

IMPORTANT INFORMATION:

- A copy of our “Safe Operating Practices” Manuals are always available free of charge either by downloading it from our Technical Publications website @ www.airwinch.com or by contacting the Factory at (800) 866-5457 for North America and (206) 624-0466 for International. The Safe Operating Practices manual must be read prior to anyone operating a **Ingersoll-Rand** winch or hoist. The manual form numbers are as follows:

“Safe Operating Practices Non-Man Rider™ Winches” Manual, Form No. MHD56250

“Safe Operating Practices for Man Rider™ Winches” Manual, Form No. MHD56251

“Safe Operating Practices for Pneumatic, Hydraulic and Electric Hoists” Manual, Form No. MHD56295

- Available winch options may require additional supplements to the basic winch manual.
- For Man Rider™ winches ensure a copy of the Man Rider™ supplement is made available to the operator prior to winch operation.

Winch Man Rider™ Supplements:

Model:	Publication No.
FA2, FA2.5, FH2, FH2.5	MHD56046
FA5	MHD56042 and MHD56220
FA10	MHD56252
FA2.5A	MHD56236
FA2B and HU40A	MHD56207
FH10MR	MHD56212
Fulcrum Electric	MHD56277
LS500HLP/ LS1000HLP	SAM0004

Model:	Publication No.
LS500RLP	SAM0011
LS1000RLP	SAM0012
LS150RLP	SAM0082
LS150RLP/500/ 1000	SAM0115
LS150RLP and LS150PLP-PH	SAM0120
LS500RLP-E	SAM0122
LS150RLP- DP5M-F	SAM0184
LS150HLP	SAM0222

- We strongly recommend that ALL maintenance on **Ingersoll-Rand** equipment be carried out by personnel certified by **Ingersoll-Rand**, or by **Ingersoll-Rand** Authorized Service Centers.
- Contact the Factory if in doubt about installation, operation, inspection and maintenance instructions.
- Use only Genuine **Ingersoll-Rand** parts when maintaining or repairing a winch, hoist or any component of a winch or hoist.
- ANSI / ASME recommends that a winch or hoist (or any components of a winch or hoist) that has been repaired be tested prior to being placed into service:
 - * **Winches** - ANSI / ASME B30.7 (BASE MOUNTED DRUM HOISTS) Refer to section 7.2.2 - Testing.
 - * **Hoists** - ANSI / ASME B30.16 (OVERHEAD HOISTS - UNDERHUNG) Refer to section 16.2.2 - Testing.

Form MHD56298

Edition 2

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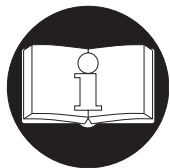
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PARTS, OPERATION AND MAINTENANCE MANUAL

force TM **AIR WINCHES**

for MODELS FA2 AND FA2.5



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 installation, operation and maintenance of these products.

⚠ WARNING

Do not use this winch for lifting, supporting, or transporting people unless winch is approved for Man Rider™ applications. Do not lift or support loads over people.

Always operate, inspect and maintain this winch in accordance with American Society of Mechanical Engineers Standards Safety Code (ASME B30.7) and any other applicable safety codes and regulations.

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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 should read this manual before operating the winch.

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* 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* 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 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 winch for lifting, supporting, or transporting people unless winch is approved for Man Rider™ applications. Do not lift or support loads over people.**
- **The supporting structures and load-attaching devices used in conjunction with this winch must provide an adequate safety factor to handle the rated load, plus the weight of the winch and attached equipment. This is the customer's responsibility. If in doubt, consult a registered structural engineer.**

Ingersoll Rand winches are manufactured in accordance with the latest ASME B30.7 standards.

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 suspended loads 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 intended path of any load.

The Occupational Safety and Health Act of 1970 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, associated with the final installation. It is the owner's and user's responsibility to determine the suitability of a product for any particular use. It is recommended that all applicable industry, trade association, federal, state and local regulations be checked. 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. Refer to ASME B30.9 for rigging information, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10015.

This manual has been produced by **Ingersoll Rand** to provide dealers, mechanics, operators and company personnel with information required to install, operate, maintain and repair the products described herein.

It is extremely important that mechanics and operators be familiar with servicing procedures of these products, or like or similar products, and are physically capable of conducting the procedures. These personnel shall have a general working knowledge that includes:

1. Proper and safe use and application of mechanics common hand tools as well as special **Ingersoll Rand** or recommended tools.
2. Safety procedures, precautions and work habits established by accepted industry standards.

Ingersoll Rand cannot know of, or provide all the procedures by which product operations or repairs may be conducted and the hazards and/or results of each method. If operation or maintenance procedures not specifically recommended by the manufacturer are conducted, it must be ensured that product safety is not endangered by the actions taken. If unsure of an operation or maintenance procedure or step, personnel should place the product in a safe condition and contact supervisors and/or the factory for technical assistance.

SAFE OPERATING INSTRUCTIONS

The following warnings and operating instructions have been adapted in part from American Society of Mechanical Engineers (Safety) Standard ASME B30.7 and are intended to avoid unsafe operating practices which might lead to injury or property damage.

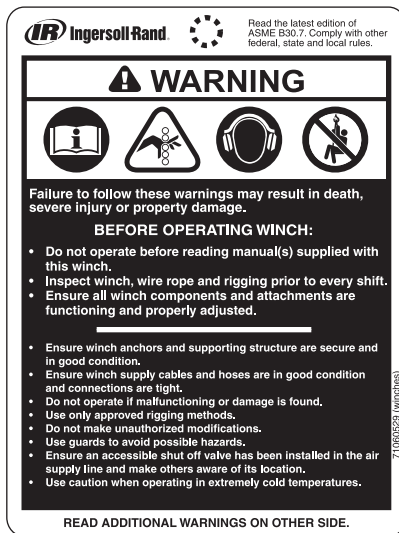
Ingersoll Rand recognizes that most companies who use winches have a safety program in force at their facility. In the event that some conflict exists between a rule set forth in this publication and a similar rule already set by an individual company, the more stringent of the two should take precedence.

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 personnel trained in safety and operation of this product to operate and maintain this winch.
2. Only operate a winch if you are physically fit to do so.
3. When a **“DO NOT OPERATE”** sign is placed on winch, or controls, do not operate winch until sign has been removed by designated personnel.
4. Before each shift, check winch for wear and damage. Never use a winch that inspection indicates is worn or damaged.
5. Never lift a load greater than rated capacity of the winch. Refer to labels attached to winch or to **“SPECIFICATIONS”** section.
6. Keep hands, clothing, etc., clear of moving parts.
7. Never place your hand in the throat area of a hook or near wire rope spooling onto or off of winch drum.
8. Always rig loads properly and carefully.
9. Be certain the load is properly seated in saddle of hook. Do not support load on tip of hook.
10. Do not **“side pull”** or **“yard”**.
11. Always ensure that you, and all other people, are clear of the path of the load. Do not lift a load over people.
12. Never use the winch for lifting or lowering people, and never allow anyone to stand on a suspended load.
13. Ease slack out of wire rope when starting a lift or pull. Do not jerk the load.
14. Do not swing a suspended load.
15. Do not leave a suspended load unattended.
16. Never operate a winch with twisted, kinked or damaged wire rope.
17. Pay attention to the load at all times when operating the winch.
18. Never use the winch wire rope as a sling.
19. After use, or when in a non-operational mode, winch should be secured against unauthorized and unwarranted use.

WARNING LABEL

Each unit is shipped from the factory with warning label shown. If the label is not attached to your unit, order a new label and install it. Refer to the parts list for part number. Label is shown smaller than actual size.



(Dwg. 71060529)

SPECIFICATIONS

Model Code

Example: FA2-16MK320P **FA2** - **16** **M** **K** **320** **P**

Series (Capacity):

Model FA2 (2 metric tons / 4400 lbs)

Model FA2.5 (2.5 US TONS / 5000 lbs)

Drum Flange Height or Man Rider Designation:

- = 19 inch (483 mm) diameter (Standard).

MR = Man Rider® *

Drum Length (Distance between drum flanges):

8 = 8 inch (203 mm)

12 = 12 inch (305 mm)

16 = 16 inch (406 mm)

24 = 24 inch (610 mm) [Standard]

Drum Brake:

A = Automatic Drum Brake

M = Manual Drum Brake

X = None

Disc Brake:

K = Automatic Disc Brake

X = None

Control:

1 = Winch mounted lever throttle (Standard)

2XX = Remote full flow lever throttle (XX = Specify hose length (feet). Max 20 ft. (6 metres)) **

3XX = Remote pilot pendant throttle (XX = Specify hose length (feet). Max 50 ft. (15 metres)) **

4XX = Remote pilot lever throttle. (XX = Specify hose length (feet). Max 50 ft. (15 metres)) **

Options: ***

Z = Sand blast and Carbozinc primer only

P = Marine 812 top coat

G = Drum Guard

7 = Drum Grooving (Number = wire rope size in sixteenths, e.g. 7/16 inch)

D = Drum Divider Flange and additional wire rope anchor

T = Tensioning Manifold

S = Rotary Limit Switch ****

L = Drum Locking Pin

* Reference Man Rider® Manual Supplement, Form No. MHD56046.

** Remote throttles are provided with 10 feet (3 metres) of hose. Specify hose lengths greater than 10 feet. For lengths greater than 20 ft. (6 metres) with the Remote Full Flow Throttle, or 50 ft. (15 metres) with the Remote Pilot Lever and Remote Pilot Pendant Throttles contact Technical Sales for control acceptability. Metric lengths for reference only, order lengths required to be in feet.

*** Documentation, witness testing and material traceability available. Specify options or contact the factory or your nearest Ingersoll-Rand distributor for information.

**** Includes mandatory remote full flow lever or remote pilot pendant throttle with 10 feet (3 metres) of hose. Contact technical sales for application suitability.

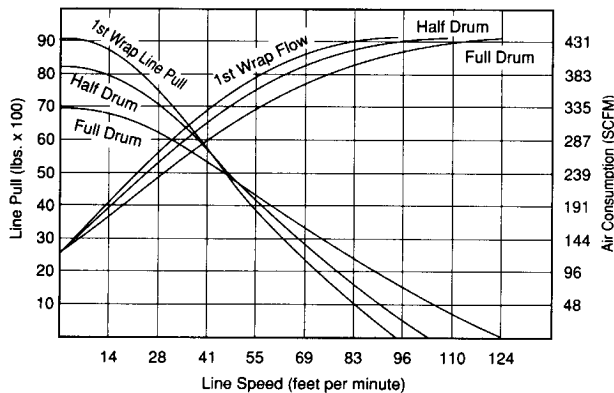
General Specifications		Model			
		FA2		FA2.5	
Air System	Rated Operating Pressure	90 psig (6.2 bar)			
	Consumption Volume (at rated pressure)	335 scfm	10 cu.m/min	700 scfm	20 cu.m/min
Rated Performance (at rated pressure / volume)	Full Drum Line Pull	4,400 lbs	2,000 kgs	5,000 lbs	2,268 kgs
	Mid Drum Line Speed	55 fpm	17 m/min	145 fpm	44 m/min
	Max Stall Pull - 1st Layer	9,000 lbs	4,082 kgs	10,000 lbs	4,536 kgs
	FA2-24MX1 Net Weight	720 lbs	327 kgs	---	---
	FA2.5-24MX1 Net Weight	---	---	910 lbs.	413 kgs
Air Motor Pipe Inlet Size		1 inch	25 mm	1-1/4 inch	32 mm
Minimum Air System Hose Size		1-1/4 inch	32 mm	1-1/2 inch	38 mm
Drum Wire Rope Storage Capacity * (feet / metres)	Drum Length (inches)	Wire Rope Diameter			
		1/2 inch **	13 mm **	5/8 inch	16 mm
	8	454 ft	138 m	171 ft	52 m
	12	681 ft	207 m	256 ft	78 m
	16	908 ft	277 m	338 ft	103 m
	24	1,362 ft	415 m	512 ft	156 m

* Wire rope storage is based on a FA2 or FA2.5 Winch with a 19 inch (483 mm) diameter drum flange and on ASME standards which require the top layer to be at least 1/2 inch (13 mm) below the drum flange diameter. Capacities shown may vary from those published elsewhere.

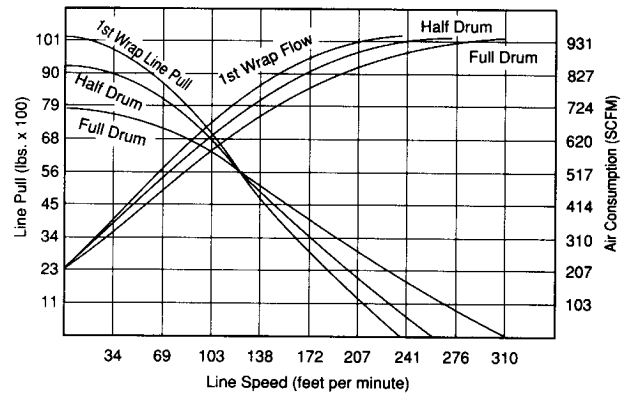
** Capacities apply to FA2 winch only.

Performance Graphs

FA2 Winch



FA2.5 Winch



INSTALLATION

Prior to installing the winch, carefully inspect it for possible shipping damage.

Winches are supplied fully lubricated from the factory. Before operation check oil levels and adjust as necessary. Use the proper type of oil as recommended in the "LUBRICATION" section.

⚠ CAUTION

• Owners and users are advised to examine specific, local or other regulations, including American National Standards Institute and/or OSHA Regulations which may apply to a particular type of use of this product before installing or putting winch to use.

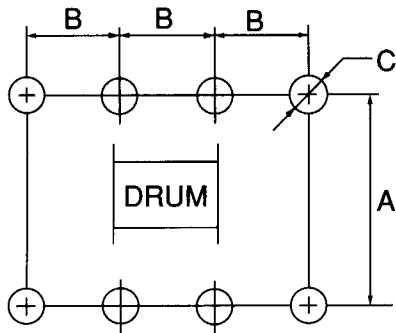
Mounting

Care must be taken when moving, positioning or mounting the winch. In most cases, lifting lugs have been provided to assist in handling the winch. If the lug locations are improper for your specific installation, great care should be taken to ensure that the winch, when lifted, will be properly balanced. Determine the weight of your winch by referring to the "SPECIFICATIONS" section. Lift the winch 3 to 4 inch (75 to 100 mm) off the ground. Verify winch is balanced and secure before continuing lift.

Mount the winch so the axis of the drum is horizontal and that the motor vent cap is not more than 15° off top vertical center. If the winch is to be mounted in an inverted position, the motor case must be rotated to position the vent cap at the top.

1. The winch mounting surface must be flat and of sufficient strength to handle the rated load plus the weight of the winch and attached equipment. An inadequate foundation may cause distortion or twisting of the winch uprights and side rails resulting in winch damage.
2. Make sure the mounting surface is flat to within 1/16 inch (2.0 mm). Shim if necessary.
3. Mounting bolts must be 5/8 inch (16 mm) Grade 8 or better. Use self-locking nuts or nuts with lockwashers. Refer to Dwg. MHTPA0133 and Table 1 for specific mounting bolt installation information.

Bolt Hole Dimensions



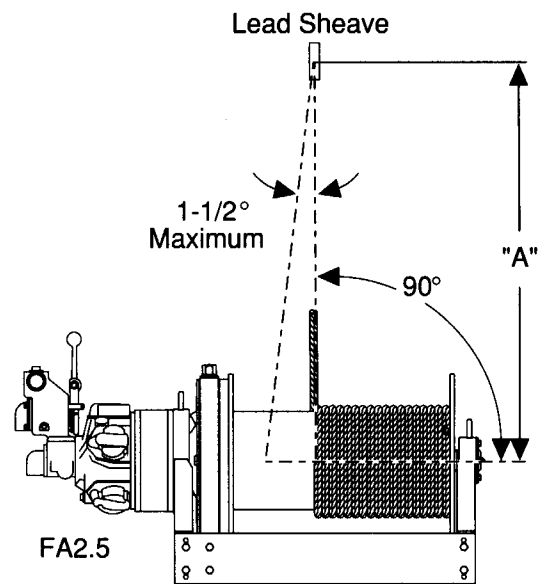
(Dwg. MHTPA0133)

Table 1
Bolt Hole Dimensions

Dimension		Drum Length (inches)			
		8	12	16	24
"A"	in.	20			
	mm	508			
"B" (with Manual Drum Brake)	in.	7.00*	9.00*	7.50	10.00
	mm	178*	229*	190	254
"B" (without Manual Drum Brake)	in.	5.50*	7.50*	6.25	9.00
	mm	140*	190*	159	229
"C"	in.	0.6875			
	mm	17.5			

* 3 Bolt holes in each side rail.

4. Tighten mounting bolts evenly and torque to 220 ft lbs (30.4 kgm) for dry thread fasteners. If the fasteners are plated, lubricated or a thread locking compound is used, torque to 170 ft lbs (23.5 kgm).
5. Maintain a fleet angle between the sheave and winch of no more than 1-1/2°. The lead sheave must be on a center line with the drum and for every inch of drum length, be at least 1.6 feet (0.5 metre) from the drum. Refer to Dwg. MHTPA0487.



"A" = 1.6 feet (0.5 metre) per inch of drum length

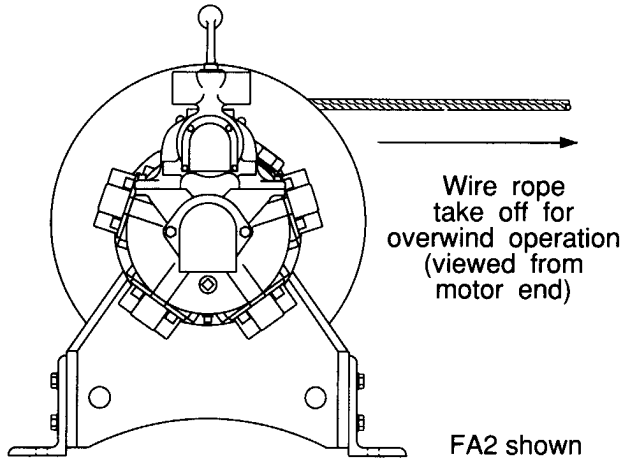
(Dwg. MHTPA0487)

6. Do not weld to any part of the winch.

Wire Rope



- Maintain at least 3 tight wraps of wire rope on the drum at all times.
- Install the wire rope to come off the drum for overwind operation. Refer to Dwg. MHTPA0202.



(Dwg. MHTPA0202)

NOTICE

- Some applications may require underwind operation. Consult the factory prior to use.

Wire Rope Selection

Consult a reputable wire rope manufacturer or distributor for assistance in selecting the appropriate type and size of wire rope and, where necessary, a protective coating. Use a wire rope which provides an adequate safety factor to handle the actual working load and that meets all applicable industry, trade association, federal, state and local regulations. When considering wire rope requirements the actual working load must include not only the static or dead load but also loads resulting from acceleration, retardation and shock load. Consideration must also be given to the size of the winch wire rope drum, sheaves and method of reeving. Wire rope construction must be 6 X 19 or 6 X 37 IWRC right lay to permit correct installation of wire rope anchor. Refer to Table 2 for minimum and maximum recommended wire rope diameters.

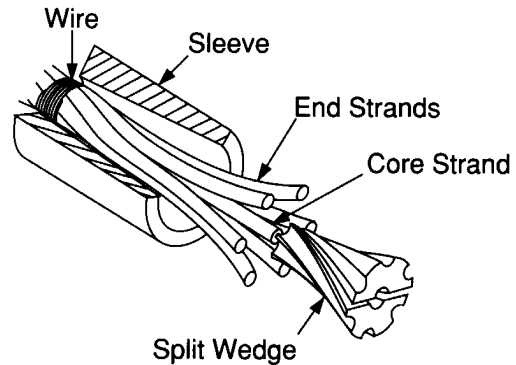
Table 2

Minimum and Maximum Wire Rope Size				
Model	Minimum		Maximum	
	inch	mm	inch	mm
FA2	1/2	13	5/8	16
FA2.5	5/8	16		

Installing Wire Rope

(Refer to Dwg. MHTPA0166.)

1. Cut wire rope to length in accordance with the wire rope manufacturer's instructions.
2. Feed the end of the wire rope into the cable anchor hole in the drum and pull through approximately one foot (305 mm) of wire rope.



(Dwg. MHTPA0166)

3. Wrap the wire rope with wire a distance from the end equal to the wedge length plus one inch (25 mm).
4. Slide the sleeve over the end of the wire rope so the larger diameter of the taper bore is nearest the end of the wire rope.
5. Spread the end strands of the wire rope and insert the split wedge until it is below the end of the wire rope.
6. Pull the sleeve over the wire rope end until tight. Check that the wire rope strands stay in the slots located on the split wedge.
7. Pull the wire rope anchor into position in the drum anchor pocket.



- Make sure the first wrap of wire rope is tight and lays flush against the drum flange.

Safe Wire Rope Handling Procedures

1. Always use gloves when handling wire rope.
2. Never use wire rope which is frayed or kinked.
3. Never use wire rope as a sling.
4. Always ensure wire rope is correctly spooled and the first layer is tight against the drum.

Wire Rope Spooling

To compensate for uneven spooling and the decrease in line pull capacity as the drum fills up, use as short a wire rope as practical. When rewinding apply tension to the end of the wire rope to eliminate line slack. This helps achieve level winding and tight spooling.

Rigging

Make sure all wire rope blocks, tackle and fasteners have a sufficient safety margin to handle the required load under all conditions. Do not allow wire rope to contact sharp edges or make sharp bends which will cause damage to wire rope, use a sheave. Refer to the wire rope manufacturer's handbook for proper sizing, use and care of wire rope.

Safe Installation Procedures

1. Do not use wire rope as a ground (earth) for welding.
2. Do not attach a welding electrode to winch or wire rope.
3. Never run the wire rope over a sharp edge. Use a correctly sized sheave.
4. When a lead sheave is used, it must be aligned with the center of the drum. The diameter of the lead sheave must be at least 18 times the diameter of the wire rope. Refer to Dwg. MHTPA0487.
5. Always maintain at least three full, tight wraps of wire rope on the drum.

Air Supply

The air supply must be clean and free from moisture.

Air Lines

The inside diameter of the winch air supply lines must not be less than the sizes shown in Table 3. Before making final connections, all air supply lines should be purged with clean, moisture free air or nitrogen before connecting to winch inlet. 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 surface friction in the lines.

Table 3

Minimum Allowable Air Supply Line Sizes		
Model	inch	mm
FA2	1-1/4	32
FA2.5	1-1/2	38

Air Line Lubricator

(Refer to Dwg. MHTPA0191.)

