



# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

# OPERATORS MANUAL

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM



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## 1. GENERAL INFORMATION

The **LCFC Filter Cart** is designed to filter oil to meet or exceed new oil cleanliness specifications. The system is designed to remove particulate contamination from a wide variety of oils, and it is typically equipped with high-efficiency filter elements made from pleated micro-glass media rated **Beta x(c)  $\geq$  1000 Per ISO 16889**, meaning that 99.9% of all particles "x" micron and larger are removed in one pass.

The oil is drawn from an existing reservoir to the filtration system by means of a self-priming positive displacement gear pump. The oil passes through the filter cartridge(s) before being discharged to the outlet, at which point it is pumped back to the existing reservoir.

**Medium weight hydraulic hoses** may be provided with the unit. If supplying your own hoses, please make sure they meet the flow and pressure rating of the system.

## 2. STANDARD FEATURES

Features	Advantages	Results
<b>Differential Pressure Indicators</b>	<ul style="list-style-type: none"> <li>Precise Filter Life Indication</li> </ul>	<ul style="list-style-type: none"> <li>Less Filter Waste</li> <li>Reduced Filter Costs</li> </ul>
<b>Positive Displacement Pump</b>	<ul style="list-style-type: none"> <li>No Need to Prime System</li> </ul>	<ul style="list-style-type: none"> <li>Less Operator Labor</li> <li>No Additional Equipment Required</li> </ul>
<b>Medium Grade Hydraulic Hose</b>	<ul style="list-style-type: none"> <li>Longer Life</li> </ul>	<ul style="list-style-type: none"> <li>Reduced Replacement Costs</li> </ul>
<b>In-Line Sample Port Valves</b>	<ul style="list-style-type: none"> <li>Quick and easy oil sampling</li> </ul>	<ul style="list-style-type: none"> <li>No system downtime for oil sampling</li> </ul>
<b>Inlet Strainer</b>	<ul style="list-style-type: none"> <li>Protects pump from large particles</li> </ul>	<ul style="list-style-type: none"> <li>Longer pump life</li> <li>Longer filter life</li> </ul>
<b>Small, Compact Design</b>	<ul style="list-style-type: none"> <li>Perfect use is tight, fined spaces</li> </ul>	<ul style="list-style-type: none"> <li>More portable</li> <li>Easier Maneuverability</li> </ul>
<b>Puncture Proof Tires</b>	<ul style="list-style-type: none"> <li>No Flat Tires</li> </ul>	<ul style="list-style-type: none"> <li>Moves Easier</li> <li>Solid Tires, no leaks</li> </ul>
<b>Swivel/Locking Casters</b>	<ul style="list-style-type: none"> <li>More Portable</li> </ul>	<ul style="list-style-type: none"> <li>Moves easier</li> <li>Lock in place</li> </ul>



## 3. MODEL CODE

Model Number: LCFC150-11-2-17-**-V-G-S-K-VFD		
Classification	Code	Description
Product Type	LCFC	Liquid Cartridge Filter Cart
Connection Size	150	1/2" FPT Inlet and Outlet
Flow Rate	11	11 Gallons per minute
Filter Element Length	2	Double Length Element
Filter Element Style	17	Built-In 50 PSID By-Pass
Media/Micron Rating	**	**µm Microglass, Beta [c] ≥ 1000 @ 99.9%
Seal Material	V	Viton®
Pressure Gauge	G	Pressure Gauge
Sample Port	S	Oil Sampling Ports
Inlet Strainer	K	Spin-On Filter Strainer
Electrical Requirements	Blank	115 Volts / 1 Phase / 60 Hertz
Pump Style	VFD	Variable Frequency Drive

## 4. SPECIFICATION SHEET

Installation Requirements	
Input Voltage	115 V / 1 PH / 60 Hz
Designed FLA (Full Load Amps)	17.6 AMPS @ MAX
Inlet Connection Size	1-1/2" Camlock
Outlet Connection Size	1-1/2" Camlock
Electrical Operating Specifications	
Oil Pump Motor	(See Motor Nameplate Rating)
Mechanical Operating Specifications	
Flow Rate	11 GPM
Maximum Discharge Pressure	100 PSI (689.5 kPa)
Maximum Oil Viscosity	1500 SSU (323.7 cSt) @ 6µm
Seal Material	Buna-N
Product Restrictions	
<b>IMPORTANT:</b> This system should never be used to remove particulates from volatile fluids such as gasoline since the pump cannot be used for solvents with low lubricity. In addition, the unit should not be used on liquids with a flash point below 200°F (93°C).	



## 5. ENGINEERING PRODUCT WARRANTY

For a period of one (1) year from the date of delivery, Precision Filtration Products (Seller) engineered products are warranted to be free from defects in materials and workmanship when properly installed, maintained, or operated within the specific working parameters for which the equipment was designed. If the engineered product does not perform as warranted, it will be repaired or replaced at the Seller's discretion. The Seller will provide parts and labor, free of charge if the defect had occurred within the first year.

This warranty does not apply to consumable components such as filter elements, light bulbs, etc. This warranty shall not apply to product altered by anyone other than Seller or their representative.

At the Purchaser's option, the defect may be handled by one of the following methods:

- Ship (freight pre-paid) the unit in its entirety to Seller for repair or replacement.
- Remove the defective component and ship (freight pre-paid) to Seller for inspection and test. Upon completion of the evaluation typically fourteen (14) business days, Seller will notify Purchaser if the claim is warranty related. If the claim is valid, a replacement component will be immediately shipped. If the claim is found to be due to improper installation, maintenance, or operation, a Purchase order will be required for the replacement component.
- Remove defective component and ship (freight pre-paid) to Seller with an open Purchase Order. Seller will immediately ship a replacement component and begin evaluation concurrently. Upon completion of the evaluation, typically fourteen (14) business days, Seller will notify Purchaser if the claim is warranty related. If the claim is valid, the open Purchase Order will be returned without any charges. If the claim is found to be due to improper installation, maintenance, or operation, the open Purchase Order will be invoiced for the amount of the replacement component.

**SELLER SHALL NOT BE RESPONSIBLE OR LIABLE FOR DOWNTIME, LOSS OF INCOME, LIVING EXPENSES, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES THAT MAY ARISE OUT OF THE USE OF THIS PROPERTY. THIS WARRANTY IS THE SOLE WARRANTY MADE BY PRECISION FILTRATION PRODUCTS IN REGARDS TO THIS EQUIPMENT. PRECISION FILTRATION PRODUCTS MAKES NO OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**





## 6. SAFETY INSTRUCTIONS

This system has been examined and tested for safety. If there is any possibility that the oil being purified is contaminated with a solvent or materials which could be considered hazardous, either with toxicant or flammable explosives, the purifier should not be used unless precautions are taken to vent the vapors in a safe manner according to local, state, and federal codes and the flash point is above 200°F (93°C). This caution is necessary to prevent the possibility of fire, explosion, or toxic injury to persons and property.

**NOTE: Normal safety practices and common sense should always be exercised when operating this unit.**

## 7. FLUID COMPATIBILITY

**Depending on the model number, the following seals apply:**

The process fluid must be compatible with Viton seal material. Viton is good in the temperature range of -15°F to +400°F. It is generally recommended for lubricating, fuel, and hydraulic oils. The unit may be ordered with other seals to provide compatibility with specialty fluids.

The process fluid must be compatible with Buna seal material. Buna-N is generally recommended for petroleum, water, diesel, and water glycol. This unit may be ordered with other seals to provide compatibility with specialty fluids. Buna-N is good in the temperature range of -65°F to +250°F.





## 8. INSTALLATION AND START-UP PROCEDURES

### 8.1 Unpacking

This system is delivered with maximum protection during transportation and handling.

**NOTE: All damage attributed to the handling and deliver of the unit must be recorded and brought to the attention of the shipper immediately.**

This unit has been thoroughly tested for a minimum of one (1) hour run time. Fluid used to test the unit is a PEAK® Performance Anti-Wear Hydraulic Oil ISO 32, unless otherwise specified by the customer. The unit has been thoroughly inspected for defects prior to the delivery. All connections, however, should be checked prior to operating this unit, vibration and/or rough handling during delivery could adversely affect component alignment and/or connection tightness.

### 8.2 Mechanical Installation

The inlet port has been sized to provide enough flow to operate the unit in the standard mode using oil with a maximum viscosity of 1500 SSU (323.7 cSt). A hose diameter equal to inlet/outlet port size (see specification sheet) is required to provide adequate oil supply to this unit.

**NOTE: Use of a smaller diameter line will restrict the flow and will adversely affect the automatic operation of the unit.**

The inlet/outlet connections have been sized for maximum hose lengths of 10 feet. Use of longer hose lengths must be approved prior to installation. Use of a "quick disconnect" on the inlet line is not recommended. This can restrict flow to the LCFC Filter Cart in specific applications. Oil is drawn into the LCFC Filter Cart by vacuum created by the positive displacement pump and is capable of pulling oil with up to 8-ft. (2.4m) of negative head. For applications that exceed this, please consult the factory.

## 8.3 Operating Instructions

Before connecting the hoses to the oil supply reservoir, make sure all valves are **CLOSED**. Then connect inlet and outlet hoses to the oil supply reservoir and **LCFC Filter Cart**. Connect the power supply cord to the electrical receptacle.

**CAUTION: Main Power Disconnect should be located within a line of sight to the power source.**

Once hoses are connected, make sure that all the valves on the LCFC Filter Cart closed. Open the inlet and outlet valves (if supplied) on the LCFC Filter Cart and the oil supply reservoir. Allow the unit to gravity fill. Please note, air can be relieved from the LCFC Filter Cart by slowly opening the air relief valve on the top of the housing until oil begins flowing (photo 1). (It is recommended that you have a small bucket or bottle to prevent spilling any oil). If oil does not begin flowing, there may not be enough head pressure to fill the LCFC Filter Cart. Please go to "Initial Starting Procedures"



Photo 1

### 8.3-1 Initial Starting Procedure:

1. Read Mechanical Installation before proceeding.
2. Plug the cord into the power source (a green light will be illuminated on the control panel to confirm that the unit has power).
3. Turn the unit on then off quickly by moving the toggle switch on the control box to the START Position then back to the STOP Position to verify proper motor rotation (Photo 2). Proper rotation is verified before each unit is shipped, but this should be verified with every power outlet that the machine will use. If the rotation is not correct, the plug should be rewired accordingly. Unplug the machine from the power source. \*If the unit does not start, make sure toggle switch is in the STOP Position and unplug the power cord. Wait a few minutes and plug the power cord back in. If the unit still does not start, please refer to Section 14, sub-section 11 - VFD Control Box.
4. Once the proper rotation is determined, it is recommended that the machine is tested with a barrel or tote of fluid without quick disconnects before any application specific fittings or quick disconnects are installed so that the flow can be visually verified.
5. For best results, we recommend connecting the suction hose to the tote drain port and the outlet (return) hose should be guided into the tote fill port.
  - a. If the machine was ordered with a wand assembly, install them and put both wands into the largest bung of a barrel or tote of oil.
  - b. If the machine was not ordered with wands, install the connection fitting on the inlet hose (suction) and leave the outlet hose without a QD Fitting.
6. Ensure that the oil sampling valves are closed.
7. Move the toggle switch on the control box to the START Position. Visually inspect that the fluid is flowing and continue to run the LCFC Filter Cart for several minutes. Flow may also be verified by opening the sampling valve on the outlet of the filter vessel.



8. While the machine is running, check for any leaks around fittings and verify that the fluid is flowing.
9. Check the element differential pressure gauge on the filter vessel (Photo 3). The gauges might show a reading or not depending on the fluid viscosity and the filter element dirt loading condition.
  - a. If the differential pressure gauge needle is in the GREEN, the element does not need to be changed.
  - b. If the needle is in the RED, the fluid may be cold or the element needs to be changed. The element is equipped with an integral bypass valve that is open when the needle is in the RED. The bypass is for pressure relief, so some fluid will continue to flow through the element.
  - c. If the needle does not move out of the RED after several minutes of recirculating the fluid, shut down the LCFC Filter Cart and replace the filter element. Please refer to Section 8.3-2 Filter Element Service Instructions.
  - d. If flow cannot be visually verified, the sampling port may be opened to confirm the flow of the fluid. The actual flow of the fluid cannot be verified but the movement of fluid can be detected.
10. Allow the LCFC Filter Cart to run for several minutes and check for leaks again. If the fluid is not flowing freely it can be attributed to any of the following conditions: cold, oil, dirty filter element, dirty Strainer on pump inlet. (Please go to step 12 if fluid cannot be verified). As the machine runs the element differential pressure gauge and vacuum indicator (if supplied) should be checked periodically (Photo 4). Check the pump protection spin-on vacuum gauge, if supplied. The gauge should be reading some vacuum. If the gauge is reading -7 in/Hg or higher, the spin-on strainer should be changed. The pump protector is equipped with a pressure relief by-pass set at 25 PSID, so the pump will not starve. The by-pass is not full flow and operating in a by-pass condition could restrict flow and expose the pump to harmful contaminant. The spin-on should be changed immediately. Refer to 8.3-3 Pump Protector Service Instructions. Only use the PFP75W8B for pump protector. Using a finer media may result in unreliable performance and premature by-pass.
11. Turn the LCFC Filter Cart off by moving the toggle switch to the STOP Position and unplug the machine.



Photo 2



Photo 3

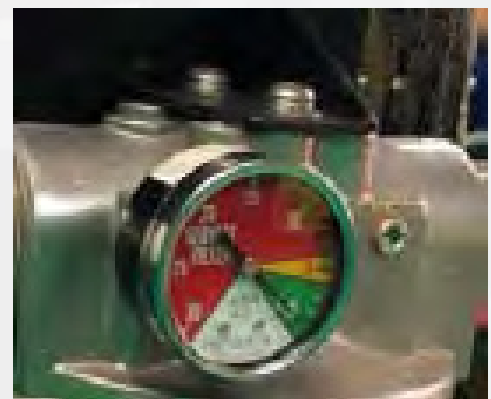


Photo 4

**8.3-2 Filter Element Service Instructions:**

1. Before servicing the filter element ensure that the LCFC Filter Cart is off and is not plugged into a power outlet. (Toggle Switch should be in the STOP Position)
2. Relieve any pressure by opening the Air Relief Valve (Photo 1). If quick disconnect fittings have been installed on the hoses, pressure may not be relieved quickly by disconnecting the LCFC Filter Cart from a machine, reservoir, tank, etc.
3. Loosen the eye bolts (Photo 5) after the pressure has been relieved.
4. Open the cover and allow it to rest against the side of the filter vessel.
5. Inspect the element to verify that the air has been allowed to bleed by the previous operator. If the air has not been bled, a portion of the element may remain dry.
6. Observe the installation of the element hold down mechanism. Remove the hold down mechanism (Photo 6).
7. Remove spent filter element. The element support tube will remain in the housing. Do not try to remove it.
8. Lubricate the o-ring(s) of the new element and the lid o-ring on the filter vessel.
9. Inspect the new element for severe dents or other damage that could compromise the integrity and result in by-pass and injury. If the element is severely damaged, discard it as by-pass or injury may be a result.
10. Install the new filter element with the handle side up (spring). The element should pop onto the support tube of the housing. You may need to push down on the filter element to ensure it is all the way down and sealed on the support tube.
11. The filter element comes with an integral by-pass valve and is held down by the attached spring. When the cover is off and the spring is not compressed the spring should be visible above the housing opening. Place the cover on the spring as the eye bolts are tightened. Continue tightening the eye bolts until the cover has sealed on the vessel tube. The bolts should be tightened to 32 ft/lbs of torque maximum. Verify all bolts are tight.
12. Refer to Section 8.3-1 Initial Starting Procedure to restart the LCFC Filter Cart.
13. Once the LCFC Filter Cart is restarted check the filter vessel lid for leakage and tighten more if necessary.



Photo 5



Photo 6



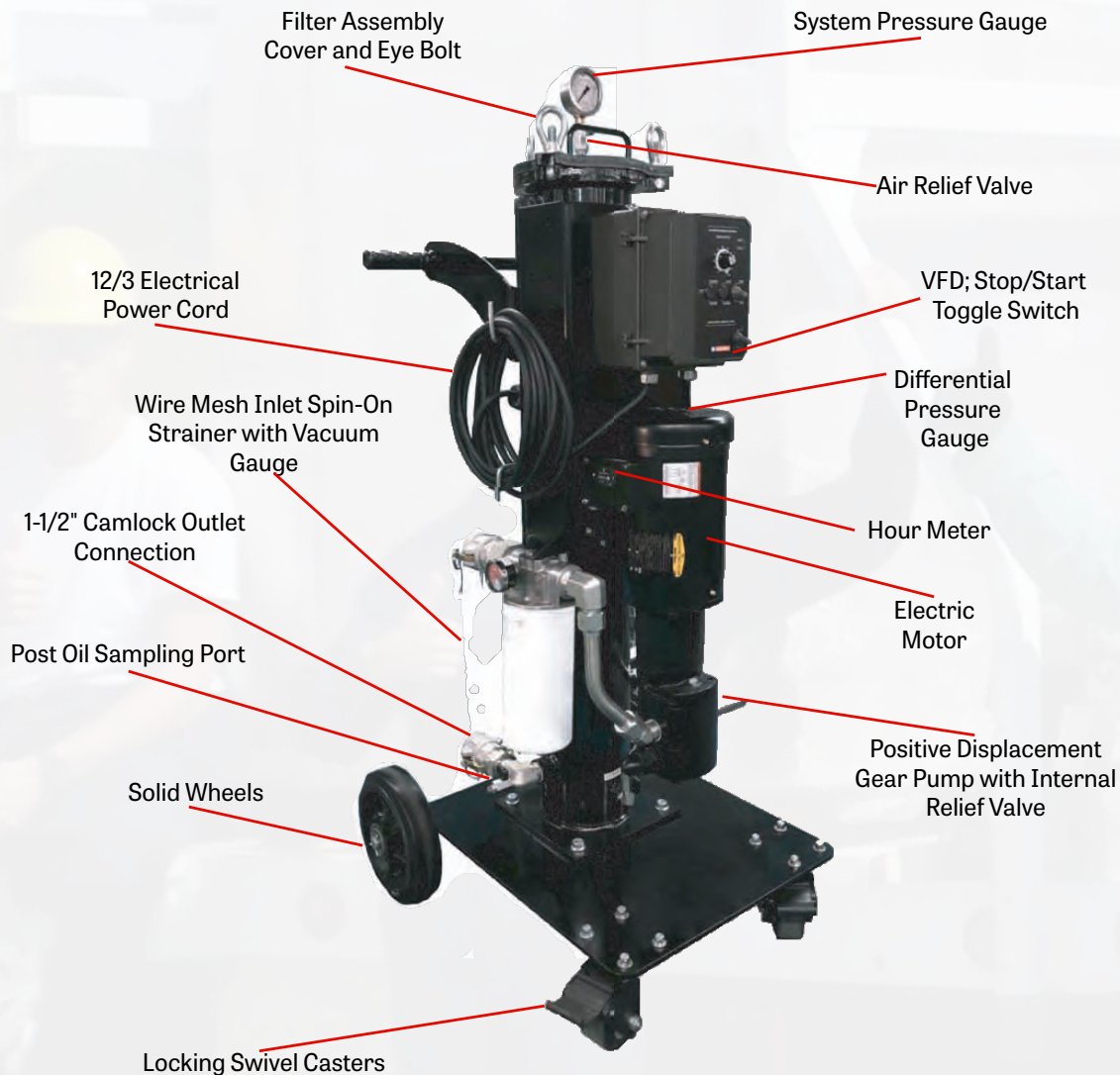
Photo 7



## 9. TROUBLESHOOTING

Problem	Cause	Solution
<b>Unit fails to start switch is activated</b>	<ul style="list-style-type: none"> <li>Improper external power connection</li> <li>Breaker at main power source tripped</li> </ul>	<ul style="list-style-type: none"> <li>Check input power</li> <li>Make sure it matches machine specifications</li> <li>Make sure the power cord is the right size</li> </ul>
<b>Unit fails to pump fluid</b>	• Inlet valve is partially or fully closed	<ul style="list-style-type: none"> <li>Position inlet valve to full open</li> <li>Valve should be "full port" type valve to reduce restrictions and should be sized as large as the inlet hose</li> </ul>
	• Air leak on inlet supply line	• Check all fittings to ensure no air leaks exist
	• Strainer screen blocked	• Remove encasement housing from strainer assembly. Remove screen and clean with clean lint free rag or blow with air
	• Outlet valve partially or fully closed	• Ensure that outlet valves on both filtration system and reservoir are fully open
<b>Unit pump making excessive noise</b>	• Inlet valves partially or fully closed	• Ensure that all inlet valves on system and reservoir are fully open
	• Strainer obstructed	• Remove and clean screen with air
	• Inlet hose sized incorrectly	• Inlet hose should be sized to match system inlet diameter with a maximum length of 20'. In the event that a longer inlet hose is needed a larger diameter should be used to ensure proper supply to the system

