SWIF-MUL

THOMAS ARTISIAN

FOUNDRY SAND MULLERS
MODELS ML65 ML125 ML250

Service Manual and Parts List

McENGLEVAN
Makers of SPEEDY-MELT Furnaces
700-708 Griggs Street • P.O. Box 31 • Danville, Illinois 61832

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SWIF MUL MODELS ML-65 AND ML-125

INSTALLATION

LOCATION

The machines are shipped completely assembled, ready to use. Both Models ML-65 and ML-125 are portable and require no special footing. They should be set and operated on a solid, level floor. The machines do not need to be bolted to the floor. Be sure to operate the muller in a location to provide adequate working space for loading and unloading the machine.

WORKING HEIGHT

Both models are designed with black iron pipe legs, so the overall, and the working height, can be varied by changing the length of the muller legs. The legs of both the ML-65 and ML-125 machines are built with round end, cast aluminum plug inserts, driven into the floor end of the pipe legs. The plug inserts can be driven from the legs by inserting a 3/4" rod through the leg and driving against the plug insert.

To change the legs of the Model ML-65, remove the pipe leg from the threaded hole in the base. Drive the foot insert casting from the pipe leg. Cut and thread new 1¼" Schedule 40 pipe to the desired length, drive foot insert into plain end of pipe leg. Screw legs into the threaded holes in the base casting.

To change the leg length of the Model 125, proceed as above, except thread the bottom ends of the 2" pipe legs after driving the foot castings from the pipe leg. Then use a 2" pipe coupling and pipe nipple to extend leg to desired length. Bolt extended leg to the muller base.

PORTABLE FEATURE OPTION

The Models ML-65 and ML-125 can be furnished with a detachable wheeled unit, so the machine can be moved easily from one shop location to another. The portable features can be purchased separate, and can be attached to machines already in the field. Instructions show how to remove the two standard legs and install the wheeled assembly.

ELECTRICAL CONNECTION

Customer must provide properly fused disconnect switch box at the machine locations. Check the motor voltage on both the muller name plate and the motor end bell. If voltage must be changed, refer to wiring diagram on succeeding pages.

Since the Models ML-65 and ML-125 mullers are built as portable machines, we suggest using Type S, 600 volt rubber covered power cord at least ten feet long. Lead size should be 10 gauge three wire for 115/230 single phase circuit, and 14 gauge four wire for 230/460 poly phase circuits. The following electrical plugs and receptacles, or their equivilent, are suggested.

Single phase three wire - Hubbell #2340 Receptacle with a #2341 grounded cap
Poly phase four wire - Hubbell #7410BG Receptacle with a Hubbell #7411G cap

If the local or area code requires a flexible metal conduit protective cover over the power cord, use 3/4" Greenfield Sealtite with Sealtite box connectors at the control box outlet. A Sealtite boot connector can be used at the cap end. Use a #7025 boot for three wire conductor and a #7541 boot for the four wire conductor. All control circuits are 115 volt grounded.

LUBRICATION

All machines are shipped with proper lubrication, however, we recommend checking the oil level in the gear box prior to operation. Models ML-65 and ML-125 are checked by removing the 1/4" pipe plug in the top half of the gear box housing. The pipe plug is located directly above the fillerpipe. The gear box capacity is three pints of high pressure gear lube.

Use 85W/140 gear lubricant.

The double ball bearings in the muller wheels are permanently lubricated at time of assembly, and should not require additional service.

OPERATION AND MAINTENANCE

START-UP

Check mulling crosshead rotation (should be clockwise). If the crosshead rotation is wrong, reverse any pair of power input leads if the machine is equipped with a poly phase motor. *OVERLOADING EITHER MODEL WILL GREATLY IMPAIR THE MULLING ACTION, ESPECIALLY WITH OIL BASE SANDS SUCH AS PETRO BOND.* The load of sand will be pushed ahead of the plows and muller wheels. No mulling or kneading of the sand mass will occur.

Check motor ammeter if unit is equipped with Mull Cycle Control. Refer to the following chart. If amperage reading is high, open dump door and dump part of load until motor amperage reading is in correct operating range at start of mulling cycle.

FULL LOAD CURRENT FOR SWIF MUL MACHINES

Model Number	Motor HP Rating	Amperage 115/1 ph.	230.1 ph.	230/3 ph.	460/3 ph.
ML-65	1.0	11.5 amp	5.5 amp	3.3 amp	1.7 amp
ML-125	2.0	20.5 amp	10.0 amp	6.2 amp	3.1 amp
ML-250	3.0	29.2 amp	NA	9.2 amp	4.6 amp

SAND CAPACITIES
Maximum Per Load

Model Number	Green Sand New Mix	Water Bonded Remull Heap	Oil Bonded Sand New Mix or Remull
ML-65	55 lbs.	75 lbs.	65/70 lbs.
ML-125	110 lbs.	135 lbs.	125/135 lbs.
ML-250	250 lbs.	285 lbs.	260/275 lbs.

GEARING USUALLY REQUIRES A BREAK IN PERIOD OF SEVERAL HOURS AND THE EFFICIENCY MAY BE LOWER DURING THIS PERIOD. IT MAY BE NECESSARY TO RUN REDUCED LOADS TO LOWER MOTOR AMPERAGE LOAD READINGS TO CORRECT READING. AFTER BREAK-IN PERIOD, MULL THE NORMAL SIZE SAND MIX. ADJUST LOAD TO KEEP MOTOR AMPERAGE READING WITHIN OPERATING LIMITS.

OPERATION OF MULLER

1. Load machine with approximate quantities shown in above machine.

2. Close cover. Machines with the cover safety interlock have a plunger type micro switch, which is wired in series with the holding circuit of the magnetic starter The cover must be closed to complete the magnetic starter holding coil circuit.

3. Push "On" button, hold the lid micro switch in the closed position, and operate muller for about 30 seconds, while observing mulling action. If the muller is loaded beyond the maximum sand capacities shown in the above chart, no mulling action will take place. The sand will move ahead of the muller wheels and plows as a mass instead of being worked by the plows and wheels. To reduce the load to the correct capacity, open the discharge door and dump part of the load. *DO NOT OPERATE MULLER FOR FULL MULLING CYCLE WITH COVER OPEN, AND DO NOT PUT HANDS INSIDE MULLER BARREL WHILE MACHINE IS OPERATING.*

4. Empty machine by opening discharge door while muller is running, to push out and discharge load.

5. *CLEAN THOROUGHLY AFTER EVERY RUN OR SHIFT,* by scraping and removing sand mix with trowel or stiff brush, or by operating machine until clean with several shovels of clean, dry sand. *IF NO-BAKE, CO_2 OR CORE SANDS ARE PREPARED IN THE MACHINES, IT IS IMPARATIVE THAT ALL SAND IS REMOVED* from the mixer plows, muller wheels and barrel. Be sure to clean all sand from around the discharge door seal. *MAXIMUM MULLING EFFICIENCY IS DEVELOPED ONLY IN A CLEAN, HIGHLY POLISHED MULLER BARREL.* With proper care, the muller barrel, plows and bottom plate will become highly polished by the scouring action of the molding sand.

6. Do not overmul the sand. The new sand or used heap sand should be mulled according to the recommended time cycle. Do not mul hot sand. If it is necessary to cool the sand, spread it on the shop floor to cool, then mul the entire load.

Steps Of Operation For Mul Cycle Control System

1. Load the machine with the recommended quantity of foundry sand. If the operator is remulling their present sand heap, they should fill the muller with cleaned and riddled sand to the proper level as indicated on the outside of the muller cage. If the operator is preparing new sand, follow the mixing and mulling instructions found in another section of this manual on preparing new sand.

2. Close the muller lid to complete the lid interlock control circuit.

3. Flip the On-Off toggle switch to the On position, to energize the electrical control system. The control indicator light comes on.

4. Pre-set the timer to the desired number of minutes selected for the specific mulling cycle. The timer will repeat the pre-set time cycle. Any change in the duration of the mulling cycle must be made by resetting the timer.

5. Depress the start button located in the center of the timer set dial, and the unit will begin its mulling cycle.

6. Check the ammeter in the control panel while the unit is running, to see whether the amperage reading is in the green range. Do not run the unit when the ammeter needle is indicating in the red limit range.

7. When the mull cycle period is completed, the timer automatically shuts off the unit. Unlock the discharge door leaving it open.

8. Depress the special unloading button on the panel to unload the sand. The muller cover must be shut to unload the unit.

9. Having completed this operation, close the unloading door and lock the handle. The unit is ready for the next load.

10. After all of the sand has been mulled, clean the inner surface of the muller cage, the plows, and the wheels to prevent rusting or corrosion while the machine is setting idle. This is especially important when mulling green sand or no bake core sands.

EMERGENCY SHUT-DOWN CAN BE MADE IN THREE WAYS:

Lift the cover to break the lid interlock switch circuit. Flip the On-Off toggle switch to the "Off" position. Return the timer to "0" setting.

MULLING PETROLEUM BONDED SANDS

Due to the lubricity of oil bonded molding sands, such as Petro Bond, they tend to slide or move as a mass, ahead of the muller wheels and plows. *THIS ACTION WILL BE MORE PRONOUNCED IF THE MACHINE IS LOADED TO A GREATER CAPACITY THAN THAT RECOMMENDED.* A loading depth decal is located on the outside surface of the mulling barrel. The machine will not develope maximum sand properties if it is overloaded. Dump some of the sand to reduce the load.

If the sliding action prevails, it can be greatly reduced, or eliminated, by installing the four half-round steel bars packed separately inside the barrel of the muller. Fasten them in the vertical locations on the inside of the muller barrel. The bars are 3/16" thick and 7/16" wide, drilled and tapped. The length, and the number of bars, will vary according to the size and model number. They are simple to install or to remove.

THE BARS SHOULD ALWAYS BE REMOVED WHEN WATER TEMPERED OR NATURAL SANDS ARE MULLED OR PREPARED. The scouring action of the water tempered sands will polish the inside of the barrel. The polished surface greatly improves the mulling action of the machine. It is important to clean the muller properly after using.

Furan, Sodium Silicate and other no-bake or cold set core sand mixtures must be cleaned thoroughly from the muller, to prevent chemical attack and corrosion of the steel parts.

MAINTENANCE

MODELS ML-65 AND ML-125

1. Check gear box oil level every thirty days. Change oil every 2000 hours. Use 48 ounces of high quality 85w 140 gear oil.
2. Inspect and lubricate upper drive spindle bearing and replace felt or seals every 2000 hours. Refer to part number 040011 on drawing. Motor bearings must be serviced according to the motor manufacturer's specifications.
3. Check and replace discharge door "O" ring seal as required. Refer to parts drawing for "O" ring seal number.

MODEL ML-250

1. Check oil level in gear case every week. Level must be above red line on site glass. Change oil every 2000 hours. Use high quality 85w 140 gear oil. Refer to gear case manufacturer bulletin enclosed.
2. Lubricate upper gear case roller bearings through the three grease fittings located on the electric line starter bracket. Use short fibre high pressure grease. Lubricate every week.
3. Inspect and lubricate upper drive spindle bearing and replace seal every 2000 hours. Motor bearings must be serviced according to the motor manufacturer's specifications.
4. Inspect and adjust vee belts every 500 hours of operation. Use Browning Gripbelt #3V450 or equivilent.

PLOW AND MULLER WHEEL ADJUSTMENT

Muller plows are hard faced at the leading edges and wear points with tungsten carbide hard surfacing. However, the abrasive action of silica sand causes rapid removal of all kinds of steels. Periodic adjustment of the machine components is required to compensate for normal wear.

Both plows should be adjusted to within approximately 1/16" of the bottom base wear plate. Spacers or flat washers are used for this adjustment. The outer plow is adjusted to within 1/8" to the barrel liner at its closest point of clearance. The smaller, inner plow must be adjusted to 1/16" clearance from the center drive spindle housing.

The muller wheels are adjusted to 1/8" clearance between the wheel and the base wear plate. This adjustment is made with the adjusting screw shown as Item 000906 in the parts drawing. Spring pressure against the sand load is adjusted with adjusting screw shown as Item 001390 in the parts drawing. Proper spring and muller wheel pressure should be adjusted as follows:

WHEEL HEIGHT ADJUSTMENT ABOVE WEAR PLATE

1. Run stop screws in until wheels touch crib bottom wear plate.
2. Place recommended amount of sand to be mulled in the muller crib.
3. Start the muller and allow it to make twenty revolutions to disperse the sand into an even layer. Stop the muller. One-half inch sand layer should be beneath each wheel.
4. Run the stop screws out until they hit the stops, then run back in one full turn.

This will minimize the formation of hard clods when dumping while still allowing full wheel pressure at all times.

WHEEL PRESSURE

The wheel pressure required for mulling varies from sand to sand. Generally, a good wheel pressure is that which will develope the molding properties of the sand in three to four minutes total mulling time. The sand in this case should be already prepared heap sand in good condition.

Replacement Of Worn Parts

The scouring action of silica sand, used in foundry and core sand mixes, is so severe that periodic replacement of four principle parts of the muller is required. These include the bottom wear plate, the muller barrel or barrel liner, the mixing plows and the muller wheels. The first three items are available in a special Abrasion Resistant steel, which normally provides four or five times the wear and abrasion resistance found in regular carbon steel plate and sheet. A R Steel is a special hardened medium carbon high manganese steel. The A R Steel parts have a different part number than the standard steel components and are normally available from factory stock.

When ordering replacements, be sure to give machine model, serial number and list replacement parts numbers. When ordering replacement electrical parts be sure to give, in addition to the above, the voltage, phase and cycles of the operating electric current. Refer to parts drawing and parts list pages.

REPLACEMENT OF MULLER WHEEL ASSEMBLY MODELS ML-65, ML-125 AND ML-250

The replacement muller wheel assembly consists of the new wheel, with a new axel, new sealed - pre lubricated bearings and new multi - lip sand seals. *DO NOT DISASSEMBLE THE WHEEL - BEARING UNIT OTHERWISE THE SAND SEALS ARE INVERTED AND ALLOW SAND TO ENTER THE BEARINGS.*

1. Remove the moisture dispersion funnel, part number 040123, from the plow head casting. Remove four bolts, part number 000908, from plow head casting and raise plow assembly from cross-head casting and wheel assembly.

2. Loosen two set screws, part number 001054, in drive shaft. Remove drive shaft bolt, part number 000930, from top end of drive shaft, and raise wheel assembly up off the drive shaft. *A wheel puller should be used to remove the cross-head casting. Evidence of hammer blows WILL NULLIFY ANY WARRANTY.*

3. Remove dowel point set screws, part number 000805, from wheel-axel casting since dowel point fits into drilled hole in the wheel axel.

4. Remove all sand or rust from the exposed portion of the axel and polish with sandpaper and lubricate to assist in its removal from wheel-axel casting, part number 040013.

5. Remove the wheel adjusting screw, part number 000906, with lock nut and reinstall in the new axel shaft.

6. Reinstall the new axel and wheel assembly into wheel-axel casting being sure that dowel point set screw, part number 000805, enters in the drilled recess hole in the new axel. Tighten set screw securely.

7. After replacing wheel-axel assembly in wheel-axel casting, replace casting and assembly on the drive shaft, align key way and replace square key, part number 040069. Tighten hex head bolt, part number 000930, being sure that washer, part number 002121, is in place. Tighten set screws, part number 001054, in the cross-head casting.

8. Replace the plow and spring assembly and secure with four bolts, part number 000908, being sure to use four lock washers, part number 002116, and two flat washers, part number 002115. Position the spring in its correct location so that spring tension adjusting bolt, part number 001390, is seated in the center hole in the tension spring.

9. Replace the moisture dispersion funnel.

10. Adjust wheel height and wheel pressure according to instructions in OPERATION AND MAINTENANCE section of Operating Manual.

REPLACEMENT OF PLOWS MODELS ML-65 AND 125

1. Remove the moisture dispersion funnel, part number 040123, from the plow head casting.

2. Remove bolts, part numbers 000908 and 000905, and remove outside plow.

3. Replace with new outside plow and bolt in place being sure to use both lock and flat washers. Rotate the wheel and cross-head assembly by hand to check clearance between bottom wear plate and bottom of the plow. If the plow rubs the bottom wear plate, raise the plow by using flat washers between the foot of the plow head casting. When proper clearance has been obtained, tighten hold down bolts.

4. Remove bolts, part number 000905, and remove inside plow assembly. Replace new plow and bolt in place. The inside plow can be adjusted vertically for proper clearance.

5. Replace the moisture dispersion funnel.

6. Recheck clearance by rotating cross-head assembly by hand to be sure the plows do not rub or bind against the bottom wear plate. Make final adjustment according to plow and muller wheel adjustment in OPERATION and MAINTENANCE section of Operating Manual.

REPLACEMENT OF BOTTOM WEAR PLATE MODELS ML-65 AND ML-125

1. Remove lid interlock switch from the edge of the muller crib, or shell. Remove the bolts from the bottom outer periphery of the crib or shell and raise lid and crib assembly off of the muller base.

2. Remove liquid dispersion funnel, part number 040123, from the plow head casting.

3. Remove four bolts, part number 000908, from cross-head casting and raise plow assembly up and off the wheel assembly.

4. Loosen the two set screws, part number 001054, in cross-head casting. Remove bolt, part number 000930, from the top end of the drive shaft and lift wheel cross-head assembly from drive shaft. *A wheel puller should be used to remove the assembly from the shaft. Evidence of hammer blows on the casting WILL NULLIFY THE WARRANTY.*

5. Remove the hold down screws, part number 000454, from the base wear plate and lift worn wear plate from muller base. Remove the small plate covering the discharge door. *If the O-ring seal around the drive shaft housing is worn, replace with 2-5/8" I.D. x 1/8" standard O-ring for the ML-65 or 3" O.D. x 1/8" standard O-ring for the ML-125. If the door seal needs replacement, replace with standard O-ring 5-1/2" x 1/4" for the ML-125.*

6. Remove all residue or dirt from base surface and install new base wear plate and discharge door plate.

7. Install wheel assembly on drive shaft and align key way. Insert 1/4" square key, part number 040069. Replace drive shaft bolt, part number 000930, and washer, part number 002121, and tighten securely. Retighten two set screws, part number 001054, in cross-head casting.

8. Replace the plow and spring assembly and secure with four bolts, part number 000908, being sure to use four lock washers, part number 002116, and two flat washers, part number 002115. Located tension spring in proper position with adjustment bolt setting in the center hole of the spring.

9. Replace the liquid dispersion funnel.

10. Replace crib on muller base and resecure the four base bolts. Reinstall lid interlock switch. Electrical connections are fastened to terminals marked *Common* and *Normally Open.*

REMOVAL AND REPLACEMENT OF GEAR BOX ASSEMBLY MODELS ML-65 AND ML-125

1. Remove lid interlock switch from the top edge of the muller crib, or shell. Remove the bolts from the bottom outer periphery of the crib or shell amd raise lid and crib assembly off of the muller base.

2. Remove liquid dispersion funnel, part number 040123, from the plow head casting.

3. Remove four bolts, part number 000908, from the cross-head casting and raise the plow assembly up and off the wheel assembly.

