OPERATING INSTRUCTIONS
AND
MAINTENANCE MANUAL
FOR

MODEL SPI-1*

(*Pump model varies)

SINGLE POINT INJECTOR

Manufactured by

HAMMONDS TECHNICAL SERVICES, INC.

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Hammonds Model SPI-1 Manual

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SPECIAL NOTICE TO USERS

PLEASE READ CAREFULLY BEFORE OPERATING EQUIPMENT

Note: the photos in this manual show a vertical flow unit. Your system may be arranged differently. The concepts are the same.

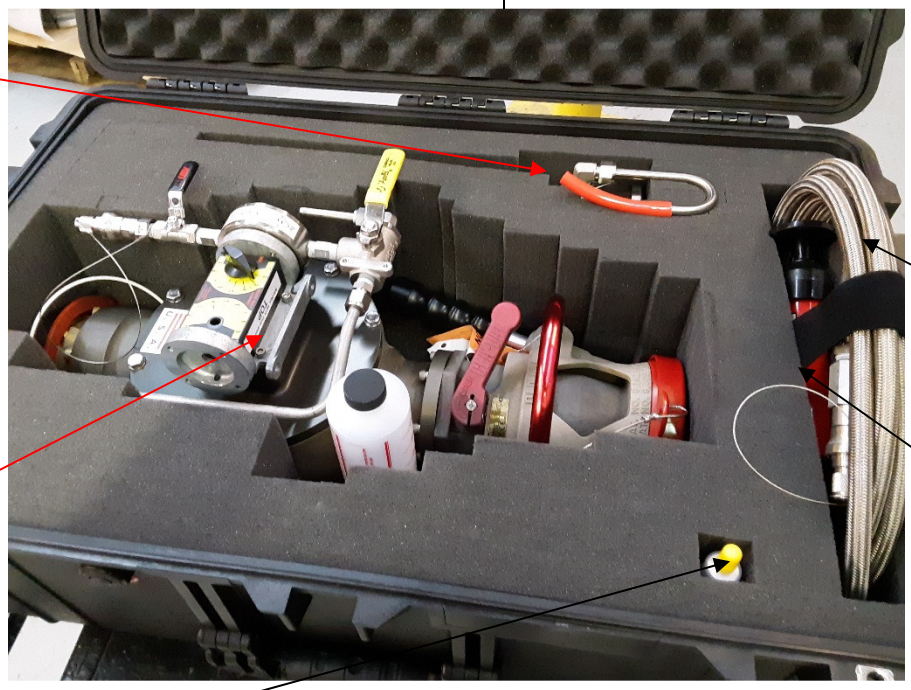
This additive injector system is designed to give consistent dependable performance when operated and maintained according to manufacturer's recommendations. However, being a mechanical device, it is subject to failure from improper installation, wear, human error and operating environments beyond the control of the system. Because of this fact, it is the responsibility of the operator to make certain that:

A. The system is installed properly.
B. The system is being operated properly.
C. The system is actually running during product transfer.
D. The system is checked after the transfer operation to make certain the proper amount of additive was injected during the operation.

The performing of these checks by the operator eliminates the possibility of product not having the proper additive ratio as required. Therefore, since the manufacturer cannot be present during each transfer operation, the responsibility for checking the performance of the system is that of the operator. Should there be any questions whatsoever, the operator should consult the distributor from whom the unit was purchased.

Do Not Take Chances.....Do Not Guess.....Be Absolutely Certain That the System Is Installed And Working As It Should.

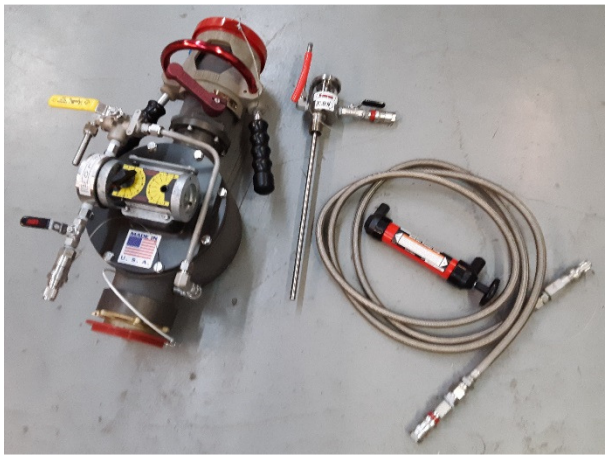
The user/operator carries the final responsibility to make certain the system is operating properly.



SPI-1S INJECTOR AND ACCESSORIES IN CASE

INSTALLATION AND PREPARATION FOR STARTUP

The Hammonds Model SPI fluid powered Single Point injector is shipped complete and ready to operate. The system should include appropriate fittings to suit your specific application.



1. Unpack only what is needed. The SPI injector, the "5SF" 5-gallon siphon tube adapter, the stainless braided suction hose, priming hand pump and desiccant dryer cartridge from the case.

2. The SPI injector comes equipped with an integral single point nozzle. When installing the unit, users must ensure that both nozzles (upstream and downstream of the unit) are positively locked to their SPR connectors. CAUTION; **DO NOT LIFT BY THE INJECTION PUMP! USE THE NOZZLE HANDLES.** With the SPI nozzle crank handle in the closed position, check the strainer coupling quick disconnect device for positive locking. Be sure the nozzle is securely locked to the aircraft by attempting to remove the nozzle with the nozzle crank handle in the open position.

Any nozzle that can be disconnected from the SPR with the nozzle crank handle in the open position is defective and must be removed from service immediately.

LIFT BY HANDLES ONLY!

3. Using a fresh 5-gallon pail of additive, remove the cap from the pail and knock out the center plastic plug. Thread the 5SF into the cap and then re-install this assembly onto the pail as shown in the following photo.

4. Remove the yellow rubber caps from the desiccant dryer cartridge and install it onto the rubber tube on the 5SF.
5. Remove the dust cap from the outlet end of the 5SF assembly. Remove the dust plug from one end of the suction hose. Couple the suction hose to the 5SF. Be certain that the coupling is fully connected.

6. Remove the dust cap from the other end of the suction hose. Remove the dust plug from the injector pump additive inlet on the SPI and fully connect the coupling.

7. The suction hose is 10 ft. long so; the pail of additive should be positioned below and as near to the SPI injector as possible.

CAUTION; Do not bend the supply hose as it may kink, starving the pump of fluid and causing erratic injection performance. The injector will pull a minimal suction lift.

8. Connect the SPR hose nozzle into the inlet end of the SPI. With the SPR nozzle crank handle in the closed position, check the strainer coupling quick disconnect device for positive locking. Prior to pressurizing the hose, be sure the nozzle is securely locked to the SPI by attempting to remove the nozzle with the nozzle crank handle in the open position. Now fueling can begin.

START UP

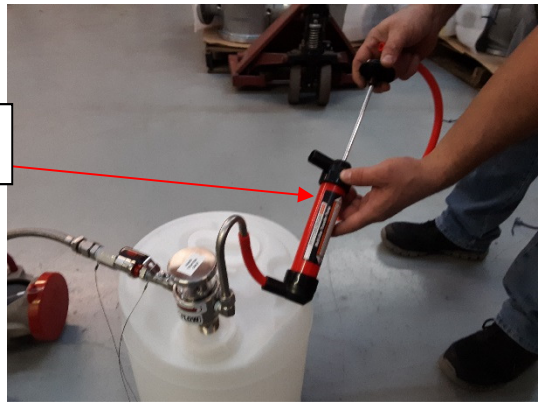
1. If you are attempting start up for the first time, the pump is “dry”. Remove the desiccant cartridge from the hose and connect the “out” end or bottom port of the priming hand pump to this hose snuggly.

2. Have a container ready to catch the fluid from the bleed tube on the pump. Place the valve handle in the bleed position as shown below.

Place container under bleed tube

With the hoses connected properly as described above, simply pump the priming pump a few of times until fluid exits the bleed tube.

Hand Pump



As the system starts, after a brief period of running, you will notice pulses of additive in the sight glass on the 5SF. The injector is now primed and will continue to inject additive as fueling continues and an adequate supply of additive is present.

3. The additive injection process may be monitored by observing this sight glass. After viewing the action of the additive in the sight glass, you will notice changes in volume of injection as the fuel flow rate changes.

FLOW CONSIDERATIONS

The Hammonds Model SPI requires a minimum of 50 and up to 250 GPM to deliver consistent ratios. This does not mean that the system cannot be used in cases where startup and shutdown fall under the 50 GPM minimum. Check with the factory if you have any questions in the area of performance.

CAUTION; Do not attempt to use this device without understanding and following proper safety precautions regarding system grounding, fire safety, and special handling for potentially dangerous additives.

Consult your Engineering Department for their specific instructions. Make certain all personnel involved with this system are thoroughly familiar with safe operating practices.

If no factory-authorized distributor is available, consult the factory directly for assistance.

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POINT OF INJECTION OF ADDITIVE

Some additives may adversely affect other components in the product handling systems, for example seals in meters, valve seals, aluminum and filter elements to name a few. The Hammonds SPI injector system utilizes a precision rotary vane pump, which does an excellent job of mixing the additive in the product, and does not inject in large slugs. Because of this superior mixing and very small concentration of additive in any one point, many customers feel that this is not a problem. **SOME DO**, and therefore, should use their own judgment as to the effect of these additives. **Hammonds Technical Services, Inc. can only advise you of the possible hazards**. The SPI comes with the injection point directly ahead of the fluid motor for good blending.

NORMAL OPERATION

Following initial start up, the system requires very little attention other than making certain that additive levels are maintained. Operators will quickly become accustomed to the performance of the system by observing the 5SF Sight Flow Indicator. On-spec injection will cause a certain response in the Sight Flow Indicator, and with some practice, operators will be able to observe the system at a glance. However, during a busy workload, these visual checks will provide assurance to the operator that the system is functioning.

Good record keeping of additive inventory and use levels compared to fuel handled can give a good indication that additive is on specification. Test such as the refractometer for FSII content should be the final test to verify additive injection ratios.

PROPER ADDITIVE INJECTION RATIOS

The only true evaluation for proper ratio is the **ASTM D-5006** evaluation for fuel system ice inhibitor (FSII). Contact Hammonds Fuel Additives, Inc. for supply of quality fuel system ice inhibitor and fuel testing procedures.

DRAINING AND STORAGE OF SPI

After fueling is completed follow these steps in their proper order to drain fuel and additive from the SPI.

1. Disconnect the fuel hose single point nozzle from the SPI inlet.
2. Disconnect the additive supply hose between the 5-gallon pail and the SPI injector. Reinstall the dust plug and dust cap into each end of the hose.
3. Install the dust plug into the injector pump additive inlet and install the dust cap onto the 5SF. These dust plugs and caps are important to protect the coupling ends from damage and to help keep the additive clean.
4. Disconnect the SPI from the fueling port of the aircraft. **BE CAREFUL NOT TO LIFT IT BY THE PUMP TUBING!**
5. Unscrew the 5SF from the cap of the 5-gallon additive pail. If there is enough additive left in the pail, and you need to store it, install a ¾" NPT pipe plug into the plastic pail cap. Otherwise, dispose of the empty container properly.
6. The SPI and all components may now be returned to their place in the case.

TROUBLE SHOOTING THE SYSTEM

The following conditions are given as a means of troubleshooting the system. Each condition lists a number of possible causes. In most cases, trouble can be solved by the use of this section. Please read it carefully before attempting repairs or making changes in the system.

FLUID MOTOR IS NOT TURNING

A. Insufficient flow to turn the motor. A minimum flow of about 50 GPM is needed to start the system.

B. A diverter valve is blocked downstream of the system, blocking the fuel flow through the system.

C. A valve is closed upstream of the fluid motor starving the product flow.

D. If the unit has been recently serviced internally, the rotor might be installed backwards. Consult the factory before disassembly.

