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D. Fluid/Air Modules

FGx, FNx, FR2, FR2L, FR4

1. Product Overview

There are several fluid/air modules available for the use with the Tool Changer as described in the table below. The FN2 and FN4 modules are shown in Figures 1.1 and 1.2.

FG2	(2) 3/8 BSPP “G” self-sealing ports
FN2	(2) 3/8 NPT self-sealing ports
FG4	(4) 3/8 BSPP “G” self-sealing ports
FN4	(4) 3/8 NPT self-sealing ports
FG2AT FN2A-T FG4A-T FN4A-T	Pass-through ports on Tool-side
FR2	(3) 3/8" BSPT “R“ self-sealing ports - Rail Mount
FR2L	(2) ½ BSPT “R” self-sealing ports
FR4	(4) 3/8 BSPT “R” self-sealing ports

Table 1.1—Fluid/Air Modules

NOTE:
The FN2, FG2, FN4, FG4, FR4 modules can be supplied as either self-sealing both sides or self-sealing on the Master side only. The FR2 and FR2L modules are self-sealing on both sides. Self-sealing ports are not to be used for vacuum service.

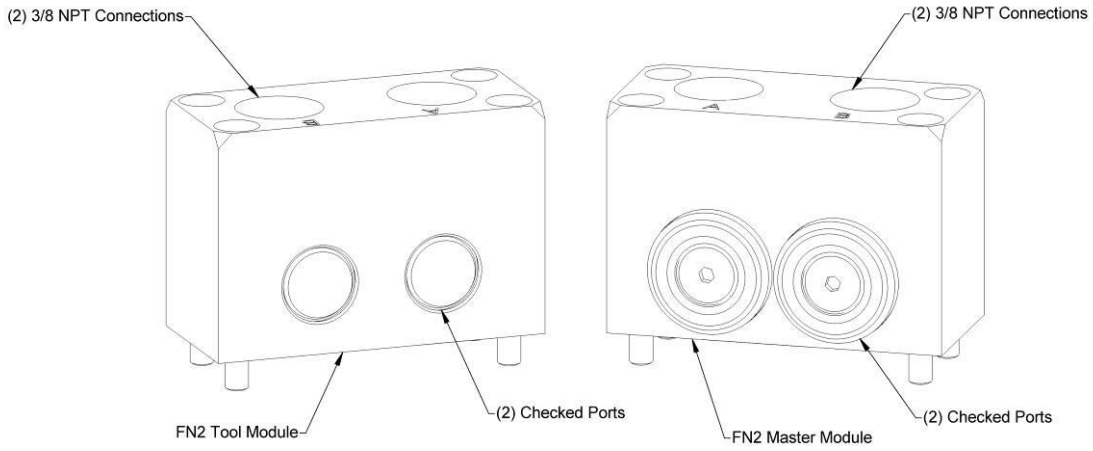


Figure 1.1—FN2 Fluid/Air Module (Typical)

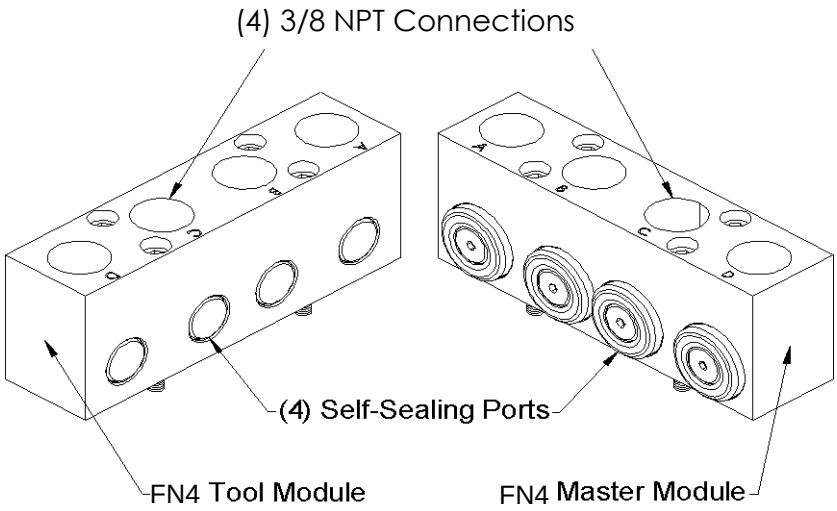


Figure 1.2—FN4 Fluid/Air Module

2. Installation

The fluid/air modules are typically installed by ATI prior to shipment. The steps below outline the field installation or removal as required.

> **WARNING:** Do not perform maintenance or repair on Tool Changer or modules with power or air on. Injury or equipment damage can occur with power or air on. Turn off power and air before performing maintenance or repair on Tool Changer or modules.

2.1 Installation

1. It may be necessary to clean the mounting surface on the Tool Changer prior to installing the module in order to remove any debris that may be present.

   > **CAUTION:** Air supply should be clean, dry, and non-lubricated. Supply pressure should not exceed 100 psi and should be filtered 50 micron or better. Connection lines should be properly strain-relieved.

2. Align the module to the holes in the pattern or Tool Changer mounting surface using the dowels that are pressed into the module housing. Push the module up flush with the mounting surface. Apply Loctite-242® (or similar) thread locker to the socket head cap screws and tighten using a hex key.
3. Connect customer plumbing to the module.

2.2 Removal

1. All customer plumbing connections to the module need to be purged and disconnected. Once the supply lines have been turned off, the self-sealing valves on the module can be manually actuated to purge the line pressure. Cover the valves with a rag prior to purging in order to keep the fluid/air from impinging upon any person.
2. Remove the socket head cap screws and pull the module off the pattern or Tool Changer.

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.

Self-sealing valves are provided so that the fluid/air circuits do not discharge during tool change.

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. Highly reinforced hoses and hard pipe must not be used.
- 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, even 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.

CAUTION: To maximize the life and performance of fluid/air components, read and follow the steps in *Section 3—Operation* of this manual.

4. Maintenance

Once installed the operation of the fluid/air modules is generally trouble free. Periodically the condition of the self-sealing valves should be checked. Replace any damaged or degraded components as necessary. Any contamination in or around the mating surfaces of the modules should be removed with industrial contact cleaner. During inspection, ensure that the fasteners attaching the modules to the Tool Changer are secure.

The modules may be field serviced as needed. The following list describes how to perform various operations.

WARNING: Do not perform maintenance or repair on Tool Changer or modules with power or air on. Injury or equipment damage can occur with power or air on. Turn off power and air before performing maintenance or repair on Tool Changer or modules.