4. Loosen the two set screws, part number 001054, in cross-head casting. Remove bolt, part number 000930, from the top end of the drive shaft and lift wheel cross-head assembly from drive shaft. *A wheel puller should be used to remove the assembly from the shaft. Evidence of hammer blows on the casting WILL NULLIFY THE WARRANTY.*

5. Remove the hold down screws, part number 000454, from the base plate and lift worn wear plate from muller base. Remove drive shaft housing O-ring seal. *If the O-ring seal around the drive shaft housing is worn, replace with 2-5/8" I.D. by 1/8" standard O-ring for the ML-65 or 3" O.D. x 1/8" standard O-ring for the ML-125.*

   NOTE: MODEL ML-125 ONLY - REMOVE SEAL RETAINING CUP, PART NUMBER 040257, FROM TOP OF DRIVE SHAFT HOUSING, AND REMOVE FLAT NYLON AND RUBBER SEALS. REMOVE SEAL SLEEVE, PART NUMBER 040254, FROM DRIVE SHAFT.

6. Lay muller base and leg assembly on side to facilitate removal of drive assembly.

7. Remove three gear box mounting bolts, part number 001515, which secures gear box to muller base, and pull gear box-motor assembly from muller base.

8. Remove four 3/8" motor bolts, and separate motor from adaptor housing casting, part number 040051.

9. Remove four 3/8" bolts, and remove motor adaptor housing, part number 040051, from gear box.

10. Loosen set screws, part number 000802, in gear box half of universal joint, part number 040052, and remove universal joint.

11. Remove air vent plug, part number 003460, from the top half of the old gear box. Remove 1/8" pipe plug from top half of new gear box, and replace with air vent, part number 003460. Return 1/8" pipe plug to old gear box for return shipment of the old gear box to factory.

12. Reassemble gear box half of universal joint on drive shaft. *The end of the gear box shaft should not protrude beyond the inner surface of the universal joint, otherwise, the rubber insert of the universal joint will receive excessive wear from the shaft.* Tighten the universal joint set screw securely against the square key in the drive shaft.

13. Reassemble the motor adaptor housing, part number 040051, to gear box.

14. Reassemble the motor to the gear box assembly and secure in place with the four hex bolts, part number 001205. Use care when realigning the rubber spider of the universal joint.

15. Insert drive shaft housing through center hole in muller base, and secure gear box to base with the three 1/2"bolts and lock washer.

16. Return muller base to upright position, replace O-ring seal and bottom wear plate.

17. *For Models ML-125 only - Replace sleeve seal, part number 040254, on drive shaft. Replace seal assembly which consists of four nylon washers, part number 040255, and three Buna N rubber washers, part number 040256. Replace seal retaining cap, part number 040257, and spacer washer, part number 040176, on top of seal sleeve on drive shaft.*

18. Reassemble per instructions outlined in REPLACEMENT OF BOTTOM WEAR PLATE.

REPLACEMENT OF GEARS AND BEARINGS IN GEAR CASE MODELS ML-65 AND ML-125

1. Follow the instructions outlining the REMOVAL AND REPLACEMENT OF GEAR BOX ASSEMBLY. Remove gear case from machine. Remove motor and motor adaptor housing from gear case.

2. Move gear box-drive shaft assembly to bench, remove all drain plugs, and drain all oil from gear box.

3. Remove the twelve bolts which fasten the two halves of the gear box together. Place gear box with bottom side up in bench vise. Take care to prevent marring drive shaft housing.

4. Separate the two gear box halves by screwing four 3/8" bolts into the threaded holes in the bottom half of the gear box housing flange. The bolts should be at least 2" long. Tighten bolts in sequence so the two halves of the gear box separates evenly. The gears should remain in the upper half of the gear box.

5. To remove and replace gears and bearings, place two small pry bars beneath the drive shaft gear, part number 040068, and raise the gear assembly. It may be necessary to alternate raising the intermediate pinion gear, part number 040067 and the motor drive pinion gear, part number 040064, until all are free of the bearing cavities in the gear case.

6. Move the top half of the gear case to an arbor press, with the drive shaft up. Press the drive shaft, part number 040250, down through the housing until it is free from the upper drive shaft bearing, part number 040251. Remove drive shaft housing.

7. Remove oil seal, part number 040063, from bottom half of gear box. Remove drive shaft bearing, part number 040251, from drive shaft housing, part number 040252.

8. Remove old gaskets from gear box flange, and clean both halves of gear box housing to remove all foreign material.

9. Replace drive pinion seal, part number 040063, using a sealent similar to "Locktite" to prevent seepage around the outer periphery of the seal.

10. Replace upper drive shaft bearing, part number 040251, if required.

TO REPLACE WORN GEARS OR BEARING ASSEMBLIES, DISASSEMBLE THE BEARING-GEAR SHAFT ASSEMBLIES WITH A GEAR PULLER. REMOVE BEARINGS FROM GEAR BOX HOUSING WITH GEAR OR BEARING PULLER ATTACHMENTS IF THEY REMAIN IN GEAR BOX CASTING.

11. To replace the bearings and gear of the main drive shaft assembly, remove the two set screws, part number 001062, from the gear hub, part number 040068, then remove gear and bearings with gear puller. Clean shaft and replace gear and bearings with new units.

12. Remove intermediate pinion, gear and bearing, part number 040067, as instructed above, disassemble and replace components as needed, per instructions in Step #11.

13. After the replacement gears, shafts, pinions, and bearings are reassembled into three separate units of the gear train, the gear train is reassembled in the bottom half of the gear case as follows: Apply grease to the seal side of the drive pinion, part number 040064, and put motor drive end of the drive pinion through gear case seal, part number 040063. Be very careful that you do not invert the inner seal ring while pressing the end of the drive pinion into place. This seal will be in the bottom of the gear case while the muller is operating. If the inner seal is inverted during assembly, oil will leak from the gear case into the motor. Before seating the drive pinion bearing, part number 040065, position the intermediate pinion assembly and the drive shaft with gear, part number 040068, and gear assembly with gear, part number 040067, in their proper location. With all three gear assemblies in position in the lower half of the gear case, using a plastic or soft tip hammer and carefully seat all components in the gear case. It will be necessary to progressively tap one shaft assembly after another until the gear shafts and roller bearings are seated in the gear case.

14. Replace gaskets on the gear case.

15. Place the bottom half of the gear case on the top half, and align the bearing in the casting recesses. When in position, tap the bottom half of the gear box gently and evenly so the bearings will enter the bearing recesses. The two dowel pins in the gear case will assist gear and bearing alignment.

16. Replace the twelve 1/4" bolts around the gear box and tighten them progressively so that the two halves of the gear case are drawn together even and tight enough to seal against oil leakage.

17. Reassemble the universal joint being sure to locate the 3/16" key on the drive pinion shaft. Locate the shaft about 1/16" below the surface of the rubber center insert of the universal joint, otherwise, the tip of the shaft will cause undue wear of the rubber insert.

18. Remount the motor adaptor, part number 040051, to the gear box, and reassemble the motor to the motor adaptor casting. Bolt the gear box-motor assembly back on to the muller base, and reassemble per instructions in REMOVAL AND REPLACEMENT OF GEAR BOX ASSEMBLY.

19. Fill gear box with gear lube as instructed in lubrication instructions of this manual. Use three pints of high pressure gear lube.

REPLACEMENT OF PLOWS FOR MODEL ML-250

1. Remove the plow arm bolts, and remove the inner plow from cross-head casting, part number 040421.

2. Replace with the new inside plow, and adjust the height so the plow clears the bottom plate between 3/32" and 1/8".

3. Remove the outside plow arm, and remove the old plow plate from the plow arm. Replace the new plow plate, and tighten bolts securely. Bolt the old plow arm-plate assembly back on the cross-head casting. Rotate the cross-arm plow assembly by hand to check plow clearance against crib liner and bottom wear plate. The outside plow-side liner clearance is adjustable. The clearance between the plow plate and the bottom wear plate can be increased by adding flat washers between the cross-head casting, and the plow arm.

REPLACEMENT OF BOTTOM WEAR PLATE AND CRIB LINER FOR MODEL ML-250

1. Disconnect all electrical power to the machine.

2. Remove lid interlock switch from the top edge of the muller crib, or shell. Remove the bolts from the bottom outer periphery of the crib and raise lid and crib assembly off of the muller base, part number 040459.

3. Remove four bolts, part number 001461, from cross-head casting and raise the plow and spring assembly up and off the wheel assembly.

4. Remove the hold down screws, part number 000903, from the base wear plate, and lift the worn wear plate sections from the muller base. Remove the smaller plate screws, and lift the smaller plate from the discharge door. If the seal gasket is worn, replace with 8-1/2" I.D. x 1/4" standard O-ring. If the seal around the drive shaft housing is worn, replace with a 4" I.D. x 1/8" standard O-ring. An easy method of replacing the drive shaft housing seal is to cut the new O-ring at an angle, install it around the shaft, then reglue the slice into a ring. Clean all sand from surface of muller base and install new bottom wear plate and discharge door plate.

5. Remove crib liner, part number 040478. If the liner is worn, it can be turned so the worn section is up, and the bottom half will not receive wear. When both the top and bottom halves of the inner surface of the crib linner are worn, the entire liner is replaced.

6. Place the muller crib with the new crib liner on the base, and rebolt the muller crib in place. Seat crib side liner against bottom wear plate. Reconnect the lid interlock microswitch connections to terminals marked "Common" and "Normally Open".

7. Replace the plow assembly and rotate the wheel and plow assembly once by hand to be sure of proper clearance between plows and new wear plate and crib liner.

REPLACEMENT OF SECTIONAL HEAVY DUTY BOTTOM WEAR PLATE FOR MODEL ML-250

The heavy duty bottom wear plate is supplied as a three sectional disc. This simplifies wear plate replacement and more suitable for more severe application where frequent replacement of wear plate is necessary.

The standard two piece wear plate supplied with the machine must be removed per the above instructions. Once the heavy duty wear plate has been installed, replacement is made as follows:

1. Disconnect all power leads to machine.

2. Remove the plow arm bolts and remove the inner plow from the cross-head casting, part number 040421.

3. Remove the outside plow arm and the plow assembly from the machine.

4. Remove all wear plate hold down screws, part number 000903, from the base wear plate and from the discharge door plate.

5. Remove crib side liner bolts and lid interlock switch bolts from muller barrel, and remove crib side liner and set aside.

6. Turn muller wheels so that they clear the one-third sections of the bottom wear plate, and remove the three bottom wear plate sections starting with the discharge door section.

7. Remove discharge door plate, and remove and replace door seal if necessary. Install new discharge door wear plate.

8. Inspect drive shaft housing seal,and replace with new O-ring seal as instructed in Step #4 of the preceeding instructions.

9. Clean all sand from surface of muller base and reinstall new bottom wear plate sections.

10. Reinstall crib liner, part number 040478.

11. Replace plows and adjust for proper clearance between the bottom of the plow and the bottom wear plate. The inner plow is adjustable by raising or lowering the plow assembly. The outer plow must be raised by placing additional flat spacer washers between the plow arm and the plow arm casting.

REMOVAL AND REPLACEMENT OF GEAR BOX ASSEMBLY FOR MODEL ML-250

1. Disconnect all power leads to machine.

2. Remove plow and spring assembly by removing four 7/16" bolts,part number 001461, and lift assembly from cross-head casting.

3. Remove plow head bolts, part number 001525, which holds the cross-head wheel assembly in position. Remove two set screws, part number 001380, from the side of the cross-head wheel casting, and use a large gear puller to remove the entire wheel assembly.

4. Remove belt guard, part number 040499, and dump chute, part number 040492. Disconnect lubricating lines between gear box and motor starter plate.

5. Remove gear box assembly, part number 040438, by removing the three 3/4" bolts, part number 001807, (this may be accomplished better by removing the muller cover and turning the machine upside down).

6. Remove drive shaft housing bolts, part number 001557, and remove drive shaft housing, part number 040451. Check the housing bearing, part number 040450,and replace if necessary.

7. Remove the sand slinger casting, part number 040447, from drive shaft.

8. Remove gear box mounting casting, part number 040510 from gear box.

9. Loosen set screws on set dollar, part number 040448, and remove collar from the bottom of the drive shaft.

10. Remove the set screws on both sides of the gear box collar which hold the drive shaft, part number 040449, in place. Remove the drive shaft from the gear box by pulling the long end of the shaft.

REASSEMBLY OF COMPONENTS INTO NEW GEAR BOX ASSEMBLY

1. Clean the drive shaft of all dirt or burrs, and reassemble it in the new gear box. Do not tighten the four set screws located in the sleeve of the gear box too tight at this step in the reassembly of the drive shaft.

2. Replace gear box mounting casting, part number 040468, sand slinger casting, part number 040447, and drive shaft housing, part number 040451.

3. Rebolt gear box assembly back to the muller base. Return machine to its upright position.

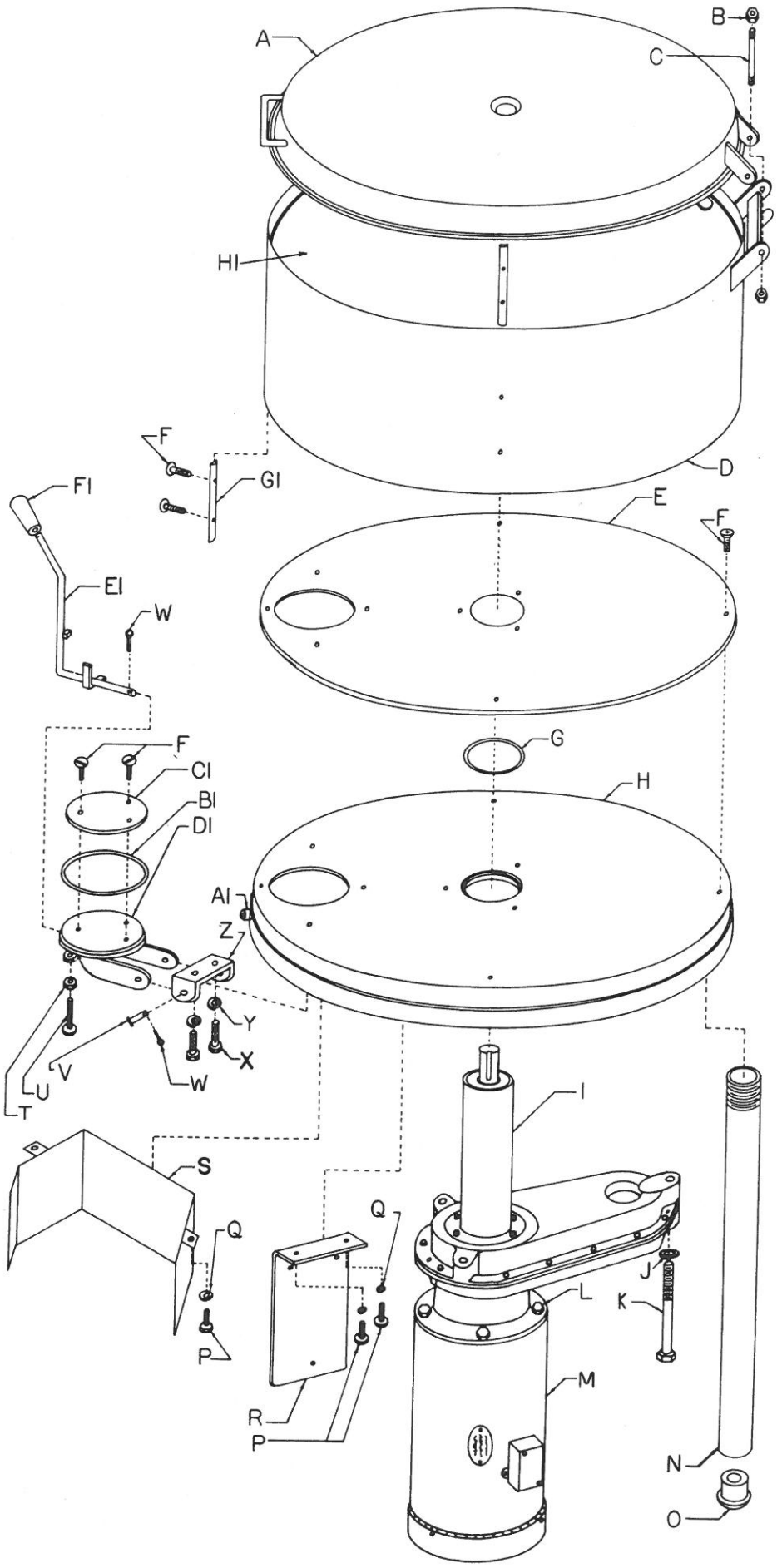
4. Replace the wheel and plow assembly and spacer, part number 040454, on drive shaft. Secure cross-head wheel drive casting on drive shaft with cross-head bolt, part number 001525. Replace and tighten set screws, part number 001380 on the side of the cross-head wheel drive casting.

5. Refer to Step 1, and at this point in the assembly, securely tighten the four set screws in the top and bottom of the sleeve that hold the drive shaft, part number 040449, in position. Then replace the set collar, part number 040448 and tighten securely in place.

6. Replace drive belts, and adjust to the proper tension. Replace belt guards,part number 040499, and dump chute, part number 040492. Reconnect the lubricating lines to the new gear box.

7. Replace the plow and spring assembly to the wheel cross-head casting. Rotate the wheel and plow assembly by hand to check clearance between the plows and the bottom wear plates.

8. Replace the machine cover and all electrical connections. Check rotation before releasing machine for production operation.



