

Bucket Elevator



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BUCKET ELEVATOR v2

February 19, 2019

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General

Introduction

This manual is intended to provide basic information regarding the general design features and installation of Warrior Mfg. Bucket Elevators. Because Warrior Mfg. offers many sizes, options and features, not all can be covered here. Refer to your particular general arrangement drawing for more specifics. This manual contains some general installation guidelines to consider. There are many contractors that install bucket elevators and many have differing methods and equipment available for installing the equipment. It is recommended a reputable and experienced contractor be considered to install this equipment. This equipment cannot be expected to perform well if it is not installed well.

Equipment Identification

Model numbers consist of pulley diameter and trunk casing width:



The equipment will have an ID tag with the order number located on the boot. The order number will be needed when making any inquiries regarding the equipment such as troubleshooting or ordering parts. Record information below for future reference.

Order #:	

Date of Purchase:	

Notes: ____



Figure 1: Typical ID tag location

Safety

General Safety Statement

Safety is everyone's responsibility. Construction sites and facilities where this equipment is being installed and operated have constantly changing conditions and hazards. Be alert and focused at all times. Identify and communicate safety hazards with workers and determine appropriate safety precautions to be taken. Follow appropriate local and federal laws and safety regulations.

During installation of this equipment, the installer will be lifting and handling a variety of different items that will be heavy, awkward and many times unbalanced. The installer should be experienced in proper lifting and rigging techniques and have the proper equipment to safely lift and install this equipment to prevent injuries and damage to equipment. It is the installer's responsibility to install the equipment in accordance with established industry practices, local codes and applicable regulations. It is also recommended to consult with civil and structural engineers for seismic, soil & foundation and guying/bracing and other related requirements. Qualified and licensed electricians must be used for the electrical wiring and servicing of the equipment to ensure adequate power is supplied to the equipment.

Do not modify the equipment without first contacting and getting approval from Warrior Mfg. Some modifications could create hazardous conditions causing equipment damage and/or injury, and may void the equipment warranty.

Operate the equipment in the manner and within the capacity in which it was intended. Misuse can cause equipment damage, severe injury, or death. Follow all lockout and other applicable safety rules when doing any maintenance and making adjustments.

Decals

The equipment has been supplied with safety labels warning individuals of potential hazards associated with operation and maintenance of the equipment. Ensure these labels remain legible at all times. Replacement labels are available at no charge from Warrior Mfg.



The safety alert symbol is used to alert you to a potential personal injury hazard. Obey all safety messages that follow this symbol to avoid possible injury or death.



DANGER indicate[s] a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING indicate[s] a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION indicate[s] a hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTICE is used to address practices not related to personal injury. CAUTION signs without the safety alert symbol also have the same meaning.

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Decal Number	Description	Image
40029, 40030	Warrior Mfg Logo	
40032	Danger Explosion	ADANGER Image: Constraint of the second se
40033	Danger Exposed Buckets	ADANGER ADANGER <th< td=""></th<>
40034	Warning Moving Parts	Markening Image: Constraint of the second

40035	Warning Rotating Parts	Image: Non-Structure Image: Non-Structure Image: Non-St
40036	Warning Flying Material	Image: Ware of the second s
40037	Warning Lock Out	Image: Ware of the second s



Receiving Inspection

Inspect all equipment on each shipment immediately when unloading for any signs of shipment damage or missing items. It is the responsibility of the receiving party to note any damages/shortages on the freight bill before you sign for the shipment and then file claim with the carrier. The carrier is responsible for any shipping damages once the shipment leaves Warrior Mfg.

All equipment, including hardware, is to be inventoried by the contractor within 48 hours of receiving the shipment. Any shortages must be reported to Warrior Mfg. within that initial 48-hour period. If shortages are discovered and reported after 48 hours, it is at Warrior's discretion to charge the contractor for any and/or all of the replacement parts and hardware needed.