## 10. SYSTEM COMPONENTS



### Recommended Viscosity Range

5 GPM\*: 28 SSU ~ 4000 SSU, 6 cSt ~ 800 cSt  
 11 GPM\*: 28 SSU ~ 4000 SSU, 6 cSt ~ 800 cSt  
 22 GPM\*: 28 SSU ~ 2000 SSU, 6 cSt ~ 400 cSt

\*At maximum viscosity clean element pressure drop on 6M media code < 10 psid.  
 Please check maximum viscosity of oil in coldest condition.

### Operating Temperature

Nitrile (Buna) -40°F to -150°F (-40°C to 66°C)  
 Fluorocarbon (Viton)\* -15°F to 200°F (-26°C to 93°C)

\*High temperature / phosphate ester design.





## 11. Pump & Motor Information



### TECHNICAL SERVICE MANUAL

SECTION	TSM 340
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INSTALLATION, START UP, TROUBLESHOOTING,  
PREVENTIVE MAINTENANCE, DO'S & DON'TS  
SERIES SG-04, SG-05 & SG-07 SPUR GEAR PUMPS

### CONTENTS

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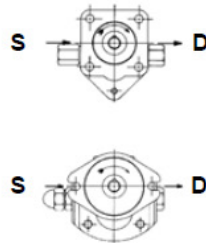


FIGURE 1

### INSTALLATION

#### General

The following items must be considered prior to pump installation:

1. Location - locate the pump as close as possible to the liquid supply. If possible locate the pump below the liquid supply. Viking pumps are self-priming; but the better the suction conditions, the better the pump will perform.
2. Accessibility - the pump must be accessible for inspection, maintenance and repair.
3. Suction/Discharge - SG Series pumps are designed for clockwise rotation as standard (viewed from end of shaft). Refer to Figure 1.
4. Pressure Relief Valve - the SG Series is a positive displacement pump and requires some form of over pressure protection. Without pressure protection, if the discharge line is blocked or becomes closed, pressure will build up until the motor stalls, drive equipment fails, a pump part breaks, or the piping and/or other equipment in the system bursts. To prevent the possibility of any one or more of the above from occurring, the use of a pressure relief valve is recommended.
5. Storage - drain the pump and apply a light coat of non-detergent SAE 30 weight oil to all internal pump parts. Apply grease to the pump shaft extension. Viking suggests rotating the pump shaft by hand one complete revolution every 30 days to circulate the oil.



IDEX CORPORATION VIKING PUMP, INC. A Unit of IDEX Corporation 2 Cedar Falls, IA 50613 USA

### MOUNTING

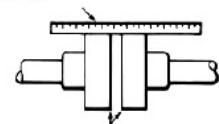
1. Surfaces to which the pump mounts must be clean and flat.
2. Use SAE Grade 5 or better capscrews to mount pump.
3. The 4 mounting capscrews for the SG-04 and SG-05 pumps must have a minimum of 1/4 inch thread engagement, and must be torqued evenly to 12-15 ft-lbs.
4. The 2 mounting capscrews for the SG-07 pumps must have a minimum of 1/2 inch thread engagement, and be evenly torqued to 50-55 ft-lbs.
5. Standard SG Series pumps are designed to be used with jaw type couplings that do not induce axial thrust on the pump shaft. If an improper type of coupling is used, internal damage may result.
6. Do not strike or press the pump drive coupling to install. Internal pump damage will result. If the coupling does not slide onto the shaft, inspect the coupling, shaft and key for nicks or burrs and remove.
7. If the pump is to be belt or gear driven, the overhung load option must be specified.
8. Once the pump has been mounted and the coupling installed, it is recommended to put lube oil into the suction port and turn the pump by hand to make sure it turns freely.

### Alignment

Check alignment after mounting.

1. If the unit has a flexible coupling, remove any coupling guards or covers and check alignment of coupling halves. A straight edge (piece of key stock will work) across the coupling must rest evenly on both rims at the top, bottom and sides. See Figure 3.
2. Make a final check on alignment after the piping is hooked up.

USE STRAIGHT EDGE. THESE  
SURFACES MUST  
BE PARALLEL



CHECK  
GAUGE

1 OR FEELER  
PARALLEL

### Piping/Hose

The cause of many pumping problems can be traced to the suction piping. It should always be as large in diameter and as short in length as possible.

Before starting the layout and installation of your piping system, consider the following points:

1. Never use piping smaller than the pump port connections. Piping larger in diameter than the port connection is sometimes required to reduce friction losses.



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2. Be sure the inside of the pipe is clean before installing.
3. When approaching an obstacle to the suction line, go around instead of over it. Going over an obstacle can create an air pocket. Where practical, slope the piping so no air or liquid pockets will be formed. Air pockets in the suction line make it hard for the pump to prime.
4. A strainer on the suction side of the pump should always be considered in any pumping system. The strainer will keep foreign matter from entering the pump. The strainer mesh or perforation size should be large enough so that it does not cause excessive pressure drop, but fine enough to protect the pump. Use of a strainer is particularly important at start up to help clean the system of weld beads, pipe scale and other foreign objects.
5. A pressure relief valve is required in the discharge line. See Pressure Relief Valves, General page 1 item 4.
6. The pump must not be used to support the piping. Hangers, supports, stands, etc. must carry the weight of the pipes.
7. When fastening piping to the pump do not impose any strain on the pump casing. "Springing" or "drawing" the piping up to the pump will cause distortion, possible misalignment and probable rapid wear of the pump. Do not use the pump to correct errors in piping layout or assembly.
8. All joints of piping system must be tight; liquid thread sealant will help assure leak free threaded joints. Loose joints result in liquid leaks or suction side leaks. Air leaks make the pump noisy and reduce flow. **CAUTION:** Be careful not to over tighten fittings as this can cause cracked joints. Do not use Teflon tape. Reduced friction makes over tightening very easy and will result in cracked ports. Leaks in the suction line can permit air to be drawn in, and will cause a noisy pump and reduction in capacity.
9. Drive alignment must be checked after piping is hooked up.
10. Provide a pressure relief device in any part of a pump and piping system that can be valved off and, thus, completely isolated. A rise in temperature will cause a liquid to expand. If there is no provision for pressure relief in the closed off section, there is a chance that the pump or piping will rupture.

## Danger !

Before starting pump, be sure all drive equipment guards are in place.  
Failure to properly mount guards may result in serious injury or death.

## START UP

Before pushing "start" button, check the following:

1. Are vacuum and pressure gauges (liquid filled) mounted on or near the pump? Gauges are the quickest and most accurate way of finding out what is happening in the pump.
2. Is the pump correctly aligned with the drive equipment?
3. Make sure there is no pipe strain on the pump ports.
4. Rotate the pump shaft by hand to be sure it turns freely.



TYPICAL SG-04/SG-05  
EXPLODED VIEW



TYPICAL SG-07  
EXPLODED VIEW

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1.	Bracket, lipseal & bearing section	6.	Relief valve kit
2.	Match ground casing & (2) gears, driver & driven shafts	8.	Lipseal
3.	Separation plate & bearing assy.	7.	O-ring
4.	Head and alignment sleeve assy.	8.	Assembly capscrews





5. Before connecting to the motor, jog it to be sure it is running in the correct direction. Refer to "General" on page 1.
6. Is the pressure relief valve installed properly?
7. Make sure suction piping is properly connected and sealed, and valves are open.
8. Make sure the discharge piping is properly connected and sealed, valves are open, and there is a place for the liquid to go.
9. Make sure all guards are in place.
10. The above checklist is a general guideline to be used prior to starting the pump. Since Viking Pump cannot foresee every application for our product and possible system design, the final responsibility is with the user. The pump must be utilized within the catalog specifications and the pump system must be designed to provide safe working conditions.

The "start" button may now be pushed.

The pump should begin to deliver liquid within 15 seconds! If not, push the stop button. Do not run the pump without liquid flow longer than 30 seconds or the pump may be ruined.

Review Startup steps 1 through 10. Consider what the suction and discharge gauges may indicate. If everything appears in order, re-prime pump. Refer to Mounting, page 2, item 8.

Push the "start" button. If nothing is flowing within 30 seconds, stop the pump. The pump is not a compressor, it will not build up much air pressure. It may be necessary to vent discharge line until liquid begins to flow.

If pump still does not deliver, consider one or more of the following:

1. The suction line has air leaks.
2. The end of the suction pipe is not submerged deeply enough in the liquid.
3. The suction lift is too great or the suction piping is too small.
4. Liquid is vaporizing in the suction line before it gets to the pump.

If after consideration of these points, the pump still does not deliver liquid, review all points given under START UP and read through the TROUBLESHOOTING guide and try again. If pump still will not deliver liquid, contact your Viking Pump supplier.

## TROUBLESHOOTING

A Viking pump that is properly installed and maintained will give long satisfactory performance.

If trouble does develop, one of the first steps toward finding the difficulty is to install a vacuum gauge in the suction line and a pressure gauge in the discharge line. Readings on these gauges often give a clue on where to start looking for trouble.

### DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting etc.) be sure:

1. That any pressure in chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.
2. That the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational so that it cannot be started while work is being done on the pump.
3. That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.

Failure to follow the above listed precautionary measures may result in serious injury or death.

### Vacuum Gauge - Suction Port

High vacuum reading would indicate:

1. The suction line is blocked, valve closed, a strainer is plugged or a pinched suction line.
2. The suction line is too small.
3. The liquid is too viscous to flow through the piping.
4. The lift required is too high.

Low reading would indicate:

1. There may be an air leak in the suction line.
2. The end of the pipe is not in the liquid.
3. The pump is worn.
4. The pump is dry and should be primed.



## Flutter, jumping or erratic reading would indicate:

1. The liquid is vaporizing.
2. Liquid is coming in to the pump in slugs, possibly an air leak or insufficient liquid above the end of the suction pipe.
3. Vibration from cavitation, misalignment, or damaged parts.

## Pressure Gauge - Discharge Port

### High reading would indicate:

1. High viscosity and small diameter and/or lengthy discharge line.
2. The strainer or filter is plugged.
3. The pressure relief valve is set too high.
4. Valve in the discharge line partially closed.
5. Line partially plugged from build up on inside of pump, solidified product or foreign object.
6. Liquid in the pipe not up to temperature.

### Low reading would indicate:

1. Pressure relief valve set too low.
2. Pressure relief valve poppet not seating properly.
3. Pump mounting capscrews into torqued to specifications (GP-04 and GP-05 Series 12-15 ft.-lbs.).
4. Pump assembly bolts not torqued into specifications (GP-07 Series 50-55 ft.-lbs.).
5. The bypass around pump partially open.
6. Pump is damaged or worn.
7. The pump has too much internal clearance.

## Flutter, jumping or erratic reading would indicate:

1. Cavitation.
2. Liquid is coming to the pump in slugs.
3. Air leak in the suction line.
4. Vibrating from misalignment or mechanical problems.

## Miscellaneous

### Pump does not pump:

1. The pump has lost its prime from air leak or low level in tank.
2. The suction lift is too high.
3. Rotating in the wrong direction.
4. The motor does not come up to speed.
5. The strainer is clogged.
6. The bypass valve is open, pressure relief valve set too low or pressure relief valve poppet stuck open.
7. The pump is worn out.
8. Any changes in liquid, system or operation that would help explain the trouble, e.g. new liquid, additional lines or process changes.

### Pump starts, then loses its prime:

1. The supply tank is empty.
2. The liquid is vaporizing in the suction line.
3. There is an air leak or air pockets in the suction line.
4. The pump is worn out.

### Pump is noisy:

1. The pump is cavitating (liquid vaporizing in suction line) or being starved (heavy liquid cannot get to pump fast enough). Increase the suction pipe size and/or reduce the length, or decrease the pump speed. If the pump is above the liquid, raise the liquid level closer to the center line of the inlet port. If the liquid is above the pump, increase the head of the liquid.
2. Check alignment.
3. Anchor the base or piping to eliminate vibration.

### Pump not delivering up to capacity:

1. The pump is starving or cavitating – see Pump is noisy, item 1.
2. The strainer partially clogged.
3. Air leak somewhere in the suction line.
4. Running too slow. Is the motor the correct speed and wired up correctly?
5. Pressure relief valve is set too low, stuck open or has damaged poppet seat.
6. The bypass line around the pump partially opened.
7. The pump is worn out.





#### Pump takes too much power (stalls motor):

1. The pump sequence valve set too high.
2. Liquid is more viscous than the unit sized to handle.
3. The system pressure relief valve set too high.
4. The pump is misaligned.

3. DO obtain, read and keep all maintenance instructions furnished with pump.

## DO'S AND DON'TS

Do's and Don'ts for installation, operation and maintenance of Viking pumps to assure safe, long, trouble free operation.

#### Installation:

1. DO install the pump as close to supply tank as possible.
2. DO leave working space around the pumping unit.
3. DO use large, short and straight suction port.
4. DO install a strainer in the suction line.
5. DO a double check of alignment after unit is mounted and piping is hooked up.
6. DO provide pressure relief valve for discharge side of pump.
7. DO check for proper rotation.
8. DO use a return line filter.
9. DO use an industrial grade hydraulic oil.
10. DO use piping, hose and fittings rated for maximum system pressure.

#### Operation

1. DON'T run the pump at speeds faster than 3600 RPM.
2. DON'T allow the pump to develop pressure higher than those shown in catalog at that size.
3. DON'T operate pumps at temperatures above or below limits shown in catalog for model.
4. DON'T operate unit without all guards in place.
5. DON'T operate pump without pressure relief valve in discharge piping; be sure valve is mounted and set correctly.
6. DON'T stick fingers in ports of pump!!! Fingers may be pinched between gears.
7. DON'T work on the pump unless driver has been "locked out" so it cannot be started while work is being done on the pump.

#### Maintenance:

1. DO record pump model number and serial number and file for further use.
2. DO have spare parts, pump or stand by units available, particularly if pump is essential part of key operation process.

**VIKING  
PUMP**

**IDEX**  
IDEX CORPORATION

#### WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, FOB. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources which are incorporated into any Viking product are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No officer or employee of IDEX Corporation or Viking Pump, Inc., is authorized to alter this warranty.