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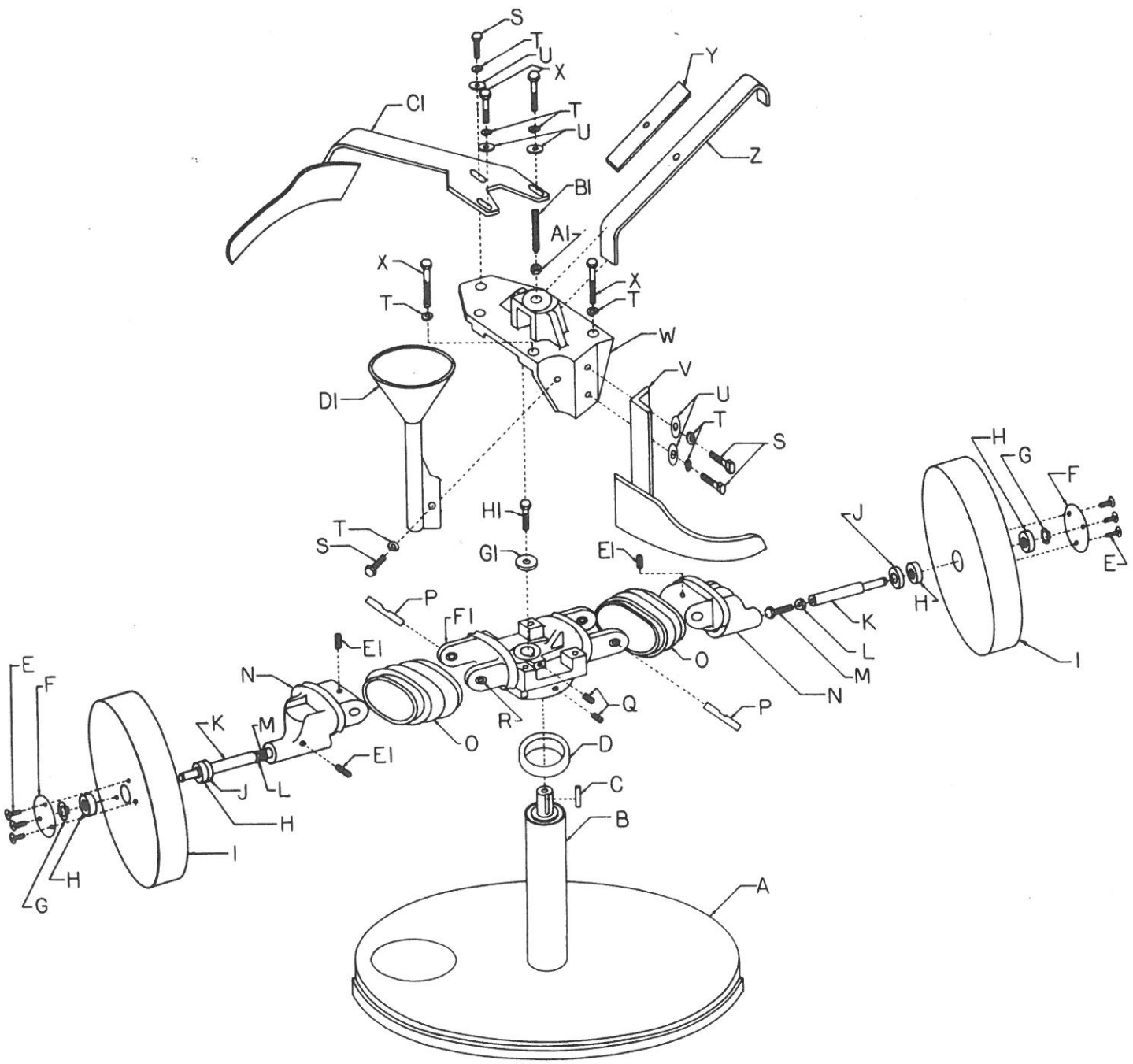
SWIF-MUL

ML-65 BASE AND TUB ASSEMBLY

			Qty
A	040110	Muller Lid Assembly	1
B	002016	3/8"-16 Hex Jam Nut	2
C	040114	3/8" Hinge Pin	1
D	040106	Muller Shell Assembly	1
E	040083	Base Wear Plate AR	1
F	000454	#10-24 x 1/2" Flat Head Machine Screw	21
G	040097	1/8" x 2 1/2" 'O' Ring	1
H	040081	Muller Cast Base	1
I	040060	Gear Box Assembly	1
J	002132	1/2" Lock Washer	3
K	001515	1/2" x 4" Hex Head Cap Screw	3
L	001205	3/8" x 1" Hex Hd Screw	4
M	004122	1 HP, 1725 RPM, 115/230V, 60 HZ, 1 PH	1
	or		
	004121	1 HP, 1725 RPM, 230/460V, 60 HZ, 3 PH	
N	040102	Muller Legs	3
O	040101	Drive In Feet	3
P	000702	1/4" x 5/8" Hex Head Machine Screw	4
Q	002112	1/4" Lock Washer	4
R	040139	Control Box Mount Bracket	1
S	040120	Dump Chute	1
T	002008	1/4" Hex Nut	2
U	000611	1/4" x 1 1/2" Rd Head Machine Screw	2
V	040091	5/16" x 1 1/2" Hinge Pin	2
W	040086	1/8" x 1" Cotter Pin	3
X	000909	5/16" x 3/4" Hex Head Cap Screw	2
Y*	002116	5/16" Lock Washer	2
Z*	040089	Dump Door Bracket	1
A1	001403	3/8" x 3/4" Socket Head Cap Screw	1
B1	040098	6" Flat Seal Ring	1
C1	040085	Dump Door Wear Plate AR	1
D1	040084	Dump Door	1
E1	040092	Dump Door Lever	1
F1	040093	Dump Door Lever Handle	1
G1	040281	Shell Ribs	4
H1	040107	Crib Liner	1



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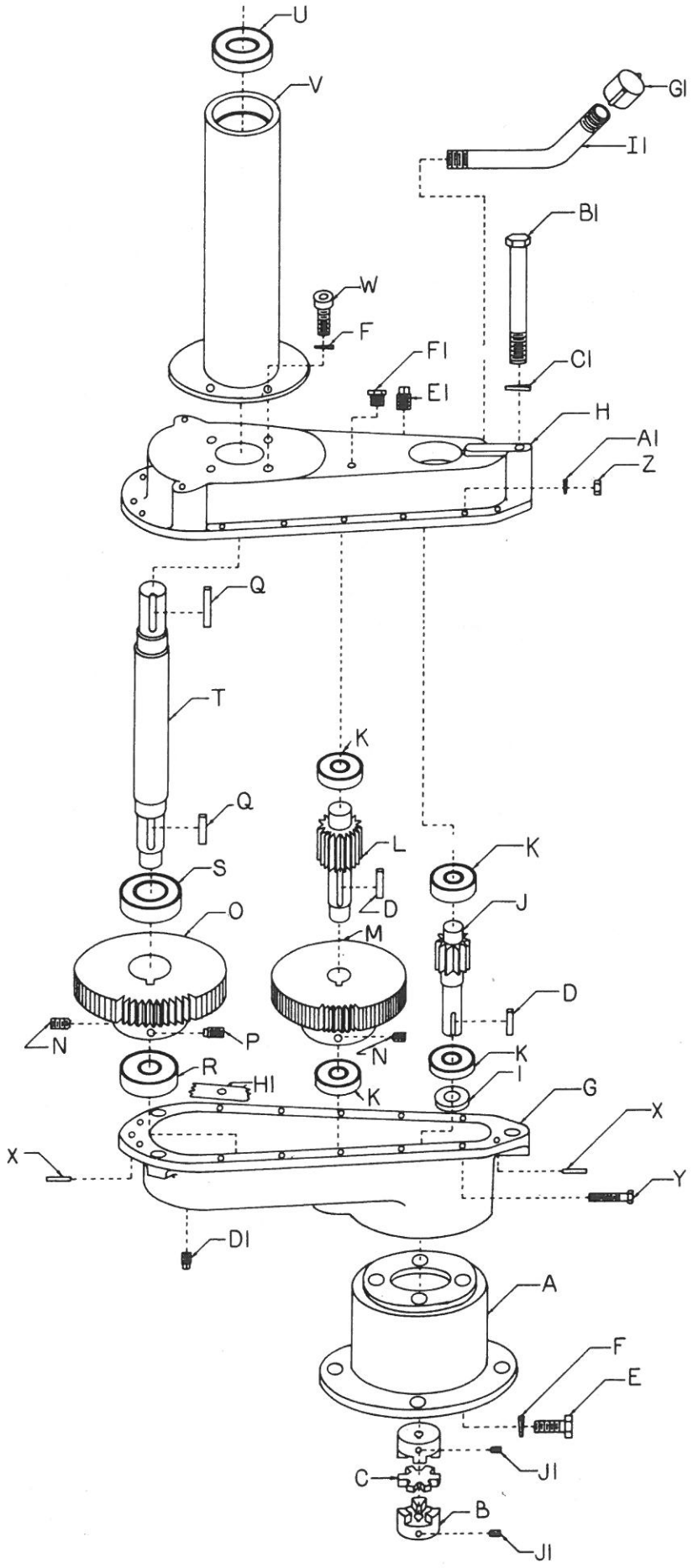
SWIF-MUL

ML-65 PLOW AND WHEEL ASSEMBLY

			Qty
A	040081	Muller Cast Base	1
B	040060	Gear Box Assembly	1
C	040069	1/4" x 1" Square Key	1
D	040011	Felt Seal	1
E	000453	#10-24 x 1/2" Self Tapping Screw	6
F	040420	Bearing Cap	2
G*	040017	Retaining Ring	2
H*	040023	Wheel Bearing	4
I	040021	Muller Wheel	2
J*	040022	Thomas Quad Seal	2
K*	040016	Axle	2
L	002013	5/16" Lock Nut	2
M	000906	5/16" x 1 1/4" Hex Head Machine Screw	2
N	040013	Axle Casting	2
O	040015	Rubber Boot Seal	2
P	040014	3/8" x 2 1/2" Pin	2
Q	001054	5/16" x 1/2" Socket Head Set Screw	2
R	040027	Pivot Pin Bushing	4
S	000905	5/16" x 1" Hex Head Cap Screw	3
T	002116	5/16" Lock Washer	7
U	002115	5/16" Flat Washer	6
V	040041	Inside Plow Assembly	1
W	040025	Plow Drive Casting	1
X	000908	5/16" x 1 3/4" Hex Head Cap Screw	4
Y*	040028	6" Tension Spring Leaf	1
Z*	040029	9 3/4" Curved Tension Spring Leaf	1
A1*	002016	3/8" Jam Nut	1
B1*	001390	3/8" x 2" Dog Point Screw	1
C1	040031	Outside Plow Assembly	1
D1	040123	Aluminum Funnel	1
E1	000805	1/4" x 1/2" Socket Head Set Screw	4
F1	040012	Wheel Drive Casting	1
G1	002121	3/8" Flat Washer	1
H1	000930	5/16" x 1 1/4" Hex Head Cap Screw	1
*	040026	Tension Spring Leaf Assembly (Includes A1, B1, Y, Z)	1
*	040141	Replacement Wheel Bearing Cartridge (Includes K, H, J, G)	2



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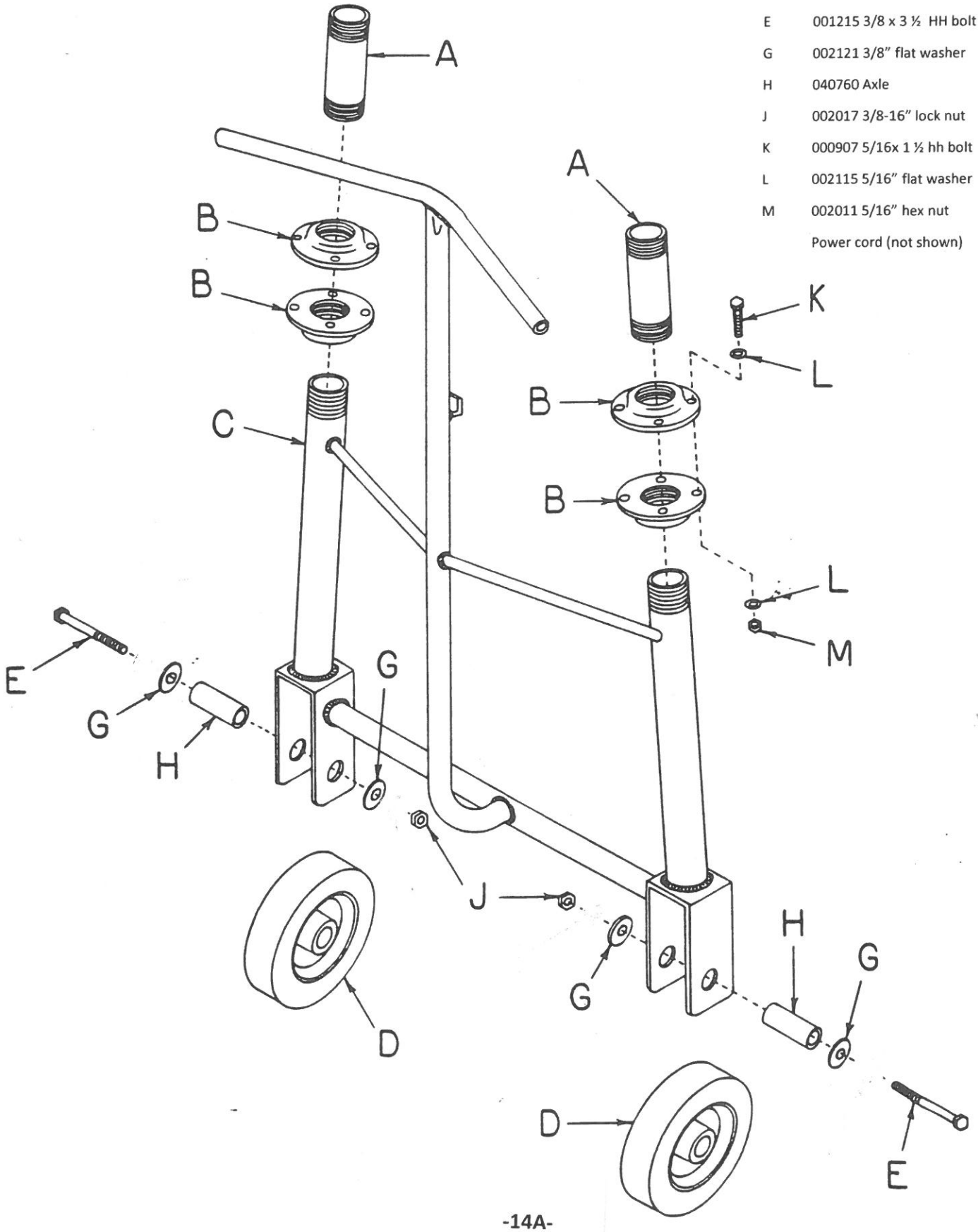
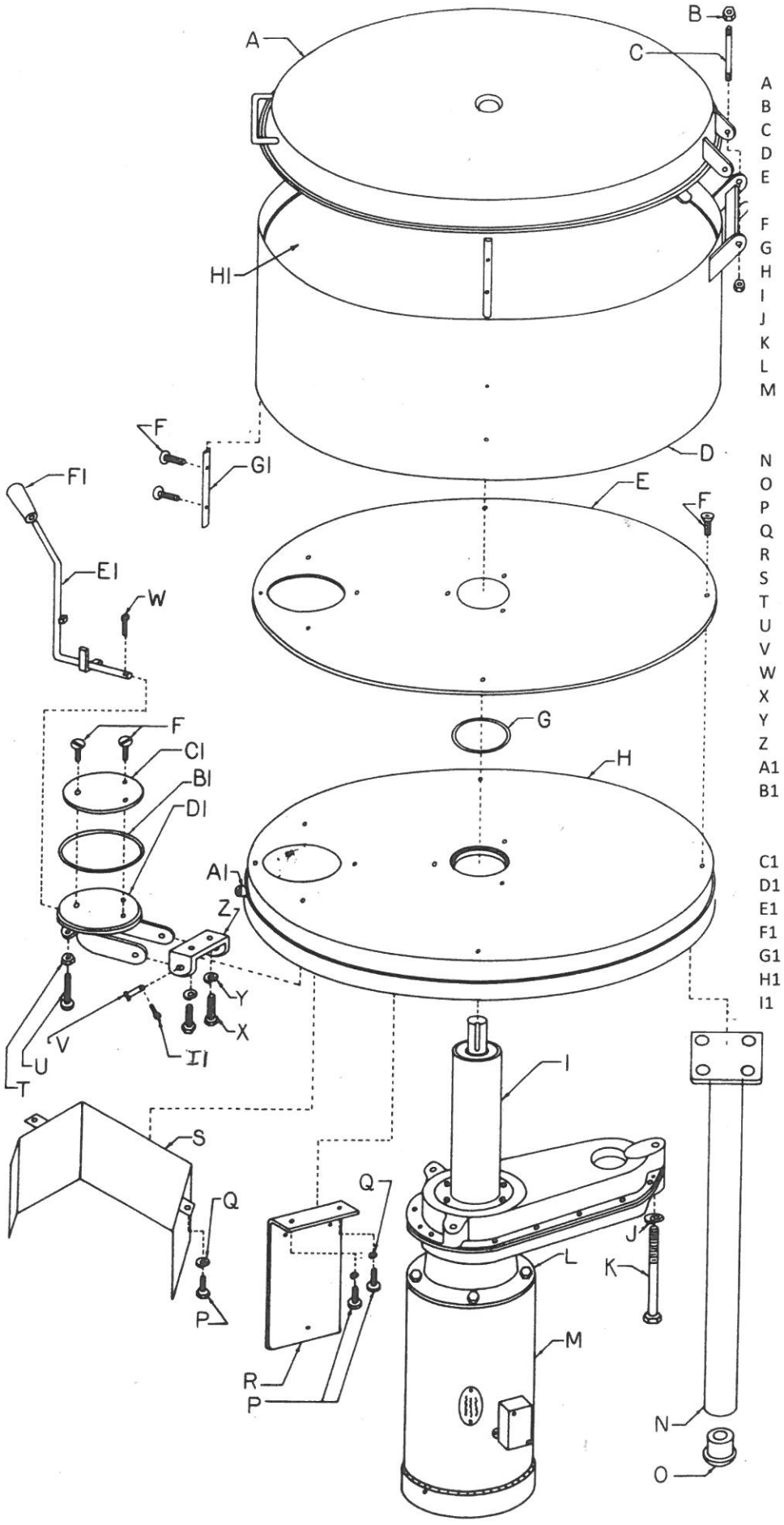
SWIF-MUL

ML-65 GEAR BOX ASSEMBLY

			Qty
A	040051	Motor Adaptor	1
B	040052	Universal Joint	1
C	040056	Universal Joint Rubber Insert	1
D	040053	3/16" Sq x 3/4" Key	2
E	001205	3/8" x 1" Hex Head Screw	4
F	002122	3/8" Lock Washer	8
G	040061	Lower Half Gear Box	1
H	040062	Upper Half Gear Box	1
I	040063	Drive Pinion Seal	1
J	040064	Drive Pinion Gear	1
K	040065	Int. Pinion Bearing	4
L	040066	Intermediate Pinion	1
M	040067	Int. Pinion Spur Gear	1
N	001053	5/16" x 3/8" Socket Head Set Screw	2
O	040068	Drive Shaft Spur Gear	1
P	001062	5/16" x 1/2" Dog Point Set Screw	1
Q	040069	1/4" Square x 1" Key	2
R	040070	Drive Shaft Bottom Brg	1
S	040071	Drive Shaft Middle Brg	1
T	040072	Drive Shaft	1
U	040071	Drive Shaft Upper Brg	1
V	040074	Drive Shaft Housing	1
W	000902	5/16" x 5/8" Socket Head Cap Screw	4
X	040078	1/4" x 3/4" Dowel Pin	2
Y	000708	1/4" x 1" Hex Head Bolt	10
Z	002008	1/4" Hex Nut	10
A1	002112	1/4" Lock Washer	10
B1	001515	1/2" x 4" Hex Head Cap Screw	3
C1	002132	1/2" Lock Washer	3
D1	003323	3/8" Black Steel Plug	1
E1	003322	1/4" Black Steel Plug	1
F1	003460	1/8" Brass Air Vent	1
G1	003330	3/8" Fill Cap	1
H1	040079	Gear Box Gaskets	2
I1	040088	Gear Box Fill Pipe	1
J1	000802	1/4" x 5/16" Set Screw	2

PM65 Porto Unit	06/2017	Qty
A	003112 1 ¼" x 4 ½" Nipple	1
B	003433 1 ¼" Floor Flange	4
C	040726 Porto Frame Assm	1
D	003507 8" Muller Wheel	2
E	001215 3/8 x 3 ½ HH bolt	2
G	002121 3/8" flat washer	4
H	040760 Axle	2
J	002017 3/8-16" lock nut	2
K	000907 5/16x 1 ½ hh bolt	8
L	002115 5/16" flat washer	16
M	002011 5/16" hex nut	8
	Power cord (not shown)	1

