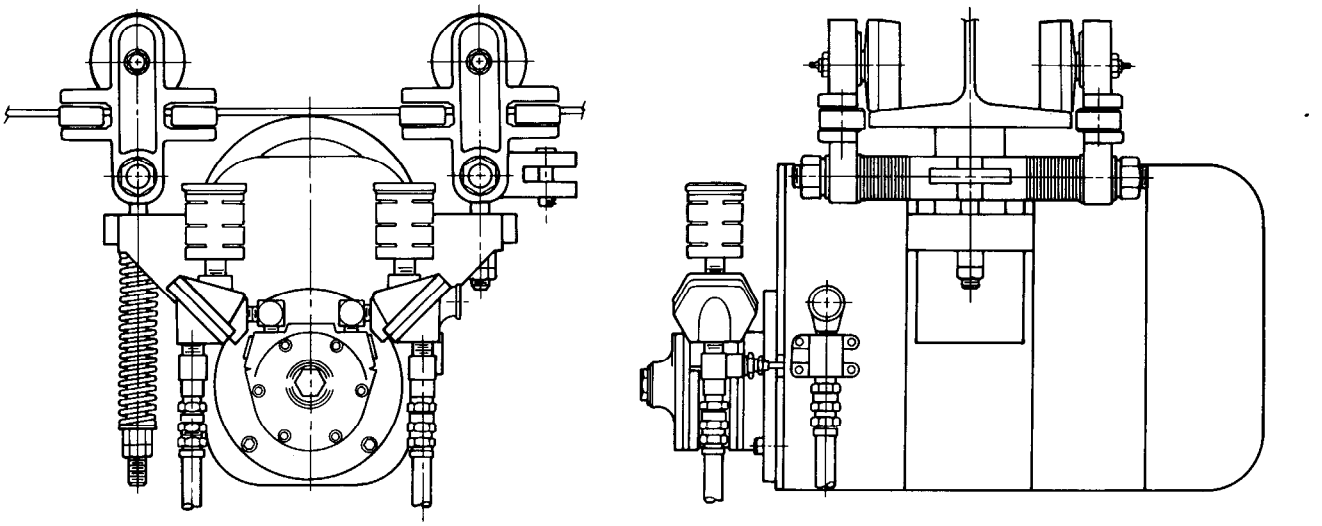
TVL TRACTOR

OPERATION AND MAINTENANCE MANUAL



READ THIS MANUAL BEFORE USING THESE PRODUCTS. This manual contains important safety, installation, operation and maintenance information. Make this manual available to all persons responsible for the operation, installation and maintenance of these products.

⚠ WARNING

Do not use this tractor for lifting, supporting, or transporting people or lifting or supporting loads over people.

Always operate, inspect and maintain this tractor in accordance with any federal state or local regulations and any other applicable safety codes.

Refer all communications to the nearest Ingersoll-Rand Material Handling Office or Distributor.

Form MHD56034
Edition 2
October 1990
71060552

INGERSOLL-RAND®
MATERIAL HANDLING

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SAFETY INFORMATION

This manual provides important information for all personnel involved with the safe installation, operation and proper maintenance of this product. Even if you feel you are familiar with this or similar equipment, you must read and understand this manual before operating the product.

Danger, Warning, Caution and Notice

Throughout this manual there are steps and procedures which, if not followed, may result in a hazard. The following signal words are used to identify the level of potential hazard.

⚠ DANGER Danger is used to indicate the presence of a hazard which ***will*** cause ***severe*** personal injury, death, or substantial property damage if the warning is ignored.

⚠ WARNING Warning is used to indicate the presence of a hazard which ***can*** cause ***severe*** personal injury, death, or substantial property damage if the warning is ignored.

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

NOTICE Notice is used to notify people of installation, operation, or maintenance information which is important but not hazard-related.

Safety Summary

⚠ WARNING

Do not use this tractor or attached equipment for lifting, supporting, or transporting people or lifting or supporting loads over people.

The supporting structures and load-attaching devices used in conjunction with this tractor must provide an adequate safety factor to handle the rated load, plus the weight of the tractor and attached equipment. This is the customer's responsibility. If in doubt, consult a qualified structural engineer.

The National Safety Council, Accident Prevention Manual for Industrial Operations, Eighth Edition and other recognized safety sources make a common point: Employees who work near cranes or assist in hooking on or arranging a load should be instructed to keep out from under the load. From a safety standpoint, one factor is paramount: conduct all lifting or pulling operations in such a manner that if there were an equipment failure, no personnel would be injured. This means keep out from under a raised load and keep out of the line of force of any load.

To the best of our knowledge, INGERSOLL-RAND Material Handling tractors are manufactured in accordance with the latest standards in effect at time of manufacture.

However, contrary to common belief, the Occupational Safety and Health Act of 1970, as we understand it, generally places the burden of compliance with the user, not the manufacturer. Many OSHA requirements are not concerned or connected with the manufactured product but are, rather, connected with the final installation: "It is the owner's responsibility and user's responsibility to determine the suitability of a product for any particular use. Check all applicable industry, trade association, federal, state and local regulations. Read all operating instructions and warnings before operation".

Rigging: It is the responsibility of the operator to exercise caution, use common sense and be familiar with proper rigging techniques. See ANSI/ASME B30.9 for rigging information, American National Standards Institute, 1430 Broadway, New York, NY 10018.

NOTICE

Using other than genuine INGERSOLL-RAND Material Handling parts will result in the void of warranty.

SAFE OPERATING INSTRUCTIONS

The following warnings and operating instructions have been adapted in part from American National (Safety) Standard ANSI B30.16 and are intended to avoid unsafe operating practices which might lead to personal injury or property damage.

These recommendations apply to tractors when used to move loaded hoists involving material handling of freely suspended unguided loads.

INGERSOLL-RAND recognizes that most companies who use tractors have a safety program in force in their plants. In the event that some conflict exists between a rule set forth in this publication and a similar rule already set by an individual company, the more stringent of the two should take precedence.

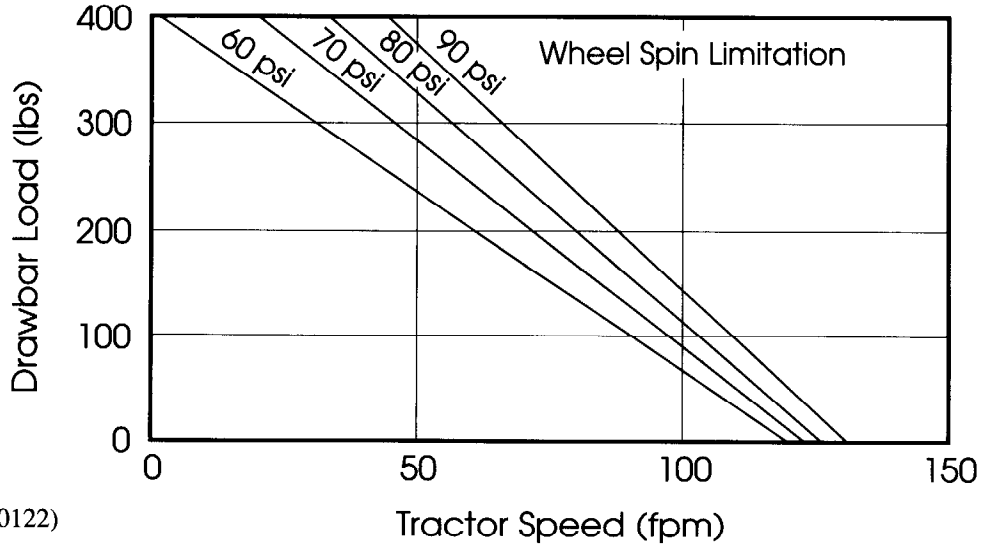
Safe Operating Instructions are provided to make an operator aware of dangerous practices to avoid and are not necessarily limited to the following list. Refer to specific sections in the manual for additional safety information.

1. Only allow qualified people (trained in safety and operation) to operate the tractor.
2. Make sure that the direction of travel is in the same direction as shown on the tractor controls.
3. Maintain firm footing when operating the tractor.
4. Make sure that the load is free to move and will clear all obstructions.
5. Make sure that all persons stay clear of the suspended load and intended load path.
6. Avoid swinging of the load.
7. Warn personnel of an approaching load.
8. Promptly report any malfunction, unusual performance, or damage, regarding the tractor.
9. Inspect the tractor on a regular basis, replace damaged or worn parts, and keep appropriate maintenance records.
10. Use the tractor manufacturer's recommended spare parts when repairing the tractor.
11. Never pull more than the rated load.
12. Do not use a damaged tractor, or a tractor that is not working correctly.
13. Do not operate the tractor unless the load is centered under the hoist.
14. Do not allow your attention to be diverted from operating the tractor.
15. Do not use the tractor to support, or transport people.
16. Never leave a suspended load unattended.
17. Do not allow sharp contact between two tractors, or between a tractor and any obstruction.
18. Do not remove or obscure the warning or safety labels, plates or tags on the tractor.
19. Do not use the tractor to support or hang any load. The tractor is designed as a towing device only.
20. Avoid unnecessary or sudden stops and starts when moving a load.
21. At all times, avoid moving loads over people.
23. Use extreme care to avoid contacting any obstruction with a moving load.
24. When a "DO NOT OPERATE" sign is placed on the tractor controls, do not operate the tractor until the sign has been removed by designated personnel.

SPECIFICATIONS

Maximum operating air supply 90 psig at 70 scfm (6.2 bar/ 620 kpa at 1.98 cu. m/min).
Tractor Weight: 125 lbs (57 kgs)
Gear Reduction 50:1
Drive Wheel 8 ins. dia. (203 mm).

Performance Graph



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Prior to installing the tractor, carefully inspect it for possible shipping damage. Tractors are shipped from the factory with the gear case filled to the proper level.

After the tractor has been mounted in its normal operating position, remove the gear case oil level plug and verify that the oil level is up to the lower edge of the level plug opening. If the oil level is not up to the lower edge of the level plug opening, add gear oil of the type specified in the Lubrication Section until the oil reaches up to the lower edge of the level plug opening.

