WorkHorse SERIES 1

FERRORESONANT BATTERY CHARGERS

Installation and Operating Instructions

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The Power of Excellence

FM1246
REV H

APPLIED ENERGY SOLUTIONS WorkHorse Series 1
INDUSTRIAL BATTERY CHARGER OWNER'S MANUAL

INSTALLATION: READ AND FOLLOW ALL SAFETY INSTRUCTIONS ON THE FOLLOWING PAGE. All AES SERIES 1 chargers are for indoor use only. Charging areas must be clean, dry and free from combustible materials, and/or open flames. Charging areas must be properly ventilated and smoking should never be allowed in or near the charging area. The temperature of the charging room should be between 32º F and 104º F.

CAUTION To reduce the risk of fire, use only on circuits provided with branch circuit protection indicated in Table 1 (page 2) in accordance with the NATIONAL ELECTRIC CODE ANSI/NFPA 70.

MOUNTING: SERIES 1 chargers must be mounted on a surface constructed from con-combustible material, such as stone, brick, concrete or metal.

INPUT POWER CONNECTION: The INPUT POWER is to be connected via the supplied line cord or to the short 10 AWG "pigtails" (consult Table 1).

Battery charging products can cause serious injury, death or damage to other equipment and property if the safety rules are not strictly followed.

SERIES 1 CONTROL FEATURES:

1. Automatic five-second delayed start upon connection of a properly sized battery.
2. Battery voltage is continually monitored.
3. Automatic charge termination 3 hours after the 80% charge point.
4. 80% charge point selectable 2.37 or 2.45 volts per cell.(consult factory representative for 2.45 vpc setting procedure)
5. On / off Equalize switch provided to extend charge 3 additional hours after normal charge termination.
6. Backup timer - 12 hours to the 80% point.
7. Automatic fault shut down: displayed numerically on the 2 digit LED readout:
    a. **Fault code 1** - Low volts per cell - less than 1.7 vpc
    b. **Fault code 2** - High volts per cell - greater than 2.7 or 2.80 vpc (set with 80% point)
    c. **Fault code 3 -** Battery disconnected from charger during charge
    d. **Fault code 4** - Charge time exceeded - backup timer expired
    e. **Fault code 5 -** Low charging current - charging current less than approximately 3 amps
8. Memory retention during AC power loss.
9. Refresh cycle (optional) - 30 minutes every 24 hours. (consult factory representative for setting procedure)
10. Delay start (optional) - 1 hour non-resettable (consult factory representative for setting procedure)
11. Automatic LED test - All LED's flash alternate red / green upon AC power and battery connection.
12. **Fault code 0 -** Manual stop button - used to end the charging process
13. Displays:
    a. 2-digit LED readout - displays charging current and Fault codes.
    b. Equalize LED - on solid when unit is set to equalize, flashes when unit is in equalize charge mode.
    c. Shutdown LED - on solid when charger has completed a normal charge cycle, flashes when a fault has occurred.

INPUT VOLTAGE CHANGEOVER: If the charger is capable of more than one input voltage consult the attached schematic and changeover label inside the charger to reconfigure the charger as required. Be sure to reconfigure both the power transformer taps and control transformer voltage switch, and replace the line cord and plug assembly with one rated per the NATIONAL ELECTRIC CODE and Table 1.

OPERATING PROCEDURE: Verify that the charger is wired for the input AC source available. Connect the charger to AC source. The charger's 2 LED's will flash several times and a "0" (zero) will scroll across the LED display.

Connect a properly sized (same cell number and amp-hrs size) battery to the charger. The charger LED's will again flash several times. If the charger and battery are matched and all are in good working order, the charger will start charging and display the charging current on the digital LED display. If the charger and battery are mismatched or either is defective the charger will shutdown and display a fault code. Consult the charger front panel label for fault codes.

The charger will automatically terminate the charge cycle 3 hours after the 80% point is reached unless the equalize button is pressed or a fault condition occurs. After a normal charge completion the charger will return to displaying the sequencing zero. The battery can now be safely unplugged since all charging has stopped. If the charger was still in charge mode, pressing the STOP button will terminate the charging process and allow the battery to be safely unplugged.