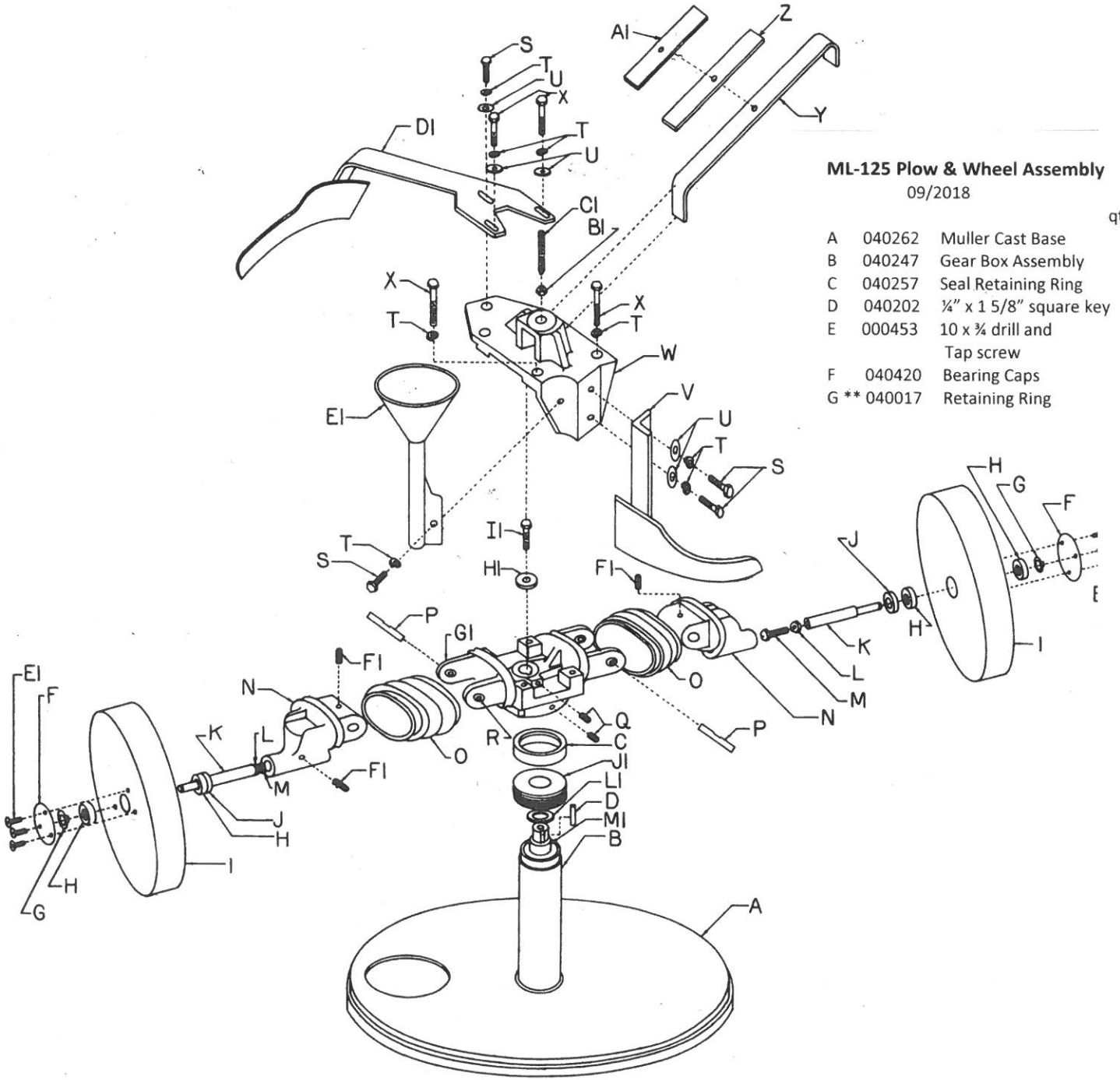




ML-125 Base and Tub Assembly

11/2018

A	040284	Muller Lid Assembly	1
B	002016	3/8-16 Hex Jam Nut	2
C	040114	3/8" Hinge Pin	1
D	040285	Muller Shell Assembly	1
E	040282	Base Wear Plate	1
	(includes C1)		
F	000454	10-24 x ½" flat head screw	21
G	040272	O'ring- **obsolete**	1
H	040262	Muller Cast Base	1
I	040247	Gear Box Assembly	1
J	002132	½" Lock Washer	3
K	001515	½" x 4" Hex Hd Capscrew	10
L	001205	3/8" x 1" Hex Hd Screw	4
M	004126	2HP motor **three** phase	1
		Or	
	004127	2HP motor **single** phase	1
N	040275	Muller leg assembly	3
O	040276	Drive In Feet	3
P	000702	¼" x 5/8" hx hd Mach Screw	4
Q	002112	¼" Lock Washer	4
R	040139	Control Box Mount Bracket	1
S	040289	Dump Chute Assembly	1
T	002008	¼" Hex Head Nut	2
U	000611	¼" x 1 ½" Rnd Hd Mach Scw	2
V	000912	5/16" x 2" Hex Bolt	2
W	040086	1/8" x 1 ½" Cotter Pin	1
X	000909	5/16" x ¾" shcs	2
Y	002116	5/16" Lock Washer	2
Z	040267	Dump Door Bracket	1
A1	001403	3/8" x ¾" shcs	1
B1	040271	7 1/16" dump door seal	1
		(FLAT SEAL)	
		Older models have oring	
C1	040264	Dump Door Wear Plate	1
D1	040263	Dump Door	1
E1	040290	Dump Door Lever	1
F1	040093-D	Dump Door Lever Handle	1
G1	040281	Muller Rib	4
H1	040287	Crib Liner	1
I1	002011	5/16" Hex Nut	2



ML-125 Plow & Wheel Assembly
09/2018

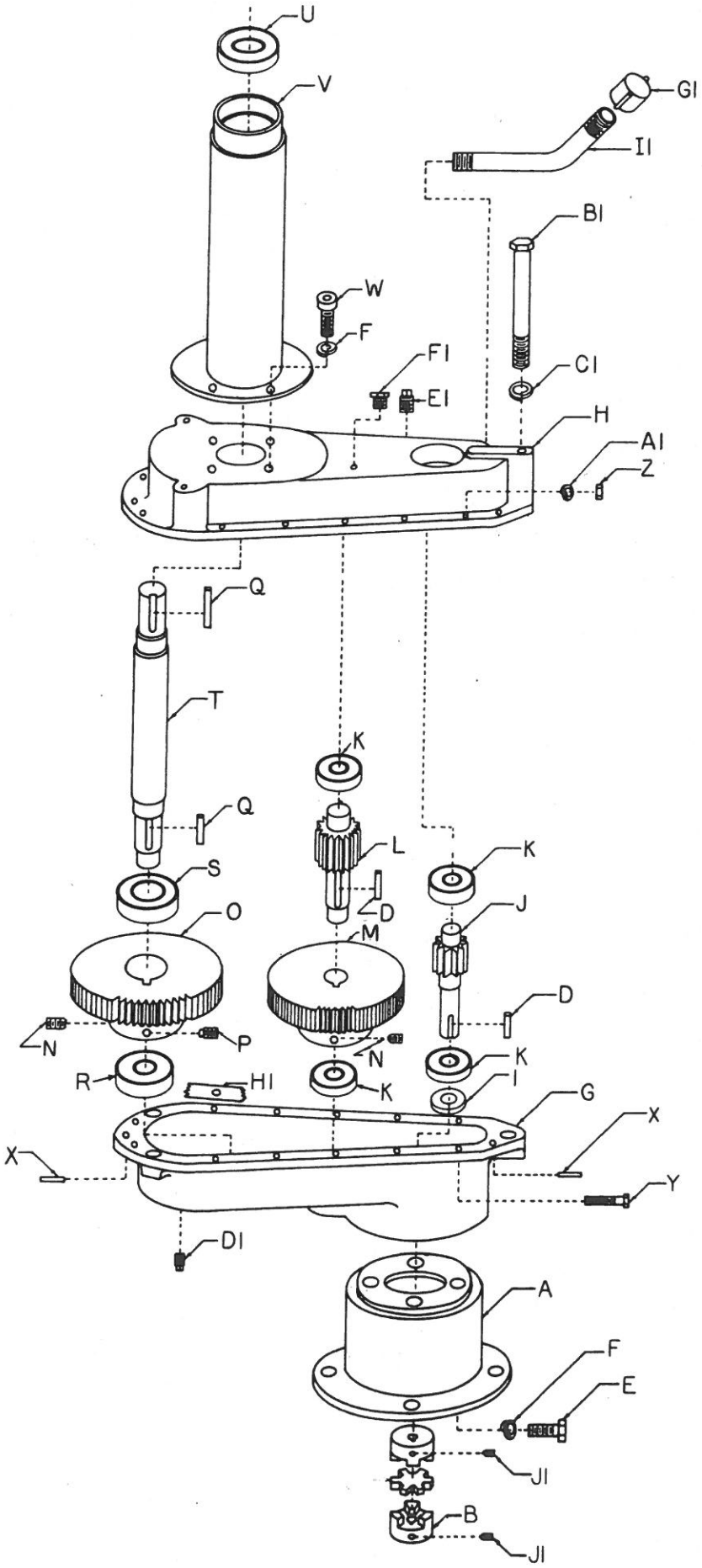
			qty
A	040262	Muller Cast Base	1
B	040247	Gear Box Assembly	1
C	040257	Seal Retaining Ring	1
D	040202	¼" x 1 5/8" square key	1
E	000453	10 x ¾ drill and Tap screw	6
F	040420	Bearing Caps	2
G **	040017	Retaining Ring	2
H**	040023	Wheel Bearing	4
I	040217	Muller Wheels	2
J **	040022	Quad Seals	2
K **	040270	Axle	2
L	002013	5/16"Lock Nut	2
M	000930	5/16" x 1 ¼" HHMS	4
N	040212	Axle Casting	2
O	040214	Rubber Boot Seal	2
P	040213	Axle Pivot Pin 3/8 x 3	2
Q	001054	5/16" x ½" socket hd	2
R	040027	Pivot Pin Bushing	4
S	000905	5/16" x 1" Hex Screw	3
T	002116	5/16" Lock Washer	7
U	002115	5/16" Flat Washer	6
V	040241	Inside Plow Assembly	1
W	040025	Plow Drive Casting	1
X	000960	5/16" x 2 ¾" stud	4
Y*	040218	Curved Tension Spring	1
Z *	040219	8" Tension Spring Leaf	1
A1*	040028	6" Tension Spring Leaf	1
B1*	002016	3/8" Jam Nut	1
C1*	001390	3/8" x2" dog pt screw	1
D1	040223	Outside Plow Assembly	1
E1	040123	Funnel	1
F1	000806	¼" x ¾" socket hd ss	4
G1	040211	Wheel Drive Casting	1
H1	040237	3/16" x 1 ½" Washer	1
I1	000930	5/16" x 1 ¼" hex hd	1
J1	040128	Washer set (6 rubber,1 plastic)	1
L1	040176	Drive Shaft Spacer	1
M1	040254	Drive Shaft Seal Ring	1

***order 040229 Tension Spring Leaf Assembly (Incldes Y,Z,A1,B1,C1) Requires one per muller**

****order 040304 Replacement wheel Bearing cartridge (includes G,H,J,K) Requires 2 cartridges per muller**

ML-125 Gear Box Assembly

Part #040247 01/2015



A	040051	Motor Adaptor Housing	1
B	040052	Coupling -2 halves and insert	1
D	040053	3/16" Square Key	2
E	001205	3/8" x 1" Hex Head Bolt	8
F	002122	3/8" Lock Washer	8
G	040061	Lower Half Gear Box	1
H	040062	Upper Half Gear Box	1
I	040063	Drive Pinion Seal	1
J	040064	Drive Pinion Gear	1
K	040065	Int.Pinion Bearing	4
L	040066	Intermediate Pinion	1
M	040067	Int.Pinion Spur Gear	1
N	001053	5/16" x 3/8" Socket Hd	2
O	040068	Drive Shaft Gear	1
P	001054	5/16" x ½" Set Screw	1
Q	040069	¼" Sq x 1 1/4" Key	2
R	040070	Drive Shaft Bottom Brg	1
S	040071	Drive Shaft Middle Brg	1
T	040250	Drive Shaft	1
U	040251	Drive Shaft Upper Bearing	1
V	040252	Drive Shaft Housing	1
W	000909	5/16-18 x 3/4"socket hd	4
X	040078	¼" x ¾" Dowel Pin	2
Y	000708	¼" x 1" Hex Hd Screw	10
Z	002008	¼" Hex Head Nut	10
A1	002112	¼" Lock Washer	10
B1	001515	½" x 4" Hex Head Capscrew	3
C1	002132	½" Lock Washer	3
D1	003323	3/8" Black Steel Plug	1
E1	003322	¼" Black Steel Plug	1
F1	003460	1/8" Brass Air Vent	1
G1	003330	3/8" Fill Cap	1
H1	040079	Gear Box Gasket	2
I1	040088	Gear Box Fill Pipe	1
J1	000802	¼" x 5/16" Socket Hd	2

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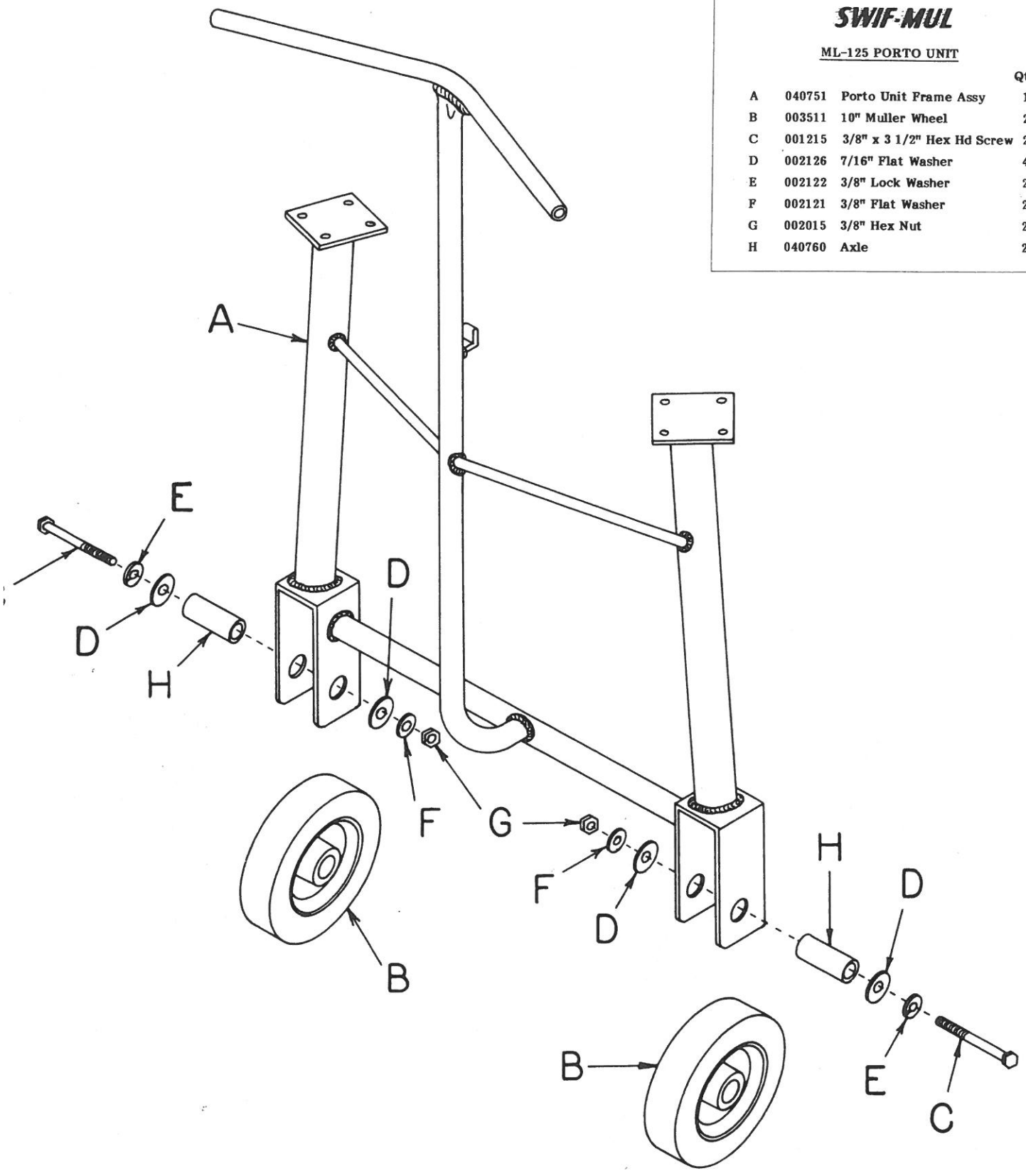
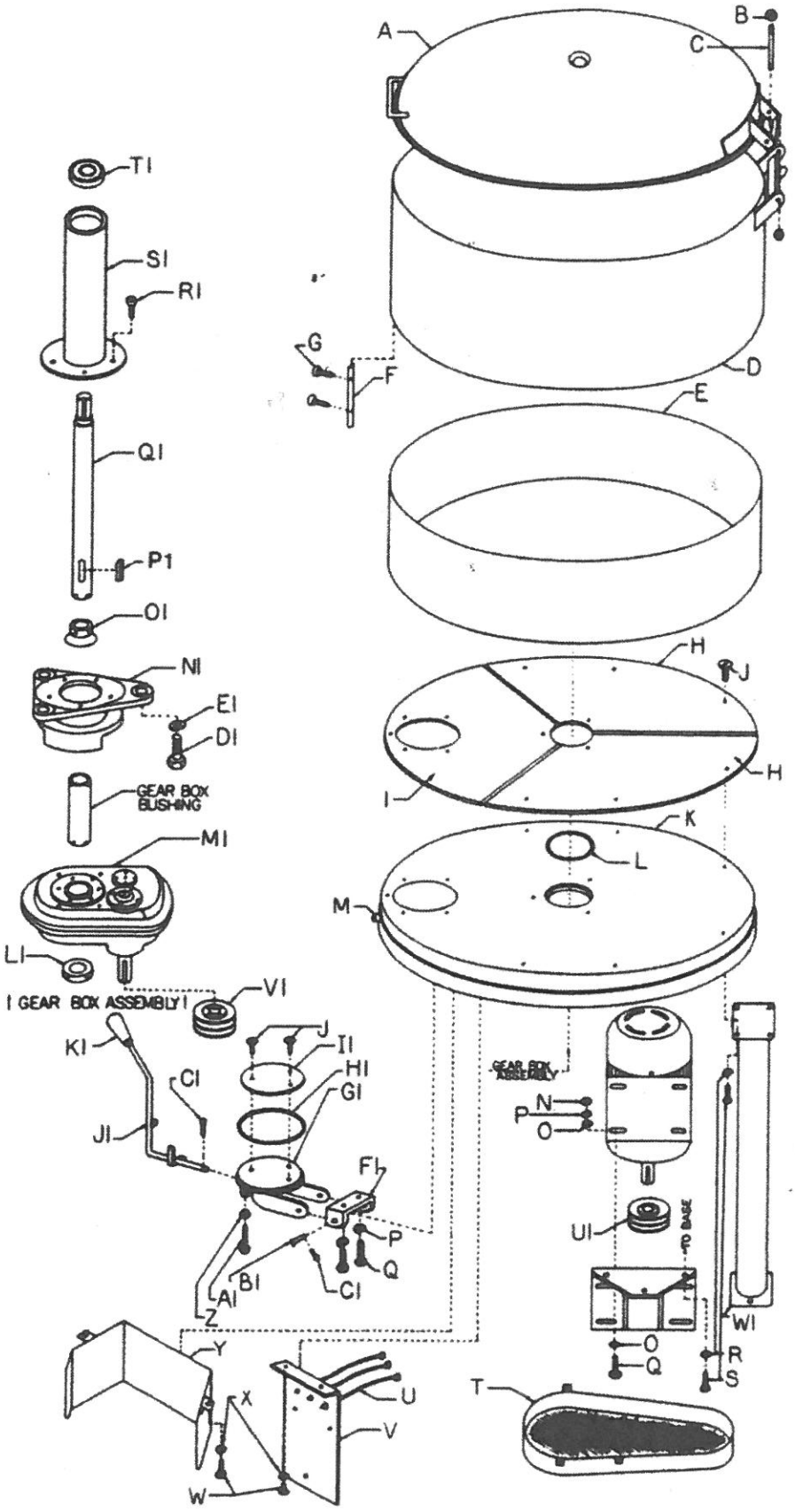
ML-125 PORTO UNIT