⚠ WARNING

• Before installing the tractor, make certain that the trolley wheel contour is correct for the type of beam the trolley will run on, and that the trolley wheel spacing is correct for the beam flange width. Failure to observe this precaution will result in rapid trolley wheel wear, or possible loss of attachment of the tractor.

There are two wheel contour styles used on three types of beams. These are the tapered wheel for standard beams, and the flat wheel for wide flange beams and patented monorail beams. The wheels supplied with INGERSOLL-RAND tractors are universal allowing operation on flat or tapered flange beams or tracks.

Tractor Installation

The following procedures cover the installation of the tractor as a complete unit.

NOTICE

• When installing the trolley assemblies, arrange the spacers and washers such that a 1/16 to 1/8 ins. (2 to 3 mm) space exists between the guide rollers and the beam flange. Also ensure that the spacers and washers are equally distributed on each side of the tractor.

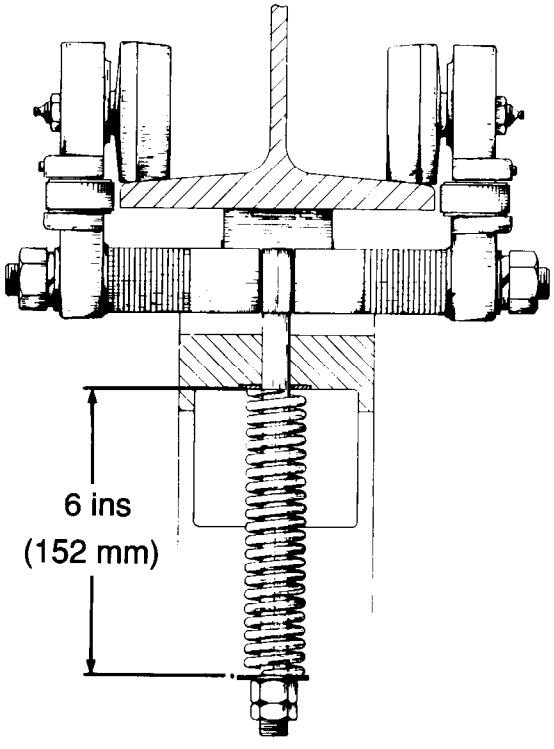
1. Raise the tractor assembly into position beneath the beam.
2. Assemble the trolley halves around the beam, and install the trolley mounting hardware. Securely tighten all mounting bolts and nuts.
3. Torque the rod bolt hex nuts to 105 ft-lbs (145 Nm).
4. After installation, check to make sure that the side plate are parallel to each other and perpendicular to the plane of the beam flange.
5. Adjust the wheel pressure as described in Wheel Pressure Adjustment in Installation Section.
6. Connect the air lines to the appropriate connections.
7. Connect the tow bar to the tractor assembly. Secure the tow bar using the tow bar pin. Secure the tow bar pin using the cotter pin.
8. Supply power to the tractor and operate the tractor along the entire length of the beam, to ensure that trolley assembly and operation is satisfactory.

Wheel Pressure Adjustment

To prevent wheel slippage adjust the length of the tensioning spring to 6 ins. (152 mm). If the wheel continues to slip, decrease the spring length until there is no perceptible wheel slip. Do not decrease spring length any more than necessary.

⚠ CAUTION

• Excessive wheel loads will decrease life of the rubber tire and increase loadings on bearings and the motor.



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Air Line Lubricator

Always use an air line lubricator with these motors. Use a lubricator having an inlet and outlet at least as large as the inlet on the motor. Install the lubricator in the air line just ahead of the motor.

Motor

For optimum performance and maximum durability of parts, operate air motor at 90 psig at 70 scfm (6.2 bar/620 kpa at 1.98 cu.m/min) air pressure. Use a 3/8 ins. (9 mm) diameter air hose. Before making final connections, all air supply lines should be purged before connecting to system inlet. The air motor should be installed as near as possible to the compressor or air receiver. Supply lines should be as short and straight as installation conditions will permit. Long transmission lines and excessive use of fittings, elbows, tees, globe valves. etc. cause a reduction in pressure due to restrictions and skin friction in the lines.

Initial Operating Checks

Tractors are tested and adjusted for proper operation prior to leaving the factory. Before the tractor is placed into service the following initial operating checks should be performed.

Checking Direction of Rotation

Since the direction of rotation of motors can be reversed by interchanging lines it is important that motion travel is in correct relationship with the pendant control lever being depressed. Carefully check the directional rotation of the motor as follows:

1. Connect the air lines.
2. Depress the FORWARD lever and note the direction of tractor travel. If travel relationship does not correspond to the lever being depressed, stop operation. Do not allow the tractor to come into contact with any object. Do not depress the REVERSE lever at this time.
3. If the tractor travel is forward when the FORWARD lever is depressed, proper installation has been attained.
4. If the tractor travels in reverse when the FORWARD lever is depressed, proper installation has not been attained. To correct this, interchange the motor air lines.

⚠ WARNING

• Disconnect, lock in closed position the valve source, and completly bleed down piping or hoses which feed the tractor to prevent air power from being applied to the tractor while repairs are being performed. Injury or death of personnel may result if this precaution is not observed.

Brake Check

⚠ WARNING

• If the brake fails to stop and hold the tractor stationary, do not attempt to operate the tractor until proper repairs and/or adjustments are performed. Malfunction of the brake may allow for an uncontrolled load. Failure to observe this precaution could lead to the injury or death of personnel.

If the tractor brake does not hold the towed load stationary, adjust and/or repair the brake as described under the topic, Brake Adjustments, in Maintenance Section.

Bolt Torques

Recommended bolt torques are listed. These torque values apply to all component mounting bolts and to bolts that attach structural members of the tractor. At least annually, all mounting and attachment bolts should be checked with a torque wrench to ensure compliance with the values listed.

Bolt Size Std.	Grade 8	
Thread	Ft.lbs	Nm
M4	2	3
M5	4	6
M6	7	10
M7	12	16
M8	18	25
M9	26	36
M10	35	49
M12	62	86
M14	97	135
M16	155	210
M18	210	290
M20	296	410
M22	398	550

Torque figures shown are for lubricated installation.

OPERATION

Description of Operation

The rubber drive wheel is driven by an air motor through a three reduction gear case. The motor is air activated and is connected directly to the air supply line. The motor direction is controlled by depressing one of the lever operators on the pendant handle valve assembly.

A disc type spring set, air released brake is used to stop and prevent rotation of the drive when the motor is de-energized.

When the motor is energized, the motor brake is energized. Energizing the brake moves the brake piston compressing the spring, thereby releasing the brake. When the motor is de-energized, the brake piston is also de-energized causing the compressed springs to move the brake piston. This clamps the friction discs between the mounting plate, pull plate, and two stationary plates. The friction discs are driven by a brake driver which is coupled directly to the input shaft. By restraining the friction discs, braking torque is applied to the motor and gear train.

⚠ CAUTION

• Only allow qualified personnel (trained in safety and operation) to operate a tractor.

INSPECTION

There are two types of inspection, the frequent inspection performed by the operator and more thorough periodic inspections performed by qualified personnel. Frequent and, periodic inspections are essential to continued safe performance of a tractor. Careful inspection on a regular basis will reveal potentially dangerous conditions while still in the early stages, allowing corrective action to be taken before the condition becomes dangerous.
Any deficiency revealed through inspection must be reported to an appointed person. A determination must be made as to whether a deficiency constitutes a safety hazard before resuming operation of the tractor.

Records and Reports
Some form of inspection record must be maintained for each tractor, listing all points requiring periodic inspection. A written report should be made monthly on the condition of the critical parts of each tractor. These reports should be dated, signed by the person who performed the inspection, and kept on file where they are readily available to authorized personnel.

Frequent Inspection
Tractors in regular service must be inspected daily, or at the start of each shift, for damage, wear, operating malfunctions, and other defects. This inspection must include, but not necessarily be limited to, the following:

1. Check all operating controls for proper function.
2. Inspect all suspension members for distortion, excessive wear, and improper connection or adjustment.
3. Check for visual signs or abnormal noises which could indicate a defect. Check for smooth operation. Do not operate tractor until all defects have been corrected.

Periodic Inspection
Periodic Inspection refers to those inspections which are performed at intervals ranging from weekly to annually. Periodic inspection must include, but not necessarily be limited to, the following:

1. Check the brake for worn discs, misadjustment or other defects.
2. Check the entire tractor unit and trolley for loose capscrews, nuts or other fasteners. Replace if missing and tighten or secure if loose.
3. Check parts such as gears, shafts, pins and bearings for corrosion, wear, cracks, or distortion. Replace worn or damaged parts. Clean, lubricate or reassemble.
4. Inspect the trolleys and/or the supporting structure from which the tractor is suspended, for continued ability to support the tractor and attached equipment.

Tractors Not in Regular Use
A tractor that has been idle for a period of time must be checked as follows, before returning it to service:

1. A tractor which has been idle for at least one month but less than six months must be inspected in the manner described under the topic, frequent inspection, by or under the direction of a designated person.
2. A tractor which has been idle for a period of six months or longer must be given a complete inspection in the manner described under the topics, frequent inspection and periodic inspection.

LUBRICATION

To ensure continuing satisfactory operation of the tractor, all points requiring lubrication must be serviced with the correct lubricant at the proper time interval as indicated for each assembly.

The lubrication intervals recommended in this manual are based on intermittent operation of the tractor eight hours each day, five days per week. If the tractor is operated almost continuously or more than one shift, more frequent lubrication will be required. Also, the lubricant types and change intervals are based on operation in an ambient temperature range from -18°C to +38°C (0°F to +100°F), and in an environment relatively free of dust, moisture, and corrosive fumes. Use only those lubricants recommended. Other lubrucants may affect the performance of the tractor. Approval for the use of other lubricants must be obtained from your INGERSOLL-RAND distributor. Failure to observe this precaution may result in damage to the tractor and/or its associated components.

INTERVAL	LUBRICATION CHECKS
Start of each shift	Check flow and level of air line lubricator (approximately 2 drops per minutes required at maximum tractor speed). Make a thorough visual inspection of the tractor for damage. Do not operate the tractor if damage is found.
3 Months	Check the oil level in the tractor gear case and add oil as required. Lubricate trolley wheel axle shafts. Lubricate all pivot points.
6 Months	Drain and refill the tractor gear case.

