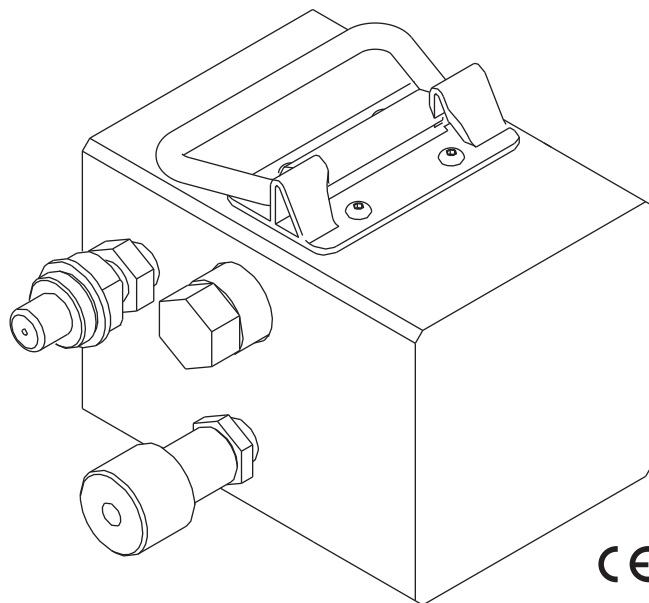


# INSTRUCTION MANUAL



## HB10 Dynapress<sup>®</sup> Hydraulic Booster

Serial Code GBL



**Read and understand** all of the instructions and safety information in this manual before operating or servicing this unit.

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## Description

The Greenlee Utility HB10 Dynapress® Hydraulic Booster is a piston-type accessory intended to allow the use of a high pressure/low flow tool with a low pressure/high flow hydraulic power source. Compatible with either open-center or closed-center hydraulic systems, the unit takes a hydraulic input of 69 to 152 bar (1000 to 2200 psi) and produces a stable output of 700 bar (10,000 psi).

The HB10 can be installed in existing two-hose type hydraulic systems, and does not require a third hydraulic line or separate reservoir. The compact and light-weight design allows the unit to be easily carried and used on the ground or in an aerial lift basket. Actuating the high-pressure circuit of the Dynapress® booster requires a remote control valve, purchased separately. The instructions and illustrations in this manual reflect using the HB10 with either of the following Greenlee Utility remote control valves:

- PVA0021A Single-Acting Control Valve
- PVA0022A Double-Acting Control Valve

The terms “**unit**” and “**booster**,” when used in this manual, refer to the HB10. The term “**tool**” refers to the device (cable cutter, crimping tool, etc) that is powered by the HB10.

## Safety

Safety is essential in the use and maintenance of Greenlee Utility tools and equipment. This instruction manual and any markings on the unit provide information for avoiding hazards and unsafe practices related to the use of this unit. Observe all of the safety information provided.

## Purpose of this Manual

This instruction manual is intended to familiarize all personnel with the safe operation and maintenance procedures for the Greenlee Utility HB10 Dynapress® Hydraulic Booster.

Keep this manual available to all personnel.


Replacement manuals are available upon request at no charge.


All specifications are nominal and may change as design improvements occur. Greenlee Textron Inc. shall not be liable for damages resulting from misapplication or misuse of its products. Dynapress is a registered trademark of Greenlee Textron Inc.

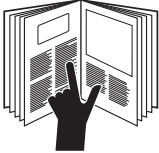
# KEEP THIS MANUAL


## IMPORTANT SAFETY INFORMATION

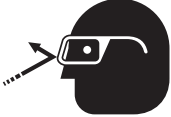
	<h3>SAFETY ALERT SYMBOL</h3>
<p>This symbol is used to call your attention to hazards or unsafe practices which could result in an injury or property damage. The signal word, defined below, indicates the severity of the hazard. The message after the signal word provides information for preventing or avoiding the hazard.</p>	
<h3>⚠ DANGER</h3>	
<p>Immediate hazards which, if not avoided, <b>WILL</b> result in severe injury or death.</p>	
<h3>⚠ WARNING</h3>	
<p>Hazards which, if not avoided, <b>COULD</b> result in severe injury or death.</p>	
<h3>⚠ CAUTION</h3>	
<p>Hazards or unsafe practices which, if not avoided, <b>MAY</b> result in injury or property damage.</p>	

	<h3>⚠ WARNING</h3>
<p>Electric shock hazard: This booster is not insulated. When using this unit near energized electrical lines:</p> <ul style="list-style-type: none"> <li>• Use only certified non-conductive hoses and proper personal protective equipment.</li> <li>• Select and maintain the hydraulic fluid to meet the minimum dielectric standards required by your safety department.</li> </ul> <p>Failure to observe this warning could result in severe injury or death.</p>	

	<h3>⚠ WARNING</h3>
<p>Skin injection hazard:</p> <ul style="list-style-type: none"> <li>• Do not use hands to check for leaks.</li> <li>• Do not hold hose or couplers while the hydraulic system is pressurized.</li> <li>• Depressurize the hydraulic system before servicing.</li> </ul> <p>Oil under pressure easily punctures skin causing serious injury, gangrene or death. If you are injured by escaping oil, seek medical attention immediately.</p>	

	<h3>⚠ WARNING</h3>
<p>Read and understand all of the instructions and safety information in this manual before operating or servicing this unit.</p> <p>Failure to observe this warning could result in severe injury or death.</p>	

	<h3>⚠ WARNING</h3>
<p>Booster may be hot during and after operation. Allow unit to cool before handling, or handle with heat-resistant gloves.</p> <p>Hot surfaces could cause severe burns.</p>	

	<h3>⚠ WARNING</h3>
<p>Wear eye protection when operating or servicing this unit.</p> <p>Failure to wear eye protection could result in serious eye injury from flying debris or hydraulic oil.</p>	

## IMPORTANT SAFETY INFORMATION

### ⚠ WARNING

Do not exceed the following hydraulic power source maximums:

- Hydraulic flow: 30.3 l/min (8 gpm)
- Pressure relief setting: 148 bar (2150 psi)
- Back pressure: 13.8 bar (200 psi)

Failure to observe this warning could result in severe injury or death.

### ⚠ WARNING

Do not disconnect booster, hoses, or fittings while the power source is running or if the hydraulic fluid is hot. Hot hydraulic fluid could cause serious burns.

### ⚠ WARNING

Do not reverse hydraulic flow. Operation with hydraulic flow reversed can cause a malfunction. Connect the pressure (supply) hose and tank (return) hose to the proper ports.

Failure to observe this warning could result in severe injury or death.

### ⚠ WARNING

- Inspect the hydraulic hoses and couplings every operating day. Repair or replace if leakage, cracking, wear, or damage is evident. Damaged hoses or couplings can fail, resulting in injury or property damage.
- Make sure all bystanders are clear of the work area when handling, starting and operating tool. Nearby personnel can be injured by flying or falling debris or by flying parts in the event of a malfunction.

Failure to observe these warnings could result in severe injury or death.

### ⚠ CAUTION

Inspect unit before operating. Replace any worn, damaged or missing components with Greenlee Utility replacement parts. A damaged or improperly assembled component can fail and strike nearby personnel.

Failure to observe this precaution may result in severe injury or death.

### ⚠ CAUTION

Use this unit for manufacturer's intended purpose only. Use other than that which is described in this manual can result in injury or property damage.

Failure to observe this precaution may result in injury or property damage.

### ⚠ CAUTION

Hydraulic oil can cause skin irritation.

- Handle the booster and hoses with care to prevent skin contact with hydraulic oil.
- In case of accidental skin contact with hydraulic oil, wash the affected area immediately to remove the oil.

Failure to observe these precautions may result in injury.

### IMPORTANT

Procedure for connecting or disconnecting hydraulic hoses, fittings, or components:

1. Move the flow lever on the hydraulic power source to the OFF position.
2. Stop the hydraulic power source.
3. Follow the sequence under "Hose Connections" to prevent pressure buildup. In case some pressure has built up, loosen hoses, fittings, or components slowly.

### IMPORTANT

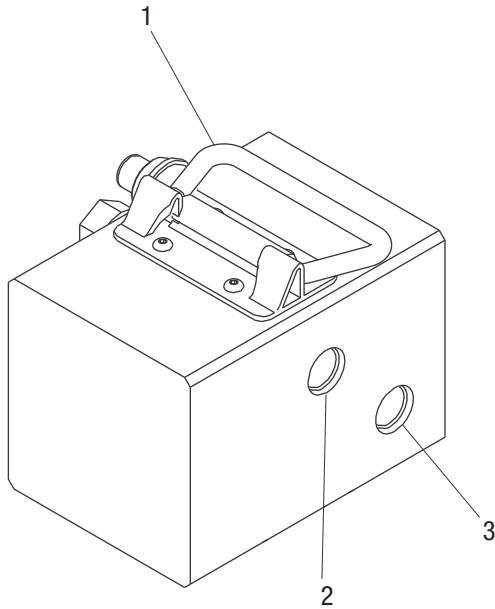
Emergency stop procedure:

1. Move the remote control valve's lever to the neutral position.
2. Move the flow lever on the hydraulic power source to the OFF position.

