ARTECHE

POWER QUALITY

INSTRUCTION MANUAL

Type SWF

Sine Wave Filters

690 Volts, 50Hz

Contents

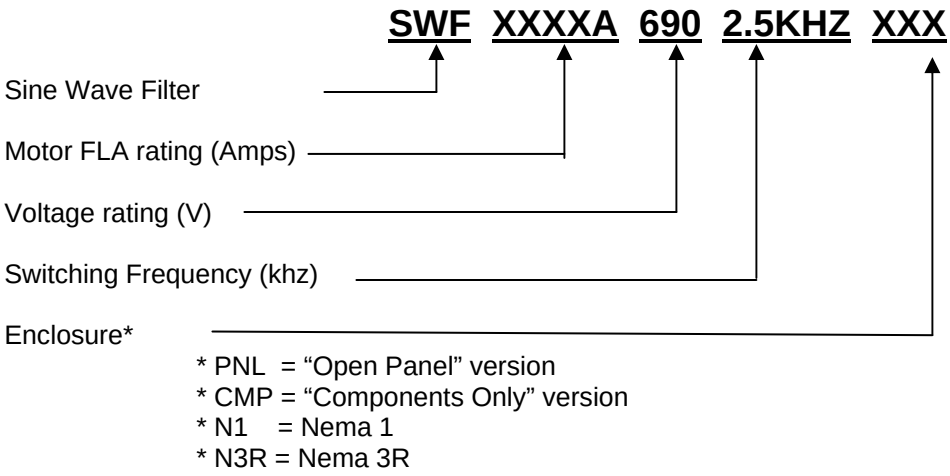
1.0 PRIOR TO INSTALLATION

This manual is intended to serve the user as a general guide for the installation and maintenance of Sine Wave Filters.

The instruction manual must be read carefully before unpacking, installation and maintenance.

Type SWF Filters are designed and intended for use with PWM inverters as found in variable frequency motor drives supplying variable torque loads such as fans and pumps. The customer is responsible for determining the filter suitability for their specific application and for installing, connecting, using and maintaining the filter in an appropriate manner and within its specifications.

1.1 Catalog Numbering System for 2.5kHz sine wave filters.

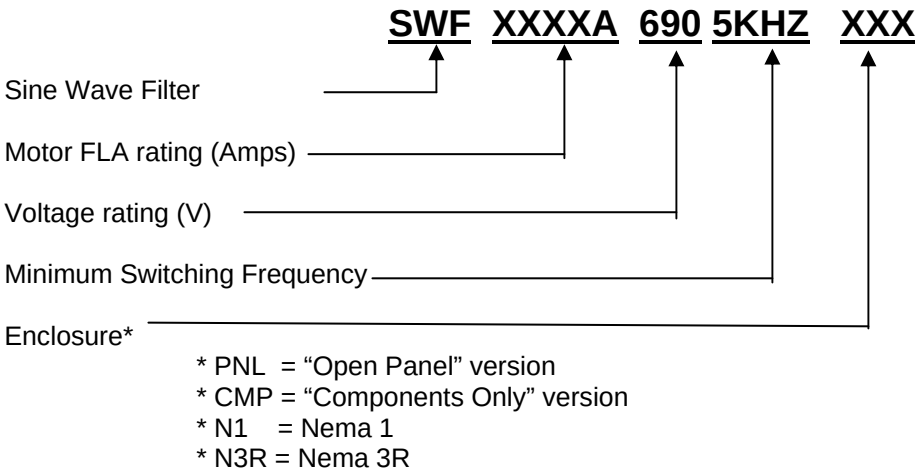


* PNL = “Open Panel” version
* CMP = “Components Only” version
* N1 = Nema 1
* N3R = Nema 3R

Catalog Number Example:

A 21 amp, 690V, Nema 3R enclosed sine wave filter is defined as: **SWF 0021A 690 2.5KHZ N3R**

1.2 Catalog Numbering System for ≥5kHz sine wave filters.



* PNL = “Open Panel” version
* CMP = “Components Only” version
* N1 = Nema 1
* N3R = Nema 3R

Catalog Number Example:

A 21 amp, 690V, Nema 3R enclosed sine wave filter is defined as: **SWF 0021A 690 5KHZ N3R**

SAFETY INSTRUCTIONS

!! CAUTION – High Voltage !!

WARNING - THE EQUIPMENT COVERED BY THIS PUBLICATION MUST BE SELECTED FOR A SPECIFIC APPLICATION AND MUST BE INSTALLED, OPERATED AND MAINTAINED BY QUALIFIED PERSONNEL WHO ARE THOROUGHLY TRAINED AND WHO UNDERSTAND ANY HAZARDS WHICH MAY BE INVOLVED. THIS MANUAL HAS BEEN WRITTEN FOR SUCH QUALIFIED PERSONNEL EXCLUSIVELY AND IS NOT INTENDED TO BE A SUBSTITUTE FOR ADEQUATE TRAINING IN SAFETY PROCEDURES FOR THIS TYPE OF EQUIPMENT.

WARNING – Only qualified electricians should handle the installation of this filter, otherwise electric shock or fire may occur.

CAUTION – Improper handling may cause mis-operation and reduce the life of the filter.

CAUTION – This manual should be given to the user of this product and should be kept in a safe place until the filter is removed from service.

WARNING – Disconnect all electrical power from the circuit into which the filter is being installed. Extreme caution must be taken to prevent contact with high voltage during installation, operation and service of this equipment. Accidental contact with high voltage can result in personal injury or death.

WARNING – This filter contains power capacitors which will store energy for a time period of up to five minutes. Using a voltmeter, confirm that the capacitor has entirely discharged as evidenced by zero voltage present between the capacitor terminals prior to performing installation, operation or service procedures. Accidental contact with energized parts may cause personal injury or death.

WARNING - There can be several live parts inside the filter while power is applied. Disconnect all electrical power to the circuit before installing or servicing the filter. Accidental contact with energized parts may cause personal injury or death.

WARNING – Observe torque requirements for all electrical connections. When making connection using crimp terminals, be sure to use the crimping tool recommended by the terminal manufacturer. Wire and cable connections having improper torque may cause fire.

WARNING – The ground terminal should always be connected to the ground using a conductor which is the same diameter (gauge) as the phase conductor. Lack of ground connection or improper grounding may result in electric shock or fire.

WARNING - Install filter in accordance with all applicable local electrical standards (NEC, etc). Failure to properly install filter in accordance with local electrical safety standards may cause electric shock, fire or service disruption.

WARNING – Install filter in an enclosure that will prevent accidental contact with live parts and by using proper wire sizes as dictated by local electrical safety standards. Accidental contact with energized parts may cause personal injury or death.

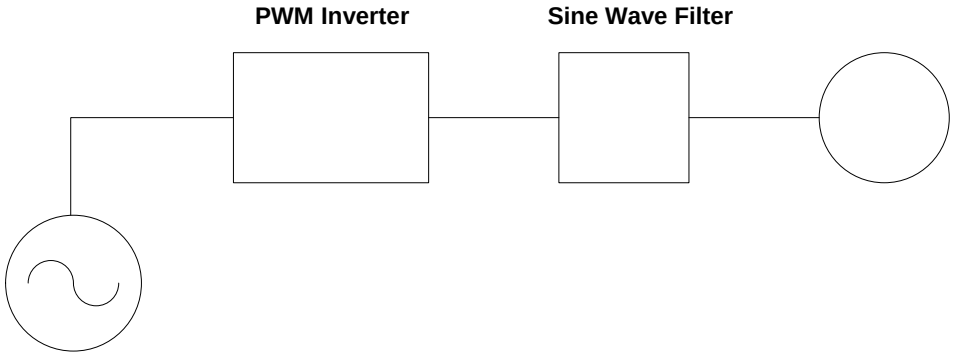
CAUTION – Install filter in an enclosure that will prevent foreign matter such as paper, lint, wood chips, metallic chips from contact with live parts, otherwise fire, personal injury or equipment mis-operation may occur.

We strongly recommend that the installation, operation and maintenance of this equipment be handled by an electrician engineer or technically qualified electrician with experience in electrical power equipment.

2.0 Theory of operation

Arteche PQ Sine Wave Filters are designed and intended for use with most PWM inverters, with fixed carrier frequency, such as those found in found in variable frequency motor drives supplying variable torque loads such as fans and pumps and distributed generation power sources. The customer is responsible for determining the filter suitability for their specific application and for installing, connecting, using and maintaining the filter in an appropriate manner and within its specifications. Contact the factory for guidance in selection of filters for other types of loads.