4.1 Master-Side Self-Sealing Valve

1. The self-sealing valve assembly (stem, check valve, spring and seals) can be inspected by removing the stem using a 2.5mm hex key. Be careful not to strip the hex on the stem during removal.
2. Once the stem is removed all seals can be inspected and replaced as required.
3. The spring in the assembly should be inspected and replaced as required.
4. The stem should be inspected for straightness and replaced if bent.
5. To re-install the valve assembly, all components should be arranged in order as they were removed. (See drawings in *Section 8—Drawings*.)
6. Loctite-222 (or similar) thread locker should be applied to the threaded end of the stem and the stem re-installed. The piston will have to be pushed down flush with the mating surface in order to get the stem thread started. It is important that the U-cup seal around the check valve is not

damaged during this step. 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 stem.

4.2 Tool-Side Self-Sealing Valve

1. The self-sealing valve assembly (plug, spring, piston and seals) can be inspected by removing the plug on the bottom of the fluid/air module using either a spanner wrench or 8mm hex key. (Note: The FR2L valve retainers are located on the valve-side of the module.) It may be necessary to remove the tool side fluid/air module to have access to the plug. (Refer to the *Section 2—Installation* for instructions for module removal.)
2. Once the plug is removed all seals can be inspected and replaced as required.
3. The spring in the assembly should be inspected and replaced as required.
4. The plug may contain a dowel pin. The pin should be inspected for straightness and replaced if bent.
5. To re-install the valve assembly, all components should be arranged in order as they were removed. (See drawings in *Section 8—Drawings*.)
6. Care should be taken not to damage the O-ring around the plug base during installation.

5. Troubleshooting

Problem	Cause	Remedy
Fluid/Air Leakage	Damaged/Worn seals	Replace seals.
	Debris blocking valve seal	Clean in and around valve components. Ensure fluid stream is free of large particulates, filter as necessary.
	Bent stem	Replace stem. Check module attachment to Tool Changer. Check robot program and ensure parallel approach trajectory during Tool Changer coupling.
	Corrosion	Consult ATI for assistance.
Fluid spray 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.
Poor Flow	Flow path blockage	Inspect valve components and supply/return lines for blockage, clean/repair as necessary.
	Debris blocking valve seal	Clean in and around valve components. Ensure fluid stream is free of large particulates, filter as necessary.
Modules Won't Couple	Bent stem, dowel pin	Replace stem, dowels as necessary. Check module attachment to Tool Changer. Check robot program and ensure parallel approach trajectory during Tool Changer coupling.

6. Recommended Spare Parts

See drawings in *Section 8—Drawings*.

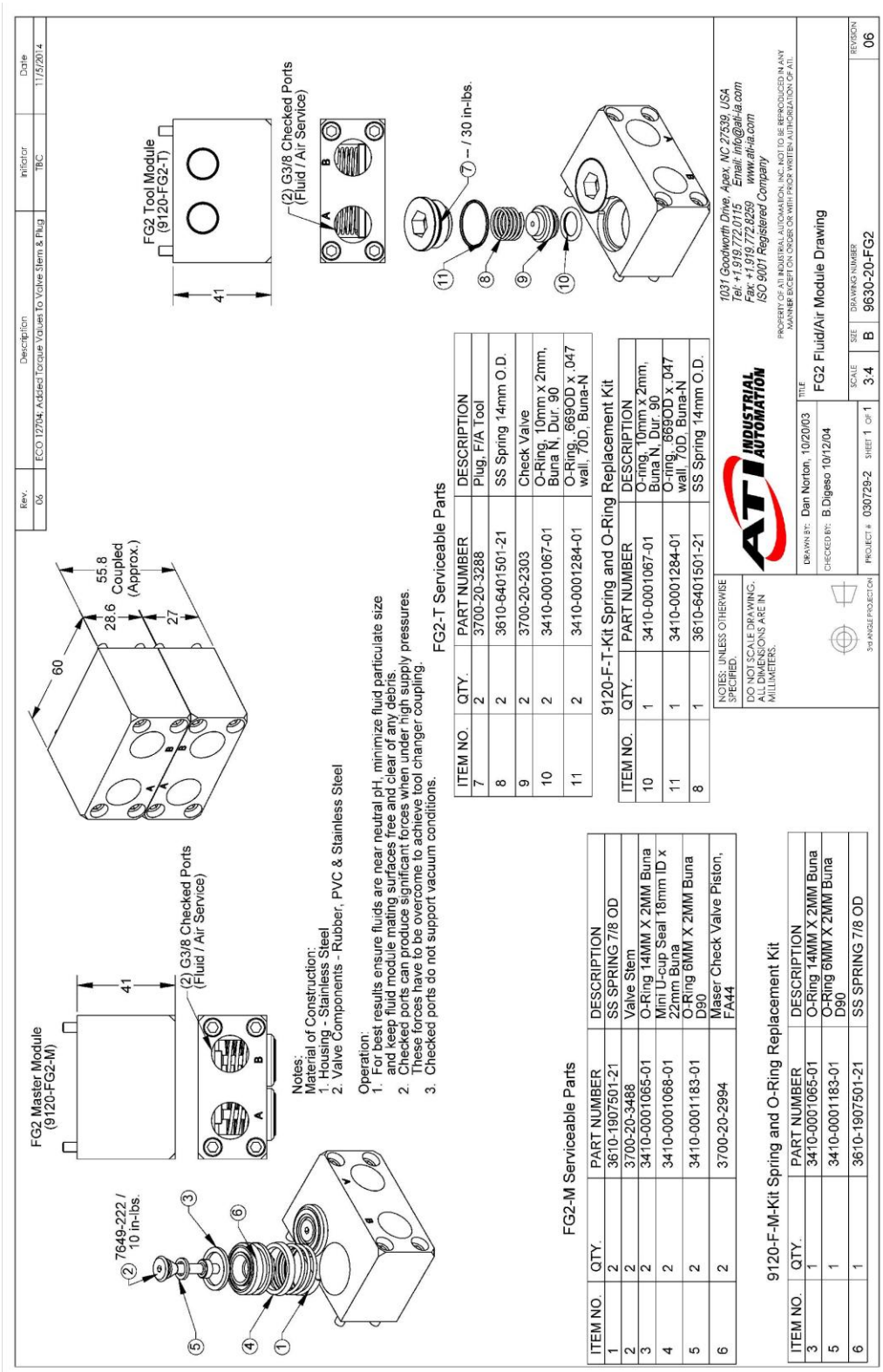
7. Specifications

Fluid/Air Modules

Pneumatic Ports, (qty) Size (C_v, min.)	**FG2-M, FG2-T** (2) 3/8 BSPP “G” (1.45)	Maximum pressure of 100psi (6.9bar), Nitrile seals, Self-sealing (cannot operate under a vacuum.
	FN2-M, FN2-T (2) 3/8 NPT (1.45)	
	FG4-M, FG4-T (4) 3/8 BSPP “G” (1.45)	
	FN4-M, FN4-T (4) 3/8 NPT (1.45)	
	FR4-M, FR4-T (4) 3/8 BSPT “R“ (1.45)	
	FR2-M, FR2-L (2) 3/8 BSPT “R“ (1.45)	Nitrile seals, Self-sealing (cannot operate under a vacuum).
	FR2L-M, FR2L-T (2) ½ BSPT “R” (1.45)	

