MATERIAL HANDLING SOLUTIONS

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6720 N. Teutonia Ave.
Milwaukee, WI 53209

DB Series | Package Handling Lift

Owner's, Installation, and Maintenance Manual

Important:

Read this entire manual. Important safety information is included.

Before starting the installation, verify the job site dimensions and the dimensions of the delivered materials against the PFlow Industries, Inc. General Arrangement (GA) drawing.

The illustrations depicted in this manual are not to scale or detail. The illustrations are for reference only.

Refer to Your Job Specific Manual

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Customer Information

Customer Name	Job Number

Safety Data Sheets

Description	Document #	Revision

Bill of Material Sheets

Document #

Option Drawings

Descriptions	Document #	Revision

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Customer Information

Customer Name	Job Number

Job Drawings

Description	Document #	Revision

Electrical Drawings

Description	Document #	Revision

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Office
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Customer Support Department
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Sales
e-mail: sales@pflow.com

For a list of contact personnel visit the PFlow Industries, Inc. website at:
https://www.pflow.com/contact

Documentation

PFlow Industries, Inc. reserves the right to make changes or improvements to the standard model line at any time. PFlow Industries, Inc. reserves the right to make changes to subsequent editions of the manual without prior notice to holders of this edition.

Copyright Notice

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System Modifications/ Disclaimer

Mechanical or electrical modifications performed on the equipment not approved by PFlow Industries, Inc. may void any warranty and/or service agreements. Please contact the PFlow Customer Support Department for assistance with service modifications.

Training

Training is available upon request from the Customer Support Department. Half-Day, Full-Day, and Two-Day sessions are customized to fit specific needs - either for a single equipment type or for the entire product line.

On-site Supervision

On-site supervision services are available from the Field Service Department. Contact our Field Service Manager for more details.

Source Language

This manual is written in American English.

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Introduction

This manual provides information about the PFlow Industries, Inc. custom designed Vertical Reciprocating Conveyor (VRC). As the nations' leading manufacturer of vertical material handling equipment, PFlow Industries, Inc. is confident that this new VRC will provide many years of reliable service.

General Overview

The VRC provides a safe and simple means of moving material from one level to another. The simplicity of design and few moving components ensure a trouble-free, long life, with low maintenance and little downtime.

Code Requirements

This VRC is designed for the movement of materials only, up to the VRC's rated capacity, from one level to the next. Do not allow anyone to ride on the VRC. VRCs are **not** elevators, and are specifically excluded within the scope of the ASME A17.1 Safety Code for Elevators and Escalators. VRCs are included in ASME B20.1 Safety Standard for Conveyors and Related Equipment, which is incorporated by reference into OSHA 29 CFR 1910. A copy of the ASME B20.1 standard can be purchased at www.asme.org and other sources. PFlow Industries, Inc. recommends that this standard be referenced for appropriate installation, maintenance, inspection, and operation in relation to hazards. All electrical designs and components are in accordance with National Electric Code (NEC) requirements. Local codes may require initial inspection of the installation and periodic inspection and testing of the unit. Contact PFlow Industries, Inc. for more information in the event an inspection is required.

NOTE

The information and illustrations in this manual are intended only as an aid to understanding the VRCs general installation. The information and illustrations do not cover every possible contingency or circumstance regarding nonstandard options or site conditions.

If there is a problem, call PFlow Industries, Inc. at (414) 352-9000, during normal business hours, 8:30 a.m. to 5:00 p.m. central standard time, Monday through Friday. Outside of those hours, see the PFlow Industries, Inc. Contact Information page for additional information. Use the model number and serial number or the PFlow Industries, Inc. General Arrangement (GA) drawing number for the lift in all correspondence.

Parts

Equipment damage resulting from modification in any manner from the original model, including the substitution of parts other than factory authorized parts, will void the warranty. Furthermore, PFlow Industries, Inc. will not be liable for any loss, injury, or damage to persons or property, nor for direct, indirect, or consequential damage of any kind resulting from modified or substitution of parts other than factory authorized parts of said material or equipment.

PFlow Industries, Inc. maintains a complete stock of, or has access to, all replacement components. Detailed records of all equipment sold are kept. If a component is damaged in shipment, is defective or missing, contact PFlow Industries immediately.

Service

The PFlow Industries, Inc. Customer Support Department will assist maintenance and service personnel with any questions or problems regarding the equipment or installation.

Feedback

Your feedback is important. Please help PFlow Industries, Inc. understand if the equipment has met your expectations. Please complete the questionnaire in this manual. The questionnaire will help us address any comments and/or concerns.

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Parts and Labor

Parts:		Labor:	
Structure	Lifetime	Structure	Lifetime
Manufactured Components	1 Year	Manufactured Components	1 Year
Purchased Components	1 Year	Purchased Components	90 Days
Gates and Enclosures	90 Days	Gates and Enclosures	90 Days

Definitions

- Structure is defined as columns, carriage, and pre-fabricated bracing (excluding carriage side guards).
- Manufactured components are defined as those components manufactured by PFlow Industries, Inc.
- Purchased components are those components that are used as supplied by vendors.

Warranty

PFlow Industries, Inc. expressly warrants to the original purchaser that this product will be free from defects in material and workmanship under normal, intended use. The warranty period begins 30 days after shipment.

Exclusions

This warranty does not apply to:

1. Equipment or components damaged or broken in transit or shipping.
2. Replacement of wear parts.
3. Equipment failures caused by abuse, misuse, exceeding recommended capacities, impact with other objects, negligence, improper installation, unskilled use, unskilled maintenance, inadequate maintenance, or incorrect adjustments.
4. Exposure to a corrosive or abrasive environment or exterior elements unless specifically built for that environment.
5. Equipment that has been repaired, altered or modified in any manner outside of the manufacturing facility, substitution of parts other than factory authorized parts, removal of any parts, or addition of any parts without prior written permission by PFlow Industries, Inc.
6. Any losses or damages resulting from loss of data, loss of revenue or profits, loss of products, incidental or consequential damages, delays, or expenses incurred by failure of said part or parts even if advised of the possibility thereof.
7. Lost time and/or additional trips for missing or damaged components.
8. Expedited freight charges.

Obligation

The obligation for PFlow Industries, Inc. is limited to only the replacement or repair of defective components that received prior authorization. This is the owner's sole remedy.

PFlow Industries, Inc. will bear normal labor charges performed by an authorized PFlow Industries, Inc. service agent during standard business hours, excluding overtime, holiday rates, or any additional fees.

This warranty applies to all models and no person except an officer of PFlow Industries, Inc. is authorized to modify this warranty or to incur on behalf of PFlow Industries, Inc. any other obligation or liability in connection with PFlow Industries, Inc. equipment.

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Liability

PFlow Industries, Inc. believes, to the best of our knowledge, that the information in the equipment manuals are accurate. In the event that technical or typographical errors exist, PFlow Industries, Inc. reserves the right to make changes to subsequent editions of the manual without prior notice to holders of this edition. The reader should consult PFlow Industries, Inc. if errors are suspected.

The customer's right to recover damages caused by fault or negligence on the part of PFlow Industries, Inc. shall be limited to the amount paid to PFlow Industries, Inc. by the customer. The limitation of liability of PFlow Industries, Inc. will apply regardless of the form of action, whether in contract or tort, including negligence. Any action against PFlow Industries, Inc. must be brought within one (1) year after that cause of action accrues.

PFlow Industries, Inc. will not be liable for any loss, injury, or damage to persons or property, nor for direct, indirect, or consequential damage of any kind resulting from failure or defective operation of said material or equipment.

Warranty Procedures

All billing must be in accordance with our Warranty Procedures. Replacement of defective parts will be handled in accordance with the Return Goods Authorization policy for PFlow Industries, Inc.

Pre-Authorization

- All warranty work must be pre-authorized by PFlow Industries, Inc. Product Support Department prior to starting work.
- Where distance and or experience may be more cost-effective, PFlow Industries, Inc. reserves the right to use alternate organizations.
- Labor is defined as a maximum of two hours travel per call, plus reasonable on-site repair time as determined by PFlow Industries, Inc.
- Local purchase of components must be pre-authorized.

1. Notify the PFlow Industries, Inc. Product Support Department of the problem for authorization.
2. PFlow Industries, Inc. will determine:
   - The cause of the problem.
   - Who will do the repair work.
   - The repair details involved.
3. If PFlow Industries, Inc. decides that your organization or your subcontractor will do the work, an authorization number will be assigned which must be referenced on all subsequent paperwork.

NOTE *Notify PFlow Industries, Inc. by phone, FAX, or e-mail during the next business day if an event occurs during our non-working hours. Issuance of an authorization number does not guarantee approval and/or payment.*

Invoices

1. Submit an invoice for approval within 30 days after the date the work was completed. Payment is made 30 days after the date of approval.
2. A deduction from outstanding payments to PFlow Industries, Inc. for warranty is never authorized.
3. Invoices received without sufficient information will be returned. Invoices will be reconsidered for approval when complete documentation is received. All invoices must include, in detail, the following:

☐ PFlow serial number.	☐ Labor hours expended resolving the problem.
☐ Date the work was performed.	☐ Rates per hour.
☐ Description of the problem.	☐ Copies of receipts for materials purchased.
☐ Travel time incurred.	☐ Detailed description of work completed.

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Read the Entire Manual

Important: Carefully read the entire manual upon receipt of the VRC. Improper installation, alteration, adjustment, service, cleaning, or maintenance could result in death, severe injury, or property damage. Instructions and warnings must be read and thoroughly understood by all operators and users. PFlow Industries, Inc. recommends that the owner conduct regular staff training including safety instructions on a regular basis to avoid the risk of accident or damage to the VRC.

Following procedures other than those indicated in this guide to install, use, and maintain the VRC is considered inappropriate and may cause fatal accidents, personal injury, or property damage, in addition to invalidating the warranty.

Intended Purpose

The intended purpose of the PFlow Industries, Inc. Vertical Reciprocating Conveyor (VRC) is to provide a safe and simple means of moving materials only, up to the VRCs rated capacity, from one level to another. VRCs are ***not*** elevators. The VRC is exclusively intended for use in establishments where all operators have been trained to understand the purpose, limitations, and associated hazards of the VRC. Any other use is strictly forbidden.

Potential Risks and Possible Misuse

PFlow Industries, Inc. has attempted to protect against as many hazards as possible. The following potential risks should be addressed before the VRC is put into operation:

- Risk of injury caused by falling products.
- Risk of injury caused by product extending beyond the confines of the carriage.
- Risk of injury caused by exceeding the weight capacity of the VRC.
- Hazards occurring at places where the VRC connects to incoming and outgoing conveyors.
- Risk of injury if any safety features are bypassed.
- Risk of injury due to the use of corrosive chemicals or water jet.

Safety Alert Symbols

To ensure your safety and the safety of those around you, it is important that you read, observe, and understand ALL safety precautions relative to a particular task. Safety precautions in the manual are labeled with an alert symbol followed by the word **DANGER**, **WARNING**, or **CAUTION**.

This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠DANGER Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

⚠WARNING Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

⚠CAUTION Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE Used to address practices not related to physical injury.

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⚠DANGER

- Stay within the rated lift capacity.
- Make sure all safety devices are in place and operable before using the equipment. If any safety device is missing or inoperable, immediately remove the equipment from service.

- High Voltage! A qualified electrician must install all electrical connections and permanent wiring in accordance with applicable local or national electrical codes. Make sure the equipment is properly grounded in accordance with local electrical codes or, in the absence of local codes, with the current edition of the National Electrical Code NFPA No. 70.
- Falling column hazard! Make sure all beams, columns, posts, enclosure panels, and components are properly supported during installation. Illustrations may show the beams, columns, posts, enclosure panels, and components unsupported in order to make the equipment and installation instructions clearly understood.

⚠WARNING

- This equipment can be dangerous if not used properly. Allow only competent adults who have been properly trained and authorized personnel to operate this equipment.
- This equipment must be maintained to ensure safety. Allow only properly trained personnel to service the equipment. Implement a routine safety inspection plan and follow the recommended preventive maintenance schedule in the owner's manual.

- Passengers are not permitted. Riding may result in death or serious personal injury.

- Lockout/tagout equipment before performing any adjustments or maintenance. If the equipment is not locked out, it could start unexpectedly and cause injury or damage. ***Make sure all personnel are aware of the potential for stored energy to be present even after the power has been locked out.*** Refer to ANSI Z244.1 and OSHA 29 CFR 1910.147 for minimum requirements for a lockout/tagout system. There may be additional country, state, or local requirements.

- Components and accessories may be heavy. To prevent serious injury, use the appropriate lifting apparatus when handling the components and installing the VRC.

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⚠WARNING

- If any defects relating to operating safety and reliability are detected or if any damage occurs, the VRC must be taken out of operation immediately.
- Before the VRC is put into operation, all VRC parts must comply with all relevant health and safety directives and regulations.
- Do not switch the main power supply on or start the VRC when persons are in contact with the VRC.

- Make sure that no persons or objects are within the range of any moving parts of the VRC.

- Climbing, sitting, walking, or riding on equipment while the equipment is in operation could result in death or serious injury.
- If this VRC needs to be modified in any way, contact PFlow Industries, Inc. for assistance. Do not make any unauthorized changes.
- Place the load in the center of the carriage platform to avoid shifting loads. Lock rolling casters in place. Make sure that any portion of the load does not overhang the perimeter of the carriage. Prevent unstable load conditions.
- If the carriage deck does not stop after contact has been made with the limit switch arm, or continues to drift past the floor level, the lift motor brake is not working properly. Discontinue use of the VRC and contact PFlow Industries, Inc. for assistance.

- Lockout/tagout the VRC before removing jammed product. Be aware that stored energy in the lift components may move or shift when the jam is removed. De-energize any circuit before work is begun.
- Do not overtravel! Stops, mechanical or electrical, must be in place to prevent the carriage from traveling beyond the intended floor level. Overtravel could cause permanent damage to the carriage or failure of the lifting mechanism.

- Entanglement hazard! Secure long hair, wear snug-fitting clothing, and avoid wearing jewelry while using the VRC.

⚠CAUTION

- Inform personnel about the location and operation of emergency stops and power disconnection points.

- During operation, the surfaces of some components may become hot. Avoid touching hot surfaces or wear protective gloves.
- If any unsafe or unusual conditions are observed, stop the equipment and remove it from service. Report the condition to your supervisor.

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Electrical Safety Precautions

⚠DANGER

High Voltage! Employees servicing or maintaining VRCs may be exposed to death or serious personal injury if hazardous energy is not properly controlled. De-energize any circuit before work is begun. Follow your facilities procedures or OSHA lockout/tagout (LOTO) procedures anytime maintenance or service is being performed on any electrical box or component.

⚠CAUTION

The incoming voltage source must match the voltage identified on the rating tag. The rating tag provides essential technical information required for any installation, maintenance, or repairs. Do not remove, damage, or modify the rating tag.

De-energize the Circuit

1. Lockout/tagout whenever any work, maintenance, or service is performed on any electrical box or component. Make sure circuits are de-energized before starting work, using a functional, properly rated, and well maintained multimeter or voltage sensing device. Make sure the device is rated for the level of voltage being measured and is sensitive enough for the application.
2. Use fuse pullers to change a fuse; ***never*** use bare hands, pliers, or screwdrivers.
3. Install covers on exposed electrical devices or wires to protect personnel from serious injury.
4. Ground all metal connection boxes, switch boxes, starting boxes, transformers, motors, limit switches, interlocks, and push-button stations to prevent shock to personnel.
5. When using a portable meter, never leave one lead dangling with the other lead connected. Anyone touching the lead may receive a shock through the meter.
6. Make sure that all is clear following lockout/tagout procedures before applying power to a circuit. This is necessary in order to protect personnel from injury and to prevent damage to the equipment.
7. Avoid accidental contact with equipment or conductors which are known to be energized or are ***not*** known to be de-energized. If it is necessary to work on equipment while it is energized, use extra care. Always test and repair equipment that appears damaged or delivers an electric shock.

Take time to be careful! Follow all safety precautions to prevent death or personal injury.

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Electrical Safety Precautions

⚠ DANGER

High Voltage! To prevent serious injury, death, or property damage, all electrical connections and permanent wiring must be installed by a qualified electrician in accordance with applicable local or national electrical codes. Arc flash and shock hazard appropriate PPE is required. This equipment must be adequately grounded in accordance with local electrical codes or, in the absence of local codes, with the current edition of the National Electrical Code NFPA No. 70.

Working on Energized Circuits

When electrical repair or maintenance work is required that prohibits de-energizing the circuits involved, extreme caution must be used. The work should be completed only by authorized, well trained and supervised personnel who are fully aware of the dangers involved. All practical safety measure must be used to protect the personnel performing the required work. In addition to the NFPA No. 70 codes, the following precautions **must** be taken:

1. Remove all wristwatches, watch chains, rings, necklaces, metal appendages to clothing, oversized metallic belt-buckles, metal piercings, or loose clothing. These items have the potential to make accidental contact with energized surfaces. In addition, secure long hair with a hair net or cover with a plastic helmet.
2. Remove all hair barrettes or bobby pins. These items are electrically conductive and accidental contact may cause serious personal injury.
3. Wear dry clothing and shoes. Moisture should not be present on the soles of shoes. Water is electrically conductive and accidental contact may cause death or serious personal injury.
4. Insulate the worker from the ground. Cover any adjacent grounded metal surfaces with an insulating material. Suitable insulating materials are dry wood, rubber mats, dry canvas, dry phenolic material, or heavy, multi-ply paper (cardboard). Make sure that the insulating material has no holes present and there are no conductive materials (e.g., staples) embedded. Cover a sufficient area with the insulating material to make sure that adequate space is permitted for worker movement.
5. Use insulated tools when working on energized circuits or fuse box. These insulated tools must be rated to withstand the voltage of the energized circuits.