Gear Case

Check the gear case oil level every three months, and add oil as required. Remove the level plug and check that the oil level is up to the lower edge of the level plug opening. If the oil level is not up to the lower edge of the level plug opening, remove the gear case breather plug and add oil as required.

Drain and refill the tractor gear case once every six months. Remove the gear case drain plug and the gear case breather plug, and drain the oil into a container, for proper disposal. Wipe the drain plug clean, apply thread sealing compound to the threads, and install the drain plug in the gear case. Remove the oil level plug and fill the gear case through the breather plug opening with gear oil until the oil reaches up to the lower edge of the level plug opening. Clean and replace the gear case breather and level plugs. The proper gear case oil capacity is 12 fluid ounces (354 ml). Use an extreme pressure (EP) gear oil meeting API classification GL5 and MIL-L-21205C.

-10°F to +10° F (-23°C to -12°C)	SAE 80
10° F to 90° F (-12°C to -32°C)	SAE 90
90° F and above (32°C and above)	SAE 140

⚠ CAUTION

- **The gear case oil capacity must not be exceeded. Excessive gear oil will cause seal failure and leakage.**

Air Line Lubricator

Keep the air line lubricator filled with a premium high viscosity index hydraulic oil with rust, oxidation and anti-foam additives. Adjust the lubricator to produce a slight oil mist in the exhaust.

Trolley Wheel Axles

Lubricate the trolley wheel axles at least every three months using recommended grease via the grease fittings provided.

Pivot Points

Points not considered to be normal wear points (latches, levers, linkages, pins, and so forth) require to be lubricated with motor oil. Apply a few drops of motor oil to each exposed pin or lever not equipped with a grease fitting at three month intervals. Wipe up excess oil which may be present after the pin or linkage has been lubricated.

TROUBLESHOOTING

This section provides the information necessary for troubleshooting this tractor. The troubleshooting guide provides a general outline of problems which could be experienced with normal use of this tractor. It lists the trouble, the possible cause, and the possible solution for the trouble being experienced.

TROUBLE	POSSIBLE CAUSE	POSSIBLE REMEDY
Tractor fails to stop when control lever is released.	Improperly adjusted brake.	Adjust brake as described under the topic, Brake Adjustment, Maintenance Section.
	Worn brake friction discs.	Replace brake friction discs when worn beyond limit specified under the topic, Brake Inspection, Maintenance Section.
	Controller malfunction.	Troubleshoot and/or repair the controller.
Tractor does not respond to controller.	Power failure in supply lines.	Check air supply 90 psig air at 70 scfm (6.2 bar/620 kpa at 1.98 cu.m/min) of dry lubricated air is required to achieve rated performance.
	Improper connection in tractor.	Check all air line connections. Tighten or repair as required.
Tractor does not stop promptly.	Tractor is overloaded.	Reduce the towed load to within rated capacity of the tractor. See performance curve in Specification Section.
	Brake is not holding.	Check the adjustment of the brake as described under the topic, Brake Adjustment, Maintenance Section. Inspect brake friction discs for wear as described under the topic, Brake Inspection, Maintenance Section.
	Wheel is sliding.	Check for proper wheel tension adjustment, overload or adverse track conditions such as slope, oil, grease or other contamination.
Tractor fails to move.	Air hoses to the motor are reversed.	Refer to the topic, Checking Direction of Rotation, in the Installation Section, and correct the problem.
Tractor moves FORWARD, not in REVERSE.	Tractor maybe overloaded.	Reduce the towed load to within the rated capacity of tractor. For track conditions refer to performance curve in Specification Section.
Oil leaks from the gear case.	Oil seals are worn or damaged.	Replace worn or damaged seals.
	Gaskets are damaged.	Replace damaged gaskets.

TROUBLESHOOTING (Continued)

TROUBLE	POSSIBLE CAUSE	POSSIBLE REMEDY
Low power or low free speed	Low air pressure at the inlet.	Check air pressure at the inlet. For top performance and durability of parts, the air pressure must be 90 psig (6.2 bar/620 kpa) at the inlet.
	Worn or broken vanes.	Install a new set of vanes.
	Improper lubrication or dirt building up in the motor.	Lubricate as instructed under Lubrication. If this does not help, flush the motor as instructed in the Operation Section.
Motor does not operate smoothly.	Worn or broken motor rotor bearings.	Examine each bearing. Install new bearing where necessary.
Scoring of motor end plates and/or cylinder.	Rotor does not have proper clearance.	Refer to Assembly of the motor.

MAINTENANCE

A good preventative maintenance program includes regular lubrication, periodic adjustments, and the immediate correction of defects revealed through frequent and periodic inspection. Preventative maintenance combined with careful inspection at regular intervals not only contributes greatly to safe tractor operation, but will also extend the useful service life of the tractor, and assures continuation of the standard warranty.

Maintenance intervals are based on intermittent operation of the tractor eight hours each day, five days per week. Depending on the severity of service, and the operating environment of the tractor, more frequent inspections and maintenance may be required. The preventative maintenance program set up by the tractor user should be based on the recommendations made in the Maintenance Section of this manual. Detailed records of maintenance performed must be kept as a permanent part of the tractor's maintenance file.

Safety Precautions
Observe the following safety precautions when performing maintenance of any type:

1. Disconnect and tag the main valve for the air supply to shut off the tractor. Make sure all lines between the tractor inlet and the shut off valve are completely bleed down.
2. Install out of order signs or similar warning signs on both the main shut off valve and thc pendant push button control.
3. The warning signs must be removed only by the person who installed them, or by some other designated person.
4. Upon completion of the required maintenance, the tractor must not be operated until all covers or guards have been installed.
5. After performing maintenance, test tractor controls for correct direction of travel and brake for ability to stop the load.

INTERVAL	MAINTENANCE CHECKS
Start of each shift	Make a thorough visual inspection of the tractor for damage. Do not operate the tractor if damage is found. Check the operation of the brake.
3 Months	Remove and inspect the brake friction discs and stationary plates. Clean or replace parts as required, and if necessary, adjust the brake for proper operating torques.
Annually	Inspect the gearing, shafts, and bearings for damage or wear. Check all of the supporting mem bers, including the trolley wheels and the trolley wheel shafts, etc. for wear or damage.

The following topics describe how to adjust, inspect and service the various tractor components.

Brake Maintenance
At three month intervals, remove and check the thickness of the brake friction discs. If the measured thickness of any disc is 1/4 ins. (6 mm) or less, replace both friction discs. Also check the stationary plates for damage, scoring, or warpage. Replace damaged parts as necessary.

NOTICE

• Before attempting an adjustment, measure the thickness of both friction discs. If either is worn to a thickness of 1/4 ins. (6 mm) or less, both discs must be replaced. New friction discs are 5/16 ins. (8 mm) thick.

After thc brake has been assembled and installed on the tractor, adjust the brake as described under the topic, Brake Adjustment. Disassembly and assembly of the brake is covered in the Maintenance Section. After adjustment or repair of the brake, always test the operation of the brake.

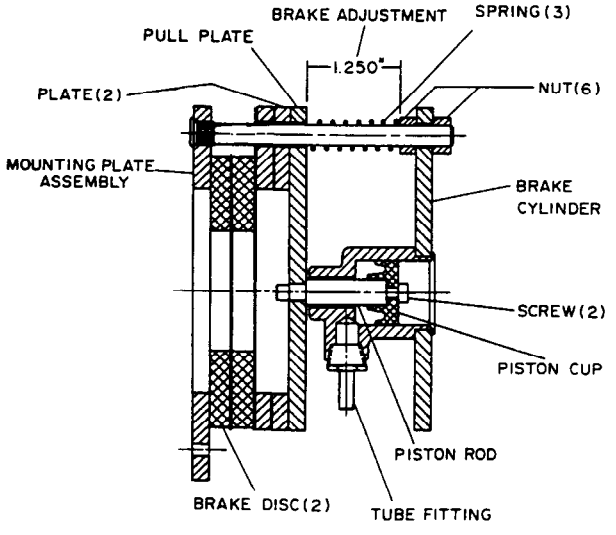
Brake Adjustment

1. Remove brake cover (1).
2. Loosen each outer nut (16) on mounting plate (4) studs approximately one revolution.
3. To increase brake torque adjust inner nut (16) in a clockwise direction. To decrease brake torque adjust inner nut (16) in a counterclockwise direction.

⚠ CAUTION

• Adjust nuts (16) on each mounting plate (4) stud equally. Failure to do this may result in premature and uneven wear on the brake friction disc's (6).

4. Measure brake adjustment gap (reference Dwg. MHTPA0117). Gap must be 1.250 to 1.260 ins. (31.7 to 32.0 mm). If correct brake torque cannot be obtained using this dimension disassemble brake assembly and measure brake friction disc's (6) and stationary plates (7). Check brake adjustment gap at each stud.
5. When correct gap has been established tighten outer nut (16), replace brake cover (1) and test tractor for ability to stop the towed load.



(Dwg. MHTPA0117)

Structural

Inspect the overall structure of the tractor, the trolley, and the tractor supporting members. Look for loose or missing hardware, broken parts, cracks, and/or damage. Replace all missing, broken, or damaged hardware. Replace parts which show signs of cracking, or damage.

Wheel Pressure Adjustment

To prevent wheel, slippage adjust the length of the tensioning spring to 6 ins. (152 mm). If the wheel continues to slip, decrease the spring length only until there is no perceptible wheel slip.

⚠ WARNING

• Do not decrease spring length any more than necessary as excessive wheel loads will decrease life of the rubber tire and increase loadings on bearings and the motor.

Motor Maintenance

⚠ CAUTION

• Shut off the supply valve and completely bleed down piping and hoses between the tractor and the air supply. Tag the valve which feeds the tractor to prevent power from being applied to the tractor while repairs are being performed. Injury or death of personnel may result if this precaution is not observed.

