

Table of Contents

D. Fluid/Air Modules	D-2
FH6-M/T, AQ3-T—Fluid/Air Module	D-2
1. Product Overview	D-2
2. Installation	D-3
2.1 Module Installation	D-3
2.2 Module Removal	D-4
3. Operation	D-5
4. Maintenance	D-6
4.1 Preventive Maintenance	D-6
5. Troubleshooting and Service Procedures	D-7
5.1 Troubleshooting	D-7
5.2 Service Procedures	D-8
5.2.1 Master Side Self-Sealing Valve Inspection and Replacement	D-8
5.2.2 Tool Side Self Sealing Valve.....	D-10
6. Serviceable Parts	D-12
6.1 Master Module Mounting Hardware	D-12
6.2 Tool Module Mounting Hardware	D-12
7. Specifications	D-12
8. Drawings	D-13
8.1 FH6-M FH6-T	D-13
8.2 FH6-M AQ3-T	D-14

D. Fluid/Air Modules

FH6-M/T, AQ3-T—Fluid/Air Module

1. Product Overview

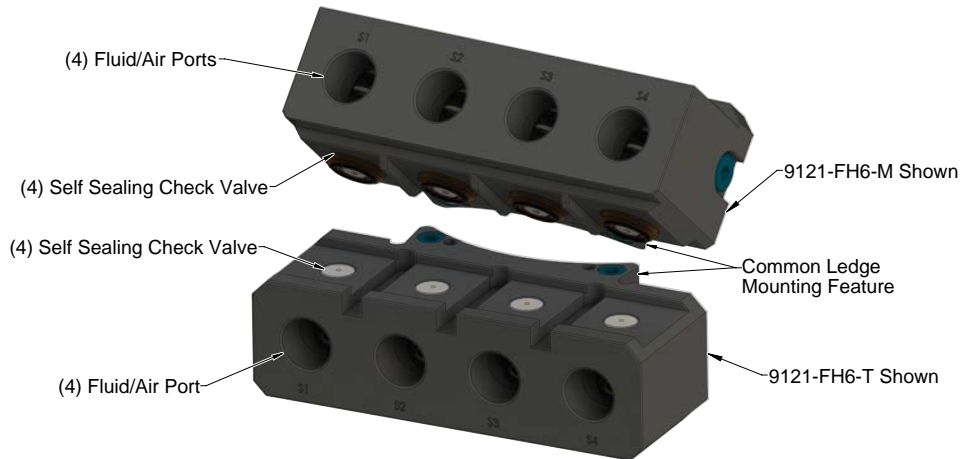
Fluid/air modules provide fluid and air utility, and are attached to the Master and Tool plates. When the Tool Changer is coupled, the Master module passes the fluid/air supply to the Tool module for use by the customer tooling. Significant forces are encountered when using these modules. Assistance from the robot may be required to overcome these forces when coupling the Tool Changer.

NOTICE: The Master and Tool modules contain self-sealing valves. Do not use self-sealing valves for vacuum utility.

Table 1.1—Fluid/Air Modules				
Module	Fluid/Air Ports	Valves	Material	Seals
FH6-M	(4) 1/2" BSPP	(4) self sealing check	Stainless Steel	Buna-N
FH6-T	(4) 1/2" BSPP	(4) self sealing check	Stainless Steel	Buna-N
AQ3-T	(1) 1/2" BSPP	(1) self sealing check	Anodized Aluminum	Buna-N

Both the FH6 Master and Tool side modules are supplied with (4) self sealing fluid/air ports. The AQ3 Tool side is supplied with (1) self sealing air port. Self sealing ports are not to be used for vacuum service.

Figure 1.1—Master and Tool Modules



2. Installation

The fluid/air modules are typically installed by ATI prior to shipment. Installation and removal are outlined in the following section.



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.



CAUTION: Do not use the Tool Changer with air pressure below 60 psi. Safe, reliable operation of the tool changer is dependent on a continuous supply of compressed air at a pressure of 60 to 100 psi. Robot motion should be halted if the air supply pressure is below 60 psi.



CAUTION: Thread locker applied to fasteners must not be used more than once. Fasteners might become loose and cause equipment damage. Always apply new thread locker when reusing fasteners.

