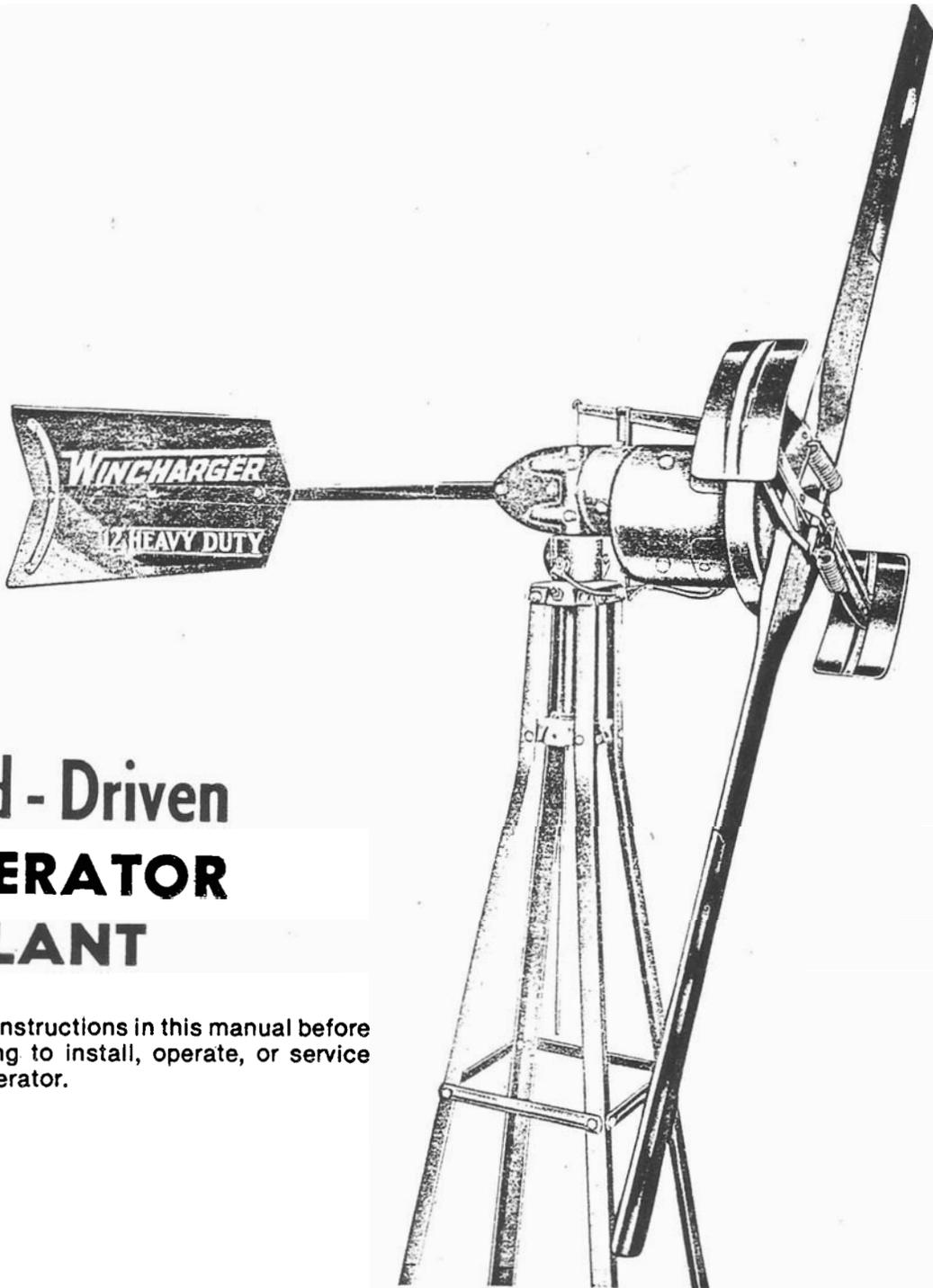


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GENERATORS

W02 W045

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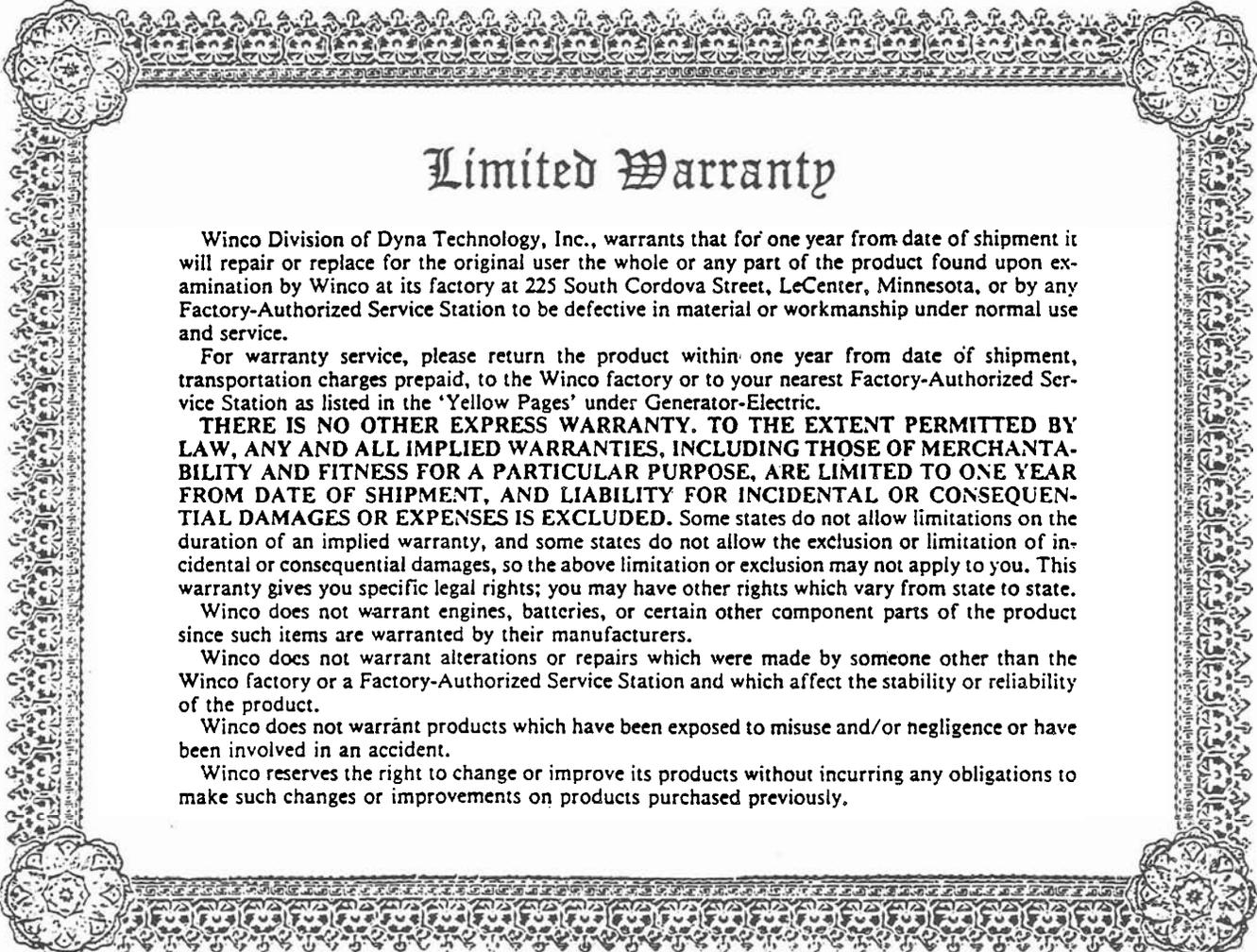
SERVICE INFORMATION, ASSEMBLY and OPERATING INSTRUCTIONS



Wind - Driven GENERATOR PLANT

Attention: Read all instructions in this manual before attempting to install, operate, or service your generator.

WINCO[®] POWER PLANTS—Over 45 Years of Leadership



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***** WINCHARGER W02 AND W045 OPERATORS MANUAL *****

SPECIAL NOTE - THIS IS AN INTERIM MANUAL ***** WE REGRET THE FINAL PRINTED MANUAL IS NOT PRESENTLY AVAILABLE. THE OLD 1222H OPERATORS MANUAL IS INCLUDED WITH THIS NEW INTERIM MANUAL TEXT TO ACCOMPLISH THE INSTALLATION AND OPERATION OF YOUR NEW WINCHARGER. THE OLD MANUAL IS INCLUDED FOR VISUAL REFERENCE ONLY. USE THE NEW TEXT FOR INSTALLATION PROCEDURES AND INSTRUCTIONS FOR OPERATION AND MAINTAINANCE. PLEASE FILL OUT YOUR OWNERS CARD AND RETURN PROMPTLY. A REMINDER FROM YOU IN THE COMMENT SECTION OF THE CARD WILL HELP ASSURE WE SEND YOU A NEW MANUAL AS SOON AS THEY ARE RECEIVED FROM THE PRINTERS. THANK YOU FOR YOUR PATIENCE - WE WELCOME YOU TO THE GROWING RANKS OF WINCHARGER ENTHUSIASTS AND WISH YOU MANY YEARS OF SATISFACTORY SERVICE.

I. ----- INTRODUCTION -----

*** A. SCOPE

THIS MANUAL COVERS THE NEW WINCHARGER MODEL SERIES W045, 450 WATT - 2.44 METER (8 FOOT) DIRECT DRIVEN PROP. AND THE ORIGINAL 200 WATT MODEL SERIES W02 - 1.83 METER (6 FOOT) DIRECT DRIVE PROP. ALL OF THE NEW MODELS (EXCEPT FOR THE 12 VOLT, 200 WATT MODEL W02-212) HAVE BEEN RE-DESIGNED TO ELIMINATE THE HIGHER MAINTANCE D.C. COMMUTATOR AND D.C. BRUSHES IN FAVOR OF A 3 PHASE ARMATURE WITH SMOOTH SLIP RINGS AND OUTSTANDING BRUSH LIFE. THE 3 PHASE A.C. OUTPUT IS RECTIFIED AT THE GENERATOR TO PROVIDE THE 12, 24, 36, AND 48 VOLT D.C. FOR BATTERY CHARGING. THESE UNITS, ALTHOUGH PRODUCING A.C. IN THE ARMATURE, ARE NOT INTENDED TO BE USED IN DIRECT CONNECTION TO THE UTILITY GRID WITHOUT PROPER INTERFACE EQUIPMENT. THESE ELECTRICAL RE-DESIGNS OF VERY SUCCESSFUL WINCHARGES HAVE BEEN THOROUGHLY TESTED AT THE FACTORY TEST SITES AND SELECTED INTERNATIONAL LOCATIONS OVER THE PAST 2 YEARS.

