MATERIAL HANDLING SOLUTIONS

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

M Series | Mechanical VRC RapidStack™

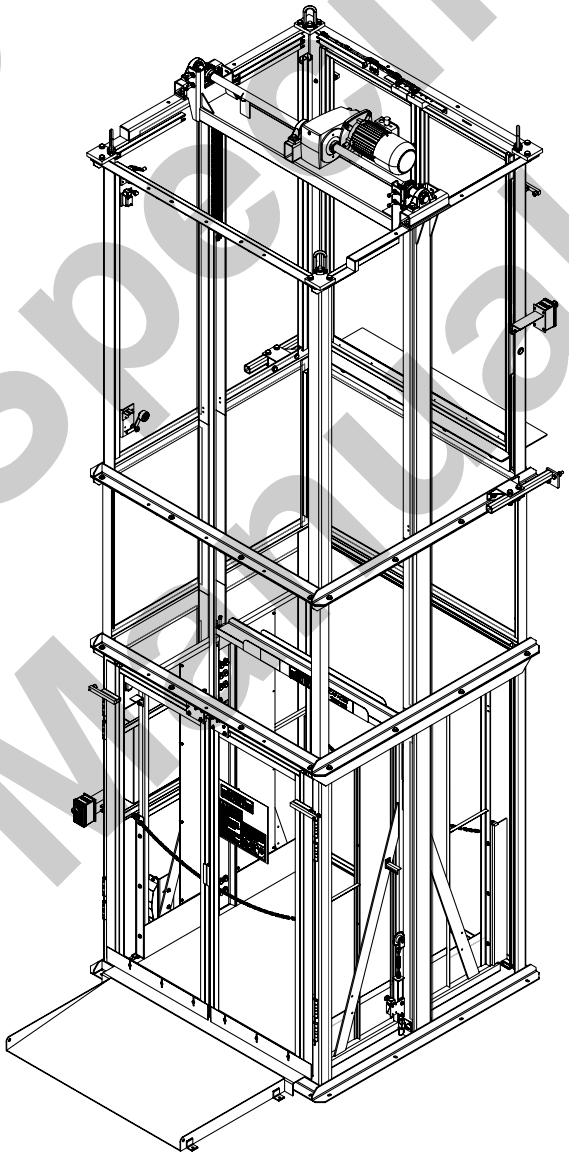
Owner's Manual

Refer to Your Job Specific Manual

Important:

Read this entire manual. Important safety information is included.

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



15705-0102 | Rev - | 2026-08-01 | Printed in the U.S.A.

Contents

Section 1: Contact Information **1 | 1**

Section 2: General Information **2 | 1**

- Introduction 2 | 1
- General Overview 2 | 1
- Code Requirements 2 | 1
- Parts 2 | 1
- Service 2 | 1
- Feedback 2 | 2

Section 3: Warranty **3 | 1**

- Parts and Labor 3 | 1
- Definitions 3 | 1
- Warranty 3 | 1
- Exclusions 3 | 1
- Obligation 3 | 1
- Liability 3 | 2
- Warranty Procedures 3 | 2
- Pre-Authorization 3 | 2
- Invoices 3 | 2

Section 4: Important Safety Information **4 | 1**

- Read the Entire Manual 4 | 1
- Intended Purpose 4 | 1
- Potential Risks and Possible Misuse 4 | 1
- Safety Alert Symbols 4 | 1
- Danger Statements 4 | 2
- Warning Statements 4 | 2
- Caution Statements 4 | 3
- De-energize the Circuit 4 | 4
- Working on Energized Circuits 4 | 5
- Notes for the Installation Electrician 4 | 5

Section 5: Entrance Below a Raised Carriage Deck **5 | 1**

- Safety Requirements 5 | 1

Minimize the Hazards 5 | 1
General Guidelines 5 | 2
Pit Access 5 | 2
Manual Access 5 | 2

Section 6: Glossary 6 | 1

Glossary Terms 6 | 1
Gate Types 6 | 7

Section 7: System Components 7 | 1

RapidStack (Full View) 7 | 1
Bottom Section 7 | 2
Middle Section 7 | 2
Top Section 7 | 3
Carriage 7 | 4

Section 8: Electrical Standards and Definitions 8 | 1

Field Electrical Wiring Standards 8 | 1
Definitions 8 | 1
Requirements 8 | 1
Electrical Ruling Bodies 8 | 2
PFlow's Standard 8 | 2
Outdoor Application 8 | 2
Corrosive Application 8 | 2
Hazardous Location 8 | 2
Class Definitions 8 | 2
Division Definitions 8 | 3
Group Designations 8 | 3

Section 9: Mechanical Overview 9 | 1

Mechanical Overview 9 | 1
Enclosures 9 | 1
Gate Assemblies 9 | 1
Drivebase Assembly 9 | 2
Lift Chains 9 | 2
Safety Cam and Wheelblock Assemblies 9 | 4

Safety Cam Function 9 | 4
Section 10: Electrical Overview 10 | 1
Electrical Overview 10 | 1
Main Disconnect Switch 10 | 1
Main Control Panel 10 | 1
Push-Button Station 10 | 1
Drivebase Assembly 10 | 1
Limit Switches 10 | 1
Section 11: Operation 11 | 1
Before You Begin 11 | 1
System Operation Overview 11 | 3
Floor Switches and Travel Limit Switches 11 | 3
Chain Tensioner Limit Switches 11 | 5
To Operate the Lift 11 | 5
Section 12: HMI Operation 12 | 1
HMI Specifications - Options 12 | 1
HMI Start-up 12 | 1
Main Screen 12 | 2
Main Screen Fault 12 | 3
Alarm Screen 12 | 4
I/O Screens 12 | 4
Section 13: Cleaning 13 | 1
Cleaning 13 | 1
Section 14: Component Manufacturer Documentation 14 | 1
Section 15: Preventive Maintenance and Schedule Checklist 15 | 1
Monthly Maintenance 15 | 2
Quarterly Maintenance 15 | 2
6-Month Maintenance 15 | 3
Annual Maintenance and Beyond 15 | 3
Additional Notes or Follow-up Requirements 15 | 3
Section 16: Troubleshooting 16 | 1
Troubleshooting Table 16 | 3

Section 17: Adjust Overcurrent Sensor 17 | 1
- Before You Begin 17 | 1
- Overcurrent Sensor (OCS) Purpose 17 | 1
- Test and Calibrate the OCS 17 | 1

Section 18: Parts 18 | 1
- Before You Begin 18 | 1
- Drivebase Assembly 18 | 1
- Chain Loop Arrangement 18 | 2
- Chain Tensioner Assembly 18 | 3
- Bi-Swing Gate Interlock 18 | 4
- GAL Interlock 18 | 5
- Safety Cam Assembly 18 | 6
- Wheelblock Assembly - 20811-0005 18 | 7

Section 19: Recommended Storage Requirements 19 | 1
- Environment 19 | 1
- Stacking 19 | 1
- Long Term Storage (Longer than 2 months) 19 | 2
- Equipment Manuals 19 | 3

Section 20: Signage Locations 20 | 1
- Before You Begin 20 | 1
- Purpose 20 | 1

Installation Questionnaire 1

Acceptance Certification 1

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 1: Contact Information



PFlow Industries, Inc.
6720 N. Teutonia Avenue
Milwaukee, Wisconsin 53209



Office
Phone: 414-352-9000
Fax: 414-352-9002



Customer Support Department
Email: csd@pflow.com



Sales
Email: 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

© Copyright March 2026 by PFlow Industries, Inc.

All rights reserved.

No part of this manual may be reproduced or used in any form without expressed written permission from PFlow Industries, Inc.

This publication may be photocopied by the original purchaser. Any other type of reproduction is prohibited without express written permission from PFlow Industries, Inc.

Trademarks

All trademarks referenced in this manual are the property of their respective owners.

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.



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 2: General Information

Introduction

This manual provides information about the PFlow Industries, Inc. custom designed Vertical Reciprocating Conveyor (VRC). As the nation's 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 VRC's general installation. They 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 modification 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.

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 3: Warranty

Parts and Labor

Parts:	
Structure	Lifetime
Manufactured Components	1 Year
Purchased Components	1 Year
Gates and Enclosures	90 Days
Labor:	
Structure	Lifetime
Manufactured Components	1 Year
Purchased Components	1 Year
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 and covered by the Supplier's labor warranty.

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 60 days after shipment.

Exclusions

This warranty does not apply to the following:

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, or has had 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.

Liability

PFlow Industries, Inc. believes, to the best of our knowledge, that the information in the equipment manuals is 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 any direct, indirect, or consequential damage 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 Materials Authorization (RMA) policy for PFlow Industries, Inc.

Pre-Authorization

- All warranty work must be pre-authorized by PFlow Industries, Inc. Customer 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. 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 email 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.
- ☐ Date the work was performed.
- ☐ Description of the problem.
- ☐ Travel time incurred.
- ☐ Labor hours expended resolving the problem.
- ☐ Rates per hour.
- ☐ Copies of receipts for materials purchased.
- ☐ Detailed description of work completed.

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 4: Important Safety Information

Read the Entire Manual

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 VRC's 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

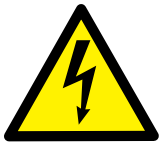
To ensure your safety and the safety of those around you, it is important that you read, observe, and understand ALL safety precautions relative to a particular task. Safety precautions in the manual are labeled with an alert symbol followed by the word DANGER, WARNING, or CAUTION.

	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.

Danger Statements

⚠ 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.
- 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, refer to Bulletin 15709-0083 for additional information or contact PFlow Industries, Inc. Customer Support Department for assistance.

Warning Statements

⚠ 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.



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



- 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 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.

⚠ 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.
- 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 no portion of the load overhangs 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.
- 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.



- 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.



- Falling Hazard! Close all gates before the carriage is moved. Never leave the lift unattended with the gates in the open position. Never close gates when a person is on the carriage or within the fenced area.



- 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.



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

Caution Statements

⚠ 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.

De-energize the Circuit

⚠ 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



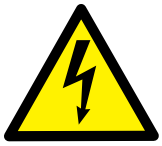
The incoming voltage source must match the voltage identified on the rating tag. The rating tag provides essential technical information required for any installation, maintenance, or repairs. Do not remove, damage, or modify the rating tag.

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. Do not use bare hands, pliers, or screwdrivers to change a fuse.
3. Install covers on exposed electrical devices and 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.

Working on Energized Circuits

DANGER



High Voltage!

To prevent serious injury, death, or property damage, all electrical connections and permanent wiring must be installed by a licensed 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.

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 measures 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.



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 5: Entrance Below a Raised Carriage Deck

Safety Requirements

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 are 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.

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. Make sure 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.

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 6: Glossary

Glossary Terms

Term	Description
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.
Back-frame	The vertical portions of the carriage on a cantilever VRC, typically a series D vertical support mast.
Backstop panel	Also known as a Mezzanine roll-off panel, this is a panel that is installed opposite the loading edge at upper loading levels of a VRC platform that does not penetrate a floor. The backstop panel helps protect personnel and/or products from falling off the platform when loading or unloading. This term should not be confused with the term "backstop" as defined in ASME B20.1.
Backstop	As defined by ASME B20.1; A mechanical device to prevent reversal of a loaded conveyor under action of gravity when forward travel is interrupted.
BVAC	A bi-panel vertical acting gate.
Cantilever	A style of VRC where the carriage rides along the guide columns that are located on the same side of the carriage. This style lift can accommodate loading on three sides; right, front, and left.
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.
Carriage gate	A gate that is mounted directly on the carriage deck.
CEMA	Conveyor Equipment Manufacturers Association: www.cemanet.org
Chain	See Drive chain, 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 Guide Tube	A tube welded to the back side of the VRC column that encloses the lift chain and tensioner chain.
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.

Term	Description
Channel weldment	A weldment consisting of a beam and welded fork channels that spans the inside bottom of a section. This is for installation purposes only, They can obstruct carriage travel and must be removed prior to operation.
Columns	The vertical structural members in which the wheelblocks attached to the carriage travel up and/or down.
Column splice	Columns shipped in more than one piece must be joined in the field during installation. Field assembly and welding is required.
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).
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).
DeckLock System	An added measure of safety to prevent uncontrolled descent of the carriage.
Diagonal drop bar	Load-defining bar and snap chain across operating end(s) of the carriage to define the load area on the platform which may minimize load movement. The diagonal drop bar is hinged at the base and swings down. This is not a load stop.
Direct acting cylinder	The cylinder which transmits lifting force directly to the carriage rather than through the use of cables, pulley, or chains.
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 typically mounted at the top of the lift guide columns.
Drive chain	Drive chains on the F series mechanical VRC, through a series of a shaft and sprockets allow the carriage to be raised and lowered.
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.
EBVAC	An electrically powered bi-panel vertical acting gate.
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 and snap chains.
Electrical cable	Electrical cables consist of at least two conductors contained within a protective outer cover.

Term	Description
Enclosure (lift guarding)	Structure surrounding a VRC to prevent outside interference with its normal operation and to safeguard personnel. Typically 8’ (2438mm) high panels composed of expanded metal or other materials that will prevent a 2” (51mm) diameter ball from passing through (ASME B20.1 requirement).
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.
EVAC	An electrically powered single panel vertical acting gate.
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).
Full Height Enclosures (FHE)	Structure surrounding the full height of a VRC to prevent outside interference with its normal operation and to safeguard personnel. Typically panels composed of expanded metal or other materials that will prevent a 2” (51mm)diameter ball from passing through (ASME B20.1 requirement).
Gate	A device that opens and closes manually or automatically to allow access to the carriage for loading and unloading. The gate is normally a swing, sliding, or vertical acting device constructed of similar expanded metal as the enclosure (see specific gate type).
General Arrangement (GA) drawing	The drawing produced by PFlow Industries, Inc. which shows the VRC lift, gates, and enclosures. 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.
Guide column	The structural members connected to the carriage that guide the carriage travel up and down.
Header	Header refers to the horizontal structure spanning the width of the carriage or gate. The carriage header defines the load height on straddle units.

