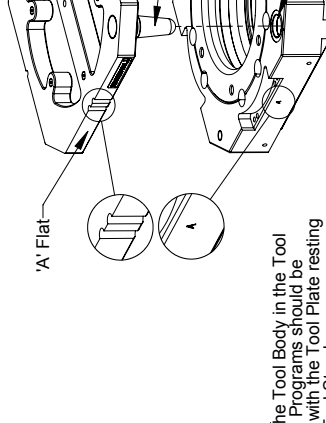
Step 2: Mount the Tool Side Aid over the Tool Body by inserting the Locating Pins into the Bushings. Orient the Tool Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Tool Body.



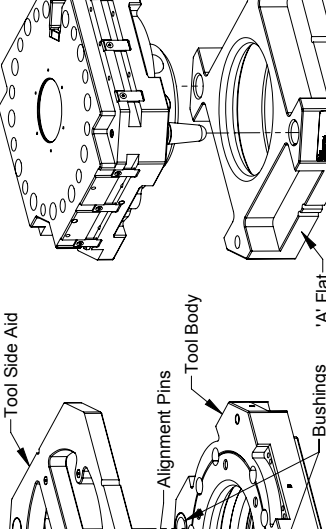
Step 3: Mount the Master Side Aid to the QC Master Body ensuring that the taper pins enter the corresponding holes in the Master Side Aid. Orient the Master Side Aid such that the 'A' Flat corresponds to the 'A' Flat on the Master Body. Energize the Locking Mechanism to secure the Master Side Aid in place.



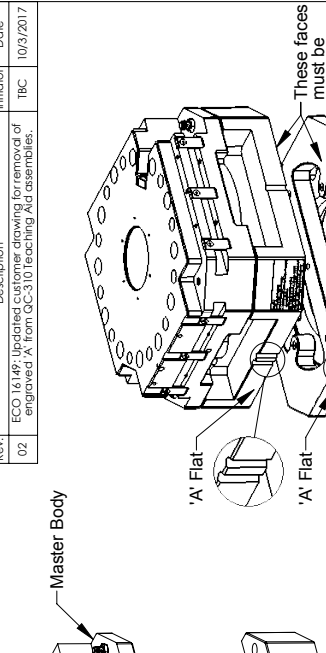
Step 4: Bring the Master Body Assembly to a position directly over the Tool Body Assembly. The Master Body Assembly's face should be parallel to the Tool Body Master and Tool assemblies are such that the Flat ID's correspond (i.e. 'A' Master to 'A' Tool, etc.).



Step 5: Move the Master Body Assembly slowly downward until the Master and Tool Side Aids are approximately 1 mm apart.

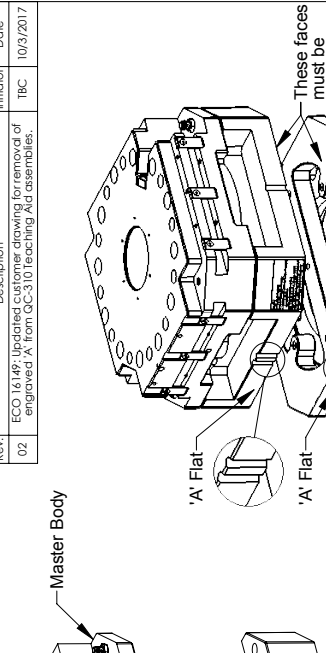


Step 6: Adjust the position of the robot to correct for any lateral misalignment. Use the Alignment Marks to align the Tool Side and Master Side Aids.



Step 7: Record the robot coordinates from Step 6. A correction must now be made to the Z coordinate to account for the thickness of the Tool and Master Side Teaching Aids. Only in this way can the correct "Pick-up" and "Replacement" coordinates be determined. Perform the following calculation to determine the "Pick-up" and "Replacement" location:

Z "Pick-up" Coordinate = (Z Coordinate from Step 6) - (71 mm)



These faces must be parallel.



