CATERPILLAR®

SENR8375
January 1996

Service Manual

Generator Set Control Panel

130-3786

Important Safety Information

Most accidents involving product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "WARNING" as shown below.

⚠ WARNING

The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning, explaining the hazard, can be either written or pictorially presented.

Operations that may cause product damage are identified by NOTICE labels on the product and in this publication.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are therefore not all inclusive. If a tool, procedure, work method or operating technique not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or repair procedures you choose.

The information, specifications, and illustrations in this publication are on the basis of information available at the time it was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service given to the product. Obtain the complete and most current information before starting any job. Caterpillar dealers have the most current information available. For a list of the most current publication form numbers available, see the Service Manual Contents Microfiche, REG1139F.

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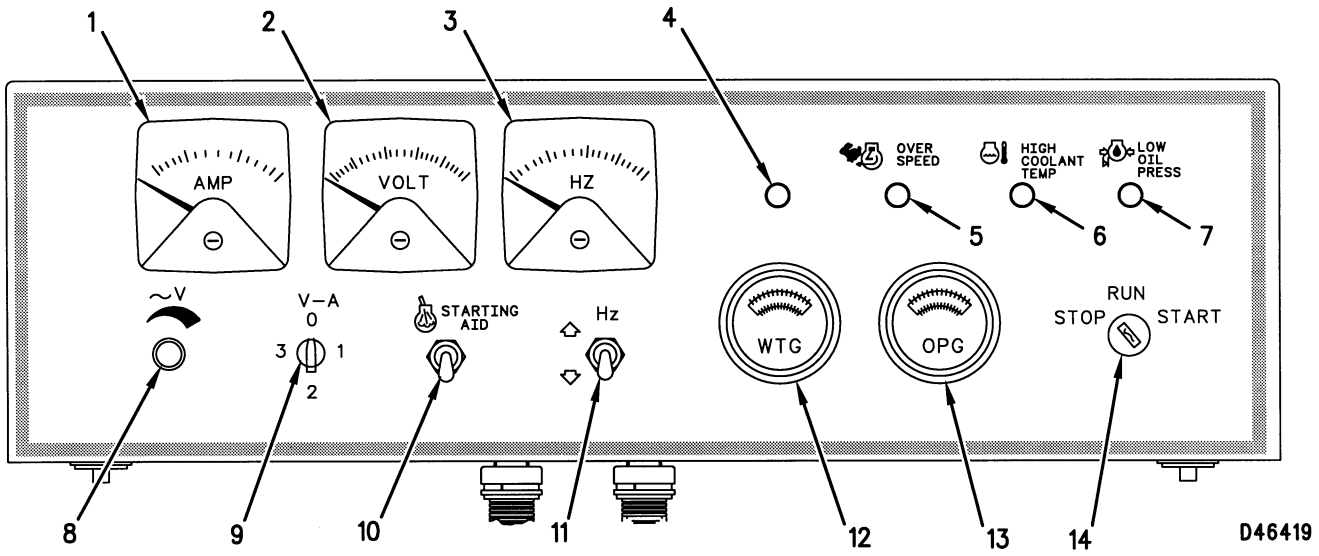
Components

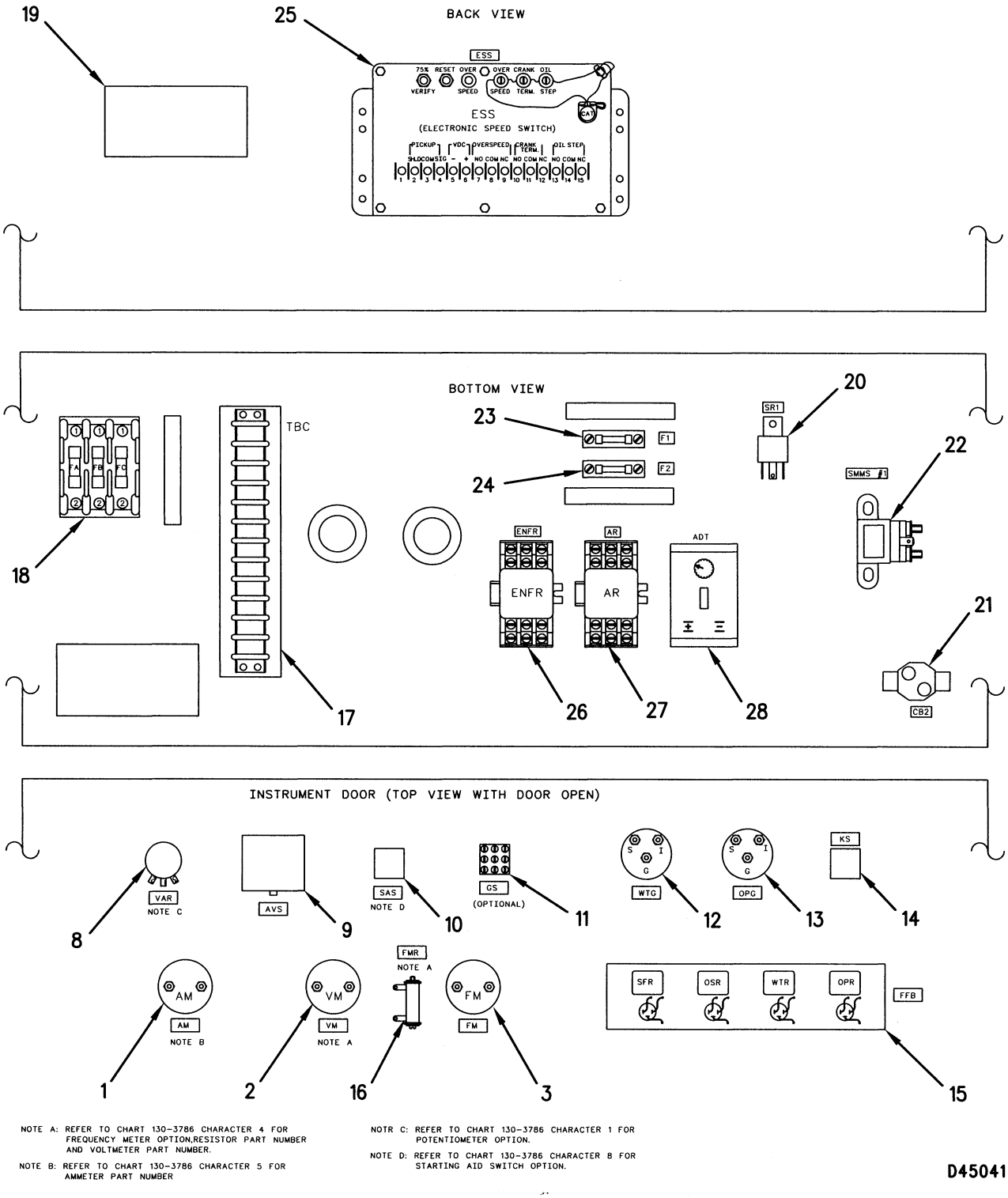
Location Of Components



Control Panel - Front View

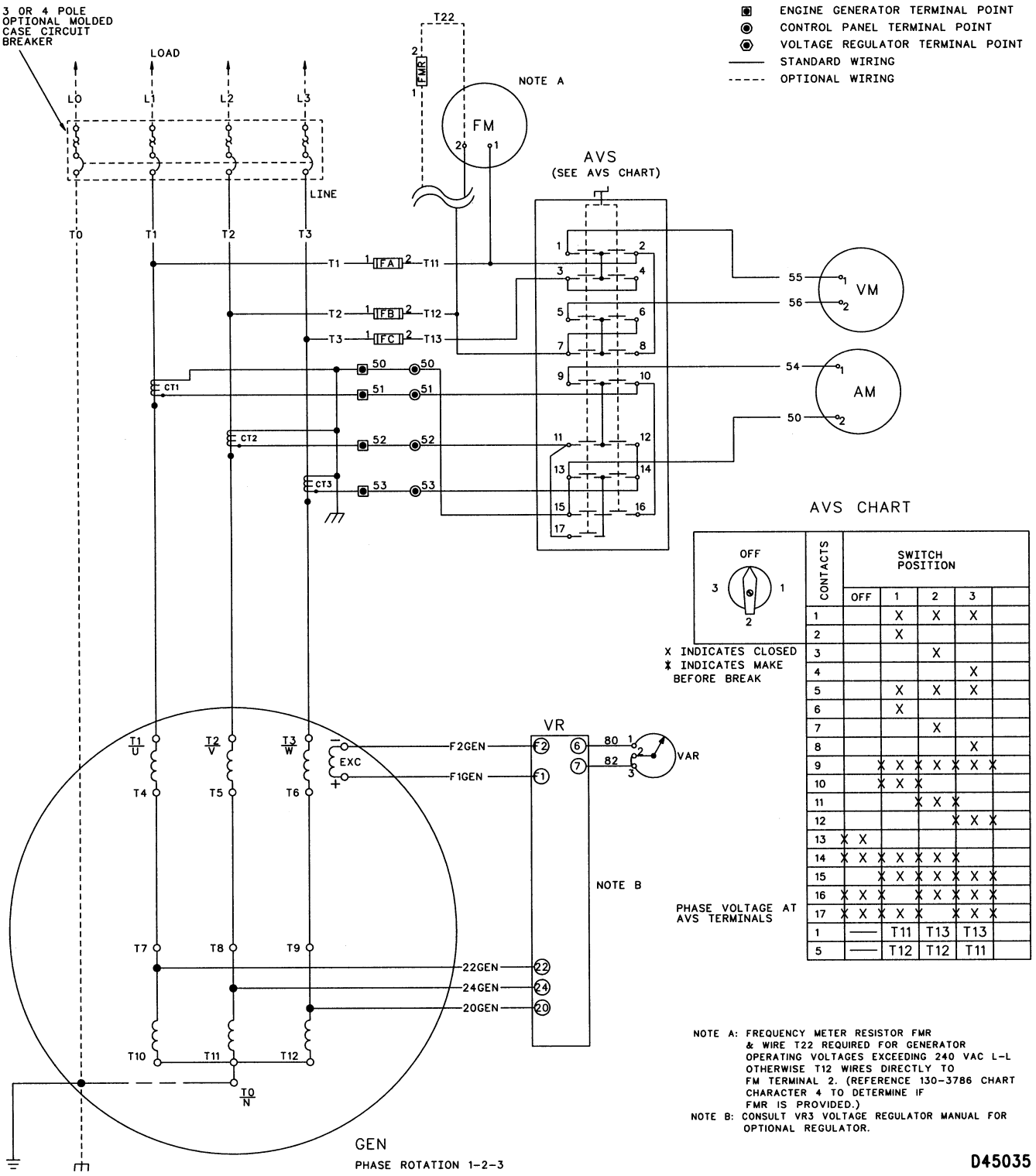
(1) AC Ammeter (AM).
(2) AC Voltmeter (VM).
(3) Frequency meter (FM).
(4) Spare fault light.
(5) Engine overspeed fault light.
(6) High coolant temperature fault light.
(7) Low oil pressure fault light.
(8) Voltage adjust rheostat (VAR).
(9) Ammeter/Voltmeter phase selector switch (AVS).
(10) Start aid switch (SAS) - optional.
(11) Governor switch (GS) - optional.
(12) Water temperature gauge (WTG).
(13) Oil pressure gauge (OPG).
(14) Key switch (KS).
(15) Four light fault board (FFB).
(16) Frequency meter resistor (FMR).
(17) Terminal board (TBC).
(18) Fuse block (FB).
(19) Name plate.
(20) Slave relay 1 (SR1).
(21) Circuit breaker 2 (CB2).
(22) Starting motor magnetic switch 1 (SMMS1).
(23) Fuse 1 (F1) - fuel shutoff solenoid.
(24) Fuse 2 (F2) - control panel.
(25) Electronic speed switch (ESS).
(26) Engine failure relay (ENFR).
(27) Arming relay (AR).
(28) Arming delay timer (ADT).

The control panel is mounted on the generator terminal box. Each control panel has a specific nine character model number. An example of a typical model number is "T3C3HXRX0". The model number is stamped on name plate (19) which is located inside the control panel on the bottom. The model number is based on control panel options and generator ratings. Each character of the model number specifies a particular component of the control panel. Included with every control panel is 130-3786 Control Panel Chart. The chart print explains the meaning of each character of the model number.



Control Panel Interior

Component Description



AC Schematic (JIC)
AM - AC Ammeter. AVS - Ammeter/Voltmeter Phase Selector Switch. FA,FB,FC - Fuses. FM - Frequency Meter. L1,L2,L3 - Load Leads. T1,T2,T3 - Generator Line Leads. VAR - Voltage Adjust Rheostat. VM - AC Voltmeter.