IMPORTANT SAFETY INSTRUCTIONS
INSTRUCTIONS IMPORTANTES CONCERNANT LA SECURITE

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1. SAVE THESE INSTRUCTIONS. THIS MANUAL CONTAINS IMPORTANT SAFETY AND OPERATING INSTRUCTIONS.
   CONSERVER CES INSTRUCTIONS. CE MANUEL CONTIENT DES INSTRUCTIONS IMPORTANTES CONCERNANT LA SECURITE ET LE FONCTIONNEMENT.

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2. WORKING IN THE VICINITY OF A LEAD-ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASSES DURING NORMAL BATTERY OPERATION. FOR THIS REASON IT IS OF THE UTMOST IMPORTANCE THAT EACH TIME BEFORE USING YOUR CHARGER, YOU READ AND FOLLOW THE INSTRUCTIONS PROVIDED EXACTLY.
   IL EST DANGEREUX DE TRAVAILLER A PROXIMITE D'UNE BATTERIE AU PLOMB. LES BATTERIES PRODUISENT DES GAS EXPLOSIFS EN SERVICE NORMAL. AUSSI EST-IL IMPORTANT DE TOUJOURS RELIRE LES INSTRUCTIONS AVANT D'UTILISER LE CHARGEUR ET DE LES SUIVRE A LA LETTRE.

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3. TO REDUCE RISK OF BATTERY EXPLOSION, FOLLOW THESE INSTRUCTIONS AND THOSE ON THE BATTERY.
   POUR REDUIRE LE RISQUE D'EXPLOSION, LIRE CES INSTRUCTIONS ET CELLES QUI FIGURENT SUR LA BATTERIE.

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4. NEVER SMOKE OR ALLOW AN OPEN SPARK OR FLAME IN THE VICINITY OF THE BATTERY OR ENGINE.
   NE JAMAIS FUMER PRES DE LA BATTERIE OU DU MOTEUR ET EVITER TOUTE ETINCELLE OU FLAMME NUE A PROXIMITE DE CES DERNIERS.

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5. USE CHARGER FOR CHARGING A LEAD-ACID BATTERY ONLY. IT IS NOT INTENDED TO SUPPLY POWER TO AN EXTRA LOW-VOLTAGE ELECTRICAL SYSTEM OR TO CHARGE DRY-CELL BATTERIES. CHARGING DRY-CELL BATTERIES MAY CAUSE THEM TO BURST AND CAUSE INJURY TO PERSONS AND DAMAGE TO PROPERTY.
   UTILISER LE CHARGEUR POUR CHARGER UNE BATTERIE AU PLOMB UNIQUEMENT. CE CHARGEUR N'EST PAS CONCU POUR ALIMENTER UN RESEAU ELECTRIQUE TRES BASSE TENSION NI POUR CHARGER DES PILES SECHES. LE FAIT D'UTILISER LE CHARGEUR POUR CHARGER DES PILES SECHES POURRAIT ENTRAINER L'ECLATEMENT DES PILES ET CAUSER DES BLESSURES OU DES COMMAGES.

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6. NEVER CHARGE A FROZEN BATTERY.
   NE JAMAIS CHARGER UNE BATTERIE GELEE.

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7. DO NOT OPERATE IN A CLOSED-IN AREA OR RESTRICT VENTILATION IN ANY WAY.
   NE PAS FAIRE FONCTIONNER LE CHARGEUR DANS UN ESPACE CLOS ET/OU NE PAS GENER LA VENTILATION.

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8. DANGER: RISK OF ELECTRICAL SHOCK. DO NOT TOUCH UNINSULATED PORTION OF OUTPUT CONNECTOR OR UNINSULATED BATTERY TERMINAL.
   DANGER: RISQUE DE CHOCS ELECTRIQUES. NE PAS TOUCHER LES PARTIES NO ISOLEES DU CONNECTEUR DE SORTIE OU LES BORNES NON ISOLEES DE L'ACCUMULATEUR.

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9. CAUTION: DISCONNECT SUPPLY BEFORE CHANGING FUSE.
   ATTENTION: COUPER L'ALIMENTATION AVANT DE REMPLACER LES FUSIBLES.

