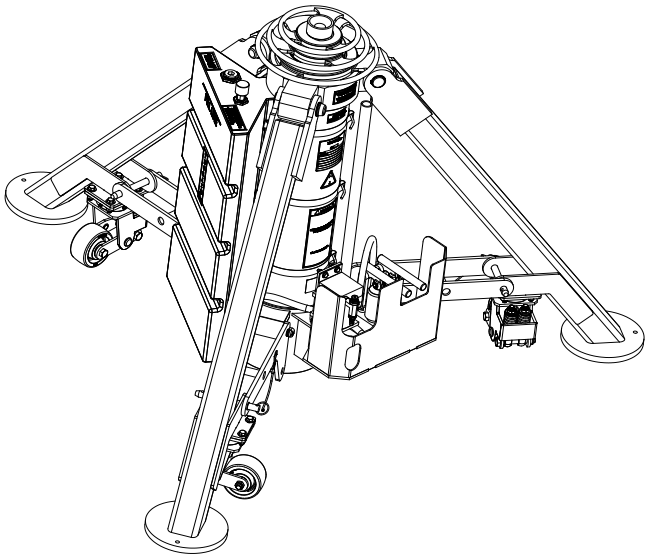
OPERATION & SERVICE MANUAL



Model: 02A7887C9100
20 Ton Two Stage Jack

CE

11/2020 - Rev. 03

Tronair, Inc.
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REVISION	DATE	TEXT AFFECTED
01	06/2012	Original Release
02	04/2013	Modified 11.0 Provision of Spares, Parts List and Hand Pump Appendix
03	11/2020	Major revision

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This product can not be modified without the written approval of Tronair, Inc. Any modifications done without written approval voids all warranties and releases Tronair, Inc., it suppliers, distributors, employees, or financial institutions from any liability from consequences that may occur. Only Tronair OEM replacement parts shall be used.

1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

20 ton two stage jack manufactured specifically for the F-35 aircraft.

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit
Finish: Powder coat gray

1.3 MANUFACTURER

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

1.4 FUNCTION

The device is intended to lift an aircraft by its fuselage and/or main wing with other hydraulic jacks arranged by position and quantity to provide proper balance, and in conjunction with the correct jack pad, whose maximum load on any one jack does not exceed the rated capacity of the jack.

The jacks are not intended for metal forming, metal working, or any purpose other than that stated above.

1.5 LIST OF DRAWINGS

Reference Parts List and Illustrations.

2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.

WARNING!
Warning is used to indicate the presence of a hazard that can cause ***severe personal injury, death, and/or substantial property damage*** if the Warning Notice is ignored.

CAUTION!
Caution is used to indicate the presence of a hazard, which will or can cause ***minor personal injury or property damage*** is the Caution Notice is ignored.

2.2 WARNING AND DANGER SIGNS

See labels on unit.

WARNING!

The ram locknuts are user operated safety devices. Failure to utilize these locknuts may result in personal injury or death.

2.3 COMPONENT SAFETY FEATURES

- **Ram Locknuts** prevent lowering of the ram. The Ram Locknuts must be lowered as the aircraft is being lifted.
- **Locknut Retention Ring** prevents locknut from being unscrewed from the 2nd stage.
- **Hold to Run Air Valve** requires the operator to hold the air valve control to raise the ram using the air pump. Releasing the air valve control stops upward movement of the ram.
- **CE Hand Pump With Check Valve** prevents unintentional decent of aircraft if relief valve fails.

2.4 FUNCTIONAL SAFETY FEATURES

Pressure Relief Valve prevents overload during raising operations.

2.5 FEATURES FOR OPERATOR SAFETY

- Hold to Run Air Valve
- Quick Disconnect
- Cautions And Instruction Labels Located on Jack
- Ram Locknut

2.6 ENVIRONMENTAL SAFETY FEATURES

Jack is non-polluting. See Appendix V Safety Data Sheet for the recommended hydraulic fluid (MIL-PRF-83282).

2.7 NECESSARY PERSONAL PROTECTIVE EQUIPMENT

CAUTION!

Always wear safety glasses.

2.8 SAFETY GUIDELINES

CAUTION!

Do not place hands on top of jack near ram locknuts while lowering or raising jack.

Pinch points exist between top of jack and threads on ram.

- **Never put hands between the aircraft and the jack pad; as after aircraft has been lowered, struts may have hung up.**
- **Never align jack under aircraft by pounding on jack legs. Dented legs may lead to jack collapse.**
- **Always lower ram locking nut(s) after jack is under load. Be sure ram nut(s) is seated fully after jacking.**
- **Always raise and lower jacks simultaneously so that aircraft remains level.**
- **Always use a tail or nose stand, as applicable, for additional stability.**

WARNING!

The ram locknuts are user operated safety devices.
Failure to utilize these locknuts may result in personal injury or death.

2.9 CONDITIONS FOR SAFE USE

- Use in a clean dry environment on a level surface.
- Operate between -20° C and 50°C/-4° F and 122° F.

2.10 OPERATOR QUALIFICATIONS

This jack is intended to be used by the skilled and trained aircraft technician. The operator must be familiar with the jacking procedures for the aircraft to be raised, lowered, and the operation of the jack.

Installation/Maintenance/Dismantling Qualifications: This jack is to be installed, maintained, and dismantled by qualified technicians familiar with hydraulic systems.

2.11 ADDITIONAL SAFETY MEASURES

This jack must be used in accordance with this technical manual, and in accordance with the aircraft manufacturer's jacking procedures.

2.12 IN CASE OF HYDRAULIC LINE FAILURE

Ram Locknut prevents unintentional descent in case of hydraulic failure. It is important to keep Ram Locknut within 1 inch of bottom of ram when lowering or raising aircraft.

3.0 TRAINING

3.1 TRAINING REQUIREMENTS

The employer of the operator is responsible for providing a training program sufficient for the safe operation of the unit.

3.2 TRAINING PROGRAM

The employer provided operator training program should cover safety procedures concerning use of the unit in and around the intended aircraft at the intended aircraft servicing location.

3.3 OPERATOR TRAINING

The operator training should provide the required training for safe operation of the unit.

NOTE: Maintenance and Trouble Shooting are to be performed by a skilled and trained technician.

4.0 ASSEMBLY

This product is shipped completely assembled and tested and requires no further assembly before operation. The following sections apply when servicing the unit.

4.1 GENERAL INSTRUCTIONS

- This product should be assembled and/or repaired using good workmanship practices and proper tools. Bolts and elastic stopnuts should be tightened to a torque not to exceed industry standards for Grade '5' bolts.
- All replacement parts must be Tronair OEM replacement parts.
- Dispose of waste per federal and local laws and regulations.
- No modifications are allowed that will adversely affect the jacks safety performance.
- The pressure relief valve is not serviceable. It must be replaced as a unit.

4.2 PRE-USE CHECKS

1. Refer to the Illustrated Parts List to identify and ensure that all parts are present.
2. Generally check over unit to assure the tightness of all nuts, bolts and fittings.
3. With rams completely collapsed, check hydraulic fluid level.
   - Replenish with MIL-PRF-83282 fluid as required.
   - Fluid level is full when fluid line is above fill line. Use 9/16 hex wrench to remove/tighten fill port plug.

NOTE: Refer to fluid manufacturer's (Appendix V) material safety data sheet, and advisory for handling and disposal of fluid.

4.3 PERSONNEL REQUIREMENTS

This jack is to be assembled by qualified technicians familiar with hydraulic systems.

4.4 INSPECTION AND TEST PROCEDURES

1. Ensure fluid level is above fill line. Use 9/16 hex wrench to remove/tighten fill port plug.
2. Raise ram to full stroke, and check for leaks.

4.5 TO COLLAPSE JACK

See Figures 4.5 A & 4.5 B

WARNING!

Keep hands and fingers clear of pinch points while collapsing jack.

1. Suspend jack using three 1" wide flexible lifting straps. Be sure to suspend jack evenly.
2. Remove ball lock pin from leg brace that secures the leg.
3. Fold leg braces inward.
4. Reinsert ball lock pin as shown to lock leg in folded position as shown.
5. Repeat above steps for all legs.
6. **Make sure vent screw and fill plug are closed to prevent leakage.**
7. Tip jack to store on pallet; ensure tank is in upright position as shown.
8. Reverse order to make jack operational.

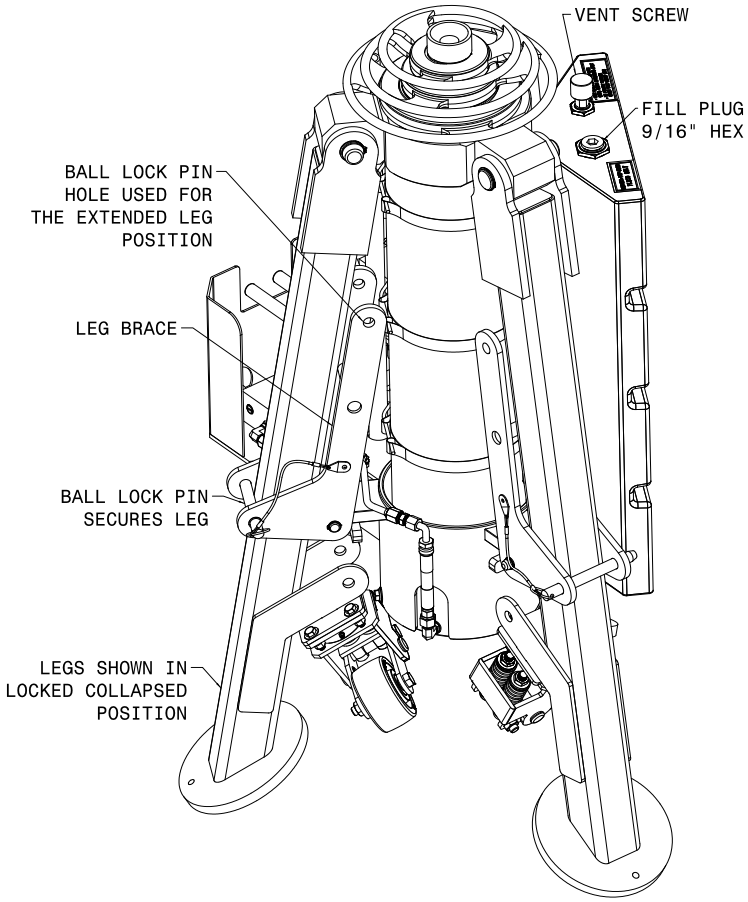


FIGURE 4.5 A - Collapsed Jack

4.5 TO COLLAPSE JACK *(continued)*

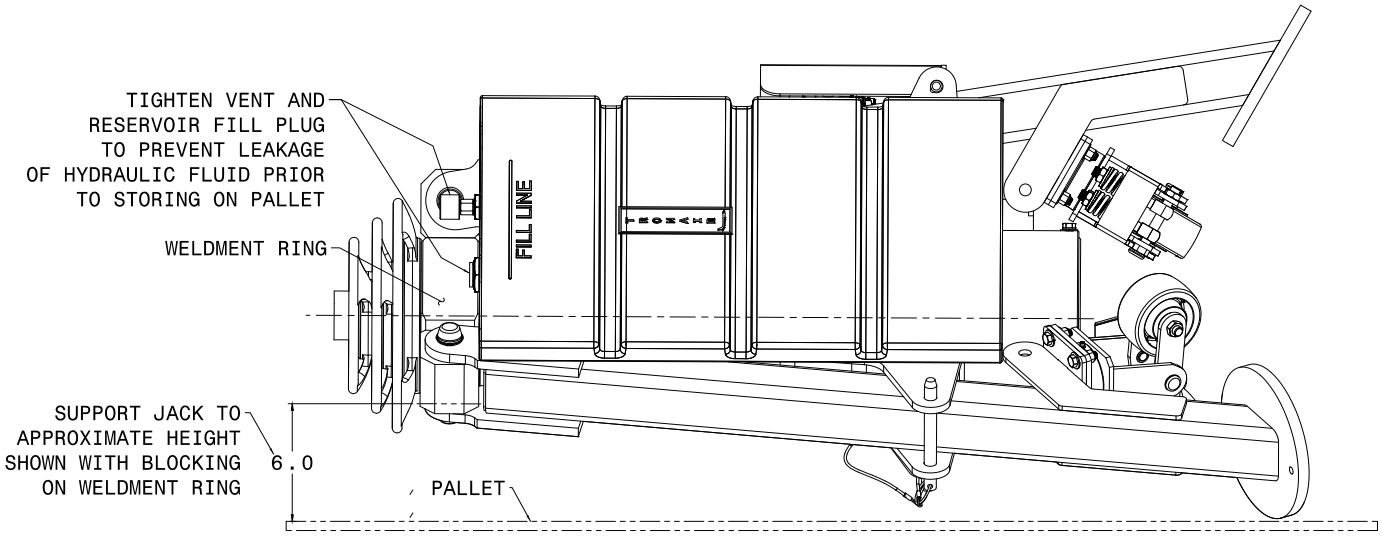


FIGURE 4.5 B – To Store On Pallet

5.0 INSTALLATION

Installation and commissioning requires connection of the hold to run air valve to an adequate air supply.

5.1 AIR SUPPLY REQUIREMENTS:

- 90 - 100 psi (6.21 - 6.89 bar) recommended

6.0 OPERATION

6.1 OPERATING PARAMETERS:

- The trained aircraft technician or operator shall work in accordance with the Operator Manual
- DO NOT work under a raised load until it is secured by suitable means, i.e. Ram Locknut
- The employer of the operator shall provide for all necessary training and give information about pumping and translating forces
- Operate between -20° C and 50°C/-4° F and 122° F
- Hydraulic pump operates with 90 – 100 psi (6.21 – 6.89 bar) air pressure

6.2 NUMERICAL VALUES

- Rated Capacity..... 40,000 lbs (18,144 kg)
- Minimum Closed Height:6 ..... 40 in (101.6 cm)
- Mechanical Extension ..... 15 in (38.1 cm)
- Hydraulic Extension: 1st Stage ..... 25 in (63.5 cm)
- .... 2nd Stage 26 in (66 cm)
- Maximum Height Obtainable:..... 106 in (269.2 cm)
- Weight..... 885 lbs (401 kg)
- Noise level is 64 dB(A) at a distance of 120 in (3,048 mm) at an inlet pressure of 100 psi (6.9 bar)

6.3 OPERATOR CONTROLS

See Figure 6.3 Operator Controls

6.4 OPERATING INSTRUCTIONS

The operator should be familiar with the following statements prior to using the jack(s):

prior to using the jack(s):

CAUTION!

1. **Never put hands between the aircraft and the jack pad; as after aircraft has been lowered, struts may have hung up.**
2. **Never align jack under aircraft by pounding on jack legs. Dented legs may lead to jack collapse.**
3. **Always lower ram locking nut(s) after jack is under load. Be sure ram nut(s) is seated fully after jacking.**
4. **Always raise and lower jacks simultaneously so that aircraft remains level.**
5. **Always use a tail or nose stand, as applicable, for additional stability.**

WARNING!

When collapsing rams by hand miss-staging may occur and cause pinch points. To collapse ram, add a minimum 50 lb load to the mechanical extension. Keep hands and fingers clear of locking nuts. Failure to adhere to this safety instruction can cause injury.

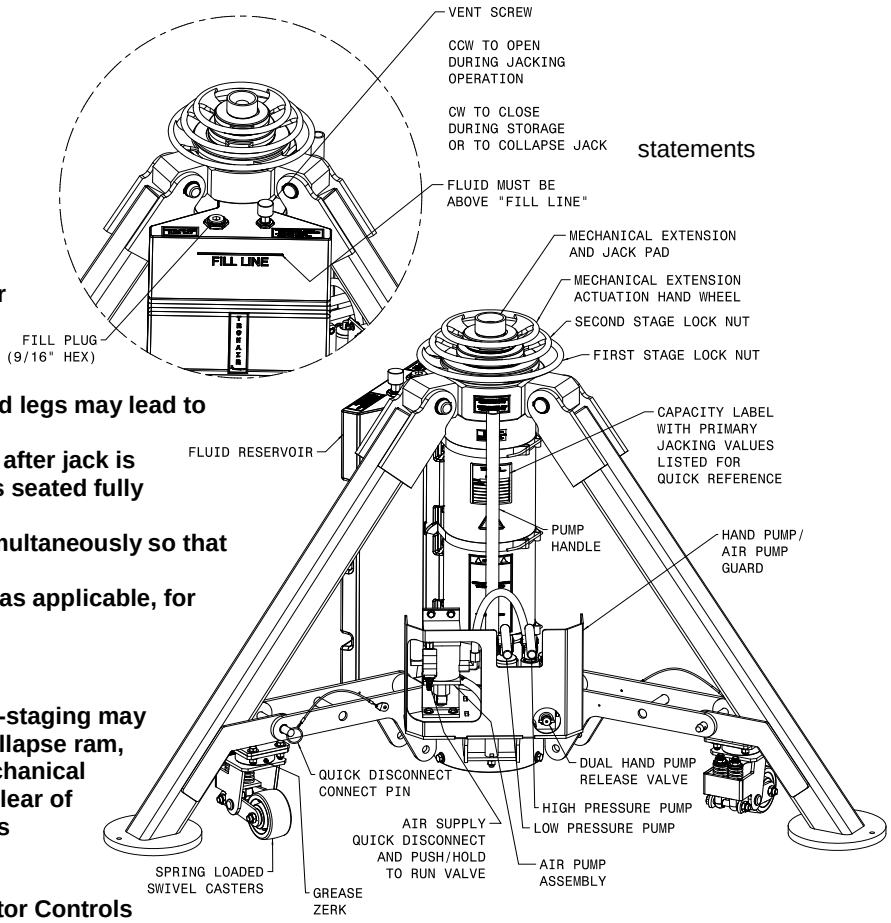


FIGURE 6.3 – Operator Controls

6.4.1 Rules For Operating

1. The operator shall work in accordance with the Operation and Maintenance Manual.
2. It is not allowed to work under the raised load until it is secured by suitable means, i.e. Ram Locknut.
3. The employer of the operator shall provide for all necessary training and give information about pumping and translating forces.
4. Operate between -20° C and 50°C/-4° F and 122° F.
5. Hydraulic pump operates with 90 – 100 psi (6.21 – 6.89 bar) air pressure

6.4.2 Jack Instructions

To Raise Aircraft:

1. Place jack on a hard, level surface.
2. **Open reservoir vent screw (counterclockwise)**
3. Hydraulic ram must be completely retracted before operating the jack.
4. Raise mechanical extension to aircraft jack pad.

NOTE: Mechanical extension has a built-in mechanical stop and is limited to a 15" travel

5. Close pump release valve and operate pump.
6. Hydraulic rams must extend in order from largest to smallest diameter.
7. Largest diameter hydraulic ram must fully extend before the next stage ram begins to raise.
8. Lower mechanical ram locknut(s) while extending rams. Keep within 1 inch of bottom of extending ram
9. Do not continue to operate air pump after all rams have fully extended.

WARNING!

The ram locknuts are user operated safety devices. Failure to utilize these locknuts may result in personal injury or death and/or damage to aircraft or equipment.

To Lower Aircraft:

1. Lower all jacks simultaneously.
2. If ram locknut(s) is tight, raise jack slightly to release nut(s) ¼ inch from tripod.
3. Ensure proper staging as aircraft is being lowered: loosen ram locknut beginning with smallest ram (1 inches max) until stage is completely lowered. Repeat for next largest stage.
4. Loosen pump release valve slightly to slowly lower aircraft.

NOTE: When using jack during washing operations, completely cover top of jack near ram seal.

CAUTION!

Do not place hands on top of jack near ram locknuts while lowering jack. Pinch points exist between top of jack and threads on ram.

Always wear safety glasses.

7.0 PACKAGING AND STORAGE

7.1 PACKAGING REQUIREMENTS

Jacks are to be packaged as required to prevent damage to legs or hydraulic equipment during shipment.

7.2 HANDLING

Jack can be rolled by hand on its casters.

7.3 STRAPPING

Jacks can be strapped down by suitable means to prevent unwanted movement during shipment and storage.

7.4 PACKAGING PROTECTION

No special packaging material for cushioning or suspension is required.

7.5 LABELING OF PACKAGING

Packaging should be labeled DO NOT DROP.

7.6 STORAGE COMPATIBILITY

No special considerations.

7.7 STORAGE ENVIRONMENT

- Store jacks between -20°C and +50°C/-4° F and 122° F.
- Always store jack with rams collapsed.
- Suitable for outdoor storage by using a full coverage waterproof tarp or canvas.