Term	Description
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.
Hydraulic cylinder	A device which converts fluid power into linear force and motion. The hydraulic cylinder usually consists of a movable element such as a piston and piston rod, plunger or ram, operating within a cylindrical bore.
Hydraulic power unit	Refers to motor, pump, and reservoir assembly. The reservoir is shipped with oil. Most hydraulic power units come with the control panel attached and pre-wired to the hydraulic pump.
Incoming voltage	The main voltage being supplied for operation of the equipment.
Interlock (Gate/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 gate or access door unless the VRC carriage is present at that particular landing or 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.
Kick plate	A curb on the outermost edge of the inoperable sides of the carriage deck which is designed to contain product and is a minimum of 4” (102mm) high.
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.).
Landing	A permanent-working surface at a fixed elevation used for loading or unloading the carriage.
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.

Term	Description
Macropoxy	Macropoxy is a fast drying, polyamide epoxy designed to protect steel in industrial exposures. Ideal for protection of sharp edges, corners, and welds.
Mechanical stop	A mechanical means of stopping travel at a fixed position.
Momentary contact push button	A push button which only has to be pressed for an instant to activate the desired operation.
Non-operating end	The side(s) of a carriage not used for loading/unloading. Handrails or expanded metal sides and kick plate are normally supplied as minimum guarding.
Operating end	The side(s) of the carriage used for loading/unloading. At a minimum the side(s) are normally equipped with a safety chain as guarding.
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 beam of light is detected by a sensor.
Pit	A depression in the floor a minimum of 1” (25mm) deeper than the carriage profile, which allows the carriage deck to be flush at operating floor or level.
Platform	The structure that forms the floor of the carriage and that directly supports the load (see Deck).
Pneumatic gate operator	A device that requires in-plant, clean and dry air to automatically open and close a gate. The device can be operated by either manually through the use of pull cords or push buttons, or automatically through the use of a PLC.
Pressure switch (hydraulic)	A sensor which detects hydraulic pressure. The sensor can be set to trip at a predetermined pressure. When this pressure setting is reached, the pressure switch will activate, opening the control circuit and stopping the pump motor.
Programmable Logic Controller (PLC)	A micro-processor based device that controls the VRC or Cartveyor™ 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.
Ramp	An access ramp used to load on and off of a carriage deck.
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.
Roll-off panel	See Back-stop panel.

Term	Description
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.
Spliced guide column	Guide column that is fabricated and delivered in two or more sections necessitated by manufacturing, handling, or installation constraints.
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.
Straddle	A style of VRC where the carriage rides between two guide columns that are located on opposite sides of the carriage. This style of lift will accommodate “C” and “Z” type loading patterns.
Top of roller (TOR)	Top elevation of a horizontal conveyor system roller which is also the lower elevation of the load.
Touchscreen	See HMI.
Transom	A panel or panels used to close an enclosure opening above the VRC entrance.
Travel	The difference in elevation between the bottommost level of the carriage platform and the uppermost level of the carriage platform, regardless of whether the carriage is pit or floor mounted.
UHMW (Ultra-High Molecular Weight)	An abrasion-resistant, high-impact, polyethylene material used throughout the VRC to protect and/or guide moving parts.
Uprights	The portion of the carriage that houses the wheels that guide the carriage between the columns.
VAC	A single panel vertical acting gate.
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.
Velocity fuse	A device that senses hydraulic flow across a control orifice when the pressure differential exceeds a predetermined amount. A spring-biased poppet closes, shutting flow to the damaged hydraulic circuit and prevents the lift carriage from descending.
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.

Term	Description
VRC specification sheet	PFlow Industries, Inc. informational data sheet providing general information on a specific VRC.
Wheelblock assembly	Sub-assembly fastened to the carriage upright that contains the guide roller elements and safety cam for the chain driven VRC lift. The lift chain is typically attached to the wheelblock assembly safety cam.

Gate Types

Gate Type	Description
Single swing gate	This type of gate hinges on one side and latches on the other, may be either right or left-hand swing. Clear space is required in front of the VRC for the gate to swing open.
Bi-parting swing gate	The bi-parting, swing gate has hinges on each side and latches in the center. Clear space is required in front of the VRC for the gates to swing open.
Single panel vertical acting gate (VAC)	The VAC gate panel closes to the floor and opens in the upward direction.
Double panel vertical acting gate (BVAC)	The BVAC gate is the same as the single panel VAC above in operation and use except the two (2) panels telescope from a nested position.
Horizontal sliding gate	The horizontal sliding gate operates in the same manner as a vertical acting gate except the gate functions in the horizontal direction.
Roll-up door	The roll-up door can be anything from an industrial type roll-up steel door to self-storage facility type door.

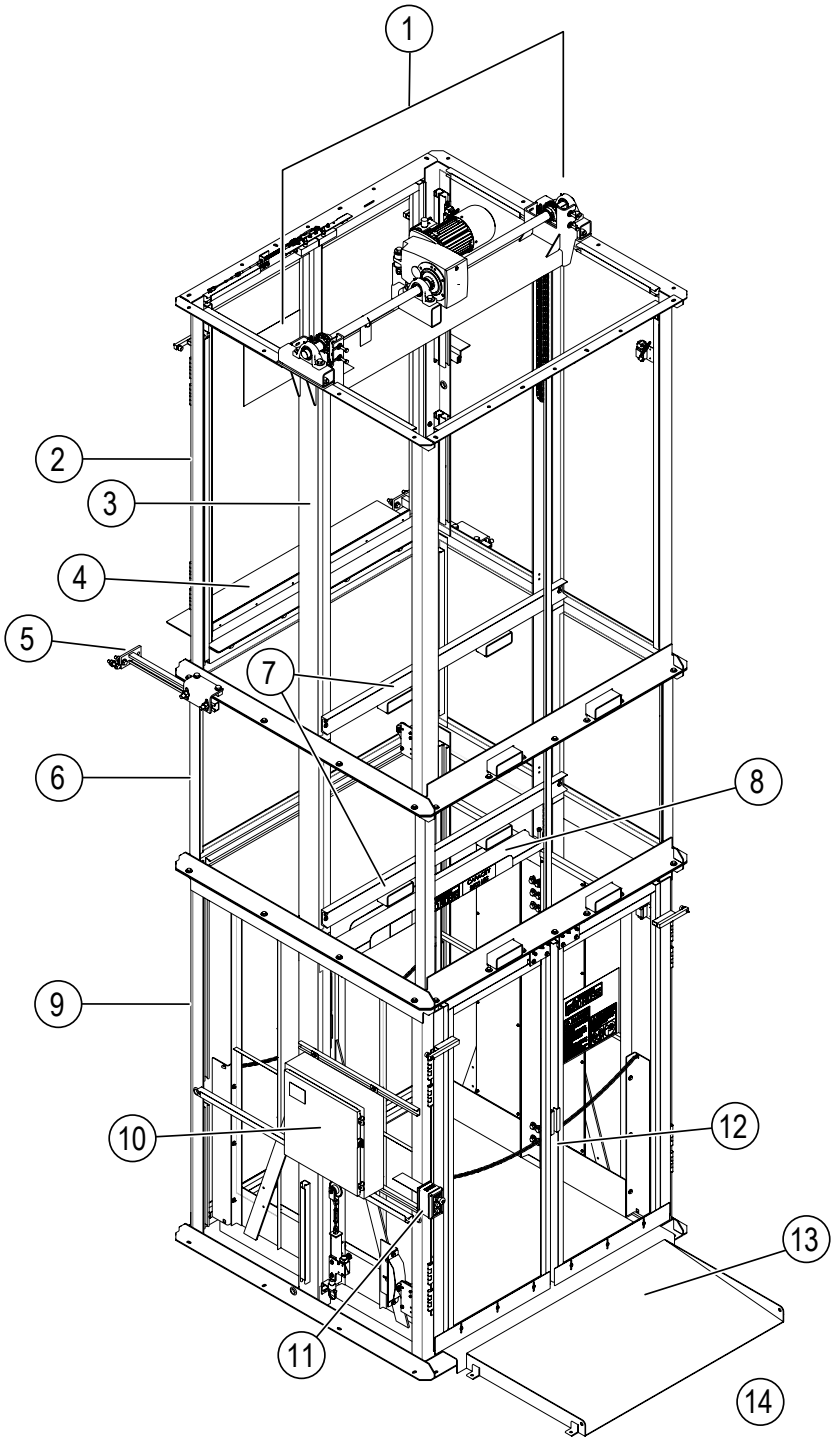


www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 7: System Components

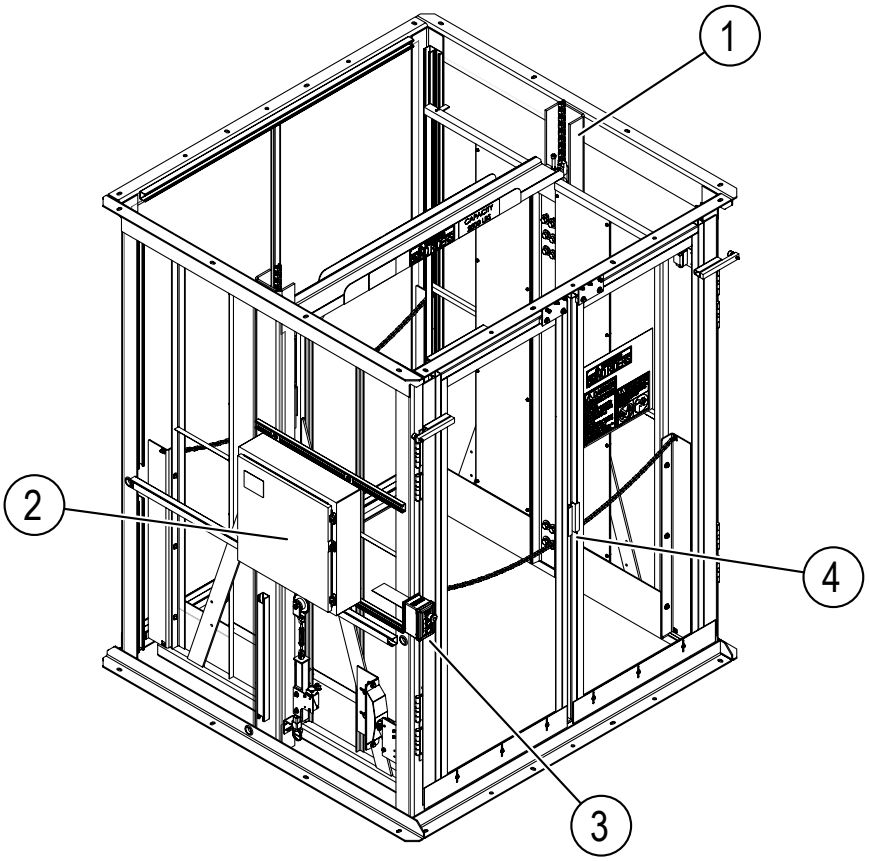
RapidStack (Full View)

1. *Drivebase assembly*
2. *Top section*
3. *Column*
4. *Threshold plate*
5. *Bolted bracing*
6. *Middle section*
7. *Channel weldment*
8. *Carriage*
9. *Bottom section*
10. *Control Panel*
11. *Push-button station*
12. *Bi-Swing gate*
13. *Ramp*
14. *Landing*