FLUID MOTOR IS TURNING AND PUMP IS RUNNING, BUT WITH NO OUTPUT

A. The pump is not getting additive. Check all connections in the line between the pump and the pail. Make certain that the quick disconnect couplings are fully coupled.

B. The vent on the pail is not open causing the pump to pull a vacuum. Check to see if the rubber cap has been removed from the dryer cartridge, if so equipped.

C. The injector pump is not priming itself at initial start up. Although the system will operate at 50 GPM, the fueling rate needs to be at least 150 GPM at first to prime the rotary vane pump. This will give the pump the speed it needs to prime itself. After it is primed it will continue to pump.

D. The pump may need to be manually primed. Install the priming bulb as described in the Start Up section. Give the priming bulb a few squeezes until additive flows from the bleed hose. Once a clear, bubble-free, stream of additive is observed, disconnect the priming hose. The pump should continue to inject.

E. The additive pail is empty...don't laugh, it happens.

THE INJECTOR IS OPERATING BUT WITH REDUCED OUTPUT

A. Air leak in suction side of system.

B. Defective tubing or piping on suction side.

C. A leak in threaded connections or quick disconnects - suction side.

F. Check to see that the supply hose is not kinked or crushed, starving the pump.

D. A leak in the 5SF glass seal.

E. Fluid motor vanes are badly worn. This would only be probable after a high number of hours of operation.

PREVENTIVE MAINTENANCE

1. Make certain to use only clean, fresh additive that has been stored in a sealed container. Most additives are moisture sensitive. Some will form heavy crystals if allowed to accumulate moisture. These crystals will stop the pump in very short order.

2. Check the additive filter screen (5SF Sight Flow Indicator) at least once a month. More often if there is an indication of possible contamination.

3. Check the system for leaks at every use. This is an extremely important safety procedure, since some additives are flammable, caustic and corrosive.

4. Check for leaks from the seal that is located at the exit point of the injector output shaft in the side plate housing. This should be done at each operation. Leakage at this point usually indicates that the mechanical seal inside the rotor housing is leaking. A leak here will be fuel, and is not only dangerous from a fire standpoint, but will quickly ruin the bearings on the rotor shaft, since all lubricant will be washed away.

5. Check the fittings for leakage around the suction strainer or sight flow indicator, if one is used on the pump. Check this fitting each time the filter is changed or cleaned. Make certain there are no leaks in the suction line. A very small leak will either change the operation of the pump or prevent it from operating all together.

6. Visually check around the pump housing and make certain there is no leaking of additive around the pump fluid end. If there is, check the tightness of the head screws. (40 inch pounds each)

7. Check the grease around the eccentric drive bearing in the pump every 12 months. Use a good quality waterproof grease.

8. It is recommended that the injector diaphragm be changed at least every 12 months. Every 6 months under extreme operating conditions. Doing so will prevent unexpected failures and unscheduled downtime.

Hammonds injectors are very dependable. If installed properly and sized appropriately to the application, they require very little maintenance. Remember; keep the additive clean, and the suction strainer clean. If you have problems with the pump working, it is usually in the suction side of the system (between the injection pump and the additive pail). Suction lines and fittings are notorious for leaking just enough to prevent the system from working. Always check to ensure optimum suction conditions should problems occur.

Remember that a leak in the suction allows air from the outside to be introduced into the system. It does not always mean a visible leak of additive. If the pump loses its prime or output is erratic, chances are good that there are problems in the suction side. Otherwise, if it is working...leave it alone.

PREVENTATIVE MAINTENANCE SCHEDULE

NOTE: It is important to read the section on preventative maintenance. These intervals are general, and may vary according to individual applications and severity of service.

SERVICE FUNCTION	0-1 HOUR DAILY	1-2 HOUR DAILY
Check additive filter screen	Monthly	Monthly
Check system for additive/fuel leaks	Daily	Daily
Inspect diaphragm or plunger seals	12 Months	6 Months
Replace diaphragm or plunger seals	12 Months	As needed
Check eccentric bearing grease	6 Months	3 Months
Check stroke adjustment parts for looseness	Monthly	Monthly
Replace stroke adjustment parts	24 Months	As needed
Disassemble and inspect fluid motor housing and internal parts	12 Months	8 Months
Check nozzle screen, if equipped	Monthly	Bi-weekly

DESICCANT DRYER

Your Hammonds additive system may include either a custom additive pail or one of several Sight Flow Indicators. Both custom pails and the 5-SF and 55-SF Sight Flow Indicator come equipped with a desiccant dryer cartridge. These units come in several different sizes.

Most systems come equipped with the standard 3/4" cartridge. This unit is attached to the pail or Sight Flow Indicator via a short length of black rubber hose. The cartridge has a housing constructed of a clear poly material and is filled with a blue colored desiccant crystal. All these units are shipped from the factory with small yellow caps on the ends of the cartridge.

The purpose of all desiccant dryers is simply to remove moisture from the air as the system breathes. All pails or portable sources of additive supply must be vented to atmosphere in order for the injector to operate. If moisture in this venting air is not removed, some additives are either ruined or seriously damaged. Fuel system icing inhibitor (FSII) FIZZY®, for example, is designed to seek out water in a fluid. So, when enough moisture is absorbed into the container, the FIZZY® (FSII) is diluted and at some point will be ruined. Biobor® JF, an anti-fungal material, will form crystals in the presence of moisture and not only perform unsatisfactorily as an additive, but will stop up pumps and lines as well.

The following instructions apply to all desiccant cartridges:

A. Remove the yellow caps when the system is placed into service.

B. Observe the color of the desiccant. The original color is blue. As moisture is absorbed, the color will change to pink. When the cartridge is completely pink, it should either have its contents removed, dried and replaced, or the entire unit replaced.

C. NOTE: The contents can be removed from plastic cartridge, placed on a pan and baked at 400°F in a conventional oven until the moisture has been removed. When the color blue returns, the cooled material may be reinstalled into the cartridge and is again ready for service.

D. COLOR change and cartridge life is totally dependent on humidity. The more moist the air, the shorter the life. Keeping it dry is especially important if additive is not consumed rapidly. Check daily and service the dryer cartridge as needed.

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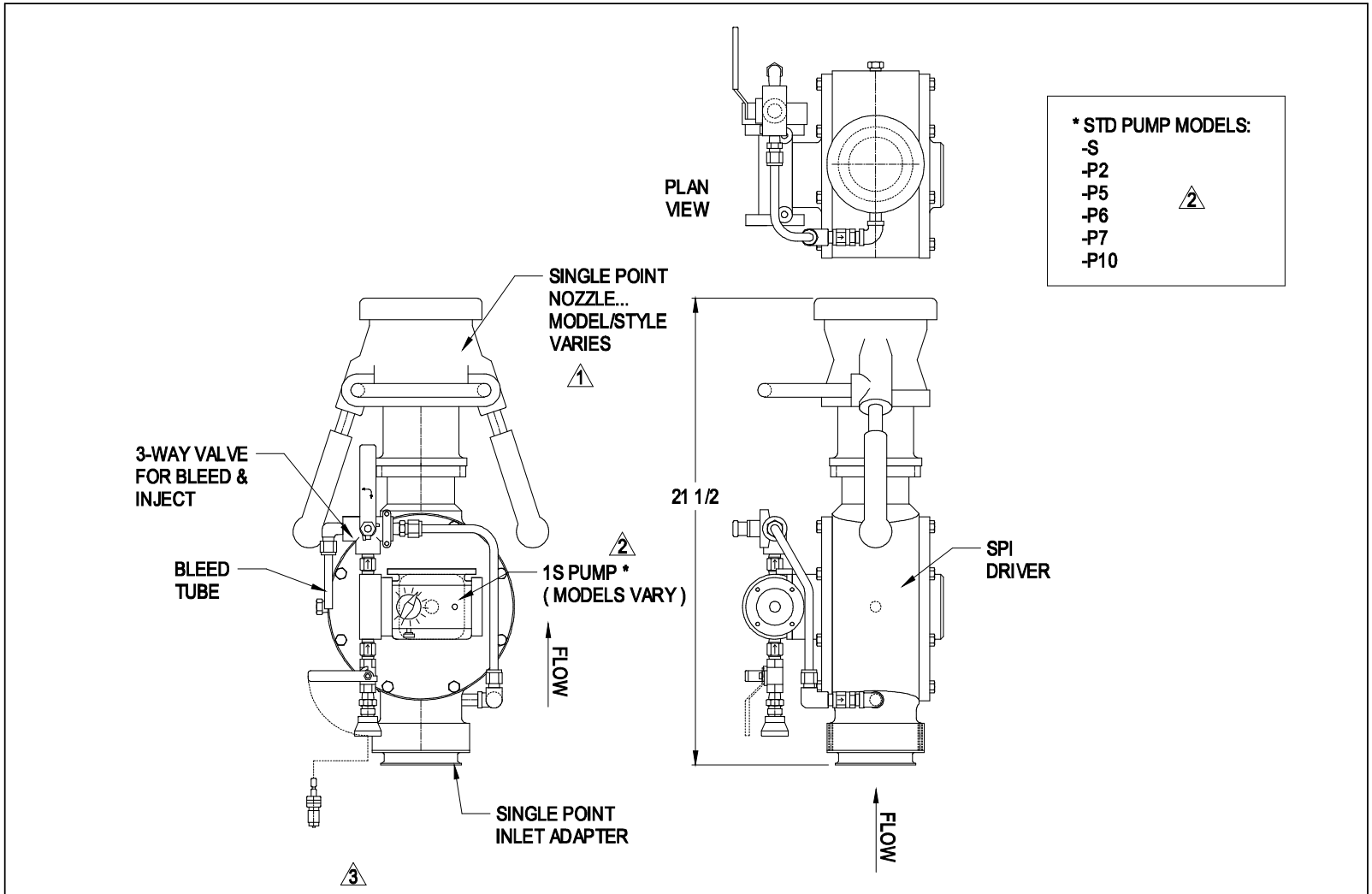


NO.	REVISION	DATE	BY	APPVD
3	SFI ON SEP PAGE	09/11/19	SS	X
2	OPTIONAL PUMPS	03/17/17	SS	X
1	DIFF. NOZZLE	03/23/16	SS	X
0	INITIAL RELEASE	01/15/16	SS	X

DRAWING	LEVELS	VIEW
SPI-1	60,61,63	1

FROM SER#	DATE	TO SER#	DATE
X	X	X	X

TOLERENCES
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

*TOL. DECIMALS:
.XXX= +/-.005
.XX= +/-.015
.X= +/-.030
FRAC.= +/-1/16

*TOL. ANGLES: +/- .5 DEGREES

*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125

*REMOVE BURRS AND BREAK EDGES .005 MIN.