*** B. SELECTING LOCATION AND TOWER HEIGHT

THE MOST IMPORTANT PART OF A SUCCESSFUL WINCHARGER INSTALLATION IS A GOOD LOCATION. AS A MINIMUM REQUIREMENT, IT IS NECESSARY FOR THE UNIT TO BE MOUNTED WHERE THE WIND FROM ALL DIRECTIONS HAS AN UNINTERRUPTED FLOW TO THE PROPELLER. ANY OBSTRUCTIONS SUCH AS TREES, HILLS, OR BUILDINGS, EVEN THOUGH THEY ARE SOMEWHAT LOWER THAN THE CHARGER, WILL SET UP ROUGH AIR CURRENTS THAT ARE CONTINUALLY SHIFTING FROM ONE DIRECTION TO ANOTHER, UPWARD OR DOWNWARD, AND SWIRLING. THESE ROUGH AIR CURRENTS FROM WIND OBSTRUCTIONS IN THE VICINITY CAUSE UNNECESSARY STRAIN, INCREASE VIBRATION, SHORTEN MACHINE LIFE, AND GREATLY REDUCE THE ELECTRICAL OUTPUT. THE HIGHER THE CHARGER THE BETTER, FOR THE AIR CURRENTS ARE SMOOTHER AND STEADIER FURTHER FROM THE GROUND. FOR GOOD OPERATION, THE CHARGER MUST BE MOUNTED AT LEAST 5 METERS (15 FEET) ABOVE ANY OBSTRUCTIONS WITHIN 120 METERS (400 FEET).

IF THE CHARGER CANNOT BE MOUNTED ANY HIGHER THAN THE SURROUNDING OBSTRUCTIONS, IT SHOULD BE MORE THAN 120 METERS (400 FEET) FROM THESE OBSTRUCTIONS. IF THE CHARGER CANNOT BE MOUNTED AS HIGH AS THE SURROUNDING OBSTRUCTIONS, IT SHOULD BE PLACED AT LEAST 250 METERS (800 FEET) FROM THESE OBSTRUCTIONS. NEITHER OF THESE INSTALLATIONS ARE RECOMMENDED IN PREFERENCE TO AN INSTALLATION IN WHICH THE CHARGER IS MOUNTED CONSIDERABLY ABOVE THE OBSTRUCTIONS. THEY ARE MERELY SUBSTITUTES FOR THE RECOMMENDED (BETTER) TYPE OF INSTALLATION.

AVERAGE WIND VELOCITY, AND CONSEQUENTLY THE POWER AVAILABLE FROM THE WIND, IS NORMALLY MUCH GREATER AT INCREASED TOWER HEIGHTS. IN ADDITION TO THIS, THE GENERATOR OPERATES AT A HIGHER EFFECIENCY IN MEDIUM WINDS THAN IN EXTREMELY LOW WINDS. FOR THESE REASONS, THE BEST TOWER HEIGHT IS OFTEN CONSIDERABLY HIGHER THAN THE MINIMUM 5 METERS REQUIRED TO CLEAR NEARBY OBSTRUCTIONS. THE APPROXIMATE EFFECT OF INCREASING TOWER HEIGHT IS SHOWN IN THE TABLE BELOW :

TABLE 1 -
EFFECT OF INCREASING THE TOWER HEIGHT

INCREASING TOWER HEIGHT	INCREASES WIND VELOCITY	INCREASES ENERGY OUTPUT
25 %	3 %	8 %
50 %	6 %	16 %
100 %	10 %	28 %
200 %	17 %	49 %

ANOTHER IMPORTANT FACT TO REMEMBER IS THAT THE CHARGER SHOULD BE MOUNTED AS CLOSE TO THE BATTERY AS POSSIBLE. THE FARTHER IT IS MOUNTED FROM THE BATTERY, THE GREATER THE LOSS OF ENERGY IN THE WIRES. SINCE THE BATTERY WILL ORDINARILY BE KEPT INDOORS, THE UNIT SHOULD BE MOUNTED AS CLOSE TO THE BUILDING AS POSSIBLE, YET RETAINING A POSITION HIGH ENOUGH TO RECEIVE AN UNOBSTRUCTED SWEEP OF THE WIND. REMEMBER THAT IF THE CHARGER IS PLACED FARTHER FROM THE BATTERY, THE WIRING COST WILL BE GREATER FOR TWO REASONS:

- (1) THE WIRE MUST BE LONGER AND
- (2) THE WIRE MUST BE A HEAVIER GAUGE (LARGER DIAMETER = MORE EXPENSIVE PER FOOT)

THE SERVICE AND SATISFACTION OF A WIND DRIVEN GENERATOR DEPENDS SO MUCH UPON PROPER LOCATION THAT IT CANNOT BE EMPHASIZED TOO STRONGLY THAT TO MAKE A GOOD INSTALLATION IT IS ABSOLUTELY NECESSARY THAT THE CHARGER NOT BE SHIELDED FROM THE WIND FROM ANY DIRECTION. INCREASING THE TOWER HEIGHT WILL OFTEN CORRECT AN APPARENT SYSTEM POWER DEFICIENCY.

C. TOWER SELECTION

THERE ARE MANY WAYS OF MOUNTING THE UNIT SATISFACTORILY. WHERE A TALL BUILDING WITH A GOOD, SOLID ROOF SUPPORT STRUCTURE IS AVAILABLE, THE STANDARD TOWER CAN BE USED AS SUPPLIED. WHERE A SEPERATE SUPPORT STRUCTURE IS NEEDED, ANY ONE OF SEVERAL REPUTABLE TOWER MANUFACTURERS CAN SUPPLY A COMMERCIAL TOWER ADEQUATE TO YOUR NEEDS. ALTERNATIVELY, A WOODEN UTILITY POLE OR GUYED, HEAVY STEEL WATER PIPE MAY BE A LESS EXPENSIVE MOUNTING. IN ANY CASE, THE IMPORTANT THINGS ARE :

- (1) ENOUGH HEIGHT TO ASSURE GOOD STEADY WINDS.
- (2) ADEQUATE STRENGTH TO WITHSTAND WEIGHT AND WIND LOADS.
- (3) ADEQUATE CLEARANCE BETWEEN PROPELLER AND TOWER.
- (4) MINIMUM VIBRATIONS AND
- (5) ACCESS FOR INSTALLATION AND SERVICE

THE MOST SEVERE STRENGTH REQUIREMENT FOR A TOWER WILL USUALLY BE IT'S ABILITY TO WITHSTAND THE LARGE LATERAL THRUSTS PRODUCED BY THE PROPELLER IN HIGH WINDS. WHILE IT IS RECOMMENDED THAT THE BRAKE BE SET WHENEVER WINDS OVER 25 M/SEC (55 MPH) ARE ANTICIPATED, THIS IS NOT ALWAYS POSSIBLE. THE TOWER MUST BE CAPABLE OF WITHSTANDING THE MAXIMUM FORCES PRODUCED BY A SPINNING PROPELLER AT 35 M/SEC (80 MPH). THIS FORCE IS EQUIVILANT TO 127 KG (280 LBS) FOR THE MODEL W02 SERIES UNITS AND 227 KG (500 LBS) FOR THE MODEL W045 SERIES UNITS.

THE WEIGHT OF THE TOWER TOP PIVOTING ASSEMBLY (GENERATOR, TAILVANE, PROPELLER, GOVENOR, ETC.) IS USUALLY ONLY A SMALL PORTION OF THE VERTICAL LOAD CARRIED BY THE TOWER IN THE WORST CASE. OTHER LOAD FACTORS ARE "LIVE" WEIGHT OF THE INSTALLATION AND SERVICE PERSONNEL, DOWNWARD PULL OF THE GUY WIRES (IF ANY), WEIGHT OF AND FORCES PRODUCED BY HOISTING EQUIPMENT, AND BRAKE CABLE FORCES REQUIRED TO PREVENT THE PROP FROM TURNING IN STRONG WINDS (OR WHILE SERVICING). MINIMUM RECOMMENDED VERTICAL LOAD CAPACITY, LESS GUY WIRE FORCES, IS 700 KG (1500 LBS). THIS CAN BE REDUCED TO 225 KG (500 LBS) ON TOWERS DESIGNED TO BE LOWERED TO THE GROUND FOR SERVICING OF THE UNIT. I.E., TOWERS THAT WILL NEVER BE CLIMBED BY SERVICE PERSONNEL.

EXCESSIVE VIBRATION CAN CAUSE A RUMBLE THROUGHOUT A BUILDING OR TOWER STRUCTURE. THIS CAN BE A PARTICULAR PROBLEM WITH ROOF MOUNTED UNITS. FOR THIS REASON, ROOF MOUNTING IS NOT RECOMMENDED WHERE ANY OTHER SATISFACTORY OPTIONS ARE AVAILABLE. VIBRATION ALSO REDUCES THE LIFE OF THE WINCHARGER AND TOWER THROUGH REPEATED HIGH STRESSES AND FATIGUE. CATASTROPHIC FAILURE, SUCH AS TOWER COLLAPSE, CAN OCCUR WHERE SEVERE VIBRATION IS ALLOWED TO OCCUR.

THESE PROBLEMS CAN OFTEN BE BROUGHT UNDER CONTROL THROUGH BETTER BALANCE OR TRACKING OF THE UNIT. TOWER HEIGHT MUST BE SUFFICIENT TO AVOID ROUGH, TURBULENT AIR DUE TO NEARBY OBSTRUCTIONS. HOWEVER, SOME VIBRATION WILL ALWAYS BE TRANSMITTED TO THE TOWER. IN SOME CASES, TOWER RESONANCES WILL ONLY OCCUR AT CERTAIN SPEEDS. THESE EFFECTS ARE OFTEN DIFFICULT TO PREDICT, AND SHOULD THEREFORE BE CAREFULLY EVALUATED AT THE TIME THE SYSTEM IS INITIALLY PUT INTO OPERATION.