2.1 Module Installation

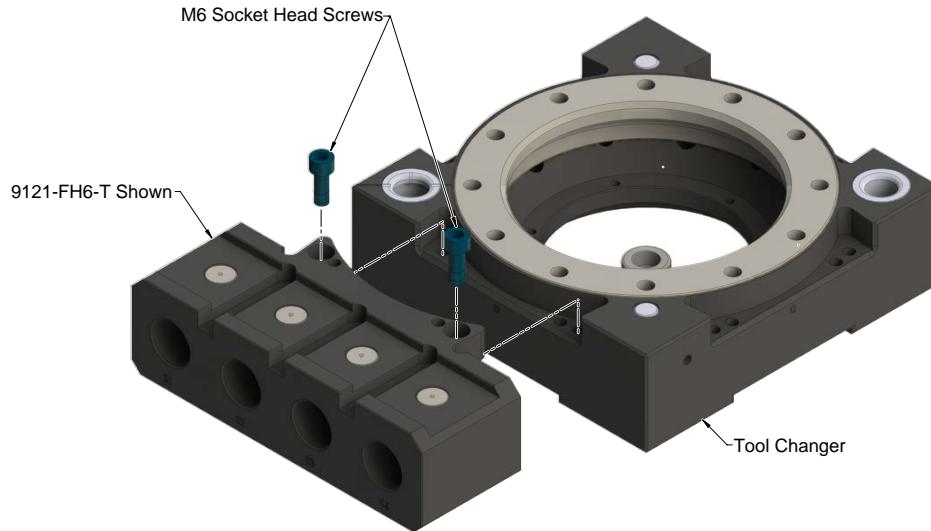
Refer to [Figure 2.1](#).

Tools required: 3 mm hex key, torque wrench

Supplies required: Clean rag, Loctite® 222

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Clean the mounting surface on the Tool Changer or Utility Coupler.
5. Place the module into the appropriate location on the Tool Changer or Utility Coupler body. Align the module with the Tool Changer using the dowels in the bottom of the ledge feature.
6. Apply Loctite 222 to the supplied M4 socket head cap screws. Using a 3 mm hex key, install the (4) M4 socket head cap screws securing the module to the Tool Changer or Utility Coupler and tighten to 22 in-lbs (2.5 Nm).
7. Connect air plumbing to the module. Ensure that the connectors are clean.
8. Safely resume normal operation.

Figure 2.1—Installation and Removal of the Module



2.2 Module Removal

Tools required: 3 mm hex key

Supplies required: Clean rag

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).

NOTICE: Debris can be expelled at high velocity during the purge, take all required safety precautions.

4. All customer plumbing connections to the module must be purged.
 - a. Verify that the supply lines are turned off.
 - b. Cover the valves with a rag for safety.
 - c. Manually actuate the self-sealing valves to purge the line pressure.
5. Use a marker pen to indicate where the module is to be re-installed.
6. Disconnect air plumbing to the module.
7. Remove the (4) M4 socket head cap screws using a 3 mm hex key.
8. Remove the module from the Tool Changer or Utility Coupler.

3. Operation

The fluid/air modules are designed to pass fluid/air utilities from the Master to the Tool for use by the customer's tooling (4) self-sealing valves are provided on the Master side so that the fluid/air circuits do not discharge during tool changes.

An additional G 1/8 plugged connection is provided on the end of the Master module. This connection is supplied from the Master module's S4 port and is provided to customers who wish to use that air to supply their valve adapter module with an integrated solenoid valve with lock/unlock air. It can not be used with air adapter modules that require separate lock and unlock air supplies. The customer is warned that if they choose to use this function, the air passing through the S4 port must never drop below the Tool Changer's minimum 60 psi (4 bar) requirement. Failure to maintain this pressure may result in improper and unsafe Tool Changer operation. Contact ATI's Application Engineers for more information.



CAUTION: If the G 1/8 connection to the master module's S4 port is used for lock/unlock air, the pressure must always maintain above 60 psi (4 Bar) to the G1/8 connection to insure proper, safe operation of the Tool Changer locking mechanism. If supply pressure drops below 60 psi (4 bar) the Tool Changer may not be securely locked or in a fail-safe condition, operation must be halted until the air pressure is returned to a minimum of 60 PSI and return the Tool Changer to a secure lock position. Always maintain a minimum of 60 psi (4 bar) to the G 1/8 connection through the S4 port.

Typically, self-sealed valves are specified on the Tool for ports being used for fluid service.