7.8 STORAGE SPACE AND HANDLING FACILITIES

	Assembled and Operational	**Collapsed**
Closed Height	40 in (101.6 cm)	50 in (127 cm)
Width	64 in (162.6 cm)	28 in (71.1 cm)
Length	56 ½ in (143.5 cm)	31 in (78.7 cm)
Weight	885 lbs (401 kg)	885 lbs (401 kg)

8.0 TRANSPORTATION

Lifting can be accomplished by crane and strap through top of tripod, or by fork truck under lower tripod support. Approximate weight: 885 lbs (401 kg)

9.0 TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	ACTION
Fluid leakage at pump piston or pump body	Damaged backup ring, o-ring, piston or pump body	Remove piston and pump body. Inspect for damage. Replace defective part(s). Replace removed o-ring and backup ring
External fluid leakage at ram(s)	Damaged o-ring, backup ring or inner cylinder wall	Remove ram(s) as a unit from cylinder. Inspect parts. Replace o-ring and defective part(s)
Jack fails to lift rated load	Release valve not closed properly	Fully tighten release valve
	Low fluid level	Fill to correct fluid level
	Pressure relief valve improperly adjusted	Adjust or replace release valve
	Leakage at inlet or outlet check ball	Inspect valve body for wear or replace valve body and check balls
	Vent screw closed	Open vent screw
Ram(s) will not support load after manual or pneumatic pump up	Leaking ram o-ring seals	Check for external leakage, if present replace defective seal and back up ring
	Leaking pressure check valve	Inspect valve body for wear or replace valve body and check balls
	Leaking pressure relief valve	Remove release valve, inspect ball and ball seat in pump block. Replace effective part(s)
Ram(s) raises and falls with each manual pump stroke	Release valve open	Fully tighten release valve
	Inlet check valve not seated or sticking	Pump rapidly to dislodge or replace valve body
	Pressure check valve not seated or sticking	Pump rapidly to dislodge or replace valve body
Jack fails to lower	Ram locknut not loosened	Raise jack ¼ inch and release locknut
	Vent screw closed	Open vent screw
	O-Ring (pinched or rolled)	Replace o-ring and back-up ring, clean up cylinder wall of debris

10.0 MAINTENANCE

10.1 GENERAL

- All maintenance and/or repair work should be done using good workmanship practices and proper tools.
- The work area should be clean and free of dirt.
- When O-rings and backup rings are removed, every effort should be made to avoid the contact of tools with the critical surfaces of parts. Surface deformities could cause degradation of seals and failure.
- It is good practice to replace both O-rings and backup rings once removed. Cut and damaged rings normally result in fluid leakage.
- At this time flush old hydraulic fluid and dirt from over-all system and replenish with new, clean hydraulic fluid.
- No modifications shall be carried out which adversely affect the compliance of the jack with draft standard 2006/42/EC.

10.2 MAINTENANCE SCHEDULE

Check Fluid Level.....Each Use
Lubricate Casters .....3 Months
Cleaning.....Annually Or As Needed
Capacity Test (105%-110% of jack's rated capacity) .....Annually

NOTE: Wipe with soft cloth only, do no pressure wash or spray water directly at ram seal.

10.2.1 Storage/Low Usage

If jack is not being used on a regular basis, every 90 days the jack should be fully extended and retracted to exercise the seals and to prevent rust build up on the cylinder I.D. While ram is extended, clean the threads and spray with DoALL RPM, LPS, or equivalent that is water repellent and will not harm BUNA "N" O-rings.

10.3 SERVICING JACK

To Disassemble Jack For Seal Replacement:

1. Raise first stage ram high enough to allow removal of the threaded tube stop.
2. Raise both first and second stage rams **together** to the point where this assembly can be lifted from the jack cylinder.

NOTE: If the second stage ram is allowed to precede the first stage ram, it will fill with oil causing an oil spill when the assembly is removed from the cylinder.

To Re-assemble Jack:

1. Re-assemble in reverse order of above.

NOTE: Lubricate cylinder, ram(s) and o-ring(s) for assembly:
Lubricate inner cylinder wall(s) with MIL-PRF-83282 hydraulic fluid
Apply suitable o-ring lubricant grease to installed o-ring(s) and to o-ring lead-in chamfer at opening of cylinder

NOTE: To minimize air entrapment under the rams. Actuate cylinder with had pump several inches and release. This will circulate oil and bleed out air.

2. Spray I.D. of cylinder and O.D. of rams with DoALL RPM, LPS or equivalent water repellent that will not harm the Buna "N" O-rings to protect surfaces from rusting when not in use.
3. Ensure locknut retaining ring is present on second stage ram to prevent nut removal after seal kit installation.

10.4 JACK FUNCTION LOAD TEST

NOTE: If function load testing is required:

1. Take all necessary precautions to prevent injury.
2. Always jack against a load and **never** against the jack itself.
3. Do not exceed a test load equal to the jack rated capacity plus 5 to 10%.

10.5 PNEUMATIC PUMP

See Appendix II Haskel Air Pump Manufacturing Data for complete parts list and repair information.

11.0 PROVISION OF SPARES

Recommended Spares to be kept on hand:

K-4501	Kit, Ram Seal Replacement
K-4679	Kit, Hand Pump Seal Replacement
K-4552	Kit, Air Pump Repair Fluid Seal (Air Option only)
K-1686	Kit, Air Pump Repair Air Seal (Air Option only)

Spare parts may be obtained from the manufacturer:

TRONAIR, Inc.	Telephone:	(419) 866-6301 or 800-426-6301
1 Air Cargo Pkwy East	Fax:	(419) 867-0634
Swanton, Ohio 43558 USA	E-mail:	sales@tronair.com
	Website:	www.tronair.com

12.0 IN-SERVICE SUPPORT

Contact Tronair, Inc. for technical services and information. See Section 1.3 – Manufacturer.

13.0 GUARANTEES/LIMITATION OF LIABILITY

Tronair products are warranted to be free of manufacturing or material defects for a period of one year after shipment to the original customer. This is solely limited to the repair or replacement of defective components. This warranty does not cover the following items:

a) Parts required for normal maintenance
b) Parts covered by a component manufacturers warranty
c) Replacement parts have a 90-day warranty from date of shipment

If you have a problem that may require service, contact Tronair immediately. Do not attempt to repair or disassemble a product without first contacting Tronair, any action may affect warranty coverage. When you contact Tronair be prepared to provide the following information:

a) Product Model Number
b) Product Serial Number
c) Description of the problem

If warranty coverage is approved, either replacement parts will be sent or the product will have to be returned to Tronair for repairs. If the product is to be returned, a Return Material Authorization (RMA) number will be issued for reference purposes on any shipping documents. Failure to obtain a RMA in advance of returning an item will result in a service fee. A decision on the extent of warranty coverage on returned products is reserved pending inspection at Tronair. Any shipments to Tronair must be shipped freight prepaid. Freight costs on shipments to customers will be paid by Tronair on any warranty claims only. Any unauthorized modification of the Tronair products or use of the Tronair products in violation of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied.

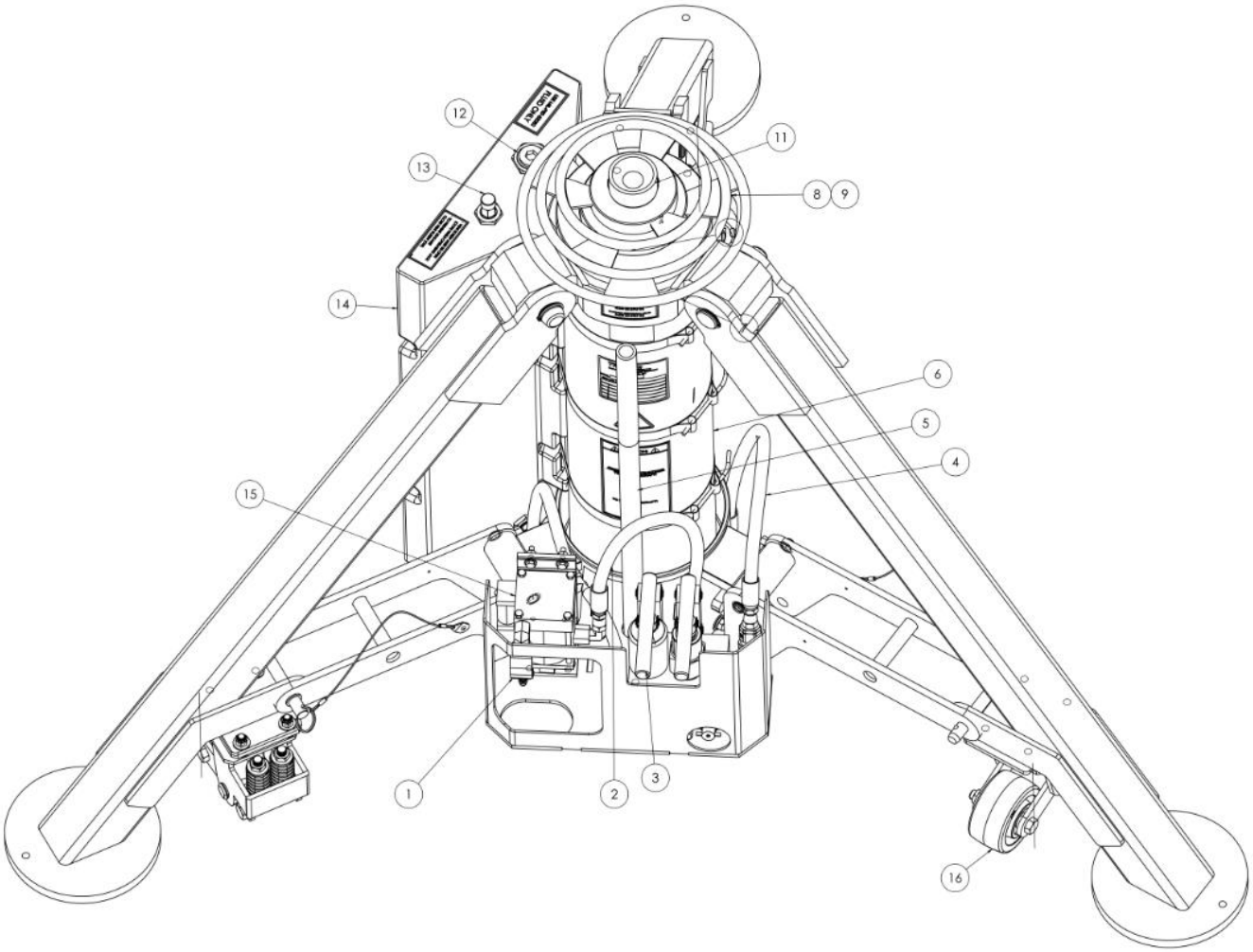
The obligations of Tronair expressly stated herein are in lieu of all other warranties or conditions expressed or implied. **Any unauthorized modification of the Tronair products or use of the Tronair products in violations of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately *void any warranty, express or implied* and Tronair *disclaims any and all liability for injury (WITHOUT LIMITATION and including DEATH), loss or damage arising from or relating to such misuse*.**

14.0 APPENDICES

APPENDIX I	Hydraulic Schematic
APPENDIX II	Haskel Air Pump Manufacturer Data
APPENDIX III	HC-2490 Tandem Hand Pump Parts List
APPENDIX IV	Declaration of Conformity
APPENDIX V	Safety Data Sheet – MIL-PRF-83282 Hydraulic Fluid
APPENDIX VI	Maintenance Schedule

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	PC-1155	Valve, Pneumatic Lever	1
2	TF-1043-17-18.0	Assembly, Hose	1
3	HC-2490	Hand Pump, Tandem SS	1
4	TF-1043-06*25.0	Assembly, Hose	1
5	TR-2189	Tube, Handle	1
6	Z-7490	Assembly Cylinder	1
7	H-3371	1st Stage Stop Nut	1
8	H-3372	2nd Stage Stop Nut	1
9	G-1621-01	Ring, Spiral External Retaining Ring	1
10	H-3368	Mechanical Extension Stop Nut	1
11	R-2575	Pad, Jack	1
12	N-2066-12-SS-B	Plug, O-Ring Hex	1
13	R-2765	Reservoir Vent	1
14	H-3369	Reservoir	1
15	Z-7508SP	Assembly, Air Pump	1
16	U-1143	Casters, Spring Loaded Swivel	3

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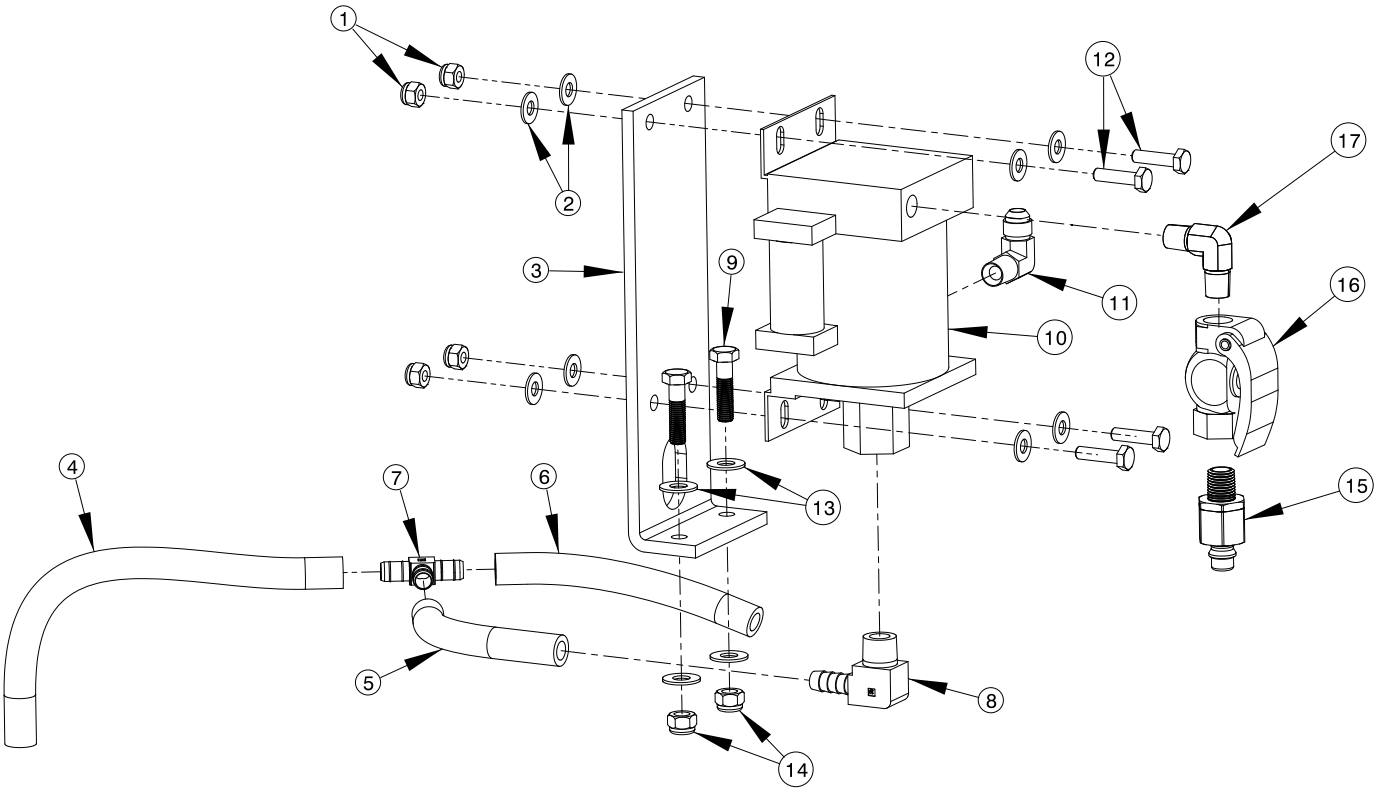
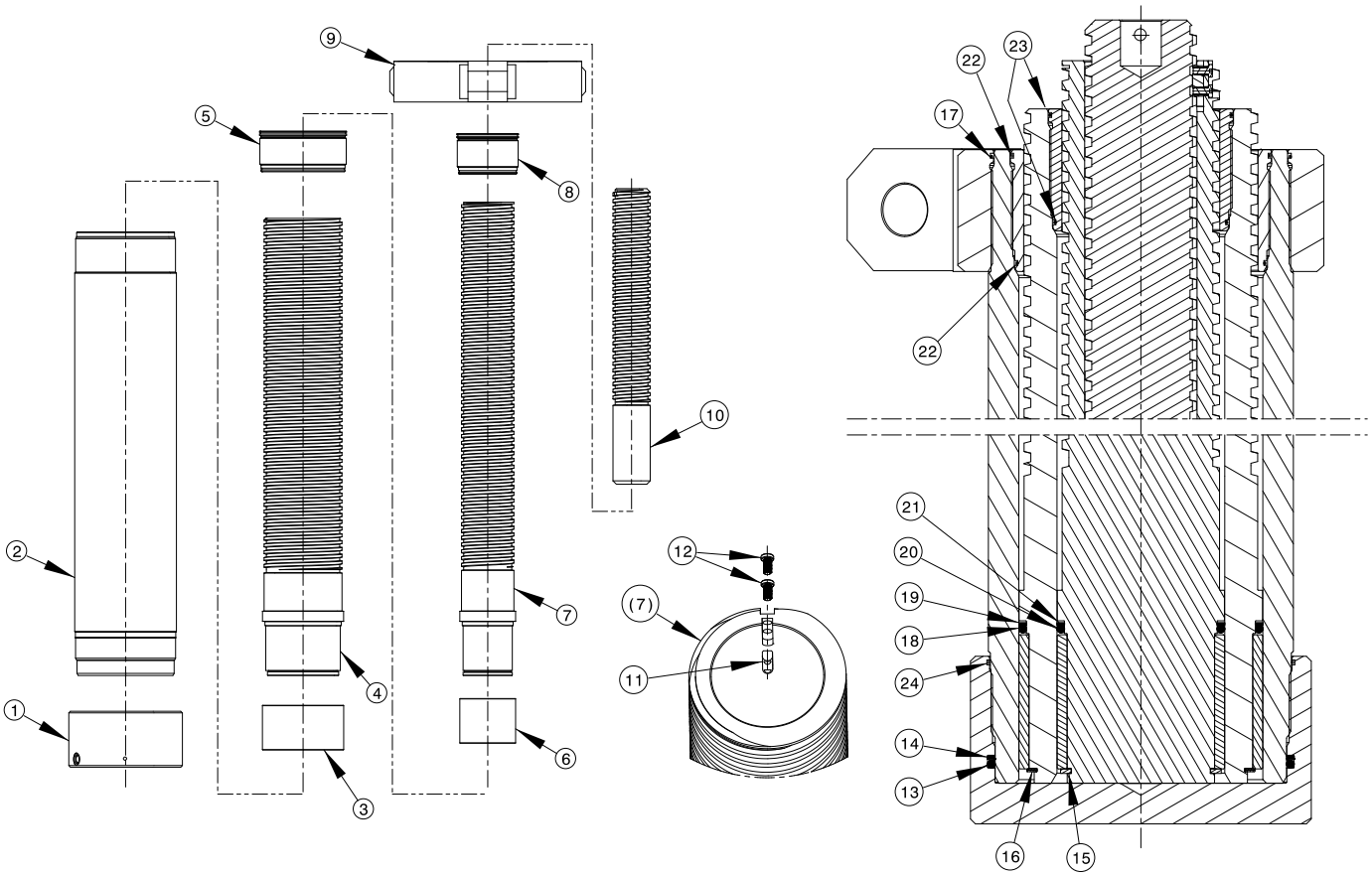
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	G-1841-1055-SS	Stopnut, SS, ¼ - 28 Elastic	4
2	G-1704-1050N	Flatwasher, SS, ¼ Narrow	8
3	J-3415-01	Bracket, Air Pump Mounting	1
4	TF-1047-04*10.0	Hose 3/8 Push-On 10” Long	1
5	TF-1047-04*5.0	Hose, 3/8 Push On 5” Long	1
6	TF-1047-04*6.0	Hose, 3/8 Push On 6” Long	1
7	N-2453-04	Tee, Union	1
8	N-2410-05	Elbow, 90º Male 3/8 NPT, 3/8 Barbed Fitting	1
9	G-1706-106112	Bolt HH, SS, GR 5, 5/16 – 24 x 1 ¼ Long	2
10	H-3376	Pump, Air, Haskel, SS Trim & Componentry	1
11	N-2005-08-SS	Elbow, 90º Male, SS ¼ NPT, JIC 37º Fitting	1
12	G-1706-105110	Bolt HH, SS, GR 5, ¼ – 28 x 1” Long	4
13	G-1704-1060N	Flatwasher, SS, 5/16 Narrow	4
14	G-1841-1065-SS	Stopnut, SS, 5/16 - 24 Elastic	2
15	N-2589-03	Plug, Male Thread	1
16	PC-1155	Valve, Pneumatic Lever	1
17	N-2201-06-B	Elbow, Male Pipe	1
NS	K-4552	Air Pump Seal Kit (Hydraulic)	1
NS	K-1686	Air Pump Seal Kit (Pneumatic)	1