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II. ----- INSTALLING THE WINCHARGER -----
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*** A. ASSEMBLY OF STANDARD TOWER

1. INVENTORY AND IDENTIFY THE PARTS GIVEN IN THE PARTS LIST. THE PARTS ARE LISTED AND ILLUSTRATED ON PAGE 21 OF THIS MANUAL. FOR 10 FOOT TOWERS, ALL TOWER HARDWARE IS ENCLOSED IN A SEPARATE BAG.

2. EXCEPT WHERE OTHERWISE NOTED, ALL CONNECTIONS ARE MADE WITH 1/4-20 X 3/4" CAP SCREWS (466) WITH NUT (438) AND LOCKWASHERS (479). ALL BOLTS MUST BE INSTALLED FROM THE INSIDE OF THE TOWER. LOCKWASHERS AND NUTS ARE INSTALLED ON THE OUTSIDE. THROUGHOUT THE ASSEMBLY PROCEDURE, CARE SHOULD BE TAKEN TO INSURE THAT THE COLLECTOR RINGS ARE NOT DAMAGED.

NOTE: PARTS ARE IDENTIFIED IN THE FOLLOWING ASSEMBLY PROCEDURE BY PART NUMBER (XXX). HARDWARE SHOULD BE INSTALLED FINGER-TIGHT DURING INITIAL ASSEMBLY, WITH FINAL TIGHTENING DONE ONLY AFTER ALL PARTS ARE IN PLACE.

3. SLIDE THE BENT END OF TOWER LEG (1371) INSIDE OF UPPER COLLECTOR RING (1408 OR 59982) BRACKET, SECURING TO UPPER AND LOWER BRACKETS WITH FOUR SCREWS. REPEAT FOR THE OTHER THREE LEGS.

4. CONNECT THE FOUR LEGS TOGETHER WITH THE FOUR UPPER CROSS BRACES (124).

5. FOR 5 FOOT TOWERS, ATTACH TOWER FEET AS DESCRIBED IN STEP 14. FOR 10 FOOT TOWERS, PROCEED TO STEP 6.

6. WITH 5 FOOT STUB SECTION LAYING ON ITS SIDE, ALIGN ONE OF THE LEGS WITH WITH A TOWER LEG EXTENSION (930). NOTE THAT THE 2 HOLES NEAR THE MIDDLE OF THE EXTENSION SHOULD BE NEARER TO THE BOTTOM OF THE TOWER, I.E., FURTHER AWAY FROM THE UPPER TOWER LEG TO WHICH IT WILL BE ATTACHED.

7. SECURE THE LOWER AND UPPER LEGS TOGETHER WITH 2 SCREWS IN THE UPPER 2 HOLES ONLY. TIGHTEN WITH A WRENCH.

8. REPEAT STEPS 6 AND 7 FOR THE OTHER 3 LEGS.

9. CONNECT THE FOUR LOWER LEGS TOGETHER WITH THE FOUR MID-BRACES (929), WITH THE BRACES FLAT SIDE UP ON THE OUTBOARD SIDE OF THE LEGS.

10. CROSS 2 LOWER CROSS BRACES TO FORM AN "X", CONNECTING WITH A SINGLE SCREW. REPEAT WITH THREE OTHER PAIRS OF LOWER CROSS-BRACES TO FORM A TOTAL OF FOUR "X" SHAPED ASSEMBLYS.

11. SLIP ONE "X" BRACE INSIDE THE LOWER TOWER SECTION, WITH THE 2 SHORT LEGS OF THE "X" TOWARD THE TOP (COLLECTOR RIG END) OF THE TOWER. WITH 2 SCREWS, SECURE THE 2 HALVES OF THE "X" BRACE TO THE MID BRACE (929).

12. ALIGN THE UPPER END HOLES IN THE "X" BRACE WITH THE 2 UNUSED HOLES WHERE THE TOWER LEG (1371) MEETS THE TOWER LEG EXTENSION (930). LAY IN THE TOP BRACE (928) ON THE OUTBOARD SIDE, WITH THE FLAT SIDE UP. SECURE THE TOWER LEGS, "X" BRACE, AND TOP BRACE TOGETHER USING 2 OF THE LONGER 1/4-20 X 1" SCREWS (439).

13. REPEAT STEPS 11 AND 12 FOR THE OTHER THREE SIDES OF THE TOWER.

14. ATTACH THE LOWER HOLE IN A TOWER FOOT TO THE LOWER HOLE IN A LEG, USING A LARGER 5/16" CAP SCREW (467), NUT (458), AND LOCKWASHER (480).

15. FROM THE INBOARD SIDE OUT, INSERT A SCREW THROUGH THE REMAINING HOLE IN THE LEG THROUGH THE SLOTTED HOLE IN THE FOOT. ON 10 FOOT TOWERS, THE LOOSE END OF THE "X" BRACE SHOULD ALSO BE SECURED BY THIS SCREW. INSTALL A FLAT WASHER (512) PRIOR TO TIGHTENING THE NUT AND LOCKWASHER. REPEAT STEPS 14 AND 15 ON THE REMAINING 3 TOWER FEET.

16. ON 10 FOOT TOWERS, SECURE THE REMAINING LOOSE "X" BRACE ENDS TO THE LOWER END OF THE TOWER LEG EXTENSIONS.

17. TIGHTEN ALL CONNECTIONS WITH WRENCHES, EXCEPT FOR THE 2 SCREWS HOLDING EACH FOOT TO THE TOWER. THESE SHOULD BE TIGHTENED AFTER THE TOWER FEET HAVE BEEN SECURED TO THE ROOF DURING INSTALLATION.

(FIVE FOOT TOWER EXTENSION: AN ADDITIONAL 5 FOOT SECTION IS AVAILABLE TO MAKE A 10 FOOT TOWER. THE LEGS OF THE LOWER EXTENSION ARE BOLTED ON THE OUTSIDE OF THE LEGS OF THE UPPER SECTION. BE SURE THAT ALL CROSS BRACES ARE PUT IN THEIR PROPER POSITION).

EACH FOOT IS ATTACHED WITH TWO BOLTS. THE LOWER ONE IS 5/16" X 3/4" AND IS PROVIDED WITH LOCK WASHER AND NUT. THE UPPER ONE IS 1/4" X 3/4" AND IS PROVIDED WITH A LOCK WASHER, FLAT WASHER AND NUT. IN THE 5-FOOT TOWER THE CROSS BRACES ARE BOLTED TO THE BACK SIDE OF THE UPPER BOLT THAT EXTENDS THROUGH THE FOOT.

*** B. LEVELING THE TOWER TOP

REGARDLESS OF WHAT TYPE OF TOWER IS USED, THE TOWER TOP MUST BE PLUMB. THIS MAY EASILY BE CHECKED BY PLACING THE FLAT SIDE OF A PIECE OF 2 X 4, SIX INCHES LONG, AGAINST THE MOUNTING PIPE DIRECTLY BELOW THE COLLECTOR RING AND PLACING A LEVEL AGAINST THE 2 X 4. IF THE STANDARD TOWER LEANS IN ANY DIRECTION IT SHOULD BE CORRECTED BY PLACING METAL SHIMS UNDER ONE OR MORE OF THE TOWER FEET.

*** C. WIRING THE TOWER, INSTRUMENT PANEL, BATTERY, AND LOADS

ALL TOWER, INSTRUMENT PANEL, AND BATTERY WIRING SHOULD BE IN PLACE BEFORE THE GENERATOR UNIT IS INSTALLED ON THE TOWER. THIS IS PARTICULARLY IMPORTANT ON MODEL W02-212, WHICH CAN BE DAMAGED IF ALLOWED TO SPIN WITHOUT BEING CONNECTED TO THE BATTERY.

* C-1. WIRING THE TOWER

ON MODEL W02 THERE ARE TWO TERMINALS ON OPPOSITE SIDES OF THE UPPER TOWER SUPPORT PLATE. THESE TERMINALS ARE MARKED (+) AND (-) ON THE TOP SIDE OF THIS PLATE. ON MODEL W045 THERE ARE THREE TERMINALS. IN THE BOX JUST BELOW THE COLLECTOR RINGS. WHEN CONNECTING THE LEAD WIRES TO THESE TERMINALS BE SURE THAT THEY ARE MARKED IN SOME WAY SO THAT THEIR IDENTITY DOES NOT BECOME CONFUSED. THE LEAD WIRES SHOULD BE OF LARGE ENOUGH DIAMETER TO CARRY THE CURRENT WITH VERY LITTLE LOSS. SEE TABLE 2 FOR RECOMMENDED WIRE SIZES. FOR A GIVEN DISTANCE FROM THE GENERATOR TO THE BATTERY, THE SHORTER AND THE LARGER THE WIRES THE BETTER. WITH LONG WIRES OF SMALL DIAMETER OVER HALF OF THE GENERATED ENERGY MAY BE LOST. UNDER THESE CONDITIONS THE GENERATOR IS ALSO WORKED AT A MUCH HIGHER VOLTAGE AND PRODUCES EXTRA WEAR AND LOAD ON THE GENERATOR.

THE WIRES ON THE TOWER SHOULD BE HELD IN PLACE WITH INSULATORS SO THEY CANNOT SWAY IN THE WIND NOR BE STRUCK BY THE PROPELLER. IN CONNECTING THESE WIRES, BE SURE THAT THE INSULATION IS THOROUGHLY SCRAPED OFF. CRIMP AND SOLDER A TERMINAL LUG OR BEND A LOOP IN THE WIRE BEFORE PUTTING IT ON THE TERMINAL BOLT. IF THE WIRE IS BENT AROUND THE BOLT, THE INSULATING WASHERS MAY BE INJURED.

ON MODEL SERIES W02, THE WIRE FROM THE POSITIVE (+) TERMINAL ON THE TOWER GOES TO THE ("A" GEN.) TERMINAL ON THE PANEL. THE WIRE FROM THE NEGATIVE (-) TERMINAL ON THE TOWER GOES TO THE ("F" GEN.-BAT.) TERMINAL ON THE PANEL.