The compressibility of gasses makes it unnecessary to isolate and discharge lines during a tool change. However, liquids are incompressible and therefore coupling lines while pressurized is to be avoided. Liquid displaced by mating coupler components creates extremely high pressure spikes and fluid velocities potentially causing seal damage. These problems become more pronounced as the operating pressure is increased.

In all liquid coupling applications, the customer is advised to take the following steps:

- Plumb the couplers using flexible hoses, which are able to absorb pressure spikes and pulses. Do not use highly reinforced hoses and hard pipe.
- Turn off the supply pump to the circuit and discharge pressure in the lines prior to a tool change.
- Hydraulic pressure accumulators should be installed on both the Master and Tool side plumbing. This is particularly important on the Tool side, with the pump turned off and Master side pressure discharged.
- During routine maintenance of the tool changer, the couplers should be inspected and re-lubricated. Water and most solvents will wash away lubricants necessary to prolong seal life.



CAUTION: Failure to follow these steps will result in premature seal failure, jetting of fluid from the couplers during tool changes, and significant pressure pulses in customer tooling.

4. Maintenance

The operation of the fluid/air modules is generally trouble free. Periodically, the condition of the self-sealing valves should be checked. Refer to [Section 4.1—Preventive 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.

4.1 Preventive Maintenance

A visual inspection and preventive maintenance schedule is provided in [Table 4.1](#).

Table 4.1—Preventive Maintenance Schedule	
Inspection Schedule	Action Required
Weekly	Clean and inspect
6 months or 500,000 cycles	Seal replacement
Checklist	
Weekly Maintenance:	
<input type="checkbox"/> Clean mating surfaces. <input type="checkbox"/> Inspect modules for air leaks. Replace components as necessary.	
6 months or 500,000 cycle Maintenance:	
<input type="checkbox"/> On modules with self-sealing ports, remove and replace self-sealing valve O-rings and seals in both the Master and Tool Module. During O-ring and seal replacement, inspect components (valve stem, check valve piston, and spring) of the valve assemblies in the Master and Tool modules. Refer to Section 5.2—Service Procedures . <input type="checkbox"/> Check that module mounting bolts are secure. Refer to Section 2.1—Module Installation .	

5. Troubleshooting and Service Procedures

This troubleshooting section provides information to help diagnose conditions with the Tool Changer or air module as well as service procedures for component replacement.



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.



CAUTION: Thread locker applied to fasteners must not be used more than once. Fasteners might become loose and cause equipment damage. Always apply new thread locker when reusing fasteners.

5.1 Troubleshooting

Troubleshooting information is provided in the following table.

Symptom	Possible Cause	Correction
Fluid/Air Leakage	The seals are damaged or worn	Replace O-rings as needed. Refer to Section 5.2—Service Procedures .
	Debris is blocking the valve seal (for self-sealing valves)	Clean in and around valve components. Ensure fluid stream is free of large particulates; filter as necessary.
	The valve piston is bent (for self-sealing valves)	Replace stem. Refer to Section 5.2—Service Procedures . Check module attachment to Tool Changer. Refer to Section 2.1—Module Installation . Check robot program and ensure parallel approach trajectory during Tool Changer coupling.
	Corrosion	Consult ATI Applications Engineering for assistance.
Fluid sprays during uncoupling	Surge/Water Hammer	Decrease pressure differential between supply and return lines or install pressure compensation system (e.g. accumulator or surge suppressor as close as possible to spraying port). Consult ATI for assistance.
Insufficient Flow	Flow path blockage	Inspect valve components and supply/return lines for blockage. Clean/repair as necessary.
	Debris is blocking the valve seal (for self-sealing valves)	Clean in and around valve components. Ensure air stream is free of large particulates; filter as necessary.
Modules do not couple	Debris is between Tool Change Master and Tool plates or modules	Clean debris from between Master and Tool Plates and modules.
	The valve piston and/or dowel pin (for self-sealing valves) is bent	Replace stem. Refer to Section 5.2—Service Procedures . Check module attachment to Tool Changer. Refer to Section 2.1—Module Installation . Check robot program and ensure parallel approach trajectory during Tool Changer coupling.

5.2 Service Procedures

Component replacement and adjustment procedures are provided in the following section.