The Sine Wave Filters are to be connected in series with and at the output of the inverter. The SWF is a low pass filter that allows fundamental frequency current to flow to the load (such as a motor, while filtering out the switching frequency which is much higher ($\geq$ 5kHZ).



Arteche Type SWF Sine Wave Filters offer superior motor protection compared to dv/dt filters because they convert PWM pulses to a near sine wave. This reduces the peak voltage to a level very close to the DC bus voltage and AC input peak voltage, and dramatically slows the voltage rise time. Type SWF filters affect both aspects of dv/dt: reduces voltage and extends rise time. Supplying the motor with voltage that is closer to sine wave can result in improved motor performance and life expectancy.

3.0 Typical results of the Sine Wave Filter

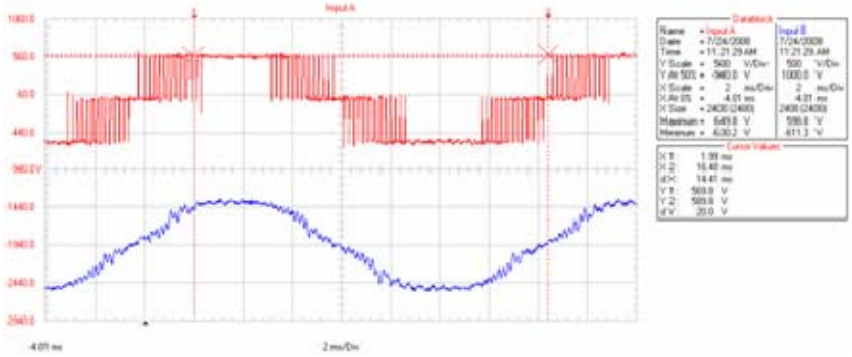
Type SWF Sine Wave Filters convert inverter produced PWM voltage to a near sine wave to prevent motor failure due to either excessive peak voltage caused by voltage reflection or excessively fast rising pulses (dv/dt). The Type SWF Sine Wave Filter offered by Arteche PQ, Inc. is a low pass filter that actually converts the PWM voltage to a sine wave, with a small amount of ripple voltage at the carrier frequency. A relatively high impedance line reactor is combined with a capacitor to form a filter with a resonant frequency well below the inverter switching frequency. This network removes most of the high frequency content (pulses) from the waveform. The result is nearly a sinewave typically with five percent of distortion or less, and with normal peak voltage. Since the output voltage is practically a sine wave, virtually infinite lead lengths are possible (excepting for voltage drop). The waveform resulting from proper application of our sine wave filter complies with the requirements of NEMA standard MG-1 for non-inverter duty motors.

While dv/dt filters offer only marginal motor protection because peak voltage and rise time are very close to Nema Mg-1, part 30 limits, Arteche Sine Wave Filters offer complete protection against both excessive peak voltage and pulse rise time and result in reduced operating temperature and extended motor life.

Typical results for 5KHZ type sine wave filter:

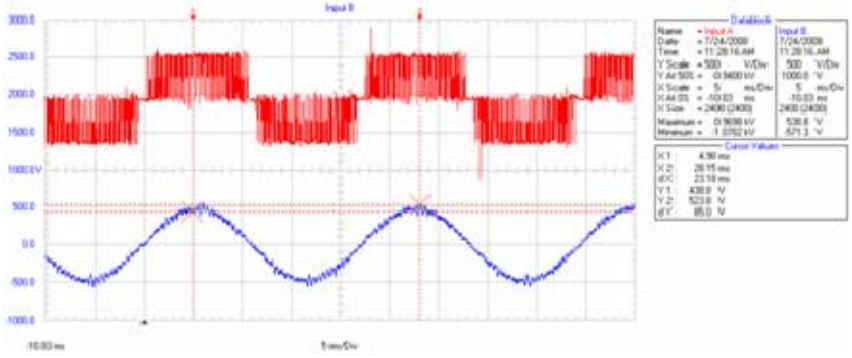
60Hz output, no load
Fc = 5khz

Red (top) = VFD output
Blue (bottom) = SWF output



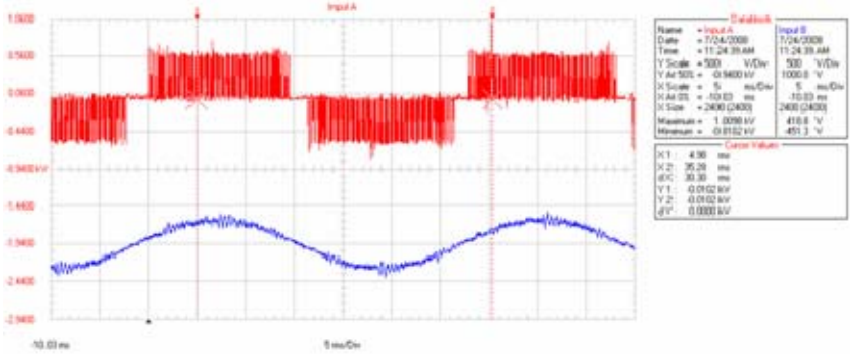
45Hz output, no load
Fc = 5khz

Red (top) = VFD output
Blue (bottom) = SWF output



30Hz output, no load
Fc = 5khz

Red (top) = VFD output
Blue (bottom) = SWF output

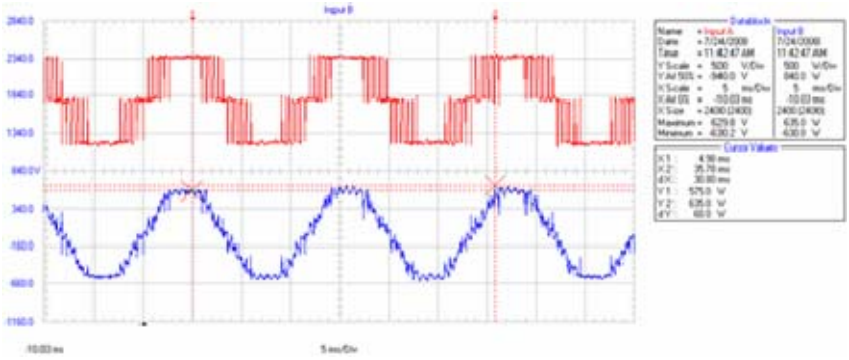


3.0 Typical results of the Sine Wave Filter (continued)

Typical results for 2.5KHZ type sine wave filter:

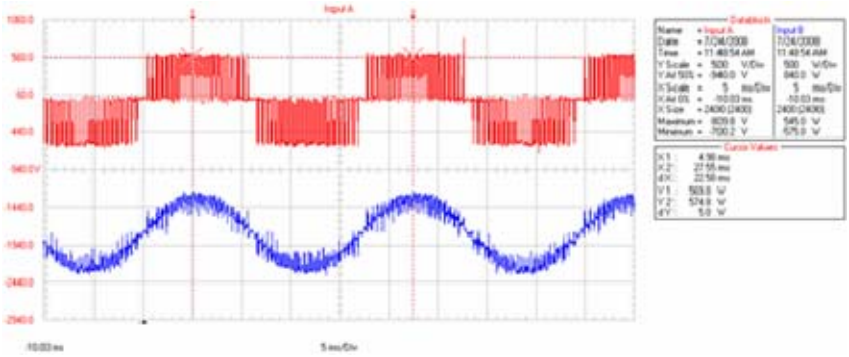
60Hz output, no load
Fc = 2.5khz

Red (top) = VFD output
Blue (bottom) = SWF output



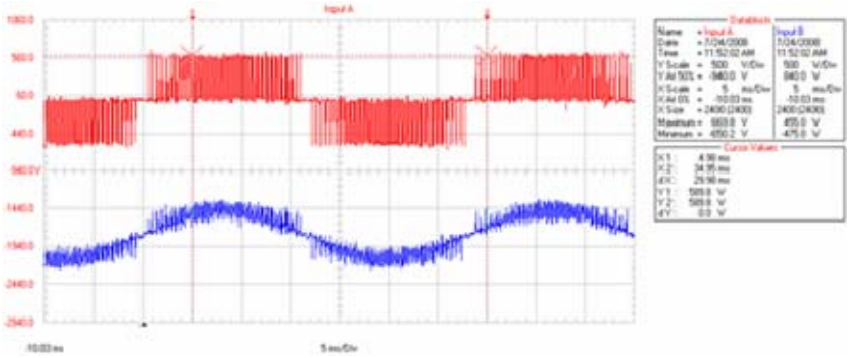
45Hz output, no load
Fc = 2.5khz

Red (top) = VFD output
Blue (bottom) = SWF output



30Hz output, no load
Fc = 2.5khz

Red (top) = VFD output
Blue (bottom) = SWF output



Sine wave filters are field repairable using factory original parts from ARTECHE PQ.