In many cases the equipment will arrive on multiple shipments, so segregation/organization of equipment and paperwork at the site will minimize confusion and misplaced items.

General Assembly

Typical Assembly/Installation Guidelines

How well the equipment is installed can have a huge impact on the overall performance and operation of the equipment. The elevator MUST be plumb within ½" or less in both directions and the head and boot pulleys must be aligned with each other or belt tracking and rubbing issues will be problematic. It is recommended that all joints between sections be caulked during installation to provide a water- and dust-proof connection.



The Bucket Elevator must be laterally supported every 20 ft from the head down to the boot. Attach only to the trunking flanges. Do NOT attach to the trunking sheet metal!

Warrior bucket elevators are designed to be self-supporting vertically but require lateral support to brace horizontally. Laterally support the leg sections every 20' during installation to the base of the head section. This is typically accomplished with horizontal supports from silos or tower structures. Optional bolt-on tower connecting plates are available for connecting lateral supports to the trunking flanges. The bucket elevator is not designed to support other equipment such as distributors, spouting, etc. These items must be supported by separate support structures.



Figure 3: Trunking joint with tie angles and support brackets.

It is recommended the installer consult with civil and/or structural engineers regarding foundations and support methods to ensure the installation is structurally sound and does not affect the mechanical operation of the equipment. Warrior does not recommend guy cables for lateral support.

Qualified and licensed electricians must be utilized to ensure adequate electrical supply to the equipment. Refer to the general arrangement drawing for the motor requirements.

In many cases, the discharge spouting and inlet transitions are field designed and fabricated. Careful consideration needs to be given to the flow of material into the boot of the elevator. Material needs to enter as straight into the boot as possible to ensure proper cup fill and to prevent belt tracking issues. Baffles may be necessary to correct side loading issues.



Figure 4: Typical minimum inlet hopper heights compared to boot pulley take-up upper limit.

General Arrangement Drawing

Refer to the general arrangement drawing for each specific bucket elevator. Each bucket elevator is unique based on many variables and options including but not limited to, size, height, capacity and other options. Some installations require heavier gauge trunking to support the weight of the elevator. In some cases, the leg sections may have added reinforcement. These sections would be located closest to the boot as shown on the general arrangement drawing along with other pertinent information. Reinforced sections are also used to support platforms and jib booms.



Figure 5: Sample bucket elevator arrangement. Refer to your As Approved general arrangement drawing for correct stacking of trunking

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Boot Installation

Install the boot in the predetermined location on a suitable foundation. Level the top of the boot in both directions where the first leg section will sit. It is recommended the boot be shimmed under the bottom as needed to level the top of the boot and anchor in place. Next, grout under the boot around the entire perimeter.

The boot has stiffeners bolted around the top perimeter to maintain straightness of the boot sides. These are to remain in place when installing the first trunk sections.



Figure 6: Typical boot components.

Gravity Take-Up Installation

Bolt upper gravity take-up brackets to provided reinforced trunking section. Bolt lower gravity take-up brackets to the sides of bearing take-up plate. After belt installation (see page 30), disconnect and remove the standard acme take-up rods from the boot take-up plates. Once installation is complete, replace all provided guarding to ensure safe operation.



Figure 7: Gravity take-up installation & adjustment points

Inspection Section Installation

The inspection section is typically the first section to be installed above the boot, or the lowest, most convenient location above a pit or at a platform. Be sure the inspection door is located on the upside and towards the outside of the casing of the bucket elevator to provide an inspection opening for viewing bucket fill and general bucket inspection. The belt and buckets can also be installed through the removable panels and the belt spliced at this location. Inspection panels may be flipped or swapped to put the inspection door at the best height for service.