5.2.1 Master Side Self-Sealing Valve Inspection and Replacement

Parts required: Refer to *Section 8—Drawings*

Tools required: 2.5 mm hex key, torque wrench

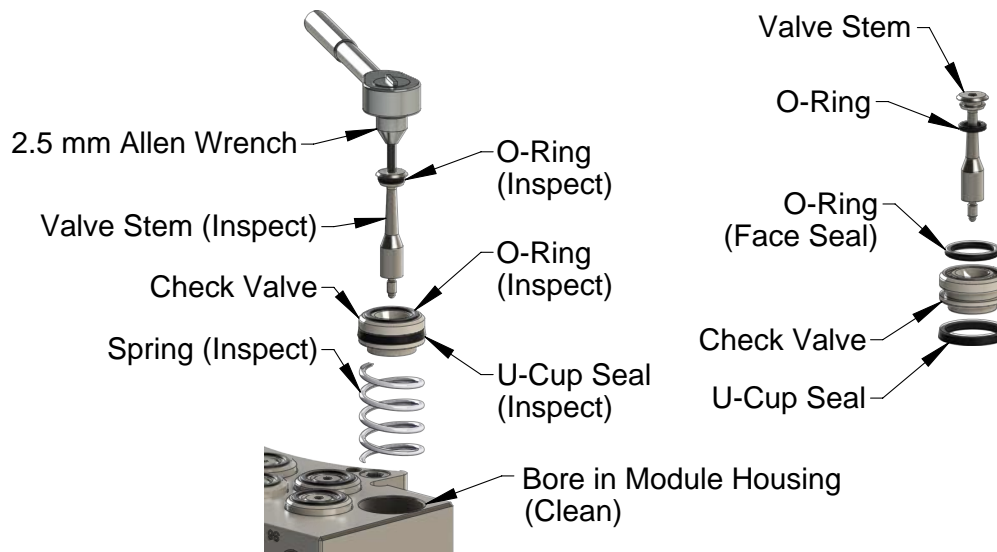
Supplies required: Clean rag, Magnalube G lubricant

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).

NOTICE: Debris can be expelled at high velocity during the purge, take all required safety precautions.

4. Purge and disconnect all customer plumbing connections to the module.
 - a. Turn the supply lines off.
 - b. Cover the valves with a rag for safety.
 - c. Manually actuate the module's self-sealing valves to purge the line pressure. Note: Debris can be expelled at high velocity during the purge, take all required safety precautions.
5. Depending on the type of service or repair, connections to the module might also need to be disconnected.
6. Remove the valve stem using a 2.5 mm hex key. Do not strip the hex on the valve stem during removal.
7. Remove the check valve piston and spring. Clean any lubrication from the check valve piston, valve stem, spring, and bore in the module housing using a clean rag.
8. Inspect the valve stem for straightness, and replace, if bent.
9. Inspect the o-rings and u-cup seal on the valve stem and check valve piston for wear and damage. Replace components that are damaged or worn.
10. Inspect the spring in the assembly and replace if damaged or worn.

Figure 5.1—Master Self-Sealing Valve



11. Lubricate the bore in the module housing with Magnalube G (Teflon/Petroleum based grease).

NOTICE: Do not lubricate the O-ring face seal until after installation. Lubricating the O-ring before installation can cause the O-ring to blow out during coupling and uncoupling.

12. If replacing seals, lubricate the valve stem O-ring and the check valve piston U-cup seal with Magnalube G (Teflon/Petroleum based grease).

13. Install the O-ring on the valve stem.

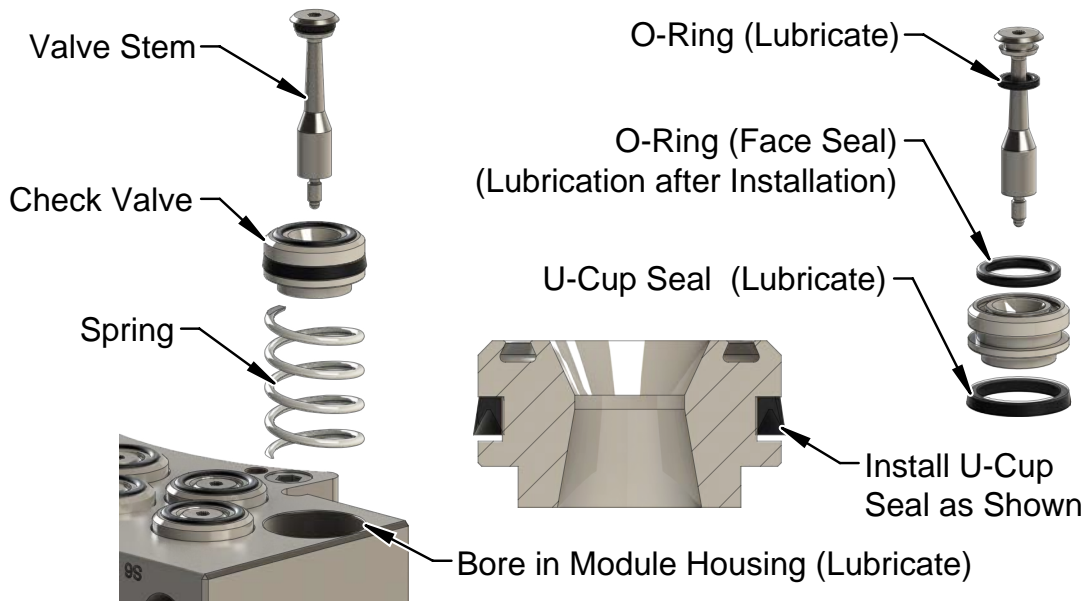
14. Install the U-cup seal on the check valve. Do not get lubrication in the face seal groove in the check valve.