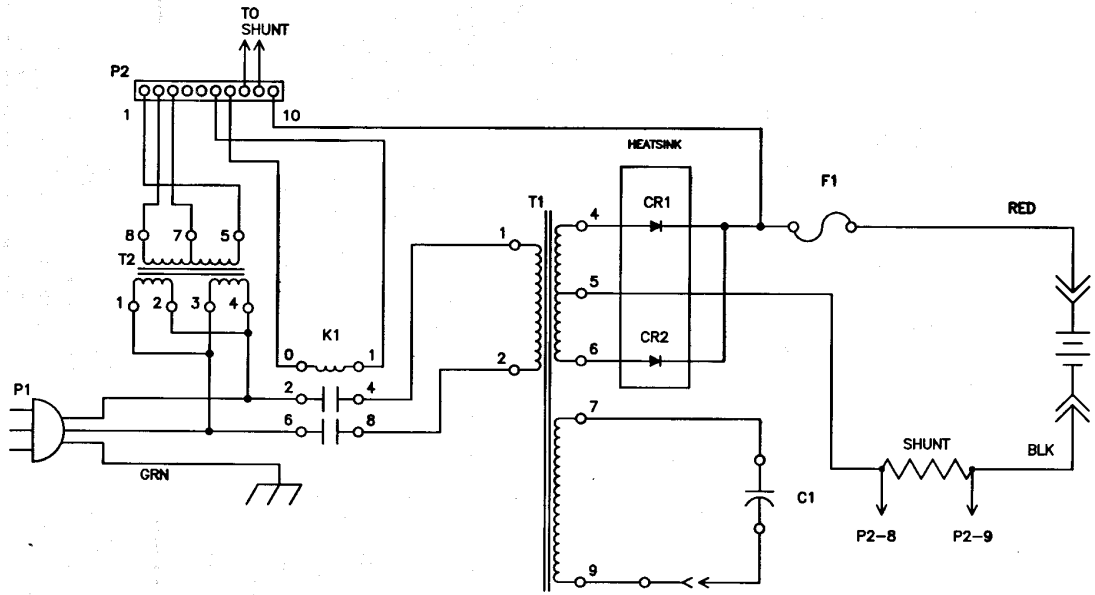
Table 1

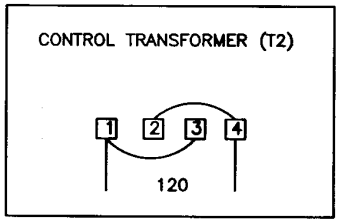
BRANCH CIRCUIT PROTECTION AND CORD/PLUG SIZING

MODEL NUMBER	INPUT VOLTAGE	BRANCH CIRCUIT PROTECTION REQUIRED	PLUG TYPE SUPPLIED
06A0380Y0A, 06A0600Y0A, 12A0380Y0A, 12A0510Y0A, 12A0510Y0A-NA	120	15A	NEMA 5-15
12A0600Y0A	120	20A	NEMA 5-20
12A0750Y1A	120	20A	“PIGTAILS” ONLY
12A0750Y1C	240	10A	NEMA 6-20
18A0450Y0A,	120	20A	“PIGTAILS” ONLY
18A0600Y1A	120	30A	
18A0600Y1C	240	15A	NEMA 6-20
18A0750Y1A	120	30A	“PIGTAILS” ONLY
18A0750Y1C	240	15A	NEMA 6-20
24A0350Y0A	120	20A	NEMA 5-20
24A0600Y1A	120	30A	“PIGTAILS” ONLY
24A0600Y1C	240	15A	NEMA 6-20
48A0350Y1A	120	30A	“PIGTAILS” ONLY
48A0350Y1C	240	20A	NEMA 6-20

REVISIONS					
REV.	ECO NO.	DESCRIPTION	DATE	DRN.	APP.

C1	CAPACITOR
CR1,2	DIODES
F1	FUSE, DC OUTPUT
K1	RELAY, CONTROL 12V
P1	PLUG, AC INLET
P2	PLUG, CONTROL BOARD
T1	TRANSFORMER, MAIN
T2	TRANSFORMER, CONTROL





DRAWN: J. DAVIS	UNLESS OTHERWISE SPECIFIED DIMENSIONS AND TOLERANCES ARE IN INCHES AND APPLY TO FINISHED PART
DATE: 05DEC05	
CHECKED:	TOLERANCES ON: 2 PLACE DECIMALS ±.015 3 PLACE DECIMALS ±.005 FRACTIONS ±1/64 ANGLES ±1°
DATE:	
APPROVED:	MATERIAL: NONE
DATE:	
CAD FILE: B80-112	
VOLUME: I:\DRAFT\B-DWGS\B80	FINISH: NONE
THIRD ANGLE PROJECTION	
PART No:	

THIS DRAWING WAS CREATED USING AUTOCAD SOFTWARE.

