

# marathon®

## LIMA®MAC

### TROUBLESHOOTING NOTES

**Symptom:** Engine bogs down or stalls even at no load.

**Problem:** Main stator has one or more taps wound or connected incorrectly. (99% probability). This problem is only seen with generators having taps on their main stator coils. It is not seen with the newer “No Tap” LIMA®MAC designs.

**Solution:** Use ohmmeter to check the resistance between the leads.

**12 Lead Generator Procedure, Reference Connection Diagram 14002-31:**

Check resistance from T13-T4. It should be some small number. Then check from T4-T16. It should be a little bit smaller or about the same if not easily detectable. Then check T13-T16. This should be almost zero. If T16-T4 is almost zero, swap the lead numbers from T13 and T16. Repeat the procedure for the other six sets of coils and leads. If the reading from T4-T16 is nearly equal to T4-T13, the internal connection between coil one and four is wrong. It must be broken and corrected. Repeat the procedure for the other six sets of coils and leads.

**10 Lead Generator Procedure, Reference Connection Diagram 14002-50:**

Check resistance from T10-T4. It should be some small number. Then check from T4-T16. It should be a little bit smaller or about the same if not easily detectable then check T10-T16. This should be almost zero. If T16-T4 is almost zero, swap the lead numbers from T10 and T16. Repeat the procedure for the other six sets of coils and leads. If the reading from T4-T16 is nearly equal to T4-T10, the internal connection between coil one and four is wrong. It must be broken and corrected. Repeat the procedure for the other six sets of coils and leads.

**Comment:** To conduct this test procedure you will need a meter that is sensitive down to a 0.1 Ohms. A meter sensitive down to 0.01 Ohms is ideal but not absolutely required. The meter does not need to be perfectly calibrated. What is required, is the ability to measure is the relative difference in resistances down to the range of 0.05 to 0.1 Ohms with repeatability.

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**Symptom:** No voltage

**Problem:** Flash the field. See restoring residual magnetism procedures on page 4. Assuming the field was flashed and there are no defective diodes, the most common problem after rewinding is the wrong phase sequence on one or both stators. In rare cases, the diodes are all in working order but there can be a poor connection on the rectifier assembly. Check all connections for corrosion.

**Solution:** Swap lead numbers from two phases on one stator only. The main and exciter stator must have the opposite phase sequence to generate voltage. See the phase sequence reversal procedure detailed on pages 5 and 6 below.

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**Symptom:** Good voltage but one or more tapped coils gets hot under load.

**Problem:** The most common problem is swapping the main lead with the tap lead next to it. They both come out of the same slot and are easily mixed up. The tapped turn(s) are designed to carry no load shunt current only. If the leads are swapped, the tap carries shunt current and load current. This causes the tap to overheat.

See Example under "Engine bogs down".

**Solution:** If the resistance from T4-T13 is less than T4-T16, then swap T13 & T16. Check and repeat for all other groups.

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**Symptom:** Good voltage but one or more tapped coils gets hot without any load.

**Problem:** Poor connection to all strands used for tapped coil.

**Solution:** See "Connection" directions.

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**Symptom:** Good voltage no load but very low voltage under full load.

**Problem:** Assuming there is no exciter damage or defect, the most likely cause is incorrect main stator coil insertion.

**Solution:** See Coil Insertion directions .

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# Rewinding Tips For "Tapped" LIMA®MAC Generators