## **BALDOR • RELIANCE**

### **Product Information Packet**

## **CEM3554T**

**1.5HP, 1760RPM, 3PH, 60HZ, 145TC, 3526M, TEFC**

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# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

**BALDOR • RELIANCE** Product Information Packet: CEM3554T - 1.5HP,1760RPM,3PH,60HZ,145TC,3526M,TEFC

Part Detail							
Revision:	R	Status:	PRD/A	Change #:		Proprietary:	No
Type:	AC	Elec. Spec:	35WGM493	CD Diagram:	CD0005	Mtg Plant:	
Mech. Spec:	35AA002	Layout:	35LYAA002	Poles:	04	Created Date:	09-23-2010
Base:	RG	Eff. Date:	03-13-2018	Leads:	9#18		

Specs			
Catalog Number:	CEM3554T	Heater Indicator:	No Heater
Enclosure:	TEFC	Insulation Class:	F
Frame:	145TC	Inverter Code:	Inverter Ready
Frame Material:	Steel	KVA Code:	L
Output @ Frequency:	1.500 HP @ 60 HZ	Lifting Lugs:	No Lifting Lugs
Synchronous Speed @ Frequency:	1800 RPM @ 60 HZ	Locked Bearing Indicator:	Locked Bearing
Voltage @ Frequency:	460.0 V @ 60 HZ	Motor Lead Quantity/Wire Size:	9 @ 18 AWG
	230.0 V @ 60 HZ	Motor Lead Exit:	Ko Box
XP Class and Group:	None	Motor Lead Termination:	Flying Leads
XP Division:	Not Applicable	Motor Type:	3526M
Agency Approvals:	UR	Mounting Arrangement:	F1
	CSA EEV	Power Factor:	73
	CSA	Product Family:	General Purpose
Auxiliary Box:	No Auxiliary Box	Pulley End Bearing Type:	Ball
Auxiliary Box Lead Termination:	None	Pulley Face Code:	C-Face
Base Indicator:	Rigid	Pulley Shaft Indicator:	Standard
Bearing Grease Type:	Polyrex EM (-20F +300F)	Rodent Screen:	None
Blower:	None	Shaft Extension Location:	Pulley End



# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

## Product Information Packet: CEM3554T - 1.5HP,1760RPM,3PH,60HZ,145TC,3526M,TEFC

Current @ Voltage:	2.200 A @ 460.0 V	Shaft Ground Indicator:	No Shaft Grounding
	4.400 A @ 230.0 V	Shaft Rotation:	Reversible
	4.500 A @ 208.0 V	Shaft Slinger Indicator:	No Slinger
Design Code:	B	Speed Code:	Single Speed
Drip Cover:	No Drip Cover	Motor Standards:	NEMA
Duty Rating:	CONT	Starting Method:	Direct on line
Electrically Isolated Bearing:	Not Electrically Isolated	Thermal Device - Bearing:	NONE (OLD)
Feedback Device:	NO FEEDBACK	Thermal Device - Winding:	None
Front Face Code:	Standard	Vibration Sensor Indicator:	No Vibration Sensor
Front Shaft Indicator:	None	Winding Thermal 1:	None
		Winding Thermal 2:	None



# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

**BALDOR • RELIANCE** Product Information Packet: CEM3554T - 1.5HP,1760RPM,3PH,60HZ,145TC,3528M,TEFC

Nameplate NP3441LUA

CAT.NO.	CEM3554T				
SPEC	35AA002M493G1				
HP	1.5				
VOLTS	230/460				
AMPS	4.4/2.2				
RPM	1760				
FRAME	145TC	HZ	60	PH	3
SF	1.15	CODE	L	DES	B
NEMA NOM. EFF	86.5	PF	73	CLASS	F
RATING	40C AMB-CONT				
CC	010A	USABLE AT 208V 4.5			
ENCL	TEFC	SER			
DE	6205	ODE	6203		
VPWM INVERTER READY					
CT6-60H(10:1)VT3-60H(20:1)	50Hz 1.5HP 190/380V 5/2.5A				
	SF1.0				





# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

**BALDOR • RELIANCE** Product Information Packet: CEM3554T - 1.5HP,1760RPM,3PH,60HZ,145TC,3526M,TEFC

Parts List		
Part Number	Description	Quantity
SA203574	SA 35AA002M493G1	1.000 EA
RA190835	RA 35AA002M493G1	1.000 EA
34FN3002B01	EXTERNAL FAN, PLASTIC, .637/.639 HUB W/	1.000 EA
NS2512A01	INSULATOR, CONDUIT BOX X	1.000 EA
35CB3009	35 CB W/1.09 DIA. LEAD HOLE @ 6:	1.000 EA
36GS1000SP	GASKET-CONDUIT BOX, .06 THICK #SV-330 LE	1.000 EA
51XB1016A07	10-16 X 7/16 HXWSSLD SERTYB	2.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
35EP3122A00	MASTER ODE,203 BRG.,683SH,#26 DRN,GRSR,F	1.000 EA
HW4500A01	1641B(ALEMITE)400 UNIV, GREASE FITT	1.000 EA
HW5100A03	WAVY WASHER (W1543-017)	1.000 EA
35EP3307D00	MASTER DE,205 BRG.,998SH,#26 DRN,GRSR	1.000 EA
HW4500A01	1641B(ALEMITE)400 UNIV, GREASE FITT	1.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
35FH4005A84SP	IEC FH W/GRSR, NO DIMPLES PRIMED	1.000 EA
51XW1032A06	10-32 X .38, TAPTITE II, HEX WSHR SLTD S	3.000 EA
35CB4521GX	CONDUIT BOX LID KIT	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	4.000 EA
HW2501D13	KEY, 3/16 SQ X 1.375	1.000 EA
HA7000A01	KEY RETAINER 7/8" DIA SHAFT	1.000 EA
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	2.000 EA
MJ1000A02	GREASE, POLYREX EM EXXON (Use 4824-15A)	0.050 LB
MG1000Y03	MUNSELL 2.53Y 6.70/ 4.60, GLOSS 20,	0.017 GA



# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

**BALDOR • RELIANCE** Product Information Packet: CEM3554T - 1.5HP, 1760RPM, 3PH, 60HZ, 145TC, 3526M, TEFC

Parts List (continued)		
Part Number	Description	Quantity
HA3100A15	THRUBOLT 10-32 X 8.375	4.000 EA
LC0005E01	CONN.DIA./WARNING LABEL (LC0005/LB1119N)	1.000 EA
NP3441LUA	ALUM SUPER-E VPWM INV READY UL CSA-EEV C	1.000 EA
36PA1000	PKG GRP, PRINT PK1016A06	1.000 EA
MN416A01	TAG-INSTAL-MAINT no wire (1100/bx) 11/14	1.000 EA
PE-0000001	ZRTG PE ASSEMBLY	1.000 EA
FE-0000001	ZRTG FE ASSEMBLY	1.000 EA



# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

**BALDOR • RELIANCE** Product Information Packet: CEM3554T - 1.5HP,1760RPM,3PH,60HZ,145TC,3526M,TEFC

## AC Induction Motor Performance Data Record # 64659 - Typical performance - not guaranteed values

Winding: 35WGM493-R078	Type: 3526M	Enclosure: TEFC
------------------------	-------------	-----------------

Nameplate Data				460 V, 60 Hz: High Voltage Connection	
Rated Output (HP)	1.5			Full Load Torque	4.47 LB-FT
Volts	230/460			Start Configuration	direct on line
Full Load Amps	4.4/2.2			Breakdown Torque	19.2 LB-FT
R.P.M.	1760			Pull-up Torque	9.4 LB-FT
Hz	60	Phase	3	Locked-rotor Torque	13.4 LB-FT
NEMA Design Code	B	KVA Code	L	Starting Current	18.3 A
Service Factor (S.F.)	1.15			No-load Current	1.37 A
NEMA Nom. Eff.	86.5	Power Factor	73	Line-line Res. @ 25°C	10.1 Ω
Rating - Duty	40C AMB-CONT			Temp. Rise @ Rated Load	44°C
S.F. Amps				Temp. Rise @ S.F. Load	52°C
				Locked-rotor Power Factor	51.5
				Rotor inertia	0.154 LB-FT <sup>2</sup>

### Load Characteristics 460 V, 60 Hz, 1.5 HP

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	31	51	65	73	79	83	77
Efficiency	76.2	84.4	86.9	87.1	86.4	85.3	86.7
Speed	1791	1781	1771	1760	1748	1735	1753
Line amperes	1.44	1.61	1.86	2.19	2.58	2.98	2.42





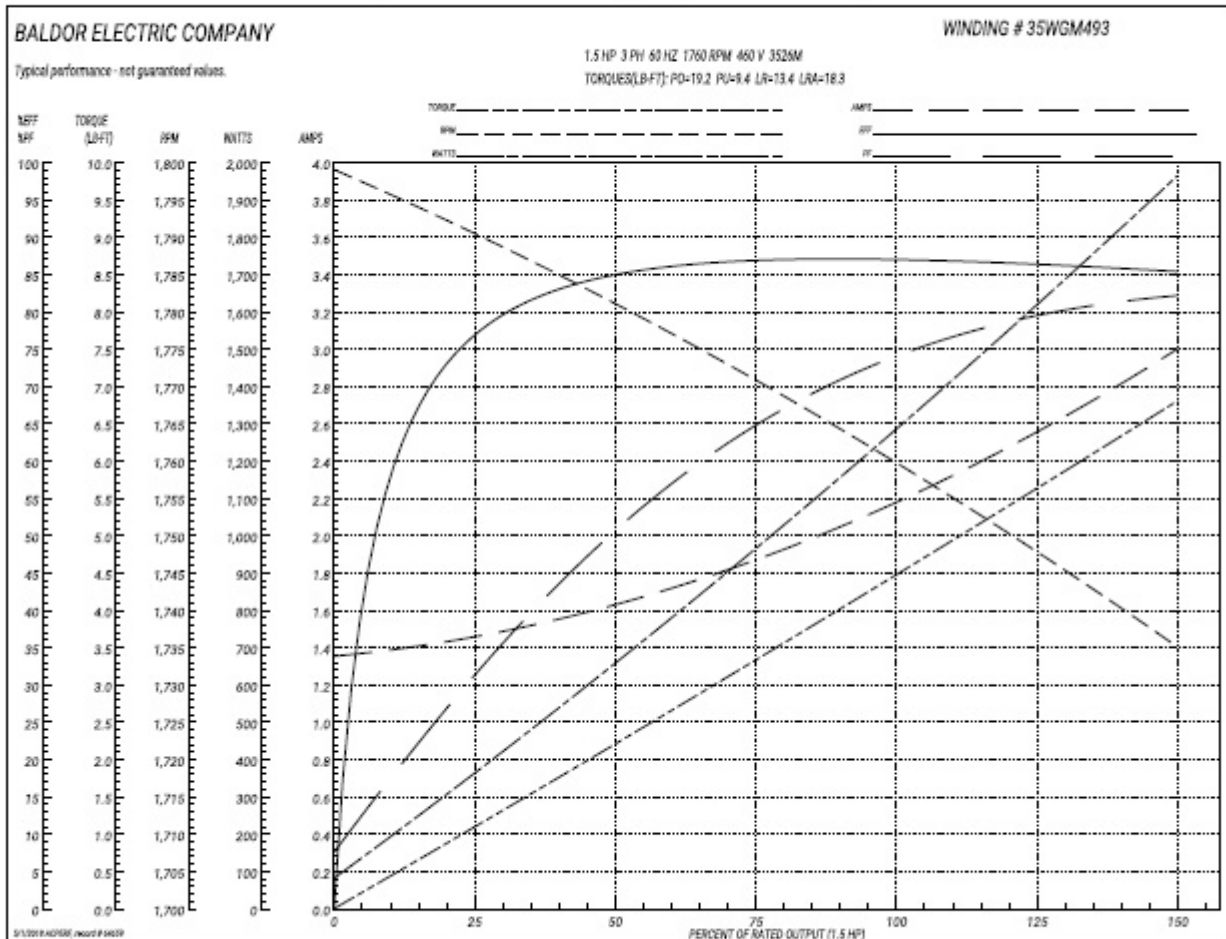
# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

**BALDOR • RELIANCE**

Product Information Packet: CEM3554T - 1.5HP, 1760RPM, 3PH, 60HZ, 145TC, 3526M, TEFC

Performance Graph at 460V, 60Hz, 1.5HP Typical performance - Not guaranteed values

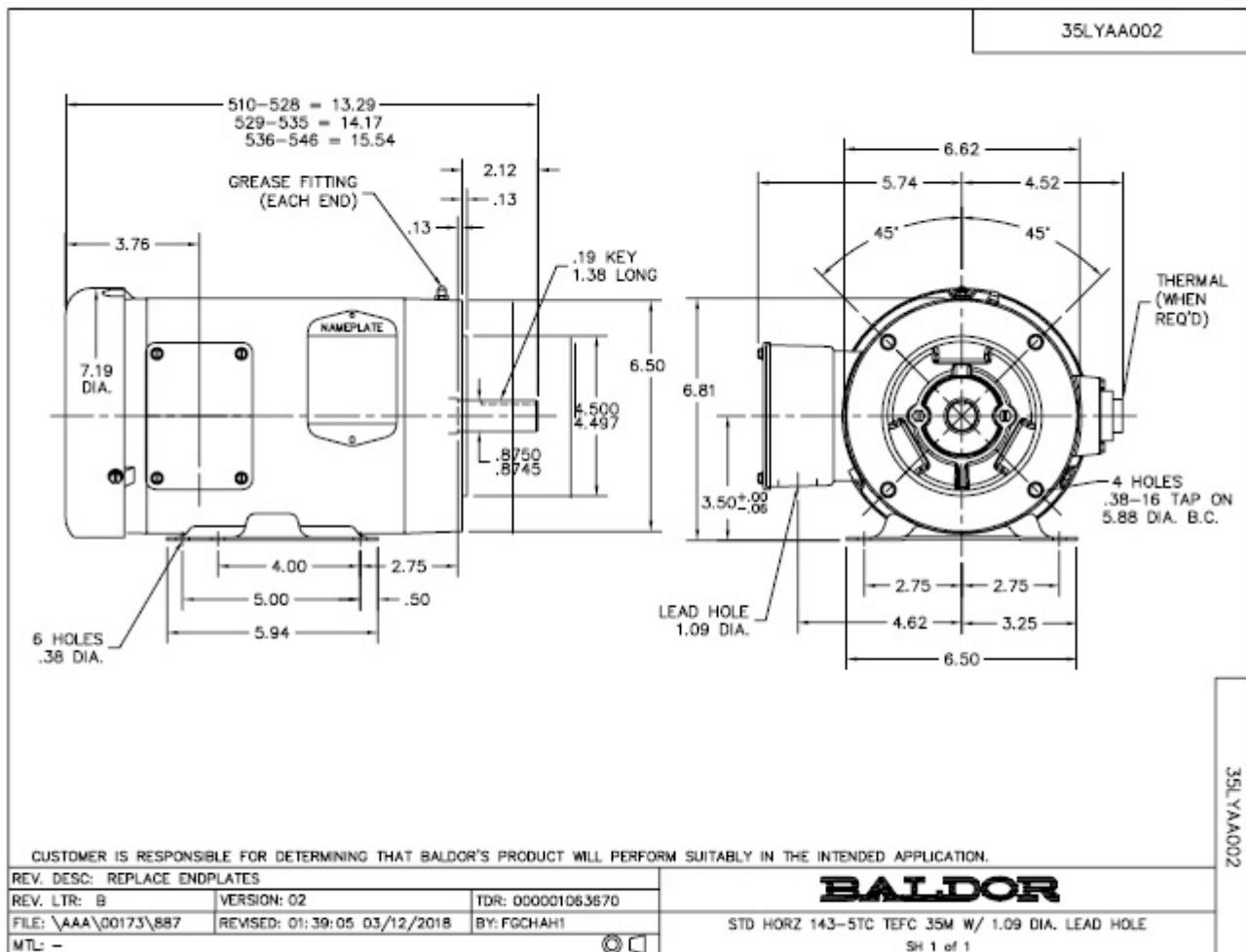




# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

**BALDOR • RELIANCE** Product Information Packet: CEM3554T - 1.5HP, 1760RPM, 3PH, 60HZ, 145TC, 3526M, TEFC

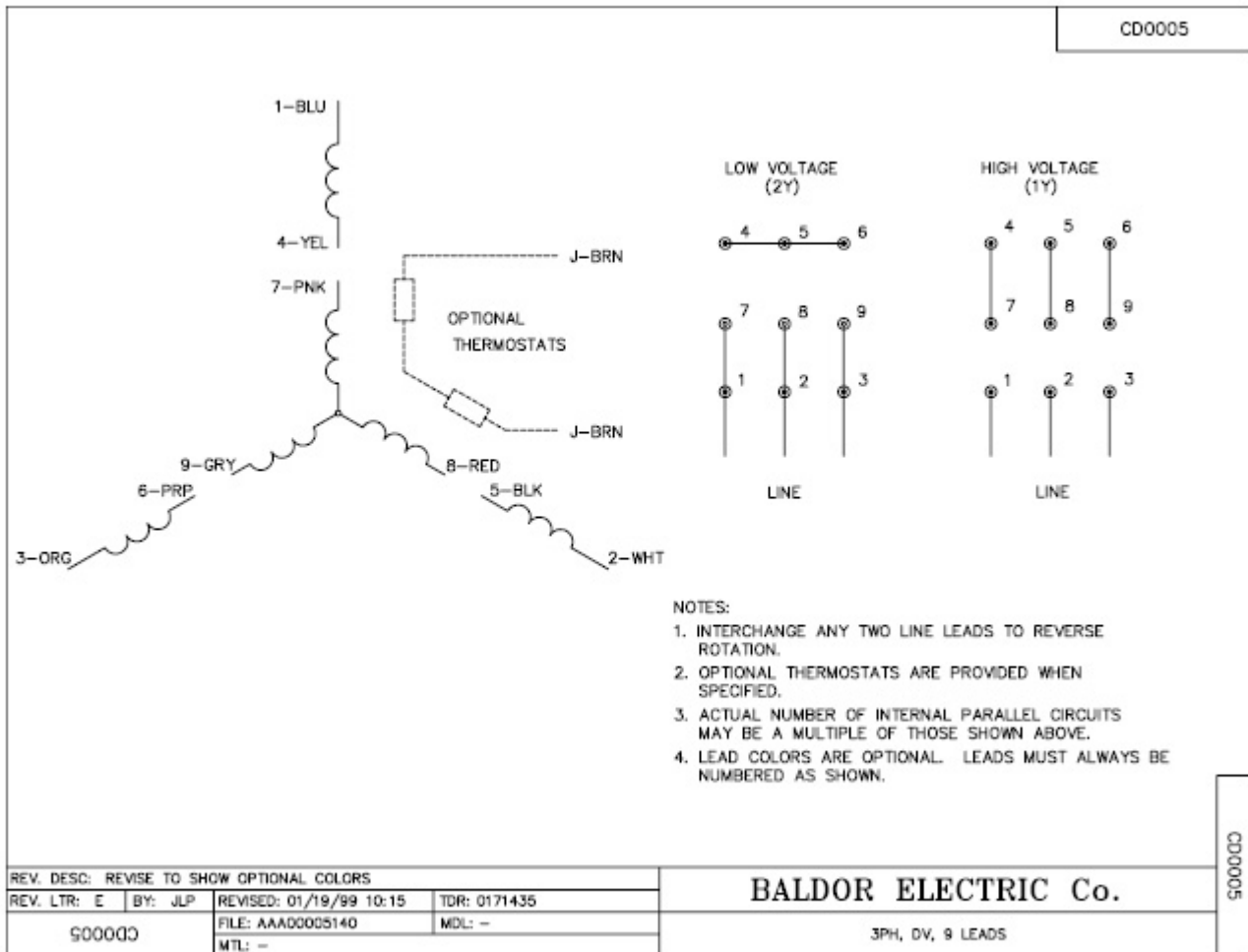




# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

**BALDOR • RELIANCE** Product Information Packet: CEM3554T - 1.5HP, 1760RPM, 3PH, 60HZ, 145TC, 3526M, TEFC





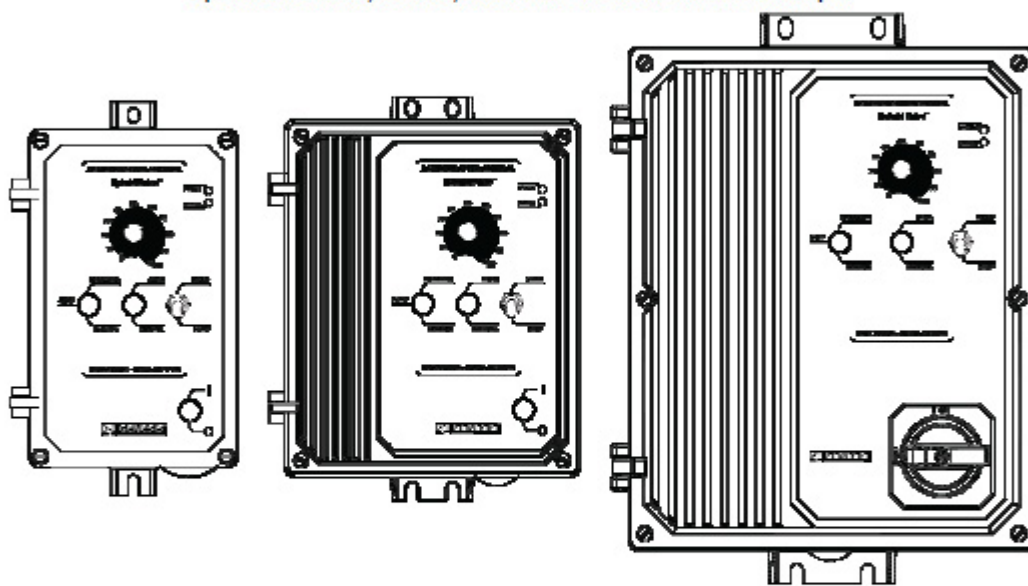
## INSTALLATION AND OPERATION MANUAL KBAC SERIES

Adjustable Frequency Drive for 3-Phase AC Motors  
NEMA 4X / IP65

Variable Speed / Soft-Start AC Motor Drive  
With Electronic Motor Overload Protection<sup>1</sup>  
Washdown and Watertight for Indoor and Outdoor Use

Rated for 208 – 230 and 400/460 Volt 50 Hz and 60 Hz  
3-Phase and PSC<sup>2</sup> AC Induction Motors from Subfractional thru 10 HP

Operates from 115, 208/230, and 400/460 Volt 50/60 Hz AC Line Input<sup>3</sup>



**NOTE:** The drive is factory set for 60 Hz motors. For 50 Hz motors, see Section 10.4 on page 19.



See Safety Warnings on page 5.