ON MODEL SERIES W045 THE WIRE FROM THE (+) TERMINAL ON THE TOWER GOES TO THE TERMINAL MARKED (GEN +) IN THE CONTROL CABINET. THE WIRE FROM THE (F) TERMINAL GOES TO THE (FIELD) TERMINAL IN THE CABINET. THE (-) TERMINAL ON THE TOWER IS GROUNDED TO THE CABINET AT THE (BAT-GEN) BOLT.

TABLE 2.
RECOMMENDED LEAD WIRES SIZES AND BATTERY CAPACITIES

MODEL	RATED VOLTS	MAX WATTS	LEAD WIRE GAUGES				BATTERY CAPACITY AMP HR
			(+ AND (-) UNDER		(F) UNDER		
			100'	200'	100'	200'	
W02-212	12	200	6	4	----	----	220
W02-224	24	200	10	8	----	----	110
W045-212	12	450	4	2	10	8	440
W045-224	24	450	6	4	12	10	220
W045-236	36	450	8	6	12	12	150
W045-248	48	450	10	8	12	12	110

* C-2. LIGHTNING PROTECTION.

THE CHARGER WILL SERVE AS A PROTECTION AGAINST LIGHTNING IF IT IS PROPERLY GROUNDED. TO GROUND IT CONNECT ONE END OF A PIECE OF NO. 4 COPPER WIRE TO THE NEGATIVE TERMINAL ON THE TOWER AND THE OTHER END TO A 3/4" GALVANIZED WATER PIPE DRIVEN 8 FEET INTO THE GROUND. BE SURE GOOD PERMANENT CONNECTIONS ARE MADE ON BOTH ENDS; A SOLDERLESS TERMINAL OR BOLT IS SATISFACTORY FOR CONNECTING THE WIRE TO THE ROD.

* C-3. CONNECTING WIRES FROM PANEL TO BATTERY

FOR GOOD SERVICE, IT IS NECESSARY TO USE A BATTERY OF LARGE CAPACITY. RECOMMENDED BATTERY CAPACITIES ARE GIVEN IN TABLE 2. MOST HIGHLY RECOMMENDED IS THE DEEP CYCLE TYPE BATTERY, SUCH AS NORMALLY USED IN ELECTRIC VEHICLES. THESE BATTERIES ARE ESPECIALLY DESIGNED FOR MAXIMUM LIFE UNDER REPEATED CHARGE - DISCHARGE CYCLING, WHILE FURNISHING A FAIRLY SMALL AMOUNT OF CURRENT OVER A LONG PERIOD OF TIME. THE LEAST DESIRABLE TYPE IS A REGULAR AUTOMOTIVE BATTERY. AUTOMOTIVE BATTERIES ARE DESIGNED TO FURNISH EXTREMELY HIGH CURRENT FOR STARTING PURPOSES, AND MUST BE KEPT NEAR FULL CHARGE AT ALL TIMES IN ORDER TO PROVIDE SATISFACTORY LIFE.

REGARDLESS OF THE TYPE OF BATTERY USED, BE SURE THAT THE TERMINALS MAKE A GOOD CONNECTION AND CONTINUE TO MAKE A GOOD CONNECTION. POOR CONNECTIONS TO THE BATTERY ARE LIABLE TO CAUSE RADIO INTERFERENCE AND BURNING OUT OF LIGHT BULBS AND RADIOS DURING PERIODS WHEN THE GENERATOR IS CHARGING AT A GOOD RATE. BATTERY CLIPS ARE WIDELY USED TO MAKE CONNECTIONS, NOT BECAUSE THEY MAKE A GOOD BATTERY CONNECTION BUT BECAUSE THEY ARE HANDY. THE SMALL AMOUNT OF TIME AND MONEY SPENT IN MAKING A GOOD BATTERY CONNECTION IS WELL WORTH WHILE.

THE BATTERIES MUST BE CONNECTED IN THE PROPER CONFIGURATION IN ORDER TO SUPPLY THE CORRECT VOLTAGE AND AMPERE - HOUR CAPACITY. WHEN TWO OR MORE BATTERIES ARE CONNECTED IN SERIES, THE TOTAL VOLTAGE IS DETERMINED BY ADDING THE VOLTAGE OF THE INDIVIDUAL BATTERIES. THE AMPERE - HOUR CAPACITY OF THE SYSTEM IS THE SAME AS THE CAPACITY OF EACH INDIVIDUAL BATTERY IN THE CHAIN. WHEN CONNECTED IN PARALLEL, THE SYSTEM VOLTAGE IS THE SAME AS THAT OF THE INDIVIDUAL BATTERIES, WHILE THE AMPERE - HOUR CAPACITY IS DETERMINED BY ADDING THE CAPACITIES OF EACH BATTERY IN THE CHAIN.

* C-4. CONNECTING LOADS TO BATTERY

IF LIGHTS ARE TO BE CONNECTED TO THE BATTERY THE WIRES MAY BE CONNECTED DIRECTLY TO THE BATTERY TERMINALS OR TO THE BATTERY TERMINALS ON THE PANEL. ONE OF THE WIRES LEADING TO THE LIGHTS SHOULD BE EQUIPPED WITH A

FUSE TO PROTECT THE CIRCUIT. IF THE LIGHTS GET BRIGHTER AND DIMMER AS THE GENERATOR CHARGING RATE INCREASES AND DECREASES THE BATTERY TERMINALS ARE PERHAPS CORRODED. REMOVE THE TERMINALS AND CLEAN THE CONNECTIONS IF NECESSARY.

IN THE CASE OF A RADIO OR OTHER ELECTRONIC DEVICE, HOWEVER, A POOR BATTERY CONNECTION IS NOT AS EASILY NOTICED AND IT MAY BE INJURED BY THE HIGHER VOLTAGE. FOR THIS REASON IT IS RECOMMENDED THAT THE RADIO BE CONNECTED DIRECTLY TO THE BATTERY RATHER THAN TO THE TERMINALS ON THE PANEL.

*** D. ASSEMBLING THE WINCHARGER

ASSEMBLY OF THE UNIT IS USUALLY DONE ON THE GROUND BEFORE HOISTING. MOST ASSEMBLY OPERATIONS CAN BE DONE ON THE TOWER, BUT ARE MUCH MORE DIFFICULT.

ASSEMBLY IS MOST EASILY DONE ON A BENCH, TABLE TOP, OR SIMILAR ELEVATED PLATFORM. LAY THE GENERATOR ON ITS SIDE ON THE TABLE WITH THE INPUT SHAFT END HANGING OVER THE EDGE.

THE GENERATOR IS SUPPORTED BY A TURNTABLE SHAFT WHICH IS SHIPPED AS PART OF THE COLLECTOR RING ASSEMBLY. DISASSEMBLE THE COLLECTOR RING COVER BY REMOVING THE TWO SCREWS HOLDING THE COVER HALVES TOGETHER. THE COVER HALVES, ALONG WITH SCREWS, NUTS, AND LOCK WASHERS, SHOULD TEMPORARILY SET ASIDE TOGETHER. THEY WILL BE REASSEMBLED AFTER THE UNIT HAS BEEN SET IN POSITION ON THE TOWER. REMOVE THE TURNTABLE SHAFT, TOP COVER PLATE, PIVOT BEARING, AND BEARING WASHER. INSERT THE TURNTABLE SHAFT BETWEEN THE GENERATOR END BRACKETS, AND ATTACH WITH TWO 5/16" X 2" BOLTS WITH NUTS AND LOCKWASHERS.

SLIP THE TOP COLLECTOR RING COVER PLATE OVER THE TURNTABLE SHAFT WITH THE CONVEX SIDE TOWARD THE GENERATOR MOUNTING BRACKETS. SLIP ON THE UPPER BEARING WASHER, BALL THURST BEARING, AND LOWER BEARING WASHER. WRAP STRING OR TAPE AROUND THE SHAFT TO TEMPORARILY HOLD THESE IN PLACE DURING HOISTING.

ASSEMBLE THE TAIL VANE SECTIONS ON THE VANE ANGLE USING 1/4" X 3/4" BOLTS. THEN FASTEN THE ONE VANE BRACE TO THE VANE. REMEMBER, THERE IS ONLY ONE VANE BRACE AND IT IS PLACED ON THE SIDE OF THE VANE THAT DOES NOT REST AGAINST THE VANE ANGLE. NEXT BOLT THE VANE ANGLE ASSEMBLY TO THE END PLATE OF THE GENERATOR USING 5/16" DIAMETER BOLTS. IT MAY BE NECESSARY TO LOOSEN THE BOLTS HOLDING THE END BRACKETS TO THE GENERATOR AND TURNTABLE IN ORDER TO MAKE ALL HOLES LINE UP. ON MODEL W02, THE OPTIONAL VOLTAGE REGULATOR ATTACHES AT THE REAR TAIL VANE BOLT, AS DESCRIBED IN THE REGULATOR INSTALLATION INSTRUCTIONS SUPPLIED WITH THE OPTIONAL REGULATOR. COMPLETE THE WIRING OF THE REGULATOR. THE RECTIFIER ASSEMBLY MODULE FOR THE MODEL W02-224 HAS A LARGE CABLE TO ELECTRICALLY CONNECT THE RECTIFIER TO THE GENERATOR. THIS CABLE WILL EXIT THE RECTIFIER MODULE FROM THE BOTTOM SIDE WHEN THE ASSEMBLY IS PROPERLY INSTALLED ON THE TWO REAR TAIL VANE BOLTS.

THE GOVERNOR IS SHIPPED WITH THE MOUNTING BOLTS IN PLACE. INSERT THESE BOLTS THROUGH THE PROPELLER FROM THE SIDE LABELED "MOUNT WITH THIS SIDE FACING WIND". AND THROUGH THE BRAKE DRUM. THEN LIFT THIS ASSEMBLY TO THE GENERATOR AND INSERT THE BOLTS THROUGH THE HUB. PUT ON THE LOCKWASHERS AND NUTS ON THE BACK SIDE.

SPIN THE PROPELLER THROUGH ONE FULL REVOLUTION TO CHECK FOR RUBBING OF THE BRAKE SHOE ON THE DRUM. IF RUBBING IS HEARD, NOTE THE POINT ON THE SHOE WHERE CONTACT IS MADE. USING A PAIR OF CHANNEL LOCKS OR SIMILAR LEVER, GRASP THE BRAKE LEVER NEAR THE PIVOT. TWIST TO THE SIDE UNTIL THE RUBBING IS ELIMINATED.

