



HEMP Filter



OPERATION AND MAINTENANCE MANUAL

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NOTICE: This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

SAFETY SYMBOL DEFINITIONS



OR



REFER TO MANUAL When product is marked with this symbol refer to instruction manual for additional information.



HIGH VOLTAGE Indicates presence of hazardous voltage. Unsafe practice could result in severe personal injury or death.



PROTECTIVE EARTH GROUND (SAFETY GROUND)

Indicates protective earth terminal. You should provide uninterruptible safety earth ground from the main power source to the product input wiring terminals, power cord, or supplied power cord set.

CAUTION

CAUTION Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Included text gives proper procedures.

WARNING

WARNING Denotes a hazard. Failure to follow instructions could result in SEVERE personal injury and/or property damage. Included text gives proper procedures.

GENERAL SAFETY CONSIDERATIONS



BEFORE POWER IS APPLIED TO THIS INSTRUMENT, GROUND IT PROPERLY through the protective conductor of the AC power cable to a power source provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal could result in personal injury.



BEFORE SERVICING: CONTACT ETS-LINDGREN - servicing (or modifying) the unit by yourself may void your warranty. If you attempt to service the unit by yourself, disconnect all electrical power before starting. There are voltages at many points in the instrument which could, if contacted, cause personal injury. Only trained service personnel should perform adjustments and/or service procedures upon this instrument. *Capacitors inside this instrument may still be CHARGED even when instrument is disconnected from its power source.*



ONLY QUALIFIED PERSONNEL should operate (or service) this equipment.

INTRODUCTION

The ETS-Lindgren Filter Panels are an electromagnetically isolated EMI Filter cabinet with EMI isolated filter elements. The filter is designed to filter internally and externally generated EMI conducted emissions and arrest a HEMP pulse as per MIL-STD-188-125.

PRECAUTIONS



Danger Lethal voltages present. This unit should be installed and maintained by a qualified electrician.

Automatic bleeder resistors discharge the capacitors to 50 Volts five (5) seconds after power is removed.

Use a shorting stick to touch all metal surfaces exposed before touching the filter.



FILTER COMPONENTS

FILTER ELEMENTS

The filter panel consists of filter elements and termination points with MOV's in the panel. There are no USER SERVICEABLE parts inside the Filter Elements. Should a filter element be determined to be defective, please contact the factory to order a replacement or to schedule its return for repair or replacement.

TERMINATIONS

INPUT

The source conductors are brought through an opening made in the field on the "dirty" side of the filter by a qualified individual in the field. The opening should be of sufficient diameter to allow the free passage of conductors according to local and national electrical codes as the case may apply. The conductors should then be directly terminated to the lugs or terminals provided (or equivalent). All conductors must be of the appropriate size to carry the required rated current according to local and national electrical codes.

OUTPUT

The output conductors are brought in to the "clean" side of the filter through a conduit penetration (if provided) or a circular opening in the back of the filter panel. Otherwise an opening made in the field on the "clean" side of the filter by a qualified individual in the field. The opening should be of sufficient diameter to allow the free passage of conductors according to local and national electrical codes as the case may apply. The conductors should then be directly terminated to the lugs provided (or equivalent). All conductors must be of the appropriate size to carry the required rated current according to local and national electrical codes.

The output terminals of the filter are EMI isolated from the inputs.

Wiring and grounding should be done in accordance to the wiring schematic provided in the Illustrations section of this manual. All conductors must be of the appropriate size to carry the required rated current according to local and national electrical codes.

MOV FAILURE AND PROTECTIVE DEVICES

The prime power circuit breaker upstream from this protector should provide overcurrent protection. This minimizes the possibility of undetected loss of Transient Protection (when provided).

AUTOMATIC DISCHARGE

The filter contains bleeder resistors that will automatically reduce the voltage on any component to less than 50 volts within 5 seconds after the removal of input power.

SHORTING STICK (NOT PROVIDED)

When it is necessary to access the interior of the filter a shorting stick (grounding rod) should be used by service personnel to insure all capacitors and other energy storage elements are discharged and in a safe state. All terminals accessible to service personnel and capable of retaining stored energy in the event of automatic discharge circuit failure are accessible and should be shorted to ground with a shorting stick or equivalent.

