

A company dedicated to solving ergonomic and material handling problems since 1955.

Ergonomic Solutions

NOTE: Pages 12-15 are views of the modular power unit. These diagrams only apply to units manufactured before 12-01-2018. Units manufactured after 12-01-2018 receive a redesigned modular power unit (MPU GEN2). Diagrams and operating instructions for GEN2 power units are provided in separate MPU-AC/DC manuals.

OWNER'S MANUAL

TILT MASTER & TILT MASTER STRADDLE MODELS TM / TMS

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WARNINGS & SAFETY INSTRUCTIONS

Ensure that all employees understand and follow the following.

- Read and understand the owner's manual before using or servicing the Tilt Master.
- For battery powered units, review the additional warnings included in the "Operation Instructions" section of the manual.
- Watch the container carefully when the tilter is in operation.
- Have the caster lock engaged solidly when the tilter is in operation.
- Verify the container (not just the pallet) is fully back against the fork carriage before tilting.
- Be alert of the possibility of parts falling from the container when it is being tilted.
- Before transporting the container, raise the forks slightly.
- The load must be removed and the forks fully lowered before any work is performed on the hydraulic system.
- Do not use the Tilt Master if damage or unusual noise is observed.
- Do not perform any modifications to the Tilt Master without the manufacturer's approval. Failure to receive authorization for changes to the equipment could void the warranty.
- Maintenance and repairs are to be done only by personnel qualified to perform the required work.
- Do not use brake fluid or jack oils in the hydraulic system. If oil is needed, use an anti-wear hydraulic oil with a viscosity grade of 150 SUS at 100° F, (ISO 32 cSt @ 40°), or Dexron transmission fluid.
- Ensure that safety and warning labels stay in place and are legible.
- Use only replacement parts either supplied or approved by the manufacturer.

WHEN ORDERING REPLACEMENT PARTS

We take pride in using quality parts on the equipment we manufacture. We are not responsible for equipment problems resulting from the use of unapproved replacement parts.

To order replacement or spare parts for this equipment, contact the factory.

In any communication with the factory please be prepared to provide the machine's serial number, which is indicated on the machine dataplate.

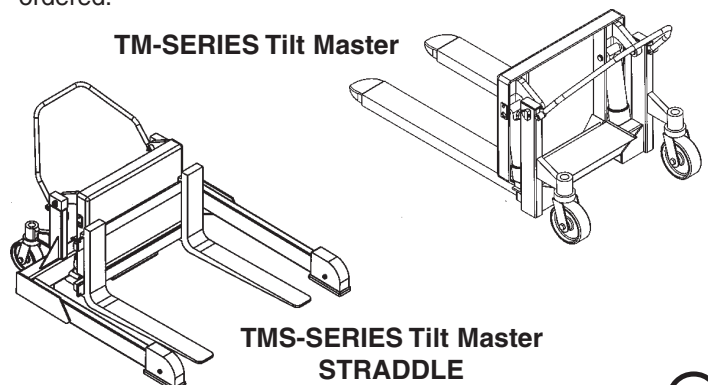
RECEIVING INSTRUCTIONS

Every unit is thoroughly tested and inspected prior to shipment. However, it is possible that the unit could incur damage during transit.

Inspect the unit closely when it arrives. *If you see evidence of damage or rough handling to either the packaging or to the product when it is being unloaded, immediately make a note of it on the Bill Of Lading!*

It is important that you remove the product's packaging upon its arrival to ensure that there is no concealed damage or to enable a timely claim with the carrier for freight damage.

Also verify that the product and its specifications are as ordered.



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OPERATION INSTRUCTIONS – TM, TMS

- *Ensure that all employees involved in the operation of the Tilt Master model box/basket rotator understand and follow these instructions!*

The standard model Tilt Master is suitable for use indoors in most industrial locations. It is intended to be used to transport, lift and rotate rigid, sturdy tote boxes or baskets containing nonhazardous materials so that they can be gradually, manually unloaded. The model TM is intended for use only with open-bottom pallets or skids. The model TMS can be used with either open- or closed-bottom pallets.

Loading:

The load rating, in pounds, is shown on the machine dataplate located on the top of the fork carriage. It indicates the net capacity of the tilter, based on loads having a center of gravity not exceeding 20" horizontally and 20" vertically. The load must be evenly distributed across both of the lifting forks.

Warning: Do not exceed the load ratings stated above. Injury to personnel or permanent damage to the machine could result from exceeding the listed capacity.

Warning: Tilting any load exceeding the 20" center of gravity rating (either horizontally or vertically) can potentially cause the Tilt Master to become unstable and tip over.

Caution: Do not drop loads onto the Tilt Master's forks. Shock loads to the carriage can cause premature wear and damage to the structure and its parts.

Note: The addition of any ancillary equipment to the Tilt Master by third parties must be taken into account when determining the maximum centers of gravity and working load that can be placed on the fork carriage.

To load the Tilt Master, fully lower the fork carriage. Push the tilter's forks under the skid or container, or place the skid or container on the forks with a fork truck, until the skid or container is back against the carriage. The forks can be raised slightly to lift them off of the load rollers, and the load can be moved to the work location.

Operation:

When the Tilt Master is in the desired location, depress the pedal on the side of each swivel caster to prevent the tilter from rolling during its operation.

Warning: Do not tilt loads more than two inches off the floor without the caster brakes properly engaged, to prevent the unit from rolling.

Warning: Keep personnel clear of the machine when it is in operation.

Warning: Loads in containers can shift quickly when tilted. Always have an effective escape route for personnel to be able to avoid being trapped or injured in the event there is an unexpected movement of the material or the machine.

Caution: Always carefully watch the Tilt Master and any load on it when it is in operation.

Warning: Be certain no part of any person or object is under the forks or fork carriage before lowering the unit.

The Tilt Master is furnished with a constant-pressure (dead-man style) push-button control.

Press the "UP" push-button to turn on the power unit to rotate the forks upward. The forks will rotate only while the control is pressed. Upon releasing the control, the forks will stop and hold position.

Pressing the "DOWN" push-button energizes the lowering valve to allow the forks to rotate downward by gravity (the motor does not run). Again, releasing the control will stop the forks' movement, and the unit will hold its position.

Caution: Never use the tilter if any damage or unusual noise is observed, if it is in need of repairs, or if it seems to be malfunctioning. Notify your supervisor or maintenance personnel if you notice anything out of the ordinary.

On DC-powered units, attempting to raise the carriage when the battery is low will cause the motor relay protection to prevent the motor's operation. Adequate battery voltage is indicated by a green LED on the motor relay. See the next page for more notes regarding operation of battery-powered units.

Ensure that all safety and warning labels stay in place and are legible. Refer to the labels page in this manual.

ADDITIONAL INSTRUCTIONS FOR BATTERY-POWERED UNITS

Note: If this product has the 24V powered traction-drive option, consult that option's information for more specific details regarding the batteries and battery charger.

Warning!

- ! Working with or near lead acid batteries is dangerous. Batteries contain sulfuric acid and produce explosive gases. A battery explosion could result in loss of eyesight or serious burns.
- ! Do not smoke or allow a spark or flame near batteries. Charge batteries in locations that are clean, dry, and well ventilated. Do not lay tools or anything metallic on top of any battery. All repairs to a battery must be made by experienced and qualified personnel.
- ! When working with batteries, remove personal items such as rings, bracelets, necklaces, and watches. Batteries can produce enough energy to weld jewelry to metal, causing a severe burn.
- ! Always have fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
- ! Operating the battery with a low battery voltage can cause premature motor contact failure.
- ! Do not expose the tilter or charger to rain or adverse conditions.
- ! Replace defective cords or wires immediately.
- ! Check the battery's water level frequently.

Battery Charger Operating Instructions

Never operate the charger with either of the cables coiled. Operating a battery charger with the cord either coiled or wrapped around itself could cause the cord to overheat, melt, and cause a short-circuit or a fire.

Connection: the ribbed wire of the charger's output cord must be connected to the battery's negative (-) terminal. The non-ribbed wire (with words printed on it) must be connected to the battery's positive (+) terminal.

When properly connected, the charger will indicate the status of its output:

Flashing green LED – the charger is not seeing a good connection to the battery.

Solid yellow LED – the charger is providing charging current to the battery.

Solid green LED – the charger is maintaining a fully charged battery.

Plug the charger into a standard 115V receptacle. If an extension cord must be used, keep it as short as possible.

Caution: Remember to unplug the charger before moving the equipment. Failure to do so could cause damage to cords, receptacles, and other equipment.

The battery charger can be left connected to the battery indefinitely without risk of harming the battery.

Troubleshooting

If the unit does not operate, check all of the wiring connections to make sure they're both mechanically and electrically sound – specifically at the battery, the motor, and at any location a wire is connected to the chassis. Also, make sure the quick-connect plug on the end of the pendant control cord is plugged in correctly (if applicable).