20 year design life expectancy on reactors and capacitors.

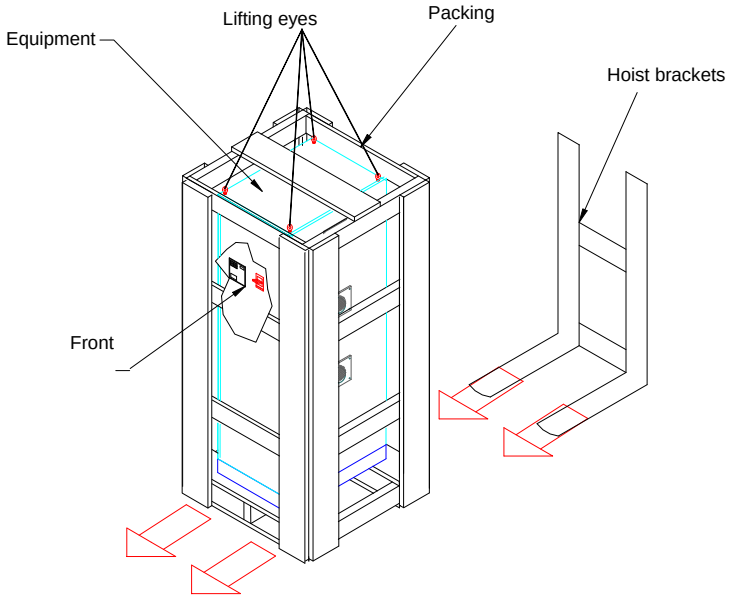
Filters are manufactured with high quality capacitor cells and reactors. Capacitor cells are constructed in metallic cases filled with high performance and biodegradable dielectric fluid which is free of PBCs. Capacitors used in sine wave filters are self-healing and self-protecting. In the event of an internal insulation breakdown, due to exposure to excessive voltage or overcurrent, capacitors will heal themselves but lose capacity gradually. A UL approved internal pressure sensitive switch interrupts the internal electrical connections before the case can rupture. The self healing and self protecting features eliminate the necessity for filter fuses. Reactors are balanced between all three phase within +/- 3% tolerance, for improved filtering and consistent voltage drop.

Capacitors and reactors, used in kits, are UL component recognized.

Sine wave filters are designed for natural convection cooling, therefore fans are only required if the customer determines it is necessary for heat removal. It is the customer's responsibility to install the filter in a suitable and well ventilated enclosure. Refer to the Technical Data section for filter watts losses.

4.0 Transportation, Handling and Storage

Sine Wave Filters are shipped in either corrugated cartons or wooden crates, depending on size, to offer maximum protection during shipment. When filters are supplied in large floor standing enclosures, then the factory will protect them with wood crates. Transportation and handling of the filter must always be done with the filter in a vertical position. For these enclosure styles, it is recommended to put the hoist by the rear part of the filters. Large enclosed and crated filters have lifting eyes to facilitate its transportation and placement. Sine wave filters should only be stored indoors within temperature and humidity ranges as contained in the specifications section 8, (page 12).



5.0 Installation

The location selected for the installation must have sufficient space around for a good air circulation. Filter enclosures, when supplied) may be provided with perforations to be fixed on the floor, or removable lifting eyes on the top for carrying and handling the filter with a crane.

5.I Upon arrival, the packing list and shipment should be carefully checked for completeness. The crating must be examined for transit damage. In the event of visible transit damage, a claim must be filed immediately with the carrier.

In the event that the equipment is not installed immediately after arrival, it should be placed in intermediate indoor storage without removing the packing. In this case, the crates are to be stored on a level area of sufficient strength to bear their weight and in a clean and non-corrosive atmosphere.

5.2 Filters should be located in a ventilated area and must be installed only by trained and qualified personal.

5.3 Filters are provided with bus bars, terminals or lugs to receive feeders and grounding conductors. To connect the filter it is necessary to fasten the conductors to the lugs and tighten with appropriate torque table (section 7) on page11. Always start by grounding the filter first, then connect power feeder conductors.

5.4 Conduit sizes, tray sizes and cable's ampacity must be according National Electrical Code or applicable electrical codes in your area.

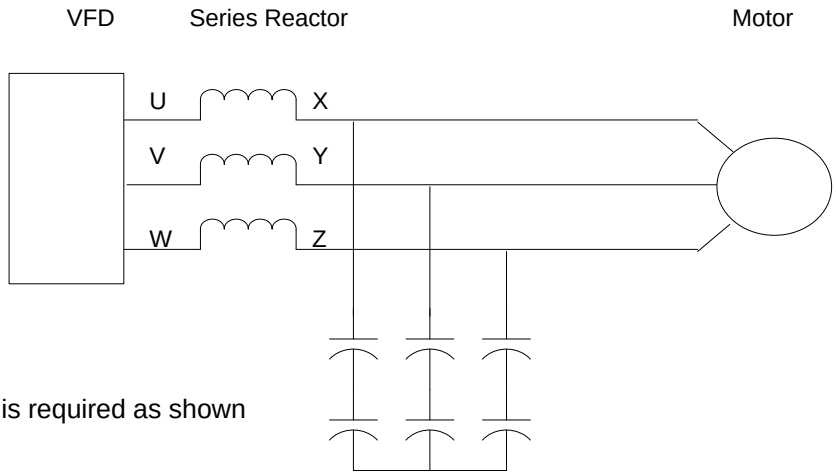
5.5 Capacitors should be located in such a manner so that reactor heat does not directly contribute to capacitor temperature. Reactors and capacitors may be mounted on either a horizontal or vertical panel. If mounted on a vertical panel, the best heat dissipation and coil temperature control will be achieved when reactors are mounted in the horizontal plane so each coil is to the left or right of each other coil.

Once the filter has been mechanically installed, verify the torques of all the electrical connections. Make sure the equipment is properly connected to ground using the grounding terminal provided.



6.0 Connection Diagrams

6.1 Basic Electrical Diagram (5KHZ type filter)

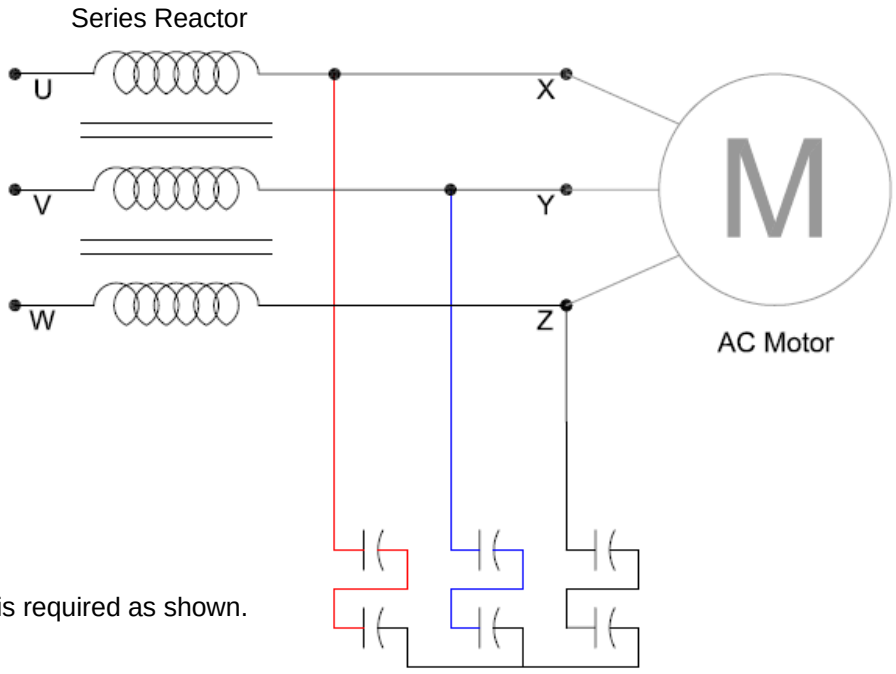


Shunt capacitors
Series connection of 2 cells is required as shown

NOTE: All 690V SWF filters require series connection of capacitors in each phase as shown.