8. Drawings

8.1 FG2 Fluid/Air Module Drawing



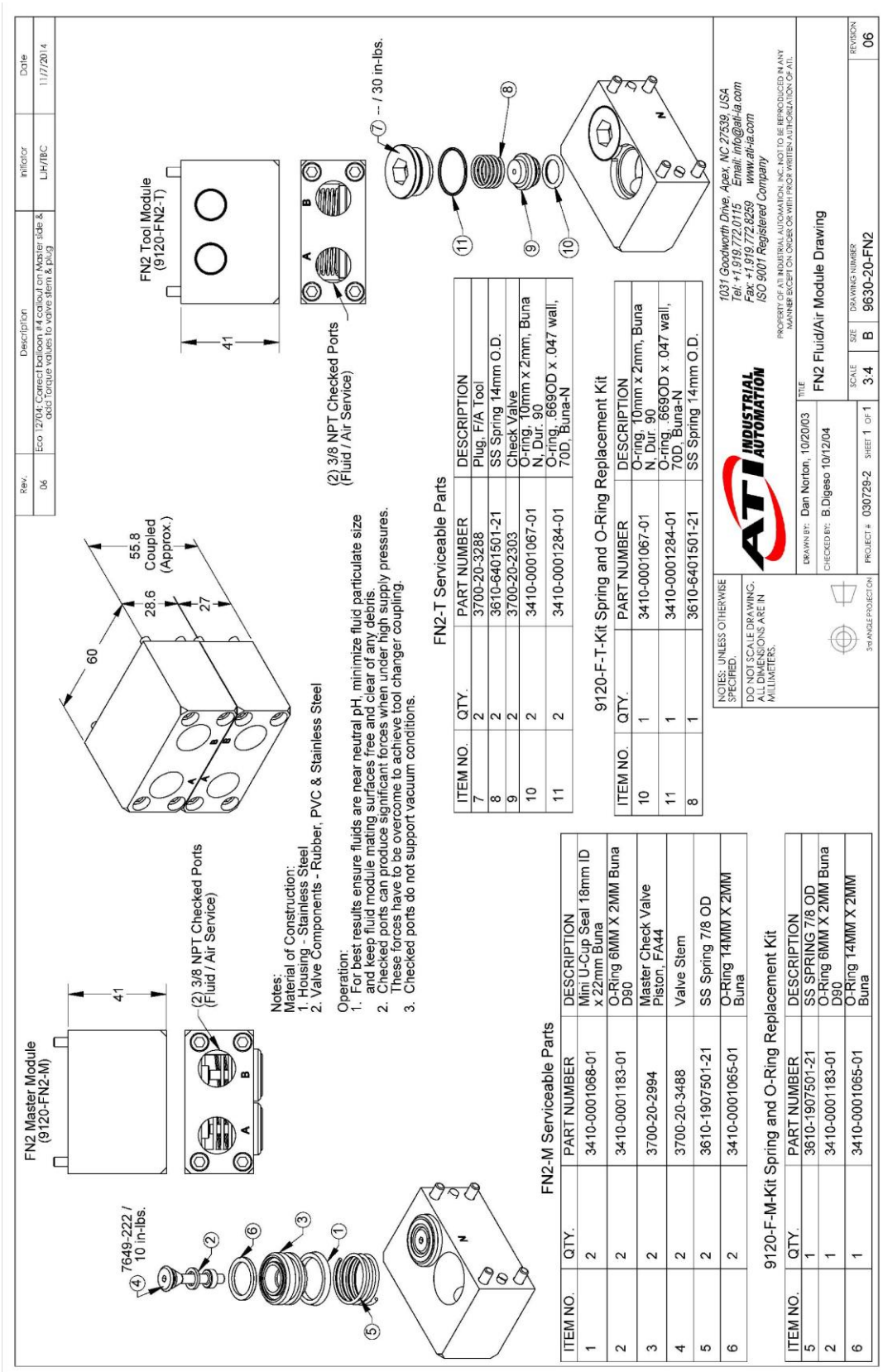
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
7	2	3700-20-3288	Plug, F/A Tool
8	2	3610-6401501-21	SS Spring 14mm O.D.
9	2	3700-20-2303	Check Valve
10	2	3410-0001067-01	O-Ring, 10mm x 2mm, Buna N, Dur. 90
11	2	3410-0001284-01	O-Ring, .669OD x .047 wall, 70D, Buna-N

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
10	1	3410-0001067-01	O-ring, 10mm x 2mm, Buna N, Dur. 90
11	1	3410-0001284-01	O-ring, .669OD x .047 wall, 70D, Buna-N
8	1	3610-6401501-21	SS Spring 14mm O.D.

