



# HYDRAULICS INTERNATIONAL, INC.

Chatsworth, California, USA



# AIR DRIVEN LIQUID PUMPS

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## PRINCIPLE OF OPERATION

Hydraulics International air driven liquid pumps operate on the principle of differential working areas. An air piston drives a smaller diameter plunger or piston to provide a pressure ratio. The pressure ratio is the method of determining maximum outlet pressure available. Hydraulics International model numbers reflect the nominal pressure ratio of the pumps.

Hydraulics International liquid pumps will cycle automatically when compressed air is first applied to the drive. It will start

cycling at its maximum speed thus producing maximum fluid flow. At this stage, the pump is acting as a transfer pump, filling the pressure system with fluid. As resistance increases in the system (creating backpressure to the pump), the pump will decrease its reciprocating action. Backpressure in the system finally balances with the incoming air drive pressure times the ratio. At this point, the pump will stall and maintain pressure without consuming any energy. If there is further demand on the system for flow, the pump will automatically start cycling again.

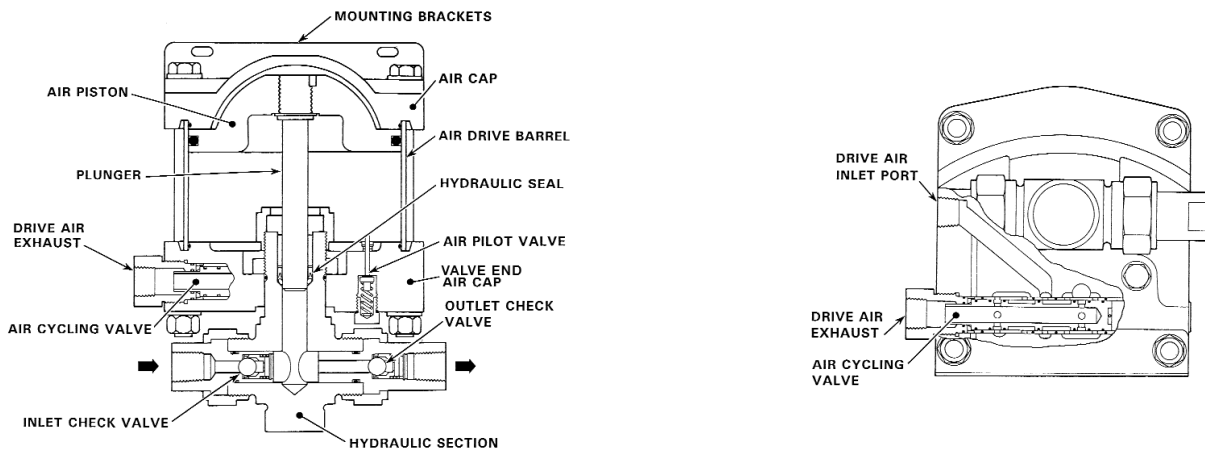


FIGURE 1. CROSS SECTION OF MODEL 5L-SS-RATIO

## FEATURES

- Air Drive line lubrication not required.
- Self-priming for immediate operation.
- Compatible with all hydraulic fluids, plain water, distilled & deionized water, solvents, mild chemicals and most liquefied aerosol type gases.
- Range of models to provide up to 80,000 psi intermittent output pressure.
- Stainless steel hydraulic body, check valves, and trim are standard, except -4 and -7 models.
- Alternative gases that can drive the pump include nitrogen, vapor from liquefied gas, pipeline natural gas and sour natural gas with proper modifications.
- Offer a wide range of standard modifications.

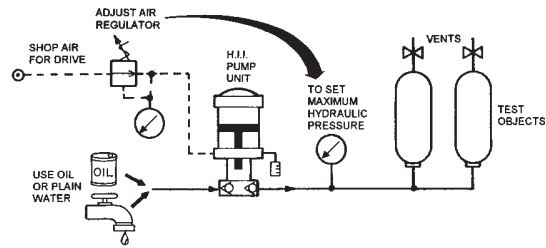
## WHY USE AIR DRIVEN LIQUID PUMPS

- Hydraulic pressure is held without energy consumption.
- Explosion proof ... requires no electrical power or connections.
- Intrinsically safe.
- Compact, lightweight and weatherproof.
- Easy to adapt automatic controls.
- Contamination tolerant.
- Outlet stall pressure pre-determined by the air drive regulator.
- High pressure capability - up to 80,000 psi.
- Ideal for stop-start applications under full load.
- Easy to install and operate.

## TYPICAL APPLICATIONS

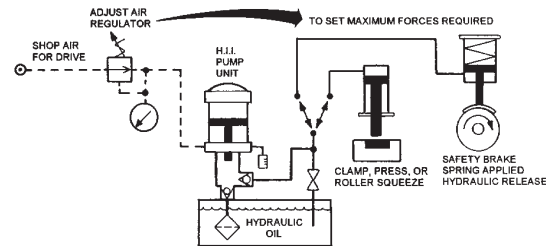
- HYDROSTATIC TESTING:**

Any component that is made to hold liquid or gas pressure needs to be carefully tested after manufacture or repair to verify its integrity, and/or to calibrate it. H.I.I. air driven pumps can simplify this requirement in a broad range of industries.



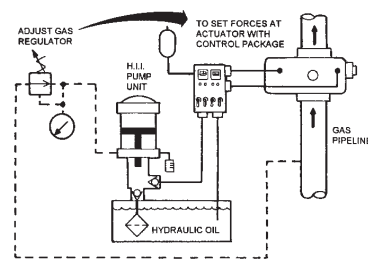
- CLAMPING-PRESSING-RELEASING:**

Hydraulic cylinders or rams that are required to maintain an output force without movement for long periods need a hydraulic pump that can maintain output pressure at zero flow for a long periods with no heat being generated. H.I.I. air driven pumps will do this over virtually any pressure range.