15. Install the non-lubricated O-ring (face seal) into the check valve.

16. Install the spring into the bore in the module housing, seat the check valve on the spring.

17. If the threaded end of the valve stem does not have pre-applied adhesive, apply Loctite 7649 primer and then Loctite 222 or similar thread locker to the threaded end of the valve stem. If the module housing is stainless steel, also add Loctite 7649 primer to the housing threads.

Figure 5.2—Master Self-Sealing Valve Installation



18. Install the valve stem. The check valve piston must be pushed down flush with the mating surface of the Master housing in order to install the threaded end of the valve stem. Do not damage the U-cup seal around the check valve piston. A small, flat-head screwdriver can be used to ensure that the U-cup seal is fully located in the recess and not folded over itself prior to screwing in the valve stem. Tighten the stem to 10 in-lbs (1.1 Nm).

19. Lubricate the installed O-ring (face seal) with Magnalube G (Teflon/Petroleum based grease).

20. Safely resume normal operation.

5.2.2 Tool Side Self Sealing Valve

Parts required: Refer to [Section 8—Drawings](#)

Tools required: 10 mm hex key, Torque wrench

Supplies required: Clean rag, Magnalube G lubricant

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).

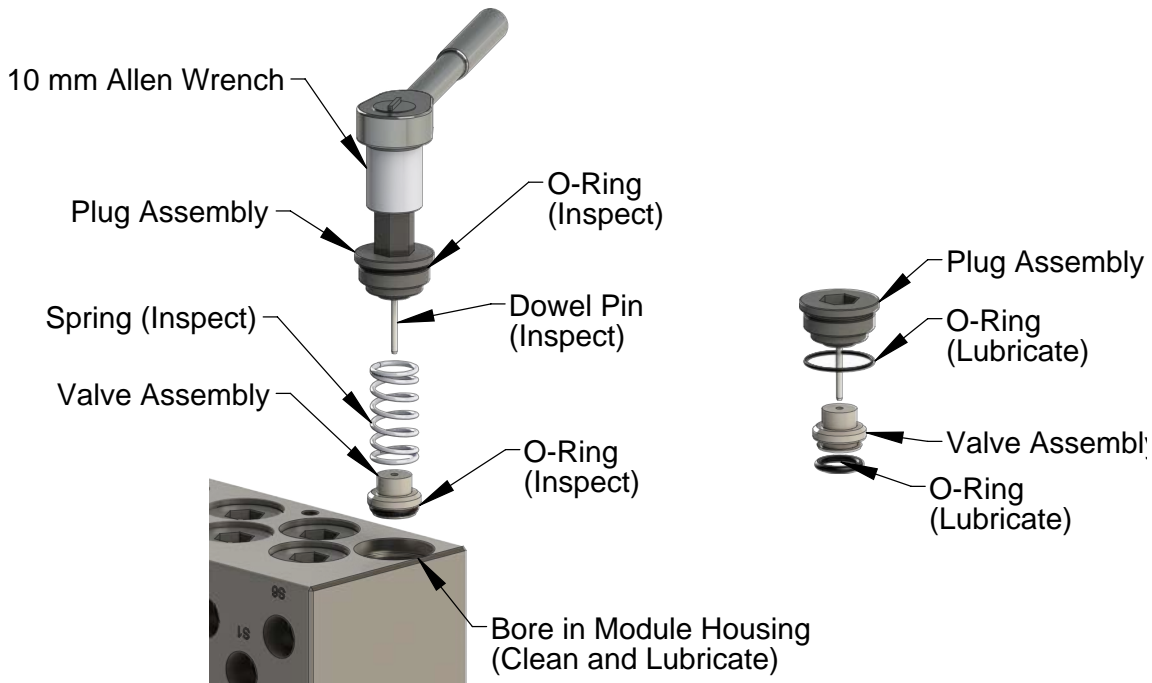
NOTICE: Debris can be expelled at high velocity during the purge, take all required safety precautions.