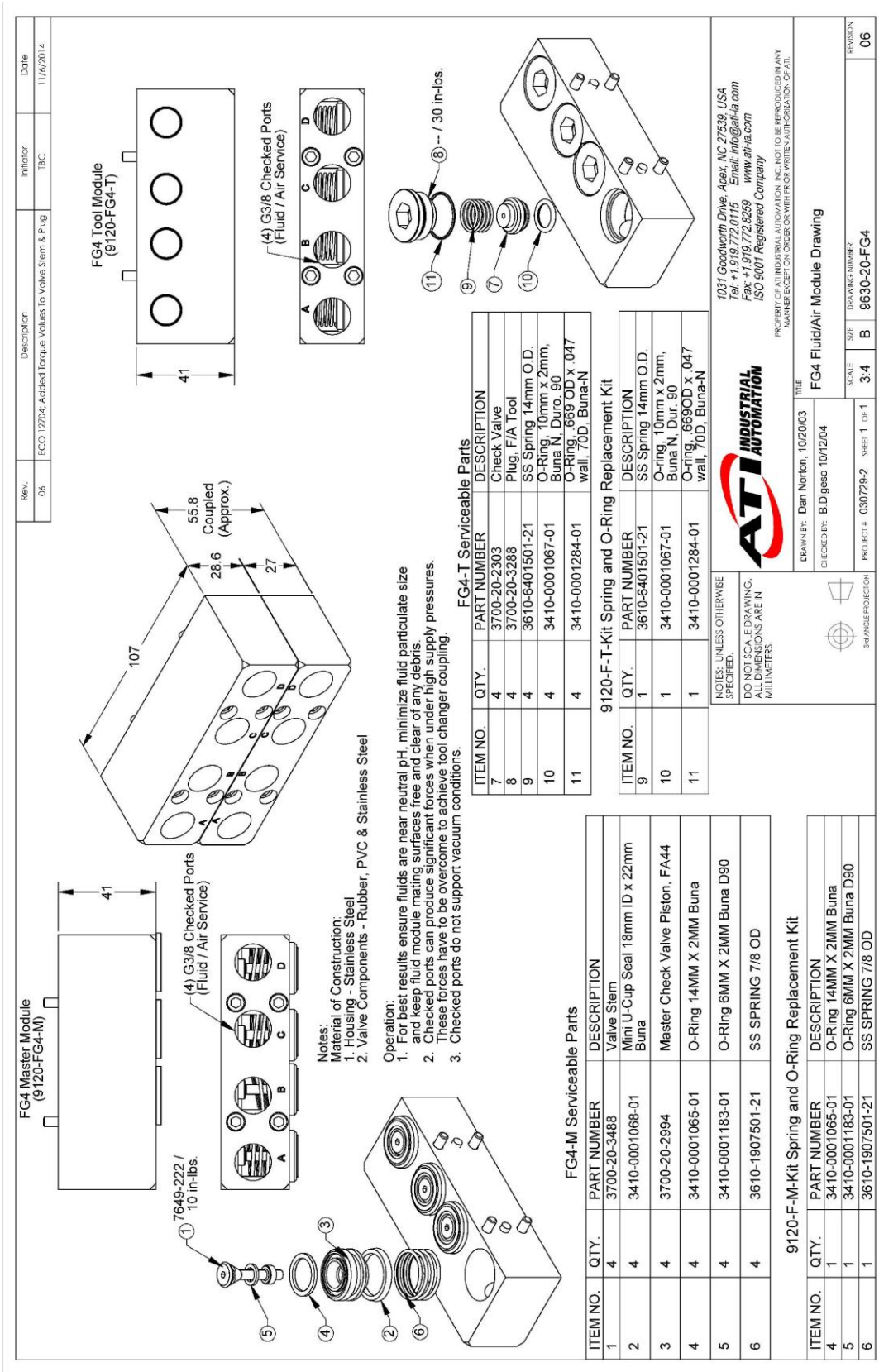
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	2	3610-1907501-21	SS SPRING 7/8 OD
2	2	3700-20-3488	Valve Stem
3	2	3410-0001065-01	O-Ring 14MM X 2MM Buna
4	2	3410-0001068-01	Mini U-cup Seal 18mm ID x 22mm Buna
5	2	3410-0001183-01	O-Ring 6MM X 2MM Buna D90
6	2	3700-20-2994	Maser Check Valve Piston, FA44

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
3	1	3410-0001065-01	O-Ring 14MM X 2MM Buna
5	1	3410-0001183-01	O-Ring 6MM X 2MM Buna D90
6	1	3610-1907501-21	SS SPRING 7/8 OD

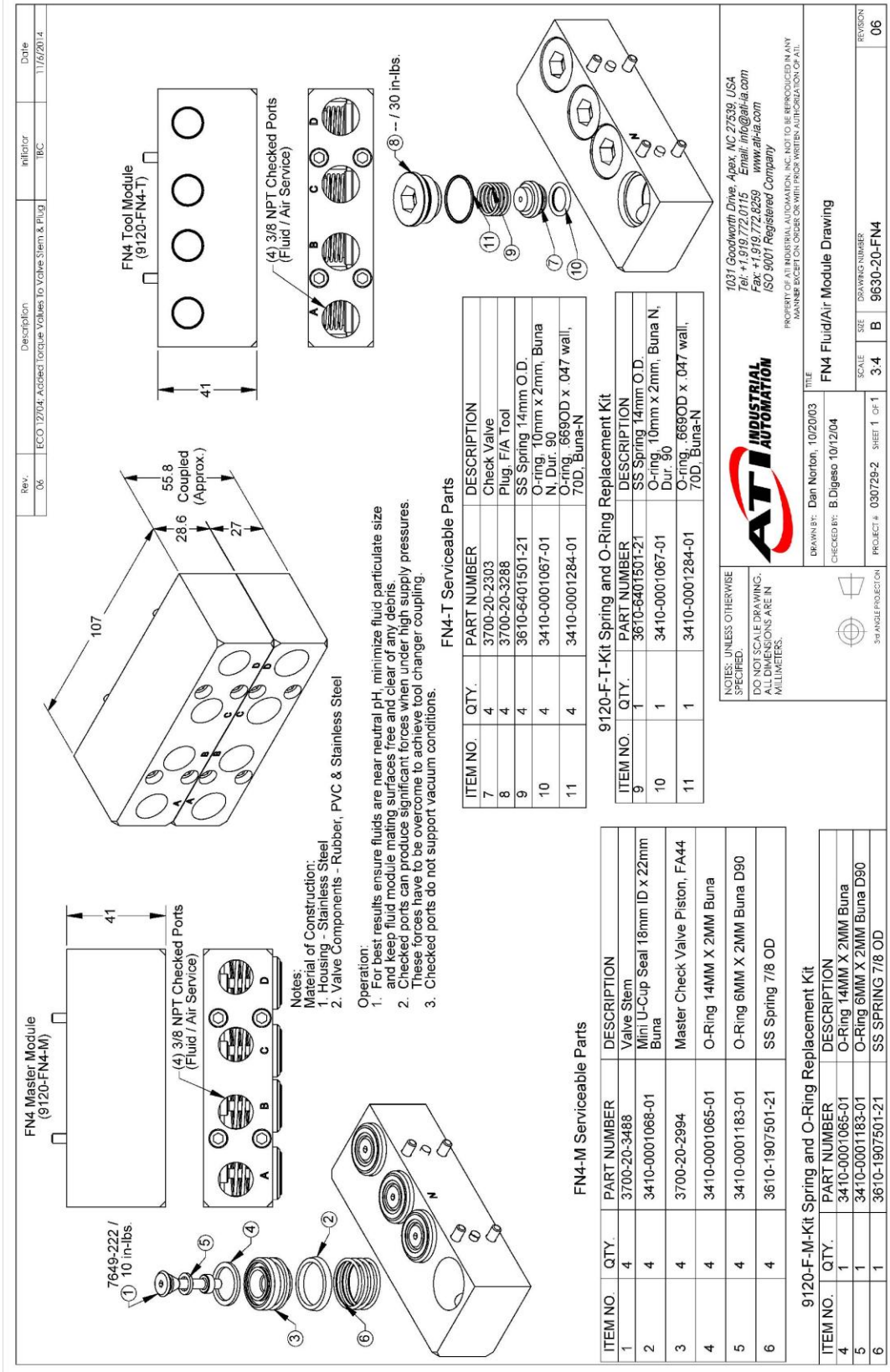
8.2 FN2 Fluid/Air Module Drawing



8.3 FG4 Fluid/Air Module Drawing



8.4 FN4 Fluid/Air Module Drawing



Rev.	Description	Initator	Date
06	ECO 12/04: Added Torque Values to Valve Stem & Plug	TBC	11/6/2014