Always use an air line lubricator with these motors. The lubricator must have an inlet and outlet at least as large as the inlet on the motor. Install the air line lubricator as close to the air inlet on the motor as possible.



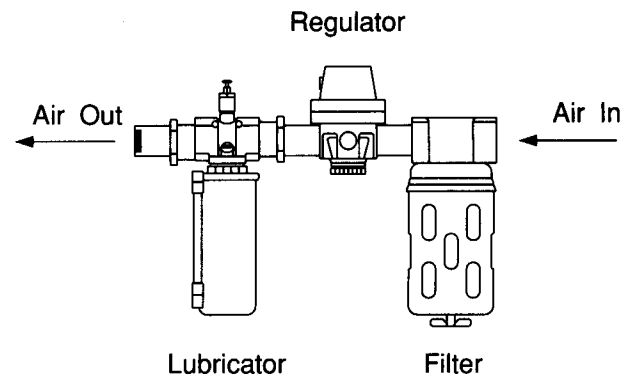
- Lubricator must be located no more than 10 ft. (3 m) from the motor.

The air line lubricator should be replenished daily and set to provide 6 to 9 drops per minute of SAE 10W oil. A fine mist will be exhausted from the throttle control valve when the air line lubricator is functioning properly.

Air Line Filter

(Refer to Dwg. MHTPA0191.)

It is recommended that an air line strainer/filter be installed as close as practical to the motor air inlet port, but before the lubricator, to prevent dirt from entering the motor. The strainer/filter should provide 20 micron filtration and include a moisture trap. Clean the strainer/filter periodically to maintain its operating efficiency.



(Dwg. MHTPA0191)

Moisture in Air Lines

Moisture that reaches the air motor through air supply lines is a primary factor in determining the length of time between service overhauls. Moisture traps can help to eliminate moisture. Other methods, such as an air receiver which collects moisture before it reaches the motor, an aftercooler at the compressor that cools the air to condense and collect moisture prior to distribution through the supply lines are also helpful.

Motor

For optimum performance and maximum durability of parts, provide an air supply of 90 psig at 335 scfm (6.2 bar/620 kpa at 10 cu.m/m) for FA2 winches and 90 psig at 700 scfm (6.2 bar/620 kpa at 20 cu.m/min) for FA2.5 winches. The air motor should be installed as near as possible to the compressor or air receiver. Recommended pressures and volumes are measured at the point of entry to the air motor.

Initial Operating Checks

Winches are tested for proper operation prior to leaving the factory. Before the winch is placed into service the following initial operating checks should be performed.

1. When first running the motor inject some light oil into the inlet connection to provide initial lubrication.
2. When first operating the winch it is recommended that the motor be driven slowly in both directions for a few minutes.

For winches that have been in storage for a period of more than one month the following start-up procedure is required.

1. Give the winch an inspection conforming to the requirements of "Winches Not in Regular Use" in the "INSPECTION" section.
2. Pour a small amount of 10W oil in the motor inlet port.
3. Operate the motor for 10 seconds in both directions to flush out any impurities.
4. The winch is now ready for normal use.

OPERATION

The four most important aspects of winch operation are:

1. Follow all safety instructions when operating the winch.
2. Allow only people trained in safety and operation of this winch to operate this equipment.
3. Subject each winch to a regular inspection and maintenance procedure.
4. Be aware of the winch capacity and weight of load at all times.

⚠ CAUTION

- Only allow personnel instructed in safety and operation to operate a winch.
- To avoid damage to the rigging, the structure supporting the rigging and the winch, do not "two-block" the end of the wire rope.

⚠ WARNING

- The winch is not designed or suitable for lifting, lowering or moving persons. Never lift loads over people.

Winch Controls

The spring loaded, motor mounted, manual throttle control valve is standard to, and normally supplied with, this winch. Optional motor throttle controls are available. Reference the model code on the winch nameplate and compare it to the "SPECIFICATIONS" section of this manual to determine your configuration. The throttle controls provide operator control of the motor speed and direction of drum rotation.

Winch Mounted Live Air Throttle (standard feature)

(Refer to Dwg. MHTPA0447.)

The spring loaded manual control throttle mounts to the air motor.

When viewed from the air motor end move the control throttle handle to the right (clockwise) to pay out wire rope and to the left (counterclockwise) to haul in wire rope.

To ensure smooth operation of the winch sudden movements of the control valve should be avoided.

Remote Live Air Throttle (optional feature)

(Refer to Dwg. MHTPA0204 and MHTPA0161.)

Provides for the remote mounting of the winch control at a fixed location at up to 20 feet (6 metres) away from the winch motor. Air hoses connect the throttle to the winch motor to provide winch operation. Throttle operation is the same as described for the winch mounted throttle

Remote Pilot Pendant Throttle (optional feature)

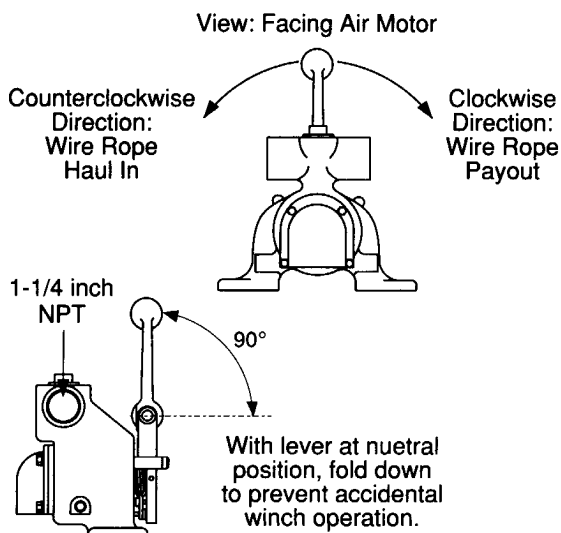
(Refer to Dwg. MHTPA0167.)

Provides for remote winch control at distances of up to * 50 feet (15 metres) away from the winch. The pendant pilot control throttle is a two lever movable control station for winch operation. Pilot pressure from the pendant pilot control throttle activates the winch control valve. The winch control valve, located on the winch motor, controls the motor speed and direction of drum rotation. Direction of rotation is determined by the pendant lever depressed.

* For distances greater than 50 feet (15 metres) contact Technical Sales for control acceptability.

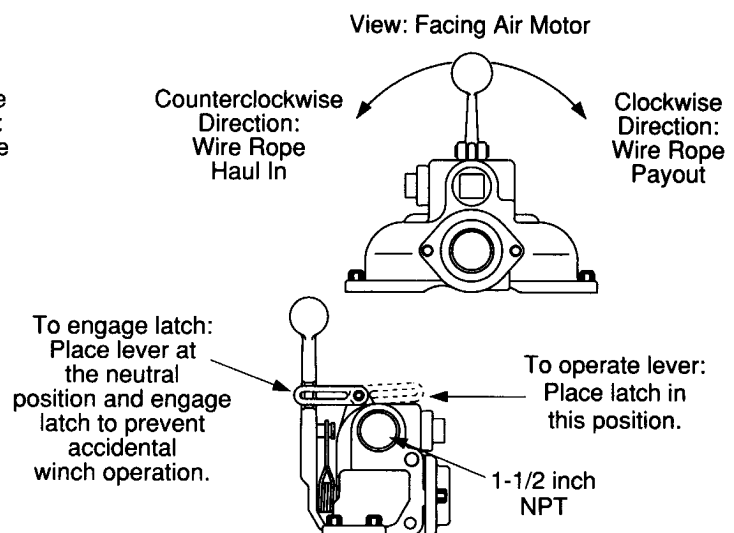
Live Air Throttle Control Valves

FA2 Throttle Control Valve



(Dwg. MHTPA0447)

FA2.5 Throttle Control Valve



Remote Pilot Lever Throttle (optional feature)

Provides for remote winch control at distances of up to * 50 feet (15 metres) away from the winch. The lever pilot control throttle is a fixed mount lever control station for winch operation. Pilot pressure from the lever pilot control throttle activates the winch control valve. The winch control valve, located on the winch motor, controls the motor speed and direction of drum rotation. Direction of rotation is determined by the direction in which the lever is shifted.

* For distances greater than 50 feet (15 metres) contact Technical Sales for control acceptability.

Winch Brakes

(Refer to Dwgs. MHTPB0152 and MHTPB0209.)

Manual Drum Brake

The manual drum brake may be applied by pushing down on the handle (104) and released by pulling up. If the handle is pushed down fully, it should lock in that position and prevent drum rotation, until released by the operator. The brake must be kept properly adjusted to hold the required load.

Automatic Drum Brake (optional feature)

The automatic drum brake is a spring applied, air released brake. Using an air actuated, spring loaded cylinder (110), the brake automatically disengages when the motor is operated. Air pressure in the cylinder overcomes spring pressure to release the brake. When the control valve is placed in the neutral position, the air in the cylinder (110) is vented and the spring automatically engages the brake to prevent drum rotation.

The cylinder clevis (107) must be kept properly adjusted to hold the required load.

Automatic Disc Brake (optional feature)

The automatic disc brake is a spring applied, air released brake. Using an air actuated, spring loaded piston (10), the brake automatically disengages when the motor is operated. Air pressure ported through the brake housing (21) shifts the piston (10) which overcomes spring pressure, disengages the friction discs (16) and releases the brake. When the control valve is placed in the neutral position, the air is vented and the springs (9) shift the piston to engage the brake and prevent drum rotation.

Drum Locking Pin (optional feature)

(Refer to Dwg. MHTPB0155.)

The drum locking pin is mounted to the winch on the end opposite the motor. It should be engaged by inserting the lock pin (136) into one of the holes in the drum (80) flange anytime a load is left suspended. The drum lock is operated by rotating a pin between two slots, one shallow the other deep.

To engage the locking pin rotate the drum (80) flange so that one of the 12 holes aligns with the locking pin (136). Pull out pull rod (140) and rotate counterclockwise 90°, aligning the pin (135) with the deep groove on gland (138). Release pull rod and ensure locking pin engages and is seated in the drum hole and gland (138) deep groove.

⚠ WARNING

- **Ensure that all braking mechanisms are engaged and all personnel are clear of the winch load and rigging before disengaging the locking pin.**
- **Extremely difficult locking pin release is an indication that the load is held by the locking pin and the braking mechanisms are not functioning properly. Do not release the locking pin until load control is established.**

To disengage the locking pin pull the pull rod (140) out until the pin (135) is clear of the deep groove and rotate clockwise 90°. Align pin with the shallow groove on gland (138) and release pull rod. Ensure pin is seated in the gland shallow groove.

LUBRICATION

To ensure continued satisfactory operation of the winch, 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 winch eight hours each day, five days per week. If the winch is operated almost continuously or more than the eight hours each day, more frequent lubrication will be required. Also, the lubricant types and change intervals are based on operation in an environment relatively free of dust, moisture, and corrosive fumes. Use only those lubricants recommended. Other lubricants may affect the performance of the winch. 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 winch and/or its associated components.

INTERVAL	LUBRICATION CHECKS
Start of each shift.	Check flow and level of air line lubricator (approximately 10 to 15 drops per minute required at maximum motor speed).
	Check oil level in the motor.
Monthly	Lubricate components supplied by grease fittings.
	Inspect and clean or replace air line filter.
	Check oil level in the reduction gear assembly.
Yearly	Drain and refill the oil in the winch reduction gear assembly.
	Drain and refill the oil in the winch motor.

Recommended Lubricants

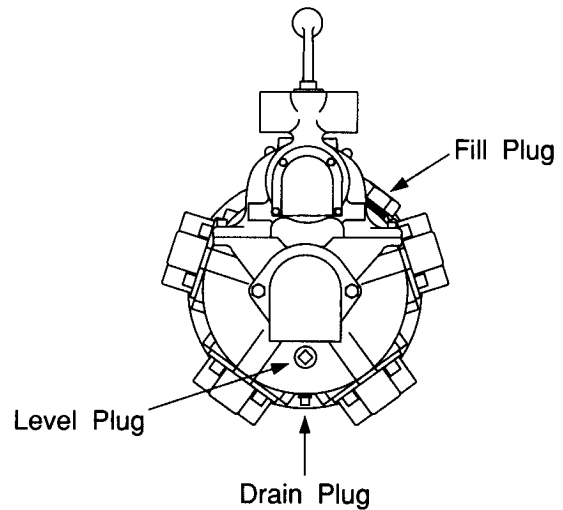
Oil

Temperature	Type Oil
1. Below 32° F (0° C)	SAE 10W
2. 32° to 80° F (0° to 27° C)	SAE 20W
3. Above 80° F (27° C)	SAE 30W

Grease

Temperature	Type Grease
1. -20° to 50° F (-30° to 10° C)	EP 1 multipurpose lithium-based grease
2. 30° to 120° F (-1° to 49° C)	EP 2 multipurpose lithium-based grease

Motor Lubrication Locations (FA2 Shown)



(Dwg. MHTPA0222)

Motor

(Refer to Dwg. MHTPA0222.)

Correct lubrication is one of the most important factors in maintaining efficient winch operation. The motor is splash lubricated by the oil in the motor housing and has no other means of lubrication. It is therefore important to use only quality, non-detergent motor oil to ensure maximum performance and minimum downtime for repairs. Refer to the 'Recommended Lubricants' section. Allow oil to settle before topping off.

Oil capacity for the **FA2** winch motor is 3/8 quart (0.35 litres). Add oil through the fill plug opening until oil flows from the level plug hole. Add oil slowly to prevent spilling. Oil capacity for the **FA2.5** winch K5B-546 motor is 3 quarts (2.8 litres.). Add oil through the filler opening until oil flows from the level plug hole. Baffles are installed in the FA2.5 motor at each motor fill port. Add oil slowly to prevent spilling.

The motor should be level-checked daily or at the start of each shift after accumulated water has been drained off. When motors are operated in temperatures below freezing, wait long enough at end of shift for water to separate from oil but not long enough for it to freeze. Drain the water then refill to the level plug. If desired, all the oil may be drained at the end of the shift and the motor refilled with new oil.

Wire Rope

Follow the wire rope manufacturer's instructions. At a minimum, observe the following guidelines.

1. Clean with a brush or steam to remove dirt, rock dust or other foreign material on the surface of the wire rope.

⚠ CAUTION

• Do not use an acid-based solvent. Only use cleaning fluids and lubricants specified by the wire rope manufacturer.

2. Apply a wire rope lubricant, LUBRI-Link[®] or SAE 30W oil.
3. Brush, drip or spray lubricant weekly, or more frequently, depending on severity of service.

Reduction Gear Assembly

(Refer to Dwg. MHTPA0140.)

The reduction gear assembly is filled and shipped with oil from the factory. Check oil level before initial winch operation. If the winch is used at a normal frequency replace the oil in the reduction housing once every year.

To ensure correct performance, highest efficiency and long life, it is essential that the lubricating oil be maintained at the correct level. Rotate the drum until the fill plug is located at top dead center then add oil up to the level plug hole. Oil capacity for the reduction gear assembly is 1-1/2 quarts (1.4 litres).

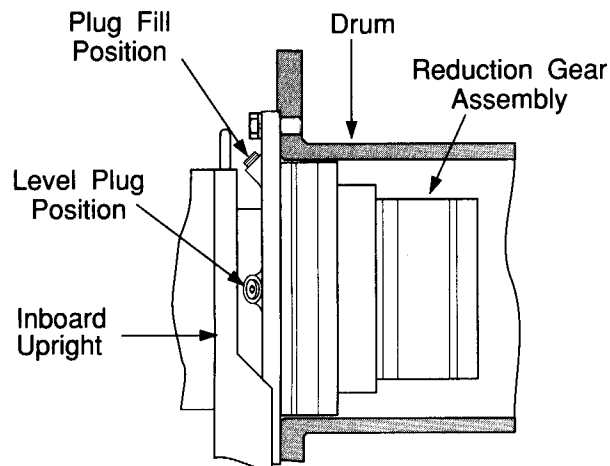
⚠ CAUTION

• Do not over fill. Excess oil will reduce operating efficiency and increase oil temperature.

The recommended grade of oil must be used at all times since the use of unsuitable oil may result in excessive temperature rise, loss of efficiency and possible damage to the gears. Refer to the 'Recommended Lubricants' section.

Use only high quality lubricants in the reduction gear assembly such as motor oil, high grade EP type hydraulic oil or their equivalents.

FA2 / FA2.5 Reduction Gear Lubrication Plug Locations



(Dwg. MHTPA0140)

Disc Brake

Oil from the reduction gear assembly also provides lubrication for the disc brake. After an oil change or winch overhaul remove the breather plug and pour a small amount of oil (6 to 8 fluid ounces (0.2 litres.)) through the breather hole in the brake housing to initially lubricate the brake discs. Refer to the 'Recommended Lubricants' section. Reinstall the breather plug before operation of winch or brakes.

Seals and Bearings

If winch is disassembled, clean all parts thoroughly and coat bearings and seals with clean grease. Refer to the 'Recommended Lubricants' section. Use sufficient grease to provide a good protective coat. Lubricate grease fittings monthly with 2 or 3 pumps of a grease gun.

Drum Locking Pin

At least once every 6 months, depending on the environment and duty cycle, lubricate the internal parts of the drum locking pin with the same grease that is recommended for the seals and bearings. Lubrication will help to prevent rust and allow easier locking pin operation. A grease fitting is provided next to the handle.

Inspection information is based in part on American National Standards Institute Safety Codes (ASME B30.7).

⚠ WARNING

- All new, altered or modified equipment should be inspected and tested by personnel instructed in safety, operation and maintenance of this equipment to ensure safe operation at rated specifications before placing equipment in service.
- Never use a winch that inspection indicates is defective.

Frequent and periodic inspections should be performed on equipment in regular service. Frequent inspections are visual examinations performed by operators or personnel trained in safety and operation of this equipment and include observations made during routine equipment operation. Periodic inspections are thorough inspections conducted by personnel trained in the safety, operation and maintenance of this equipment. ASME B30.7 states inspection intervals depend upon the nature of the critical components of the equipment and the severity of usage. Frequent and periodic inspection intervals for equipment use under various operating conditions are listed below:

1. Frequent Inspection:

NORMAL	HEAVY	SEVERE
monthly	weekly	daily

2. Periodic Inspection:

NORMAL	HEAVY	SEVERE
yearly	yearly	quarterly

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.

Deficiencies revealed through inspection, or noted during operation, must be reported to designated personnel instructed in safety, operation and maintenance of this equipment. A determination as to whether a condition constitutes a safety hazard must be decided, and the correction of noted safety hazards accomplished and documented by written report before placing the equipment in service.

Records and Reports

Inspection records, listing all points requiring periodic inspection should be maintained for all load bearing equipment. Written reports, based on severity of service, should be made on the condition of critical parts as a method of documenting periodic inspections. These reports should be dated, signed by the person who performed the inspection, and kept on file where they are readily available for review.

Wire Rope Reports

Records should be maintained as part of a long-range wire rope inspection program. Records should include the condition of wire rope removed from service. Accurate records will establish a relationship between visual observations noted during frequent inspections and the actual condition of wire rope as determined by periodic inspections.

Frequent Inspection

On equipment in continuous service, frequent inspection should be made by operators at the beginning of each shift. In addition, visual inspections should be conducted during regular operation for damage or evidence of malfunction.

1. WINCH. Prior to operation, visually inspect winch housings, controls, brakes, sideplates and drum for indications of damage. Do not operate the winch unless the wire rope feeds onto the drum smoothly, and any discrepancies noted have been reviewed and inspected further by personnel instructed in the operation, safety and maintenance of this winch.
2. WIRE ROPE. Visually inspect all wire rope which can be expected to be in use during the day's operations. Inspect for damage indicated by distortion of wire rope such as kinking, "birdcaging," core protrusion, main strand displacement, corrosion, broken or cut strands. Also inspect the drum flange points, crossover points and repetitive pickup points. If damage is evident, do not operate winch until the discrepancies have been reviewed and inspected further by personnel instructed in the operation, safety and maintenance of this winch.

NOTICE

• The full extent of wire rope wear cannot be determined by visual inspection. At any indication of wear inspect the wire rope in accordance with instructions in "Periodic Inspection."

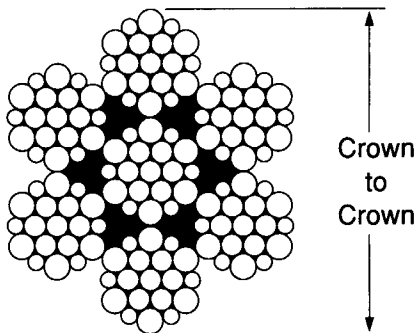
3. AIR SYSTEM. Visually inspect all connections, fittings, hoses and components for indication of air leaks. Repair any leaks or damaged components found.
4. CONTROLS. During operation of winch, verify response to control is quick and smooth. If winch responds slowly or movement is unsatisfactory, do not operate winch until all defects have been corrected.
5. BRAKES. During winch operation test brakes.

Periodic Inspection

Disassembly may be required as a result of frequent inspection findings or in order to properly inspect the individual components. Disassembly steps are described in the "MAINTENANCE" section. Maintain written records of periodic inspections to provide an accumulative basis for continuing evaluation. Inspect all items listed in "Frequent Inspection."

Also inspect the following:

1. **SIDE FRAMES.** Check for deformed, cracked or corroded main components. Replace damaged parts.
2. **FASTENERS.** Check retainer rings, split pins, cap-screws, nuts, and other fasteners on winch, including mounting bolts. Replace if missing or damaged and tighten if loose.
3. **DRUM AND SHEAVES.** Check for cracks, wear or damage. Replace if necessary.
4. **WIRE ROPE.** Additionally inspect for the following:
 - a. Build-up of dirt and corrosion. Clean with steam or a stiff wire brush to remove dirt and corrosion if necessary.
 - b. Loose or damaged end connection. Replace if loose or damaged.
 - c. Check wire rope anchor is secure in drum.
 - d. Verify wire rope diameter. Measure the diameter of the wire rope from crown-to-crown throughout the life of the wire rope. Recording of the actual diameter should only be done with the wire rope under equivalent loading and in the same operating section as accomplished during previous inspections. If the actual diameter of the wire rope has decreased more than 1/64 inch (0.4 mm) a thorough examination of the wire rope should be conducted by an experienced inspector to determine the suitability of the wire rope to remain in service. (Refer to Dwg. MHTPA0056).



(Dwg. MHTPA0056)

5. **ALL COMPONENTS.** Inspect for wear, damage, distortion, deformation and cleanliness. If external evidence indicates damage, disassemble as required to conduct a detailed inspection. Inspect gears, shafts, bearings, sheaves, springs and covers. Replace worn or damaged parts. Clean, lubricate and reassemble.