THE UNIT IS NOW READY TO BE HOISTED.

*** E. MOUNTING THE WINCHARGER

MOUNTING OF THE WINCHARGER ON THE TOWER SHOULD BE DONE ON A CALM DAY. A MINIMUM OF TWO STRONG PEOPLE ARE NEEDED TO DO THE JOB.

BEFORE THE UNIT IS HOISTED, THE COLLECTOR RING PIVOT SUPPORT ASSEMBLY SHOULD BE IN PLACE AND LEVEL. ALL WIRING OF THE TOWER TO THE CONTROL PANEL SHOULD BE COMPLETED, AND THE BATTERY SHOULD BE CONNECTED.

HOISTING IS MOST CONVENIENTLY DONE USING A CRANE OR CHERRY PICKER. IF NOT AVAILABLE, A DAVIT TYPE HOISTING ARM, CONNECTED TO THE TOWER, MAY BE USED. A PULLEY, BLOCK AND TACKLE, OR CHAINFALL WITH EXTRA CHAIN CAN BE HUNG FROM THE DAVIT. THE BRAKE ROD MAY BE USED AS A LIFTING EYE. BUT THE HOOK SHOULD BE TIED TO THE PROPELLER SIDE OF THE BRAKE SPRING HOLDER TO PREVENT IT FROM SLIPPING FORWARD ALONG THE ROD. IF ROPE IS USED FOR HOISTING, THE BRAKE ROD SHOULD BE WRAPPED WITH SEVERAL LAYERS OF TAPE TO PREVENT THE ROPE FIBERS FROM BEING CUT BY THE SHARP EDGES ON THE LOWER SIDE.

IF A SIMPLE PULLEY ARRANGEMENT IS USED, A WINCH IS NORMALLY NECESSARY TO CONTROL THE WEIGHT OF THE UNIT DURING HOISTING. THIS WINCH SHOULD BE OF THE HAND-POWERED TYPE TO AVOID MOVING THE UNIT TOO FAST WHILE SETTING IT ATOP THE TOWER.

RECOMMENDED MINIMUM CAPACITY OF ALL HOISTING EQUIPMENT (DAVITS, PULLEYS, ROPES OR CHAINS, WINCHES, HOOKS, ETC) IS FIVE TIMES THE HOISTING WEIGHT (GENERATOR, TAIL VANE, PROPELLER, GOVERNOR, BRAKE DRUM, TURNTABLE SHAFT OF THE UNIT. HOISTING WEIGHT FOR THE MODEL W02 IS 27 KG (60 LB). HOISTING WEIGHT FOR THE MODEL W045 IS 45 KG (100 LB).

ALL PERSONNEL WORKING ON THE TOWER SHOULD BE EQUIPPED WITH SAFETY BELTS. A TOOL BELT IS ALSO USEFUL.

WHILE RAISING THE UNIT, CARE MUST BE TAKEN TO PREVENT THE UNIT FROM HITTING AND RUBBING AGAINST THE TOWER. THIS IS MOST EASILY DONE BY TYING ONE OR TWO ROPES TO THE UNIT, AND USING THEM TO PULL IT AWAY FROM THE TOWER AS IT IS RAISED.

THE UNIT SHOULD BE SLOWLY LOWERED ONTO THE TOWER AS ONE CLIMBER, EQUIPPED WITH A SAFETY BELT, GUIDES THE TURNTABLE SHAFT INTO PLACE. ONCE THE SHAFT IS STARTED INTO THE PIVOT SUPPORT, THE TAPE HOLDING THE BEARING AND COVER PLATE CAN BE REMOVED. LOWER THE UNIT GENTLY TO REST ON THE PIVOT SUPPORT, ALIGNING THE TWO TABS ON THE COVER PLATE WITH THE TAIL VANE SIDE OF THE GENERATOR MOUNTING BRACKETS.

NEXT, PASS THE BRAKE ROD THROUGH THE SMALL WASHER PROVIDED. DROP THE ROD THROUGH THE END HOLE IN THE BRAKE LEVER AND DOWN THROUGH THE TURNTABLE SHAFT. THE BOTTOM END OF THE ROD CAN NOW BE LOOPED TO CONNECT TO A ROPE OR CHAIN LEADING TO THE BASE OF THE TOWER WITHIN EASY REACH OF THE GROUND, SO THAT THE UNIT CAN BE SHUT OFF WHEN DESIRED.

THE NEXT STEP IS TO INSTALL THE COLLECTOR RING COVER HALVES, WHICH INCLUDE THE BRUSHES. THE HALF WITH THE ("+") TERMINAL GOES ON THE RIGHT SIDE; AS SEEN LOOKING FROM TAIL VANE TOWARD PROPELLER. THE LIPS ON THE COVER HALVES SHOULD OVERLAP THE TOP COVER PLATE.

THE GENERATOR LEAD WIRES CAN NOW BE CONNECTED TO THE TERMINAL BOLTS ON THE COLLECTOR RING COVER. WIRES TAGGED ("POS") CONNECT TO THE ("+") TERMINAL, ("NEG") WIRES TO THE ("-") TERMINAL, AND ("FLD") WIRES TO ("F"). ON MODEL W02 UNITS WITH VOLTAGE REGULATORS, THE RED REGULATOR LEAD CONNECTS TO POS (+), AND THE WHITE TO NEG (-).

THE UNIT SHOULD NOW BE PIVOTED ONE FULL REVOLUTION ON THE TURNTABLE TO CHECK FOR FREE MOVEMENT AND LEAD WIRE CLEARANCE. RE-ROUTE ALL WIRES AS NECESSARY, USING TAPE OR WIRE TIES TO HOLD WIRES WELL AWAY FROM ANY NEARBY PARTS.

TO AVOID VIBRATION IT IS IMPORTANT THAT BOTH PROPELLER TIPS AND BOTH GOVERNOR FLAPS TRAVEL AT EQUAL DISTANCES FROM THE TOWER LEGS. THIS DISTANCE CAN EASILY BE MEASURED. BE SURE THAT THE CHARGER DOES NOT REVOLVE ON THE TURNTABLE WHILE TAKING THESE MEASUREMENTS. IF ONLY A SMALL AMOUNT OF PROPELLER TRACKING CORRECTION IS NECESSARY IT MAY BE ACCOMPLISHED BY TIGHTENING ONE OF THE PROPELLER BOLTS A LITTLE MORE. IF MORE CORRECTION IS NECESSARY, INSERT A THIN METAL SHIM BETWEEN THE HUB AND THE PROPELLER; TO DO THIS WILL REQUIRE LOOSENING THE PROPELLER BOLTS. GOVERNOR TRACKING CAN BE DONE BY GRASPING THE FRAME JUST INSIDE THE FLAPS AND GENTLY BENDING TOWARD OR AWAY FROM THE TOWER AS REQUIRED.

BEFORE DESCENDING THE TOWER, GIVE THE INSTALLATION A FINAL VISUAL CHECK, AND DOUBLE CHECK ALL BOLTS AND SCREWS TO INSURE THAT THEY ARE TIGHT.

*** F. INSTALLATION CHECK

***** NOTICE: ***** THE FOLLOWING PROCEDURE FOR "MOTORING" APPLIES ONLY TO W02-212, 200 WATT, 12 VOLT WINCHARGER. ALTHOUGH NO HARM WILL OCCUR IN ATTEMPTING TO "MOTOR" THE RECTIFIED AC TYPE UNITS, THE PROPELLER WILL NOT "MOTOR".

AFTER COMPLETING ALL CONNECTIONS ON THE MODEL W02-212, IT IS ADVISABLE TO "MOTOR" THE GENERATOR. THIS WILL PROPERLY POLARIZE THE GENERATOR AND WILL ALSO INDICATE WHETHER OR NOT THE ELECTRICAL CIRCUIT IS COMPLETE. THIS INSTALLATION CHECK IS BEST MADE WHEN THERE IS NO WIND. DURING PERIODS OF LOW WIND VELOCITY THERE IS NO POSITIVE WAY OF KNOWING WHETHER THE GENERATOR IS "MOTORING" OR WHETHER THE WIND IS CAUSING THE PROPELLER TO TURN.

BEFORE ATTEMPTING TO MOTOR THE GENERATOR, RELEASE THE BRAKE. REMOVE THE POSITIVE GENERATOR LEAD FROM THE ("A" GEN) TERMINAL BOLT ON THE INSTRUMENT PANEL. FIRMLY PRESS THE END OF THIS POSITIVE GENERATOR LEAD TO THE BASE OF THE LARGE ALUMINUM HEAT SINK MOUNTED ON THE PANEL. THE AMMETER SHOULD SHOW A DISCHARGE OF APPROXIMATELY 4 TO 6 AMPERES WHILE MOTORING IN NO WIND. IF IT DOES NOT, SOMETHING IS WRONG - SEE "LOCATING TROUBLE". IF THE INSTALLATION IS COMPLETED WHEN THERE IS WIND, ONE PERSON SHOULD RELEASE THE BRAKE AND ANOTHER PERSON SHOULD MOTOR THE GENERATOR THE INSTANT THE BRAKE IS RELEASED BEFORE IT HAS A CHANCE TO PICK UP SPEED.

III.----- SERVICE -----

*** A. PROPER CHARGER INSTALLATION

IT IS ABSOLUTELY NECESSARY THAT THE CHARGER BE INSTALLED WHERE THE PROPELLER WILL OBTAIN THE FULL SWEEP OF THE WIND FROM ALL DIRECTIONS. UNLESS YOUR CHARGER IS PROPERLY INSTALLED IT CANNOT GIVE GOOD PERFORMANCE. IN THE MAJORITY OF CASES OF POOR PERFORMANCE, THE INSTALLATION IS FAULTY. REMEMBER, THE CHARGER SHOULD BE AT LEAST 5 METERS (15 FEET) HIGHER THAN ANY OBSTRUCTION WITHIN 400 FEET.