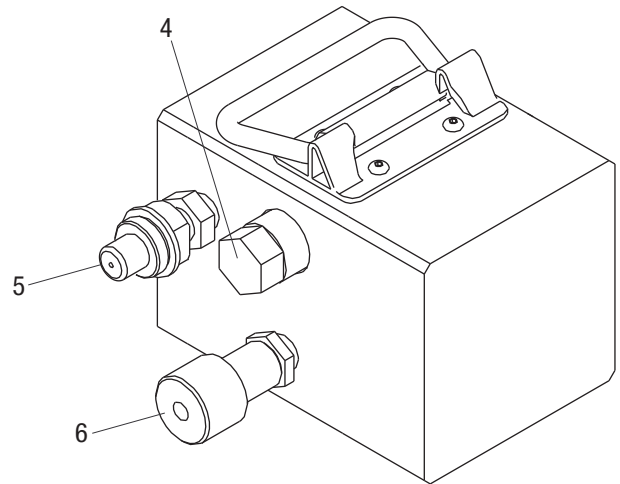
*Note: Keep all decals clean and legible, and replace when necessary.*

*When disposing of any components (hydraulic hoses, hydraulic fluid, worn parts, etc.), do so in accordance with federal, state, and local laws or ordinances.*

**Identification**



**Input Side**  
69 to 152 bar  
(1000 to 2200 psi)



**Output Side**  
700 bar (10,000 psi)

**HB10 Dynapress® Hydraulic Booster**

- |                             |                              |
|-----------------------------|------------------------------|
| 1. Handle                   | 4. Unloading Valve           |
| 2. Input Side Pressure Port | 5. Output Side Tank Port     |
| 3. Input Side Tank Port     | 6. Output Side Pressure Port |

## Specifications

### HB10

Type of Hydraulic System.....Open-center or closed-center

#### Hydraulic Ports and Couplers

##### Power Source (low pressure) Ports

Pressure ..... 3/4–16 SAE O-ring Boss  
 Tank ..... 3/4–16 SAE O-ring Boss

##### Tool (high pressure) Couplers

Pressure ..... 1/4–18 NPTF (Parker #3050-2)  
 Tank ..... 1/4–18 NPTF (Parker #3010-2)

Input Pressure ..... 69 to 152 bar (1000 to 2200 psi)

Output Pressure ..... 700 bar (10,000 psi)

Noise Level (at operator's position) ..... < 85 dB (A)

Mass/Weight..... 4.7 kg (10.3 lb)

#### Width

Housing Only.....102 mm (4")  
 Housing and Couplers ..... 159 mm (6.25")

Height (handle folded) ..... 114 mm (4.5")

### Hydraulic Power Source

## ⚠ WARNING

Do not exceed the following hydraulic power source maximums:

- Hydraulic flow: 30.3 l/min (8 gpm)
- Pressure relief setting: 148 bar (2150 psi)
- Back pressure: 13.8 bar (200 psi)

Failure to observe this warning could result in severe injury or death.

Type of Hydraulic System.....Open-center or closed-center

#### Flow

Minimum ..... 15.1 l/min (4 gpm)  
 Recommended..... 22.7 l/min (6 gpm)  
 Maximum ..... 30.3 l/min (8 gpm)

Pressure Relief Setting ..... 148 bar (2150 psi)

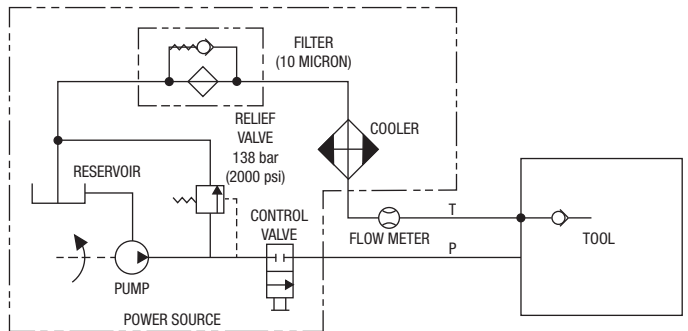
Back Pressure (maximum)\* ..... 13.8 bar (200 psi)

Filtration.....10 Micron (nominal)

\* 13.8 bar (200 psi) is the maximum agreed standard back pressure for the HTMA (Hydraulic Tool Manufacturers Association). Greenlee Utility tool will operate satisfactorily at this standard.

1. Maximum hydraulic fluid temperature must not exceed 60 °C (140 °F). A sufficient oil cooling capacity is needed to limit the hydraulic fluid temperature.
2. Hydraulic flow must not exceed 30.3 l/min (8 gpm). Install a flow meter in the return line to measure to rate of hydraulic flow before using the unit.
3. Pressure relief valve setting must not exceed 148 bar (2150 psi) at your tool's maximum flow. Locate the pressure relief valve in the supply circuit to limit excessive hydraulic pressure to the booster.

### Hydraulic Schematic



### Recommended Hydraulic Fluids

Use any non-detergent, petroleum-based hydraulic fluid which meets the following specifications or HTMA specifications.

#### S.U.S. @

38 °C (100 °F).....	140 to 225
99 °C (210 °F).....	40 minimum
Flash Point.....	170 °C (340 °F) minimum
Pour Point.....	-34 °C (-30 °F) minimum

## Hose Connections

### Connecting Hoses

Use this procedure to prevent pressure buildup in the hydraulic circuit:

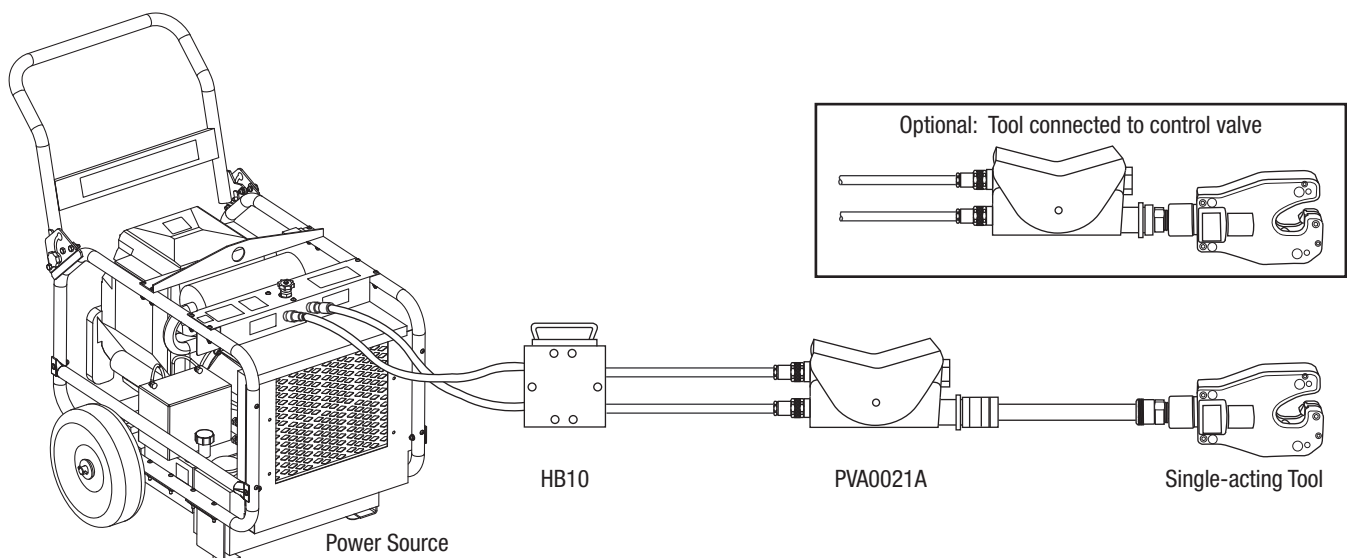
1. Move the flow lever on the hydraulic power source to the OFF position.
2. Stop the hydraulic power source.
3. Connect high-pressure hoses to the high-pressure ports as follows:
  - **return (tank) hose:** remote control valve to booster
  - **supply (pressure) hose:** remote control valve to booster
  - **return (tank):** remote control valve to tool (This step applies to double-acting tool and control valve only.)
  - **supply (pressure) hose:** remote control valve to tool
4. Connect the low-pressure hoses to the low-pressure ports as follows:
  - **return (tank) hose:** booster to power source
  - **supply (pressure) hose:** power source to booster

### Disconnecting Hoses


Use this procedure to prevent pressure buildup in the hydraulic circuit:

1. Move the flow lever on the hydraulic power source to the OFF position.
2. Stop the hydraulic power source.
3. Disconnect the hoses in reverse order of the connection sequence.
4. Install dust caps to prevent contamination.


## Typical Setup

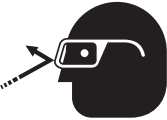


## Operation

	<b>⚠ WARNING</b>
	<p>Electric shock hazard:</p> <p>This booster is not insulated. When using this unit near energized electrical lines:</p> <ul style="list-style-type: none"> <li>• Use only certified non-conductive hoses and proper personal protective equipment.</li> <li>• Select and maintain the hydraulic fluid to meet the minimum dielectric standards required by your safety department.</li> </ul> <p>Failure to observe this warning could result in severe injury or death.</p>

1. Start the hydraulic power source.  
*Note: Allow the power source to run for a few minutes to warm the hydraulic fluid.*
2. To actuate the tool, press down and hold the lever in the ADVANCE position.
  - When the pressure exceeds approximately 207 bar (3000 psi), the operator may release the control lever. The lever will remain in the ADVANCE position.
  - When the pressure reaches the relief setting of the unloading valve – 700 bar (10,000 psi) – the high pressure oil will dump back to tank and the system pressure will drop to nearly zero. The operator can then release the remote control lever back to the neutral position.
3. To return or retract the ram, press down and hold the lever in the RETRACT position.


