Project Name: DTE ENERGY

Katolight File # 90118, S/O # 14002

Model:	NL130FPG4 Form: 130G/0503	kW:	125	KVA:	156.3
Phase:	THREE	Power Factor:	0.8	Leads:	12
Voltage:	120/208	RPM:	1800	Frequency:	60

Table of Contents

Date: 06/03

KATOLIGHT CORPORATION
STANDBY LIMITED WARRANTY

"TWO YEAR OR 1500 HOURS"

Your Katolight Product has been manufactured and inspected with care by experienced craftspeople. If you are the original consumer, Katolight Corporation warrants, for the period indicated below, each product to be free from defects in materials and workmanship. Repair, replacement or appropriate adjustment at Katolight Corporation's option will be furnished if the product, upon Katolight Corporation's inspection, is properly installed, maintained and operated in accordance with Katolight Corporation instruction manuals. This warranty does not apply to malfunctions caused by damage, unreasonable use, misuse, repair or service by unauthorized persons, or normal wear and tear.

KATOLIGHT PRODUCT PERIOD OF WARRANTY: Engine Generator Set: Two (2) years or 1500 hours from the date of invoice by factory. Accessories: One (1) year from date of invoice from factory. The warranty period can be adjusted to the date of start up if completed within six (6) months of invoice date. A valid warranty requires that: (1) the Katolight start-up validation form must be completed, returned and on file at Katolight Corporation; (2) the engine registration form must be completed and returned to manufacturer as stated in the instructions with registration form; and (3) all supporting maintenance records must be kept on file with the end user and made available upon request from factory. The generator set must be routinely exercised in accordance with operating instructions. Engine generator sets that are stored longer than six months (180 days) from date of shipment are subjected to special requirements. Contact Katolight's Factory Service Center for instructions

For a description of accessories and exclusions from this limited warranty, review the listing on the back of this document.

TO OBTAIN WARRANTY SERVICE: Contact your nearest Katolight Service Representative by calling or writing Katolight Corporation, Attention: Service Department. (See address and telephone below.)

Katolight shall not be liable for any claim greater in amount than the purchase price of the product, in respect of which such claim is made, and in no event shall Katolight be liable for any special, indirect or consequential damages.

THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE DESCRIBED HEREIN. NO WARRANTIES SHALL BE IMPLIED OR OTHERWISE CREATED UNDER THE UNIFORM COMMERCIAL CODE, INCLUDING BUT NOT LIMITED TO A WARRANTY OF MERCHANTABILITY, AND A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

State laws regarding rights of consumers may vary from state to state.

KATOLIGHT CORPORATION
100 Power Drive / PO Box 3229
Mankato, MN 56002-3229
Phone: (507) 625-7973 / Fax: (507) 625-2247

1. The following items are among those that are not considered nor will be covered under the existing warranty program.
   a. Battery or Batteries of any type or kind. The Battery Manufacturer warranty applies to these only. Any warranty for such, should be handled with the manufacturer according to their policies.
   b. Adjustments to fuel systems or governor system at time of start up or any time after. This is acceptable only when a defective part has been replaced, returned to the factory and approved as defective.
   c. Normal maintenance cost: adjustments, loose/leaking fittings or clamps, and tune-ups.
   d. Non-Katolight replacement part(s) will void the entire limited warranty.
   e. Products that are modified in any form without the written consent of Katolight will void the entire limited warranty.
   f. Shipping damage of any type. All equipment is shipped F.O.B. factory and is consigned to the carrier once loaded for shipment. It is the responsibility of the receiver to sign and note any damage to the equipment and a freight damage claim filed by the receiver.
   g. Any installation errors or damage of the equipment when shipped as ordered.
   h. Any overtime travel or labor to make repairs under warranty.
   i. Any special access fees required to gain access to Katolight equipment not limited to but including any training or safety policy requirements to gain access.
   j. Rental equipment used during warranty work such as Generators, rigging equipment such as a crane or boom truck, load banks and special testing above factory requirements, etc.
   k. Excess mileage charges. Any distributor may provide warranty service anywhere but will only be paid travel from the nearest service center.
   l. Any equipment not factory approved or engineered for use on Katolight product. This includes but is not limited to after market items such as special fuel systems, enclosures, exhaust systems, or switch gear that had been sought out and quoted by third party to be included in billing of the Katolight equipment.
   m. Misuse or abuse including installation and thereafter.
   n. Normal wear and tear, maintenance and consumable items that are not required as part of a warranty repair. Consumable items include but are not limited to belts, hoses, coolant, oil, filters, and fuses.
   o. Acts of nature such as lightning, wind, flood, or earthquake.
   p. Any damage due to situations beyond the control of the manufacturing of the product or workmanship of the product.
   q. Installation or operation outside the guidelines as stated in the Installation Guide and Owners Manual.
   r. Misapplication of the equipment such as usage outside the original design parameters as stated on the nameplate of the equipment.
   s. Travel expense on portable equipment.
   t. More than one trip to job-site because Service Vehicle was not stocked with normal service parts.
   u. Lodging expense of person(s) performing service.
   v. Engine fluids.
   w. Cords, Receptacles, and Cord reels.
   x. Housing lights and light switches
   y. Trailer lights, wiring, brake system, tow hitch and tires.
   z. Units purchased as Standby Power and are identified as Prime Power.
   aa. Any repair labor time that is determined to be excessive, e.g., two or more people performing a one-person job.
   bb. Any expenses associated with investigating performance complaints.
   cc. Any associated costs for replacing components that are found not to be defective.

2. The aforementioned is a representation of things not covered by the standard **"LIMITED WARRANTY".** If there are questions as to warranty coverage it is advisable to contact the factory in advance of filing a claim.

3. The accessories shown below are limited to one (1) year warranty:
   a. Battery Chargers
   b. Water Heater
   c. Load Banks
   d. Tap changing switches
   e. Circuit breakers
   f. Day tank pumps and controls
   g. Hand prime pump
   h. Oil leveler system
   i. Strip heater
   j. Gas solenoid valves
   k. Gas flex pipe

Operating Instructions

MANUAL START:

If the Engine-Generator Set is located in a closed space, start the ventilation fan or open the doors and windows to allow an ample supply of air to the unit.

A. Place the generator circuit breaker in the **OPEN** position.
B. Put the engine control in the **MANUAL / RUN** position.
   NOTE: If the engine does not start, check the Operator's Manual.

MANUAL:

C. Check the unit frequency. Speed should be 3 to 5 % of rated speed (60 Hz). If not, refer to Operator's Manual for governor adjustment.
D. Check the unit AC voltage. (If the AC voltage is not reading correct, refer to the Operator's Manual for the proper procedure to adjust the voltage regulator to the rated voltage.)
E. Check engine parameters, via gauges or by scrolling through the microprocessor control panel for proper readings.
F. Close the generator circuit breaker.

The Engine-Generator Set is now ready to supply power to the load and will continue to supply power until the operator shuts down the set or an engine failure occurs.

MANUAL SHUTDOWN:

A. Open the generator circuit breaker, move handle to the **DOWN** position.
B. Put the engine control in the **OFF** position.
   NOTE: Following daily service or other maintenance on generator set, place the engine control to desired operating mode. When desired operating mode is automatic, reset the generator circuit breaker by placing its handle in the **UP** position.

EMERGENCY STOP PUSH BUTTON: (OPTIONAL EQUIPMENT)

In case of emergency the operator may shutdown the generator set by pushing the red mushroom head button. If equipped, this is located in the lower right corner of the control panel. This will stop and lock out the generator set. The push button's red light will also turn on to indicate the generator was stopped, by initiating the emergency stop button. The red push button must be pulled out to reset the generator set and turn off the red indicating light. Place the engine control to the "OFF" position to reset the engine control before restarting the unit. Reset the main line circuit breaker before returning the generator set to "AUTOMATIC" operation.

AUTOMATIC OPERATIONS

For automatic operation the Engine-Generator Set will be controlled by the automatic transfer switch and the automatic engine control.

A. For detailed operations of the transfer switch, refer to the Operations Manual supplied with the transfer switch.

B. For detailed operations of the automatic engine control, refer to Operations Manual, supplied with the Genset.

I. Standby State

(a) Leave the engine control in the "AUTO" position.
(b) Leave the generator set circuit breaker in the "ON" position.

II. Power Fails

(a) The remote start contact in the transfer switch will close and complete a circuit to the automatic start control terminals marked "E" in the control panel.
(b) This will cause the engine to start and come up to speed and voltage, then transfer to the load to the Engine-Generator Set.

III. Power Returns

(a) The load transfers back to normal power after a time delay (if provided).
(b) The remote start contact in the transfer switch will open after a time delay (if provided), and the unit will shutdown and be ready for the next power failure.

WEEKLY CHECK LIST EXPLANATION

Date:	- fill in the date of the inspection.
Ambient Temp:	- record outside or room air temperature.
Oil Level:	- record the level from the oil dipstick and the amount of oil added to engine if it was needed.
Water Level:	- record the level of the water in radiator and the amount of water added to radiator if it was needed.
Heaters:	- feel the block heater inlet and outlet hoses to make sure they are warm.
Belts:	- check belts to make sure they are tight. You cannot hear loose belts over the unit noise. **Make sure the engine control is in the "OFF" position.**
Battery Charger:	- visual inspection of charger to verify operation. If equipped with a dial meter verify charge rate. If equipped with LEDs verify LEDs lit. **Red** LED only indicates battery discharged, charging at "Bulk" rate. **Red & Green** LED only indicates charger charging at "Absorption" rate. **Green** LED only indicates "Float" rate, battery is fully charged.
Battery Levels & Cables:	- make sure batteries are full of water, cables are tight and battery posts are clean.
Leaks: (Oil-Water-Fuel)	- check all hoses and connections for dripping, tighten hose clamps if needed.
Amps:	- when the unit is running with load, record the amp reading.
Volts:	- when the unit is running with load, record the volt reading.
Frequency:	- when the unit is running with load, record the hertz reading.
Oil Pressure:	- when the unit is running with load, record the oil pressure.
Water Temperature:	- when the unit is running with load, record the water temperature reading once stabilized.
BC Volts:	- battery charger DC voltage reading.
RTM:	- running time meter total should be recorded before each test - this will allow you to determine if the unit has run since the last exercise.
ATS:	- automatic transfer switch should be filled in as "OK" if the test performed a load transfer properly.
Mechanic:	- should be initialed by the person doing the test.

WEEKLY CHECK LIST

Date:	Ambient Temp:	Oil Level:	Water Level:	Heaters:	Belts:	Battery Charger:	Battery Levels & Cables:	Leaks Oil, Water or Fuel:	Amp:	Volts:	Freq:	Oil Pressure:	Water Temp:	BC Amp:	RTM:	ATS:	Mechanic:	Comments:

KATOLIGHT® CORPORATION

Power System Solutions

16 Light Annunciator Panel

2-Wire Repetitive Alarm

Interconnect up to 4000' with Twinaxial Shielded Computer Cable
(*2-Conductor Twisted Pair)

12 OR 24 Volt

KATOLIGHT ANNUNCIATORS MEET THESE SPECIFICATIONS: The National Electric Code: Section 700-12, and the National Fire Protection Association: Section No. 110, standard for emergency and standby power systems. These codes require audible and visual signal devices powered by an electrical storage battery to give warning of derangement or alarm conditions in the alternate electric power source (standby electric generating set). The signal device (ANNUNCIATOR) must be installed outside the standby generating room in a location readily observed by operating personnel at a regular work station. **In accordance with NFPA 110 the alarm of the annunciator system will not be permanently shut down or bypassed. Katolight's control of the repetitive alarm annunciator audible system allows for a first alarm to be silenced and if a second alarm occurs, the audible alarm system will again sound the alarm.** Other Codes and Specifications also include these requirements.

The attractive standard panel face is of cold rolled steel flat black paint (18 gauge).

Katolight Corporation recommends specific Twinaxial Shielded Computer Cable for 2-Wire annunciator applications. Refer to "Drawings and Dimensions" located on the back of this page for specifications.

12 LIGHT FUNCTIONAL LED'S PLUS 4 SPARES. Both are audible or visual

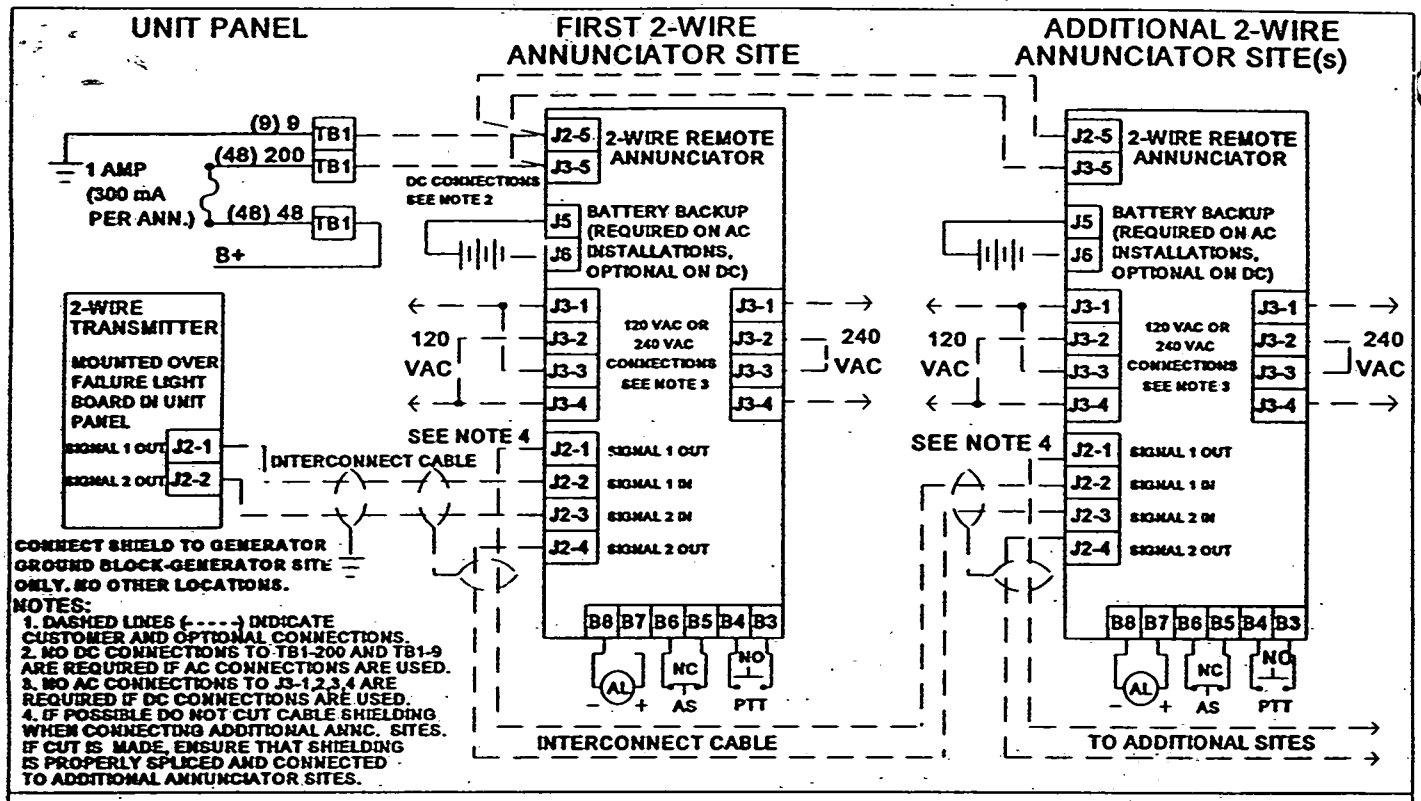
LED Legend	Condition Indicated	Derangement Signals		Adders Required	
		Audible	Visual	External Contacts	Contact Location
Low Battery Voltage	Charger Failed	NO	YES	N.O.	Battery Charger
Charger Malfunction	Battery Charger Failed	NO	YES	N.O.	Battery Charger
High Engine Temperature	Excessive Water Temperature	YES	YES	N.O.	Engine Control
Low Oil Pressure	Low Lube Oil Pressure	YES	YES	N.O.	Engine Control
Engine Overspeed	Engine Overspeed	YES	YES	N.O.	Engine Control
Engine Overcrank	Elec. Plant Failed to Start	YES	YES	N.O.	Engine Control
EPS Supplying Load	Elec. Plant Carrying Load	NO	YES	N.O.	Transfer Switch
Low Water Temperature	Low Water Jacket Temperature	YES	YES	N.O.	On Engine
High Engine Temp. Prealarm	Water Temperature Approaching limit	YES	YES	N.O.	Panel
Low Oil Pressure Prealarm	Oil Pressure Approaching Limit	YES	YES	N.O.	Panel
Low Fuel	Fuel System Low	YES	YES	N.O.	In Fuel Tank
Unit Not In Auto	Elec. Plant Not in Automatic	YES	YES	N.O.	Panel On Select Sw.
4 - Spare LED's					

* Certain applications may require two additional wires for power and ground.
** Normally open contacts.

Form RAAP16/799

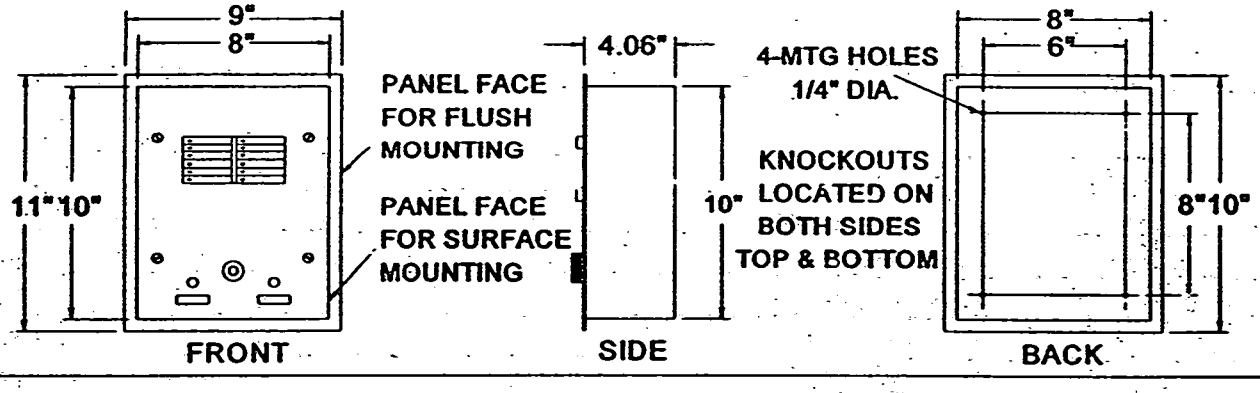
3201 Third Avenue • Mankato, MN 56001
507-625-7973 • Fax: 507-625-2968 • Internet: http://www.katolight.com

Drawings & Dimensions



INTERCONNECT CABLE SPECIFICATIONS: TWINAXIAL SHIELDED COMPUTER CABLE.
NOM. O.D. .243in, NOM. IMP. (OHMS) 78, 9.5 OHMS/1000ft , NOM. CAP. 19.7pF/ft , AWG 20,
STRANDED 7x28, 300V 80 DEG. C, UL 2464, POLYETHYLENE INSULATION,
FOR CABLE WITH THESE SPECIFICATIONS, PLEASE CONTACT OUR SERVICE DEPARTMENT.

CONNECT ALL SIGNAL WIRES BEFORE ENERGIZING ANY CIRCUIT BOARDS



PANEL COMPONENTS

KATOLIGHT ANNUNCIATOR PANELS are designed for either surface or flush mounting. The enclosure has knockouts on top, bottom, or either side for ease of installation. The annunciator panels are to be used in conjunction with KATOLIGHT autostart control KASSEC, KLAS 33 and 61 series.

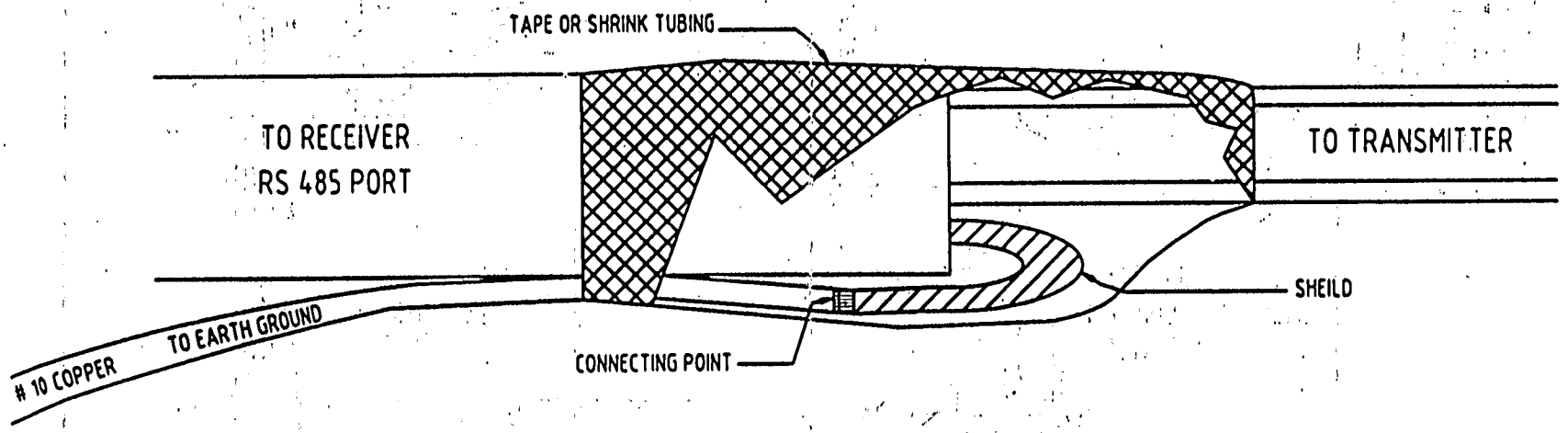
Materials and Specifications may change without notice.

For more information contact your nearest Representative, Distributor, or Dealer below:

KATOLIGHT CORPORATION
3201 Third Avenue P.O. Box 3229
Mankato, Minnesota 56002-3229
Phone: (507) 625-7973 Fax: (507) 625-2968

Printed in U.S.A.

PROPER WAY TO INSTALL GROUND SHEILD CABLE



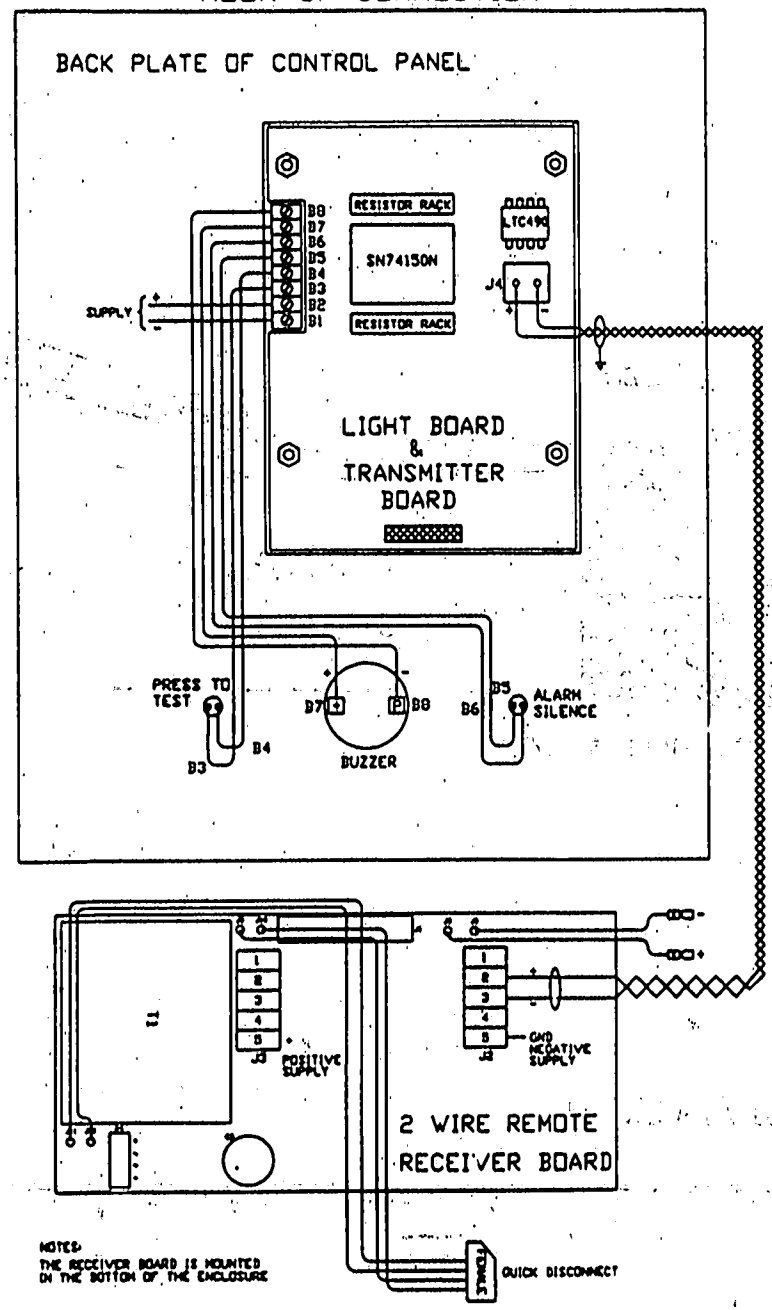
KATOLIGHT
MANKATO, MINNESOTA

CABLE DIAGRAM

SIZE	DATE	DWG NO
B	3-15-99	800-171

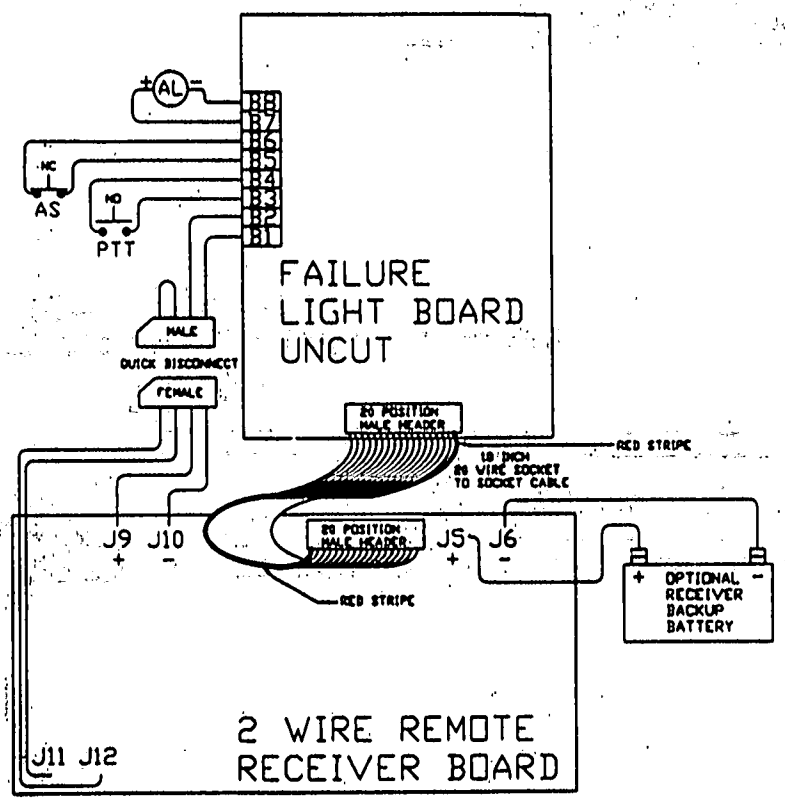
DESCRIPTION		DWN BY		SHEET
	SHEILD CABLE		SL	1 OF 1

HOOK UP CONNECTION



NOTES:
THE RECEIVER BOARD IS MOUNTED IN THE BOTTOM OF THE ENCLOSURE

SCHEMATIC



QUANTITY	KATOLIGHT PART NUMBER	DESCRIPTION
4	40830	FEMALE CRIMP TERMINAL 0.062"
4	40829	MALE CRIMP TERMINAL 0.062"
1	40829	4 PIN FEMALE PLUG 0.062"
1	40827	4 PIN MALE PLUG 0.062"
1	50418	18" FEMALE HEADER-HEADER CABLE
8	40826	1/4" HEX MALE-FEMALE STANDOFF 6-32, 3/8"
1	40831	ANNUNCIATOR POWER AND WARNING LABELS
1	50411	20 PIN MALE HEADER, DUAL ROW
1	90150	2 WIRE RECEIVER BOARD
1	40499	18 VOLT LEAD ACID BATTERY (OPTIONAL)
1	40498	BATTERY MOUNTING BRACKETS (OPTIONAL)

ORIGINAL

UNLESS OTHERWISE NOTED ALL DIMENSIONS ARE EXPRESSED IN INCHES.

KATOLIGHT
MANKATO, MINNESOTA

2 WIRE ANN. RECEIVER

SIZE	DATE	DWG NO	REVISED JOB DATE
C	2-10-99	800-170	2-10-99

DESCRIPTION ASSEMBLY | DWN BY SL | SHEET 1 OF 1

at&t

ENGINE RUN LOG

ATT-TELCO-002-561-001 (Retention required for life of engine)

E-5697
(10/08)

Office (CLLI): BXTRMNACCM2
BLDG GEO LOC:
City & State: BAXTER, MN

ENG MFR.: ENERGY/NOW
Model: L125FPG4
Serial #: WA534605-90118-0703

Rating (KW): 125
Brake Horsepower:
Fuel Tank Capacity:

ENG # / DESG.:
MFR. Date:

Date & Time	ENG Hour Meter Start/End	Temperature (Levels)				Pressure			FREQ	KW Load	Amperes			Volts - Phases			Fuel Gauge READ Start/End	REAS for OPER	Fuel / Fluid Piping INSP. (P/F)	OPER By (ATTUID or Full Name)
		Room	Fuel	Lube Oil	COOL	Fuel	Lube Oil	COOL Temp			1 A	2 B	3 C	1-2 A-B	2-3 B-C	3-1 C-A				
5/13/09	119.4	N/A	N/A	Full	Add 1QT				60											JC574N
5/18/09	120.6	N/A	N/A	Full	OK				60											JC574N
5/27/09	121.7	N/A	N/A	Full	Add 1QT				60											JC574N
6-1-09	122.8			Full	OK				60											JC574N
6-8-09	123.9	N/A	N/A	Full	OK				60											JC574N
6-22-09	126.3	N/A	N/A	Full	OK				60											JC574N
6-29-09	127.5	N/A	N/A	Full	OK				60											JC574N
7-7-09	128.6	N/A	N/A	Full	OK				60											JC574N
7-13-09	130.4	N/A	N/A	Full	OK		25	170	62			263AMPS		400V		(BATT) 13.8V				
7-20-09	131.3	N/A	N/A	Full	OK															JC574N
7/27/09	132.7	N/A	N/A	Full	OK															JC574N

Notes: Use following to indicate any problems or concerns. Indicate date, names and resolution. For Portables: Note Current Location, responsible parties, dates, etc.

Date	ATTUID/Name	Concern/Resolution

ENG # / DESG.: List if multiple engines present, local number or designation.
Brake Horsepower: See reference practice.
For Portables: See reference practice, indicate current location in above Notes section.

Reason for Operation: RR - Routine Run; PF - Power Failure; AR - Annual Run; TT - Trouble Test; ECF - Equip. Component Fail.; DC - DC Power Review

at&t

ENGINE RUN LOG

ATT-TELCO-002-561-001 (Retention required for life of engine)

E-5697
(10/08)

Office (CLLI): BXTRMNACCM2
BLDG GEO LOC:
City & State: BAXTER MN

ENG MFR.:
Model:
Serial #:

Rating (KW): 125
Brake Horsepower:
Fuel Tank Capacity: NATURAL GAS

ENG # / DESG.:
MFR. Date:

Date & Time	ENG Hour Meter Start/End	Temperature				Pressure			FREQ	KW Load	Amperes			Volts - Phases			Fuel Gauge READ Start/End	REAS for OPER	Fuel / Fluid Piping INSP (P/F)	OPER By (ATTUID or Full Name)
		Room	Fuel	Lube Oil	COOL	Fuel	Lube Oil	COOL			1 / A	2 / B	3 / C	1-2 / A-B	2-3 / B-C	3-1 / C-A				

Notes: Use following to indicate any problems or concerns. Indicate date, names and resolution. For Portables: Note Current Location, responsible parties, dates, etc.

Date	ATTUID/Name	Concern/Resolution

ENG # / DESG.: List if multiple engines present, local number or designation.
Brake Horsepower: See reference practice.
For Portables: See reference practice, indicate current location in above Notes section.

Reason for Operation: RR - Routine Run; PF - Power Failure; AR - Annual Run; TT - Trouble Test; ECF - Equip. Component Fail.; DC - DC Power Review

Accessory 11BG Kit Installation for ASCO® Series 300 Automatic Transfer Switches and some* ASCO® Series 300L Automatic Power Transfer Load Centers

*** Can be installed on only this Series 300L Automatic Power Transfer Load Center**

Check the BOM number listed in *PRODUCT DATA* area of the nameplate.

BOM number	Catalog Number
769561	D300L32200F1XM with Acc. 96CP in aluminum outdoor enclosure

Accessory 11BG module includes a programmable engine– generator exerciser and power source availability contacts. It can be added to a Series 300 Automatic Transfer Switch (ATS) that has a Group 1 Controller. If an existing engine exerciser (Acc. 11CD) is already installed, it must be disconnected first.

The Accessory 11BG module mounts directly behind the Series 300 ATS operator interface on the inside of the enclosure door. The module connects to the Series 300 ATS operator interface board and Group 1 controller.

Kits K629830 & K749999 include the Acc. 11BG module, mounting hardware, and all necessary wiring.

Tools required: 1/4", 5/16" nutdrivers, small blade screwdriver
your Series 300 ATS Operator's Manual for setting the DIP switches

⚠ DANGER

ELECTROCUTION – FLASH HAZARD
Do not work on the transfer switch until both the utility and generator are off. Turn OFF both circuit breakers.

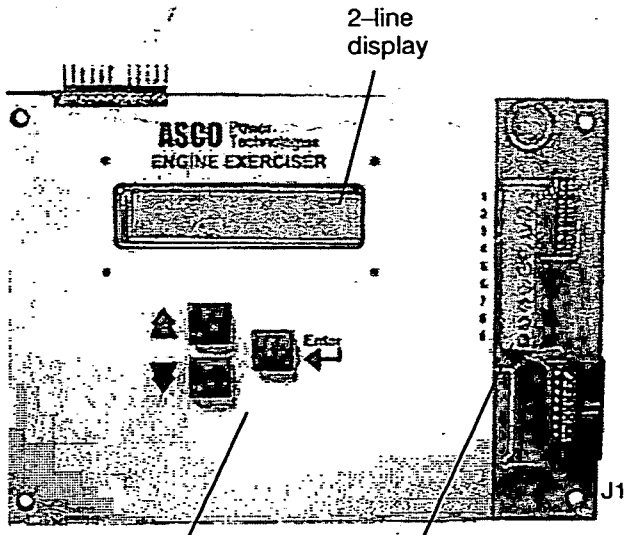


Figure 1. Accessory 11BG Module in kits.

Module Installation – Figures 2 & 3

1. With all power OFF, open the enclosure door. Locate the operator interface (membrane controls) mounted on the inside of the enclosure door. Use a 5/16" nutdriver to remove (counterclockwise) the four hex nuts from the corners of the operator interface. Do not remove the operator interface board (Figures 2 & 3).
2. Install (clockwise) four standoffs (from the kit) onto the four studs and tighten them with a 1/4" nutdriver.
3. Install the Acc. 11BG module on top of the operator interface so that four standoffs fit through the corner holes. Then install (clockwise) four 6–32 hex nuts (from the kit) to secure the assembly. Tighten the nuts.

Connecting the Module – Figures 1, 2, 4

1. With all power OFF, locate the two ribbon cables and note direction and orientation of each cable.
2. Unplug the ribbon cable (coming from the Controller) from the operator interface (J3 lower right side) and reconnect it (same orientation) to the Acc. 11BG module (J1 lower right side). See Figures 1, 2, & 4.
3. Connect the new ribbon cable (coming from the Acc. 11BG module upper right side) to the operator interface (J3 lower right side) with the same orientation as the original cable that was moved. See Figures 2 & 4.
4. Strip the insulation from both ends of the #16 gauge white wire (from the kit). Connect this prepared wire between Acc. 11BG module terminal 9 (right side) and the Group 1 Controller terminal 4 (bottom). Figure 4.

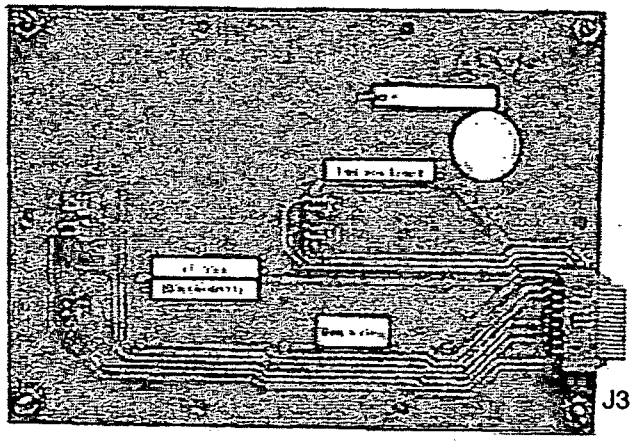


Figure 2. Series 300 ATS operator Interface board mounted on the enclosure door (back view).

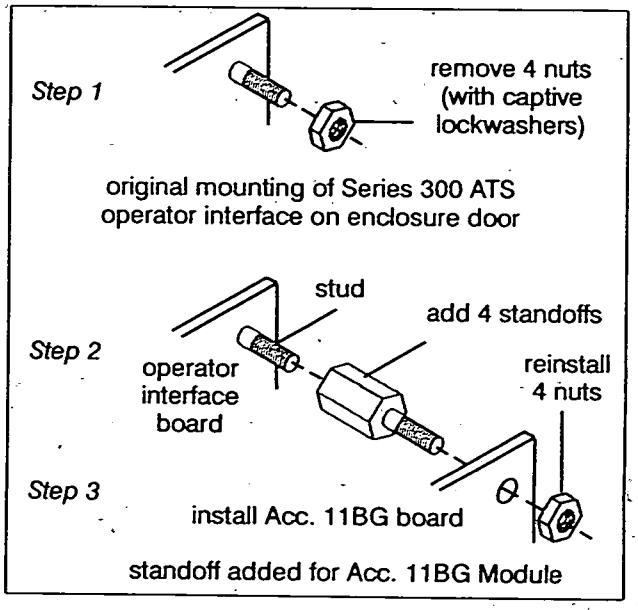
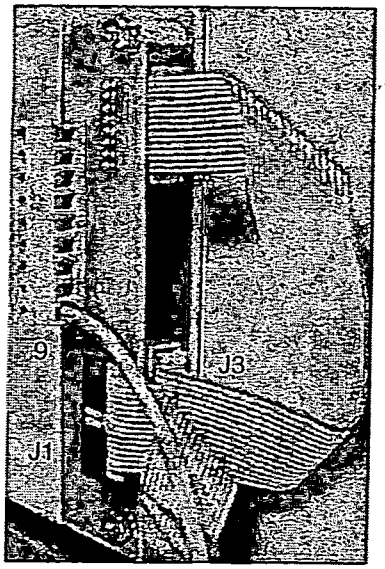
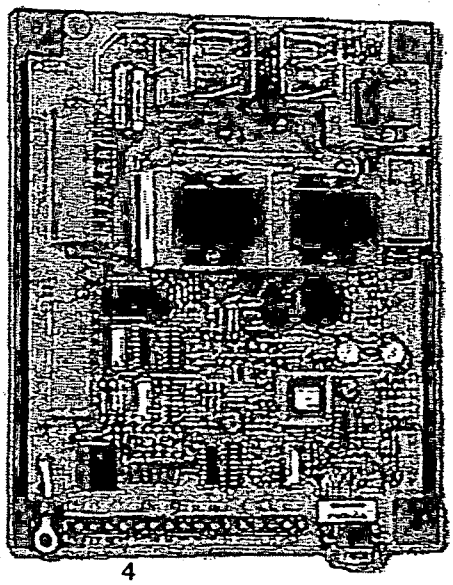


Figure 3. Module installation hardware.



Acc. 11BG Module mounted behind operator interface.

wiring



Group 1 Controller (cover removed)

Figure 4. Accessory 11BG module (mounted behind operator interface and connected to the controller [shown at the right]) includes power source availability signal contacts and a programmable engine exerciser.

Power Source Availability Signal Contacts

The module provides one Form C contact each for the normal and emergency power sources to signal the acceptability of the source as sensed by the controller. The signal contacts operate in conjunction with the *Source Available* lights on the operator interface. Field wiring terminals are provided as shown in Figure 5 and the wiring diagram.

Contact ratings:
2 amps @ 30 Vdc, 0.5 amp. @ 125 Vac resistive

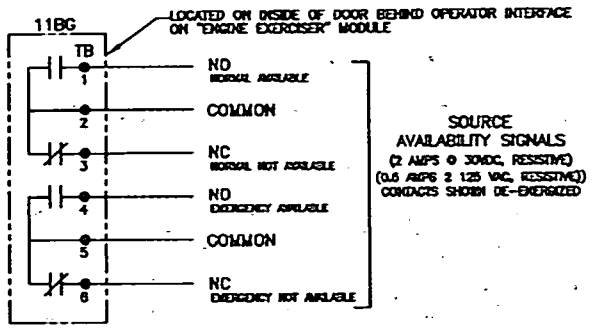


Figure 5. Power source availability signal contacts.

Programmable Engine–Generator Exerciser

Note: Refer to your Series 300 ATS Operator's Manual to set DIP switches S1 & S2 in the Group 1 Controller.

A backup battery in the Series 300 ATS Group 1 Controller (see Operator's Manual, Sections 4 and 5) must be turned on to maintain the settings and to allow programming with the normal and emergency power sources turned off.

The Acc. 11BG module includes a programmable generator exerciser that provides for weekly or biweekly operation. The exerciser may have to be turned on (enabled) by setting S1 DIP switch actuator 7 to OFF (left position), and S2 DIP switch actuator 5 to OFF (left position).

The programmable engine–generator exerciser incorporates a 7–day or 14–day time base. Proper Group 1 Controller settings must be made to determine whether or not the test will be done with or without load transfer (S1 DIP switch actuator 8).

See next page for instructions on setting the exerciser.

S1 DIP Switch Settings in Series 300 ATS Group 1 Controller

Programmable Exerciser Function	ACTUATORS 7 & 8 OFF ON		
Enabled & Exercise without Load	Actuator 7 OFF Actuator 8 OFF	ON OFF	EXER ACTV LOAD
Enabled & Exercise with Load	Actuator 7 OFF Actuator 8 ON	ON OFF	EXER ACTV LOAD

S2 DIP Switch Settings in Series 300 ATS Group 1 Controller

Programmable Exerciser Function	ACTUATOR 5 OFF ON		
Enabled	Actuator 5 OFF	OFF	EXT EXER
Disabled	Actuator 5 ON	ON	EXT EXER

▨ Shaded DIP switches are standard factory settings.

Programmable Engine Exerciser Settings

Fill in your settings for future reference

Weekly or Bi–weekly	Day of Week	Start Time	Run Time
Every = weekly *Alt* = bi–weekly	*Sun* through *Sat*	*0* – *23* hour *0* – *59* minute	*0* – *23* hour *0* – *59* minute *30* minutes is the default setting

Date exerciser was set _____

How to Set Optional Programmable Engine Exerciser

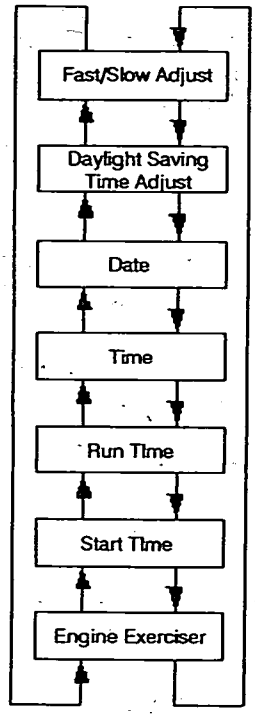
(part of Acc. 11BG module)

⚠ DANGER

Hazardous voltage capable of causing shock, burns, or death is used in this transfer switch. Deenergize both Normal & Emergency power sources before programming the exerciser.

Navigating the Menu

Use the UP and DOWN arrow keys to move through the displays.



Changing the Parameters

Use the UP and DOWN arrow keys to move though the displays to the parameter to be changed. Push the ENTER key to start the editing process. The first parameter will flash. Use the UP and DOWN arrow keys to adjust the parameter to the desired value and press the ENTER key to save the value. The next parameter will now flash. Repeat the process until each parameter is properly configured.

Engine Exerciser Display

The Engine Exerciser Display shows the status of the engine exerciser. When the unit is shipped from the factory the programmable engine exerciser is "Disabled" and must be set to "Enabled" by the customer. When the engine exerciser is running, this display will count down the remaining time until the end of the exercise period.

Start Time Display

The Start Time Display shows the engine exerciser start time. There are four parameters that determine the start time:

weekly ("Every") or bi–weekly ("Alt") operation
day of week ("Sun" through "Sat")
start hour (0 through 23)
start minutes (0 through 59)

For example, if the user wants the exerciser to run every other Saturday at 3 PM, the proper configuration would be:

"Alt Sat @ 15:00"

NOTE: When choosing bi–weekly operation, the exerciser will always run on the week designated "(1)" on the date display.

Run Time Display

The Run Time Display shows the run time for the engine exerciser. The default setting from the factory is 30 minutes.

Time Display

The Time Display shows the present system time. The format is "hours:minutes:seconds".

NOTE: During total power outages, power to the accessory is maintained by a battery in the Controller (see page 4–2 of Operator's Manual). Be sure that the 9–volt alkaline battery is fresh and enabled (jumper in ON position) so that the time and date settings are not lost.

Date Display

The Date Display shows the present system date. The format is "day of week (week) month/day of month/year".

NOTE: Week is either week 1 or week 2. This is used in conjunction with the bi–weekly timer.

Daylight Savings Time Adjust Display

This display shows whether the automatic daylight saving time adjustment is active. The factory default is "NO". If enabled, the unit will automatically adjust for daylight saving time at 2 AM on Sunday as follows:

Part No.	629857–001*	629857–002*
Start	first Sunday in April	2nd Sunday in March
Stop	last Sunday in Oct	first Sunday in Nov

* Part no. on back of circuit board. New DST starts in 2007.

Fast / Slow Adjust Display

This display shows the automatic fast/slow adjustment value. The factory default is 0. This feature can be used to trim a clock that runs fast or slow. For example, if your clock runs 10 seconds slow per week, change the fast/slow adjust value to "+10" and the unit will automatically add 10 seconds to the clock every week.

NOTE: Adjustments are made Sunday morning at 2 AM. If you want your exerciser period to start at 2 AM on Sunday, you cannot use this feature and the adjustment must be set to 0.

BASIC GENERATOR SET INSTRUCTION & OPERATION MANUAL

CALIFORNIA
Proposition 65 Warning
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

SAFETY PRECAUTIONS

Before operating the generator set, read the operators manual! Become familiar with the equipment and safe operating procedures. Safe operation can be achieved only if the equipment is properly operated and maintained.

Dangers, Warnings and Cautions are used in this publication to alert the operator to special instructions concerning a particular procedure that may be hazardous if performed incorrectly. These "Safety Alerts" alone can not eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus "common sense" operation, are major accident prevention measures. Katolight Corporation can not anticipate every possible circumstance that might involve a hazard. The warnings in this Manual and on tags and decals affixed to equipment are therefore, not all-inclusive.

The following safety rules should be strictly complied with:

The standby electric system must be installed, tested, and inspected per the manufacturer's recommendations. All codes, standards, regulations, and laws pertaining to the installation must be strictly complied with.

DANGEROUS voltages are present at power terminals of this equipment. Contact with such terminals will result in extremely dangerous and possibly lethal electric shock. Never allow any unqualified person to install, operate or service the equipment.

The frame and external electrically conductive parts of this equipment must be properly connected to an approved earth ground, in accordance with applicable electrical codes. A grounding lug is provided on the generator and in other equipment for this purpose.

Gasoline, Natural Gas and Liquid Propane Gas are extremely flammable and vapors are ***EXPLOSIVE.***

Diesel fuel is highly flammable. Comply with all laws regulating the storage and handling of these fuels. Check for leaks frequently and correct such leakage immediately.

