

Customer: Job Number:

M Series | Mechanical VRC 2-Post Straddle and Cantilever

Owner's Manual with NORD Motordrive

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.







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Customer Information		
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Descriptions	Document #	Revision



Customer Information Job Number Customer Name Job Number

Job Drawings			
Description	Do	cument #	Revision

Electrical Drawings		
Description	Document #	Revision

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MATERIAL HANDLING SOLUTIONS



Section 1 | Contact Information



	PFlow Industries, Inc. 6720 N. Teutonia Avenue Milwaukee, Wisconsin 53209 Office Phone: 414-352-9000 Fax: 414-352-9002 Product Support Department e-mail: psd@pflow.com Sales e-mail: sales@pflow.com For a list of contact personnel visit the PFlow Industries, Inc. website at: http://www.pflow.com/contact-us/
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 April 2018 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 of the VRC. 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 VRC not approved by PFlow Industries, Inc. may void any warranty and/or service agreements. Please contact the PFlow Product Support Department for assistance with service modifications.
Training	Training is available upon request from the Product Support Department. Half-Day, Full-Day, and Two-Day sessions are customized to fit specific needs - either for a single VRC type or for the entire product line.
On-site Supervision	On-site supervision services are available from the Product Support Department. Contact our Field Operations Manager for more details.
Source Language	This manual is written in American English.

Section 1 | Contact Information



MATERIAL HANDLING SOLUTIONS





Introduction	This manual provides information about the PFlow Industries, Inc. custom designed Vertical Reciprocating Conveyor (VRC). As the nations' leading manufacturer of vertical material handling equipment, PFlow Industries, Inc. is confident that this new VRC will provide many years of reliable service.
General Overview	The VRC provides a safe and simple means of moving material from one level to another. The simplicity of design and few moving components ensure a trouble-free, long life, with low maintenance and little downtime.
Code Requirements	This VRC is designed for the movement of materials only, up to the VRC's rated capacity, from one level to the next. Do not allow anyone to ride on the VRC. VRCs are not elevators, and are specifically excluded within the scope of the ASME A17.1 Safety Code for Elevators and Escalators. VRCs are included in ASME B20.1 Safety Standard for Conveyors and Related Equipment, which is incorporated by reference into OSHA 29 CFR 1910. A copy of the ASME B20.1 standard can be purchased at www.asme.org and other sources. PFlow Industries, Inc. recommends that this standard be referenced for appropriate installation, maintenance, inspection, and operation in relation to hazards. All electrical designs and components are in accordance with National Electric Code (NEC) requirements. Local codes may require initial inspection of the installation and periodic inspection and testing of the unit. Contact PFlow Industries, Inc. for more information in the event an inspection is required.
NOTE	The information and illustrations in this manual are intended only as an aid to understanding the VRCs general installation. The information and illustrations do not cover every possible contingency or circumstance regarding nonstandard options or site conditions.
	If there is a problem, call PFlow Industries, Inc. at (414) 352-9000, during normal business hours, 8:30 a.m. to 5:00 p.m. central standard time, Monday through Friday. Outside of those hours, see the PFlow Industries, Inc. Contact Information page for additional information. Use the model number and serial number or the PFlow Industries, Inc. General Arrangement (GA) drawing number for the lift in all correspondence.
Parts	Equipment damage resulting from modification in any manner from the original model, including the substitution of parts other than factory authorized parts, will void the warranty. Furthermore, PFlow Industries, Inc. will not be liable for any loss, injury, or damage to persons or property, nor for direct, indirect, or consequential damage of any kind resulting from modified or substitution of parts other than factory authorized parts of said material or equipment.
	PFlow Industries, Inc. maintains a complete stock of, or has access to, all replacement components. Detailed records of all equipment sold are kept. If a component is damaged in shipment, is defective or missing, contact PFlow Industries immediately.
Service	The PFlow Industries, Inc. Product 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.

Section 2 | General Information



MATERIAL HANDLING SOLUTIONS



Section 3 | Warranty Information



MATERIAL HANDLING SOLUTIONS

Parts			l			
and Labor	Parts:	T . C	Labor:	T • C · •		
	Structure	Lifetime	Structure	Lifetime		
	Manufactured Components	1 Year	Manufactured Components	1 Year		
	Purchased Components	1 Year	Purchased Components	90 Days		
	Gates and Enclosures	90 Days	Gates and Enclosures	90 Days		
Definitions	 (excluding carriage side Manufactured compone by PFlow Industries, In 	e guards). ents are defi c.	rriage, and pre-fabricated brac ned as those components man omponents that are used as sup	ufactured		
Warranty		ects in mate	s to the original purchaser that rial and workmanship under n s 30 days after shipment.			
Exclusions	This warranty does not apply to: 1. Equipment or components damaged or broken in transit or shipping.					
	2. Replacement of wear parts.					
	 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. Exposure to a corrosive or abrasive environment or exterior elements unless 					
	specifically built for that e					
	5. Equipment that has been repaired, altered or modified in any manner outside of the manufacturing facility, substitution of parts other than factory authorized parts, removal of any parts, or addition of any parts without prior written permission by PFlow Industries, Inc.					
	6. Any losses or damages resulting from loss of data, loss of revenue or profits, loss of products, incidental or consequential damages, delays, or expenses incurred by failure of said part or parts even if advised of the possibility thereof.					
	7. Lost time and/or additional trips for missing or damaged components.					
	8. Expedited freight charges.					
Obligation	The obligation for PFlow Industries, Inc. is limited to only the replacement or repair of defective components that received prior authorization. This is the owner's sole remedy.					
	PFlow Industries, Inc. will bear normal labor charges performed by an authorized PFlow Industries, Inc. service agent during standard business hours, excluding overtime, holiday rates, or any additional fees.					
	This warranty applies to all models and no person except an officer of PFlow Industries, Inc. is authorized to modify this warranty or to incur on behalf of PFlow Industries, Inc. any other obligation or liability in connection with PFlow Industries, Inc. equipment.					

Section 3 | Warranty Information



MATERIAL HANDLING SOLUTIONS

Liability	 PFlow Industries, Inc. believes, to the best of our knowledge, that the information in the equipment manuals are accurate. In the event that technical or typographical errors exist, PFlow Industries, Inc. reserves the right to make changes to subsequent editions of the manual without prior notice to holders of this edition. The reader should consult PFlow Industries, Inc. if errors are suspected. The customer's right to recover damages caused by fault or negligence on the part of PFlow Industries, Inc. shall be limited to the amount paid to PFlow Industries, Inc. by the customer. The limitation of liability of PFlow Industries, Inc. will apply regardless of the form of action, whether in contract or tort, including negligence. Any action against PFlow Industries, Inc. will not be liable for any loss, injury, or damage to persons or property, nor for direct, indirect, or consequential damage of any kind resulting from failure or defective operation of said material or equipment. 		
Warranty Procedures		r Warranty Procedures. Replacement of defective the Return Materials Authorization (RMA) policy for	
Pre- Authorization	 All warranty work must be pre-authorized by PFlow Industries, Inc. Product Support Department prior to starting work. Where distance and or experience may be more cost-effective, PFlow Industries, Inc. reserves the right to use alternate organizations. Labor is defined as a maximum of two hours travel per call, plus reasonable on-site repair time as determined by PFlow Industries, Inc. Local purchase of components must be pre-authorized. Notify the PFlow Industries, Inc. Product Support Department of the problem for authorization. PFlow Industries, Inc. will determine: The cause of the problem. Who will do the repair work. The repair details involved. If PFlow Industries, Inc. decides that your organization or your subcontractor will do the work, an authorization number will be assigned which must be referenced on all 		
subsequent paperwork. NOTE Notify PFlow Industries, Inc. by phone, FAX, or e-mail during the next business day if a occurs during our non-working hours. Issuance of an authorization number does not approval and/or payment.			
Invoices	 Payment is made 30 days after the date of approval. 2. A deduction from outstanding payments to PFlow Industries, Inc. for warranty never authorized. 3. Invoices received without sufficient information will be returned. Invoices will reconsidered for approval when complete documentation is received. All invoi must include, in detail, the following: PFlow serial number. Date the work was performed. Description of the problem. 		
		□ Detailed description of work completed.	



MATERIAL HANDLING SOLUTIONS

Read the Entire Manual	Important: carefully read the entire manual upon receipt of the VRC. Improper installation, alteration, adjustment, service, cleaning, or maintenance could result in death, severe injury, or property damage. Instructions and warnings must be read and thoroughly understood by all operators and users. PFlow Industries, Inc. recommends that the owner conduct regular staff training including safety instructions on a regular basis to avoid the risk of accident or damage to the VRC.
	Following procedures other than those indicated in this guide to install, use, and maintain the VRC is considered inappropriate and may cause fatal accidents, personal injury, or property damage, in addition to invalidating the warranty.
Intended Purpose	The intended purpose of the PFlow Industries, Inc. Vertical Reciprocating Conveyor (VRC) is to provide a safe and simple means of moving materials only, up to the VRCs rated capacity, from one level to another. VRCs are not elevators. The VRC is exclusively intended for use in establishments where all operators have been trained to understand the purpose, limitations, and associated hazards of the VRC. Any other use is strictly forbidden.
Potential Risks and Possible Misuse	PFlow Industries, Inc. has attempted to protect against as many hazards as possible. The following potential risks should be addressed before the VRC is put into operation:
	 Risk of injury caused by falling products. Risk of injury caused by product extending beyond the confines of the carriage. Risk of injury caused by exceeding the weight capacity of the VRC. Hazards occurring at places where the VRC connects to incoming and outgoing conveyors. Risk of injury if any safety features are bypassed. Risk of injury due to the use of corrosive chemicals or water jet.
Safety Alert Symbols	To ensure your safety and the safety of those around you, it is important that you read, observe, and understand ALL safety precautions relative to a particular task. Safety precautions in the manual are labeled with an alert symbol followed by the word DANGER , WARNING , or CAUTION .
	This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
A DANGER	Indicates a hazardous situation that, if not avoided, will result in death or serious injury.
	Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
	Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
NOTICE	Used to address practices not related to physical injury.



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• If any defects relating to operating safety and reliability are detected or if any damage occurs, the VRC must be taken out of operation immediately.
• Before the VRC is put into operation, all VRC parts must comply with all relevant health and safety directives and regulations.
• Do not switch the main power supply on or start the VRC when persons are in contact with the VRC.
• Make sure that no persons or objects are within the range of any moving parts of the VRC.
• Climbing, sitting, walking, or riding on equipment while the equipment is in operation could result in death or serious injury.
• If this VRC needs to be modified in any way, contact PFlow Industries, Inc. for assistance. Do not make any unauthorized changes.
• 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.
• Place the load in the center of the lift platform to avoid shifting loads. Make sure that any portion of the load does not overhang the perimeter of the carriage. This could create an unstable load condition.
• If the carriage deck does not stop after contact has been made with the limit switch arm, or continues to drift past the floor level, the lift motor brake is not working properly. Discontinue use of the VRC and contact PFlow Industries, Inc. for assistance.
• Lockout/tagout the VRC before removing jammed product. Be aware that stored energy in the lift components may move or shift when the jam is removed. De-energize any circuit before work is begun.
• Do not overtravel! Stops, mechanical or electrical, must be in place to prevent the carriage from traveling beyond the intended floor level. Overtravel could cause permanent damage to the carriage or failure of the lifting mechanism.

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



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A CAUTION	•	• During operation, the surfaces of some components may become hot. Avoid touching hot surfaces or wear protective gloves.	
	•	Inform personnel about the location and operation of emergency stops and power disconnection points.	

• If any unsafe or unusual conditions are observed, stop the equipment and remove it from service. Report the condition to your supervisor.



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Electrical Safety Precautions

A DANGER



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

CAUTION

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

De-energize the Circuit

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

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



Electrical Safety Precautions



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.

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

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

Notes for the Installation Electrician

- **r the** 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 six feet [1829mm]).
 - 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.



Safety First

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

- Work must be performed by qualified maintenance technicians.
 - ASME B20.1-2015 defines a qualified person 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 B20.1-2015 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**

General

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 Tripping hazards Confined space Unsafe or lack of pit ladders Improper air quality The presence of moisture/water/oil Inadequate lighting Moving equipment Improper access Where a VRC is operating in a multiple Use proper hand protection while **Guidelines** unit hoistway, that portion of the cleaning the area beneath a raised hoistway where the work is to be carriage. performed shall be fully separated or • Remove parts, lubricants, cleaning accessible equipment locked out. equipment, etc from inside the pit. Ensure that all portable lights and Do not stand on the hydraulic piping or tools are connected through a Ground electrical conduit. Fault Circuit Interrupter (GFCI). Never straddle over the traveling Provide adequate lighting especially if cable(s) if so equipped and protect it
 - in a shaftway.
 - For a deep pit, never "jump" into the pit - always use a ladder.

against damage.



Pit Access	Access to the area beneath the raised carriage deck can be gained through manual measures implemented by qualified maintenance technicians or automatically through the use of a factory supplied option known as maintenance mode.		
Manual	1. Call the carriage to the lower level.		
Access	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 the PFlow Industries, Inc. Product Support Department.		
	3. Barricade the lower level gate opening to prevent unintended access and provide hazard warning signs.		
	4. Verify that the carriage is empty. Raise the carriage to the upper level making sure all personnel are clear of the moving carriage.		
	5. Lockout the lift 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 Factory.		
	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.		
Automatic Access - Maintenance Mode with DeckLocks	If the VRC is equipped with this option, refer to Maintenance Mode Sequence of Operation Bulletin #15879-0009 for details.		