	<b>⚠ WARNING</b>
	<p>Skin injection hazard:</p> <ul style="list-style-type: none"> <li>• Do not use hands to check for leaks.</li> <li>• Do not hold hose or couplers while the hydraulic system is pressurized.</li> <li>• Depressurize the hydraulic system before servicing.</li> </ul> <p>Oil under pressure easily punctures skin causing serious injury, gangrene or death. If you are injured by escaping oil, seek medical attention immediately.</p>

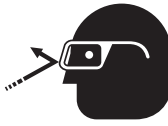
	<b>⚠ WARNING</b>
	<p>Wear eye protection when operating or servicing this unit.</p> <p>Failure to wear eye protection could result in serious eye injury from flying debris or hydraulic oil.</p>

<b>⚠ WARNING</b>
<p>Read and understand all of the instructions and safety information supplied with the tool.</p> <p>Failure to observe this warning could result in severe injury or death.</p>



## Maintenance

	<b>⚠ WARNING</b>
	<p>Skin injection hazard:</p> <ul style="list-style-type: none"> <li>• Do not use hands to check for leaks.</li> <li>• Do not hold hose or couplers while the hydraulic system is pressurized.</li> <li>• Depressurize the hydraulic system before servicing.</li> </ul> <p>Oil under pressure easily punctures skin causing serious injury, gangrene or death. If you are injured by escaping oil, seek medical attention immediately.</p>

	<b>⚠ WARNING</b>
	<p>Wear eye protection when operating or servicing this unit.</p> <p>Failure to wear eye protection could result in serious eye injury from flying debris or hydraulic oil.</p>

*Note: Keep all decals clean and legible, and replace when necessary.*

*When disposing of any components (hydraulic hoses, hydraulic fluid, worn parts, etc.), do so in accordance with federal, state, and local laws or ordinances.*

### Daily

1. Wipe all booster surfaces clean.
2. Inspect the hydraulic hoses and fittings for signs of leaks, cracks, wear or damage. Replace if necessary.
3. Install dust caps when the unit is disconnected.

### Monthly

Perform a thorough inspection of the hydraulic hoses and fittings as described in “Hose and Hose Assemblies” at the end of this manual or in publication 99930323, SAE J1273.

### Periodically

Use a non-filled pressure gauge, like the Greenlee Utility 137779, to verify that the unloading valve relief pressure is 700 bar (10,000 psi). Send the booster to a Greenlee Utility Authorized Service Center if adjustment is necessary.

### Annually

If required by your organization, have the booster inspected by a Greenlee Utility Authorized Service Center.

## Troubleshooting

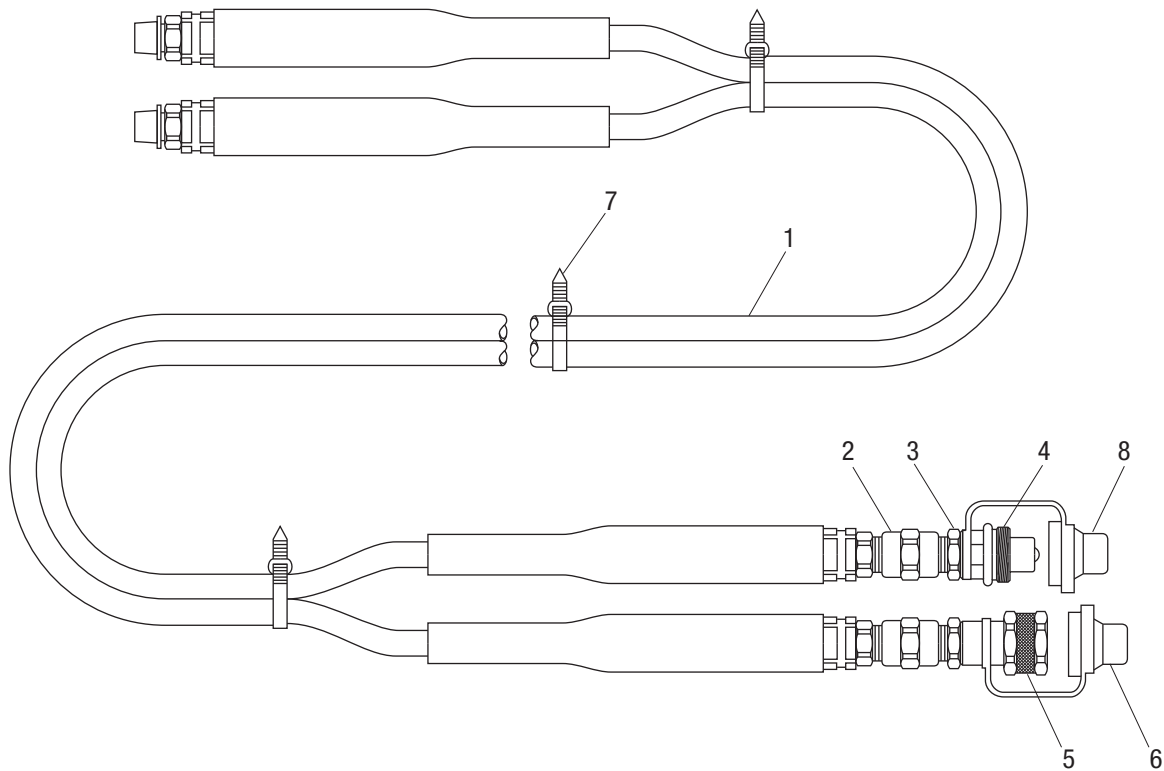
Before troubleshooting, determine whether the problem is in the booster, the hoses, or the power source. Substitute a booster, hoses, or power source known to be in good working order to identify the item that is not operating.

If the problem is in the booster, refer to the troubleshooting table below. If the problem is in the power source, refer to the troubleshooting section of the power source instruction manual.

<b>Problem</b>	<b>Probable Cause</b>	<b>Probable Remedy</b>
Booster does not operate.	Improper power source.	Verify that the power source meets the specifications. Refer to the "Specifications" section.
	Hydraulic fluid level low.	Check the fluid level. Check system for leaks.
	Incorrect hydraulic fluid viscosity.	Use hydraulic fluid with the correct viscosity. Refer to the "Specifications" section.
Booster operates slowly or erratically.	Hydraulic fluid cold.	Allow fluid to warm to the operating temperature. Actuate the tool intermittently to reduce the warming time.
	Power source not adjusted correctly.	Refer to power source operator's manual. Set the flow and pressure to correspond with the booster.
	Hydraulic fluid level low.	Check the fluid level. Check system for leaks.
	Air in the hydraulic system.	Refer to power source manufacturer's instructions for removing air from the system.
	Incorrect hydraulic fluid viscosity.	Use hydraulic fluid with the correct viscosity. Refer to the "Specifications" section.
Tool feels hot.	Hydraulic fluid level low.	Check the fluid level. Check system for leaks.
	Incorrect hydraulic fluid viscosity.	Use hydraulic fluid with the correct viscosity. Refer to the "Specifications" section.
	Hydraulic fluid dirty.	Refer to the power source owner's manual for procedure to replace hydraulic oil and filter.





**Accessories**


UPC No. Key 78-3310-	Part No.	Description	Qty
<b>Complete Hose Assemblies Rated at 700 bar (10,000 psi)</b>			
41107	50411074	6 ft (includes items 1-7).....	1
41108	50411083	10 ft (includes items 1-7).....	1
<b>Remote Control Valves</b>			
42948	50429481	Single-acting .....	1
42949	50429491	Double-acting .....	1
<b>Hoses Rated at 700 bar (10,000 psi)</b>			
1	41795	50417951 6 ft, 1/4 MNPT x 1/4 MNPT .....	1
1	41796	50417961 10 ft, 1/4 MNPT x 1/4 MNPT .....	1

UPC No. Key 78-3310-	Part No.	Description	Qty
<b>Couplers and Fittings</b>			
2	41401	50414014 Coupler, 1/4 FNPT x 1/4 FNPT .....	2
3	41344	50413442 Adapter, 1/4 MNPT x 1/4 MNPT .....	1
4	54169	51541690 Male coupler, 1/4 FNPT .....	1
5	42096	50420961 Female coupler, 1/4 MPNT .....	1
	41842	50418421 O-ring, 5/8 x 13/16 x 3/32-90D .....	1
6	41834	50418341 Dust cap .....	1
7	41587	50415870 Ty-Rap .....	3
8	41830	50418301 Dust cap .....	1

## HOSE AND HOSE ASSEMBLIES

### SELECTION, INSTALLATION AND MAINTENANCE OF HOSE AND HOSE ASSEMBLIES —SAE J1273 1986

#### SAE Recommended Practice

##### 1. Scope

Hose (also includes hose assemblies) has a finite life and there are a number of factors which will reduce its life.

This recommended practice is intended as a guide to assist system designers and/or users in the selection, installation, and maintenance of hose. The designers and users must make a systematic review of each application and then select, install, and maintain the hose to fulfill the requirements of the application. The following are general guidelines and are not necessarily a complete list.

### **⚠ WARNING**

Improper selection, installation, or maintenance may result in premature failures, bodily injury, or property damage.