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



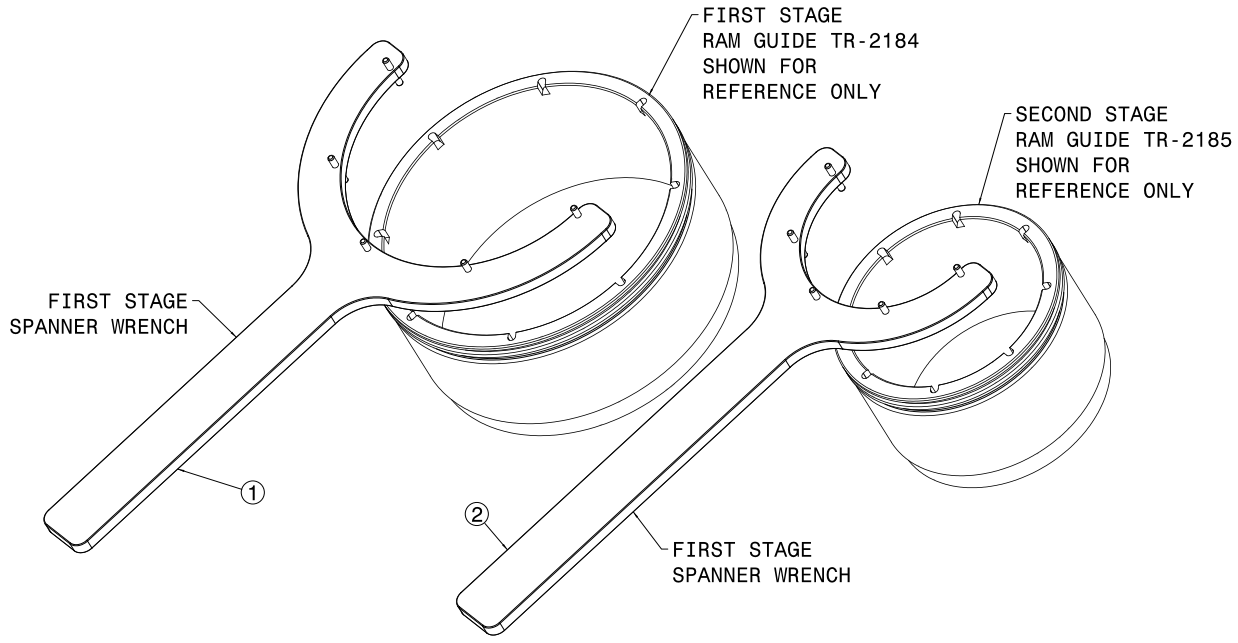
Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
01	R-2576-01	Cap, Bottom	1
02	TR-2183-01	Cylinder, Machined	1
03	TR-2181	Bushing, 1st Stage Ram	1
04	TR-2182	Ram, First Stage	1
05	TR-2184	Guide, 1st Stage Ram	1
06	TR-2180	Bushing, 2nd Stage Ram	1
07	R-2574	Ram, 2nd Stage	1
08	TR-2185	Guide, 2nd Stage Ram	1
09	Z-7488-01	Weldment, Ring	1
10	R-2564	Extension, Mechanical	1
11	J-4836	Key	1
12	G-1620	Screw, 10-32 Low Pro Cap, SS Mod	2
15	G-1395-57	Ring, External Retaining	1
16	G-1397-525	Ring, External Retaining	1
	K-4501	**Kit, Cylinder/Ram Seal**; *consists of:*	
13	HC-2000-366	O-Ring, Series 2	1
14	HC-2023-365	Backup, Parback	1
17	HC-2000-168	O-Ring, Series 2	1
18	HC-2000-358	O-Ring, Series 2	1
19	HC-2023-358	Backup, Parback	1
20	HC-2000-343	O-Ring, Series 2	1
21	HC-2023-343	Backup, Parback	1
22	HC-2000-163	O-Ring, Series 2	1
23	HC-2000-155	O-Ring, Series 2	1
24	HC-2000-169	O-Ring, Series 2	1

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

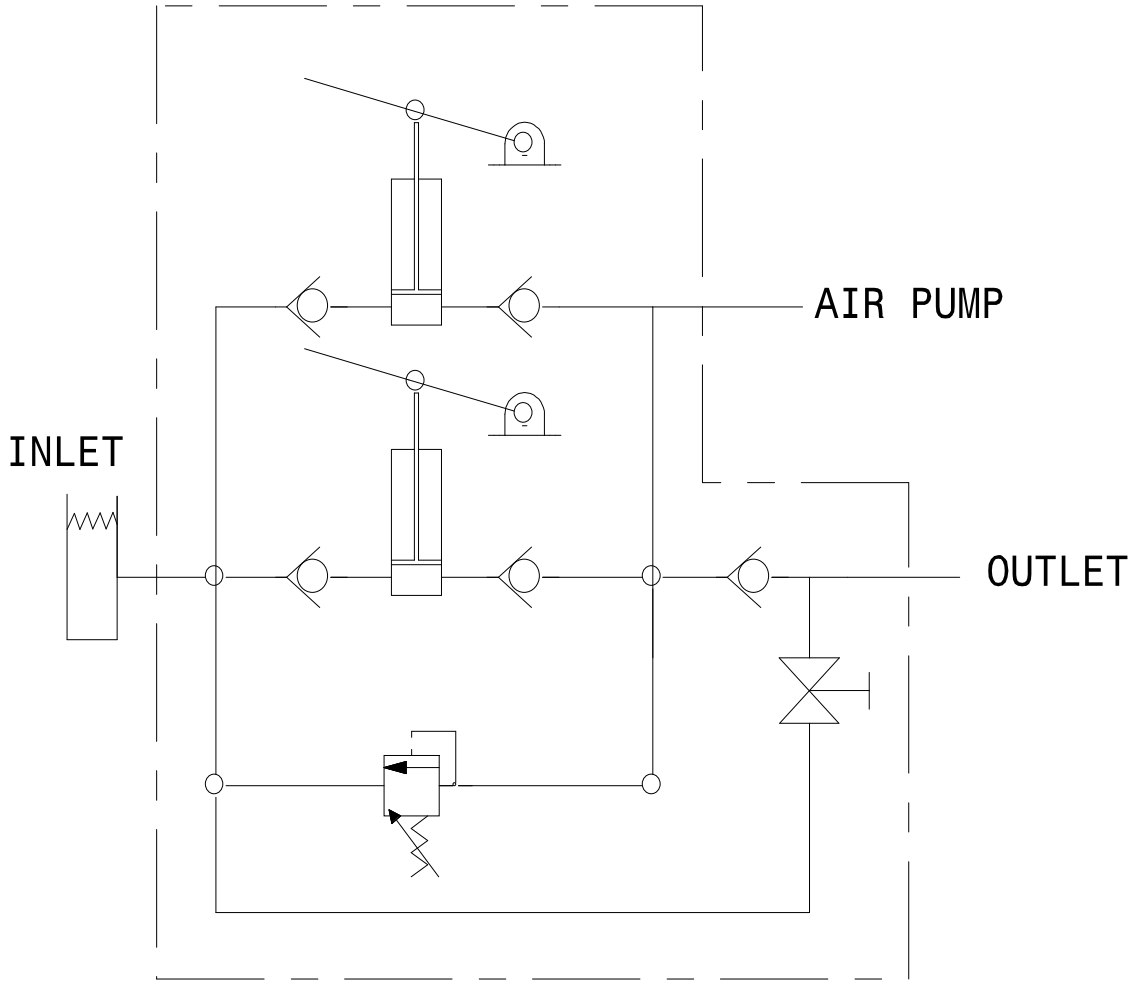


Item	Part Number	Description	Qty
	K-4670	**Kit, Spanner Wrenches**; *consists of:*	
1	K-4682	Wrench, 1st Stage	1
2	K-4683	Wrench, 2nd Stage	1

APPENDIX I

Hydraulic Schematic

Hydraulic Schematic



APPENDIX II

Air Pump Manufacturer Data

Haskel
MILTON ROY

PNEUMATIC DRIVEN LIQUID PUMPS

PERFORMANCE • QUALITY • RELIABILITY

Welcome to Haskel

Haskel is an international organization offering a worldwide service through the Haskel group of companies and factory trained distributors. The Haskel group is headquartered in Burbank, California, with facilities throughout the world. We have built an enviable reputation for quality based on high pressure fluid and gas handling equipment.

In addition to offering a comprehensive range of pneumatic driven liquid pumps, air amplifiers, pneumatic and hydraulic driven gas boosters, high pressure valves, fittings and accessories, we custom design and build power pacs and test rigs. Our continued investment in technology ensures that Haskel will stay at the leading edge of high pressure technology.

This brochure introduces our pneumatic driven liquid pump range. Technical details and advice on any of the products shown is available on request.

We are here to solve your problems. Just give us a call at 818-843-4000 or visit our website at www.haskel.com for more information or to locate a distributor.

Why Use Haskel Pneumatic Driven Pumps?

Our pumps offer many advantages over electrically driven pumps:

- Safe pneumatic operation – no heat, flame or spark risk
- Up to 100000 psi (7000 bar) capability
- Infinitely variable cycling speed
- Stall feature at pre-determined pressure to hold that pressure without consuming power
- Problem-free stop/start applications
- Easily automated – many modification and control options
- Suitable for most liquids and liquefied gases
- Alternative gas drive options – sour gas, natural gas, boil off gases, nitrogen
- No need for air line lubrication – saves costs and prevents contamination
- Robust, reliable, compact and easy to maintain proven design
- Unbalanced cycling spool provides immediate response to pressure changes
- Also available in standard, or custom built power pac configurations
- Excellent worldwide service for spares and repairs
- Can be manufactured to meet API 675, ATEX, CE and NACE

Applications include:

- Pressure testing
- Work holding/power clamping
- Jacking/lifting
- Valve actuator control
- Hydraulic cylinder actuation
- Press safety overload devices
- Roller tensioning
- Metering
- Precision lubrication and spraying
- Liquified gas transfer

Pressure and Flow on Demand

This guide will help you to pre-select the pump ideally suited for your application. If you have specific questions, however, we urge you to provide us with details of the duties you require from the pump, available air/gas drive pressure, and pressure/flow requirements, and we will recommend a model and any corresponding accessories.

Output Horsepower Ratings

The pumps are categorized on their horsepower ratings (see pages 6-7). These are approximate and peak at 100 psi (7 bar), assuming adequate drive air, pressure and volume. Peak horsepower is at about 75% nominal ratio x air drive pressure, i.e. 100:1 pump @ 100 psi air drive peaks at 100 x 100 = 10000 x 0.75 psi = 7500 psi (517 bar) hydraulic pressure.

Operation

The pumps automatically reciprocate on a differential piston principle. A large piston driven by relatively low pressure drive acts directly upon a smaller hydraulic piston.

The nominal ratio between piston sizes is indicated in the model coding and approximates to the maximum working pressure. The actual ratio is about 15% above nominal so that the pump continues to cycle when drive pressure equals nominal ratio. Initially, the pump will cycle at maximum speed acting as a transfer pump to pressurize downstream.

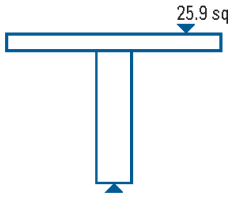
It will cycle at a slower rate as the fluid meets resistance until it stalls at maximum output pressure. When a pressure drop downstream occurs, it will recycle as necessary in an effort to maintain maximum pressure. Stall pressure is achieved when the outlet pressure rises and offers more resistance to the reciprocating differential piston assembly. The piston assembly then stalls when the forces balance, e.g. when drive pressure x drive piston area equals outlet (stall) pressure x driven hydraulic plunger area. The pump design is sensitive to very small pressure drops due to the low frictional resistance of the large diameter drive piston and hydraulic piston seals.

Double and Triple Air Head Pumps

Performance can be extended by stacking air pistons without changing the hydraulic piston. Haskel multi-head pumps consume less air than competitive single head pumps of the same area, as only one head is pressurized on the return stroke; e.g., on a 1.5 hp pump additional heads can raise performance to 2 hp.

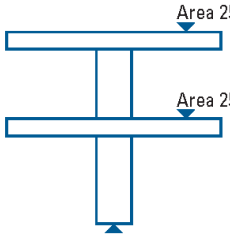
Double air head pumps are identified by the last digit 2 in the pump model number. Thus, a nominal 50:1 ratio pump with two air heads is described as a 52. Similarly, a triple air head pump is identified with a last digit 3. Thus, a 900 ratio pump with three air heads is described as a 903.

Single Drive Head Pump



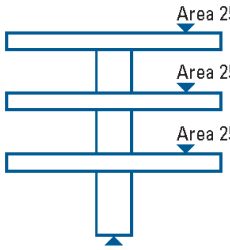
Therefore, actual ratio = 40:1
Nominal Ratio = 35:1

Double Air Head Pump



Therefore, actual ratio = 79:1
Nominal Ratio = 72:1*

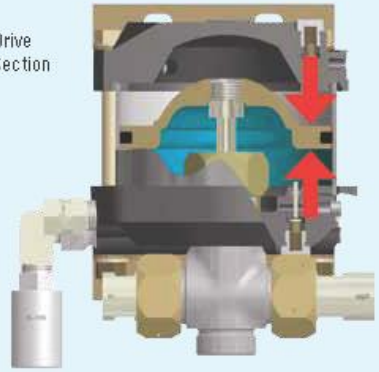
Triple Air Head Pump



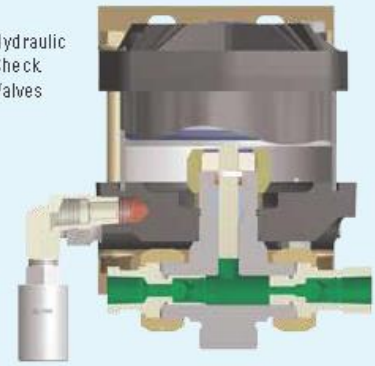
Therefore, actual ratio = 118:1
Nominal Ratio = 103:1**

Nominal Ratio
* (2) Indicates Double Drive Piston
** (3) Indicates Triple Drive Piston

1. Drive Section

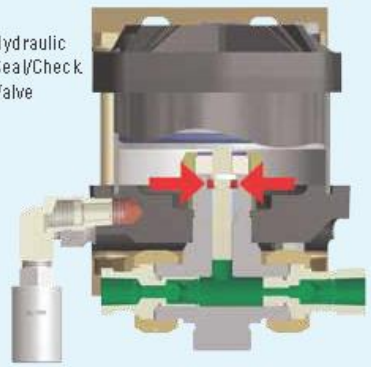


2. Hydraulic Check Valves



3. Drive Cycling Valve

4. Hydraulic Seal/Check Valve



Anatomy of a Pneumatic Driven Pump

1. Drive Section

The piston, complete with "O" ring seal, operates in an epoxy filled, fiberglass wound barrel, the diameter of which is constant throughout a given series of pumps. Drive media forces the piston down on the compression stroke and raises it on the suction stroke (M series have a spring return). The piston is pre-lubricated during assembly and therefore no air line lubricator is necessary.

2. Hydraulic Section/Check Valves

This is directly linked to the drive piston by the hydraulic piston, the bottom portion of which is in the hydraulic body. Outlet flow and pressure are determined by the area of the hydraulic piston head, its nominal ratio with the drive piston head, and drive pressure. On the down stroke, liquid in the hydraulic section is forced under compression through the outlet check valve. Fresh liquid is induced via the inlet check valve on the return stroke. These check valves control the flow of liquid through the hydraulic section. They are spring-loaded and have a very low cracking pressure, allowing maximum opening on the induction stroke. The pressure of hydraulic fluid on the down stroke closes the inlet check valve and acts against the spring to open the outlet check valve.

3. Drive Cycling Valve

This is a pilot-operated, unbalanced, lightweight spool, which directs drive pressure, first to the top of the drive piston, and then to the underside to reciprocate the piston (cycle). It actuates via pilot valves at the top and the bottom of the stroke, which causes the unbalanced spool to shift and reciprocate the piston.

4. Hydraulic Seal/Check Valves

This is one of the few wear parts. Its function is to allow the hydraulic piston to reciprocate without passing fluid into the drive section. The liquid, its pressure and its temperature determine seal specification. A distance piece can be incorporated between drive and hydraulic sections for complete contamination-free operation on most Haskel pumps.

Pump Selection Information

All Haskel pumps are identified by letters coding the type of pump, followed by a number indicating the practical working ratio of the drive area to the hydraulic plunger area. These letters are explained in the chart below.

Pump Model Letter Coding

M	.875" stroke .33 hp miniature pump series
S	Stainless steel hydraulic piston and body
29723	.33 hp Chemical Pump
D (Prefix)	Pump incorporates a Distance Piece
D (Suffix)	Double Acting pump
4B	1" stroke .75 hp pump series (bottom inlet only)
A	2" stroke 1.5 + 2 hp pump series
H	2" stroke 1.5 + 2 hp High Pressure pump series
-C	Filter, regulator with gauge and shut-off/speed control valve

XH	2" stroke 1.5 + 2 hp Extreme High Pressure pump series
G	4.5" stroke 6 hp pump series
8	4.5" stroke 8 hp pump or booster series
14	4" stroke 10 hp pump series
W	Polyurethane U-cup dynamic seal
F	UHMWPE (Ultra-high Molecular Weight Polyethylene Dynamic Seal
T	Reinforced teflon dynamic seal
V	Viton o-ring static seal
-B	Bottom inlet
-CP	Chemical Pump

Quick Model Comparison Chart

The chart to the right shows the pressure/flow capability of each pump in the range. The diagonal lines show constant output horsepower for each series. The model ratios are circled.

Example

The pressure required is 2175 psi (150 bar). The flow required is 215 cubic inches (3.52 liters) per minute. The black dot plots position. Only models on diagonals to the right of the dot will meet the demand; e.g., the -35 ratio 1.5 hp pump, assuming a supply at 100 psi (7 bar) and 70 scfm (119m³/hr) can be met; if not, a -32 or -52 2 hp pump would be needed.

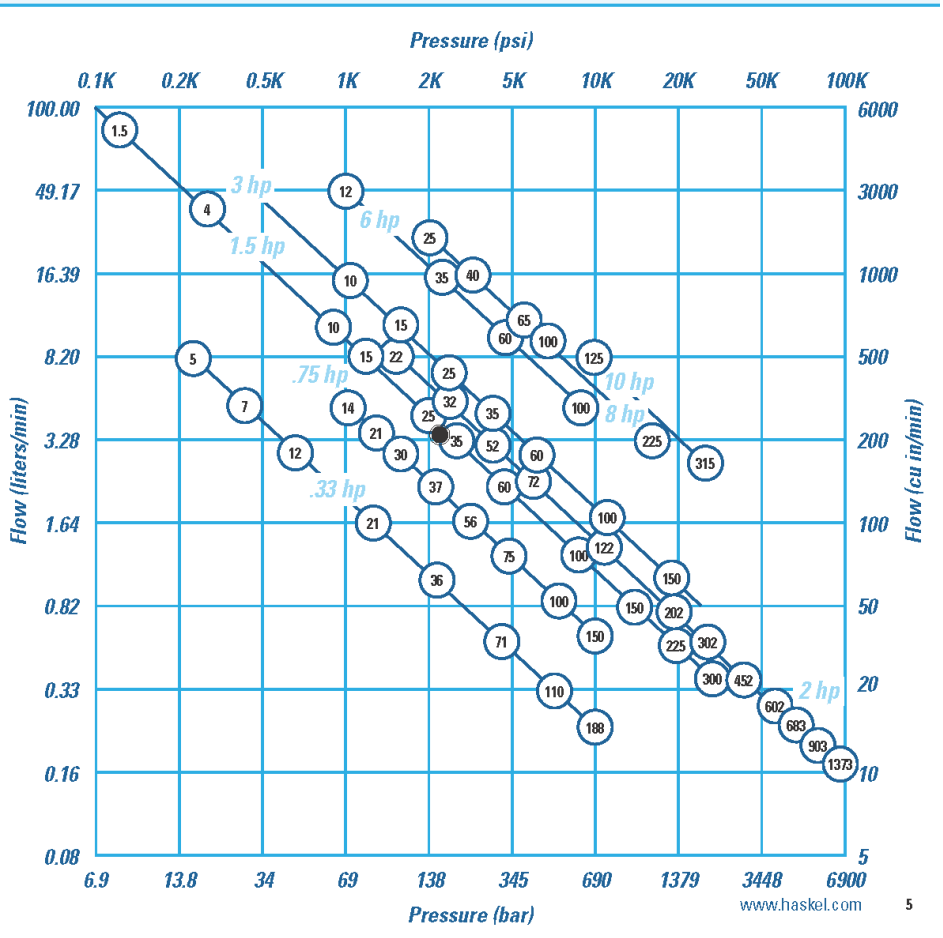
Note: For specific performance curves, refer to Liquid Pump Rapid Reference Guide.

The diagonal horsepower lines in the chart below are based on 100 psi (7 bar) drive pressure. Drive flow requirement is different for each series as follows:

.33 hp	15 scfm (25 m³/hr)
.75 hp	45 scfm (76 m³/hr)
1.5 hp	70 scfm (119 m³/hr)
2 hp	85 scfm (144 m³/hr)

3 hp	85 scfm (144 m³/hr)
6 hp	175 scfm (297 m³/hr)
8 hp	225 scfm (382 m³/hr)
10 hp	270 scfm (459 m³/hr)

Reduced air drive flow or pressure will result in a corresponding reduction in output horsepower. This chart can be used to select pump series and model ratio.