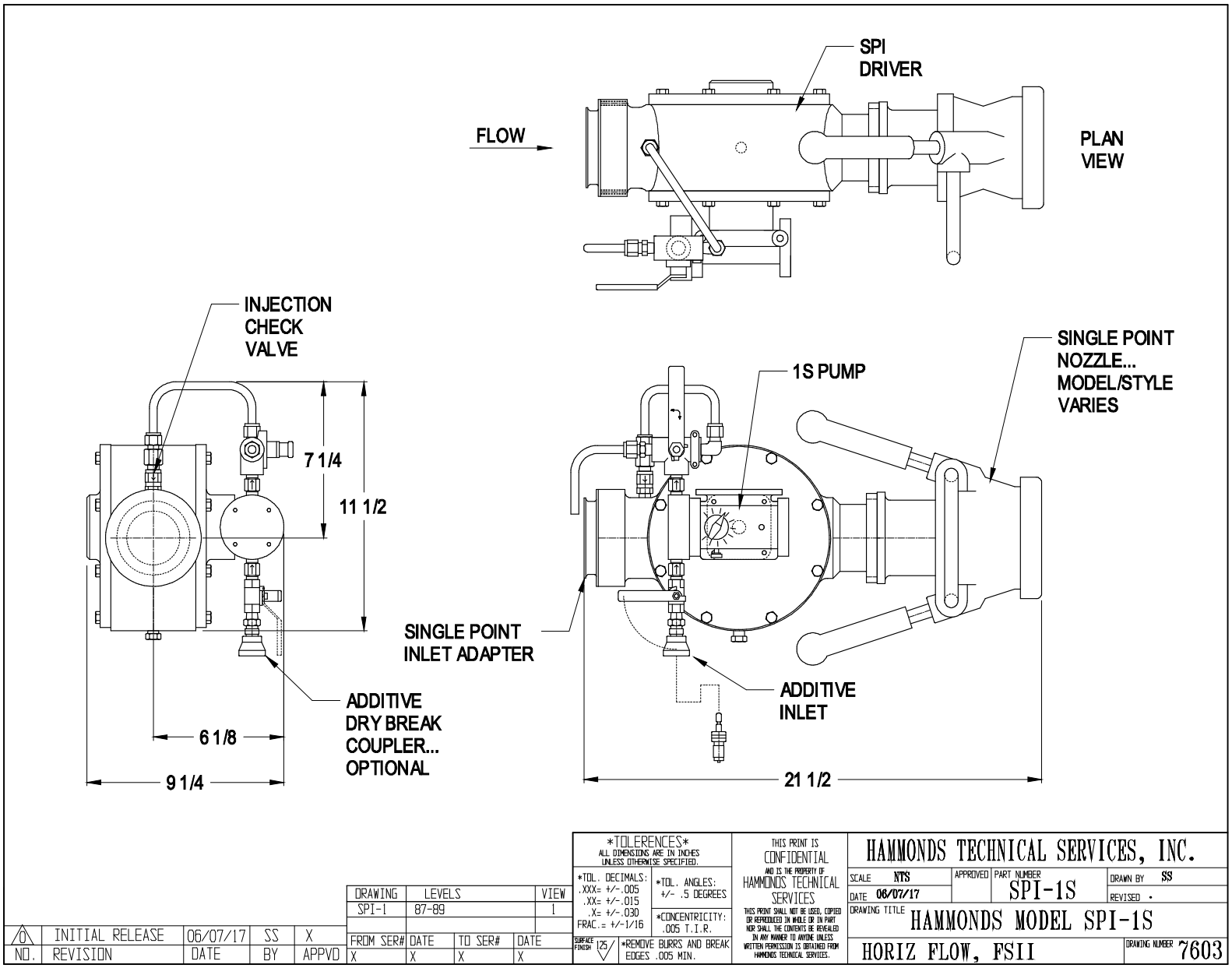
HAMMONDS TECHNICAL SERVICES, INC.

SCALE	APPROVED	PART NUMBER	DRAWN BY
NTS		.	SS
DATE 01/15/16			REVISED 09/11/19

DRAWING TITLE
HAMMONDS MODEL SPI-1S*
VERTICAL UP, *OPT PUMPS

DRAWING NUMBER 7326

Hammonds Model SPI-1 Manual



NO.	REVISION	DATE	BY	APPVD
0	INITIAL RELEASE	06/07/17	SS	X

DRAWING	LEVELS	VIEW
SPI-1	87-89	1

FROM SER#	DATE	TO SER#	DATE
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FRAC.= +/-1/16

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*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125

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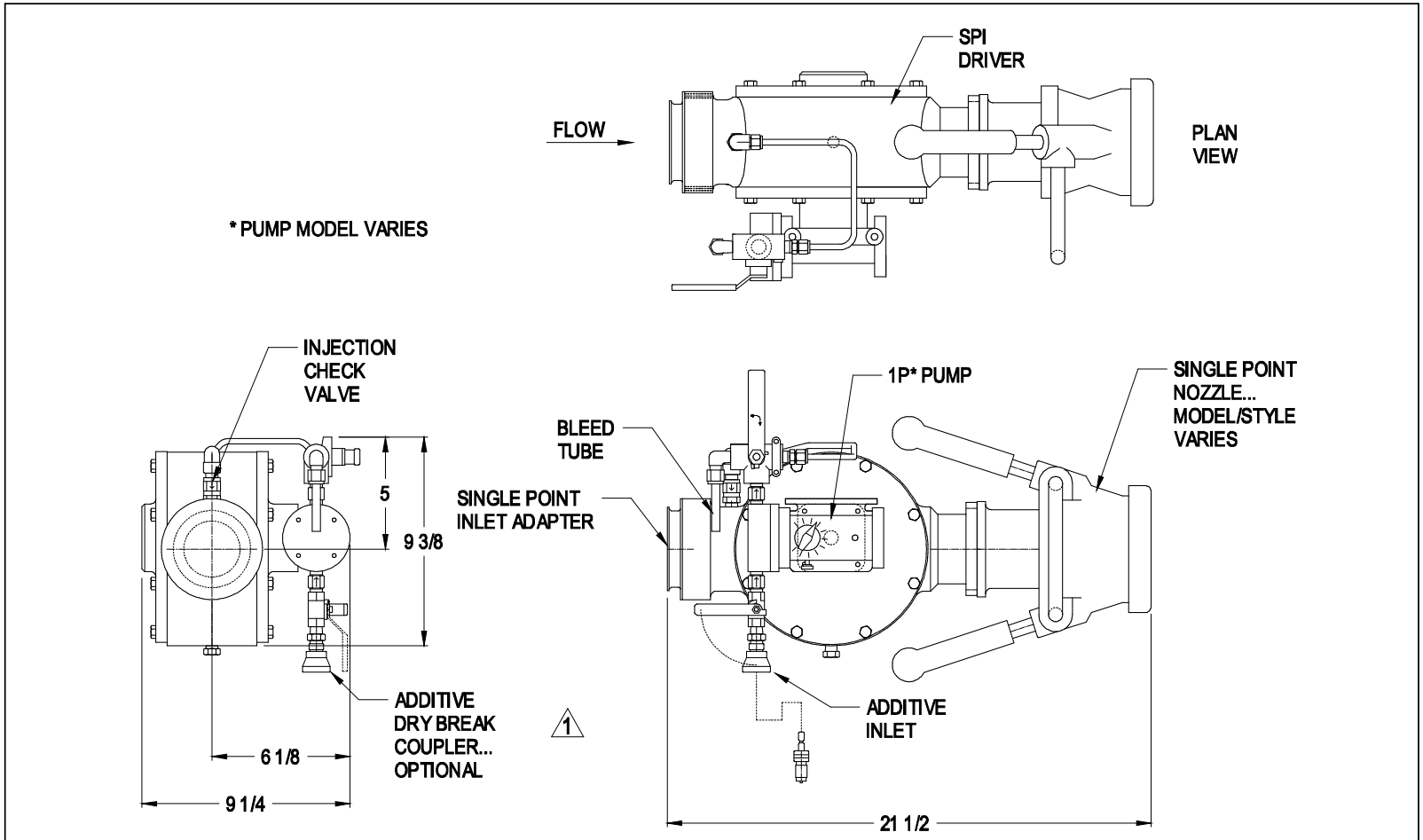
SCALE	APPROVED	PART NUMBER	DRAWN BY
NTS		SPI-1S	SS
DATE 08/07/17			REVISED .

DRAWING TITLE
HAMMONDS MODEL SPI-1S
HORIZ FLOW, FSII

DRAWING NUMBER 7603

Hammonds Model SPI-1 Manual



NO.	REVISION	DATE	BY	APPVD
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SPI-1	93-95		1
FROM SER#	DATE	TO SER#	DATE
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FRAC.= +/-1/16

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*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125 *REMOVE BURRS AND BREAK EDGES .005 MIN.

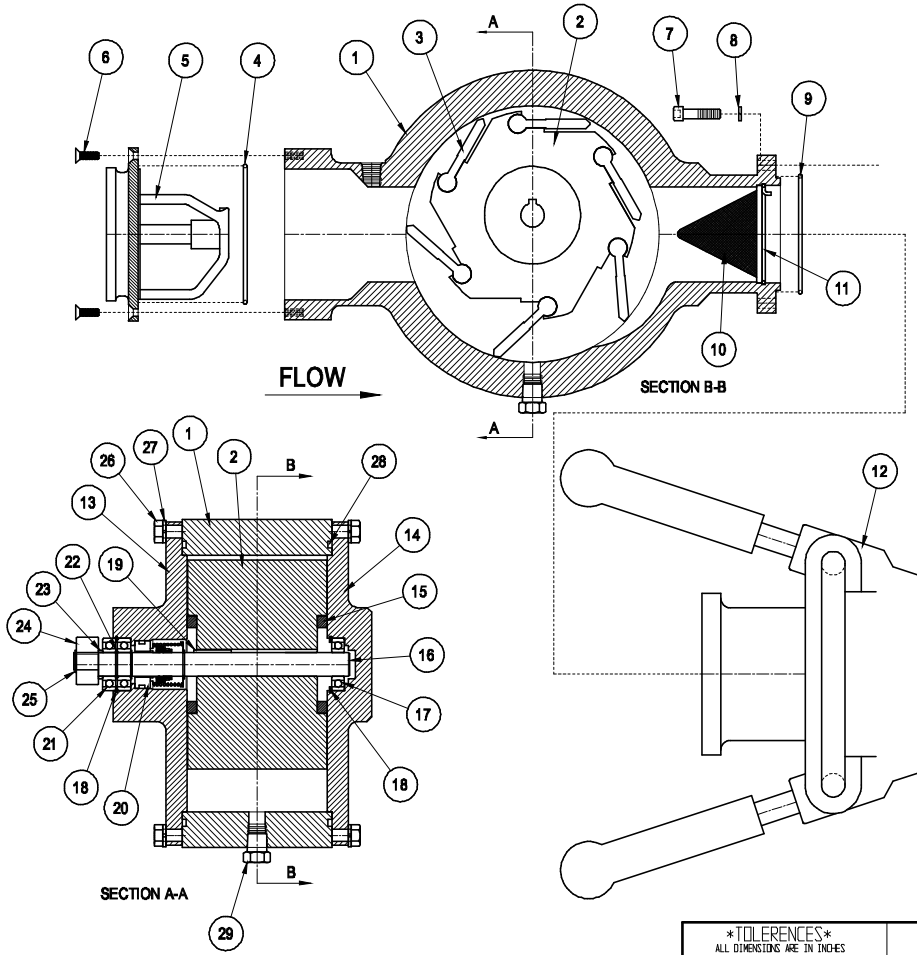
HAMMONDS TECHNICAL SERVICES, INC.