			Qty
A	040751	Porto Unit Frame Assy	1
B	003511	10" Muller Wheel	2
C	001215	3/8" x 3 1/2" Hex Hd Screw	2
D	002126	7/16" Flat Washer	4
E	002122	3/8" Lock Washer	2
F	002121	3/8" Flat Washer	2
G	002015	3/8" Hex Nut	2
H	040760	Axle	2





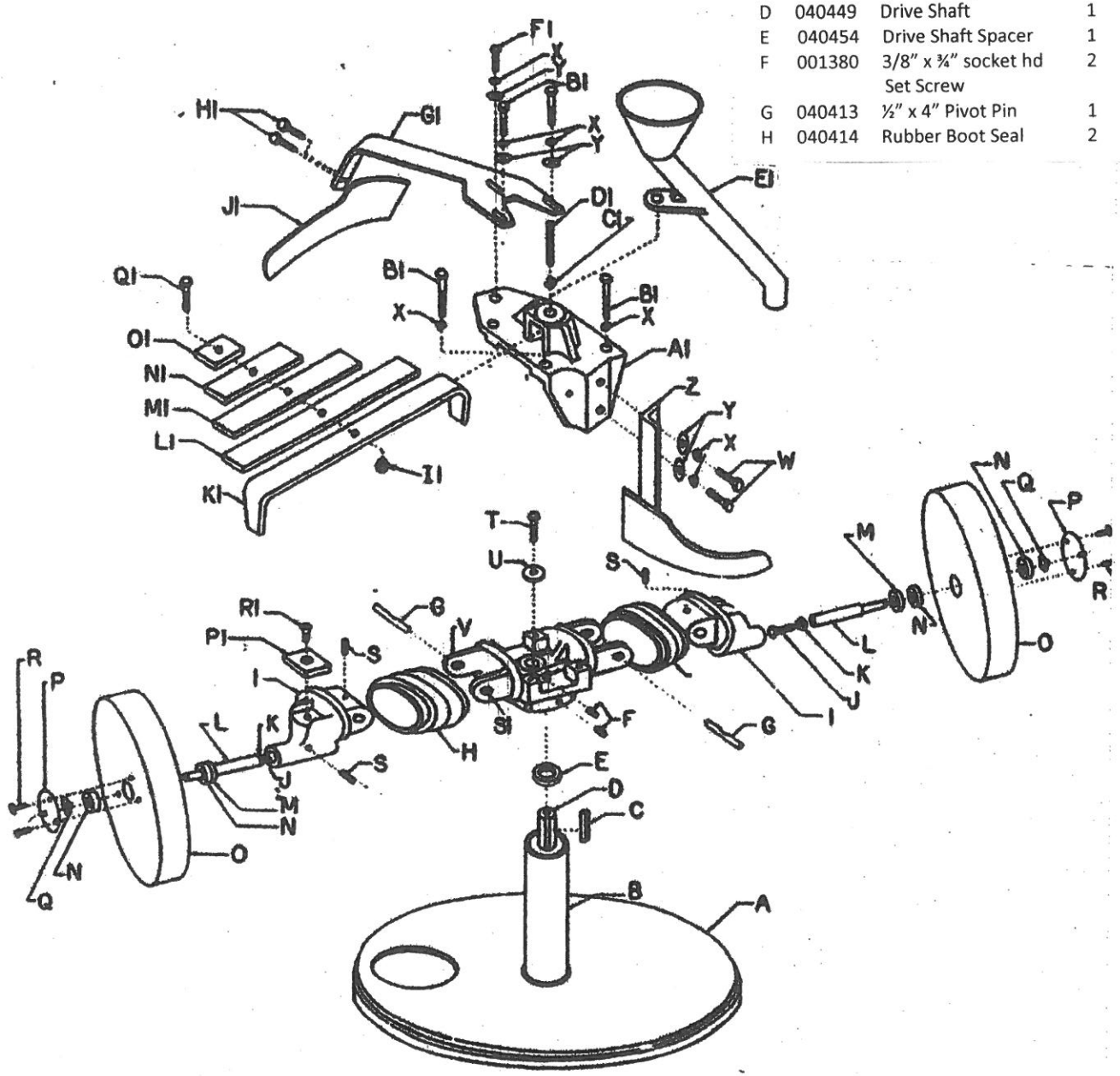
ML-250 Base & Tub Assembly

09/2017

			qty
A	040480	Muller Lid Assembly	1
B	002023	½" Jam Nut	2
C	040484	½" Lid Hinge Pin	1
D	040477	Muller Shell Assembly	1
E	040550	Crib Lining AR with ribs	1
F	040281	Muller Ribs	8
G	000454	#10-24 x ½" flat hd ms	16
H	040460	Base Wear Plate Solid Pc	2
I	040461	Base Wear Plate w/Opening	1
J	000902	5/16" x 3/4" FSH	20
K	040459	Muller Cast Base	1
L	040472	1/8" x 4 1/4" OD O ring	1
M	001555	½" x 1" SH set screw	1
N	002015	3/8" Hex Head Nut	4
O	002121	3/8" Flat Washer	4
P	002122	3/8" Lock Washer	6
Q	001201	3/8" x 1 1/2" SH screw	2
R	002132	½" Lock Washer	12
S	001504	½" x 1 ¼" Hx Hd CS	12
T	040499	Belt Guard	1
U	040456	Lubrication Assembly (obsolete part)	1
V		Control Mount Plate	1
W	000702	¼" x 5/8" HHMS	4
X	002112	¼" Lock Washer	4
Y	040492	Dump Chute Assembly	1
Z	002012	5/16" Jam Nut	2
A1	000710	¼" x 1 ½" hex hd bolt	2
B1	001211	3/8" x 2 ½" bolt	2
C1	040086	1/8" x 1 ½" Cotter Pin	2
D1	001808	¾" x 2" HHCS	3
E1	002146	¾" Lock Washer	3
F1	040466	Dump door Bracket	1
G1	040462	Dump Door	1
H1	040471	9 1/32 OD x 7 3/8 OD flat seal	1
I1	040463	Dump Door Wear Plate AR	1
J1	040467	Dump Door Lever	1
K1	040093	Dump Door Lever Handle	1
L1	040448	Set Collar (older models only)	1
M1	040438	Gear Box	1
N1	040625	Gear Box Mount Bracket	1
O1	040447	Sand Slinger Casting (obsolete part)	1
P1	040517	Drive Shaft Key	1
Q1	040449	Drive Shaft	1
R1	001557	½" x 1 ½" Hex HdCS	4
S1	040451	Drive Shaft Housing	1
T1	040450	Upper Drive Shaft Bearing	1
U1	040524	Motor Pulley 2AK49H	1
V1	040526	Gear Box Pulley	1
W1	040473	Muller Leg Assembly	3

ML-250 Plow & Wheel Assembly

08/2016



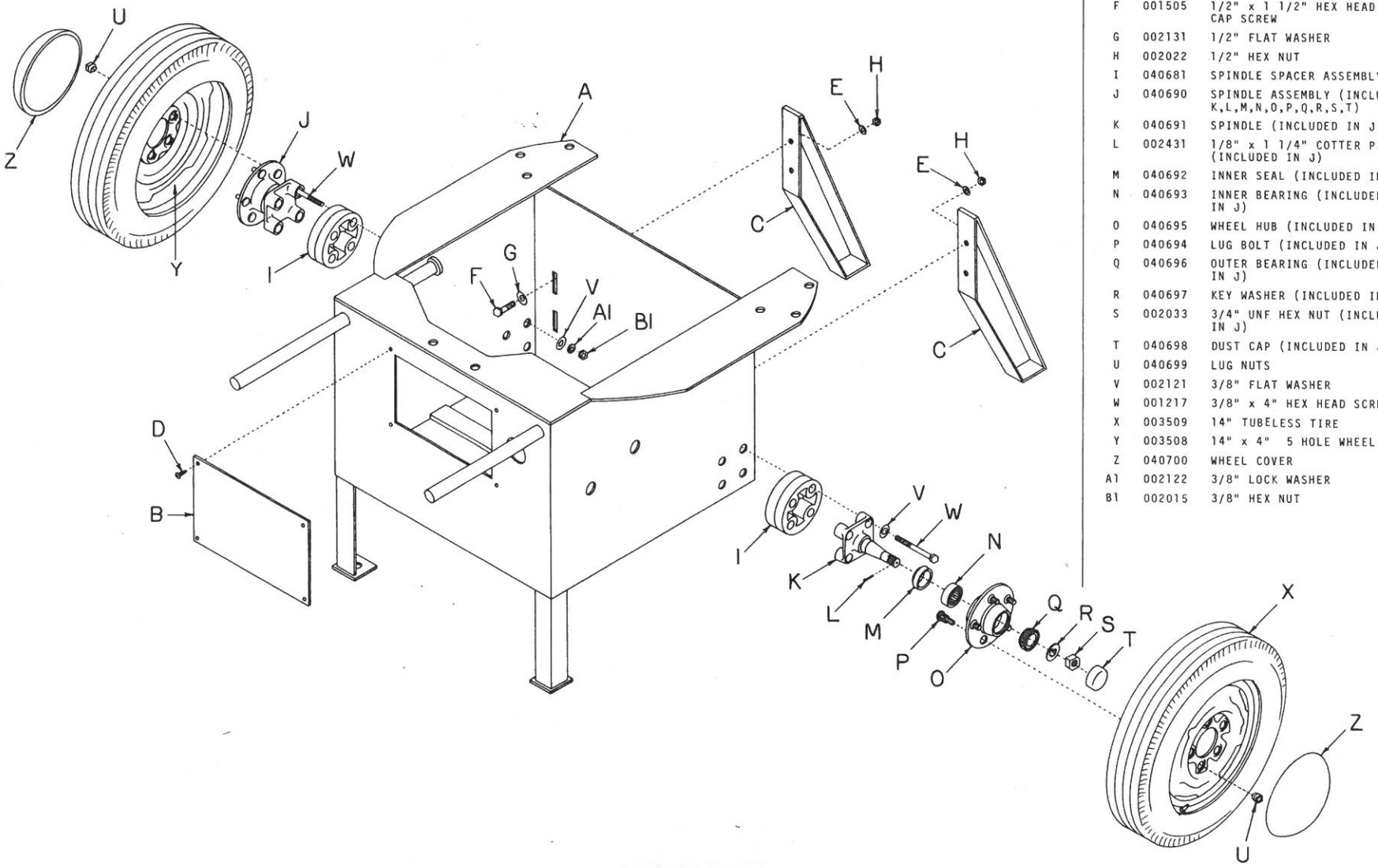
			qty
A	040459	Muller Cast Base	1
B	040451	Drive Shaft Housing	1
C	040517	3/8" x2"Key	1
D	040449	Drive Shaft	1
E	040454	Drive Shaft Spacer	1
F	001380	3/8" x ¾" socket hd Set Screw	2
G	040413	½" x 4" Pivot Pin	1
H	040414	Rubber Boot Seal	2
I	040412	Axle Casting	2
J	001208	3/8" x 1 ¾" Hx Hd Screw	2
K	002016	3/8" Jam Nut	2
L **	040415	Axle	2
M **	040419	Thomas Quad Seal	2
N **	040418	Wheel Bearing	4
O	040417	Muller Wheel	2
P	040420	Wheel Bearing Cap	2
Q **	040512	Wheel Retaining Ring	2
R	000453	#10 x 3/4" Self Tapping Screw	4
S	001053	5/16" x 3/8" Set Screw	4
T	001525	½" x 1 ½" Fine Thread Hex Head Cap Screw	1
U	002131	½" Flat Washer	1
V	040411	Wheel Drive Casting	1
W	001455	7/16" x 1 ½" Stud	2
X	002127	7/16" Lock Washer	7
Y	002126	7/16" Flat Washer	7
Z	040434	Inside Plow Assembly	1
A1	040421	Plow Drive Casting	1
B1	001461	7/16" x 4" stud	4
C1	002023	½" Jam Nut	1
D1	001620	½" x" 3" Sq Hd Bolt	1
E1	040493	Water Funnel	1
F1	001455	7/16" x 1 ½" stud	1
G1	040432	Outside Plow Arm	1
H1	001205	3/8" x 1" Hx Hd Screw	2
I1 *	002008	¼" Hex Nut	1
J1	040430	Outside Plow Blade	1
K1*	040422	Curved Tension Spring Leaf	1
L1*	040426	13 ½" Flat Spring Leaf	1
M1 *	040425	10 ½" Flat Spring Leaf	1
N1*	040424	7 ½" Flat Spring Leaf	1
O1*	040423	4 ½" Flat Spring Leaf	1
P1	040513	Spring Wear Pad	1
Q1*	000710	¼" x 1 ½" Hex Head Machine Screw	1
R1	000652	¼" x 1 ½" Flat Head Machine Screw	1
S1	040514	Axle Pivot Pin Bushing	4

***order 040427 Tension Spring Leaf Assembly (Incldes I1,K1,L1,M1,N1,O1,Q1) Requires one per muller**

****order 040429 Replacement wheel Bearing cartridge (includes L,M,N,Q) Requires 2 cartridges per muller**

McENGLEVAN
SWIF-MUL

PM-250 PORTABLE MULLER



			QTY
A	040652	CARRIAGE BODY ASSY	1
B	040661	MOTOR ACCESS HOLE PLATE	1
C	040670	FRONT LEG ASSEMBLY	2
D	000523	#10-24 SELF TAPPING MACHINE SCREW	4
E	002132	1/2" LOCK WASHER	4
F	001505	1/2" x 1 1/2" HEX HEAD CAP SCREW	4
G	002131	1/2" FLAT WASHER	4
H	002022	1/2" HEX NUT	4
I	040681	SPINDLE SPACER ASSEMBLY	2
J	040690	SPINDLE ASSEMBLY (INCLUDES K,L,M,N,O,P,Q,R,S,T)	2
K	040691	SPINDLE (INCLUDED IN J)	2
L	002431	1/8" x 1 1/4" COTTER PIN (INCLUDED IN J)	2
M	040692	INNER SEAL (INCLUDED IN J)	2
N	040693	INNER BEARING (INCLUDED IN J)	2
O	040695	WHEEL HUB (INCLUDED IN J)	2
P	040694	LUG BOLT (INCLUDED IN J)	10
Q	040696	OUTER BEARING (INCLUDED IN J)	2
R	040697	KEY WASHER (INCLUDED IN J)	2
S	002033	3/4" UNF HEX NUT (INCLUDED IN J)	2
T	040698	DUST CAP (INCLUDED IN J)	2
U	040699	LUG NUTS	10
V	002121	3/8" FLAT WASHER	16
W	001217	3/8" x 4" HEX HEAD SCREW	8
X	003509	14" TUBELESS TIRE	2
Y	003508	14" x 4" 5 HOLE WHEEL	2
Z	040700	WHEEL COVER	2
A1	002122	3/8" LOCK WASHER	8
B1	002015	3/8" HEX NUT	8

ELECTRICAL CHARACTERISTICS AND SPECIFICATIONS

THE SELECTION OF FIELD WIRE FOR INCOMING POWER SHALL BE BASED ON THE FOLLOWING:

MINIMUM CIRCUIT AMPACITY:

	ML-65	ML-125	ML-250
460 V. 3 Ph. =	2 Amps	4 Amps	9 Amps
230 V. 3 Ph. =	4 Amps	8 Amps	18 Amps
230 V. 1 Ph. =	8.2 Amps	15 Amps	35 Amps
115 V. 1 Ph. =	16.3 Amps	30 Amps	70 Amps

THE SELECTION OF FIELD FUSES FOR THE EQUIPMENT PROTECTION SHALL BE BASED ON THE FOLLOWING FUSE SIZES:

	ML-65	ML-125	ML-250
460 V. 3 Ph. =	15 Amps	15 Amps	15 Amps
230 V. 3 Ph. =	15 Amps	15 Amps	30 Amps
230 V. 1 Ph. =	15 Amps	30 Amps	60 Amps
115 V. 1 Ph. =	30 Amps	50 Amps	110 Amps

ALL FUSES SHALL BE THE DUAL ELEMENT TYPE TO COMPLY WITH N.E.C. ARTICLE 430-52-1975. ALL FUSES ARE THE ***MAXIMUM FUSE SIZE***.

USE DIAGRAM #___ FOR FIELD POWER CONNECTION OR TO TROUBLE SHOOT THE ELECTRICAL SYSTEM.