Engine exhaust gases contain ***DEADLY*** carbon monoxide gas. If breathed in sufficient concentrations, this gas can cause unconsciousness or even death. Provide adequate ventilation to prevent buildup of exhaust gases. When the generator is installed inside a room or enclosure, exhaust gases must be piped outdoors. Install the exhaust system so exhaust gas does not leak at joints or piping connections. The exhaust manifold, turbocharger(s), and extended exhaust piping are ***HOT*** when the engine is running. These can remain hot for long periods of time after the engine shuts off. Avoid contact with these parts. Consider insulating the exhaust system if installation is such that unintentional contact with the exhaust system components is likely.

Coolants under pressure have a higher boiling point than water. ***DO NOT*** open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first.

Wear protective safety eyeglasses and gloves when handling starting batteries and electrolyte. Battery acid can cause serious burns if it contacts eyes and skin.

Moving parts can cause severe personal injury or death. Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.

Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage, which present a potential fire hazard.

Installation Procedures: Refer to Katolight's "Installation Guide" Procedures

OPERATIONS PROCEDURES

! CAUTION !

The high engine temperature shutdown system will not operate if the coolant level is too low. The high engine temperature sensor monitors coolant temperature. Loss of coolant will prevent sensor operation and allow the engine to overheat causing severe damage to the engine. Therefore, maintain adequate coolant level for proper operation of the high engine temperature shutdown system.

Low Coolant Level Shutdown – A submerged sensor in the top portion of the radiator shuts down the engine and lights the Hi Engine Temp fault lamp when the coolant level falls below the level of the sensor. Top off coolant frequently

STARTING PROCEDURE

The following sections cover the three systems used to start the generator set. See Pages 8 – 14 for panel description and illustrations.

Starting at Control Panel

Move the MANUAL/OFF/AUTO switch on the control panel to the MANUAL position. This will activate the engine control system and the starting system. The starter will begin cranking and after a few seconds the engine should start. The starter will disconnect when the engine reaches a speed of 500-750 RPM. If the engine does not start, the starter will disengage at the end of the cranking cycle. Katolight generator sets with the cycle cranking will crank for 10 seconds and then rest for 10 seconds until 5 cycles have been completed, then lock out on overcrank (fail to start). To clear an overcrank fault, place the MANUAL/OFF/AUTO switch in the OFF position. Wait two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt at starting, refer to the Troubleshooting section.

Automatic Starting

Placing the MANUAL/OFF/AUTO switch on the generator set control panel in the AUTO position if an automatic transfer switch is used. This allows the transfer switch to start the generator set if a power outage occurs and stop it when the power returns. **Be aware the set could start at any time in the "AUTO" mode – keep clear of all moving parts and be sure to turn switch to "OFF" position before servicing and disconnect the negative battery cable after disconnecting the battery charger circuit.**

STOPPING

Before Stopping

Run the generator set at no load for three to five minutes before stopping. This allows the lubricating oil and engine coolant to carry heat away from the combustion chamber and bearings.

To Stop

If the set was started at the set control panel or at a remote control panel, move the MANUAL/OFF/AUTO switch or remote starting switch to the OFF position. If an automatic transfer switch started the set, the set will automatically stop after the normal power source returns, and time delays have been satisfied.

BREAK-IN

Drain and replace the crankcase oil and oil filter(s) after the first 30/50 hours of operation on new generator sets. Refer to the MAINTENANCE section of the Engine manual for the recommended procedures.

NO-LOAD OPERATION

Periods of no load operation should be held to minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will

be obtained by connecting a "dummy" electrical load. Such a load could consist of Load Banks.

EXERCISE PERIOD

Generator sets on continuous standby must be able to go from a cold start to being fully operational in a matter of seconds. This can impose a severe burden on engine parts. Regular exercising keeps engine parts lubricated, prevents oxidation of electrical contacts and in general helps provide reliable engine starting. Exercise the generator set at least once a week for a minimum of 30 minutes with load so the engine reaches normal operating temperatures. The Automatic Transfer switch has as an optional exerciser that can be preset to provide regular exercise periods. Typically the exerciser can be set for time of start, length of run, and day of week.

LOW OPERATING TEMPERATURES

Use a coolant heater if a separate source of power is available. The optional heater will help provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating. The heater should be in use year round.

AUTOMATIC TRANSFER SWITCH

! DANGER !

HAZARDOUS VOLTAGE
Will cause severe injury or death.
Turn OFF all power before installation, adjustment or removal or transfer switch or any of its components.

EQUIPMENT INSPECTION

Immediately inspect the transfer switch when received to detect any damage, which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Katolight representative. The switch cabinet should be opened at inspection to check for internal freight damage, even if the box and cabinet enclosure appear undamaged.

FINAL EQUIPMENT INSPECTION

Prior to energizing the transfer switch:

Remove any debris incurred due to shipment or installation. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.

Verify that all cabled connections are correct. Verify phase rotation and position of wild leg at both sources.

Check engine start connections and verify the correct connection of all control wires.

Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required.

Check the integrity of power connections by verifying actual lug torque values as specified in the ATS manual.

Make sure that all covers and barriers are installed and properly fastened.

FUNCTIONAL TEST

The functional testing of the transfer switch consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the transfer switch. Read

and understand all instructions and review the operation of all accessories provided.

Before starting the operation test, check the equipment-rating nameplate on the transfer switch to **verify the correct system voltage.**

To begin the test, close the Normal source circuit breaker. The micro-controller will illuminate the Normal Available LED if proper voltage is sensed. Verify the phase to phase voltages at the Normal line terminals.

Next, close the Emergency source breaker and start the engine generator. The Emergency available LED indicator will illuminate when preset voltage and frequency levels are achieved. Check the phase to phase voltages at the Emergency line terminals. Also, verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.

After the sources have been verified, shut down the engine generator, and put the starting control in the automatic position. Complete the visual inspection of the transfer switch, and close and lock the cabinet door.

Initiate the electrical transfer test by activating the test switch. **Hold the test switch until transfer to Emergency is accomplished.** After the engine start time delay, the micro-controller will send an engine start signal and sensing will determine when the auxiliary source reaches preset levels. The switch will transfer to the Emergency source after the time delay of the transfer to the Emergency timer.

Deactivating the test switch will start retransfer to the Normal source. The switch will retransfer to the Normal source after the time delay of the retransfer to Normal timer. The engine over-run timer allows the engine generator to run unloaded for a preset cool-down period.

For complete details of timer and voltage sensing operations, please refer to the Automatic Transfer Switch Operation Manual.

MAINTENANCE AND TESTING

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items.

INSPECTION AND CLEANING

! DANGER !

HAZARDOUS VOLTAGE
De-energize all sources of power before doing any work on the transfer switch. Note: If approved disconnects are not in place contact your Local Electric Utility or a qualified Electrician before proceeding.

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contracts. Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

SERVICING

All worn or inoperative parts must be replaced using recommended replacement parts. Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact your nearest Distributor.

The operating mechanism of the transfer switch is lubricated. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the

mechanism, clean and apply additional lubricant. (See Automatic Transfer Switch Manual for proper lubricant type).

TESTING

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. Both power sources MUST be disconnected before manual operation of the switch. Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the test switch. Engine start timer will time out and the micro-controller will send an engine start signal. When the transfer to Emergency time has elapsed, the switch will complete its transfer by closing into the Emergency source.

Deactivating the test switch will start retransfer to the Normal source. The switch will complete its retransfer to Normal after the time delay of the retransfer to Normal timer. The engine over-run timer allows the engine generator to run unloaded for a preset cool down period.

GOVERNORS

MECHANICAL GOVERNOR ADJUSTMENTS

All Katolight Gen-Sets are tested at full load prior to shipment and the speed settings are adjusted. The typical settings will vary from 60 – 63 Hz at no load and are set to operate at 60 Hz when loaded to the nameplate rating. If the system load does not reach the nameplate rating the speed can be adjusted down to 60 Hz. Care must be taken to insure that the Katolight Gen-Set operates at no less than 60 Hz when the entire load to be on the unit is applied. See Figures 2 – 1 and 3 – 1 to find the typical speed adjust locations.

ELECTRONIC GOVERNOR ADJUSTMENTS

Governor Speed Setting

The governed speed set point is increased by clockwise rotation of the Speed adjustment control. Remote speed adjustment can be obtained with an optional Speed Trim Control. See Figure 1 – 1.

Governor Performance

Once the engine is at operating speed and at no load, the following governor performance adjustments can be made:

Rotate the Gain adjustment clockwise until instability develops. Gradually move the adjustment counterclockwise until stability returns. Move the adjustment 1/8 of a turn further counterclockwise to insure stable performance.

Rotate the Stability adjustment clockwise until instability develops. Gradually move the adjustment counterclockwise until stability returns. Move the adjustment 1/8 of a turn further counterclockwise to insure stable performance.

Gain and stability adjustment may require minor changes after engine load is applied. Normally, adjustments made at no load achieve satisfactory performance. A strip chart recorder can be used to optimize the adjustments further.

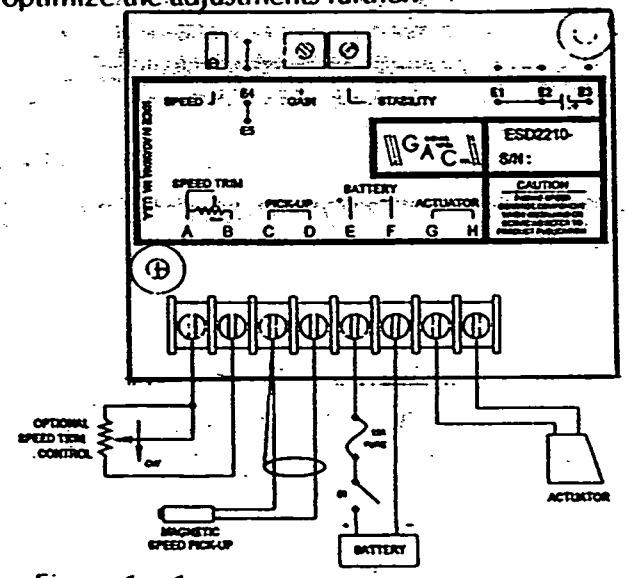


Figure 1 – 1
Typical Electronic Governor

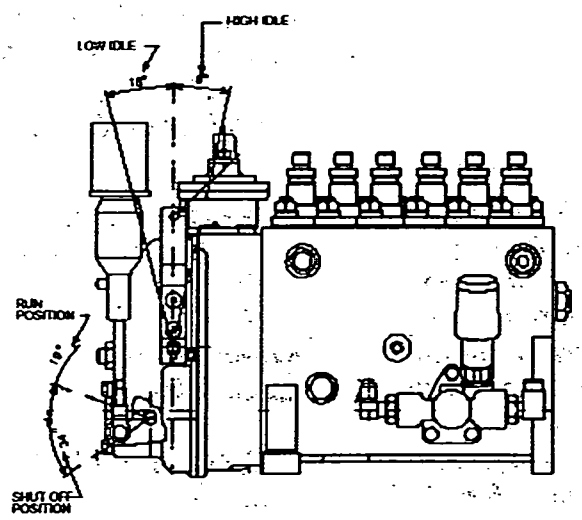


FIGURE 2-1

TYPICAL MECHANICAL GOVERNOR FOR DIESEL ENGINES

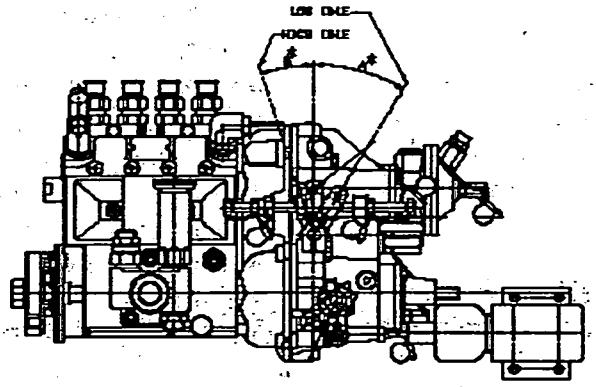


FIGURE 3-1

TYPICAL MECHANICAL GOVERNOR FOR DIESEL ENGINES

45 Series Panel

1. **AC Voltmeter**
   This meter will monitor generator output voltage. There are 2 scales on the meter upper for 208/240-volt systems and lower for 480-volt systems.

2. **Frequency Meter**
   This meter will monitor generator speed, which is measured in Hertz. Typical relationship with RPM is Hertz x 30 = RPM. Standard systems will operate at a minimum of 60.0 Hz – maximum of 63.0 Hz.

3. **AC Ammeter**
   This meter will monitor the load applied to the generator. This load is measured in amperes. The reading on this meter will vary with the load, but should never exceed the nameplate rating.

4. **High Engine Temp/Low Coolant Level LED**
   Indicates the unit has sensed coolant temperature in excess of 225°F and/or indicates the coolant level is low.

5. **Low Oil pressure LED**
   Indicates the unit has sensed the oil pressure has fallen below 15 PSI.

6. **Engine over speed LED**
   Indicates the unit has exceeded the speed limit of 71Hz for gas units or 66 Hz for diesel units.

7. **Engine Overcrank LED**
   Indicates the unit has exceeded the 5 crank cycles.

8. **Engine Control Switch**
   This switch allows the operator to choose from three control's modes – MANUAL for local start and run (to the left) OFF for no run and reset (center) AUTO for remote start and run (to the right).

9. **Ammeter/Voltmeter Selector Switch**
   This switch allows the operator to change the output lines to be monitored by the AC ammeter and the AC voltmeter (amperage is monitored on each line and voltage is monitored line to line) Example: L1 - L2 = Volts position 1 and Amps on L1.

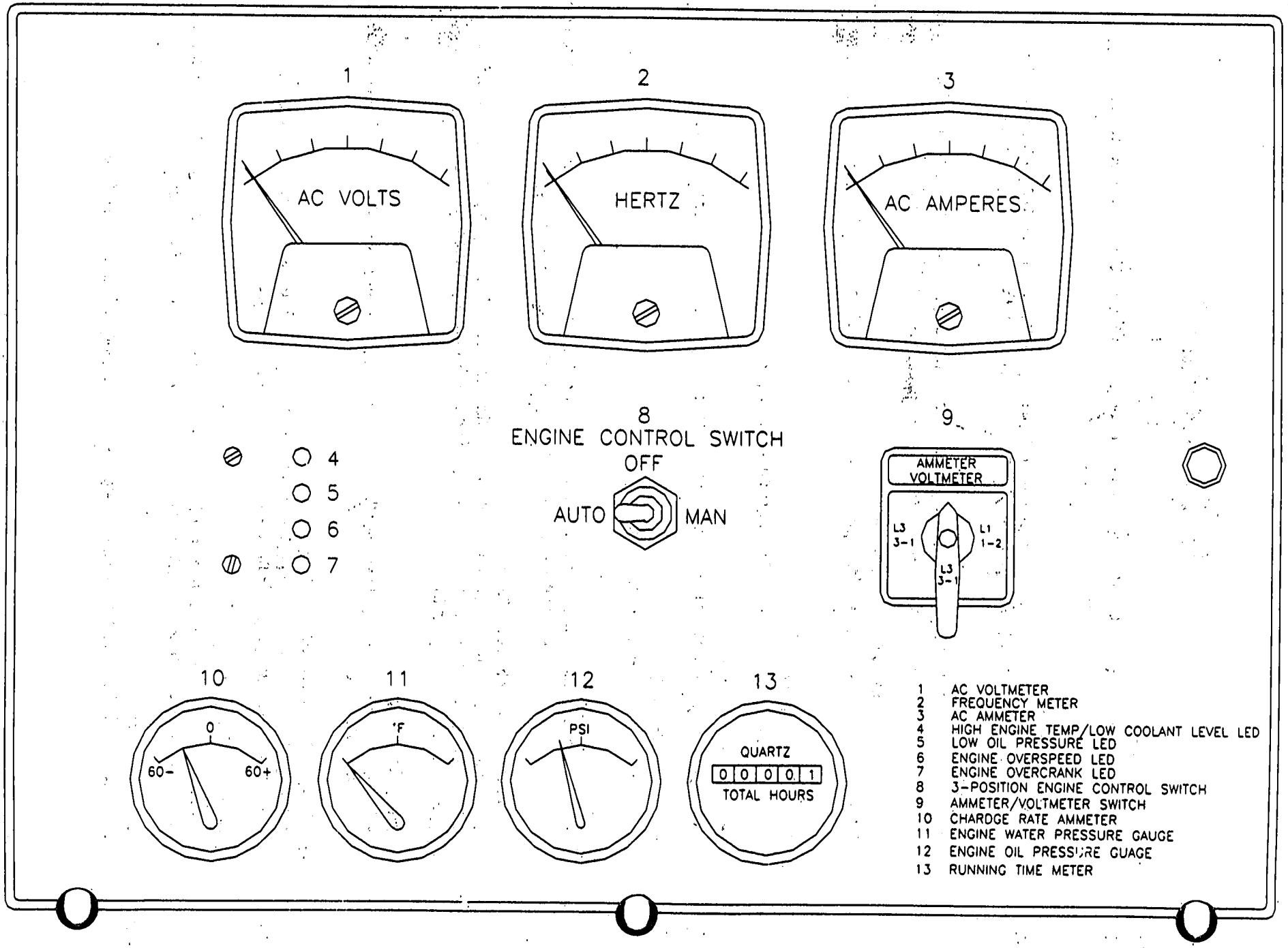
10. **Charge Rate Ammeter**
    This gauge indicates the rate of charge from the engine-mounted alternator to the starting battery, reading is shown in DC amperes.

11. **Engine Water Temperature Gauge**
    This gauge indicates operating temperature of the engine coolant. The reading is shown in degree Fahrenheit. **Note:** This gauge will not read zero when unit is not running.

12. **Engine Oil Pressure Gauge**
    This gauge indicates operating pressure of the engine lubricating system. The reading is shown in pounds per square inch (PSI). Note: This gauge will not read zero when unit is not running.

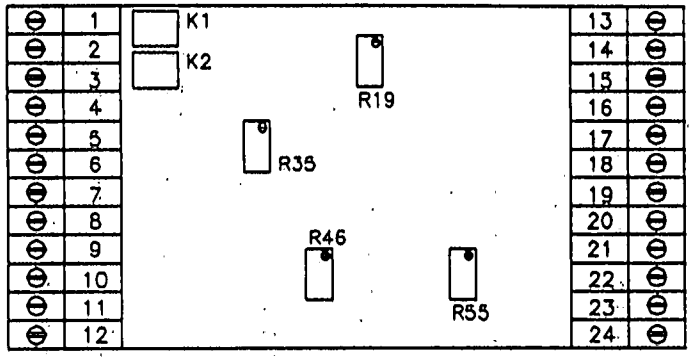
13. **Run Time Meter**
    This meter will indicate accumulative run time in hours of operating increments of 1/10.

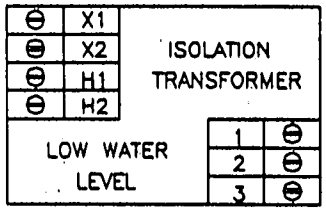
STANDARD 45 SERIES CONTROL PANEL FACE

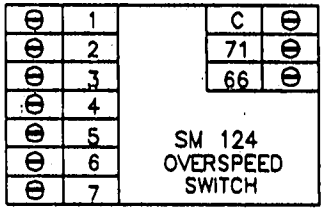


1 AC VOLTMETER
2 FREQUENCY METER
3 AC AMMETER
4 HIGH ENGINE TEMP/LOW COOLANT LEVEL LED
5 LOW OIL PRESSURE LED
6 ENGINE OVERSPEED LED
7 ENGINE OVERCRANK LED
8 3-POSITION ENGINE CONTROL SWITCH
9 AMMETER/VOLTMETER SWITCH
10 CHARDGE RATE AMMETER
11 ENGINE WATER PRESSURE GAUGE
12 ENGINE OIL PRESSURE GUAGE
13 RUNNING TIME METER

STANDARD 45 SERIES CONTROL PANEL BACK PLATE





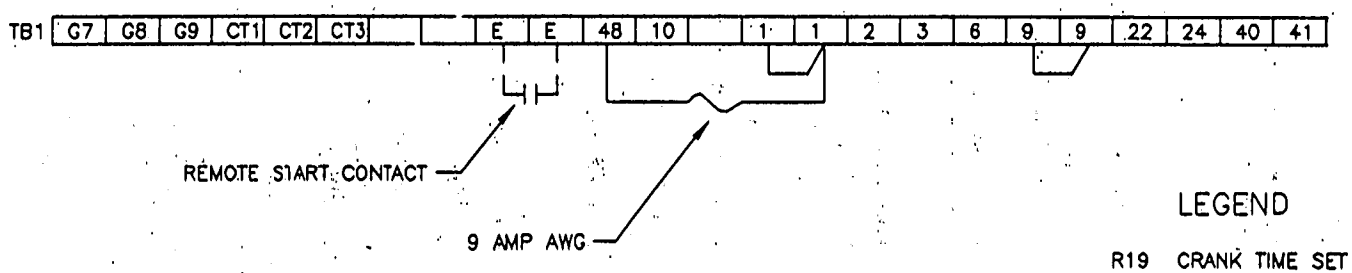


RELAYS

RELAYS INCLUDE: GOVENOR PILOT, AUXILARY, AIR DAMPER OR ALARM RELAYS, EITHER 2 POLE OR 3 POLE, IF THERE ARE 2 OR MORE RELAYS THEY WILL BE STACKED IN THIS CORNER OR WHERE THER IS ROOM.

ELECTRONIC GOVERNOR

(GOVERNOR WILL BE LOCATED HERE OR ON SIDE OF PANEL)



LEGEND

R19 CRANK TIME SET
R35 ENGINE ALTERNATOR FREQUENCY ADJUST
R46 MAG PICK-UP CRANK DISCONNECT
R55 OIL FAILURE TIME SET

50 Series Panel

1. **Low Battery Voltage LED**
   Indicates that the starting battery voltage has dropped below 10 volts DC on 12-volt system or 22 on 24-volt system. Possible problem with the battery(s) or charging system.

2. **Charger Malfunction LED**
   Indicates that the starting battery is at a high DC voltage above 15 volts for 12-volt systems or 30 on 24-volt system. Possible problem with the charging system.

3. **High Engine Temp/Low Coolant Level LED**
   Indicates the unit has sensed coolant temperature in excess of 225° F and/or indicates the coolant level is low.

4. **Low Oil pressure LED**
   Indicates the unit has sensed the oil pressure has fallen below 15 PSI.

5. **Engine over-speed LED**
   Indicates the unit has exceeded the speed limit of 71Hz for gas units or 66 Hz for diesel units.

6. **Engine Overcrank LED**
   Indicates the unit has exceeded the 5 crank cycles.

7. **EPS Supplying Load LED**
   Indicates that the automatic transfer switch is in the emergency position and generator is supplying power to the load.

8. **Low Water Temp LED**
   Indicates that the coolant temperature has reached 50°F. Possible problem with the jacket water heater.

9. **High Engine Temp Pre-alarm LED**
   Indicates the jacket water temp has dropped below 215°F and may go into a high temp shut down.

10. **Low Oil Pressure Pre-alarm LED**
    Indicates that the engine oil pressure has dropped below 20 PSI and may go into a low oil pressure shut down.

11. **Low Fuel LED**
    Indicates that the fuel supply is critically low on fuel and requires refueling.

12. **Unit Not In Auto LED**
    Indicates that the engine control switch is not in the AUTO position.

13. **Press To Test Button**
    This is the red button on the panel face. By pressing it will activate all LED's and sound the alarm for testing purposes.

14. **Panel Lights**
    These are located on the top of the panel face and will illuminate the control panel and gauges.

50 Series Panel (continued)

15. AC Voltmeter
This meter will monitor generator output voltage. There are 2 scales on the meter, upper for 208/240 volt systems and lower for 480 volt systems.

16. Frequency Meter
This meter will monitor generator speed, which is measured in Hertz. Typical relationship with RPM is Hertz x 30 = RPM. Standard systems will operate at a minimum of 60.0 Hz – maximum of 63.0 Hz.

17. AC Ammeter
This meter will monitor the load applied to the generator. This load is measured in amperes. The reading on this meter will vary with the load, but should never exceed the nameplate rating.

18. Buzzer
This is an audible alarm that will sound when any of the LED's are activated indicating engine failure or pre-alarm (Exception EPS Supplying Load LED).

19. Alarm Silence Button
This is the black button on the panel face. By pressing it will turn the audible alarm off.

20. Panel Light Switch
This switch will activate the panel lights for use in low light conditions.

21. Engine Control Switch
This switch allows the operator to choose from three control's modes – MANUAL for local start and run (to the left) OFF for no run and reset (center) AUTO for remote start and run (to the right).

22. Ammeter/Voltmeter Selector Switch
This switch allows the operator to change the output lines to be monitored by the AC ammeter and the AC voltmeter (amperage is monitored on each line and voltage is monitored line to line) Example: L1 - L2 = Volts position 1 and Amps on L1.

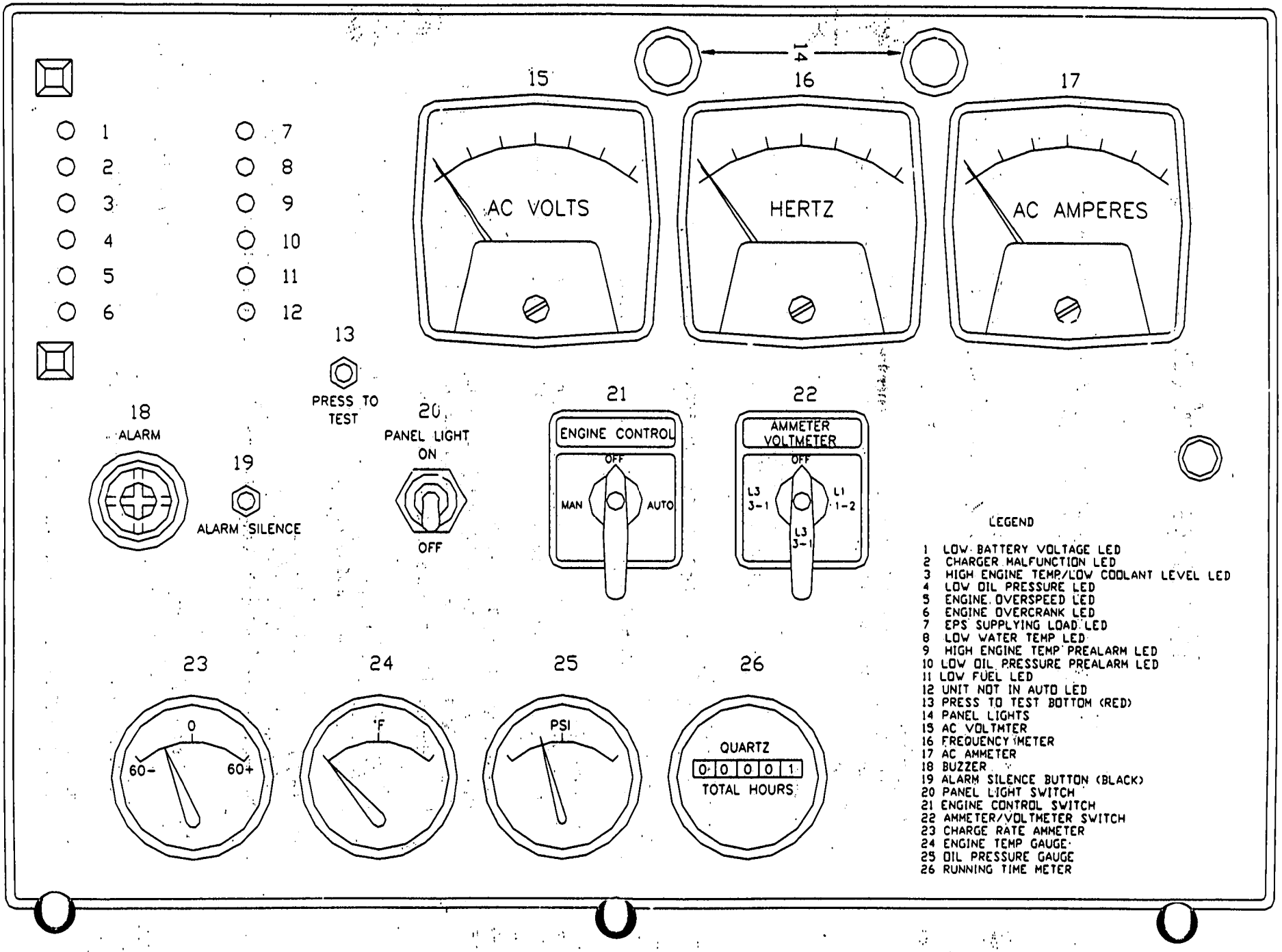
23. Charge Rate Ammeter
This gauge indicates the rate of charge from the engine-mounted alternator to the starting battery, reading is shown in DC amperes.

24. Engine Water Temperature Gauge
This gauge indicates operating temperature of the engine coolant. The reading is shown in degree Fahrenheit. Note: This gauge will not read 0 when unit is not running.

25. Engine Oil Pressure Gauge
This gauge indicates operating pressure of the engine lubricating system. The reading is shown in pounds per square inch (PSI). Note: This gauge will not read zero when unit is not running.

26. Run Time Meter
This meter will indicate accumulative run time in hours of operating increments of 1/10.

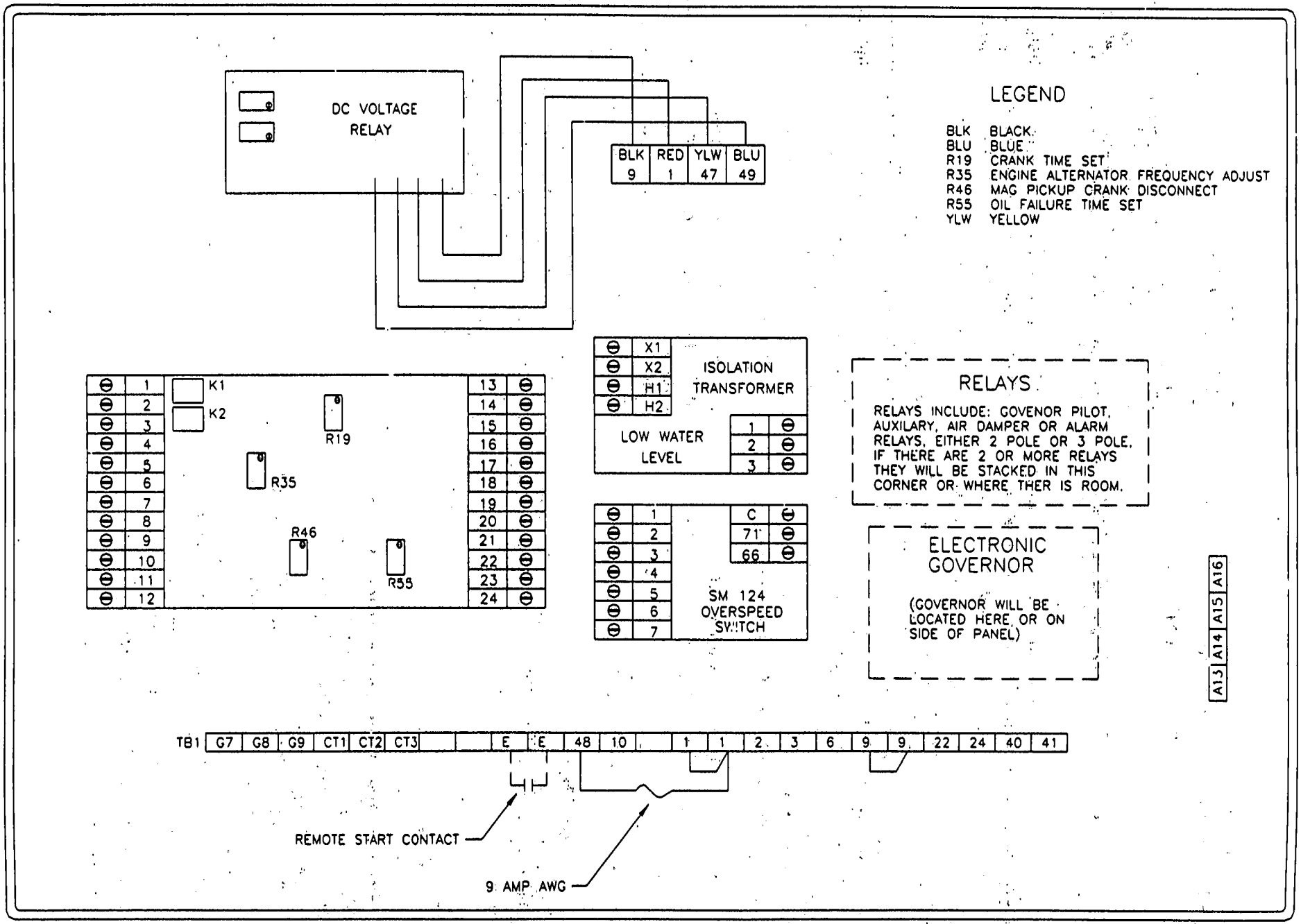
STANDARD 50 SERIES CONTROL PANEL FACE



LEGEND

1 LOW BATTERY VOLTAGE LED
2 CHARGER MALFUNCTION LED
3 HIGH ENGINE TEMP/LOW COOLANT LEVEL LED
4 LOW OIL PRESSURE LED
5 ENGINE OVERSPEED LED
6 ENGINE OVERCRANK LED
7 EPS SUPPLYING LOAD LED
8 LOW WATER TEMP LED
9 HIGH ENGINE TEMP PREALARM LED
10 LOW OIL PRESSURE PREALARM LED
11 LOW FUEL LED
12 UNIT NOT IN AUTO LED
13 PRESS TO TEST BOTTOM (RED)
14 PANEL LIGHTS
15 AC VOLTMTER
16 FREQUENCY METER
17 AC AMMETER
18 BUZZER
19 ALARM SILENCE BUTTON (BLACK)
20 PANEL LIGHT SWITCH
21 ENGINE CONTROL SWITCH
22 AMMETER/VOLTMETER SWITCH
23 CHARGE RATE AMMETER
24 ENGINE TEMP GAUGE
25 OIL PRESSURE GAUGE
26 RUNNING TIME METER

STANDARD 50 SERIES CONTROL PANEL BACK PLATE



If instability cannot be corrected or further performance improvements are required, contact the nearest Distributor or Service Center.

TROUBLESHOOTING

The generator set has a number of sensor units that continuously monitor the engine for abnormal conditions such as low oil pressure or high coolant temperature. If an abnormal condition does occur, the engine monitor will activate a fault lamp and may also stop the engine depending on the condition. If the generator set does shut down, the operator may be able to restart the set after making certain adjustments or corrections. This section describes the operation of the fault condition system and suggested troubleshooting procedures for the operator.

The standard 45 series control has four RED fault lights. The optional 50 Series control has 12 RED fault lights, an audible alarm which will sound when a fault occurs. The alarm will have a silence button to stop the audible alarm only.

Safety Considerations

High voltages are present within the control panel and generator outlet box when the generator is running.

! WARNING !

Contacting high voltage components can cause serious personal injury or death. Keep control and outlet box covers in place during troubleshooting.

Generator set installations are normally designed for automatic starting or remote starting. When trouble shooting a set that is shut down, make certain the generator set cannot be accidentally restarted. Place the MANUAL/OFF-RESET/AUTO switch in the OFF position and remove the negative battery cable from the starting battery.

! WARNING !

Accidental starting of the generator set during troubleshooting can cause severe personal injury or death. Disable the generator set before troubleshooting.

When a fault comes on during operation, follow the procedures to locate and correct the problem. For any symptom not listed, contact your Distributor for service.

Resetting the Control

Placing the MANUAL/OFF-RESET/AUTO switch in the OFF position and pressing the alarm silence switch can deactivate the external alarm and fault lamp. Locate the problem and make the necessary corrections before restarting the generator set.

Main Line Circuit Breaker (Optional)

The optional generator output mainline circuit breaker mounts on the side of the generator outlet box. If the load exceeds the breaker current rating, the breaker will open to prevent the generator from being overloaded. If the circuit breaker trips, locate the source of the overload and correct as required. Manually reset the breaker to reconnect the load to the generator, by pushing the handle down to the open OFF position, then up to the closed ON position.

TROUBLESHOOTING

! WARNING

Many troubleshooting procedures present hazards, which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.

*** 12 – Denotes LED found on 50 Series Panel Only**

SYMPTOM	CORRECTIVE ACTION
***1.** PRE-HI ENGINE TEMP LED. Engine continues to operate.	**1.** Indicates engine has begun to overheat and engine temperature has risen to approximately 215°F (105°C). If generator is powering non-critical and critical loads and cannot be shut down. Use the following: a. Reduce load if possible by turning off non-critical loads. b. Check air inlets and outlets and remove any obstructions to airflow. c. Open doors or windows in generator area to increase ventilation. If engine can be stopped, follow procedure in Step 2.
2. HI ENGINE TEMP LED. Engine shuts down.	**2.** Indicates engine has overheated (engine temperature has risen above 225°F/110°C) or coolant level is low (sets with coolant level sensor). Allow engine to cool down completely before proceeding with the following checks: a. Check coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary. b. Check for obstructions to cooling airflow and correct as necessary. c. Check for a slipping fan belt and tighten if loose. d. Reset control and restart after locating and correcting problem. Contact your Dealer or Distributor if none of the above.

*** 12 – Denotes LED found on 50 Series Panel Only**

***3.** PRE LOW OIL PRESSURE LED. Engine continues to operate.	**3.** Indicates engine oil pressure has dropped to 20 psi (138kPa). If generator is powering critical loads and cannot be shut down, wait until next shutdown period and then follow Step 4 procedure. If engine can be stopped, follow procedures in Step 4.
4. LOW OIL PRESSURE LED. Engine shuts down. **NOTE:** See also Step 5	**4.** Indicates engine oil pressure has dropped to 15 psi (97kPa). Check oil level, lines and filters. If oil system is okay, but oil level is low, replenish. Reset control and restart. Contact your Dealer or Distributor if oil pressure is not in the range of 35 to 55 psi (21 to 379 kPa).
5. OVERCRANK LED. Engine stops cranking. Or Engine runs, shuts down, and LOW OIL PRESSURE LED.	**5.** Indicates possible fuel system problem. a. Check for empty fuel tank, fuel leaks, or plugged fuel lines and correct as required. b. Check for dirty fuel filter and replace if necessary (See Maintenance section of Engine Manual). c. Check for dirty or plugged air filter and replace if necessary (See Maintenance section of Engine Manual). d. Refer to Step 4. e. Reset the control and restart after correcting the problem. Contact your Dealer or Distributor for service if none of the above.
6. Engine runs and then shuts down, OVERSPEED LED.	**6.** Indicates engine has exceeded normal operating speed. Refer to governor adjust procedure. Contact your Dealer or Distributor for service.
***7.** UNIT NOT IN AUTO LED.	**7.** Indicates AUTO/OFF/MANUAL switch is in the OFF position which will prevent automatic starting if an automatic transfer switch is used. Move the AUTO/OFF/MANUAL switch to the AUTO position for automatic starting.
8. LOW FUEL LED. Engine continues to run.	**8.** Indicates diesel fuel supply is running low. Check fuel supply and replenish as required.
***9.** LOW FUEL LED. Engine shuts down and LOW OIL PRESSURE LED.	**9.** Indicates engine has run out of fuel. Check fuel level and replenish as required. See Engine Manual for fuel system priming procedure.

*** 12 – Denotes LED found on 50 Series Panel Only**

***10.** LOW ENGINE TEMPERATURE LED. Set is in standby mode but not operating.	**10.** Indicates engine coolant heater is not operating or is not circulating coolant. Check for the following conditions: a. Coolant heater not connected to power supply. Check for blown fuse, open circuit breaker or disconnected heater cord and correct as required. b. Check for low coolant level and replenish if required. Look for possible coolant leakage points and repair as required. c. Contact your Dealer or Distributor if none of the above.
***11.** CHARGER MALFUNCTION LED. Unit continues to run.	**11.** Indicates possible fault with the battery charging system. If LED is on only when unit is running indicated problem with battery charging alternator. Check and repair. Contact Dealer or Distributor for assistance.
***12.** LOW BATTERY LED.	**12.** Indicates starting battery voltage is low. Check electrolyte level and charger output or replace the battery.
13. FAULT LED on but no fault exists. Engine gauges show oil pressure, engine temperature, and frequency (speed) are within normal limits.	**13.** The monitor board or a sensor may be at fault. Contact your Dealer or Distributor for service.
14. Engine starts from generator control panel, but will not start automatically or from a remote panel. (Note: The AUTO/OFF/MANUAL switch must be in the AUTO position for Automatic or remote starting	**14.** Indicates possible fault with remote start circuit. Check the following: a. Check wire to ATS. b. See ATS section for further troubleshooting. c. Contact your Dealer or Distributor for assistance.
15. Engine will not crank.	**15.** Indicates possible fault with control or starting system. Check for the following conditions: a. Fault lamp on. Correct fault and reset control. b. Poor battery cable connections. Clean the battery cable terminals and tighten all connections. c. Discharged or defective battery. Recharge or replace the battery. d. Contact your Dealer or Distributor for assistance if none of the above.

*** 12 – Denotes LED found on 50 Series Panel Only**

16. No AC output voltage.	**16.** Indicates possible fault with voltage regulator. a. Verify output with another meter if ok check meter, if ok check meter fuses. b. Regulator fuse is blown. Replace fuse. Contact your Dealer or Distributor if voltage build-up causes fuse to blow. c. Check rotating rectifier for damaged diodes. Replace all diodes if any are failed.
17. No Engine Start	**17.** Indicates Engine Start wires not terminated properly or Generator in OFF position. a. Check Engine Start connections. b. Investigate why Engine Control Switch was put in manual. c. Contact your Dealer or Distributor for assistance.
18. No Engine Stop	**18.** Indicates Timing Cycle not complete, Engine Start wires not terminated correctly or Generator in MANUAL. a. Check Engine Start Timer setting. b. Check Engine Start Connections. c. Investigate why the Engine Control Switch was put in Manual. d. Contact your Dealer or Distributor for assistance.
19. ATS will not transfer to Emergency	**19.** Indicates Emergency voltage or frequency not within acceptable parameters, Power supply harness unplugged, Limit Switch harness unplugged or Timing Cycle not complete. a. Check Engine Start connections, Generator output, and Engine Control Switch. b. Plug in Power Supply harness. c. Plug in Limit Switch harness. d. Check transfer to Emergency Timer setting. e. Contact your Dealer or Distributor for assistance.

*** 12 – Denotes LED found on 50 Series Panel Only**

0. ATS will not transfer to Normal	**20.** Indicates Normal voltage or frequency not within acceptable parameters, Power Supply harness unplugged, Limit Switch harness unplugged or retransfer to Normal timing cycle not complete. a. Check Utility and Utility breakers. b. Plug in Power Supply harness. c. Plug in Limit Switch harness. d. Check retransfer to Normal Timer setting. e. Contact your Dealer or Distributor for assistance.

CONTACT KATOLIGHT AT
1-800-325-5450
TO FIND YOUR LOCAL DISTRIBUTOR
OR SERVICE AGENT

NG

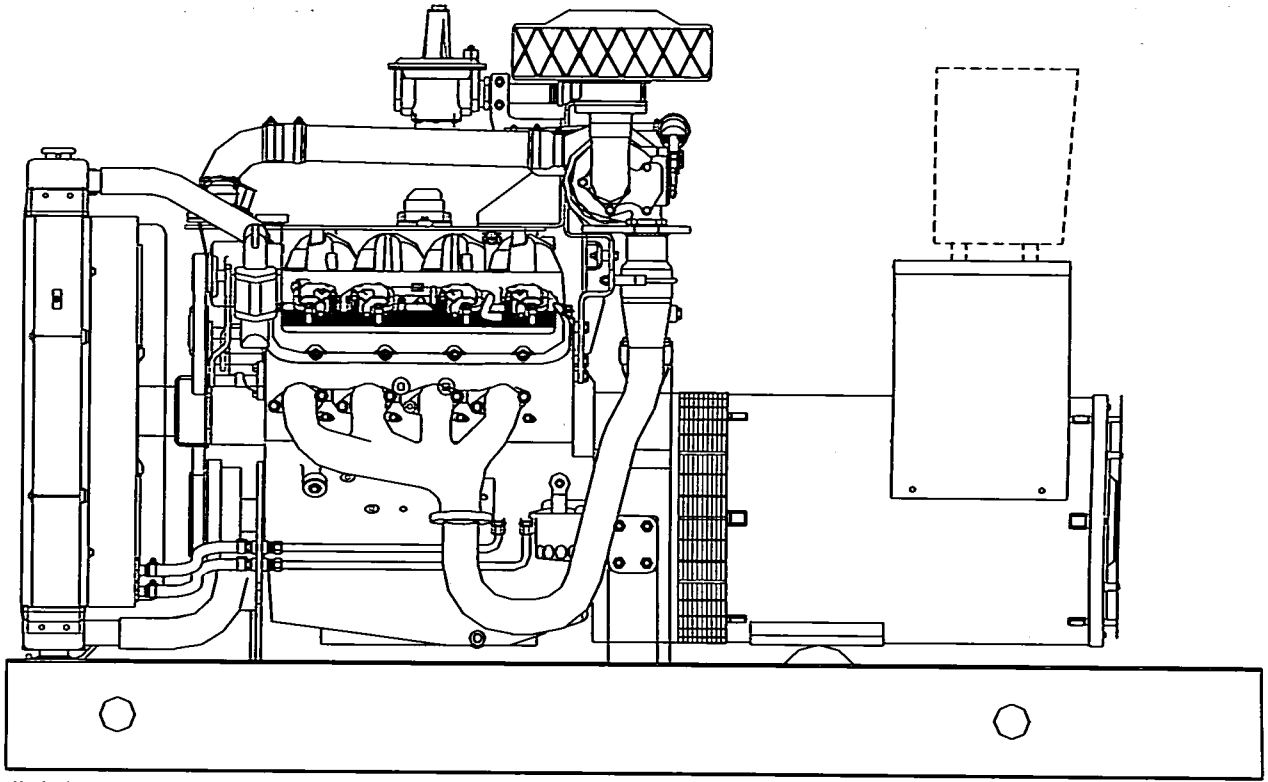
130F*G4

Power System Solutions

KATOLIGHT CORPORATION

130 KW @ 60 Hz.
Stand-By Power

110 KW @ 60 Hz.
Prime Power



- Katolight's commitment to quality has been an industry standard since 1952.
- Katolight specializes in custom designing any application to meet the customers' most stringent specifications.
- Each and every unit is factory tested. This can eliminate costly startup and installation delays.
- Katolight supplies a broad range of accessories, fully integrated to our generator sets, to match any requirement worldwide.
- All generator set components and accessories are covered by Katolight with a limited two-year warranty. Optional warranty periods are also available.
- This model accepts 100% of nameplate rating, per NFPA 110.

Model #	Volts	Hz	Phase	Power Factor	Natural Gas Standby Ratings		Natural Gas Prime Ratings		Connection
					Amps	kW/kVA	Amps	kW/kVA	
130FRG4	277/480	60	3	0.8	195	130/162.5	165	110/137.5	12 LEAD HI WYE
130FPG4	120/208	60	3	0.8	451	130/162.5	382	110/137.5	12 LEAD LOW WYE
130FJG4	120/240	60	3	0.8	391	130/162.5	331	110/137.5	12 LEAD HI DELTA
130FNG4	347/600	60	3	0.8	156	130/162.5	132	110/137.5	4 LEAD WYE
130FGG4	120/240	60	1	1.0	521	125/125	458	110/110	12 LEAD ZIG-ZAG
130FDG4	120/240	60	1	1.0	521	125/125	458	110/110	4 LEAD

STANDARD EQUIPMENT

CONTROL PANEL

- Model #45 control panel
- AC voltmeter, 3½", 2% accuracy
- AC ammeter, 3½", 2% accuracy
- Combination VM/AM selector switch, 4 position
- Frequency meter, 3½", 55-65 Hz.
- Vibration shock mounts (4)
- Engine control - KASSEC-12 VDC, with cyclic cranking timer
- 4 engine shutdowns with separate failure lights
  - * High water temperature
  - * Low oil pressure
  - * Engine overspeed
  - * Engine overcrank
- Engine gauges - 2"
  - * Battery voltmeter
  - * Water temperature
  - * Oil pressure
  - * Running time meter - 5 digits
- 3 position mode switch (auto-off-manual)

ENGINE

- Air cleaner
- Oil pump
- Full flow oil filter
- Jacket water pump
- Thermostat
- Exhaust manifold - dry
- Blower fan & fan drive
- Radiator - unit mounted
- Vibration isolators - pad type
- Electric starting motor - 12V

ENGINE (cont.)