A fully charged lead acid battery in good condition at room temperature should read 12.65 volts. At 11.9 volts it is considered to be fully discharged and in need of charging. When checking battery voltage, wait at least 1/2 hour after the charger has been turned off before checking the battery's voltage.

If the batteries don't seem to be taking a charge, check the charger's 115V supply circuit and the charger's output with a voltmeter. If all check okay, confirm the battery's state of charge using a hydrometer or a voltmeter.

ROUTINE MAINTENANCE & SAFETY CHECKS – TM, TMS

- *Care should be taken to identify all potential hazards and comply with applicable safety procedures before beginning work.*
 - *The load must be removed and the forks fully lowered before any work is performed on the hydraulic system.*
 - *Only qualified individuals trained to understand mechanical devices and their associated electrical and hydraulic circuits should attempt troubleshooting and repair of this equipment*
- (A) Before each use inspect for the following:
- 1.) Frayed wires
 - 2.) Oil leaks
 - 3.) Pinched or chafed hoses
 - 4.) Damage or structural deformation to the structural members, the cylinder brackets, etc.
 - 5.) Unusual noise or binding, or evidence thereof.
 - 6.) Proper functioning of the locking caster (to prevent wheel rotation).
 - 7.) Proper functioning of all limits.
- (B) In addition to the above, inspect monthly for:
- 1.) The oil level. Oil should be 1" to 1½" below the reservoir's fill hole with the forks fully lowered.
 - 2.) Worn or damaged hydraulic hoses and electrical wires.
 - 3.) Pivot point wear at the hinge pins and cylinder ends.
 - 4.) Intact pin and clevis retaining rings and / or fasteners.
 - 5.) Looseness, wear, or damage to the casters' bearings, mounting hardware, locking mechanism, or surface material.
 - 6.) Proper water level in the battery. (DC units.)
 - 7.) Unusual noises.
 - 8.) Information and warning labels being in place and in good condition.
 - 9.) The need to clean off dirt and debris.

(C) Yearly inspection

The oil should be changed if the oil darkens, becomes gritty, or turns a milky color (indicating the presence of water). Replace with an anti-wear hydraulic oil with a viscosity grade of 150 SUS at 100°F, (ISO 32 @ 40°C). Ex: AW 32 or HO 150 hydraulic fluid, or Dexron transmission fluid.

Ordering replacement parts:

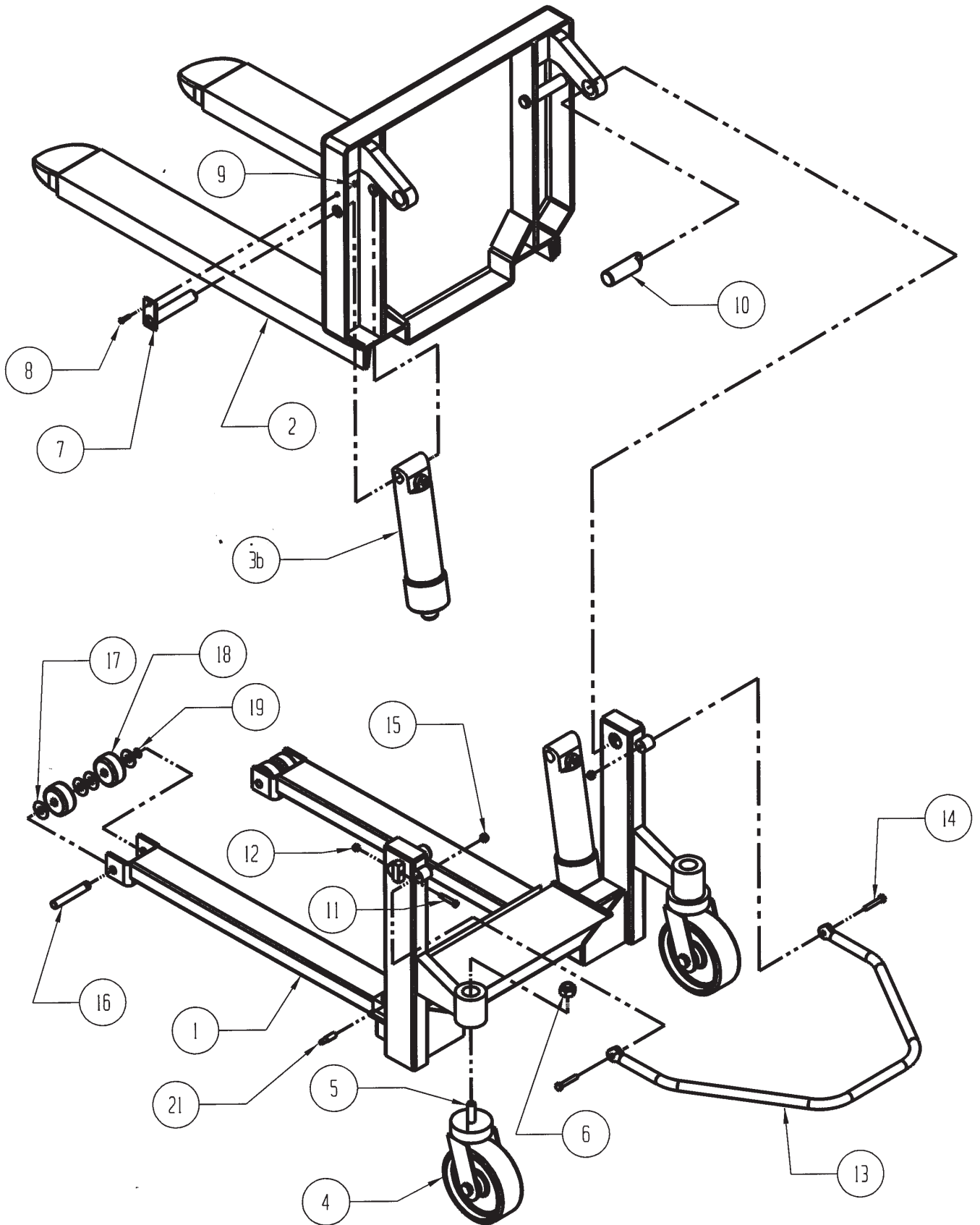
We take pride in using quality parts on the equipment we manufacture. We are not responsible for equipment problems resulting from the use of unapproved replacement parts.

Note: Motors, cylinders, and pumps can vary by model. Consult the manufacturer to determine the exact part numbers for these items.

To order replacement or spare parts for this equipment, contact the manufacturer.

In any communication with the manufacturer, please be prepared to provide the machine's serial number, which is indicated on the machine dataplate.