Ammeter/Voltmeter Phase Selector Switch (AVS)

⚠ WARNING

To avoid personal injury due to electrical shock, make sure jumpers are installed correctly on the AVS.

For reference, see the preceding AC Schematic illustration.

The ammeter/voltmeter phase selector switch (AVS) allows the operator to select which electrical phase is shown on the AC ammeter (AM) and the AC voltmeter (VM). The AVS has four positions:

- When in position 1, the AM shows T1 phase current and the VM shows T1-T2 phase voltage. AVS contacts 1, 2, 5, 6, 9, 10, 14, 15 and 17 of the AVS are closed.
- When in position 2, the AM shows T2 phase current and the VM shows T2-T3 phase voltage. AVS contacts 1, 3, 5, 7, 9, 11, 14, 15 and 16 are closed.
- When in position 3, the AM shows T3 phase current and the VM shows T3-T1 phase voltage. AVS contacts 1, 4, 5, 8, 9, 12, 15, 16 and 17 are closed.
- When in position OFF, nothing is shown on the AM and the VM. AVS contacts 13, 14, 16 and 17 are closed.

AC Ammeter (AM)

For reference, see the preceding AC Schematic illustration.

The AC ammeter (AM) shows the amperes of the line current in phase 1, phase 2 or phase 3. The ammeter/voltmeter phase selector switch (AVS) is used to select the phase which is shown on the AC ammeter. The AVS connects the AM to a current transformer (CT1, CT2 or CT3) on phases T1, T2 or T3 respectively. The CT's transform the actual line current of the respective phase lead to a level (approximately 0 to 5 amps) which is within the input range of the AM. The AM is calibrated (has marks) to give an indication of the actual current flow in one phase of the generator.

AC Voltmeter (VM)

For reference, see the preceding AC Schematic illustration.

The AC voltmeter (VM) shows the voltage between phases T1-T2, phases T2-T3, or phases T3-T1. The ammeter/voltmeter phase selector switch (AVS) is used to select the phase which is shown on the VM. T1-T2 phase voltage is shown on VM when AVS is in position 1. T2-T3 phase voltage is shown on VM when AVS is in position 2. T3-T1 phase voltage is shown on VM when AVS is in position 3.

Frequency Meter (FM)

For reference, see the preceding AC Schematic illustration.

The frequency meter (FM) shows the frequency in hertz (Hz, cycles per second) of the alternating current being made by the generator set. There is a direct relation between the frequency of the electricity and the RPM of the engine, as shown in the following formula:

$$\text{frequency (hertz)} = \frac{\text{number of generator poles x rpm}}{120}$$

NOTE: A frequency meter resistor (FMR) is required for generators with operating voltages exceeding 240 VAC.

Voltage Adjust Rheostat (VAR)

For reference, see the preceding AC Schematic illustration.

The voltage adjust rheostat (VAR) connects to the voltage regulator and is used to adjust the voltage output of the generator. The VAR replaces the voltage level rheostat located on the generator voltage regulator assembly.

NOTE: When the VAR is used with the VR3 voltage regulator, there is NO jumper wire connecting terminal four and terminal seven of the VR3.

Start Aid Switch (SAS) - Optional

The optional start aid switch (SAS) is used to inject ether into the engine for starting in cold weather conditions. The SAS is a spring return switch which has to be held in the ON position to activate. When the key switch is in the START position and the SAS is pressed and held in the ON position, the start aid solenoid valve (SASV) energizes and meters a specific amount of ether into a holding chamber. When the SAS is released, the SASV de-energizes and the ether is released to the engine.

If the temperature of the engine is high enough to open the start aid temperature switch (SATS), then the SAS cannot activate ether injection.

NOTICE

The engine must be cranking before using the start aid switch (SAS). Otherwise, damage to the engine is possible.

Governor Switch (GS) - Optional

The optional governor switch (GS) is available when the engine governor is equipped with a speed adjust (synchronizing) motor. The GS is used to raise or lower the engine speed. The GS makes the synchronizing of generators easier. After the engine is running, the governor switch (GS) is enabled, permitting a change in engine rpm (generator frequency). Pressing and holding the GS in the up position will increase engine rpm. Pressing and holding the GS in the down position will decrease engine rpm.

Key Switch (KS)

For reference, see the DC Schematics.

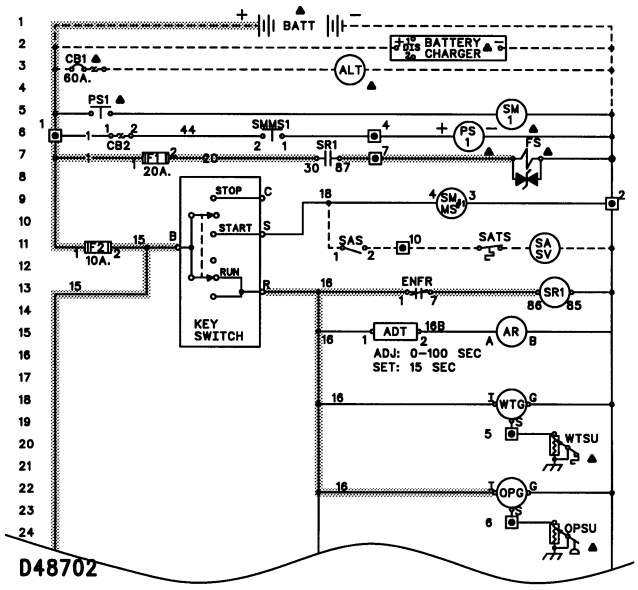
The key switch (KS) is used to start and stop the engine. The key switch (KS) has three positions: STOP, START and RUN.

STOP position - When turned to this position from the RUN position, contact R opens. This de-energizes the slave relay (SR1) and the engine shuts down. If a fault has occurred and the KS is turned to the STOP position, all fault relays and fault lights will shut off and are reset. The key switch must remain in the RUN position for the fault light to stay ON. The key switch should be kept in the STOP position while a fault is being corrected.

START position - This position energizes the starting motor magnetic switch (SMMS) and the engine cranks. The START position is spring loaded to return to the RUN position. There is a mechanical block within the KS that prevents returning the KS to the START position without going to the STOP position first. This prevents cranking the engine while the engine is running. To restart the engine, turn the key switch to the STOP position before again turning to START.

RUN position - During normal operation, the RUN position allows the engine to operate until the key switch is turned to the STOP position. If a fault should occur, the control panel will automatically shut the engine down and the corresponding fault light will illuminate. The key switch must remain in the RUN position for the fault light to stay ON. The key switch should be turned to the STOP position while a fault is being corrected.

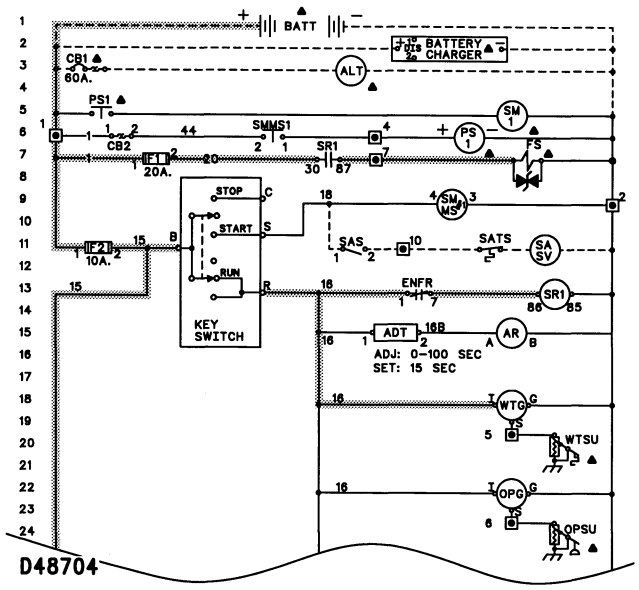
Oil Pressure Gauge (OPG)



DC Schematic Of Oil Pressure Gauge

The oil pressure gauge (OPG) shows engine oil pressure. The OPG is powered whenever the key switch is in the RUN position. The value shown on the OPG is proportional to the flow of current through the OPG. The current flow is controlled by the resistance of the oil pressure sending unit (OPSU). As the oil pressure changes there is a corresponding change in the resistance of the OPSU and therefore a corresponding change in the value shown on the OPG.

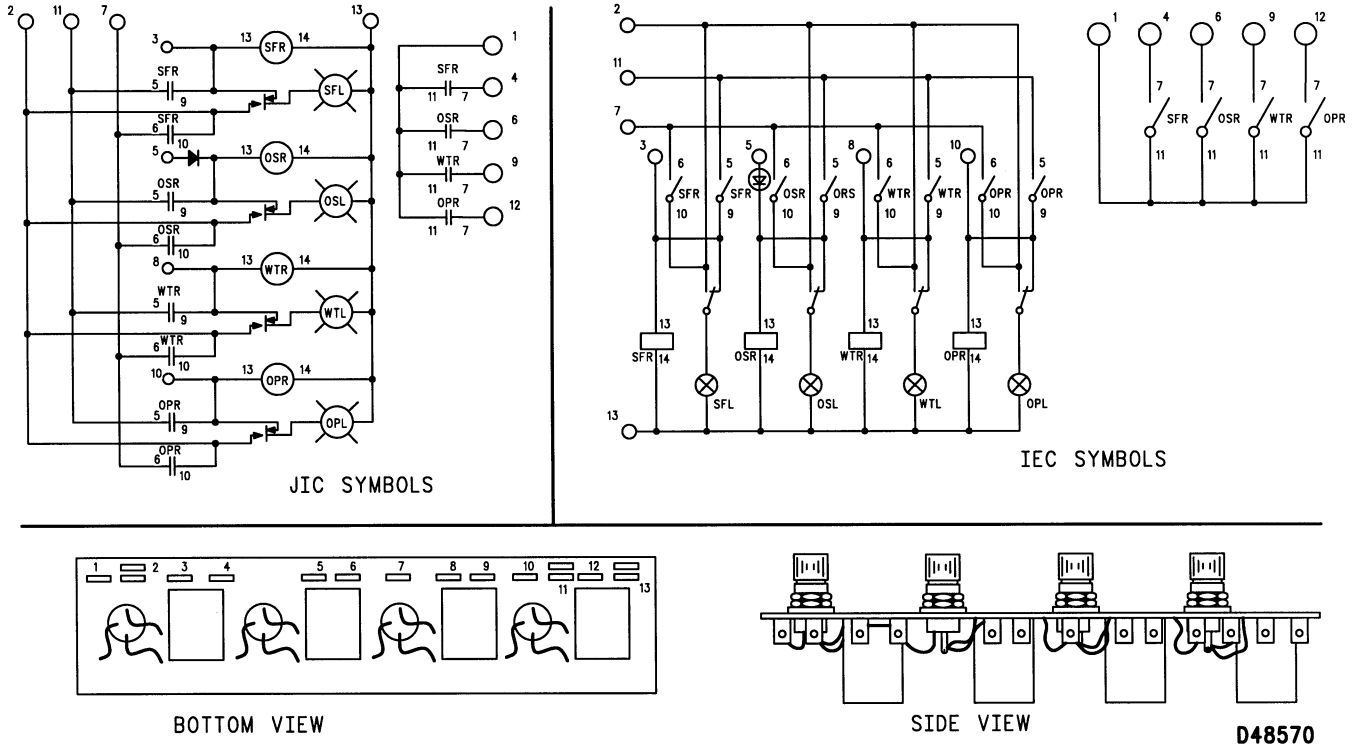
Water Temperature Gauge (WTG)



DC Schematic Of Water Temperature Gauge

The water temperature gauge (WTG) shows the engine water temperature. The WTG is powered whenever the key switch is in the RUN position. The value shown on the WTG is proportional to the flow of current through the WTG. The current flow is controlled by the resistance of the water temperature sending unit (WTSU). As the water temperature changes there is a corresponding change in the resistance of the WTSU and therefore a corresponding change in the value shown on the WTG.

Four Light Fault Board (FFB)



Four Light Fault Board (FFB)
(OPL) Oil Pressure Light
(OPR) Oil Pressure Relay
(OSL) Overspeed Light
(OSR) Overspeed Relay
(SPL) Spare Fault Light
(SPR) Spare Fault Relay
(WTL) Water Temperature Light
(WTR) Water Temperature Relay

There are four fault indicator lights and relays mounted on a printed circuit board assembly. The board assembly mounts to the inside face of the control panel. The purpose of the four light fault board is to activate an engine shutdown and to inform the operator or service personnel as to the cause of the shutdown.