Performance and Specification Overview

Max Drive	Drive Head	HP	Pump Model Code	Nominal Ratio	Actual Ratio	Maximum Rated Output Pressure – Continuous psi	Maximum Rated Output Pressure – Continuous bar	Maximum Rated Output Pressure – Intermittent psi	Maximum Rated Output Pressure – Intermittent bar	Displacement/Cycle cu in	Displacement/Cycle ml	Maximum Flow cu in/min	Maximum Flow l/min
125 psi/8.6 bar	Single	0.33 hp	M, MDSTV	-5	5.6	625	43	625	43	0.83	13.6	506	8.30
			M, MS	-7	7.8	900	62	900	62	0.60	9.8	366	6.00
				-12	14	1500	103	1500	103	0.36	5.9	234	3.83
			M, MS, 29723	-21	25	2600	179	2600	179	0.20	3.3	130	2.13
				-36	41	4500	310	4500	310	0.12	2.0	78	1.28
				-71	82	8800	607	8800	607	0.060	1.0	39	0.64
				-110	126	13500	931	13500	931	0.039	0.6	25	0.42
			M, MS	-188	217	15000	1034	15000	1034	0.023	0.4	18	0.29
			MS	-220	237	20000	1380	25000	1723	0.021	0.344	14	0.22
100 psi/7 bar	Single	0.75 hp	4B	-14	16	1500	103	1500	103	0.90	14.7	428	7.01
				-21	24	2300	159	2300	159	0.60	9.8	285	4.67
				-25	29	2700	186	2700	186	0.50	8.2	238	3.89
				-30	34	3200	221	3200	221	0.43	7.0	204	3.35
				-37	42	3800	262	3800	262	0.35	5.7	166	2.72
				-55	63	6000	414	6000	414	0.22	3.6	105	1.71
				-75	86	7800	538	7800	538	0.17	2.8	81	1.32
				-100	114	10600	731	10600	731	0.13	2.0	62	1.01
				-150	171	15000	1034	15000	1034	0.088	1.44	42	0.68
150 psi/10.5 bar	Single	1.5 hp	DSTV	-1.5	1.6	120	8	160	11	31.90	513	5104	83.6
			ATV, DTV	-4	80	690	48	1200	83	20.00	328	3200	52.4
			AW, ASF, DF, DSF, DSTV	-B10	11.5	1600	110	1600	110	4.05	66.4	1215	19.9
				-B15	17	2400	165	2400	165	2.70	44.3	810	13.3
				-25	29	4000	276	4000	276	1.62	26.6	486	8.0
				-35	40	5700	393	5700	393	1.16	19.0	348	5.7
				-60	69	9800	676	9800	676	0.67	11.0	201	3.3
				-100	115	15000	1034	16500	1138	0.41	6.7	123	2.0
				-150	173	15000	1034	20000	1380	0.27	4.5	81	1.3
			HF, HSF, DHF, DSHF	-151	173	25000	1724	25000	1724	0.27	4.5	81	1.3
				-225	260	30000	2069	37000	2551	0.18	3.0	41	0.7
				-300	345	30000	2069	50000	3448	0.14	2.3	32	0.5
			HF	-450	533	25000	1724	45000	3403	0.091	1.5	20	0.3
	Double	2 hp	AW, ASF, DF, DSF, DSTV	-B22	23	3200	221	3200	221	4.05	66.4	1215	19.9
				-B32	34	4800	331	4800	331	2.70	44.3	810	13.3
				-52	57	5000	345	8000	552	1.62	26.6	486	8.0
				-72	80	11000	758	11000	758	1.16	19.0	348	5.7
				-122	138	15000	1034	19000	1310	0.67	11.0	201	3.3
			HF, HSF, DHF, DSHF	-202	230	30000	2069	33000	2275	0.41	6.7	92	1.5
				-302	346	30000	2069	50000	3448	0.27	4.5	61	1.0
			DXHF, DSXHF	-452	520	30000	2069	70000	4827	0.18	3.0	41	0.7
				-602	690	30000	2069	75000	5171	0.14	2.3	32	0.5
100 psi/7 bar	Triple	2 hp	DXHF, DSXHF	-683	780	30000	2069	70000	4827	0.18	3.0	25	0.41
				-903	1038	30000	2069	75000	5171	0.14	2.3	20	0.33
			DSXHW	-1373	1575	30000	2069	100000	6895	0.086	1.4	12	0.197
125 psi/8.6 bar	Single	2.2	AFD, DFD, ASFD, DSFD	-B60	69	6500	448	6500	448	1.34	2.2	369	6.0
150 psi/10.5 bar		3 hp	ASFD	-10	11.5	1600	110	1600	110	8.10	133	1823	29.9
				-15	17	2400	165	2400	165	5.40	89	1215	19.9
				-25	29	4000	276	4000	276	3.24	53.2	729	11.9
				-35	40	5700	393	5700	393	2.32	38.0	522	8.6
				-60	69	9800	676	9800	676	1.34	22.0	302	4.9
				-100	115	15000	1034	16500	1138	0.82	13.4	185	3.0
				-150	173	15000	1034	20000	1380	0.54	9.0	122	2.0
				-202	230	30000	2069	33000	2275	0.82	13.4	144	2.4
125 psi/8.6 bar	Single	6 hp	GWD, GSFD, DGFD, DGSFD, DGSTVD	-12	14.8	1850	128	4000	276	15.9	260	5009	82.1
			GW, DGF, GSF, DGSF, DGSTV	-35	40.3	4375	302	4375	302	6.0	98	1890	31.0
				-60	69	7500	517	7500	517	3.5	57	1103	18.1
				-100	115	8000	552	10000	690	2.1	34	662	10.8
		8 hp	8SFD, 8DSFD, 8DSTVD	-25	27.5	3575	246	4000	276	14.0	229	2660	44
			8SFD	-40	43.5	6000	414	6000	414	8.90	145	1691	28
				-65	73	10000	690	10000	680	5.40	88	1026	17
			8DSFD	-100	112	10000	690	10000	680	3.52	57.5	669	11
			8HSFD	-225	253	22500	1530	22500	1530	1.56	25.5	296	5
		10 hp	D14STD, D14SFD	-125	138	16000	1103	16000	1103	8.80	144	704	11.5
				-315	347	36000	2482	36000	2482	3.50	57.4	280	4.6

Typical Performance Based on 100 psi (7 bar) Pressure and Drive Flow Data on Page 5							
Outlet Pressure		Outlet Flow		Outlet Pressure		Outlet Flow	
psi	bar	cu in/min	l/min	psi	bar	cu in/min	l/min
225	15.5	500	8.20	415	29	249	4.09
300	21	350	5.70	600	41	160	2.60
700	48	200	3.28	1125	78	100	1.64
1500	103	90	1.48	2000	138	48.9	0.80
1700	117	70	1.15	3100	214	39.6	0.65
3000	207	39	0.64	6000	414	19	0.31
7500	517	20	0.33	8500	586	17	0.28
5000	345	18	0.30	10000	690	14	0.23
7500	517	14	0.23	15000	1034	12	0.20
700	48	400	6.55	1450	100	61	1
1000	69	270	4.42	2000	138	120	2
1250	86	230	3.77	2500	172	61	1
1500	1034	200	3.28	3000	207	62	1
1750	121	170	2.78	3500	241	82	1.33
2000	138	110	1.8	5000	345	66	1.08
2500	172	87	1.42	7500	517	37	0.6
5000	345	57	0.93	10000	690	26	0.43
7500	517	37	0.6	15000	1034	7	0.11
50	3	5000	81.9	150	10.3	1000	16.4
100	7	1953	32	400	28	750	12.3
400	28	1000	16.4	990	68	500	8.19
750	52	598	9.8	1600	110	200	3.28
1000	69	403	6.6	2500	172	195	3.2
2000	138	350	4.1	3600	248	98	1.6
3000	207	152	2.5	6200	427	50	0.82
4000	276	100	1.64	10000	690	24.4	0.4
7000	483	59.7	0.98	15000	1034	29.9	0.49
7000	483	59.7	0.98	15000	1034	29.9	0.49
7500	517	39.6	0.65	24000	1655	9.8	0.16
15000	1034	29.9	0.49	27000	1862	20.1	0.33
36000	2483	14.6	0.24	45000	3103	9.2	0.15
400	28	799	13.1	2100	145	200	3.28
700	48	500	8.2	3000	207	152	2.5
1900	131	299	4.9	5000	345	97.6	1.6
2000	138	226	3.7	7500	517	50	0.82
4000	276	122	2	12000	828	40.2	0.66
7000	483	91.5	1.5	20000	1379	20.1	0.33
10000	690	45.2	0.74	30000	2069	15.2	0.25
10000	690	34.8	0.57	40000	2759	15.2	0.25
15000	1034	24.4	0.4	50000	3448	12.2	0.2
15000	1034	19.5	0.32	60000	4138	4.9	0.08
15000	1034	15.9	0.26	70000	4828	5.5	0.09
16000	1103	9.2	0.15	90000	6207	3.1	0.05
1000	69	348	5.7	5500	379	152	2.5
500	34	1520	24.9	1000	69	380	6.22
750	52	1030	16.88	1500	103	260	4.26
1000	69	662	10.85	2500	172	162	2.66
1500	1034	465	7.62	3500	248	100	1.64
3000	138	248	4.07	6000	414	56	0.92
5000	345	151	2.48	10000	690	41	0.67
7500	517	103	2	15000	1034	27	0.44
10000	690	63	1.03	20000	1379	47	0.77
200	14	5004	82	1200	83	1454	24
1000	69	1770	29	3500	241	600	9.8
2000	138	976	16	5500	379	397	6.5
2000	138	573	9.4	10000	690	195	3.2
1000	69	2400	39.3	2500	172	280	4.6
2000	138	1420	23.2	4000	276	200	3.27
3000	207	880	14.4	6000	414	310	5.08
5000	345	555	9.1	10000	690	163	2.67
10000	690	270	4.4	20000	1379	144	2.36
8000	552	488	8.0	12000	828	195	3.2
15000	1034	238	3.9	30000	2069	79.3	1.3

Guidelines for Continuous Duty Applications for Maximizing Seal Life Performance

Pump Series	Maximum Cycles per Minute
0.3 hp	325 cpm
0.75 hp	225 cpm
1.5, 2.0 and 2.2 hp (Single and Double Drive Piston)	80 cpm
2.0 hp (Triple Drive Piston)	60 cpm
3.0 hp	80 cpm
6.0 hp	60 cpm
8.0 hp	50 cpm
10.0 hp	40 cpm

.33 hp (.25 kW) M Series Pump Models

Model	Nominal Ratio	Maximum Working Pressure	Displacement per Cycle
M, MDSTV	-5	625 psi (43 bar)	.83 cu in (13.6 ml)
M, MS[3]	-7	900 psi (62 bar)	.6 cu in (9.8 ml)
	-12	1,500 psi (103 bar)	.36 cu in (5.9 ml)
M, MS[3], 29723[3]*	-21	2600 psi (179 bar)	.2 cu in (3.3 ml)
	-35	4,500 psi (310 bar)	.12 cu in (2.0 ml)
	-71	8800 psi (607 bar)	.06 cu in (1.0 ml)
	-110	13500 psi (931 bar)	.039 cu in (0.6 ml)
	-188	15000 psi (1034 bar)	.023 cu in (.4 ml)
MS	-220	25000 psi (1723 bar)	.021 cu in (.34 ml)

** Not available in 188 ratio

(3) Maximum intermittent pressure for stainless steel in the MS and 29723 is 10000 psig (690 bar.)

For service codes, see page 17.
For weights and dimensions, see page 18.

Key Features

- Choice of 5 models, 9 ratios, 27 possible combinations
- Flows to 2 gpm (7.5 l/min)
- Choice of wetted materials
- Single air head
- Drive pressure 25 to 125 psi (1.8 to 9 bar)
- Pressures to 25000 psi (1724 bar)
- All Hydraulic fluids, water (plain or DI), solvents, mild chemicals, liquefied gases

Optional Modifications

Number	Description
-HP	Hand pump attachment (with handle). Provides manual operation of pump for precision pressure control or use without air power.
26082	Handle only.
26220-2	With handle.
26220-3	Without handle.
	Kits for converting existing units.
-V	Manual release with relief valve. For M and MS pumps only. Provides high pressure needle valve with internal adjustable safety relief downstream of pump outlet checks. Tank return is ⅛" NPT in pump body.
26063-3	Dead Man valve. ¼" NPT port.
26064-3	Combination air regulator/filter with gauge. ¼" NPT port.
26065-3	Speed control valve. ¼" NPT port.
26065-3 plus 26064-3	-C air controls installed on pump. ¼" NPT port.
28320	Manifold mount inlet port. Provides O-ring boss in aluminum block to enable mounting on side of tank below oil level. Modification applies to M-21 through M-188 only.
28590	Palm or foot start/stop button drive. Spring loaded shut.
28700-1	Air OP release valve.
28925	Remote start/stop control. Provides ⅛" NPT bleed signal port for single line remote control.
29002	Viton air drive.
29697	Single stroke from remote air pulse. Useful for metering applications. One stroke per air pulse signal; eliminates automatic cycling. ⅛" NPT signal port.
51331	EPR seals for liquid section for 29723-XX ratio pumps.
51788	Piped exhaust – standard. Provides connection ports for drive and pilot exhausts. Enables under tank top mounting and/or natural gas drive.
51794	Piped exhaust – sour gas. With hand pump (HP).
51794-2	Piped exhaust – sour gas. Without hand pump (HP).
51804	Muffler (for use with piped exhaust modifications below). ¼" NPT male port.
51809	Normally open air operated release with relief valve. Provides highest release flow capacity. Will hold full pump psi piloted from drive air. Vents are not threaded. Ref. drawing 56643 for tank top mounting parts.
51809-1	Normally closed air operated release with relief valve. Used to hold hydraulic jacks. Will release up to 11000 psi (using 100 psi air). Vents are not threaded. Ref. drawing 56643 for tank top mounting parts. Not available in 188:1 ratio.
51810	Safety relief valve. Relief is upstream of outlet check. Vent hole 1/16 NPT M or MS series -21 through 188.
51811	External air pilot. Provides ⅛" NPT port for external air to pilot for remote start/stop.
52340	Solid air cap.
52950	Electric stroke counter provision. Micro switch (BZE6-2R0) mounted on upper cap trips with each cycle.
53175	Level II cleaning.
53304	High pressure outlet port. Fits ¼" O.D. high pressure threaded and coned tube.
53784	Piped exhaust (drive only). For field conversion of any .33 HP pump. Provides ¼" NPT exhaust port.
53935	Low temperature drive. Enables operation down to 5°F. Some sacrifice of seal life at normal temperature. M or MS series.
54179	Stroke adjuster (includes 29697 above). Useful for metering applications. Knurled knob with vertical scale on pump cap.
57905	No return spring. Provides improved fill on suction stroke pumping liquefied gases by utilizing the inlet pressure. Only available on M and MS series.
59888	Cycle timer installed.
80103	Noise reduction kit fitted.
80348	SAE outlet for M-pumps, ⅜" SAE, 6500 psi (448 bar) max.
81499	EPR Seals for M and MS series for Liquid Section.
82357	SS trim for ¼ hp drive
82500	ATEX Modification (Available on MS & 29723 but not M series).
85630	Conversion kit, new style exhaust muffler.
86337	Extended life air drive.

.75 hp (.56 kW) Pump Models

Model	Nominal Ratio	Maximum Working Pressure	Displacement per Cycle
4B	-14	1500 psi (103 bar)	.9 cu in (14.8 ml)
	-21	2300 psi (159 bar)	.6 cu in (9.8 ml)
	-25	2700 psi (186 bar)	.5 cu in (8.2 ml)
	-30	3200 psi (221 bar)	.43 cu in (7.1 ml)
	-37	3800 psi (262 bar)	.35 cu in (5.7 ml)
	-55	6000 psi (414 bar)	.22 cu in (3.6 ml)
	-75	7800 psi (538 bar)	.17 cu in (2.8 ml)
	-100	10600 psi (731 bar)	.13 cu in (2.1 ml)
	-150	15000 psi (1034 bar)	.088 cu in (1.4 ml)

For service codes, see page 17.
For weights and dimensions, see page 19.

Key Features

- One model available in 9 ratios
- Output pressures to 15000 psi (1034 bar)
- Flows to 1.5 gpm (5.7 l/min)
- Choice of wetted materials
- Single air head
- Drive pressure 3 psi to 100 psi (.2 to 7 bar)

Optional Modifications

Number	Description
-C	Air drive controls.
56564	Extreme cycling service. Not recommended for long stall periods.
56594	External air pilot port ⅛" NPT. Allows remote start/stop of pump.
57639	Low drive air pressure. Allows user to regulate drive air to as low as 3 psi (.2 bar).
57960	Single acting drive. Used for pumping liquefied gases under pressure.
58475	⅛" NPT port on drive for recycle valve connection.
59354	Noise reduction kit fitted.
59888	Cycle timer installed.
80637	SAE outlet fitting for ratio 37 to 100, ¼" SAE, 6500 psi (448 bar) max.
82104	Viton air drive.
82500	ATEX modification.
86337	Extended life air drive.

1.5 hp (1.12 kW) Pump Models

Key Features

- Choice of 11 models, 13 ratios, 48 possible combinations
- Output pressures to 50000 psi (3448 bar)
- Flows to 2.2 gpm (83.0 l/min)
- Choice of wetted materials
- Single air head
- Drive pressure 3 to 150 psi (.2 to 10 bar)

Model	Nominal Ratio	Maximum Working Pressure	Displacement per Cycle
DSTV[1]	-1.5	160 psi (11 bar)	31.9 cu in (513.0 ml)
ATV, DTV[1]	-4	1200 psi (83 bar)	2.00 cu in (32.8.0 ml)
AW, ASF, DF, DSF, DSTV	-B10	1600 psi (110 bar)	4 cu in (66.4 ml)
	-B15	2400 psi (165 bar)	2.7 cu in (44.3 ml)
	-25	4000 psi (276 bar)	1.6 cu in (26.6 ml)
	-35	5700 psi (393 bar)	1.2 cu in (19 ml)
	-60	9800 psi (676 bar)	.7 cu in (11 ml)
AW, ASF, DF, DSF, DSTV	-100	16500 psi (1138 bar)	.4 cu in (6.7 ml)
	-150	20000 psi (1375 bar)	.28 cu in (4.5 ml)
HF, HSF, DSHF	-151	25000 psi (1724 bar)	.28 cu in (4.5 ml)
	-225	37000 psi (2551 bar)	.18 cu in (3.0 ml)
	-300	50000 psi (3448 bar)	.14 cu in (2.3 ml)
HF	-450	49000 psi (3403 bar)	.09 cu in (1.5 ml)

(1) These series are "Lift" pumps and maximum outlet pressure is (air drive x pump ratio) + inlet pressure.

For service codes, see page 17.
For weights and dimensions, see page 20.

Optional Modifications

Number	Description
-C	Air controls (filter, regulator, gauge, shut-off). ½" NPT.
-CP	Air controls with precision regulator. ½" NPT.
-CO	Air controls with recycle button. ½" NPT.
-CPO	Air controls with precision regulator and recycle button. ½" NPT.
-B	Bottom Inlet (designate "B" before ratio dash number, "BR" on -B10, -B15, -B22 and -B32) 1.5 hp and 2 hp pumps (not applicable to high output, chemical, 2.2 hp, or AWD series pumps).
-W	Additional upper foot bracket.
16821	Low air pressure control feature. For operating at air pressures as low as 3 to 4 psi (.2 to .3 bar). Includes 28881 modification.
16831	Low temperature modification. For special sealing in air drive for operating temperatures from as low as -20°F up to normal +120°F.
16834	Exhaust adapter. With back pressure balance piston.
17860	Electrical stroke counter provision. Includes BZE5-2RQ microswitch.
25721	Mechanical stroke counter, installed (6 digit).
27964	Interconnecting inlet-outlet tubing. ½" female for 4:1 ratio series pumps (ATV-4 or DTV-4).
28000	Threaded vent (or purge) ports on standard distance piece. Except 1.5:1 ratio.
28003	Test port. Provides access port in pump's body between inlet and outlet check valves for 1.5 hp and 2 hp pumps. -10 ratio or higher, single acting.
28881	Air pilot modification. ¼" NPT. Allows remote start/stop of pump.
29376	Three-way cycling spool. For 1.5 hp and 2 hp single acting pumps, for use with CO_2.
29702	Single stroke modification.

Number	Description
29806	Double distance piece. For 1.5 hp and 2 hp pumps only, except 1.5:1 ratio.
51050	Extreme service cycling modification. Not recommended for long stall periods.
51056	Exhaust/pilot vent combination.
51331	EPR (Ethylene propylene) static seals in wetted section. Applies to distance piece pumps only.
51345	Sour gas drive provision to N.A.C.E. specifications. 1.5 hp to 2.2 hp distance piece pumps only, single air head and double air head.
52788	Viton seals air drive.
53925	Severe Arctic low temperature service. -25, -35, -60, -100, -150, -151, -225, -300, -450 ratios.
54885	Rotate pump body 90° from standard.
54935	SS trim for 5/3 air drive.
55305	Tube ports. ¾" SAE inlet and outlet. For 1.5 hp to 2 hp pumps. 15 pump minimum.
55516	Polyurethane ("W") seal. For F or TV series pumps, except high output models.
55630	Stainless steel (AISI-316) distance piece. For 1.5 hp to 2 hp pumps.
59353	Noise reduction kit fitted. Not available on AFD, DFD, ASFD or DSFD.
82460	HNBR seals in air drive section.
82500	ATEX modification (not available on AW or DSXHW pumps).
82958	¾" High pressure outlet converts medium ratio 10-122 outlet ¼ port to high pressure port.
86337	Extended life air drive.