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1 Technology Place Caledonia, NY 14423
ONE TECHNOLOGY PLACE, CALEDONIA, NEW YORK 14423

TITLE	SCHEMATIC, WORKHORSE 1, 120VAC INPUT	
SIZE: B	DRAWING No: B80-112	REV. —
SCALE: NONE	SHEET 1 OF 1	

REVISIONS					
REV.	ECO NO.	DESCRIPTION	DATE	DRN.	APP.
A	8863	TERMINAL BLOCK W/JUMPERS WAS 4-POSTION.	20NOV06	JFD	PEM

C1	CAPACITOR
CR1,2	DIODES
F1	FUSE, DC OUTPUT
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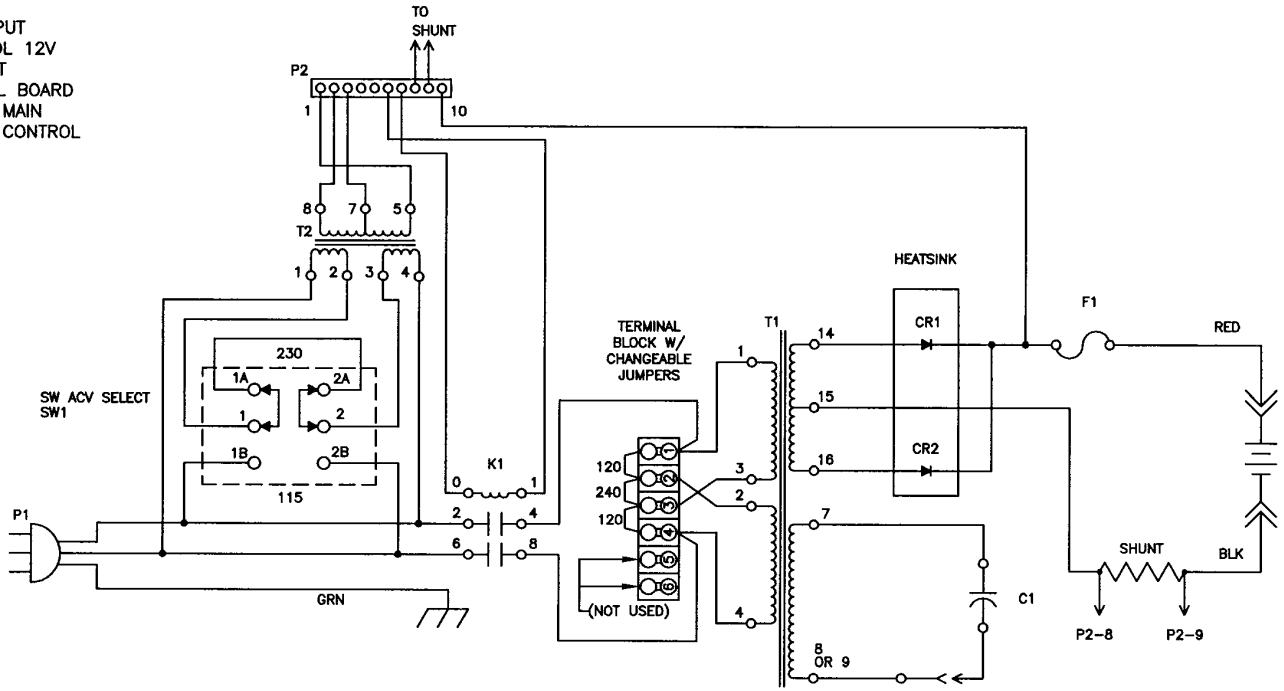