6. **BRAKES.** Individually test brakes installed to ensure proper operation. Brakes must hold a 125% rated load with full drum without slipping. If indicated by poor operation or visual damage, disassemble and repair brake(s). Check all brake surfaces for wear, deformation or foreign deposits. If brake lining thickness is less than minimum as described in the "MAINTENANCE" section replace brakes. Clean and replace components as necessary.
7. **SUPPORTING STRUCTURE.** Check for distortion, wear and continued ability to support winch and rated load. Ensure winch is firmly mounted and that fasteners are in good condition and tight.
8. **LABELS AND TAGS.** Check for presence and legibility of labels. Replace if damaged or missing.

Winches Not in Regular Use

1. Equipment which has been idle for a period of one month or more, but less than six months, shall be given an inspection conforming to the requirements of "Frequent Inspection" before being placed in service.
2. Equipment which has been idle for a period of over six months shall be given a complete inspection conforming with the requirements of "Periodic Inspection" before being placed in service.
3. Standby equipment shall be inspected at least semi-annually in accordance with the requirements of "Frequent Inspection". In abnormal operating conditions equipment should be inspected at shorter intervals.

INSPECTION AND MAINTENANCE REPORT (Ingersoll-Rand Force 5 Series Air Winch)

Model Number:	Date:
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Serial Number:	Inspected by:
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Reason for Inspection: (Check Applicable Box)

<input type="checkbox"/> 1. Scheduled Periodic Inspection (___ Monthly ___ Yearly)	Operating Environment: Normal ___ Heavy ___ Severe ___
<input type="checkbox"/> 2. Discrepancy(s) noted during Frequent Inspection	
<input type="checkbox"/> 3. Discrepancy(s) noted during maintenance	
<input type="checkbox"/> 4. Other: _____	

Refer to the Parts, Operation and Maintenance Manual "INSPECTION" section for general inspection criteria. Also, refer to appropriate National Standards and codes of practice. If in doubt about an existing condition contact the nearest Ingersoll-Rand Distributor or the factory for technical assistance.

COMPONENT	CONDITION		CORRECTIVE ACTION		NOTES
	Pass	Fail	Repair	Replace	
End Frames and Side Frames					
Drum Band Brake (125% Load Test)					
Disc Brake (125% Load Test)					
Drum Band Brake (Visual Inspection)					
Disc Brake (Visual Inspection)					
Motor					
Limit Switches					
Controls					
Air System					
Fasteners					
Reduction Gears					
Labels and Tags			---		
Shafts					
Wire Rope Anchor Wedge			---		
Other Components (list in NOTES section)					

TESTING	Pass	Fail	NOTES
Operational (No Load)			
Operational (10% Load)			
Operational (Maximum Test Load *)			

* Maximum test load is 125% of rated line pull.

TROUBLESHOOTING

This section provides basic troubleshooting information. Determination of specific causes to problems are best identified by thorough inspections performed by personnel instructed in safety, operation and maintenance of this equipment. The chart below provides a brief guide to common winch problems, probable causes and solutions.

PROBLEM	CAUSE	SOLUTION
Winch will not operate.	No air supply to winch.	Check air supply line connections and hoses.
	Winch is overloaded.	Reduce load to within rated capacity.
	Disc brake does not release.	Pressurize disc brake release port and check for leakage. Replace brake piston seals if leakage is found.
	Shipping plugs may still be in place.	Remove shipping plugs in valve and motor exhaust ports.
Load continues to move when winch is stopped.	Drum brake is slipping.	Check drum brake adjustment and brake band lining wear.
	Winch is overloaded.	Reduce load to within rated capacity.
Winch does not lift load or does not lift rated capacity.	Motor may be damaged.	Remove and disassemble motor as described in the "MAINTENANCE" section. Examine all parts and replace any that are worn or damaged.
	Insufficient air supply.	Verify air supply pressure and volume at winch inlet meets the requirements listed in the "SPECIFICATIONS" section. Clean air line filter.
Throttle lever moves but winch does not operate.	Motor may be damaged.	Disassemble and clean the motor and replace any broken or damaged parts.
	Insufficient air supply.	Ensure the air pressure at the winch inlet is at least 90 psig at rated volume. Clean air line filter.
Motor runs hot or makes excessive noise during operation.	Low oil level.	Check oil levels in the motor. Drain or add oil as required to obtain the proper level.
	Improper lubrication.	Replace oil with type recommended in the "LUBRICATION" section applicable to the operating environment.
	Water in oil.	Drain and refill with oil. Operate winch with no load slowly, in both directions. If noise still exists or motor overheats disassemble and repair motor.
	Damaged or broken piston or connecting rod.	Disassemble and repair motor.
Winch runs slow.	Improper hose or fitting sizes.	Check fittings, connections and hoses for correct size and length. Replace parts that may cause restricted air flow. Inspect air line filter.
	Motor may be damaged.	Remove and disassemble motor as described in the "MAINTENANCE" section. Inspect all parts and replace all worn or damaged parts.

PROBLEM	CAUSE	SOLUTION
Air lines freeze.	Water in air supply.	Install or drain air system moisture traps, moisture collecting air receivers and compressor aftercoolers. After corrective actions have been taken, disconnect lines at winch inlet and purge with clean, dry air or nitrogen prior to attaching to and operating winch.

Automatic Drum Brake:

Brake cylinder will not release.	Drum brake out of adjustment.	Adjust drum brake to maintain correct cylinder stroke.
	Defective cylinder seals.	If air is noticed escaping from the cylinder breather when attempting to release the brake replace or repair cylinder.
	Dirty filter in air supply.	Clean or replace filter.
	Faulty dump valve.	Check dump valve exhaust port. Air should exhaust when control valve handle is in neutral. If no air escapes, replace dump valve.

Automatic Disc Brake:

Brake fails to release.	Low air supply pressure.	Ensure the air pressure at the inlet to the disc brake is at least 50 psig (3.4 bar).
	Defective piston seals.	Inspect the brake breather. If air escapes from the brake breather when attempting to release the brake, the brake seals must be replaced.
	No release pressure at the brake port.	Check for proper operation of winch controls.
	Sticking brake piston.	Apply 50 psig (3.4 bar) to the brake release port and check for brake disc movement. (Brake discs can be viewed through the brake breather hole.) If brake discs do not move, disassemble and inspect the disc brake as described in the "MAINTENANCE" section.

⚠ WARNING

- Never perform maintenance on the winch while it is supporting a load.
- Before performing maintenance, tag controls:
DANGER - DO NOT OPERATE - EQUIPMENT BEING REPAIRED.
- Only allow service personnel trained in safety and maintenance on this winch to perform maintenance.
- After performing any maintenance on the winch, test winch to 125% of its rated capacity before returning to service.
- Turn off air system and depressurize air lines before performing any maintenance.

Reduction Gear Assembly

It is recommend that the first oil change be done after approximately 50 hours initial operation. Always inspect removed oil for evidence of internal damage (metal shavings, dirt, water, etc.).

Check the oil in the reduction housing as recommended in the "LUBRICATION" section. If low, replenish. The oil should be changed at least once every year.

Refer to the "LUBRICATION" section for recommended oil.

INTERVAL	MAINTENANCE CHECK
Start of each shift (Operator or Maintenance Personnel)	Make a thorough visual inspection of the winch for damage. Do not operate the winch if damaged.
	Operate the winch at low RPM in both directions. Winch must operate smoothly without sticking, binding or abnormal noises. Check the operation of the brake(s).
3 Months (Maintenance Personnel)	Inspect the drum brake friction linings. Clean or replace parts as required. Adjust drum brake as necessary.
Yearly (Maintenance Personnel)	Inspect the winch gearing, shafts and bearings for wear and damage. Repair or replace as necessary.
	Check all the supporting members, including the foundation, fasteners, nuts, sheaves and rigging, etc. for indications of damage or wear. Repair or replace as required.

Adjustments

Disc Brake Adjustment

Brake adjustment is **not** required. If the disc brake does not hold the rated load disassemble and repair.

If the brake assembly is removed or repaired ensure the breather is installed and located at the top of the brake housing during reassembly.

Manual Drum Brake Adjustment

(Refer to Dwg. MHTPB0209.)

1. Release wire rope tension on the drum.
2. Raise handle (104) to free brake bands (128).
3. Remove cotter pin (102) and pin (101).
4. Rotate link stud (103) clockwise to increase brake torque.
5. Install pin (101) and check adjustment.
6. Brake should be adjusted until brake lever over center position can be attained with 50 to 100 lb. (23 to 45 kg) force on the handle (104).
7. Install cotter pin (102) when adjustment is completed.

⚠ CAUTION

- When any part of the brake lining measures 0.062 inch (2 mm) or less, brake bands (128) must be replaced.

Automatic Drum Brake Adjustment

(Refer to Dwg. MHTPB0209.)

1. Remove cotter pin (102) and washer (129) at adjustment clevis (107).
2. Apply air to the brake cylinder (110) and remove pin (106) to disconnect clevis from brake lever (105).
3. Turn adjustment clevis (107) clockwise to increase cylinder rod extension. Turn clevis counterclockwise to decrease cylinder rod extension.
4. Assemble clevis (107) to brake lever (105) using pin (106). Release air to brake cylinder (110).
5. Measure cylinder rod extension and readjust if necessary.
6. Install cotter pin (102) and washer (129) to secure clevis to brake lever when adjustment is complete.

Pilot Air Valve Adjustment (optional feature)

(Refer to Dwg. MHTPA0141.)

If winch operating speeds differ from performance specifications the pilot air valve valve may require adjustment. Loosen nut (271) and adjust screw (270), located in the valve end cap (268), until drum speed for no-load haul-in equals the drum speed for full load pay-out. It is suggested that a chalk mark be placed on the drum flange so that drum rpm can be accurately counted.

Disassembly

General Disassembly Instructions

The following instructions provide the necessary information to disassemble, inspect, repair, and assemble the winch. Parts drawings are provided in the parts section.

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

It is recommended that all maintenance work on the winch be performed in a clean dust free work area.

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

1. Never disassemble the winch 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 flame to free it for removal, unless the part being heated is already worn or damaged beyond repair and no additional damage will occur to other parts.

In general, the winch 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 winch.
6. 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.
7. Do not remove any part which is a press fit in or on a subassembly unless the removal of that part is necessary for repairs or replacement.
8. When removing ball bearings from shafts, it is best to use a bearing puller. When removing bearings from housings, drive out the bearing with a sleeve slightly smaller than the outside diameter of the bearing. The end of the sleeve or pipe which contacts the bearing must be square. Protect bearings from dirt by keeping them wrapped in clean cloths.

Winch Disassembly

(Refer to Dwg. MHTPC0214.)

1. Remove the wire rope from the drum.
2. Operate the winch to position reduction gear drain plug at its lowest position.
3. Relieve pressure in the air lines by operating the winch control several times after the air supply has been turned off.

WARNING

• **Shut off, bleed down and disconnect the air supply line before performing any disassembly procedures.**

4. Disconnect and tag the air lines.
5. Remove the winch from its mounting and take to a suitable work area before beginning disassembly.
6. Remove lower case drain plug (464) in motor housing (463) on FA2 winches or drain plug (225) on motor housing (217) in FA2.5 winches and allow the oil to drain into a suitable container. Loosen fill cap (462) on FA2 winches or fill cap (210) on FA2.5 winches to vent the motor housing.
7. Drain oil from the gear reduction assembly by removing pipe plug (48) when positioned at its lowest point.
8. For winches with a disc brake remove pipe plug (24) in brake housing (21) to drain brake oil. If the winch is equipped with a drum band brake the winch outboard end (opposite the motor end) must be elevated to prevent draining oil from contaminating the brake band lining.

WARNING

• **The FA2 air motor weighs approximately 117 lb. (53 kg). The FA2.5 air motor weighs approximately 260 lb. (118 kg). Adequately support the air motor before removing the motor mounting capscrews.**

9. Remove drum band brake, drum guard and any other externally mounted winch attachments.
10. Remove the capscrews and lockwashers securing the motor assembly to the motor adapter. Using a hoist to support the motor, pull the motor straight away from the winch. Reference the applicable **Motor Disassembly** section if motor disassembly is required.

Instructions 11 through 17 apply only to winches with a disc brake.

11. Alternately and evenly loosen capscrews (4) on FA2 winches, or capscrews (1) on FA2.5 winches until the brake spring tension has been released. Remove capscrews and motor adapter (6).
12. Remove the brake housing (21). If the brake housing sticks, tap it with a brass hammer until the pieces separate. **Note the position of all brake pieces for reassembly.**
13. Remove friction plates (16) and drive plates (17).
14. Remove springs (9) from brake piston (10).
15. Remove brake piston (10) from brake housing (21). Tap lightly with a plastic mallet to separate parts if necessary.
16. Remove seals (11) and (12) from brake piston (10).

17. Splined hub removal:
 - a. **FA2 Winches:** Remove splined hub (19) from shaft (35) followed by retainer ring (32).
 - b. **FA2.5 Winches:** Loosen the capscrew in collar (18) and slide collar from shaft (35) with the splined hub (19). Remove retainer ring (32) and spacer (34) from shaft (35).
18. Remove retainer ring (36) from the bore of the drum shaft (41).
19. Pull shaft and bearing assembly from the drum shaft (41).
20. Support the drum (80) and remove capscrews (39) from the drum shaft (41). Pry drum shaft (41) from the inboard upright (42).
21. Remove capscrews (85) and lockwashers (46) which secure the side rails (82) and (83) to the inboard upright (42). Drive out dowel pins (87).
22. Remove inboard upright (42).
23. Remove end cover (95), capscrews (97) and lockwashers (96) from the outboard upright (84).
24. Remove capscrews (93) and bearing retainer (92) from the drum (80).
25. Remove drum and reduction gear assembly.
26. Remove the remaining capscrews (85) and lockwashers (46) which attach the side rails (82) and (83) to the outboard upright (84). Drive out dowel pins (87).
27. Remove bearing (86) and seal (99) from outboard upright (84).
28. Remove capscrews (45) and lockwashers (46) from the gear carrier (47). Lift reduction gear assembly from the drum (80). To disassemble reduction gear refer to the **Reduction Gear Disassembly** section.

Manual or Automatic Drum Brake

(Refer to Dwg. MHTPB0209.)

Actuator Disassembly:

1. Automatic Brake
 - a. Disconnect and remove hose, fittings and dump valve (112) from the cylinder (110).
 - b. Remove cotter pin (102), washer (129) and pin (101) from the link stud (103) and brake band (128).
 - c. Remove cotter pin (102), washer (129) and pin (106). Separate the clevis (107) from brake lever (105).
 - d. Remove cylinder (110) from bracket (118).
2. Manual Brake:
 - a. Remove cotter pin (102) and pin (101) from handle (104) then remove handle (104) from brake band (128).

Brake Disassembly:

3. Remove capscrews (119), lockwashers (117) and stop plate (126).
4. Use a hoist to raise the winch approximately 6 in. (15 cm). Separate the brake band (128) halves and rotate the brake band assembly slowly until it can be removed from the drum (80).

5. Remove cotter pins (102) and pins (121) so brake band halves (128) can be removed from the arm (124). Lower winch when brake band assembly has been removed.

Reduction Gear Disassembly

(Refer to Dwg. MHTPC0214.)

1. Place the reduction gear assembly on a clean work bench such that the end containing seal (43) is down.
2. Remove capscrews (75) and pry off cover (73).
3. Remove ring gear (72), sun gear (69) and planet assembly (67).
4. Gear Removal:

(FA2 Winches)

 - a. Remove capscrews (60) from the input housing (59).
 - b. Lift off input housing (59) followed by ring gear (63) and sun gear (66).
 - c. Remove planet assembly (58) and sun gear (56).
 - d. Remove spacer (71), planet assembly (54) and ring gear (53).
 - e. Remove retainer ring (50) from gear carrier (47) and press out bearing (49).

(FA2.5 Winches)
(Refer also to Dwg. MHTPA0523.)

 - a. Lift off spacer (71).
 - b. Remove sun gear (66), planet assembly (54) and ring gear (63).
 - c. Remove retainer ring (50) from gear carrier (47) and press out bearing (49).

FA2 Motor Disassembly

(Refer to Dwg. MHTPB0210.)

1. Remove capscrews (364), lockwashers (363) and exhaust cover (469). Pull out rotary valve (467) and rotary valve bushing (466). Remove adapter valve (468).
2. Remove the capscrews (451), lockwashers (452) and cylinders (453) from the motor housing (463).
3. Rotate the crankshaft assembly (473) to bring each wrist pin (457) above the motor housing (463), then push out the wrist pin (457) and remove piston (455). Plugs (456) pressed into ends of wrist pins (457) should not be removed. To avoid breakage use extreme care when removing compression rings (454).
4. Pull the crankshaft assembly (473) with attached connecting rods (459) out of the motor housing (463) by shifting the connecting rods (459) to clear the cylinder holes. The connecting rods (459) are joined through a common journal on the crankshaft and are held in place by connecting rod rings (474) on each side of the main rib.
5. To remove the connecting rods (459) from the crankshaft (473), take out setscrew (478) and drive out the taper pin (479) securing the counterbalance to the crankshaft.
6. Loosen the capscrew (480), remove counterbalance, then pull off connecting rod rings (474), connecting rods (459), bushing (476) and sleeve (475).

FA2.5 Motor (K5B) Disassembly

(Refer to Dwg. MHTPC0156.)

1. Remove the five capscrews (253) from the exhaust flange (254). **Do not** remove the two capscrews (256) from the throttle valve assembly (260).
2. Remove the rotary valve housing (247) by pulling it out of the motor housing (217) as an assembly with the exhaust flange (254).

CAUTION

• **Do not remove the exhaust flange (254) until the rotary valve (250) has been removed from the rotary valve housing (247).**

3. Remove rotary valve (250) by pulling it out from the assembly through the motor housing end of the rotary valve housing (247).
4. Remove exhaust flange (254) and throttle valve assembly (260) by removing capscrews (255) and (257), respectively.
5. Remove each cylinder head (201) by removing the four capscrews (200). Remove head gasket (209).
6. Remove mounting adapter (6) by removing capscrews and then pulling mounting adapter straight off.
7. Pull the cylinder liner (208) straight out.
8. Position the piston (204) at the top of its stroke. In this position, with the cylinder liner pulled out in step 7, the wrist pin (203) can be removed. Remove one retainer ring (205) from either side of piston (204). Push the wrist pin (203) out by hand from one side. If the wrist pin is too tight it is acceptable to carefully heat the piston to **200° F (93° C) or less** and then push the wrist pin out.

NOTICE

• **If piston, wrist pin, connecting rod or cylinder liner are to be re-assembled, number each set. Also add radial alignment marks for each piston and cylinder liner to the motor housing.**

9. Remove the remaining cylinder liners and pistons as described in steps 7 and 8 as required. To remove the crank assembly, all pistons and cylinder liners must be removed.
10. Crank assembly (231) can now be removed with the oil slinger (230) by pulling straight out from the motor housing (217). Use care while guiding the connecting rods (206) through the inside of the motor housing.

Crankshaft Disassembly

1. Remove cotter pin (236) and the pin nut (237).
2. Remove lock pin (235) by carefully driving it out of its location. Use care not to damage the threads.
3. Pull the crankshaft valve end (231) off the crankshaft.
4. Remove connecting rod rings (234), connecting rod bushing (233), sleeve (232) and connecting rods (206). Record the five connecting rod (206) numbers and foot directions so they can be re-installed in the same order.
5. Oil slinger (230) does not have to be removed unless damaged. If removal is required heating of the five screws (229) may be required to loosen the Loctite® connection.

FA2 Live Air Throttle Valve

(Refer to Dwg. MHTPA0203.)

NOTICE

• **Match mark throttle valve parts to ensure proper re-assembly.**

1. Remove pins (428) and tap out pin (428) from handle bracket (426).
2. Mark the square end on the valve body (316) and the handle (300) to ensure correct orientation during re-assembly. Remove handle assembly.
3. Make note on how spring (427) is positioned before removing it. Remove capscrews (444), lockwashers (443) and exhaust cover (442) from housing (438).
4. Remove pipe plug (434), spring (422), poppet valve (436) and ball (421) from housing (438).
5. Pull valve (441) out of the valve bushing (440).
6. Check parts for score marks or wear. Clearance between the valve bushing (440) and valve (441) should not exceed .002 in. (0.05 mm) or excessive air leakage will occur.

FA2.5 Live Air Throttle Valve

(Refer to Dwg. MHTPA0165.)

NOTICE

• **Match mark throttle valve parts to ensure proper re-assembly.**

1. Remove the two capscrews (302) and lockwashers (304) that hold the valve body retainer (305).
2. Mark the square end on the valve body (316) and the handle (300) to ensure correct orientation during re-assembly.
3. Drive out pin (301) and remove handle (300).
4. Make note on how the spring (303) is positioned before removing it. Pull valve body (316) out of the valve bushing (314) while disconnecting the spring (303).
5. Remove seal rings (315) from valve body (316).
6. Check parts for score marks or wear.

7. Measure clearance between the valve bushing (314) and valve body (316). To prevent excessive air leakage, the maximum allowable clearance is 0.002 inch (0.05 mm).

Cleaning, Inspection and Repair

Clean all winch component parts in solvent (except the drum brake bands and disc brake friction plates). The use of a stiff bristle brush will facilitate the removal of accumulated dirt and sediments on the housings, frame and drum. If bushings have been removed it may be necessary to carefully remove old Loctite[®] from the bushing bores. Dry each part using low pressure, filtered compressed air. Clean the drum brake band using a wire brush or emery cloth. Do not wash the drum brake band in liquid. If the drum brake band lining is oil soaked, it 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 shafts for ridges caused by wear. If ridges caused by wear are apparent on shafts, replace the shaft.
4. Inspect all threaded items and replace those having damaged threads.
5. Inspect the drum band brake lining for oil, grease and glazing. If the drum band brake lining is oil-soaked replace the brake bands as a set. Remove glazed areas of band brake lining by sanding lightly with a fine grit emery cloth.
6. Measure the thickness of the drum band brake lining. If the drum brake band linings are less than 0.062 inch (2 mm) thick anywhere along the edges replace the brake bands (128) as a set.

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.

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.

Assembly

General instructions

- use all new gaskets and seals.
- replace worn parts.
- assemble parts using match marks attached during disassembly. Compare replacement parts with originals to identify installation alignments.
- lubricate all internal parts with a mixture of half SAE 20W oil and half molybdenum disulfide lubricant compound (eg. STP).

FA2 Live Air Throttle Valve Assembly

(Refer to Dwg. MHTPA0203.)

NOTICE

• During assembly align parts using match marks made during disassembly.