This Manual Covers 2G and 3G Models<sup>3,6</sup>

KBAC-24D, 27D, 29, 29 (1P), 45, 48, 217, 217S, 217F, 217SF, 416, 416S, 416F, 416SF

The information contained in this manual is intended to be accurate.

However, the manufacturer retains the right to make changes in design which may not be included herein.

**Notes:** 1. UL approved as an electronic overload protector for motors. 2. Special software is available for PSC motors – contact Technical Support. 3. Third Generation (3G) drives are jumper selectable (J12) for standard and sensitive GFCIs. 4. Installation of a CE approved RFI (EMI) filter is required. 5. Third Generation (3G) drives KBAC-24D, 27D, 29, 29 (1P), 45, 48 are marked "3G" on the product label. All KBAC-217, 416 Series drives are Third Generation (3G).

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**PENTA KB POWER**

A COMPLETE LINE OF MOTOR DRIVES



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**TABLE 1**  
**DRIVE MODEL NO., PART NO., AND CASE REFERENCE SIZE**

Model No.	Part No.		Case Reference Size	Model No. <sup>3</sup>	Part No.		Case Reference Size
	Gray Case (2G and 3G <sup>2</sup> )	White Case <sup>1</sup> (2G and 3G <sup>2</sup> )			Gray Case	White Case <sup>1</sup>	
KBAC-24D	9987	9988	A	KBAC-217	8868	8879	C
KBAC-27D	9520	9521	B	KBAC-217S	8863	8855	C
KBAC-29	9528	9529	B	KBAC-217F	8861	8853	C
KBAC-29 (1P)	10001	10002	B	KBAC-217SF	8869	8880	C
KBAC-45	9530	9531	B	KBAC-416	8870	8881	C
KBAC-48	9540	9541	B	KBAC-416S	8864	8856	C
				KBAC-416F	8874	8883	C
				KBAC-416SF	8871	8882	C

Notes: 1. White FDA approved finish. 2. Third Generation (3G) drives KBAC-24D, 27D, 29, 29 (1P), 45, 48 are marked "(3G)" on the product label. Third Generation (3G) drives are jumper selectable (J12) for standard and sensitive GFCIs. 3. All KBAC-217, 416 Series drives are Third Generation (3G).

### UL NOTICE

**230 Volt Drives:** Suitable for use on a circuit capable of delivering not more than 5 kA RMS symmetrical Amperes. 230 Volts maximum. Use copper conductors rated 75 °C. Suitable for operation in a maximum surrounding air temperature of 40 °C.

**460 Volt Drives:** Suitable for use on a circuit capable of delivering not more than 5 kA RMS symmetrical Amperes. 460 Volts maximum. Use copper conductors rated 75 °C. Suitable for operation in a maximum surrounding air temperature of 40 °C.



## 1 – QUICK-START INSTRUCTIONS

Also see Section 4 – Important Application Information on page 5.

**Important:** You must read these simplified instructions before proceeding. These instructions are to be used as a reference only and are not intended to replace the details provided herein. You must read the Safety Warnings on page 5 before proceeding.

**Reconditioning the Bus Capacitors:** If this drive has been in storage for over one year, it is necessary to recondition the power supply bus capacitors. To recondition the bus capacitors, apply the AC Line, with the drive in the Stop Mode, for a minimum of one hour. Not following this procedure will cause the bus capacitors to fail.

**WARNING! High Voltage!** Disconnect the main power before making connections to the control. Do not depend on the POWER or STATUS LEDs, located on the front cover, to no longer be illuminated as a guaranteed power off condition.

### 1.1 – MOUNTING INSTRUCTIONS

See Section 5 on page 12.

### 1.2 – AC LINE INPUT FUSING

It is recommended that a fuse(s) or circuit breaker be installed in the AC Line. Fuse each conductor that is not at ground potential. For the recommended fuse size, see Table 2 on page 7. Also see Section 6 on page 15.

### 1.3 – AC LINE INPUT CONNECTION

Connect the AC Line input to Terminal Block TB1, as shown in Figure 1. Also see Section 7.1 on pages 15 and 16.

**GFCI Operation:** Third Generation (3G) drives are jumper selectable (J12) for standard and sensitive GFCIs.

**CAUTION!** The rated AC Line voltage of the drive must match the actual AC Line input voltage. On KBAC-24D, 27D the setting of Jumper J1 must match the actual AC Line input voltage.

**KBAC-24D, 27D, 29 (1P):** Designed to accept 1-phase (Terminals L1, L2) AC Line Input only. Rated for 208/230 Volt AC Line Input with Jumper J1 set to the "230V" position (factory setting). Rated for 115 Volt AC Line Input with Jumper J1 set to the "115V" position. KBAC-27D is rated for 1½ HP maximum with 115 Volt AC Line Input and 2 HP maximum with 208/230 Volt AC Line Input.

**KBAC-29:** Designed to accept 1-phase (Terminals L1, L2) or 3-phase (Terminals L1, L2, L3) AC Line Input. Rated for 208/230 Volt AC Line Input only. Rated for 2 HP maximum with 1-phase AC Line Input and 3 HP maximum with 3-phase AC Line Input.

**KBAC-217, 217S, 217F, 217SF:** Designed to accept 3-phase (Terminals L1, L2, L3) AC Line Input only. Rated for 208/230 Volt AC Line Input only.

**KBAC-45, 48, 416, 416S, 416F, 416SF:** Designed to accept 3-phase (Terminals L1, L2, L3) AC Line Input only. Rated for 400/460 Volt AC Line Input only.

### 1.4 – MOTOR CONNECTION

Connect the motor to Terminal Block TB1 Terminals U, V, W, as shown in Figure 1 above. See Section 7.2 on page 16. Motor cable length should not exceed 100 ft. (30 m) – special reactors may be required – contact Technical Support.

### 1.5 – GROUND CONNECTION

Connect the ground wire (earth) to the ground screw, as shown in Figure 1 above. See Section 7.3 on page 16. Be sure the motor is also properly grounded.

### 1.6 – 60 Hz AND 50 Hz MOTOR OPERATION

The drive is factory set for 60 Hz motor operation (Jumper J4 set to the "1X" position and Jumper J5 set to the "60Hz" position). For 50 Hz motor operation, be sure Jumper J4 is set to the "1X" position and set Jumper J5 to the "50Hz" position. See Section 10.4 on page 19.

### 1.7 – START/STOP SWITCH

A prewired Start/Stop Switch is supplied to electronically "start" and "stop" the drive, as described in Section 7.5 on page 17. This switch must be used to "start" the drive each time the AC Line is applied to the drive or to "restart" the drive. Also see Section 10.8 on page 20.

### 1.8 – JUMPER SETTINGS

All jumpers have been factory set for most applications. However, some jumpers may need to be set in order to tailor the drive for a specific application. See Section 10 on pages 19 and 20.

**IMPORTANT:** To ensure that the motor is properly protected with the IP Overload Protection feature, it is required that Jumper J2 is set to the corresponding position for the motor horsepower being used, as shown in Figure 23 on page 19.

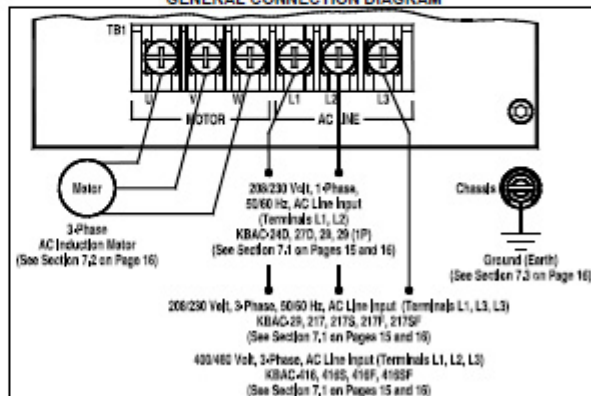
### 1.9 – TRIMPOT ADJUSTMENTS

All trimpots have been factory set for most applications. Some applications require adjustment of the trimpots to tailor the drive for a specific requirement. See Section 12 on page 21 and 22.

### 1.10 – DIAGNOSTIC LEDs

After power has been applied, observe the LEDs to verify proper drive operation, as described in Section 13 on page 23.

**FIGURE 1  
GENERAL CONNECTION DIAGRAM**





## 2 – SAFETY WARNINGS

### Definition of Safety Warning Symbols



Electrical Hazard Warning Symbol: Failure to observe this warning could result in electrical shock or electrocution.



Operational Hazard Warning Symbol: Failure to observe this warning could result in serious injury or death.



### SAFETY WARNING! – PLEASE READ CAREFULLY!

This product must be installed and serviced by a qualified technician, electrician, or electrical maintenance person familiar with its operation and the hazards involved. Proper installation, which includes electrical connections, fusing or other current protection, and grounding, can reduce the chance of electrical shocks, and/or fires, in this product or products used with this product, such as electric motors, switches, coils, solenoids, and/or relays. Do not use this drive in an explosion-proof application. Eye protection must be worn and insulated adjustment tools must be used when working with drive under power. This product is constructed of materials (plastics, metals, carbon, silicon, etc.) which may be a potential hazard. Proper shielding, grounding, and filtering of this product can reduce the emission of radio frequency interference (RFI) which may adversely affect sensitive electronic equipment. It is the responsibility of the equipment manufacturer and individual installer to supply this Safety Warning to the ultimate end user of this product. (SW 8/2012)

The control contains electronic Start/Stop circuits, which can be used to start and stop the control. However, these circuits are never to be used as safety disconnects since they are not fail-safe. Disconnect the input power for this purpose. Be sure to read and follow all instructions carefully. Fire and/or electrocution can result due to improper use of this product.



This product complies with all CE directives pertinent at the time of manufacture. Contact Technical support for Declaration of Conformity. Installation of a CE approved RFI filter is required. See RFI Filters & Chokes Selection Guide D-321 (Part No. A42027) for selection of filters that meet the Industrial or Residential Standard. Additional shielded cable and/or AC Line cables may be required along with a signal isolator.

## 3 – IMPORTANT APPLICATION INFORMATION

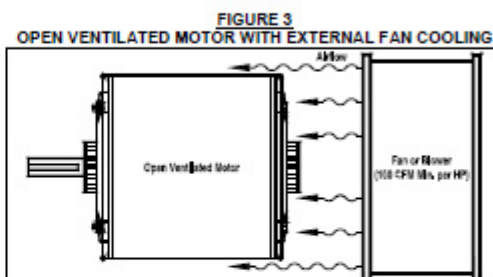
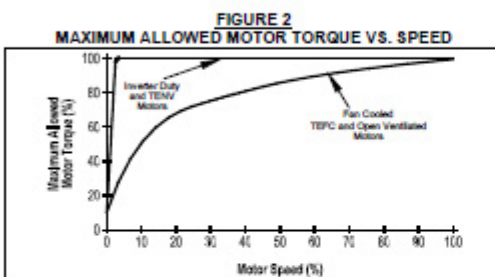
### 3.1 – MOTOR WITH EXTERNAL FAN COOLING

Most totally enclosed fan-cooled (TEFC) and open ventilated 3-phase AC induction motors will overheat if used beyond a limited speed range at full torque. Therefore, it is necessary to reduce motor load as speed is decreased.

**Note:** Some fan-cooled motors can be used over a wider speed range. Consult the motor manufacturer for details.



**CAUTION!** 1. Some motors have low speed characteristics which cause overheating and winding failure under light load or no-load conditions. If the motor is operated in this manner for an extended period of time, it is recommended that the unloaded motor current be checked from 2 – 15 Hz (60 – 450 RPM) to ensure motor current does not exceed the nameplate rating. Do not use the motor if the motor current exceeds the nameplate rating. 2. It is recommended that the drive be used with Inverter Duty or TENV motors. Inverter duty and most totally enclosed non-ventilated (TENV) motors can provide full rated torque over an extended speed range without overheating. See Figure 2. 3. If external fan cooling is provided, open ventilated motors can also achieve an extended speed range at full rated torque. A box fan or blower with a minimum of 100 CFM per HP is recommended. Mount the fan or blower so the motor is surrounded by the airflow. See Figure 3.



### 3.2 – Electronic Motor Overload Protection

The drive contains Modified I<sup>2</sup>t Overload Protection (UL approved as an overload protector for motors). Part of this function consists of a Current Limit (CL) circuit, which limits the drive current to a preset level of 160% of the rated drive current. The CL Trimpot is used to recalibrate the drive current from 60% thru 200%. The Power Start™ circuit provides an overshoot function that allows most motors to develop more than 200% of starting torque and breakdown torque.

Standard I<sup>2</sup>t is undesirable because it causes nuisance tripping. It allows a very high motor current to develop and will turn the drive off after a short period of time. The RMS Current Limit Circuit, which includes I<sup>2</sup>t plus an I-t timing circuit (as described in the paragraph below), avoids this nuisance tripping while providing maximum motor protection.

If the motor is overloaded to 120% of full load (75% of the CL setting), the I-t Timer starts. If the motor continues to be overloaded at the 120% level, the timer will shut down the drive after 30 minutes. If the motor is overloaded to 160% of full load, the drive will trip in 5 seconds.





## 4 – INTRODUCTION

Thank you for purchasing the KBAC Adjustable Frequency Drive. KB Electronics, Inc. is committed to providing total customer satisfaction by producing quality products that are easy to install and operate. The KBAC is manufactured with surface mount components incorporating advanced circuitry and technology.

The drives are variable speed controls housed in a rugged NEMA 4X / IP65 washdown and watertight die-cast aluminum enclosure. They are designed to operate 208 – 230 and 400/460 Volt 50 & 60 Hz 3-phase AC induction motors from subfractional thru 10 HP. The sine wave coded Pulse Width Modulated (PWM) output operates at a carrier frequency of 16 kHz which provides high motor efficiency and low noise. Adjustable Linear Acceleration and Deceleration are provided, making the drive suitable for soft-start applications.

Due to its user-friendly design, the KBAC AC drive is easy to install and operate. Tailoring to specific applications is accomplished with selectable jumpers and trimpots, which eliminate the computer-like programming required on other drives. However, for most applications no adjustments are necessary.

Main features include adjustable RMS Current Limit and IPt Motor Overload Protection (UL approved as an electronic overload protector for motors). In addition, Adjustable Slip Compensation with Static Auto-Tune and Boost provides high torque and excellent load regulation over a wide speed range. Power Start™ delivers over 200% motor torque to ensure start-up of high frictional loads. Electronic Inrush Current Limit (EICL™) eliminates harmful AC Line inrush current. A Run/Fault Relay is provided, which can be used to turn equipment on or off, to signal a warning if the drive is put into the Stop Mode, or if a fault has occurred. The drive is suitable for machine or variable torque (HVAC) applications. Also, a jumper is provided for selection of Regenerative or DC Injection Braking.

Standard front panel features include Diagnostic LEDs for "Power On" and "Drive Status", a Start/Stop Switch, and a Main Speed Potentiometer. Other features include a Barrier Terminal Block to facilitate wiring of the AC Line and motor, adjustable trimpots (MIN, MAX, ACCEL, DECEL, COMP, CL, JOG, BOOST), customer selectable jumpers (Line Voltage (dual voltage models only)), Motor Horsepower, Automatic Ride-Through / Manual Start, Motor Frequency, Frequency Multiplier, Fixed/Adjustable Boost, Regenerative / Injection Braking, "Run" or "Fault" Output Relay Operation, NO/NC Stop Contact, Constant/Variable Torque, Switching Frequency, and GFCI operation (Third Generation (3G) drives only).

Optional accessories include: Forward-Stop-Reverse Switch, On/Off AC Line Switch, Run-Stop-Jog Switch, Signal Isolator, Auto/Manual Switch, Class A AC Line Filter, Multi-Speed Board, and Liquidtight Fittings. A connector is provided for easy installation of accessories. Custom software: all models can be factory programmed for applications which require special timing, PLC functions, and GFCI operation.

## 4.1 – STANDARD FEATURES

**Industrial Duty Die-Cast Aluminum Case with Hinged Cover:** Available in dark gray finish or FDA approved white finish.

**Simple to Operate:** Does not require programming. Uses trimpots and jumpers, which are factory set for most applications.

**Motor HP Selection Jumper (J2):** Allows the drive to be used on a wide range of motors without recalibration.

**Switching Frequency and GFCI Selection Jumper (J12):** Allows the drive to be operated at 8 kHz or 12 kHz and on Standard (G1) or Sensitive (G2) GFCIs. (Third Generation (3G) drives only.)

**Diagnostic LEDs:** Power on (POWER) and drive status (STATUS).

**Run/Fault Relay Output Contacts:** Can be used to turn equipment on or off, to signal a warning if the drive is put into the Stop Mode, or a fault has occurred.