When any one of the following conditions exist, the corresponding fault light will illuminate, the corresponding relay will energize and the engine will shutdown.

- If the engine should overspeed as determined by the electronic speed switch (ESS).
- If the engine water temperature should rise above the upper limit of the water temperature switch (WTS).
- If the engine oil pressure should fall below the low limit of the engine oil pressure switch (OPS).
- If a shutdown condition should occur for the spare fault as determined by the customer.

As long as the key switch is in the RUN position, the corresponding relay will remain energized and the corresponding fault light indicator will remain lit. To de-energize the relay and to turn off the fault light indicator, turn the key switch to the OFF position.

Each fault light indicator is a combination light and test button. The lamp of a particular fault light indicator can be tested by pushing the indicator in. The lamp will remain lit as long as the indicator is pushed in. If the lamp does not illuminate, replace the bulb.

The relays are the miniature type and are 4PDT. The relay coils are 24 DCV with a maximum pickup voltage of 14 DCV. The relay contacts are 5 amp maximum at 24 DCV resistive. The individual relays and fault light indicators are not replaceable.

Fuses

The basic control panel has five fuses located inside on the bottom of the control panel.

Fuse A (two amps) is connected in series between the generator output terminal T1 and terminal 2 of the ammeter/voltmeter phase selector switch (AVS). If this fuse is faulty, no frequency reading will be shown on the frequency meter.

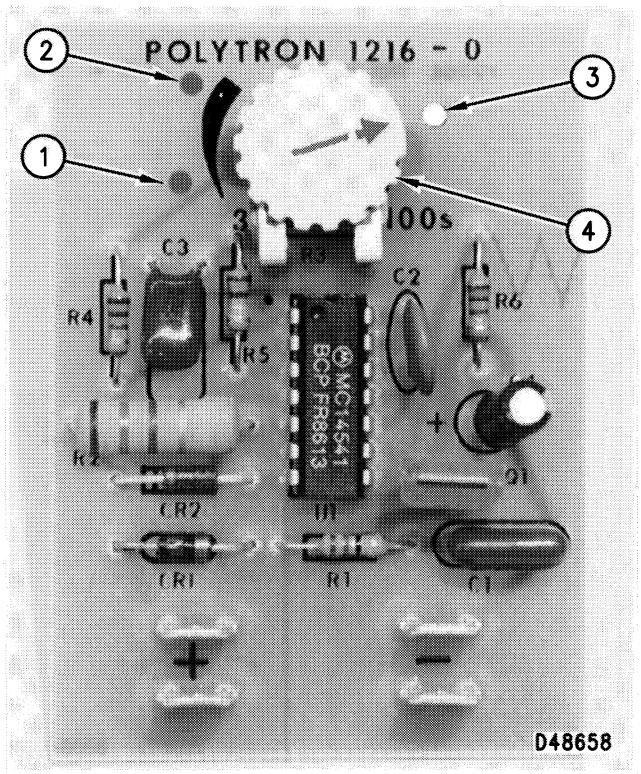
Fuse B (two amps) is connected in series between the generator output terminal T2 and terminal 7 of the ammeter/voltmeter phase selector switch (AVS). If this fuse is faulty, no frequency reading will be shown on the frequency meter.

Fuse C (two amps) is connected in series between the generator output terminal T3 and terminal 3 of the ammeter/voltmeter phase selector switch (AVS). If this fuse is faulty, no voltmeter reading will be shown when the AVS is position 3 (T3-T1 phase voltage).

Fuse 1 (20 amps) is connected between battery (B+) and the engine fuel control solenoid. If this fuse is faulty, the fuel solenoid will not function.

Fuse 2 (10 amps) is connected between battery (B+) and the control panel. If this fuse is faulty, the control panel will not function.

Arming Delay Timer (ADT)

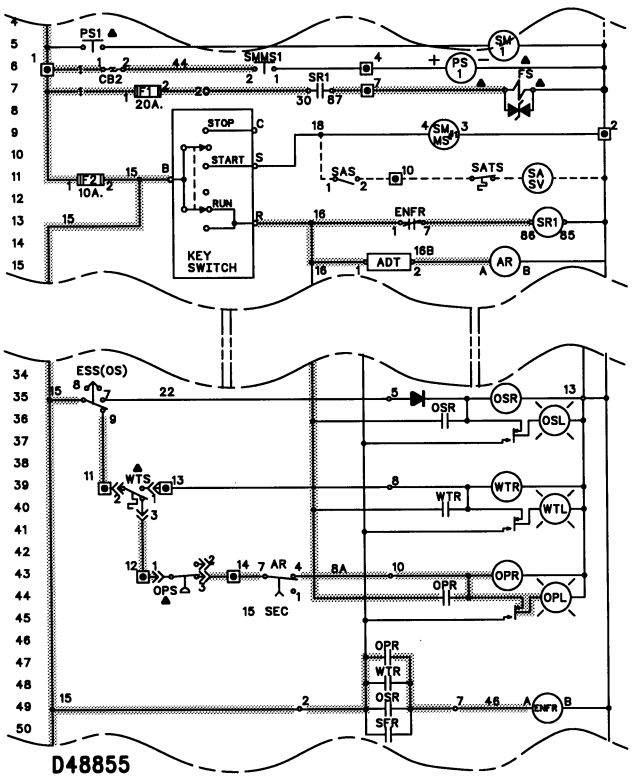


Arming Delay Timer (ADT)
(1) Blue dot. (2) Red dot. (3) White dot. (4) Knob.

The purpose of the arming delay timer (ADT) is to prevent the activation of an oil pressure fault during the time immediately following engine starting. Low oil pressure is normal for a short period of time after engine starting. The ADT controls the amount of time that the oil pressure relay circuit is disabled after engine cranking. The timer is factory set to 15 seconds.

The arming delay timer is adjustable from 0 to 100 seconds. Three dots on the board correspond to a value of time. There is an arrow located on knob (4). When the arrow is pointing to a particular dot, the corresponding value of time is selected.

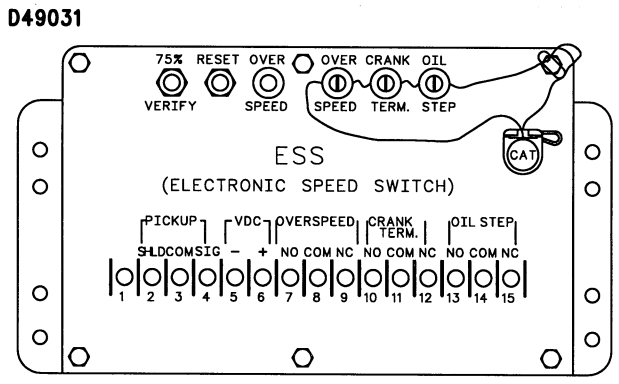
Blue dot (1) ..... 10 seconds
Red dot (2) ..... 30 seconds
White dot (3) ..... 90 seconds



DC Schematic Of Arming Delay Timer (ADT)

When battery (B+) is applied to the ADT (key switch contacts B-R [lines 11 and 13] are closed), the ADT (line 15) begins. Approximately ten seconds after the ADT is energized, arming relay (AR) contacts (line 43) close. This allows the engine time to develop enough oil pressure to open oil pressure switch (OPS) contacts 1-3 and close contacts 1-2. If the engine does not have sufficient oil pressure to function properly, OPS contacts 1-3 will remain close. This will energize the oil pressure relay (OPR) and shutdown the engine for an oil pressure fault.

Electronic Speed Switch (ESS)

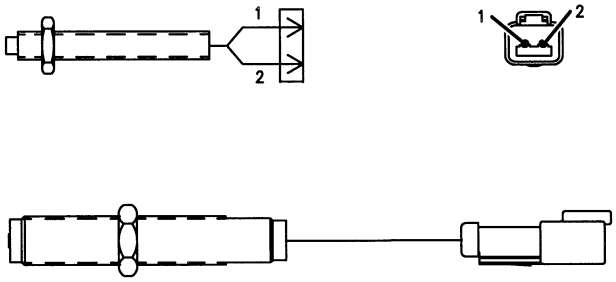


Electronic Speed Switch (ESS)

The electronic speed switch (ESS) performs the function of protecting the engine from overspeeding. A magnetic speed pickup (MPU) supplies the ESS with engine speed information. The ESS evaluates the speed information. If the engine speed is greater than the limit, the ESS activates the overspeed relay (OSR). Then the OSR activates the engine failure relay (ENFR) which deactivates the slave relay (SR1). With SR1 deactivated, contacts 30 and 87 of SR1 open and the fuel solenoid (FS) is de-energized. Fuel is no longer provided to the engine and the engine stops.

REFERENCE: For Overspeed Calibration and Overspeed Verify tests of the ESS, see the service procedures section of SENR3207, Troubleshooting Guide (ETR).

Magnetic Speed Pickup (MPU)



Magnetic Speed Pickup (MPU)

The purpose of the magnetic speed pickup (MPU) is to send a signal which represents the speed of the engine to the ESS. The MPU is located on the engine flywheel housing. The MPU is a single pole, permanent magnetic generator made of wire coils around a permanent magnet pole piece. As the teeth of the flywheel ring gear go through the magnetic lines of flux around the pickup, an AC voltage is generated. A positive voltage is generated when each tooth goes by the pole piece. Each time the space between the teeth goes by the pole piece, a negative voltage is generated. The ESS counts the frequency of the this speed signal and determines the speed of the engine.

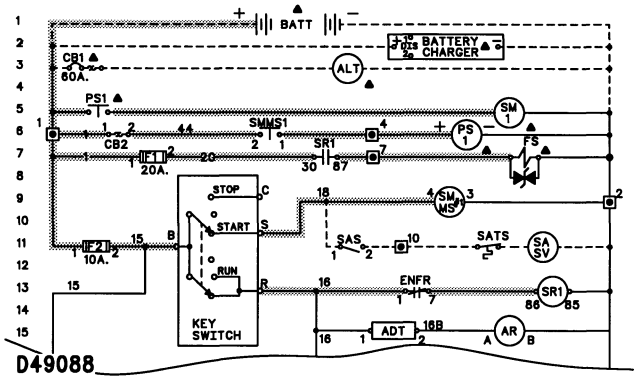
Systems Operation

General System Description

The control panel is normally used for prime power operation and only operates with engine systems that are energized to run. The control panel will shut down the generator set when an engine fault occurs. At the same time, it will indicate by a fault lamp whether the fault is due to high water temperature, low oil pressure, engine overspeed, or spare fault (if connected).

Key Switch Operation

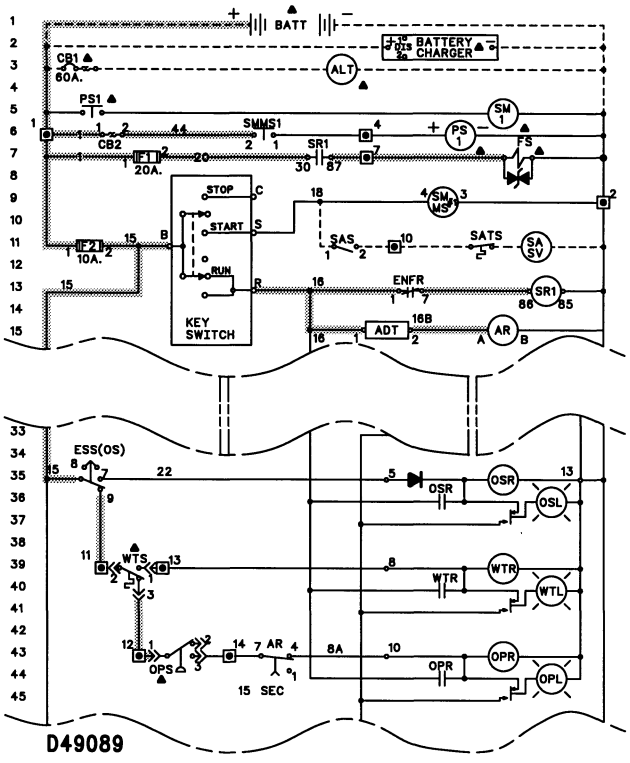
Key Switch In START Position



DC Schematic Of Key Switch In START Position

When the key switch (KS) is in the START position, KS contacts B and S (lines 11 and 10) and contacts B and R (lines 11 and 13) are closed. The starting motor magnetic switch (SMMS1) (line 9) is now energized. SMMS1 closes it's contact (line 6) to energize the pinion solenoid (PS1) (line 6). PS1 closes it's contact (line 5) to energize the starting motor (SM1) (line 5). The slave relay (SR1) (line 13) is also energized when the KS is in the START position. SR1 contacts 30 and 87 (line 7) close to energize the fuel solenoid (FS). Fuel is now provided to the engine during starting.