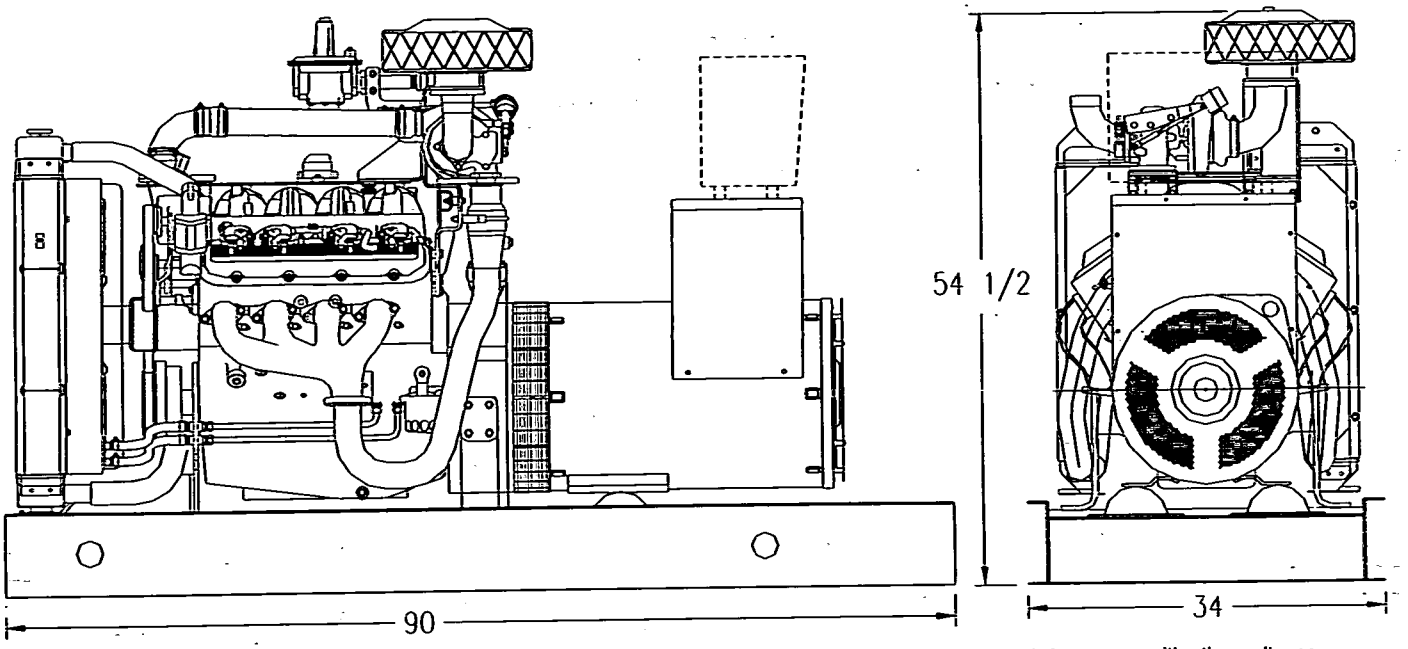
- Governor – Electric Isochronous
- Base - formed steel
- Flywheel & Enclosure
- Charging alternator - 12V
- Battery box & cables
- Flexible fuel & exhaust connectors

GENERATOR

- A.C. Generator
- Brushless design
- Single bearing
- Direct connection with flex plate
- Class H insulation
- All models manufactured to meet NEMA MG1-22.4 and CSA standards
- Telephone influence factor is well within NEMA standards
- Wave form deviation factor is no more than 5%, well within NEMA standards
- Harmonic content is 3.0% maximum
- Permanently lubricated ball type bearings
- Generator is self-ventilated
- Drip-proof construction

VOLTAGE REGULATOR

- Voltage adjust rheostat
- EMI filter (Internal Electromagnetic Interference)
- Underspeed protection
- Overexcitation protection
- Fully encapsulated
- Regulation - 1%



Drawing above for illustration purposes only. Based on standard open power 480 volt generator. Lengths may vary with other voltages.

KATOLIGHT

130F*G4 NG Gen-Set

ENGINE TECHNICAL DATA

	60 HZ	
Model:	8.1L Turbo	
Type:	4-Cycle	
Aspiration:	Turbocharged	
Cylinder Arrangement: (Number, inline, V, etc.):	8-V	
Displacement- Cu.In. (lit):	494 (8.1)	
Bore- in. (cm) x stroke- in. (cm):	4.25 (10.8) x 4.5 (11.1)	
Compression Ratio:	9.1:1	
Rated RPM:	1800	
Rating	**Standby**	**Prime**
BMEP: psi (kPa):	166 (1,145)	149 (1,027)
Maximum Power at Rated RPM – bhp (kW)	210 (157)	183 (136)

INSTALATION DATA*

Exhaust System		
Gas Temp. (Stack): °F (°C)	1,480 (804)	1,329 (721)
Gas Volume at Stack Temp.: CFM (m^3/min)	1,245 (35.3)	1,176 (33.3)
Maximum Allowable Back Pressure: in. H_2O (kPa)	27.2 (6.8)	27.2 (6.8)
Emissions – HC: g/hp-hr	C/F	C/F
Emissions – CO: g/hp-hr	C/F	C/F
Emmisions - NO_x g/hp-hr	C/F	C/F
Cooling System		
Ambient Capacity of Radiator: °F (°C)	117 (47)	120 (49)
Maximum Allowable Static Pressure on Rad. Exhaust: in. H_2O (kPa)	0.5 (0.12)	0.5 (0.12)
Water Pump Capacity: gpm (lit/min)	40.9 (154.8)	40.9 (154.8)
Heat Rejection to Coolant: BTUM (kW):	5,128 (90)	4,667 (82)
Heat Radiated to Ambient: BTUM (kW):	4,603 (81)	4,185 (74)
Air Requirements		
Aspirating: CFM (m^3/min)	369 (10)	332 (9.4)
Air Flow Required for Rad. Cooled unit.: CFM (m^3/min)	14,250 (404)	13,471 (381)
Air Flow Required for Heat Exchanger/ Remote Rad. Based on 20°F Rise CFM (m^3/min)	12,787 (362)	11,625 (329)
Fuel Consumption: (NG-1000 BTU/ft^3 / LP-2500 BTU/ft^3)	**NG**	**NG**
At 100% of Power Rating: ft^3/hr (m^3/hr)	1,591 (45)	1,562 (44)
At 75% of Power Rating: ft^3/hr (m^3/hr)	1,234 (35)	1,212 (34)
At 50% of Power Rating: ft^3/hr (m^3/hr)	1,087 (31)	1,068 (30)

Sound Level Data #

Sound Level at:	Full Load	No Load	Full Load	No Load
23 ft (7m) opu w/ critical grade muffler (dBA)	89	86	88	85
23 ft (7m) Sound Attenuated Enclosure (dBA)	82	80	80	79

Dimensions & Weight

Length: in. (cm)	90 (229)
Width: in. (cm)	34 (86.36)
Height: in. (cm)	54.5 (138)
Weight (dry): lb. (kg)	2,330 (1,057)

Liquid Capacity

Total Oil System: gal (lit)	2.1 (8.0)
Engine Jacket Water Capacity: gal (lit)	3.6 (13.7)
System Coolant Capacity: gal (lit)	8.2 (30.9)

Fuel Inlet

Fuel connection size:	1.5" NPT
Fuel supply pressure in H_2O (mm H_2O)	7-11 (178-279)

Electrical System

Electric Volts DC	12
Cold Cranking Amps under 0°F (-17.8°C)	1,160

Remote Radiator System

Connection sizes:	
Jacket Water Radiator Inlet in. (cm)	2 (5.1)
Jacket Water Radiator Outlet in. (cm)	2 (5.1)
Static head allowable Above engine ft H_2O (kPa)	17 (51)
Total system friction pressure Max. allowable psi (kPa)	C/F

Heat Exchanger System

Connection sizes:	
Jacket Water Heat Ex. Inlet in. (cm)	1 (2.54)
Jacket Water Heat Ex. Outlet in. (cm)	1 (2.54)
Water Consumption @60°F (16°C) gpm (lit/min)	25 (95)

*Installation data based on 480 volt, 60 HZ. Application and open power unit.
For sound level readings with other enclosures, please contact factory.
Sound level data acquired per Test Method SAE J1074. Installation factors and site conditions can affect sound levels.
Deration Factor: Altitude: Derate: .5% per 328 ft (100m) above 4,921 ft (1,500m). Temperature: Derate: 2% per 18°F (10°C) above 77°F (25°C).

OPTIONS

NG Gen-Set

Control Panel

** NOTE: #45 series control panel is standard on all units, see page 2 of spec sheet for standard features.

- O Model #45 Series Control Panel Options
  - O Emergency stop button
  - O Alarm buzzer with silencing switch
  - O Auxiliary relay for dry contacts (2 max.)
  - O A separate low water level light is optional
  - O Hooded panel lights (2) and on/off switch
  - O NEMA 12 Panel Face
  - O Additional LED lights (4 max.) One or two of the following conditions may be indicated:
    - ☐ unit not in auto
    - ☐ low fuel level
    - ☐ low water level
    - ☐ low water temp.
    - ☐ EPS supplying load
    - ☐ pre-alarm oil
    - ☐ pre-alarm temp.
    - ☐ charger malfunction
- O Model #50 Series Control Panel
  STANDARD FEATURES: same as #45 series control panel except for these added features:
  - O Hooded panel lights (2) and on/off switch
  - O 4 Engine shutdowns
  - O 12 light engine control package meeting NFPA-110 requirement
  - O Repetitive alarm buzzer and silencing switch
  - O Light and alarm press to test

  #50 SERIES OPTIONS
  - O Emergency stop button
  - O Additional space for one $3^1/_2$ meter
  - O Auxiliary relay for dry contacts (2 max.)
  - O A separate low water level light is optional
  - O Additional LED lights (4 max.) One to four additional conditions may be indicated: customer to specify
  - O NEMA 12 Panel Face
- O Model #60 and #80 Series Custom Control Panels
  It may be necessary to use a 60 or 80 series control panel on certain units where numerous options are required.
- O Microprocessor Control Panel- KDGC

GEN-SET OPTIONS

Cooling System

- O Remote Radiator
- O High Ambient Radiator
- O Heat Exchanger Cooling
- O Radiator Duct Flange

Fuel System

- O Fuel Strainer
- O Dual Fuel
  - ☐ Manual Change-over
  - ☐ Auto Change-over

Exhaust System

- O Residential Grade Muffler
- O Critical Grade Muffler
- O Hospital Grade Muffler
- O Rain Cap

Engine Electrical System

- O Battery
  - ☐ Lead-Acid
  - ☐ Nicad
- O Battery Warmer Plate
- O Battery Rack
- O Battery Charger
  - ☐ Automatic
  - ☐ Trickle
  - ☐ Mounted & Wired

Generator

- O Main Line Circuit Breaker
  - ☐ Shunt trip
  - ☐ Auxiliary switch
- O PMG Excitation & DVR 2000 Regulator
- O Space Heaters 120/240 volt
- O Special Testing
- O Additional Temperature Rise Generators Available (80°C, 105°C, & 130°C)

Additional Optional Equipment

- O Spring vibration isolators
- O Oil Drain Extension
- O Enclosures
  - ☐ Sound Attenuated
  - ☐ Weather Proof
  - ☐ Aluminum
  - ☐ Interior lights AC or DC
  - ☐ Floor Plate
- O Jacket Water Heater
- O Crankcase Oil Heater
- O Remote Annunciator
- O 12 Light Annunciator
  - ☐ Flush Mounted
  - ☐ Surface Mounted
  - ☐ 4 additional lights, if needed
- O Export Boxing
- O Warranties
  - ☐ 2 Year
  - ☐ 5 Year
- O Operating instructions under plexi-glass
- O Service indicator light
- O Wind rated enclosure

KATOLIGHT® CORPORATION

100 Power Drive • Mankato, MN 56001

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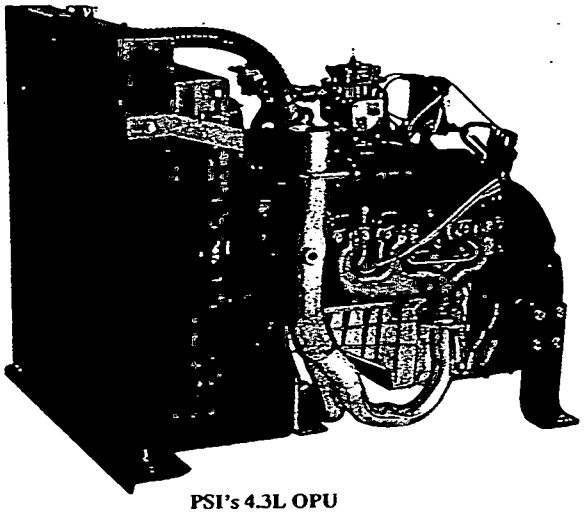
PSI

POWER SOLUTIONS, INC.

Operation and Maintenance

Manual



PSI's 4.3L OPU

Industrial Gasoline
and
Alternate Fueled Engines

1.6L, 3.0L, 4.3L, 5.7L, 7.4L and 8.1L Engines

A GM *Powertrain* Product
by Power Solutions, Inc.
Wood Dale, IL 60191

36100007/REV041602

LC50 Initial Adjustments

The main adjustment screw (MAS) settings are measured from the MAS valve body (not the jam nut) to the exterior end of the MAS screw. The zero-pressure regulator settings are measured from the top of the spring adjustment screw to the top of the spring tower.

These initial settings should get the gensets up and running for final adjustment with an oxygen sensor or exhaust analyzer. The MAS should be adjusted first with significant (75-90%) load on the engine. The ZPR should then be adjusted at no-load. One or two more iterations at full load for the MAS and no load for the ZPR should provide the correct air/fuel ratio over the entire operating range.

For dual-fuel configurations, the standard NG fuel set up should have a tee added between the ZPR and MAS. The side-leg of the tee should then have the MAS and ZPR for the LP fuel. The initial settings for dual-fuel NG and LP are the same as the single-fuel settings below. The final air/fuel ratio adjustments should be done on NG first, then LP, using the procedure above for each fuel.

50mm LC50
NG: MAS (3/4") 19mm, ZPR (Maxitrol R600Z) 16mm
LP(vap): MAS (3/4") 16mm, ZPR (Maxitrol R500Z) 14mm (5.7L)

43mm LC50
NG: MAS (3/4") 17mm, ZPR (Maxitrol R600Z) 16mm
LP(vap): MAS (3/4") 15mm, ZPR (Maxitrol R500Z) 14mm (4.3L)

36mm LC50
NG: MAS (1/2") 11mm, ZPR (Maxitrol R500Z) 16mm
LP(vap): MAS (1/2") 9.5mm, ZPR (Maxitrol R500Z) 14mm (3.0L)

Table of Contents

Page

Table of Contents (cont.)

Table of Contents (cont.)

Introduction

Power Solutions, Inc. is pleased that you have selected a GM *Powertrain* engine for your requirements. Power Solutions, Inc. takes great pride in our tradition of quality products produced from the GM *Powertrain* line of industrial gasoline and alternative fuel engines.

Power Solutions engines are inspected and tested before leaving the factory. However, certain checks should be made before placing the engine into regular service. **Please read the Initial Start-Up inspection requirements in the Maintenance Section of this manual.**

How to Use this Manual

This manual contains instructions on the safe operation and preventive maintenance of your GM *Powertrain* industrial engine. We urge you to read this manual prior to start up or operation of the engine.

The Table of Contents permits you to quickly open the manual to any section.

Power Solutions, Inc., engines are built with a variety of standard and/or optional components to suit a broad range of customer requirements. This manual **does not** identify equipment as standard or optional. All the equipment described in this manual may not be found on your engine or power unit.

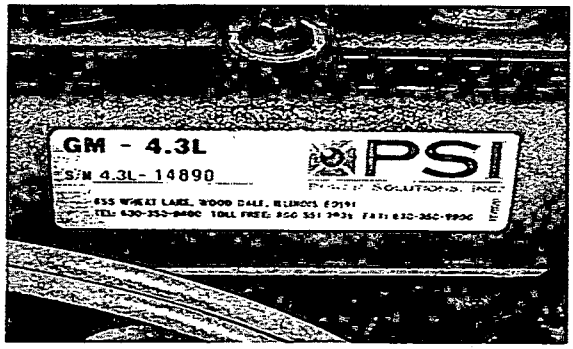
Please pay special attention to the **NOTES, CAUTIONS,** and **WARNINGS.** **WARNINGS** remind you to be careful in areas where carelessness can cause personal injury. **CAUTIONS** are given to prevent you from error that could cause damage to the equipment. **NOTES** give you added information designed to help you.

The descriptions and specifications contained in this manual were in effect at the time of publication. Power Solutions, Inc. reserves the right to discontinue models at any time, or to change specifications or design without notice and without incurring obligation.

Power Solutions, Inc.
655 Wheat Lane
Wood Dale, IL 60191

Engine Identification

An identification label is affixed to the right side of the engine on the rocker cover when looking at the engine from the flywheel end.. (The engine serial number is also stamped into the left side of the cylinder block near the engine flywheel.) The label contains the engine model number (i.e. 4.3L, 5.7L, etc.) and a serial number which identifies the engine from other GM *Powertrain* engines provided by Power Solutions, Inc. The engine model and serial number are required when seeking information concerning the engine and/or ordering replacement service parts.



Parts and Service

Replacement parts can be obtained from Power Solutions, Inc. by calling the Service Parts Department at **800-551-2938.** The engine model and serial number will be required when seeking information and/or ordering parts.

Service and technical support for GM *Powertrain* engines supplied by Power Solutions, Inc. can be obtained by contacting the Service Department at **800-551-2938.**

Service Literature

Additional operator manuals and service manuals for specific GM *Powertrain* engines provided by Power Solutions, Inc. can be obtained by contacting the Parts or Service Department at **800-551-2938**

Operating Instructions

Controls

Ignition Switch

The ignition switch is located on the control panel. The switch is a 3 position switch, OFF, RUN and START. The OFF position disconnects the electrical system from the battery. The key can be removed from the switch when it is in this position.

In the RUN position, the electrical system is activated.

Engage the starter by turning the key to the START position. Release the key when the engine starts and it will return to the ON position.

Safety Gauges

Power Solutions, Inc., industrial power units are equipped with instrument panels which contain shut down gauges for High Engine Water Temperature and Low Engine Oil Pressure. A push button 'Tattletale' relay is utilized with this system. When starting the engine it is necessary to 'depress' the safety switch override button, until the engine starts and engine oil pressure is obtained (usually 2 to 5 seconds). The engine will continue to run when the button is released.

CAUTION: If the engine does not continue to run when the button is released, it will be necessary to check the instrument panel fuse and/or the engine lubrication system (i.e. oil level, etc.) before restarting the engine.

NOTE: Power Solutions, Inc. provides engines to many different original equipment manufacturers. Not all manufacturers use the PSI instrument panel. Please refer to the equipment Operators Manual for instructions on engine starting.

Fuel Systems

Several different fuel systems have been used on Power Solutions, Inc. GM *Powertrain* engines. A chart identifiying the different types of fuel systems used by engine model can be found in the back of this manual.

NOTE: Some fuel systems are installed by the original equipment manufacturer. Therefore it may be necessary to contact the equipment manufacturer for information pertaining to your specific fuel system if it cannot be found in the chart.

Governors

As with fuel systems, several different governor controls have also been used with the Power Solutions, Inc. GM *Powertrain* engines. A chart identifying the different types of governor systems used is included at the back of this manual.

NOTE: Some governors are installed by the original equipment manufacturer. If your governor is not included in the chart, it will be necessary to contact the equipment manufacturer.

Instruments

Oil Pressure Gauge

The oil pressure gauge show the engine lubrication system pressure in pounds per square inch (psi) and should be checked frequently to ensure that the system is functioning correctly. Should the pressure fluctuate or drop, stop the engine and find the cause. Do not operate the engine at lower than normal oil pressure (see maintenance schedule for minimum engine oil pressure).

CAUTION: Do not continue to operate your engine below the normal operating range. Severe engine damage could occur.

Temperature Gauge

The temperature gauge registers the coolant temperature and will indicate overheating which may arise from low coolant level, plugged radiator, loose fan belt or faulty thermostat. Coolant level should be checked daily.

CAUTION: If the engine continues to overheat, have the cooling system checked and serviced.

Instruments (cont.)

Voltmeter

The voltmeter indicates the battery charging voltage. If the meter consistently indicates less than 13 volts or more than 15.7 volts under normal operating conditions, you should have the engine electrical system checked by a qualified service technician.

Tachometer/Hourmeter

The tachometer indicates the engine speed in hundreds of revolutions per minute (rpm). It serves, as a guide to insure that engine speed is set correctly.

The hourmeter records the hours of operation and is used to determine when periodic maintenance is required.

Starting the Engine

Warning:

All internal combustion engines give off various fumes and gases while running. Do no start or run the engine in a closed or poorly ventilated building where exhaust gases can accumulate. Avoid breathing these gases as they may contain poisonous carbon monoxide, which can endanger your health or life if inhaled steadily for even a few minutes.

If the engine is equipped with a manual clutch it must be disengaged prior to starting the engine. Starting the engine with the clutch engaged imposes unnecessary strain on the battery, starter, and driven components.

CAUTION: If the engine stalls or falters during starting, wait 3 to 4 seconds before re-engaging the starter. This will prevent possible damage to the starter or the engine. DO NOT operate the starter for periods longer than 30 seconds at a time. An interval of at least 1-minute should be observed between cranking periods to protect the starter from overheating.

Carbureted, Mechanical Governor, Manual Choke

Pull the throttle cable out approximately ½ inch, and the choke out full. Turn the ignition key to the START position. After the engine starts, release the key, decrease the throttle setting and adjust the choke cable for fast idle warm-up. When the engine is at operating temperature, push the choke in all the way.

When the engine is warm, it may not be necessary to use the choke for starting.

Carbureted, Electric Choke, Electronic Governor

Turn the On/Off switch on the instrument panel to the ON position. Turn the ignition key to the ON position. This allows the electric choke to pre-set prior to starting. Turn the ignition key to the START position. After the engine starts release the key to the ON position. Allow a few minutes for the engine to warm up. Move the governor control switch to the **LOW** position. Engage the clutch, then move the governor control switch to the **HI** position.

LPG or NG Fuel Systems, Velocity Governors

Turn on the gas supply to the engine. Turn the ignition key to the START position. After the engine starts release the key to the ON position.

PSI Fuel Injection (Gasoline)

Turn the ignition key to the ON position, this energizes the electric fuel pump to charge the fuel system with fuel. Turn the ignition key to the START position. After the engine starts release the key to the ON position.

PSI Fuel Injection (Gasoline/LPG)(Dual Fuel)

Select the desired fuel switch position for starting the engine (Gasoline/LPG). Turn the ignition key switch ON, then move ignition key to the START position. After the engine starts release the key to the ON position.

Zenith Z.E.E.M.S. Throttle Body Fuel Injection, Integral Governor

Turn the ignition key to the ON position to energize the fuel pump. Ensure that the Hi/Lo switch on the instrument is in the Lo position. Turn the ignition key to the START position. After the engine starts release the key to the ON position. Allowing a few minutes for engine warm-up, move the Hi/Lo switch to the Hi position.

Stopping the Engine

Normal Conditions: Following normal operating conditions, **lower the engine speed to idle,** pushing the throttle cable in on mechanical systems or with electronic systems placing the Hi/Lo switch in the Lo position.

If the machine is equipped with a clutch, move the clutch lever to the disengaged position.

Run engine for a few minutes at idle to allow the coolant system to cool down before turning the ignition switch to the OFF position.

Abnormal Conditions (Carbureted): Under abnormally overheated conditions, the engine may continue to run after the switch is turned OFF. If this is encountered, turn the ignition switch to the ON position immediately and allow the engine to run at idle until it has cooled down enough to stop.

(Fuel Injected) Fuel injected engines generally will not after run, even if hot. These systems require that the fuel delivery be shut off completely when turning the ignition switch to the OFF position.

WARNING:

Avoid injury when checking a Hot Engine. Allow the engine to cool down before removing the radiator cap.

CAUTION: Before restarting the engine ensure that both the coolant system and the engine oil level have been checked and re-filled if necessary.

Fuel Recommendations

Fuel Quality

Using a high quality unleaded gasoline will help maintain the power, fuel economy and emissions performance of your engine. A properly formulated gasoline will be comprised of well refined hydrocarbons and chemical additives and will perform the following functions:

- Minimize varnish, lacquer, and other induction system deposits.
- Prevent gum formation or other deterioration during storage.

Protect fuel tank and other fuel system components from corrosion or degradation.

Fuel Recommendations (cont.)

- Provide the correct seasonally and geographically adjusted volatility which should provide easy starting in the winter and summer.

- Avoid fuel system icing.

In addition, the fuel must be free of water, debris, and other impurities.

It is recommended that the fuel supply be kept fresh when the engine is in storage (especially in hot weather). The fuel tank should be kept at least ¾ full.

Fuel stored for more than two months should be drained, properly discarded, and the fuel tank re-filled.

Anti-Knock Index (Octane Rating)

This engine is designed to operate on unleaded 87 or 89 octane gasoline with an (R + M)/2"minimum anti-knock index. Federal regulations require that each retail gasoline dispensing pump must display a label bearing the minimum index rating.

Use of unleaded gasoline with anti-knock index rating lower than 87 can cause persistent, heavy spark knock, which can lead to engine damage. If your engine knocks heavily when you use gasoline with an anti-knock index rating of 87 or higher, or if you hear continuous spark knock while maintaining constant operating speeds, consult a dealer or qualified technician.

Gasohol and Alcohol/Gasoline Fuels

Gasohol, a mixture of gasoline and ethanol (grain alcohol), is available in some areas. PSI, GM *Powertrain* engines should operate satisfactorily on gasohol blends containing no more than 10% ethanol by volume and having and anti-knock index of 87 or 89. **CAUTION: In some cases, methanol (wood alcohol) or other alcohol's may be added to gasoline. PSI GM *Powertrain* engines should operate satisfactorily on blends containing up to 5% methanol by volume when cosolvents and other necessary additives are used. DO NOT USE blends containing more than 5% methanol by volume or blends that do not contain cosolvents and corrosion inhibitors.**

CAUTION: Discontinue use of any gasohol or alcohol/gasoline blend if fuel system problems occur. Do not use such fuels unless they are UNLEADED.

Spark plugs

Always use the recommended spark plugs for your engine. Hotter or colder plugs, or similar plugs that are not exact equivalents to the recommended plugs, can cause permanent engine damage, reduce the engines useful life, and cause many other problems such as hard starting, spark knock and run-on. Installing new spark plugs regularly is one of the best ways to keep your engine at peak performance.

Power Loss at Higher Elevations

All engines will experience power loss when operated at elevations above sea level, unless they are turbocharged or supercharged. Turbochargers and superchargers are mechanical pumps that put extra air into the engine to make up for the lower air density at higher elevations.

Carbureted Engines

Carbureted engines will loose power for two reasons. First, power is reduced 3.5% for each 1000 feet it is operated above sea level due to the decreased air density. With less dense air, the engine receives less oxygen to burn the fuel. The engine power is decreased in direct proportion to the reduction of available oxygen. Second, the reduced oxygen causes the fuel mixture to have too much fuel for the available oxygen. This is a rich mixture (rich with fuel) and not only causes the engine to produce sooty black exhaust, but causes additional loss of power and premature spark plug fouling. Engines that are operated over 3000 feet of elevation, that exhibit black smoke or produce less than optimum power should have the fuel system re-calibrated. For additional information on optimizing your engine for higher elevations contact your dealer or Power Solutions, Inc. at 800-551-2938.

Caution: Engines re-calibrated for high elevations will run ***lean*** at lower elevations. Lean running can burn valves, will reduce valve and valve seat life and can cause engine overheating. Failures caused by these problems are not covered by warranty.

Fuel Injected Engines

Fuel injected engines will loose 3.5% power for every 1000 feet the engine is operated above sea level. All fuel injection systems installed by Power Solutions, Inc. are equipped with a "manifold absolute pressure sensor" (MAP Sensor). The MAP sensor senses barometric pressure and automatically corrects the fuel system calibration for changes in altitude. This means the air/fuel mixture will always be optimized, regardless of elevation (or barometric pressure), however, the engine will still loose 3.5% power for every 1000 feet increase in elevation.

MAINTENANCE INSTRUCTIONS

Initial Start Up Maintenance

The initial start-up checks must be made before putting the engine into service. Please refer to the Maintenance Schedule on page II and perform the initial start-up operations in the sequence shown in column 1.

Routine Maintenance

Routine maintenance provides the best solution for making sure that the engine is ready when you are. The following are some routine service points:

- Keep the fuel tank filled. A full tank of fuel reduces the possibility of condensation forming in the fuel tank and moisture entering the fuel system
- Make frequent checks of the engine oil and coolant levels
- Repair any oil or coolant leaks immediately
- Check battery condition and cables frequently
- Keep the engine air filter clean
- Monitor engine coolant temperature
- Monitor engine oil pressure
- Check voltmeter and charging system

Scheduled Preventive Maintenance

Refer to the Maintenance Schedule on page II to ensure that all of the maintenance items listed are checked and replaced as recommended at the hours shown.

Engine Oil Level Check

The engine oil level should be checked daily. It is recommended that the oil be checked just before the engine is started for the first time for that day. The oil level should be between the 'Add' and the 'Full' marks on the dipstick.

CAUTION: Do not operate the engine with the oil level below the bottom or 'Add' mark on the dipstick, or above the top or 'Full' mark on the dipstick.

Adding Engine Oil

It is normal to add some oil in the period of time between oil changes. The amount will vary with the severity of operation. When adding or replacing engine oil, be sure the oil meets or exceeds the recommended specification.

Changing Engine Oil and Filter

The engine oil and filter must be changed every 200 hours or every 3 months whichever occurs first. Under normal operating conditions, you do not need to change them more often if you use oil and filters of the recommended quality.

The oil and filter should be changed more often if the engine is operating in dusty or extremely dirty areas, or during cold weather. No oil additives or break-in oil change is required.

Engine Oil Quality

To achieve proper engine performance and durability, it is important that you use only engine lubricating oils of the correct quality in your engine. Proper quality oils also provide maximum efficiency for crankcase ventilation systems, which reduces pollution.

Important: use only engine oils displaying the American Petroleum Institute (API) **"Starburst"** Certification Mark **'FOR GASOLINE ENGINES'** on the container.

Gasoline engines that are converted for LPG or NG fuels **MUST** use oils labeled **'FOR GASOLINE ENGINES'.** Do not use oils that are specifically formulated for Diesel Engines only. CC or CD classification oils, even when labeled Heavy Duty or for Natural Gas Engines, **ARE NOT ACCEPTABLE.**

Engine Oil Recommendation

Multi-viscosity oils are recommended. SAE 10W-30 is recommended for your engine from 0 degrees F (-18 degrees C) or above. If ambient temperatures are consistently below 0 degrees F, SAE 5W-30 oil can be used. Synthetic oils are not recommended for industrial or stationary engines.

Oil Filter

The PSI GM *Powertrain* engines use an AC Delco oil filter as original equipment. An equivalent oil filter must be used when servicing the engine (see Engine Specifications for the recommended oil filter for your engine).

The filter protects your engine from harmful, abrasive, or sludgy particles without blocking the flow of oil to vital engine parts.

To replace the filter, use a proper filter wrench to remove the filter.

Clean the filter mounting base and lightly coat the gasket surface of the new filter with engine oil. Hand tighten the filter until the gasket contacts the base, then tighten another ½ turn. Fill the engine with the correct amount of oil, run the engine and check for oil leaks at the drain plug and oil filter gasket. Tighten as necessary to stop any oil leakage noted.

Engine Air Cleaner

The engine air cleaner filters air entering the engine intake system and acts as a silencer and flame arrester when assembled to the intake system.

Air that contains dirt and grit produces an abrasive fuel mixture and can cause severe damage to the cylinder walls and piston rings. Damage to the cylinder walls and piston rings will cause high oil consumption and shorten engine life.

A restricted or dirty air cleaner will also cause a rich fuel mixture. Thus, it is extremely important that the air cleaner be serviced properly at the recommended intervals.

CAUTION: Service the air cleaner more frequently under severe dusty or dirty conditions.

Remove the primary air cleaner element from the air cleaner assembly and inspect the element for foreign material restrictions or signs of excessive wear or damage. Replace the element if necessary.

Remove all dust and foreign matter from the air cleaner housing.

Reinstall the air cleaner element. Reinstall the air cleaner cup, and securely fasten the retaining clips.

Safety Element

If your engine is equipped with an air cleaner which utilizes a safety element, ensure that the element is properly in place before installing the primary element.

Change the safety element annually.

Cooling System

Coolant Level

Check the coolant level of the radiator daily and only when the engine is cool. Generally a good time to do this is just prior to starting the engine for the first time each day.

Maintain the coolant level at ¾ to 1½ inches below the filler neck seat of the radiator when the coolant is cold. When ever coolant level checks are made inspect the condition of the radiator cap rubber seal. Make sure it is clean and free of any dirt particles which would keep it from seating on the filler neck seat. Rinse off with clean water if necessary. Also make sure that the filler neck seat is free of any dirt particles.

WARNING

Never remove the radiator cap under any conditions while the engine is operating. Failure to follow these instruction could result in damage to the cooling system, engine, or cause personal injury. To avoid having scalding hot coolant or steam blow out of the radiator, use extreme caution when removing the radiator cap from a hot radiator. If possible, wait until the engine has cooled, then wrap a thick cloth around the radiator cap and turn slowly to the first stop. Step back while the pressure is released from the cooling system. When all the pressure has been released, press down on the cap and remove it slowly.

DO NOT add coolant to any engine that has become overheated until the engine cools. Adding coolant to an extremely hot engine can result in a cracked block or cylinder head.

Use only a permanent-type coolant when refilling or flushing the coolant system. Recommended ethylene glycol mix 52/48 is normal up to a maximum of 60% glycol, 40% water.

Refer to the mixture chart on the container for additional antifreeze protection information. DO NOT use alcohol or methanol antifreeze, or mix them with the specified coolant.

Plain water may be used in an emergency (except in freezing temperatures), but replace it with the specified coolant as quickly as possible to avoid damage to the system.

Radiator

Inspect the exterior of the radiator for obstructions. Remove all bugs, dirt or foreign material with a soft brush or cloth. Use care to avoid damaging the core fins. If available, use low pressure compressed air or a stream of water in the opposite direction of the normal air flow.

Check all hoses and connections for leaks. If any of the hoses are cracked, frayed, or feel spongy, they must be replaced.

Fan Belts

The water pump is usually belt driven. The same belt may also drive the fan and/or the alternator. The drive belts should be properly adjusted at all times. A loose belt can cause improper alternator, fan and water pump operation, in addition to overheating.

Serpentine Belt

Some GM *Powertrain* engines utilize serpentine belts on the front of the engine. This type of belt system incorporates a belt tensioning device which keeps the belt at the proper tension.

This belt should be checked routinely for cracks or 'checking' on the groove side of the belt. If cracks or 'checking' are apparent the belt must be changed.

V-Type Belt

V-Type belts are generally tensioned by adjusting the alternator, or through a mechanical belt tensioner. The belt is generally correctly tensioned when there is an ½ inch of depression on the belt between the water pump and the crankshaft pulley.

Fuel Filter

Carbureted Engines

On carbureted engines, an in-line fuel filter is incorporated into the fuel supply line. It is recommended that this filter be changed every 250 hours or every 6 months which ever occurs first.

TBI Engines

On PSI Fuel Injection or Fuel Injection/Dual Fuel two fuel filters are used in the gasoline fuel supply line to the engine TBI unit.

A coarse fuel filter is located in the supply line between the fuel tank and the electric fuel pump. This filter protects the fuel pump from debris in the fuel tank.
This filter must be changed every 200 hours or every 6 months which ever occurs first.

A primary fuel filter is located between the fuel pump and the TBI unit on the engine. This filter protects the injectors from microscopic particles in the fuel which can cause plugging of the injectors. This filter **MUST** be changed every 500 hours or annually which ever occurs first.

Zenith Z.E.E.M.S. TBI Fuel Injection requires an in-line fuel filter in the fuel supply line from the fuel tank to the TBI unit, ahead of the electric fuel supply pump. This filter must be changed every 200 hours or every 6 months which ever occurs first.

CAUTION: Failure to change the fuel system filters as recommended can result in premature failure of the TBI fuel system components.

NOTE: Some original equipment manufacturers install their own fuel systems. Please refer to the manufacturers manual if the gasoline fuel system is different than described here.

WARNING

Use extreme care when changing the fuel filters on gasoline engines. Gasoline is highly flammable and should not be exposed to open flame, sparks, or hot engine components. Allow the engine to cool to ambient temperatures prior to changing fuel filters.

Ignition Systems

Types of Ignition Systems

Three types of ignition systems are used on PSI GM *Powertrain* engines. Solid state electronic distributor, solid state electronic distributor with ECU (Electronic Control Unit) and distributor-less electronic ignition with ECU.

Please refer to the General Specification chart to determine the ignition system used on your particular engine.

Ignition Timing

Proper adjustment of the ignition timing must be obtained to provide the optimum engine power output and economy.

To properly adjust timing refer to the timing procedure section of this manual.

Spark Plugs

Spark plugs should be replaced at the recommended intervals described in the Maintenance Schedule. Use only the recommended spark plug or an equivalent as described in the General Specifications.

Spark plug gap, should be adjusted as recommended in the General Specifications.

When removing spark plugs, always note which cylinder each plug came out of. Look at the porcelain around the center electrode of each plug. You can detect many engine problems from the color and type of deposits that have built up on the white porcelain. For example, if the deposits are a glossy brown, that cylinder is burning excess oil. If the deposits are a very dark gray or sooty black color, your engine is running rich, and you are burning excess fuel. The optimum color of the deposits on the porcelain is light tan or light brown. This shows optimum fuel mixture and proper engine running conditions. If the deposits are almost white, the engine may be running excessively lean. Lean running is very detrimental to your engine life, and should be corrected immediately.
If one or more cylinders are burning oil, the smoke from the engine will be a blue-gray color. Most common causes are piston rings (worn out or not broken in) and valve stem seals (cut, nicked, or worn out). If the engine is running rich the exhaust smoke will be a sooty black color and it will smell like gasoline (on gasoline engines).

Storage

One to Six Months

If the engine or machine is to be placed in storage for a period of one to six months it is recommended that the following steps be followed:

- Add **'Stabil'** or equivalent fuel conditioner to the fuel tank as recommended on the bottle. Run the engine for approximately 10 to 15 minutes to insure that the treated fuel is completely through the fuel system.
- Fill the fuel tank with fuel
- Protect the air cleaner inlet from water entry
- Protect the exhaust outlet or muffler outlet from water entry
- Check the coolant protection and top off radiator
- Store indoors if possible

For Extended Periods

Follow the above recommended procedures, plus do the following:

- Drain the engine crankcase and refill with recommended oil
- Change the oil filter
- Disconnect and remove the battery
- Clean exterior surface of the engine
- If the engine is equipped with an automotive type clutch or PTO clutch, make sure that the clutch is disengaged

Removing the Engine From Extended Storage

When removing the engine from extended storage:

- Install a fully charged battery
- Remove all protective coverings from the air inlet, air cleaner, exhaust, and muffler openings
- Check the coolant level in the radiator and verify the protection level of the coolant

Removing the Engine From Extended Storage (cont.)

- Start the engine and allow it to run at slow idle. Verify engine oil pressure
- Run the engine at idle until the coolant temperature approaches 120 degrees F (49 degrees C)
- Run the engine a various speeds for approximately 15 minutes
- Shut the engine down, drain the oil, change the oil filter, and re-fill with the recommended grade of oil

GM Engine Timing Procedures

Carbureted, LPG an NG 3.0L, 4.3L, 5.7L, 7.4L PSI/GM Engines

PSI Timing Connector Part Number 33000036 **MUST** be used when checking and adjusting the engine timing.

1. With the engine shut-off, plug the 33000036 Timing Connector into the distributor. **DO NOT** connect the alligator clip to any positive or negative terminal. (Connecting this wire to any battery terminal prior to starting the engine will cause the distributor module to fail when starting the engine.)
2. Start the engine and run at slow idle. 800 to 1000 rpm.
3. Connect the alligator clip to a B+ terminal. (This connection cancels the programmed timing advance from the distributor module. You will notice a change in engine sound and rpm when making this connection.)
4. Connect an electronic timing light to the No.1 spark plug wire. (The front cylinder on the 3.0L engine and the front cylinder on the left bank of the 4.3L, 5.7L and 7.4L engines.)
5. Check and adjust the distributor as necessary viewing the timing mark on the crankshaft pulley in relation to the pointer on the engine timing case. (On some engines there may be a timing port in the flywheel housing also.)
6. Refer to the General Specifications chart in this manual, for the initial timing specification for your engine and type of fuel being used.

PSI Fuel Injected and Dual Fuel engines

For engines equipped with this type of fuel system, the engine timing is controlled by the ECM (Engine Control Module).

Checking the initial timing on engines equipped with PSI fuel injected and dual fuel engines incorporating and ECM can only be accomplished when using a laptop computer or a hand held diagnostic meter. It will be necessary to contact the OEM or PSI for the necessary equipment and instructions for checking and adjusting the engine timing. (CAUTION: **Failure to follow the correct specified procedures when checking and adjusting the engine timing, can cause severe damage to the engine.)**

Zenith Z.E.E.M.S. Throttle Body Fuel Injected Engines

Engine timing for Zenith TBI fuel injected engines is checked and adjusted following the procedures noted under Carbureted engines. Check the General Specifications chart for the correct engine timing.

Generator Timing

PSI/GM engines operating on generators are timed at 1800 RPM. Timing procedures are the same as for Carbureted engines. Check the General Specifications chart for the correct engine timing for the type of fuel being used.

Maintenance Schedule

Power Solutions, Inc.

GM *Powertrain*

1.6L, 3.0L, 4.3L, 5.7L, 7.4L, and 8.1L Engines

Initial Start-Up Sequence Checks	Operation	Daily	Weekly	Every 50 hrs	Every 100 hrs	Every 200 hrs	Every 400 hrs	Every 800 hrs	As Req.
1	Check Engine Oil Level	x							
2	Check Coolant Level	x							
3	Check for Fluid Leaks	x							
4	Governor, Mechanical (Check oil level)(2)		x						
	Change Engine Oil & Filter (1)					x			
5	Battery, Check Charge & Fluid Level		x						
	Inspect & Clean Radiator Exterior		x						
	Clean Battery Cables								x
6	Check Belts and Belt Tension				x				
	Lubricate Throttle, Governor & Choke Linkage (Carbureted Engines Only)				x				
	Check & Adjust Idle Speed (Carbureted Engines Only)								x
	Inspect and Clean Air Cleaner Element		x						
	Replace Primary Air Cleaner Element (1)						x		
	Replace Safety Air Cleaner Element								x
	Check Coolant Protection & Tighten Hose Clamps						x		
	Replace Engine Coolant (3)							x	
	Replace Gasoline Fuel Filter (4)						x		
	Replace LPG Filter – Zenith EFI (4)							x	
	Replace PCV Valve (If Equipped)							x	
	Check PCV Hoses, Tubes, and Fittings							x	
	Replace Spark Plugs (3)							x	
	Distributor Cap & Rotor (5)							x	
	Secondary Ignition Wires								x
	Adjust Throttle & Governor (3)								x
7	Check All Engine Bolts & Nuts for Tightness								x

(1) More frequent intervals may be required in dusty or dirty operating conditions.
(2) Mechanical governor (belt driven).
(3) To be performed at specified interval or annually, whichever occurs first.
(4) More frequent intervals may be required with dirt in the fuel system.
(5) Does not apply to engines with DIS ignition.

Capacities

Engine	1.6L	3.0L	4.3L	5.7L	7.4L	8.1L
Oil Capacity Without Filter	3.4 qts.	4 qts.	4.5 qts.	5 qts.	8 qts.	8 qts.
Oil Capacity With Filter	3.7 qts.	4.5 qts.	5 qts.	5.5 qts.	9 qts.	9 qts.
Coolant Capacity Without Radiator	3.5 qts.	4 qts.	7.75 qts.	8.1 qts.	14.5 qts.	14.5 qts.
Coolant Capacity With Radiator	10 qts.	12 qts.	17 qts.	17.5 qts.	28 qts. 31 qt (Turbo)	28.5 qts.