4. All customer plumbing connections to the module must be purged.
 - a. Verify that the supply lines are turned off.
 - b. Cover the valves with a rag for safety.
 - c. Manually actuate the self-sealing valves to purge the line pressure.
5. If required disconnect connections to the module.

NOTICE: You might need to remove the Tool side module to access the plug.

6. Remove the plug assembly from the bottom of the air module using a 10 mm hex key.
7. Remove the spring and valve assembly from the housing.

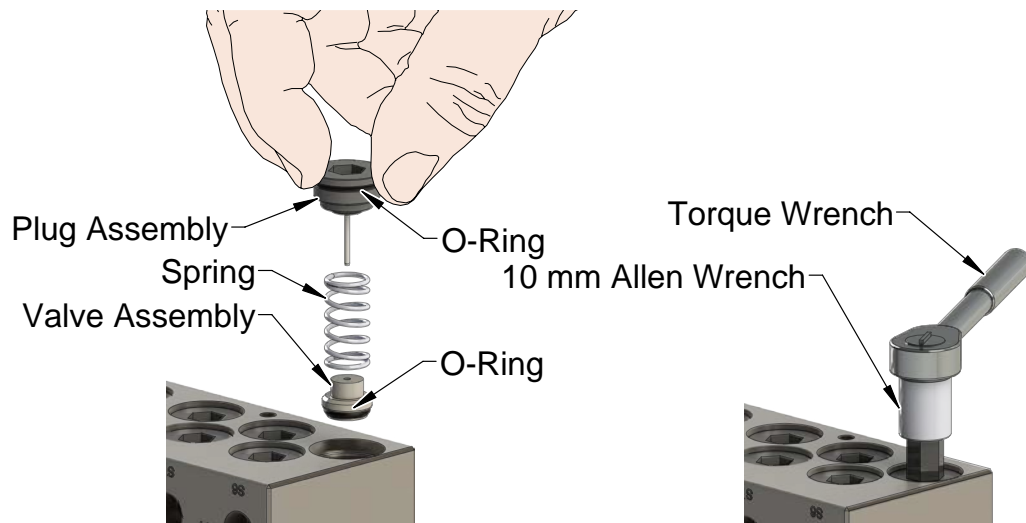
Figure 5.3—Tool Self-Sealing Valve (Disassembly)



8. Clean all lubrication from the plug assembly, valve assembly, spring, and bore in the housing using a clean rag.
9. Inspect the dowel pin that is contained in the plug assembly for straightness. Replace the plug assembly if the dowel pin is bent.
10. Inspect the O-rings on the plug and valve assemblies, replace if worn or damaged.
11. Inspect the spring in the assembly and replace if worn or damaged.

12. If replacing the O-rings, lubricate both new O-rings with Magnalube G (Teflon/Petroleum based grease).
13. Install the O-rings on the plug assembly and the valve assembly.

Figure 5.4—Tool Self-Sealing Valve (Assembly)



14. Install the check valve piston, make sure it is seated properly in the housing.
15. Install the spring into the housing, make sure it is installed over the step on the check valve.



CAUTION: Do not use excess force when installing the plug assembly into the housing. Using excessive force can damage the O-ring and strip the threads on the plug assembly. Thread the plug assembly into the Tool housing by hand, until several threads are engaged into the housing. Then use a 10 mm hex key to complete the installation. Torque the plug to 30 in-lbs (3.39 Nm).

16. Carefully install the plug assembly aligning the dowel pin into the check valve piston. Thread the plug assembly into the housing by hand until several threads are engaged in the housing.
17. Tighten the plug assembly using a 10 mm hex key to 30 in-lbs (3.39 Nm).
18. Verify the check valve piston is seated properly in the housing.
19. Safely resume normal operation.

6. Serviceable Parts

See drawings in [Section 8—Drawings](#) of this manual.