Figure 8: Varying heights of inspection section door

Leg Section Installation, Standard and Pressure Relief Vent Sections

Continue installing leg sections above the inspection section while ensuring they are straight, plumb and not twisted. Refer to the general arrangement drawing for specific leg section locations. Pressure relief vent sections, if included, are typically installed every other section vertically spacing the vents at 20' intervals. The pressure relief vents will typically be located at the top of each 10' leg section and are always designed to have the hinge at the bottom of each vent panel. The vent panel will swing downward in the event of a deflagration event to relieve pressure.



Pay particular attention to orientation of leg sections. Some installations require heavier gage sheet metal trunking and/or additionally reinforced sections. These will typically be installed toward the bottom closest to the boot. Reinforced sections are also used to support platforms & jib booms. Refer to general arrangement drawings for locations.

Tie angles connect between leg sections and are typically bolted on top of the leg flanges. Special tie angles are used to connect ladder supports at predetermined locations. Refer to general arrangement drawing for details.

3/8"-16 Grade 5 bolts are supplied to connect trunking sections to one another. All bolts are long enough to have at least 2 exposed threads (about 1/8") past the nut through tie angles and supports. If thicker structural ties are used for lateral support of the elevator, longer bolts than those supplied may be required.



Figure 9: Typical trunking joint and tie angle installation February 19, 2019

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Head and Hood Installation

The head section is normally assembled at the factory with the shaft, bearings and pulley installed. The head has lifting points located in the upper flanges that can be utilized to hoist the section into position. Once in place, ensure adequate support/bracing is utilized to laterally support the head and dynamic forces imposed by the drive, wind and other attached devices.



Figure 10: Typical head assembly lift points.



When rigging to the hood assembly, lift ONLY the hood. It cannot support the weight of the head section. The head section must be lifted separately.

The hood assembly is shipped separate and is normally installed after the belt and buckets have been installed. When installing the hood onto the head assembly, caulk between the hood flange and mating surface of the head to provide a water- and dust-proof connection. BUCKET ELEVATOR v2 February 19, 2019

Ensure the entire installation is vertical and plumb within ½" left-to-right and front-to-back. Check the head shaft to ensure it is perfectly level. The head shaft must be level or belt tracking will be problematic. If necessary, the head shaft can be leveled by adjusting shims located under the head bearings. Warrior Mfg. elevators come with shims installed under the head bearings to simplify the leveling process. Determine which side of the shaft needs to be lowered in order to achieve level. Loosen the bearing housing bolts and utilize the jack bolt(s) under the bearing to lift weight off the bearing shim(s). Remove appropriate number of shims then back out the jack bolt(s) to lower the bearing.



Figure 11: Head bearing adjustment points.

Repeat process until level, tighten bearing housing bolts, and replace bearing guards.



Figure 12: Typical head bearing guard installation. February 19, 2019

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Platforms and Optional Equipment

If optional platforms or jib booms are being supplied as part of the order, refer to the appropriate general arrangement drawing for assembly details.

Refer to the manufacturer's instructions on other optional equipment such as rub blocks, bearing sensors, speed sensors, etc. for installation, operation and maintenance of those items.

Motor/Drives

Refer to the general arrangement drawing to ensure the proper motor, reducer and drive package components are being installed on the equipment. If installing a backstop, manually rotate reducer to ensure the backstop is installed the correct direction to prevent damage on startup. Once reducer and backstop are installed, ensure reducer is filled with oil.

Refer to the manufacturer's instructions on motors, reducers and drive components for proper installation, operation and maintenance intervals.

NOTICE

Reducers are shipped without oil. Once installed, ensure reducer is filled to the proper level with oil.

Before installing the drive belts, jog the motor to check for proper rotation to prevent damage to the backstop and other components.

Belt guards and mounting brackets are universal in nature to allow adjustability. When mounting, be sure motor and reducer shafts do not rub. Ensure the drive sheaves are aligned for maximum belt life and that they don't rub on belt guard.



Figure 14: Belt drive package components.

Check tension on new drive belts frequently according to the manufacturer's specifications to prevent slippage and premature wear.