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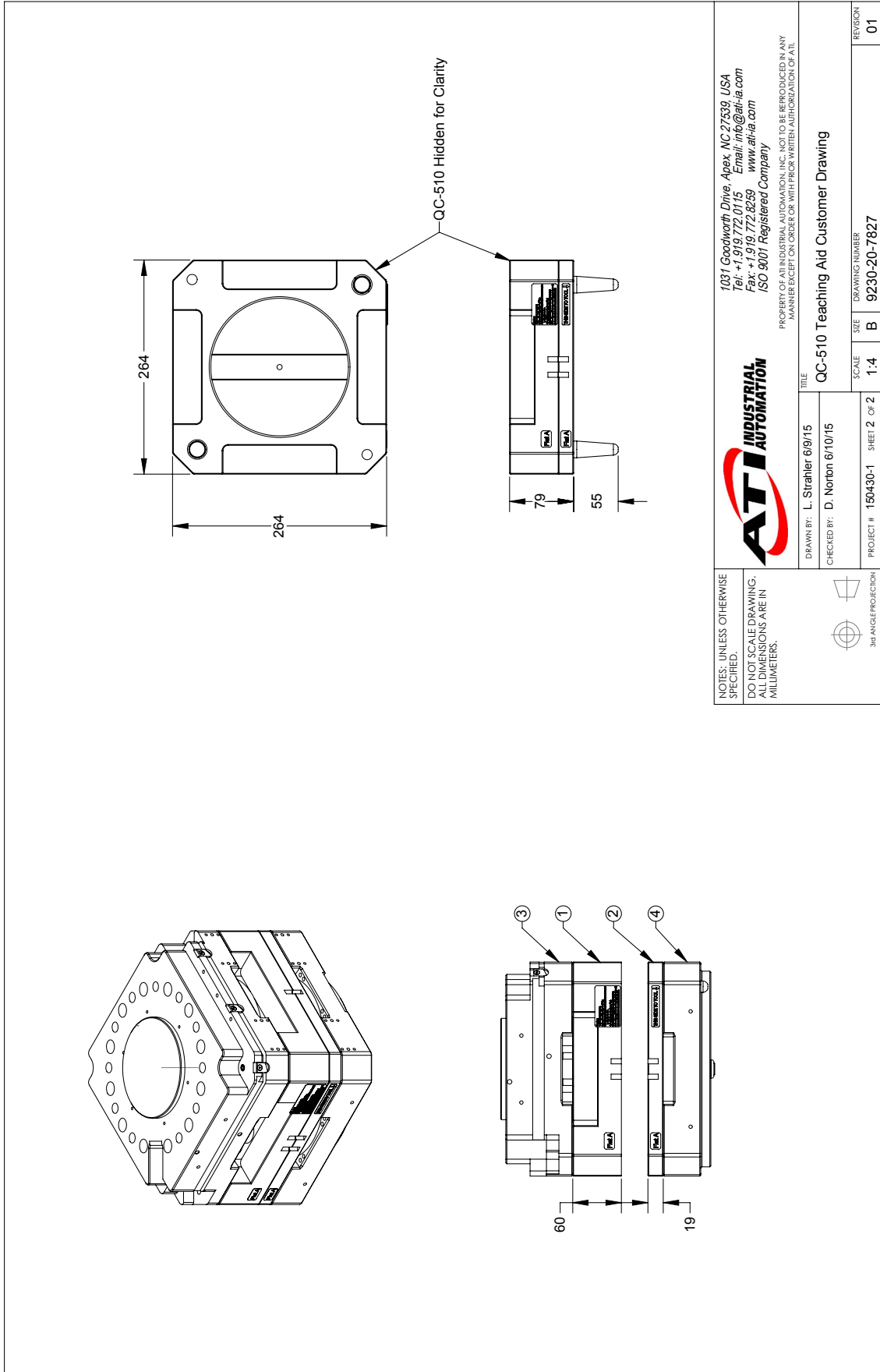
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8.6 QC-510 Teaching Aid Assembly