1. Install valve (441) and valve bushing (440) into the housing (438).
2. Install ball (421), poppet valve (436), spring (422) and pipe plug (434) in housing (438).
3. If screws (430) were removed during disassembly, reinstall in housing (438) and handle bracket (426).
4. Place spring (422) and ball (421) in handle bracket (426). Depress spring and ball with handle (420) and install pin (425) with washers (424) and pins (423).
5. Install spring (427) and handle assembly on square shaft of valve (441) taking note of the match marks put on during disassembly. The ends of the spring (427) must straddle the screw (430) on handle bracket (426). Secure handle assembly to valve with pins (429) and (428).
6. Install sleeves (432) and capscrews (431) on housing (438). Attach exhaust cover (442) to housing (438) with capscrews (444) and lockwashers (443).
7. Check throttle handle moves fully left and right without sticking or binding. Throttle handle should center, by spring force, automatically when released.

FA2.5 Live Air Throttle Valve Assembly

(Refer to Dwg. MHTPA0165.)

NOTICE

• During assembly align parts using match marks made during disassembly.

1. Install seal rings (315) on each end of valve body (316).
2. Install valve body (316) into valve bushing (314).
3. Insert valve bushing (314) into valve housing (311). Ensure ports in bushing and flat cutout in valve body are properly aligned with housing ports as shown in Dwg. MHTPA0165.
4. Install valve body retainer (305) with two capscrews (302) and lockwashers (304). Torque capscrews to 25 ft lbs (3.5 kgm).
5. If removed, re-install spring retaining stud (306) and torque to 25 ft lbs (3.5 kgm).

6. Install spring (303) and handle (300) on square shaft of valve body (316). The spring (303) ends must straddle the spring retaining stud (306) on throttle handle (300). Install roll pin (301).
7. Check throttle handle moves fully left and right without sticking or binding. Throttle handle should center, by spring force, automatically when released.

FA2 Motor Assembly

(Refer to Dwg. MHTPB0210.)

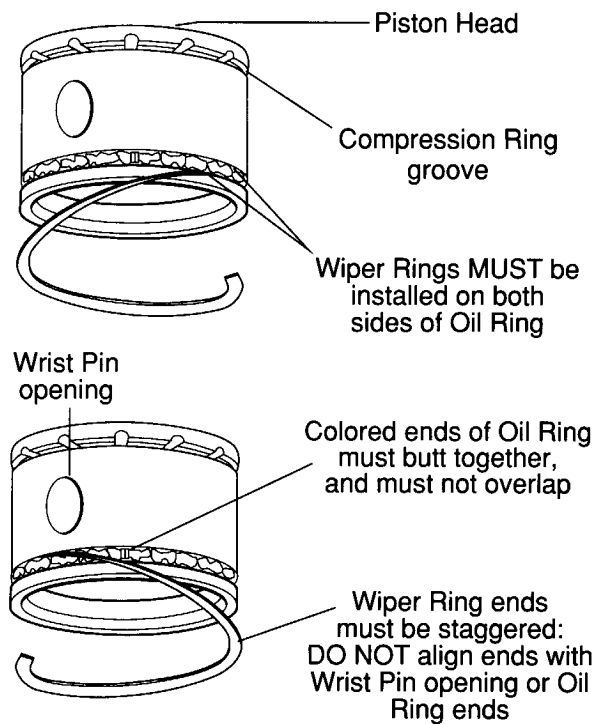
1. Press bearing (465) onto crankshaft counterbalance. Place the connecting rods (459) on the bushing (476) and hold them in place with the two connecting rod rings (474). Install connecting rod rings (474) so the chamfered side is next to the connecting rod (459).
2. Place the sleeve (475) on the crankshaft (473), then install the connecting rod (459) assembly on the crankshaft (473).
3. Secure the crankshaft counterbalance to the crankshaft with the taper pin (479) and tighten capscrew (480).
4. Attach the rotary valve housing and valve cover to the motor housing (463) with at least two capscrews. This is necessary to correctly locate bearing (465) when installing the crankshaft in the motor housing (463), shifting it as necessary so each connecting rod (459) end will project through a cylinder hole.
5. Align bearing (465) in the bore of the motor housing (463) and tap crankshaft assembly in place until bearing (465) bottoms on the rotary valve bushing.
6. Check the fit of each compression and oil ring by placing one ring at a time in the cylinder, making sure that it is not canted or tilted in relation to the cylinder wall. With a feeler gauge, measure the ring gap.
7. Make sure that compression rings, oil rings, and pistons are absolutely clean. Carefully place oil rings (458) and compression rings (454) in their respective grooves on the pistons (455).

NOTICE

• **Do not interchange the compression and oil rings. The plain compression ring (454) must be placed nearest the head of the piston (455). The oil ring (458) (identified by several oil channel grooves) must be placed nearest the skirt of the piston (455).**

8. Compression and oil ring joints (gaps) should be staggered and positioned so that joints (gaps) do not coincide with wrist pin (457) openings. (Ref. Dwg. MHTPA0224).
9. Rotate the crankshaft so each connecting rod (459) in succession will project enough beyond the motor housing (463) to permit inserting the wrist pin (457) through the piston (455) and connecting rod (459).

10. After each piston (455) is assembled to its connecting rod (459), install a gasket (460) and cylinder (453).
11. Slide each cylinder (453) over the piston (455), guiding it carefully over the compression and oil rings. Note that the cylinder has four tapered ears around the skirt of the piston which serve as ring compressors to aid in installation. The cylinder should go into place by tapping lightly. If force is required, there may be an alignment problem which must be corrected before continuing.
12. Secure cylinders (453) to the motor housing (463) by uniformly tightening capscrews (451) and lockwashers (452).
13. Remove exhaust cap (469). Install rotary bushing (466) and rotary valve (467) in adapter valve (468). Align the drive pins on the rotary valve (467) with the end of the crank shaft (473). The three drive pins on the crank shaft end of the rotary valve should fit in the holes in the crank shaft without appreciable play. If the holes in the crank shaft are elongated, the crank shaft should be replaced. The drive pins are located so that the rotary valve will always be returned to the correct position.
14. Replace the exhaust cap (469) and secure in position with capscrews (364) and lockwashers (363).



(Dwg. MHTPA0224)

FA2.5 Motor (K5B) Assembly

(Refer to Dwg. MHTPC0156.)

1. Assemble throttle valve assembly (260), gasket (248) and exhaust flange (254) to rotary valve housing (247) using four capscrews (257) and lockwashers (258). Install the two capscrews (255) and lockwashers (256) that attach exhaust flange (254) to throttle valve housing.
2. Tighten capscrews (255 and 257) to 25 ft lbs (3.5 kgm). Throttle handle should move fully left and right without sticking or binding, and should center (by spring force) automatically when released.
3. Assemble bearing (252) to rear of rotary valve (250) by pressing only on the inner race of the bearing. With the exhaust flange (254) down install rotary valve (250) into rotary valve housing (247). Slide rotary valve out of the rotary valve housing far enough to install seal ring (251) on the crank shaft end of the rotary valve (250). Slide rotary valve back into the rotary valve housing (247).
4. Install 'O' ring (244) into motor housing (217).
5. Install the rotary valve housing gasket (243) onto rotary valve housing (247). With the exhaust flange down on the bench, install motor housing (217) on to rotary valve housing (247). Check for any evidence of damage to 'O' ring (244) when the rotary valve housing is fully engaged. Install and tighten capscrews (253) to 50 ft lbs (7 kgm).
6. If removed, press crank bearing (228) on crank assembly (231). Apply pressure only on the inner race of the bearing.
7. Place crank assembly (231) on a work bench with the oil slinger (230) down and slide the sleeve (232) (with tang up) on the crankpin.
8. Slide connecting rod bushing (233) over the sleeve (232) and first connecting rod ring (234) with the chamfer up.
9. Install the connecting rods (206) in the same order as removed, with all feet pointing in the same direction, using the first connecting rod ring (234) to hold one side of the connecting rod feet.
10. Slide the second connecting rod ring (234) over the other side of the connecting rod feet with the chamfer on the ring facing down (toward the stem of the connecting rod).
11. Slide the crank shaft valve end over the crankpin while simultaneously aligning the tang on the sleeve (232) with the slot in the crank shaft.
12. Rotate and position the crank shaft valve end relative to the crankpin to allow installation of the lock pin (235).
13. Tap the lock pin (235) in place and install the pin nut (237). Torque nut to 60 ft lbs (8.3 kgm).
14. Install cotter pin (236).
15. Install roll pin (240) and bearing (228) into the valve end of the crank shaft.

16. Check that all connecting rods move freely around the crank. Position the crank assembly (231) into the motor housing (217) with the bearing (228) seated and connecting rods (206) centered in the cylinder holes.

NOTICE

- **Make certain that the roll pin (240) and the three lugs on the rotary valve (250) line up with the corresponding hole and lugs on the crank shaft.**
- **Do not allow the rotary valve (250) to slide back in rotary valve housing (247). If the rotary valve slides in too far, the seal ring (251) will lock-up in the internal grooves of the rotary valve housing (247) and restrict further assembly.**

17. Rotating the crank assembly, position one connecting rod (206) is at the top of its stroke. Install a piston (204) with its rings (202 and 207) to the connecting rod (206) with wrist pin (203) and retaining rings (205).
18. Install a new cylinder head gasket (209) before installing the cylinder liner (208).
19. Install the cylinder liner (208) over the piston (204) by compressing both piston rings (202 and 207) with a single band ring compressor.
20. Install cylinder head (201) over the cylinder and secure cylinder head to motor housing (217) with four capscrews (200). Torque capscrews to 60 ft lbs (8.3 kgm).
21. Repeat Steps 17 through 20 with the remaining cylinders.

NOTICE

- **When installing the two lowest cylinder heads (201), use seal washers on capscrews (200).**
22. Rotate motor by hand. Motor should rotate without binding.
 23. Install mounting flange (216) and gasket (226) on the front of the motor housing (217). Make sure notches on both parts are aligned.
 24. Temporarily install capscrews and nuts finger tight to retain motor adapter (6).
 25. Install eye bolts (213) and vent cap assemblies (210) in the motor housing (217).
 26. Ensure oil drain and level plugs are installed.

FA2 Reduction Gear Assembly

(Refer to Dwg. MHTPC0214.)

1. Lubricate and install 'O' rings (62) on ring gear (72). Assemble ring gear (72), cover (73) and spacer (71). Check dowel and capscrew holes are aligned.
2. Drive dowels (74) into assembly so they are flush with the cover (73).
3. Position assembled parts vertically with the cover (73) down. Install planet assembly (67) and gear (69) into ring gear (72).
4. Press bushing (55) into sun gear (66) and install sun gear (66) into planet assembly (67).
5. Lubricate and install 'O' rings (62) on ring gear (63). Install ring gear on spacer (71) being careful not to damage the 'O' ring. Align dowel and capscrew holes.
6. Tap dowels (70) into ring gear (63) and spacer (71). Leave approximately 0.37 inch (9 mm) exposed for engagement with input housing (59).
7. Install planet assembly (58) so planet gear teeth mesh in the ring gear (63) and with the sun gear (66).
8. Carefully install input housing (59) so it locates on dowels (70). Tilt assembly on the work bench and install capscrews (75) with Loctite® 242 and torque to 32 ft lbs (5 kgm).
9. Return assembly to the vertical position. Install bushing (55) and retainer ring (57) on sun gear (56) and install sun gear (56) in planet assembly (58).
10. Lubricate and install 'O' ring (51) on ring gear (53). Line up dowel and capscrew holes and install ring gear (53) on input housing (59) being careful not to damage 'O' ring (51).
11. Install planet assembly (54) so planet gear teeth mesh with ring gear and sun gear.
12. Lubricate and install 'O' ring (51) on ring gear (53).
13. Install oil plugs (61) in input housing (59).
14. Press bearing (49) into bore of gear carrier (47). Install retainer ring (50).
15. Install gear carrier (47) on ring gear (53) being careful not to damage 'O' ring (51). Check capscrew and dowel holes are lined up. Install capscrews (60) with Loctite® 242. Torque capscrews (60) to 94 ft lbs (13 kgm).
16. Tap dowels (52) through ring gear (53), input housing (59) and gear carrier (47) until they are just below the flange surface of the gear carrier (47).

FA2.5 Reduction Gear Assembly

(Refer to Dwgs. MHTPC0214 and MHTPA0523.)

1. Lubricate and install 'O' rings (62) on ring gear (72). Assemble ring gear (72), cover (73) and spacer (71). Check dowel and capscrew holes are aligned.
2. Drive dowels (74) into assembly so they are flush with the cover (73).
3. Position assembled parts vertically with the cover (73) down. Install planet assembly (67) and gear (69) into ring gear (72).
4. Press bushing (55) into sun gear (66) and install sun gear (66) into planet assembly (67).

Drum Brake Assembly

(Ref. Dwg. MHTPB0209)

1. Install pivot bracket (122) on the end of arm (124) with pin (121), washer (123) and cotter pin (102). Recessed side of the threaded hole must be toward the band side.
2. Install connecting link (125) on the arm (124) and secure in position with pin (121), washer (123) and cotter pin (121). Assemble connecting link (125) so curved surface matches contour of the brake band.
3. Install halves of brake band (128) to the connecting link (125) and secure with pins (101), (121) and cotter pins (102).
4. Lift the winch assembly, with a suitable hoist, approximately 6 inches (15 cm) off the floor or work bench.
5. Position the brake band sub-assembly around the brake diameter on the drum (80) so the arm (124) lays at the bottom. When positioned, lower the winch.
6. Mount pivot bracket (122) on the inside surface of the side rail (130) and secure in position with capscrews (116) and lockwashers (117).
7. Screw link stud into handle and install the handle (104) in the lug on the end of the brake band (128). Lubricate the pivot points being careful not to get grease on the brake band lining.
8. Pull the halves of the brake band together and install pin (101) through the lug on band (128) and the adjusting screw (103) of the handle assembly.
9. Install stop plate (126) on the inside of the side rail (131) with capscrews (119) and washers (117). Install adjusting screw (127) and locknut (120) through the side rail (131) and stop plate (126) until it contacts the arm (124).
10. Adjust brake as described at the start of the "MAINTENANCE" section.

Automatic Drum Brake Actuator Assembly

11. Install bracket (118) on side rail (130) with capscrews (116) and lockwashers (117).
12. Screw nut (108) and clevis (107) onto cylinder rod.
13. Attach brake lever (105) to brake band (128).
14. Install cylinder (110) so it connects with bracket (118) and brake lever (105). Use pins (106), washers (129) and cotter pins (102) to secure in position.
15. Install dump valve (112) fittings and hose (115) to the cylinder (110).
16. Adjust automatic brake as described at the start of the "MAINTENANCE" section.

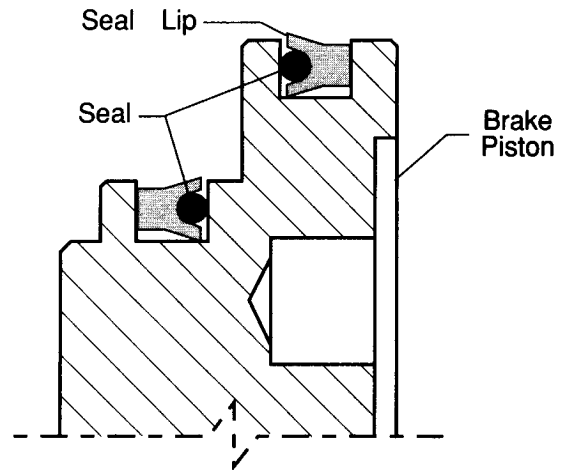
Winch Assembly

(Refer to Dwg. MHTPC0214.)

1. Clean both mating surfaces on the inboard upright (42) and install drum shaft (41) through the bore aligning the dowel pin holes.
2. Install dowel pins (40) flush or slightly below the surface of the drum shaft (41).
3. Install capscrews (39) with Loctite® 242 and torque to 44 ft lb (6 kgm) on FA2 winches or 85 ft lb (12 kgm) on FA2.5 winches.
4. Press bearing (37) onto the shaft (35) using Loctite® 609. On FA2.5 winches install retainer ring (38).
5. Install shaft and bearing into the drum shaft (41) so smaller splined end enters first. On FA2.5 winches install retainer ring (36) in bore of drum shaft (41).

Instructions 6 through 17 cover winches with a disc brake. For winches without a disc brake skip to instruction 18.

6. On FA2 winches install retainer ring (32) and splined hub (19) on shaft (35) so splined side of outside diameter goes on first. Seat splined hub (19) against retainer ring (32).
7. On FA2.5 winches install spacer (34) on shaft (35). Install splined hub (19) so splined side on outside diameter goes on first. Install capscrew in locking ring (18) and place on shaft (35). Maintain pressure on the locking ring to keep it against the splined hub (19) and tighten capscrew in locking ring (18).
8. Lubricate and install 'O' ring (33) on hub of drum shaft.
9. Install brake housing (21) on drum shaft (41) being careful not to damage 'O' ring (33).
10. Position brake housing (21) so brake port is in the 2 o'clock position (as viewed from the motor end). Install drain plug (24) in brake housing (21) at the 6 o'clock position.
11. Install fitting (22) and breather (23) in the top of the brake housing (21).
12. Lubricate friction plates (16) with a light SAE 10W motor oil and install friction plates (16) and drive plates (17) in brake housing (21). Begin with a friction plate (16) then alternate between drive plates (17) and friction plates (16). Ensure the splined teeth mesh. Do not use force.
13. Lubricate and install seals (11) and (12) in brake piston (10) grooves so seal lips face each other. Do not overstretch seals during this procedure. Refer to Dwg. MHTPA0139.



(Dwg. MHTPA0139)

14. Install brake piston assembly in brake housing (21) so stepped side enters first. Gently tap into position using a soft mallet until seated.
15. Install one brake spring (9) in each of the brake spring holes.
16. Lubricate and install 'O' ring (20) on motor adapter (6) for FA2 winches or in the groove on the brake housing (21) on FA2.5 winches.
17. On FA2.5 winches install the brake reaction plate (8) in the motor adapter (6).
18. On FA2.5 winches install the seal adapter (15) in the mounting flange (216) if required.
19. On FA2.5 winches two of the threaded holes in the motor adapter (6) are centered between the mounting bolt holes. Install motor adapter with these two holes in the 6 o'clock position. On FA2 winches the motor adapter is symmetrical and can be mounted in any position.
20. On FA2.5 winches install motor adapter (6) with eight capscrews (1) using Loctite® 242. Torque to 85 ft lbs (12 kgm). On winches with a disc brake install capscrews evenly to compress brake springs. Do not allow plate to become cocked. Evenly hand tighten all capscrews before applying final torque.
21. On disc brake equipped winches install shaft extender (7) on end of shaft (35). On FA2.5 winches without disc brake install seal sleeve (14) on shaft (35).
22. Lubricate and install 'O' ring (5) in groove on the motor adapter (6).
23. Ensure seal adapter (15) (FA2.5 only) and oil seal (2) are installed in the bore of the motor assembly. Seal lip must face into the motor assembly.

⚠ WARNING

- The FA2 air motor weighs approximately 117 lb. (53 kg). The FA2.5 air motor weighs approximately 260 lb. (118 kg). Adequately support the air motor while installing the motor mounting capscrews.

24. On FA2 winches mount motor assembly to motor adapter (6) with capscrews (97) and lockwashers (96). Torque capscrews (97) to 30 ft lbs (4 kgm).
25. On FA2.5 winches, if motor assembly is being mounted with the winch in a vertical position, install one short bolt and nut to keep motor mounting flange (216) from dropping off. Lower motor assembly carefully onto the shaft. Position throttle assembly at the top. Be careful not to damage oil seal (2). When correctly positioned remove bolt and nut and lower motor assembly the remaining distance.
26. On FA2.5 winches install the motor assembly to the motor mounting plate using capscrews (4) with Loctite® 242. Torque capscrews to 85 ft lbs (12 kgm).
27. On FA2.5 winches make sure seal sleeve is in place in drum shaft (41). Due to very thin wall section, use extreme care to prevent damage to the seal sleeve.
28. On winches with a disc brake install fitting (31) in dump valve (30) and screw into the brake release port. Install vented fitting (29) in dump valve (30). Install fitting (25) in valve assembly (260) with elbow (26). Install steel tube (27) between fitting on the dump valve (30) and elbow (26).

Drum Assembly

1. Lay gear carrier (47) on the work bench and install bearing (49), retainer ring (50) and 'O' ring (51).
2. Align the dowel pins (52) and install reduction gear assembly to gear carrier (47).
3. Apply Loctite 262 on threads of capscrews (60) FA2, and (75) FA2.5, and install, torque to 33 ft lbs (44.7 Nm).
4. Clean surfaces of the drum (80) and gear carrier (47). Apply Loctite® 515 gasket sealant to drum mating surface. Lower reduction gear assembly into drum (80).
5. Install capscrews (45) and lockwashers (46) with Loctite® 242 and torque to 70 ft lbs (10 kgm) on FA2 winches or 210 ft lbs (29 kgm) on FA2.5 winches.
6. Install fill/drain plugs (48) in gear carrier (47).
7. Apply a thin coat of Loctite® 609 to the outside of seal (43) and install in gear carrier (47).
8. Place drum in an upright position. Carefully lower inboard assembly into the drum (80) making sure splines on shaft (35) and drum shaft (41) mesh in the drum and reduction gear assembly.
9. Using a 'C' clamp, clamp the inboard flange assembly to the drum flange and place complete assembly in a horizontal position.
10. Clean seal surface and install oil seal (99) in outboard upright (84) with lip toward the drum.
11. Pack bearing (86) with grease and install in outboard upright (84).
12. Install outboard upright (84) on the drum end. Ensure assembly is kept centered on seal and journal during this step.

13. Install shaft retainer (92) using capscrews (93) with Loctite® 242. Torque to 30 ft lbs (4 kgm).
14. Apply a light coat of Loctite® 515 sealant to the mating surface of the outboard upright (84) and install end cover (95) using capscrews (97) and lockwashers (96). Apply a small amount of Loctite® 242 to capscrew (97) threads and torque to 30 ft lbs (4 kgm).
15. Install pipe plug (98) in end cover (95).
16. Install side rails to uprights and loosely secure using capscrews (85) and lockwashers (46).
17. Tap dowel pins (87) into position so they are flush with the side rails.
18. Apply Loctite® 242 to capscrews (85) and lockwashers (46) and torque to 70 ft lbs (9.7 kgm).

Testing

Operational Test

Prior to initial use, all new, altered or repaired winches shall be tested to ensure proper operation.