6.1 Master Module Mounting Hardware

Table 6.1—Master Module Mounting Hardware		
Part Number	Qty	Description
3500-1066020-21A	2	M6 x 20 Socket Head Cap Screw, SS, ND Microspheres

6.2 Tool Module Mounting Hardware

Table 6.2—Tool Module Mounting Hardware		
Part Number	Qty	Description
3500-1065016-21	2	M6 X 16 Socket Head Cap Screw, SS316

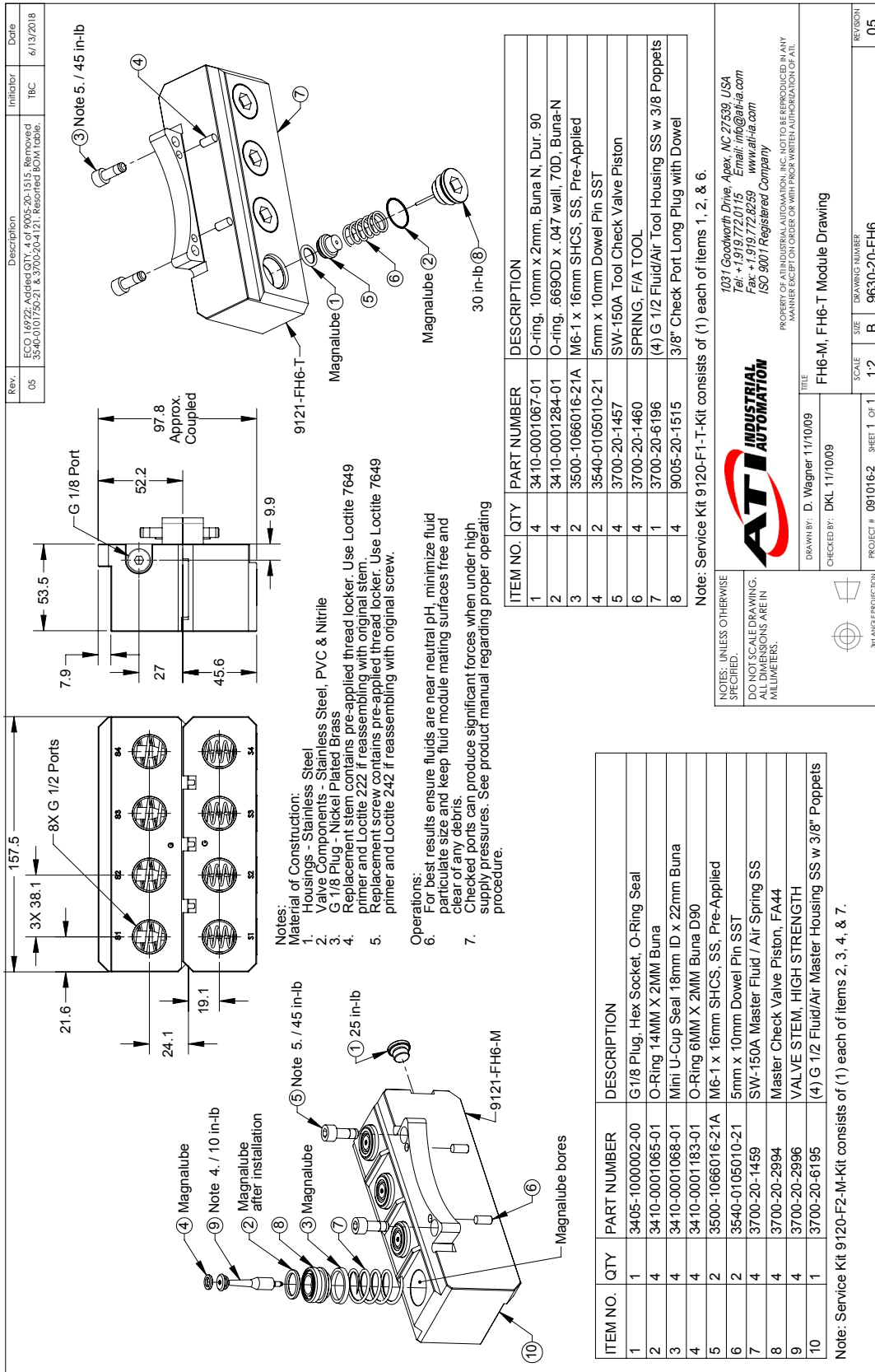
7. Specifications

Table 7.1—FH6 Module Specifications	
9121-FH6-M	Stainless Steel Fluid/Air module with (4) 1/2" G self sealing ports, style 1d - Master side
9121-FH6-T	Stainless Steel Fluid/Air module with (4) 1/2" G self sealing ports, style 1d - Tool side
Materials of Construction	Various - Stainless Steel valve components and housing, Buna-N seals
Weight:	
Master Module	6.6 lbs (3.0 kg)
Tool Module	4.9 lbs (2.2 kg)
Self sealing Valves:	
Quantity	4
Air Pressure	Maximum pressure of 100 psi (6.9 bar)
Cv, Min	1.6
Customer Port Connection	1/2" BSPP "G"

Table 7.2—AQ3 Module Specifications	
9121-AQ3-T	Pneumatic module with (1) G 1/2 self sealing port - Tool side
Materials of Construction	Various - Stainless Steel valve components, aluminum housing, Buna-N seals
Weight:	
Tool Module	4.9 lbs (2.2 kg)
Self sealing Valves:	
Quantity	4
Air Pressure	Maximum pressure of 100 psi (6.9 bar)
Cv, Min	1.6
Customer Port Connection	1/2" BSPP "G"

8. Drawings

8.1 FH6-M FH6-T



8.2 FH6-M AQ3-T

9121-AQ3-T

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	1	3405-1000002-00	G 1/8 Plug, Hex Socket, O-Ring Seal
2	4	3410-0001065-01	O-Ring 14MM X 2MM Buna
3	4	3410-0001068-01	Mini U-Cup Seal 18mm ID x 22mm Buna
4	4	3410-0001183-01	O-Ring 6MM X 2MM Buna D90
5	2	3500-1066020-21A	MG-1 x 20mm SHCS, SS, Pre-Applied
6	2	3540-0105010-21	5mm x 10mm Dowel Pin SST
7	4	3700-20-1459	SW-150A Master Fluid / Air Spring SS
8	4	3700-20-2994	Master Check Valve Piston, FA44
9	4	3700-20-2996	VALVE STEM, HIGH STRENGTH