SERVICE DIAGNOSIS FOR ML UNITS

CONDITION	POSSIBLE CAUSE	CORRECTION
Unit fails to start	(a) No power from the service supply	(a) Check for blown fuse or faulty circuit breaker
	(b) Control fuse blown	(b) Remove and test fuse
	(c) No power from the general service system	(c) Check for other working machinery or main power source
	(d) Jammed micro switch on lid interlock	(d) Lift the muller cover and depress the lid switch several times
Motor hums	(a) Low incoming voltage	(a) Voltage for the motor must be within 10% plus or minus the rated motor voltage. Check the actual voltage supply with a voltmeter
	(b) Loose interconnecting terminal connections	(b) Check latest connection done at the main switch and at the muller control box
	(c) Jammed gear box	(c) Contact the manufacturer
	(d) Muller overloaded with sand	(d) Check lid label for maximum load weight
Excessive noise	(a) Motor bearings are worn out	(a) Replace motor bearings
	(b) Motor mounting bracket is loose	(b) Tighten the bolts of the mounting bracket
	(c) Improper adjustment of the plows	(c) Adjust the plows and wheels per instructions in operating manual
	(d) Dirt in the bearing	(d) Replace seal and bearing
Excessive wear	(a) Improper cleaning	(a) Clean muller per step #5 in operating Bulletin #1025 of manual
Motor runs and then stops	(a) The load is too heavy for the motor	(a) Check for proper weight
	(b) Motor protector trips out	(b) Allow enough time for the motor to cool off, and the automatic protector will reset
	(c) Line voltage may be too low	(c) Check the actual voltage supply
Sand moves ahead of the wheels and plows	(a) Occurs when mulling oil bonded sand	(a) Reduce amount of sand to proper level. Refer to instructions in operating manual
Plows and wheels stop rotating. On Model ML 250 only	(a) Broken "V" belts	(a) Replace with similar type of "V" belt
	(b) Belt adjustment loose	(b) Tighten belt adjustment

PREPARATION OF GREEN MOLDING AND CORE SANDS

Mulling, Preparation and Mixing Methods

WATER TEMPER MOLDING SAND

All foundry molding sands must be mulled and prepared correctly or casting difficulties will occur. Mulling must be thorough. All mulling and mixing devices have recommended time cycles established by the manufacturer for achieving the best performance. Since sand, clay, additives and water mixtures must be mulled thoroughly, a shortened mixing or mulling operating is not advised.

Sand, clay bond and temper water, when correctly mulled and prepared, produce a satisfactory green molding sand mixture. Many other products may be added to supplement the mixture for special reasons. A few of the more popular foundry additives are: Western Bentonite, Southern Bentonite, Ground Kaolinite (fire clay), Wood Flour (cellulose), Iron Oxide, and Sea Coal (carbon).

A typical *SYNTHETIC GREEN SAND MIXTURE* for light to medium castings is as follows:

Silica or Bank Sand, A.F.S.; GFN 90-180	95.0% by wt.
Southern Bentonite (Panther Creek)	5.0% by wt.
Temper Water	3.0-3.5% by wt.

A popular *SEMI-SYNTHETIC GREEN SAND MIXTURE* for light to medium castings is:

Silica or Bank Sand, A.F.S.; GFN 90-140	73.0% by wt.
Natural Bonded Sand (8%-12% natural clay as mined)	25.0% by wt.
Southern Bentonite (Panther Creek)	2.0% by wt.
Temper Water	4.0% by wt.

The ideal molding sand mixture contains grains evenly coated with bentonite or clay, with but little left free in the interstices between them. In that condition the bond strength of the bentomite is utilized to its fullest value and the molding sand is at its best for overall foundry properties. To accomplish this, mulling must be thorough.

THE MULLING PROCESS DIFFERS FROM MIXING. The purpose of mixing is to distribute the various supplemental ingredients (such as bentonite, additives, and water) uniformly throughout the sand mass, while the purpose of mulling is to develop the strength and plasticity of the clay bond by "working it," to coat the sand grains with a film of plastic clay and water.

The most effective method of developing maximum plasticity and green strength is to employ a "kneading" action which causes the material mass to "flow" under heavy pressure. The "kneading" action is obtained by rolling large, spring-loaded muller wheels over the sand, forcing the sand to "flow" under extremely high unit pressures. Plows following the muller shells, repile the sand in the muller wheels path. The sand is squeezed out to either side under the heavy pressure of the wheel.

The kneading and plowing action of the muller develops the green compression strength of bentonite bonded sand to the utmost. A mulling time of only 5 to 6 minutes brings out 80% to 90% of the green compression strength that would have been obtainable in 15 minutes. The results of a tested mixture containing 4% by weight Volclay and 96% by weight silica sand with 2.5 temper water are illustrated in the following mulling time series. Mulling time verses green strength in psi. is as follows:

3 min.----6.5 psi.	5 min.----7.8 psi.	15 min.----8.6 psi.
4 min.----7.2 pis.	6 min.----8.0 psi.	10 min.----9.0 psi.

MANUAL MIXING PRIOR TO MULLING

Bentonite can be blended with heap sand by hand shoveling when no other facilities are available. The molding sand must necessarily be worked in small batches, Granular bentonite works best and is first stirred uniformly through the heap sand in dry

form. It is better to measure the additions of bentonite by weight rather than by volume, since this is often difficult, the method of measuring by volume should be carefully watched.

The proper sequence of ingredient additions to the sand is essential when building a proper sand mixture. The mixing and/or mulling of ingredients in the foundry can be a big variable. A very small percentage of specified materials are used with a larger percentage of sand. A 1% additive addition may be considered good practice, but a 2% additive addition may be detrimental to the outcome of the castings. Indifferent and careless work must not be tolerated.

MULLING NEW WATER TEMPERED SAND

New water tempered sand - general instructions:

1. Put dry sand in the muller.
2. Add the water and mull for one minute to mix uniformly.
3. Add the bentonite and mull for approximately eight minutes. (If wheel pressure is properly adjusted, eight minutes is usually sufficient. More time may be required if the wheel pressure is too low. If more than twelve minutes is required, the wheel pressure should be increased.)

TEMPERING - WATER ADDITION - SEQUENCE OF ADDITIONS

Some foundries prefer to add only one-half the batch of the total molding sand to the muller for retempering and rebonding. After mulling for two minutes, all the temper water required for the molding mixture is added. After mulling this over-tempered one-half batch load for approximately two minutes in a vertical wheel muller, the balance of the molding sand is added, together with the required bond and additives.

The length of mulling time is more important when the sand mixture requires little temper water, as sand control dictates that the molding mixture be worked under a 3.0% moisture content.

REBONDING, TEMPERING, AND SEQUENCE OF ADDITIONS

When it is necessary to rebond green molding sand to regain green strength or other properties, a small amount of fire clay, bentonite or other binder can be added prior to adding the temper water. Generally, a 2% to 3% Volclay addition is sufficient when using 50% new sand and 50% old sand if the old sand has a little retained bond strength.

A sand mixture containing used molding sand needs more water than a mixture containing A-1 new sand because the dead clay and other inert fines in the used sand absorb some of the water, leaving less to develop the needed plasticity of the bentonite.

Best results are attained in water tempered heap sand needing rebonding, by following these procedures:

1. Load muller and mull for one minute to break down large sand lumps and mix sand.
2. Stop muller and check sand to determine required amount of water to be added to bring sand up to molding properties. (This will have to be done by trial and error initially, but with a little experience, accurate estimates can be made.)
3. Restart the muller, add the water and mull until sand <u>just</u> comes up to molding strength. About two to three more minutes. <u>Do not</u> over mull or sand will eventually become overly strong which results in difficulty in ramming to uniform hardness and in poor surface finishes.

OIL BONDED MOLDING SAND

Petroleum bonded molding sand, usually referred to as "Petro Bond", or oil bonded green sand. A non-detergent oil is used to activate the binder in the sand mixture. The greatest advantage of petroleum bonded sand for school use is the elimination of the need to "temper" the sand. The petroleum bonded sands require far less care and attention, have good sand flow characteristics, produce good detail in castings because of the finer grain size sand used.

The major disadvantages are; the smoke and fumes caused by combustion of the oil during pouring and the casting shakeout, the cost and the necessity for more frequent mulling and conditioning of the sand. Hot metal causes the oil to dry and "burn out" of the sand. Mulling and adding small quantities of oil during the mulling process will usually reactivate the sand and binder to its near original condition.

There are several firms which manufacture petroleum bonded sands, and each manufacturer has specific instructions for their own product. Three of the more popular products are "Petro Bond" made by Boroid Division of National Lead Company, "Neo-Bond" made by American Colloid Company, and "Aridry J-82", made by the Thiem Corporation. The following are mixing and mulling instructions for preparing the sands and bonding agents of the above listed manufacturers. *IF THE BINDER YOU ARE USING IS MADE BY OTHER THAN THOSE LISTED ABOVE, IT IS IMPERATIVE THAT YOU FOLLOW THEIR SPECIFIC INSTRUCTIONS VERY CLOSELY.*

BARIOD "PETRO BOND" OIL BOND SAND

Sand

This petroleum bonded sand consists of a mulled mixture of fine sand, oil, Petro Bond, and a small amount of Catalyst P-1. The type and grade of silica sand has an important effect on the physical properties and surface finish of the casting. Silica sands with a clay content below 1/2% give very good results. The finer the grain size of the silica sand, the smoother the surface of the casting and the greater detail produced. A grain fineness number of 120 to 180 has been used successfully in the laboratory and commercial foundries for casting aluminum and copper base alloys, depending on weight of casting. The use of a dried premium quality silica sand is advisable because trouble-free operation is assured.

Oil

One of the most important ingredients in making a good Petro Bond sand is the oil. Oils containing inhibitors such as specialized industrial oils and lubricating oils are not recommended as they may interfere with the Petro Bond reaction. Suitable conventionally refined oils without inhibitors can be obtained from your local dealer.

RECOMMENDED OILS TO BE USED WITH PETRO BOND

Manufacturer	ID. Number	Manufacturer	ID. Number
Texaco	Ursa P-40	Gulf	#926
Gulf	Endurance #81	Shell	Corena 72-67116

"Petro Bond"

Petro Bond is a mixture of various clays and binders, which, when added to silica sand, then mixed and mulled with oil and a catalyst, will produce petroleum bonded sand.

Catalyst

Catalyst P-1 has proved cheaper and superior to alcohol. Methyl alcohol is a satisfactory catalyst as a substitute for P-1, however, it is more volatile. About 1/8 pound of methyl alcohol per 100 pounds of sand is required. Petro Bond Catalyst P-1 has proven far superior to methanol as a catalyst. In virgin mix, the maximum requirement is one ounce per 100 pounds of sand.

Proportions For A Typical Mix

In order to prepare a typical mix, add the following material in the sequence shown:

1. 100 lbs. dried Silica Sand
2. 5 lbs. Petro Bond
3. 2 lbs. Petro Bond oil (approx. 2 pints)
4. 1 ounce Catalyst P-1

It is recommended that all ingredients be carefully weighed.

Mixing Procedure

THE SAND MIXTURE SHOULD BE MIXED IN A SAND MULLER. The time of mixing varies with the type of muller used and can be determined by varying the mixing time until the desired strength is obtained.

In a slow muller the dry ingredients should be mixed for a minimum of one minute. Subsequently, the oil can be added slowly while the muller is in motion and mulled for a period of 10 minutes. The catalyst P-1 is then added and mixed for 3 to 5 minutes. The mix can then be stored indefinitely and will be usable at any time without further treatment.

The green strength continually increases with mulling time. Fortunately, over 85% of the maximum green strength is achieved after five minutes of mulling after the Catalyst P-1 addition. If this mix results in a stronger sand than desired, it may be cut with clean sand.

The mixing of Petro Bond sand is divided into the following three phases:

FIRST — Weigh out 100 lbs. of sand and mix into it 5 lbs. of Petro Bond. Dump the load into the muller and mix dry for about one minute.

SECOND — Add to the mix in the muller 2 lbs. or 2 pints of Petro Bond oil and mull for about ten minutes.

THIRD — Add 1 ounce Catalyst P-1 and mix for 3 to 5 minutes longer. With many sands the green strength will be at least 8.5 psi.

Re-Use Of "Petro Bond" Sand

THE SAND SHOULD BE REBONDED AND RECONDITIONED BY USING A WHEEL OR PLOW TYPE MULLER INSTEAD OF A SAND MIXER. As the Petro Bond sand mix is used, the color of the mix darkens until it becomes blackened in appearance. As the mix is used, it must be revitalized by adding the mixing Petro Bond, Petro Bond oil and Catalyst P-1. The quantity and frequency of additions vary considerably, depending on the metal cast, the pouring temperature, the ratio of sand to metal, the frequency of use in the system, etc.

A sound method to follow is to use the original mixture without binder additions, but to remull and airate until the green strength has been reduced to a minimum level. At this stage binder additions and mulling must be employed. Addition of 1% Petro Bond, 1% Petro Bond oil, and 1 ounce Catalyst P-1 is a good starting point. The ratio of oil to Petro Bond used here is slightly higher than that suggested for the original mix. The oil requirement increases slightly as the mixture is used because of the accumulation of dead material which absorbs oil. The order of addition and the mulling time are the same as for preparing the original mix.

To have uniformity, add Neo-Bond and oil as often as possible and mull.

THIEM "ARIDRY J-82" OIL BOND SAND

Sand

Thiem Aridry J-82 is a waterless green sand binder in powder form and is used with very fine sands. Very small additions of a common SAE non-detergent 30 weight oil are used in the sand mix to provide a homogeneous sand with desirable flowability characteristics. Controlled Aridry J-82 sands generate very little smoke during pouring and shakeout. It requires only Aridry, oil, and sand for a complete moldable sand and may be used with fine sands of all types; i.e. silica, zircon, olivene.

Mixing Procedure

Aridry J-82 is suggested for use with fine grained sands ranging from 90 to 180 GFN. Additions of 8% to 10% Aridry and 0.1% to 0.5% of Aridry oil activator are required by weight of sand.

Aridry bonded sands may be mixed in all conventional type mullers. Average mulling times in a slow wheel muller would be 6 to 8 minutes.

A typical mixing procedure is to add Aridry J-82 to a measured amount of sand and mix til mixture is completely homogeneous. Amount of Aridry will depend on the GFN of the sand. Generally for lower GFN sands, lesser amounts of Aridry are required. Add Aridry activator oil until desired feel or moldability is reached. (Generally 0.1% to 0.3% is sufficient). If this does not develop the desired moldability, increase oil at 0.1% increments to a maximum of 0.5%. The oil should be kept at the lowest level possible.

Final mix should be flowable but possess good hand feel and be free from lumps and continuous in appearance. Sand properties expected from a typical sand mix are 8 to 9 psi. green compression and 2 to 3 psi. green shear.

Re-Use Of Thiem Aridry J-82

Shakeout sands will recover good feel after cooling. Due to Aridry's excellent durability, the rebond requirements of binder and oil are very low. It is very durable and requires only small additions of binder and oil for rebonding closed systems. Normal molding practice should be followed in producing Aridry bonded molds. Use of good quality parting agents is suggested.

Clay Balls

Mulling and mulling facing sands having a make-up of either oil bonded sand or silica may present a problem during the mulling operation due to the formation of clay balls referred to by many foundrymen as rabbit daub.

Clay balls are formed during the mulling or mixing operation. In order to prevent this it is necessary to reverse the sequence of adding the sand binders and moisture (or oil). Mix sand and binders with a certain percent of pre-determined amount of moisture (or oil) to the batch of sand. After the moisture is added it enters the sand mixture as droplets and is absorbed by the bentonites in the binders and is retained in the fluid condition. To prevent the formation of clay balls add the water to the water bonded sand (or oil to the oil bonded sand) prior to the addition of the binders. This disperses the moisture (or oil) throughout the basic sand mass and allows the entire batch to be mixed evenly. Add the binder after the sand and water (or oil) has been thoroughly mixed and continue as in the previous paragraphs for preparing molding or facing sands. The proper amount of water or oil measured should not be added indiscriminately.

Clay balls are particularly harmful since the moisture in the ball will cause surface defects in the finished casting. Changing the sequence of addition of each item in the sand make-up is the only way to prevent or allieviate the presence of clay balls and the quality of sand will not be effected by the sequence of the change of addition of the ingredients.

The normal procedure would be to weigh out the amount of clean silica sand then calculate the amount of moisture (or oil) needed in the batch and add this to the clean silica sand. Next weigh the correct amount of binder and sprinkle this over the sand mixture in the base of the muller.

Some types of no bake core sand must also be mixed in a similar way to get the proper results.

PREPARATION OF CORE SAND

The sand most commonly used in core making is silica sand. Other sands which can be used are bank, olivine, or zircone, depending on the application. The sand fineness number and other properties depend entirely on the requirements of the casting being poured, but it is usually between 60-90 AFS G.F.N.

The binder is a material, or a combination of materials, mixed together with the silica which bind or cement the indificual grains of sand together to form the core. Organic binders are the most frequently used ingredients in the non ferrous foundry. The original core oil formulation was approximately 60% linseed oil, 30% rosin, and 10% kerosene. The kerosene served as a solvent and thinner for the rosin and the linseed oil.

The core sand and the core oil binder were mixed in various proportions and made into the form of the core, by the use of a core mold or box. The core was then set into a core oven and baked at a temperature high enough to drive off the kerosene and develop a resin bond to hold the grains of silica sand together.

Many new commercial core binders have been recently developed. They are classified as oil binders, water soluble binders, resin binders, sodium silicate, carbon type such as pitch, and the clay binders such as bentonite. Some of the more common binders which are added to core sand are starch, glue, molasses, and other organic and inorganic materials which have adhesive properties.

One of the more popular cores being used is the resin binder shell cores. The powdered resin is mixed with silica core sand in certain proportion, and mulled and mixed so that each grain of sand is coated with a layer of resin. The resin coated sand is then injected or blown into a metalic core box which has been heated to a temperature where the resin will melt. Upon cooling and solidification the resin binds the grains of sand together.

The selection of materials for core mixtures depend on the specific requirements of the cores. The most significant are as follows:

1. Refractoriness (should be high enough to resist the temperature of the molten metal without immediate disintegration).
2. Green strength (enough for forming the core and aiding its stand-up abilities in the green or uncured state).
3. Dry strength (satisfactory to aid handling and resist abrasion or rubbing after it has been baked or dried).
4. Fired strength (enough to resist metal abrasion and thermal shock of extremely hot metals such as iron or steel, yet collapse after the casting has started to solidify).
5. Permeability and venting (enough to assure the escape of gases formed by the disintegration or break-down of the binder. The gas must escape from the core, through the green molding sand and into the atmosphere).
6. Resistance to heat (the fired core must resist cracking due to quick volume change and thermal shock).
7. Resistance to wetting or washing action of the molten metal.
8. Gas content of the binder (minimum preferred to avoid pin holes, porosity or gas absorbtion of the casting).
9. Smoothness of the core surface (to furnish a fine finish to the casting).

Regardless of the type of core binder used, it must be designed to disintegrate through a specific temperature range. The binders used for cores for aluminum casting must retain its shape for temperatures up to approximately 1400°F for a suffi-

cient period of time to allow the casting to begin to solidify. After the casting has begun to solidify the core binder must disintegrate and collapse rapidly to allow the casting to go through its normal thermal shrink as it cools from the liquid to the solid state. If the core does not disintegrate and collapse, the casting will tear and crack as it shrinks.

The mixing or mulling together of the binding ingredients is an important aspect of proper core sand practice. The first point to consider is that the dry additives, whether they are cereal, clay or in some cases resins, may need moisture for activation. If the cereal or clay binder is used in the core mix it is important that the cereal or the clay be added to a batch of water-wetted sand, or to a dry base sand, then the cereal and water are mulled together before core oil is added. If the sequence of steps is not followed, the dry binder can be water proofed by the core oil and proper mixing and curing cannot occur.

If a liquid resin binder is used instead of a core oil, the order of additions is not critical since the resin binder is usually dissolved and disbursed in water instead of petroleum. Time is an important factor in the development of green strength in core sands, so the addition of cereal or clay at various moments during the mulling cycle is necessary. If the dry binders are added to a damp sand, there is less tendency for them to "dust out" during the preliminary mixing cycle. This results in better control of the additive.