6.2 Connection using optional wiring (R, BL, WH) harnesses.

Connect terminals U, V, W to VFD output terminals using appropriate wire size per National Electrical Code (NEC).

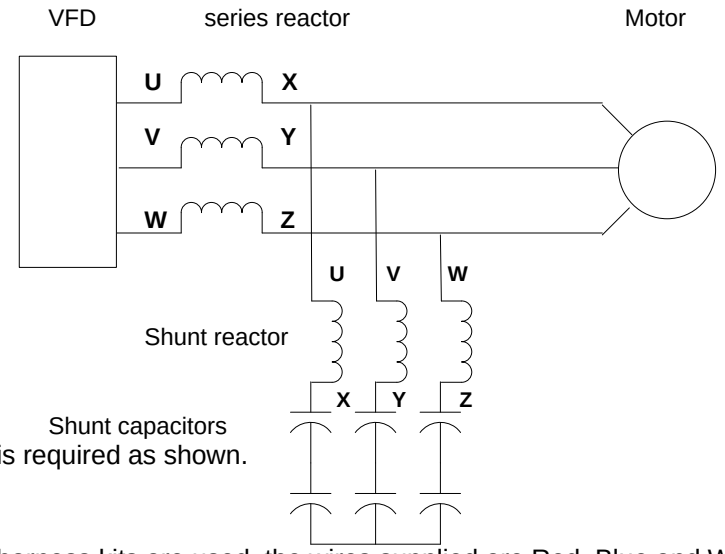


Shunt capacitors
Series connection of 2 cells is required as shown.

When our (WH-xxxx) wiring harness kits are used, the wires supplied are Red, Blue and White.

NOTE: All 690V SWF filters require series connection of capacitors in each phase as shown.

6.3 Basic Electrical Diagram (2.5KHZ type filter)



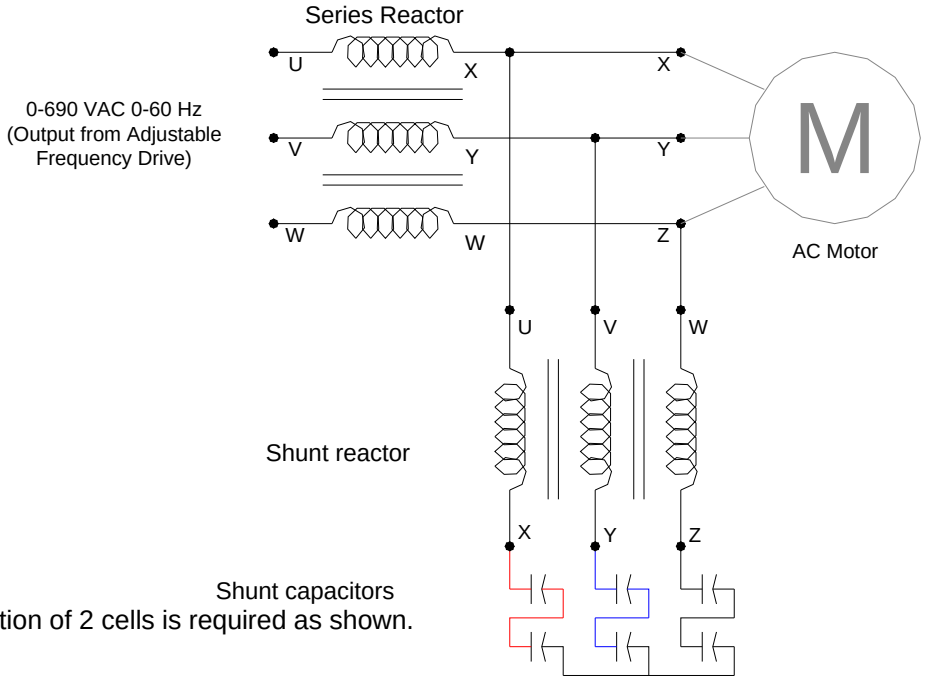
Series connection of 2 cells is required as shown.

When our (WH-xxxx) wiring harness kits are used, the wires supplied are Red, Blue and White.

NOTE: All 690V SWF filters require series connection of capacitors in each phase as shown.

6.4 Connection using optional wiring (R, BL, WH) harnesses.

Connect terminals U,V,W to VFD output terminals using appropriate wire size per National Electrical Code (NEC).



Series connection of 2 cells is required as shown.

When our (WH-xxxx) wiring harness kits are used, the wires supplied are Red, Blue and White.

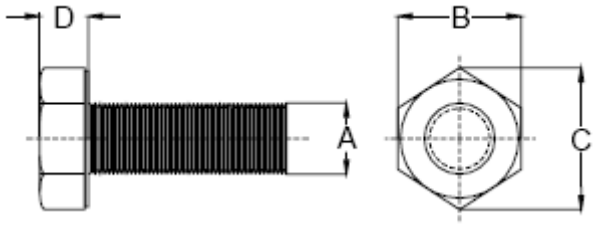
NOTE: All 690V SWF filters require series connection of capacitors in each phase as shown.

7.0 Torque Requirements:

Verify torque of all the mounting hardware and terminals as they may have loosened during transportation. See table below.

7.1 Bolt Tightening Torque Requirements

Bolt Dimensions				Torque	
A	B	C (in.)	D (in.)	Lbs-in	N-m
¼”	7/16”	0.50	0.16	80	9.0
5/16”	½”	0.56	0.21	180	20.3
3/8”	9/16”	0.65	0.24	240	27.1
½”	¾”	0.87	0.32	480	54.2
5/8”	15/16”	1.08	0.40	660	75.5
¾”	1-1/8”	1.30	0.48	1050	118.6



Note: 1ft-lb = 12 in-lb

7.2 Cable / terminal tightening torque requirements

Cable size AWG or kcmil	Terminal Torque Requirements			
	Slotted Hd Screw		Hex Hd Screw	
	Lbs-in	N-m	Lbs-in	N-m
18 – 10	35	4.0	80	9.0
8	40	4.5	80	9.0
6 – 4	45	5.1	165	18.6
3	50	5.6	275	31.1
2	50	5.6	275	31.1
1	50	5.6	275	31.1
1/0 – 2/0	50	5.6	385	43.5
3/0 – 4/0	50	5.6	500	56.5
250 – 350	50	5.6	650	73.4
400	50	5.6	825	93.2
500	50	5.6	825	93.2
600 - 750	50	5.6	1000	113.0

Note: 1ft-lb = 12 in-lb

8.0 Technical Data & Product Specifications:

8.1 Filter Specifications (2.5KHZ type filters):

	SWF xxxxA 690 2.5KHZ xxx
System Voltage:	690 volts rms, 3-phase
System Voltage tolerance:	+ / - 10%
Voltage Drop at Full Load:	7.5%
Fundamental Frequency:	5Hz to 60Hz
VFD Switching Frequency:	2.5kHz (other Fc upon request)
Loads:	Motors or transformers supplying motors only
Service Factor:	1.0 x filter current rating
Power losses:	0.5% of rated load is typical
Ambient temperature:	40C maximum
Temperature rise:	120C
Altitude:	1000 meters maximum
Relative Humidity:	95% maximum
Voltage Distortion	≤ 10% typical

8.1 Filter Specifications (≥5KHZ type filters):

	SWF xxxxA 690 5KHZ xxx
System Voltage:	690 volts rms, 3-phase
System Voltage tolerance:	+ / - 10%
Voltage Drop at Full Load:	6%
Fundamental Frequency:	5Hz to 60Hz
VFD Switching Frequency:	5kHz to 20kHz
Loads:	Motors or transformers supplying motors only
Service Factor:	1.0 x filter current rating
Power losses:	0.75% of rated load is typical
Ambient temperature:	40C maximum
Temperature rise:	120C
Altitude:	1000 meters maximum
Relative Humidity:	95% maximum
Voltage Distortion	≤ 5% typical

8.2 Reactor Specifications:

Design	: three-phase, iron core
Core construction	: PolyGap™ core structure
Voltage	: 690 volt class
Enclosure	: Open core & coil, IP 00 for indoor use, or for use in an enclosure
Cooling	: free convection air cooled
Ambient temperature	: 50C maximum
Standards	: VDE 0532 and IEC 289
Impregnation	: impregnated under vacuum and over-pressure; temperature class H resin
Terminals	: copper bars
Separate source test voltage	: coil to core 3.0 kV - 1 min acc. to IEC 76/3
Tolerances of the inductances	: +3 / -3% % of L_N for all three phases

