



Harrison Hydra-Gen®
Hydraulic Driven AC Generator System

Operation and Installation Guide

For Harrison Hydra-Gen Model(s):

15.0 NCM – 16F

20.0 NCM – 16F

(01-31-2013) - Spec. B

For technical assistance contact:

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WARRANTY REGISTRATION CARD

Keep top section for your permanent records.

DATE OF PURCHASE	
GENERATOR MODEL	
SERIAL NUMBER	
PUMP MODEL NUMBER	
SERIAL NUMBER	
WHERE PURCHASED	
ADDRESS	
CITY, STATE, ZIP	



IMPORTANT: A completed warranty registration card (form no. WR-1 below) is required for the fulfillment of any warranty service. Please return this section immediately to ensure your service is not denied or delayed pending proof of purchase information verification.

WARRANTY REGISTRATION CARD

FORM NO. WR-1

COMPANY NAME: _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP:** _____

CONTACT: _____ **PHONE NO.:** _____

GENERATOR MODEL NO.: _____ **SERIAL NO.:** _____

PUMP MODEL NO.: _____ **SERIAL NO.:** _____

WHERE PURCHASED: _____

Please cut card along
dotted line, fold, and secure
with tape before mailing.

CUT HERE



Harrison Hydra-Gen, Ltd
14233 West Rd.
Houston, TX 77041

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SAFETY PRECAUTIONS

WARNING!

THIS SYMBOL WARNS OF IMMEDIATE HAZARDS OR UNSAFE PRACTICES WHICH WILL RESULT IN SEVERE PERSONAL INJURY OR DEATH.

CAUTION!

THIS SYMBOL REFERS TO A HAZARD OR UNSAFE PRACTICE, WHICH CAN RESULT IN PERSONAL INJURY OR PRODUCT OR PROPERTY DAMAGE.

WARNING!

DO NOT OPERATE THE GENERATOR IF THE VEHICLE HAS BEEN DRIVEN THROUGH HIGH WATER OR SUSPECTED WATER HAS ENTERED THE GENERATOR.

WARNING!

DO NOT SET OPERATING FREQUENCY ABOVE 63 HZ. THE GENERATOR AND ELECTRICAL EQUIPEMENTS CAN BE SEVERELY DAMAGED IF OPERATING FREQUENCY IS SET ABOVE 63 HZ.

WARNING!

WITH THE NEW 2007 EMISSIONS, ENGINE EXHAUSTS ARE OPERATING HOTTER. IF OIL COMES IN CONTACT WITH THE EXHAUST, A FIRE COULD OCCUR.

GENERAL SAFETY

- Electrical equipment and moving parts present potential hazards that may result in serious personal injury. Take care in following these recommended procedures.
- Do not work on this equipment when mentally or physically fatigued.
- Always wear safety glasses.

ELECTRICAL SHOCK

- Disengage power before moving protective shields or touching electrical equipment.
- Use rubber insulating mats placed on dry wood platforms over floors that are metal or concrete.
- Do not wear damp clothing (including wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Jewelry is a good conductor of electricity and therefore should be removed when working on electrical equipment.
- Use extreme caution when working on electrical components. High voltages cause injury or death.
- Generator installation and operation must comply with all applicable local, state, and federal codes and regulations.
- Have all electrical installations performed by a qualified licensed electrician.

MOVING PARTS

- Avoid moving parts when working on the unit.
- Do not wear loose clothing when working around rotating components.
- Make sure all the nuts and bolts are secure.
- Keep power shields and guards in position.
- If adjustments must be made while the unit is running, use extreme caution around rotating and/or hot components.

HYDRAULIC FLUID UNDER PRESSURE

- Hydraulic fluid can penetrate the skin, which can result in possible blood poisoning.
- Always shut down the primary engine driving the hydraulic pump before loosening or tightening any fittings.

CLEAN UNIT AND SURROUNDING AREA

- Keep the unit and surrounding area clean.
- Remove all accumulated grease and oil from the unit. **Do not** store anything in the generator compartment. Both can cause generator system problems (overheating, noise, and vibration), eventual generator damage, and/or potential fire hazards.

INTRODUCTION

ABOUT THIS MANUAL

This manual covers the specifications, installation, operation, and maintenance of your Harrison Hydra-Gen hydraulic generator.

PARTS & SERVICE

To obtain parts or service, please have your **model and serial number** ready and contact us toll free at 1-800-723-3334. Outside of the United States, please call 1-281-807-4420. You can also reach us via fax at 1-281-807-4815. Our office hours are Monday through Friday between 8:00 AM and 5:00 PM Central Standard Time.

Alternately, you may access product information online at www.harrisonhydragen.com and obtain support via customerservice@harrisonhydragen.com.

SYSTEM OVERVIEW

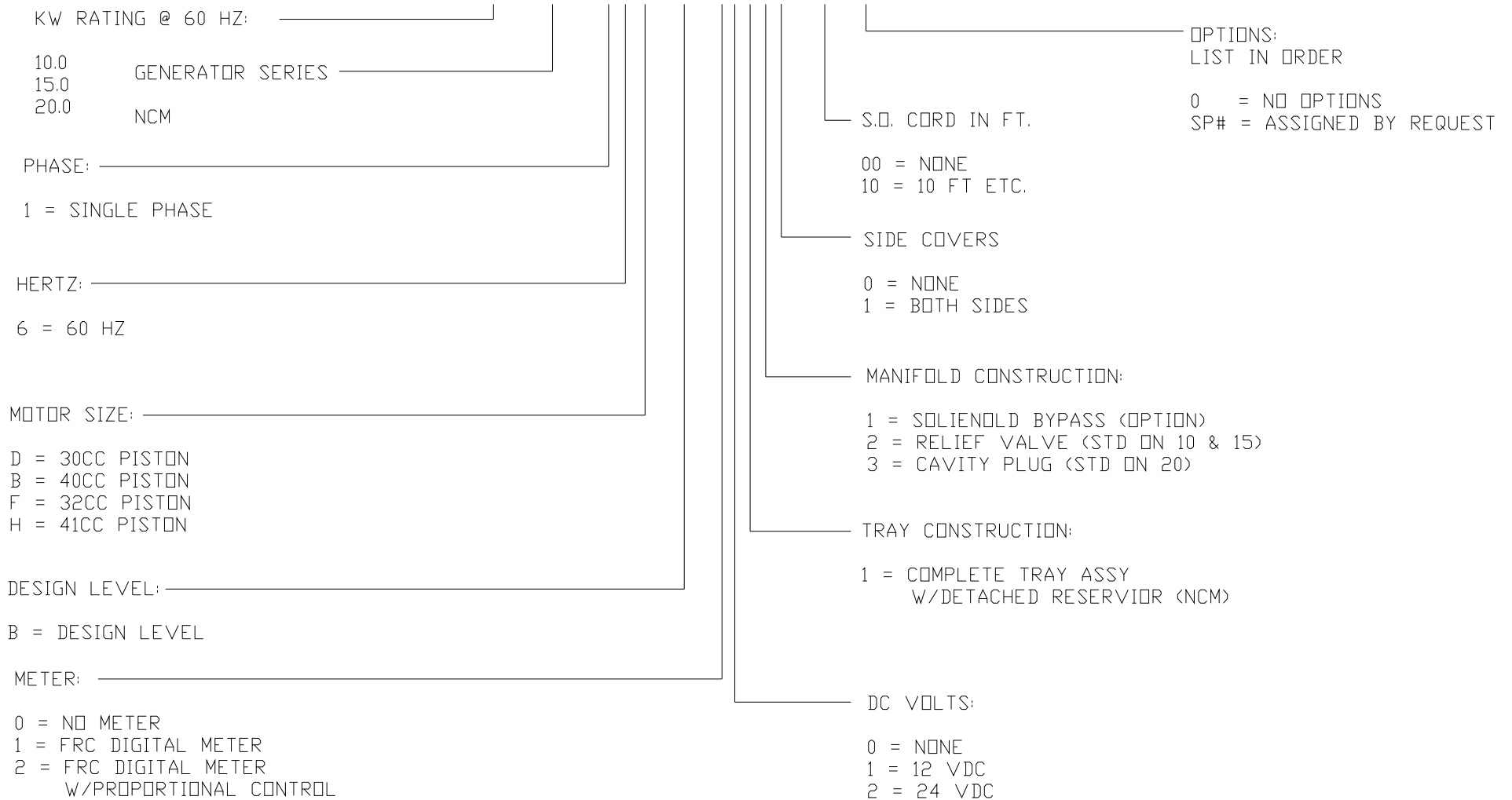
Harrison Hydra-Gen hydraulic generators are comprised of several components. A general hydraulic and electrical component overview for our generator is described below.

- **Hydraulic Pump:** The hydraulic pump sends hydraulic fluid (oil) to the motor at a constant flow under varying engine speeds.
- **Motor:** The hydraulic motor drives the alternator.
- **Alternator:** An AC brushless revolving field alternator provides regulated 120/240 VAC.
- **Heat Exchanger:** When the oil leaves the motor it is cooled in an oil-to-air heat exchanger before it is returned to the reservoir.
- **Hydraulic Reservoir:** The hydraulic oil reservoir is equipped with an oil filter, oil level sight glass, oil temperature gauge, oil filter and breather cap.
- **Display:** The generator is also equipped with a FRC meter which displays output voltage, frequency, current, oil temperature, and unit running time.