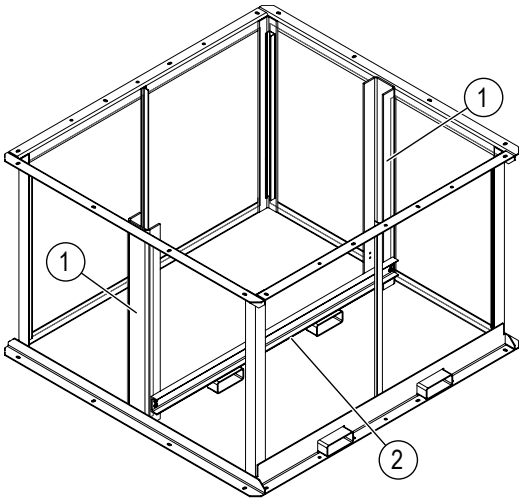
Bottom Section

1. *Column*
2. *Control panel*
3. *Push-button station*
4. *Bi-Swing gate*



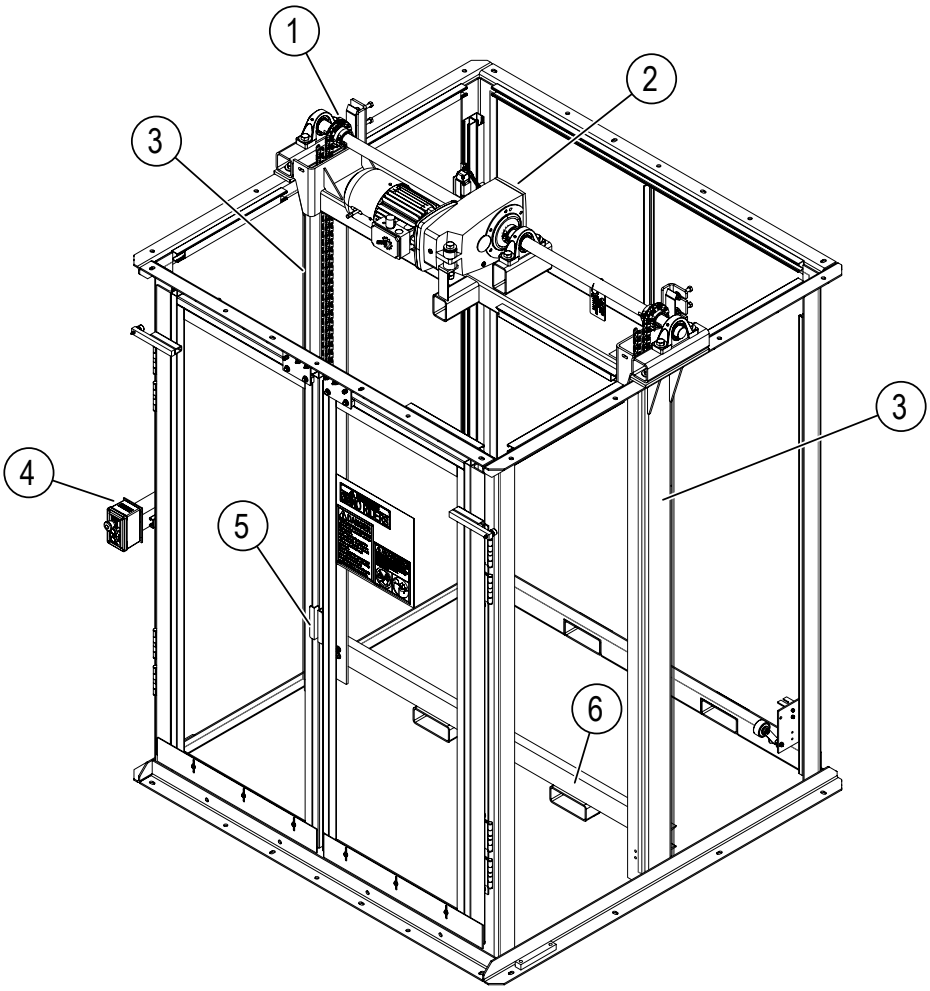
Middle Section

1. *Column*
2. *Channel weldment*



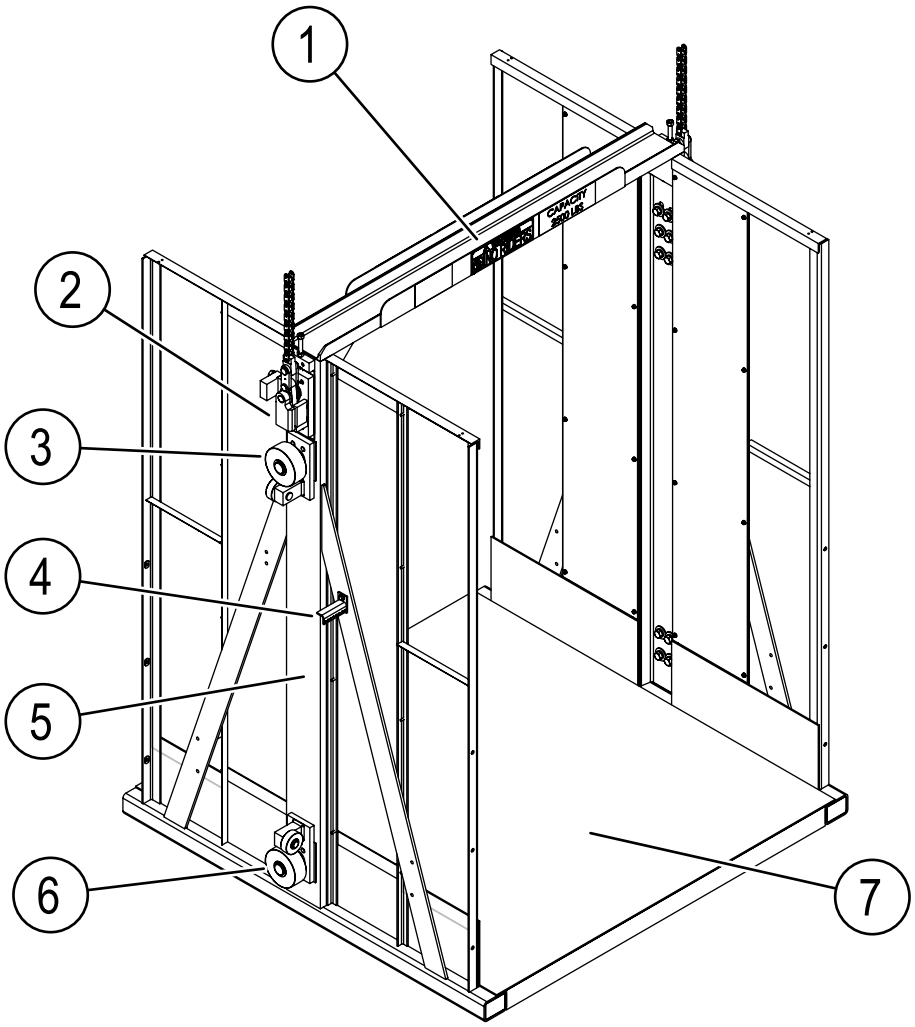
Top Section

1. *Chain and sprocket*
2. *Drive motor*
3. *Column*
4. *Push-button station*
5. *Bi-Swing gate*
6. *Channel weldment*



Carriage

1. *Carriage header*
2. *Safety cam*
3. *Upper wheelblock*
4. *Tensioner chain bracket*
5. *Carriage upright*
6. *Lower wheelblock*
7. *Carriage deck*



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 8: Electrical Standards and Definitions

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

⚠ CAUTION

PFlow Industries, Inc. does not recommend or support the use of temporary power for its equipment. The customer assumes all responsibility for any damage to PFlow equipment resulting from its use.

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

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" (13mm). Connectors and couplings shall be appropriate for conduit type.
9. Flexible conduit shall be a minimum of 1/2" (13mm), 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.

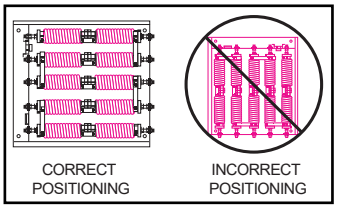


Figure 8-1: *Resistor Bank Positioning*

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.

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.



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 9: Mechanical Overview

Mechanical Overview

Each RapidStack Series (mechanical) Vertical Reciprocating Conveyor (VRC) consists of 2 columns, a drivebase assembly with a gearmotor reducer, drive shaft with 2 lift sprocket assemblies, a moving carriage deck with a safety gate, and an enclosure with interlocked safety gates at each floor level. In addition, a control panel, disconnect switch, and one push-button station per level are furnished. For more information on the electrical components, see “Section 10: Electrical Overview” in this manual.

Lift Columns

Each modular section of the RapidStack Series contains 1 segment of column on each side of the enclosure. The bottom section is anchored to the floor, and then the sections are bolted together. The RapidStack is braced to the building structure at the upper level.

Enclosures

The RapidStack Series VRC is constructed of 3 enclosed sections. The top and bottom enclosures are approximately 8’ (2,438 m) tall and include an interlocked safety gate. The middle section is fully enclosed, and the height varies per job site.

Gate Assemblies

A safety gate assembly is provided at each level opening of the VRC. When a gate is open, the interlocking sensor prevents movement of the carriage. When the carriage is between levels, the interlocking sensors keep the gates locked.

Drivebase Assembly

The drivebase assembly consists of a motor, brake, gearmotor reducer (gear motor assembly), lift sprockets, a drive shaft, bearings, and a support structure. Roller lift chains connect to tensioner chains, which are connected to chain tensioner assemblies. See Figure 9-1 and Figure 9-2.

Lift Chains

Inside each column, one end of a lift chain connects to a safety cam assembly which is bolted to the carriage upright.

The lift chain goes up and over the lift sprocket at the top of the column drivebase assembly, then proceeds downward the side of the column and connects to the smaller tensioner chain.

The tensioner chain then travels around the small chain tensioner sprocket and back up to the carriage to fasten to a chain tensioner bracket (shown in Figure 9-2, Item 8).

The tensioner sprocket is spring-loaded by the chain tensioner which maintains tension on the chain/tensioner combination. If the lift chain is pulled too tight or becomes slack, the chain tensioner limit switch is activated to shut off power to the VRC.

The chain tensioner is adjusted at a turnbuckle on the chain tensioner assembly.

NOTE: *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.*

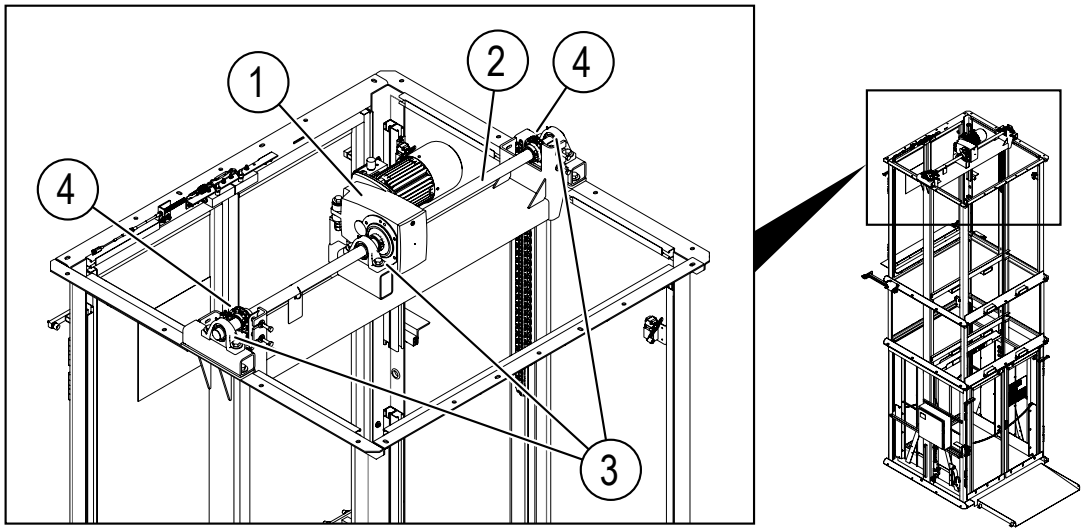


Figure 9-1: *Drivebase Assembly*

1. *Motor/Brake/Reducer Assembly*
2. *Driveshaft*
3. *Bearings*
4. *Chain Sprockets*

1. *Lift Sprocket*
2. *Lift Chain*
3. *Master Link*
4. *Swivel*
5. *Tensioner Chain Master Link*
6. *Tensioner Chain*
7. *S-Hook*
8. *Chain Tensioner Bracket*
9. *Lift Chain Master Link*
10. *Safety Cam Toggle*
11. *Safety Cam Link*
12. *Clevis Pin*
13. *Cotter Pin*
14. *Safety Cam Assembly*

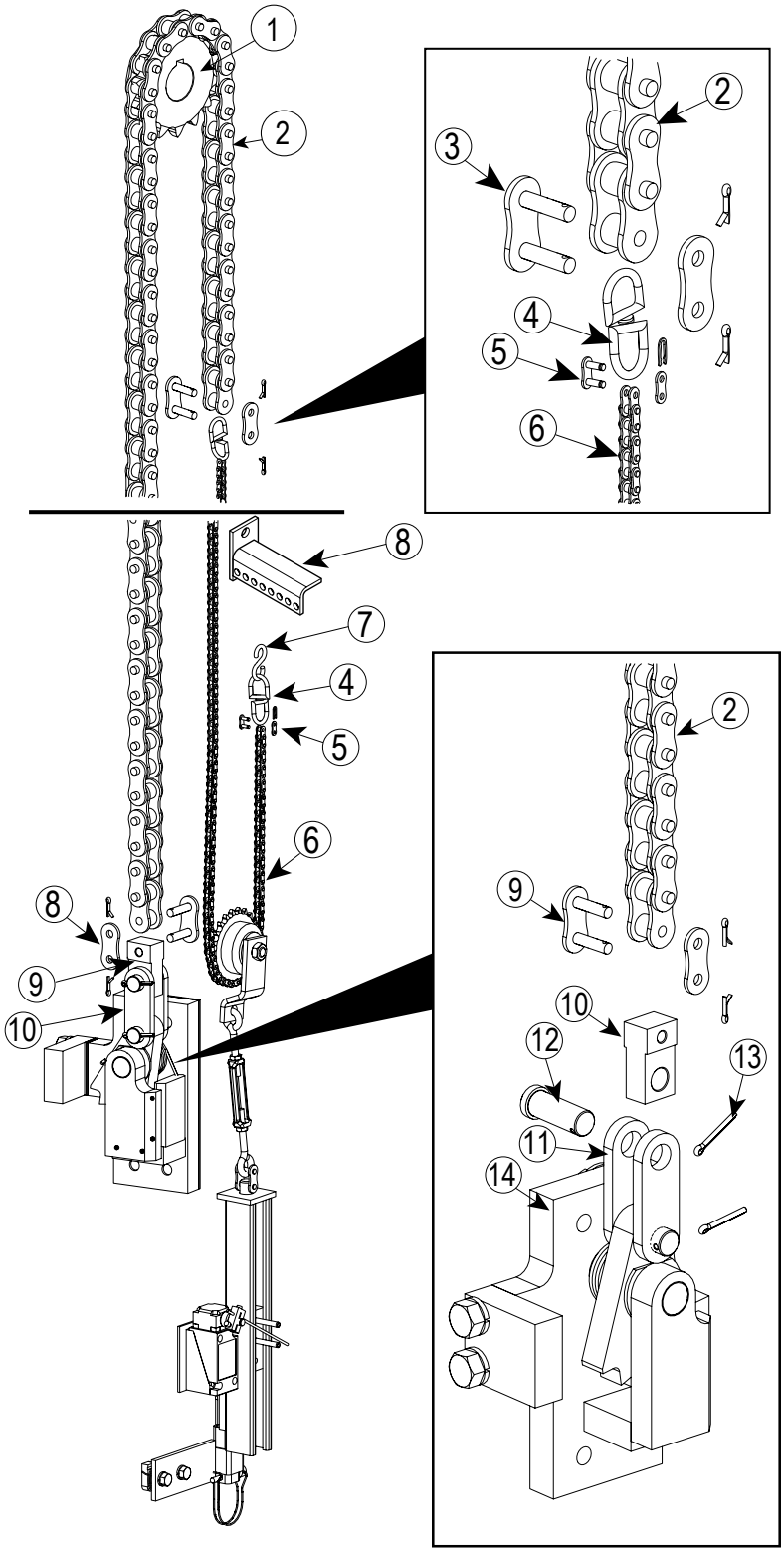


Figure 9-2: *Lift Chains*

Safety Cam and Wheelblock Assemblies

The VRC has 2 safety cam assemblies bolted to the carriage uprights that reside inside the column. It also has 4 wheelblock assemblies bolted to the carriage (2 on each side) with 1 wheel riding within the column and the other wheel riding on the outside of the column.