## Coil Winding

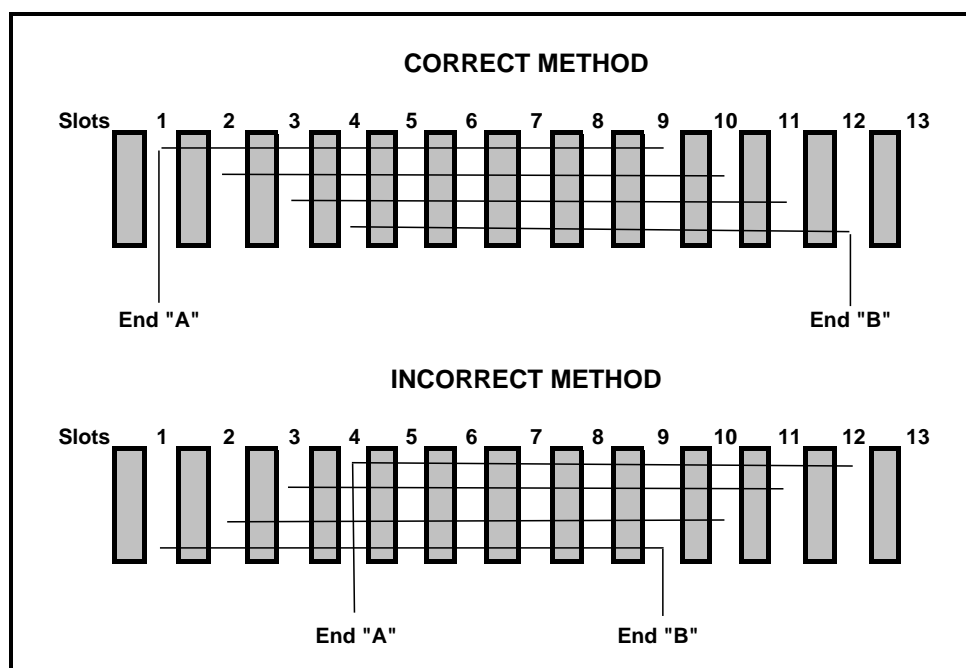
The taps should be the specified number of turns (usually 1 or 2) away from the start or end of the coil group. 250 frames have taps at the end of the coils and all others have taps at the beginning of the coils. Only the first or last coil of the coil group should be tapped. Taps are typically made with a small twist in the wire while winding the coils.

## Coil Insertion

Using either 14002-31, or 14002-50 as a reference, the coil insertion can be seen using the "Coil Connect" circle. Tapped coils have a "C" to denote the tap. Standard coils have "A" & "B" ends only. The "A" side of the coils lie in the bottom of the slot toward the "outside" of the core. The "B" side of the coils lie on top of another coil in the slot toward the "inside" of the core. One side of the tapped coil occupies the same slot as the "B" end and the other side is four slots away from the "A" end. The tap can be made anywhere between these two points. Diagram 14002-133 and -134, used for 250 LIMA®MAC only, have the taps on the opposite side. Using -31 instead of -133 on a 250 LIMA®MAC may result in low voltage under load.

Viewing the "Coil Connect" circle as shown, the coils are inserted in a counter-clockwise (CCW) direction. The "A" side is inserted first in a CCW direction. Coil end "A" is in the last slot to be inserted. The "B" side is then inserted. After insertion, coil ends "A" & "B" must be at the outer edges of the coil group. If they are inserted to the inside of the coil group, the unit may have low voltage under load. See Diagram 1. Inserting the coils in a clockwise direction is acceptable if done consistently. It may result in a reversed phase sequence, though.

**DIAGRAM 1 LIMA®MAC MAIN STATOR COIL INSERTION DIAGRAM**



## Connections

Coils are to be connected as shown in the "Connect Table". All coil ends and leads on the same line are connected together. Refer to the "Coil Connect" circle for coil numbers. The "Lead Tag" circle is a physical representation of the lead locations after connecting but before lacing. It is used to speed connect time but the table contains all necessary information. Electrically they will be as shown in the schematic diagram. The tap lead must be electrically connected to all strands in the turn. If two strands of magnet wire are used per turn, the lead must be connected to both of them.