ELECTRICAL PERFORMANCE CHARACTERISTICS

VOLTAGE DROP

The total AC voltage drop from input to output is designed to be no more than 2 percent of the rated voltage, when measured into a unity power factor.

OVERLOAD CURRENT and SCCR

The filter can withstand an overload current of 1.4 times the rated current in amperes for a period of 15 minutes and maintain filtering during this period. The filters can also survive without degradation or damage, a short circuit current according to the SCCR rating on the table below when supplied with appropriate fuse or circuit breaker protection.

Model	Amperage	Short Circuit Current Rating (SCCR)	Max Voltage	Wires
HEMP-2010	10	5 kA	277/480	2
HEMP-2030	30	25 kA	277/480	2
HEMP-3030	30	25 kA	277/480	3
HEMP-4030	30	25 kA	277/480	4
HEMP-2060	60	25 kA	277/480	2
HEMP-3060	60	25 kA	277/480	3
HEMP-4060	60	25 kA	277/480	4
HEMP-2100	100	25 kA	277/480	2
HEMP-3100	100	25 kA	277/480	3
HEMP-4100	100	25 kA	277/480	4
HEMP-3250	250	25 kA	277/480	3
HEMP-4250	250	25 kA	277/480	4
HEMP-3X400	400	50 kA	277/480	3
HEMP-4X400	400	50 kA	277/480	4
HEMP-3X600	600	125 kA	277/480	3
HEMP-4X600	600	125 kA	277/480	4
HEMP-3X800	800	125 kA	277/480	3
HEMP-4X800	800	125 kA	277/480	4
HEMP-3X1200	1200	150 kA	277/480	3
HEMP-4X1200	1200	150 kA	277/480	4

POWER FILTER CHARACTERISTICS

UL listed filters will bear a UL listing label. The filter and filter elements comply with MIL-F-15733 and UL-1283 most recent editions.

INSERTION LOSS

80 dB from 10 MHz to 1 GHz, 100dB from 1 GHz to 20 GHz per MIL-STD-220C in symmetric and asymmetric mode.

VOLTAGE

For 60 Hz filters-- Nominal: 277 VAC/VDC Line-to-Ground, 480 VAC/VDC Line-to-Line. The filter may operate with DC voltages up to the maximum rated AC voltage.

CURRENT

As specified in filter label. Filter may be operated up to the filter's rated maximum current. This is an RMS rating and is a continuous 100 % duty cycle rating. The filter may be operated on DC up to the same rating.

FREQUENCY OF OPERATION

The filter is designed to operate in DC voltages up to the rated frequency of operation on the label.

ENVIRONMENTAL SPECIFICATIONS

Attribute	Operating	Non-operating
Temperature	-40°C to +65°C	-55°C to +90°C
Altitude	Sea Level to 8,000 ft	Sea Level to 40,000 ft
Humidity	Relative humidity between 10 percent and 90 percent at air temperatures between +25°C and +32°C	Relative humidity as low as 14 percent at an air temperature of +71°C and as high as 100 percent at temperatures from -33°C to +33°C with condensation at all temperatures lower than +30°C

The filter will withstand transportation loads of +/- 5 g vertical and +/- 3 g in both horizontal axes, as packaged for shipment.

INSTALLATION

Uncrate all parts. NOTE: Do not discard any packaging material until the unit is installed. Check all parts for any shipping damage. Ensure a clear area is available for installing the filter.



CAUTION: Electrical connection should only be performed by a qualified electrician and in compliance with all applicable regulatory agencies.

Connection to the filter should be made by qualified electricians. Refer to the "Terminations" section for further details.

Wiring and grounding should be done in accordance to the wiring schematic provided in the Illustrations section of this manual.

Installation of the conduit penetration and EMI gasket should be done in accordance to the drawing provided in the Illustrations section of this manual.

ALL POWER FILTERS MUST BE GROUNDED TO THE BUILDING GROUND FOR SAFETY AND PERFORMANCE REASONS.

POWER ON

Before applying power to the filter, verify that there are no shorts from any line to ground or neutral using an Ohmmeter. There are no special requirements or procedures prior to applying power other than making sure that the wiring is done correctly and verifying that no shorts exist.



CAUTION: Electrical wiring verification should only be performed by a qualified electrician and in compliance with all applicable regulatory agencies.

