



OPERATING INSTRUCTIONS FOR BOSSRAM DOUBLE-ACTING HYDRAULIC CYLINDERS

NOTE: Repair parts sheets for this product are available from the Duff Norton Air Motor Jack Co. website at www.duffnortonairmotorjacks.com, or from your nearest Authorized Warranty Service Center.

SAFETY EXPLANATIONS:

- A **CAUTION** is used to indicate correct operating or maintenance procedures and practices to prevent damage to, or destruction of equipment or other property.
- A **WARNING** indicates a potential danger that requires correct procedures or practices to avoid personal injury.
- A **DANGER** is only used when your action or lack of action may cause serious injury or even death.



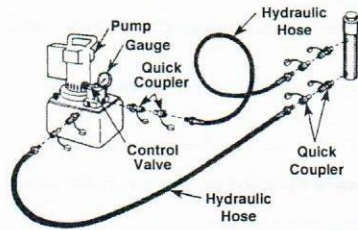
WARNING: It is the operator's responsibility to read and understand the following safety statements. Follow all safety precautions to avoid personal injury or property damage during system operation. Duff Norton Air Motor Jack Co. cannot be responsible for damage or injury resulting from unsafe product use, lack of maintenance, or incorrect product and/or system operation

- Only qualified operators should install, operate, adjust, maintain, clean, repair or transport this machinery.
- These components are designed for general use in normal environments. These components are not specifically designed for lifting and moving people agri-food machinery, certain types of mobile machinery, or special work environments such as: explosive, flammable, or corrosive. Only the user can decide the suitability of this machinery in these conditions or extreme environments. Duff Norton Air Motor Jack Co. will supply information necessary to help make these decisions.

DOUBLE-ACTING HYDRAULIC SYSTEMS

A basic double-acting hydraulic system consists of a pump (which moves the hydraulic fluid), a double-acting cylinder or ram (to do the work), a hydraulic hose (which routes the fluid to the advance cylinder or ram port), a second hydraulic hose (which routes the fluid to the retract cylinder or ram port), and a control valve which can change the direction of the hydraulic fluid.

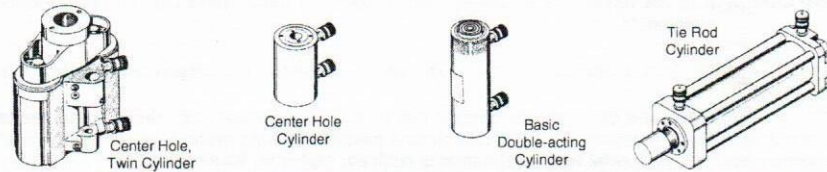
TYPICAL INSTALLATION



A double-acting cylinder or ram can be either extended or retracted hydraulically.

Most double-acting cylinders or rams are classed as "differential cylinders" because of the different sized areas that the hydraulic fluid pushes against during the extend and retract strokes. Because of this difference, the extend stroke can exert more force than the retract stroke.

VARIOUS TYPES OF DOUBLE-ACTING CYLINDERS



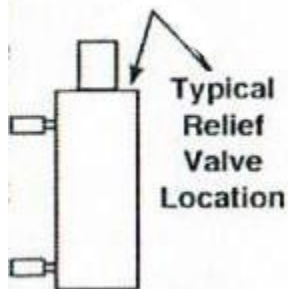
NOTE: The capacity of a hydraulic system is determined by the effective area of the cylinder and the system pressure.

SAFETY PRECAUTIONS



DANGER

- A double-acting cylinder or ram must have both hoses and all couplers securely connected to both ports. If one of the two ports is restricted or becomes disconnected, pressure will build and the cylinder, hose, or coupler can burst, possibly causing serious injury or death.
- When extending double-acting cylinders or rams, the retract port must not be restricted. A restricted retract port will prevent pressure from being released and the cylinder can burst, possibly causing serious injury or death.
- DO NOT attempt to adjust or service the relief valve on a double-acting cylinder ram head. If oil leakage is detected from this relief valve, discontinue use of the cylinder or ram immediately and contact your nearest Authorized Warranty Service Center. If improperly adjusted, the cylinder or ram could develop excessive pressure and cause the cylinder, hose or couplers to burst, which could cause serious injury or death.



- When extending a cylinder or ram under load, always insure that the couplers or port threads have not been damaged or do not come in contact with any rigid obstruction. If this condition does occur, the coupler's attaching threads may become stripped or pulled from the cylinder or ram, resulting in the instantaneous release of high pressure hydraulic fluid, flying objects, and loss of the load. All of these possible results could cause serious injury or death.

- Avoid off-center loads, which could damage the cylinder or ram and/or cause loss of the load, possibly causing serious injury or death.
- Control the load at all times. Do not drop the load.
- Properly rated adapters must be installed and used correctly for each application.