EXPLODED STRUCTURAL PARTS VIEW — TM



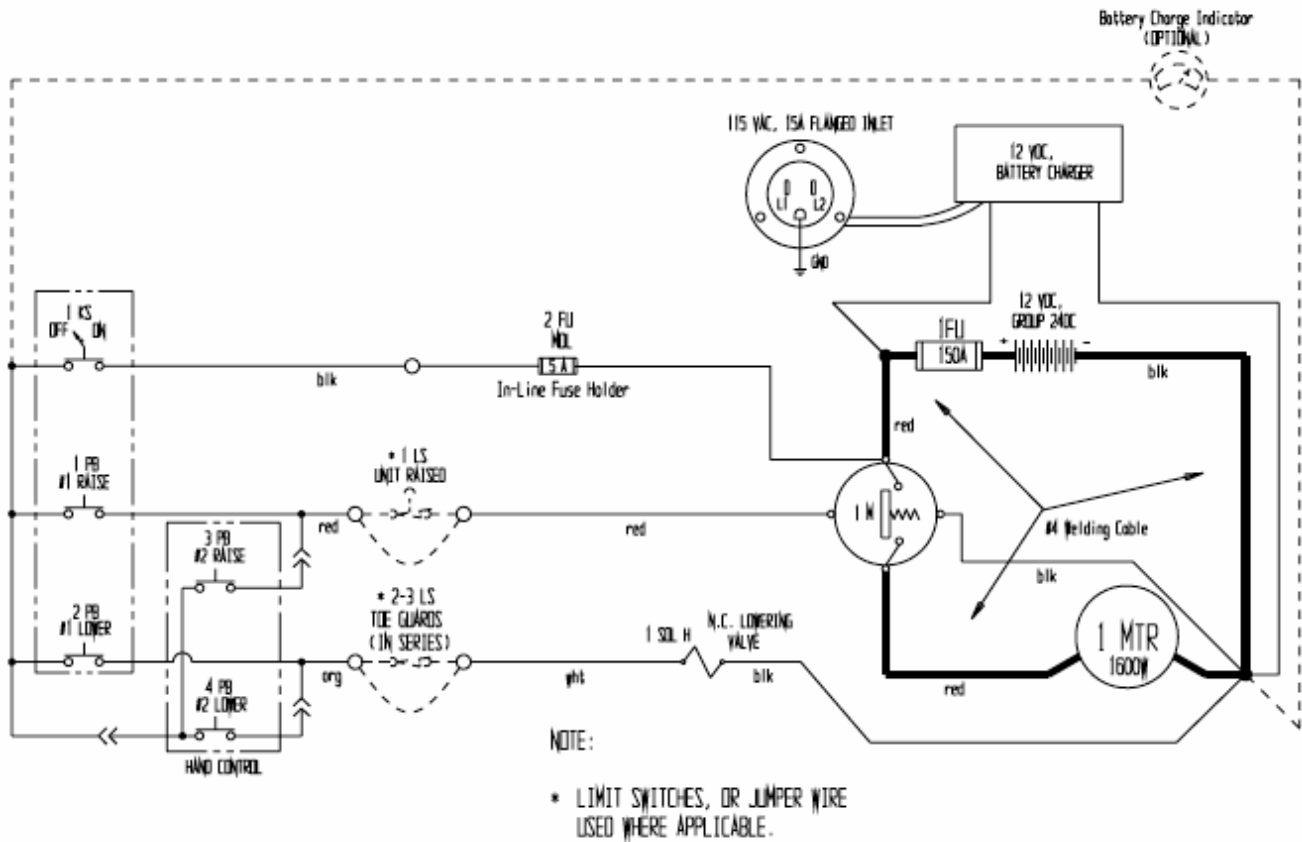
BILL OF MATERIALS - TM

Item No.	Description	Part No.	Qty.
1	Frame weldment	38-514-033	1
2	Deck weldment	38-513-006	1
3	Cylinder, 3" x 10", TM-60	99-021-901	2
	Cylinder, 2-1/2" x 10", TM-40	99-021-906	2
	Cylinder, 2" x 10", TM-20	99-021-903-001	2
4	Caster, Ø8" x 3" phenolic, swivel	PH-8/3-S-SWB-NTP	2
5	Bolt, 3/4" -10 x 3 long	13365	2
6	3/4" -10 jam top lock nut	37275	2
7	Cylinder pin weldment	38-612-003	2
8	Bolt, 1/4" -20 x 1" long	A/L	2
9	Nut, 1/4" -20	A/L	2
10	Hinge pin weldment, Ø1 1/8" x 4"	38-612-004	2
11	Screw, self-tapping, 5/16" x 3/4" long	A/L	2
12	Cap, plastic, black	99-024-003	2
13	Push handle	38-525-001	1
14	Bolt, 3/8"-16 x 2-1/4" long	A/L	2
15	Nylock nut, 3/8" - 16	A/L	2
16	Roller pin, Ø3/4" x 4-3/4" long	38-112-014	2
17	Flat washer, 3/4" ID	A/L	8
18	Wheel, Ø3" x 1-1/2" wide phenolic	PH-3/1.5	4
19	Snap ring, external, 3/4"	A/L	2
20	Limit switch, roller arm	01-022-001	1
21	Bolt, cylinder retaining, 1/2" -13 x 2" long	01-118-001	2

BILL OF MATERIALS - TMS

Item No.	Description	Part No.	Qty.
1	Frame weldment	38-514-034	1
2	Deck weldment	38-513-008	1
3	Handle assembly weldment	38-525-001	1
4	Bolt, 1/2" -13 x 2-1/4" long	A/L	2
5	Nylock nut, 1/2" -13	A/L	4
6	Hinge pin weldment, Ø1/8" x 4" long	05-112-003	2
7	Cap, plastic, black	99-024-003	2
8	Stem caster, Ø8" x 3" wide phenolic swivel	PH-8/3-S-SWB-NTP	2
9	Bolt, 3/4" -10 x 3-1/4" long	A/L	2
10	Lock nut, 3/4" -10	A/L	2
11	Cylinder, 2" x 10", TMS-20	99-021-903-001	2
	Cylinder, 2-1/2" x 10", TMS-40	99-021-906	2
	Cylinder, 3" x 10", TMS-60	99-021-901	2
12	Cylinder pin weldment	38-612-003	2
13	Bolt, 1/4" -20 x 1" long	A/L	2
14	Nut, 1/4" -20	A/L	2
15	Bolt, cylinder retaining, 1/2" -13 x 2" long	01-118-001	2
16	Wheel, Ø8" x 2" wide phenolic	PH-8/2-W	2
17	Bolt, w/ grease zirk, 1/2" -13 x 3-1/2" long	ZA2	2
18	Class II lifting fork, 36" long	38-028-007 or 38-028-013	2
19	Bolt, 3/8" -16 x 1" long, w/ 3/8" -16 lock nut	A/L	2
20	Screw, self-tapping, 5/16" x 3/4" long	A/L	2
21	Limit switch, roller arm (not shown)	01-022-001	1

Mobile Power Unit electrical system diagram, DC configuration (battery powered)

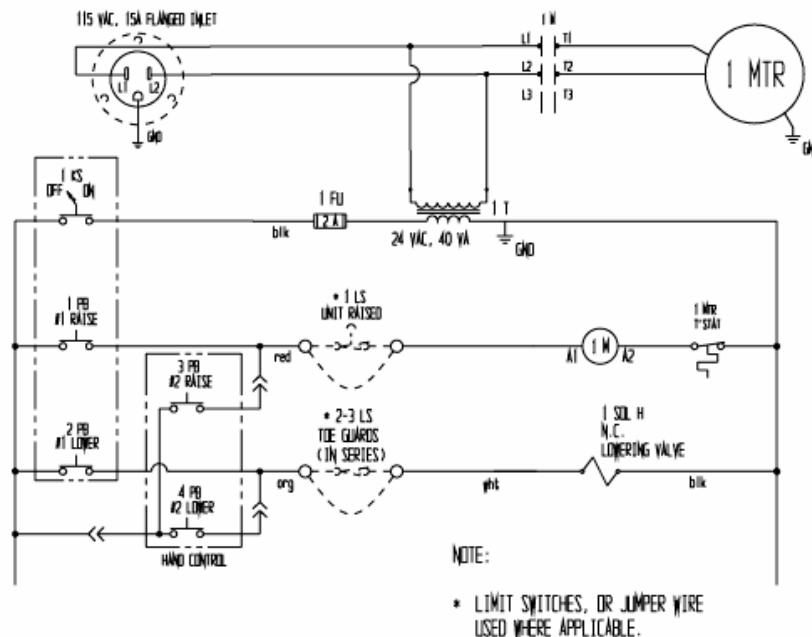


Mobile Power Unit electrical system diagram, AC configuration



DANGER Electrocutation hazard: Disconnect the power cord from the energy source BEFORE opening/removing the plastic housing. DO NOT modify the power unit.

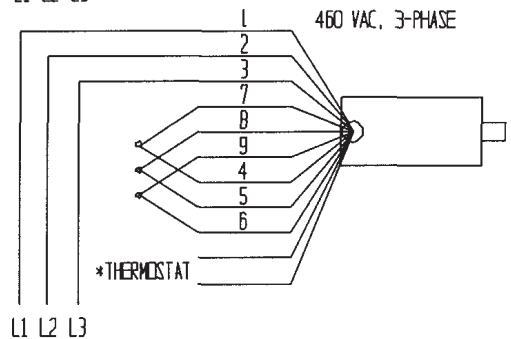
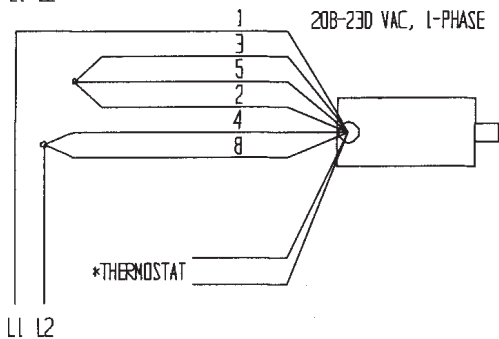
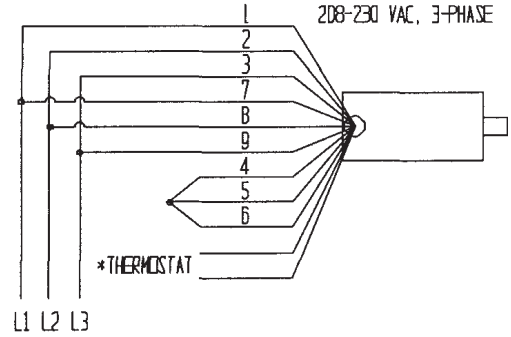
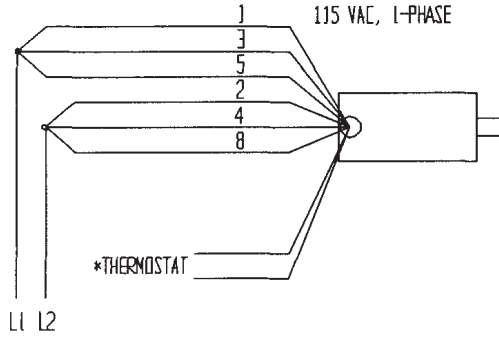
OVERCURRENT & SHORT-CIRCUIT PROTECTION, AND DISCONNECT, ARE TO BE PROVIDED BY THE END-USER PER THE NEC (NFPA 70) AND LOCAL CODES.