IN-RUSH CURRENT

In rush current is not typically a problem with filters as it is not a function of the rated current of the filter. In-rush current will be determined mainly by the load connected after the filters. The filter itself is capable of withstanding high in-rush currents created by the load for several seconds.

REACTIVE (LEAKAGE) CURRENT

Reactive current is the normal presence of current on the filter lines even when no load is connected. This fact is sometimes surprising, but a closer examination of what a filter is should reveal the fact that as soon as voltage is applied to the filter, there will be a normal current drain. This normal current drain is usually less than 10 % of the rated current of the filter. The presence of this current does not indicate a problem unless it is above the level expected. Contact the factory for specific leakage current for any particular filter model.

MAINTENANCE



DANGER Lethal voltages present. Risk of electric shock. After removing power from the unit the automatic bleeder resistors will discharge the unit to 50 volts in 5 seconds. Use a shorting stick to touch all metallic surfaces exposed before touching the filter.

Periodically power down the filter and remove the lids to check inside for dirt, debris, corrosion, or signs of overheating. Dirt, debris and corrosion inside the filter compartments, should be removed according to appropriate procedures. User's own procedures for the removal of spills, dirt, debris and corrosion should suffice. Should EMI gasket become torn or unusable, please contact the factory to order replacement part E-903-008.

If overheating is observed, the cause should be investigated before power on.

The MOV arrestor (when supplied) should be replaced when an MOV test, as shown below, fails to indicate a working MOV. This test may be scheduled annually or as often as the installation procedures requires it.

Once a filter is properly installed it typically does not require maintenance under normal operating conditions. However, if there is an extraordinary event affecting the filters (such as a severe voltage overload or water entering the wiring compartments), then the following procedures should be followed depending on the nature of the event. Follow the "Inspection and Cleaning of Wiring Compartments" procedure after an event that causes abnormal contamination of filter wiring compartments with liquid or debris. Follow the "Capacitance Measurement and MOV Inspection Procedure" following an event that causes abnormal voltage overloads or spikes beyond that which the filters are designed to accommodate.

INSPECTION AND CLEANING OF WIRING COMPARTMENTS

1. Remove power from the filter(s).
2. Wait at least 60 seconds, then remove the wiring compartment covers.
3. Short the filter terminals to the filter case using a conductive shorting stick to insure that the filter capacitors are fully discharged.
4. Inspect the filter terminals and insulators for contamination and/or damage.
5. If the terminals or insulators are cracked or damaged replace the damaged component in accordance with the directions provided with the replacement parts.
6. Clean the terminals and insulators as necessary and remove any loose debris from the wiring compartments.
7. Re-install the wiring compartment covers. Insure even compression of the RF gasket around the RF tight wiring compartment. Begin by torquing all of the cover screws to 24 inch-pounds, starting in the center of each flange and working out towards the corners. Then using the same pattern torque all screws to 48 inch-pounds.

Re-apply power to the filters(s)

CAPACITANCE MEASUREMENT AND MOV INSPECTION PROCEDURE

If no Transient Protection is provided the sections pertaining to MOV's do not apply.

1. Remove power from the filter(s).
2. Wait at least 60 seconds, then remove the wiring compartment covers. Verify no voltage is present with a voltmeter.
3. Short the filter terminals to the filter case using a conductive shorting stick to insure that filter capacitors are fully discharged.

4. Disconnect the phase and neutral electrical wiring from the electrical termination points.
5. Inspect the filter terminals and insulators for contamination and/or damage.
6. If any of the terminals or insulators are cracked or damaged replace the damaged component in accordance with the directions provided with the replacement parts.
7. Inspect the MOV's (when provided) for damage.
8. If any MOV's are damaged replace the damaged component in accordance with the directions provided with the replacement parts.
9. MOV's may be measured with a device such as a Bourns Model 4030-01 to determine if they are still operational. If they are not, replace.
10. Measure the line to ground capacitance of each phase. Using an LCR Bridge, measure Capacitance of each phase at 120 Hz. The reading should be according to drawings. A DF measurement should be done at the same time and recorded. DF readings above 0.08 should be noted and the factory should be called for advice before re-applying power to the filter.
11. Clean the terminals and insulators as necessary and remove any loose debris from the wiring compartments.
12. Re-install the phase and neutral electrical wiring to the electrical termination points. Torque the bolts and/or nuts to the specified torque noted next to the termination point.
13. Re-install the wiring compartment covers. Insure even compression of the RF gasket around the RF tight wiring compartment. Begin by torquing all of the cover screws to 4 foot-pounds, starting in the center of each flange and working out towards the corners. Then torque all screws to 8 foot-pounds following the same pattern.
14. Re-apply power to the filter(s).