Notes for the Installation Electrician

The installation electrician must take the following precautions:

1. Locate and review the electrical schematics furnished with the equipment.
2. Verify the proper fit-up, wiring and operation of all required electrical components.
3. Mount the push button station out of reach of someone located on the carriage (approximately 6' [1,829 m]).
4. Wire standard lift limit switches on the chain tensioning assembly (see the job specific electrical schematic as required) for mechanical VRCs as follows:
   If the tensioner chain becomes slack causing the arm on the limit switch to move down or if a strong tension is exerted on the tensioner chain causing the arm to move up, there is a break in the control power. The limit switches are designated with an LS# on the electrical schematic.

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Entrance Below a Raised Carriage Deck

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Safety First

The most common reason to access the area below a raised carriage deck is to clean debris from the pit or hoistway. This is best accomplished using a long handled broom or rake to avoid entry under the raised carriage deck. Entry under the raised carriage deck is acceptable only when unavoidable and then only if the proper precautions are taken. It is the user's responsibility to ensure that the following conditions be met before allowing qualified personnel to enter the area under the raised carriage deck.

- Work must be performed by qualified maintenance technicians.
  - ◊ A qualified person is defined as a person who, by possession of recognized degree or certificate of professional standing or by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.
- The facility has performed a Risk Assessment per ASME B20.1 5.16
  - ◊ Reference OSHA 3071 for Job Hazard Analysis
  - ◊ Reference CEMA Technical Report 2015-01, ASSE Z590.3, and MIL-STD-882 for Risk Assessment examples.
- A proper lockout/tagout (LOTO) procedure has been performed on the VRC.
  - ◊ Refer to ANSI/ASSE Z244.1-2003 (R2014), Control of Hazardous Energy — Lockout/Tagout and Alternative Methods, and OSHA Standard 29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout).
- At least two (2) means of support are used to secure the raised platform.
  - ◊ The lifting systems can be used as one means of support provided that no work is to be done on the hydraulic system or mechanical drive system and an appropriate LOTO has been performed on the VRC.
  - ◊ Additional means of support include adequately sized maintenance chains, maintenance pins, DeckLocks, or straps with shackles around the drivebase that are capable of supporting the weight of the carriage.

Minimize the Hazards

Every employee must be aware of the hazards before entering the area under a raised carriage. Take appropriate steps to minimize these hazards and any others that are identified. Some of the more common hazards are:

- Inadequate refuge space
- Confined space
- Improper air quality
- Inadequate lighting
- Improper access
- Tripping hazards
- Unsafe or lack of pit ladders
- The presence of moisture/water/oil
- Moving equipment

General Guidelines

- Where a VRC is operating in a multiple unit hoistway, that portion of the hoistway where the work is to be performed shall be fully separated or accessible equipment locked out.
- Ensure that all portable lights and tools are connected through a Ground Fault Circuit Interrupter (GFCI).
- Provide adequate lighting especially if in a shaftway.
- For a deep pit, never "jump" into the pit – always use a ladder.
- Use proper hand protection while cleaning the area beneath a raised carriage.
- Remove parts, lubricants, cleaning equipment, etc. from inside the pit.
- Do not stand on the hydraulic piping or electrical conduit.
- Never straddle over the traveling cable(s) if so equipped and protect it against damage.

Entrance Below a Raised Carriage Deck

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Pit Access

Access to the area beneath the raised carriage deck can be gained through manual measures implemented by qualified maintenance technicians.

Manual Access

1. Call the carriage to the lower level.
2. Open the lower gate and bypass the gate open switch at the interlock or in the main control panel. If there is any confusion about how to do this, call PFlow Industries, Inc. Customer Support Department.
3. Barricade the lower level gate opening to prevent unintended access and provide hazard warning signs.
4. Verify that the carriage is empty. Raise the carriage to the upper level making sure all personnel are clear of the moving carriage.
5. Lockout the VRC in accordance with the facility lockout/tagout program.
6. Secure the carriage at the upper level using adequately sized maintenance chains, maintenance pins, or straps with shackles around the drivebase that are capable of supporting the weight of the carriage to provide additional safety.

NOTICE

Do not attempt to do any work on the lifting system (e.g., hydraulic system, motor drive). When work is to be done on the hydraulic system or mechanical drive system, a different procedure must be followed. The carriage must be landed on stands or secured by another means in order to prevent any weight from relying on the lifting means or when the hydraulic pressure is fully relieved. Consult PFlow Industries, Inc.

7. Return to the lower level and verify that the gate and the carriage does not move if the push-buttons are pressed. Wedge or block the lower level gate in the open position to prevent the gate from closing while someone is in the pit area.
8. Perform the necessary maintenance, adjustments, or cleaning under the carriage.
9. Exit the pit and remove the wedge or block holding the lower level gate open.
10. Reverse the process to return the VRC into service.

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Unique Descriptions and Names

PFlow Industries, Inc. has incorporated, as well as created, a number of unique descriptions, names, and terminology for parts, components, and devices included in the Vertical Reciprocating Conveyor (VRC). This glossary includes these unique terms and other common terms to help understand this manual and the information it contains. In addition, the glossary will aid the user in communicating the correct information during troubleshooting and service situations. Although the wording and descriptions may sound familiar to the person who has read the manual, other terms and descriptions might not. It is recommended by PFlow Industries, Inc. that this glossary be reviewed before reading the remainder of this manual.

Alkyd paint	A fast-drying enamel paint, color-mixed per the customer's request, and applied using standard methods as specified by the paint manufacturer.
ANSI	American National Standards Institute: www.ansi.org
ASME	American Society of Mechanical Engineers: www.asme.org
Authorized person	Trained or qualified personnel approved to perform a specific duty or duties.
Capacity	The maximum load for which the VRC is designed.
Carriage	The entire structural assembly that travels on the guide columns and carries the load.
CEMA	Conveyor Equipment Manufacturers Association: www.cemanet.org
Chain	See Lift chain and Roller chain.
Chain Driven Live Roller (CDLR)	A horizontal conveyor that is driven by separate loops of chain or a continuous chain. The chain contacts all roller sprockets, depending on the type and function of the horizontal conveyor. Either double or single sprockets are fitted to the horizontal conveyor rollers.
Chain tensioner	A device that monitors the lift chain tension. If the lift chain is too tight, becomes slack, or breaks, the limit switch mounted on the chain tensioner will trip and remove control power.
Constant Pressure Push-Button	A push-button which must remain pressed and maintained by the operator in order to perform a desired operation. If the push-button is released, the desired operation will stop.
Controls	Any combination of electrical devices used to control the operation of a VRC. This normally includes push-buttons, relays, limit switches, interlocks, etc.
Control panel	An enclosure housing various electrical components that control the VRC.
Control voltage	The control voltage is typically provided by the control transformer and is used to energize the various low voltage electrical devices.
Conveyor, Vertical Reciprocating	See Vertical Reciprocating Conveyor (VRC).

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Dead load	A static load that is a permanent force, acting on a structure (see Platform).
Deck	The floor of the carriage (can be smooth plate, tread plate, or open).
Drivebase assembly	Gear reducer, brake motor and mechanical components that power the chain that lifts and lowers the carriage for mechanical VRCs. This assembly is mounted at the bottom of box lifts.
Drift	The action of a lift carriage slowly dropping, usually due to slight internal leaks in a hydraulic system or mechanical slippage of a motor brake.
Effective width/length	Refers to usable space for the materials load on the carriage, not the overall dimensions which includes space allowed for carriage side guards.
Electrical cable	Electrical cables consist of at least two conductors contained within a protective outer cover.
Epoxy coating	Abrasion-resistant, two-part industrial-strength protective coating system applied over sandblasted and primed steel or direct to metal. The epoxy coating is ideal for outdoor, chemical, or caustic wash-down environments or applications where standard alkyd enamel is viewed as insufficient.
Expanded metal (EM)	A sheet of metal uniformly slit and stretched, forming diamond-shaped openings in the metal sheet. Expanded metal is a one piece construction that will not unravel under normal circumstances and will hold its shape. Expanded metal comes in a standard (raised) or flattened diamond pattern in a variety of gauges, opening sizes, materials and sheet sizes.
Explosion proof (EXP)	Electrical devices (e.g., control panels, motors, limit switches) that are designed to operate safely in a specific location or area where potentially explosive environments can or do exist.
Floor-to-Floor distance	The distance from one operating floor level to the adjacent operating floor level (see Vertical travel).
General Arrangement (GA) drawing	The drawing produced by PFlow Industries, Inc. which shows the VRC lift. The drawing may show but does not specify building details.
Guarded by location	Describes moving parts so protected by the parts remoteness from the floor, platform, walkway, or other working level, or by the parts location with reference to the frame, foundation, or structure to reduce the foreseeable risk of accidental contact by persons or objects. The parts remoteness from foreseeable, regular, or frequent presence of public or employed personnel may constitute guarding by location in reasonable circumstances. (See ASME B20.1 standard)
Guide angles	Guide angles are attached to the guide column to help capture and contain the guide wheels in the columns and guide the carriage.

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Header	Header refers to the horizontal structure spanning the width of the carriage. The carriage header defines the load height.
HMI (Human Machine Interface)	The user interface in the control system that provides graphic control of the VRC. The HMI communicates with the programmable logic controller (PLC).
Hollow shaft	VRC mechanical shaft of the mechanical drivebase which penetrates the gear motor rather than coupling to the gear motor. This minimizes wear points.
Incoming voltage	The main voltage being supplied for operation of the equipment.
Interlock (Door)	An electro-mechanical locking system used on the gates or access doors of a VRC. The system prevents the VRC operation unless all such gates or access doors are closed. The system also prevents the opening of any such access door unless the VRC carriage is present at that particular opening.
Intermediate level	A floor level or levels between the uppermost and bottommost operating floor.
Junction box	An electrical control box used to join, centralize, and distribute wiring from different locations.
Keylock control	A keyed push-button station that prevents unauthorized use of the VRC.
Knock-down (KD)	Lift components shipped in two or more pieces. Typically field welding is required (e.g., KD carriage, KD headers, KD uprights, KD gates, etc.).
Lift chain	A chain that lifts the carriage and load.
Lift location light	Illuminated push-button that indicates at which level the carriage is located.
Lifted load	The total weight that the VRC is designed to lift at a specific speed. Typically, this is the dead load plus live load (see Rated load).
Limit switch	An electrical device which is used to control the carriage position and monitor various mechanical devices.
Load pattern	A method to describe the direction a load can be moved on and off a carriage at different operating floors or levels. These can be used in combinations. ● **"C" load pattern:** Carriage configuration allowing a load/unload opening on one side of the carriage deck. ● **"Z" load pattern:** Carriage configuration allowing a load/unload opening on opposite sides of carriage deck. ● **"90 degree" load pattern:** Carriage configuration allowing a load/unload openings at right angles on the carriage deck.
Load test	The carriage is loaded to rated capacity, and the lift is operated.

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Macropoxy	Macropoxy is a fast drying, polyamide epoxy designed to protect steel in industrial exposures. Ideal for protection of sharp edges, corners, and welds.
Momentary contact push-button	A push-button which only has to be pressed for an instant to activate the desired operation.
Operating end	The side(s) of the carriage used for loading/unloading.
Overall dimension	The outside dimension of the carriage structure or the entire lift.
Overtravel limit switch	A safety device provided on mechanical VRCs to stop carriage travel beyond the uppermost or lowermost floor level if the floor level positioning limit switch fails.
Photo eye	Photoelectric sensor that uses a focused beam of light to span the distance to a reflector. The VRC controls receive a signal when the reflected bean of light is detected by a sensor.
Platform	The structure that forms the floor of the carriage and that directly supports the load (see Deck).
Programmable Logic Controller (PLC)	A micro-processor based device that controls the VRC through a resident software program.
Push-button (PB) station	The wall mounted, pedestal mounted, or hand held device used to control the operation of the VRC.
Qualified person	A person, who by possession of a recognized degree, certificate, professional standing, or skill, and who by knowledge, training and experience, has demonstrated the ability to deal with problems relating to the subject matter, the work, or the project.
Rated load	The load the VRC is designed for and installed to lift at a rated speed (see Lifted load).
Reflector	A plastic, prismatic object used to reflect a beam of light emitted from a photoelectric sensor.
Roller chain	The type of chain drive most commonly used for transmission of mechanical power. The roller chain consists of a series of short cylindrical rollers held together by side links and connecting pins. The roller chain is driven by a toothed wheel called a sprocket.
Safety cam	Spring-loaded, hardened steel cam directly attached to the lift chain or gate chain that engages if the lift chain or gate chain breaks or slackens, preventing the carriage or gate panel from dropping more than a few inches.
Side guards	A protective enclosure on the outermost edge of the inoperable sides of the deck welded to the carriage to contain load. Can be rails, sheet steel, or expanded metal.
Slack chain device	A device that monitors a chain and trips if the chain goes slack. If the chain becomes slack or breaks, the limit switch mounted on the slack chain device will trip and remove power to the circuit.

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Sprocket	A wheel typically mounted on a shaft. The wheel has a row of teeth around its edge that fit into the links of a chain.
Top of roller (TOR)	Top elevation of a horizontal conveyor system roller which is also the lower elevation of the load.
Touchscreen	See HMI.
Travel	The difference in elevation between the bottommost level of the carriage platform and the uppermost level of the carriage platform.
UHMW (Ultra-High Molecular Weight)	An abrasion-resistant, high-impact, polyethylene material used throughout the VRC to protect and/or guide moving parts.
VFD (Variable-Frequency Drive)	A VFD is a type of drive used in electro-mechanical drive systems to control AC motor speed and torque by varying the motor frequency and voltage.
Vertical travel	Distance the carriage deck travels; floor-to-floor or total distance (see Travel).
Vertical Reciprocating Conveyor (VRC)	A reciprocating power actuated lifting device (not designed to carry passengers or an operator) that receives loads on a carriage and transports these objects from one operating elevation to another.
VRC specification sheet	PFlow Industries, Inc. informational data sheet providing general information on a specific VRC.

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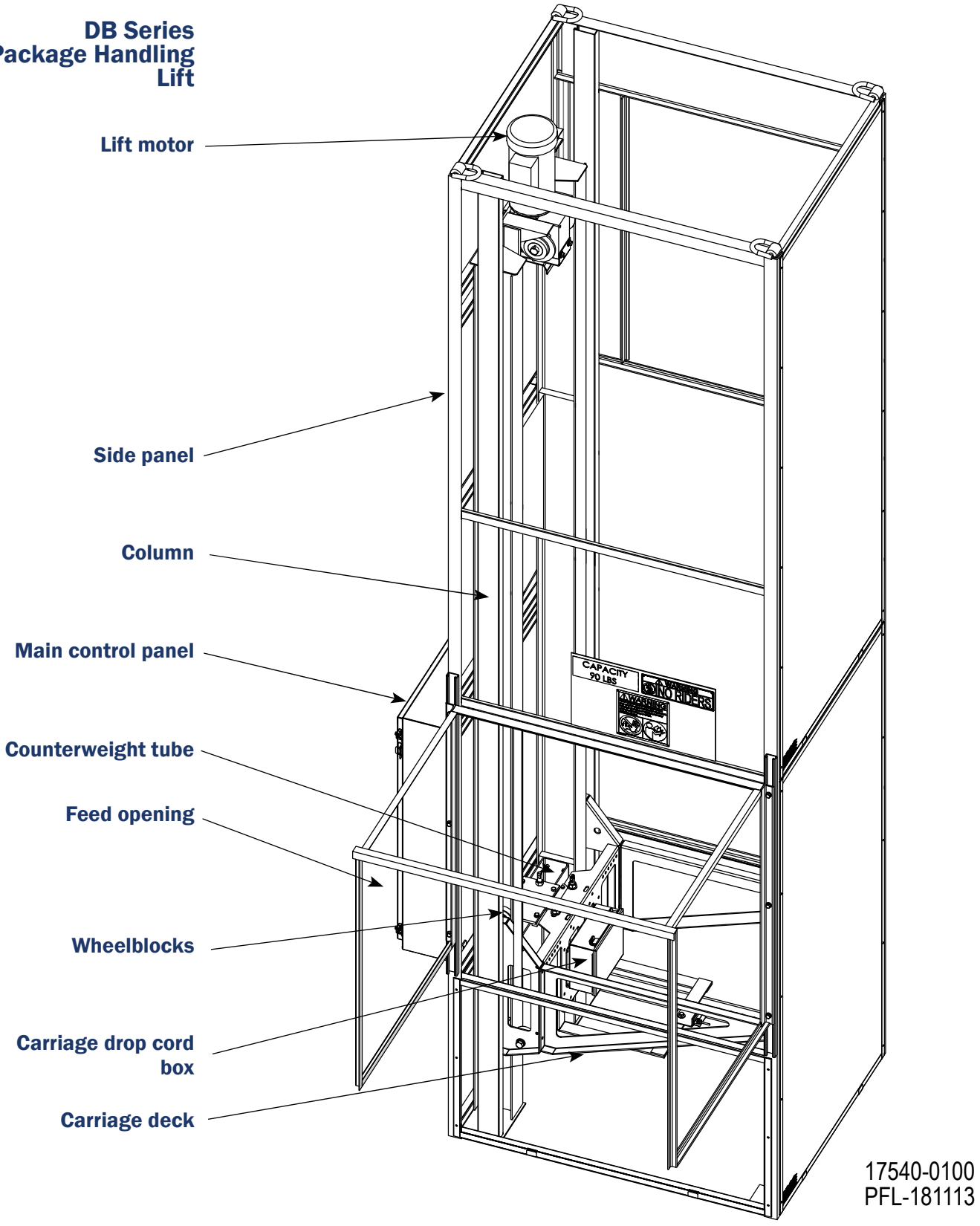
DB Series Package Handling Lift



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Field Electrical Wiring Standards

All electrical wiring and craftsmanship completed in the field shall be in accordance with existing state, local and National Electrical Code (NEC) standards.