**Start/Stop Switch:** Provides electronic start and stop functions.

**Barrier Terminal Block:** Facilitates wiring of motor, AC Line, and Run/Fault Relay Output Contacts.

**Jumper Selection of Drive Output Frequency:** Increases the motor speed up to two times the rated RPM.

**Ride-Through:** Provides smooth recovery to the previous set speed during a momentary power loss (of less than 2 seconds).

**Holding Torque at Zero Speed:** Resists motor shaft rotation when the drive is in Stop Mode.

**Adjustable Trimpots:** Maximum Speed (MAX), Minimum Speed (MIN), Acceleration (ACCEL), Deceleration (DECEL), DC Injection Brake (DECEL), Boost (BOOST), Current Limit (CL), Jog (JOG), Slip Compensation (COMP).

**Selectable Jumpers:** AC Line Input Voltage (J1 – KBAC-24D, 27D only), Motor Horsepower (J2), Automatic Ride-Through or Manual Start (J3), Frequency Multiplier (J4), Motor Frequency (J5), Fixed or Adjustable Boost (J6), Regeneration or DC Injection Braking (J7), "Run" or "Fault" Output Relay Operation (J8), Normally Open or Closed Stop Contact (J9), Constant or Variable Torque (J10), Switching Frequency and GFCI (J12 – Third Generation (3G) drives only).

## 4.2 – PERFORMANCE FEATURES

**Power Start™:** Provides more than 200% starting torque which ensures startup of high frictional loads.

**Slip Compensation with Static Auto-Tune and Boost:** Provides excellent load regulation over a wide speed range.

**Speed Range:** 60:1.

## 4.3 – PROTECTION FEATURES

**Motor Overload (IPt) with RMS Current Limit:** Provides motor overload protection which prevents motor burnout and eliminates nuisance trips. UL approved as an electronic overload protector for motors.

**Electronic Inrush Current Limit (EICL™):** Eliminates harmful inrush AC Line current during startup.

**Short Circuit:** Shuts down the drive if a short circuit occurs at the motor (phase-to-phase).

**Regeneration:** Eliminates tripping due to high bus voltage caused by rapid deceleration of high inertial loads.

**Undervoltage and Overvoltage:** Shuts down the drive if the AC Line Input voltage goes above or below the operating range.

**MOV Input Transient Suppression:** Protects the drive components against damaging voltage spikes on the AC Line.

**Microcontroller Self-Monitoring and Auto Reboot.**





# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

TABLE 2  
ELECTRICAL RATINGS

Model No.	Part No.		Ac Line Input			Fuse or Circuit Breaker Rating (Amps)	Output			Horsepower Selection (Jumper J2) <sup>2</sup>					Net Weight	
	Gray	White	Volts AC (50/60 Hz)	Phase (Φ)	Maximum Current (Amps AC)		Voltage Range (Volts AC)	Maximum Continuous Load Current (Amps/Phase)	Maximum Horsepower (HP (kW))						lbs	kg
KBAC-24D	9987	9988	115	1	14.4	20	0 - 208/230	3.6	1 (0.75)	1	3/4	1/2	1/4	1/8	5.9	2.7
			208/230	1	8.1	15										
KBAC-27D	9520	9521	115	1	22	25	0 - 208/230	5.5	1½ (1.13)	—	1½ <sup>3</sup>	1	3/4	1/2	10.3	4.7
			208/230	1	16.7	20										
KBAC-29	9528	9529	208/230	1	16.7	20	0 - 208/230	6.7	2 (1.5)	—	A	B	C	D	E	
				3	11.7	15										
KBAC-29 (1P)	10001	10002	208/230	1	20.5	25	0 - 208/230	9.0 <sup>6</sup>	3 (2.25)	3	2	1½	1	3/4	10.3	4.7
KBAC-45	9530	9531	400/460	3	7.2	10	0 - 400/460 <sup>6</sup>	5.5	3 (2.25)	3	2	1½	1	3/4		
KBAC-48	9540	9541	400/460	3	11	15	0 - 400/460 <sup>6</sup>	8.3	5 (3.75)	5	3	2	1½	1		
KBAC-217	8868	8879	208/230	3	22.1	25	0 - 208/230	17	5	5	3	2			22	10
KBAC-217S	8863	8855														
KBAC-217F	8861	8853														
KBAC-217SF	8869	8880														
KBAC-416	8870	8881	400/460	3	20.8	25	0 - 400/460 <sup>6</sup>	16	10	10	7.5	3				
KBAC-416S	8864	8856														
KBAC-416F	8874	8883														
KBAC-416SF	8871	8882														

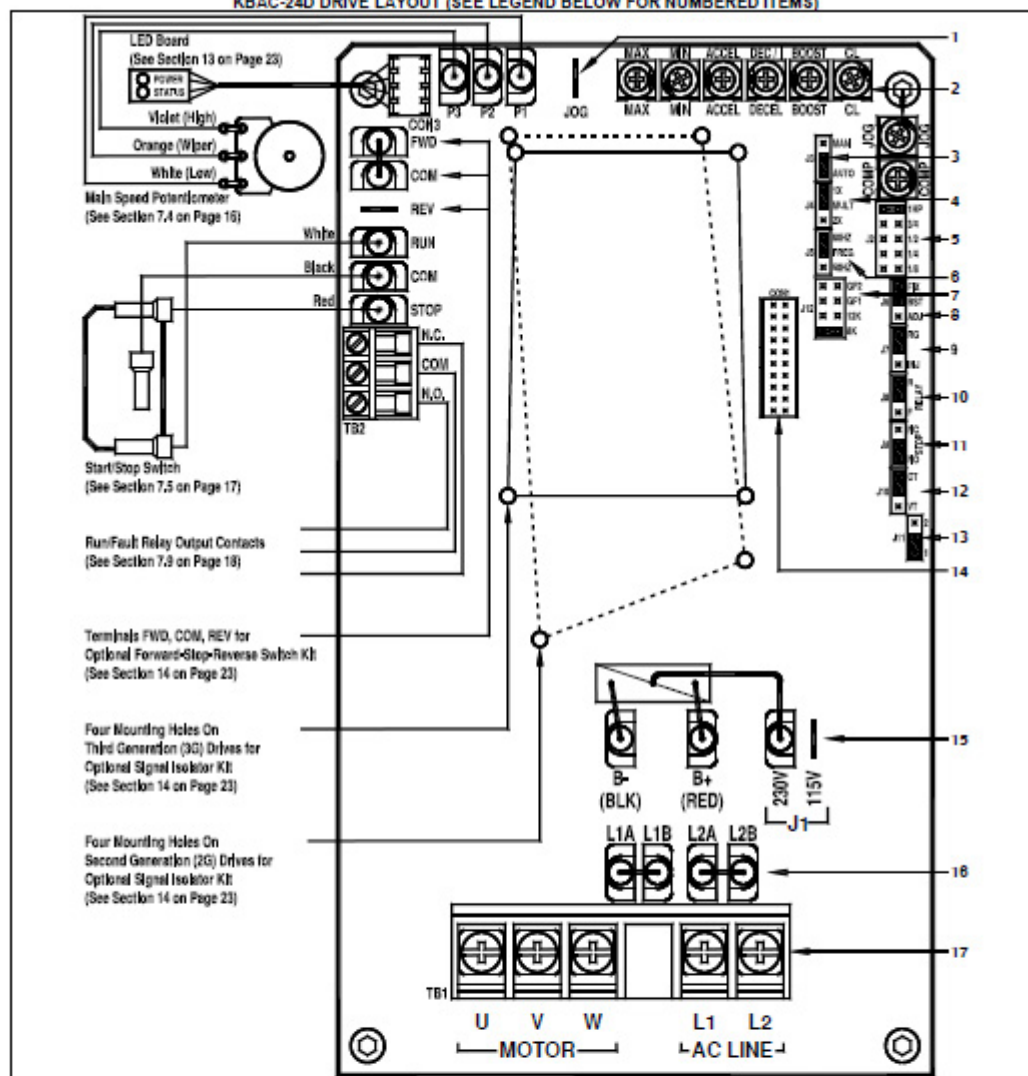
Notes: 1. White FDA approved finish. 2. Bold indicates factory setting. KBAC-24D: J2 is labeled "1", "3/4", "1/2", "1/4", "1/8" (factory set to the "1" position). KBAC-27D: J2 is labeled "2", "1½", "1", "3/4", "1/2" (factory set to the "1½" position). KBAC-29, 45, 48: J2 is labeled "A", "B", "C", "D", "E" (factory set according to the table). KBAC-217, 416 Series: J2 is labeled "A", "B", "C" (factory set to the "A" position). 3. KBAC-27D: Rated 1½ HP maximum with 115 Volt AC Line Input and 2 HP maximum with 208/230 Volt AC Line Input. 4. KBAC-29: Rated 2 HP maximum with 1-phase AC Line Input and 3 HP maximum with 3-phase AC Line Input. 5. KBAC-29 (1P): Rated 0 Amps at 35 °C / 95 °F and derated to 8.3 Amps at 40 °C / 104 °F. For ambient temperatures above 40 °C / 104 °F, the drive is derated 2.5% per °C. 6. KBAC-45, 48, 416 Series: Rated 0 - 400 Volts AC for 50 Hz motor operation and 0 - 460 Volts AC for 60 Hz motor operation.

TABLE 3  
GENERAL PERFORMANCE SPECIFICATIONS

Description	Specification	Factory Setting
115 Volt AC Line Input Voltage Operating Range (Volts AC)	115 (±15%)	—
208/230 Volt AC Line Input Voltage Operating Range (Volts AC)	208 (-15%) / 230 (+15%)	—
400/460 Volt AC Line Input Voltage Operating Range (Volts AC)	380 (-15%) - 460 (+15%)	—
Maximum Load (% Current Overload for 2 Minutes)	150	—
Switching Frequency (kHz) (Jumper J12) (3G Drives Only) <sup>1</sup>	8, 12	8
Signal Following Input Voltage Range <sup>2</sup> (Volts DC)	0 - 5	—
Output Frequency Resolution (Bits, Hz)	10, 0.06	—
Maximum Speed Trimpt (MAX) Range (% Frequency Setting)	70 - 110	100
Minimum Speed Trimpt (MIN) Range (% Frequency Setting)	0 - 40	0
Acceleration Trimpt (ACCEL) Range (Seconds)	0.3 - 20	1.5
Deceleration Trimpt (DECEL) Range (Seconds)	0.3 - 20	1.5
DC Injection Brake (DECEL) (Seconds)	0.3 - 6.0	1.7
Boost Trimpt (BOOST) Range (Volts)	0 - 30	5
Current Limit Trimpt (CL) Range (% Full Load)	40 - 200	160
Jog Trimpt (JOG) Range (% Frequency Setting)	0 - 100	35
Slip Compensation Trimpt (COMP) Range at Drive Rating (Volts/Hz)	0 - 3	1.5
Motor Frequency Setting (Hz) (Jumper J5)	50, 60	60
Output Frequency Multiplier (1X, 2X) (Jumper J4) <sup>3</sup>	1, 2	1
Minimum Operating Frequency at Motor (Hz)	1	—
Speed Range (Ratio)	60:1	—
Speed Regulation (30:1 Speed Range, 0 - Full Load) (% Base Speed) <sup>4</sup>	2.5	—
Overload Protector Trip Time for Stalled Motor (Seconds)	6	—
Undervoltage/Overvoltage Trip Points for 115 Volt AC Line Input (± 5%) (Volts AC) <sup>5</sup>	76 - 141	—
Undervoltage/Overvoltage Trip Points for 208/230 Volt AC Line Input (± 5%) (Volts AC) <sup>5</sup>	151 - 282	—
Undervoltage/Overvoltage Trip Points for 400/460 Volt AC Line Input (± 5%) (Volts AC) <sup>5</sup>	302 - 567	—
Run/Fault Relay Output Contact Rating (Amps at 30 Volts DC, 125 Volts AC, 250 Volts AC)	1, 0.5, 0.25	—
Operating Temperature Range (°C / °F)	0 - 40 / 32 - 104	—
Operating Humidity Range (% Relative, Non-Condensing)	0 - 95	—
Storage Temperature (°C / °F)	-25 - +85 / -13 - +185	—

Notes: 1. Third Generation (3G) drives are marked "3G" on the product label. 2. Requires an isolated signal. If a non-isolated signal is used, or if using 0 to ±2.5 thru 0 to ±25 Volts DC, or 4 - 20 mA DC signal input, install the Signal Isolator. 3. Allows the motor to operate up to two times the rated RPM. Constant horsepower will result when operating the drive in the "X2" mode above the motor rated frequency. 4. Dependent on motor performance. 5. Do not operate the drive outside the specified AC Line Input voltage operating range. 6. See Table 2 above.

**FIGURE 4**  
**KBAC-24D DRIVE LAYOUT (SEE LEGEND BELOW FOR NUMBERED ITEMS)**

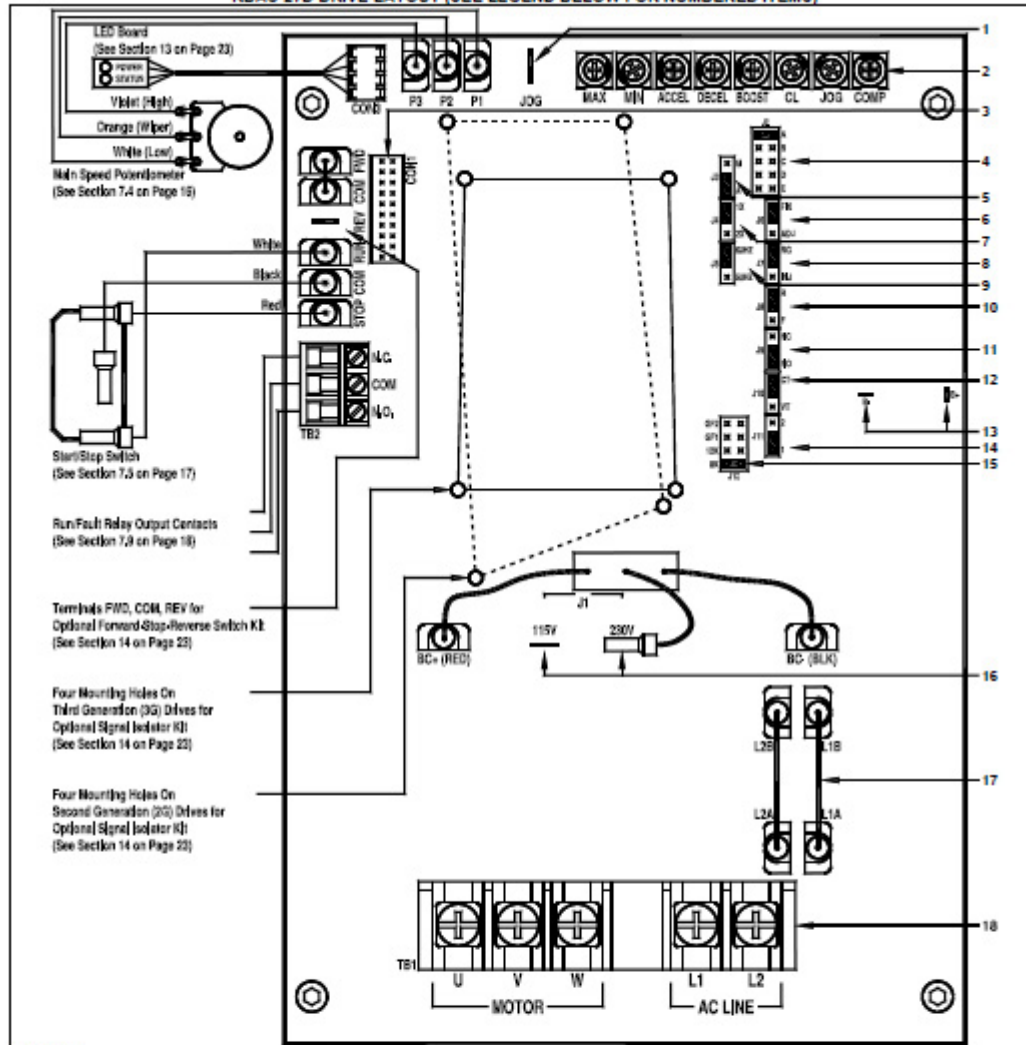


**LEGEND:**

1. Jog Terminal: Used with optional Run-Stop-Jog Switch Kit. See Section 14 on page 23.
2. Adjustable Trimpots: Maximum Speed (MAX), Minimum Speed (MIN), Acceleration (ACCEL), Deceleration (DECEL), DC Injection Brake (DECEL), Boost (BOOST), Current Limit (CL), Jog (JOG), Slip Compensation (COMP). See Section 12 on pages 21 and 22.
3. Jumper J3: Automatic Ride-Through or Manual Start selection. See Section 10.3 on page 19.
4. Jumper J4: Frequency Multiplier selection. See Section 10.4 on page 19.
5. Jumper J2: Motor Horsepower selection. See Section 10.2 on page 19.
6. Jumper J5: Motor Frequency selection. See Section 10.4 on page 19.
7. Jumper J12: Switching Frequency and GFCI selection. Third Generation (3G) drives only. See Section 10.11 on page 20.
8. Jumper J6: Adjustable Boost selection. See Section 10.5 on page 20.
9. Jumper J7: Regeneration or DC Injection Braking. See Section 10.6 on page 20.
10. Jumper J8: "Run" or "Fault" Output Relay Operation selection. See Section 10.7 on page 20.
11. Jumper J9: Normally Open or Closed Stop Contact selection. See Section 10.8 on page 20.
12. Jumper J10: Constant or Variable Torque selection. See Section 10.9 on page 20.
13. Jumper J11: Factory use only.
14. Connector CON1: Used to connect optional accessories to the drive.
15. Jumper J1: AC Line Input Voltage selection. See Section 10.1 on page 19.
16. Terminals L1A/L1B and L2A/L2B: Used for optional On/Off AC Line Switch Kit and RFI Filter Kit. See Section 14 on page 23.
17. Terminal Block TB1: AC Line Input and Motor connections. See Sections 7.1 and 7.2 on page 15 and 16.