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Rev. 01</td> <td style="width: 50%;">Date 6/9/2015</td> </tr> <tr> <td colspan="2">Description Initial Drawing</td> </tr> <tr> <td>Initiator LCS</td> <td></td> </tr> </table>	Rev. 01	Date 6/9/2015	Description Initial Drawing		Initiator LCS			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>ITEM NO.</th> <th>QTY</th> <th>PART NUMBER</th> <th>DESCRIPTION</th> </tr> <tr> <td>1</td> <td>1</td> <td>9005-20-2448</td> <td>Master Side QC-510 Teaching Aid</td> </tr> <tr> <td>2</td> <td>1</td> <td>9005-20-2449</td> <td>Tool Side QC-510 Teaching Aid</td> </tr> <tr> <td>3</td> <td>1</td> <td>9121-510DM-0-0-0-0</td> <td>Base Assembly, Master, QC-510</td> </tr> <tr> <td>4</td> <td>1</td> <td>9121-510DT-0-0-0-0</td> <td>BASE ASSEMBLY, TOOL, QC-510</td> </tr> </table> <p>NOTES: UNLESS OTHERWISE SPECIFIED: DO NOT SCALE DRAWING. DIMENSIONS ARE IN MILLIMETERS.</p> <p style="text-align: center;">ATI INDUSTRIAL AUTOMATION</p> <p style="text-align: center; font-size: small;">1031 Goodworth Drive, Apex, NC 27539, USA Tel: +1.919.772.0115 Email: info@ati-ia.com Fax: +1.919.772.8259 www.ati-ia.com ISO 9001 Registered Company</p> <p style="text-align: center; font-size: x-small;">PROPERTY OF ATI INDUSTRIAL AUTOMATION, INC. NOT TO BE REPRODUCED IN ANY MANNER EXCEPT ON ORDER OR WITH PRIOR WRITTEN AUTHORIZATION OF ATI.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>DRAWN BY: L. Strahler 6/9/15</td> <td>TITLE: QC-510 Teaching Aid Customer Drawing</td> </tr> <tr> <td>CHECKED BY: D. Norton 6/10/15</td> <td></td> </tr> <tr> <td>PROJECT #: 150430-1</td> <td>SHEET 1 OF 2</td> </tr> <tr> <td>SCALE: 1:4</td> <td>DRAWING NUMBER: 9230-20-7827</td> </tr> <tr> <td></td> <td>REVISION: 01</td> </tr> </table>	ITEM NO.	QTY	PART NUMBER	DESCRIPTION	1	1	9005-20-2448	Master Side QC-510 Teaching Aid	2	1	9005-20-2449	Tool Side QC-510 Teaching Aid	3	1	9121-510DM-0-0-0-0	Base Assembly, Master, QC-510	4	1	9121-510DT-0-0-0-0	BASE ASSEMBLY, TOOL, QC-510	DRAWN BY: L. Strahler 6/9/15	TITLE: QC-510 Teaching Aid Customer Drawing	CHECKED BY: D. Norton 6/10/15		PROJECT #: 150430-1	SHEET 1 OF 2	SCALE: 1:4	DRAWING NUMBER: 9230-20-7827		REVISION: 01
Rev. 01	Date 6/9/2015																																					
Description Initial Drawing																																						
Initiator LCS																																						
ITEM NO.	QTY	PART NUMBER	DESCRIPTION																																			
1	1	9005-20-2448	Master Side QC-510 Teaching Aid																																			
2	1	9005-20-2449	Tool Side QC-510 Teaching Aid																																			
3	1	9121-510DM-0-0-0-0	Base Assembly, Master, QC-510																																			
4	1	9121-510DT-0-0-0-0	BASE ASSEMBLY, TOOL, QC-510																																			
DRAWN BY: L. Strahler 6/9/15	TITLE: QC-510 Teaching Aid Customer Drawing																																					
CHECKED BY: D. Norton 6/10/15																																						
PROJECT #: 150430-1	SHEET 1 OF 2																																					
SCALE: 1:4	DRAWING NUMBER: 9230-20-7827																																					
	REVISION: 01																																					

Notes:
 1. Slots used for End Effector Alignment.



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DRAWN BY: L. Strahler 6/9/15
 CHECKED BY: D. Norton 6/10/15

TITLE: QC-510 Teaching Aid Customer Drawing

PROJECT #: 150430-1 SHEET 2 OF 2
 SCALE: 1:4
 SIZE: B
 DRAWING NUMBER: 9230-20-7827
 REVISION: 01

8.7 QC-1210 Teaching Aid Assembly

Rev.	Description	Initiator	Date
01	Initial Drawing	ERDO	1/7/2014
02	ECO 12273: Changed arrow formatting, updated 9005-20-2286.	Dboh	6/20/2014

Step 1:
Place the Tool in the Tool Stand. Programs should be written with the Tool Plate resting in the Tool Stand.