GENERATOR ORDERING CODE

NCM GENERATOR MODEL NUMBER

10.0NCM-16D/B-11010/10/0



HYDRAULIC PUMP ORDERING CODE

PUMP MODEL CODE

D R 1 R 0 - 0 1 / 1

TYPE/SIZE

- D = 45CC DELTA Q
- F = 60CC REXROTH
- G = 23CC GEAR PUMP
- K = 80CC KAWASAKI
- R = 45CC REXROTH
- W = 80CC REXROTH
- X = 71CC REXROTH
- Y = 100CC REXROTH

DESIGNATOR FOR KW

- A = 10-20 MPC 50HZ
- B = 30 MPC 60HZ
- D = 10-20 MPC 60HZ
- F = FORD APPL. GEAR
- G = 30 MPC 50HZ
- R = LPG, MAS, MCR, MSV

ROTATION

- 1 = CLOCKWISE
- 2 = COUNTER CLOCKWISE

PORTING

- R = REAR PORTED
- S = SIDE PORTED

OPTIONS

- 1 = NO OPTIONS
- 2 = LOADING CONTROL
- A = SPECIAL ALLISON FIT REAR SAE PORT COVER FOR 45 CC DELTA Q PUMP CW ROTATION ONLY
- TM = TAPPING MANIFOLD

INPUT MOUNT AND SHAFT

- 01 = SAE B, 2 BOLT, 13 TOOTH
- *02 = SAE C, 2 BOLT, 14 TOOTH
- *03 = SAE C, 2 BOLT, 1/14" KEYED SHAFT
- 04 = SAE B, 2 BOLT, BB SHAFT 15 TOOTH
- **05 = SAE A, 2 BOLT, 11 TOOTH
- 06 = SAE B, 2 BOLT, BB 1" KEYED SHAFT

OUTPUT SHAFT (THRU DRIVE)

- 0 = NO OUTPUT SHAFT
- 1 = SAE A, 2BOLT, 9 TOOTH
- 2 = SAE B, 2 BOLT, 13 TOOTH
- *3 = SAE C, 2 BOLT, 14 TOOTH
- *4 = SAE BB, 2 BOLT, 15 TOOTH

THE SIZE OR THE PUMP DICTATES THE RPM REQUIRED TO OPERATE THE GENERATOR. CONTACT HARRISON FOR BEST APPLICATION.

* INDICATES THIS OPTION IS NOT AVAILABLE ON THE 45 CC PUMP.

** ONLY AVAILABLE ON 23CC GEAR PUMP.

SPECIAL ORDER PUMPS ARE AVAILABLE UPON REQUEST.

SPECIFICATIONS

UNIT DIMENSIONS AND WEIGHTS

TRAY	15.0KW	20.0KW	RESERVOIR
<i>Height</i>	18.63"	18.63"	13.9"
<i>Width</i>	16.15"	16.15"	19"
<i>Length</i>	43.38"	43.38"	9.3"
<i>Weight</i>	350 lbs	384 lbs	
<i>Max KW</i>	15	20	
<i>Amps @ 120V</i>	125	167	
<i>Amps @ 240V</i>	63	84	
<i>Power Required</i>	34 HP	44 HP	
<i>Max System Pressure</i>	3900 PSI	4600 PSI	

ALTERNATOR DETAIL

Design: Brushless revolving field, four pole, and 1800 rpm for 60-hertz operation.
Rating: See nameplate for individual unit rating.
Regulation: ± 1% Voltage regulation from nameplate rating.
Waveform: Harmonic distortion is limited to just 4%.
Insulation: Class H, 200°C, Slot Insulation, Varnish, Additional Marine Coating.
Power Factor, Pf: 1.0 (unity) for single phase units, 0.8 for three phase units.

HYDRAULIC SYSTEM

Type of oil: Use only premium hydraulic fluid with anti wear, anti foam, and anti rust additives. Optimum operating viscosity is 80-170 SUS. Viscosity should never exceed 4,600 SUS at the coldest startup temperature, and should never be less than 60 SUS at 180°F.
Capacity: The reservoir should contain a minimum of 5.0 gallons (U.S.) of hydraulic oil.

DRIVE MOTOR

Type: Bent-axis piston motor
Displacement: 30 CC
Max. Pressure: 5800 psi
Case Drain: External
Rotation: Bi-Directional

PUMP REQUIREMENTS

Flow: 15.0 GPM
Pressure: 3900 psi

DIMENSION DRAWINGS

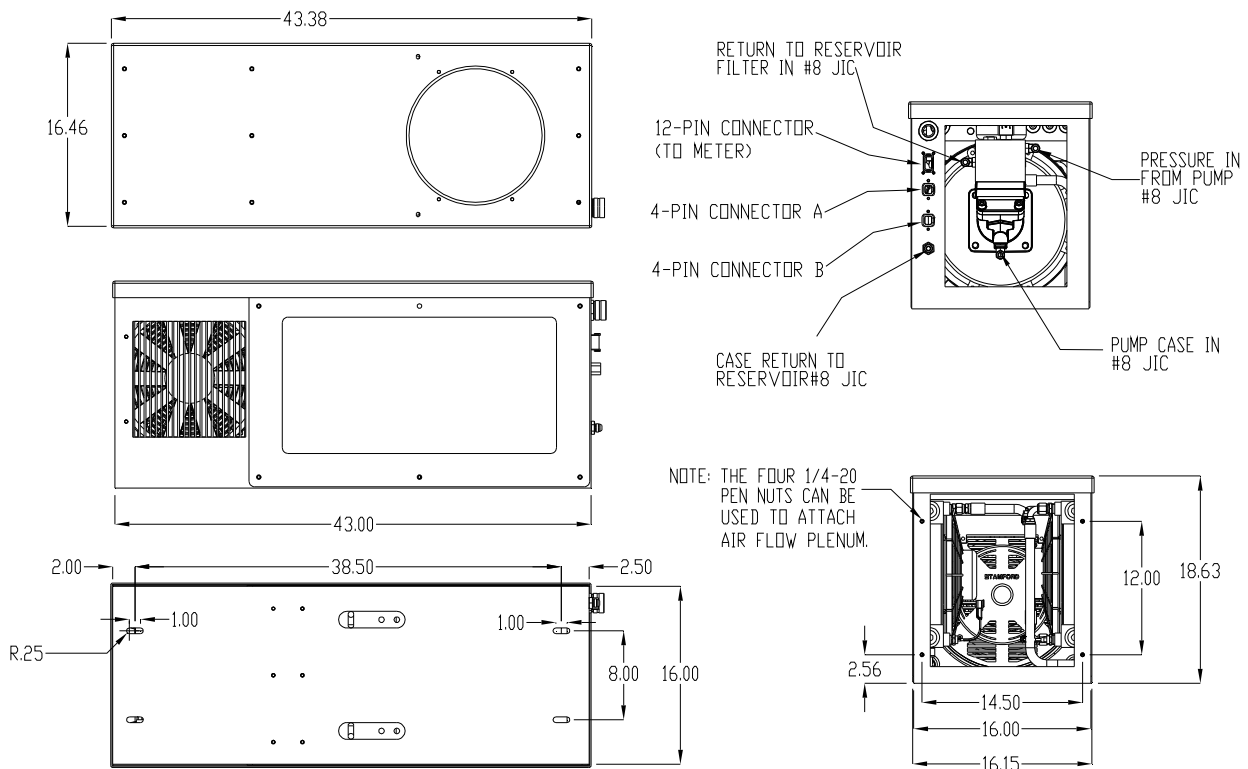


Figure 1: Generator Tray Dimension Drawing

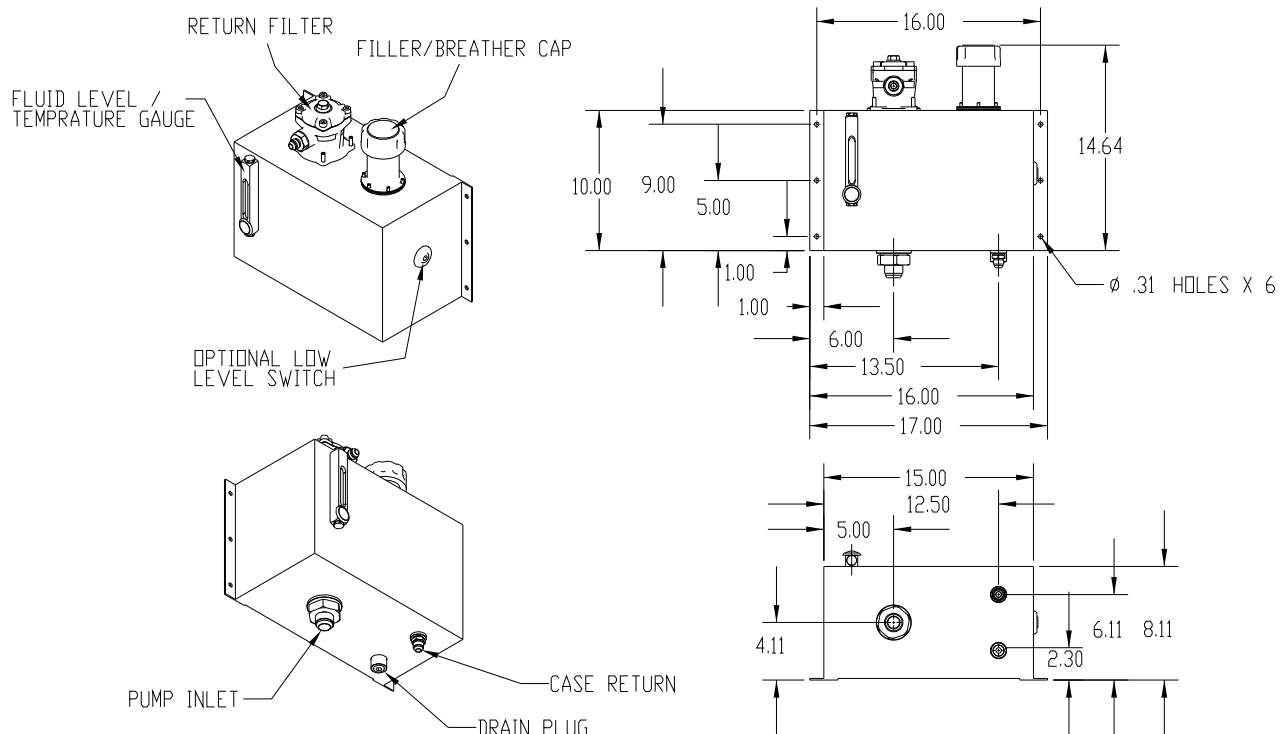


Figure 2: Reservoir Dimension Drawing

HYDRAULIC PUMP INFORMATION

80CC KAWASAKI PUMP

Min / Max Shaft Speed	900 / 3000 rpm †
Displacement	80 CC
Min / Max Temperature	-4 / 204° F
Pump Weight	78 lbs
Maximum Input Torque	295 ft. lbs
Pump Shaft	SAE "C" Spline or Keyed
Maximum Pressure	5200PSI
Rotation	CW or CCW
Maximum Vacuum	10.0 in. Hg.