Revised 12/27/01

Power Solutions, Inc.
GM *Powertrain* Industrial Engines

Filter Chart

Engine	1.6L	3.0L	4.3L	5.7L	7.4L/7.4LT	8.1L
Oil Filter	94632619	P-25 or Equivalent	PF-47/PF-52 or Equivalent	PF-1218 Equivalent	PF-1218 or Equivalent	PF-454 or Equivalent
Fuel Filter (Carbureted)		32500020 (101021)	32500020 (101021)			
Fuel Filter (PSI TBI Coarse)		32500111	32500111			
Fuel Filter (PSI TBI Fine)		32500058	32500058			
Fuel Filter Zenith Z.E.E.M.S	Gasoline C282-224 LPG C282-5	32500292	32500292			
Air Filter Primary (PSI Power Unit)		P822768	P8228889			
Air Filter Safety (PSI Power Unit)		P822769	P829333			

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Power Solutions, Inc.
GM *Powertrain* Industrial Engines

Fuel System Chart

Engine	1.6 L	3.0L	4.3L	5.7L	7.4L/T	8.1L
Zenith Carburetor (013448) Manual Choke		x				
Zenith Carburetor (015017) Electric Choke		x				
Zenith Carburetor (015052) used w/Dual Fuel System		x	x			
Holley Carburetor (0-7448) Electric Choke			x			
Holley Carburetor(0-82010) Electric Choke			x			
Impco LPG Fuel System		x	x	x	x	
Nolff LPG Fuel System	x	x	x	x	x	x
PSI Fuel Injection (Gasoline)	x	x	x			
PSI Fuel Injection/LPG Mixer (Dual Fuel)	x	x	x			
Impco Natural Gas Mixer		x	x	x	x	
Nolff Natural Gas Mixer	x	x	x	x	x	x
Zenith Z.E.E.M.S Fuel Injection	x	x	x			

Governor Chart

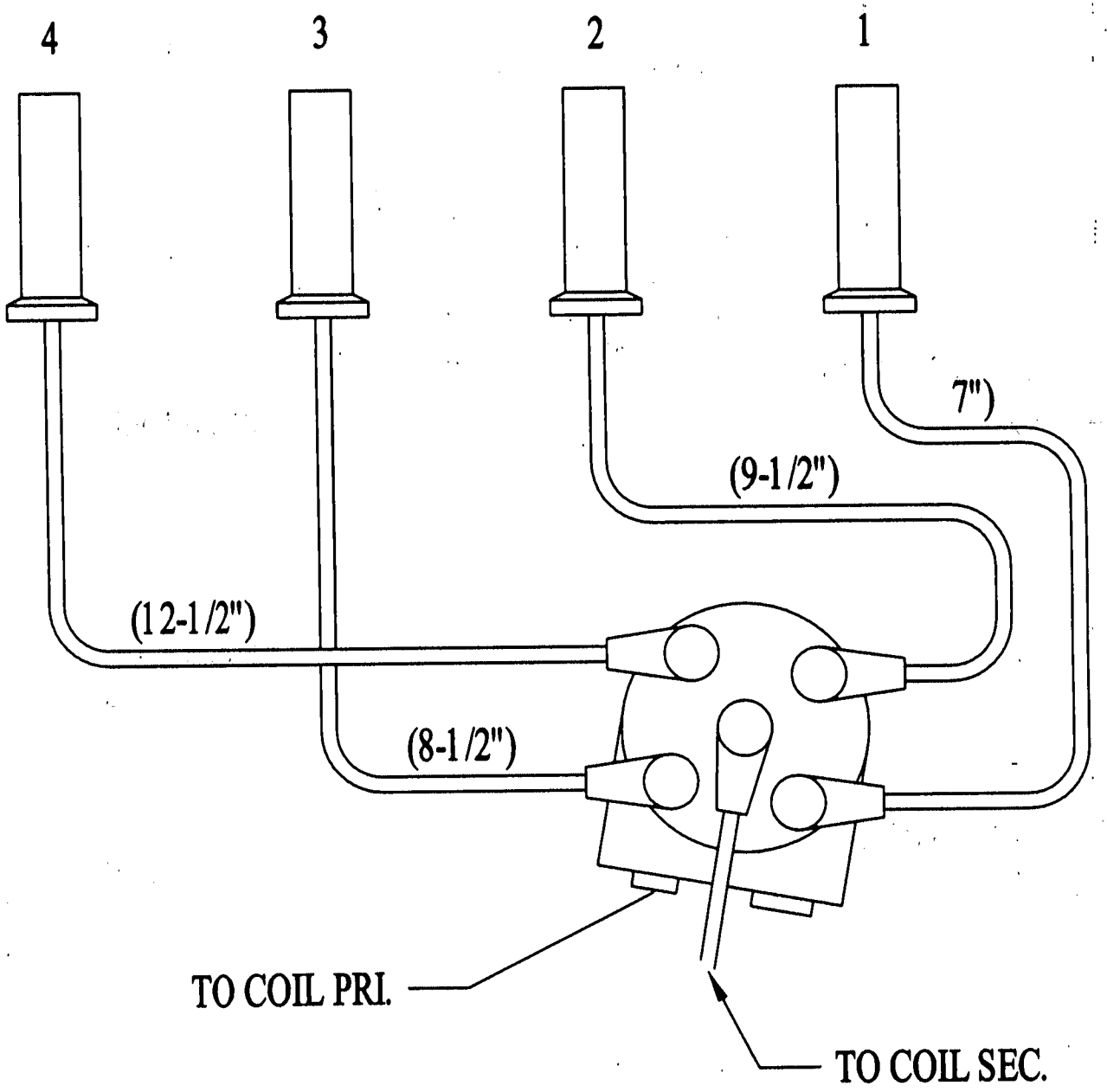
Engine	1.6L	3.0L	4.3L	5.7L	7.4L/T	8.1L
Hoof Mechanical (Belt Driven)(No Longer Available)		x				
Hoof Velocity Governor		x(NLA)	x(NLA)	x	x	
Aisan Velocity Governor		x	x			
Barber Colman Electronic		x	x			
Governors America		x	x	x	x	
Barber Colman Power Flow, PSI ECU		x	x	x		x
Zenith Z.E.E.M.S. Fuel Injection	Integral	Integral	Integral			
Woodward						x

Revised 06/05/01

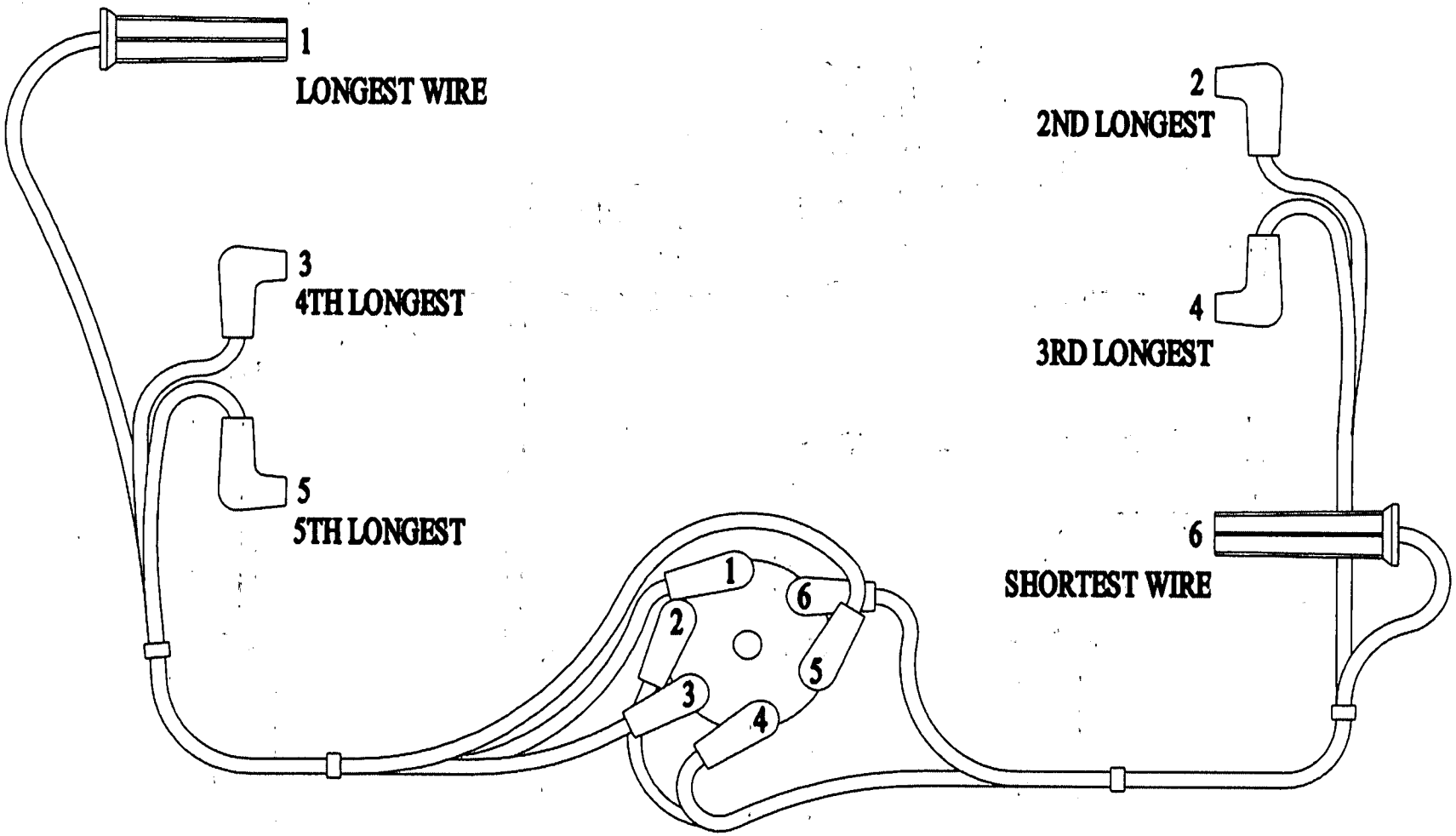
GENERAL SPECIFICATIONS
Power Solutions, Inc.
GM *Powertrain* Industrial Engines

Engine	1.6L	3.0L	4.3L	5.7L	7.4L/7.4L Turbo	8.1L/8.1L Turbo
Type	1.6-2V	3.0L L4	4.3L V-6	5.7L V-8 GEN-1E	7.4L V-8	8.1L V-8
Displacement cc (c.i.d.)	1600 (98)	2966 (181)	4294 (262)	5735 (350)	7441 (454)	8127 (496)
Compression Ratio	9.4:1	9.2:1	9.4:1	9.4:1	8.9:1	9.1:1
Valve Configuration	Overhead Cam	Push Rod Actuated Overhead Valve	Push Rod Actuated Overhead Valve	Push Rod Actuated Overhead Valve	Push Rod Actuated Overhead Canted Valve	Push Rod Actuated Overhead Valve
Valve Lifters	Hydraulic	Flat Follower	Hydraulic Roller	Hydraulic Roller	Hydraulic Roller	Hydraulic Roller
Bore x Stroke mm (Inches)	79.0x81.5 (3.11x3.21)	101.60x91.44 (4.00x3.60)	101.60x88.39 (4.00x3.48)	101.60x88.39 (4.00x3.48)	107.95x101.60 (4.25x4.00)	107.95x111 (4.25x4.37)
Main Bearing Caps	2 Bolt	2 Bolt	2 Bolt	2 Bolt	4 Bolt	4 Bolt
Balance Method	External	External	Internal Balance Shaft	External	External	External
Intake Manifold	TBI	TBI, Carburetor, Mixer	TBI, Carburetor, Mixer	Mixer	Mixer	Mixer
Firing Order	1-3-4-2	1-3-4-2	1-6-5-4-3-2	1-8-4-3-6-5-7-2	1-8-4-3-6-5-7-2	1-8-7-2-6-5-4-3
Oil Capacity With Oil Filter	3.4 qts. (3.2L) 3.7 qts. (3.5L)	4 qts. (3.8L) 5 qts. (4.7L)	4.5 qts. (4.3L) 5 qts. (4.7L)	4.5 qts. (4.3L) 5 qts. (4.7L)	8 qts. (7.6L) 9 qts. (8.5L)	8 qts. (7.6L) 9 qts (8.5L)
Oil Filter		PF-25 or Equivalent	PF-47/PF-52 or Equivalent	PF-1218 or Equivalent	PF-1218 or Equivalent	PF-454 or Equivalent
Minimum Oil Pressure (Hot)	21 psi @ idle	6 psi @ 1000 rpm 18 psi @ 2000 rpm	6 psi @1000 rpm 18 psi @ 2000 rpm	6 psi @ 1000 rpm 18 psi @ 2000 rpm	6 psi @ 1000 rpm 18 psi @ 2000 rpm	5 psi @ 1000 rpm 15 psi @ 2000 rpm
Coolant Capacity (Engine)	3.5 qts.	4 qts. (3.78L)	7.75 qts. (7.3L)	8.1 qts (7.8L)	14.5 qts (13.7L)	14.5 qts (13.7L)
Coolant Capacity (W/PSI Rad)	10 qts	12 qts. (11.4L)	17 qts. (16L)	17.5 qts. (16.6L)	28 (26.5L)	28 qts (26.5L)
Fuel Type	Gasoline, LPG	Gasoline, LPG, NG	Gasoline, LPG, NG	LPG, NG	LPG, NG	LPG, NG
Engine Rotation (Flywheel End)	CCW	CCW	CCW	CCW	CCW	CCW
Ignition System	Distributor-less Electronic (ECU)	Solid State Distributor	Solid State Distributor	Solid State Distributor	Solid State Distributor	Distributor-less Electronic ECU
Ignition Timing (Degrees BTDC) Gasoline (Carb) Gasoline (TBI) LPG NG Dual Fuel	 DIS No Adjustment	 0 0 10 (4 Europe) 10 0	 0 0 10 (4 Europe) 10 0	 0 0 10 (4 Europe) 10 0	 0 0 10 10 0	 DIS No Adjustment
Ignition Timing (Degrees BTDC) Generators 1800 RPM LPG NG	 DIS No Adjustment	 26 36	 26 36	 26 36	 26 36	 26 30
Spark Plugs	AC Delco 93206675	AC Delco R45TS	AC Delco 41-932	AC Delco 41-932	AC Delco MR43LTS	AC Delco R42LTS
Spark Plug Gap TBI LPG NG Dual Fuel	 .8mm-.9mm all	 .045 all	 .035 .035 .035 .035	 .035 .035 .035 .035	 .035 .035 .035	 .030/.025T .030/.025T .030/.025T
Valve Clearance (Lash) Intake Exhaust	 No Adjustment OHC Engine	 ½ to 1 Turn Down From 0 Lash	 Net Lash No Adjustment	 1 Turn Down From 0 Lash	 Net Lash No Adjustment	 Net Lash No Adjustment
Manufactured	Brazil	Toluca, Mexico	Tonawanda, NY	Toluca, Mexico	Tonawanda, NY	Tonawanda, NY

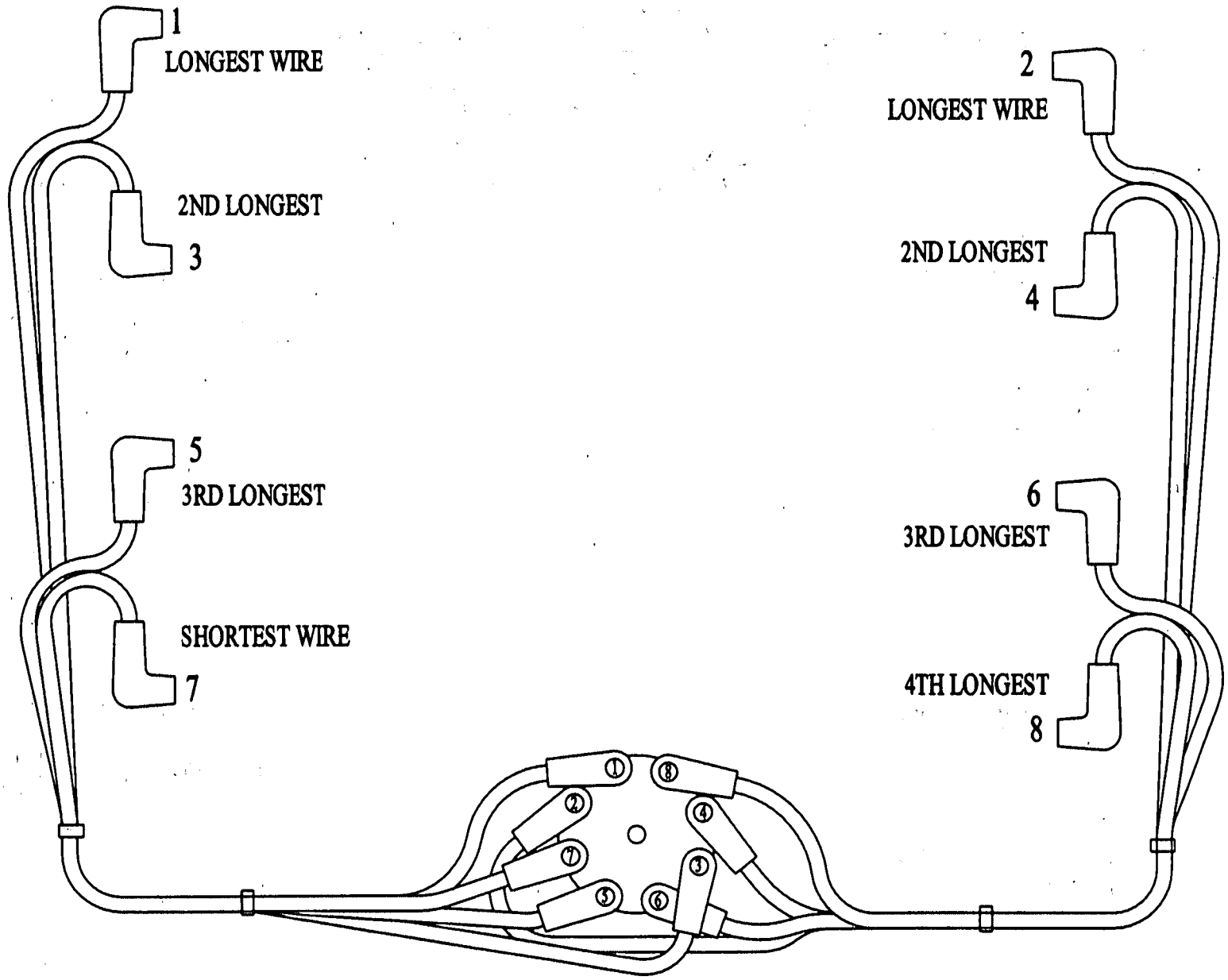
Revised 02/09/02



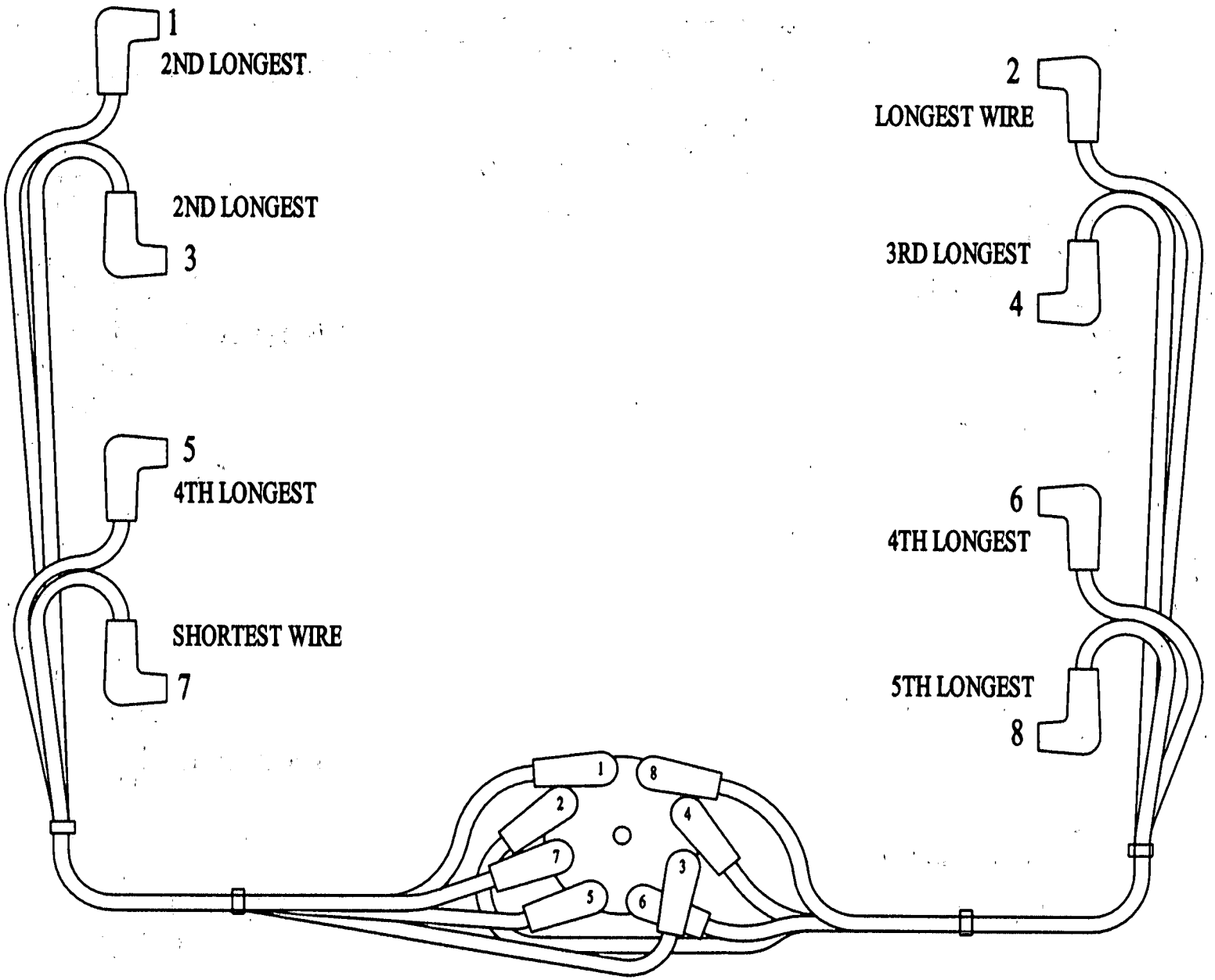
3.0L Engine Spark Plug Wire Routing



4.3L Engine Spark Plug Wire Routing



5.7L Engine Spark Plug Wire Routing



7.4L Engine Spark Plug Wire Routing

Gas Solenoid Valves

General Description:
These solenoid valves are designed to control the flow of fuel gases in industrial and commercial gas burner systems. The valves are suitable for mainline, pilot line and venting applications. Burner construction valves, suffix "B", are designed to handle liquefied petroleum gases (propane) in both the liquid and gaseous states. Series 8030, 8040, 8044, and 8262 valves are direct acting constructions. Series 8042, 8043, 8210, 8214, and 8215 valves are internal pilot operated constructions.

Specifications:
Solenoid enclosures: valves listed in this series have eighter Red-Hat II molded epoxy solenoids. Red-Hat II solenoids are identified by the change letter "G" or "H" in the catalog numbers, e.g., 8210G74, and are shown in red.

Standard Enclosures:
Red-Hat Type I general purpose Red-Hat II-Types 1, 2, 3, 3S, 4 and 4X combination general purpose with watertight with ½" conduit hub.

Optional Enclosures:
Red-Hat-Type 3R rainproof. To order, add prefix "R" to the catalog number.

Red-Hat-Types 3, 4, 7 and 9 combinations explosionproof and watertight. To order add prefix "EF" to catalog number. (Except for Series 8214, and catalog umber 8215A40, 8215A90 and 8215B93.)

Red-Hat II-Types 3, 3S, 4, 4X, 6, 6P, 7 and 9 combination explosionproof and watertight. To order, add prefix "EF" to the catalog number.

Electrical: Standard Voltages – 24, 120, 240, 480 volt, AC, 60 Hz except where noted otherwise. For DC voltages, consult factory.

Coils: Continuous duty molded class F or H as listed.

Valve Parts in Contact with Fluids: Body-aluminum or brass as listed, stainless steel (300 Series) available at ½", ¾" and 1" NPT pipe sizes.
Consult Factory.
Seals, Diaphragms and Discs – Buna N
Disc Holder – nylon (10.1 watt Normally Open Only)
Core Guide – Acetal, except suffix "B" valves which use brass
Rider Rings – Filled Teflon*
Core and Plugnut – 430F s.s.
Springs – 302 s.s
Shading coil – copper
Plug – Zinc plated steel

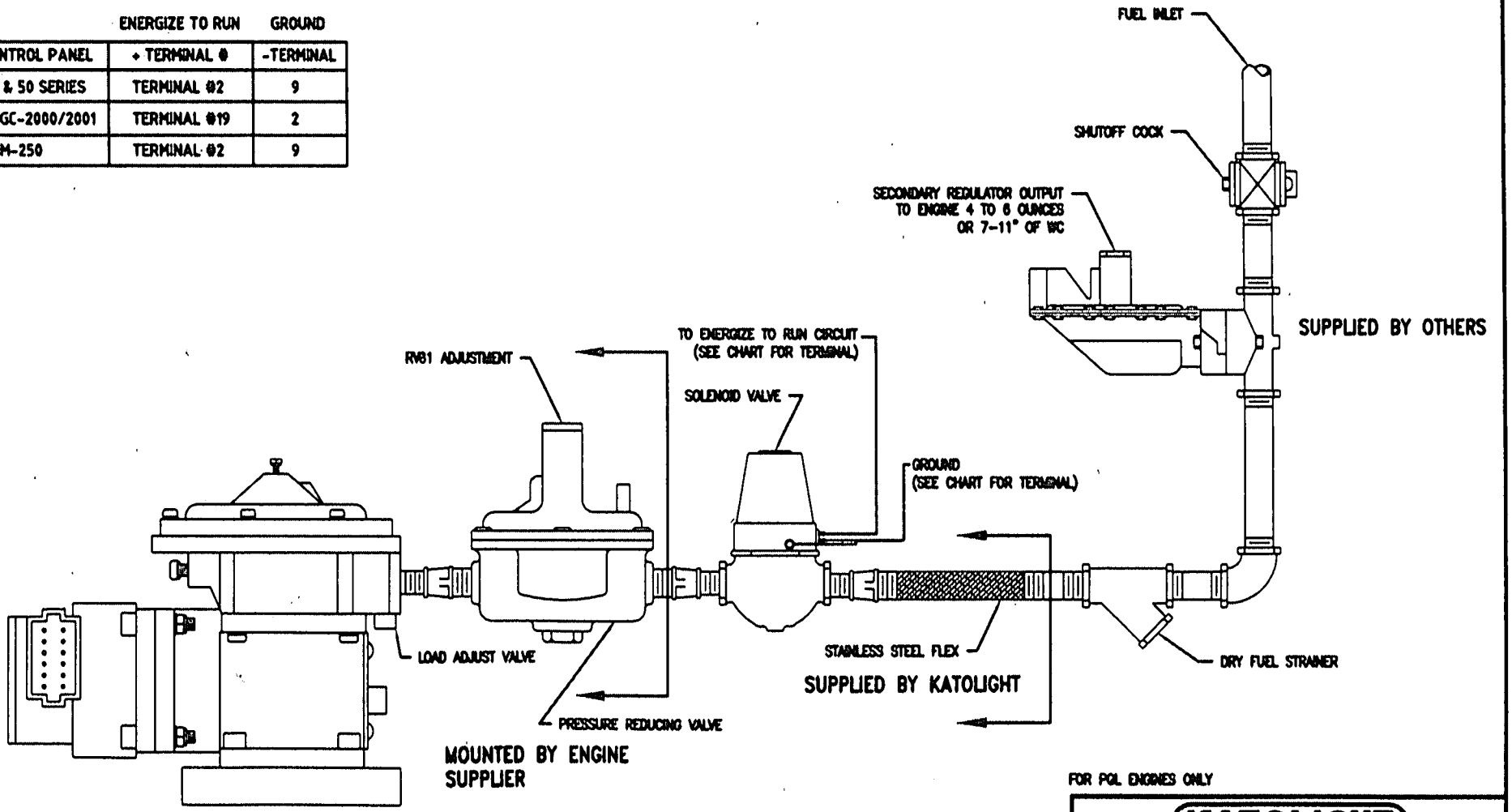
Ordering Information:
Important: We must have catalog number and voltage and Hertz. Use strainers with solenoid valves. Red-Hat valves requiring CSA must be ordered with CSA suffix to cover special marking and handling. Red-Hat II valves are provided with CSA approval marking as standard.

Constr. Ref.	H	L	P	T	W
46	6-13/16	6-5/32	5-15/32	2-7/32	5-3/8
47	6-13/16	6-5/32	5-15/32	2-7/32	5-3/8

Pipe Size (ins.)	Orifice Size (ins.)	Cr Flow Factor	Operating Pressure Differential (psi)		Fluid & Ambient Temp °F		Standard Solenoid Enclosure Red-Hat Type I Red-Hat – Type I 2,3,3S,4&4X		Gas Capacity	Approval Listings						Watt Rating/ Class of Coil Insulation
			Min	Max	Min	Max	Cat. #	Const Ref #	Btw/Hr	UL	FM	CSA	CGA 3.9	CGA 6.5	AGA Z21.21	AC
NORMALLY CLOSED (Closed when de-energized) Aluminum Body with Buna "N" Seating																
3/8	¾	3.4	0	5	-40	125	8214G10	8	183,000	0	0	0	0	0	0	17.1/F
½	¾	4.4	0	5	-40	125	8214G20	9	238,500	0	0	0	0	0	0	17.1/F
¾	¾	5.1	0	5	-40	125	8214G30	10	247,500	0	0	0	0	0	0	17.1/F
¾	1-5/8	11					JB821435#	46	580,000	0	(2)	0	0	0	0	20/F
1	1-5/8	21	0	5	-40	125	JB821450*	46	1,119,000	0	(2)	0	0	0	0	20/F
1-1/4	1-5/8	32	0	5	-40	125	JB821460*	47	1,730,000	0	(2)	0	0	0	0	20/F
1-1/2	1-5/8	35	0	5	-40	125	JB821470*	47	1,900,000	0	(2)	0	0	0	0	20/F
2	2-3/32	60	0	5	-40	125	JB821480*	48	2,800,000	0	(2)	0	0	0	0	20/F

NPT	VOLTAGE	KL-P/N	NPT	VOLTAGE	KL-P/N
¾	12	46013	¾	24	46049
1	12	46021	1	24	46048
1½	12	46010	1½	24	46050
2	12	46029	2	24	46027

CONTROL PANEL	ENERGIZE TO RUN + TERMINAL #	GROUND -TERMINAL
40 & 50 SERIES	TERMINAL #2	9
KDGC-2000/2001	TERMINAL #19	2
KGM-250	TERMINAL #2	9



FOR PGL ENGINES ONLY

NOTES:
1. TYPICAL PIPING LAYOUT WHEN LINE REGULATOR IS MOUNTED NOT MORE THAN TEN FEET FROM CARBURATOR
2. FOR LP VAPOR FUEL REMOVE REGULATOR SPRING. THE REGULATOR NEEDS TO BE TURNED DOWN

KATOLIGHT
MANKATO, MINNESOTA

8.1L GM ENGINE NG AND LP FUEL SYSTEM

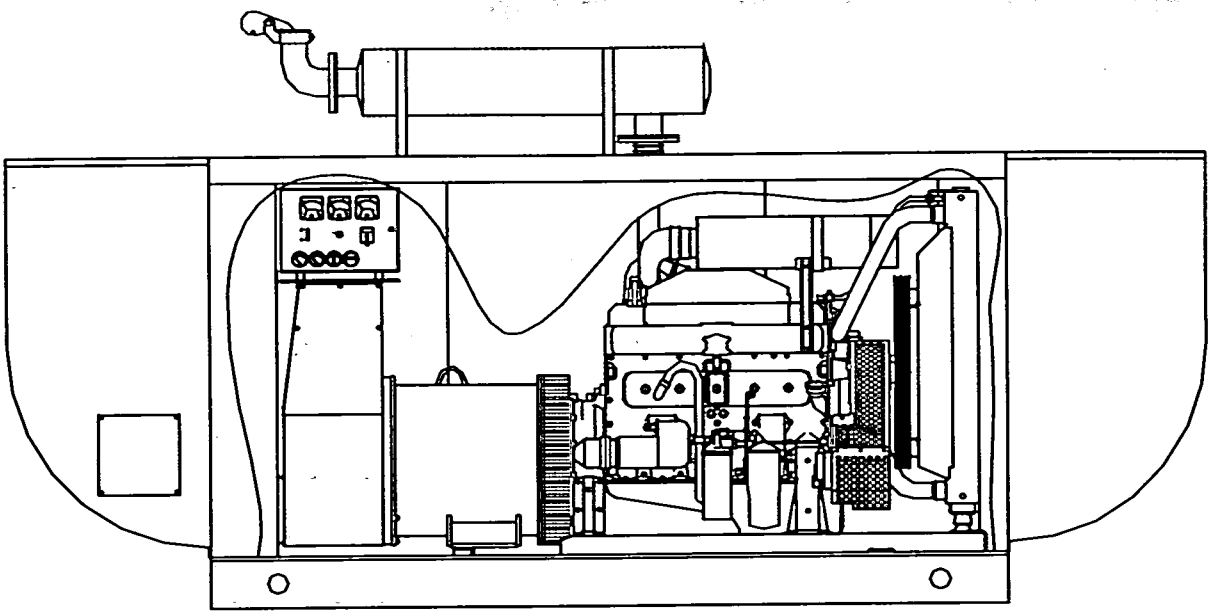
SIZE	DATE	DWG NO
B	3-7-02	204-206-30

SCALE	PART NO	DWN BY	SHEET
NONE		JRD	1 OF 1

KATOLIGHT CORPORATION

Outdoor Enclosures

150 kW - 175 kW (Volvo) / 220 kW (Deere) / 125 kW - 150 kW (LPG/NG)



Engine Generator Set Enclosure

Katolight's Engine Generator Set Enclosures are designed to meet a wide variety of engine generator applications requiring convenient, attractive and weather protective housing design. The rugged units of all steel construction safely house engine driven equipment and assure protection of other mechanical and electrical equipment used with engine generator sets. These units are available in three basic modular sizes and heights.

The Katolight enclosures are offered in two ways:

1) Assembled at the Katolight factory directly onto the skid base of the engine generator set.

2) The housing shipped for field assembly with a minimum number of pieces and dropped over the unit to be mounted directly to a concrete slab.

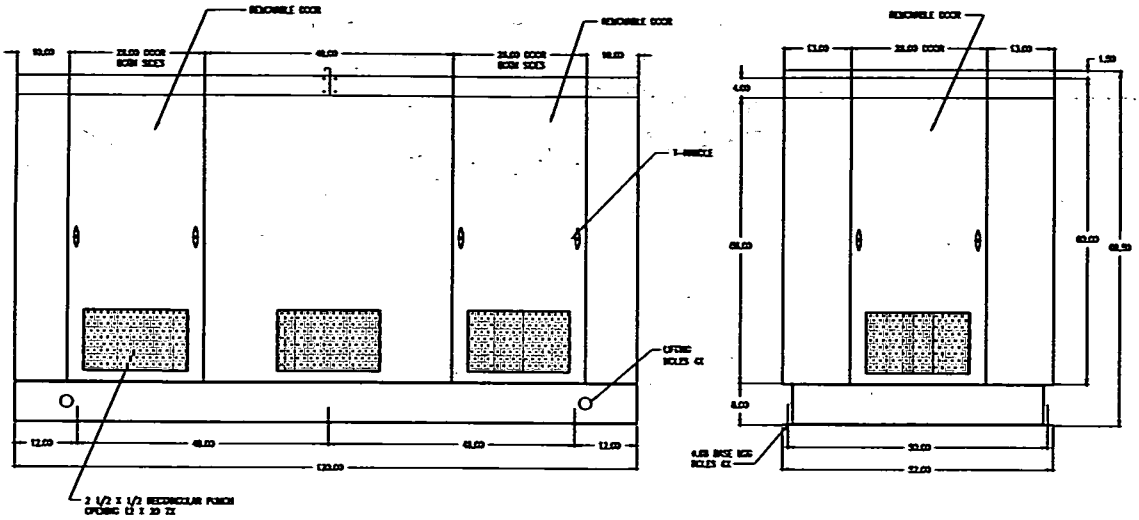
DESIGN FEATURES:

- All steel, 14 gauge modular construction
- Bolted construction
- Interchangeable panels
- Locks on all doors
- 2 point latches

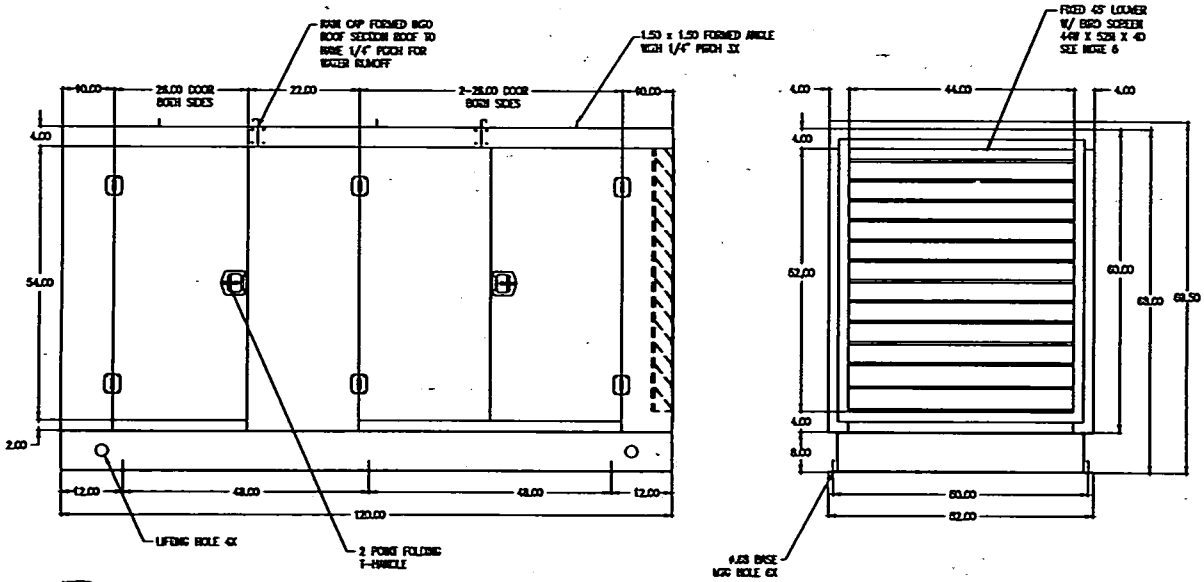
ACCESSORIES:

- Exhaust hole cap
- Muffler brackets
- Sub & skid bases
- Lifting eyes

3201 Third Avenue • Mankato, MN 56001
507-625-7973 • Fax: 507-625-2968 • Internet: http://www.katolight.com



HSG-105
APPROX WT: 675#



HSG-255
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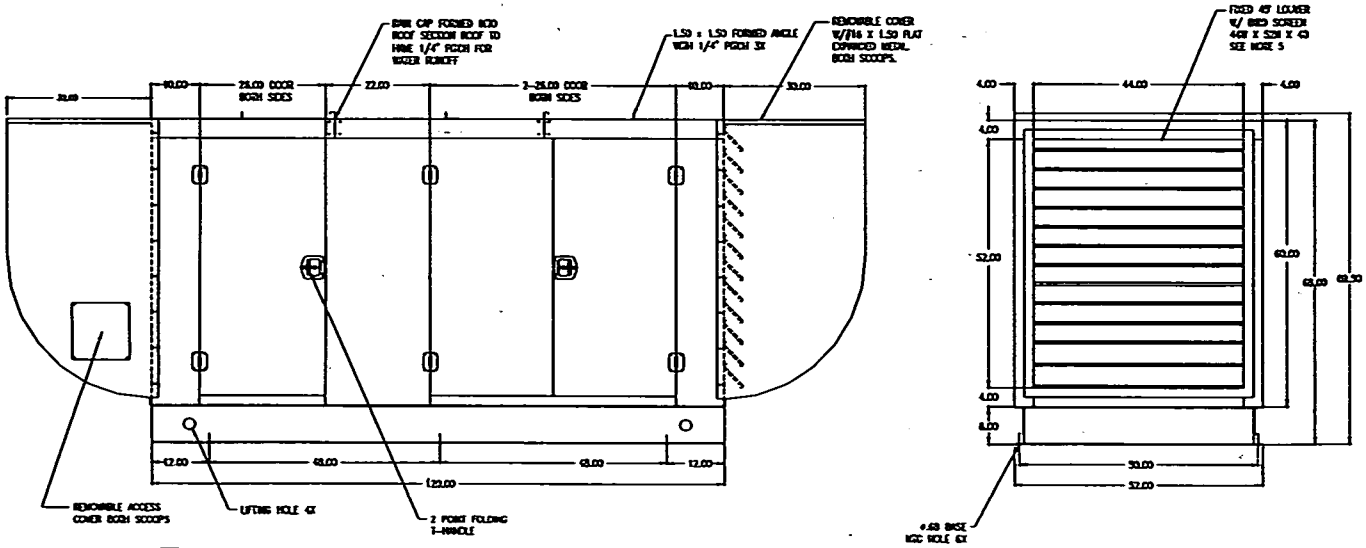


HSG-255-S
APPROX WT: 675#

SHOP ORDER STATUS
DETAIL REPORT

www.katolight.com *Ph: 507-625-7973* *Fax: 507-625-2968*

100 POWER DRIVE
BOX 3229
MANKATO, MN 56002-3229

CUSTOMER: DTE ENERGY TECHNOLOGIES
1715 LAKE DRIVE WEST
CHANHASSEN MN 55317-8580

SHOP ORDER: 14002-0	ITEM: 800815 NL125F*G4 (8.1L TURBO)	ORDER QTY	COMPLETED QTY	DATE STARTED	DATE DUE
JOB #: 090118		1	0	06/24/2003	07/11/2003

*** ENERGY NOW UNIT ***
PROCESSED BY JIM K 5-21-03
RPM: 1800
KW: 125.0
KVA: 156.3
FREQ: 60
PF: .8
TEMP RISE RATING: 80 DEGREE C.
****UNIT DRAWINGS:****
AC DRAWING: 819-B-13040
DC DRAWING: 819-C-6175
PP DRAWING: 819-B-13041
DIMENSION DRAWING: 100-2508-20
BASE DRAWING: 102-2465-A
DUCT FLANGE DRAWING: N/A
ENCLOSURE DRAWING: HSG-255
INTAKE SCOOP DWG: 105-1614
EXHAUST SCOOP DWG: 105-1615
EXHAUST FLEX DWG: N/A
TANK DRAWING: N/A
FUEL SYSTEM DWG: 204-206-30
STANDARD UNIT
GM 8.1L TURBO 12V UMR (125KW)
VOLTAGE: 208 3 PHASE
SPECIFY OPTIONAL GENERATOR
431PSL6202 PMG/DVR 3&11.5 12W
13LT 50K CONTROL PANEL 12V
RELAY ENGINE FAIL 12V 2P
RELAY ENGINE RUN 12V 2P
LOW WATER LEVEL LED
CONTROL PANEL UNIT MOUNTED
13LT 2W SURF MTD ANNUNCIATOR
ANNUNCIATOR OTHER/XTRA LITES
LOW WATER LEVEL LED
AMMETER 0-500
VOLTMETER 0-300/0-600 240VAC
FREQUENCY METER 55-65HZ
CURRENT TRANSFORMER 500A 3X
STD ELECT GOVERNOR CONTROL WOODWARD LC-50
ENCLOSURE 250/260 SERIES
SOUND ATTENUATED
INTAKE SCOOP
EXHAUST SCOOP
CONTROL PANEL MOUNTED LSFG
STD STEEL BASE HSD FORMED
COOLING SYSTEM STANDARD
LOW WATER LEVEL W/LED
BREAKER 400A 3P 240V W/ENC
400A BKR MTD RIGHT SIDE
STANDARD BATTERY RACK ONLY
SPECIFY OPT HEATER REQ'D
WATER HEATER 3000W 208V 1PH CL130810-000
HEATER PLUMBED W/BALL VALVES
HEATER WIRED TO TERMINAL
PAD ISOLATORS HOUSED
OIL DRAIN EXTENSION REQUIRED
FCA12-6-2411U BATTERY CHARGER
CHARGER MTD-DC & AC WIRED
SPECFY GRADE EXH/OPT MTG INS
CRITICAL GRADE EXHAUST
MUFFLER MTD SOLID TO ENGINE ELBOW UP THRU ROOF
ENGINEERING TO SPEC EXHAUST
EXHAUST FLEX NOT REQUIRED
FUEL SYSTEM NATURAL GAS STD 204-206-30
SWITCHES & SENDERS 50K PANEL

SPECIFY OPT PAINT REQUIRED
PAINT UNIT PUTTY WHITE
INCLUDE DECALS AND BLUE STRIPE
1 O&M MANUAL SEND W/UNIT
STANDARD COMMERCIAL TEST
UNIT TO SHIP WET
2 YEAR WARRANTY 1500HR LIMIT
PAINT UNIT PUTTY WHITE INCLUDE DECALS AND BLUE STRIPE
ANNUNCIATOR PANEL

SHOP ORDER #: 14002 ITEM #: 800815

ITEM #	DESCRIPTION	UM	QTY PER UNIT	QTY ISSUED
100151	COMPLETE CONTROL PANEL	EA	1	0
32007	BREAKER CIR 400A 240V 3P **SP TJD432400WL	EA	1	0
35070	SWITCH TEMP 55F 1/2 NPT NC STD LWT SWITCH	EA	1	0
35098	SWITCH TEMP 215F 6A NO 3/8" NPT STD PSD SWITCH TT-F2A-215R	EA	1	0
35198	VALVE BALL 3/4" NPT BRONZE W/TEFLON SEAT, USE AS STANDARD 28-8620	EA	2	0
39548	HEATER TANK 3000W 208V 1PH HORIZONTAL KIM W/THERMOSTAT CL130810-000	EA	1	0
40509	RACK BATTERY UNIT MTD 16" OAL HOLDS 30H BATTERIES**SP 204-109	EA	1	0
41709	TRANSFORMER CURRENT 500:5 600V 12.5VA SEC**SP	EA	3	0
42820	BLOCK FUSE 3P 600V FOR 13/32" X 1 1/2" FUSES	EA	1	0
42828	FUSE 10A 600V JX6-10 KTK-10	EA	3	0
44320	CLAMP MUFFLER 3" **SP WALKER #35794	EA	1	0
44323	CLAMP MUFFLER 4" **SP WALKER #35752	EA	1	0
44404	ELBOW TUBING 4" ID-OD 90 DEG **SP WALKER #41005/320289	EA	1	0
44982	ENCLOSURE BKR NEMA 1 TJ400S ORDER W/NEUTRAL BLOCK TNIA400 TJ400S	EA	1	0
45205	CAP RAIN VERTICAL/HORIZ. 4"SP FITS 3 1/2" PIPE & 4" TUBING FB5345	EA	1	0
45220	FLANGE ANGLE RING 5" I.D.	EA	1	0
45641	FLEX FUEL SS BRAIDED OAL 13" 1 1/2" NPT X 1 1/2" NPT	EA	1	0
45900	SENDER GAUGE PRESSURE 0-100PSI USE W/GAUGE 42919**SP 411-K	EA	1	0
45973	SENDER TEMP 100-230 DEG F 3/8" NPT USE W/GAUGE 45974 DATCON# 02079-02	EA	1	0
46000	SOLENOID START 12VDC **SP	EA	1	0
46010	VALVE SOLENOID 1 1/2"NPT 12VDC USED ON GAS UNITS 8215B70	EA	1	0
46110	SWITCH PRESSURE 20PSI 10A SPDT 1/8NPT STD OIL PSD SWITCH SM-2C-20F/309 (GOLD CONTACTS)	EA	1	0
46114	SWITCH TEMP 225F 6A NO 1/2NPT STD TEMP SHUTDOWN SWITCH TT-F1A-225R/GG	EA	1	0
46115	SWITCH PRESSURE 15PSI 10A SPDT 1/8" NPT STD OIL SHTDWN SWITCH SM-2C-15F/298 (GOLD CONTACTS)	EA	1	0
46900	MOUNT VIBE 1 1/4" ISOPRENE W/ 5/16-18 X 9/16" STUD FOR PANEL 3105754400	EA	4	0
46906	MOUNT VIB PAD 2 X 10 X 1/4 **SP 105-1661 SEND LOOSE	EA	6	0
46987	MOUNT VIBE 1" NEOPRENE W/ 1/4-20 X 1/2" STUDS FOR PANEL 1352-162	EA	4	0
47428	ELBOW PIPE 90 DEG 1 1/2" SCHED 40 THREADED	EA	1	0
65010	VALVE OIL DRAIN 12MM-1.75 USED ON GM ENGINES**SP F-107-N	EA	1	0
69028	COVER BASE 3" LIFTING HOLE 4 X 4 16 GA**SP 105-1393	EA	4	0

SHOP ORDER #: 14002 ITEM #: 800815

ITEM #	DESCRIPTION	UM	QTY PER UNIT	QTY ISSUED
70380	HINGE TORPEDO LH JONES# H0090 STD ON ALL HOUSINGS **SP 26808 AUSTIN	EA	6	0
70381	HINGE TORPEDO RH JONES# H0095 STD ON ALL HOUSINGS**SP 26809 AUSTIN	EA	6	0
70407	SCOOP INTAKE FOR HSG-255 105-1614	EA	1	0
70408	SCOOP EXHAUST FOR HSG-255 105-1615	EA	1	0
70763	ADAPTER 14MM X 1.5 TO 1/4 PIPE SEE BELOW FOR WHERE USED**SP USED FOR QST-30 OIL PRESS SW AND FOR JD 6068 FUEL SUPPLY	EA	1	0
71170	TANK COOLANT RECOVERY PLASTIC UNIVERSAL**SP 82300 CARQUEST#	EA	1	0
71198	GENERATOR 431/6202 DVR2000 SAE 3 FLYWHEEL 11 1/2 12W *UL*	EA	1	0
71793	BRACKET COOLANT REC TANK**SP FOR 3.0, 4.3, 5.7 & 7.4 (70KW) 105-1967	EA	1	0
73375	ENCLOSURE WEATHER PROOF 120LX52WX60H HSG-255	EA	1	0
73389	ENGINE GM 8.1LT 12V UMR WW GOV SAE 3 FW 11 1/2 TURBO	EA	1	0
73418	BRACKET OIL PRESSURE SW MTG FOR ALL GM & ALL JD 6125AF/HF 105-2241	EA	1	0
73470	INSULATION BLANKET EXHAUST FOR 12" OD BODY X 19 1/4" L**SP FKAT-213-104	EA	1	0
73488	HARNESS WIRING 8.1L GM (PGL) STD 45 SERIES PANEL	EA	1	0
74490	ROD LATCH 34"LONG 5/16 DIA**SP CUT TO FIT USE W/LATCH #74489 312-34	EA	8	0
75661	BRACKET MUFFLER SUPPORT 125KW 8.1LT GM **SP 105-2566	EA	1	0
75801	INSULATION BLANKET EXHAUST 18" FOR 2 1/2" OD TUBING FKAT-213-110 USED ON 8.1L ENGINES	EA	4	0
75825	BAR BUS COPPER 1 5/8 X 7/8 USED ON 8.1L GM STARTERS 105-2330	EA	1	0
75828	FITTING HOSE BARB REDUCING 3/8 ID X 5/8 ID HOSE 5463K227	EA	1	0
75851	BRACKET ROOF SUPPORT PITCHED INTERNAL FOR HSG-105/255 105-2323	EA	2	0
75858	NAMEPLATE FUEL SYSTEM DATA **SPCL** FOR DTE GAS UNITS SAME AS P/N 74879 BUT: "ENERGY NOW" (LOGO)	EA	1	0
75859	PAINT "ENERGY NOW" GRAY (PUTTY WHITE) F78W100	GL	5	0
75879	DECAL "ENR 125" FOR ENERGY NOW UNITS 10" OAL	EA	2	0
75935	SENSOR SPEED MAGNETIC (MSC) 5/8-18 X 3 7/8" LONG **SP MSC P/N 401093-10	EA	1	0
75952	FILTER AIR CLEANER USED ON GM 8.1L TURBO	EA	1	0
75968	ADAPTER 28MM X 1.25 TO 1/2 NPT (MALE METRIC TO FEMALE PIPE)	EA	1	0
76212	BRACKET WATER HEATER MTG FOR 2500W KIM HEATERS**SP 105-2408	EA	1	0
76677	BASE HSD FORMED 120 X 52 8.1LT 8" RAIL FOR HSG-105/255 102-2465-A	EA	1	0
76804	MUFFLER 4" EM SPACE SAVER 3" SLEEVED INLET & 4" OUTLET CPJS-04	EA	1	0
77055	BRACKET MUFFLER MTG 13" 5" HIGH (125KW SP) **SP** 105-179-24	ST	1	0
77070	BRACKET CHARGER MTG FOR SENS BATTERY CHARGER (ALUMINUM) 105-2614 **DO NOT PRIME** (ALUMINUM)	EA	1	0
77141	SHIELD RAIN 4" 21702B	EA	1	0
77193	CHARGER BATTERY 12V 6A 120VAC SENS MODEL: FCA12-6-2411UA FCA12-6-2411UA	EA	1	0
77270	SHIELD HEAT FOR 8.1LT GM (LEFT SIDE) 105-2585	EA	1	0
77271	SHIELD HEAT FOR 8.1LT GM (STARTER)	EA	1	0