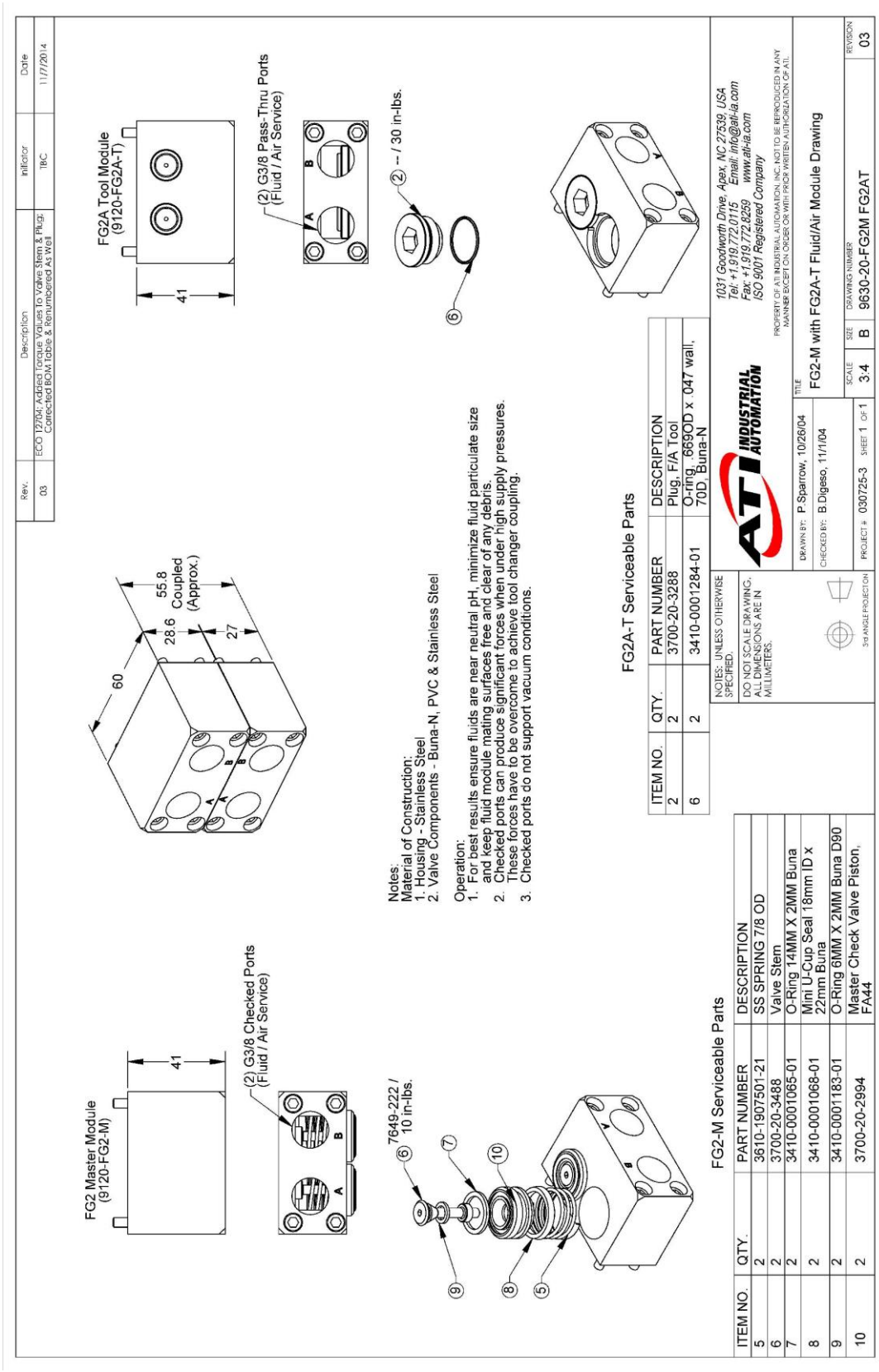
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	4	3700-20-3488	Valve Stem
2	4	3410-0001068-01	Mini U-Cup Seal 18mm ID x 22mm Buna
3	4	3700-20-2994	Master Check Valve Piston, FA44
4	4	3410-0001065-01	O-Ring 14MM X 2MM Buna
5	4	3410-0001183-01	O-Ring 6MM X 2MM Buna D90
6	4	3610-1907501-21	SS Spring 7/8 OD

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
4	1	3410-0001065-01	O-Ring 14MM X 2MM Buna
5	1	3410-0001183-01	O-Ring 6MM X 2MM Buna D90
6	1	3610-1907501-21	SS SPRING 7/8 OD