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Belt and Bucket Installation

Several methods of installing the belt and buckets may be utilized depending upon size, width of belt, height of elevator, space available to work and equipment available. The removable panels on the inspection section are an ideal location to feed the belt into the elevator, attach buckets and make the splice. The buckets may be installed before installing the belt or afterwards depending on factors as mentioned above.

Whichever method is used, once the belt is installed, pre-stretching the belt prior to final splicing will require less adjustment and re-splicing during the break in period.

When attaching buckets, the head of the elevator bolt should lie against the inside surface of the elevator belt with the washers and nuts on the inside of the elevator bucket. An ideal installation will result in the elevator bolt head fitting snuggly just below the surface of the elevator belt. It is recommended that a pneumatic wrench or battery-operated drill-driver be used. The proper torque setting for installing elevator bolts is truly impossible to specify. Each assembly system will have its own unknown coefficients of friction and properties of resistance depending on the coating or other contaminates. Elevator belts vary in hardness or softness which affects the torque required to get the head of the bolt to seat properly.



Figure 15: Standard hardware package and installation order.

For fanged bolts, align the fangs in a horizontal line across the width of the belt. Sometimes it helps to "set" the fangs into the belt cover by tapping them with a mallet. Once the bolt is tightened, the fangs will draw up into the belt so that the head can properly seat. Fanged bolts may have trouble penetrating unusually hard belts like PVC450, especially in cold temperatures.



Figure 16: Proper alignment of fanged bolts.

Several splicing methods may be utilized including lap and mechanical splices. The method needs to be determined when ordering the belt to ensure adequate belt length. Belt splices must be square or tracking problems will be encountered. If a lap splice is utilized, refer to the general arrangement drawing for proper number of buckets overlap for the splice. Make sure the boot pulley is adjusted to the top of its take-up range prior to splicing the belt. Refer to Figure 17 below for an example of a lap splice, or the manufacturer's instructions for installation of mechanical splices.



Figure 17: Example of 3-bucket lap belt splice. See the As Approved drawing for each order for the actual splice type required.

Throat Wiper Adjustment

Once the belt and buckets have been installed, the throat wiper located in the discharge throat of the head must be adjusted to within 1/8" to 1/4" from the lip of the buckets. If a lap or butt splice is used, be sure to adjust the throat wiper to accommodate for one belt thickness at the splice area. Loosen the throat wiper retaining bolts, slide the throat wiper to get proper clearance and retighten the bolts.



Figure 18: Throat wiper to bucket tip adjustment in head assembly.

Common Platform Components



Common Platform Components (continued)



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Pre-Startup Inspection & Checklist

Initial Belt Tension

Initial belt tension can be accomplished by loosening the nuts on the boot takeup adjusting screws allowing the boot pulley to slide down under its own weight and rest in the cradle of the belt. Adjust the take-up nuts that apply downward pressure to the boot pulley until they begin applying downward pressure. Turn the nuts an additional 1-2 turns. Check to ensure both sides are adjusted evenly. Final tensioning will be done under full load and is covered later in this manual (see page 33) .



Figure 19: Boot pulley take-up adjustment points.

Gravity Take-Up

To ensure proper tension of belts with a gravity take-up, first use a lifting harness with forklift or come-along to check that the take-up travels up and down freely along its range of movement. Remove the gravity take-up bin cover and place inside the required amount of counterweight. Warrior will provide in writing the minimum amount of weight required for use, as well as maximum amount of weight that can be added and avoid failure. Replace the bin cover to keep water and foreign material from adding unwanted weight to the take-up.



Figure 20: Tracking & tension adjustment points on boots with gravity take-up

Self-Cleaning Boot Tensioning

Self-cleaning boots have a single acme screw on each side to adjust the bucket clearance as well as belt tension. Start by adjusting the bottom section of the acme screw, so the clearance from the outer-most bucket tips (including digger buckets or those on the extra thickness of a lap splice) to the curved bottom of the boot is within acceptable limits. Then adjust belt tension with the top section of the acme screw using the standard method above. Loosen until the pulley rests under its own weight, then tighten until pressure is applied, plus an additional 1 - 2 turns.