SHOP ORDER #: 14002 ITEM #: 800815 ITEM #	DESCRIPTION	UM	QTY PER UNIT	QTY ISSUED
	105-2586			
77272	SHIELD HEAT FOR 8.1LT GM (REAR)	EA	1	0
	105-2587			
77273	SHIELD HEAT FOR 8.1LT GM (RIGHT SIDE)	EA	1	0
	105-2588			
77274	SHIELD HEAT FOR 8.1LT GM (OIL COOLER LINE)	EA	1	0
	105-2589			
77284	LATCH FLUSH MTD FOLDING T-HAND 2 POINT USING LATCH RODS	EA	4	0
77559	FOAM INSULATION KIT HSG-255	EA	1	0
	HSG-255 KIT			
77815	SENSOR WATER LEVEL "LEVELPRO" 1/4 NPT INTELLISENCE "W/DELAY"	EA	1	0
	3G8579-2 W/5-SECOND TIME DELAY			

SHOP ORDER: 14002-1	ITEM: 100151	ORDER QTY	COMPLETED QTY	DATE STARTED	DATE DUE
JOB #: 090118	COMPLETE CONTROL PANEL	1	0	06/10/2003	06/23/2003

SHOP ORDER #: 14002 ITEM #: 100151

ITEM #	DESCRIPTION	UM	QTY PER UNIT	QTY ISSUED
100157	ASY 12 LED LIGHT BOARD 12/24V FOR 12 WIRE LIGHT BOARDS ONLY	EA	1	1
100374	ASY ANNUNCIATOR 16LT 2 WIRE SURFACE MTD	EA	1	1
35030	SWITCH PUSHBUTTON 3A 125V NO RED USED W/ 12 LED BOARDS	EA	1	1
35054	SWITCH AM/VM 4 POS STD AM/VM SWITCH	EA	1	1
35064	RELAY VOLTAGE 12/24V OVR/UNDER HI/LW BAT RELAY FOR 50SER PNL	EA	1	1
35083	SWITCH SPEED SM124S	EA	1	1
35125	SWITCH ENG CONTRL AUTO OFF MAN USED ON 50 SERIES PANELS *** M221US1A1757-05 ***	EA	1	1
36008	SWITCH PUSHBUTTON 3A 125V NC BLACK USED W/ 12LED BOARDS	EA	1	1
40218	ALARM BUZZER 12-24VDC STD PANEL ALARM SONALERT	EA	1	1
40309	METER AMP AC 0-500 3 1/2" 2% 90 DEG 250-340LSSF	EA	1	1
42703	METER FREQUENCY 55-65 120V STD 3 1/2" 90 DEG DIAL TYPE 60HZ 254350ANAN	EA	1	1
42806	HOLDER FUSE 20A 1P PANEL MTG FITS TYPE AG FUSES**SP 342828L	EA	1	1
42919	GAUGE PRESSURE OIL 2" 0-100PSI USE SENDER 45900 DATCON# 100174	EA	1	1
43907	LIGHT PANEL HOOD THREADED STD W/PANEL LIGHTS	EA	2	2
43910	BULB LIGHT 12VDC MINI BAYONET STD PANEL LIGHT BULB 12V	EA	2	2
45530	RELAY 12V DC 2PDT 10A USE W/ SOCKET 45534**SP	EA	2	2
45534	SOCKET RELAY 3PDT 10A 11 PIN SPADE**SP	EA	2	2
45800	METER HOUR 8-32VDC 2 1/2" 6 DIGIT RTM KL STANDARD 85371	EA	1	1
45974	GAUGE TEMP 100-240 DEG F ELECTRIC 2 1/8" SENDER 45973 DATCON# 100683	EA	1	1
46133	SWITCH TOGGLE 2POS 6A 240V FOR PANEL LIGHTS ETC	EA	1	1
47004	METER VOLT 0-300/0-600 AC DUAL 0-300V MVMT 3 1/2 2% 90 DEG 250-344RXRX7JAR	EA	1	1
55302	FACE PANEL 50K STANDARD SEE BELOW FOR NOTES 804-473	EA	1	1
55302-P	POWDER COATING FOR PN 55302 50K PANEL FACE	EA	1	1
55305	ENCLOSURE PANEL 45K & 50K STANDARD TO INCLUDE BACK PLATE 105-1330 & 105-1330-1	EA	1	1
55305-P	POWDER COATING FOR PN 55305 45/50K ENCLOSURE	EA	1	1
58431	HARNESS WIRING STD 50 PANEL 818-138	EA	1	1
73395	KNOB PULL BLACK PHENOLIC THREADED INSERT 8-32	EA	1	1
73606	FASTENER 1/4 TURN OVAL HEAD USE ON CSA PANEL DOORS 84-50-080-10 OVAL HEAD W/ SLOT USE ON CONTROL PANELS FOR ALL CSA APPROVED UNITS	EA	1	1
74063	TRANSFORMER ISOLATION (STD) **STANDARD FOR CONTROL PANEL**	EA	1	1
74997	METER VOLT DC 10-16 2" 2% 90DEG VP0128	EA	1	1
76231	LABEL FOR PANEL FUSE (10 AMP) SEE BELOW (UL)	EA	1	1
76718	LABEL "DANGER HIGH VOLTAGE" 1.125" X 1.875" (UL)	EA	2	2

SHOP ORDER #: 14002 ITEM #: 100151 ITEM #	DESCRIPTION	UM	QTY PER UNIT	QTY ISSUED
68417				
77123	BOOT INSULATOR FOR SCREW TERM, USED ON SCREW TERM. ON METERS	EA	7	7
5102				
77365	PROTECTOR TERMINAL STRIP "SP" FOR 45/50K PANELS	EA	1	1
105-2612				
90153	CONTROL ENG 12V KASSEC COMP STD ENGINE CONTROL	EA	1	1

SHOP ORDER: 14002-2	ITEM: 100374 ASY ANNUNCIATOR 16LT 2 WIRE SURFACE MTD	ORDER QTY	COMPLETED QTY	DATE STARTED	DUE
JOB #: 090118		1	0	05/28/2003	06/09/2003

SHOP ORDER #: 14002 ITEM #: 100374 ITEM #	DESCRIPTION	UM	QTY PER UNIT	QTY ISSUED
35030	SWITCH PUSHBUTTON 3A 125V NO RED USED W/ 12 LED BOARDS	EA	1	0
36008	SWITCH PUSHBUTTON 3A 125V NC BLACK USED W/ 12LED BOARDS	EA	1	0
39004	LABEL STD 16LT ANNUNCIATOR (UL)	EA	1	0
7009-2				
40218	ALARM BUZZER 12-24VDC STD PANEL ALARM SONALERT	EA	1	0
40827	CONNECTOR WIRE MALE PLUG 4 PIN .06	EA	0	0
40828	CONNECTOR WIRE FEMALE PLUG 4 PIN .06	EA	0	0
40829	CONNECTOR WIRE MALE CRIMP .062	EA	0	0
40830	CONNECTOR WIRE FEMALE CRIMP .062	EA	0	0
40831	LABEL ANNUNCIATOR 2 WIRE	EA	1	0
R & D REMOHOK DWG				
41817	LED RED SUPER BRIGHT DIFFUSED USED IN 4 & 12 LIGHT BOARDS	EA	12	0
41978	FACE ANNUNCIATOR 12 LED SURFACE MOUNTED STANDARD	EA	1	0
804-169-20-1A				
41978-P	POWDER COATING FOR PN 41978 12 LED SURF. ANNUNCIATOR FACE	EA	1	0
43101	BOX HANDY SCREW COVER 10X8X4 LESS KNOCKOUTS	EA	1	0
ASE1084NK				
46539	BLOCK TERMINAL 4PT PCB MTG USED ON ISOLATION XFORMER BD	EA	2	0
70458	CABLE FLAT RIBBON IDC USED ON 2 WIRE ANNUNCIATORS	EA	1	0
71792	BOARD PC 16 LIGHT W/2 WIRE MOD USED IN 50K PNL W/2 WIRE ANN	EA	1	0
90147	BOARD PC TRANSMITTER 2 WIRE ANNUNCIATOR	EA	1	0
800-170 *****RECEIVING DEPARTMENT***** ***BRING TO PANEL DEPT*** ****P4" CONNECTOR & "U8" CHIP				
90147	BOARD PC TRANSMITTER 2 WIRE ANNUNCIATOR	EA	1	0
MUST BE INSTALLED PRIOR TO ADDING INTO INVENTORY***				
90150	BOARD PC RECEIVER 2 WIRE ANNUNCIATOR	EA	1	0
PRIOR TO ADDING TO INVENTORY**				
90150	BOARD PC RECEIVER 2 WIRE ANNUNCIATOR	EA	1	0
800-170 ***RECEIVING DEPARTMENT*** *****BRING TO PANEL DEPT***** ****U9" CHIP MUST BE INSTALLED				

Power System Solutions

KATOLIGHT® CORPORATION

Engineering Data and Proposal
This proposal has been prepared specifically for

DTE ENERGY TECHNOLOGIES
Energy Now Submittal
Project: Dobson c/o Cellular One

It contains all the necessary literature, drawings and component information for the following equipment.

(1) 8.1L Engine, Model ENRNL130FPG4
125 kW, 156.3 kVA, 3 Phase,
120/208 Volt, .8 PF,
60 Hz, 12 Leads, 1800 RPM,
Energy Now Natural Gas Engine Generator Set

✺ Unit Description ✺

RPM: 1800
KW: 125.0
KVA: 156.3
FREQ: 60
PF: .8
TEMP RISE RATING: 80 DEGREE C.
****UNIT DRAWINGS:****
AC DRAWING:
819-B-13040
DC DRAWING:
819-C-6175
DIMENSION DRAWING:
100-2508-20
BASE DRAWING:
102-2465-A
DUCT FLANGE DRAWING:
N/A
ENCLOSURE DRAWING:
HSG-255
INTAKE SCOOP DWG:
105-1614
EXHAUST SCOOP DWG:
105-1615
EXHAUST FLEX DWG:
N/A
TANK DRAWING:
N/A
FUEL SYSTEM DWG:
204-206-30
STANDARD UNIT
GM 8.1L TURBO 12V UMR (125KW)
VOLTAGE: 208 3 PHASE
SPECIFY OPTIONAL GENERATOR
431PSL6202 PMG/DVR 3&11.5 12W
13LT 50K CONTROL PANEL 12V
RELAY ENGINE FAIL 12V 2P
RELAY ENGINE RUN 12V 2P
LOW WATER LEVEL LED
CONTROL PANEL UNIT MOUNTED
13LT 2W SURF MTD ANNUNCIATOR
ANNUNCIATOR OTHER/XTRA LITES
LOW WATER LEVEL LED
AMMETER 0-500
VOLTMETER 0-300/0-600 240VAC
FREQUENCY METER 55-65HZ
CURRENT TRANSFORMER 500A 3X
STD ELECT GOVERNOR CONTROL
WOODWARD LC-50
ENCLOSURE 250/260 SERIES
SOUND ATTENUATED
INTAKE SCOOP
EXHAUST SCOOP
CONTROL PANEL MOUNTED LSFG
STD STEEL BASE HSD FORMED
COOLING SYSTEM STANDARD
LOW WATER LEVEL W/LED
BREAKER 400A 3P 240V W/ENC
400A BKR MTD RIGHT SIDE
STANDARD BATTERY RACK ONLY
SPECIFY OPT HEATER REQ'D
WATER HEATER 3000W 208V 1PH
CL130810-000
HEATER PLUMBED W/BALL VALVES
HEATER WIRED TO TERMINAL
PAD ISOLATORS HOUSED
OIL DRAIN EXTENSION REQUIRED
FCA12-6-2411U BATTERY CHARGER
CHARGER MTD-DC & AC WIRED
SPECFY GRADE EXH/OPT MTG INS
CRITICAL GRADE EXHAUST
MUFFLER MTD SOLID TO ENGINE
ELBOW UP THRU ROOF

ENGINEERING TO SPEC EXHAUST
EXHAUST FLEX NOT REQUIRED
FUEL SYSTEM NATURAL GAS STD
204-206-30
SWITCHES & SENDERS 50K PANEL
SPECIFY OPT PAINT REQUIRED
PAINT UNIT PUTTY WHITE
INCLUDE DECALS AND BLUE STRIPE
1 O&M MANUAL SEND W/UNIT
STANDARD COMMERCIAL TEST
UNIT TO SHIP WET
2 YEAR WARRANTY 1500HR LIMIT

KATOLIGHT HISTORY

A HISTORY OF MEETING INDUSTRY'S NEED FOR POWER

Since 1952, Katolight generator sets have been helping customers meet their need for reliable power for communications, hospitals, government installations and a myriad of other industrial applications.

Katolight began its dependable power story by serving agribusiness in the heart of the Midwest farm belt. Now Katolight generator sets can be found in thousands of places around the world, such as the National Institute of Health in Washington, D.C., the Beijing Newspaper in China, Telesat-Satellite Communications in Macau, Bonneville Power Authority of Oregon and Washington, and in hospitals, factories and government installations across the United States.

Katolight provides generator sets that meet the growing demands in the industrial, government, commercial and agricultural markets. Katolight's technical knowledge in the field of standby power generation has led to the development of diesel and gaseous powered generator sets used in these markets throughout the world.

The widespread acceptance of Katolight equipment reflects its reputation for quality and reliability in design, manufacturing and service. Katolight Corporation places great value on the establishment of long-term relationships with its customers. This is evident in our superior level of technical support and our emphasis on customer service.

Katolight Corporation has a great deal of successful experience in projects involving the development of generator sets to meet critical specifications. Much of this equipment has been produced to strict government performance and construction specifications. Katolight can design, produce and test engine-generator sets to demanding quality and performance requirements.

Katolight Corporation also produces commercial engine-generator systems. This product line uses air and liquid cooled diesel, natural gas and liquid petroleum gas engines in sets ranging in size from 5 kW to 2000 kW. Commercial systems feature standard or special controls, as well as components and switchgear to meet specific user standards and requirements. Katolight generating sets are designed to satisfy utility or special purpose applications.

Katolight Corporation currently operates out of over 140,000 square feet of manufacturing and office space with more than 150 employees and a national and international distribution network. Our customers continue to benefit directly from our years of experience and flexibility.

100 Power Drive
Mankato, Minnesota USA
Phone: 507-625-7973/Fax: 507-625-2968
www.katolight.com

PERFORMANCE ASSURANCE CERTIFICATION

This Performance Assurance Certification provided by Katolight® Corporation certifies that each model and every production unit will reliably produce its rated output with all accessories with the selected fuel.

Katolight® Corporation throughout its history since 1952 has always tested all equipment to the maximum. Certified tests for all units are on file for review and reference.

- Katolight® Corporation Performance Assurance Certification is the most complete and extensive testing in the engine-generator industry and has always been the standard test performance of Katolight® Corporation.
- Torsional vibration analysis is necessary to assure reliable performance and to prevent catastrophic failures. The analysis verifies compatibility of the engine-generator.
- Unit operational general vibration analysis is also performed to eliminate fatigue failure of medical components. Noise level is measured at specified distances to provide data to meet noise level regulations.
- All models are tested under short circuit conditions at zero power factor and specific power factor to exceed the most severe load conditions. All models are designed, selected and tested to withstand the mechanical and electrical stresses of line to line short circuits. Properly designed engine-generator systems will not be damaged by short circuits.
- Each Katolight® Corporation model is supported by extensive temperature rise testing. This insures continuous operation at rated load. All generators have NEMA class H insulation or better. Continuous heat run tests for each model using thermocouple hot spot detectors to verify each generator design.
- Voltage and frequency transient measurements verify operational model performance of all major components, engine, generator, regulator, and governor.

100 Power Drive • Mankato, MN 56001
507-625-7973 • Fax: 507-625-2968 • Internet: http://www.katolight.com

The Standard Unit Will Include:

Full rated load at PF and maximum load, to verify engine power, overload and maximum capability.

KVA, kilowatts, amperes, voltage, frequency, and voltage transients at 1/2 and rated load frequency at: no load, full load rated and maximum output.

Regular range (adjust), phase sequence, phase voltage balance.

Stator and exciter field resistance.

Insulation test, generator field, exciter armature, exciter field, generator armature or stator.

Dielectric test, generator field, exciter armature, exciter field, generator armature or stator.

All safety shutdown and automatic controls.

Lube oil pressure (if applicable), water temperature (if applicable), battery charger (if applicable).

Heaters, jacket water and/or lube oil, starting aids.

Accessories (annunciator panel, chargers, pumps, transfer switches as supplied).

Standard testing includes portions of MIL-STD-705: Katolight® Corporation has performed complete MIL-STD-705 testing for many critical, precise power, government and military installations.

MIL-STD-705 METHODS

301.1b-	Insulation Resistance Test.
302.1a-	High Potential Test.
401.1a-	Winding Resistance Test.
410.1a-	Open Circuit Saturation Curve Test.
503.1b-	Start and Stop Test.
505.2a-	Overspeed Protective Device Test.
507.1c-	Phase Sequence Test (Rotation).
508.1c-	Phase Balance Test (Voltage).
510.1c-	Rheostat Range Test.
511.1c-	Regulator Range Test.
511.2b-	Frequency Adjustment Range Test.
513.2-	Indicating Instrument Test (Electrical).
515.1a-	Low Oil Pressure Protective Device Test.
515.2a-	Overtemperture Protective Device Test.
516.1-	Controls, Direction of Rotation.
640.1c-	Maximum Power Test

Application performance is certified by Katolight for every unit manufactured. Our company's philosophy and performance are regularly reviewed to insure continuity of the program and conformance with National and other codes or regulations affecting generator systems such as NFPA 99 - Health Care Facilities, NFPA 70 - National Electrical Code, NFPA 110 - Emergency and Standby Power Systems, State of Pennsylvania Department of Labor and Industry.

Every generator system application is unique. Design, manufacture and testing must be adaptable to the continuous variable and unique characteristics of each application.

All Katolight® Corporation equipment is designed, built and tested to this standard.

pac2000

NG

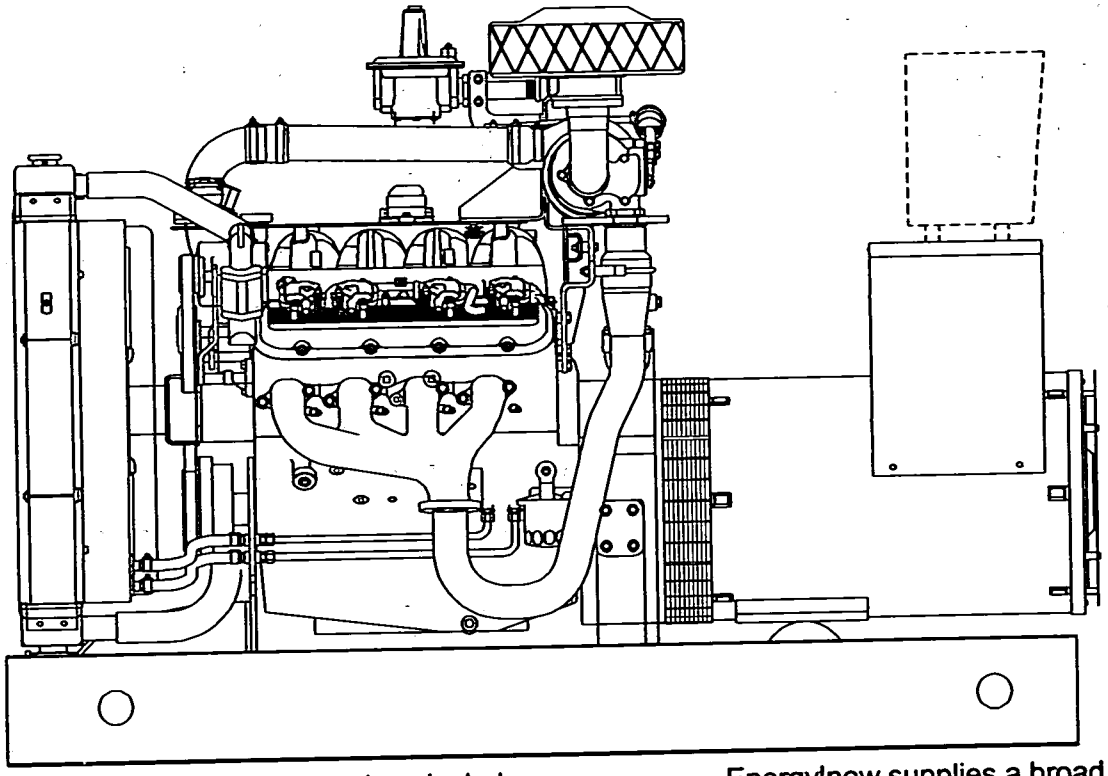
ENRN130F*G4

DTE Energy

DTE Energy Technologies

130 KW @ 60 Hz.
Stand-By Power

110 KW @ 60 Hz.
Prime Power



Energy|now's reciprocating engines include high-efficiency diesel and natural gas units ranging from 8-5,000 kw for a wide range of commercial and industrial applications.

Energy|now specializes in custom designing any application to meet the customers' most stringent specifications.

Each and every unit is factory tested. This can eliminate costly startup and installation delays.

Energy|now supplies a broad range of accessories, fully integrated to our generator sets, to match any requirement worldwide.

Energy|now generator sets come standard with a 2-year, 1500 hour limited warranty. Optional warranty periods are also available, contact factory for details.

This model accepts 100% of nameplate rating, per NFPA 110.

Model #	Volts	Hz	Phase	Power Factor	Natural Gas Standby Ratings		Natural Gas Prime Ratings		Connection
					Amps	kW/kVA	Amps	kW/kVA	
ENRN130FRG4	277/480	60	3	0.8	195	130/162.5	165	110/137.5	12 LEAD HI WYE
ENRN130FPG4	120/208	60	3	0.8	451	130/162.5	382	110/137.5	12 LEAD LOW WYE
[illegible]130FJG4	120/240	60	3	0.8	391	130/162.5	331	110/137.5	12 LEAD HI DELTA
[illegible]130FNG4	347/600	60	3	0.8	156	130/162.5	132	110/137.5	4 LEAD WYE
ENRN130FGG4	120/240	60	1	1.0	521	125/125	458	110/110	12 LEAD ZIG-ZAG
ENRN130FDG4	120/240	60	1	1.0	521	125/125	458	110/110	4 LEAD

energy|now

*ENRN130F*G4*
NG Gen-Set

STANDARD EQUIPMENT

CONTROL PANEL

- Model #45 control panel
- AC voltmeter, 3½", 2% accuracy
- AC ammeter, 3½", 2% accuracy
- Combination VM/AM selector switch, 4 position
- Frequency meter, 3½", 55-65 Hz.
- Vibration shock mounts (4)
- Engine control - KASSEC-12 VDC, with cyclic cranking timer
- 4 engine shutdowns with separate failure lights
  - * High water temperature
  - * Low oil pressure
  - * Engine overspeed
  - * Engine overcrank
- Engine gauges - 2"
  - * Battery voltmeter
  - * Water temperature
  - * Oil pressure
  - * Running time meter - 5 digits
- 3 position mode switch (auto-off-manual)

ENGINE

- Air cleaner
- Oil pump
- Full flow oil filter
- Jacket water pump
- Thermostat
- Exhaust manifold - dry
- Blower fan & fan drive
- Radiator - unit mounted
- Vibration isolators - pad type
- Electric starting motor - 12V

ENGINE (cont.)

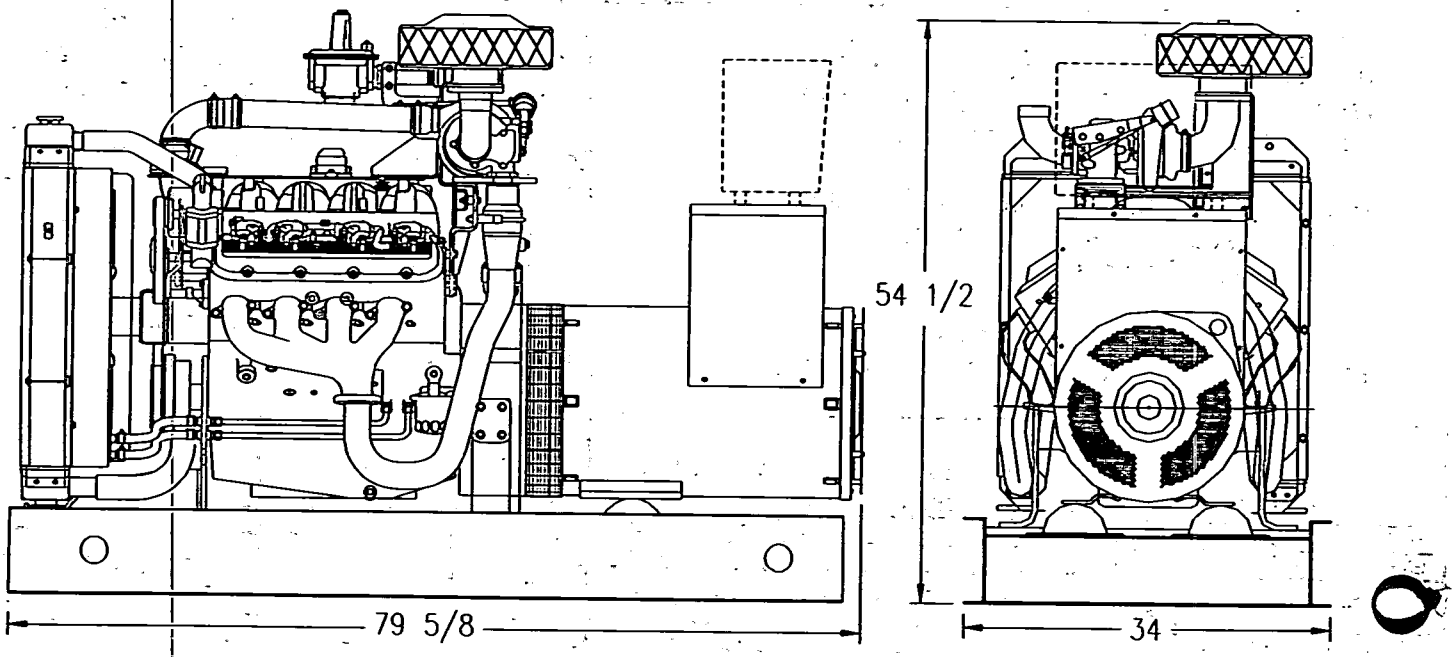
- Governor – Electric Isochronous
- Base - formed steel
- Flywheel & Enclosure
- Charging alternator - 12V
- Battery box & cables
- Flexible fuel & exhaust connectors

GENERATOR

- A.C. Generator
- Brushless design
- Single bearing
- Direct connection with flex plate
- Class H insulation
- All models manufactured to meet NEMA MG1-22.4 and CSA standards
- Telephone influence factor is well within NEMA standards
- Wave form deviation factor is no more than 5%, well within NEMA standards
- Harmonic content is 3.0% maximum
- Permanently lubricated ball type bearings
- Generator is self-ventilated
- Drip-proof construction

VOLTAGE REGULATOR

- Voltage adjust rheostat
- EMI filter (Internal Electromagnetic Interference)
- Underspeed protection
- Overexcitation protection
- Fully encapsulated
- Regulation - 1%



Drawing above for illustration purposes only. Based on standard open power 480 volt generator. Lengths may vary with other voltages.

ENERGY|NOW

ENRN130F*G4
NG Gen-Set

ENGINE TECHNICAL DATA

	60 HZ	
Model:	8.1L Turbo	
Type:	4-Cycle	
Aspiration:	Turbocharged	
Cylinder Arrangement: (Number, inline, V, etc.):	8-V	
Displacement- Cu.In. (lit):	494 (8.1)	
Bore- in. (cm) x stroke- in. (cm):	4.25 (10.8) x 4.5 (11.1)	
Compression Ratio:	9.1:1	
Rated RPM:	1800	
Rating	Standby	Prime
BMEP: psi (kPa):	166 (1,145)	149 (1,027)
Maximum Power at Rated RPM – bhp (kW)	210 (157)	183 (136)

INSTALLATION DATA*

Exhaust System

Gas Temp. (Stack): °F (°C)	1,480 (804)	1,329 (721)	
Gas Volume at Stack Temp.: CFM (m^3/min)	1,245 (35.3)	1,176 (33.3)	
Maximum Allowable Back Pressure: in. H_2O (kPa)	27.2 (6.8)	27.2 (6.8)	
Emissions – HC: g/hp-hr	C/F	C/F	
Emissions – CO: g/hp-hr	C/F	C/F	
Emissions - NO_x g/hp-hr	C/F	C/F	

Cooling System

Ambient Capacity of Radiator: °F (°C)	117 (47)	120 (49)
Maximum Allowable Static Pressure on Rad. Exhaust: in. H_2O (kPa)	0.5 (0.12)	0.5 (0.12)
Water Pump Capacity: gpm (lit/min)	40.9 (154.8)	40.9 (154.8)
Heat Rejection to Coolant: BTUM (kW):	5,128 (90)	4,667 (82)
Heat Radiated to Ambient: BTUM (kW):	4,603 (81)	4,185 (74)

Air Requirements

Aspirating: CFM (m^3/min)	369 (10)	332 (9.4)
Air Flow Required for Rad. Cooled unit.: CFM (m^3/min)	14,250 (404)	13,471 (381)
Air Flow Required for Heat Exchanger/ Remote Rad. Based on 20°F Rise CFM (m^3/min)	12,787 (362)	11,625 (329)

Fuel Consumption: (NG-1000 BTU/ft^3 / LP-2500 BTU/ft^3)

	NG	NG
At 100% of Power Rating: ft^3/hr (m^3/hr)	1,591 (45)	1,562 (44)
At 75% of Power Rating: ft^3/hr (m^3/hr)	1,234 (35)	1,212 (34)
At 50% of Power Rating: ft^3/hr (m^3/hr)	1,087 (31)	1,068 (30)

Sound Level Data

Sound Level at:	Full Load	No Load	Full Load	No Load
23 ft (7m) opu w/ critical grade muffler (dBA)	89	86	88	85
23 ft (7m) Sound Attenuated Enclosure (dBA)	82	80	80	79

Dimensions & Weight

Length: in. (cm)	81.5 (207)
Width: in. (cm)	34 (86.36)
Height: in. (cm)	56.25 (143)
Weight (dry): lb. (kg)	2,330 (1,057)

Liquid Capacity

Total Oil System: gal (lit)	2.1 (8.0)
Engine Jacket Water Capacity: gal (lit)	3.6 (13.7)
System Coolant Capacity: gal (lit)	8.2 (30.9)

Fuel Inlet

Fuel connection size:	1.5" NPT
Fuel supply pressure in H_2O (mm H_2O)	7-11 (178-279)

Electrical System

Electric Volts DC	12
Cold Cranking Amps under 0°F (-17.8°C)	1,160

Remote Radiator System

Connection sizes:		
Jacket Water Radiator Inlet	in. (cm)	2 (5.1)
Jacket Water Radiator Outlet	in. (cm)	2 (5.1)
Static head allowable Above engine	ft H_2O (kPa)	17 (51)
Total system friction pressure Max. allowable	psi (kPa)	C/F

Heat Exchanger System

Connection sizes:		
Jacket Water Heat Ex. Inlet	in. (cm)	1 (2.54)
Jacket Water Heat Ex. Outlet	in. (cm)	1 (2.54)
Water Consumption @60°F (16°C) gpm (lit/min)		25 (95)

*Installation data based on 480 volt, 60 HZ. Application and open power unit.
For sound level readings with other enclosures, please contact factory.
Sound level data acquired per Test Method SAE J1074. Installation factors and site conditions can affect sound levels.
Deration Factor: Altitude: Derate: .5% per 328 ft (100m) above 4,921 ft (1,500m). Temperature: Derate: 2% per 18°F (10°C) above 77°F (25°C).

OPTIONS

Control Panel

** NOTE: #45 series control panel is standard on all units, see page 2 of spec sheet for standard features.

- 2 Model #45 Series Control Panel Options
  - 2 Emergency stop button
  - 2 Alarm buzzer with silencing switch
  - 2 Auxiliary relay for dry contacts (2 max.)
  - 2 A separate low water level light is optional
  - 2 Hooded panel lights (2) and on/off switch
  - 2 NEMA 12 Panel Face
  - 2 Additional LED lights (4 max.) One or two of the following conditions may be indicated:
    - unit not in auto
    - low fuel level
    - low water level
    - low water temp.
    - EPS supplying load
    - pre-alarm oil
    - pre-alarm temp.
    - charger malfunction
- 2 Model #50 Series Control Panel

  STANDARD FEATURES: same as #45 series control panel except for these added features:
  - 2 Hooded panel lights (2) and on/off switch
  - 2 4 Engine shutdowns
  - 2 12 light engine control package meeting NFPA-110 requirement
  - 2 Repetitive alarm buzzer and silencing switch
  - 2 Light and alarm press to test

  #50 SERIES OPTIONS
  - 2 Emergency stop button
  - 2 Additional space for one $3^1/_2$ meter
  - 2 Auxiliary relay for dry contacts (2 max.)
  - 2 A separate low water level light is optional
  - 2 Additional LED lights (4 max.) One to four additional conditions may be indicated: customer to specify
  - 2 NEMA 12 Panel Face
- 2 Model #60 and #80 Series Custom Control Panels
  - It may be necessary to use a 60 or 80 series control panel on certain units where numerous options are required.
- 2 Microprocessor Control Panel- KDGC

GEN-SET OPTIONS

Cooling System

- 2 Remote Radiator
- 2 High Ambient Radiator
- 2 Heat Exchanger Cooling
- 2 Radiator Duct Flange

Fuel System

- 2 Fuel Strainer
- 2 Dual Fuel
  - Manual Change-over
  - Auto Change-over

Exhaust System

- 2 Residential Grade Muffler
- 2 Critical Grade Muffler
- 2 Hospital Grade Muffler
- 2 Rain Cap

Engine Electrical System

- 2 Battery
  - Lead-Acid
  - Nicad
- 2 Battery Warmer Plate
- 2 Battery Rack
- 2 Battery Charger
  - Automatic
  - Trickle
  - Mounted & Wired

Generator

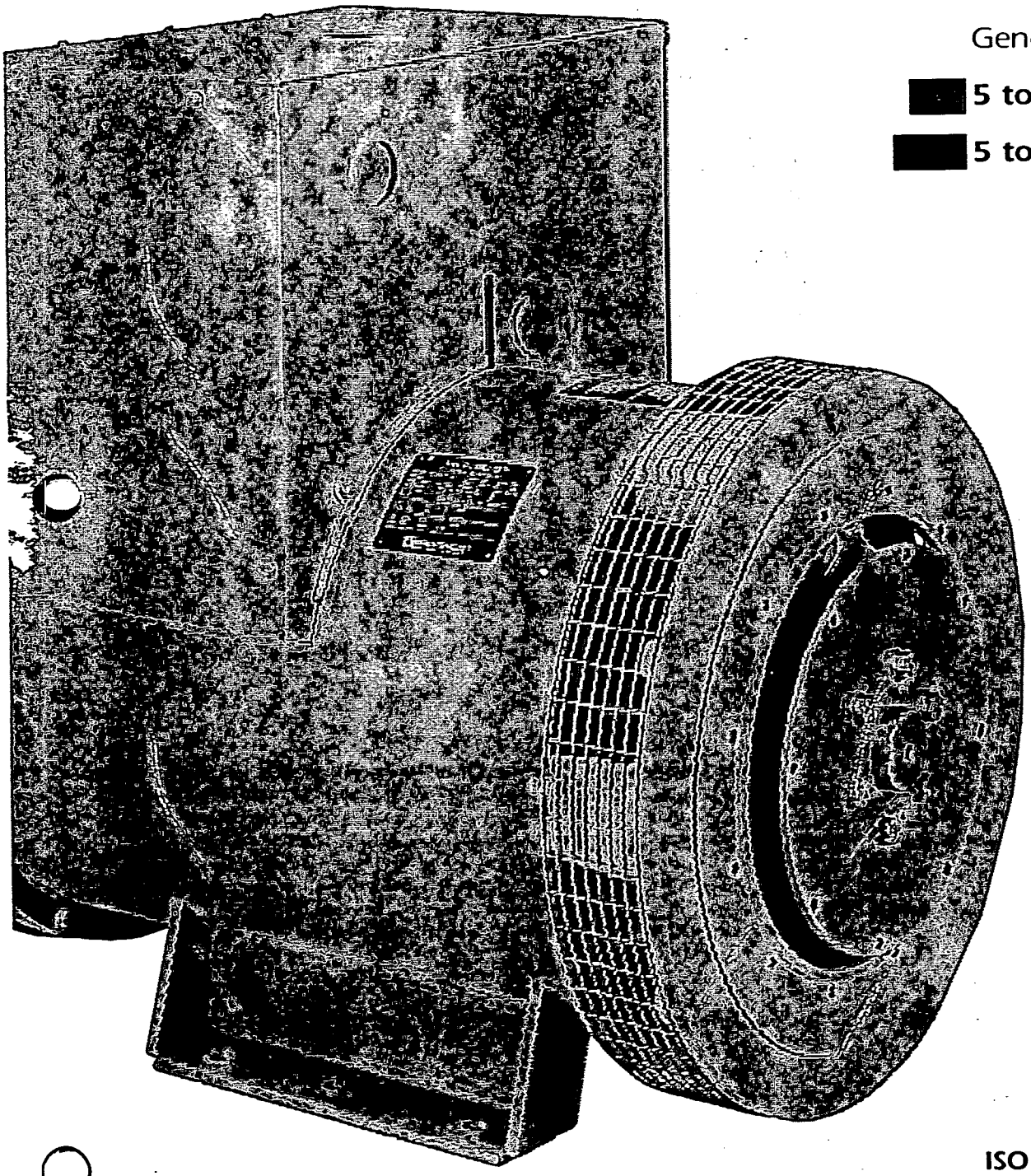
- 2 Main Line Circuit Breaker
  - Shunt trip
  - Auxiliary switch
- 2 PMG Excitation & DVR 2000 Regulator
- 2 Space Heaters 120/240 volt
- 2 Special Testing
- 2 Additional Temperature Rise Generators Available (80°C, 105°C, & 130°C)

Additional Optional Equipment

- 2 Spring vibration isolators
- 2 Oil Drain Extension
- 2 Enclosures
  - Sound Attenuated
  - Weather Proof
  - Aluminum
  - Interior lights AC or DC
  - Floor Plate
- 2 Jacket Water Heater
- 2 Crankcase Oil Heater
- 2 Remote Annunciator
- 2 12 Light Annunciator
  - Flush Mounted
  - Surface Mounted
  - 4 additional lights, if needed
- 2 Export Boxing
- 2 Warranties
  - 2 Year
  - 5 Year
- 2 Operating instructions under plexi-glass
- 2 Service indicator light
- 2 Wind rated enclosure

MAGNAPLUS®

Power Generation for the 21st Century



Generator Ratings:

5 to 430 (60 Hertz)

5 to 420 (50 Hertz)

ISO 9002 Certified

MARATHON® ELECTRIC

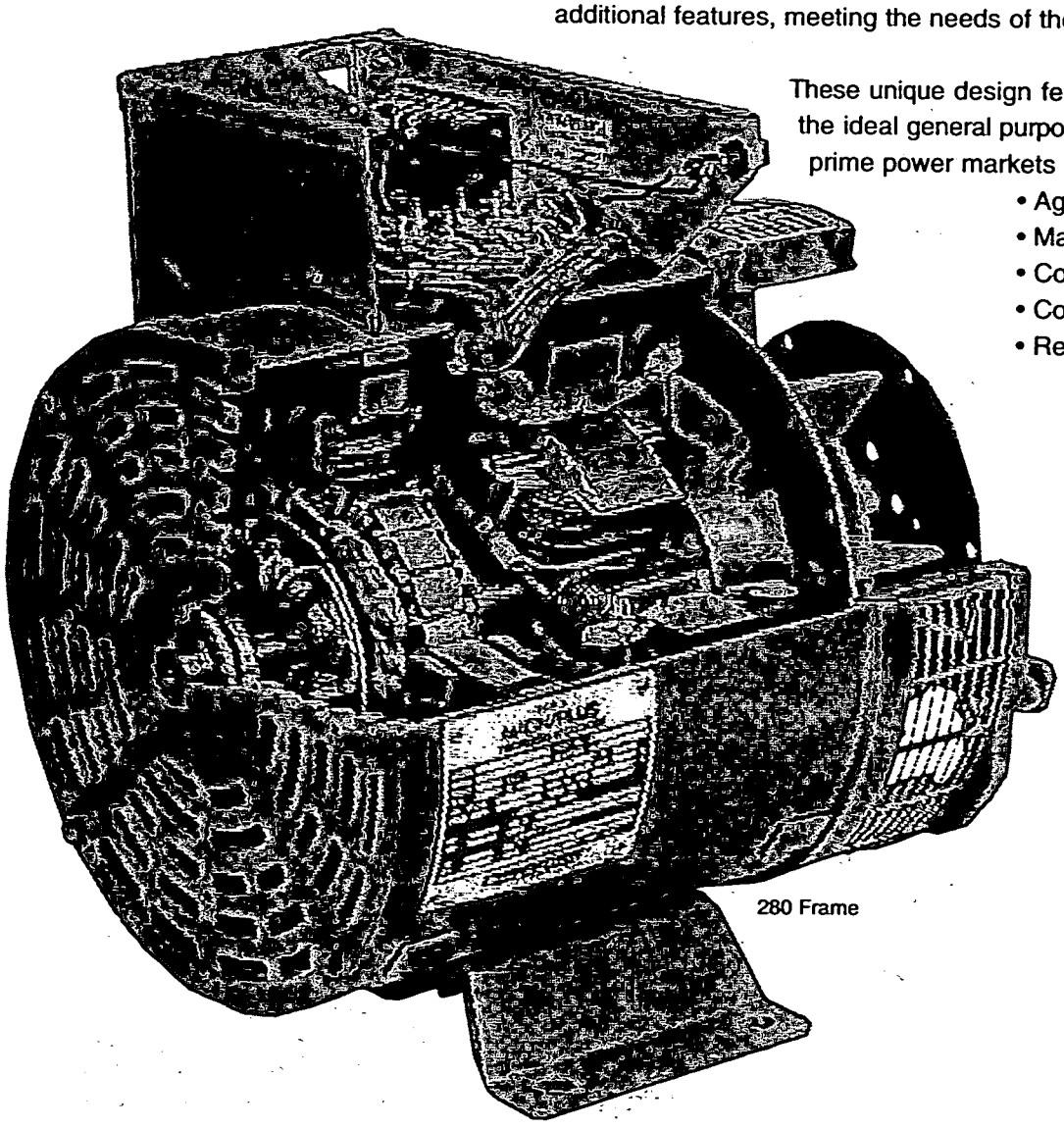
A Subsidiary of Regal-Beloit Corporation

MAGNAPLUS®

innovation

Proven top performers in every respect, MAGNAPLUS® generators offer powerful performance, reliable power generation, and easy installation. With a full range of voltage regulator configurations, MAGNAPLUS® provides application flexibility to meet unique installation requirements. Ruggedly constructed with solid state technology, Marathon's SE350 voltage regulator, included with all standard equipment, is a solid performer.

MAGNAPLUS® offers a field-adaptable, permanent magnet generator, coupled with the PM300 or DVR®2000 voltage regulator, for installations requiring fault current support or for applications utilizing distorting loads. These regulators enhance generator performance and offer additional features, meeting the needs of the most difficult applications.



280 Frame

These unique design features make MAGNAPLUS® the ideal general purpose generator for standby and prime power markets such as:

- Agricultural
- Marine
- Commercial
- Construction
- Rental Markets

performance & reliability . . .

Product Features

Choice . . . abounds with more than 20 stock models ranging from 5–430 kW (60 Hz) and 5–425 kVA (50 Hz). All three-phase generators are 12-lead reconnectable, providing voltage and phase flexibility. For applications requiring price-sensible, dedicated single-phase generators, Marathon Electric stocks 17 models. Standard and optional conduit box designs are available to meet all customer requirements and to ease installation of accessories.

Easy Mount SAE Adapters . . . provided with every generator, are designed with easy drive disc access to simplify the mounting to all popular engines. Generator foot mounting location is unaffected by adapter changes. Special adaptations for automotive engines are available.

Class H Insulation System . . . utilizes an unsaturated polyester varnish for optimal insulation life and superior moisture protection. A tropical insulation is added for increased environmental protection. Field windings are wet wound with epoxy and designed to withstand overspeeds of 125%. All windings are 100% copper with class H insulation.

Linkboards . . . are standard to simplify voltage reconnection and support lead termination.

SE350 Voltage Regulator . . . is encapsulated for reliable performance in all environments. The SE350 regulator provides 1% regulation, underspeed protection, stability adjustment to optimize transient performance, and EMI filtering to commercial standards.

Optimized Electrical Design . . . with four-pole, brushless features, utilizes a 2/3 pitch winding to minimize harmonic distortion. The main rotor, utilizing Marathon Electric's unirotor construction, provides exceptional waveshape and voltage balance. The unirotor construction method incorporates full amortisseur windings facilitating parallel operation and distorting loads.

Enhanced Ventilation . . . created by a high efficiency cast aluminum fan and optimized internal air flow patterns, maximizes heat transfer and minimizes hot spot differentials for extended winding life. Durable aluminum alloy fans avoid breakage problems associated with steel weldments or plastic fans.

Fully Guarded . . . for operator safety and generator protection. No rotating or electrically energized parts are exposed. All openings are covered by louvers or screens.

Heavy Duty Bearings . . . are double shielded and pre-lubricated for the life of the bearing. This helps resist contamination and ensures a minimum B-10 life of 100,000 hours.

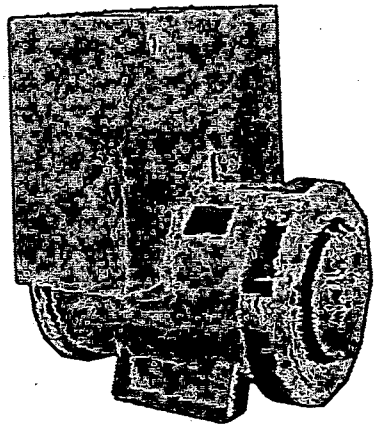
Design Specs and Agency Approvals . . . are important at Marathon. All MAGNAPLUS® units meet NEMA MG1.22, BS5000, CSA C22.2 and IEC 34-1 requirements. Marine versions are available to meet American Bureau of Shipping, Lloyds, Det Norske Veritas, or Nippon Kaiji Kyokai requirements.

Marathon Electric: The Experts in Your Field

As an independent manufacturer with more than fifty years of experience as a leading supplier to the generator market, Marathon Electric is dedicated to designing and manufacturing the highest quality electrical products.

