Central Vacuum System

Installation, Operation, Maintenance, and Troubleshooting Guide

KICE INDUSTRIES, INC.

INTRODUCTION

The following information outlines typical installation, operation, maintenance, and troubleshooting information associated with Kice Centro-Vac Systems. There may be unique situations, designs and/or requirements that fall outside of this guide.

FOLLOW ALL SAFETY GUIDELINES WHEN WORKING ON OR OPERATING EQUIPMENT

General System Components

Kice "Centro-Vac" systems generally consist of the following components:

- High Vacuum Filter/Receiver
- Rotary Airlock Valve (installed under the filter/receiver discharge)
- Vacuum Air Power Unit
- Ducting runs ending in a Kice Snap Cap connection
- Kice Vacuum Tool Set(s)
- Electrical Control Panel Enclosure with push button start/stop

Reference Appendix A for example system layouts
Reference Appendix B for coupling information
Reference Appendix C for relief valve maintenance, installation, and operation

System Overview

The main system components are the high vacuum filter/receiver with airlock on the discharge and Vacuum Air Power Unit providing the suction. From the filter, various header runs go out to the pickup locations. Each pickup location is terminated with a Kice Snap Cap. Users connect the Kice 25A fitting on the hose to the 3" Snap Cap by lifting the Snap Cap open and inserting the fitting. Once the system is turned on, a high vacuum should be at the Snap Cap and/or end of hose, tool, etc.

Generally, the number of drops is not important. The number of "users" at any given time and total ducting equivalent length (vertical, horizontal, number of elbows, etc.) is of primary concern. The system is designed to provide approximately 200 CFM per operator and between 8" and 12" HG vacuum. Kice standard vacuum hose is 25 feet long.

> **IMPORTANT:** A dust collection system is not a Central-Vac system and a Central-Vac System is not a dust collector. Typically dust collection systems have larger air volumes and lower dust loading while Central-Vac systems have lower air volumes and much higher dust loading.

Installation Guidelines

General Equipment Installation

- Refer to and follow all drawings provided. Once equipment is in place, verify dimensions from drawing. Occasionally, the structure(s) legs will need to be spread slightly to set per drawing, due to transportation, lifting and/or setting.

- Reference all specific equipment manuals provided with the equipment. Contact Kice Industries or the original equipment manufacturer for any questions *(see page 3 for contact info)*.

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Vacuum Line Installation

• Cut all tubing square and deburr.

• Typically 3” OD 16 ga. Aluminum tubing (unpainted) may be used for straight runs due to lighter weight, ease of installation, and runs not typically being associated with wear issues.

• Use 3” OD 16 ga. Carbon Steel (unpainted) for short radius elbows for additional wear resistance.

IMPORTANT: Unpainted vacuum lines provide better electrical continuity and grounding for the system. If painted vacuum lines are required, make sure paint is removed underneath the coupling or connecting flange for direct bare metal to bare metal contact.

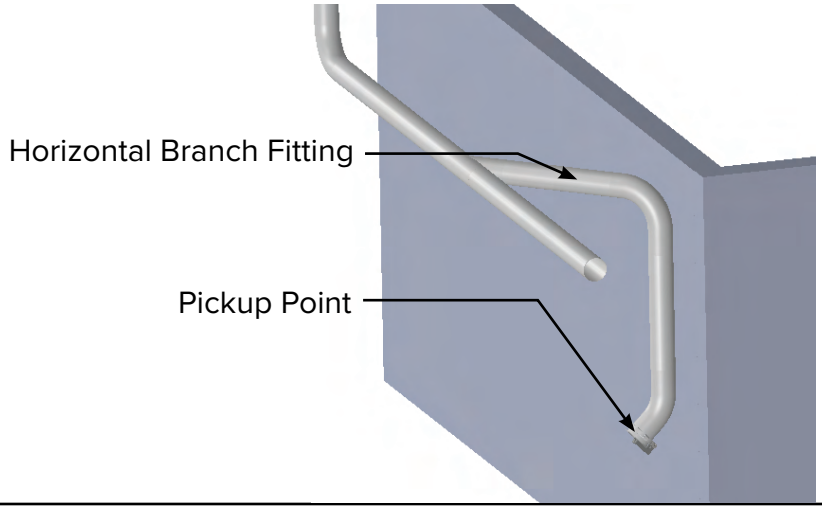
NOTICE: If wear is not an issue, consider using Aluminum elbows. If wear is an issue, consider using 11 ga. carbon steel elbows.

• On header lines use Kice 82M series 3” OD x 3-bolt heavy-duty compression couplings with ground strip to connect lines. Tighten the coupling bolts until the flanges touch *(see Appendix B for reference)*.

IMPORTANT: To get best grounding, make sure grounding strip on the coupling touches bare metal on both sides of the coupling.

• Kice recommends orienting branch fittings horizontally and then turning down vertically to keep material from falling back into line.

NOTICE: Typically material “slugs” along the bottom of the tubing runs. Horizontal branch fittings keep material from falling into an unused drop. Horizontal branch fittings are recommended, but other considerations like building design, end-user requirements, or ease of installation, may require the system to have branch fittings that drop straight down.



• Include 3” OD Snap Cap at each pickup point. Snap Cap should be located approximately 3’- 4’ above floor.

NOTICE: A 45-degree elbow should be installed prior to Snap Cap when possible to keep the hose from pointing either horizontal or vertical. This keeps the hose from kinking.

• 3” OD header designed for up to two (2) users per header.

NOTICE: Centro-Vac systems may have multiple inlets and can allow multiple users, but should be limited to two (2) users per 3” OD header.

• Ducting from the Filter/Receiver to the Vacuum Air Power Unit is typically larger than the header lines to allow for reduction in air velocity to APU.

• Support tubing as needed.

NOTICE: Kice can provide an 88A3 Aluminum Support Ring for 3” OD tubing if needed.

• Stock Chamber may be used at the bottom of “vertical up” run systems for heavy items (bolts, etc.) that will drop out of a vertical “up” run. These items can fall down into the stock chamber. Stock Chambers can quickly fill up and become an operations/maintenance item.

Standard Vacuum Hose

• Kice standard vacuum hose part #10002977 - 2” ID x 25’ long *(Refer to OPTIONAL TOOLS AND ACCESSORIES on page 9 for additional information)*.