##### 2. Selection

The following is a list of factors which must be considered before final hose selection can be made.

- 2.1 Pressure – After determining the system pressure, hose selection must be made so that the recommended maximum operating pressure is equal to or greater than the system pressure. Surge pressures higher than the maximum operating pressure will shorten hose life and must be taken into account by the hydraulic designer.
- 2.2 Suction – Hoses used for suction applications must be selected to insure the hose will withstand the negative pressure of the system.
- 2.3 Temperature – Care must be taken to insure that fluid and ambient temperatures, both static and transient, do not exceed the limitations of the hose. Special care must be taken when routing near hot manifolds.
- 2.4 Fluid Compatibility – Hose selection must assure compatibility of the hose tube, cover, and fittings with fluid used. Additional caution must be observed in hose selection for gaseous applications.
- 2.5 Size – Transmission of power by means of pressurized fluid varies with pressure and rate of flow. The size of the components must be adequate to keep pressure losses to a minimum and avoid damage to the hose due to heat generation or excessive turbulence.
- 2.6 Routing – Attention must be given to optimum routing to minimize inherent problems.
- 2.7 Environment – Care must be taken to insure that the hose and fittings are either compatible with or protected from the environment to which they are exposed. Environmental conditions such as ultra-violet light, ozone, salt water, chemicals, and air pollutants can cause degradation and premature failure and, therefore, must be considered.
- 2.8 Mechanical Loads – External forces can significantly reduce hose life. Mechanical loads which must be considered include excessive flexing, twist, kinking, tensile or side loads, bend radius, and vibration. Use of swivel type fittings or adapters may be required to insure no twist is put in the hose. Unusual applications may require special testing prior to hose selection.
- 2.9 Abrasion – While a hose is designed with a reasonable level of abrasion resistance, care must be taken to protect the hose from excessive abrasion which can result in erosion, snagging and cutting of the hose cover. Exposure of the reinforcement will significantly accelerate hose failure.
- 2.10 Proper End Fitting – Care must be taken to insure proper compatibility exists between the hose and coupling selected based on the manufacturer's recommendations substantiated by testing to industry standards such as SAE J517d.
- 2.11 Length – When establishing proper hose length, motion absorption, hose length changes due to pressure, as well as hose and machine tolerances must be considered.
- 2.12 Specifications and Standards – When selecting hose, government, industry, and manufacturer's specifications and recommendations must be reviewed and applicable.
- 2.13 Hose Cleanliness – Hose components vary in cleanliness levels. Care must be taken to insure that the assemblies selected have an adequate level of cleanliness for the application.
- 2.14 Electrical Conductivity – Certain applications require that the hose be non-conductive to prevent electrical current flow. Other applications require the hose to be sufficiently conductive to drain off static electricity. Hose and fittings must be chosen with these needs in mind.

## HOSE AND HOSE ASSEMBLIES (cont'd)

### 3. Installation

After selection of proper hose, the following factors must be considered by the installer.

- 3.1 Pre-Installation Inspection – Prior to installation, a careful examination of the hose must be performed. All components must be checked for correct style, size, and length. In addition, the hose must be examined for cleanliness, I.D. obstructions, blisters, loose cover, or any other visual defects.
- 3.2 Follow Manufacturers' Assembly Instructions.
- 3.3 Minimum Bend Radius – Installation at less than minimum bend radius may significantly reduce hose life. Particular attention must be given to preclude sharp bending at the hose/fitting juncture.
- 3.4 Twist Angle and Orientation – Hose installations must be such that relative motion of machine components produces bending of the hose rather than twisting.
- 3.5 Securement – In many applications, it may be necessary to restrain, protect, or guide the hose to protect it from damage by unnecessary flexing, pressure surges, and contact with other mechanical components. Care must be taken to insure such restraints do not produce additional stress or wear points.
- 3.6 Proper Condition of Ports – Proper physical installation of the hose requires a correctly installed port connection while insuring that no twist or torque is put into the hose.
- 3.7 Avoid External Damage – Proper installation is not complete without insuring tensile loads, side loads, kinking, flattening, potential abrasion, thread damage, or damage to sealing surfaces are corrected or eliminated.
- 3.8 System Check Out – After completing the installation, all air entrapment must be eliminated and the system pressurized to the maximum system pressure and checked for proper function and freedom from leaks.

*Note: Avoid potential hazardous area while testing.*

### 4. Maintenance

Even with proper selection and installation, hose life may be significantly reduced without a continuing maintenance program. Frequency should be determined by the severity of the application and risk potential.

A maintenance program should include the following as a minimum.

- 4.1 Hose Storage – Hose products in storage can be affected adversely by temperature, humidity, ozone, sunlight, oils, solvents, corrosive liquids and fumes, insects, rodents and radioactive material. Storage areas should be relatively cool and dark, and free of dust, dirt, dampness and mildew.
- 4.2 Visual Inspection – Any of the following conditions requires replacement of the hose:
  - a. Leaks at fitting or in hose.  
(Leaking fluid is a fire hazard).
  - b. Damaged, cut or abraded cover.  
(Any reinforcement exposed).
  - c. Kinked, crushed, flattened or twisted hose.
  - d. Hard, stiff, heat cracked or charred hose.
  - e. Blistered, soft degraded or loose cover.
  - f. Cracked, damaged, or badly corroded fittings.
  - g. Fitting Slippage on hose.
- 4.3 Visual Inspection – The following items must be tightened, repaired, or replaced as required:
  - a. Leaking port conditions.
  - b. Clamps, guards, shields.
  - c. Remove excessive dirt buildup.
  - d. System fluid level, fluid type, and any air entrapment.
- 4.4 Functional Test – Operate the system at maximum operating pressure and check for possible malfunctions and freedom from leaks.  
*Note: Avoid potential hazardous areas while testing.*
- 4.5 Replacement Intervals – Specific replacement intervals must be considered based on previous service life, government or industry recommendations, or when failures could result in unacceptable down time, damage, or injury risk.

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**GREENLEE®**

A Textron Company

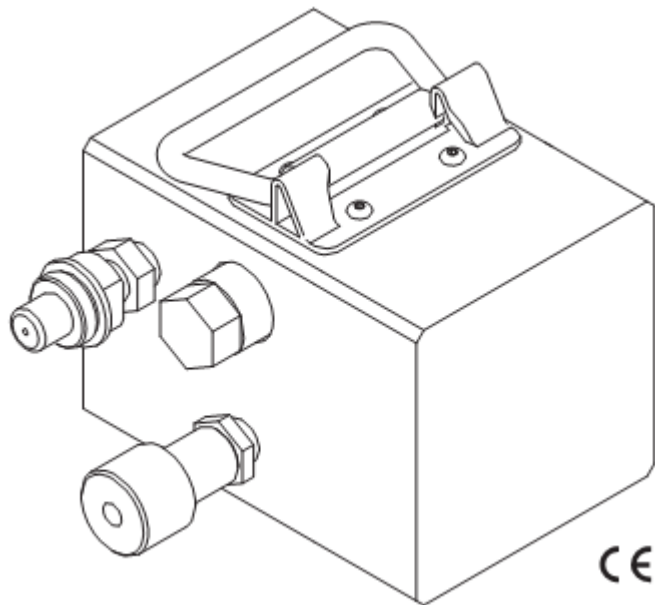
USA	800-435-0786	Fax:	800-451-2632
	815-397-7070	Fax:	815-397-1865
Canada	800-435-0786	Fax:	800-524-2853
International	+1-815-397-7070	Fax:	+1-815-397-9247

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# 使用说明书



## HB10 Dynapress® 液压增压泵 系列编号 GBL



在运行使用或维护本设备装置之前，请阅读并熟悉本使用说明书的所有说明与安全信息。



# HB10 Dynapress® 液压增压泵

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本使用说明书中给出的规格均为标准标称的规格，可随设计的改进予以更改。Greenlee Textron 公司对误用、错用本产品而引起的任何损失、损害不负任何责任。

Dynapress 为 Greenlee Textron 公司的一个注册商标。

## 说明

Greenlee utility HB10 Dynapress® 液压增压泵是活塞型附件，其允许高压/低流量工具配置接到低压/高流量液压源上使用。该设备兼容开中位式或闭中位式液压系统，该设备液压输入压力为 69-152bar (1000-2200psi)，稳定输出压力为 700bar (10000psi)。HB 10 可安装在现有双油管型液压系统，无需第三方液压管线或单独油箱（贮液器）。小型、质轻设计使该设备携带方便，可置于地面或空中升降斗中作业。启动 Dynapress® 增压泵高压回路需要一个远程控制阀，该阀需另购置。本手册中的说明和插图描述的情况是 HB10 与下列 Greenlee utility 远程控制阀之一进行配用：

- PVA0021A 单作用控制阀
- PVA0022A 双作用控制阀

本手册使用的术语“装置(unit)”和“增压泵 (booster)”，均指 HB10。术语“工具 (tool)”指 HB10 驱动的设备（电缆剪、压接工具等）。

## 安全

在 Greenlee utility 工具和仪器设备的使用和维护过程中，安全性是至关重要的一个因素。该使用说明书以及装置上的标记提供用以避免与本工具装置的使用有关的危险和不安全做法的信息。请遵守提供的所有安全信息。