WARRANTY STATEMENT

ETS-Lindgren Inc., hereinafter referred to as the Seller, warrants that the RF filters purchased under this contract will be free from defects in workmanship performed by the Seller, and will conform to the applicable specifications and/or drawings.

This warranty is limited to either giving credit, repairing or replacing with reasonable promptness after written notice from the buyer of such defect promptly after discovery of same and in no case later than the warranty period after shipment by Seller. The Buyer shall notify the Seller in writing of any defect and include a complete description of the defect within fourteen (14) days after discovery of same to allow the Seller to arrange for appropriate action to make good this warranty, should the Seller determine that the claim is valid.

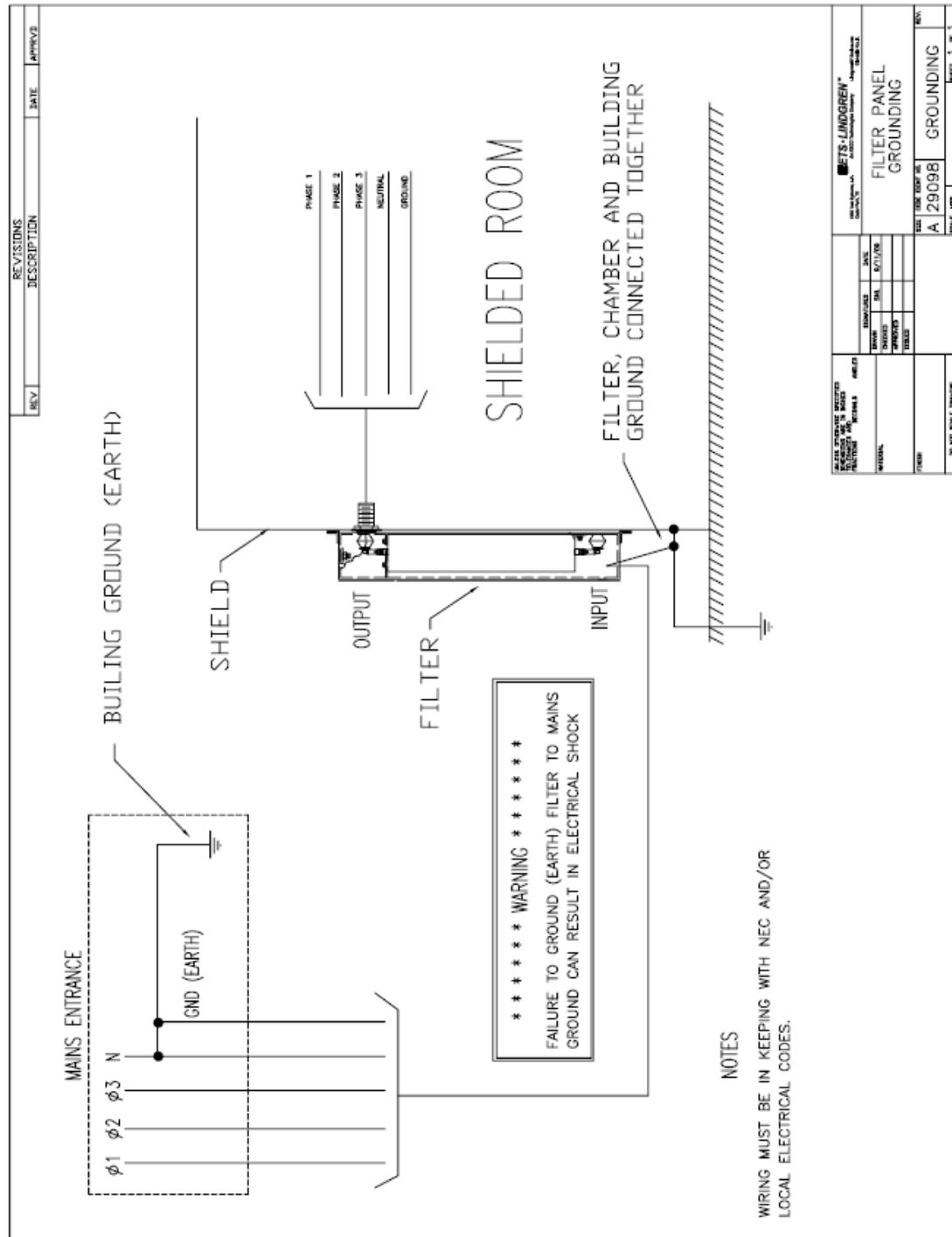
This warranty does not extend to any portion of the material which has been subject to misuse, neglect, accident, installation or operations not in accordance with the Seller's installation Procedure, nor does it extend to any portion of the material which has been repaired or altered by other than the Seller. The Buyer, upon request shall furnish to the Seller reasonable evidence that the defect arose from causes other than those contained in the preceding sentence.