SCALE	NTS	APPROVED	PART NUMBER	DRAWN BY	SS
DATE	07/19/17		.	REVISED	11/19/19

DRAWING TITLE: HAMMONDS MODEL SPI-1P*

HORIZONTAL FLOW

DRAWING NUMBER 7621



	ITEM	PART NO.	QTY.	DESCRIPTION
3	1	212118	1	SPI STR. HSG, CLA-VAL NOZ.
	2	212288	1	ROTOR
	3	212304	6	VANE, TEFLON, SOLID
1		212304-1	6	VANE, TEFLON, VENTED
	4	881987	1	O-RING, BUTADIENE-ACRYLONITRILE
2		885294	1	O-RING, BUNA-N
	5	881975	1	SINGLE POINT RECEPTACLE
	6	881980	6	10-24 x 5/8" F H SCREW
	7	881291	6	SCREW, 1/4-20 x 1"
	8	883529	6	LOCK WASHER, 1/4" HI-COL
	9	212557	1	O-RING, VITON
2		885295	1	O-RING, BUNA-N
	10	885246	1	NOZZLE SCREEN, 100 MESH
	11	885247	1	RETAINING CLIP
	12	882667	1	SINGLE POINT NOZZLE
	13	882011	1	PUMP PLATE
3	14	212119	1	BACK PLATE
	15	882012	2	WEAR RING
	16	212549	1	SHAFT, SPI-ECC
	17	212272	1	BEARING, SHIELDED
	18	881121	2	INTERNAL SNAP RING
	19	212002	1	KEY, 3/16" SQ x 1"
	20	141006	1	MECHANICAL SEAL, VITON
2		141048	1	MECHANICAL SEAL, BUNA-N
	21	881120	2	BEARING, SEALED
	22	881119	3	EXTERNAL SNAP RING
	23	881629	1	SPACER
	24	881157	1	HD DRIVE BEARING
	25	101045	1	EXTERNAL SNAP RING
	26	881422	16	HEX BOLT, 5/16-18 x 1"
	27	881417	16	LOCK WASHER, 5/16"
	28	881910	2	O-RING, VITON
2		881154	2	O-RING, BUNA-N
	29	151005	1	PIPE PLUG, 1/4"

NO.	REVISION	DATE	BY	APPVD
3	WAS 212117, 212309	06/07/17	SS	JH
2	ADDED BUNA-N SEAL	06/07/17	SS	X
1	ADDED VENTED VANE	06/03/16	SS	X
0	INITIAL RELEASE	03/31/16	SS	X

DRAWING	LEVELS	VIEW
SPI	28,87,89	1

FROM SER#	DATE	TO SER#	DATE
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*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125

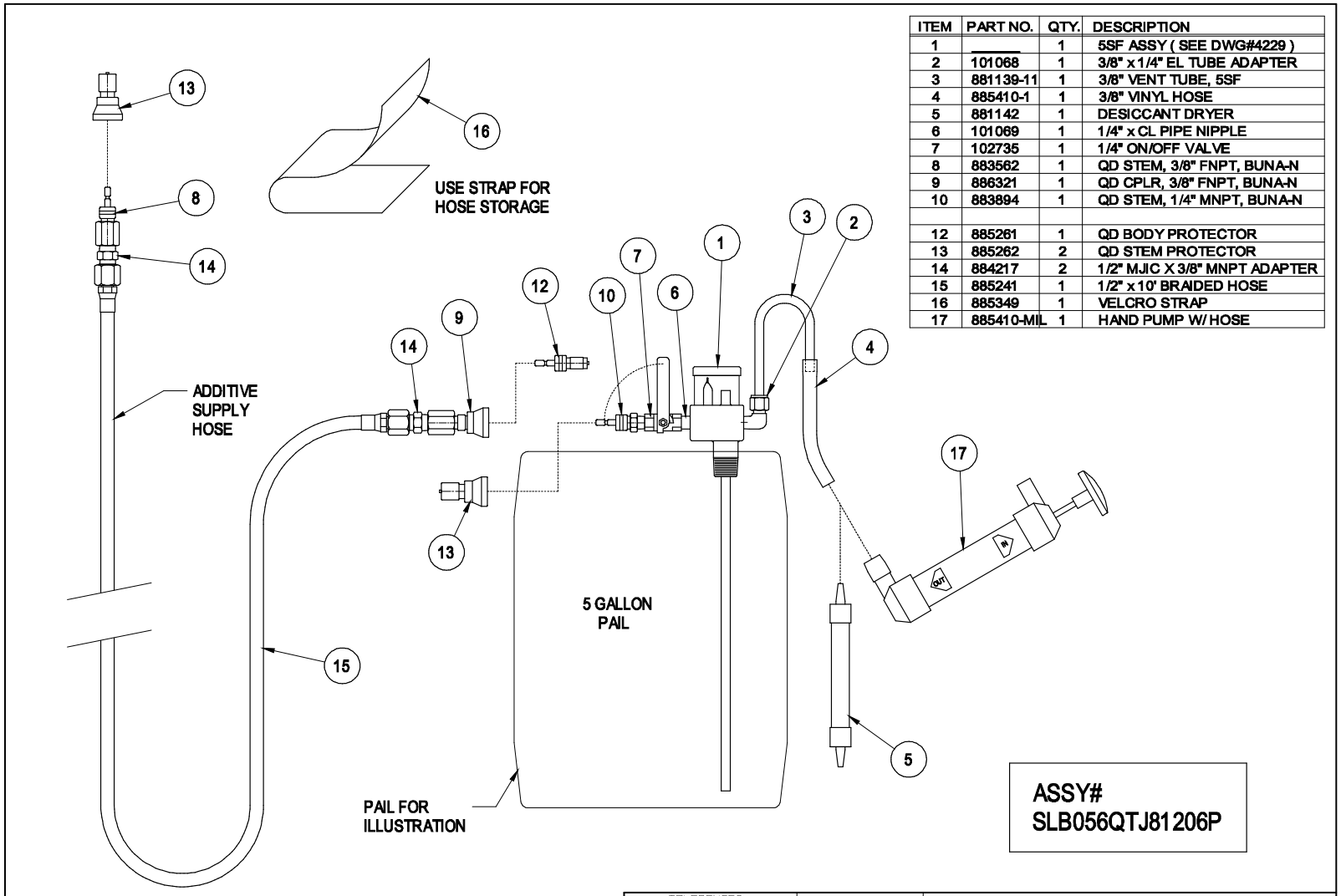
*REMOVE BURRS AND BREAK EDGES .005 MIN.

HAMMONDS TECHNICAL SERVICES, INC.

SCALE	NTS	APPROVED	PART NUMBER	DRAWN BY	SS
DATE	03/31/16		.	REVISED	06/07/17

DRAWING TITLE
SPI DRIVER ASSEMBLY
STRAIGHT HSG, ECC DRIVE

DRAWING NUMBER 7359



ITEM	PART NO.	QTY.	DESCRIPTION
1	_____	1	5SF ASSY (SEE DWG#4229)
2	101068	1	3/8" x 1/4" EL TUBE ADAPTER
3	881139-11	1	3/8" VENT TUBE, 5SF
4	885410-1	1	3/8" VINYL HOSE
5	881142	1	DESICCANT DRYER
6	101069	1	1/4" x CL PIPE NIPPLE
7	102735	1	1/4" ON/OFF VALVE
8	883562	1	QD STEM, 3/8" FNPT, BUNA-N
9	886321	1	QD CPLR, 3/8" FNPT, BUNA-N
10	883894	1	QD STEM, 1/4" MNPT, BUNA-N
12	885261	1	QD BODY PROTECTOR
13	885262	2	QD STEM PROTECTOR
14	884217	2	1/2" MJIC X 3/8" MNPT ADAPTER
15	885241	1	1/2" x 10' BRAIDED HOSE
16	885349	1	VELCRO STRAP
17	885410-MIL	1	HAND PUMP W/ HOSE

NO.	REVISION	DATE	BY	APPVD
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DRAWING	LEVELS		VIEW
SPI-1	118-120		1
FROM SER#	DATE	TO SER#	DATE
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SURFACE FINISH 125 *REMOVE BURRS AND BREAK EDGES .005 MIN.

HAMMONDS TECHNICAL SERVICES, INC.

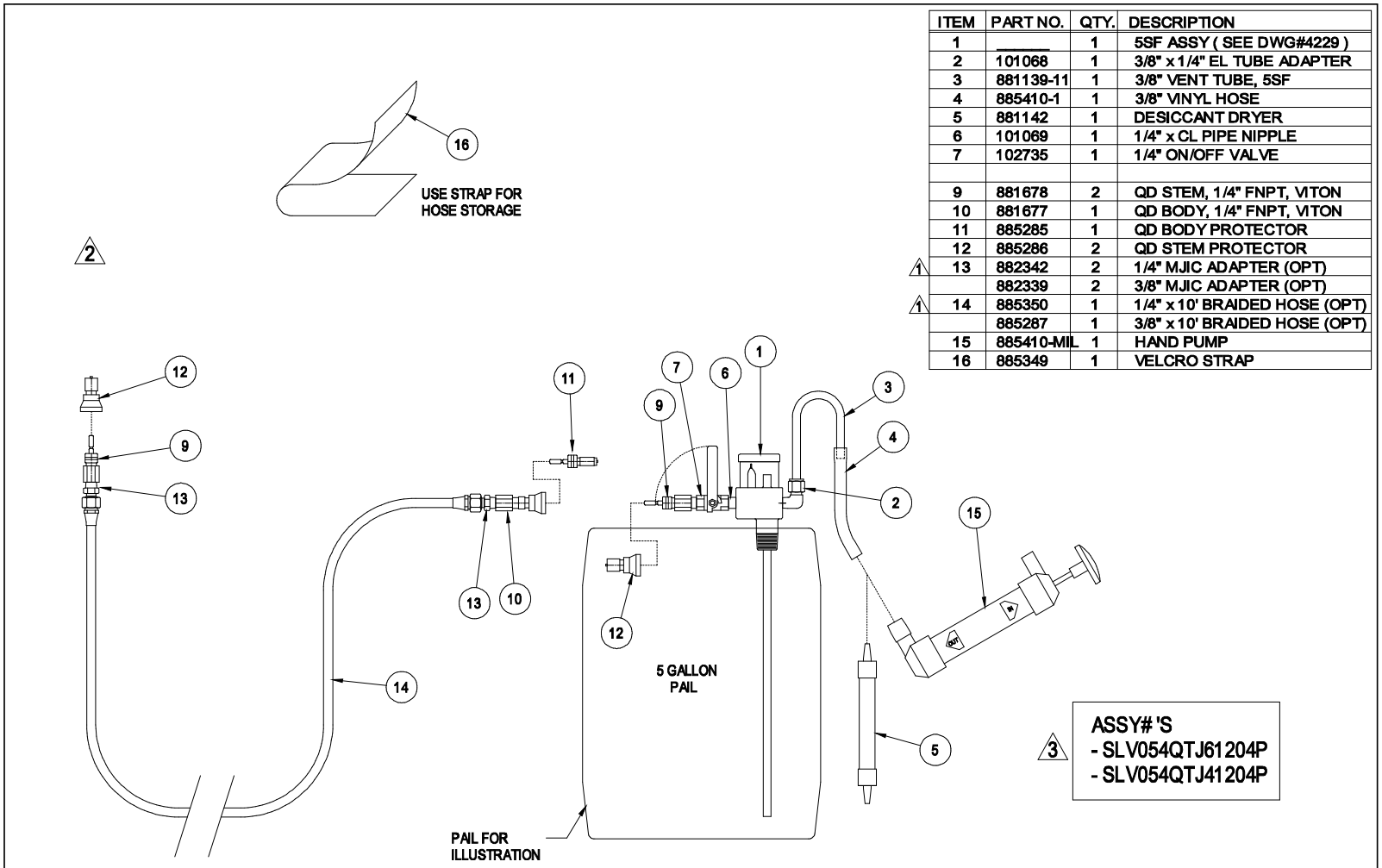
SCALE	NTS	APPROVED	PART NUMBER	DRAWN BY	SS
DATE	11/07/19		SEE ASSY#	REVISED	.

DRAWING TITLE 5SF ASSY. FOR SPI-1S

w/ 3/8" VENT

DRAWING NUMBER 7604-1

Hammonds Model SPI-1 Manual



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5	881142	1	DESICCANT DRYER
6	101069	1	1/4" x CL PIPE NIPPLE
7	102735	1	1/4" ON/OFF VALVE
9	881678	2	QD STEM, 1/4" FNPT, VITON
10	881677	1	QD BODY, 1/4" FNPT, VITON
11	885285	1	QD BODY PROTECTOR
12	885286	2	QD STEM PROTECTOR
1 13	882342	2	1/4" MJIC ADAPTER (OPT)
	882339	2	3/8" MJIC ADAPTER (OPT)
1 14	885350	1	1/4" x 10' BRAIDED HOSE (OPT)
	885287	1	3/8" x 10' BRAIDED HOSE (OPT)
15	885410-MIL	1	HAND PUMP
16	885349	1	VELCRO STRAP

NO.	REVISION	DATE	BY	APPVD
3	ADDED ASSY #'S	11/19/19	SS	X
2	REMOVED PUMP	09/16/19	SS	X
1	ADDED OPT HOSE	07/19/17	SS	X
0	INITIAL RELEASE	04/24/17	SS	X

DRAWING	LEVELS	VIEW
SPI-1	84-86	1

FROM SER#	DATE	TO SER#	DATE
X	X	X	X

TOLERENCES
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

*TOL. DECIMALS: .XXX= +/-.005 .XX= +/-.015 .X= +/-.030 FRAC.= +/-1/16

*TOL. ANGLES: +/- .5 DEGREES

*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125

*REMOVE BURRS AND BREAK EDGES .005 MIN.