MOTOR & TRANSFORMER CONNECTION DIAGRAMS

Caution! *If the motor voltage is changed, the wire on the control transformer's primary wire has to be changed to match the new motor voltage also*

MOTOR LEAD CONNECTION DIAGRAM FOR ALL
.5HP, .75HP AND 3HP SINGLE-PHASE MOTORS AND FOR
ALL 2HP, 5.5HP, AND 6.5HP THREE-PHASE MOTORS

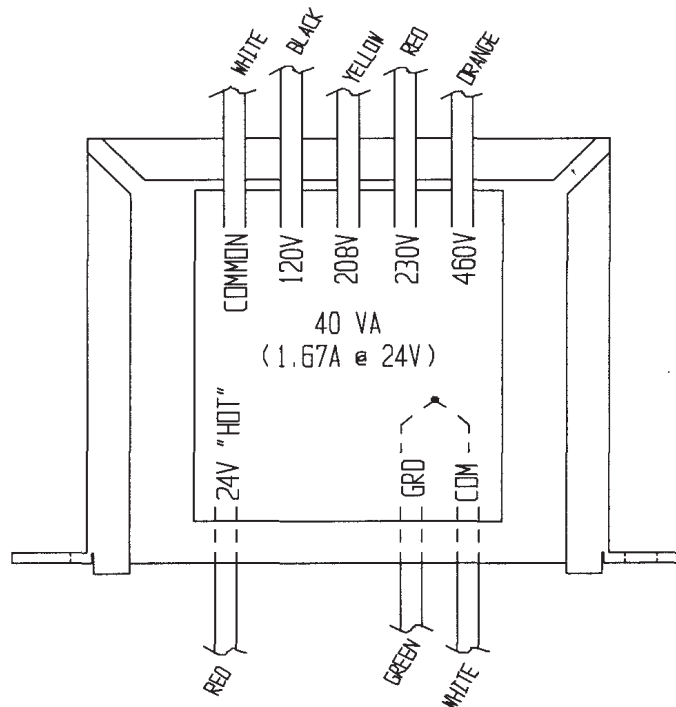


* The two thermostat leads go to: 1) the grounded side of the transformer secondary, and; 2) the motor relay coil, in either order.



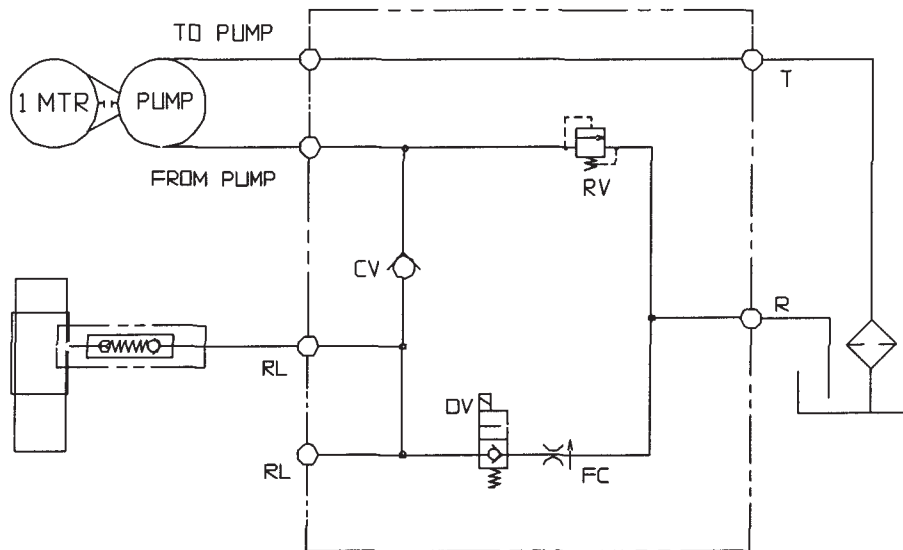
BE SURE ALL POWER IS OFF BEFORE ATTEMPTING TO WORK ON THIS EQUIPMENT!

CAUTION: SERVICE WORK SHOULD BE PERFORMED ONLY BY TRAINED & QUALIFIED PERSONNEL

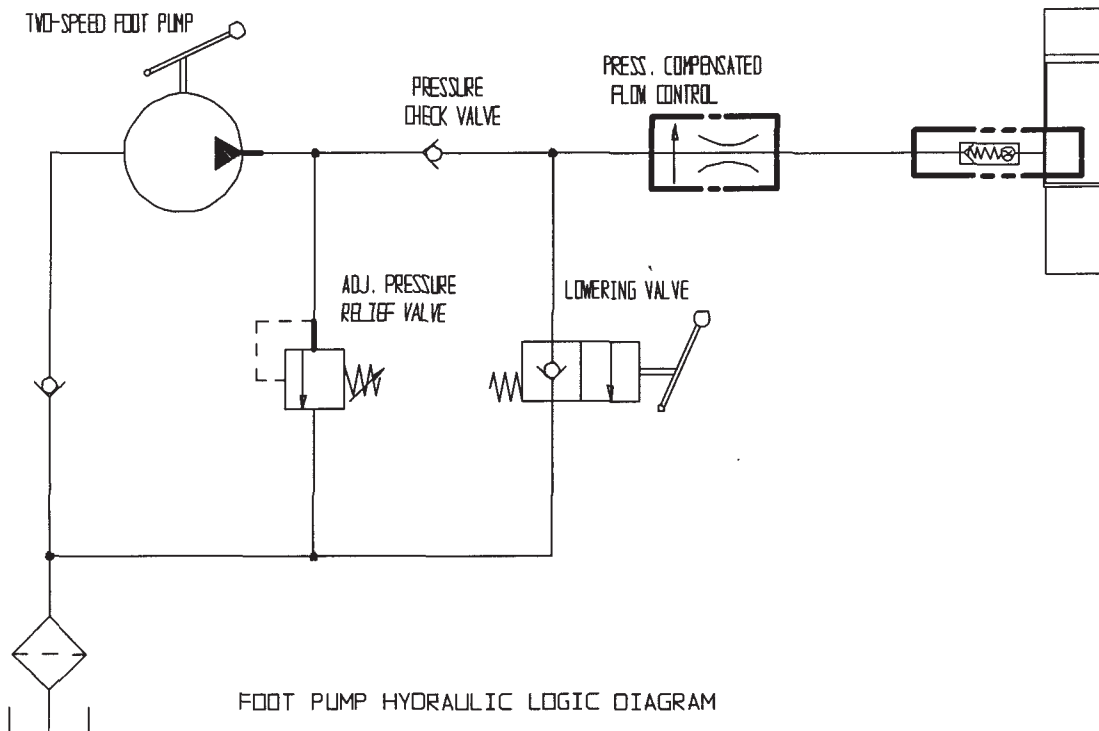


HYDRAULIC DIAGRAM – LIFT-HOLD-LOWER CIRCUITS

- *Warning: Care should be taken to identify all potential hazards and comply with applicable safety procedures before beginning work. Fully lower or secure the forks, and ensure that all system pressure and power have been removed, before attempting to work on the electrical or hydraulic systems.*
- *Fully lower the unit before beginning any inspections or work.*
- *Only qualified individuals trained to understand mechanical devices and their associated electrical and hydraulic circuits should attempt troubleshooting and repair of this equipment*
- *Caution: Do not use brake fluid or jack oils in the hydraulic system. If oil is needed, use an anti-wear hydraulic oil with a viscosity of 150 SUS at 100°F (ISO 32 @ 40°C), or non-synthetic transmission fluid.*



GEAR PUMP HYDRAULIC LOGIC DIAGRAM



FOOT PUMP HYDRAULIC LOGIC DIAGRAM

THE POWER UNIT'S OPERATION – TM, TMS

The electric / hydraulic pallet tilter utilizes an electric motor directly coupled to a gear-type hydraulic pump to produce the needed fluid pressure and flow to allow the cylinder(s) to perform the work of tilting a container.

A hydraulic manifold houses the hydraulic control components, and is bolted directly onto the gear pump.

The power unit's hydraulic components are all rated for 3,000 psi working pressure.