Figure 21: Self-cleaning boot adjustment points.

Startup Preparation

As stated above, make sure the motor rotation has been checked with the drive belts removed to prevent damage to the backstop and other components.

Ensure all tools, parts, and equipment are clear of the bucket elevator and workers are safely located before initial startup. The checklist on the following page can be used as a reference for starting up the equipment for the first time.

Warrior Mfg



Bucket Elevator Startup Checklist

PRE-STARTUP INSTALLATION INSPECTION				
Verify boot hopper location and check for possible side loading issues.				
Ensure leg sections are straight and plumb.				
Ensure all joints are sealed with caulk.				
Ensure all hardware is installed and tight.				
Verify elevator is properly supported/braced.				
Review drive for proper installation and verify reducer filled with oil.				
Verify motor rotation. Remove drive belts to prevent any damage if reversed.				
Ensure backstop is installed correctly.				
Verify head and boot pulleys are centered, aligned, and plumb.				
Ensure belt is spliced correctly and splice is straight.				
Ensure bucket bolts are seated completely on backside of belt, and washers and nuts are used inside the plastic bucket.				
Ensure all platforms, ladders, etc. are securely mounted and fasteners are seated and tight.				
Verify throat wiper below head pulley has been properly adjusted.				
Verify auxiliary equipment such as speed switches, rub blocks, etc. have been installed and tested.				
Ensure boot pulley take-ups are adjusted for initial belt tension.				
INITIAL STARTUP				
Position observers at the head and boot areas to observe belt tracking.				
Jog elevator and if tracking well, continue to run.				
Adjust boot pulley take-ups for belt tracking. Adjust head pulley shims as needed.				
Continue listening for any noises and inspect drive and drive belts.				
Verify head shaft RPM matches the general arrangement drawing.				
INITIAL OPERATION				
Begin feeding product slowly while observing belt tracking and listen for any				
unusual noises.				
Refer to general arrangement drawing for bucket fill level, material type and speed				
Observe belt tracking as material is added and adjust pulleys as necessary.				
Slowly increase flow to full capacity while observing for any issues.				
 While running under full load, adjust boot take-ups for proper belt tension to				
While running under full load, adjust boot take-ups for proper belt tension to prevent slippage on head pulley.				
While running under full load, adjust boot take-ups for proper belt tension to prevent slippage on head pulley. Verify no feeding or discharge issues. Utilize strobe light for bucket fill if needed.				

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Startup and Tracking

Startup

Safely position workers at head and boot areas to observe belt tracking on initial startup. If there are initial tracking issues, the equipment should be stopped immediately to prevent damage. Also listen for any unusual noises and correct and/or make adjustments as needed.

Head Pulley Tracking

If belt tracks to one side at the head, head bearing shims may need to be adjusted to correct tracking. Remove shim(s) and lower head shaft on opposite side belt tracks towards. The belt will begin to track towards the side being lowered. Refer to head installation section of manual above for more detail.



Figure 22: Correction of belt tracking at head.

Other causes of head pulley misalignment include loose bearings, a bent head shaft, or pulley movement along the shaft due to loose bushings.

Boot Pulley Tracking and Take-up Adjustment

Small adjustments may be needed at the boot pulley to get the belt tracking in the middle of the pulley. If the belt tracks to one side, adjust the take-up on that side downward to get the belt tracking in the middle. Be sure to recheck the belt tracking at the head.



Figure 23: Correction of belt tracking at boot.

Other causes of boot pulley misalignment include grain entering the inlet hopper at an angle, the head pulley out of plumb, or pulley movement along the shaft due to loose bushings.