General Hose Recommendations:

- Hose should not exceed 25’ in length.
- Hoses account for considerable resistance and longer hoses tend to get caught in and around machinery more easily.
- Long hose lengths can isolate the static from the ground wire.
- If longer hose lengths are required, the additional pressure loss due to the longer length should be considered.

Vacuum Air Power Unit Installation

• Blowers are shipped from Kice dry to end user.

LUBRICATION (i.e., oil) NEEDS TO BE ADDED TO THE VACUUM AIR POWER UNIT BEFORE STARTUP or blower/pump may seize. This is not covered by any warranty.

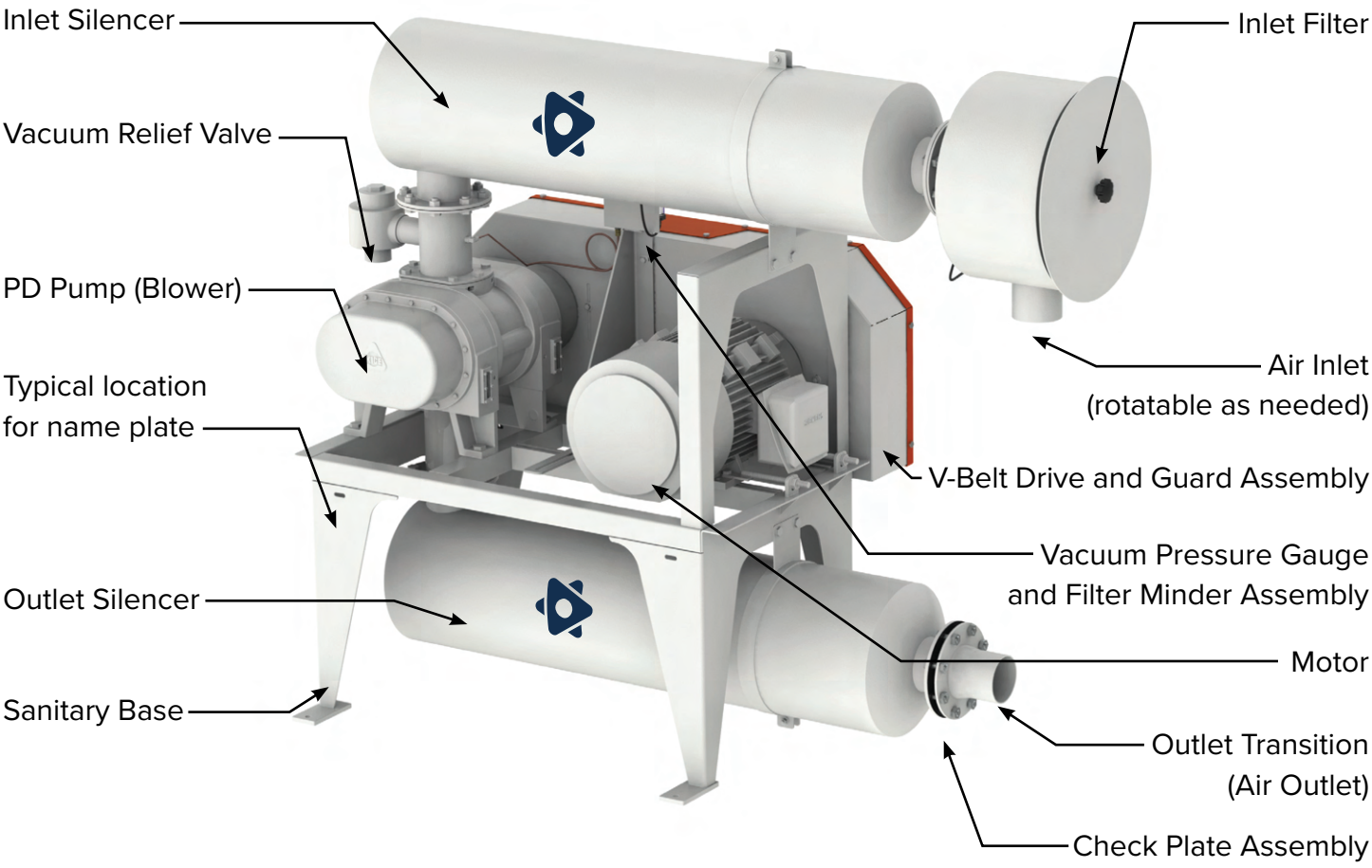
• Refer to blower/pump manufacturer manual for lubrication requirements.

• Motor protection should be provided with the motor starter devices.

• The horsepower has been sized based upon the vacuum relief setting, so that if the system does plug and the vacuum relief goes off, the increased power can be handled.

• Air Power Unit Relief Valve is usually set 2-4” HG above the “normal” setting and allows free air in to protect the PUMP from overheating, not the motor.

Vacuum Air Power Unit



Filter Installation

• Set filter per drawing. Filter will typically require 110V (or 24vDc) and 80-120 PSIG compressed air to run the cleaning mechanism.

• Filter Timer Board ships from Kice set for continuous cleaning, 150 m/s (milli-second) “ON time, and 50 seconds “OFF time.

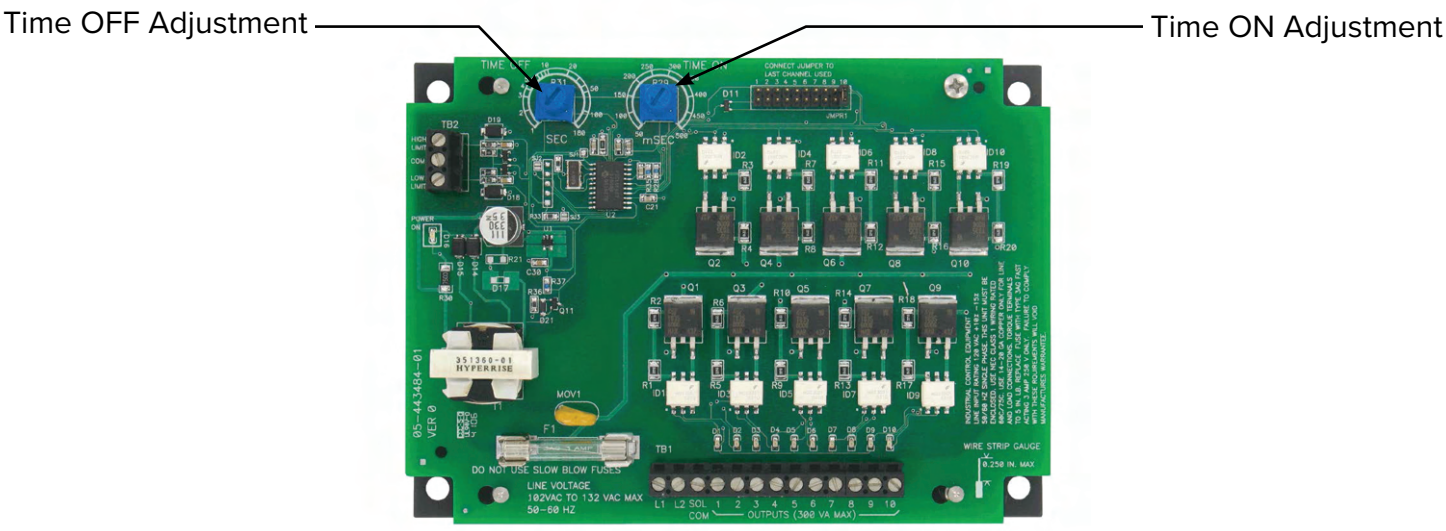
NOTICE: There is no single “set and forget” setting for the Kice filter timer board. The setting can be adjusted based on the application and requirements.