Motor Information

If the motor operates sluggishly, flush it with a clean, nontoxic, nonflammable commercial solvent in a well ventilated area. To flush the motor, disconnect the air line and muffler, and pour 6 or 8 cc of solvent into each inlet. Rotate the rotor shaft by hand in both directions several times to assure that all the internal parts are thoroughly cleaned. Attach the air hose and, while keeping your face away from the exhaust air, slowly increase the air flow until there is no trace of the solvent in the exhaust. After flushing, shut off the air supply and disconnect the air hose. Pour 6 or 8 cc of a premium high viscosity index hydraulic oil into the air inlet side of the motor, and reconnect the air supply line and muffler. Increase the air flow slowly so that the internal parts of the motor will be covered with a film of oil.

If the motor is still low in power, check for damaged vanes or foreign material in the vane slots in the rotor.

Vane Replacement

Vanes will last 5000 to 15,000 hours of operation, depending upon the speed of the motor, operating pressure, lubrication and preventative maintenance. Periodically, you should check the vanes for wear, and replace them if the width of the vane is equal to or less than the replacement width of 9/16 ins. (14 mm). The width of a new vane is 3/4 ins. (19 mm).

NOTICE

• Always replace vanes in sets; never replace an individual vane.

Replace vanes as follows:

1. Disconnect the air line at the motor.
2. Unscrew and remove the rear end cap (92).
3. Unscrew and remove the rear end plate capscrews (91).

4. Using a puller, pull the rear end plate along with the rear rotor bearing (90) from the motor.
5. Wipe each of the new vanes to be installed with a thin film of light oil.
6. Rotate the rotor (83) by hand to place two of the vanes in a horizontal position.
7. Obtain a stiff piece of wire or length of key stock that will slide into the vane slots, and grind one end of it to a gentle, sloping bevel. You will use this for depressing the vane pins while changing vanes.
8. Insert the depressing tool in the vane slot along the bottom edge of the vanes so that it passes between the vane and the vane pin.
9. Depress the vane pin (86) toward the center of the rotor (83) and, while holding it in this position withdraw the worn vane and install the new vane with its notched side toward the center of the rotor.
10. Repeat this procedure with each vane.

Tractor Removal

The following procedure describes how to remove the tractor from its mounting as a complete unit.

⚠ WARNING

• Disconnect air supply and tag the tractor valve control to prevent air from being applied to the tractor while repairs are being performed. Injury or death of personnel may result if this precaution is not observed.

1. Tag and disconnect the air lines to the tractor, at the tractor itself.
2. Remove the tow bar pin, and separate the tow bar from the tractor.
3. Release the tension applied to the drive wheel by loosening the jam nut and hex nut used to tension the spring.

⚠ WARNING

• Support the tractor before attempting to remove the mounting hardware. Failure to adequately support the tractor before removing the mounting hardware will result in the tractor falling to the floor. Injury or death of personnel may result if this precaution is not observed.

4. Support the tractor using suitable lifting device. Remove the tractor mounting hardware which secures the tractor to its mounting.
5. Lower the tractor to the floor and move it to a work area before starting disassembly or repairs.
6. Remove the gear case drain plug, and drain the gear case oil into a container.

Tractor Disassembly

The following instructions provide the necessary information to disassemble, inspect, repair, and assemble the tractor. When needed, for special installation and operation checks, references are made to the Installation Section in this manual.

A cross section view of the tractor is provided in the Parts Section for reference. Tractor disassembly is divided into three separate topics. These topics are:

1. Motor end disassembly.
2. Brake end disassembly.
3. Gear case disassembly.

If a tractor is being completely disassembled for any reason, follow the order of the topics as they are presented.

With the exception of the control valve, brake and motor, all work on the tractor involving disassembly must be performed on a bench. Repairs to the brake, air motor and the control valve can be accomplished while the tractor is in its normal operating position.

General Disassembly

In the process of disassembling the tractor, observe the following:

1. Never disassemble the tractor any further than is necessary to accomplish the needed repair. A good part can be damaged during the course of disassembly.
2. Never use excessive force when removing parts. Tapping gently around the perimeter of a cover or housing with a soft hammer, for example, is sufficient to break the seal.
3. Do not heat a part with a torch to free it for removal, unless the part being heated is already worn or damaged beyond repair.

In general, the tractor is designed to permit easy disassembly and assembly. The use of heat or excessive force should not be required.

4. Keep the work area as clean as practical, to prevent dirt and other foreign matter from getting into bearings or other moving parts.
5. All seals and 'O' rings should be discarded once they have been removed. New seals and 'O' rings should be used when assembling the tractor.
6. Make certain that all hoses are clearly marked before disconnecting them. This will ensure proper reconnection.
7. Before moving the tractor to a bench for disassembly, remove the drain plug, drain the gear oil into a container. Clean and reinstall the drain plug.

8. When grasping a part in a vise, always use leather-covered or copper-covered vise jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded members and housings.
9. Do not remove any part which is press fit in or on a subassembly unless the removal of that part is necessary for repairs or replacement.

Motor End Disassembly

Use the following procedure to disassemble the motor end of the tractor:

1. Remove the air motor assembly by removing capscrews (75) and lockwashers (76). As the motor assembly is being removed the small air hoses to the brake shuttle (65) will be exposed to the point that the hose nuts (101) may be backed off and the small hoses removed from fittings (100).
2. Pull motor assembly completely away from the tractor.
3. Remove the motor plate (62) by removing screws (63) and lockwashers (64). Remove the motor plate (62) enough to access the small air line going from the brake shuttle (65) to the brake. Remove the hose nut and hose at the shuttle valve and then fully remove the motor plate (62).
4. Remove capscrews (57) which secure the motor housing (55) to the center frame (50). Separate the motor housing from the center frame.
5. Remove the cross shaft (60) and the motor shaft coupling (61) from the motor shaft.

Motor Disassembly

⚠ CAUTION

• The vanes in the motor are spring-loaded. Do not withdraw the rotor from the cylinder unless it is absolutely necessary. Vanes can easily be replaced without withdrawing the rotor.

NOTICE

• After these motors were assembled at the factory, cylinder dowel alignment pins were pressed into the end plates and cylinder. During disassembly, these pins will usually remain with the cylinder. Do not remove them.

Disassembly of Rear End

1. Unscrew and remove the rear end cap (89).
2. Unscrew and remove the rear end plate capscrews (91).
3. Using a puller, pull the rear end plate along with the rear rotor bearing from the motor.
4. The rear rotor bearing (90) is a slip fit in the rear end plate (89). Slide or push it from the bearing recess.

Disassembly of Front End Plate

1. Unscrew the front end plate capscrews (74).
2. Using a puller, pull the front end plate (78) along with the front rotor bearing (79) from the rotor shaft.

NOTICE

• The rotor shaft seal (80) is pressed into the front end plate. Do no remove this seal unless you have a new seal on hand. This seal is always destroyed in the removal process. If you have to remove the rotor shaft seal, pry it out with a large screwdriver.

3. The front rotor bearing (79) is a slip fit in the front end plate (78). Slide or push it from the bearing recess.

Removal of the Rotor

1. If the rotor (83) must be withdrawn from the cylinder (77), remove the rear end plate as previously described.
2. Unscrew the front end plate capscrews (82).
3. Carefully withdraw the assembled front end plate and rotor from the cylinder.

⚠ CAUTION

• As the rotor is withdrawn, grasp the rotor body so that the vanes, vane springs and vane pins do not fly.

4. After withdrawing the rotor (83), remove the vanes (84), vane springs (85) and vane pins (86).
5. Support the front end plate as close to the rotor body as possible, and press the rotor from the front rotor bearing.

Brake Disassembly

Disassemble the brake end of the tractor using the following procedure:

1. Remove the capscrews (3) which secure the brake cover (1) to the gear case (19). Remove the brake cover (1).
2. Disconnect the brake hose (72) at the brake.
3. Remove the capscrews (5) which secure the brake to the gear case. Remove the brake assembly from the brake housing.
4. If necessary, disassemble the brake assembly using the following procedure:

a. Unthread nuts (16) from the studs of mounting plate (4).
b. Remove brake cylinder then untread remaining nuts (16).
c. Remove spring (9), pull plate (8), stationary plates (7), and friction discs (6) from mounting plate (4).
d. Separate the piston cup (13) capscrew (12) and piston rod (11) from the brake cylinder.
e. Clean and inspect the components of the brake as described under the topic, Cleaning, Inspection, and Repair.

Gear Case Disassembly

Use the following procedure to disassemble the gear case:

1. Remove snap ring (18) which secures brake spline (17). Remove the brake spline.
2. Remove capscrews (23) which secure gear cases (25 and 19) together. Then, lift gear case (19) off gear case (25).
3. Remove gasket (24) from the face of the gear case.
4. Pull input pinion (35) from the gear case until the bearing clears its recess. Tilt the input pinion away from the intermediate gear (40), and remove the intermediate gear from the gear case.
5. Remove snap ring (43) which secures output gear (42) on output shaft (47).
6. Remove motor gear (37), input pinion (35), and output gear (42) from gear case (25).
7. Remove washers (39) from intermediate gear (40) and input gear (37).
8. Remove bushings (28 and 20) from gear case (25 and 19) only if they are to be replaced.
9. Remove the capscrews (31) which secure gear case (25) to center frame (50). Lift the gear case off the center case.
10. Remove 'O' ring (44) from the groove on output shaft (47).
11. Remove bearings (48 and 49) from output shaft (47).
12. Remove snap rings (46) which secure wheel (45) to output shaft (47). Remove the wheel from the output shaft.
13. Remove the wheel (45) and output shaft assembly from gear case (25).
14. Remove oil seals (29, 27 and 21) from the gear cases.

Cleaning, Inspection and Repair

Use the following procedures to clean, inspect, and repair the components of the tractor.

Cleaning

⚠ CAUTION

• A bearing that appears loose or rotates roughly must be replaced. Failure to observe this precaution will result in bearing and/or tractor component damage.

Clean all tractor component parts in solvent (except for the brake friction discs). The use of a stiff bristle brush will facilitate the removal of accumulated dirt and sediments in the gear case or other components. Dry each part using low pressure, filtered compressed air. Clean the brake friction discs using a wire brush or emery cloth. Do not wash the brake friction discs in liquid. If the brake friction discs are oil soaked, they must be replaced.