- a. Check oil level in motor, reduction gear assembly and disc brake are correct.
- b. To initially 'break in' new or overhauled motors operate without load, in both directions, for 2 hours at 100 - 200 RPM.
- c. New Drum Brake Band Lining Run-in Procedure: All new drum brake band linings require a 'run-in' period. Operate the winch without load in the payout direction while gradually applying the brake. Allow the brake to slip for approximately one minute. Winch motor may stall as drum brake band lining fully engages. Do not allow brake to overheat.
- d. Check operation of brakes. Adjust if necessary as described in the "MAINTENANCE" section.
- e. Check operation of limit switches, locking devices and all safety devices when equipped.
- f. Check foundation mounting fasteners are secure.
- g. Install drum guard when provided.

Load Test

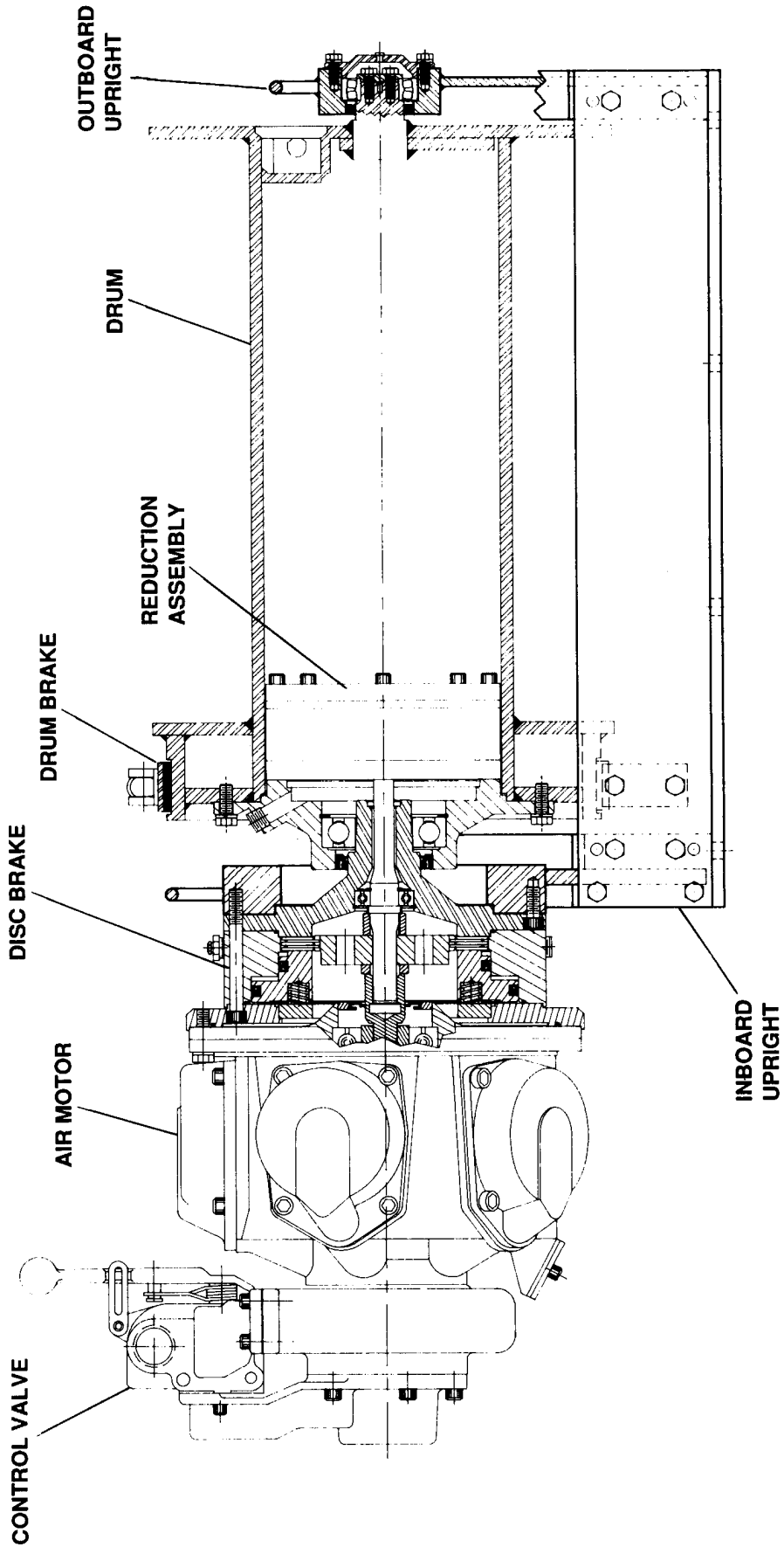
Prior to initial use, all new, extensively repaired, or altered winches shall be load tested by or under the direction of a person trained in the operation and safety of this winch and a written report furnished confirming the rating of the winch. Test loads shall not be more than 125% of the rated line pull.

To test the winch at 125% of the rated load apply the following load with the wire rope on the first layer of the drum:

FA2 Winch	7223 lb. (3283 kg)
FA2.5 Winch	8223 lb. (3738 kg)

SERVICE NOTES

FA2.5 ASSEMBLY DRAWINGS REFERENCE DIAGRAM

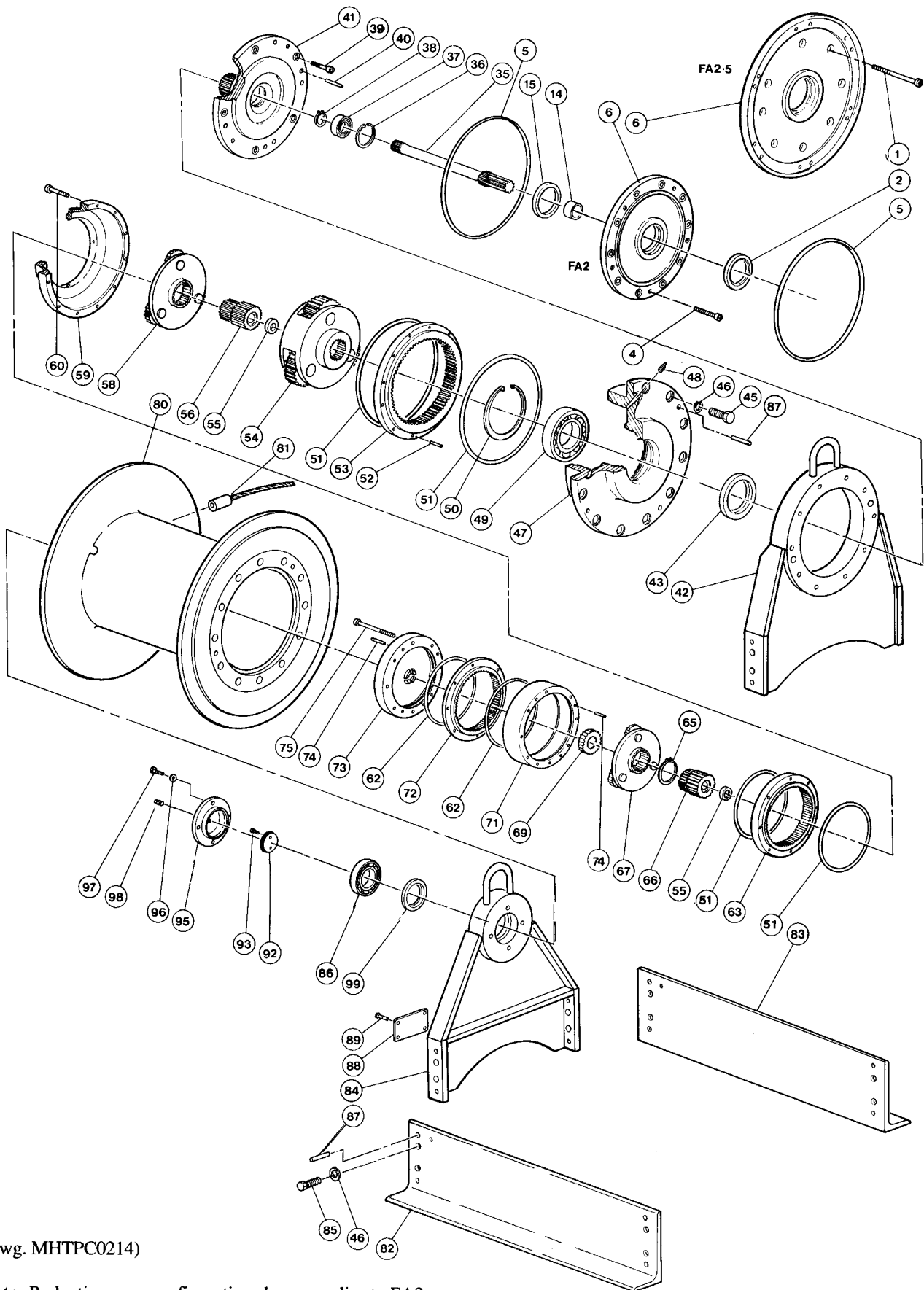


(Dwg. MHTPB0215)

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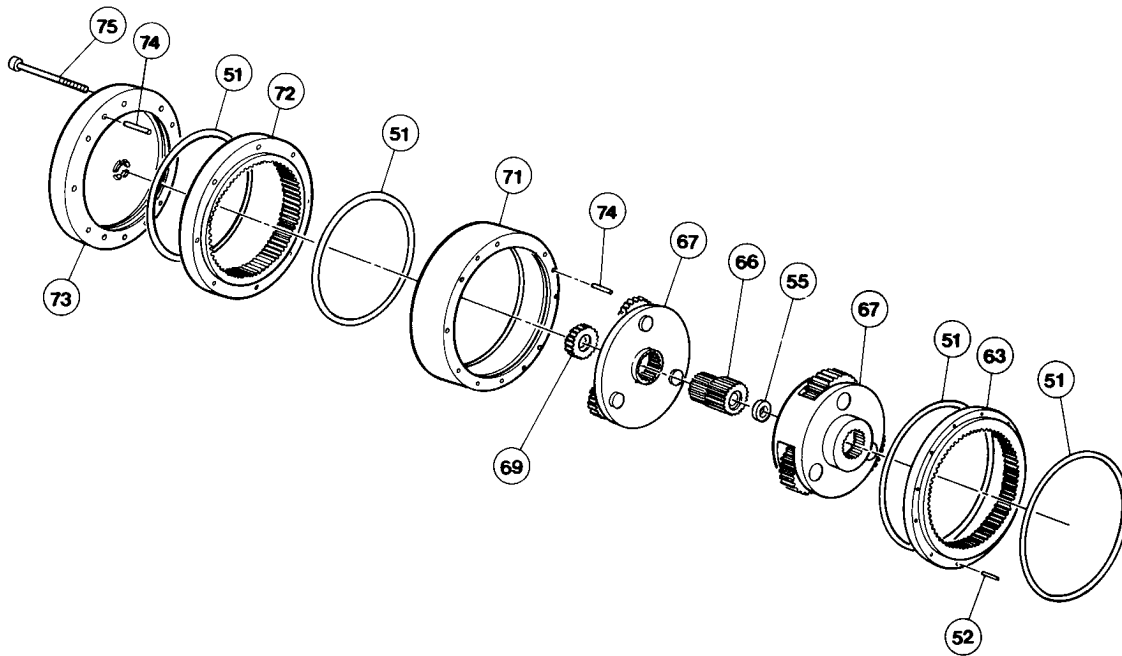
DRUM, BASE AND FA2 REDUCTION GEAR ASSEMBLY DRAWING



(Dwg. MHTPC0214)

Note: Reduction gear configuration shown applies to FA2 winch only.

FA2.5 REDUCTION GEAR ASSEMBLY DRAWING



(Dwg. MHTPA0523)

DRUM, BASE AND REDUCTION GEAR ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER	
			FA2	FA2.5
1	Capscrew (without Disc Brake)	8	---	52379
• 2	Oil Seal	1	52223	51873
4	Capscrew	See ()	51931 (5)	50197 (10)
• 5	'O' Ring	2	51484	51460
6	Motor Adapter	1	10361	14227
14	Seal Ring (for units without Disc Brake)	1	11107	10598
15	Seal Adapter	1	---	16354
35	Shaft	1	11095	11359
36	Retainer Ring	1	---	51871
• 37	Bearing	1	52229	51870
38	Retainer Ring	1	---	51872
39	Capscrew	See ()	51766 (5)	52380 (8)
40	Pin	2	52683	50984
41	Drum Shaft	1	14021	14037
42	Inboard Upright	1	10342	11376
• 43	Seal	1	51475	

• Recommended spare.

DRUM, BASE AND REDUCTION GEAR ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER	
			FA2	FA2.5
45	Capscrew	See ()	50973 (20)	50973 (24)
46	Washer	See ()	50181 (20)	50181 (24)
47	Gear Carrier	1	15451	
48	Pipe Plug	2	51467	
49	Bearing	1	51473	
50	Retainer Ring	1	51479	
---	Reduction Gear Assembly	1	51783	11409
• 51	'O' Ring	See ()	52149 (4)	52149 (2)
52	Dowel Pin	4	71068472	
53	Ring Gear	1	71068548	---
54	Planet Assembly	1	71068555	
55	Thrust Bearing	1	71068647	
56	Sun Gear	1	71068530	---
58	Planet Assembly	1	71068498	---
59	Input Housing	1	71107429	---
60	Capscrew	8	71106736	---
62	'O' Ring	2	52273	---
63	Ring Gear	1	71068514	71068548
65	Retainer Ring	1	---	
66	Sun Gear	1	71107460	71068530
67	Planet Assembly	1	71107452	71107627
69	Sun Gear	1	10498	71107635
71	Spacer	1	71068522	
72	Ring Gear	1	71107437	71068514
73	Cover	1	71107486	71068654
74	Dowel Pin	4	---	71068464
75	Capscrew	8	71107445	71106736
80	Drum (8 inch long)	1	11236-1	
	Drum (12 inch long)		11236-2	
	Drum (16 inch long)		11236-3	
	Drum (24 inch long)		11236-5	
* 81	Wire Rope Anchor 1/2 in. (13 mm)	1	52001	
	Wire Rope Anchor 5/8 in. (16 mm)		52306	
82	Side Rail (8 inch long drum)	1	11262-1	12331-1
	Side Rail (12 inch long drum)		11262-2	12331-2
	Side Rail (16 inch long drum)		11262-3	12331-3
	Side Rail (24 inch long drum)		11262-5	12331-5

• Recommended spare.

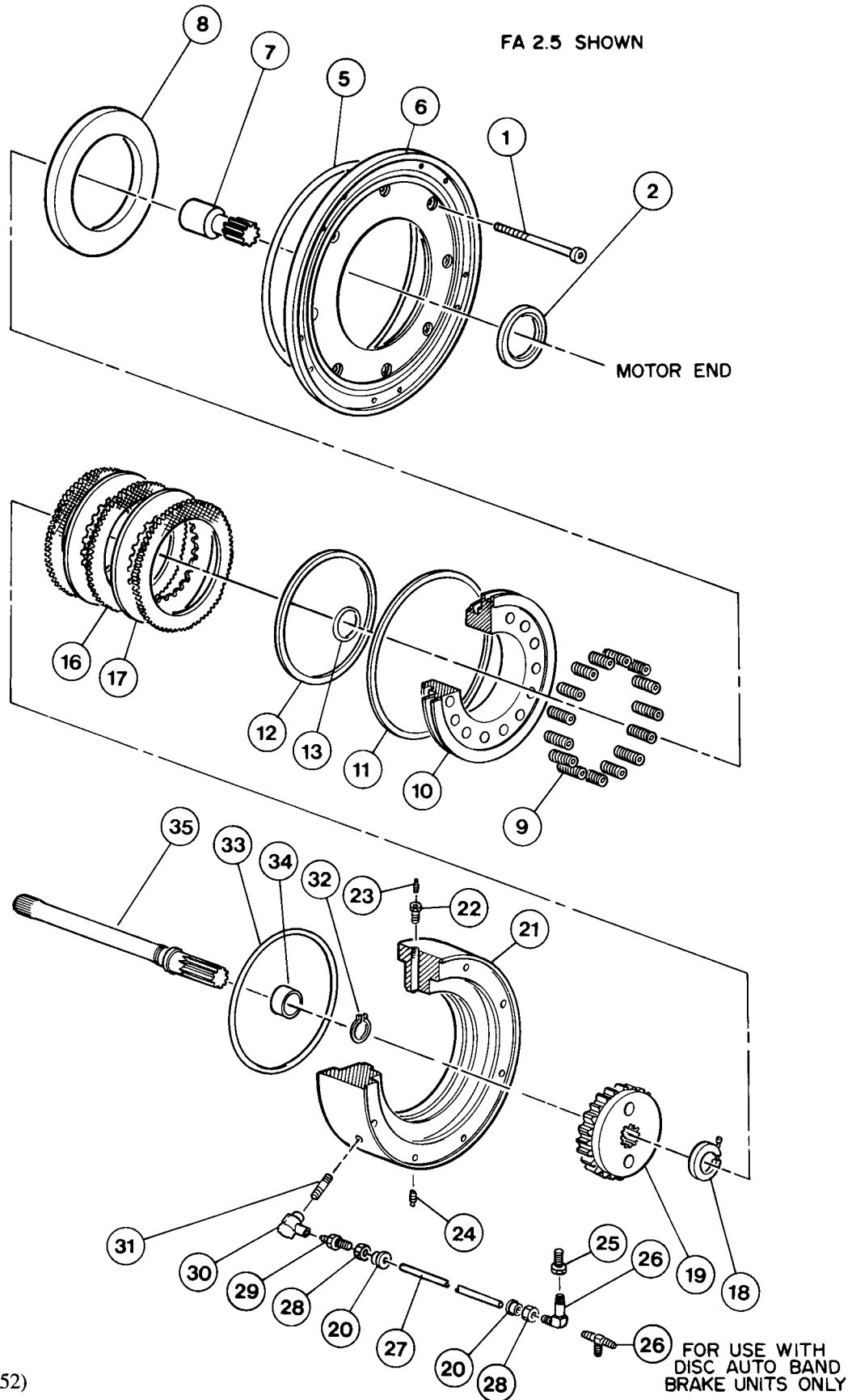
* Wire rope anchors are for use with 6 X 19 or 6 X 37 IWRC right lay construction wire rope only.

DRUM, BASE AND REDUCTION GEAR ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER	
			FA2	FA2.5
83	Side Rail (8 inch long drum)	1	11358-1	12332-1
	Side Rail (12 inch long drum)		11358-2	12332-2
	Side Rail (16 inch long drum)		11358-3	12332-3
	Side Rail (24 inch long drum)		11358-5	12332-5
84	Outboard Upright	1	10268	
85	Capscrew	8	50973	
• 86	Bearing	1	51797	
87	Dowel Pin	10	50984	
88	Name Plate	1	2844-1	
89	Drive Screw	4	50915	
92	Shaft Retainer	1	10267	
93	Capscrew	2	51485	
95	End Cover	1	10266	
96	Washer	4	50200	
97	Capscrew	4	50829	
98	Pipe Plug	1	54292	
• 99	Seal	1	51474	

• Recommended spare.

DISC BRAKE ASSEMBLY DRAWING



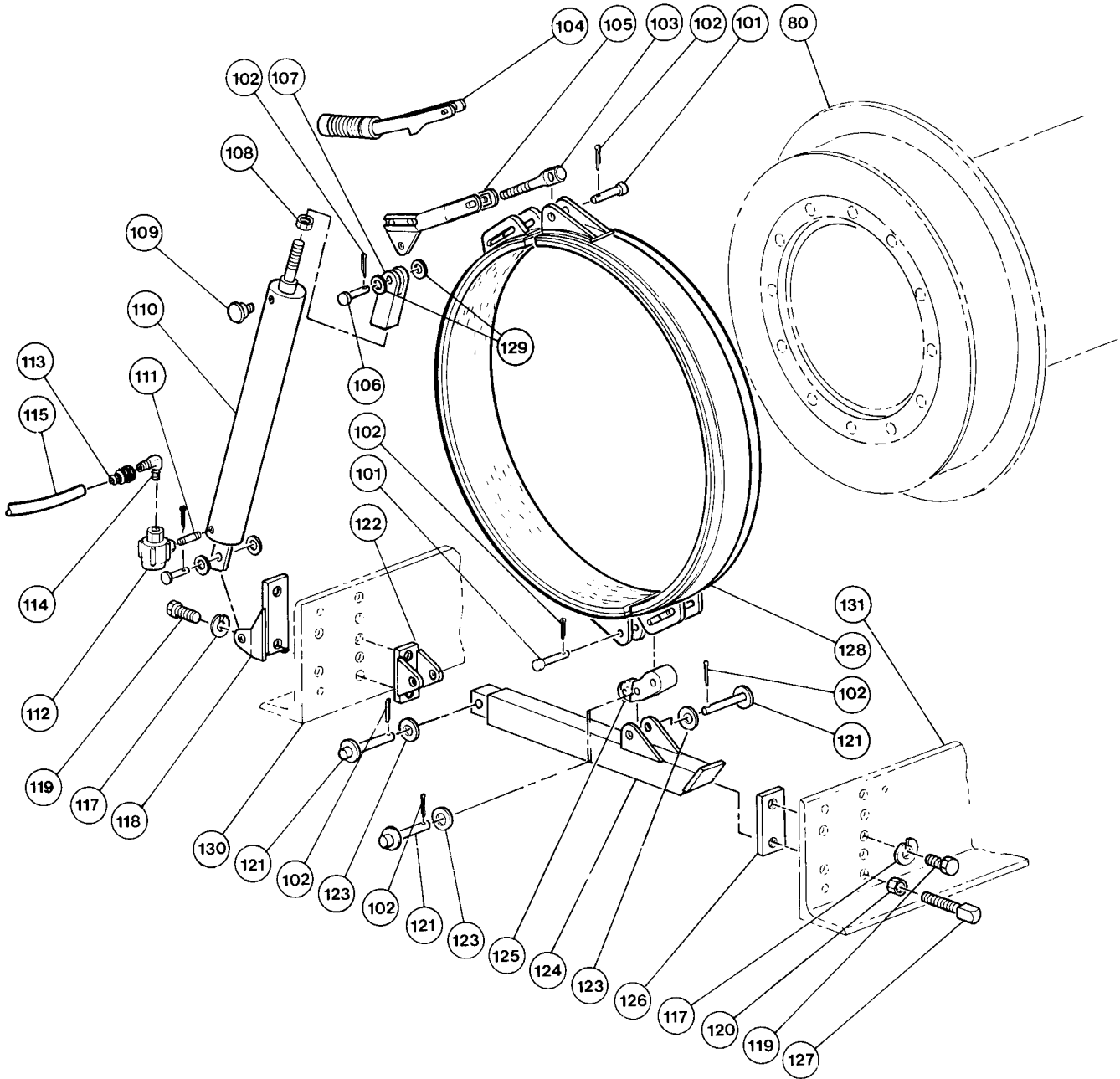
(Dwg. MHTPA0152)

DISC BRAKE ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER	
			FA2	FA2.5
1	Capscrew (with Disc Brake)	See ()	51448 (5)	51471 (8)
• 2	Oil Seal	1	52223	54463
• 5	'O' Ring	1	51484	51459
6	Motor Adapter	1	10361	14227
7	Shaft Extender	1	11104	10594
8	Brake Reaction Plate	1	---	10597
• 9	Spring	See ()	50751 (12)	50751 (15)
10	Brake Piston	1	15453	15437
• 11	Seal	1	51483	51462
• 12	Seal	1	51482	51461
15	Seal Adapter	1	---	16354
• 16	Friction Plate	See ()	51481 (2)	50772 (3)
• 17	Drive Plate	See ()	51480 (1)	50773 (2)
18	Collar	1	---	71039333
19	Splined Hub	1	11136	10600
20	Sleeve, Fitting	2	55014	
21	Brake Housing	1	11324	11322
22	Fitting	1	51803	
• 23	Breather	1	51857	
24	Pipe Plug	1	50801	
25	Fitting	1	52182	
26	Elbow Fitting	1	71056972	
	Tee Fitting (for units with auto drum band brake and disc brake only)	1	52181	
27	Tubing	1	52520	
28	Nut, Fitting	2	55013	
29	Vented Fitting	1	51814	
• 30	Dump Valve	1	50276	
31	Fitting	1	51034	50859
32	Retainer Ring	1	52227	50904
• 33	'O' Ring	1	51460	
34	Spacer	1	---	18683
35	Shaft	1	11095	10579

• Recommended spare.