8.3 Capacitor Specifications:

Capacitor Type	: Low ESR, individual capacitor cells
Connection	: two (480V) cells connected in series per phase, phases wye connected.
Capacitance Tolerance	: +4% / -4%
Maximum Voltage	: 110% of rated AC voltage
Maximum Current	: 135% of rated AC current
Power Loss	: 0.4 watts per kVAr
Dielectric Strength	
Terminal to case	: each cell: 2 x rated AC voltage + 1000 volts, for one second
Terminal to Terminal	: each cell: 1.75 x rated AC voltage for one second
Construction	: Impregnated Metalized Polypropylene (MPP)
Operating Temperature	: -40 degrees C to +85 degrees C
Ambient temperature	: 50C maximum
Life Expectancy	: Over 1,000,000 hours at 40 degrees C operation
Agency Approval	: UL Component Recognized (File # E71645)

8.4 Technical Data: Consult factory for other ratings.

8.4.1 Technical Data for 2.5KHZ Type filters

Motor FLA (Amps	Catalog Number	Total Capacitor uF per phase	Series Reactor	Shunt Reactor (not used on 5KHZ filter)	Minimum Power Wire Size	Minimum Shunt Circuit Wire Size	Total Power Losses (Watts)
0.5	SWF 000.5A 690	0.05	L1-1138	L1-1138	12 awg	12 awg	21
0.7	SWF 000.7A 690	0.075	L1-1139	L1-1139	12 awg	12 awg	21
1.0	SWF 0001A 690	0.11	L1-1133	L1-1133	12 awg	12 awg	41
1.4	SWF 001.4A 690	0.11	L1-1134	L1-1134	12 awg	12 awg	41
1.7	SWF 001.7A 690	0.165	L1-1135	L1-1135	12 awg	12 awg	41
2.5	SWF 002.5A 690	0.235	L1-1136	L1-1136	12 awg	12 awg	61
3.3	SWF 003.3A 690	0.33	L1-1137	L1-1137	12 awg	12 awg	82
4.1	SWF 0004A 690	0.50	L1-1101	L3-3162	12 awg	12 awg	82
7.0	SWF 0007A 690	1	L1-1102	L3-3164	12 awg	12 awg	132
8.3	SWF 0008A 690	1	L1-1103	L3-3164	12 awg	12 awg	132
14	SWF 0014A 690	1	L1-1104	L1-1104	12 awg	12 awg	143
17	SWF 0017A 690	2	L1-1105	L1-1105	12 awg	12 awg	183
21	SWF 0021A 690	2	L1-1106	L3-3168	10 awg	12 awg	234
24	SWF 0024A 690	2.5	L1-1107	L3-3169	10 awg	12 awg	285
35	SWF 0035A 690	3.75	L1-1108	L3-3171	8 awg	12 awg	377
41	SWF 0041A 690	3.75	L1-1109	L3-3171	6 awg	12 awg	388
52	SWF 0052A 690	5	L1-1110	L1-1110	6 awg	12 awg	490
59	SWF 0059A 690	6	L1-1111	L3-3172	4 awg	12 awg	515
87	SWF 0087A 690	10	L1-1112	L3-3175	2 awg	12 awg	705
104	SWF 0104A 690	10	L1-1113	L3-3175	1 awg	12 awg	775
121	SWF 0121A 690	10	L1-1114	L1-1114	2/0	12 awg	875
156	SWF 0156A 690	20	L1-1115	L3-3178	3/0	12 awg	1065
208	SWF 0208A 690	20	L1-1116	L3-3179	300 kcmil	12 awg	1300
243	SWF 0243A 690	25	L1-1117	L3-3180	350 kcmil	12 awg	1485
278	SWF 0278A 690	25	L1-1118	L3-3181	500 kcmil	12 awg	1515
312	SWF 0312A 690	25	L1-1119	L3-3181	600 kcmil	12 awg	1615
365	SWF 0365A 690	35	L1-1120	L3-3183	700 kcmil	12 awg	1830
400	SWF 0400A 690	35	L1-1121	L3-3184	900 kcmil	12 awg	1970
486	SWF 0486A 690	50	L1-1122	L3-3186	1500 kcmil	12 awg	2190
556	SWF 0556A 690	50	L1-1123	L3-3187	Consult Local Electrical Codes.	12 awg	2500
608	SWF 0608A 690	50	L1-1124	L3-3188		12 awg	2805
643	SWF 0643A 690	60	L1-1125	L3-3189		12 awg	2975
730	SWF 0730A 690	70	L1-1126	L3-3190		12 awg	3235
800	SWF 0800A 690	70	L1-1127	L3-3191		12 awg	3485
886	SWF 0886A 690	90	L1-1128	L3-3192		12 awg	3535

Wire size is based on filter current and 75C copper conductor.
Check VFD manual and local electrical codes for proper size.

8.4.2 Technical Data for 5KHZ Type filters

Motor FLA (Amps	Catalog Number	Total Capacitor uF per phase	Series Reactor	Minimum Power Wire Size	Minimum Shunt Circuit Wire Size	Power Losses (Watts)
0.5	SWF 000.5A 690	0.05	L1-1138	12 awg	12 awg	11
0.7	SWF 000.7A 690	0.075	L1-1139	12 awg	12 awg	11
1.0	SWF 0001A 690	0.11	L1-1133	12 awg	12 awg	21
1.4	SWF 001.4A 690	0.11	L1-1134	12 awg	12 awg	21
1.7	SWF 001.7A 690	0.165	L1-1135	12 awg	12 awg	21
2.5	SWF 002.5A 690	0.235	L1-1136	12 awg	12 awg	31
3.3	SWF 003.3A 690	0.33	L1-1137	12 awg	12 awg	42
4.1	SWF 0004A 690	0.50	L1-1101	12 awg	12 awg	42
7.0	SWF 0007A 690	1	L1-1102	12 awg	12 awg	62
8.3	SWF 0008A 690	1	L1-1103	12 awg	12 awg	62
14	SWF 0014A 690	1	L1-1104	12 awg	12 awg	73
17	SWF 0017A 690	2	L1-1105	12 awg	12 awg	93
21	SWF 0021A 690	2	L1-1106	10 awg	12 awg	114
24	SWF 0024A 690	2.5	L1-1107	10 awg	12 awg	145
35	SWF 0035A 690	3.75	L1-1108	8 awg	12 awg	197
41	SWF 0041A 690	3.75	L1-1109	6 awg	12 awg	208
52	SWF 0052A 690	5	L1-1110	6 awg	12 awg	250
59	SWF 0059A 690	6	L1-1111	4 awg	12 awg	255
87	SWF 0087A 690	10	L1-1112	2 awg	12 awg	345
104	SWF 0104A 690	10	L1-1113	1 awg	12 awg	415
121	SWF 0121A 690	10	L1-1114	2/0	12 awg	445
156	SWF 0156A 690	20	L1-1115	3/0	12 awg	525
208	SWF 0208A 690	20	L1-1116	300 kcmil	12 awg	730
243	SWF 0243A 690	25	L1-1117	350 kcmil	12 awg	750
278	SWF 0278A 690	25	L1-1118	500 kcmil	12 awg	775
312	SWF 0312A 690	25	L1-1119	600 kcmil	12 awg	875
365	SWF 0365A 690	35	L1-1120	700 kcmil	12 awg	930
400	SWF 0400A 690	35	L1-1121	900 kcmil	12 awg	950
486	SWF 0486A 690	50	L1-1122	1500 kcmil	12 awg	1140
556	SWF 0556A 690	50	L1-1123	Consult Local Electrical Codes.	12 awg	1350
608	SWF 0608A 690	50	L1-1124		12 awg	1555
643	SWF 0643A 690	60	L1-1125		12 awg	1625
730	SWF 0730A 690	70	L1-1126		12 awg	1785
800	SWF 0800A 690	70	L1-1127		12 awg	1785
886	SWF 0886A 690	90	L1-1128		12 awg	1885

Wire size is based on filter current and 75C copper conductor.
Check VFD manual and local electrical codes for proper size.