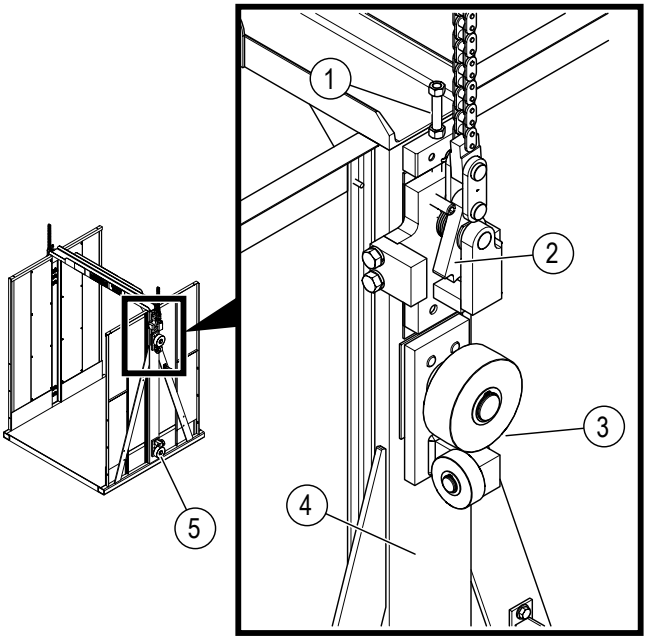


Figure 9-3: *Safety Cam and Wheelblock Location*

1. *Jackscrew*
2. *Safety Cam Assembly*
3. *Upper Wheelblock Assembly*
4. *Carriage Upright*
5. *Lower Wheelblock Assembly*

Safety Cam Function

If the lift chain breaks or becomes slack, the safety cam will pivot into a jam position with the column guide angle to stop the carriage from falling. The safety cam shoe on the outside of the guide angle track helps wedge the safety cam teeth. See Figure 9-4 and Figure 9-5.

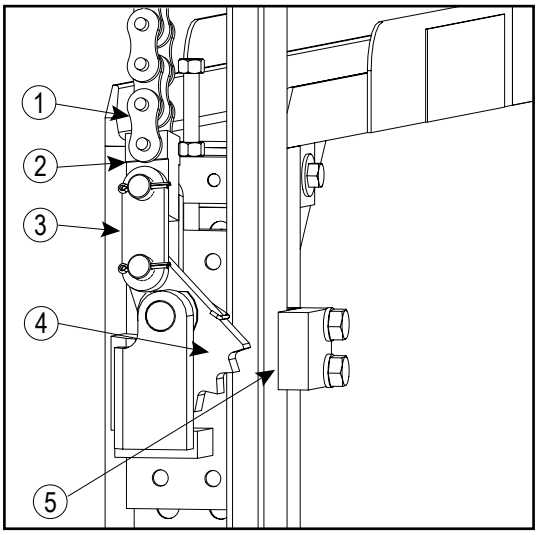


Figure 9-4: *Safety Cam Disengaged*

1. *Lift Chain*
2. *Toggle*
3. *Connecting Link*
4. *Safety Cam (in disengaged position)*
5. *Safety Cam Shoe*

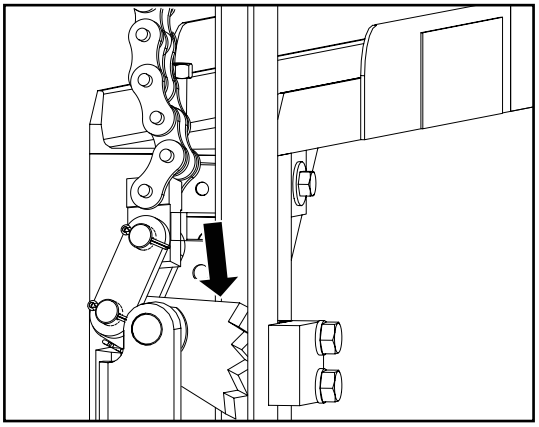


Figure 9-5: *Safety Cam in Engaged Position*

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 10: Electrical Overview

Electrical Overview

The following is a standard description of the electrical wiring of a RapidStack Series VRC. This does not include any specifics on options available or ordered (e.g., doors, maintenance pins, 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.

⚠ WARNING



Falling hazard! 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.

Per ASME B20, all gates or doors accessing the lift area must be electro-mechanically interlocked. This requires electrical contacts to prevent the lift from operating if a door is open when the carriage is at the level and mechanical locks to lock the gate until the carriage is at that level.

Main Disconnect Switch

As required by NEC code, the main disconnect switch must be lockable, located within the line of sight of the main control panel and no more than 6’ 7” (2 m) off the floor.

Main Control Panel

The main control panel contains a DC power supply, a GFCI outlet, and an HMI display. See “Section 12: HMI Operation” for information about screen controls.

Push-Button Station

One push-button station is supplied for each level. ASME B20.1 code requires that the push-button stations be remotely located and unable to be activated by someone standing on the carriage. Each push-button station includes an emergency stop (E-stop) push-button and a “Send to” push-button for each floor level.

The Send to “x” push-buttons are momentary contact. This means that if the VRC is enabled, 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. When pressed, the emergency stop prevents the carriage from moving. The emergency stop must be pulled out before carriage movement can be initiated again.

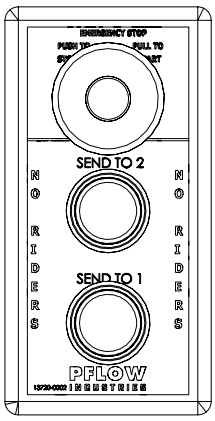


Figure 10-1: *Push-Button Station*

Drivebase Assembly

The motor and brake are located on the drivebase assembly. The motor and brake wiring must be verified prior to energizing the VRC.

Limit Switches

The RapidStack Series VRC has five (5) limit switches incorporated into a standard two-level VRC: one (1) at each level to stop the carriage, one (1) overtravel, and two (2) chain tensioner switches.



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 11: Operation

Before You Begin

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

Service must be performed by qualified and trained service technicians only.

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



- Falling column hazard! Make sure all beams, columns, posts, and components are properly supported during installation. Illustrations may show the beams, columns, posts, and components unsupported in order to make the equipment and installation instructions clearly understood.

- 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.
- Keep clear of unsupported carriages and rotator. Stay out of the area under a raised carriage and rotator. If a maintenance operation requires the carriage to remain in the raised position, physically secure the carriage at the upper level using adequately sized maintenance chains or straps with shackles around the lift motor drivebase and rotator that are capable of supporting the weight to provide additional safety.

⚠ WARNING



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



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

- Close all gates before the carriage is moved. Never leave the lift unattended with the gates in the open position. Never close gates when a person is on the carriage or within the fenced area.
- 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.
- Entanglement hazard! Secure long hair, wear snug-fitting clothing, and avoid wearing jewelry while using the VRC.

System Operation Overview

NOTE: *The carriage cannot travel while the gate on either floor is open.*

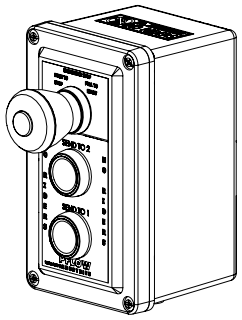


Figure 11-1: *Push-button station*

When the operator pushes a push-button to move the carriage to a different level, the system releases the motor brake. The motor turns the gears in the reducer, which rotates the keyed drive shaft. The drive sprockets on the shaft turn, which moves the lift chains up and down.

When the carriage arrives at the next level, an actuator mounted on the carriage trips the floor level limit switch. See Figure 11-2. When the floor limit switch is activated, the switch cuts the power to the motor circuit. The motor starter contacts open, the motor stops, and the brake operates. This stops and holds the carriage in position.

Floor Switches and Travel Limit Switches

The carriage overtravel limit switch is a safety device mounted on the enclosure above the upper floor level limit switch. If the upper floor level limit switch fails, an actuator on the carriage activates the overtravel limit switch. This stops the motor and applies the brake, which stops and holds the carriage in position. If a switch fails, have a qualified electrical controls technician correct the problem before operating the VRC.