THIS WARRANTY IS EXCLUSIVE. NO OTHER WARRANTY, WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE REMEDIES PROVIDED BY THIS WARRANTY ARE THE BUYER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT IS THE SELLER LIABLE FOR ANY DAMAGES WHATSOEVER, INCLUDING BUT NOT LIMITED TO, DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

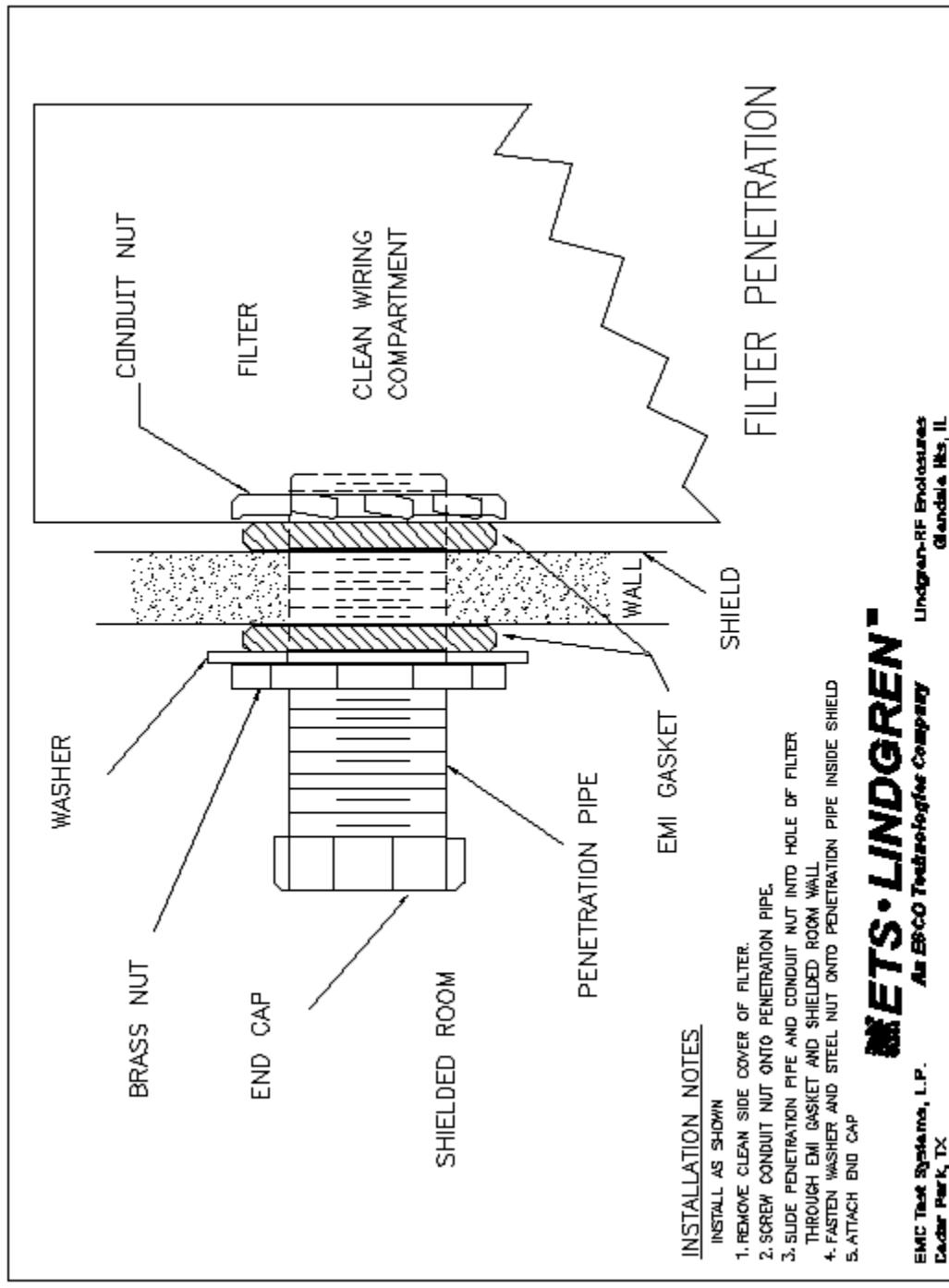
If the Seller is required to take corrective action under the terms of this warranty, it shall be done at no cost to the Buyer. If after proper determination it is found that any claim of defect is indeed the result of causes not covered by this warranty, the Buyer shall pay all costs including reasonable profit to the Seller for expenses incurred during investigation of the Seller of the unwarranted claim.