Definitions

In-field electrical wiring — All hard wiring of all electrical devices external of control panel.

Control circuit — The control circuit refers to all circuits and devices at 120 VAC and below.

Power circuit — Power circuit refers to all circuits and devices at 208 VAC and above.

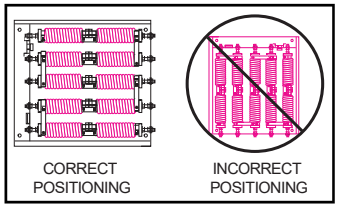
Systems — Systems refers to automated vertical and horizontal conveyors.

Requirements

1. It is recommended that all control circuit wiring is #14 AWG, copper, stranded, type THHN or equal, 600 VAC.
2. It is required that all power circuit wiring is #12 AWG minimum (sized appropriately for the load), copper, stranded, type THHN or equal. A green grounding wire shall be provided to power devices.
3. Per NFPA 79, the colors of individual conductors shall be:

   Power wiring - Black
   115 VAC - Red
   115 VAC neutral - White
   24 VAC - Red/black
   24 VAC neutral - White
   24 VDC - Blue
   0VDC - White/blue
   Ground - Green or green/yellow

   Note: These colors only apply to individual conductors. These colors do not apply to prefabricated cables.
4. All wires must be labeled on each end with the wire number from the electrical drawing using a machine or computer generated label, utilizing black characters on a white background.
5. All field devices must be individually terminated in the control panel.
6. Screw on solderless connectors (wire nuts) shall be of the insulated type, spring lock, and of the proper size to accommodate wires.
7. Terminal lugs shall be of the insulated type, crimp style, and of the proper size to accommodate wire(s) and terminal fasteners.
8. Conduit and related hardware shall conform to local, state, and NEC standards. The minimum size shall be 1/2". Connectors and couplings shall be appropriate for conduit type.
9. Flexible conduit shall be a minimum of 1/2", shall be of the liquid-tight type, and shall be installed with compatible liquid-tight connectors.
10. The customer shall locate and install a fused disconnect switch within the line of sight of the control panel. The customer shall ensure accessibility to the disconnect switch with regard to existing electrical codes and standards.
11. Control wiring and conduit shall be separate from the power wiring and conduit.
12. When mounting resistor banks, make sure the resistor elements are horizontally positioned.
13. Drop cords (flexible cords) shall be multi-conductor festoon-type cable where applicable.



Resistor Bank Positioning

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Electrical Ruling Bodies

NEMA	***National Electrical Manufacturers Association*** provides national testing and manufacturing standards body of electrical apparatus.
UL	***Underwriters Laboratories, Inc.*** is an independent testing laboratory. Many local codes require UL control panels and electrical apparatus.
JIC	***Joint Industry Council*** is an advisory group that provides standards for production equipment, safety, and dependability.
NFPA	***National Fire Protection Association*** is the ruling board of NEC and sets national fire and safety standards for equipment and manufacturing facilities.
CSA	***Canadian Standards Association*** is a regulatory agency of Canada.
ANSI	***American National Standards Institute*** oversees the creation, promulgation, and use of thousands of norms and guidelines that directly impact businesses.
ASME	***American Society of Mechanical Engineers*** is a leader in technical innovation with a focus on advancing and applying engineering knowledge and communicating the excitement of engineering. This group is the Secretariat for ANSI.
NEC	***National Electrical Code*** is an advisory board to NFPA with recommendations and codes usually adopted throughout the United States.

PFlow's Standard

NEMA 12 classification is to be used in a general purpose, indoor only application.

All PFlow Industries, Inc. control systems are built to a NEMA 12 minimum classification. All PFlow Industries, Inc. control systems conform to the following standards:

- ***NFPA 70 (NEC):*** The National Electrical Code.
- ***NFPA 79:*** Electrical standard for industrial machinery.

Outdoor Application

Outdoor equipment or electrical devices exposed to severe weather conditions should not be rated less than NEMA type 4. This is a watertight, dust-tight, indoor-outdoor classification that will provide protection against splashing water, seepage of water, falling or hose-directed water, and severe external condensation.

Corrosive Application

The chemical industry on the whole usually specifies a minimum NEMA type 4X. A NEMA 4X rating is similar to a NEMA 4 with added corrosion resistance.

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PFlow's Standard (continued)

Hazardous Location

Hazardous locations are an extremely specialized electrical classification. Few electrical experts exist in this field. All hazardous locations must be handled as defined by the class, division, and group designator for the job site condition.

The NEC has three classes (I, II, III), - two divisions, (1 and 2) and seven group designations (A, B, C, D, E, F, and G).

Class Definitions

Class I locations: Locations in which flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

Class II locations: Locations that are hazardous because of the presence of combustible dust.

Class III locations: Locations that are hazardous because of the presence of easily ignitable fibers or where materials producing combustible flyings are handled, manufactured, or used, but in which such fibers/filings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixture.

Division Definitions

Division 1 is an extremely dangerous explosive condition that exists normally.

Division 2 is a dangerous explosive condition that could exist but usually does not.

Group Designations

Group designations are given by the NFPA, State Fire Marshals, insurance companies or consulting engineering firms according to the gasses, dust, or other particles in the area and the spark or temperature needed to produce an explosion.

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Arrival

A fork truck capable of lifting approximately 2,000 lbs. (907 kg) is required. Larger Vertical Reciprocating Conveyors (VRCs) may require a heavier lifting capacity fork truck or crane. Refer to the shipping weights for the equipment required for your job. Prior to shipping, PFlow Industries, Inc. takes pictures of all the items shipped, contents of the parts crate, and individual boxes to make sure the shipment is complete.

NOTICE

The material in the boxes, cartons, etc. are delivered to the carrier agent complete and in good condition. Report shipping damage or discrepancies immediately to the PFlow Industries, Inc. Customer Support Department. ***PFlow Industries, Inc. is not responsible for damage due to shipping or receiving once the equipment has left the factory nor will PFlow Industries, Inc. file any claims for damage that may occur.***

Inspection

Upon receipt, conduct an immediate inspection while the equipment is still on the truck or immediately after it is moved to the receiving area. Do not wait until after the equipment is moved to a storage area.

Verify that the number of items on the Bill of Lading agrees with the number of items delivered. Examine all pieces to determine if damage has occurred during transit. Do not sign a delivery receipt or a freight bill until a proper count has been made and inspection of all packages are complete. Should damage occur in shipment, it is a matter between the carrier and the consignee. In such cases, the carrier is assumed to be responsible for the safe delivery of the equipment, unless negligence can be established on the part of the shipper.

Verify the dimensions of the delivered materials against the PFlow Industries, Inc. General Arrangement (GA) drawing. If anything is missing or incorrect, contact the PFlow Industries, Inc. Customer Support Department immediately. Failure to notify the PFlow Industries, Inc. Customer Support Department may affect the completion time of the installation. The warranty does not cover lost time and/or additional trips for missing or damaged components.

Transportation Damage and Claims

1. Note all visible loss or damage that has occurred directly on the carrier's delivery receipt.
2. Have the driver sign the delivery receipt. If the driver refuses to sign, make a notation of this refusal on the receipt.
3. If the driver refuses to allow inspection, write the following on the delivery receipt: Driver refuses to allow inspection of containers for visible damage. Have the driver sign the delivery receipt.
4. Contact the carrier's office immediately upon finding damage and request an inspection. Mail a written confirmation to the carrier's office with the time, date, and the person called.
5. Save any packages and packing material for further inspection by the carrier.
6. Promptly file a written claim with the carrier and attach copies of all supporting paperwork. Report all hidden damage directly to the freight carrier within seven days of delivery.

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Shipping Photograph Examples

Parts Box

Parts Box Contents

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Shipping Packet

The shipping packet contains the Owner's, Installation, and Maintenance Manual, General Arrangement drawing, electrical schematic, and additional information applicable to the installation.

An additional copy of the schematic is inside the control panel.

Return Materials Authorization (RMA)

All replacement components needed as a result of any damage will require a purchase order, authorization number, and compliance with PFlow Industries, Inc. Return Materials Authorization (RMA) procedures. The RMA number shall be obtained from PFlow Industries, Inc. Customer Support Department. The RMA number helps to identify and track the component when returned to PFlow Industries, Inc.

Warranty Work

Warranty procedures are included in this manual. All warranty work must be pre-authorized by the PFlow Industries, Inc. Customer Support Department prior to starting work.

1. Notify the PFlow Industries, Inc. Customer Support Department of the problem for authorization.
2. PFlow Industries, Inc. will determine:
   - The cause of the problem.
   - Who will do the repair work.
   - The repair details involved.
3. If PFlow Industries, Inc. decides that your organization or your subcontractor will do the work, an authorization number will be assigned which must be referenced on all subsequent paperwork.

NOTE *Notify PFlow Industries, Inc. by phone, FAX, or e-mail during the next business day if an event occurs during our non-working hours. Issuance of an authorization number does not guarantee approval and or payment.*

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Recommended Tools

The following is a list of recommended tools necessary to expertly install the equipment to industry standards. This is only a guideline. Individual sites and applications may require additional items.

	Welding Machine and Equipment (Helmet, Gloves, Rods)		Fire Extinguisher
	Cutting Torch with Tanks		Disk Grinder
	Lifting Cables, Straps, Slings or Chains: 1,000 lb. (454 kg) Capacity (Minimum)		Socket Set: 3/8" Drive Sockets Sizes to 3/4"
	Chain Fall: 2,000 lb. (907 kg) Capacity (Minimum)		Hammer Drill & Bits: (3/8", 1/2" Anchors; 4" Length Minimum)
	Scissor Lift (optional but helpful)		Open or Box-End Wrenches to 3/4"
	Fork Lift: 2,000 lb. (907 kg) Lifting Capacity (Minimum)		Electric Drill and Drill Bits
	Step Ladder(s)		Allen Wrenches to 3/8"
	Come-Along Tool		Plumb Bob
	“C” Clamps		Sledge Hammer (Plastic)
	Drift Punch		Extension Cords
	Spirit Level: 4' (1,219 m) Long		Chalk Snap-Line
	Carpenter’s Framing Square		25' (7,62 m) Measuring Tape
	Pry bar		Rags
	Portable Light		Grease Gun
	SAE 30W Non-Detergent Motor Oil		Hack-Saw, Reciprocating Saw, or Portable Band-Saw
	Tap set: 5/8" - 11		

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Before You Begin

Read this entire manual.

Pre-Installation Responsibilities

Proper preparation of the job site before beginning the installation can mean the difference between an installation that is safe and smooth and an installation that is difficult. Being aware of who is responsible for the listed activities will make sure the installation is a smooth process.

PFlow Industries, Inc. recommends that an installer with knowledge and experience on how to rig and erect structural steel discuss not only these items but all other concerns directly with the people on the job site.

A pre-installation job site visit is always recommended and considered to be included in the responsibilities of the mechanical installer.

End User Responsibilities

1. Assign the authorized on-site contact.
2. Provide the contact information for the authorized on-site contact.
3. Determine the work hours allowed to work on-site.
4. Arrange for other trades or in-plant production to avoid conflict with the proposed installation schedule or between trades.
5. Determine the work procedures and safety guidelines particular to the job site.
6. Communicate on-site safety meetings prior to beginning the installation.

End User and/or Mechanical Installer and/or Electrical Installer Responsibilities

1. Secure any required job site, local, or state permits before beginning the installation.
2. Determine if a local inspection and sign-off is required after the installation has been completed.
3. Unload and transport the equipment to the installation area.
4. Determine storage options (if applicable). Storing the equipment outside will void the warranty. If the equipment is stored indoors for a month or longer, consult PFlow Industries, Inc. for maintenance procedures required to keep the warranty in effect.
5. Prepare all necessary job site areas (e.g., pit, floor opening, adequate bracing locations, shaftway openings, doorways) for the installation.
6. Coordinate any job site or building modifications necessary to get the equipment to the installation area.
7. Determine if the weight and the size of the components exceed the lift requirements to handle and lift the heaviest load. If the weight of the load is in question, please contact the PFlow Industries, Inc. Customer Support Department.
8. Locate the pick-point capable of lifting and handling the necessary components.
9. Determine approved bracing locations and attachment points on the job site. Make sure that the bracing attachment points will withstand the static lateral load for bracing the lift. Details are called out on the GA drawing.
10. Make sure that the floor under the columns will withstand the base plate loading stated on the VSP spec sheet.

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Mechanical Installer Responsibilities

1. Conduct a pre-installation job site visit.
2. Review the General Arrangement (GA) drawing for any discrepancies between the GA drawing and the job site.
3. Compare the dimensions listed on the GA drawing to the dimensions on the actual job site.

NOTE *Discrepancies in the pit length, pit width, pit depth, overhead clearances, and a pit that is not square or level are just a few items that could create a problem. These discrepancies must be addressed immediately with PFlow Industries, Inc.*

4. Report any discrepancies to the PFlow Industries, Inc. Customer Support Department.
5. Determine if additional bracing material is required.
6. Complete mechanical erection of the equipment as sold by PFlow Industries, Inc. and called out on the GA drawing, and follow all instructions in the installation manual and safe work procedures.
7. Mount all electrical devices at non-union job sites.
8. Return trip upon completion of the electrical installation and be present for the final checkout, adjustments, and training. Complete and return the Installation Completion Checklist to PFlow Industries, Inc. Customer Support Department at csd@pflow.com

Electrical Installer Responsibilities

1. Review the General Arrangement (GA) drawing for any discrepancies between the GA drawing and the job site.
2. Report any discrepancies to the PFlow Industries, Inc. Customer Support Department.
3. Complete electrical connection of the equipment as sold by PFlow Industries, Inc. and shown on the electrical drawings and GA drawing.
4. Follow all instructions in the installation manual and safe work procedures.
5. Be present for the final checkout, adjustments, and training. Complete and return the Installation Completion Checklist to PFlow Industries, Inc. Customer Support Department at csd@pflow.com

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Before You Begin

Read this entire manual.

General Arrangement (GA) Drawing

Job site conditions may be different than those listed on the GA drawing. This drawing includes configuration and dimensional data specific to the job site:

- Job number
- Equipment dimensions
- Clearance dimensions
- Static lateral load
- Applicable options

The VRC can only be used according to the specifications given in this manual and the General Arrangement (GA) drawing. If the VRC is to be used outside the original design, contact the PFlow Industries, Inc. Customer Support Department to determine if the intended use is possible.

⚠WARNING

Inappropriate and/or modified use of the VRC can result in dangerous safety issues and/or damage. If this VRC needs to be modified in any way, contact PFlow Industries, Inc. for assistance. Do not make any unauthorized changes.

Obtain written confirmation from PFlow Industries, Inc. before using the VRC in a modified or unspecified manner. PFlow Industries, Inc., cannot be held liable for any accidents and/or damages that may occur through inappropriate or unauthorized use of the VRC.

1. Locate the PFlow Industries, Inc. GA drawing in the shipping packet inside the parts crate.
2. Review the GA drawing for any discrepancies.
3. Compare the dimensions listed on the GA drawing to the dimensions of the actual job site and the materials received.

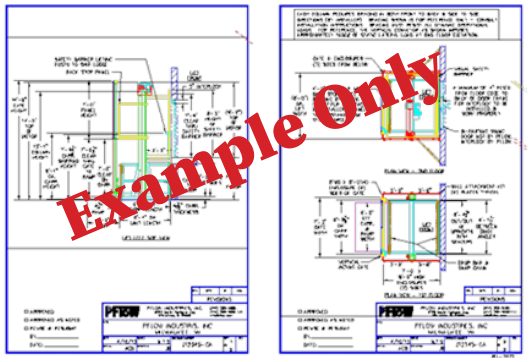
NOTE *Discrepancies in the pit length, pit width, pit depth, overhead clearances, and a pit that is not square are just a few items that could create a problem. These discrepancies must be addressed immediately with PFlow Industries, Inc.*

4. Report any discrepancies to the PFlow Industries, Inc. Customer Support Department.

Contact the PFlow Industries, Inc. Customer Support Department with any questions or concerns at any time throughout the installation of this equipment.

Sample GA Drawing

The sample drawing shown is only an example and is not applicable to this VRC.