Marathon's commitment to long term customer support and an intensive product development program means you get more:

- Design & Application Experience
- Advanced Testing Facilities
- Technical Support Staff
- Broad Product Line
- Availability



430 Frame with oversized conduit box

Your Independent Generator Source

MARATHON® ELECTRIC

[redacted]

MAGNAPLUS

60 Hertz

Single Phase

12 Leads

- 120 Volt* or 120/240 Volt
- 1800 RPM
- 40°C Ambient

Model Number	kW Continuous Duty				kW Standby Duty			
	Class F 105°C		Class H 125°C		Class F 130°C		Class H 150°C	
	0.80 P.F.	1.0 P.F.	0.80 P.F.	1.0 P.F.	0.80 P.F.	1.0 P.F.	0.80 P.F.	1.0 P.F.
281PSL1500	3.6	5.5	3.8	5.7	3.8	5.8	4.0	6.0
281PSL1501	4.5	6.8	4.8	7.1	4.8	7.2	5.0	7.5
281PSL1502	6.0	8.0	6.2	8.5	6.3	8.6	6.6	9.0
282PSL1503	7.8	10.0	8.1	11.0	8.2	11.0	8.5	12.0
282PSL1504	8.8	12.0	9.3	12.5	9.5	13.0	10.0	13.5
282PSL1505	10.0	14.0	11.0	15.0	11.0	15.5	12.0	16.0
283PSL1506	12.5	17.0	14.0	18.0	14.0	18.5	15.0	20.0
283PSL1507	14.0	18.0	15.0	20.0	15.0	20.0	16.0	21.5
284PSL1508	17	22	20	25	20	25	21	27
284CSL1542	23	29	24	32	24	32	27	33
361PSL1600	25	31	27	34	27	34	30	36
361PSL1601	30	40	32	43	32	43	35	45
361PSL1602	33	45	36	50	36	50	38	52
362PSL1604	44	55	48	60	48	60	50	65
362PSL1606	48	60	53	66	53	66	55	70
363PSL1607	55	70	60	75	60	75	63	80
431PSL6202	90	115	95	120	96	121	100	125
431PSL6204	100	125	106	133	107	135	110	140
431PSL6206	120	150	130	165	132	166	135	175
431PSL6208	120	150	130	165	132	166	136	175
432PSL6210	147	185	158	200	161	201	165	206
432PSL6212	147	175	158	200	161	201	165	206
433PSL6216	175	220	190	240	193	241	200	250
433PSL6220	175	220	190	240	193	241	200	250

[redacted]

MAGNAPLUS

60 Hertz

Dedicated Single Phase

4 Leads

- 120 Volt* or 120/240 Volt
- 1800 RPM
- 40°C Ambient

Model Number	kW Continuous Duty				kW Standby Duty			
	Class F 105°C		Class H 125°C		Class F 130°C		Class H 150°C	
	0.80 P.F.	1.0 P.F.	0.80 P.F.	1.0 P.F.	0.80 P.F.	1.0 P.F.	0.80 P.F.	1.0 P.F.
281PSL1511	4.0	6.0	4.2	6.5	4.2	6.5	4.4	6.8
281PSL1512	4.8	7.7	5.1	8.2	5.1	8.2	5.3	8.5
281PSL1513	6.6	10.0	7.0	10.5	7.0	10.5	7.5	11.0
282PSL1514	7.7	12.0	8.4	13.0	8.5	13.0	9.0	13.5
282PSL1515	11.0	17.0	12.0	18.0	12.0	18.0	12.5	19.0
283PSL1516	12.5	20.0	14.0	22.0	14.0	22.0	15.0	23.0
283PSL1517	17.0	25.0	18.5	27.0	18.5	27.0	20.0	30.0
284PSL1518	20	30	21	32	22	32	23	35
361PSL1611	26	37	29	40	30	40	32	45
361PSL1612	33	45	36	50	36	50	40	55
361PSL1613	43	55	47	60	47	60	50	65
362PSL1615	54	70	59	75	60	75	65	80
363PSL1617	58	90	66	100	66	100	70	105
431PSL6222	68	110	73	115	73	115	78	125
431PSL6224	90	145	100	155	100	155	110	165
431PSL6226	100	155	110	175	110	175	115	185
432PSL6228	145	195	155	210	155	210	170	225

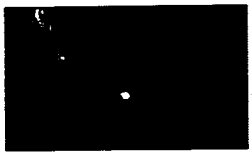
* For 120 volt only service, use an AVC63-4A, a VR63-4C, or a step up transformer with the SE350 regulator.

MAGNAPLUS

60 Hertz
Three Phase
12 Leads

- 1800 RPM
- 0.8 Power Factor
- 40°C Ambient

Model Number	kW Continuous Duty				kW Standby Duty			
	Class F 105°C		Class H 125°C		Class F 130°C		Class H 150°C	
	480Y/240Y	416Y/208Y	480Y/240Y	416Y/208Y	480Y/240Y	416Y/208Y	480Y/240Y	416Y/208Y
281PSL1500	6.0	6.4	6.5	6.9	6.6	7.0	7.0	7.4
281PSL1501	7.5	8.0	8.1	8.6	8.2	8.7	8.7	9.2
281PSL1502	10.5	10.0	11.0	10.5	11.0	10.5	12.0	11.0
282PSL1503	13.5	12.5	14.5	13.0	15.0	13.5	15.5	14.0
282PSL1504	15.0	14.5	16.0	15.5	16.5	15.5	17.0	16.5
282PSL1505	20.0	19.0	21.0	20.0	22.0	20.0	23.0	21.0
283PSL1506	23	23	25	25	25	25	27	26
283PSL1507	28	28	30	30	30	30	33	31
284PSL1508	32	32	35	35	35	35	38	37
284CSL1542	40	36	43	40	43	40	46	41
361PSL1600	45	40	48	42	48	42	50	45
361PSL1601	55	50	60	55	60	55	65	58
361PSL1602	65	60	70	65	70	65	76	68
362PSL1604	84	72	90	80	90	80	95	85
362PSL1606	96	90	105	100	105	100	113	105
363PSL1607	125	110	135	125	135	125	150	135
431PSL6202	142	140	151	147	155	151	160	155
431PSL6204	170	165	180	175	181	176	190	182
431PSL6206	200	191	211	202	215	210	225	217
431PSL6208	211	203	226	216	230	225	240	227
432PSL6210	260	260	275	275	280	280	291	287
432PSL6212	275	260	300	276	300	280	310	300
433PSL6216	342	343	375	366	380	375	400	387
433PSL6220	375	362	403	385	411	400	430	417



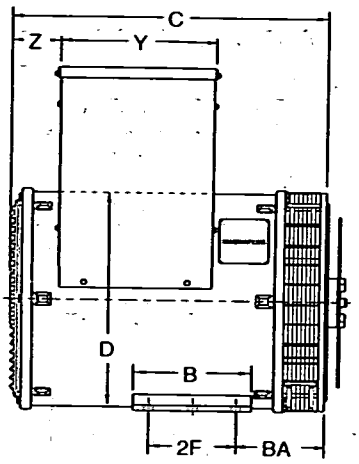
MAGNAPLUS

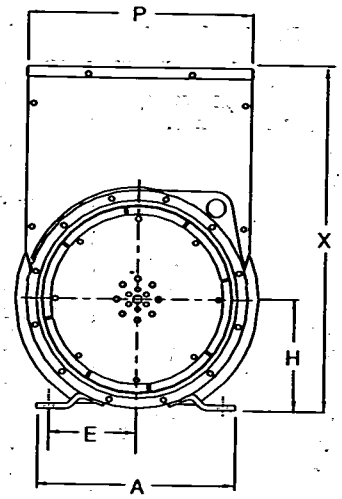
50 Hertz
Three Phase
12 Leads

- 1500 RPM
- 0.8 Power Factor
- 40°C Ambient

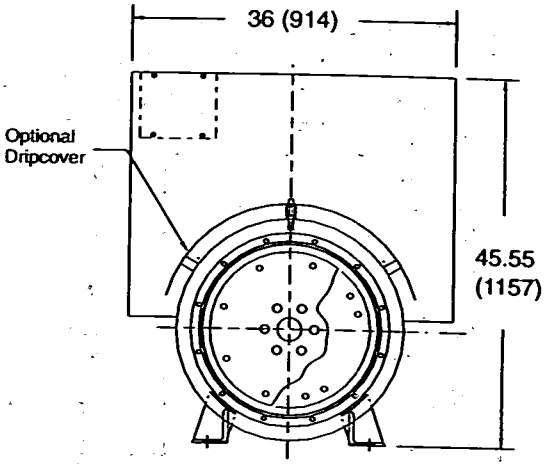
Model Number	kVA Continuous Duty				kVA Standby Duty			
	Class F 105°C		Class H 125°C		Class F 130°C		Class H 150°C	
	415Y/208Y	380Y/190Y	415Y/208Y	380Y/190Y	415Y/208Y	380Y/190Y	415Y/208Y	380Y/190Y
281PSL1500	5.6	6.3	6.3	6.6	6.3	6.9	6.6	7.3
281PSL1501	6.8	7.5	7.5	8.0	7.5	8.3	8.0	8.8
281PSL1502	10.0	10.6	10.8	11.3	10.9	11.4	11.4	12.0
282PSL1503	12.0	13.8	13.1	13.8	13.8	14.4	14.4	15.0
282PSL1504	13.8	15.0	15.0	15.6	15.0	15.6	16.3	16.9
282PSL1505	18.8	20.0	20.6	21.3	21.3	21.3	22.5	22.5
283PSL1506	22.5	23.1	25.0	25.0	25.0	25.0	26.3	26.3
283PSL1507	26.3	26.3	30.0	30.0	30.0	30.0	31.3	31.3
284PSL1508	31.3	31.3	35.0	35.0	35.0	35.0	37.5	37.5
284CSL1542	36.3	37.5	40.0	41.3	40.0	41.3	42.5	43.8
361PSL1600	45	44	50	45	50	45	53	50
361PSL1601	50	54	56	58	56	58	60	63
361PSL1602	60	65	65	70	65	70	73	75
362PSL1604	81	80	90	85	90	85	96	91
362PSL1606	90	94	100	100	100	100	110	110
363PSL1607	113	113	130	130	125	125	133	133
431PSL6202	140	143	150	151	150	155	155	160
431PSL6204	165	166	175	176	176	180	183	185
431PSL6206	185	200	200	211	205	215	211	225
431PSL6208	206	210	225	225	225	230	235	235
432PSL6210	240	256	260	275	265	280	275	290
432PSL6212	270	270	300	300	300	300	310	303
433PSL6216	320	345	350	370	360	376	375	390
433PSL6220	355	375	400	400	400	410	410	423

MAGNAPLUS®





280–430 frame



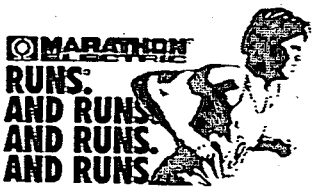
Optional Box (for 430 frame only)

Dimensions in inches and (millimeters)

All dimensions are approximate.
Refer to dimension section of the Generator Catalog for full dimensional data.

Frame Size	A	B	BA	C	D	E	2F	H	P	X	Y	Z
281	14.00 (356)	7.00 (178)	6.56 (167)	15.95 (405)	13.75 (349)	6.25 (159)	5.00 (127)	8.00 (203)	13.42 (341)	18.56 (471)	6.86 (174)	3.50 (89)
282	14.00 (356)	7.00 (178)	6.56 (167)	17.94 (456)	13.75 (349)	6.25 (159)	5.00 (127)	8.00 (203)	13.42 (341)	18.56 (471)	6.86 (174)	3.50 (89)
283	14.00 (356)	7.00 (178)	6.56 (167)	20.44 (519)	13.75 (349)	6.25 (159)	5.00 (127)	8.00 (203)	13.42 (341)	18.56 (471)	6.86 (174)	3.50 (89)
284	14.00 (356)	7.00 (178)	6.56 (167)	22.44 (570)	13.75 (349)	6.25 (159)	5.00 (127)	8.00 (203)	13.42 (341)	18.56 (471)	6.86 (174)	3.50 (89)
361	16.00 (406)	9.50 (241)	7.00 (178)	24.88 (632)	17.35 (441)	7.00 (178)	7.00 (178)	9.00 (229)	18.19 (462)	27.85 (707)	12.44 (316)	3.52 (89)
362	16.00 (406)	9.50 (241)	7.00 (178)	28.50 (724)	17.35 (441)	7.00 (178)	7.00 (178)	9.00 (229)	18.19 (462)	27.85 (707)	12.44 (316)	3.52 (89)
363	16.00 (406)	9.50 (241)	10.50 (267)	31.62 (803)	17.35 (441)	7.00 (178)	7.00 (178)	9.00 (229)	18.19 (462)	27.85 (707)	12.44 (316)	3.52 (89)
431	21.46 (545)	15.00 (381)	10.00 (254)	34.19 (868)	22.64 (575)	9.00 (229)	11.00 (279)	13.00 (330)	24.36 (619)	36.10 (917)	16.00 (406)	2.66 (68)
432	21.46 (545)	15.00 (381)	10.00 (254)	37.69 (957)	22.64 (575)	9.00 (229)	11.00 (279)	13.00 (330)	24.36 (619)	36.10 (917)	16.00 (406)	2.66 (68)
433	21.46 (545)	15.00 (381)	10.00 (254)	42.69 (1084)	22.64 (575)	9.00 (229)	11.00 (279)	13.00 (330)	24.36 (619)	36.10 (917)	16.00 (406)	2.66 (68)

Please Note: Connection boxes shown are furnished as standard product. Consult factory for optional connection boxes.



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Wausau, WI 54402-8003 U.S.A.

Phone: (715) 675-3359
Fax: (715) 675-8026

For an immediate, dependable source of high quality electrical power, specify . . . MAGNAPLUS® . . . the leader in the race for quality, reliability, and value.

MAGNAPLUS GENERATORS

Basic Model 431PSL6202 Test Report No. WC1900

TYPICAL SUBMITTAL DATA

Kilowatt ratings at	1800 RPM	60 Hertz					12 Leads		
kW (kVA)	3 Phase	0.8 Power Factor					Dripproof or Open Enclosure		
	Class B	Class F					Class H		
Voltage*	80° C ① Continuous	90° C ① Lloyds	95° C ① ABS	105° C ② British Standard	105° C ① Continuous	130° C ① Standby	125° C ② British Standard	125° C ① Continuous	150° C ① Standby
240/480	125 (156)	131 (164)	135 (169)	142 (178)	142 (178)	155 (194)	145 (181)	151 (189)	160 (200)
230/460	125 (156)	132 (165)	136 (170)	143 (179)	143 (179)	155 (194)	145 (181)	152 (190)	160 (200)
220/440	125 (156)	132 (165)	136 (170)	143 (179)	143 (179)	153 (191)	145 (181)	151 (189)	160 (200)
208/416	125 (156)	130 (163)	133 (166)	140 (175)	140 (175)	151 (189)	141 (176)	147 (184)	155 (194)
190/380	115 (144)	120 (150)	123 (154)	130 (163)	130 (163)	140 (175)	132 (165)	135 (169)	145 (181)

① *Rise by resistance method, Mil-Std-705, Method 680.1b.* ② *Rating per BS 5000.*

Submittal Data: 240/480 Volts*, 187 kVA, 1800 RPM, 60 Hz, 3 Phase

Mil-Std-705B Method	Description	Value
301.1b	Insulation Resistance	> 1.5 Meg
302.1a	High Potential Test	
	Main Stator	2000 Volts
	Main Rotor	1500 Volts
	Exciter Stator	1500 Volts
	Exciter Rotor	1500 Volts
	PMG Stator	NS**
401.1a	Stator Resistance, Line to Line	
	High Wye Connection	0.0718 Ohms
	Rotor Resistance	0.598 Ohms
	Exciter Stator	18.5 Ohms
	Exciter Rotor	0.116 Ohms
	PMG Stator	NS**
410.1a	No Load Exciter Field Amps at 240/480 Volts Line to Line	0.6 A DC
420.1a	Short Circuit Ratio	0.42
421.1a	Xd Synchronous Reactance	3.08 pu
422.1a	X2 Negative Sequence Reactance	0.258 pu
423.1a	X0 Zero Sequence Reactance	0.048 pu
425.1a	X'd Transient Reactance	0.183 pu
426.1a	X"d Subtransient Reactance	0.175 pu
—	Xq Quadrature Synchronous Reactance	1.425 pu
427.1a	T'd Transient Short Circuit Time Constant	0.048 sec.
428.1a	T"d Subtransient Short Circuit Time Constant	0.005 sec.
430.1a	T'do Transient Open Circuit Time Constant	1.34 sec.
432.1a	Ta Short Circuit Time Constant of Armature Winding	0.018 sec.

Mil-Std-705B Method	Description	Value
505.3b	Overspeed	2250 RPM
507.1c	Phase Sequence CCW-ODE	ABC
508.1c	Voltage Balance, L-L or L-N	0.20%
601.4a	L-L Harmonic Maximum - Total (Distortion Factor)	5.0%
601.4a	L-L Harmonic Maximum - Single	3.0%
601.1c	Deviation Factor	5.0%
—	TIF (1960 Weightings)	< 50
625.1c	Sustained 3 Phase Short Circuit Current High Wye Connection (3)	876 Amps
652.1a	Shaft Current	< 0.1 ma
—	Main Stator Capacitance to Ground	0.015 mfd

Additional Prototype Mil-Std Methods are Available on Request.

–	Generator Frame	431
–	Type	Ext. Voltage Regulated, Brushless
–	Insulation	Class H
–	Coupling - Single Bearing	Flexible
–	Amortisseur Windings	Full
–	Cooling Air Volume	1100 CFM
–	Exciter	Rotating
–	Voltage Regulator	SE350
–	Voltage Regulation	1%
–	Sensing	1 Phase

(3) Excitation support system or PMG required to sustain short circuit currents.

* *Voltages refer to wye (star) connection, unless otherwise specified.*

** *Not supplied as standard equipment.*

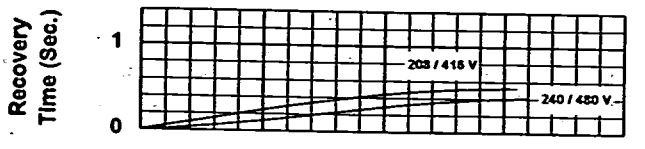
MARATHON ELECTRIC
A Subsidiary of Regal-Beloit Corporation
P.O. Box 8003 Wausau, WI 54402-8003
Ph: 715-675-3311 Fax: 715-675-8026

MAGNAPLUS GENERATORS

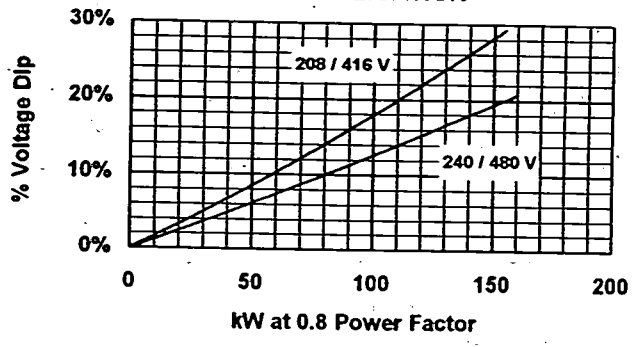
Basic Model 431PSL6202 Test Report No. WC1900

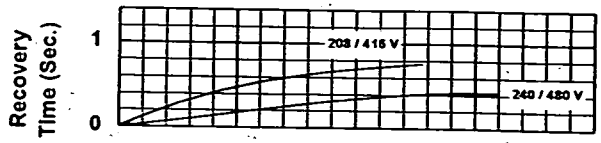
TYPICAL DYNAMIC CHARACTERISTICS

60 Hertz

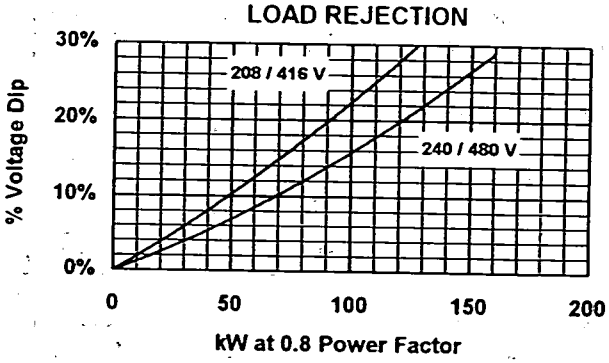


LOAD APPLICATION

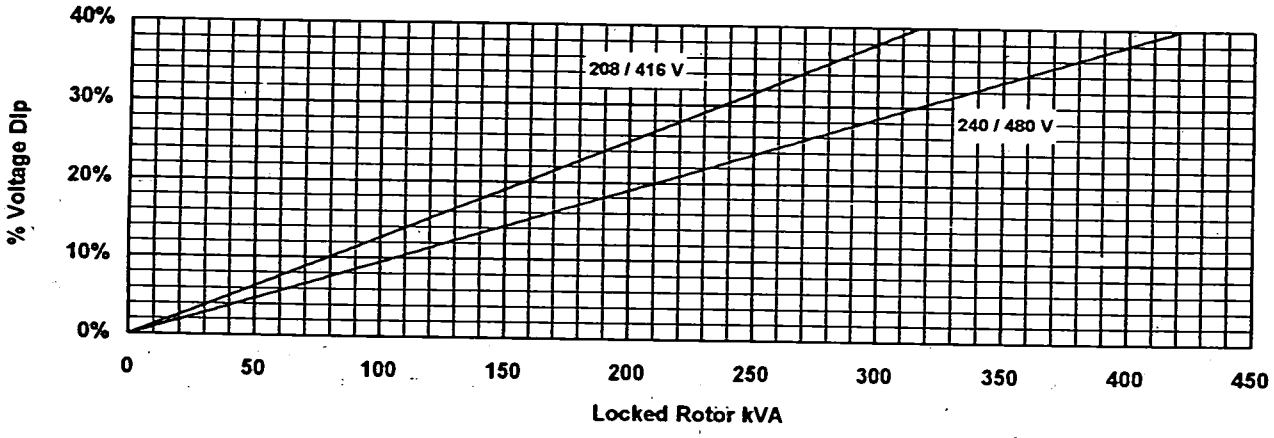




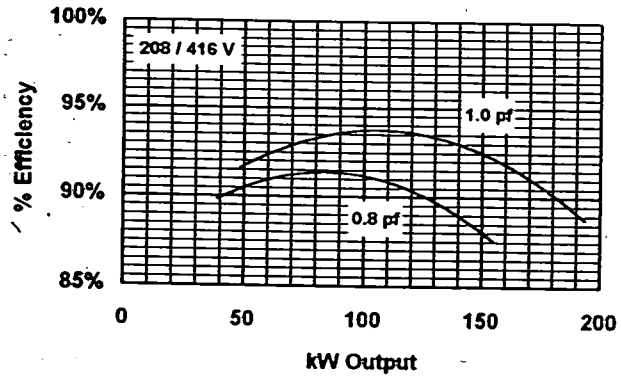
LOAD REJECTION

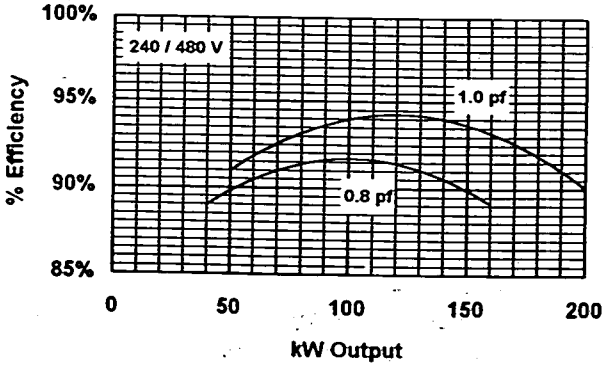


TYPICAL MOTOR STARTING CHARACTERISTICS



TYPICAL GENERATOR EFFICIENCY





Voltages refer to wye (star) connection, unless otherwise specified.

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P.O. Box 8003 Wausau, WI 54402-8003
Ph: 715-675-3311 Fax: 715-675-8026

DVR® 2000

The First... Digital Technology Voltage Regulator

Advanced Features:

True RMS Sensing - One or Three Phase
Connect the sensing mode you prefer. Senses 95 to 600 volts ± 10% at 50/60 or 400 hertz. Patented circuitry senses true RMS voltage, rather than average for superior load regulation.

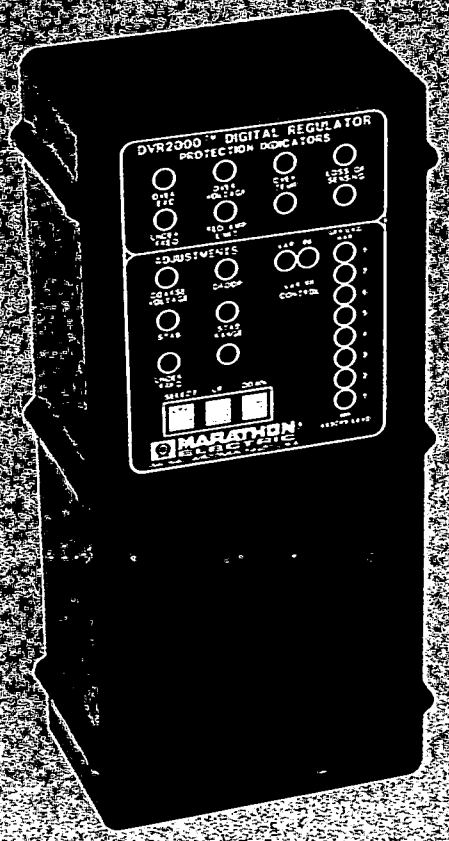
Soft-Start Ramp on Initial Start-Up
Controlled increase to rated voltage. Limits overshoot of voltage during voltage build-up.

Engine Unloading
Monitors the rate of frequency change during transient conditions. Provides additional voltage dip during speed drop to allow engine to recover faster.

Overvoltage Shutdown
Provides generator protection during sustained overvoltage. The overvoltage point is preset at 15% over normal generator operating voltage, with a preset timeout of 0.75 seconds.

VAR/PF Controller
Model DVR2000C (optional) provides control when paralleled to utility power. VAR or PF control can be selected or changed by regulator adjustment.

Fully Encapsulated Design
Maximum protection against moisture or abrasive contamination which can lead to early regulator failure. Tested to MIL-STD-705 Method 711-1C. Salt fog tested to ASTM B117-73.



CSA APPROVED

Solid State Voltage Build-Up eliminates voltage build-up relays with contacts that arc and fail.

ISO 9002 CERTIFIED

Another First by the Generator Leader

MARATHON® ELECTRIC

RUNS.® AND RUNS. AND RUNS. AND RUNS

DVR®2000 Regulator Specifications

Voltage Regulation. 0.25% for precise voltage control on most applications. Voltage drift less than 0.5% for 40C ambient temperature change (15 - 70C range).

Output Power. 3.0 Adc, 75 Vdc, 225 watts, maximum continuous rating; 7.5 Adc, 150 Vdc, 1125 watts forcing for one (1) minute.

Exciter Field DC Resistance. Nominal hot resistance 18 to 25 ohms.

Voltage Adjustment. Minimum of ± 10% of nominal voltage range. Remote adjustment can be made up to 150 feet from voltage regulator.

50 or 60 Hertz Operation. No reconnection required for frequency change.

Power Input. 180 - 240 volts AC, 250 to 300 hertz PMG supply.

Wide Operating Temperature Range. -40C to +70C covers all normal operating environments. Regulator "latches" off when +70C is exceeded.

Loss of Sensing Shutdown. Protects the generator against uncontrolled voltage output when the sensing circuit to the regulator is opened. Regulator shuts down when the sensing circuit to the regulator does not find continuity.

Overexcitation Shutdown. Protects the generator against damage caused by prolonged field forcing.

Paralleling Mode. Paralleling for multiple generator setups is standard. Simply add 5 VA current transformers for parallel operation in "droop" or "cross current" compensatation.

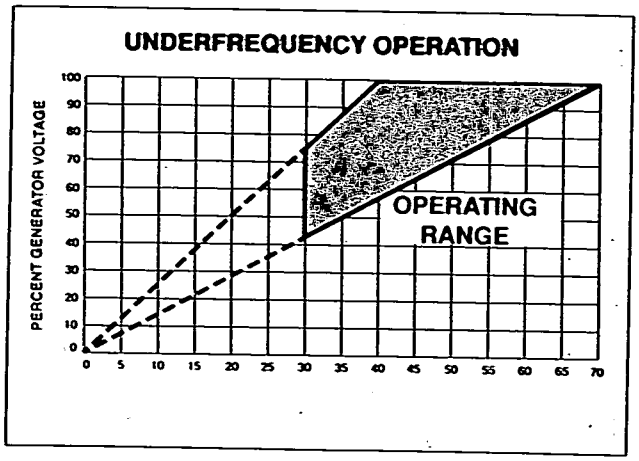
Shock. Withstands up to 20 G's in each of three (3) perpendicular planes.

Vibration. Withstands 0.035 inch peak, 20 - 60 hertz.

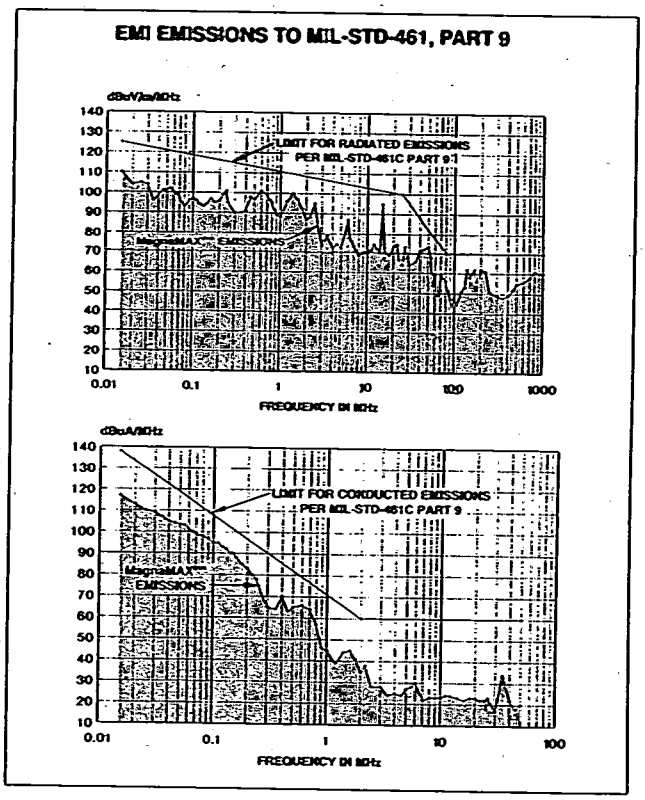
Multiple Use of Current Transformers. The same current transformers can be used for multiple functions. The voltage regulator does not require separate transformers for paralleling or metering.

Ease of Use. All regulator adjustments and LED indicators are located on one side for easy use and adjustment. Push button controls allow adjustment of the various regulator functions.

Volts-Per-Hertz Operation. Protects the generator during underspeed operation and aids the prime mover during 100% block load pickup. Adjustable transition between flat regulation and volts per hertz ramp adjustable from 40 to 70 hz. True volts per hertz operation down to 30 hertz.



EMI Suppression. Internal electromagnetic interference filter meets MIL-STD-461C, Part 9 for radiated and conducted emissions susceptibility when mounted in the MagnaMAX generator conneciton box.



MARATHON® ELECTRIC

MARATHON ELECTRIC MFG., CORP., P.O. BOX 8003, WAUSAU, WISCONSIN USA 54402-8003, (715) 675-3311
FACSIMILE NO. (715) 675-7290 TELEX NO. 260175

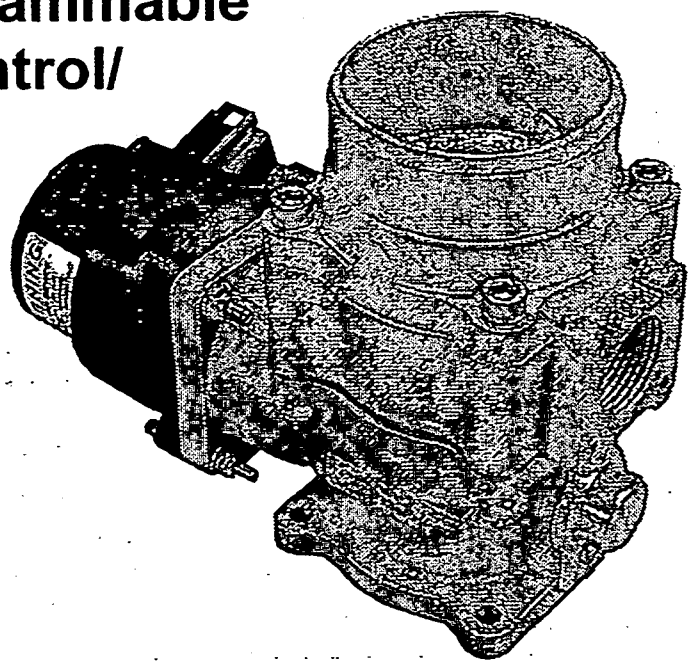
SB386 3/95 Printed in U.S.A.

WOODWARD

Product Specification
03222

LC-50

Integrated gas mixer, throttle body, and programmable speed control/ actuator



- Integrated, bi-directional actuator and programmable speed control
- Suitable for gaseous engines
- OEM configurable
- Venturi mixer has superior mixing with no moving parts
- Eliminates external linkages
- Reduces total engine assembly costs
- Optional positioner mode
- Five sizes available
- Optional air/fuel ratio trim valve
- Sealed ball-bearing throttle body design
- Optional external throttle position switch

APPLICATION

The LC-50 is designed for use on gaseous fueled industrial engines between 5 and 100 kW (7 and 134 hp). The throttle and venturi sizes are between 24 and 50 mm. Applications include power generation, refrigeration units, pumps, irrigation, and mobile industrial.

The mixer can be used with propane and natural gas and requires a zero pressure regulator. The throttle body incorporates the proven Woodward LCS speed control, which operates the throttle plate. The LC-50 can be programmed via the RS-232 port of a PC/laptop to a variety of configurations, as follows:

- isochronous speed control
- droop
- auxiliary input
- dual dynamics
- adjustable ramp time
- self-tuning
- overspeed/underspeed protection
- remote speed setting
- three speed select
- error relay driver

DESCRIPTION

The LC-50 provides a building block approach to total engine management. This modular design consists of a die-cast aluminum throttle body, mixer, plus a fully programmable integrated digital speed control and bi-directional actuator.

This unique design includes a venturi style annular ring mixer with no moving parts for superior mixing. The throttle body incorporates a corrosion-protected, plated steel shaft, plate, and a sealed ball-bearing design for durability and long life. An internal throttle return spring is standard to close the throttle in the event of power failure.

The LC-50 modular design reduces total engine assembly cost, eliminates external linkages, lowers inventory and part number proliferation. The programmable controller offers security to your configuration.

The LC-50 is compatible with Woodward's venturi-style mixer and other brands of gas mixers using suitable adapters (see LCS product specification 03225 for actuator details and operating parameters).

WOODWARD

Woodward /
Industrial Controls
PO Box 1519
Fort Collins CO 80522
1000 East Drake Road
Fort Collins CO 80525
Ph: (1)(970) 482-5811
Fax: (1)(970) 498-3058

Manufactured by
Woodward / Small
Industrial Engine Controls
102 Mitchell Road
Oak Ridge TN 37830

NSF

Quality System Registered to
ISO 9001:1994
(with QS-9000:1998)

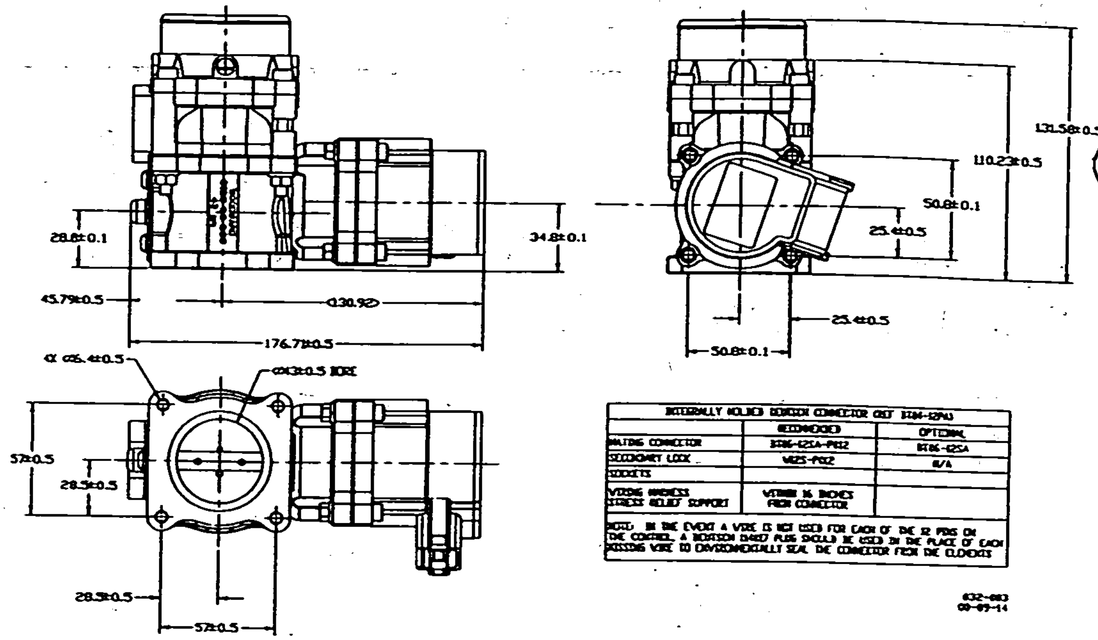
Dutch Council for Accreditation

American National Standards Institute–Registrar Accreditation Board

Distributors & Service
Woodward has an international network of distributors and service facilities. For your nearest representative call (1)(800) 835-5182 or see the Worldwide Directory on our web site.

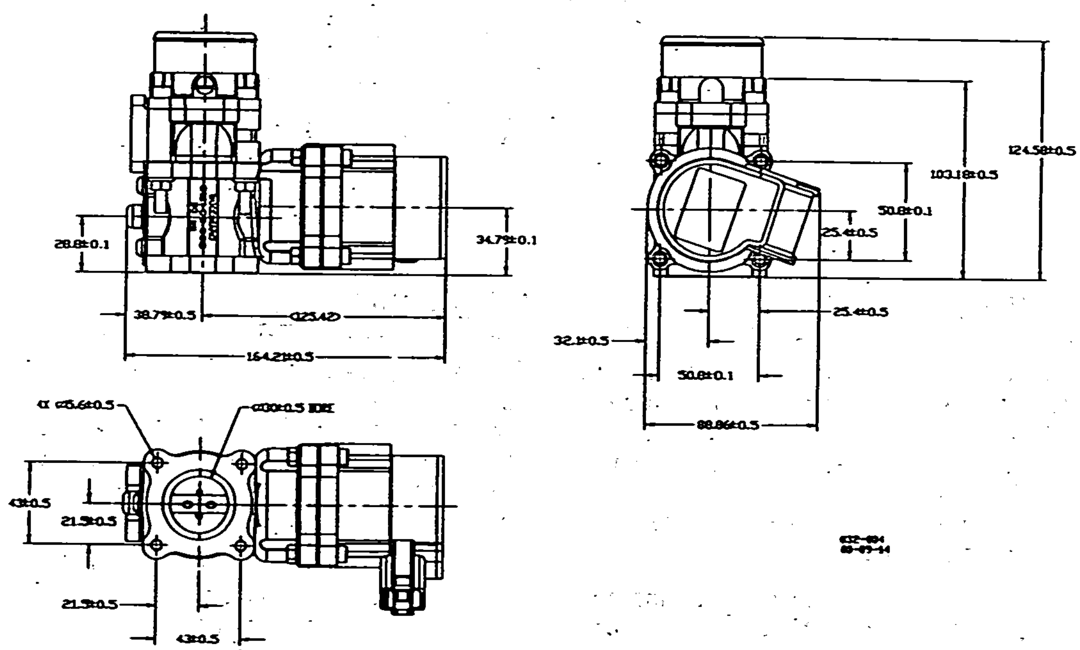
Corporate Headquarters
Rockford IL, USA
Ph: (1)(815) 877-7441

www.woodward.com



INTERNALLY HOUSED DEUTSCH CONNECTOR [illegible]		
	RECOMMENDED	OPTIONAL
MATING CONNECTOR	[illegible]	[illegible]
SECONDARY LOCK	[illegible]	N/A
SOCKETS		
WIRING HARNESS STRESS RELIEF SUPPORT	WITHIN 16 INCHES FROM CONNECTOR	
NOTE: IN THE EVENT A WIRE IS NOT USED FOR EACH OF THE 12 PINS ON THE CONTROL, A [illegible] PLUG SHOULD BE USED IN THE PLACE OF EACH MISSING WIRE TO ENVIRONMENTALLY SEAL THE CONNECTOR FROM THE ELEMENTS		

Representative Drawing of 43 mm LC-50



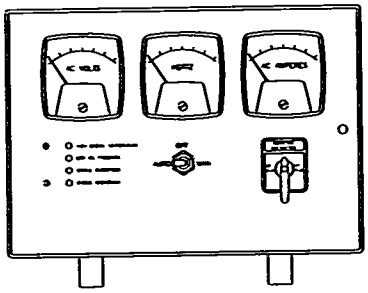
Representative Drawing of 30 mm LC-50

For more information contact:

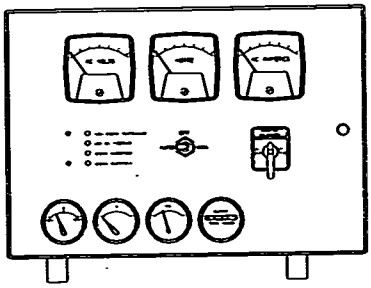
CONTROL PANELS TECHNICAL INFORMATION

KATOLIGHT CORPORATION

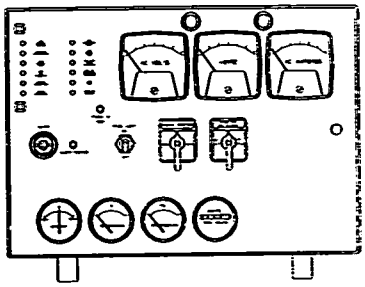
☐ **40 Series (Optional) Air Cooled Engine Models**



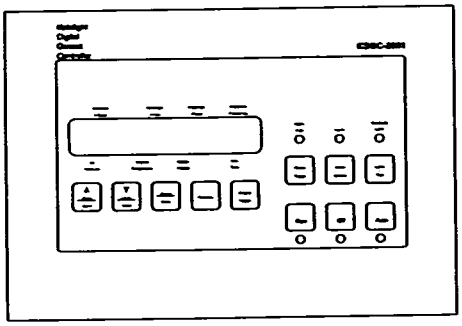
☐ **45 Series (Standard) Water Cooled Engine Models**



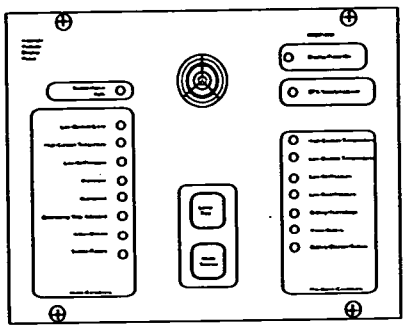
☐ **50 Series (Optional)**



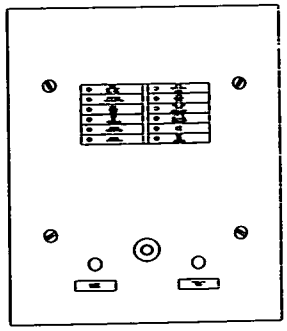
☐ **KDGC-2001 (Optional)**



☐ **KRDP-110 (Optional)**



☐ **12 Light Annunciator (Optional)**



Note: Make your panel and/or annunciator selection on this page by checking the appropriate panel option and then refer to information that follows pertaining to that selection.

TABLE OF CONTENTS	

■ 40, 45, and 50 Series
Katolight Standard Control Panels

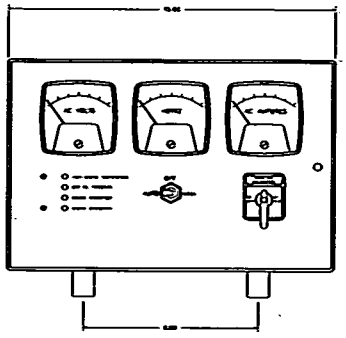
STANDARD FEATURES

Voltmeter: 3 ½ ", 2% Accuracy
Ammeter: 3 ½ " , 2% Accuracy
Frequency Meter: 3 ½", 55-65 Hz Dial Type
Combination Selector Switch
- 4 position, 3 phase
- Ammeter (only) 3 phase, 1 position
- (4) Vibration shock mounts

Engine Control:
- KASSEC, 12 or 24 volt DC with cycle cranking timer, 5 engine shutdowns with 4 separate failure lights, when the following conditions are indicated:
- High water temperature/low water level
- Low oil pressure
- Engine overspeed
- Engine overcrank
- A three position mode switch (auto-off-manual). Engine control is designed for switch grounding on failure.

All Standard series control panels are complete packages, ready for installation. The panels have been designed and tested to insure a reliable quality product.

Standard 40 Series-

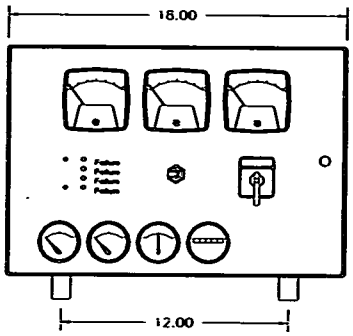


Optional Features available for the 40 Series:
- Alarm buzzer with silencing switch
- Auxiliary relay for dry contacts (1 max.)
- Emergency stop button

OR
- Two hooded panel lights & on/off switch

Engine Fail Relay
Engine Run Relay
Low Water Level LED

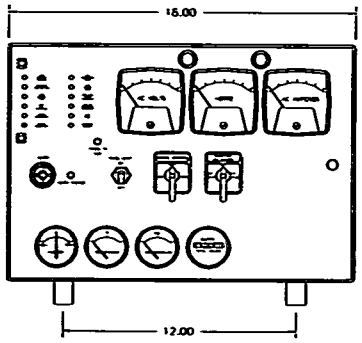
Standard 45 Series-



Additional Engine Gauges are displayed on the 45 Series Control Panel:
- Battery Charging DC Ammeter, 2"
- Water Temperature, 2"
- Oil Pressure, 2" Running Time Meter, 2" DC, 5 digits
- DC Running Time Meter, 5 digits, 2"

Optional Features available for the 45 Series:
- Emergency stop button
- Alarm buzzer with silencer switch
- Auxiliary relay for dry contacts (2 max.)
- Low water level LED
- Two hooded panel lights & on/off switch
- NEMA 12 enclosure adder

Standard 50 Series-



Additional Features on the 50 Series:
- Oil Pressure Gauge with Sender
- Coolant Temperature Gauge with Sender
- Battery Charger Ammeter
- Running Time Meter (DC)
- Two Hooded Panel Lights with On/Off Switch

Additional Engine Controls displayed on the 50 Series Control Panel:
- Low Battery Voltage
- Charger Malfunction
- EPS Supplying Load
- Low Oil Prealarm
- High Engine Temperature Prealarm
- Low Fuel (add switch to fuel tank)
- Unit Not in Auto

■ KDGC-2001
Katolight Digital Genset Controller

Katolight's Digital Genset Controller (KDGC-2001) offers a low cost microprocessor based integrated alternative for small to medium sized genset control and monitoring. Control includes engine starting and shutdown as well as system monitoring and remote annunciation. KDGC-2001 allows user inputs and programming to provide a reliable, customizable genset controller. This unique design has features not found on any competitive models. It monitors and displays up to eight engine and generator parameters on the front panel and up to a total of 28 parameters via the front panel scrolling feature.

FEATURES

- Microprocessor based design
- Permanently displays eight parameters
- Displays 28 generator set parameters
- Controls engine starting and shutdown
- Front panel programmability
- PC settable via the serial link
- LCD display with backlighting
- Programmable engine cranking
- Programmable alarm setpoints
- NFPA 110 Level 1 compatible
- Optional dial out modem
  informs a pager of alarm or pre-alarm
  four phone number capability
- Additional I/O (Optional)
  four input and eight output contacts, inputs labeled for LCD display, programmable outputs
- Remote annunciation via Katolight's model KRDP-110
- Enhanced Communication Option
  provides remote start-stop control, viewing of faults, metering of parameters. Requires internal modem option

SPECIFICATIONS

Environmental Specifications

- Vibration: 10 to 500 Hz at 2 Gs
- Shock: 15 Gs in each of three mutually perpendicular axes
- Ambient operating temperature: -40°C to +70°C
- Salt Fog Testing: Per ASTM 117B-1989 for 100 hours
- Weight: 1.9 pounds (0.86 kilograms)

SPECIFICATIONS (CONT.)

Inputs

DC Power Input (Battery)

- 12Vdc nominal systems (8-16Vdc)
- 24Vdc nominal systems (16-32Vdc)
  (Both Negative Ground systems)
- Power dissipated is 16 Watts

General Voltage Input: 12-576Vac continuous, 50/60 Hz at less than 1 VA

Generator Line Current: 1 or 5 Amp at less than 1 VA

Oil Pressure Sender: 0 to 100 PSI (34-240Ω)

Coolant Temperature: 100°F to 300°F (37°C to 149°C) (62.6-637.5Ω)

Speed Input: Magnetic pickup 3V peak minimum to 35V. Peak into a 10kΩ (32Hz-10kHz) impedance

Fuel Level: 0-100% (240-33Ω)

Contact Sensing Inputs: Emergency Stop, Low Coolant Level, Automatic Transfer Switch

Outputs

Contact Ratings:

10A at 24 Vdc make, break, and carry
(Crank, Fuel solenoid)
2A at 24 Vdc make, break, and carry
(EPS supplying load, Alarms, Pre-Alarms, Pre-start pre-alarms)

Monitoring

GENERATOR

- **Generator Voltage:** 0 to 600 Vac
  Display range is 0 to 15,000 V
  Accuracy is ±0.5% of indication or 1 a RMS at 25°C (with Phase selection switch and panel indication)
- **Generator Frequency:** Derived from voltage inputs
  Display range is 4 to 70 Hz
  Accuracy is ±0.25% of indication or 0.1 Hz at 25°C
- **Line Current Input:** 0 to 5 Aac or 0 to 1 Aac RMS
  Display range is 0 to 5000 A
  Accuracy is ±0.5% of indication or 1 a RMS at 25°C (with phase selection switch and panel indication)
- **kVA:** Calculated from voltage and current inputs
  Display range is 0 to 9999 kVA
  Accuracy is ±0.5% of indication or ±0.1 kVA, whichever is greater at 25°C
- **kW:** Calculated from voltage and current inputs
  Display range is 0 to 9999 kW
  Accuracy is ±0.5% of indication or ±0.1 kW, whichever is greater at 25°C
- **Power Factor:**
  Calculated from voltage and current inputs
  Display range is =1.0 to -1.0PF both leading and lagging
  Accuracy is ±0.01PF of indication at 25°C
- **kWH:** Display range is 0-999,999,999 kWH
  Accuracy is ±0.5% of reading or ±1 kWH whichever is greater at 25°C

SPECIFICATIONS (CONT.)