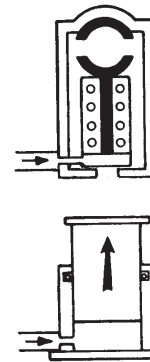
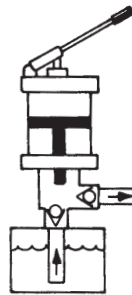
- VALVE ACTUATION:**

Pipeline gas is commonly used for bootstrap operation of pneumatic valve actuators. But where high force requirements meet low gas pressures, the size of the pneumatic actuator needed may be impractical. A gas driven H.I.I. pump with a small hydraulic actuator can often solve this at less cost.



- PORTABLE HYDRAULIC TOOLS:**

To be easily handled on the job, these tools must be compact with minimum weight. This means hydraulic pressures beyond the reach of rotary hydraulic pumps ... but easily provided by H.I.I. air driven hydraulic pumps. For portability of the pump-tank package, the oil supply need be little more than the displacement of the tool it is teamed with because overheating can not occur.



Compact H.I.I. pump & tank unit with optional hand pump kit if air or gas not available



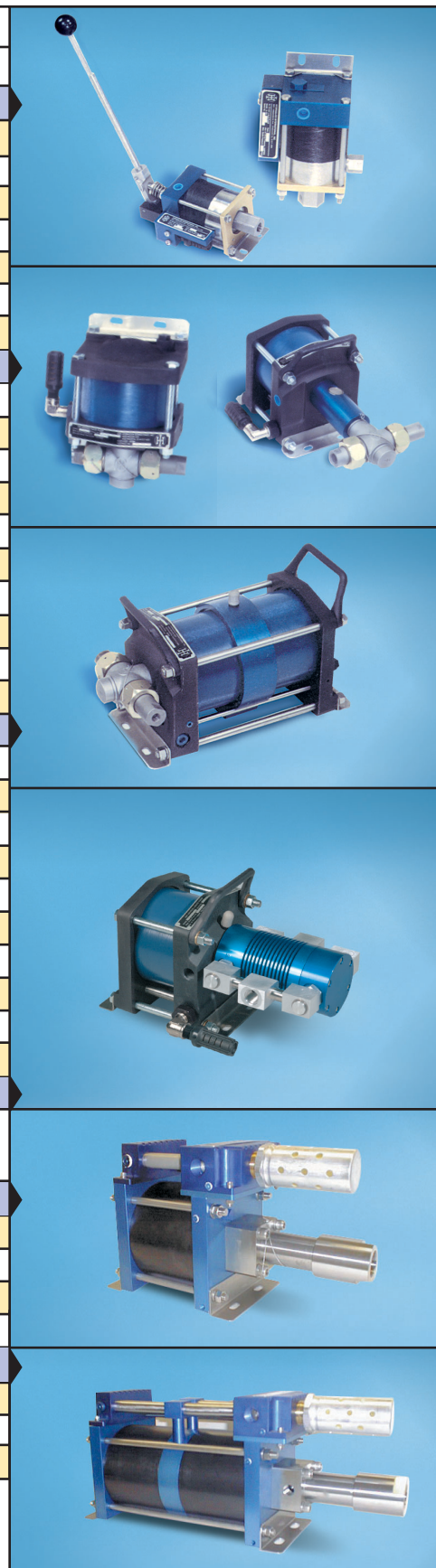
QUICK REFERENCE INTERNATIONAL EQUIVALENTS	
PRESSURE:	1 BAR = 14.5 PSI = 100 Kpa = 1.02 Kg/cm <sup>2</sup> 1 Mpa = 10 BAR = 1000 Kpa
VOLUME:	1 LITRE = 61 IN <sup>3</sup> = .26 U.S. GALLON 1 NM <sup>3</sup> = 35.3 SCF
WEIGHT:	1 Kg = 2.2 LBS
LENGTH:	1 IN = 25.4 mm

## MODEL SELECTION TABLE

Item #	Model with Ratio Dash Number <sup>1</sup>	Maximum Outlet Pressure <sup>2</sup> (PSI)	Volume Displacement Per Cycle (IN <sup>3</sup> )	Liquid Port Detail <sup>3</sup>	
				Inlet	Outlet
<b>3" Single Acting, Single Air Drive</b>					
1	3L-SS-8	1,200	0.82	3/4" NPT	1/2" NPT
2	3L-SS-14	1,950	0.46	3/4" NPT	1/2" NPT
3	3L-SS-25	3,750	0.25	3/8" NPT	1/4" NPT
4	3L-SS-41	6,150	0.15	3/8" NPT	1/4" NPT
5	3L-SS-81	12,150	0.08	3/8" NPT	1/4" NPT
6	3L-SS-125	15,000 <sup>2</sup>	0.05	3/8" NPT	1/4" NPT
7	3L-SS-220	15,000 <sup>2</sup>	0.03	3/8" NPT	1/4" SP <sup>5</sup>
<b>5-3/4" Single Acting, Single Air Drive</b>					
8	5L-SS-10	1,500	4.42	1" NPT	3/4" NPT
9	5L-SS-15	2,250	3.07	1" NPT	3/4" NPT
10	5L-SS-30	4,500	1.88	1/2" NPT	1/2" NPT
11	5L-SS-45	6,750	1.24	1/2" NPT	1/2" NPT
12	5L-SS-60	9,000	0.89	1/2" NPT	1/2" NPT
13	5L-SS-115	17,250	0.48	1/2" NPT	1/2" NPT
14	5L-SS-150	22,500	0.36	1/2" NPT	1/4" SP <sup>5</sup>
15	5L-SS-205	30,750	0.26	1/2" NPT	1/4" SP <sup>5</sup>
16	5L-SS-300	45,000	0.18	1/2" NPT	1/4" SP <sup>5</sup>
17	5L-SS-450	67,500	0.12	1/2" NPT	1/4" SP <sup>5</sup>
<b>5-3/4" Single Acting, Double Air Drive</b>					
18	5L-SD-20	3,000	4.42	1" NPT	3/4" NPT
19	5L-SD-30	4,500	3.07	1" NPT	3/4" NPT
20	5L-SD-60	9,000	1.88	1/2" NPT	1/2" NPT
21	5L-SD-90	13,500	1.24	1/2" NPT	1/2" NPT
22	5L-SD-120	18,000	0.89	1/2" NPT	1/2" NPT
23	5L-SD-230	34,500	0.48	1/2" NPT	1/4" SP <sup>5</sup>
24	5L-SD-300	45,000	0.36	1/2" NPT	1/4" SP <sup>5</sup>
25	5L-SD-410	61,500	0.26	1/2" NPT	1/4" SP <sup>5</sup>
26	5L-SD-600	80,000	0.18	1/2" NPT	1/4" SP <sup>5</sup>
27	5L-SD-900	80,000	0.12	1/2" NPT	1/4" SP <sup>5</sup>
<b>5-3/4" Double Acting, Single Air Drive</b>					
28	5L-DS-4	1,250	24.1	-10 SAE	-10 SAE
This model uses inlet pressure to assist the force of the drive. e.g. If inlet pressure is 200psi; drive pressure 100psi; stall will be approx. 200+400=600psi.					
<b>7" Double Acting<sup>4</sup>, Single Air Drive</b>					
29	7L-DS-7	1,250	41.4	-10 SAE	-10 SAE
30	7L-DS-35	5,250	7.8	1-1/4" NPT	1/2" NPT
31	7L-DS-60	9,000	4.7	1-1/4" NPT	1/2" NPT
32	7L-DS-100	15,000	2.8	1-1/4" NPT	1/2" NPT
<b>7" Double Acting<sup>4</sup>, Double Air Drive</b>					
33	7L-DD-70	10,500	7.8	1-1/4" NPT	1/2" NPT
34	7L-DD-120	18,000	4.7	1-1/4" NPT	9/16" MP <sup>5</sup>
35	7L-DD-200	20,000	2.8	1-1/4" NPT	9/16" MP <sup>5</sup>