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Frequently Asked Questions

Proper preparation of the job site before beginning the installation can mean the difference between an installation that is smooth and an installation that is difficult. PFlow Industries, Inc. has prepared a list of site specific questions to investigate:

1. Is 3-phase power available for the installation work?
2. Is welding permitted?
3. Is a “hot permit” required?
4. Is a fire watch required? Are there special welding requirements (e.g., special coatings such as epoxy paint, or hot dipped galvanized steel)?
5. Are there any protrusions or rough spots in the floor level or wall space that could interfere with the installation or the operation?
6. Are the floors level?
7. Can the equipment pass through all openings, doorways, hallways, and shaftway openings?
8. Is there other non-PFlow Industries, Inc. equipment to be integrated with the PFlow Industries, Inc. VRC components?
9. Is a job specific bracing drawing required?
10. Is the work site union or non-union?
11. Is the customer’s forklift available for use?
12. Do the weight and size of the Vertical Reciprocating Conveyor (VRC) components exceed the capability of the on-site equipment to handle and lift the VRC components? If the weight of the load is in question, contact the PFlow Industries, Inc. Customer Support Department.
13. Is there a pick-point capable of lifting the necessary lift components?

Contact the PFlow Industries, Inc. Customer Support Department with any questions or concerns at any time throughout the installation of this equipment.

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Mechanical Overview

The standard DB Series Package Handling Lift Vertical Reciprocating Conveyor (VRC) consists of a frame, a motor drive assembly with a brake and worm gear reducer, lift sprockets, roller chain, counterweight, a moving carriage deck, and enclosures. In addition, a main control panel and typically at least one push-button station per level are furnished. For more information on the electrical components, see Electrical Overview in this manual.

NOTE

Certain applications require a belt drive using a high-efficiency reducer with adjustable speed capabilities. See drawing attachments regarding non-standard applications.

Steel Frame

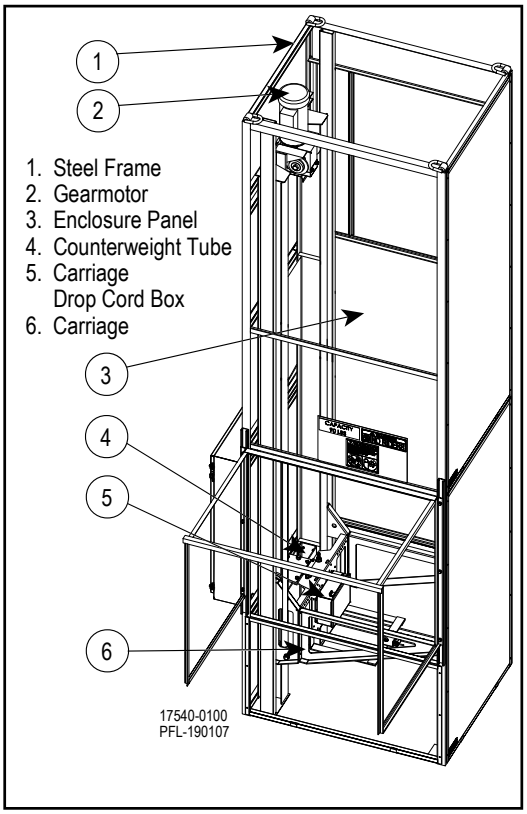
The steel frame consists of structural beams and columns, drive mount, base, enclosure framing, and expanded metal enclosures.

Gearmotor, Roller Chains, and Counterweight

The gearmotor and lift sprockets are mounted to the top of the frame. The roller chains travel over the lift sprockets, are attached to the carriage at one end, with a counterweight at the other end.

Enclosure Panels

The standard enclosure panels will reject a ball 3/4" (19mm) in diameter and are the full height of the VRC.



Modular Frame Figure 11-1

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Motor Drive Assembly

The motor drive assembly consists of a motor, brake, gearmotor reducer (commonly referred to as a gear motor assembly), lift sprockets, a keyed drive shaft, bearings, and a support structure. See Figure 11-2.

Motor Drive Assembly Figure 11-2

Lift Chains

Dual lift chains connect to the top of the carriage frame, go up and over lift sprockets attached to the motor drive assembly and attach to the counter weight assembly. See Figure 11-3 and Figure 11-4.

NOTICE

This VRC uses special high strength chain. Do not use standard ANSI roller chain or connecting links as a replacement. Contact PFlow Industries, Inc. Customer Support Department for the required chain specification.

Lift Chains Figure 11-3

Counterweight Assembly Figure 11-4

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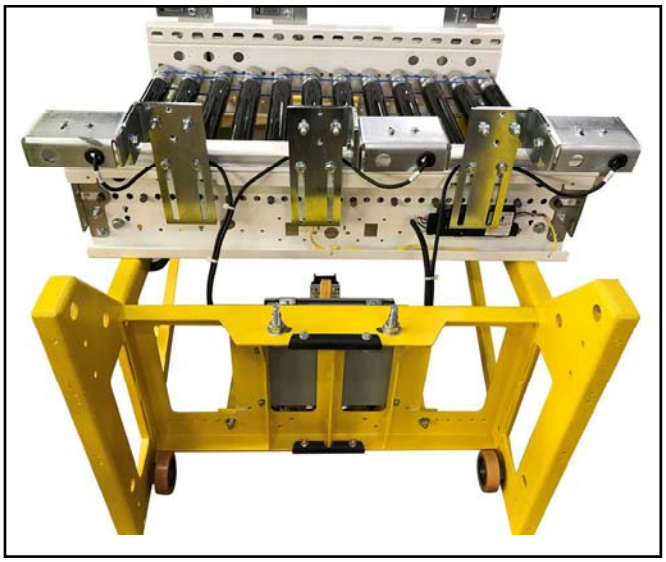
Carriage Assembly

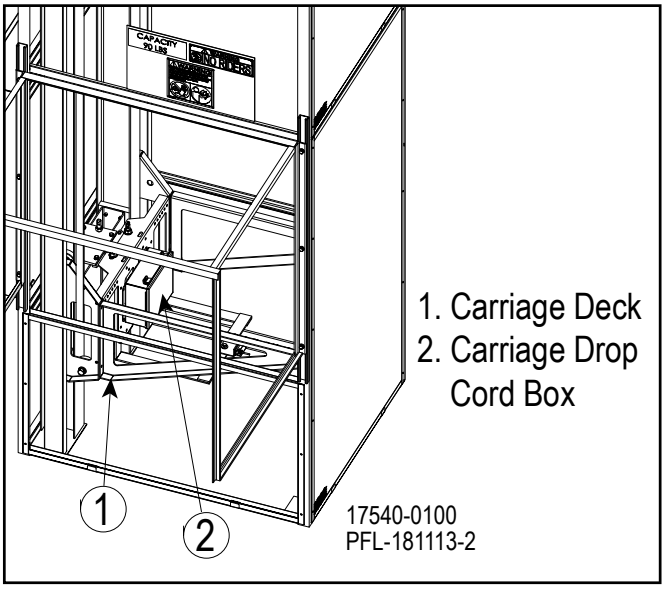
The carriage assembly consists of a deck frame (see yellow areas in Figure 11-5), two (2) guide rollers, and a carriage drop cord box. See Figure 11-5 and Figure 11-6.

Both lift chains are attached to the top of the carriage assembly with a master link and clip for each lift chain. See Figure 11-7.

NOTE *Conveyor, photo eyes, and other accessories are optional.*



Carriage Details Figure 11-5



Carriage Details Figure 11-6

Lift Chain Attachment Figure 11-7

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Electrical Overview

The following is a standard description of the electrical wiring of a DB series VRC. This does not include any specifics on options available or ordered (e.g., photo eyes) A copy of the electrical schematic can be found in the control panel and the shipping packet originally included in the parts crate.

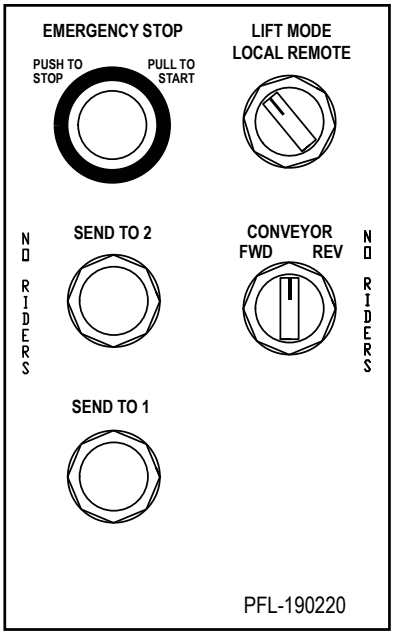
The standard two-level DB series VRC incorporates three (3) limit switches: one (1) limit switch at each level, and an overtravel limit switch. Acceleration and deceleration limit switches are optional.

Main Control Panel

The main lift motor, conveyor, and limit switches are pre-wired individually to the main control panel. The main control panel contains a fused step-down transformer for the control circuit, motor starter or Variable Frequency Drive (VFD). Power to the main control panel is provided by a customer supplied fused disconnect switch.

Push Buttons

The main control panel includes push buttons for manually operating the VRC in local mode. An emergency stop (E-stop) push button is also provided which is functional in both ***local*** and ***remote*** modes. When pressed, the emergency stop prevents the carriage from moving. The emergency stop must be pulled out before carriage movement can be initiated again.



Push Buttons Figure 12-1

The ***lift mode*** selector switch allows the operator to switch between ***local*** operation (using the push buttons on the main control panel door) and ***remote*** operation (using signals from the customer's control system).

The ***Send to "x"*** push buttons are momentary contact. This means the operator can press and release the ***Send to "x"*** push button and the carriage will travel to the selected level. The operator does not need to hold the ***Send to "x"*** push button for the carriage to continue moving.

The ***conveyors*** selector switch allows the operator to control the carriage conveyor forward and reverse, provided the VRC is enabled and the carriage is at a selected level. The selector switch is constant pressure, meaning that the carriage conveyor will operate as long as the selector switch is held in position.

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Before You Begin

Read this entire manual.

This section is provided for the assistance of qualified and trained service technicians only and is not intended for use by untrained or unauthorized service personnel. This section is not a replacement for the Leeson™ Drivesystems instructions. Additional resources and information can be found at www.grovegear.com under the Technical Information tab.

NOTICE

A qualified person is defined as a person who, by possession of a recognized degree or certificate of professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.

Personnel to carry out work at the brake must exclusively be qualified personnel who - based upon their education, experience, instructions as well as knowledge concerning relevant standards and provisions, accident prevention, regulations and operating conditions - have been authorized by the person being responsible for safety, to carry out the activities described in these instructions and who - when doing so - are in a position to recognize possible risks early and to avoid them.

⚠DANGER

High Voltage! Installation or maintenance work may only be performed when no power is available to the motor. Electric motors, electrical brakes, and variable frequency drives contain potentially dangerous high-voltage. Shut down the power at the circuit breaker or power switch. Employees servicing or maintaining VRCs may be exposed to death or serious personal injury if hazardous energy is not properly controlled. De-energize any circuit before work is begun. Follow your facilities procedures or OSHA lockout/tagout (LOTO) procedures anytime maintenance or service is being performed on any electrical box or component.

⚠WARNING

Burn Hazard! Surfaces of motors and gear units may become hot during operation or shortly after start-up. In some instances additional protection against accidental contact may be necessary. Use caution to avoid burns or serious injury!

Reducers are not to be considered fail safe or self-locking devices. If these features are required, a properly sized, independent holding device should utilized. ***Reducers should not be used as a brake.***

Use of an oil with an ED additive on VRCs with backstops may prevent proper operation of the backstop. Injury to personnel, damage to the reducer or other equipment may result.

Mounting bolts should be routinely inspected to make sure the motor is firmly anchored for proper operation.

For safe operation and to maintain the unit warranty, when changing a factory installed fastener for any reason, it becomes the responsibility of the person making the change to properly account for fastener grade, thread engagement, load, tightening torque and the means of torque retention.

Overhung loads subject shaft bearings and shafts to stress which may cause premature bearing failure and/or shaft breakage from bending fatigue, if not sized properly.

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Important Information

The motor manufacturer makes no warranties or representations, express or implied, by operation of law or otherwise, as to the merchantability or fitness for a particular purpose of the goods sold hereunder. Buyer acknowledges that it alone has determined that the goods purchased hereunder will suitably meet the requirements of their intended use. In no event will the Leeson be liable for consequential, incidental or other damages. Even if the repair or replacement remedy shall be deemed to have failed of its essential purpose under Section 2-719 of the Uniform Commercial Code, Leeson shall have no liability to Buyer for consequential damages.

Environment

Friction surfaces and the friction lining should not under any circumstances be in contact with oil or grease since small quantities reduce the braking torque considerably!

General Operating Conditions:
Operating time: 100%
Ambient temperature: 0°C to +40°C (32°F to 104°F)

Should any of the above parameters be exceeded contact the PFlow Industries, Inc. Customer Support Department for advice.

Directive and Standards

Leeson® Electric motors are UL Listed, cUL Listed and CSA certified for both explosion proof and non-explosion proof enclosures. Leeson® Electric motors are manufactured in accordance with all applicable areas of NEMA standards in MG1-2006. When applied in accordance with the “Guidelines for Application of Three Phase Motors on Variable Frequency Drives”, Leeson® Electric motors are in full compliance with NEMA MG1-2006, Part 31, Section 4.4.2, as pertaining to voltage spikes. 460 volt motors must withstand voltage spikes of up to 1426 volts; 575 volt motors must withstand spikes up to 1788 volts.

- ISO 001:2008 registrar NSF-ISR

The Leeson® Electric brake is not an independently operable machine but intended to be installed in other machinery.

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Labeling

All new stock and custom 800 Series Grove Gear and Electra-Gear worm gear reducers are identified by a model number. The model number appears on the nameplate and describes pertinent features of the reducer. A list follows with the various letters and positions used.

All reducers have a catalog number. Reducers and replacement parts should be ordered by catalog number. If a stock reducer has been factory modified by the addition of an optional base for example, the modification number T818EL is stamped in the blank column of the nameplate.

Catalog numbers 5000 and higher are custom reducers manufactured for a specific application. PFlow Industries, Inc. should be contacted for replacement reducers.

Typical Nameplate (Electra-Gear shown)

Series Code

GR - Grove Gear IRONMAN Cast Iron Reducers
NH - Grove Gear IRONMAN Narrow Housing Cast Iron Reducers
EL - Electra-Gear Aluminum Reducers
GRG - Grove Gear Flexaline Interchange (Sizes 821, 826, 832)
GRL - Leeson IRONMAN Interchange (Sizes 821, 826, 832)

Style

SOLID OUTPUT SHAFT
BMQ – Motorized, Quill Input
BM – Motorized, Flexible Coupling Input
B – Non-Flanged

HOLLOW OUTPUT SHAFT
HMQ – Motorized, Quill Input
HM – Motorized, Flexible Coupling Input
H – Non-Flanged

WASHGUARD STYLES
W prefix; i.e. WBMQ denotes WASHDOWN Reducer
S prefix; i.e. SHMQ denotes All-Stainless Steel Reducer

Size

800 SERIES CENTER DISTANCES

Size	Center Distance (Inches)
813	1.33
815**	1.54
818	1.75
821	2.06
824	2.38
826	2.62
830	3.00
832	3.25
842	4.25
852	5.25
860	6.00
870*	7.00
880*	8.00
8100*	10.00

* GR Series only
** Not available in EL Series

Ratio

See Selection Tables on pages 22-48, for all available ratios.

Output Shaft Orientation

L – Left-hand Output Shaft*
R – Right-hand Output Shaft*
D – Double Output Shaft
H – Hollow Output Shaft
* Viewed from drive end of reducer.

Motor Flange

Input Code		For Input Type	
Single Input	Dual Input		
blank	A	non-motorized	
48**	48A	48CZ	NEMA Input
56	56A	56C	NEMA Input
140	140A	143-5TC	NEMA Input
180	180A	182-4TC	NEMA Input
210	210A	213-5TC	NEMA Input
250	250A	254-6TC	NEMA Input
63	Contact Factory	D63D B5	IEC Input
71		D71D B5	IEC Input
80		D80D B5	IEC Input
90		D90D B5	IEC Input
110		D100LD/D112MD B5	IEC Input
132		D132D	IEC Input

** Not available in EL Series

Output Bore Code

Hollow Shaft Only
See bottom right hand pages of Max Ratings Tables starting on page 27.

NOTICE

Observe the data on all nameplates and verify published ratings for the item(s) in question. Do not operate any Leeson® equipment outside the published performance range. Failure to comply may result in damage to the drive unit, driven machine, or the environment.

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LEESON MOTOR MODEL NUMBER NOMENCLATURE

All LEESON motors, both stock and custom, have a catalog number and a model number. The model number appears on the motor's nameplate and describes pertinent electrical and mechanical features of the motor. An example follows along with a listing of the various letters and positions used.

POSITION 1: U.L. PREFIX

A = Auto protector. UL recognized for locked rotor plus run, also recognized construction (UL 1004)*.
M = Manual protector. UL recognized for locked rotor plus run, also recognized construction (UL 1004)*.
C = Component recognition. (UL 1004) No protector.
U = Auto protector. UL recognized construction (UL1004).
Motor/protector combination not UL recognized.
P = Manual protector. UL recognized construction (UL1004).
Motor/protector combination not UL recognized.
T = Thermostat, not UL recognized.
N = No overload protection.