1.5 hp (1.12 kW) High Output Flow Pumps

Available in a choice of 3 models, these high output, low ratio pumps are capable of pressures to 1200 psi (82 bar) and flow rates of up to 22 gpm (83 l/min). These are "lift" pumps whereby the outlet pressure equals the air drive x the pump ratio plus the inlet pressure.

Model DSTV-1.5 has a maximum air drive of 150 psi (10 bar) and is capable of pressures up to 160 psi (11 bar). The model ATV and DTV-4 work on a maximum air drive of 150 psi (10 bar) and have a maximum pressure rating of 1200 psi (83 bar). A noise reduction modification is available for applications where noise level is an issue.

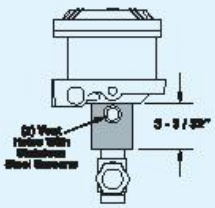
Distance Piece (Separation)

Pumps with prefix "D" in the model number have aluminum distance piece between the air drive and pump section (except DSTV-1.5). Vent holes can be threaded ½" NPT female at extra cost. Specify modification number 28000. Horizontal mounting is recommended for non-exchange of contaminants.

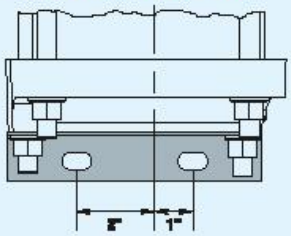
Mounting Brackets

All series mounting brackets have 7/16" holes (slots) for 3/8" bolts. Upper mounting brackets are not furnished as standard on single air head non-distance piece units.

Dimensional Data



Mounting Brackets

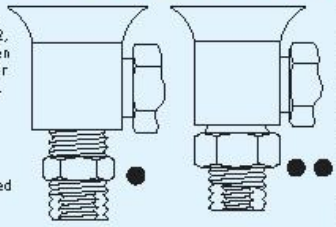


Optional Pump Inlets for Tank Mounting

To specify ratios -10, -15, -22 or -32, add `BR` between the model number and the ratio, e.g. AW-BR10.

Inlet externally threaded 1 ¼" NPT male

Internally threaded 1" NPT female



To specify ratios -25 through -903, add `B` between the model number and the ratio, e.g. AW-B25.

Inlet on the bottom and externally threaded 1" NPT male

Internally threaded ½" NPT female

Drive inlet and exhaust are ½" NPT female. Drive inlet also includes a ½" NPT male x ½" NPSM female (straight pipe thread) swivel adapter (connecting male nipple should include 30° inside bevel for proper fit).

2 & 2.2 hp (1.49 & 1.64 kW) Pump Models

Key Features

- Choice of 16 models, 13 ratios, 46 possible combinations
- Output pressures to 100000 psi (7000 bar)
- Flows to 5 gpm (15 l/min)
- Choice of wetted materials
- Double and triple air heads
- Drive pressure 3 to 100 psi (.2 to 7 bar)

	Model	Nominal Ratio	Maximum Working Pressure	Displacement per Cycle
2 hp	AW, ASF, DF, DSF, DSTV	-B22	3200 psi (221 bar)	4 cu in (66.4 ml)
		-B32	4800 psi (331 bar)	2.7 cu in (44.3 ml)
		-52	8000 psi (552 bar)	1.6 cu in (26.6 ml)
		-72	11000 psi (758 bar)	1.2 cu in (19 ml)
		-122	19000 psi (1310 bar)	.7 cu in (11 ml)
	HF, HSF, DHF, DSHF	-202	33000 psi (2275 bar)	.4 cu in (6.7 ml)
		-302	50000 psi (3448 bar)	.28 cu in (4.5 ml)
	DXHF, DSXHF	-452	70000 psi (4827 bar)	.18 cu in (3.0 ml)
		-602	75000 psi (5171 bar)	.14 cu in (2.3 ml)
	DXHF, DSXHF	-683	70000 psi (4827 bar)	.18 cu in (3.0 ml)
		-903	75000 psi (5171 bar)	.14 cu in (2.3 ml)
	DSXHW	-1373	100000 psi (6895 bar)	.09 cu in (1.4 ml)
2.2 hp	AFD, DSFD, DFD, ASFD	-B60	6500 psi (448 bar)	1.3 cu in (22 ml)

For service codes, see page 17.
For weights and dimensions, see page 20.

3 hp (2.24 kW) Pump Models

Key Features

- One model available in 8 ratios
- Output pressures to 33000 psi (2275 bar)
- Flow rates to 8 gpm (30 l/min)
- Single air head
- Drive pressure 3 to 150 psi (.2 to 10 bar)

Model	Nominal Ratio	Maximum Working Pressure*	Displacement per Cycle
ASFD	10	1600 psi (110 bar)	8.1 cu in (132.8 ml)
	15	2400 psi (165 bar)	5.4 cu in (88.6 ml)
	25	4000 psi (276 bar)	3.3 cu in (53.2 ml)
	35	5700 psi (393 bar)	2.3 cu in (38 ml)
	60	9800 psi (676 bar)	1.3 cu in (22 ml)
	100	16500 psi (1138 bar)	.8 cu in (13.4 ml)
	150	20000 psi (1379 bar)	.5 cu in (9 ml)
	202	33000 psi (2275 bar)	.8 cu in (13.4 ml)

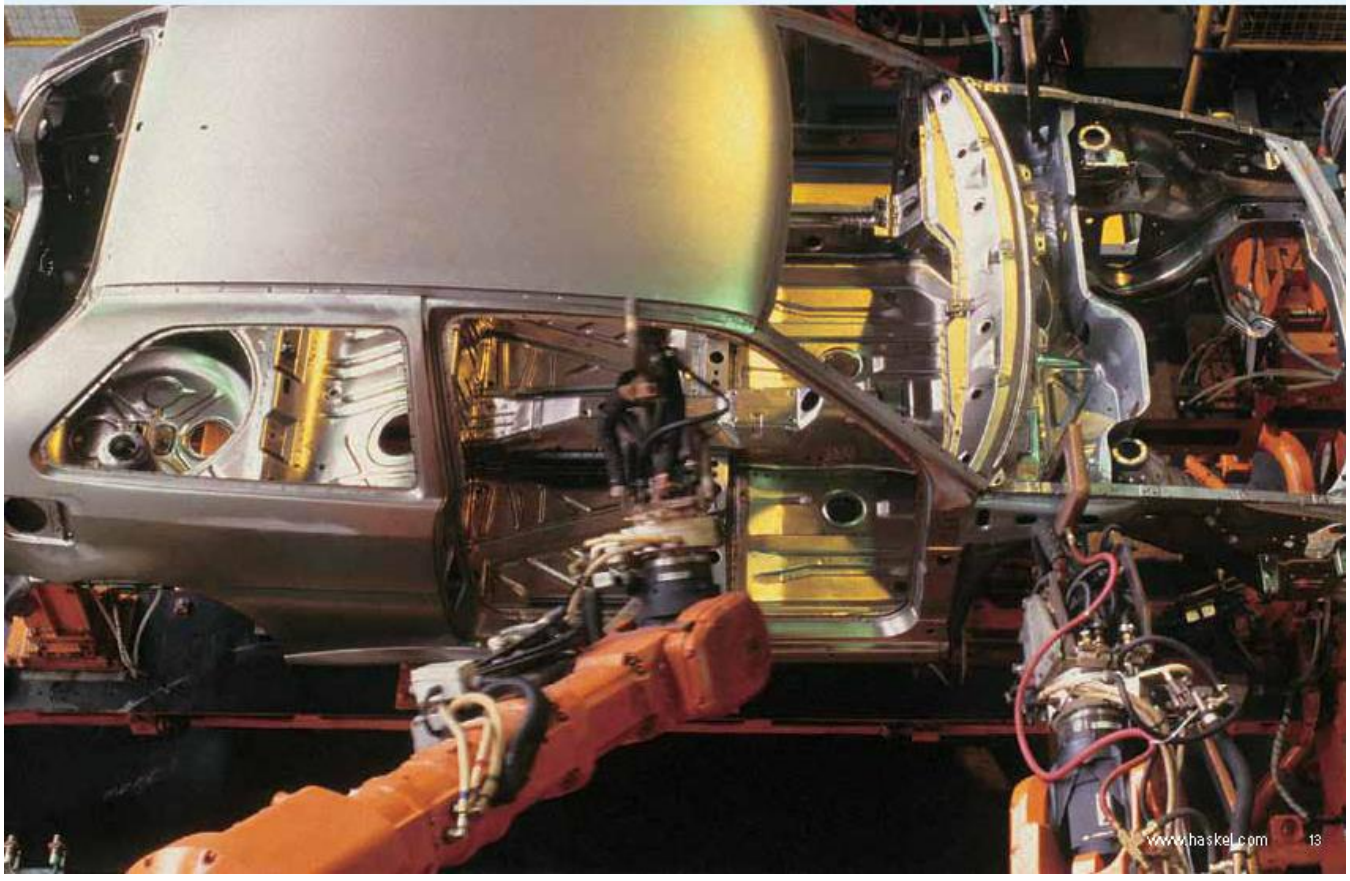
* Continuous/Intermittent

For service codes, see page 17.
For weights and dimensions, see page 21.

Optional Modifications (for 2 hp, 2.2 hp and 3 hp pump models)

Number	Description
-C	Air controls (filter, regulator, gauge, shut-off. ½` NPT.
-CP	Air controls with precision regulator. ½` NPT.
-CO	Air controls with recycle button. ½` NPT.
-CPO	Air controls with precision regulator and recycle button. ½` NPT.
-B	Bottom Inlet (designate `B` before ratio dash number, `BR` on -B10, -B15, -B22 and -B32) 1.5 hp and 2 hp pumps (not applicable to high output, chemical, 2.2 hp, or AWD series pumps)
16821	Low air pressure control feature. For operating at air pressures as low as 3 to 4 psi (.2 to .3 bar).
16831	Low temperature modification. For special sealing in air drive for operating temperatures from as low as -20°F up to normal +120°F.
16834	Exhaust adapter. With back pressure balance piston.
17860	Electrical stroke counter provision. Includes BZE6-2RQ microswitch.
25721	Mechanical stroke counter. Installed (6 digit).
27964	Interconnecting inlet-outlet tubing. ½` female for 4:1 ratio series pumps (ATV-4 or DTV-4).
28000	Threaded vent (or purge) ports on standard distance piece. Except 1.5:1 ratio and 3 hp pump.
28003	Test port. Provides access port in pump's body between inlet and outlet check valves for 1.5 hp and 2 hp pumps, -10 ratio or higher, single acting.
28881	Air pilot modification. ¼` NPT – Allows remote start/stop of pump.
29376	Three-way cycling spool. For 1.5 hp and 2 hp single acting pumps.
29702	Single stroke modification. Except 3 hp pump.
29806	Double distance piece. For 1.5 hp and 2 hp pumps only, except 1.5:1 ratio.

Number	Description
51050	Extreme service cycling modification. Not recommended for long stall periods.
51056	Exhaust/pilot vent combiner.
51331	EPR (Ethylene propylene) static seals in wetted section. Applies to distance piece pumps only.
51345	Sour gas drive provision to N.A.C.E. specifications. 1.5 hp to 2.2 hp distance piece pumps only, single air head and double air head.
52788	Viton seals. Air drive only – 1.5 hp to 2.2 hp pumps only.
53825	Severe Arctic low temperature service. -25, -35, -60, -100, -150, -151, -225, -300, -450 ratios except 3 hp pump.
54885	Rotate pump body 90° from standard. Except 3 hp pump.
54935	SS trim for 5/3 air drive.
55191	Mounting ring kit for AWD series.
55192	3/4 NPT inlet port installed on AWD series (in place of threaded port).
55193	Extra foot bracket installed.
55305	Tube ports. ⅜` SAE inlet and outlet – for 1.5 hp to 2 hp pumps, 15 pump minimum.
55465	Ceramic Plunger -60 Ratio.
55516	Polyurethane `W` seal in `F` series pumps-except high output models.
55630	Stainless steel (SS-316) distance piece – for 1.5 thru 2 hp pumps.
59353	Noise reduction kit fitted. Not available on AFD, DFD, ASFD or DSFD.
59888	Cycle timer installed.
82460	HNBR Seals in air drive section.
82500	ATEX modification (not available on AW or DSXHW pumps).
86337	Extended life air drive.



6 hp (4.47 kW) Pump Models

Model	Nominal Ratio	Maximum Working Pressure	Displacement per Cycle
GWD, GSFD, DGFD[1], DGSFD[1], DGSTVD[1]	-12	4000 psi (276 bar)	1.59 cu in (260 ml)
GW, GSF, DGF, DGSF, DGSTV	-35	4375 psi (302 bar)	6.0 cu in (98 ml)
	-60	7500 psi (517 bar)	3.5 cu in (57 ml)
	-100	10000 psi (690 bar)	2.1 cu in (34.5 ml)

(1) Double Acting "Lift" Pumps

For service codes, see page 17.
For weights and dimensions, see page 22.

Key Features

- Choice of 10 models, 4 ratios, 20 possible combinations
- Output pressures to 10000 psi (690 bar)
- Flow rates to 21 gpm (80 l/min)
- Choice of wetted materials
- Single air head – double acting
- Drive pressure 3 to 125 psi (.2 to 9 bar)
- All hydraulic fluids, water (plain or DI), solvents

Incorporating 10 models, this heavy duty range of double acting pumps provide pressures up to 10000 psi (690 bar) and flow rates up to 4 gpm (15 l/min).

Designed to operate with air drive pressures between 40 and 125 psi (2.8 and 9 bar). For drive pressures 3 to 40 psi (.2 to 2.8 bar), order 51875-1 mod.

8 hp (5.97 kW) Pump Models

Model	Nominal Ratio	Maximum Working Pressure	Displacement per Cycle
8SFD, 8DFD, 8DSFD, 8DSTVD 8FD	-25[1]	4000 psi (276 bar)	14 cu in (229 ml)
8SFD 8DSFD	-40	6000 psi (408 bar)	9 cu in (145.3 ml)
	-65	10000 psi (690 bar)	5.4 cu in (88.2 ml)
	-100[1]	10000 psi (690 bar)	3.5 cu in (57.5 ml)
8HSFD	-225[1]	22500 psi (1530 bar)	1.6 cu in (25.5 ml)

(1) Double Acting "Lift" Pumps

For service codes, see page 17.
For weights and dimensions, see page 23.

Key Features

- Choice of 6 models, 5 ratios, 9 possible combinations
- Pressures to 22500 psi (1530 bar)
- Flow rates to 11.5 gpm (44 l/min)
- All hydraulic fluids, water (plain or DI), solvents, liquefied gases
- Choice of wetted materials
- Single air head – double acting
- Drive pressure 3 to 125 psi (.2 to 9 bar)

10 hp (7.46 kW) Pump Models

Model	Nominal Ratio	Maximum Working Pressure	Displacement per Cycle
D14 STD	125[1] 315[1]	16000 psi (1103 bar) 36000 psi (2482 bar)	8.8 cu in (144.2 ml) 3.5 cu in (57.4 ml)
D14 SFD	125[1] 315[1]	16000 psi (1103 bar) 36000 psi (2482 bar)	8.8 cu in (144.2 ml) 3.5 cu in (57.4 ml)

(1) Double Acting "Lift" Pumps

For service codes, see page 17.
For weights and dimensions, see page 23.

Key Features

- Choice of 4 models, 4 ratios, 4 possible combinations
- Pressures to 36000 psi (2500 bar)
- Flow rates to 3 gpm (11 l/min)
- Drive pressure 3 to 125 psi (.2 to 9 bar)
- All hydraulic fluids, water (plain or DI), solvents, liquefied gases
- Choice of wetted materials

Incorporating two basic models, this heavy duty range of double acting pumps provide pressures up to 36000 psi (2482 bar) and output flow rate up to 3 gpm (11 l/min).

Operating from a maximum air drive pressure of 125 psi (9 bar), these pumps are designed for medium to high pressure service with minimum maintenance.

These large, slow speed pumps approach a seal life as high as 5 times that of many smaller pumps and this advantage becomes ever greater in heavy duty service involving water, or other liquids with negligible lubricity.

Optional Modifications (for 6 hp, 8 hp and 10 hp pump)

Number	Description
C	Air controls.
17860	Electrical stroke counter provision (includes BZE6-2RQ micro switch).
25721	Mechanical stroke counter installed (5 digit).
29077	Interconnecting tubing – 6 hp and 8 hp pumps, double ended.
29077-1	Interconnecting tubing – 6 hp and 8 hp pumps, double ended low ratio pumps.
29078	Same as 29077, 29077-1 double ended w/distance piece.
29078-1	Same as 29077, 29077-1 double ended w/distance piece low ratio pumps.
29079	Interconnecting tubing – 10 hp pumps.
29125	External pilot modification – for 6 hp thru 10 hp pumps.
51875-1	Low air pressure control – for 6 hp thru 10 hp pumps.
54030	Sour gas air drive provision to NACE spec. 6 hp distance piece pumps only.
54312	Extreme service cycling modification – for 6 hp thru 10 hp pumps.
54936	Exhaust/pilot vent combiner.
55330	Interconnecting tubing 8DSFD-100 low pressure inlet.
55330-1	Interconnecting tubing 8DSFD-100 high pressure inlet.
55366	Interconnecting tubing 8DSFD-225.
57002	Viton seals – air drive only – 6 hp.
57944	Viton seals – air drive only – 8 hp.
59888	Cycle timer installed.
82500	ATEX modification available for 6 hp only, not available on 8 hp or 14 hp drive, nor on GW, GSF, DGSF, GSFD, or DGSFD models.
86337	Extended life air drive.

Power System Specialists

World safety standards and quality demands are rising. Component manufacturers are required to provide test certification and product quality assurance which can only be determined using the types of systems which Haskel can provide. Typically, we have built systems for production and field testing the proof, leak, and burst aspects of hoses, cylinders, and valves.

These systems can be portable, mobile, or static test rigs. We also offer a range of standard pressure packs used for power jacking, clamping, and other applications where reliable power is needed.

Quality and After-Sale Service

Haskel meets the requirements of international quality assurance ISO 9001. Build quality is matched by an innovative design and problem solving ability which stems from years of years of experience. Our representatives around the world are carefully chosen and trained to help you arrive at a correct product choice, and to offer a maintenance and parts service that is second to none.

Selecting Your Accessories

Haskel can either provide accessories separately or supply them fitted to form a complete package suited to your application. Additionally, Haskel can fit customer nominated accessories. Our accessories catalog is available and our technical support team is always ready to advise you on the most suitable choice of accessories for your application.

- Air pilot switches
- Air pilot valves
- Regulating relief valves
- Directional control and release valves
- Hydraulic accumulators, gas receivers and storage cylinders
- High pressure valves, fittings and tubing
- Plenum chambers
- Port adapters
- Pressure regulators
- Gauge snubbers
- Filters
- Stainless steel check valves
- Intensifiers with integral checks for cycling
- Capillary type gauge snubbers

Please ask for your copy of our latest accessories brochure.

Liquids Compatible with Haskel Pumps

To assist in easier pump selection, we have classified various popular liquids in groups and assigned to each group a service code. These service code numbers are featured in the chart to the right and are designated for each pump series. Seals and other wetted materials can be supplied to suit your preferred liquid. For advice, please contact our technical services personnel at 818-843-4000.

Services

Service Codes

1 Petroleum-based oils, kerosene, water with 5% soluble oil.

2 Plain water, diesel fuel.

3 Most phosphate ester-based fire-resistant hydraulic fluids, e.g. Pydraul, Lindol, Cellulube, Fyrquel, and Houghtosafe 1120 and petroleum-based solvents compatible with UHMWPE (Ultra-high Molecular Weight Polyethylene) dynamic seals and Viton static seals.

4 Petroleum-based solvents, e.g. boron fuels, aromatic hydrocarbons (benzene, toluene, xylene, hylene, etc.); chlorinated solvents (trichlorethylene, carbon tetrachloride, chlorobenzine, etc.); mercaptans, Dowtherm A, fluoronated solvents (fluorobenzene, fluorochlorethylene, etc.); Dowtherm E, plus all of Group 3 and some mildly corrosive acids compatible with wetted materials. See note 5A for service with methyl-ethyl-ketone, methyl acetone, diacetone, alcohol and freon 22.

5 Skydrol and Aerosafe hydraulic fluid; acetone and some alcohols (ethyl, methyl, and isopropyl).
5A. Also suitable for these fluids if Viton static seals are replaced with EPR; specify modification number 51331 (no extra charge); e.g., 51331-MDTV-5. Most phosphate ester-based fluids solidify at approximately 30000 psi.

6 Deionized water; demineralized water.

Note: Dynamic seal life with non-lubricating fluids will understandably be less than with lubricating types.