† Note: Consult Harrison Hydra-Gen factory for pump speeds above 3000 rpm.

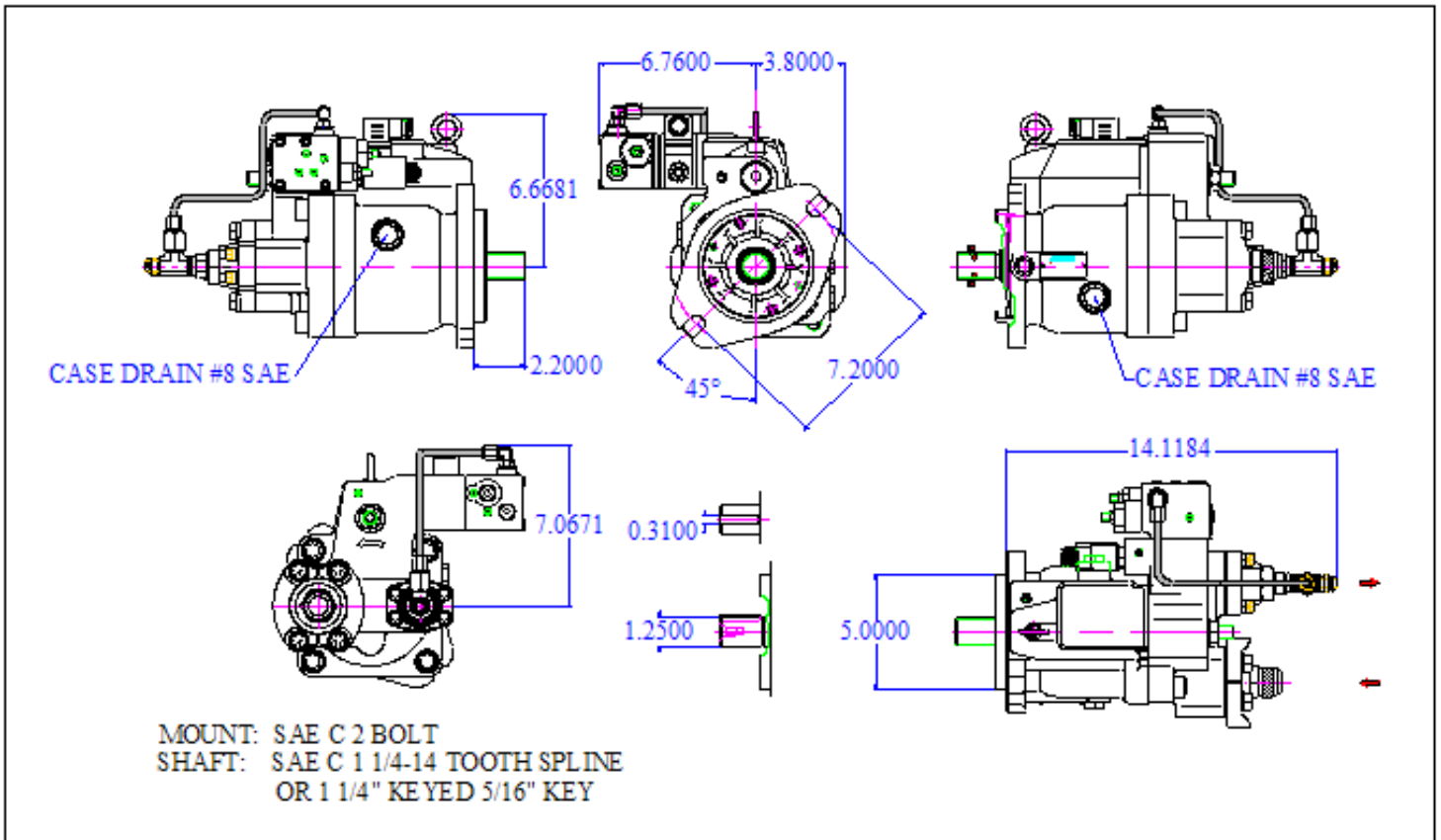


Figure 3: 80cc Kawasaki Pump

INSTALLATION GUIDE

The hydraulic generator system must be installed properly to operate reliably, quietly, and most importantly, safely. Read the entire manual and option instructions before installation.

INSTALLATION CLEANLINESS

CAUTION!

MAINTAIN OIL CLEANLINESS DURING INSTALLATION. DEBRIS IN A HYDRAULIC SYSTEM MAY DAMAGE INTERNAL COMPONENTS OR CAUSE THE PUMP COMPENSATOR TO STICK, RESULTING IN ERRATIC OPERATION.

- Ensure the work area is free of dirt and always keep ports plugged until hoses are installed.
- Filter oil through a 10 micron (or better) absolute filter before using it in the generator. Even a new barrel of oil can contain contamination that is harmful to a hydraulic system.
- Thoroughly flush hoses before connecting. It is best to clean your hoses using an air gun like the one shown below. See the Accessories page in the Appendix for more information.



Figure 4: Air Gun Projectile Cleaner

HYDRAULIC OIL REQUIREMENTS

Harrison Hydra-Gen, Ltd. recommends a premium anti wear hydraulic oil to be used in the generator system. Dextron III **does not** fall in this category. Dextron is formulated to operate in transmissions.

The weight of the oil is determined by the climate the system is operating in. Using an **AW46** will provide good protection in most year round US climate conditions.

A graph of ISO Oil Grades versus applicable fluid temperatures is shown below. The lowest allowed cold start temperature (at 4600 SUS) for each grade is shown as a triangle. The bar represents the ideal viscosity range for that fluid (80-170 SUS). The diamond at the top signifies the upper temperature limit of the fluid (at 60 SUS). Do not exceed this limit for a prolonged time period.

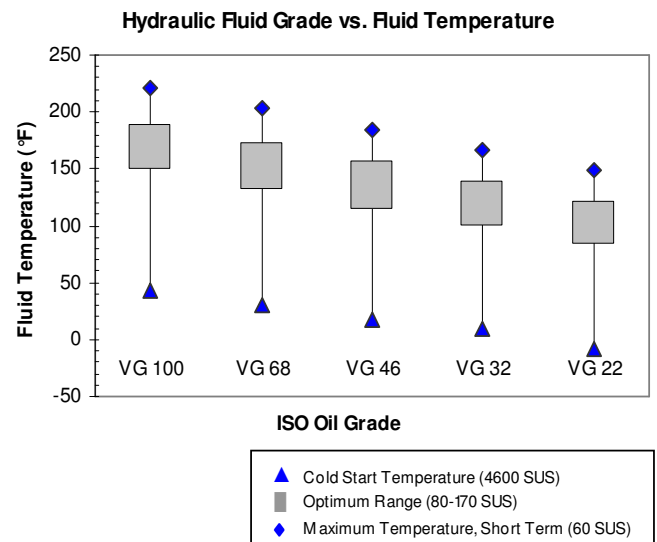


Figure 5: Hydraulic Fluid Selection Graph

The operating temperature of the fluid in the hydraulic generator system is maintained at 120°F to 180°F, depending on the ambient air temperature and load. Fluids with a viscosity rating of less than 60 SUS at this temperature are not acceptable. For cold

climates, the oil must not have a rating higher than 4600 SUS. Conditions that allow the fluid to drop in temperature causing the viscosity to be higher than 930 SUS will require warm up procedures before using the system. If there is some uncertainty about the oil that you are using, consult with the manufacturer or distributor of the oil.

Every oil mfg. offer oils that meet the needs of hydraulic systems. An example of good oil is **Mobile DTE-25** or equivalent.

HYDRAULIC PUMP MOUNTING

CAUTION!

FRETTING OCCURS WHEN A MALE SPLINE SHAFT IS INSTALLED INTO A FEMALE SPLINE AND THE TEETH BECOME WORN OVER TIME. BEFORE INSTALLING THE PUMP INTO THE PTO, GREASE THE SPLINES WITH AN APPROVED SPLINE LUBRICANT.

FRETTING

During installation, ensure grease is applied to all the teeth and teeth roots of both the PTO and pump. Fill the valleys of the spline roots of both PTO and pump shaft. This allows extra lubricant to carry through the spline contact area by centrifugal force. While it can significantly prolong spline life, this procedure cannot guarantee to completely eliminate excessive wear. Chelsea supplies a packet of this grease with every PTO they sell and it is also available in a grease gun tube. For more information, see the Accessories page in the Appendix.