- Important parts of the power unit include:
 - The electric motor operates on 12 VDC deep-cycle battery supply.
 - The gear pump. Its shaft is coupled directly to the shaft of the electric motor.
 - The check valve. Its purpose is to prevent the backflow of fluid through the pump. In this way it allows the fork carriage to be held at a given elevation indefinitely.
 - The pressure relief valve. Its job is to open a path for fluid to flow back to the reservoir in the event that the fluid pressure built up by the pump exceeds 3,000 psi. Thus the system cannot see more than 3,000 psi.
 - The lowering solenoid valve. This is an electrically operated cartridge valve. It contains a screen to keep contaminants from entering the valve.
 - The pressure-compensated flow control spool. This rests under the lowering valve, and regulates the fluid flow back to the reservoir when the valve opens. It allows the forks to always lower at the same rate regardless of whether there is a load on the fork carriage or not.
 - The hydraulic tilt cylinder(s). These are displacement-style cylinders. They have a bleeder valve located at their top end to allow air to be bled from the hydraulic system.
 - The safety velocity fuse. This is a device that is installed in the cylinder's hose port. It closes quickly in the event of a catastrophic hose failure to prevent the fork carriage from collapsing down. The forks remain stationary until pressure is reapplied to the system.
 - The hydraulic fluid. The system uses HO150 hydraulic fluid. Any anti-wear hydraulic fluid with a viscosity grade of 150 SUS at 100°F (ISO 32 @ 40°C) such as AW-32 or Dexron transmission fluid are acceptable.

When the forks are to be tilted, press the "UP" push-button. The motor turns, and in turning it spins the hydraulic gear pump. Oil is drawn from the reservoir through the suction filter and into the pump. The pump pushes the then-pressurized oil through the check valve and out to the tilt cylinder(s).

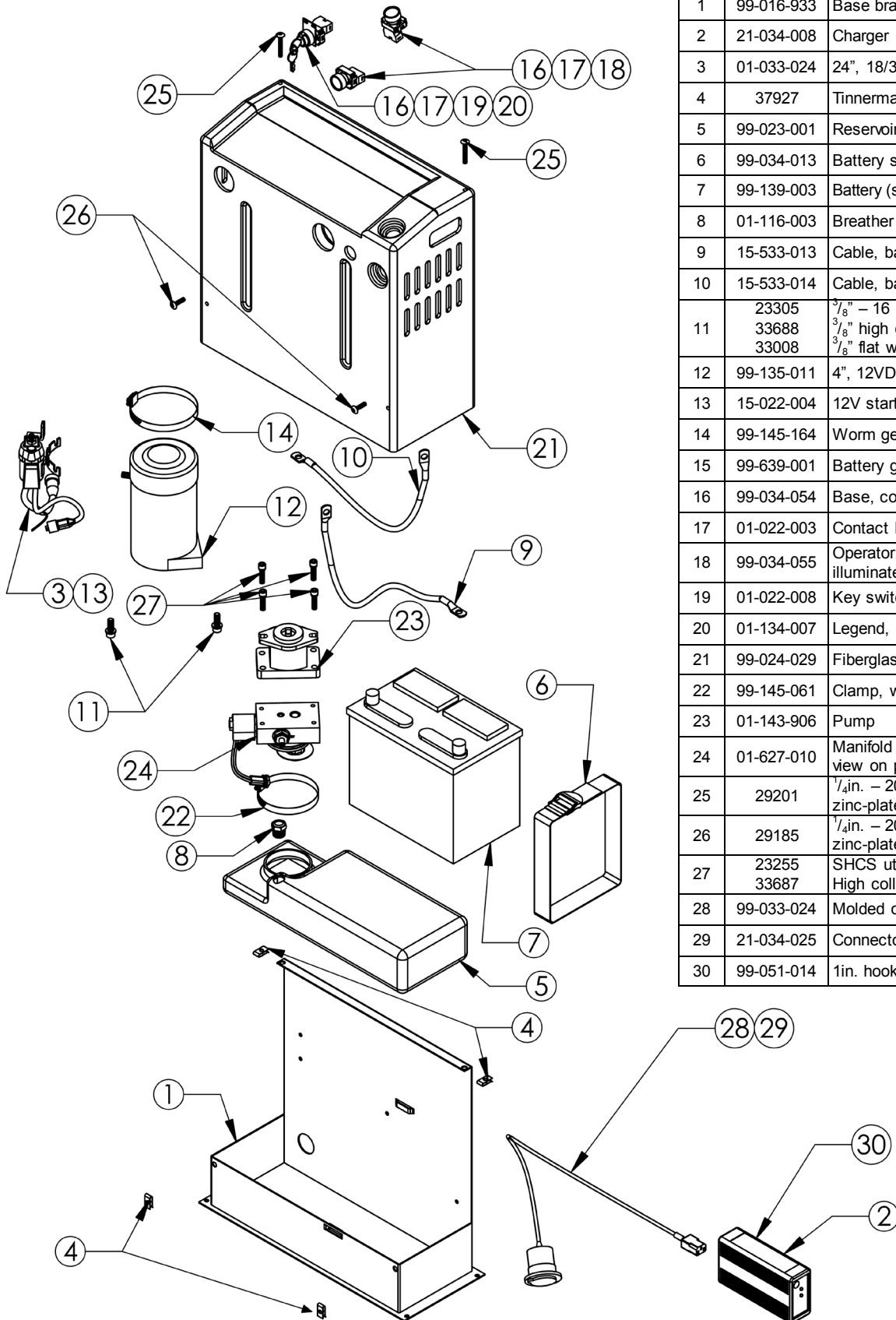
When the fork carriage is to be lowered, press the "DOWN" push-button. The lowering valve opens, bypassing the check valve and allowing the oil in the cylinder(s) to return back to the reservoir through the return hose. The rate at which the fork carriage lowers is regulated by the internal pressure-compensated flow spool.

- In the event that the fork carriage creeps down slowly after releasing the "DOWN" control, it will be necessary to remove the lowering cartridge valve for inspection and cleaning, as follows:
 - Lower the forks until they are fully lowered.
 - Remove any load from the forks.
 - Remove the nut holding the solenoid coil on the valve stem, then remove the coil, and then unscrew the valve from the manifold.
 - Inspect the valve for contaminants, and the valve's o-rings and backup washers for cuts, tears, or other damage.
 - With the valve immersed in mineral spirits or kerosene, use a thin tool such as a small screwdriver or a small hex wrench to push the poppet in and out several times from the bottom end of the valve. The valve should move freely, about 1/16" from closed to open position. If it sticks in, the valve stem could be bent and will need to be replaced if it doesn't free up after cleaning. Blow the valve off with a compressed-air gun while again pushing the poppet in and out.
 - Inspect the bottom of the manifold's valve cavity for contaminants.
 - Again with the thin tool, press on the middle of the flow control spool located in the bottom of the cavity. It should move down and back up freely.
 - Reinstall the valve into the manifold, tightening the valve with approximately 20 lb-ft of torque.
- If the fork carriage lowers extremely slowly, or not at all, the cylinder's velocity fuse could be closing. This can be caused by air in the hydraulic cylinder(s). To bleed the air from the system:
 - Lower the fork carriage until it is fully lowered.
 - Remove any load from the forks.
 - Hold a rag over the cylinder's bleeder valve (it looks like a grease zirk) and open the valve about 1/2 turn with a 1/4" or 5/16" wrench. Oil and air will sputter from the valve – once no air is observed, close the valve.

MODULAR POWER UNIT PARTS BREAKDOWN — DC-1

- Note: Motors, cylinders, and pumps can vary by model. Consult the manufacturer to determine the exact part numbers for these items.