## Restoring Residual Magnetism

The current necessary to magnetize the alternator field during operation is obtained from the exciter. Initially, upon starting the unit, voltage is induced into the main stator (armature) by the flux across the air gap supplied by the permanent magnets embedded in the poles of the main rotor. Current then flows through interconnecting leads to the shunt portion of the exciter stator which induces current in the exciter rotor. This current is then rectified to DC excitation current by the rotating rectifier, and fed to the main field windings via the main rotor leads further strengthening the main field until rated voltage is reached.

The residual magnetism contained in the field poles of the main rotor may be lost or severely weakened when the unit is disassembled for rewinding or other service operation. Should the generator fail to build up voltage after being reassembled, a momentary short circuit of any two generator output leads while the unit is running at rated speed should be sufficient to correct this condition. This action is termed "Flashing the Field".

If the voltage does not build up with the above procedure, an alternate method may be used. Apply 120Vac from any wall outlet to any two generator output leads. Best practice is to insert a 20A or 30A circuit breaker in the supply voltage circuit to prevent any damage in case the build-up power supply voltage is not removed quickly enough. This procedure is conducted with the generator running at rated speed)

Start the generator and observe voltage build-up. Re-flash field if generator voltage does not build up. Verify that generator speed is at, or slightly above rated nameplate speed.

## Ball Testing of Stator Windings

A ball test is simply another method of testing a stator winding to check for proper connections. The equipment consists of a large steel ball usually 1 to 2 inches in diameter. The diameter should be slightly larger than the distance between two adjacent stator slots. Sometimes, an inner or outer race of a ball bearing is used. The winding is usually connected in the high voltage wye connection, and a reduced voltage (about 2 voltage) is applied to the output leads. The ball or race is then placed on the inside of the stator core. If the completed winding has been done properly, the ball will spin around the inside of the core at an even or uniform rate. If the winding is improperly connected, the movement of the ball will be erratic, or perhaps no movement will occur.

## Reversing the Phase Sequence of a Rewound Stator.

There have been many instances where a repair facility will rewind either a main stator or an exciter stator on a LIMA®MAC generator, and then not be able to generate a voltage at the terminals during test running. In almost every case of this nature, the problem is either in a loss of residual magnetism, or with the phase sequence of the rewind stator. **The phase sequence of the exciter stator must be opposite to that of the main stator, or the unit will not build up voltage.** To correct an improper phase sequence problem, you will have to reverse the phase sequence of the rewind stator. To reverse the phase sequence of a stator winding, all lead tags of one phase of the stator will be switched with the leads the next phase, and then these renumbered leads will be connected to matching numbered leads of the original (non-rewound) stator. If both stators have been re-wound, reverse tag only one stator.

**Suggestion:** After a stator rewind, run a ball test on both stators once they are installed in the frame and inter-connected. **The ball in the main stator must rotate in the opposite direction to that of the exciter stator.** If rotation is the same for both stators, reverse tag using the procedures below, and re-connect before proceeding with installing the rotor assembly in generator.

**A. Reverse tagging of the main stator of a 12 lead LIMA®MAC generator.** Break apart the connections of leads T13, T16, T19, T22; and T14, T17, T20, T23. Working only on the leads of the main stator: Physically re-tag lead T13 - T14, and T14 - T13; T16 - T17, and T17 - T16; T19 - T20, and T20 - T19; T22 - T23, and T23 - T22. Leads T4, T5, T10, and T11 are output leads. Re-tag T4 - T5, and T5 - T4; T10 - T11, and T11 - T10. You have now reversed the phase sequence of the exciter stator. Re-interconnect these leads to the main stator leads, re-install the splice insulation, bundle the entire group of interconnecting leads as before.

**B. Reverse tagging of the main stator of a 10 lead LIMA®MAC generator.** Break apart the connections of leads T10, T16, T13, T19; and T11, T17, T14, T20. Working only on the leads of the main stator: Physically re-tag lead T10 - T11, and T11 - T10; T16 - T17 and T17 - T16; T13 - T14 and T14 - T13; T19 - T20 and T20 - T19. Since load leads T4 and T5 are output leads, simply swap their tags to make T4 become T5, and T5 to become T4. You have now reversed the phase sequence of the main stator. Re-interconnect these leads to the exciter stator leads, re-install the splice insulation, bundle the entire group of interconnecting leads as before.