Operating Temperatures

Drive Section

-4° (25°F) to +65°C (150°F) (low temperature seals are available for Arctic operation).

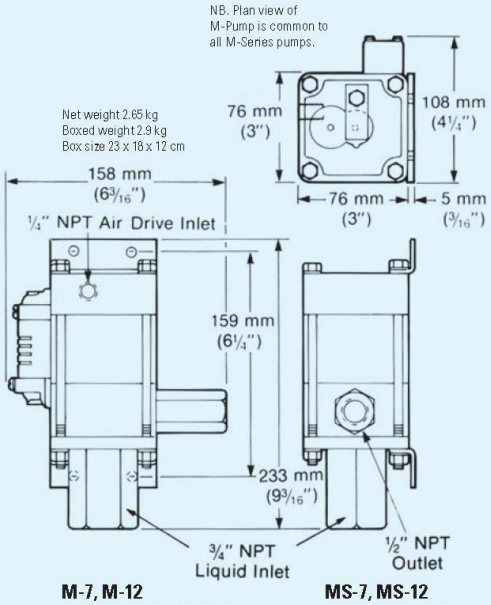
Liquid Section

For reasonable seal life, high temperature should be limited to 54° C (130° F), for F and W seal models, 135° C (275° F) for T and TV models (with distance piece).

		Services						
hp	Model	1	2	3	4	5	5A	6
.33	M	•						
	MS	•	•					
	MDTV	•		•			•	
	MDSTV	•	•	•	•		•	
	MCPV	•	•	•	•	•		
	29723	•	•	•		•		•
.75	4B -14 to -37	•						
	4B -55 to -150	•	•					
1.5 2 2.2	AW	•						
	ASF	•	•					
	DF	•		•			•	
	DSF	•	•	•			•	•
	HF	•						
	HSF	•	•					
	DHF	•					•	
	DSHF	•	•				•	•
	DSTV	•	•	•	•		•	
	ATV	•	•					
	DTV	•	•				•	
	DSTV -1.5	•	•	•	•		•	•
	AFD	•						
	DFD	•		•			•	
	ASFD	•	•					
	DSFD	•	•	•			•	•
	DXHF	•					•	
	DSXHF	•	•				•	•
	DSXHW	•	•					
3	ASFD	•	•					
6	GW	•						
	GSF	•	•					
	DGF	•		•			•	
	DGSF	•	•	•			•	•
	DGSTV	•	•	•	•		•	
	GWD	•						
	GSFD	•	•					
	DGFD	•		•			•	
	DGSFD	•	•	•	•		•	•
	DGSTVD	•	•	•	•		•	
8	8FD	•						
	8SFD	•	•	•	•		•	
	8DFD	•						
	8DSFD	•	•					
	8DSTVD	•		•			•	
	8HSFD	•	•	•	•		•	
10	D14STD -125	•	•	•	•		•	
	D14STD -315	•	•	•	•		•	
	D14SFD -125	•	•	•			•	•
	D14SFD -315	•	•	•			•	•

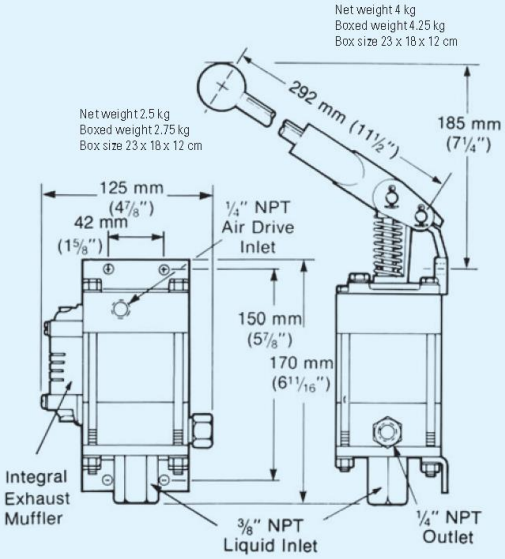
Weights and Dimensions

.33 hp (.25 kW) M Series Pump Models



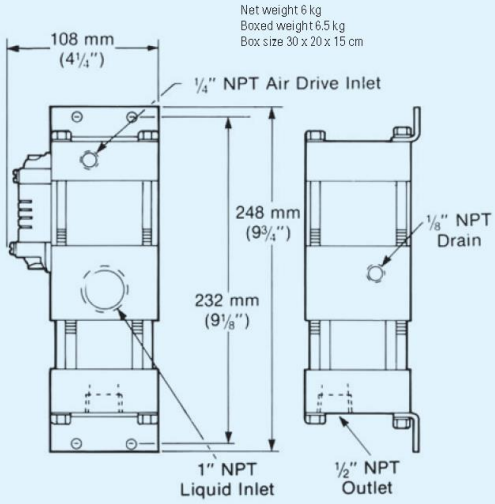
M-7, M-12
approx. weight 9 lbs (4 kg)

MS-7, MS-12
approx. weight 9 lbs (4 kg)

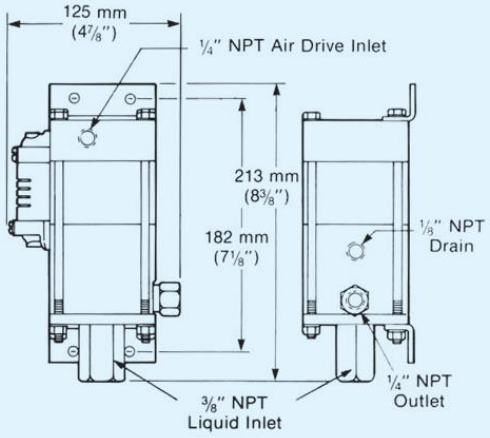


MS-21, MS-36, MS-71, MS-110, MS-188, MS-220
approx. weight 6 lbs (2.7 kg)

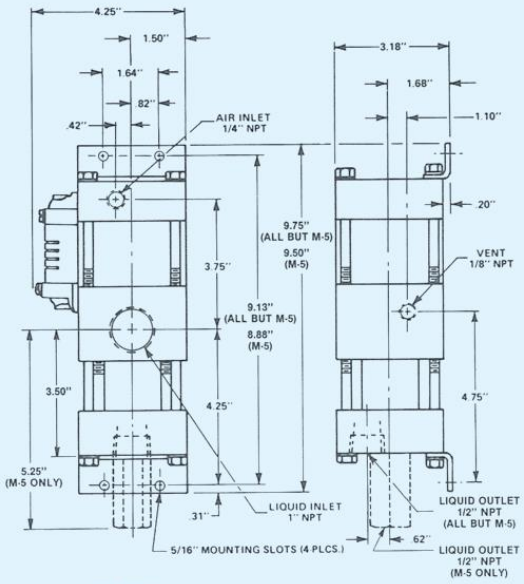
M-21, M-36, M-71, M-110, M-188 approx. weight 6 lbs (2.7 kg)



M-5 approx. weight 9 lbs (4 kg)

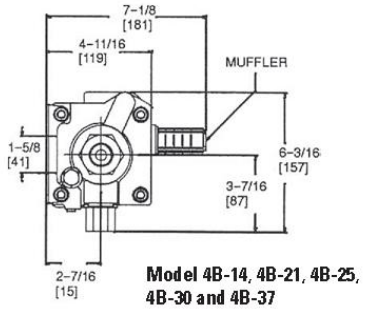


29723-21, 29723-36, 29723-71, 29723-110
approx. weight 6.5 lbs (3 kg)

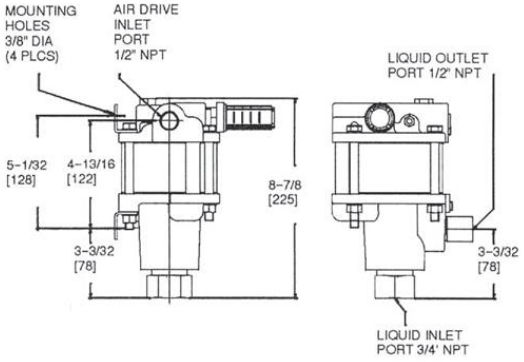


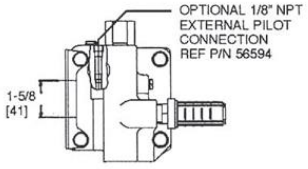
MDSTV-5
Approx weight 15 1/2 lbs (7 kg)

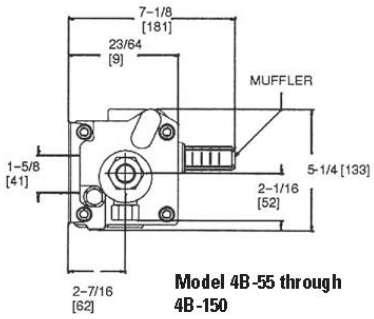
.75 hp (.56 kW) Pump Models



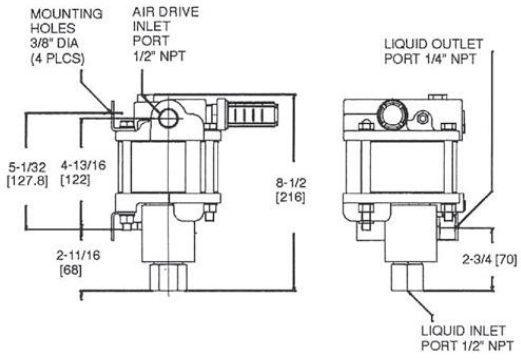
Model 4B-14, 4B-21, 4B-25, 4B-30 and 4B-37

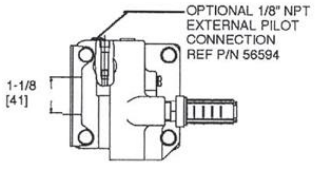




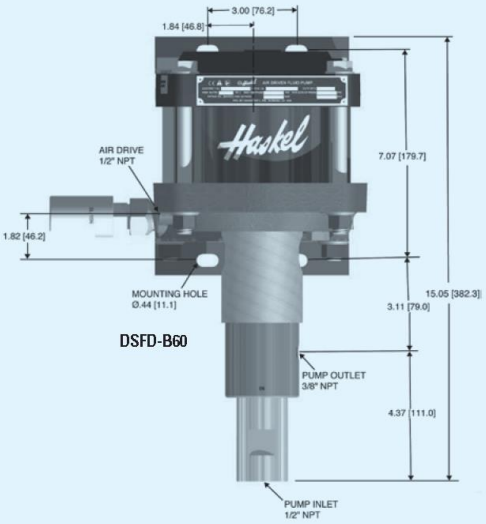


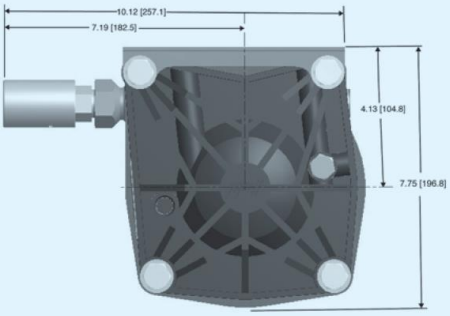
Model 4B-55 through 4B-150



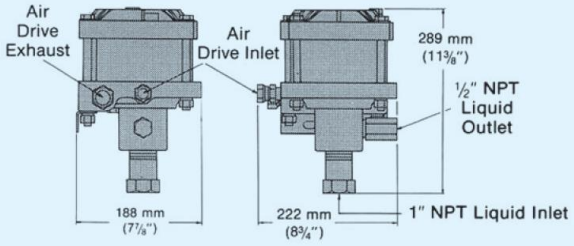


1.5 hp, 2 & 2.2 hp (1.12, 1.49 & 1.64 kW) Pump Models



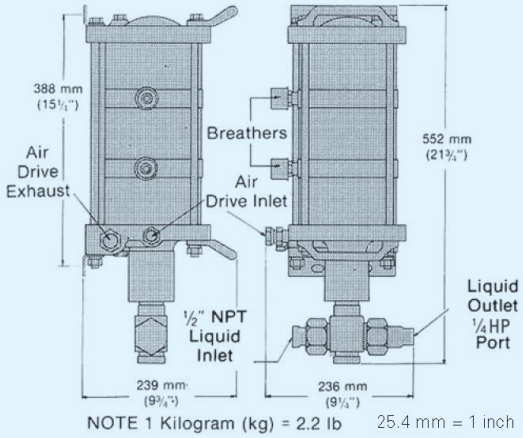


Net weight 10 kg
Boxed weight 11 kg
Box size 37 x 37 x 38 cm



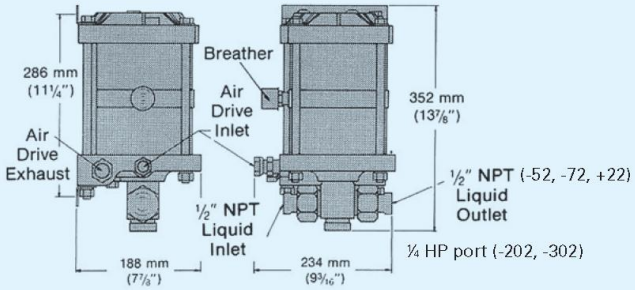
1.5 and 2 hp low ratio pumps;
-B10 and -B15 ratios

Net weight 18 kg
Boxed weight 20 kg
Box size 68 x 42 x 50 cm

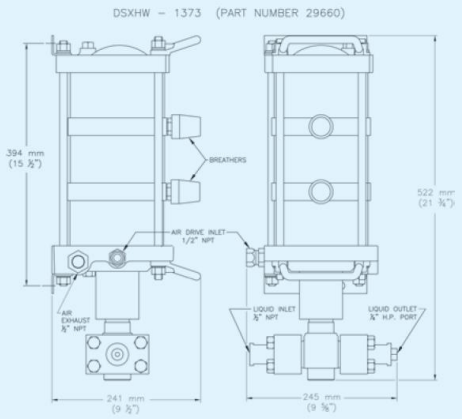


1.5 and 2 hp high ratio pumps;
-683 and -903 ratios

Net weight 14 kg
Boxed weight 15 kg
Box size 52 x 40 x 40 cm

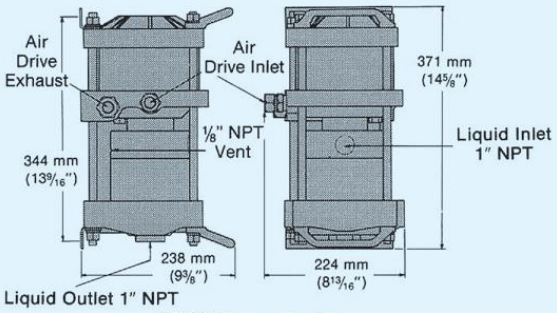


1.5 and 2 hp medium ratio pumps;
-52, -72, -122, -202 and -302 ratios



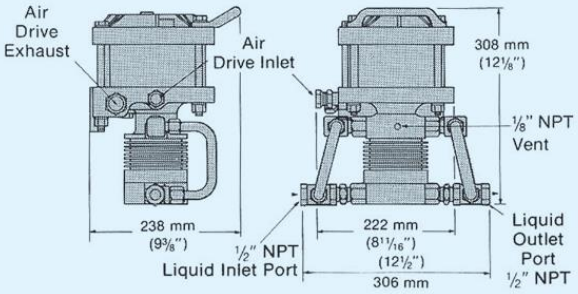
2 & 2.2 hp (1.49 & 1.64 kW) Pump Models

Net weight 18 kg
Boxed weight 19 kg
Box size 45 x 37 x 44 cm



DSTV-1.5 pump; single acting, high output

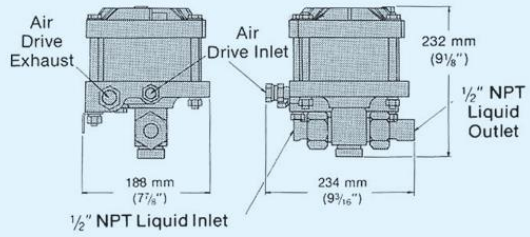
Net weight 10 kg
Boxed weight 11 kg
Box size 45 x 37 x 44 cm



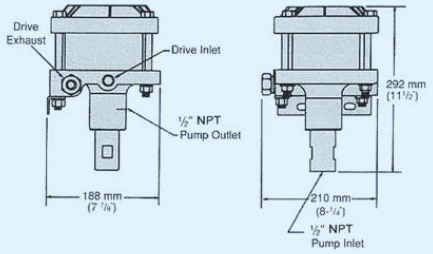
ATV-4 pumps; double acting, high output

Note: For model DTV-4, add distance piece dimension from page 11. Interconnecting inlet and outlet port tubing shown.

Net weight 9.5 kg
Boxed weight 10 kg
Box size 25 x 26 x 22 cm

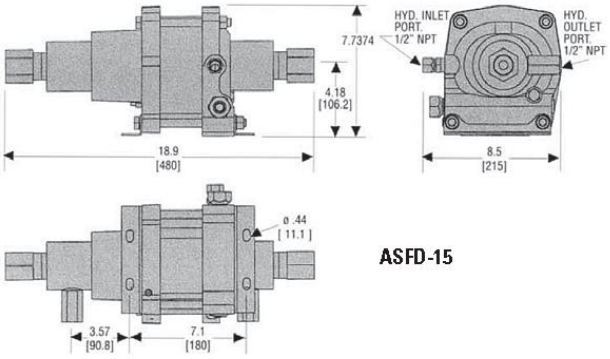


1.5 and 2 hp medium and high ratios; -25 through -150, -151, -225, -300 and -450 ratios

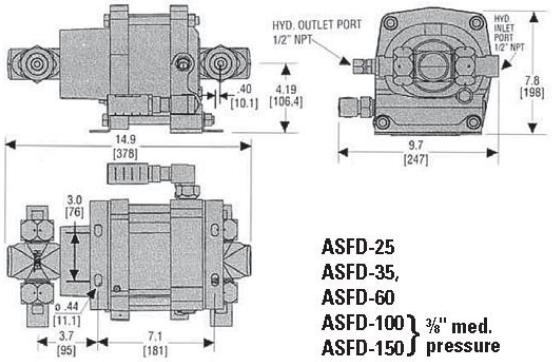


AFD or ASFD, -B60, -B100 pumps; double acting, high output

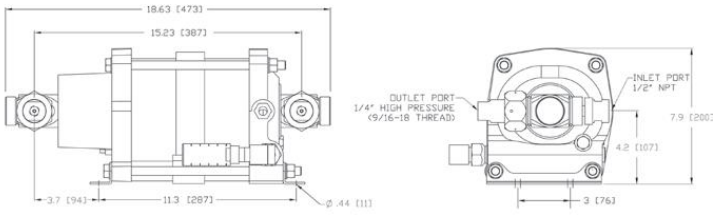
3 hp (2.24 kW) Pump Models



ASFD-15



ASFD-25
ASFD-35,
ASFD-60
ASFD-100 } ⅜" med. pressure
ASFD-150 }

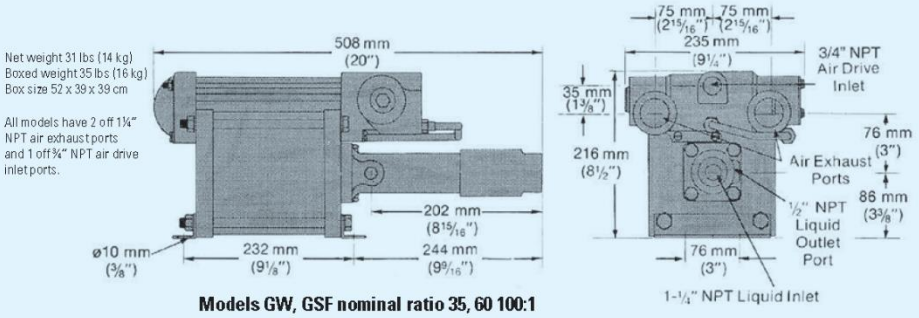


ASFD-202

6 hp (4.47 kW) Pump Models

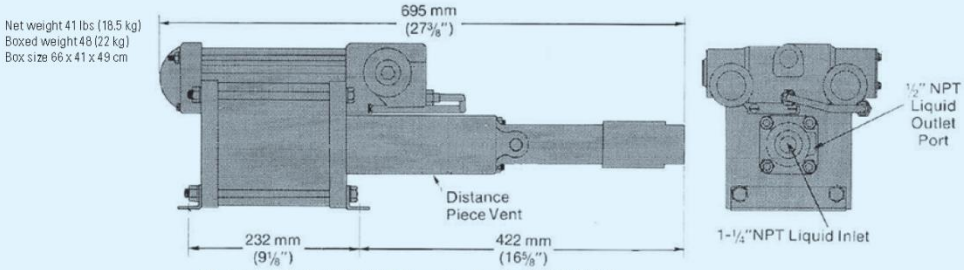
Net weight 31 lbs (14 kg)
Boxed weight 35 lbs (16 kg)
Box size 52 x 39 x 39 cm

All models have 2 off 1¼" NPT air exhaust ports and 1 off ¾" NPT air drive inlet ports.