WARNING

- All WARNING statements must be carefully observed to help prevent personal injury.

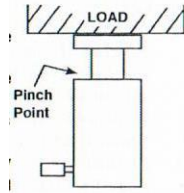
HYDRAULIC HOSES AND FLUID TRANSMISSION LINES

- Avoid straight line tubing connections in short runs. Straight line runs do not provide for expansion and contraction due to pressure and/or temperature changes. See diagrams in Set-Up section of this manual.
- Eliminate stress in the tube lines. Long tubing runs should be supported by brackets or clips. Tubes through bulkheads must have bulkhead fittings. This makes easy removal possible and helps support the tubing.
- Before operating the pump, all hose connections must be tightened with the proper tools. Do not overtighten. Connections should only be tightened securely and leak-free. Overtightening can cause premature thread failure or high pressure fittings to split at pressures lower than their rated capacities.
- Should a hydraulic hose ever rupture, burst, or need to be disconnected, immediately shut off the pump and release all pressure. Never attempt to grasp a leaking hose with your hands. The force of escaping hydraulic fluid could cause serious injury.
- Do not subject the hose to potential hazard such as fire, sharp surfaces, extreme heat or cold or heavy impact. Do not allow the hose to kink, twist, curl, crush, cut, or bend so tightly that the fluid flow within the hose is blocked or reduced. Periodically inspect the hose for wear, because any of these conditions can damage the hose and possibly result in personal injury.
- Do not use the hose to move attached equipment. Stress can damage the hose and possibly cause personal injury.
- Hose material and coupler seals must be compatible with the hydraulic fluid used. Hoses also must not come in contact with corrosive materials such as creosote-impregnated objects and some paints. Hose deterioration due to corrosive materials can result in personal injury. Consult the manufacturer before painting a hose. Never paint a coupler.

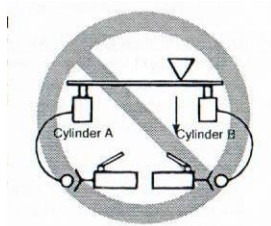
CYLINDER

- The user must be a qualified operator familiar with the correct operation, maintenance, and use of the cylinder(s). Lack of knowledge in any of these areas can lead to personal injury.
- Read and understand all safety and warning decals and instructions.
- Use only approved accessories and approved hydraulic fluid. Hoses, seals, and all components used in a system must be compatible with the hydraulic fluid used.
- Do not exceed the rated capacities of the cylinders. Excess pressure can result in personal injury.
- Inspect each cylinder and coupler before each shift or usage to prevent unsafe conditions from developing.
- Do not use cylinders if they are damaged, altered, or in poor condition.
- Do not use cylinders with bent or damaged couplers or damaged port threads.
- Under certain conditions, the use of an extension with a hydraulic cylinder may not be advisable and could present a dangerous condition.

- Avoid pinch points or crush points that can be created by the load or parts of the cylinder.



- Cylinder must be on a stable base which is able to support the load while pushing or lifting.
- To help prevent personal injury, use shims, friction material, or constraints to prevent slippage of the base or load.
- Do not set poorly-balanced or off-center loads on a cylinder. The load can tip or the cylinder can “kick out” and cause personal injury.
- Do not create an uneven fulcrum and lever condition or overload condition where force exerted by one cylinder on a lever will intensify downward force on a pressure-checked cylinder at the other end of the lever. For example: If straightening an axle as illustrated, when cylinder A extends, an uneven fulcrum and lever condition will intensify force downward on pressure-checked cylinder B. The pressure created in cylinder B will be increased to dangerously high levels.



- If this component is used to lift or lower loads, be certain that the load is under operator control at all times and that others are clear of the load. Do not drop the load.
- As the load is lifted, use blocking and cribbing to guard against a falling load.
- To help prevent personal injury, do not allow personnel to go under or work on a load before it is properly cribbed or blocked. All personnel must be clear of the load before lowering.
- Never use extreme heat to disassemble a hydraulic cylinder or ram. Metal fatigue and/or seal damage will result and can lead to unsafe operating conditions.
- This guide cannot cover every hazard or situation, so always do the job with SAFETY FIRST.

IMPORTANT:

- Wear proper personal protective gear when operating hydraulic equipment.
- Keep the cylinder clean at all times.
- While at a job site, when the cylinder is not in use, keep the piston rod fully retracted and upside down.
- Use an approved, high-grade pipe thread sealant to seal all hydraulic connections. PTFE tape can be used if only one layer of tape is used and it is applied carefully (two threads back) to prevent the tape from being pinched by the coupler and broken off inside the pipe end. Any loose pieces of tape could travel through the system and obstruct the flow of fluid or cause jamming of precision-fit parts.
- Always use protective covers on disconnected quick couplers.
- Limiting the stroke and pressure on all cylinders will prolong their life.