8.5 Component Lists

8.5.1 Components List for 2.5KHZ Type filters:

FLA	Series Reactor Pt. No.	Shunt Reactor (2.5kHz only) Pt. No.	Capacitor Cells per Phase (series connection required)										Totals	
			0.10 uF	0.15 uF	0.22 uF	0.33 uF	0.47 uF	0.68 uF					uF per phase	Capacitor Qty
0.5	L1-1138	L1-1138	2										0.05	6
0.7	L1-1139	L1-1139		2									0.075	6
1.0	L1-1133	L1-1133			2								0.11	6
1.4	L1-1134	L1-1134			2								0.11	6
1.7	L1-1135	L1-1135				2							0.165	6
2.5	L1-1136	L1-1136					2						0.235	6
3.3	L1-1137	L3-3162						2					0.33	6

FLA	Series Reactor Pt. No.	Shunt Reactor (2.5kHz only) Pt. No.	Capacitor Cells per Phase (series/parallel connection required)										Totals	
			C1-3005	C1-3006	C1-3007	C1-3008	C1-3009	C1-3010	C1-3001	C1-3002	C1-3003	C1-3004		
			480	480	480	480	480	480	480	480	480	480		
			1 uF	2 uF	4 uF	5 uF	7.5 uF	10 uF	12 uF	20 uF	39 uF	50 uF	uF per phase	Capacitor Qty
4.1	L1-1101	L3-3164	2										0.50	6
7.0	L1-1102	L3-3164		2									1	6
8.3	L1-1103	L1-1103		2									1	6
14	L1-1104	L1-1104		2									1	6
17	L1-1105	L1-1105			2								2	12
21	L1-1106	L1-1106			2								2	12
24	L1-1107	L1-1107				2							2.5	6
35	L1-1108	L1-1108					2						3.75	6
41	L1-1109	L1-1109					2						3.75	6
52	L1-1110	L1-1110						2					5	6
59	L1-1111	L1-1111							2				6	6
87	L1-1112	L1-1112								2			10	6
104	L1-1113	L1-1113								2			10	6
121	L1-1114	L1-1114								2			10	6
156	L1-1115	L1-1115								4			20	12
208	L1-1116	L1-1116								4			20	12
243	L1-1117	L1-1117									2		25	6
278	L1-1118	L1-1118									2		25	6
312	L1-1119	L1-1119									2		25	6
365	L1-1120	L1-1120								2	2		35	12
400	L1-1121	L1-1121								2	2		35	12
486	L1-1122	L1-1122									4		50	12
556	L1-1123	L1-1123									4		50	12
608	L1-1124	L1-1124									4		50	12
643	L1-1125	L1-1125								2	4		60	18
730	L1-1126	L1-1126						2		2	4		70	24
800	L1-1127	L1-1127						2		2	4		70	24
886	L1-1128	L1-1128								4	4		90	24

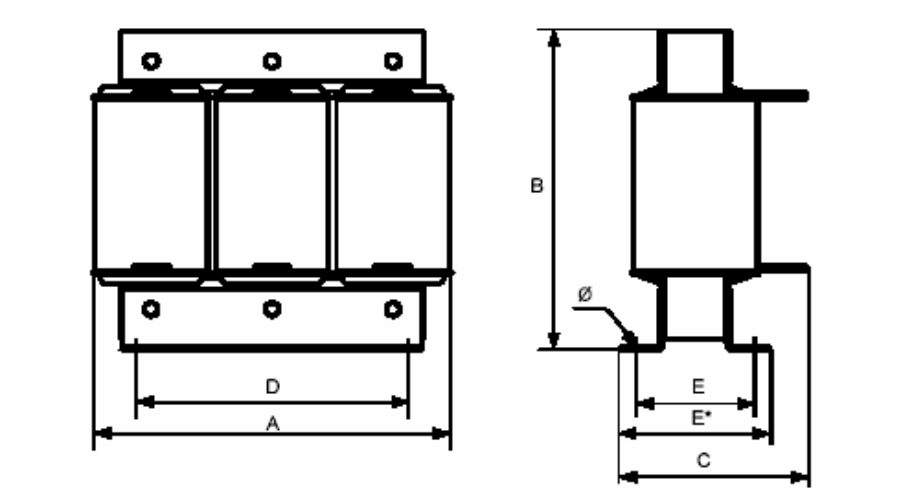
8.5.2 Components List for 5KHZ Type filters:

FLA	Series Reactor Pt. No.	Capacitor Cells per Phase (series connection required)										Totals	
		0.10 uF	0.15 uF	0.22 uF	0.33 uF	0.47 uF	0.68 uF					uF per phase	Capacitor Qty
0.5	L1-1138	2										0.05	6
0.7	L1-1139		2									0.075	6
1.0	L1-1133			2								0.11	6
1.4	L1-1134			2								0.11	6
1.7	L1-1135				2							0.165	6
2.5	L1-1136					2						0.235	6
3.3	L1-1137						2					0.33	6

FLA	Series Reactor Pt. No.	Capacitor Cells per Phase (series/parallel connection required)										Totals	
		C1-3005	C1-3006	C1-3007	C1-3008	C1-3009	C1-3010	C1-3001	C1-3002	C1-3003	C1-3004		
		480	480	480	480	480	480	480	480	480	480		
		1 uF	2 uF	4 uF	5 uF	7.5 uF	10 uF	12 uF	20 uF	39 uF	50 uF	uF per phase	Capacitor Qty
4.1	L1-1101	2										0.50	6
7.0	L1-1102		2									1	6
8.3	L1-1103		2									1	6
14	L1-1104		2									1	6
17	L1-1105			2								2	12
21	L1-1106			2								2	12
24	L1-1107				2							2.5	6
35	L1-1108					2						3.75	6
41	L1-1109					2						3.75	6
52	L1-1110						2					5	6
59	L1-1111							2				6	6
87	L1-1112								2			10	6
104	L1-1113								2			10	6
121	L1-1114								2			10	6
156	L1-1115								4			20	12
208	L1-1116								4			20	12
243	L1-1117									2		25	6
278	L1-1118									2		25	6
312	L1-1119									2		25	6
365	L1-1120								2	2		35	12
400	L1-1121								2	2		35	12
486	L1-1122									4		50	12
556	L1-1123									4		50	12
608	L1-1124									4		50	12
643	L1-1125								2	4		60	18
730	L1-1126						2		2	4		70	24
800	L1-1127						2		2	4		70	24
886	L1-1128								4	4		90	24

8.6 Component Dimensions:

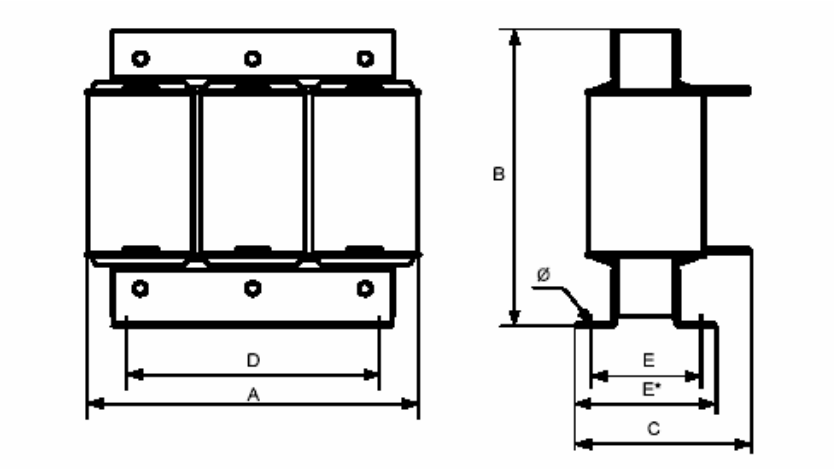
8.6.1 Series Reactor



Series Reactor dimensions (inches) [Used for both 2.5KHZ and 5KHZ versions]