Inspection

All disassembled parts should be inspected to determine their fitness for continued use. Pay particular attention to the following:

1. Inspect all gears for worn, cracked, or broken teeth.
2. Inspect all bushings for wear, scoring, or galling.
3. Inspect all bearings for play, distorted races, pitting and roller or ball wear or damage. Inspect bearings for freedom of rotation.
4. Inspect shafts for ridges caused by wear. If ridges caused by wear are apparent on shafts, replace the shaft. Inspect all surfaces on which oil seal lips seat. These surfaces must be very smooth to prevent damage to the seal lip.
5. Inspect all threaded items and replace those having damaged threads.
6. Inspect the motor brake stationary plates (7) and friction discs (6) for oil. If the friction discs (6) have become oil-soaked, replace them. If the stationary plates have become glazed, sand them lightly using fine emery cloth and a flat surface as backing. Inspect the remaining brake parts for warpage or other damage, and replace damaged parts as necessary. Replace the input pinion shaft oil seal (21).

Measure the thickness of each brake friction disc. The brake friction discs must show an even wear pattern. If the brake friction discs are 1/4 ins. (6 mm) or less, replace both discs.

Repair

Actual repairs are limited to the removal of small burrs and other minor surface imperfections from gears and shafts. Use a fine stone or emery cloth for this work. Do not use steel wool.

1. Worn or damaged parts must be replaced. Refer to the applicable Parts Listing for specific replacement parts information.
2. Inspect all remaining parts for evidence of damage. Replace or repair any part which is in questionable condition. The cost of the part is often minor in comparison with the cost of redoing the job.
3. Smooth out all nicks, burrs, or galled spots on shafts, bores, pins, or bushings.
4. Examine all gear teeth carefully, and remove nicks or burrs.
5. Polish the edges of all shaft shoulders to remove small nicks which may have been caused during handling.
6. Remove all nicks and burrs caused by lockwashers.
7. Replace all gaskets, oil seals, and 'O' rings any time the tractor is disassembled for repair.

Tractor Assembly

Assembly of a completely disassembled tractor can be accomplished in the order of topics as presented below. For reference, a cross section view of the tractor is provided with the parts listing.

Gear Case Assembly

Assemble the gear case using the following procedure:

1. Install wheel (45) into center frame (50).
2. Install output shaft (47) into wheel (45). Secure wheel (45) to output shaft (47) using snap rings (46).
3. Assemble bearings (48 and 49) to output shaft (47).
4. Assemble 'O' ring (44) onto the output shaft (output gear end).
5. Install oil seal (29) into gear case (25). Make sure that the seal lip is facing toward the inside of the gear case.
6. Secure center frame (50) to gear case (25) using the capscrews provided.

NOTICE

• When assembling the center frame to the gear case, make sure that the output shaft is properly seated into gear case (25).

7. Lubricate the internal spline of output gear (42) using gear oil. Install output gear (42) onto the end of the output shaft. Use care when working the gear through oil seal (29).
8. Secure output shaft (47) to output gear (42) using snap ring (43).
9. Install oil seals (21 and 27) into their bores in gear cases (25 and 19).
10. If necessary, install bushings (20 and 28) into gear cases (25 and 19).
11. Install the bearings and spacer on input pinion (35).
12. Lubricate input pinion (35) using gear oil. Insert one end of the input pinion through oil seal (27) in gear case (25).

NOTICE

• At this time, do not press the input pinion in so far that the bearing seats in its recess.

13. Position one washer (39) on input gear (37).
14. Tilt and hold input pinion (35) to one side, and install input gear (37) into its bushing, large end first.
15. Install intermediate gear (40) into its bushing bore, small end first.
16. Straighten input pinion (35) and fully seat it into its bearing recess.
17. Install remaining washers (39) onto input gear (37) and intermediate gear (40).
18. Install dowel pins (2) into gear case (19). Coat the gear case mating surfaces with oil, and position gasket (24) on the face of gear case (25).
19. Position gear case (19) onto gear case (25). Align the shafts and pins with their respective bores.

NOTICE

• Do not force the housing halves together. They should fit together easily but snugly.

20. Secure the gear cases together using capscrews (23). Evenly tighten each capscrew to 20 in-lbs (2 Nm).
21. Assemble brake spline (17) to the protruding end of the input pinion, flat side first. Secure the brake spline to the motor pinion using snap ring (18).

Brake Assembly

Assemble the brake of the tractor using the following procedure:

1. If the brake assembly had been disassembled earlier, use the following procedure to assemble and adjust the brake as a complete unit:

a. Position mounting plate (4) on a bench with the studs facing up.
b. Position the friction discs (6), stationary plate (7), and pull plate (8) onto the mounting plate.
c. Install springs (9) and first nut (16) on studs of mounting bolt plate.

NOTICE

• Make sure that the splines of the friction discs are aligned with each other before completely assembling the brake.

d. Install piston cup (13) capscrew (12) and piston rod (11) in the brake cylinder.
e. Position brake cylinder (10) onto the mounting plate studs and install second nut (16).
2. Slide the assembled brake into place while engaging the friction discs with the brake spline (17). Secure the brake assembly using the capscrews (5).
3. Replace any air components which may have been removed earlier. Make all hose connections and replace the brake cover (1).

Motor Assembly

1. Coat all parts with a thin film of oil before installing them in the motor.
2. Always press on the inner ring of a ball-type bearing when pressing the bearing on a shaft.
3. Always press on the outer ring of a ball-type bearing when pressing the bearing in a bearing recess.

Front or Rear End Plate Assembly

1. Support the motor on the front end plate when assembling the rear end plate. Support the motor on the rear end plate to assemble the front end plate.
2. Place an end plate gasket on the face of the cylinder (77), making certain that it is properly oriented relative to the cylinder dowels and tapped holes in the cylinder.

NOTICE

• If installing a new gasket, it will be necessary to punch or cut two holes in it to accommodate the cylinder dowels. Do this by placing the gasket on the rear end plate to determine the location of the dowel holes. Use a proper size gasket punch to cut the required dowel holes.

3. Align the dowel holes in either the front or rear end plate with the cylinder dowels in the cylinder (77) and, using a plastic hammer, tap the end plate into place against the gasket.
4. Using a sleeve that contacts only the inner ring of the bearing, press the rotor bearing onto the rotor shaft until it seats in the bearing recess in the end plate.

⚠ CAUTION

• Do not bind the end plate against the rotor.

5. Rotate the rotor (83) by hand. It should rotate freely with no binding or rubbing against the cylinder (77). If the rotor rubs or binds, tap the top edge of the end plate with a plastic hammer in the area midway between the inlet and outlet ports. Tap the end plate gently. The rotor needs only .0015 ins. (.038 mm) clearance from the top of the cylinder. If the rotor continues to rub, it may be contacting the opposite end plate due to pressing on the rotor bearing. If installing the rear end plate, lightly tap the keyed end of the rotor shaft with a plastic hammer. If installing the front end plate remove the rear end cap and lightly tap the end of the rotor hub with a plastic hammer. The rotor needs about .002 ins. (.051 mm) clearance between the rotor body and each end plate.
6. When the rotor turns freely, install the end plate capscrews and torque to 8 to 10 ft-lb (11 to 14 Nm).
7. If installing the rear end plate slip the end cap gasket over the threaded hub of the rear end cap, and thread the rear end cap into the rear end plate.
8. If installing the front end plate moisten the lip of a new rotor shaft seal with 'O' ring lubricant, and press the seal, lip side first, into the front end plate until the trailing face of the seal is flush with the face of the end plate.

Assembly of the Motor

1. Position the rotor (83) vertically on the table of an arbor press so that the short hub is upward.
2. Place the rear end plate, flat side first, on the rotor.
3. Place a .002 ins. (.051 mm) thick shim on each side of the rotor between the rotor body and the rear end plate.
4. Using a sleeve that contacts only the inner ring of the bearing, press the rear rotor bearing onto the hub of the rotor until it seats in the bearing recess in the rear end plate.
5. Withdraw the shims.
6. Stand the assembled rotor and end plate upright on the hub of the rear end plate.
7. Place a vane spring in the center of each cross-hole in the rotor body. Place a vane pin at each end of each vane spring.
8. Moisten each vane with a film of light oil.
9. Place a vane, notched side first, in each vane slot.
10. Place a rubber band around the rotor body to hold the vanes, vane springs and vane pins in place.
11. Place an end plate gasket on the face of the cylinder, making certain that it is properly oriented relative to the cylinder dowels and tapped holes in the cylinder.

NOTICE

• If installing a new gasket, it will be necessary to punch or cut two holes in it to accommodate the cylinder dowels. Do this by placing the gasket on the rear end plate to determine the location of the dowel holes. Use a proper size gasket punch to cut the required dowel holes.

12. Slide the assembled rotor and rear end plate into the cylinder until the end plate contacts the cylinder dowels.
13. Using a wire hook inserted between the end plate and cylinder, pull the rubber band free of the rotor, thus leaving the vanes, vane springs, and vane pins trapped in the cylinder.
14. Align the dowel holes in the rear end plate with the cylinder dowels in the cylinder and, using a plastic hammer, tap the rear end plate into place against the gasket.
15. Install the front end plate as described in the section titled Front End or Rear End Plate Assembly.
16. Check rotor rotation as described in step 5 in the section titled Front or Rear End Plate Assembly.
17. When the rotor turns freely, install the end plate cap screws and torque to 8 to 10 ft-lb (11 to 14 Nm).
18. Install the rotor shaft seal and front end cap as described in step 8 in the section titled Front End Plate Assembly.
19. Install the rear end cap as described in step 7 in the section titled Front and Rear End Plate Assembly.
20. Again, Check the rotor to see that it rotate freely. Make certain it is rotating freely before connecting the air supply line.

Motor End Assembly

Use the following procedure to assemble the motor end of the tractor:

1. Assemble the cross shaft coupling (59) to the end of the input pinion (35).
2. Insert the cross shaft (60) into the cross shaft coupling (59).
3. Install the alignment dowel pin (56) into the center frame (50).
4. Assemble the motor housing (55) to the center frame (50) making sure that all pins and shafts are properly engaged.