ENGINE

- Oil pressure: input from sender
  Display range is 3 to 100 PSI or 103-1035kPP
  Accuracy is ±0.5%or ±1PSI/1kPA,
  whichever is greater at 25°C
  (with Stewart Warner sender 411K or equivalent)
- Coolant temperature: input from sender
  Display range is 100°F to 300°F (37°C to 149°C)
  Accuracy is ±0.5% or ±1°F/1°C
  whichever is greater at 25°C
  (with Stewart Warner sender 334P or equivalent)
- Battery voltage: input from battery is 0 to 36Vdc
  Display range is 3 to 36Vdc
  Accuracy is ±0.5% of indication or ±0.1 volts,
  whichever is greater at 25°C
- Engine runtime: display range is 0 to 99,999 hours
  Accuracy is ±0.5% of indication or ±1 hour, whichever is greater at 25°C
- Fuel level: input from sender
  Display range is 0-100%
  Accuracy is ±0.5% of indication or 1% at 25°C
- RPM: display range is 750 to 3600 RPM
  Accuracy is ±0.5% of indication or ±2 RPM,
  Whichever is greater at 25°C

NOTE: Final engine parameter accuracies are subject to sender accuracy.

Total Monitored Parameters

GENERATOR

Voltage (three phases and three phases to neutral)

Current (three phases)	kWH
KW total and per phase	Power Factor
kVA total and per phase	Frequency

ENGINE

Oil pressure	Hours to next service
Coolant temperature	Total run time
Fuel level	Engine RPM
Battery voltage	

GENERATOR SET PROTECTION

Alarms:

- Low oil pressure
- Overspeed
- Overcrank
- Emergency Stop button input
- High coolant temperature
- Sender failure
- Low coolant level
- Low fuel level

Pre-Alarms:

- Low oil pressure
- Engine kW overload
- Maintenance interval timer
- High coolant temperature
- Low coolant temperature
- Battery charger failure
- High battery voltage
- Low battery voltage
- Fuel leak
- Weak battery
- Low fuel level

TIMERS

- Engine cooldown: 0 to 60 minutes
- Engine maintenance: 0 to 5000 hours
- Pre-Alarm time delays:
  Weak battery and low battery voltage: 1-10 seconds
- Alarm time delays:
  - Overspeed: 0-500ms
  - Sender failure: 0-10 seconds
- Arming delays after crank disconnect:
  - Low oil pressure: 5-15 seconds
  - High coolant temperature: 50-150 seconds
  - Pre-crank delay: 0-30 seconds

Serial Communications

The KDGC-2001 is fully programmable via the RS-232 DB9 connector. The KDGC-2001 may be programmed via the provided Windows® 95 software. This software permits individual parameter setting or complete file transfers from a personal computer to the KDGC-2001 for fast, accurate setup of the KDGC-2001.

The KDGC-2001 also has an RS-485 port for four-wire communications to the KRDP-110 remote display unit. This unit may be placed up to 4000 feet from the KDGC-2001 and provides NFPA-110 compatible annunciation of 17 operating and alarm indications with only four wires.

KDGC-2001 FRONT PANEL DISPLAY

Figure 1 shows the front panel human-machine interface (HMI) for the KDGC-2001

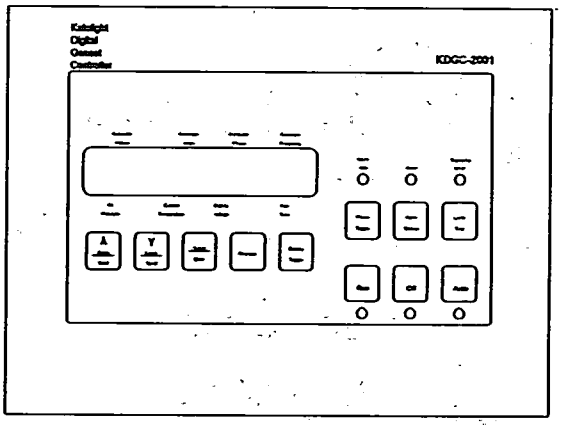


Figure 1 - Front Panel

FRONT PANEL LED INDICATORS

Run:	Indicates the engine is running (operating)
Off:	Indicates the engine is not running (shutdown)
Auto:	Indicates the unit is in the AUTO mode of operation
Not-in-Auto:	Indicates unit is not in the AUTO mode
Alarm:	Indicates an alarm situation by continuous illumination. Indicates a Pre-alarm by flashing
Supplying Load:	Indicates the system is supplying power to the connected load

PACKAGING:

KDGC-2001 is delivered ready to install. It utilizes 1/4" quick connect fasteners for interconnection to the genset.

DIMENSIONS

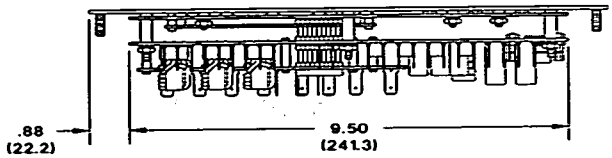


Figure 2 - Dimensions - Top View

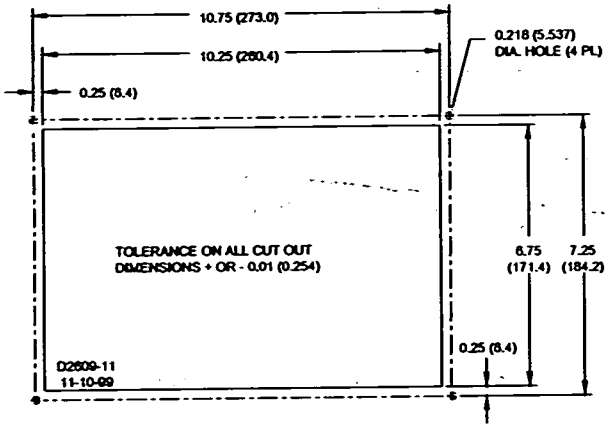


Figure 3 - Case Cutout Dimensions

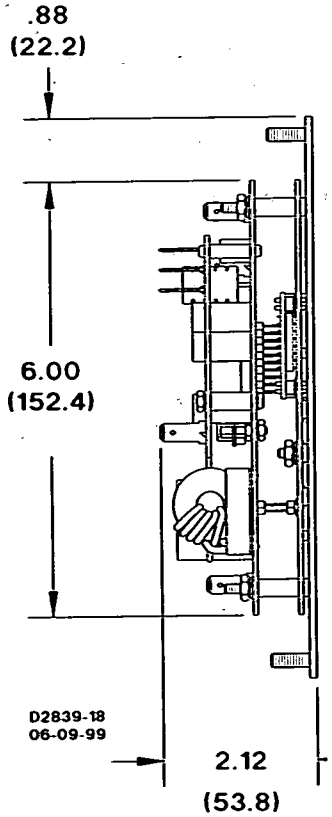


Figure 4 - Dimensions - Side View

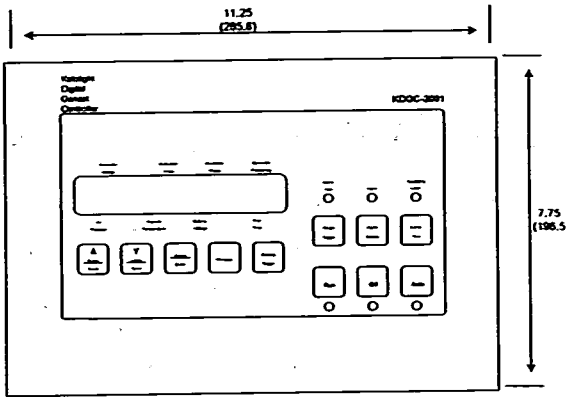


Figure 5 - Dimensions - Front View

NOTES: 1. Dimensions in parentheses are in millimeters
2. All drawings and data subject to change without notice.

CONNECTIONS

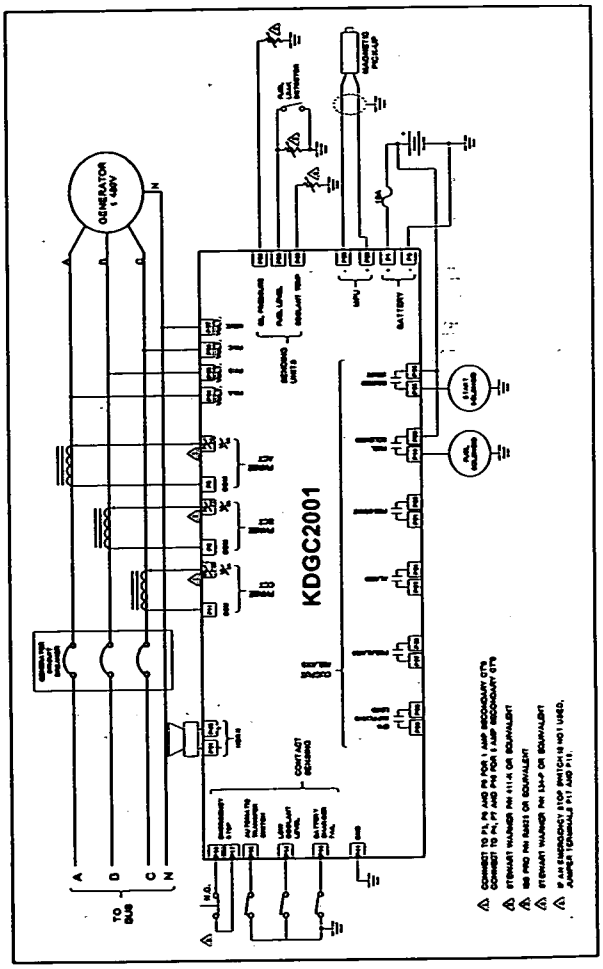


Figure 6 - KDGC 2001 Wiring

■ KRDP-110
Katolight Remote Display Panel

The KRDP-110 is used in conjunction with the KRDP family of Digital Genset Controllers to provide remote annunciation of the emergency standby generator system. This panel complies with the requirements of NFPA 110. The KDGC detects an alarm or pre-alarm conditions and communicates via RS-485 to the KRDP-110. The KRDP-110 is available in two mounting configurations, surface and semi-flush mount.

FEATURES

- Annunciation of 17 alarms and pre-alarms as detected by the KDGC
- Audible alarm horn
- Lamp test and Alarm Silence
- Power supply inputs for 12, 24Vdc or 120Vac (at the KRDP-110 location)
- RS-485 communication reduces the number of interconnection wires to four
- Two mounting configurations
- Conduit box included
- Designed for use in harsh environments

DESCRIPTION

The KRDP-110 is a remote annunciation device used in conjunction with the KDGC family of digital genset controllers, to meet the requirements of NFPA-110. The KRDP-110 may be powered from the starter batteries at 12 or 24Vdc, or it may be powered with an ac source at 120Vac. The KRDP-110 uses RS 485 communications between the KRDP-110 and the KDGC to limit to only four of the number of wires required to activate all the alarms. The RS-485 communications can be used on remote displays up to 4000 feet away from the KDGC. The KRDP-110 has 18 LEDs to indicate Alarms, Pre-Alarms and operating conditions of the emergency standby generator system. It has an audible alarm horn rated at 80db (from a distance of two feet). The KRDP-110 is available in two mounting configurations, semi-flush and surface mount. The KRDP-110 also comes complete with a conduit box for easy installation.

SPECIFICATIONS

Power Input
DC Voltage: 8-32Vdc (2.5W)
AC Voltage: 80-144Vac (5VA)

Communications Port
RS-485 interface with KDGC

Isolation
1800Vdc for one minute between chassis ground and AC voltage input. 700Vdc for one minute between any of the following groups:

- Chassis ground
- Battery and RS-485 terminals
- AC voltage inputs

RFI (Radio Frequency Interference)
Type tested using 5 watt, handheld transceiver operating at random frequencies centered around 144MHz and 440MHz with the antenna located within six inches (15 centimeters) of the device in both vertical and horizontal planes.

Environmental and Physical

- Operating temperature: -40°C to +70°C (-40°F to +158°F)
- Storage temperature: -40°C to +85°C (-40°F to +185°F)
- Salt Fog: Qualified to ASTM B 117-1989
- Vibration: The device withstands 2g in each of the three mutually perpendicular planes, swept over the range of 10 to 500Hz for a total of six sweeps, 15 minutes each sweep, without structural damage or degradation of performance.
- Shock: 15g
- Weight: 6.5 pounds (3 kilograms)
- Grounding: Twisted Pair Belden 9463 is grounded on the remote display side to earth ground.

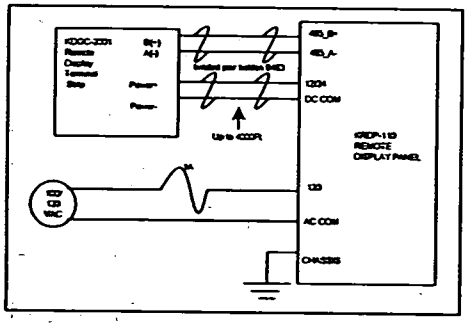


Figure 1 - Typical Interconnection Diagram

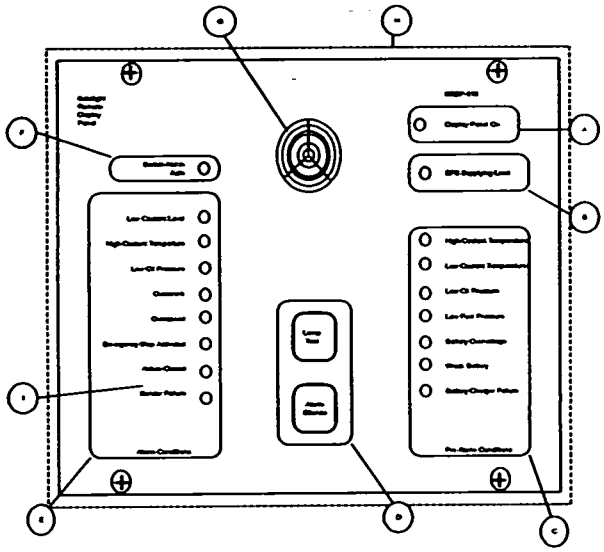


Figure 2 - Front Panel Controls and Indicators

A. LED illuminates when power is applied to the KRDP-110.

B. LED turns ON when the generator supplies more than two percent of rated current.

C. Pre-Alarm Conditions

D. Pushbuttons
Lamp Test Pushbutton exercises the audible alarm and tests all LEDs.
Alarm Silence Pushbutton silences the audible alarm.

E. Alarm Conditions

F. LED illuminates when the KDGC is not in AUTO

G. Audible alarm annunciates when KDGC is not in AUTO and when alarms and pre-alarms occur

H. Dashed line indicates the front panel outside edges when semi-flush mounted.

I. When a KRDP-110-1 is selected, this label indicates "Fuel Leak/Fuel Sender Failed".

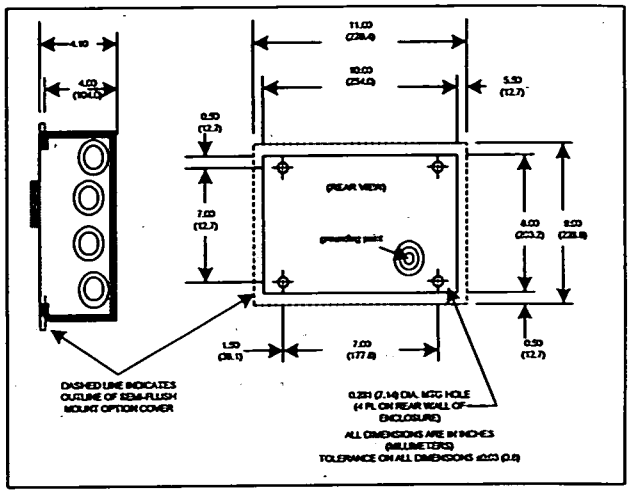
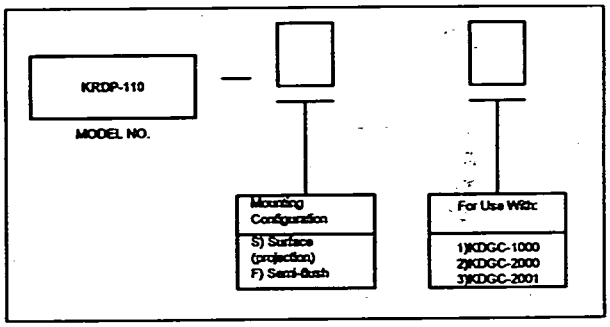


Figure 3 - Outline Diagram

ORDERING INFORMATION

Style Number Identification Chart

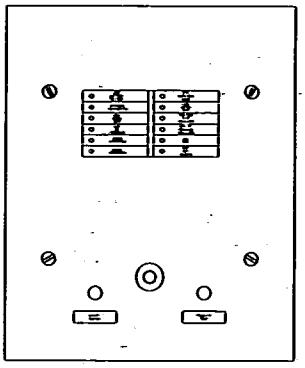


■ Repetitive Alarm Annunciator Panel:

The attractive standard panel face is of cold rolled steel flat black paint (18 gauge).

KATOLIGHT ANNUNCIATORS MEET THESE SPECIFICATIONS: The National Electric Code: Section 700-12, and the National Fire Protection Association: Section No. 110, standard for emergency and standby power systems. These codes require audible and visual signal devices powered by an electrical storage battery to give warning of derangement or alarm conditions in the alternate electric power source (standby electric generating set). The signal device (ANNUNCIATOR) must be installed outside the standby generating room in a location readily observed by operating personnel at a regular work station. In accordance with NFPA 110 the alarm of the annunciator system will not be permanently shut down or bypassed. Katolight's control of the repetitive alarm annunciator audible system allows for a first alarm to be silenced and if a second alarm occurs, the audible alarm system will again sound the alarm. Other Codes and Specifications also include these requirements.

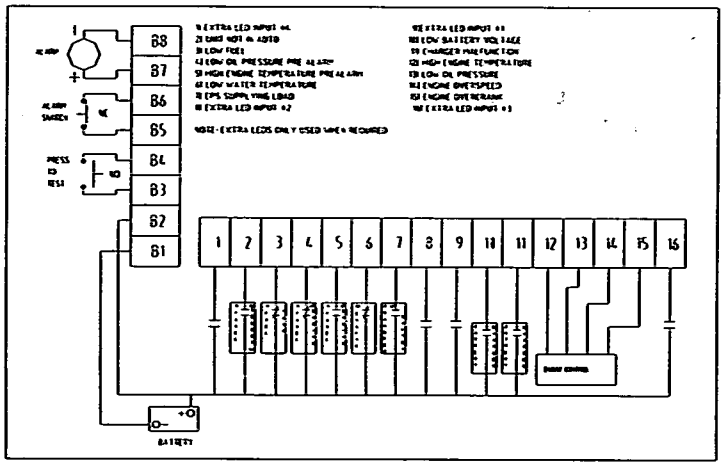
12 OR 24 Volt



FUNCTIONAL LED'S ARE AUDIBLE/VISUAL OR BOTH

LED Legend	Condition Indicated	Derangement Signals		Adders Required	
		Audible	Visual	External Contacts	Contact Location
Low Battery Voltage	Charger Failed	NO	YES	N.O.	Battery Charger
Charger Malfunction	Battery Charger Failed	NO	YES	N.O.	Battery Charger
High Engine Temperature	Excessive Water Temperature	YES	YES	N.O.	Engine Control
Low Oil Pressure	Low Lube Oil Pressure	YES	YES	N.O.	Engine Control
Engine Overspeed	Engine Overspeed	YES	YES	N.O.	Engine Control
Engine Overcrank	Elec. Plant Failed to Start	YES	YES	N.O.	Engine Control
EPS Supplying Load	Elec. Plant Carrying Load	NO	YES	N.O.	Transfer Switch
Low Water Temperature	Low Water Jacket Temperature	YES	YES	N.O.	On Engine
High Engine Temp. Prealarm	Water Temp Approaching Limit	YES	YES	N.O.	Panel
Low Oil Pressure Prealarm	Oil Pressure Approaching Limit	YES	YES	N.O.	Panel
Low Fuel	Fuel System Low	YES	YES	N.O.	In Fuel Tank
Unit Not in Auto	Elec. Plant Not in Automatic	YES	YES	N.O.	Panel On Select Sw.

Low Water Level LED



PANEL COMPONENTS:

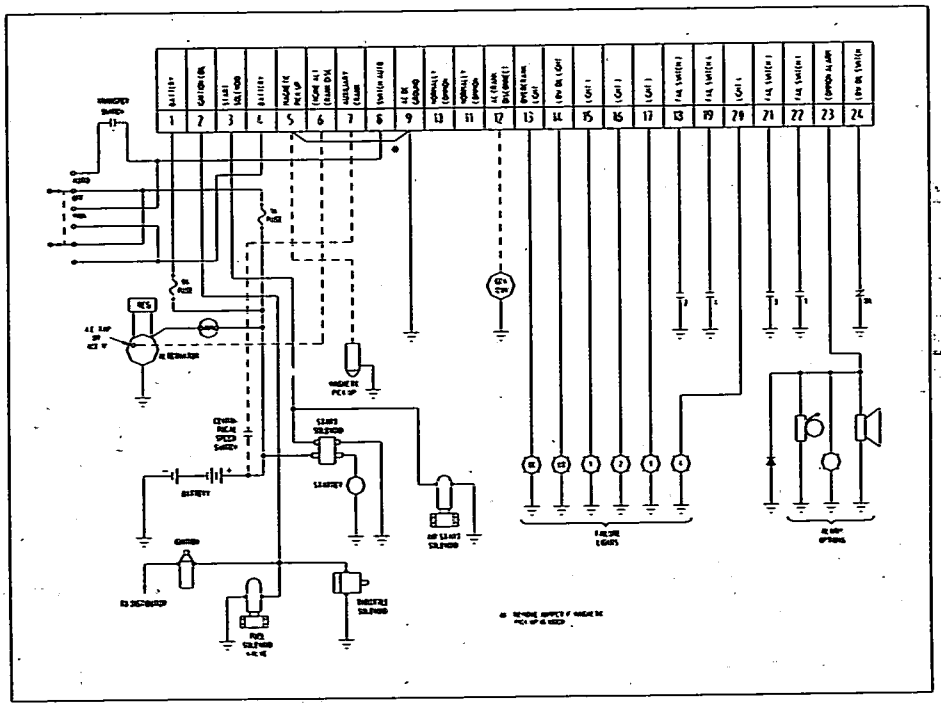
KATOLIGHT ANNUNCIATOR PANELS are designed for either surface or flush mounting. The enclosure has knockouts on top, bottom or either side for ease of installation. The annunciator panels are to be used in conjunction with KATOLIGHT autostart control KASSEC, KLAS 33 and 61 series. NOTE: Up to four extra LEDS are available.

■ Katolight Automatic Solid State Engine Control Technical Kassec Bulletin (12 Volt Or 24 Volt):

Katolight Automatic Solid State Engine Control (KASSEC) will automatically start and stop diesel, gasoline, natural gas and LPG engines or engine-generator sets under the control of an automatic transfer switch of load start contact closed to run. KASSEC is manufactured and tested to the highest quality control standards to ensure reliability.

FEATURES:

- Consistent operation from -30° C (-22° F) to +60° C (+140° F).
- Reliable Katolight solid-state design.
- Accommodates requirements for NFPA-110 annunciator for hospital application.
- Compatibility with virtually all engines in today's marketplace.
- Ease of installation, simple mounting bracket.
- Barrier screw type terminals U.L. and C.S.A. listed, with approved means for solderless connection of conductors.
- Adjustable seven (7) to fifty (50) second engine cranking circuit.
- Adjustable one (1) or five (5) crank, rest cycles.
- Adjustable seven (7) to fifty (50) second oil failure circuit.
- External alarm circuit for remote failure indication. Source 2 Amp Resistive.
- Available for 12 or 24 volt negative ground battery systems.
- Four (4) crank disconnects are available. (Mag pickup, engine alternator, 110 VAC, and auxiliary 12V DC or 24V DC). The mag pickup and engine alternator crank disconnects are adjustable.
- Positive lockout circuits prohibit recranking while engine is running.
- First failure shutdown lockout.
- 8 amp relay contacts for start and ignition system.
- Unit is sealed with a durable conformal coating.



KASSEC Operation:

KASSEC will be in the "standby monitoring" mode whenever terminals #1 and #4 have battery voltage on them. In the "standby monitoring" mode, KASSEC will draw approximately 15 mA of current on the 12 volt model and approximately 17 mA of current on the 24 volt mode.

In the "standby monitoring" mode: when battery voltage is placed on Terminal #8 by the closing of a remote switch, relay or a transfer switch, the logic signal in KASSEC will operate the relays in KASSEC initiating cranking. Terminals #2 and #3 will have battery voltage on during the "cranking" period. During the "cranking rest" period, Terminals #2 and #3 will have zero voltage on them.

If the engine starts, one or more of the crank disconnect terminals #5, 6, 7 or 12 must have a signal placed on them. The KASSEC "start" relay will then open and Terminal #3 will go to zero volts. KASSEC is now in the "run" mode.

KASSEC has cyclic cranking which is adjustable. If the engine does not start in the first period of the cranking cycle, cranking will rest for the second period of the cranking cycle. These periods are equal. KASSEC will repeat cycle-cranking for an adjustable amount of cranks (1-5). If the engine has not started, KASSEC will go into an "overcrank failure" mode and both the Common Alarm Terminal #23 and the Overcrank Failure Terminal #13 will activate and battery voltage will be supplied from these terminals to be used for a failure light. Terminals #2 and #3 will go to zero volts. KASSEC is now locked in an "overcrank failure" mode resettable by turning the power to Terminal #4 off and on again.

When the engine starts, the Oil Failure circuit of KASSEC starts timing. If the Oil Failure Sender Terminal #24 does not activate (open from the ground) before the end of the timing period, KASSEC will go into the "low oil pressure failure" mode and shut the engine down. Terminals #2 and #3 will go to zero volts. The Common Alarm Terminal #23 and the Oil Failure Terminal #14 will activate and battery voltage will be supplied by these terminals to be used for a failure light. KASSEC is now locked in a "low oil pressure failure" mode resettable by turning the power to Terminal #4 off and on again. If Terminal #24 is grounded while KASSEC is in the "run" mode, KASSEC will go into the "low oil pressure failure" mode and shut the engine down. Terminals #2 and #3 will go to zero volts. The Common Alarm Terminal #23 and the Oil Failure Terminal #14 will activate and battery voltage will be supplied by these terminals to be used for a failure light. KASSEC is now locked in a "low oil pressure failure" mode resettable by turning the power to Terminal #4 off and on again.

NOTE: "battery voltage" or "supply voltage" will refer to the battery's positive voltage. "Ground" will refer to the negative side of the battery.

Terminal #1 supplies battery voltage to the high current requirement sections of the circuit. Battery voltage is supplied by KASSEC to the six Failure Lamps (Terminals #13, 14, 15, 16, 17 and 20), the Common Alarm Terminal #23, the Start Terminal #3 and the "energized to run" terminal #2.

Terminal #2 is the "energized to run" terminal. Up to 8 amps is available from this terminal to supply an external engine "run" component such as an ignition coil or fuel solenoid.

Terminal #3 is the Starter Solenoid Terminal. Up to 8 amps is available from this terminal to supply a starter solenoid on the engine.

Terminal #4 supplies battery voltage to all the logic circuitry. Anytime Terminal #4 is brought from the ground to battery voltage, KASSEC will be reset. Note: Terminal #4 is the main reset terminal for KASSEC.

Terminal #5 is the Mag Pickup Crank Disconnect input. This is one of four crank disconnects on KASSEC. When KASSEC is in the "cranking" mode and the input frequency of the mag pickup equals a value set by the adjustable resistor on KASSEC, KASSEC will crank disconnect and go into the "run" mode. If the signal from the mag pickup is lost while KASSEC is in the "run" mode and this is the only crank disconnect being used, KASSEC will go into the "overcrank failure" mode and shut the engine down.

NOTE: Whenever Terminal #5 is not in use, it must be tied to Terminal #9, Ground, to prevent accidental triggering of the crank disconnect circuitry.

Terminal #6 is the Engine Alternator Crank Disconnect Terminal. This is one of four crank disconnects on KASSEC. When an A.C. signal from the stator terminal of the engine alternator is fed to this terminal and KASSEC is in the "cranking" mode, KASSEC will crank disconnect and go into the "run" mode. With KASSEC in the "run" mode, the unit will not shut down or go into overcrank with loss of the alternator Crank Disconnect.

Terminal #7 is the Auxiliary Crank Disconnect Terminal. This is one of four crank disconnects on KASSEC. When a positive voltage is placed on this terminal and KASSEC is in the "cranking" mode, KASSEC will go into a "run" mode and this is the only crank disconnect being used. Loss of the positive voltage on Terminal #7 will place KASSEC into an "overcrank failure" mode and shut the engine down.

Terminal #8 is the Transfer Switch Terminal. This terminal is the main controlling terminal. Anytime this terminal is at battery positive, the unit will be in active modes of trying to start, run, failure. If Terminals #1 and #4 have battery voltage on them and Terminal #8 has no battery voltage present, KASSEC is in a "standby" position. Whenever this terminal is brought to battery voltage, KASSEC will be in an "operate" mode. The only exception to this is when a shutdown failure has occurred. KASSEC can only be reset from a failure mode by bringing Terminal #4 from Ground to battery voltage.

Terminal #9 is the Ground Terminal for KASSEC. All the grounded points should be common to this terminal.

Terminal #10 is not connected.

Terminal #11 is not connected.

NOTE: Terminals #10 and #11 are left open for isolation between Ground and the 120 volts A.C. These terminals may be used as tie points if needed.

Terminal #12 is the 120 volt A.C. Crank Disconnect. This is one of four crank disconnects on KASSEC. When KASSEC is in the "cranking mode" and a 120 volt A.C. 60 Hz. Signal is fed to this terminal, KASSEC will crank disconnect and go into a "run" mode: With KASSEC in the "run" mode, the unit will not shut down or go into "overcrank" mode with loss of the 120 Volt Crank Disconnect.

Terminal #13 is the Overcrank Failure Indicator Terminal. When an overcrank failure occurs, the unit has cranked for a preset number of times and failed to start or the loss of the overcrank signal (mag pickup or auxiliary crank disconnect) has occurred. The maximum "on state" load current that Terminal #13 can supply is two (2) amps resistive.

Terminal #14 is the Oil Failure Indicator Terminal. If Terminal #24 is brought to ground after the oil timer on KASSEC times out, Terminal #14 will supply battery voltage indicating an oil failure. The maximum "on state" load current that Terminal #14 can supply is two (2) amps resistive.

Terminal #15 is a failure indicator output terminal. If Terminal #22 is brought to ground, Terminal #15 will supply battery voltage for a failure lamp. The maximum "on state" load current that Terminal #15 can supply is two (2) amps resistive.

Terminal #16 is a failure indicator output terminal. If Terminal #18 is brought to ground, Terminal #16 will supply battery voltage for a failure lamp. The maximum "on state" load current that Terminal #16 can supply is two (2) amps resistive.

Terminal #17 is a failure indicator output terminal. If Terminal #21 is brought to ground, Terminal #17 will supply battery voltage for a failure lamp. The maximum "on state" load current that Terminal #17 can supply is two (2) amps resistive.

Terminal #18 is a failure sender input terminal. If this terminal is brought to ground, Terminal #16 will indicate a failure and the engine will shut down.

Terminal #19 is a failure sender input terminal. If this terminal is brought to ground, Terminal #20 will indicate a failure and the engine will shut down supplying battery voltage. This terminal will also supply battery voltage if the number of recranks has been satisfied or if a crank disconnect (mag pickup or auxiliary crank disconnect) has been lost. The maximum "on state" load current that Terminal #23 can supply is two (2) amps resistive.

NOTE: When an inductive load is connected on Terminal #23, a clamping diode must be connected across the inductive load.

Terminal #24 is the Oil Failure Sender Terminal. If this terminal is brought to ground after a preset time delay, set by an adjustable resistor, Terminal #14 will supply battery voltage for a failure lamp and the engine will shut down.

Terminal #5 Mag Pickup	Terminal #6 Engine Alternator	Terminal #7 Auxiliary	Terminal #12 120 Volt	Will Shut Down?
		X		YES
X				YES
X		X		YES
			X	NO
		X	X	NO
X			X	NO
X		X	X	NO
	X			NO
	X	X		NO
X	X			NO
X	X	X		NO
	X		X	NO
	X	X	X	NO
X	X		X	NO
X	X	X	X	NO

For a full understanding of the crank disconnects on KASSEC, refer to the crank disconnect chart. Any combination of crank disconnects may be used. As can be seen from the chart, if the signal on Terminal #5, the Mag Pickup Crank Disconnect, is lost while KASSEC is in the "run" mode and this is the only crank disconnect being used, KASSEC will go into an "overcrank failure" mode and shut the engine down. The same is true for Terminal #7, the Auxiliary Crank Disconnect. When used by itself, if this signal is lost while KASSEC is in the "run" mode, KASSEC will go into an "overcrank failure" mode and shut the engine down.

When the combination of Terminals #5 and #7 are used together and KASSEC is in the "run" mode, both crank disconnect signals must be lost, then KASSEC will go into an "overcrank failure" mode and shut the engine down. When using any other crank disconnect or combination of other crank disconnects, loss of one or all of the crank disconnects will not shut the engine down.

(1) Note: Both must be disconnected before unit will shut down.

INSTALLATION RECOMMENDATIONS:

When solid state electronics are used as engine controls, the major problems causing the majority of malfunctions are excessive load currents connected to the outputs, low battery voltages (mainly at cranking) and EMI electrical noise. The following information will help alleviate these problems and insure a proper running system.

1. An auxiliary relay driven by KASSEC should be used whenever the current of an output exceeds the following parameters: total current of starter and ignition outputs, 8 amps; any single failure output 2 amps resistive.
2. If the cranking system for a particular engine demands a very high cranking current, another battery which supplies power only to KASSEC may be required.
3. When fused properly, the maximum load current that KASSEC can supply is 8 amps and the maximum input operating current for KASSEC is 1 amp. The size of wire used to supply power to KASSEC under maximum load should never be less than #16. Proper sizing of wire will eliminate excessive voltage drops when the system requires maximum power.
4. Although KASSEC has been designed to reject induced noise, certain precautions should be taken to reduce the common noise which is present on all engine and generator sets. To prevent false signals from being induced into the magnetic pickup circuitry of KASSEC, the wires to KASSEC from the magnetic pickup should be a twisted of shielded pair.

A. Whenever an inductive load is de-energized, a back EMF which can damage solid state components is generated. To alleviate this effect, a clamping diode should be connected across all inductive loads.

B. Components such as the ignition system, high and low voltage wiring, starter, A.C. generator wiring and battery charger to alternator all generate a certain amount of noise. If possible, wiring connected to KASSEC should be routed away from these components.

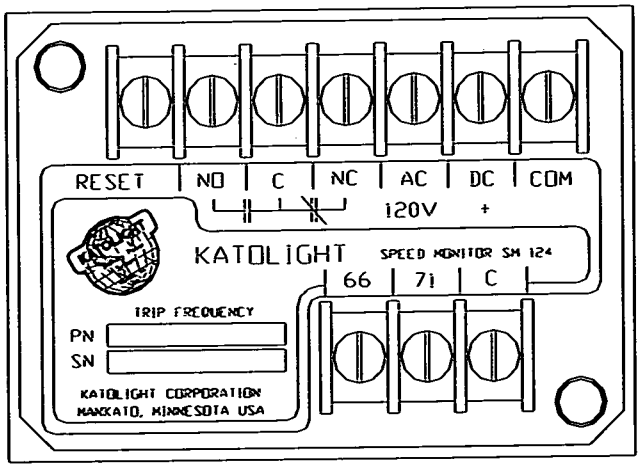
C. A voltmeter, test light or other appropriate test instrument should be used to check the input and output terminal of KASSEC. Shorting any of KASSEC's terminals to battery positive or negative when testing could create major problems if the wrong terminals were to be shorted. This type of testing can result in blown fuses and damage to KASSEC's solid state components.

NOTE: Due to the fact that KASSEC utilizes electrical control to start and stop the engine, any hydraulic or pneumatic devices such as starters or fuel solenoids must have an electrical to mechanical interface to activate them.

Troubleshooting Chart:

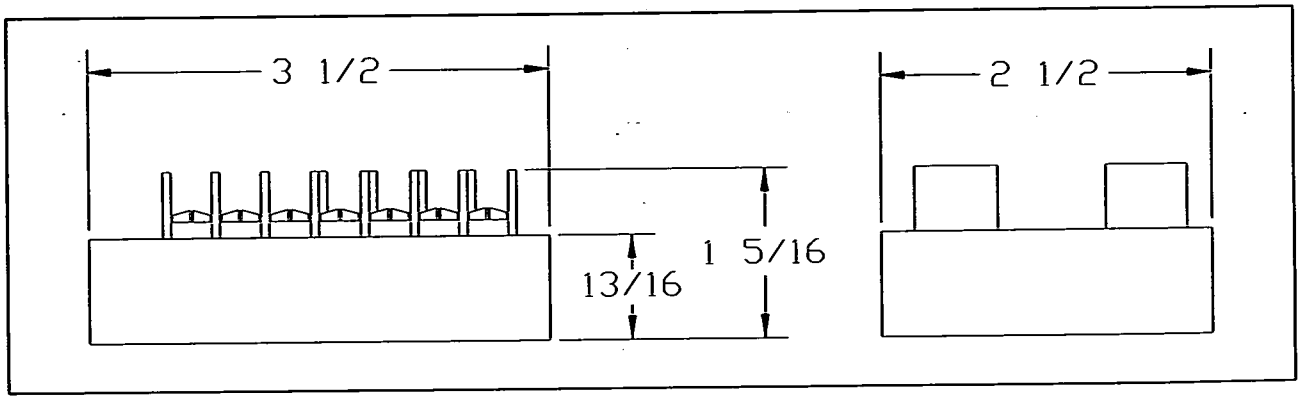
SYMPTOM	CHECK FOR	CAUSE
FAIL TO CRANK	Blown Fuse on Terminal #1	Shorted leads when hooking up or overloaded circuits. Replace fuse with 9 amp fuse
	Low Battery	Defective battery. Charger not functioning. Corroded or loose battery connection.
	Voltage at Start Solenoid	If voltage is present at starter solenoid, may have defective starter or solenoid. If no voltage at starter solenoid, may have open leads to solenoid.
	Voltage Present at Terminal #7	If present, check for voltage source. There should be no voltage present.
	Unused Terminal #5	Terminal #5 should be connected to the KASSEC Terminal #9, ground, when not in use or it may prevent unit from starting.
	Failure Lights	Unit will not crank if any failure lamps are on. Correct failure before trying to start.
UNIT CRANKS, DOES NOT START	Fuel Supply	Empty fuel tank. Air in fuel lines. Wrong pressure on Natural Gas or LPG units.
	Voltage on Terminal #2 While Cranking	If present may have defective fuel valve, defective ignition system or loose connection.
UNIT WILL START THEN FAIL	Loss of Fuel	Empty fuel tank. Restricted fuel filter. Restricted, broken or loose fuel line.
	Failure Lights	Overcrank light lit – Lost signal on Mag Pickup Crank Disconnect Terminal or lost signal on Auxiliary Crank Disconnect terminal after unit started. Low Oil light lit – Low oil in crankcase. Oil pump failed. Defective pressure switch. High Water Temperature light lit – Low water level in radiator. Thermostat closed. Broken fan belt. Restricted flow through radiator. Ambient temperature too high. Defective temperature switch. Overspeed light lit – Lost governor control. Defective overspeed switch.
	Loose or Open Connections	May have lost power to control or ignition system.
UNIT STARTS BUT STARTER DOES NOT DISENGAGE	Voltage on Terminal #3 After Unit Running	Signal must be present at either Terminal #5, 6, 7, or 12 after unit starts to operate crank disconnect of control.
	No Voltage on Terminal #3 After Unit is Running	Starter drive could be hanging up or the solenoid on starter is not disengaging.

■Speed Monitor – Model SM124
(Protects Generator Sets Against Engine Overspeed)



SPECIFICATIONS:

- Construction – Epoxy Encapsulated
- Sensing – 120 VAC
- Operating Trip Point – 66.5 or 71 Hz selectable
- Switch Contact Rating - .6 amp, 120 VAC resistive - 2 amp, 40 VDC
- Operating Temperature - -40 to +70° C. (-40 to + 158° F)
- Current Draw - .07 amp maximum
- Voltage – 12 or 24 VDC #35083
- Accuracy = ± .5 Hz.
- Mounting – two holes



Katolight Circuit Breaker Enclosures

Dimensions

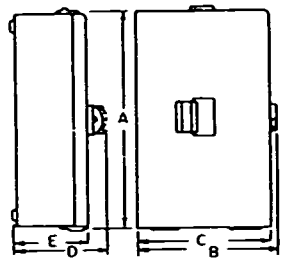


Fig. 1 Suffix F (flush)
Suffix S (surface)

Type 1

See Fig. 1

Catalog Number	Dimensions in Inches					Outline Drawing Number
	A①	B①	C①	D	E	
TE100F,S	17	—	7⅞	5½	4¾	139C5651 Sh 1
TE150F,S	26 9/16	8⅞	8⅞	6 9/16	5½	139C5497 Sh 1
TF225F,S	29⅞	8⅞	8⅞	6 9/16	5½	139C5497 Sh 2
SG400F	31⅜	—	15 5/32	7 9/16	6⅝	208C2891 Sh 1
SG400S	30 9/16	—	14⅛	7 9/16	6⅝	208C2891 Sh 1
TJ400F,S②	27 1/16	15 7/16	15 7/16	7⅛	6 7/16	139C5497 Sh 3
SG600F	44	—	18 9/16	9	8⅜	208C2891 Sh 2
SG600S	42¾	—	17⅛	9	8⅜	208C2891 Sh 2
TJ4V600F,S	46⅝	17 3/16	17 3/16	9 1/16	8⅜	139C5497 Sh 4
TJ600F,S	46⅝	17 3/16	17 3/16	9 1/16	8⅜	139C5497 Sh 4
TJ9V600F,S	46⅝	17 3/16	17 3/16	9 1/16	8⅜	139C5497 Sh 4
TK4V1200F,S	48⅛	21 5/16	21 5/16	9 9/16	8 1/16	139C5497 Sh 5
TPL212C	9 5/32	7½	7½	3 9/16	3 9/16	—
TQC100F,S	15¼	—	6⅞	4¾	4	139C5651 Sh 1
TQD225F,S	26 7/16	8⅞	8⅞	6 7/16	5½	139C5497 Sh 1
TQL70F,S	11⅛	—	5⅞	4	3¼	139C5651 Sh 1
TQL100F,S	15¼	—	6⅞	4¾	4	139C5651 Sh 1

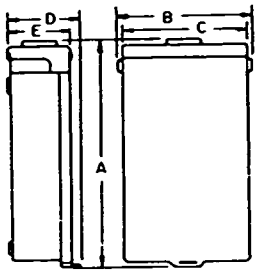


Fig 2. Outdoor Enclosure

Type 3R

See Fig. 2

Catalog Number	Dimensions in Inches					Outline Drawing Number
	A	B	C	D	E	
TE100R	18⅛	7⅞	7½	5 1/16	5⅜	139C5652 Sh 1
TE150R	27 7/16	10¼	10	6¼	5½	139C5498 Sh 1
TF225R	30 13/16	10¼	10	7	6¼	139C5498 Sh 2
SG400R	30 13/16	14 15/16	14⅝	9⅛	8	208C2837 Sh 1
SG600R	43	18⅞	18 9/16	8 13/16	7 1/16	208C2838 Sh 1
TJ400R②	27 9/16	15⅞	15 1/16	8 1/16	8	139C5498 Sh 4
TJ4V600R	46 3/16	18 1/16	18 1/16	8⅝	7⅜	139C5519 Sh 1
TJ600R	46 3/16	18 1/16	18 1/16	8⅝	7⅜	139C5519 Sh 1
TJ9V600R	46 3/16	18 1/16	18 1/16	8⅝	7⅜	139C5519 Sh 1
TK4V1200R	47¾	23⅜	22 9/16	9 1/16	8 9/16	139C5520 Sh 1
TPL212R	9 5/32	7½	7½	3 9/16	3 9/16	—
TQC100R	15¾	7⅞	7½	5 1/16	5⅜	139C5652 Sh 1
TQD225NR	26 13/16	7 13/16	7⅞	5⅛	4 1/16	139C5498 Sh 3
TQD225R	26⅜	10¼	10	6¼	5½	139C5498 Sh 1
TQL70R/100R	17	7¼	6⅞	6	5	139C5652 Sh 1

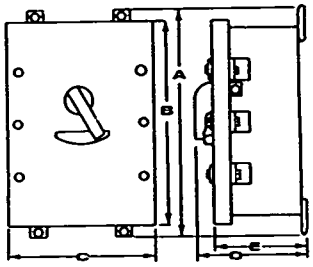


Fig. 3. Stainless Steel

Type 4/4X

See Fig. 3

Catalog Number	Dimensions in Inches					Outline Drawing Number
	A	B	C	D	E	
SE100CS	19¼	18½	8½	7	5	139C5654 Sh 1
TE100CS	19¼	17¼	8½	7	5	139C5654 Sh 1
TF225CS	31¾	30	10 7/16	9 9/16	7⅛	139C5496 Sh 1
SF250CS	36½	35⅜	10⅜	7 15/16	6 9/16	208C2887 Sh 1
TJ400CS②	29¼	27½	16¼	9 9/16	7⅛	139C5496 Sh 2
TJ4V600CS	46¼	45½	19⅛	9 9/16	7⅛	139C5496 Sh 3
SG400CS	32	31¼	14⅛	9 9/16	7 7/16	208C2888 Sh 1
TJ600CS	46¼	45½	19⅛	9 9/16	7⅛	139C5496 Sh 3

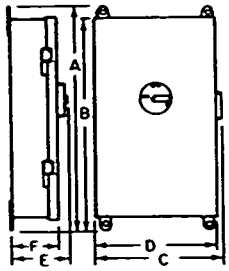


Fig. 4. Suffix D (with KO's)
Suffix J (without KO's)

Type 12 and 12K

See Fig. 4

Catalog Number	Dimensions in Inches						Outline Drawing Number
	A	B	C	D	E	F	
TB100J	23⅛	21⅜	9	8	5¾	4⅜	139C5653 Sh 1
TB400J	48 7/16	46 15/16	17¾	17 3/16	9¾	8⅜	139C5682 Sh 5
TB800J	56 9/16	54 13/16	22 1/16	22	10 7/16	8 1/16	139C5682 Sh 6
SE100D,J	19¼	17 9/16	9	8	5⅜	4⅛	139C5653 Sh 1
TE100D	19¼	17 9/16	9	8	5¾	4⅛	139C5653 Sh 1
TE100J	19¼	17 9/16	9	8	5¾	4⅛	139C5653 Sh 1
SF250D,J	36¼	35⅜	9 13/16	9 9/16	7 9/16	6½	208C2884 Sh 1, Sh 2
TF225D	31¾	30¼	9½	9	7 9/16	6 7/16	139C5682 Sh 1
TF225J	31¾	30¼	9½	9	7 9/16	6 7/16	139C5682 Sh 2
SG400D,J	31⅜	30½	16 9/16	15 1/16	7⅛	6 9/16	208C2885 Sh 1, Sh 2
TJ400D②	29 9/16	27 13/16	14¼	13 9/16	7⅛	6 7/16	139C5682 Sh 3
TJ400J②	29 9/16	27 13/16	14¼	13 9/16	7⅛	6 7/16	139C5682 Sh 4
TJ4V600J	48 7/16	46 15/16	17¾	17 3/16	9¾	8⅜	139C5682 Sh 5
SG600J	44⅛	44	18	17⅜	9 9/16	8⅜	208C2886 Sh 2
TJ600J	48 7/16	46 15/16	17¾	17 3/16	9¾	8⅜	139C5682 Sh 5
TJ9V600J	48 7/16	46 15/16	17 3/16	17 3/16	9¾	8⅜	139C5682 Sh 5
SK1200J	56 9/16	55 7/16	22 1/16	22	10 7/16	8 1/16	139C5682 Sh 5
TK4V1200J	56 9/16	54 13/16	22 1/16	22	10 7/16	8 1/16	139C5682 Sh 6
TK9V1200J	56 9/16	54 13/16	22 1/16	22	10 7/16	8 1/16	139C5682 Sh 6
TK1200J	56 9/16	54 13/16	22 1/16	22	10 7/16	8 1/16	139C5682 Sh 6

① Flush front extends approximately ⅝-inch beyond each side.