Motor FLA (Amps	Catalog Number	Reactor Pt. No.	A	B	C	D	D'	E	E'	Ø1	Ø2	Weight (Lbs)
0.5	SWF 000.5A 690 5KHZ *	L1-1138	4.72	4.33	3.54	3.54	-	1.97	2.52	0.200	-	7
0.7	SWF 000.7A 690 5KHZ *	L1-1139	4.72	4.33	3.54	3.54	-	1.97	2.52	0.200	-	7
1.0	SWF 0001A 690 5KHZ *	L1-1133	4.72	4.33	3.54	3.54	-	1.97	2.52	0.200	-	7
1.4	SWF 001.4A 690 5KHZ *	L1-1134	4.72	4.33	3.54	3.54	-	1.97	2.52	0.200	-	7
1.7	SWF 001.7A 690 5KHZ *	L1-1135	5.91	5.32	3.54	4.45	-	1.97	2.52	0.236	-	9
2.5	SWF 002.5A 690 5KHZ *	L1-1136	5.91	5.32	3.54	4.45	-	1.97	2.52	0.236	-	9
3.3	SWF 003.3A 690 5KHZ *	L1-1137	5.91	5.32	3.54	4.45	-	1.97	2.52	0.236	-	11
4.1	SWF 004A 690 5KHZ *	L1-1101	5.91	5.32	4.13	4.45	-	2.56	3.31	0.236	-	13
7.0	SWF 0007A 690 5KHZ *	L1-1102	7.09	6.30	4.72	5.35	3.94	3.03	3.78	0.275	0.354	12
8.3	SWF 0008A 690 5KHZ *	L1-1103	7.09	6.30	4.72	5.35	3.94	3.03	3.78	0.275	0.354	12
14	SWF 0014A 690 5KHZ *	L1-1104	10.43	7.72	6.50	7.87	5.91	4.02	5.20	0.393	0.433	49
17	SWF 0017A 690 5KHZ *	L1-1105	10.43	7.72	6.50	7.87	5.91	4.02	5.20	0.393	0.433	49
21	SWF 0021A 690 5KHZ *	L1-1106	10.43	7.72	6.50	7.87	5.91	4.02	5.20	0.393	0.433	49
24	SWF 0024A 690 5KHZ *	L1-1107	10.43	7.72	6.50	7.87	5.91	4.02	5.20	0.393	0.433	49
35	SWF 0035A 690 5KHZ *	L1-1108	9.45	8.27	6.50	7.28	5.91	4.21	5.00	0.393	0.433	51
41	SWF 0041A 690 5KHZ *	L1-1109	10.43	9.45	6.50	7.87	5.91	4.02	5.20	0.393	0.433	60
52	SWF 0052A 690 5KHZ *	L1-1110	11.81	9.45	7.09	8.82	5.91	4.69	5.79	0.393	0.433	73
59	SWF 0059A 690 5KHZ *	L1-1111	11.81	9.45	8.07	8.82	5.91	5.28	6.38	0.393	0.433	86
87	SWF 0087A 690 5KHZ *	L1-1112	11.81	10.63	8.07	8.82	5.91	5.28	6.38	0.393	0.433	99
104	SWF 0104A 690 5KHZ *	L1-1113	11.81	11.81	8.07	8.82	5.91	5.28	6.38	0.393	0.433	110
121	SWF 0121A 690 5KHZ *	L1-1114	11.81	12.99	8.07	8.82	5.91	5.28	6.38	0.393	0.433	121
156	SWF 0156A 690 5KHZ *	L1-1115	14.17	13.98	8.66	10.39	-	6.10	7.21	0.393	-	157
208	SWF 0208A 690 5KHZ *	L1-1116	16.54	16.14	9.45	12.44	-	6.93	8.11	0.512	-	218
243	SWF 0243A 690 5KHZ *	L1-1117	16.54	16.14	10.63	12.44	-	6.93	8.11	0.512	-	286
278	SWF 0278A 690 5KHZ *	L1-1118	16.54	16.14	10.63	12.44	-	6.93	8.11	0.512	-	297
312	SWF 0312A 690 5KHZ *	L1-1119	18.89	16.93	11.81	13.98	-	8.39	9.84	0.512	-	357
365	SWF 0365A 690 5KHZ *	L1-1120	18.89	16.93	11.81	13.98	-	8.39	9.84	0.512	-	370
400	SWF 0400A 690 5KHZ *	L1-1121	18.89	19.29	11.81	13.98	-	8.39	9.84	0.512	-	429
486	SWF 0486A 690 5KHZ *	L1-1122	18.89	19.29	11.81	13.98	-	8.39	9.84	0.512	-	432
556	SWF 0556A 690 5KHZ *	L1-1123	16.54	19.68	10.63	12.44	-	8.11	9.29	0.512	-	462
608	SWF 0608A 690 5KHZ *	L1-1124	18.89	25.20	11.42	13.98	-	8.39	9.84	0.512	-	537
643	SWF 0643A 690 5KHZ *	L1-1125	18.89	25.20	11.42	13.98	-	8.39	9.84	0.512	-	570
730	SWF 0730A 690 5KHZ *	L1-1126	18.89	25.20	11.42	13.98	-	8.39	9.84	0.512	-	572
800	SWF 0800A 690 5KHZ *	L1-1127	18.89	25.20	12.48	13.98	-	9.45	10.90	0.512	-	689
886	SWF 0886A 690 5KHZ *	L1-1128	18.89	25.20	13.27	13.98	-	10.23	11.69	0.512	-	755

8.6.1 Shunt Reactor



Shunt Reactor dimensions (inches) [Used in 2.5kHz version only]

Motor FLA (Amps)	Catalog Number	Reactor Pt. No.	A	B	C	D	D'	E	E'	Ø1	Ø2	Weight (Lbs)
0.5	SWF 000.5A 690 2.5KHZ *	L1-1138	4.72	4.33	3.54	3.54	-	1.97	2.52	0.200	-	7
0.7	SWF 000.7A 690 2.5KHZ *	L1-1139	4.72	4.33	3.54	3.54	-	1.97	2.52	0.200	-	7
1.0	SWF 001A 690 2.5KHZ *	L1-1133	4.72	4.33	3.54	3.54	-	1.97	2.52	0.200	-	7
1.4	SWF 001.4A 690 2.5KHZ *	L1-1134	4.72	4.33	3.54	3.54	-	1.97	2.52	0.200	-	7
1.7	SWF 001.7A 690 2.5KHZ *	L1-1135	5.91	5.32	3.54	4.45	-	1.97	2.52	0.236	-	9
2.5	SWF 002.5A 690 2.5KHZ *	L1-1136	5.91	5.32	3.54	4.45	-	1.97	2.52	0.236	-	9
3.3	SWF 003.3A 690 2.5KHZ *	L1-1137	5.91	5.32	3.54	4.45	-	1.97	2.52	0.236	-	11
4.1	SWF 0004A 690 2.5KHZ *	L3-3162	5.91	5.31	4.13	4.45	-	1.97	2.64	0.236	-	11
7.0	SWF 0007A 690 2.5KHZ *	L3-3164	7.09	6.30	5.31	5.35	3.93	3.03	3.78	0.275	0.354	22
8.3	SWF 0008A 690 2.5KHZ *	L3-3164	7.09	6.30	5.31	5.35	3.93	3.03	3.78	0.275	0.354	22
14	SWF 0014A 690 2.5KHZ *	L1-1104	10.43	7.72	6.50	7.87	5.91	4.02	5.20	0.393	0.433	49
17	SWF 0017A 690 2.5KHZ *	L1-1105	10.43	7.72	6.50	7.87	5.91	4.02	5.20	0.393	0.433	49
21	SWF 0021A 690 2.5KHZ *	L3-3168	10.23	9.25	6.69	11.50	7.87	4.84	6.42	0.393	0.393	49
24	SWF 0024A 690 2.5KHZ *	L3-3169	10.43	7.72	6.50	7.87	5.91	4.02	5.20	0.393	0.433	49
35	SWF 0035A 690 2.5KHZ *	L3-3171	10.43	7.72	6.50	7.87	5.91	4.02	5.20	0.393	0.433	49
41	SWF 0041A 690 2.5KHZ *	L3-3171	10.43	7.72	6.50	7.87	5.91	4.02	5.20	0.393	0.433	49
52	SWF 0052A 690 2.5KHZ *	L1-1110	11.81	9.45	7.09	8.82	5.91	4.69	5.79	0.393	0.433	73
59	SWF 0059A 690 2.5KHZ *	L3-3172	10.43	9.45	6.50	7.87	5.91	4.02	5.20	0.393	0.433	60
87	SWF 0087A 690 2.5KHZ *	L3-3175	11.81	10.63	8.08	8.82	5.91	5.28	6.38	0.393	0.433	95
104	SWF 0104A 690 2.5KHZ *	L3-3175	11.81	10.63	8.08	8.82	5.91	5.28	6.38	0.393	0.433	95
121	SWF 0121A 690 2.5KHZ *	L1-1114	11.81	12.99	8.07	8.82	5.91	5.28	6.38	0.393	0.433	121
156	SWF 0156A 690 2.5KHZ *	L3-3178	14.17	13.97	8.66	10.39	-	6.10	7.20	0.393	-	154
208	SWF 0208A 690 2.5KHZ *	L3-3179	14.17	13.97	8.66	10.39	-	6.10	7.20	0.393	-	161
243	SWF 0243A 690 2.5KHZ *	L3-3180	16.54	16.14	9.45	12.44	-	6.93	8.11	0.512	-	216
278	SWF 0278A 690 2.5KHZ *	L3-3181	16.54	16.14	9.45	12.44	-	6.93	8.11	0.512	-	220
312	SWF 0312A 690 2.5KHZ *	L3-3181	16.54	16.14	9.45	12.44	-	6.93	8.11	0.512	-	284
365	SWF 0365A 690 2.5KHZ *	L3-3183	16.54	16.14	10.63	12.44	-	8.11	9.29	0.512	-	293
400	SWF 0400A 690 2.5KHZ *	L3-3184	18.90	16.93	11.81	13.98	-	8.39	9.84	0.512	-	355
486	SWF 0486A 690 2.5KHZ *	L3-3186	18.90	25.20	11.42	13.98	-	8.39	9.84	0.512	-	330
556	SWF 0556A 690 2.5KHZ *	L3-3187	18.90	25.20	11.42	13.98	-	8.39	9.84	0.512	-	423
608	SWF 0608A 690 2.5KHZ *	L3-3188	18.90	25.20	11.42	13.98	-	8.39	9.84	0.512	-	423
643	SWF 0643A 690 2.5KHZ *	L3-3189	18.90	20.86	11.81	13.98	-	8.39	9.84	0.512	-	451
730	SWF 0730A 690 2.5KHZ *	L3-3190	18.90	20.86	11.81	13.98	-	8.39	9.84	0.512	-	454
800	SWF 0800A 690 2.5KHZ *	L3-3191	18.90	25.20	11.42	13.98	-	8.39	9.84	0.512	-	531
886	SWF 0886A 690 2.5KHZ *	L3-3192	18.90	25.20	11.42	13.98	-	8.39	9.84	0.512	-	555