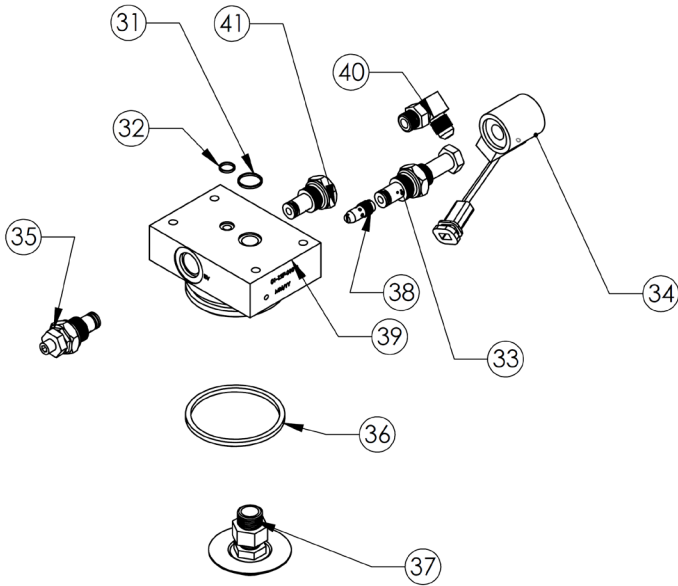
Item	Part no.	Description	Quantity
1	99-016-933	Base bracket	1
2	21-034-008	Charger (Soniel)	1
3	01-033-024	24", 18/3, 4-pin plug	1
4	37927	Tinnerman clip	4
5	99-023-001	Reservoir	1
6	99-034-013	Battery strap	1
7	99-139-003	Battery (spillable)	1
8	01-116-003	Breather	1
9	15-533-013	Cable, battery, 23" black	1
10	15-533-014	Cable, battery, 23" red	1
11	23305 33688 33008	$\frac{3}{8}$ " - 16 x 1" utility grade bolt $\frac{3}{8}$ " high collar lock washer $\frac{3}{8}$ " flat washer	2 2 2
12	99-135-011	4", 12VDC motor w/ tang dr.	1
13	15-022-004	12V start solenoid relay	1
14	99-145-164	Worm gear hose clamp	1
15	99-639-001	Battery gauge	1
16	99-034-054	Base, contact block	3
17	01-022-003	Contact block N.O.	3
18	99-034-055	Operator, black, non-illuminated	2
19	01-022-008	Key switch, 2-position	1
20	01-134-007	Legend, ON - OFF	1
21	99-024-029	Fiberglass cover	1
22	99-145-061	Clamp, worm gear	1
23	01-143-906	Pump	1
24	01-627-010	Manifold assembly (exploded view on p. 12)	1
25	29201	$\frac{1}{4}$ in. - 20 x 1 $\frac{1}{4}$ in. TPHMS zinc-plated	2
26	29185	$\frac{1}{4}$ in. - 20 x 1in. TPHMS zinc-plated	2
27	23255 33687	SHCS utility grade High collar lock washer	4 4
28	99-033-024	Molded cord	1
29	21-034-025	Connector, charge	1
30	99-051-014	1in. hook and loop press	10"



MODULAR POWER UNIT PARTS BREAKDOWN — DC-2

- Note: Motors, cylinders, and pumps can vary by model. Consult the manufacturer to determine the exact part numbers for these items.

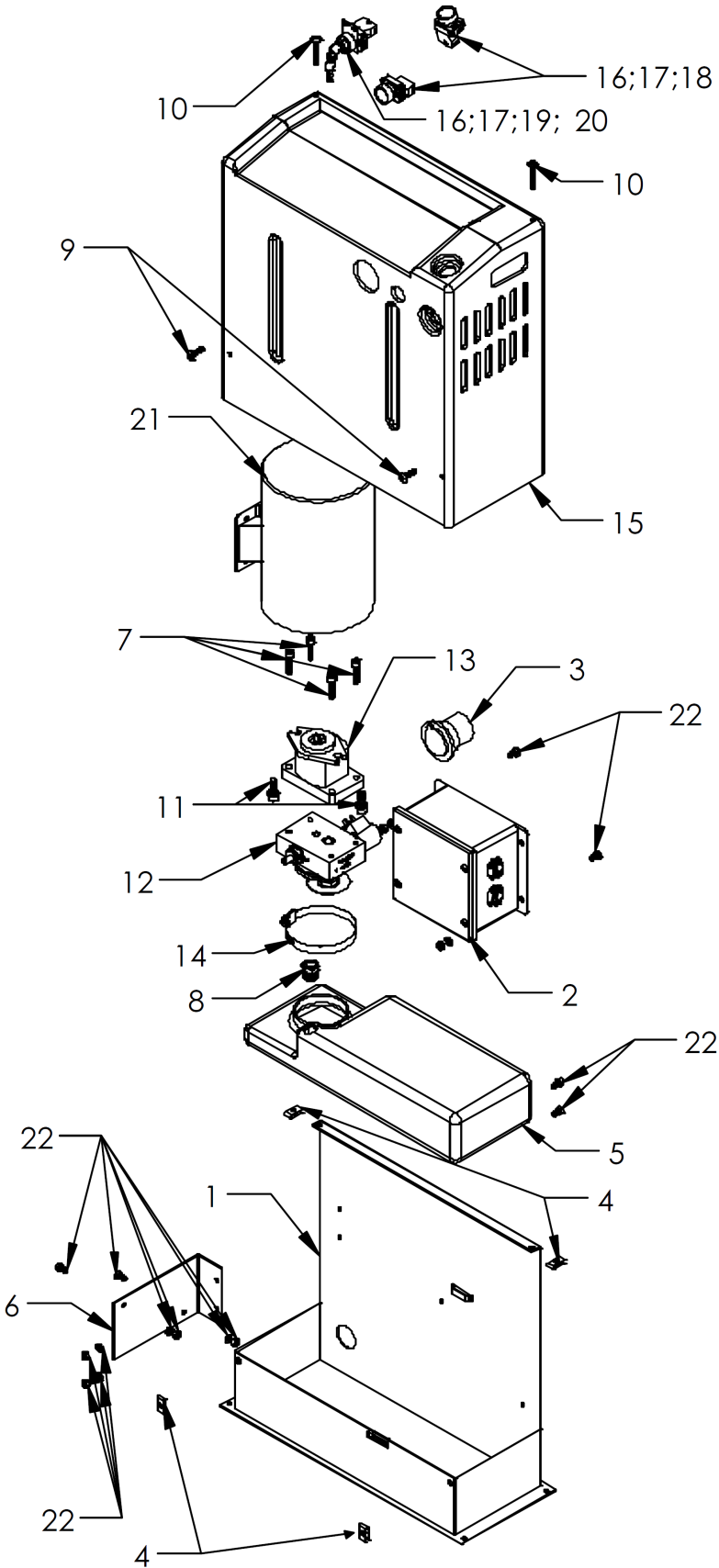
Manifold assembly (item no. 24 on p. 12)



Item	Part no.	Description	Quantity
31	99-144-023	O-ring	1
32	99-144-022	O-ring	1
33	99-153-015	Valve, cartridge, normally closed	1
34	99-034-010	Coil with weather-tite plug	1
35	99-153-006	Valve, pressure relief	1
36	99-144-007	O-ring	1
37	99-531-005	Filter	1
38	99-153-038	Flow control, 1.0GPM	1
39	01-127-010	Manifold	1
40	99-116-033	MJ-MAORB 90 degree	1
41	99-153-011	Valve, check	1

MODULAR POWER UNIT PARTS BREAKDOWN — AC-1

Note: Motors, cylinders, and pumps can vary by model. Consult the manufacturer to determine the exact part numbers for these items.