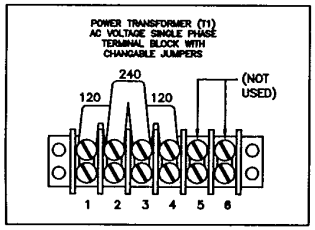

DRAWN: J. DAVIS DATE: 05DEC05	UNLESS OTHERWISE SPECIFIED DIMENSIONS AND TOLERANCES ARE IN INCHES AND APPLY TO FINISHED PART	Applied Energy Solutions 1 Technology Place Caledonia, NY 14423
CHECKED: DATE:	TOLERANCES ON: 2 PLACE DECIMALS ±.015 3 PLACE DECIMALS ±.005 FRACTIONS ±1/64 ANGLES ±1°	
APPROVED: DATE:	MATERIAL: NONE	TITLE: SCHEMATIC, WORKHORSE 1, 120/240VAC INPUT
CAD FILE: B80-113 VOLUME: I:\DRAFT\B-DWGS\B80	FINISH: NONE	SIZE: B DRAWING No: B80-113 REV.: A
THIRD ANGLE PROJECTION PART No:		SCALE: NONE SHEET 1 OF 1

THIS DRAWING WAS CREATED USING AUTOCAD SOFTWARE.

CHARGER WARRANTY

APPLIED ENERGY SOLUTIONS warrants that each new and unused battery charger manufactured and supplied with good workmanship is free from any known mechanical defect, provided that (A) the product is installed and operated in accordance with the accepted industrial standards and in accordance with the printed instructions furnished by APPLIED ENERGY SOLUTIONS, (B) the product is used under normal conditions for which designed, (C) the product is not used in a corrosive, abnormally dusty or high humidity moisture condensing environment, and (D) the product is not subjected to misuse or negligence, and the product receives proper care, protection and maintenance under supervision of competent personnel.

Warranty Terms and Conditions

APPLIED ENERGY SOLUTIONS WorkHorse 1 Industrial Battery Chargers are warranted for 2 Years[(1)] (10 years on power transformers and diodes)[(2)], which begins on the date of shipment from APPLIED ENERGY SOLUTIONS.

NOTES: [(1)] Warranty covers parts and labor, [(2)] Warranty covers parts only
AC fuses and DC fuses are not warranted unless they are found to be defective prior to use.

NON-TRANSFERABLE WARRANTY. This warranty is extended by APPLIED ENERGY SOLUTIONS only to the original user (purchaser) of new equipment from APPLIED ENERGY SOLUTIONS or one of its authorized agents. The product purchased under this agreement shall be used exclusively by the buyer. There shall be no third party beneficiary of this warranty.

REPAIR LIMITATIONS. APPLIED ENERGY SOLUTIONS has the right to site inspection and judgment of the claimed defects in any product covered by this warranty. APPLIED ENERGY SOLUTIONS' liability is limited to the repair of any defects found to exist by APPLIED ENERGY SOLUTIONS or, at APPLIED ENERGY SOLUTIONS' option, the replacement of the defective product.

APPLIED ENERGY SOLUTIONS and its authorized agents shall not be liable for direct or indirect damages in excess of such repair or replacement. In no event shall the purchaser be entitled to recover for contingent expenses from, but not limited to, telephone calls, telegrams, travel expenses, lodging, duties and taxes, labor, rental or replacement equipment, loss of business or profit or other commercial losses.

CONTINUED USE OF DEFECTIVE PRODUCTS. The continued use of an APPLIED ENERGY SOLUTIONS Industrial Battery Charger that is known to be defective VOIDS ALL WARRANTIES.

REPAIR OF MODIFIED EQUIPMENT. Except as authorized in writing the warranty specified does not cover any equipment that has been repaired by any party other than APPLIED ENERGY SOLUTIONS or its authorized agents. Except as authorized in writing the warranty specified does not cover any equipment that has been modified, mechanically or electrically, by any party other than APPLIED ENERGY SOLUTIONS.

WARRANTY EXPENSE LIMITATIONS. APPLIED ENERGY SOLUTIONS will limit the warranty expense of all chargers to be paid at a maximum of the original purchase price of the charger.

The provisions of this warranty shall not apply to product in use outside of the continental USA.

Except as stated above, all other warranties and conditions, either expressed or implied, including implied warranties of merchantability and fitness for a particular purpose, are excluded and buyer assumes all risk and liability resulting from the use of goods. APPLIED ENERGY SOLUTIONS neither assumes or authorizes any persons to assume for APPLIED ENERGY SOLUTIONS any other liability in connection with the sale or use of the goods sold and there are no oral agreements or warranties collateral to or affecting this written warranty.

When installing, servicing or operating these products, safe practices should be used by skilled and qualified technical persons.