


INVERSINE™


ADVANCED UNIVERSAL SINEWAVE FILTER (AUSF)



IMPORTANT SAFETY INSTRUCTION

SAVE THESE INSTRUCTIONS - This manual contains important instructions for the Inversine that must be followed during installation, operation, and maintenance of the Inversine and its auxiliary equipment.

	<p style="text-align: center;">WARNING</p> <p style="text-align: center;">OPENING ENCLOSURES EXPOSES HAZARDOUS VOLTAGES. ALWAYS REFER SERVICE TO QUALIFIED PERSONNEL ONLY.</p>
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	<p style="text-align: center;">WARNING</p> <p>As standards, specifications, and designs are subject to change, please ask for confirmation of the information given in this publication.</p> <p>This manual is a controlled document; pages should not individually be removed from this document.</p>
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INVERSINE™

INSTALLATION, OPERATION AND MAINTENANCE GUIDE

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MIRUS International Inc.
31 Sun Pac Blvd.
Brampton, Ontario
Canada L6S 5P6

1 - 888 - TO - MIRUS (1 - 888 - 866 - 4787)
Tel: (905) 494-1120
Fax: (905) 494-1140
E-Mail: mirus@mirusinternational.com
Website: www.mirusinternational.com

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Revision History

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1.0 Installation

	<p>WARNING</p> <p><i>Danger! There is the potential of electric shock whenever working in or around electrical equipment such as sine-wave filters. Power must be shut off before any work is conducted on a sine-wave filter.</i></p>
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1.1 Location

Location of the Inversine Sine Wave Filter should be made with consideration given to accessibility, ventilation and atmospheric conditions. Sufficient clearances from walls and other obstructions should be provided to permit unrestricted opening of hinged and removable doors, covers and panels for the purpose of wiring terminations, inspection, maintenance and testing. Also, **proper ventilation requires at least 6 in. (155mm) clearance** at all ventilation openings.

Installation locations should be free of contaminants including dust, fertilizer, excessive moisture, corrosive gases, flammable materials or chemical fumes. Filtered air may be considered to reduce maintenance where air born contaminants are a problem.

Enclosures are designed in accordance with NEMA and UL standards and can allow for installation in various environments. Standard enclosures for the Inversine are NEMA3R and NEMA3R Enhanced.

Where Inversine are connected to lines subject to lightning exposure or other voltage surges, careful coordination of BIL levels and protective surge arresters must be made. For derating factors which apply to installation at high altitudes, refer to ANSI C57.12.01-1989.

1.2 Inspection

Upon receipt of shipment the Inversine should be inspected for any damage incurred during shipment. Before energization an internal inspection should be conducted with emphasis on loose or broken connections, damaged or displaced parts, cracked insulators, dirt or foreign material, or evidence of moisture.

1.3 Handling

The Inversine should be thoroughly protected against the entrance of dust, rain or snow when handled outdoors.

When lifting the Inversine, the lifting cables should be held apart by a spreader to avoid bending the lifting lugs or other parts of the structure. The Inversine may be skidded or moved on rollers but care must be taken not to damage the base or tip it over. When rollers are used under larger units, skids must be used to distribute the stress over the base.

After the Inversine is placed in permanent position, shipping braces should be removed and shipping bolts, if present, should be loosened. **Where isolation pads have been included, the bolt should be loosened until the spring washer has been relaxed before putting into service.** This will reduce noise resulting from the Inversine natural vibration.


1.4 Grounding

Consideration must be given to equipment grounding (case and core) and must be made in accordance with all applicable electrical codes.

2.0 Storage

Condensation and moisture absorption must be prevented during storage. The Inversine must be stored in a warm, dry location. Ventilation openings should be covered to keep out dust. If outdoor storage cannot be avoided, the Inversine must be protected to prevent entrance of water, moisture and foreign material.

3.0 Maintenance

	<p>WARNING</p> <p><i>Internal maintenance must be performed with a sine-wave filter de-energized, isolated and with the terminals grounded.</i></p>
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3.1 Periodic Inspection and Maintenance


The Inversine has no moving or active parts and therefore requires only minimal periodic maintenance when installed in a clean and well ventilated environment. This should include:

- 3.1.1 Visual inspection for evidence of loose connections, dirt, moisture, rusting, corrosion, and deterioration of the insulation, varnish or paint. Observations should be made for signs of overheating and overvoltage creeping. Corrective measures should be taken as necessary.
- 3.1.2 For early detection of any developing hotspots, an infrared scan can be performed while the Inversine is operating under its heaviest load condition.
- 3.1.3 Measuring the current in each of the 3 phases of the capacitor circuit can be a quick and easy method of determining the condition of the capacitors. The capacitors can be assumed to be in good operating condition when all 3 phases carry approximately the same amount of load current. Measurements should be taken at the input to the capacitor fuse block and can be done at any loading condition. If the phase currents are found to be substantially different, the unit should be taken offline and serviced by a qualified technician. This test should be conducted annually or whenever the unit seems to be operating in an abnormal manner.

3.2 Cleaning

Excessive accumulations of dirt on the Inversine sine-wave filter windings or insulators and capacitor terminals should be removed to permit free circulation of air and to guard against the possibility of insulation breakdown. Particular attention should be given to cleaning the top and bottom ends of the winding assemblies and to cleaning out ventilating ducts. Windings should be lightly cleaned by the use of a vacuum cleaner. If necessary a blower or compressed air may be used but pressure should not exceed 25 psi. Lead supports, tap changers and terminal boards, bushings, and other major insulating surfaces should be brushed or wiped with a dry cloth. The use of liquid cleaners is not recommended due to deteriorating effects on most insulating materials.

3.3 Drying of Core and Coil Assembly


	<p>CAUTION</p> <p><i>Constant attention during the drying process is recommended.</i></p>
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When it is necessary to dry a Inversine sine-wave filter before installation or after an extended shutdown under relatively high humidity conditions, internal and/or external heating methods can be used. (See ANSI/IEEE C57.94-1982 for a description of these methods).

It is important that most of the heated air pass through the winding ducts and not around the sides. Good ventilation is essential in order that condensation not take place in the reactor itself or inside the case. A sufficient quantity of air should be used to assure approximately equal inlet and outlet temperatures.

Air temperature should not exceed 70°C.

4.0 Operation

	<p style="text-align: center;">WARNING</p> <p><i>Internal maintenance must be performed with a sine-wave filter de-energized, isolated and with the terminals grounded.</i></p>
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Caution: Do not remove covers, panels, or any enclosure parts while the Inversine is energized.

4.1 Effect of Humidity

While the Inversine is energized, humidity conditions are generally not important since the heat from the reactor will prevent condensation. If a shutdown exceeding 24 hours occurs during a period of high humidity that could cause condensation within the Inversine sine-wave filter, precautions should be taken. Small strip heaters may be energized in the bottom of the unit to maintain the temperature of the unit a few degrees above that of the outside air. If such precautions are not taken the unit should be inspected for evidence of moisture and insulation resistance checked. If necessary, dry as described in Maintenance section above.

4.2 Loading

A Inversine should only be loaded in accordance with its nameplate rating.



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Canada L6S 5P6

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Website: www.mirusinternational.com