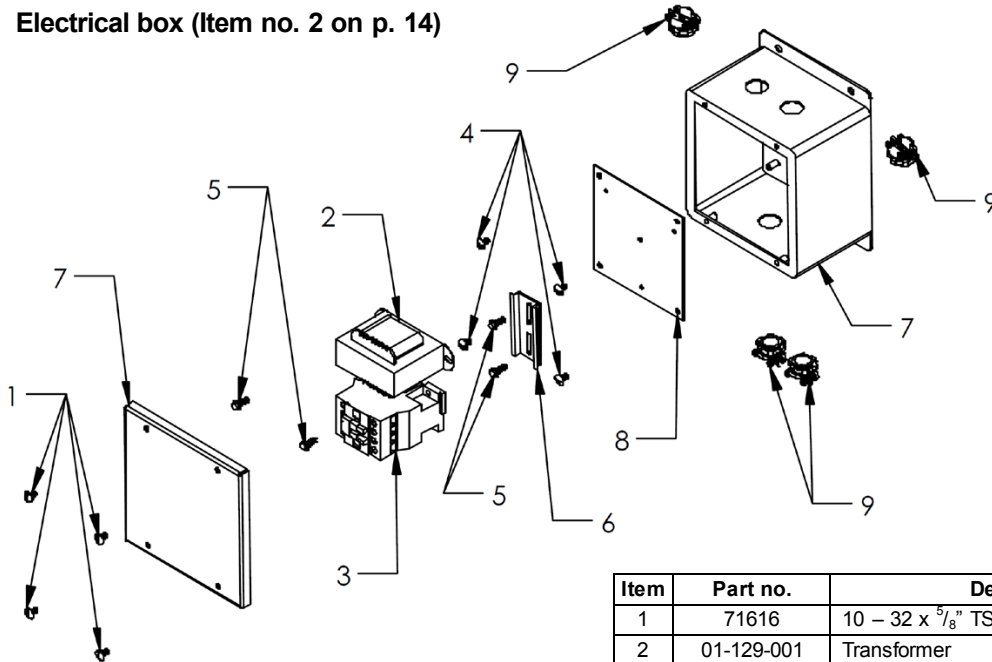


Item	Part no.	Description	Qty.
1	99-016-933	Base bracket	1
2	21-034-008	Electrical box (see FIG. 6B)	1
3	21-034-005	AC adaptor plug	1
4	37927	Tinnerman clip	4
5	99-023-001	Reservoir	1
6		Motor brace	1
7	23255 33687	$\frac{5}{16}$ " - 18 x 1" utility grade bolt $\frac{5}{16}$ " high collar lock washer	4 4
8	01-116-003	Breather	1
9	29185	$\frac{1}{4}$ " - 20 x 1" TPHMS z-plated screw	1
10	29201	$\frac{1}{4}$ " - 20 x 1 $\frac{3}{4}$ " TPHMS z-plated screw	1
11	23305 33688 33008	$\frac{3}{8}$ " - 16 x 1" utility grade bolt $\frac{3}{8}$ " high collar lock washer $\frac{3}{8}$ " flat washer	2 2 2
12	01-627-010	Manifold (see FIG. 6C)	1
13	01-143-906	Pump	1
14	99-145-061	Worm gear hose clamp	1
15	99-024-029	Fiberglass cover	1
16	99-034-054	Base, contact block	3
17	01-022-003	Contact block N.O.	3
18	99-034-055	Operator, black, non-illuminated	2
19	01-022-008	Key switch, 2-position	1
20	01-134-007	Legend, ON - OFF	1
21	99-135-003	Motor, electric, 1ph.	1
22	99-145-061	Clamp, worm gear, hose	1
23	01-143-906	Pump	1
24	01-627-010	Manifold assembly (exploded view on p. 12)	1
25	29201	$\frac{1}{4}$ in. - 20 x 1 $\frac{3}{4}$ in. TPHMS zinc-plated	2
26	29185	$\frac{1}{4}$ in. - 20 x 1in. TPHMS zinc-plated	2
27	23255 33687	SHCS utility grade High collar lock washer	4 4
28	99-033-024	Molded cord	1
29	21-034-025	Connector, charge	1
30	99-051-014	1in. hook and loop press	10"

MODULAR POWER UNIT PARTS BREAKDOWN — AC-2

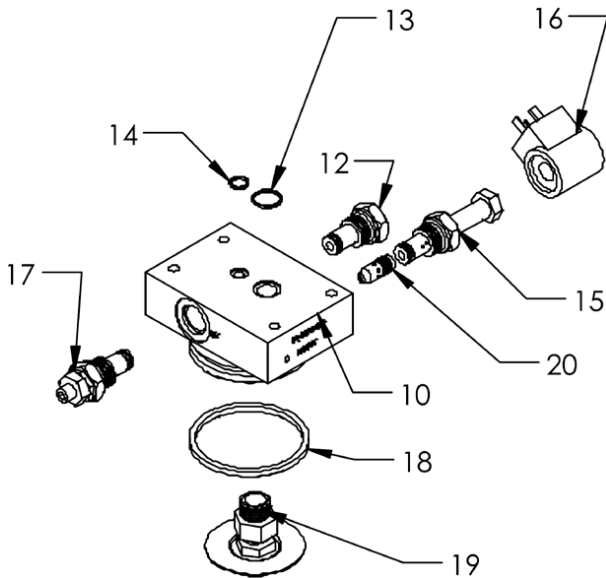
- Note: Motors, cylinders, and pumps can vary by model. Consult the manufacturer to determine the exact part numbers for these items.

Electrical box (Item no. 2 on p. 14)



Item	Part no.	Description	Qty.
1	71616	10 – 32 x $\frac{5}{8}$ " TSHMS screws	4
2	01-129-001	Transformer	1
3	132560	Motor contactor	1
4	27531	10 – 32 x $\frac{1}{4}$ " PSHMS zinc-plated screws	4
5	32028	8 – 18 x $\frac{1}{2}$ " HWH TEK drill and tap screws	4
6	99-034-941	Aluminum din rail	3"
7	01-029-006	$\frac{5}{16}$ " – 18 x 1" utility grade bolt	1
8	AB66JP	6" x 6" enclosure plate	1
9	99-034-037	$\frac{3}{8}$ " ($\frac{1}{2}$ " knockout) Romex 2-screw NM clamp connector	4
10	01-127-010	LHL standard manifold, 3" boss	1
11	99-116-033	$\frac{3}{8}$ " – 16 x 1" utility grade bolt	2
12	99-153-011	Check valve	1
13	99-144-023	O-ring	1
14	99-144-022	O-ring	1
15	99-153-015	Normally closed cartridge valve	1
16	99-034-008	24VAC coil	1
17	99-153-006	Pressure relief valve	1
18	99-144-007	O-ring	1
19	99-531-005	Filter	1
20	99-153-038	Flow control, 1.0GPM	1

Manifold (item no. 12 on p. 14)



TROUBLESHOOTING GUIDE — TM, TMS

Before performing any task, always lower the carriage fully to the floor and disconnect the power supply.

Consult the manufacturer for problems not addressed below.

* Check the DC notes page for troubleshooting other problems specific to battery-powered units.

<u>Problem:</u>	<u>Possible cause(s):</u>	<u>Action:</u>
Power unit doesn't run when "UP" button is pressed.	No supply voltage (AC). Upper-travel limit switch is engaged or bad. Bad connection in control circuit. No control voltage (AC). Bad motor relay coil. Battery voltage low (DC).	Test with meter. Check fuses, breakers, and overloads to determine the cause. Inspect and test switch. Replace if bad. Test all circuits with meter. Check for 24 VAC at control transformer's secondary; replace fuse if blown. Test with meter; replace if bad. Test with meter. Charge battery if low (is motor relay LED on?). Verify motor shaft rotates CCW. Consult factory for replacement. Ensure reservoir is filled. Same as above.
Motor runs properly, carriage doesn't raise. Motor and pump not noisy.	Motor rotation is wrong (AC). Pump has failed. Fluid level is low. See second item above, for when carriage doesn't raise.	Check power installation for adequacy. Check incoming voltage <i>while motor is running</i> . Correct problem found.
Motor or control enclosure hums, chatters, or buzzes, or some type of squeal can be heard; the carriage does not move, or the carriage moves only slowly.	Excess voltage drop to motor, due to power wire size too small, wire run too long, or incoming voltage too low (AC). Motor is "single-phasing" (AC). Contamination holding open the lowering valve or the check valve.	Determine cause of loss of voltage on one phase; correct. Remove and inspect. Clean per instructions in this manual. Same as above.
Carriage raises, then drifts down. Carriage lowers too quickly.	See last paragraph, above. See above. Flow control spool is stuck.	Same as above. Same as above. See below.
Carriage lowers too slowly.	Flow control spool is stuck. Pinched hose.	Remove plug from FC port; push on flow spool to ensure it is fully pressed into the cavity. Check pressure, supply, and return hoses for kinks. Same as for jerky carriage motion.
Carriage won't lower.	Velocity fuse locking (carriage only slowly creeps down.) Velocity fuse locking. Control transformer (AC). No supply voltage (AC). Valve solenoid is bad.	Same as for jerky carriage motion. Test with meter; replace if bad. Check for 24 VAC at secondary; replace fuse if blown. Check with multimeter on diodecheck function. (Reading for ohms will not provide an accurate test of the coil.) Test all of circuit with meter.
Spongy or jerky carriage motion.	Bad connection in control circuit. Physical blockage of the structure. Solenoid valve or suction hose screen plugged. Excessive air in the hydraulic cylinders.	Inspect for foreign material or objects blocking the carriage. Remove and inspect. Clean per instructions in this manual. Bleed air per procedure described in this manual.

SAFETY LABEL IDENTIFICATION

* Product safety signs or labels should be periodically inspected and cleaned by the product users as necessary to maintain good legibility for safe viewing distance — ANSI 535.4 (10.21). Contact the manufacturer for replacement labels.

1

MODEL TM

▲ WARNING	▲ ADVERTENCIA	▲ AVERTISSEMENT
KEEP CLEAR WHEN IN USE	MANTENGASE ALEJADO CUANDO SE ESTA OPERANDO	SE TENIR À DISTANCE LORS DU FONCTIONNEMENT
<small>VESTIL MANUFACTURING CORPORATION • Angola, Indiana USA • Phone (260) 665-7586 • sales@vestil.com • www.vestil.com 339 Rev 08/03</small>		