*This applies only to 48, S56, and 56 frame designs through 1 HP, Open & TENV.

POSITION 2: FRAME

4 = 48 Frame	24 = 24 Frame	40 = 40 Frame
6 = 56 Frame	25 = 25 Frame	43 = 43 Frame
42= 42 Frame	30 = 30 Frame	44 = 44 Frame
143 = 143T Frame	31 = 31 Frame	
145 = 145T Frame	32 = 32 Frame	
182 = 182T Frame	34 = 34 Frame	
184 = 184T Frame	38 = 38 Frame	
213 = 213T Frame		
215 = 215T Frame		
254 = 254T Frame		
256 = 256T Frame		
284 = 284T Frame		
286 = 286T Frame		
324 = 324T Frame		
326 = 326T Frame		
364 = 364T Frame		
365 = 365T Frame		
404 = 404T Frame		
405 = 405 T Frame		
444 = 444T Frame		
447 = 447T Frame		
449 = 449T Frame		

POSITION 3: MOTOR TYPE

C =Cap. Start/Ind. Run	T =Three Phase
D =Direct Current	B =Brushless DC
K =Cap. Start/Cap. Run	H =Inverter Rated/IEEE841
P =Permanent Split	S =Split Phase

Odd frequencies other than 50 Hz show synchronous speed code. DC and special motors may have one, two, or three digits indicating motor speed rounded to the nearest hundred RPM.

EXAMPLE:

Position No.	1	2	3	4	5	6	7	8
Sample Model No.	A	4	C	17	D	B	1	A

POSITION 4: RPM

RPM-Single Speed	RPM-Multi-Speed
34 = 3450 RPM 60 Hz 2 Pole	24 = 2 and 4 Poles
28 = 2850 RPM 50 Hz 2 Pole	26 = 2 and 6 Poles
17 = 1725 RPM 60 Hz 4 Pole	82 = 2 and 8 Poles
14 = 1425 RPM 50 Hz 4 Pole	212 = 2 and 12 Poles
11 = 1140 RPM 60 Hz 6 Pole	46 = 4 and 6 Poles
9 = 950 RPM 50 Hz 6 Pole	48 = 4 and 8 Poles
8 = 960 RPM 60 Hz 8 Pole	410 = 4 and 10 Poles
7 = 720 RPM 50 Hz 8 Pole	412 = 4 and 12 Poles
7 = 795 RPM 60 Hz 10 Pole	68 = 6 and 8 Poles
6 = 580 RPM 50 Hz 10 Pole	
6 = 580 RPM 60 Hz 12 Pole	

POSITION 5: ENCLOSURE

D = Drip-Proof
E = Explosion-Proof TENV
F = Fan Cooled
N = TENV
O = Open
S = Splashproof
W = Weatherproof, Severe Duty, Chemical Duty, WASHGUARD® - TEFC
X = Explosion-Proof TEFC
V = Weatherproof, Severe Duty, Chemical Duty, WASHGUARD - TENV

POSITION 6: MOUNTING

B = Rigid base standard
C = "C" face - no base - NEMA
D = "D" flange - no base - NEMA
H = 48 frame - 56 frame mounting/shaft rigid
J = 48 frame - 56 frame mounting/shaft resilient
K = Rigid mount with "C" flange
M = Motor parts - rotor and stator
R = Resilient base
S = Shell motor
T = Round body
Z = Special mounting

POSITION 7: SEQUENCE NUMBER

Number assigned as required when new designs with new characteristics are needed.

POSITION 8: MODIFICATION LETTER

Major modification letter. Used when revisions made in existing model will affect service parts.

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⚠WARNING ***Do not change mounting positions without contacting factory.*** Altering the mounting position may require special lubrication provisions which must be factory installed.

Installation and General Operation

1. For shipment purposes, pipe plugs are installed in the unit and a vent plug is packed separately. After the VRC has been installed upright, remove the appropriate pipe plug and install the vent plug. See Section 13, page 7 for orientation. Failure to vent the unit can cause premature seal wear or loss of seal and oil. These conditions are not covered by warranty.
2. Make sure the oil level is correct. Do not operate the reducer without making sure it contains the correct amount of oil. Do not overfill or underfill with oil, or injury to personnel, reducer or other equipment may result.
3. Make sure the motor is connected to the speed reducer.
4. Run the motor which drives the reducer and verify the direction of reducer output rotation. Consult motor nameplate for instructions to reverse the direction of rotation.

NOTICE

- Improper oil levels may lead to premature component wear and diminished service life. The gear reducer may not receive proper lubrication if the unit is not mounted in the position for which it is designed.
- Do not weld on the gear unit or use the gear unit as an earth or ground connection for any welding procedure as this may cause permanent damage to the bearings and gears.
- Unless special measures are taken, the immediate vicinity around the gear drive or motor should not be exposed to any aggressive or corrosive substances, contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity, etc.

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Lubrication

All standard reducers ordered from Factory are filled with Mobil Glygoyle 460 polyglycol (PAG) lubricant or equivalent suitable for continuous option within a -10 to 120°F (-23 - 49°C) ambient temperature range. Double and triple reduction units have separate oil sumps and must be filled/inspected independently. Prior to startup, verify that the oil is at the level shown on page 7. Lubricant type is stamped on all nameplates.

The precision-made gears and bearings in Grove Gear / Electra-Gear Speed Reducers require high-grade lubricants of the proper viscosity to maintain trouble-free performance. All standard reducers ordered from the factory are filled with ISO viscosity grade 460 polyglycol (PAG) lubricant. If oil needs to be added or changed, ***only*** compatible polyglycol lubricants should be used. Contact the factory for more information.

NOTICE

- Do not mix different oils in the reducer. Grove Gear / Electra-Gear reducers are shipped standard with PAG lubricant – this lubricant is not compatible with conventional mineral or PAO synthetic oils.
- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food-grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, verify with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.

Change Intervals

Standard compounded lubricants (non-synthetic) should be changed every six months or 2500 operating hours, whichever comes first. Factory installed synthetic lubricants should be changed only when performing maintenance that requires gearbox disassembly.

Oil should be changed more often if reducer is used in a severe environment (e.g., dusty, humid).

In the Food and Drug Industry (including animal food), consult the lubrication supplier for recommendation of lubricants which are acceptable to the Food and Drug Administration and/or other authoritative bodies having jurisdiction. Factory supplied PAG oil is acceptable for incidental food contact (NSF H1) for use in and around food processing areas.

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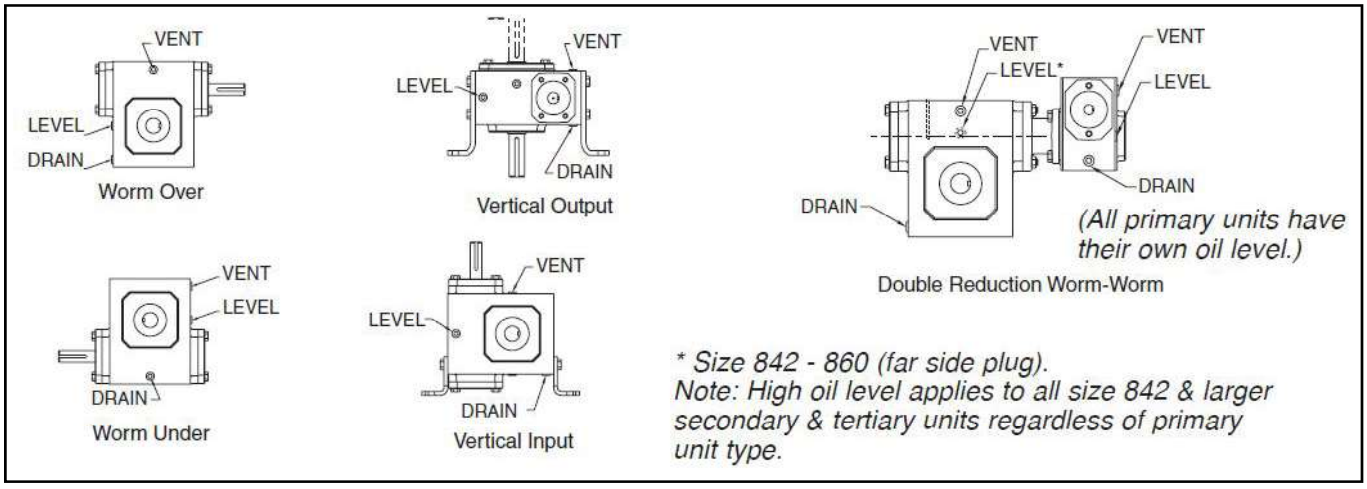
Oil Capacities

OIL CAPACITIES - (OUNCES) STANDARD UNITS														
Mounting Position	UNIT SIZE													
	813	815	818	821	824	826	830	832	842	852	860	870*	880*	8100*
Worm Over	4	12	12	20	24	40	56	72	112	188	312	560	768	1152
Worm Under	8	16	20	28	40	60	84	108	152	304	328	524	820	1280
Vertical Output	4	16	16	28	32	48	68	88	128	248	320	332	460	640
Vertical Input	4	16	16	24	32	48	72	92	128	248	325	584	800	1200
Extended Bearing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	128	192	272	432	640	1008	1632
Worm Over on Secondary Unit of Double Reduction	N/A	N/A	N/A	N/A	N/A	N/A	N/A	192	308	320	485	805	1144	1716
White Washguard - All Mounting Positions	6	14	18	26	32	50	78	98	N/A	N/A	N/A	N/A	N/A	N/A
Unified Stainless Steel - All Mounting Positions	7	15	15	19	28	44	N/A	76	N/A	N/A	N/A	N/A	N/A	N/A
CAUTION	Always check for proper oil level after filling. Oil should rise to the bottom edge of level hole on Standard Units. DO NOT OVER FILL													
* Shipped Dry														

As of 12/26/2013

Vent Plug, Level, and Drain Locations



Maintenance

Dismantling or replacement of components must be done by Grove Gear / Electra-Gear to maintain the warranty.

1. Frequently inspect the oil level of the reducer. If oil level is low, (refer to reducer vent and level position chart) add proper lubrication through the filler plug until the oil comes out the oil level plug.
2. Inspect vent plug often to ensure it is clean and operating.
3. Always verify proper oil level after filling. Do not overfill or underfill with oil. Injury to personnel, or damage to the reducer or other equipment may result.

NOTICE

Do not mix different oils in the reducer. Grove Gear / Electra-Gear reducers are shipped standard with PAG lubricant – this lubricant is not compatible with conventional mineral or PAO synthetic oils.

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Seal Replacement

The reducer utilizes premium quality seals which are state-of-the-art in sealing technology. Seals are, however, a wear item and eventually need to be replaced. Replacement can be easily accomplished by following the steps below:

1. Remove the worn seal without damaging the shaft surface or the seal bore. This can be done by drilling a .062 diameter hole in the seal casing (being careful not to drill into the bearing behind the seal). Install a #10 sheet metal screw into the hole and pry out the seal.
2. Clean the seal bore of sealant.
3. Before installing the new seal, use electrical tape to cover any keyways on the shaft to prevent seal lip damage.
4. Apply bearing grease to the seal lips and apply a sealant to the seal bore.
5. Slide the seal into the shaft being careful not to fold the inner lip over on any shaft steps.
6. Press the seal into its bore with a sleeve that presses on the seal casing, being careful to keep the seal square in its bore.

Removing the Motor

The motor can only be removed after power has been disconnected from the VRC, the brake and motor has been de-energized, and the brake is torque-free.

⚠ DANGER

High Voltage! Employees servicing or maintaining VRCs may be exposed to death or serious personal injury if hazardous energy is not properly controlled. De-energize any circuit before work is begun. Follow your facilities procedures or OSHA lockout/tagout (LOTO) procedures anytime maintenance or service is being performed on any electrical box or component.

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Troubleshooting the Motor

The following table identifies some of the most common issues, the possible causes, and the suggested solution.

Malfunction	Possible Cause	Solution
Motor fails to start upon initial installation.	Motor is miswired.	Verify motor is wired correctly.
	Motor damaged and rotor is striking stator.	May be able to reassemble; otherwise, replace motor.
	Fan guard bent and contacting fan.	Replace fan guard.
Motor has been running, then fails to start.	Fuse or circuit breaker tripped.	Replace fuse or reset the breaker.
	Stator is shorted or went to ground. Motor will make a humming noise and the circuit breaker or fuse will trip.	Disassemble motor and inspect windings and internal connections. A blown stator will show a burn mark. Motor must be replaced or the stator rewound.
	Motor overloaded or load jammed.	Inspect to see that the load is free. Verify amp draw of motor matches the nameplate rating.
	Capacitor (on single phase motor) may have failed.	First discharge capacitor. To test capacitor, set volt-ohm meter to RX100 scale and touch its probes to capacitor terminals. If capacitor is OK, needle will jump to zero ohms, and drift back to high. Steady zero ohms indicates a short circuit; steady high ohms indicates an open circuit.
	Starting switch has failed.	Disassemble motor and inspect both the centrifugal and stationary switches. The weights of the centrifugal switch should move in and out freely. Make sure that the switch is not loose on the shaft. Inspect contacts and connections on the stationary switch. Replace switch if the contacts are burned or pitted.
Motor runs but dies down.	Voltage drop.	If voltage is less than 10% of the motor's rating contact power company or investigate if some other equipment is taking power away from the motor.
	Physical load increased.	Verify the capacity has not been exceeded. Inspect for any mechanical interference.
Motor runs in the wrong direction.	Incorrect wiring.	Rewire motor according to wiring schematic provided.

(continued on next page)

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Malfunction	Possible Cause	Solution
Motor takes too long to accelerate.	Defective capacitor.	Test capacitor.
	Faulty stationary switch.	Inspect switch contacts and connections. Verify that switch reeds have some spring in them.
	Bad bearings.	Replace noisy or rough feeling bearings.
	Voltage too low.	Make sure the voltage is within 10% of the motor's nameplate rating. If not, contact power company or investigate if some other equipment is taking power away from the motor.
Motor overload protector continually trips.	Load too high.	Verify that the load is not jammed. If motor is a replacement, verify that the rating is the same as the previous motor. If previous motor was a special design, a stock motor may not be able to duplicate the performance. Remove the load from the motor and inspect the amp draw of the motor unloaded. It should be less than the full load rating stamped on the nameplate.
	Ambient temperature too high.	Verify that the motor is getting enough air for proper cooling. Most motors are designed to run in an ambient temperature of less than 104°F (40°C). (Note: A properly operating motor may be hot to the touch.)
	Protector may be defective.	Replace the motor's protector with a new one of the same rating.
	Winding shorted or grounded.	Inspect stator for defects, or loose or cut wires that may cause it to go to ground.
Motor vibrates.	Motor misaligned to load.	Realign load.
	Load out of balance. (Direct drive application.)	Remove motor from load and inspect motor by itself. Verify that motor shaft is not bent. Rule of thumb is .001" runout per every inch of shaft length.
	Motor bearings defective.	Test motor by itself. If bearings are bad, you will hear noise or feel roughness. Replace bearings. Add oil if a sleeve of bearing. Add grease if bearings have grease fittings.
	Rotor out of balance.	Inspect motor by itself with no load attached. If it feels rough and vibrates but the bearings are good, it may be that the rotor was improperly balanced at the factory. Rotor must be replaced or rebalanced.
	Motor may have too much end play.	With the motor disconnected from power turned shaft. It should move but with some resistance. If the shaft moves in and out too freely, this may indicate a preload problem and the bearings may need additional shimming.
	Winding may be defective.	Test winding for shorted or open circuits. The amps may also be high. Replace motor or have stator rewound.

(continued on next page)

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Malfunction	Possible Cause	Solution
Bearings continuously fail.	Load to motor may be excessive or unbalanced.	Besides inspecting load, also inspect drive belt tension to ensure it's not too tight or too high. An unbalanced load will cause the bearings to fail.
	High ambient temperature.	If the motor is used in a high ambient, a different type of bearing grease may be required. Consult PFlow Industries, Inc. for assistance.
The motor, at start up, makes a loud rubbing or grinding noise.	Rotor may be striking stator.	Ensure that motor was not damaged in shipment. Frame damage may not be repairable. If you cannot see physical damage, inspect the motor's rotor and stator for strike marks. If signs of rubbing are present, the motor should be replaced. Sometimes simply disassembling and reassembling motor eliminates rubbing. End bells are also sometimes knocked out of alignment during transportation.
Start capacitors continuously fail.	The motor is not coming up to speed quickly enough.	Motor may not be sized properly. Verify how long the motor takes to come up to speed, Most single phase capacitor start motors should come up to speed within three seconds. Otherwise the capacitors may fail.
	The motor is being cycled too frequently.	Verify duty cycle. Capacitor manufacturers recommend no more than 20, three-second starts per hour. Install capacitor with higher voltage rating, or add bleed resistor to the capacitor.
	Voltage to motor is too low.	Verify that voltage to the motor is within 10% of the nameplate value. If the motor is rated 208-230V, the deviation must be calculated from 230V.
	Starting switch may be defective, preventing the motor from coming out of start winding.	Replace switch.
Run capacitor fail.	Ambient temperature too high.	Verify that ambient does not exceed motor's nameplate value.
	Possible power surge to motor, caused by lightning strike or other high transient voltage.	If a common problem, install surge protector.