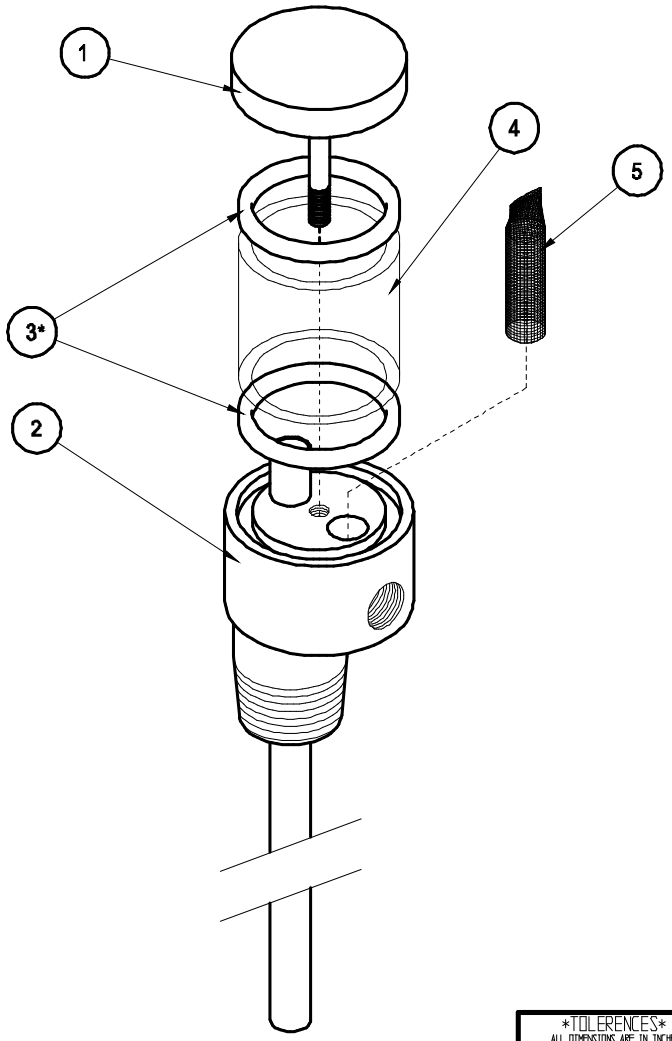
HAMMONDS TECHNICAL SERVICES, INC.

SCALE	NTS	APPROVED	PART NUMBER	DRAWN BY	SS
DATE	04/24/17		SEE ASSY#'S	REVISED	11/19/19

DRAWING TITLE 5SF ASS'Y. FOR SPI-1P*

FOR OPTIONAL PUMPS

DRAWING NUMBER 7569



ITEM	PART NO.	QTY.	DESCRIPTION
1	152074	1	CAP, ASS'Y.
2	152084	1	BODY, ASS'Y. 5SF
3	151002	2	O-RING, BUNA
4	151001	1	GLASS
5	152002	1	FILTER ELEMENT
* 3	151007	2	O-RING, VITON (OPT)
* 3	151027	2	O-RING, NEOPRENE (OPT)

* NOTE: THIS COMPONENT IS PART OF VARIOUS ASSEMBLIES

NO.	REVISION	DATE	BY	APPVD
0	INITIAL RELEASE	10/11/01	SS	X

DRAWING	LEVELS		VIEW
0159	7,8		1
FROM SER#	DATE	TO SER#	DATE
X	X	X	X

TOLERENCES
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

*TOL. DECIMALS:
.XXX= +/-.005
.XX= +/-.015
.X= +/-.030
FRAC.= +/-1/16

*TOL. ANGLES: +/- .5 DEGREES

*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125

*REMOVE BURRS AND BREAK EDGES .005 MIN.

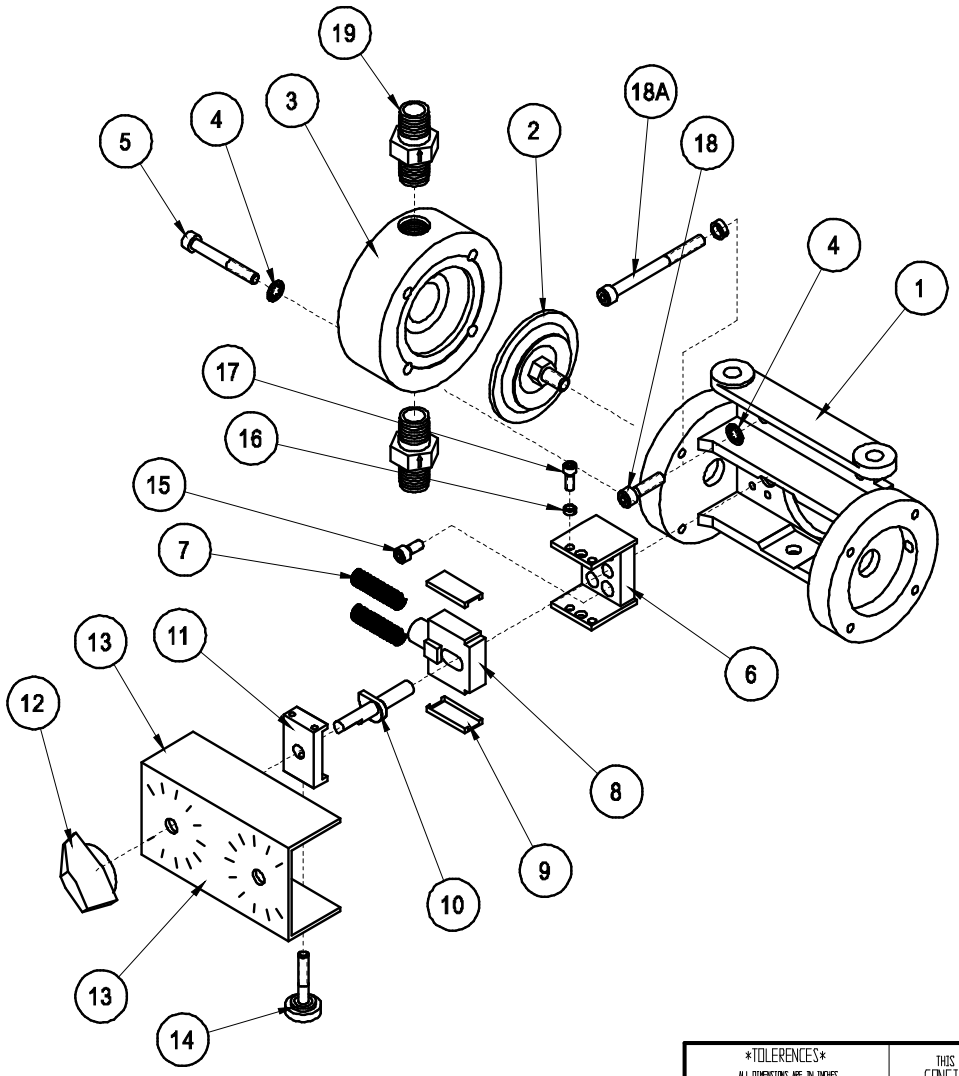
HAMMONDS TECHNICAL SERVICES, INC.

SCALE	NTS	APPROVED BY		DRAWN BY	SS
DATE	10/11/01		•	REVISED	

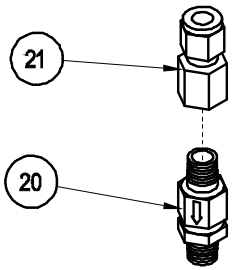
DRAWING TITLE: 5SF SIGHT FLOW INDICATOR

* BASE 5SF

DRAWING NUMBER: 4229



ITEM	PART NO.	QTY.	DESCRIPTION
1	101014	1	POWER FRAME
2	101016	1	DIAPHRAGM, S
	101455	1	DIAPHRAGM, S, VITON (OPTION)
3	102001	1	FLUID END, S
4	882949	8	LOCK WASHER, #10
5	101037	4	SCREW, 10-32 x 1 1/2"
2	6	101842	1	CROSSHEAD GUIDE
7	101007	2	RETURN SPRING
8	101006	1	CROSSHEAD
9	101152	2	SLIDE BEARING
10	101005	1	STROKE ADJUSTMENT CAM
11	101003	1	CAM GUIDE
12	101001	1	STROKE ADJUSTMENT KNOB
13	101002	1	POWER FRAME COVER
14	101004	1	LOCK SCREW
15	101009	4	SCREW, 8-32 x 3/8"
16	881086	4	LOCKWASHER, #8
17	101010	4	SCREW, 6-32 x 3/8"
18	881089	4	SCREW, 10-32 x 3/4"
18A	881660	4	SCREW, 10-32 x 2 1/4" (OPT)
4 3	19	102463	2	CHECK VALVE, AFLAS, STD.
	102464	2	CHECK VALVE, VITON (OPT)
	102642	2	CHECK VALVE, KALREZ (OPT)
4	20	882911	1	CHECK VALVE, 5 PSI, AFLAS (STD.)
	101576	1	CHECK VALVE, 5 PSI, VITON (OPT.)
	102643	1	CHECK VALVE, 5 PSI, KALREZ (OPT.)
21	101088	1	3/8 x 1/4 FNPT TUBE ADAPT.



NO.	REVISION	DATE	BY
4	NEW CHECK VALVES	03/15/04	SS
3	SOFT SEAT CHK VLV	09/03/02	SS
2	WAS #101008	08/99	SS
1	ADDED INJ CHK VLV	01/06/98	SS