Maintaining this area requires removing the pump from the PTO, cleaning the splines of the old grease, drying the cleaner, reapplying new lube and re-installing the pump. This is not easy to do and is very time intensive. Some Chelsea PTOs, such as the constant mesh series, have the option to install grease fitting which allows grease to be pumped into this area without removing the pump. Consult your PTO manufacturer for availability. We strongly suggest

this option for constantly engaged PTOs since it greatly reduces maintenance time.

MAINTENANCE CONSIDERATIONS

Even the best lubricant is eventually pushed out of the connection area by centrifugal force, temperature, and vibration. The time frame for maintenance depends on many operational and environmental factors, so a fixed time schedule is not practical. When the lubricating film is lost it must be replenished. Consult your PTO manufacturer for more information.

Shaft fretting is not a failure of the generator, pump or PTO. Fretting conditions are a result of torsion vibration generated by the engine. This vibration is transmitted through the transmission and PTO. Since the pump is the last member in the chain, the spline areas of the PTO and pump suffer the effect. This condition occurs primarily at low engine idle speeds. To avoid this condition and prolong shaft life, keep it well lubricated. Since this condition occurs at engine idle, you may consider using a hot shift PTO instead of a constant PTO. With a constant PTO, the pump is always on when the engine is on. This subjects the pump and other components to unnecessary wear. Also, consider operating the generator at a high engine idle.

We understand that every application is different and is driven by your needs. If you require generator power at low engine idle and operation with a constant PTO, our generator will provide many years of reliable power if the maintenance requirements are met.

PUMP MOUNTING LOCATIONS

Pump mounting varies with each application and pump used. Mounting options include mounting directly to the PTO or to the transmission. Ensure you are using the correct PTO ratio so the pump operates at the correct rpm.

! CAUTION!

FAILURE TO PROPERLY ISOLATE THE PUMP FROM THE CHASSIS MAY RESULT IN UNWANTED NOISE AND/OR DAMAGE TO THE PUMP SHAFT.

PTO DIRECT MOUNTING

When mounting the pump directly to the PTO you **MUST** lubricate the pump and PTO splines. Failure to do this will cause premature spline failure (fretting).

Most PTOs limit the weight on the flange to 40 lbs. Most of our pumps weigh more than this limit. To avoid damage to the PTO, secure the rear of the pump to the vehicle's transmission case with a triangle brace. While the brace must not exceed 1/8" thick under the pump bolt, the remainder of the bracket should be sufficiently thick to support the pump. Torque the pump bolt and the transmission case bolts as specified in the transmission service manual.

TRANSMISSION MOUNTING

Before mounting the pump to the transmission, obtain approval from the manufacturer. Verify the extra weight does not exceed the recommended stress on the transmission. In most cases, a pump-mounting bracket can be built to fasten to the bolt pattern off the rear of the transmission.

In some cases there is no room for a direct mount and the pump will need to be mounted onto the chassis using an "L" bracket such as the one in the figures b7 and 8. When driving the pump via drive shaft, design the "L" bracket with consideration of pump harmonics and the usage of vibration isolators.

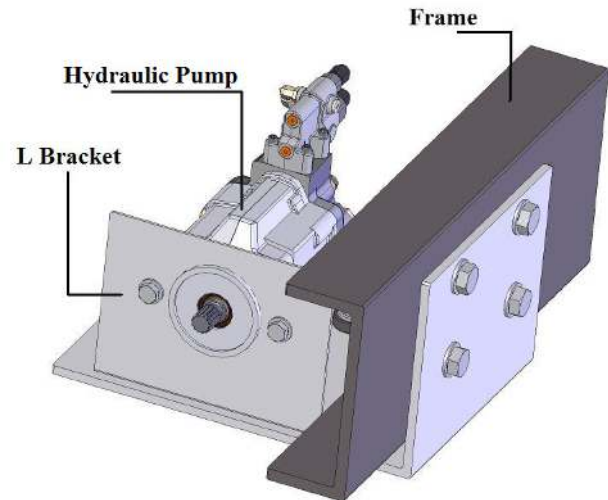


Figure 6: Pump Mounting L-Bracket Front View

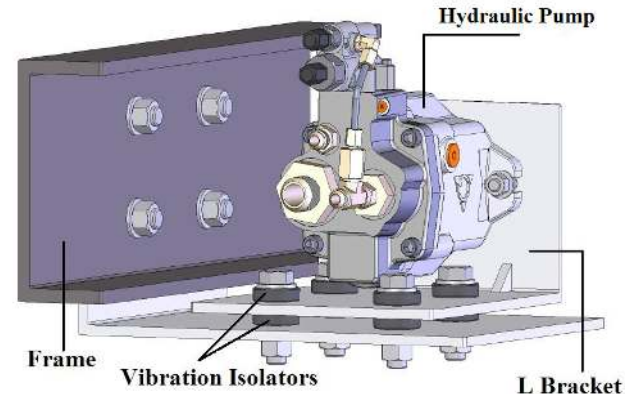


Figure 7: Pump Mounting L-Bracket Rear View

It is important to follow good driveline installation practices:

- Maintain drive shaft angularity within 5-8°.
- Maintain phase relationship between end yokes.
- Allow slip movement in shaft make up.
- Ensure shafts are parallel within 1.5°.

Proper installation techniques for the drive shaft, PTO, clutches, or other mechanical means of driving the hydraulic pump must be followed. Consult the factory or authorized distributor of the device for installation assistance.

SOFT START WIRING

Pumps equipped with a soft start valve require a time delay relay. Install the relay to activate the soft start valve 3 seconds after the PTO is engaged.

On the 60 CC Rexroth pump, the soft start valve is mounted off of the pressure port fitting. The coil includes 2 lead wires to connect to 12 VDC. The polarity is not critical.

KEY POINTS

1. Always mount the pump with the case drain on top. Pump failure will occur if the case drain port is on the bottom of the pump. **Improperly installing the case drain will void the warranty.**
2. If used, ensure the soft start valve (mounted on pump) is wired to a time delay relay or is multiplexed so that the **soft start solenoid** activates **3 seconds after the PTO** has been engaged. If there are any secondary or remote switches, be sure that they cannot be activated prior to 3 seconds of PTO engagement.
3. All PTO manufacturers require PTO engagement below 1000 rpm. High-speed engagement will cause catastrophic damage to the PTO and/or the pump. A high-speed lock out may be prudent. Consult with your PTO manufacturer for more information.
4. Use sweeping 90° fittings whenever possible.
5. Consider making a heat shield for your pump. This will help reduce heat radiation and will protect the exhaust and other components from oil in the event of a hydraulic leak such as hose failure. Configure the shield so that any oil is directed down and away from the exhaust. Although a heat shield is not required, it is a good safety device.

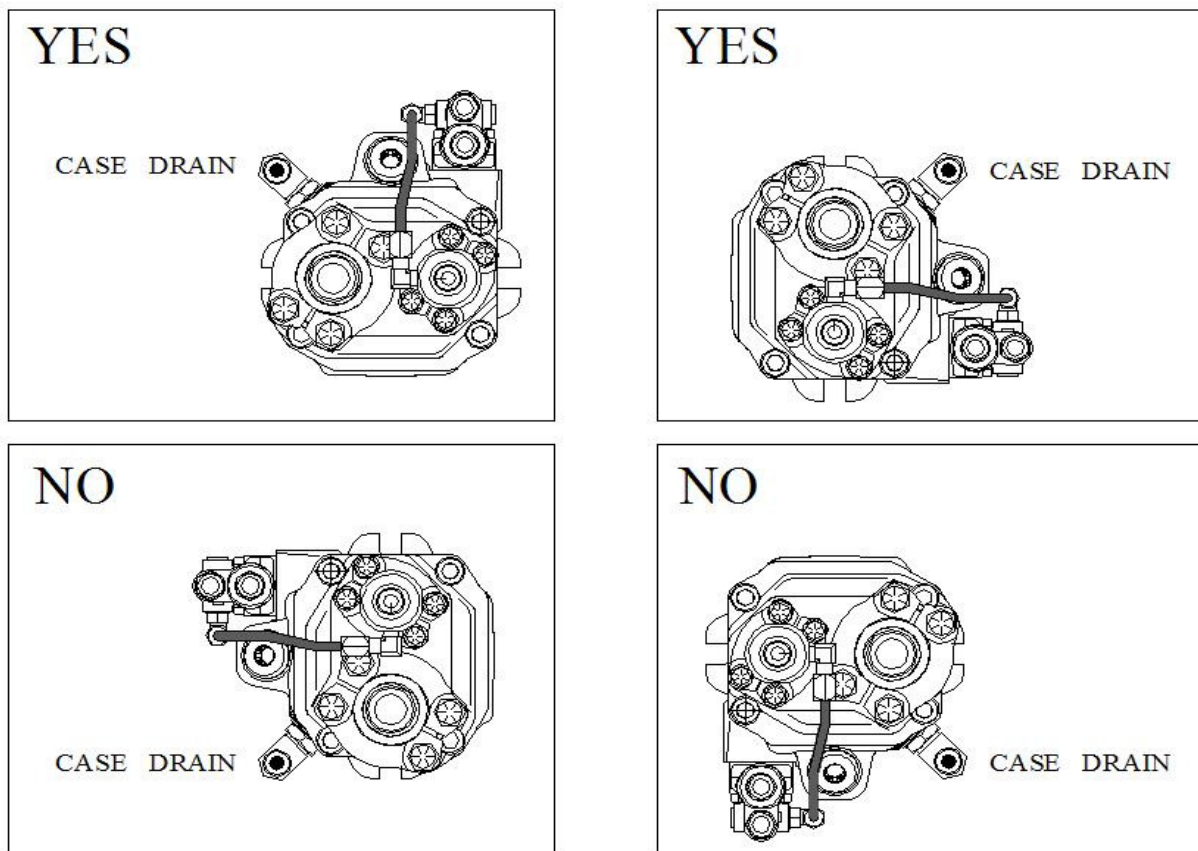


Figure 8: Pump Case Drain Orientation

GENERATOR TRAY MOUNTING AND AIRFLOW

The generator tray is constructed of 11 gauge steel that has been powder coated for protection from the elements. When choosing a mounting location for the generator tray unit, take into account the following factors:

- Airflow and ventilation, 176 sq. in. inlet area
- Protection from debris and water
- Service and weight constraints

The most important factor to consider when mounting the tray unit is the air ventilation. The **minimum** distance between the nearest wall to both the intake and exhaust is 4 inches. Also, arrange the unit so that the exhaust air does not re-circulate into the inlet.