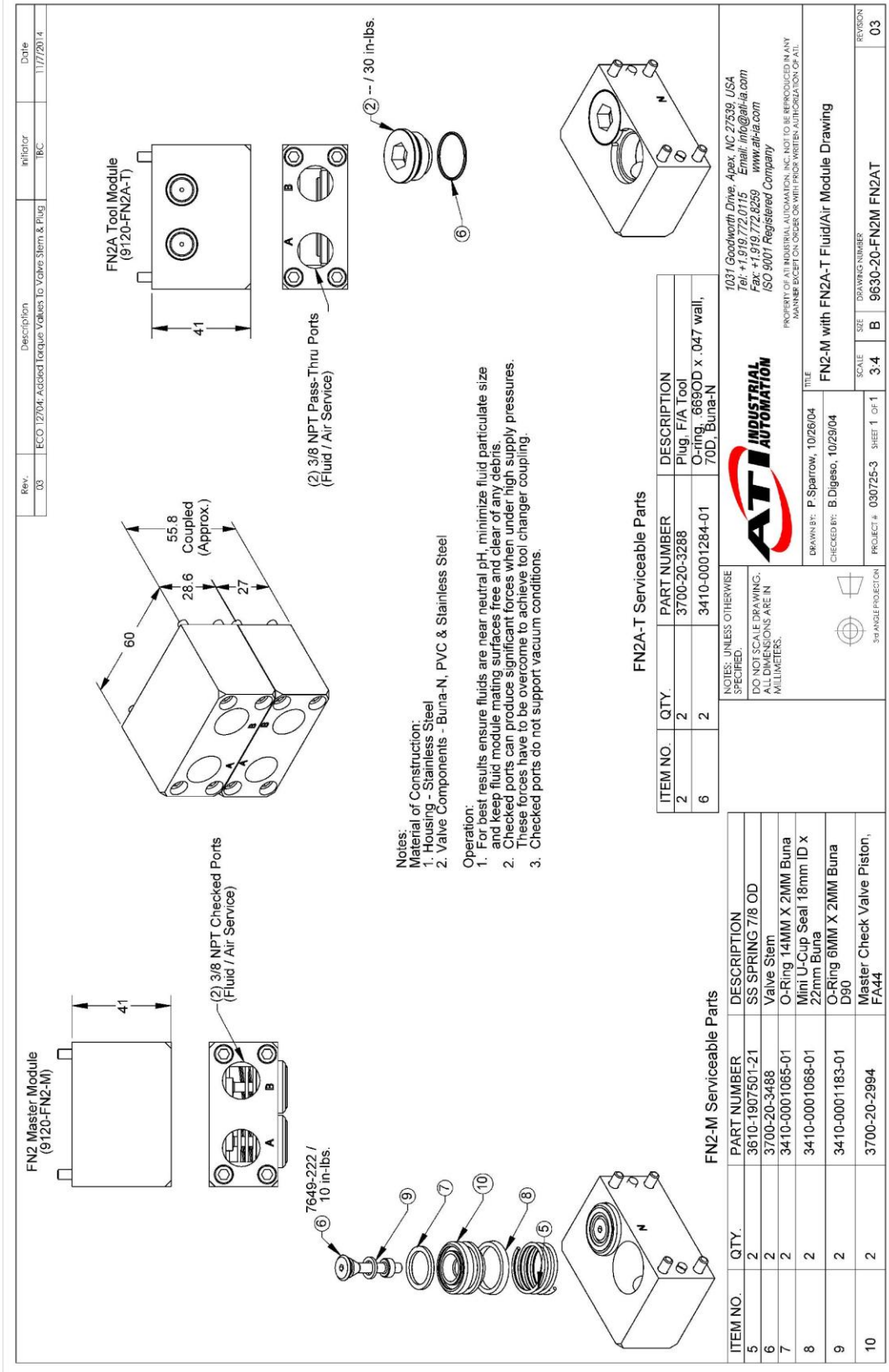
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
7	4	3700-20-2303	Check Valve
8	4	3700-20-3288	Plug, F/A Tool
9	4	3610-6401501-21	SS Spring 14mm O.D.
10	4	3410-0001067-01	O-ring, 10mm x 2mm, Buna N, Dur. 90
11	4	3410-0001284-01	O-ring, .669OD x .047 wall, 70D, Buna-N

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
9	1	3610-6401501-21	SS Spring 14mm O.D.
10	1	3410-0001067-01	O-ring, 10mm x 2mm, Buna N, Dur. 90
11	1	3410-0001284-01	O-ring, .669OD x .047 wall, 70D, Buna-N

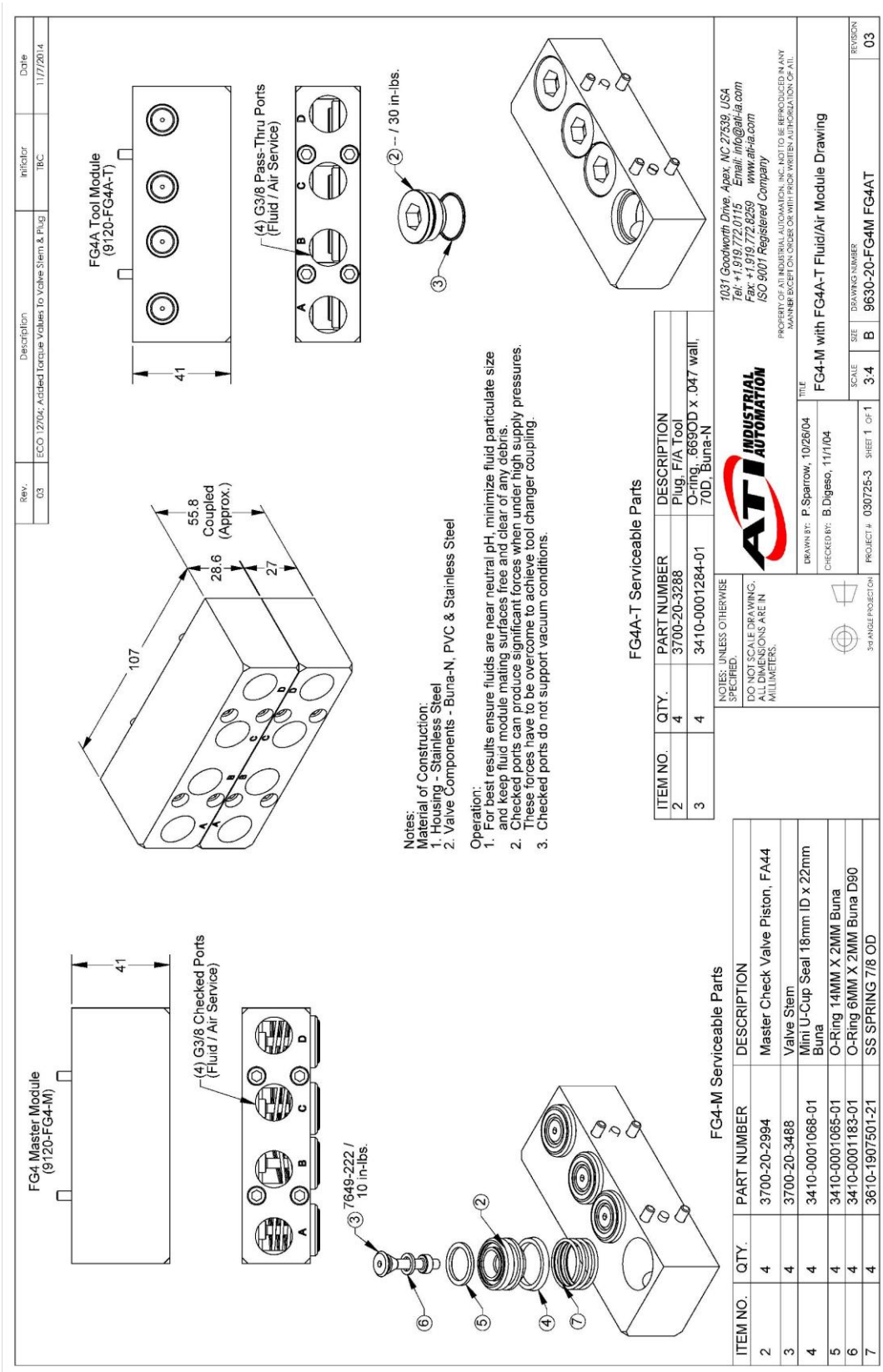
8.5 FG2-M with FG2A-T Fluid/Air Module Drawing