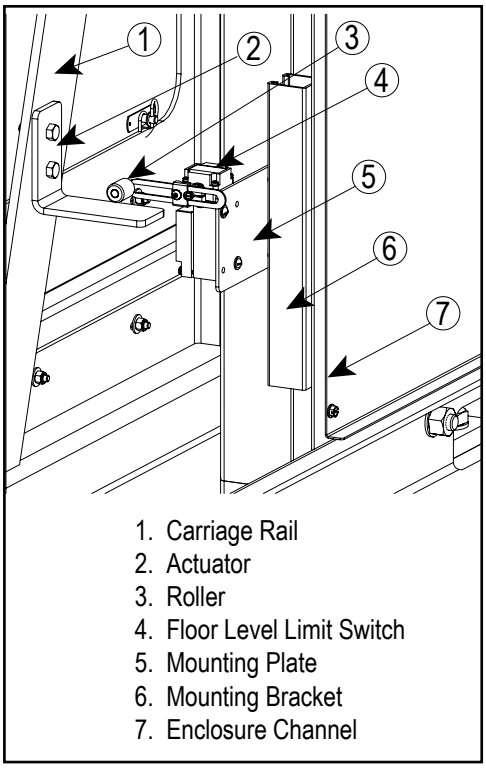


Figure 11-2: *Floor Level Limit Switch (example)*

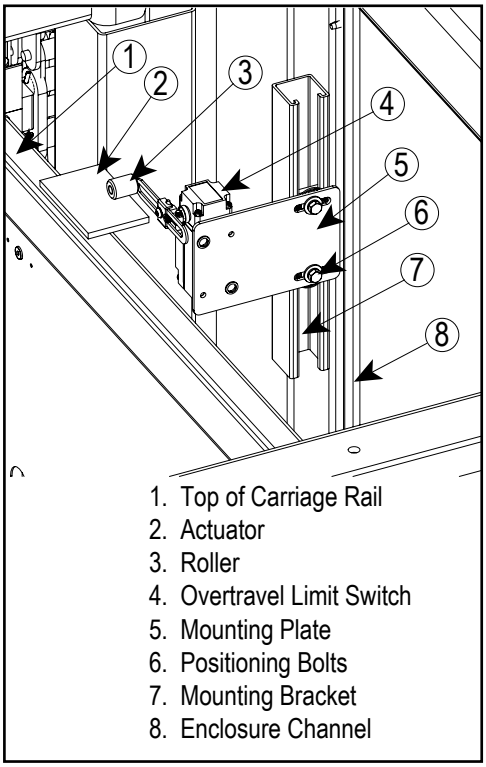


Figure 11-3: *Overtravel Limit Switch (example)*

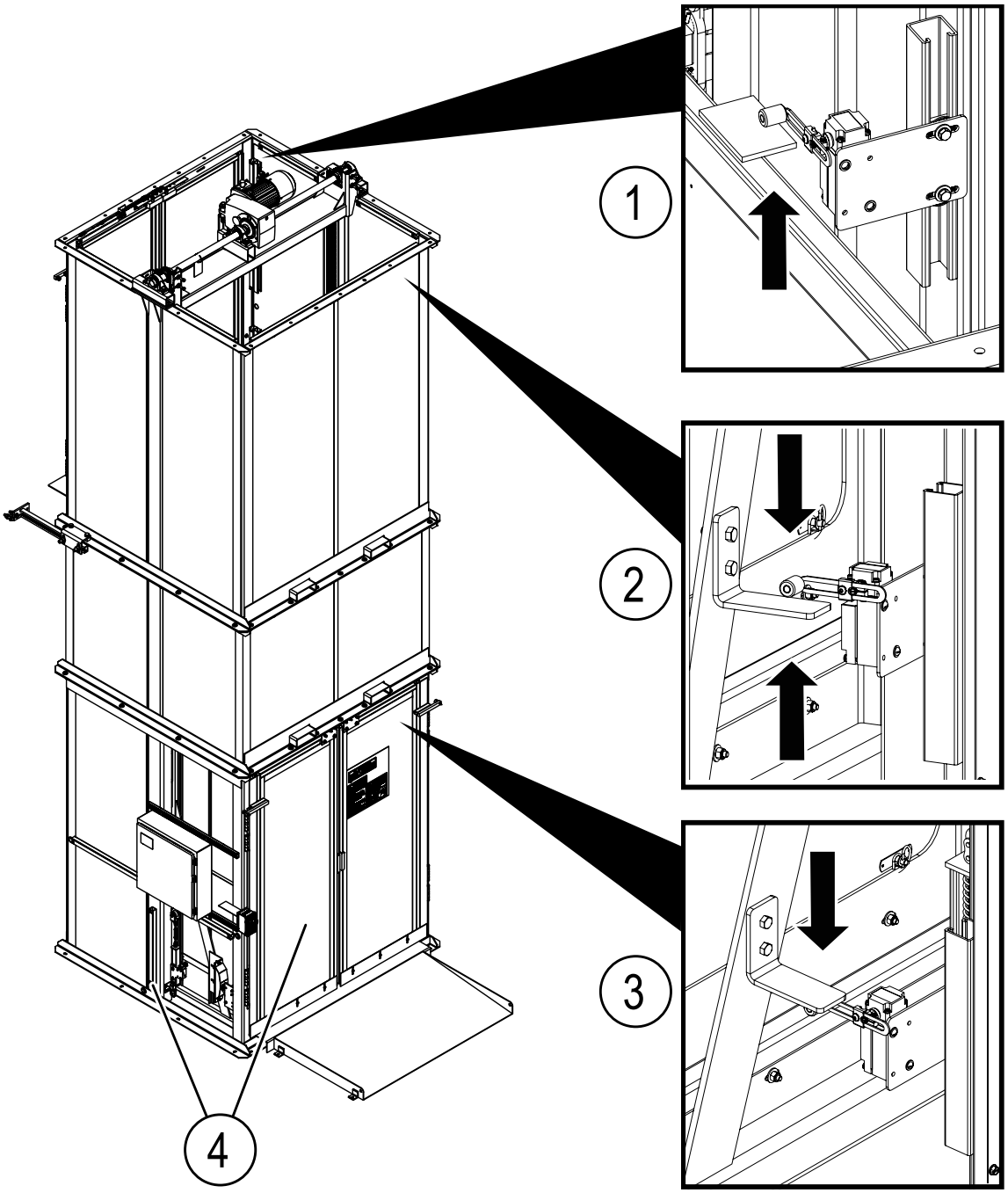


Figure 11-4: *Limit Switches*

1. *Overtravel Limit Switch*
2. *Upper Level Limit Switch*
3. *Lower Level Limit Switch*
4. *Chain Tensioner Limit Switches (at the bottom of each lift column)*

Chain Tensioner Limit Switches

A chain tensioner limit switch is mounted at the bottom of each lift column. If a lift chain becomes slack or breaks, the chain tensioner limit switch activates to shut off power to the motor and apply the brake. The safety cam rotates and sets on the column. The carriage stops. The VRC will not operate until the lift chain is repaired and the chain tensioner is readjusted.

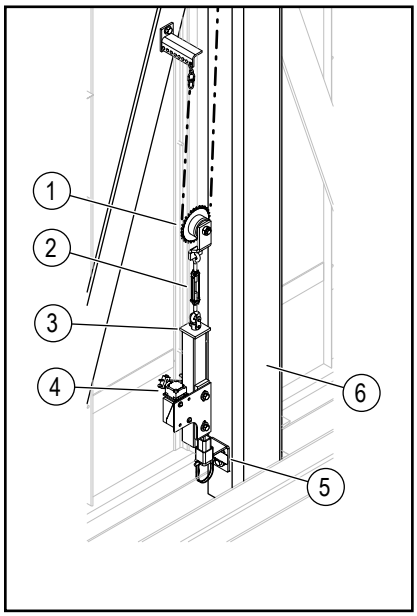


Figure 11-5: *Chain Tensioner Assembly*

1. *Sprocket*
2. *Turnbuckle*
3. *Chain Tensioner Assembly*
4. *Limit Switch and Arm*
5. *Chain Tensioner Mounting Bracket*
6. *Outside of column*

To Operate the Lift

⚠ WARNING

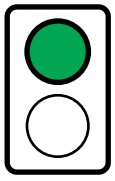


FOR MATERIALS USE ONLY - NO RIDERS

1. Open both the floor level gate.
2. Center the load on the platform and secure the load. Make sure the weight of the load does not exceed the capacity. Remove excess weight if needed.
3. Close the gate.
4. Press the ***Send to*** push-button to send the carriage to the desired level.

   If an emergency occurs while the carriage is moving, push the emergency stop button.

   The VRC is inoperable until the emergency stop button is pulled out.

Push-button Floor Indicator Lights	Carriage Status	Light Indication
	At chosen level and gate is closed	Solid
	Moving to chosen level	Flashing
	At chosen level and gate is open	Fast flashing



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 12: HMI Operation

HMI Specifications - Options

Component	Specifications
Safety devices	can support up to 2 safety devices
Ethernet port	can be used to interface with an external, standalone remote access device

NOTE: *The Control Panel for your system may have different dimensions from the example shown in Figure 12-1.*

HMI Start-up

1. Apply power at the main disconnect switch.
2. The Human Machine Interface (HMI) display on the control panel will begin initializing. See Figure 12-1.

   NOTE: *This screen will take 1 to 1-1/2 minutes to initialize. Do not press any buttons until the screen is fully initialized.*

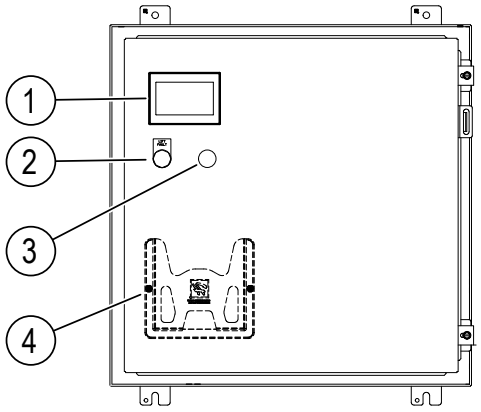


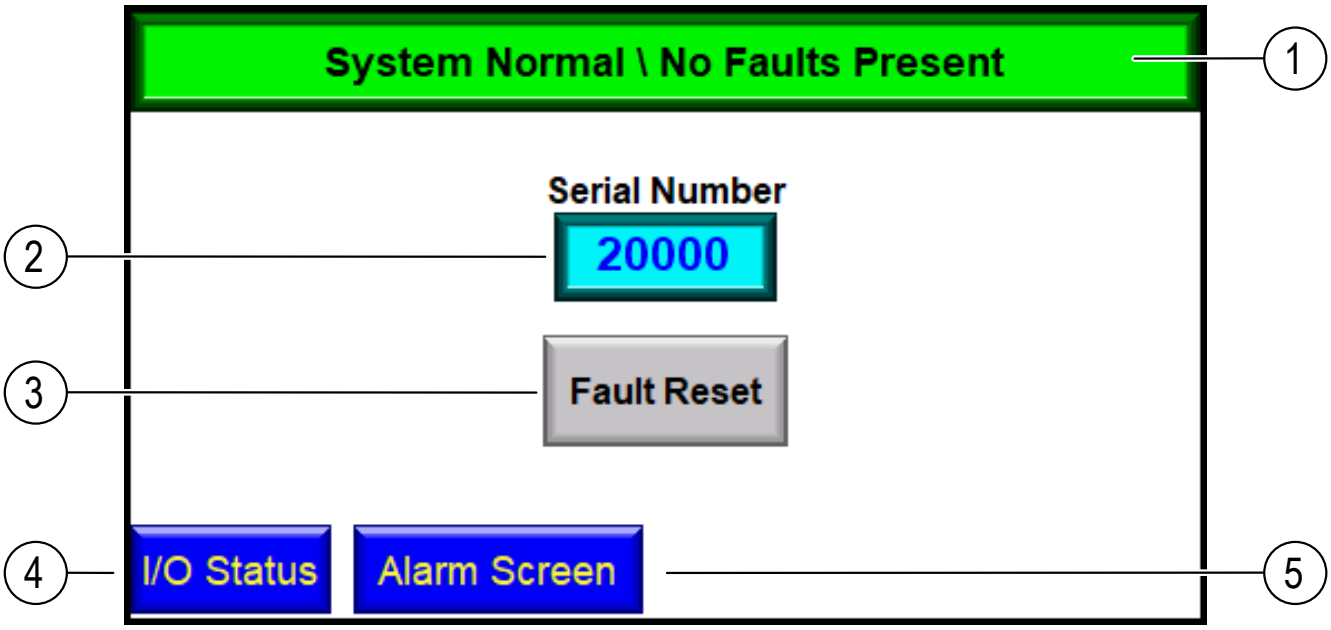
Figure 12-1: *HMI Control Panel (example)*

1. *HMI Screen*
2. *Fault Light (red)*
3. *Ethernet Port*
4. *Wiring Diagram Storage (inside door)*

Main Screen

The HMI provides a direct interface to the PLC that allows you to monitor electrical components on the VRC without opening the electrical panel. It provides information about system faults and alarms that can help you troubleshoot problems with sensors, switches, and other controls on the system.

The Main Screen shows when the HMI starts up.



Item	Name	Description
1	***Status Message***	The banner is green during normal operation. The banner turns red when a fault occurs.
2	***Serial Number***	Shows the serial number of the VRC.
3	***Fault Reset***	Clears a system fault and returns the VRC to normal operation. A qualified person must correct the condition that caused the fault before you can clear the fault.
4	***I/O Status***	Shows the current status of the Programmable Logic Controller (PLC) inputs and outputs.
5	***Alarm Screen***	Shows a summary of alarms.

Main Screen Fault

The red banner indicates a fault. See the fault table below for how to return the system to normal operation.

You can press the Alarm Screen to see the fault on the Alarm Summary.

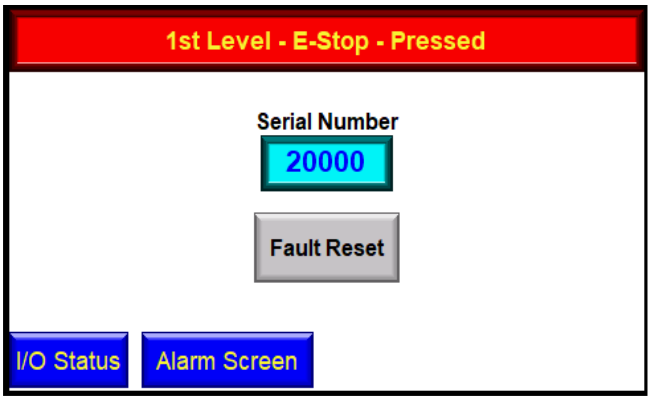


Figure 12-2: *Main Screen - Fault*

HMI Fault Message	Cause	Remedy
X Level E-Stop Pressed	The E-Stop button has been pushed in.	Pull out the E-Stop button to clear the fault condition and return the system to normal operation. Note: For the E-Stop fault only, it is not necessary to press the Fault Reset button.
Lift Motor Overcurrent Sensor	The overcurrent sensor detected a current level higher than what was set.	Have a qualified technician identify the cause, and then press Fault Reset.
Lift Motor Overload Tripped	The motor overload detected a current level higher than what was set.	Have a qualified technician identify the cause, and then press Fault Reset.
Upper Overtravel Limit Switch Tripped	Something hit the upper overtravel limit switch.	Have a qualified technician investigate why the uppermost floor level limit switch failed and correct the problem.
Drive Chain Tensioner Limit Switch Tripped	One of the drive chains is too tight, too loose, or is broken.	Have a qualified technician identify the cause, and then press Fault Reset.
Lift Chain Tensioner Limit Switch Tripped	One of the lift chains is too tight, too loose, or is broken.	Have a qualified technician identify the cause, and then press Fault Reset.
Carriage Present at Multi-Floor Level	More than 1 floor level limit switch has been tripped at the same time.	Have a qualified technician investigate why the floor level limit switch(es) failed and correct the problem.
X Level Gate Open – Carriage not present	A gate is open at the “X” level and the carriage is not at that level.	Close the gate until the carriage arrives. Press the Fault Reset button.

Alarm Screen

The Alarm Summary shows all faults that have occurred on the system. It gives the date and time that each fault occurred. You can press a fault to select it from the list, and then press the Detail button to get more information about that fault.

Active faults show in red. The Fault Reset button on the Main Screen deactivates the fault and changes it to grey. (To deactivate the E-Stop fault, you must pull out the E-Stop button).

The Fault Reset button does not clear faults on the Alarm Screen. The Alarm Summary lists all faults indefinitely until you push the Clear All button.

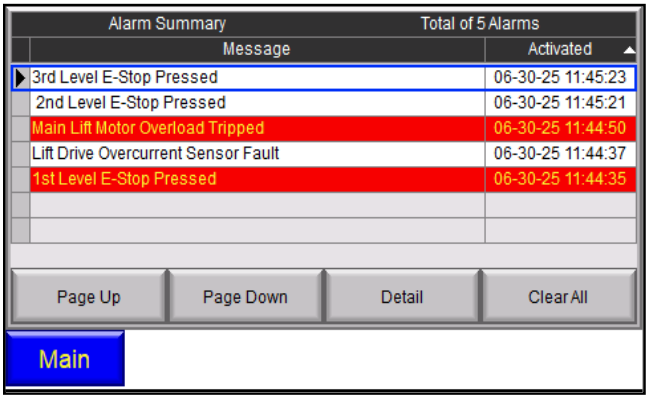


Figure 12-3: *Alarm Screen Example*

I/O Screens

The system has 3 I/O screens that show all the input and output signals for system components controlled at the PLC. Inactive inputs and outputs are white. Active inputs and outputs are green. You can navigate between I/O screens using the ***Next*** and ***Previous*** buttons.

The top banner of the I/O Screen shows the same active system faults as the Main Screen.