8.6.2 Capacitors (C1)

C1 Capacitor Cell dimensions (inches)

(Dimensions refer to a single capacitor assembly only)

I.D. No.	uF	Volts	Dimensions (inches)		
			Dia.	Height	Hole for Mtg Stud
C1-1001	48	240	2.00	4.37	.50
C1-1002	80	240	2.50	4.37	.50
C1-2001	38.5	346	2.50	4.37	.50
C1-2002	46	346	2.50	4.37	.50
C1-2003	57	346	2.50	4.37	.50
C1-2004	72	346	2.50	4.37	.50
C1-3001	12	480	2.00	3.37	.50
C1-3002	20	480	2.00	3.37	.50
C1-3003	40	480	2.50	4.37	.50
C1-3004	50	480	2.50	4.37	.50
C1-3005	1	480	1.75	2.84	.375
C1-3006	2	480	1.75	2.84	.375
C1-3007	4	480	1.75	2.84	.375
C1-3008	5	480	1.75	2.84	.375
C1-3009	7.5	480	1.75	2.84	.375
C1-3010	10	480	2.00	2.84	.375

8.6.3 Optional Capacitor Assemblies:

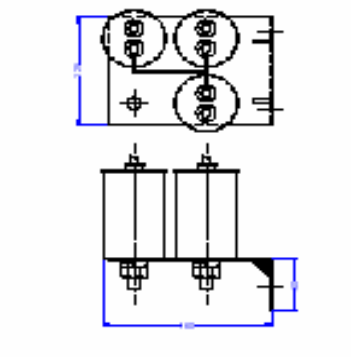


Fig. 1

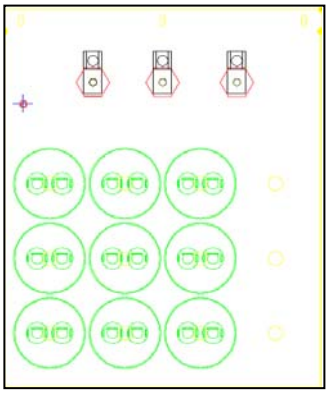


Fig. 2

9.0 Maintenance (POWER OFF).

Turn OFF electrical power to the drive (VFD) and filter prior to performing any maintenance, service or inspection.

Generally, the sine wave filter is considered to be maintenance free.

During the course of normal operation, the capacitor cells will experience minute levels of expansion and contraction due to fluctuations in operating and ambient temperatures.

The following inspections should be made during regular maintenance intervals.

- Periodically inspect the individual capacitor cells for bulging. If the top (terminal area) is bulging, then it is likely that the pressure switch has opened and the capacitor is no longer operational. Any failed capacitor cells should be replaced with direct factory replacements.

- Remove any dust that may have accumulated within your filter cabinet.

- To verify the general condition of the capacitors, take a current measurement in each capacitor phase. A discrepancy in current between phases may indicate a failed capacitor cell.

- Routinely check torque on all terminations. Verify they are tight as per the specification.

9.1 Troubleshooting Guide
Troubleshooting should only be performed by qualified electrical service personnel.

Symptom	Problem	Action	VFD Power	Filter Power
Filter output voltage is not nearly sinusoidal	Filter is connected improperly	Check wiring of filter. Be certain that capacitors are connected to output (load) side of reactor, between reactor and motor.	**OFF**	**OFF**
	Light load or NO load connected	Voltage waveform may change with actual load. Monitor over a range of loads to confirm proper operation.	**ON**	**ON**
	Failed capacitor(s)	Check each capacitor for a bulge on the top (terminal end) of capacitor. If bulge is present, capacitor pressure switch activated and capacitor can no longer be used. Replace only with proper Arteche capacitor cell.	**OFF**	**OFF**
Output voltage is low	Capacitor(s) not connected or failed	Verify that the proper ratings and quantity of capacitors are in use and that all capacitors are properly connected.	**OFF**	**OFF**
Phase currents are not balanced	Failed capacitor	Measure capacitor current to locate failed capacitor. All capacitor currents should be equal within approximately 5%	**ON**	**ON**
Excessive audible noise in filter	VFD Switching frequency too low	Check the setting of the VFD carrier frequency and make sure it is compatible with filter rating (ie: $\geq$ 5kHZ or 2.5kHZ).	**ON**	**OFF**
Reactor overheats	VFD Switching frequency too low	Check the setting of the VFD carrier frequency and make sure it is compatible with filter rating (ie: $\geq$ 5kHZ or 2.5kHZ).	**ON**	**OFF**
	Capacitance is too large	Check to be sure proper capacitance is connected to the output stage of filter	**OFF**	**OFF**

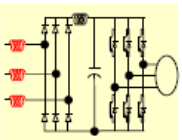
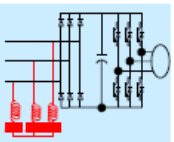
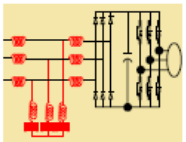
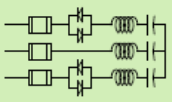
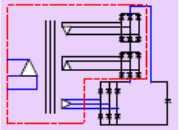
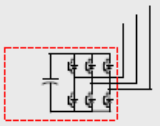
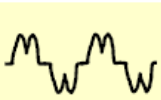
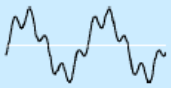
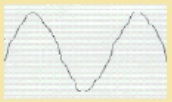
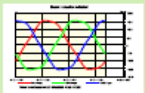
Arteche produces a wide variety of solutions for inverter applications and for general facility power quality improvement. In addition to our sine wave filters, our other solutions include power factor improvements systems, harmonic mitigation equipment. We offer equipment for both single phase or three phase, as well as low, medium and high voltage systems (up to 525,000 volts).

ARTECHE POWER QUALITY

Harmonic Mitigation Solutions

That solve harmonic distortion right at the source!

iPQ intelligent Power Quality

Type of Solution	Harmonic Mitigating Reactor	Tuned 5th Harmonic Filter	Low Pass (Wide Band) Harmonic Filter	Dynamic Harmonic Filter	12 or 18 Pulse Rectifier Conversion Kit	Active Harmonic Filter
Configuration						
Current Waveform						
Harmonic Current Distortion	35% to 45% THD-I	15% to 25% THD-I	5% or 10% THD-I	15% to 25% THD-I	5% to 10% THD-I	5% THD-I
Basic Product Photo						

Consult Factory for any other information not contained in this manual.

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