- Time “ON” is adjustable - this controls the duration of compressed air “blast”.
- Time “OFF” is adjustable - this controls the time between “blasts”.
- Can be set for “On Demand” cleaning with modification to timer board jumper settings. This allows the system to turn on when pressure differential reaches a certain “preset” value.

• Install filter bags and cages per the filter bag installation instructions.

• If supplied with explosion vent(s), all installation and maintenance instructions and warnings provided by the explosion vent manufacturer must be followed.

IMPORTANT: If the filter is located inside and an explosion vent duct is required, this must be included in the original design of the filter. If a vent duct wasn’t included contact Kice Industries before installation to review the application.



Filter Timer Board Example

- Kice Standard OEM explosion vent(s) are engineered for high vacuum.
  - Kice Part # 10003337: Rupture Panel, 18x36 CV-S-HV, Domed vent. Burst pressure: 1.5PSIG @ 72 deg F. Vacuum Rating -10.15 PSIG, Material: 316 SST and FEP Seal
  - Kice Part # 10003334: Rupture Panel, 18x36 CV-S-HV, Domed vent with burst sensor. Burst pressure: 1.5PSIG @ 72 deg F. Vacuum Rating -10.15 PSIG, Material: 316 SST and FEP Seal

  NOTICE: The Kice OEM High Vacuum Domed explosion vent is recommended as it is designed to better withstand pressure cycles during cleaning and handling higher vacuum pressures.
  - Other vents used for high vacuum service (check for compatibility):
    - Kice Part # RP18X36SF-CF: Rupture Panel, non-insulated, 18” x 36”, Burst Pressure 1.5 PSIG
    - Kice Part # RP18X36SF-CFBI: Rupture Panel w/ Burst Indicator, non-insulated, 18” x 36”, Burst Pressure 1.5 PSIG

  NOTICE: The Kice OEM High Vacuum cross broke/foam filled explosion vent can be used in lower vacuum applications and is designed to better withstand pressure cycles during cleaning. Additionally, by reducing the “ON” time, and increasing the “OFF” time of the filter timer board, the “life” of the explosion vent is increased by further reducing the number of flexing cycles the panel is exposed to during operation.
- If burst sensor kit is included, it should be interlocked with all other necessary equipment.

  NOTICE: Explosion vent area may differ between panel manufacturers. The required vent area should be verified when replacing panels.

Typical START UP / SHUT DOWN Sequencing (Assuming basic push button controls)

Start Up Sequence:

1. Rotary Airlock (if possible, allow airlock to run 1 minute to clear material in hopper).
2. Filter Timer Board (start timer board when Vacuum Air Power Unit is started).
3. Vacuum Air Power Unit (to start high vacuum suction).

Shut Down Sequence:

1. Vacuum Air Power Unit (to shut down high vacuum suction).
2. Filter Timer Board (Shut off timer board when Vacuum Air Power Unit is shut down).
3. Rotary Airlock (if possible, allow airlock to run 1 minute longer after filter turned off to clear material in hopper).

Basic Operation Guidelines

- The system is operational if...
    - The Vacuum Air Power Unit is running and
    - The filter cleaning system is working (i.e., blowing down the filter bags) and
    - The Rotary Airlock is turning

  NOTICE: Suction will be highest closest to the filter. Suction will be the least farthest away from the filter, due to the resistance of the air through the tubing, fittings, elbows, tools, etc.
- Once the system is “ON” and running...
    - WITH NO SNAP CAPS OPEN, RELIEF VALVE MAY BE OPEN to pull free air in until 1 or more snap caps are opened.
    - IF 1 or 2 SNAP CAPS ARE OPEN, then vacuum will come from the pickup location and not the relief valve so the system will have good suction at the Snap Cap location and the relief valve will be closed.
- Connection of hose to header...
    - Open the Snap Cap and insert the Aluminum 25A fitting.
    - Attached hose to 25A fitting.
    - Attached tool to hose.
        - Typically, the hose has a “button lock” male end and “button lock” female end.
        - Tools can connect to these “button locks” for secure connection.
- Pickup up “piles” of material...
    - Recommend using a “Gulper Tool”, available from Kice, that has an open annular space to allow in free air.
    - “Work” the pile, allowing the tool end to get free air along with material.
    - Spread the pile out allowing the tool end to get free air along with material.

System Control Options (if applicable)

Your system may have a control panel enclosure for starting/stopping the Central-Vac system. Type and design is based on the area classification and other criteria. Typically, the enclosure is a Wall Mount Control Enclosure – UL approved, NEMA 4 with push buttons, but other options are available as required. If Kice has supplied the control panel a printed copy of Kice electrical drawings should be in the control panel and/or available in electronic form from Kice.

NOTICE: Customer is responsible for power feed to the motor and for all wiring between the control panel and the motor and any other field devices.

AVAILABLE OPTION: Individual control enclosures for each floor for push button start and timed shut-off. This allows operator to start system from each remote control enclosure location rather than having to go to the primary control panel each time. Timed shut offs helps prevent the system from accidentally being left on, wasting horsepower and causing possible overheating.