10	1	3700-20-6195	(4) G 1/2 Fluid/Air Master Housing SS w 3/8" Poppets

Note: Service Kit 9120-F2-M-Kit consists of (1) each of items 2, 3, 4, & 7.

9121-FH6-M

Notes:

Material of Construction:

- Housings - Stainless Steel
- Valve Components - Stainless Steel, PVC & Nitrile
- G 1/8 Plug - Nickel Plated Brass
- Replacement stem contains pre-applied thread locker. Use Loctite 7649 primer and Loctite 222 if reassembling with original stem.
- Replacement screw contains pre-applied thread locker. Use Loctite 7649 primer and Loctite 242 if reassembling with original screw.

Operations:

- For best results ensure fluids are near neutral pH, minimize fluid particulate size and keep fluid module mating surfaces free and clear of any debris.
- Checked ports can produce significant forces when under high supply pressures. See product manual regarding proper operating procedure.

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	1	3410-0001067-01	O-ring, 10mm x 2mm, Buna N, Dur. 90
2	1	3410-0001284-01	O-ring, .6690D x .047 wall, 70D, Buna-N
3	2	3500-1066016-21A	M6-1 x 16mm SHCS, SS, Pre-Applied
4	2	3540-0105010-21	5mm x 10mm Dowel Pin SST
5	1	3700-20-1457	SW-150A Tool Check Valve Piston
6	1	3700-20-1460	SPRING, F/A TOOL
7	1	3700-20-6925	(1) G 1/2 Air Tool Housing w 3/8" Poppet at Port S4
8	1	9005-20-1515	3/8" Check Port Long Plug with Dowel

Note: Service Kit 9120-F1-T-Kit consists of (1) each of items 1, 2, & 6.

NOTES: UNLESS OTHERWISE SPECIFIED:

DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.

3/4 ANGLE PROJECTION

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Rev.	Description	Initiator	Date
04	ECO 14921-9121-AQ3-T, Added QTY, 1 of 9005-20-1515, Removed 3540-0101750-21 & 3700-20-4121. Resorted BOM table.	TBC	6/9/2018

TITLE	SCALE	SIZE	DRAWING NUMBER	REVISION
FH6-M, AQ3-T Module Drawing	1:2	B	9630-20-FH6M-AQ3T	04

PROJECT # 091016-2 SHEET 1 of 1