Key Switch In RUN Position



DC Schematic Of Key Switch In RUN Position

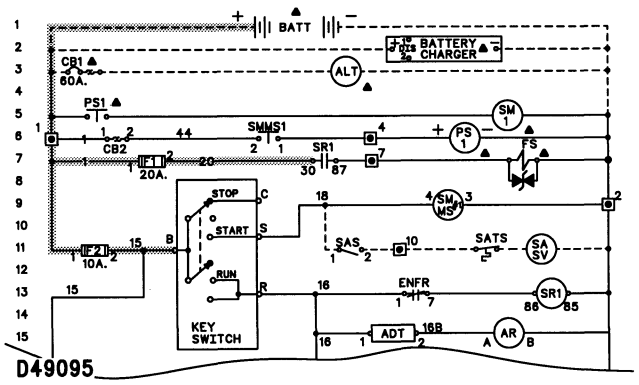
After the engine starts and the key switch (KS) is returned to the RUN position, KS contacts B and S (line 11 and 10) open. The starting motor magnetic switch (SMMS1) (line 9) is now de-energized. There is a mechanical block within the KS that prevents returning the KS to the START position without going to the STOP position first. This prevents cranking the engine while the engine is running.

With the KS in the RUN position, contacts B and R (line 11 and 13) close to keep the slave relay (SR1) (line 13) energized. SR1 contacts 30 and 87 (line 7) remain closed to energize the fuel solenoid (FS). Fuel is now provided to the engine.

The arming delay timer (ADT) (line 15) is also energized when the KS is in the RUN position. The ADT controls the amount of time that the oil pressure shutdown circuit is disabled after engine cranking. The ADT has an adjustable time delay (factory set at 15 seconds) that must elapse before the arming relay (AR) (line 15) is energized. The delay allows time for engine oil pressure to build-up after engine starting. During the delay, the activation of an oil pressure fault is prohibited. The control panel ignores the oil pressure switch (OPS) (line 43) during the delay time. After the time delay elapses, the ADT energizes the arming relay (AR). Contacts 4 and 7 of the AR (line 43) close. The oil pressure relay (OPR) (line 43) and the oil pressure light (OPL) (line 44) can now respond to an OPS contact closure for a low oil pressure shutdown fault.

NOTE: The fault light indicators (OSR, WTR and OPR) can be ON only when key switch is in the RUN position. To reset a fault light, turn key switch to the STOP position.

Key Switch In STOP Position



DC Schematic Of Key Switch In STOP Position

When the keyswitch (KS) is turned to the STOP position (line 10), KS contacts B and R (lines 11 and 13) open and slave relay (SR1) (line 13) is de-energized. SR1 contacts 30 and 87 (line 7) open and fuel solenoid (FS) (line 7) is de-energized. Fuel is no longer provided to the engine.

Engine Shutdown Operation

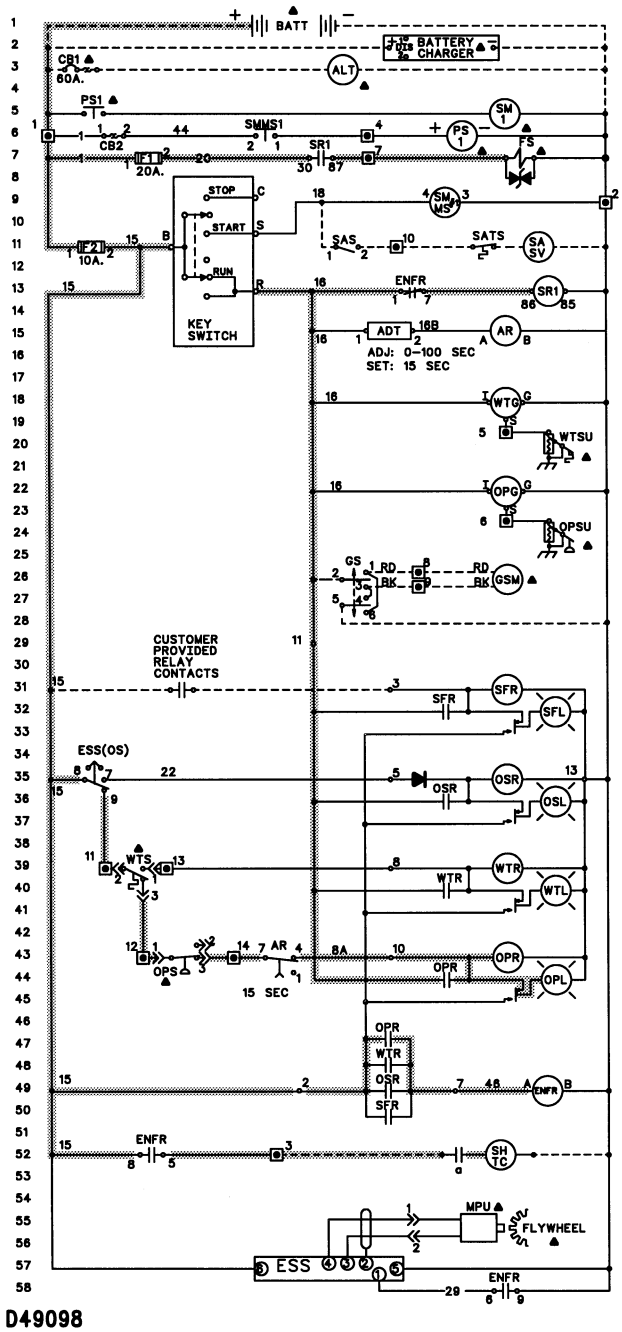
The engine can be shutdown manually or automatically. The most common method of shutting down the engine is by manually turning the key switch to the STOP position. For more information on this method, see the topic Key Switch In STOP Position.

When any one of the following conditions exist, the corresponding fault light will illuminate, the corresponding relay will energize and the engine will shutdown automatically.

- If the engine should overspeed as determined by the electronic speed switch (ESS).
- If the engine water temperature should rise above the upper limit of the water temperature switch (WTS).
- If the engine oil pressure should fall below the low limit of the engine oil pressure switch (OPS).
- If a shutdown condition should occur for the spare fault as determined by the customer.

Each of these shutdown methods (except spare fault) are described in the topics which follow. The conditions required for the spare fault shutdown are determined by the customer. However, the actual shutdown operates the same as the other faults.

Engine Shutdown Caused By Oil Pressure Fault



DC Schematic Of Engine Shutdown Caused By Oil Pressure Fault

When the key switch (KS) returns to RUN from the START position, KS contacts B and R (lines 11 and 13) close. The slave relay (SR1) (line 13) is now energized. SR1 contacts 30 and 87 (line 7) close to keep the fuel solenoid (FS) energized. Fuel is now provided to the engine.

The arming delay timer (ADT) (line 15) is also energized when the KS is in the RUN position. The ADT controls the amount of time that the oil pressure shutdown circuit is disabled after engine cranking. When the ADT is first energized a 15 second delay begins before the arming relay (AR) (line 15) is energized. After the 15 second delay the ADT energizes the AR. Contacts 4 and 7 of the AR (line 43) close. The oil pressure relay (OPR) (line 43) and the oil pressure light (OPL) (line 44) can now respond to a closed OPS (low oil pressure). During normal conditions, the 15 second delay allows the initial oil pressure to build-up which opens the oil pressure switch (OPS) (line 43).

If initial oil pressure does not build-up in the 15 second time delay, the OPS (line 43) will remain closed. Also, AR contacts 7 and 4 (line 43) are now closed. The circuit to the oil pressure relay (OPR) (line 43) and the oil pressure light (OPL) (line 44) is now complete. The OPR and the OPL are energized. OPR contacts (line 44) close and the OPR is latched. Also, OPR contacts (line 47) close to energize the engine failure relay (ENFR) (line 49). The normally closed ENFR contacts 1 and 7 (line 13) open to de-energize slave relay (SR1) (line 13). Without current to SR1, SR1 contacts 30 and 87 (line 7) open and fuel solenoid (FS) (line 7) is de-energized. Fuel is no longer provided to the engine.

While ENFR relay (line 49) is energized, the ENFR contacts 8 and 5 (line 52) close and provide power to the optional shunt trip coil (SHTC) (line 52). The optional SHTC opens the optional generator output circuit breaker.

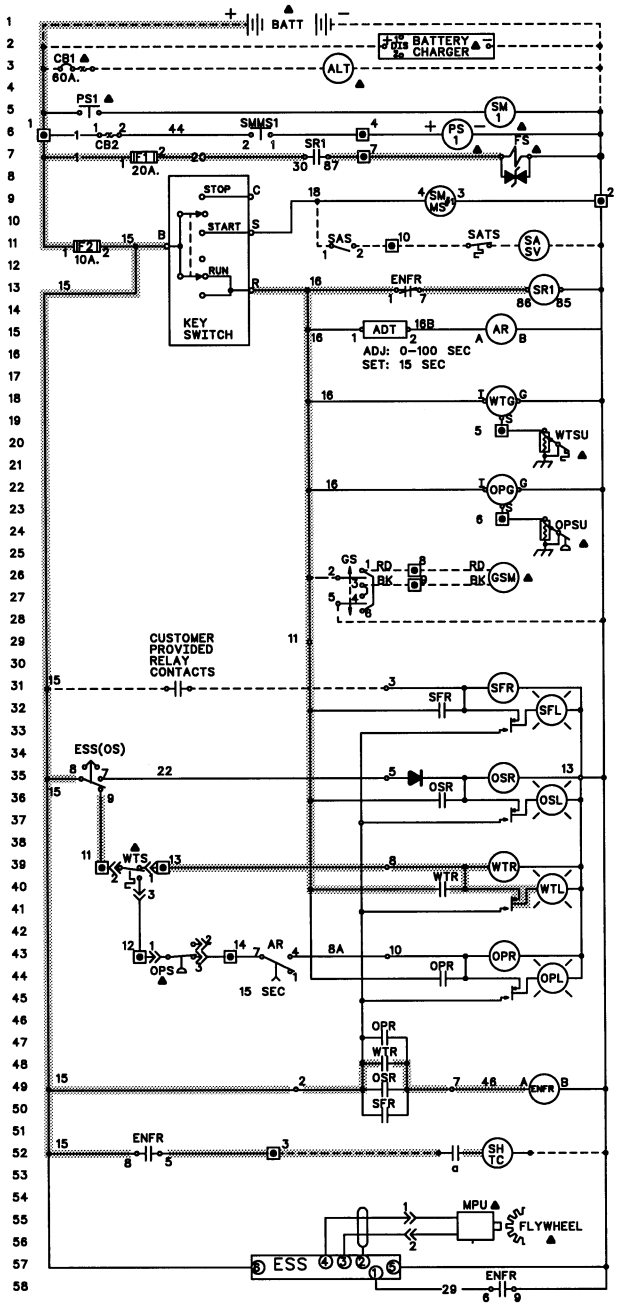
Procedure To Restart The Engine

⚠ WARNING

To prevent personal injury due to accidental starting of the engine, disconnect the batteries before doing maintenance or repair work.

1. Turn the key switch (KS) to STOP. The OPL (line 44) turns off. The AR (line 13) de-energizes which opens AR contacts (line 43). With AR contacts (line 43) open, the OPR (line 43) de-energizes which opens OPR contacts (line 44). Also, OPR contacts (line 47) open to de-energize the ENFR (line 49). The ENFR contacts 1 and 7 (line 13) close to allow restart.
2. Correct the low oil pressure fault.
3. Close the optional circuit breaker.
4. The system is ready to start when the key switch is turned to the START position.

Engine Shutdown Caused By Water Temperature Fault



D49100

DC Schematic Of Engine Shutdown Caused By Water Temperature Fault

When engine coolant temperature becomes too high, the water temperature switch (WTS) (line 39) closes. The water temperature relay (WTR) (line 39) and the water temperature light (WTL) (line 40) are now energized. WTR contacts (line 40) close and the WTR is latched. Also, WTR contacts (line 48) close to energize the engine failure relay (ENFR) (line 49). The normally closed ENFR contacts 1 and 7 (line 13) open to de-energize slave relay (SR1) (line 13). Without current to SR1, SR1 contacts 30 and 87 (line 7) open and fuel solenoid (FS) (line 7) is de-energized. Fuel is no longer provided to the engine.

While ENFR relay (line 49) is energized, the ENFR contacts 8 and 5 (line 52) close and provide power to the optional shunt trip coil (SHTC) (line 52). The optional SHTC opens the optional generator output circuit breaker.