INTRODUCTION

These instructions are written to help you, the user, more effectively use and maintain your double-acting cylinders and rams. If you have any questions, please call Duff Norton Air Motor Jack Co. or an Authorized Warranty Service Center.

NOTE: For a detailed parts list or to locate an Authorized Warranty Service Center, contact Duff Norton Air Motor Jack Co.

Some of the information included in these instructions was selected from ASME B30.1-2015 and applies to the construction, installation, operation, inspection, and maintenance of hydraulic cylinders. It is strongly recommended that you read ASME B30.1-2015 to answer any questions not covered in these instructions. The complete ASME B30.1-2015 standard which contains additional information can be obtained at a nominal cost from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th, New York, NY 10017.

An inspection checklist is available upon request from Duff Norton Air Motor Jack Co.

SYSTEM EVALUATION

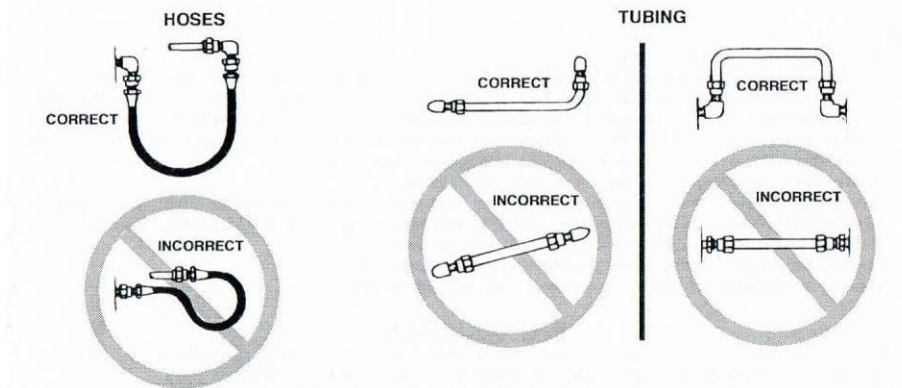
Your cylinder, hose(s), couplings, and pump must all be rated for the same maximum operating pressure, correctly connected, and compatible with the hydraulic fluid used. An improperly matched system can cause the system to fail and possibly cause serious injury. If you are in doubt, consult Duff Norton Air Motor Jack Co. or an Authorized Warranty Service Center.

SET-UP

HYDRAULIC CONNECTIONS

Remove the thread protectors or dust covers from the hydraulic ports if applicable. Clean the areas around the fluid ports of the pump and cylinder. Inspect all threads and fittings for signs of wear or damage, and replace as needed. Clean all hose ends, couplers, and union ends. Connect all hose assemblies to the pump and cylinder. Use an approved, high-grade pipe sealant to seal all hydraulic connections. Tighten securely and leak-free, but do not overtighten.

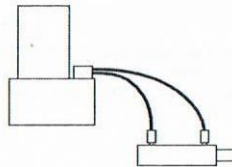
Hydraulic lines and fitting can act as restrictors as the cylinder or ram retracts. The restricting or slowing of the fluid flow causes back pressure that slows the cylinder's or ram's return. Return speed also varies because of the applications, condition of the cylinder or ram, inside diameter of hose or fitting, length of the hose, and the temperature and viscosity of the hydraulic fluid.



BLEEDING THE SYSTEM

After all connections are made, the hydraulic system must be bled of any trapped air. Refer to the diagram below.

With no load on the system and the pump vented and positioned higher than the cylinder or ram, cycle the system several times. If you are in doubt about venting your pump, read the operating instructions for your pump. Check the reservoir for possible low fluid level and fill to proper level with approved, compatible hydraulic fluid as necessary.



System with a double-acting cylinder

IMPORTANT: Some spring return cylinders or rams have a cavity in the rod which forms an air pocket. This type of cylinder or ram should be bled when positioned upside down or lying on its side with the port facing upward.

INSPECTION

Before each use, visually inspect for the following items:

1. Cracked or damaged cylinder
2. Excessive wear, bending, damage, or insufficient thread engagement
3. Leaking hydraulic fluid
4. Scored or damaged piston rod
5. Improperly functioning swivel heads and caps
6. Loose bolts
7. Damaged or improperly assembled accessory equipment
8. Modified, welded, or altered equipment
9. Bent or damaged couplers or port threads

Preventative Maintenance (yearly or sooner, if the cylinder or ram condition suggests damage)—Visual examination by the operator or other designated personnel with a dated and signed equipment record.