Many times, intricate cores must be made in sections, then the sections are cemented together to form a single core. A refractory material known in the foundry trade as "core paste" is used for joining the sections. It must have low gas or stean evolution and good adhesion properties. Core sections are usually dried, then pasted.

Where severe metal penetration of the core occurs, a zircone spray or wash coating of the core surface will help. The core should be dried after coating.

GAS AND COLLAPSIBILITY ARE TWO MAJOR PROBLEMS TO BE DEALT WITH IN ALL TYPES OF CORE MAKING. If these two factors can be controlled, there is generally no problem. Coring-out, or hollowing-out of the core usually lessens these problems. Since the hollow core can disintegrate and collapse easier, and the hollow core provides a passage for gas. Venting the core is a highly regarded and recommended practice. The source of gas in a core can always be traced when excessive amounts of organic binders or moisture used in formulation of the core. *IT IS, THEREFORE, OF EXTREME IMPORTANCE THAT THE INSTRUCTIONS GIVEN BY THE SUPPLIER OF THE BINDER BE FOLLOWED VERY CAREFULLY. THE AMOUNTS OF THE VARIOUS INGREDIENTS SHOULD BE CAREFULLY WEIGHED TO GET THE PROPER PROPORTIONS.*

General procedures for mixing and mulling core sand are as follows:

1. Add the sand and all dry ingredients suggested by the supplier to the muller and mull dry for two minutes.

2. Add the temper water through the funnel tube and mull for an additional two minutes.

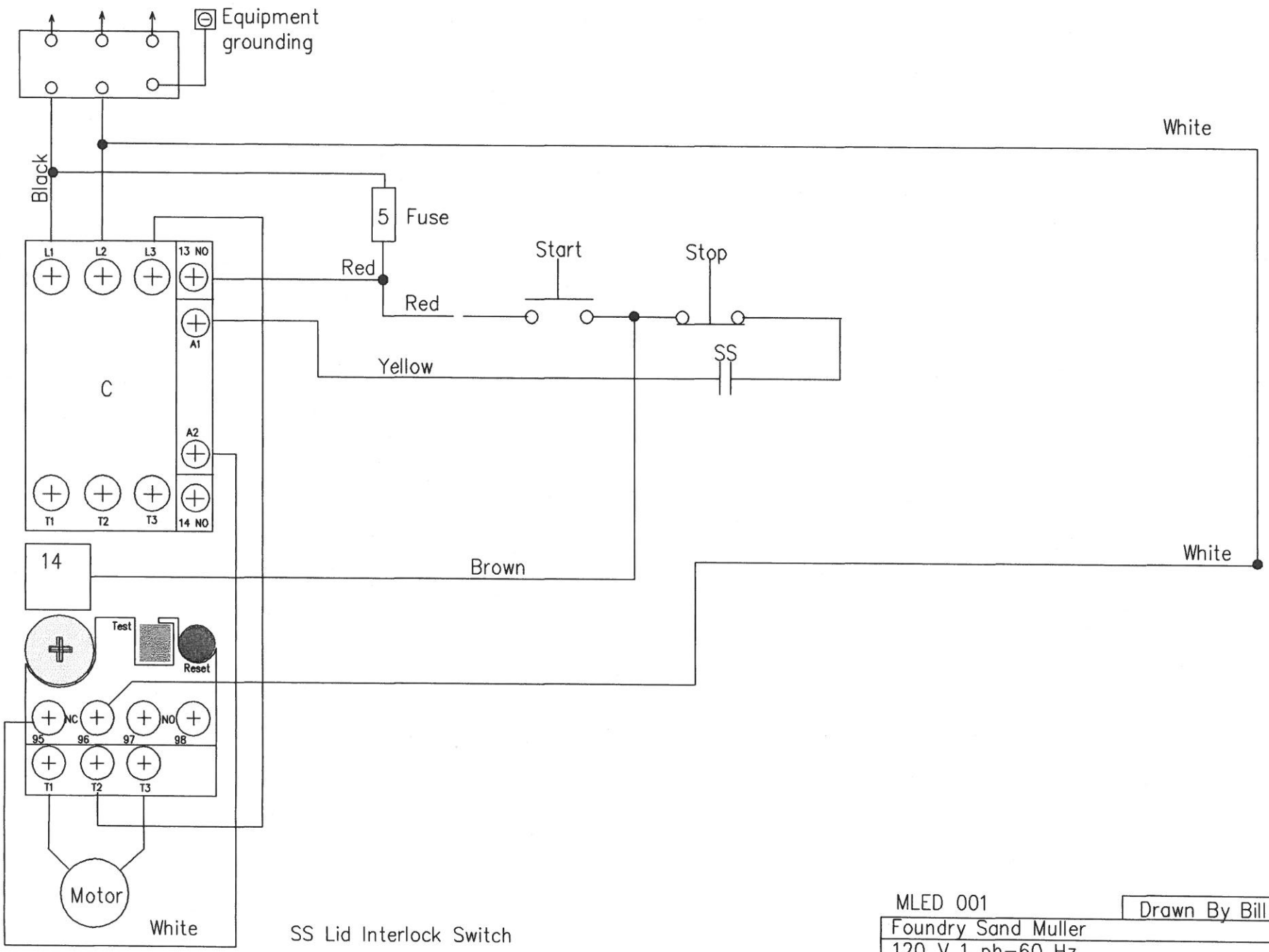
3. Stop the muller, raise the lid, make several pockets in the sand, pour the binder into the pockets, restart the muller and mull until the core sand is ready.

Note: The core binders are best added by making binder sand pockets, since most of the binders are quite viscous and do not flow readily through the funnel tube. The amounts of binder are so small that the amount remaining in the funnel tube could alter the actual proportions required for a correct core mix.

FOLLOW MANUFACTURER'S INSTRUCTIONS ON FINAL MULLING AND, BAKING TIME AND TEMPERATURES. CORE PROPERTIES CAN BE VARIED BY USING DIFFERENT BAKING TEMPERATURES AND TIMES.

Power Block 120 V–1Ph–60 Hz

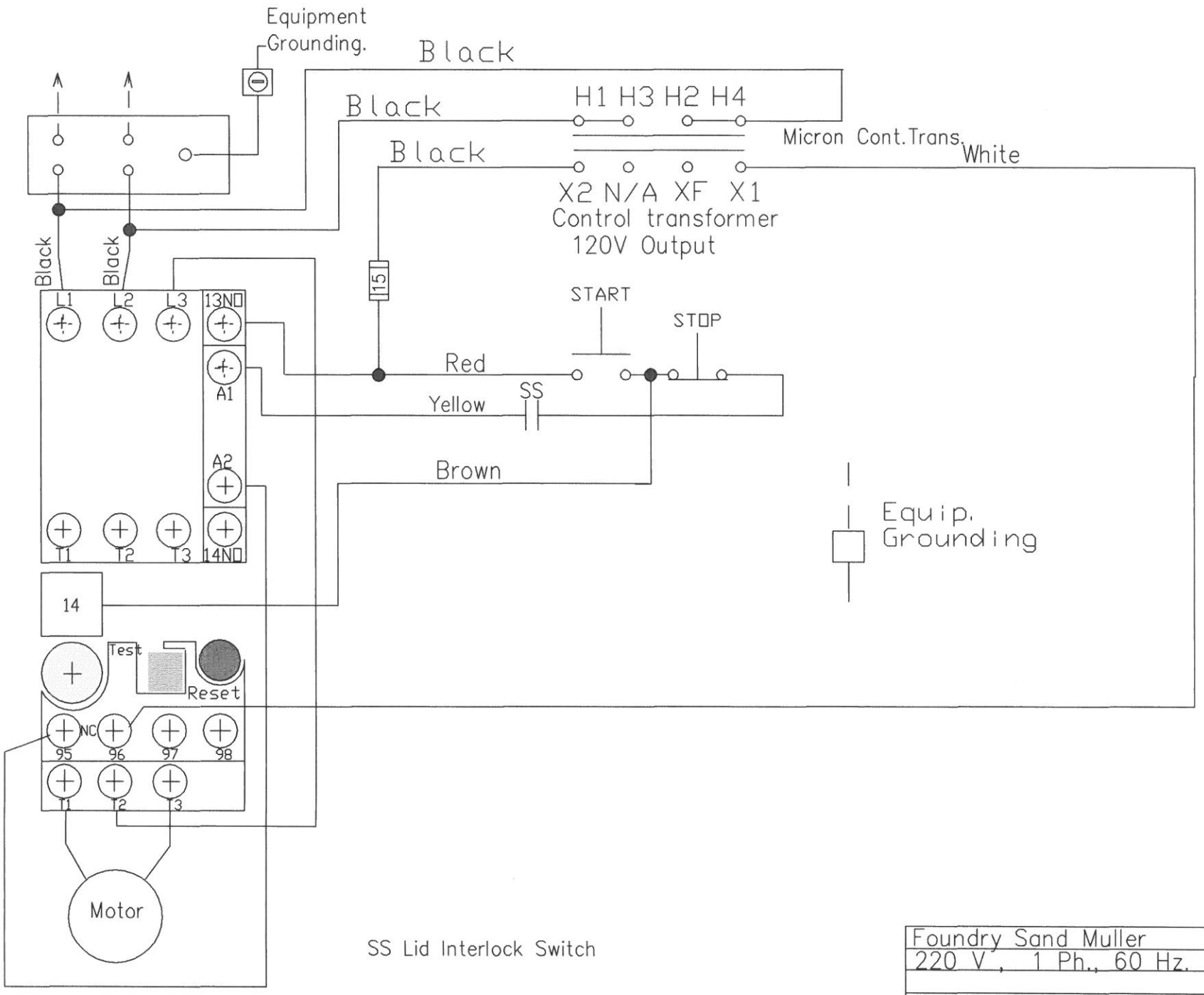
Foundry Sand Muller With Start-Stop



MLED 001	Drawn By Bill Walter
Foundry Sand Muller	
120 V 1 ph–60 Hz	
MIFCO	2/20/2013

Foundry Sand Muller With Stop/Start

Power Block
230 V, 1 Ph., 60 Hz

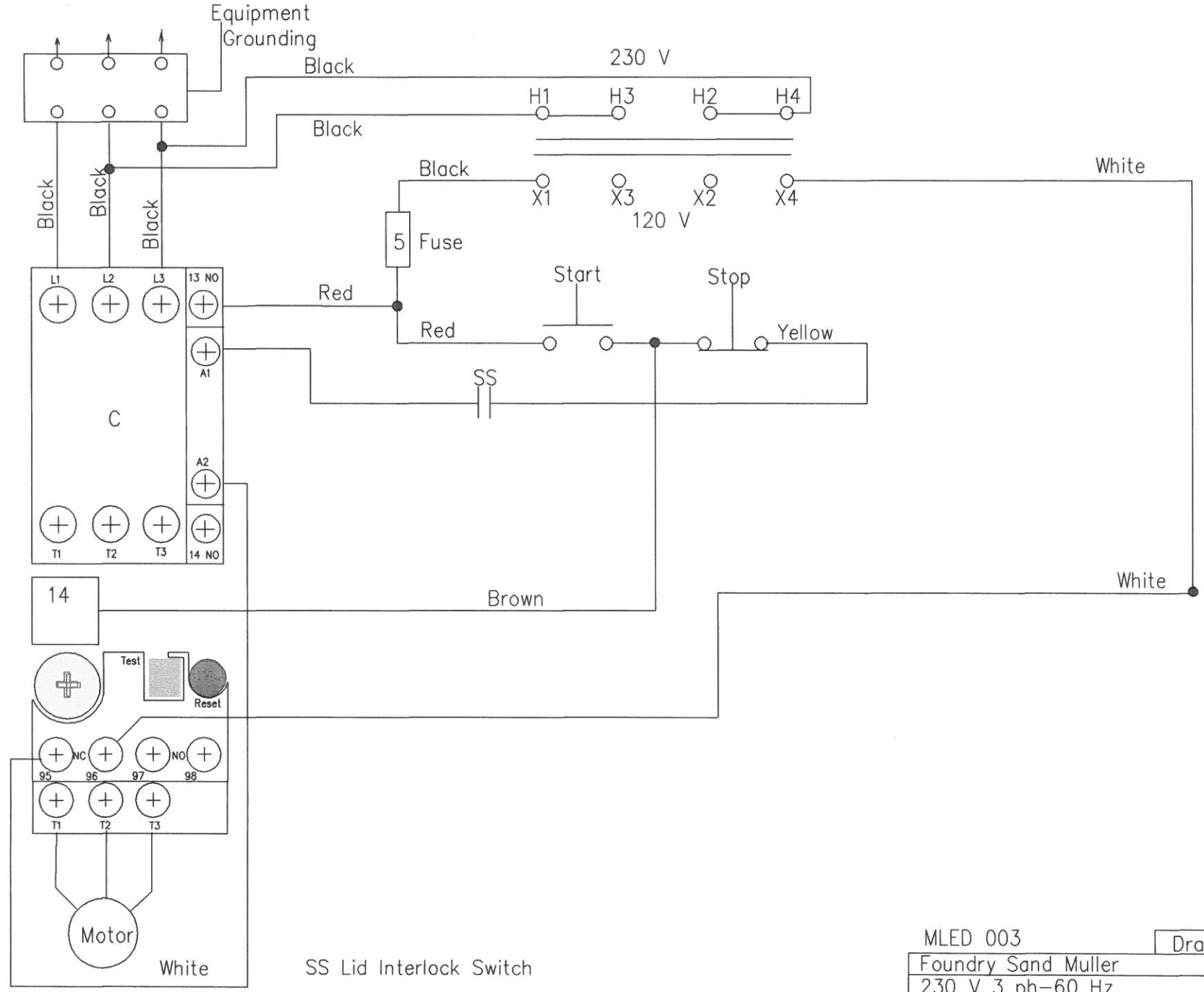


SS Lid Interlock Switch

MLED 002

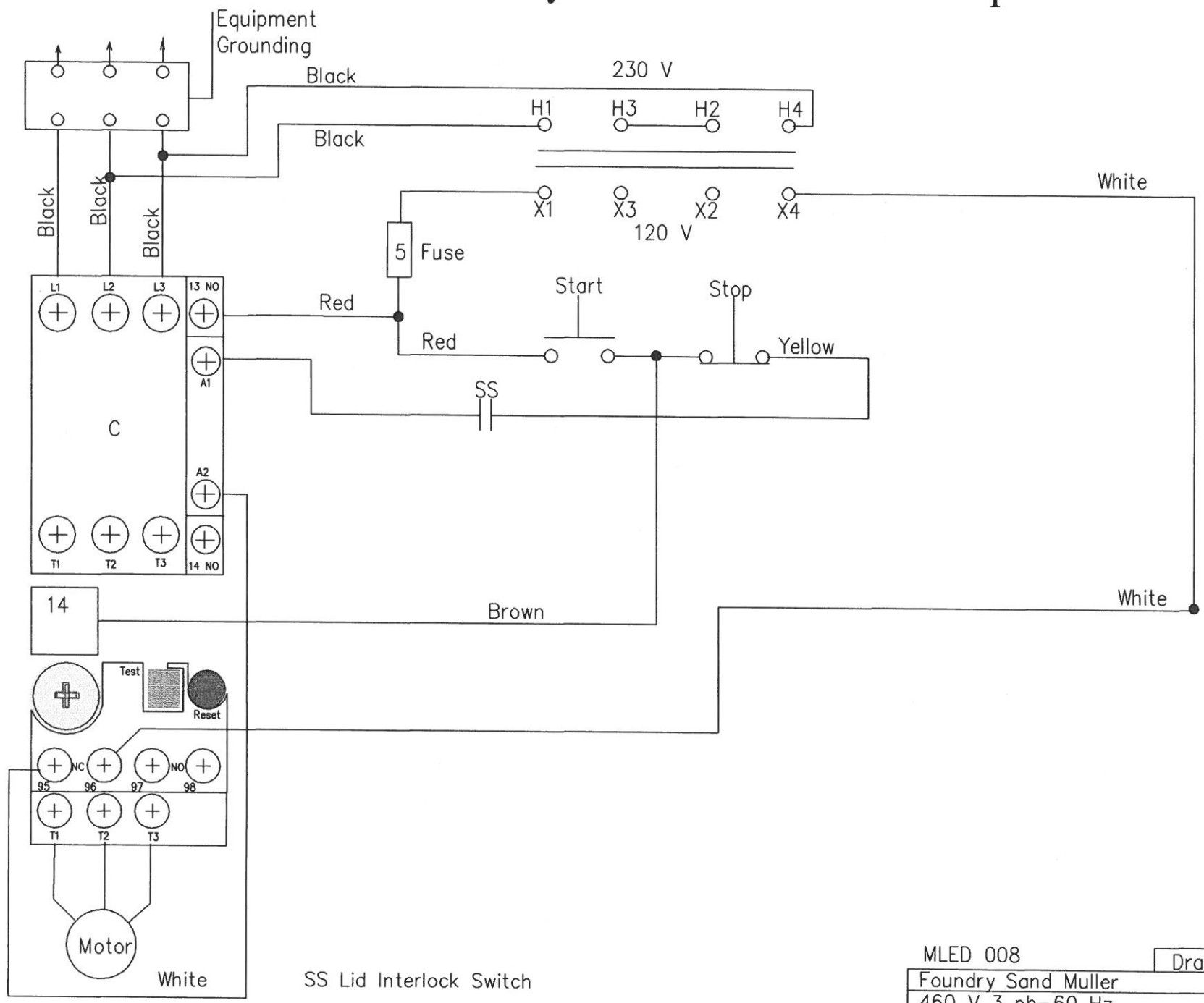
Foundry Sand Muller
220 V, 1 Ph., 60 Hz.
MIFCO 6/22/2013

Foundry Sand Muller With Start-Stop



MLED 003	Drawn By Bill Walter
Foundry Sand Muller	
230 V 3 ph–60 Hz	
MIFCO	6/23/2013