ILLUSTRATIONS

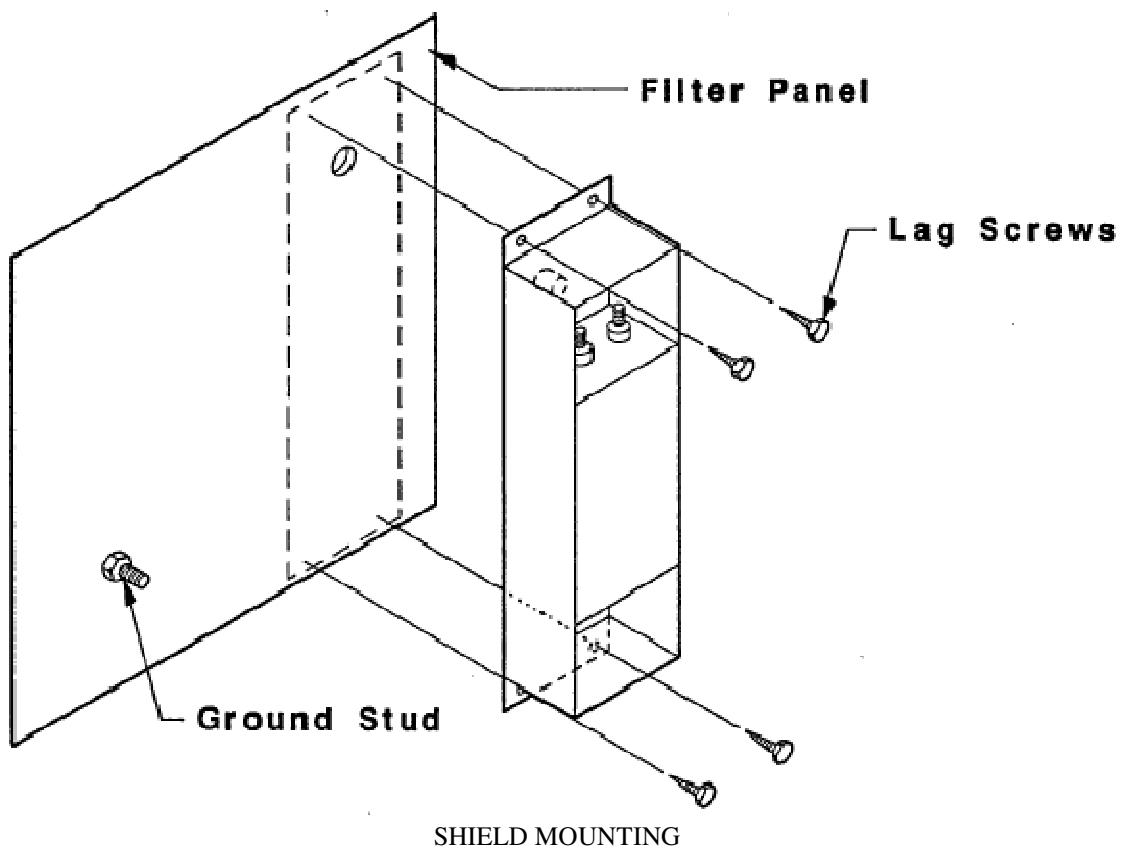
TYPICAL WIRING FOR A 50/60Hz 3 PHASE + NEUTRAL PANEL INSTALLATION