Final Belt Tensioning

Belt tension must be sufficient to prevent slippage on the head pulley under full load. If belt is allowed to slip for a significant period of time, the head lagging may become glazed and greater belt pressure will be required for proper traction on the belt. Severe cases will result in belt damage. Once the belt begins to slip, the buckets will begin to overfill, adding to the weight being elevated and compounding the problem. This can also be a cause of the elevator not achieving capacity.

Once the elevator has been operated empty and belt is tracking well at both head and boot, begin slowly feeding material into the elevator while observing tracking at the head and boot. Continue increasing material until full capacity is reached. At the same time, slowly loosen the take-up nuts on both sides of the BUCKET ELEVATOR v2 February 19, 2019 34 boot and allow the boot pulley to go down and rest in the cradle of the belt as it stretches under load. Adjust the nuts pushing down on the pulley until they make contact with the take-up mounting bracket and give an additional 1 turn of downward pressure. If slippage is still observed, apply more downward pressure with the take-up nuts as necessary. Recheck tracking and adjust as needed. Repeat this process often during the belt break in period to maintain tension and prevent slippage.

If belt tracking wanders, ensure head shaft is still level. Check for side loading issues into the boot and look at bucket fill to ensure the buckets are filling evenly.

If not done earlier, verify head shaft rpm closely matches the speed identified on the general arrangement drawing to ensure proper capacity can be attained and to prevent operational issues such as overamping the motor and poor discharging of material from the buckets.

Troubleshooting

When troubleshooting the equipment, consider the basic theory of operation and, depending on the issue, evaluate the entire system. What effect could other equipment have on the performance, such as conveyors, spouting, and dust collection systems? Pay particular attention to when it happens, is there a pattern? Does the issue occur all the time or just when loaded to capacity or partial capacity? Does it happen at the beginning of loading, at the end or somewhere in-between?

Below is a list of common problems in the industry associated with bucket elevators. It is not a full comprehensive list of all the possible problems one may encounter. This list is meant to lend assistance in resolving issues. If there is a problem that is not on the list or if you have any questions, contact Warrior Mfg.

PROBLEM POSSIBLE CAUSE		POSSIBLE SOLUTION
Belt not tracking straight,	Elevator not plumb or twisted, head & boot pulleys misaligned	Check elevator for straightness and plumb, adjust lateral supports as needed.
rubbing or running to one	Head pulley/shaft not level	Level head shaft, adjust shims under head bearings as needed.
Side	Boot pulley tracking out of adjustment	Adjust boot pulley take-up screws to center belt on pulley.
	Belt tension too loose, belt not guided by boot pulley	Adjust boot pulley take-up screws to apply more tension. Re-splice belt if out of adjustment.
	Sticky material, buildup on boot pulley	Clean pulley, consider wing or spiral wing pulley in place of drum pulley.
	Material side loading into boot, pushing belt	Straighten flow of material into boot, add baffles in transition.
	Material side loading into boot, getting between pulley and belt	Straighten flow of material into boot, add baffles in transition.
	Worn head pulley lagging	Inadequate crown on pulley, replace lagging.
	Belt splice not straight	Re-splice belt.
	Buckets not filling evenly	Straighten flow of material into boot, add baffles in transition.

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Actual capacity less	Change in material density	Check current material lbs/cu ft, compare against design specs.
than rated capacity	Change in material flow	Verify proper capacity is being supplied into elevator.
	Head shaft rpm slower than design speed	Verify correct drive belt sheaves on reducer and motor.
	Drive belts slipping	Check/adjust drive belt tension.
	Elevator belt slipping	Re-tension with boot take-up. Refer to final belt tensioning section above.
		Head pulley lagging glazed/worn. Replace lagging.
	Buckets under filled	Verify proper capacity is being supplied into elevator.
		Belt speed faster than design speed. Verify correct drive belt sheaves on reducer and motor.
		Upside boot hopper too low. Bottom of hopper should be approximately boot shaft height or higher.
		Light, fluffy material. Consider vented buckets.
		Look for any feeding issues into boot. Even cup fill.
	Damaged/missing buckets	Determine cause of damage. Replace buckets.
	Back legging, downside of leg	Inspect/adjust throat wiper in head.
		Buckets not discharging material correctly. Verify belt running at design speed.
		Material not discharging. Inspect discharge spouting for blockages, flat angles and adequate size.
	Material buildup in buckets	Sticky material building up in buckets reducing capacity. Circulate abrasive material to clean buckets.
Buckets over filled	Change in material density	Check current material lbs/cu ft, compare against design specs.