DRAWING	LEVELS	VIEW
INJECTOR	10,12,14,16,18,20,24,28,	7
	30-33,37,39-44,129	

FROM SER#	DATE	TO SER#	DATE
X	X	X	X

TOLERENCES
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

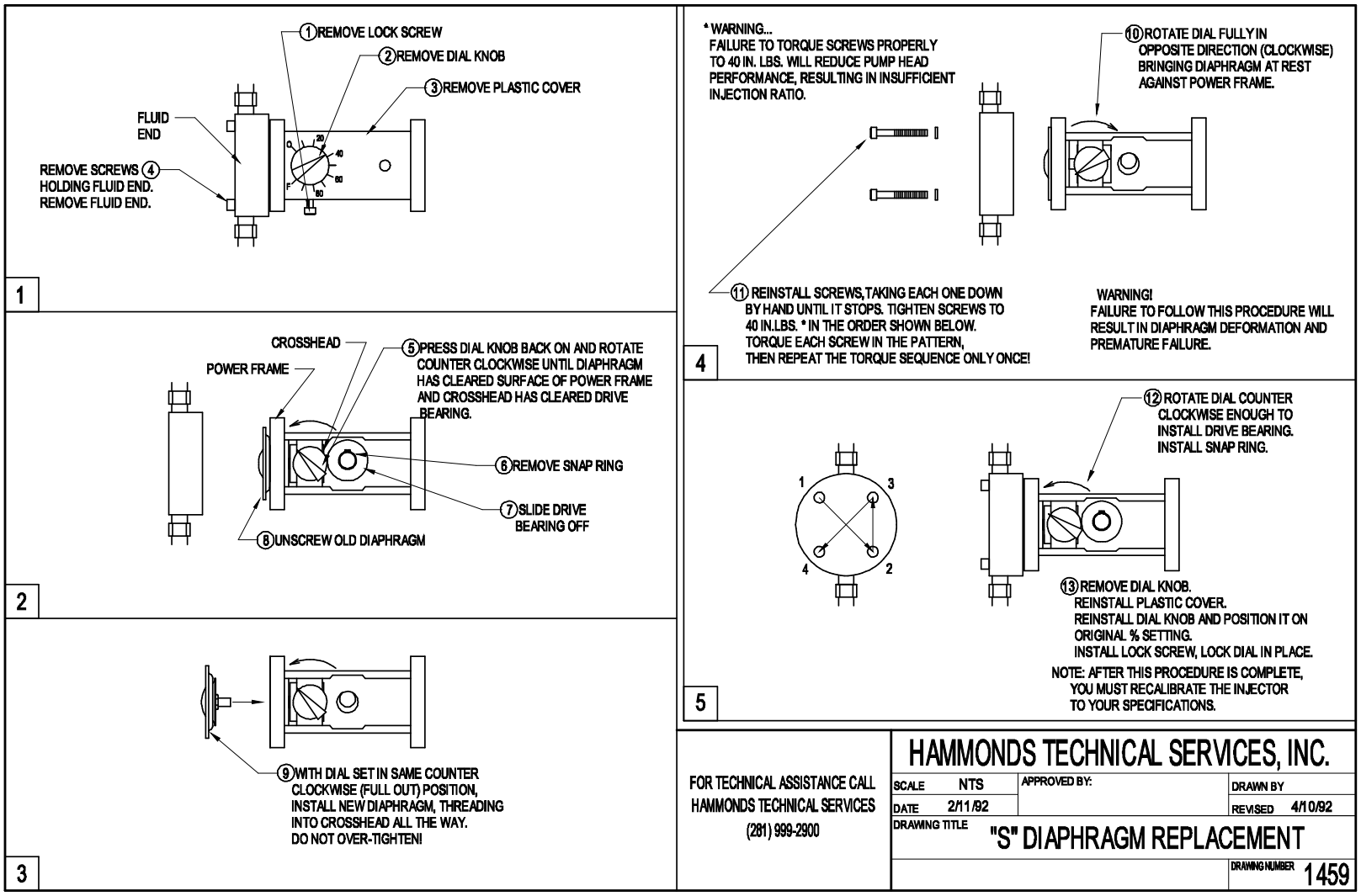
*TOL. DECIMALS: .XXX= +/-.005 .XX= +/-.015 .X= +/-.030
*TOL. ANGLES: +/- .5 DEGREES
*CONCENTRICITY: .005 T.I.R.
SURFACE FINISH 125
*REMOVE BURRS AND BREAK EDGES .005 MIN.

HAMMONDS TECHNICAL SERVICES, INC.

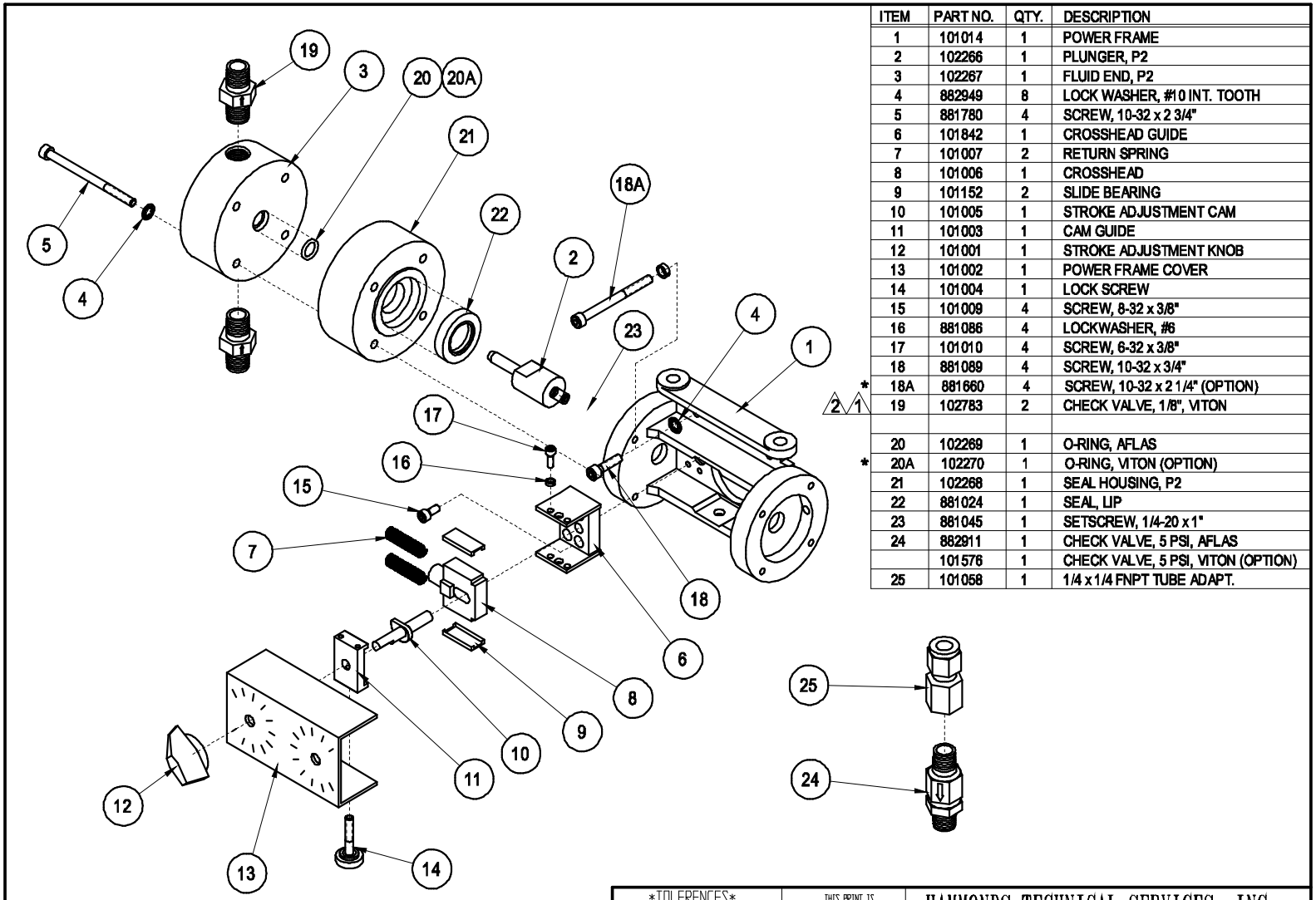
SCALE	NTS	APPROVED BY:		DRAWN BY	SS
DATE	10/15/91			REVISED	03/15/04

DRAWING TITLE: HAMMONDS 1S PUMP ASSEMBLY

DRAWING NUMBER: 1358


1 REMOVE LOCK SCREW
2 REMOVE DIAL KNOB
3 REMOVE PLASTIC COVER
FLUID END
REMOVE SCREWS 4 HOLDING FLUID END.
REMOVE FLUID END.
1
CROSSHEAD
POWER FRAME
5 PRESS DIAL KNOB BACK ON AND ROTATE COUNTER CLOCKWISE UNTIL DIAPHRAGM HAS CLEARED SURFACE OF POWER FRAME AND CROSSHEAD HAS CLEARED DRIVE BEARING.
6 REMOVE SNAP RING
7 SLIDE DRIVE BEARING OFF
8 UNSCREW OLD DIAPHRAGM
2
9 WITH DIAL SET IN SAME COUNTER CLOCKWISE (FULL OUT) POSITION, INSTALL NEW DIAPHRAGM, THREADING INTO CROSSHEAD ALL THE WAY. DO NOT OVER-TIGHTEN!
3
* WARNING... FAILURE TO TORQUE SCREWS PROPERLY TO 40 IN. LBS. WILL REDUCE PUMP HEAD PERFORMANCE, RESULTING IN INSUFFICIENT INJECTION RATIO.
10 ROTATE DIAL FULLY IN OPPOSITE DIRECTION (CLOCKWISE) BRINGING DIAPHRAGM AT REST AGAINST POWER FRAME.
11 REINSTALL SCREWS, TAKING EACH ONE DOWN BY HAND UNTIL IT STOPS. TIGHTEN SCREWS TO 40 IN.LBS. * IN THE ORDER SHOWN BELOW. TORQUE EACH SCREW IN THE PATTERN, THEN REPEAT THE TORQUE SEQUENCE ONLY ONCE!
WARNING! FAILURE TO FOLLOW THIS PROCEDURE WILL RESULT IN DIAPHRAGM DEFORMATION AND PREMATURE FAILURE.
4
1 3 4 2
12 ROTATE DIAL COUNTER CLOCKWISE ENOUGH TO INSTALL DRIVE BEARING. INSTALL SNAP RING.
13 REMOVE DIAL KNOB. REINSTALL PLASTIC COVER. REINSTALL DIAL KNOB AND POSITION IT ON ORIGINAL % SETTING. INSTALL LOCK SCREW, LOCK DIAL IN PLACE.
NOTE: AFTER THIS PROCEDURE IS COMPLETE, YOU MUST RECALIBRATE THE INJECTOR TO YOUR SPECIFICATIONS.
5
FOR TECHNICAL ASSISTANCE CALL HAMMONDS TECHNICAL SERVICES (281) 999-2900
HAMMONDS TECHNICAL SERVICES, INC.
SCALE NTS
APPROVED BY:
DRAWN BY
DATE 2/11/92
REVISED 4/10/92
DRAWING TITLE "S" DIAPHRAGM REPLACEMENT
DRAWING NUMBER 1459

Hammonds Model SPI-1 Manual



ITEM	PART NO.	QTY.	DESCRIPTION
1	101014	1	POWER FRAME
2	102266	1	PLUNGER, P2
3	102267	1	FLUID END, P2
4	882949	8	LOCK WASHER, #10 INT. TOOTH
5	881780	4	SCREW, 10-32 x 2 3/4"
6	101842	1	CROSSHEAD GUIDE
7	101007	2	RETURN SPRING
8	101006	1	CROSSHEAD
9	101152	2	SLIDE BEARING
10	101005	1	STROKE ADJUSTMENT CAM
11	101003	1	CAM GUIDE
12	101001	1	STROKE ADJUSTMENT KNOB
13	101002	1	POWER FRAME COVER
14	101004	1	LOCK SCREW
15	101009	4	SCREW, 8-32 x 3/8"
16	881086	4	LOCKWASHER, #6
17	101010	4	SCREW, 6-32 x 3/8"
18	881089	4	SCREW, 10-32 x 3/4"
* 18A	881660	4	SCREW, 10-32 x 2 1/4" (OPTION)
2 1 19	102783	2	CHECK VALVE, 1/8", VITON
20	102269	1	O-RING, AFLAS
* 20A	102270	1	O-RING, VITON (OPTION)
21	102268	1	SEAL HOUSING, P2
22	881024	1	SEAL, LIP
23	881045	1	SETSCREW, 1/4-20 x 1"
24	882911	1	CHECK VALVE, 5 PSI, AFLAS
	101576	1	CHECK VALVE, 5 PSI, VITON (OPTION)
25	101058	1	1/4 x 1/4 FNPT TUBE ADAPT.

NO.	REVISION	DATE	BY	APPVD
2	WAS #102463	02/20/08	SS	X
1	WAS #101933	03/15/04	SS	X

DRAWING	LEVELS		
INJECTOR	10,12,14,16,18,20,24,28,		
	30,39-41,89,90,202-205		
FROM SER#	DATE	TO SER#	DATE
X	X	X	X

TOLERENCES
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
*TOL. DECIMALS: .XXX= +/-.005 .XX= +/-.015 .X= +/-.030 FRAC.= +/-1/16
*TOL. ANGLES: +/- .5 DEGREES
*CONCENTRICITY: .005 T.I.R.
SURFACE FINISH 125
*REMOVE BURRS AND BREAK EDGES .005 MIN.