**NOTES:**

- <sup>1</sup> Dash no. is approx. area ratio of drive vs. liquid section. Max. drive pressure: 150 PSI.
- <sup>2</sup> Max. rated outlet pressure for stainless steel configuration
- <sup>3</sup> Air drive ports: Inlet: 3L-series - 1/4" NPT, 5L-series - 8 SAE, 7L-series - 3/4" NPT  
Exhaust: 3L-series - 1/4" NPT, 5L-series - 1/2" NPT, 7L-series - 1-1/4" NPT
- <sup>4</sup> Items 30-35 in the 7L Series take in the full displacement on their suction stroke, while discharging 1/2 that volume. Then on the opposite stroke, the other 1/2 of the volume is discharged to complete one cycle. Item 29 takes in and discharges 1/2 of its displacement with either direction of stroke. It also uses inlet pressure to assist the force of the drive, e.g. If inlet pressure is 200 psi; drive pressure 100 psi; stall will be approx. 200 + 700 = 900 psi.
- <sup>5</sup> 1/4 SP fits super pressure threaded and coned 1/4" OD tube. 9/16 MP fits medium pressure threaded and coned 9/16 OD tube.



**Model Designation System:** [1] - [2] [3] - [4] - [5]  
Example: 5L-SD-300-X

Box 1: Pump Series: 3L, 5L, or 7L.  
Box 2: Pump Action: S-Single Acting, D-Double Acting  
Box 3: Drive Piston(s): S-Single piston, D-Two Pistons  
Box 4: Nominal Area Ratio-Drive vs Pump Section  
Box 5: Modification (See Page 10)

## TYPE OF MATERIALS IN CONTACT WITH FLUID

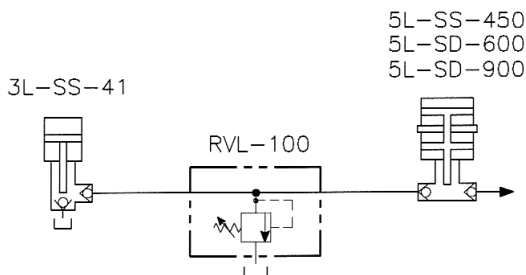
Series	Hydraulic Body	Hydraulic Plunger	Check Valves		Static O-Rings	Plunger Seal
			Inlet	Outlet		
<b>3L</b>						
-8 thru -81	316SS	316 SS	316 SS	316 SS	BUNA-N	UHMWPE <sup>1</sup>
-125 thru -220	15-5 PH	316 SS	316 SS	316 SS	BUNA-N	UHMWPE
<b>5L</b>						
-10 thru -230	15-5 PH	15-5 PH	15-5 PH	15-5 PH	BUNA-N	UHMWPE
-300 thru -900	15-5 PH	STELLITE	15-5 PH	15-5 PH	BUNA-N	UHMWPE
-4	ALUMINUM	15-5 PH (Rod & Piston)	316 SS	316 SS	BUNA-N	Compounded PTFE (Rod & Piston)
<b>7L</b>						
-7	ALUMINUM	15-5 PH (Rod & Piston)	316 SS	316 SS	BUNA-N	Compounded PTFE
-35 thru -200	15-5 PH		15-5 PH			UHMWPE (Rod & Piston)

LIQUID COMPATIBILITY:	SERIES		
	3L	5L	7L
Hydraulic Fluid - Petroleum, Water, or Veg. Oil Based	Yes	Yes	Yes
Hydraulic Fluid - Skydrol or Brake Fluids	Yes <sup>2</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>
Water - Plain, Distilled, Deionized	Yes	Yes	Yes
Solvents Compatible with BUNA-N	Yes	Yes	Yes
Liquified Gases <sup>3</sup>	Yes	Yes	No <sup>3</sup>

SUCTION PRESSURES <sup>5</sup>	Up to maximum outlet pressure	Limit to approx. 30 PSI. Except 7L-DS-7: Approx 500 PSI.
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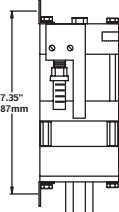
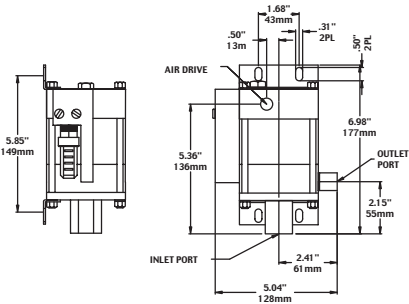
TEMPERATURE LIMITATIONS:	+10°F to +150°F. "V" Modification (pg. 10) can increase limit to about 200°F
Drive Sections <sup>4</sup>	
Liquid Sections	+180°F Maximum. If higher, contact factory.