5. Secure the motor housing (55) to the center frame (50) using capscrews (57). Torque the capscrews to 50 in-lbs (6 Nm).
6. Install cross shaft coupling (61) on the end of the motor shaft so it engages with the key (87).
7. Reconnect the air lines.
8. Install motor (73) secure with capscrews.

Test Check

Upon completion of all tractor repairs and maintenance install and check tractor operation following all procedures in the installation section.

NOTICE

• Following the installation of an assembled tractor, fill the gear case to the level specified in the Lubrication Section. Perform the initial operating checks listed under the topic, Initial Operating Checks, in the Installation Section.

Pendant Control Maintenance

Maintenance on the pendant control system components should be limited to the periodic removal of cap (122) for inspection of the 'O' rings (120) and cleaning of the valve (119).

⚠ WARNING

• Disconnect air lines and tag the tractor valve control to prevent air from being applied to the tractor while repairs are being performed. Injury or death of personnel may result if this precaution is not observed.

Trolley Repair

General tractor removal and installation instructions are provided earlier in this manual. Once the tractor is removed from its mounting, the trolley is easily accessible for repairs.

Refer to trolley manufacturers service maintenance and Parts manual for additional information.

Tractor Storage

If the tractor has been operated and is to be stored for more than six months, it should be protected as follows:

1. Drain the tractor gear case and fill with fresh gear oil as described under the topic Lubrication, Gear Case. Replace the gear case breather with a pipe plug. Disconnect the hoses to the motor and flood the motor with air line lubricant.

⚠ CAUTION

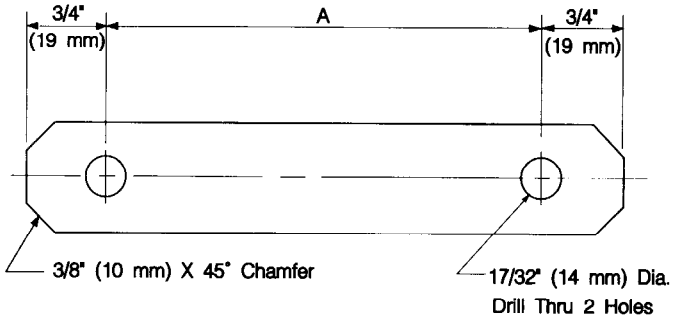
• An air motor flooded with air line lubrication will exit that lubrication through the exhaust when operated.

2. Every six months, remove the tractor from storage and operate it on a test bench for a few minutes. Reinstall the gear case breather during test bench operation. Flood motor with air line lubrication before returning to storage.
3. Every six months, disassemble the brake. Inspect the brake piston and brake plates for rust. Remove any rust which is present using fine emery paper.
4. Inspect the control system components for rust or corrosion, and if necesssary, clean, repair, or replace components.
5. Reinstall the gear case breather when the tractor is to be removed from storage and returned to normal service.

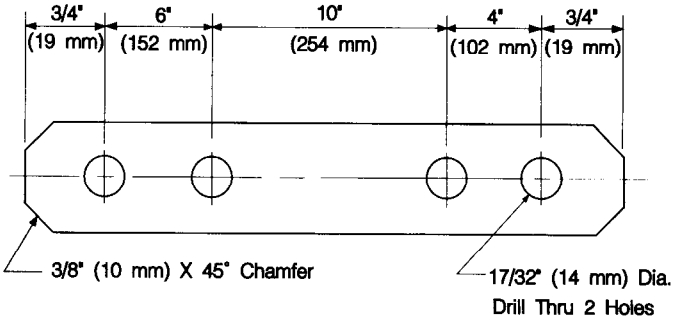
Drawbar

Drawing MHTPA0118 shows how to make a suitable Drawbar, while drawing MHTPA0119 illustrates a "universal" Drawbar (Part No. TVH50A-704) available from Ingersoll-Rand. The latter is long enough for practically any application, and the spacing of the holes is such that it can be cut to produce one or more intermediate length drawbars. In addition, a Drawbar with holes spaced 4 ins. (102 mm) (Part No. TVH50A-704-4) is available. This Drawbar is satisfactory for connecting the tractor to an Ingersoll-Rand Low Headroom Hoist or a Standard Headroom Hoist when the hoist is mounted with the rope drum crosswise to the track.

Use 3/8 x 1-1/2 ins. cold rolled steel. It is unnecessary to cut the corners if the unit is used only on a straight track. Dimension "A" must at least equal the distance between the centers of the Drawbar pin hole in the clevis on the Tractor and the one on the hoist when the tractor and hoist are as close as possible to each other on the track.



(Dwg. MHTPA0118)



(Dwg. MHTPA0119)

Drawings MHTPA0118 and MHTPA0119 are not shown to scale.

Drawbar Yoke Kits have been established for connecting Tractors to Trolley Mounted Hoists. The following is a list of Hoists with Trolleys and the available Drawbar Yoke Kits for them. Series HLK Hoists with Rigid Trolley do not require a Drawbar Yoke kit.

For Series

C6CA, C620C, C6H20A, C6H20B, C640A, C6H40A, D660A and D6H60A:

Standard Headroom Hoists with Rigid Trolley.....C6CA-K1

Standard Headroom and Low Headroom Hoists with Swivel Trolleys..... C6H20A-K2

Low Headroom Hoists with Rigid Trolley..... C640ALH-K1

MR, ML, MRK and MLK Hoists and A and B Hoists with Rigid Trolley.....MR-K1

PARTS ORDERING INFORMATION

The use of replacement parts other than INGERSOLL-RAND Material Handling Products will invalidate the Company's warranty. For prompt service and genuine INGERSOLL-RAND Material Handling Products parts, provide your nearest Distributor with the following:

1. Complete model number as it appears on the nameplate: TVL Tractor.
2. Part number and part description as shown in manual.
3. Quantity required.

Return Goods Policy

INGERSOLL-RAND will not accept any returned goods for warranty or service work unless prior arrangements have been made and written authorization has been provided from the location where the goods were purchased.

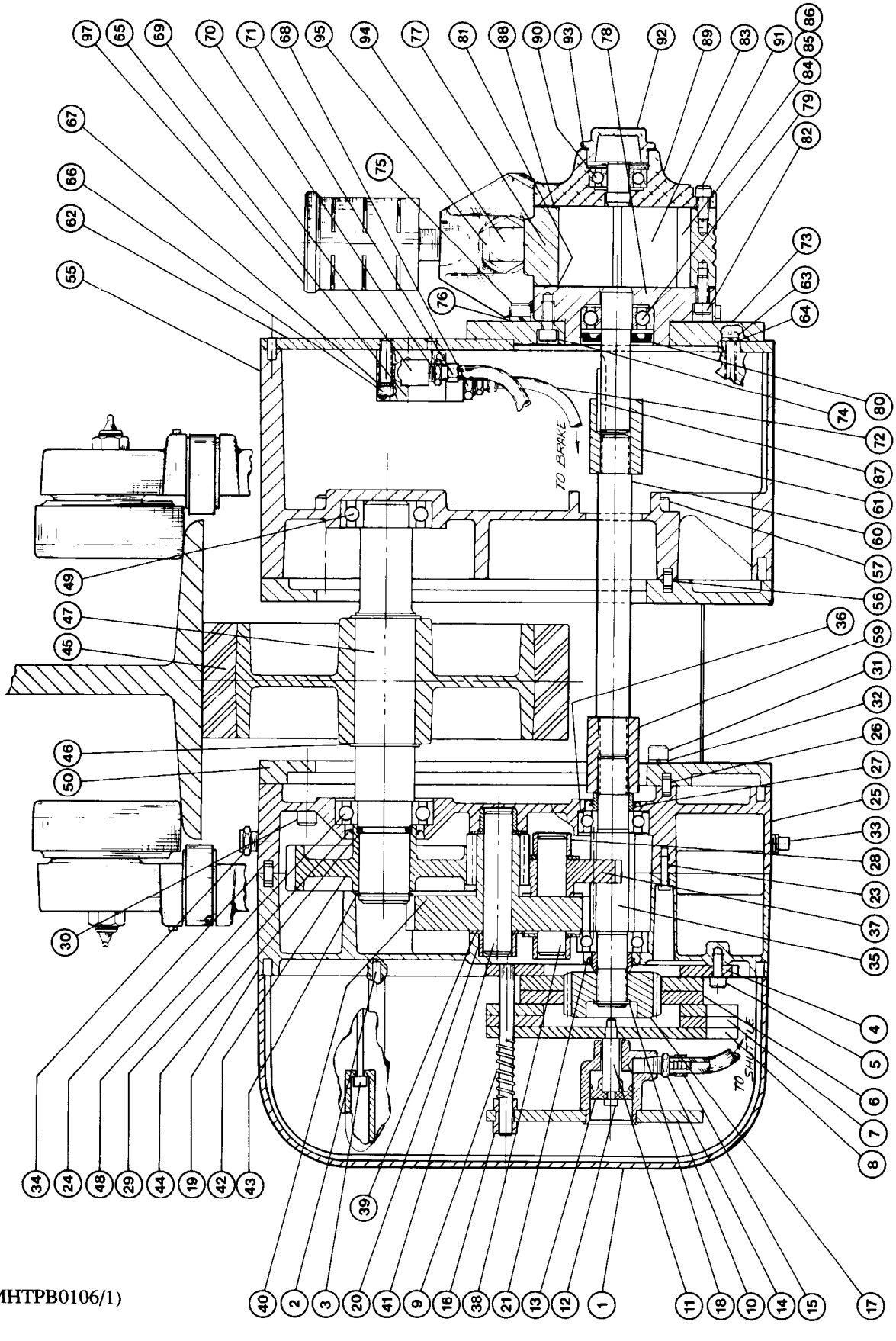
Tractors which have been modified without INGERSOLL-RAND approval, mishandled or overloaded, will not be repaired or replaced under warranty.

A printed copy of the warranty which applies to this tractor is provided inside the back cover of this manual.

NOTICE

• Continuing improvement and advancement of design may cause changes to this tractor which are not included in this manual. Manuals are periodically revised to incorporate changes. Always check the manual edition number on the front cover for the latest issue.