Unique Descriptions and Names	PFlow Industries, Inc. has incorporated, as well as created, a number of unique descriptions, names, and terminology for parts, components, and devices included in the Vertical Reciprocating Conveyor (VRC). This glossary includes these unique terms and other common terms to help understand this manual and the information it contains. In addition, the glossary will aid the user in communicating the correct information during troubleshooting and service situations. Although the wording and descriptions may sound familiar to the person who has read the manual, other terms and descriptions might not. It is recommended by PFlow Industries, Inc. that this glossary be reviewed before reading the remainder of this manual.	
Alkyd paint	A fast-drying enamel paint, color-mixed per the customer's request, and applied using standard methods as specified by the paint manufacturer.	
ANSI	American National Standards Institute: www.ansi.org	
ASME	American Society of Mechanical Engineers: www.asme.org	
Authorized person	Trained or qualified personnel approved to perform a specific duty or duties.	
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.	
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.	



DriftThe action of a lift carriage slowly dropping, usually due to slight internal leaks in a hydraulic system or mechanical slippage of a motor brake.EBVACAn electrically powered bi-panel vertical acting gate.Effective width/lengthRefers 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 cableElectrical cables consist of at least two conductors contained within a protective outer cover.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 applied over sandblasted and primed steel or direct to metal. The epoxy coating is ideal for outdoor, chemical, or cautic wash-down environments or applications where standard alkyd enamel is viewed as insufficient.EvacA 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 (EM)Floor-to-Floor distance (FHF)The distance from one operating floor level to the adjacent operating floor level (see Vertical travel).Fluit 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).<	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.		
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	Gate	to the carriage for loading and unloading. The gate is normally a swing,		



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.	
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 opening on openings at right angles on the carriage deck. 		
Load test	The carriage is loaded to rated capacity, and the lift is operated.		
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.		

Section 5 | Glossary



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.	
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.	



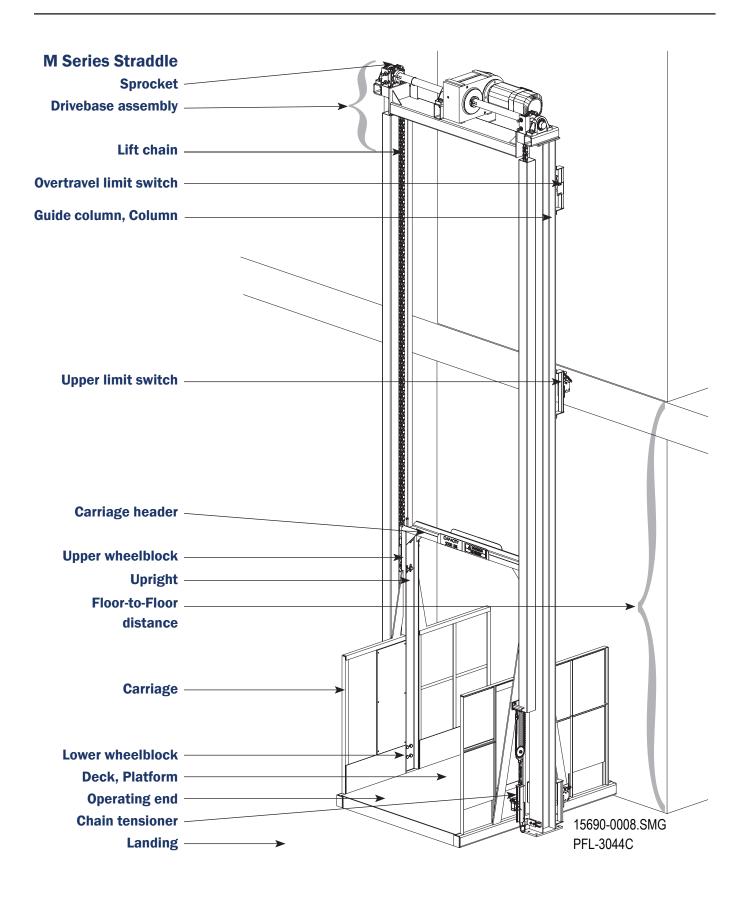
Spliced guide column	Guide column that is fabricated and delivered in two or more sections necessitated by manufacturing, handling, or installation constraints.	
Sprocket	A wheel typically mounted on a shaft. The wheel has a row of teeth around its edge that fit into the links of a chain.	
Straddle	A 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.	
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:

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.	

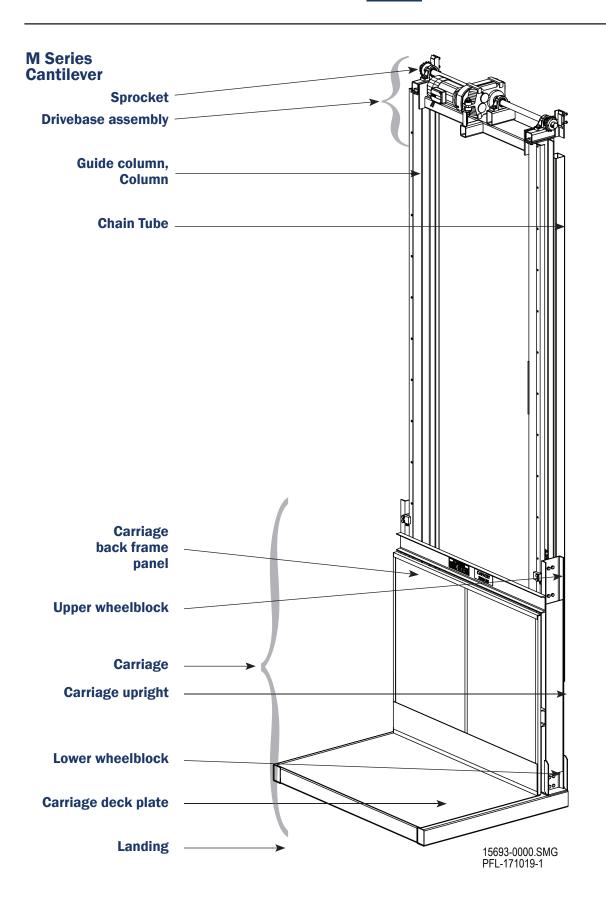




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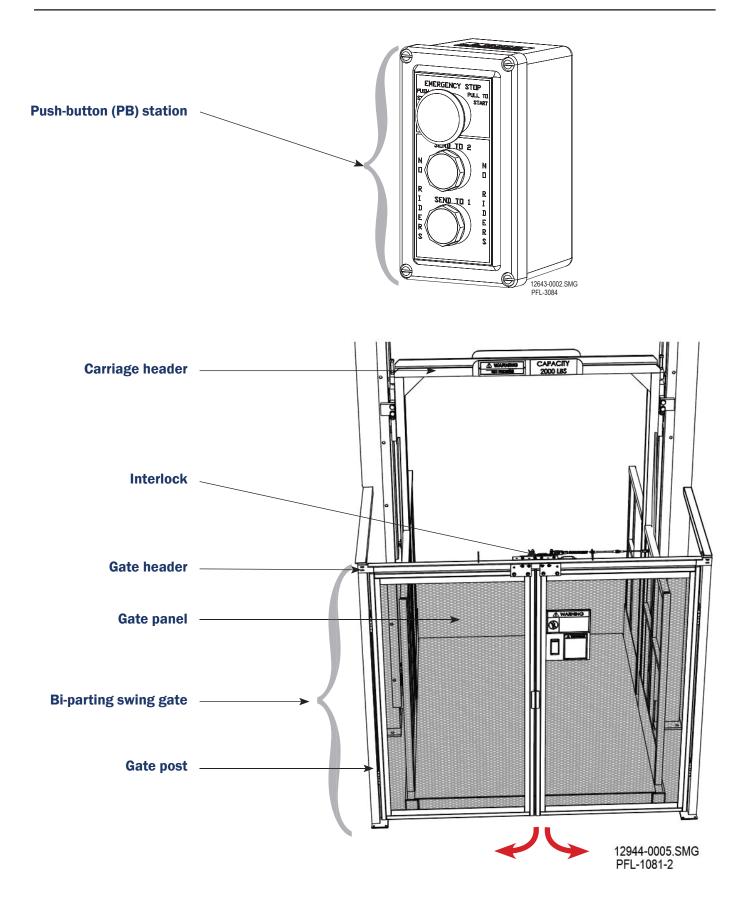
MATERIAL HANDLING SOLUTIONS



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MATERIAL HANDLING SOLUTIONS









Section 6 | Electrical Standards and Definitions



MATERIAL HANDLING SOLUTIONS

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 c	ircuits and devices at 120 VAC and below.	
Power circuit	Power circuit refers to all circuits and devices at 208 VAC and above.		
Systems	Systems refers to automated vertical and horizontal conveyors.		
Requirements	1. It is recommended that all constranded, type THHN or equa	ntrol circuit wiring is #14 AWG, copper, l, 600 VAC.	
	1 1	rcuit wiring is #12 AWG minimum (sized opper, stranded, type THHN or equal. A green ded to power devices.	
	3. Per NFPA 79, the colors of ind Power wiring - Black 115 VAC - Red 115 VAC neutral - White 24 VAC - Red/black	ividual conductors shall be: 24 VAC neutral - White 24 DC - Blue 0VDC - White/blue Ground - Green or green/yellow	
	Note: These colors only apply apply to prefabricated cables.	to individual conductors. These colors do not	
	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 indiv	idually 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.		
		shall conform to local, state, and NEC shall be 1/2". Connectors and couplings shall be.	
	9. Flexible conduit shall be a minimum of 1/2", shall be of the liquid-tight type, and shall be installed with compatible liquid-tight connectors.		
	line of sight of the control par	l install a fused disconnect switch within the nel. The customer shall ensure accessibility to gard to existing electrical codes and standards.	
	11.Control wiring and conduit sh and conduit.	nall be separate from the power wiring	
	12.Drop cords (flexible cords) sh where applicable.	all be multi-conductor festoon-type cable	



Electrical Ruling Bodies	
NEMA	<i>National Electrical Manufacturers Association</i> provides national testing and manufacturing standards body of electrical apparatus.
UL	<i>Underwriters Laboratories, Inc.</i> is an independent testing laboratory. Many local codes require UL control panels and electrical apparatus.
JIC	<i>Joint Industry Council</i> is an advisory group that provides standards for production equipment, safety, and dependability.
NFPA	<i>National Fire Protection Association</i> 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	<i>American National Standards Institute</i> oversees the creation, promulgation, and use of thousands of norms and guidelines that directly impact businesses.
ASME	<i>American Society of Mechanical Engineers</i> 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	<i>National Electrical Code</i> 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:
	 <i>NFPA 70 (NEC):</i> The National Electrical Code. <i>JNFPA 79:</i> Electrical standard for industrial machinery.
Outdoor Application	Outdoor VRCs 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.

Section 6 | Electrical Standards and Definitions



PFlow's Standard (continued)	
Hazardous Location	Hazardous locations are an extremely specialized electrical classification. Few electrical experts exist in this field. All hazardous locations must be handled as defined by the class, division, and group designator for the job site condition.
	The NEC has three classes (I, II, III), - two divisions, (1 and 2) and seven group designations (A, B, C, D, E, F, and G).
Class Definitions	Class I locations: Locations in which flammable gases, flammable liquid- produced vapors, or combustible liquid-produced vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.
	<i>Class II locations:</i> 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	<i>Division 1</i> is an extremely dangerous explosive condition that exists normally.
	<i>Division 2</i> 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.

Section 6 | Electrical Standards and Definitions



MATERIAL HANDLING SOLUTIONS



Section 7 | Mechanical Overview



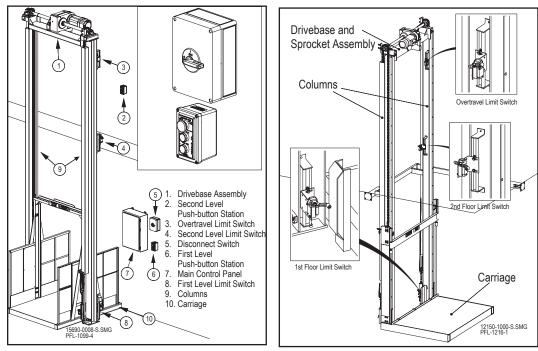
MATERIAL HANDLING SOLUTIONS

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

Mechanical
OverviewEach Series M (mechanical) Vertical Reciprocating Conveyor (VRC) consist of
two (2) columns, a drivebase assembly with a gearmotor reducer, drive shaft
with two (2) lift sprocket assemblies, a moving carriage deck, and if furnished,
interlocked safety gates or doors. In addition, a main control panel and typically
at least one push-button station per level are furnished. For more information on
the electrical components, see Section 8 in this manual.Lift ColumnsThe Series M consists of two (2) vertical upright columns. These are anchored
to the floor at the lower floor level, positioned by the drivebase at the top, and
braced to the building structure at the upper and intermediate levels.Each column has a guide angle welded to one flange of the column to form a
track. A chain tube guard is welded to the face of the other flange.

Straddle / Cantilever Configuration

There are two (2) configuration types available for this model. "Straddle" has a column located on each side of the carriage. The guide angles face each other allowing the carriage to ride between them. See Figure 7-1. "Cantilever" has both columns located at the back of the carriage. See Figure 7-2. There is no difference in the operation or maintenance between these models.



Straddle Orientation Figure 7-1

Cantilever Orientation Figure 7-2



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Drivebase Assembly

The drivebase assembly consists of a motor, brake, gearmotor reducer (commonly referred to as a gear motor assembly), lift sprockets, a drive shaft, bearings, and a support structure. Roller lift chains connect to tensioner chains and chain tensioners complete the components. See Figure 7-3 and Figure 7-4.

Inside each column, one end of a lift chain connects to an upper wheelblock 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

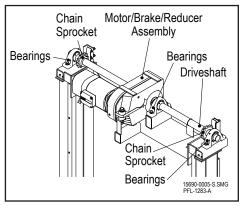
assembly, then proceeds downward through the chain guard (chain tube), and connects to the smaller tensioner chain.

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 7-4, Item 5) or bolt on the upper wheelblock.