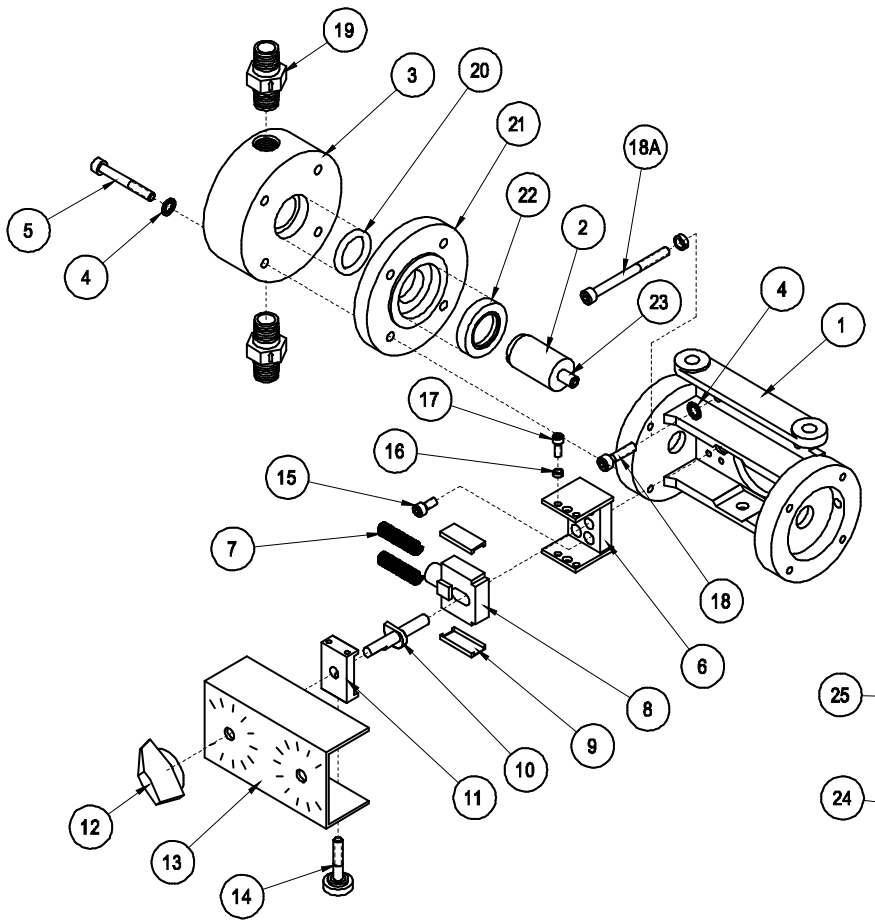
HAMMONDS TECHNICAL SERVICES, INC.

SCALE	NTS	APPROVED	PART NUMBER	DRAWN BY	SS
DATE	06/20/95		.	REVISED	02/20/08

DRAWING TITLE: HAMMONDS 1P2 PUMP

DRAWING NUMBER: 4567

Hammonds Model SPI-1 Manual



ITEM	PART NO.	QTY.	DESCRIPTION
1	101014	1	POWER FRAME
2	102339	1	PLUNGER, P5
3	102340	1	FLUID END, P5
4	882949	8	LOCK WASHER, #10 INT. TOOTH
5	881317	4	SCREW, 10-32 x 2"
6	101842	1	CROSSHEAD GUIDE
7	101007	2	RETURN SPRING
8	101006	1	CROSSHEAD
9	101152	2	SLIDE BEARING
10	101005	1	STROKE ADJUSTMENT CAM
11	101003	1	CAM GUIDE
12	101001	1	STROKE ADJUSTMENT KNOB
13	101002	1	POWER FRAME COVER
14	101004	1	LOCK SCREW
15	101009	4	SCREW, 8-32 x 3/8"
16	881086	4	LOCKWASHER, #8
17	101010	4	SCREW, 6-32 x 3/8"
18	881089	4	SCREW, 10-32 x 3/4"
18A	881660	4	SCREW, 10-32 x 2 1/4" (OPTION)
1 19	102463	2	CHECK VALVE, AFLAS, STD.
	102464	2	CHECK VALVE, VITON (OPTION)
3	102642	2	CHECK VALVE, KALREZ (OPTION)
20	101856	1	O-RING, AFLAS
	101857	1	O-RING, VITON (OPTION)
3	103514	1	O-RING, KALREZ (OPTION)
21	102341	1	SEAL HOUSING, P5
22	881079	1	SEAL, LIP
23	881045	1	SETSCREW, 1/4-20 x 1" (PART OF #2)
2 24	882911	1	CHECK VALVE, 5 PSI, AFLAS
	101576	1	CHECK VALVE, 5 PSI, VITON (OPT)
3	102643	1	CHECK VALVE, 5 PSI, KALREZ (OPT)
25	101088	1	3/8 x 1/4 FNPT TUBE ADAPT.

NO.	REVISION	DATE	BY	APVD
3	ADDED KALREZ OPT	06/25/09	SS	.
2	WAS #101671	03/15/04	SS	.
1	WAS #101933	03/15/04	SS	.

DRAWING	LEVELS		
INJECTOR	10,12,14,16,18,20,24,28,30		
	39-41,89-93,95-97,99,118,119		
FROM SER#	DATE	TO SER#	DATE
X	X	X	X

TOLERENCES
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

*TOL. DECIMALS:
.XXX= +/-.005
.XX= +/-.015
.X= +/-.030
FRAC.= +/-1/16

*TOL. ANGLES: +/- .5 DEGREES

*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125 *REMOVE BURRS AND BREAK EDGES .005 MIN.

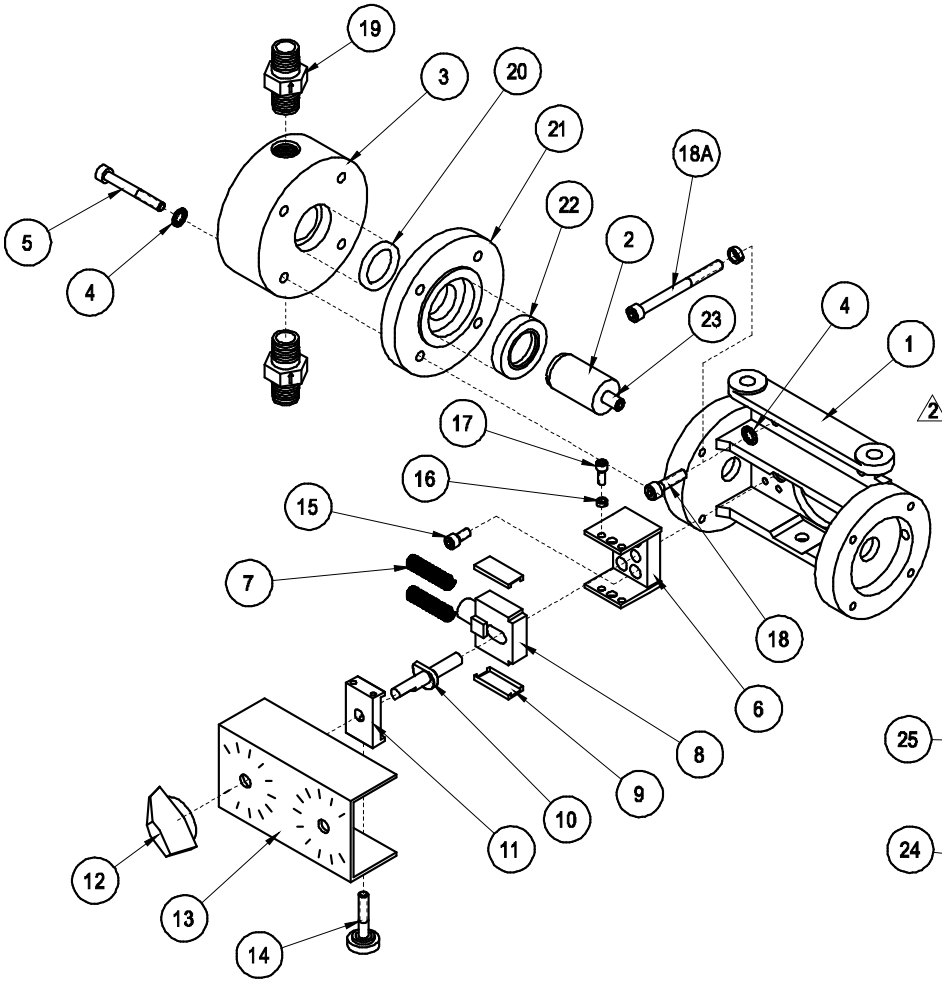
HAMMONDS TECHNICAL SERVICES, INC.

SCALE	NTS	APPROVED	PART NUMBER	DRAWN BY	SS
DATE	10/07/99		-	REVISED	06/25/09

DRAWING TITLE: HAMMONDS 1P5 PUMP

DRAWING NUMBER 3836

Hammonds Model SPI-1 Manual



ITEM	PART NO.	QTY.	DESCRIPTION
1	101014	1	POWER FRAME
2	102137	1	PLUNGER, P6
3	102138	1	FLUID END, P6
4	882949	8	LOCK WASHER, #10 INT. TOOTH
5	881317	4	SCREW, 10-32 x 2"
6	101842	1	CROSSHEAD GUIDE
7	101007	2	RETURN SPRING
8	101006	1	CROSSHEAD
9	101152	2	SLIDE BEARING
10	101005	1	STROKE ADJUSTMENT CAM
11	101003	1	CAM GUIDE
12	101001	1	STROKE ADJUSTMENT KNOB
13	101002	1	POWER FRAME COVER
14	101004	1	LOCK SCREW
15	101009	4	SCREW, 8-32 x 3/8"
16	881086	4	LOCKWASHER, #6
17	101010	4	SCREW, 6-32 x 3/8"
18	881089	4	SCREW, 10-32 x 3/4"
* 18A	881660	4	SCREW, 10-32 x 2 1/4" (OPTION)
2 1 19	102463	2	CHECK VALVE, AFLAS, STD.
*	102464	2	CHECK VALVE, VITON (OPT)
20	101491	1	O-RING, AFLAS
*	101417	1	O-RING, VITON (OPTION)
21	102139	1	SEAL HOUSING
22	881024	1	SEAL, LIP
23	881045	1	SETSCREW, 1/4-20 x 1"
2 24	882911	1	CHECK VALVE, 5 PSI, AFLAS, STD.
	101576	1	CHECK VALVE, 5 PSI, VITON, (OPT)
25	101088	1	3/8 x 1/4 FNPT TUBE ADAPT.

NO.	REVISION	DATE	BY
2	NEW CHECK VALVES	03/15/04	SS
1	WAS #102263	09/03/02	SS

DRAWING	LEVELS		VIEW
INJECTOR	10,12,14,16,18,20,24,28,30 39-41,89-93,95-97,99,113,114		7
FROM SER#	DATE	TO SER#	DATE
X	X	X	X

TOLERENCES
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

*TOL. DECIMALS: .XXX= +/-.005 .XX= +/-.015 .X= +/-.030

*TOL. ANGLES: +/- .5 DEGREES

*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125 *REMOVE BURRS AND BREAK EDGES .005 MIN.

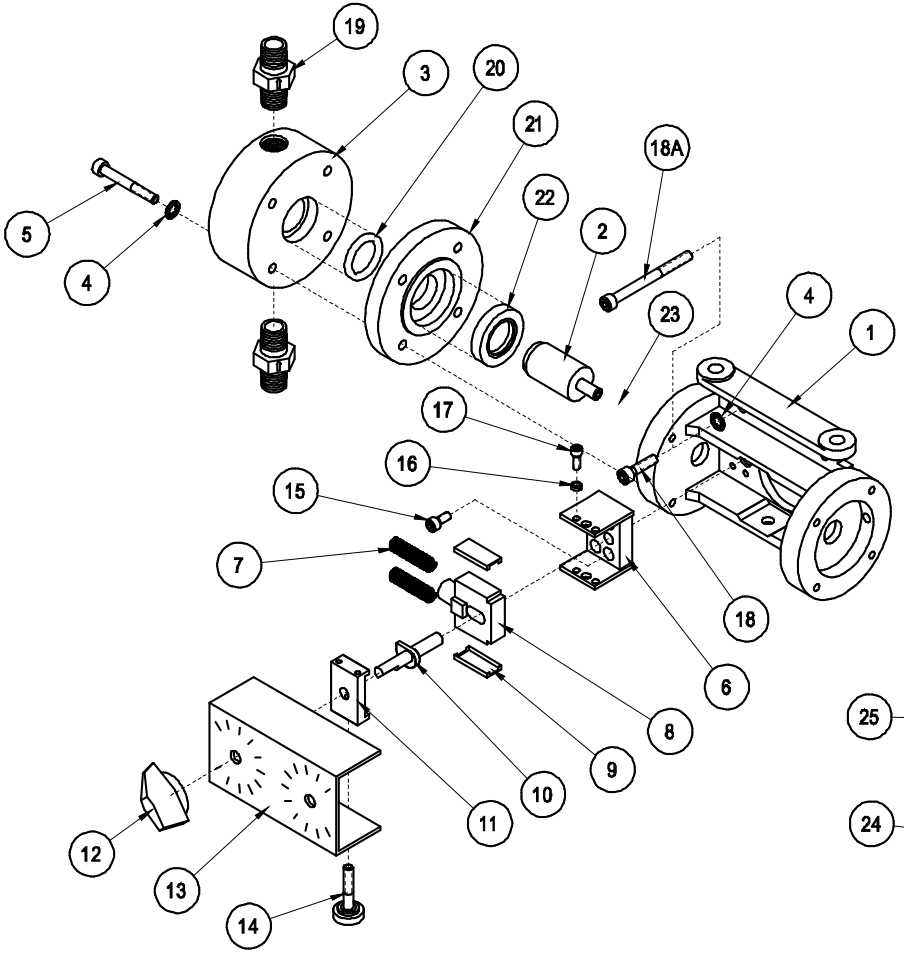
HAMMONDS TECHNICAL SERVICES, INC.

SCALE	NTS	APPROVED BY:	DRAWN BY SS
DATE	09/22/92		REVISED 03/15/04

DRAWING TITLE: HAMMONDS 1P6 PUMP

DRAWING NUMBER: 1687

Hammonds Model SPI-1 Manual



ITEM	PART NO.	QTY.	DESCRIPTION
1	101014	1	POWER FRAME
2	102192	1	PLUNGER, P7
3	102193	1	FLUID END, P7
4	882949	8	LOCK WASHER, #10 INT. TOOTH
5	881317	4	SCREW, 10-32 x 2"
2 6	101842	1	CROSSHEAD GUIDE
7	101007	2	RETURN SPRING
8	101006	1	CROSSHEAD
9	101152	2	SLIDE BEARING
10	101005	1	STROKE ADJUSTMENT CAM
11	101003	1	CAM GUIDE
12	101001	1	STROKE ADJUSTMENT KNOB
13	101002	1	POWER FRAME COVER
14	101004	1	LOCK SCREW
15	101009	4	SCREW, 8-32 x 3/8"
16	881086	4	LOCKWASHER, #8
17	101010	4	SCREW, 6-32 x 3/8"
18	881089	4	SCREW, 10-32 x 3/4"
18A	881660	4	SCREW, 10-32 x 2 1/4" (OPTION)
4 3	19	102463	2 CHECK VALVE, AFLAS
6		102464	2 CHECK VALVE, VITON (OPTION)
		102642	2 CHECK VALVE, KALREZ (OPTION)
	20	101490	1 O-RING, AFLAS
6		101226	1 O-RING, VITON (OPTION)
		101754	1 O-RING, KALREZ (OPTION)
	21	102194	1 SEAL HOUSING
	22	881765	1 SEAL, LIP
	23	881045	1 SETSCREW, 1/4-20 x 1"
5	24	882911	1 CHECK VALVE, 5 PSI, AFLAS, STD.
		101576	1 CHECK VALVE, 5 PSI, VITON, (OPT)
6		102643	1 CHECK VALVE, 5 PSI, KALREZ, (OPT)
	25	101088	1 3/8 x 1/4 FNPT TUBE ADAPT.

NO.	REVISION	DATE	BY
6	ADDED PART NOS.	01/21/14	SS
5	WAS #101671	03/15/04	SS
4	WAS #101933	03/15/04	SS
3	WAS #102263	09/03/02	SS
2	WAS #101008	08/99	SS
1	ADDED INJ CHK VLV	01/06/98	SS

DRAWING	LEVELS	VIEW
INJECTOR	10,12,14,16,18,20,24,28,30	1
	39-41,89-93,95-97,99,110,111	

FROM SER#	DATE	TO SER#	DATE
X	X	X	X

TOLERENCES
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

*TOL. DECIMALS:
.XXX= +/-.005
.XX= +/-.015
.X= +/-.030
FRAC.= +/-1/16

*TOL. ANGLES: +/- .5 DEGREES

*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125 *REMOVE BURRS AND BREAK EDGES .005 MIN.

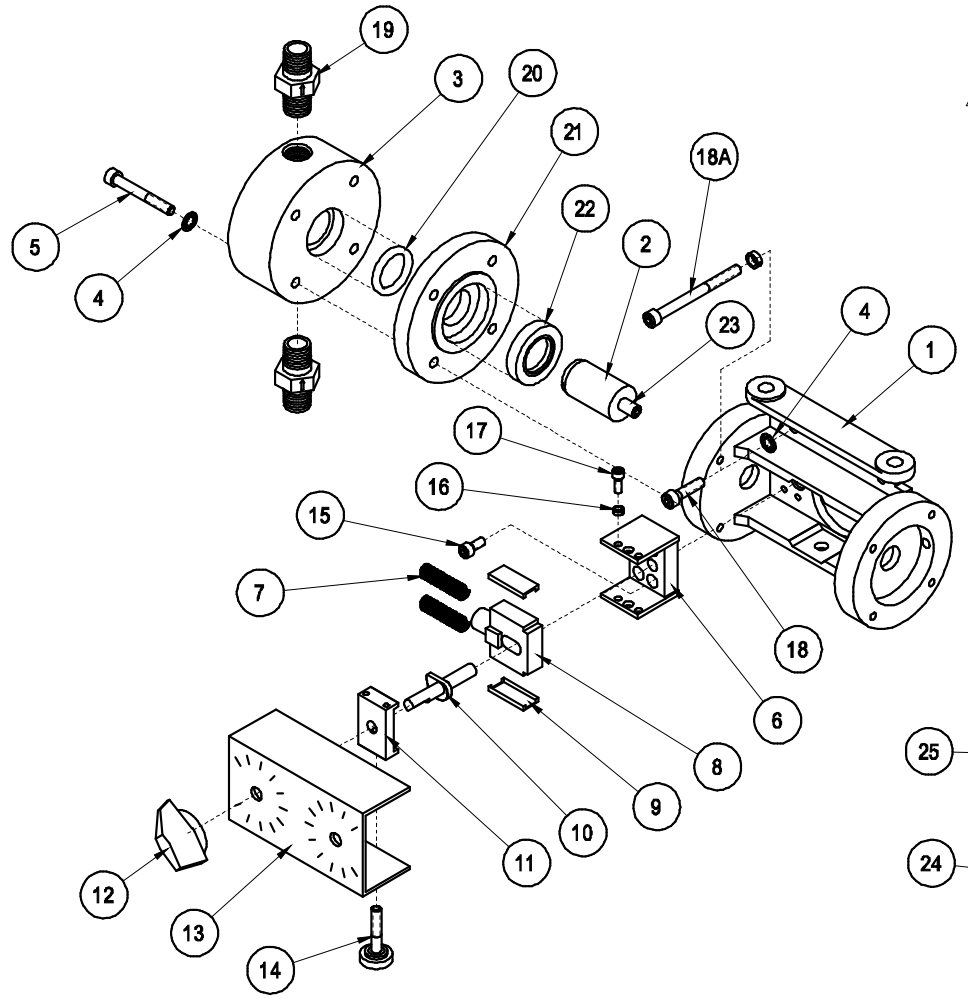
HAMMONDS TECHNICAL SERVICES, INC.

SCALE	NTS	APPROVED	PART NUMBER	DRAWN BY	SS
DATE	05/11/93		.	REVISED	01/21/14

DRAWING TITLE: HAMMONDS 1P7 PUMP ASSEMBLY

DRAWING NUMBER: 1911

Hammonds Model SPI-1 Manual



ITEM	PART NO.	QTY.	DESCRIPTION
1	101014	1	POWER FRAME
2	102224	1	PLUNGER, P10
3	102225	1	FLUID END, P10
4	882949	8	LOCK WASHER, #10 INT. TOOTH
5	881317	4	SCREW, 10-32 x 2"
△1 6	101842	1	CROSSHEAD GUIDE
7	101007	2	RETURN SPRING
8	101006	1	CROSSHEAD
9	101152	2	SLIDE BEARING
10	101005	1	STROKE ADJUSTMENT CAM
11	101003	1	CAM GUIDE
12	101001	1	STROKE ADJUSTMENT KNOB
13	101002	1	POWER FRAME COVER
14	101004	1	LOCK SCREW
15	101009	4	SCREW, 8-32 x 3/8"
16	881086	4	LOCKWASHER, #8
17	101010	4	SCREW, 6-32 x 3/8"
18	881089	4	SCREW, 10-32 x 3/4"
18A	881660	4	SCREW, 10-32 x 2 1/4" (OPTION)
△2 19	102463	2	CHECK VALVE, AFLAS, STD.
	102464	2	CHECK VALVE, VITON, (OPTION)
20	101537	1	O-RING, AFLAS
	101839 △3	1	O-RING, VITON (OPTION)
	101883	1	O-RING, EPDM (OPTION)
21	102226	1	SEAL HOUSING
22	881908	1	SEAL, LIP
23	881045	1	SETSCREW, 1/4-20 x 1"
△4 24	882911	1	CHECK VALVE, 5 PSI, AFLAS, STD.
	101576	1	CHECK VALVE, 5 PSI, VITON (OPT)
25	101088	1	3/8 x 1/4 FNPT TUBE ADAPT.

NO.	REVISION	DATE	BY	APPVD
△4	WAS #101671	03/15/04	SS	X
△3	WAS #101933	03/15/04	SS	X
△2	WAS #102263	09/03/02	SS	X
△1	WAS #101008	08/99	SS	X

DRAWING	LEVELS		
INJECTOR	10,12,14,16,18,20,24,28,30		
	39-41,89-93,95-97,99,116,117		
FROM SER#	DATE	TO SER#	DATE
X	X	X	X

TOLERENCES
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

*TOL. DECIMALS:
.XXX= +/-.005
.XX= +/-.015
.X= +/-.030
FRAC.= +/-1/16

*TOL. ANGLES: +/- .5 DEGREES

*CONCENTRICITY: .005 T.I.R.

SURFACE FINISH 125

*REMOVE BURRS AND BREAK EDGES .005 MIN.

HAMMONDS TECHNICAL SERVICES, INC.

SCALE	NTS	APPROVED	PART NUMBER	DRAWN BY	SS
DATE	09/23/93		.	REVISED	03/15/04

DRAWING TITLE HAMMONDS 1P10 PUMP

DRAWING NUMBER 2668