TRACTOR ASSEMBLY DRAWING



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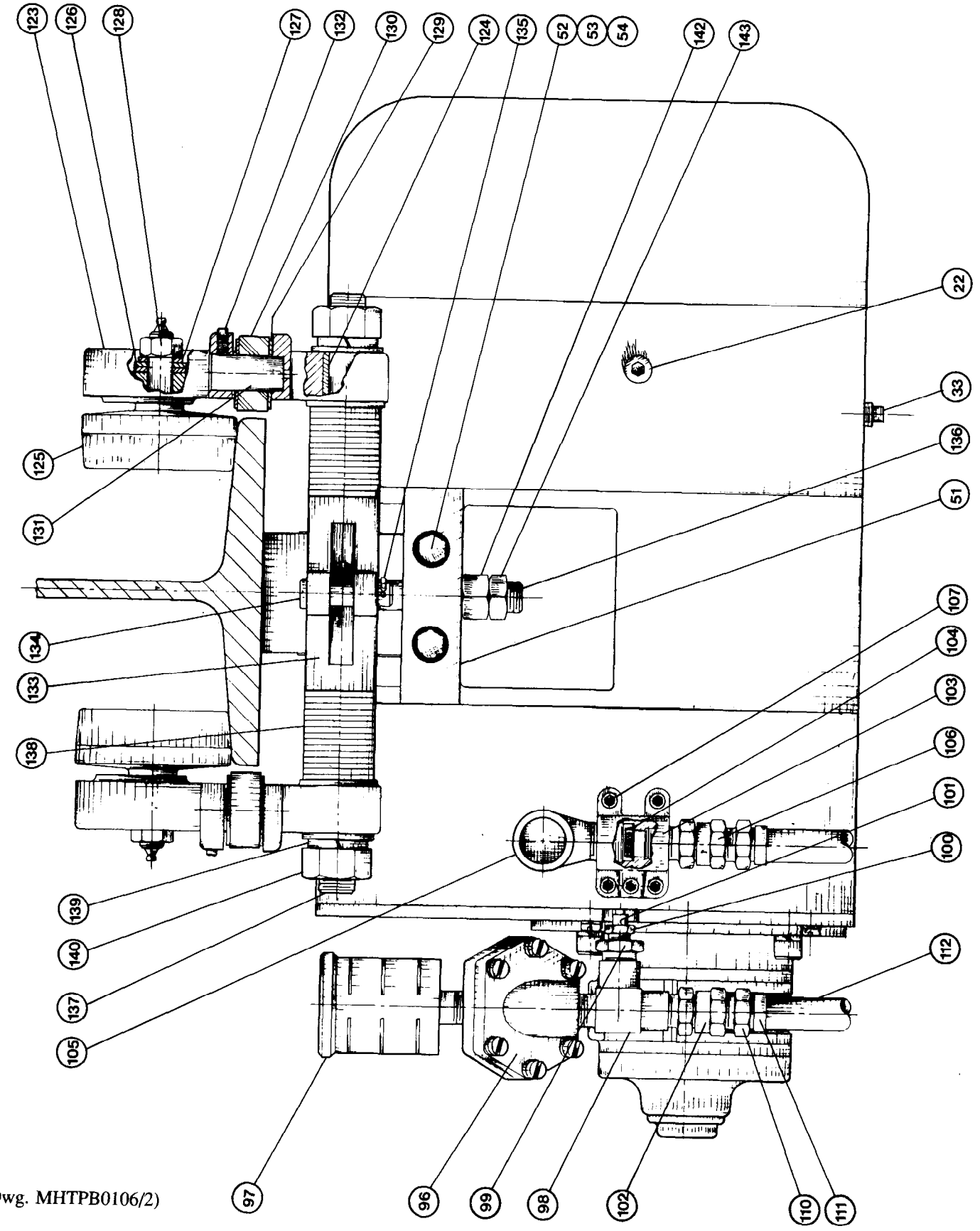
TRACTOR ASSEMBLY DRAWING



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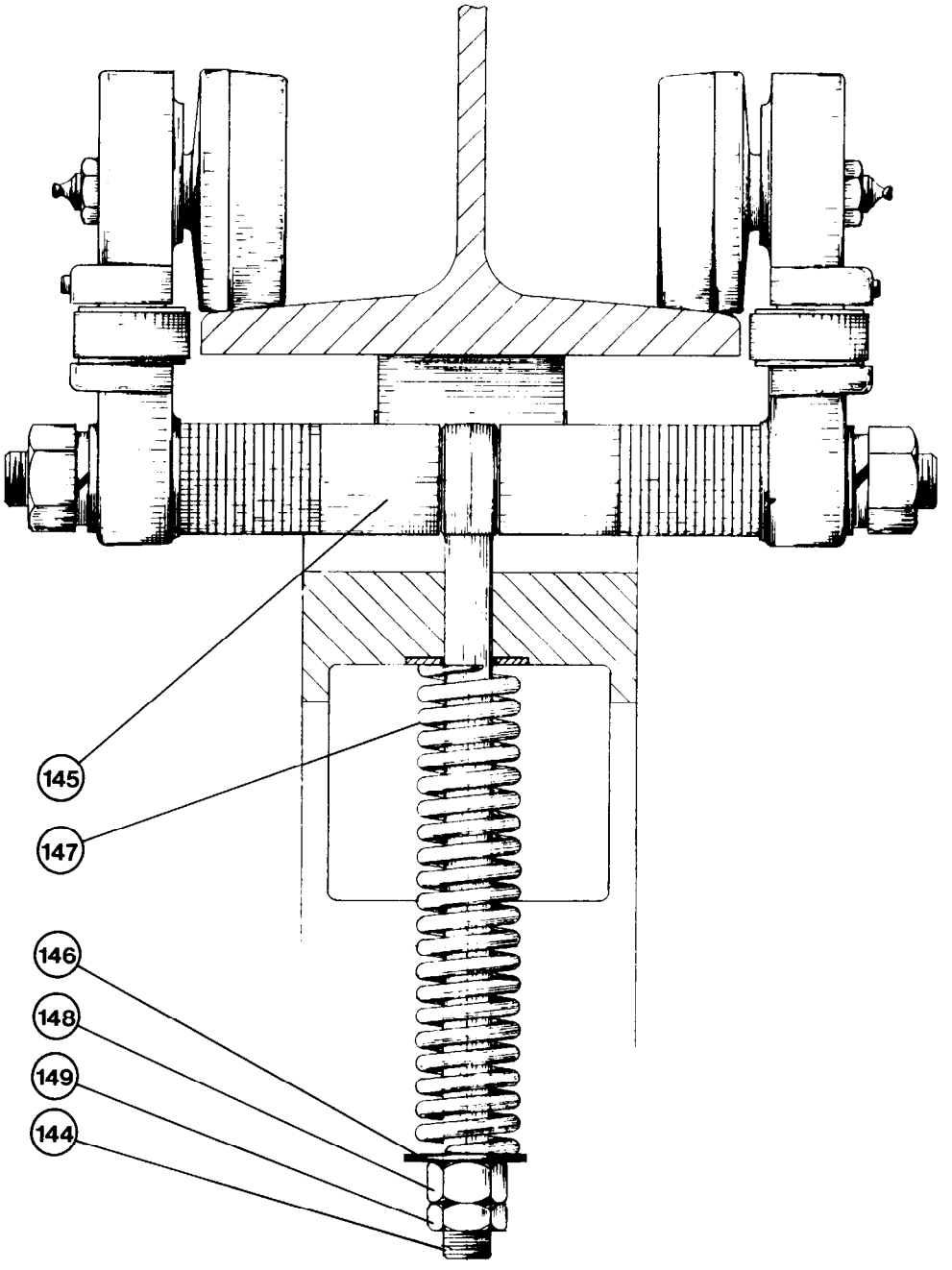

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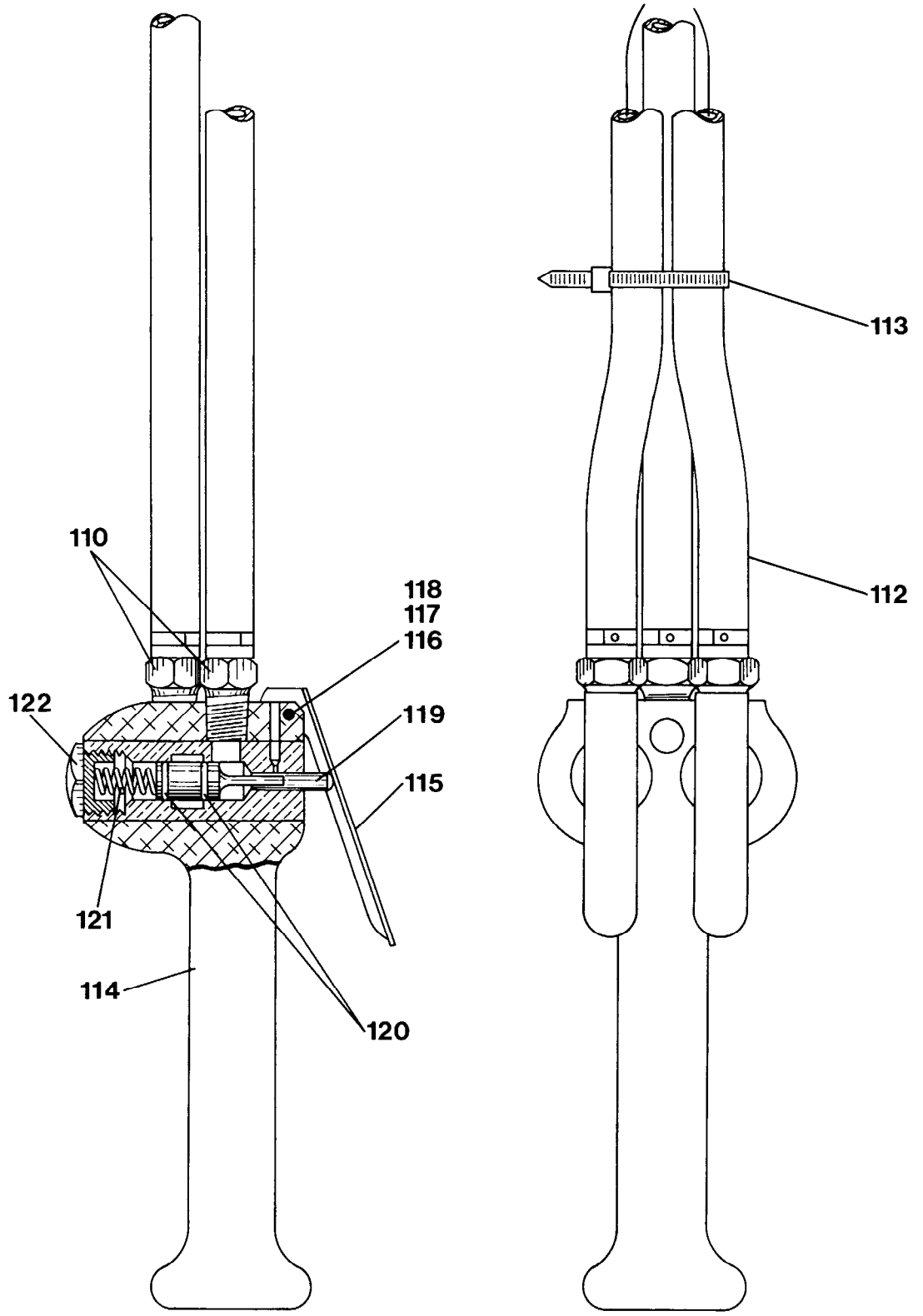