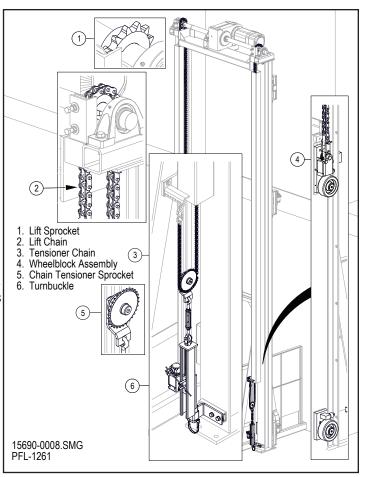
The tensioner sprocket is spring-loaded by the chain tensioner which maintains tension on the chain/ tensioner combination. If the lift chain is pulled too tight or becomes slack, the chain tensioner limit switch is activated to shut off power to the VRC.

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

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



Drivebase Assembly Figure 7-3



Lift Chain Tensioner Assembly Figure 7-4

Section 7 | Mechanical Overview

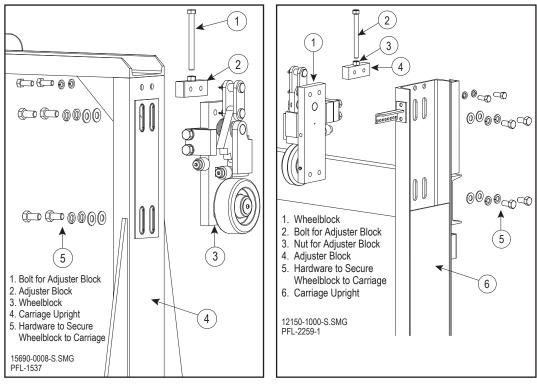


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Upper Wheelblocks

Two (2) upper wheelblocks are bolted to the carriage uprights. This allows the wheels to ride within the lift columns and guide the carriage travel. See Figure 7-5 for straddle VRCs and Figure 7-6 for cantilever VRCs.



Straddle Orientation Figure 7-5

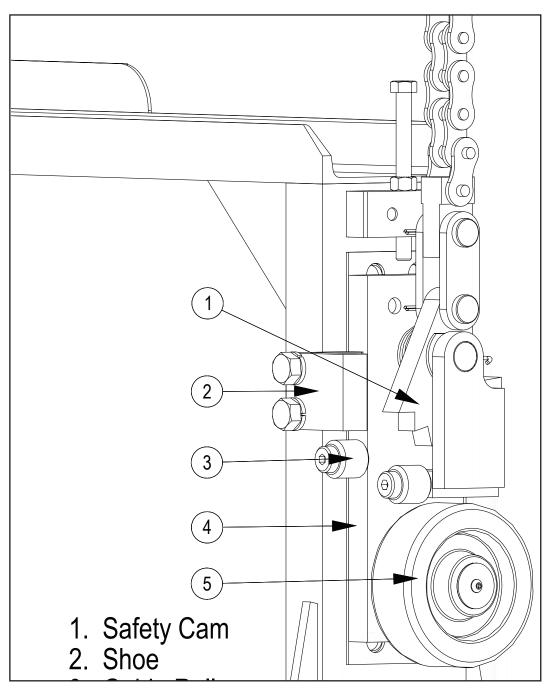
Cantilever Orientation Figure 7-6



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Upper Wheelblocks

Each upper wheelblock has a mounting base block, a wheel, and two (2) guide rollers. The guide rollers locate the wheelblocks within the guide angle. Each upper wheelblock has a safety cam with teeth and a wheelblock shoe. The wheelblock shoe (bolted to the wheelblock base) fits around the outside of the column guide angle track while the steel safety cam is pivoted on the wheelblock mounting block. It is torsion spring-loaded. See Figure 7-7.



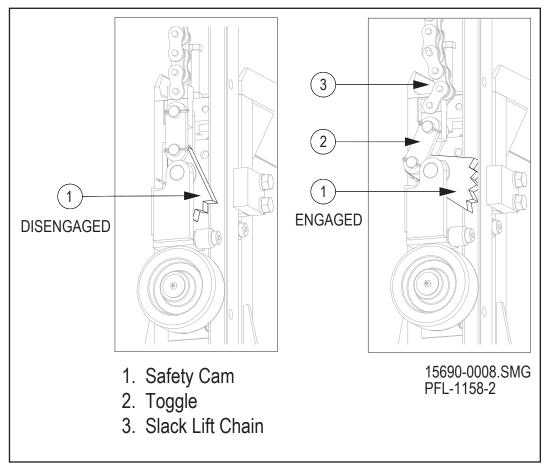
Upper Wheelblock Figure 7-7



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Wheelblock 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 guide shoe on the outside of the guide angle track helps wedge the guide angle track wheelblock shoe and the safety cam teeth. See Figure 7-8.



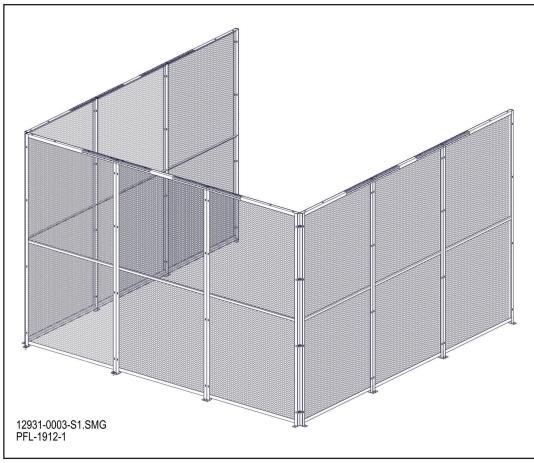
Wheelblock Safety Cam Figure 7-8



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Enclosures

In accordance with ASME B20.1-2015, Section I-3.9, PFlow Industries, Inc. supplies standard 8' (2438mm) tall enclosure panels to be installed around the Vertical Reciprocating Conveyor (VRC) as required by site conditions. The enclosure panels are steel with 1-1/2" (38mm) angle frame and 16 gauge flattened expanded metal designed to reject a ball 2" (51mm) in diameter. PFlow Industries, Inc. standard enclosure panels are typically 8' tall (2438mm). Full height enclosures (FHE) are furnished when designed for site specific requirements. See Figure 7-9.



Floor Level Enclosures Figure 7-9



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Gate Assemblies A safety gate assembly or door is provided at each level opening accessing in the lift area. All gates and/or doors accessing the lift area are electromechanically interlocked. When a gate or door is open the interlock prevents movement of the carriage away from the respective level. When the carriage is not present at a level, opening the gate or door is prevented by the mechanical interlock. See Figure 7-10.

PFlow Industries, Inc. offers various styles of interlocks depending upon the gate type and application.

Single Swing Gate Bi-Swing Gate Bi-Swing Gate 1 Gate Panel 2 GAL Interlock 3 Carm 4 Lift Column 5 Roller Arm Assembly 6 Control Cable Assembly 7 Carriage 8 Header

The parts section of this manual contains views with part numbers.



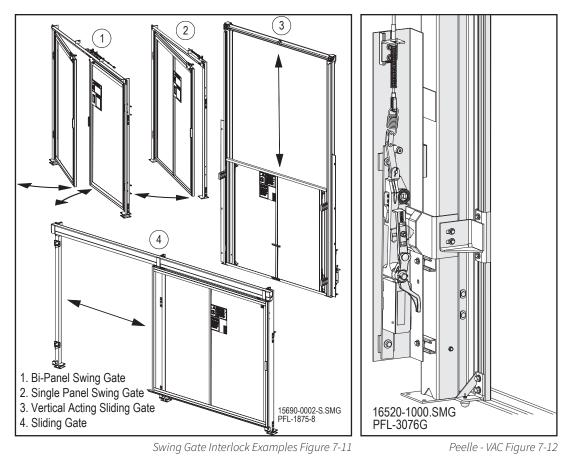
Section 7 | Mechanical Overview

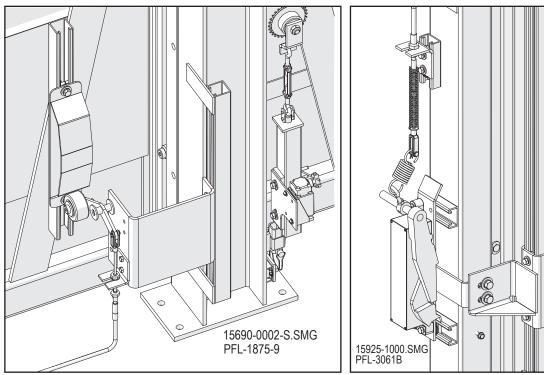


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Examples





Cable Actuator Figure 7-13

Anderson - VAC Figure 7-14



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Electrical Overview

The following is a standard description of the electrical wiring of an M series VRC. This does not include any specifics on options available or ordered (e.g., gates, DeckLocks, 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 gate is open when the carriage is at the level and mechanical locks to lock the gate until the carriage is at that level.

NOTE Different gate interlock types and styles are supplied depending upon the gate type and site conditions. Standard gate styles can incorporate one to four electrical components per gate.

Main Control Panel

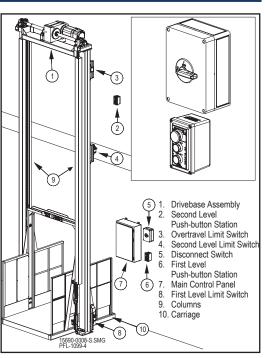
Push-button

Stations

All electrical devices are connected individually to the main control panel. The main control panel contains a fused transformer, motor starter, relays, etc. A motor overload and current sensor is provided to protect the motor from excessive current draw.

One station is normally 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 contains Send to "x" push-buttons and an emergency stop (E-stop).

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



Electrical Components Figure 8-1

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.

Main Disconnect Switch

As required by NEC code, the main disconnect switch must be fused, lockable, and located within line of sight of the control panel and no more than 6' 6" (1981mm) off the floor.



Drivebase Assembly	The motor / brake is located on the drivebase assembly. The motor and brake wiring must be verified prior to energizing the VRC.		
Limit Switches	The M 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. All limit switches require field mounting and wiring. VRCs servicing more than two levels require two (2) additional limit switches for each intermediate level.		



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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. ASME B20.1-2015 defines a qualified person 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.					
NOTICE						
	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.					
	• 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.					
	• Falling hazard! Always make sure the carriage is present before walking through doorways.					
	• 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, physically secure the carriage with a maintenance pin, DeckLock system, chains, cables, or with a maintenance operation option for the platform.					
AWARNING	 Passengers are not permitted. Riding may result in death or serious personal injury. 					
	• Allow only competent adults who have been properly trained in the safe use of this equipment to operate it.					
	• This equipment can be dangerous if not used properly. Allow only properly trained and authorized personnel to operate this equipment.					
	• 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 lift platform to avoid shifting loads. Make sure that any portion of the load does not overhang the perimeter of the carriage. This could create an unstable load condition.					
M Series 15705-0013 Rev B	2019-03-01 e-mail psd@pflow.com Section 9 1					



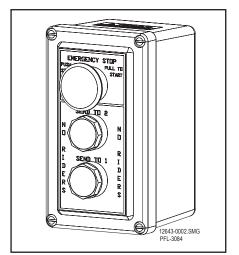
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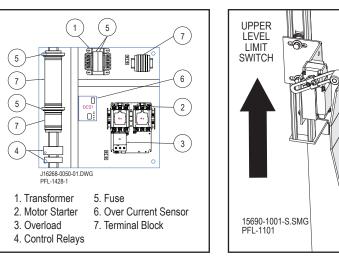
Begin Sequence

1. Press the desired floor level button. See Figure 9-1. The coil in the motor starter magnetically closes the high voltage contacts and the power circuit to the motor starter. See Figure 9-2. This action turns the motor in the needed direction.

- 2. The brake is released. The motor turns the gears in the reducer, which in turn rotates the keyed drive shaft. The drive sprockets on the shaft turn resulting in the raising or lowering of the lift chains. The lift chains are fastened to carriage wheelblocks, which are bolted to the carriage uprights. Adjustments to the wheelblock levels the carriage deck.
- 3. When the carriage arrives at the next level, the floor level limit switch is activated by a carriage mounted cam. See Figure 9-3. 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 is applied. This stops and holds the carriage position.



Push-button Station Figure 9-1



Control Panel Example Figure 9-2

Limit Switch / Cam Figure 9-3

9

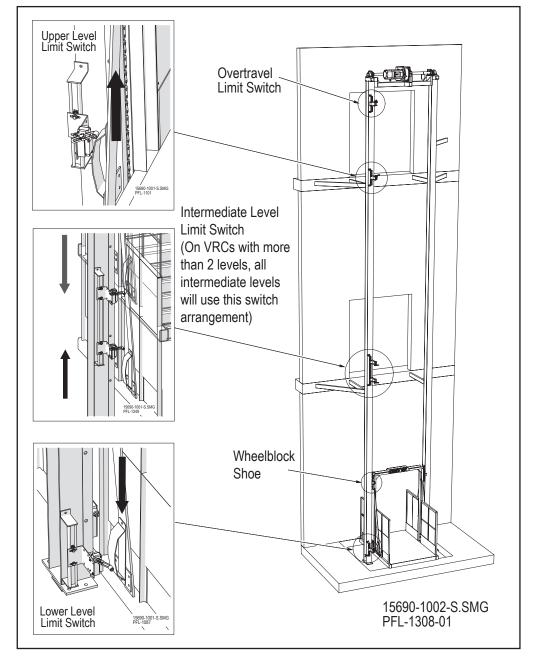


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Sequence (continued)

4. The carriage overtravel limit switch is a safety device mounted on the column above the uppermost floor level limit switch. In the event of failure to activate the uppermost floor level limit switch, the overtravel limit switch is activated when it comes into contact with the carriage mounted wheelblock shoe on the side of the carriage. The switch cuts the power to the motor circuit. The motor starter contacts open, the motor stops, and the brake is applied. This stops and holds the carriage position. Before activating the VRC, have a qualified electrical controls technician investigate why the uppermost floor level limit switch failed and correct the problem. See Figure 9-4.