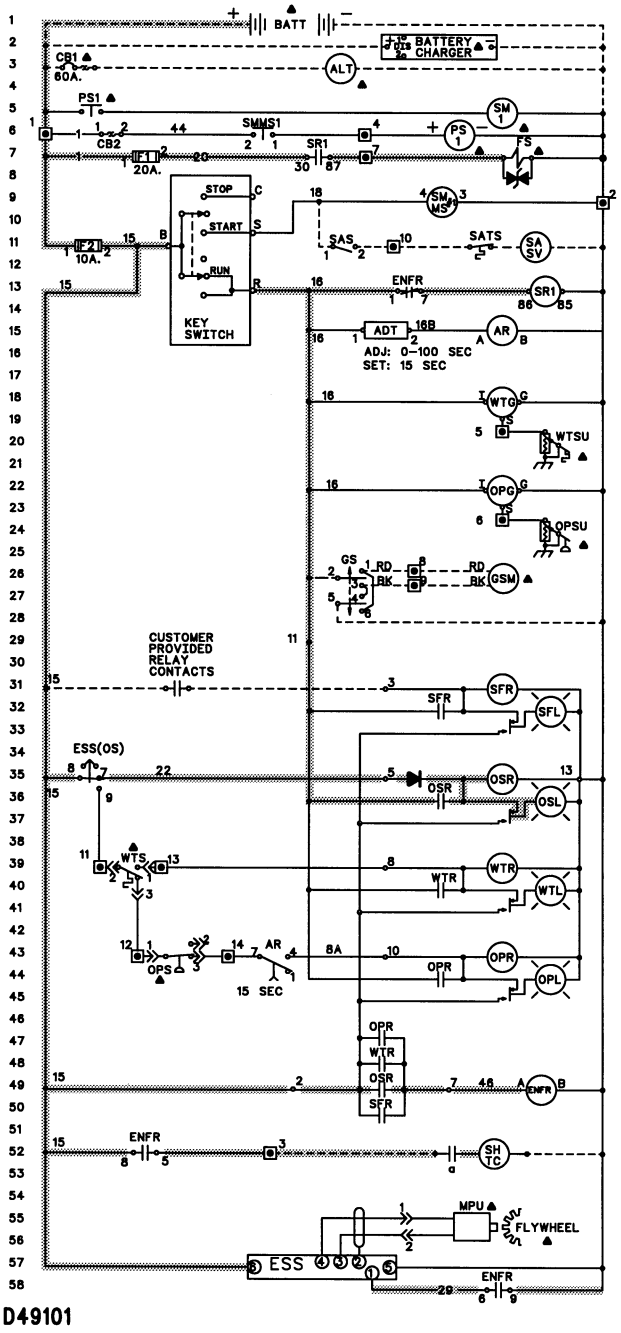
Procedure To Restart The Engine

⚠ WARNING

To prevent personal injury due to accidental starting of the engine, disconnect the batteries before doing maintenance or repair work.

1. Turn the key switch (KS) to STOP. When the engine cools, the WTS opens which de-energizes the WTR and turns OFF the WTL. WTR contacts (line 48) open to de-energize the ENFR relay (line 49). The ENFR contacts 1 and 7 (line 13) close to allow restart.
2. Correct the high water temperature problem. Allow the engine temperature to cool so that the WTS will open (reset).
3. Close the optional circuit breaker.
4. The system is ready to start when the key switch is turned to the START position.

Engine Shutdown Caused By Engine Overspeed Fault



DC Schematic Of Engine Shutdown Caused By Engine Overspeed Fault

When engine speed increases above the overspeed setting (118% of rated speed) of the electronic speed switch (ESS), ESS contacts 7 and 8 (line 35) close. The overspeed relay (OSR) (line 35) and the overspeed light (OSL) (line 36) are now energized. OSR contacts (line 36) close and the OSR is latched. Also, OSR contacts (line 49) close to energize the engine failure relay (ENFR) (line 49). The normally closed ENFR contacts 1 and 7 (line 13) open to de-energize slave relay (SR1) (line 13). Without current to SR1, SR1 contacts 30 and 87 (line 7) open and fuel solenoid (FS) (line 7) is de-energized. Fuel is no longer provided to the engine.

Also when the ENFR (line 49) is energized, ENFR contacts 6 and 9 (line 58) close. This resets the electronic speed switch (ESS) (line 57).

While ENFR relay (line 49) is energized, the ENFR contacts 8 and 5 (line 52) close and provide power to the optional shunt trip coil (SHTC) (line 52). The optional SHTC opens the optional generator output circuit breaker.

Procedure To Restart The Engine

⚠ WARNING

To prevent personal injury due to accidental starting of the engine, disconnect the batteries before doing maintenance or repair work.

1. Turn the key switch (KS) to STOP. ESS contacts 7 and 8 (line 35) open. The OSL (line 36) turns off and the the OSR (line 35) de-energizes. OSR contacts (line 49) open to de-energize the ENFR relay (line 49). The ENFR contacts 1 and 7 (line 13) close to allow restart.
2. Correct the engine overspeed problem.
3. Close the optional circuit breaker.
4. The system is ready to start when the key switch is turned to the START position.

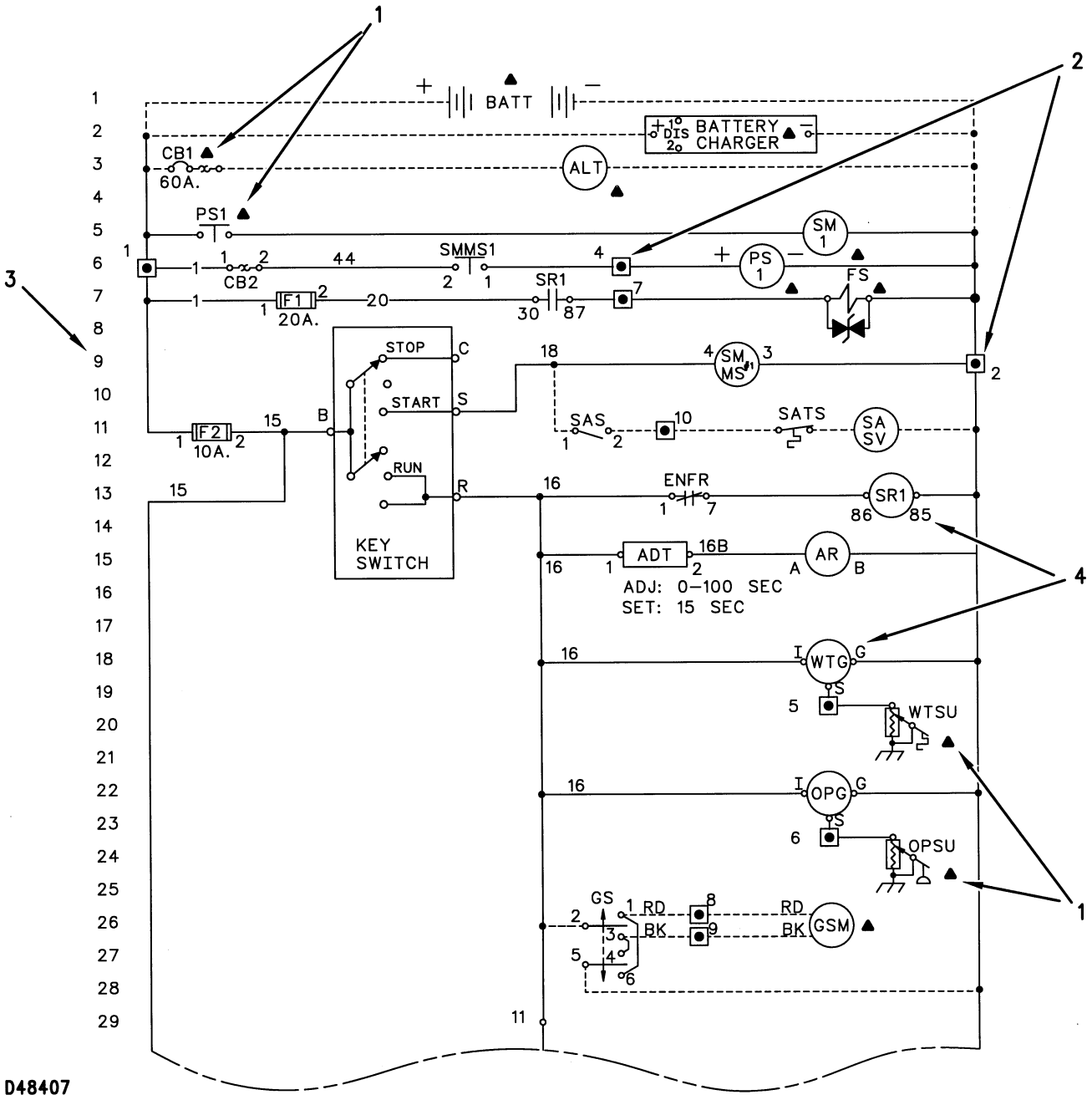
Schematics And Wiring Diagrams

Abbreviations

A	Amps
ADT	Arming Delay Timer
ALT	Alternator
AM	AC Ammeter
AR	Arming Relay
AVS	Ammeter/Voltmeter Phase Selector Switch
AWG	American Wire Gage
BATT	Battery
C	Common
CB	Circuit Breaker
CT	Current Transformer
D	Diode
EFL	Engine Failure Light
ENFR	Engine Failure Relay
ESS	Electronic Speed Switch
EXC	Exciter Field
F	Fuse
FB	Fuse Block
FFB	Four Light Fault Board
FM	Frequency Meter
FMR	Frequency Meter Resistor
FS	Fuel Solenoid
GFR	Genset Fault Relay
GOV	Governor
GS	Governor Switch
GSM	Governor Synchronizing Motor
GSOV	Gas Shut-Off Valve
HZ	Frequency
KS	Key Switch
L	Load Leads
LFS	Latching Fuel Control Solenoid
MAN	Manual
MPU	Magnetic Speed Pickup
NC	Normally Closed
NO	Normally Open
OP	Oil Pressure
OPG	Oil Pressure Gage
OPL	Oil Pressure Light
OPR	Oil Pressure Relay
OPSU	Oil Pressure Sending Unit
OSL	Overspeed Light
OSR	Overspeed Relay
POT	Potentiometer
PS	Pinion Solenoid
RAN	Remote Annunciator
SASV	Start Aid Solenoid Valve
SATS	Start Aid Temperature Switch
SAS	Start Aid Switch
SEC	Second
SFL	Spare Fault Light
SFR	Spare Fault Relay
SHTC	Shunt Trip Coil
SIG	Signal
SM	Starting Motor
SMMS	Starting Motor Magnetic Switch
SMR	Starting Motor Relay
SP	Speed Adjust Potentiometer
SR	Slave Relay
T	Generator Line Leads
TD	Time Delay Relay
TSC	Transfer Switch Position Indicating Contact
VAR	Voltage Adjust Rheostat
VM	AC Voltmeter
VR	Voltage Regulator
WT	Water Temperature
WTG	Water Temperature Gage
WTL	Water Temperature Light
WTR	Water Temperature Relay
WTSU	Water Temperature Sending Unit
XDUCER	Transducer
Z	Zener Diode
2301	Electronic Governor (Speed Sensing)