*** B. BATTERY CARE.

THE MOST IMPORTANT PRECAUTIONS IN CARING FOR THE BATTERY ARE TO KEEP THE TERMINALS CLEAN AND TO ADD ENOUGH DISTILLED WATER OCCASIONALLY TO KEEP THE LIQUID ABOUT HALF INCH ABOVE THE PLATES. PETROLEUM JELLY APPLIED TO THE BATTERY POSTS AND LEAD WIRE TERMINALS WILL HELP TO PREVENT CORROSION. IF THEY DO BECOME CORRODED THEY MAY BE CLEANED WITH A LITTLE BAKING SODA AND WATER. IF BATTERY ACID IS SPILLED ON THE CLOTHING OR FLOOR IT SHOULD BE NEUTRALIZED IMMEDIATELY WITH BAKING SODA, WASHING SODA OR HOUSEHOLD AMMONIA.

SOMETIMES A PLATE IN A BATTERY BECOMES SHORTED, RESULTING IN A DEAD BATTERY, AND THE FAULT IS LAID TO THE GENERATOR. OBSERVE THE AMMETER TO SEE THAT THE GENERATOR IS CHARGING PROPERLY DURING GOOD STEADY WIND. IF THE BATTERY CANNOT BE KEPT CHARGED, AND THE GENERATOR IS WORKING PROPERLY, EITHER THE LOAD IS TOO HEAVY OR THE BATTERY IS FAULTY.

*** C. BRUSHES

* C-1 GENERATOR BRUSHES

CURRENT IS TAKEN FROM THE GENERATOR'S ROTATING ARMATURE THROUGH THE BRUSHES, WHICH RUN AGAINST A COMMUTATOR OR SLIP RINGS ON THE FRONT END OF THE ARMATURE. THE MODEL W02-212 USES TWO BRUSHES WITH A 49 BAR COMMUTATOR. THE MODEL W02-224 AND W045 USE THREE PARALLEL SLIP RINGS, WITH TWO BRUSHES RUNNING ON EACH FOR A TOTAL OF SIX BRUSHES. THE BRUSHES ARE ACCESSED BY LOOSENING THE BRUSH COVER SCREWS ENOUGH TO REMOVE THE COVERS.

THE BRUSHES ARE AN IMPORTANT ITEM. NEVER WAIT UNTIL THE BRUSHES BECOME WORN TO REPLACE THEM. AS THIS IS INJURIOUS TO THE COMMUTATOR OR SLIP RINGS. BY CHECKING THE BRUSHES OCCASIONALLY, IT IS A SIMPLE MATTER TO CHANGE THEM BEFORE THEY ARE WORN SO LOW THAT THE SPRING TENSION IS TAKEN OFF THE BRUSH. THE LOOSE BRUSH THEN MAKES POOR CONTACT AND RESULTS IN BURNING OF THE COMMUTATOR OR SLIP RINGS. THE MODEL W02-212 BRUSHES HAVE BEEN ADJUSTED AT THE FACTORY FOR THE BEST GENERATOR PERFORMANCE. DO NOT TRY TO IMPROVE THIS SETTING. NO ADJUSTMENT IS REQUIRED ON THE MODEL W02-224 OR W045.

ON THE MODEL W02-212, THE BRUSHES SHOULD BE CHECKED AFTER ONE YEAR OF OPERATION, AND EVERY SIX MONTHS THEREAFTER. ON MODEL W02-224 AND W045, BRUSHES SHOULD BE CHECKED ONCE EVERY TWO YEARS. UNDER SEVERE OPERATING CONDITIONS, IT IS ADVISABLE TO CHECK BRUSHES MORE OFTEN. A RECORD SHOULD BE KEPT OF DATES WHEN THE BRUSHES ARE CHECKED AND CHANGED.

THE BRUSHES ON THE MODEL W02 ARE LOCATED UNDER THE TWO LOWER COVER PLATES. THESE MAY BE CHECKED WITHOUT REMOVING THE BRUSHES FROM THE UNIT BY OBSERVING THE POSITION OF THE BRUSH SPRING RELATIVE TO ITS STOP. THE ENDS OF NEW BRUSHES WILL BE APPROXIMATELY FLUSH WITH THE END OF THE BRUSH HOLDER. AS WEAR OCCURS, THE BRUSHES WILL BE PUSHED FARTHER INTO THE HOLDER BY THE BRUSH SPRING. THE END OF THE SPRING PROGRESSES THROUGH A SLOT IN THE HOLDER UNTIL IT STOPS AGAINST THE END OF THE SLOT. THE BRUSHES SHOULD BE REPLACED WHEN THE SPRING END COMES WITHIN 2 MM (1/16 INCH) OF THE END OF THE SLOT.

THE SIX BRUSHES ON THE MODELS W02-224 AND W045 ARE LOCATED UNDER THE TWO UPPER BRUSH COVERS. THESE MUST BE REMOVED FROM THE GENERATOR TO BE CHECKED. WHEN REMOVING AND REPLACING BRUSHES, CARE MUST BE TAKEN TO AVOID DROPPING SCREWS AND CONNECTING STRIPS INTO THE GENERATOR. BY CHECKING ONE SIDE OF THE GENERATOR AT A TIME, THE CONNECTING STRIPS CAN BE LEFT IN PLACE. IF PARTS ARE DROPPED, THEY CAN USUALLY BE RETRIEVED THROUGH THE LOWER BRUSH COVERS. THE LENGTH OF A NEW BRUSH (LENGTH OF THE FULL CROSS SECTION ONLY, LESS SPRING LOCATING TAB) IS APPROXIMATELY 19MM (3/4 INCH). BRUSHES SHOULD BE REPLACED WHEN WORN DOWN TO 10MM (3/8 INCH) OR LESS. UNDER NORMAL CONDITIONS, A SET OF BRUSHES SHOULD LAST SEVERAL YEARS. WHEN REPLACING THE BRUSHES, BE SURE TO RE-CONNECT THE THREE RECTIFIER LEADS. THESE LEADS MAY BE CONNECTED TO THE BRUSHES IN ANY ORDER -- THEIR POSITIONS ARE INTERCHANGEABLE. BE SURE THAT ALL SCREWS ARE TIGHT BEFORE REPLACING THE BRUSH COVERS.

* C-2. COLLECTOR RING BRUSHES

THE COLLECTOR RING BRUSHES ARE LOCATED ON THE INSIDE OF THE COVER HALVES. THEY SHOULD BE CHECKED OCCASIONALLY FOR WEAR AND SPRING TENSION. THICKNESS OF A NEW BRUSH IS 3.2MM (1/8 INCH) ON MODEL W02, AND 4.8MM (3/16 INCH) ON MODEL W045. THE BRUSH AND SPRING ASSEMBLY SHOULD BE REPLACED WHEN THE BRUSHES ARE WORN TO A THICKNESS OF 1MM (1/32 INCH). FOR PROPER BRUSH SPRING TENSION, THE NEAREST POINTS SHOULD BE APPROXIMATELY 30MM (1-1/8 INCH) APART IN THE FREE POSITION, AND THE TWO SPRING LEGS SHOULD BE BENT TO APPROXIMATELY THE SAME ANGLE.

*** D. GREASING THE CHARGER

* D-1. GENERATOR:

THE GENERATOR IS EQUIPPED WITH DOUBLE GREASED SEALED BALL BEARINGS AND WILL NOT REQUIRE FURTHER GREASING FOR ITS ENTIRE LIFE.

* D-2. PIVOT BEARING AND TURNTABLE SHAFT:

THE COLLECTOR RING PIVOT BEARING SHOULD OCCASSIONALLY BE GREASED UNLESS THIS IS WELL LUBRICATED. THE PROPELLER WILL NOT FACE THE WIND AS THE WIND DIRECTION SHIFTS. ON THE MODEL W02, THE TURNTABLE SHAFT SHOULD ALSO BE GREASED. TO DO THIS REMOVE THE BOLTS WHICH HOLD THE COLLECTOR RING CUP HALVES TOGETHER. LIFT THE SHAFT UP A FEW INCHES, AND APPLY A LIGHT COAT OF CUP GREASE.

* D-3. GOVERNOR:

TO INSURE FREE OPERATION, A FEW DROPS OF OIL SHOULD OCCASDIONALLY BE PUT ON THE PIN JOINTS OF THE GOVERNOR.

*** E. VIBRATION

ONE OF THE COMMON CAUSES OF VIBRATION IS A PROPELLER THAT IS NOT TRACKING PROPERLY.

AN OUT OF BALANCE PROPELLER OR GOVERNOR WILL ALSO CAUSE VIBRATION. IF NECESSARY, THE PROPELLER AND GOVERNOR MAY BE REBALANCED DURING TIMES WHEN THERE IS NO WIND. ON MODEL W02-212, LOOSEN THE LOWER BRUSH COVER BOLTS ENOUGH TO REMOVE THESE COVERS. WITH A STRING OR PIECE OF FINE WIRE TIE THE BRUSHES BACK SO THEY CANNOT REST ON THE COMMUTATOR. ON MODEL W02-224 AND MODEL W045, ALL SIX BRUSHES MUST BE REMOVED FROM THE GENERATOR. THESE CAN BE ACCESSED BY REMOVING THE TWO UPPER BRUSH COVERS.

THE PROPELLER WILL NOW REVOLVE VERY EASILY WITH PRACTICALLY NO FRICTION. STOP THE PROPELLER IN A HORIZONTAL POSITION (PARALLEL TO THE GROUND) WITH THE GOVERNOR FRAME IN A VERTICAL POSITION (STRAIGHT UP AND DOWN). IF THE PROPELLER AND GOVERNOR START TO TURN FROM THIS POSITION THE PROPELLER IS OUT OF BALANCE; TURN A WOOD SCREW INTO THE BACK EDGE OF THE LIGHT END OF THE PROPELLER AND PUT ENOUGH WEIGHT ON IT SO THAT BALANCE WILL BE RESTORED. NEVER ADD WEIGHT MORE THAN 0.6 METERS (2 FEET) FROM THE CENTER OF THE PROPELLER. IF THERE ARE ANY BALANCING WEIGHTS ON THE PROPELLER THESE CAN BE MOVED TO RESTORE BALANCE. WHEN IT HAS BEEN BALANCED TO THE POINT WHERE IT DOES NOT START TO TURN BY ITSELF, GIVE IT A HALF REVOLUTION AND AGAIN STOP IT TO BE SURE IT WILL ALSO REMAIN AT REST IN THAT POSITION.