2

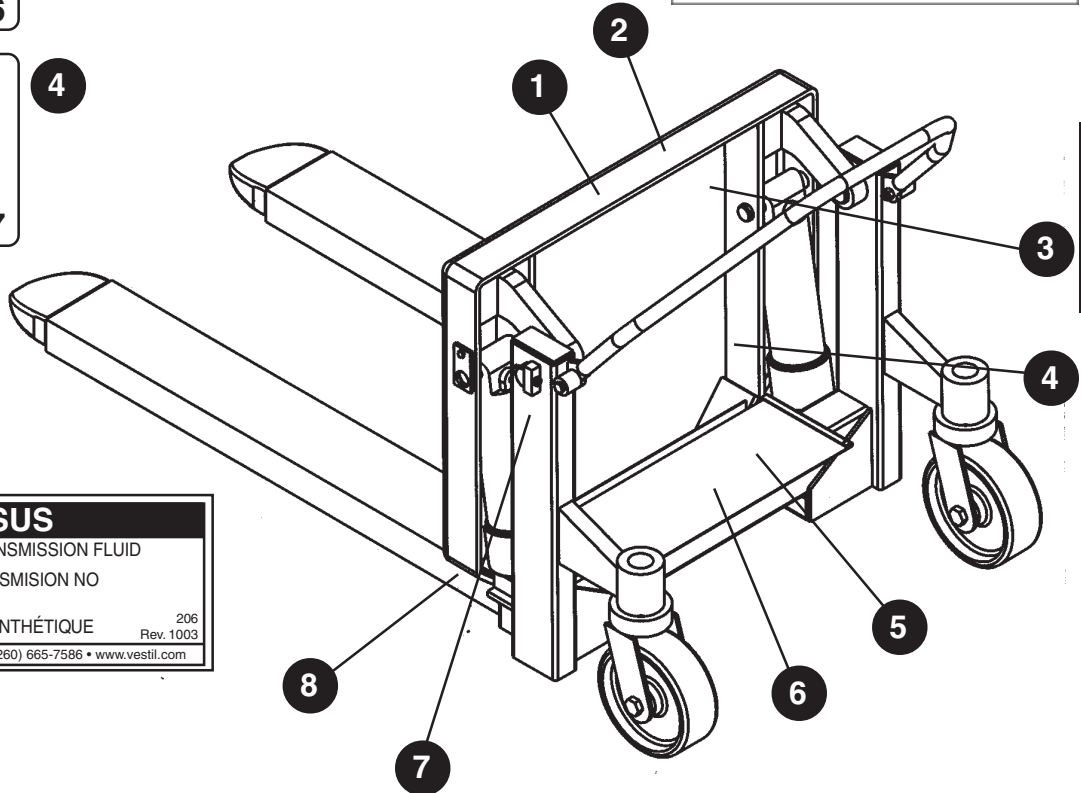
**RAISE
EL AUMENTO
AUGMENTATION**
376

3

MODEL/MODÉLO/MODÈLE _____
 CAPACITY _____ lbs.
 CAPACIDAD/CAPACITÉ _____ kgs.
 SERIAL/SERIE/SÉRIE _____
 VESTIL MANUFACTURING CORPORATION 387
 sales@vestil.com • www.vestil.com REV 09/03

**LOWER
MAS BAJO
PLUS BAS**
377

4



ENGLISH

5 Inside on Reservoir

ISO 32 / 150 SUS
 HYDRAULIC OIL OR HIGH-SYNTHETIC TRANSMISSION FLUID
 ACEITE HIDRAULICO O LIQUIDOS DE TRANSMISION NO SINTETICOS
 HUILE OU LIQUIDE HYDRAULIQUE NON-SYNTHÉTIQUE 206
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6

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PELIGRO
 MATERIAL CORROSIVO
DANGER
 MATIÈRES CORROSIVES

T & S Equipment Company
 Pk 271000-0021 • Fax: (213) 938-1339
 Near area code (213) 938-1339 388

7 Both Sides

**VESTIL
MANUFACTURING
CORPORATION**

Phone: (260) 665-7586
 Fax: (260) 665-1339
 E-mail: sales@vestil.com
 www.vestil.com

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8 Both Sides

▲ WARNING	▲ ADVERTENCIA	▲ AVERTISSEMENT
KEEP CLEAR OF PINCH POINT	MANTENGASE ALEJADO DEL PUNTO DE CORTE	SE TENIR À DISTANCE DU POINT DE PINCEMENT
<small>VESTIL MANUFACTURING CORPORATION • Phone (260) 665-7586 • Fax: (260) 665-1339 • sales@vestil.com • www.vestil.com 385 Permen04/03</small>		

SAFETY LABEL IDENTIFICATION

* Product safety signs or labels should be periodically inspected and cleaned by the product users as necessary to maintain good legibility for safe viewing distance — ANSI 535.4 (10.21). Contact the manufacturer for replacement labels.

MODEL TMS

1

⚠ WARNING	⚠ ADVERTENCIA	⚠ AVERTISSEMENT
KEEP CLEAR WHEN IN USE	MANTENGASE ALEJADO CUANDO SE ESTA OPERANDO	SE TENIR À DISTANCE LORS DU FONCTIONNEMENT
<small>VESTIL MANUFACTURING CORPORATION • Angelo, Indiana USA • Phone (260) 665-7586 • sales@vestil.com • www.vestil.com 229 Rev 08/03</small>		

3

**RAISE
EL AUMENTO
AUGMENTATION**

376

4

**LOWER
MAS BAJO
PLUS BAS**

377

2

MODEL/MODÉLO/MODÈLE _____
 CAPACITY _____ lbs.
 CAPACIDAD/CAPACITÉ _____ kgs.
 SERIAL/SERIE/SÉRIE _____
 VESTIL MANUFACTURING CORPORATION 239
 sales@vestil.com • www.vestil.com REV 08/03

5 Inside on Reservoir

ISO 32 / 150 SUS
 HYDRAULIC OIL OR HIGH-SYNTHETIC TRANSMISSION FLUID
 ACEITE HIDRAULICO O LIQUIDOS DE TRANSMISION NO SINTETICOS
 HUILE OU LIQUIDE HYDRAULIQUE NON-SYNTHÉTIQUE

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8 Both Sides

⚠ WARNING	⚠ ADVERTENCIA	⚠ AVERTISSEMENT
KEEP CLEAR OF PINCH POINT	MANTENGASE ALEJADO DEL PUNTO DE CORTE	SE TENIR À DISTANCE DU POINT DE PINCEMENT
<small>VESTIL MANUFACTURING CORPORATION • Phone (260) 665-7586 • Fax (260) 665-1339 • sales@vestil.com • www.vestil.com 236 Rev 08/03</small>		

LIMITED WARRANTY

Vestil Manufacturing Corporation ("Vestil") warrants this product to be free of defects in material and workmanship during the warranty period. Our warranty obligation is to provide a replacement for a defective, original part covered by the warranty after we receive a proper request from the Warrantee (you) for warranty service.

Who may request service?

Only a warrantee may request service. You are a warrantee if you purchased the product from Vestil or from an authorized distributor AND Vestil has been fully paid.

Definition of "original part"?

An original part is a part used to make the product as shipped to the Warrantee.

What is a "proper request"?

A request for warranty service is proper if Vestil receives: 1) a photocopy of the Customer Invoice that displays the shipping date; AND 2) a written request for warranty service including your name and phone number. Send requests by one of the following methods:

US Mail
Vestil Manufacturing Corporation
2999 North Wayne Street, PO Box 507
Angola, IN 46703

Fax
(260) 665-1339
Phone
(260) 665-7586

Email
info@vestil.com
Enter "Warranty service request"
in subject field.

In the written request, list the parts believed to be defective and include the address where replacements should be delivered. After Vestil receives your request for warranty service, an authorized representative will contact you to determine whether your claim is covered by the warranty. Before providing warranty service, Vestil will require you to send the entire product, or just the defective part (or parts), to its facility in Angola, IN.

What is covered under the warranty?

The warranty covers defects in the following original, dynamic parts: motors, hydraulic pumps, motor controllers, and cylinders. It also covers defects in original parts that wear under normal usage conditions ("wearing parts"), such as bearings, hoses, wheels, seals, brushes, and batteries.

How long is the warranty period?

The warranty period for original dynamic components is 1 year. For wearing parts, the warranty period is 1 year. Both warranty periods begin on the date Vestil ships the product to the Warrantee. If the product was purchased from an authorized distributor, the periods begin when the distributor ships the product. Vestil may, at its sole discretion, extend a warranty period for products shipped from authorized distributors by up to 30 days to account for shipping time.

If a defective part is covered by the warranty, what will Vestil do to correct the problem?

Vestil will provide an appropriate replacement for any *covered* part. An authorized representative of Vestil will contact you to discuss your claim.

What is not covered by the warranty?

The Warrantee (you) is responsible for paying labor costs and freight costs to return the product to Vestil for warranty service.

Events that automatically void this Limited Warranty.

- Misuse;
- Negligent assembly, installation, operation or repair;
- Installation/use in corrosive environments;
- Inadequate or improper maintenance;
- Damage sustained during shipping;
- Collisions or other accidents that damage the product;
- Unauthorized modifications: Do not modify the product IN ANY WAY without first receiving written authorization from Vestil.

Do any other warranties apply to the product?

Vestil Manufacturing Corp. makes no other express warranties. All implied warranties are disclaimed to the extent allowed by law. Any implied warranty not disclaimed is limited in scope to the terms of this Limited Warranty. Vestil makes no warranty or representation that this product complies with any state or local design, performance, or safety code or standard. Noncompliance with any such code or standard is not a defect in material or workmanship.