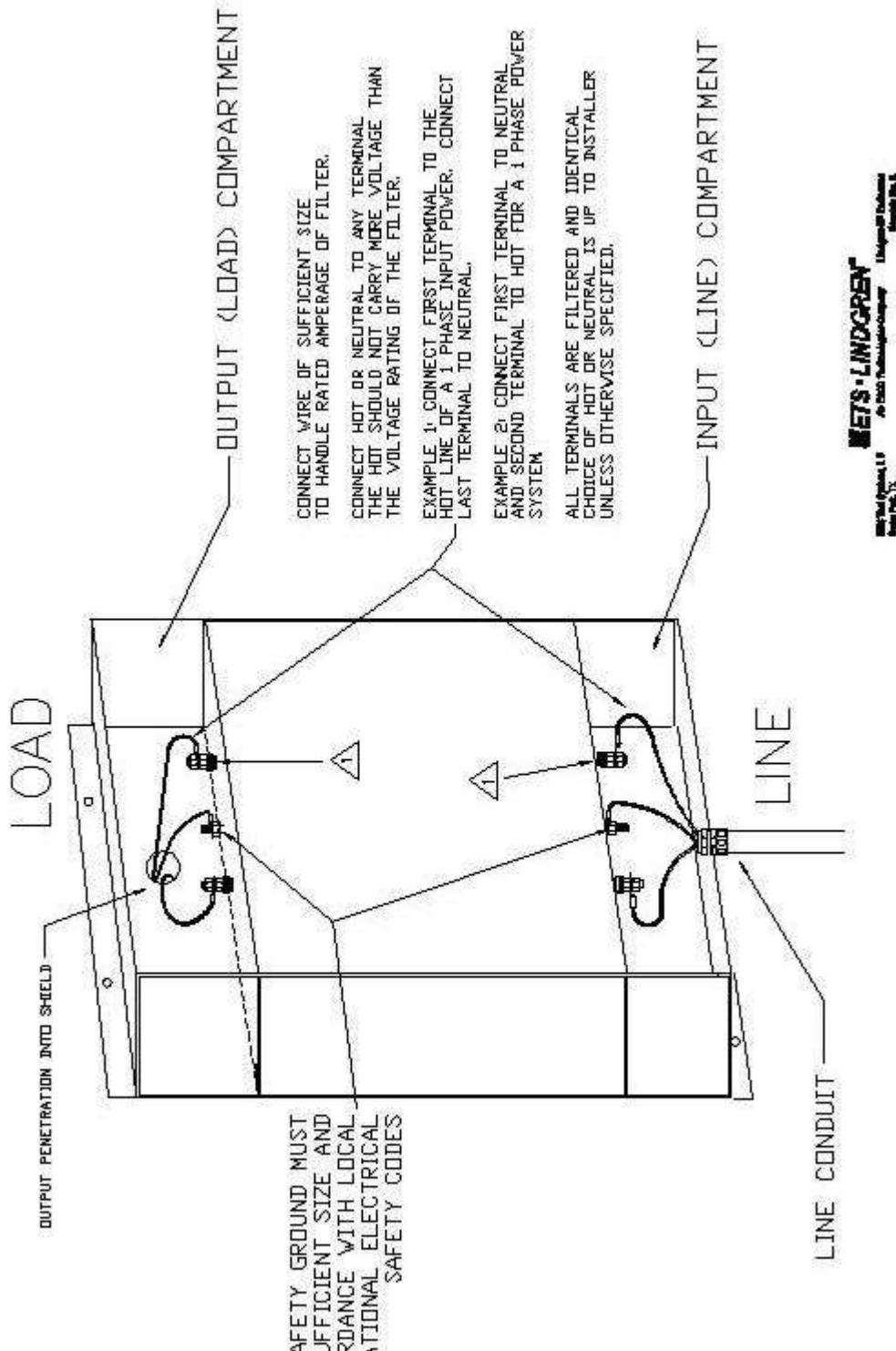


PROPER GROUNDING (EARTH) AND WIRING OF FILTER IN CHAMBER INSTALLATION