AFTER THE PROPELLER HAS BEEN PROPERLY BALANCED IN THIS POSITION, STOP IT IN A VERTICAL POSITION (STRAIGHT UP AND DOWN) WITH THE GOVERNOR FRAME IN A HORIZONTAL POSITION. IF THE PROPELLER AND GOVERNOR START TO TURN FROM THIS POSITION, BALANCE MAY BE RESTORED BY SCREWING A WEIGHT ON ONE SIDE OF THE PROPELLER HALF WAY BETWEEN THE ENDS, THAT IS, DIRECTLY TO THE SIDE OF THE CENTER. WHEN IT HAS BEEN BALANCED TO A POINT WHERE IT DOES NOT START TO MOVE FROM A HORIZONTAL POSITION, GIVE IT A HALF TURN AND AGAIN STOP IT TO BE SURE THAT IS REMAINS AT REST IN THAT POSITON.

WITH BOTH GOVERNOR AND PROPELLER BALANCED, THEY SHOULD REMAIN AT REST WHEN STOPPED IN ANY POSITION. BE SURE TO DO THIS ONLY WHEN THERE IS ABSOLUTELY NO WIND. A PERFECT BALANCE CAN BE OBTAINED BY THIS METHOD WITHOUT REMOVING ANY PART OF THE CHARGER IF DONE WHILE THERE IS NO MOVEMENT OF AIR.

*** F. CORRECT CHARGING RATES:

TABLE 3 SHOWS THE CURRENT OUTPUT WHEN THE GENERATOR IS RUN AT VARIOUS SPEEDS:

TABLE 3.
OUTPUT CURRENT VS. RPM

RPM	MODEL W02		MODEL W045			
	12V	24V	12V	24V	36V	48V
240	0.0	0.0	0.1	0.1	0.1	0.1
290	0.1	0.1	8.0	4.0	2.7	2.0
350	2.5		16.0	8.0	5.3	4.0
440	6.0		24.0	12.0	8.0	6.0
570	10.0		30.0	15.0	10.0	7.5
700	12.0		31.0	15.0	10.0	7.5
900	14.0		32.0	16.0	10.7	8.0

LEAVING THE TEST BULB CONNECTED AS IN PARAGRAPH D. TOUCH A SHORT WIRE FROM THE + TERMINAL TO THE - TERMINAL ON THE COLLECTOR RING CUP. IF THE BULB LIGHTS, THE CIRCUIT IS SATISFACTORY TO THIS POINT. IF IT DOES NOT, THERE IS AN OPEN IN THIS PART OF THE CIRCUIT. TAKE OUT THE BOLTS WHICH HOLD THE COLLECTOR RINGS TOGETHER SO THAT IT MAY BE REMOVED. TOUCHING THE WIRE FROM ONE COLLECTOR RING TO THE OTHER SHOULD LIGHT THE BULB. IF IT DOES NOT THERE IS AN OPEN IN THE COLLECTOR RING LEADS. IF IT DOES LIGHT, THIS INDICATES THAT SINCE IT DID NOT LIGHT WHEN TOUCHED TO THE COLLECTOR RING TERMINALS, A POOR CONTACT WAS BEING MADE BETWEEN THE COLLECTOR RING AND THE COLLECTOR RING BRUSH. CAREFULLY CLEAN THEM WITH GASOLINE, POLISH WITH SANDPAPER IF NECESSARY AND EXAMINE THE BRUSH SPRINGS TO SEE THAT THEY HAVE ENOUGH TENSION TO HOLD THE BRUSHES FIRMLY AGAINST THE COLLECTOR RINGS.

IF THE CIRCUIT IS COMPLETE ANY TIME THE PROPELLER IS STOPPED THE TEST BULB WILL LIGHT WHEN THE LEADS ARE CONNECTED TO THE + BAT. AND "A" GEN TERMINALS ON THE PANEL.

AFTER THE "OPEN" IS LOCATED, BE SURE TO REMOVE THE TEST LIGHT FROM THE PANEL BEFORE STARTING THE PLANT.

*** J. BATTERY CANNOT BE CHARGED

IF THE BATTERY CANNOT BE KEPT CHARGED THERE MAY BE SEVERAL CAUSES FOR TROUBLE. (1) THE CHARGER IS INSTALLED WHERE THE WIND DOES NOT HAVE A CLEAR SWEEP TO THE PROPELLER. (2) THE CHARGING RATE IS LOW (WATCH THE AMMETER AND COMPARE WITH PROPER CHARGING RATE). (3) THE BATTERY IS IN POOR CONDITION (BE SURE TO ADD WATER WHEN NEEDED). (4) THE LOAD IS TOO HEAVY (USING THE LIGHTS OR RADIO TOO MUCH) OR (5) THE DIODE IS SHORTED ALLOWING THE GENERATOR TO MOTOR WHEN THE WIND GOES DOWN.

IF NO SHORTS OR OPENS CAN BE DETECTED IN THE CIRCUIT, AND THE GENERATOR IS IN WORKING ORDER, AND STILL NO CHARGE IS INDICATED DURING GOOD STEADY WINDS, IT IS POSSIBLE THAT THE DIODE IS OPEN. WHILE THE PROPELLER IS TURNING AT A GOOD RATE OF SPEED, BYPASS THE DIODE WITH A SHORT PIECE OF WIRE AS EXPLAINED ABOVE. IF A CHARGE IS INDICATED WHEN THESE TERMINALS ARE CONNECTED TOGETHER BUT WILL NOT SHOW A CHARGE WHEN THEY ARE NOT CONNECTED, THE DIODE IS OPEN AND MUST BE REPLACED.

*** K. GENERATOR DOES NOT CHARGE:

IN MOST CASES THIS IS CAUSED BY AN OPEN OR SHORT BUT IT MAY ALSO FAIL TO CHARGE BECAUSE THE BRUSHES ARE NOT PROPERLY TOUCHING THE COMMUTATOR. REMOVE THE LOWER BRUSH COVERS ON THE GENERATOR AND PULL OUTWARD ON THE BRUSHED. IF THERE ARE ANY EVIDENCES OF STICKING DUE TO RUST OR CORROSION IT SHOULD BE REMOVED WITH FINE SANDPAPER AND LUBRICATED WITH A DROP OF LIGHT OIL.

*** L. LOW CHARGING RATE:

BRUSHES WHICH ARE SO BADLY WORN THAT THEY DO NOT MAKE FIRM CONTACT ON THE COMMUTATOR OR A DIRTY OR ROUGH COMMUTATOR REDUCES THE CHARGING RATE OF THE GENERATOR. THEY MAY BE INSPECTED BY REMOVING THE GENERATOR COVER BAND. IF THE BRUSHES ARE WORN DOWN TO ABOUT 1/2 INCH THEY SHOULD BE REPLACED.

THE NORMAL CHARGING RATE OF THE GENERATOR AT VARIOUS SPEED IS ON PAGE C-2. IF THE COMMUTATOR, BRUSHES AND WIRING ALL SEEM TO BE SATISFACTORY, BUT THE GENERATOR CURRENT OUTPUT IS LESS THAN IT SHOULD BE ACCORDING TO THIS TABLE, THE GENERATOR MAY BE REMOVED AND TESTED AT A RELIABLE REPAIR SHOP. REMEMBER HOWEVER, THAT HIGH CURRENT OUTPUTS CANNOT BE EXPECTED IN ROUGH SWIRLING AIR CURRENTS. SO BE SURE THE CHARGER IS MOUNTED HIGH ENOUGH.

THE COMMUTATOR NEED NOT BE OF LIGHT COPPER COLOR FOR BEST PERFORMANCE. AS LONG AS IT IS NOT STICKY, BURNED OR PITTED IT SHOULD NOT BE SANDED DOWN. IT MAY BE CLEANED UP WITH GASOLINE OR IF IN POOR CONDITION IT MAY BE CLEANED WITH NO 00 SANDPAPER (DO NOT USE EMERY PAPER). A COMMUTATOR THAT IS IN GOOD CONDITION HAS A DARK BROWN COLOR AND A GLOSSY APPEARANCE.

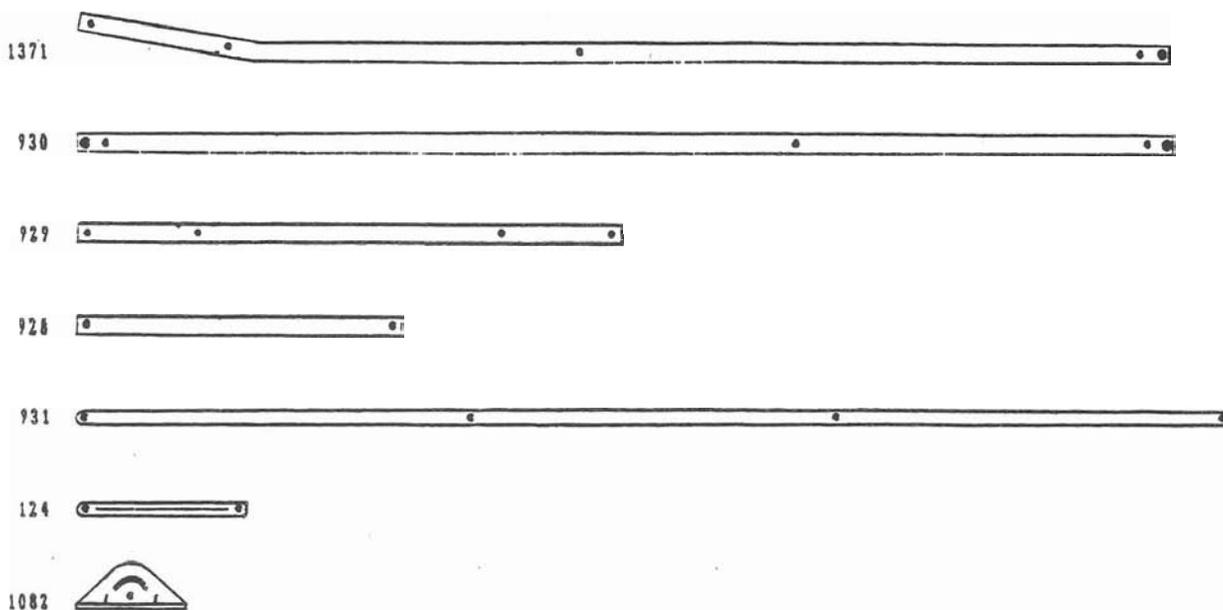
*** CAUTION ***

DO NOT TRY TO ADJUST THE BRUSHES TO OBTAIN MORE OUTPUT

V.		TOWER KIT PARTS CHECK-LIST	
*** #	P/N	DESCRIPTION	QUANTITY REQ'D
			# 1359 (5FT) # 1715 (10FT)
	1371	TOWER LEG	4 4
	930	TOWER LEG EXTENSION	-- 4
	929	MID-BRACE	-- 4
	928	TOP BRACE	-- 4
	931	CROSS BRACE - LOWER	-- 8
	124	CROSS BRACE - UPPER	4 4
	1082	TOWER FOOT	4 4
	466	CAP SCREW (1/4-20X3/4")	28 60
	439	CAP SCREW (1/4-20X1")	-- 8
	438	HEX NUT (1/4-20)	28 68
	479	LOCKWASHER (1/4 SPLIT)	28 68
	512	FLAT WASHER (1/4)	4 4
	467	CAP SCREW (5/16-18X3/4)	4 4
	458	HEX NUT (5/16-18)	4 4
	480	LOCK WASHER (5/16 SPLIT)	4 4