Models GW, GSF nominal ratio 35, 60 100:1

Net weight 41 lbs (18.5 kg)
Boxed weight 48 (22 kg)
Box size 66 x 41 x 49 cm

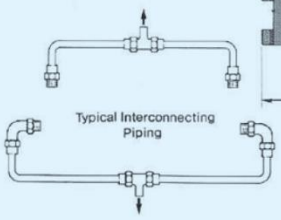


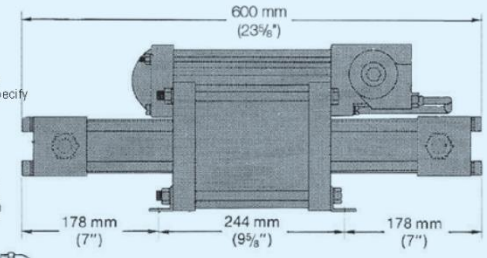
Models DGF, DGSF, DGSTV nominal ratio 35, 60 100:1

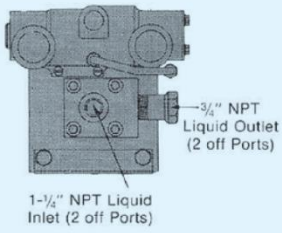
End dimensions as GW/GSF

Net weight 57 lbs (26 kg)
Boxed weight 61 (27 kg)
Box size 66 x 41 x 49 cm

If interconnecting piping for the two inlets and two outlets is required, specify modification 29077 with your order.





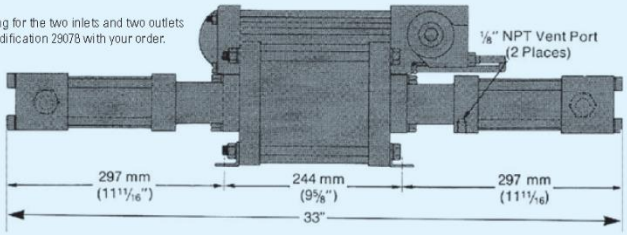


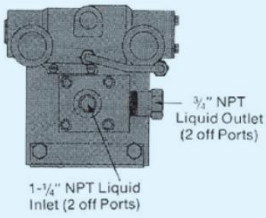
Models GWD, GSFD nominal ratio 12:1

End dimensions as GW/GSF

Net weight 66 lbs (30 kg)
Boxed weight 75 lbs (34 kg)
Box size 91 x 51 x 39 cm

If interconnecting piping for the two inlets and two outlets is required, specify modification 29078 with your order.



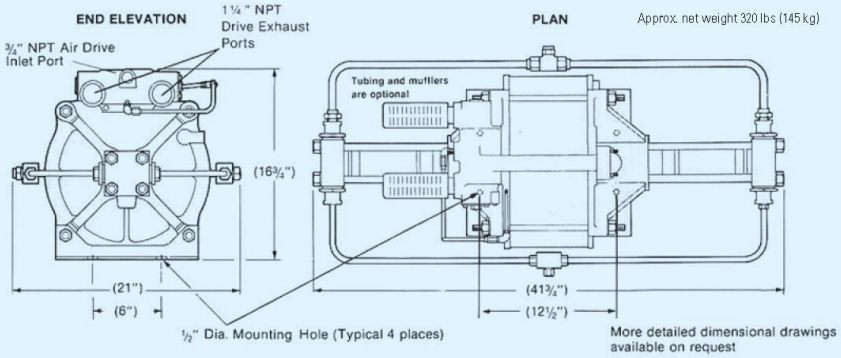


Models DGFD, DGSFD, DGSTVD nominal ratio 12:1

8 hp (5.97 kW) Pump Models

Model	Length	Width	Height	Weight	Air Drive	Liquid Inlet	Liquid Outlet
8FD-25 **8SFD-25**	25 3/8" (644.5 mm)	9 1/2" (241 mm)	11" (279 mm)	80 lbs (36 kg)	3/4"	1 1/4" NPT[2]	3/4" NPT[2]
8DFD-25 **8DSFD-25** **8DSTVD-25**	34 3/4" (883 mm)	9 1/2" (241 mm)	11" (279 mm)	94 lbs (43 kg)	3/4"	1 1/4" NPT[2]	3/4" NPT[2]
8SFD-40	26 7/8" (683 mm)	9 1/2" (241 mm)	11" (279 mm)	64 lbs (29 kg)	3/4"	1" NPT	3/8" NPT
8SFD-65	26 7/8" (683 mm)	9 1/2" (241 mm)	11" (279 mm)	63 lbs (28.5 kg)	3/4"	1" NPT	1/2" NPT
8HSFD-225	28 3/8" (721)	9 1/2" (241 mm)	11" (279 mm)	71 lbs (32 kg)	3/4"	3/8" M/P (20K coned and threaded connection)	3/8" M/P (20K coned and threaded connection)
8DSFD-100	41 3/4" (1060 mm)	9 1/2" (241 mm)	11" (279 mm)	92 lbs (42 kg)	3/4"	1 1/4" NPT[2]	3/4" NPT[2]

10 hp (7.46 kW) Pump Models



Note: See 29079 interconnecting tubing optional page 15. (29079 shown)
Single Inlet port – 3/4 JIC male flare connection, single outlet port 3/8 HP ports (BuTech).
Individual Pump ports – Liquid inlets 2 ea. 1/2 NPT ports, 2 ea. 3/8 HP ports (BuTech)

CELEBRATING OVER 60 YEARS OF HYDRAULIC AND PNEUMATIC ENGINEERING EXPERIENCE IN THE DESIGN AND MANUFACTURING OF HIGH PRESSURE GENERATING EQUIPMENT AND CONTROLS

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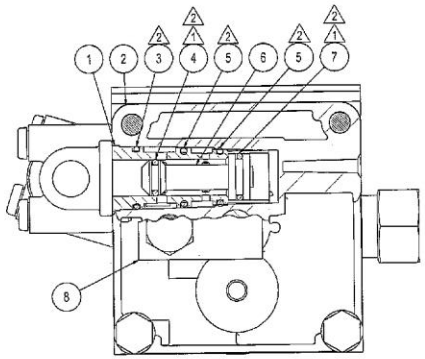
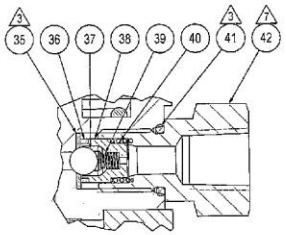
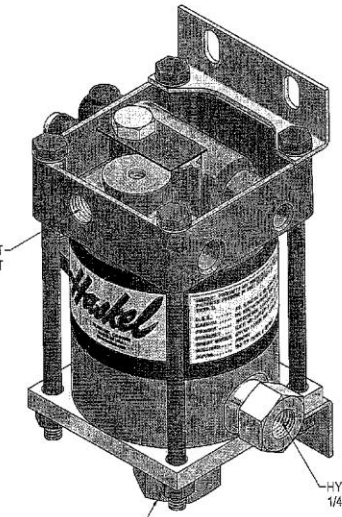
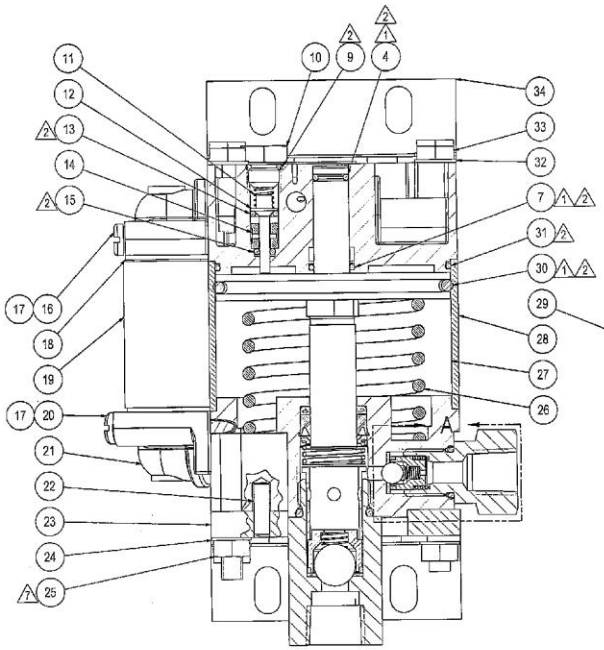
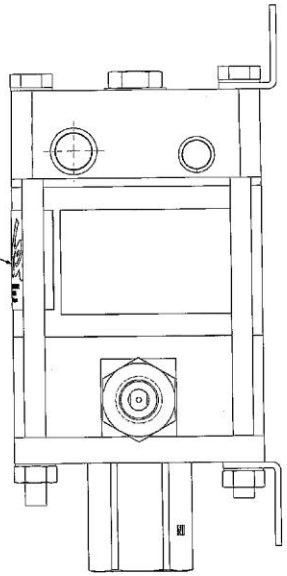




DETAIL A







NOTES:

1. APPLY A VERY LIGHT COAT OF HASKEL LUBRICANT PER HPS-3.14 TO THE DYNAMIC SEALS IN THE AIR DRIVE.
2. THESE PARTS ARE INCLUDED IN 17178 AIR DRIVE SEAL KIT.
3. THESE PARTS ARE INCLUDED IN 26410-XXX HYDRAULIC SEAL KIT.
4. 55763-XXX TOOL MAYBE USED TO INSTALL THE HYDRUALIC SEAL.
5. TORQUE INLET CHECK FITTING TO 50 FT-LBS FOR MS-21 & MS-36
6. TORQUE INLET CHECK FITTING TO 125 FT-LBS FOR MS-71, MS-110, & MS-188.
7. TORQUE TO 50 FT-LBS.

REVISION			
REV	DESCRIPTION	DATE	CHECKED
M	REVISED PER ECO	7/1/09	GS

MS-XXX PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	QTY
1	17158	SLEEVE	1
2	17151	AIR CAP	1
3	568016-2	O-RING	1
4	568011-21	O-RING	2
5	58286-2	O-RING	2
6	17157	SPOOL	1
7	568013-2	O-RING	2
8	17184	PLATE	1
9	568011-2	O-RING	1
10	50111	PLUG	1
11	17161	SPRING	1
12	17156	STEM, PILOT	1
13	568009-2	O-RING	1
14	17159	TUBE	1
15	54602	O-RING	1
16	17196	SHCS 10-24 X 1-1/4 LONG	2
17	CNF00026	WASHER,L.IT,TYPEA,#10	4
18	17193-9	CAP, EXHAUST	1
19	85196-1	EXHAUST TUBE	1
20	17196-4	SHCS 10-24 X 1-1/2 LONG	2
21	17193-10	CAP, EXHAUST	1
22	3/16 X 5/8 HDP	PIN	1
23	28066	RETAINING PLATE	1
24	CNF00027	LOCKWASHER, 1/4	4
25	17188	NUT 1/4-20 UNC	4
26	17162	SPRING RETURN	1
27	17071	BARREL	1
28	27146	DECAL, PATENT LABEL	1
29	57680-2	HASKEL LOGO	1
30	27270	O-RING	1
31	568038-2	O-RING	1
32	CNF00021	WASHER, 1/4	4
33	17167	HEX BOLT	4
34	29373	BRACKET	2
35	28081-1	SEAT	1
36	28083-1	RING	1
37	28130-8	BALL	1
38	28083-2	SHANK	1
39	26685	SPRING	1
40	28082	SPRING	1
41	568906-9	O-RING	1
42	28104-3	BODY, OUTLET	1

NEXT ASSY (REF ONLY)

APPROVALS		DATE
DRAWN	S.R.	04/01/74
CHECKED	R.L.	01/23/75
APPROVED	R.L.	01/23/75
CAD FILENAME	MS-21	

Haskel International, Inc.
Burbank, California 91502

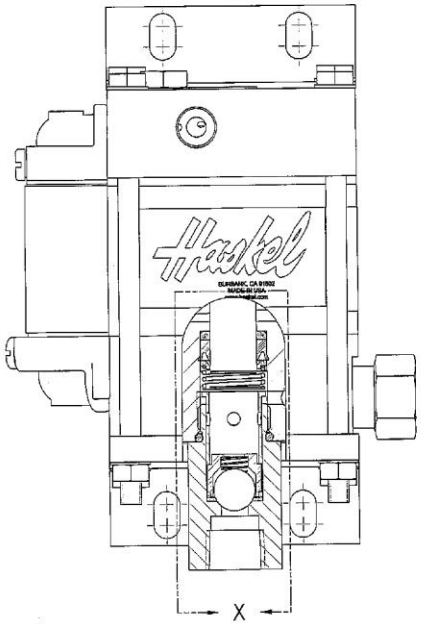
TITLE: ASSEMBLY DRAWING, MODEL "MS" PUMP

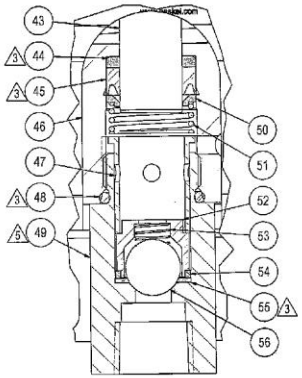
SIZE: D | CAGE CODE: 81400 | DWG NO.: 28560-TAB | REV: M

SCALE: N/A | INVENTOR DRAWING | SHEET 1 OF 2

28560-TAB

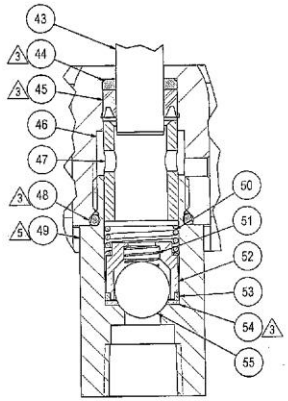
REVISION			
REV	DESCRIPTION	DATE	CHECKED
	SEE SHEET 1		





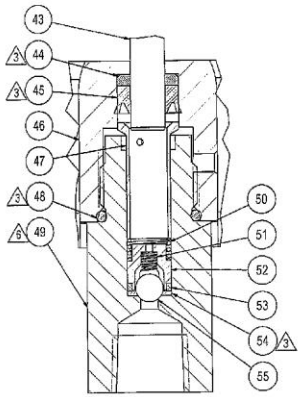
DETAIL X
(MS-21)

MS-21 PARTS LIST (CONT.)			
ITEM	PART NUMBER	DESCRIPTION	QTY
43	59402-21	PISTON ASSEMBLY	1
44	29703-21	BEARING	1
45	29744-21	CUP SEAL	1
46	28530-21	CAP-HYDRAULIC	1
47	28138	SPACER	1
48	568910-9	O-RING	1
49	28131-3	FITTING, INLET	1
50	28137	SPACER	1
51	17978	SPRING	1
52	28117	RETAINER	1
53	28116	SPRING	1
54	28118	RING	1
55	28119	SEAT	1
56	26130-16	BALL	1



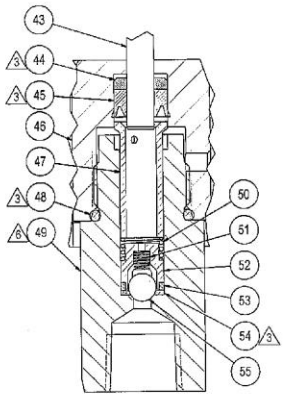
DETAIL X
(MS-36)

MS-36 PARTS LIST (Cont.)			
ITEM	PART NUMBER	DESCRIPTION	QTY
43	59402-36	PISTON ASS'Y, M	1
44	29703-36	BEARING	1
45	29744-36	CUP SEAL	1
46	28530-36	CAP-HYDRAULIC	1
47	28141	SPACER	1
48	568910-9	O-RING	1
49	28131-3	FITTING, INLET	1
50	28123	SPRING	1
51	28116	SPRING	1
52	28117	RETAINER	1
53	28118	RING	1
54	28119	SEAT	1
55	26130-16	BALL	1



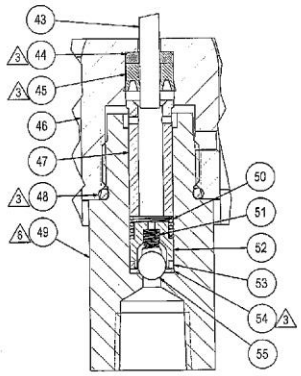
DETAIL X
(MS-71)

MS-71 PARTS LIST, (Cont.)			
ITEM	PART NUMBER	DESCRIPTION	QTY
43	59402-71	PISTON ASSEMBLY	1
44	29703-71	BEARING	1
45	29744-71	CUP SEAL	1
46	28530-71	CAP, HYD, M-36	1
47	28142	SPACER	1
48	568910-9	O-RING	1
49	28136-3	FITTING, INLET	1
50	28082	SPRING	1
51	26685	SPRING	1
52	28083-2	SHANK	1
53	28083-1	RING	1
54	28081-3	SEAT	1
55	26130-8	BALL	1



DETAIL X
(MS-110)

MS-110 PARTS LIST, (Cont.)			
ITEM	PART NUMBER	DESCRIPTION	QTY
43	59402-110	PLUNGER ASSY, MS	1
44	29703-110	BEARING	1
45	29744-110	CUP SEAL	1
46	28530-110	CAP, HYD, M, 110	1
47	28143	SPACER	1
48	568910-9	O-RING	1
49	28136-3	FITTING, INLET	1
50	28082	SPRING	1
51	26685	SPRING	1
52	28083-2	SHANK	1
53	28083-1	RING	1
54	28081-3	SEAT	1
55	26130-8	BALL	1



DETAIL X
(MS-188)

MS-188 PARTS LIST, (Cont.)			
ITEM	PART NUMBER	DESCRIPTION	QTY
43	59402-188	PISTON ASSEMBLY	1
44	29703-188	BEARING	1
45	29744-188	CUP SEAL	1
46	28530-188	CAP, HYD, M, 188	1
47	28144	SPACER	1
48	568910-9	O-RING	1
49	28136-3	FITTING, INLET	1
50	28082	SPRING	1
51	26685	SPRING	1
52	28083-2	SHANK	1
53	28083-1	RING	1
54	28081-3	SEAT	1
55	26130-8	BALL	1

Haskel International, Inc. Burbank, California 91503		SIZE	CAGE CODE	DWG NO.	REV
DRAWN	S.R.	D	81400	28560-TAB	L
CHECKED	R.L.	SCALE: NA	INVENTOR DRAWING	SHEET 2 OF 2	

82367-TAB

REVISIONS			
REV	DESCRIPTION	DATE	CHECKED
A	RELEASED PER ECO 25823	11/12/05	CMV

82367

THIS MODIFIES ANY 29723-XXX OR MCPV-XXX LIQUID PUMP
FOR STAINLESS STEEL TRIM

DELETE			REPLACE WITH		
PART NUMBER	DESCRIPTION	QTY	PART NUMBER	DESCRIPTION	QTY
29373	BRACKET	2	80184	BRACKET	2
17187-10	BOLT	4	17187-10-8	BOLT	4
CNF00021	WASHER	4	AN960-C416	WASHER	4
28066	RETAINING PLATE	1	28066-4	RETAINING PLATE	1
17196	SCREW	2	17196-6	SCREW	2
CNF00026	LOCKWASHER	4	CNF00279	LOCKWASHER	4
17196-4	SCREW	2	17196-7	SCREW	2
17188	NUT	4	17188-8	NUT	4

82367-2

THIS MODIFIES ANY M SERIES LIQUID PUMP
FOR STAINLESS STEEL TRIM

DELETE			REPLACE WITH		
PART NUMBER	DESCRIPTION	QTY	PART NUMBER	DESCRIPTION	QTY
29373	BRACKET	2	80184	BRACKET	2
17187	BOLT	4	17187-X-8	BOLT	4
CNF00021	WASHER	4	AN960-C416	WASHER	4
28066	RETAINING PLATE	1	28066-4	RETAINING PLATE	1
17196	SCREW	2	17196-6	SCREW	2
CNF00026	LOCKWASHER	4	CNF00279	LOCKWASHER	4
17196-4	SCREW	2	17196-7	SCREW	2
17188	NUT	4	17188-8	NUT	4

NEXT ASSY (REF ONLY)

APPROVALS	DATE
DRAWN V VU	1/10/05
CHECKED CMV	11/12/05
APPROVED SA	11/14/05
CAD FILE NAME 82367-TAB	

Haskel MILTON ROY
Haskel International, Inc.
Burbank, California 91502

TITLE: STAINLESS STEEL TRIM & SOUR GAS MOD
29723 & MCPV & M SERIES PUMPS

SIZE	FSCM NO.	DWG NO.	REV
B	81400	82367-TAB	A

SCALE N/A | NO MANUAL REVISIONS ALLOWED | SHEET 1 OF 1

REV A 10/27/2004 ECO 25659

TRONAIR®

APPENDIX III

HC-2490
Hand Pump Parts List

Model: HC-2490
3250 psi Hand Pump

***

Parts List
With Illustrations

07/2012 – Rev. 01

Tronair, Inc.
1 Air Cargo Pkwy East
Swanton, OH 43558

Phone: (419) 866-6301 | 800-426-6301
Web: www.tronair.com
Email: sales@tronair.com

This product can not be modified without the written approval of Tronair, Inc. Any modifications done without written approval voids all warranties and releases Tronair, Inc., its suppliers, distributors, employees, or financial institutions from any liability from consequences that may occur. Only Tronair OEM replacement parts shall be used.