## 本使用说明书要旨


该使用说明书目的在于使所有人员熟悉 Greenlee utility HB10 Dynapress® 液压增压泵的安全操作与维护程序。

保证对所有人员提供本使用说明书，使之随时可资利用。

如有要求，将免费提供本使用说明书手册的更换手册。


## 保留本使用说明书

## 重要安全信息




### 安全警示符号


本符号用于提醒您注意，任何危险或不安全操作可能会带来人身伤害或财产损失。将通过定义如下的文字符号描述危险的严重程度。文字符号后面的信息则是用以防止或避免危险的发生。

 **危险**



如果不加以防范，瞬时危险将导致严重的人员伤亡。



 **警告**



如果不加以防范，此危险可能导致严重的人员伤亡。



 **小心**



如果不加以防范，危险或不安全操作可能导致人身伤害或财产损失。

	<div style="text-align: center;">  <b>警告</b> </div> <p><b>触电危险：</b> 该增压泵为非绝缘装置设备。当在通电的电力管线附近使用该装置时：</p> <ul style="list-style-type: none"> <li>• 应仅使用已鉴定的绝缘油管和正确的个人防护设备。</li> <li>• 应选择和维护液压流体以符合您的安全部门要求的最低电介质标准。</li> </ul> <p>如不遵守本警告，将可能会导致严重的人员伤亡。</p>
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	<div style="text-align: center;">  <b>警告</b> </div> <p><b>皮肤受喷射危险：</b></p> <ul style="list-style-type: none"> <li>• 请勿用手检查是否存在泄露。</li> <li>• 液压系统加压的时候，请勿手持油管或连接装置。</li> <li>• 在进行维护之前，降低液压系统的压力。</li> </ul> <p>油受压后，很容易刺破皮肤，从而严重伤害皮肤，导致皮肤组织坏死甚至死亡。如果你被流出的油所伤，请立即就医。</p>
---	---

	<div style="text-align: center;">  <b>警告</b> </div> <p>在运行使用或维护本装置之前，请阅读并熟悉理解本使用说明书的所有说明与安全信息。如不遵守本警告，将可能会导致严重的人员伤亡。</p>
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	<div style="text-align: center;">  <b>警告</b> </div> <p>增压泵在操作中和操作后可能很热。装置冷却后进行操作处理，或戴上隔热手套进行操作。热表面会可能导致严重烫伤。</p>
--	---

	<div style="text-align: center;">  <b>警告</b> </div> <p>在操作使用或维护该装置时配戴眼罩。不遵循本规定佩戴护眼罩的，飞屑或液压油可能会严重伤害眼部。</p>
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## 重要安全信息

### 警告

勿超过下列液压动力源最大值：

- 液压流量： 30.3 l/min (8 gpm)
- 压力释放设置： 148 bar (2150 psi)
- 背压： 13.8 bar (200 psi)

如不遵守本警告，可能会导致严重的人员伤亡。

### 警告

当液压动力源在运转中或液压流体很热时，勿断开增压泵、油管或接头。热液压流体可能会导致严重烫伤。

### 警告

勿倒转液压流向。液压流反向运行可能会导致故障。将压力（供压）管和油箱（回流）油管连接至正确接口。如不遵守本警告，可能会导致严重的人员伤亡。

### 警告

- 每个工作日须检查液压油管和联轴器。若出现泄露、破裂、磨损或损坏，应进行修理或更换。受损油管或联轴器可能会失效，从而带来人身伤害或财产损失。
  - 处置、启动和使用工具时，确保所有旁观者处于工作区域之外。如果出现故障。附近人员可能受到飞溅或掉落的碎片或飞溅的零件所伤害。
- 如不遵守本警告，可能会导致严重的人员伤亡。

### 小心

操作前检查装置。采用 Greenlee utility 替换零件更换已磨损、损坏或缺失的部件。损坏的或组装不当的组件可能会失效从而伤害到附近人员。

如不遵守本警告，可能会导致严重的人员伤亡。

### 小心

仅允许将本装置用于实现制造商规定的目的。使用情况与本说明书中所述不同可能导致人身伤害或财产损失。如不遵守该预防措施，可能导致人身伤害或财产损失。

### 小心

液压油可能会导致皮肤刺激。

- 处置增压泵和油管需小心，避免皮肤接触液压油。
- 如果皮肤意外接触到液压油，立即冲洗受影响部位，洗掉液压油。

未遵守本要求可能导致人身伤害。

### 重要

连接或断开液压油管、接头或组件的程序：

1. 将液压动力源上的流量杆移至 OFF 位置。
2. 关停液压动力源。
3. 遵守“油管连接”部分的程序，防止压力增加。若压力已经增加，应缓慢松开油管、接头或组件。

### 重要

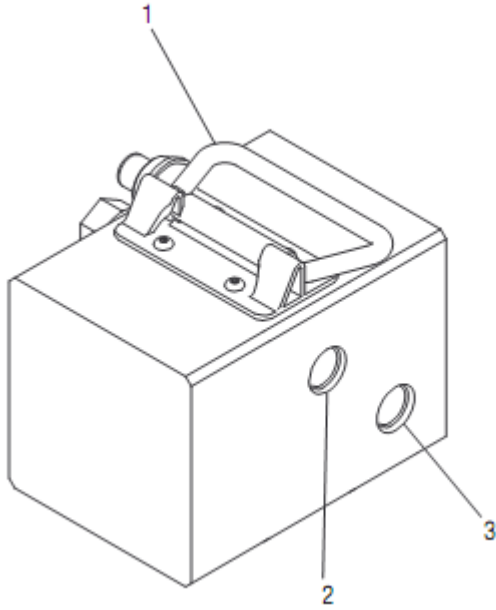
应急关停程序：

1. 将远程控制阀杆移至空挡。
2. 将液压动力源上的流量杆移至 OFF 位置。

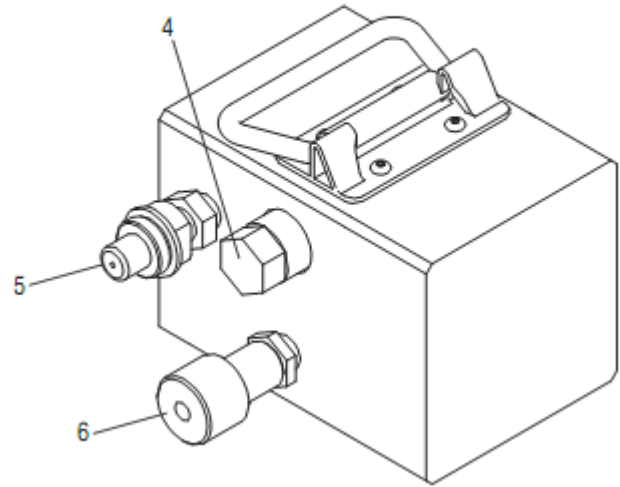
注：保持所有贴花纸清洁易读，必要时进行更换。

处置任何组件（液压油管、液压流体、磨损部件等）时，应遵守联邦、州及当地法律或法令。

## 部件标识



输入侧  
69 至 152 bar  
(1000 to 2200 psi)



输出侧  
700 bar (10,000 psi)

### HB10 Dynapress® 液压增压泵

- |    |         |    |         |
|----|---------|----|---------|
| 1. | 把手      | 4. | 卸载阀     |
| 2. | 输入侧压力接口 | 5. | 输出侧油箱接口 |
| 3. | 输入侧油箱接口 | 6. | 输出侧压力接口 |

## 规格

HB10

液压系统类型.....开心式或闭心式

液压接口与接头

动力源 (低压) 接口

压力口.....3/4 - 16 SAE O-ring Boss

回油口.....3/4 - 16 SAE O-ring Boss

工具(高压)接头

压力口.....1/4 - 18 NPTF (Parker #3050-2)

罐回油口.....1/4 - 18 NPTF (Parker #3010-2)

输入压力.....69 至 152 bar (1000 至 2200 psi)

输出压力.....700 bar (10,000 psi)

噪音级别 (在操作员位置).....< 85 dB (A)

质量/重量.....4.7 kg (10.3 lb)

宽度

仅机壳.....102 mm (4")

机壳与接头.....159 mm (6.25")

高度(把手折叠).....114 mm (4.5")

## 液压动力源



**警告**

勿超过下列液压动力源最大值:

- 液压流量: 30.3 l/min (8 gpm)
- 压力释放设置: 148 bar (2150 psi)
- 背压: 13.8 bar (200 psi)

如不遵守本警告, 可能会导致严重的人员伤亡。

液压系统类型.....开中位或闭中位

流量

最小值.....15.1 l/min (4 gpm)

推荐值.....22.7 l/min (6 gpm)

最大值.....30.3 l/min (8 gpm)

压力释放设置.....148 bar (2150 psi)

背压(最大值)\*.....13.8 bar (200 psi)

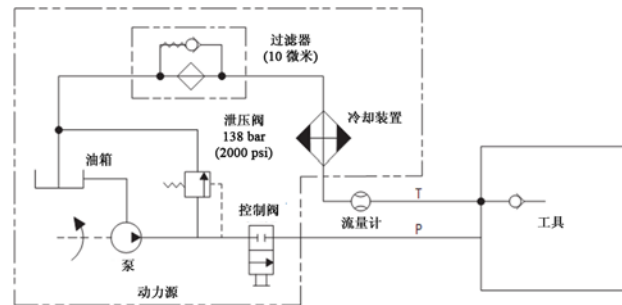
过滤.....10 微米(公称)