AVAILABLE OPTION: For “Blitz” type cleaning using multiple pickup points at one time, consider using a VFD to control the Vacuum Air Power Unit speed. The speed can be controlled either by inductive switches on each pickup point or via an operator interface (PanelView) mounted on the Control Panel housing this VFD. Please consult the Kice Automation department before finalizing the design.

Recommended Maintenance

The key to long and trouble-free system operation is good maintenance practices. Follow all recommended preventative maintenance provided for each piece of equipment. Periodically inspect the overall system connections, fittings, and snap caps for leaks and make sure components are properly grounded. Below are a few basic examples for reference. These should not replace specific required maintenance as described in the instruction manuals provided for each piece of equipment.

Vacuum Air Power Unit Maintenance:

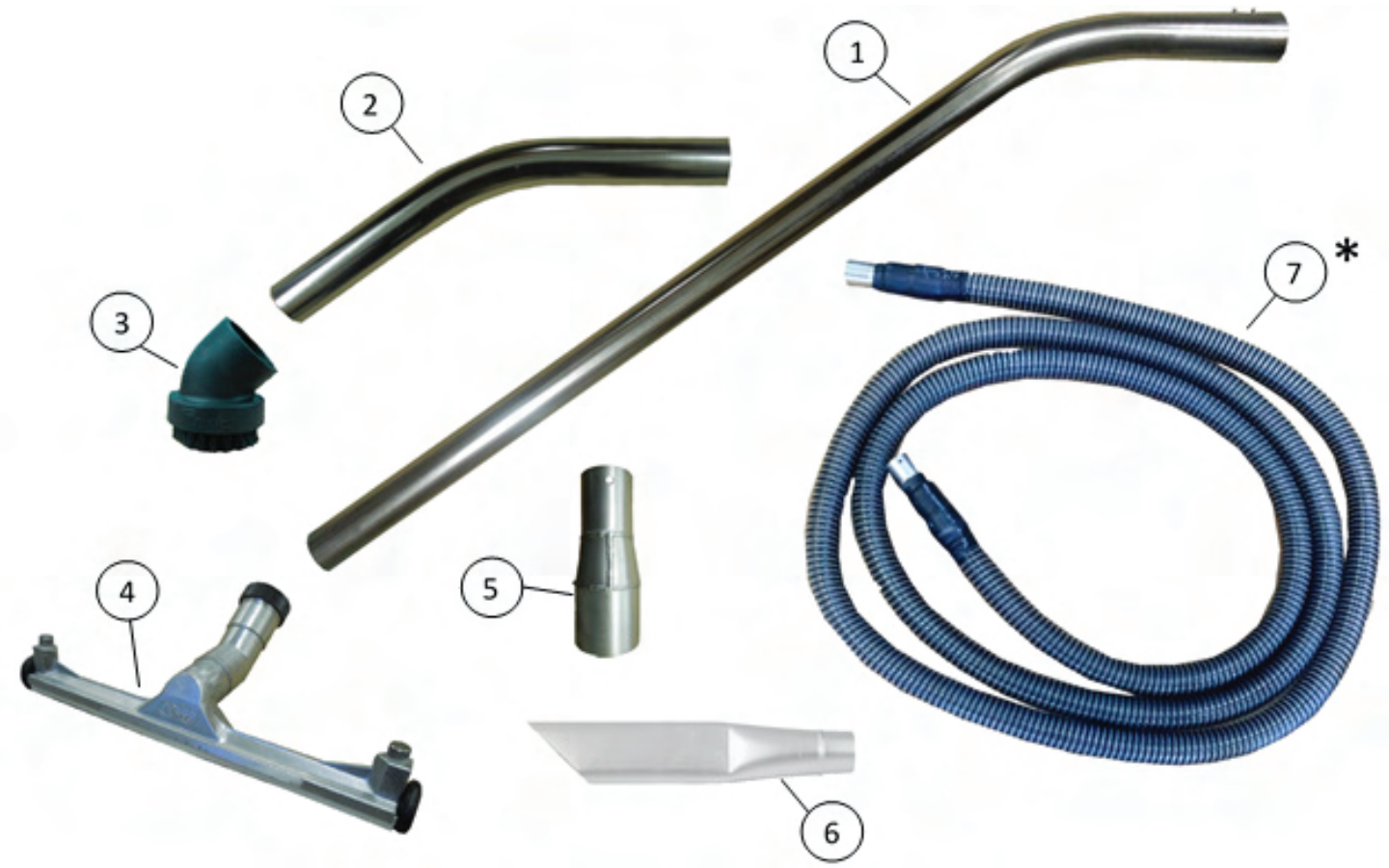
• A newly installed blower should be checked frequently, particularly during the first month of operation.
• Change lubrication after short time interval after startup.
• Listen and check for any unusual noise or vibration.
• Regularly check the air inlet Filter Minder® gauge. Change air filter when the position indicator reaches the red zone.
• Refer to blower/pump manufacturer manual for lubrication and maintenance requirements.
• The duration between oil changes may vary depending on the type of oil and operating temperature.
• Check operation of Vacuum Relief valve per manufacturer suggested intervals.

Filter Minder®

Filter Maintenance:

• Check condition of the filter bags. Filter bags should prevent most dust from passing to the Vacuum Air Power Unit prefilter.
• Check the pressure differential across the filter bags. When the pressure on the Magnehelic Gauge is consistently at or above 6” w.c. it is recommended that the bags be changed.
• If the filter is supplied with explosion vents, inspect explosion vents for breaks in tabs or premature failure on a regular basis.
• Refer to the filter maintenance manual for additional information regarding maintenance and service.

Optional Tools and Accessories



Item #	Part Number	Description
1	5003-BL	45” hose wand, single bend, button lock
2	5010-BL	18” single wand for hand-held tools, button lock
3	5034	3” round brush, rubber body
4	5060	20” floor tool with rollers and squeegee, aluminum body
5	10000952	13/16 – 2 1/8” hose transition, aluminum with hole for button lock
6	5016-BL	15” crevice tool, aluminum body, button lock
7*	10002729	Hose, 2" Id x 10’ long, static-dissipative, abrasion resistant, transparent urethane, with enclosed copper grounding wire, (509910) along with 5220-BL and 5221 button-lock connectors permanently affixed with banding clamp and heat shrink sleeve, FDA approved materials, -40 to 195 degree
7	10002977	Hose, 2" Id x 25’ long, static-dissipative, abrasion resistant, transparent urethane, with enclosed copper grounding wire, (509925) along with 5220-BL and 5221 button-lock connectors permanently affixed with banding clamp and heat shrink sleeve, FDA approved materials, -40 to 195 degree

NOTICE: Items 1-6 are available in a complete set Kice Part Number: VacSetTools

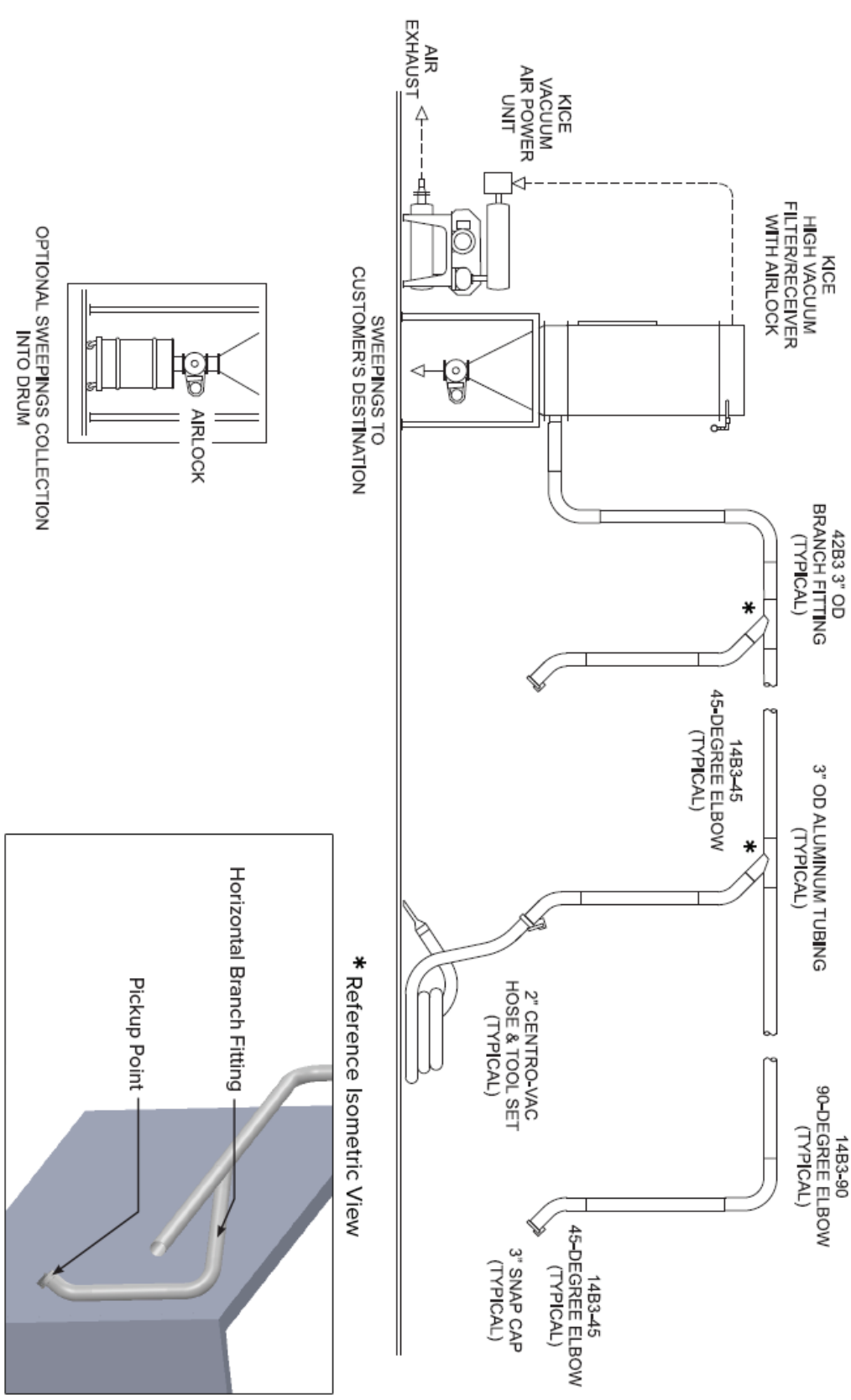
TROUBLESHOOTING

Problem	Probable Cause/Suggested Actions
Lack of suction at pickup points	1. Additional snap caps are open somewhere in the system 2. Filter bags are clogged or dirty 3. Air Power Unit prefilter is clogged or dirty 4. Vacuum hose wand is buried in pile of material or clogged 5. Relief valve stuck in open position or air leaking by valve
Relief valve on Air Power Unit is ALWAYS pulling in free air	1. There is a clog somewhere in the system -Check Air Power Unit prefilter – if dirty, APU cannot get free air anywhere except from the relief valve. -If clean: a) Start at first pickup and open snap cap, if low/no suction and relief valve is still open, clog is between the first pickup/snap cap and filter inlet. b) Continue checking pickups and opening snap caps systematically through the system, if low/no suction and relief valve still open, clog is between this pickup and first pickup points.
Vacuum APU clogged inlet filter	1. Product has gotten past the filter bags - Check filter bags for holes and replace if necessary. - Check filter bags for proper installation.
Static Shock	1. System and/or hose is not properly grounded - Change hose to a static dissipative hose. - Check hose for continuity–hose may have been damaged or grounding wire is broken or disconnected. - Verify that each coupling is grounded. Grounding strip should be in contact with bare metal on the connecting elbow, fitting, and/or tubing. - Utilize copper grounding wire across couplings and/or fittings if necessary. - Verify that the filter/receiver and structure are properly grounded.

TROUBLESHOOTING CONTINUED

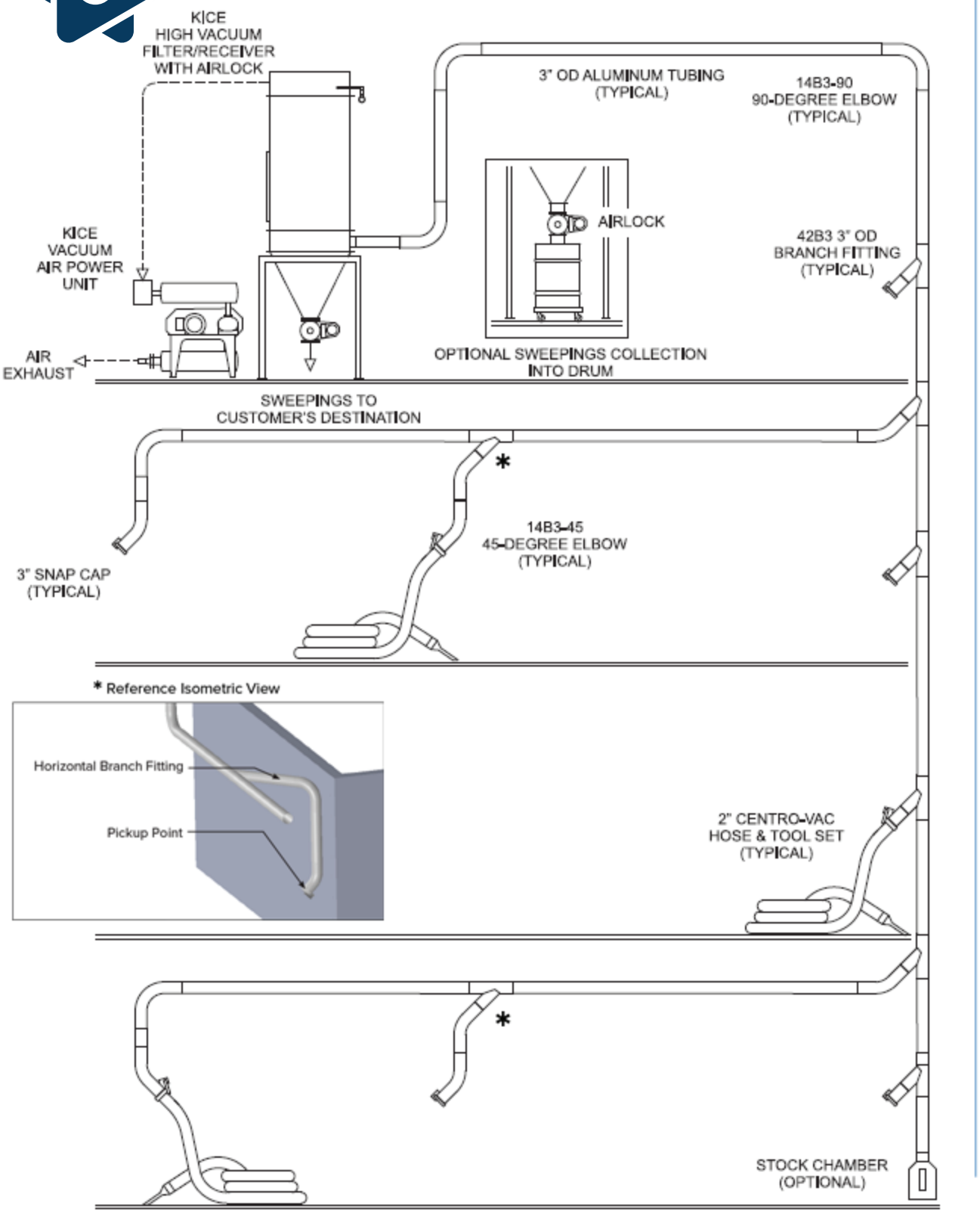
Problem	Probable Cause/Suggested Actions
Filter hopper backing up with material	1. The airlock is not functioning - Check to make sure the airlock is turned on. - If motor is running, check to make sure that the airlock shaft is rotating, not just that the drive sprocket is turning. 2. The airlock discharge is blocked - Check the discharge. The discharge below the airlock may have too steep of angle and/or is too close. 3. There is a material bridge in hopper - Check the hopper and clear material bridge.
Failure of explosion vent **INWARD**	1. Verify correct explosion vent for application 2. Verify Pressure Relief Valve working as intended (i.e., Relief valve rusted shut and not opening) 3. Replace Relief Valve
Failure of explosion vent **OUTWARD**	1. Result of deflagration - Did an event occur? 2. Overpressure of system - Incoming pressure greater than exhaust causing overpressure inside the filter housing. - Check exhaust fan for size, rotation, open damper, etc. 3. Material “riding up” in cyclonic inlet damaging vent - Replace with material handling inlet section. 4. Pulsing cleaning mechanism with vacuum pump not running - Cause momentary overpressuring of filter housing that can fatigue or fail vents over time.
Vacuum Air Power Unit operating at high noise level	1. Noise level may vary depending on vacuum setting 2. Install Sound Enclosure around Vacuum Air Power Unit 3. Extend discharge up and away from existing structures, bins, etc.