Foundry Sand Muller With Start-Stop

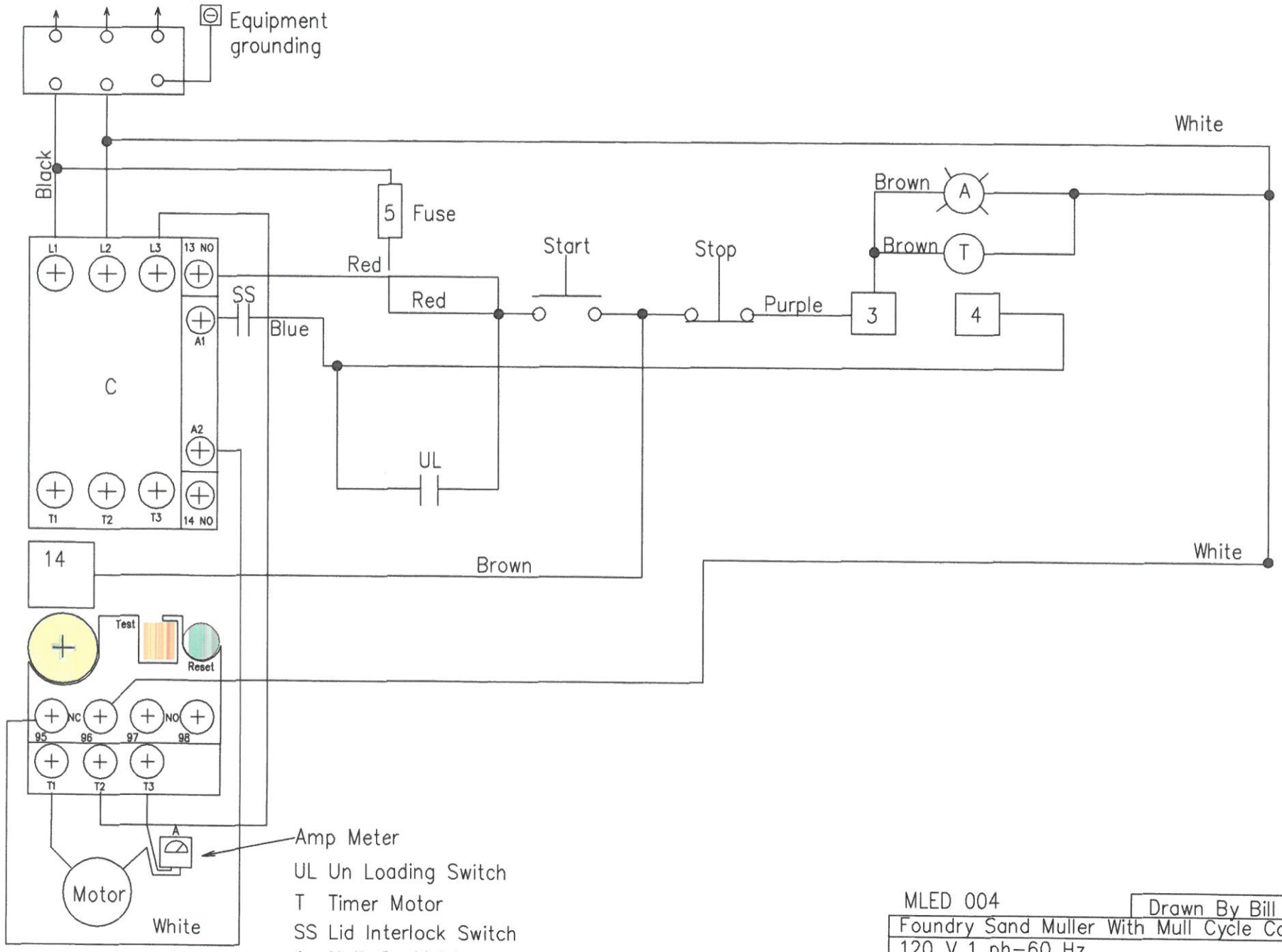


SS Lid Interlock Switch

MLED 008	Drawn By Bill Walter
Foundry Sand Muller	
460 V 3 ph–60 Hz	
MIFCO	3/24/2013

Power Block 120 V-1Ph-60 Hz

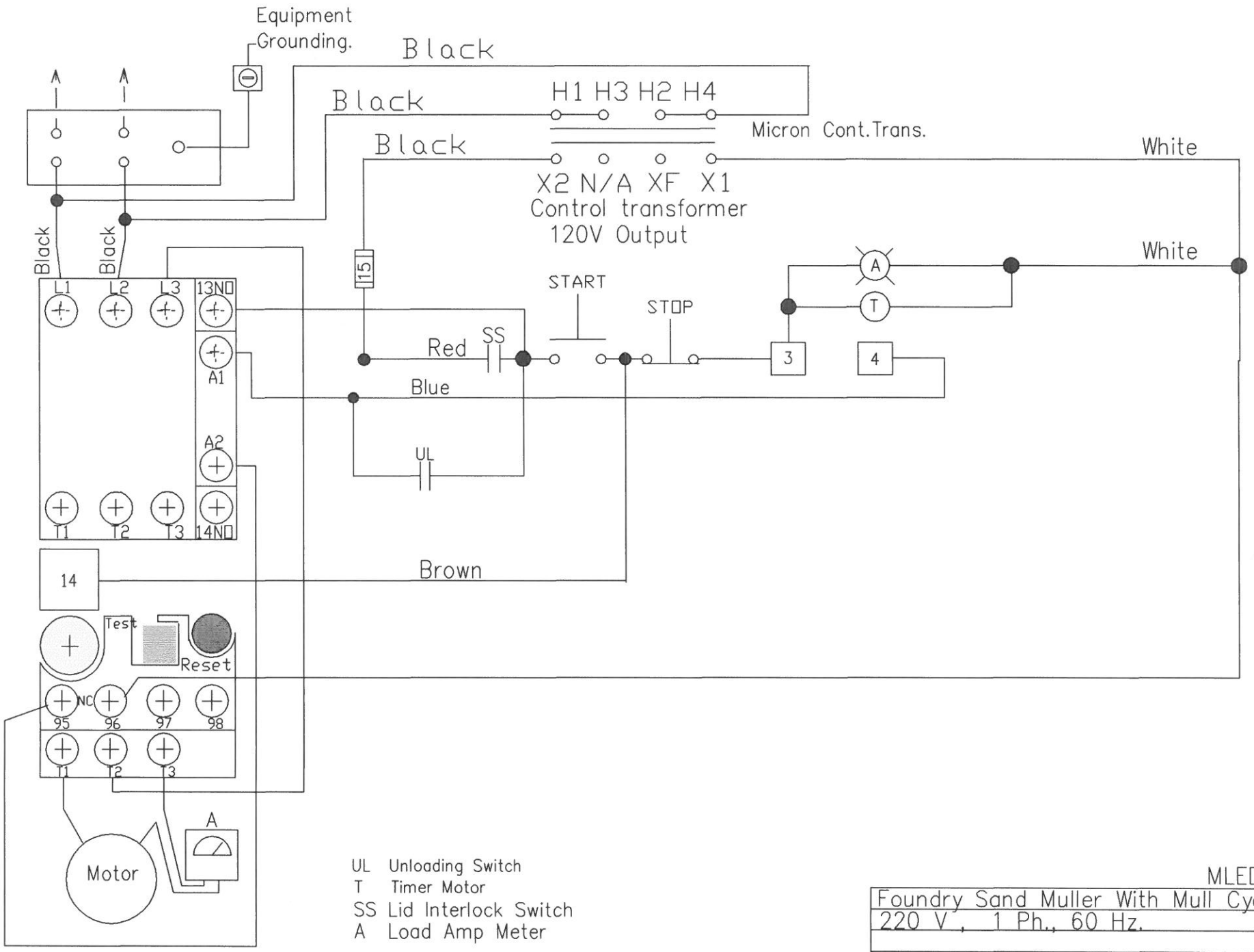
Foundry Sand Muller With Mull Cycle Control



MLED 004	Drawn By Bill Walter
Foundry Sand Muller With Mull Cycle Control	
120 V 1 ph-60 Hz	
MIFCO	2/20/2013

Foundry Sand Muller With Mull Cycle

Power Block
208 V, 1 Ph., 60 Hz



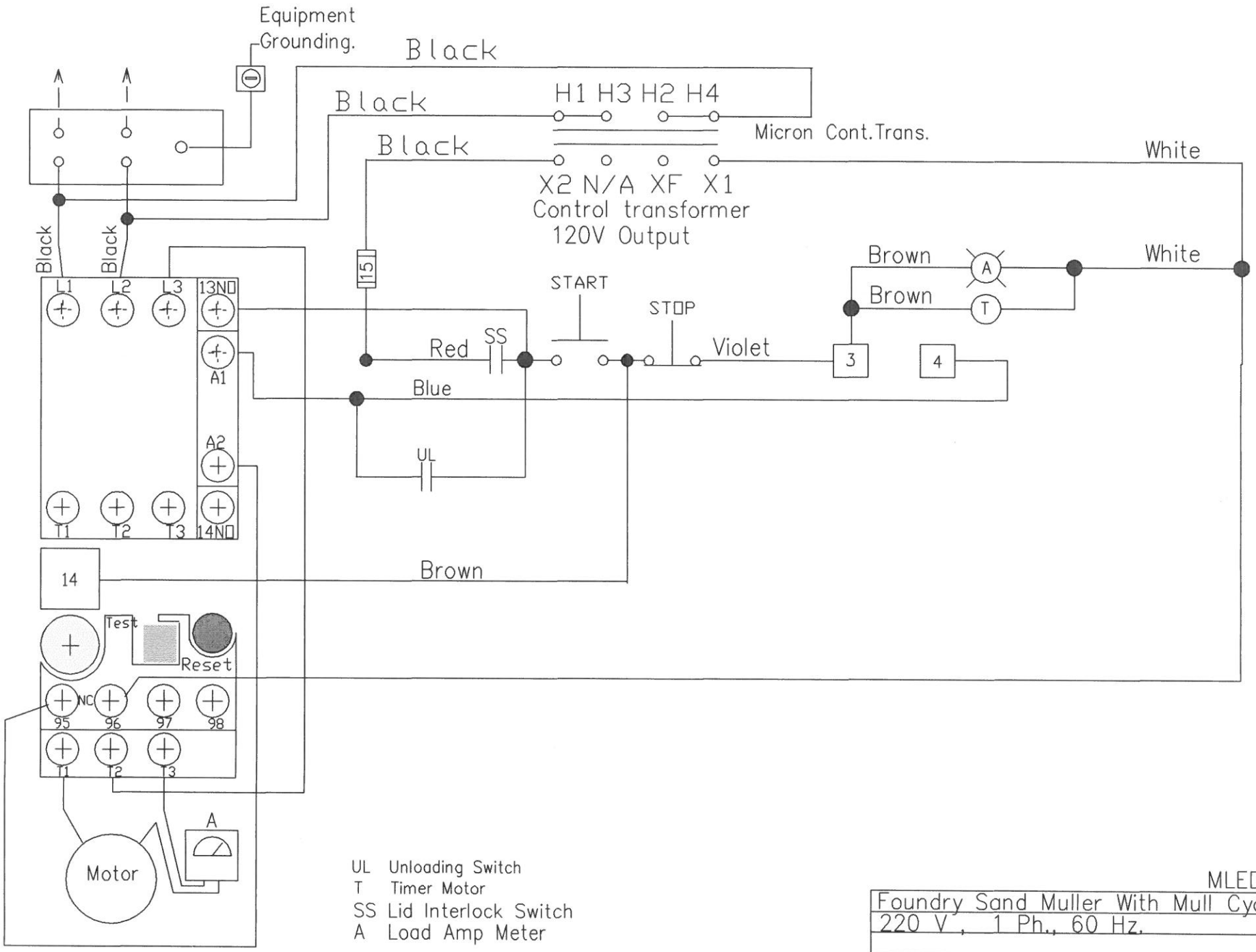
UL Unloading Switch
T Timer Motor
SS Lid Interlock Switch
A Load Amp Meter

MLED 009

Foundry Sand Muller With Mull Cycle
220 V., 1 Ph., 60 Hz.
MIFCO 6/22/2013

Foundry Sand Muller With Mull Cycle

Power Block
230 V, 1 Ph., 60 Hz



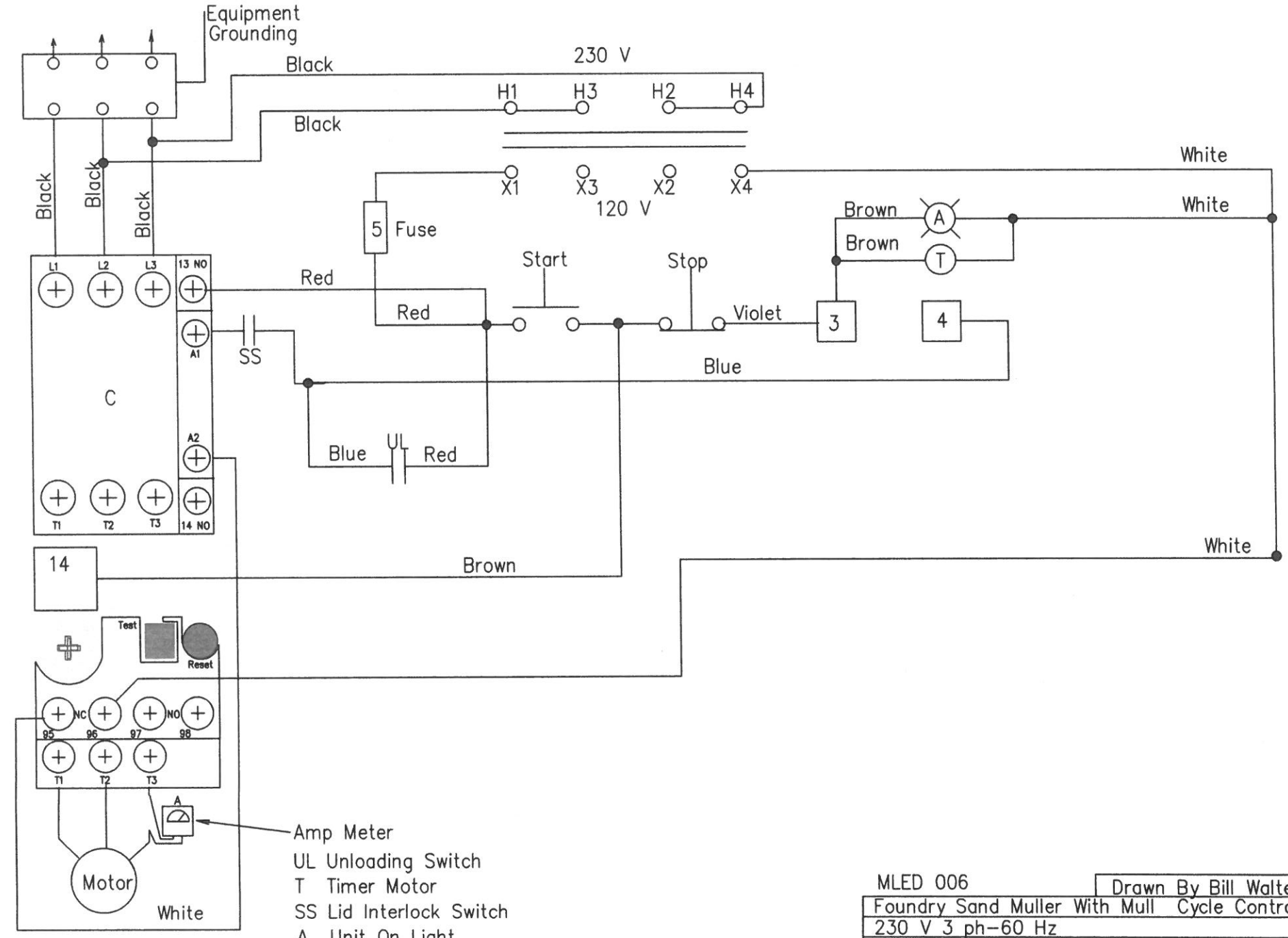
UL Unloading Switch
T Timer Motor
SS Lid Interlock Switch
A Load Amp Meter

MLED 005

Foundry Sand Muller With Mull Cycle
220 V, 1 Ph., 60 Hz.
M I F C O 6/22/2013

Foundry Sand Muller With Mull Cycle

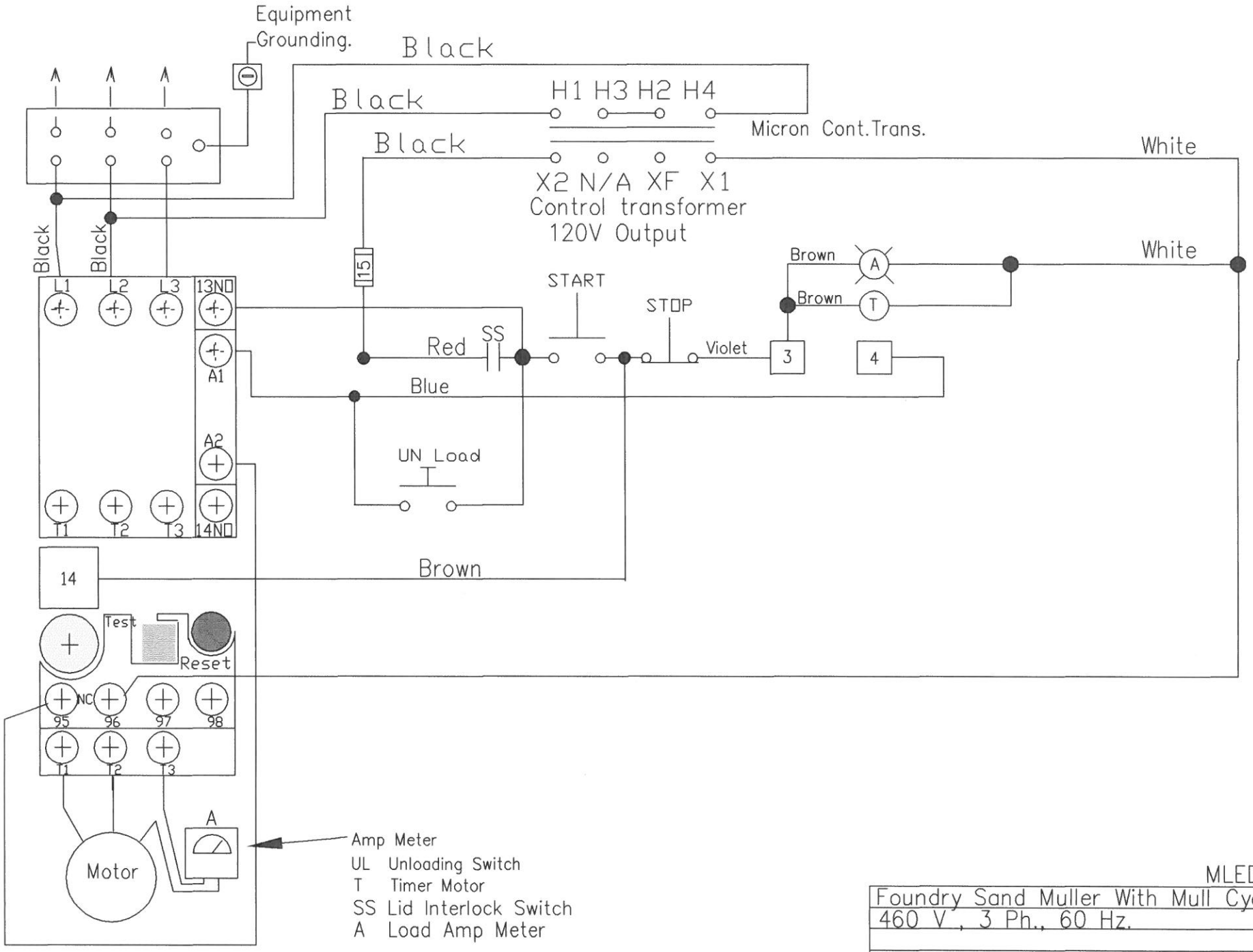
Power Block 230 V–3Ph–60 Hz



MLED 006	Drawn By Bill Walter
Foundry Sand Muller With Mull Cycle Control	
230 V 3 ph–60 Hz	
MIFCO	6/23/2013

Power Block
460 V, 3 Ph., 60 Hz

Foundry Sand Muller With Mull Cycle



MLED 007

Foundry Sand Muller With Mull Cycle	
460 V, 3 Ph., 60 Hz.	
MIFCO	6/22/2013