- NOTES:**
- Ultra-High-Molecular-Weight Polyethylene
  - Requires "D" and "E" modifications (pg 10). Note: For most other industrial phosphate ester fluids if drive receives "V" modification, "D" and "E" modifications not required.
  - Ref. HII technical bulletin TB101. Model 7L-DS-7 is suitable for liquified gases.
  - Pneumatic motors and drives of all types severely cool their drive air or gas while performing work. Unless the drive air is heated and the dew point is well below 32° F, there is potential for ice to form in the drive resulting in slow down or stopping. This probably indicates a common misapplication: running the pump under load for a sustained period. For suggestions on how this can be avoided, contact factory.
  - Although all models will self-prime when tank-top mounted with most fluids, a flooded suction is recommended for models -200 thru -900, all series.  
For models 5L-SS-450, -SD-600, -SD-900 in heavy duty hydrostatic testing or isostatic press applications, a supercharge pump such as model 3L-SS-41 is recommended to extend fatigue life. The supercharge pump should also be protected from reverse leakage with a relief valve set at 10% above its stall pressure.



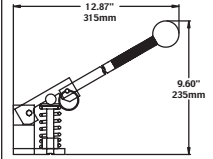
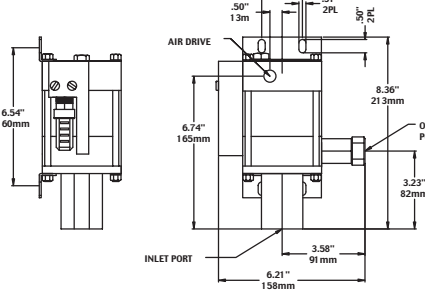
# DIMENSIONAL DATA

**3L-SS -25 THRU -220**



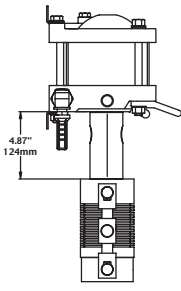
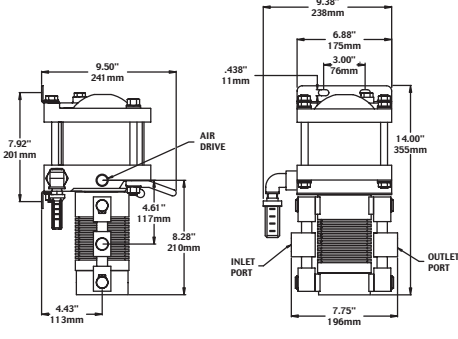
**'D' MOD.**

**3L-SS-8, -14**



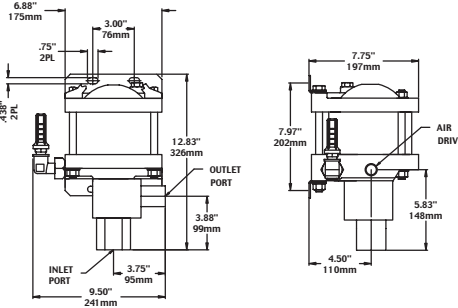
**'H' MOD.**

**5L-DS-4**

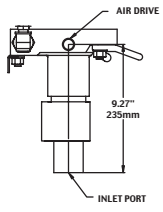
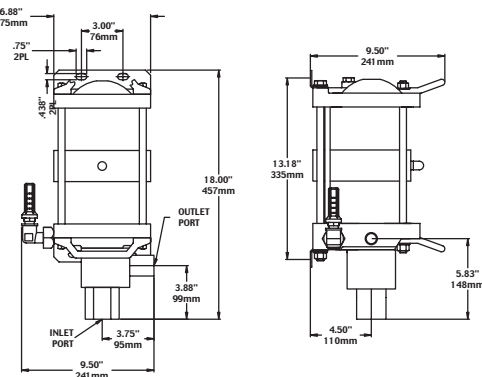


**'D' MOD.**

**5L-SS -10, -15**

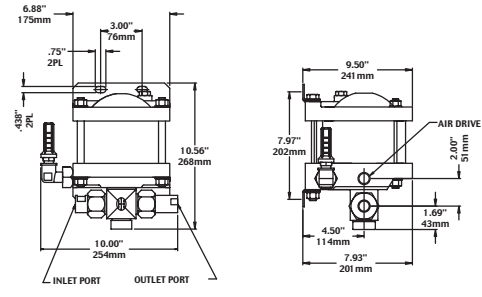


**5L-SD -20, -30**

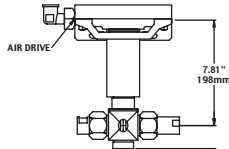
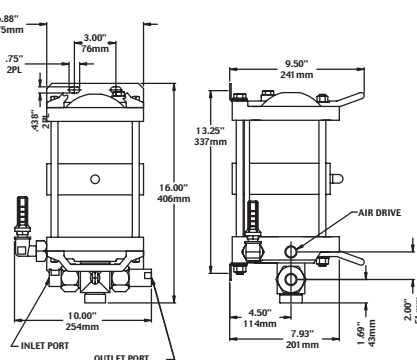