NOTE: *The I/O screens show only components that are installed on your system.*

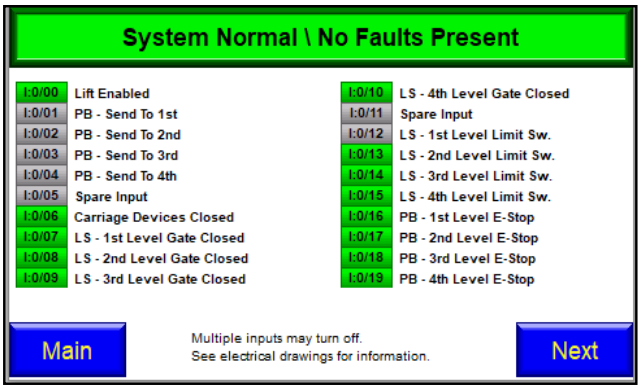


Figure 12-4: *I/O Screen 1*

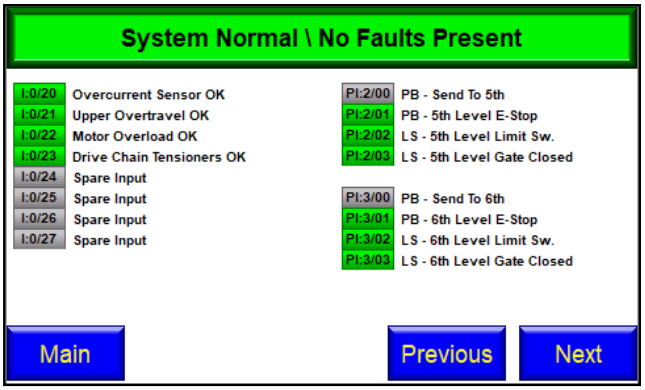


Figure 12-5: *I/O Screen 2*

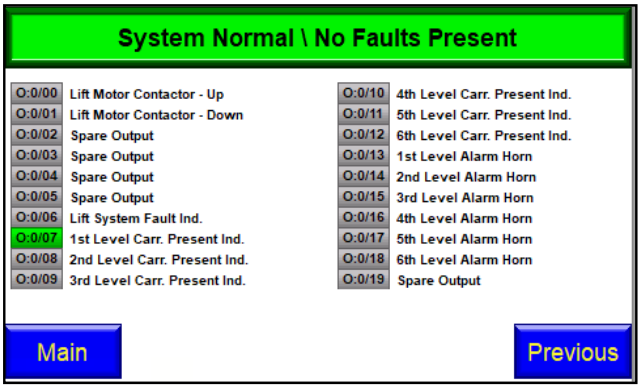


Figure 12-6: *I/O Screen 3*

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 13: Cleaning

⚠ WARNING



- Climbing, sitting, walking, or riding on equipment while the equipment is in operation could result in death or serious injury.



- 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.

- 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.
- 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.

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.



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 14: Component Manufacturer Documentation

OEM (Original Equipment Manufacturer) documentation refers to manuals provided by the manufacturers of individual components. The below OEM manuals are referenced in this manual to assist with preventive maintenance and troubleshooting tasks. PFlow provides the below digital copies of the OEM manuals as part of the system order. Contact PFlow Customer Support if you need help.

Component	Function/Location	Contents	PFlow Reference Number (Digital Distribution)
Nord motor SK4282	VRC lifting motor	Installation & Operating Instructions	Contact PFlow customer support



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 15: Preventive Maintenance and Schedule Checklist

The VRC requires minimal attention on a regular basis to prevent equipment failures or accelerated wear and tear. VRCs operating during multiple daily shifts need to be maintained more often. 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 an individual who, through possession of a recognized degree or professional certification, or through extensive knowledge, training, and experience, has successfully demonstrated their ability to solve problems related 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.
- Take appropriate measures for safely working at heights.
- 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 parts must comply with all relevant health and safety directives and regulations.



- Lockout/tagout the VRC before performing maintenance. De-energize any circuit before work is begun.



- 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.



- Falling Hazard! 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.



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

Monthly Maintenance

√	Action
	Verify overall operation.
	Verify that all level stops are flush with the floor level. Adjust as necessary.
	Verify that all areas under and around the VRC are clean.
	Verify that all gates and interlocks are functioning properly.
	Verify that all electrical components are undamaged.
	Verify that all gates and enclosures are undamaged and properly installed.
	Verify that all push-button stations and Emergency Stops (e-stops) are functioning on each level.
	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.

Quarterly Maintenance

√	Action
	Verify that all nuts and bolts are tight. Adjust as necessary.
	Verify that all moving components are functioning properly.
	Inspect and lubricate all chains (e.g., lift, tensioner, gate) with non-detergent, petroleum-based SAE 30 oil. Inspect for wear, rust, bent, cracked, or binding links.
	Inspect limit switches and operation. Adjust as necessary.
	Verify that the chain sprocket is centered over the chain tube (or column channel). Adjust the position if necessary. Apply Loctite® Blue #242® Threadlocker to the chain sprocket setscrew and the split collar setscrews. Tighten and torque all setscrews.
	Inspect all additional options and accessories (e.g., DeckLocks, maintenance pins) and operation. Adjust as necessary
	Visually inspect the wheelblock guide rollers for rotation interference and wear.
	Verify that all electrical connections are tight.
	Verify that all tensioners are properly adjusted. Adjust as necessary.

6-Month Maintenance

✓	Action
	Verify that the carriage is level. Adjust as necessary.
	Inspect all welding, bracing, and anchoring for structural integrity.
	Inspect all chain sprockets for wear.
	Lubricate the pillow block bearings on the drivebase with lithium axle grease. Apply Loctite® Blue #242® Threadlocker to the setscrews. Tighten and torque setscrews.
	Inspect the gear reducer oil level and replenish as necessary. The minimum acceptable oil level is 0.15" (4mm) below the oil level hole.

Annual Maintenance and Beyond

✓	Action	How Often
	Inspect the motor and brake. Measure and record the air gap on the brake.	12 months
	Inspect the wheels, roller guides, and safety cams for deterioration.	12 months
	Replace gear reducer mineral oil every 10,000 operating hours or every two years.	2 years
	Replace gear reducer synthetic oil every 20,000 operating hours or every four years.	4 years

Additional Notes or Follow-up Requirements

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



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 16: Troubleshooting

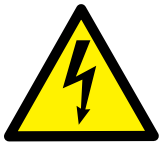
Read this entire manual before any troubleshooting and service is attempted on the Vertical Reciprocating Conveyor (VRC).

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, maintenance pins, DeckLocks, or straps with shackles around the drivebase 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.
- Toppling Hazard! Secure all VRC components (e.g., lift chain, gate panels, enclosure panels) that may fall during the troubleshooting process.



- 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 state or local requirements.



- Falling Hazard! Secure all VRC access areas (e.g., gates, push-button stations) before any troubleshooting or service is begun. 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.

Troubleshooting Table

Malfunction	Possible Cause	Solution
Push-button controls do not start the motor.	The emergency stop is pulled out.	Push the emergency stop in.
	Gate or door is open or ajar.	Verify that all gates/doors are closed.
	Proofed diagonal drop bar on the carriage is up.	Lower the drop bar into position.
	Main power disconnect is off.	Verify that there is a reason the power is off before turning the power on.
	Thermal overload has tripped.	Press the reset button. If it trips again, determine the cause. The motor is overheating.
	Control fuse is blown.	Investigate if the problem is related to the main power fuses or the control fuses. Correct the problem and replace the fuse.
	Power circuit between the disconnect and starter is dead.	Using a voltmeter, measure the voltage. Repair as needed.
	Loose lift chain or tensioner chain.	Tighten the chain or adjust the chain tensioner or chain sensor.
	Broken tensioner chain.	Repair or replace as needed.
	A switch on the DeckLock is not functioning properly.	Investigate the DeckLock switches and repair as needed.
Motor starts and carriage raises, but motor stops before the second level.	Object encountered.	Identify the problem. Remove or repair as needed.
	Drive component interference.	Remove object. Repair if needed.
	OCS relay has tripped.	Lower and remove excessive weight. Inspect brake for possible malfunction, excessive ambient temperature, or mechanical binding.
	Loose lift chain or tensioner chain.	Tighten the chain or adjust the chain tensioner or chain sensor.
	Broken tensioner chain.	Repair or replace chain as needed.
Lift motor starts for two seconds and stops.	Overcurrent sensor or motor overload trips.	Lighten the lifted load.
Carriage fails to stop at floor level.	Floor level limit switch is inoperable.	Adjust, repair, or replace the floor level limit switch.
	Brake inoperable.	Determine cause and effect. Repair if needed.

Malfunction	Possible Cause	Solution
Carriage raises but will not lower.	Safety cam has set.	Identify the problem and repair as needed.
Carriage lowers but stops early.	Debris in the pit.	Remove debris from pit and clean the area.
Rough or noisy operation.	Interference between the chain and chain guards or chain guides.	Determine the cause and correct.
	Shaft pillow block bearings are worn or dry.	Inspect, lubricate, and replace as needed.
	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.
	Wheel guide rollers are worn.	Inspect and replace as needed. Determine the cause and correct.
	Wheelblock guide shoe is rubbing on main beams.	Determine the cause and correct.
	Chain tensioner sprocket bushing is worn or corroded.	Inspect and replace as needed.
	Carriage is not level.	Determine the cause and correct.
Motor hums but shaft does not rotate, then thermal overload trips.	Single phasing.	Use a voltmeter to ensure the incoming main leads are wired properly. Repair as needed.

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 17: Adjust Overcurrent Sensor

Before You Begin

Read this entire manual.

Overcurrent Sensor (OCS) Purpose

The PFlow Industries, Inc. Vertical Reciprocating Conveyor (VRC) is equipped with an Overcurrent Sensor (OCS). The OCS is pre wired and located inside the electrical control panel. See Figure 17-1.

The OCS monitors the motor amp draw and provides enhanced over current protection of the lift motor. The OCS must be adjusted to the maximum "expected" current draw. If the motor current rises above the OCS set point, the OCS will trip. Tripping can be caused by a circuit malfunction, overloading the capacity of the lift, or an overhanging load trapped between floors.



Figure 17-1: *Overcurrent Sensor*

Test and Calibrate the OCS

Steps	Did the OCS trip?	Action
1. Turn the trip point dial to its lowest position.	N/A	N/A
2. Place the maximum product weight on the carriage.	N/A	N/A
3. Run the carriage up.	Yes	Turn the trip point dial clockwise a small amount, and then run the carriage up. Repeat until the OCS does not trip.
	No	Go to Step 2.
4. Run the carriage down.	Yes	Turn the trip point dial clockwise a small amount, and then run the carriage down. Repeat until the OCS does not trip.
	No	Go to Step 3.
5. Run the carriage up and down several times.	Yes	Turn the trip point dial clockwise a small amount and run the carriage up and down several times.
	No	The OCS is correctly adjusted.



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

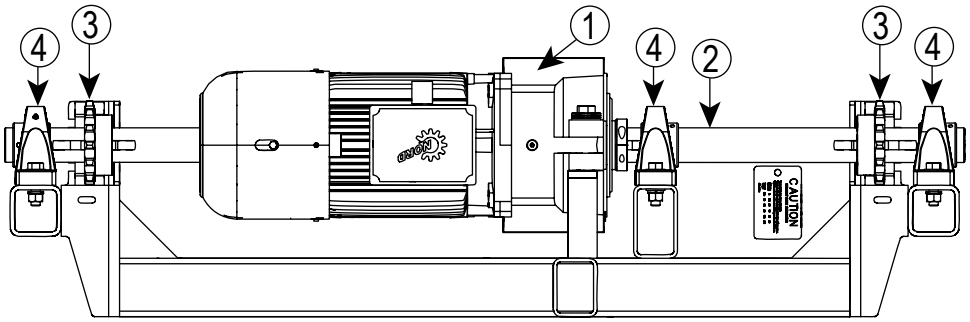
Section 18: Parts

Before You Begin

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.

Drivebase Assembly

To ensure correct replacement components are used, consult the PFlow Industries, Inc. Customer Support Department for proper part numbers. Please send a photo of the SO number from the reducer assembly and have the PFlow serial number available when requesting this information.



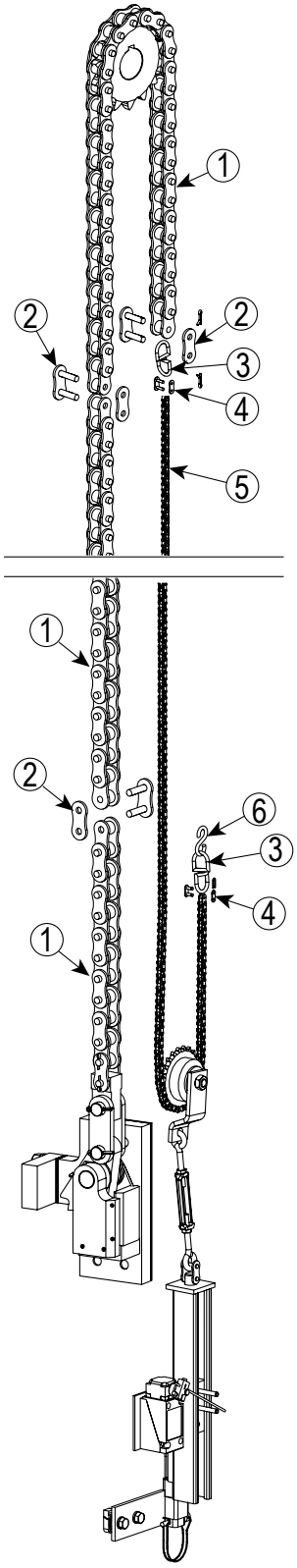
1. Motor/Brake/Reducer Assembly
2. Driveshaft
3. Drive Sprocket
4. Bearing, Pillow Block

Figure 18-1: *Drivebase Assembly*

Chain Loop Arrangement

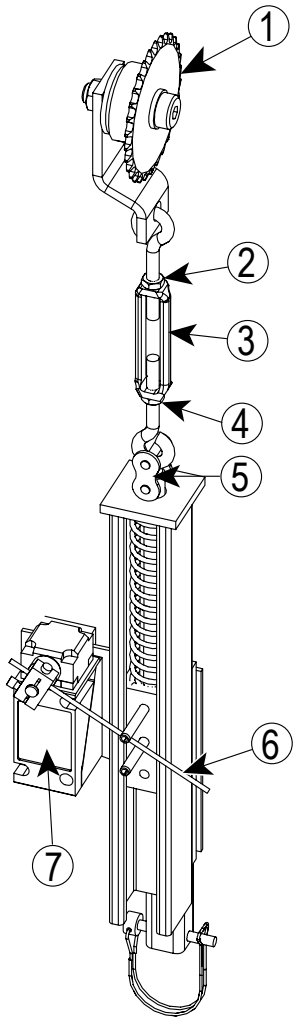
The following drawings illustrate the path of the lift chain and tensioner chain. Consult PFlow Industries, Inc. Customer Support Department before ordering.