**C. Reverse tagging of the main stator of a 10 lead NO-TAP LIMA®MAC generator.** Break apart the connections for T4, T6, T7, T9, T13, T15, T16, T18. Working only on the leads of the exciter stator: Physically re-tag: T7-T9, T13-T15, T16-T18. Since load leads T4 and T6 are output leads, simply swap their tags to make T4 become T6, and T6 to become T4. You have now reversed the phase sequence of the main stator. Re-interconnect these leads to the exciter stator leads, re-install the splice insulation, bundle the entire group of interconnecting leads as before.

**Testing A, B, or C:** Connect the generator output leads for the proper connection and retest. Note: You may need to flash the field to achieve voltage build up after this procedure.



## Winding Specifications

<b>10 Lead Lima® MAC Resistance Table</b>			
<b>Model</b>	<b>Stator</b>	<b>Main Rotor</b>	<b>Exciter Rotor</b>
250MSL1237	2.0841	0.99	0.28
250MSL1238	1.4415	0.68	0.28
280MSL0054	0.8995	0.76	0.28
280MSL0055	0.5139	0.87	0.28
280MSL0056	0.4429	0.95	0.28
360MSL0057	0.3884	0.9	0.23
360MSL0058	0.2622	0.97	0.23
360MSL0059	0.1773	10.5	0.23
360MSL0060	0.1282	1.15	0.23
440MSL0885	0.0803	0.64	0.114
440MSL0886	0.0613	0.67	0.114
440MSL0887	0.0501	0.73	0.114
440MSL0888	0.0396	0.84	0.114
580MSL0889	0.0332	0.44	0.125
580MSL1166	0.0239	0.48	0.151
580MSL0891	0.0128	0.53	0.125
580MSL0892	0.0114	0.59	0.013
680MSL0893	0.0064	0.79	0.125
680MSL0894	0.0043	0.89	0.151

<b>12 Lead Lima® MAC Resistance Table</b>			
<b>Model</b>	<b>Stator</b>	<b>Main Rotor</b>	<b>Exciter Rotor</b>
250MSL1235	1.8765	0.99	0.28
250MSL1236	1.0021	0.62	0.28
280MSL0079	0.6793	0.76	0.28
280MSL0080	0.4293	0.87	0.28
280MSL0081	0.3261	0.95	0.28
360MSL0082	0.3218	0.9	0.23
360MSL0083	0.22	0.97	0.23
360MSL0084	0.1596	10.5	0.23
360MSL0085	0.1118	1.13	0.23
440MSL0860	0.0703	0.64	0.114
440MSL0861	0.058	0.67	0.114
440MSL0862	0.0358	0.73	0.114
440MSL0863	0.0352	0.84	0.114
<b>4 Lead, Single Phase Lima® MAC Resistance Table</b>			
250MSL1185	0.68	0.89	0.21
250MSL1152	0.32	1.06	0.21
<b>10 Lead Lima® MAC Reefer Resistance Table</b>			
260MSL1361	0.4429	0.95	0.28