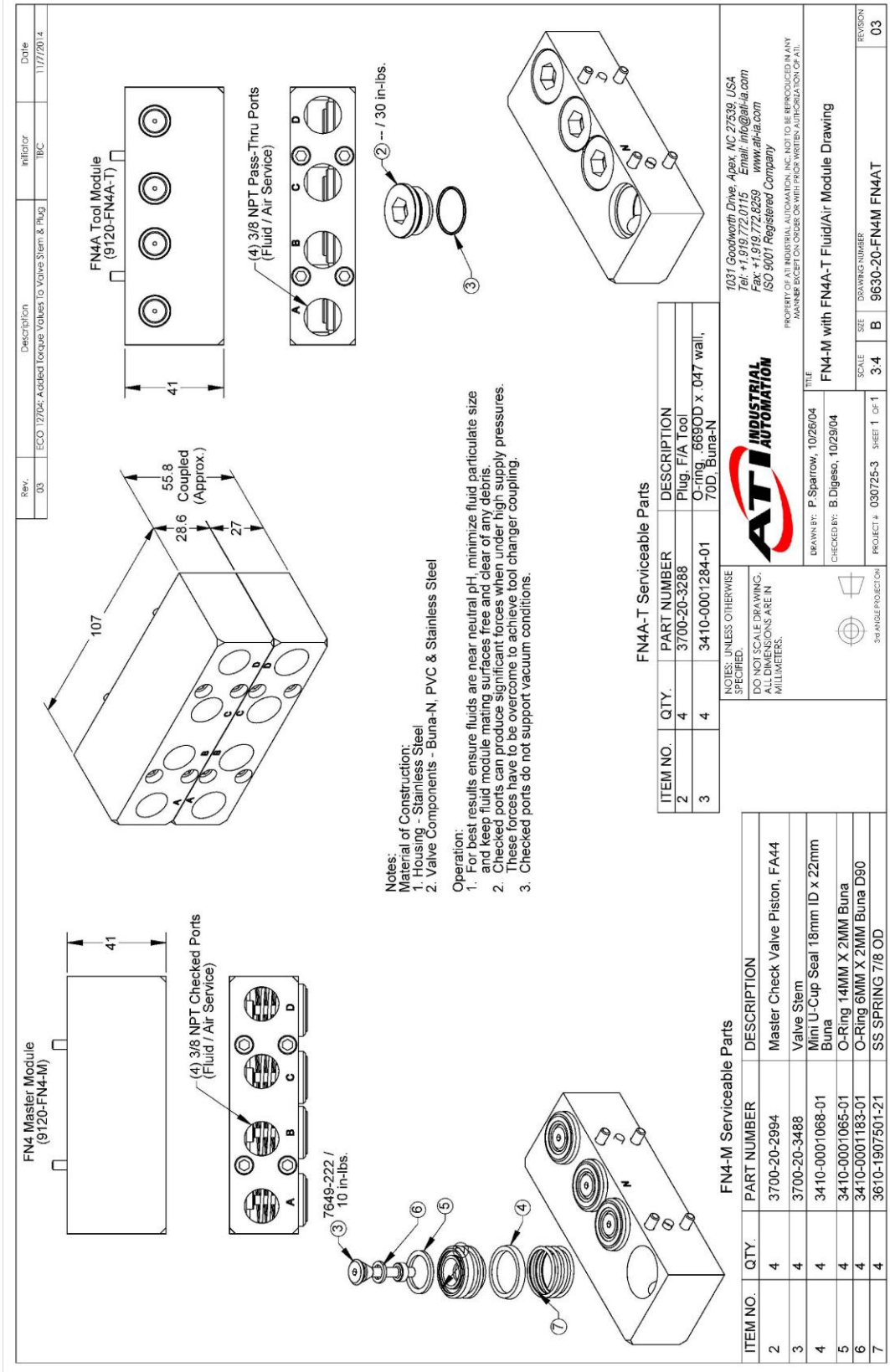
8.6 FN2-M with FN2A-T Fluid/Air Module Drawing



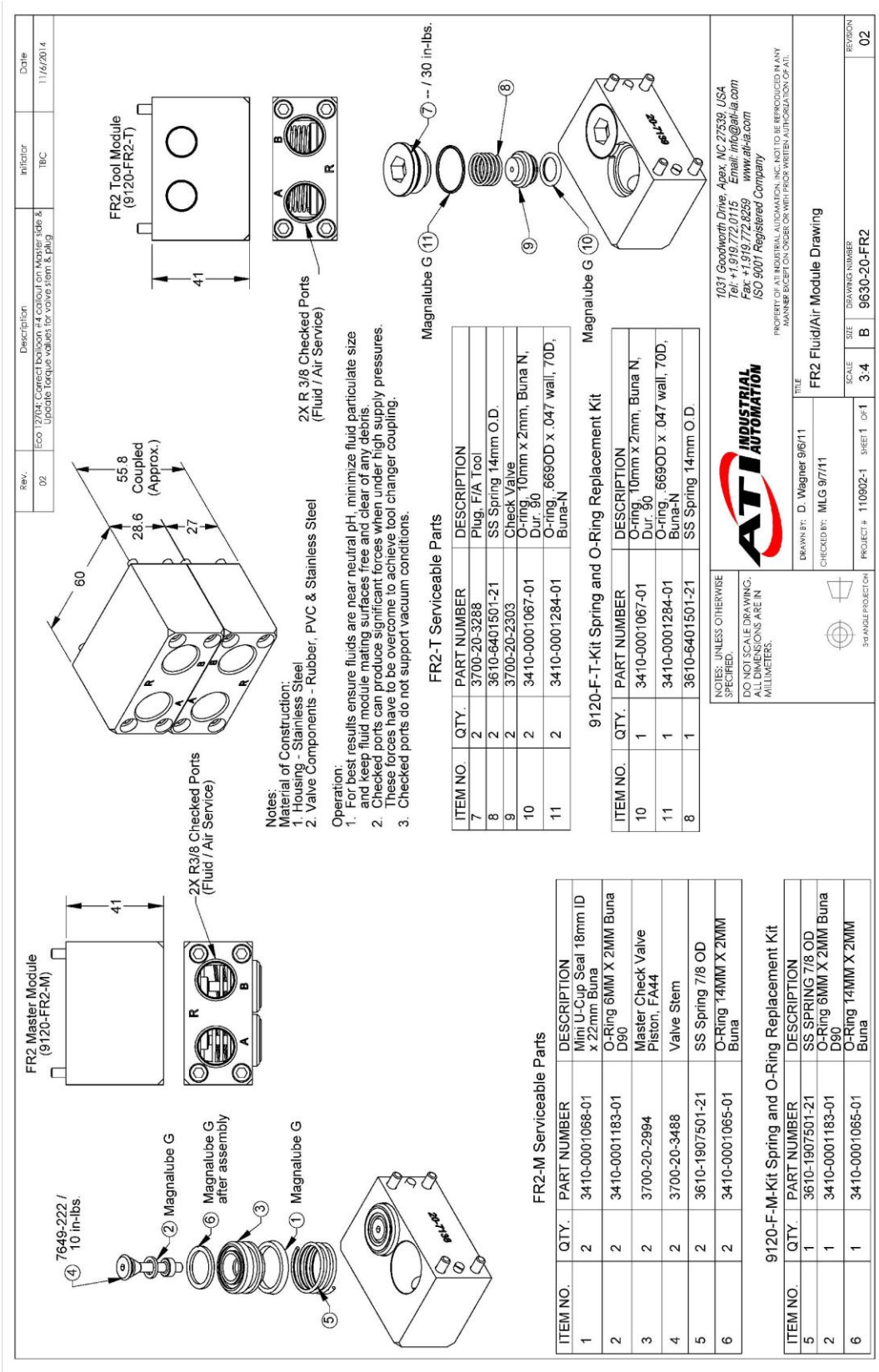
8.7 FG4-M with FG4A-T Fluid/Air Module Drawing