Step 2:
Mount the Tool Side aid over the Tool Plate by inserting the Locating Pins into the Bushings.

Step 3:
Mount the Master Side Aid to the QC Master Plate ensuring that the taper pins enter the corresponding holes in the Master Side Aid.
Energize the Locking Mechanism to ensure the Master Side Aid is in place.

CAUTION: Make sure hands and fingers are free and clear of Locking Mechanism.

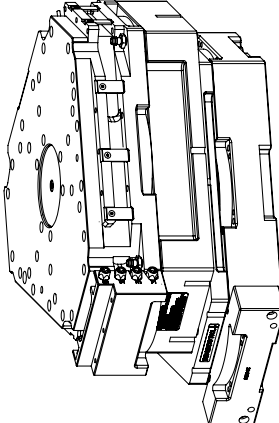
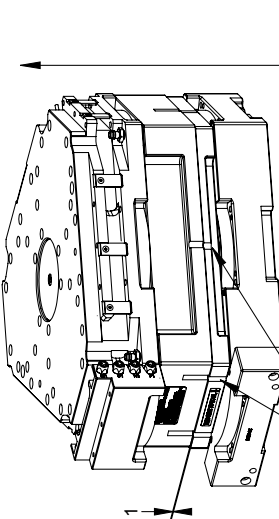
Step 4:
Bring the Master Plate Assembly to a position directly over the Tool Plate Assembly. The Master Plate Assembly's face should be parallel to the Tool Plate Assembly's face. Ensure that the orientation of the Master and Tool Assemblies are such that the Flat Alignment marks correspond.

NOTES: UNLESS OTHERWISE SPECIFIED,
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	TITLE QC-1210 Alignment Teaching Aids	SCALE 1:4	DRAWING NUMBER 9230-20-7701
DRAWN BY: E. Donkor 1/7/2014 CHECKED BY: D. Norton 1/16/2014		SHEET 1 OF 2	REVISION 02
PROJECT # 140103-2			

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Rev.</td> <td style="width: 30%;">Description</td> <td style="width: 10%;">Initiator</td> <td style="width: 5%;">Date</td> </tr> <tr> <td style="text-align: center;">-</td> <td style="text-align: center;">See Sheet1</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> </table>	Rev.	Description	Initiator	Date	-	See Sheet1	-	-	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Ensure that the Tool Side and Master Side Alignment Marks are precisely aligned.</p> </div> <div style="text-align: center;">  <p>+Z Direction</p> </div> </div> <div style="margin-top: 20px;"> <p>Step 5: Move the Master Plate Assembly slowly downward until the Master and Tool Side Aids are approximately 1mm apart.</p> <p>Step 6: Adjust the position of the robot to correct for any lateral misalignment. Use the Alignment Marks to align the Tool Side and Master Side Aids.</p> <p>Step 7 Record the robot coordinates from Step 6. A correction must now be made to the Z coordinate to account for the thickness of the Tool and Master Side Teaching Aids. Only in this way can the correct "Pick-up" and "Replacement" coordinates be determined. Perform the following calculation to determine the "Pick-up" and "Replacement" location: Z "Pick-up" Coordinate = (Z Coordinate from Step 6) - (70mm)</p> </div>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">ATI INDUSTRIAL AUTOMATION</td> </tr> <tr> <td colspan="2" style="text-align: center; font-size: small;"> 1031 Goodworth Drive, Apex, NC 27639, USA Tel: +1.919.772.0115 Email: info@ati-ia.com Fax: +1.919.772.8259 www.ati-ia.com ISO 9001 Registered Company </td> </tr> <tr> <td colspan="2" style="text-align: center; font-size: x-small;"> PROPERTY OF ATI INDUSTRIAL AUTOMATION, INC. NOT TO BE REPRODUCED IN ANY MANNER EXCEPT ON ORDER OR WITH PRIOR WRITTEN AUTHORIZATION OF ATI. </td> </tr> <tr> <td style="width: 50%;">DRAWN BY: E. Donkor 1/17/2014</td> <td style="width: 50%;">TITLE: QC-1210 Alignment Teaching Aids</td> </tr> <tr> <td>CHECKED BY: D. Norton 1/16/2014</td> <td>SCALE: 1:3</td> </tr> <tr> <td>PROJECT #: 140103-2</td> <td>SHEET 2 OF 2</td> </tr> <tr> <td>DRAWING NUMBER: 9230-20-7701</td> <td>REVISION: 02</td> </tr> </table>	ATI INDUSTRIAL AUTOMATION		1031 Goodworth Drive, Apex, NC 27639, USA Tel: +1.919.772.0115 Email: info@ati-ia.com Fax: +1.919.772.8259 www.ati-ia.com ISO 9001 Registered Company		PROPERTY OF ATI INDUSTRIAL AUTOMATION, INC. NOT TO BE REPRODUCED IN ANY MANNER EXCEPT ON ORDER OR WITH PRIOR WRITTEN AUTHORIZATION OF ATI.		DRAWN BY: E. Donkor 1/17/2014	TITLE: QC-1210 Alignment Teaching Aids	CHECKED BY: D. Norton 1/16/2014	SCALE: 1:3	PROJECT #: 140103-2	SHEET 2 OF 2	DRAWING NUMBER: 9230-20-7701	REVISION: 02
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9. Terms and Conditions of Sale