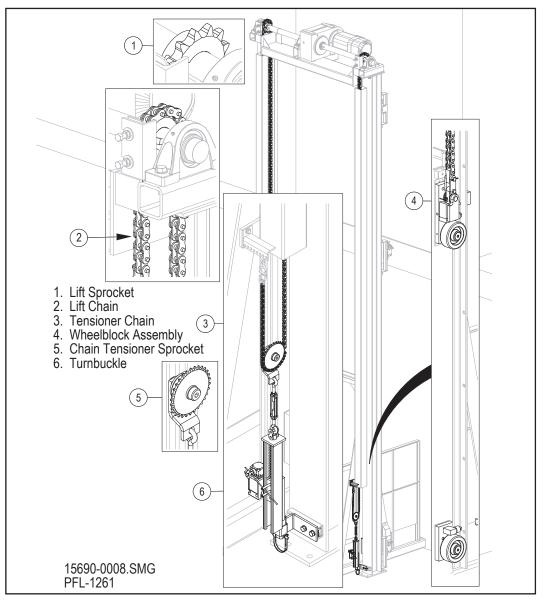
Limit Switch Figure 9-4



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Sequence (continued)

- 5. If there is excessive motor current draw that can cause motor overheating, the overcurrent sensor (OCS) in the control panel will protect the lift motor by cutting off the power to the control circuit. This will happen when the VRC is loaded beyond its rated capacity. See Section 15 for more information.
 - 6. The chain tensioner limit switch is typically mounted at the bottom of the lift column. If a lift chain becomes slack or are broken, the chain tensioner limit switch will activate to shut off power to the motor and apply the brake. The wheel block safety cam will rotate and set on the column. The carriage will stop. The VRC will not operate until the lift chain is repaired and the chain tensioner readjusted. See Figure 9-5.



Lift Chain Tensioner Figure 9-5

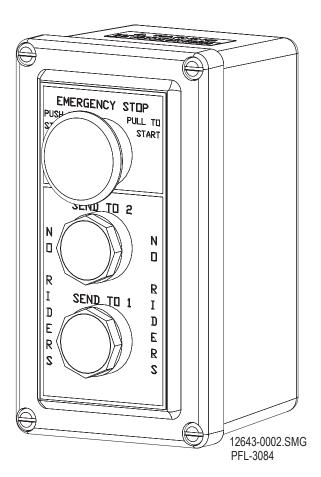


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To Operate the Lift

- 1. Close all gates and make sure the gate latches are engaged.
- 2. Press the desired floor level button to move the carriage to the desired floor. The carriage will stop when the appropriate level is reached.
- 3. When the VRC arrives at the appropriate level and comes to a complete stop, open the gate.
- 4. If an emergency occurs when the carriage is moving, push the emergency stop (E-stop) button. The button will keep the lift inoperable until the button is pulled out. See Figure 9-6.



Push-button Station Figure 9-6



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Before You Begin Read this entire manual.

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NOTICE ASME B20.1-2015 defines a qualified person as a person who, by possession of a recognized degree or certificate of professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.

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

Safety Warnings



A DANGER



High Voltage! Installation or maintenance work may only be performed when no power is available to the motor. Electric motors, electrical brakes, and variable frequency drives contain potentially dangerous high-voltage. Shut down the power at the circuit breaker or power switch. Employees servicing or maintaining VRCs may be exposed to death or serious personal injury if hazardous energy is not properly

controlled. De-energize any circuit before work is begun. Follow your facilities procedures or OSHA lockout/tagout (LOTO) procedures anytime maintenance or service is being performed on any electrical box or component.



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

Working brake	Brake which implements friction work in regular operation, i.e. performs a braking function
Brake	Spring-applied brake = electromagnetically released spring-applied brake
Data sheet	Technical data sheet
Holding brake	Brake which does not perform friction work during regular operation but holds the load in position. In case of an emergency, however, it may also perform a braking function.
End plate	Motor end plate = end plate of an electric motor
Shaft	Motor shaft = shaft of an electric motor

Terms



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Friction surfaces and the friction lining should not under any **Environment** circumstances be in contact with oil or grease since small quantities reduce the braking torque considerably! **General Operating Conditions:** Operating time: 100% Ambient temperature: -10°C to +45°C (14°F to 113°F) Should any of the above parameters be exceeded contact the PFlow Industries, Inc. Product Support Department for advice. The "Ambient Temperature" is intended to be an operation guideline Ambient based upon the typical properties of the lubricant. The viscosity and **Temperature** other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier before considering changes in oil type or viscosity. To prevent reducer overheating, observe the maximum operating oil temperature limits: Mineral Oil: 80-85°C (176 – 180°F) Synthetic Oil: 105°C (225°F) In the following instances, please consult PFlow Industries, Inc. Product Support Department for specific recommendations: • Gear units will operate in high ambient temperature conditions exceeding 40°C (104°F). • Gear units will operate in cold ambient temperature conditions approaching 0°C (32°F) or lower. • Lower than an ISO VG100 viscosity oil is being considered for a coldtemperature service. • Fluid grease is required for lubricating the gear unit.



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Directive and Standards	The spring-applied brake was produced in accordance with the following EC directives and standards:				
	 EC Directive Machinery (2006/42 EC) EN ISO 12100-1 and 12100-2: Safety of Machinery (Basic Concepts) EC Directive Electromagnetic Compatibility (2004/108 EG). Compliance with this directive has to be safeguarded with the appropriate switchgear of the user. 				
	The spring-applied brake is not an independently operable machine but intended to be installed in other machinery. Its commissioning is prohibited until the establishment is reached that the machines comply with the provisions of the EC Directive.				
Labeling	The lettering of the spring-pressure brake includes important data. This data and the contractual provisions for the brakes establish the limits of use.				
	Lettering on the brake housing:				
	103V 12 09 40 Image: Image of the structure in th				
	 Month of manufacture				
	Operating voltage (DC) in Volt				
Tune Oode	FDB 15 N H F R T S M 20 H7 24 VDC				
Type Code	Operating voltage Hub bore Hub bore Micro switch Dust guard ring Tapped bores for encoder mounting ¹⁰ Friction plate Flange Manual release without code: Operating noise-damped Brake type: N = standard; C = adjustable Brake size (08, 10, 13, 15, 17, 20, 23, 26, 30, 40)				
	Brake designation (series)				

 $^{\scriptscriptstyle 1)}$ only available on Design ${\sf N}$

* Options I must be requested at the time of order (e.g., by using the code)

** Option II is the only option for the **FDB** series. This option, if required, must be indicated at the time of order and is not retrofittable. Instructions for the micro switch must be observed.



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NOTICE

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



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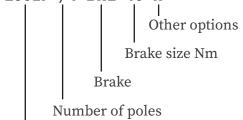
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Motor Options and	PFlow Industries, Inc. of
Nomenclature	will be shown in the mot

Flow Industries, Inc. offers many options for its motors. The option code vill be shown in the motor nomenclature.

Lettering on the motor housing:

100LP /4 BRE 40 H



Frame size

Motor Option Codes

	•		
AICM	Additional Internal Insulation Coating Applied	OL	TENV Motor – Without Fan / With Cover
BRE	With Brake	OL/H	TENV Motor - Without Fan & Cover
EAR	Single Phase, Start Cap/Run Cap	Р	Premium Efficient Motors
ECR	Single Phase, Start Cap/Run Cap Increased SF	RD	Canopy Cover
EHB	Single Phase, Run Capacitor Only	RDD	Double Canopy Cover
EP	Epoxy Dipped Windings	RG	Brake – Corrosion Protected
F	Blower Cooling Fan - 3ph and 1ph	RLS	Backstop
FC	Blower Cooling Fan - 1ph	SH	Motor Space Heater
FHL	Brake – Lockable Manual Release	SR	Brake – Dust Protected
Н	Energy Efficient	TF	Thermistor
HL	Brake – Manual Hand Release	TW	Thermostat
IG	Incremental Encoder	VN	10:1 Constant Torque Rated Motor
IP66	IP66 Environmental Protection	VR	5:1 Constant Torque Rated Motor
IR	Brake – Current Sensing Relay	VW	20:1 Constant Torque Rated Motor
KB	Condensation Holes - Removable Plugs	VZ-F	1000+:1 Constant Torque Rated Motor
KD	Condensation Holes - Open	WE	2nd Motor Shaft End
MIK	Brake – Microswitch	WU	High Slip Rotor
MS	Power Plug Connector	Z	High Inertia Motor Fan



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The electromagnetically released spring-applied brakes of the FDB series are fail-safe brakes. The braking torque is generated by the means of spring force, and released by magnetic force.

During braking, the pressure springs (see Figure 10-1, item 4) apply pressure to the armature plate (item 2) trapping the rotor (item 3.1 and 3.2) which is keyed to the machine shaft, against the counter-friction surface (flange (item 7), friction plate (item 8) or motor flange). The two friction sides of the rotor and the armature disk and/or the counter-friction surface produces the braking torque.

During release, a magnetic force is produced through applying a direct voltage to the magnet body (item 1.1 / 1.2) via the field winding. Said magnetic force draws the armature disk (item 2) to the magnet body and the brake rotor is released.

During manual release (only if brakes are designed with manual release), the armature disk is mechanically pulled against the magnet body by pulling the manual release handle (item 5, with screwed-in manual releasing lever (item 5.1)) and thus the rotor is released. This enables you to release the brake, for example, even if there is a power failure.



Operation of

the Brake

CAUTION

Carriage drop hazard! For safety reasons, the adjustment of the manual release must not be changed!

- 1 Magnet Body
- 2 **Armature Plate**
- 3 Rotor
- 4 **Pressure Springs**
- 5 Manual Release Handle
- 7 Flange
- 8 **Friction Plate**
- 10 Adjusting Ring

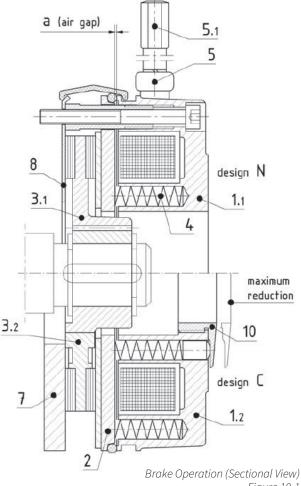
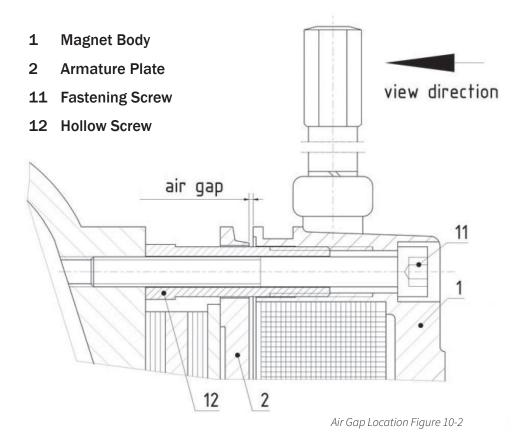


Figure 10-1



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Brake Running Operation	Without any malfunctions occurring, the running operation does not require any maintenance except for verifying the size of the air gap (See Figure 10-2) (this increases as the lining on the rotor wears). The air gap must be verified in accordance with the following schedule unless a particular sensor for wear monitoring has been included in the brake.				
	Inspection intervals:				
	Working brake:	According to service life calculation According to specifications made by the customer			
	Holding brake:	At least every two years According to specifications made by the customer Use shorter intervals in case of frequent emergency stops			





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Safety Warnings



A DANGER



High Voltage! Installation or maintenance work may only be performed when no power is available to the motor. Electric motors, electrical brakes, and variable frequency drives contain potentially dangerous high-voltage. Shut down the power at the circuit breaker or power switch. Employees servicing or maintaining VRCs may be exposed to death or serious personal injury if hazardous energy is not properly

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

• 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, physically secure the carriage at the upper level using adequately sized maintenance chains, maintenance pins, DeckLocks, or straps with shackles around the drivebase that are capable of supporting the weight of the carriage to provide additional safety.



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Manual Release Identification

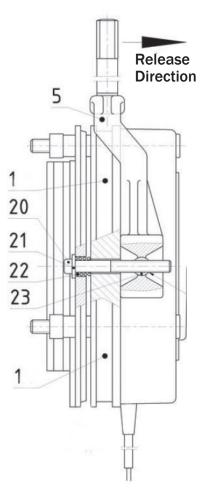
During manual release of the brake (only if brakes are designed with manual release), the armature disk is mechanically pulled against the magnet body by pulling the manual release handle (item 5, with screwed-in manual releasing lever (item 5.1)) and the rotor is released. This enables you to release the brake, even if there is a power failure.



CAUTION

Carriage drop hazard! For safety reasons, the adjustment of the manual release must not be changed!