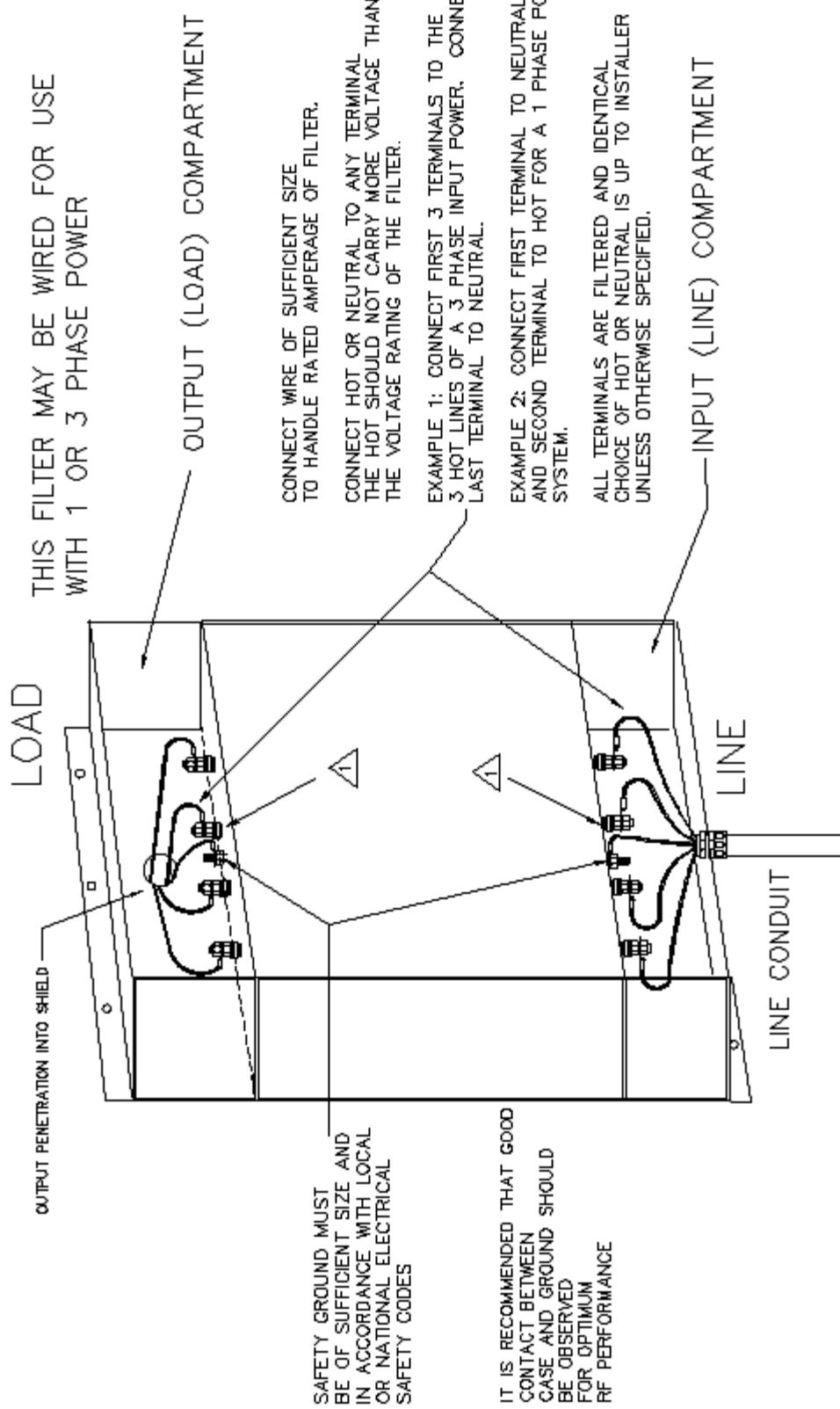


FILTER PENETRATION MOUNTING





WIRING OF SINGLE PHASE FILTER



WIRING OF 3 PHASE AND 4 WIRE FILTERS