KICE TYPICAL SINGLE FLOOR CENTRO-VAC SYSTEM



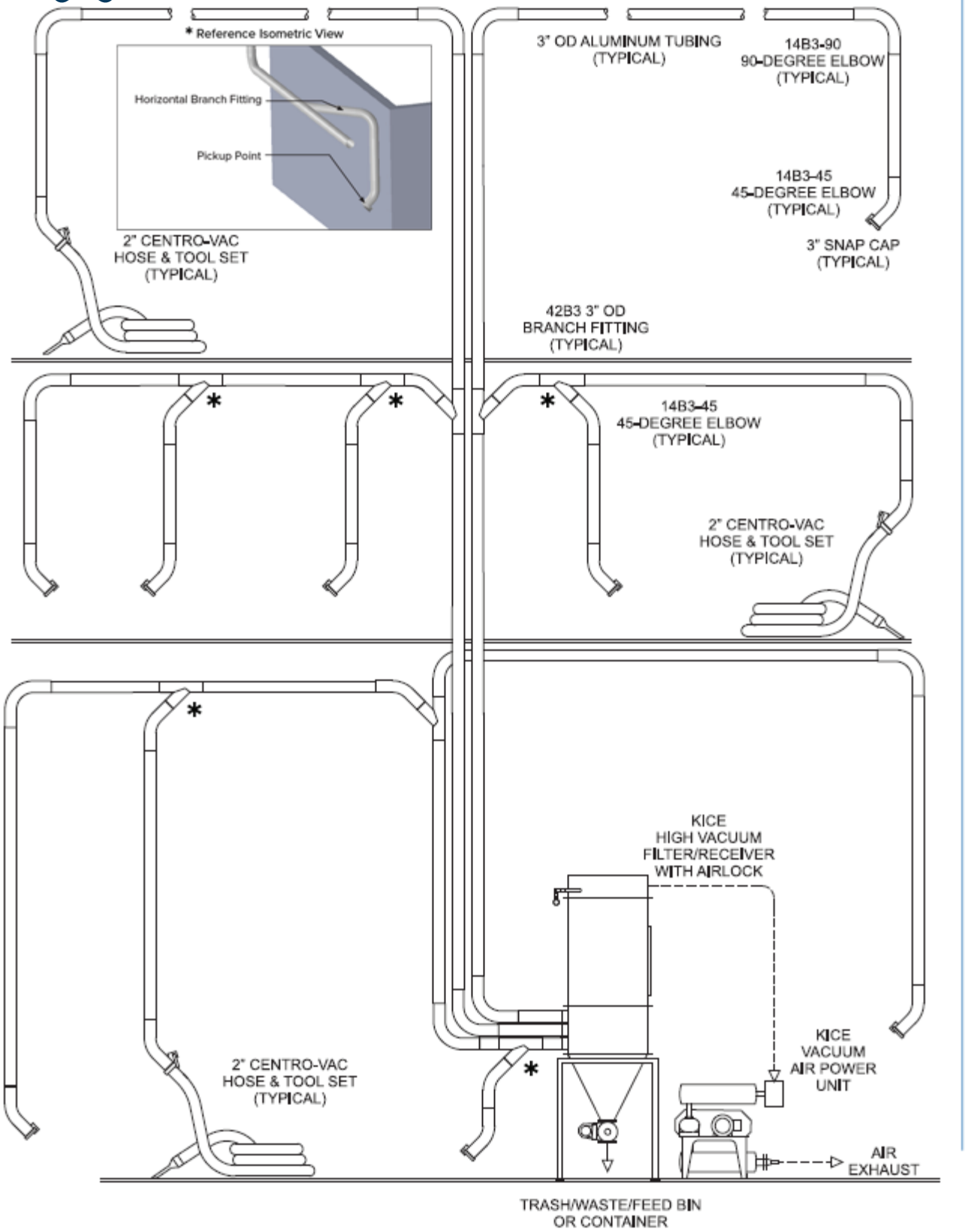
Central Vacuum Design Guide Example 02-Rev0

KICE TYPICAL MULTI FLOOR CENTRO-VAC SYSTEM

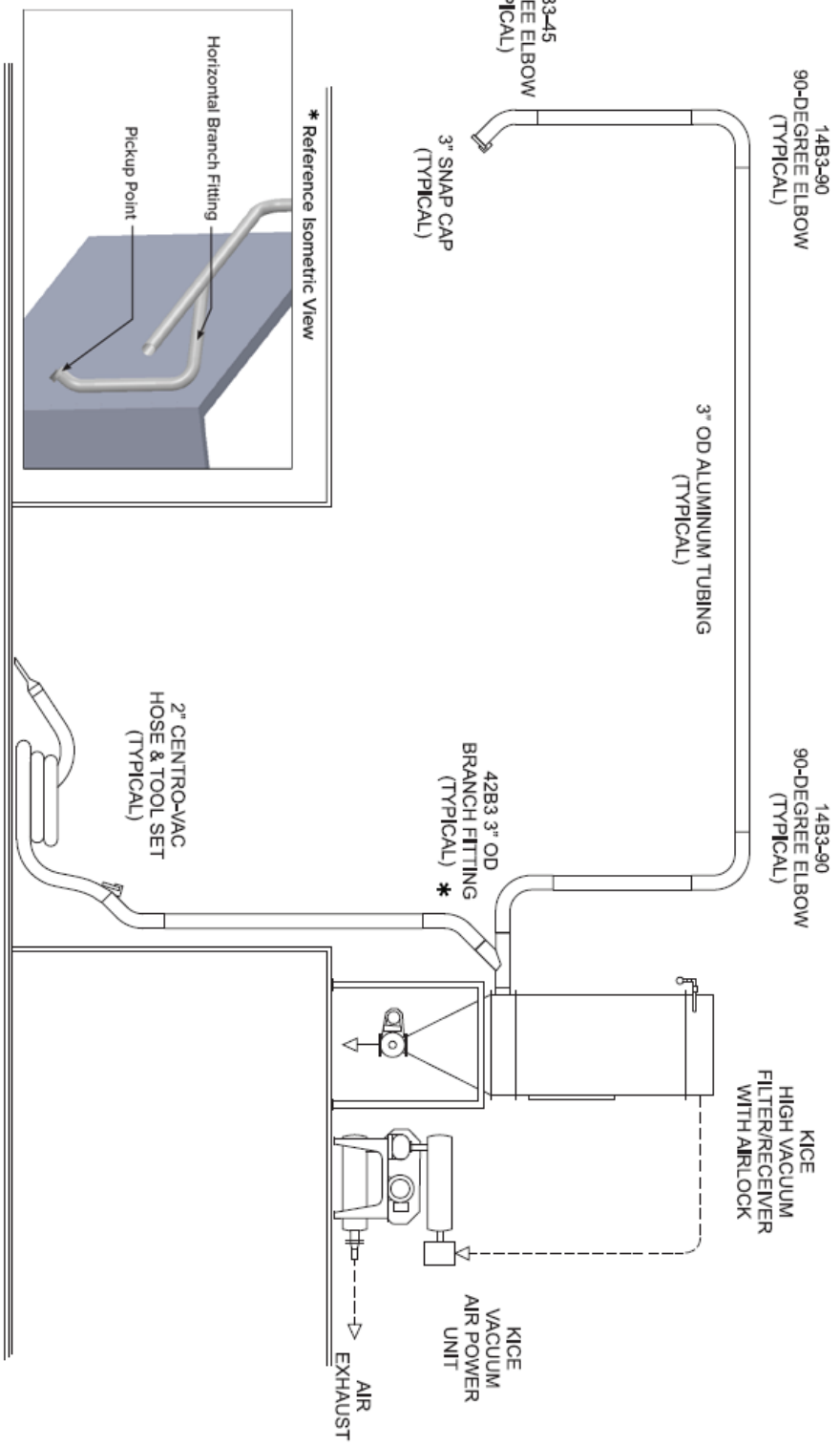


Central Vacuum Design Guide Example 03-R0

KICE TYPICAL MULTI HEADER CENTRO-VAC SYSTEM
3 EACH 3"OD HEADERS SHOWN (1 OR 2 OPERATORS PER HEADER)



KICE TYPICAL ELEVATOR PIT CENTRO-VAC SYSTEM



Central Vacuum Design Guide Example 04-Rev0

APPENDIX B

KICE SERIES 82M HEAVY DUTY COMPRESSION COUPLING

Installation Instructions

NOTICE: Kice Series 82M Heavy Duty Compression Couplings shipped standard with White Food Grade Gasket and SS Grounding Strips. When replacement gaskets are shipped, a replacement SS Grounding Strip is also included. Other gasket materials available upon special request.

Holding The Coupling Properly

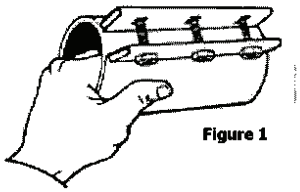


Figure 1

• To avoid slippage of the gasket, sleeve, and gasket protector (when used) always hold couplings as shown in Figure 1.
• Couplings are shipped in “ready-to-use” condition and should not be disassembled.

Prepare For Installation

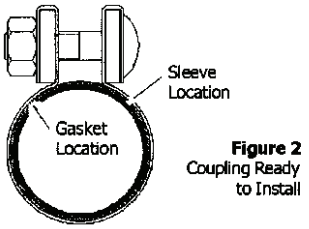


Figure 2
Coupling Ready to Install

• Check code number for OD of pipe or tube you intend to join. Coupling has been factory-sized and inspected before shipping.
• Clean outside of tube to make it free of dirt and grease, which can cause coupling slippage.
• Make sure tube is free of jagged ends and external burrs, which could cut gaskets.
• Make sure outside surface of tube is dry.
• Make sure sleeve and gasket partings are in opposed positions (Figure 2).
• Be sure gasket teeth (and gasket protector teeth) mesh and do not overlap.

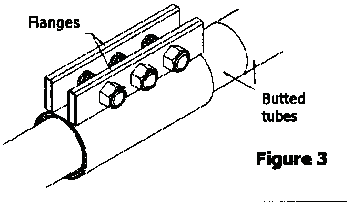


Figure 3

Assembling Tube and Coupling

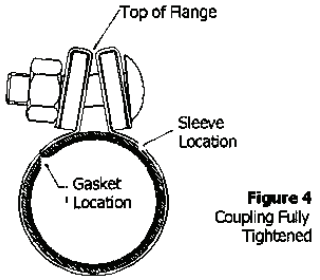


Figure 4
Coupling Fully Tightened

• Slide coupling over one tube end until end of that tube is exposed.
• Butt tube ends (Figure 3).
• Slide coupling back until it is centered over point where tubes are butted. Use care to avoid wrinkling, or overlapping gasket or gasket protector.
• *When the potential for static buildup exists, a grounding strip must be used.*

Tightening the Coupling

• To assure proper seating of inner sleeve and gasket, partially tighten bolts in a uniform manner.
• Tighten bolts evenly to torques shown in chart to right.
• The assembly is completed when the coupling is evenly tightened to the recommended torque. The flanges should touch only at their top edges (Figure 4).

Bolt Size	Ft. Lbs. Torque
5/16”	12
1/2”	12
5/8”	65
3/4”	95

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Email: quickship@kice.com / www.kice.com

APPENDIX C

KUNKLE PRESSURE RELIEF VALVES

Installation and Operating Instructions *(Rev B 01/14/2002)*

Pre-Installation Handling

This pressure relief valve is designed to protect equipment from overpressure. The valve should be handled with care, not subjected to heavy shock loads, and protected to prevent contamination from getting inside. It should be installed correctly per A.S.M.E. Boiler & Pressure Vessel Code requirements. Failure to do so could result in property damage or serious injury to personnel. When hoisting the valve into position for installation, care should be exercised so that lifting straps do not contact the valve lift lever.

Installation

Always wear proper safety equipment, including safety glasses and ear protection.

1. Mount the valve in a vertical position so that the valve body is self-draining. If a body drain port is provided, make sure it is open when required by the ASME code. Do not plug any bonnet vent openings. The inlet piping should be as short as possible, with no elbows, and equal to or greater than the size of the pressure relief valve inlet connection. This will help to limit the inlet pressure drop to 3% or less when the valve is relieving.

2. When discharge piping is connected to valve outlet, make sure it is self-draining if a body drain port is not used. The valve should not be connected to any discharge pipe that contains pressure before the valve opens or to any pipe where the pressure build-up is greater than 10% of the set pressure when the valve is open and relieving. Discharge piping, other than a short tailpipe, must be supported. For steam service, a drip pan elbow or flexible connection between the valve and the pipe should be used to prevent excessive pipe stress, due to thermal expansion, from being imposed on the valve body.

3. For threaded valves, to prevent sealing compound from entering and damaging the valve, apply a small amount of pipe thread sealing compound to external threads only. Do not put any sealing compound on the first thread or on any internal threads. To do so may cause the sealing compound to enter the valve and cause seat leakage. Do not use the valve body or bonnet for installing the valve in threaded connections. Use the wrench flats provided to tighten the valve to the connecting pipe, and do not overtighten. To do so may cause valve leakage.

4. For flanged valves, use new gaskets and tighten the mounting studs evenly.

Operation

1. Maintain a system operating pressure at least 5 psig or 10% below the set pressure of the valve, whichever is greater. Operating too close to the valve set pressure will cause seat leakage and will shorten the time between valve maintenance.

2. Do not use the safety valve as a control valve to regulate system operating pressure. Excessive operation will cause the seat to leak and will require more frequent valve maintenance.
3. ASME Section I and VIII valves equipped with lift levers are designed to be operated only when the system pressure is 75% of set pressure or greater. ASME Section IV valves may be operated at any set pressure. When hand operating the valve, hold it open long enough to purge any foreign matter from the seat area. If a cable or wire is attached to the lift lever for remote actuation, make sure the direction of pull is the same as it would be if the lever were pulled directly by hand.

Maintenance

Maintenance should be performed on a regular basis. An initial inspection interval of 12 months is recommended. Depending on the service conditions and the condition of the valve, the inspection interval may be decreased or increased. Use only Kunkle parts for repair. Depending on the local jurisdictional requirements where the valve is installed, repairs may have to be made by a repair facility holding a VR stamp.

Warning

Removal of the seal wires or any attempt to adjust, repair or modify this product by non-qualified or non-authorized persons voids the product guarantee and may cause serious damage to equipment, personal injury, and death. Kunkle Valve is not liable for any damage resulting from misuse or misapplication of its products.

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