- 1 Magnet Body
- 5 Manual Release Handle
- 20 Screw
- 21 Washer
- 22 Pressure Spring
- 23 Pins



Manual Release View Figure 11-1



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Brake Running Operation	Without any malfunctions occurring, the running operation does not require any maintenance except for verifying the size of the air gap (See Figure 11-2) (this increases as the lining on the rotor wears). The air gap must be verified in accordance with the following schedule unless a particular sensor for wear monitoring has been included in the brake.				
	Inspection intervals:				
	Working brake: At least every year According to specifications made by the customer				
	Holding brake: At least every two years According to specifications made by the customer Use shorter intervals in case of frequent emergency stops				
	1 Magnet Body				
	2 Armature Plate view direction				
	11 Fastening Screw				
	12 Hollow Screw				
	ir gap i				
Air Gap Values	The air gap must be measured with a feeler gauge at three different positionsNominal air sizemax. air gap gap				

around the brake. * Maximum air gap: Holding brakes with

emergency-stop properties

Size	Nominal air gap [mm]	max. air gap [mm]			
	a _{nenn}	a _{max}			
08	0,2 +0,15	0,60	0,45*		
10	0,2 +0,15	0,70	0,45*		
13	0,3 +0,15	0,80	0,55*		
15	0,3 +0,15	0,90	0,60*		
17	0,3 +0,15	1,00	0,60*		
20	0,4 +0,15	1,10	0,80*		
23	0,4 +0,15	1,10	0,80*		
26	0,5 +0,2	1,20	0,90*		
30	0,5 +0,2	1,20	0,90*		
40**	0,6 +0,2	1,20	1,20*		



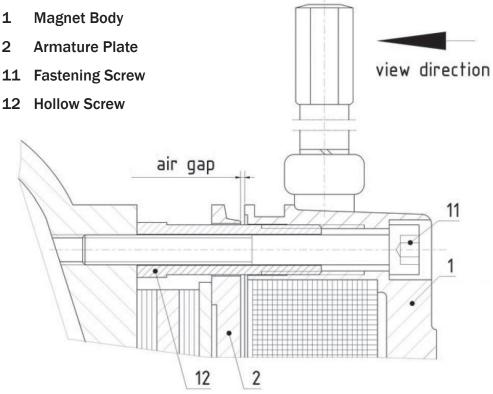
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Brake Maintenance	The spring-applied brake is virtually maintenance-free. However, when the maximum air gap is reached, an adjustment of the air gap is required for the safe operation of the brake. The functional capability and safety function of the brake will be compromised as additional wear occurs and must be replaced.			
Adjust the Air Gap	1. While viewing in the direction of the brake (see Figure 11-3) loosen the fastening screws (item 11) by turning the fastening screws half a rotation counter-clockwise.			
	2. Turn the hollow screws (item 12) counter-clockwise into the magnet body.			
	3. Turn the fastening screws clockwise into the motor flange until the nominal air gap is reached (measured with a feeler gauge) at three different positions <i>around the brake</i> . [See the previous page for the appropriate measurement.]			
	 Turn the hollow screws clockwise out of the magnet body until locked against the counter-friction surface to reset the hollow screws. 			

5. Tighten the fastening screws with the tightening torque as per the chart below.

Size	08	10	13	15	17	20	23	26	30	40
Torque [Nm]	3	6	10	10	25	25	25	50	50	85



Air Gap Location Figure 11-3



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Troubleshooting the Brake

The following table includes typical problems during the operation of the brake, the possible causes, and instructions on how to solve the problem.

Malfunction	Possible Cause	Solution				
Brake does not release	Air gap is too large.	Inspect and adjust air gap.				
	Brake is not supplied with voltage.	Verify electrical connection.				
	Voltage at the coil is too low.	Verify the supply voltage of the coil.				
	Armature plate is obstructed.	Remove the obstruction.				
Brake release is delayed	Air gap is too large.	Inspect and adjust air gap.				
	Voltage at the coil is too low.	Verify the supply voltage of the coil.				
Brake does not apply	Voltage at the coil is too low.	Verify the supply voltage of the coil.				
	Armature plate is obstructed.	Remove the obstruction.				
Brake application is delayed	Voltage at the coil is too large.	Verify the supply voltage of the coil.				



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Removing the Brake



Disposal of the Brake and Gear Motor

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

DANGER



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

Because of the different material components, the components of our springapplied brakes and gear motors must be disposed of and recycled separately. Follow official regulations. Important AAV (List of Wastes Ordinance) key numbers are indicated below. Depending on the material connection and the kind of separation, other key numbers may apply to components made of such materials.

- Ferrous metals (key number 160117)
- Non-ferrous metals (key number 160118)
- Brake linings (key number 160112)
- Plastics (key number 160119

Components	Material
Gear wheels, shafts, rolling bearing, parallel keys, snap rings, spacers, shims, etc.	Steel
Gear housing and housing components	Cast iron or Aluminum (depending on type and size)
Worm gears	Bronze alloy
Radial seals, sealing caps, and rubber components	Elastomers with some steel
Coupling components	Plastic or Elastomer with steel
Housing gaskets and flat oil seals	Asbestos-free sealing or gasket material (various types used)
Gear Oil	Mineral, SHC-Synthetic or PG-Synthetic (can vary)



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NOTICE		e component wear and diminished service oper lubrication if the unit is not mounted in
	the position for which it is designed.	
	Do not weld on the gear unit or use the ge for any welding procedure as this may ca and gears.	ear unit as an earth or ground connection use permanent damage to the bearings
	Unless special measures are taken, the in or motor should not be exposed to any ag contaminated air, ozone, gases, solvents,	ggressive or corrosive substances,
	The single shaft key must engage the full hollow shaft.	bore-land length at each end of the
Gearbox Lubrication	Proper gearbox lubrication is essential component wear. Lubricants reduce h "fluid boundary" between mating part contact. Lubricants also help prevent of foam, improve heat transfer, optimize and reduce noise.	eat and wear by inserting a protective s and preventing direct metal to metal
	Most reducers are shipped from the fa level in accordance to the specified red	
NOTE	Consult the sticker adjacent to the fill plug installed at the factory. Some units have s certain environments or intended to exten range of the lubricant. If in doubt about w application, please contact the PFlow Inde	becial lubricants designed to operate in d the service life or service temperature hich lubricant is needed for a certain
Lubrication Replacement	If the gear unit is filled with mineral of least after every 10,000 operating hour unit is filled with synthetic oil, the lub every 20,000 operating hours or after e are exposed to extreme ambient condi conditions, or dirty and dusty operatin it is important to establish a condition	s or after every two years. If the gear ricant should be replaced at least after every four years. Often gear reducers tions, hostile environments, wet ag areas. Especially in these situations,
Maximum Oil Temperature	To prevent reducer overheating, the re temperature limit must not be exceede (up to 3 hours continuous operation de	ed for prolonged periods of operation
	ОіІ Туре	Maximum Oil Temperature Limit
	Mineral	80 - 85°C (176 - 185°F)
	Synthetic	105°C (220°F)



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Oil Drain and Fill-level Plugs	All reducer gaskets bet housing. It screw for th used oil fro screw locat	Drain Plug						
Oil Formulation	MIN-EP							
Codes	PAO-EP							
	PAO Synthetic Polyalphaolefin Oil							
	PG	Fill Level Plug						
	FG	Food-Grade Oil	Plug Identification Figure 11-4					
	FG-PAO	Food-Grade, Synthetic Poyalphaolefin Oil	с с С					

Food-Grade, Synthetic Polyglycol Oil

Oil Lubricants

Standard Oil Lubricants

FG-PG

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type		
	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP220		
VG220	PAO	-35 to 60°C (-31 to 140°F)	Mobil SHC630		
	FG	-5 to 40°C (23 to 104°F)	Fuchs FM220		
Optional Oil Lubrican		Ambient Temperature Danne	Manufacture Duand/Tur		
Optional Oil Lubrican ISO Viscosity	ts Oil Type	Ambient Temperature Range	Manufacturer Brand/Type		
ISO Viscosity		Ambient Temperature Range -35 to 80°C (-31 to 176°F)	Manufacturer Brand/Type Mobil SHC 634		
•	Oil Type		21		
ISO Viscosity	Oil Type PAO	-35 to 80°C (-31 to 176°F)			
ISO Viscosity	Oil Type PAO FG-PAO	-35 to 80°C (-31 to 176°F) -35 to 80°C (-31 to 176°F)	Mobil SHC 634 Mobil SHC Cibus 460		

Ambient Temperature

- The "Ambient Temperature" is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier before considering changes in oil type or viscosity.
- To prevent reducer overheating, observe the maximum operating oil temperature limits: Mineral Oil: 80 - 85°C (176 - 180°F) Synthetic Oil: 105°C (225°F)
- In the following instances, please consult PFlow Industries, Inc. Product Support Department for specific recommendations:
 - Gear units will operate in high ambient temperature conditions exceeding 40°C (104°F).
 - Gear units will operate in cold ambient temperature conditions approaching 0°C (32°F) or lower.
 - Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
 - Fluid grease is required for lubricating the gear unit.



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Lubrication Notes	Avoid using (EP) gear oils in worm gears that contain sulfur-photo- chemistries, as these additives can react adversely with bronze and accelerate wear.	1
	Food-grade lubricants must be in compliance with FDA 212 CFI and qualify as a NSF-H1 lubricant. Please consult with lubricati manufacturer for more information.	
	When making a lubrication change, check with the lubrication to assure compatibility and to obtain recommended cleaning o procedures.	
	Make sure not to mix different oils with different additive pack	ades or

• Make sure not to mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not capable of being mixed with other oil types and should never be mixed with mineral oil or polyalphaolefin (PAO) synthetic oil.

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	EUCH3
	MIN-EP	0 to 40°C (32 to 140°F)	Mobilgear 600XP220	Omala 52 G 220	Alpha SP220	Renolin EP220
	PAO-EP	-30 to 60 °C (-22 to 140°F)	Mobilgear SHC220	Omala 54 GX 220	Alphasyn EP220	Gearmaster SYN220/NA
	PAO	-30 to 60°C (-22 to 140°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A
VG220	PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM 220	N/A	N/A	Fuchs FM220
	FG-PAO	-25 to 60°C (-13 to 140°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220
	FG-PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220
	Viscosity	Viscosity Type MIN-EP PAO-EP PAO VG220 PG FG FG-PAO	Viscosity Type Range MIN-EP 0 to 40°C (32 to 140°F) PAO-EP -30 to 60 °C (-22 to 140°F) PAO -30 to 60°C (-22 to 140°F) PAO -30 to 60°C (-13 to 140°F) FG 0 to 40°C (32 to 104°F) FG-PAO -25 to 60°C (-13 to 140°F) FG-PAO -25 to 60°C (-13 to 140°F)	Viscosity Type Range Mobil MIN-EP 0 to 40°C (32 to 140°F) Mobilgear 600XP220 PAO-EP -30 to 60 °C (-22 to 140°F) Mobilgear SHC220 PAO -30 to 60 °C (-22 to 140°F) Mobil Glygoyle 220 PG -25 to 60°C (-13 to 140°F) Mobil Glygoyle 220 FG 0 to 40°C (32 to 104°F) Mobil SHC 220 FG-PAO -25 to 60°C (-13 to 140°F) Mobil SHC Cibus 220 FG-PAO -25 to 60°C (-13 to 140°F) Mobil Glygoyle	Viscosity Type Range Mobil Shell MIN-EP 0 to 40°C (32 to 140°F) Mobilgear 600XP220 Omala S2 G 220 PAO-EP -30 to 60 °C (-22 to 140°F) Mobilgear SHC220 Omala S4 GX 220 PAO -30 to 60 °C (-22 to 140°F) Mobil SHC630 Morlina S4 B 220 PAO -30 to 60°C (-13 to 140°F) Mobil Glygoyle 220 Omala S4 B 220 PG -25 to 60°C (-13 to 140°F) Mobil DTE FM 220 N/A FG-PAO -25 to 60°C (-13 to 140°F) Mobil SHC Cibus 220 N/A FG-PAO -25 to 60°C (-13 to 140°F) Mobil Glygoyle N/A N/A	Viscosity Type Range Mobil Shell Castrol MIN-EP 0 to 40°C (32 to 140°F) Mobilgear 600XP220 Omala 52 G 220 Alpha SP220 PAO-EP -30 to 60 °C (-22 to 140°F) Mobilgear SHC220 Omala 54 GX 220 Alphasyn EP220 PAO -30 to 60 °C (-22 to 140°F) Mobil SHC630 Morlina S4 B 220 Alphasyn T220 PAO -30 to 60°C (-13 to 140°F) Mobil Glygoyle 220 Omala S4 B 220 Alphasyn T220 PG -25 to 60°C (-13 to 140°F) Mobil DTE FM 220 N/A N/A FG-PAO -25 to 60°C (-13 to 140°F) Mobil SHC Cibus 220 N/A N/A FG-PAO -25 to 60°C (-13 to 140°F) Mobil SHC Cibus 220 N/A N/A



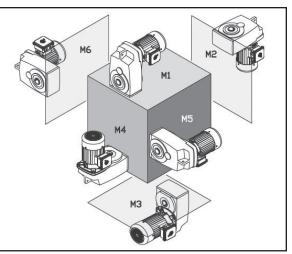
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Oil Volume

Gear reducers are shipped from the factory with a predetermined oil fill level in accordance to the specified reducer size and mounting position.

Actual oil volume can vary slightly depending upon the gear case size, mounting, and ratio. Prior to starting the reducer, check the oil-fill level using the reducer's oil level plug and drain or add oil as needed. The minimum acceptable oil level is 0.15" (4mm) below the oil level hole.