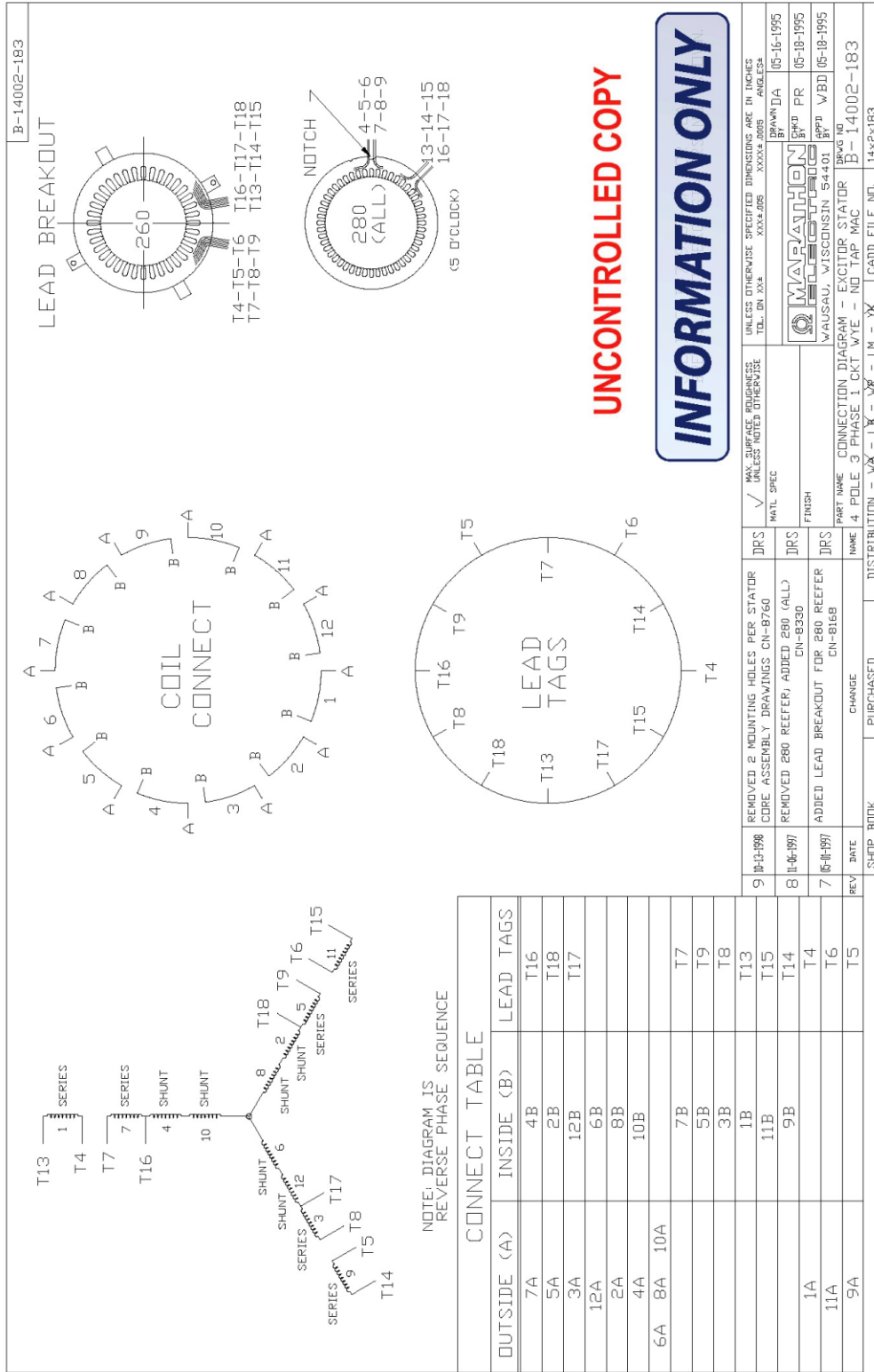






## CONNECTIONS FOR BALL TEST OF 280 FRAME "NO-TAP" LIMA®MAC EXCITER STATOR:

Tie together T4/T7; T5/T8/T6/T9; Leave open T16, T17, and T18. Apply low voltage, three phase power to T13, T14, and T15.



With connection ends of both the main and exciter stator pointing in the same direction, the balls should rotate in opposite directions.

**Resistance Line to Line of Shunt Circuit**  
If wound with #24 wire, T16-17; T17-18; T18-T16: 36 Ohms  
If wound with #25 wire, T16-17; T17-18; T18-T16: 46 Ohms