DRUM BRAKE ASSEMBLY DRAWING



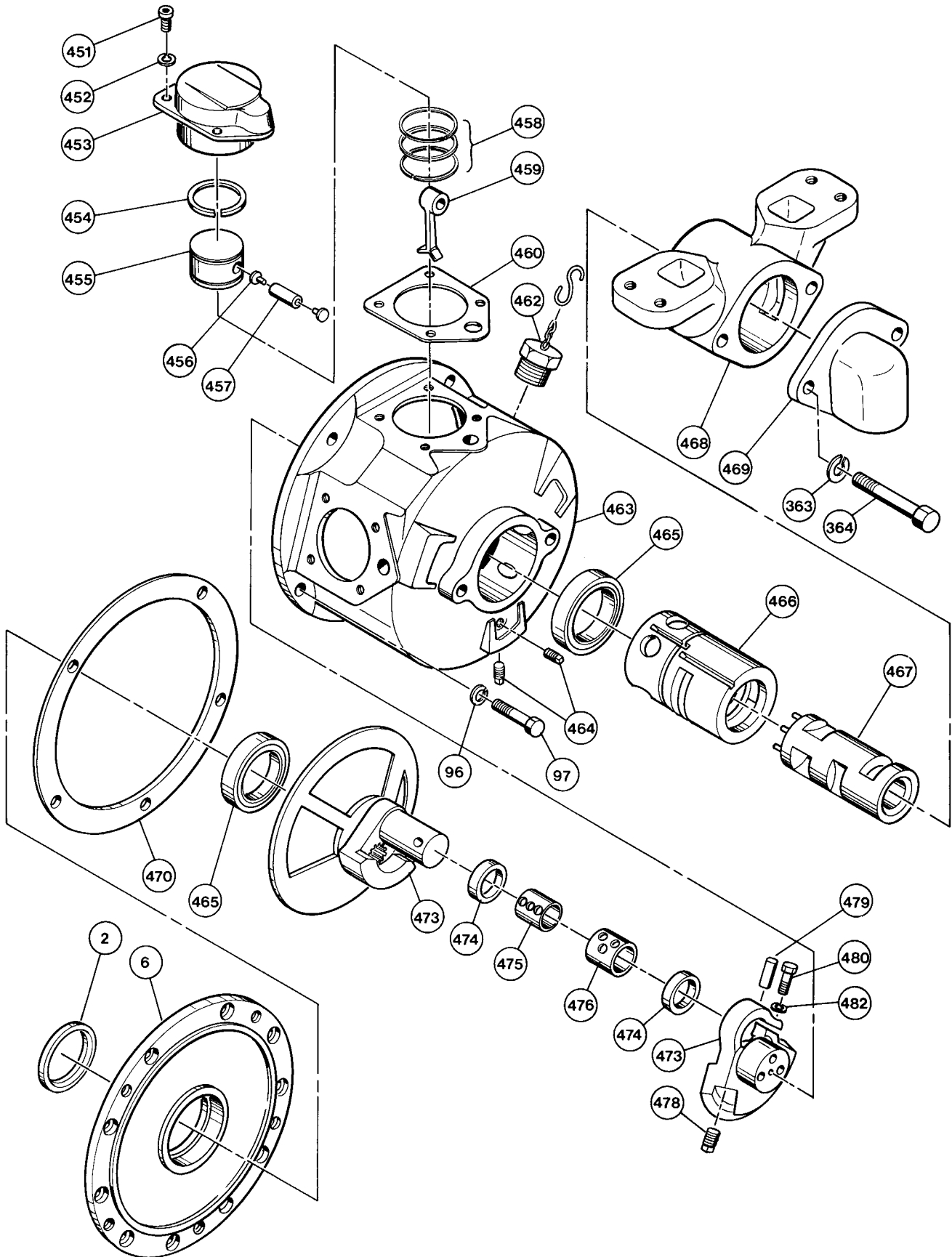
(Dwg. MHTPB0209)

DRUM BRAKE ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER	
			MANUAL BRAKE	AUTOMATIC BRAKE
80	Drum (8 inch long)	1	11354-1	
	Drum (10 inch long)		11354-2	
	Drum (16 inch long)		11354-3	
	Drum (24 inch long)		11354-5	
101	Pin	2	4303-S	
102	Cotter Pin	See ()	51937 (5)	51937 (7)
103	Link Stud	1	2448	
104	Handle	1	2329	---
105	Brake Lever	1	---	11498
106	Pin	2	---	8609
107	Clevis	1	---	6237-2
108	Nut	1	---	50159
109	Breather	1	---	52384
110	Cylinder	1	---	4575-1
111	Fitting	1	---	52006
• 112	Dump Valve	1	---	51954
113	Fitting	2	---	52385
114	Elbow	1	---	52330
115	Hose	1	---	50923
116	Capscrew	3	---	50873
117	Lockwasher	3	50181	
118	Bracket	1	---	11493
119	Capscrew	3	50973	
120	Nut	See ()	50171 (1)	50171 (2)
121	Pin	3	3704-S	
122	Pivot Bracket	1	11146	
123	Washer	As Req'd	50890	
124	Arm	1	11147	
125	Connecting Link	1	11144	
126	Stop Plate	1	11145	
127	Screw	1	52226	
• 128	Brake Band	1 Set	10724 (Set)	
	Brake Band Lining Kit	1 Kit	10724-BLK	
129	Washer	5	52914	
130	Side Rail (8 inch long drum)	1	11357-1	
	Side Rail (12 inch long drum)		11357-2	
	Side Rail (16 inch long drum)		11357-3	
	Side Rail (24 inch long drum)		11357-5	
131	Side Rail (8 inch long drum)	1	11358-1	
	Side Rail (12 inch long drum)		11358-2	
	Side Rail (16 inch long drum)		11358-3	
	Side Rail (24 inch long drum)		11358-5	

• Recommended spare.

FA2 MOTOR ASSEMBLY DRAWING



(Dwg. MHTPB0210)

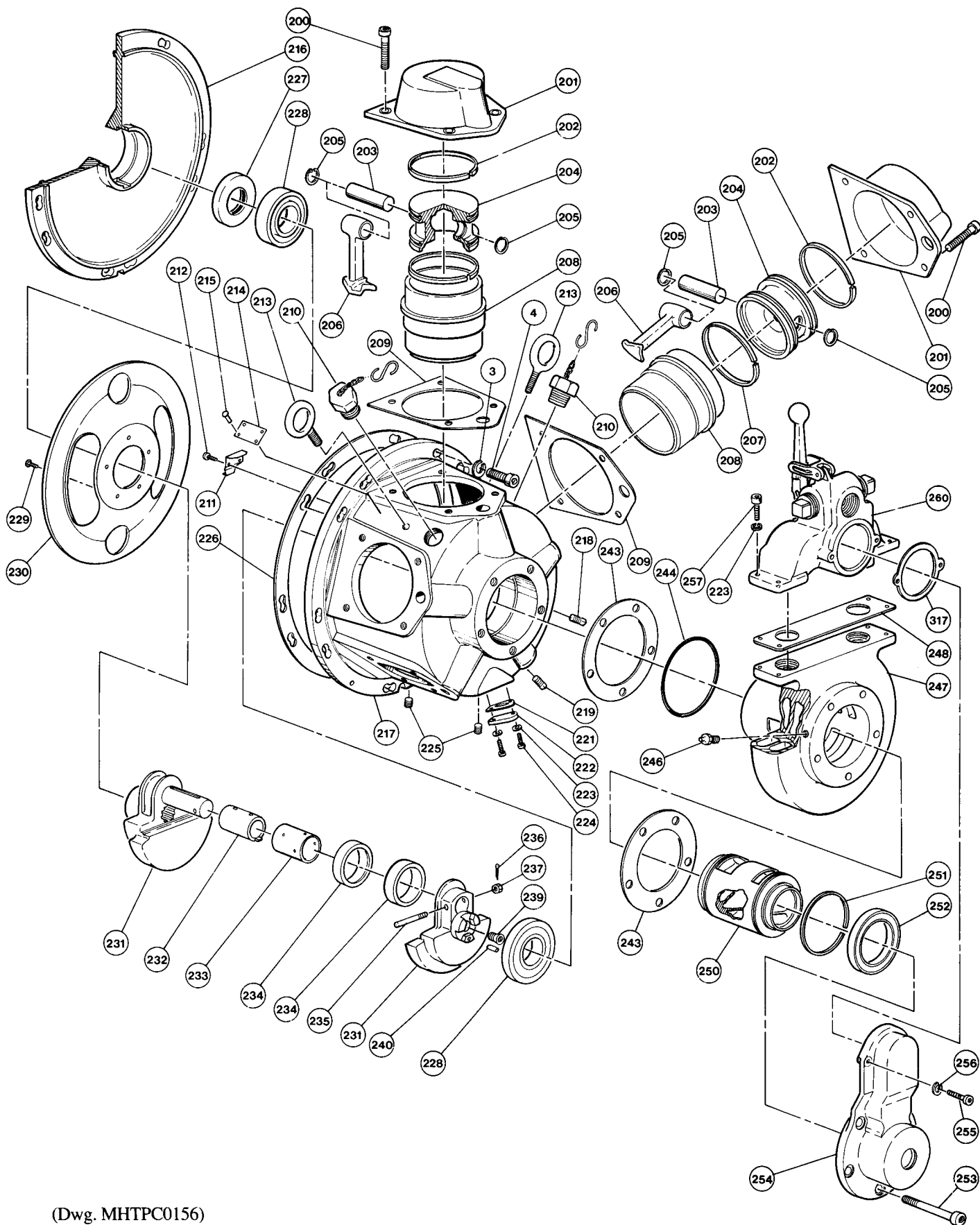
FA2 MOTOR ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER
*	Motor Assembly	1	50259-1
• 2	Oil Seal	1	52223
6	Motor Adapter	1	10361
96	Lockwasher	5	50200
97	Capscrew	5	50829
363	Lockwasher	2	51486
364	Capscrew	2	54840
451	Capscrew	20	50871
• 452	Copper Washer	1 Set	94-027-20
453	Cylinder	5	94-024
• 454	Compression Ring	5	Order Kit 94-RS
455	Piston Assy (Incl's items 454, 457, & 458)	5	94-010A
456	Plug	10	Order 94-011-1A (Item 457)
457	Wrist Pin Assembly (Incl's item 456)	5	94-011-1A
• 458	Oil Ring	5	Order Kit 94-RS
459	Connecting Rod	5	94-009
• 460	Gasket	1 Set	94-025-5
462	Vent Cap Assembly	1	94-018
463	Motor Housing	1	94-014
464	Pipe Plug	2	94-015
465	Bearing	2	50944
• 466	Rotary Bushing	1	10986
• 467	Rotary Valve	1	94-019
468	Adapter Valve	1	10987
469	Exhaust Cap	1	21-1
• 470	Gasket	1	94-029
473	Crank Shaft Assembly	1	94-001
474	Connecting Rod Ring	2	94-008
475	Sleeve	1	94-007
476	Bushing	1	94-006
478	Setscrew	1	94-005
479	Pin	1	94-004
480	Capscrew	1	51712
482	Lockwasher	1	50200

• Recommended spare.

* Motor Assembly includes items listed above.

FA2.5 MOTOR ASSEMBLY DRAWING



(Dwg. MHTPC0156)

FA2.5 MOTOR ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER
- - -	Motor Assembly	1	K5B-546
3	Lockwasher	10	50201
4	Capscrew	10	14227
200	Capscrew	20	52317
201	Cylinder Head	5	K5B-H505
• 202	Compression Ring	5	K5B-337-47
203	Wrist Pin	5	HU-514A
204	Piston	5	Not Sold Separately
205	Retainer Ring	10	902A45-632
206	Connecting Rod	5	K5B-509
• 207	Oil Ring	5	K5B-338-47
208	Cylinder Liner	5	K5B-L505-47
• 209	Head Gasket	5	K5B-507
201	Vent Cap Assembly (Oil fill cap)	2	K5B-A303
211	Baffle	2	K5B-528
212	Screw	4	J-376
213	Eye Bolt	2	KU-888
214	Nameplate	1	K5B-301
215	Drive Screw	4	R4K-302-12
216	Mounting Flange	1	K5B-502
217	Motor Housing	1	K5B-501
218	Pipe Plug (Oil level)	1	ROH-377
219	Pipe Plug	1	TC-368
• 221	Gasket	1	K5B-1002
222	Cover Plate	1	K5B-1001
223	Lockwasher	6	D02-321-10
224	Capscrew	2	119A2A202
225	Pipe Plug (Drain)	3	GA57-95
• 226	Gasket	1	K5B-592
• 227	Oil Seal	1	K5B-270
228	Crank Bearing *	2	Not sold separately
229	Button Head Screw *	5	Not sold separately
230	Oil Slinger *	1	Not sold separately
231	Crank Assembly	1	K5B-A516
232	Sleeve *	1	Not sold separately
233	Connecting Rod Bushing *	1	Not sold separately
234	Connecting Rod Ring *	1	Not sold separately

• Recommended spare.

FA2.5 MOTOR ASSEMBLY PARTS LIST

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER
235	Lock Pin *	1	Not sold separately
236	Cotter Pin *	1	Not sold separately
237	Pin Nut *	1	Not sold separately
239	Flat Head Screw	1	139A2A266
240	Roll Pin	1	WF171-15
• 243	Gasket	2	K5B-928
• 244	'O' Ring	1	20A11CM248
246	Grease Fitting	1	23-188
247	Rotary Valve Housing	1	K5B-545
• 248	Gasket	1	K5B-547
250	Rotary Valve	1	K5B-526
• 251	Seal Ring	1	K5B-607
• 252	Bearing	1	K5B-97
253	Capscrew	5	51471
254	Exhaust Flange	1	K5B-276
255	Capscrew	2	119A2A200
256	Lockwasher	2	D02-321-10
257	Capscrew	4	51766
260	Valve Assembly	1	K5B-REMOTE
317	Gasket	1	K5B-275

• Recommended spare.

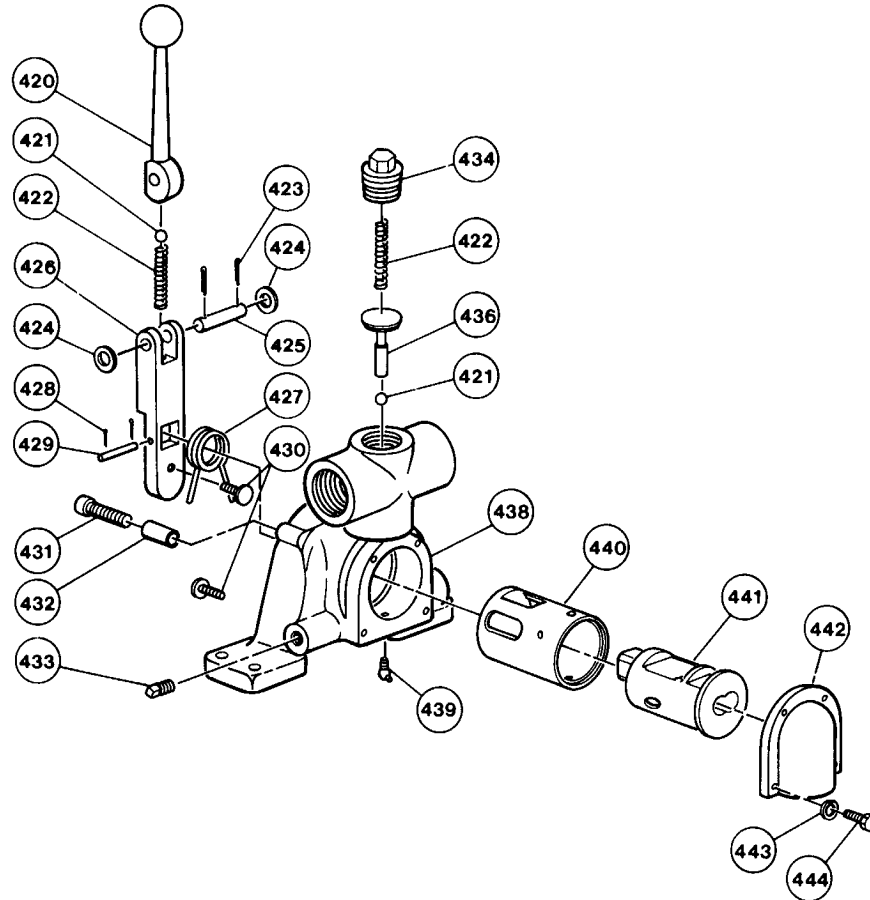
* Parts not sold separately. Refer to the "FA2.5 Motor Assembly Kit List."

** Motor Assembly consists of items 200 through 260 and 317.

FA2.5 Motor Assembly Kit List:

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER
231	Crank Assembly (Incl's items 206 and 228 through 237)	1	K5B-A516
261	Piston Assembly (Incl's items 202 through 205 and item 207)	1	K5B-A513-47
262	Cylinder Assembly (Incl's items 201 and 208)	1	K5B-A505-47

FA2 LIVE AIR CONTROL VALVE ASSEMBLY DRAWING AND PARTS LIST



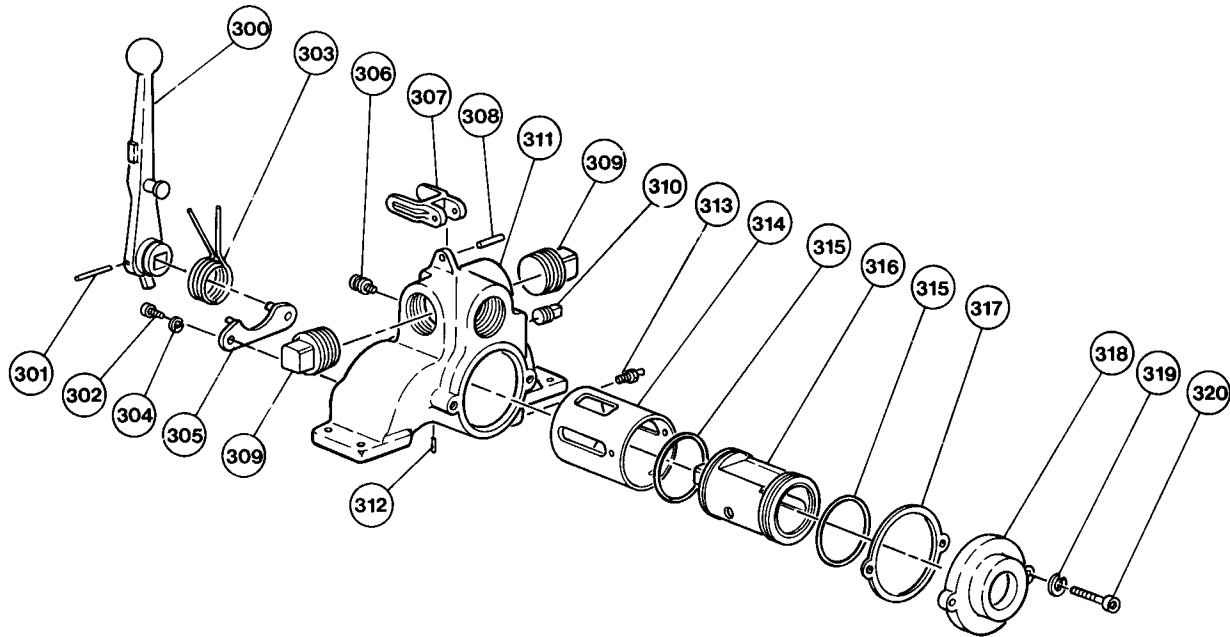
(Dwg. MHTPA0203)

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER	ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER
260	Valve Assembly (Incl's items 420 through 444)	1	51710	431	Capscrew	2	51025
				432	Sleeve	2	71077473
				433	Pipe Plug	1	51599
420	Handle	1	11882	434	Pipe Plug	1	11886
• 421	Ball	2	71077119	436	Poppet Valve	1	11879
• 422	Spring	2	11862	438	Housing	1	*
423	Pin	2	71077101	439	Grease Fitting	1	50192
424	Washer	2	52914	• 440	Valve Bushing	1	11883
425	Pin	1	11860	• 441	Valve	1	11865
426	Handle Bracket	1	11878	442	Exhaust Cover	1	11881
• 427	Spring	1	11880	443	Lockwasher	4	51801
428	Pin	2	52161	444	Capscrew	4	51770
429	Pin	1	11861	444	Capscrew	4	51770
430	Screw	2	11884				

• Recommended spare.

* Not sold separately. Order Valve Assembly 51710 (item 260).