8.8 FN4-M with FN4A-T Fluid/Air Module Drawing



8.9 FR2 Fluid/Air Module Drawing



Rev.	Description	Initiator	Date
02	ECO 12/04: Correct balloon #4 callout on Master side & Update Torque values for valve stem & plug	TBC	11/6/2014

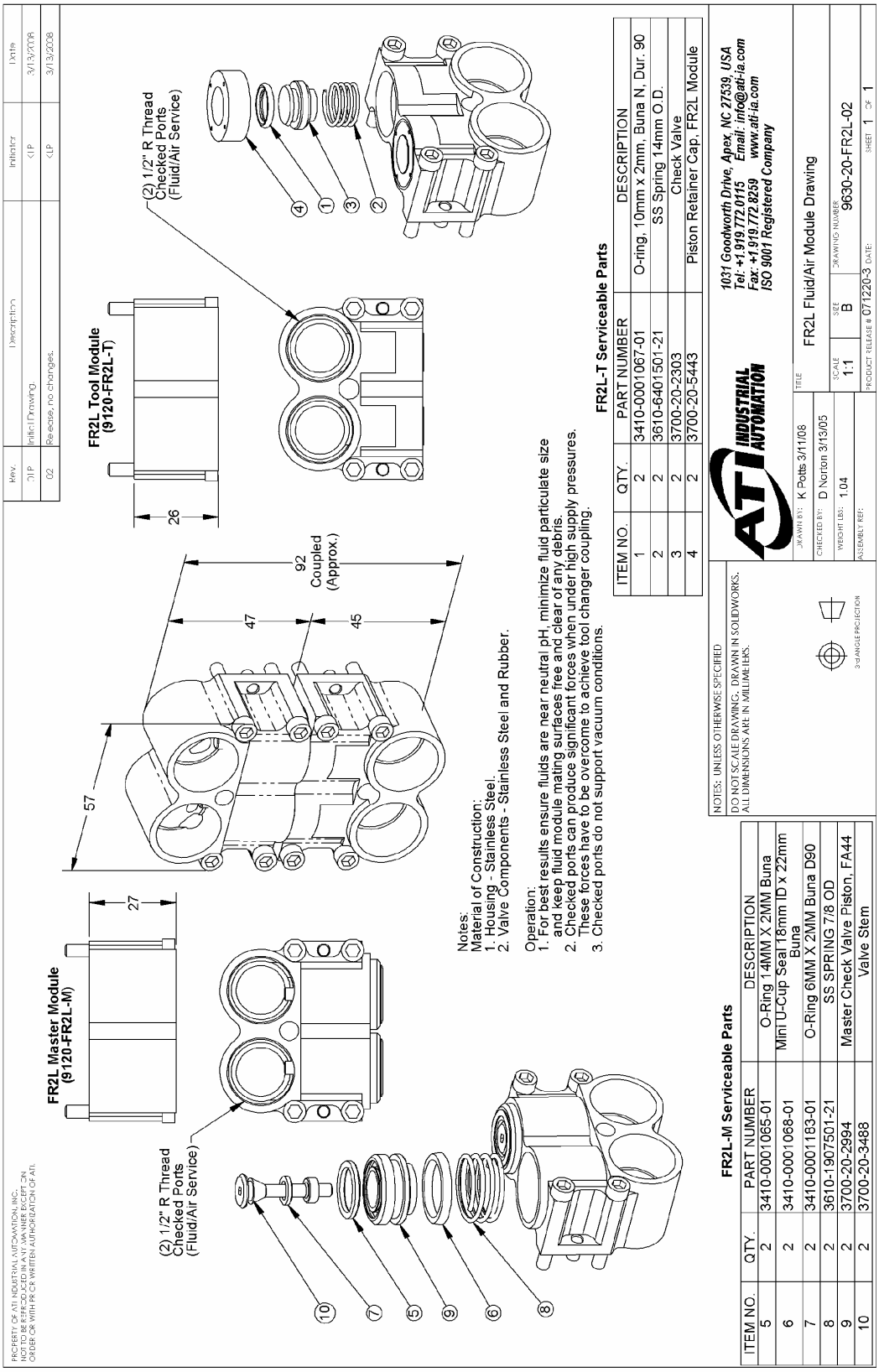
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
7	2	3700-20-3288	Plug, F/A Tool
8	2	3610-6401501-21	SS Spring 14mm O.D.
9	2	3700-20-2303	Check Valve
10	2	3410-0001067-01	O-ring, 10mm x 2mm, Buna N, Dur. 90
11	2	3410-0001284-01	O-ring, .669OD x .047 wall, 70D, Buna-N

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
10	1	3410-0001067-01	O-ring, 10mm x 2mm, Buna N, Dur. 90
11	1	3410-0001284-01	O-ring, .669OD x .047 wall, 70D, Buna-N
8	1	3610-6401501-21	SS Spring 14mm O.D

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	2	3410-0001068-01	Mini U-Cup Seal 18mm ID x 22mm Buna
2	2	3410-0001183-01	O-Ring 6MM X 2MM Buna D90
3	2	3700-20-2994	Master Check Valve Piston, FA44
4	2	3700-20-3488	Valve Stem
5	2	3610-1907501-21	SS Spring 7/8 OD
6	2	3410-0001065-01	O-Ring 14MM X 2MM Buna

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
5	1	3610-1907501-21	SS SPRING 7/8 OD
2	1	3410-0001183-01	O-Ring 6MM X 2MM Buna D90
6	1	3410-0001065-01	O-Ring 14MM X 2MM Buna

8.10 FR2L Fluid/Air Module Drawing



8.11 FR4 Fluid/Air Module Drawing, (4) R 3/8 Ports