CAUTION!

SUPPLY THE GENERATOR TRAY WITH ENOUGH FRESH AIR AT THE INLET. ALSO, THE HOT EXHAUST AIR NEEDS AN ADEQUATE OUTLET SO IT DOES NOT CIRCULATE INTO THE INLET.

Figure 10 shows example of bad and good air flow installations. An intake shroud may be necessary for certain installations. If the system oil temperature exceeds 180°F, check the inlet and exhaust for restrictions. If the inlet air temperature is above 120°F, this may be an indication that the hot exhaust air is re-circulating into the intake and additional baffling is necessary.

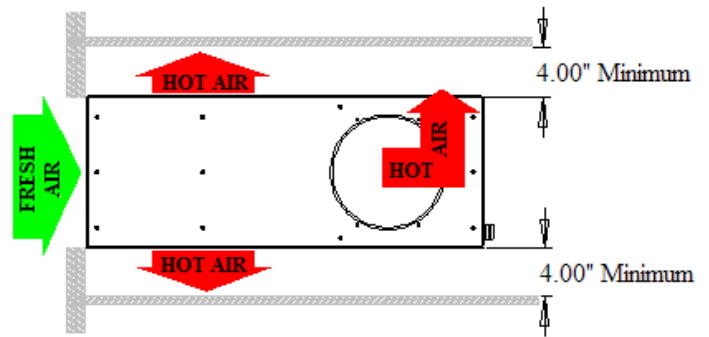


Figure 9: Good Generator Airflow Installation

An installation with good airflow allows at least 4.00" of space around the unit for the exhaust air to evacuate properly. A shroud or an air deflector is used in cases where re-circulation is possible.

Generally, all alternators cool the same way. Fresh air is pulled in one end of the rotor/stator assembly and exhausted out the other end. It is important to keep out road salt, dirt, snow, water, and other contaminants. Another consideration is high water crossings. Inspect the tray assembly on a regular basis. If any generator system is submerged in water, it will destroy the electrical components unless it is completely dried before use. Contact the Harrison factory for more information.

HYDRAULIC RESERVOIR MOUNTING



CAUTION!

ALWAYS MOUNT THE RESERVOIR AT LEAST 12 INCHES HIGHER THAN THE CENTERLINE OF THE PUMP TO ELIMINATE CAVITATIONS.

Key considerations when remote mounting a reservoir include:

- Ease of access for replacing hydraulic fluid and filter, and checking the fluid level and temperature.
- Heat from external sources, such as adjacent motor or pump-house access holes.

HYDRAULIC CONNECTIONS



CAUTION!

ENSURE THE PUMP CASE DRAIN IS ON THE TOP OR SIDE WHEN MOUNTING THE PUMP. FAILURE MAY OCCUR IF IT IS LOCATED ON THE BOTTOM.

Harrison Hydra-Gen standard hose sizing is #16 hose for the pump suction inlet, #8 hose for the pump pressure outlet and #8 or #6 for pump case drain, depending on model. Hose sizes and ratings are included in the following installation section and are good for applications where hose lengths are less than 20 feet.

For hose lengths greater than 20 feet, we recommend hose sizes at least one (1) size larger than specified above. This is to ensure an adequate hydraulic fluid flow rate to the pump. Contact the Harrison Hydra-Gen factory at **1-800-723-3334** for assistance.

HOSE SPECIFICATIONS

Suction Hose (#16), “Wire Inserted Suction” Hose

Must be rated for suction

Max Operating Pressure: 60 psi

Vacuum Service (sizes 12 – 64): 28 in./Hg.

Approved Example: SAE100R4

Route from the reservoir outlet to the pump inlet.

Pressure Hose (#8)

Max Operating Pressure: 4000 psi

Temperature Rating: -40°F - +200°F

Approved Example: SAE100R12

or

Max Operating Pressure: 5000 psi

Temperature Rating: -40°F - +200°F

Approved Example: SAE100R13

Match hose to system pressure requirements. Route from the pump outlet to the generator tray pressure in port.

Case Drain Hoses (#8)

Max Operating Pressure: 250 psi

Temperature Rating: -40°F - +200°F

Approved Examples:

SAE100R3, SAE100R1A, and SAE100R1AT

Route from the pump case to the generator tray case in port.

Reservoir Return Hoses (#8)

Max Operating Pressure: 600 psi

Approved Examples:

SAE 100R1A or SAE 100R1AT

Loop Return: Route from the generator tray to the reservoir filter in port.

Case Return: Route from the generator tray to the case in port of the reservoir.



CAUTION!

DO NOT USE A PRESSURE HOSE THAT IS NOT RATED FOR VACUUM FOR THE SUCTION HOSE.

The standard pump for our generator is rated with both vacuum and pressure requirements. During normal operation, the suction hose experiences a maximum of 60 psi; however, upon startup the pump will pull a vacuum. If a non-vacuum rated hose is used, its interior wall will collapse. Evidence of this is sustained cavitations of the pump during startup. Repeated sustained cavitations will damage the pump.

SAE100R5 hose is not acceptable. This type of hose does not carry enough vacuum rating in the sizes above #12. Verify the suction hose size during installation or service. Incorrect hose sizing may cause hydraulic pump failures, poor operation and may result in personal injury or equipment damage.

The SAE100R4 hose maximum working pressure for a band clamp or a bolted clamp (similar to a radiator hose clamp) is only 50 psi. This type of clamp will not carry the required pressure rating; therefore, **a crimped hose end must be used.** All fittings are JIC 37° Flare.

See the hydraulic schematics on the following pages for hose routing. **It is important not to cross hoses during installation.** We recommend marking and capping/plugging hose ends **before** routing hoses. It is very easy to mix them up once they are routed in the vehicle.

KEY POINTS

- Keep hose lengths as short as possible. If the hose length is 20ft or longer, increase the hose diameter. Contact the Harrison factory for a recommendation.
- Hose sizes and hose fittings must match.
- Always flush and blow out hoses before use.
- Mark and cap all hose ends before routing.
- Hoses flex under pressure. Do not band them together tightly, pull them tight, or cut them too short.
- Never bend hoses beyond the manufacturer's recommended bend radius. Hoses will pinch if you exceed the bend radius of the hose, causing a restriction in the flow. Avoid short elbows. If a 90° fitting must be used, use a sweeping 90° instead of a short 90°.