FA2.5 LIVE AIR CONTROL VALVE ASSEMBLY DRAWING AND PARTS LIST

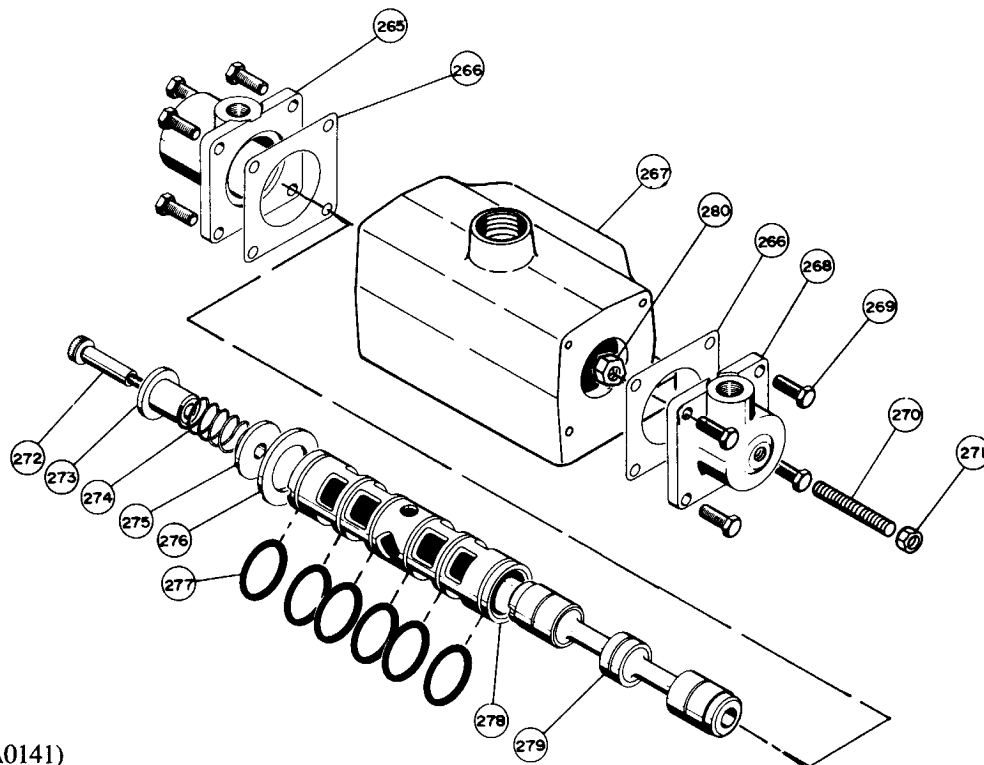


(Dwg. MHTPA0165)

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER	ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER
260	Valve Assembly (Includes items 300 through 320)	1	K5B-REMOTE	311	Valve Housing (matched set with item 314)	1	K5B-1101
300	Handle	1	K5B-556	312	Roll Pin	1	25A13C92
301	Roll Pin	1	K5B-1115	313	Grease Fitting	1	23-188
302	Capscrew	2	50853	314	Valve Bushing (matched set with item 311)	1	K5B-1101
• 303	Spring	1	K5B-412				
304	Lockwasher	2	50200	• 315	Seal Ring	2	K5B-606
305	Valve Body Retainer	1	K5B-1110	316	Valve Body	1	K5B-944
306	Spring Retainer	1	K5B-553	317	Gasket	1	K5B-275
307	Latch	1	K5B-869	318	Flange	1	KK5B-276S
308	Roll Pin	1	HLK-20	319	Lockwasher	2	D02-321-10
309	Pipe Plug	2	E5UD-947	320	Capscrew	2	50853
310	Pipe Plug	1	71026025				

• Recommended spare.

PILOT AIR CONTROL VALVE (OPTIONAL) ASSEMBLY DRAWING AND PARTS LIST



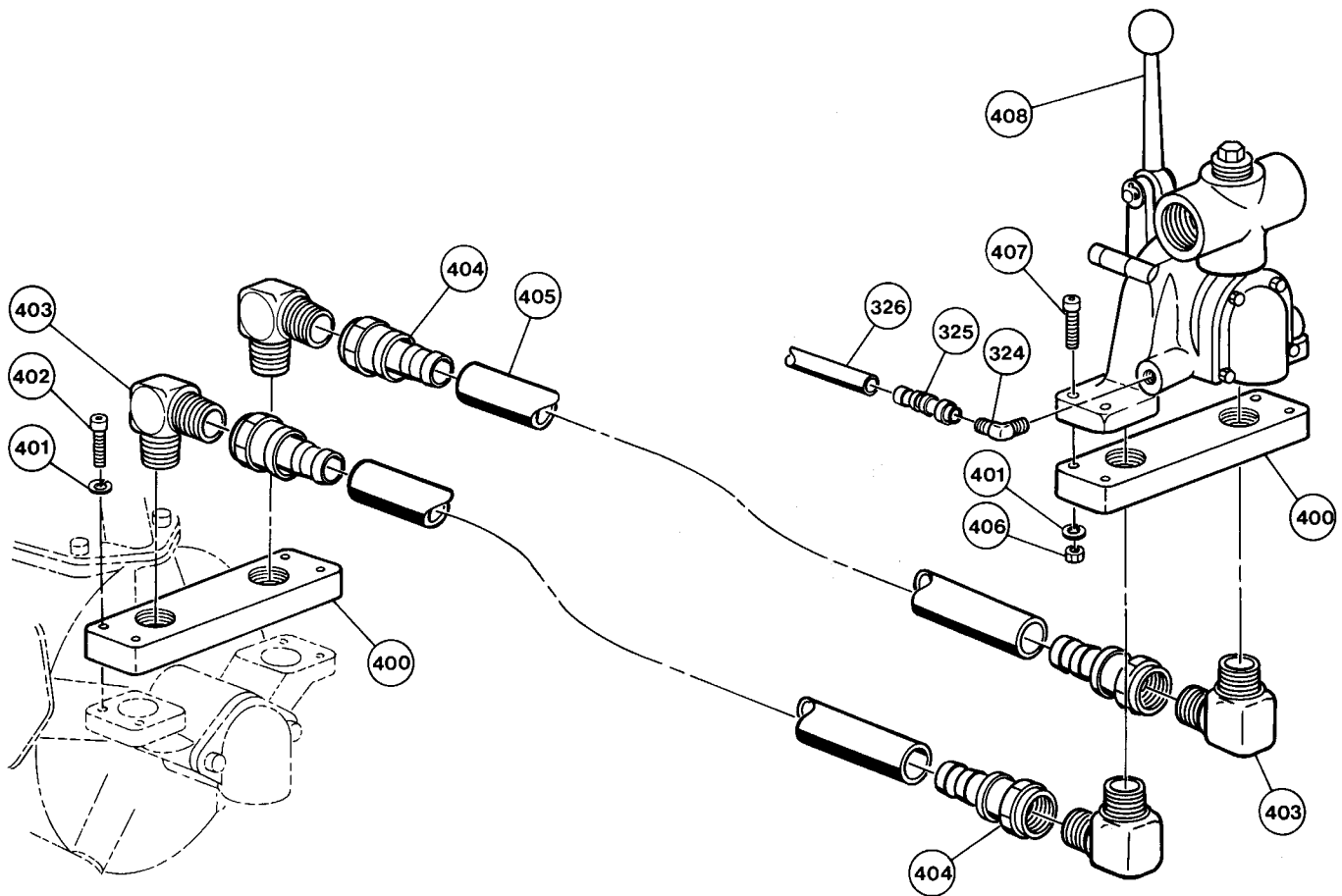
(Dwg. MHTPA0141)

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER		
			FA2		FA2.5
			310 size *	410 size *	510 size *
355	Valve Assembly (Incl's items 265 through 280)	1	20991	20992	20993
265	End Cap	1	52241		321-064
• 266	Gasket	2	52457		521-066
267	Valve Body	1	Not sold separately, order item 355		
268	End Cap (Inlet Side)	1	11778		
269	Capscrew	8	52234		
270	Adjusting Screw	1	71083968		
271	Nut	1	52265		
272	Shoulder Screw	1	817-002		
273	Guide	1	52233		321-071
274	Spring	1	52240		814-019
275	Washer	1	52239		321-072
276	Spacer	1	52238		321-068
• 277	O' Ring	6	51632		808-013
278	Valve Sleeve	1	Not sold separately, order item 355		
279	Valve Spool	1	Not sold separately, order item 355		
280	Stop	1	11777		

• Recommended spare.

* Consult the nearest Ingersoll-Rand office or distributor for technical assistance in determining the correct valve.

FA2 REMOTE AIR CONTROL (OPTIONAL) ASSEMBLY DRAWING AND PARTS LIST

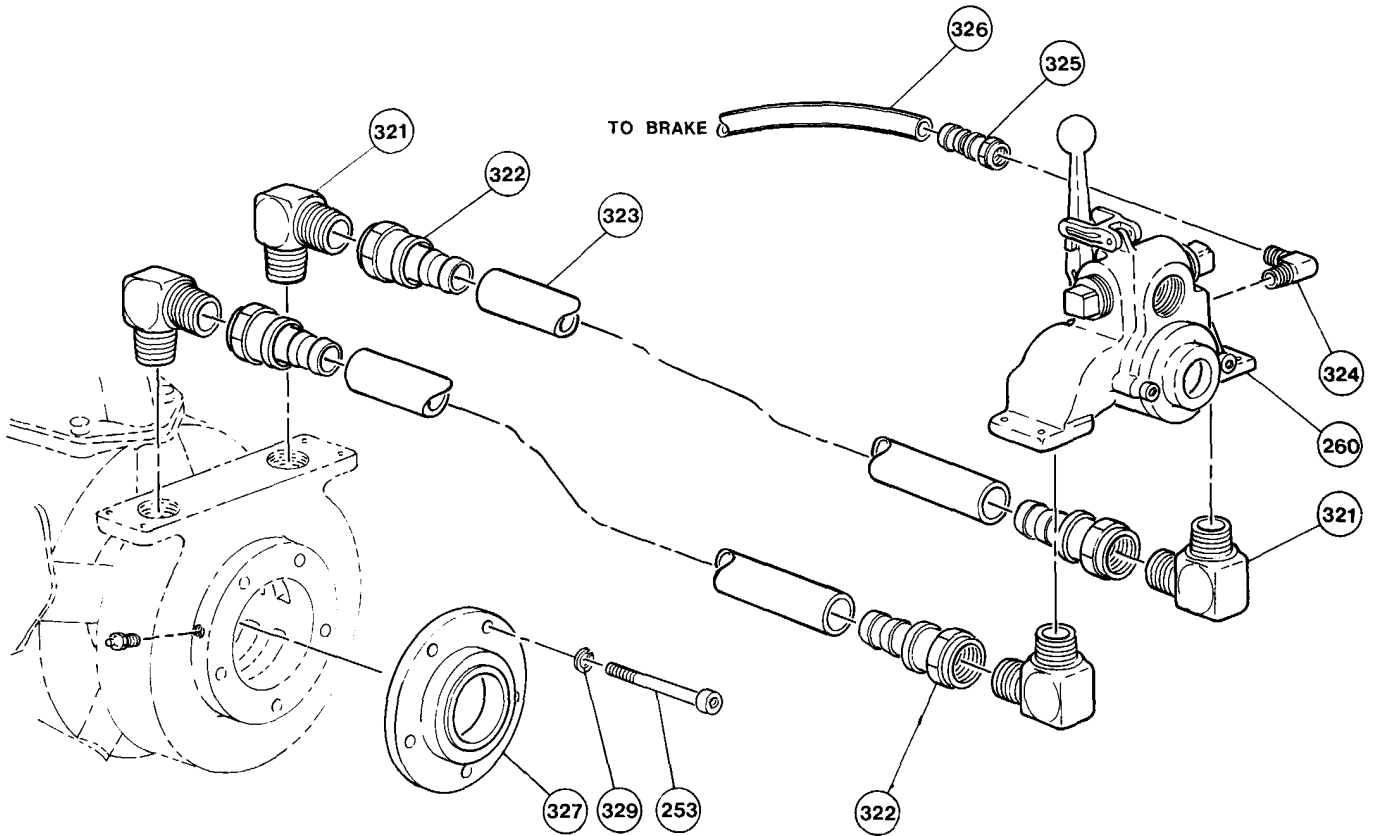


(Dwg. MHTPA0204)

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER
408	Control Valve Assembly	1	51710
324	Elbow Fitting	1	52182
325	Hose End	2	51029
326	Hose	1	50923-*
400	Adapter Manifold	2	17851
401	Lockwasher	8	50200
402	Capscrew	4	54240
403	Elbow Fitting	4	71015457
404	Hose End	4	54125
405	Hose	2	50766-*
406	Nut	4	50170
407	Capscrew	4	51931

* Add hose length (feet/metres). Maximum length = 20 feet (6 metres). Contact Technical Sales for information on control applicability for lengths greater than 20 feet (6 metres).

FA2.5 REMOTE AIR CONTROL (OPTIONAL) ASSEMBLY DRAWING AND PARTS LIST



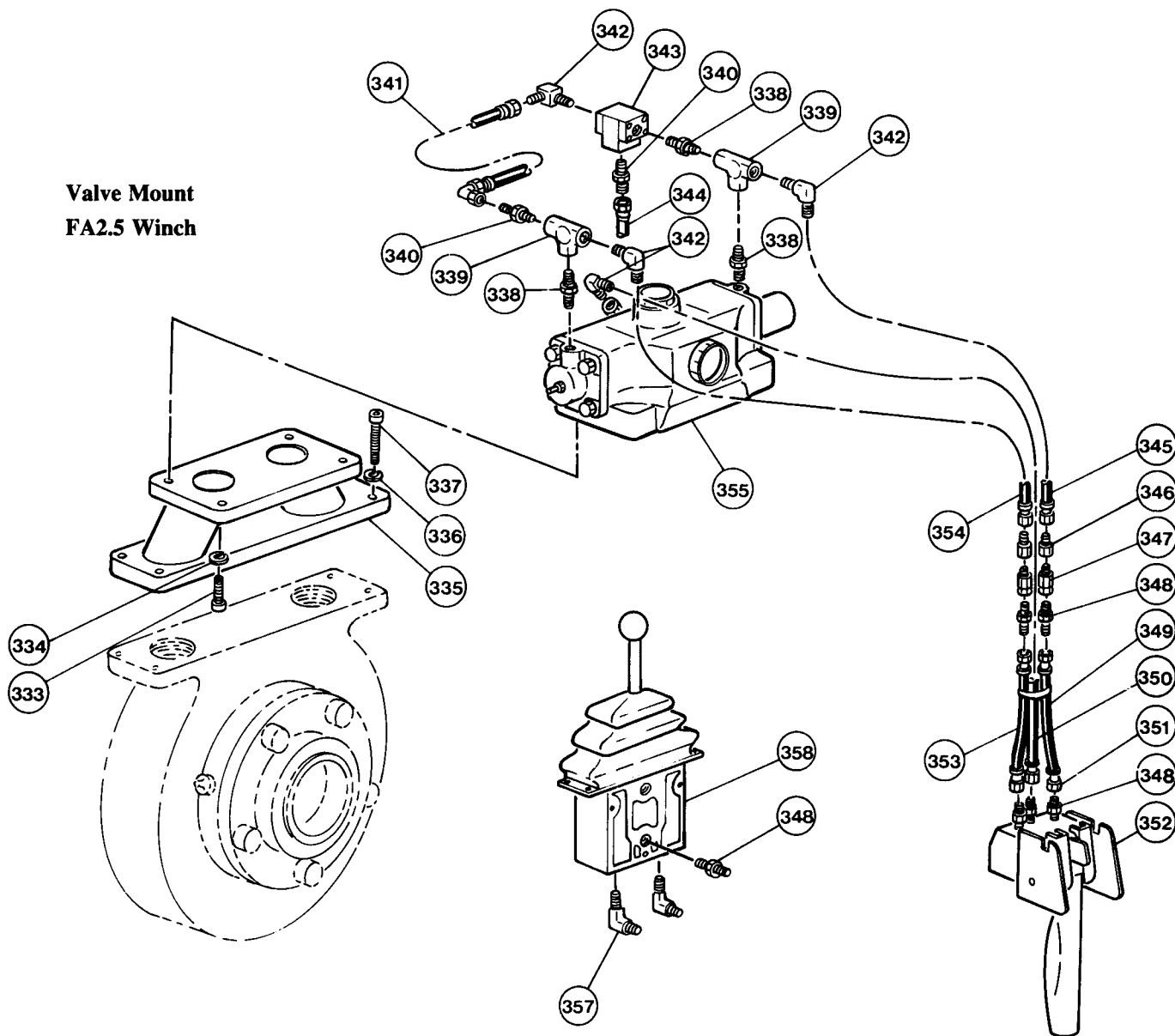
(Dwg. MHTPA0161)

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER
260	Control Valve Assembly	1	K5B-REMOTE
253	Capscrew	5	119A2A267
321	Elbow Fitting	4	54270
322	Hose End	4	54738
323	Hose	2	54737-*
324	Elbow Fitting	1	52182
325	Hose End	2	51029
326	Hose	1	50923-*
327	Exhaust Cover	1	KK5B-276M
329	Lockwasher	5	50181

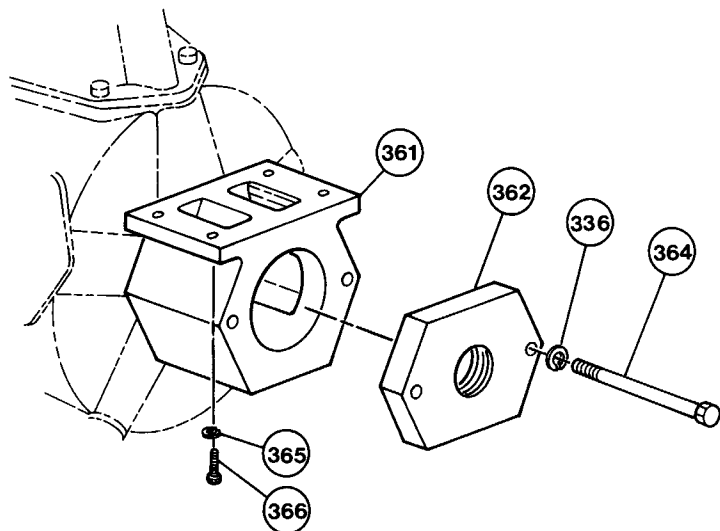
* Add hose length (feet/metres). Maximum length = 20 feet (6 metres). Contact Technical Sales for information on control applicability for lengths greater than 20 feet (6 metres). Metres are for reference only; order quantities in feet.

REMOTE PILOT AIR CONTROL (OPTIONAL) ASSEMBLY DRAWINGS

Valve Mount
FA2.5 Winch



(Dwg. MHTPA0167)



Valve Mount
FA2 Winch

(Dwg. MHTPA0211)

REMOTE PILOT AIR CONTROL (OPTIONAL) ASSEMBLY PARTS LISTS

Remote Pilot Pendant Throttle Control

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER			
			10 ft (3 m)	20 ft (6 m)	30 ft (9 m)	40 ft (12 m)
324	Elbow Fitting	4	52182			
325	Hose End Fitting	See ()	51029 (6)	51029 (10)		51029 (14)
333	Capscrew	4	54681			
334	Lockwasher	4	50893			
335	Manifold	1	13881			
336	Lockwasher (FA2)	2	51486			
	Lockwasher (FA2.5)	4				
337	Capscrew	4	50829			
338	Nipple Fitting	3	54274			
339	Pipe Tee Fitting	2	54678			
340	Adapter Fitting	2	51814			
341	Hose Assembly	1	17073-6			
• 343	Shuttle Valve	1	50277			
344	Hose Assembly (Brake)	1	17073-10			
345	Hose	See ()	50923-(132)	50923-(242)	50923-(233)	50923-(245)
346	Adapter Fitting	As Req'd	---	71048284		
347	Exhaust Valve*	As Req'd	---	20417		
348	Adapter Fitting	As Req'd	71048268			
349	Hose	See ()	---	50923-(6)	50923-(123)	50923-(6)
350	Hose	See ()	50923-(123)	50923-(252)	50923-(372)	50923-(492)
352	Control Pendant	1	MLK-A269A			
353	Hose	See ()	---	50923-(6)	50923-(135)	50923-(6)
354	Hose	See ()	50923-(120)	50923-(230)	50923-(233)	
355	Valve Assembly (FA2)	1	20991			
	Valve Assembly (FA2.5)		20992			
356	Hose **	See ()	---	---	---	50923-(233)
361	Rotary Valve	1	9148			
362	Cover	1	11543			
364	Capscrew	2	54840			
365	Lockwasher	4	51013			
366	Capscrew	4	52906			

• Recommended spare.

* Must be installed at 20 foot (6 metre) intervals. Part number 20417 includes items 346 and 348.

** Not shown. Install between exhaust valves.

() = Quantity in inches.

Remote Pilot Lever Throttle Valve Associated Components

Note: Requires item #'s 325, 333 through 344 (Reference "Remote Pilot Pendant Throttle Control") plus the following parts.

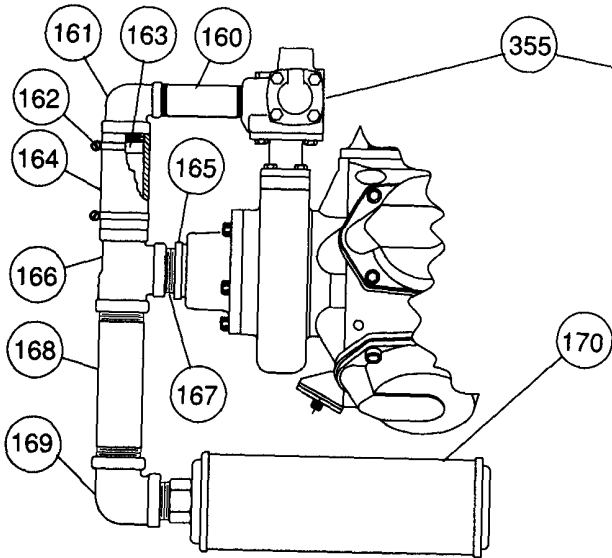
ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER	ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER
345	Hose	See ()	50923-(233)	350	Hose	See ()	50923-(372)
346	Adapter Fitting	2	71048284	353	Hose	See ()	50923-(123)
347	Exhaust Valve **	2	71047898	354	Hose	See ()	50923-(233)
348	Adapter Fitting	1	71048268	357	Elbow Fitting	2	51281
349	Hose	See ()	50923-(135)	358	Pilot Lever Throttle	1	71069561

* Part numbers and quantities are for a 30 foot (9 metre) hose assembly.

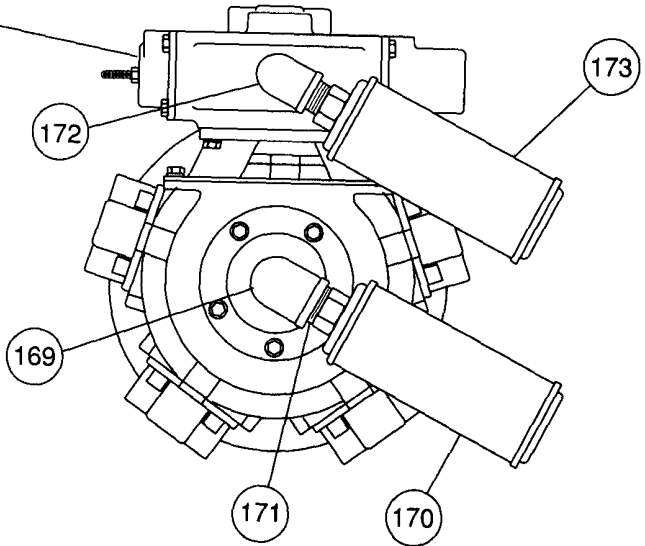
() = Quantity in inches.