Motor and Gear Reducer Orientations Figure 11-5

Туре	M	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	
SK 0182NB	0.42	0.40	0.58	0.55	0.58	0.55	0.42	0.40	0.42	0.40	0.42	0.40	
SK 0282NB	0.74	0.70	1.16	1.10	0.85	0.80	1.16	1.10	0.95	0.90	0.95	0.90	
SK 1282	1.00	0.95	1.37	1.30	0.95	0.90	1.37	1.30	1.06	1.00	1.06	1.00	
SK 1382NB	1.48	1.40	2.43	2.30	2.32	2.20	2.32	2.20	2.11	2.00	2.11	2.00	
SK 1382	1.53	1.45	1.69	1.60	1.22	1.15	1.80	1.70	1.16	1.10	1.16	1.10	
SK 2282	1.80	1.70	2.43	2.30	1.80	1.70	2.32	2.20	2.01	1.90	2.01	1.90	
SK 2382	2.43	2.30	2.85	2.70	2.22	2.10	3.38	3.20	2.11	2.00	2.11	2.00	
SK 3282	2.96	2.80	4.23	4.00	3.49	3.30	4.02	3.80	3.17	3.00	3.17	3.00	
SK 3382	4.02	3.80	4.54	4.30	3.17	3.00	5.81	5.50	3.17	3.00	3.17	3.00	
SK 4282	4.44	4.20	5.71	5.40	4.65	4.40	5.28	5.00	4.44	4.20	4.44	4.20	
SK 4382	6.45	6.10	7.29	6.90	5.18	4.90	8.88	8.40	5.28	5.00	5.28	5.00	
SK 5282	7.93	7.50	9.30	8.80	7.93	7.50	9.30	8.80	7.61	7.20	7.61	7.20	
SK 5382	13.2	12.5	12.7	12.0	7.08	6.70	14.8	14.0	8.77	8.30	8.77	8.30	
SK 6282	18.0	17.0	16.4	15.5	13.2	12.5	18.5	17.5	11.6	11.0	14.8	14.0	
SK 6382	16.9	16.0	13.7	13.0	10.6	10.0	19.0	18.0	14.8	14.0	13.2	12.5	
SK 7282	26.9	25.5	22.2	21.0	21.7	20.5	28.5	27.0	16.9	16.0	22.2	21.0	
SK 7382	23.2	22.0	22.2	21.0	16.9	16.0	26.4	25.0	24.3	23.0	23.2	22.0	
SK 8282	39.6	37.5	34.9	33.0	32.2	30.5	46.5	44.0	32.8	31.0	32.8	31.0	
SK 8382	36.5	34.5	34.3	32.5	26.4	25.0	40.2	38.0	37.0	35.0	31.7	30.0	
SK 9282	79.2	75.0	74.0	70.0	58.1	55.0	76.1 +	72.0 †	63.4	60.0	62.4	59.0	
SK 9382	78.2	74.0	74.0	70.0	47.6	45.0	79.2 †	75.0 t	68.7	65.0	63.4	60.0	
SK 10282	95.0	90.0	95.0	90.0	42.3	40.0	95.0 †	90.0 †	63.0	60.0	87.0	82.0	
SK 10382	90.0	85.0	95.0	90.0	77.0	73.0	106 †	100 †	85	80.0	85.0	80.0	
SK10382.1	80.3	76.0	84.5	80.0	75.0	71.0	98.2	93.0	76.1	72.0	70.8	67.0	
SK 11282*	174	165	169	160	153	145	206 †	195 †	106	100	148	140	
SK 11382*	169	160	164	155	148	140	222 †	210 †	164	155	143	135	
SK11382.1*	134.2	127	140.5	133	124.7	118	205	194	131	124	118.4	112	
SK 12382*	169	160	164	155	148	140	222 †	210 †	164	155	143	135	

* For shipping purposes the larger gear units are supplied without oil.

[†] Oil quantities shown are for the gearbox only. When the OT (oil tank) option is used, the oil must be filled to the level shown on the dipstick which is located inside of the oil tank. Even when the gear unit is filled by the manufacturer, the user MUST add more oil until the oil is filled to the proper level.

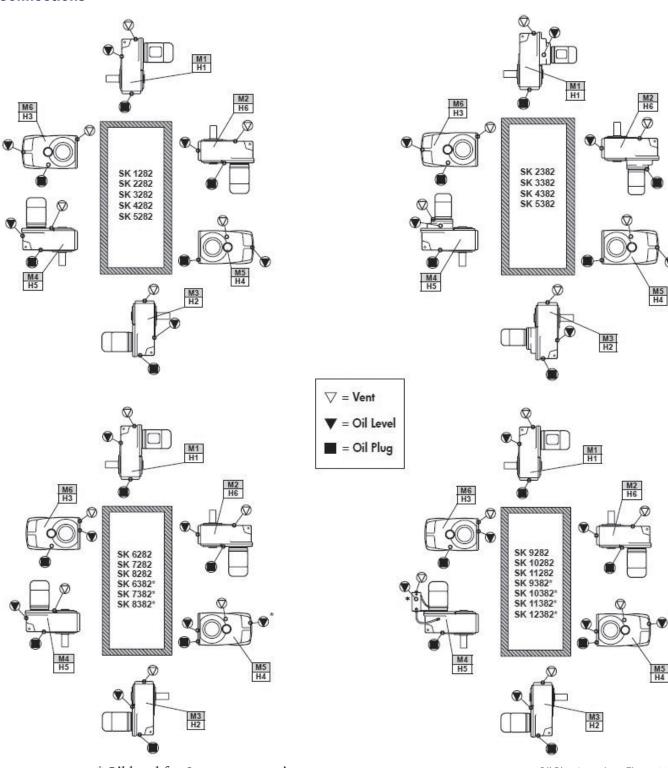
Section 11 | NORD Motor Maintenance and Troubleshooting



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Oil Plug Connections



* Oil level for 3 stage gear units

⁺ Verify the oil fill level using the dip stick located in the oil tank for the M4/H5 position. Oil Plug Locations Figure 11-6

Section 11 | NORD Motor Maintenance and Troubleshooting



MATERIAL HANDLING SOLUTIONS

Troubleshooting	The following table identifies some of the most common issues with speed
the Reducer	reducers, the possible causes, and the suggested solution.

Malfunction Possible Cause		Solution
Runs hot - Overloading	Load exceeds the capacity of the reducer.	Verify the rated capacity of the reducer and replace with unit with a larger capacity or reduce the load.
Runs hot - Improper lubrication	Insufficient lubrication.	Inspect lubricant level and adjust up to recommended levels.
	Excessive lubrication.	Inspect lubricant level and adjust down to recommended levels.
	Wrong lubrication.	Flush out and refill with correct lubricant as recommended.
Runs noisy - Loose foundation bolts	Weak mounting structure.	Inspect the mounting of the reducer. Tighten loose bolts and/or reinforce mounting and structure.
	Loose hold down bolts.	Tighten bolts.
Runs noisy - Failure of bearings	Lack of lubricant.	Replace the bearing. Clean and flush the reducer and fill with the recommended lubricant.
	Overload.	Verify the rated capacity of the reducer.
Runs noisy - Insufficient lubricantLevel of lubricant in reducer not properly maintained.Verify the lubricant le recommended level.		Verify the lubricant level and adjust to factory recommended level.
Output shaft does not turn - Internal parts are broken or missingOverloading of reducer can cause damage.Replace broken the reducer.		Replace broken parts. Verify the rated capacity of the reducer.
	Key missing or sheared off on input shaft.	Replace key.
	Coupling loose or disconnected.	Properly align the reducer and coupling. Tighten the coupling.
Oil leakage - Worn seals	Caused by dirt or grit entering the seal.	Replace seals. Autovent may be clogged. Replace or clean the Autovent.
Oil leakage - Unit runs hot or leaks	Overfilled reducer.	Inspect the lubricant level and adjust to the recommended level.
	Vent clogged.	Clean or replace, making sure to prevent any dirt from falling into the reducer.



	• Do not use any corrosive or flammable solvents or cleaning agents on the machine that contain TRI, PER, TETRA, or FCHC. Read the instructions on the packaging when use is made of chemical substances (cleaning agents).
	• Electrical components should not make contact with water or other liquids.
	• Do not clean the VRC or any of its components with compressed air or water under high pressure.
	• Do not use abrasive steel pads, wire brushes, or scrapers when cleaning.
	• Avoid parts made of rubber or plastic, such as cables and gaskets, from making contact with oil, solvents, or other chemicals.
	• Climbing, sitting, walking, or riding on equipment while the equipment is in operation could result in death or serious injury.
	• Close all gates before the carriage is moved. Never leave the VRC unattended with the gates in the open position. Never close gates when a person is on the carriage or within the fenced area.
	• The most common reason for access to the area beneath the carriage is to remove debris from the pit. This is best accomplished using a long handled broom or rake to avoid entering the pit under the raised carriage deck. Only qualified person following proper lockout/tagout procedures with the carriage properly secured in a raised position are permitted to access the pit or hoistway enclosure at the bottom level. Refer to Bulletin 15709-0083 for additional information.
	• Entanglement hazard! Secure long hair, wear snug-fitting clothing, and avoid wearing jewelry while using the VRC.
Cleaning	1. Remove all product from the VRC carriage.
oreaning	 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.

Section 12 | Cleaning - VRC



MATERIAL HANDLING SOLUTIONS



Section 13 | M Series Preventive Maintenance and Schedule Checklist



MATERIAL HANDLING SOLUTIONS

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

NOTICE	ASME B20.1 defines a qualified person as a person who, by possession of a recognized degree or certificate of professional standing, or by extensive knowledge training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.	
WARNING	• If any defects relating to operating safety and reliability are detected or if any damage occurs, the VRC must be taken out of operation immediately.	
	• Lockout/tagout the VRC before performing maintenance on electrical components. De-energize any circuit before work is begun.	
	• Take appropriate measures for safely working at heights.	
	• Make sure that no persons or objects are within the range of any moving parts of the VRC.	
	• Climbing, sitting, walking, or riding on equipment while the equipment is in operation could result in death or serious injury.	
	• If this VRC needs to be modified in any way, contact PFlow Industries, Inc. for assistance. Do not make any unauthorized changes.	
	• Before the VRC is put into operation, all VRC parts must comply with all relevant health and safety directives and regulations.	
	• 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.	
	• Entanglement hazard! Secure long hair, wear snug-fitting clothing, and avoid wearing jewelry while using the VRC.	

Section 13 | M Series Preventive Maintenance and Schedule Checklist



MATERIAL HANDLING SOLUTIONS

\checkmark	Action	How Often
	Verify overall operation.	monthly
	Verify that all level stops are flush with the floor level. Adjust as necessary.	monthly
	Verify that all areas under and around the VRC are clean.	monthly
	Verify that all gates and interlocks are functioning properly.	monthly
	Verify that all electrical components are undamaged.	monthly
	Verify that all gates and enclosures are undamaged and properly installed.	monthly
	Verify that all push-button stations and Emergency Stops (e-stops) are functioning on each level.	monthly
	Identify any unsafe condition. Document and report the condition immediately to the customer and then PFlow Industries, Inc. Product Support Department. Do not allow the lift to operate when unsafe conditions arise.	monthly
	Verify that all nuts and bolts are tight. Adjust as necessary.	3 months
	Verify that all moving components are functioning properly.	3 months
	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.	3 months
	Inspect limit switches and operation. Adjust as necessary.	3 months
	Verify that the chain sprocket position is centered over the chain tube. Adjust the position if necessary. Apply Locktite® Blue 242 to the setscrew. Tighten and torque setscrew.	3 months
	Inspect all additional options and accessories (e.g., DeckLocks, maintenance pins) and operation. Adjust as necessary	3 months
	Inspect the wheelblock guide rollers for rotation interference and wear.	3 months
	Verify that all electrical connections are tight.	3 months
	Verify that all tensioners are properly adjusted. Adjust as necessary.	3 months
	Verify that the carriage is level. Adjust as necessary.	6 months
	Inspect all welding, bracing, and anchoring for structural integrity.	6 months
	Inspect the drivebase chain sprocket for wear.	6 months
	Grease the pillow block bearings on the drivebase with lithium axle grease. Apply Locktite® Blue 242 to the setscrews. Tighten and torque.	6 months
	Inspect the motor and brake. Measure and record the air gap on the brake.	12 months
	Remove the wheelblocks. Inspect the wheelblocks and safety cam for deterioration.	12 months



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



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

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

NOTICE ASME B20.1 defines a qualified person 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.



- High Voltage! A licensed 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.



- Assess the VRC and identify any potential load jambs.
- 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.
- Toppling Hazard! Secure all VRC components (e.g., lift chain, gate panels, enclosure panels) that may fall during the troubleshooting process.



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.



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

Malfunction	Possible Cause	Solution
Push-button	The emergency stop is pushed in.	Pull the emergency stop out.
controls do not start the motor.	Gates or doors are open or ajar.	Verify that all gates and 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	Gates or doors are open or ajar.	Close the gate or door. Inspect the door magnets and interlock. Adjust as needed.
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.



Malfunction	Possible Cause	Solution
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.
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.

Section 14 | Troubleshooting



MATERIAL HANDLING SOLUTIONS



Section 15 | Adjust Overcurrent Sensor



MATERIAL HANDLING SOLUTIONS

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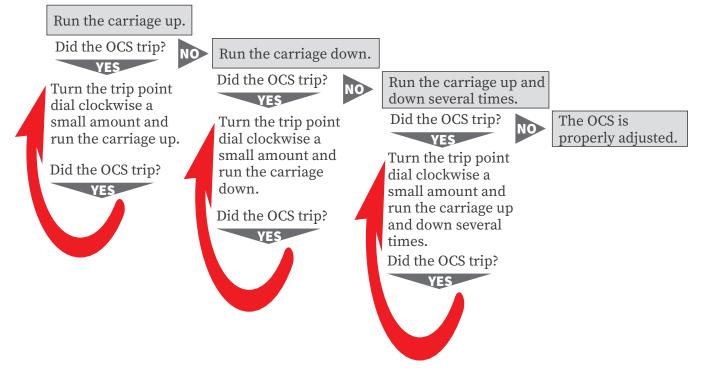
Before You Begin	Read this entire manual.	
Overcurrent Sensor (OCS) Purpose	The PFlow Industries, Inc. Vertical Reciprocating Conveyor (VRC) is equipped with an Overcurrent Sensor (OCS). The OCS is pre wired and located inside the electrical control panel. See Figure 21-1. The OCS monitors the motor 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.

Overcurrent Sensor Figure 21-1

Test and Calibrate the OCS

- 1. Turn the trip point dial to its lowest position.
- 2. Place the maximum product load on the carriage.