② Suitable for parallel 250MCM maximum. If larger cable is applied, use 600-amp enclosure.

NOTES:

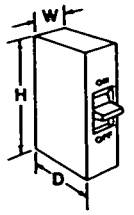
DEM - 0404

Katolight Molded Case Circuit Breakers

Molded Case Circuit Breakers

Quick Reference Guide

Ratings do not apply to molded case switches.



Q Line (UL File E11592; Fixed Thermal Magnetic Trip Unit)

Circuit Breaker Type	Ampere Rating	No. Poles	Maximum Voltage Rating		UL Listed Interrupting Ratings— rms Symmetrical Amps (In Thousands)								Dimensions (In.)							Std. Pack
					ac Voltage						dc Voltage									
			ac	dc	120	120/240	240	277	480	600	125	250	H	W	D	A	B	C	E	
THQP②	15-50	1	120/240	—	—	10	—	—	—	—	—	—	3 9/32	1/2	2 3/8	—	—	—	—	100
		2												1						50
TQL/TQB/ TQC	10	1	120/240	—	—	5①	—	—	—	—	—	—	3 9/32	1	2 3/8	—	—	—	—	50
		2					5①							2						25
		3	240			—								3						15
THQL② THQB② THQC②	15-70	1	120/240	—	—	10	—	—	—	—	—	—	3 9/32	1	2 3/8	—	—	—	—	50
	15-125	2					10							2						25
	15-100	3	240			—								3						15
THHQB② THHQC②	15-70	1	120/240	—	—	22	—	—	—	—	—	—	3 9/32	1	2 3/8	—	—	—	—	50
	15-100	2					22							2						25
		3	240			—								3						15
THHQL②	15-70	1	120/240	—	—	22	—	—	—	—	—	—	3 9/32	1	2 3/8	—	—	—	—	50
	15-125	2					22							2						25
	15-100	3	240			—								3						15
TXQL② TXQB② TXQC②	15-30	1	120/240	—	—	65	—	—	—	—	—	—	3 9/32	1	2 3/8	—	—	—	—	50
		2												2						25
		3	240			—	65							3						15
TQDL	125-200	2	120/240	—	—	10	—	—	—	—	—	—	6 1/16	2	2 3/8	—	—	—	—	12
THQDL	125-200	2	120/240	—	—	22	—	—	—	—	—	—	6 1/16	2	2 3/8	—	—	—	—	12
TQD②	100-225	2	240	—	—	10	10	—	—	—	—	—	6 9/16	2 3/4	2 5/8	2 7/16	2 7/16	—	27/32	1
	100-225	3	240			—	10							4 1/8				1 1/16		1
THQD②	100-225	2	240	—	—	22	22	—	—	—	—	—	6 9/16	2 3/4	2 5/8	2 7/16	2 7/16	—	27/32	1
	100-225	3	240			—	22							4 1/8				1 1/16		1
TJD	250-400	2	240	—	—	22	22	—	—	—	—	10	10 1/8	8 1/4	3 13/16	3 15/16	3 13/16	1 3/8	1 3/16	1
		3	240			—	22													1

CB3 (UL File E51075; Fixed Thermal Magnetic Trip Unit)

THOB THOC THQL ...GF	15-30	1	120	—	10	—	—	—	—	—	—	—	3 9/32	1	2 3/8	—	—	—	—	10
		2	120/240		—	10								2						10
THHQL ...GF, THHQB ...GF	15-30	1	120	—	22	—	—	—	—	—	—	—	3 9/32	1	2 3/8	—	—	—	—	10

① Not UL Listed. ② UL Listed as HACR.

NOTES:

Drawings and data subject to change without notice

Q Line Circuit Breakers

Types TXQL, TXQC, TXQB
15-30 Amps
65,000 Amps IC

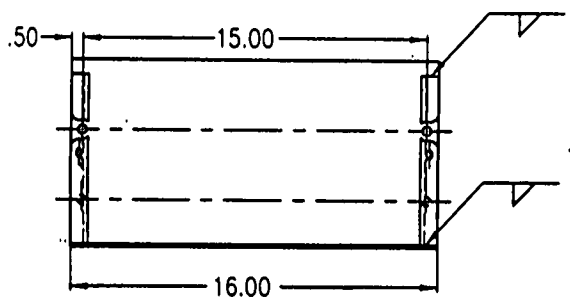
Ampere Rating	TXQL, THQL Plug-in			TXQC, THQC Lug-lug①			TXQB, THQB Bolt-on		
	Item No.	Qty.	Catalog Number	Item No.	Qty.	Catalog Number	Item No.	Qty.	Catalog Number
Single-pole, 120/240 Volts ac②									
15③			TXQL1115			TXQC1115WL			TXQB1115
20③			TXQL1120			TXQC1120WL			TXQB1120
25			TXQL1125			TXQC1125WL			TXQB1125
30			TXQL1130			TXQC1130WL			TXQB1130
Two-pole, 120/240 Volts ac②									
15			TXQL2115			TXQC2115WL			TXQB2115
20			TXQL2120			TXQC2120WL			TXQB2120
25			TXQL2125			TXQC2125WL			TXQB2125
30			TXQL2130			TXQC2130WL			TXQB2130
Three-pole, 240 Volts ac②									
15			TXQL32015			TXQC32015WL			TXQB32015
20			TXQL32020			TXQC32020WL			TXQB32020
25			TXQL32025			TXQC32025WL			TXQB32025
30			TXQL32030			TXQC32030WL			TXQB32030

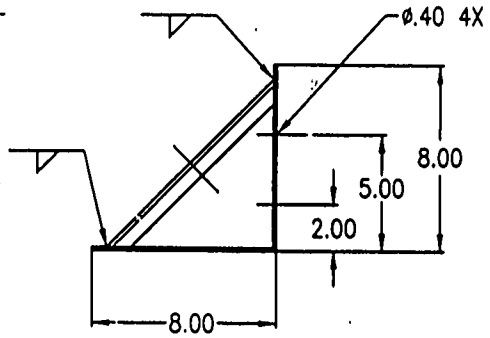
Types TQDL, THQDL, TQD,② THQD,② TJD
100-400 Amps
10,000 and 22,000 Amps IC

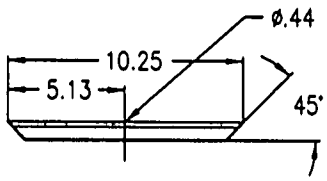
Ampere Rating	10,000 Amp IC						22,000 Amp IC					
	TQDL Plug-in 120/240 Volts ac			TQD Lug-lug④ 240 Volts ac			THQDL Plug-in 120/240 Volts ac			TJD, THQD Lug-lug④ 240 Volts ac		
	Item No.	Qty.	Catalog Number	Item No.	Qty.	Catalog Number	Item No.	Qty.	Catalog Number	Item No.	Qty.	Catalog Number
Two-pole												
100			—			TQD22100WL			—			THQD22100WL
125			TQDL21125			TQD22125WL			THQDL21125			THQD22125WL
150			TQDL21150			TQD22150WL			THQDL21150			THQD22150WL
175			TQDL21175			TQD22175WL			THQDL21175			THQD22175WL
200			TQDL21200			TQD22200WL			THQDL21200			THQD22200WL
225			—			TQD22225WL			—			THQD22225WL
225 Molded Case Switch						TQD22Y225			—			—
250			—			—			—			TJD422250WL
300			—			—			—			TJD422300WL
350			—			—			—			TJD422350WL
400			—			—			—			TJD422400WL
400 Molded Case Switch					—			—				TJD422Y400
Three-pole												
100			—			TQD32100WL			—			THQD32100WL
125			—			TQD32125WL			—			THQD32125WL
150			—			TQD32150WL			—			THQD32150WL
175			—			TQD32175WL			—			THQD32175WL
200			—			TQD32200WL			—			THQD32200WL
225			—			TQD32225WL			—			THQD32225WL
225 Molded Case Switch						TQD32Y225			—			—
Three-pole												
250			—			—			—			TJD432250WL⑤
300			—			—			—			TJD432300WL⑤
350			—			—			—			TJD432350WL⑤
400			—			—			—			TJD432400WL⑤
400 Molded Case Switch						—			—			TJD432Y400⑤

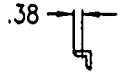
① Requires mounting plate.
② UL Listed as HACR type.
③ UL Listed as SWD (switching duty) rated. Suitable for switching 120-volt ac fluorescent lighting loads.
④ Includes line and load lugs.
⑤ TJD uses same accessories as J600 line.

NOTES:

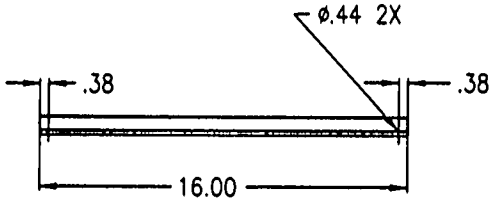




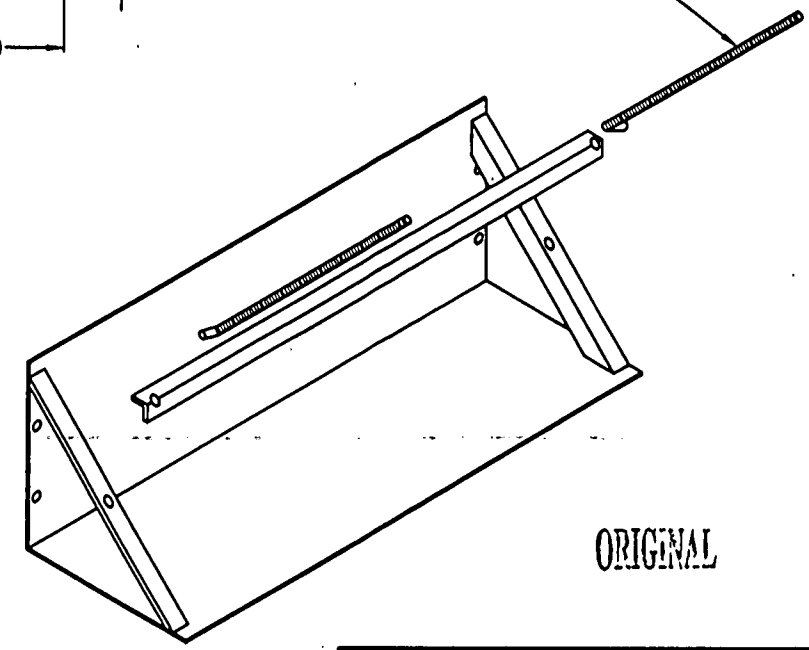




MTG ANGLES
.75 X .75 X .18 ANGLE IRON
2 REQUIRED



BATTERY HOLD DOWN
.75 X .75 X .18 ANGLE IRON
1 REQUIRED



ORIGINAL

NOTES:
1. MATERIAL: 12 GA CRS

REVISIONS: 1. ADDED 4 ø.40 MTG HOLES 9-13-96 MRL
2. ALSO CHANGED TO ø.44 FROM ø.50 MTG HOLES
3. MOVED MTG HOLES FROM 8.00 TO 8.00 FROM BOTTOM AND IN TO .50 FROM SIDES. 9-17-96 MRL

KATOLIGHT
MANKATO, MINNESOTA

BATTERY RACK

SIZE	DATE	DWG NO
B	7-10-91	204-109

SCALE	PART NO	DWN BY	SHEET
.2=1	40509	RAA	1 OF 1

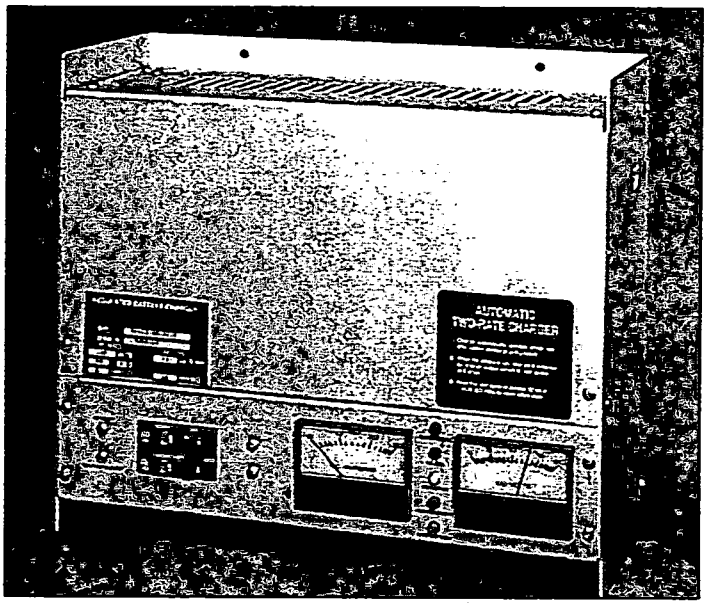
KATOLIGHT® CORPORATION

FC/FCA Battery Charger

Accurate, Completely Automatic Charging for All Battery Types.

- **Automatic 2-rate charging**– offers fastest battery charging and lowest water consumption.
- **Temperature compensation**– eliminates the No. 1 cause of premature battery failure.
- **Compact housing sizes**– saves space and money.
- **Comprehensive alarm system**– provides status on charger and battery (*FCA* only).
- **Rugged aluminum housing**– gives modern appearance and corrosion protection.
- **Proven quality**– means years of trouble-free service.

FCA Battery Charger



Product Highlights

FC and *FCA* battery chargers offer accurate, automatic charging of lead-acid and nickel-cadmium batteries. Unlike unregulated "battery boilers" or poorly regulated ferro-resonant chargers, the output voltage automatically adjusts to changing input, load, battery and ambient conditions. This prevents battery over-charging and consequent loss of battery electrolyte.

FC/FCA chargers are ideal for either lead-acid or nickel-cadmium batteries.

Standard *FC* features include AC line compensation, precision voltage regulation, current limiting, automatic 2-rate charging, voltmeter and ammeter, temperature compensation and UL listing in most sizes.

The *FCA* offers, in addition, a comprehensive alarm system that meets NFPA requirements.

Specifications

Input Frequency & Voltage Range

60 Hz standard; 50 Hz optional, ±5%.
120 volt standard; 100, 208, 230, 277, 380, 480 volt optional, ±10%.

Output Voltage

- 12, 24, or 32 volts nominal.
- Float voltage adjustable from 100% to 120% of nominal.
- Equalize voltage adjusts to 15% above float voltage.

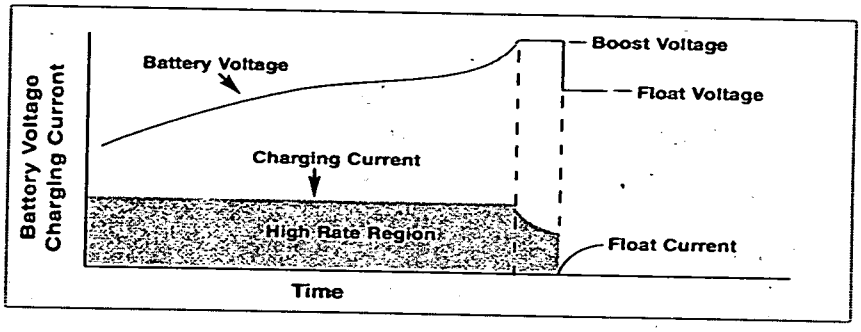
Output Voltage Regulation

±1% of the correct temperature compensated value from no load to full load with simultaneous variations in input voltage of 10% and frequency of 5%.

AUTOBOOST

(See Figure 1)
After battery discharge or AC failure, the charger operates in the high-rate constant current mode until the battery voltage rises to the pre-set BOOST (EQUALIZE) level. The charger will operate in this constant voltage BOOST mode until the battery's current acceptance falls to 70% of the charger's rating. At this point, the charger reverts to the lower FLOAT voltage, where it remains until another battery discharge or AC failure.

Figure 1



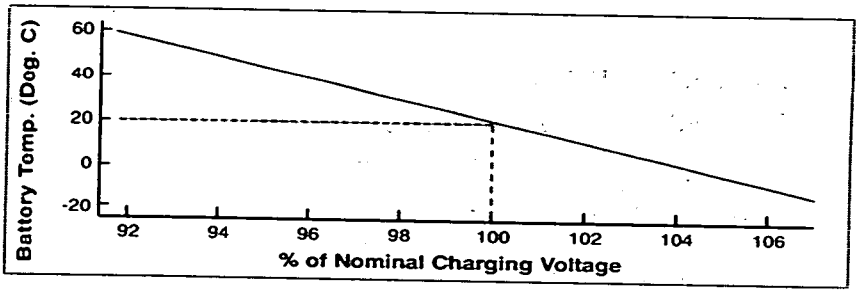
Temperature Compensation

(See Figure 2)
All batteries have a negative temperature coefficient. *FC/FCA* is equipped with the appropriate temperature compensation (-0.2% per deg. C) to assure correct charging in all conditions. Remote sensing of battery temperature is optional.

Current Limiting & Overload Protection

- Soft start – ensures smooth start-up.
- Electronically current limited at 110% of rated output.
- AC & DC fuses (6 & 10 A units).
- AC & DC breakers (20 & 25 A units).

Figure 2



Controls & Adjustments

- Separate internal adjustment for float & boost voltages.
- Separate internal adjustment for low and high DC alarms.

Indicators

DC voltmeter: 2.5" scale (63mm).
DC ammeter: 2.5" scale (63mm).
Alarm indicators and remote contacts optional.
(See Alarm Systems Table)

Ambient

Operating temperature:
-10 C to +50 C.
Humidity: 5% to 95% non-condensing.

Model Number Breakout

FC A 24-10- □□□□□□

Model

Alarm Config.
Blank: No alarms
A: Alarms
*Only available in 6A & 10A units.

Output Voltage

Output Current

Input Volts
2: 120
3: 208
4: 230
6: 277
8: 480*

Alarm System Code
0: No alarm system
2: LEDs & Form C relays:
- AC fail LED
- Charge fail LED
- Low battery voltage LED
- High battery voltage LED
- Charge fail Form C contact
- Low battery Form C contact

4: Alarms #2 plus:
- AC fail Form C contact
- High battery Form C contact

Fuses/ Breakers
1: One-pole AC fuse, one-pole DC fuse
2: Two-pole AC fuse, one-pole DC fuse
3: One-pole AC breaker, one-pole DC breaker factory-selected only.

Float/ Equalize Control
0: Single rate
1: "Autoboost" automatic 2-rate
6: Equalize timer 0-24 hour
7: Equalize timer 0-72 hour

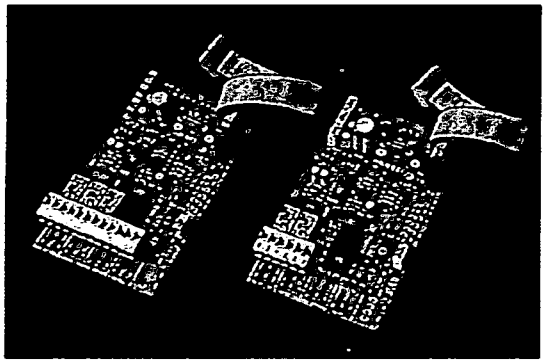
Suffix
U: UL listed (120 V only)
5: 50 Hz

Factory Designator

Alarm Systems Table

Alarm System Code*	0	2	4
System Status	Indication	Indication	Indication
AC on	None	Green LED	Green LED
AC fail	None	Red LED	Red LED & Form C contact
Charger fail	None	Red LED & Form C contact	Red LED & Form C contact
Low battery voltage	None	Red LED & Form C contact	Red LED & Form C contact
High battery voltage	None	Red LED	Red LED & Form C contact

*The Alarm System Code is used as part of the model number when the unit is ordered. See Model Number Breakout diagram.



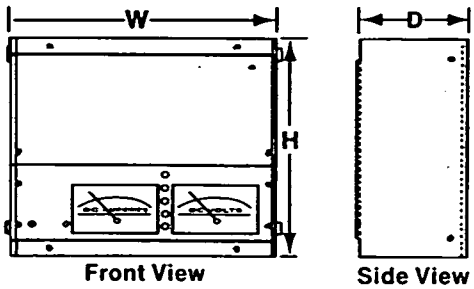
FCA Alarm Board

Housing Dimensions Table

Housing	Width	Depth	Height
FC-1	11.00" (275mm)	5.00" (125mm)	11.00" (275mm)
FC-1.5	15.00" (375mm)	6.00" (150mm)	13.00" (325mm)

Mechanical

Housing: Clear anodized aluminum, wall mounting.



Front View Side View

Optional Features

- Alarms (see Model Number Breakout).
- Non-standard input voltage.
- Fungus proofing of circuit boards.
- NEMA 3R housing.
- Remote temperature sensing.

How To Order

1. Determine standard charger model number. Refer to the Ordering Information Table and Model Number Breakout.
2. If non-standard input, alarm system or float/equalize control are required, please contact the factory to verify the correct part number.
3. Specify options as line items (e.g. remote temperature sensing).

Ordering Information Table

Output Volts	Output Amps	Model Number	Housing Size	Weight Lbs	Weight KG	Certification
12	6	FC(A)12-6-2X11	FC-1	15	7	UL listed*
12	10	FC(A)12-10-2X11	FC-1	17	8	UL listed*
12	20	FC(A)12-20-2X31	FC-1.5	29	13	
12	25	FC(A)12-25-2X31	FC-1.5	29	13	
24	6	FC(A)24-6-2X11	FC-1	24	11	UL listed*
24	10	FC(A)24-10-2X11	FC-1	26	12	UL listed*
24	20	FC(A)24-20-2X31	FC-1.5	37	17	UL listed*
24	25	FC(A)24-25-2X31	FC-1.5	39	18	
32	6	FC(A)32-6-2X11	FC-1	26	12	
32	10	FC(A)32-10-2X11	FC-1	26	12	
32	20	FC(A)32-20-2X31	FC-1.5	38	17	

(A) indicates alarms; X specifies alarm configuration (see Model Number Breakout to specify alarm configuration).
*120 VAC input only.

NOTE: Generic chargers are shown. Refer to the Model Number Breakout diagram for how to specify alarms, input voltage and options.

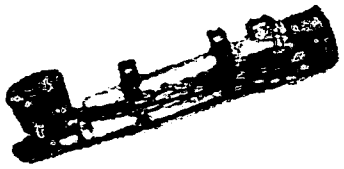
KATOLIGHT® CORPORATION
100 POWER DRIVE
MANKATO, MN 56001
PHONE 507-625-7973
FAX 507-625-2968
Email http://www.katolight.com

KATOLIGHT CORPORATION

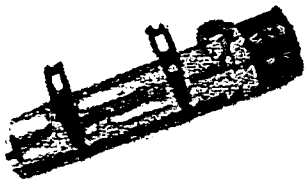
Industrial Tank Heaters

1500 – 5000 Watt

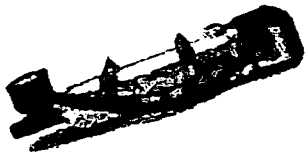
- Weather Tight
- Conduit Connection
- Horizontal or Vertical Mounting
- Single Phase



CB Model assembled with thermostat



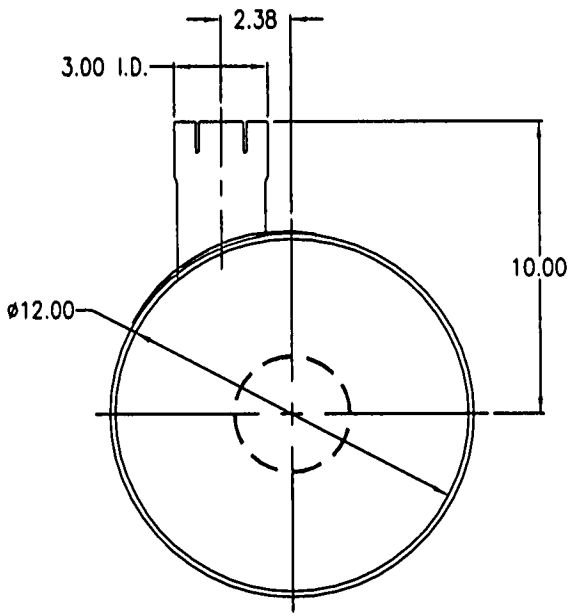
CB Model without thermostat

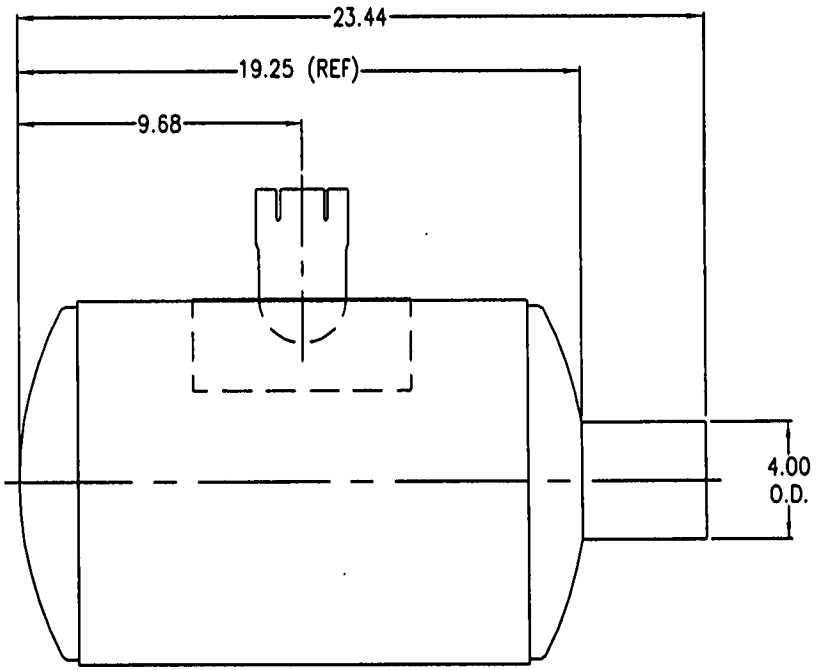


CL Model assembled

Ambient Above -20° F	Ambient Below -20° F	Model Number Without Thermostat	Model Number with Thermostat	Volts	Phase	Watts	Amps
350-500 Cubic Inch Or Less	200-300 Cubic Inch Or Less	CB115100-000	CB1151XX-000	120	1	1500	12.5
		CB115800-000	CB1158XX-00	208	1	1500	7.2
		CB115200-000	CB1152XX-000	240	1	1500	6.3
		CB115700-000	CB1157XX-000	277	1	1500	5.4
		CB115300-000	CB1153XX-000	380	1	1500	3.9
		CB115400-000	CB1154XX-000	480	1	1500	3.1
500-600 Cubic Inch Or Less	300-400 Cubic Inch Or Less	CB120100-000	CB1201XX-000	120	1	2000	16.7
		CB120800-000	CB1208XX-000	208	1	2000	9.6
		CB120200-000	CB1202XX-000	240	1	2000	8.3
		CB120300-000	CB1203XX-000	380	1	2000	5.3
		CB120400-000	CB1204XX-000	480	1	2000	4.2
600-800 Cubic Inch Or Less	400-500 Cubic Inch Or Less	CB125100-000	CB1251XX-000	120	1	2500	20.8
		CB125800-000	CB1258XX-000	208	1	2500	12.0
		CB125200-000	CB1252XX-000	240	1	2500	10.74
		CB125700-000	CB1257XX-000	277	1	2500	9.0
		CB125300-000	CB1253XX-000	380	1	2500	6.6
		CB125400-000	CB1254XX-000	480	1	2500	5.2
800-1000 Cubic Inch Or Less	500-600 Cubic Inch Or Less	CL130100-100	CL1301XX-100	120	1	3000	25.0
		CL130800-100	CL1308XX-100	208	1	3000	14.4
		CL130200-100	CL1302XX-100	240	1	3000	12.5
		CL130700-100	CL1307XX-100	277	1	3000	10.8
		CL130300-100	CL1303XX-100	380	1	3000	7.9
		CL130400-100	CL1304XX-100	480	1	3000	6.3
1000-1350 Cubic Inch Or Less	600-800 Cubic Inch Or Less	CL140800-100	CL1408XX-100	208	1	4000	19.2
		CL140200-100	CL1402XX-100	240	1	4000	16.7
		CL140700-100	CL1407XX-100	277	1	4000	14.4
		CL140300-100	CL1403XX-100	380	1	4000	10.5
		CL140400-100	CL1404XX-100	480	1	4000	8.3
1350-1650 Cubic Inch Or Less	800-1000 Cubic Inch Or Less	CL150800-100	CL1508XX-100	208	1	5000	24.0
		CL150200-100	CL1502XX-100	208	1	5000	20.8
		CL150700-100	CL1507XX-100	277	1	5000	18.1
		CL150300-100	CL1503XX-100	380	1	5000	13.2
		CL150400-100	CL1504XX-100	480	1	5000	10.4

100 Power Drive, Mankato, MN, 56001, Phone: 800-325-5450, Fax: 507-625-2968, www.katolight.com





KATOLIGHT
MANKATO, MINNESOTA

4" 130KW GM CRITICAL GRADE MUFFLER

SIZE	DATE	DWG NO
B	8-20-02	76804
DRAWN TO SCALE	PART NO	DWN BY J/L SHEET 1 OF 1

Gas Solenoid Valves

General Description :
These solenoid valves are designed to control the flow of fuel gases in industrial and commercial gas burner systems. The valves are suitable for mainline, pilot line and venting applications. Burner construction valves, suffix "B", are designed to handle liquified petroleum gases (propane) in both the liquid and gaseous states. Series 8030, 8040, 8044, and 8262 valves are direct acting constructions. Series 8042, 8043, 8210, 8214 and 8215 valves are internal pilot operated constructions.

Specifications:
Solenoid enclosures: valves listed in this series have eighter Red-Hat II molded epoxy solenoids. Red-Hat II solenoids are identified by the change letter "G" or "H" in the catalog numbers, e.g., 8210G74, and are shown in red.

Standard Enclosures:
Red-Hat-Type I general purpose Red-Hat II-Types 1, 2, 3, 3S, 4 and 4X combination general purpose and watertight with ½" conduit hub.

Optional Enclosures:
Red-Hat-Type 3R rainproof. To order, add prefix "R" to the catalog number.

Red-Hat-Types 3, 4, 7, and 9 combination explosionproof and watertight. To order add prefix "EF" to catalog number. (Except for Series 8214, and catalog number 8215A40, 8215A90 and 8215B93.)

Red-Hat II-Types 3, 3S, 4 4X, 6, 6P, 7 and 9 combination explosionproof and watertight. To order, add prefix "EF" to the catalog number.

Electrical: Standard Voltages - 24, 120, 240, 480 volt, AC, 60 Hz except where noted otherwise. For DC voltages, consult factory.

Coils: Continuous duty molded class F or H as listed.

Valve Parts in Contact with Fluids:
Body-aluminum or brass as listed, stainless steel (300 Series) available in 1/2", 3/4" and 1" NPT pipe sizes.
Consult Factory.
Seals, Diaphragms and Discs - Buna N
Disc Holder - nylon (10.1 watt Normally Open Only)
Core Guide - Acetal, except suffix "B" valves which use brass
Rider Rings - filled Teflon*
Core and Plugnut - 430F S.S.
Springs - 302 S.S.
Shading coil - copper
Plug - Zinc plated steel

Ordering Information:
Important: We must have catalog number and voltage and Hertz. Use strainers with solenoid valves. Red-Hat valves requiring CSA must be ordered with CSA suffix to cover special marking and handling. Red-Hat II valves are provide with CSA approval marking as standard.

Constr. Ref.	H	L	P	T	W
46	6 13/16	6 5/32	5 15/32	2 7/32	5 3/8
47	6 13/16	6 5/32	5 17/32	2 7/32	5 3/8

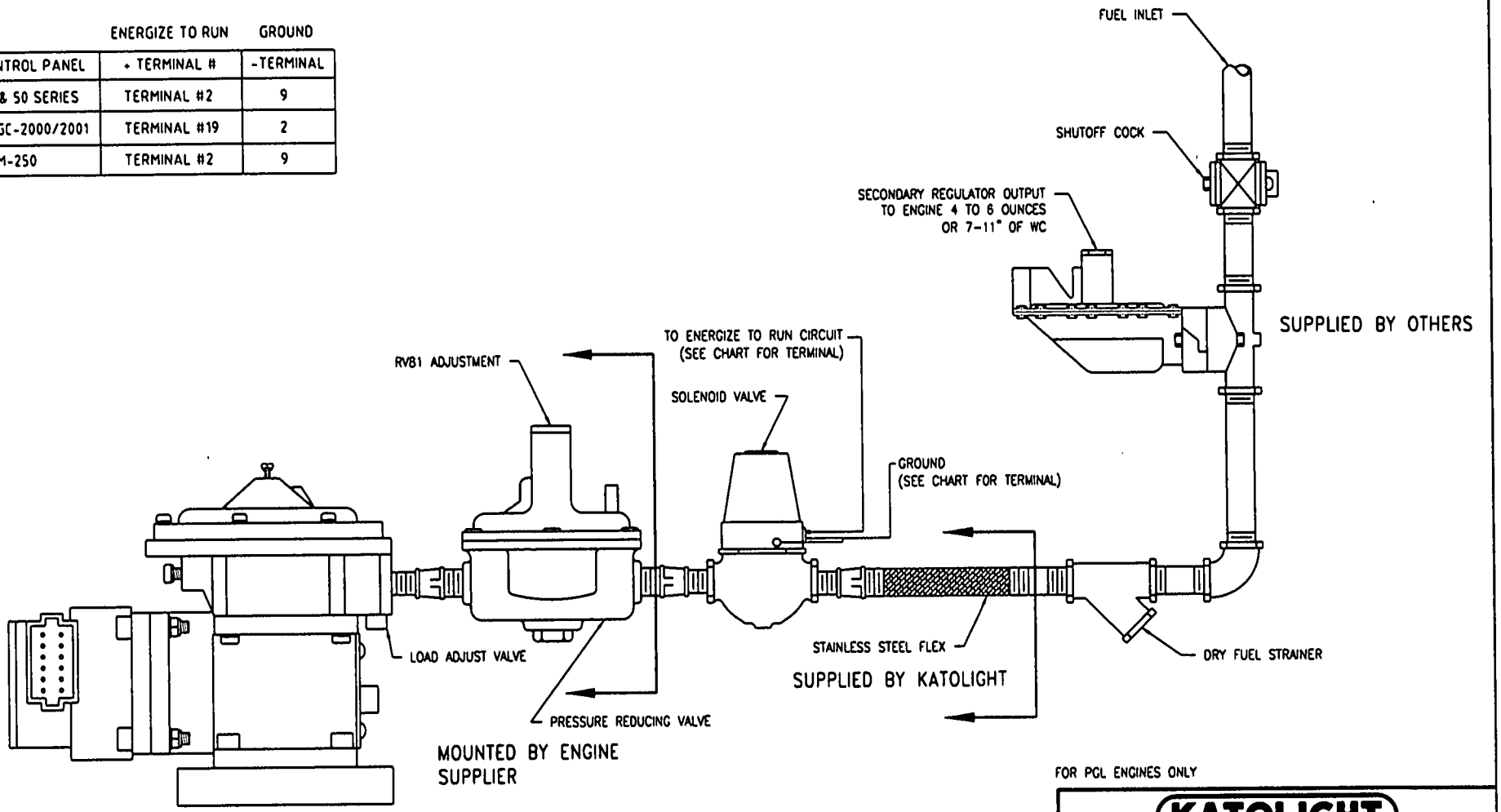
Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating pressure differential (psi)		Fluid & Ambient Temp. °F		Standard solenoid enclosure Red-Hat - Type I Red-Hat - Type I 2, 3, 3S, 4 & 4x		Gas Capacity ①	Approval Listings						Watt rating/Class of coil insulation
			Minimum	Maximum	Min	Max	Catalog #	Constr. Ref. #	Btu/Hr.	UL	FM	CSA	CGA 3.9	CGA 6.5	AGA Z21.21	AC
NORMALLY CLOSED (Closed when de-energized) Aluminum Body with Buna "N" Seating																
3/8	3/4	3.4	0	5	-40	125	8214G10	8	183,000	0	0	0	0	0	0	17.1/F
½	3/4	4.4	0	5	-40	125	8214G20	9	238,500	0	0	0	0	0	0	17.1/F
3/4 3/4	3/4 1 5/8	5.1 11	0	5	-40	125	8214G30 JB821435*	10 46	247,500 580,000	0 0	0 ②	0 0	0 0	0 0	0 0	17.1/F 20/F
	1 5/8	21	0	5	-40	125	JB821450*	46	1,119,000	0	②	0	0	0	0	20/F
	1 5/8	32	0	5	-40	125	JB821460*	47	1,739,000	0	②	0	0	0	0	20/F
1 1/2	1 5/8	35	0	5	-40	125	JB821470*	47	1,900,000	0	②	0	0	0	0	20/F
2	2 3/32	60	0	5	-40	125	JB821480*	48	2,800,000	0	②	0	0	0	0	20/F

GAS SOLENOID VALVES

NPT	VOLTAGE	KL-P/N	MAGNETROL	McQUAY	ASCO
3/4	12	46013	18D13	Y50200	HV272992-002
1	12	46021	18D14		JB821450
1 ½	12	46010	18D16		JB821470
2	12	46029	33D17		JB821480
3/4	24	46049	18D13		
1	24	46048	18D14		JB821450
1 ½	24	46050	18D16		JB821470
2	24	46027	33D17		JB821480

Form: GSV/299

	ENERGIZE TO RUN	GROUND
CONTROL PANEL	+ TERMINAL #	-TERMINAL
40 & 50 SERIES	TERMINAL #2	9
KOGC-2000/2001	TERMINAL #19	2
KGM-250	TERMINAL #2	9



FOR PGL ENGINES ONLY

NOTES:
1. TYPICAL PIPING LAYOUT WHEN LINE REGULATOR IS MOUNTED NOT MORE THAN TEN FEET FROM CARBURATOR
2. FOR LP VAPOR FUEL REMOVE REGULATOR SPRING. THE REGULATOR NEEDS TO BE TURNED DOWN

KATOLIGHT
MANKATO, MINNESOTA

8.1L GM ENGINE NG AND LP FUEL SYSTEM

SIZE	DATE	DWG NO
B	3-7-02	204-206-30

SCALE	PART NO	DWN BY	SHEET
NONE		JRD	1 OF 1

KATOLIGHT CORPORATION
STANDBY LIMITED WARRANTY

"TWO YEAR OR 1500 HOURS"

Your Katolight Product has been manufactured and inspected with care by experienced craftspeople. If you are the original consumer, Katolight Corporation warrants, for the period indicated below, each product to be free from defects in materials and workmanship. Repair, replacement or appropriate adjustment at Katolight Corporation's option will be furnished if the product, upon Katolight Corporation's inspection, is properly installed, maintained and operated in accordance with Katolight Corporation instruction manuals. This warranty does not apply to malfunctions caused by damage, unreasonable use, misuse, repair or service by unauthorized persons, or normal wear and tear.

KATOLIGHT PRODUCT PERIOD OF WARRANTY: Engine Generator Set: Two (2) years or 1500 hours from the date of invoice by factory. Accessories: One (1) year from date of invoice from factory. The warranty period can be adjusted to the date of start up if completed within six (6) months of invoice date. A valid warranty requires that: (1) the Katolight start-up validation form must be completed, returned and on file at Katolight Corporation; (2) the engine registration form must be completed and returned to manufacturer as stated in the instructions with registration form; and (3) all supporting maintenance records must be kept on file with the end user and made available upon request from factory. The generator set must be routinely exercised in accordance with operating instructions. Engine generator sets that are stored longer than six months (180 days) from date of shipment are subjected to special requirements. Contact Katolight's Factory Service Center for instructions.

For a description of accessories and exclusions from this limited warranty, review the listing on the back of this document.

TO OBTAIN WARRANTY SERVICE: Contact your nearest Katolight Service Representative by calling or writing Katolight Corporation, Attention: Service Department. (See address and telephone below.)

Katolight shall not be liable for any claim greater in amount than the purchase price of the product, in respect of which such claim is made, and in no event shall Katolight be liable for any special, indirect or consequential damages.

THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE DESCRIBED HEREIN. NO WARRANTIES SHALL BE IMPLIED OR OTHERWISE CREATED UNDER THE UNIFORM COMMERCIAL CODE, INCLUDING BUT NOT LIMITED TO A WARRANTY OF MERCHANTABILITY, AND A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

State laws regarding rights of consumers may vary from state to state.

KATOLIGHT CORPORATION
100 Power Drive / PO Box 3229
Mankato, MN 56002-3229
Phone: (507) 625-7973 / Fax: (507) 625-2247

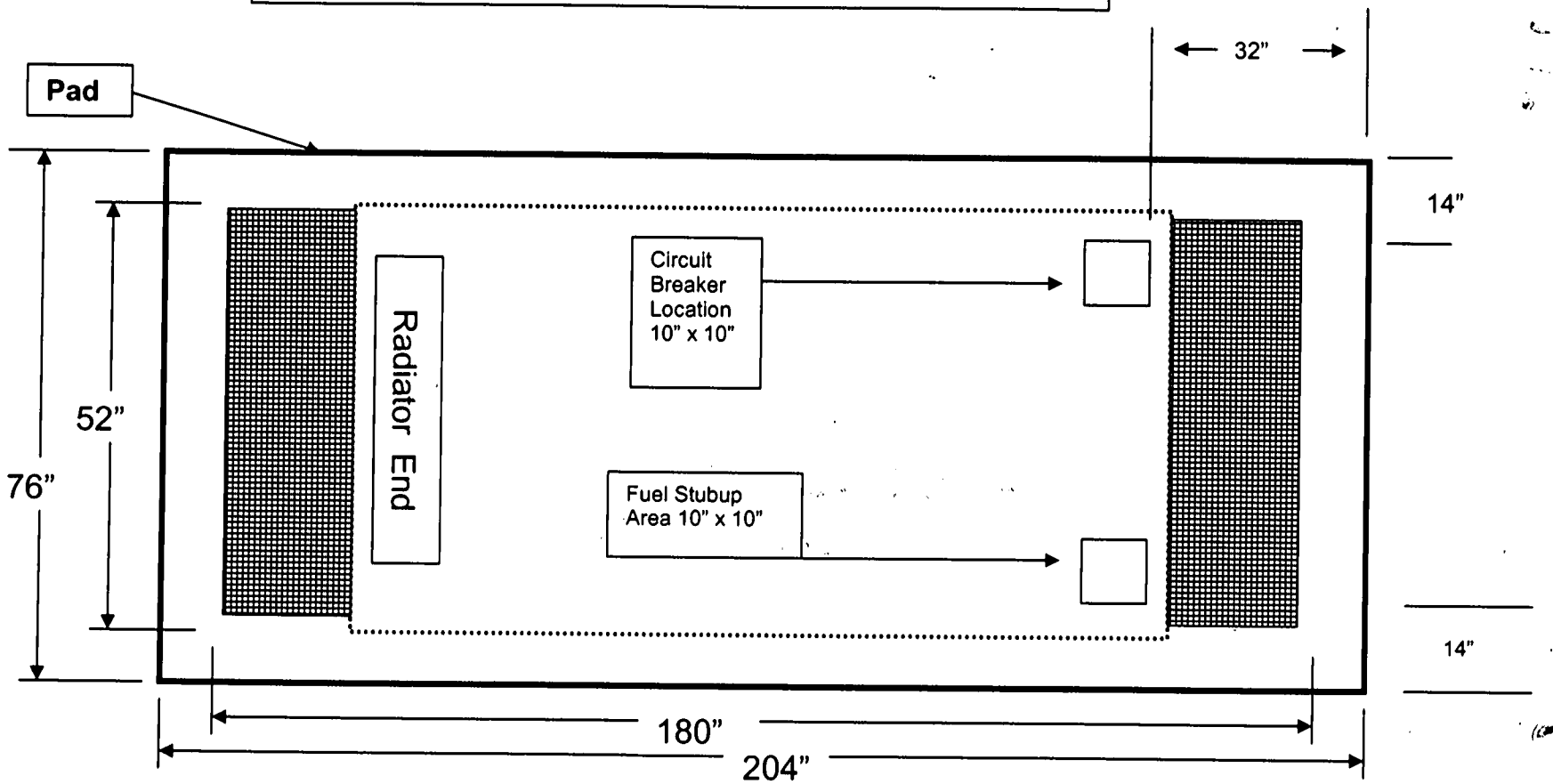
1. The following items are among those that are not considered nor will be covered under the existing warranty program.
   a. Battery or Batteries of any type or kind. The Battery Manufacturer warranty applies to these only. Any warranty for such, should be handled with the manufacturer according to their policies.
   b. Adjustments to fuel systems or governor system at time of start up or any time after. This is acceptable only when a defective part has been replaced, returned to the factory and approved as defective.
   c. Normal maintenance cost: adjustments, loose/leaking fittings or clamps, and tune-ups.
   d. Non-Katolight replacement part(s) will void the entire limited warranty.
   e. Products that are modified in any form without the written consent of Katolight will void the entire limited warranty.
   f. Shipping damage of any type. All equipment is shipped F.O.B. factory and is consigned to the carrier once loaded for shipment. It is the responsibility of the receiver to sign and note any damage to the equipment and a freight damage claim filed by the receiver.
   g. Any installation errors or damage of the equipment when shipped as ordered.
   h. Any overtime travel or labor to make repairs under warranty.
   i. Any special access fees required to gain access to Katolight equipment not limited to but including any training or safety policy requirements to gain access.
   j. Rental equipment used during warranty work such as Generators, rigging equipment such as a crane or boom truck, load banks and special testing above factory requirements, etc.
   k. Excess mileage charges. Any distributor may provide warranty service anywhere but will only be paid travel from the nearest service center.
   l. Any equipment not factory approved or engineered for use on Katolight product. This includes but is not limited to after market items such as special fuel systems, enclosures, exhaust systems, or switch gear that had been sought out and quoted by third party to be included in billing of the Katolight equipment.
   m. Misuse or abuse including installation and thereafter.
   n. Normal wear and tear, maintenance and consumable items that are not required as part of a warranty repair. Consumable items include but are not limited to belts, hoses, coolant, oil, filters, and fuses.
   o. Acts of nature such as lightning, wind, flood, or earthquake.
   p. Any damage due to situations beyond the control of the manufacturing of the product or workmanship of the product.
   q. Installation or operation outside the guidelines as stated in the Installation Guide and Owners Manual.
   r. Misapplication of the equipment such as usage outside the original design parameters as stated on the nameplate of the equipment.
   s. Travel expense on portable equipment.
   t. More than one trip to job-site because Service Vehicle was not stocked with normal service parts.
   u. Lodging expense of person(s) performing service.
   v. Engine fluids.
   w. Cords, Receptacles, and Cord reels.
   x. Housing lights and light switches
   y. Trailer lights, wiring, brake system, tow hitch and tires.
   z. Units purchased as Standby Power and are identified as Prime Power.
   aa. Any repair labor time that is determined to be excessive, e.g., two or more people performing a one-person job.
   bb. Any expenses associated with investigating performance complaints.
   cc. Any associated costs for replacing components that are found not to be defective.

2. The aforementioned is a representation of things not covered by the standard **"LIMITED WARRANTY".** If there are questions as to warranty coverage it is advisable to contact the factory in advance of filing a claim.

3. The accessories shown below are limited to one (1) year warranty:
   a. Battery Chargers
   b. Water Heater
   c. Load Banks
   d. Tap changing switches
   e. Circuit breakers
   f. Day tank pumps and controls
   g. Hand prime pump
   h. Oil leveler system
   i. Strip heater
   j. Gas solenoid valves
   k. Gas flex pipe

June 3, 2003

Concrete Pad & Installation Drawing
Katolight Model NL125 Sound Attenuated Weather Proof Enclosure / with Intake and Exhaust Scoops



Notes:

1. *Pad thickness 8" with mesh or re-bar design. Pad area shall be undercut and poured on solid base material.*
2. *Minimum Clearances: Right, Left, and alternator sides 36", Radiator end 72".*
3. *Generator pad dimension allows for 12" apron around perimeter of Generator.*
4. *This is a recommedation by DTE Energy Technologies.*

DTE Energy

DTE Energy Technologies