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TRACTOR ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NO.
1	Brake Cover	1	TVL-862
2	Dowel Pin	2	CE110-347
3	Capscrew	4	CE110-302
4	Mounting Plate	1	CE110-A834
5	Capscrew	3	CE110-354
6	Friction Disc	2	CE110-855
7	Stationary Plate	2	CE110-834
8	Pull Plate	1	CE110-838
9	Spring	3	CE110-832
10	Brake Cylinder	1	CA110-802
11	Piston Rod	1	CA110-805
12	Capscrew	2	CE110-868
13	Piston Cup	1	CA110-809
14	Fitting	1	AF120-339
15	Clamp	1	AF120-342
16	Nut	6	CE110-139
17	Brake Spline	1	CE110-842
18	Snap Ring	1	G57-729
19	Gear Case Housing	1	TVL-352
20	Bushing	2	CE110-316
21	Seal	1	CE110-103
22	Plug	1	ROH-377
23	Capscrew	10	CE110-354
24	Gasket	1	CE110-931
25	Gear Case Housing	1	TVL-353
26	Dowel Pin	4	CE110-347
27	Seal	1	CE110-103
28	Bushing	2	CE110-316
29	Seal	1	C6H20A-872
30	Capscrew	1	R4800-638
31	Capscrew	2	34U-103
32	Lockwasher	2	34U-58
33	Plug	1	P250-368
34	Vent Plug	1	CE210-120
35	Input Pinion	1	CE110-A319
36	Spring Washer	1	MOV003AA-278
37	Input Gear	1	CA110-A364
38	Shaft	1	CE110-365
39	Thrust Washer	4	CE110-332
40	Intermediate Gear	1	CA110-A357
41	Shaft	1	CE110-358
42	Output Gear	1	TVL-368
43	Snap Ring	1	162A13S106
44	O' Ring	1	20A11CM119

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NO.
45	Wheel	1	TVL-653
46	Snap Ring	2	TVL-654
47	Output Shaft	1	TVL-652
48	Bearing	1	MR-593
49	Bearing	1	SS800-359
50	Center Frame	1	TVL-650
51	Bumper	2	TVL-651
52	Capscrew	4	FM-554
53	Lockwasher	4	T11-58
54	Washer	4	S12-643
55	Motor Housing	1	TVL-300
56	Dowel Pin	3	CE110-347
57	Capscrew	4	34U-104
59	Coupling	1	TVL-318
60	Shaft	1	TVL-319
61	Coupling	1	CE110-317
62	Plate	1	TVL-502
63	Screw	4	CE110-226
64	Lockwasher	4	4U-58
65	Shuttle Valve	1	UWB-802
66	Capscrew	2	119A2A70
67	Lockwasher	2	4U-58
68	Bushing	3	20BM-193
69	Elbow	2	HRA20A-275
70	Fitting	3	AF120-339
71	Clamp	3	AF120-342
72	Hose	5	HRA20A-B930
73	Mounting Flange	1	MRV015-AH633
74	Capscrew	3	34U-667A
75	Capscrew	4	34U-103
76	Lockwasher	4	34U-58
77	Cylinder	1	MRV015-AH632
78	Front End Plate	1	MRV015-AH631
79	Bearing	1	MRV015-AB519
80	Seal	1	MRV015-AC726
81	Gasket	1	MRV015-AC730
82	Capscrew	6	5081T-961
83	Rotor	1	MRV015-AM455A
84	Vane	4	MRV015-AC727
85	Vane Spring	2	MRV015-AC728
86	Vane Pin	4	MRV015-AC731
87	Key	1	MRV015-AB136
88	Gasket	1	MRV015-AC730
89	Rear End Plate	1	MRV015-AC728

Recommended Spare

TRACTOR ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NO.
90	Bearing	1	MRV015-AA299J
91	Capscrew	6	MRV015-638
92	End Cap	1	MRV015-AM307
93	Gasket	1	MRV015-AA46
94	Elbow	2	125A23S02
95	Bushing	2	H-82
96	Exhaust Valve	2	MR-939
97	Muffler	2	TA223A-311
98	Tee	2	135A23S06
99	Bushing	2	HRA-802
100	Fitting	2	AF120-339
101	Clamp	2	AF120-342
102	Union Fitting	2	MR-129
103	Block	1	CA110-581
104	Screen	1	402-61
105	Elbow	1	D01-581
106	Union Fitting	1	MR-129
107	Capscrew	5	CE110-354
108	Chain	7	D02-B413
109	S-Hook	2	D02-421
110	Nipple	6	RV1-46
111	Clamp	6	B-1
112	Hose	3	H6A-7
113	Strap	3	HRE20A-283
114**	PT Handle	1	MR-269A
115	Lever	2	MR-273
116	Lever Pin	1	DLC-120A
117	Screw	2	MLK-SR662
118	Lockwasher	2	D02-138
119	Valve	2	MR-264
120	'O' Ring	4	20A11CM111

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NO.
121	Spring	2	D01-51A
122	Cap	2	D02-180A
123	Trolley Bracket	4	TVL-690
124	Spacer	4	TVL-691
125	Wheel	4	TVH50A-A691
126	Spacer	8	23-725
127	Lockwasher	4	D10-322
128	Nut	4	D02-418A
129	Washer	16	TVL-721
130	Roller	8	TVL-719
131	Pin	8	TVL-720
132	Set Screw	8	R2J-561
133	Clevis	1	TVH50A-703
134	Pin	1	TVH50A-705A
135	Cotter Pin	1	TVL-330
136	Capscrew	1	TVH50A-699
137	Bolt	2	TVH50A-746-12
138	Spacer	80	21-748
139	Lockwasher	4	D01-692
140	Nut	4	DU-562
142	Nut	1	HU-776
143	Jam Nut	1	G7-18
144	Bolt	1	TVH50A-713
145	Spacer	2	TVH50A-711-54
146	Spring Seat	2	24-741
147	Spring	1	TVL-715
148	Nut	1	HU-776
149	Jam Nut	1	G7-18
150*	Nameplate	1	TP200-914
151*	Screw	4	R4K-302
152*	Warning Label	1	TA-147A

* Not Shown

Recommended Spare

** See Form #P6778 For 2 and 3 Motor Handles Used with Hoist and Crane Propelling Motors.

SERVICE NOTES

HOIST AND WINCH LIMITED WARRANTY

Ingersoll-Rand Company (I-R) warrants to the original user its Hoists and Winches (Products) to be free of defects in material and workmanship for a period of one year from the date of purchase. I-R will repair, without cost, any Product found to be defective, including parts and labor charges, or at its option, will replace such Products or refund the purchase price less a reasonable allowance for depreciation, in exchange for the Product. Repairs or replacements are warranted for the remainder of the original warranty period.

If any Product proves defective within its original one year warranty period, it should be returned to any Authorized Hoist and Winch Service Distributor, transportation prepaid with proof of purchase or warranty card.

This warranty does not apply to Products which I-R has determined to have been misused or abused, improperly maintained by the user, or where the malfunction or defect can be attributed to the use of non-genuine I-R parts.

I-R makes no other warranty, and all implied warranties including any warranty of merchantability or fitness for a particular purpose are limited to the duration of the expressed warranty period as set forth above.

I-R's maximum liability is limited to the purchase price of the Product and in no event shall I-R be liable for any consequential, indirect, incidental, or special damages of any nature rising from the sale or use of the Product, whether based on contract, tort, or otherwise.

Note: Some states do not allow limitations on incidental or consequential damages or how long an implied warranty lasts so that the above limitations may not apply to you.

This warranty gives you specific legal rights and you may also have other rights which may vary from state to state.

IMPORTANT NOTICE

It is our policy to promote safe delivery of all orders.
This shipment has been thoroughly checked, packed and inspected before leaving our plant and receipt for it in good condition has been received from the carrier. Any loss or damage which occurs to this shipment while enroute is not due to any action or conduct of the manufacturer.

VISIBLE LOSS OR DAMAGE

If any of the goods called for on the bill of lading or express receipt are damaged or the quantity is short, do not accept them until the freight or express agent makes an appropriate notation on your freight bill or express receipt.

CONCEALED LOSS OR DAMAGE

When a shipment has been delivered to you in apparent good condition, but upon opening the crate or container, loss or damage has taken place while in transit, notify the carrier's agent immediately.

DAMAGE CLAIMS

You must file claims for damage with the carrier. It is the transportation company's responsibility to reimburse you for repair or replacement of goods damaged in shipment. Claims for loss or damage in shipment must not be deducted from the Ingersoll-Rand invoice, nor should payment of Ingersoll-Rand invoice be withheld awaiting adjustment of such claims as the carrier guarantees safe delivery.
You may return products damaged in shipment to us for repair, which services will be for your account and form your basis for claim against the carrier.

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