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Buckets over filled	Change in material flow	Verify proper capacity is being supplied into elevator.
(continued)	Head shaft rpm slower than design speed	Verify correct drive belt sheaves on reducer and motor.
	Drive belts slipping	Check/adjust drive belt tension.
	Elevator belt slipping	Re-tension with boot take-up, refer to final belt tensioning section above.
		Head pulley lagging glazed/worn. Replace lagging.
Motor running high	Change in material density	Check current material lbs/cu ft, compare against design specs.
current/over amperage	Change in material flow	Verify proper capacity is being supplied into elevator.
	Head shaft rpm faster than design speed	Verify correct drive belt sheaves on reducer and motor.
	Buckets over filled	Elevator belt slipping. Re-tension with boot take-up, refer to final belt tensioning section above.
		Drive belts slipping. Check/adjust drive belt tension.
		Over full buckets add extra weight.
	Buckets digging material in boot	Verify proper capacity is being supplied into elevator.
	Electrical issues	Verify good electrical connections and proper wire size for distance.
		Verify voltage at motor, all three phases. Ensure voltage does not drop under load and equal on all three phases.
		Verify amperage at motor, all three phases. Ensure amperage is balanced between phases.
		Verify high amperage limit set correctly on control
Unable to start elevator	Drive issues	Verify proper motor rotation, backstop or reducer malfunction. Check for proper sheaves.

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Unable to start elevator (continued)	Bucket caught in leg	Look for obstruction, head and boot area. Belt loose and/or elevator out of plumb. Inspect for loose buckets.
	Buckets over filled	Verify proper capacity is being supplied into elevator. Over-full buckets add extra weight.
		Belt slipping, over-full buckets adding extra weight requiring more belt tension. Re-tension with boot take-up, refer to final belt tensioning section above.
	Boot plugged	Buckets digging through a plug condition. Remove boot clean out plates to clean out material from boot.
		Run elevator longer after infeed is stopped to clean out elevator.
	Soft start	If a soft start is being used, it may not be able to supply line voltage thus reducing motor starting torque. Verify soft start and motor specs with an electrician.

Maintenance

General Maintenance and Routine Inspection

A regularly scheduled maintenance and inspection program should be implemented to keep the equipment in good operating condition and reduce downtime. The program should include housekeeping, routine inspection and lubrication based on operating frequency and operating environment.

Routine inspections can reveal small issues needing minor adjustment before they become big problems requiring downtime and repair. Listen for any unusual noises that may indicate need for adjustment or repair.

On newly installed equipment, check belt tracking multiple times the first day of operation. If tracking is stable, check daily for the first couple weeks during the break-in period. Belt tension will need to be adjusted regularly as it will stretch during break-in. New drive belts will need the same attention. During this break in period, check bucket bolt tightness and do an overall inspection of the installation including ladders and platforms to ensure fasteners remain seated and tight. Also look for any movement or out-of-plumb conditions due to settling, etc. Inspect drive, head, and boot bearings to ensure they remain secure and look for any signs overheating.