Item	Qty	Part No.	Description
1	2	5667-6100	Lift Chain, #60
2	2	5667-6101	Master Link, #60 Chain
3	4	7651-0000	Swivel, Round Eye Double
4	4	7938-1001	Master Link, #35 Chain
5	2	7938-0000	Tensioner Chain, #35
6	2	3715-0000	S-Hook
7	2	7924-0000	Toggle, Safety Cam, #60



Chain Tensioner Assembly

Item	Qty	Part No.	Description
	1	10101-0020	Chain Tensioner Assembly with Right-hand Bracket, Single Pole Limit Switch, and Limit Switch Arm
	1	10101-0021	Chain Tensioner Assembly with Left-hand Bracket, Single Pole Limit Switch, and Limit Switch Arm
	1	10107-0035	Chain Tensioner Assembly without Limit Switch
1	1	10244-0035	Sprocket and Bracket Assembly
2	1	3732-0010	Nut, 5/16-18, LH Thread
3	1	2520-0000	Turnbuckle, Tensioner
4	1	8326-0010	Nut, Hex, Jam, 5/16-18
5	1	5667-1001	Link, Mater, #60 SBR
6	1	5959-0000	Arm, Limit Switch, Adjustable
7	1	2893-0000	Limit Switch
*	1	**	Bolt, Limit Switch Mounting
*	1	**	Lock Washer, Limit Switch Mounting
*	1	**	Washer, Limit Switch Mounting
*	5"	4211-0000	Channel, Unistrut, P3300, 13/16
Unistrut Mounting Hardware:			
*	2	5927-0020	Screw, HHC, 3/8-16x1.25, GR2
*	2	5858-0011	Lock Washer, Std, 3/8
*	2	6296-0011	Washer, Flat, Std, 3/8
*	2	7879-0000	Nut, Twirl, 3/8-16

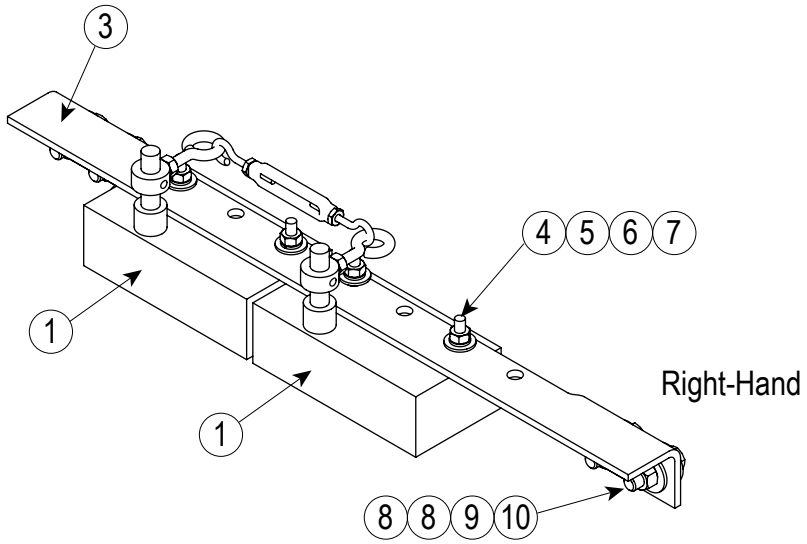


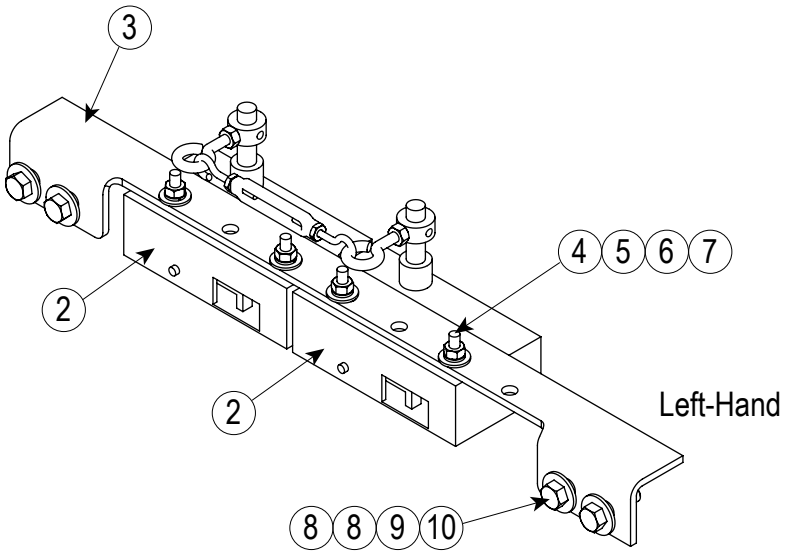
** Not Shown on Illustration*

*** Contact PFlow Industries, Inc. Customer Support Department for part number. VRC serial number required.*

Bi-Swing Gate Interlock

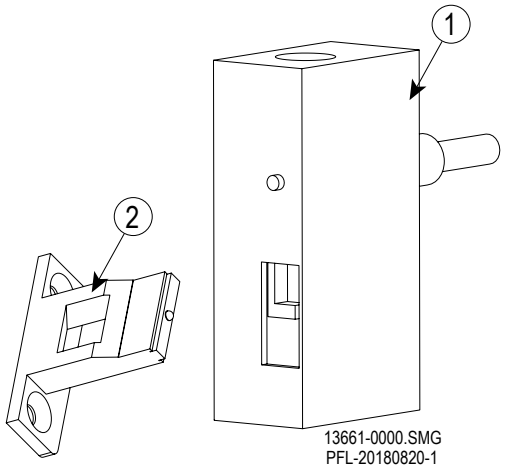
Right-Hand	20811-15652
Left-Hand	20811-15651





Item	Qty	Part No.	Description	Item	Qty	Part No.	Description
1	1	15655-1000	Interlock Ay, Bi-Swing, QD, LH	6	4	13813-0016	Screw,PPH/SL MS, 1/4-20 x 1
2	1	15655-0000	Interlock Ay, Bi-Swing, QD, RH	7	4	6296-0009	Washer, Flat, Std 1/4
3	1	20811-19277	Bracket, Interlock Mount	8	8	6296-0011	Washer, Flat, Std 3/8
4	4	6358-0009	Nut, Hex, 1/4-20, GR5	9	4	6358-0011	Nut, Hex, 3/8-16, GR5
5	4	5858-0009	Lockwasher, Std, 1/4	10	4	5927-0020	Screw,HHC, 3/8-16 x 1.25, GR5

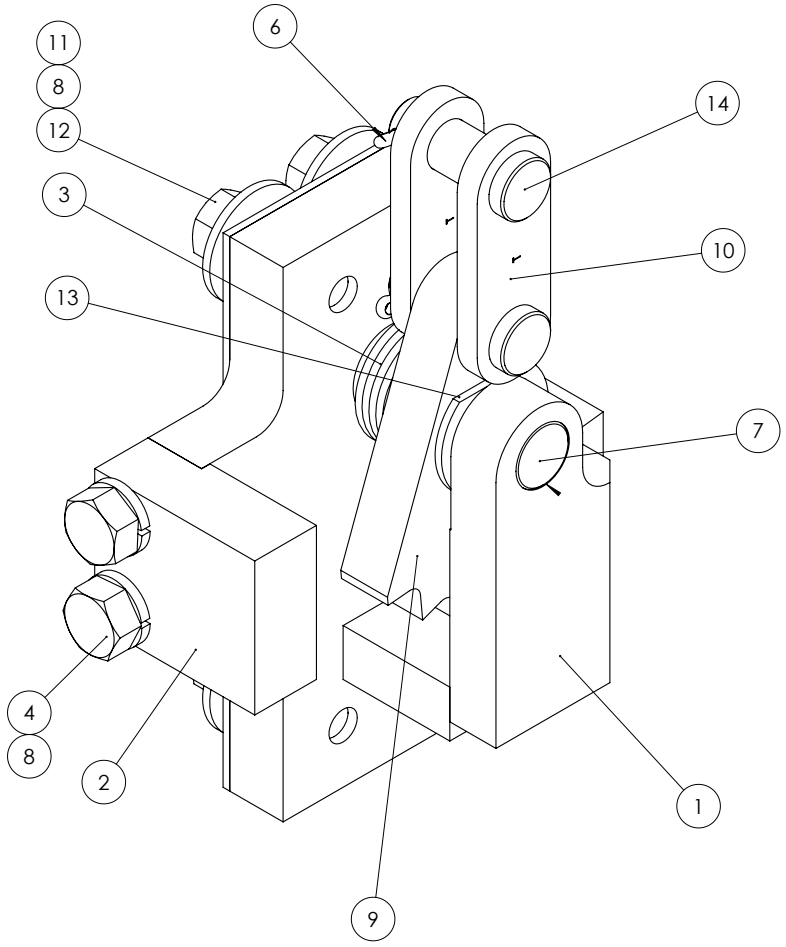
GAL Interlock



Item	Qty	Part No.	Description
1	1	13660-0000	Interlock, GAL, RH
	1	13661-0000	Interlock, GAL, LH
2	1	8078-0013	Keeper

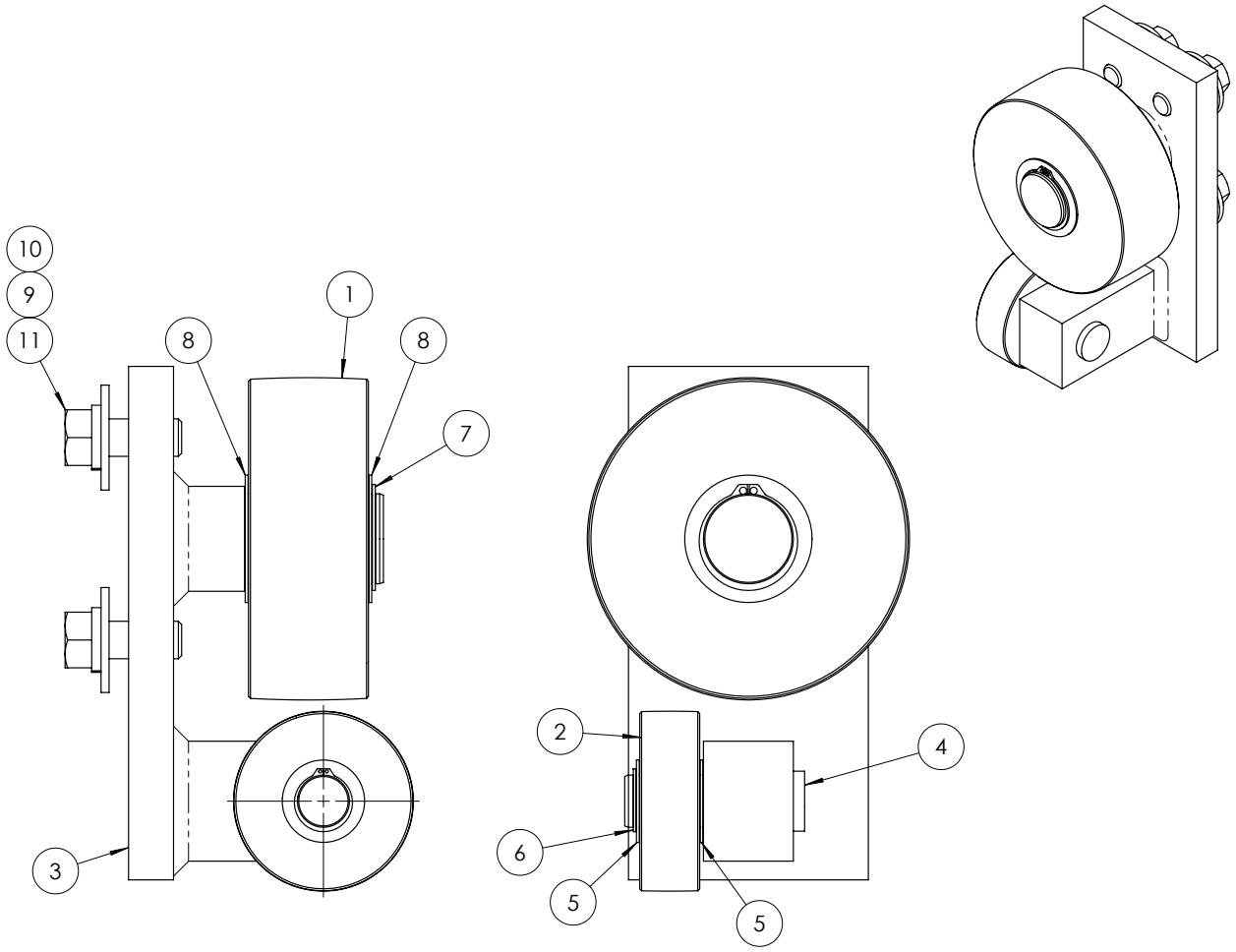
Safety Cam Assembly

Right-Hand	20811-0030
Left-Hand	20811-1030



Item	Qty	Part No.	Description	Item	Qty	Part No.	Description
1	1	17551-0000	WLDMNT,SAFETY CAM,RH	8	6	5858-0015	LOCKWASHER, STD, 5/8
2	1	20811-0031	SHOE, SAFETY CAM	9	1	6186-0000	SAFETY CAM ASSY
3	1	2127-0000	SPRING,CAM,TORSION	10	2	6187-0001	LINK,SAFETY CAM,HT
4	2	2198-0040	SCREW,HHC,5/8-11X2.25,GR8	11	4	6296-0015	WASHER, FLAT, STD 5/8
5	1	2377-0003	SPACER, SAFETY CAM, 1/8”	12	4	6758-0028	SCREW,HHC,5/8-11X1.75,GR5
6	2	2522-0000	PIN, COTTER, 5/32 X 1 1/4	13	1	8339-0000	BEARING, THRUST
7	1	5230-0001	PIN,CAM, 1 OD	14	2	8742-0032	PIN,CLEVIS,3/4 X 2 LG