**'D' MOD.**

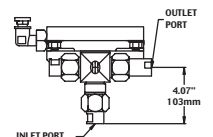
**5L-SS -30 THRU -450**



**5L-SD -60 THRU -900**

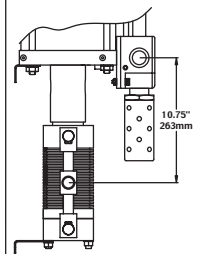
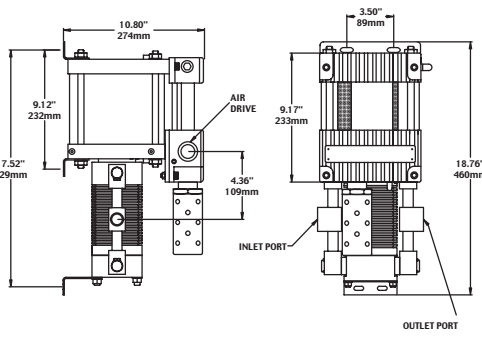


**'D' MOD.**



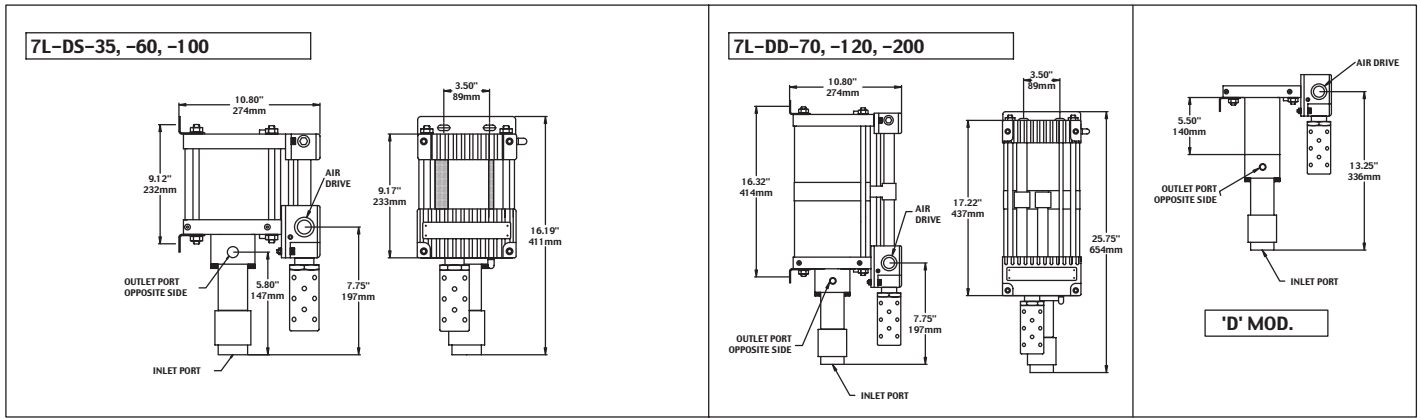
**'B' MOD.**

**7L-DS-7**

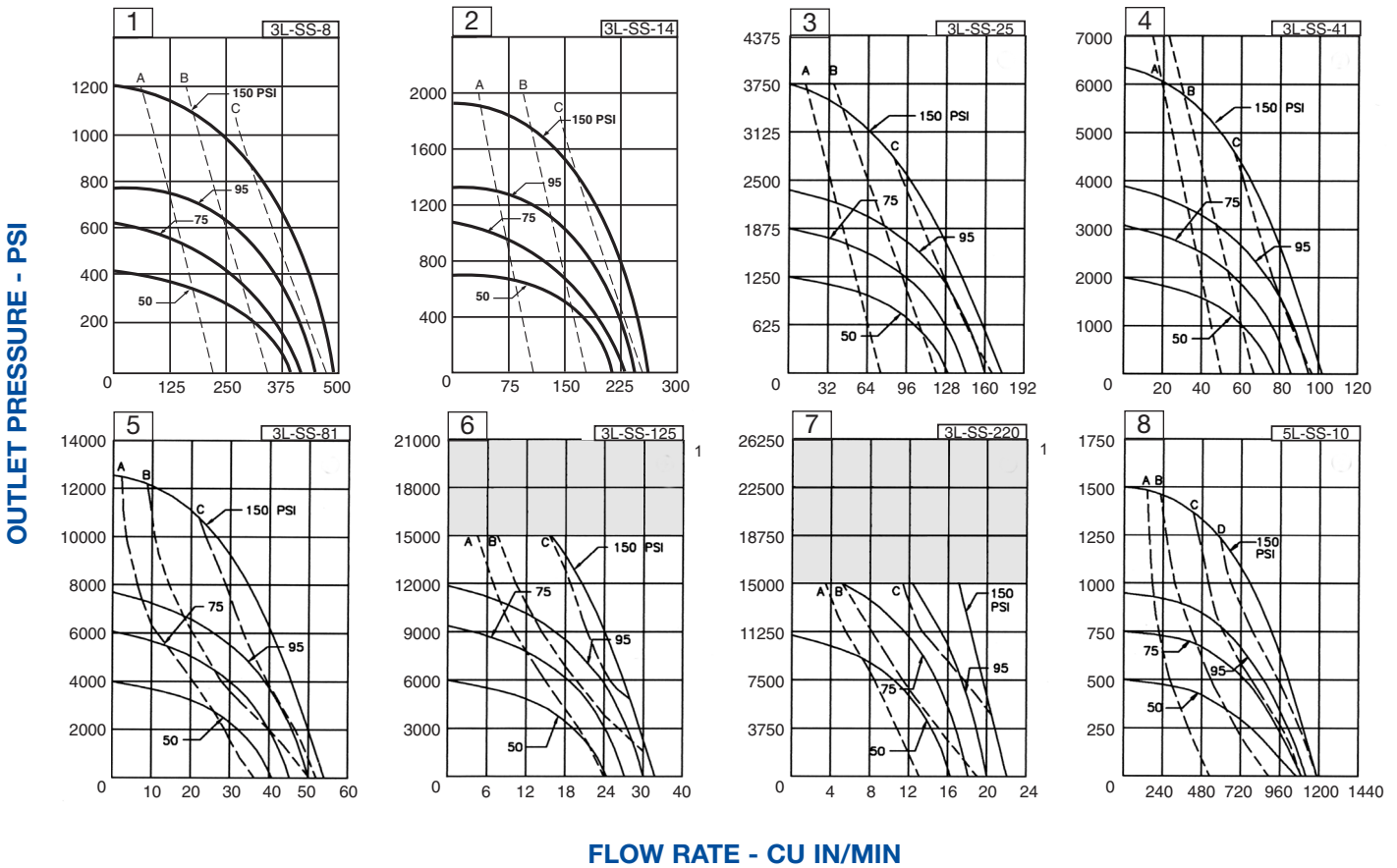


**'D' MOD.**

## DIMENSIONAL DATA



## PERFORMANCE CURVES



**NOTES:**

1 Shaded area exceeds rated pressure. For intermittent use in this area, consult factory.

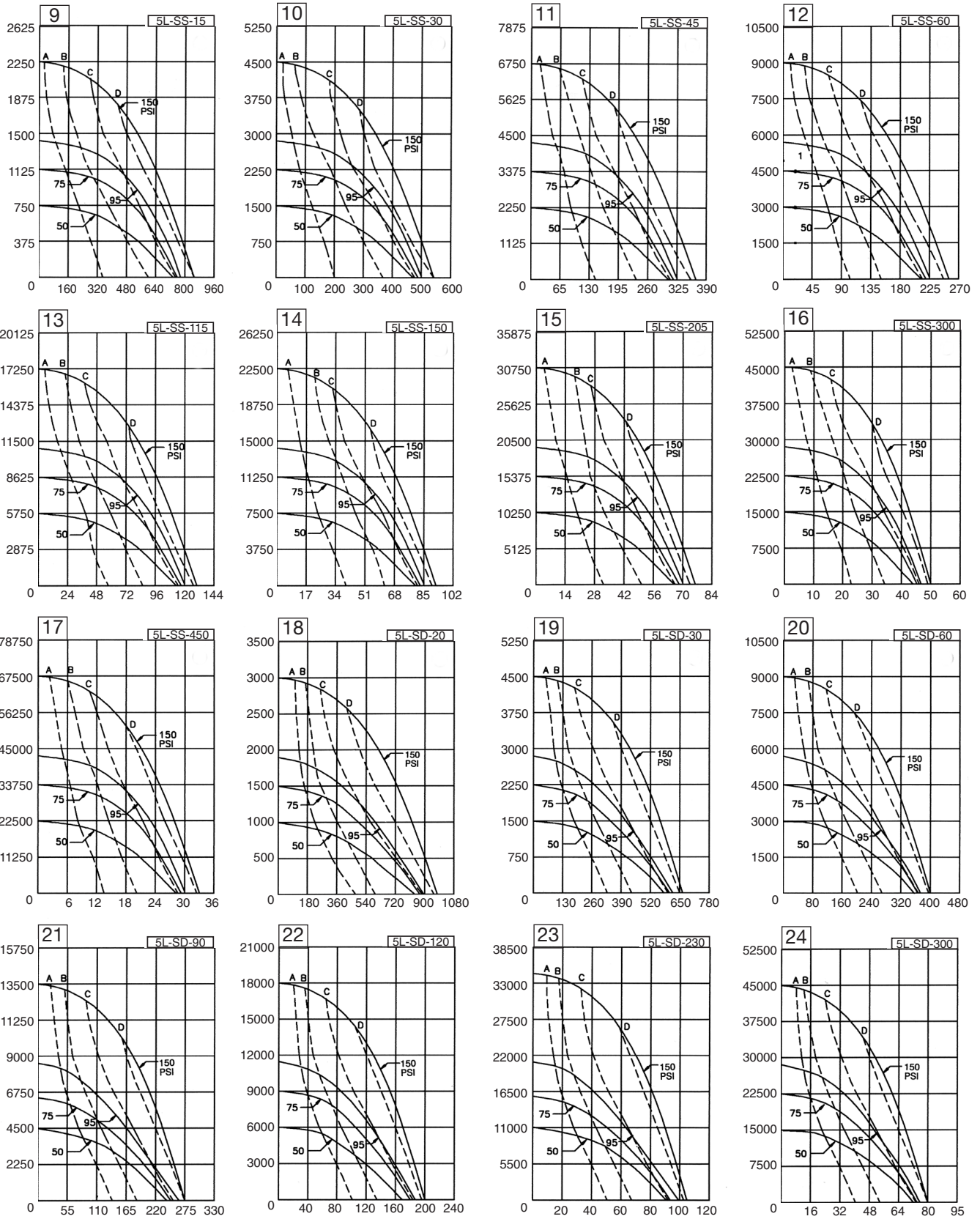
These curves predict the performance of each model using drive pressures shown (interpolate for other pressures). Maximum flow points presume 1/4" I.D. drive line minimum to 3L Series; 1/2" I.D. minimum to 5L Series; And 3/4" I.D. minimum to 7L Series. Note: Limited drive flow does not inhibit maximum outlet pressure capacity.

**AIR DRIVE FLOW (DOTTED CURVES)**

3L-SERIES	A	B	C	
	6 SCFM	12 SCFM	18 SCFM	
5L-SERIES	A	B	C	D
	15 SCFM	30 SCFM	60 SCFM	75 SCFM

# PERFORMANCE CURVES

OUTLET PRESSURE - PSI



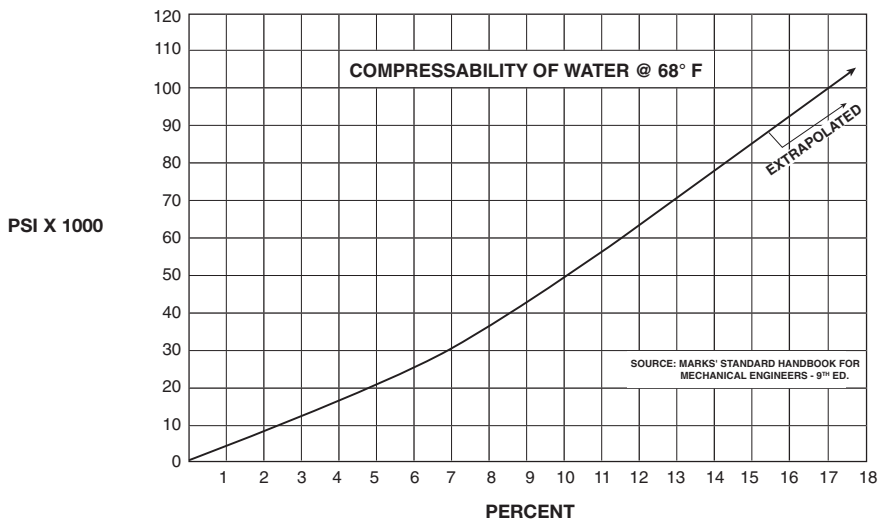
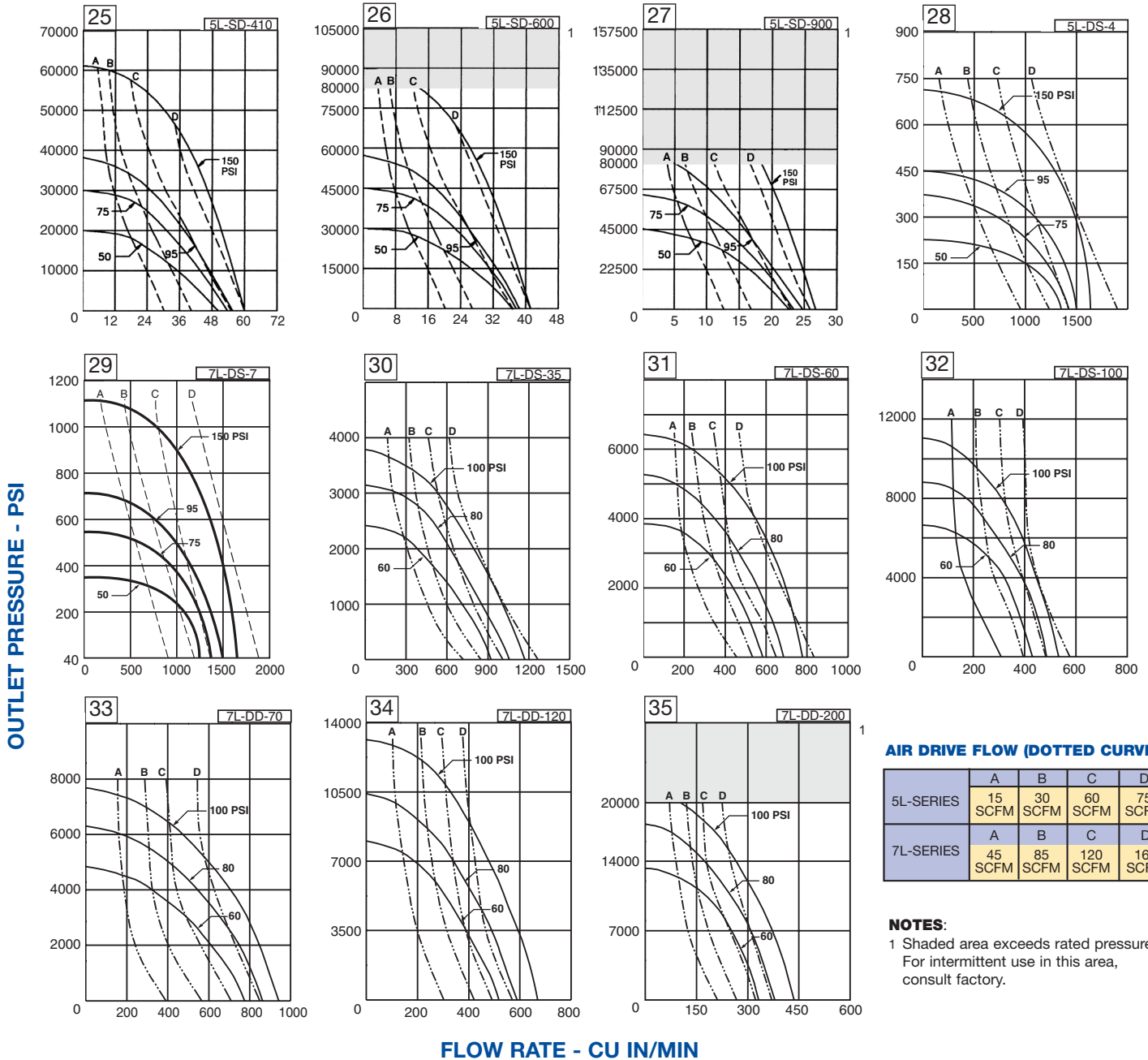
FLOW RATE - CU IN/MIN