The following Terms and Conditions are a supplement to and include a portion of ATI's Standard Terms and Conditions, which are on file at ATI and available upon request.

ATI warrants to Purchaser that robotic Tool Changer products purchased hereunder will be free from defects in material and workmanship under normal use for a period of three (3) years from the date of shipment. The warranty period for repairs made under a RMA shall be for the duration of the original warranty, or ninety (90) days from the date of repaired product shipment, whichever is longer. ATI will have no liability under this warranty unless: (a) ATI is given written notice of the claimed defect and a description thereof within thirty (30) days after Purchaser discovers the defect and in any event not later than the last day of the warranty period; and (b) the defective item is received by ATI not later ten (10) days after the last day of the warranty period. ATI's entire liability and Purchaser's sole remedy under this warranty is limited to repair or replacement, at ATI's election, of the defective part or item or, at ATI's election, refund of the price paid for the item. The foregoing warranty does not apply to any defect or failure resulting from improper installation, operation, maintenance or repair by anyone other than ATI.

ATI will in no event be liable for incidental, consequential or special damages of any kind, even if ATI has been advised of the possibility of such damages. ATI's aggregate liability will in no event exceed the amount paid by purchaser for the item which is the subject of claim or dispute. ATI will have no liability of any kind for failure of any equipment or other items not supplied by ATI.

No action against ATI, regardless of form, arising out of or in any way connected with products or services supplied hereunder may be brought more than one (1) year after the cause of action accrued.

No representation or agreement varying or extending the warranty and limitation of remedy provisions contained herein is authorized by ATI, and may not be relied upon as having been authorized by ATI, unless in writing and signed by an executive officer of ATI.

Unless otherwise agreed in writing by ATI, all designs, drawings, data, inventions, software and other technology made or developed by ATI in the course of providing products and services hereunder, and all rights therein under any patent, copyright or other law protecting intellectual property, shall be and remain ATI's property. The sale of products or services hereunder does not convey any express or implied license under any patent, copyright or other intellectual property right owned or controlled by ATI, whether relating to the products sold or any other matter, except for the license expressly granted below.

In the course of supplying products and services hereunder, ATI may provide or disclose to Purchaser confidential and proprietary information of ATI relating to the design, operation or other aspects of ATI's products. As between ATI and Purchaser, ownership of such information, including without limitation any computer software provided to Purchaser by ATI, shall remain in ATI and such information is licensed to Purchaser only for Purchaser's use in operating the products supplied by ATI hereunder in Purchaser's internal business operations.

Without ATI's prior written permission, Purchaser will not use such information for any other purpose or provide or otherwise make such information available to any third party. Purchaser agrees to take all reasonable precautions to prevent any unauthorized use or disclosure of such information.

Purchaser will not be liable hereunder with respect to disclosure or use of information which: (a) is in the public domain when received from ATI; (b) is thereafter published or otherwise enters the public domain through no fault of Purchaser; (c) is in Purchaser's possession prior to receipt from ATI; (d) is lawfully obtained by Purchaser from a third party entitled to disclose it; or (f) is required to be disclosed by judicial order or other governmental authority, provided that, with respect to such required disclosures, Purchaser gives ATI prior notice thereof and uses all legally available means to maintain the confidentiality of such information.