TOWER PARTS ILLUSTRATION

PART NUMBER



VI. ----- WINCHARGER AND TOWER REPLACEMENT PARTS LIST -----				
*** #	P/N	DESCRIPTION	MODEL W02 200 WATT	MODEL W045 450 WATT
***** TURNTABLE AND COLLECTOR RING ASSEMBLY *****				
1408		TURNTABLE AND COL RING ASSY	1	--
59982		TURNTABLE AND COL RING ASSY	--	1
671		COL RING CUP W/BRUSHES	1	--
61268		COL RING CUP W/BRUSHES	--	1
1202		COL RING BRUSH ASSY	2	--
1706		COL RING BRUSH ASSY	--	3
865		SPRING, BRUSH BACKUP	--	3
57521-1		PIVOT BEARING	1	--
57521-0		PIVOT BEARING	--	1
57520		BEARING WASHER (2 REQ'D)	2	--
60757		BEARING WASHER (2 REQ'D)	--	2
1351		COVER PLATE, COL RING	1	--
1591		COVER PLATE, COL RING	--	1
60810		TERMINAL BLOCK	--	1
60816		COVER, TERMINAL BLOCK	--	1
1458		COL RING ASSY (INCL SUPPORT PLATES, TERMINALS	1	--
60808		COL RING ASSY (INCL SUPPORT PLATES, TERMINALS	--	1
***** GENERATOR MOUNTINGS AND VANE *****				
1409		TURNTABLE SHAFT	1	--
59941		TURNTABLE SHAFT	--	1
*****		TAIL VANE *****		
545-3		TAIL VANE (PAIR)	1	1
1275		VANE ANGLE	1	1
1515		VANE BRACE	1	1
***** TOWER *****				
1715		10-FT TOWER (LESS HARDWARE)	1	1
1359		5-FT TOWER (LESS HARDWARE)	1	1
927		5 FT TOWER EXTENSION TO MAKE A 10 FT TOWER (LESS HARDWARE)	1	1
676		BAG OF BOLTS (10FT TWR)	1	1
673		BAG OF BOLTS (5FT TWR)	1	1
674		BAG OF BOLTS (5FT TWR EXT)	1	1
***** PROPELLER, GOVERNOR, AND BRAKE ASSEMBLIES *****				
9439		PROPELLER	1	--
59999		PROPELLER	--	1
1413		HUB	1	--
1626		HUB	--	1
8830		GOVENOR	1	--
1410		GOVENOR	--	1
1537		BRAKE SHOE, LEVER, AND POVOT BRACKETS (ASSEMBLED)	1	--
59987		BRAKE SHOE, LEVER, AND PIVOT BRACKETS (ASSEMBLED)	--	1
1538		BRAKE DRUM	1	1
114		SPRING HOUSING	1	1
105		SPRING, BRAKE LEVER	1	1
107		BRAKE ROD	1	1
***** INSTRUMENT PANEL, CONTROLS *****				
INSTRUMENT PANEL LESS VOLTAGE REGULATOR				

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1334	12 VOLT	1	--
60839	12 VOLT	--	1
1334-1	24 VOLT	1	--
60839-1	24 VOLT	--	1
60839-2	36 VOLT	--	1
60839-2	48 VOLT	--	1

INSTRUMENT PANEL INCLUDING VOLTAGE REGULATOR

60839-3	12 VOLT	--	1
60839-4	24 VOLT	--	1
58367	VOLTAGE REGULATOR KIT (12 V)	1	--
61196-1	VOLTAGE REGULATOR KIT (12 V)	--	1
61196-2	VOLTAGE REGULATOR KIT (24 V)	--	1
45930-2	RECTIFIER AND HEAT SINK ASSY	1	--
91460	DIODE	--	1
576	AMMETER (20-0-20 AMP)	1	--
60836-0	AMMETER (0-30 AMP)	--	1
60836-1	AMMETER (0-15 AMP)	--	1
60836-2	AMMETER (0-10 AMP)	--	1

***** GENERATOR REPLACEMENT PARTS *****

1543	FIELD SHELL	1	--
59827	FIELD SHELL	--	1
FIELD COIL SET			
1890	12 VOLT	1	--
1891	12 VOLT	1	--
2632	12 VOLT	1	--
2633	12 VOLT	1	--
59829	12 VOLT	--	1
59829-1	12 VOLT	--	1
59829-2	12 VOLT	--	1
59829-3	12 VOLT	--	1
59748	24 VOLT	1	--
59748-1	24 VOLT	1	--
59748-2	24 VOLT	1	--
59748-3	24 VOLT	1	--
60903	24 VOLT	--	1
60903-1	24 VOLT	--	1
60903-2	24 VOLT	--	1
60903-3	24 VOLT	--	1
60904	36 VOLT	1	--
60904-1	36 VOLT	1	--
60904-2	36 VOLT	1	--
60904-3	36 VOLT	1	--
60905	48 VOLT	1	--
60905-1	48 VOLT	1	--
60905-2	48 VOLT	1	--
60905-3	48 VOLT	1	--
3962	POLE SHOE	4	--
59830	POLE SHOE	--	4
1546	REAR END CASTING (MACHINED)	1	1
1496	REAR BEARING	1	1
1411	GEN. MOUNTING BRKT (L)	1	1
1412	GEN. MOUNTING BRKT (R)	1	1
1550	DRIVE END CASTING (MACHINED)	1	--
1550-1	DRIVE END CASTING (MACHINED)	--	1
1496	BEARING, DRIVE END	1	1
1146	BEARING, DRIVE END	--	1
1532	BRUSH HOLDER ASSY (12 VOLT) (LESS BRUSHES AND SPRINGS)	1	--
59750	BRUSH HOLDER PLATE ASSY (LESS BRUSHES-24 VOLT)	1	--

59833	BRUSH HOLDER PLATE ASSY (LESS BRUSHES-ALL VOLTAGES)	--	1
988	NOISE ELIMINATOR	1	1
1496	CONDENSER (12 VOLT)	1	--
GENERATOR BRUSH			
1612	12 VOLT	2	--
61259	12 VOLT	--	6
61259	24, 36, 48 VOLT	6	6
1113	BRUSH SPRING - 12 VOLT	2	--
1157	COVER, BRUSH	--	--
	12 VOLT	4	3
	24, 36, 48 VOLT	3	3
59990	COVER W/HOLE	--	--
	12 VOLT	--	1
	24, 36, 48 VOLT	1	1
59991	BUSHING, BRUSH COVER	--	--
	12 VOLT	--	1
	24, 36, 48 VOLT	1	1
ARMATURE W/BEARINGS INSTALLED			
3504	12 VOLT	1	--
59826	12 VOLT	--	1
59747	24 VOLT	1	--
60900	24 VOLT	--	1
60901	36 VOLT	--	1
60902	48 VOLT	--	1
1549	ARMATURE SHAFT NUT	1	1
40552	ARMATURE SHAFT LOCKWASHER	1	1
647	WOODRUFF KEY	1	--
348	WOODRUFF KEY	--	1
1514	BOLT (5/16-18X6-1/2)	4	--
60819	BOLT (5/16-18X9-1/2)	--	4
59996	RECTIFIER ASSY W/CORD (24V)	1	--
60792	RECTIFIER ASSY	--	1
60732	BRACKET, RECTIFIER SUPPORT	--	1
91459	HEAT SINK, RECTIFIER	--	2
60793	DIODE - POS LEAD	--	3
60793-1	DIODE - NEG LEAD	--	3

***** POINTS TO REMEMBER *****

1. MOUNT THE CHARGER HIGH ENOUGH TO ALLOW AN UNDEFLECTED SWEEP OF THE WIND FROM ALL DIRECTIONS. (15 FEET HIGHER THAN ANY OBSTRUCTION WITHIN 400 FEET).
2. USE PROPER SIZE WIRE FROM CHARGER TO BATTERY.
3. BE SURE TO MAKE GOOD PERMANENT ELECTRICAL CONNECTIONS TO THE BATTERY TERMINALS.
4. SOLDER AND TAPE ALL WIRE SPLICES.
5. NEVER ALLOW CHARGER TO RUN WITHOUT A BATTERY CONNECTED, OR WITHOUT SHORTING OUT THE GENERATOR.
6. INSTALL THE PROPELLER WITH THE CORRECT SIDE TOWARD THE WIND. THIS INFORMATION IS STAMPED ON THE CENTER OF THE PROPELLER.
7. USING REGULAR LIGHTENING CABLE OR NO. 4 WIRE, CONNECT THE NEGATIVE TERMINAL ON THE TOWER TO A ROD DRIVEN 8 FEET INTO THE GROUND.
8. LOADS AND CHARGER CAN BE CONNECTED TO SAME BATTERY, AND BATTERY CAN BE CHARGED WHILE LOADS ARE IN USE.
9. THE GENERATOR IS EQUIPPED WITH DOUBLE GREASE SEALED BEARINGS, MAKING IT UNNECESSARY TO EVER OIL THE GENERATOR DURING ITS ENTIRE LIFE.