**AIR DRIVE FLOW (DOTTED CURVES)**

3L-SERIES	A	B	C	
	6 SCFM	12 SCFM	18 SCFM	
5L-SERIES	A	B	C	D
	15 SCFM	30 SCFM	60 SCFM	75 SCFM



## PERFORMANCE CURVES (continued)



# STANDARD MODIFICATIONS

- **“B” Bottom Inlet.** See dimensional data pg.6 and selection table pg. 4. This modification applies only to model item numbers 10 through 17 and 20 through 27. It is not available for item 28 or 29. It is standard on items 1-9, 18, 19, and 30-35 (which are not available with side inlet).
- **“D” Distance Piece.** All series. Provides vented, dual seal protection where leakage or fumes from pumped fluid could attack the air drive section with only the single seal. Specify by adding -“D” after model number, e.g. Model 5L-SS-30-D. Double distance piece also available to protect air drive from some high or low temperature liquids. Specify by adding -“DD” after model number (5L Series only).
- **“E” EPR (Ethylene Propylene) Static Seals in Liquid Section Only.** All series. Replaces all Buna static seals. Provides needed chemical resistance if liquid section is used with liquids incompatible with Buna, such as Skydrol. Standard Ultra High Molecular Weight Polyethylene plunger seal is not changed. It is compatible with Skydrol. Specify by adding -“E” after model number, e.g. Model 5L-SS-30-E. Note: -“D” Modification also highly recommended to protect air drive seals.
- **“H” Hand Pump Attachment.** 3L Series only. Permits supplementary operation of the pump by hand. Useful in precise testing or emergency backup applications requiring a hand pump in addition to a power pump. Specify by adding “H” after model number, e.g. Model 3L-SS-41-H.
- **“L” Low Air Drive Pressure.** 5L Series only. Allows operation of the pump with an air drive pressure regulated as low as 2-3 psi. Also includes “X” modification. External pilot pressure must be 30 psi or more. Specify by adding -“L” after model number, e.g. Model 5L-SS-30-L.
- **“P” Piped Exhaust.** All series. Enables complete capture of exhaust air or gas from both the drive and pilot exhaust ports. Permits submerged operation inside hydraulic tanks, and/or piping exhausting gases out of the area for safety considerations. Exhaust ports for drive and pilot are 1/4” NPT and 1/8” NPT respectively on the 3L and 1-1/4” & 1/8” NPT on the 7L Series. On the 5L Series, drive and pilot exhaust are joined at a 1/2” NPT outlet. Specify by adding -“P” after the model number, e.g. 5L-SS-30-P.
- **“S” Single Stroke.** 5L Series only except -4. Useful for testing, metering or single stroke intensifier type hydraulic applications. Pump cycles once when momentary air pulse is applied to 1/8” NPT “S” port. Pump will not cycle otherwise. Specify by adding “S” after model number, e.g. Model 5L-SS-30-S.
- **“RC” Retract Command.** 5L Series only except -4. Similar to “S”. Momentary air pulse will put pump on retract stroke; otherwise pump cycles normally. Used for close control of test pressures. Precision air regulator recommended.
- **“V” Viton Sealed Drive Section.** 3L, 5L and 7L Series. Replaces all Buna static and dynamic seals. Provides needed chemical resistance if drive air or gas has entrained substances incompatible with Buna, such as hydrogen sulfide or some synthetic lubricants sometimes found in plant air compressors. Specify by adding -“V” after model number, e.g. Model 5L-SS-30-V.
- **“V1” Viton Static Orings in Liquid Section.** For higher temperatures than advisable for Buna, and for extra resistance to some chemicals. Specify by adding “V1” after model number.
- **“X” External Pilot Port on the Drive Section.** All series. Enables start-stop control of drive with small shutoff valve. 3L, 7L Series 1/8” NPT, 5L Series -4 SAE. Specify by adding -“X” after model number, e.g. Model 5L-SS-30-X.
- **“R” Remove Return Spring in Drive Section.** 3L Series only. For use with pressurized suction applications such as liquified gases. Improves filling action in the pump body on the suction stroke. Usually limited to -8 thru -41 ratios.
- **“T” 3 Way Cycling Spool in Drive.** 5L Series only. For use with pressurized suction applications (As described for “R” Mod above).
- **“M” Bottom Mount Adapter.** 5L Series only (Except -4, -10, -15, -20, -30 ratios). Enables pump to be mounted vertically on a flat surface with no other support. Installation drawing available.

# HYDRAULICS INTERNATIONAL, INC. OVERVIEW

Founded in 1976, HII has evolved into a fully integrated manufacturer of hydraulic and pneumatic test equipment. HII maintains two modern facilities in Chatsworth, California, totaling 250,000 square feet.

Along with air driven liquid pumps, HII offers gas boosters, air amplifiers, flowmeters, sophisticated custom systems and components. HII products are designed and manufactured in the USA.



Notes:

# OTHER HII QUALITY PRODUCTS

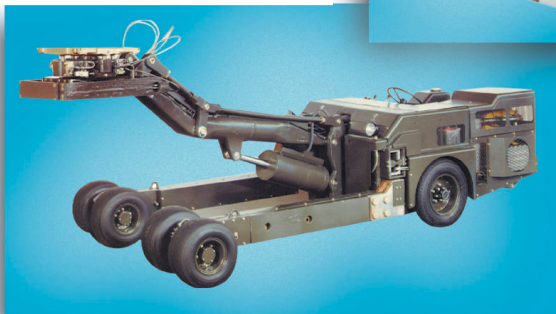
## AIR DRIVEN GAS BOOSTERS

- Airline lubrication not required
- Boosts pressure from 50 to 25,000 PSI
- Lightweight, 1-man portable
- Corrosion resistant including offshore environment
- Self-cooling using own exhaust air
- No electrical connections needed
- Wide range of models in single acting, double acting, two stage, and double air drive configuration



## AIR DRIVEN AIR AMPLIFIERS

- Boosting shop air to pneumatic tools, cylinders and devices
- Boosting shop air to drive high-pressure pneumatic diaphragm transfer pumps
- Boosting shop air to start oilfield and marine diesel engines
- Maximizing efficiency at pneumatic workstations or machinery
- Tire pressure top off on large mining vehicles
- Replace bottled nitrogen for gas testing, lab or production, up to 700 psi



## COMPONENTS

- Check valves - up to 20,000 PSI, up to 2"
- Needle valves - straight or angled to 5,000 PSI
- Inline filters rated to 5,000 PSI, 3 to 25 micron
- Double acting hand pumps - to 3,000 PSI
- Pressure relief valves - to 60,000 PSI
- Liquid Flowmeters - to 15,000 GPM
- Gas Flowmeters - to 15,000 CFM

## CUSTOM SYSTEMS

- Ground Support Equipment (portable and stationary)
- Component Test Equipment
- Customer Designed Equipment
- Central Systems
- Commercial and Military Applications
- Self Propelled Aerial Lift Truck

Our products are designed, sourced and manufactured in the U.S.A.

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