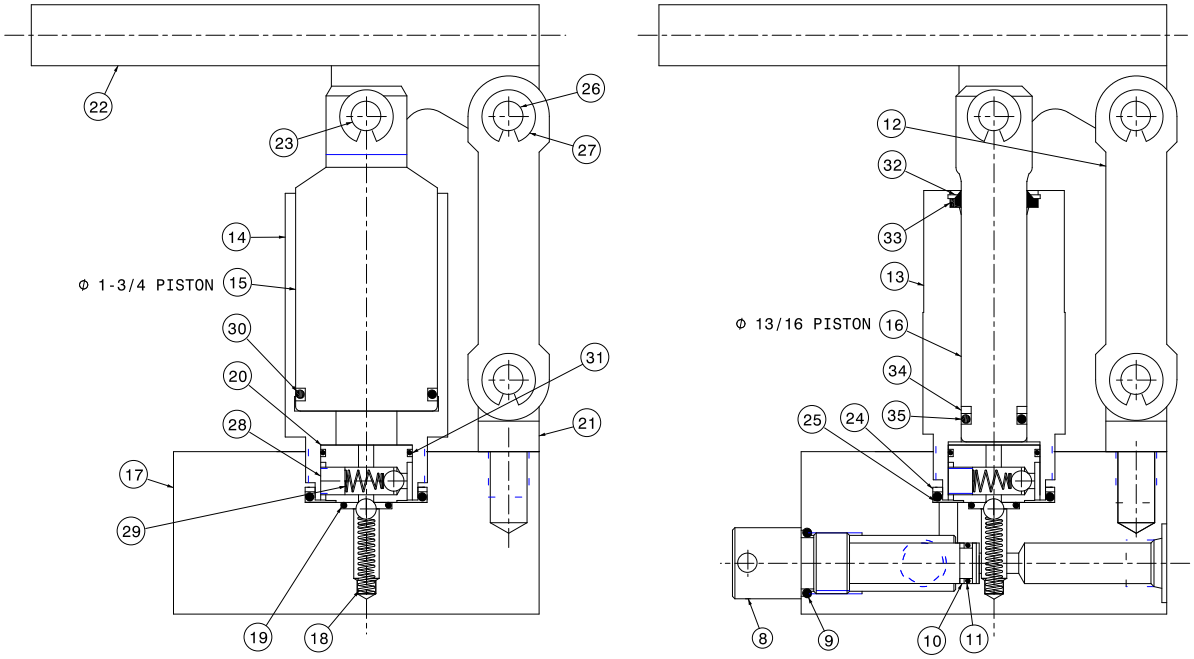
This pump is compatible with MIL-PRF-5606/MIL-PRF-83282 Hydraulic Fluids only.

INSTALLATION INSTRUCTIONS:

1. Inspect all parts. Replace all worn or otherwise defective parts.
2. Clean all parts prior to re-assembly.
3. Lubricate all O-rings with O-ring lubricant grease prior to installation.

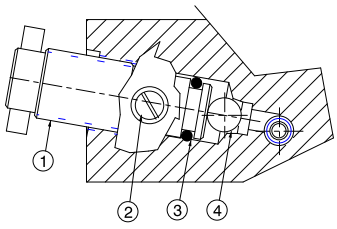
Parts List

When ordering Replacement Parts/Kits, please specify Model and Serial Number of your Unit.



SECTION A-A

SECTION B-B



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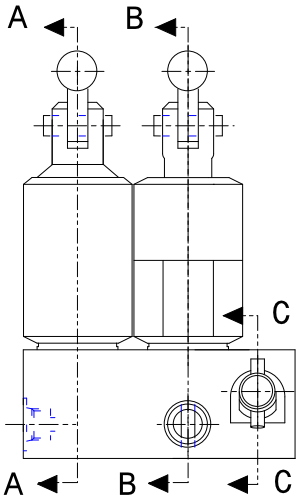

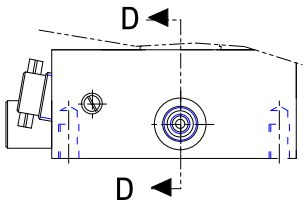

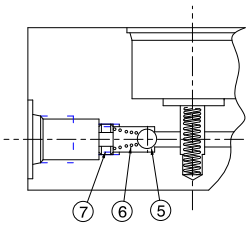

SECTION D-D

WARNING!

Item 21 (H-3534) is a preset relief valve. Do Not disassemble this valve. Replacement parts are available as a preset relief valve assembly

Parts List

When ordering Replacement Parts/Kits, please specify Model and Serial Number of your Unit.

Item	Part Number	Description	Qty
17	Not Sold Separately	Pump Body	1
7		Screw, Lock (apply Loctite #423 blue)	4
21	H-3534	Assembly, Relief Screw	1
NS	TR-2189	Handle, Pump	1
	K-4674	**Kit, Linkage Replacement**; *consists of:*	
12		Strap with Bushing	2
21		Pivot	1
22		Bracket, Pump Handle	1
23		Pin, Pivot	1
26		Pin, Pivot	2
27		Ring, Retaining	6
	K-4675	**Kit, 1 ¾ Piston/Cylinder Replacement**; *consists of:*	
14		Tube	1
15		Piston	1
19		O-ring, Outlet Check Ball	1
20		Assembly, Valve Body (Includes Items 5, 28, 29)	1
24		Ring, Tube Back-Up	1
25		O-ring, Tube	1
30		O-ring, Piston	1
31		O-ring, Valve Body	1
	K-4676	**Kit, 1 ¾ Piston/Seal Replacement**; *consists of:*	
15		Piston	1
30		O-ring, Piston	1
	K-4677	**Kit, 13/16 Piston/Cylinder Replacement**; *consists of:*	
13		Tube	1
16		Piston	1
19		O-ring, Outlet Check Ball	1
20		Assembly, Valve Body (Includes Items 5, 28, 29)	1
24		Ring, Tube Back-Up	1
25		O-ring, Tube	1
31		O-ring, Valve Body	1
32		Ring, Retainer	1
33		Wiper, Piston	1
34		Ring, Piston Backup	1
35		O-ring, Piston	1
	K-4678	**Kit, 13/16 Piston/Seal Replacement**; *consists of:*	
16		Piston	1
22		Ring, Retainer	1
33		Wiper, Piston	1
34		Ring, Backup	1
35		O-ring, Piston	1

Parts List

When ordering Replacement Parts/Kits, please specify Model and Serial Number of your Unit.

Item	Part Number	Description	Qty
	K-4679	**Kit, Seal Replacement**; *consists of:*	
3		O-ring, Release Screw	1
9		O-ring, Relief Screw	1
10		O-ring, Relief Screw	1
11		Ring, Screw Backup Relief	1
19		O-ring, Outlet Check	2
24		Ring, Tube Back-Up	2
25		O-ring, Tube	2
30		O-ring, Piston	1
31		O-ring, Valve Body	2
33		Wiper, Piston	1
34		Ring, Backup	1
35		O-ring, Piston	1
	K-4680	**Kit, Internal Parts Replacement**; *consists of:*	
5		Ball, Check	5
6		Spring, Inlet Check	1
18		Spring, Outlet Check	2
29		Spring, Inlet Check	2
	K-4681	**Kit, Release Screw Replacement**; *consists of:*	
1		Screw, Release	1
2		Retainer, Screw	1
3		O-ring	1
4		Ball, Check	1

TRONAIR®

APPENDIX IV

Declaration of Conformity

DECLARATION of CONFORMITY

The design, development and manufacture is in accordance with European Community guidelines

Tripod Jack
02A7887C9100

Relevant provisions complied with by the machinery:
2006/42/EC

Relevant standards complied with by the machinery:
EN ISO 12100-1

Identification of person empowered to sign on behalf of the manufacturer:

Patrick Finch

Quality Assurance Representative

1740 Eber Rd
Holland, OH 43528-9794
USA

Tronair, Inc.
www.tronair.com
Email: sales@tronair.com

Phone: (419) 866-6301
800-426-6301
Fax: (419) 867-0634

APPENDIX V

Safety Data Sheet
MIL-PRF-83282 Hydraulic Fluid

SAFETY DATA SHEET

Section 1. Identification

Product name Brayco Micronic 882

SDS # 451700

Historic SDS #: 27009

Code 451700-US03

Relevant identified uses of the substance or mixture and uses advised against

Product use Hydraulic fluid
For specific application advice see appropriate Technical Data Sheet or consult our company representative.

Supplier

Castrol Industrial North America, Inc.
150 W. Warrenville Road
Naperville, IL 60563
Product Information: +1-877-641-1600

BP Lubricants USA Inc.
1500 Valley Road
Wayne, NJ 07470
Telephone: (973) 633-2200

EMERGENCY SPILL INFORMATION: 1 (800) 424-9300 CHEMTREC (USA)

Section 2. Hazards identification

OSHA/HCS status This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms

Signal word Danger

Hazard statements May be fatal if swallowed and enters airways.

Precautionary statements

Prevention Not applicable.

Response IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting.

Storage Store locked up.

Disposal Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified Defatting to the skin.
Note: High Pressure Applications
Injections through the skin resulting from contact with the product at high pressure constitute a major medical emergency.
See 'Notes to physician' under First-Aid Measures, Section 4 of this Safety Data Sheet.

Section 3. Composition/information on ingredients

Substance/mixture Mixture

Synthetic lubricant and additives.

Ingredient name	CAS number	%
1-Decene, homopolymer, hydrogenated	68037-01-4	≥50 - ≤75

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Check for and remove any contact lenses. Get medical attention.

Skin contact Wash skin thoroughly with soap and water or use recognized skin cleanser. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if symptoms occur.

Inhalation If inhaled, remove to fresh air. Get medical attention if symptoms occur.

Ingestion Do not induce vomiting. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Aspiration hazard if swallowed. Can enter lungs and cause damage. Get medical attention immediately.

Protection of first-aiders No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Most important symptoms/effects, acute and delayed

See Section 11 for more detailed information on health effects and symptoms.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician Treatment should in general be symptomatic and directed to relieving any effects. Product can be aspirated on swallowing or following regurgitation of stomach contents, and can cause severe and potentially fatal chemical pneumonitis, which will require urgent treatment. Because of the risk of aspiration, induction of vomiting and gastric lavage should be avoided. Gastric lavage should be undertaken only after endotracheal intubation. Monitor for cardiac dysrhythmias.

Note: High Pressure Applications
Injections through the skin resulting from contact with the product at high pressure constitute a major medical emergency. Injuries may not appear serious at first but within a few hours tissue becomes swollen, discolored and extremely painful with extensive subcutaneous necrosis.
Surgical exploration should be undertaken without delay. Thorough and extensive debridement of the wound and underlying tissue is necessary to minimize tissue loss and prevent or limit permanent damage. Note that high pressure may force the product considerable distances along tissue planes.

Specific treatments No specific treatment.

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media In case of fire, use foam, dry chemical or carbon dioxide extinguisher or spray.

Unsuitable extinguishing media Do not use water jet.

Section 5. Fire-fighting measures

Specific hazards arising from the chemical

In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous combustion products

Combustion products may include the following:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters

Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters

Fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Put on appropriate personal protective equipment. Floors may be slippery; use care to avoid falling. Contact emergency personnel.

For emergency responders

Entry into a confined space or poorly ventilated area contaminated with vapor, mist or fume is extremely hazardous without the correct respiratory protective equipment and a safe system of work. Wear self-contained breathing apparatus. Wear a suitable chemical protective suit. Chemical resistant boots. See also the information in "For non-emergency personnel".

Environmental precautions

Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill

Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill

Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. Contaminated absorbent material may pose the same hazard as the spilled product. Dispose of via a licensed waste disposal contractor.

Section 7. Handling and storage

Precautions for safe handling

Protective measures

Put on appropriate personal protective equipment (see Section 8). Avoid breathing vapor or mist. Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Do not reuse container. Do not swallow. Aspiration hazard if swallowed. Can enter lungs and cause damage. Never siphon by mouth.

Advice on general occupational hygiene

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Wash thoroughly after handling. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Keep container tightly closed and sealed until ready for use. Store and use only in equipment/containers designed for use with this product. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

1-Decene, homopolymer, hydrogenated	None.

Appropriate engineering controls

All activities involving chemicals should be assessed for their risks to health, to ensure exposures are adequately controlled. Personal protective equipment should only be considered after other forms of control measures (e.g. engineering controls) have been suitably evaluated. Personal protective equipment should conform to appropriate standards, be suitable for use, be kept in good condition and properly maintained.
Your supplier of personal protective equipment should be consulted for advice on selection and appropriate standards. For further information contact your national organisation for standards.
Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits.
The final choice of protective equipment will depend upon a risk assessment. It is important to ensure that all items of personal protective equipment are compatible.

Environmental exposure controls

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.
Appropriate techniques should be used to remove potentially contaminated clothing.
Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection

Safety glasses with side shields.

Skin protection

Hand protection

Wear protective gloves if prolonged or repeated contact is likely. Wear chemical resistant gloves. Recommended: Nitrile gloves. The correct choice of protective gloves depends upon the chemicals being handled, the conditions of work and use, and the condition of the gloves (even the best chemically resistant glove will break down after repeated chemical exposures). Most gloves provide only a short time of protection before they must be discarded and replaced. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Gloves should therefore be chosen in consultation with the supplier/ manufacturer and with a full assessment of the working conditions.

Body protection

Use of protective clothing is good industrial practice.
Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required.
Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection

Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls/personal protection

Respiratory protection

In case of insufficient ventilation, wear suitable respiratory equipment.
The correct choice of respiratory protection depends upon the chemicals being handled, the conditions of work and use, and the condition of the respiratory equipment. Safety procedures should be developed for each intended application. Respiratory protection equipment should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions.

Section 9. Physical and chemical properties

Appearance

Physical state	Liquid.
Color	Red. [Dark]
Odor	Mild.
Odor threshold	Not available.
pH	Not available.
Melting point	Not available.
Boiling point	Not available.
Flash point	Open cup: 205°C (401°F) [Cleveland.]
Pour point	-55 °C
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable. Based on - Physical state
Lower and upper explosive (flammable) limits	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Density	<1000 kg/m³ (<1 g/cm³) at 15°C
Solubility	insoluble in water.
Partition coefficient: n-octanol/water	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Kinematic: 14 mm^2/s (14 cSt) at 40°C

Section 10. Stability and reactivity

Reactivity

No specific test data available for this product. Refer to Conditions to avoid and Incompatible materials for additional information.

Chemical stability

The product is stable.

Possibility of hazardous reactions

Under normal conditions of storage and use, hazardous reactions will not occur.
Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid

No specific data.

Incompatible materials

Reactive or incompatible with the following materials: oxidizing materials.

Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Aspiration hazard

Name	Result
1-Decene, homopolymer, hydrogenated	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure Routes of entry anticipated: Dermal, Inhalation.

Potential acute health effects

Eye contact No known significant effects or critical hazards.

Skin contact No known significant effects or critical hazards.

Inhalation Vapor inhalation under ambient conditions is not normally a problem due to low vapor pressure.

Ingestion Aspiration hazard if swallowed -- harmful or fatal if liquid is aspirated into lungs.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact No specific data.

Skin contact Adverse symptoms may include the following:
irritation
dryness
cracking

Inhalation No specific data.

Ingestion Adverse symptoms may include the following:
nausea or vomiting

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects Not available.

Potential delayed effects Not available.

Long term exposure

Potential immediate effects Not available.

Potential delayed effects Not available.

Potential chronic health effects

General No known significant effects or critical hazards.

Carcinogenicity No known significant effects or critical hazards.

Mutagenicity No known significant effects or critical hazards.

Teratogenicity No known significant effects or critical hazards.

Developmental effects No known significant effects or critical hazards.

Fertility effects No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

No testing has been performed by the manufacturer.

Persistence and degradability

Not expected to be rapidly degradable.

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{OC})	Not available.
Mobility	Non-volatile.Liquid.insoluble in water.

Other adverse effects No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods The generation of waste should be avoided or minimized wherever possible. Significant quantities of waste product residues should not be disposed of via the foul sewer but processed in a suitable effluent treatment plant. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	TDG Classification	IMDG	IATA
UN number	Not regulated.	Not regulated.	Not regulated.	Not regulated.
UN proper shipping name	-	-	-	-
Transport hazard class(es)	-	-	-	-
Packing group	-	-	-	-
Environmental hazards	No.	No.	No.	No.
Additional information	-	-	-	-

Special precautions for user Not available.

Transport in bulk according to Annex II of MARPOL and the IBC Code Not available.

Section 15. Regulatory information

U.S. Federal regulations

United States inventory (TSCA 8b): All components are listed or exempted.

TSCA 12(b) one-time export: 2,2',6,6'-tetra-tert-butyl-4,4'-methylenediphenol

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 311/312

Classification: Not applicable.

SARA 313

Form R - Reporting requirements: This product does not contain any hazardous ingredients at or above regulated thresholds.

Supplier notification: This product does not contain any hazardous ingredients at or above regulated thresholds.

State regulations

Massachusetts: None of the components are listed.

New Jersey: None of the components are listed.

Pennsylvania: None of the components are listed.

California Prop. 65: No products were found.

Other regulations

Australia inventory (AICS): All components are listed or exempted.

Canada inventory: All components are listed or exempted.

China inventory (IECSC): All components are listed or exempted.

Japan inventory (ENCS): All components are listed or exempted.

Korea inventory (KECI): All components are listed or exempted.

Philippines inventory (PICCS): All components are listed or exempted.

Taiwan Chemical Substances Inventory (TCSI): Not determined.

REACH Status: The company, as identified in Section 1, sells this product in the EU in compliance with the current requirements of REACH.

Section 16. Other information

National Fire Protection Association (U.S.A.)

History

Date of issue/Date of revision: 03/27/2017.

Date of previous issue: 11/22/2016.

Prepared by: Product Stewardship

Key to abbreviations

ACGIH = American Conference of Industrial Hygienists
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
CAS Number = Chemical Abstracts Service Registry Number
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container

Section 16. Other information

IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
OEL = Occupational Exposure Limit
SDS = Safety Data Sheet
STEL = Short term exposure limit
TWA = Time weighted average
UN = United Nations
UN Number = United Nations Number, a four digit number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods.
Varies = may contain one or more of the following 101316-69-2, 101316-70-5, 101316-71-6, 101316-72-7, 64741-88-4, 64741-89-5, 64741-95-3, 64741-96-4, 64741-97-5, 64742-01-4, 64742-44-5, 64742-45-6, 64742-52-5, 64742-53-6, 64742-54-7, 64742-55-8, 64742-56-9, 64742-57-0, 64742-58-1, 64742-62-7, 64742-63-8, 64742-64-9, 64742-65-0, 64742-70-7, 72623-85-9, 72623-86-0, 72623-87-1, 74869-22-0, 90669-74-2

Indicates information that has changed from previously issued version.

Notice to reader

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from BP Group.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken. You can contact the BP Group to ensure that this document is the most current available. Alteration of this document is strictly prohibited.

APPENDIX VI

Maintenance Schedule

TRONAIR®

Maintenance Schedule

Multi-Stage Tripod Jacks

Tronair recommends performing preventative maintenance on all jacks,
which should include a 90-day routine inspection and a 12-month load test.

Model Number _____ **Serial Number** _____

Maintenance Performed By _____ **Date** _____

90-Day Maintenance:

- ❑ Check hydraulic system for leaks including the following:
  - Hydraulic lines; hoses and fittings
  - Hand pump; cylinder, fittings and seals
  - Reservoir; welds and fittings
  - Air operated pump (optional equipment); fittings, air side and oil side seals
- ❑ Check jack structure for corrosion, bending, cracking and excessive wear including the following:
  - Ball lock pins
  - Mechanical extension
  - Welded joints; tripod legs, cylinder and foot pads
  - Ram retaining rings
  - Ram lock nuts; gouge marks and cracks in threads
  - Jack pads
- ❑ Check fluid level with rams fully retracted. See manual or reservoir tag for proper level height
- ❑ Extend rams and visually inspect for corrosion, foreign matter, excessive wear and leaks around ram seals. Remove any foreign matter
- ❑ Check air operated pump if equipped (reference air operated pump service manual).
- ❑ Check paint condition, touch-up areas that are exposed
- ❑ Actuate the hand pump and raise the ram to full extension at least once with a minimum weight of 50 lbs applied.
  Do not pressurize hydraulic system once fully extended
  Do not allow jack to miss-stage when raising the rams to full extension
- ❑ Extend rams and visually inspect for corrosion, foreign matter, excessive wear and leaks around ram seals. Remove any foreign matter
- ❑ Apply DoAll, RPM, LPS or equivalent water repellant that is Buna N compatible to the rams
- ❑ Open release valve and verify that rams fully retract
- ❑ Lubricate casters (if applicable)

Annual (12-Month) Maintenance:

- ❑ Check hydraulic fluid for contamination (dirt/water) drain and flush if required
- ❑ Perform 90-day maintenance checklist
- ❑ Capacity test (105% - 110% of jack's rated capacity)

NOTE: The jack may be returned to Tronair for load testing, or sent to a local hydraulic repair shop. Please contact Tronair to obtain a "Return Material Authorization Number" (RMA #) before sending any product to Tronair.