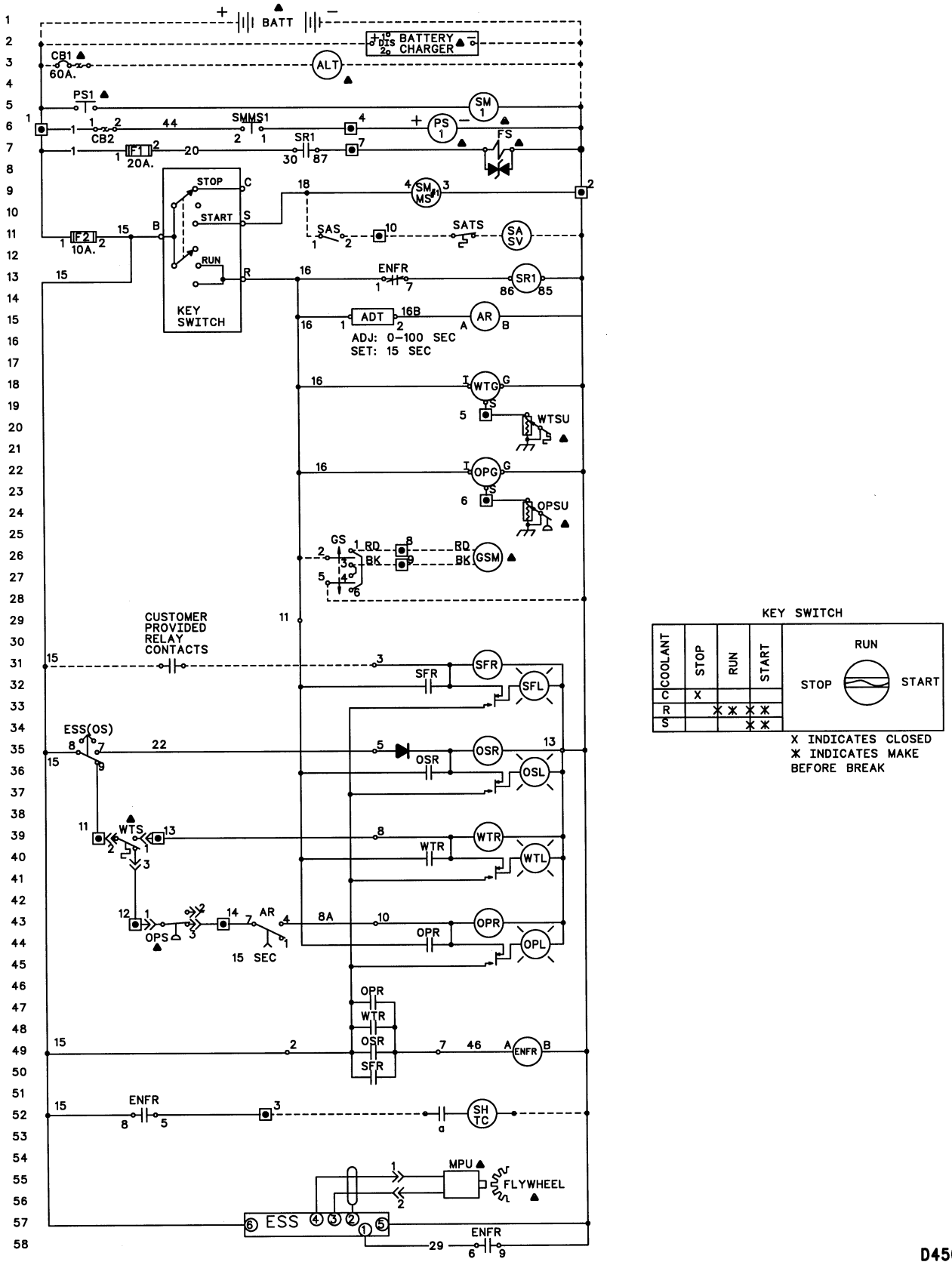
Symbols

D45033



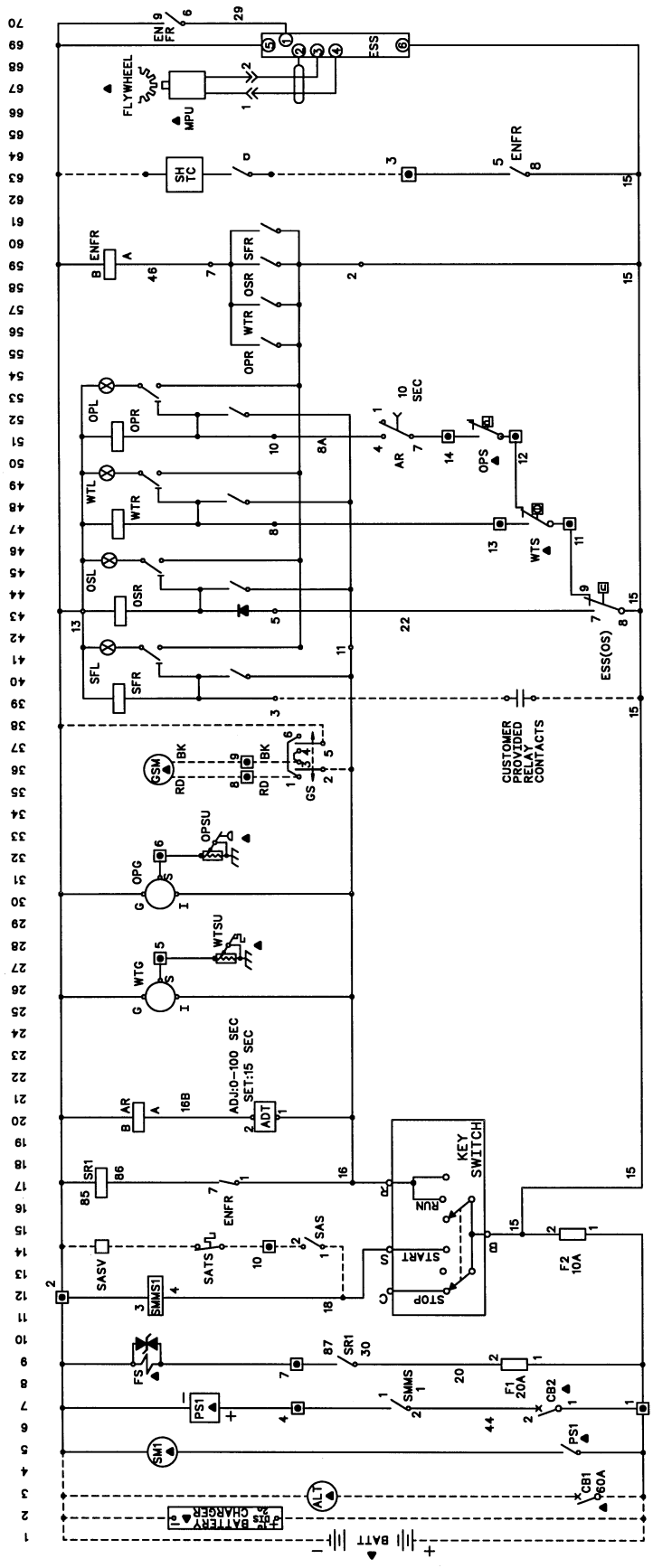
Typical DC Schematic
(1) Symbol which identifies the components that are not mounted on the control panel.
(2) Symbol which identifies a terminal that is mounted on the generator.
(3) Line numbers used for component location. For example, ALT is on line 3.
(4) Pin identification on component.

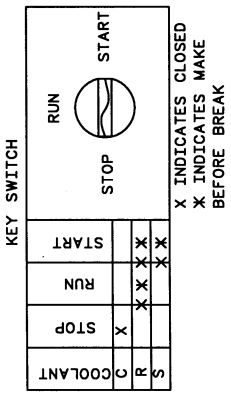
DC Schematic - JIC



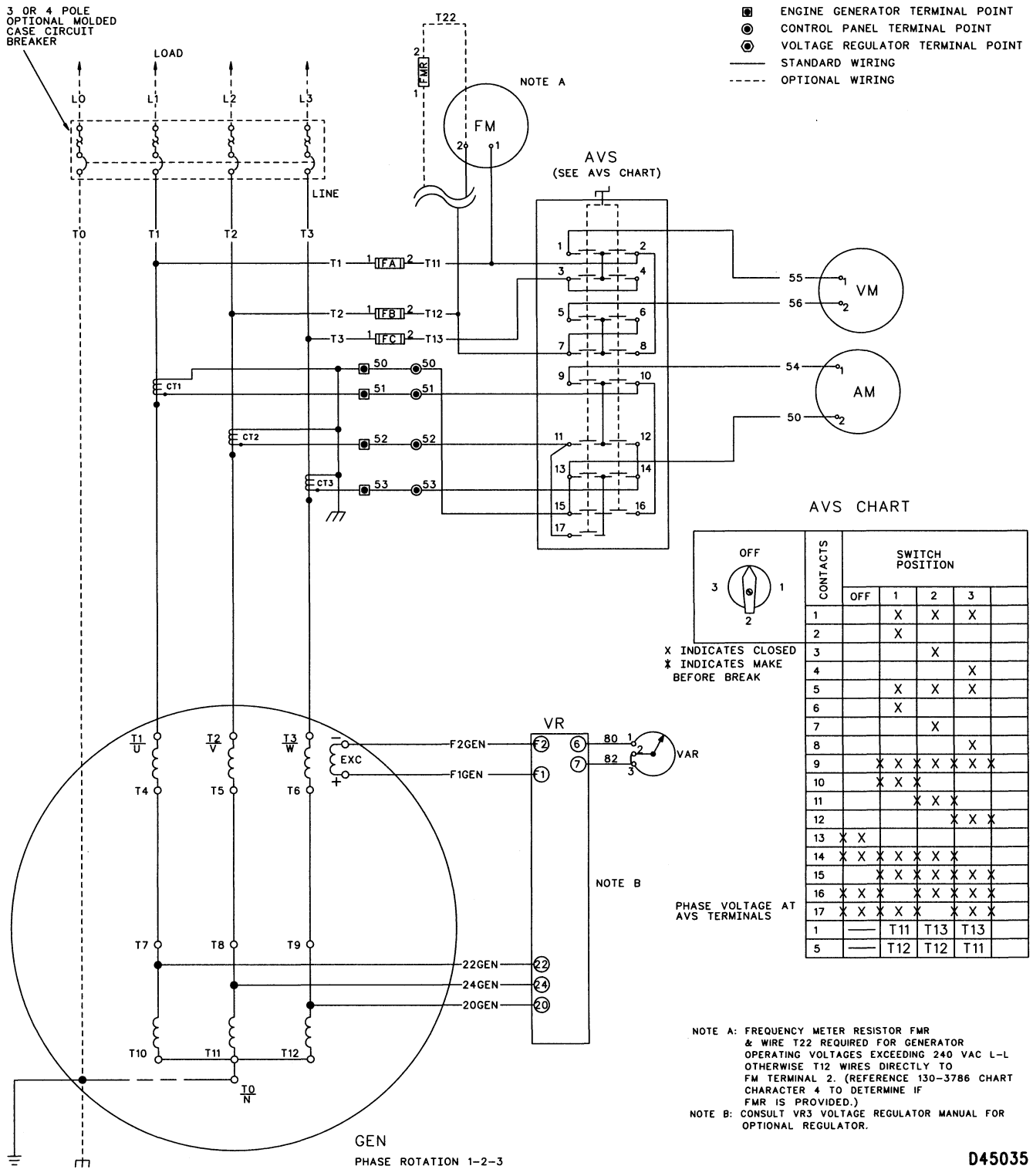
D45038

DC Schematic - IEC





D45039



AVS CHART

X INDICATES CLOSED
✱ INDICATES MAKE BEFORE BREAK

CONTACTS	SWITCH POSITION				
	OFF	1	2	3	
1		X	X	X	
2		X			
3			X		
4				X	
5		X	X	X	
6		X			
7			X		
8				X	
9		✱	X	✱ X	✱ X
10		✱	X	✱	
11			✱	X ✱	
12				✱	X ✱
13	✱ X				
14	✱ X	✱	X ✱	X ✱	
15		✱	X ✱	X ✱	X ✱
16	✱ X	✱		X ✱	X ✱
17	✱ X	✱	X ✱		X ✱
1	—	T11	T13	T13	
5	—	T12	T12	T11	

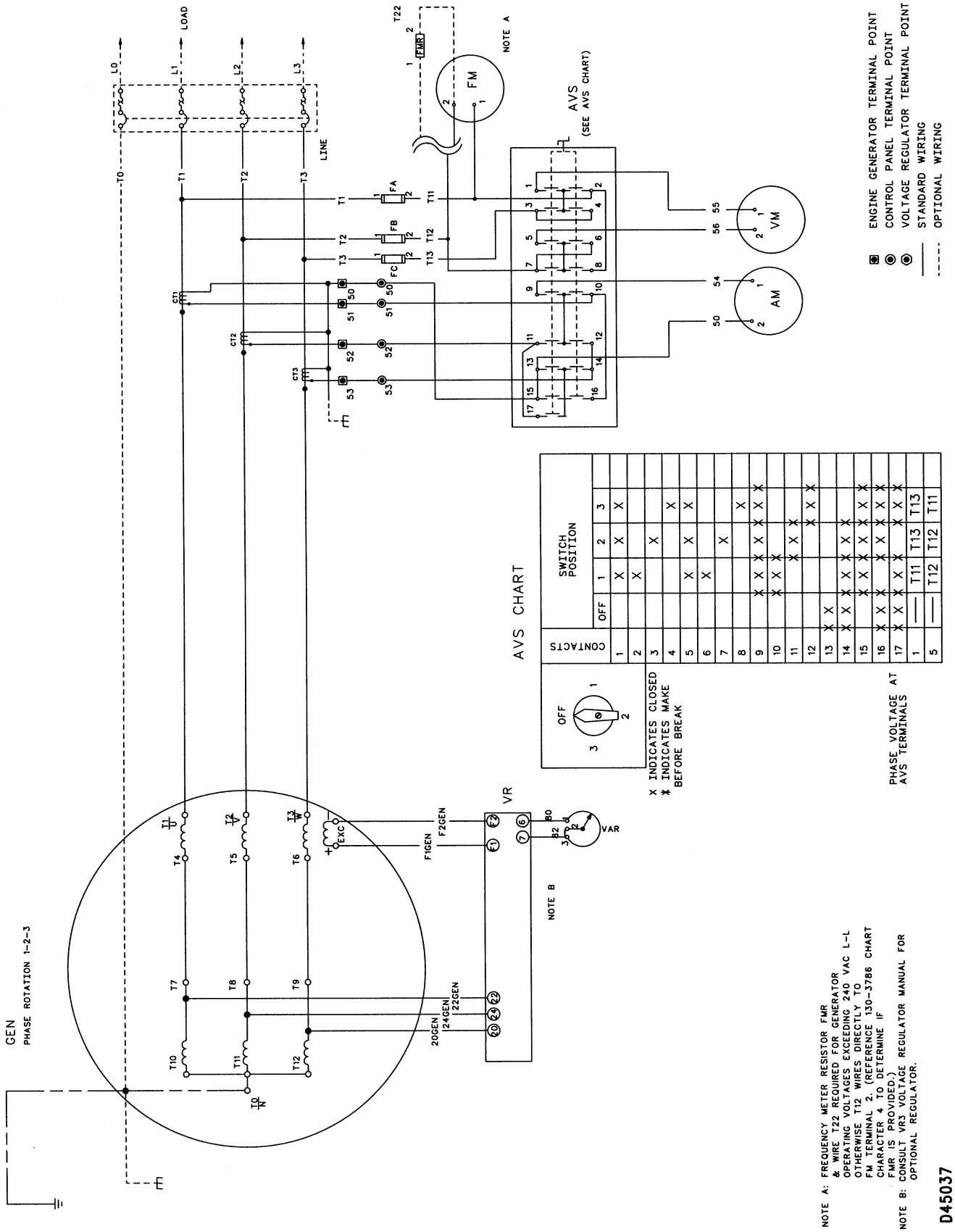
PHASE VOLTAGE AT AVS TERMINALS

NOTE A: FREQUENCY METER RESISTOR FMR & WIRE T22 REQUIRED FOR GENERATOR OPERATING VOLTAGES EXCEEDING 240 VAC L-L OTHERWISE T12 WIRES DIRECTLY TO FM TERMINAL 2. (REFERENCE 130-3786 CHART CHARACTER 4 TO DETERMINE IF FMR IS PROVIDED.)

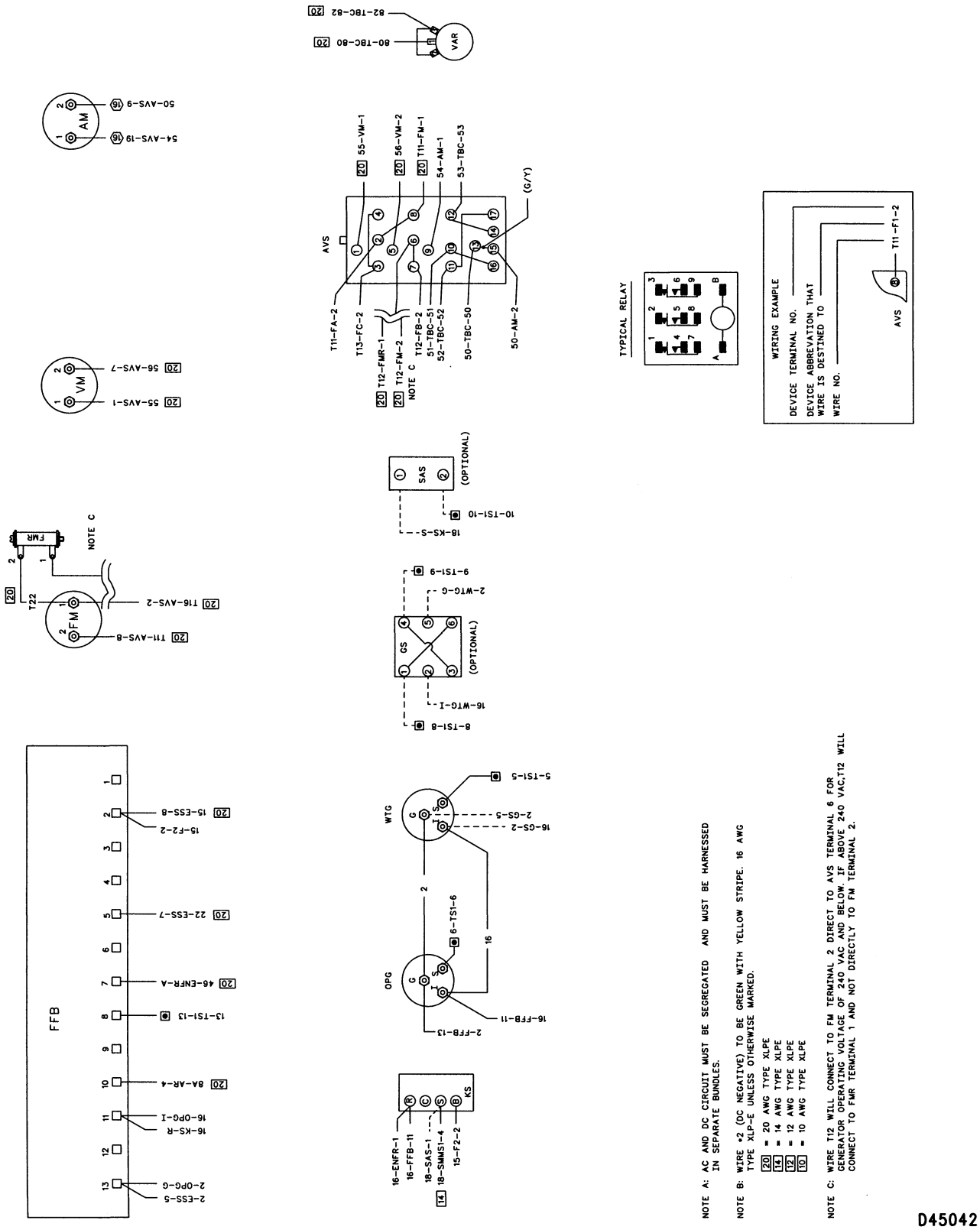
NOTE B: CONSULT VR3 VOLTAGE REGULATOR MANUAL FOR OPTIONAL REGULATOR.

D45035

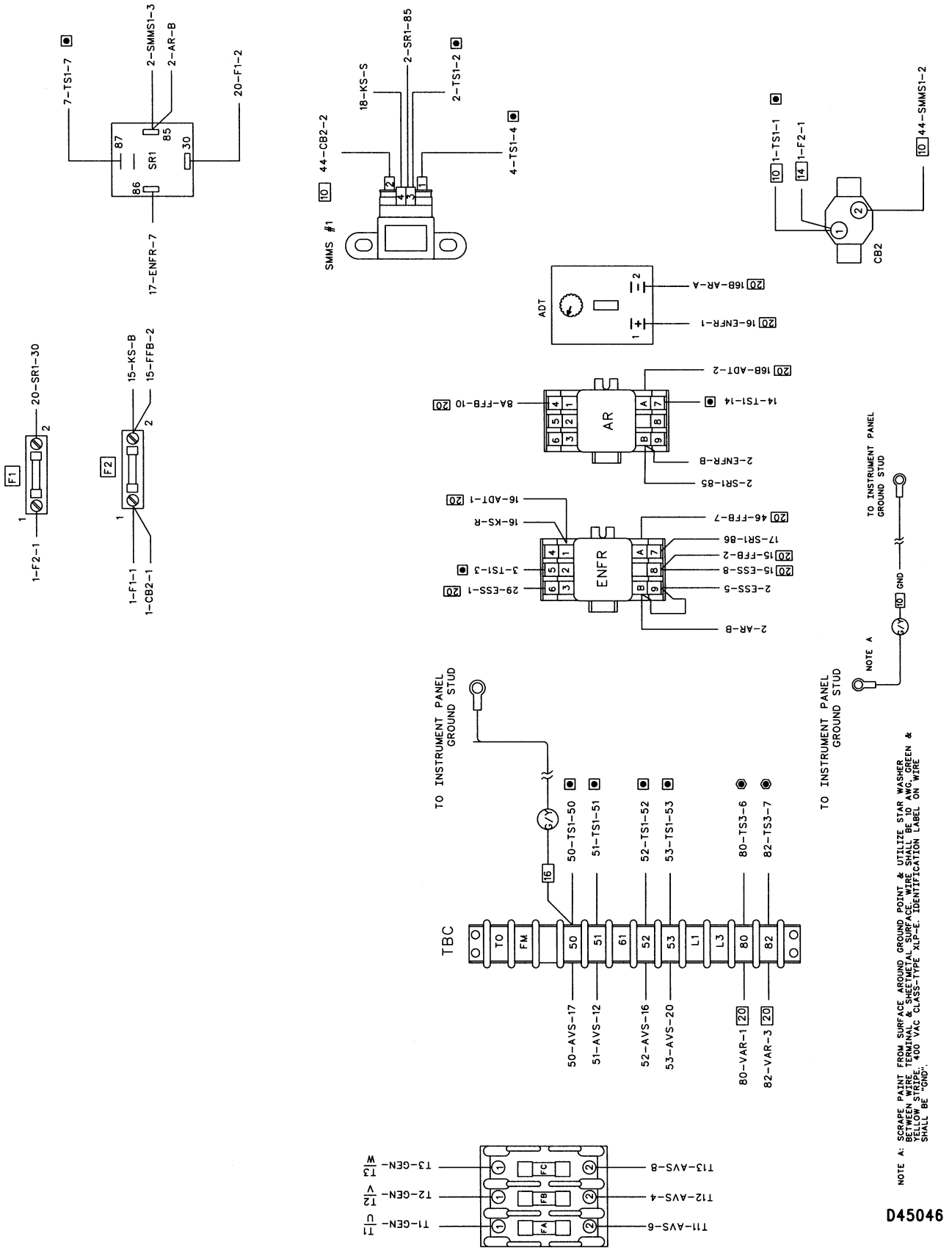
AC Schematic - IEC



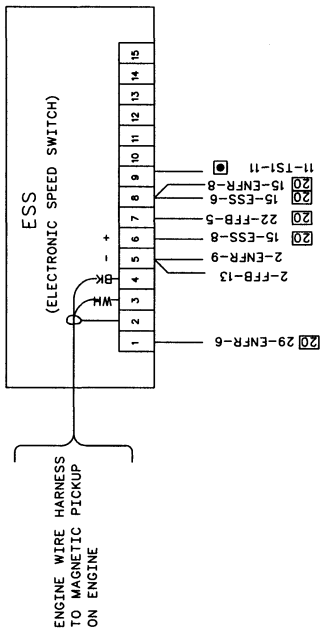
Wiring Diagram - Door of Control Panel



Wiring Diagram - Bottom of Control Panel

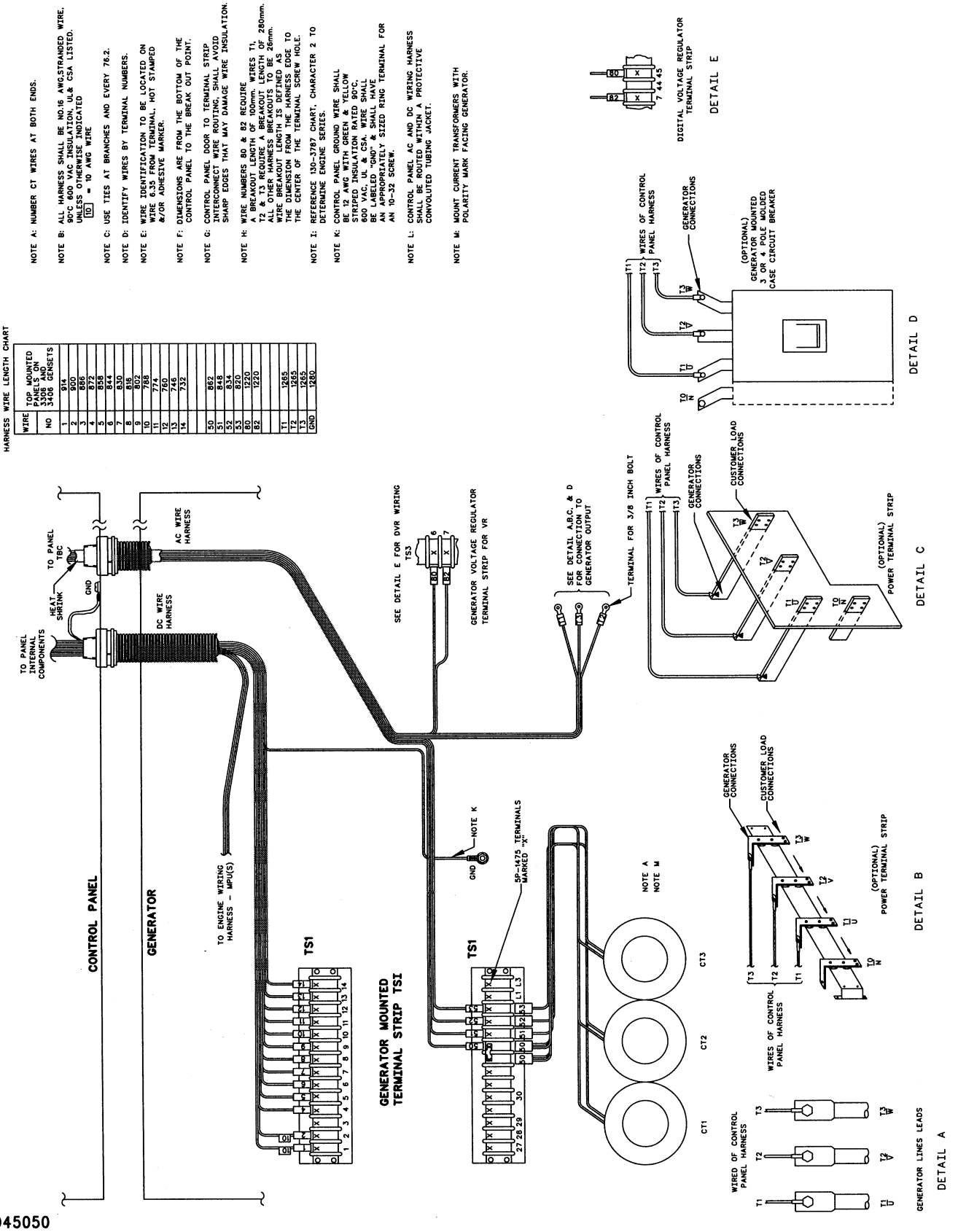


Wiring Diagram - Rear of Control Panel

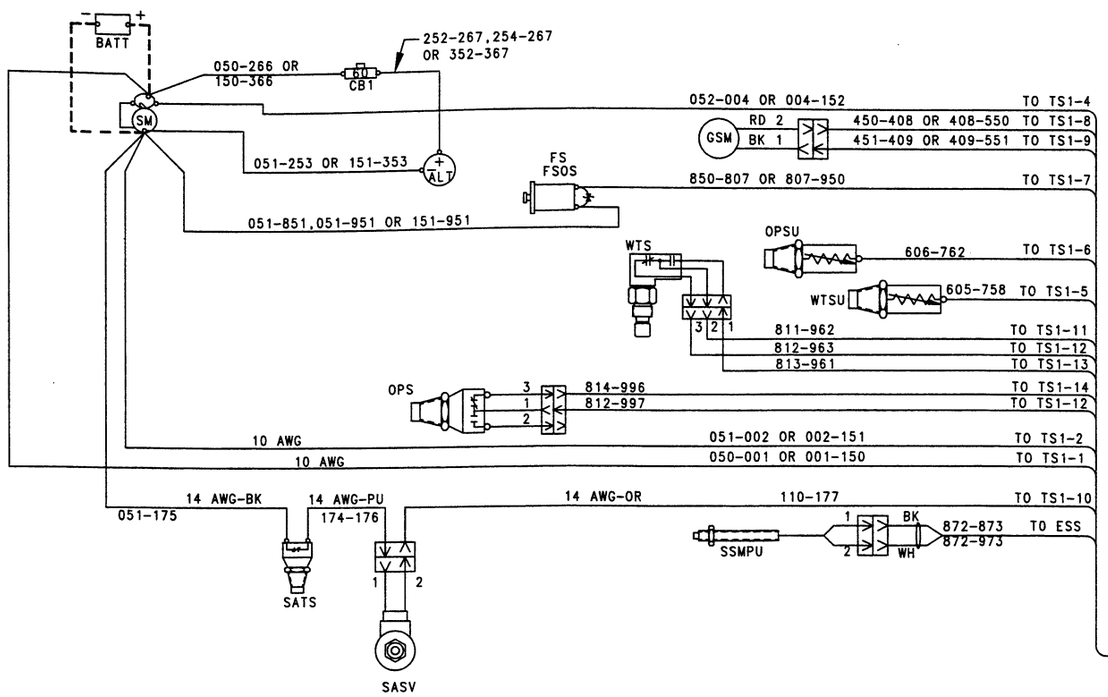


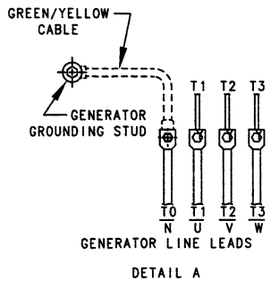
D45047

Wiring Diagram - Harness

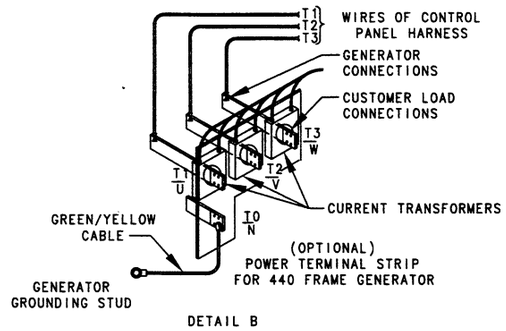


Wiring Diagram - Generator

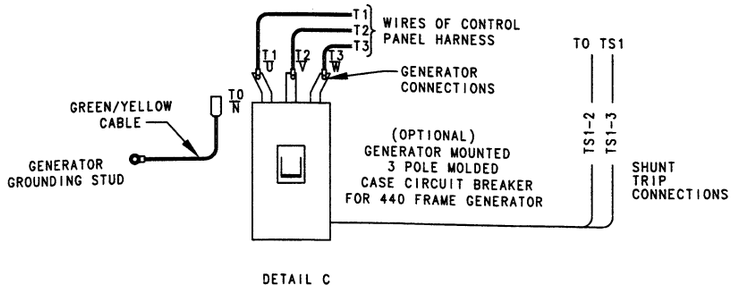




DETAIL A



DETAIL B

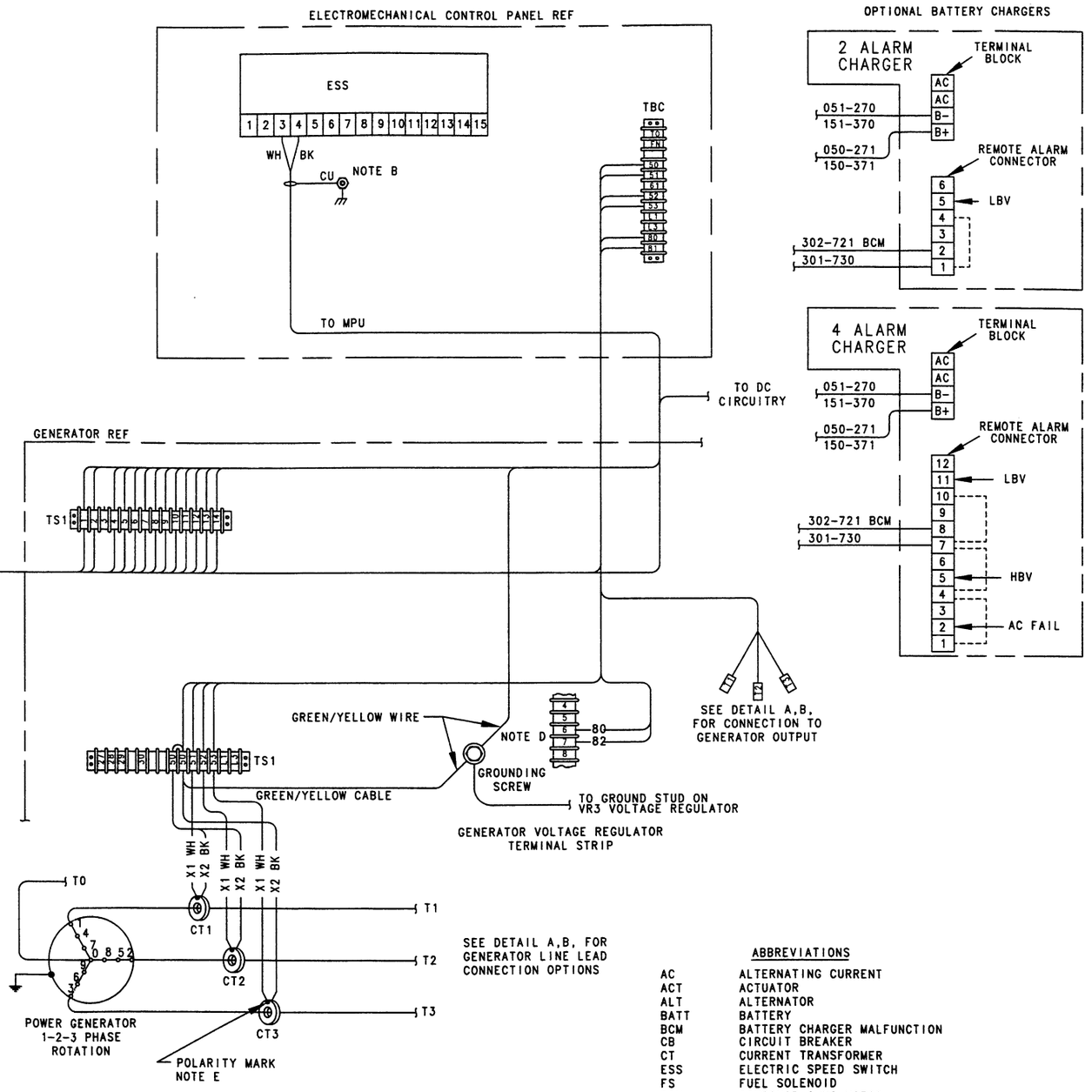


DETAIL C

D47587

BATTERY CABLE SIZE
MAX ONE WAY LENGTH (25°C)

GAGE	SINGLE STARTING MOTOR	DUAL STARTING MOTOR
0000	5m	2.5m
000	4m	2m
00	3.25m	1.5m
0	2.5m	1.25m



NOTE A: DO NOT OPERATE ALTERNATOR WITHOUT A BATTERY CONNECTED TO THE SYSTEM. DO NOT POLARIZE ALTERNATOR. DO NOT OPERATE ALTERNATOR SIMULTANEOUSLY WITH A DC GENERATOR TO CHARGE A COMMON BATTERY.

NOTE B: GROUND MPU SHIELDED CABLE AT CONTROL PANEL MOUNTING STUD ONLY.

NOTE C: REFER TO 5N-9532 CHART FOR WIRE IDENTIFICATION CODES.

NOTE D: CONNECT CONTROL PANEL HARNESS WIRE NO. 80 TO TERMINAL NO. 6 WHEN THE VR3 (COMPLETELY ENCLOSED) IS PROVIDED. REMOVE THE JUMPER BETWEEN VOLTAGE REGULATOR TERMINALS 4 AND 7. CONNECT CONTROL PANEL HARNESS WIRE NO.82 TO TERMINAL NO.7.

NOTE E: MOUNT CURRENT TRANSFORMERS WITH POLARITY MARK FACING GENERATOR.

ABBREVIATIONS

AC	ALTERNATING CURRENT
ACT	ACTUATOR
ALT	ALTERNATOR
BATT	BATTERY
BCM	BATTERY CHARGER MALFUNCTION
CB	CIRCUIT BREAKER
CT	CURRENT TRANSFORMER
ESS	ELECTRIC SPEED SWITCH
FS	FUEL SOLENOID
GSM	GOVERNOR SYNC MOTOR
HBV	HIGH BATTERY VOLTAGE
LBV	LOW BATTERY VOLTAGE
NEG	NEGATIVE
OPS	OIL PRESSURE SWITCH
OPSU	OIL PRESSURE SENDING UNIT
POS	POSITIVE
PWR	POWER
SASV	START AID SOLENOID VALVE
SATS	START AID TEMPERATURE SWITCH
SM	STARTING MOTOR
SSMPU	SPEED SWITCH MAGNETIC PICKUP
STTS	SHUNT TRIP TERMINAL STRIP
SPD POT	SPEED SETTING POTENTIOMETER
WTS	WATER TEMPERATURE SWITCH
WTSU	WATER TEMPERATURE SENDING UNIT
------	CUSTOMER WIRING

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