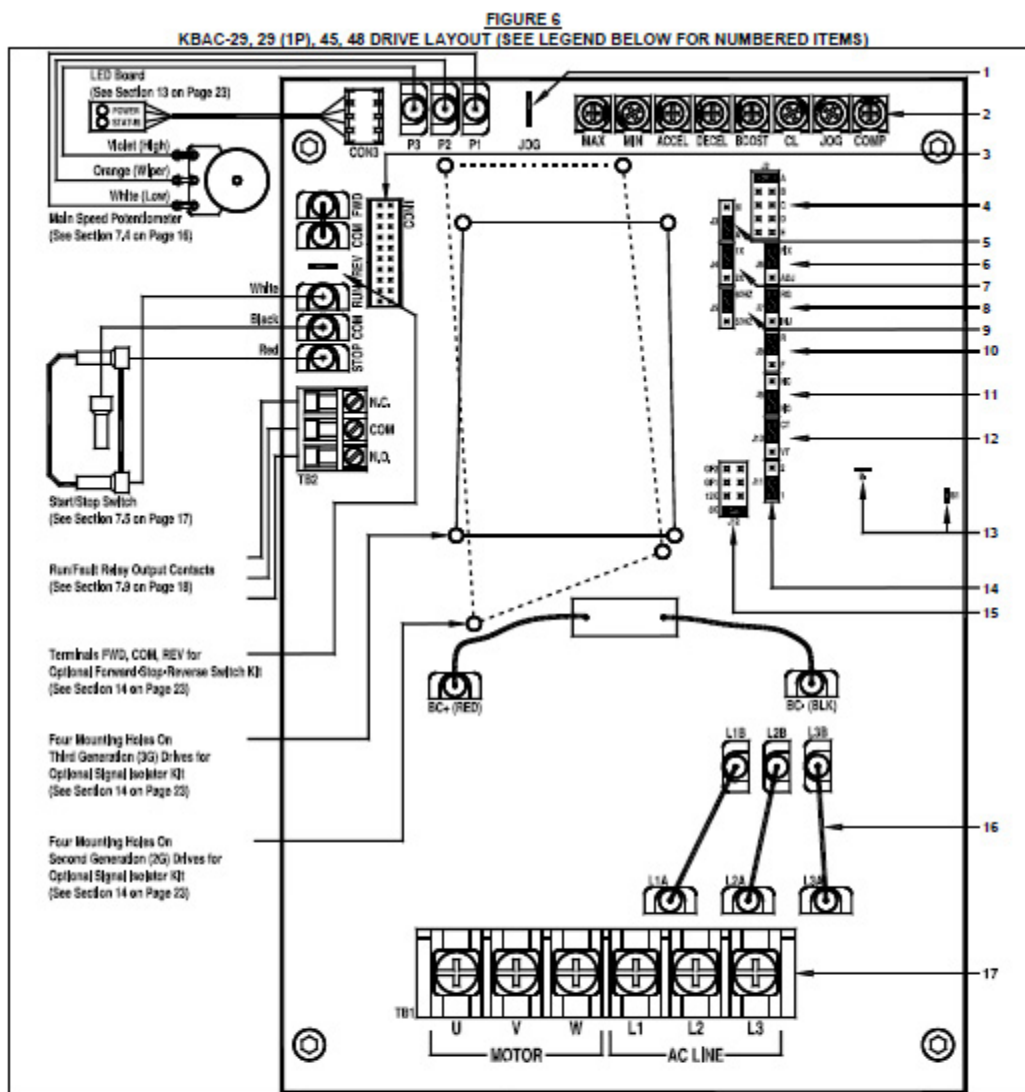


**FIGURE 5**  
**KBAC-27D DRIVE LAYOUT (SEE LEGEND BELOW FOR NUMBERED ITEMS)**



- LEGEND:**
1. Jog Terminal: Used with optional Run-Stop-Jog Switch Kit. See Section 14 on page 23.
  2. Adjustable Trimpots: Maximum Speed (MAX), Minimum Speed (MIN), Acceleration (ACCEL), Deceleration (DECEL), DC Injection Brake (DECEL), Boost (BOOST), Current Limit (CL), Jog (JOG), Slip Compensation (COMP). See Section 12 on pages 21 and 22.
  3. Connector CON1: Used to connect optional accessories to the drive.
  4. Jumper J2: Motor Horsepower selection. See Section 10.2 on page 19.
  5. Jumper J3: Automatic Ride-Through or Manual Start selection. See Section 10.3 on page 19.
  6. Jumper J6: Adjustable Boost selection. See Section 10.5 on page 20.
  7. Jumper J4: Frequency Multiplier selection. See Section 10.4 on page 19.
  8. Jumper J7: Regeneration or DC Injection Braking. See Section 10.6 on page 20.
  9. Jumper J5: Motor Frequency selection. See Section 10.4 on page 19.
  10. Jumper J8: "Run" or "Fault" Output Relay Operation selection. See Section 10.7 on page 20.
  11. Jumper J9: Normally Open or Closed Stop Contact selection. See Section 10.8 on page 20.
  12. Jumper J10: Constant or Variable Torque selection. See Section 10.9 on page 20.
  13. Terminals B+ and B-: Used to power optional accessories.
  14. Jumper J11: Factory use only.
  15. Jumper J12: Switching Frequency and GFCI selection. Third Generation (3G) drives only. See Section 10.11 on page 20.
  16. Jumper J1: AC Line Input Voltage selection. See Section 10.1 on page 19.
  17. Terminals L1A/L1B and L2A/L2B: Used for optional On/Off AC Line Switch Kit and RFI Filter Kit. See Section 14 on page 23.
  18. Terminal Block TB1: AC Line Input and Motor connections. See Sections 7.1 and 7.2 on page 15 and 16.





**LEGEND:**

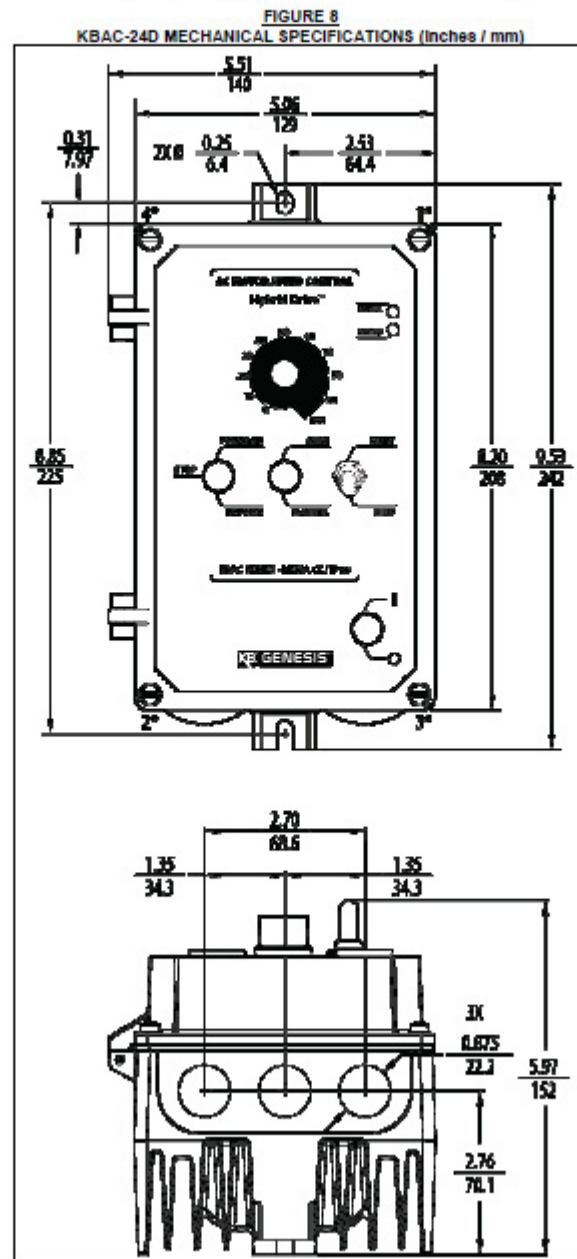
- LEGEND:**
1. Connector CON3: For diagnostic LED board. See Section 13 on page 23.
  2. Terminals RUN, COM, STOP: For factory installed Start/Stop Switch. See Section 7.5 on page 17.
  3. Terminals FWD, STOP, REV: For optional Forward-Stop-Reverse Switch. See Section 14 on page 23.
  4. Terminals P1, P2, P3: For factory installed Main Speed Potentiometer. See Section 7.4 on page 16.
  5. Terminal Block TB2: Run/Fault Relay Output Contacts. See Section 7.9 on page 18.
  6. Jog Terminal: Used with optional Run-Stop-Jog Switch Kit. See Section 14 on page 23.
  7. Adjustable Trimpots: Maximum Speed (MAX), Minimum Speed (MIN), Acceleration (ACCEL), Deceleration (DECEL), DC Injection Brake (DECEL), Boost (BOOST), Current Limit (CL), Jog (JOG), Slip Compensation (COMP). See Section 12 on pages 21 and 22.
  8. Selectable Jumpers: Motor Horsepower (J2), Automatic Ride-Through or Manual Start (J3), Frequency Multiplier (J4), Motor Frequency (J5), Fixed or Adjustable Boost (J6), Regeneration or DC Injection Braking (J7), "Run" or "Fault" Output Relay Operation (J8), Normally Open or Closed Stop Contact (J9), Constant or Variable Torque (J10), Switching Frequency and GFCI (J12). See Section 10 on pages 19 and 20.
  9. Connector CON1: Used to connect optional accessories to the drive.
  10. Four mounting holes for optional Signal Isolator. See Section 14 on page 23.
  11. Terminals L1A, L2A, L3A: Used for factory installed On/Off AC Line Switch and factory installed RFI Filter Kit. See Section 14 on page 23.
  12. Terminal Block TB1: AC Line Input and Motor connections. See Sections 7.1 and 7.2 on page 15 and 16.
  13. Ground Screws: Chassis (earth ground).



## 5 - MOUNTING

It is recommended that the drive be mounted vertically on a flat surface with adequate ventilation. Leave enough room below the drive to allow for AC Line, motor connections, and any other wiring that is required. Although the drive is designed for outdoor and washdown use, care should be taken to avoid extreme hazardous locations where physical damage can occur. When mounting the drive in an enclosure, the enclosure should be large enough to allow for proper heat dissipation so that the ambient temperature does not exceed 40 °C (104 °F) at full rating. See Figures 8 – 10 on pages 12 – 14.

**WARNING!** Do not use this drive in an explosion-proof application. Be sure the control is securely mounted.





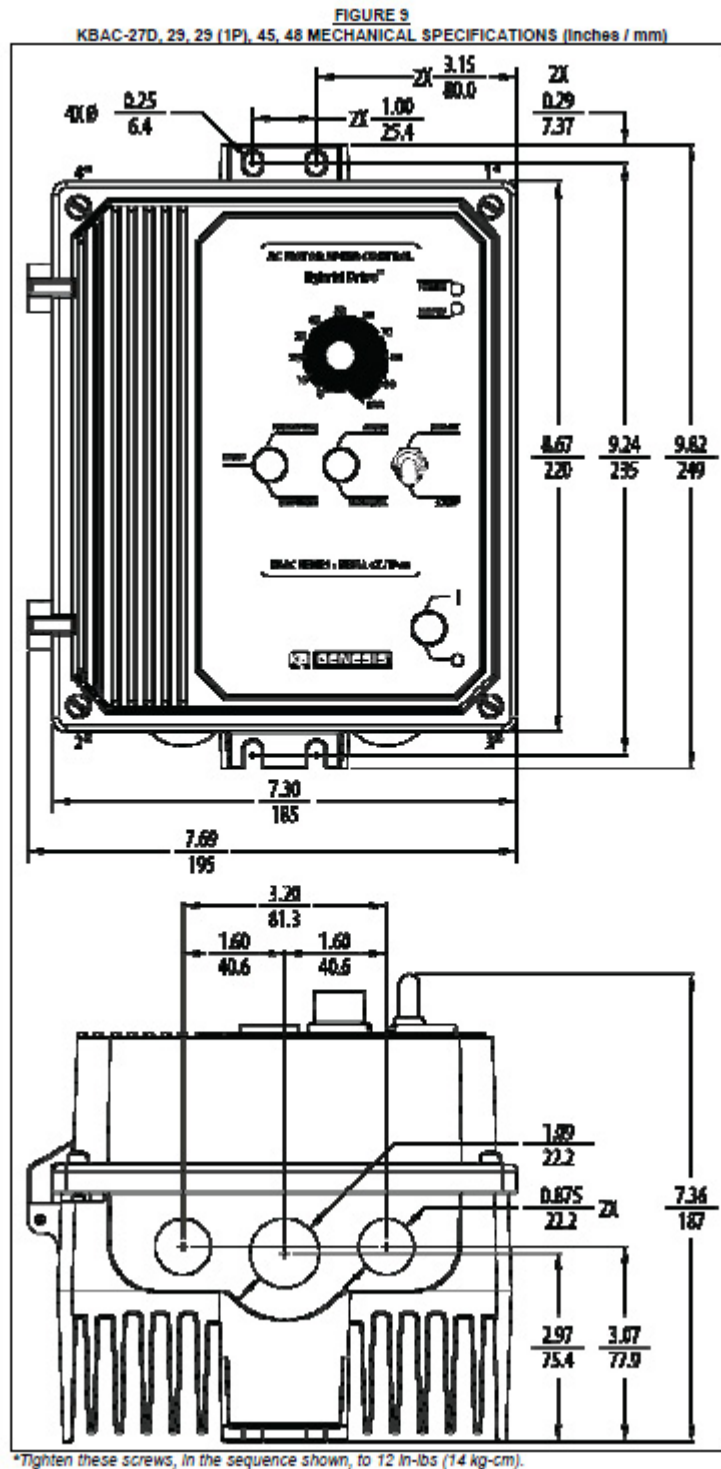
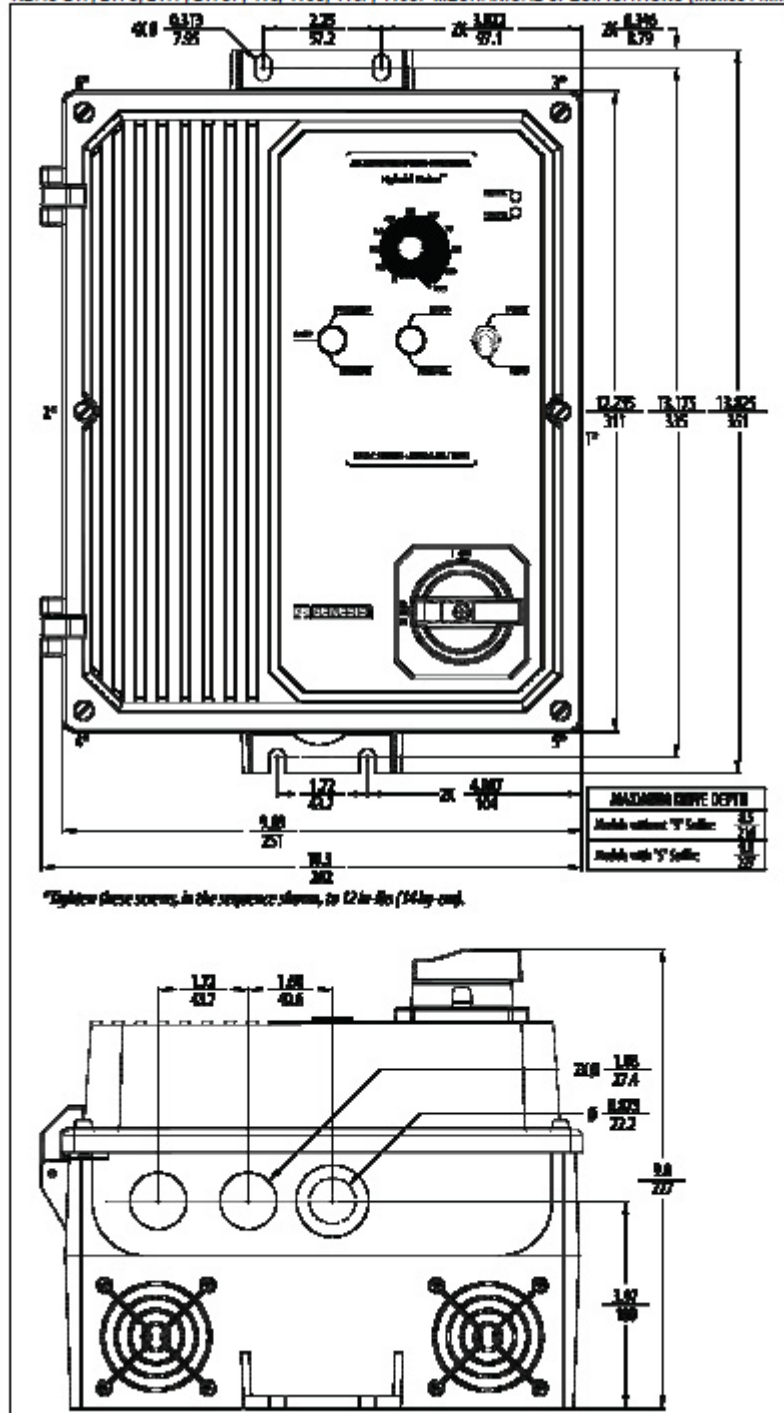


FIGURE 10  
KBAC-217, 217S, 217F, 217SF, 416, 416S, 416F, 416SF MECHANICAL SPECIFICATIONS (Inches / mm)





## 6 – AC LINE INPUT FUSING

The drive does not contain line fuses. Most electrical codes require that each ungrounded conductor contain circuit protection. Do not fuse neutral or ground connections. It is recommended to install a fuse (Littelfuse 312/314, Buss ABC, or equivalent) or a circuit breaker in series with each ungrounded conductor. Do not fuse motor leads. For the recommended fuse size, see Table 2 on page 7.

**CAUTION!** Do not fuse neutral or grounded connections.

## 7 – ELECTRICAL CONNECTIONS

Wire the drive in accordance with the National Electrical Code requirements and other local codes that may apply to the application.

**WARNING!** Read Safety Warnings, on page 5, before using the drive. Disconnect main power before making connections to the drive. To avoid electric shock, be sure to properly ground the drive. It is highly recommended that the Signal Isolator be installed when using signal following.

**WARNING! HIGH VOLTAGE! REMOTE CONNECTIONS OF POTENTIOMETER, SWITCHES, ETC., WILL HAVE WIRING THAT IS AT LINE POTENTIAL. IT IS REQUIRED THAT THE SIGNAL ISOLATOR BE INSTALLED FOR REMOTE CONNECTIONS.**

Be sure to properly fuse each AC Line conductor that is not at ground potential. Do not fuse neutral or grounded conductors. A separate AC Line switch or contactor must be wired as a disconnect so that each ungrounded conductor is opened. For fuse or circuit breaker selection, see Table 2 on page 7. Also see Section 6 above.

To maintain the watertight integrity of the drive, be sure to use suitable liquidtight fittings and wiring which are appropriate for the application. Liquidtight Fittings Kits are available for all models. See Section 14 on page 23.

The drive is designed with a hinged case so that when the front cover is open, all wiring stays intact. To open the cover, the four screws must be loosened so they are no longer engaged in the case bottom. After mounting and wiring, close the cover making sure that the wires do not get caught or crimped as the cover is closed. Tighten the four screws so that the gasket is slightly compressed. The recommended tightening torque is 12 in-lbs (14 kg-cm) – do not overtighten. See Figures 8 – 10 on pages 12 – 14 for the tightening sequence.