Section 15 | Adjust Overcurrent Sensor



MATERIAL HANDLING SOLUTIONS





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

Description	Quantity	Part Number	
Wheelblocks (choose one size wheel type - refer to Bill of Materials in Owner's Manual)			
Wheel Assembly, Steel, 5 1/2	2	16505-0000	
Wheel Assembly, Steel, 5 3/8	2	6304-0001	
Wheel Assembly, Steel, 5 1/4	2	6380-0000	
Wheel Assembly, Phenolic, 5 1/2	2	16716-0000	
Wheel Assembly, Phenolic, 5 3/8	2	2591-1001	
Wheel Assembly, Phenolic, 5 1/4	2	2591-0001	
Roller, 1.25 OD Guide Plastic	4	5221-0000	
Bolt, Shoulder, 5/8 x 1 1/4	4	5874-0020	
Push-button Stations			
PB Station, 2-LVL, 22mm	1	13675-0002	
Emergency Stop (E-Stop)	1	13692-0014	
Operator Push-button Black Flush	1	13690-0003	
General			
Paint 13 oz. PFlow Blue Aerosol Spray	1	2871-0003	
Electrical Components		-	
Fuse, 0.8A, 600V, Class CC, Time Delay	5	8953-0007	
Fuse, 1A, 250V, Time Delay	5	9448-0008	
Fuse, 2A, 250V, Non-Time Delay	5	5992-0007	
Chains and Chain Tensioners			
S Hook	2	3715-0000	
Swivel Round Eye Double	2	7651-0000	
Link, Master, #35, SBR	2	7938-1001	

Part numbers in this manual are subject to change or correction without notice. Minimum order charge is \$35, FOB Milwaukee, Wisconsin. Components replaced under warranty will be charged for in accordance with our RMA procedures. PFlow Industries, Inc. Product Support Department must issue an authorization in advance of any claim for warranty and/or warranty labor. This list is based on the job as manufactured and shipped new from PFlow Industries, Inc. Any changes, updates, parts by others, or modifications after shipment are unknown to PFlow Industries, Inc.

Section 16 | Recommended Spare Parts M Series



MATERIAL HANDLING SOLUTIONS

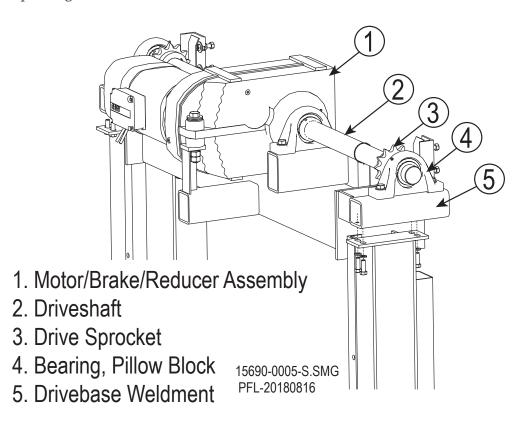




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Before You Begin Part numbers in this manual are subject to change without notice. Components replaced under warranty will be charged for in accordance with our RMA procedures. Minimum order charge is \$35, FOB Milwaukee, Wisconsin.

Drivebase Assembly These are custom-designed components and vary by job. To ensure correct replacement components are used, consult the PFlow Industries, Inc. Product Support Department for proper part numbers. Please have the SO number from the reducer assembly and the PFlow serial number available when requesting this information.



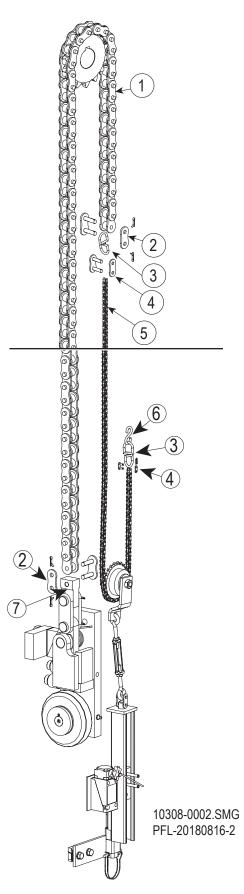


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Chain Loop Arrangement

The following drawings illustrate the path of the lift chain and tensioner chain. The size of the drive and the chains vary by application. Consult PFlow Industries, Inc. Parts Department before ordering.

Item	Qty	Part No.	Description
1	1	5667-1000	Chain, #60
	1	2692-1000	Chain, #80
	1	2693-1000	Chain, #100
	1	4102-1000	Chain, #120
2	2	5667-1001	Master Link, #60 Chain
	2	2692-1001	Master Link, #80 Chain
	2	2693-1001	Master Link, #100 Chain
	2	4102-1001	Master Link, #120 Chain
3	2	7651-0000	Swivel, Round Eye Double
4	2	7938-1001	Master Link, #35 Chain
5	2	7938-0000	Chain, #35 x Length
6	2	3715-0000	"S" Hook
7	2	6191-0000	Toggle, #60 Chain
	1	6190-0000	Toggle, #80 Chain
	1	6189-0000	Toggle, #100 Chain
	1	6188-0000	Toggle, #120 Chain

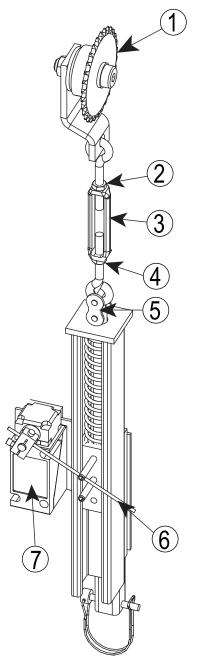




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Chain Tensioner Assembly

Item	Qty	Part No.	Description
	1	10101-0000	Chain Tensioner Assembly with Right-hand Bracket, Single Pole Limit Switch, and Limit Switch Arm
	1	10101-0001	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
	1	10244-1000	Sprocket and Bracket Assembly, S/S
2	1	6358-0010	Nut, 5/16-18, RH Thread
3	1	2520-0000	Turnbuckle, Tensioner
4	1	3732-0010	Nut, 5/16-18, LH Thread
5	1	5668-0000	Link, Tensioner
6	1	5959-0007	Arm, Limit Switch, 5" (127mm) Long
7	1	2893-0000	Limit Switch
		2893-0005	Limit Switch, Single Pole
		6269-0000	Limit Switch, Double Pole
		2889-0006	Limit Switch, XPF 4/7
*	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. Parts Department for part number. VRC serial number required.



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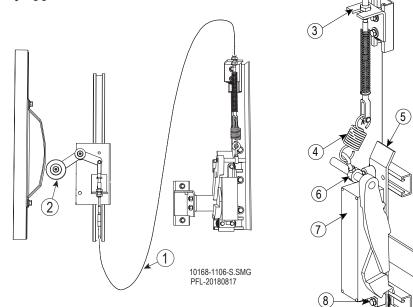
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15925-1000.SMG PFL-20180820

Interlocks

The interlock is a device used to mechanically prevent the gate from opening. Below is the Anderson interlocks supplied. As a safety device, replacement components are only available as shown below. Some configurations may vary by application.



Item	Qty	Part No.	Description
1	1	9292-0120	10' Control Cable Assembly
	1	9292-0180	15' Control Cable Assembly
	1	9292-0300	25' Control Cable Assembly
	1	9292-0360	30' Control Cable Assembly
2	1	9280-0000	Roller Arm Assembly
	1	2618-0000	Wheel only
3	1	10170-0000	Bracket, Mtg, Control Cable
4	1	**	Extension Spring
5	1	10167-0000	Plate, Interlock, Gate V.A.
6	1	9332-0009	Set Collar, Cable Interlock
	1	3694-0000	Eye Bolt, 1/4-20, 1" Long
	1	6358-0009	Hex Nut, 1/4-20, Plated
7	1	2678-0000	Interlock, Anderson, LH
	1	2678-0001	Interlock, Anderson, RH
	1	2678-4000	Interlock, Anderson, LH, Water Resistant
	1	2678-4001	Interlock, Anderson, RH, Water Resistant
	1	2678-0000-QD	Interlock, Anderson, LH, with Quick Disconnect
	1	2678-0001-QD	Interlock, Anderson, RH, with Quick Disconnect
	1	2678-4000-QD	Interlock, Anderson, LH, Water Resistant, with QD
	1	2678-4001-QD	Interlock, Anderson, RH, Water Resistant, with QD
8	1	6029-0020	Screw, HHC, 1/4-20, 1-1/4"
	1	5858-0009	Lock Washer, Std, 1/4
	1	5834-0001	Nut, 1/4-20, with Spring

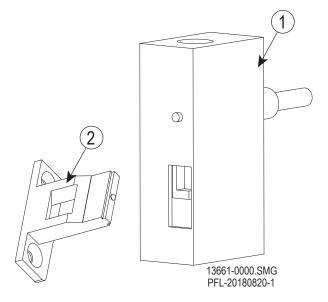
** Contact PFlow Industries, Inc. Parts Department for part number. VRC serial number required.



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Interlocks

The interlock is a device used to mechanically prevent the gate from opening. Below is the GAL interlock supplied. As a safety device, replacement components are only available as shown below. Some configurations may vary by application.



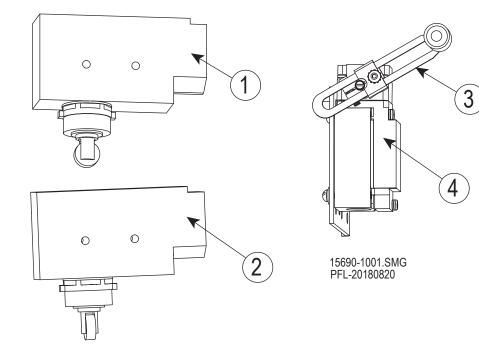
Item	Qty	Part No.	Description
1	1	13660-0000	Interlock, GAL, RH
	1	13661-0000	Interlock, GAL, LH
2	1	8078-0013	Keeper



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Gate Status Switches

A gate status switch is supplied when the contact are not being used. If required, it will be mounted to the gate post or header. Normally the GAL and Anderson interlocks do not use this switch. Specific order requirements may differ.



Item	Qty	Part No.	Description			
1	1	6220-0000	Roller Plunger, Parallel			
2	1	6216-0000	Roller Plunger, Perpendicular			
3	1	2891-0000	Adjustable Roller Arm			
4	1	2893-0000	Switch, Limit, Single Pole			



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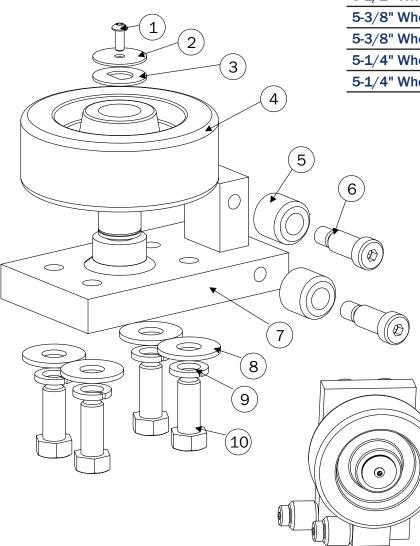
Upper Wheelblock Assembly Phenolic Wheel 5-1/2" Wheel **Right-hand** 16719-0000 5-1/2" Wheel Left-hand 16720-0000 (1)5-3/8" Wheel **Right-hand** 6197-1000 2 3 4 9 5-3/8" Wheel Left-hand 6196-1000 11 (10) 5-1/4" Wheel **Right-hand** 6197-0000 J Ŧ 5-1/4" Wheel Left-hand 6196-0000 8 6 5 (\$ \circ 0 0 Ð \bigcirc C 7 ø 0 Ð ۲ ٢ Ø 6) (12) (13) (14)(15) (17) (20) (16) (18) (19)

Item	Qty	Part No.	Description	Item	Qty	Part No.	Description
1	1	2888-0010	BHSCS, 1/4-20 X 5/8	10	2	2522-0000	Pin, Cotter, 5/32 X 1 1/4
2	1	5222-0000	Washer, Flat	11	2	6187-0000	Link, Safety Cam
3	1	8774-0000	Washer, D, 3/4 ID X 1 1/2	12	4	7278-0024	Screw, HHC, 5/8-11 X 1.5, Gr5
4	1	16716-0000	Wheel, Phenolic, 5 1/2	13	2	5874-0020	Bolt, Shoulder, 5/8 X 1 1/4
	1	2591-1001	Wheel, Phenolic, 5 3/8	14	2	5221-0000	Roller 1.25 OD Guide Plstc
	1	2591-0001	Wheel, Phenolic, 5 1/4	15	1	2443-0000	Spring, Cam, Torsion
5	1	5224-0000	Whlblk Wldm, Upper RH	16	1	2767-0000	Spacer, Whiblk Shoe, .08
	1	5223-0000	Whlblk Wldm, Upper LH	17	1	2754-0000	Shoe, Wheelblock
6	1	5230-0000	Pin, Cam, Wheelblock				Screw, HHC,
7	1	8339-0000	Bearing, Thrust	18	2	2198-0040	5/8-11 X 2.25, Gr8
8	1	6186-0000	Safety Cam Assy	19	6	5858-0015	Lock Washer, Std, 5/8
9	2	2521-0000	Pin, Clevis, 3/4 X 2	20	4	6296-0015	Washer, Std, Flat, 5/8



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Lower Wheelblock Assembly Phenolic Wheel



5-1/2" Wheel	Right-hand	16718-0000
5-1/2" Wheel	Left-hand	16717-0000
5-3/8" Wheel	Right-hand	2721-1000
5-3/8" Wheel	Left-hand	2089-1000
5-1/4" Wheel	Right-hand	2721-0000
5-1/4" Wheel	Left-hand	2089-0000

Item	Qty	Part No.	Description		Item	Qty	Part No.	
1	1	2888-0010	BHSCS, 1/4-20 X 5/8		6	2	5874-0020	ſ
2	1	5222-0000	Washer, Flat		7	1	2079-0000	ľ
3	1	8774-0000	Washer, D, 3/4 ID X 1 1/2			1	5223-0000	ľ
4	1	16716-0000	Wheel, Phenolic, 5 1/2		8	4	6296-0015	
	1	2591-1001	Wheel, Phenolic, 5 3/8		9	6	5858-0015	
	1	2591-0001	Wheel, Phenolic, 5 1/4		10	4	7278-0024	ſ
5	2	5221-0000	Roller 1.25 OD Guide Plstc	'			1	L