PLUMBING DIAGRAMS

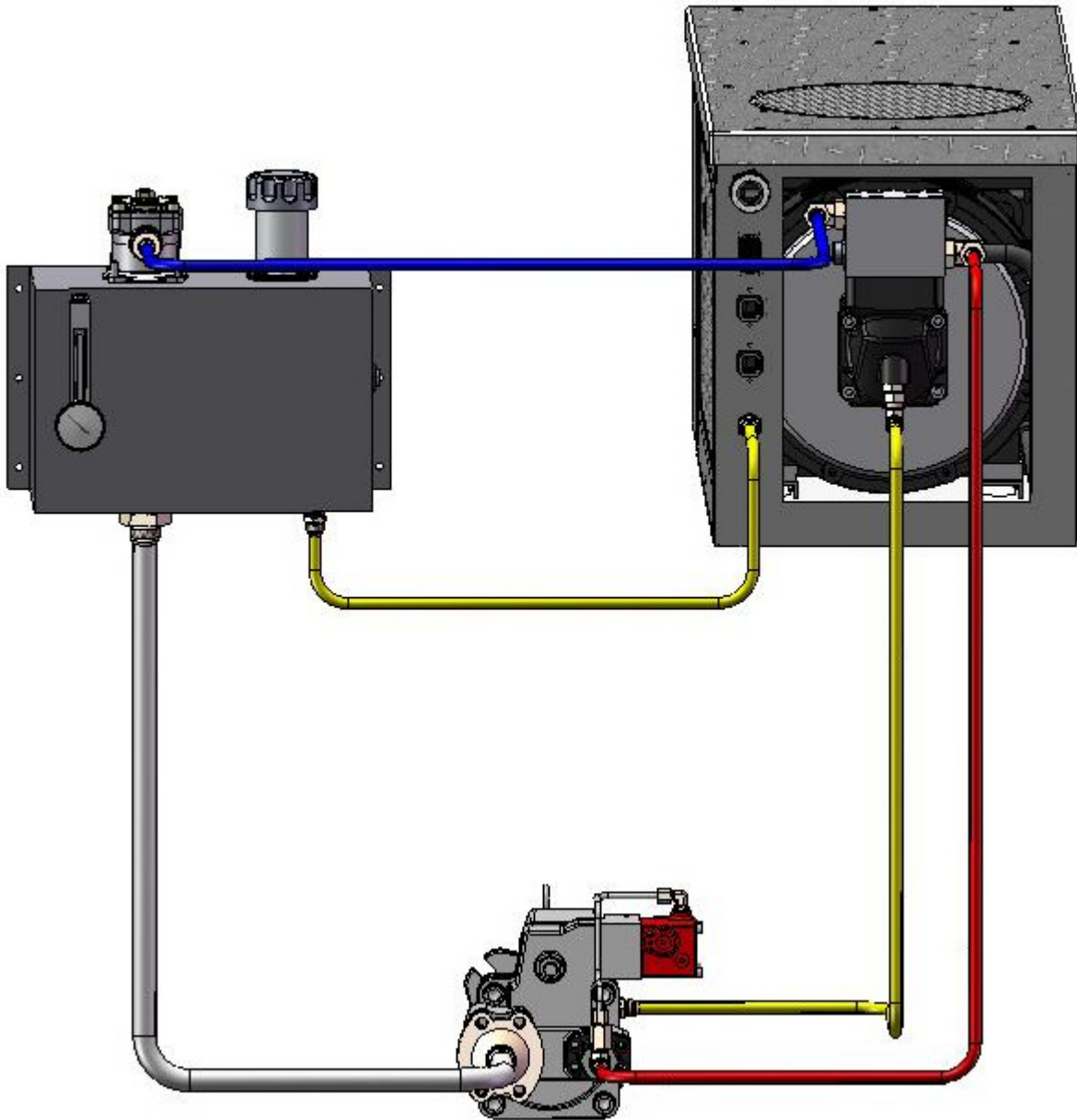


Figure 10: NCM Plumbing Diagram

HYDRAULIC CIRCUIT DIAGRAM

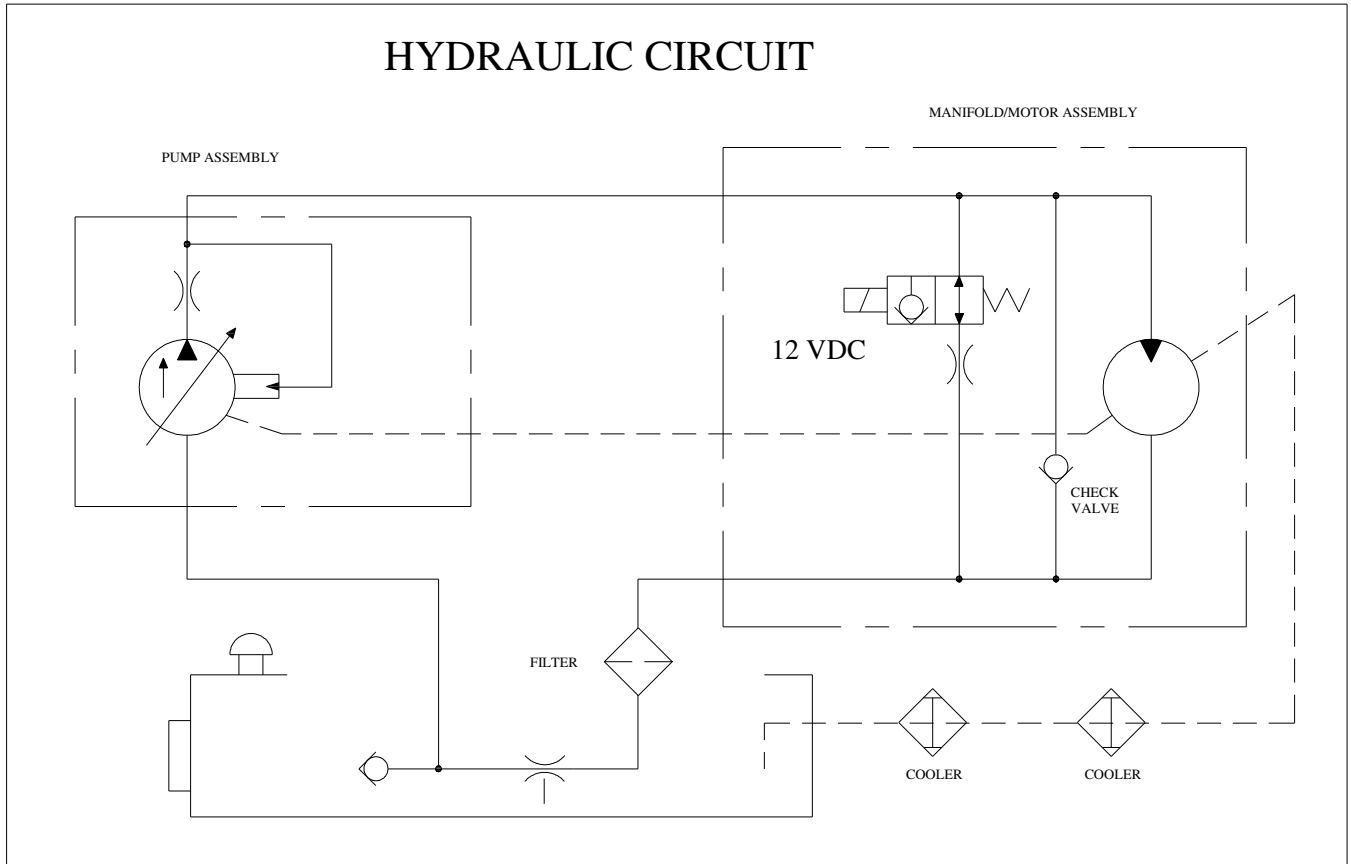


Figure 11: Hydraulic Circuit Diagram

DISPLAY METER MOUNTING

Each Harrison Hydra-Gen generator is shipped with a meter display. This meter displays output voltage, frequency, and current. The key components packaged outside of the generator unit are:

- Display Module
- Extension Cables, 30 ft.

The display module should be mounted where the generator operator can see the readout. The display has a square flange with overall dimensions of 4.25" w x 4.25" h.

A cutout hole shown in the figure below is required for the meter display.

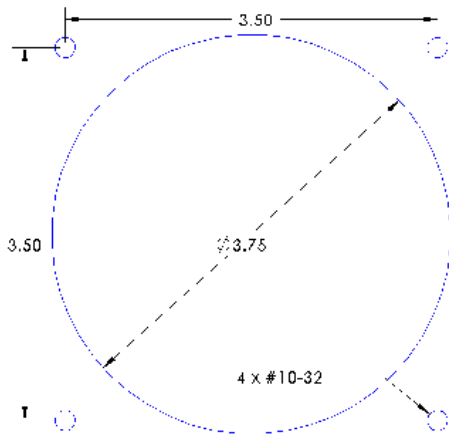


Figure 12: Meter Display Cutout Dimensions

Follow these steps to install the meter display:

1. Locate a suitable location for the display and cut the cutout hole and drill the 4 #10-32 mounting screw holes.
2. Route the 12-conductor extension cable from the generator to the meter. Plug the cable in to the generator supplied connector and the meter connector.

3. A buzzer must be connected for the audible alarm. Refer to the Electrical Wiring Diagram at the end of this chapter for details.

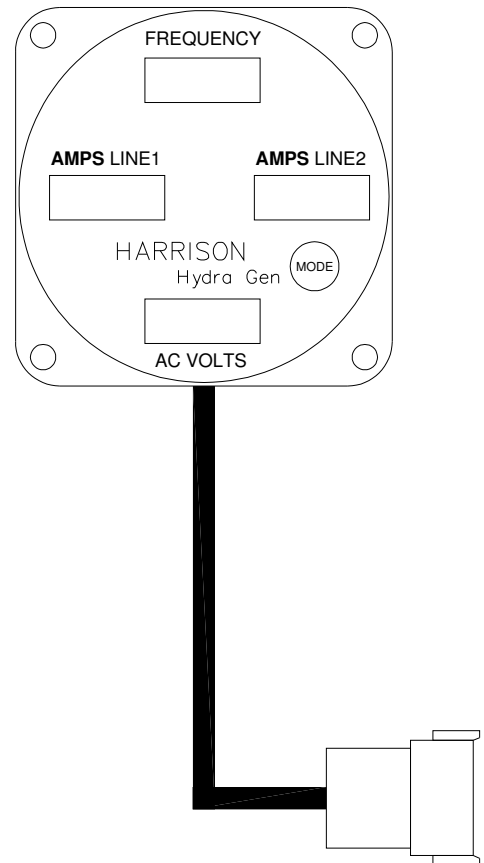


Figure 13: Meter Display

ELECTRICAL CONNECTIONS

All wiring must meet applicable local, state, and federal electrical codes. Accordingly, have a qualified electrician install and inspect the wiring. Mount switches and controls securely to prevent damage from vibration and road shock. All switches must be vibration proof to prevent accidental opening and closing of circuits while the vehicle is in motion.



WARNING!

EXHAUST GAS IS DEADLY! SEAL ALL WIRE OPENINGS IN THE VEHICLE INTERIOR TO KEEP OUT EXHAUST GAS.

The generator system output conductors must be rated no less than 115% of the nameplate current rating of the generator system. The factory supplied conductor insulation is rated at 90°C. Wires connected to the generator must meet or exceed this insulation rating (See National Electrical Code, NFPA 70). State and local codes specify different grounding requirements for mobile vehicles with electric generator systems. These specific codes must be followed in order to ensure personal protection.



WARNING!