**Application Note:** To avoid erratic operation, do not bundle the AC Line and motor wires with each other or with wires from signal following, start/stop contacts, or any other signal wires. Also, do not bundle motor wires from multiple drives in the same conduit. Use shielded cables on all signal wiring over 12" (30 cm). The shield should be earth grounded on the drive side only. Wire the drive in accordance with the National Electrical Code requirements and other local codes that may apply.

**TABLE 4**  
**TERMINAL BLOCK WIRE SIZE AND TIGHTENING TORQUE SPECIFICATIONS**

Terminal Block	Description	Model	Maximum Wire Size (Cu)		Recommended Tightening Torque	
			AWG	mm <sup>2</sup>	in-lbs	kg-cm
TB1	AC Line Input and Motor Wiring	KBAC-24D	12	3.3	7	8
		KBAC-27D, 29, 29 (1P), 45, 48	12	3.3	12	14
TB2	Run/Fault Relay Output Contacts	KBAC-24D, 27D, 29, 29 (1P), 45, 48	14	2.08	3.5	4
		KBAC-217, 217S, 217F, 217SF, 416, 416S, 416F, 416SF	12	3.3	4.4	5

### 7.1 – AC LINE INPUT CONNECTION

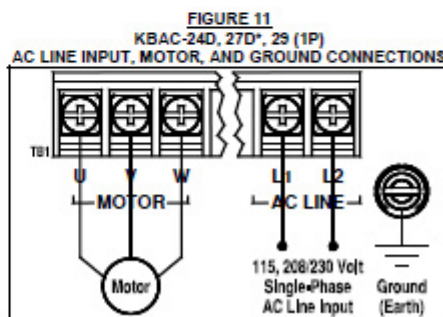
Connect the AC Line Input to Terminal Block TB1. See Figures 11 – 13 on pages 15 and 16.

**GFCI Operation:** Second Generation (2G) models require custom software – contact Technical Support. Third Generation models are jumper selectable (J12) for Standard (G1) or Sensitive (G2) GFCIs.

**CAUTION!** The rated AC Line voltage of the drive must match the actual AC Line input voltage. On KBAC-24D, 27D the setting of Jumper J1 must match the AC Line input voltage.

**KBAC-24D, 27D:** Designed to accept 1-phase AC Line Input only (Terminals L1, L2). Rated for 208/230 Volt AC Line Input with Jumper J1 set to the "230V" position (factory setting). Rated for 115 Volt AC Line Input with Jumper J1 set to the "115V" position. See Figure 11.

**KBAC-29 (1P):** Designed to accept 1-phase AC Line Input (Terminals L1, L2). Rated for 208/230 Volt AC Line Input only. See Figure 11.





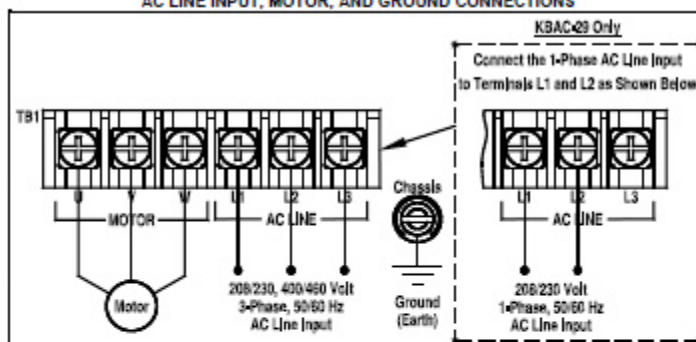
**KBAC-29:** Designed to accept 1-phase (Terminals L1, L2) or 3-phase (Terminals L1, L2, L3) AC Line Input. Rated for 208/230 Volt AC Line Input only. See Figure 12.

**KBAC-45, 48:** Designed to accept 3-phase AC Line input only (Terminals L1, L2, L3). Rated for 400/460 Volt AC Line Input only. See Figure 12.

**KBAC-217, 217S, 217F, 217SF:** Designed to accept 3-phase (Terminals L1, L2, L3) AC Line Input. Rated for 208/230 Volt AC Line Input only. See Figure 13.

**KBAC-416, 416S, 416F, 416SF:** Designed to accept 3-phase (Terminals L1, L2, L3) AC Line Input. Rated for 400/460 Volt AC Line Input only. See Figure 13.

**FIGURE 12**  
KBAC-29\*, 45, 48  
AC LINE INPUT, MOTOR, AND GROUND CONNECTIONS



## 7.2 – MOTOR CONNECTION

Connect the motor to Terminal Block TB1 Terminals U, V, W. See Figures 11 – 13 on pages 15 and 16.

Motor cable length should not exceed 100 feet (30 m) – special reactors may be required – contact Technical Support. Be sure Jumper J2 is set to the corresponding motor horsepower rating, as described in Section 10.2 on page 19.

## 7.3 – GROUND CONNECTION

Connect the Ground Wire (Earth) to the Green Ground Screw. The Ground Screws are located next to Terminal Block TB1. See Figures 11 – 13 on pages 15 and 16.

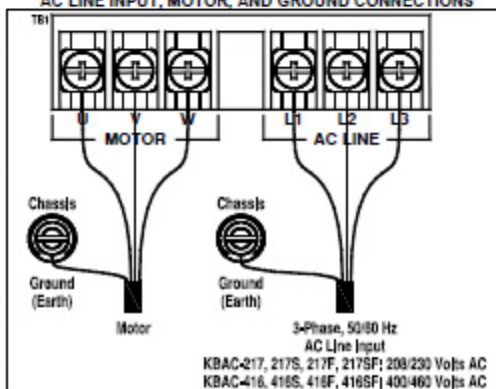
## 7.4 – REMOTE MAIN SPEED POTENTIOMETER CONNECTION

The drive is supplied with a prewired Main Speed Potentiometer mounted on the front cover. To operate the drive from a remote potentiometer (5 kΩ), remove the white, orange, and violet potentiometer leads from Terminals P1, P2, P3. The wires may be taped and left inside the drive. The potentiometer assembly may be removed if a watertight seal is used to cover the hole in the front cover. Connect the Main Speed Potentiometer to Terminals P1 (low side), P2 (wiper), and P3 (high side). See Figure 14.

**WARNING!** Do not earth ground any Main Speed Potentiometer terminals.

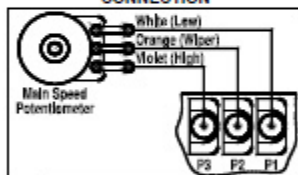
**Application Note:** If it is required that the Remote Main Speed Potentiometer be isolated from the AC Line, install the Signal Isolator. See Section 14 on page 23.

**FIGURE 13**  
KBAC-217, 217S, 217F, 217SF, 416, 416S, 416F, 416SF  
AC LINE INPUT, MOTOR, AND GROUND CONNECTIONS



**FIGURE 14**

## REMOTE MAIN SPEED POTENTIOMETER CONNECTION



**WARNING! HIGH VOLTAGE!**  
See Warning on page 15.

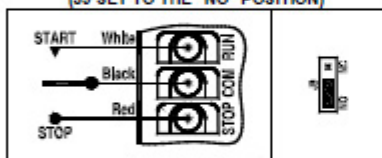
## 7.5 – REMOTE START/STOP SWITCH CONNECTIONS

The drive is supplied with a prewired Start/Stop Switch mounted on the front cover to electronically start and stop the drive. Also see Section 10.8 on page 20.

To operate the drive from a remote Start/Stop Switch (type (ON)-OFF-(ON), SPDT), remove the white, black, and red wires from Terminals RUN, COM, and STOP. The wires may be taped and left inside the drive. The switch assembly may be removed if a liquidtight seal is used to cover the hole in the front cover. After applying power to the drive, momentarily set the Start/Stop Switch to the "START" position. Jumper J9 must be set to the "NO" position. See Figure 15.

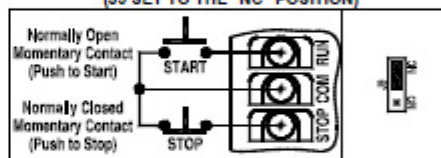
For Start/Stop Switch with normally closed stop contact, set Jumper J9 to the "NC" position. See Figure 16.

**FIGURE 15**  
REMOTE START/STOP SWITCH CONNECTION  
WITH NORMALLY OPEN STOP CONTACT  
(J9 SET TO THE "NO" POSITION)



**WARNING! HIGH VOLTAGE!** See Warning on page 15.

**FIGURE 16**  
REMOTE START/STOP SWITCH CONNECTION  
WITH NORMALLY CLOSED STOP CONTACT  
(J9 SET TO THE "NC" POSITION)



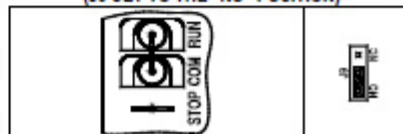
## 7.6 – AUTOMATIC RESTART

Automatic restart requires the elimination of the Start/Stop Switch. Remove the white, black, and red wires from Terminals RUN, COM, and STOP. The wires may be taped and left inside the drive. The switch assembly may be removed if a liquidtight seal is used to cover the hole in the front cover.

To eliminate the Start/Stop function, hardwire Terminals RUN and COM with the jumper that is provided. Be sure Jumper J9 is set to the "NO" position. See Figure 17.

**WARNING!** Using a jumper to eliminate the Start/Stop function will cause the motor to run at the Main Speed Potentiometer setting when the AC Line is applied.

**FIGURE 17**  
START/STOP FUNCTION ELIMINATED  
(TERMINALS HARDWIRED) (JUMPER INSTALLED)  
(J9 SET TO THE "NO" POSITION)



**WARNING! HIGH VOLTAGE!** See Warning on page 15.

## 7.7 – VOLTAGE FOLLOWING CONNECTIONS

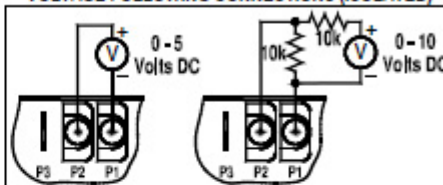
An isolated 0 – 5 Volt DC analog signal input can also be used to control motor speed in lieu of the Main Speed Potentiometer. The drive output will linearly follow the analog signal input. Wire the signal input positive lead (+) to Terminal P2 and the negative lead (-) to Terminal P1. With external circuitry, a 0 – 10 Volt DC analog signal can also be used. See Figure 18.

**WARNING!** The signal input must be isolated from the AC Line. Earth grounding signal wiring will damage the drive and void the warranty. It is highly recommended that the Signal Isolator be installed when using signal following.

\*If a non-isolated signal is used, install the Signal Isolator. It accepts voltage (0 to  $\pm 2.5$  thru 0 to  $\pm 25$  Volts DC) or current (4 – 20 mA DC) signal inputs. See Section 14 on page 23.

**Note:** For signal following operation, the Minimum Speed Trimpot (MIN) must be set fully counterclockwise.

**FIGURE 18**  
VOLTAGE FOLLOWING CONNECTIONS (ISOLATED)



**WARNING! HIGH VOLTAGE!** See Warning on page 15.

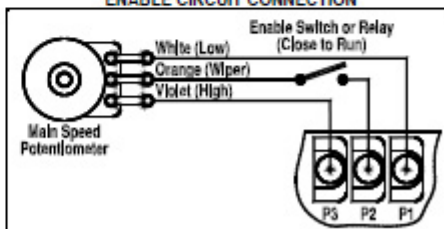
## 7.8 – ENABLE CIRCUIT CONNECTION

The drive can also be started and stopped with an Enable circuit (close to run, open to stop). See Figure 19.

The Enable function is established by wiring a switch or contact in series with the orange Main Speed Potentiometer lead which connects to Terminal P2. When the Enable Switch is closed, the motor will accelerate to the Main Speed Potentiometer setting. When the Enable Switch is opened, the motor will decelerate to stop.

**WARNING!** If the Enable Switch is to be mounted remotely, it is highly recommended that the Signal Isolator be installed.

**FIGURE 19**  
ENABLE CIRCUIT CONNECTION



**WARNING! HIGH VOLTAGE!** See Warning on page 15.





## 10 – SETTING SELECTABLE JUMPERS

The drive has customer selectable jumpers which must be set before the drive can be used.

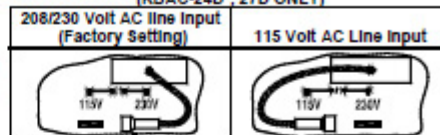
**WARNING! HIGH VOLTAGE!** Disconnect the AC Line before changing position of jumpers.

### 10.1 – AC LINE INPUT VOLTAGE SELECTION (KBAC-24D, 27D ONLY) (J1)

**CAUTION!** The rated AC Line voltage of the drive must match the actual AC Line input voltage. On KBAC-24D, 27D the setting of Jumper J1 must match the actual AC Line input voltage.

Jumper J1 is factory installed on Terminal "230V" for 208/230 Volt AC Line Input. For 115 Volt AC Line Input, the jumper must be removed and installed on Terminal "115V". To remove the terminal, use pliers to gently rock the terminal back and forth while pulling it upward. See Figure 22.

**FIGURE 22**  
AC LINE INPUT VOLTAGE SELECTION  
(KBAC-24D\*, 27D ONLY)



\*Layout of KBAC-24D varies slightly.

### 10.2 – MOTOR HORSEPOWER SELECTION (J2)

Jumper J2 must be set to the corresponding position for the motor being used. See Figure 23.

**FIGURE 23**  
MOTOR HORSEPOWER SELECTION (J2)

	KBAC-24D	KBAC-27D	KBAC-29*	KBAC-29 (1P)*	KBAC-45*	KBAC-48*	KBAC-217 Series*	KBAC-416 Series*
<b>A</b>	<b>1</b>	<b>2**</b>	<b>3***</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>5</b>	<b>10</b>
<b>B</b>	<b>3/4</b>	<b>1 1/2**</b>	<b>2***</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>7.5</b>
<b>C</b>	<b>1/2</b>	<b>1</b>	<b>1 1/2</b>	<b>1 1/2</b>	<b>1 1/2</b>	<b>2</b>	<b>2</b>	<b>5</b>
<b>D</b>	<b>1/4</b>	<b>3/4</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1 1/2</b>	—	—
<b>E</b>	<b>1/8</b>	<b>1/2</b>	<b>3/4</b>	<b>3/4</b>	<b>3/4</b>	<b>1</b>	—	—

The factory setting is shown in bold. \*J2 on KBAC-29, 29 (1P), 45, 48 is labeled "A, B, C, D, E" and on KBAC-217, 416 Series is labeled "A, B, C". \*\*KBAC-27D: Rated 1 1/2 HP maximum with 115 Volt AC Line input and 2 HP maximum with 208/230 Volt AC Line input. \*\*\*KBAC-29: Rated 2 HP maximum with 1-phase AC Line input and 3 HP maximum with 3-phase AC Line input.

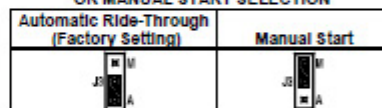
### 10.3 – AUTOMATIC RIDE-THROUGH OR MANUAL START SELECTION (J3)\*

Jumper J3 is factory set to the "A" position for Automatic Ride-Through. If the power is interrupted for up to 2 seconds, the drive will shut down and then "ride-through" and automatically return to the set frequency. See Figure 24.

If Jumper J3 is set to the "M" position, the drive will have to be manually restarted for a momentary power loss using the Start/Stop Switch. Also see Section 13.2 on page 23 for the Status (ST) LED indication.

\*On KBAC-24D, 217, 217S, 217F, 217SF, 416, 416S, 416, 416F, 416SF Jumper J3 is labeled "AUTO" and "MAN".

**FIGURE 24**  
AUTOMATIC RIDE-THROUGH  
OR MANUAL START SELECTION



### 10.4 – MOTOR FREQUENCY SELECTION (J4 AND J5)

Both Jumpers J4 and J5 must be set for the appropriate motor nameplate frequency rating. See Figures 25 and 26.

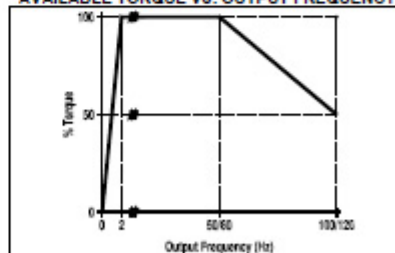
#### 10.4.1 – SETTING THE DRIVE FOR 60 Hz OR 50 Hz MOTOR OPERATION

The drive is factory set to operate 60 Hz motors. Jumper J4 is factory set to the "1X" position and Jumper J5 is factory set to the "60Hz" position. For 50 Hz motors, set Jumper J5 to the "50Hz" position, and be sure Jumper J4 is set to the "1X" position. See Figure 26.

#### 10.4.2 – SETTING THE DRIVE FOR TWO TIMES THE RATED MOTOR RPM

The drive can also operate the motor up to two times the rated RPM. However, constant horsepower will result when operating the drive in the "2X" mode above the motor rated frequency. For 120 Hz output with 60 Hz motor, set Jumper J4 to the "2X" position and be sure Jumper J5 is set to the "60Hz" position. For 100 Hz output with 50 Hz motor, set Jumper J4 to the "2X" position and set Jumper J5 to the "50Hz" position. See Figure 26.

**FIGURE 25**  
AVAILABLE TORQUE VS. OUTPUT FREQUENCY



**FIGURE 26**  
MOTOR FREQUENCY SELECTION

60 Hz Motor Operation (Factory Setting)	60 Hz Motor Operation	120 Hz Motor Operation	100 Hz Motor Operation
J4: 1X, J5: 60Hz	J4: 1X, J5: 50Hz	J4: 2X, J5: 60Hz	J4: 2X, J5: 50Hz





## 10.5 – BOOST MODE SELECTION (J6)

Jumper J6 is factory set to the "FIX" position for Fixed Boost. For Adjustable Boost using the BOOST Trimpot, set Jumper J6 to the "ADJ" position. See Figure 27. Also see Section 12.8 on page 22 for the Boost Trimpot.

FIGURE 27

### BOOST MODE SELECTION



Fixed Boost (Factory Setting)	Adjustable Boost
	

## 10.6 – BRAKING MODE SELECTION (J7)

Jumper J7 is factory set to the "RG" position for Regenerative Braking when the Start/Stop Switch is set to the "STOP" position. For DC Injection Braking, set Jumper J7 to the "INJ" position. See Figure 28. Also see Section 12.5 on page 21 for the DC Injection Brake Trimpot.

FIGURE 28

### BRAKING MODE SELECTION

Regenerative Braking (Factory Setting)	DC Injection Braking
	



When the Injection Brake Mode is selected, the DECEL Trimpot is used to set the amount of time the DC current is applied to the motor.

## 10.7 – RUN/FAULT OUTPUT RELAY OPERATION SELECTION (J8)

Jumper J8 is factory set to the "R" position for "Run" operation of the Run/Fault Relay. For "Fault" operation of the Run/Fault Relay, set Jumper J8 to the "F" position. See Figure 29.

FIGURE 29

### RUN/FAULT OUTPUT RELAY OPERATION SELECTION

"Run" Operation (Factory Setting)	"Fault" Operation
	



For Run/Fault Relay output contacts, see Section 7.9 on page 18. The Run/Fault Relay contact status for various drive operating conditions is shown in Table 5 on page 18.

## 10.8 – STOP CONTACT TYPE SELECTION (J9)

Jumper J9 is factory set to the "NO" position for a normally open stop contact. For remote normally closed stop contact, set Jumper J9 to the "NC" position. See Figure 30. For wiring information, see Section 7.5 on page 17.

FIGURE 30

### STOP CONTACT TYPE SELECTION



Normally Open Stop Contact (Factory Setting)	Normally Closed Stop Contact
	

## 10.9 – TORQUE MODE SELECTION (J10)

Jumper J10 is factory set to the "CT" position for Constant Torque Mode, which is desirable for most machine applications. For Variable Torque Mode, used for HVAC and fan applications, set Jumper J10 to the "VT" position. See Figure 31.

FIGURE 31

### TORQUE MODE SELECTION

Constant Torque (Factory Setting)	Variable Torque
	

## 10.10 – JUMPER J11

Factory use only.










## 10.11 – SWITCHING FREQUENCY AND GFCI SELECTION (J12) (THIRD GENERATION (3G) DRIVES ONLY)

Jumper J12 is factory set to the "8K" position for a switching frequency at the motor of 8 kHz. For 12 kHz switching frequency, set Jumper J12 to the "12K" position. This jumper also allows the drive to be used on standard ("G1" position) or sensitive ("G2" position) GFCIs. See Figure 32.

Note: GFCI operation may increase audible motor noise.

FIGURE 32

### SWITCHING FREQUENCY AND GFCI SELECTION

KBAC-24D, 27D, 29, 29 (1P), 45, 48	KBAC-217, 416 Series
 Sensitive GFCI	 8 kHz Switching Frequency*
 Standard GFCI	 12 kHz Switching Frequency
 12 kHz Switching Frequency	 Standard GFCI
 8 kHz Switching Frequency*	 Sensitive GFCI
	 Not Used

\*Factory setting.

\*Factory setting.

## 11 – DRIVE OPERATION

### 11.1 – START-UP PROCEDURE

After the drive has been properly setup (jumpers and trimpots set to the desired positions) and wiring completed, the start-up procedure can begin. If the AC power has been properly brought to the drive, the power (PWR) LED will illuminate green. The status (ST) LED will indicate drive status, as described in Section 13.2 on page 23.

To start the drive, momentarily set the Start/Stop Switch to the "START" position. The motor will begin to accelerate to the set speed.



**WARNING!** Using a jumper to eliminate the start/stop function will cause the motor to run at the Main Speed Potentiometer setting when the AC Line is applied. See Section 11.2 on page 21.

Note: If the motor rotates in the incorrect direction, it will be necessary to disconnect the AC Line, reverse any two motor leads, and repeat the start-up procedure.



## 11.2 – RESTARTING THE DRIVE AFTER A FAULT HAS CLEARED<sup>1,2</sup>

The drive monitors five faults: Undervoltage, Overvoltage, Short Circuit at the motor (phase-to-phase), Overload and Phase Loss Detection. See Section 13.2 on page 23 for the Status (ST) LED Indication. Also see Section 10.3 on page 19 for Automatic Ride-Through or Manual Restart selection with Jumper J3.

To restart the drive after a fault has been cleared, use the Start/Stop Switch.<sup>2,3</sup> If the Start/Stop Switch has been eliminated (bypassed), see Section 7.6 on page 17.<sup>4</sup> The drive can be restarted (after the fault has been cleared) by disconnecting the AC power, and all LEDs are no longer illuminated, and then reconnecting the AC power.

**Notes:** 1. For an Overload Fault, be sure the fault has been cleared before restarting the drive. Check the motor current with an AC RMS responding ammeter. Also, the CL setting may be set too low. See Section 13.7 on page 30. 2. For an Overvoltage Fault, if the drive is set for Automatic Ride-Through, the drive will automatically restart when the AC Line voltage returns to below the specified Overvoltage Trip Point. 3. If the Forward-Stop-Reverse Switch has been installed, it can be used to restart the drive. 4. If the Start/Stop Switch has been eliminated (bypassed), the AC Line must be used to restart the drive after an Overload Fault has been cleared.

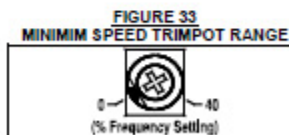
## 12 – TRIMPOT ADJUSTMENTS

The drive contains trimpots which are factory set for most applications. See Figures 4 – 7 on pages 8 – 11 for the location of the trimpots and their approximate factory calibrated positions. Some applications may require readjustment of the trimpots in order to tailor the drive for a specific requirement. The trimpots may be readjusted as described in this section.

**WARNING!** If possible, do not adjust trimpots with the main power applied. If adjustments are made with the main power applied, an insulated adjustment tool must be used and safety glasses must be worn. High voltage exists in this drive. Fire and/or electrocution can result if caution is not exercised. The Safety Warnings on page 5 must be read and understood before proceeding.

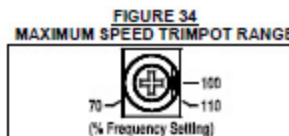
### 12.1 – MINIMUM SPEED TRIMPOT (MIN)

Sets the minimum speed of the motor. The MIN Trimpot is factory set to 0% of frequency setting. For a higher minimum speed setting, rotate the MIN Trimpot clockwise. See Figure 33.



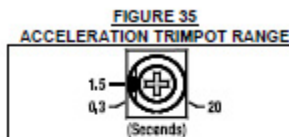
### 12.2 – MAXIMUM SPEED TRIMPOT (MAX)

Sets the maximum speed of the motor. The MAX Trimpot is factory set to 100% of frequency setting. For a lower maximum speed setting, rotate the MAX Trimpot counterclockwise. For a higher maximum speed setting, rotate the MAX Trimpot clockwise. See Figure 34.



### 12.3 – ACCELERATION TRIMPOT (ACCEL)

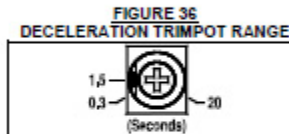
Sets the amount of time for the motor to accelerate from zero speed to full speed. The ACCEL Trimpot is factory set to 1.5 seconds. For a longer acceleration time, rotate the ACCEL Trimpot clockwise. For more rapid acceleration, rotate the ACCEL Trimpot counterclockwise. See Figure 35.



**Note:** Rapid acceleration settings may cause the current limit circuit to activate, which will extend the acceleration time.

### 12.4 – DECELERATION TRIMPOT (DECEL)

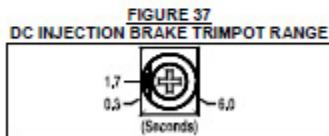
Sets the amount of time for the motor to decelerate from full speed to zero speed. The DEC/I Trimpot is factory set to 1.5 seconds. For longer deceleration time, rotate the DEC/I Trimpot clockwise. For more rapid deceleration, rotate the DEC/I Trimpot counterclockwise. See Figure 36.



**Application Note:** On applications with high inertial loads, the deceleration time may automatically increase. This will slow down the decrease speed to prevent the bus voltage from rising to the Overvoltage Trip point. This function is called Regeneration Protection. It is recommended that for very high inertial loads that both the ACCEL and DEC/I Trimpots be set to greater than 10 seconds.

### 12.5 – DC INJECTION BRAKE TRIMPOT (DECEL)

The drive is factory set for Regenerative Braking (Jumper J7 set to the "RG" position). When the drive is set for DC Injection Brake (Jumper J7 set to the "INJ" position), the DECEL Trimpot is used to set the amount of time the DC current is applied to the motor. See Figure 37. Also see Section 10.6 on page 20.





## 12.6 – SLIP COMPENSATION TRIMPOT (COMP)

Sets the amount of Volts/Hz to maintain set motor speed under varying loads. The COMP Trimpot is factory set to 1.5 Volts/Hz, which provides excellent speed regulation for most motors. To increase the slip compensation, rotate the COMP Trimpot clockwise. To decrease the slip compensation, rotate the COMP Trimpot counterclockwise. See Figure 38.

The slip compensation may be adjusted as follows:

1. Wire an AC RMS ammeter in series with one motor phase.
2. Run the motor and set the unloaded speed to approximately 50% (900 RPM on 4-pole 1500/1725 RPM motors).
3. Using a tachometer, record the unloaded speed.
4. Load the motor to the nameplate rated current (AC Amps).
5. Adjust the COMP Trimpot until the loaded RPM is equal to the unloaded RPM.
6. The motor is now compensated to provide constant speed under varying loads.

FIGURE 38  
SLIP COMPENSATION TRIMPOT RANGE

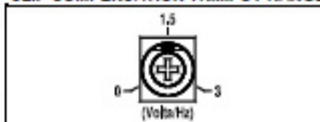


FIGURE 39  
CURRENT LIMIT TRIMPOT RANGE



## 12.7 – MOTOR OVERLOAD (P<sub>t</sub>) WITH RMS CURRENT LIMIT TRIMPOT (CL)\*

Sets the current limit (overload), which limits the maximum current to the motor, which prevents motor burnout and eliminates nuisance trips. The CL Trimpot is factory set to 160% of the drive rated current. To increase the current limit, rotate the CL Trimpot clockwise. To decrease the current limit, rotate the CL Trimpot counterclockwise. See Figures 39 and 40.

\*UL approved as an electronic overload protector for motors.

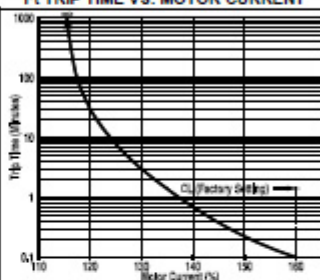
The current limit may be adjusted as follows:

1. Connect an AC RMS ammeter in series with one motor phase.
2. Set the CL Trimpot fully counterclockwise.
3. Adjust the speed setting to 30%.
4. Lock the motor shaft and adjust the CL Trimpot to 160% of the motor nameplate rated current.

Note: This adjustment must be made within 8 seconds or an P<sub>t</sub> Trip will occur.

**CAUTION!** Adjusting the current limit above 160% of the motor nameplate rated current can cause overheating of the motor. Consult the motor manufacturer. Do not leave the motor in a locked rotor condition for more than a few seconds since motor damage may occur. In order to ensure that the motor is properly protected with the P<sub>t</sub> feature, it is required that the CL Trimpot be set for 160% of the motor nameplate rated current, as described below.

FIGURE 40  
P<sub>t</sub> TRIP TIME VS. MOTOR CURRENT



## 12.8 – BOOST TRIMPOT (BOOST)

The drive is factory set for Fixed Boost (Jumper J6 set to the "FIX" position). When the drive is set for Adjustable Boost (Jumper J6 set to the "ADJ" position), the BOOST Trimpot can be used to adjust the amount of boost voltage to the motor. See Figure 41. Also see Section 10.5 on page 20.

Application Note: The Boost function operates over a frequency range of 0 – 15 Hz. If the frequency range required is above 15 Hz, Boost adjustment is not necessary.

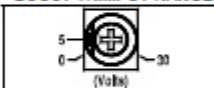
**WARNING!** To avoid motor winding overheating and failure, do not overboost the motor.

Note: An unloaded motor with excessive boost will draw more current than a partially loaded motor.

The boost voltage may be adjusted as follows:

1. Wire an AC RMS ammeter in series with one motor phase.
2. Run the motor unloaded at approximately 4 Hz (or 120 RPM).
3. Increase the boost until the ammeter reaches the motor nameplate rated current (Amps AC).
4. Using the Main Speed Potentiometer, slowly adjust the motor speed over a 1 – 15 Hz (0 – 450 RPM) range. If the motor current exceeds the nameplate rating, decrease the boost setting.

FIGURE 41  
BOOST TRIMPOT RANGE



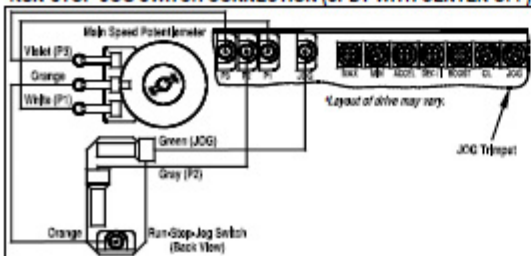
## 12.9 – JOG TRIMPOT (JOG)

The Jog feature requires the installation of the optional Run-Stop-Jog Switch Kit. The JOG Trimpot range is shown in Figure 42. Connect the switch as shown in Figure 43.

FIGURE 42  
JOG TRIMPOT RANGE



FIGURE 43  
RUN-STOP-JOG SWITCH CONNECTION (SPDT WITH CENTER OFF)



The orange Main Speed Potentiometer wire (wiper) which connects to Terminal P2 on the drive must be removed and installed on Terminal RUN on the switch. Terminal JOG on the drive connects to "JOG" on the switch. Terminal "P2" on the drive connects to the center (common) terminal on the switch. When the switch is in the "JOG" position, the JOG Trimpot is used to set the "jog" speed. When the switch is in the "RUN" position, the Main Speed Potentiometer is used for speed setting. The Run-Stop-Jog Switch is available as an optional accessory. See Section 14 on page 23.



## 13 – DIAGNOSTIC LEDs

The drive contains two diagnostic LEDs mounted on the enclosure cover to display the drive's operational status.

**WARNING!** Do not depend on the PWR LED as a guaranteed power off condition. Be sure the main power switch or circuit breaker is in the "OFF" position before servicing this drive.

### 13.1 – POWER ON LED (PWR)

The "PWR" LED will illuminate green when the AC Line is applied to the drive.

### 13.2 – STATUS LED (ST)

The "ST" LED is a tricolor LED which provides indication of a fault or abnormal condition. The information provided can be used to diagnose an installation problem such as incorrect input voltage, overload condition, and drive output miswiring. It also provides a signal which informs the user that all drive and microcontroller operating parameters are normal. Table 6 summarizes the "ST" LED functions.

**TABLE 6**  
DRIVE OPERATING CONDITION AND STATUS LED INDICATOR

Drive Operating Condition	Flash Rate <sup>1</sup> and LED Color
Normal Operation	Slow Flash Green
Overload (120% – 160% Full Load)	Steady Red <sup>2</sup>
Pt (Drive Timed Out)	Quick Flash Red <sup>2</sup>
Short Circuit	Slow Flash Red
Undervoltage	Quick Flash Red / Yellow <sup>3</sup>
Overvoltage	Slow Flash Red / Yellow <sup>3</sup>
Stop	Steady Yellow
Stand-By <sup>4</sup>	Slow Flash Yellow
Input Phase Loss <sup>5</sup>	Rapid Flash Yellow
Overtemperature Trip <sup>6</sup>	Slow / Quick Flash Red <sup>4</sup>

Notes: 1. Slow Flash = 1 second on and 1 second off. Quick Flash = 0.25 second on and 0.25 second off. 2. When the Overload is removed, before the Pt times out and trips the drive, the "ST" LED will flash green. 3. When the Undervoltage or Overvoltage condition is corrected, the "ST" LED will flash Red / Yellow / Green. 4. Only if the Forward-Stop-Reverse Switch is Installed. 5. KBAC-20, with three-Phase AC Line Input and KBAC-45, 48. Rapid Flash = 4 mSec on and 6 mSec off. 6. KBAC-217, 416 Series only.

## 14 – OPTIONAL ACCESSORIES

Detailed instructions are provided with all accessories. See Table 7.

**TABLE 7**  
OPTIONAL ACCESSORIES

Description	KBAC-24D	KBAC-27D	KBAC-29	KBAC-29 (1P)	KBAC-45	KBAC-48	KBAC-217 Series KBAC-416 Series
Forward-Stop-Reverse Switch Kit: Provides motor reversing and stop functions. Mounts on the enclosure cover and is supplied with a switch seal to maintain liquidtight integrity.	9480	9480	9480	9480	9480	9480	8888
On/Off AC Line Switch Kit: Disconnects the AC Line. Mounts on the enclosure cover and is supplied with a switch seal to maintain liquidtight integrity.	9482	9523	9523	9523	9532	9532	"S" Suffix Models (Factory Installed)
Run-Stop-Jog Switch Kit: Selects speed setting from either the Main Speed Potentiometer or the JOG Trimpot. Mounts on the enclosure cover and is supplied with a switch seal to maintain liquidtight integrity.	9340	9340	9340	9340	9340	9340	8889
SIAC-PS Signal Isolator Kit: Provides isolation between a non-isolated signal source and the drive. Mounts on the drive's PC board with four snap-ins.	2G	9600C	9600C	9600C	9600C	9600C	—
	3G <sup>1</sup>	8890	8890	8890	8890	8890	8890
Auto/Manual Switch Kit: When used with the Signal Isolator, it selects remote process signal or the Main Speed Potentiometer. Mounts on the enclosure cover and is supplied with a switch seal to maintain liquidtight integrity.	9481	9481	9481	9481	9481	9481	8891
SIAC-PS Signal Isolator Kit and Auto/Manual Switch Kit	9605	9605	9605	9605	9605	9605	8893
AC Line Filter Kit <sup>2</sup> : Provides Class A RFI (EMI) suppression. Installs onto the drive's PC board with quick-connect terminals. "S" Suffix filter is used when On/Off AC Line Switch is Installed. "NS" Suffix filter is used when On/Off AC Line Switch is not Installed.	"S" Suffix	9507	9512	9479	—	9479	"F" Suffix Models (Factory Installed)
	"NS" Suffix	9507	9512	9515	—	9515	
Liquidtight Fittings Kit: Provide a liquidtight seal for wiring the drive.	9526	9526	9526	9526	9526	9526	8892

Notes: 1. Third Generation (3G) drives are marked "(3G)" on the product label. 2. Complies with CE Council Directive 89/336/EEC Industrial Standard.





# LCFC Filter Cart

Flow rate available in 1 GPM, 5 GPM, 11 GPM, & 22 GPM

**TO VALIDATE THE 18 MONTH WARRANTY, PLEASE REGISTER THIS PRODUCT ONLINE**



**[KBElectronics.com/registration.htm](http://KBElectronics.com/registration.htm)**

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