MUFFLER ASSEMBLY DRAWINGS

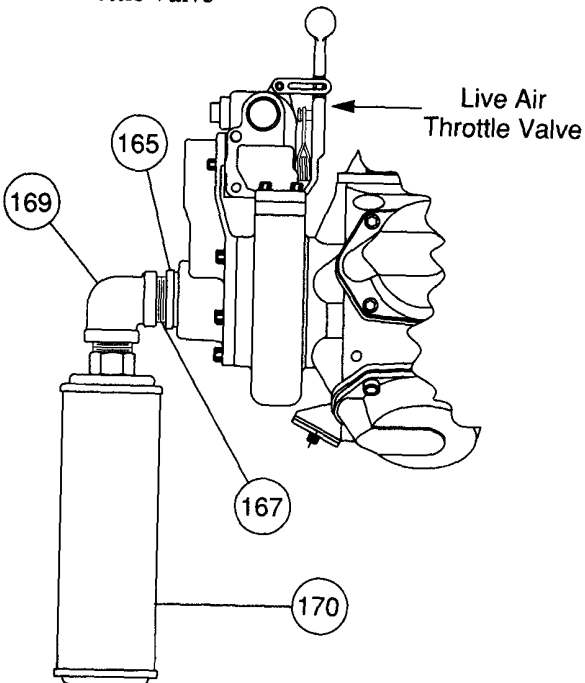
FA2.5 Muffler with Remote Actuated Pilot Control Valve (Old Style)



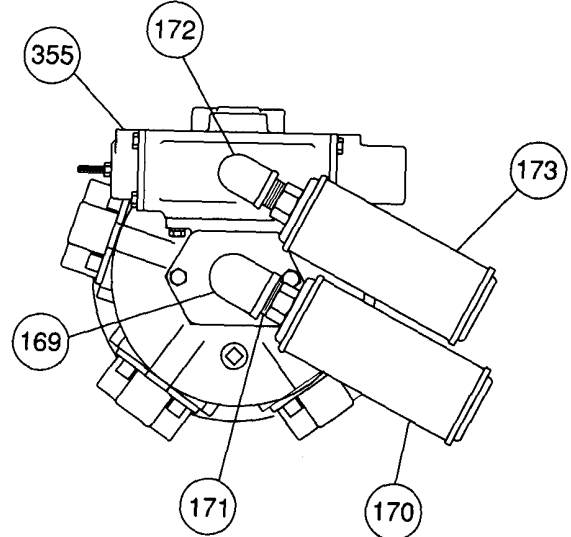
FA2.5 Mufflers with Remote Actuated Pilot Control Valve (New Style)



FA2.5 Muffler with Live Air Throttle Valve



FA2 Mufflers with Remote Actuated Pilot Control Valve



(Dwg MHTPA0515)

MUFFLER ASSEMBLY PARTS LIST

ITEM NUMBER	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER
-------------	---------------------	----------------	-------------

FA2 with Live Air Throttle Valve

169	Pipe Elbow	1	52103
170	Muffler	1	52465
171	Pipe Nipple	1	51704

FA2 with Remote Actuated Pilot Valve

			Old Style	New Style
169	Pipe Elbow	1	53368	52103
170	Muffler	1	50592	52465
171	Pipe Nipple	1	---	51704
172	Pipe Elbow	1	52190	53368
173	Muffler	1	52104	50592

FA2.5 with Live Air Throttle Valve

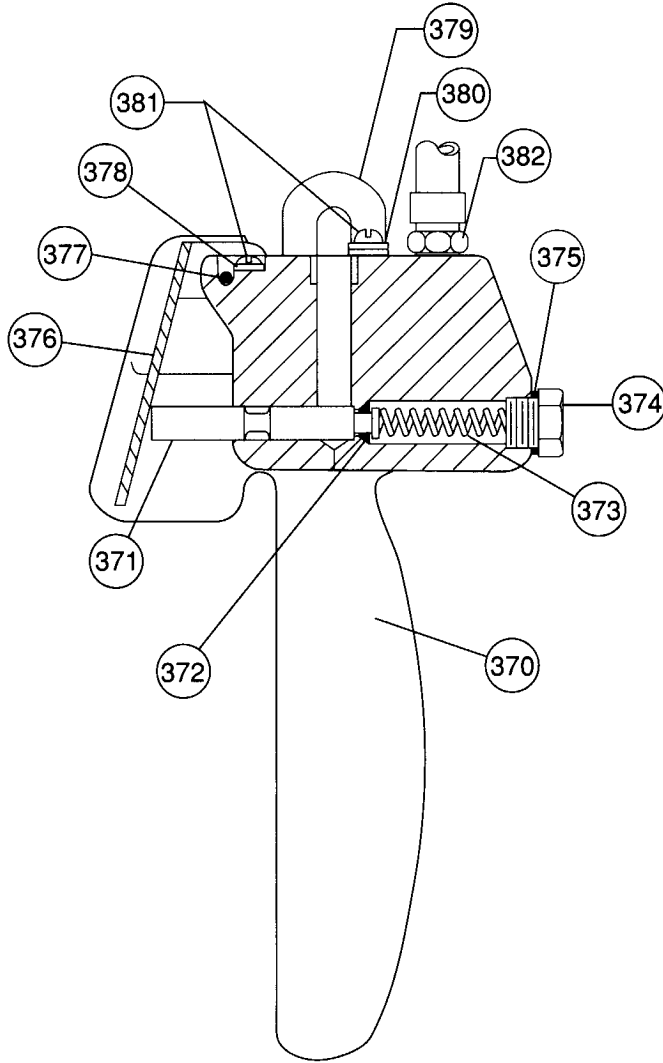
165	Reducer Bushing	1	71057459
167	Pipe Nipple	1	71057467
169	Pipe Elbow	1	71057434
170	Muffler	1	50594

FA2.5 with Remote Actuated Pilot Valve

			Old Style	New Style
160	Pipe Nipple	1	71057491	---
161	Pipe Elbow	1	71033450	---
162	Hose Clamp	2	71033500	---
163	Pipe Nipple	2	71057483	---
164	Hose	1	71033492	---
165	Reducer Bushing	1	71057459	---
166	Pipe Tee	1	71057442	---
167	Pipe Nipple	1	71057467	
168	Pipe Nipple	1	71057475	---
169	Pipe Elbow	1	71057434	
170	Muffler	1	50594	
171	Pipe Nipple	1	---	51704
172	Pipe Elbow	1	---	52103
173	Muffler	1	---	52465

Note: Reference the "PILOT AIR CONTROL VALVE ASSEMBLY DRAWING AND PARTS LIST" section for Pilot Valve Assembly (355) component part numbers

PENDANT CONTROL ASSEMBLY (OPTIONAL) DRAWING AND PARTS LIST



(Dwg. MHTPA0168)

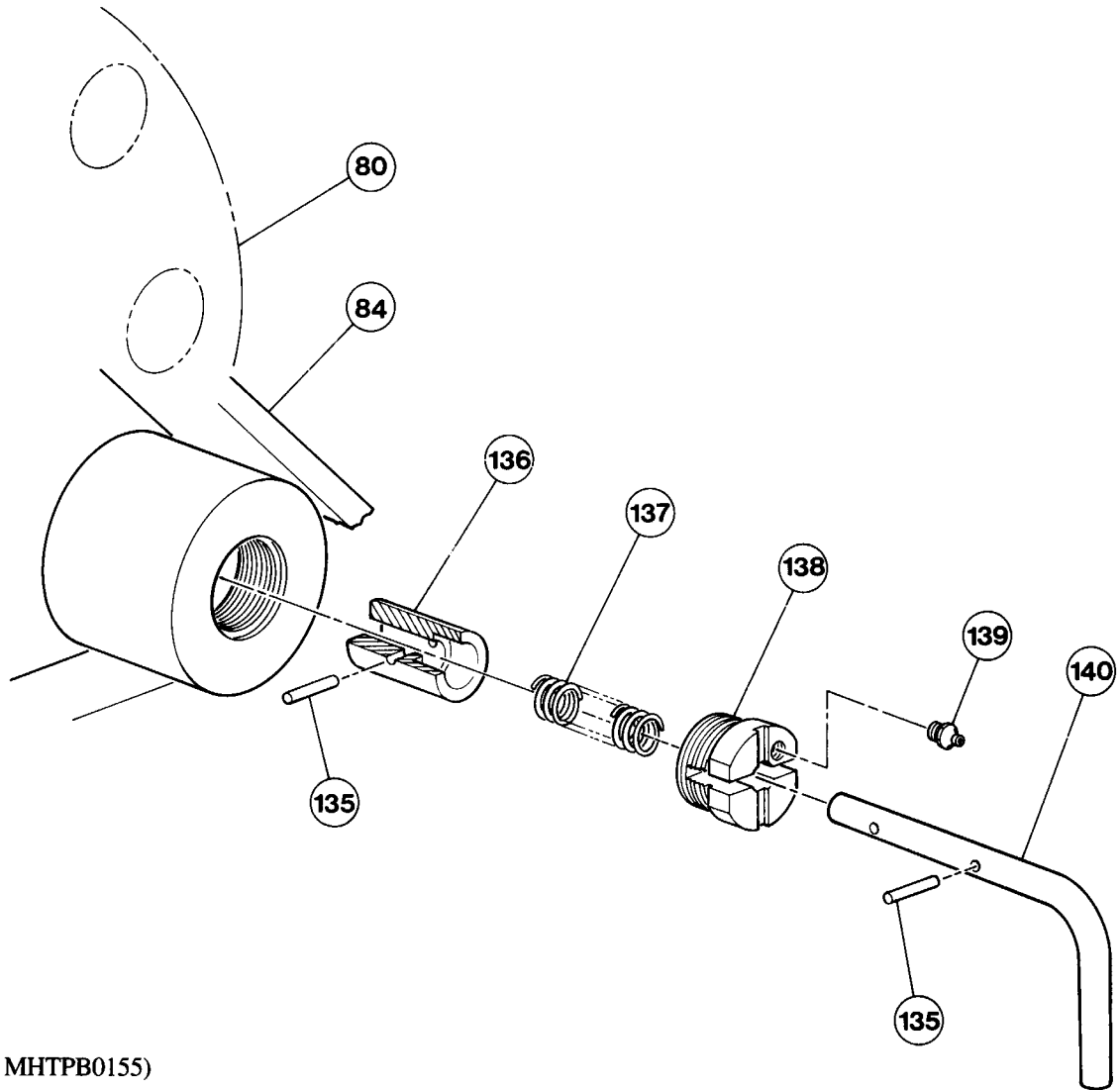
ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER
352	Pendant Assembly *	1	MLK-A269A
370	Pendant Handle	1	MLK-269
371	Throttle Valve	2	MLK-K264A
372	Throttle Valve Face	2	R000BR1C-2
• 373	Spring	2	MKL-51A
374	Throttle Valve Cap	2	MLK-266A
• 375	Valve Cap Gasket	2	MLK-504

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER
376	Lever	2	MLK-273
377	Throttle Lever Pin	1	DLC-120A
378	Pin Lock Washer	2	D02-138
379	Support	1	MLK-450
380	Lockwasher	2	H54U-352
381	Handle Screw	4	HRE20A-68
382	Hose Fitting	3	52092

• Recommended spare.

* Assembly includes items 370 thru 381.

DRUM LOCKING PIN (OPTIONAL) ASSEMBLY DRAWING AND PARTS LIST

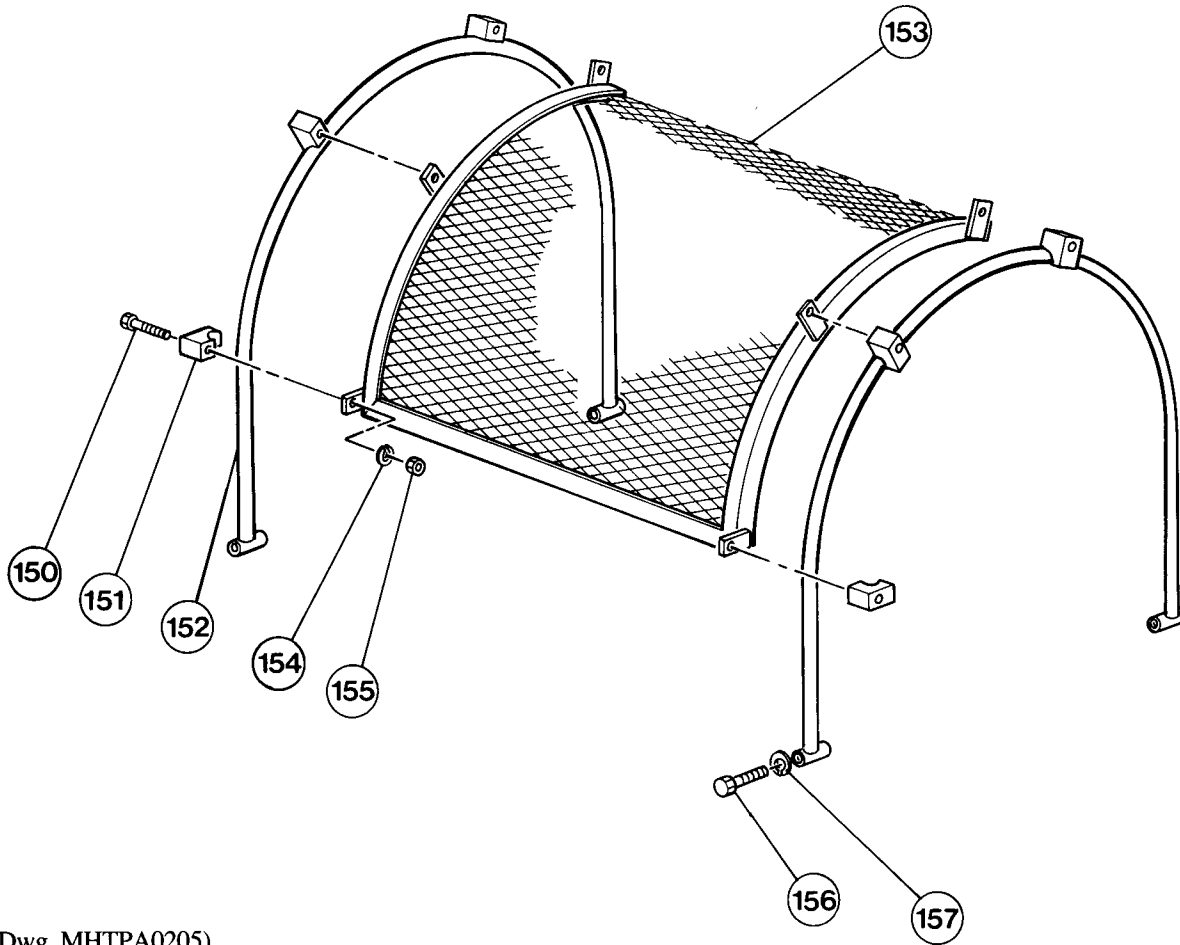


(Dwg. MHTPB0155)

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER
80	Drum (without band brake)	1	16330*
	Drum (with band brake)		16331*
84	Outboard Upright	1	16327
135	Pin	2	51933
136	Lock Pin	1	16328
137	Spring	1	54453
138	Gland	1	16329
139	Grease Fitting	1	53498
140	Pull Rod	1	16310

* Part numbers reference the drawings required for information on drilling holes in the drum flange for locking pin installation. Contact Ingersoll-Rand Technical Sales or the factory for assistance.

DRUM GUARD ASSEMBLY DRAWING AND PARTS LIST

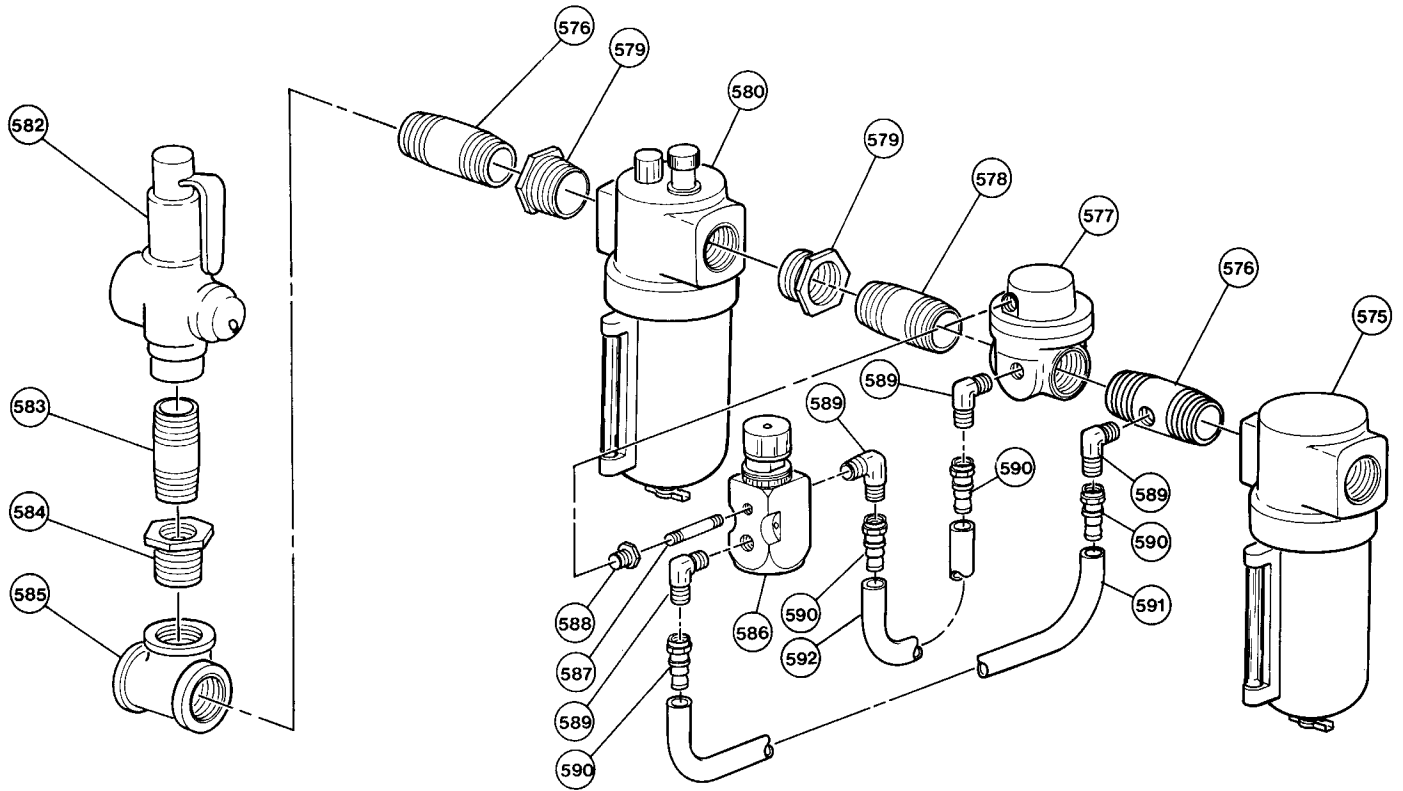


(Dwg. MHTPA0205)

ITEM NO.	DESCRIPTION OF PART	QUANTITY TOTAL	PART NUMBER
*	Drum Guard Assembly (8 inch long drum)	1	11283-1
	Drum Guard Assembly (12 inch long drum)		11283-2
	Drum Guard Assembly (16 inch long drum)		11283-3
	Drum Guard Assembly (24 inch long drum)		11283-5
150	Capscrew	4	71072243
151	Clamp	4	10399
152	Support	2	10400
153	Drum Guard (8 inch long drum)	1	11259-1
	Drum Guard (12 inch long drum)		11259-2
	Drum Guard (16 inch long drum)		11259-3
	Drum Guard (24 inch long drum)		11259-5
154	Lockwasher	4	51580
155	Nut	4	71061584
156	Capscrew	4	53391
157	Washer	4	50182

* Drum Guard Assemblies include items 150 through 157.

AIR PREPARATION ASSEMBLY DRAWING AND PARTS LIST



(Dwg. MHTPA0223)

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER
*	Air Preparation Assembly	1	10389
575	Filter	1	F42-0A-000
576	Pipe Nipple	2	51670
577	Regulator	1	R30-0A-G00
578	Pipe Nipple	1	51704
579	Pipe Bushing	2	51706
580	Lubricator	1	L40-0A-G00
582	Relief Valve	1	51702
583	Pipe Nipple	1	50933

ITEM NO.	DESCRIPTION OF PART	QTY TOTAL	PART NUMBER
584	Pipe Bushing	1	51705
585	Pipe Tee	1	51707
586	Regulator	1	51802
587	Pipe Nipple	1	51804
588	Pipe Bushing	1	51803
589	Pipe Elbow	4	51805
590	Hose End	4	51806
591	Hose	()	51807-(8)
592	Hose	()	51807-(11)

* Air Preparation Assembly for 1-1/4 inch system.

() = Quantity in inches .

PARTS ORDERING INFORMATION

Use of other than **Ingersoll Rand** replacement parts may adversely affect the safe operation and performance of this product.

For your convenience and future reference it is recommended that the following information be recorded.

Model Number _____

Serial Number _____

Date Purchased _____

When ordering replacement parts, please specify the following:

1. Complete model number and serial number as it appears on the nameplate.
2. Part number(s) and part description as shown in this manual.
3. Quantity required.

The nameplate is located on the winch outboard upright.

NOTICE

- **Continuing improvement and advancement of design may cause changes to this equipment 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.**
- **Sections of this manual may not apply to your winch.**
- **The use of other than genuine Ingersoll Rand replacement parts may result in safety hazards, decreased performance and increased maintenance and invalidate all warranties.**

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.

Winches 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 winch is provided inside the back cover of this manual.

Disposal

When the life of the unit has expired, it is recommended that it be disassembled, degreased and parts separated as to materials so that they may be recycled.

For additional information contact:

Ingersoll Rand

2724 Sixth Avenue South
Seattle, WA 98134 USA
Phone: (206) 624-0466
Fax: (206) 624-6265

or

Ingersoll Rand

Douai Operations
529, Avenue Roger Salengro
59450 Sin Le Noble, France
Phone: (33) 3-27-93-08-08
Fax: (33) 3-27-93-08-00

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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