\* 13.8bar (200psi) 为 HTMA (液压工具制造商协会) 的最大商定标准背压。

Greenlee utility 工具在此标准下操作会非常稳定。

1. 最大液压流体温度不得超过 60°C (140°F)。需要足够的油冷却能力以限制液压流体温度。
2. 液压流量不得超过 30.3 l/min (8 gpm)。
3. 在回流管线中安装一个流量计以在使用该装置前测量液压流速。  
在您的工具的最大流量下, 压力释放阀设置不得超过 148bar (2150psi)。将压力释放阀定位在供应回路中以限制过高液压压力加到增压泵上。

## 液压示意图



## 推荐液压流体

使用符合下列规格或 HTMA 规格的不含清洁剂的不含清洁剂的油基液压油。

S.U.S. @

38 °C (100 °F) ..... 140 to 225

99 ° C (210 ° F) ..... 40 (最低)

闪点..... 170 ° C (340 ° F) (最低)

倾点..... -34 ° C (-30 ° F) (最低)

## 油管连接

### 连接油管

采用此程序以防止液压回路中增加压力。

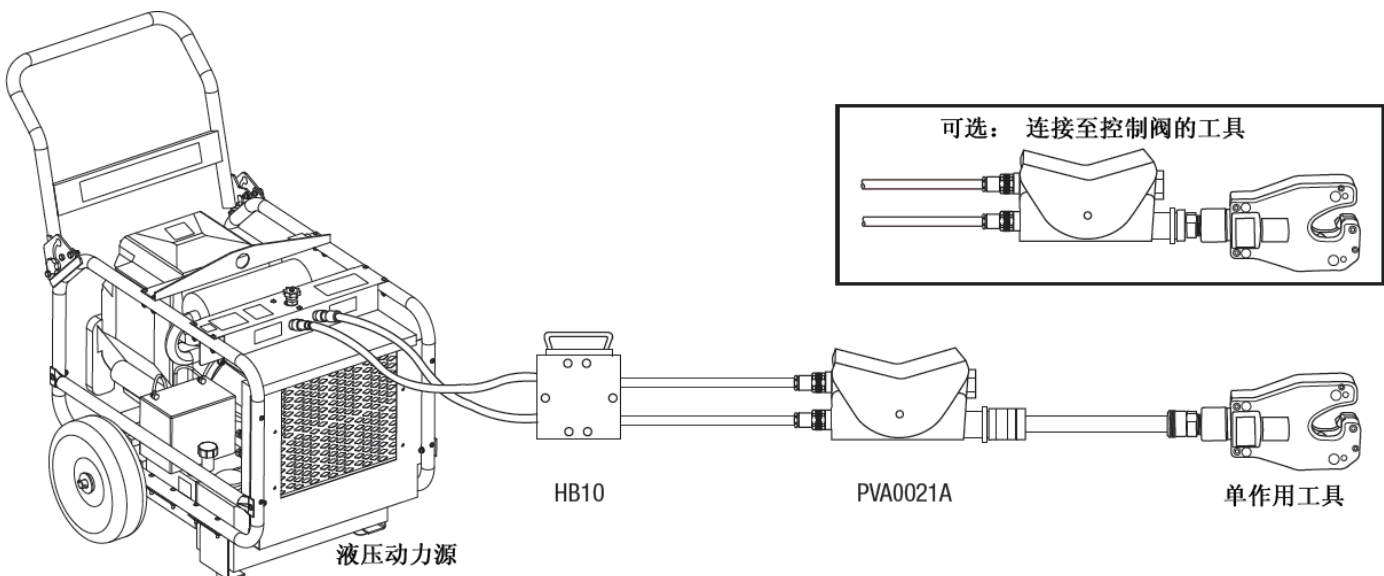
1. 将液压动力源上的流量杆移至 OFF 位置。
2. 关停液压动力源。
3. 按以下所述将高压油管连接至高压接口：
  - **回流（油箱）油管：** 远程控制阀至增压泵
  - **供应（压力）油管：** 远程控制阀至增压泵
  - **回流（油箱）：** 远程控制阀至工具（这一步仅适于双作用工具和控制阀。）
  - **供应（压力）油管：** 远程控制阀至增压泵
4. 按以下所述将低压油管连接至低压接口：
  - **回流（油箱）油管：** 增压泵至动力源
  - **供应（压力）油管：** 动力源至增压泵

### 断开油管



采用此程序以防止液压回路中增加压力。



1. 将液压动力源上的流量杆移至 OFF 位置。
2. 关停液压动力源。
3. 以连接顺序的相反顺序断开油管。
4. 安装防尘盖防止污染。



## 典型配置




## 操作

	 <b>警告</b>
	<p><b>触电危险：</b> 该增压泵为非绝缘装置。 当在通电的电力管线附近使用该装置时：</p> <ul style="list-style-type: none"> <li>• 应仅使用已鉴定的绝缘油管和正确的个人防护设备。</li> <li>• 应选择和维护液压流体以符合您的安全部门要求的最低电标准。</li> </ul> <p>如不遵守本警告，可能会导致严重的人员伤亡。</p>

	 <b>警告</b>
	<p><b>皮肤受喷射危险：</b></p> <ul style="list-style-type: none"> <li>• 请勿用手检查是否存在泄露。</li> <li>• 液压系统加压的时候，请勿手持油管或连接装置。</li> <li>• 在进行维护之前，降低液压系统的压力。</li> </ul> <p>油受压后，很容易刺破皮肤，从而严重伤害皮肤，导致皮肤组织坏死甚至死亡。如果你被流出的油所伤，请立即就医。</p>



	 <b>警告</b>
	<p>在操作或维护该装置时配戴眼罩。不佩戴护眼罩的，飞屑或液压油可能会严重伤害眼部。</p>



 <b>警告</b>
<p>阅读并理解随工具提供的所有说明和安全信息。如不遵守本警告，可能会导致严重的人员伤亡。</p>

1. 启动液压动力源。  
*注： 让动力源运行几分钟使液压流体变暖。*
2. 要启动工具，下压该杆并将其保持在前进位置。
  - 当压力超过约 207bar (3000psi) 时，操作员可以释放控制杆。 该杆将保持在前进位置。
  - 当压力达到卸载阀的释放设定值即 700bar (10000psi) 时高压油会排回油箱中，系统压力将下降至接近零。然后操作员可将远程控制阀释放回到空挡。
3. 要返回或退回柱塞，按下该杆并将其保持在回退位置。



## 维护

	 <b>警告</b>
	<p>皮肤受喷射危险：</p> <ul style="list-style-type: none"> <li>• 请勿用手检查是否存在泄露。</li> <li>• 液压系统加压的时候，请勿手持油管或连接装置。</li> <li>• 在进行维护之前，降低液压系统的压力。</li> </ul> <p>油受压后，很容易刺破皮肤，从而严重伤害皮肤，导致皮肤组织坏死甚至死亡。如果你被流出的油所伤，请立即就医。</p>

	 <b>警告</b>
	<p>在操作或维护该装置时配戴眼罩。不佩戴护眼罩的，飞屑或液压油可能会严重伤害眼部。</p>

注： 保持所有贴花纸清洁易读，必要时进行更换。  
 处置任何组件（液压油管、液压流体、磨损部件等）时，应遵守联邦、州及当地法律或法令。

### 每日

1. 擦净增压泵所有表面。
2. 检查液压油管和接头有无泄露、破裂、磨损或损坏迹象。必要时进行更换。
3. 装置断开时安装防尘盖。

### 每月

按照本手册末尾或出版物 99930323, SAE J1273 中的“油管及油管总成”所述，对液压油管和配接件进行彻底检查。

### 定期

用非充液压力计如 Greenlee utility 137779 验证卸载阀释放压力为 700bar (10000psi)。如需要调节，将增压泵送 Greenlee utility 授权服务中心。

### 每年

如您的公司需要，让 Greenlee utility 授权服务中心对增压泵进行检查。

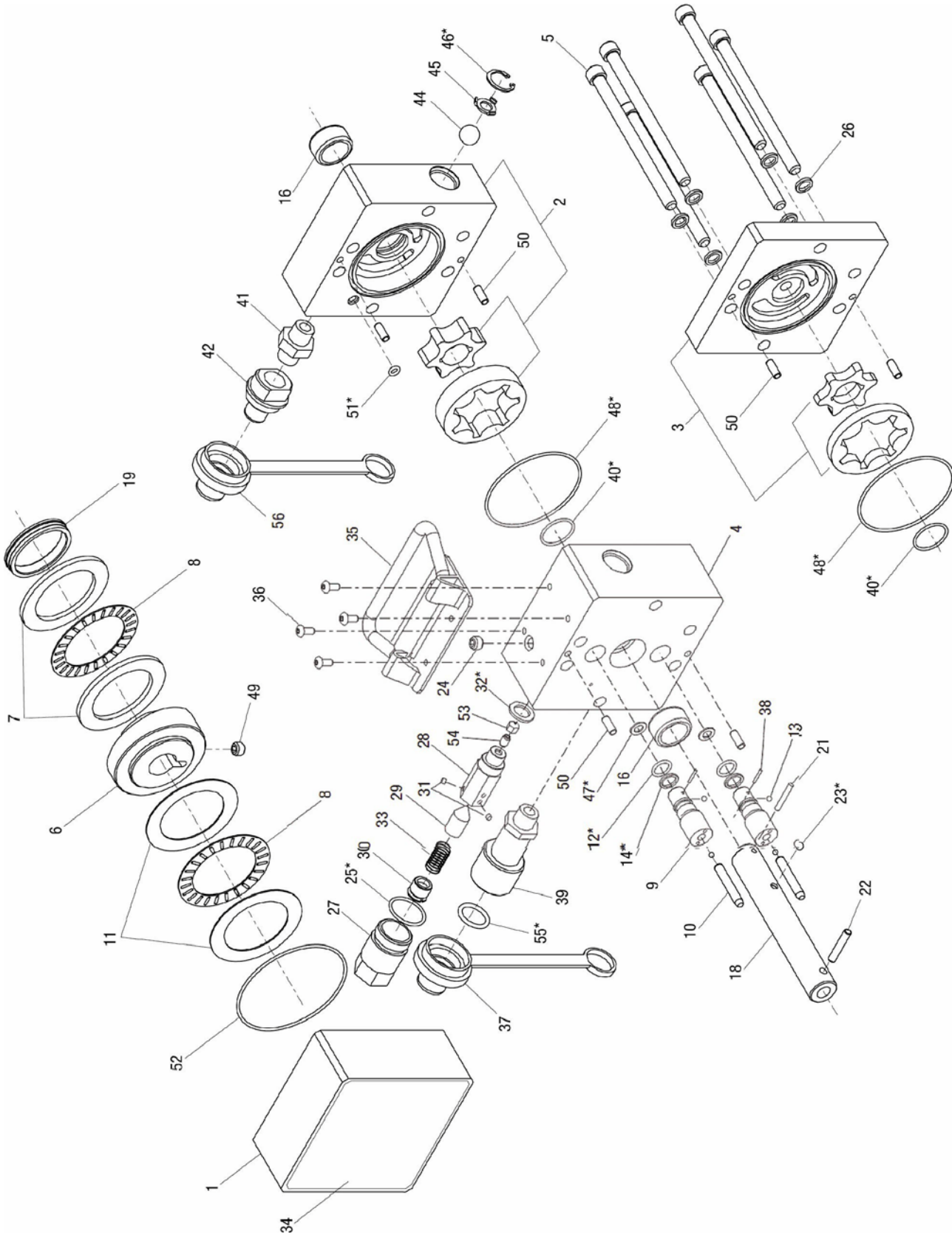
## 故障排除

故障排除之前，确认问题在增压泵、油管还是动力源。可换用已知处于良好工作状态的增压泵、油管或动力源以识别不能运转的部件。

如果问题出现在增压泵，参见下面的故障排除表。如果问题出现在动力源，参见动力源说明手册中的故障排除部分。

问题	可能原因	可用补救措施
增压泵不工作。	液压动力源不正常。	验证动力源是否符合规格。参见“规格”部分。
	液压流体液位低	检查流体液位。检查系统泄露。液压流体粘度
	不正确的液体粘度。	使用正确粘度的液压流体。 参见“规格”部分。
增压泵动作缓慢或不稳定	液压流体太冷。	让流体变暖达操作温度。 间歇式启动工具以缩短变暖时间。
	动力源未正确调节。	参见动力源操作员手册。 设置流速与压力使之与增压泵一致。
	液压流体液位低	检查流体液位。检查系统泄露。
	空气进入液压系统。	参见动力源制造商说明以除去系统中的空气。
	液压流体粘度不正确。	使用正确粘度的液压流体。 参见“规格”部分。
工具太热。	液压流体液位低	检查流体液位。检查系统泄露。
	液压流体粘度不正确。	使用正确粘度的液压流体。 参见“规格”部分。
	液压流体太脏。	参见动力源用户手册的程序，以更换液压油和过滤器。

附图



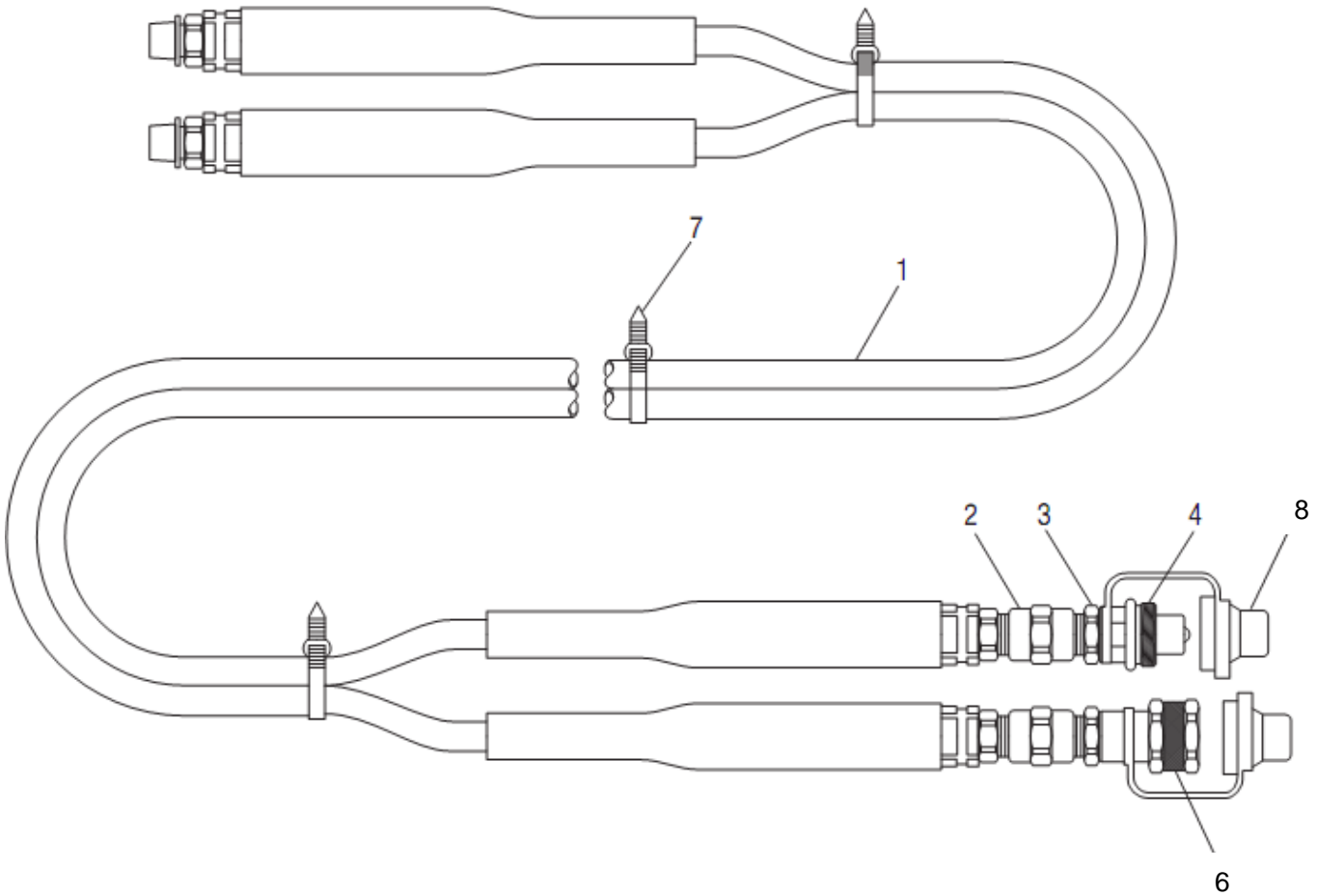


## 零件清单

UPC 编号				
序号	78-3310-	产品编号	描述	数量
1	76834	52001736	摇摆板机壳 .....	1
2	20967	52024955	电动机内齿轮油泵机壳组件总成 .....	1
3	10376	52024956	清除器内齿轮油泵机壳总成组件 .....	1
4	49834	50498347	高压机壳 .....	1
5	49835	52001738	内六角帽螺钉, 5/16 - 18 x 4.5 .....	6
6	13144	52001038	摇摆板 .....	1
7	13131	52001039	止推垫圈, 直内径 1.785 .....	2
8	41892	50418921	止推轴承, 1.750 x 2.500 x .078 .....	2
†9			活塞衬套 .....	2
†10			活塞 .....	2
11	41895	50418951	止推垫圈, 1.750 x 2.500 x .032 .....	2
*†12			O 型环, .375 x .500 x .062 - 90D .....	2
†13			钢珠, 直径.125 .....	4
*†14			单匝支承环, .390 x .492 x .048 .....	2
16	43097	50430971	滚针轴承, .750 x 1.500 .....	3
18	49841	52001743	传动轴 .....	1
19	13143	52001037	轴承承托 .....	1
21	43120	50431200	接合销, .125 x .875 .....	1
22	43149	50431498	接合销, .187 x 1 .....	1
*23			钢珠, 直径.187 .....	1
24	41888	50418881	1/ 16 NPTF 液位位级密封管塞 .....	1
*25			O 型环, .750 x .875 x .062 - 70D .....	1
26			锁紧垫圈, 5/16 .....	6
27	40675	50406751	卸压阀盖 .....	1
28	43961	50439618	卸载阀阀体 .....	1
29	43930	50439308	阀卸载阀 Pintal 锥栓 .....	1
30	40682	50406821	弹簧盖止动器 .....	1
31	41874	50418740	定位螺钉, #8 - 32 x .109 中空内凹头 .....	2
*32			铜质平垫圈, .440 x .680 x .060 .....	1
33	40692	50406921	卸载阀弹簧 .....	1
34	49960	52001744	识别标记贴花纸 .....	1
35			手柄把手 .....	1

UPC 编号				
序号	78-3310-	产品编号	描述	数量
36			圆头帽螺丝#8 - 32 x .375 .....	4
37	41834	50418341	防尘盖 .....	1
†38			接合销, 1/16 x 7/16 .....	2
39	42096		液压耦合器 .....	1
*40			O 型环, .812 x 1.062 x .125 - 85D .....	2
41	41344	50413442	六角管螺纹接套, 1/4 NPTF x 1.37 .....	1
42	41811	51541690	液压耦合器 .....	1
43	41432	50414323	塑料塞 3/4 - 16 .....	2
44	41873	50418730	钢珠球, 直径.500 .....	1
45	49234	50492349	球形档块 .....	1
*46			定位环, .687 Truarc .....	1
†47			铜质平垫圈, .250 x .437 x .031 .....	2
*48			O 型环, 2.500 x 2.625 x .062 - 70D .....	2
49			内六角螺栓圆端点定位螺钉, 1/4 - 20 x .250 .....	1
50	40742	50407422	接合销, .188 x .500 .....	6
*51			O 型环, .187 x .312 x .062 - 90D .....	1
*52			O 型环 .....	1
53	40696	50406960	止回阀止动器 .....	1
54	40697	50406970	止回阀阀体, .....	1
*55			O 型环, .625 x .812 x .094 - 90D .....	1
56	41830	50418301	Dust cap .....	1
<b>修理工具箱包</b>				
*	49979	50499793	成套包封装修理工具套件(包括标有星号项) .....	1
†	49980	50499807	活塞/衬套组件总成(包括件 Cincludes items marked with†等项) .....	1

## 配件



UPC 编号			
序号 78-3310-	产品编号	描述	数量
<b>整套油管组件总成, 额定压力为 700 bar (10,000 psi)</b>			
41107	50411074	6 ft (包括件 1 - 7 项).....	1
41108	50411083	10 ft (包括件 1 - 7 项).....	1
<b>远程控制阀</b>			
42948	50429481	单作用 .....	1
42949	50429491	双作用 .....	1
<b>油管, 额定压力为 700 bar (10,000 psi)</b>			
1	41795	50417951 6 ft, 1/4 MNPT x 1/4 MNPT.....	1
1	41796	50417961 10 ft, 1/4 MNPT x 1/4 MNPT.....	1

UPC 编号			
序号 78-3310-	产品编号	描述	数量
<b>接头</b>			
2	41401	50414014 耦合器, 1/4 FNPT x 1/4 FNPT .....	2
3	41344	50413442 适配器, 1/4 MNPT x 1/4 MNPT.....	1
4	41811	51541690 凸型适配器外牙快接, 1/4 FNPT .....	1
5	42096	50420961 凹型适配器内牙快接, 1/4 MPNT .....	1
41842	50418421	O 型环, 5/8 x 13/16 x 3/32 - 90D.....	1
6	41834	50418341 防尘盖.....	1
7	41587	50415870 Ty-Rap 扎带.....	3
8	41830	50418301 Dust cap.....	1

## 油管 and 油管套件

### 油管和油管套件的选型、安装与维护—SAE J1273 1986

#### SAE 推荐方法

##### 1. 范围

油管（亦包括油管总成）有一定的使用寿命，诸多因素会造成其寿命缩短。

推荐方法作为指导，协助系统设计者及/或使用者的油管选型、安装与维护。设计者与使用者必须系统查看每项应用，然后进行选型、安装和维护，以实现应用需求。以下是一般指南，并非完整列表。



**警告**

不正确的选型、安装或维护会导致早期失效、人身伤害或财产损失。

##### 2. 选型

以下是在对油管进行最后选型之前的一系列必须加以考虑的因素。

- 2.1 压力—确认系统压力之后，油管选型时必须让推荐最大操作压力等于或大于系统压力。波动压力大于最大操作压力会缩短油管寿命，液压设计者必须加以考虑。
- 2.2 抽气—用于抽气的油管必须能耐系统负压。
- 2.3 温度—必须谨慎确保流体和环境温度（包括静态的和瞬态的）不得超过油管的极限值。当管线布线靠近热管时必须特别小心。
- 2.4 流体兼容性—油管选型必须确保管道、盖和紧固件与所用流体的兼容性。在针对气体应用油管选型时必须加倍谨慎。

- 2.5 尺寸—通过承压流体进行动力传递随压力和流速变化。组件尺寸必须足以将压力损失保持在最小值，避免热量产生或过度紊流造成的油管损坏。
- 2.6 管道布线—必须注意优选路线以最小化内在问题。
- 2.7 环境—必须注意确保油管和接头兼容或者不受所暴露的环境影响。环境条件例如紫外光、臭氧、盐水、化学品和空气污染物会导致性能恶化和早期失效，因此必须加以考虑。
- 2.8 机械负载—外部压力会显著减少油管寿命。必须加以考虑的机械负载包括过度挠曲、扭曲、压曲、拉伸或侧负载、弯曲半径、振动。旋转型配接件或适配器的使用可能有要求以确保油管内无扭曲。不常见应用可能要求在油管选型前进行特殊测试。
- 2.9 磨损—油管设计成具有一定程度的耐磨性时，必须注意保护油管不受过度磨损，过度磨损可能导致油管包覆的腐蚀、磨损和切断。露筋会显著加速油管失效。
- 2.10 正确的终端接头—必须注意要确保基于按工业标准（如 SAE J517d）进行试验落实的制造厂家的标准选择的油管和接头之间的正确兼容。
- 2.11 长度—确立了正确的油管长度后，必须考虑运动吸收，管长随压力的变化，以及油管公差和机械公差。
- 2.12 规格与标准—当选择油管时，必须查看政府和工业和制造商的规格和推荐值，它们必须是可用的。
- 2.13 油管清洁度—油管组件因清洁度级别而异。必须注意确保所选总成有足够级别适合应用的清洁度。
- 2.14 导电性—某些应用要求油管绝缘以防电流流过。其他应用要求油管能充分导电以放掉静电。油管和接头必须根据这些需求加以选择。

## 油管和油管套件（续）

### 3. 安装

选择正确的油管后，安装人员必须考虑以下因素。

- 3.1 安装前检查—安装前，必须仔细检查油管。必须检查所有组件的类型、尺寸和长度是否正确。另外，必须检查油管的清洁度、内径堵塞物、气泡、松动的包覆、或任何其它可见缺陷。
- 3.2 遵守制造商的组装说明书。
- 3.3 最小弯曲半径—小于最小弯曲半径进行安装会显著减少油管寿命。必须尤其注意在油管/接头接合处排除锐弯状况。
- 3.4 扭曲角和方向—安装油管时，机械组件的相对运动只允许产生油管弯曲而不是扭曲。
- 3.5 牢固—在许多应用中，必须对油管加以限制、保护或导引，防止出现不必要的挠曲、压力骤增和接触其他机械组件，从而造成损坏。必须注意确保这些限制不会产生额外的应力或磨损点。
- 3.6 正确的接口条件—正确的油管物理安装需要正确安装的接口连接，同时确保油管内无扭曲或扭矩。
- 3.7 避免外部损坏—必须确保拉伸负载、侧负载、死结、扁平、潜在磨损、螺纹损坏，以及密封表面的损坏得到修正或消除之后，安装才算完成。
- 3.8 系统检查—安装完成后，必须消除所有滞留空气，将系统给压至最大系统压力，并检查是否功能正确，无泄漏。

*注：测试时避免潜在危险区域。*

### 4. 维护

即使进行了正确选型和安装，若不执行持续维护方案，油管寿命仍可能显著减少。频率需由应用和潜在风险的严重程度而定。

维护方案应至少包括以下内容。

- 4.1 油管存放—存放中的油管产品可能受到温度、湿度、臭氧、阳光、油、溶剂、腐蚀液体和烟气、昆虫、啮齿动物和放射性物质的不利影响。存放区域应相对低温、避光、无灰尘、无潮气、不发霉。
- 4.2 目视检查—出现下列情况之一需更换油管：
  - a. 接头处或油管内泄露。（泄露液体有着火危险）。
  - b. 包覆损坏、切断或磨损。（任何露筋）。
  - c. 油管出现扭结、压碎、压平或扭曲。
  - d. 油管硬化、僵直、热裂纹或烧焦。
  - e. 包覆起泡、软降解或松动。
  - f. 接头裂开、损坏或严重腐蚀。
  - g. 接头在油管上滑动。
- 4.3 目视检查—以下各项必须视需要进行拧紧、维修或更换。
  - a. 出现泄露的接口。
  - b. 管夹、防护装置、屏蔽板。
  - c. 除去过多的脏物堆积。
  - d. 系统流体液位、流体类型、滞留空气。
- 4.4 功能测试—在最大操作压力下操作系统，检查可能有的异常且无泄露。

*注：测试时避免潜在危险区域。*
- 4.5 更换间隔时间—专门的更换时间间隔须参照之前的使用寿命、政府或行业的建议来考虑，或基于失效可能导致严重停机、损坏或伤害危险的时间来考虑。

承蒙 1990 SAE 手册允许而重印。



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