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⚠WARNING

- Do not use any corrosive or flammable solvents or cleaning agents on the machine that contain TRI, PER, TETRA, or FCHC. Read the instructions on the packaging when use is made of chemical substances (cleaning agents).
- Electrical components should not make contact with water or other liquids.
- Do not clean the VRC or any of its components with compressed air or water under high pressure.
- Do not use abrasive steel pads, wire brushes, or scrapers when cleaning.
- Avoid parts made of rubber or plastic, such as cables and gaskets, from making contact with oil, solvents, or other chemicals.

- Climbing, sitting, walking, or riding on equipment while the equipment is in operation could result in death or serious injury.
- Close all gates before the carriage is moved. Never leave the VRC unattended with the gates in the open position. Never close gates when a person is on the carriage or within the fenced area.

- The most common reason for access to the area beneath the carriage is to remove debris from the pit. This is best accomplished using a long handled broom or rake to avoid entering the pit under the raised carriage deck. Only qualified person following proper lockout/tagout procedures with the carriage properly secured in a raised position are permitted to access the pit or hoistway enclosure at the bottom level. Refer to Bulletin 15709-0083 for additional information.

- Entanglement hazard! Secure long hair, wear snug-fitting clothing, and avoid wearing jewelry while using the VRC.

Cleaning

1. Remove all product from the VRC carriage.
2. Lockout the VRC in accordance with the facility Lockout/Tagout program.
3. Remove spills and dirt by hand.
4. Refer to Bulletin 15709-0083 for additional information on procedures to access the area beneath the carriage to remove debris from beneath the carriage.
5. Report any unsafe condition or damage to the personnel responsible for the VRC and make sure that any damage is remedied before restarting the VRC. Do not allow the VRC to operate when unsafe conditions arise.

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The VRC requires minimal attention on a regular basis to prevent equipment failures or accelerated wear and tear. This section is provided for the assistance of qualified and trained service technicians only and is not intended for use by untrained or unauthorized service personnel. Make sure all steps are completed. A record of regular, properly conducted preventive maintenance provides a running history of any issues the VRC may have. The reports will identify trends, and helps anticipate expected wear and tear repairs. Sign and return to PFlow Industries, Inc. Customer Support Department via e-mail to csd@pflow.com

NOTICE

A qualified person is defined as a person who, by possession of a recognized degree or certificate of professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.

⚠WARNING

- If any defects relating to operating safety and reliability are detected or if any damage occurs, the VRC must be taken out of operation immediately.

- Lockout/tagout the VRC before performing maintenance on electrical components. De-energize any circuit before work is begun.
- Take appropriate measures for safely working at heights.

- Make sure that no persons or objects are within the range of any moving parts of the VRC.

- Climbing, sitting, walking, or riding on equipment while the equipment is in operation could result in death or serious injury.
- If this VRC needs to be modified in any way, contact PFlow Industries, Inc. for assistance. Do not make any unauthorized changes.
- Before the VRC is put into operation, all VRC parts must comply with all relevant health and safety directives and regulations.

- Entanglement hazard! Secure long hair, wear snug-fitting clothing, and avoid wearing jewelry while using the VRC.

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√	Action	How Often
	Inspect the VRC for any obvious structural damage.	6 months
	Verify overall operation.	6 months
	Verify that all level stops are at the floor level. Adjust as necessary.	6 months
	Verify that all areas under, around, and inside the VRC are clean.	6 months
	Verify that all electrical components are undamaged.	6 months
	Verify that all push-button stations and e-stops are functioning on each level.	6 months
	Identify any unsafe condition. Document and report the condition immediately to the customer and then PFlow Industries, Inc. Customer Support Department. Do not allow the lift to operate when unsafe conditions arise.	6 months
	Verify that all nuts and bolts are tight. Adjust as necessary.	6 months
	Verify that all moving components are functioning properly.	6 months
	Inspect all chains for wear, rust, bent, cracked, or binding links.	6 months
	Lubricate all chain as needed.	6 months
	Inspect the carriage roller assembly for rotation interference and wear.	6 months
	Verify that the overtravel switch is undamaged and functioning properly.	6 months
	Verify that all electrical connections are tight.	6 months
	Verify that all tensioners are properly adjusted. Adjust as necessary.	6 months
	Inspect all welding, bracing, and anchoring for structural integrity.	6 months
	Inspect the lift chain sprockets for wear.	6 months
	Inspect the motor and brake for any damage or oil leaks.	12 months

Customer signature:	Date work completed:
Name/Phone:	Authorized Technician(s):
Title:	Name:
E-mail:	Name:

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Before You Begin

Read this entire manual before any troubleshooting and service is attempted on the Vertical Reciprocating Conveyor (VRC).

Service must be performed only by qualified and trained service technicians familiar with the safe operation of this equipment.

NOTICE

A qualified person is defined as a person who, by possession of a recognized degree or certificate of professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.

Personnel to carry out work on the VRC must exclusively be qualified personnel who - based upon their education, experience, instructions as well as knowledge concerning relevant standards and provisions, accident prevention, regulations and operating conditions - have been authorized by the person being responsible for safety, to carry out the activities described in these instructions and who - when doing so - are in a position to recognize possible risks early and to avoid them.

⚠DANGER

- High Voltage! A qualified electrician must install all electrical connections and permanent wiring in accordance with applicable local or national electrical codes. Make sure the equipment is properly grounded in accordance with local electrical codes or, in the absence of local codes, with the current edition of the National Electrical Code NFPA No. 70.
- Keep clear of unsupported platforms. Stay out of the area under a raised platform. If a maintenance operation requires the carriage to remain in the raised position, use a means of support such as adequately sized maintenance chains, or straps with shackles around the top of the carriage frame that are capable of supporting the weight of the carriage. Refer to Bulletin 15709-0083 for additional information.

⚠WARNING

- Assess the VRC and identify any potential load jams.
- Lockout/tagout equipment before performing any adjustments or maintenance. If the equipment is not locked out, it could start unexpectedly and cause injury or damage. ***Make sure all personnel are aware of the potential for stored energy to be present even after the power has been locked out.*** Refer to ANSI Z244.1 and OSHA 29 CFR 1910.147 for minimum requirements for a lockout/tagout system. There may be additional country, state, or local requirements.
- Toppling Hazard! Secure all VRC components (e.g., chains, counterweights, and carriage) that may fall during the troubleshooting process.
- Secure all VRC access areas (e.g., openings, HMI stations) before any troubleshooting or service is begun.

- Entanglement hazard! Secure long hair, wear snug-fitting clothing, and avoid wearing jewelry while using the equipment.

- Climbing, sitting, walking, or riding on equipment while the equipment is in operation could result in death or serious injury.
- If this equipment needs to be modified in any way, contact PFlow Industries, In.c for assistance. Do not make any unauthorized changes.
- Before the system is put into operation, all parts must comply with all relevant health and safety directive and regulations.

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The following table identifies some of the most common issues with the VRC, the possible causes, and the suggested solution.

Malfunction	Possible Cause	Solution
HMI controls do not start the motor.	The emergency stop is pushed in.	Pull out the emergency stop button.
	Main power disconnect is off.	Determine the reason the power is off before turning the power on.
	The drive has faulted.	Press the reset button. If it trips again, determine the cause. The motor is overheating.
	Fuse is blown.	Verify circuit voltage and wiring before replacing the fuse.
	Power circuit between the disconnect and starter is dead.	Measure the voltage with a voltmeter. Repair as needed.
	Loose chain or belts.	Tighten the chain or belts.
	Broken or jammed chain or belt.	Repair or replace as needed.
	The Up/Down/Off switch on the control panel is in the Off position.	Turn the Up/Down/Off switch to the Up or Down position.
Motor starts and carriage raises, but motor stops before the carriage reaches the second level.	Object encountered.	Identify the problem. Remove or repair as needed.
	Drive component interference.	Remove object. Repair if needed.
	Overload condition causing a VFD fault.	Press the VFD fault button on the HMI display screen to reset. Lower and remove excessive weight. Inspect brake for possible malfunction, excessive ambient temperature, or mechanical binding.
	Loose or broken lift chain or belt.	Tighten or repair as needed.

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Malfunction	Possible Cause	Solution
Carriage fails to stop at the first or second level.	First or second level limit switch is inoperable.	Adjust, repair, or replace the level limit switch.
	Brake inoperable.	Determine cause and effect. Repair or replace if needed.
Carriage fails to slow down as it approaches the level.	Optional deceleration limit switch is inoperable.	Adjust, repair, or replace the optional deceleration limit switch.
Carriage lowers but stops early.	Debris below the carriage.	Remove debris and clean the area.
Rough or noisy operation.	Motor / reducer.	Determine the cause and correct.
	Travel interference.	Identify the problem, remove, and repair as needed.
	Drive component interference.	Identify the problem, remove, and repair as needed.
	Guide rollers are worn.	Inspect and replace as needed. Determine the cause and correct.
	Chain idler sprocket is worn or corroded.	Inspect and replace as needed.
Motor hums but shaft does not rotate, then thermal overload trips.	Motor wiring is incorrect.	Use a voltmeter to ensure the incoming main leads are wired properly. Repair as needed.
		Inspect motor wiring for the required voltage.
	Fuse blown.	Inspect main fused disconnect to locate blown fuse. Replace as needed.

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This recommended spare parts list is generic (not specific to your unit). Part numbers are deleted due to variables specific to each application. This list is a guide to assist the customer in establishing an emergency inventory for your PFlow Industries, Inc. VRC. Convenience and minimal down time are two good reasons to maintain an inventory of spare parts. This list does not imply that any part is subject to failure. However, should any of these parts fail, the VRC could be put out of service.

Description	Quantity	Part Number
Carriage		
Guide Rollers	4	
Conveyor Roller	1	
Drive		
Drive Belt	1	
Sprocket	1	
Masterlink	1	
Taperlock Bushing	1	
General		
Lubricant Film Spray	1	
Paint 13 oz. PFlow Blue Spray	1	
Electrical		
Photo Eye	2	
Reflector	2	
Proximity Sensor	2	

This is a general spare parts list. All Vertical Reciprocating Conveyors (VRCs) are custom built to order. Confirm with PFlow Industries, Inc. before ordering. Part numbers in this manual are subject to change without notice. Components replaced under warranty will be charged for in accordance with our RMA procedures. Minimum order charge is $35, FOB Milwaukee, Wisconsin. PFlow Industries, Inc. Customer Support Department must issue an authorization in advance of any claim for warranty and/or warranty labor.

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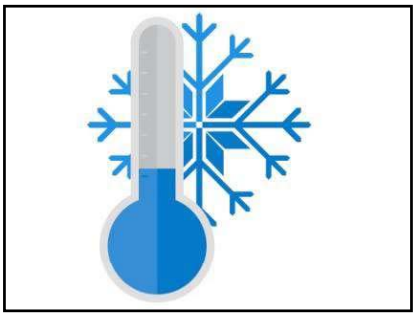
Environment

All components should be ***stored indoors***. The area of storage should be kept at a constant temperature above 55°F (13°C) and relative humidity of approximately 40%, free from heavy dust and contaminants.

NOTICE

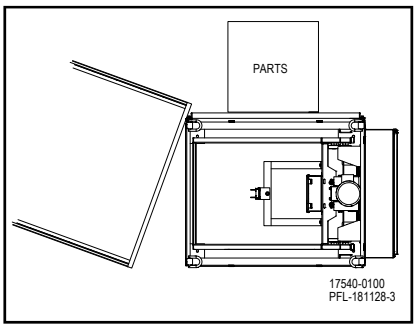
Outdoor storage is ***not*** recommended. Our warranty policy does not cover damage as a result of improper storage.



Avoid Cold Temperatures Figure 18-1

Stacking

Stacking or leaning the various components upon each other is strictly forbidden. Serious damage can occur to the frame, panels, and drive base assemblies. See Figure 18-2.

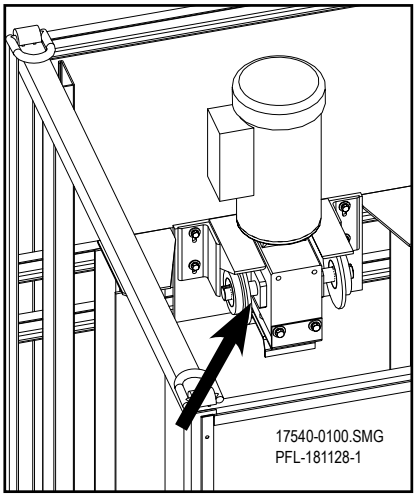


Do Not Stack Components Figure 18-2

Long Term Storage

Storage for more than two months after shipment, will require that the following maintenance procedures be performed every sixty days from date of shipment:

1. If ***roller chains*** are stored for an extended period of time or in a corrosive environment, they must be dipped or stored in a non-detergent oil to retain their original condition.
2. Lightly coat the ***sprockets*** with a non-detergent oil to prevent corrosion.
3. Elevate the assembled VRC ***frame*** off the ground and cover with a tarp. Allow adequate ventilation to minimize condensation. Protect all exposed or unpainted shaft and flange surfaces with an anti-corrosion agent or grease. Store in a location free from shock and vibration, to avoid false brinelling of the bearing elements and raceways.



Lubricate Sprockets Figure 18-3

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Long Term Storage (continued)

⚠DANGER

High Voltage! Employees servicing or maintaining VRCs may be exposed to death or serious personal injury if hazardous energy is not properly controlled. Follow your facilities procedures or OSHA lockout/tagout (LOTO) procedures anytime maintenance or service is being performed on any electrical box or component. Only qualified and trained service technicians are to apply power to the motor.

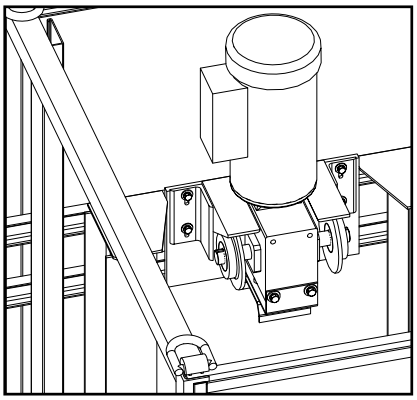
⚠CAUTION

The incoming voltage source must match the voltage identified on the rating tag. The rating tag provides essential technical information required for any installation, maintenance, or repairs. Do not remove, damage, or modify the rating tag.

NOTICE

A qualified person is defined as a person who, by possession of a recognized degree or certificate of professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.

4. ***Apply power*** to the motor/brake with a start and stop switch using the correct voltage and correct brake wiring configuration. This will rotate the drive shaft and cycle the brake. See Figure 18-4.
5. Plug the ***electrical component*** inlets to prevent moisture and other contaminants from entering them. Store in a dry, temperature controlled location to prevent corrosion. Place silica gel desiccant inside the control enclosure. Inspect the inside of the control enclosure for any moisture build up. See Figure 18-5.
6. Make sure the ***parts carton*** remains sealed and dry.



Motor Components Figure 18-4

Storage for Longer than Six Months

For units stored longer than six months, it is recommended that you contact the PFlow Industries, Inc. Customer Support Department for additional information that may be available prior to starting up your unit.

Equipment Manuals

The VRC installation manual, electrical, and owner's manuals are located in the parts carton. Do not open the parts carton. If the manuals are required, contact the PFlow Industries, Inc. Customer Support Department for an electronic copy (.pdf).

Place Inside Control Enclosure Figure 18-5

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Before You Begin

Read this entire manual. Before starting the installation, verify the job site dimensions and the dimensions of the delivered materials against the PFlow Industries, Inc. General Arrangement (GA) drawing. If the site conditions or the delivered materials do not match the GA drawing, please consult the PFlow Industries, Inc. Customer Support Department.

⚠DANGER

Falling equipment hazard! The installation of this equipment requires a qualified installer with extensive knowledge and experience on how to rig, erect, and support structural steel.

NOTICE

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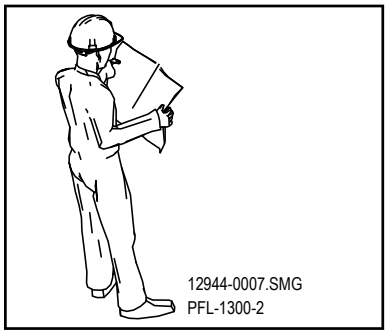
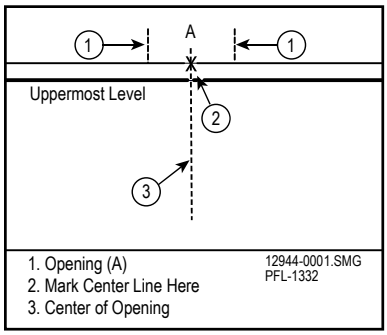


Verify Site Dimensions Figure 19-1

Verify Job Site Dimensions and Carriage Orientation

The Vertical Reciprocating Conveyor (VRC) was built using dimensions supplied to PFlow Industries, Inc. as listed on the General Arrangement drawing (e.g., floor-to-floor distance, upper level opening, etc.).

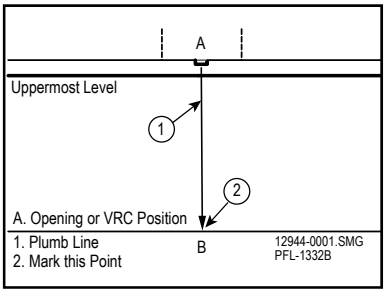
These instructions are representative of an installation in which the assembled VRC frame is placed in position before any additional components are placed in position.