RAM AND CYLINDER MAINTENANCE

- **Always use clean, approved hydraulic fluid and change as needed.**
- **Any exposed threads (male or female) must be cleaned and lubricated regularly, and protected from damage.**
- **If a cylinder or ram has been exposed to rain, snow, sand, grit-laden air, or any corrosive environment, it must be cleaned, lubricated, and protected immediately after exposure.**

PERIODIC CLEANING

A routine should be established to keep the hydraulic system as free from dirt as possible. All unused couplers must be sealed with dust covers. All hose connections must be free of dirt and grime. Any equipment attached to the cylinder must be kept clean. Use only Mobil DTE 10 Excel 32 hydraulic fluid and change as recommended or sooner if the fluid becomes contaminated (never exceed 300 hours).

STORAGE

Double-acting cylinders and rams should be stored in a vertical position with the rod end down in a dry, well-protected area where they will not be exposed to corrosive vapors, dust, or other harmful elements.

If a double-acting cylinder or ram has been stored for a year or more, it must be thoroughly inspected before it is used.

TROUBLE-SHOOTING GUIDE

IMPORTANT:

- The following trouble-shooting and repair procedures should be performed by qualified personnel familiar with this equipment. Use the proper equipment when trouble-shooting!

NOTE:

- All the following statements may not apply to your particular model of cylinder or ram. Use the guide as a general reference for trouble-shooting.

PROBLEM	CAUSE	SOLUTION
Erratic action	<ol style="list-style-type: none"> 1. Air in system or pump cavitation 2. Internal leakage in double-acting cylinders 3. Cylinder sticking or binding 	<ol style="list-style-type: none"> 1. Add fluid, bleed air, and check for leaks 2. Replace worn packings. Check for excessive contamination or wear. Replace contaminated fluid as necessary 3. Check for dirt or leaks. Check for bent, misaligned, worn parts or defective packings.
Cylinder/Ram does not move	<ol style="list-style-type: none"> 1. Loose couplers 2. Faulty coupler 3. Improper valve position 4. Low or no hydraulic fluid in pump reservoir 5. Air-locked pump 6. Pump not operating 7. Load is above the capacity of the system 8. Fluid leaks out of rod end relief valve 	<ol style="list-style-type: none"> 1. Tighten couplers 2. Verify that female coupler is not locked up (ball wedged into seat). Replace both female and male couplers. 3. Close release valve or shift to new position 4. Fill and bleed the system 5. Prime pump per pump operating instructions 6. Check pump's operating instructions 7. Use the correct equipment 8. Make sure all couplers are fully coupled. Contact your nearest Authorized Warranty Service Center
Cylinder/Ram extends only partially	<ol style="list-style-type: none"> 1. Pump reservoir is low on hydraulic fluid 2. Load is above the capacity of the system 3. Cylinder piston rod binding 	<ol style="list-style-type: none"> 1. Fill and bleed the system 2. Use the correct equipment 3. Check for dirt or leaks. Check for bent, misaligned, worn parts or defective packings.
Cylinder/Ram moves slower than normal	<ol style="list-style-type: none"> 1. Loose connection or coupler 2. Restricted hydraulic line or fitting 3. Pump not working correctly 4. Cylinder seals leaking 	<ol style="list-style-type: none"> 1. Tighten 2. Clean and replace if damaged 3. Check pump operating instructions 4. Replace worn seals. Check for excessive contamination or wear

<p>Cylinder/Ram moves but does not maintain pressure</p>	<ol style="list-style-type: none"> 1. Leaky connection 2. Cylinder seals leaking 3. Pump or valve malfunctioning 	<ol style="list-style-type: none"> 1. Clean, reseal with thread sealant and tighten connection 2. Replace worn seals. Check for excessive contamination or wear. Replace contaminated fluid as necessary. 3. Check pump or valve operating instructions
<p>Cylinder/Ram leaks hydraulic fluid</p>	<ol style="list-style-type: none"> 1. Worn or damaged seals 2. Loose connections 3. Rod end relief valve has activated 	<ol style="list-style-type: none"> 1. Replace worn seals. Check for excessive contamination or wear. Replace contaminated fluid as necessary. 2. Clean, reseal with thread sealant, and tighten connection. 3. Make sure all couplers are fully coupled. <ol style="list-style-type: none"> a. If relief valve is still leaking, do not attempt to service this component. Contact your nearest Authorized Warranty Service Center
<p>Cylinder/Ram will not retract or retracts slower than normal</p>	<ol style="list-style-type: none"> 1. Pump release valve closed 2. Loose couplers 3. Blocked hydraulic lines 4. Weak or broken retraction springs 5. Cylinder damaged internally 6. Pump reservoir too full 	<ol style="list-style-type: none"> 1. Open pump release valve 2. Tighten couplers 3. Clean and flush 4. Send to service center for repair 5. Send to service center for repair 6. Drain hydraulic fluid to correct level.