Section	17	8
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Description

Whibik Widm, Lower RH

Whibik Widm, Upper LH

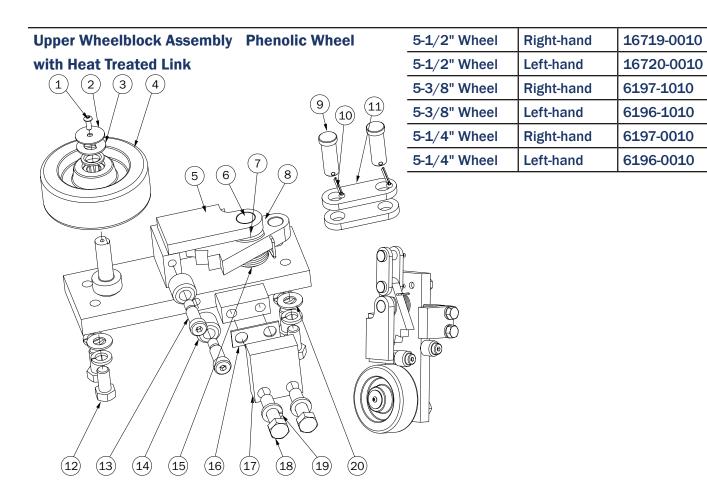
Washer, Std, Flat, 5/8

Lock Washer, Std, 5/8

Screw, HHC, 5/8-11 X 1.5, Gr5

Bolt, Shoulder, 5/8 X 1 1/4





ltem	Qty	Part No.	Description	Item	Qty	Part No.	Description
1	1	2888-0010	BHSCS, 1/4-20 X 5/8	10	2	2522-0000	Pin, Cotter, 5/32 X 1 1/4
2	1	5222-0000	Washer, Flat	11	2	6187-0001	Link, Safety Cam
3	1	8774-0000	Washer, D, 3/4 ID X 1 1/2	12	4	7278-0024	Screw, HHC, 5/8-11 X 1.5, Gr5
4	1	16716-0000	Wheel, Phenolic, 5 1/2	13	2	5874-0020	Bolt, Shoulder, 5/8 X 1 1/4
	1	2591-1000	Wheel, Phenolic, 5 3/8	14	2	5221-0000	Roller 1.25 OD Guide Pls
	1	2591-0001	Wheel, Phenolic, 5 1/4	15	1	2443-0000	Spring, Cam, Torsion
5	1	5224-0000	Whibik Widm, Upper RH	16	1	2767-0000	Spacer, Whiblk Shoe, .08
	1	5223-0000	Whibik Widm, Upper LH	17	1	2754-0000	Shoe, Wheelblock
6	1	5230-0000	Pin, Cam, Wheelblock				Screw, HHC,
7	1	8339-0000	Bearing, Thrust	18	2	2198-0040	5/8-11 X 2.25, Gr8
8	1	6186-0000	Safety Cam Assy	19	6	5858-0015	Lock Washer, Std, 5/8
9	2	2521-0000	Pin, Clevis, 3/4 X 2	20	4	6296-0015	Washer, Std, Flat, 5/8



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Upper Wheelblock Assembly Steel Wheel	5-1/2" Wh
	5-1/2" Wh
	5-3/8" Wh
(1) (2) (3) (4) (5)	5-3/8" Wh
	5-1/4" Wh
	5-1/4" Wh

5-1/2" Wheel	Right-hand	16503-0000
5-1/2" Wheel	Left-hand	16504-0000
5-3/8" Wheel	Right-hand	6199-0000
5-3/8" Wheel	Left-hand	6198-0000
5-1/4" Wheel	Right-hand	6491-0001
5-1/4" Wheel	Left-hand	6492-0001

Item	Qty	Part No.	Description	[tem	tem Qty	tem Qty Part No.
	449	- untition	Becomption				
1	1	16505-0000	Wheel, Steel, 5 1/2	11		. 2	2 2521-0000
	1	6304-0001	Wheel, Steel, 5 3/8	12		2	2 6187-0000
	1	6381-0001	Wheel, Steel, 5 1/4	13		4	4 7278-0024
2	1	5209-0012	Pin, Roll, 3/16 X 3/4" Lg	14		6	6 5858-0015
3	1	4299-0016	Screw, FHSC, 1/2-13 X 1	15		4	4 6296-0015
4	1	3629-0000	Washer, Retainer Steel	16		1	1 5244-0000
5	1	3622-0000	Washer, Thrust, 2 3/4 0D			1	1 5245-0000
6	1	6186-0000	Safety Cam Assy	17		2	2 5221-0000
7	1	8339-0000	Bearing, Thrust	18		2	2 5874-0020
8	1	5230-0000	Pin, Cam, Wheelblock	19	•	1	1 2767-0000
9	1	2443-0000	Spring, Cam, Torsion	21		1	1 2754-0000
10	2	2522-0000	Pin, Cotter, 5/32 X 1 1/4	20		2	2 2198-0040

M Series | 15705-0024 | Rev A | 2020-01-01 | e-mail psd@pflow.com



Right-hand

5-1/2" Wheel

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16501-0000

16502-0000

2403-0000

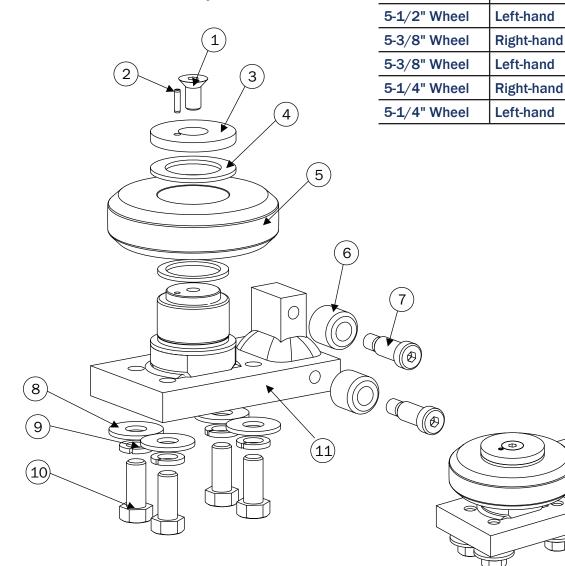
2474-0000

6493-0000

6494-0000

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Lower Wheelblock Assembly Steel Wheel



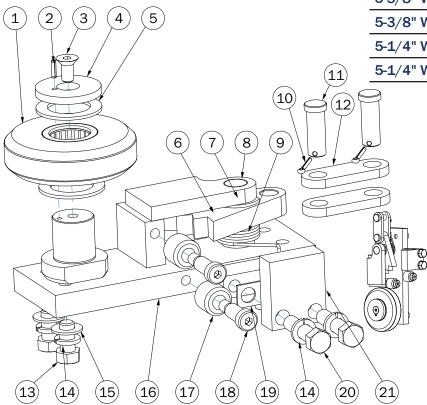
Item	Qty	Part No.	Description	Item	Qty	Part No.	Description
1	1	4299-0016	Screw, FHSC, 1/2-13 X 1	6	2	5221-0000	Roller 1.25 OD Guide Plstc
2	1	5209-0012	Pin, Roll, 3/16 X 3/4" Lg	7	2	5874-0020	Bolt, Shoulder, 5/8 X 1 1/4
3	1	3629-0000	Washer, Retainer Steel	8	4	6296-0015	Washer, Std, Flat, 5/8
4	1	3622-0000	Washer, Thrust, 2-3/4 OD	9	6	5858-0015	Lock Washer, Std, 5/8
5	1	16505-0000	Wheel, Steel, 5 1/2	10	4	7278-0024	Screw, HHC, 5/8-11 X 1.5, Gr5
	1	6304-0001	Wheel, Steel, 5 3/8	11	1	2400-0000	Whibik Widm, Lower RH
	1	6381-0001	Wheel, Steel, 5 1/4		1	2453-0000	Whibik Widm, Upper LH



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Upper Wheelblock Assembly Steel Wheel

with Heat Treated Link



5-1/2" Wheel	Right-hand	16503-0010
5-1/2" Wheel	Left-hand	16504-0010
5-3/8" Wheel	Right-hand	6199-0010
5-3/8" Wheel	Left-hand	6198-0010
5-1/4" Wheel	Right-hand	6491-0011
5-1/4" Wheel	Left-hand	6492-0011

					$\underline{}$		
Item	Qty	Part No.	Description	Item	Qty	Part No.	Description
1	1	16505-0000	Wheel, Steel, 5 1/2	11	2	2521-0000	Pin, Clevis, 3/4 X 2
	1	6304-0001	Wheel, Steel, 5 3/8	12	2	6187-0001	Link, Safety Cam
	1	6381-0001	Wheel, Steel, 5 1/4	13	4	7278-0024	Screw, HHC, 5/8-11 X 1.5, Gr5
2	1	5209-0012	Pin, Roll, 3/16 X 3/4" Lg	14	6	5858-0015	Lock Washer, Std, 5/8
3	1	4299-0016	Screw, FHSC, 1/2-13 X 1	15	4	6296-0015	Washer, Std, Flat, 5/8
4	1	3629-0000	Washer, Retainer Steel	16	1	5244-0000	Whibik Widm, Upper RH
5	1	3622-0000	Washer, Thrust, 2 3/4 OD		1	5245-0000	Whibik Widm, Upper LH
6	1	6186-0000	Safety Cam Assy	17	2	5221-0000	Roller 1.25 OD Guide Plastic
7	1	8339-0000	Bearing, Thrust	18	2	5874-0020	Bolt, Shoulder, 5/8 X 1 1/4
8	1	5230-0000	Pin, Cam, Wheelblock	19	1	2767-0000	Spacer, Whiblk Shoe
9	1	2443-0000	Spring, Cam, Torsion	21	1	2754-0000	Shoe, Wheelblock
10	2	2522-0000	Pin, Cotter, 5/32 X 1 1/4	20	2	2198-0040	Screw, HHC, 5/8-11 X 2.25, Gr8

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Section 18 | Recommended Storage Requirements



MATERIAL HANDLING SOLUTIONS

Environment NOTICE	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 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. See Figure 18-2.	Avoid Cold Temperatures Figure 18-1
Long Term Storage	 Storage for more than two months after shipment, will require that the following maintenance procedures be performed every sixty days from date of shipment: 1. If <i>roller chains</i> are stored for an extended period of time or in a corrosive environment, they must be dipped or stored in a non-detergent oil to retain their original condition. 2. Lightly coat the <i>sprockets</i> with a nondetergent oil to prevent corrosion. 3. Lubricate the <i>safety cams</i> on the exposed <i>wheelblock assemblies</i> with a nondetergent oil and rotate to make sure the safety cams move freely. See Figure 18-3. 4. Elevate the <i>drivebase assemblies</i> 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. 	Image: constraint of the second sec



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Long Term Storage (continued)

DANGER



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

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** ASME B20.1 defines a qualified person 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.
 - 5. Rotate the drivebase shaft. *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. *Manually cycle the brake* several times using the lever on the side of the motor. After rotating with temporary power, remove the vent plug and install the original plug to prevent contamination of the reducer oil. Before initial use, drain and replace the reducer oil.
 - 6. Apply lithium-type grease to the *pillow block and bearings*. Wrap or trap the pillow blocks to avoid exposure to contaminants if needed.
 - 7. Plug the *electrical component* inlets to prevent moisture and other contaminants from entering them. Store in a dry, temperature controlled location to prevent corrosion. Place silica gel desiccant inside the control enclosure. Inspect the inside of the control enclosure for any moisture build up. See Figure 18-4.
 - 8. 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. Product Support Department for additional information that may be available prior to starting up your unit.



Place Inside Control Enclosure Figure 18-4

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 the manuals are required, contact the PFlow Industries, Inc. Product Support Department for an electronic copy (.pdf).



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Before You Begin Read this entire manual.

Purpose

The PFlow Industries, Inc. Vertical Reciprocating Conveyor (VRC) is designed for the movement of materials only, up to the VRC's rated capacity, from one level to the next. Passengers are not allowed. The placement of capacity labels, and safety warnings are the installer's responsibility. Make sure the warning labels are placed on each gate and each push button station.

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



Section 19 | Signage Locations



MATERIAL HANDLING SOLUTIONS



Section 20 | Installation Questionnaire



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Thank You PFlow Industries, Inc. would like to thank you for the opportunity to serve you. Your business is appreciated. Please help us to ensure that your expectations are met by taking a few minutes to tell us about the equipment and service that you have received. Complete the Installation Questionnaire and Acceptance Certificate. Return both forms to PFlow Industries, Inc. via e-mail to psd@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?	
D	

Describe any "No" answers areas in detail.

Testing

Was the equipment tested at full load capacity?	
Were all gates tested to ensure proper operation and interlock operation?	

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

Section 20 | Installation Questionnaire



MATERIAL HANDLING SOLUTIONS





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

PFlow Serial Number:	Model Number:	□ B	□ D	□ DB	□ F	□ M	□ MQ	□ 21	□ CV	Other
Job Name:										
Site Street Address:										
Site Mailing Address:									4	
Site City:			Sta	te:			Zip	Code	•	
Customer Contact Name:			Contact Title:							
Customer Contact Phone: ()	Ext		E-N	/ail:						

	Load Capacity:				Start-up Date:
ned	Load Test:	□ Yes	🗆 No	at % of lift capacity	Customer Initials:
Performed	Operation Test:	□ Yes	□ No		Comments:
Tests Pe	Gate/Interlock Operation:	□ Yes	🗆 No	□ Not Applicable	
Te	Other Test:				
	Other Test:				

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

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

Please return a copy of this form to the PFlow Industries, Inc. Product Support Department.