Initial Layout Figure 19-2

Mark Alignment

1. Verify that the first level installation (e.g., no restricted shaftway, etc.) allows the assembled VRC frame to be placed before any additional components are installed.
2. Mark the center line position of the opening at the upper level. See Figure 19-2.
3. Clearly mark the tip of the plumb bob on the first floor. Point B is the center point of the assembled VRC at the lower level. See Figure 19-3.



Mark Lower Floor Figure 19-3

NOTICE

All protrusions from the floor, wall, or other areas must be removed. Plumb lines must be positioned 1" (25mm) beyond the furthest protrusion or the assembled VRC will not clear the protrusion during assembly.

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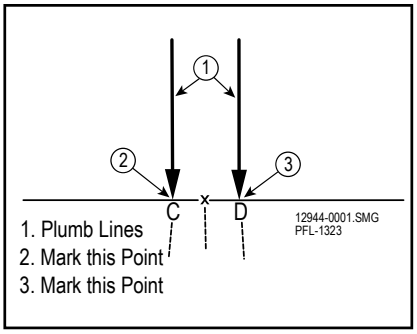
Mark Alignment (continued)

5. Drop two plumb lines from the upper level roughly 2' (1219mm) on each side of the center line. The plumb line must be 1" (25mm) beyond the furthest protrusion. See Figure 19-4.
6. Locate the three marks on the first floor. Snap a chalk line between C and D. See Figure 19-5.

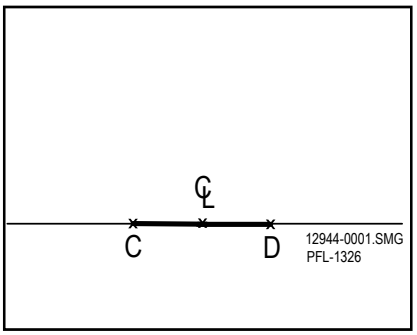
⚠CAUTION

To prevent personal injury or damaging the VRC, attach rigging only to the lifting shackles when lifting the module. Do not attach rigging to any shaft, sprockets or belts.

NOTE *The carriage is banded in place to prevent movement during shipment. Leave the bands in place until the VRC is standing upright, in position, plumbed, and anchored.*



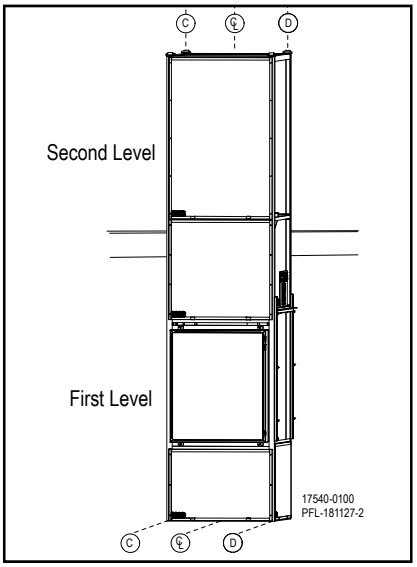
Align Floor-to-Floor Figure 19-4



Align Lower Floor Figure 19-5

Move the Assembled VRC into Position

1. Remove plastic wrap and unstrap the VRC from the skid.
2. Make sure the counterweight is secured and remains secured until the VRC is standing upright, in position, plumbed, and anchored.
3. Review the weight of the assembled VRC to confirm that the pick point or lifting apparatus will withstand the weight.
4. Use a suitable hoisting system that complies with local regulations.
5. Put a sling through the top of the assembled VRC using the supplied lifting shackles and proper rigging techniques. Attach the lifting device.
6. Carefully and slowly lift the assembled VRC.
7. Move the VRC to align the center of the VRC frame to the center line floor marks. See Figure 19-6.



Place Assembled VRC Figure 19-6

NOTICE If the VRC needs to be pushed into place, push only on the edges of the frame. Use a block of wood on the bottom frame to tap into place. Do not push on the face of the enclosure panels to avoid denting the surface.

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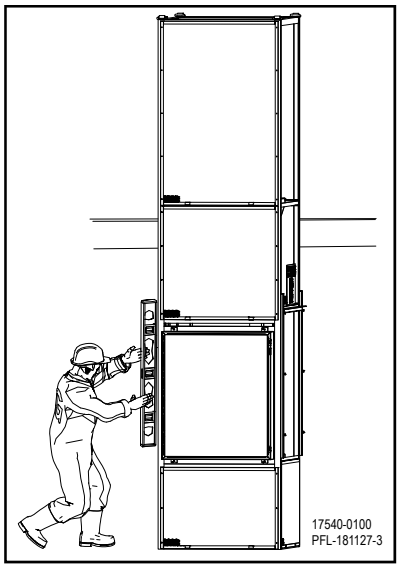
Plumb and Level the VRC Frame

1. Remove the screws holding the front and rear removable enclosure panels in place.
2. Remove the enclosure panels and set aside. Make sure not to damage the panels.
3. Plumb structural columns side to side and front to back. See Figure 19-7.
4. Level the VRC using shims under the frame base plates.

NOTICE

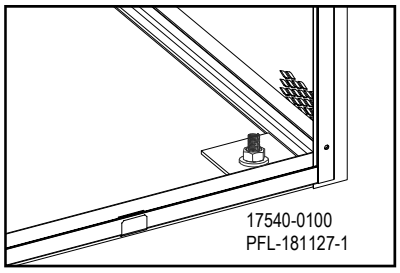
Alignment is critical. Incorrect alignment will cause problems during operation and damage to the VRC. Leveling the carriage is done later in the installation.



Plumb and Level VRC Figure 19-7

Anchor the VRC Frame

1. Verify the proper floor anchor size and type for the job site. Special conditions (e.g., seismic site location) require that proper anchoring and bracing methods are used.
2. When the VRC frame is plumb, anchor the base plates to the floor according to local or state codes especially in seismic zones. PFlow Industries, Inc. recommends a minimum of 1/2" x 4" (13mm x 102mm) long wedge style anchors installed according to the manufacturers instructions. See Figure 19-8.



Anchor the Base Plates Figure 19-8

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Before You Begin

Read this entire manual. Verify the job site dimensions against the PFlow Industries, Inc. General Arrangement (GA) drawing before starting the installation. If the site conditions do not match the GA drawing, please consult the PFlow Industries, Inc. Customer Support Department.

⚠DANGER

Falling equipment hazard! The installation of this equipment requires a qualified installer with extensive knowledge and experience on how to rig, erect, and support structural steel. Be sure to properly support the VRC during installation. Do not depend on the base plates or feet to prevent the VRC from falling.

NOTICE

A qualified person is defined as a person who, by possession of a recognized degree or certificate of professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.

⚠CAUTION

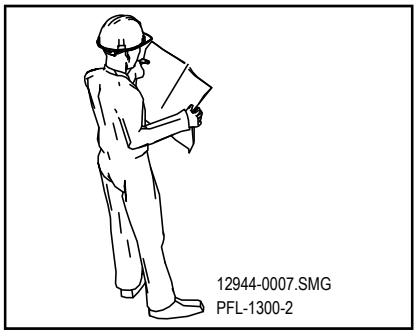
Lifting hazard! Components and accessories may be heavy. Use the appropriate lifting apparatus or get help when moving or lifting.

Anchoring and Bracing Guidelines

Anchoring of the Vertical Reciprocating Conveyor (VRC) is ***required***. The DB Series VRC is designed to be self-standing. PFlow Industries, Inc. highly recommends to install sway bracing at the top of the VRC. Illustrations in this section are to be used for reference only. Job site conditions may require a different alternative to those PFlow Industries, Inc. suggests in this document. A job specific bracing drawing may be provided. Verify drawing details prior to beginning any field bracing work. Before any final field welding is done, verify that the VRC modular sections are aligned correctly.

All field welding must conform to the latest edition of AWS D1.1. The weld filler material is to be a minimum of E60xx.

- Fully weld horizontal floor braces.
- Fully weld support bracing at upper levels (unless shown otherwise).



Review GA Drawing Figure 20-1

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Sway Bracing

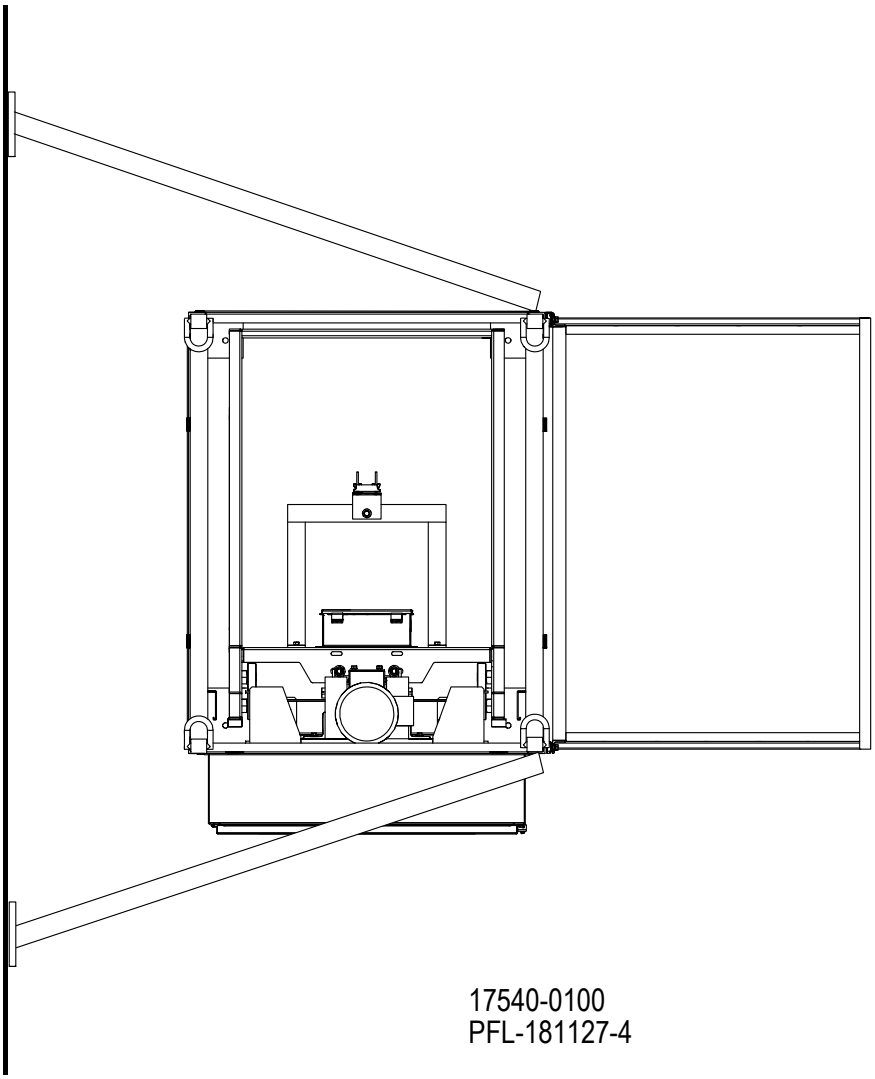
Sway bracing at the top of the Vertical Reciprocating Conveyor (VRC) is highly recommended. Bracing of the VRC and enclosures is the responsibility of the installer. Weld or bolt structural angle or tube from the top of the VRC to a stationary part of the building structure.

It is the customer's responsibility to make sure that the job site conditions have a structure with enough strength to be used for bracing in order to withstand the forces of weight and gravity.

NOTE *If PFlow Industries, Inc. prepared seismic bracing materials, the bracing requirements and the General Arrangement (GA) drawing are provided in the shipping packet. It is the installer's responsibility to verify the information included in the shipping packet prior to commencing work.*

⚠WARNING

Falling VRC hazard! To avoid personal injury, do not operate the carriage or load the VRC until the VRC bracing is adequately sized and welded.



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Typical Mezzanine
Figure 20-2

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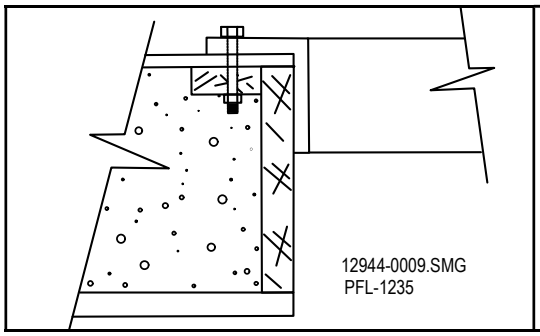
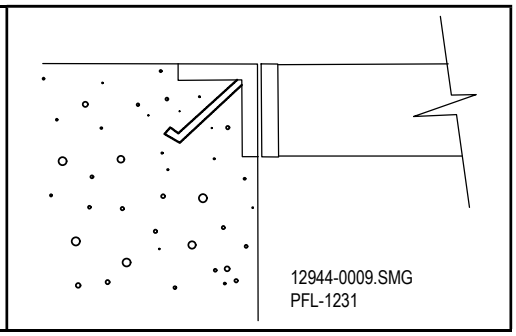
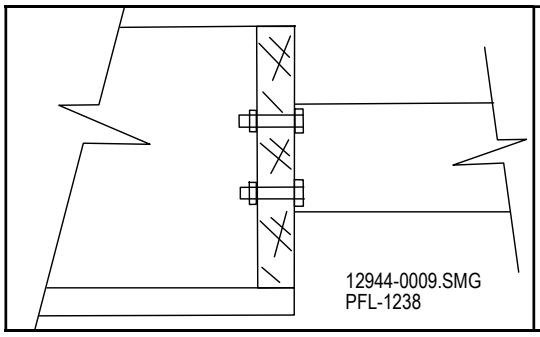
Anchoring Guidelines



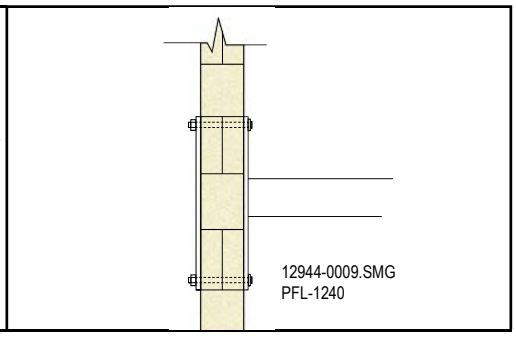
Using a tie plate Figure 20-3



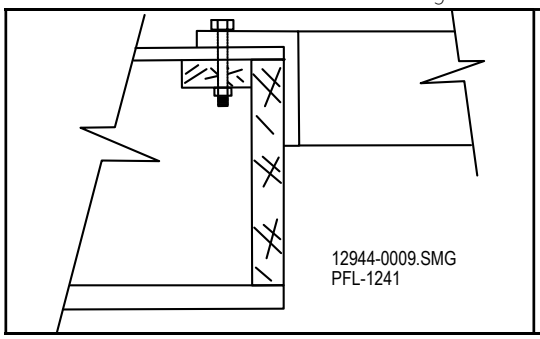
Welding to a curb angle Figure 20-4



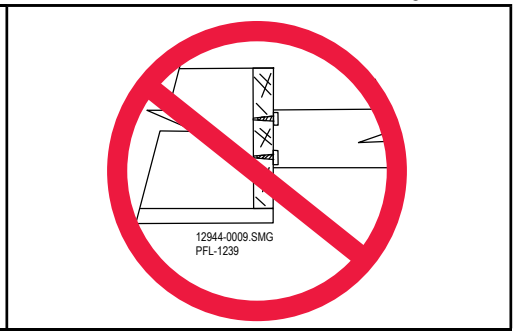
Anchoring to a wood floor - through bolting Figure 20-5



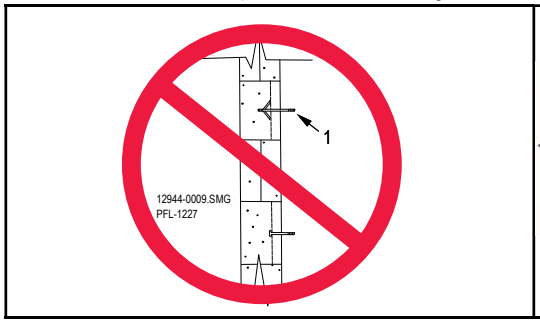
Anchoring to a CMU wall with backing plates Figure 20-6



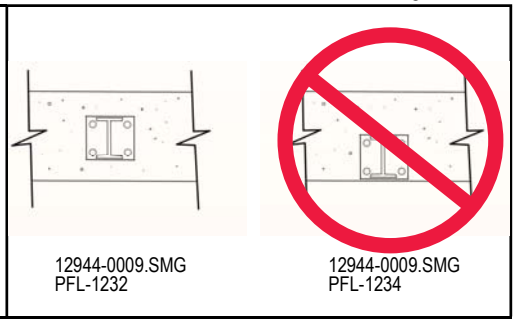
Anchoring to a wooden floor (preferred method) Figure 20-7



Anchoring to a wooden floor (not recommended) Figure 20-8



Anchoring to CMU wall (not recommended) Figure 20-9



Anchoring mounting plate to solid floor Figure 20-10

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Before You Begin

Read this entire manual before installing the Vertical Reciprocating Conveyor (VRC).