FAULTY ELECTRICAL GROUNDING CAN LEAD TO FIRE OR ELECTROCUTION, RESULTING IN SEVERE PERSONAL INJURY OR DEATH. GROUNDING MUST BE DONE IN ACCORDANCE WITH APPLICABLE CODES.

Generators mounted permanently on a mobile vehicle must be grounded securely to the vehicle frame. In addition, the **neutral conductor of the generator output must be grounded at the generator only.** Remove any grounding tabs or connectors that may be in the meter panels or distribution panels. This will avoid problems with personnel safety and Ground Fault (GFCI) devices.

The 4 generator AC output leads are visibly marked. Connect the leads as shown in the electrical diagram on the following page. All standard units are wired 120/240 VAC; however, generators can be reconnected for straight 120 VAC.

	CONNECTION
4-Wire S.O Cord	Generator to Breaker:
	Green – Ground
	White – Neutral
	Red – Leg 2
	Black – Leg 1
4-Wire Power Cable (Connector A)	Power Input:
	Green – 12Vdc (+)
	Red – 12Vdc (+)
	Black – Ground (-)
	Yellow – 12Vdc ON/OFF
2-Wire Power Cable (Connector B)	Power Input:
	Red – 12Vdc (+)
	Black – Ground (-)

Figure 14: Summary of Electrical Connections

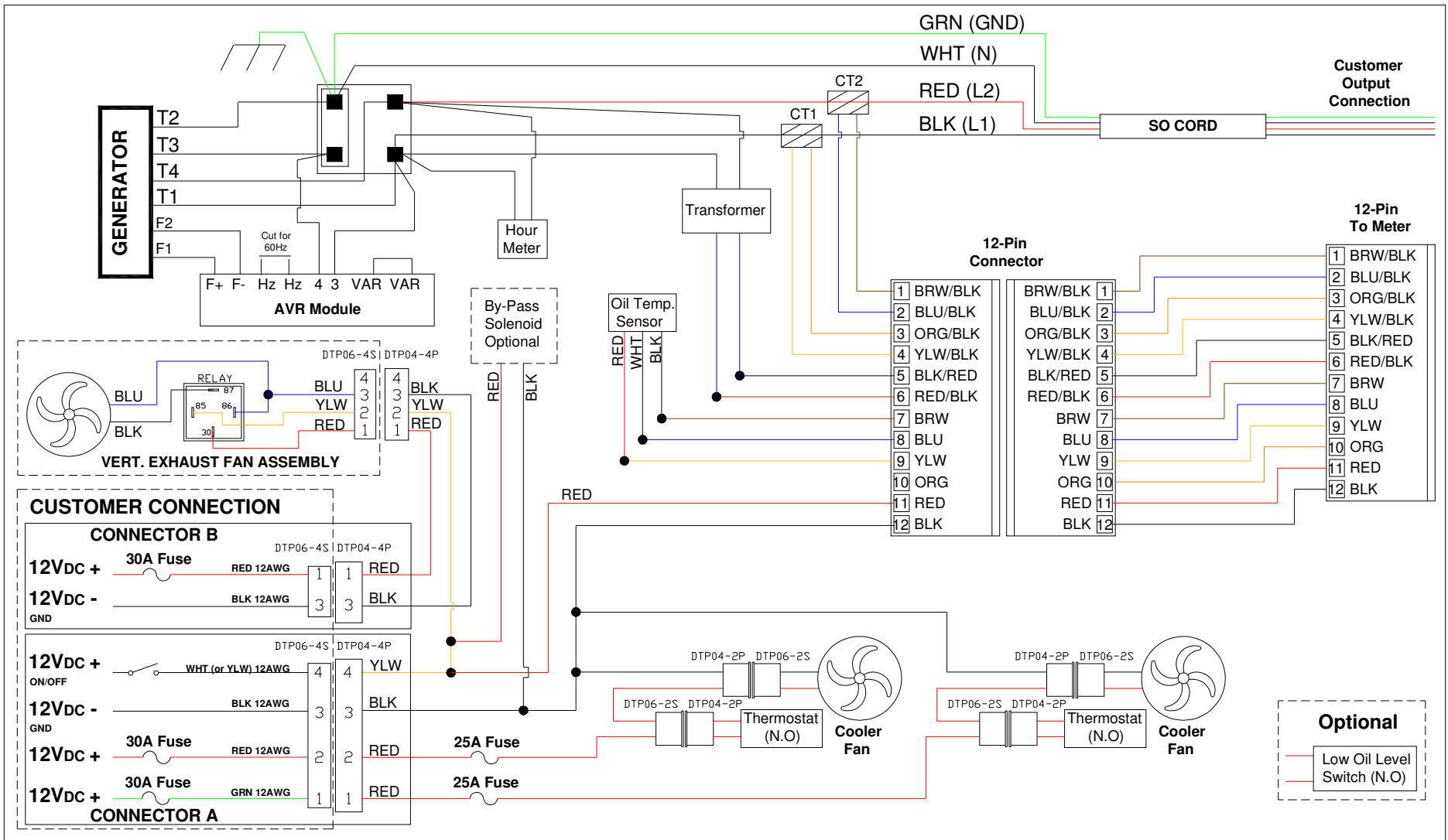


Figure 15: Electrical Circuit Diagram

OPERATOR'S GUIDE

BEFORE STARTING

Perform the applicable pre-operational service checks presented in this section before starting the system, after installation, or after major repairs or fluid and filter changes. Anytime the hydraulic system has been opened for repairs the fill and bleed sequence **must** be followed.

FILL AND BLEED SEQUENCE

CAUTION!

CONTAMINATED OIL CAN SEVERELY DAMAGE A HYDRAULIC SYSTEM.

Always use filtered hydraulic fluid (ISO 4406 or better) when filling the reservoir. Contaminated fluid can cause improper system operation and result in excessive wear of system components. Do not transfer fluid from its shipping container into the generator reservoir. Transfer oil from the shipping container through a filter cart with a minimum of a 10 micron filter. If a filter cart is not available use a filter cloth in a clean funnel. Check the fluid level of the reservoir and do not attempt to operate with a partially filled system.

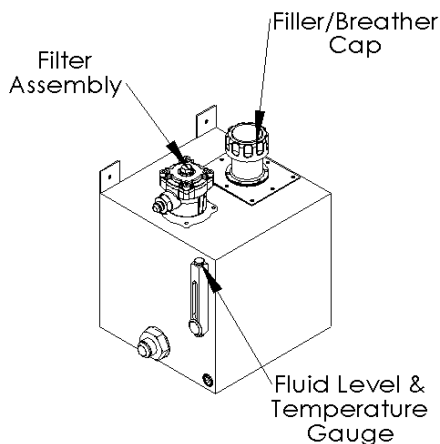


Figure 16: Example of Hydraulic Fluid Reservoir

1. Ensure all loads have been disconnected and the main line circuit breaker is in the OFF position.
2. Transfer the filtered oil into the reservoir using a clean funnel. Fill the reservoir to the full mark on the sight glass. **Do not overfill!**
3. Fill the pump case with filtered oil.
4. Loosen the hydraulic hose connections at the pump inlet, pump case drain, and pressure hose. One turn should be enough.
5. If there is no free-flow of oil at the pump, pressurize the reservoir (maximum pressure 5 psi) to force oil throughout the system until there is oil at all three hose connection points on the pump end.
6. Re-tighten all hose-connections and wipe dry. Refill the reservoir with filtered oil to the full line. Cap the reservoir.
7. Turn the generator ON, engage the PTO (if equipped) and turn over the engine for a few seconds, if possible, without starting it.
8. Check oil level and fill accordingly.
9. Repeat steps 7 and 8 until the oil levels stabilize.
10. Start the engine and let the engine warm up until normal idle speed is obtained. Listen for pump noise. If a grinding noise (pump cavitations) is detected, shut the generator down and repeat steps 7 and 8.

CAUTION!

SUSTAINED CAVITATIONS WILL DESTROY THE PUMP. PURGE ALL AIR BEFORE CONTINUING.

11. Continue running the engine at a low idle, check the total hydraulic system for leaks. If a leak is found, tighten the fitting and wipe dry. Do not over torque the flare fittings. Consult your fitting and hose supplier for the correct torque values. If

a leak persists, turn off the system and check the condition of the mating flare. If the flare is deformed or damaged, replace it and begin the bleeding process from the beginning.

12. Increase engine speed to the operating rpm. Let the system run without load for 10 to 15 minutes to allow trapped air to escape. Top-off the reservoir to the full mark with filtered oil.
13. Check the generator output and verify correct voltage and frequency readings. If readings are incorrect refer to the Frequency Adjustment section.
14. If the frequency or voltage is unstable, the system may still have a small amount of air trapped inside. Lower the engine speed to idle, and let the system run for another 10 to 15 minutes without load. Increase the engine to operating rpm and verify the voltage and frequency readings. Repeat this step as necessary in order to obtain stability in the system.
15. If frequency has stabilized at 61.5 Hz, run a final test for leaks with engine running at operating rpm and full load on the generator system. If frequency has not stabilized, refer to the section on Frequency Adjustment.

FREQUENCY ADJUSTMENT

The frequency (Hertz) is an indication of the hydraulic pump flow.

1. Turn OFF the main line circuit breaker and remove any loads on the generator.
2. Start the vehicle's engine.
3. Engage the PTO.
4. Set the vehicle's engine rpm at high idle and let the hydraulic oil temperature warm up to a minimum of 100°F.
5. Turn the generator ON and check the frequency on the display module. If frequency is not set at 61.5 Hz, proceed to the next step.

CAUTION!

BEFORE PROCEEDING, TURN OFF THE LOAD ON THE GENERATOR SYSTEM AND VERIFY THAT THE PUMP IS WITHIN THE RPM OPERATING PARAMETERS.

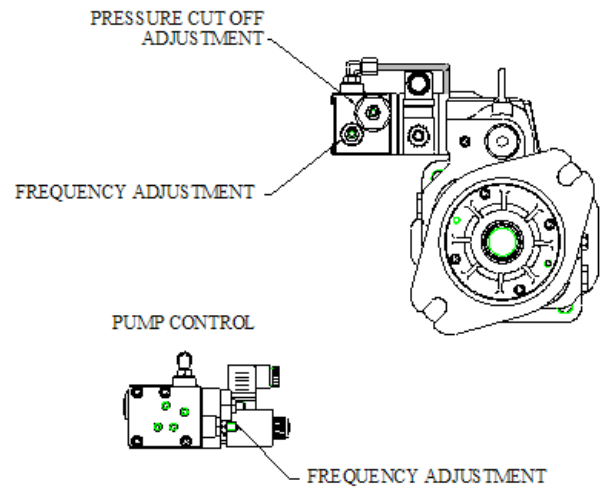


Figure 17: Kawasaki Pump Control

6. At the Pump Control, remove the frequency adjustment cap and loosen the jam nut with a wrench.
7. While holding the jam nut with the wrench (to keep it from turning), use an Allen wrench and turn the adjustment screw **clockwise to increase** the frequency and **counterclockwise to decrease** the frequency.
8. When the frequency has been adjusted satisfactorily, hold the adjusting screw and tighten the jam nut securely and replace the cap.
9. Re-apply the load to the generator and verify that the frequency remains within the parameters.

If frequency is not stable or falls more than 3 hertz, air or contamination may be trapped in the pump spool valve. To flush the compensator, remove the spool valve. Run the system for 2 to 3 minutes. Re-install the spool and re-check the frequency.

NORMAL OPERATION

Before operation of the system, always check the fluid level in the reservoir. Keep the generator system, cooling surfaces, and cooler fins clean. Keep hydraulic oil stored in dust-tight containers. Change the oil as frequently as necessary. The normal fluid and filter change interval is 500 hours of operation or one year of service, whichever comes first.

After installation and initial startup, follow the steps below to operate the system:

TURNING SYSTEM ON

1. Start the vehicle's engine.
2. Engage PTO.
3. Turn on the generator.
4. Set engine to operating rpm.
5. Check voltage for proper output.
6. Set all circuit breakers to the "ON" position.
7. Apply load to the generator.

TURNING SYSTEM OFF

1. Remove all loads from the generator.
2. Set all circuit breakers to the "OFF" position.
3. Turn off the generator.
4. Return engine speed to idle.
5. Disengage the PTO.

All operators of the vehicle should become familiar with the procedure for starting and stopping the generator system.

METER DISPLAY MODULE

The FRC generator display module is designed to display AC generator data per NFPA 1901. Integrated warnings can alert the operator if a critical condition needs an appropriate action.

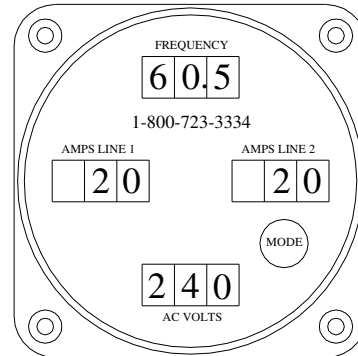


Figure 18: Meter Display Module

Excessive Current Warning

When the generator is operating outside the range of its rated capacity, the AMP 1 and AMP 2 display will start to flash. The audible buzzer must be connected for the audible warning.

Voltage Out-of-Range Warning

If the output voltage is below 100/200 VAC or above 130/270 VAC, the voltage readout will begin to flash. This will give the operator an indication that the generator output falls outside the safe operating level. There is no audible alarm for the voltage out of range warning.

Hot Oil Temperature Warning

This warning will be activated if the oil temperature rises above 170°F, ± 5°F. The frequency readout will flash OIL to warn the operator and the audio alarm will also be activated.

MAINTENANCE

Very little routine maintenance is required with a Harrison hydraulic generator. It consists primarily of changing the oil and filter and performing a visual inspection of the generator tray. With a little maintenance and a proper installation, the system should operate trouble free for many years.



WARNING!

ACCIDENTAL STARTING OF THE GENERATOR DURING MAINTENANCE CAN CAUSE SEVERE PERSONAL INJURY OR DEATH!

The hydraulic fluid and the filter should be changed every 500 hours or one year, whichever occurs first. Use a 10 micron absolute filtering system or better to clean the oil before adding it to the reservoir. Refer to the Installation section for oil selection recommendations. Refer to the Appendix for the replacement filter element. If the oil appears discolored, smells burnt, or feels abrasive to the touch, this is an indication of a system problem and steps should be taken to diagnose it.

Visually inspect the electrical wiring for corrosion and loose or bad connections.

Visually inspect the generator for debris or greasy soil build-up. This can impede airflow and cause premature generator failure.

Blow out the heat exchanger fins and the inside of the alternator with an air hose. **Do not use water to clean the inside of the alternator.**

If the alternator has been submerged in water, the windings **must** be dried before use. Immersion in salt water requires cleaning of the generator and possibly re-coating with epoxy before use.

Check the fittings for loose connections or leaks. Inspect hoses for any bulges, chaffing, or damage. Replace immediately if defects are found.

Check that the pump is securely mounted to the PTO or drive shaft and that there are no leaks from the fittings or the front seal. A leak at the front seal may indicate bad alignment or the need for vibration isolators. If a leak at the front seal is caught early enough and the problem is corrected, it can eliminate expensive repairs down the road. If the pump is directly mounted to the PTO, the splines on the shaft and PTO **must** be properly greased and maintained. Read the caution on fretting under Maintenance Considerations in the Specifications and Installation Guide.

APPENDIX

MANUFACTURER'S LIMITED WARRANTY

Harrison extends to the original purchaser of goods for use, the following warranty covering the HARRISON HYDRAULIC SOLUTIONS® HYDRAULIC MOTOR/GENERATOR SYSTEM manufactured or supplied by Harrison, subject to the qualifications indicated. A HARRISON HYDRAULIC SOLUTIONS® SYSTEM consists of the following sub-assemblies, sold and supplied as a matched system: a Harrison Hydraulic Motor/Generator Assembly, a Harrison Hydraulic Pump Assembly, and Control Valves.

THERE IS NO OTHER EXPRESS WARRANTY.

IMPLIED WARRANTIES INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO PERIODS OF WARRANTY SET FORTH BELOW AND TO THE EXTENT PERMITTED BY LAW. ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED.

IN NO EVENT IS HARRISON LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

- (1) Harrison warrants the original purchaser for the period set forth below that the HARRISON HYDRAULIC SOLUTIONS® SYSTEM manufactured or supplied by it will be free from defects in workmanship and material, provided such goods are installed, operated and maintained in accordance with Harrison's written installation instructions, and further provided that each new application be reviewed and approved by Harrison's Applied Engineering Group.

PRODUCT APPLICATION

Generator Systems used in commercial vehicles
or marine applications.
Repair or replacement parts.

PERIOD OF WARRANTY

- Two (2) years or 2,000 hours, which ever comes first, from date of initial startup.
One hundred eighty (180) days from Date of purchase.

- Must be registered within thirty (30) days of initial startup on FORM NO. WR-1, to be provided and completed by the seller.
- (2) Harrison's sole liability and Purchaser's sole remedy for a failure of goods under this warranty and for any and all other claims arising out of the purchase and use of the goods, including negligence on the part of the manufacturer, shall be limited to the repair or replacement of the product, at Harrison's option, of the parts that do not conform to this warranty, provided that the product or parts are returned to Harrison's factory at 14233 West Rd., Houston, Texas 77041, or at a Harrison Authorized Distributor or it's designated service representative, transportation prepaid.
- (3) All claims must be brought to the attention of Harrison, an Authorized Distributor or designated service representative within thirty (30) days after goods or parts failed to meet this warranty.
- (4) THIS WARRANTY SHALL NOT APPLY TO:
- (a) Cost of maintenance, adjustments, installation or startup.
 - (b) Paint, hydraulic fluid, and interconnecting hoses (external to system assemblies).
 - (c) Failures due to accident, misuse, abuse, negligence, improper installation or lack of maintenance.
 - (d) Products altered or modified in a manner not authorized by the manufacturer in writing.
 - (e) Telephone or other communications expense.
 - (f) Excessive labor due to components being concealed in vehicle as a result of installation.
 - (g) High water, road debris, or excessive dirt.
- (5) No person is authorized to give any other warranties or to assume any other liabilities on Harrison's behalf, unless made or assumed in writing by an officer of Harrison.
- (6) This warranty gives the user specific legal rights, and the user may also have other rights that may vary from state to state.

ACCESSORIES

Description	Part Number	Supplier	Phone Number
Air gun hose cleaning system	UC-EL-1-1/4"	Ultra Clean Technologies	(800) 791-9111
Spline lubricant, grease gun tube	379831	Chelsea	(662) 895-1101
Oil Reservoir Filter Element	WO206-2200	Harrison Hydra-Gen	(800) 723-3334

GENERATOR DISPLAY & METER KIT

FRC Meter Display Package

Harrison Hydra-Gen Part Number: **FR800-4812**

The FRC meter kit consists of the following components:

<u>Qty.</u>	<u>Description</u>
1	Display Unit
1	Alarm Buzzer
1	Voltage Transformer
1	Oil Temperature Sensor
2	Current Transformer

OIL RESRVIOR FILTER ASSEMBLY