Regularly scheduled inspection, maintenance and lubrication intervals should be established. The following are some items to consider:

- Check belt tracking at both head and boot pulleys.
- Check/adjust belt tension, re-splice belt when take-up has no more adjustment.
- Check V-belt tension/alignment and inspect for damage/wear. Replace in matched sets.
- General housekeeping for cleanliness and accumulation of dust and debris on motors and reducers so they can dissipate heat, also to prevent fire and explosion hazards. Check reducer breather vent to ensure it is not plugged, which can build pressure and cause seals to leak.
- Periodically remove the clean out panels in the boot and clean out old material.

- Check safety devices such as rub blocks, speed switches and other electrical devices for proper operation.
- Refer to manufacture instructions on motors, reducers, and bearings for proper maintenance and lubrication intervals. Use the appropriate grease and oil as specified. Follow reducer manufacture recommendations on oil level and oil change intervals.
- Check bearings and drive components for signs of looseness, overheating, leaks, etc.
- Inspect belt and splice for signs of wear or damage.
- Inspect buckets for tightness, missing, damage, or wear.
- Inspect head pulley lagging for signs of wear and glazing. Replace as needed.
- Inspect head and boot pulleys for any issues. Check that bushings and bolts remain tight.
- Inspect throat wiper for wear, damage, or need of adjustment.
- Check wear lining in head and boot areas for wear, damage, or missing pieces. Replace as needed.
- Check guy cabling and lateral supports to ensure they remain securely fastened and properly tensioned.
- Check elevator hardware including head and boot assemblies, trunking, ladders, platforms, and handrails to ensure they remain seated and tight.

If the elevator will be shut down for more than one month, perform the following operations:

- Remove all foreign material from the elevator.
- Inspect the surface coatings.
- Lubricate and protect all bearings and drives according to the manufacturer instructions.
- Coat all exposed metal surfaces with rust prevention oil according to the manufacturer instructions.
- Prior to start-up, perform the installation and operation instructions in this manual.

WARRANTY - All items manufactured by Warrior Mfg., LLC are warranted against: defects, quality in material, or quality in workmanship for one (1) year from the date of shipment (but not against damage caused by accident, abuse, or faulty installation). Any product proved defective in such manner within one (1) year of shipment will be repaired or replaced free of charge. The responsibility of Warrior Mfg., LLC under this warranty is limited to supplying a new or functionally operative part. The warranty does not include: the cost of labor involved or required in diagnosing trouble, removing or installing a new part or parts, nor does it include any damage to any part or parts to which a Warrior Mfg., LLC product may be attached or which may have arisen for any reason whatsoever. No allowance will be made for repairs, alterations, or changes unless specifically authorized in writing and signed by an executive officer of Warrior Mfg., LLC. All freight costs incurred in returning any product to Warrior Mfg., LLC shall be borne by the customer.

LIMITATIONS OF WARRANTIES - Warrior Mfg., LLC implies no product warranties beyond those stated herein.

LIMITATION OF LIABILITY - Liability of Warrior Mfg., LLC to the purchaser for damages arising out of the: manufacture, sale, delivery, use, or resale of the equipment, whether based on warranty, contract negligence, or otherwise, shall be limited to and shall not exceed the cost of the repair or replacement of the defective part or parts. Upon expiration of the warranty, all such liabilities shall terminate. The seller shall not be liable to the purchaser or user for: loss of anticipated profits, loss by reason of plant shutdown or non-operation, increased expenses of operation of other equipment, or other consequential loss or damages of any nature arising from any cause, whatsoever, by reason of the manufacture, sale, delivery, and/or use or resale of the equipment covered by this quotation or sales order.

FIELD MODIFICATIONS - No field modifications shall be permitted on new nor existing equipment without PRIOR WRITTEN AUTHORIZATION from WARRIOR MFG., LLC, AND THE OWNER. Repair of unapproved field modifications which are made without the express written authorization of Warrior Mfg., LLC, and the Owner shall be at the CONTRACTOR'S EXPENSE. The Contractor shall be held liable for the design of all equipment (new and existing) on which field modifications are made prior to receipt of written authorization from product manufacturer and the Owner – even if approval is given after the modification has been made.