⚠DANGER

- The installation of this equipment requires a qualified installer with extensive knowledge and experience on how to rig, erect, and support structural steel.
- High Voltage! A qualified electrician must install all electrical connections and permanent wiring in accordance with applicable local or national electrical codes. Make sure the equipment is properly grounded in accordance with local electrical codes or, in the absence of local codes, with the current edition of the National Electrical Code NFPA No. 70.
- Keep clear of unsupported platforms. Stay out of the area under a raised platform. If a maintenance operation requires the carriage to remain in the raised position, use a means of support such as adequately sized maintenance chains, or straps with shackles around the top of the carriage frame that are capable of supporting the weight of the carriage. Refer to Bulletin 15709-0083 for additional information.

⚠WARNING

- Assess the VRC and identify any potential load jams.
- Lockout/tagout equipment before performing any adjustments or maintenance. If the equipment is not locked out, it could start unexpectedly and cause injury or damage. ***Make sure all personnel are aware of the potential for stored energy to be present even after the power has been locked out.*** Refer to ANSI Z244.1 and OSHA 29 CFR 1910.147 for minimum requirements for a lockout/tagout system. There may be additional country, state, or local requirements.
- Toppling Hazard! Secure all VRC components (e.g., lift chain, carriage) that may fall during the installation process.
- Secure the chains, carriage, and counterweight before any installation or service is begun. Removing the chains from the carriage for any reason will cause the counterweight to drop.

NOTICE

A qualified person is defined as a person who, by possession of a recognized degree or certificate of professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.

Personnel to carry out work on the VRC must exclusively be qualified personnel who - based upon their education, experience, instructions as well as knowledge concerning relevant standards and provisions, accident prevention, regulations and operating conditions - have been authorized by the person being responsible for safety, to carry out the activities described in these instructions and who - when doing so - are in a position to recognize possible risks early and to avoid them.

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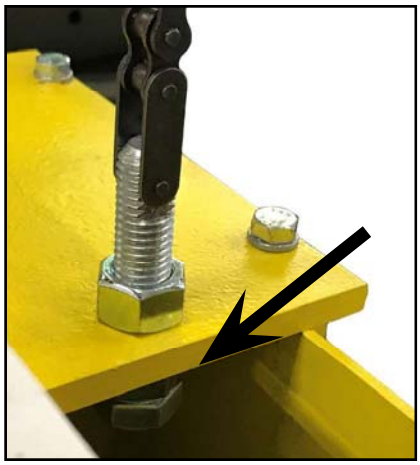
Level the Carriage

1. Remove the banding and shipping blocks that hold the carriage and counterweight in place.
2. Make sure the carriage is hanging level from the chains or belts.

NOTE *The chains or belts may have jumped a tooth on the sprocket or pulley during shipping or installation. Realign before operating the VRC.*

3. Adjust the carriage mounting brackets or studs on the rear of the carriage if the carriage is not level by less than one pitch of the chains or belts. See Figure 21-1.

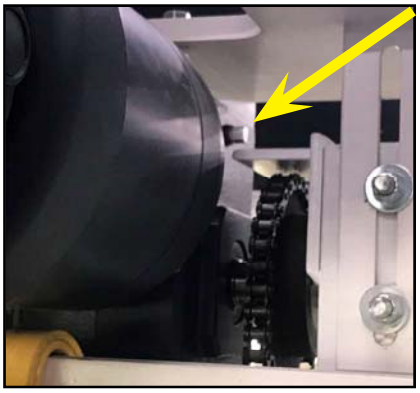


Adjust Carriage Mounting Brackets Figure 21-1

Make Final Adjustments

1. Remove all shipping braces and make sure that the carriage travel is free of obstructions.
2. Make sure all limit switch arms are not bent or damaged. See Figure 21-2.
3. Make sure the brake on the motor is engaged.
4. Remove the plug in the top of the gear reducer and replace with the vent plug shipped with the installer packet. See Figure 21-3.

Inspect Limit Switch Arms Figure 21-2



Install Vent Plug Figure 21-3

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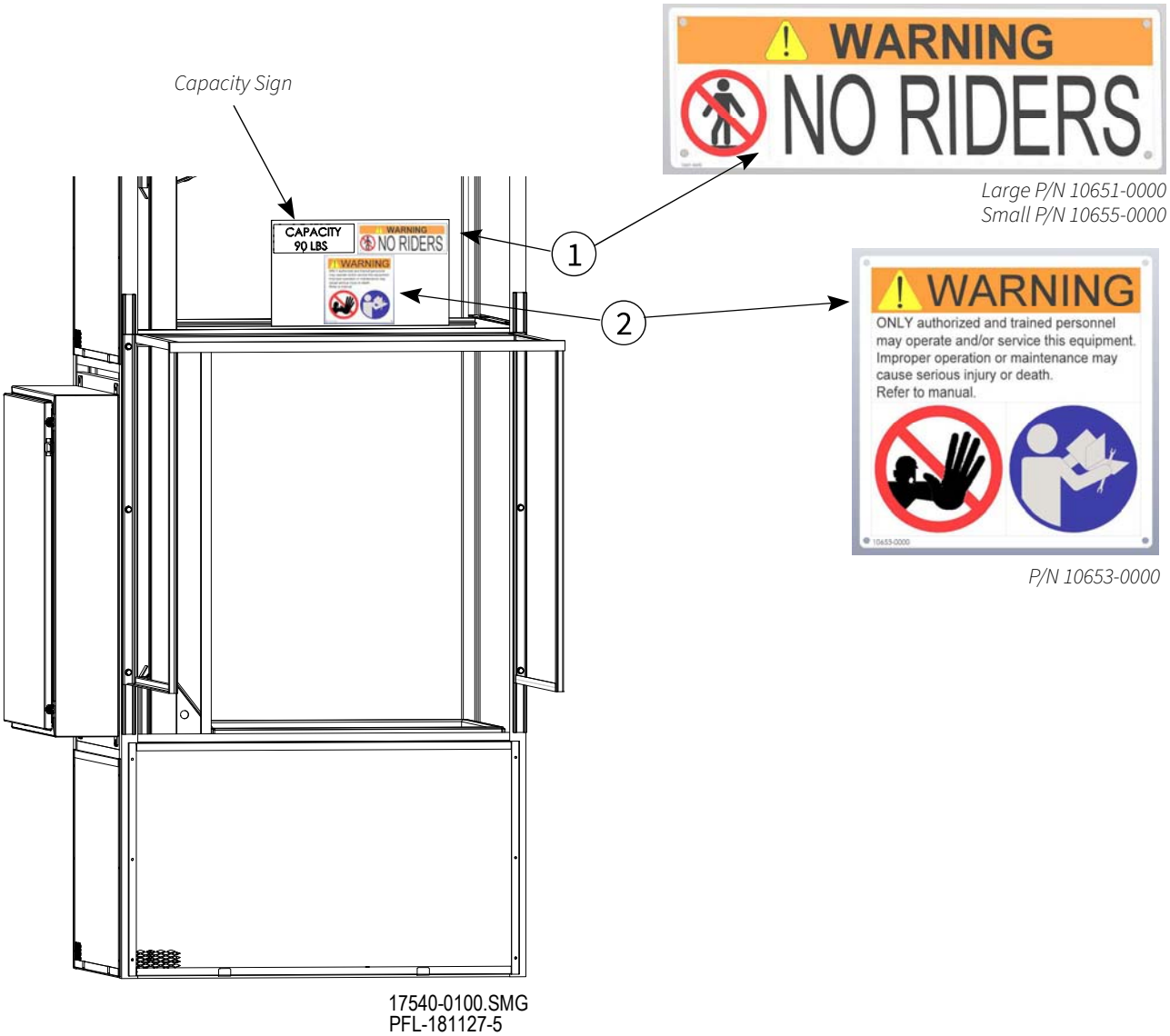
Before You Begin

Read this entire manual.

Purpose

The PFlow Industries, Inc. Vertical Reciprocating Conveyor (VRC) is designed for the movement of materials only, up to the VRC's rated capacity, from one level to the next. Passengers are not allowed. The placement of capacity labels, safety information, and operation instructions are the installer's responsibility. Make sure the warning labels are placed above each conveyor opening.

PFlow Industries, Inc. supplies the appropriate signage in a manila envelope in the parts crate with the original shipment. Contact PFlow Industries, Inc. Customer Support Department for signage if another language is needed.



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Before You Begin

Read this entire manual.

⚠DANGER

High Voltage! A qualified electrician must install all electrical connections and permanent wiring in accordance with applicable local or national electrical codes. Make sure the equipment is properly grounded in accordance with local electrical codes or, in the absence of local codes, with the current edition of the National Electrical Code NFPA No. 70.

⚠CAUTION

The incoming voltage source must match the voltage identified on the rating tag. The rating tag provides essential technical information required for any installation, maintenance, or repairs. Do not remove, damage, or modify the rating tag. Connect all push-button stations, limit switches, and accessories before applying power to the control panel. Never override any electrical component or manually operate the motor starter to operate the Vertical Reciprocating Conveyor (VRC).

Start-Up Procedures

1. Confirm that all bolts on the VRC are tight.
2. Confirm that bracing and finish welds are complete.

Confirm Emergency Stop Safety Operation

1. While you and the carriage are at the first level, push in the Emergency Stop (E-stop) button on the push-button station.
2. Push the up button on the push-button station. The carriage should not move.
3. Pull out the E-stop button on the push-button station.

Confirm Motor Rotation

NOTICE

A second person should be next to the disconnect station to immediately disconnect power to the VRC. There's not much reaction time available before components are damaged if not properly installed.

1. Push the up button on the push-button station just long enough to raise the carriage 1' (305mm). Push in the E-stop button on the push-button station.

NOTE

If pushing in the E-stop button on the push-button station does not stop the VRC from moving, immediately disconnect power to the VRC.

If nothing happens when the up button is pushed, contact PFlow Industries, Inc. Customer Support Department for troubleshooting assistance.

*If the motor is **not** operating in the correct direction, stop the motor immediately. Using established Lockout/Tagout procedures, have a qualified electrician inspect and switch the T1 and T2 wires of the incoming 3-phase power for the motor. Confirm that the motor rotation is correct after any wiring change has been made.*

2. Pull out the E-stop button on the push-button station.

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Confirm Carriage Stops are Level with the Conveyor

1. Push the up button on the push-button station.
2. Make sure the carriage deck stops level with the opening of the upper level. Adjust the switch position if necessary. When moving switches to match the upper level, loosen the hex head bolts on the limit switch bracket and move the switch and bracket up or down to adjust the stopping position. Tighten bolts and check alignment.

NOTE

When moving switches to match the level, all switches for the level, overtravel and deceleration must be moved the same distance. The carriage should not "top out" or "bottom out" against any physical stops.

3. Push the down button on the push-button station.
4. Make sure the carriage deck stops level with the opening of the lower level. Adjust the switch position if necessary. When moving switches to match the lower level, loosen the hex head bolts on the limit switch bracket and move the switch and bracket up or down to adjust the stopping position. Tighten bolts and check alignment.

Inspect for "Top Out" or "Bottom Out" Damage

The counterweight in each DB series VRC is manufactured specifically for the ordered live load and the corresponding dead load (carriage weldment, conveyor controls, wheels, etc.). Attaching additional weight to the carriage will off-set the effectiveness of the counterweight and may cause damage to the drive.

1. Inspect the carriage for level.
2. Make sure both chains and/or belts are tight.
3. Inspect sprockets or pulleys, shafts, chains, or belts and adjustment brackets for damage.
4. Inspect limit switch arms and cams for damage.

Replace Enclosure Panels

Replace all enclosure panels that were previously removed for installation purposes.

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⚠WARNING

Avoid Shifting Loads! Place the load in the center of the carriage platform to avoid shifting loads. Lock rolling casters in place. Make sure that any portion of the load does not overhang the perimeter of the carriage. Prevent unstable load conditions.

Conduct a Load Test

1. With the carriage deck at the lower level, add weight up to, but not to exceed, the VRCs rated capacity.
2. Push the up button on the push-button station.
3. Monitor the position of the carriage deck as it reaches the upper level.
4. Continue to monitor the position of the carriage deck. Allow the VRC to hold the lift at the upper level for a half hour.

NOTE *The motor brake is not holding if the carriage deck drops below the upper level. Make a note of the weight used, and the amount of time that the carriage deck held the position before dropping down. Push the down button and contact PFlow Industries, Inc. Customer Support Department for troubleshooting assistance.*

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Post Installation Checklist

Make sure all steps are completed. Sign and return to PFlow Industries, Inc. Customer Support Department via e-mail to csd@pflow.com

✓	Verify Mechanical Completion
☐	Final bracing for the VRC is completed
☐	All operational signs are posted.
☐	All weld marks, scrapes, etc. are touched up with paint.
☐	There is no excessive noise or binding during travel.
☐	The carriage stops level at each floor.
☐	Full load test is completed.
☐	The installation site is clean and all debris is removed.
☐	The customer received instructions regarding proper VRC operation.
☐	The customer received instructions regarding preventive maintenance of the VRC.
☐	The customer received instructions regarding procedures in the event of a problem or safety related issues.
☐	Identify any unsafe condition. Document and report the condition immediately to the customer and then PFlow Industries, Inc. Customer Support Department. Do not allow the VRC to operate when unsafe conditions arise.

Additional Notes or Follow-up Requirements

PFlow Serial Number	Customer/User	Date
Mechanical Checklist Completed by		E-mail Address
Company		Phone Number

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Post Installation Checklist

Make sure all steps are completed. Sign and return to PFlow Industries, Inc. Customer Support Department via e-mail to csd@pflow.com

✓	Verify Electrical Completion
☐	Make sure all electrical connections are tight and properly made.
☐	The push-button station operates correctly on all floor levels.
☐	The emergency stop button operates correctly on all floor levels.
☐	The floor level limit switches are adjusted and the carriage stops level at each door.
☐	The overtravel limit switch is adjusted and the carriage stops before reaching the motor assembly.
☐	The installation site is clean and all debris is removed.
☐	The customer received instructions regarding electrical control panel location and power shutoffs.
☐	The customer received instructions regarding procedures in the event of a problem or safety related issues.
☐	Identify any unsafe condition. Document and report the condition immediately to the customer and then PFlow Industries, Inc. Customer Support Department. Do not allow the VRC to operate when unsafe conditions arise.

Additional Notes or Follow-up Requirements

PFlow Serial Number	Customer/User	Date
Electrical Checklist Completed by		E-mail Address
Company		Phone Number

Section 25 | Installation Questionnaire

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Thank You

PFlow Industries, Inc. would like to thank you for the opportunity to serve you. Your business is appreciated. Please help us to ensure that your expectations are met by taking a few minutes to tell us about the equipment and service that you have received. Complete the Installation Questionnaire and Acceptance Certificate. Return both forms to PFlow Industries, Inc. via e-mail to csd@pflow.com Additional space for comments is available on the next page.

	Yes ✓	No ✓
Product Perception		
Was the equipment shipment complete as expected?	☐	☐
What items were missing, if any?		
Was the equipment in good condition?	☐	☐
Describe the equipment damage or concerns with the workmanship, if any.		
Did the equipment match the General Arrangement (GA) drawing?	☐	☐
Was the equipment dimensionally correct with form, fit, and function?	☐	☐
Describe any problem areas in detail.		
Electrical Installation		
Was the electrical field wiring completed as required?	☐	☐
Were there any issues with the electrical components?	☐	☐
After the electrical installation was completed, was it necessary to return for final adjustments, testing, and training?	☐	☐
Were you made aware of any electrical problems?	☐	☐
Describe any “No” answers in detail.		
Testing		
Was the equipment tested at full load capacity?	☐	☐
Were all gates tested to ensure proper operation and interlock operation?	☐	☐

PFlow Serial Number	Customer/User	Date
Questionnaire Completed by		E-mail Address
Company		Phone Number

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Acceptance

We, the Customer, accept the equipment listed below as being properly installed, tested, and performing to our satisfaction. For the purpose of quality assurance by PFlow Industries, Inc., this form covers both the mechanical and the electrical installation of the equipment. This acceptance in no way releases either PFlow Industries, Inc. or the installing contractor(s) of any warranty obligations. If there are any exceptions or unresolved items, please include detailed information.

PFlow Serial Number:	Model Number:	☐ B	☐ D	☐ DB	☐ F	☐ M	☐ MQ	☐ 21	☐ CV	Other _____
Job Name:										
Site Street Address:										
Site Mailing Address:										
Site City:					State:			Zip Code:		
Customer Contact Name:					Contact Title:					
Customer Contact Phone: ( ) Ext					E-Mail:					

Tests Performed					
	Load Capacity:			Start-up Date:	
	Load Test:	☐ Yes	☐ No	at ____ % of lift capacity	Customer Initials:
	Operation Test:	☐ Yes	☐ No		Comments:
	Gate/Interlock Operation:	☐ Yes	☐ No	☐ Not Applicable	
	Other Test:				
	Other Test:				

Personnel Instructed on the Operation and Preventive Maintenance:	
Name:	Company:
Name:	Company:

Accepted by:	Acceptance Date:
Name/Phone:	PFlow Rep Present:
Title:	Name:
Company:	Company:

Please return a copy of this form to the PFlow Industries, Inc. Customer Support Department at csd@pflow.com.

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