Wheelblock Assembly - 20811-0005



Item	Qty	Part No.	Description	Item	Qty	Part No.	Description
1	1	20811-0010	WHEEL,NYLOIL, 5.38 X 2.00	7	1	20811-0025	RETAINING RING,EXT,1 1/2”
2	1	20811-0011	WHEEL,NYLOIL, 3.00 X 1.00	8	2	20811-0026	SHIM, .047” X 1 1/2” ID
3	1	20811-0019	WHEELBLOCK WLDM	9	4	5858-0015	LOCKWASHER, STD, 5/8
4	1	20811-0020	SPINDLE, LATERAL WHEEL	10	4	6296-0015	WASHER, FLAT, STD 5/8
5	2	20811-0022	SHIM, .047” X 7/8” ID	11	4	6758-0024	SCREW,HHC,5/8-11X1.5,GR5
6	1	20811-0024	RETAINING RING, EXT, 7/8”				



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 19: Recommended Storage Requirements

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.*

Stacking

Except for placing the parts container (crate) and bracing on the empty carriage, stacking of the various gate components is strictly forbidden. Enclosure and gate panels will warp. Objects stacked on top of the columns, drivebase assembly and/or hydraulic cylinders may cause severe damage.

⚠ 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, national, or local safety 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.

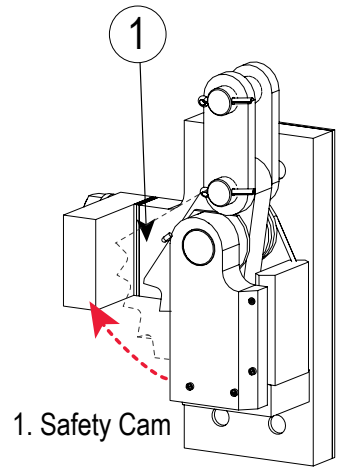
⚠ CAUTION

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 an individual who, through possession of a recognized degree or professional certification, or through extensive knowledge, training, and experience, has successfully demonstrated their ability to solve problems related to the subject matter and work.*

Long Term Storage (Longer than 2 months)

If the system is stored for more than 2 months after shipment, you must do the following maintenance procedures every 60 days from the date of shipment:

Component	Long-term Storage Maintenance
Roller chains	If 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.
Sprockets	Lightly coat with a non-detergent oil to prevent corrosion.
Safety Cams	Lubricate the safety cams on the exposed safety cam assemblies with a non-detergent oil and rotate to make sure the safety cams move freely.  1. Safety Cam
Drivebase Assemblies	Elevate 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.
Drivebase Shaft	1. Rotate the drivebase shaft. 2. ***Apply power*** to the motor/brake with the correct voltage and correct brake wiring configuration with the vent plug installed in the reducer. This will rotate the drive shaft and cycle the brake once. 3. ***Manually cycle the brake*** several times using the lever on the side of the motor. 4. After rotating with temporary power, remove the vent plug and install the original plug to prevent contamination of the reducer oil. **NOTICE:** *Before initial use, drain and replace the reducer oil.*
Pillow block and bearings	Apply lithium-type grease to the pillow block and bearings. Wrap or trap the pillow blocks to avoid exposure to contaminants if needed.
Electrical Component Inlets	Plug 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.
Parts Crate	Make sure the parts crate remains sealed and dry.

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 container (crate). Do not open the parts container (crate). If you need electronic copies of the manuals, contact the PFlow Industries, Inc. Customer Support Department.



www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Section 20: Signage Locations

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, and safety warnings are the installer's responsibility. Make sure the warning labels are placed as shown below.

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.

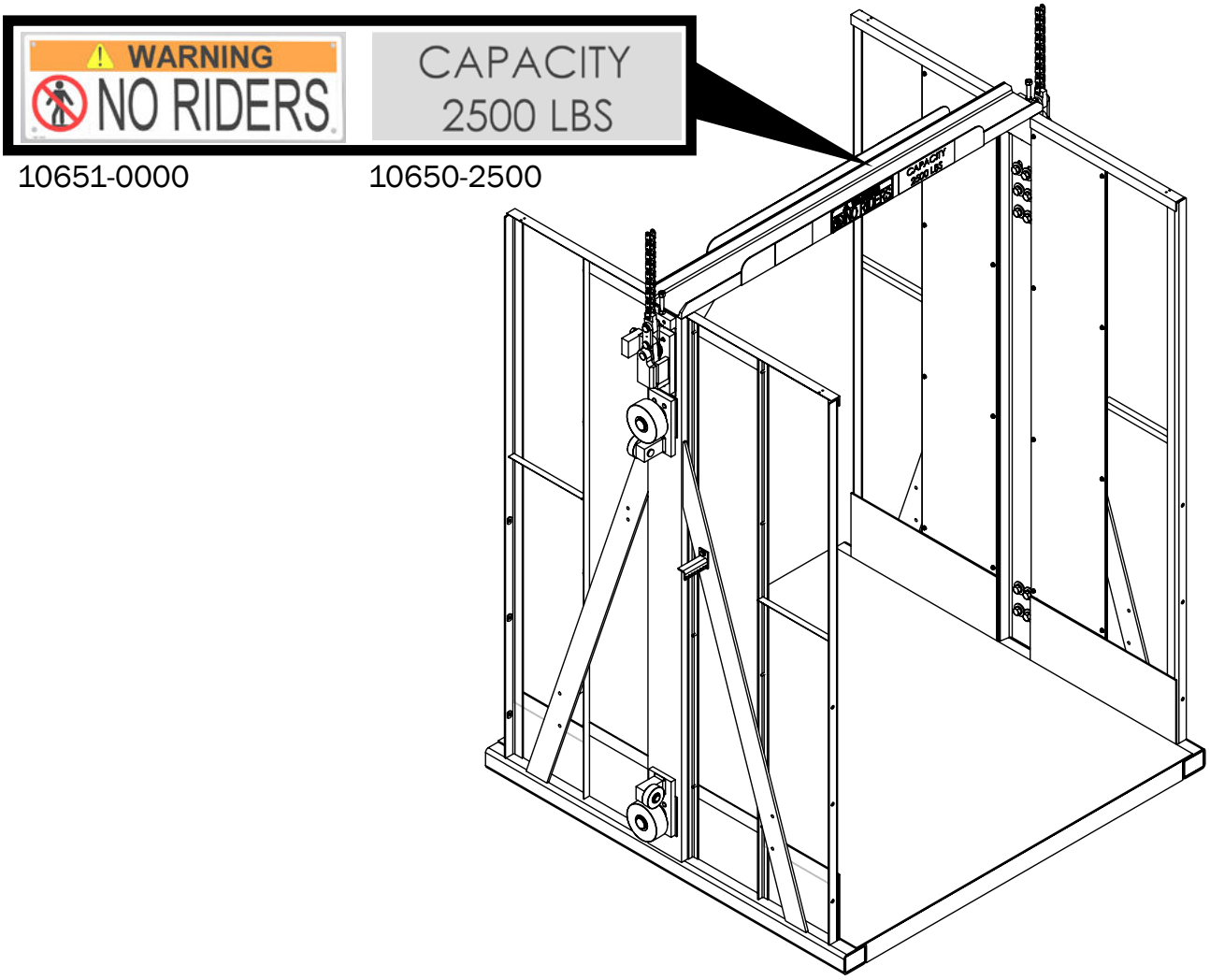


Figure 20-1: *Carriage Signage*

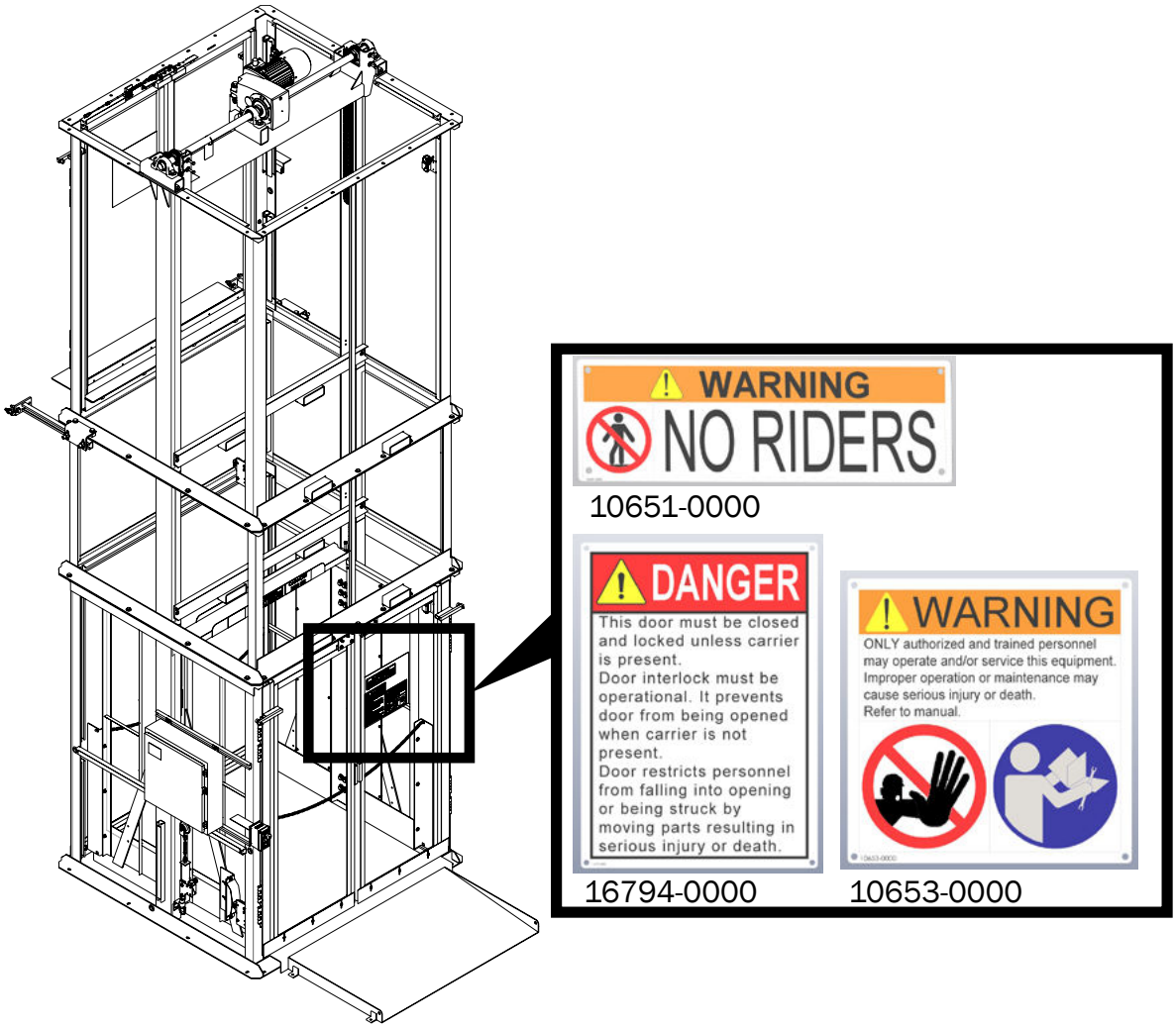


Figure 20-2: *Gate Signage*

PFLOW INDUSTRIES
MATERIAL HANDLING SOLUTIONS

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Installation Questionnaire

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 email 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			Email		
Company			Phone Number		



PFLOW INDUSTRIES
MATERIAL HANDLING SOLUTIONS

www.pflow.com
P 414 352 9000
F 414 352 9002
6720 N. Teutonia Ave.
Milwaukee, WI 53209

Acceptance Certification

Acceptance

We, the Customer, accept the equipment listed below as being properly installed, tested, and performing to our satisfaction. 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:	☐ B ☐ D ☐ DB ☐ F ☐ M ☐ 21	Other:
Job Name:			
Site Street Address:			
Site Mailing Address:			
Site City:		State:	Zip Code:
Customer Contact Name:		Contact Title:	
Customer Contact Phone: ( ) Ext		Email:	

Tests Performed					
	Load Capacity				Start-up Date:
	Load Test:	☐ Yes	☐ No	at ____% of lift capacity	Customer Initials:
	Operation Test	☐ Yes	☐ No		Comments:
	Get/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:

