

Customer	BLUE MARBLE PRODUCTIONS, INC
Location	INDIANAPOLIS, IN
Sales Order No.	5028930
Machine Model No.	HL4200
Serial No.	2111.7434.3394
Voltage	480V-3PH-60HZ
Complete Mechanical	3.3394.000
Complete Electrical	328.27.7434

HOME OFFICE

Columbia Machine, Inc.
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NON-DISCLOSURE STATEMENT

This document, and all technical information contained herein, is proprietary to Columbia Machine, Inc. It is not to be disclosed in any manner to any competitors of Columbia Machine, Inc., or to any other parties.

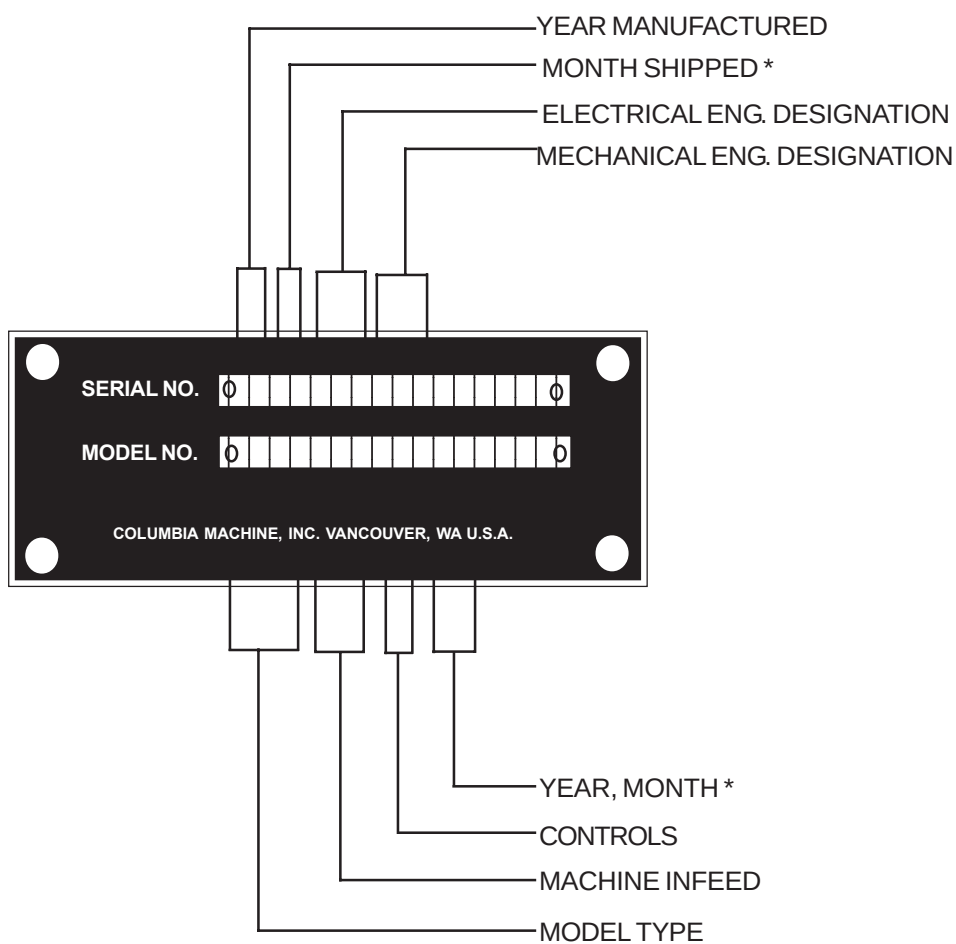
PALLETIZER
MODEL 4200

INSTRUCTION/ OPERATOR MANUAL



PALLETIZER IDENTIFICATION PLATE

The serial and model number plate illustrated below serves as the main identifier of the entire palletizer. This plate is located on the main frame structure for your convenience. Please refer to the information on this plate and/or the customer information sheet within the machine manuals when machine identification is required.



* Should symbols appear in these designated areas other than information that the location specifies, please contact the Service Department of Columbia Machine, Inc.

WARNING

TO ALL PLANT PERSONNEL

THIS MACHINE IS
AUTOMATICALLY CONTROLLED
IT MAY START AT ANY TIME!

**NEVER WORK ON, CLEAN OR SERVICE THIS MACHINE OR
OPEN OR REMOVE ANY PROTECTIVE COVER, GUARD,
GRATE, DOOR, OR MAINTENANCE PANEL UNTIL THE POWER
HAS BEEN TURNED OFF AND LOCKED OUT.**

AVOID PERSONAL INJURY BY TAKING
EVERY PRECAUTION!

SAFETY GUARDS

ARE PROVIDED FOR YOUR PROTECTION

NEVER OPERATE EQUIPMENT WITHOUT GUARDS INSTALLED

SAFETY FIRST!

Maintenance in the form of repairing and cleaning on top of, around, or within the machinery itself can lead to accident or death if the person or persons involved in the maintenance do not observe certain absolute precautions. Hoists and lifting mechanisms can fall unexpectedly during maintenance, jam clearing, or troubleshooting activities. Please note the following suggestions to insure safety procedures for the above operations.

ALWAYS PLACE THE HOIST OR LIFTING MECHANISM IN THE DOWN POSITION OR ON A RETAINING MECHANISM OR PIN BEFORE ACCESSING THE EQUIPMENT FOR ANY ACTIVITY THAT EXPOSES PERSONNEL TO AN UNEXPECTED MOVEMENT OF A HOIST OR LIFT.

1. Turn automatic switch to manual control, operate pushbutton station to set machine at desired 'at rest' position depending upon the chore to be performed.
2. Lockout the main disconnect switch which kills all power to all of the machine motors with only **the repairman** to do the work **retaining the single key** to the padlock **on his person** so that no one else can inadvertently start any of the motors and only he can unlock the disconnect to actuate them.
3. Disconnect, vent and lockout the pneumatic power supply to the machine. **The repairman** to do the work should **retain the single key** to the padlock **on his person** to prevent inadvertent pressurization of the system. Check for pressurized air or hydraulic fluid that may be trapped in any pneumatic or hydraulic circuit that maintenance is being performed on.
4. Always wear hard hats and safety glasses for cleaning or repair procedures involving chipping or hammering or cutting.
5. Be especially cautious during manual operating when checking all machinery.
6. Use care and good reasoning when working on any equipment to prevent personal injury.
7. Housekeeping as needed.

Service/Parts/Modifications

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Normal office hours: 8:00am – 5:00pm Pacific Daylight Savings time. After hours coverage is available using the 800 phone number. We are available 24 hours a day, 7 days a week. If you'd like more information on our services, please call (800) 628-4065 and ask for the Palletizer Customer Care Department or email us directly at mhservice@colmac.com

TO ORDER PARTS:

To enable Columbia to give you the fastest, most accurate service possible please give us the following information when ordering:

Your name and your company's name

Your company's city and state

Your purchase order number

Model and serial numbers of the equipment
Machine line number - yours and ours

The list of items you want to order:

Quantity to order

Part number of item
(We will be glad to assist you with part numbers.)

Description of item

How to Ship

Truck Freight (coast to coast 7-9 days)

UPS Ground (coast to coast 5-7 days)

UPS Blue (coast to coast 2 days) Note - UPS limit 70 lbs.

UPS Red (coast to coast overnight)

Air Freight - Overnite to 4-day service available.
Inquire when ordering.

The logo for Columbia Machine, Inc. features the word "Columbia" in a stylized, cursive script font.

COLUMBIA MACHINE, INC.
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TELEPHONE: 360-694-1501

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NOTES:

Columbia makes every effort to ship items of machinery complete with the latest developments in design and engineering.

Every effort is also made to provide a manual that corresponds exactly with the equipment.

Should developments occur that are not in your manuals, yet pertain to your machinery, "correction pages" will be issued and forwarded to you to be incorporated into your manuals. Please provide a contact name so the pages will be sent to the proper person.

Your machinery is normally shipped to you by truck or rail. In transit, vibration may loosen parts. To assure proper operation when your machinery arrives, the following steps should be taken:

- 0 Tighten all mounting bolts, nuts and set screws.
- 0 Check for missing parts.
- 0 Approximately one week after machinery is in operation, re-check all fasteners. Tighten as necessary.

Your machinery should provide excellent production. However, periodic checking of these tips and other necessary maintenance information covered in the manuals is highly recommended for establishing a reliable and consistent preventive maintenance program.

A collage of various safety signs. At the top right is a circular 'DO NOT ENTER' sign. Below it is a diamond-shaped 'HIGH VOLTAGE' sign with a lightning bolt symbol. To the left of the 'HIGH VOLTAGE' sign is a triangular pedestrian crossing sign. Below the pedestrian sign is a circular sign with a hand symbol and a diagonal line through it. To the right of the 'HIGH VOLTAGE' sign is a rectangular sign with a lightning bolt symbol and the word 'DANGER' partially visible. In the center is a large triangular warning sign with an exclamation mark. Below the exclamation mark sign is a rectangular sign with the words 'THINK SAFETY' in bold letters. To the left of the 'THINK SAFETY' sign is a diamond-shaped sign with a plus sign. To the right of the 'THINK SAFETY' sign is a rectangular sign with a lightning bolt symbol. At the bottom right is a diamond-shaped sign with a lightning bolt symbol.

SAFETY INFORMATION

WARNING

**TO AVOID SERIOUS BODILY INJURY OR DEATH,
LOCKOUT THIS MACHINE BEFORE
CONDUCTING ANY MAINTENANCE,
OR CLEARING OF PRODUCT.**

ALWAYS LOCKOUT THIS MACHINE AT THE
MAIN CONTROL PANEL, PNEUMATIC POWER INLET AND
HYDRAULIC TANK (IF APPLICABLE) BEFORE CONDUCTING
MAINTENANCE OR CLEARING PRODUCT.

NEVER USE THE MANUAL CONTROLS AS A
SUBSTITUTE FOR LOCKING OUT THE POWER WHEN
CONDUCTING MAINTENANCE OR CLEARING PRODUCT.

GENERAL PRECAUTIONS

INTRODUCTION

Your Columbia Palletizing System is designed to be totally automated requiring no operator interface under normal operating conditions. Since the machine is automatic it is important to remember that any portion of the machine can start any time without warning. You must never enter or reach into any portion of the palletizing system until all power sources are locked out.

Columbia Machine has manufactured selected equipment to accommodate a specific materials handling requirement within your facility. This section of the manual is intended to familiarize you with general safety precautions relating to your Columbia Palletizing System. Additional safety related information is located throughout the manual. All affected supervisors, operators and authorized maintenance personnel are also required to totally familiarize themselves with the manual and all cautions, warnings, guarding devices and other instructional decals, labels and signs located on the machine as well as related lockout/tagout procedures.

Safety related information in this manual is designated by well defined, easy to read graphic symbols. Whenever these specific safety symbols appear they are intended to draw attention and isolate this information from the manual's text for the specific purpose of critical safety awareness. These symbols indicated safety information that **MUST** be clearly understood and constantly observed by all authorized and affected personnel during operating and maintenance procedures.

For palletizing systems requiring hydraulic power units, the Electrical Main Power Disconnect located on the palletizer control panel removes power from the pump unit. When this disconnect is locked out, the hydraulic power unit is locked out. If the customer remotely located the hydraulic power unit, Columbia highly recommends that the wiring configuration to the pump power unit remain unchanged. If the customer is using a common pump unit to power more than just the palletizer, some form of lockout protection must be provided for the hydraulic system serving the palletizer.

It is the customer's responsibility to install and use Columbia products in accordance with provisions of the Occupational Safety and Health Act and/or other local codes or industry standard that are pertinent to the particular end use. Installation or use not in accordance with these codes and standards could be hazardous to personnel and/or equipment.

SPECIAL INSTRUCTIONS DEFINITIONS



A statement preceded by DANGER is information that must be acted upon to prevent the possibility of severe bodily injury or loss of life.



A statement preceded by WARNING is information that MUST be acted upon to prevent bodily injury.



A statement preceded by CAUTION is information that MUST be acted upon to prevent machine damage.



A statement preceded by IMPORTANT is information that contains special significance.



A statement preceded by NOTE is information that is handy to know and may make your job easier.

BEFORE START-UP

Do not attempt to operate this machinery until you have read all safety information provided and the complete instruction manual.

- After reading the complete instruction manual, review Section Two (Electrical Operation) for necessary step by step start-up and shut-down functions and related procedures.
- Become completely familiar with the location and operation of the Emergency Stop Switch(es) to stop the machine immediately if and when the need arises.
- Columbia supplies both a Power Disconnect Switch, located on the main panel, and a pneumatic release and lockout device between the machinery and the main source of air supply within your facility.
- All personnel must become familiar with Lockout/Tagout Procedures shown on page S-17.
- Keep all unauthorized and untrained personnel away from the machine before and after start-up.
- If a shield, guard or designated safety device is removed, damaged or missing, repair or replace that item **BEFORE** any machine operation is initiated.
- **DO NOT** wear loose clothing such as ties, garment belts, loose shop robes, untied shoe laces and any over-sized clothing while working around the machine. Loose clothing can, on occasion, become entangled in the machinery and can cause severe personal injury.
- If used, remove all cleaning fluids, tools and equipment away from the machine **BEFORE** starting machinery.
- Before actual start, visually check entire machine and clear all personnel from the immediate area. **LOUDLY** announce “**ALL CLEAR-STARTING OPERATION**”.

DURING OPERATION

- Maintain adequate lighting around working area of entire machine. If inadequate, improve lighting immediately to meet your plant standards before continuing production runs or initiating any machinery maintenance.
- Always maintain secure footing and physical balance while operating machinery. **DO NOT** climb on, over, or into any portion of the machine without using the lockout/tagout procedures.
- If there is a product jam during operation, stop the machine immediately. Press the “Controlled Stop” Pushbutton to stop Automatic Operation. Then press the Emergency Stop Button to remove power from the machine. If there is an emergency situation always press the E-Stop immediately.
- **“NOTE TO TECHNICIANS FOR COMPLIANCE.”** If the situation requires getting on or into the machine to clear product or pallet jams, “Lock-Out/Tag-Out” both the Electrical Main Power Disconnect Switch and Pneumatic lockout device with a padlock. The key(s) must be kept by the maintenance or operator person(s) clearing the jam. “Always follow proper Lock-Out/Tag-Out Procedures.”
- **“NEVER”** clear product/pallet jams, attempt repair or maintenance on the Hoist Assembly until it has been raised to the proper height. This is the elevation that the hoist assembly is lifted to allow “Safety Pins” to be inserted under the hoist.” A secondary safe position would be with the Hoist Down removing any chance of stored energy.

 CAUTION

Under no circumstances should any attempt to be made to Lower the hoist unless the safety pins have been removed.

 IMPORTANT

Prior to securing the hoist to Lockout/Tagout condition, ensure that the hoist is aligned with the hoist retainment system.

**DANGER**

IF A JAM HAS OCCURRED AND THE HOIST CANNOT BE RAISED TO INSERT "SAFETY PINS" OR LOWERED TO FULLY DOWN POSITION, THEN THE HOIST MUST BE SECURED (FROM ABOVE) IN AN INTERMEDIATE POSITION.

**DANGER**

ON MODELS FL2000/FL3000 HOIST CHAINS COULD HAVE SLACK IN THEM CAUSING THE COUNTER WEIGHTS AND/OR HOIST TO FALL IF NOT PROPERLY SECURED.

**DANGER**

ON MODEL FL1000 MACHINES BOTH THE ROW FORMER AND HOIST MOVE VERTICALLY. THE APRON HOIST MUST BE PINNED AND THE ROW FORMER IN THE DOWN POSITION ON ITS STOPS BEFORE ENTRY INTO PALLETIZER AFTER LOCK OUT.

- Operator and/or maintenance personnel must be fully aware of the location of other plant personnel before starting any procedures. Make sure they are standing clear of the immediate area during all phases of operation.
- Do not check areas of clearance (pinch points) with any portion of your body such as fingers, hands, arms and legs. This is extremely important for personal safety whether the machine is in an operating or shut-down mode.
- Remove all cleaning fluids, tools and material from the machine area when repair or maintenance has been completed. DO NOT leave any materials in the way of the operator(s) where it may cause safety and/or fire hazards.

GENERAL PRECAUTIONS

INFEED ASSEMBLY

Columbia Machine offers a variety on Infeed Assemblies that differ considerably in design due to individual customer specifications, product requirements and other subsequent functions. Therefore, these areas of the machine present unique and potentially hazardous conditions to the operator and assisting personnel. Extreme care must be observed when maintaining or clearing these mechanisms.



- **DO NOT** attempt any maintenance or clearing of product jams while the machine is in operation. If the need should arise to clear product jams or perform any maintenance, initiate the proper shut-down procedure, as required, described on page S-16 of this text.
- **DO NOT** reach into or cross the infeed area of the machine without following proper shut-down procedures as referenced in the above paragraph.
- **DO NOT** proceed with any work on the Infeed Assembly until all mechanisms such as rollers, belts, and chains have completely stopped after shut-down.
- **DO NOT** reach under a turntable device (if so equipped) for any maintenance unless this mechanism has been properly supported (blocked) in the 'up' position. During this procedure use a 'Stage Three' shut-down as found on page S-16 of this text.
- **DO NOT** remove any guards unless they are replaced immediately after completing required maintenance. Never remove guards while machine is operating.

ROW FORMING/LAYER FORMING

The row forming area of the palletizer also represents an area of potential hazard. It must be approached with extreme caution during clearing of jams and general maintenance.



- **DO NOT** attempt any maintenance or clearing of product jams while the machine is in operation. If the need should arise to clear product jams or perform any maintenance, initiate the proper shut-down procedure, as required, described on page S-16 of this text.
- **DO NOT** proceed with any work on the Row Former until all mechanisms such as rollers, belts, and chains have completely stopped after shut-down.
- **DO NOT** remove any guards unless they are replaced immediately after completing required maintenance. Never remove guards while machine is operating.
- **DO NOT** check areas of clearance (pinch points) with any portion of the body such as fingers, hands, arms or legs.
- **DO NOT** restart machine for any reason until all personnel are warned to stand clear of the machine. Warn personnel to stand clear of the entire machine before restarting operation.

HOIST/STRIPPER PLATE/STRIPPER APRON

The hoist and stripper plate or apron area of the machine can be extremely hazardous. To avoid machine damage and possible personal injury, the following precautions **must** be observed.



- When performing maintenance in this area, raise the hoist, insert safety pins, and 'Lock-Out' the power disconnect switch, located on the main control panel, with a padlock. Authorized maintenance personnel must keep the padlock key(s) on their person until the repair is completed.
- Machine should be locked out at panel and pneumatic lockout.
- **DO NOT** attempt any maintenance or clearing of products jams while the machine is in operation. If the need should arise to clear product jams or perform any maintenance, initiate the proper shut-down procedure, as required, described on page S-16 of this text.
- **DO NOT** remove any guards unless they are replaced immediately after completing required maintenance. Never remove guards while machine is operating.
- **DO NOT** stand on the stripper plate or in the hoist area when machine is in automatic.
- **DO NOT** place any portion of your body into the area of the hoist arms when the machine is in automatic. If, for any reason the need should arise to enter this area, the hoist must be lifted onto the safety pins or completely lowered. In either case, the Main Disconnect Switch and pneumatics must be 'Locked Out'.
- **DO NOT** enter the area under the hoist for any reason until the hoist is raised, place on support pins, and the Main Disconnect Switch and Pneumatic System have been 'Locked Out' with a padlock. The key(s) must be kept by the designated repairman until the problem has been resolved.

- **DO NOT** enter the area under the hoist for repair or maintenance without wearing proper apparel, such as hard hat and safety glasses.
- **DO NOT** check areas of clearance (pinch points) with any portion of the body such as fingers, hands, arms or legs.
- **DO NOT** restart machine for any reason until all personnel are clear of the hoist/stripper plate area. The hoist must be raised and the support pins removed before restarting machine.

OPTIONAL PALLET DISPENSER

To avoid machine damage and possible personal injury, the following precautions **must** be observed:



- When performing maintenance, clearing jams or aligning pallets, always 'Lock Out' the Power Disconnect Switch, located on the main control panel, with a padlock. Authorized maintenance personnel must keep the padlock key(s) on their person until the repair has been completed.
- All guards must be properly positioned and securely attached to machinery prior to operation.
- **DO NOT** remove any guards unless they are replaced immediately after completing required maintenance. Never remove guards while machine is operating.
- **DO NOT** overload Dispenser by stacking pallets above hopper walls.
- If load is uneven, remove oversize/undersize pallets. Reload pallet hopper evenly by stacking pallets flush against the inside walls of the upright side plates.
- **DO NOT** check areas of clearance (pinch points) with any portion of the body such as fingers, hands, arms or legs.
- **DO NOT** load pallets that have loose or missing boards or protruding nails.
- Clear area of all personnel when manually operating machine function.
- **DO NOT** restart machine for any reason until all personnel are warned to stand clear of the machine. Warn personnel to stand clear of the entire machine before restarting operation.

OPTIONAL SHEET DISPENSER



To avoid machine damage and possible injury, the following precautions **MUST** be observed

- All guards must be properly positioned and securely attached to machinery prior to operation.
- **DO NOT** remove any guards unless they are replaced immediately after completing required maintenance. Never remove guards while machine is operating.
- **DO NOT** check areas of clearance (pinch points) with any portion of the body such as fingers, hands, arms or legs.
- Clear area of all personnel when manually operating machine function.
- **DO NOT** restart machine for any reason until all personnel are warned to stand clear of the machine. Warn personnel to stand clear of the entire machine before restarting operation.

MACHINE GUARDING

Guards appearing on this machine have been designed to provide safe operation of the machinery and reduce the possibility of personal injury and/or machine damage. It is absolutely essential to keep all shields, guards and safety device that have been removed for any purpose, or are damaged or missing, repair or replace that particular assembly **BEFORE** beginning any machine operation.

The following Guidelines for safety guarding devices are provided to familiarize affected and authorized personnel with a general description of their purpose and usage. Additional and special guarding would be in accordance with acceptable customer specifications.

Fixed Enclosure/Barrier Guards

- Provided to keep operating/maintenance personnel from areas of potential danger during machine operation.
- This type of guard is fastened to the machine or floor and requires tool(s) for removal and replacement. Never alter the guard to allow entry without the use of a tool.
- Not normally opened or removed except to perform maintenance or repair. Proper lockout procedures must be observed when access to area is necessary and in accordance with federal regulations.

Adjustable Barrier/Gate Guard

- Located at point of operation or where work maybe performed.
- Provided to keep operating/maintenance personnel from areas of potential danger during machine operation.
- Remains in place through positive connectors. Can be opened without a tool.
- Shut down machine when opened. Never defeat the function of this interlock circuit.
- Lock-Out/Tag-Out procedures must be observed when access to area is necessary and in accordance with federal regulations.

Belts/Pulleys, Chain/Sprockets, Gear Guards

- Permanent, but with removable mounting.
- Guarded in accordance with federal regulations.
- These guards must remain in place and should only be removed for maintenance purpose after locking-out the machine.
- Lockout/Tagout procedures must be observed when access to area is necessary and in accordance with federal regulations.

Safety Disconnects

- Located on panel – interrupts all electrical power for machine lockout capability.
- Located on machine – interrupts pneumatic power for machine lockout capability.
- Located on Hydraulic Pump (if applicable) interrupts pneumatic power for machine lockout capability.



SHUT DOWN PROCEDURES

The information contained within this portion of the overall safety section of the manual is designed to provide Columbia customers with instructions regarding proper shut-down procedures pertaining to this machinery.

Columbia Machine recognizes and strongly advises the use of two different and totally independent stages of safe and reliable shut-down procedures. The two stages provide affected operators and authorized personnel with methods of protection against the possibility of personal and machine mishaps.

These two stages are described on the following page.

SHUT DOWN PROCEDURES

Level 1

Press Controlled Stop. Press E-Stop Lockout Main Power, Pneumatic Power and Hydraulic Power, if applicable. Once Lockout is achieved, this level can be used to gain access to limited areas of the machine for light maintenance and the clearing of jams.

DO NOT enter the Hoist area during this level of shut down.

Level 2

Press the Controlled Stop Pushbutton. Use the manual functions to place the hoist on the safety pins or lower the hoist to the full down position after the hoist is positioned. Press the E-Stop. Lockout Main Power, Pneumatic Power and Hydraulic Power, if applicable. Once lockout is achieved at Level 2 all maintenance procedures can be performed.



SAFETY PRECAUTIONS REVIEW

The preceding text has presented a broad comprehensive view of information in association with the use of this equipment. Operating and maintenance personnel must use extreme caution when installing, inspecting, operating, repairing and maintaining this equipment. **DO NOT** attempt these functions without first initiating the safety procedures stated in this text. Be especially cautious to avoid electrical shock in all circuits.

Keep in mind that as operators and maintenance personnel, you have a direct safety responsibility to members of your crew. Any affected Co-workers must be instructed on the safety precautions associated with this equipment. Each affected Co-worker must know where the operating and emergency stop controls are located, where potentially unsafe areas might be, and, of course, be advised how to work safely around the machine. New personnel should immediately be briefed on established plant safety practices and both affected and authorized personnel should set a good example for other employees by following these practices.

In conclusion, it is the employer's responsibility to implement federal and state plant safety procedures and insure that safe operating practices are implemented when operating and maintaining this machinery. To that end, a brief overview of the program, 29 CFR 1910.147 has been included for reference purposes. This information is intended **only as guide** to Lockout/Tagout procedures and is not intended as a complete program regarding your plant's individual needs and requirements.

For federal regulation assistance, contact the regional offices of the Occupational Safety and Health Administration, and affiliated state agencies in your area.

TYPICAL MINIMUM LOCKOUT/TAGOUT SYSTEM PROCEDURES

GENERAL

Lockout is the preferred method of isolating machines or equipment from energy sources. The following procedure is provided for reference in lockout/tagout program. For developing your lockout-tagout program be sure to utilize the OSHA regulations (CFR 1910.147) and ANSI publication Z244.1-1982, Lockout/Tagout of Energy Sources – Minimum Requirements. Creation and enforcement of the lockout/tagout procedures are vital to the safety of your employees.

LOCKOUT/TAGOUT PROCEDURE

PURPOSE

This procedure establishes the minimum requirements for the lockout or tagout of energy isolating devices. It shall be used to ensure that the machine or equipment is isolated from all potentially hazardous energy, and locked out or tagged out, before employees perform any servicing or maintenance activities where the unexpected energization, start up or release of stored energy could cause injury (Type(s) and Magnitude(s) of energy and Hazards).

RESPONSIBILITY

Appropriate employees shall be instructed in the safety significance of the lockout (to tagout) procedure (Name(s)/Job Titles(s) of employees authorized to lockout or tagout). Each new or transferred affected employee and other employees whose work operations are or may be in the area shall be instructed in the purpose and use lockout of tagout procedure (Name(s) Job Title(s) of effected employees and how to notify).

PREPARATION FOR LOCKOUT OR TAGOUT

Make a survey to locate and identify all isolating devices to be certain which switch(es), valve(s) or other energy isolating devices apply to the equipment to be locked or tagged out. More than one energy source (electrical, mechanical, or others) may be involved. (Type(s) and location(s) of energy isolating means).

SEQUENCE OF LOCKOUT OR TAGOUT SYSTEM PROCEDURE

1. Notify all affected employees that a lockout or tagout system is going to be utilized and the reason therefore. The authorized employee shall know the type and magnitude of energy that the machine or equipment utilizes and shall understand the hazards thereof.
2. If the machine or equipment is operating, shut it down by the normal stopping procedure (depress stop button, open toggle switch, etc.)
3. Operate the switch, valve, or other energy isolating devices (s) so that the equipment is isolated from its energy source(s). Stored energy (such as that in springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam or water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down, etc (Type(s) of Stored Energy – methods to dissipate or restrain).
4. Lockout and/or tagout the energy isolating devices with assigned individual lock(s) or tag(s) (Method(s) Selected; i.e., lock tags, additional safety measures, etc.)
5. After ensuring that no personnel are in the immediate area and to confirm that the machine is at zero energy, push/turn the pushbutton on the control panel to the “ON” or “AUTO” position to make certain the equipment will not start. (Type(s) of Equipment checked to ensure disconnections).

**CAUTION**

Return operating control(s) to “neutral” or “off” position after the test.

6. The equipment is now locked out or tagged out.

RESTORING MACHINES OR EQUIPMENT TO NORMAL PRODUCTION OPERATIONS

1. After the servicing and/or maintenance are complete and equipment is ready for normal production operations, check the area around the machines or equipment to ensure that no one is exposed.
2. After all tools have been removed from the machine or equipment, guards have been reinstalled and employees are in the clear, remove all lockout or tagout devices. Operate the energy isolating devices to restore energy to the machine or equipment.

PROCEDURE INVOLVING MORE THAN ONE PERSON

In the preceding steps, if more than one individual is required to lockout or tagout equipment, each shall place his/her own personal lockout device or tagout device on the energy isolating device(s). When an energy isolating device cannot accept multiple locks or tags, a multiple lockout or tagout device (hasp) may be used. If lockout is used, a single lock may be used to lockout the machine or equipment with the key being placed in a lockout box or cabinet which allows the use of multiple locks to secure it. Each employee will then use his/her own lock to secure the box or cabinet. As each person no longer needs to maintain his or her lockout protection, that person will remove his/her lock from the box or cabinet (Name(s)/Job Title of employees authorized for group lockout or tagout.)

BASIC RULES FOR USING LOCKOUT OR TAGOUT SYSTEM PROCEDURE

All equipment shall be lockout or tagged out to protect against accidental or inadvertent operation when such operation could cause injury to personnel. Do not attempt to operate any switch, valve, or other energy isolating device where it is locked or tagged out.



LOCKOUT (OR TAGOUT) PROCEDURE

Entry No.	Description
1.	Name of Company
2.	Type(s) and Magnitude(s) of energy and hazards
3.	Name(s)/Job Title(s) of employees authorized to lockout or tagout
4.	Name(s)/Job Title(s) of affected employees and how to notify
5.	Type(s) and Location of energy isolating means
6.	Type(s) of Stored Energy - methods to dissipate or restrain
7.	Method(s) Selected i.e., locks, tags, additional safety measures, etc.
8.	Type(s) of Equipment checked to ensure disconnections
9.	Name(s)/Job Title(s) of employees authorized for group lockout or tagout

Ref. FR 29 CFR 1910.147
FR Vol. 54 No. 169 Friday, September 1, 1989
Federal Rules & Regulation

The Columbia Palletizing system is designed to be totally automated requiring no operator interface under normal operating conditions. However, personnel are occasionally needed to clear product and pallet jams, as well as regularly maintain the equipment. These events may require the operator or maintenance personnel to enter hazardous areas of the system. In addition to the Lockout/Tagout procedure, it is encouraged that trained employees work safely and use proper safety equipment (when needed) to avoid possible personal injury.

Any affected employee must be instructed on the safety precautions and protective devices associated with operating and maintaining any Columbia Machine equipment. It is the employer's responsibility to provide Personal Protective Equipment (PPE) to any employee exposed to any hazardous conditions to prevent possible injury (ref OSHA 1910.132).

In conclusion, it is the employer's responsibility to implement federal and state safety procedures and insure that safe operating practices are implemented when operating and maintaining any Columbia Machine equipment.

For federal regulation assistance, contact the regional offices of the Occupational Safety and Health Administration (OSHA), and affiliated state agencies in your area.

FALL PROTECTION

On occasion, an employee is required to climb onto/into the palletizing section to clear product jams or service the equipment. It is recommended that any employee working above an elevation of 4 feet above the ground, or work platform, use a Fall Arrest System or Safety Harness for fall protection. Any affected employee must be instructed on the proper use of these safety devices.

ERGONOMIC HEAVY LIFTING

On occasion, machine operator intervention is needed to clear jammed product or pallets. These situations often require the lifting of product and/or empty pallets out of the equipment. Confined spaces and limited access can lead to awkward postures and uneven lifting.

Columbia Machine recommends that any affected employee must be able to lift a single empty pallet (approximately 65lbs) minimum, or any product that is heavier than an empty pallet. A few simple steps can be taken to prevent personal injury while attempting to lift or move heavy objects.

- Properly plan the lift. Assess the weight, shape, and location of the object to be lifted.
- Inspect any pallets before lifting. Sharp edges or wood splinters may be exposed.
- Gloves may improve grip, also protect against wood splinters.
- Use mechanical assist devices or aids (e.g. lifts, hoists, cranes, or pallet jacks).
- Ask for assistance (if needed), use multiple personnel if not accessible with an assist device.
- Use proper lifting techniques (e.g. lifting from the legs and not back).

DEFINITIONS

Affected Employees: An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized Employee: A person who locks or implements a tagout system procedure on machines or equipment. An authorized employee and an affected employee may be the same person when the affected employee's duties also include performing maintenance or service on a machine or equipment which must be locked or a tagout system implemented.

“Capable of Being Locked Out”: An energy isolating device will be considered to be capable of being locked out either if it is designated with a hasp or other attachment or integral part of which, or through which a lock can be affixed, or if it has a locking mechanism built into it. Other energy isolating devices will also be considered to be capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device.

Energized: Connected to an energy source or containing residual or stored energy.

Energy Isolating Device: A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker, a disconnect switch (a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition no pole can be operated independently), a slide gate, a slip blind, a line valve, a block, and any similar device used to block or isolate energy. The term does not include a pushbutton, selector switch, and other control circuit type devices.

Energy Source: Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Lockout: The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout Device: A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment.

Normal Production Operations: The utilization of a machine or equipment to perform its intended production function.

Servicing and/or Maintenance: Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning, or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization of start-up of the equipment or release of hazardous energy.

Tagout: The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated.

Tagout Device: A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.



Columbia Machine, Inc.

Customer Care Department
1-800-628-4065

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SECTION 1

GENERAL INFORMATION

The Model HL4200 is a high level case palletizer designed to automatically stack product on the pallets or slip sheets and discharge completed loads for shipment or storage.

The following pages will describe the purpose and components of each section of the palletizer. These pages also contain important installation information regarding connection points, weights and measurements.

Technical drawing of the 1000 Series Case, showing front, side, and top views with dimensions and callouts.

Dimensions:

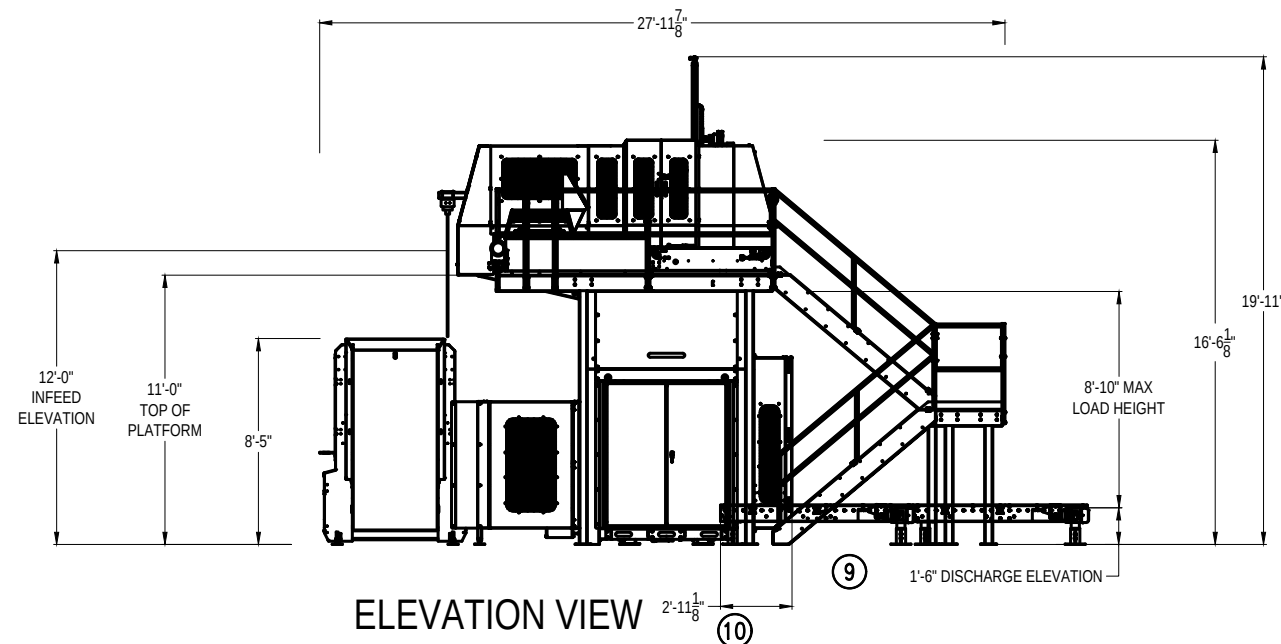
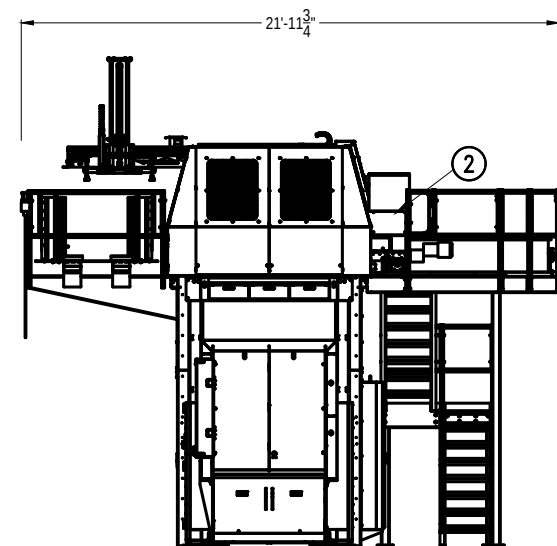
- Overall Width: $18'-4\frac{3}{4}"$
- Overall Depth: $21'-8\frac{5}{8}"$
- Top Section Width: $7'-6\frac{3}{8}"$ and $4'-4\frac{5}{8}"$
- Top Section Depth: $5'-10\frac{1}{2}"$
- Front Section Depth: $5'-8\frac{5}{8}"$, $4'-1\frac{7}{8}"$, $4'-1\frac{7}{8}"$, and $6'-5\frac{1}{4}"$
- Bottom Section Width: $10'-1\frac{1}{2}"$

Callouts:

- 1: Bottom front view
- 2: Bottom left corner detail
- 3: Top left corner detail
- 4: Bottom right corner detail
- 5: Front view (indicated by arrows)
- 6: Left side view
- 11: Right side view
- 13: Bottom right section
- 14: Bottom right corner detail
- 15: Top right section
- 16: Top right corner detail

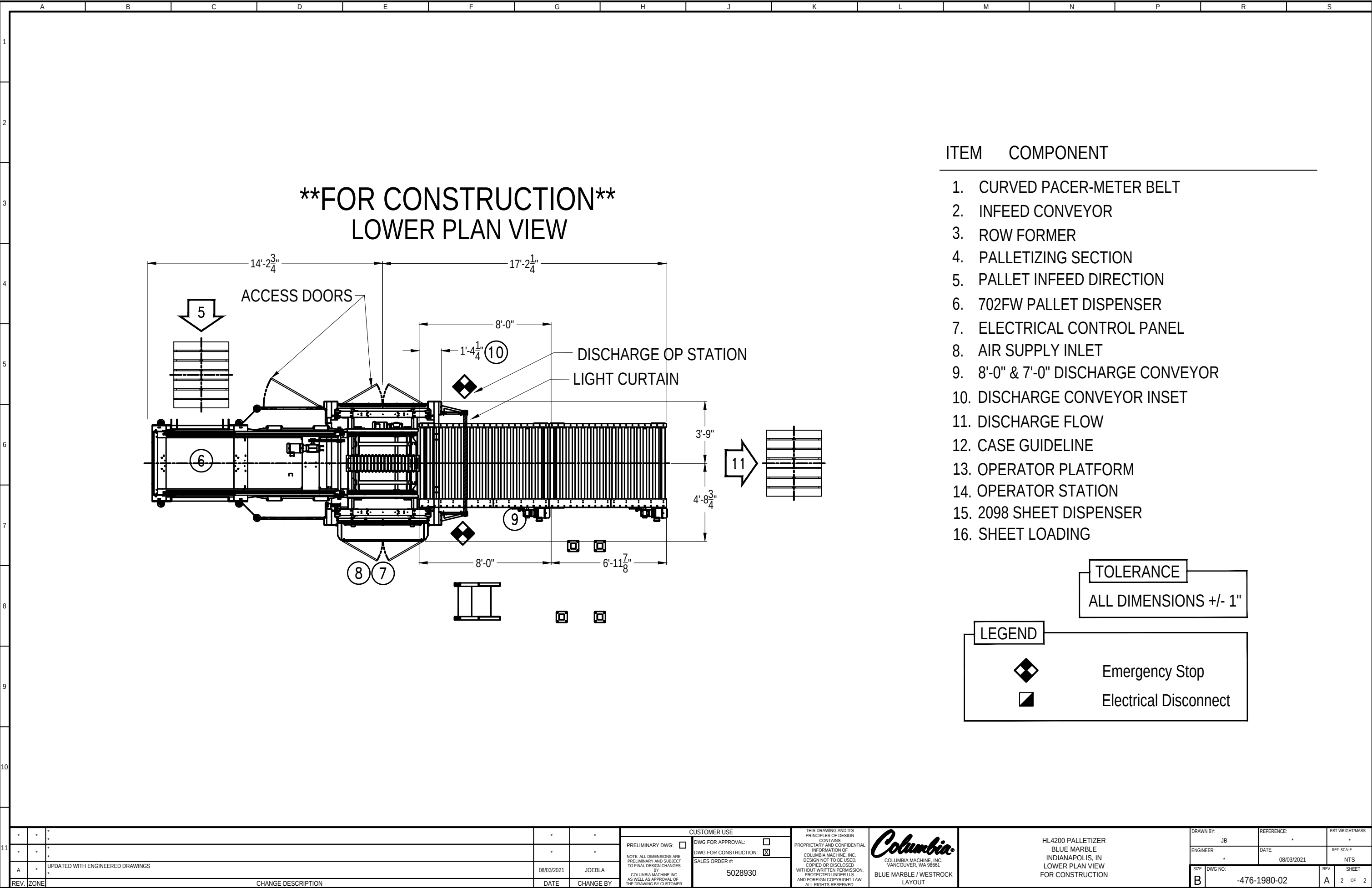
Note: CASE MUST ENTER EDGE ALIGNED

- TOLERANCE**
ALL DIMENSIONS +/- 1"
- LEGEND**
- | | |
|---|-----------------------|
|  | Emergency Stop |
|  | Electrical Disconnect |



ELEVATION VIEW

* * *		* *		CUSTOMER USE		THIS DRAWING AND ITS PRINCIPLES OF DESIGN CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION OF COLUMBIA MACHINE, INC. DESIGN NOT TO BE USED, COPIED OR DISCLOSED WITHOUT WRITTEN PERMISSION. PROTECTED UNDER U.S. AND FOREIGN COPYRIGHT LAW. ALL RIGHTS RESERVED.		 COLUMBIA MACHINE, INC. VANCOUVER, WA 98661 BLUE MARBLE / WESTROCK LAYOUT	HL4200 PALLETIZER BLUE MARBLE INDIANAPOLIS, IN UPPER PLAN & ELEVATION VIEWS FOR CONSTRUCTION	DRAWN BY: JOEBLA		REFERENCE: *		EST WEIGHT/MASS: *	
* * *		* *		PRELIMINARY DWG: ☐ DWG FOR APPROVAL: ☐ DWG FOR CONSTRUCTION: ☒ SALES ORDER #: 5028930		ENGINEER: SAMKNI				DATE: 08/03/2021		REF. SCALE: NTS			
A		08/03/2021		JOEBLA		COLUMBIA MACHINE INC. AS WELL AS APPROVAL OF THE DRAWING BY CUSTOMER.				SIZE: B		REV: A		SHEET: 1 OF 2	
REV. ZONE		CHANGE DESCRIPTION		DATE		CHANGE BY				DWG NO.		-476-1980-04			
* UPDATED WITH ENGINEERED DRAWINGS															



MODEL HL4200 CASE PALLETIZER

DESCRIPTION/OPERATION

The Columbia Model HL200 Case Palletizer is a high level, high speed machine, utilizing electric and pneumatic systems. The HL6200 uses a multi-stage, lowering conveyor beneath the upper layer accumulation area. This feature allows product to be formed, layer by layer on a waiting pallet that has been lifted up and positioned directly under the stripper apron. This function permits several pre-determined layers of product to be stacked without the time consuming hoist re-positioning, thereby increasing product layer and completed load cycle speeds. Machine speeds are directly related to the pattern configuration and case dimensions.

INFEED ASSEMBLY

Product enters the machine at the infeed assembly. This unit is a powered three-stage conveyor. These stages, in operational sequence, are the pacer belt, meter belt, and turning device. As product is presented to the pacer belt it is moved forward and accumulates up to the meter belt area where it hesitates slightly, staging one unit of product forward onto the meter belt at a time by designed speed differential between the two belts through gearing. Necessary spacing between units of product occurs at this point.

As the product continued forward onto the infeed rolls, following a pre-determined product guide line, turning devices and assists are activated to initiate product arrangement of each layer of the final load. This is accomplished by pre-programmed engagement of rollers (some equipped with poly sleeves to assist in turning products) and a cylinder activated turn device. From this point product is transferred to the row pusher section of the row former.

ROW FORMER

The row former is a two-stage product layer forming and accumulation area. This section permits the actual arrangement of each layer of a load by pre-programmed interlocking patterns. The first area (row pusher section) receives product unit by unit forming one complete row consisting of the required quantity of product and required arrangement. At this point the row is transferred forward by means of a chain driven flight pusher onto the layer table. This cycle continues to be repeated as each layer formed on the layer table area is placed onto a waiting pallet previously position by the pallet dispenser resting on the full load conveyor, or a layer of product previously placed on the pallet.

PALLETIZING SECTION

The palletizing section is made up of several components designed to process layers of product both horizontally and vertically.

The horizontal transfer device which allows horizontal to vertical transition of product is the stripper plate. Product is moved in a selected pattern onto the stripper plate by the row former, row by row. Once a full layer has been formed and properly aligned by the selected retainer, the stripper plate is retracted and the layer of product is deposited on a raised pallet or a previously deposited layer of product positioned by the palletizing section hoist. As each layer of product is added, the hoist stages downward until a pre-determined load of product has been formed. Once the full load of product has been formed, it is then automatically moved out from the palletizing section by the full load conveyor onto the discharge conveyor for removal and shipping or stage. As the removal of a load occurs, the pallet dispenser provides the next pallet, which is moved forward on powered rollers into position on the hoist surface. The pallet is raised into position beneath the hoist and the cycle repeats itself as required.

PALLET DISPENSER

The pallet dispenser, upon demand, will insert a pallet onto the full load conveyor to be loaded with a completed load from the palletizing section. The pallet dispenser holds several pallets in a hopper providing them to the loading area one at a time according to a pre-determined program. The hopper is loaded from the top and pallets are then dispensed singularly from the bottom by means of a transfer carriage.

SHEET DISPENSER - 6098

Functionally the sheet dispenser places tie sheets onto a completed layer, providing a firm base of stability for the completed load. This occurs according to the resident program within the control panel. As each sheet is required, suction cups mounted on a carriage move out over a stack of tie sheets in the sheet dispenser hopper. The hoist of this assembly lowers allowing sheet pick up, then elevates the sheet to the desired level. The carriage moves in over the selected layer of product, deposits the sheet and returns to its previous location over the sheet stack repeating its function as required by the program.

INSTALLATION PROCEDURES - MODEL HL6200

The complete palletizer is modular in design and made up of the following major components. Extreme care must be taken when maneuvering these assemblies with lifting equipment.

Refer to the plant layout drawings and installation prints provided. Identify the exact location of the machinery within your facility. Check all dimensions and measurements of the location with the installation prints for accurate placement of the machinery **PRIOR** to unloading and locating the equipment within your plant.

The entire assembly is composed of the following:

- Infeed Assembly
- Upper Main Frame
- Lower Main Frame
- Full Load Conveyor
- Pallet Dispenser
- Sheet Dispenser
- Discharge Conveyor
- Machinery Guarding

Mechanical, electrical, and pneumatic connections are 'match-point' labeled for ease of identification and subsequent assembly.



DO NOT attempt to maneuver, transport or lift any components with devices that are not properly secured. Damage to the machinery and components due to improper lifting and handling could adversely affect installation and operation.

The recommended sequence of installation is as follows:

- Re-assemble main frame (if disassembly was required)
- Re-string chains for the hoist conveyor
- Infeed Conveyor
- Pallet Dispenser
- Attach hoses, pipes, tubing and inter-electrical system
- Machine Perimeter Guarding
- Connect plant electrical and pneumatic power.

**DANGER**

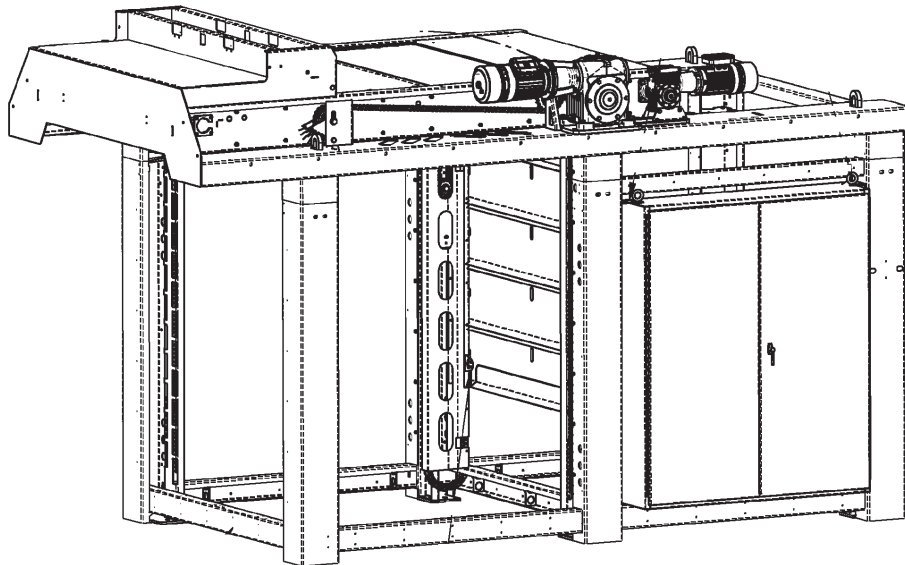
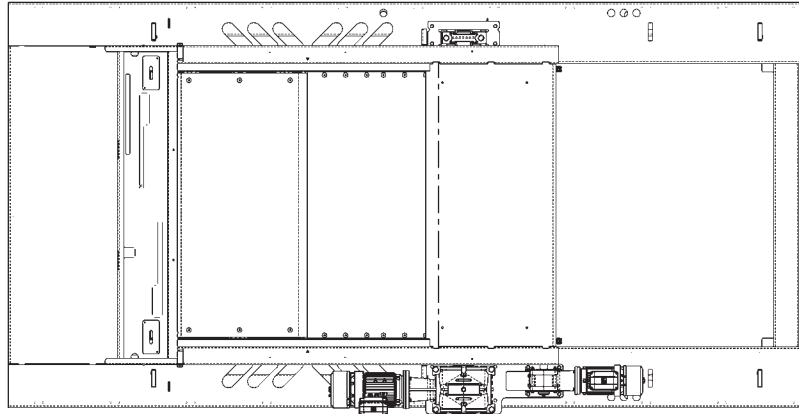
DO NOT climb on, over, or under any portion of the machinery when it is being moved or suspended during installation.

**WARNING**

DO NOT start machinery until all shipping devices (straps, blocks, hold-downs, etc.) have been removed from their locations. All installation personnel and support staff must be cleared from the area of machinery operating at time of start up with only the designated/authorized operator remaining in the immediate area.

Refer to Section 2, Electrical Controls, for start-up procedures.

PALLETIZING SECTION - MODEL HL6200



PALLETIZING SECTION - MODEL HL6200

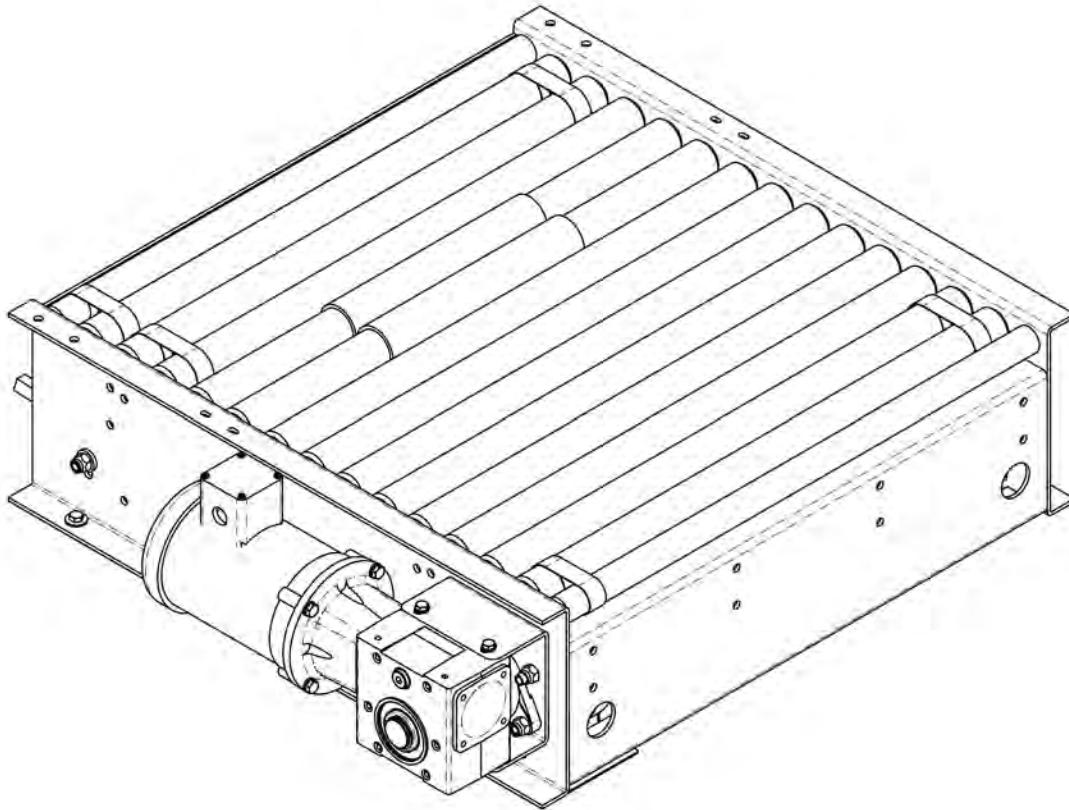
This section includes the main frame, hoist, stripper plate and pusher assemblies. Products are transferred from the infeed to the pusher section by belt driven rollers and are formed into single rows. These single rows are transferred from the pusher section to the modular plastic belt layer table by the overhead pusher.

After a complete layer is formed, it is transferred to the stripper plate. The stripper plate is then retracted and the layer is 'stripped' onto the hoist. This is an electric motor/chain actuated hoist that lowers as each layer is stripped. After the last layer, the completed load lowers to the bottom position and is automatically discharged from the machine. Then a new pallet is dispensed into position on the hoist.

Components -

- Chain driven flight bars
- Full layer accumulation zone
- Four-point lift hoist assembly - right and left hand gearboxes, input shaft, and Demag electric brake motor
- Pneumatic side layer guide
- Main frame
- Stripper plate - rack and pinion drive, electric brake motor, and gear reducer
- V-belt driven pusher rollers - gearbox and electric motor

INFEEED ASSEMBLY



PACER/METER BELT



NUMBER OF CONNECTIONS

Lube.....0
Hyd.0
Elect.....3
Air0

WEIGHT AND MEASUREMENTS

Length.....8'-0'
Width.....21"BF
Height..... 11-5/8"
Weight.....1,100 lbs.

PACER / METER BELT

The infeed assembly is a modular unit and as such is shipped in one piece, pre-assembled, using the following major components:

- Pacer Belt
- Meter Belt

INSTALLATION

Locate the mounting holes, level the infeed rolls with the row forming rolls and tighten the mounting bolts.

TENSIONING AND TRACKING BELTS

- 1) Be sure the frame is square. Assemble shafts so that they are parallel to each other and square to the frame. Measure from the end of the frame to the center of each shaft on both sides to ensure they are parallel. Measure to the edge of each pulley to make sure they are in line.
- 2) Install the snubber rolls so they are parallel to the drive and idler roller. Initial installation should be at the center of the take up slot.
- 3) With the conveyor turned off, tension belt until the belt just conforms to the pulley crowns. There should be no play between the edge of the belt and the crowned pulleys. Be sure to take up equal amounts on each side so shafts remain parallel.
- 4) Now operate the belt conveyor and observe closely to see if there is any slippage at the drive pulley and the belt. If slippage occurs, more tension is needed. Be sure to not over tension the belt.
- 5) Track belt with snubber rollers only. The belt moves toward the end of the roll it contacts first. With the belt empty and running, adjust the snubber closest to the driver pulley. Let the belt run for several revolutions after each adjustment. Try to spread the adjustment event between the two snubber rollers.
- 6) Verify tracking with full load and adjust if needed.

702FW PALLET DISPENSER





702FW PALLET DISPENSER

The pallet dispenser is shipped in one (1) piece, assembled, using the following components:

- Dispenser Frame
- Dispenser Conveyor Section

INSTALLATION

The pallet dispenser contains a replenishable predetermined quantity of pallets to be injected into or onto a receiving station one at a time. This pallet then becomes a stable platform for product being processed for shipping.

Once the dispenser has been moved into position next to the palletizing section according to the plant layout, insert jacking bolts into the brackets provided at all four points and lower assembly.

- Move the dispenser toward the palletizing section and connect by bolting connecting plates to both the palletizing section lower frame and the pallet dispenser frame.
- Using a right angle and a spirit level, check alignment to palletizing section.
- Use jacking bolts previously inserted to level assembly matching results of previous step.
- Once alignment is set, bolt dispenser to floor using adjustable brackets provided
- Restring dispenser chains.
- Connect all pneumatic and electrical transmission lines. Attach according to match point labeling.
- Check all connectors and fasteners for proper tension. Tighten as required.

SOFT TURN INFEED

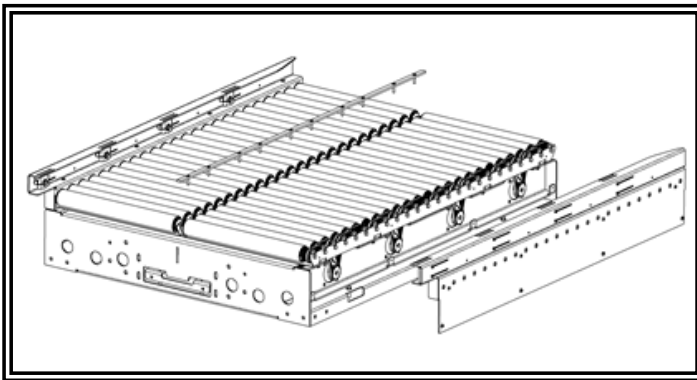
The standard Soft Turn has 4 zones of rollers. Each zone one motor on the left driving several rollers and one motor on the right driving rollers. A total of 8 motors. Capable of turning 90 clockwise, 90 counterclockwise, 180 degrees, or run (not turned). The standard zone length is 13.5 inches. Gaps between product must be kept larger than this for turn consistency.

Servo motors directly drive poly-V belts which power the rollers. The servos have integrated controls with PWM generators used to control RPM. 75 Volt DC power supplies the motors.

MAINTENANCE

Rollers may need to be replaced if bearings fail or roll covers become excessively worn. Poly-V drive belt tension is not adjustable. Poly-V belts may be replaced if excessive wear is present. Bearings are sealed for life. No other lubrication required.

Replacing Belts or Rollers



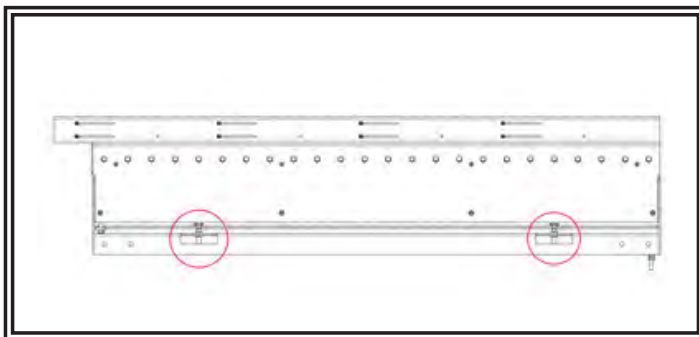
Remove 8 fasteners holding the side belt covers on.

Remove side belt covers.

Remove center bar hold-down.

Belts and rollers can now be accessed for replacement.

Adjusting “V” (Roller Deck Angle)

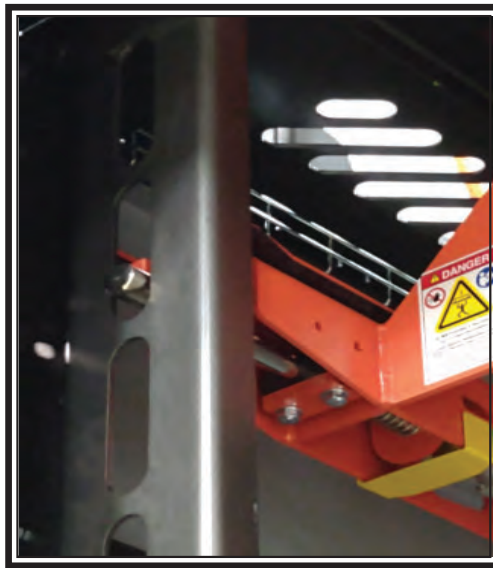


Each side of the conveyor has jacking screws under the outer edge below the belt covers. Raising the jacking screws will increase the “V” (or angle of roller deck) and allow cases with rounded bottoms to turn more consistently.

HOIST LOCKS AND PINS

Columbia palletizing equipment has been designed to accomplish a specified task safely and efficiently. To that end a variety of area designated guards and safety devices are incorporated into the design of our machinery to assist in preventing injury to personnel and/or machine damage.

One such device, on machinery with product lifting mechanisms (i.e., elevator/hoist) are Hoist Locks, installed to prevent accidental lowering of the hoist during maintenance and/or repair. These are located at the Full Load Conveyor Hoist.



The hoist position retainer is a series of slots attached to the frame that are engaged with a steel dog (Hoist Lock) automatically if pneumatic power is lost from the system. This will occur automatically in an SOA or Lockout condition. This can be done from the HMI with the “Insert Hoist Locks” button. It can be retracted manually from the HMI.

The standard Hoist Pin (located on the sheet dispenser) acts as a mechanical stop that requires physically locking out machine power in addition to locating and inserting the pin manually. Refer to safety data at the beginning of the manual for procedures.

OPERATION

The pneumatic cylinders prevent the retainers from engaging with slots in the frame during normal operation. The retainers are spring loaded and will insert into the frame slots when pneumatic power is lost.

MACHINE GUARDING

Guards appearing on the machine have been designed for the purpose of prompting safe operation of the machinery and to reduce the possibilities of personal injury and/or machine damage. All shields, guards and safety devices need to be in place at all times.

If a shield, guard or safety device has been removed for any purpose, or is damaged or missing, repair or replace that particular assembly before any machine operation is begun.



WARNING

If circumstances require removing a shield, guard or safety device, or entering or getting onto the machine for any purpose, for your safety you **MUST 'LOCK OUT'** the electrical main power disconnect switch, the ball valve on the pump unit, and the pneumatic lock-out device(s) with a padlock **BEFORE** check out is begun. The designated operator or repairman must keep the key(s) until the problem is resolved and all guarding that might have been removed has been replaced. Do **NOT** restart machinery until all personnel are clear of the area.



IMPORTANT

Refer to the SAFETY INFORMATION section located at the beginning of this manual for additional safety procedures regarding machine operation, repair and maintenance.

INSTALLATION CHECK

Upon completing the installation of all components of the palletizing system initiate the following checks before beginning operation.

**WARNING**

The installation check requires placing yourself and possibly members of your crew on, over and under the various sections of the machinery. Therefore, for your safety you **MUST 'LOCK OUT'** the electrical main power disconnect switch, the pneumatic lock-out device(s) with a padlock **BEFORE** check out is begun.

The entire system must be level and properly aligned to the palletizing section to function properly. Begin the installation check at that point.

Through the use of a square and plumbing device, set horizontal and vertical adjustments through right angle alignments. Additionally, it may be necessary to place shims under the foot pads of the various assemblies (as applicable) to allow accurate leveling due to possible irregularities in the surface of the floor. Once the alignment, leveling, and inter-component attachments are completed and are double checked, bolt the foot pads to the floor to finalize this stage of the installation.

**NOTE**

Remove any unnecessary blocking at this time and other non-functional restraining devices used for shipping purposes.

- Check that ALL shipping devices/restraints have been removed.
- Check belts for correct tension.
- Check chains for slack or overtightening.
- Check pneumatic lines and component connections.
- Check lube system for leaks or over-lubrication.
- Check all rollers, wheels, sprockets, and tensioners for correct setting.
- Check electrical fittings and connections
- Check gearboxes for proper level of lubricant.



- Check all system connecting brackets for tightness.
- Check all fasteners, nuts, bolts and lockwashers for tightness.
- Check operation of all safety devices.
- Check safety interlocks for correct operation.
- Check that ALL guards are in place and tightly secured.
- Check all decals, signs and tags for pertinent safety information.

Refer to plant layout drawings, electrical diagrams, and pneumatic drawings for location of connections.



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IMPORTANT NOTICE

THE FOLLOWING PATTERN INFORMATION IS INCLUDED FOR YOUR REFERENCE AND IS REPRESENTATIVE OF PRODUCT ARRANGEMENT REQUIREMENTS ESSENTIAL AT THE TIME OF MACHINE MANUFACTURE ONLY.

FOR INFORMATION ON ADDITIONAL PATTERNS ADDED AFTER MACHINE MANUFACTURE AND INSTALLATION, CONTACT THE FOLLOWING:

COLUMBIA MACHINE, INC.
SERVICE DEPARTMENT
107 Grand Blvd.
Vancouver, Washington 98661
(360) 694-1501

OSHA Exception to Lockout - Minor Servicing

OSHA 1910.147(a)(2)(ii)(B) "Minor Service Exception to Lockout/Tagout" describes exceptions to Lockout/Tagout, as long as certain criteria are met. ANSI Z244.1-2003(R2008) "Control of Hazardous Energy – Alternatives to Lockout" includes recommendations for developing safety programs incorporating the Minor Service Exception.

Minor Servicing is limited to tasks which are approved by the OSHA Exception to Lockout/Tagout - Minor Servicing [OSHA 1910.147(a)(2)(ii)(B)]. These tasks are covered under the standard if they are "routine, repetitive, and integral to the use of the equipment for production". Your equipment may be provided with trapped key gate interlocks that meet the intent of OSHA's minor servicing guidelines.

The trapped key system is coupled with CAT3 automatic air dump/s. The trapped key system is a series of interlocking keys used consecutively to place the machine in a power safe condition allowing limited entry to perform approved minor servicing tasks. Minor Servicing requires the operator performing the work to retain the final key in the system in their possession at all times while in the machine. **No personnel may enter the machine at any time during a Minor Servicing operation if they do not have possession of the key.** Situations requiring multiple personnel are not covered by Minor Servicing and would require compliance with Lockout/Tagout procedures.

Every situation, application and environment involving palletizing equipment is unique. **Columbia Machine requires a Risk Assessment by the end user to determine if the Minor Servicing procedure is appropriate at your facility BEFORE implementing this protocol.** Please give careful consideration to every task being evaluated for minor servicing, taking into account the unique environment and conditions of your facility, as well as your company's safety policies. Minor Servicing may not be compatible for the conditions at your facility.

Minor servicing may be used in lieu of Lockout/Tagout only after the task has been evaluated by your company and deemed appropriate. Remember that all tasks require strict adherence to OSHA Lockout/Tagout standards. **No tools may be used during the performance of any Minor Servicing task.**

The tasks that could be considered “minor servicing” are:

- 1.) Clearing Product Jams
- 2.) Clearing Fallen Product
- 3.) Clearing Pallet Jams
- 4.) Clearing Product Debris
- 5.) Clearing Pallet Debris

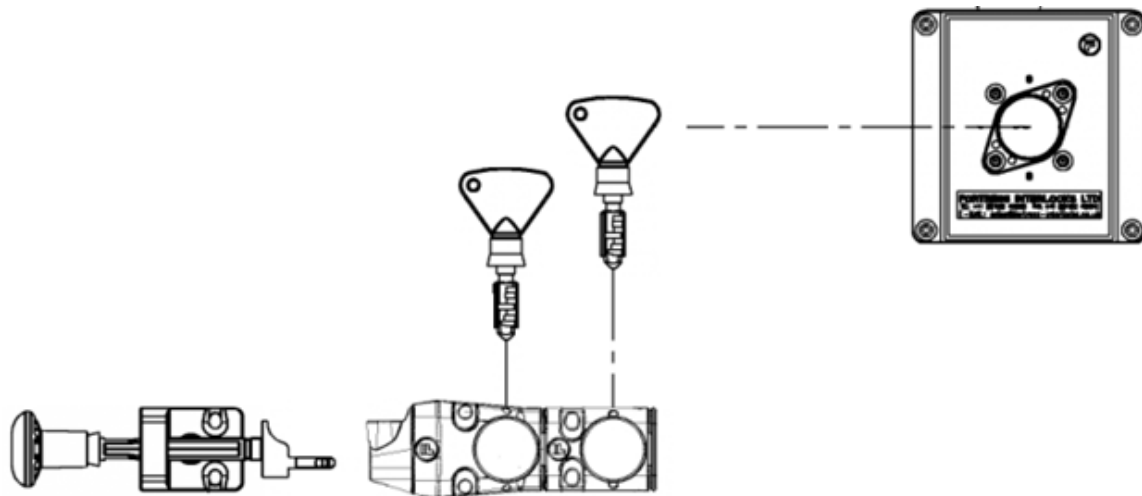
Any task that does not match the descriptions of the five tasks listed above must be performed following the OSHA Lockout/Tagout protocol. There are no exceptions to this requirement.



This symbol indicates a recommended Minor Servicing area



This symbol indicates **NOT** a minor servicing area.



The picture above is an example of a trapped key interlocked switch.

If entering the Palletizer for Minor Servicing, follow this procedure:

- 1.) Stop the Palletizer by pressing the Controlled Stop push button.
- 2.) Press the Emergency Stop push button.
- 3.) Verify that the red light is solid.
- 4.) Remove the trapped key from the control panel or STA1.
- 5.) Use the trapped key to release the Red Personnel Key at the guard door.
- 6.) Retain the Red Personnel Key while in the machine. Minor Servicing requires the operator performing Minor Servicing to retain the Red Personnel Key in their possession at all times while in the machine. This will ensure that the system cannot be activated while the task is performed in the perimeter guarding area.

No personnel may enter the machine at any time during a Minor Servicing operation if they do not have possession of the Red Personnel Key.

- 7.) After the minor service task is complete, exit the perimeter guarding area.
- 8.) Verify all personnel are clear of perimeter guarding area and all conveyors outside of the perimeter guarding area.
- 9.) Close guard door, latch door, insert and turn Red Personnel Key, and re move the trapped key.
- 10.) Return to control panel or STA1 with the trapped key and re-start operation.

SECTION 2

ELECTRICAL INFORMATION

ALLEN BRADLEY CONTROL SYSTEM

Your Columbia equipment is controlled by an Allen Bradley Programmable Controller. This system represents the latest in technology combined with ease of understanding and reliability.

All machine functions are controlled by the Allen Bradley Compact Logix Programmable Control System. This specific control system is completely solid state with the inherent capability of performing the same logic functions as relays, static control, or card logic. It detects changes in the state of input signals from proximity switches and photocell, then acts on these to operate solenoid valves and motor starters through its outputs. Its decisions are made based on a program written into its memory.

This program is written from standard ladder diagram schematics and is easily understood by plant electricians. There is no special programming language.

The basic system consists of a Compact Logix Processor with the appropriate number of input / output modules and motion control modules.

See the control panel layout in this manual for the location of these items in your panel.



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PALLETIZER WITH PANELVIEW DESCRIPTION AND OPERATING INSTRUCTIONS

GENERAL DESCRIPTION OF BUTTONS

EMERGENCY STOP - Illuminated maintained mushroom pushbutton switch used to stop all machine functions when there is danger to personnel or equipment. When illuminated the “Emergency Stop Circuits” are disabled and all control power is disconnected. When not illuminated all control power is enabled.

START UP/SHUT DOWN FUNCTIONS

EMERGENCY STOP ENABLE- Illuminated pushbutton used to enable the “Emergency Stop Circuitry” and the safety seal-in-circuit. After the operator presses this pushbutton the pushbutton will illuminate indicating the “Emergency Stop Circuitry” is enabled and the safety seal-in-circuitry is enabled. The pushbutton will stay illuminated as long as none of the EMERGENCY STOP buttons are pushed. The pushbutton will stay illuminated as long as none of the safety entry photocell/switches are blocked or opened. The safety entry photocells/switches are around the infeed area, discharge area, or any guard that can be opened.

 NOTE

If equipped with VFD's (Variable Frequency Drives), the Blue Indicator light will blink when the safety circuit is enabled until all of the VFD's are powered on and communicating with the PLC (Programmable Logic Controller).

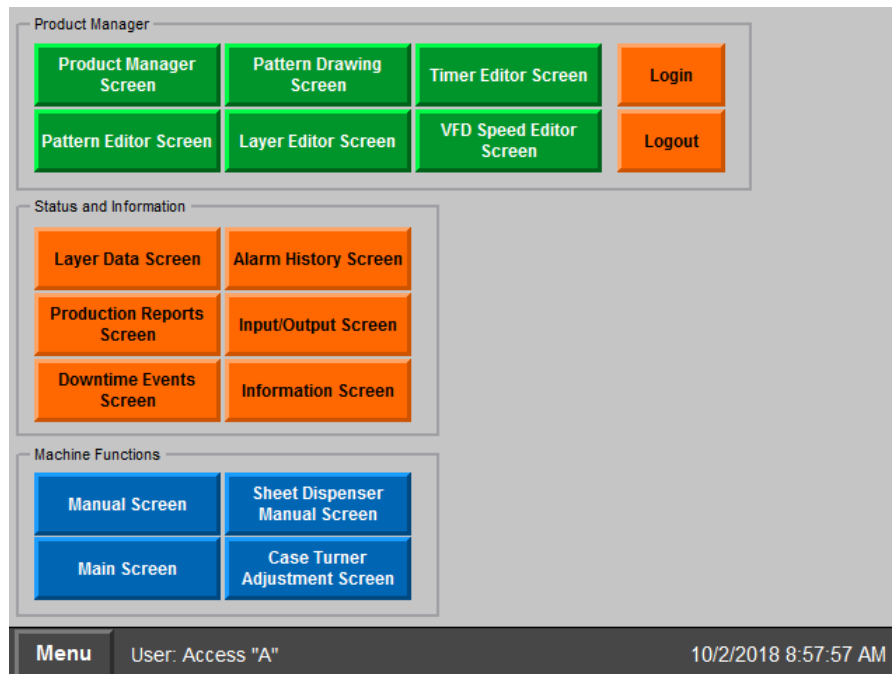
AUTOMATIC CYCLE START - Pushbutton used to resume the automatic cycle of the palletizer. After the operator presses this pushbutton the **AUTOMATIC CYCLE START** pushbutton will illuminate indicating the palletizer is in the automatic cycle or mode.

 NOTE

Whenever the palletizer is put in the automatic cycle or mode, a warning horn will oscillate on and off for six (6) seconds to alert any personnel in the area that the palletizer is going into the automatic cycle or mode. After the six (6) second delay the warning horn will silence and a green strobe beacon will illuminate, indicating the machine is in the automatic cycle or mode.

CONTROLLED STOP - Illuminated pushbutton used to take the machine out of the automatic cycle. Once depressed, the pushbutton will blink until the machine is out of automatic. The pacer belt will stop or grate will pop up, not allowing any more cases into the palletizer. Once all of the machine functions have come to a rest, the machine will be taken out of auto.

MENU



The Menu screen, above, can be accessed by pressing the “Menu” pushbutton located on the bottom left corner of all screens. From here you will have access to other functions and features of the Palletizer depending on your access level. The text display to the right of the Menu pushbutton shows what user level is currently logged in. This will display the following: Not Logged In, Invalid Entry, Access “A”, Access “B” or Access “C”.

Not Logged In – This will be displayed when no user is currently logged in. The user will not have access to the Product Manager screens when not logged in. All other features will be accessible.

Invalid Entry – If an incorrect password is entered, this text will be displayed for 10 seconds, then switch back to Not Logged In.

Access “A” – When logged in as user Access “A”, you will now have access to the Product Manager screens.

Access “B” and Access “C” – These accounts are reserved for customer specific requirements, they are not used by default.

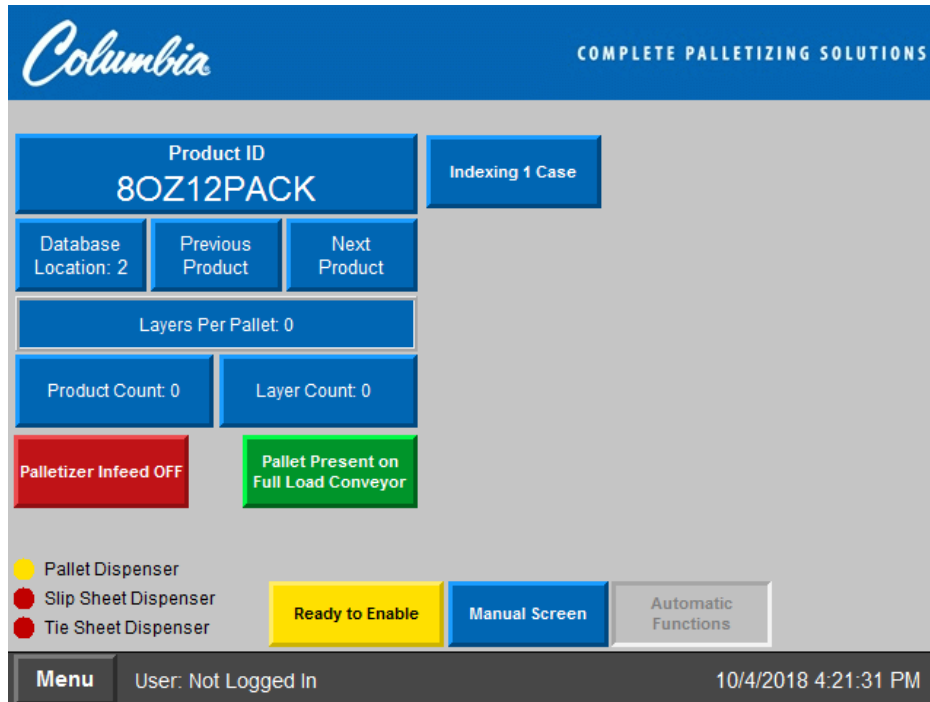
The Menu screen is broken up into 3 sections. Machine Functions, Status and Information and Product Manager. As mentioned above, the Product Manager screens are password protected and the default user (Not Logged In) does not have access to these screens.

Machine Functions – Includes navigating to the Main Screen, Manual Functions for the Palletizer and Manual Functions for optional equipment like Sheet Dispensers, Pallet Dispensers or Conveyor Systems when equipped.

Status and Information – These screens include Alarm History, Production Reports, Downtime Events, I/O Status and the Information Screen. All of these screens are available to the default user.

Product Manager – The Product Manager is a set of screens that will allow the operator to add, delete and modify patterns and parameters for each product they will run on the Palletizer.

MAIN SCREEN



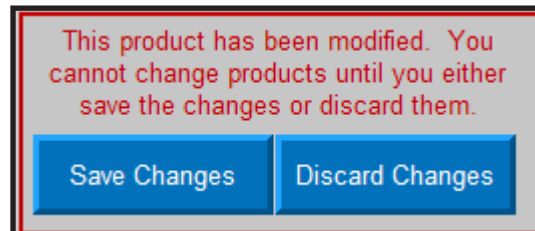
The screenshot shows the main interface of the Columbia Machine. At the top, there is a blue header with the 'Columbia' logo on the left and 'COMPLETE PALLETIZING SOLUTIONS' on the right. Below the header, the interface is divided into several sections. On the left, there is a 'Product ID' section displaying '8OZ12PACK'. To its right is a button labeled 'Indexing 1 Case'. Below the product ID, there are three buttons: 'Database Location: 2', 'Previous Product', and 'Next Product'. Further down is a 'Layers Per Pallet: 0' section. Below that are two buttons: 'Product Count: 0' and 'Layer Count: 0'. At the bottom left, there is a red button labeled 'Palletizer Infeed OFF' and a green button labeled 'Pallet Present on Full Load Conveyor'. Below these buttons, there is a legend with three items: a yellow circle for 'Pallet Dispenser', a red circle for 'Slip Sheet Dispenser', and a red circle for 'Tie Sheet Dispenser'. To the right of the legend are three buttons: 'Ready to Enable' (yellow), 'Manual Screen' (blue), and 'Automatic Functions' (grey). At the very bottom, there is a dark grey bar containing a 'Menu' button, the text 'User: Not Logged In', and the date/time '10/4/2018 4:21:31 PM'.

The Main Screen provides general status of the machine. The top panel on the screen displays alarm information when an alarm is active and a reset button for the alarm if the condition has been corrected.

Product Panel – This upper left region of the screen show information about what product is running, its database location, number of layers in a pallet and product/layer counts. The look will change depending on conditions like whether or not the machine is in the automatic mode, if the current product has been modified.

- When the Palletizer is in Automatic Mode, the Product ID and the Product/Layer counts cannot be changed.
- When the Palletizer is in Manual Mode, Product/Layer counts can be changed.
- When in Manual Mode and the Product/Layer counts are not zero, the Product cannot be changed. The counts must be zero first.

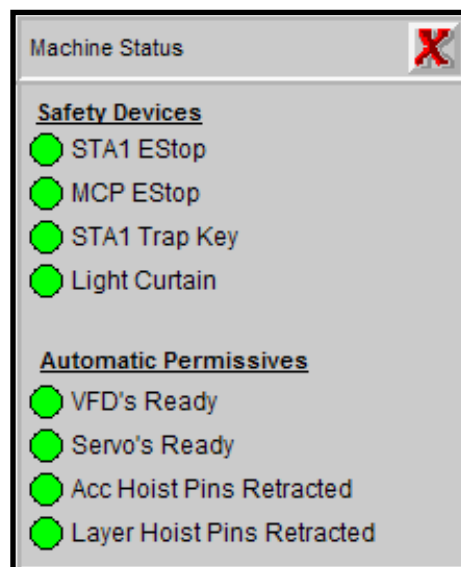
- If there is an unsaved edit to the current running product, the Product ID cannot be changed until the changes are either saved or discarded. In this situation, a message will appear to the right of the Product Panel.



Infeed On/Off Button – Whenever the Palletizer goes out of Automatic Mode, the “Infeed” will automatically switch to “Off”. This way, cases will not start feeding into the Palletizer once in Automatic Mode. The Infeed must be switched back to On.

Pallet Present – Indicates when the machine thinks there is or is not a pallet ready to be stacked onto. Typically this will change to “No Pallet Present” when the pallet discharges from the Palletizer, then will switch back to “Pallet Present” when a new pallet is in position in the load building area. If there is a Pallet staged properly in the machine, and this indicates that there is No Pallet Present, this can be pressed to tell the Palletizer that there is actually a pallet into the machine. This situation can happen if a pallet is manually jogged into the machine, for example.

Palletizer Mode Status – This Pushbutton Indicator shows the following 5 states and if pressed, will bring up a popup screen, showing detailed information. This is shown in the **Machine Status** popup.

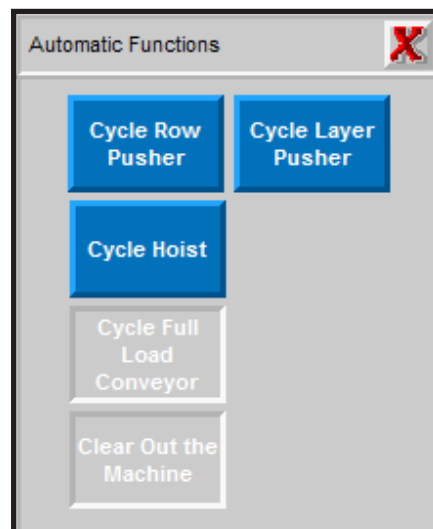


- 1) Safety Device Activated (Red) – An emergency stop is pressed, door switch is open, trap key is removed or light curtain is blocked.
- 2) Ready to Enable (Yellow) – Indicates ready for Emergency Stop Enable.
- 3) Missing Automatic Permissive (Yellow Blink) – One or more permissive for automatic mode is missing. These can include a Hoist Pin, VFD/Servo not ready.
- 4) Ready for Automatic – All permissive for automatic mode are met, pressing Automatic Cycle Start will put the Palletizer in Automatic Mode.
- 5) Running in Automatic – The Palletizer is running in Automatic Mode.

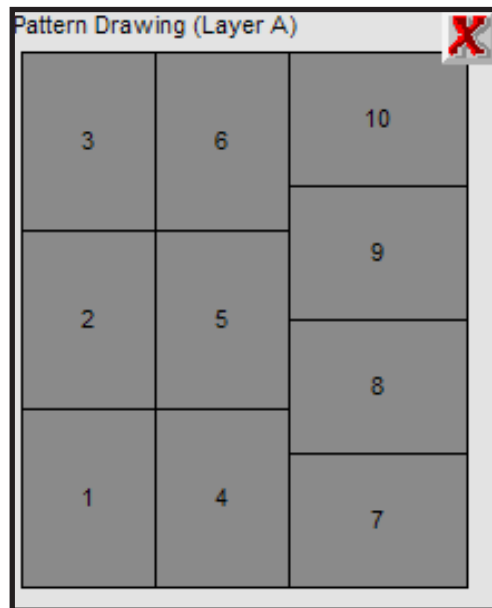
Send n Cases into Machine – You can use this feature to send a specific number of cases into the Palletizer while in Automatic Mode. This is typically used for testing new products.

Manual Functions – Switches to the Manual Functions screen for quick access to the Manual Functions. This is only available when the Palletizer is in the Manual Mode.

Automatic Functions – This is a panel popup that gives access to the “Automatic Functions”. Automatic Functions can include “Cycle Row Pusher”, “Cycle Layer Pusher”, “Cycle Hoist”, “Cycle Full Load Conveyor” and “Clear Machine”. These functions will tell the Palletizer to perform one of the functions that happen in Automatic Mode. For example, Cycle Layer Pusher will transfer a layer from the Layer Table to the Hoist. These differ from Manual Functions in that they will complete each cycle in the same way that the Palletizer normally would when running product. These can be useful when recovering from a jam.

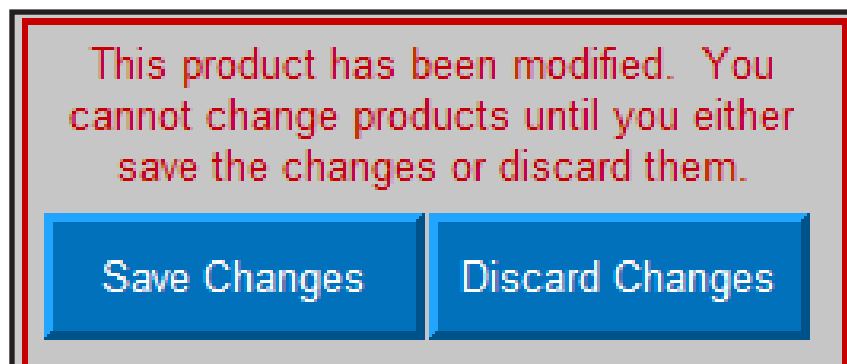


Pattern Drawing – A popup panel that shows the drawing of the current product pattern that was drawn in the Pattern Drawing Editor (Product Manager). Each case will indicate as it enters the machine. Also displays which layer is currently being built (A,B,C). This can be useful for selecting the appropriate Product to run, or a reference to how the pattern forms.

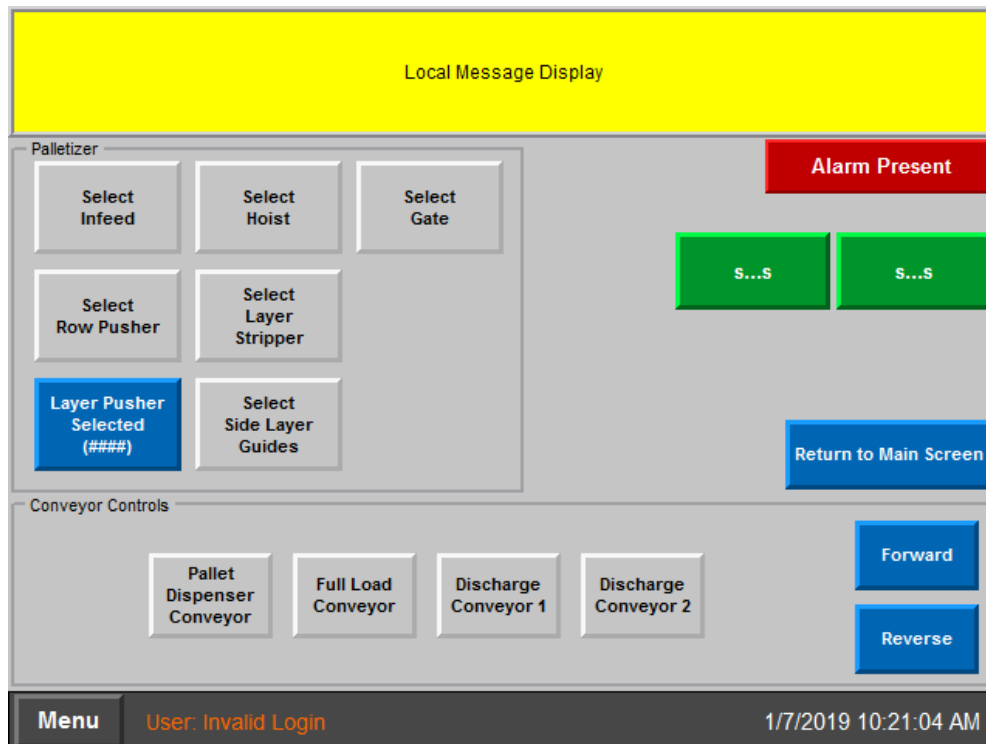


Case Rate – Case rate is indicated on the right side of the screen. This is a sample taken periodically and will reflect the rate which cases are being fed to the Palletizer. Keep in mind that this may be lower than expected if cases don't enter the machine back to back.

Save/Discard Changes – This message will appear whenever any changes have been made to the current running product via the Product Manager. You will not be allowed to change products until the changes are either saved or discarded. If saved, all changes are permanently stored in the database. If discarded, all changes since the product was first selected will be restored.



MANUAL SCREEN



The palletizer must be out of automatic for the following pushbuttons to operate.



NOTE

When a function is selected (function can be operated with the UP/DOWN or FWD/REV pushbutton) the button will be Dark Blue in color. Only one function at a time can be selected. Example, if the Hoist is selected (Dark Blue) then the Row Pusher is selected, the Hoist will become deselected (Grey) automatically. When the function is not selected the button will be Grey in color.



NOTE

The directional pushbuttons (Green) shown on the upper section will display the direction the selected component will be moving. Typical selections are JOG, FWD/REV, UP/DOWN, OUT/BACK, OPEN/CLOSE and CW/CCW.

SELECT GATE/GATE SELECTED - This button will allow the operator to jog the Layer Pusher forward and reverse. When this button is in the “Selected” state the “OUT” and “BACK” pushbuttons will appear on the left. If the OUT pushbutton is pressed the Gate will move forward until the pushbutton is released or the Out PX is made. If the BACK pushbutton is pressed the Gate will move backwards until the Back PX is made.

SELECT LAYER PUSHER/LAYER PUSHER SELECTED - This button will allow the operator to jog the Layer Pusher forward and reverse. When this button is in the “Selected” state the “FWD” and “REV” pushbuttons will appear on the left. If the FWD pushbutton is pressed the Layer Pusher will move forward until the pushbutton is released or the Home PX is made. If the REV pushbutton is pressed the Layer Pusher will move backwards until the Back PX is made.

SELECT ROW PUSHER/ROW PUSHER SELECTED - This button will allow the operator to jog the Row Pusher forward and reverse. When this button is in the “Selected” state the “FWD” and “REV” pushbuttons will appear on the left. If the FWD pushbutton is pressed the Row Pusher will move forward until the pushbutton is released or the Home PX is made. If the REV pushbutton is pressed the Row Pusher will move backwards until the Back PX is made.

SELECT LAYER STRIPPER/LAYER STRIPPER SELECTED - This button will allow the operator to jog the Layer Stripper forward and reverse. When this button is in the “Selected” state the Open or Close pushbuttons will appear on the left. If the FWD/Open pushbutton is pressed the Layer Stripper will move forward until the pushbutton is released or the Forward/Open PX is made. If the REV/Close pushbutton is pressed the Layer Stripper will move backwards until the pushbutton is released or the Back/Closed PX is made.

SELECT HOIST/HOIST SELECTED - This button will allow the operator to jog the Hoist up and down. When this button is in the “Selected” state the “UP” and “DOWN” pushbuttons will appear on the left. If the Up pushbutton is pressed the Hoist will move up until the pushbutton is released or the Up PE is made. If the Down pushbutton is pressed the Hoist will move down until the pushbutton is released, or the down PE is made.

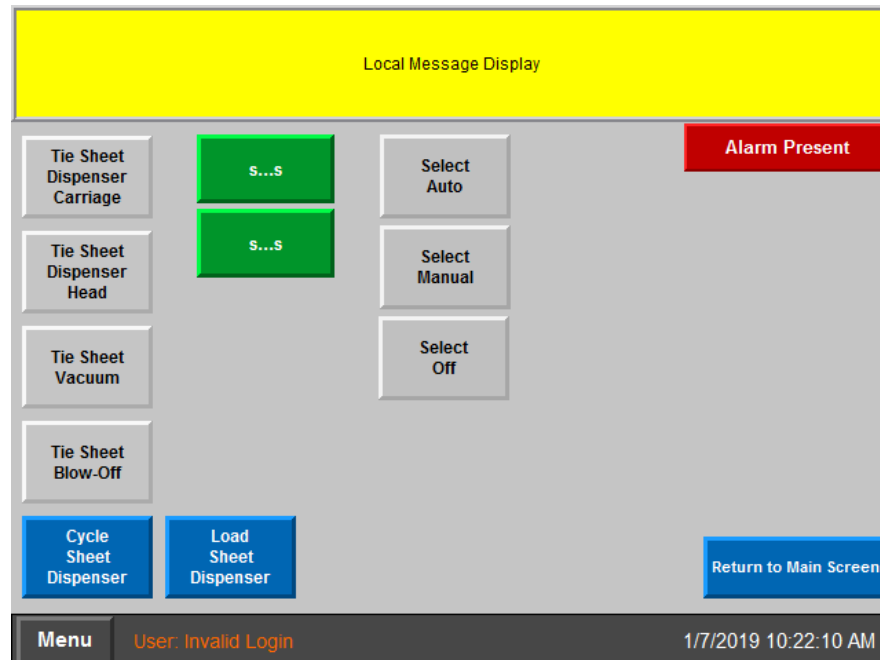
SELECT SIDE GUIDES/SIDE GUIDES SELECTED - This button will allow the operator to jog the Side Guides forward and reverse. When this button is in the “Selected” state the Out and Back pushbuttons will appear on the right. If the Out pushbutton is pressed the Side Layer Guides will move towards the product until the pushbutton is released or the position count has been reached. If the Back pushbutton is pressed the Side Layer Guides will move away from the product until the pushbutton is released or the Back PX is made. If equipped with a Front Layer Guide, it will move in the same manner as the Side Layer Guides.

SELECT INFEED/INFEED SELECTED - This button will allow the operator to jog the pacer & meter belt forward. When this button is in the “Selected” state the “FWD” pushbutton will appear on the right.

Conveyor Controls

SELECT CONVEYOR SECTIONS – When conveyors are “Selected” the Forward and Reverse Buttons will allow the operator to move the conveyors in manual forward and reverse. They will appear blue if selected and grey if not (only selected conveyors will run).

TIE SHEET DISPENSER MANUAL CONTROLS (if equipped)



Description of Operation:

The Sheet Dispenser can place sheets on the pallet (slip sheet), or between layers (tie sheets), or on top of the load (cap sheets). Some palletizers may use another sheet dispenser to place slip sheets only if special sheets are required or a higher output of product is needed.



NOTE

If the sheet dispenser tries to pick up a sheet three (3) consecutive times and fails, the Head will home itself in the up position and the Palletizer will back up waiting for a sheet to be placed. Turning the sheet dispenser **Off** and back **On** again will reset the sheet dispenser and allow it to pick up a sheet again.

FL Series Typical Tie Sheet Operations

When a Tie/Cap Sheet is required the Hoist will move to the Down PX leaving room for the sheet to be placed on the layer.

When a Slip Sheet is required the Hoist will move to the Up PX allowing the sheet to be placed on the pallet.

The reason for the movements of the Hoist is so the Sheet Dispenser can clear the frame and components on the Hoist to place the sheet.

HL Series Typical Tie Sheet Operations

When a Tie/Cap Sheet is required the sheet will be placed once the Layer Stripper is forward/open and the layer is now on the load/pallet. If the optional placement of a Slip Sheet is needed once the load is discharged, the Layer Stripper will NOT close and remain open. A new pallet will be placed on the Hoist. Once the Hoist is fully up and not moving, a sheet will be placed on the pallet. If unitizing (no pallet required) the sheet will be placed directly on the Hoist/Full Load Conveyor (FLC).

Description of Buttons:

CYCLE SHEET DISPENSER (if equipped) – The Palletizer and Sheet Dispenser must be in Automatic for this pushbutton to work. If this button is pressed the Sheet Dispenser will place a sheet on the Load or Pallet. The Hoist and/or Layer Stripper will move to position to allow the sheet to be placed. Once the sheet has been placed the Hoist and/or Layer Stripper will return to a “Home” position and will be ready to receive more product.

SHEET DISPENSER OFF – Press this pushbutton to turn the Sheet Dispenser Off. This will also reset the sheet dispenser in an alarm condition. Some models will return the sheet back to the hopper and send the Head to the Up (HL series) or Above Pallet (FL series) PX's. All requests for a sheet while in the Off mode will be ignored and the palletizer will continue to run.

SHEET DISPENSER MANUAL – Press this pushbutton to turn the sheet dispenser in manual mode. When in manual the jog pushbuttons are enabled, some functions may not operate if the palletizer is still in the Automatic mode. If there is a request for a sheet while in the Manual mode the palletizer will back up until a sheet has been placed automatically.

SHEET DISPENSER AUTO – Press this pushbutton to turn the Sheet Dispenser in automatic mode. When in automatic mode the sheet dispenser will put sheets on the load when required.



NOTE

The sheet dispenser will not operate automatically unless the palletizer is in automatic.



NOTE

The sheet dispenser doors must be closed for the palletizer to go into automatic operation.



NOTE

The directional pushbuttons (green) shown on the upper section will display the direction the selected component will be moving. Typical selections are FWD/REV, UP/DOWN and OUT/BACK.



NOTE

When a function is selected the button will be Blue in color. Only one function at a time can be selected. When the function is not selected the button will be Grey in color.



NOTE

The “Emergency Stop Circuitry” **MUST** be enabled for all the following pushbuttons and selector switches to operate.



NOTE

Palletizer must be out of automatic to run the sheet dispenser arm out on some models.



NOTE

THE FOLLOWING SWITCHES WILL NOT OPERATE UNLESS THE SHEET DISPENSER IS IN THE MANUAL MODE.

SHEET DISPENSER CARRIAGE – This button will allow the operator to jog the Carriage forward and reverse. When this button is in the “Selected” state the FWD and REV pushbuttons will be displayed on the right. If the FWD pushbutton is pressed the Carriage will move forward until the pushbutton is released or the Forward PX(s) are made. If the REV pushbutton is pressed the Carriage will move backwards until the Back PX is made.

SHEET DISPENSER HEAD – This button will allow the operator to jog the Head up and down. When this button is in the “Selected” state the Up and Down pushbuttons will be displayed on the right. If the Up pushbutton is pressed the Carriage will move Up until the pushbutton is released or the Up PX is made. If the down pushbutton is pressed the Head will move down until the Cups Detect PX is made.

SHEET DISPENSER VACUUM – This pushbutton allows the operator to turn the vacuum ON to pick up a sheet. A special valve is used to keep the Vacuum on even after power is removed, as long as air is still being applied. If the pushbutton is Green there is power on the valve keeping it on. When the pushbutton is pressed again the button will turn grey removing power from the valve, but the Vacuum will remain on until Blow-Off is requested.

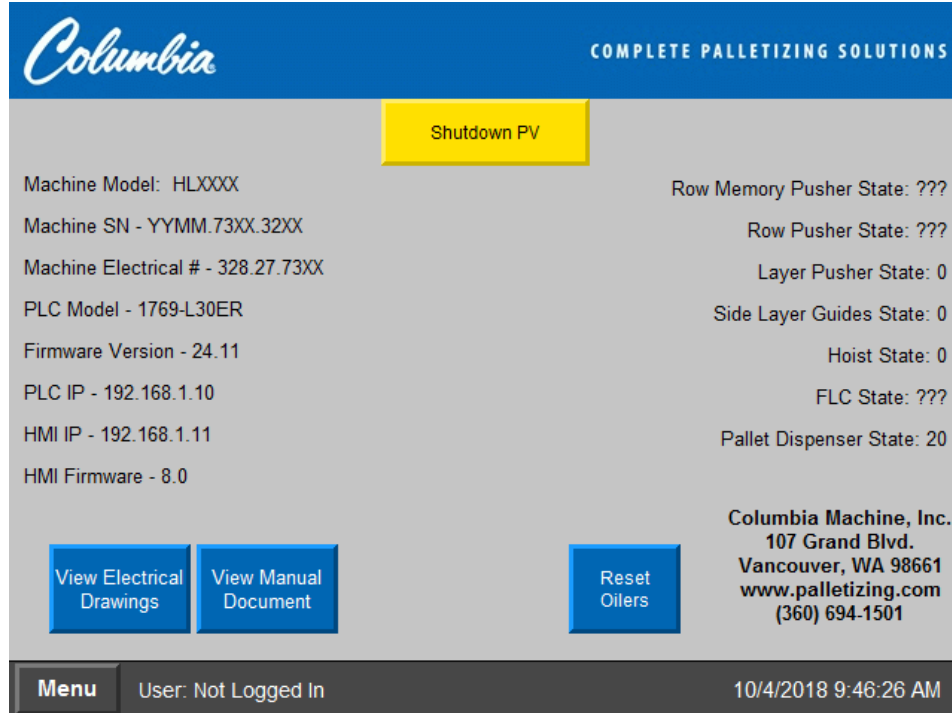
SHEET DISPENSER BLOW-OFF – This pushbutton allows the operator to turn the blow-off ON to separate the sheet from the suction cups. This is a momentary valve and regardless of how long you press the button the valve will only turn on for a preset duration. Turning On the Blow-Off will also turn off the Vacuum if it is still on.

Loading the Sheet Cartridge

- The fork lift/truck operator will pull the yellow handled cord.
- Once the white beacon is blinking, indicating the sheet dispenser head is clear of the cartridge, they can remove the cartridge.
- When the cartridge is removed the white beacon will stop blinking and become steady.
- During this process the sheet dispenser will not return to the cartridge area.
- While the cartridge is being loaded/unloaded the palletizer will continue run and will place a sheet if it has one on the cups and it is required. If a sheet is required and is NOT present on the cups the palletizer will wait and eventually back up. This will stop the flow of product into the machine.
- After the cartridge has been placed properly the white beacon will start blinking again, indicating that it is still in the loading process.

- As the fork lift/truck driver is moving away from the cartridge, the cord will need to be pulled again. This indicates that they are done and the white beacon will turn off.
- If there is not a sheet on the cups the sheet dispenser will return to pick up a new sheet.
- The operation of the palletizer will resume once the sheet has been placed, if it was waiting.

INFORMATION SCREEN



The screenshot shows the 'INFORMATION SCREEN' of a Columbia Machine. At the top, there is a blue header with the 'Columbia' logo on the left and 'COMPLETE PALLETIZING SOLUTIONS' on the right. Below the header, there is a yellow button labeled 'Shutdown PV'. The main content area is divided into two columns. The left column lists machine specifications: Machine Model: HLXXX, Machine SN - YYMM.73XX.32XX, Machine Electrical # - 328.27.73XX, PLC Model - 1769-L30ER, Firmware Version - 24.11, PLC IP - 192.168.1.10, HMI IP - 192.168.1.11, and HMI Firmware - 8.0. The right column shows various machine states: Row Memory Pusher State: ???, Row Pusher State: ???, Layer Pusher State: 0, Side Layer Guides State: 0, Hoist State: 0, FLC State: ???, and Pallet Dispenser State: 20. At the bottom of the main content area, there are three blue buttons: 'View Electrical Drawings', 'View Manual Document', and 'Reset Oilers'. To the right of these buttons, the company contact information is displayed: Columbia Machine, Inc., 107 Grand Blvd., Vancouver, WA 98661, www.palletizing.com, and (360) 694-1501. At the very bottom, there is a dark grey footer bar containing a 'Menu' button, the text 'User: Not Logged In', and the timestamp '10/4/2018 9:46:26 AM'.

This is a good screen to get some basic information about the palletizer, especially if you need some technical support. The machine serial number is the best number and can help our Parts, Customer Care and Engineering departments find your palletizer and support you faster.

The “States” shown on the right side are a great tool when calling about an operational issue you may have with the palletizer. With these values our Customer Care department can help resolve some issue easier and faster. Depending on the Model of your palletizer the States displayed may vary.

DOWNTIME REPORTING SCREEN

Downtime Events		
	Current Day	Previous Day
Shift Uptime	0	162
Shift Idle Time	0	67
Completed Units	0	0
Partial Units	0	3
Shift Downtime Events	0	106
Shift Downtime Minutes	76	58556
Reset Current Shift Last Time Reset 2/29/2016 20:09		
Menu User: Access "A" 10/26/2016 12:36:03 PM		

You can view this screen by pressing the “Downtime” button on the “Reports” submenu. This screen shows the Current and Previous Day downtime events in minutes for two (2) shifts.

RESET CURRENT SHIFT – Pressing this pushbutton will bring up the screen below. By pressing the YES pushbutton the values under “Current Day” display, will change to zero (0) and move them to the “Previous Day” display. The time of reset will be displayed on the screen. There are not any features to print these reports, so any recording of these values will have to be done manually.

Are you sure you want to Reset
all the Production and
Downtime information
for the current shift?

YES NO

Menu User: Not Logged In 3/18/2015 2:18:41 PM



NOTE

Pressing YES on this screen will also reset values for the Production Report. See Production Report Screen for more information.

You can view this screen by pressing the “Production” button on the “Reports” submenu. This screen shows the Current and Previous Day production in minutes for two (2) shifts.

Shift Up Time – This displays how long the palletizer was in the Automatic mode and running product through the machine in minutes.

Shift Idle Time – This displays how long the palletizer was in the Automatic mode and waiting for product in minutes.

Complete Units – This displays how many complete loads have been discharged.

Partial Units – This displays how many incomplete loads have been discharged.

RESET CURRENT SHIFT – Pressing this pushbutton will bring up the screen below. By pressing the YES pushbutton the values under “Current Day” display, will change to zero (0) and move them to the “Previous Day” display. The time of reset will be displayed on the screen. There are not any features to print these reports, so any recording of these values will have to be done manually.

DOWNTIME EVENTS

Downtime Events				
	Alarm Number	Time Stamp	Duration (Min:Sec)	Pallet Loads
Alarm Description	66	1/1 02:27	1344:47	0
Alarm Description	66	1/1 02:22	5:11	0
Alarm Description	66	1/1 01:43	38:38	0
Alarm Description	66	1/1 01:43	1:33	0
Alarm Description	202	10/19 16:17	95:33	0
Alarm Description	202	10/19 16:13	0:16	0

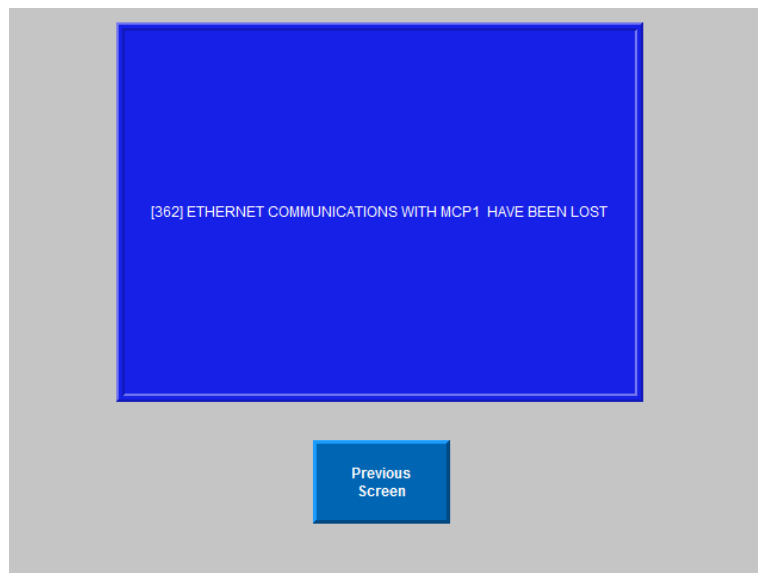
Menu
User: Not Logged In
10/24/2016 10:43:16 AM

You can view this screen by pressing the “Downtime Events” button on the “Reports” submenu. This screen shows the last six (6) events that took the palletizer out of automatic and how long before resuming auto. It also will display how many pallet loads were ran through the palletizer between events.

Downtime Events				
	Alarm Number	Time Stamp	Duration (Min:Sec)	Pallet Loads
Alarm Description	66	1/1 02:27	1344:47	0
Alarm Description	66	1/1 02:22	5:11	0
Alarm Description	66	1/1 01:43	38:38	0
Alarm Description	66	1/1 01:43	1:33	0
Alarm Description	202	10/19 16:17	95:33	0
Alarm Description	202	10/19 16:13	0:16	0

Menu
User: Not Logged In
10/24/2016 10:43:16 AM

If you press the Event Description on the left side of the screen the Event Description will be displayed. After reading the code, press Previous Screen to return to the Events screen.

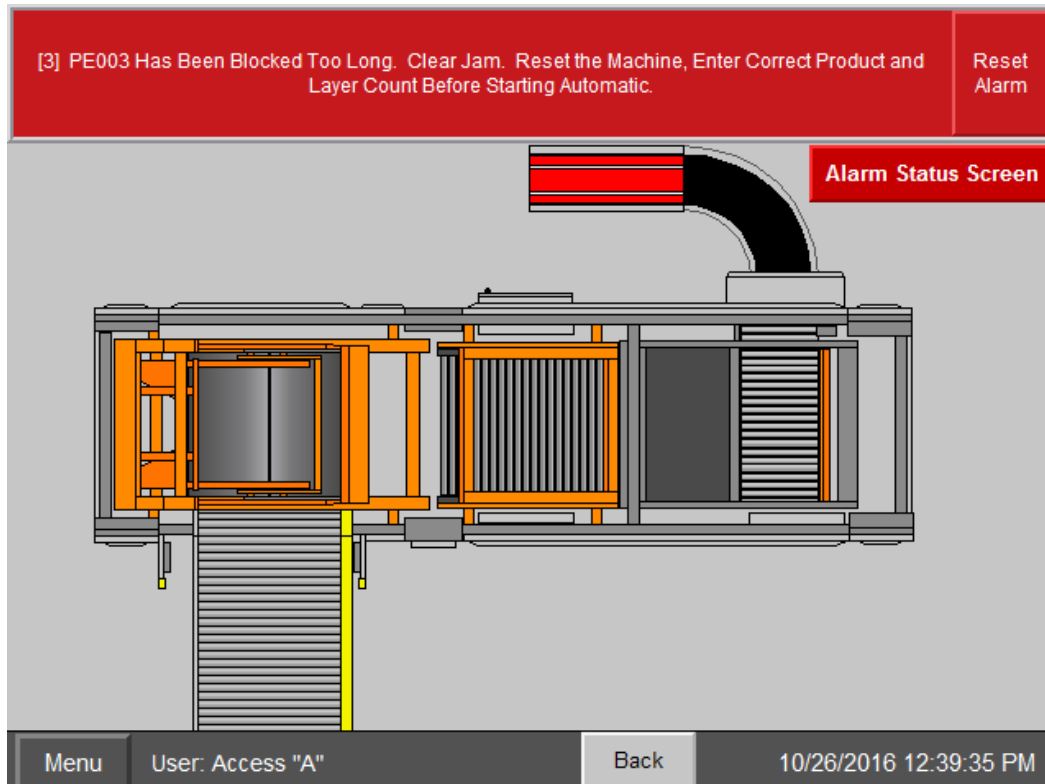


ALARM HISTORY SCREEN

Alarm List	
[73]	9/28/2018 9:34:0
[192] The discharge light curtain has been blocked. Do not restart the machine before verifying all personnel are clear.	9/27/2018 13:14:42
[192] The discharge light curtain has been blocked. Do not restart the machine before verifying all personnel are clear.	9/27/2018 11:5:57
[108] PE019 has been blocked too long or is misaligned. Check photocell.	9/27/2018 9:52:3
[108] PE019 has been blocked too long or is misaligned. Check photocell.	9/27/2018 9:48:4
[108] PE019 has been blocked too long or is misaligned. Check photocell.	9/27/2018 9:29:29
[108] PE019 has been blocked too long or is misaligned. Check photocell.	9/27/2018 9:29:28
[73]	9/27/2018 9:24:58
Displaying Alarms 0 to 8	Prev 8 Next 8 Alarm History Current Alarms Top 8 Alarms
Menu	User: Access "A" Back 10/2/2018 9:00:26 AM

The Alarm History stored up to 500 alarms and can be displayed 8 alarms at a time. A time stamp and the message will be displayed. The most recent alarm will always be on top. You can also select to display current alarms, which will display up to 8 active alarms. This can be helpful if 2 VFD's are faulted for example.

ALARM LAYOUT SCREEN



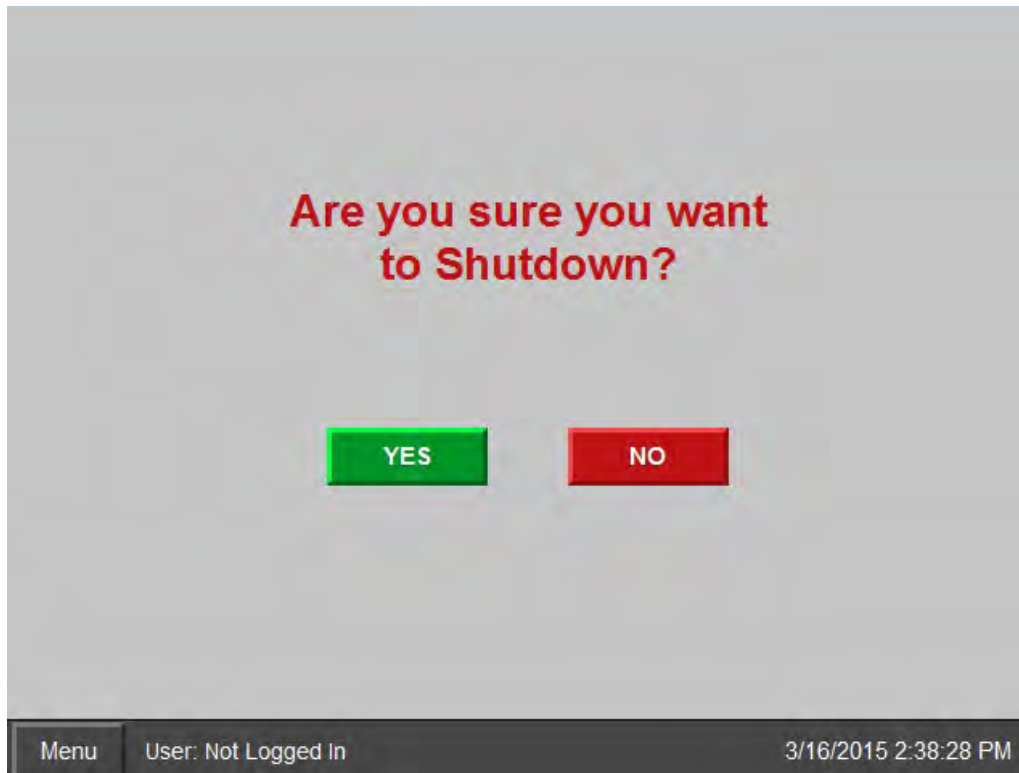
This screen shows which section has an alarm. The section containing an alarm will blink red.



NOTE

The Machine above may not match your machine Layout. It will be correct In the HMI on the machine. This is just to describe the function of the screen.

SHUTDOWN PANELVIEW



You can view this screen by pressing the “Shutdown PV” button on the “Maintenance” submenu. This screen is only accessible if the user is logged in with at least Level “A” access. From this screen, if you press the Yes pushbutton the Panelview will shut down and the Panelview configuration screen will appear. It is recommended only trained personnel access this feature.

PRODUCT MANAGER

DESCRIPTION AND OPERATING INSTRUCTIONS

The Product Manager is a series of screens that allow you to add/delete/modify the product database of the Palletizer. Each product that you run has sets of parameters that can be adjusted. This includes timers, drive speeds, pattern configurations, stack height, stack configuration and drawings of the actual pattern. The standard Product Manager can store up to 100 product configurations and can be optionally expanded.

Each product can be configured with 3 different layer configurations, we refer to this as Layer A, Layer B and Layer C. For products that require a Column Stack configuration, only Layer A needs to be configured. Layer B will typically be used for Alternating stack configurations where every other layer will alternate. Layer C configuration can be used for special circumstances where the last layer needs to be different than the other layers in the pallet stack, for example.

Drawings of each product can be created using the Pattern Drawing Editor. This can be useful for identifying Products when starting production runs, or even editing the pattern if they are drawn prior to editing the pattern.

One other feature of the Product Manager is the ability to adjust products on the fly and either save or discard changes that have been made to the product while it is running. When a product is selected on the Main Screen, a snapshot of its settings is saved. Adjustments can be made during operation and before the product can be changed, all changes must be saved or discarded. A message will appear on the Main Screen indicating this.

A typical workflow for adding new products to the Product Manager database would be:

- Log into the Product Manager from the Main Menu
- Go to the Product Manager screen
- Scroll through the database using the Next/Previous buttons to select a similar product to the one that you will be adding. Picking a similar one (weight, dimensions) will get you close with timer presets and drive speeds
- Press Copy Current Product, enter new name.
- Enter the Length/Width of the cases for your new product.

- Go to Edit Pattern screen to enter the pattern data the new pattern. If you copied a pattern that was the same, this will already be done since this data was copied as well.
- Go to Edit Layer to select the number of layers to be built, how the layers will be stacked (A/B/C) and sheet locations (if equipped).
- Go to Pattern Drawing Editor screen to make a graphical representation of the pattern. This is not required but can help when selecting the product later.
- Once it's time to test the product, you can make necessary adjustments to the timers and drive speeds using the Timer Editor and VFD Speed Editor.

PRODUCT MANAGER SCREEN

The screenshot shows the 'Product Manager' interface. At the top, there's a header bar with 'Product Manager' on the left and a red 'Alarm Present' button on the right. Below this is a section titled 'Current Product Information'. It contains several blue buttons: 'Product ID' with the value 'COLMAC', 'Case Length' with '17.75', 'Database Location: 2', 'Previous Product', 'Next Product', and 'Case Width' with '11.50'. Below these is 'Layer Height 5'. At the bottom of the main area, there are two panels: 'Add New Product' with a 'Ready to Copy' status and a 'Copy Current Product' button, and 'Rename Current Product' with a 'Ready to Rename' status and a 'Rename Current Product' button. To the right of these panels is a button that says 'Press and Hold to Delete Current Product'. At the bottom of the screen, there's a dark bar with a 'Menu' button, 'User: Not Logged In', and the date/time '7/29/2019 2:23:08 PM'.

The main Product Manager screen is the starting point for adding/deleting/editing products in your database. There are 3 ways to select which product you wish to edit. Typing the name if it is already known, entering a products database location or scrolling by pressing Next/Previous. Only database locations with products stored in them will be displayed, any empty locations will be skipped.

Case Length/Width – Used for pattern drawings in order to scale each box correctly. This should be entered to the proper case dimensions before drawing the pattern in the Pattern Drawing Editor

Copy Current Product – Pressing will open up a text entry that will allow you to enter a name for your new product. When a name is entered, all settings from the currently selected product will be copied and stored into the next available database location with the new name that was given.



NOTE

If you want to copy the pattern information, including the pattern drawing, press the blue button. If there is an “X” on it then these will both be copied, if there is not and “X”, then this information will be ignored. This would be selected if the new product you are entering is the same configuration as the one you copying. Even if the information is copied, you can still make changes if needed.

Rename Current Product – Opens a text entry that will allow you to provide a new name for the currently selected product. Names in the database cannot be duplicated, so it will check to see if the name already exists before renaming. If the name does exist, a notification will be given.

Delete Current Product – Products that are no longer being produced can be deleted from the database. This is permanent so please use this with caution. The button must be held for 3 seconds in order to delete the product.

Case Length and Case Width- These values are used for creating the case drawing on the Pattern Drawing Screen.

EDIT LAYER INFORMATION SCREEN

Layer Editor For: COLUMBIA

Number of Layers to Build

4

Layer Configuration Selection

Select the configuration for each layer (A,B or C)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	B	A	B																
21	22	23	24	25	26	27	28	29	30										

Slip Sheet?

Tie Sheet Locations

Select which layers will require tie sheets

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30										

Menu
User: Access "A"
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The number of layers to build, stack configuration and sheet selections (if equipped) can be edited from this screen. First you would enter the number of layers to build for your pallet pattern. Then select how you want the pallet to stack. The most common configurations are column stacking (A is selected for each layer), interlocking (A and B are selected for every other layer), or a combination of the two where A might be selected for the first 3 layers, then the rest alternate (A,A,A,B,A,B). Occasionally a third layer configuration might be required, C can be used for this. For example if the last layer of the pallet needs to have its own configuration, C can be used for the last layer.

If a Tie Sheet Dispenser is equipped, which layer, Tie Sheets will be placed on, can be configured here as well. Simply check the box for which layer you desire a sheet on. Keep in mind that the information is loaded each time a new pallet is started, so when you are in the middle of building a pallet and this information is changed, the changes don't take effect until after the pallet discharges and a new pallet starts.

PATTERN EDITOR SCREEN

Pattern Editor For: RIPPLE 3X2 6PK

Case Selection

Case: 1

Previous Case Next Case

Layer A Layer B Layer C

Single Case Editor

Select Case Orientation Run Turn

Row/Layer Push Selection No Push Push Row Push Row With Delay Push Layer Push Layer With Delay

Package Stops 0 6,9,10,12,17,18,19,20,22,24,28,32

Pause Meter Belt No

Menu User: Access "A" 10/2/2018 8:58:58 AM

The Pattern Editor gives you a way to edit your pattern configurations for each product in your database. The option for editing layers A, B and C are done one case at a time. You have the ability to edit whether each case is a Run/Turn, if it needs to be pushed or not, if it stops on a package stop and if the meter belt needs to pause

Run/Turn – Every case in your pattern needs to be set to a run or turn. On machines equipped with a Soft Turn, there will be additional settings for which direction the turn is (Clockwise and Counter-Clockwise) as well as 180° turns for facing labels for display cutouts.

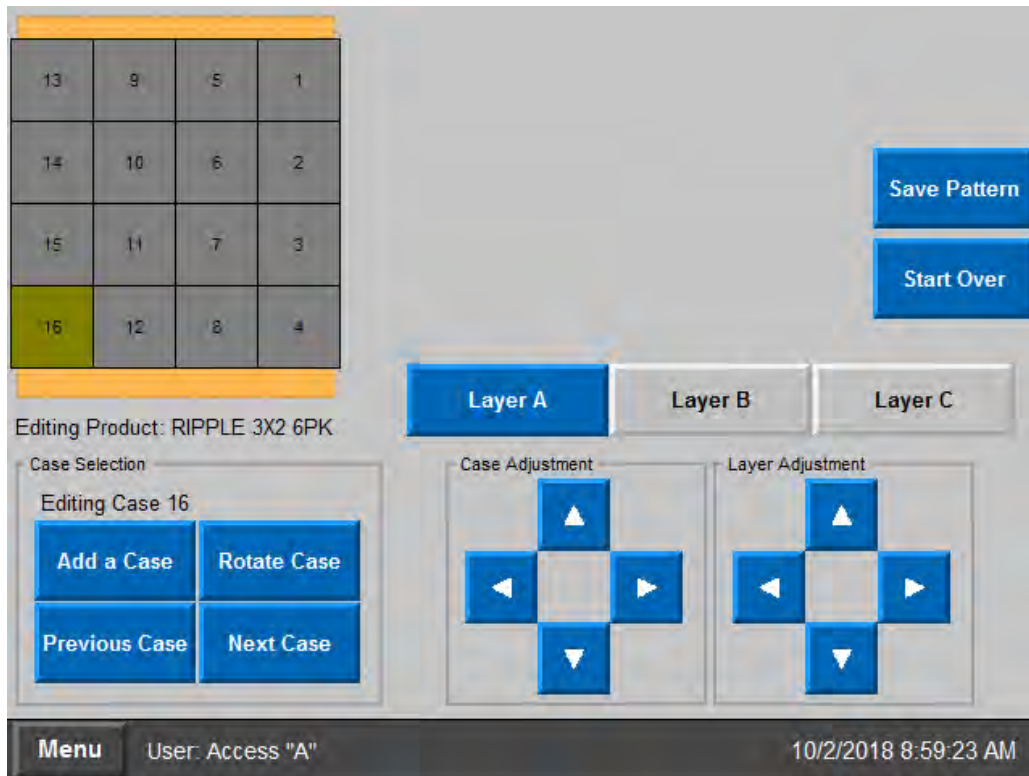
Row/Layer Push – The end of each Row and the end of a Layer needs to be configured. For the end of a row, there are two options. Row Push and Row Push with Delay. Row Push will use the “Normal” delay found on the timer screen to allow the case to settle before it is pushed. Some pattern configurations requires more time, for example when a single case needs to be pushed but it needs to move all the way down the row former before pushing. This is what Row

Push With Delay is for, it uses the “Extra” push delay on the timer screen. The same applies to the last case of a layer.

Package Stops – Package Stops are used to create gaps in patterns or hold cases in a position for alignment purposes. Available stops will be listed to the right of the Package Stop Entry.

Pause Meter Belt – This can be useful if a larger gap is required between cases. For example, a Run case can catch up with a Turn case because Turn cases tend to turn slower. When Pause Meter Belt is selected in this scenario, the belt will shut off for that case for the duration specified on the Timer Editor screen.

PATTERN DRAWING SCREEN



The Pattern Drawing Screen allows you to create a graphical representation of the pattern for each Product ID. This information can help in the pattern data entry and case arrangement when running if there is an issue. Please note that you must go to the Product ID screen and verify the case dimensions are correct before building your pattern drawing. This is a representation of the pattern and does not create or manipulate the actual pattern configuration, it is for display purposes only.

SAVE PATTERN – Once a pattern is done, or if you need to leave this screen while editing, press this button to save your work.

START OVER – This pushbutton will delete all the cases shown on the screen. When starting a new pattern, there will be cases shown from the previous pattern that was copied, so pressing this button will quickly get you ready to start creating your new pattern.

ADD A CASE – Press this button to add a new case to the drawing. Once it is added you can move it with your finger by dragging it and/or using the “Case Adjustment” arrow buttons.

ROTATE CASE – Use this pushbutton to change the orientation of the case 90 degrees.

PREVIOUS CASE and NEXT CASE – These pushbutton can be used to highlight previously entered cases. Once a case is highlighted it can be moved and/or rotated as needed.

LAYER A, LAYER B and LAYER C – These pushbuttons are used to select which layer you want create the drawing for.

LAYER ADJUSTMENT ARROWS – These pushbuttons can be used move ALL of the cases shown on the drawing at the same time. Once you have placed all of the cases on the pallet you may not be positioned properly. With these buttons you can move the whole layer, instead of moving each case, one at a time.

TIMER EDITOR SCREEN

Timer Settings For: COLUMBIA	
Release MB For Run Case "Side Infeed"	100
Release MB For Turn Case "Side Infeed"	100
Case Assist Back Delay	100
Case Assist Out Delay	150
Normal Row Push Delay	1
Extra Row Push Delay	1100
Drop Case Stops After Row Push	1000
Side Layer Guides Out Delay	20
Side Layer Guides Position Count (Actual = 0)	8
Front Layer Guide Centering Delay	500
Pallet In Position Delay	725

1000 = 1 Second

Menu User: Access "A" 10/24/2016 2:22:34 PM

The Timer Screens allow the values to be changed for each individual Product ID. By pressing on the square box next to the name of the timer, a numerical key pad will open. Enter the value and press the enter key. Once the enter key is pressed then the timer value will be changed. (Your screen may vary.)


NOTE

Time base is 1 msec. For example enter in 2000 for a 2 second timer value. This screen may vary depending on the options and model of machine.

DRIVE SPEED EDITOR SCREEN

VFD Speed Editor For: COLUMBIA

Pacerbelt Speed	110
Meterbelt Speed	210
Row Pusher Speed	150
Layer Pusher Speed	150
Full Load Conveyor	60
Discharge Conveyor	60

Enter Drive Speed
In FPM (Feet Per Minute)

Menu
User: Access "A"
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The drive speed screen allows the values to be changed for each individual Product ID. By pressing on the square box next to the name of the VFD, a numerical keypad will open. Enter the value and press the enter key. Once the key is pressed then the VFD Speed value will be changed. (Your screen may vary.)



This screen will be available if the palletizer is equipped with VFD's (Variable Frequency Drives). Speeds are set by feet per minute and depending on controls may only be selected by Slow, Medium, Base or Fast speed.

NO HAZARD STOP

Press the **CONTROLLED STOP** pushbutton to temporarily stop the functions of the palletizer. When there is no danger to personnel or equipment, operation will resume by pressing the AUTOMATIC CYCLE START pushbutton.



NOTE

Whenever the palletizer is put in the automatic cycle or mode, a warning horn will oscillate on and off for six (6) seconds to alert any personnel in the area that the palletizer is going into the automatic cycle or mode. After the six (6) second delay the warning horn will silence and a green strobe beacon will illuminate, indicating the machine is in the automatic cycle or mode.

CLEARING A PARTIAL LOAD

If there are too few cases to complete a full pallet load, such as at the end of a product run, perform the following:

- Allow all available product to enter the palletizer.
- Wait until the palletizer is no longer processing product and no movement is present.
- Press the PALLETIZER INFEED pushbutton to OFF – located on the Main Screen of the Panelview (to insure different product won't enter the palletizer during the clearing cycle).
- Press the CLEAR OUT THE MACHINE pushbutton located on the Automatic Functions screen of the Panelview.
- The Row Pusher will cycle one (1) time.
- The Layer Pusher will cycle one (1) time.
- The Hoist will cycle one (1) time.
- The load will discharge and a new pallet will feed automatically.



NOTE

When the CLEAR OUT THE MACHINE pushbutton is depressed, the meter belt will stop momentarily or the grate will remain up, until the row pusher bar has cycled.



NOTE

If the product needs to be rearranged, removed, or straightened in the row forming or Layer Table areas, you must do the following.

PRODUCT PATTERN MANIPULATION

If for some reason the pattern forming gets out of sequence, (bad, damaged, unsealed, etc., product) it is possible to correct using the following procedure.

- Press the **CONTROLLED STOP** pushbutton.
- Examine the pattern/layer to this point.
- Each product that is on the Row Forming Rolls or Layer Table counts as one product count.
- Each layer that is on the pallet counts as one layer count.



WARNING

If the product needs to be rearranged, removed, or straightened in the Row Forming or Hoist areas **YOU MUST DO THE FOLLOWING:**

1. **LOCK OUT THE MAIN POWER DISCONNECT** on the control panel in the 'OFF' position.
2. **LOCK OUT THE MAIN AIR SUPPLY** before rearranging, replacing, or straightening up the product.



NOTE

If the Main Power Disconnect was turned to the 'OFF' position the following procedure will need to be done before proceeding with this Product Pattern Manipulation procedure.

- Turn main power disconnect "ON".
- Turn on the main air supply.
- Press the **EMERGENCY STOP ENABLE** pushbutton (EMERGENCY STOP ENABLE push button will illuminate).

- Enter the correct product count located on the Main Screen of the Panelview.
- Enter the correct layer count located on the Main Screen of the Panelview.
- Press the **AUTOMATIC CYCLE START** pushbutton.



NOTE

Whenever the palletizer is put in the automatic cycle or mode, a warning horn will oscillate on and off for six (6) seconds to alert any personnel in the area that the palletizer is going into the automatic cycle or mode. After the six (6) second delay the warning horn will silence and a green strobe beacon will illuminate, indicating the machine is in the automatic cycle or mode.

- Press the **PALLETIZER INFEED** pushbutton located on the Main Screen of the Panelview to turn on. Operation will resume.

SHUT DOWN

- Press the **CONTROLLED STOP** pushbutton.
- Push in the **EMERGENCY STOP** push/pull switch on the Main Control Panel.

If the main power disconnect is left on, the power to the programmable controller will stay on and the backup battery will maintain its charge longer.



NOTE

If product is left in the Palletizer at shut down, operation can be resumed at the next start up as long as the **Case Count** or **Layer Count** was not changed after the Automatic Cycle Hold pushbutton was pressed or before the **AUTOMATIC CYCLE START** pushbutton is pressed at the next start up.

POWER UP



Prior to applying electrical power to the Palletizer make sure that there is no danger to personnel or equipment by applying power. Make sure all electrical panel doors are closed. Make sure that all machinery guards/doors are in place/closed. Applying power to the Palletizer energizes the control Panel with 230 or 480 VAC 3 phase power.

It will take approximately three (3) minutes for the **HMI** (Human Machine Interface) screen to initialize after power is applied. Adjust all mechanical guides (Infeed Conveyor, Stripper Plate, Row Former, etc.) prior to applying power to the Palletizer.

Turn the **MAIN DISCONNECT** handle to the “ON” position.

Turn on the air supply.

Pull out all **EMERGENCY STOP** pushbuttons.

Press the **EMERGENCY STOP ENABLE** pushbutton. If all safety doors with switches are closed and no **EMERGENCY STOP** pushbuttons are active (pushed in), the **EMERGENCY STOP ENABLE** pushbutton will illuminate (BLUE).

POWER DOWN

CAUTION

480 or 230VAC 3 phase power will still be present on the **LINE SIDE** (top) of the **Main Disconnect** when it is in “OFF” position. It will take approximately 30 seconds for residual power in Variable Frequency Drives (if applicable) to dissipate after the **Main Disconnect** has been turned “OFF”.

Turn the Meterbelt/Infeed off from the Main Screen of the HMI unit to stop product flow into the Palletizer.

Press the **CONTROLLED STOP** pushbutton to stop machine cycles prior to turning “OFF” the **Main Disconnect**.

Move the **Main Disconnect** handle to the “OFF” position.

Turn off the air supply.

CAUTION

Do not enter the Palletizer until the **Main Disconnect** is locked in the “OFF” position. Do not enter the Palletizer until the air supply is locked in the “OFF” position.

NOTE

In an **EMERGENCY**, the **Main Disconnect** and air supply may be turned “OFF” at any time.



GENERAL TROUBLESHOOTING - ELECTRICAL

MACHINES WITH ALLEN BRADLEY CONTROLS

It is impractical to describe every possible failure. This section will instead describe a general procedure to use.

Most problems that occur will be evident by the failure of some function to occur when required.

Begin by determining which output module powers the affected valve. Check the L.E.D. (Light Emitting Diode) indicator on the module for that output.

If the output is not on, consult the schematic to see which inputs (proximity switches or photocells) can affect it. Check the L.E.D.'s on these inputs for indication and proceed to the switches/photocells if necessary.

If the output is on, check for voltage at its terminal. Check the fuse and proceed to the valve checking voltage there.



WARNING

Safety information contained in this manual must be observed during all phases of electrical maintenance. Since performance of electrical troubleshooting procedures can cause a condition where the machine will operate without warning. It is important that other personnel are not allowed to work on the machine during electrical maintenance.

SOLENOID COIL CHECK

Before a directional valve solenoid will operate, there must be voltage applied to the coil. If a voltage is present but the valve will not operate, the coil is probably defective. Generally, a burned out coil will display a distinct electrical burned odor.

Before replacing a solenoid coil, determine what caused the coil to burn out. Normally, the spool sticks in the valve causing the coil to overheat or both coils on a valve have been energized at the same time.

When solenoid valves burn out they occasionally cause the output module to fail, even though they are fused. When this occurs, the module will usually fail in the 'ON' condition with voltage present all the time whether the L.E.D. is on or not.



Once the fuse and the solenoid coil are replaced, check that the module is not shorted 'ON' or the coil will burn out again.

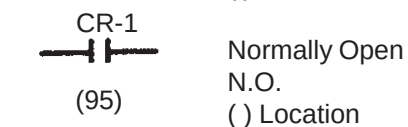
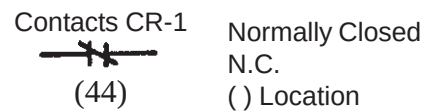
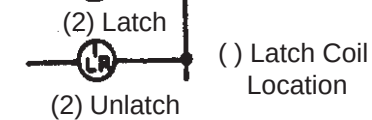
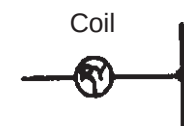
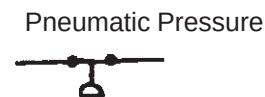
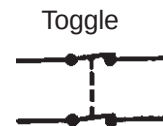
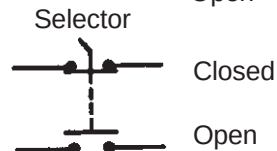
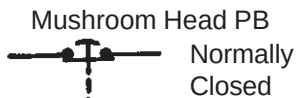
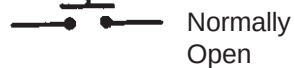
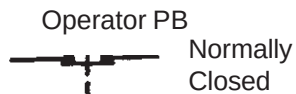
PHOTOCELL ALIGNMENT

Each photocell must be precisely aligned with the center of the corresponding reflector. With the light source active, perform the following procedures for correct alignment and adjustment of each photocell and reflector.

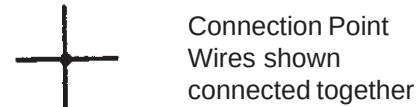
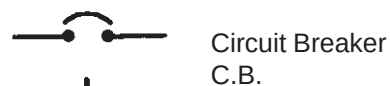
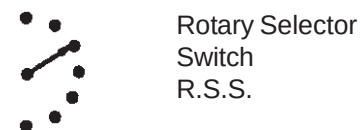
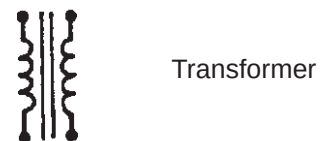
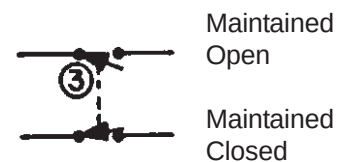
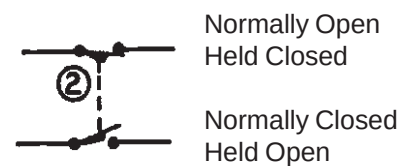
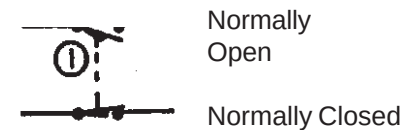
- Adjust position of reflector until L.E.D. is activated, signaling correct alignment. Dependent on operating setup of the control (light or dark operated), blocking the invisible beam will turn the load on or off.
- Determine the approximate center of the beam by moving the reflector up, down, left and right. Tighten adjustment screws with beam in center of reflector.
- To check operation, block the beam several times with the palm of your hand; the L.E.D. should turn on and off.

ELECTRICAL SYMBOL LEGEND

CONTROL SWITCHES



LIMIT SWITCHES



SECTION 3

PNEUMATIC INFORMATION

INTRODUCTION

The pneumatic systems used on Columbia equipment are normally designed with the following basic components:

- 1) Air Preparation
 - A) Air Shut-off
 - B) Air Filter & Water Traps
 - C) Pressure Regulator
 - D) Air Dump
- 2) Directional Control Valves
- 3) Special Purpose Valves
 - A) Quick Release Valves
 - B) Check Valves
- 4) Metering Devices
 - A) Flow Control Valves
 - B) Needle Valves
- 5) Air Cylinders

In the following pages, each component will be covered in general. With a better understanding of each component, an operator will be able to troubleshoot any pneumatic circuit more effectively.

With each discussion, a pictorial and symbolic representation of each component will be supplied whenever possible. The graphic symbols are used in the schematic diagrams provided in your manual for each pneumatic circuit.



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Customer Care Department
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AIR PREPARATION

Air preparation includes the filtration and pressure regulation of incoming air. Attention to these subjects is important to the operation and life of your equipment.

AIR SHUT-OFF

The On/Off valves for pressurizing and venting pneumatic installations is operated manually, by turning the rotary knob. The knob can be secured with a padlock.

There is an option to attach a silencer and/or to duct the exhaust air.

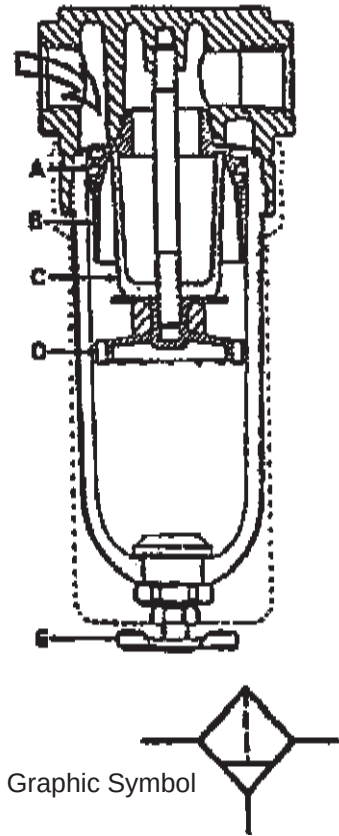
AIR FILTER & WATER TRAPS

With this device, the filter and pressure regulator are combined into a single unit. The sintered filter with water separator removes contamination, pipe scale, rust and condensate from the compressed air.

Air entering the filter is guided into a swirling pattern by specially designed louvers. Airborne liquid and coarse particles are thrown against the bowl's wall by centrifugal force and run down to the bottom of the bowl. The Deflector Shield is used to ensure that all air impinges against the bowl's wall and does not pass directly through the Filter Element while it still retains liquid. The Baffle creates a 'quiet zone' at the bottom of the bowl to prevent air turbulence from drawing separated liquid into the outgoing air stream. Air leaving the bowl passes through the filter element where finer solid particles are removed and retained.

The filter may have either a manual or automatic drain. The Manual Drain is a simple petcock at the bottom of the bowl. Manual drain models must be drained periodically. If liquid level in bowl is allowed to rise above the baffle, liquid will be carried downstream.

Air Filter



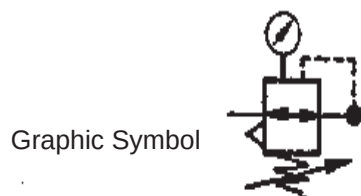
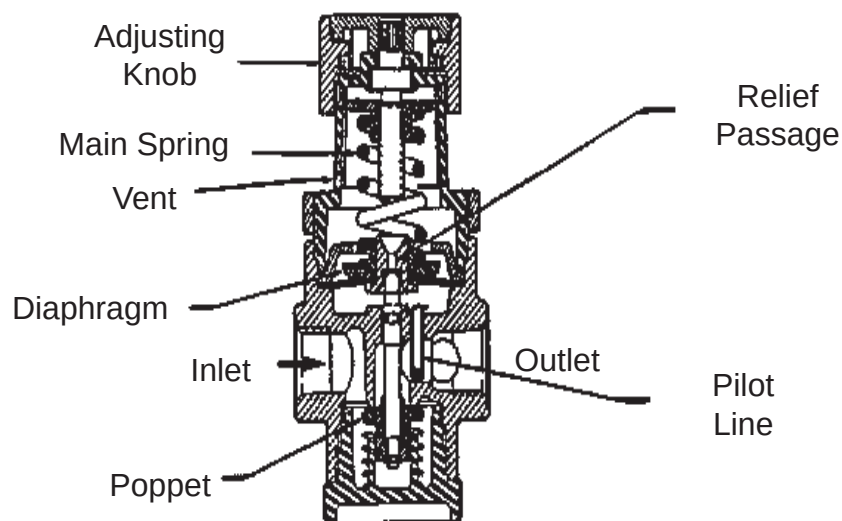
PRESSURE REGULATOR

The function of a pressure regulator is to deliver constant reduced pressure from its outlet regardless of variations in the supply pressure. Air pressure can be set on the machine according to the precise level needed, thereby providing consistent and repeatable action at the required force level. It further serves to reduce air waste by permitting an operator to adjust the pressure to no more than is actually required.

A regulator is a poppet valve which is opened and closed by pilot pressure from its outlet. To adjust the outlet pressure to a higher valve, main spring tension should be increased. For a lower pressure setting, decrease spring tension. A self relieving regulator will decrease its outlet pressure automatically if the operator decreases the pressure setting.

When properly protected by a filter, no routine maintenance is required.

Pressure Regulator



AIR DUMP

The electropneumatic soft-start and quick exhaust valve is used to reduce pressure quickly and safely and to build up pressure gradually in industrial pneumatic piping systems and terminal equipment.

The MS6-SV-D has two safety functions: pressure release and protection from unexpected start-up (non-switching).

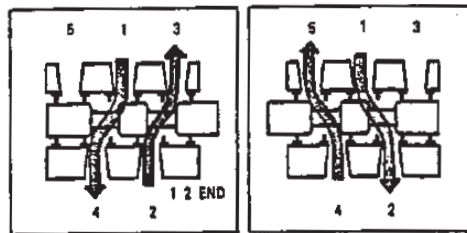
DIRECTIONAL CONTROL VALVES

Directional control valves are used to direct the flow of air to and from air operated actuators, such as cylinders and motors. There are many designs of valves. Columbia most often uses 4-way, 5-port pilot operated solenoid spool valves in either 2- or 3-position configuration.

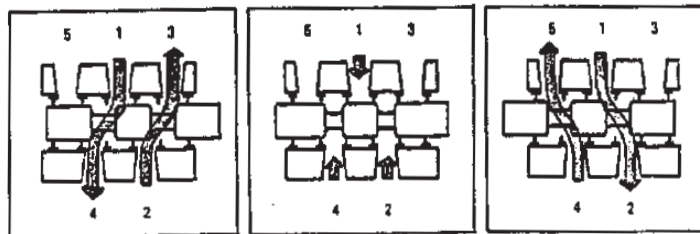
The most common valve used is the 2-position, single solenoid, spring return valve. The term 2-position means that there are only two possible positions the main spool can be in.

In a few pneumatic circuits a 3-position valve is used. The three lateral positions are: (1) all the way to the left, (2) directly in the center, and (3) all the way to the right. In the de-energized position the valve spool is centered by centering springs.

Spool Positions



2-POSITION, 5-PORT



3-POSITION, 5-PORT - ALL PORTS BLOCKED CENTER

In a pilot operated valve the main spool is not shifted by the solenoid alone. The solenoid shifts a miniature valve called the pilot valve. The pilot valve either pressurizes or vents the main spools end chambers. When the solenoid is energized the pilot valve pressurizes the end chamber of the main spool causing it to shift. This happens just like a piston being moved in a cylinder. When the solenoid is de-energized the chamber is vented to the atmosphere.

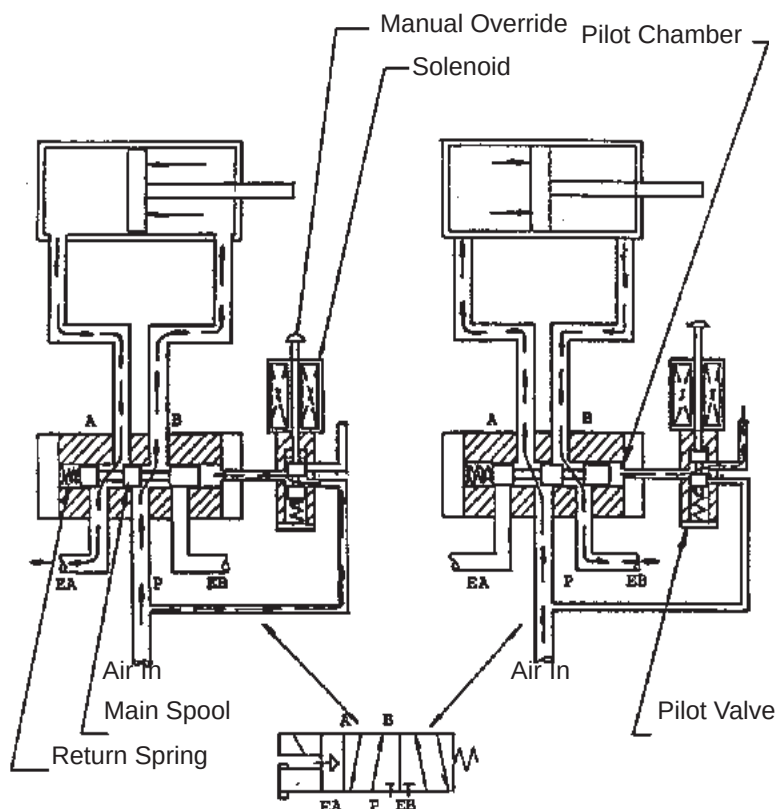
The most common problem found in air systems is dirty or contaminated air. The problem could be metal chips, water or anything that would not be normally found in a clean air system.

Most pilot operated valves are equipped with a manual override button which shifts the pilot spool directly. This feature is very useful in troubleshooting.

If a valve has its coil burned out, the manual override will shift the valve but the solenoid will not shift it.

If a valve is mechanically bound internally, the manual override, when depressed, will not shift the spool. The solenoid will not shift it either. This problem is experienced when contaminants enter the system.

2-position Pilot Operated Solenoid Valve in a Cylinder Circuit



SPECIAL PURPOSE VALVES

QUICK RELEASE VALVE

The quick release valves speed the exhausting of your air cylinders, clutches or other pneumatic devices. They vent air pressure close to the operated device instead of back through the control valve. Equipment cycling or release times are reduced for increased output.

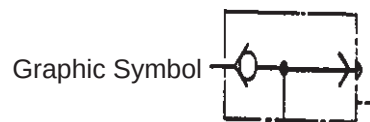
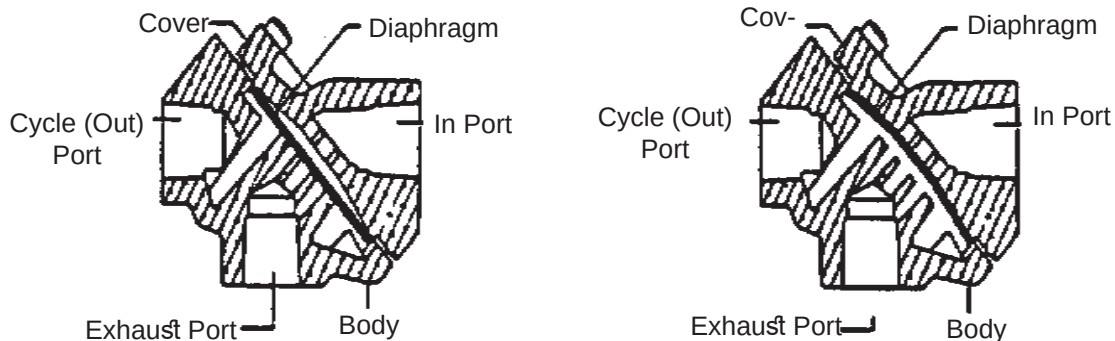
Air pressure entering the inlet port forces the diaphragm against the exhaust port, closing it. Air pressure also deflects the rim of the diaphragm to open a direct passage around the diaphragm to the outlet port.

When air pressure at the inlet port is reduced, a differential in the pressure acting on the diaphragm is created. This differential in pressure lifts the diaphragm from the exhaust port and seats it on the inlet port. This opens the exhaust port, allows air to flow freely from the outlet port to atmosphere, and closes the inlet ports.

Should outlet air pressure drop below inlet pressure, the differential in pressure seats the diaphragm on the exhaust port, stopping further exhaust.

No regular attention is required and the only wearing part is the diaphragm.

Quick Release Valve



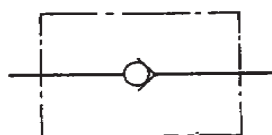
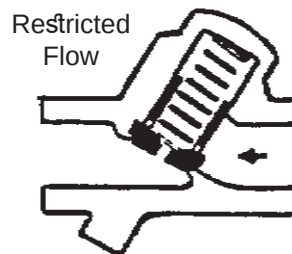
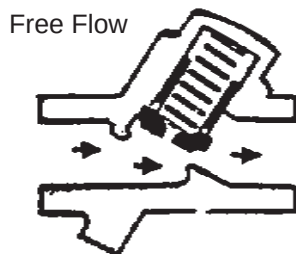
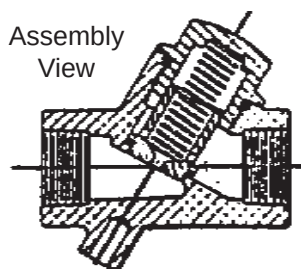
CHECK VALVE

Check valves will allow air to flow in one direction only.

In the free-flow direction, the poppet is unseated and the air is free to flow. When flow stops, the light spring will seat the poppet and prevent reverse flow.

No regular attention is required. If leakage occurs, the valve seat, seal and spring should be inspected. Clean or replace if necessary.

Check Valve



Graphic Symbol

METERING DEVICES

These devices control the rate of flow of air to or from a cylinder or motor.

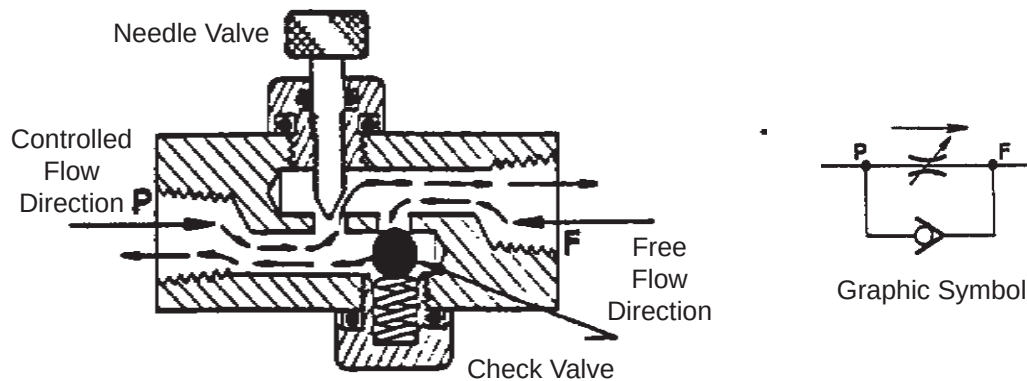
There are two types of metering devices normally used on Columbia equipment. They are the in-line Flow Control valve and Needle Valve.

FLOW CONTROL VALVE

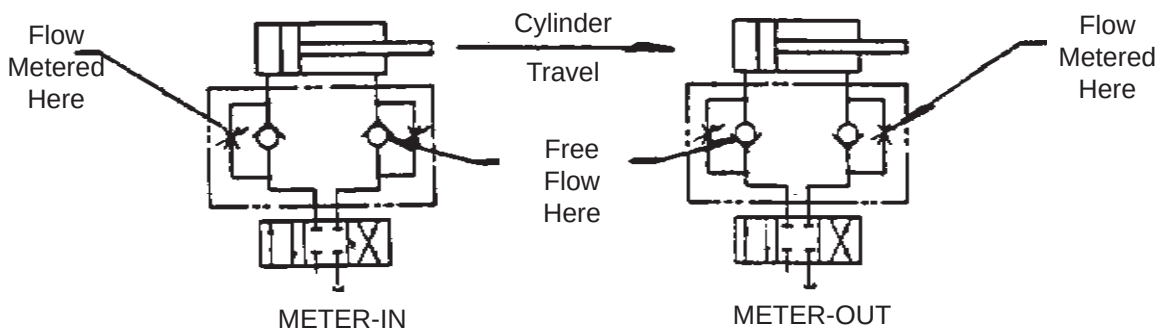
The Flow Control valve is used on any circuit that has a reversing motor or cylinder that requires independent adjustment of speed for both directions of motion. The valve is designed to allow free flow in one direction and metered flow in the other.

A flow control valve can either be used in a Meter-in or Meter-out application.

Typical Flow Control Valve



Meter-in or Meter-out Flow Control Valve

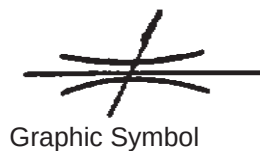
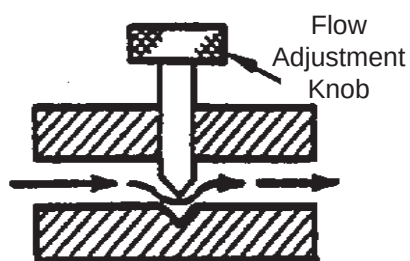


NEEDLE VALVE

Needle valves will meter flow in both directions equally. They are used in circuits such as non-reversing motors, or any circuit that does not require independent speed control.

These valves require no maintenance or repair and are usually replaced when defective.

Needle Valve



AIR CYLINDERS

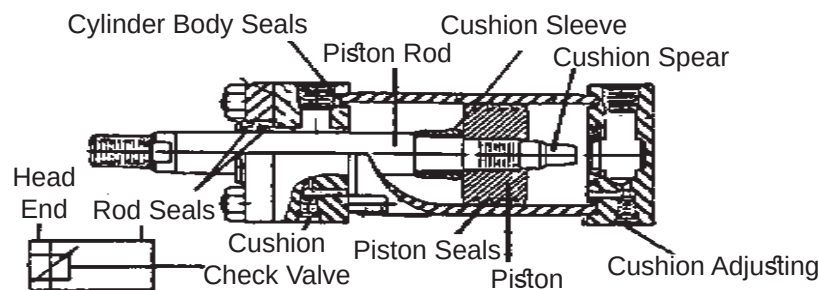
Air Cylinders provide linear motion.

There are two basic types of cylinders used on Columbia equipment. The most common is the standard double acting design. This cylinder can produce a working force in both directions.

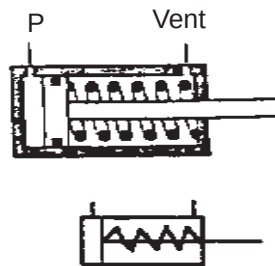
Single acting spring return cylinders are used less frequently and can only supply a working force in one direction.

Most air cylinders are supplied with cushions at one or both ends of the stroke. These devices provide a smooth de-acceleration of the cylinder piston and load. They are normally adjustable and can be set as required.

Typical Double Acting Cylinder



Typical Single Acting Spring Return Cylinder



Air cylinders should require little or no regular attention except making sure the air is filtered and lubricated properly. If an air leak occurs, replace the defective seals.

Cylinders are supplied with adjustable cushions. It is important that they are adjusted for smooth cylinder operation. Adjustment will prolong the life of both the cylinder and the whole machine.



Air cylinders can store energy even when the machine is turned off. Be extremely careful when working around a jammed air cylinder since it can lunge forward when freed. To prevent bodily injury, '**LOCK-OUT**' the Main Power Disconnect Switch with a padlock and bleed off all pneumatic energy before attempting to free jammed cylinders and initiate any other pneumatic repair.



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SECTION 4

LUBRICANT INFORMATION

INTRODUCTION

This section covers machine lubrication. Proper lubrication will insure long life of moving parts on this equipment. Reference to the subsequent data within this section will be of assistance for the description and maintenance of lubrication points.

Should you require additional information on lubrication of your machine, please contact the Columbia Machine, Inc., Service Manager for assistance.



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DESCRIPTION

- All mounted bearings are lubed for life and do not require greasing.
- Linear Rails require grease packs for lubrication.
- Chains should be cleaned and oiled after every 1000 hours of operation; more frequently in damp or dirty environments.



Always use cleaning solvents in a well ventilated area. Read and follow all cleaning material instructions supplied by that manufacturer. Safety glasses and protective gloves should be used during this procedure.



Before attempting any service work, be certain equipment is secured with the main power disconnect locked in the open position, the air supply removed, and all air or hydraulic system pressure bled off.



RECOMMENDED GREASE LUBRICANTS

Columbia recommends the use of a grease that conforms to the NLGI #0 specification for both automatic and manual grease systems.

The NLGI rating system was developed by the National Lubricating Grease Institute and is an indication as to the pumpability of a grease. The ratings range from NLGI #000 to NLGI #6 and the lower the number the easier it is to pump the grease.

PNEUMATIC FILTERS

Although suitable air filters and water traps are installed on Columbia equipment, they are designed and sized to remove only the normal amount of matter that will pass through a properly maintained air system. Filters that are partially plugged, due to lack of maintenance, can cause an air pressure drop. If the filtering element is damaged, foreign material swept through the air system can cause plugged orifices and excessive wear on moving parts.

When the bowl or filter shows visual signs of dust build up, the filter should be cleaned or replaced. To do so, turn off the plant air supply to the regulator-filter with the shut-off valve in stack prior to regulator. Unscrew the filter element, blow from the inside toward the outside with high pressure air (opposite the normal air flow) and re-assemble.

The regulator-filter should be blown down (using the manual petcock) any time moisture collects in the bowl. The moisture should not be allowed to reach the filter baffle.

**IMPORTANT**

Wear protective eye covering, such as safety glasses, during this operation.

**IMPORTANT**

See Pneumatic Section of this manual for additional information.

GEARBOX LUBRICANTS

Some gearbox manufacturers supply gearboxes filled with lubricant while others need to be filled by Columbia at the time of assembly. This creates a potential for a wide variety of lubricants to be used for each machine installation depending on the gearboxes used.

All gearboxes will be filled with proper lubricant prior to shipment.

To ensure maximum service life from your gearbox, Columbia has developed the following chart listing various gearbox manufacturers, type of lubricant, and the required maintenance schedule. Keep in mind this chart is developed for standard temperature and service conditions. If your service condition is severe in nature, adjustments to maintenance schedules should be considered.

If the ambient temperature around the palletizer in your facility is not within the temperature ranges shown on the chart, locate the vendor data section of your Parts Manual. There will be data for each gearbox vendor detailing all the maintenance requirements. A list of approved lubricants and their application can aid in the selection of the proper lubricant for your specific application. Your local lubricant supplier can also help in determining the proper oil for your specific application.

GEARBOX LUBRICANTS

<u>MANUFACTURER</u>	<u>FILLED WITH</u>	<u>INITIAL CHANGE</u>	<u>REGULAR CHANGE</u>
Boston-Wormgear	AGMA 8 Temp. Range 50-125 Deg. F.	100 Hours	2,500 Hours
Electra-Wormgear	Mobile SCH 634 Temp Range 50-125 Deg. F.	4000 Hours	4000 Hours
Electra-Helical	AGMA 4EP Temp. Range 60-165 Deg. F	100 Hours	2,500 Hours
DEMAG	Mobil Gear 630 Temp. Range 25-75 Deg. F.	Not Required	10,000 Hours
Eurodrive	Mobile Gear 630 Temp Range 50-125 Deg. F	Not Required	10,000 Hours
Cone Drive- Wormgear	Mobile SHC 634 Temp. Range 50-125 Deg. F	2 Weeks	2,500 Hours
Hub City - Bevel	AGMA 4EP Temp. Range 60-165 Deg. F	100 Hours	2,500 Hours
US Motors - Helical (Leroy Somers)	SHC 629 AGMA 4EP Temp Range 22-122 Deg. F	Not Required	Lubed for Life
Sumitomo	Mobile SHC 634 Temp Range 86 - 125 Deg.F	500 Hours	5,000 Hours
Nord	Mobile 600 XP220 Temp Range 20-104 Deg. F	Not Required	10,000 Hours
Varmec	Mobile SHC 630 Temp Range 32-104 Deg F.	Not Required	10,000 Hours



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SECTION 5

GENERAL MAINTENANCE (HL6200)

MECHANICAL, SPEED & TIMING ADJUSTMENTS

EQUIPMENT DESCRIPTION

The HL6200 Palletizer utilizes electric motors and pneumatic cylinders to provide all of its operating functions.

The brake portion of the electric brake motors used on the HL6200 are adjustable in some of the applications. (See brake motor adjustment sheet.)



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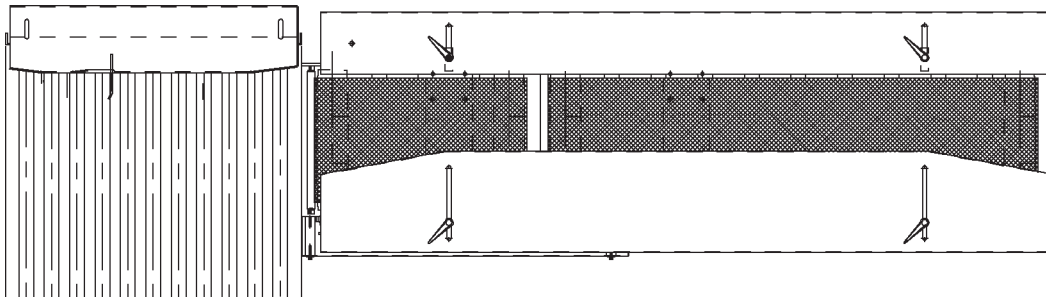
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INFEED CONVEYOR

The HL6200 side infeed consists of two belts (pacer belt and meter belt), conveyor rollers, and a turn shoe.

The pacer and meter belts are used in combination to provide a smooth continuous flow of product into the machine. This assembly is powered by an electric motor through a worm gear reducer. Belt speed and motor are controlled by a Variable Frequency Drive (VFD).

In order to insure that there is an adequate gap between incoming cases to allow the cases to be counted and turned, the meter belt speed is faster than that of the pacer belt. The speed differential between the two belts is a function of case length and is selectable for each product type in the Product Manager screen of the HMI.



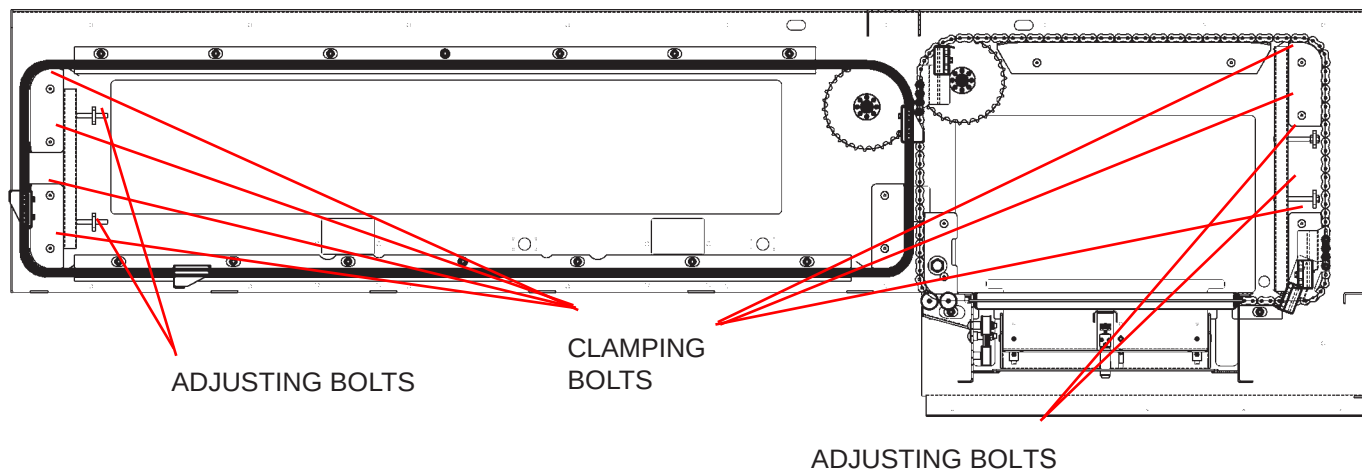
To assist in turning product around the turn shoe, some of the conveyor rollers are fitted with polyurethane sleeves for the purpose of gripping the product for positive drive around the turn fender. If the sleeves slip or wear, it can greatly affect the way the product handles.

ROW & LAYER FORMING AREAS

Product travels from the infeed to the row forming area where it is then properly spaced through the use of pop-up stops. After one complete row of product is in the row forming area, the row former flight bar pushes the row into the layer forming area. After one complete tier of product is in the layer forming area, the layer forming flight bar pushes the tier onto the stripper plate.

Both of the flight bars are powered by electric motors through worm drive gear reducers. The row former flight bar is controlled by a Variable Frequency Drive. Smooth starting and stopping of the flight bar can be achieved by adjusting the VFD. The motor driving the layer table is controlled by a Gearbox and VFD.

Tension of the flight bar chains is adjusted by loosening the clamping bolts on the adjusters and turning the adjusting bolts. Take care not to overtighten the adjusters as this will slow the flight bar speeds and may cause the motors to overheat.



The rollers in the row forming area are driven by a v-belt held to the bottom side of the rollers by small idler pulleys. By adjusting the idlers, the amount of drive can be varied.



NOTE

To prolong belt life adjust the idlers for the minimum amount of pressure required to drive the rolls.

MAINTENANCE SECTION HL6200

PACER/METER BELT



Maintenance Points for Pacer/Meter Belt

DAILY PM - Belt Tracking

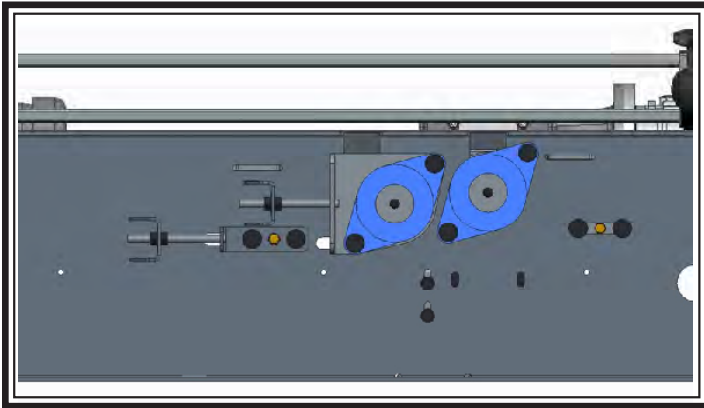
If adjustment is required:

MAINTENANCE SECTION

HL6200

EVERY 130,000 LOADS PM **PACER/METER BELT**

Check tension of drive:



LOCK OUT ALL POWER SOURCES

Proper belt tension on the Pacer/Meter belt is essential for positive starts/stops and belt tracking. Under tensioning can result in belt slipping during high line pressure, over tensioning can cause belt and or bearing failure

EVERY 1,500,000 LOADS PM **PACER/METER BELT**

Replace drive belts. Or as wear occurs.

TO TENSION AND TRACK BELTS:

- 1) Be sure frame is square. Assemble shafts so they are parallel to each other and square to the frame. Measure from the end of the frame to the center of each shaft on both sides to ensure they are parallel. Measure to the edge of each pulley to make sure they are in line.
- 2) Install the snubber rolls so they are parallel to the drive and idler roller. Initial installation should be at the center of the take up slot.
- 3) With the conveyor turned off, tension the belt until it conforms to the pulley crowns. There should be no play between the edge of the belt and the crowned pulleys. Be sure to take up equal amounts on each side so the shafts remain parallel.

BELT TENSIONING CONTINUED:

4) Now operate the belt conveyor and observe closely to see if there is any slippage at the drive pulley and the belt. If slippage occurs, more tension is needed. Do not over tension the belt.

5) Track belt with snubber rollers only. "The belt moves toward the end of the roll it contacts first." With the belt empty and running, adjust the snubber closest to the tail pulley. Let the belt run for several revolutions after each adjustment. Try to spread the adjustment evenly between the two snubber rollers.

6) Verify tracking with a full load, and adjust if needed.

MAINTENANCE

PALLETIZING SECTION

DAILY OPERATOR PM



View of Upper Palletizing Section



View of Lower Palletizing Section

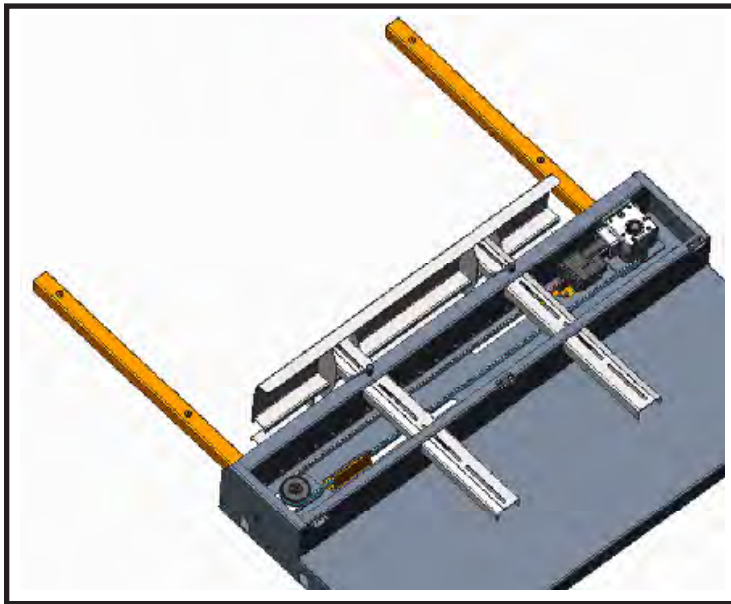
Clean the area under the hoist daily.

LOCK OUT MACHINE BEFORE PREFORMING ANY MAINTENANCE

MAINTENANCE

PALLETIZING SECTION

DAILY OPERATOR PM



Check side layer guides for smooth action.

Belt tension should only be tight enough to keep the teeth from jumping.

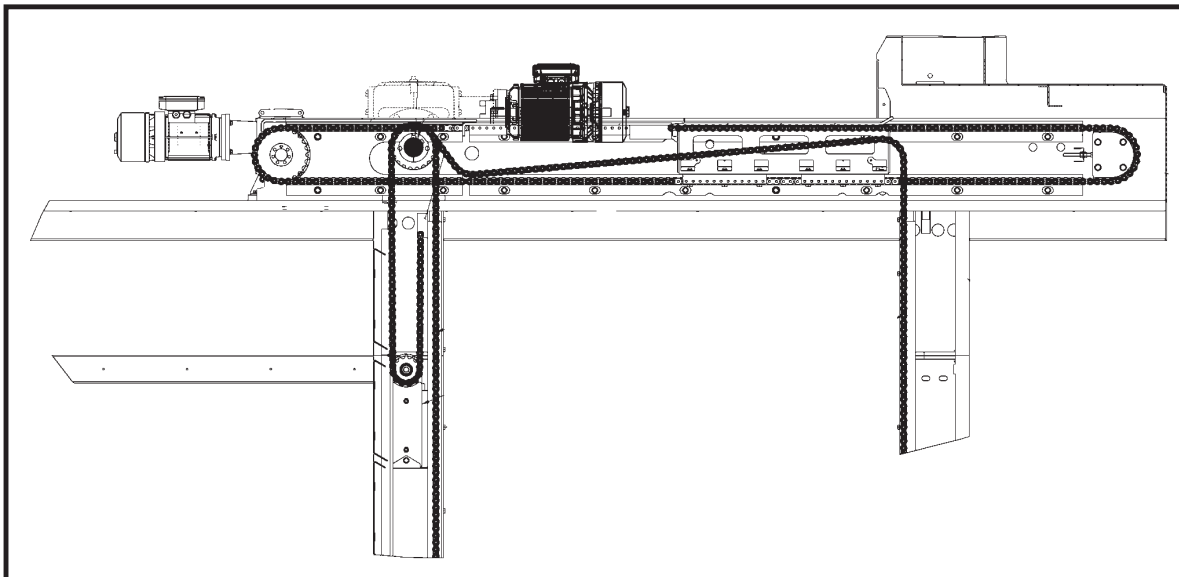


LOCK OUT MACHINE BEFORE PREFORMING ANY MAINTENANCE

MAINTENANCE

PALLETIZING SECTION

400,000 LOADS PM



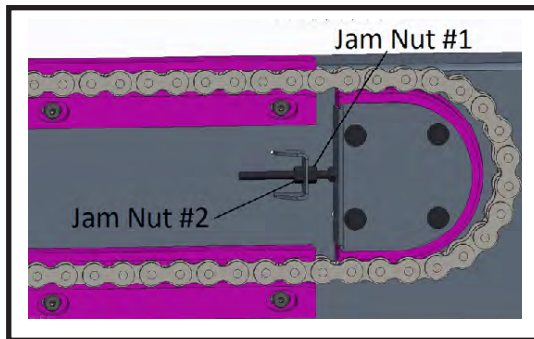
Layer Stripper Chains

The layer stripper chain will stretch over time.

Noise will be the primary indicator to re-tension. Over/undertravel, excessive contact, or plate impact will also indicate the layer stripper chains need re-tensioning.

LOCK OUT ALL POWER SOURCES!

Layer Stripper Chain Tensioning Continued



Loosen the four capscrews locking the UHMW to the frame.

Loosen jam nut #1.

Tighten jam nut #2.

Lock in plate with jam nut #1.

Tighten frame mounting capscrews.

Do not overtighten.

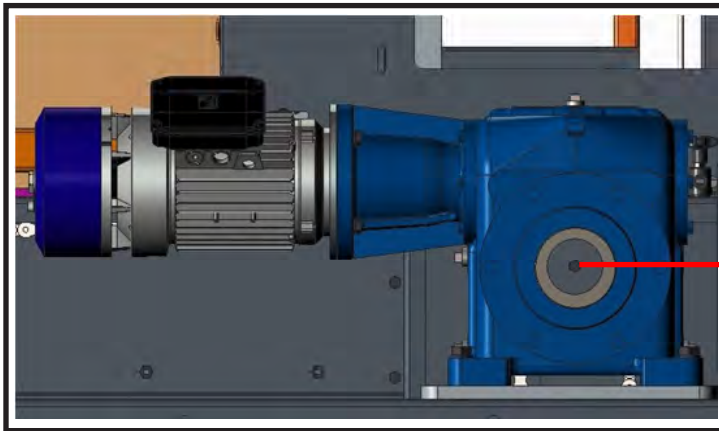
Must perform this procedure for both sides.

LOCK OUT MACHINE BEFORE PREFORMING ANY MAINTENANCE

MAINTENANCE

PALLETIZING SECTION

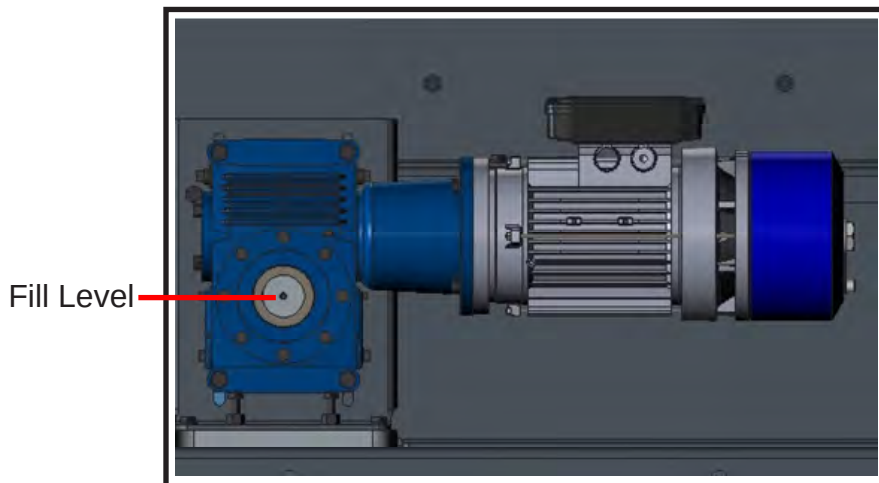
400,000 LOADS PM (cont.)



Fill Level

Replace fluid in Layer Stripper and Hoist Gearboxes with Mobile SHC634.

These are the only boxes that require inspection.



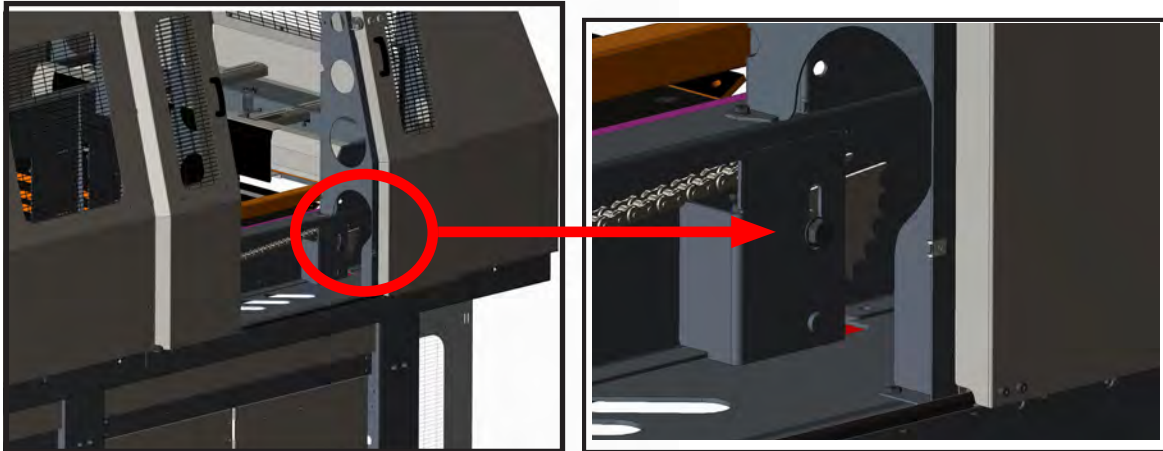
Fill Level

Fill for continuous run condition halfway up lower shaft.

LOCK OUT MACHINE BEFORE PREFORMING ANY MAINTENANCE

MAINTENANCE

PALLETIZING SECTION: ECCENTRIC IDLER



To Re-level:

The eccentric idler is used to adjust the height on the hoist.

Lower the hoist to the bumpers at the lowest position.

LOCK OUT ALL POWER SOURCES!

Loosen the bolt holding the eccentric idler and rotate idler until the appropriate height is reached.

Replace chains when 3% stretch is reached.

MAINTENANCE

FULL LOAD CONVEYOR SECTION

Daily Preventive Maintenance



Inside the Hoist Frame is a Conveyor referred to as the Full Load Conveyor.

Daily-

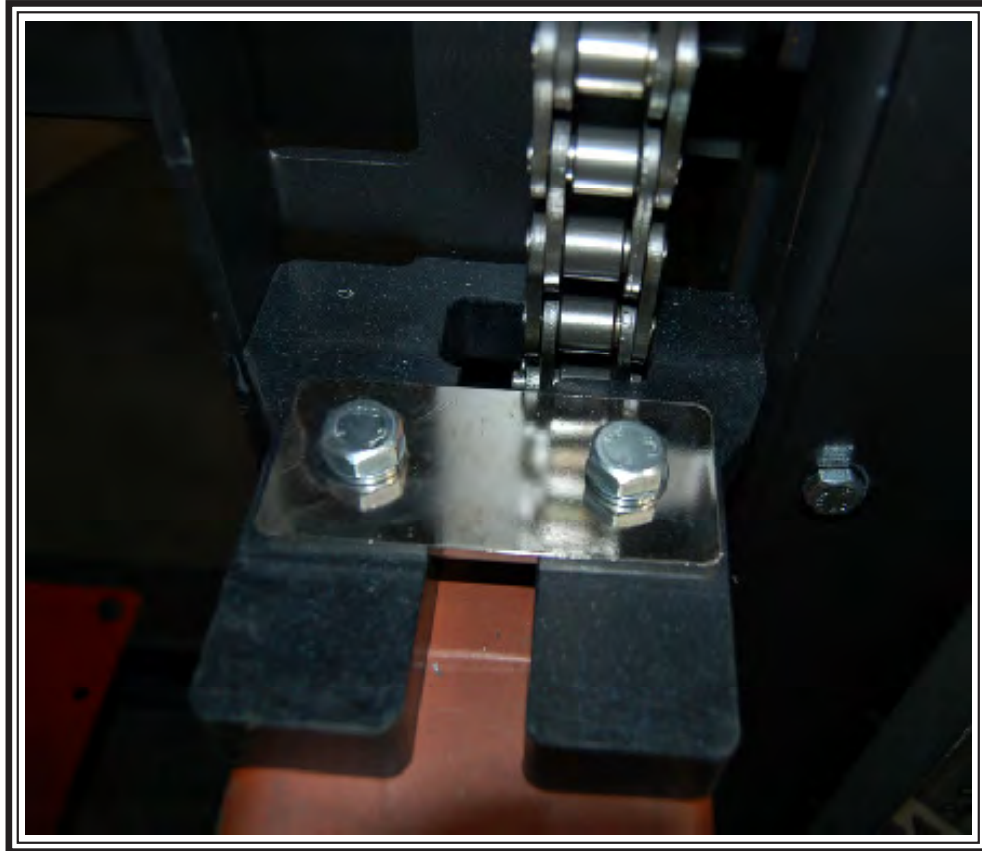
Clean under the Full Load Conveyor. Any product left under the Full Load Conveyor may cause damage to the Lift Mechanism.

Watch that the loads transition smoothly to the discharge conveyor.

MAINTENANCE

FULL LOAD CONVEYOR SECTION

130,000 Load Preventive Maintenance



The Full Load Conveyor is guided on vertical frame components inside the Palletizing Section frame.

Check the play in the Hoist Guides.

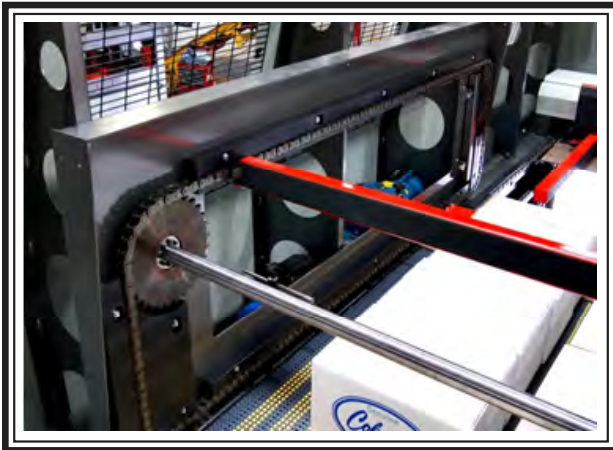
If hoist moves more than 1/16 of an inch in any direction rework the guide system.

It is very important to limit the play. Missing a switch can cause damage to the palletizer. The guides will need to be replaced or shimmed as they wear.

MAINTENANCE

HL6200 LAYER FORMING

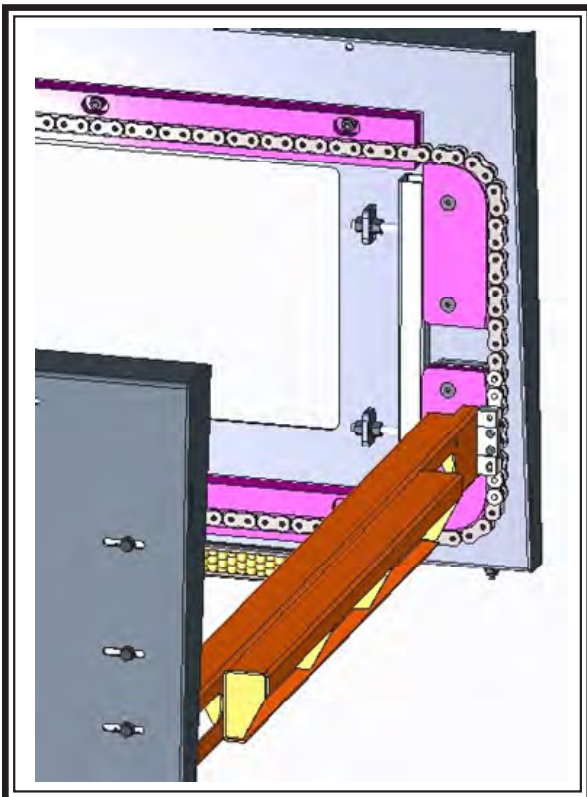
DAILY OPERATOR PM



LOCK OUT ALL POWER SOURCES

Check that the flight bar motion is smooth and positions the product properly.

The flight bar may be squared by loosening the B-LOC holding the gear and moving the chains independently until they are squared up. See B-LOC in General Maintenance



Check chain tension. The noise level is a common indicator of a loose chain.

The bar attached to UHMW guides at the end of the layer former is used to tension the chain.

To Tension:

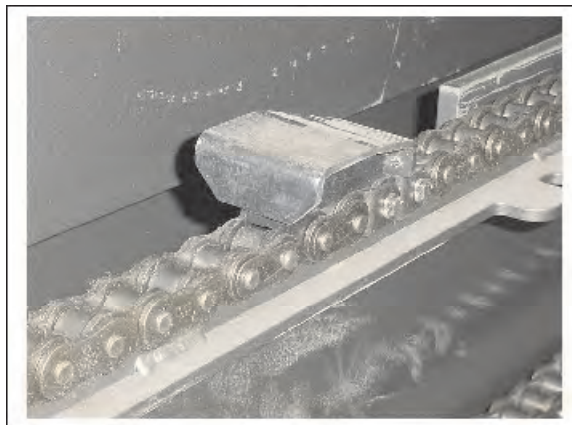
Loosen capscrews securing UHMW. Loosen jam nut. Tension top and bottom of each side the same amount. Re-tighten jam nut and capscrew.

702 PALLET DISPENSER

LOCK OUT MACHINE BEFORE PERFORMING ANY MAINTENANCE



The pallet dispenser provides a pallet, one at a time, to the palletizer. The 702 pallet dispenser separates pallets with the use of lugs on the dispenser chains. The lugs remove the bottom pallet from the stack of pallets in the hopper.



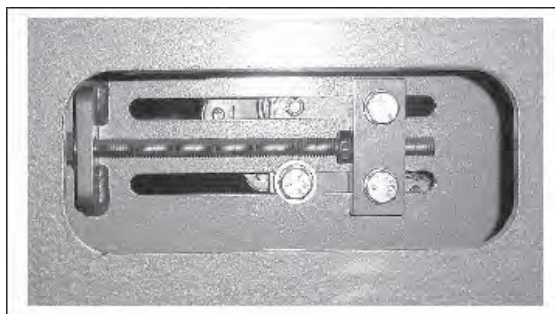
The lugs should be timed so that the lugs are in line across the pallet dispenser. Rotating the sprocket on the drive shaft forward or backward to meet the positioning requirement can change the lug position. The use of B-Loc Hubs is explained in the general maintenance section.

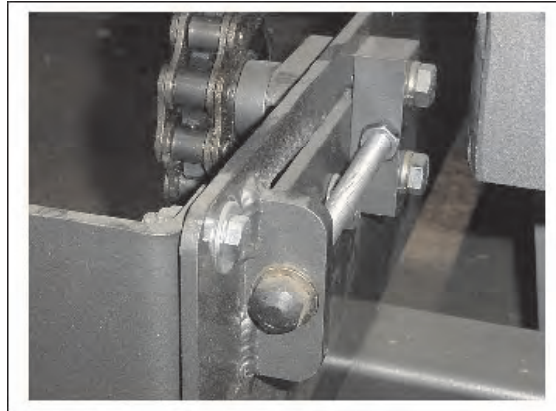
Check the drive chain every month checking for slack. If slack in the drive chain is found remove by:



1. Lockout machine
2. Loosen four capscrews under the gearbox-mounting channel.
3. Loosen jam nuts on setscrews.
4. Turn setscrews clockwise to tighten chain. Do not over tighten.
5. Tighten jam nuts on setscrews and capscrews under cross manner.
6. Secure from Lockout condition

The pallet dispenser conveyor chains may require tension from time to time to remove slack in the chain.





1. Lockout Machine.
2. Locate the take-up location.
3. Loosen the three capscrews holding the idler sprocket mounting plate.
4. Loosen jam nut on all thread.
5. Turn all thread clockwise to tighten the jam nut and capscrews.
6. After removing slack, tighten the jam nut and capscrews.
7. Secure from Lockout.

PREVENTIVE MAINTENANCE INSPECTION AND LUBRICATION SCHEDULE

The maintenance program described in this manual is based on a machine operated eight (8) hours a day, 5 days a week, with normal environmental conditions.

If your operating conditions are considerably different, discuss a maintenance program with the Columbia Service Engineer when your machine is installed or contact the Columbia Service Manager directly.

Before beginning maintenance LOCK OUT ALL POWER SOURCES!

FREQUENCY	DESCRIPTION
WEEKLY	1. GENERAL a) Keep area around the palletizer clean and orderly. b) Check that all safety circuits (light curtain, door switches, etc) are operational. 2. INFEED SECTION (Rear and Side) a) Inspect the rollers. Check for bent rollers, frozen bearings, or loose roll covers. b) Inspect the product guide rails for loose mounting brackets, and bent or damaged rails. c) Inspect the case turn device for loose bolts or loose mounting brackets. d) Check the belt tension. Adjust tension as needed by adjusting the belt take-up in the pusher section. e) Check individual tensioner pulleys for proper pressure against belt. f) Check belt return pulleys for alignment. Adjust as needed to keep belt running true g) Check for smooth turn grate operation on front and rear infeed machines if present.

FREQUENCY	DESCRIPTION
WEEKLY	3. ROW PUSHER SECTION a) Check stops and stop mounting brackets for loose bolts. Tighten as needed. b) Check UHMW flight bar chain guides for wear. c) Check flight bar chain for stretch. Adjust as required.

FREQUENCY	DESCRIPTION
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Check the following in addition to the weekly items:

MONTHLY	1. INFEED (Rear and Side) a) Inspect V-belt for wear. Tension belt as needed. b) Inspect pneumatic cylinders and air lines for leakage. c) Check overall frame work and components for loose fasteners. 2. ROW PUSHER SECTION a) Inspect belt pulleys for misalignment. Adjust as needed. b) Inspect stop assemblies for alignment and loose fasteners. 3. HOIST/LAYER STRIPPER a) Inspect the camrollers on the layer stripper for signs of wear. Replace as needed. All rollers should turn freely as layer stripper moves out and back. b) Inspect layer stripper chain tension and track for wear.
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- c) Inspect hoist guides for wear. Adjust or replace as needed.
- d) Level hoist by adjusting the lift chains on the eccentric idler mount.

FREQUENCY	DESCRIPTION
-----------	-------------

MONTHLY

3.

- e) Remove the hoist drive guards and inspect drive sprockets, set screws and keys for tightness. Check for sprocket wear and replace as needed. Tension by adjusting motor with adjuster bolts on motor base.

4. MANUAL AND AUTO LUBE SYSTEMS

- a) Lubricate the bearings as required. All mounted bearings are lubed for life. Lube linear bearings every 4000 hours. **Do not over grease!**



In order to perform the above operations, some or all guards had to be removed. Replace all guarding back in its proper location before starting machine.



DO NOT OPERATE THIS MACHINE WITH THE GUARDS OR COVERS REMOVED!

‘LOCTITE’ INSTALLATION AND REPLACEMENT

DESCRIPTION – Recommended as a preventive maintenance tool. ‘Loctite’ Threadlock 290 Adhesive Sealant offers manufacturing the capability of locking specified items **after** final assembly. This is made possible by the inherent chemical characteristics that allow the product to follow the threads of a pre-assembled fastener through capillary action both vertically and horizontally. Through this action the product will then self-harden to a medium to high strength plastic bond when confined in a metal joint.

REMOVAL OF FASTENERS – Due to the large area of the machinery, exact location of each Loctite application is too complex and variable to list. Therefore, at time removal of a particular fastener is desired, test with minimum exerted manual pressure. If the fastener (such as set screws, nuts and bolts) does not begin to release, you may safely assume Loctite has been applied to this area. Removal can be accomplished by using an acetylene torch to heat the area to be separated to approximately 400° Fahrenheit.

**WARNING**

Whenever heat is required to separate assembly, perform this function away from all possible combustible products or confined areas where combustible fumes may be present. Wear protective goggles and gloves during heating and removal process.

REPLACEMENT – Upon removing the required assembly from the machine, before replacing with new parts, completely clean male and female threaded areas with a wire brush and cloth to remove any visible contaminants and/or oils from area to be secured.

- Apply threadlocker sealant to thread engagement area filling thread root. Assemble.
- For blind holes, put a few drops into the hole and onto the fastener. Assemble.
- For already assembled parts, clean any oil/grease or other contaminants from fastener/nut parting line area. Apply threadlocker 290 in the interface area and capillary action will carry the adhesive into the threads either horizontally or vertically. Wipe off excess. Allow approximately thirty (30) minutes or more set up time before usage.



SUGGESTED ELECTRICAL MAINTENANCE SCHEDULE CONTROL SYSTEM

The maintenance schedule is to be used along with your Columbia Parts and Instruction Manuals.

Whenever maintenance has been performed on the machine, check the eyes, prox. switches, etc., for adjustment or alignment in that area.

While the machine is running, watch for broken pallets, pieces of wood, etc., that may jam up against switch trips, and eyes - especially in the Pallet Dispenser. As the product enters the machine, watch for wet loads, broken or torn cases, etc.

Keep control panel clear of nuts, bolts, tools, etc. Keep prints up to date; keep a copy in the control panel.

Always keep Columbia Machine, Inc., informed of any changes being made to your equipment such as logic changes, wiring, etc.

Following are daily, weekly, monthly, and yearly maintenance schedule:

DAILY: Check all photocells for misalignment.

WEEKLY: Repair broken conduits, flex conduits, and damaged electrical cords. Check eye alignment, tighten brackets and check eye sensitivity and adjustment. Check for broken or loose switches.

MONTHLY: Check all fittings and areas of inter-connection of electrical devices.

YEARLY: Check all terminal strips for loose connections. Blow out cabinet with low pressure and clean, dry air.



Arc welding produces a wide spectrum of electrical noise. Arc welding on your Columbia equipment or attached machinery may cause portions of the controller memory to change.

Before doing arc welding, the following procedure should be follows:

- Turn the main power supply to the panel off.
- Remove the three power leads that are attached to the top of the processor. All three (the line, common, and ground) should be removed.
- Disconnect the input/output cable from the processor.
- Following welding, reconnect the input/output cable and the three power leads.

**NOTE**

The power leads must be attached as follows:

Blue - Line

White with a Blue stripe - Common

Green - Ground

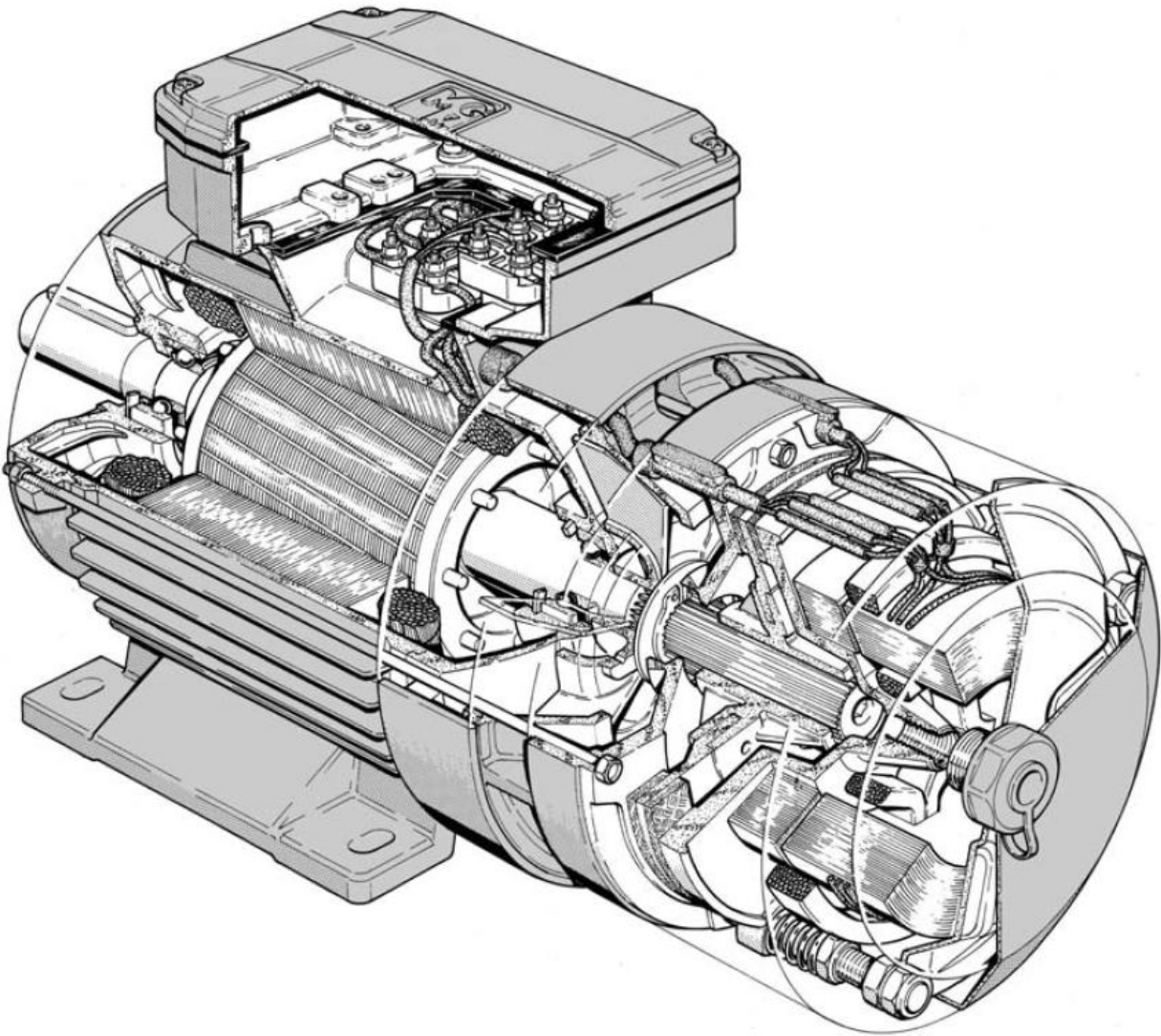
**CAUTION**

Static charge that build up on your body may cause damage or memory change to the processor's memory. Make certain to discharge static electricity from your body before handling any memory cards or chips. Transport chips or memory cards in anti-static materials. This also applied to the U.V. PROM chips, if so equipped.

See examples on following pages.

MGM Brake Motor

Brake Air Gap Adjustment



Columbia Machine

Step 1.1: Remove Rear Cover

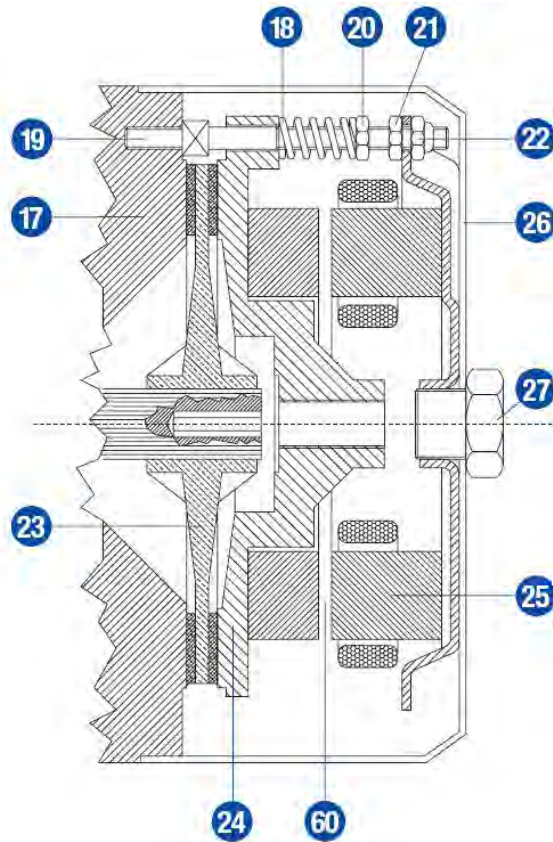
Using a large Crescent Wrench remove the white plastic nut retaining the rear cover on the motor.



The motor looks as shown below after cover has been removed.



Step 2.1: Identify Components



17: Motor Housing

18: Brake spring

19: Brake stud

20: Brake spring adjusting nut

21: Brake housing adjusting nut

22: Brake housing adjusting nut

23: Brake rotor

24: Brake moving element

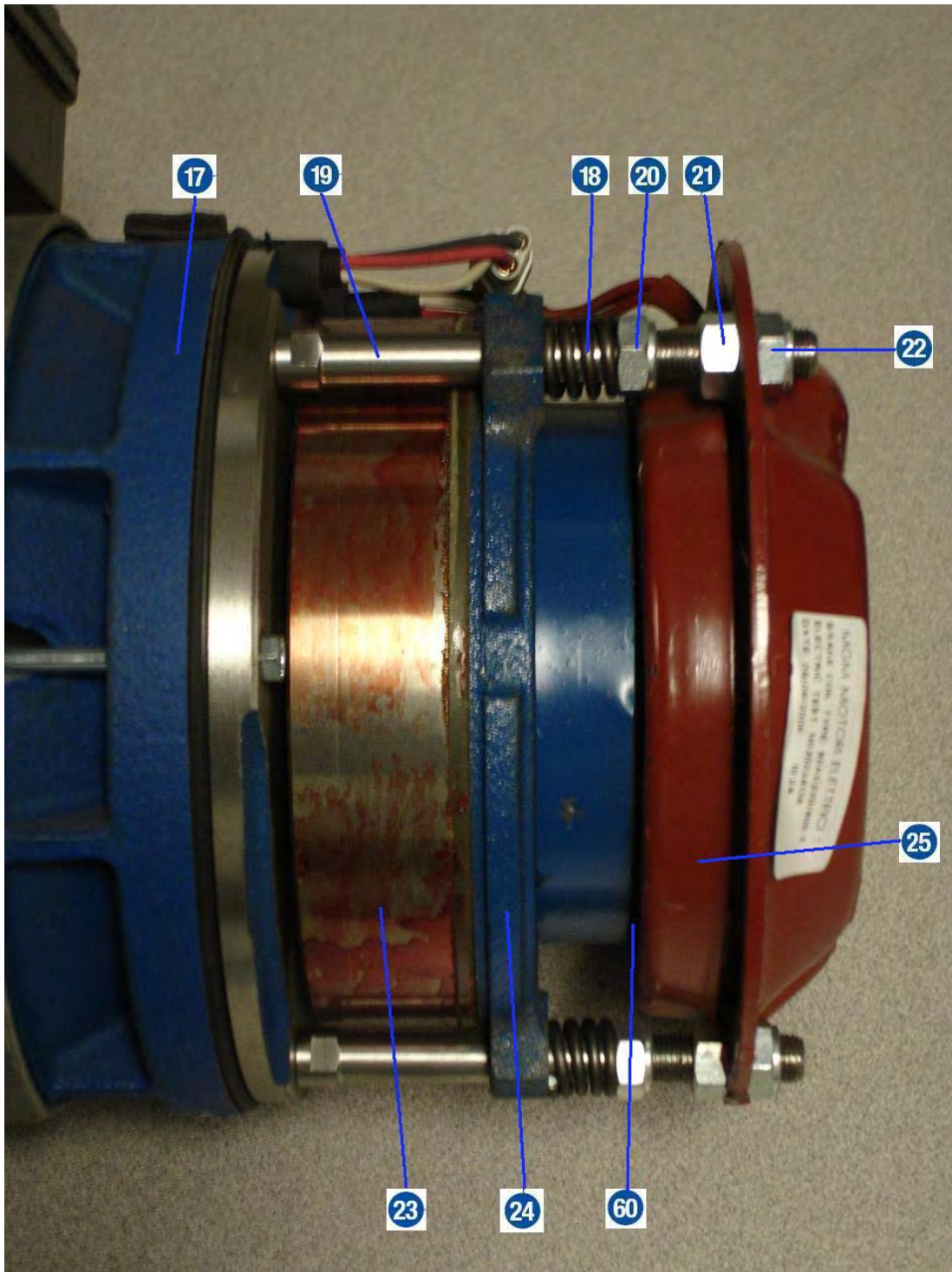
25: Brake coil

26: Rear housing cover adjusting nut

27: Cover attaching nut

60: Air gap

Step 2.2: Identify components on motor



*Items 26 and 27 not shown for clarity

Step 3.1: Selecting feeler gauge for air gap check

First refer to the chart below to select the correct feeler gauge based on the frame size of the motor. The frame size of the motor can be found on the motor id tag.

Frame Size	Air Gap (in)	Air Gap (mm)
71-80	.010-.020	0.25-0.5
90-100	.012-.024	0.3-0.6
112-132	.016-.031	0.4-0.8
160-200	.020-.039	0.5-1.0
225	.024-.047	0.6-1.2

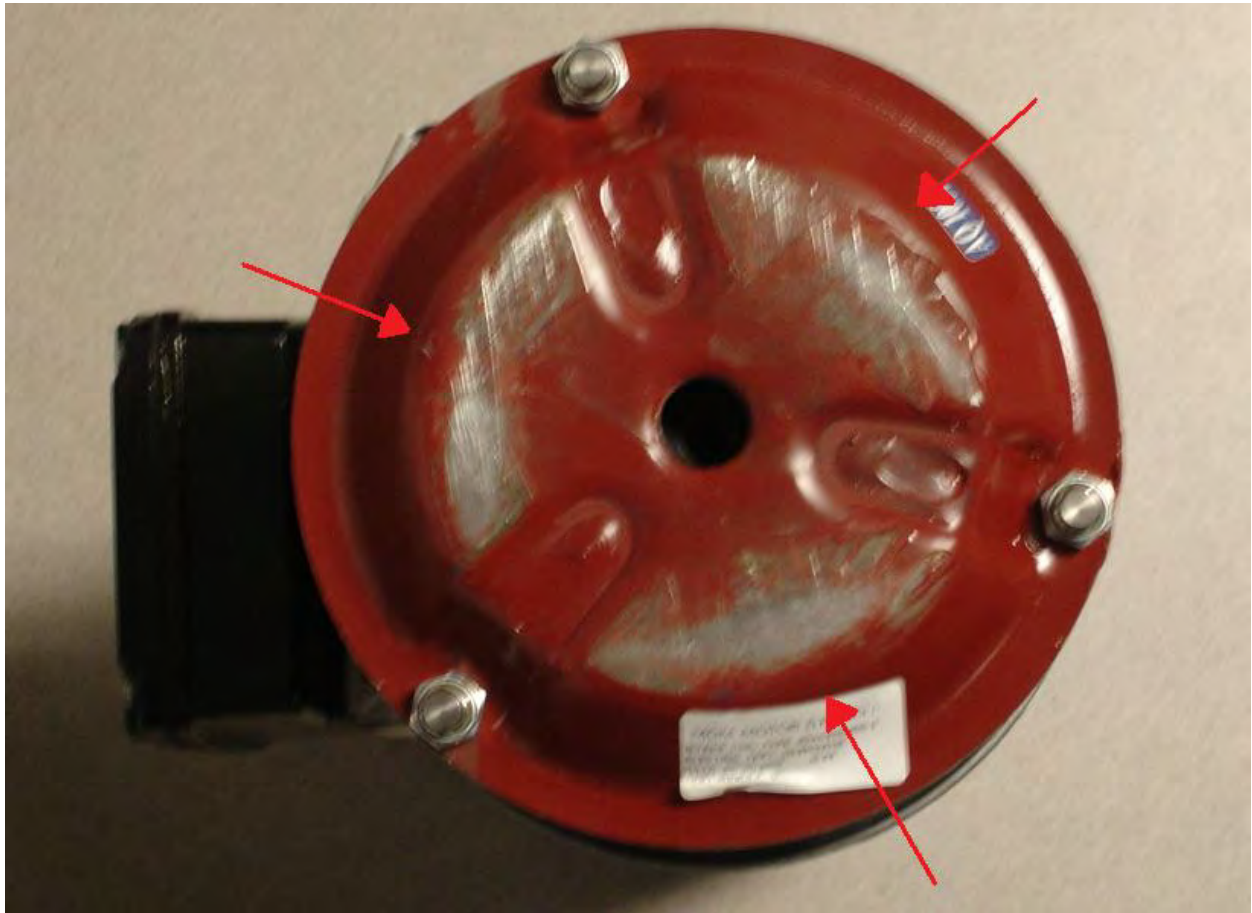
Step 3.2: Checking air gap

The air gap on MGM motors needs to be checked in the area indicated by the red arrows below.



DO NOT INSTALL THE BRAKE RELEASE TOOL WHILE CHECKING THE AIR GAP.

The air gap must be checked at a minimum of three locations that are equiangular around the circumference of the checking area. Preferably these locations would be in between each of the brake studs.





Exercise caution when checking the gap as there are recesses around the circumference of the brake that will give false readings on air gap. Red arrow indicates recessed area

Check the gap by inserting the feeler gauge between the Brake Coil (Item 25 on parts diagram) and the Brake moving element (Item 24 on the parts diagram). There should be slight drag on the feeler gauge as it is inserted and extracted from between the two components. If the drag is severe or the feeler gauge will not fit then the brake gap is too small. If the feeler has no drag or is very loose then the air gap is too large.

Step 3: Adjusting air gap

If the brake air gap checked in step 3.2 was even around the circumference **ONLY ADJUST EACH STUD IN EQUAL AMOUNTS**. Failure to do so will require additional set up procedure and time.

If the brake gap is insufficient turn each of the **Brake Adjusting Nut (Item 22 from parts diagram, "A" shown below)** $\frac{1}{4}$ of a turn away from the brake rotor (Counterclockwise if looking at the motor from the brake end). Relock the **Brake Lock Nut (Item 21 from parts diagram, "B" shown below)** by tightening it against the brake coil housing. This is a very critical step – failure to complete this will result in inaccurate readings and brake adjustment. When brake adjustment has been complete repeat Step 2 to recheck the brake.

If the brake gap is too large turn each of the **Brake Lock Nuts (Item 21 from the parts diagram, "B" shown below)** $\frac{1}{4}$ turn towards the brake rotor (Clockwise if looking at the motor from the brake end). Relock the **Brake Adjusting Nut (Item 22 from the parts diagram, "A" shown below)** by tightening it against the brake coil. This is a very critical step – failure to complete this will result in inaccurate readings and brake adjustment. When brake adjustment has been complete repeat Step 2 to recheck the brake.

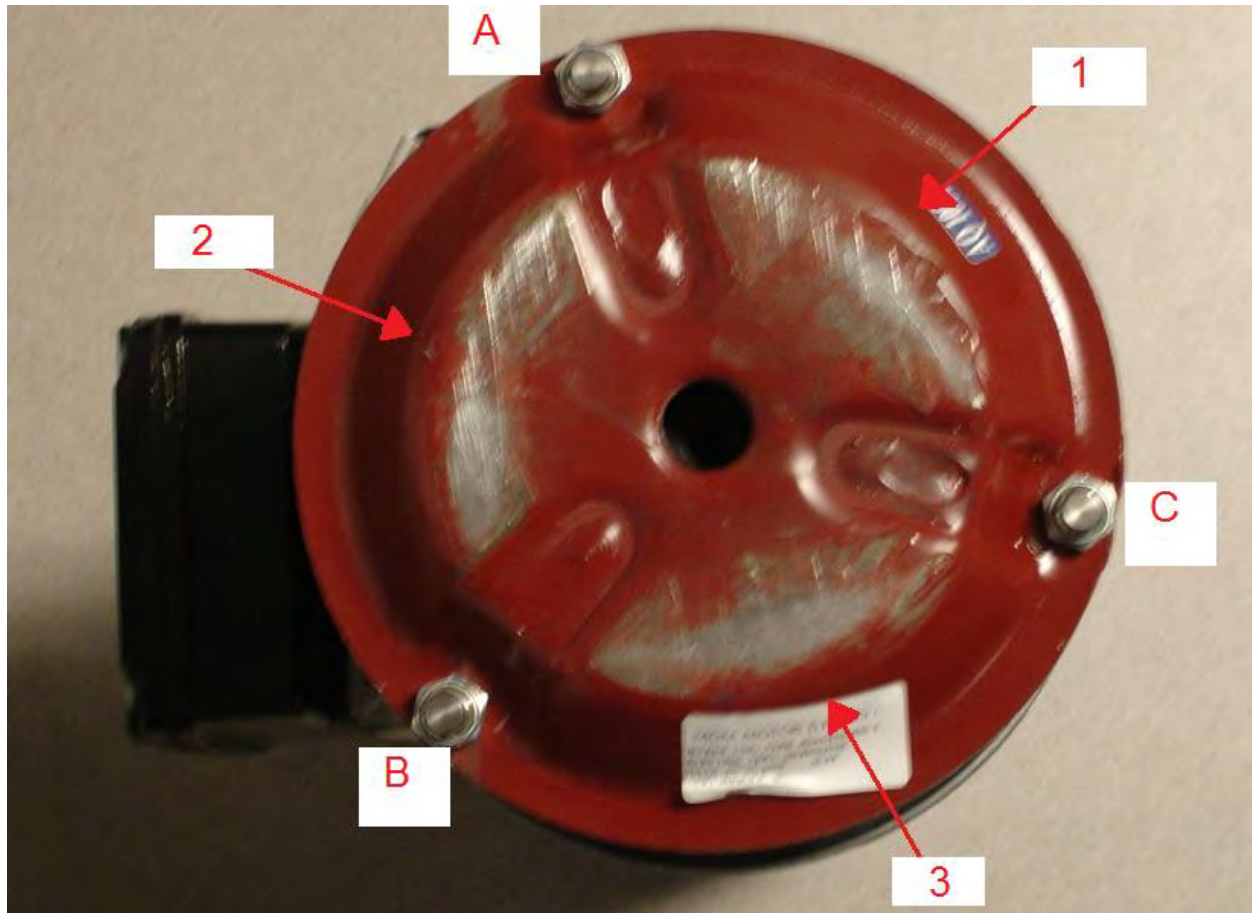


To increase brake air gap turn "A" away from brake rotor (counterclockwise when looking at motor from brake end)

To decrease brake air gap turn "B" towards brake rotor (clockwise when looking at motor from brake end)

Step 4: Equaling the air gap

The air gap must be equal around the entire circumference of the brake area. If the gap is uneven it can be corrected using the following steps below.



If the air gap at 1 is too small or too large change the gap by adjusting at A and C

If the air gap at 2 is too small or too large change the gap by adjusting at A and B

If the air gap at 3 is too small or too large change the gap by adjusting at B and C

When the air gap checks out evenly around the entire circumference refer to **Step 3** to adjust the air gap to the correct setting. Remember to only use equal changes on the studs to keep the air gap even around the circumference.

Step 5: Reassembling rear cover

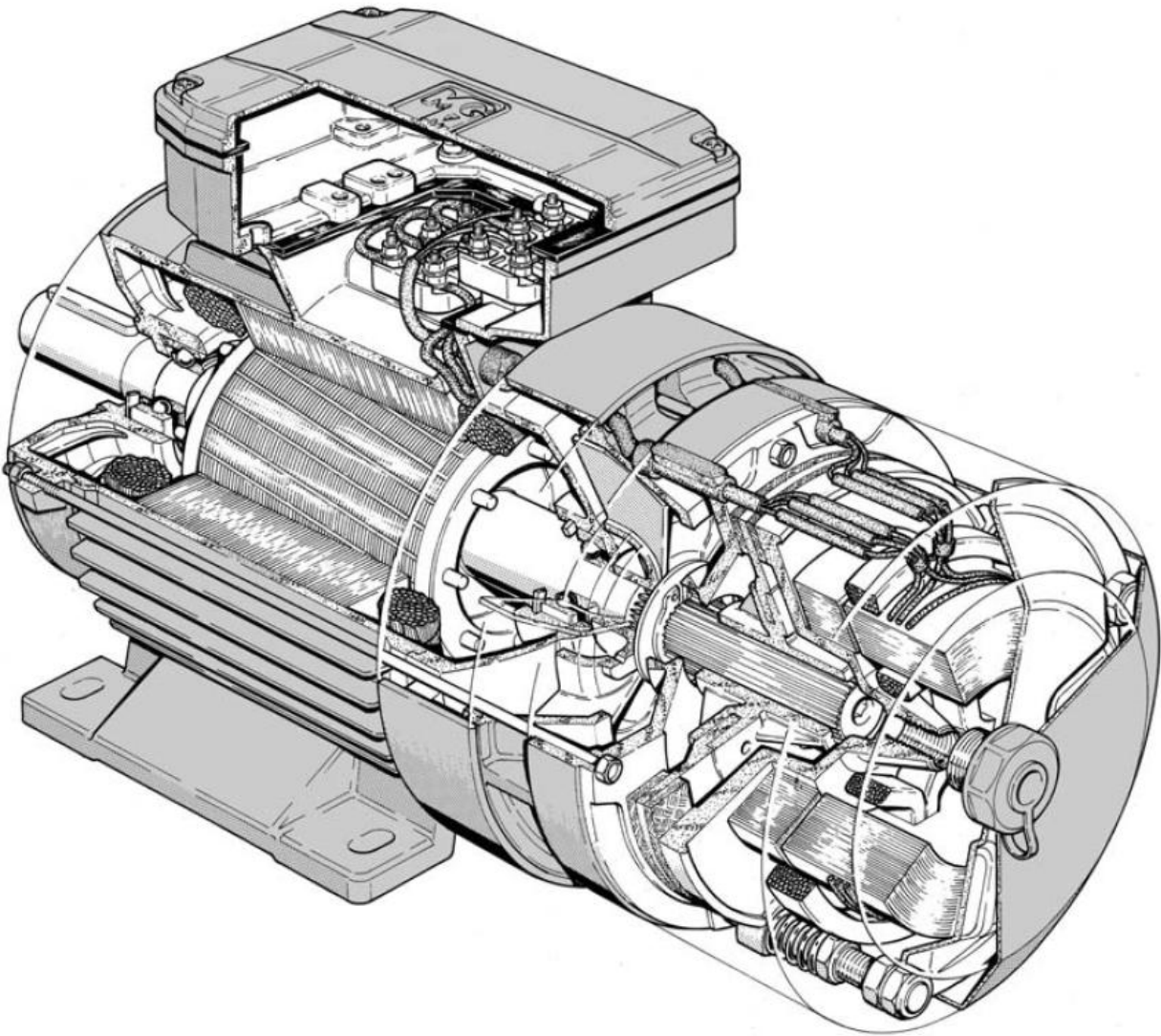
Use caution when reassembling rear cover. Ensure that wires are in the correct location when fastening the rear cover. The connectors should be in the location and orientation shown below. Check to make sure that the wires are not and cannot contact the brake rotor with the cover in place. If caution is not exercised the wires may contact the brake rotor causing immediate motor failure



The connectors need to be tucked down between the brake moving element and the brake coil. Most importantly insure that the wires cannot contact the brake rotor.

MGM Brake Motor

Brake Spring Adjustment



Columbia Machine

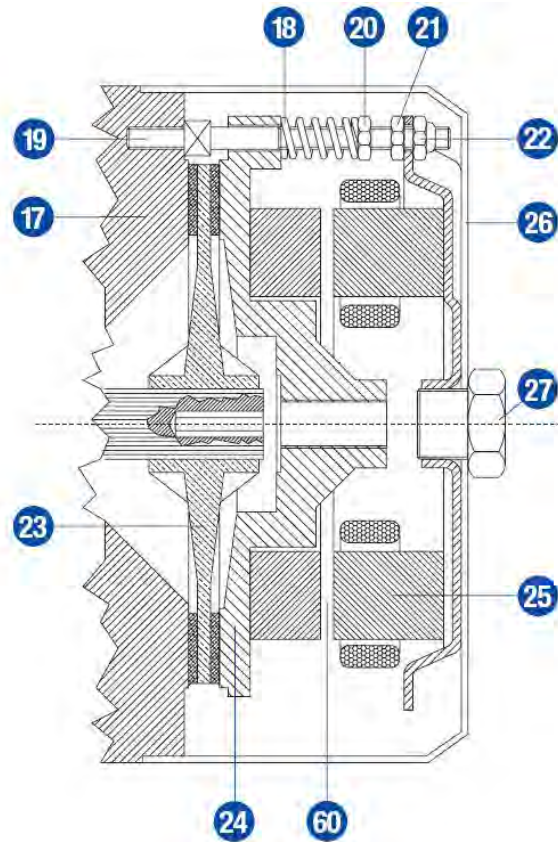
Step 1.1: Remove Rear Cover

Using a large Crescent Wrench remove the white plastic nut retaining the rear cover on the motor.



The motor looks as shown below after cover has been removed.



Step 2.1: Identify Components

17: Motor Housing

18: Brake spring

19: Brake stud

20: Brake spring adjusting nut

21: Brake housing adjusting nut

22: Brake housing adjusting nut

23: Brake rotor

24: Brake moving element

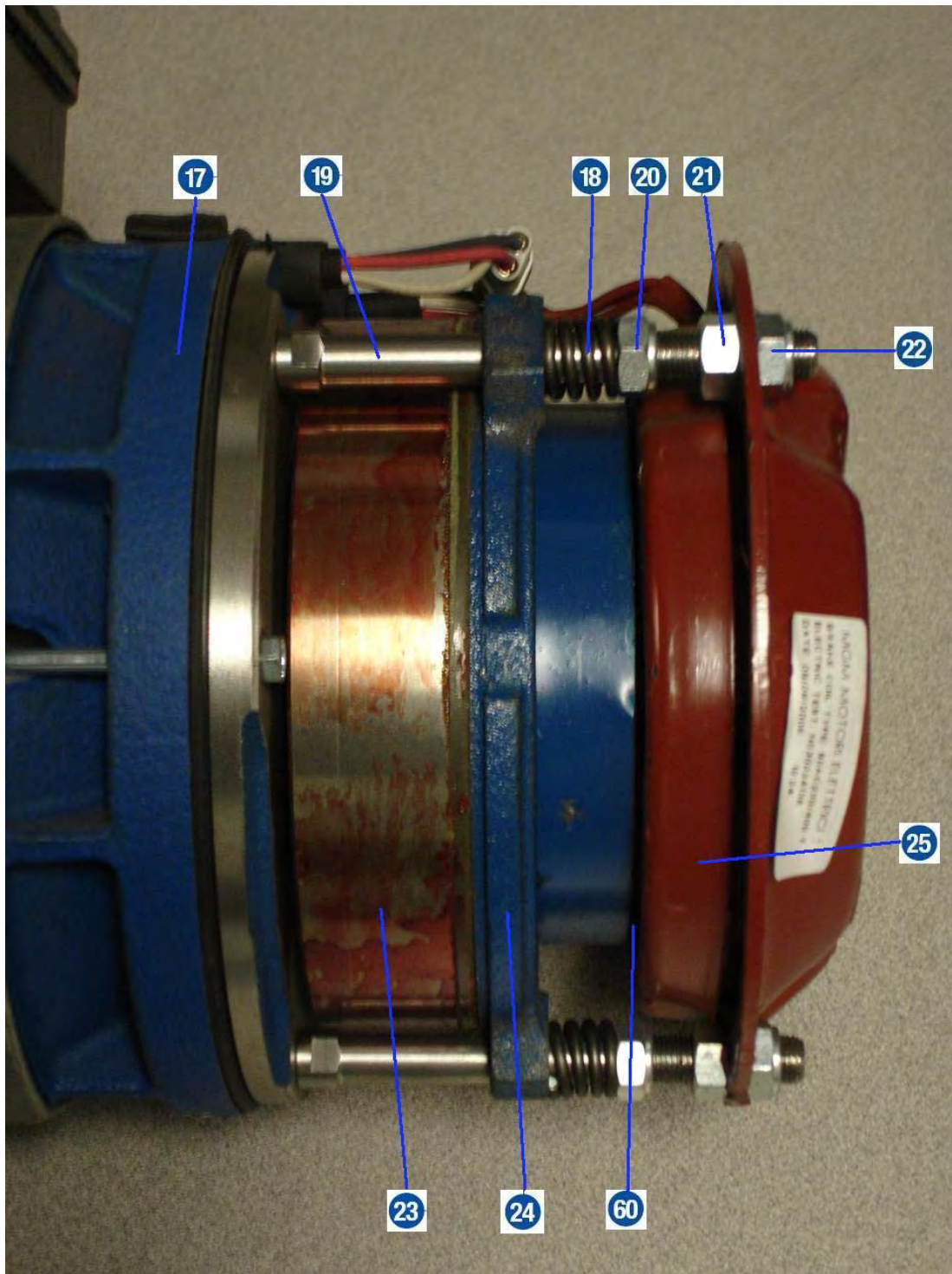
25: Brake coil

26: Rear housing cover adjusting nut

27: Cover attaching nut

60: Air gap

Step 2.2: Identify components on motor



*Items 26 and 27 not shown for clarity

Step 3.1 Select the correct spring adjustment

Using the chart below select the correct spring gap number based on the frame size of motor that you are working on. The frame size can be found on the motor nameplate.

Frame Size	Spring gap "H" (in)	Spring gap "H" (mm)
71	0.49	12.5
80	0.49	12.5
90	0.63	16
100	0.59	15
112	0.61	15.4

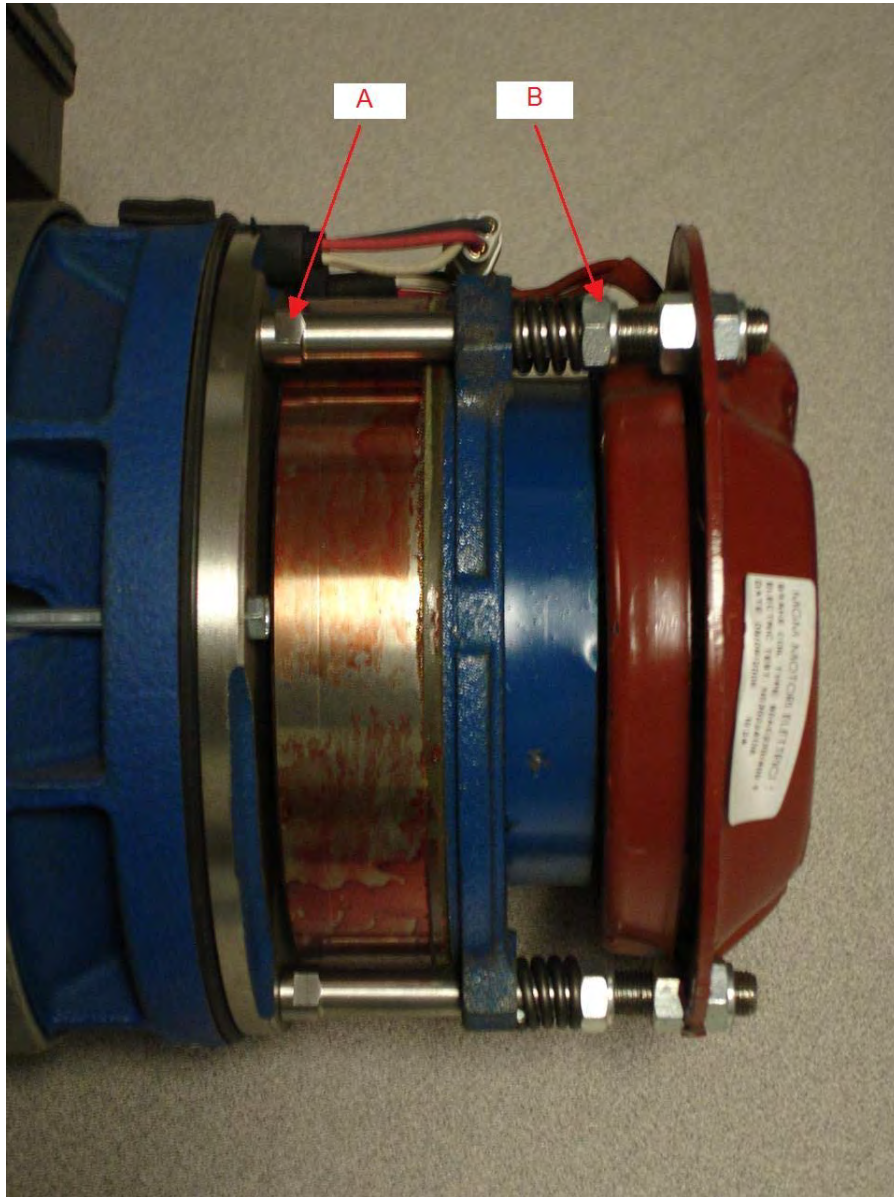
These numbers are a baseline only. Adjusting the springs to the above measurements will give approximately 75% of the maximum braking torque.

Step 3.2 Adjusting the Brake spring

The brake spring is measured by the distance "H" shown below.



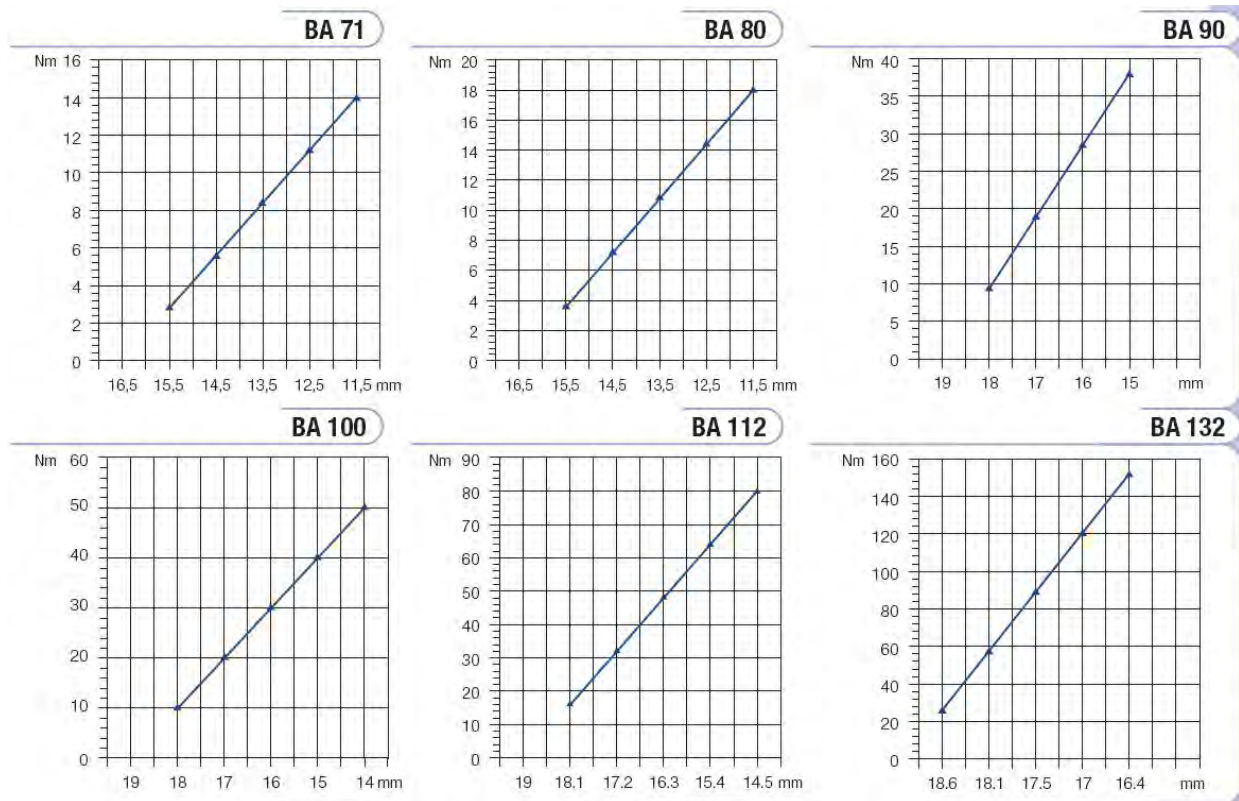
To adjust the brake spring hold the Brake stud (Item 19 in the parts diagram, Item A below) with a wrench and turn the Brake Spring Adjusting Nut (Item 20 in the parts diagram).



The DECREASE the brake spring gap TIGHTEN the Brake Adjusting Nut (Turn it clockwise if looking at the motor from the brake end

To INCREASE the brake spring gap LOOSEN the Brake Adjusting Nut (Turn it counterclockwise if looking at the motor from the brake end)

The brake spring gap given in the chart in Step 3.1 is only a starting point. Brake performance and behavior can be adjusted as desired according to the Manufacturer's charts below.



Caution: Never adjust the brake spring gap out of the adjustment given in the charts above. If the gap is too large the brake may fail to actuate causing severe machine damage. If the gap is too small the brake may not release causing immediate motor damage.

Step 5: Reassembling rear cover

Use caution when reassembling rear cover. Ensure that wires are in the correct location when fastening the rear cover. The connectors should be in the location and orientation shown below. Check to make sure that the wires are not and cannot contact the brake rotor with the cover in place. If caution is not exercised the wires may contact the brake rotor causing immediate motor failure.



The connectors need to be tucked down between the brake moving element and the brake coil. Most importantly insure that the wires cannot contact the brake rotor.



Columbia Machine, Inc.

Customer Care Department
1-800-628-4065

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Customer	BLUE MARBLE PRODUCTIONS, INC
Location	INDIANAPOLIS, IN
Sales Order No.	5028930
Machine Model No.	HL4200
Serial No.	2111.7434.3394
Voltage	480V-3PH-60HZ
Complete Mechanical	3.3394.000
Complete Electrical	328.27.7434

HOME OFFICE

Columbia Machine, Inc.
107 Grand Blvd.
Vancouver WA 98661

Phone: 360.694.1501

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PALLETIZER
MODEL 4200

Columbia Palletizer Parts

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MODEL HL4200
PALLETIZER S/N 2111.7434.3394

For: **BLUE MARBLE PRODUCTIONS, INC**
INDIANAPOLIS, IN

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Section 2	Infeed No. 3.3394.002
Section 3	Row Former No. 3.3394.003
Section 4	Palletizer No. 3.3394.004
Section 5	Hoist/Full Load Conveyor No. 3.3394.005
Section 6	Side Layer Guides No. 3.3394.006
Section 7	Pallet Dispenser No. 3.3394.007
Section 8	Discharge Conveyor No. 3.3394.008

(continued)

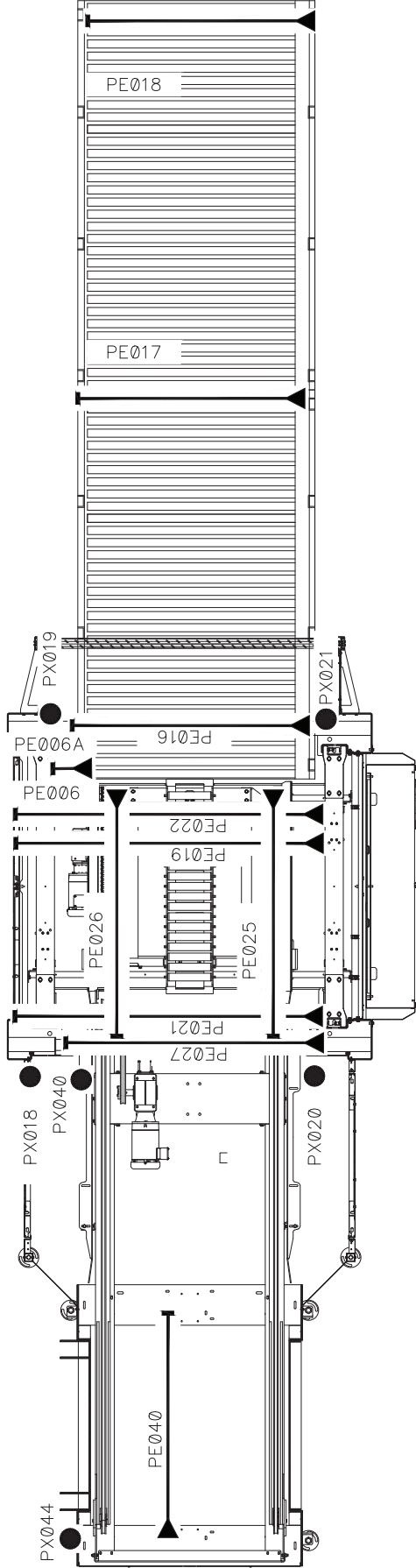
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(continued)

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Section 10.	Tie Sheet Dispenser No. 3.3394.014
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Section 12.	Pneumatic Piping No. 3.3394.016
Section 13.	Operator Platform No. 3.3394.018
Section 14.	Ship Loose No. 3.3394.024
Section 15	Safety Decals & ID Kit No. 3.3394.011
Complete Electrical No. 328.27.7434	

NOTES:

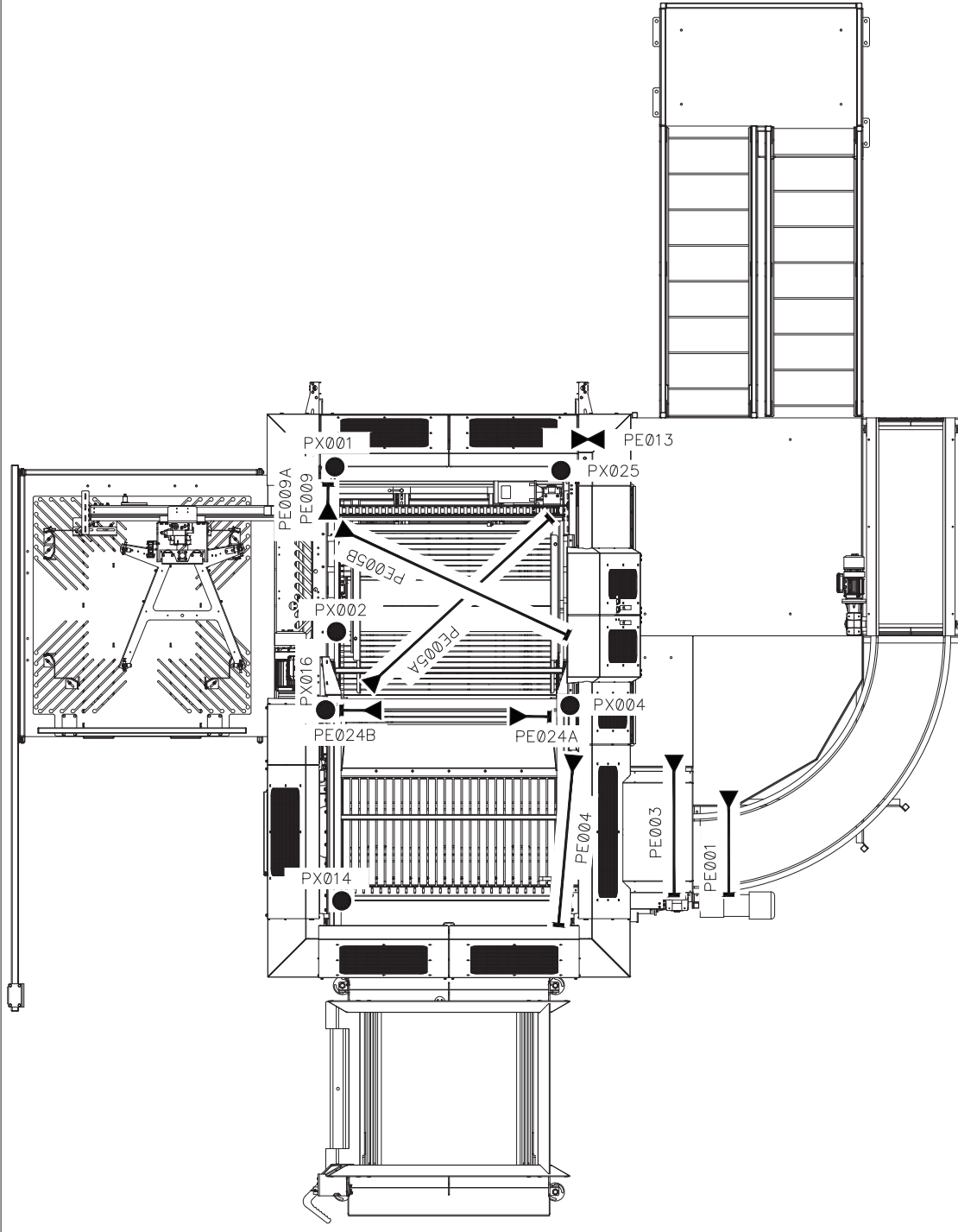
1. ALL DEVICE CABLES ARE TO BE STRAIGHT CONNECTORS ON BOTH ENDS, EXCEPT WHERE NOTED. 90° CABLES WILL BE 90° AT THE DEVICE END ONLY.
2. IF A SOFT TURN IS INSTALLED, "SIDE A" IS ALWAYS ON THE LEFT (SIDE B, RIGHT), WITH DIRECTION OF CASE FLOW.



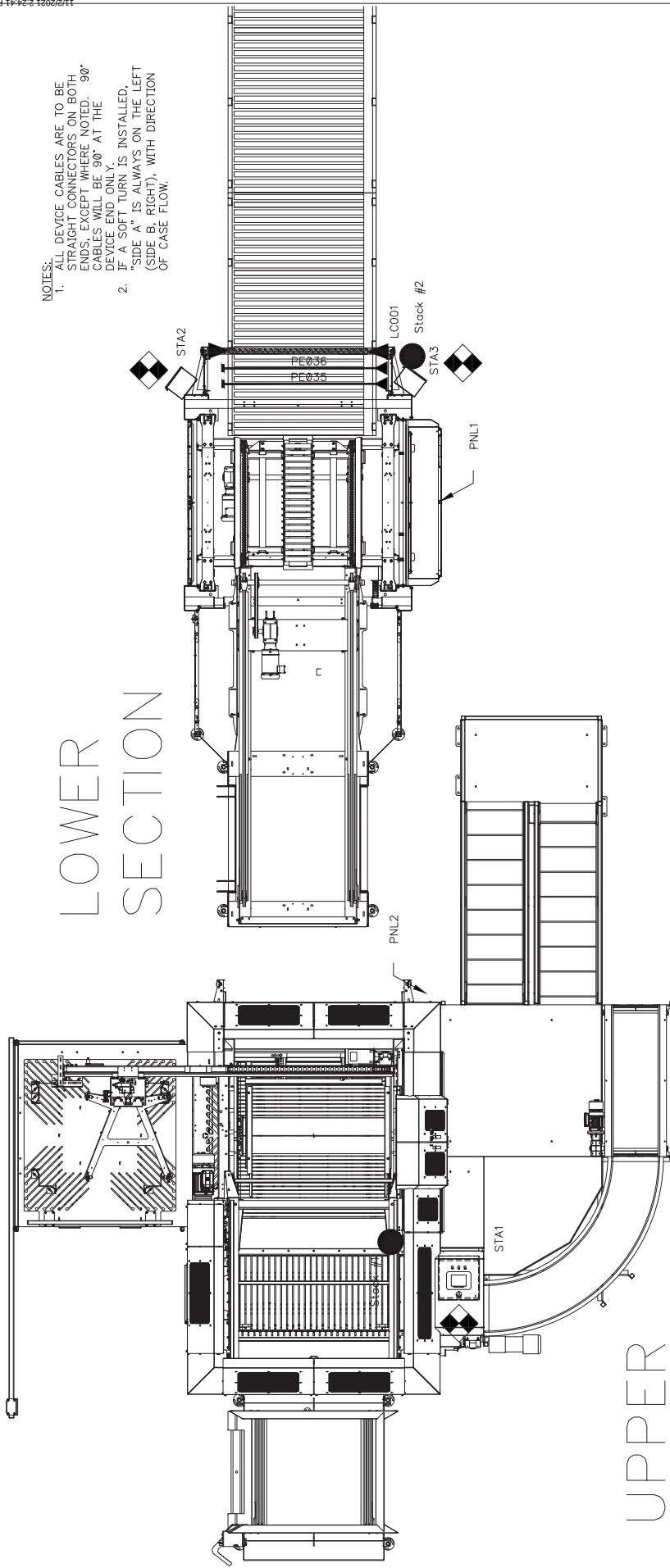
REV. ZONE	CHANGE DESCRIPTION	DATE	CHANGE BY	INSTALL MOTOR OVERLOAD RELAYS PER MOTOR MANUFACTURER'S INSTRUCTIONS. OVERLOAD RELAYS ARE TO BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE AND LOCAL CODES AND ORDINANCES. INSTALLATION IS TO BE PERFORMED BY A LICENSED ELECTRICIAN AND INSPECTED BY LOCAL AUTHORITIES. PLEASE DISCONNECT ALL POWER BEFORE SERVICING.	THIS DRAWING AND ITS CONTENTS ARE THE PROPERTY OF COLUMBIA. NO PART OF THIS DRAWING OR INFORMATION CONTAINED HEREIN IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM COLUMBIA. ALL RIGHTS RESERVED.	 COLUMBIA MACHINE INC. VANCOUVER, WA 98661 PALLETIZER DIVISION	BLUE MARBLE PRODUCTIONS INDIANAPOLIS, IN HL4200 PALLETIZER SENSOR LAYOUT LOWER SECTION	DRAWN BY: JOHFLA ENGINEER: JOHFLA SIZE/DWG NO: B 328.27.7434.6	REFERENCE: --- AS SHIPPED DATE: 5/6/21	PRINTED SHEETS 5 REF. SCALE SCALE REV. SHEET 3 of 5
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NOTES:

- 1. ALL DEVICE CABLES ARE TO BE STRAIGHT CONNECTORS ON BOTH ENDS, EXCEPT WHERE NOTED. 90° CABLES WILL BE 90° AT THE DEVICE END ONLY.
- 2. LOCATE PE001 8" FROM END OF THE METERBELT (INFEED ROLLS SIDE).
- 3. IF A SOFT TURN IS INSTALLED, "SIDE A" IS ALWAYS ON THE LEFT (SIDE B, RIGHT), WITH DIRECTION OF CASE FLOW.



REV. ZONE	CHANGE DESCRIPTION	DATE	CHANGE BY	INSTALL MOTOR OVERLOAD RELAYS PER MOTOR MANUFACTURER'S RECOMMENDATIONS. EQUIPMENT TO BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE AND LOCAL CODES AND ORDINANCES. INSTALLATION IS TO BE PERFORMED BY LICENSED ELECTRICAL CONTRACTORS INSPECTED BY LOCAL AUTHORITIES. PLEASE DISCONNECT ALL POWER BEFORE SERVICING.	THIS DRAWING AND ITS CONTENTS ARE THE PROPERTY OF BLUE MARBLE PRODUCTIONS. NO INFORMATION OF ANY KIND IS TO BE DISCLOSED OR REPRODUCED WITHOUT THE WRITTEN PERMISSION OF BLUE MARBLE PRODUCTIONS. ALL RIGHTS RESERVED.	 COLUMBIA MACHINE INC. VANCOUVER, WA 98661 PALLETIZER DIVISION	BLUE MARBLE PRODUCTIONS INDIANAPOLIS, IN HL4200 PALLETIZER SENSOR LAYOUT UPPER SECTION	DRAWN BY: JOHFLA ENGINEER: JOHFLA SIZE DWG NO: B 328.27.7434-6	REFERENCE: --- AS SHIPPED DATE: 5/6/21 REV.	PRINTED SHEETS 5 REF. SCALE SCALE SHEET 2 of 5
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NOTES:
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2. IF A SOFT TURN IS INSTALLED, "SIDE A" IS ALWAYS ON THE LEFT (SIDE B, RIGHT), WITH DIRECTION OF CASE FLOW.

UPPER SECTION

LOWER SECTION

- STACK #1
- WARNING HORN
 - FAULT (RED)
 - AUTO BEACON (GREEN)
 - LOW MATERIALS (BLUE)
 - 5 PIN CABLE BASE
- STACK #2
- LC1 MUTING BEACON (YELLOW)
 - 4 PIN CABLE BASE

REV. ZONE	CHANGE DESCRIPTION	DATE	CHANGE BY	STACK #1	STACK #2	PRINTED SHEETS
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*		*	*			5
*		*	*			5
A	THESE DRAWINGS WERE UPDATED TO MATCH THE FINAL ASSEMBLY PRIOR TO SHIPMENT FROM COLUMBIA MACHINE ON THE DATE SHOWN.	11/2/21	JOHFLA			5
REV. ZONE	CHANGE DESCRIPTION	DATE	CHANGE BY	STACK #1	STACK #2	PRINTED SHEETS

DRAWN BY:	REFERENCE:	PRINTED SHEETS
JOHFLA	---	5
ENGINEER:	AS SHIPPED DATE:	REF. SCALE
JOHFLA	5/6/21	SCALE
SIZE DWG NO:	REV.	SHEET
B	328.27.7434-6	1 of 5

BLUE MARBLE PRODUCTIONS
INDIANAPOLIS, IN
HI4200
PALLETIZER SENSOR LAYOUT
ELECTRICAL BOX LOCATIONS
& SAFETY DEVICES

Columbia
COLUMBIA MACHINE INC.
VANCOUVER, WA 98661
PALLETIZER
DIVISION

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INSTALL MOTOR OVERLOAD DEVICES PER MOTOR MANUFACTURER'S INSTRUCTIONS. MOTOR OVERLOAD DEVICES ARE TO BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE AND LOCAL CODES AND ORDINANCES. INSTALLATION IS TO BE PERFORMED BY A LICENSED ELECTRICIAN. INSPECTED BY LOCAL AUTHORITIES. PLEASE DISCONNECT ALL POWER BEFORE SERVICING.

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A	THESE DRAWINGS WERE UPDATED TO MATCH THE FINAL ASSEMBLY PRIOR TO SHIPMENT FROM COLUMBIA MACHINE ON THE DATE SHOWN.	11/2/21	JOHFLA

Columbia Palletizer Parts

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SECTION 1

Complete Palletizer Assembly
3.3394.000

Page 1 Complete Palletizer Assembly List

Columbia Palletizer Parts

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Columbia Palletizer Parts

COMPLETE PALLETIZER ASSEMBLY LIST No. 3.3394.000

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
2.	Inf,Blue Marble(L2),5028930	3.3394.002	1
3.	Rf,Blue Marble(L2),5028930	3.3394.003	1
4.	Paltz,Blue Marble(L2),5028930	3.3394.004	1
5.	Hoist,Blue Marble(L2),5028930	3.3394.005	1
6.	S.L.G.,Blue Marble(L2),5028930	3.3394.006	1
7.	Pd,Blue Marble(L2),5028930	3.3394.007	1
8.	Dsch,Blue Marble(L2),5028930	3.3394.008	1
11.	Decals,Blue Marble(L2),5028930	3.3394.011	1
12.	P/M,Blue Marble(L2),5028930	3.3394.012	1
14.	T.Sd,Blue Marble(L2),5028930	3.3394.014	1
15.	Guards,Blue Marble(L2),5028930	3.3394.015	1
16.	Pneu,Blue Marble(L2),5028930	3.3394.016	1
18.	Op Pltfrm,B.Marble(L2),5028930	3.3394.018	1
24.	Shplse,Blue Marble(L2),5028930	3.3394.024	1
902.	P/K Pnl1,Blue Marble,5028930	328.27.7434.2	1

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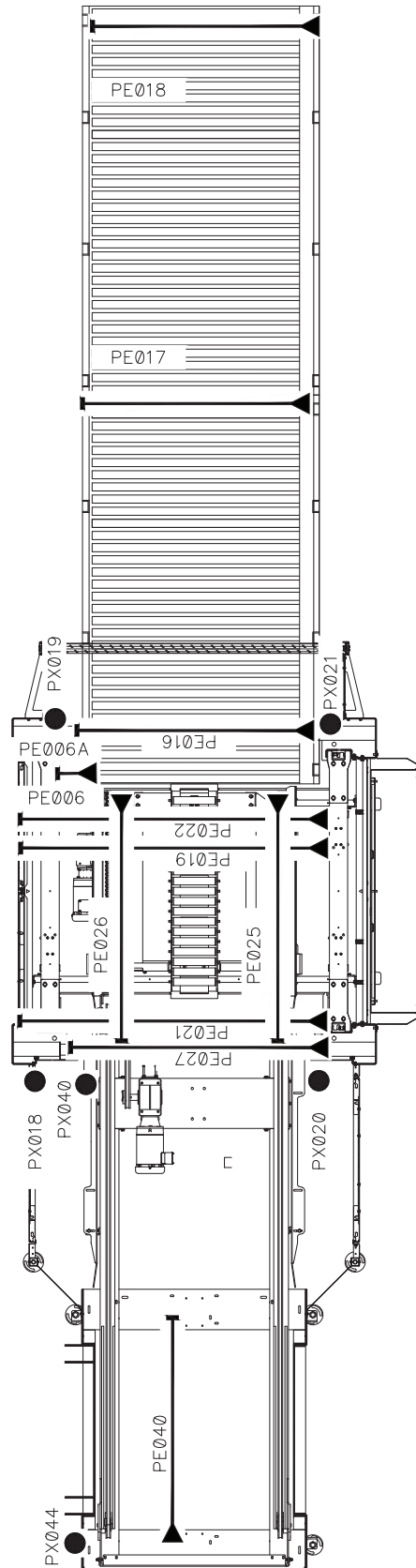
1. ALL DEVICE CABLES ARE TO BE STRAIGHT CONNECTORS ON BOTH ENDS, EXCEPT WHERE NOTED. 90° CABLES WILL BE 90° AT THE DEVICE END ONLY.
2. LOCATE PE001 8' FROM END OF THE METERBELT (INFEED ROLLS SIDE).
3. IF A SOFT TURN IS INSTALLED, "SIDE A" IS ALWAYS ON THE LEFT (SIDE B, RIGHT), WITH DIRECTION OF CASE FLOW.

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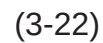
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* * *	*	*	INSTALL MOTOR OVERLOAD HEATERS PER MOTOR NAMEPLATE AND BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND LOCAL CODES AND ORDINANCES. INSTALLATION IS TO BE PERFORMED BY A LICENSED ELECTRICIAN AND INSPECTED BY LOCAL AUTHORITIES. PLEASE DISCONNECT ALL POWER BEFORE SERVICING.	THIS DRAWING AND ITS PRICE CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION OF COLUMBIA MACHINE, INC. COLUMBIA MACHINE, INC. IS NOT BE RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION. COLUMBIA MACHINE, INC. IS NOT BE RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION. COLUMBIA MACHINE, INC. IS NOT BE RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION. Columbia COLUMBIA MACHINE, INC. VANCOUVER, WA 98661	BLUE MARBLE PRODUCTIONS INDIANAPOLIS, IN HL4200	DRAWN BY: JOHLEA ENGINEER: JOHLEA	REFERENCE: AS SHIPPED DATE: 5/6/21	PRINTED SHEETS 5
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SECTION 2

Infeed
3.3394.002

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Page 2-3 Infeed Assembly
Page 4-7 Turn Device, Linear
Page 8-9 Bump Turn, Linear Assembly List

Columbia Palletizer Parts

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Columbia Palletizer Parts

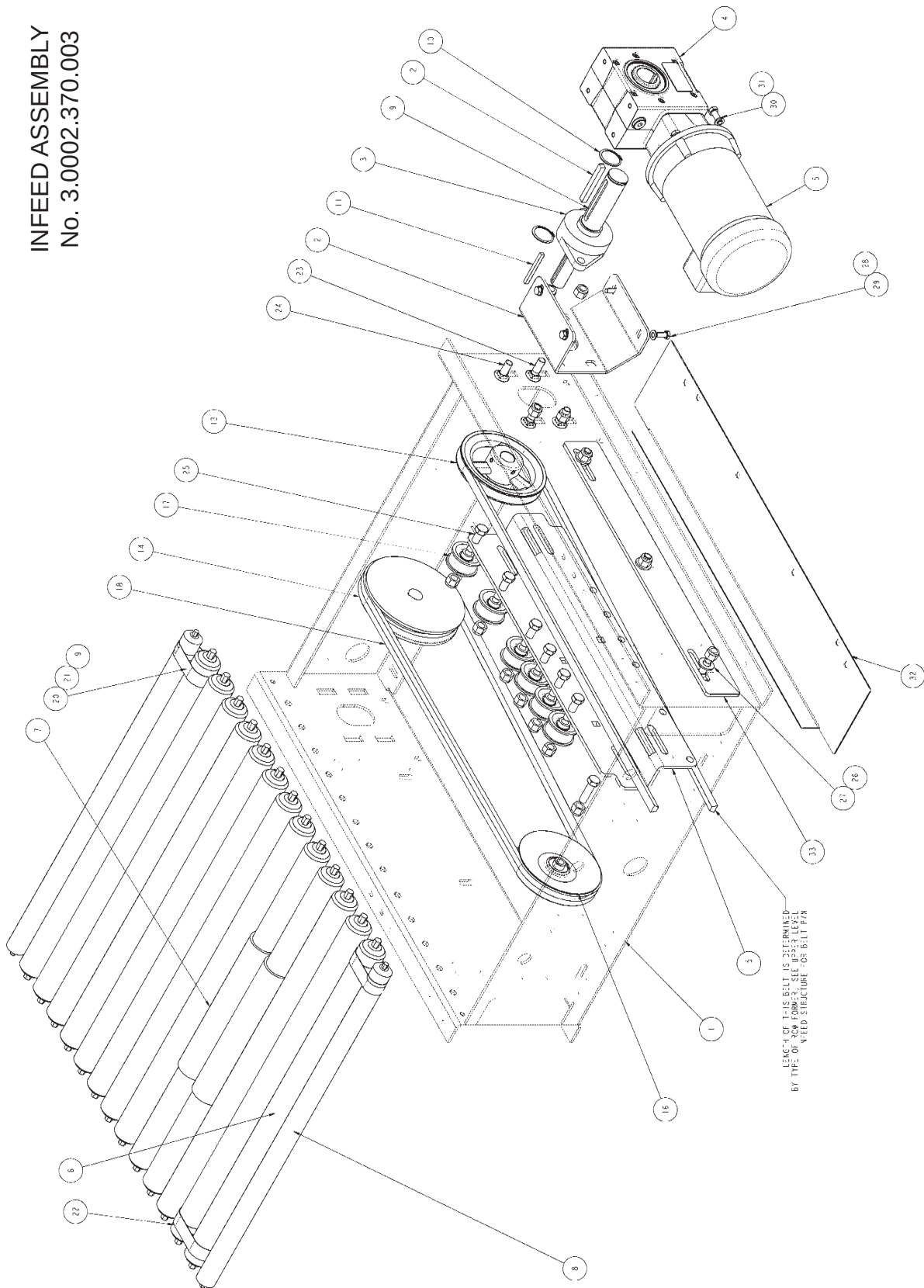
INFEED ASSEMBLY LIST

No. 3.3394.002

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Infd Assy,HI6200,Lh Side	3.0002.370.003	1
2.	Turn Device,Linear,Std	3.3056.080.008	1
3.	V-Belt,Cp200,200.9 Pitch	4280410	1
910.	P/K Infeed,Blue Marble,5028930	328.27.7434.10	1

Columbia Palletizer Parts

INFEED ASSEMBLY
No. 3.0002.370.003



Columbia Palletizer Parts

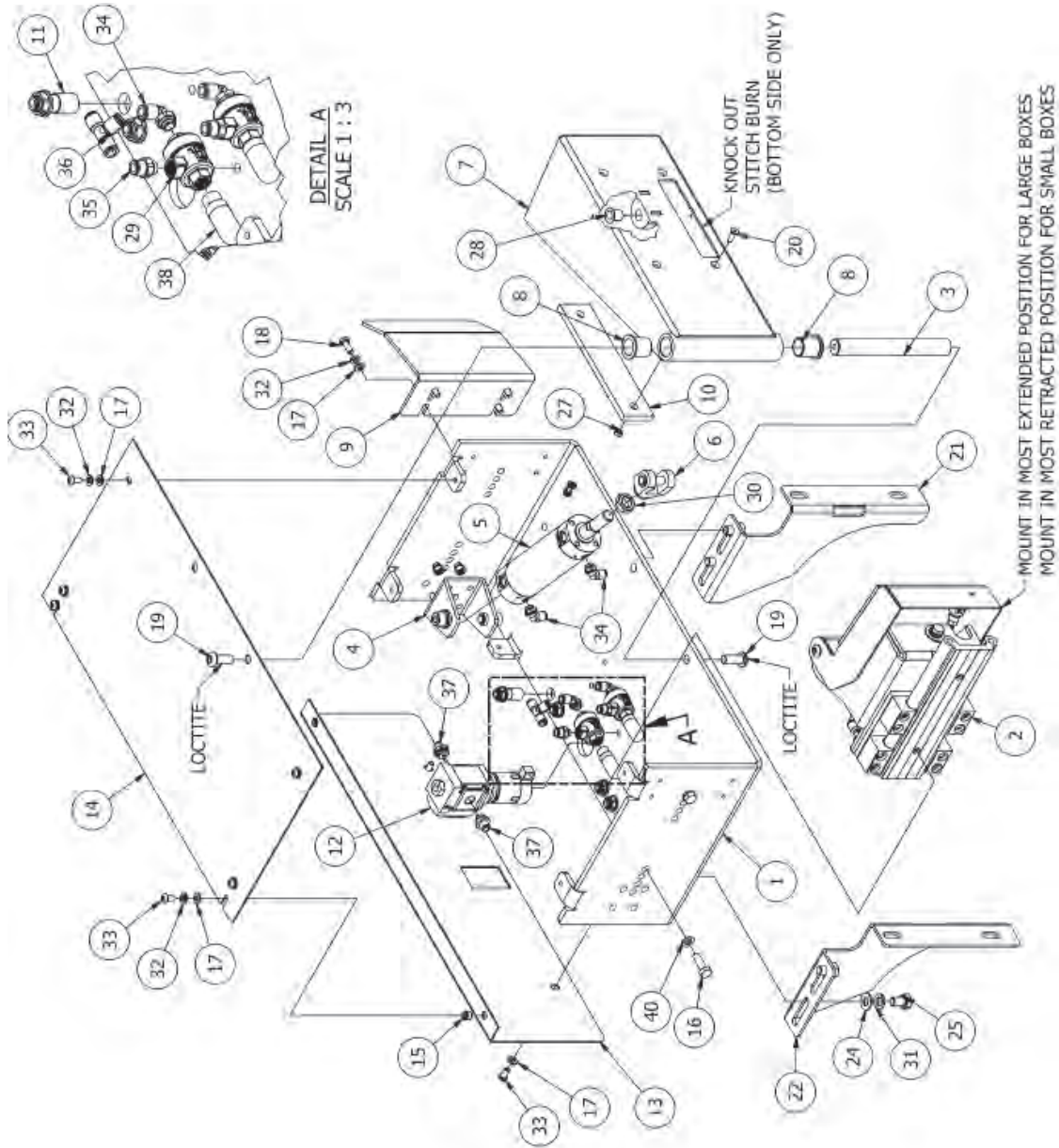
INFEED ASSEMBLY

No. 3.0002.370.003

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Infeed Wldmt, HI6200	3.2592.485.001	1
2.	Gbox Bracket,B04,Spl	3.2300.805.005	1
3.	Brg,2Bolt,1-7/16,Ucft207/Nkb23	410011	1
4.	Gbox,Cone,B041015.Waat1	460285	1
5.	Mtr,.75,1800,56C,460D60,T,B	365.3.8.15	1
6.	Roller,1.775.R81.M70-29.88	486101	13
7.	Roll Cover-Plastic	380.592.24	2
8.	Roller,1.457.G38.Z62-29.88RI	486191	2
9.	Drive Shaft,B04,1.43Dia,1.00	3.2481.048.010	1
10.	Snap Ring-External, 1.438 Dia.	430154	2
11.	Squares, C1018, 1/4	903632.02.75	1
12.	Squares, C1018, 3/8	903634.03.25	1
13.	Sheave,Ab,6.25 Od,1.00 Bore	429813	1
14.	Sheave, Single, 1.002B, 5.84Rd	404.2.30	1
15.	Idler Support	3.2592.488.001	1
16.	Pulley,V,Vh-82-Bc-12	429357	1
17.	Pulley,Idler,Zfh32146	429356	6
18.	V-Belt,C68,70.9 Pitch	426463	1
19.	Flat Blt,Ureth,0.03X0.5X4.11CI	4260082	2
20.	Flat Blt,Ureth,0.03X0.5X5.64CI	4260083	10
21.	Flat Blt,Ureth,0.03X1.0X8.78CI	4260084	2
22.	Flat Blt,Ureth,0.03X1.0X9.94CI	4260085	4
23.	Bolt, Rd Hd-Sq Neck-13 Unc Gd5	100102.08.24	2
24.	Bolt,Rd Hd-Sq Neck-13 Unc Gd5	100102.08.20	5
25.	Cpscr, Hex Head-Gd 5-13 Unc	100000.08.28	7
26.	Nut, Poly Ins Full Hgt-13 Unc	100160.08	14
27.	Washer, Plain Hardened Steel	100222.08	3
28.	Washer, Plain, Metric	100239.08	4
29.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.20	4
30.	Washer, Lock Helical Spring	100226.06	4
31.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.16	4
32.	Belt Guard,Infid	3.2860.693	1
33.	Idle Support Spacer Plt	3.2592.495	1

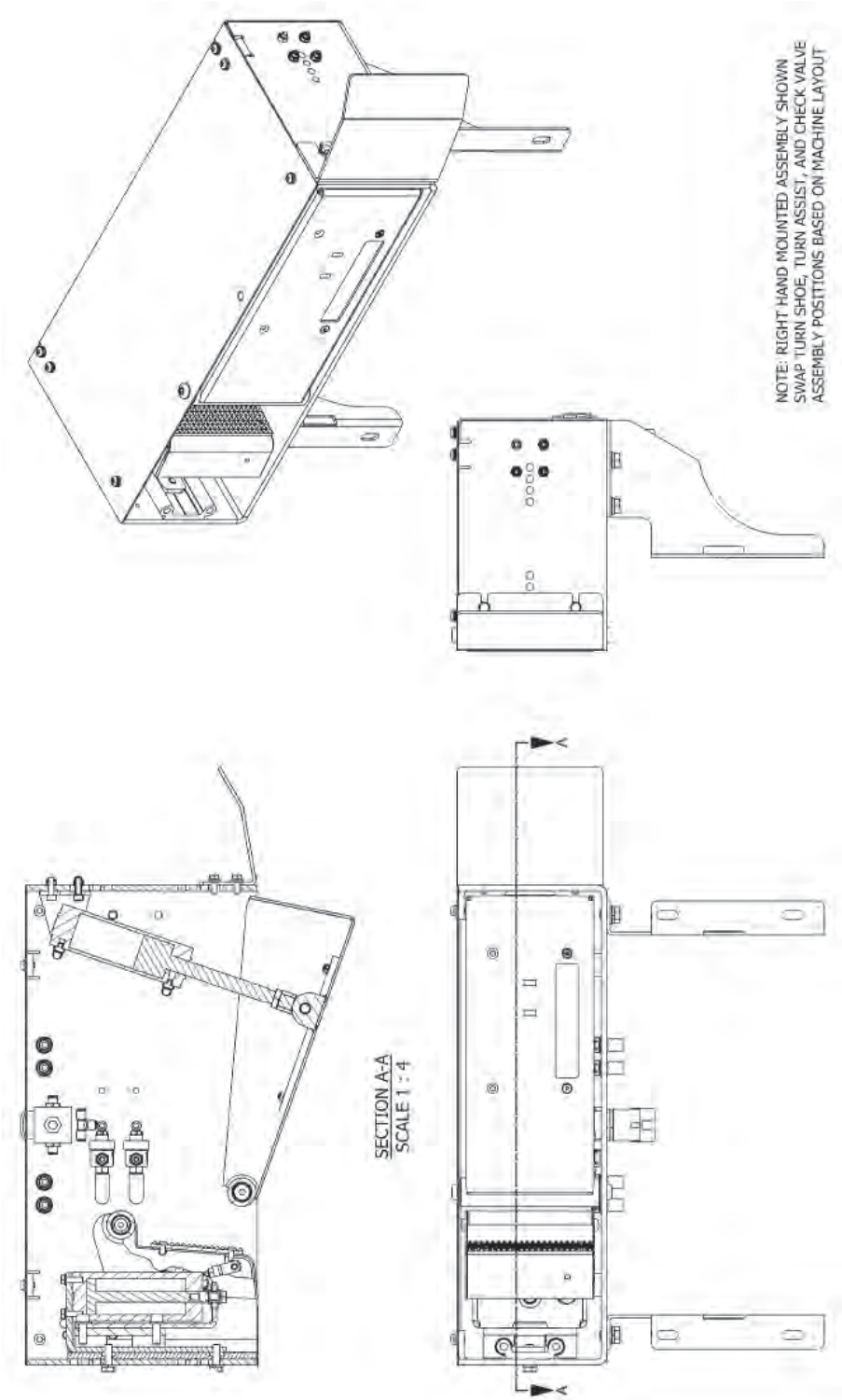
Columbia Palletizer Parts

TURN DEVICE, LINEAR
No. 3.3056.080.008

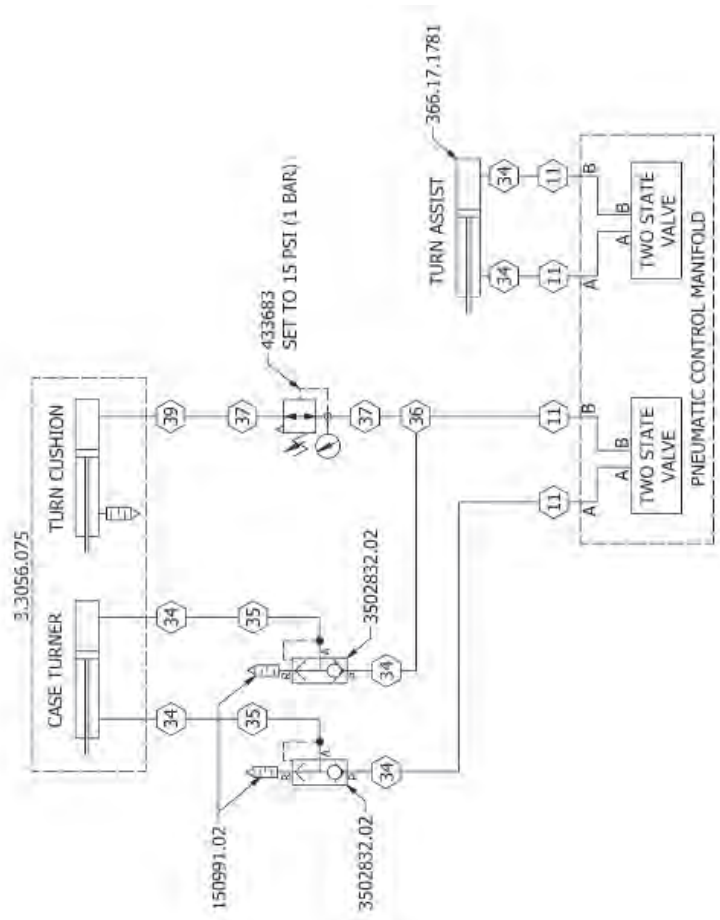
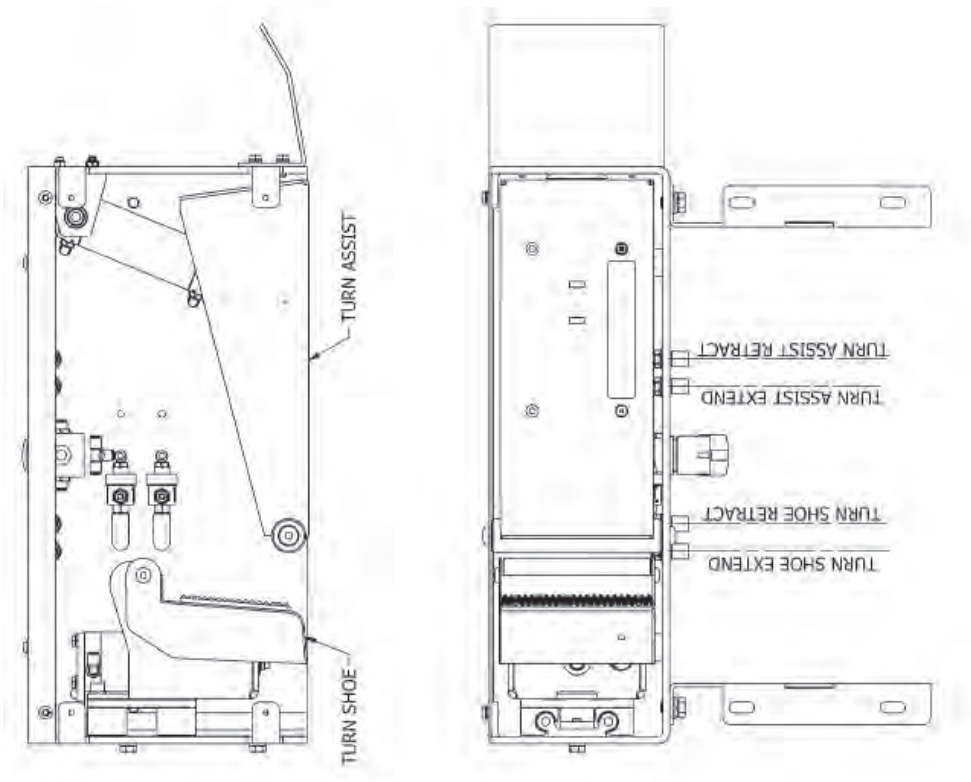


Columbia Palletizer Parts

TURN DEVICE, LINEAR
No. 3.3056.080.008



TURN DEVICE, LINEAR
No. 3.3056.080.008



NOTE: RIGHT HAND MOUNTED ASSEMBLY SHOWN
SWAP TURN SHOE, TURN ASSIST, AND CHECK VALVE
ASSEMBLY POSITIONS BASED ON MACHINE LAYOUT

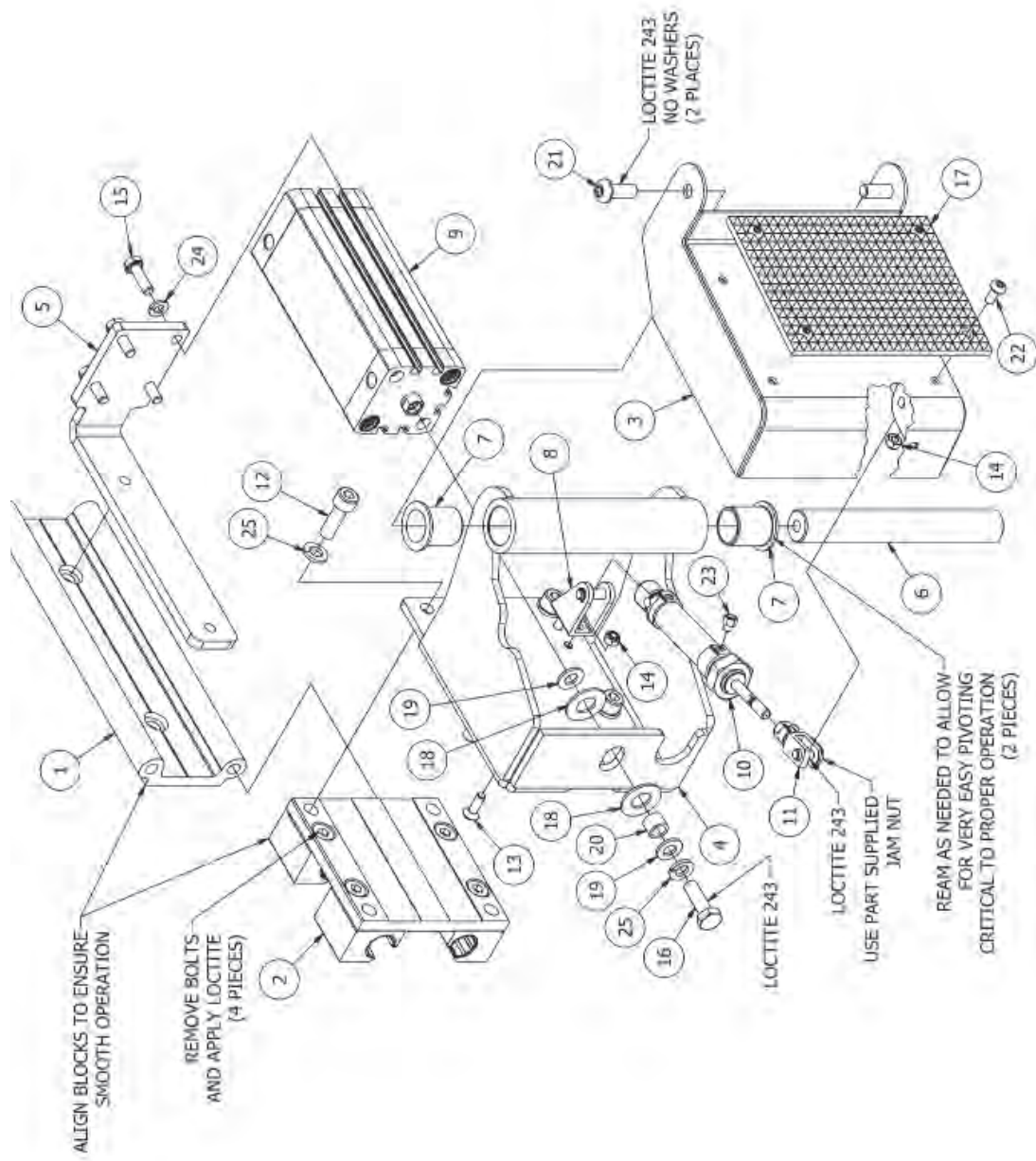
Columbia Palletizer Parts

TURN DEVICE, LINEAR

No. 3.3056.080.008

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Turn Device Base	3.3056.091.005	1
2.	Bump Turn,Linear Assy	3.3056.075	1
3.	Turn Pivot Pin, M10	3.2767.094.001	1
4.	Trunion Bracket,Phd,Ocg,40Mm	438382	1
5.	Cyl,A,40,75,16,Na,Phd,Ocg	366.17.1781	1
6.	Clevis Joint,Rod End,M14X1.5	438092	1
7.	Turn Assist Wldmt	3.3056.085	1
8.	Iglide J Flanged Pln Brng 0.75	414641	2
9.	Lead In Plt,Turn Assy	3.2800.214.002	1
10.	Reflector,7X1.5,Brt-180X40A	2015622	1
11.	Ftg,Tube,Bulkhd-Str,F-G1/4,6Mm	150607.06.04	4
12.	Reg,Festo,Ms4,G1/4,80Psi Gauge	433683	1
13.	Turn Device Cover,Back	3.3056.092.004	1
14.	Turn Device Cover,Top	3.3056.092.005	1
15.	Rivet Nut Insert,M6X1	4597585	2
16.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.25	2
17.	Washer,Plain,Metric	100239.06	12
18.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.16	4
19.	Cpscr,Button Hd,Metric	100005.10.25	2
20.	Cpscr, Flat Ct'Snk, Metric	100021.05.16	2
21.	Mount Brkt,Turn Assy,Lh	3.3056.094	1
22.	Mount Brkt,Turn Assy,Rh	3.3056.095	1
23.	Cpscr, Hex Soc. Head, Metric	100020.06.20	4
24.	Washer, Plain, Metric	100239.1	4
25.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.16	4
26.	Nut,Poly Insert,Full,Class 10	100136.06	4
27.	Nut,Poly Insert,Full,Class 10	100136.05	2
28.	Iglide J Flanged Pln Brg 10Mm	414631	1
29.	Va,Quick Exhaust,Female,G1/8	3502832.02	2
30.	Nut, Hex Jam, Fine-Metric	100137.14	1
31.	Washer,Lock,Metric	100240.1	4
32.	Washer,Lock,Metric	100240.06	4
33.	Cpscr,Button Hd,Metric	100005.06.12	8
34.	Ftg,Tube,90,G1/8,6Mm	150531.02.06	6
35.	Ftg,Tube,Str,G1/8,6Mm	150530.02.06	2
36.	Ftg,Tube,Tee,6Mm	150535.06	1
37.	Ftg,Tube,Str,G1/4,6Mm	150530.04.06	2
38.	Muffler,Met,1/4Bspp,06740013	435039	2
39.	Ftg,Tube,Str,M5,6Mm	150530.005.06	1
40.	Washer,Lock,Metric	100240.08	2
41.	Tube,Poly,6Mm,Blue	392010.06	40

BUMP TURN, LINEAR ASSEMBLY LIST
No. 3.3056.075



Columbia Palletizer Parts

BUMP TURN, LINEAR ASSEMBLY LIST No. 3.3056.075

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Drylin Rail,16Mm,60Wx210L	414855	1
2.	Drylin,16Mm,Carriage	414856	1
3.	Turn Shoe Arm Wldmt	3.3056.073	1
4.	Turn Shoe Face Wldmt	3.3056.070	1
5.	Turn Cyl Tail Mount	3.3056.093	1
6.	Turn Pivot Pin	3.2767.094.002	1
7.	Iglide J Flanged Pln Brng 0.75	414641	2
8.	Clevis Foot Cylinder Mount	438380	1
9.	Cyl,A,40.0,100,12,F,Adn:609442	366.17.1914	1
10.	Cyl,A,16.0,15.0,6,Na,F,6432	366.17.1783	1
11.	Rod Clevis,6Mmx1.00	438381	1
12.	Cpscr, Hex Soc. Head, Metric	100020.08.25	4
13.	Cpscr, Flat Ct'Snk, Metric	100021.05.16	2
14.	Nut,Poly Insert,Full,Class 10	100136.05	2
15.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.20	4
16.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.25	1
17.	Belting,Rough Top	3.3056.208	1
18.	Plate Spring,Igus,Jtem-12	498083	2
19.	Washer, Plain, Metric	100239.08	2
20.	Spacer,Rnd,12L14,.33,0.47,.35	901.033.047.035	1
21.	Cpscr,Button Hd,Metric	100005.08.20	2
22.	Cpscr,Button Hd,Metric,Plated	100005.05.12P	4
23.	Silencer,Compact,Met	150991.01	1
24.	Washer,Lock,Metric	100240.06	4
25.	Washer,Lock,Metric	100240.08	5

Columbia Palletizer Parts

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SECTION 3

Row Former
3.3394.003

Page 1 Row Former Assembly List
Page 2-5 Row Former Assembly
Page 6 Sprocket
Page 7 Flight Bar Assembly
Page 8 Link Bar Assembly
Page 9 Transition Plate Assembly
Page 10 Case Stop Kit
Page 11-14 Stop Assemblies

Columbia Palletizer Parts

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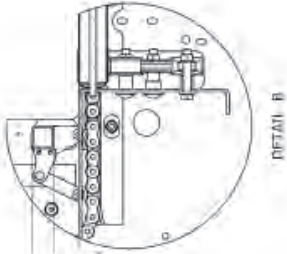
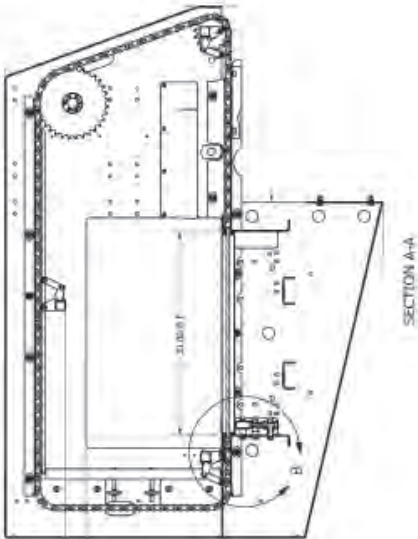
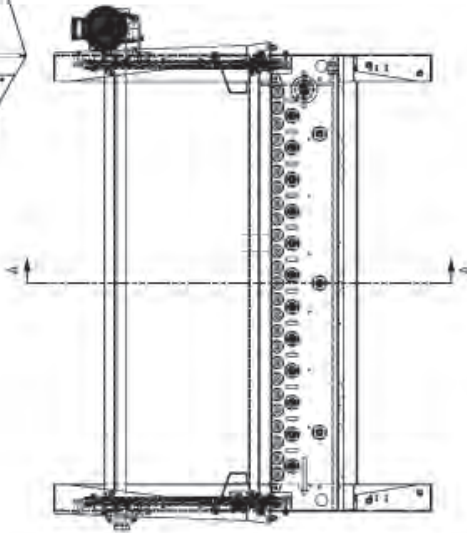
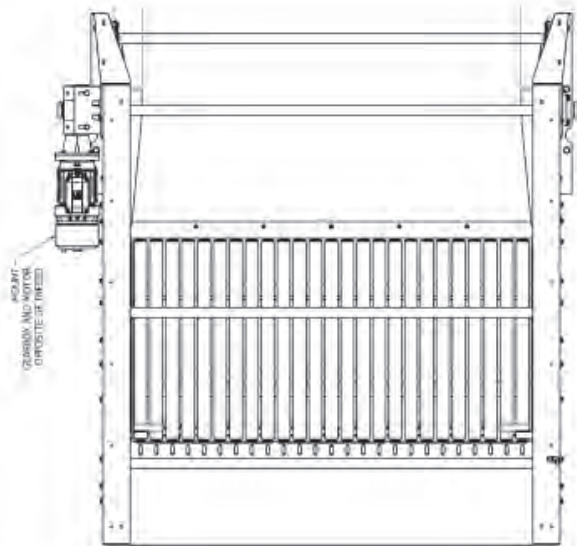
Columbia Palletizer Parts

ROW FORMER ASSEMBLY LIST No. 3.3394.004

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Row Former,HI4200,Rh	3.0003.209.006	1
2.	Transition Plate Assy,HI4200	3.3260.096.001	1
3.	Case Stop Kit,HI4200,Std	3.2800.440.011	1
4.	A/P,Stop Assy,Cc,Festo,10-Stp	3.0053.197.010	1
5.	Spacer Plate,Apron Guide,HI420	3.3260.105.002	2
911.	P/K R/Lyr,Blue Marble,5028930	328.27.7434.11	1

Columbia Palletizer Parts

ROW FORMER ASSEMBLY
No. 3.0003.209.006



ROW FORMER ASSEMBLY
No. 3.0003.209.006



Columbia Palletizer Parts

ROW FORMER ASSEMBLY

No. 3.0003.209.006

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Row Former Wldmt, HI4200	3.3260.219.003	1
2.	Roller, 1.775.R81.M70-29.88	486101	25
3.	Roller, 1.457.G38.Z62-29.88RI	486191	2
4.	Spacer, Rnd, 12L14, .53, 1.00, .50	901.053.100.050	1
5.	Spacer, Rnd, 12L14, .53, .88, .88	901.053.088.088	15
6.	Idler, Va4002/Sb0006	429807	1
7.	Pulley, Idler, Zfh32146	429356	15
8.	Washer, Plain Hardened Steel	100222.1	13
9.	Bolt, Rd Hd-Sq Neck-13 Unc Gd5	100102.08.48	13
10.	Washer, Lock Helical Spring	100226.08	16
11.	Washer, Plain Hardened Steel	100222.08	3
12.	Cpscr, Hex Head-Gd 5-13 Unc	100000.08.48	3
14.	Fixed Stop, HI4200	3.2200.254.015	1
15.	Drive Shaft, HI4200 Rf, 1.438	3.2860.037.004	1
16.	Gbox/Brg Mnt, Ucf207	3.2800.409.001	2
17.	Brg, 4 Bolt, Std Duty, 1-7/16	410061	1
18.	Gbox Mt, Cone B06, Ucf-207	3.2531.079	1
19. @	Gbox, Cone, B061025.Waat1	460964	1
20.	Flt Bar, C1018, 5/16X3/8	905929.04.00	1
21.	Set Col Dbl Splt, 1.44X2.25X.56	448120	2
22. @	Mtrb, 1.0, 1750, 56C, 460D, T, M	365.3.59.5	1
23.	Sprkt, 80B32, 65Mm Bore	367.5.1030	2
24.	Locking Assy, B106-In, 1.438	429399	2
25.	Idler Sprocket Mt, Metric	3.2592.171.005	2
26.	Sprocket, Idle, 80Bb15H	367.5.957	2
27.	Snap Ring-External, 0.750 Dia.	430140	2
28.	Chain Guide Spacer, HI7200	3.2800.301.001	4
30.	Chain Takeup, HI4200	3.2860.229.002	2
31.	Chain Guide, Rf, Upper, Rh, HI4200	3.3260.228.001	1
32.	Chain Guide, Rf, Upper, Lh, HI4200	3.3260.229.001	1
33.	Chain Guide, Rf, Lower, Rh, HI4200	3.3260.230.001	1
34.	Chain Guide, Rf, Lower, Lh, HI4200	3.3260.231.001	1
35.	Flight Bar Assy, HI4200	3.3260.233.002	1
36.	Washer, Plain, Metric	100239.1	40
37.	Nut, Poly Insert, Full, Class 10	100136.1	36
38.	Cpscr, Hex Soc. Head, Metric	100020.10.45	24
39.	Cpscr, Flat Ct'Snk, Metric	100021.10.40	8
40.	Washer, Lock, Metric	100240.1	12

Continued on the next page.

@See Vendor Data for more information.

Columbia Palletizer Parts

ROW FORMER ASSEMBLY

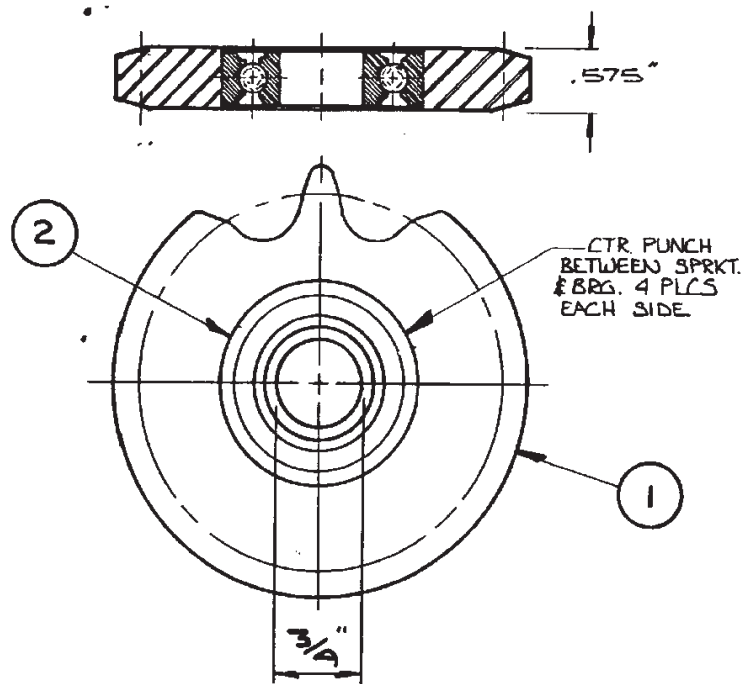
No. 3.0003.209.006

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
41.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	12
42.	Nut, Hex Jam, Gd 04, Metric	100139.12	8
43.	Cpscr, Flat Ct'Snk, Metric	100021.10.30	8
44.	Washer,Lock,Metric	100240.12	8
45.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.30	14
46.	Washer, Lock Helical Spring	100226.06	4
47.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.20	4
48.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.30	4
49.	Washer,Lock,Metric	100240.2	2
50.	Cpscr,Hex Head,Metric,Gd 8.8	100019.20.30	2
51.	Washer, Plain, Metric	100239.12	10
52.	Nut,Poly Insert,Full,Class 10	100136.12	10
53.	Product Lead In,Rf,Rh,HI4200	3.3260.235.001	1
54.	Product Lead In,Rf,Rh,HI4200	3.3260.236.001	1
55.	Pc,Reflector Brkt,90,Banner	3.1186.949.001	1
57.	Washer, Plain, Metric	100239.08	8
58.	Nut,Poly Insert,Full,Class 10	100136.08	8
59.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.25	8
60.	Washer,Plain,Metric	100239.06	2
61.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.20	2
62.	Nut,Poly Insert,Full,Class 10	100136.06	2
63.	Flat Blt,Ureth,0.03X0.5X4.11CI	4260082	2
64.	Flat Blt,Ureth,0.03X0.5X5.64CI	4260083	6
65.	Flat Blt,Ureth,0.03X1.0X8.78CI	4260084	2
66.	Flat Blt,Ureth,0.03X1.0X9.94CI	4260085	2
67.	Chain Guide,Curved,HI4200,Rh	3.2800.302.002	2
68.	Chain Guide,Curved,HI4200,Lh	3.2800.302.003	2
69.	Spacer Plate,Apron Guide,HI420	3.3260.105.003	2
70.	Nut, Hexagon Full, Gd 5-13 Unc	100140.08	16
71.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.20	4

Columbia Palletizer Parts

SPROCKET No. 367.5.975

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sprocket, 80A15H	367.5.958	1
2.	Brg, Ball, Light, .75B	410970	1



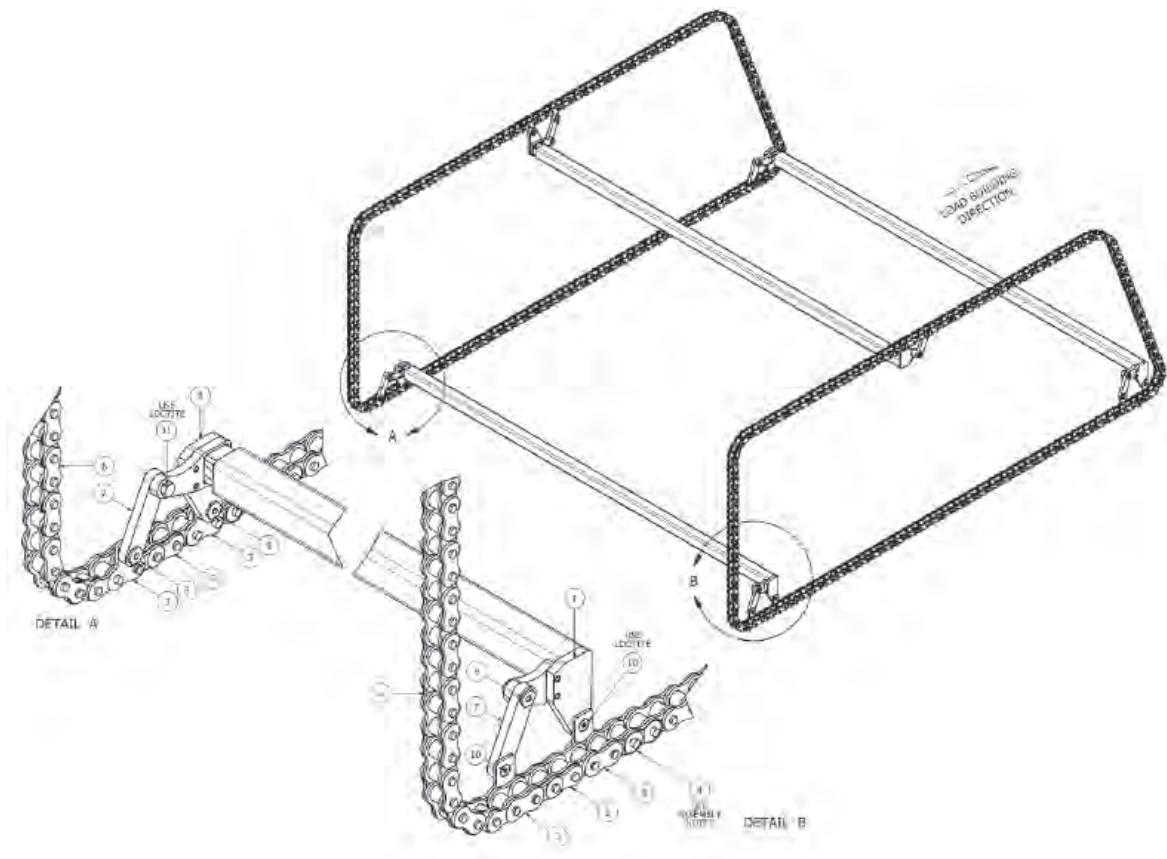
PITCH = 80
PITCH DIAMETER = 4.810
OUTSIDE DIAMETER = 5.30
NUMBER TEETH = 15 HARDENED

Columbia Palletizer Parts

FLIGHT BAR ASSEMBLY

No. 3.3260.233.001

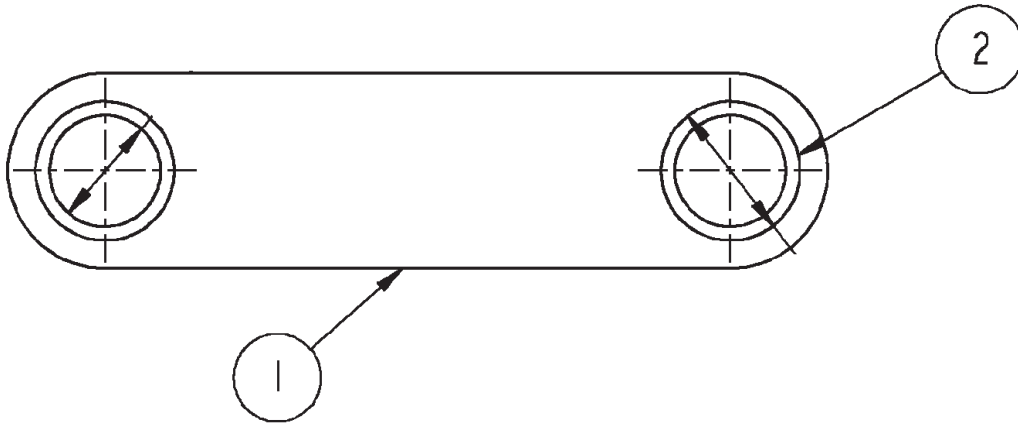
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Flight Bar Wd Rh, HI4200	3.2592.219.003	3
2.	Flight Bar Wd Lh	3.2592.222	3
3.	Chain, M35 Conn Link, C80, C'Sink	418494	12
4.	Chain, Offset Link, #80	418232	6
5.	Chain, Std Sgl Str Roller #80	418007.003.00	6
6.	Chain, Std Sgl Str Roller #80	418007.057.00	6
7.	Link Bar Assy	3.2592.164	6
8.	Link Arm Mt Boss 1/2 Dia, M6	3.2592.162.002	12
9.	Link Arm Mt Boss 1/2 Dia, M8	3.2592.226.001	6
10.	Cpscr, Flat Ct'Snk, Metric	100021.06.16	12
11.	Cpscr, Hex Head, Metric, Gd 8.8	100019.08.20	6



Columbia Palletizer Parts

LINK BAR ASSEMBLY No. 3.2592.164

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	PLT, A36	900076	1
2.	Bronze Bearing	414162	2

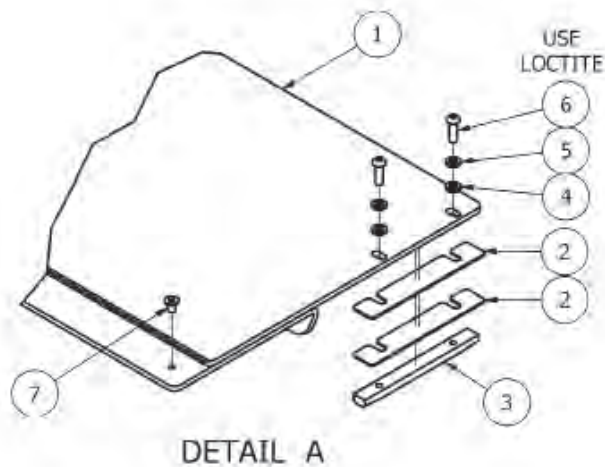
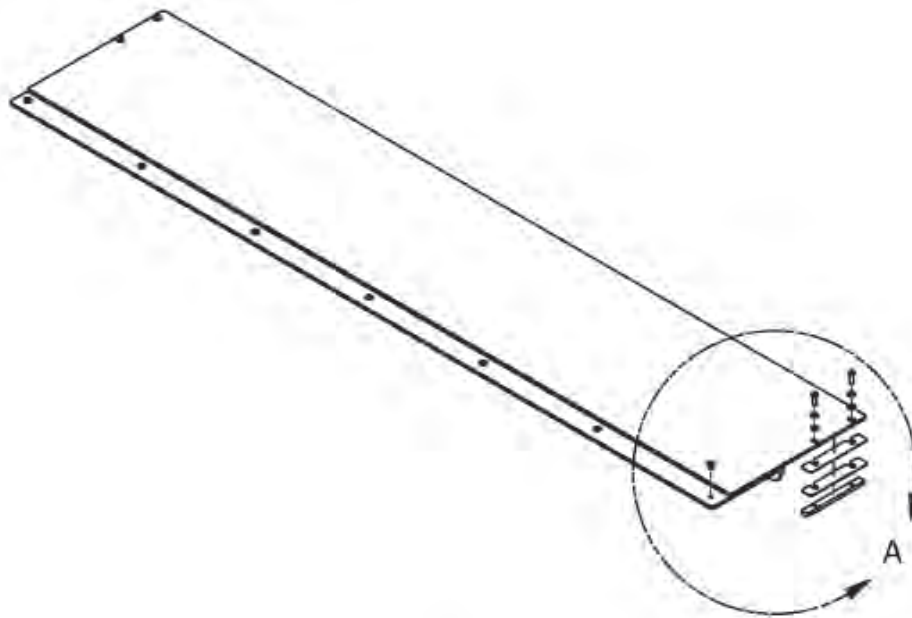


Columbia Palletizer Parts

TRANSITION PLATE ASSEMBLY

No. 3.3260.096.001

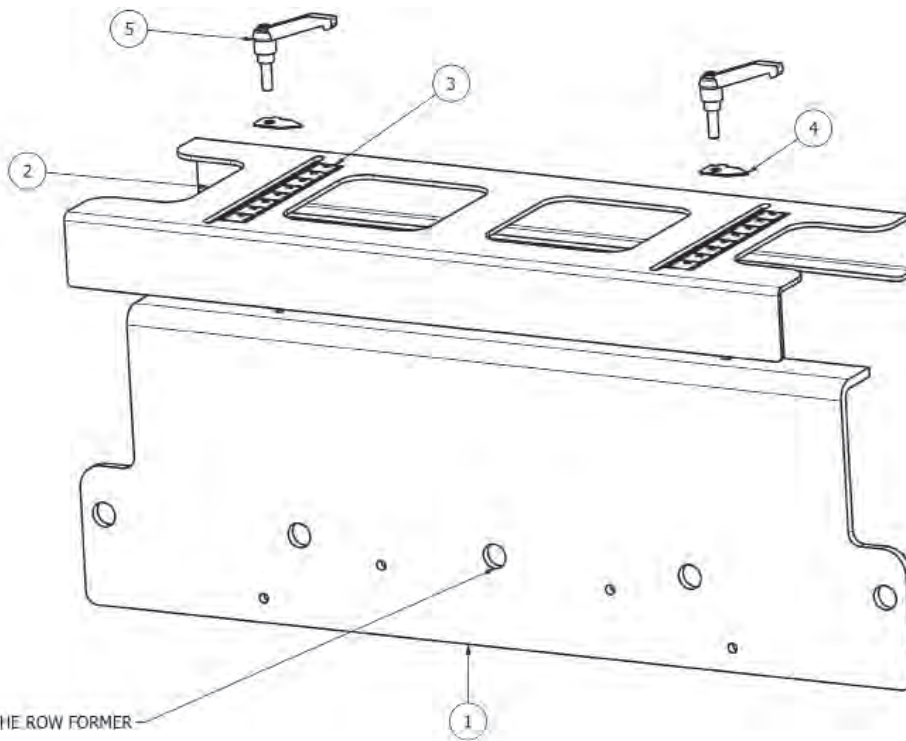
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Transition Plate Wldmt, HI4200	3.3260.097.001	1
2.	Shim Plate, .05, Trans Plate	3.2592.492	4
3.	Transition Support, 3/8", Metric	3.2200.470.002	2
4.	Washer, Plain, Metric	100239.06	4
5.	Washer, Lock, Metric	100240.06	4
6.	Cpscr, Button Hd, Metric	100005.06.20	4
7.	Cpscr, Flat Ct'Snk, Metric	100021.06.10	7



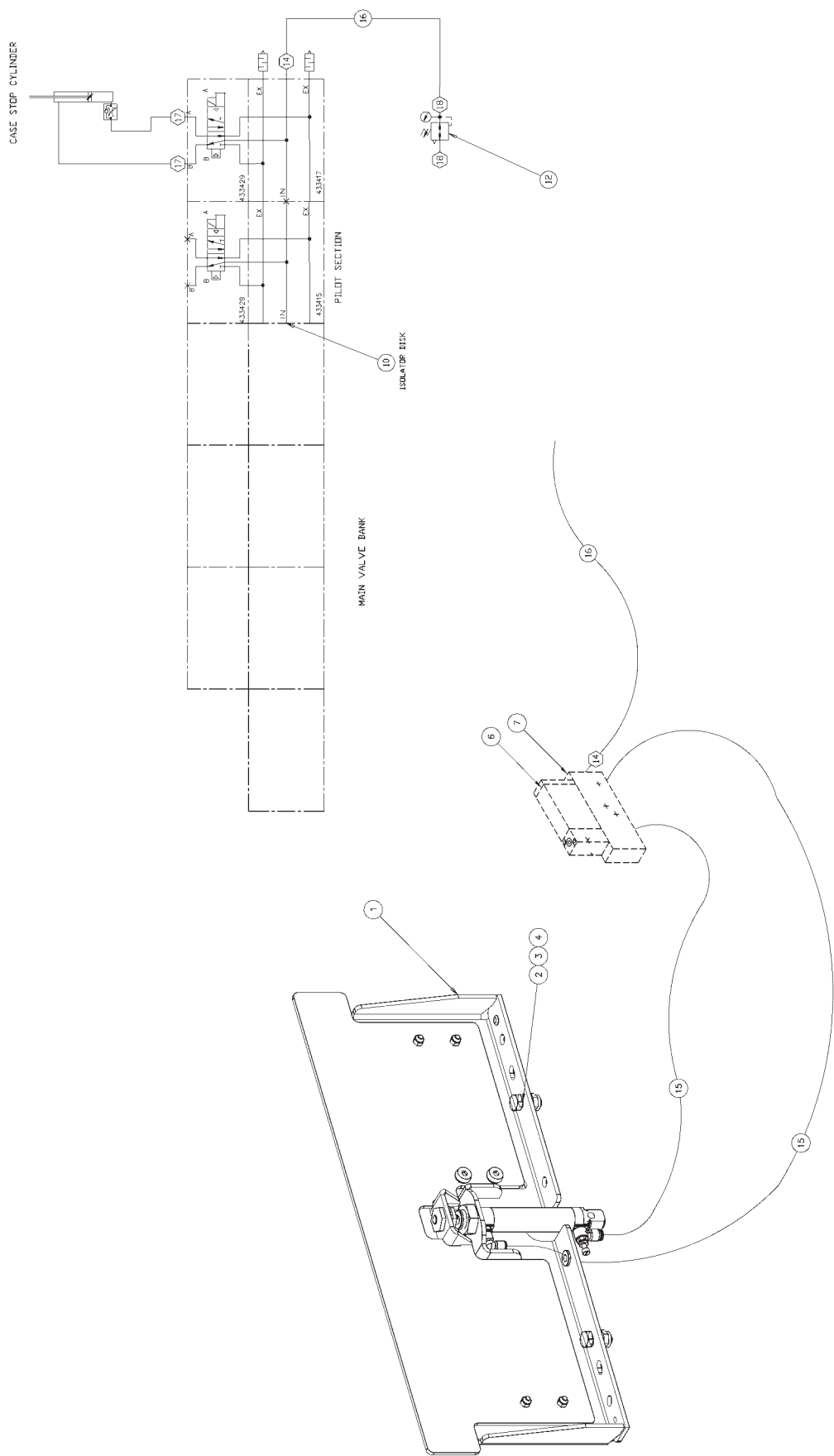
Columbia Palletizer Parts

CASE STOP KIT No. 3.2800.440.011

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Case Stop Mount, HI4200,Std	3.2800.441.008	1
2.	Case Stop Face Plt,Short	3.2800.442.008	1
3.	Ruler,Adhesive,Ez Read,12In	8708.4584	2
4.	Pointer Brkt, Adj Handle, 3/8"	3.1888.1100	2
5.	Handle,Adj,M10X1.5,Kha 7296	401919	2



STOP ASSEMBLY
No. 3.0053.197.010



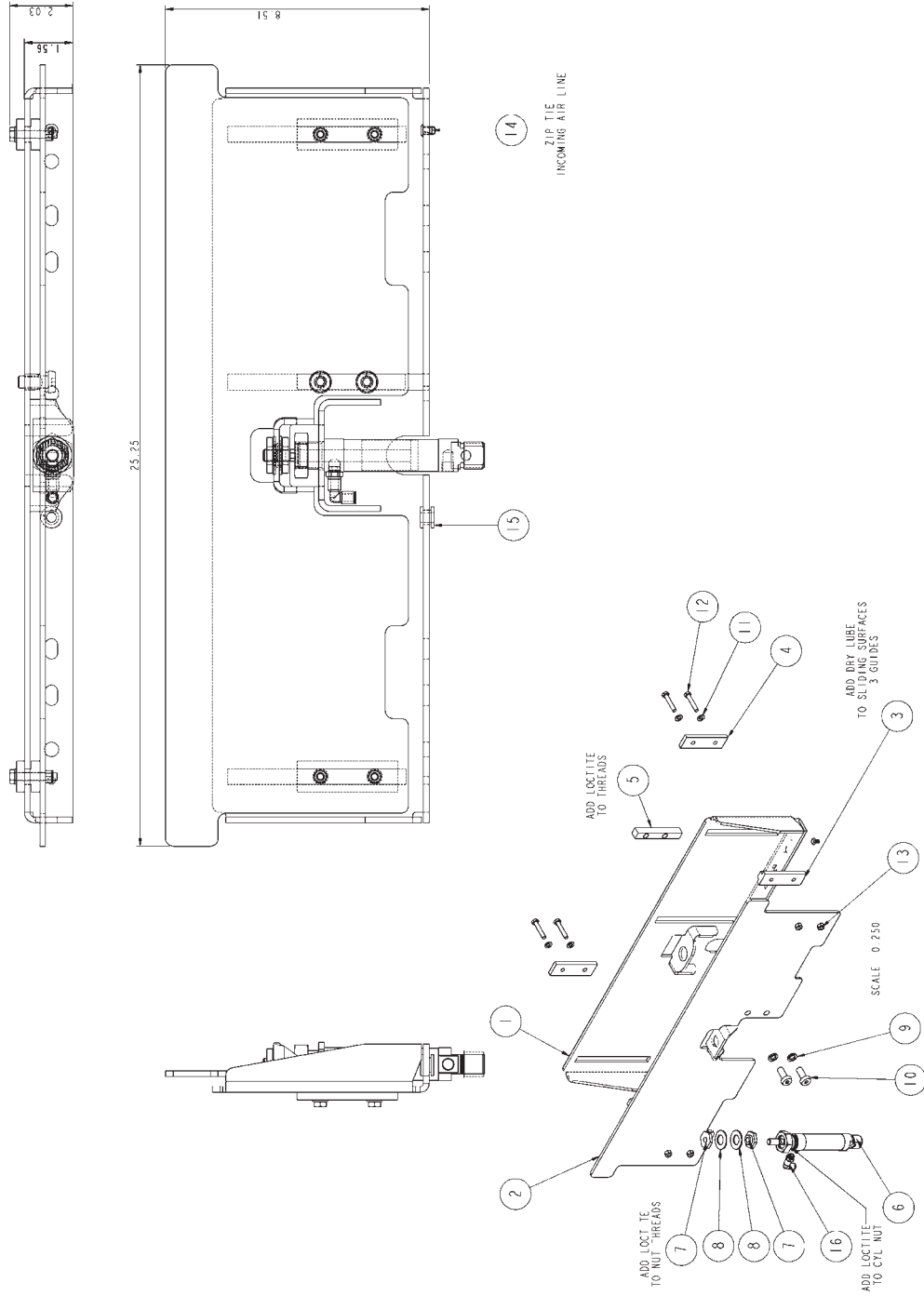
Columbia Palletizer Parts

STOP ASSEMBLY No. 3.0053.197.010

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Stop Assy, Thin, Std, Festo	3.2200.961.001	10
2.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.25	20
3.	Washer, Plain, Metric	100239.1	40
4.	Nut, Poly Insert, Full, Class 10	100136.1	20
6.	Va, 92B-Eab-000-Dm-Ddap1Dm=8529	433429	10
7.	Mfld, 92B-000-Ek1-M1705-Sm16Sgl	433415	9
10.	Isolator Kit, N-92018	433278	1
11.	Mfld, 92B-000-Ep2-M1705-Sm16DbI	433417	1
12.	Regulator, P32Ra14Bnmp	435056	1
13.	Angle Bracket, P32Ka00Mr	435059	1
14.	Ftg, Tube, 90, G3/8, 10Mm	150531.06.10	1
15.	Tube, Poly, 6Mm, Blue	392010.06	400
16.	Tube, Poly, 10Mm, Blue	392010.1	200
17.	Ftg, Tube, 90, G1/4, 6Mm	150531.04.06	20
18.	Ftg, Tube, 90, G1/2, 10Mm	150531.08.10	2

Columbia Palletizer Parts

STOP ASSEMBLY
No. 3.2200.197.001



Columbia Palletizer Parts

STOP ASSEMBLY No. 3.2200.197.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Stop Mtg Angle,Wldmt Festo	3.2200.931.015	1
2.	Stop Blade Wldmt,Thin,Festo	3.2652.036.019	1
3.	Stop Guide,Milled,Uhmw	3.2200.221	2
4.	Stop Guide Backing Plate,Uhmw	3.2200.222	2
5.	Stop Guide,Steel,Met	3.2200.223.003	1
6.	Cyl,A,25,40,10,N/A,F,Dsnu	366.17.1967	1
7.	Cyl Rod Bushing	3.2652.035.001	2
8.	Plate Spring,Igus,Jtem-16	498050	2
9.	Washer, Hi-Collar-Metric	100241.1	2
10.	Cpscr, Button Hd, Metric	100005.10.20	2
11.	Washer,Plain,Metric	100239.06	4
12.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.35	4
13.	Nut,Poly Insert,Full,Class 10	100136.06	4
14.	Cable Tie Mnt,3/16 Panel Thick	235482	1
15.	Grommet, 1/4X1/4X15/32	454124	1
16.	Ftg,Tube,90,G1/8,6Mm	150531.02.06	1
17.	Ftg,Flow Cont,90,G1/8,6Mm	150490.02.06	1

SECTION 4

Palletizer
3.3394.004

Page 1 Palletizer Assembly List
Page 2-5 Palletizing Assembly
Page 6 Gear Reducer
Page 7 Sprocket
Page 8-11 Apron Assembly
Page 12 Apron Chain Assembly, RH
Page 13 Apron Chain Assembly, LH
Page 14 Hoist CWT Assembly
Page 15 Sprocket
Page 16-17 Panel Kit, Side
Page 18-19 CW Guide Kit
Page 20 Pallet Track Kit
Page 21-22 Light Dty Photoeye Kit
Page 23 Lifting Spreader Kit

Columbia Palletizer Parts

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Columbia Palletizer Parts

PALLETIZER ASSEMBLY LIST

No. 3.3394.004

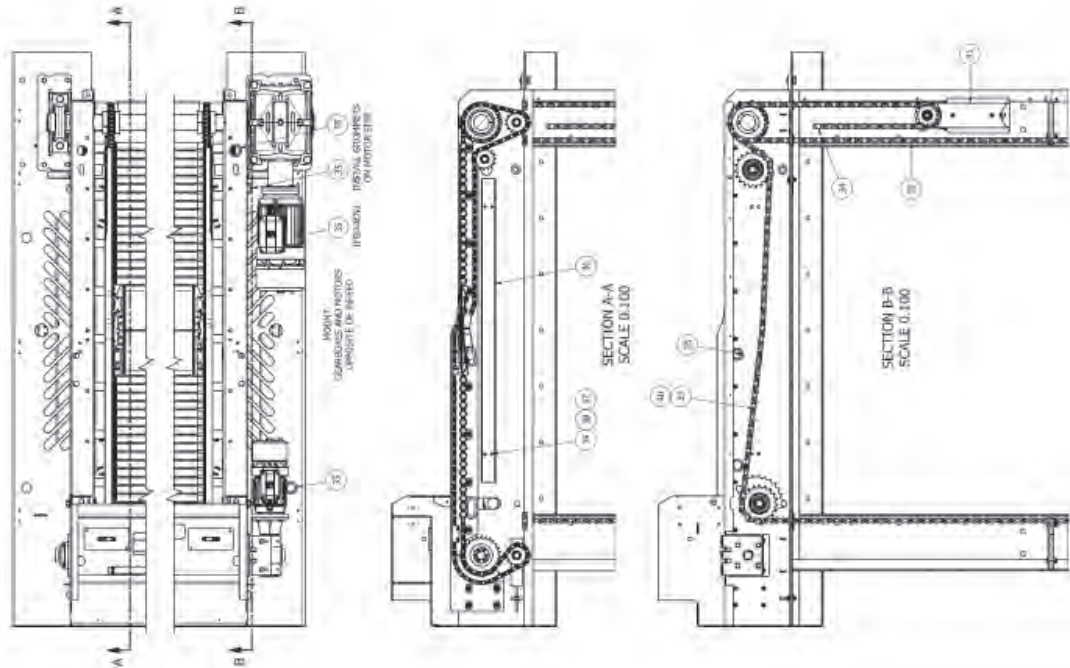
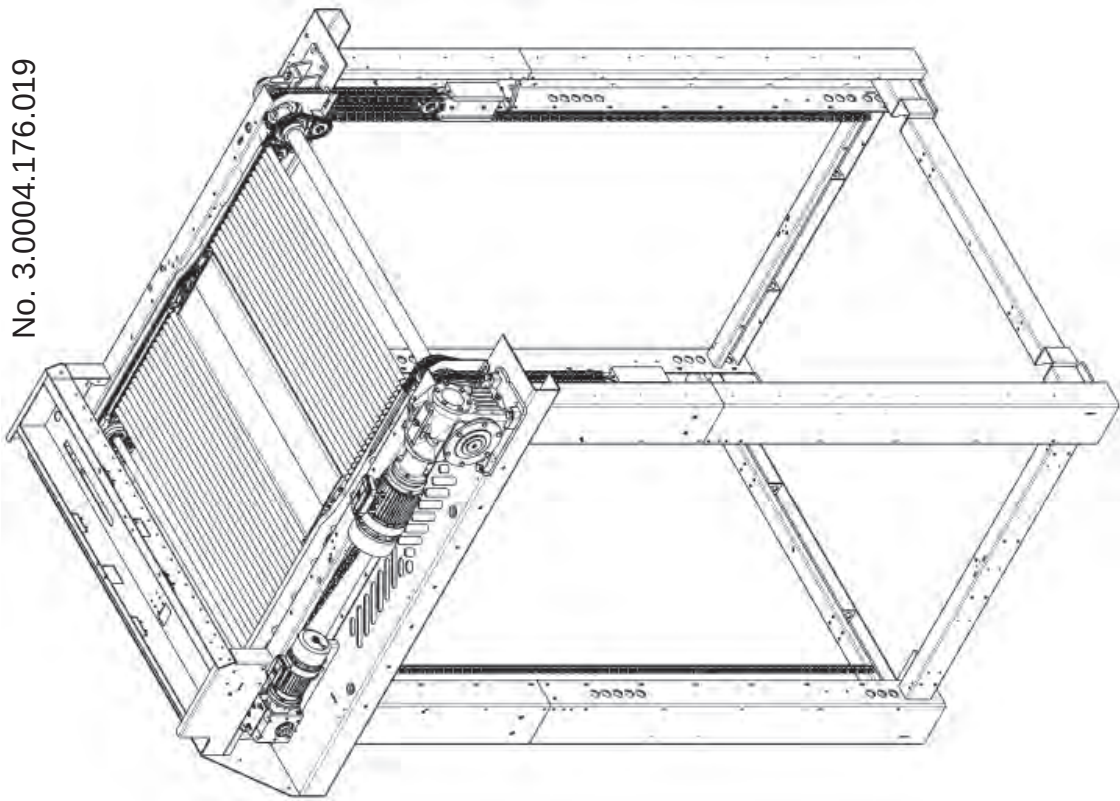
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pall Sect,HI4200,109,Rh,Frt	3.0004.176.019	1
2.	Panelkit,Side,HI4200,72X60,109	3.3260.290.005	1
3.	Cw Guide Kit,HI4200,109	3.3260.280.005	1
4.	Pallet Track Kit,Side,Leuze,18	3.3260.310.015	1
5.	Eh,HI4200,Std,Banner,Side Disc	3.0020.304.085	1
6.	Op Station Mount Wldmt,12X14	3.2592.195.001	1
7.	Lifting Spreader Kit,HI4200	3.2890.054.005	2
8.	Reflector Mount, HI7200 Hoist	3.0020.712	2
9.	Pe Mount, HI7200 Hoist	3.0020.760	2
912.	P/K Paltz,Blue Marble,5028930	328.27.7434.12	1

PALLETIZING ASSEMBLY
No. 3.0004.176.019



Columbia Palletizer Parts

PALLETIZING ASSEMBLY
No. 3.0004.176.019



Columbia Palletizer Parts

PALLETIZING ASSEMBLY

No. 3.0004.176.019

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Frame Wldmt, HI4200, 109, Frt	3.3260.040.017	1
2.	Lift Reducer Mt Plt, HI4200	3.3260.053.001	1
3.	Motor Adapter, 142Tc-112B14	3.2692.049.001	1
4.	Mtrb, 7.5, 1750, B14, 460D, T, M	365.3.56.8	1
5.	Coupling Hub, L-110 X 28Mm	4243680	1
6.	Gear Redu, Cone, Msho50, 40:1	367.33.44	1
7.	Lift Drive Shaft, HI7200	3.2860.114.001	1
8.	Squares, C1018, 5/8	903638.06.00	1
9.	Hoist Bearing Mount Wldmt	3.2860.230	1
10.	Brg, Pillow, Std Duty, 2-3/4	410119	1
11.	Ds80Atb20H 2 3/4 Timed	4213700	2
12.	Shaft Endcap, 3.00 Od	3.2860.145	2
13.	Squares, C1018, 5/8	903638.03.75	2
14.	Sprocket Assy, 80A19, Er210, 50Mm	3.0033.28	4
15.	Hoist Idler Shaft, HI7200	3.2860.124	4
16.	Pin, Slotted Spring Type A	100256.250.10	4
17.	Washer, Plain, Metric	100239.2	4
18.	Cpscr, Hex Head, Metric, Gd 8.8	100019.20.40	4
19.	Hoist Idler Eccentric, HI7200	3.2860.125	4
20.	Cpscr, Hex Soc. Head, Metric	100020.08.30	4
21.	Washer, Lock Helical Spring	100226.06	4
22.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.20	4
23.	Washer, Lock, Metric	100240.2	14
24.	Cpscr, Hex Head, Metric, Gd 8.8	100019.20.60	4
25.	Cpscr, Hex Head, Metric, Gd 8.8	100019.20.30	8
26.	Cpscr, Hex Head, Metric, Gd 8.8	100019.20.50	2
27.	Cpscr, Flat Ct'Snk, Metric	100021.10.30	2
28.	Cplg Spacer, 28Mmx1.88X0.88	3.2200.460.005	1
29.	Cplg Spacer, 1.50X2.00X1.00	3.2860.788	1
30.	Apron Assy, HI4200, Rh	3.3260.100.001	1
31.	Hoist Cwt Assy	3.2860.115.002	2
32.	Chain, Hvy Sgl Str Roller #80	418018.209.00	2
33.	Chain, Hvy Sgl Str Roller #80	418018.275.00	2
34.	Chain, Conn Link #80 Heavy	418245	4
35.	Grommet, 1-1/2X1/4X1-3/4	454087	6
36.	Under Apron Array Brkt, HI4200	3.3260.240.001	2
37.	Washer, Plain, Metric	100239.06	8
38.	Nut, Poly Insert, Full, Class 10	100136.06	8
39.	Cpscr, Hex Head, Metric, Gd 8.8	100019.06.20	8
40.	Chain, Offset Link #80 Heavy	418246	2
41.	Grommet, 7/8X3/16X1-1/4	454073	2

Columbia Palletizer Parts

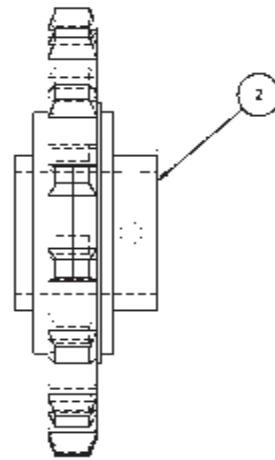
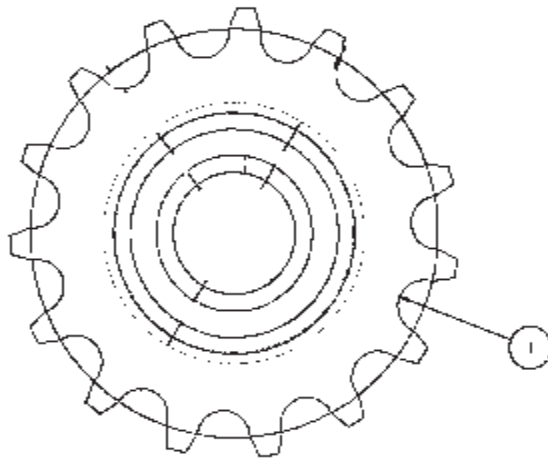
GEAR REDUCER No. 367.33.44

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Oilseal,4"/5" Worm,156W262	4601170	2

Columbia Palletizer Parts

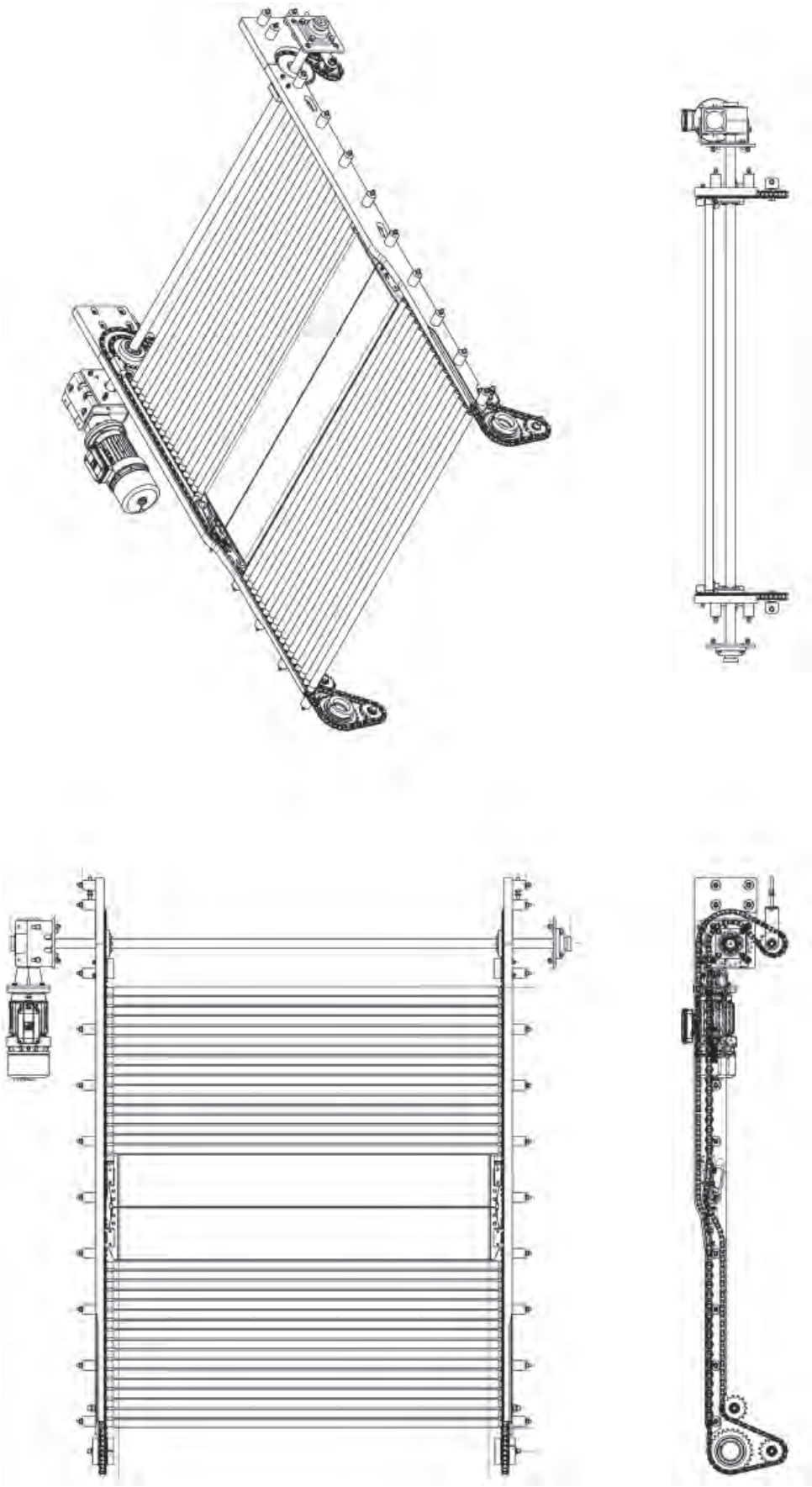
SPROCKET No. 3.0033.28

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sprocket	407819	1
2.	Bearing Assembly	4110845	1



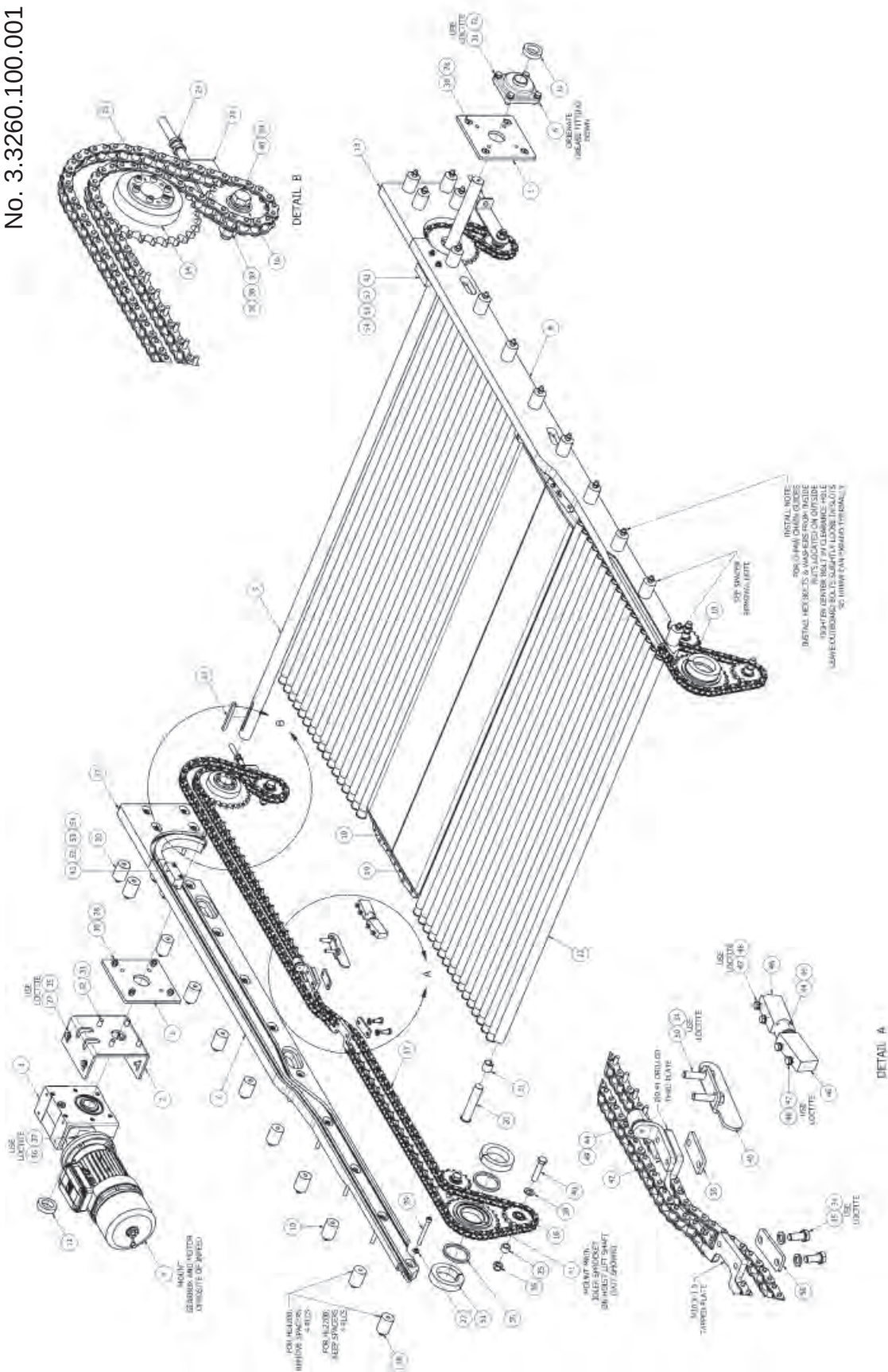
Columbia Palletizer Parts

APRON ASSEMBLY
No. 3.3260.100.001



Columbia Palletizer Parts

APRON ASSEMBLY
No. 3.3260.100.001



Columbia Palletizer Parts

APRON ASSEMBLY

No. 3.3260.100.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Gbox/Brg Mnt,Ucf207	3.2800.409.001	2
2.	Gbox Mt, Cone B06,Ucf-207	3.2531.079	1
3. @	Gbox,Cone,B061020.Waat1	459731	1
4. @	Mtrb,1.0,1750,56C,460D,T,M	365.3.59.5	1
5.	Drive Shaft, HI4200 Aprn,1.438	3.2860.037.005	1
6.	Brg, 4 Bolt, Std Duty, 1-7/16	410061	1
7.	Apron Chain Guide,Lh,HI4200	3.3260.101.001	1
8.	Apron Chain Guide,Rh,HI4200	3.3260.102.001	1
10.	Spacer,Rnd,12L14,.41,1.50,2.00	901.041.150.200	26
11.	Set Col Dbl Splt,1.44X2.25X.56	448120	2
12.	Apron Chain Gde,Lh,Frt,HI4200	3.3260.103.001	1
13.	Apron Chain Gde,Rh,Frt,HI4200	3.3260.104.001	1
14.	Sprocket,60B27 W/65Mm Bore	3.0033.22	2
15.	Locking Assy,B106-In,1.438	429399	2
16.	Sprocket, Idler, 60Bb15H, .64B	407886	6
17.	Apron Chain Assy,Rh,HI4200	3.3260.106.001	1
18.	Apron Chain Assy,Lh,HI4200	3.3260.107.001	1
19.	Apron Ramp Wldmt, Sp4000	3.2592.082.003	2
20.	Apron Tube Insert	3.2592.265	68
21.	Diverter Pin Clip	3.1953.775	34
22.	Plated Apron Tube	3.2491.047	34
23.	Apron Idler Tensioner Wldmt	3.3260.116.001	2
24.	Nut, Hex Jam, Gd 04, Metric	100139.12	4
25.	Spacer,Rnd,12L14,.66,1.00,.63	901.066.100.063	4
26.	Spacer,Rnd,12L14,.66,1.00,.44	901.066.100.044	2
27.	Washer, Plain, Metric	100239.1	30
28.	Nut,Poly Insert,Full,Class 10	100136.1	34
29.	Cpscr, Hex Soc. Head, Metric	100020.10.90	26
30.	Cpscr, Flat Ct'Snk, Metric	100021.10.30	8
31.	Washer,Lock,Metric	100240.12	8
32.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.30	8
33.	Flt Bar, C1018,5/16X3/8	905929.04.00	1
34.	Washer,Lock,Metric	100240.1	12
35.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	8
36.	Washer, Lock Helical Spring	100226.06	4
37.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.20	4
38.	Washer, Plain, Metric	100239.16	8
39.	Nut,Poly Insert,Full,Class 10	100136.16	6
40.	Cpscr,Hex Head,Metric,Gd 8.8	100019.16.70	6

@See Vendor Data for more information.

Continued on the next page.

Columbia Palletizer Parts

APRON ASSEMBLY

No. 3.3260.100.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
41.	Sprocket, Idler, 60A27, 2.75"	407896	2
42.	Stop Brkt, Split Apron, HI4200	3.3260.108.001	2
43.	Stop Block, Split Apron, HI4200	3.3260.109.002	2
44.	Absorb Shock, Gba-2	351166	4
45.	Apron Trip Flag, HI4200, Rh	3.3260.119.003	1
46.	Apron Stop Bumper Mt, HI4200	3.3260.115.001	4
47.	Washer, Lock, Metric	100240.06	8
48.	Cpscr, Hex Head, Metric, Gd 8.8	100019.06.20	8
49.	Cpscr, Hex Soc. Head, Metric	100020.06.16	4
50.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.40	4
51.	Set Col Split, 2.75X4.00X.88	448085	4
52.	Cpscr, Hex Soc. Head, Metric	100020.08.75	4
53.	Washer, Plain, Metric	100239.08	4
54.	Nut, Poly Insert, Full, Class 10	100136.08	4
55.	Spacer, Brg, Lift Shaft, Apron	3.3260.120.001	4
56.	Shim Plate, Apron Ramp, 0.188	3.3260.121.001	4
97.	Spacer, Rnd, 12L14, .66, 1.00, .81	901.066.100.081	4
98.	Spacer, Rnd, 12L14, .66, 1.00, .69	901.066.100.069	2
99.	Apron Trip Flag, HI4200, Lh	3.3260.119.002	1

Columbia Palletizer Parts

APRON CHAIN ASSEMBLY, RH No. 3.3260.106.001

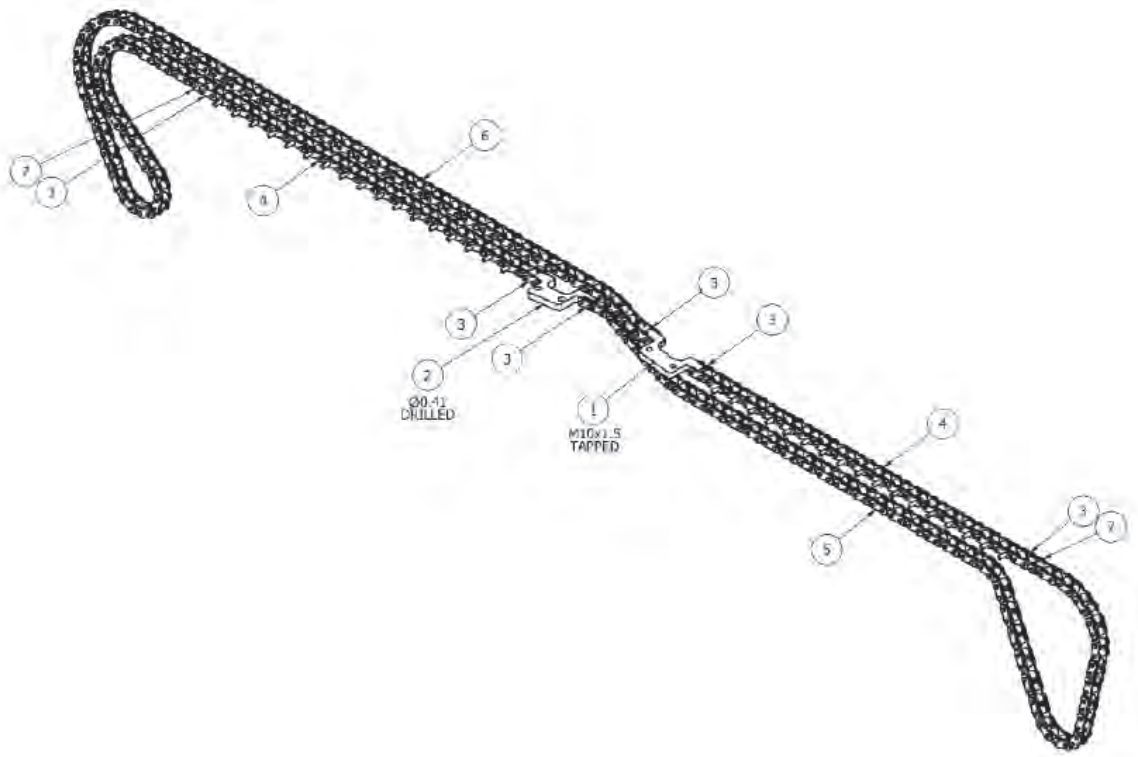
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Apron Ramp Chain Attach,Tapped	3.2592.264.004	1
2.	Apron Ramp Chain Attach,Thru	3.2592.264.001	1
3.	Chain, Conn Link,#60,Cotr	418280	6
4.	Chain, 60-D1	418865.26.25	2
5.	Chain,Std Sgl Str Roller #60	418006.61.50	1
6.	Chain,Std Sgl Str Roller #60	418006.81.00	1
7.	Chain, Offset Link,#60	418231	2



Columbia Palletizer Parts

APRON CHAIN ASSEMBLY, LH No. 3.3260.107.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Apron Ramp Chain Attach,Tapped	3.2592.264.004	1
2.	Apron Ramp Chain Attach,Thru	3.2592.264.001	1
3.	Chain, Conn Link,#60,Cotr	418280	6
4.	Chain, 60-D1	418865.26.25	2
5.	Chain,Std Sgl Str Roller #60	418006.61.50	1
6.	Chain,Std Sgl Str Roller #60	418006.81.00	1
7.	Chain, Offset Link,#60	418231	2

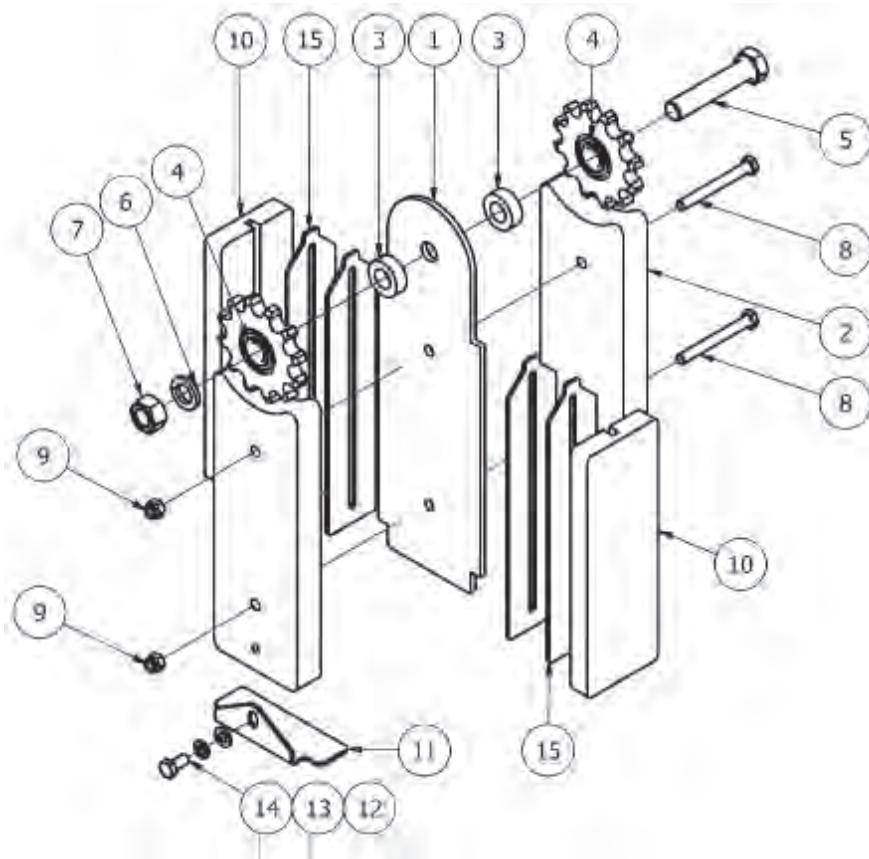


Columbia Palletizer Parts

HOIST CWT ASSEMBLY

No. 3.2860.115.002

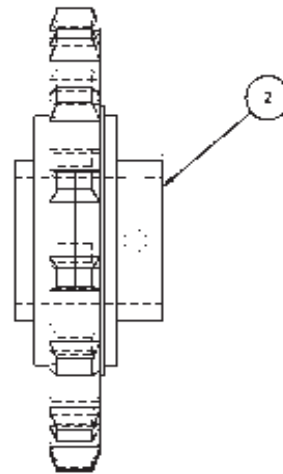
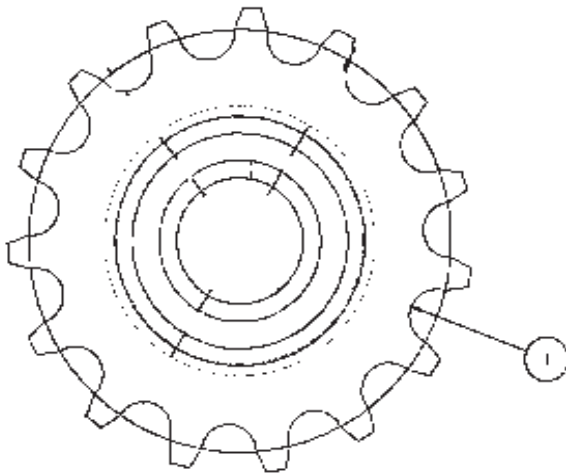
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Hoist Cwt Center Plate	3.2860.116	1
2.	Hoist Cwt Sideplate	3.2860.117	2
3.	Spacer,Rnd,12L14,0.81,1.50,.47	901.081.150.047	2
4.	Sprocket Assy,80Bb12H,20Mm	3.0033.27	2
5.	Cpscr,Hex Head,Metric,Gd 8.8	100019.20.100	1
7.	Nut,Poly Insert,Full,Class 10	100136.2	1
8.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.90	2
9.	Nut,Poly Insert,Full,Class 10	100136.1	2
10.	Hoist Cwt Guide, Wide,Uhmw	3.2860.119	2
11.	Hoist Cwt Guide Keeper	3.2860.120	1
12.	Washer, Plain, Metric	100239.1	1
13.	Washer,Lock,Metric	100240.1	1
14.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.20	1
15.	Counterweight Guide Shim	3.2860.915	4



Columbia Palletizer Parts

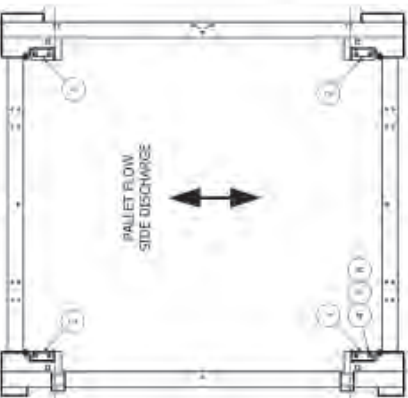
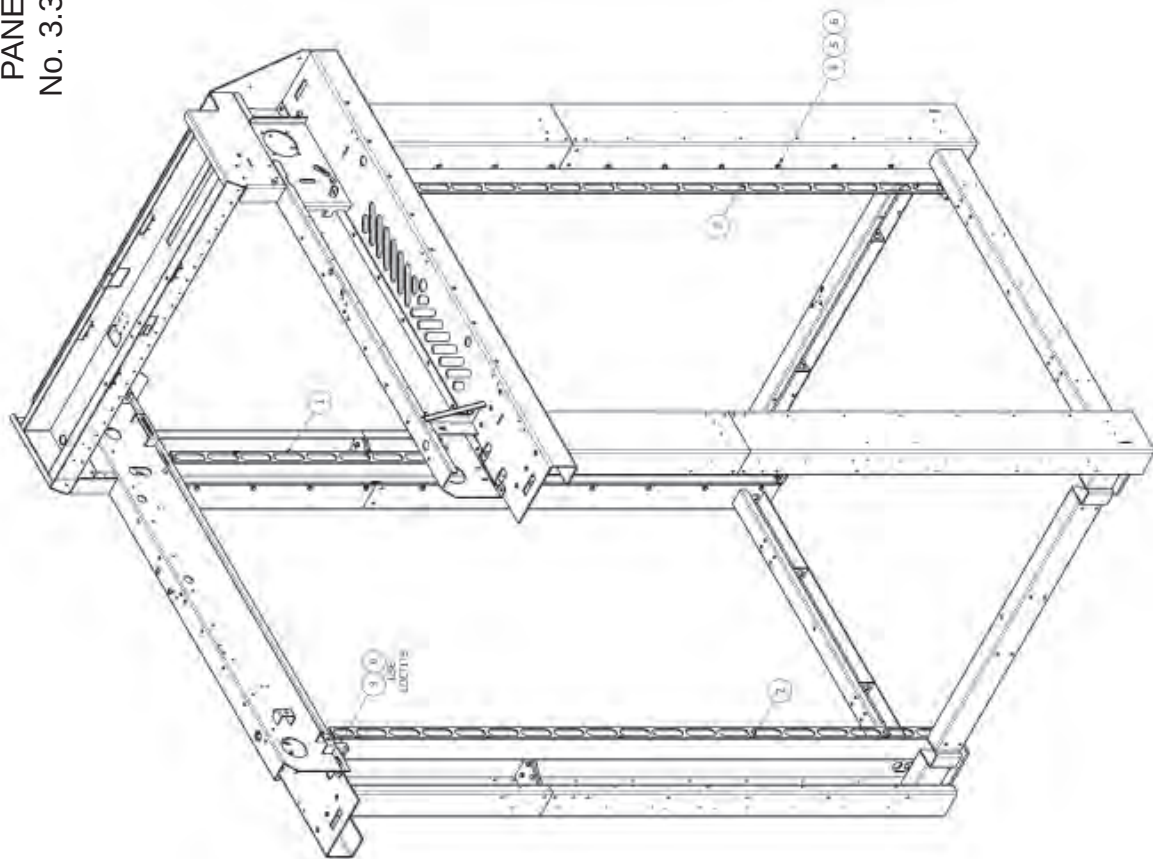
SPROCKET No. 3.0033.27

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sprocket	407836	1
2.	Bearing, Ball Light Retain	410996	1



Columbia Palletizer Parts

PANEL KIT, SIDE
No. 3.3260.290.005

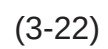


Columbia Palletizer Parts

PANEL KIT, SIDE No. 3.3260.290.005

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Lockout Plate Wd 95 Side Rh	3.3260.260.005	2
2.	Lockout Plate Wd 95 Side Lh	3.3260.261.005	2
3.	Hoist Chain Attach, Fixed	3.2860.126.001	4
4.	Washer, Plain, Metric	100239.1	48
5.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.30	40
6.	Nut, Poly Insert, Full, Class 10	100136.1	40
7.	Washer, Lock, Metric	100240.1	8
8.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.20	8
9.	Cpscr, Flat Ct'Snk, Metric	100021.08.25	8

CW GUIDE KIT
No. 3.3260.280.005



Columbia Palletizer Parts

CW GUIDE KIT No. 3.3260.280.005

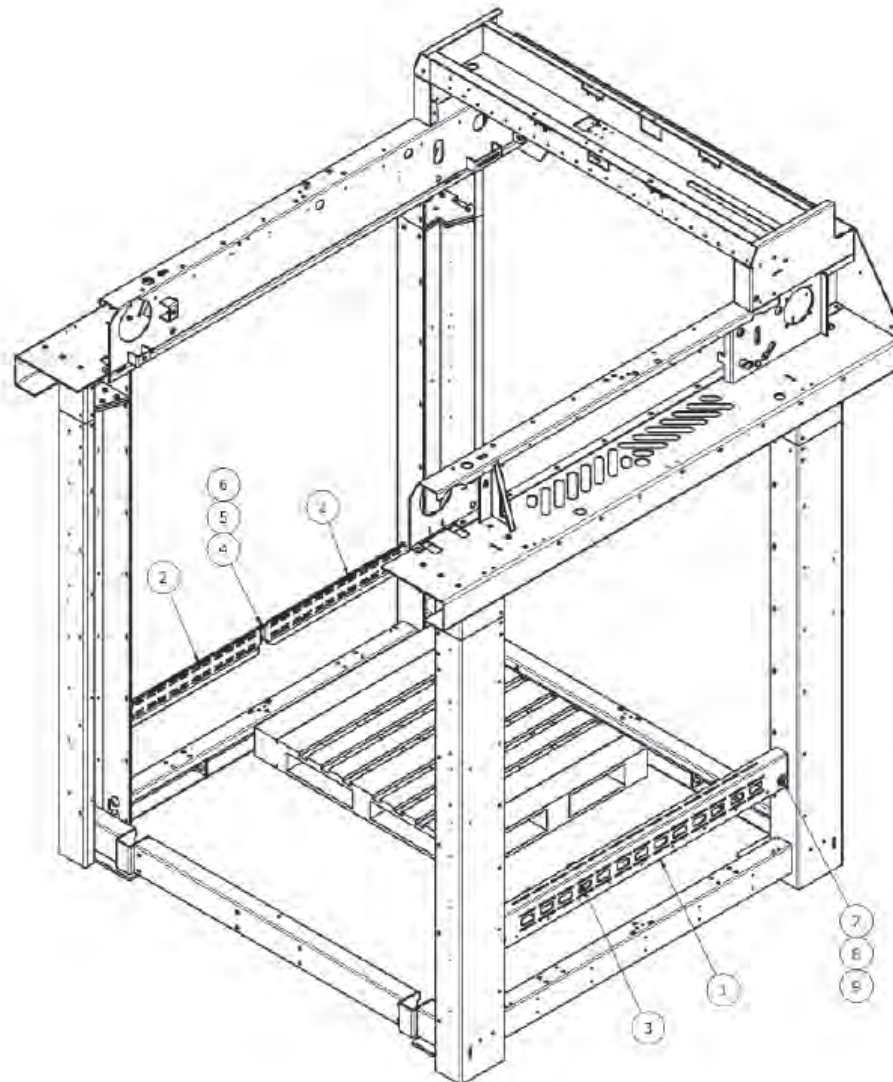
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Cw Guide Wldmt,HI4200,Rh,109	3.3260.281.005	1
2.	Cw Guide Wldmt,HI4200,Lh,109	3.3260.282.005	1
3.	Above Panel,Upper Pnl,HI4200	3.3260.305.007	1
4.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.20	18
5.	Washer, Plain, Metric	100239.08	18
6.	Nut,Poly Insert,Full,Class 10	100136.08	18
7.	Washer, Plain, Metric	100239.1	16
8.	Washer,Lock,Metric	100240.1	12
9.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.20	12
10.	Nut,Poly Insert,Full,Class 10	100136.1	4
11.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	4
12.	E-Chain Mntg Brkt,114-3-12Pz	4453011	1
13.	E-Chain,Z14-3-038-0	4453481	65
14.	Splice Plate,Hoist Guide	3.3260.326.001	2

Columbia Palletizer Parts

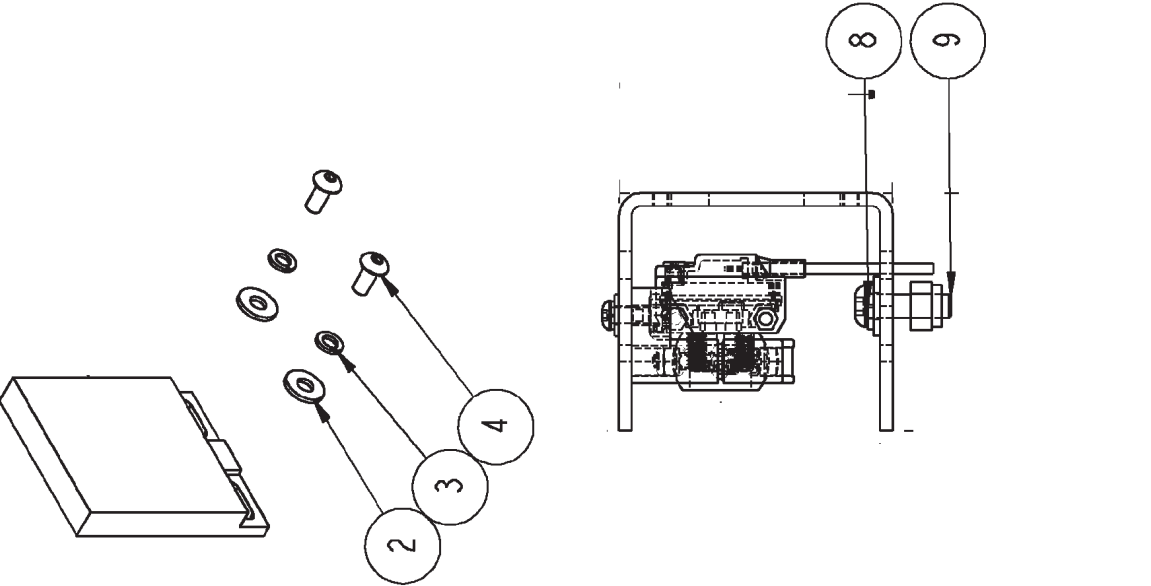
PALLET TRACK KIT

No. 3.3260.310.015

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Plt Tracking Rail,Side,HI4200	3.3260.314.003	1
2.	Pallet Tracking Refl Mount	3.3260.315.003	2
3.	Mount Brkt,Photoeye,Leuze	3.3260.316.001	3
4.	Washer,Plain,Metric	100239.06	8
5.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.16	8
6.	Nut,Poly Insert,Full,Class 10	100136.06	8
7.	Washer, Plain, Metric	100239.1	4
8.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	4
9.	Nut,Poly Insert,Full,Class 10	100136.1	4



LIGHT DUTY PHOTOEYE KIT
No. 3.0020.707.006



Columbia Palletizer Parts

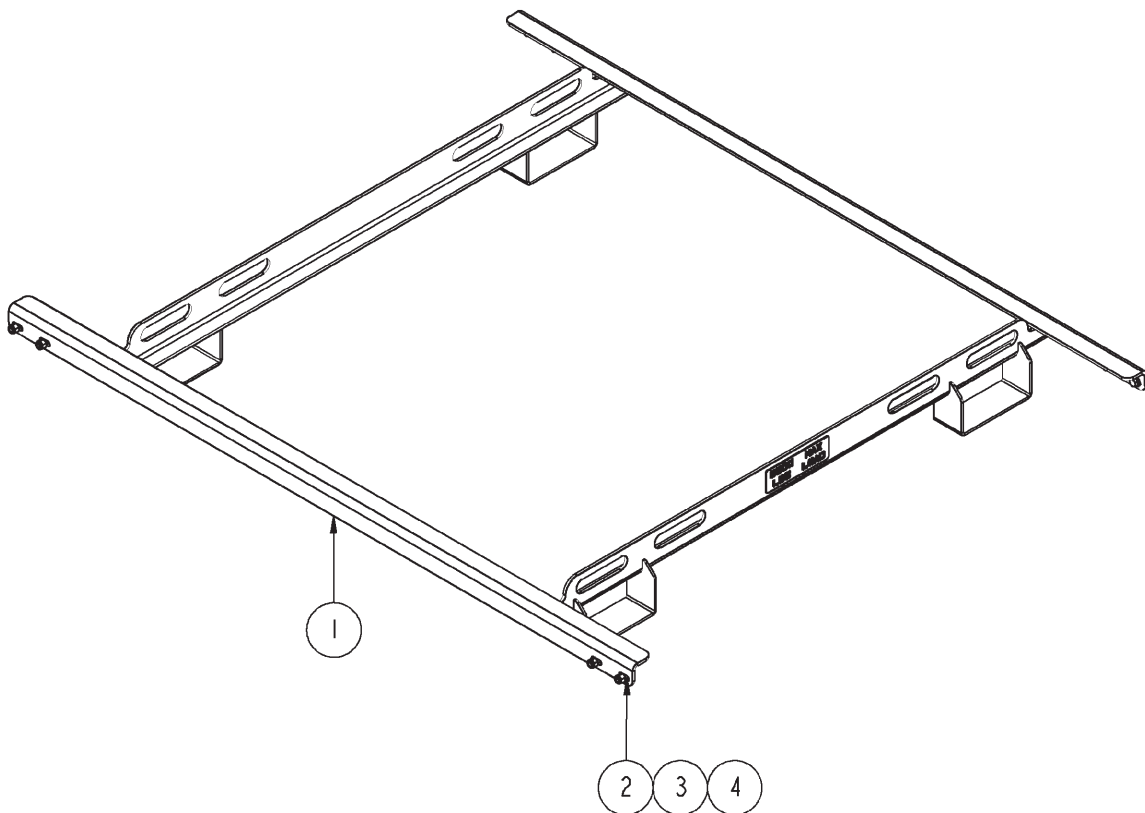
LIGHT DUTY PHOTOEYE KIT No. 3.0020.707.006

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Photocell Brkt Mt,Frmed	3.0020.708.006	1
2.	Washer, Plain Steel Type A	100220.88	4
3.	Washer, Lock Helical Spring	100226.88	4
4.	Cpscr, Button Hd-32 Unc	100006.88.06	2
5.	Nut, Hex Mach Screw-32 Unc	100146.88	2
6.	Cpscr, Button Hd-32 Unc	100006.88.10	2
7.	Washer, Plain Steel Type A,Sae	100220.04.00	2
8.	Washer, Lock Helical Spring	100226.04	2
9.	Cpscr, Button Hd-20 Unc	100006.04.14	2
10.	Nut, Poly Ins Full Hgt-20 Unc	100160.04	2

Columbia Palletizer Parts

LIFTING SPREADER KIT No. 3.2890.054.005

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Lifting Spreader Wldmt,HI4200	3.2890.053.005	1
2.	Washer, Plain, Metric	100239.12	8
3.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.50	8
4.	Nut,Poly Insert,Full,Class 10	100136.12	8



SECTION 5

Hoist/Full Load Conveyor
3.3394.005

Page 1 Hoist/Full Load Conveyor Assembly List
Page 2-3 Hoist Assembly
Page 4-5 Hoist Lock Assembly
Page 6-7 Hoist Lockout Assembly
Page 8-9 Light Duty Photocell Kit
Page 10-13 Full Load Conveyor Assembly
Page 14 Kit Cylinder Replacement
Page 15-16 Full Load Conveyor Stand Off Kit

Columbia Palletizer Parts

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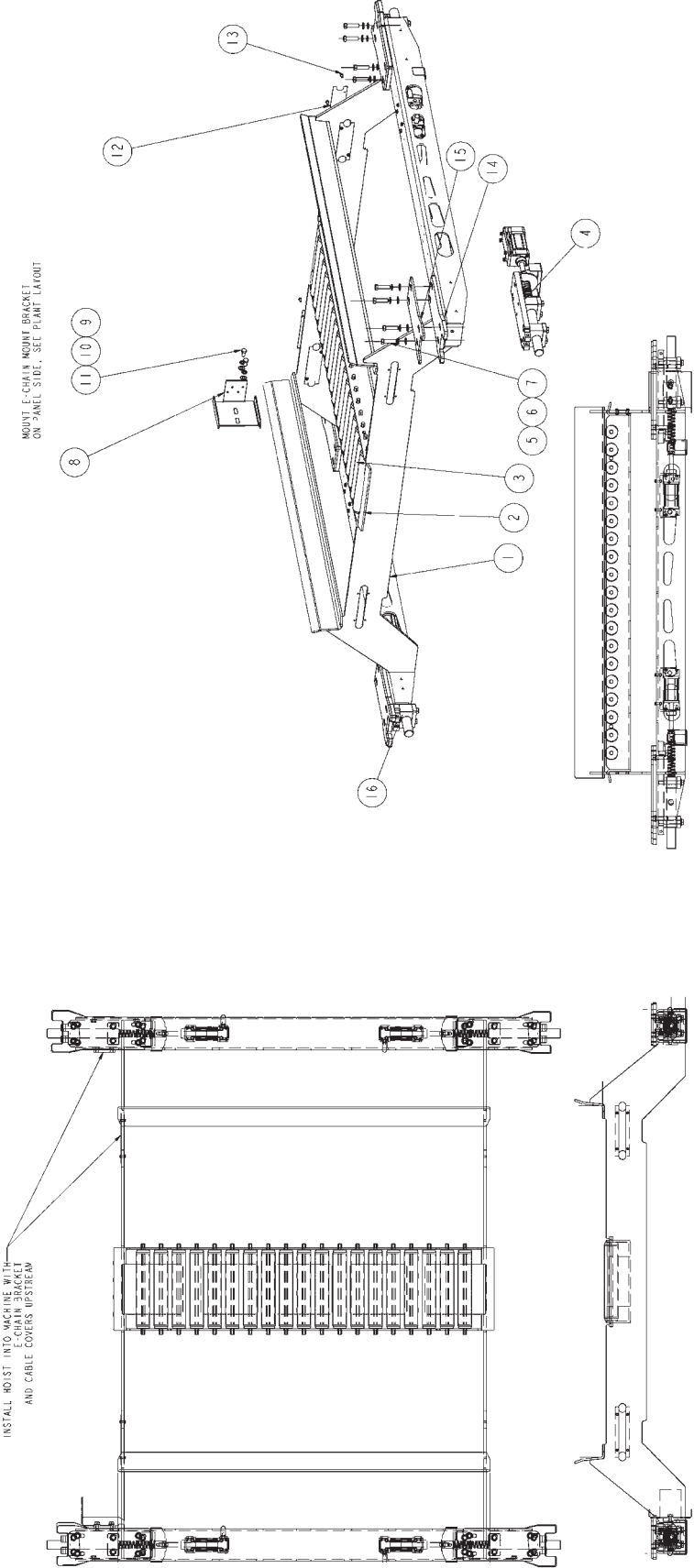
Columbia Palletizer Parts

HOIST/FULL LOAD CONVEYOR ASSEMBLY LIST No. 3.3394.005

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Hoist Assy, HI7200, 48,Sgl	3.0005.098.004	1
2.	Hoist Lockout,HI4200,109,Frt	3.3260.269.054	1
3.	Light Duty Photocell Kit	3.0020.707.005	2
4.	Pc Cover Hoist	3.0020.104.004	2
5.	Flc,48In,HI4200,97Fpm,Side	3.0030.042.009	1
6.	Flc Stand Off Kit,HI6200,Front	3.3260.270.002	2

Columbia Palletizer Parts

HOIST ASSEMBLY
No. 3.0005.098.004



Columbia Palletizer Parts

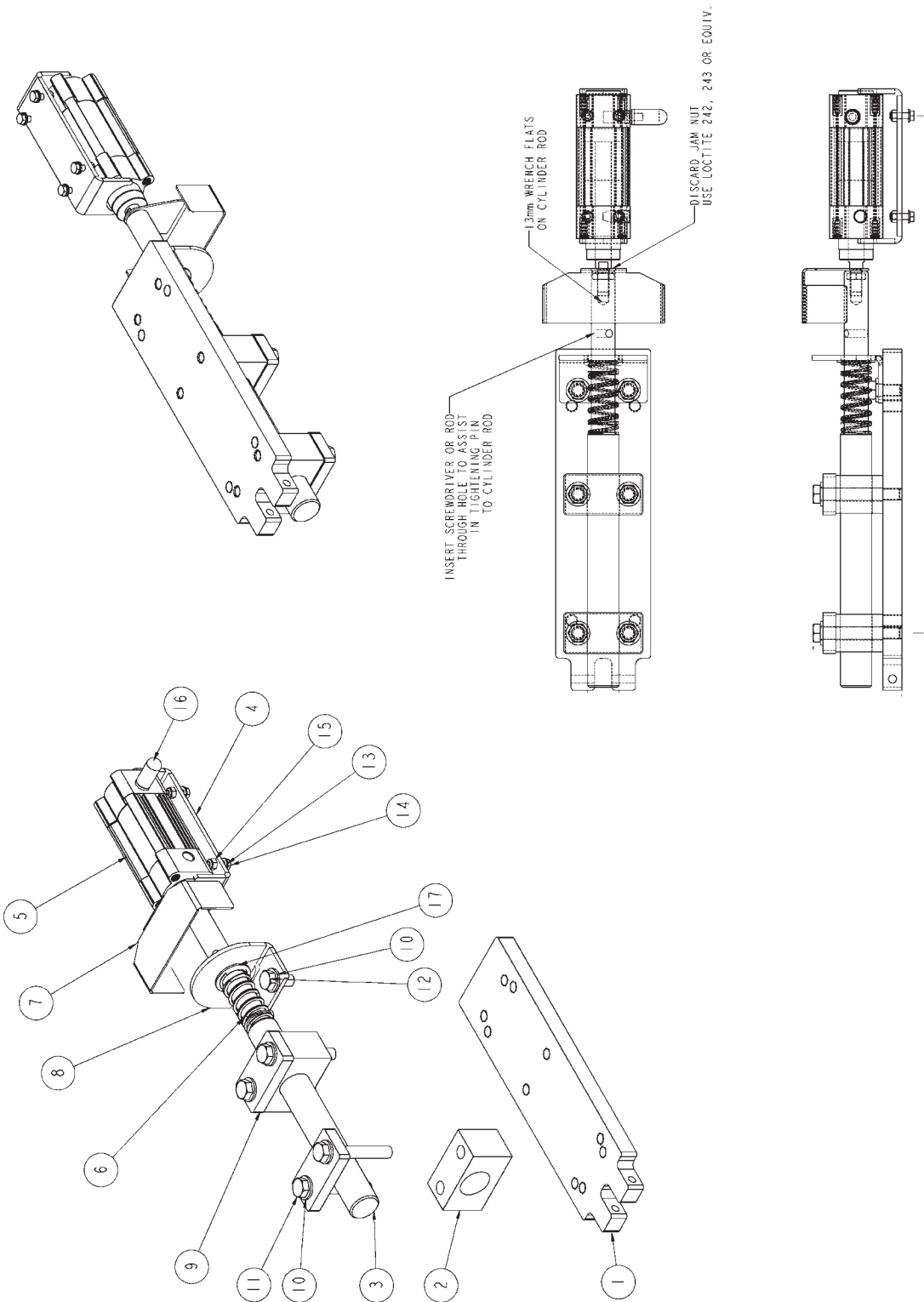
HOIST ASSEMBLY

No. 3.0005.098.003

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Hoist Wldmt, HI7200, 48	3.2860.185.004	1
2.	Center Support Wldmt, HI7200	3.2860.343	1
3.	Roller, 1.220.G48.C41.10.88	485792	19
4.	Hoist Lock Assy, HI7200, Sgl Pin	3.2860.949.001	4
5.	Washer, Plain, Metric	100239.12	16
6.	Washer, Lock, Metric	100240.12	16
7.	Cpscr, Hex Head, Metric, Gd 8.8	100019.12.45	16
8.	Plasti-Trak Bracket	3.2860.569.001	1
9.	Washer, Plain, Metric	100239.1	9
10.	Washer, Lock, Metric	100240.1	2
11.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.20	2
12.	Cover Plate	3.3092.040	4
13.	Cpscr, Button Hd, Metric	100005.06.12	8
14.	Hoist Guide, HI7200, Uhmw	3.2860.950.001	4
15.	Hoist Guide Clamp Plate	3.2860.951.001	4
16.	Nut, Poly Insert, Full, Class 10	100136.1	7

Columbia Palletizer Parts

HOIST LOCK ASSEMBLY
No. 3.2860.949.003



Columbia Palletizer Parts

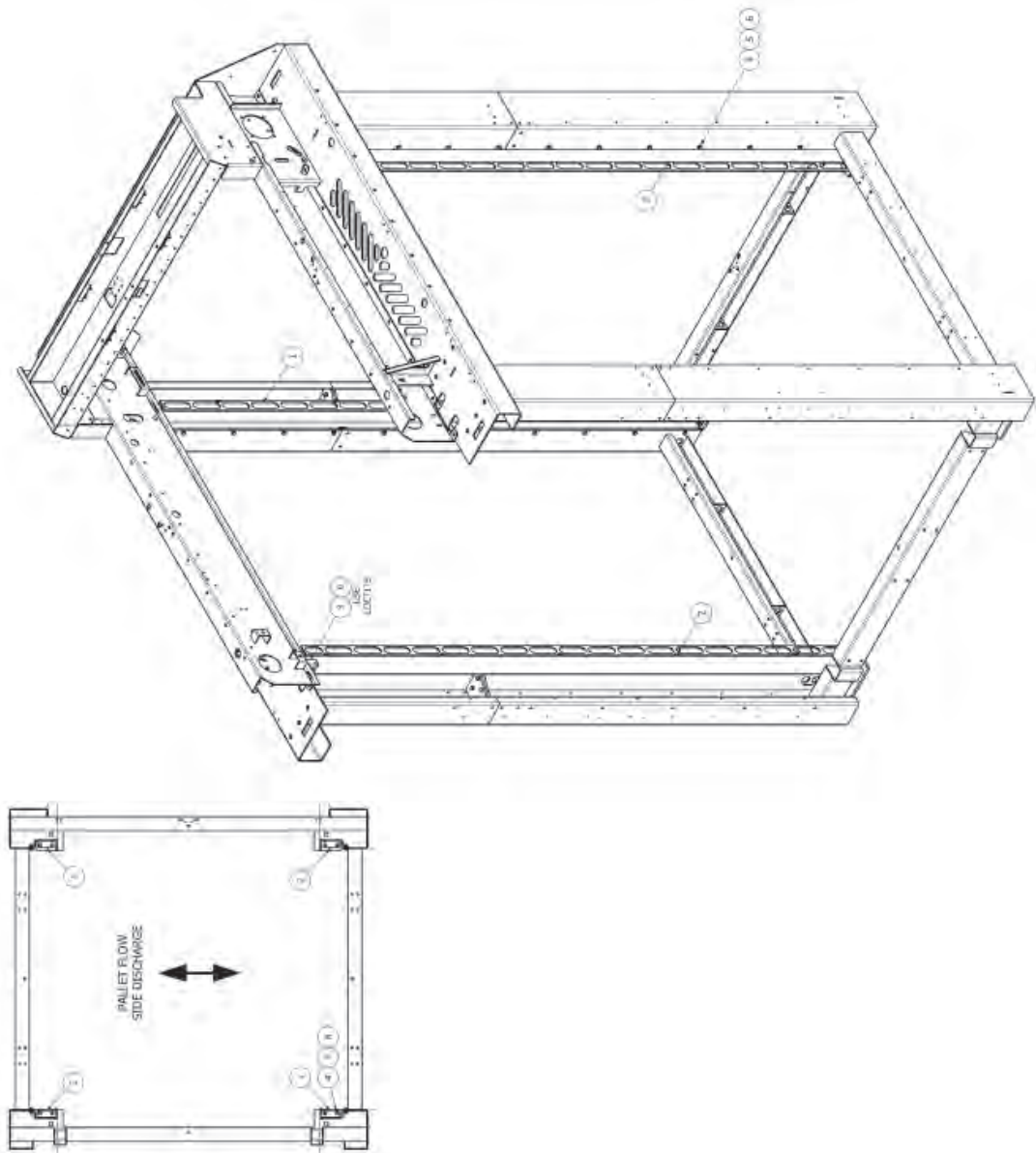
HOIST LOCK ASSEMBLY

No. 3.2860.949.003

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Hoist Lock Chain Attach	3.2860.952	1
2.	Pin Mount Block,Nylon	3.2800.549	2
3.	Hoist Pin,Fl6200 Auto,Metric	3.2800.091.003	1
4.	Cylinder Brkt,Hoist Pin,HI7200	3.2800.418.003	1
5.	Cyl,A,40.0,40,16,Na,F,Dsb	366.17.1938	1
6.	Spring, Compression	498043	2
7.	Pointer,Flag,Hoist,HI7200	3.2800.419.006	1
8.	Hoist Lock Spring Retainer	3.2860.953	1
9.	Hoist Pin Block Plate,Thru	3.2800.548.002	2
10.	Washer, Plain, Metric	100239.12	6
11.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.80	4
12.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.25	2
13.	Washer,Plain,Metric	100239.06	4
14.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.20	4
15.	Nut,Poly Insert,Full,Class 10	100136.06	4
16.	Muffler,Met,1/4Bspp,06740013	435039	1

Columbia Palletizer Parts

HOIST LOCKOUT ASSEMBLY
No. 3.3260.269.054



Columbia Palletizer Parts

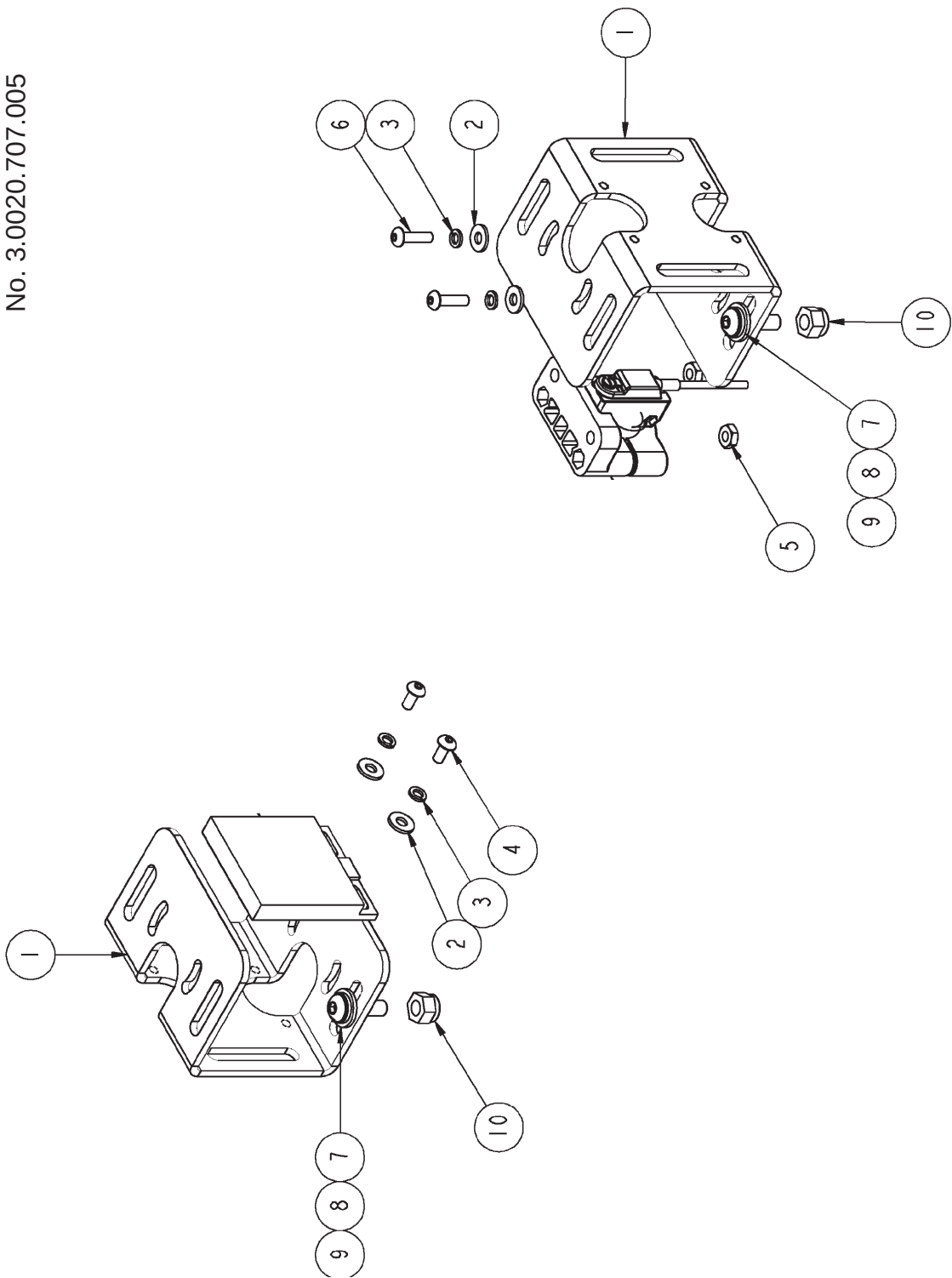
HOIST LOCKOUT ASSEMBLY

No. 3.2890.269.054

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Lockout Plate Wd 95 Side Rh	3.3260.260.005	2
2.	Lockout Plate Wd 95 Side Lh	3.3260.261.005	2
3.	Hoist Chain Attach, Fixed	3.2860.126.001	4
4.	Washer, Plain, Metric	100239.1	48
5.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.30	40
6.	Nut, Poly Insert, Full, Class 10	100136.1	40
7.	Washer, Lock, Metric	100240.1	8
8.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.20	8
9.	Cpscr, Flat Ct'Snk, Metric	100021.08.25	8

Columbia Palletizer Parts

LIGHT DUTY PHOTOCELL KIT
No. 3.0020.707.005

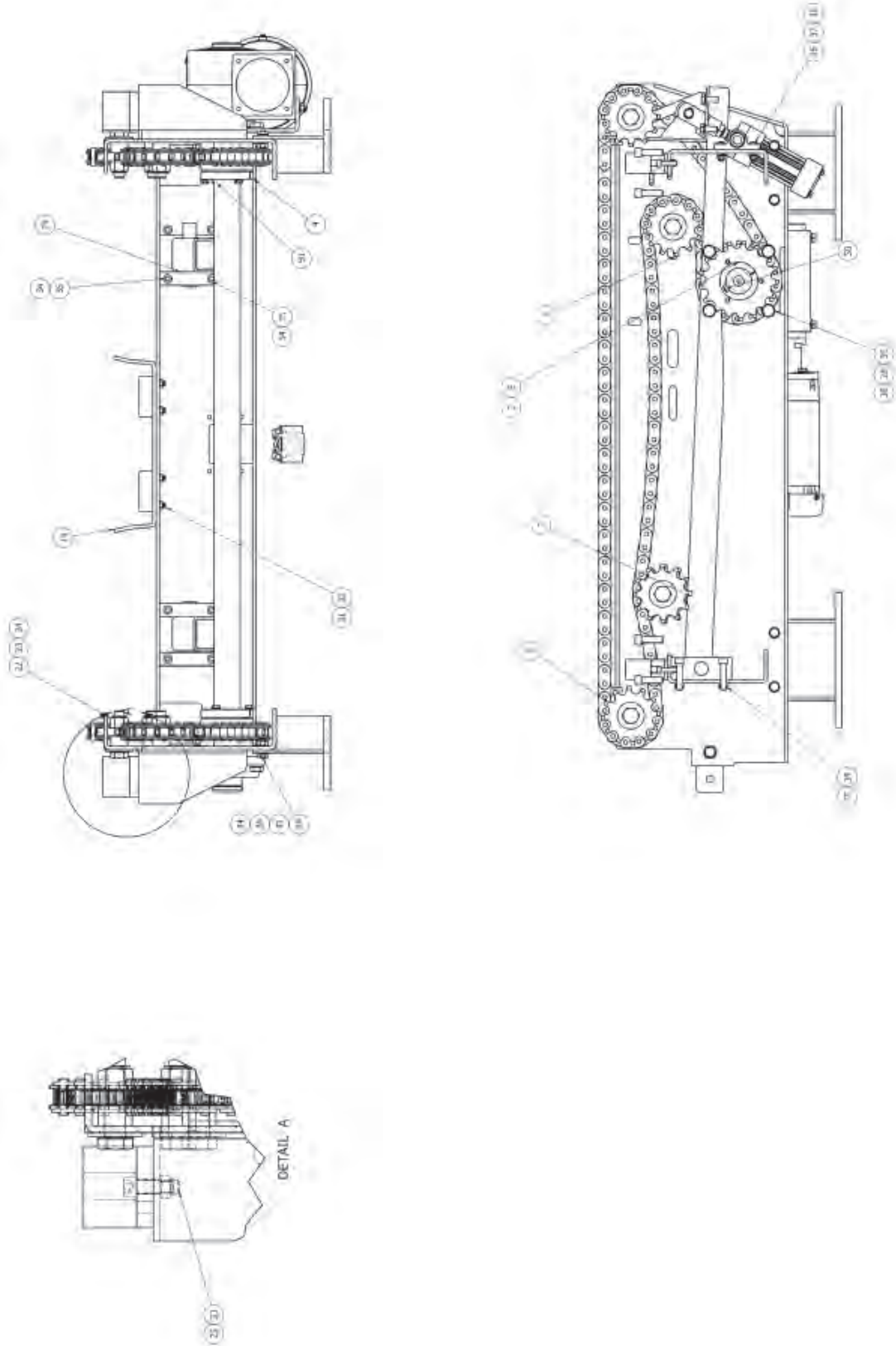


Columbia Palletizer Parts

LIGHT DUTY PHOTOCELL KIT No. 3.0020.707.005

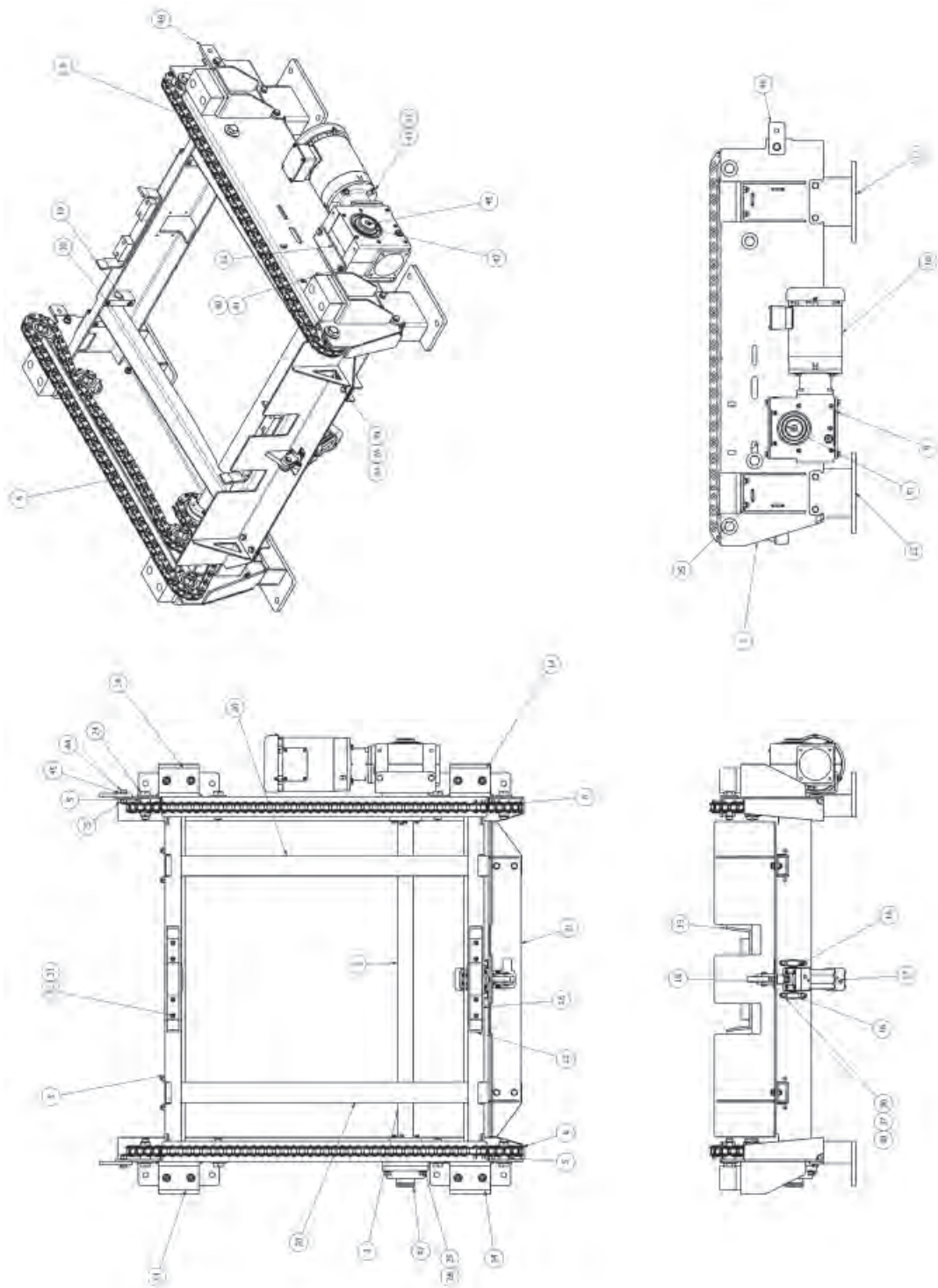
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Photocell Bracket Mt,Frmed,Nickel	3.0020.708.006	2
2.	Washer, Plain Steel Type A	100220.88	4
3.	Washer, Lock Helical Spring	100226.88	4
4.	Capscrew, Button Hd-32 Unc	100006.88.06	2
5.	Nut, Hex Mach Screw-32 Unc	100146.88	2
6.	Capscrew, Button Hd-32 Unc	100006.88.10	2
7.	Washer, Plain Steel Type A,Sae	100220.04.00	4
8.	Washer, Lock Helical Spring	100226.04	4
9.	Capscrew, Button Hd-20 Unc	100006.04.14	4
10.	Nut, Poly Ins Full Hgt-20 Unc	100160.04	4

FULL LOAD CONVEYOR ASSEMBLY
No. 3.0030.042.009



Columbia Palletizer Parts

FULL LOAD CONVEYOR ASSEMBLY
No. 3.0030.042.009



Columbia Palletizer Parts

FULL LOAD CONVEYOR ASSEMBLY

No. 3.0030.042.009

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Flc Conv Wldmt, 48	3.2860.938.001	1
2.	Brg,4 Bolt, Ucf210 31, 1-15/16	410066	1
3.	Drive Shaft,Flc,54.625"	3.2200.062.010	1
4.	Bushing, Qd-Sk, 1.938 Dia	425117	2
5.	Spacer,Rnd,12L14,.78,1.25,.75	901.078.125.075	8
6.	Sprocket, Qd, 80Sk17H	407304	2
7.	Spkt, Idler Hb80A12, 0.75 Bore	407693	8
8.	Chain,Std Sgl Str Roller #80	418007.125.00	2
9. @	Gbox,Cone,B081025.Waaq1	460968	1
10. @	Mtr,1,1800,56C460D60,T,B	365.3.78.21	1
11.	Gbox Mt,Cone B08,Thin	3.2531.191.003	1
12.	Leg Wldmt,Pall Conv,4 In	3.2860.374.001	4
13.	Cradle,Center Support	3.2818.094	2
14.	Pad, Bumper, 3X5X2.63	380.663.71	4
15.	Rubber Foot,3.0X1.5X1.0,80A	454187	4
16.	Pillow Block,Igubal,Kstm-16	414593	2
17.	Kit,Cyl Replacement,Festo	382.972.30	1
18.	Clevis,50/63Mm	438304	1
19.	Brg,Uhmw,1 In	3.1953.260	4
20.	Flc Stop Arm Wldmt	3.2860.942	2
21.	Flc Stop Blade Wldmt, Wwl	3.2860.944.001	1
22.	Nut, Poly Ins Full Hgt-10 Unc	100160.12	8
23.	Washer, Plain Steel Type A	100220.12	8
24.	Cpscr, Hex Head-Gd 5-10 Unc	100000.12.48	8
25.	Nut,Poly Insert,Full,Class 10	100136.12	10
26.	Washer, Plain, Metric	100239.1	20
27.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.30	8
28.	Washer,Lock,Metric	100240.14	8
29.	Cpscr,Hex Head,Metric,Gd 8.8	100019.14.40	4
30.	Cpscr,Hex Head,Metric,Gd 8.8	100019.14.30	4
31.	Nut,Poly Insert,Full,Class 10	100136.08	8
32.	Cpscr, Hex Soc. Head, Metric	100020.08.30	8
33.	Cpscr, Hex Soc. Head, Metric	100020.12.40	8
34.	Nut,Poly Insert,Full,Class 10	100136.1	20
35.	Cpscr, Hex Soc. Head, Metric	100020.10.50	8
36.	Cpscr, Hex Head-Gd 5-20 Unc	100000.04.20	4
37.	Nut, Poly Ins Full Hgt-20 Unc	100160.04	4
38.	Washer, Plain Steel Type A,Sae	100220.04.00	4

@See Vendor Data for more information.

Continued on the next page.

Columbia Palletizer Parts

FULL LOAD CONVEYOR ASSEMBLY

No. 3.0030.042.009

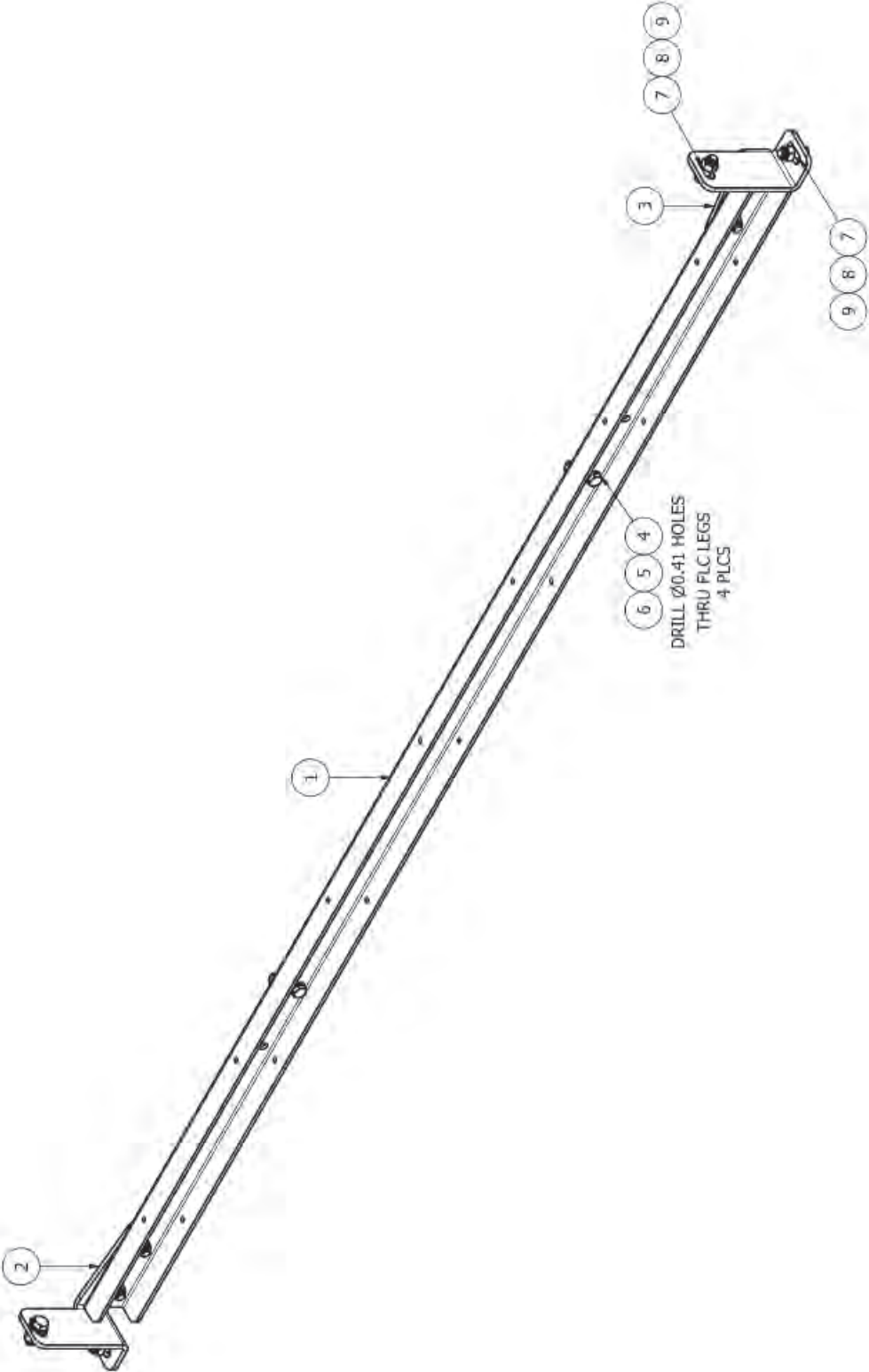
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
39.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	4
40.	Washer,Lock,Metric	100240.1	4
41.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.20	4
42.	Washer, Lock Helical Spring	100226.06	4
43.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.10	4
44.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.35	2
45.	Washer, Plain, Metric	100239.12	4
46.	Chain,Conn Link,#80C,Clip	418531	2
47.	Shaft End Cap, 2.25, M10	3.2860.946	2
48.	Cpscr, Flat Ct'Snk, Metric	100021.10.25	2
49.	Splice Plt,2 C-C, 0.38	3.2860.367.002	2
50.	Squares, C1018, 1/2	903636.02.00	2
51.	Flt Bar, C1018, 7/16X1/2	905978.04.75	1

Columbia Palletizer Parts

KIT CYLINDER REPLACEMENT No. 382.972.30

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Cyl,A,50,50,20,Na,F,Dsbc	366.17.1944	1
2.	Trunnion Flange,50,Festo	4383750	1
3.	Rod Clevis,M16X1,5,50/63Mm	4383040	1

FULL LOAD CONVEYOR STAND OFF KIT
No. 3.3260.270.002



Columbia Palletizer Parts

FULL LOAD CONVEYOR STAND OFF KIT No. 3.3260.270.002

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Flc Stand Off Channel,Formed	3.3260.271.002	1
2.	Flc Stand Off End,Rh,Formed	3.3260.272.001	1
3.	Flc Stand Off End,Lh,Formed	3.3260.273.001	1
4.	Washer, Plain, Metric	100239.1	4
5.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	4
6.	Nut,Poly Insert,Full,Class 10	100136.1	4
7.	Washer, Plain, Metric	100239.12	8
8.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.30	8
9.	Nut,Poly Insert,Full,Class 10	100136.12	8

SECTION 6

Side Layer Guide
3.3394.006

Page 1 Side Layer Guide Assembly List
Page 2-4 Side Layer Guide Assembly
Page 5 Idler Assembly
Page 6 Pulley
Page 7-8 Front Retainer Assembly

Columbia Palletizer Parts

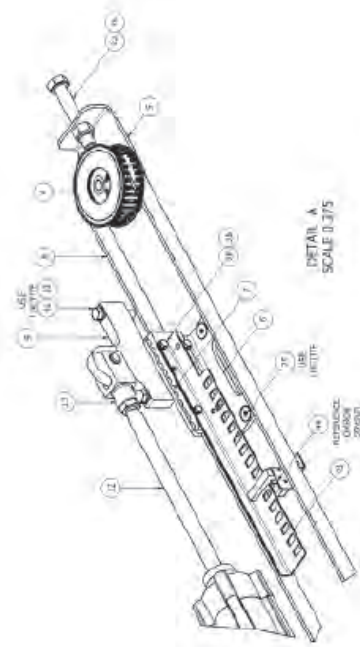
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Columbia Palletizer Parts

SIDE LAYER GUIDE ASSEMBLY LIST No. 3.3394.006

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Obs See: 3.0010.103.014	3.0010.103.009	1
2.	Front Ret Assy, HI4200	3.3260.130.001	1

SIDE LAYER GUIDE ASSEMBLY
No. 3.0010.103.009



Columbia Palletizer Parts

SIDE LAYER GUIDE ASSEMBLY

No. 3.0010.103.009

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Lin Brg,Hgw30Cc2R0860Z0C/E2	41001070	2
2.	Side Retainer Arm Wldmt, Rh	3.2860.262.003	1
3.	Side Retainer Arm Wldmt, Lh	3.2860.263.003	1
4.	Idler Assy,At10,32T,Met	3.2800.135.002	2
5.	Idler Adjuster	3.2860.271	2
6.	Side Retainer Belt Attachment	3.2860.267	2
7.	Clamping Plate,50X160 At10B	428306	2
8.	Blt,Timing,25At10,3470Mm	428560.347	1
9.	Side Ret Clevis Brkt, HI7200	3.2860.268	1
10.	Clevis Foot,63Mm,Festo	4383110	1
11.	Swivel Flange,63Mm,Festo	4383610	1
12.	Cyl,A,63.0,270,20,Na,F,Dsb	366.17.1940	1
13.	Rod Clevis,M16X1,5,50/63Mm	4383040	1
14.	Bumper,Threaded M6 X 1.0	454234	2
15.	Side Ret Support Bearing	3.2860.269	2
16.	Washer, Plain, Metric	100239.16	2
17.	Cpscr,Hex Head,Metric,Gd 8.8	100019.16.40	2
18.	Front Ret Support, HI7200	3.2860.272	4
19.	Hinge,Plastic,Reid Jcl-321	400164	3
20.	Side Retainer Cover Wldmt	3.2860.279	1
21.	Side Ret Bearing Cover	3.2860.282	1
22.	Cpscr,Hex Hd Full-Thrd,Metric	100025.16.100	2
23.	Cpscr, Flat Ct'Snk, Metric	100021.10.30	8
24.	Nut,Poly Insert,Full,Class 10	100136.1	12
25.	Cpscr, Flat Ct'Snk, Metric	100021.10.25	4
26.	Washer,Lock,Metric	100240.06	14
27.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.16	4
28.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.20	8
29.	Cpscr, Flat Ct'Snk, Metric	100021.06.25	12
30.	Nut,Poly Insert,Full,Class 10	100136.06	12
31.	Cpscr, Hex Soc. Head, Metric	100020.08.35	22
32.	Nut,Poly Insert,Full,Class 10	100136.08	22
33.	Washer,Lock,Metric	100240.1	18
34.	Washer, Plain, Metric	100239.1	20
35.	Cpscr, Hex Soc. Head, Metric	100020.10.30	16
36.	Nut,Poly Insert,Full,Class 10	100136.16	2
37.	Spacer,Rnd,12L14,.28,.63,.25	901.028.063.025	2
38.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.25	2
39.	Bolt Plate, M8 35 X 52	3.2860.283	1

@See Vendor data for more information.

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Columbia Palletizer Parts

SIDE LAYER GUIDE ASSEMBLY

No. 3.0010.103.009

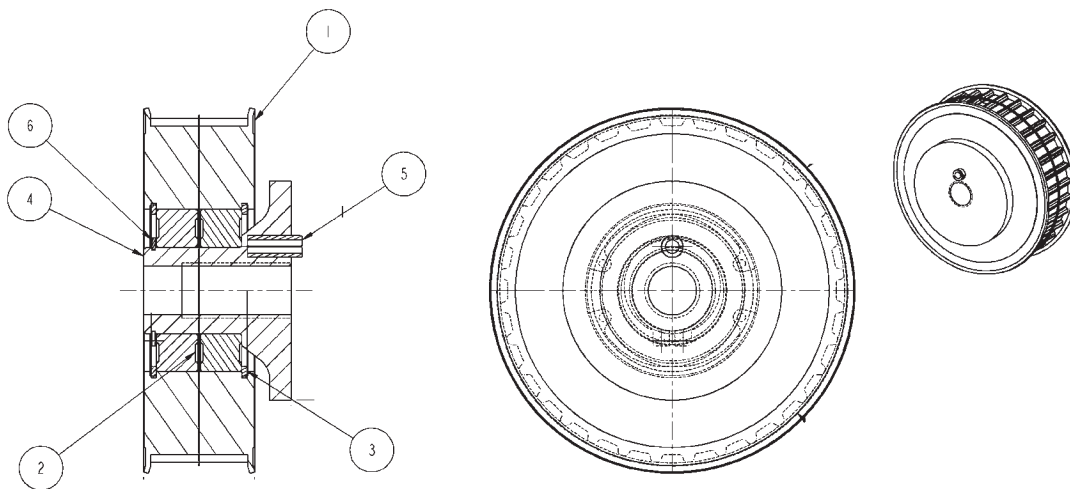
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
40.	Cpscr, Hex Soc. Head, Metric	100020.08.25	4
41.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.55	2
42.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	4
43.	Smart Squeeze Trigger	3.0020.571	1
44.	Mount,Omron,E3Z-G81	3.0020.570	1
45.	Shim, Side Ret, 22Ga	3.3090.103	12
46.	Guide Face Ext,Lower,Lh	3.2860.512.012	1
47.	Guide Face Ext,Lower,Rh	3.2860.513.012	1

Columbia Palletizer Parts

IDLER ASSEMBLY No. 3.2800.135.002

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	* Pulley	3.2800.134	1
2.	Ball Bearing, Extralight	410865	2
3.	Snap Ring-Internal	430045	2
4.	Idler Boss	3.2800.133.002	1
5.	Pin, Slotted Spring Type A	100256.250.10	1
6.	Snap Ring-External	430145	1

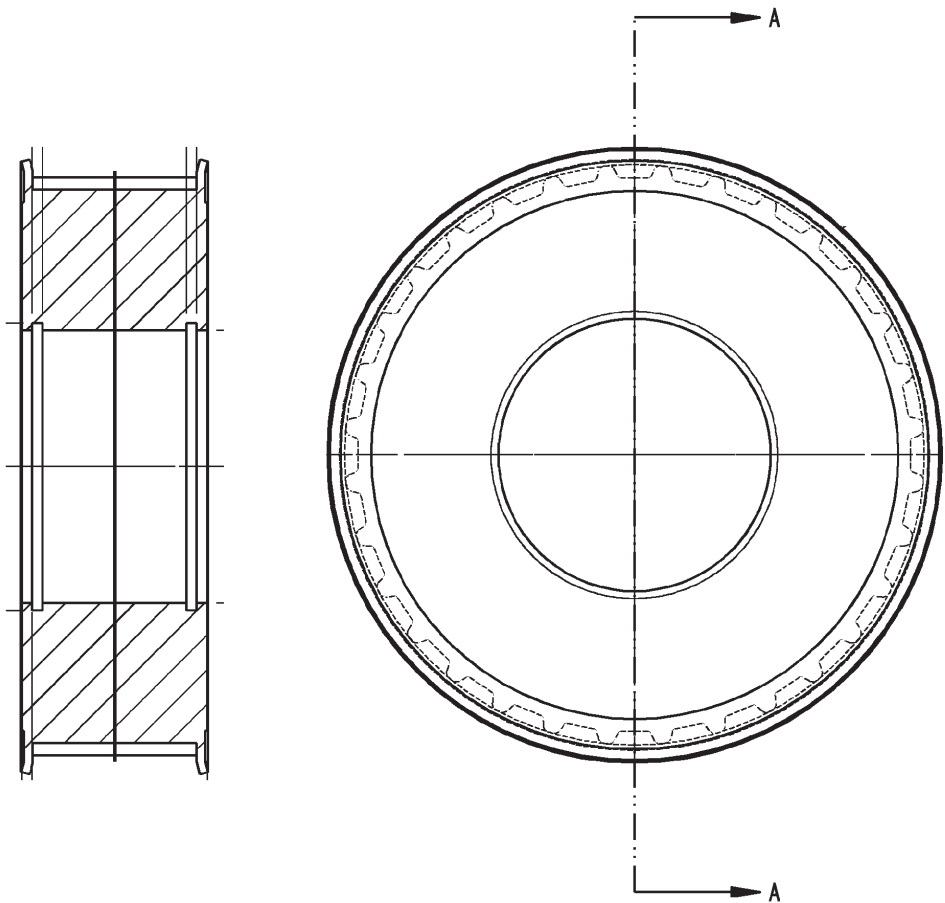
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Columbia Palletizer Parts

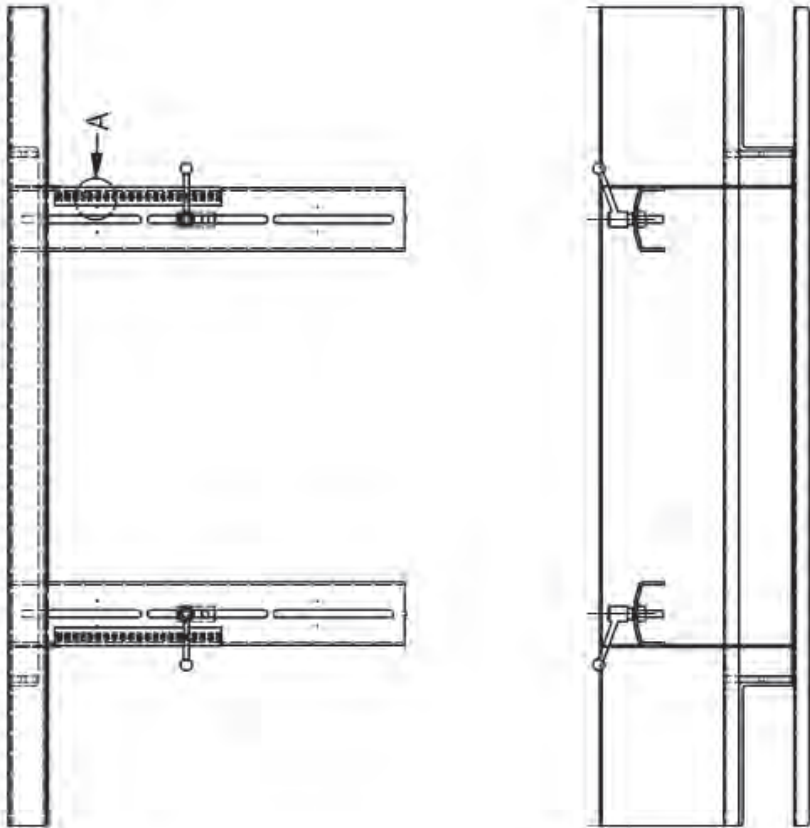
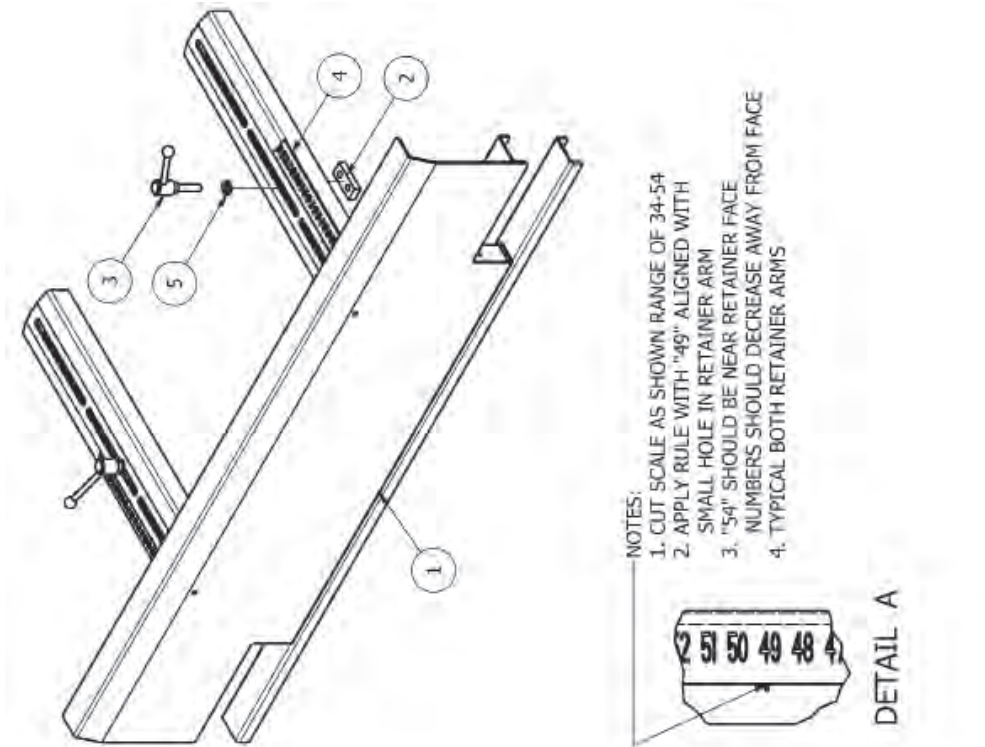
PULLEY
No. 3.2800.134

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pulley	427490	1



Columbia Palletizer Parts

FRONT RETAINER ASSEMBLY No. 3.3260.130.001



Columbia Palletizer Parts

FRONT RETAINER ASSEMBLY

No. 3.3260.130.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Front Ret Wldmt,HI4200	3.2860.273.003	1
2.	Clamp Plate, M12	3.2200.538.002	2
3.	Handle,Adj,Met,Khx-370	455020	2
4.	Ruler,Adh,1/2Scale,Center,80In	8708.4586	2
5.	Washer, Plain, Metric	100239.12	2

SECTION 7

Pallet Dispenser
3.3394.007

Page 1 Pallet Dispenser Assembly List
Page 2-3 702FW Pallet Dispenser
Page 4-5 702FW Hopper Assembly
Page 6-7 Pallet Conveyor Assembly
Page 8 Sprocket
Page 9-10 Idler Sprockets
Page 11 Chain Assembly w/ Trip
Page 12 Chain Assembly w/o Trip
Page 13-14 Pallet Stack Retainer Kit
Page 15 Pallet Guide Kit, PD
Page 16-17 Pallet Backstop Kit

Columbia Palletizer Parts

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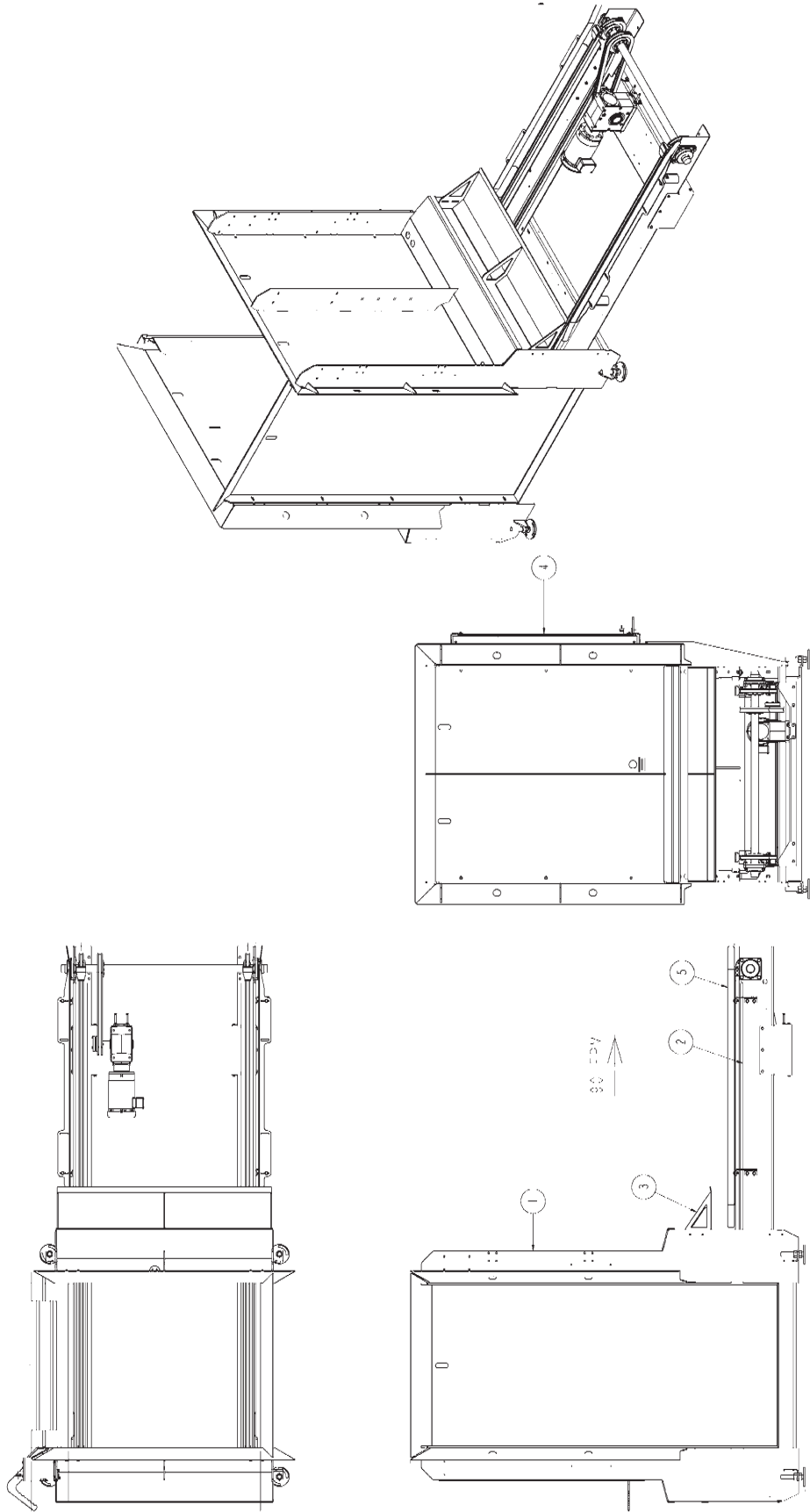
Columbia Palletizer Parts

PALLET DISPENSER ASSEMBLY LIST No. 3.3394.007

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	702Fw Pd Assy,40X48 Wwl,HI4200	3.0007.161.114	1
2.	Heavy Duty Photocell Kit,6	3.0020.623.001	1
3.	Pallet Backstop Kit	3.3367.109	1
940.	P/K Pd,Blue Marble,5028930	328.27.7434.40	1

Columbia Palletizer Parts

702FW PALLET DISPENSER
No. 3.0007.161.114



Columbia Palletizer Parts

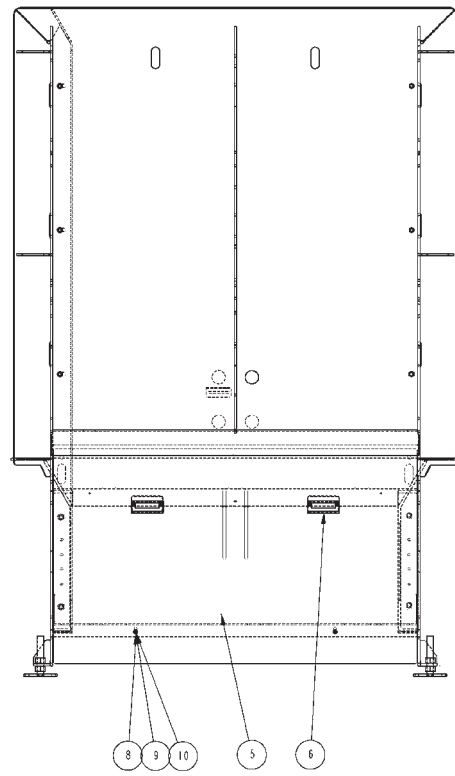
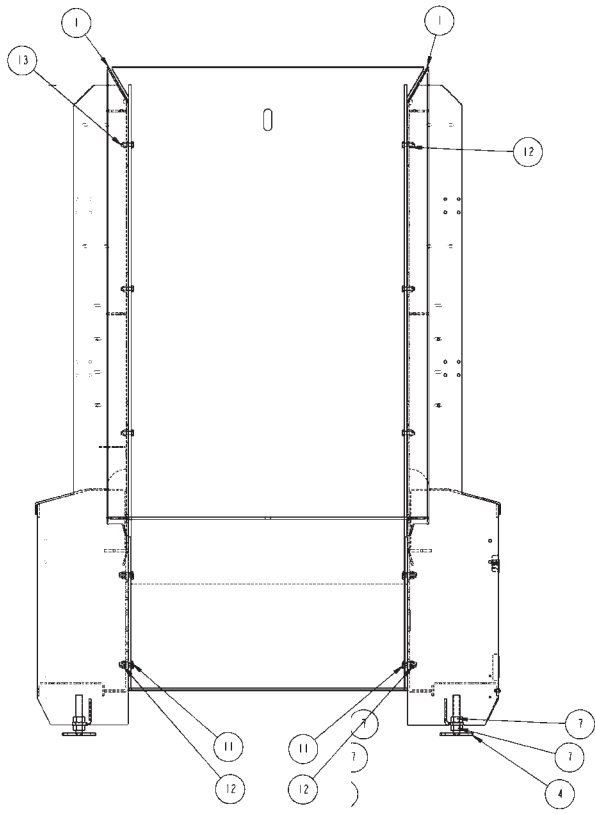
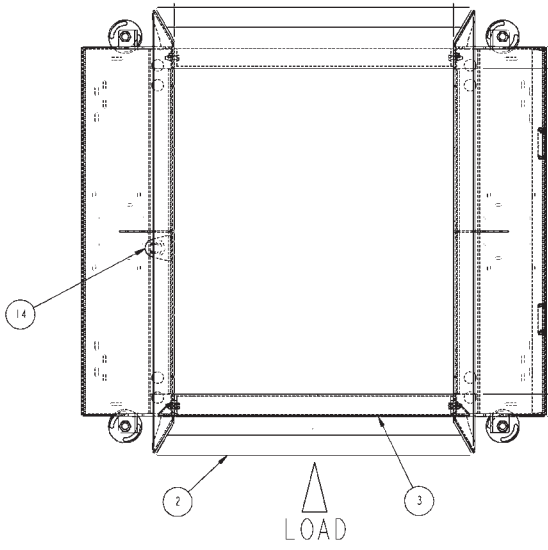
702FW PALLET DISPENSER

No. 3.0007.161.114

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	702Fw 40X48, Wide Way Lead	3.2280.644.010	1
2.	Pall Conv Assy, 48 Wwl, 90Fpm	3.0030.007.276	1
3.	Pallet Guide Wldmt	3.2280.804.004	1
4.	Pallet Stack Retainer Kit, Pin	3.2280.1080.011	1
5.	Pallet Guide Kit, Pd	3.2735.038.008	1

Columbia Palletizer Parts

702FW HOPPER ASSEMBLY No. 3.2280.644.010



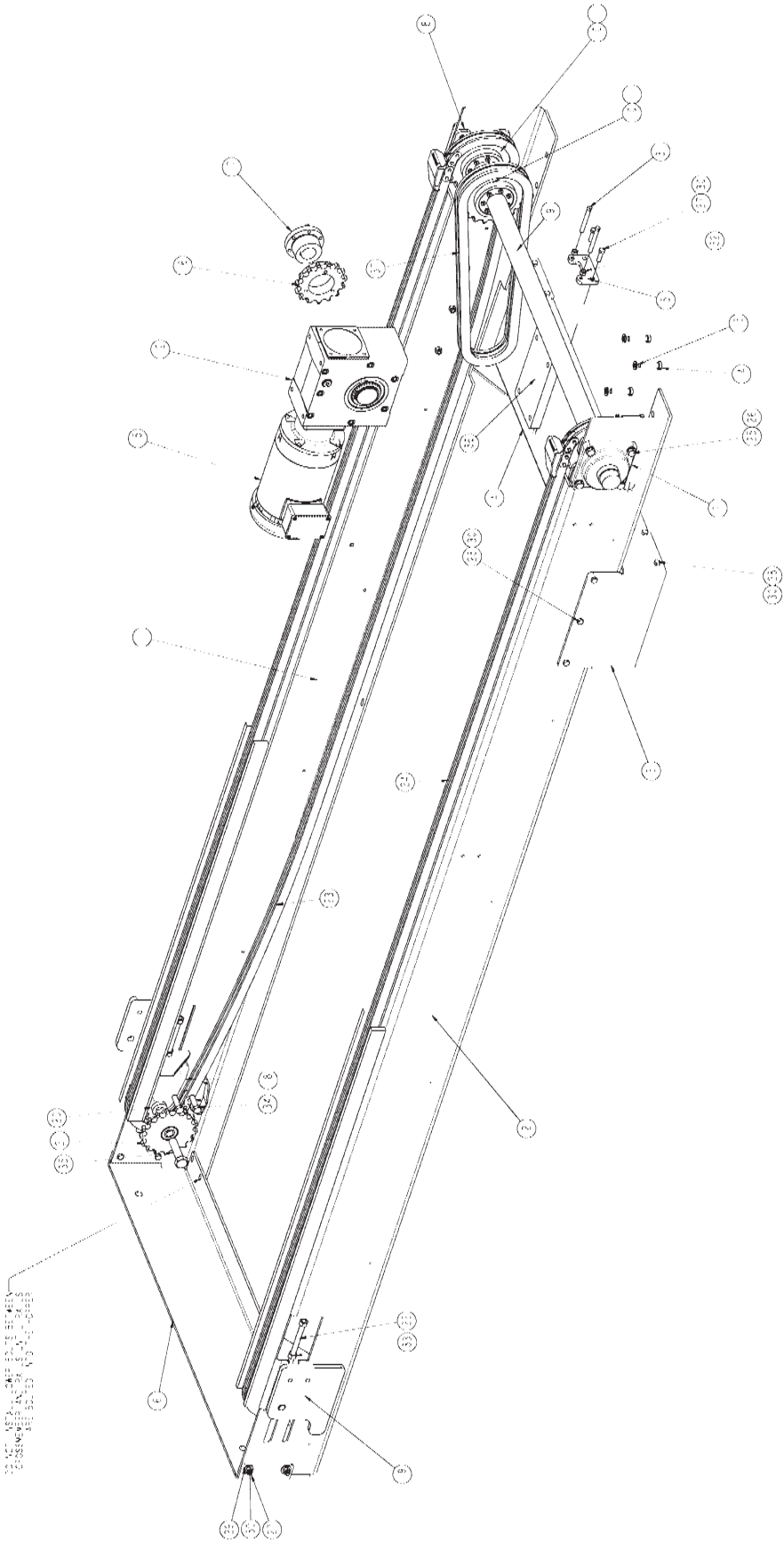
Columbia Palletizer Parts

702FW HOPPER ASSEMBLY

No. 3.2280.644.010

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Hopper Wall Wldmt,48In	3.2280.721.005	2
2.	Side Spreader Wldmt,42In	3.2280.786.004	1
3.	Back Wall Wldmt	3.2280.800.006	1
4.	Anchor Bolt Wldmt	3.1706.046	4
5.	End Guard,Formed,48In	3.2280.731	1
6.	Handle,P1-30-101-11	401497	2
7.	Nut, Hexagon Full, Gd 5-08 Unc	100140.16	8
8.	Washer, Plain Steel Type A,Sae	100220.04.00	2
9.	Cpscr, Button Hd-20 Unc	100006.04.12	2
10.	Nut, Poly Ins Full Hgt-20 Unc	100160.04	2
11.	Cpscr, Hex Head-Gd 5-13 Unc	100000.08.28	8
12.	Nut, Poly Ins Full Hgt-13 Unc	100160.08	14
13.	Cpscr, Hex Head-Gd 5-13 Unc	100000.08.24	6
14.	18Mm Pc Brkt, Banner Smb18Sf	3.0020.690.001	1

PALLET CONVEYOR ASSEMBLY
No. 3.0030.007.276



Columbia Palletizer Parts

PALLET CONVEYOR ASSEMBLY

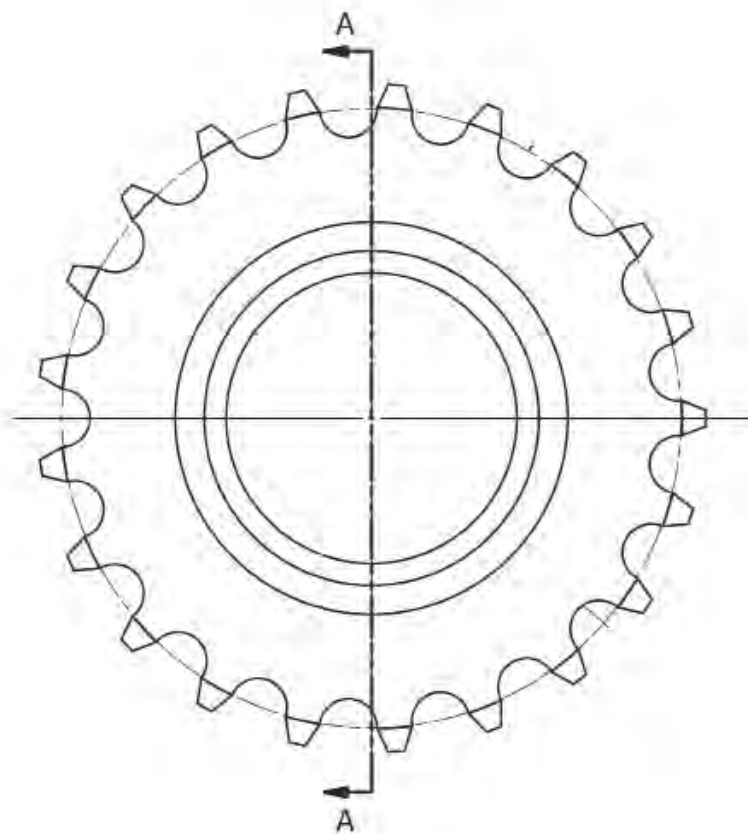
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<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Chain Rail Wldmt,Pall Conv,Rh	3.2200.646.028	1
2.	Chain Rail Wldmt,Pall Conv,Lh	3.2200.647.028	1
3.	Crossmember Mount,Formed	3.2280.839	2
4.	Gbox Mount,48In,B09	3.2280.928	1
5.	Jacking Bolt Plate	3.2280.574	1
6.	Rear Spreader,Formed 48	3.2280.838.001	1
7.	Brg, 4 Bolt, Std Duty,1-15/16	410066	2
8.	Bolting Plate,Ucf210-31 Brg	3.2200.048	2
9.	Rnd Bar, 1045 Tg&P, 1-15/16Dia	903387.52.50	1
10.	Sprocket,80B21H,80Mm Bore	3.0033.10	3
11.	Locking Assy,B106-In,1.938	429851	3
12.	Gbox,Cone,B091025.Wanrb	4609790	1
13.	Washer, Plain, Metric	100239.12	4
14.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.50	4
15.	Mtr,1.5,1800,56C,460D60,T,B	365.3.78.30	1
16.	Sprocket, Qd, 80Sk15H	407302	1
17.	Bushing, Qd-Sk, 1.500 Dia	425110	1
18.	Idler Sprocket Mount	3.2280.848.001	2
19.	Idler Bolt Plt	3.2280.849.001	2
20.	Spacer Rnd,12L14,.78,1.5,.44	901.078.150.044	2
21.	Sprocket, Idler, 80Bb17H	367.5.816	2
22.	Adj Bolt	3.1196.046	2
23.	Chain Assy,W/Trip,2 Lug	3.2280.706.053	1
24.	Chain Assy,W/O Trip,2 Lug	3.2280.707.053	1
25.	Washer, Lock Helical Spring	100226.08	8
26.	Cpscr, Hex Head-Gd 5-13 Unc	100000.08.24	8
27.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.20	6
28.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.16	14
29.	Washer, Plain Steel Type A,Sae	100220.06	4
30.	Nut, Poly Ins Full Hgt-16 Unc	100160.06	20
31.	Screw, Sq Hd Cup Pt-16 Unc	100200.06.48	2
32.	Nut, Hexagon Full, Gd 5-16 Unc	100140.06	2
33.	Nut, Hexagon Full, Gd 5-13 Unc	100140.08	2
34.	Cpscr, Hex Head-Gd 5-13 Unc	100000.08.28	4
35.	Cpscr, Hex Head-Gd 5-10 Unc	100000.12.48	2
36.	Gbox Spacer,1 In,B09	3.2544.061	1
37.	Chain,Std Sgl Str Roller #80	418007.57.00	1

Columbia Palletizer Parts

SPROCKET
No. 3.0033.10

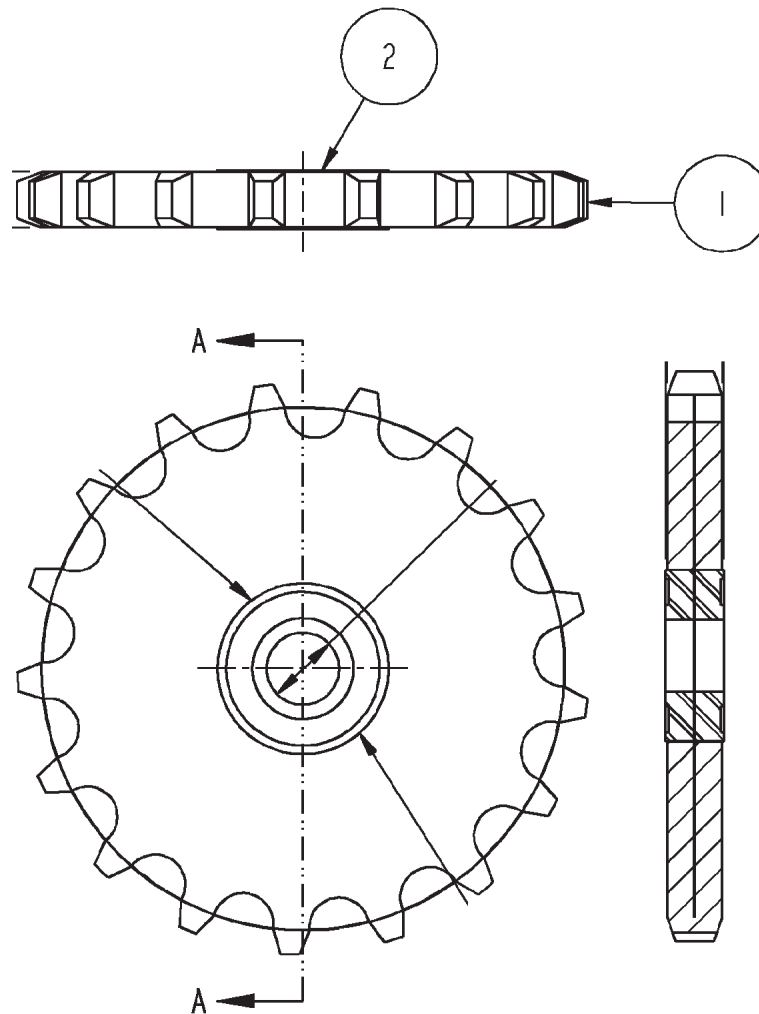
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sprocket	417764	1



Columbia Palletizer Parts

IDLER SPROCKET No. 367.5.816

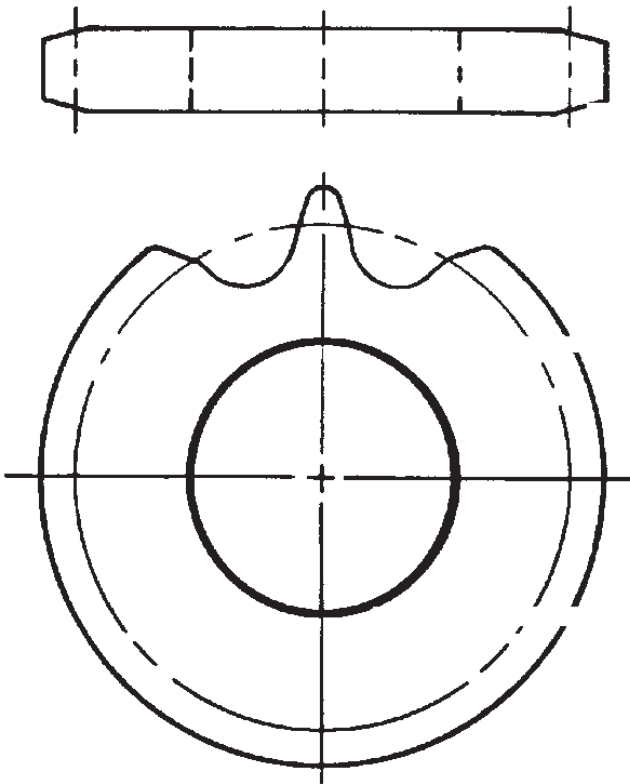
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sprocket	367.5.815	1
2.	Ball Bearing, Light	410970	1



Columbia Palletizer Parts

IDLER SPROCKET
No. 367.5.815

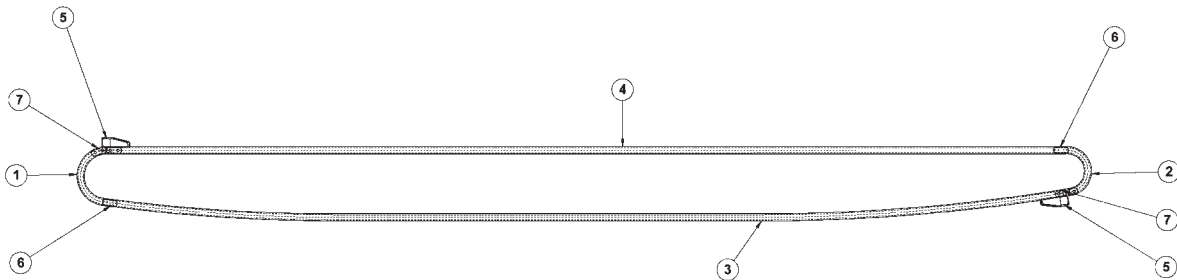
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sprocket, 80A17H, Stock Cut	407833	1



Columbia Palletizer Parts

CHAIN ASSEMBLY
(w/ Trip, 2 Lug)
No. 3.2280.706.053

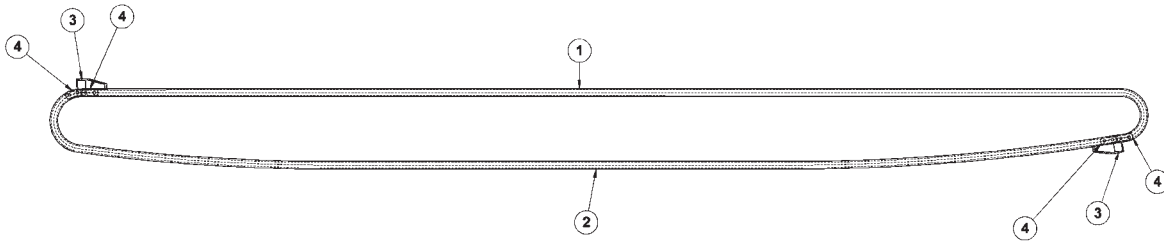
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Chain,Std Sgl Str Roller #80	418007.11.00	1
2.	Chain,Std Sgl Str Roller #80	418007.11.00	1
3.	Chain,Std Sgl Str Roller #80	418007.121.00	1
4.	Chain,Std Sgl Str Roller #80	418007.121.00	1
5.	Pusher Lug Wldmt	3.2200.078	2
6.	Prox. Trip Link	3.1196.073	2
7.	Chain, Conn Link, #80, Cotr	418281	4



Columbia Palletizer Parts

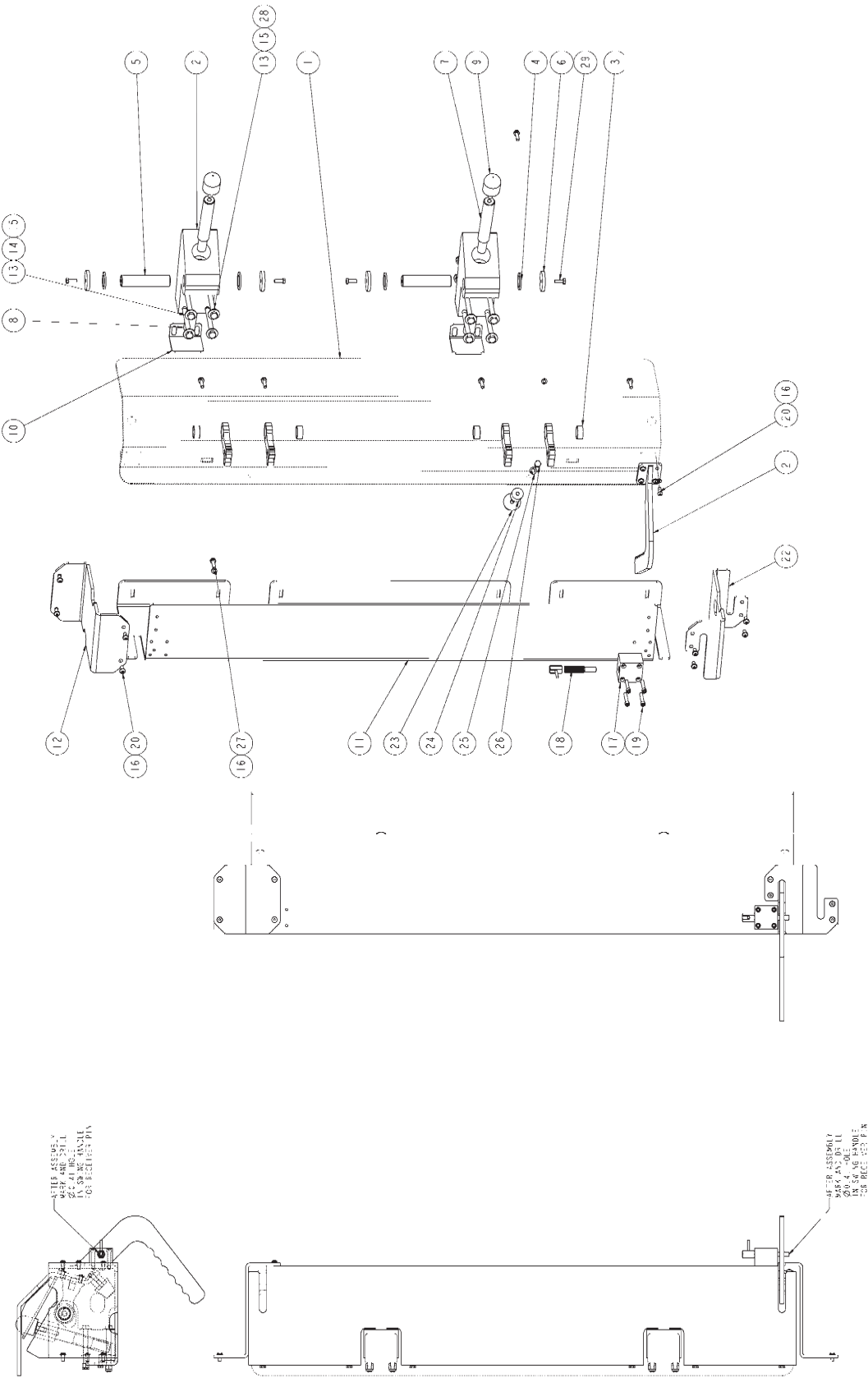
CHAIN ASSEMBLY
(w/o Trip, 2 Lug)
No. 3.2280.707.53

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Chain,Std Sgl Str Roller #80	418007.133.00	1
2.	Chain,Std Sgl Str Roller #80	418007.133.00	1
3.	Pusher Lug Wldmt	3.2200.078	2
4.	Chain, Conn Link, #80, Cotr	418281	4



Columbia Palletizer Parts

PALLET STACK RETAINER KIT
No. 3.2280.1080.011



Columbia Palletizer Parts

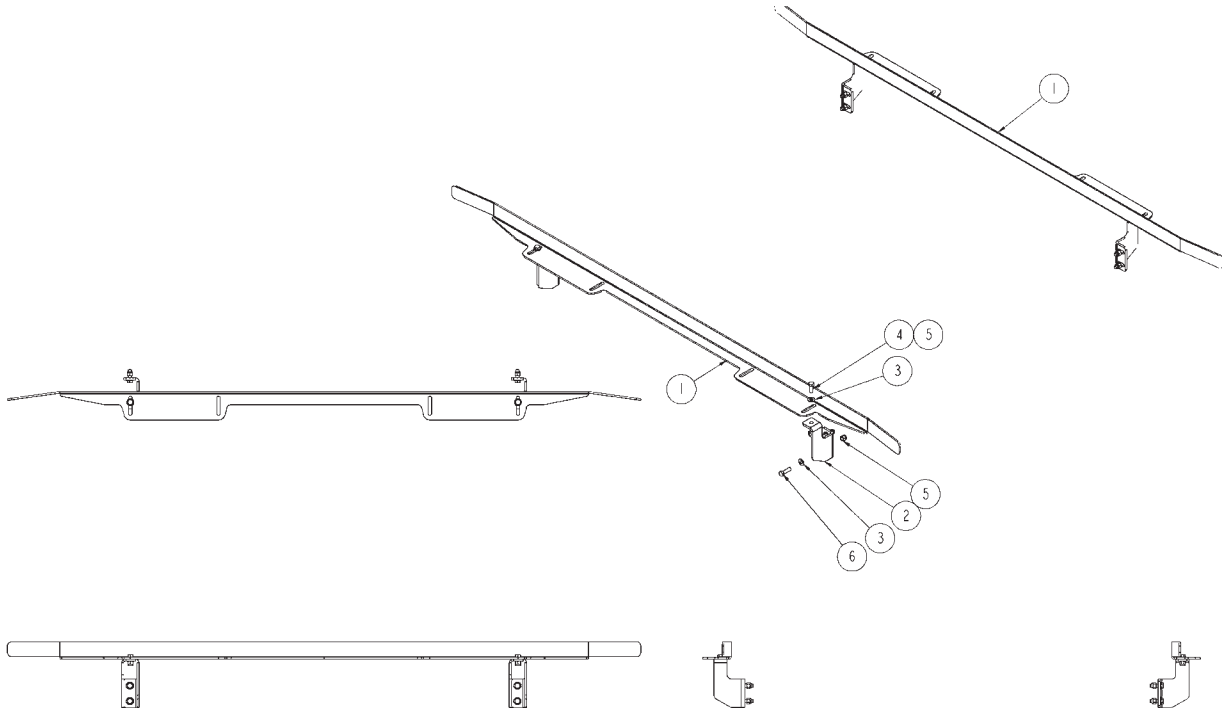
PALLET STACK RETAINER KIT No. 3.2280.1080.011

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pall Stack Retainer Wldmnt	3.2280.1060.001	1
2.	Uhmw Mnt Block,Pall Retainer	3.2280.1066	2
3.	Brg,Plastic,1.0X1.13X0.5Lg	414933	4
4.	Brg,Bn Thrust,1.00X1.50X0.13	411600	4
5.	Pallet Stack Retainer Shaft	3.2280.1067	2
6.	Cap	3.2280.1068	4
7.	Spring Return Shaft	3.2280.1069	2
8.	Spring,Comp, .105 Wire 9657K442	498065	2
9.	Ball Transfer 6460K61	414849	2
10.	Compression Spring Backing Plt	3.2280.1072	2
11.	Pallet Stack Retainer Guard	3.2280.1071.009	1
12.	Guard Mnt Plt	3.2280.1073.004	1
13.	Washer, Plain Steel Type A,Sae	100220.06	8
14.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.56	4
15.	Nut, Poly Ins Full Hgt-16 Unc	100160.06	8
16.	Washer, Lock Helical Spring	100226.04	18
17.	Pin Block,Uhmw,Pal Ret	3.2280.1152	1
18.	Spring Plunger Fr-625	401491	1
19.	Cpscr, Socket Hd-20 Unc	100008.04.24	4
20.	Cpscr, Button Hd-20 Unc	100006.04.10	12
21.	Pallet Retainer Handle Wldmnt	3.2280.1084.001	1
22.	Guard Mnt Plt	3.2280.1073.003	1
23.	Rubber, Bumper-Conical	454012	1
24.	Tapped Spacer	3.2857.080.001	1
25.	Washer, Lock Helical Spring	100226.05	1
26.	Cpscr, Hex Head-Gd 8-24 Unf	100003.05.12	1
27.	Cpscr, Hex Head-Gd 5-20 Unc	100000.04.16	6
28.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.60	4
29.	Cpscr, Hex Head-Gd 5-20 Unc	100000.04.12	4

Columbia Palletizer Parts

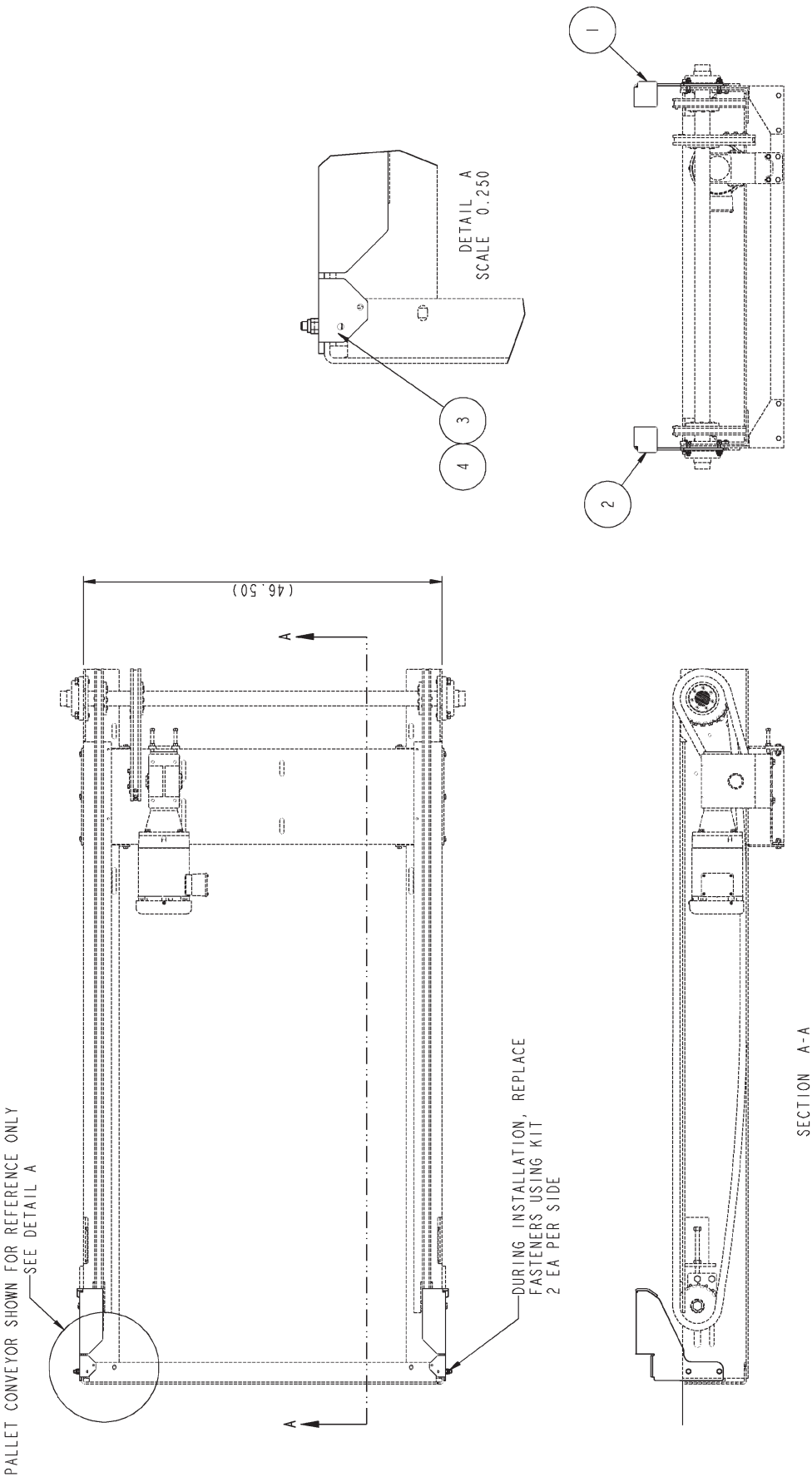
PALLET GUIDE KIT, PD No. 3.2735.038.008

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pallet Guide, Formed	3.2735.039.011	2
2.	Pallet Guide Support Brkt	3.1844.086.002	4
3.	Washer, Plain Steel Type A, Sae	100220.06.00	12
4.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.16	4
5.	Nut, Poly Ins Full Hgt-16 Unc	100160.06	12
6.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.20	8



Columbia Palletizer Parts

PALLET BACKSTOP KIT
No. 3.3367.109



Columbia Palletizer Parts

PALLET BACKSTOP KIT

No. 3.3367.109

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pallet Stop, Right	3.3367.103	1
2.	Pallet Stop, Left	3.3367.104	1
3.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.24	4
4.	Nut, Poly Ins Full Hgt-16 Unc	100160.06	4

Columbia Palletizer Parts

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SECTION 8

Discharge Conveyor
No. 3.3394.008

Page 1 Discharge Conveyor Assembly List
Page 2 Heavy Duty Photocell Kit

Columbia Palletizer Parts

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Columbia Palletizer Parts

DISCHARGE CONVEYOR ASSEMBLY LIST No. 3.3394.008

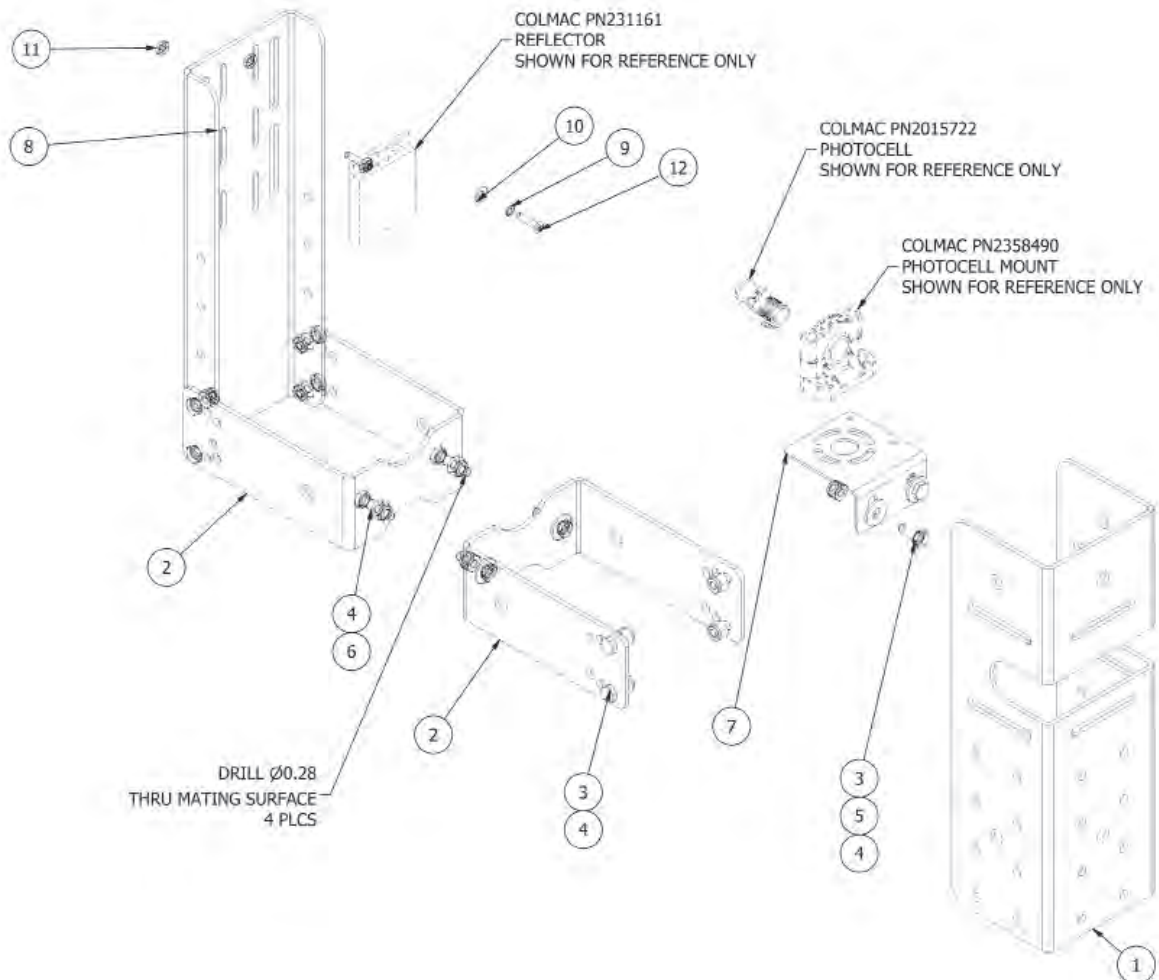
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Cdlr,7'-1.5",52.25"Ew,4.5"Rc	3.0008.105.124	1
2.	Cdlr,7'-10.5",52.25"Ew,4.5"Rc	3.0008.105.125	1
3.	Heavy Duty Photocell Kit,6	3.0020.623.001	2

Columbia Palletizer Parts

HEAVY DUTY PHOTOCELL KIT

No. 3.0020.623.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Photocell Can	3.0020.614	1
2.	Photocell Can Mt.	3.0020.615	2
3.	Reflector Bracket	3.0020.617	1
4.	Capscrew, Hex Head	100000.04.10	10
5.	Nut, Poly Ins. Full Hgt	100160.04	14
6.	Washer, Plain Steel	100220.04	6
7.	Capscrew, Button Head, PI	100006.88.12P	2
8.	Washer, Plain Steel	100220.88	2
9.	Washer, Lock Helical Spring	100226.88	2
10.	Nut, Hex Machine Screw	100146.88	2
11.	Capscrew, Hex Head	100000.04.16	4
12.	PC, Reflector Brkt	3.1186.949.001	1



SECTION 9

Curve Belt
No. 3.3394.012

Page 1 Curve Belt Assembly List
Page 2-4 Meter Belt Assembly
Page 5 MGM Brake Motor
Page 6-7 Value Guide Scale Mount Kit, Large
Page 8-9 Mt Shelf Kit, Infeed Conveyor

Columbia Palletizer Parts

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Columbia Palletizer Parts

CURVE BELT ASSEMBLY LIST No. 3.3394.012

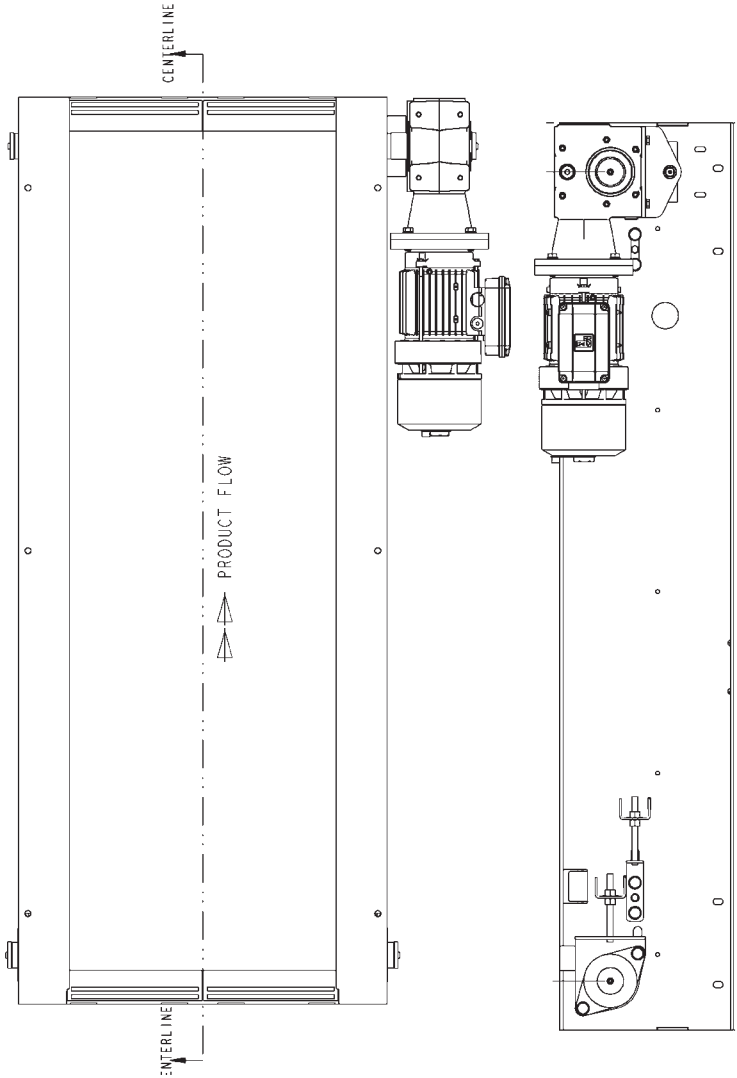
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pcr Blt,21Bfx60,115 Fpm,Metric	3.0002.368.007	1
2.	Valu Guide Kit, 8"	3.2835.042.005	2
3.	Curve Belt,51lr,210,Rh,Cw,Flr	3.0018.008.139	1
4.	Mt Shelf Kit,lnfd Conv,Pcr/Mtr	3.3260.345.001	1

METER BELT ASSEMBLY
No. 3.0002.368.007

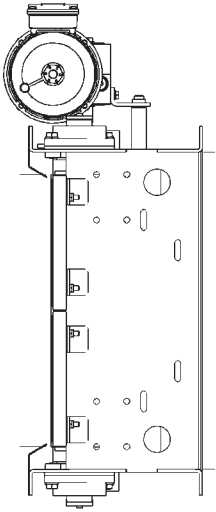
PROPER BELT TENSION ON METER BELTS IS ESSENTIAL FOR POSITIVE STARTS/STOPS AND BELT TRACKING. UNDER TENSIONING CAN RESULT IN BELT SLIPPING DURING HIGH LINE PRESSURE, OVER TENSIONING CAN CAUSE BELT AND OR BEARING FAILURE.

TO TENSION AND TRACK BELTS:

- 1) BE SURE FRAME IS SQUARE. ASSEMBLE SHAFTS SO THAT THEY ARE PARALLEL TO EACH OTHER AND SQUARE TO THE FRAME. MEASURE FROM END OF FRAME TO CENTER OF EACH SHAFT BOTH SIDES TO ENSURE THEY ARE PARALLEL. MEASURE TO THE EDGE OF EACH PULLEY TO MAKE SURE THEY ARE IN LINE.
- 2) INSTALL THE SNUBBER ROLLS SO THAT THEY ARE PARALLEL TO THE DRIVE AND IDLER ROLLER. INITIAL INSTALLATION SHOULD BE AT THE CENTER OF THE TAKE UP SLOT.
- 3) WITH CONVEYOR TURNED OFF, TENSION BELT UNTIL THE BELT JUST CONFORMS TO PULLEY CROWNS. THERE SHOULD BE NO PLAY BETWEEN THE BELT AND THE PULLEY. THE PULLEY BE SURE TO TAKE UP EQUAL AMOUNTS ON EACH SIDE SO SHAFTS REMAIN PARALLEL.
- 4) NOW OPERATE THE BELT CONVEYOR AND OBSERVE CLOSELY TO SEE IF THERE IS ANY SLIPPAGE AT THE DRIVE PULLEY AND THE BELT. IF THERE IS, MORE TENSION IS NEEDED. DO NOT OVER TENSION.
- 5) TRACK BELT WITH SNUBBER ROLLERS ONLY. "THE BELT MOVES TOWARD THE END OF THE ROLL IT CONTACTS FIRST." WITH THE BELT EMPTY AND RUNNING, ADJUST THE SNUBBER CLOSEST TO THE DRIVER PULLEY. LET THE BELT RUN FOR SEVERAL REVOLUTIONS AFTER EACH ADJUSTMENT. TRY TO SPREAD THE ADJUSTMENT EVENLY BETWEEN THE TWO SNUBBER ROLLERS.
- 6) VERIFY TRACKING WITH FULL LOAD AND ADJUST IF NEEDED.



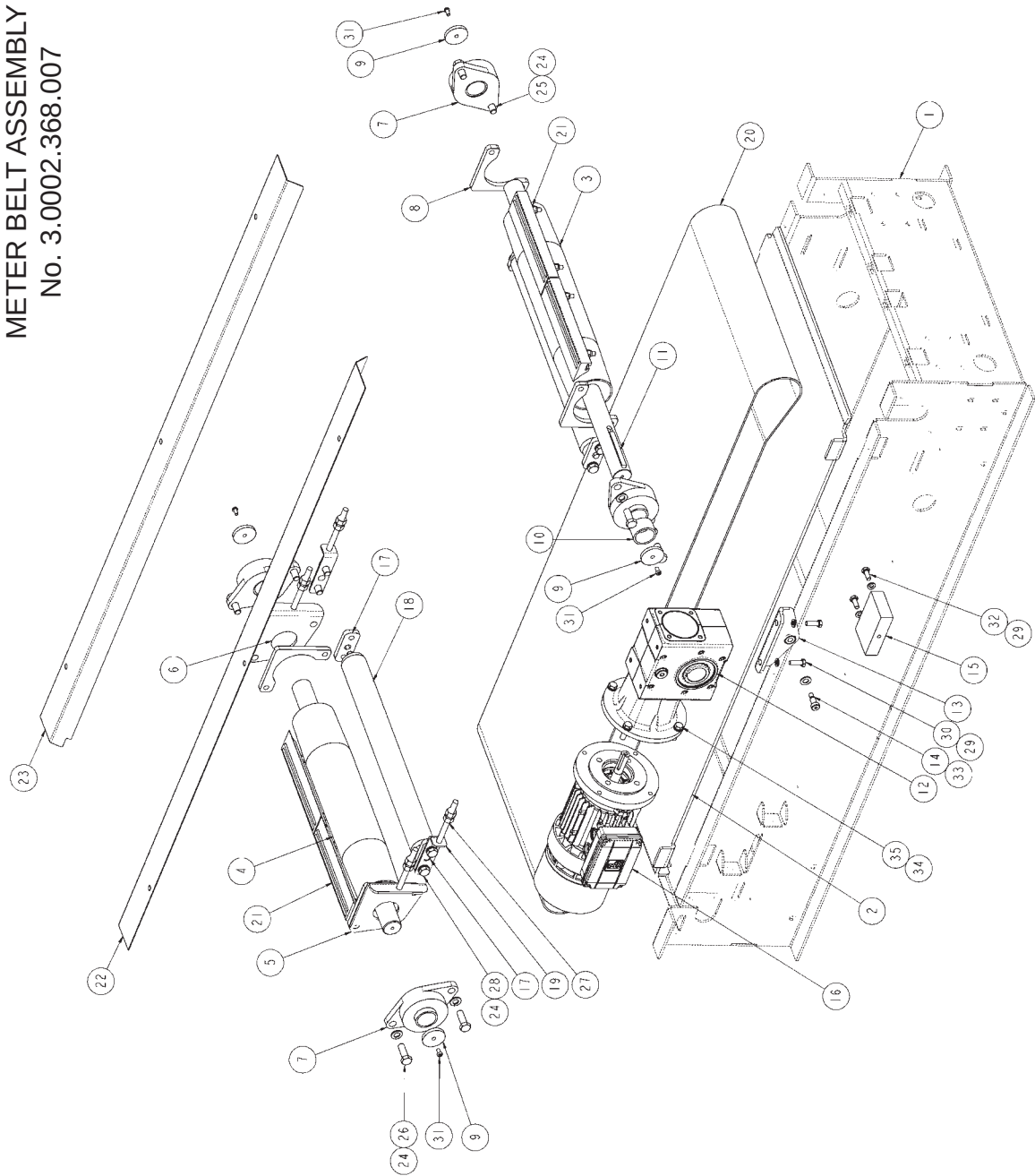
115 FPM @ 60HZ



SECTION CENTERLINE-CENTERLINE

Columbia Palletizer Parts

METER BELT ASSEMBLY
No. 3.0002.368.007



Columbia Palletizer Parts

METER BELT ASSEMBLY

No. 3.0002.368.007

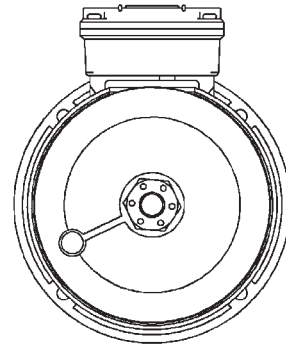
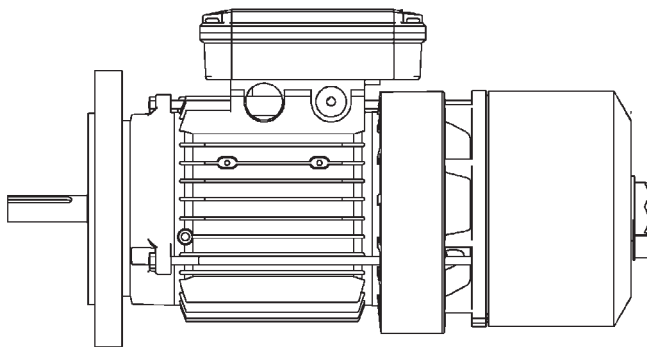
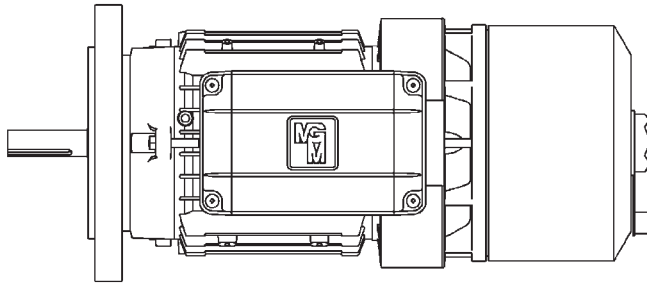
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Frame Wldmt,Mtrblt 21X60"	3.2814.088.003	1
2.	Slider Bed,Mtrblt,21Bf,60"	3.2814.095.002	1
3.	Roll,3.5Dia,21 Bf,Head,Metric	3.2522.078.009	1
4.	Roll,3.5 Dia,21Bf,Tail,Met	3.2522.079.006	1
5.	Brg Take-Up Wldmt,Rh,Fnt,Met	3.2342.039.001	1
6.	Brrg Take-Up Wldmt,Lh,Fnt,Met	3.2342.041.001	1
7.	Brg,2Bolt,1-7/16,Ucft207/Nkb23	410011	4
8.	Bolt Plate,1-7/16,Metric	3.2522.047.006	4
9.	Spacer,Rnd,12L14,.28,1.75,.25	901.028.175.025	4
10.	Spcr,Rnd,12L14,1.47,1.75,1.06	901.147.175.106	1
11.	Squares, C1018, 3/8	903634.03.50	1
12. @	Gbox,Cone,B041015.Waat1	460285	1
13.	Torque Arm,Cone B04 Gearbox	460766	1
14.	Bolt,Shldr,Soc,Gd-12.9.Metric	100106.10.16	1
15.	Torque Arm Mount Bar,B04,Met	3.2814.038.002	1
16. @	Mtrb,0.5,1750,56C,460D,T,M	365.3.59.2	1
17.	Support,Snub Roll,Metric	3.2198.184.001	4
18.	Roller,1.770.R81.U05-19.88RI	486219	2
19.	Take-Up Wldmt,Snib Roll,Metric	3.1953.065.001	2
20.	18"Wd,Cr67 Gry,W/Lacing	952228.117.00	1
21.	Dynaplt,Trans Roll,16S00023Sr	485716	4
22.	Belt Guard,Mtr Blt,Lh,60"	3.2814.096.003	1
23.	Belt Guard,Mtr Blt,Rh,60"	3.2814.097.003	1
24.	Washer,Lock,Metric	100240.12	16
25.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.30	4
26.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.35	4
27.	Nut, Hexagon Full, Metric	100176.1	8
28.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.20	8
29.	Washer,Lock,Metric	100240.08	4
30.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.25	2
31.	Cpscr,Button Hd,Metric	100005.06.12	4
32.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.20	2
33.	Washer, Plain, Metric	100239.1	1
34.	Washer, Lock Helical Spring	100226.06	4
35.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.20	4

@See Vendor data for more information.

Columbia Palletizer Parts

MGM BRAKE MOTOR No. 365.3.59.2

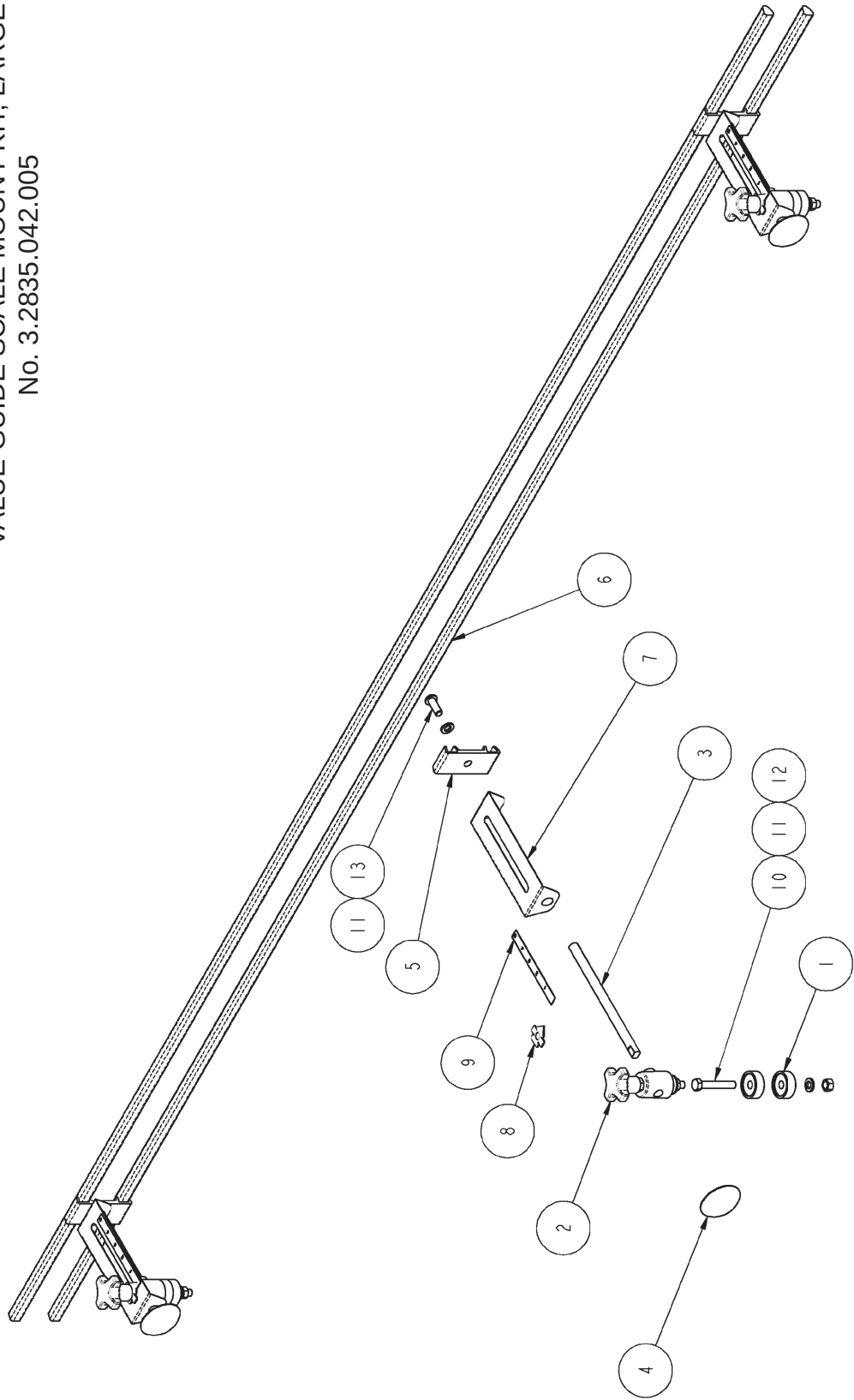
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Mgm Ba71 Brake Coil 230/460/60	255770.01	1
2.	Mgm Ba71 Brake Disc	255770.05	1
3.	Mgm Ba71 Brake Assy	255770.06	1



BA 71B4 - (0.5) HP MOTOR NEMA 56C FLANGE & SHAFT 230/460V,
W/460V BRAKE. DUAL VOLTAGE 230/460 WINDINGS, INVERTER DUTY
MOTOR 3-PH AC BRAKE, MANUAL BRAKE RELEASE CLASS F STANDARD
INERTIA FLYWHEEL

Columbia Palletizer Parts

VALUE GUIDE SCALE MOUNT KIT, LARGE
No. 3.2835.042.005

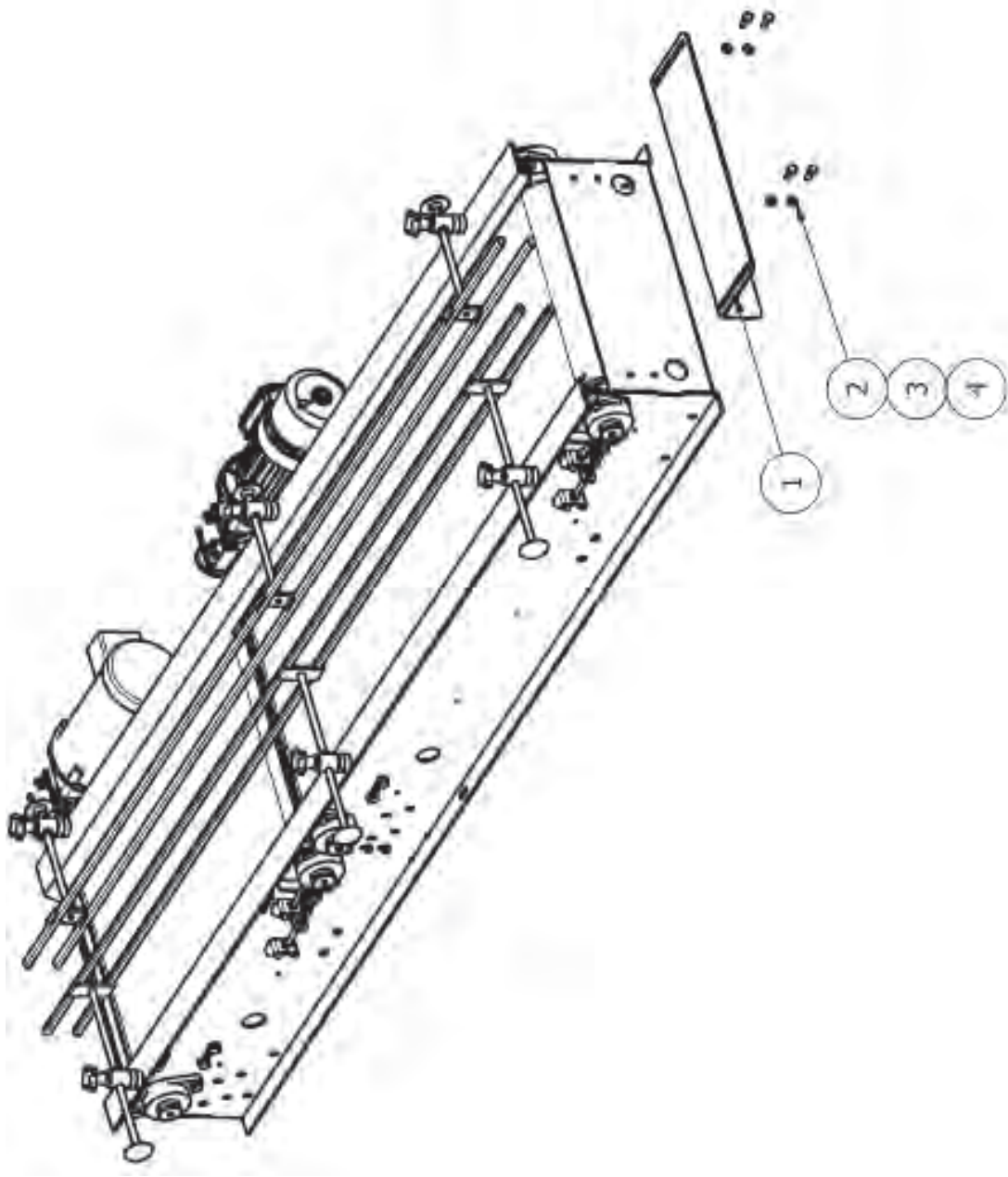


Columbia Palletizer Parts

VALUE GUIDE SCALE MOUNT KIT, LARGE No. 3.2835.042.005

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Stacking Ring, Vg-Vsr	486073	6
2.	Trans. Cap Assy, Vg-203Tc-12	486072	3
3.	Guide Rod, 1/2X8, Vg-212-8-38	4860523	3
4.	Safety Cap, Vg-200-225-12-B	486074	3
5.	Rail Clamp, Double, Vg-011-01	486053	3
6.	Round Rail, 10Ft, Vg-Gsr-10	486050	2
7.	Valu Guide Scale Mount, 7.0"	3.2835.041.003	3
8.	Pointer Bkt, Adj Handle, 3/8 Spl	3.1888.1100.001	3
9.	Ruler, Adhesive, Narrow, 12In	8708.4663	3
10.	Cpscr, Hex Head-Gd 5-16 Unc	100000.06.36	3
11.	Washer, Lock Helical Spring	100226.06	6
12.	Nut, Hexagon Full, Gd 5-16 Unc	100140.06	3
13.	Cpscr, Button Hd-16 Unc, Plated	100006.06.16P	3

MT SHELF KIT, INFEED CONVEYOR
No. 3.3260.345.001



Columbia Palletizer Parts

MT SHELF KIT, INFEED CONVEYOR
No. 3.3260.345.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Mt Shelf,Infeed Conv,Pcr/Mtr	3.3260.348.001	1
2.	Washer, Plain, Metric	100239.1	4
3.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	4
4.	Nut,Poly Insert,Full,Class 10	100136.1	4

Columbia Palletizer Parts

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SECTION 10

Tie Sheet Dispenser
No. 3.3394.014

Page 1 Tie Sheet Dispenser Assembly List
Page 2-3 4298 Sheet Dispenser, RH, End Load
Page 4-8 7298 Arm Assembly
Page 9-10 Sheet Head Assembly
Page 11-12 E-Chain Assemblies
Page 13 Idler Assembly
Page 14 Pulley
Page 15 Ship Bracket Assembly
Page 16 Lift Bracket Assembly
Page 17-18 Sheet Table Assembly
Page 19 Pull Cord Mnt. Installation

Columbia Palletizer Parts

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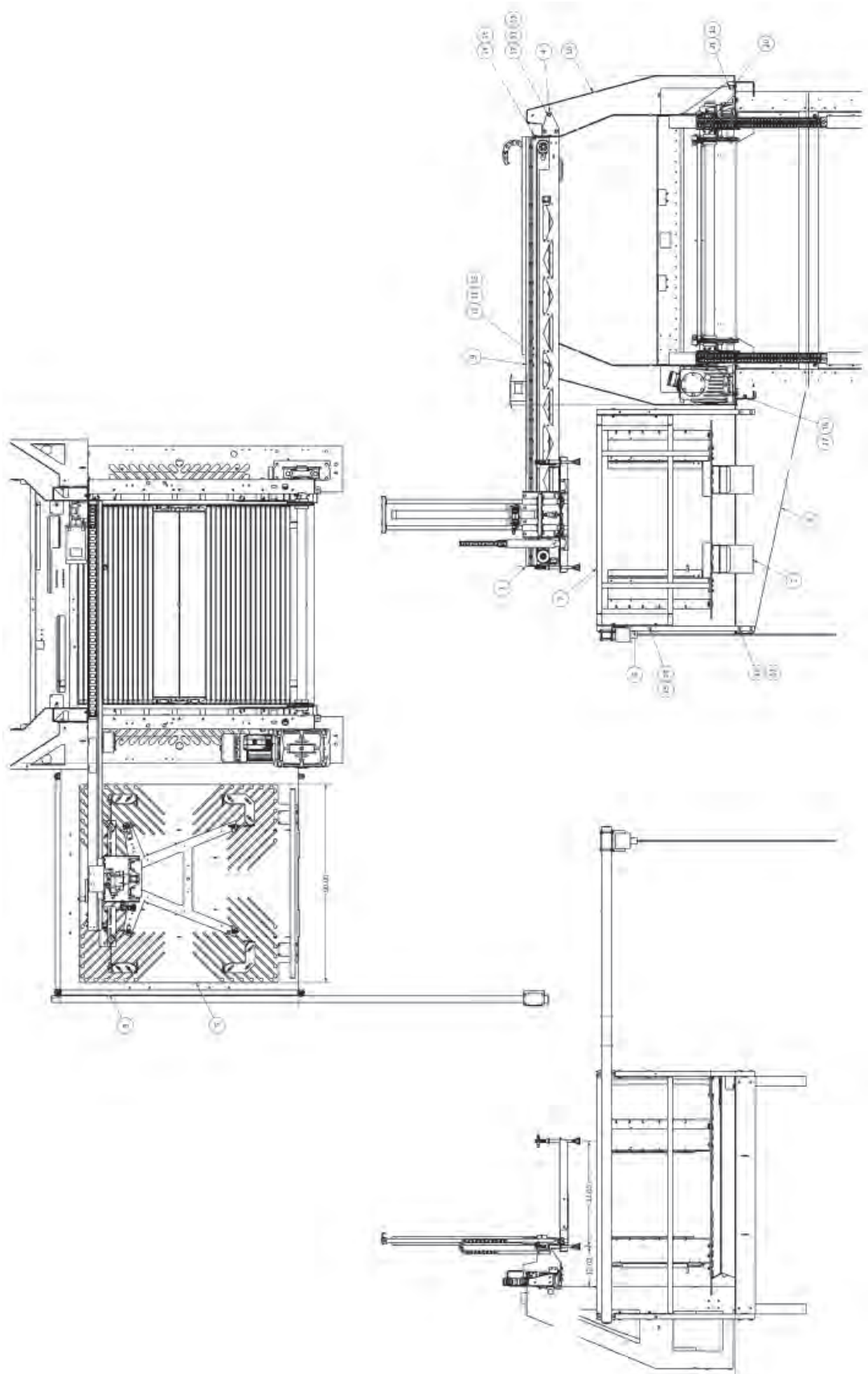
Columbia Palletizer Parts

TIE SHEET DISPENSER ASSEMBLY LIST No. 3.3394.014

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	4298 Sht Disp,Rh,End Load	3.0011.154.008	1
2.	Suction Cup,Bx52P.4K.05Ad.F	454309	4
3.	Lift Brkt Assy 7298 Sht Disp	3.3322.900	1
4.	Guard Plt,Pulley End,7298	3.3322.210.001	1
960.	P/K T.Sd,Blue Marble.5028930	328.27.7434.60	1

Columbia Palletizer Parts

4298 SHEET DISPENSE, RH, END LOAD
No. 3.0011.154.008



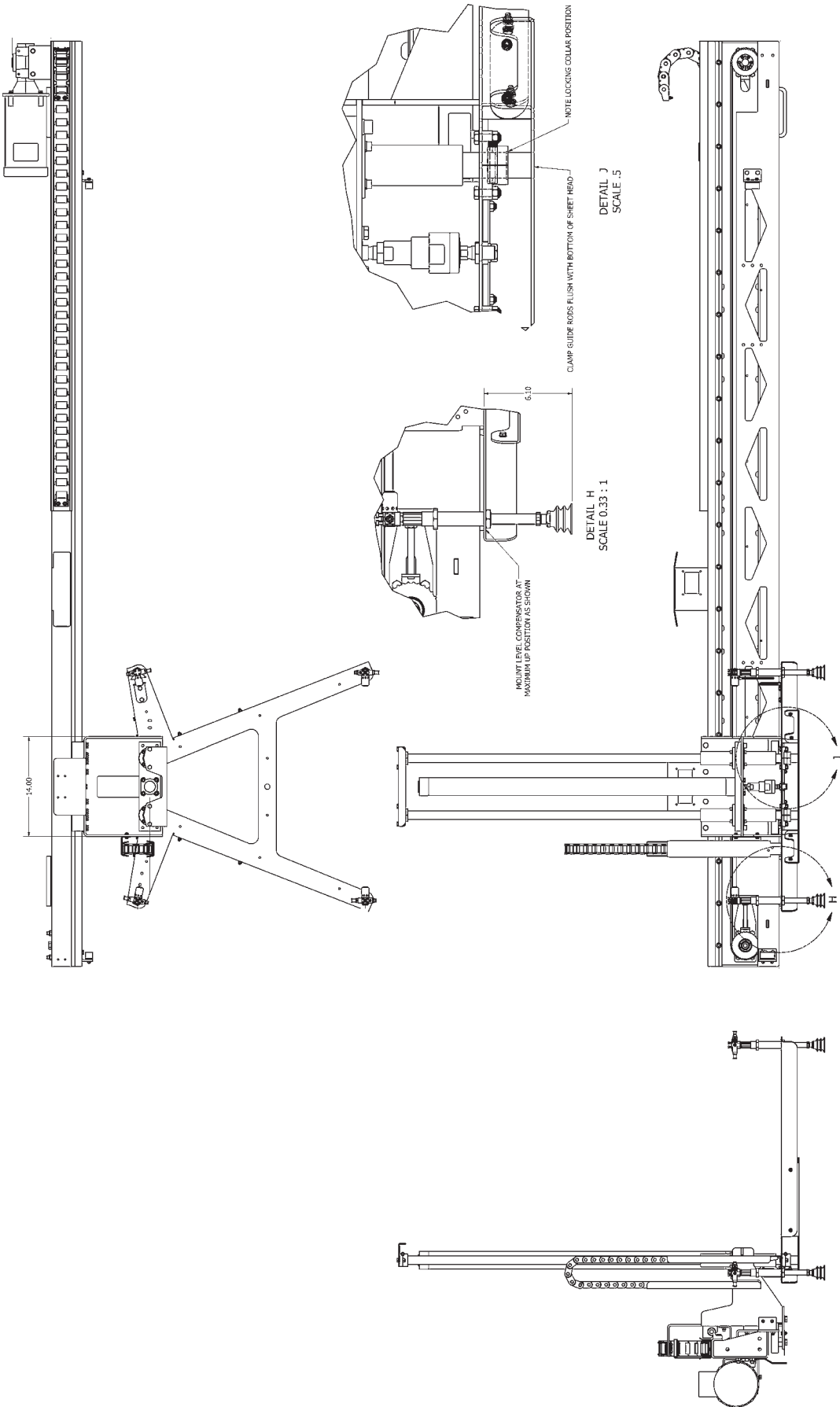
Columbia Palletizer Parts

4298 SHEET DISPENSE, RH, END LOAD No. 3.0011.154.008

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	7298 Arm Assy,40X114,Std	3.3322.200.001	1
2.	Frame Wldmt,7298,Side	3.3322.150.001	1
3.	Alignment Guide Wldmt	3.3322.158.001	2
4.	7298 Tail Mount,Rh	3.3322.139.002	1
5.	Sheet Table Assy,30" Stack	3.3322.115.001	1
6.	Vertical Support,Handrail	3.1953.801.051	4
7.	Handrail,No Posts, 64.00	3.2778.037.107	1
8.	Handrail,No Posts, 72.00	3.2778.037.285	1
9.	4298 Rail Mnt Wldmt	3.3322.140.003	1
10.	4298 Rail Mnt Wldmt Opp	3.3322.140.004	1
11.	Washer, Plain, Metric	100239.12	22
12.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.35	15
13.	Nut,Poly Insert,Full,Class 10	100136.12	23
14.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.30	3
15.	Nut,Poly Insert,Full,Class 10	100136.1	15
16.	Nut,Poly Insert,Full,Class 10	100136.16	7
17.	Cpscr,Hex Head,Metric,Gd 8.8	100019.16.35	7
18.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.60	8
19.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.60	8
20.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.16	4
21.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	4
22.	Pull Switch Mount Install	3.2740.136.008	1

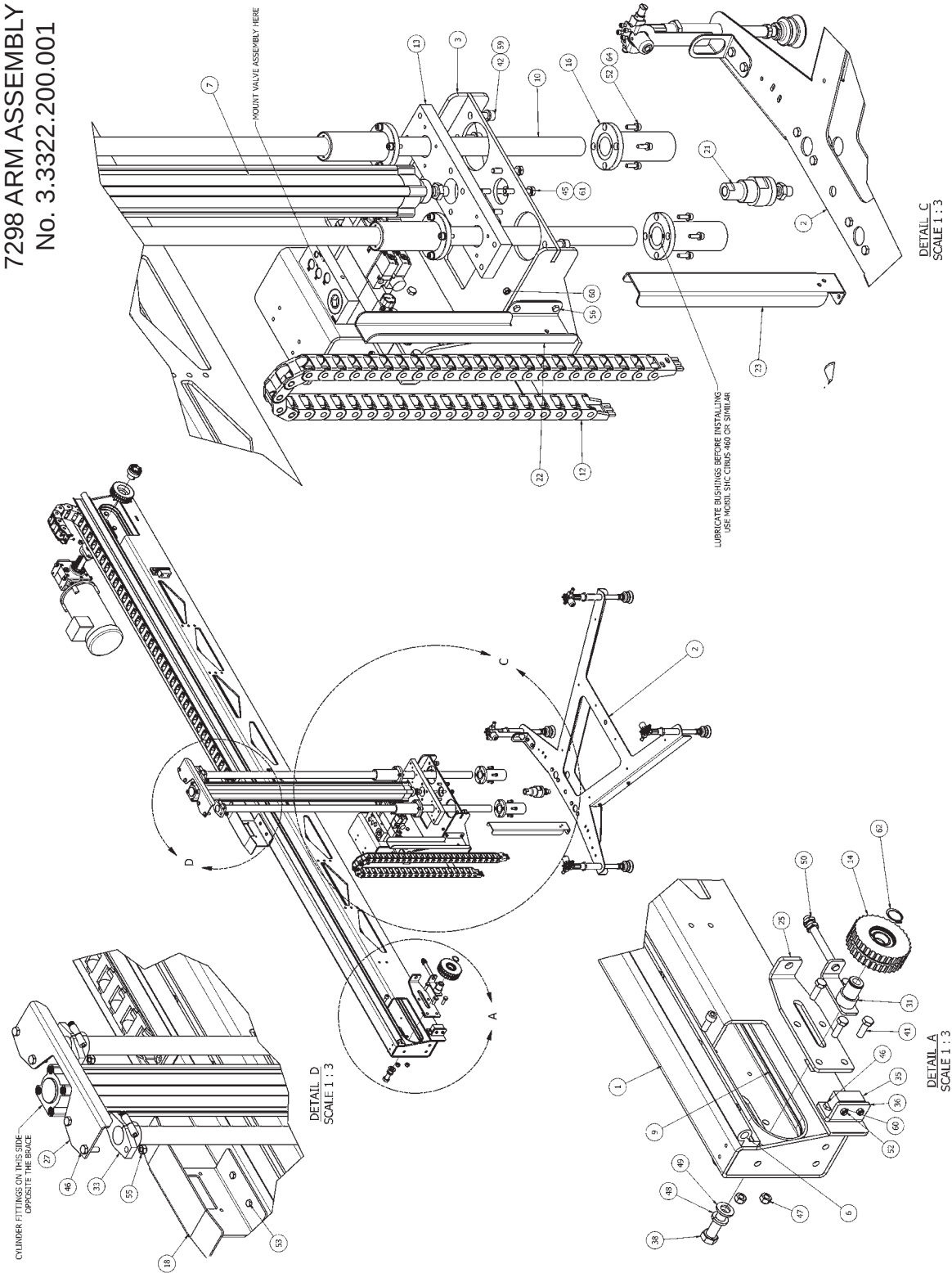
Columbia Palletizer Parts

7298 ARM ASSEMBLY
No. 3.3322.200.001

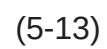


Columbia Palletizer Parts

7298 ARM ASSEMBLY
No. 3.3322.200.001



7298 ARM ASSEMBLY
No. 3.3322.200.001



Columbia Palletizer Parts

7298 ARM ASSEMBLY

No. 3.3322.200.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	7298 Arm Weldment	3.3322.100.001	1
2.	Sheet Head Assy,32X32	3.3322.122.002	1
3.	Carriage Wldmt	3.3322.129.001	1
4.	Mtr,.5,1800,56C,460D60,T,B	365.3.8.10	1
5.	Gbox,Cone,B021010.Waau1	459372	1
6.	Drylin Rail,Ws-25-3300,Igus	414993	1
7.	Cyl,A,50,1020,20,N/A,F,Dsbc	366.17.2009	1
8.	E-Chain Assy,7298	3.3322.148.001	1
9.	Blt,Timng,25At10-S-01-G6/6500M	428562.65	1
10.	Brg,30Mm Steel Shaft,1425Mm	438417	2
11.	E-Chain Guide	3.3322.147.001	1
12.	E-Chain Assy,7298 Vertical	3.3322.165.001	1
13.	Guide Rod And Cyl Mnt	3.3322.120.001	1
14.	Idler Assy,Atk10K6,32T,Met	3.2800.135.004	1
15.	Pulley,Atk10K6-0,1.339In,Bore	3.2800.134.002	1
16.	Brg,30Mm Flange,Double,Pbc	438416	4
17.	Gbox Mnt,Cone B02	3.3322.173.001	1
18.	E-Chain Support	3.3322.168.001	1
19.	Brg,2 Bolt,1.0 Accu-Loc	4100121	1
20.	Drive Shaft,1"	3.3322.127.001	1
21.	Alignment Coupler,16X1.5	438406	1
22.	E-Chain Guide,7298	3.3322.166.001	1
23.	E-Chain Guide,7298,Head	3.3322.167.001	1
24.	Belt Attachment,At10	3.3322.172.001	1
25.	Idler Takeup Mnt	3.3322.138.001	1
26.	Wheel,Power-Core,3"Od,75D	441238	3
27.	Rod Brace,Horse Shoe	3.3322.131.001	1
28.	Drylin W25 Pillow Block,Fixed	414988	4
29.	Clamp Plt,50X160,Atk10K6B,Cs	428321	1
30.	30Mm Prox Mounting Plate	3.0020.453.004	2
31.	Idler Takeup Wldmt	3.3322.135.001	1
32.	Locking Assy,C170E.1.0"	429898	1
33.	Flange Mnt Shaft Support,30Mm	438407	2
34.	Prox Flag	3.3322.170.001	1
35.	Rubber Foot,2.0X1.0X1.0,80A	4541872	2
36.	Overtravel Hardstop Mount	3.3300.118.001	2
37.	Eccentric Wheel Mount Met.	3.1360.204.002	3
38.	Cpscr,Hex Head,Metric,Gd 8.8	100019.16.50	1
39.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.30	3
40.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.40	2

Columbia Palletizer Parts

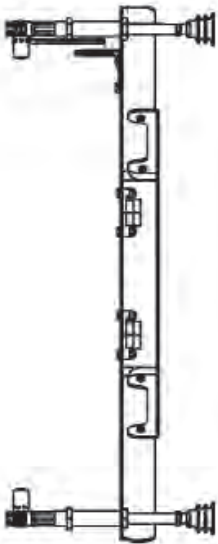
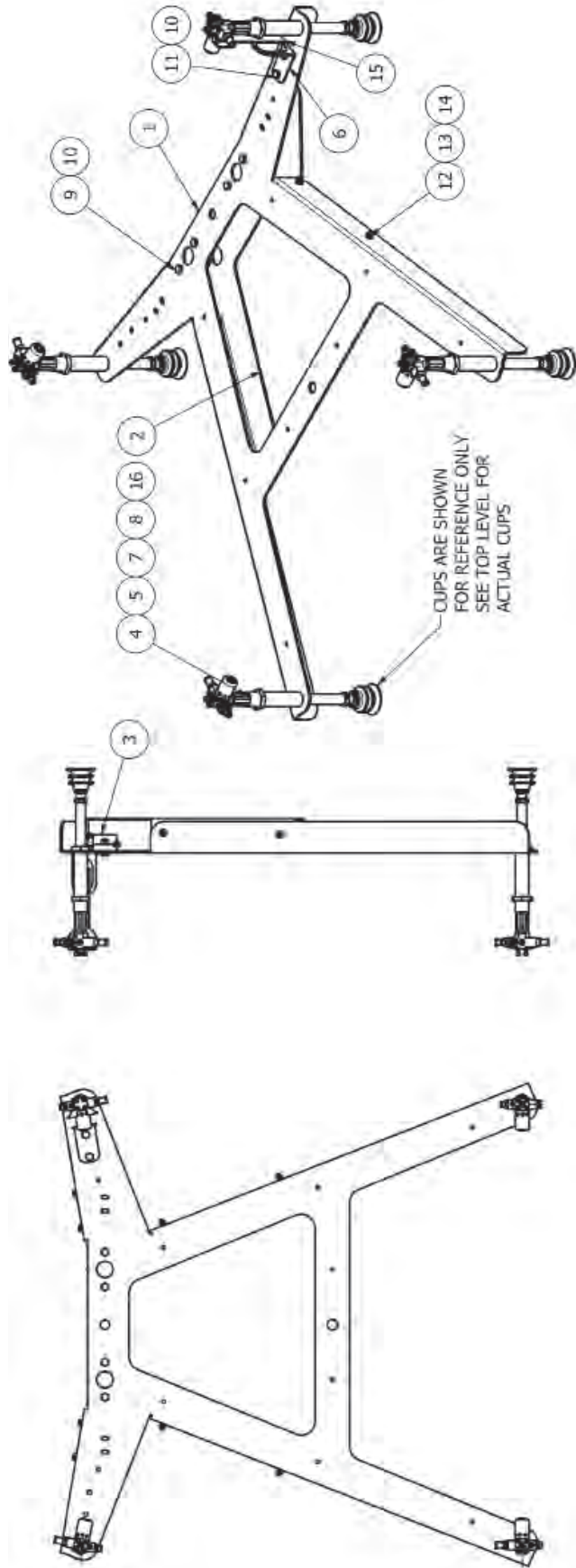
7298 ARM ASSEMBLY

No. 3.3322.200.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
41.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.30	8
42.	Cpscr, Hex Soc Head Metric	100020.10.25	27
43.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	2
44.	Squares, C1018, 1/4	903632.03.25	1
45.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.50	4
46.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.25	14
47.	Nut,Poly Insert,Full,Class 10	100136.1	31
48.	Washer,Lock,Metric	100240.16	1
49.	Washer, Plain, Metric	100239.16	1
50.	Nut, Hex Jam, Gd 04, Metric	100139.12	2
52.	Cpscr, Hex Soc. Head, Metric	100020.06.20	20
53.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.20	2
54.	Cpscr, Flat Ct'Snk, Metric	100021.06.25	4
55.	Nut,Poly Insert,Full,Class 10	100136.08	10
56.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.16	4
57.	Washer,Lock,Metric	100240.12	3
58.	Cpscr, Flat Ct'Snk, Metric	100021.05.20	2
59.	Washer,Lock,Metric	100240.1	8
60.	Nut,Poly Insert,Full,Class 10	100136.06	14
61.	Washer,Lock,Metric	100240.08	12
62.	Snap Ring-External, 0.984 Dia.	430145	4
63.	Nut,Poly Insert,Full,Class 10	100136.05	2
64.	Washer,Lock,Metric	100240.06	16
65.	Washer, Plain, Metric	100239.08	8
66.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.20	4
67.	Ship Brkt Assy 7298 Sht Disp	3.3322.902	2

Columbia Palletizer Parts

SHEET HEAD ASSEMBLY
No. 3.3322.122.002



Columbia Palletizer Parts

SHEET HEAD ASSEMBLY

No. 3.3322.122.002

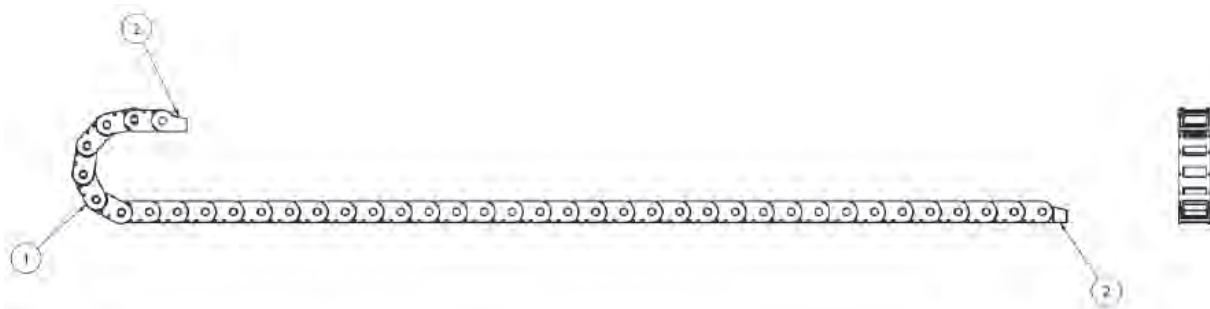
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
.1.	Sheet Head,Formed,32X32	3.3322.123.002	1
2.	Sheet Head Brace	3.3322.124.002	1
3.	Flange Mnt Shaft Support,30Mm	438407	2
4.	Level Compensator	374042	4
6.	Prox Brkt,30Mm,Sht Head	3.2940.062.001	1
7.	Vac Pump,Vgs3010.Ab.00.Ba	378075	4
8.	Vacuum Release,Piab 1/8	378076	4
9.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.25	4
10.	Nut,Poly Insert,Full,Class 10	100136.08	6
11.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.16	2
12.	Washer,Plain,Metric	100239.06	12
13.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.20	6
14.	Nut,Poly Insert,Full,Class 10	100136.06	6
15.	Piab Cup Detect Trip	3.0020.695	1
16.	Ftg,Bspp Hex Nipple,G3/8	334294	4

Columbia Palletizer Parts

E-CHAIN ASSEMBLY

No. 3.3322.148.001

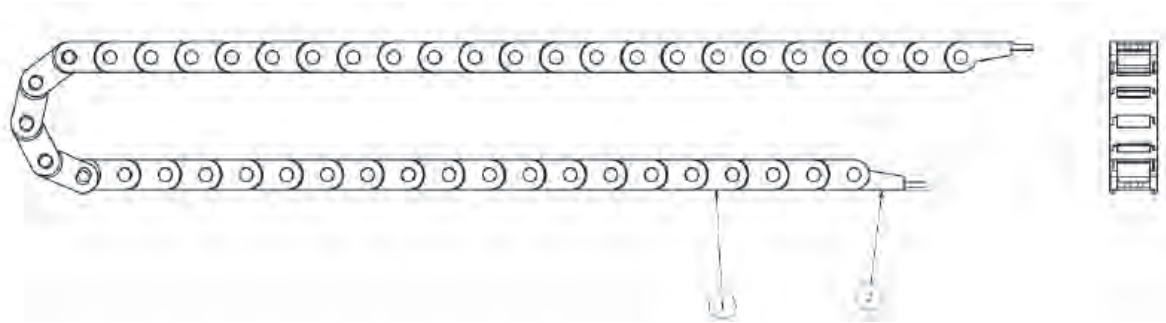
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	E-Chain 250-03-075	445136	39
2.	Mtg Brkt,2030-12Pz,Set	445137	1



Columbia Palletizer Parts

E-CHAIN ASSEMBLY
No. 3.3322.165.001

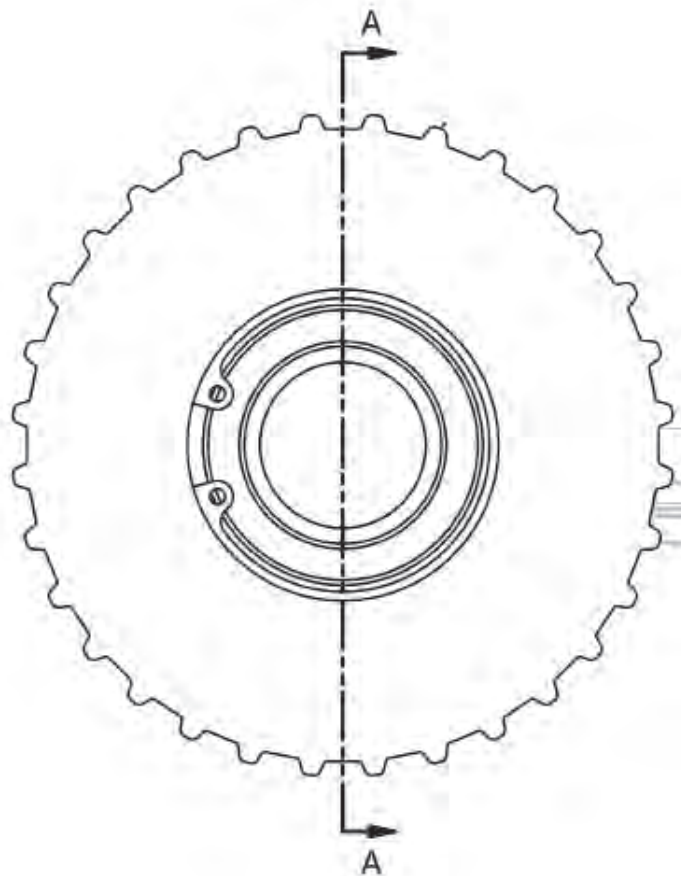
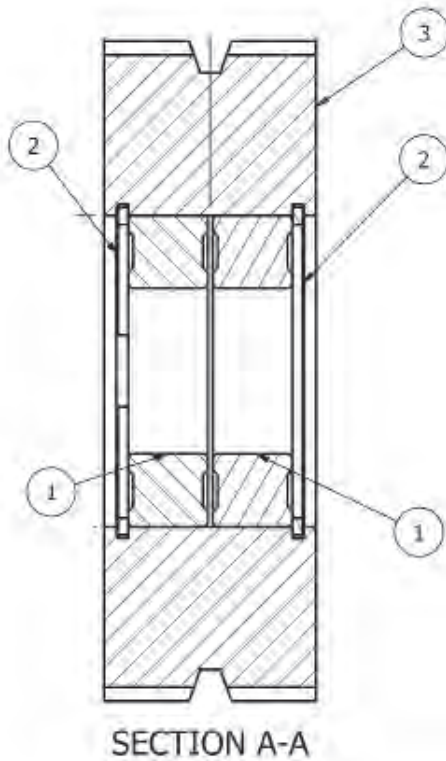
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	E-Chain,B15-025-038	445306	45
2.	E-Chain,Mntg Brkt,1025-34Pz	445307	1



Columbia Palletizer Parts

IDLER ASSEMBLY No. 3.2800.135.004

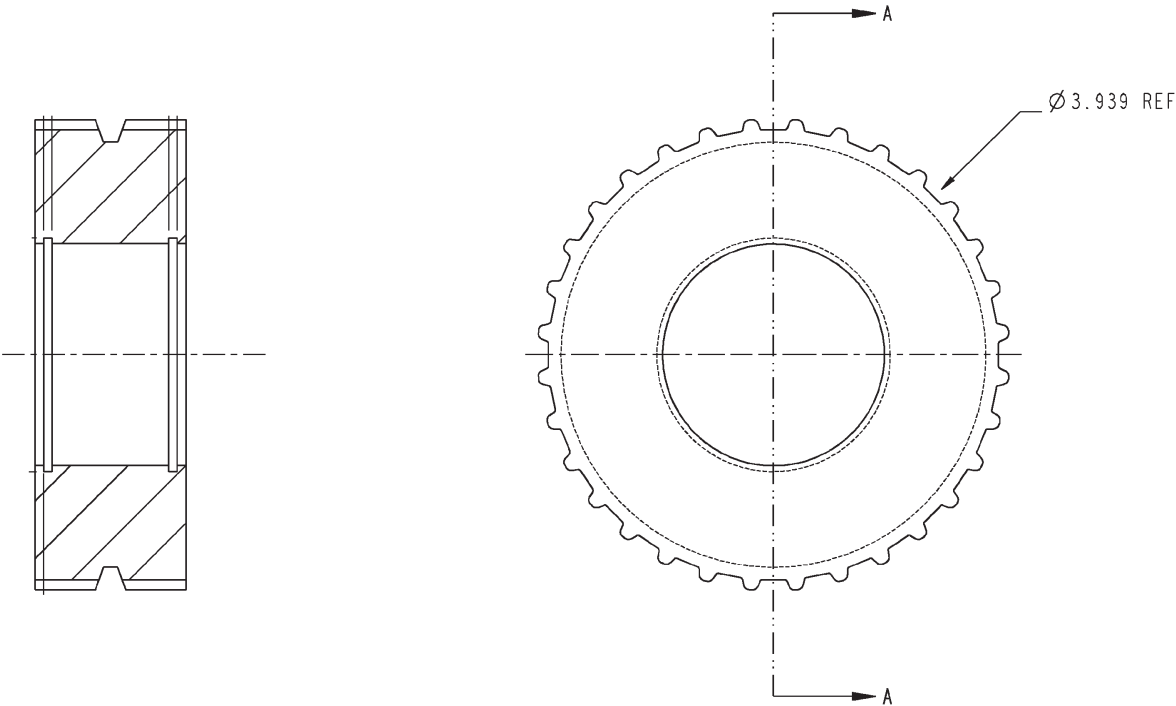
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Brg,Ball,Extralight,2 Seal,025	410865	2
2.	Snap Ring-Internal, 1.875 Dia.	430045	2
3.	Pulley,Atk10K/32-0,47Mm Bore	3.2800.134.001	1



Columbia Palletizer Parts

PULLEY
No. 3.2800.134.001

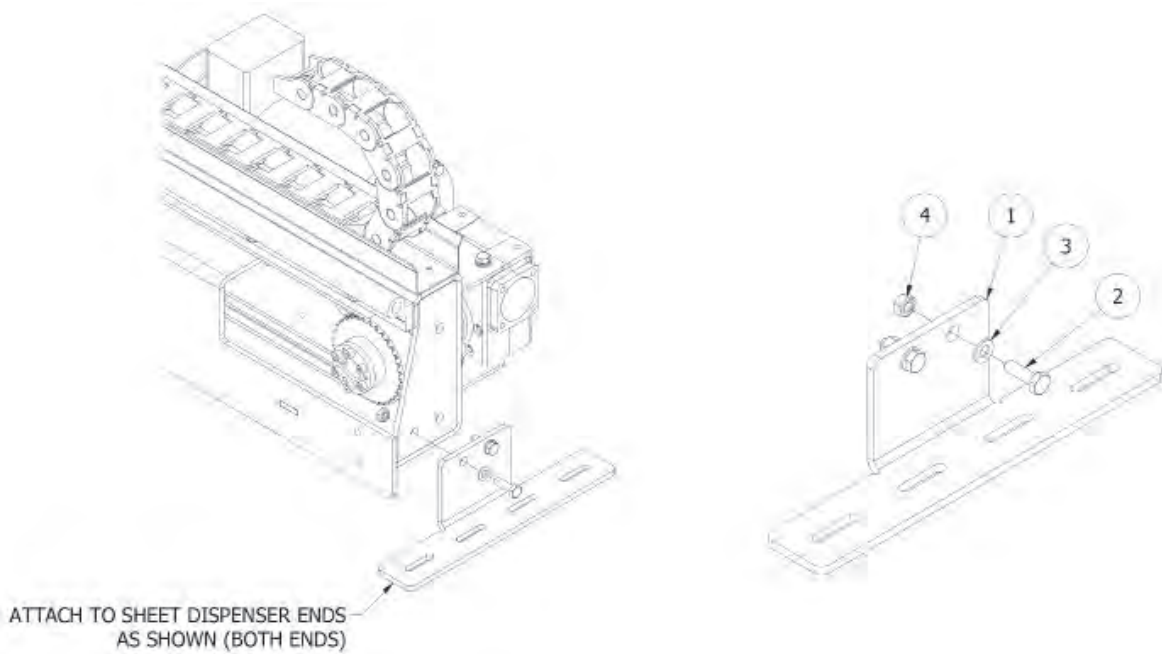
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pulley,Atk10,32T,25Bw,K6	427518	1



Columbia Palletizer Parts

SHIP BRACKET ASSEMBLY No. 3.3322.902

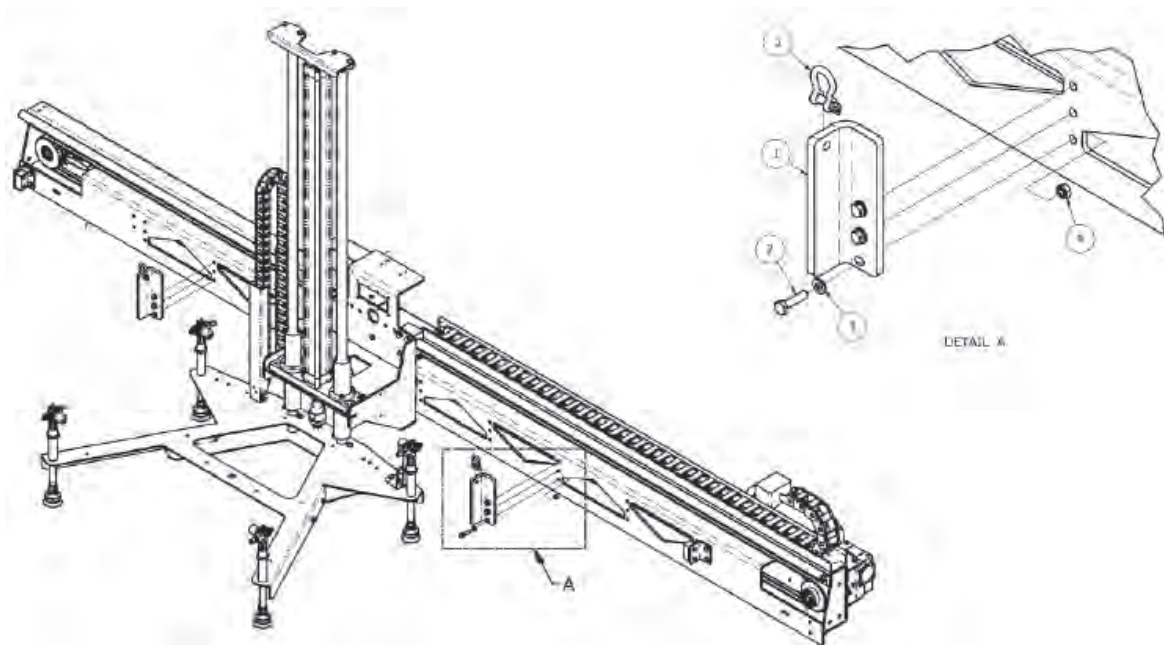
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Shipping Bracket 7298 Sht Disp	3.3322.903	1
2.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.25	2
3.	Washer, Plain, Metric	100239.08	2
4.	Nut, Hexagon Full, Metric	100176.08	2
5.	Lift Brkt Assy 7298 Sht Disp	3.3322.900	1



Columbia Palletizer Parts

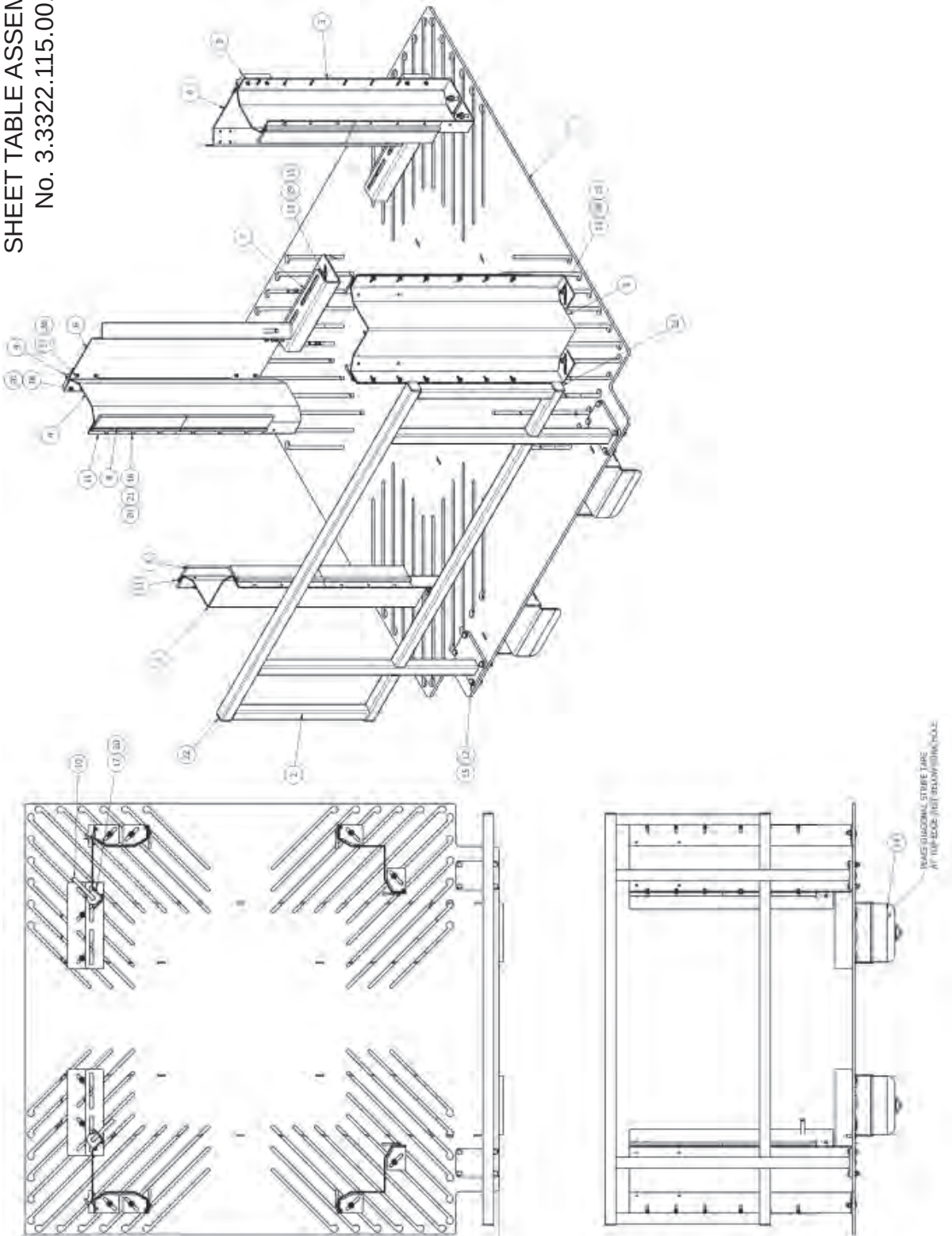
LIFT BRACKET ASSEMBLY No. 3.3322.900

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Lifting Bracket 7298 Sht Disp	3.3322.901	2
2.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.30	6
3.	Washer, Plain, Metric	100239.08	6
4.	Nut, Hexagon Full, Metric	100176.08	6
5.	Shackle,0.25X0.31 Pin Dia	466209	2



Columbia Palletizer Parts

SHEET TABLE ASSEMBLY
No. 3.3322.115.001



Columbia Palletizer Parts

SHEET TABLE ASSEMBLY

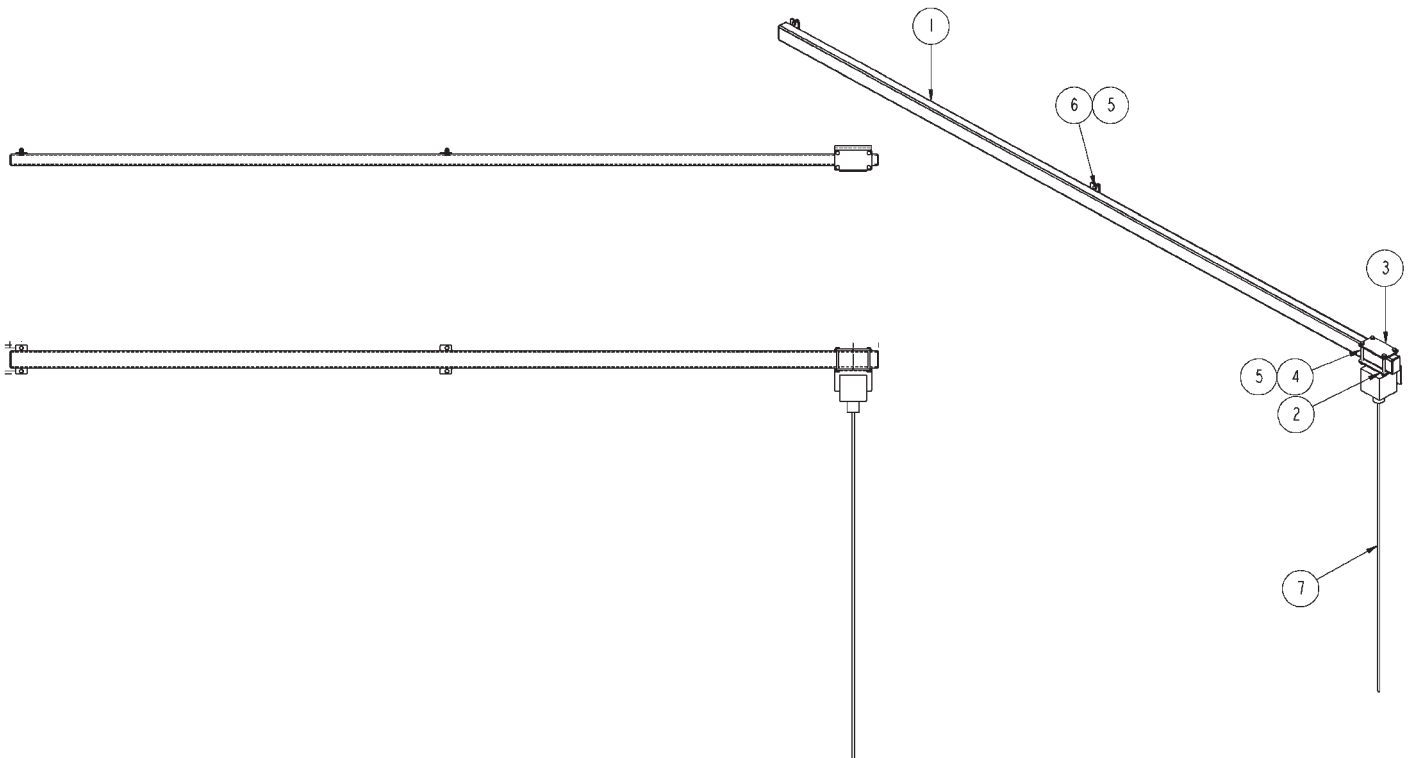
No. 3.3322.115.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sheet Table Wldmt	3.3322.105.001	1
2.	Handrail,Sheet Table	3.2307.210.008	1
3.	Sheet Guide,Corner,Fixed,30"	3.3300.161.001	2
4.	Sheet Guide,Rh,30"	3.3300.162.004	1
5.	Sheet Guide,Lh,30"	3.3300.162.003	1
6.	Sheet Door,30 Stack	3.3300.163.001	2
7.	Sheet Guide/Door Latch	3.3300.164.001	2
8.	Brush,Fibre,2X13	358.61.117	12
9.	Hinge, Vg-634Ab	486055	4
10.	Latch Hinge, By-2595	401607	2
11.	Brush Holder, Single H, 13Long	442072	12
12.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.35	8
13.	Bolt,Rd Hd-Sq Neck,M10X1.5	100109.10.30	14
14.	Tape, Safety Diag Stripe	8708.2404	1
15.	Nut,Poly Insert,Full,Class 10	100136.1	20
16.	Cpscr, Hex Soc. Head, Metric	100020.06.25	8
17.	Cpscr, Hex Soc. Head, Metric	100020.06.16	16
18.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.14	25
19.	Washer, Plain, Metric	100239.1	12
20.	Nut,Poly Insert,Full,Class 10	100136.06	49
21.	Washer,Plain,Metric	100239.06	25
22.	Plug,1-1/2In,Sqr-1-1/2-10-14	334152	4

Columbia Palletizer Parts

PULL CORD MNT. INSTALLATION No. 3.2740.136.008

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pull Switch Mtg Tube Wd	3.2740.132.008	1
2.	Switch Mtg Angle	3.2740.133	1
3.	Clamp Plate	3.2740.134	1
4.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.100	4
5.	Nut,Poly Insert,Full,Class 10	100136.1	8
6.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	4
7.	Rope,3/8 Dia,Nyl Soft	367690.150.00	1



Columbia Palletizer Parts

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SECTION 11

Guards

No. 3.3394.015

Page 1	Guards Assembly List
Page 2-3	Door Kit, Side
Page 4	Door Set, Fortress
Page 5-6	Guard Panel Assemblies
Page 7	Fortress Lock Kit
Page 8-9	Guard Assembly, Upper
Page 10	End Cover Assembly, Front
Page 11	Sidecover Assembly
Page 12	Aux Panel Mount
Page 13-14	Slider Door Assembly, 18-18
Page 15-16	Sidecover Assemblies
Page 17	Slider Door Assembly, RH, Rollon
Page 18	Slider Door Assembly, LH, Rollon
Page 19	Sidecover Assembly
Page 20	Infeed Tunnel Assembly
Page 21-22	Discharge Guard Assembly
Page 23	Panel Mount Kit
Page 24-25	Guard Assembly Kit, PD to MF
Page 26-27	Door Panel Assemblies
Page 28-29	Fortress Lock Kit

Columbia Palletizer Parts

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Columbia Palletizer Parts

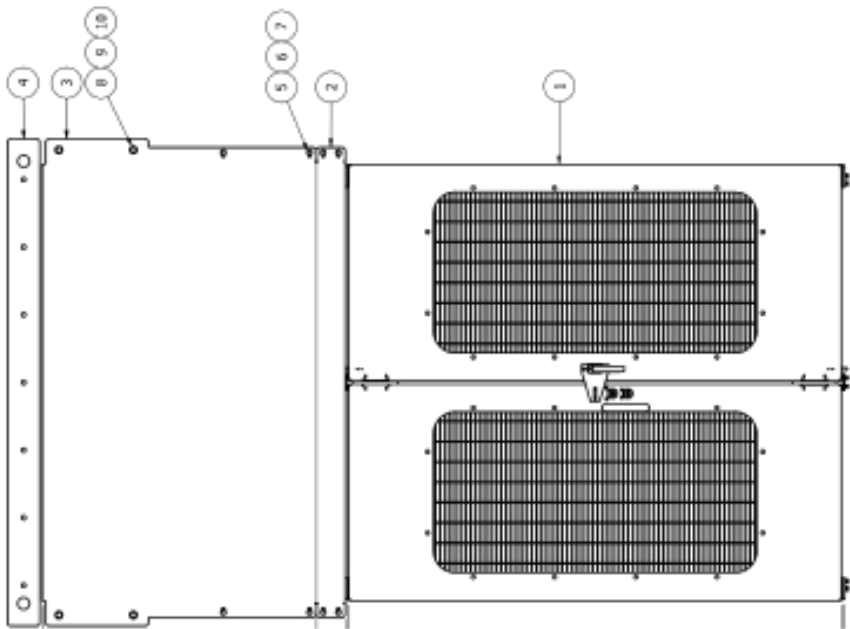
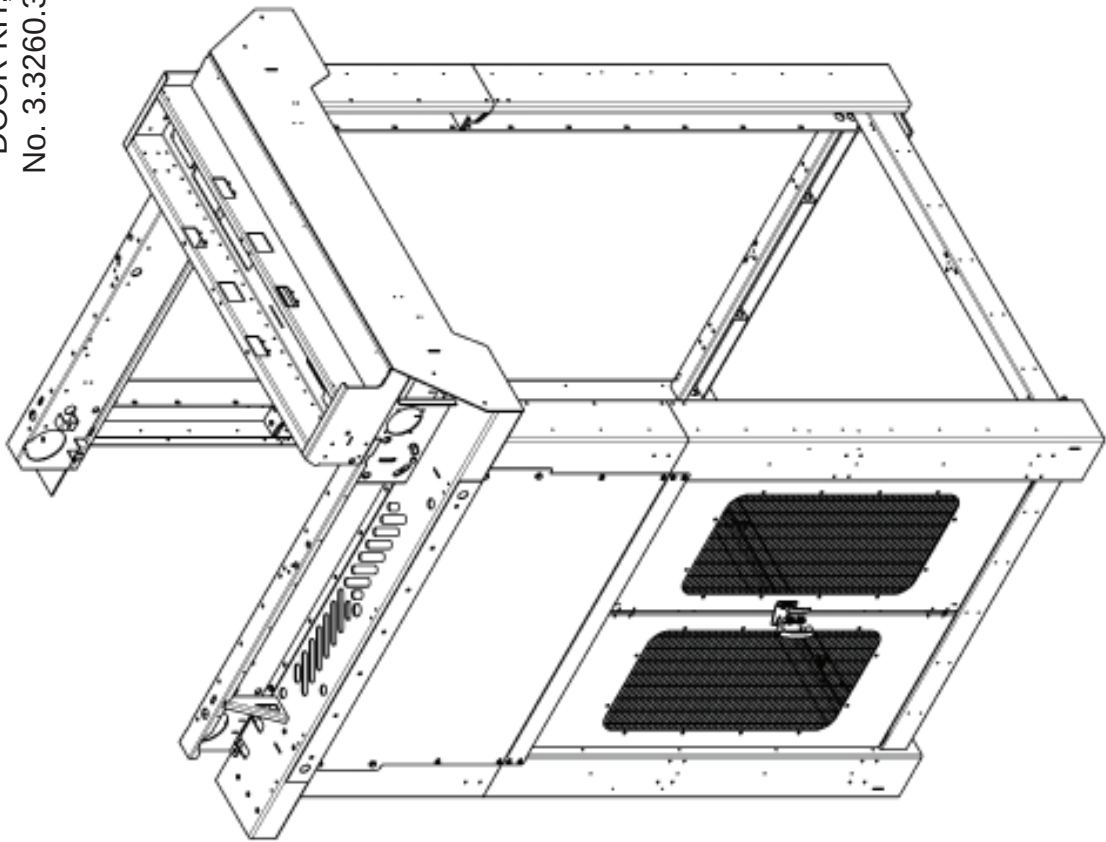
GUARDS ASSEMBLY LIST

No. 3.3394.015

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Door Kit,Side,HI4200,109,Spl	3.3260.320.055	1
2.	Guard Assy,Upper,HI4200	3.3260.400.015	1
3.	Disch Grd Assy, Qs18 Pc Std	3.0020.622.035	1
4.	Guard Rail Wldmt, 4200, Lh,67	3.2860.572.014	1
5.	Guard Rail Wldmt, 4200, Rh,67	3.2860.572.023	1
6.	Drip Tray,HI4200,Row Fmr	3.3260.330.002	1
7.	Guard Assy Kit,Pd To Mf,HI4200	3.3291.051.008	1
8.	Op Station Mt Wldmt,Tunnel	3.3260.383.002	1

Columbia Palletizer Parts

DOOR KIT, SIDE
No. 3.3260.320.055



Columbia Palletizer Parts

DOOR KIT, SIDE
No. 3.3260.320.055

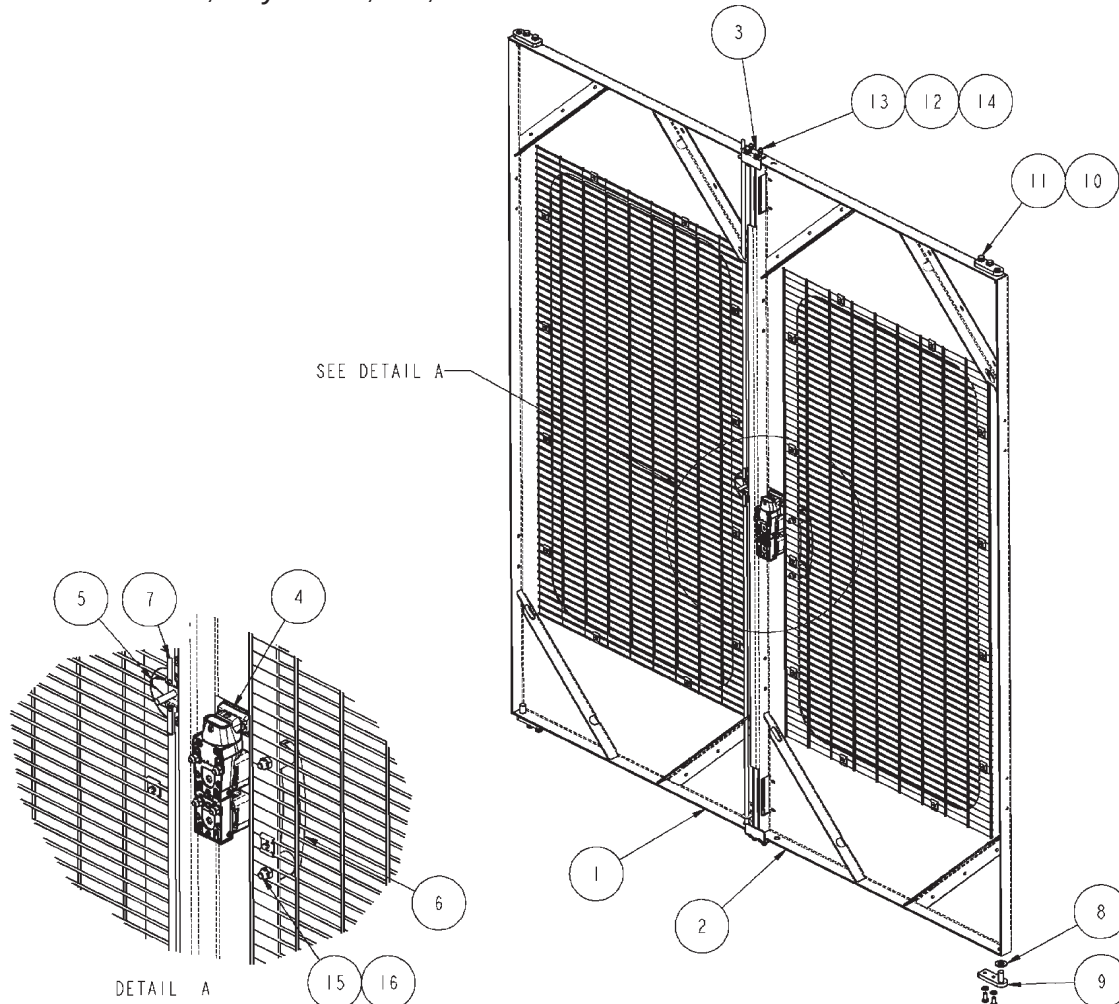
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Door Set,Hd,Frtres,HI4200,Side	3.2860.425.024	1
2.	Above Door,Lower Pnl,HI4200	3.3260.322.002	1
3.	Above Door,Upper Pnl,HI4200	3.3260.323.016	1
4.	Spacer Plate,4298,Sheet Table	3.3322.180.001	1
5.	Washer, Plain, Metric	100239.1	8
6.	Nut,Poly Insert,Full,Class 10	100136.1	8
7.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	8
8.	Washer, Plain, Metric	100239.14	4
9.	Cpscr,Hex Head,Metric,Gd 8.8	100019.14.35	4
10.	Nut,Poly Insert,Full,Class 10	100136.14	4

Columbia Palletizer Parts

DOOR SET, FORTRESS

No. 3.2860.425.024

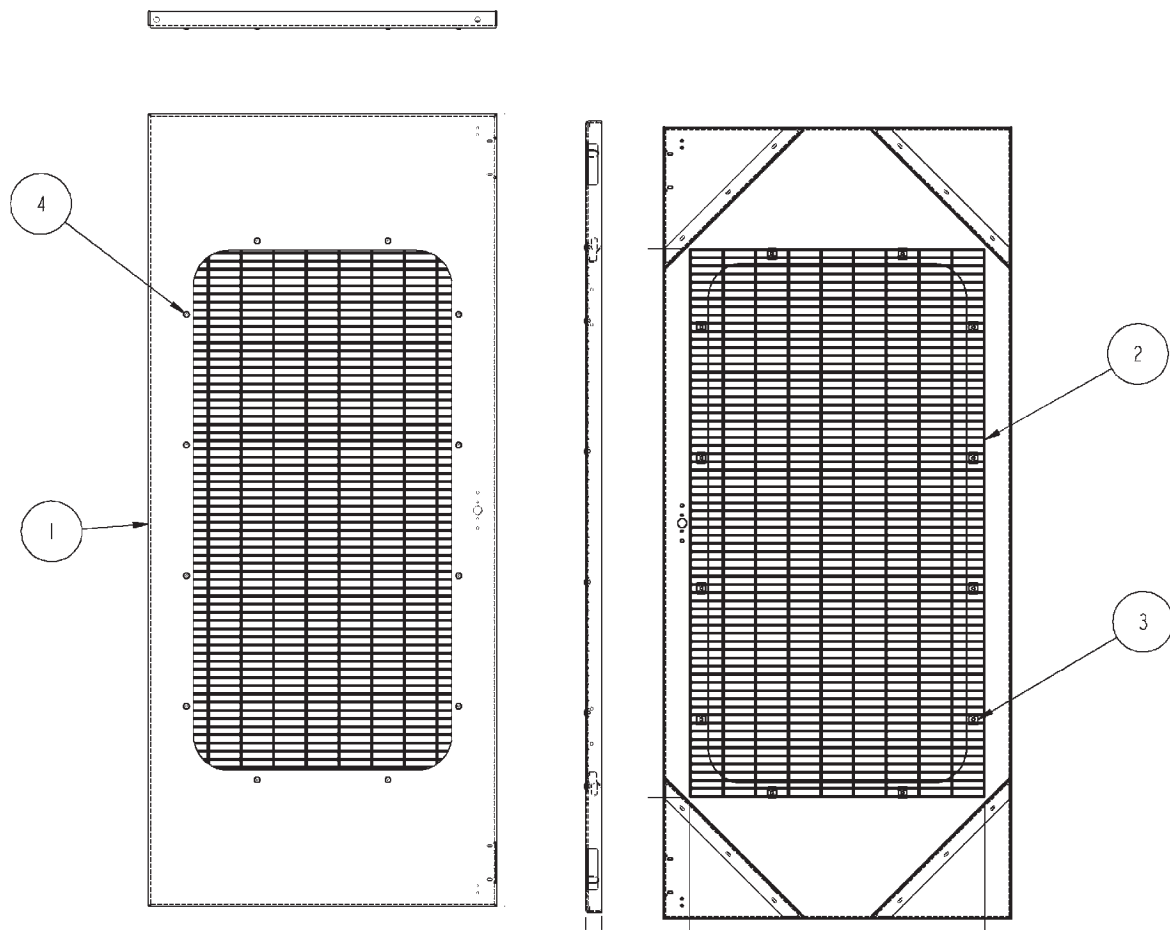
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Grd Pnl Assy,32.00,Fort,Hd,Spl	3.2800.710.006	1
2.	Grd Pnl Assy,32.00,Fortress	3.2800.700.005	1
3.	Door Stop Angle	6.1121.040	2
4.	Fortress Lock Kit	3.0020.560.002	1
5.	Handle Latch,92-31-521	401474	1
6.	Handle,Front Mount,Esp-124	401899	1
7.	Latch Rod Assy,A5-31-480-10	400903	2
8.	Washer, Plain Steel Type A,Sae	100220.08.00	2
9.	Hinge Wldmt, M8	3.1301.050.006	4
10.	Washer,Lock,Metric	100240.08	8
11.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.16	8
12.	Washer,Plain,Metric	100239.06	4
13.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.20	4
14.	Nut,Poly Insert,Full,Class 10	100136.06	4
15.	Cpscr, Hex Soc. Head, Metric	100020.08.35	2
16.	Nut,Poly Insert,Full,Class 10	100136.08	2



Columbia Palletizer Parts

GUARD PANEL ASSEMBLY No. 3.2800.710.006

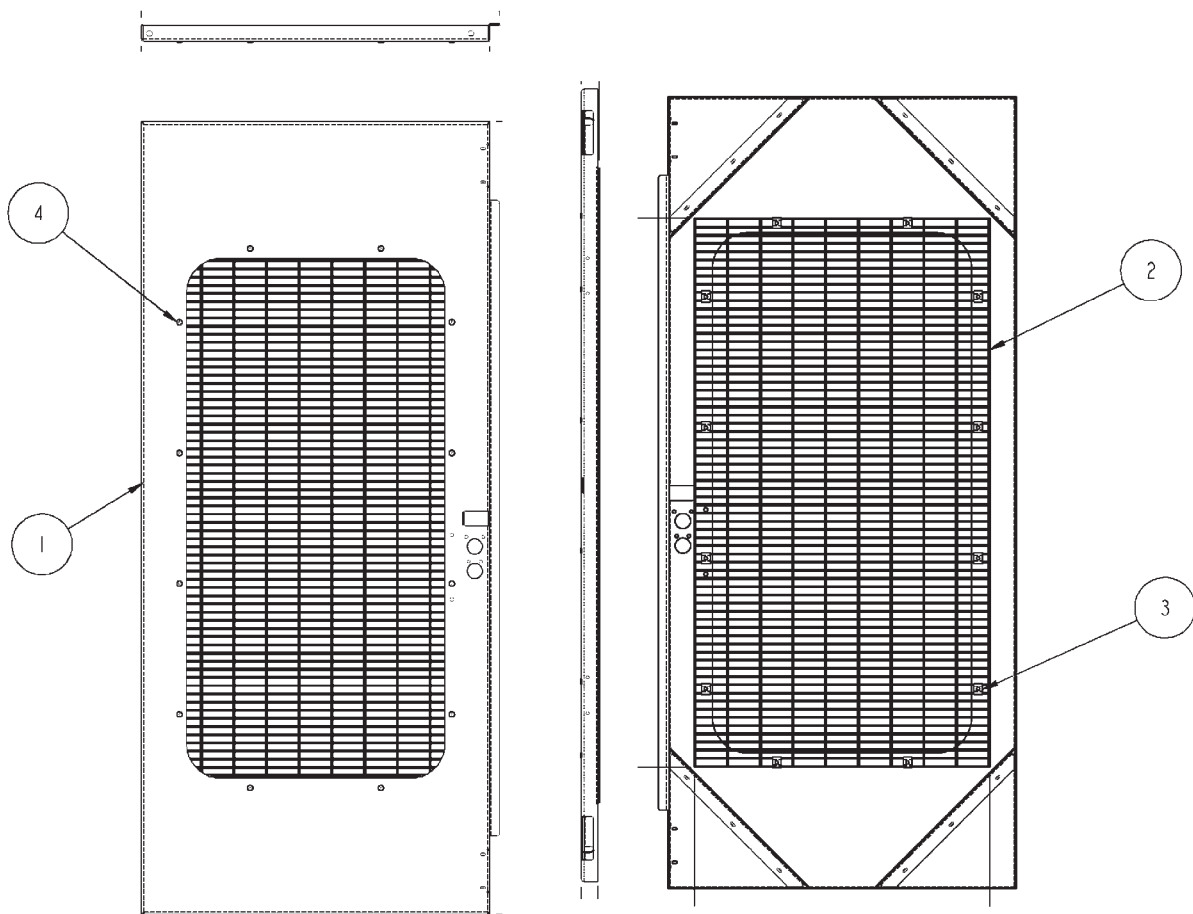
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Door Wldmt,Latch,32.00X72.75,S	3.2800.711.006	1
2.	Wldwre,3X3/4,27.00X50.25	901104.026	1
3.	Panel Clip,Welded Wire,.75"	4850860	12
4.	Rivets, Pop, .250 X .805	100271.86	12



Columbia Palletizer Parts

GUARD PANEL ASSEMBLY No. 3.2800.700.005

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Door Wldmt,Latch,34.63X72.75	3.2800.711.005	1
2.	Wldwre,3X3/4,27.00X50.25	901104.026	1
3.	Panel Clip,Welded Wire,.75"	4850860	12
4.	Rivets, Pop, .250 X .805	100271.86	12



No. 3.0020.560.002

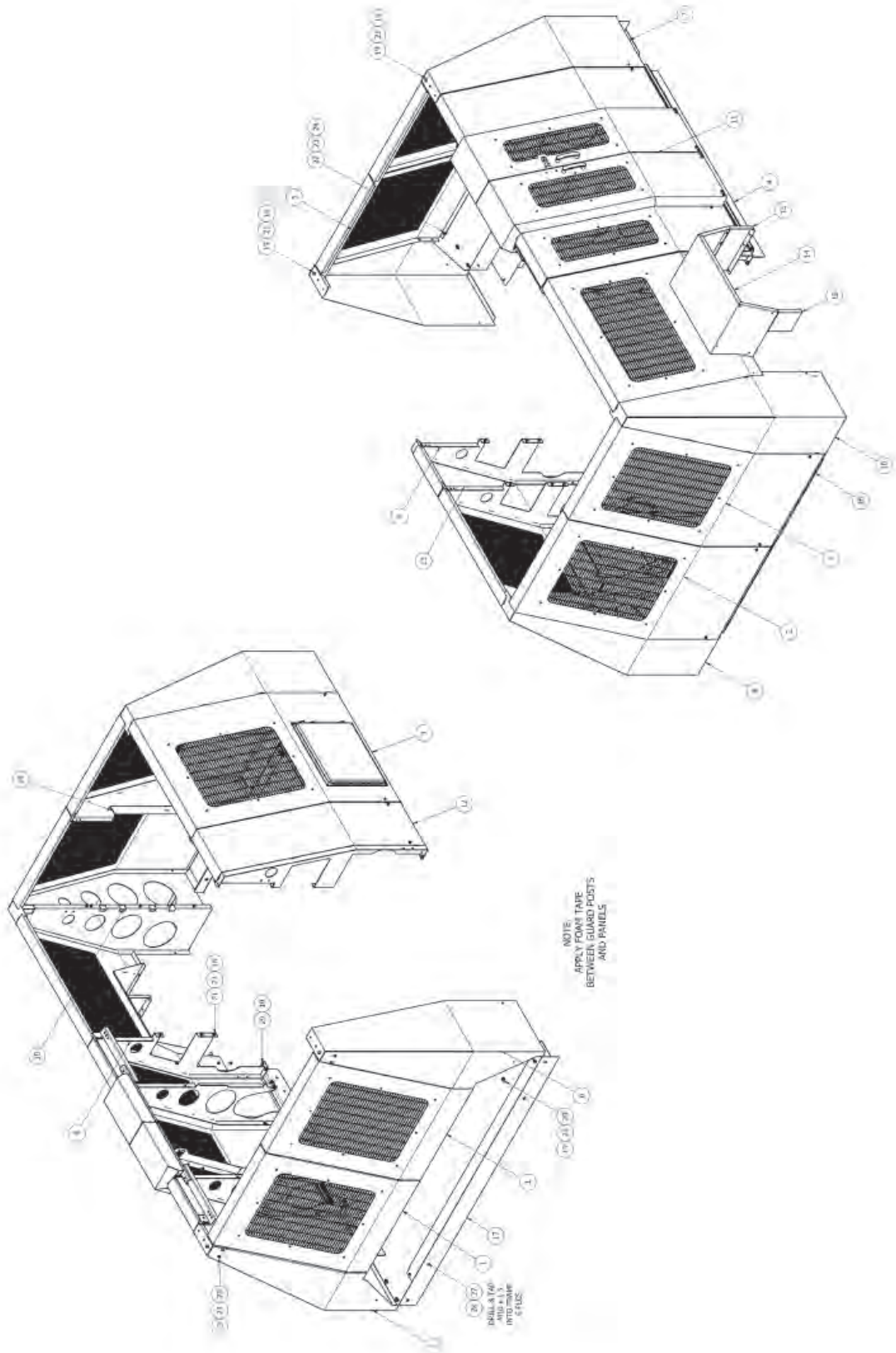
Exploded view diagram of the MBob Mount assembly. The diagram shows the following components and their assembly sequence:

- 1**: MBob Mount base plate.
- 2**: Mounting bracket.
- 3**: Two long mounting screws.
- 4**: Two shorter mounting screws.
- 5**: Mounting nut.
- 6**: Mounting pin.
- 7**: Two small mounting screws.
- 8**: Two small mounting screws.
- 9**: Two small mounting screws.

Labels in the diagram:

- REFERENCE MBOB MOUNT
- REFERENCE FORTRESS SWITCH

GUARD ASSEMBLY, UPPER, HL4200
No. 3.3260.400.01r5



Columbia Palletizer Parts

GUARD ASSEMBLY, UPPER, HL4200

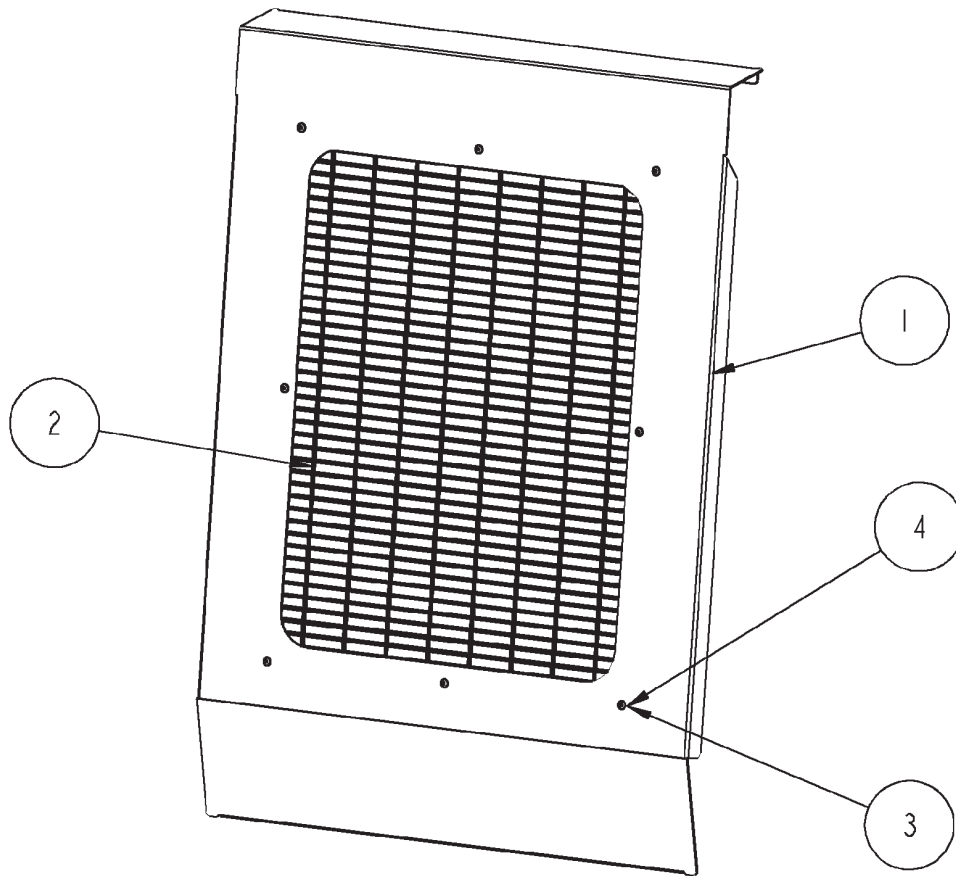
No. 3.3260.400.015

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	End Cover Assy,35.5, Front	3.2860.411	2
2.	Sidecover Assy, 36 Inch	3.2860.1012.002	2
3.	Aux Pnl Mount,Mesh,20X24,Lh	3.2860.659.010	1
4.	Slider Door Pltfrm,Formed	3.3149.047.006	1
5.	Corner Guard Brace, Upper	3.2860.422	1
6.	Corner Guard,Rh	3.2860.418.014	1
7.	Corner Guard,Lh	3.2860.419.014	1
8.	Guard Post Wldmt, Lt	3.2860.401.005	2
9.	Corner Post Wldmt,HL4200,Rh	3.2860.680.003	1
10.	Corner Post Wldmt,HL4200,Lh	3.2860.681.003	1
11.	Slider Door Assy,18-18,Spl	3.2860.675.017	1
12.	Sidecover Assy, 16.56 Inch	3.2860.1012.006	1
13.	Guard Post Wldmt, Spl	3.2860.401.006	1
14.	Infeed Tunnel Assy,HL4200	3.2860.690.008	1
15.	Tunnel Lower Filler,Rh,HL4200	3.2860.968.002	1
16.	Tunnel Lower Filler,Lh,HL4200	3.2860.969.003	1
17.	Front Cover Panel,HL4200	3.2860.993.001	1
18.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	23
19.	Washer, Plain, Metric	100239.1	35
20.	Cpscr,Button Hd,Metric	100005.10.25	8
21.	Nut,Poly Insert,Full,Class 10	100136.1	34
22.	Washer, Plain, Metric	100239.08	4
23.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.20	4
24.	Nut,Poly Insert,Full,Class 10	100136.08	4
25.	Guard Post Wldmt,HL6200,Rear	3.2860.668	1
26.	Slider Door Pltfrm,Formed	3.3149.047.005	1
27.	Washer,Lock,Metric	100240.1	6
28.	Cpscr, Button Hd, Metric	100005.10.16	6
29.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.16	4
30.	Foam Tape,3/16Tk X 3/4 W	454386	3
99.	Receptacle1/4Turn,85-47-101-15	400155	12

Columbia Palletizer Parts

END COVER ASSEMBLY, FRONT No. 3.2860.411

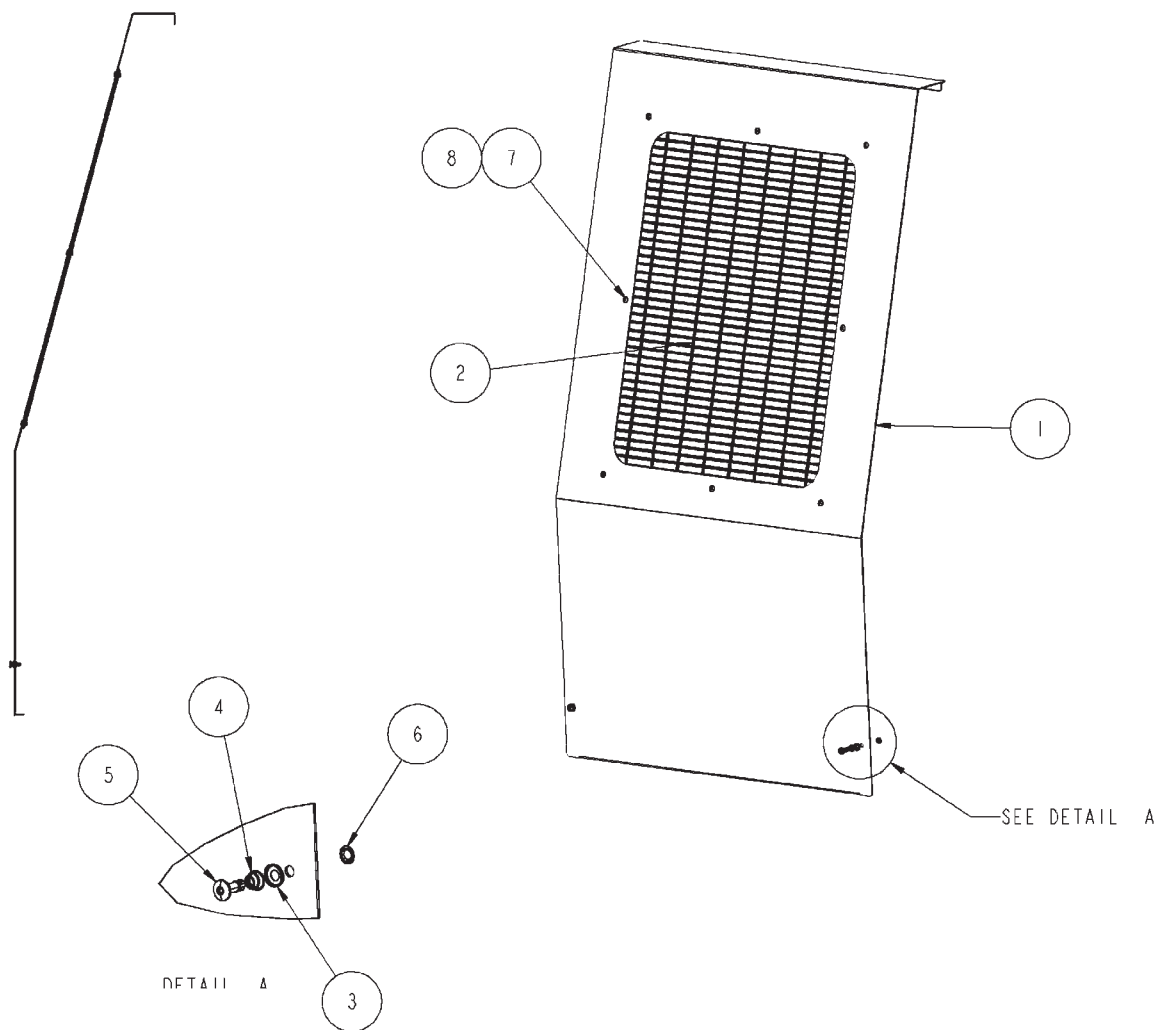
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Endcover, 35.5	3.2860.416	1
2.	Wldwre,3X3/4,27.00X33.00	901104.071	1
3.	Panel Clip,Welded Wire,.75"	4850860	8
4.	Rivets, Pop, .250 X .805	100271.86	8



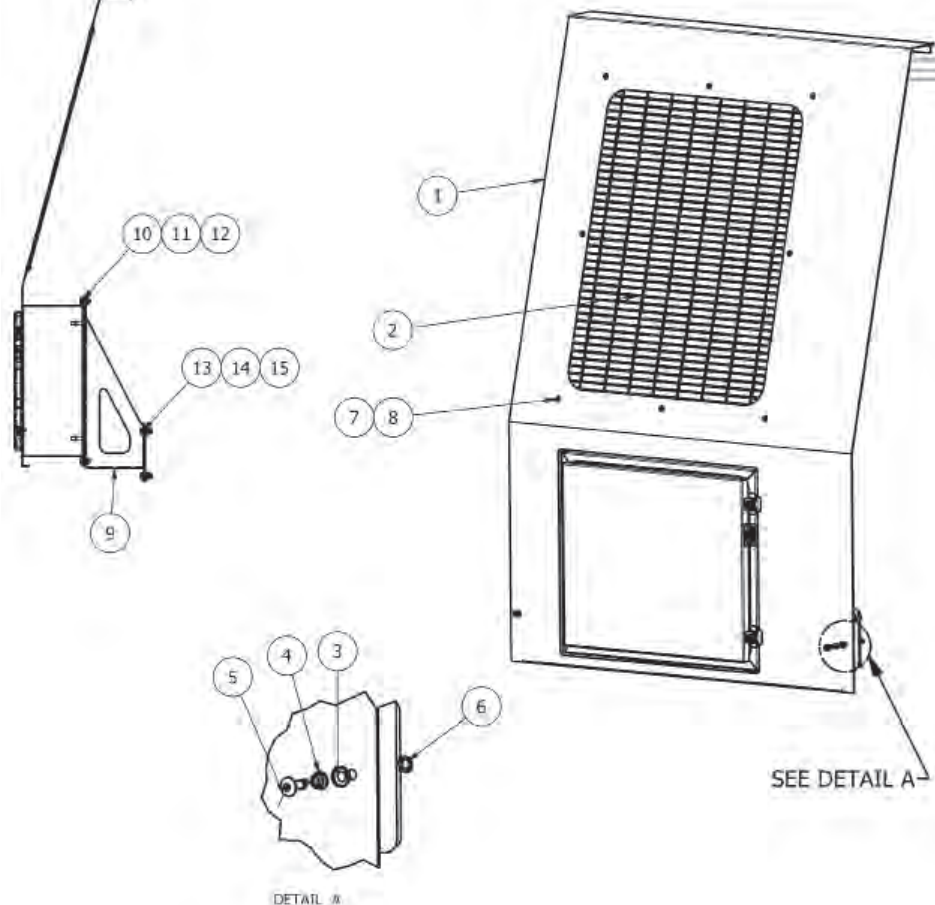
Columbia Palletizer Parts

SIDECOVER ASSEMBLY No. 3.2860.1012.002

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sidecover ,36 Inch	3.2860.1013.002	1
2.	Wldwre,3X3/4,27.00X33.00	901104.071	1
3.	Washer,Nylon Wear,85-46-101-41	400154	2
4.	Ejector Spring,14-18-150-24	400150	2
5.	Stud,1/4 Turn,85-78-420-16	4001523	2
6.	Retainer,1/4 Turn,85-34-201-20	4001522	2
7.	Panel Clip,Welded Wire,.75"	4850860	8
8.	Rivets, Pop, .250 X .805	100271.86	8

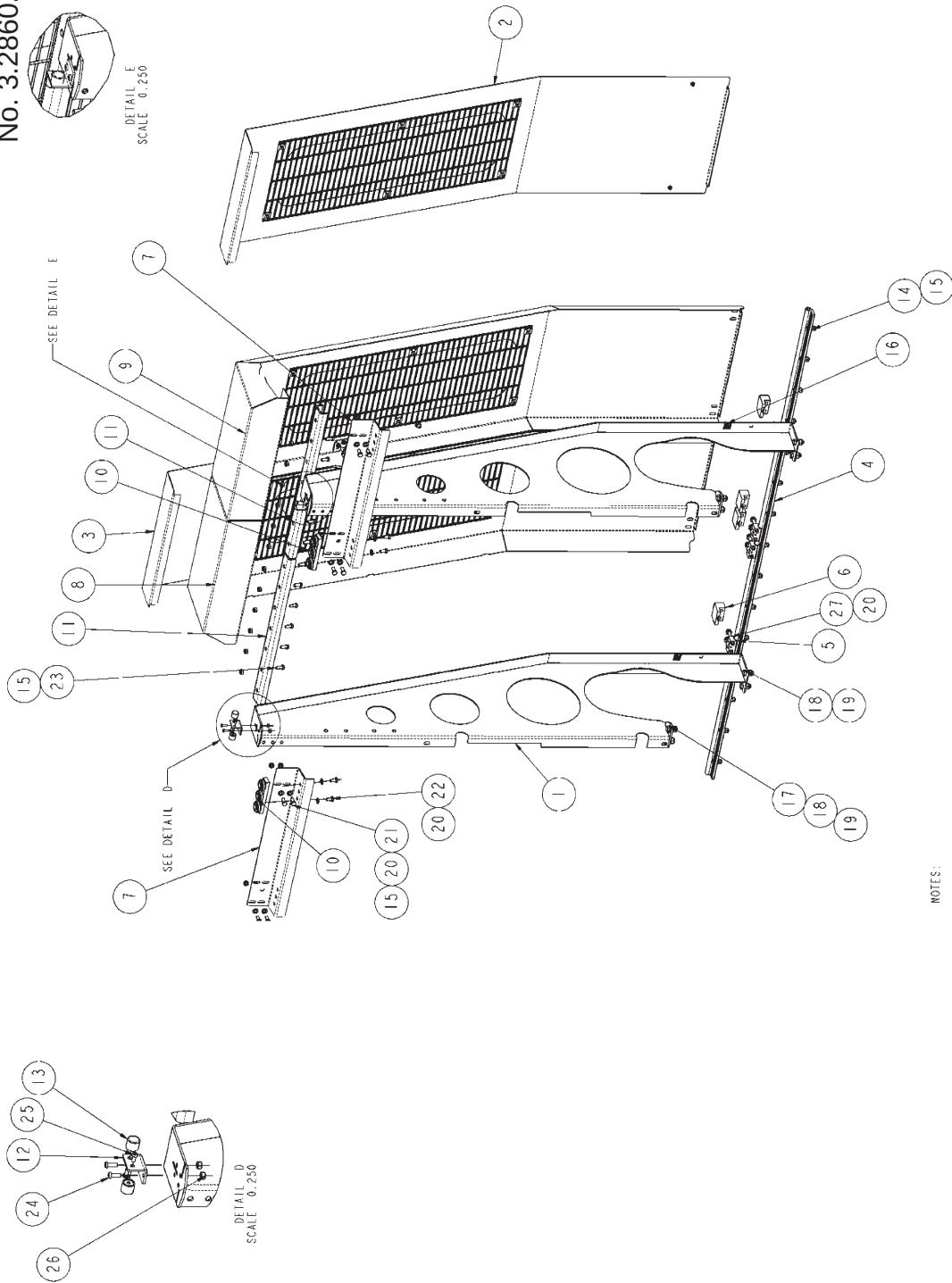


No. 3.2860.659.010



Columbia Palletizer Parts

SLIDER DOOR ASSEMBLY, 18-18 No. 3.2860.675.017



Columbia Palletizer Parts

SLIDER DOOR ASSEMBLY, 18-18 No. 3.2860.675.017

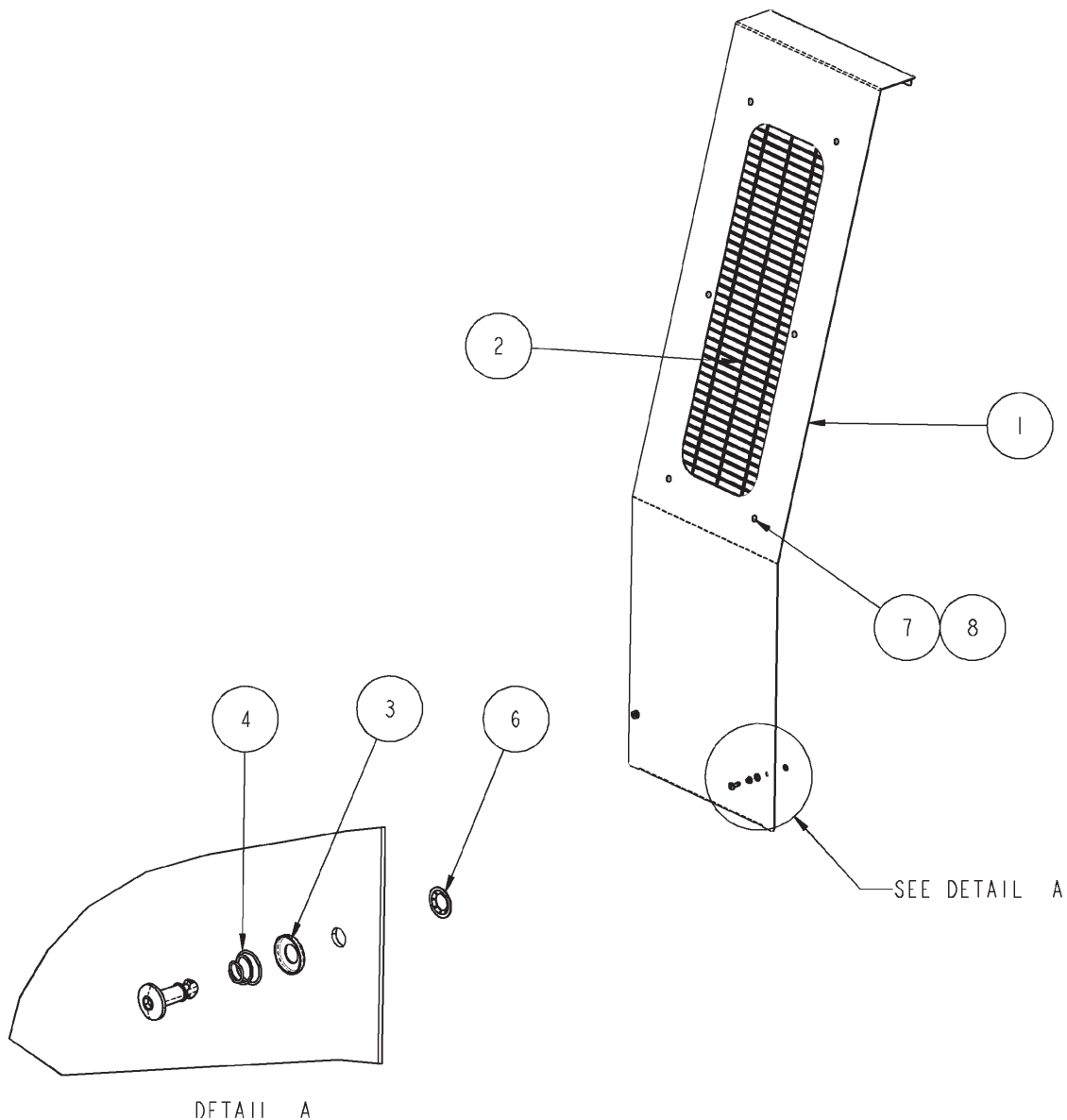
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Guard Post Wldmt	3.2860.402.002	2
2.	Sidecover Assy, 18 Inch	3.2860.1012.001	1
3.	Sidecover Assy, 18 Inch	3.2860.1012.009	1
4.	Linear Rail,Ws-16-1800,Igus	414935	1
5.	Lin Rail,Brg,Wjrm-01-16	414931	4
6.	Sliding Door Spacer	3.2860.420	4
7.	Door Slide Mount,18	3.2860.958.003	2
8.	Slider Door Assy, Rh,Rollon	3.2860.409.007	1
9.	Slider Door Assy, Lh,Rollon	3.2860.410.007	1
10.	Slider,Rollon,Cesu45-120-2Z	414863	2
11.	Rail,Rollon,Ues45-0560	414864	2
12.	Door Slider End Stop	3.2860.957	2
13.	Bumper,Threaded M6 X 1.0	454234	4
14.	Cpscr, Hex Soc. Head, Metric	100020.08.20	15
15.	Nut,Poly Insert,Full,Class 10	100136.08	35
16.	Receptacle1/4Turn,85-47-101-15	400155	4
17.	Washer, Plain, Metric	100239.1	4
18.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	8
19.	Nut,Poly Insert,Full,Class 10	100136.1	8
20.	Washer, Plain, Metric	100239.08	20
21.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.20	8
22.	Cpscr,Hex Head,Metric,Gd 8.8	100019.08.16	4
23.	Cpscr,Button Hd,Metric	100005.08.20	12
24.	Cpscr,Button Hd,Metric	100005.05.16	4
25.	Cpscr,Button Hd,Metric	100005.05.12	4
26.	Nut,Poly Insert,Full,Class 10	100136.06	4
27.	Cpscr, Hex Soc. Head, Metric	100020.08.60	8

Columbia Palletizer Parts

SIDECOVER ASSEMBLY

No. 3.2860.1012.001

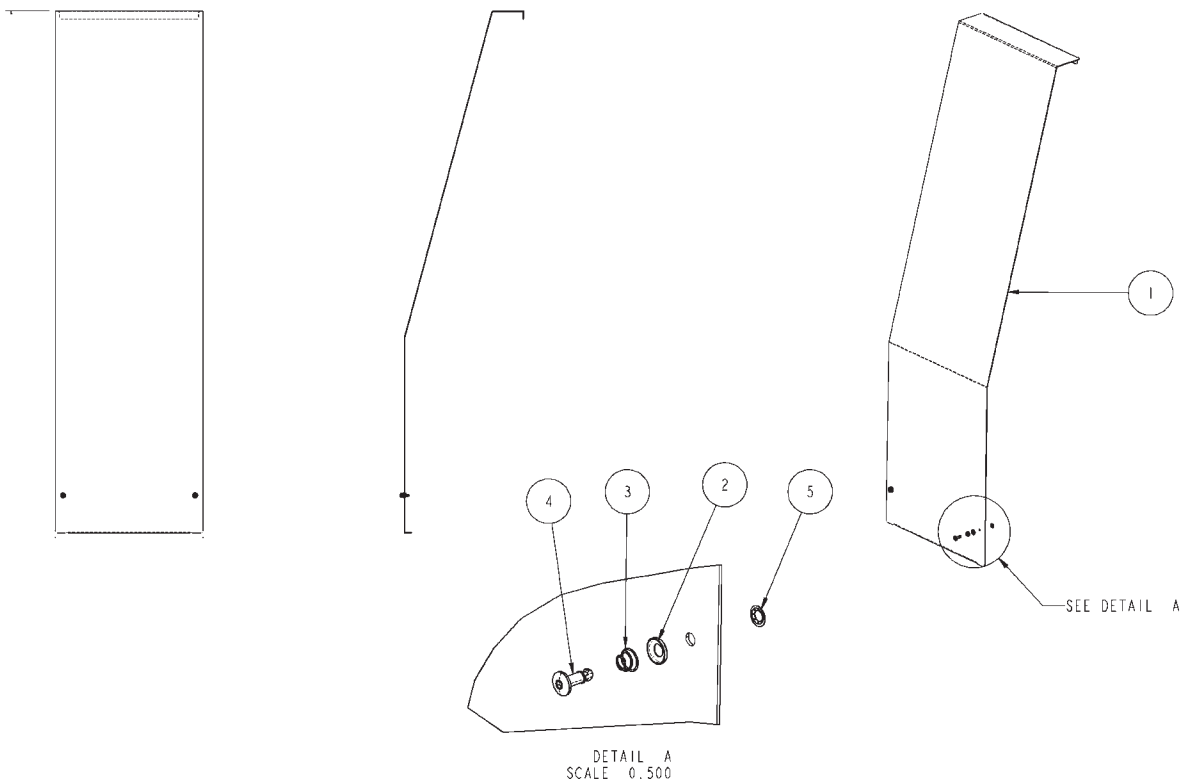
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sidecover ,18 Inch	3.2860.1013.001	1
2.	Wldwre,3X3/4,12.00X33.00	901104.096	1
3.	Washer,Nylon Wear,85-46-101-41	400154	2
4.	Ejector Spring,14-18-150-24	400150	2
5.	Stud,1/4 Turn,85-78-420-16	4001523	2
6.	Retainer,1/4 Turn,85-34-201-20	4001522	2
7.	Panel Clip,Welded Wire,.75"	4850860	6
8.	Rivets, Pop, .250 X .805	100271.86	6



Columbia Palletizer Parts

SIDECOVER ASSEMBLY No. 3.2860.1012.009

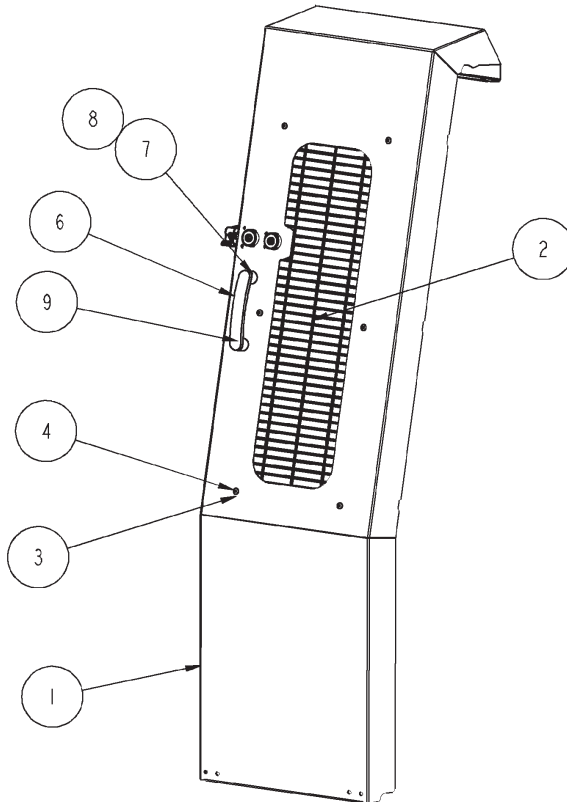
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sidecover ,18 Inch	3.2860.1013.009	1
2.	Washer,Nylon Wear,85-46-101-41	400154	2
3.	Ejector Spring,14-18-150-24	400150	2
4.	Stud,1/4 Turn,85-78-420-16	4001523	2
5.	Retainer,1/4 Turn,85-34-201-20	4001522	2



Columbia Palletizer Parts

SLIDER DOOR ASSEMBLY, RH, ROLLON No. 3.2860.409.007

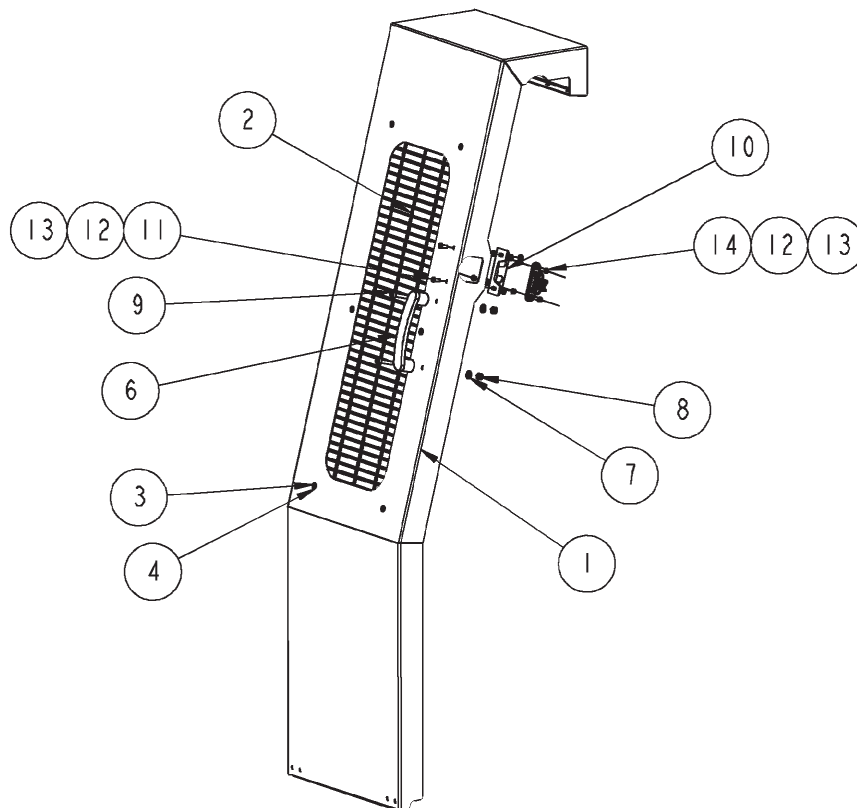
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Slider Door, Rh,Rollon	3.2860.414.005	1
2.	Wldwre,3X3/4,12.00X33.00	901104.096	1
3.	Panel Clip,Welded Wire,.75"	4850860	6
4.	Rivets, Pop, .250 X .805	100271.86	6
6.	Handle,Front Mount,Esp-124	401899	1
7.	Washer, Plain, Metric	100239.08	2
8.	Nut,Poly Insert,Full,Class 10	100136.08	2
9.	Cpscr, Hex Soc. Head, Metric	100020.08.35	2



Columbia Palletizer Parts

SLIDER DOOR ASSEMBLY, LH, ROLLON No. 3.2860.410.007

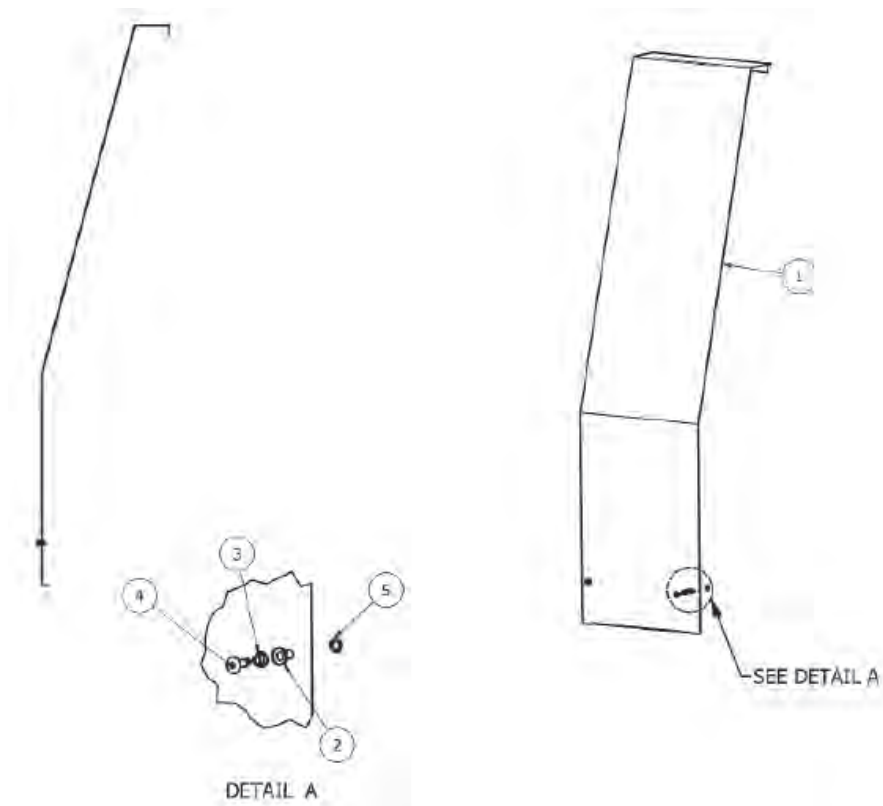
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Slider Door, Lh, Rollon	3.2860.415.005	1
2.	Wldwre, 3X3/4, 12.00X33.00	901104.096	1
3.	Panel Clip, Welded Wire, .75"	4850860	6
4.	Rivets, Pop, .250 X .805	100271.86	6
6.	Handle, Front Mount, Esp-124	401899	1
7.	Washer, Plain, Metric	100239.08	2
8.	Nut, Poly Insert, Full, Class 10	100136.08	2
9.	Cpscr, Hex Soc. Head, Metric	100020.08.35	2
10.	Fortress Dm-C Mount 1	3.2860.423.001	1
11.	Cpscr, Button Hd, Metric	100005.06.16	2
12.	Washer, Plain, Metric	100239.06	4
13.	Spec, Nut, Poly Insert Full, Met	100136	4
14.	Cpscr, Button Hd, Metric	100005.06.20	2



Columbia Palletizer Parts

SIDECOVER ASSEMBLY No. 3.2860.1012.006

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sidecover, 16.56 Inch	3.2860.1013.006	1
2.	Washer,Nylon Wear,85-46-101-41	400154	2
3.	Ejector Spring,14-18-150-24	400150	2
4.	Stud,1/4 Turn,85-78-420-16	4001523	2
5.	Retainer,1/4 Turn,85-34-201-20	4001522	2

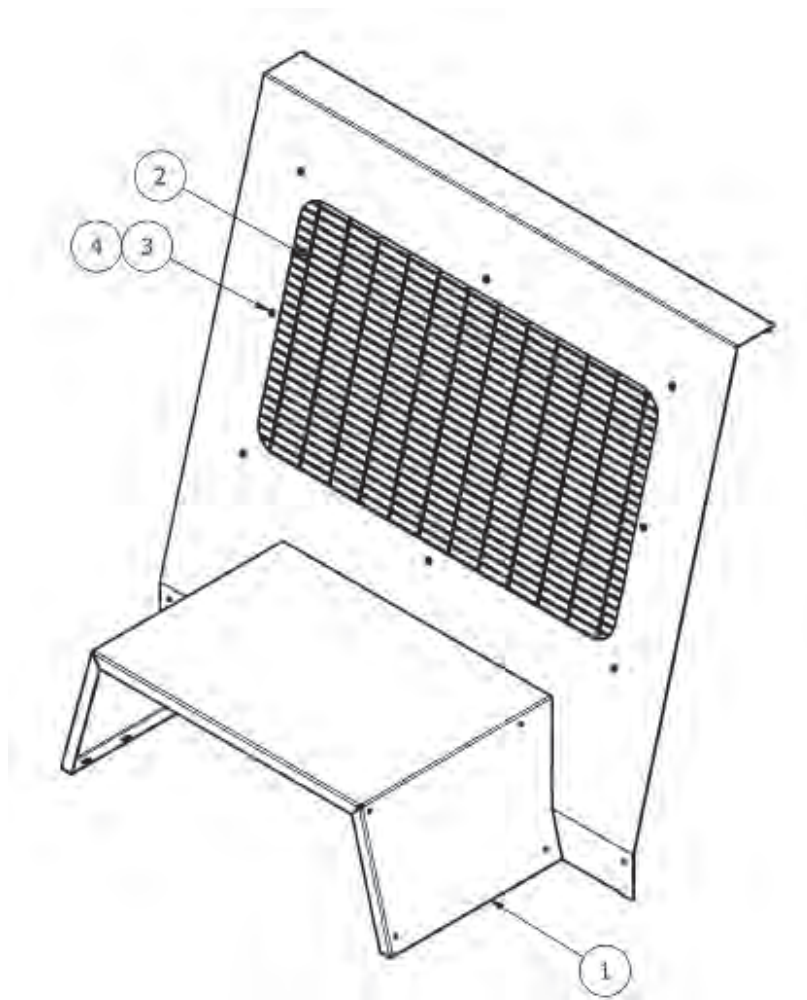


Columbia Palletizer Parts

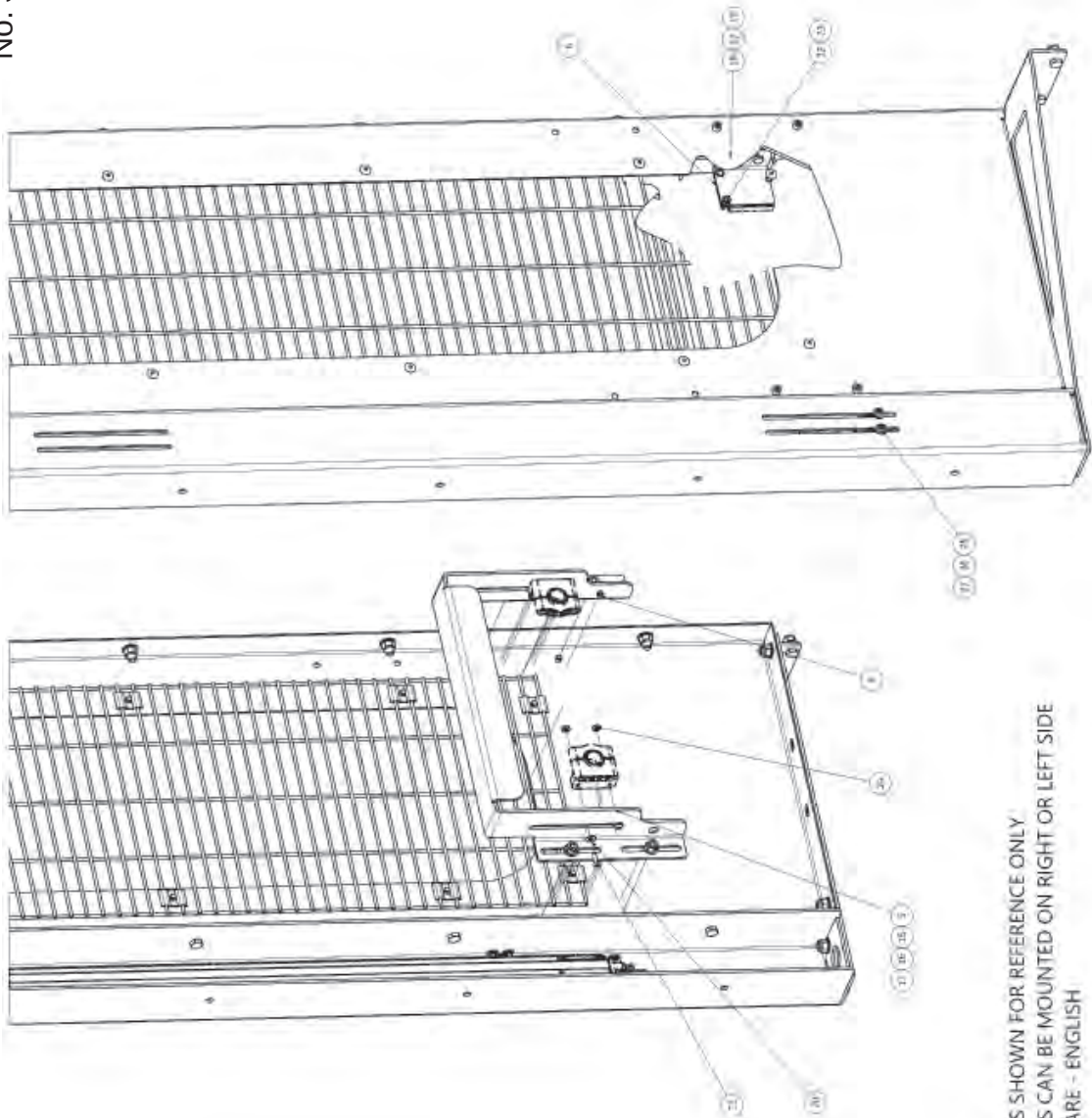
INFEED TUNNEL ASSEMBLY

No. 3.2860.690.008

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Tunnel Wldmt, HI4200	3.2860.686.009	1
2.	Wldwre,3X3/4,39.00X23.25	901104.13	1
3.	Panel Clip,Welded Wire,.75"	4850860	8
4.	Rivets, Pop, .250 X .805	100271.86	8



DISCHARGE GUARD ASSEMBLY
No. 3.0020.622.035



- NOTES:
- 1) PHOTO EYES AND REFLECTORS SHOWN FOR REFERENCE ONLY
 - 2) PHOTO EYES AND REFLECTORS CAN BE MOUNTED ON RIGHT OR LEFT SIDE
 - 3) ALL IMPERIAL (INCH) HARDWARE - ENGLISH

Columbia Palletizer Parts

DISCHARGE GUARD ASSEMBLY

No. 3.0020.622.035

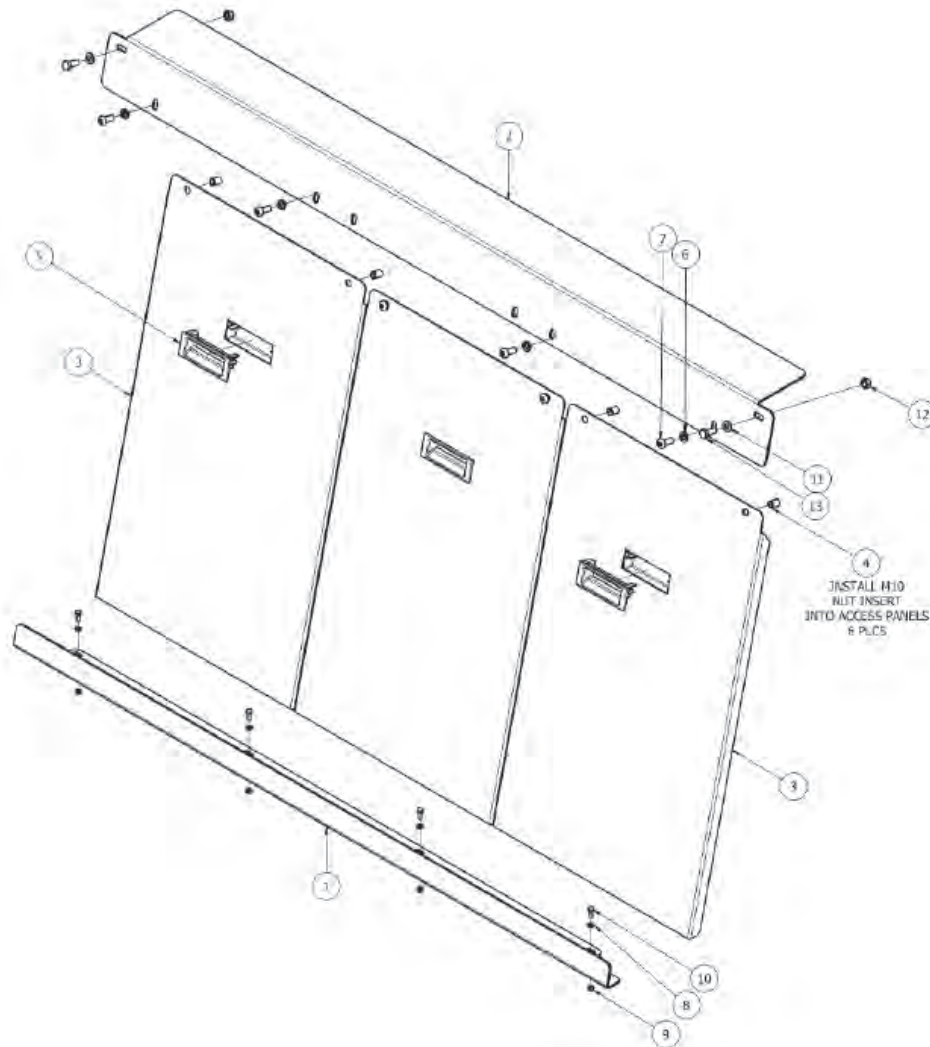
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Disch Wing Guard Panel,Formed	3.3090.181.001	2
2.	Disch Wing Gusset,Lh	3.2747.034.009	2
3.	Disch Wing Gusset,Rh	3.2747.035.009	2
4.	Light Curtain Guard Formed,65	3.2751.149.018	2
5.	Muting Pc Mnt,Std,Qs18 Pc	3.0020.620.004	2
6.	Pc #6 Reflector Mount	3.1186.949	2
7.	Wldwre,3X3/4,12.00X50.25	901104.029	2
8.	Cable Tie Mnt,3/16 Panel Thick	235482	2
9.	Panel Clip,Welded Wire,.75"	4850860	24
10.	Rivets, Pop, .250 X .805	100271.86	24
12.	Washer, Plain Steel Type A,Sae	100220.05.00	40
13.	Cpscr, Hex Head-Gd 5-18 Unc	100000.05.12	24
14.	Nut, Poly Ins Full Hgt-18 Unc	100160.05	40
15.	Washer, Plain Steel Type A,Sae	100220.04.00	8
16.	Cpscr, Socket Hd-20 Unc	100008.04.12	8
17.	Nut, Poly Ins Full Hgt-20 Unc	100160.04	12
18.	Cpscr, Hex Head-Gd 5-20 Unc	100000.04.12	4
19.	Washer,Plain Hardened Steel	100222.04	4
20.	Washer, Plain Steel Type A	100220.88	8
21.	Cpscr, Button Hd-32 Unc	100006.88.08	4
22.	Nut, Poly Inst Thin Hgt-32 Unc	100162.88	4
23.	Cpscr, Button Hd-32 Unc	100006.88.10	4
24.	Nut, Hex Mach Screw-32 Unc	100146.88	4
25.	Washer, Plain Steel Type A	100220.9	16
26.	Cpscr, Socket Hd-32 Unf,Plated	100009.90.12P	8
27.	Nut,Poly Ins Full Hgt,10-24Unc	100160.9	8
28.	Cpscr, Hex Head-Gd 5-18 Unc	100000.05.14	16

Columbia Palletizer Parts

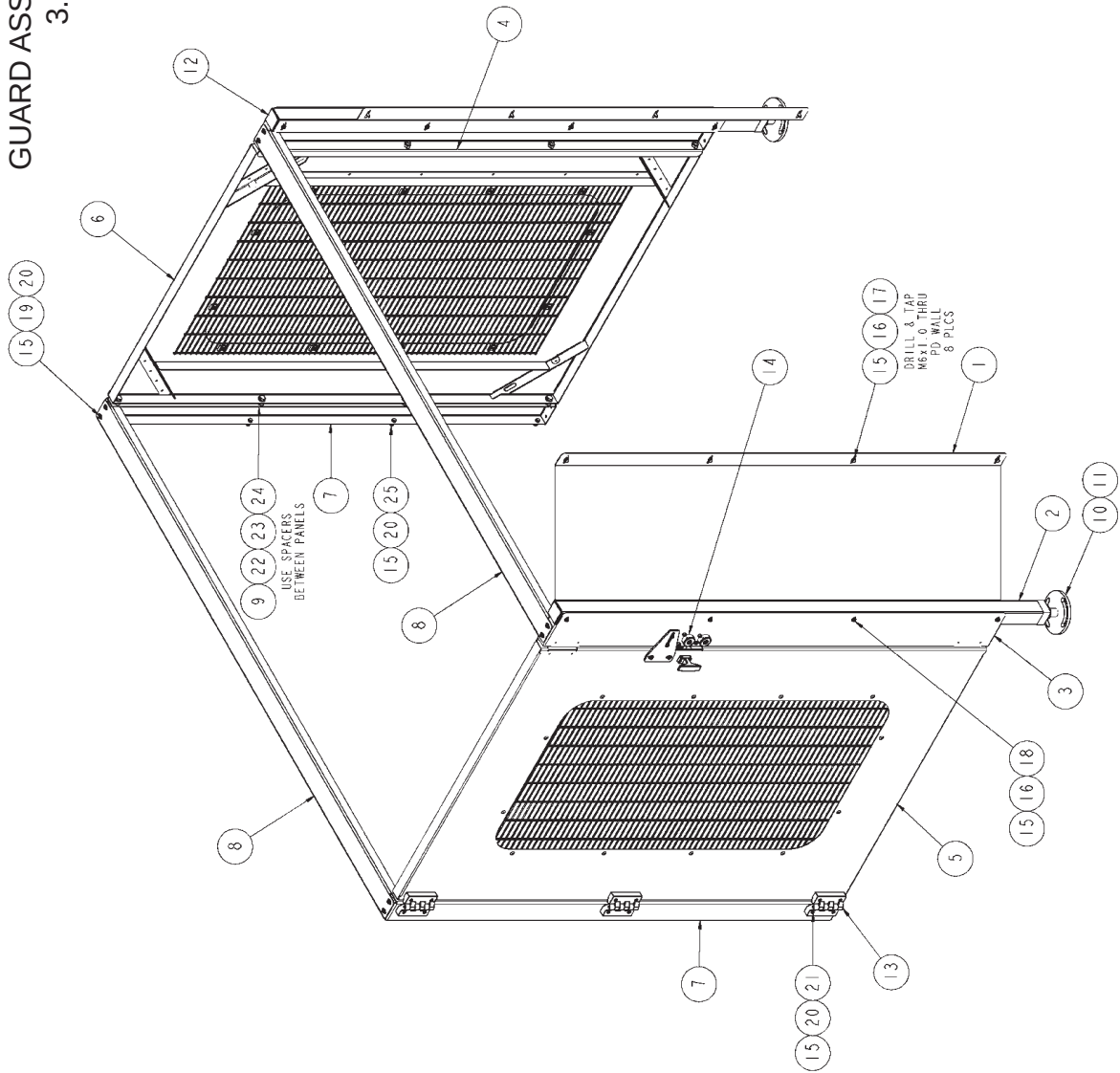
PANEL MOUNT KIT

No. 3.3260.330.002

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Drip Tray,Lower,X-Member	3.3260.331.002	1
2.	Drip Tray,Upper X-Member	3.3260.332.002	1
3.	Drip Tray Door Panel,Rh	3.3260.333.002	3
4.	Nut,Poly-Rivet,Metric,M10X1.5	1001791.1	6
5.	Handle,P1-30-101-11	401497	3
6.	Washer,Lock,Metric	100240.1	6
7.	Cpscr,Button Hd,Metric	100005.10.25	6
8.	Washer,Plain,Metric	100239.06	4
9.	Nut,Poly Insert,Full,Class 10	100136.06	4
10.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.16	4
11.	Washer, Plain, Metric	100239.1	2
12.	Nut,Poly Insert,Full,Class 10	100136.1	2
13.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	2



GUARD ASSEMBLY KIT, PD TO MF
3.3291.051.008



Columbia Palletizer Parts

GUARD ASSEMBLY KIT, PD TO MF

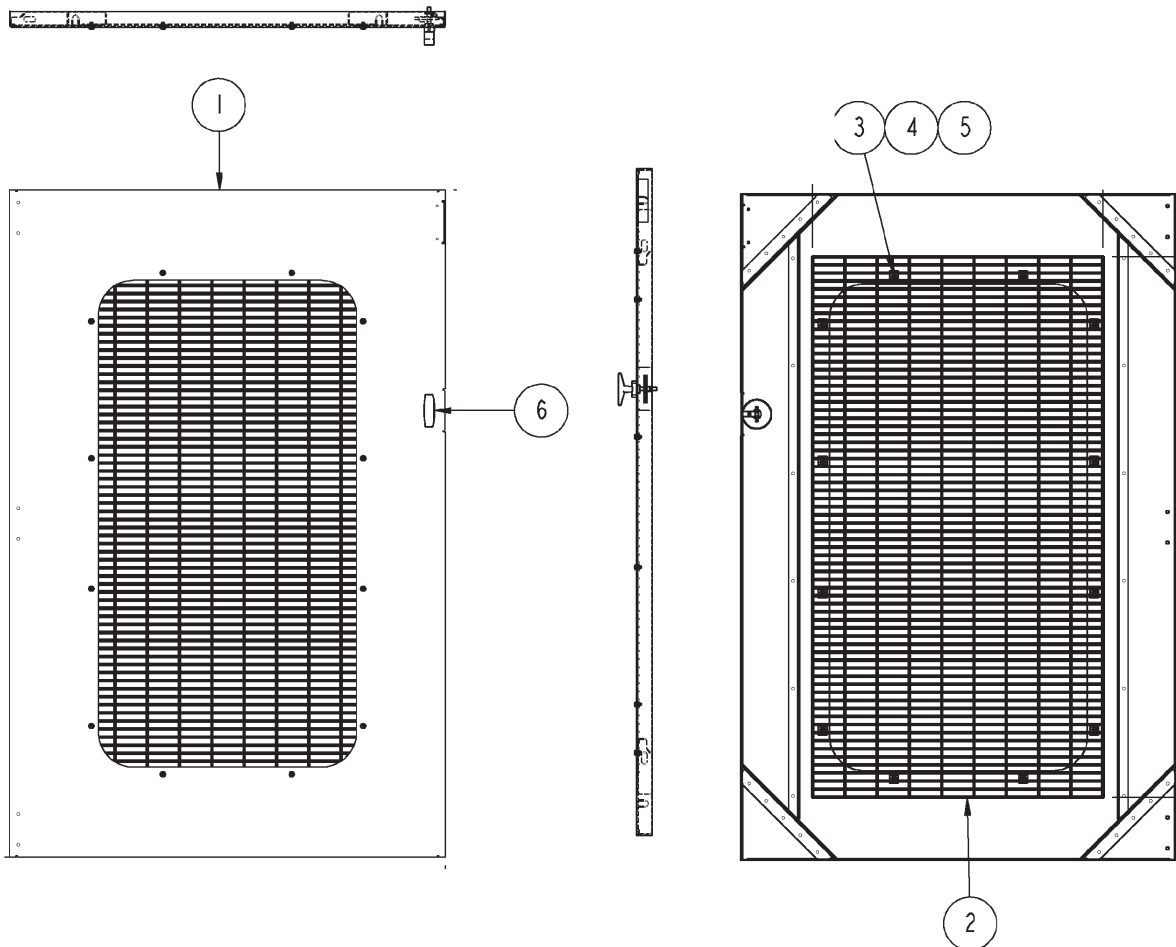
No. 3.3291.051.008

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Guard Panel,Pd To Sht Disp	3.2887.052.022	2
2.	Guard Tube,Wldmt,Metric	3.2837.045.009	2
3.	Door Latch Panel,Pd To Mf	3.2887.056.020	1
4.	Door Latch Panel,Pd To Mf	3.2887.056.021	1
5.	Door Panel Assy,Pd To Mf	3.2887.057.005	1
6.	Door Panel Assy,Pd To Mf	3.2887.057.010	1
7.	Hinge Panel Formed,Pd To Mf	3.2887.061.010	2
8.	X-Member,Header,Pd To Mf	3.2887.062.008	2
9.	Spacer,Rnd,12L14,.41,1.00,.38	901.041.100.038	8
10.	Anchor Bolt Wldmt,Metric	3.1706.046.003	2
11.	Nut, Hex Jam, Gd 04, Metric	100139.24	2
12.	Plug,2In Sq 11Ga Fp-321	334153	2
13.	Hinge, Vg-634Bb	486054	3
14.	Fortress Lock Kit	3.0020.560.001	1
15.	Washer,Plain,Metric	100239.06	52
16.	Washer,Lock,Metric	100240.06	24
17.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.16	8
18.	Cpscr, Button Hd, Metric	100005.06.10	16
19.	Cpscr,Button Hd,Metric	100005.06.16	8
20.	Nut,Poly Insert,Full,Class 10	100136.06	28
21.	Cpscr, Hex Soc. Head, Metric	100020.06.25	12
22.	Washer, Plain, Metric	100239.1	8
23.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.30	8
24.	Nut,Poly Insert,Full,Class 10	100136.1	8
25.	Cpscr,Hex Head,Metric,Gd 8.8	100019.06.20	8

Columbia Palletizer Parts

DOOR PANEL ASSEMBLY No. 3.2887.057.005

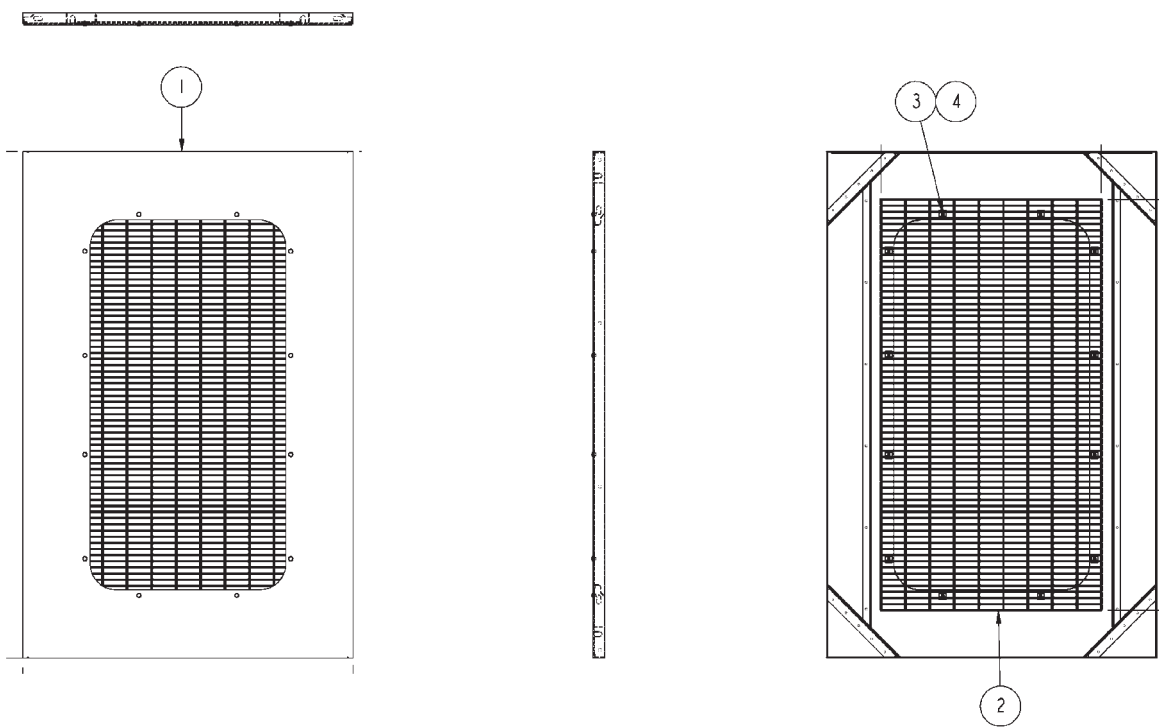
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Door Panel Weldmt,Pd To Mf	3.2887.058.005	1
2.	Weldwire,3X3/4 S-Slot,27X50.25	901104.026	1
3.	Panel Clip,Welded Wire,.75"	4850860	12
4.	Cpscr, Button Hd-20 Unc	100006.04.08	12
5.	Nut, Poly Inst Thin Hgt-20 Unc	100162.04	12
6.	T-Hand Latch E3-41-15	401475	1



Columbia Palletizer Parts

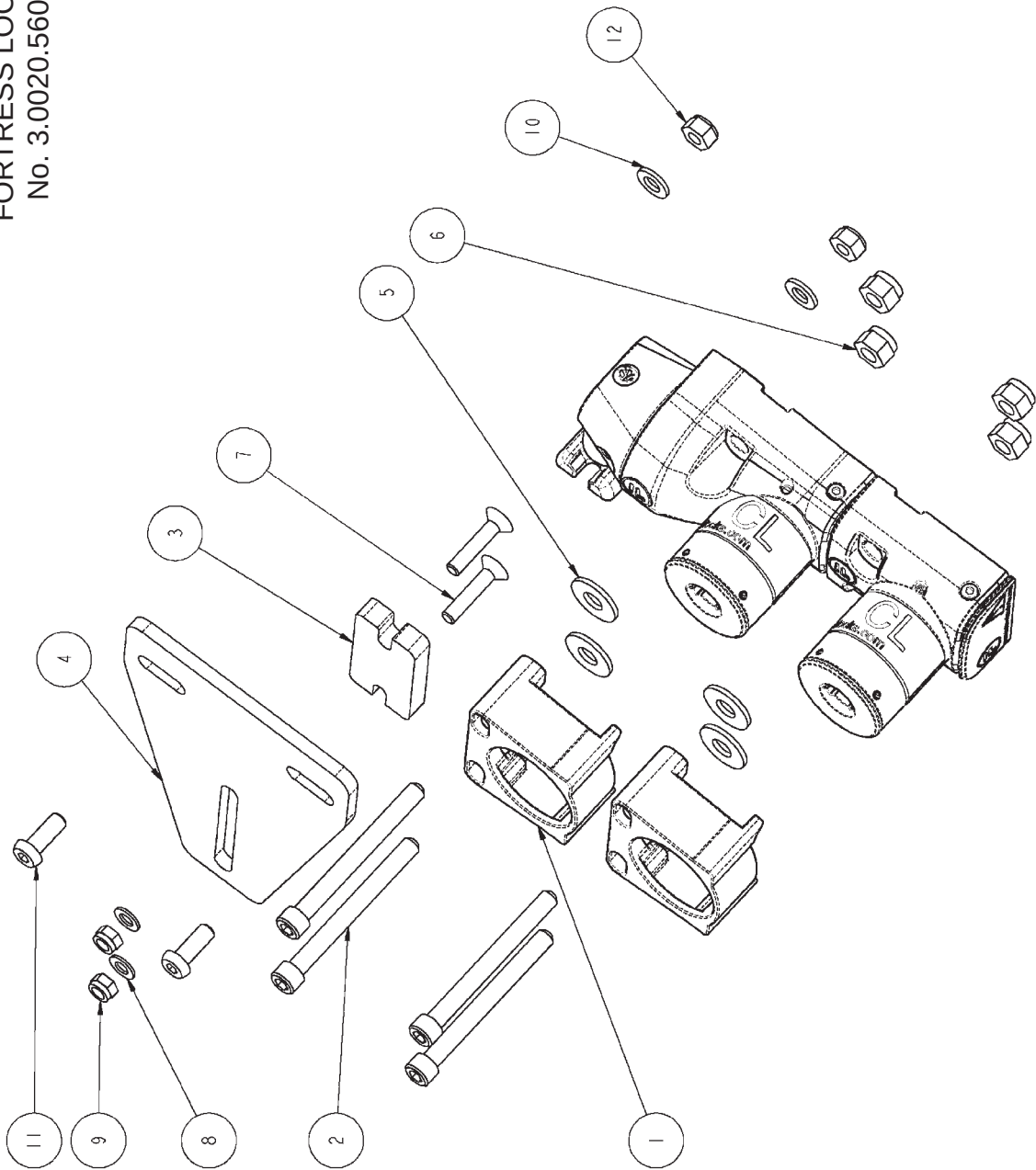
DOOR PANEL ASSEMBLY No. 3.2887.057.010

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Door Panel Weldmt,Pd To Mf	3.2887.058.010	1
2.	Wldwre,3X3/4,27.00X50.25	901104.026	1
3.	Panel Clip,Welded Wire,.75"	4850860	12
4.	Rivets, Pop, .250 X .805	100271.86	12



Columbia Palletizer Parts

FORTRESS LOCK KIT
No. 3.0020.560.001



Columbia Palletizer Parts

FORTRESS LOCK KIT

No. 3.0020.560.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Mount Kit,Fortress,Mbob	2358458	2
2.	Cpscr, Socket Hd-20 Unc	100008.04.40	4
3.	Spacer Plt,Fortress Dm-C Mount	3.2860.429.001	1
4.	Fortress Dm-C Mount 9	3.2860.423.009	1
5.	Washer, Plain Steel Type A	100220.04	4
6.	Nut, Poly Ins Full Hgt-20 Unc	100160.04	4
7.	Cpscr, Flat Ct'Snk, Metric	100021.05.25	2
8.	Washer,Plain,Metric	100239.05	2
9.	Nut,Poly Insert,Full,Class 10	100136.05	2
10.	Washer,Plain,Metric	100239.06	2
11.	Cpscr, Button Hd,Metric	100005.06.16	2
12.	Nut,Poly Insert,Full,Class 10	100136.06	2

Columbia Palletizer Parts

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SECTION 12

Pneumatic Piping
No. 3.3394.016

Page 1 Pneumatics
Page 2-3 Pneumatic Piping
Page 4-5 Pneumatic Piping List
Page 6 Pneumatic Piping (Sheet Dispenser Kit)

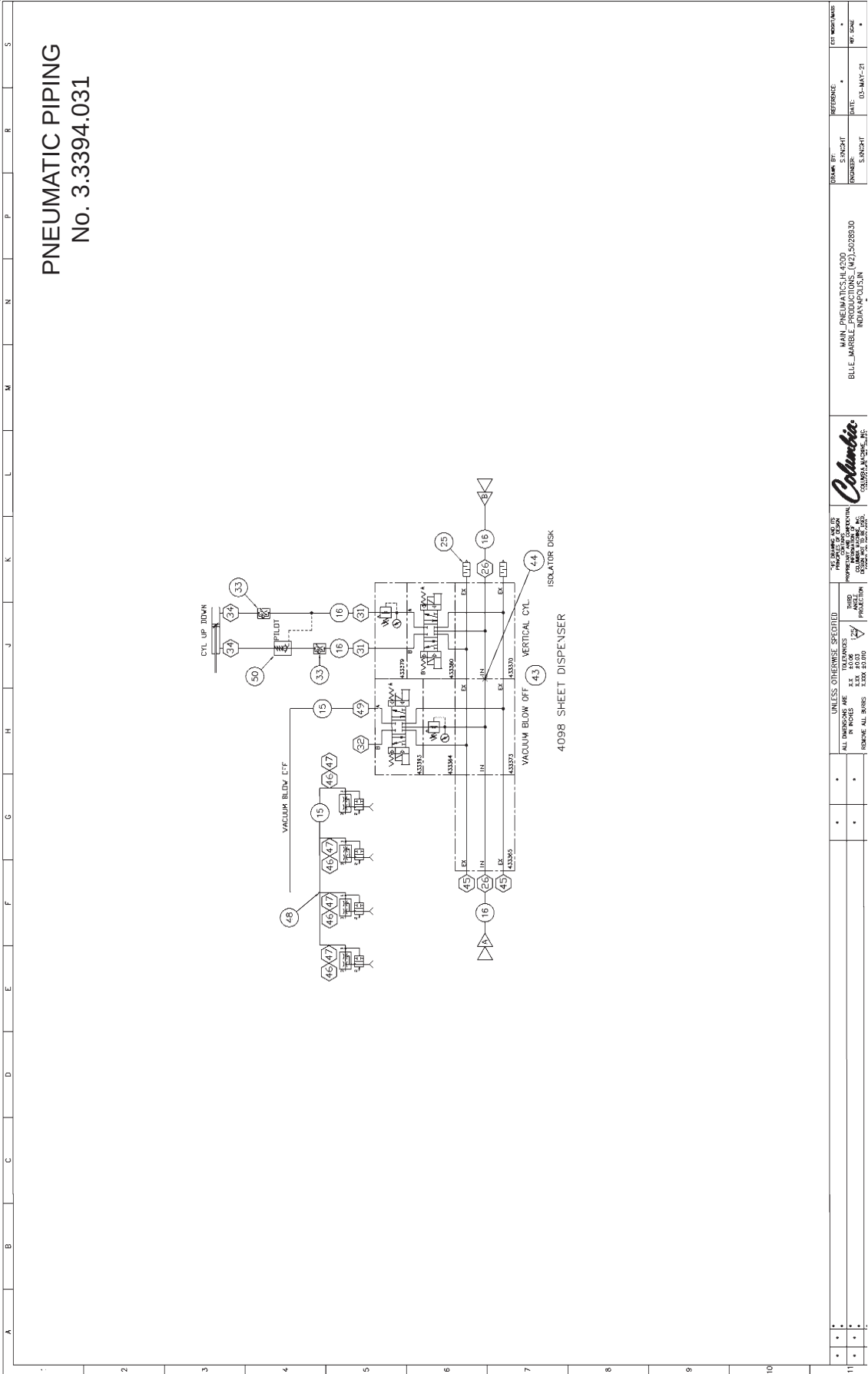
Columbia Palletizer Parts

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Columbia Palletizer Parts

PNEUMATICS
No. 3.3394.016

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	A/P,Blue Marble(L2),5028930	3.3394.031	1
2.	Air Prep Mount Wldmt	3.2200.633.002	1
3.	Bracket,Pressure Indicator	3.3107.040	1



Columbia Palletizer Parts

PNEUMATIC PIPING LIST

No. 3.3394.031

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Air Prep Unit, Festo Ms6, G1/2	362827	1
2.	End Plt Kit,M-92010-25-1P	433418	1
3.	Mfld,92B-000-Ek1-M1705-Sm16Sgl		433415 4
4.	Va,92B-Aab-000-Dm-Ddap-1Dm	433351	4
5.	Mfld,92B-000-Ek2-M1705-Sm16DbI		433416 1
6.	Va,92B-Kab-000-Dm-Ddap-1Dm	433396	1
7.	Reg,Pr92C-Pcba	433379	1
8.	Va,Flow Control,Fc-92B-Ba	433363	1
9.	Mfld,92B-000-Ek1,Sm16DbI,Pilot	433431	1
10.	Va,92B-Aab-000-Dm-Ddap-1Dma003		433430 1
11.	Isolator Kit,N-92018	433278	1
12.	Regulator,P32Ra14Bnmp	435056	1
13.	Angle Bracket,P32Ka00Mr	435059	1
14.	Tube,Poly,6Mm,Blue	392010.06	1000
15.	Tube,Poly,8Mm,Blue	392010.08	240
16.	Tube,Poly,10Mm,Blue	392010.1	480
17.	Tube,Poly,12Mm,Blue	392010.12	480
18.	Tube, Poly, 16Mm, Blue	392011.16	300
19.	Manifold,Bspp,G1/2,8-Way	3.3090.254.001	1
20.	Ftg,Tube,Qd,90,G1/2,16Mm	150488.08.16	2
21.	Ftg,Tube,Tee,12Mm	150535.12	2
22.	Ftg,Tube,Reducer,10Mm,12Mm	150537.10.12	1
23.	Ftg,Tube,Reducer,6Mm,12Mm	150537.06.12	1
24.	Ftg,Tube,Str,G3/8,12Mm	150530.06.12	1
25.	Muffler,Met,3/8Bspp,06740017	435006	6
26.	Ftg,Tube,Str,G3/8,10Mm	150530.06.10	3
27.	Ftg, Pipe-Steel Hex Soc Plug	150032.01	2
28.	Ftg,Tube,Str,M5,6Mm	150530.005.06	1
29.	Ftg,Tube,90,G1/4,10Mm	150531.04.10	2
30.	Ftg,Tube,Str,G1/4,6Mm	150530.04.06	4
31.	Ftg,Tube,Str,G1/4,10Mm	150530.04.10	9
32.	Ftg,Met,Bspp Hollow Hex Plug	150704.04	4
33.	Flow Cntrl,Inline,10Mm Od Tube	362804	4
34.	Ftg,Tube,90,G3/8,10Mm	150531.06.10	4
35.	Ftg,Tube,90,G1/4,8Mm	150531.04.08	6
36.	Muffler,Met,1/8Bspp,0674 00 10	435038	4
37.	Ftg,Tube,Y,8Mm	150536.08	2
38.	Ftg,Tube,Reducer,8Mm,10Mm	150537.08.10	2
39.	Ftg,Tube,Tee,10Mm	150535.1	1

Columbia Palletizer Parts

PNEUMATIC PIPING LIST

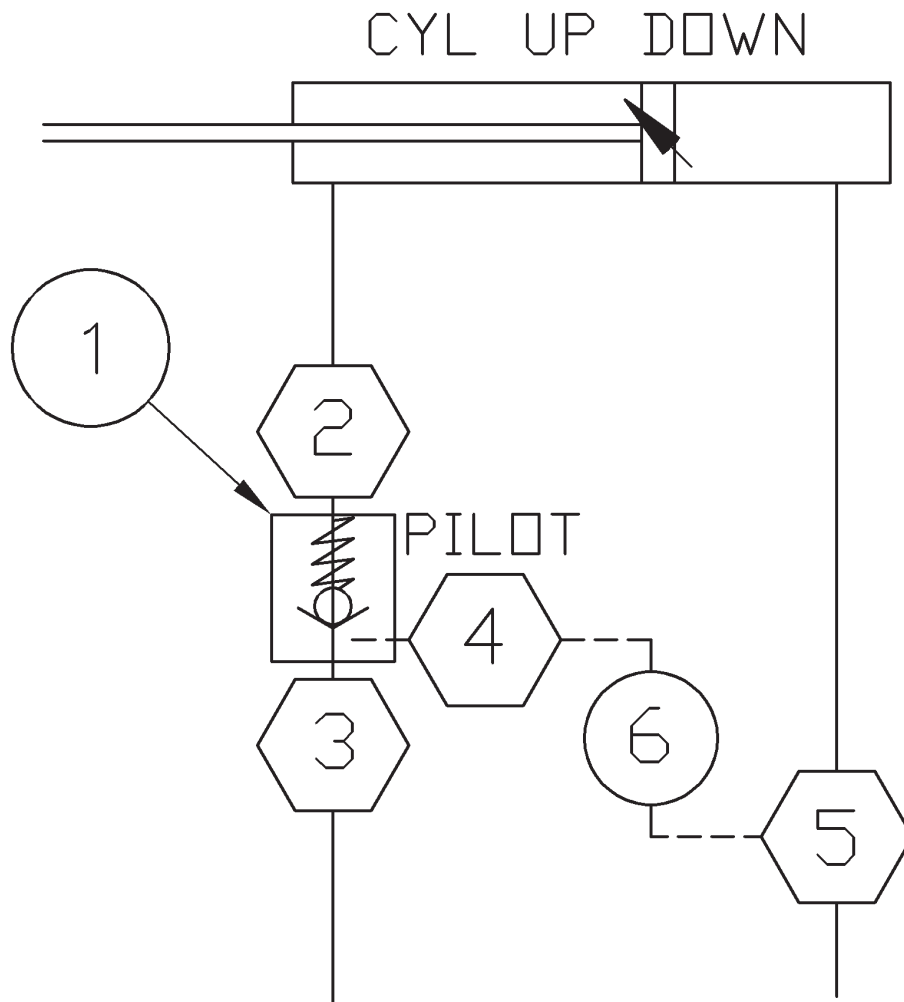
No. 3.3394.031

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
40.	Ftg, Tube, Qd, Str, G1/2, 10Mm	150483.08.10	3
41.	Ftg, Tube, Qd, Str, G1/2, 12Mm	150483.08.12	2
42.	Ftg, Met, Bspp Hollow Hex Plug	150704.08	4
43.	Va Bank, 597/2098/6098/8098Bsp	4320046	1
44.	Isolator Kit, N-92018	433278	1
45.	Ftg, Pipe-Steel Hex Soc Plug	150032.06	2
46.	Ftg, Tube-Br, Psh-On, Sw El Adpt	150334.02.04	4
47.	Ftg, Tube-Br, Psh-On, Sw Tee Adap	150342.02.04	4
48.	Ftg, Tube, Tee, 8Mm	150535.08	1
49.	Ftg, Tube, Str, G1/4, 8Mm	150530.04.08	1
50.	A/P, Po Check Kit, Sheet Disp	3.0061.139.001	1

Columbia Palletizer Parts

PNEUMATIC PIPING (Sheet Dispenser Kit) No. 3.0061.139.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Ftg, Check Va, G1/4, G1/8, Piloted	3360451	1
2.	Ftg, Tube, Str, G1/4F, 10Mm	1504830.04.10	1
3.	Ftg, Tube, Qd, Str, G1/4, 10Mm	150483.04.10	1
4.	Ftg, Tube, Str, G1/8, 6Mm	150530.02.06	1
5.	Ftg, Tube, Qd, Tee, 10Mm, 6Mm	150484.10.06	1
6.	Tube, Poly, 6Mm, Blue	392010.06	24



SECTION 13

Operator Platform
No. 3.3394.018

Page 1 Operator Platform Assembly List
Page 2-3 Operator Platform Assembly
Page 4-5 Stair Assemblies
Page 6 Curve Mount Kit

Columbia Palletizer Parts

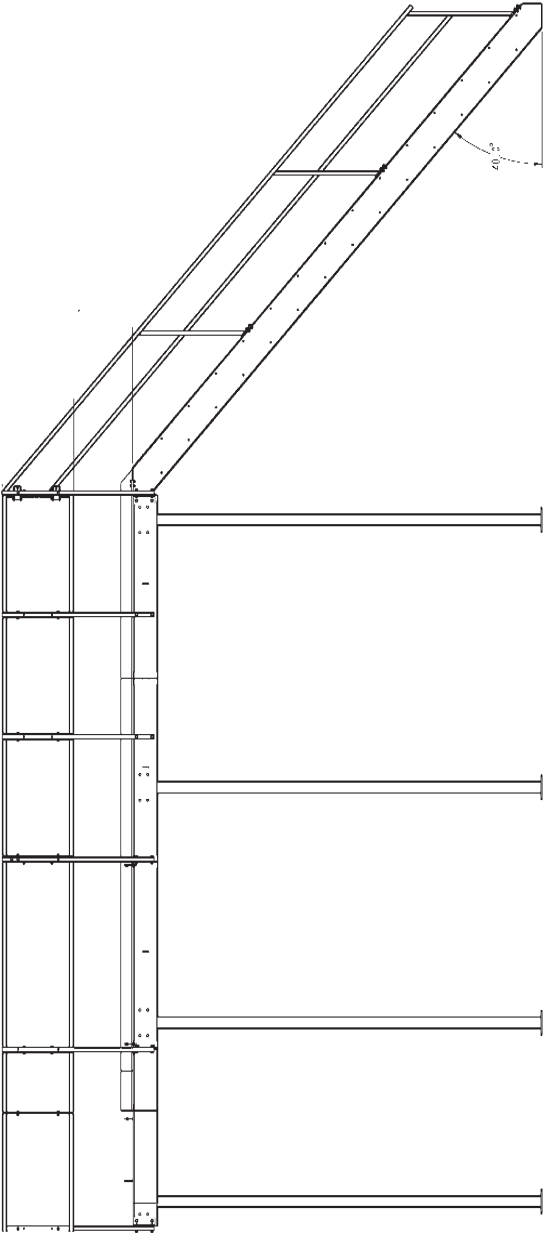
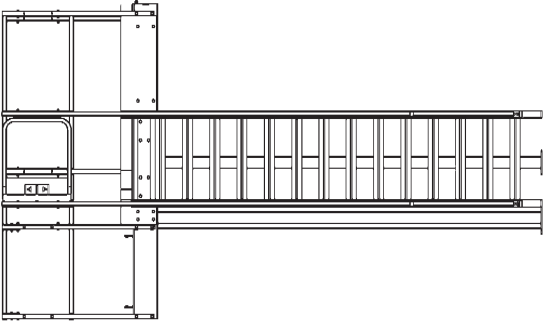
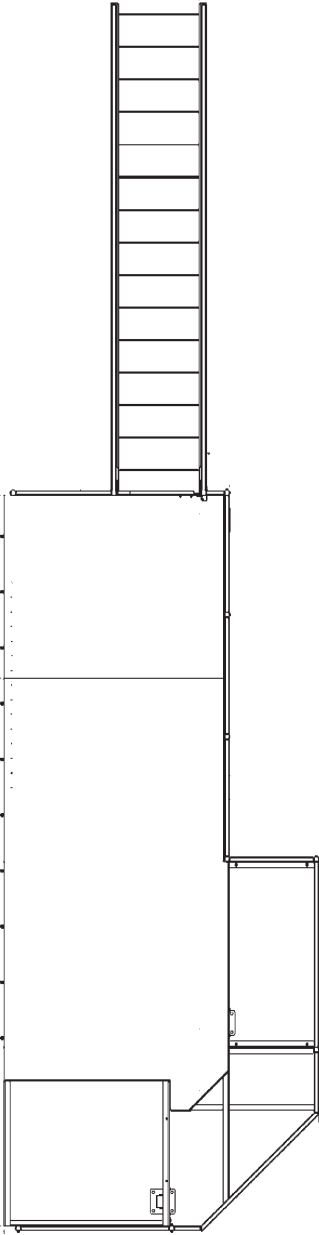
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Columbia Palletizer Parts

OPERATOR PLATFORM ASSEMBLY LIST No. 3.3394.018

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Op Platform, HI4200, Spl	3.3394.100.001	1
2.	Curve Mount Kit, Feet, Op Pltfrm	3.3394.042.001	1

OPERATOR PLATFORM ASSEMBLY
No. 3.3393.100.001



Columbia Palletizer Parts

OPERATOR PLATFORM ASSEMBLY

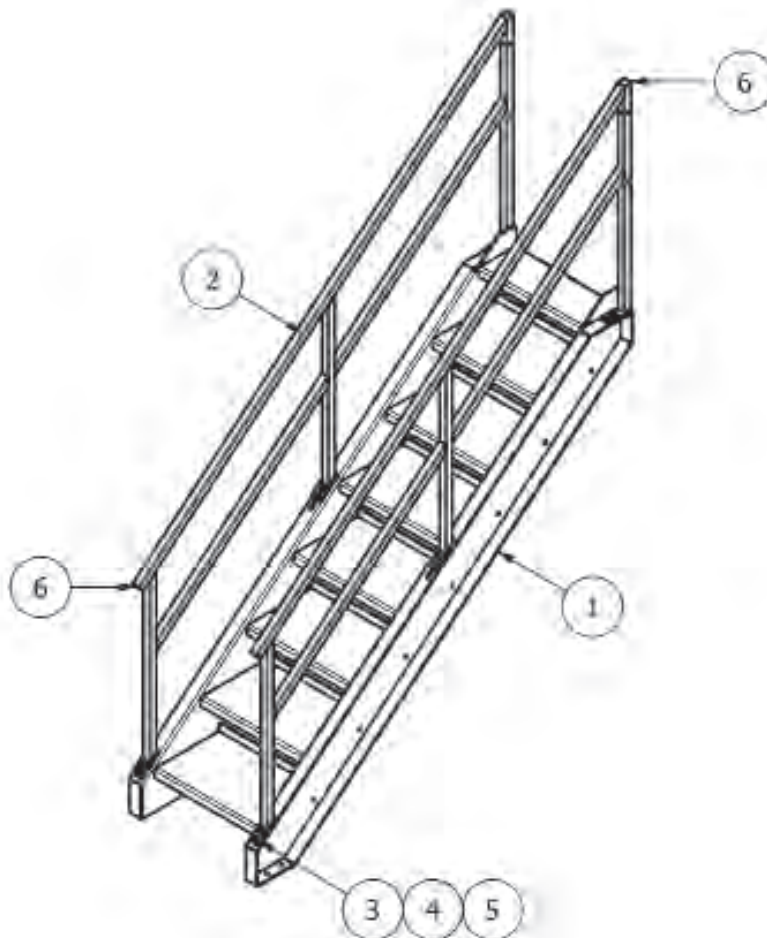
No. 3.3393.100.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Platform Weldment, HI6200	3.3393.110.001	1
2.	Platform Weldment, HI6200	3.3393.120.001	1
3.	Platform Weldment, HI6200	3.3393.130.001	1
4.	Platform Weldment, HI6200	3.3393.140.001	1
5.	Stair Assy, 40 Deg, 132.25"	3.3366.100.005	1
6.	Leg Wldmt, 132.25" Elev	3.2592.125.072	4
7.	Handrail Mnt Brkt, Formed	3.2740.095.017	2
8.	Vertical Support, Handrail	3.1953.801.034	9
9.	Handrail, No Posts, 31.00	3.2778.037.145	1
10.	Handrail, No Posts, 6.00	3.2778.037.097	1
11.	Handrail, No Posts, 37.88	3.2778.037.296	3
12.	Handrail Wldmt, Single, 27.38	3.2740.182.025	1
13.	Handrail, No Post, 60.00	3.2778.037.169	1
14.	Handrail, No Posts, 48.00	3.2778.037.087	1
15.	Handrail, No Posts, Spl	3.2778.037.043	1
16.	Handrail, No Posts, 8.63	3.2778.037.297	1
17.	Handrail, No Posts, 19.63	3.2778.037.298	1
18.	Plug, 1-1/2In, Sqr-1-1/2-10-14	334152	9
19.	Kickplate, Work Platform	3.2592.396.043	1
20.	Kickplate, Work Platform	3.2592.396.044	1
21.	Washer, Plain, Metric	100239.16	10
22.	Cpscr, Hex Head, Metric, Gd 8.8	100019.16.35	10
23.	Nut, Poly Insert, Full, Class 10	100136.16	10
24.	Washer, Plain, Metric	100239.12	78
25.	Cpscr, Hex Head, Metric, Gd 8.8	100019.12.60	18
26.	Cpscr, Hex Head, Metric, Gd 8.8	100019.12.30	60
27.	Nut, Poly Insert, Full, Class 10	100136.12	78
28.	Washer, Plain, Metric	100239.1	32
29.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.60	20
30.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.65	8
31.	Cpscr, Hex Head, Metric, Gd 8.8	100019.10.30	4
32.	Nut, Poly Insert, Full, Class 10	100136.1	32
33.	All Thrd, 12Mm X 1.75	905458.03.75	4
34.	All Thrd, 8Mm X 1.25	905456.03.75	2
35.	Nut, Hex Jam, Gd 04, Metric	100139.12	16
36.	Nut, Hex Jam, Gd 04, Metric	100139.08	8
37.	Safety Door, Ps Door, Lsg-27-Pcy	3.3131.033	1
38.	Curve Support Wldmt, Op Pltfrm	3.3393.148.001	1

Columbia Palletizer Parts

STAIR ASSEMBLY No. 3.3366.100.012

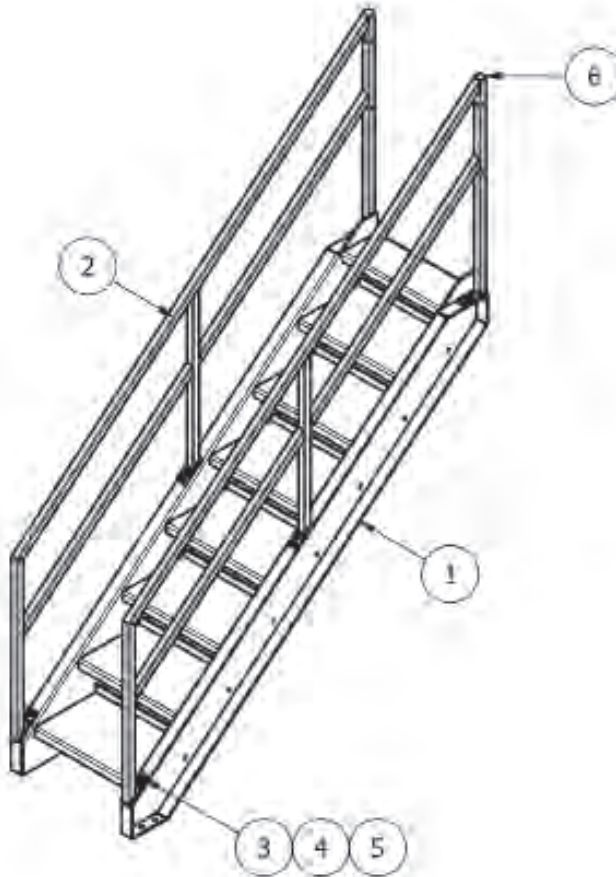
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Stair Wldmt,40 Deg,66.13",Spl	3.3366.101.011	1
2.	Stair Rail Wldmt,40 Deg,66.13"	3.3366.201.010	2
3.	Washer, Plain, Metric	100239.12	12
4.	Nut,Poly Insert,Full,Class 10	100136.12	12
5.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.35	12
6.	Plug,1-1/2In,Sqr-1-1/2-10-14	334152	4
1.	Stair Wldmt,40 Deg,66.13",Spl	3.3366.101.011	1
2.	Stair Rail Wldmt,40 Deg,66.13"	3.3366.201.011	2
3.	Washer, Plain, Metric	100239.12	12
4.	Nut,Poly Insert,Full,Class 10	100136.12	12
5.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.35	12
6.	Plug,1-1/2In,Sqr-1-1/2-10-14	334152	2



Columbia Palletizer Parts

STAIR ASSEMBLY No. 3.3366.100.013

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Stair Wldmt,40 Deg,66.13",Spl	3.3366.101.011	1
2.	Stair Rail Wldmt,40 Deg,66.13"	3.3366.201.011	2
3.	Washer, Plain, Metric	100239.12	12
4.	Nut,Poly Insert,Full,Class 10	100136.12	12
5.	Cpscr,Hex Head,Metric,Gd 8.8	100019.12.35	12
6.	Plug,1-1/2In,Sqr-1-1/2-10-14	334152	2



Columbia Palletizer Parts

CURVE MOUNT KIT

No. 3.3394.042.001

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Curve Mt Bracket,4.0"	3.3394.043.001	8
2.	All Thrd, 12Mm X1.75	905458.07.00	8
3.	Washer, Plain, Metric	100239.12	32
4.	Nut, Hex Jam, Gd 04, Metric	100139.12	32

SECTION 14

Ship Loose
No. 3.3394.024

Page 1 Ship Loose List
Page 2 Ship Loose Parts

Columbia Palletizer Parts

SHIP LOOSE LIST

No. 3.3394.024

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pd Machine Touch-Up Paint	3.SHPLSE.PNT	1
924.	P/K Shplse,Blue Marble,5028930	328.27.7434.24	1

Columbia Palletizer Parts

SHIP LOOSE PARTS

No. 3.SHPLSE.PNT

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Tb230Cmegg, Flat Guard Gray	PNT.GRY.AER.06	1
2.	Tb230Cmfgm, Aerosol Frame Gray	PNT.GRY.AER.01	1
3.	Tb230Cmmpo, Aerosol Orange	PNT.ORG.AER.01	1

Columbia Palletizer Parts

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SECTION 15

Safety Decals & ID Kit
No. 3.3394.011

Page 1 Decals Assembly List
Page 2 Safety Decals (Meter Belt)
Page 3 Safety Decals (Infeed)
Page 4-8 Safety Decals (Palletizer)
Page 9-10 Safety Decals (Hoist)
Page 11-12 Safety Decals (702 Pallet Dispenser)
Page 13 Safety Decals (Minor Servicing)
Page 14 Safety Decals (Electrical Panel)
Page 15 Safety Decals (Layer Pusher)
Page 16 Safety Decals (ID Kit, Name Plate)

Columbia Palletizer Parts

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Columbia Palletizer Parts

DECALS ASSEMBLY LIST

No. 3.3394.011

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Decals,Meterbelt,96",English	3.0023.002.061	1
2.	HI2000,Infeed Decals	3.0023.002.062	1
3.	Decals,Pall Section,HI*200	3.0023.004.095	1
4.	Decals,Hoist,HI7200	3.0023.005.005	1
5.	Decals,702Fw Pall Dispenser	3.0023.007.037	1
6.	Disc For Design	3.0023.013.002	1
7.	Legend,HI4200,54X13,White	8708.4705	1
8.	Decal,Elec Pnl,High,Main,Std	3.0023.010.022	1
9.	Decal,Hoist Flag Notice,Narrow	8708.4672	2
10.	Decal,Danger,Hoist Area,FI,Nar	8708.4761	2
11.	Id Kit,Okura	380.959.3.16	4

(Meter Belt)

No. 3.0023.002.061

Diagram illustrating the exploded view of the HP-1000 printer mechanism, showing various components and their assembly order. The diagram includes numbered callouts (1 through 10) and a legend:

- 1. TOP COVER
- 2. FRONT PANEL
- 3. REAR PANEL
- 4. MAIN FRAME
- 5. PRINT HEAD
- 6. CARTRIDGE
- 7. PAPER FEED MECHANISM
- 8. PAPER SUPPORT ROLLER
- 9. PAPER GUIDE
- 10. PAPER EXIT GUIDE

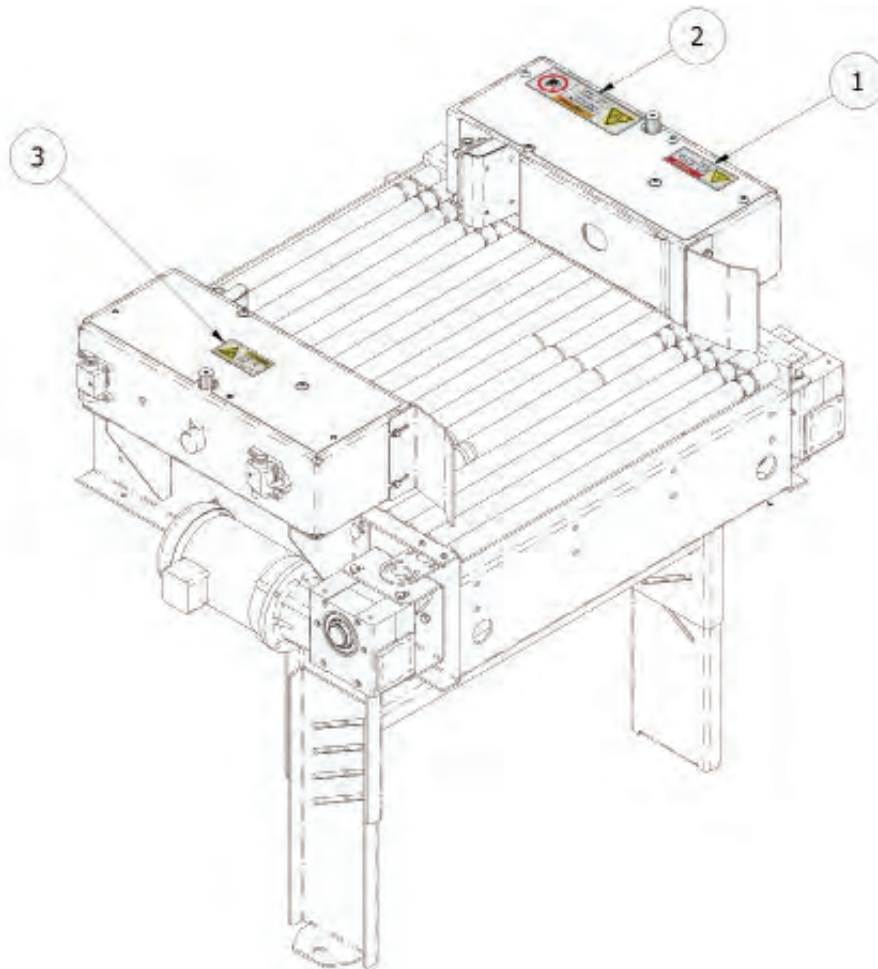
Assembly order: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

NOTICE: SEE THE HP-1000 SERVICE MANUAL FOR MORE INFORMATION.

Columbia Palletizer Parts

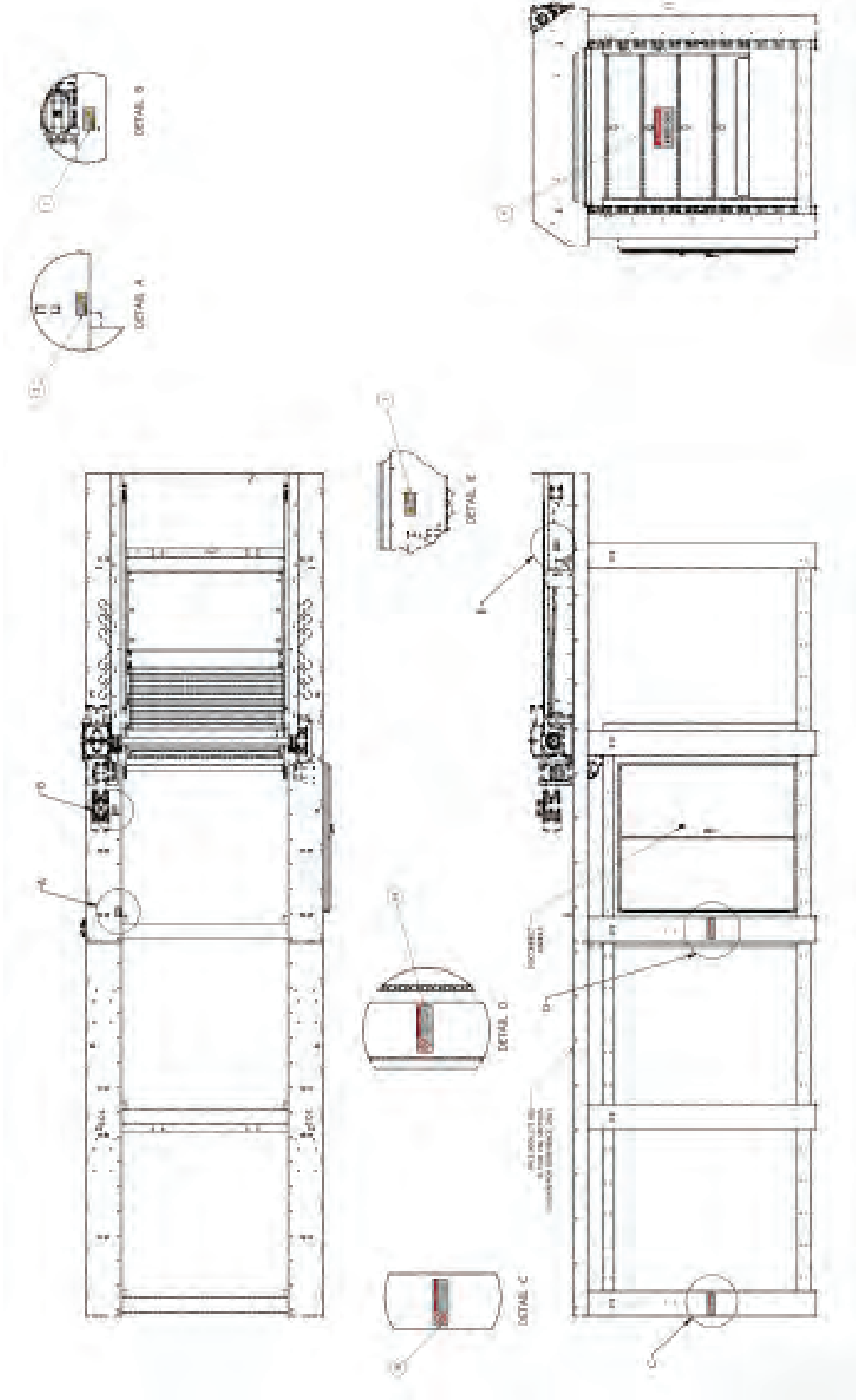
SAFETY DECALS (Infeed) No. 3.0023.002.062

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Decal,Danger,Keep Off	8708.4345	1
2.	Decal,Warn,Auto Start	8708.477	1
3.	Decal,Warning,Pinch,Roll,Lock	8708.4755	1

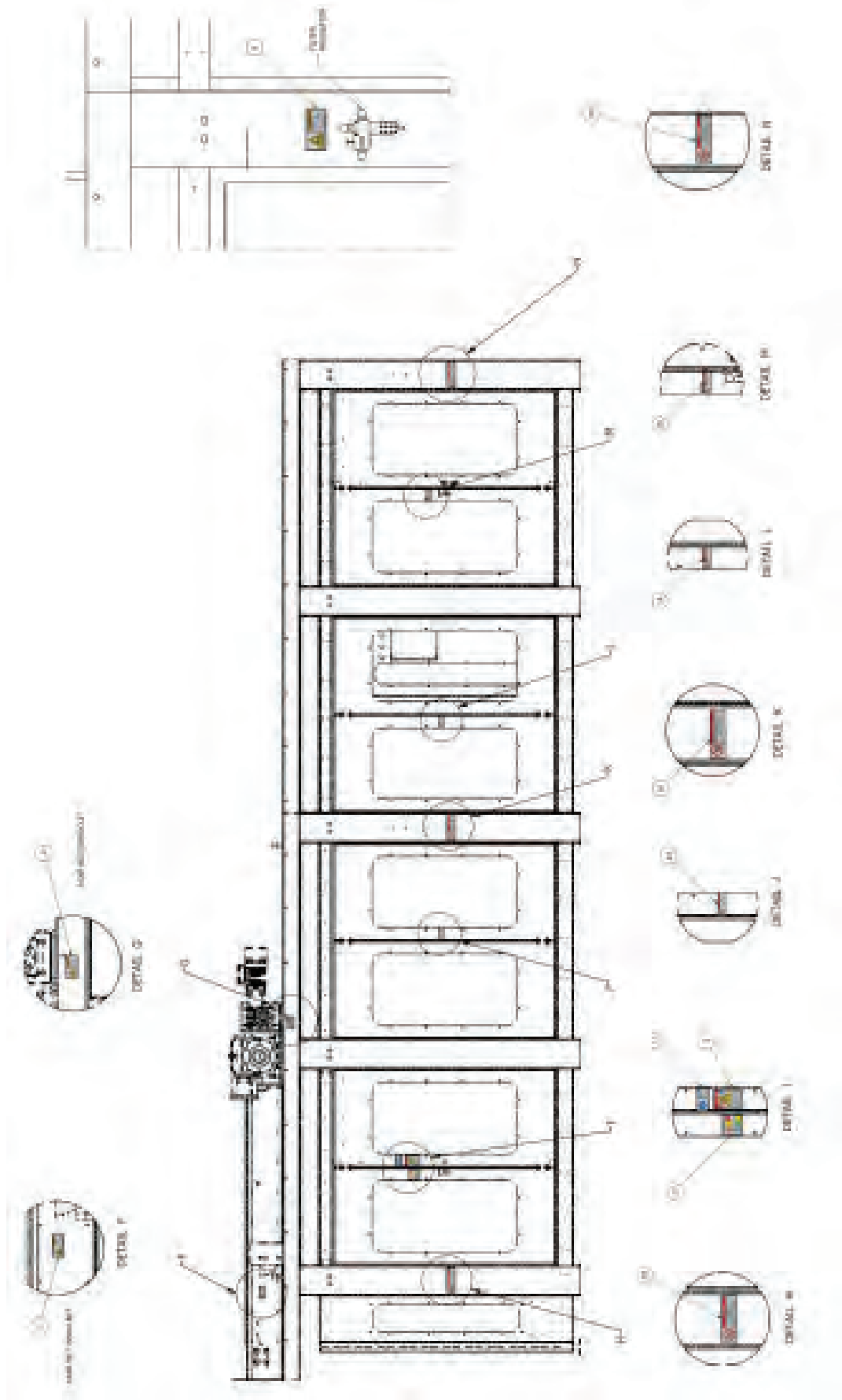


Columbia Palletizer Parts

SAFETY DECALS
(Palletizer)
No. 3.0023.004.095

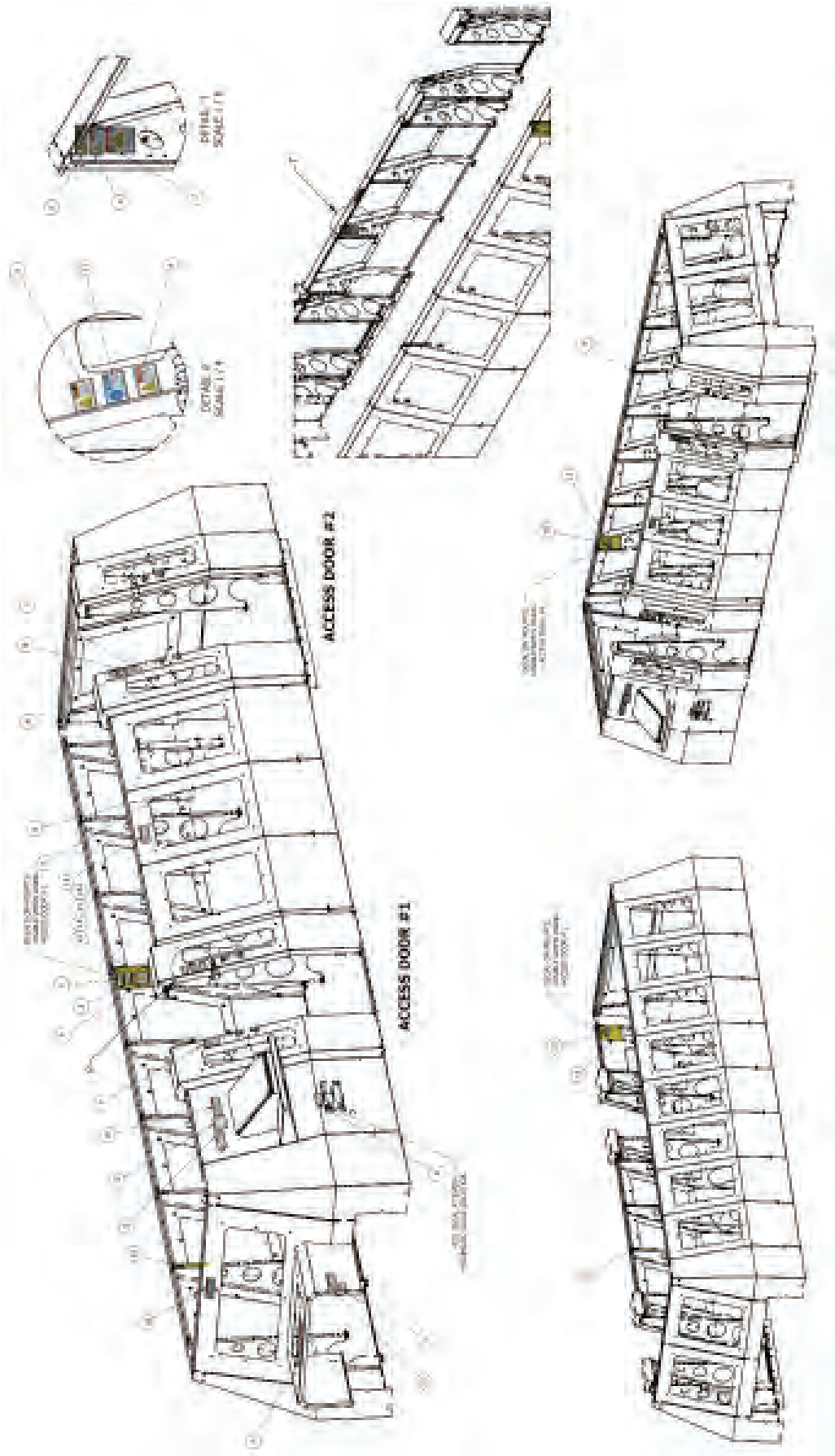


SSAFETY DECALS
(Palletizer)
No. 3.0023.004.095



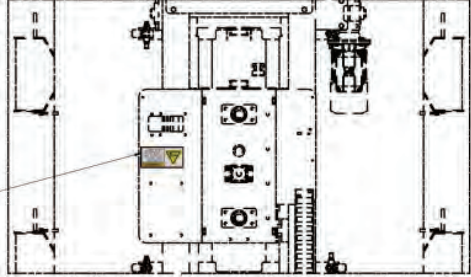
Columbia Palletizer Parts

SAFETY DECALS
(Palletizer)
No. 3.0023.004.095

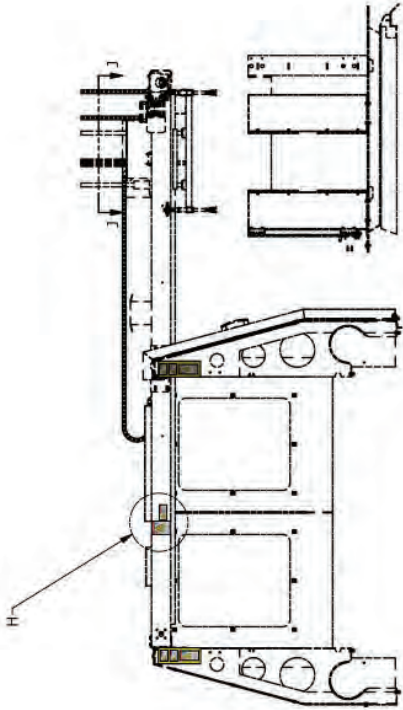


Columbia Palletizer Parts

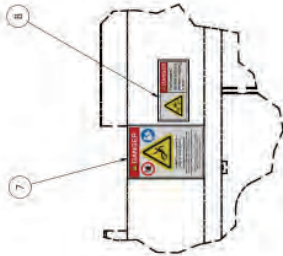
SAFETY DECALS
(Palletizer)
No. 3.0023.004.095



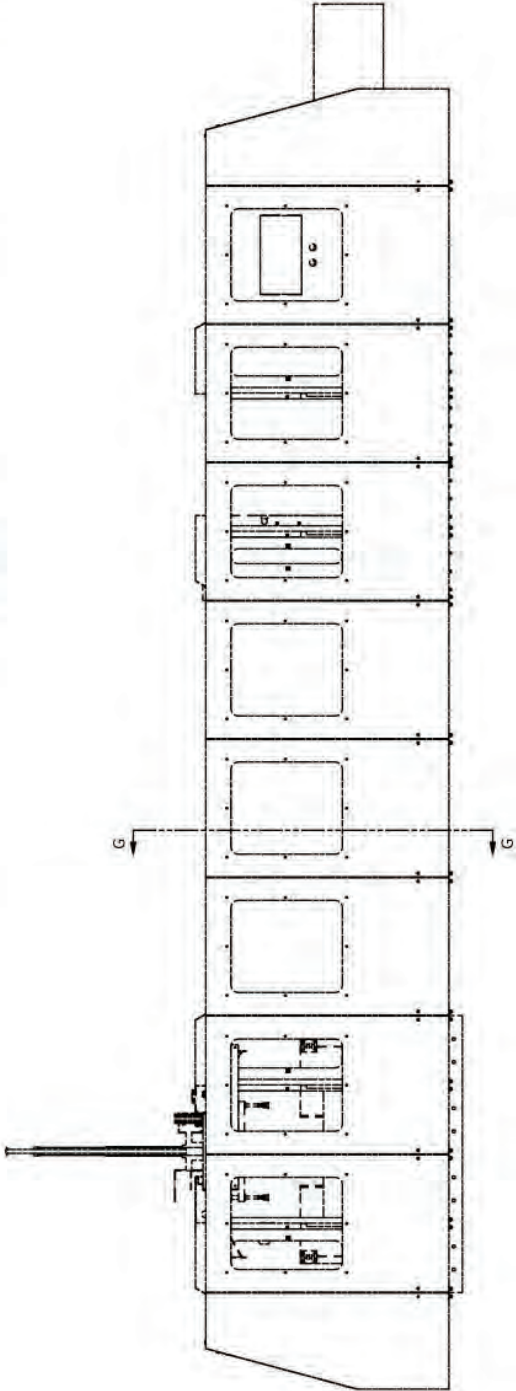
SECTION J-J
SCALE .125



SECTION G-G
SCALE .0625



DETAIL H
SCALE 1 / 4



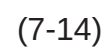
Columbia Palletizer Parts

SAFETY DECALS, PALLETZIER

No. 3.0023.004.095

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Decal,Warning,Pinch,Roll,Lock	8708.4755	3
2.	Decal,Warn,Cutcrush,Gear,Lock	8708.4756	4
3.	Decal,Danger,Hoist Area,FI	8708.476	4
4.	Sign, Danger Keep Out	8708.1636	2
5.	Decal,Warn,Auto Start	8708.477	2
6.	Decal,Relieve Pressure	8708.4336	4
7.	Decal,Danger,Hoist Area,HI	8708.4765	5
8.	Decal,Danger,No Entry,Layer St	8708.4747	5
9.	Decal,Warn,Slippery Surface	8708.4734	4
10.	Decal,Notice,Not Minor Service	8708.4735	2
11.	Decal,Notice,Guard Minor Srvce	8708.4736	2
12.	Decal,Ms Instr,Minor Service	8708.4737	1
13.	Mount Plate,Decal,45D,5.9X11.0	3.2860.611.002	4
14.	Washer, Plain, Metric	100239.1	16
15.	Cpscr,Hex Head,Metric,Gd 8.8	100019.10.25	8
16.	Nut,Poly Insert,Full,Class 10	100136.1	8
17.	Decal,Hoist Flag Notice	8708.4671	4
18.	Decal,Danger,Never Work On..	8708.4775	10
19.	Decal,Danger Guard Removal	8708.2246	5
20.	Decal,Danger,Hoist Area,FI,Nar	8708.4761	2
21.	Decal,Hoist Flag Notice,Narrow	8708.4672	2

SAFETY DECALS
(Hoist)
No. 3.0023.005.005



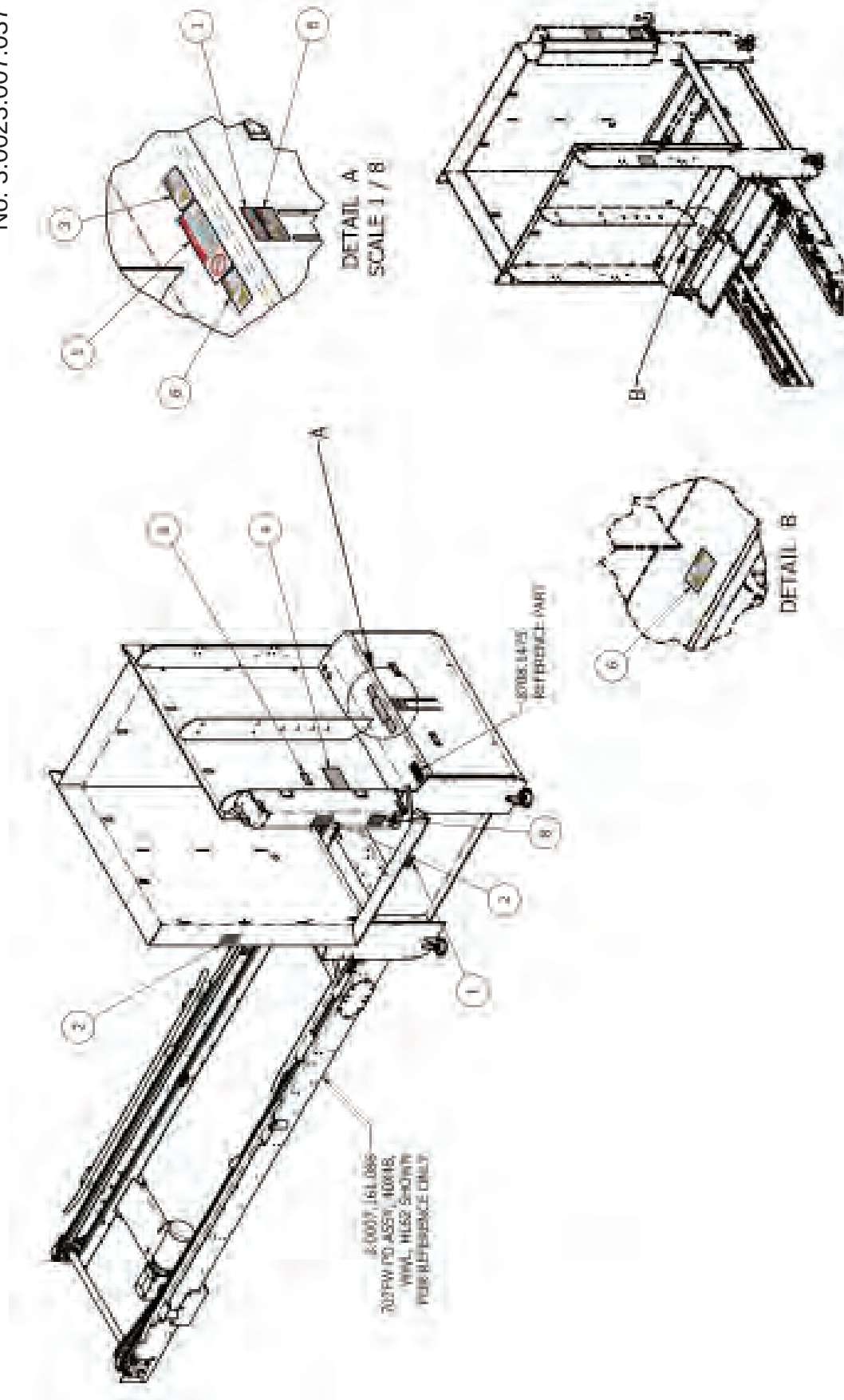
Columbia Palletizer Parts

SAFETY DECALS
(Hoist)
No. 3.0023.005.005

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Tape, Safety Diag Stripe	8708.2404	1
2.	Decal,Danger,Keep Off	8708.4345	2
3.	Decal,Danger,Hoist Area,FI	8708.476	2
4.	Decal,Hoist,Pin Flag	8708.4662	8

Columbia Palletizer Parts

SAFETY DECALS
(702 Pallet Dispenser)
No. 3.0023.007.037



Columbia Palletizer Parts

SAFETY DECALS
(702 Pallet Dispenser)
No. 3.0023.007.037

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Decal,Danger Guard Removal	8708.2246	2
2.	Decal,Pal Disp Overload,Warn	8708.4791	2
3.	Decal,Warn,Cutcrush,Plate,Lock	8708.4757	1
4.	Decal,Pal Disp Oper,Elec,Warn	8708.4792	1
5.	Decal,Danger,Never Work On..	8708.4775	1
6.	Decal,Warning,Pinch,Roll,Lock	8708.4755	4
7.	Decal,Warn,Auto Start	8708.477	1
8.	Decal,Pin Position,Notice	8708.4794	1

Columbia Palletizer Parts

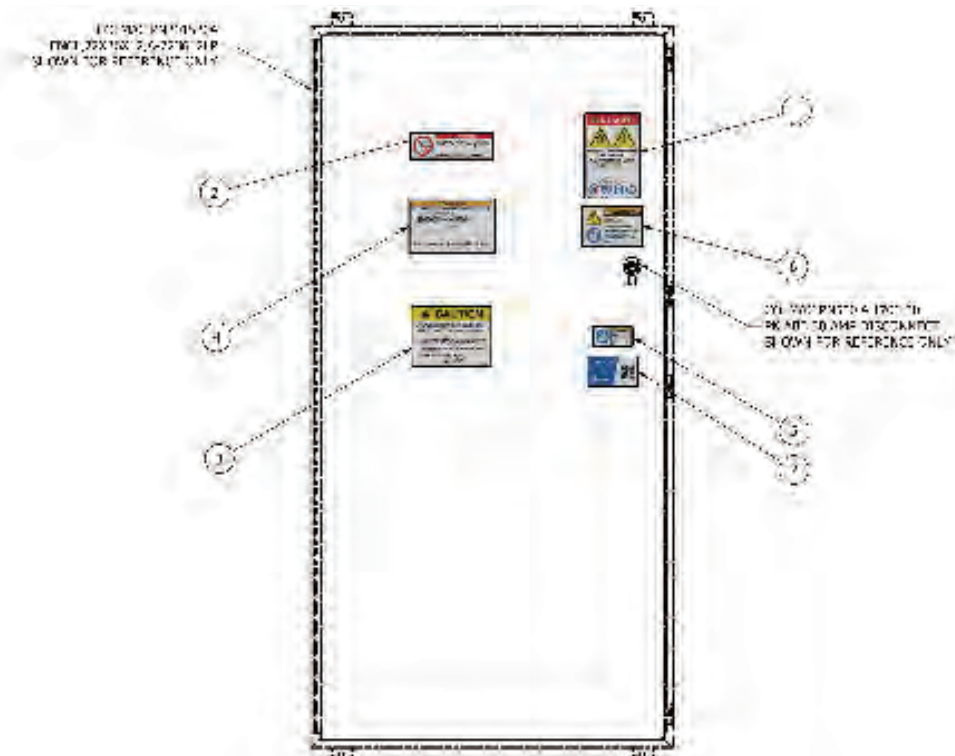
SAFETY DECALS
(Minor Servicing)
No. 3.0023.013.002

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Decal,Notice,Not Minor Service	8708.4735	2
2.	Decal,Danger,Hoist Area,HI	8708.4732	4
3.	Decal,Warn,Fall Protection	8708.4733	4
4.	Decal,Warn,Slippery Surface	8708.4734	2
5.	Decal,Notice,Guard Minor Srvce	8708.4736	4
6.	Decal,Ms Instr,Minor Service	8708.4737	2
7.	Decal,Danger,Hoist Area,FI	8708.4731	4

Columbia Palletizer Parts

SAFETY DECALS (Electrical Panel) No. 3.0023.010.022

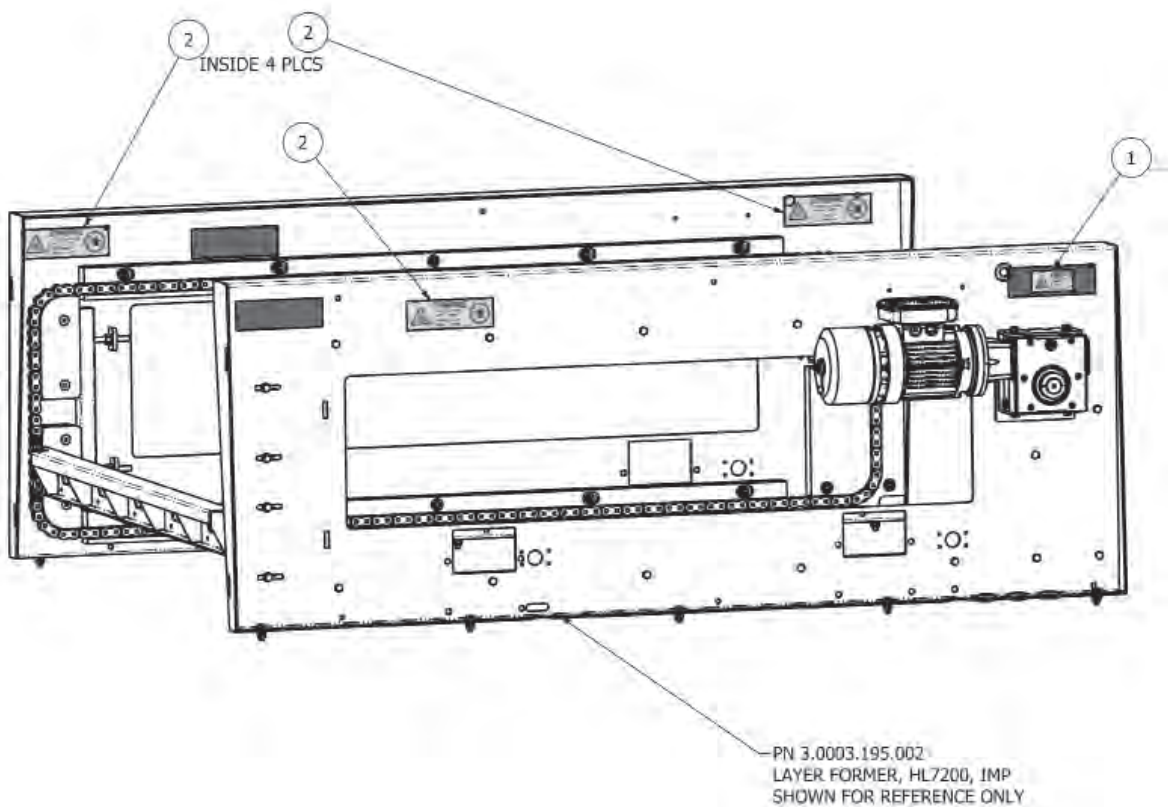
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Decal,Danger,Arcflash,Highvolt	8708.478	1
2.	Decal,Danger,Never Work On..	8708.4775	1
3.	Caution Arc Welding Decal	8708.3672	1
4.	Decal,Pall Oper,Elec,Warning	8708.475	1
5.	Decal,Warn,Safe Funct,No Alter	8708.4785	1
6.	Decal,Warn,Disconnect Off	8708.479	1
7.	Decal,Service Contact,Qr Code	8708.4716	2



Columbia Palletizer Parts

SAFETY DECALS (Layer Pusher) No. 3.0023.003.032

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Decal, Warn, Cutcrush, Gear, Lock	8708.4756	1
2.	Decal, Warn, Auto Start	8708.477	6



Columbia Palletizer Parts

SAFETY DECALS
(ID Kit, Name Plate)
No. 380.959.3.16

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Sign, Columbia N.P. 2.25X6.12	8708.1475	1
2.	Rivets, Ct'Sk Head Drive	100276.06	4



ELECTRICAL

Complete Electrical
No. 328.27.7434

Page 1	Complete Electrical List
Page 2-10	Electrical P/K (Panel 1)
Page 11-12	Electrical P/K (Panel 2)
Page 13-15	Electrical P/K (Op Station 1)
Page 16-17	Electrical P/K (Op Station 2)
Page 18-19	Electrical P/K (Op Station 3)
Page 20	Electrical P/K (Infeed)
Page 21	Electrical P/K (Row Layer)
Page 22	Electrical P/K (Palletizer)
Page 23	Electrical P/K (Pallet Dispenser)
Page 24	Electrical P/K (Tie Sheet Dispenser)
Page 25	Electrical P/K (24V Enclosure Fan Kit)
Page 26	Electrical P/K (ABB 60 AMP Disconnect)
Page 27	Electrical P/K (800FM E-Stop)
Page 28	Electrical P/K (800FM Ext III Blue PB 1-N.O.)
Page 29	Electrical P/K (800FM PB Black)
Page 30	Electrical P/K (800FM Mush III Yellow)
Page 31	Electrical P/K (800FM 3 POS Spring Ret 2-N.O.)
Page 32	Electrical P/K (800FM 2 Flush PB Black)
Page 33	Electrical P/K (Banner SLS LC 65")
Page 34	Electrical P/K (Light Stack Mount Kit 12")
Page 35	Electrical P/K (Pallet Track PE w/ Bracket)
Page 36	Electrical P/K (Pressure Switch)
Page 37	Electrical P/K (Ship Loose)
Page 38	Electrical P/K (Fuses)

Columbia Palletizer Parts

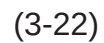
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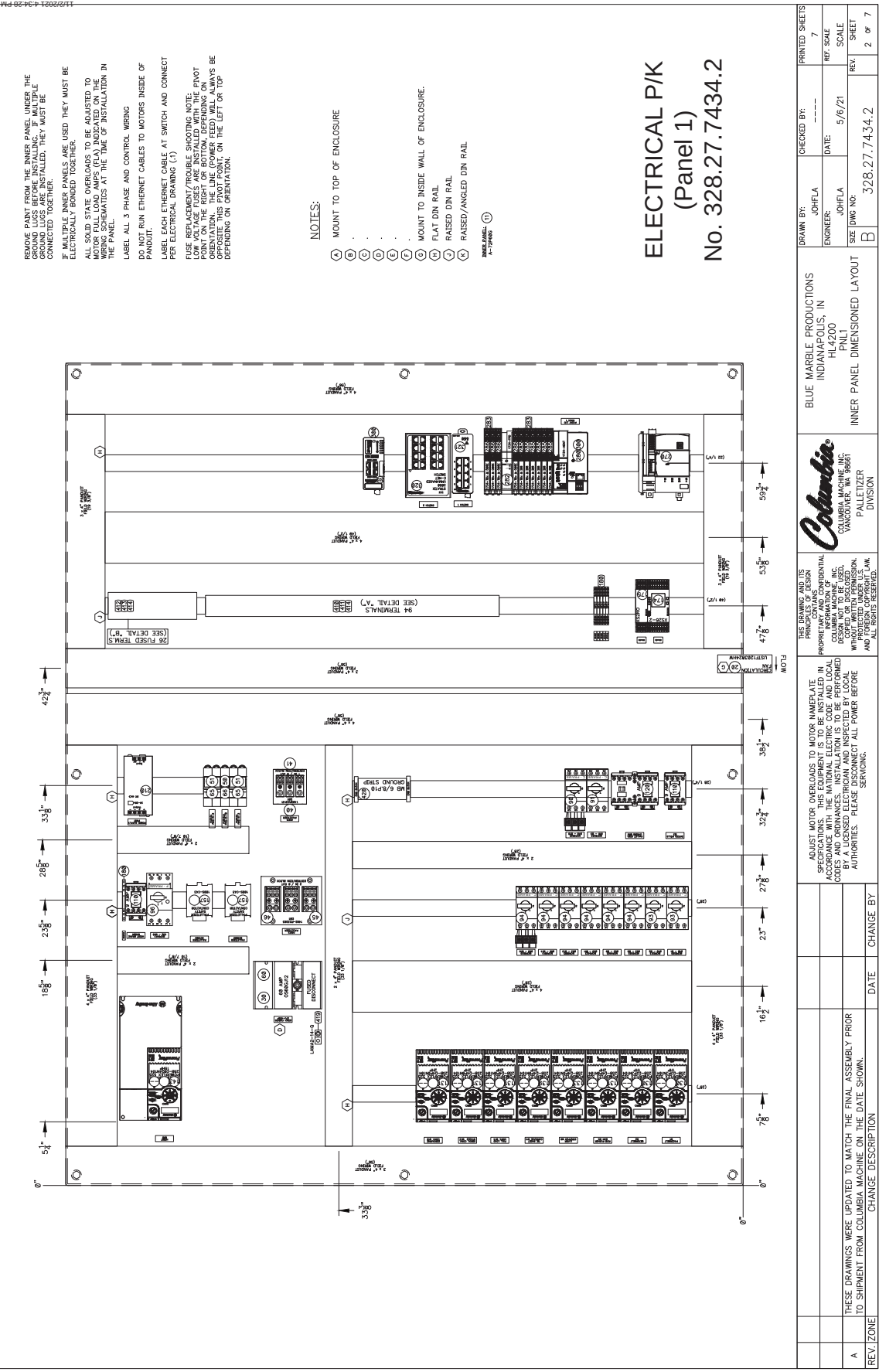
Columbia Palletizer Parts

COMPLETE ELECTRICAL LIST No. 328.27.7434

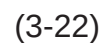
<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
2.	P/K Pnl1,Blue Marble,5028930	328.27.7434.2	1
10.	P/K Infeed,Blue Marble,5028930	328.27.7434.10	1
11.	P/K R/Lyr,Blue Marble,5028930	328.27.7434.11	1
12.	P/K Paltz,Blue Marble,5028930	328.27.7434.12	1
24.	P/K Shplse,Blue Marble,5028930	328.27.7434.24	1
40.	P/K Pd,Blue Marble,5028930	328.27.7434.40	1
60.	P/K T.Sd,Blue Marble.5028930	328.27.7434.60	1

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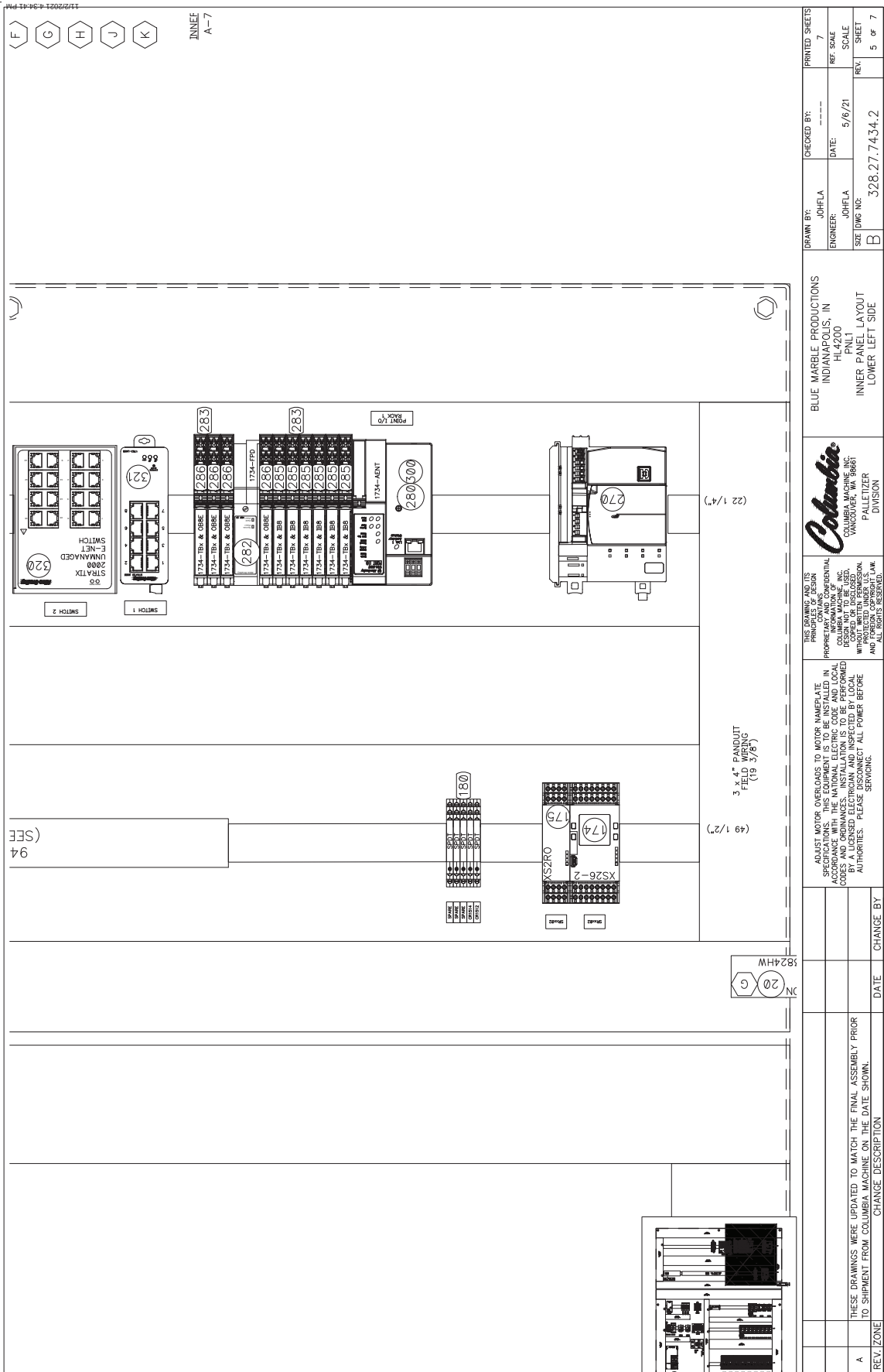
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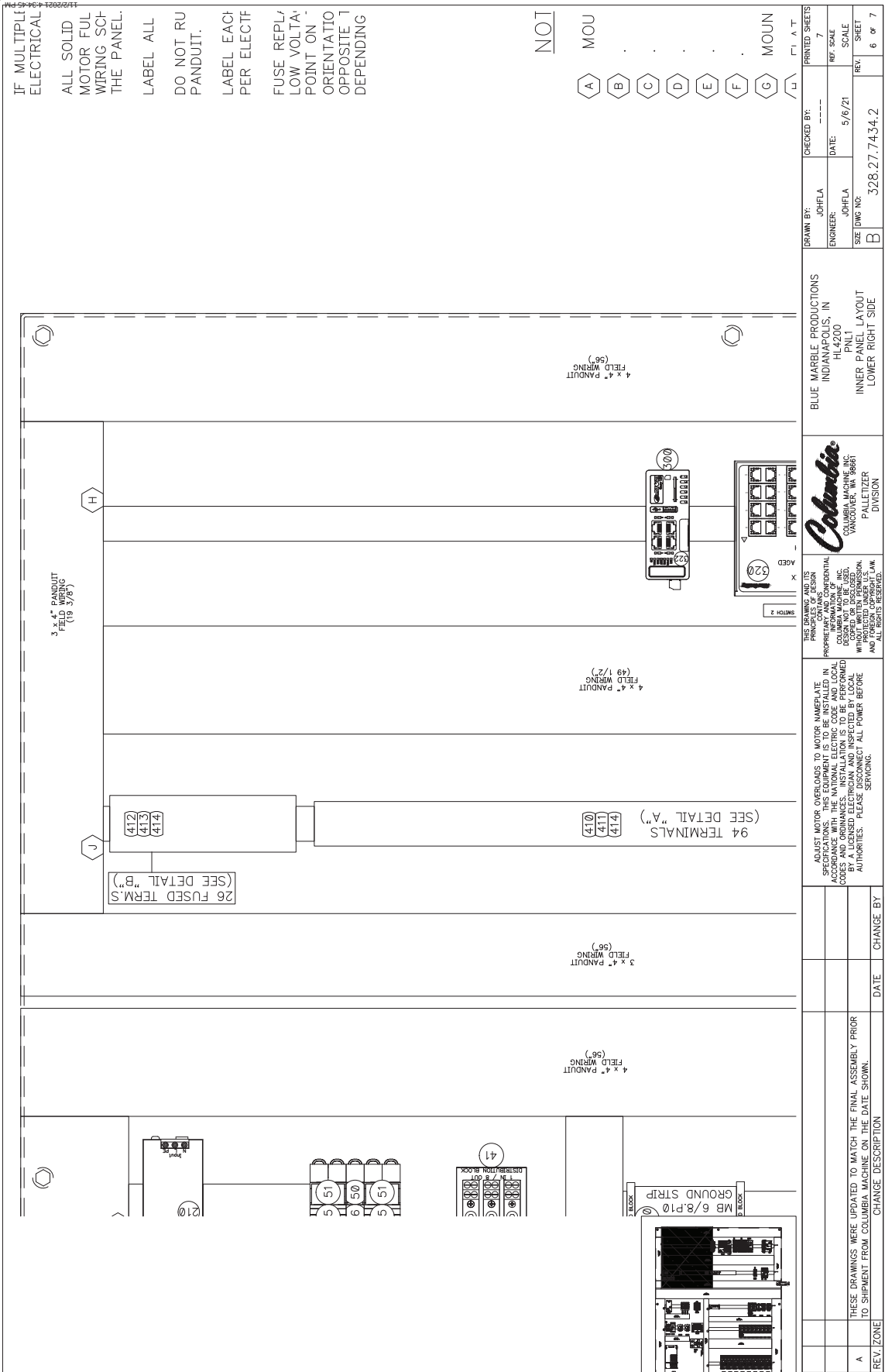
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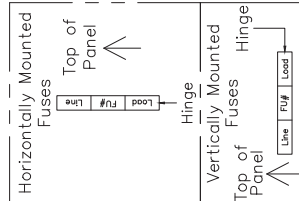
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SAFETY RELAY

FIXED BRIDGE BAR

ALL SOLID STATE OVERLOAD RELAYS TO BE SET TO TRIP CLASS 20 AT TIME OF INSTALLATION IN PANEL.

ALL SOLID STATE OVERLOAD RELAYS TO BE ADJUSTED TO MOTOR FULL LOAD AMPS (FLA) INDICATED ON WIRING SCHEMATICS AT TIME OF INSTALLATION IN PANEL.

LABEL ALL 3 PHASE AND CONTROL WIRING

LABEL ALL 3 PHASE AND CONTROL WIRING

(3-22)

Columbia Palletizer Parts

ELECTRICAL P/K
(Panel 1)
No. 328.27.7434.2

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
10.	Encl,Nema12,7,A-726012Ulp	2010146	1
11.	Back Pnl Steel,72X60,Colmac	20104851	1
20.	24V Enclosure Fan Kit	500.4.1719	1
23.	A/C 1000Btu,460V,N170146G010	2015771	1
30.	Pk Abb 60 Amp Disconnect	500.4.1706.60	1
43.	Dist Blk,3Pole,175A,1492Pd3141	204958	1
44.	Dist Block Cover,1492-Pbc1	204957	1
45.	Dist Block Power 3 1492-Pd3263	2010697	1
46.	Distribution Block Cover	204955	1
50.	Fuse Holder Cc,1492-Fb1C30-L	2000771	1
51.	Fuse Holder Cc,1492-Fb2C30-L	2000772	2
60.	Fuse Lpj-40Sp	202727.040.000	3
65.	Fuse, Fnq-R, 3A	202518.003.000	4
66.	Fuse, Fnq-R, 10A	202518.010.000	1
91.	Mtr Prot Cb,140M-C2E-B16	2104805.001.60	1
93.	Mtr Prot Cb,140M-C2E-B40	2104805.004.00	3
94.	Mtr Prot Cb,140M-C2E-B63	2104805.006.30	6
99.	Mtr Prot Cb,140M-F8E-C32	2104805.032.00	1
105.	3Ph Bsbr 45Mm,140M-C-W452N	230568.00.02	1
106.	3Ph Bsbr 45Mm,140M-C-W453N	230568.00.03	1
108.	3Ph Bsbr 45Mm,140M-C-W455N	230568.00.05	1
109.	Cmpt Busbar Fdr,140M-C-Wten	230568.03.00	2
110.	Contactor,Non Rev,100-C09Ej10	2305855.09	2
120.	Contactor,Rev,104-C09Ej22	2305856.09	1
130.	Vfd Pf525 480V 1Hp Frame A	311030.480.010	2
131.	Vfd Pf525 480V 2Hp Frame A	311030.480.020	6
143.	Vfd Pf525 480V 15Hp Frame D	311030.480.150	1
146.	Diode, 1N4004	233065	2
156.	Contactor,Sfty,100S-C43Ej14Bc	2305854.43	2
174.	Relay,Pgmbl Safety,Xs26-2	2104934.001.03	1
175.	Relay,Lc,Expansion,Xs2Ro	2104934.003.01	1
180.	Rly,24Vdc,Dinrail,6A,250V,Spdt	238303	5
210.	Ps,1Ac,24Vdc,10A,120Vac	311097.24.10	1
250.	Plc,5069-L320Er,2Mb	2105673.020.00	1
251.	5069 Compact I/O Power Term	2105674.008	1
280.	Pt I/O,Enet Adpt, 1 Port,Aent	311111.00.00.24	1
282.	Pt I/O,Pwr Module	311111.02.00.24	1
283.	Pt I/O,Term Block Spring,Tbs	311111.29.00	10
285.	Pt I/O, Sink In, 8,Dc,Ib8	311111.05.08.24	6
286.	Pt I/O,Src Out, 8 P,Dc,Ob8E	311111.11.08.24	4
300.	Eth Cbl Shld,1585J-M8Hbjm-4	2017423.004.00	5

Columbia Palletizer Parts

ELECTRICAL P/K
(Panel 1)
No. 328.27.7434.2

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
302.	Eth Cbl Shld,1585J-M8Hbjm-3	2017423.003.00	4
303.	Eth Cbl Shld,1585J-M8Hbjm-0M6	2017423.000.60	4
320.	Enet Sw,16 Port,Unmanaged	311261.16.00	1
321.	Enet Sw,8 Port,Lightly Managed	311261.08.01	1
329.	Ewon Cosy131 Vpn Ec61330	2017682	1
334.	Prog,Port Enet,P-R2-K4Rf3	2107229	1
410.	Trmnl Blk, M4/6,#10	201580	94
411.	Trmnl,End Cover,Std,118.368.16	201582	1
412.	Trmnl Fuse,8Mm,1Snk508410R0000	203656	26
413.	Trmnl End Cover 8Mm,116-951.15	203657	1
414.	Clamp,End,Entrelec,206.351.16	201583	30
419.	Grd Lug,Lama2-14-Q	2015007	1
420.	Mb 6/8.P10 Gnd Term Strip	230787	1
441.	Fuse, Gmc, 1 Amp	202527.001.000	5
442.	Fuse, Gmc, 2 Amp	202527.002.000	2
443.	Fuse, Gmc, 4 Amp	202527.004.000	3
444.	Fuse, Gmc, 5 Amp	202527.005.000	1
446.	Fuse, Gmc, 10 Amp	202527.010.000	1
447.	Fuse, Gma, 500Ma	202526.000.500	2
450.	Fuse, Gma, 4 Amp	202526.004.000	4

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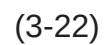
Columbia Palletizer Parts

ELECTRICAL P/K
(Panel 2)
No. 328.27.7434.4

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
10.	Encl,20X24X8,A-202408Lp	2015226	1
11.	Panel F/21X17 Nema,A-24P20	2015281	1
180.	Rly,24Vdc,Dinrail,6A,250V,Spdt	238303	2
280.	Pt I/O,Enet Adpt, 1 Port,Aent	311111.00.00.24	1
282.	Pt I/O,Pwr Module	311111.02.00.24	1
283.	Pt I/O,Term Block Spring,Tbs	311111.29.00	10
285.	Pt I/O, Sink In, 8,Dc,Ib8	311111.05.08.24	6
286.	Pt I/O,Src Out, 8 P,Dc,Ob8E	311111.11.08.24	4
300.	Eth Cbl Shld,1585J-M8Hbjm-10	2017423.010.00	1
410.	Trmnl Blk, M4/6,#10	201580	30
411.	Trmnl,End Cover,Std,118.368.16	201582	1
412.	Trmnl Fuse,8Mm,1Snk508410R0000	203656	4
413.	Trmnl End Cover 8Mm,116-951.15	203657	1
414.	Clamp,End,Entrelec,206.351.16	201583	10
418.	Trmnl Gnd,Grn,165-113.16	2011423	2
440.	Fuse, Gmc, 1 Amp	202527.001.000	1
442.	Fuse, Gmc, 2 Amp	202527.002.000	1
447.	Fuse, Gma, 500Ma	202526.000.500	1

(3-22)





Columbia Palletizer Parts

ELECTRICAL P/K
(Operator Station 1)
No. 328.27.7434.19

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
10.	Encl, Consolet, 20X20	2015240	1
305.	Eth Cbl Shld,1585J-M8Hbjm-10	2017423.010.00	1
340.	Pv+7 7",Ts,Color,Enet,Dc	2021317.07.24T	1
350.	Pk 800Fm E-Stop III 2-N.C. 2-N	500.4.1720.06	1
351.	Pk 800Fm Ext III Blu Pb 1-N.O.	500.4.1720.03	1
352.	Pk 800Fm III Grn Pb 1-N.O.	500.4.1720.01	1
353.	Pk 800Fm Mush III Yel Pb -1Nc	500.4.1720.02	1
410.	Trmnl Blk, M4/6,#10	201580	60
411.	Trmnl,End Cover,Std,118.368.16	201582	2
414.	Clamp,End,Entrelec,206.351.16	201583	4
418.	Trmnl Gnd,Grn,165-113.16	2011423	2
480.	Switch,Xmr1-Mlil-02022P	2105017.1.7434	1
482.	Gold Key,Mlk-Sugs	2105018.743	1

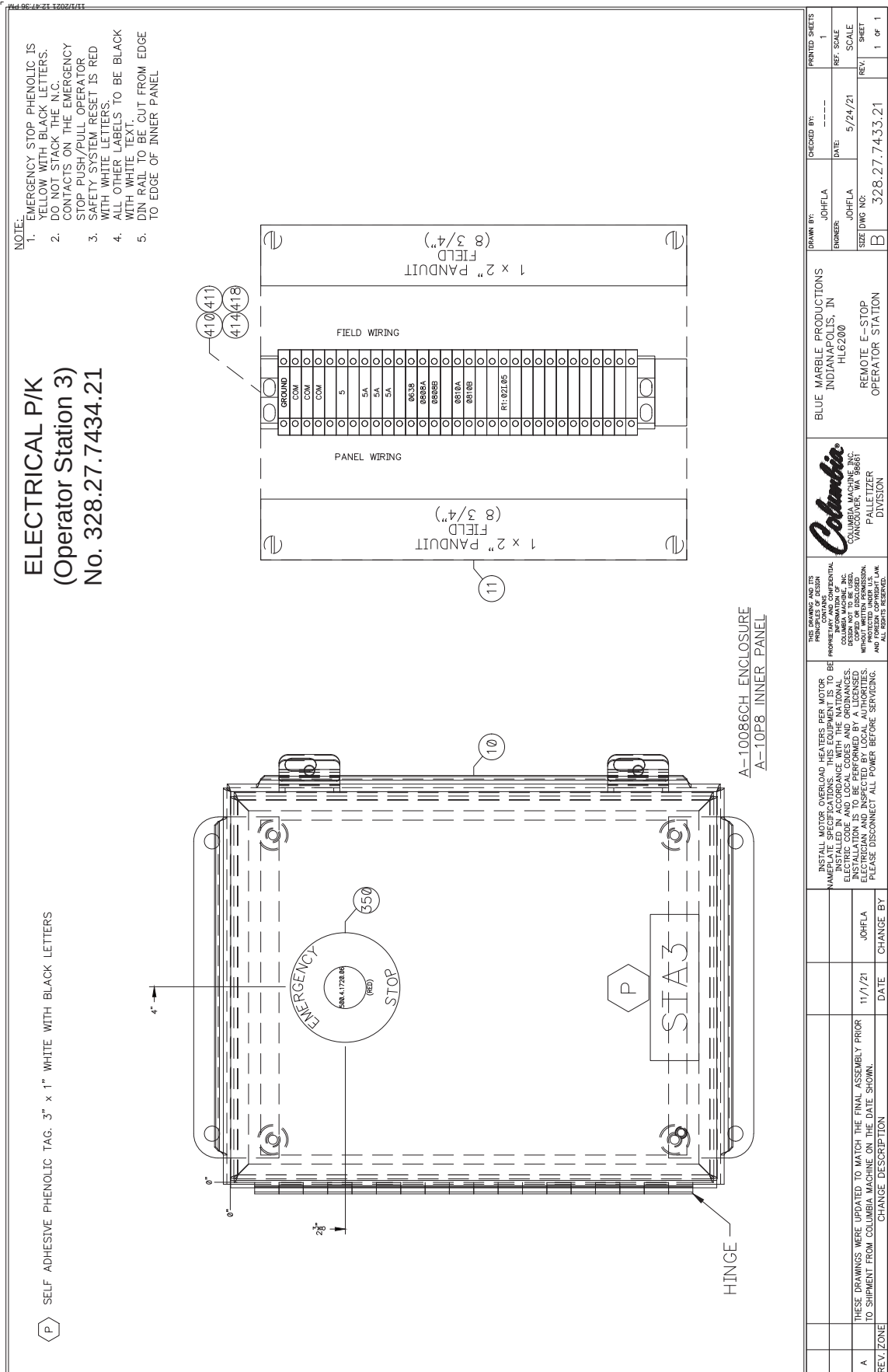
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Columbia Palletizer Parts

ELECTRICAL P/K
(Operator Station 2)
No. 328.27.7434.20

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
10.	Encl,14X12X8 Ch,A-14128Ch	2015260	1
11.	Panel F/14X12 Jic,A-14P12	2015300	1
350.	Pk 800Fm E-Stop III 2-N.C. 2-N	500.4.1720.06	1
351.	Pk 800Fm Ext III Blu Pb 1-N.O.	500.4.1720.03	1
353.	Pk 800Fm Mush III Yel Pb -1Nc	500.4.1720.02	1
355.	Pk 800Fm 3 Pos Spr Ret 2-N.O.	500.4.1720.07	5
357.	Pk 800Fm Flush Pb Blk 2-N.O.	500.4.1720.04	1
410.	Trmnl Blk, M4/6,#10	201580	96
411.	Trmnl,End Cover,Std,118.368.16	201582	2
414.	Clamp,End,Entrelec,206.351.16	201583	4
418.	Trmnl Gnd,Grn,165-113.16	2011423	2
480.	Switch,Xmr2-Mlil-02022P	2105017.2.7434	1
482.	Gold Key,Mlk-Sugs	2105018.743	2



Columbia Palletizer Parts

ELECTRICAL P/K
(Operator Station 3)
No. 328.27.7434.21

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
10.	Encl,10X8X6 Ch,A-10086Ch	2015273	1
11.	Panel F/10X8 Jic,A-10P8	2015309	1
350.	Pk 800Fm E-Stop III 2-N.C. 2-N	500.4.1720.06	1
410.	Trmnl Blk, M4/6,#10	201580	30
411.	Trmnl,End Cover,Std,118.368.16	201582	1
414.	Clamp,End,Entrelec,206.351.16	201583	1
418.	Trmnl Gnd,Grn,165-113.16	2011423	1

Columbia Palletizer Parts

ELECTRICAL P/K
(Infeed)
No. 328.27.7434.10

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
550.	Photocell,Retro,Qs18Vp6Lpq5	2015722	3
554.	Pc Mnt,18Mm,Smb18Sf	2358490	3

Columbia Palletizer Parts

ELECTRICAL P/K
(Row Layer)
No. 328.27.7434.11

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
584.	Prox Qd,Bi10-M30E-Ap6X-H1141	200016	2

Columbia Palletizer Parts

ELECTRICAL P/K
(Palletizer)
No. 328.27.7434.12

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	O/S Sta1,Blue Marble,5028930	328.27.7434.19	1
2.	O/S Sta2,Blue Marble,5028930	328.27.7434.20	1
3.	O/S Sta3,Blue Marble,5028930	328.27.7434.21	1
4.	P/K Pnl2,Blue Marble,5028930	328.27.7434.4	1
148.	Brake Res,460V,15Hp,R4-15A02	2104975.460.15	1
205.	Sola Hs1F1Bs, 1Kva, 240/480	311096.1000.1.2	1
485.	Doorlatch,Dm2-Mlis-C-Rb	2105019.743	3
487.	Door Latch,Dm-F No Springs	2017446	3
501.	Pk Banner Sls Lc 65"	500.4.1707.65	1
520.	Light Stack,TI50Hbgraq	2017674.BGRA	1
523.	Pk Light Stack Mount Kit 12"	500.4.1713.12	1
550.	Photocell,Retro,Qs18Vp6Lpq5	2015722	9
551.	Photocell,Laser W/Reflector	235819	2
554.	Pc Mnt,18Mm,Smb18Sf	2358490	9
555.	Omron Photo Sensor E3Z-G81	2000818	1
573.	Pk Pallet Track Pe W/Bracket	500.4.1715	4
584.	Prox Qd,Bi10-M30E-Ap6X-H1141	200016	2
585.	Prox Qd,Bi10-M30-Ap6X-H1141	2017415	2
592.	Prox Switch,M12X1,3-Pin	352003	5
601.	Pk Pressure Switch	500.4.1717	1
628.	Cable,Mac Valve 20Ft	500.1.1545	1
630.	Cord,Pico,3Pin,Pkg3M-4	2017823.04	2
631.	Plug W/10M Cord,Ms6 Festo Soft	372086	2

Columbia Palletizer Parts

ELECTRICAL P/K
(Pallet Dispenser)
No. 328.27.7434.40

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
550	Photocell,Retro,Qs18Vp6Lpq5	2015722	1
554	Pc Mnt,18Mm,Smb18Sf	2358490	1
584	Prox Qd,Bi10-M30E-Ap6X-H1141	200016	2

Columbia Palletizer Parts

ELECTRICAL P/K
(Tie Sheet Dispenser)
No. 328.27.7434.60

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
522.	Light Stack,TI50Hwq	2017674.W	1
525.	Beacon Mount Bracket,Formed	3.0020.465	1
540.	Pull Sw No/Nc Ps-1003 Bsw	2000260	1
541.	Rope 3/8 Dia,Nyl Soft	367690.72.00	1
542.	Receptical,Dc Micro Style,4-P	2016616	1
544.	Prox Qd,Bi10-M30E-Ap6X-H1141	200016	4
550.	Photocell,Retro,Qs18Vp6Lpq5	2015722	1
567.	Pc Mnt,18Mm,Smb18Sf	2358490	1
574.	Ifm Effector580,18Mm,M12-4Pin	2104944	1
585.	Prox Qd,Bi10-M30-Ap6X-H1141	2017415	1
593.	Prox Switch,M12X1,3-Pin	352003	1
624.	Cbl Str,Rk4.43T-5	2015410.005.00	1

Columbia Palletizer Parts

ELECTRICAL P/K
(24V Enclosure Fan Kit)
No. 500.4.1719

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
20.	Fan,24Vdc,Ustf1203824Hw	2030043	1
21.	Encl Acc Fan,B,Abrkt4	2010488	1
22.	Encl Acc Guard,Wagard4	2010188	2

Columbia Palletizer Parts

ELECTRICAL P/K
(ABB 60 AMP Disconnect)
No. 500.4.1706.60

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1-19.	Not Used		
20.	60A Fused Disconnect	2017203	1
21.	Operating Handle, Disc	2017207	1
22.	Operating Shaft Disc	2017210	1

Columbia Palletizer Parts

ELECTRICAL P/K
(800FM E-Stop)
No. 500.4.1720.06

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Pb Ill. E-Stop,800Fm-Lmp44	2015505	1
2.	Power Mod White Led 800F-Mn3W	2000745	1
3.	Pb Contact Blk N.C. 800F-X01	2015091	2
4.	Pb Contact Blk N.O. 800F-X10	2015090	2

Columbia Palletizer Parts

ELECTRICAL P/K
(800FM Ext III Blue PB 1-N.O.)
No. 500.4.1720.03

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Ab,Pb,Raised,Illum,Blue,22Mm	311230.12.00.6	1
2.	Power Mod White Led 800F-Mn3W	2000745	1
3.	Pb Contact Blk N.O. 800F-X10	2015090	1

Columbia Palletizer Parts

ELECTRICAL P/K
(800FM PB Black)
No. 500.4.1720.01

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Ab,Pb,Flush,Illum,Green,22Mm	311230.11.00.3	1
2.	Power Mod White Led 800F-Mn3W	2000745	1
3.	Pb Contact Blk N.O. 800F-X10	2015090	1

Columbia Palletizer Parts

ELECTRICAL P/K
(800FM Mush III Yellow)
No. 500.4.1720.02

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Ab,Pb Mom,Illum,Yellow,22Mm	311230.4.00.4	1
2.	Pb Contact Blk N.C. 800F-X01	2015091	1
3.	Power Mod White Led 800F-Mn3W	2000745	1

Columbia Palletizer Parts

ELECTRICAL P/K
(800FM 3 Pos Spring Ret 2-N.O.)
No. 500.4.1720.07

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Ab, Ss, Blk, Sh, 3-Pos, N-Illum, 22Mm	311230.64.00.3	1
2.	Pb Cont. 2N.O. Latch 800F-Mx20	2015093	1

Columbia Palletizer Parts

ELECTRICAL P/K
(800FM 2 Flush PB Black)
No. 500.4.1720.04

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Ab,Pb,Flush,N-Illum,Blk,22Mm	311230.01.00.2	1
2.	Pb Cont. 2N.O. Latch 800F-Mx20	2015093	1

Columbia Palletizer Parts

ELECTRICAL P/K
(Banner SLS LC 65")
No. 500.4.1707.65

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1-119.	Not Used		
120.	Light Curtain,65",W/O Mute	2000738	1
121.	Splitter Module,Sls Curtains	20159761	1
122.	Cube67 I/O Y-Couplers	2015644	1
123.	Cable,M12Qd,8P,8W,4M,Fst,Mstxs	2396179.04.00	1
124.	Not Used		
125.	Cordset,12Pin,10M,Rk-12T-10	2014659.010.00	1
127.	Sensor Photo Reflector,Brt-2X	231161	2
128.	Photocell,Retro,Qs18Vp6Lpq5	2015722	2
129.	Not Used		
130.	Light Stack,TI50Hyq	2017674.Y	1
131.	Cbl Str,Rk4.43T-.2	2015410.000.20	1
132.	Pc Mnt,18Mm,Smb18Sf	2358490	2
133.	Cbl Str,Rk4.43T-3	2015410.003.00	1
134.	Cbl Str,Rk4.4T-.2-Rs4.4T/S675	2104935.000.20	1

Columbia Palletizer Parts

ELECTRICAL P/K
(Light Stack Mount Kit 12")
No. 500.4.1713.12

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Cable 5Pin 10M,889D-F5Ac-10	2007816	1
2.	Light Stack,Top Mt,Sa-M30Te12	2017677	1
3.	Light Stack,Bot Mt,Sa-E12M30	2017678	1
4.	Beacon Mount Bracket,Formed	3.0020.465.001	1
5.	Pipe Adapt,1/2"X12"	311471.03.12	1

Columbia Palletizer Parts

ELECTRICAL P/K
(Pallet Track PE w/ Bracket)
No. 500.4.1715

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Photcell,Ret,Rk46C.Dxl3/4P-M12	2021215	1
2.	Photocell,Bracket,Bt46	2021216	1
3.	Reflector,84Mm Square	311212.84.84	1

Columbia Palletizer Parts

ELECTRICAL P/K
(Pressure Switch)
No. 500.4.1717

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Psw,Digital Air Pressure Sw	202580	1
2.	Brk,Panel Mount For Air Switch	202581	1
3.	Psw,Front Protector Cover	202582	1
4.	Cord,Pico,4Pin,889P-R4Ab-10	2017443	1
5.	Ftg,Tube,Male,M5,1/4"	1505300.04.05	1

Columbia Palletizer Parts

ELECTRICAL P/K
(Ship Loose)
No. 328.27.7434.24

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
5.	Sp Fuses,Blue Marble.5028930	328.27.7434.5	1

Columbia Palletizer Parts

ELECTRICAL P/K
(Fuses)
No. 328.27.7434.5

<u>No.</u>	<u>Description</u>	<u>Columbia Part Number</u>	<u>No. Req'd.</u>
1.	Term Screw Driver,W26035	201619	1
2.	Prox Wrench 18Mm-30Mm	3.2089.269	2
410.	Trmnl Blk, M4/6,#10	201580	10
411.	Trmnl,End Cover,Std,118.368.16	201582	10
412.	Trmnl Fuse,8Mm,1Snk508410R0000	203656	10
413.	Trmnl End Cover 8Mm,116-951.15	203657	10
414.	Clamp,End,Entrelec,206.351.16	201583	10
418.	Trmnl Gnd,Grn,165-113.16	2011423	5
440.	Fuse, Gmc, 3 Amp	202527.003.000	5
441.	Fuse, Gmc, 1 Amp	202527.001.000	5
442.	Fuse, Gmc, 2 Amp	202527.002.000	5
443.	Fuse, Gmc, 4 Amp	202527.004.000	5
444.	Fuse, Gmc, 5 Amp	202527.005.000	5
446.	Fuse, Gmc, 10 Amp	202527.010.000	5
447.	Fuse, Gma, 500Ma	202526.000.500	5

Columbia Palletizer Parts

HL6200 PALLETIZER

VENDOR DATA

<u>EQUIPMENT</u>	<u>PART NUMBER</u>	<u>PUBL. NO.</u>
------------------	--------------------	------------------

GEARBOXES

GEARBOX, CONE B06	459731	444-545-58
	460773	
B04	460285	
	460951	
	460968	
	460958	

CONE DRIVE	367.33.44	444-545-43
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MOTORS

BALDOR MOTOR	365.3.78.21	444-510-46
	365.3.78.15	
	365.3.75.8	

Electric Motor, MGM	365.3.59.2	MGM-609
	365.3.59.6	
	365.3.59.5	
	365.3.56.8	
	365.3.56.1	

Columbia Palletizer Parts

HL6200 PALLETIZER

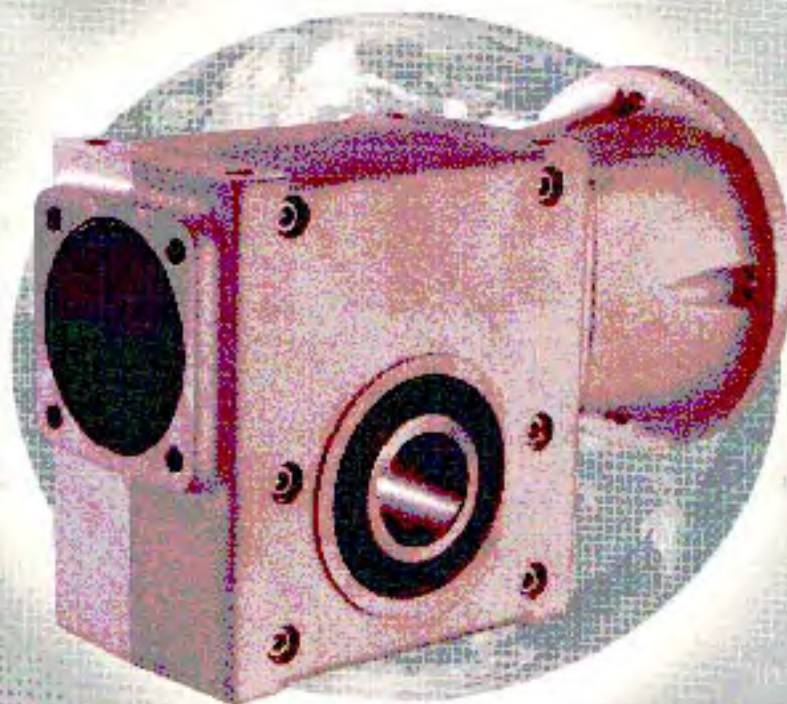
VENDOR DATA

<u>EQUIPMENT</u>	<u>PART NUMBER</u>	<u>PUBL. NO.</u>
<u>MISCELLANEOUS</u>		
QD BUSHINGS & SPROCKETS	XXXXXX	444-550-21
PNEUMATIC VALVES 92B	433351 433353	444-520-116
FLOW CONTROL	433363 433364	
REGULATOR, R75	362779	444-540-57
HYTROL CDLR	3.0008.110.058	
TRANSNORM CURVE	3.0018.008.100	

Series B

Cone Drive

444-545-58



444-545-58

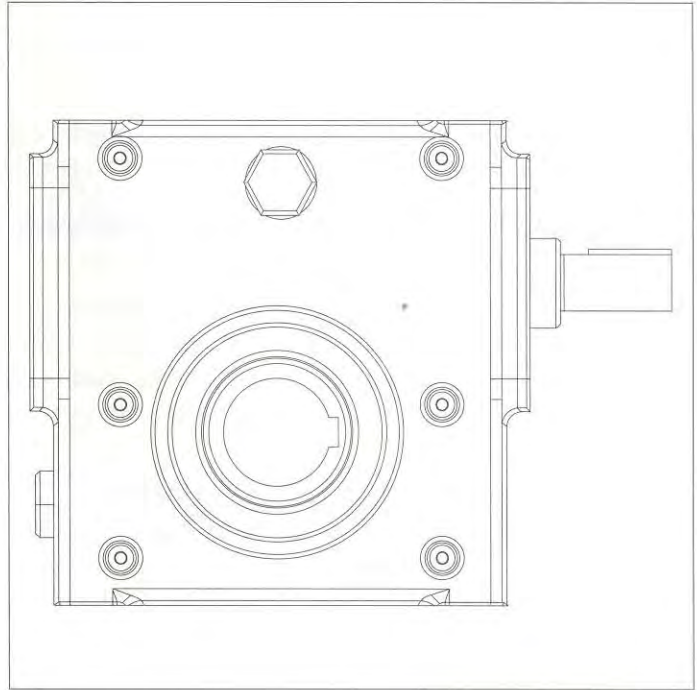
TEXTRON POWER TRANSMISSION



Columbia Machine, Inc.

Customer Care Department
1-800-628-4065

INTENTIONALLY BLANK



**INSTALLATION
MAINTENANCE
& LUBRICATION**

SERIES B

SERIES B

INSTALLATION AND MAINTENANCE

0108

1 GENERAL INFORMATION

The following instructions will help you achieve a satisfactory installation of your Series B unit, ensuring the best possible conditions for a long and trouble free operation.

All units are tested and checked prior to shipment, a great deal of care is taken in packing and shipping arrangements to ensure that the unit arrives at the customer in the approved condition.

Optimum performance is best achieved by a process of gradual load increments, up to the full value, over the first 50 hours or so of their working life. During these early stages of running, sensible precautions should be taken to avoid overloads.

The gear unit operating temperature may be higher during this period of run-in. A progressive reduction in temperature may occur over many hours until the unit has reached its highest efficiency.

2 MOUNTING OF COMPONENTS TO EITHER THE UNIT INPUT OR OUTPUT SHAFT

Shaft dimensions and tolerances are on page 12.

- Items (such as gears, sprockets, couplings etc) should not be hammered onto these shafts since this would damage the shaft support bearings.
- The item should be pushed onto the shaft using a screw jack device fitted into the threaded hole.
- Items being fitted may be heated to 80/100°C (176/212°F) to aid assembly further.

3 WEATHER PROTECTION OF UNIT

All Series B units are provided with protection against normal weather conditions. Where units are to operate in extreme conditions, or where they are to stand for long periods without running, e.g. during plant construction, we should be notified when ordering so that arrangements for adequate protection can be made.

4 INSTALLATION

4.1 MOTORIZED AND REDUCERS

All sizes are factory filled with a high quality synthetic lubricant. They are 'Lubricated for Life' and require no routine maintenance in service.

4.2 MOUNTING TO CUSTOMER EQUIPMENT

Mounting the gearhead flange facing or feet to the customer equipment use screws to ISO grade 8.8 minimum.

Torque tighten to:

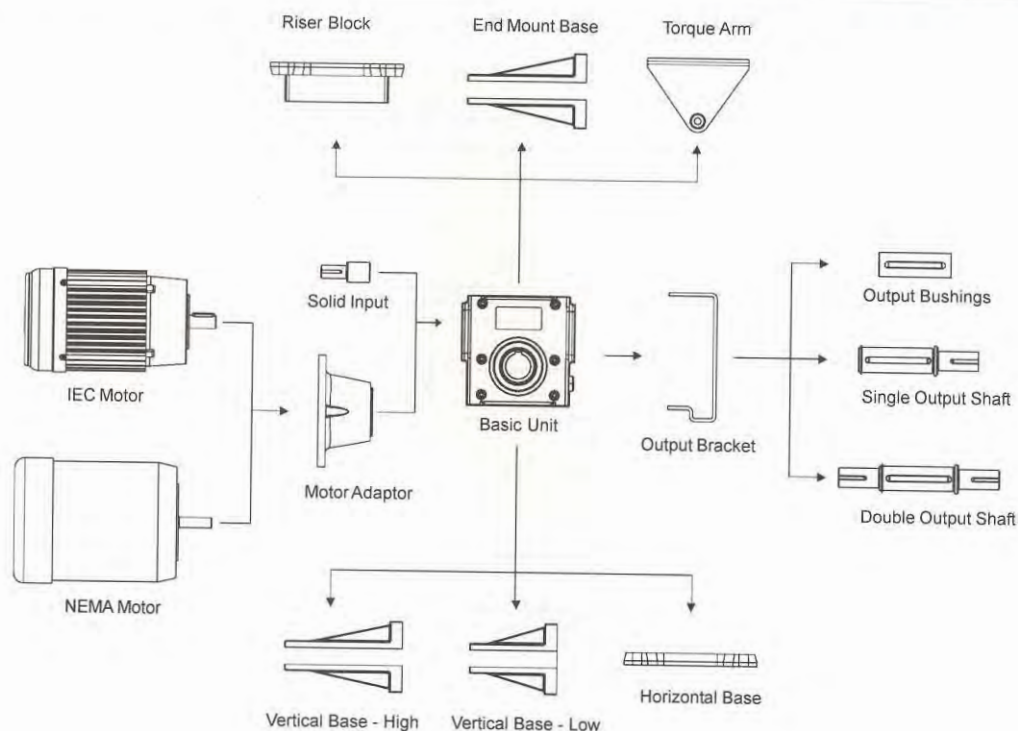
Screw Size	Tightening Torque	Tightening Torque
M6	88 lb-ins	7.3 lb-ft
M8	220 lb-ins	18.3 lb-ft
M10	450 lb-ins	37.5 lb-ft
M12	750 lb-ins	62.5 lb-ft
M16	1770 lb-ins	147.5 lb-ft
M20	3100 lb-ins	258.3 lb-ft
M24	5400 lb-ins	450.0 lb-ft

4.3 MOTOR CONNECTIONS TO MAINS

Connection of the electric motor to the mains supply should be made by a qualified person. The current rating of the motor will be identified on the motor plate, and correct sizing of the cables to electrical regulations is essential.

SERIES B

INSTALLATION AND MAINTENANCE



BASE ASSEMBLY (TYPES B, H, L, J)

- 1 Clean shaft extension with petroleum spirit.
- 2 Remove paint from locating faces on gearcase with scraper and petroleum spirit.
- 3 Secure feet to gear case with nuts and bolts provided to thumb tightness, in required operating position.
- 4 Ensure foot pads are correctly seated.
- 5 Secure to foundations with bolts to thumb tightness and line up unit.
- 6 Tighten feet bolts to unit.
- 7 Check shaft alignment (see page 25) and tighten down bolts.

OUTPUT SHAFT ASSEMBLY

- 1 Clean output shaft and bore in gear unit with petroleum spirit.
- 2 Fit keys into output shaft, ensuring they are firmly seated.
- 3 Press shaft into gear unit bore to give desired shaft handling (Left or Right), until firmly up against shaft shoulder.
- 4 Fit circlip into groove in shaft on opposite side to extension.

SERIES B

APPROVED LUBRICANTS

0211

Series B units are factory filled with a high quality synthetic lubricant. They are "Lubricated for Life" and require no routine maintenance in service.

In the event of a major overhaul involving strip-down and re-assembly of the gear unit refer to Table 1 for a list of approved lubricants. Lubricant quantities are given in Tables 2 & 3.

Table 1 Approved Lubricants

Type H Polyalphaolefin based synthetic lubricants

These lubricants are suitable for ambient temperatures of 32°F to 104°F (0°C to 40°C); outside of this, please contact our Application Engineers

SUPPLIER	LUBRICANT RANGE	GRADE 7H
		OIL SUPPLIERS' CORRESPONDING DESIGNATIONS
Chevron-Texaco	Clarity Synthetic PMO	460 (-23)
Exxon Mobil Corporation	SHC 600 Series	634 (-34)

DANGER Numbers in brackets indicate recommended minimum operating temperature in °F.
The unit must not run below this temperature

Table 2 Lubricant Quantities (liters)

Applicable for all mounting positions:

CONVERSION TABLE

Liters to US gallons = liters x 0.26
Liters to Imperial gallons = liters x 0.22

MOTORIZED or REDUCER		UNIT SIZE								
		B02	B03	B04	B05	B06	B08	B09	B10	B11
Oil Capacity	Quarts	0.14	0.26	0.34	0.45	0.58	0.96	1.48	2.00	1.70
	Liters	0.13	0.25	0.33	0.43	0.55	0.91	1.40	1.89	1.61

Table 3 Double Reduction Lubricant Quantities

Applicable for all mounting positions:

Unit Size	B0520		B0620		B0820		B0920		B1020		B1120	
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary
	B0210	B0510	B0210	B0610	B0410	B0810	B0410	B0910	B0510	B1010	B0510	B1110
Quarts	0.14	0.60	0.14	0.80	0.34	1.25	0.34	1.80	0.45	2.60	0.45	2.21
Liters	0.13	0.57	0.13	0.76	0.33	1.18	0.33	1.70	0.43	2.46	0.43	2.09

SERIES B

SHAFT ALIGNMENT

0108

GENERAL INSTRUCTIONS

SHAFT ALIGNMENT Coupling Connections

Angular Errors

- 1 Take up end float pushing in shaft ends.
- 2 Using thickness and feeler gauges, take readings in positions 1, 2, 3 and 4 (Fig 2).
- 3 Adjust unit by shimming under feet.

Fig 1

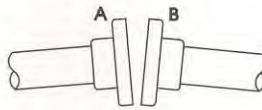
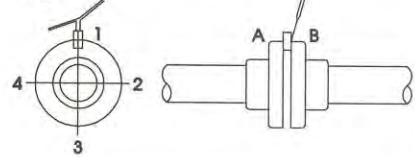


Fig 2



Eccentric Errors

- 1 Place straight edge across coupling halves at points 1, 2, 3 and 4 (Fig 4). If coupling diameters are not equal, use feeler gauge equal to half the difference in diameters.
- 2 If error is in vertical plane, adjust height of unit. If error is in horizontal plane, move unit transversely.

Fig 3

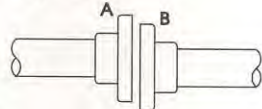
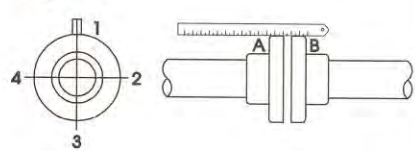


Fig 4



CHAIN AND BELT DRIVES

Mount sprockets or pulleys as close to the gear unit as possible to avoid undue bearing loads and shaft deflection see Fig 5. Chains and belts should be sufficiently light as to prevent slip **OVER TIGHTENING CAN CAUSE DAMAGE TO THE UNIT.** Consult manufacturers' recommendations.

Check that driving and driven shafts are square and parallel using straight edge as in Fig 6.

Check horizontal shaft alignment using combined square and level as in Fig 7.

Fig 5

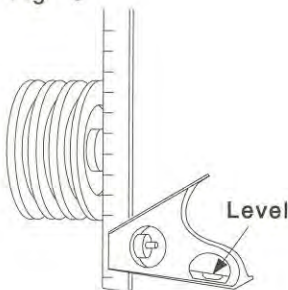


Fig 6

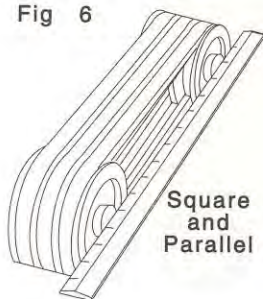
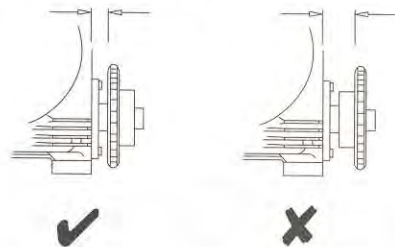


Fig 7



FIT GUARDS IN ACCORDANCE WITH REGULATIONS

If a unit is to be subject to long term storage contact our Application Engineers.

WARNING

The customer shall be responsible for the proper use of articles supplied by us, particularly the rotating shafts between their driving and driven members, and their guarding for safety. We shall not be responsible for any injury or damage sustained as a result of the improper use of the articles supplied.

Attention is hereby drawn to the danger of using naked lights in proximity of opening in gearboxes and gear units supplied by us, and the company shall not be liable for any claim for injury or damage arising from any action in contradiction of this warning.

GENERAL SAFETY

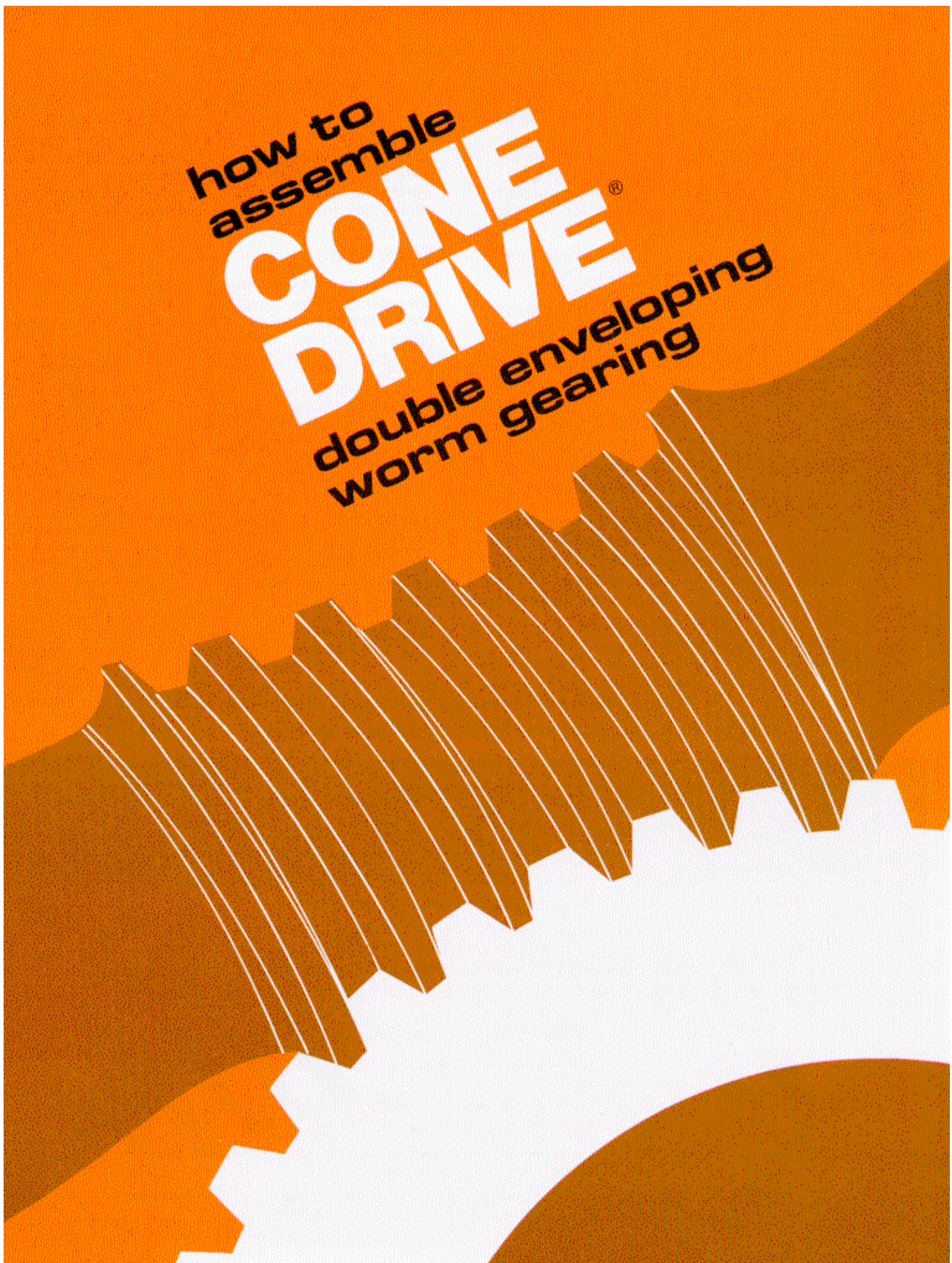
Potential hazards which can be encountered during installation, maintenance and operation of drives is covered in greater detail in the product safety page at the back of this booklet.

Advice is also given on sensible precautions which need to be taken to avoid injury or damage. **PLEASE READ !**

how to
assemble

CONE DRIVE®

double enveloping
worm gearing



The Controlling Dimensions:

The controlling dimensions for proper assembly of Cone Drive gearsets are: worm end-position, gear side-position and center distance. Since these dimensions are held during the manufacture of gearsets, these same dimensions should be maintained within the specified limits to properly locate the gearing in the housing.

Variations in housing flange face dimensions affect the end-position of the worm and side position of the gear. We compensate for these variations by inserting shims between the bearing cap or carrier face and the housing flange face. The shims are adjusted to centralize the worm and gear in the housing. Where opposed single-row tapered roller bearings are used, shims also adjust the bearing end-play.

Errors in Angularity:

Errors in the angular relation between the worm and gearshaft, beyond permissible limits, cannot be corrected by altering any of the locating dimensions. Care should be taken that the housing bores for the worm shaft and gear shaft are machined square with each other within .004" per linear foot.

Tolerances:

The recommended tolerance limits for the controlling dimensions, (Worm end-position, gear side-position and center distance) are as follows, according to size (center distance):

Center Distance:	Tolerance
Up to 6"	$\pm .001$
6" to 12"	$\pm .002$
over 12"	$\pm .003$

Adjustment of Bearing Play or Looseness:

Opposed mounted single-row tapered roller bearings require adjustment for end-play. Select proper bearing setting according to R.P.M. from the chart below. Double-row tapered roller bearings are pre-set at the factory with the proper clearance and do not require additional adjustment for end-play.

RECOMMENDED BEARING SETTINGS

**Single Reduction, Double Reduction Primaries,
Gearmotors, Right Angle Drives and Attachable Helical Reducers**

REDUCER SIZE (CENTER DISTANCE)	WORM SPEED (1000-2000 RPM)	WORM SPEED (2001-3600 RPM)
15 to 25 (1.500" to 3.500")	.003 $\pm$.001	.005 $\pm$.001
40 to 60 (4.000" to 6.000")	.004 $\pm$.001	.006 $\pm$.001
70 to 80 (7.000" to 8.000")	.006 $\pm$.001	.007 $\pm$.001

- NOTE:**
- A. Settings shown in above chart are axial looseness.
 - B. All gear bearings up to and including 12.000" C.D. are set to a preload of $(-) .001 \pm .001$ for output speeds of 350 rpm or less. Contact Application Engineering for gear bearing settings for speeds in excess of 350 rpm.
 - C. For all double worm reducers, the secondary worm bearings are set to $.001 \pm .001$ (loose).
 - D. 7.000" and 8.000" C.D. prior to 1980 have preset worm bearings.
 - E. 10.000" C.D. and larger worm bearings and 15.000" C.D. and larger gear bearings are preset.
 - F. These bearing settings are for standard and special reducers unless otherwise specified on the assembly drawing.
 - G. If low backlash is critical, some applications may require reduced settings. Contact Application Engineering for review.
 - H. If the reducer is to be operated at input speeds other than those indicated above, contact Application Engineering for review.



Running-in:

An advantage of Cone Drive gearing is that the manufacturing methods inherently reduce the amount of running-in required to obtain the desired contact. The worm and gear are regenerative (ie: they tend to regenerate themselves if assembled in a misaligned position). However, the more accurate the alignment of the worm gear, the less "running-in" required to obtain maximum efficiency and performance.

"O" Marking:

"O" markings will appear on some, but not all gear sets with multiple threaded worms. In the past, all Cone Drive multiple threaded worms had "O" markings, but today, due to new manufacturing processes, "O" markings are not always used. When "O" markings are present, care should be taken during assembly to ensure that the "O" marks are properly aligned. As indicated in the sketch below, when properly aligned, the "O" stamped worm thread will pass through the "O" stamped space between two gear teeth. See sketch at lower left.

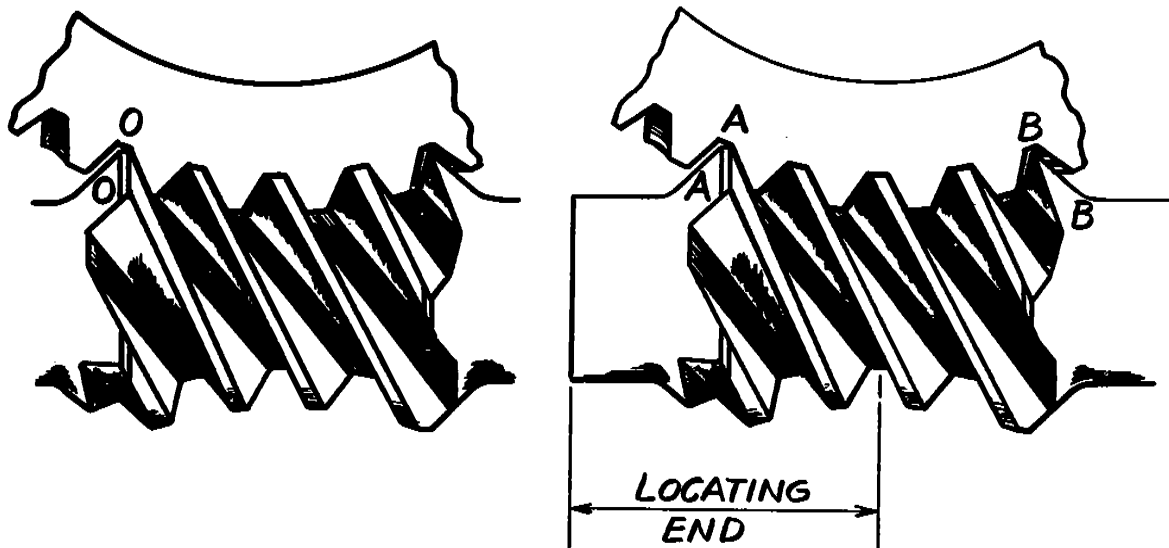
Single worm thread designs and self-indexing gearsets will not show "O" markings.

Matching Relationship:

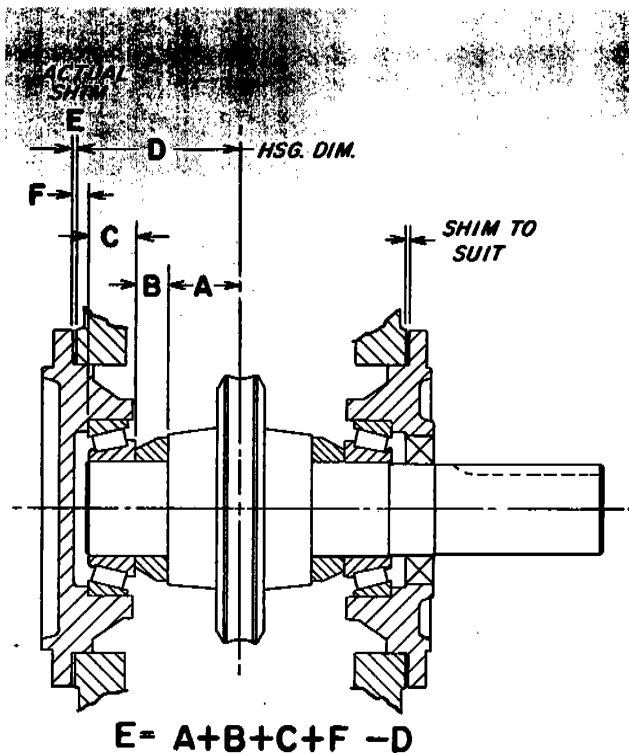
For optimum performance, gear sets should be assembled in the same relationship as matched at the factory. Generally, the matching note on the worm drawing would read "with worm on top (over gear) looking into the extension or drive-end of the worm, the gear marking is to the right (or left)".

Another method used is "A" and "B" marking. In this case, the letter "A" is stamped on the locating end of the worm as shown in the sketch below. This is particularly helpful in the case of a symmetrical worm, where it is difficult to determine the locating-end. At the time of assembly, the letters "A" and "B" stamped on the worm must coincide with the letters "A" and "B" stamped on the gear. See sketch at lower right.

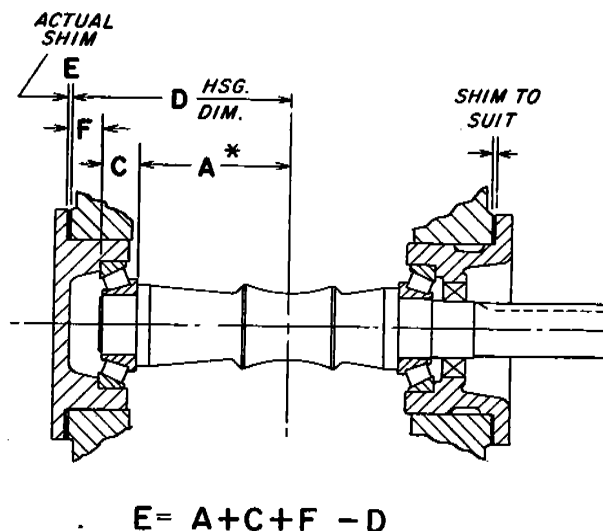
See worm print for proper matching relationship. Most standard gear sets are matched "with the worm on top (over gear), looking into the worm extension or drive-end, the gear marking is to the left.



OPPOSED BEARINGS



SKETCH No. 1



SKETCH No. 2

*Dimension held exact in manufacturing.

Measuring:

Since there are numerous combinations of mounting arrangements, it would be virtually impossible to describe the measurement of each. However, by selecting one or a combination of the following methods, the measurement of any type of mounting arrangement can be accomplished.

Gear Assembly

1. Make the required measurements as shown in Sketch #1 and determine shim thickness E. If a grease retainer is required on the locating end add the thickness of the retainer to Dimension A.
2. Press the gear on the gearshaft being sure to observe the matching relationship discussed on Page 3. Add gear spacers and grease retainers (if required) and press the gear bearings onto the shaft.
3. Assemble one carrier, bearing cup, and shims (E thickness), to the housing. Drop the gearshaft sub-assembly into the housing from the opposite side and assemble the second gear bearing carrier and bearing cup with sufficient shims to provide .000 bearing setting.
4. Remove 1 carrier and remove the gearshaft sub-assembly from the housing. Keep the shim pack with the removed carrier.

Worm Assembly

1. Make the required measurements as shown in Sketch #2 and determine shim thickness E. If a grease retainer is required on the locating end, add the thickness of the retainer to Dimension A.
2. Press the worm bearing cones on the worm. If a grease retainer is required, it must be positioned between the bearing and the worm shoulder.
3. Assemble one carrier, bearing cup, and shims (E thickness) to the housing and drop the worm into the housing from the opposite side. Assemble the second worm carrier, bearing cup and shims to provide .000 bearing setting.

Check Contact

Apply a light coat of red lead or prussian blue to the worm and carefully lower the gear sub-assembly into the housing and into mesh with the worm observing match markings and 0 marking if required (See Page 3). Assemble the gear bearing carrier, bearing cup, and shims and check the contact pattern as shown on Pages 6 and 7 by rotating the worm in each direction.

Final Shim Adjustment

Add or remove shims **equally** at each end of the worm and gear shafts to provide the bearing settings shown on Page 2.

DOUBLE ROW THRUST BEARINGS

General

The worm is assembled into the housing before the gear on Model HV up to and including 10.000" C.D. and on all Model HU and HO reducers with split type housing. On Model HV 12.000" C.D. and larger the worm is assembled last using an eccentric thrust bearing carrier to bring the worm into mesh with the gear.

Worm

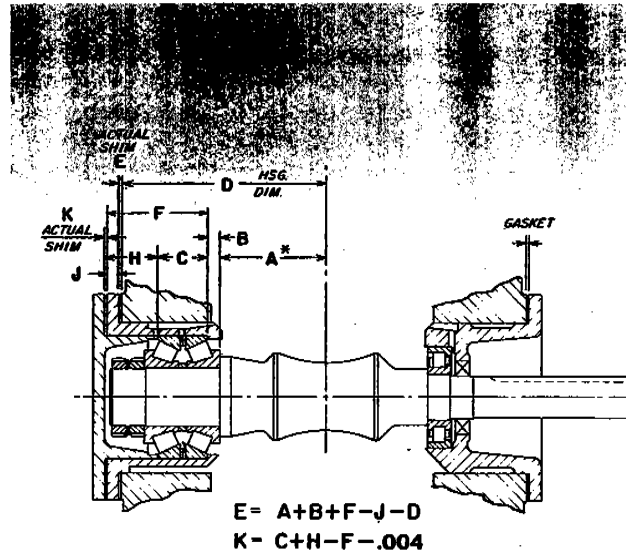
1. Make the required measurements as shown in Sketch #3 and determine shim thickness E. If a grease retainer is required on the locating end, add the thickness of the retainer to Dimension A.
2. Press all worm bearings on the worm. If a grease retainer is required, it must be positioned between the bearing and the worm shoulder. Assemble the locknuts and lock washers.
3. Assemble the worm into the housing using E shim thickness between the thrust bearing carrier and the housing. Lock the thrust bearing in place by installing K shim thickness between the bearing cap and the thrust bearing carrier. This should provide a .003-.005 clamp on the bearing cups.

Gear

1. Make the required measurements as shown in Sketch #4 and determine the spacer width J. If a grease retainer is required on the locating end, add the thickness of the retainer to Dimension A. Grind the thrust bearing spacer to J dimension and assemble the spacer, grease retainer (if required), and the thrust bearing to the shaft.
2. Press the gear on the gearshaft being sure to observe the matching relationship discussed on Page 3. Add the radial gear spacer and grease retainer (if required) and press the radial bearing into place. Assemble the locknuts and lock washers.

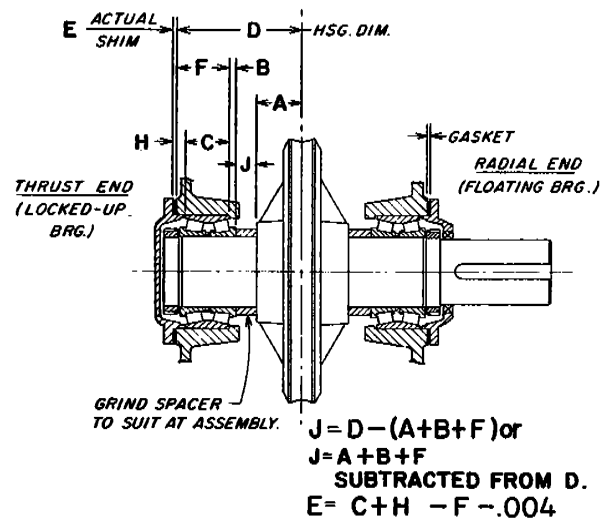
Check Mounting

1. Apply a light coat of prussian blue or red lead to the worm.
2. Assemble the gearshaft sub-assembly into the housing and lock the thrust bearing in place by installing E shim thickness between the gear bearing cap and the housing. This should provide a .003-.005 clamp on the bearing cups.
3. Check the gearset contact patterns as shown on Pages 6 and 7 by rotating the worm in both directions.
4. No bearing adjustment is required on double row thrust bearings. The endplay is preset at the factory.



SKETCH No. 3

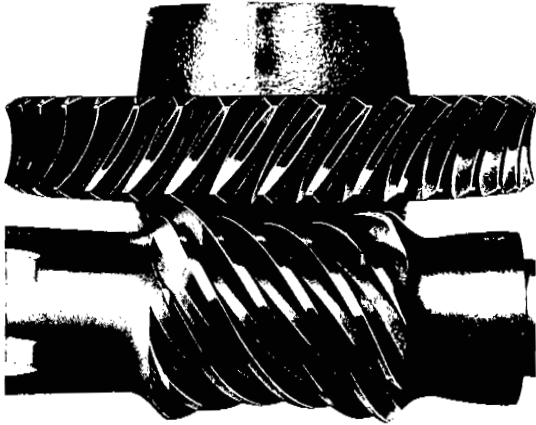
*Dimension held exact in manufacturing



SKETCH No. 4

FAST RATIOS (5:1-25:1)

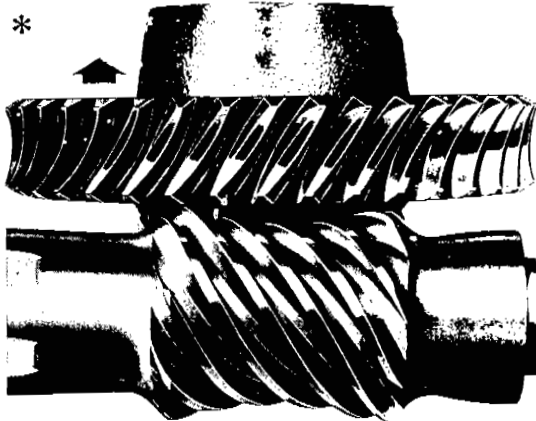
GEAR SET



5:1 RATIO — CORRECT POSITION

After the worm and gear have been assembled in the housing to the correct relative position, the assembly should be checked as follows: Brush a light even coat of red lead or prussian blue on the entire worm thread portion. Rotate the worm in both directions against a light retarding load on the gearshaft until a clear contact pattern is obtained on the worm thread and gear teeth. If the gear set is properly aligned, the contact should be approximately as shown by the shaded portion in the photographs on the top of this and the following page.

The ends of the worm thread are relieved slightly to provide a smooth entry into the gear teeth. After a short run-in under load the worm and gear will seat themselves and show increased contact on both members.



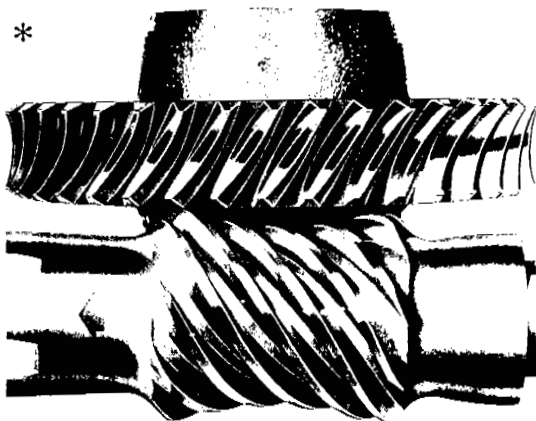
5:1 RATIO — GEAR OFF SIDE POSITION

GEAR OFF

Note that the contact pattern on the gear shows that the worm is making contact with the gear too soon on the left side of the gear teeth and too late on the right side of the gear teeth. This is corrected by moving the gear up to make the contact pattern symmetrical on both sides of the gear.

HOW TO CORRECT "GEAR OFF SIDE POSITION"

If the contact pattern on the gear teeth is similar to the illustrations shown at the left or right, the gear should be moved up a few thousandths as shown



5:1 RATIO — WORM OFF END POSITION

WORM OFF

Note that the left end of the worm shows full contact on the threads and the right end of the worm shows no contact. This is corrected by moving the worm to the left which will centralize the contact pattern.

HOW TO CORRECT "WORM OFF END POSITION"

If the contact pattern on the worm threads is similar to the illustrations shown on the left or right, the worm should be moved a few thousandths to the left as shown by the arrow. If the contact is opposite that shown, the worm should be moved to the right.

* For illustration purposes only, the above 4 photographs show extreme conditions of off-positioning. Normal care at assembly will produce contact patterns more closely resembling the "correct positioning shown above."

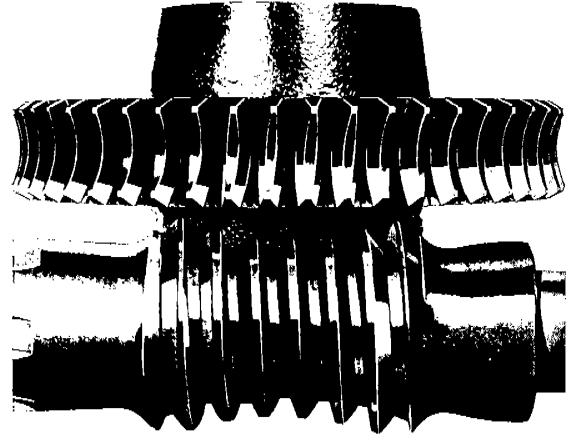
CONTACT

If the preceeding instructions have been followed accurately, the gearset should be positioned properly. However, minor inaccuracies in the housing, bearings or mountings may require a slight adjustment to the worm or gear to obtain proper gearset contact.

The most important objective when assembling worm gearing is to obtain a contact pattern that is symmetrical about the centerline of the worm and gear. The length and area of contact will vary with ratio, but regardless of ratio, the contact pattern should be symmetrical.

These illustrations represent optimum contact which may not be achieved at initial assembly. Lesser contact is acceptable providing it is relatively equal on either side of the worm and gear centerline.

SLOW RATIOS (30:1-70:1)



50:1 RATIO — CORRECT POSITION

SIDE POSITION

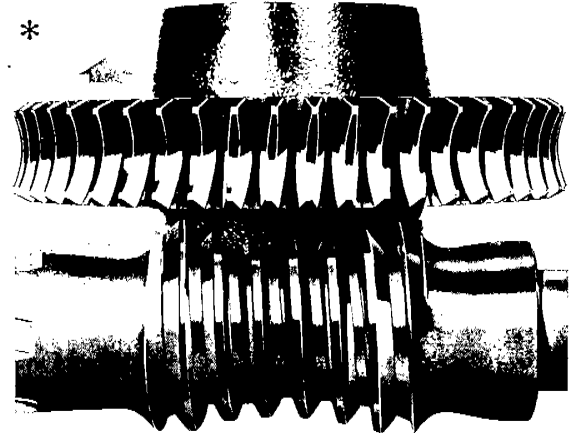
by the arrow. If the contact is opposite that shown, the gear must be moved down.

OPPOSED BEARINGS

The gear is moved by removing shims from under one gear carrier and putting the **same amount of shims** under the opposite gear carrier. (E shim as shown in Sketch #1, Page 4.)

DOUBLE ROW THRUST BEARINGS

The gear is moved by grinding the spacer between the locked up bearing and the gear.



50:1 RATIO — GEAR OFF SIDE POSITION

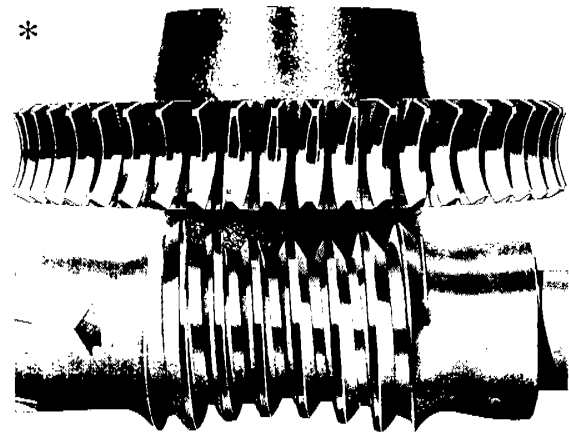
END POSITION

OPPOSED BEARINGS

The worm is moved by removing shims from under one worm carrier and putting the **same amount of shims** under the opposite worm carrier. (E shim as shown in Sketch #2, Page 4.)

DOUBLE ROW THRUST BEARINGS

The worm is moved by adding or removing shims between the thrust bearing carrier and the housing. (E shim as shown in Sketch #3, Page 5.)



50:1 RATIO — WORM OFF END POSITION

LUBRICATION CHART

AGMA STANDARD SPECIFICATION FOR LUBRICATION
OF INDUSTRIAL ENCLOSED GEARING (250)

LIMITATIONS

Gear drives operating in normal ambient temperatures, -10°C (15°F) to 40°C (100°F), and at or below their thermal horsepower ratings (continuous duty), should have a maximum sump temperature not exceeding 93°C (200°F). Those operating in ambient temperatures less than -10°C (15°F) or greater than 40°C (100°F), or those operating in extremely humid, chemical, or dust laden atmosphere, should be referred to Cone Drive Application Engineering for recommendations.

NOTE: 200°F max operating sump temperature

TYPE OF OIL

Lubricating oils for use in gear units should be high quality well refined petroleum oils. They must not be corrosive to gears, to ball, roller, or sleeve bearings; they must be neutral in reaction; free from grit or abrasives; and have good defoaming properties. They may be subject to high operating temperatures, so they must have good resistance to oxidation. Extreme Pressure (E.P.) lubricants or cylinder oils with sulphur-phosphorus additives are not acceptable and should not be used with Cone Drive worm gearing.

Worm gears generally require steam cylinder oils with additions of 3 percent to 10 percent of acidless tallow or similar animal fats.

VISCOSITY

Oils recommended for AGMA 7 comp, 8 comp and 8A comp must have a minimum viscosity index of 90.

LUBRICATION RECOMMENDATIONS

Pour Point of the oil used should be less than the minimum ambient temperature expected.

BEARING GREASE RECOMMENDATIONS

Reducers supplied with grease fittings are to be greased with a high quality lithium base NLGI #2 or NLGI #3 grease.

SLUDGE

It is necessary that the oil be clean and free from sludge at all times to obtain long life from a gear unit.

Sludge in gear units may be caused by metallic particles ground off the gears, from dust and dirt and by the presence of moisture or chemical fumes. Therefore, every precaution should be taken to prevent water and foreign particles from entering the gear case.

OIL CHANGE

If an approved synthetic lubricant is used, it should be changed after 5,000 hours of operation or once per year, whichever occurs first. If a recommended steam cylinder oil is used, the change interval should be after 2,500 hours of operation or every six months, whichever occurs first. This is recommended for units operating under favorable conditions. Where operating conditions are severe, such as a rapid rise and fall in temperature of the gear case with accompanied sweating of the inside walls and resulting formation of sludge, or where operation is in moist or dusty atmospheres, or in the presence of chemical fumes, or extended running at sump temperatures in excess of 180°F., it may be necessary to change the oil at intervals of one to three months.

VISCOSITY RANGE FOR VARIOUS AGMA LUBRICANTS			
AGMA LUBRICANT NUMBER	VISCOSITY RANGE		
	ASTM SYSTEM		ISO GRADE
	SUS @ 210°F	SUS @ 100°F	CST @ 40°C
7 COMP.	125-150	1919-2346	414-506
8 COMP.	150-190	2837-3467	612-748
8A COMP.	190-250	4171-5098	900-1100

Above oils are compounded with 3 to 10 percent of acidless tallow or other suitable animal fats.

Refer to Cone Drive "Approved List of Lubricants" for specific oils that meet the above specifications. Cone Drive recommends only those lubricants listed or any lubricant which meets all the requirements of AGMA 250 "Lubrication of Industrial Enclosed Gear Drives" as it applies to double enveloping worm gearing. Use of other lubricants can result in gearset failure which will not be covered under warranty.

DOUBLE-ENVELOPING WORMGEAR UNITS					
CENTER DISTANCE	Worm Speed Up to rpm	AMBIENT TEMP.		Worm Speed* Above rpm	AMBIENT TEMP.
		-10°C to 10°C	10°C to 40°C		
		15°F to 50°F	50°F to 100°F		
Up to 6 in. inclusive	0-700	8 comp	8A comp	700	8 comp
Over 6 in. to 12 in.	0-450	8 comp	8A comp	450	8 comp
Over 12 in. to 18 in.	0-300	8 comp	8A comp	300	8 comp
Over 18 in. to 24 in.	0-250	8 comp	8A comp	250	8 comp
Over 24 in.	0-200	8 comp	8A comp	200	8 comp

*Wormgears operating at speeds above 2400 rpm or 2000 feet per minute rubbing speed may require force feed lubrication. In general, an AGMA #7 lubricant of lower viscosity than recommended in the above table may be used with a force feed system.

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Installation, Operation & Maintenance Instructions For Cone Drive Speed Reducers

Cone Drive double enveloping worm gear speed reducers are used throughout Industry to provide smooth and quiet speed

reduction. When properly selected, applied and maintained, they will provide optimum performance.

IMPORTANT: When a Cone Drive reducer is used in an application where failure of any drive train component can result in injury to personnel or damage to property on, around or below

the driven equipment, the system must be equipped with a fail-safe device located after the drive train that will stop and hold the load in the event of a power or drive train failure.

THE FOLLOWING INFORMATION IS FOR YOUR PROTECTION. PLEASE READ CAREFULLY.

1. Do not attempt to install or operate this reducer until all of these instructions are read and thoroughly understood. If you have any questions, please contact Cone Drive.
2. The horsepower or output torque capacity of this reducer and the service factor (maximum allowable operating cycle) are stamped on the reducer nameplate. **These values are not to be exceeded as overloading can result in reducer failure.**
Exceeding the rating and duty cycle will void the warranty. Please contact Cone Drive with any questions regarding rating and service factors.
3. Each reducer is specifically arranged to operate at the input speed and service factor specified on the nameplate. If the input speed is not specified by the customer, it is set up for 1750 RPM and service factor 1.0. Do not operate the reducer at speeds or under service other than specified on the nameplate without contacting Cone Drive for specific instructions on oil level location and bearing settings.
4. Do not alter the reducer in any way without approval from Cone Drive.
5. This reducer has moving mechanical components and connected electrical devices, operating under high voltage to achieve its intended purpose. Operation and repair should only be done by qualified personnel.
6. Before servicing a speed reducer, the main electrical disconnect must be moved to and **locked** in the off-position. The person performing the work should **post on that disconnect a warning to others not to turn on the power.**
7. It is normal for the reducer to operate at a housing temperature of up to 200° F. To prevent burns, proper guards or shields must be provided by the purchaser or user to prevent personnel from touching the reducer.
8. Cone Drive products are furnished without guard covers. It is the responsibility of the purchaser or user to provide guards for all exposed shafting, couplings, sprockets, sheaves, belts, chains, clutches, and any other moving parts in accordance with current OSHA requirements.
9. Failure to follow the instructions contained in this bulletin may result in unit failure, property damage or personal injury.

Finish Coat Painting

Cone Drive speed reducers are furnished with a prime coat of paint on exterior housing surfaces. The reducer should be painted with a finish coat to protect the housing exterior, particularly if subjected to outdoor service, periodic wash-down or harsh environments.

Mask all shafts, oil seals, tags, name plates, oil level stickers, breathers, gauges etc. before painting. (Painting seal lips can result in oil leakage.)

Installation

IMPORTANT: All Cone Drive speed reducers are shipped without oil and must be filled to the oil level gage or plug with the proper oil before start-up. See the following section on lubrication.

1. The speed reducer must be securely mounted to a rigid flat foundation or base plate. If necessary, shim under the reducer feet to provide a flat mounting surface.
2. Bolt the reducer to the foundation or mounting base using the largest diameter bolt that will fit through the foot holes of the reducer. **At least four (4) mounting bolts are required on all reducers** and the larger reducers will require more. **Be sure to use a bolt in all mounting feet holes.** If the reducer will be subjected to heavy chain pull or thrust loading, **heat treated** mounting bolts must be used to prevent stretching and loosening of the bolts.
3. The input and output shafts of the reducer should be coupled to the motor and driven shafts with flexible couplings and the reducer aligned with these shafts within $\pm .001"$. Solid or rigid couplings should be avoided. Failure to properly align shafts and the use of solid couplings can result in excessive coupling and bearing wear, shaft deflection and eventual failure of one (1) or more of the components.
4. Couplings, sheaves and sprockets should be mounted on the reducer shafts carefully. Do not pound or hammer them onto the shafts as this will damage bearings and oil seals.

5. Sprockets and sheaves should be mounted as close to the reducer as possible and "V" belts and chains adjusted to the proper tension to keep bearing loading and shaft deflection to a minimum. Too much tension in belts and improper location of sheaves and sprockets will lead to excessive chain pull, bearing wear and shaft deflection. For specific information on chain pull capacity, shaft stress and bearing life please contact Cone Drive.
6. **Before starting motor** review motor rotation, reducer rotation and required direction of driven machine to insure that the motor is wired for proper direction of rotation. In many instances a machine must run in one direction and failure to wire the motor properly can result in damage to the driven machine.

7. IMPORTANT: Fill unit to proper level with recommended oil. Grease all fittings with recommended grease (see section on lubrication). In the case of double or triple reduction reducers, be sure to fill each reduction stage to the proper oil level.

NOTE: All reducers are built for **one** mounting position, i.e.: floor mounted or wall mounted with worm vertical up or ceiling mounted, etc. If the reducer is to be mounted in any position other than the position for which it was furnished, contact Cone Drive for information on relocating oil level, grease packing bearings, etc., before start-up. If a reducer is operated in a mounting position other than the position for which it was assembled, reducer failure may occur from improper oil level or grease fitting location resulting in lack of lubrication to the gearset and bearings.

Start-Up

1. After the reducer has been properly mounted, aligned and lubricated, it is ready for start-up.
2. Make sure driven machine is clear of all obstructions and all safety guards and covers are in place. If possible, turn motor shaft by hand to confirm drive system is operating freely and in correct direction of rotation.
3. Jog motor to confirm proper rotation.
4. Operate reducer with minimum load for approximately 15 minutes (in both directions if applicable) to seat gears, bearings, and oil seals.

Operation

1. All reducers require a few hours of "run-in" under load to achieve optimum efficiency. During this initial run-in the reducer will probably run warmer than normal and draw more current than after the run-in period. Reducers operating at a very low load or speed will take much longer to run-in and even if operated continuously at low load or speed may never achieve the efficiency that they would if operated at or near their catalog rating.

2. IMPORTANT: Normal reducer operating temperature measured on the oil sump area of the housing should not exceed 100° F above ambient temperature or 200° F. If the reducer operating temperature exceeds 200° F, shut down the unit and contact Cone Drive. Excessive oil sump temperature is indicative of overloading, misalignment, or improper or marginal lubrication. Continuous operation of the reducer with the oil sump temperature above 200° will result in breakdown of the oil and failure of the reducer.

Maintenance

1. The reducer oil level should be checked weekly and the recommended oil added as required to maintain the proper oil level.
2. The oil should be changed as outlined in the lubrication section.
3. All grease fittings should be lubricated with the recommended grease once per month.
4. The reducer, particularly finned areas and fan covers, should be kept clean to allow maximum heat dissipation.
5. All reducer and foundation bolts should be checked for tightness after three (3) months of service and annually thereafter.
6. If a reducer has to be repaired, contact Cone Drive for detailed instructions, blueprints, parts lists, etc. If it is necessary field service is available.
7. If a reducer is to be returned, contact Cone Drive for instructions and a returned material authorization (RMA) number.

Storage Recommendations For Cone-Drive Speed Reducers

If a reducer is to be stored or shut down for more than 30 days, it should be protected from water condensation and corrosion as follows:

Any enclosed system of gearing is subject to water condensation on the inside of the reducer caused by fluctuating ambient temperatures. This condensation can cause severe rusting of the worm and bearings which could lead to premature failure of the reducer. However, this condition can

be easily prevented by following the recommendations outlined below for various storage conditions. If the reducer is furnished with a motor — follow the motor manufacturers recommendations for motor preservation.

1. Standard Shipping Procedure — Protection for Maximum Storage Duration of 30 Days.

Cone Drive speed reducers are run-in tested using a rust

inhibiting oil, drained, painted with one coat of primer, and all exposed shafting coated with a rust preventative prior to shipment. This procedure is intended to protect the reducers during shipment and short term inside storage for a maximum period of thirty (30) days after shipment.

2. Long Term Storage (Indoors) for Periods up to One Year.

(a) Fill the reducer completely full with one of the lubricants shown on our approved list of lubricants. A copy of this lubricant list is shipped with each unit. (b) Rotate the wormshaft and gearshaft at least once per month to keep the seals from sticking to the wear rings and/or shafts. (c) If it is not practical to rotate the wormshaft periodically we recommend purchasing a spare set of oil seals to have on hand in the event of seal leakage at start-up. (d) Before putting the reducer into service, lower the oil in the reducer to the proper operating oil level.

3. Long Term Storage (Outdoors) for Periods Up to One Year.

Proceed as in (2) above with the following additions. (a) After filling the unit with oil, plug the breather hole with a pipe plug and wire the breather to the unit. (b) Paint the outside of the unit with a finish coat of paint. (Reducer from the factory is prime coated only.) (c) Coat all exposed shafting with a long term rust preventative.

4. Extended Storage Periods Exceeding One Year.

(a) Immediately after receipt of the reducer blow approximately 1/3 oz. of #260 "VPI" powder into the unit thru the breather hole. Plug the breather hole with a pipe plug and wire the breather to the unit. (b) Paint the exterior of the unit with a finish coat of paint. (c) Coat all exposed shafting with a long term rust preventative. (d) Place the unit in a heavy plastic bag and put approximately 1/2 oz. #260 "VPI" powder in the bag. Seal the bag air tight. (e) Crate the unit and cover the crate to keep out water. (f) Purchase a spare set of oil seals to have on hand at start-up.

Lubrication Data

Note: Lubrication is very important for successful operation of Cone Drive gearsets and speed reducers. Inadequate lubrication can result in increased power consumption, added maintenance and gearset failure. Please review the following recommendations and the "Approved List of Lubricants" shipped with all Cone Drive gearsets and speed reducers. Cone Drive recommends only those lubricants listed or any lubricant which meets all the requirements of AGMA 250 "Lubrication of Industrial Enclosed Gear Drives" as it applies to double enveloping worm gearing. Use of other lubricants can result in gearset failure which will not be covered under warranty.

1. Type of Oil

Lubricating oils for use in gear units should be high quality well refined steam cylinder petroleum oils. They must not be corrosive to gears, to ball, roller or sleeve bearings; they must be neutral in reaction; free from grit or abrasives; and have good defoaming properties. As they may be subject to high operating temperatures, they must have good resistance to oxidation.

For worm-gears additions of 3 percent to 10 percent of acidless tallow or similar animal fats are desirable.

2. Ambient Temperature

The oils shown on the list of approved lubricants shipped with all Cone Drive gearsets and speed reducers are for use in an ambient temperature range of approximately 15° to 100° F with the low end of the range depending on the pour point of the specific oil used. If the ambient temperature will be below or above this range please contact Cone Drive for specific recommendations on proper lubricant as well as proper oil seal and shim materials.

3. Sludge

It is necessary that the oil be clean and free from sludge at all times to obtain long life from gear unit.

Sludge in gear units may be caused by excessive heat, from dust and dirt and other contaminants and by the presence of moisture or chemical fumes. Therefore, every precaution should be taken to prevent water and foreign particles from entering the gear case.

4. Cone Drive Reducers Are Shipped Without Oil

After assembly all reducers are test run with rust inhibiting oil and drained. This oil coats all internal parts and will protect the reducer for a period of 30 days. If the unit is to be stored longer than 30 days, see long term storage instructions.

5. Oil Change

If an approved synthetic lubricant is used, it should be changed

after 5000 hours of operation or once per year, whichever occurs first. If a recommended steam cylinder oil is used, the change interval should be after 2500 hours of operation or every six months, whichever occurs first. These change intervals are recommended for units operating under favorable conditions. Where operating conditions are severe, such as a rapid rise and fall in temperature of the gear case with accompanied sweating of the inside walls and resulting formation of sludge, or where operation is in moist or dusty atmospheres, or in the presence of chemical fumes or extended running at sump temperatures in excess of 180° F., it may be necessary to change the oil at intervals of one to three months. It is recommended, a sampling program be established with your lubricant manufacturer where reducers are exposed to the severe operating conditions, mentioned above.

6. Oil Level

Cone Drive reducers are furnished with a bronze colored hex head pipe plug to indicate oil level. An oil level tag is affixed to the unit near the oil level indicator. Oil level should **always** be checked with the unit stopped. Estimated oil capacities for standard reducers are listed on the following page.

7. Double & Triple Reduction Reducers

These units utilize separate housings and are furnished with **separate** oil sumps. It is important that all sumps are filled to the proper oil level.

8. Grease Packed Bearings

Bearings that are at least partially submerged in oil or oiled by internal oil scoops do not require special maintenance. However, bearings that are not lubricated as above require grease lubrication. Grease fittings and internal retainers are furnished when required. They should be greased with a high quality lithium base NLGI #2 or NLGI #3 bearing grease at normal maintenance intervals depending on the duty cycle of the reducer.

Oil Capacities

Approximate Capacities in Quarts & Gallons

SINGLE REDUCTION REDUCERS - FLOOR MOUNTED POSITION																
UNIT SIZE		20	25	30	35	40	50	60	70	80	100	120	150	180	220	240
WORM OVER GEAR	HO SHO	1 Qt.	1½ Qt.	2½ Qt.	1 Gal.	1½ Gal.	2½ Gal.	3¾ Gal.	6½ Gal.	10½ Gal.	19 Gal.	45 Gal.				
	ALT OIL LEVEL	½ Qt.	1 Qt.	1½ Qt.	2½ Qt.	1 Gal.	1¾ Gal.	2½ Gal.	4 Gal.	6½ Gal.	12½ Gal.	26 Gal.				
WORM UNDER GEAR	HU	½ Qt.	1 Qt.	1½ Qt.	3½ Qt.	1½ Gal.	2¼ Gal.	3½ Gal.	5¼ Gal.	7¾ Gal.	15 Gal.	30 Gal.	45 Gal.	70 Gal.		
	SHU															
VERTICAL OUTPUT SHAFT	HV SHV	1 Qt.	1 Qt.	1½ Qt.	2½ Qt.	1 Gal.	1¾ Gal.	2¾ Gal.	5 Gal.	6½ Gal.	14 Gal.	26 Gal.	50 Gal.	80 Gal.		

DOUBLE REDUCTION REDUCERS - FLOOR MOUNTED POSITION																
UNIT SIZE	20 30	20 35	25 40	25 50	30 60	30 70	35 70	40 70	40 80	50 100	60 120	70 150	80 180	100 220	100 224	
OO-UO-VO OOS-UOS-VOS	3 Qt.	1½ Gal.	1¼ Gal.	2¼ Gal.	4¼ Gal.	7 Gal.	7¼ Gal.	7½ Gal.	11½ Gal.	20¾ Gal.	47½ Gal.					
OU-UU-VU	2½ Qt.	1 Gal.	1¼ Gal.	2½ Gal.	4 Gal.	5¼ Gal.	5½ Gal.	6 Gal.	8½ Gal.	16 Gal.	30 Gal.	50 Gal.	76 Gal.			
OUS-UUS-VUS																
OV-UV-VV OVS-UVS-VVS	2 Qt.	3 Qt.	1¼ Gal.	2 Gal.	3¼ Gal.	6¼ Gal.	6½ Gal.	7 Gal.	9¾ Gal.	18½ Gal.	34 Gal.					

GEARMOTORS & HELICAL/WORM REDUCERS - ALL POSITIONS											
UNIT SIZE		25	30	35	40	50	60	70	80	100	120
ALL MODELS MOUNTED WITH WORM UNDER GEAR	STANDARD SHAFT	2 Qt.	2½ Qt.	1¾ Gal.	2¼ Gal.	3 Gal.	4¼ Gal.	7 Gal.	8½ Gal.		
	HOLLOW SHAFT										
ALL MODELS MOUNTED WITH WORM OVER GEAR		1½ Qt.	1¼ Gal.	2 Gal.	2¼ Gal.	4 Gal.	5 Gal.	9 Gal.	11 Gal.		
ALL MODELS MOUNTED WITH VERTICAL OUTPUT SHAFT		2½ Qt.	3½ Qt.	1½ Qt.	2¼ Gal.	3 Gal.	3¾ Gal.	8 Gal.	10½ Gal.		
ALL MODELS MOUNTED WITH INPUT END UP		4 Qt.	1¼ Gal.	2¼ Gal.	3 Gal.	5¼ Gal.	6¼ Gal.	13½ Gal.	16 Gal.		
ALL MODELS MOUNTED WITH INPUT END DOWN		3½ Qt.	1 Gal.	1¾ Gal.	2¼ Gal.	3½ Gal.	4¾ Gal.	8¾ Gal.	10½ Gal.		

IMPORTANT: Do not overfill units. Fill to center line of oil gauge or to pipe plug identified with oil level sticker. Oil capacities will vary due to mounting positions or type of gearshaft mounting used, such as solid shaft, hollow shaft or spread bearings.

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Cone Drive **TEXTRON****CONE DRIVE OPERATIONS INC./
SUBSIDIARY OF TEXTRON INC.**120 E. 12th Street, P.O. Box 272
Traverse City, MI 49685-0272
PH: 616-946-8410 • FAX: 616-946-0235**APPROVED LIST OF LUBRICANTS
FOR CONE DRIVE
DOUBLE-ENVELOPING WORM GEAR
SPEED REDUCERS & GEARSETS
(SEE BACK FOR "WORLDWIDE" LIST)**

CENTER DISTANCE	WORM SPEED (RPM)	† AMBIENT TEMPERATURE		‡ WORM SPEED ABOVE (RPM)	† AMBIENT TEMPERATURE	§ MAXIMUM INPUT SPEED			AGMA LUBRICANT NUMBER	VISCOSITY RANGE		
		-10°C to +10°C (14°F to 50°F)	+10°C to +50°C (50°F to 125°F)			CENTER DISTANCE		RPM		ASTM SYSTEM		ISO GRADE
						INCH	MM			SUS @ 210°F	SUS @ 100°F	CST @ 40°C
Up to 6" inclusive	0-700	8 Comp.	8A Comp.	700	8 Comp.	2.0 thru 3.5	up to 89	3600	7 Comp.	125 - 150	1919 - 2346	ISO460 (414-506)
Over 6" to 12"	0-450	8 Comp.	8A Comp.	450	8 Comp.	4.0	102	3000	8 Comp.	150 - 190	2837 - 3467	ISO680 (612-748)
Over 12" to 18"	0-300	8 Comp.	8A Comp.	300	8 Comp.	5.0	127	2400	8A Comp.	190 - 250	4171 - 5098	ISO1000 (900-1100)
Over 18" & above	0-200	8 Comp.	8A Comp.	200	8 Comp.	6.0 thru 8.0	152 thru 203	1750				
						10.0	254	1150				
						12.0 thru 15.0	305 thru 381	870				
						18.00	457	720				
Extracted from AGMA Standard 250 "Lubrication" (American Gear Manufacturers Association)						For input speed above the maximums listed contact Cone Drive Engineering.			Above oils are compounded with 3 to 10 percent of acidless tallow or other suitable animal fats.			

† Pour Point of the oil used should be 5°C (9°F) less than the minimum ambient temperature expected. For special temperature or operating conditions, contact Cone Drive Engineering Department for the proper lubricant selection.

‡ Worm gears operating at a sliding velocity in excess of 10 m/s (2000 feet per minute) may require force feed lubrication. The ISO460 (AGMA #7) compounded oils are only for use with a force feed lubrication system. See maximum recommended input rpm chart. To determine sliding velocity, see Cone Drive catalog general information section under "Lubrication Data".

§ AGMA specifications require a viscosity index (VI) of 90 (min.). However, lubricants listed with a VI of less than 90 may be used if a recommended lubricant with a VI of 90 (min.) is not available.

If a Cone Drive reducer is to be operated at an input rpm other than that shown on the name tag, contact Cone Drive Engineering Department for recommendations.

For double and triple reduction reducers an ISO1000 (AGMA #8A) lubricant can be used in primary as well as the final reduction stages.

All PowerDrive Reducers Must Use An "Approved PowerDrive Lubricant".

Cone Drive recommends only those lubricants listed or any lubricant which meets all the requirements of AGMA 250 "Lubrication of Industrial Enclosed Gear Drives" as it applies to double enveloping worm gearing. Use of other lubricants can result in gearset failure which will not be covered under warranty.

AGMA #7 COMPOUND (NON-E.P.)				AGMA #8 COMPOUND (NON-E.P.)				AGMA #8A COMPOUND (NON-E.P.)				MANUFACTURER
BRAND NAME	#VI	P.P.°F	SUS @ 210°F	BRAND NAME	#VI	P.P.°F	SUS @ 210°F	BRAND NAME	#VI	P.P.°F	SUS @ 210°F	
				Uptime™ 600 W Super Cyl. Oil	95	10°	155	Uptime™ Extra Hecla Super Cyl. Oil	90	20°	198	Distributed by Cone Drive/Textron, Inc. expressly from Mobil Oil Corp.
NOTE: Uptime™ SHC 634 Synthetic Lubricant Acceptable For All Three Conditions								"Approved PowerDrive and AccuDrive Lubricant"				
Alubco Safe Gear D.F.	95	15°	155	Safe Gear D.F. 8	95	15°	200					American Lubricants Co.
*Cyl. Oil 460	94	15°	147	*Cyl. Oil 680	91	15°	185	*Cyl. Oil 1000	95	15°	243	Amoco Oil Company
■ Energol DC-C 460	97	43°	*420 CST					■ Energol DC-C 1000	100	43°	*1000 CST	BP Oil
**Steam Cyl. Oil 130	95	5°	135	**Steam Cyl. Oil 150	95	5°	167	**Steam Cyl. Oil 250	93	10°	205	Bel-Ray Company, Inc.
				No-Tox Steam Cylinder Oil (Food Grade)	117	0°	179					Bel-Ray Company, Inc.
Steam Cyl. Oil 600	103	10°	*438 CST	Steam Cyl. Oil H-600	109	5°	*632 CST	Steam Cyl. Oil XH600	114	5°	*974 CST	Cato Oil and Grease Co.
				*Garwal 680	90	35°	182					Century Lubricating Oils, Inc.
Certified Compound Oil #7	99	20°	146	Certified Compound Oil #8	97	20°	183	Certified Compound Oil #8A	93	30°	228	Certified Laboratories
*Cylinder Oil W-ISO 460	87	0°	*441 CST	*Cylinder Oil W-ISO 680	99	10°	*675 CST	*Cylinder Oil W-ISO 1000	102	10°	*945 CST	Chevron U.S.A., Inc.
**Cyl. Oil 400-5	95	16°	137	**Cyl. Oil 680-7	95	16°	193					Citgo Petroleum Corp.
**Inca Oil 460	98	20°	151	**Inca Oil 680	95	30°	184	**Inca Oil 1000	85	35°	224	Conoco Inc.
**DSL DH-167	91	25°	135	**DSL DH-210 HO Super Cyl. Oil	88	30°	160	**DSL DH-210 Heavy Super Cyl. Oil	87	35°	200	Davis-Howland Oil Corp.
Special Cyl. Oil 460	99	19°	147	Super 600 Strn. Cyl. Oil	98	20°	179					Dryden Oil Company
Enlulob SCO-135	108	15°	*455 CST	Enlulob SCO-3400	115	15°	*666 CST	Enlulob 193	100	15°	*1050 CST	Engineered Lubricants Co.
**Cylesstic TK 460	99	20°	147	**Cylesstic TK 680	97	20°	184	**Cylesstic TK 1000	93	30°	227	Exxon Company
Cylan Cyl. Oil ISO 460	95	10°	140	Cylan Cyl. Oil ISO 680	93	20°	175					Fina Oil Company
**Lubriplate CP-7	99	10°	145	**Lubriplate CP-8	90	22°	160	**Lubriplate CP-8A	90	35°	230	Fiske Brothers Refining Co.
				∴Lubriplate SPO-288	99	20°	173					Fiske Brothers Refining Co.
***NOTE: Emery-2843 Synthetic Industrial Gear Lubricant 460 For All Three Conditions								"Approved PowerDrive and AccuDrive Lubricant"				Henkel Corp. - Emery Group
**PQ-AGMA #7	90	10°	135	**PQ-AGMA #8	90	10°	175					Hüls
**Cylesso TK460	90	37°	*460 CST	**Cylesso TK680	90	37°	*680 CST	**Cylesso TK1000	90	37°	*925 CST	Imperial Oil Ltd. - Esso
				▲Kendco 155 Comp.	100	25°	177	▲Kendco 206 Comp.	97	35°	229	Kendall Refining Company
**Keygear K-600	100	45°	145									Keystone™/Atochem
***NOTE: Keystone KSL-367 Synthetic Lubricant Acceptable For All Three Conditions								"Approved PowerDrive and AccuDrive Lubricant"				
				680 Almasol	95	15°	195					Lubrication Engineers

NOTE #1: Major oil companies, not on the above list, do not have products which meet the requirements of AGMA 250.

NOTE #2: Extreme Pressure (E.P.) lubricants or cylinder oils with sulphur-phosphorus additives are not acceptable and should not be used in Cone Drive speed reducers.

NOTE #3: Recommended lubricant change - every 2500 hours or 6 months, whichever comes first. If a synthetic lubricant is used, the lubricant should be changed every 5000 hours or one year, whichever comes first.

NOTE #4: Recommended Bearing Grease - high quality lithium base NLGI #2 or NLGI #3.

*.....Available in Canada

**.....Available Worldwide

***..Special - not an AGMA compound

▲.....Not available in Canada

*.....ISO viscosity in centistokes @ 40° Centigrade

■.....Not available in United States

(CONTINUED ON REVERSE SIDE)

APPROVED LIST OF LUBRICANTS CONTINUED

All PowerDrive Reducers Must Use An "Approved PowerDrive Lubricant".

Cone Drive recommends only those lubricants listed or any lubricant which meets all the requirements of AGMA 250 "Lubrication of Industrial Enclosed Gear Drives" as it applies to double enveloping worm gearing. Use of other lubricants can result in gearset failure which will not be covered under warranty.

AGMA #7 COMPOUND (NON-E.P.)				AGMA #8 COMPOUND (NON-E.P.)				AGMA #8A COMPOUND (NON-E.P.)				MANUFACTURER
BRAND NAME	#VI	P.P.°F	SUS @ 210°F	BRAND NAME	#VI	P.P.°F	SUS @ 210°F	BRAND NAME	#VI	P.P.°F	SUS @ 210°F	
				Modoc 175	85	30°	175					Lyondell Petrochemical Co.
**600 W Cylinder Oil	99	15°	142	**600 W Super Cylinder Oil	95	10°	155	**Extra Hecla Super Cyl. Oil	90	20°	198	Mobil Oil Corp.
***NOTE: Mobil SHC-634 Synthetic Lubricant Acceptable For All Three Conditions				"Approved PowerDrive and AccuDrive Lubricant"								Mobil Oil Corp.
Cylinder Oil #5	96	15°	*460 CST	*Cylinder Oil #6	96	30°	*680 CST	Cylinder Oil 1000	96	30°	250	Pennzoil Products
Cylinder Oil #4	94	10°	*470 CST	*Cylinder Oil #6-NR	87	35°	*680 CST					Pennzoil Products
*Senate 460	88	30°	140	*Senate 680	85	25°	173	*Senate 1000	86	25°	201	Petro Canada
Hector 460 S	95	10°	134	Hector 630 S	90	5°	166					Phillips 66 Co.
243 Cylinder Oil #7	95	15°	142					243 Cylinder Oil #8A	95	15°	220	Primrose Oil Company
				*#147 Steam Cylinder Oil	98	10°	190					Schaeffer Mfg. Company
**Valvata Oil 460	94	15°	142	**Valvata Oil 680	94	20°	177					Shell Oil Company
*Sulflo AGMA #7 Comp.	101	20°	160	*Sulflo AGMA #8 Comp.	95	25°	190	*Sulflo AGMA #8A Comp.	90	25°	250	Sulflo, Inc.
Vanguard Cyl. Oil 460	94	10°	142	Honor Cyl. Oil 680	97	20°	190	650 *T* Cyl. Oil 1000	90	25°	220	Texaco Lubricant Co.
**Tribol 1105/7C	99	5°	144	**Tribol 1105/8C	95	10°	178					Tribol

WORLDWIDE APPROVED LIST OF LUBRICANTS

ISO 460 AGMA #7 COMPOUND (NON-E.P.)				ISO 680 AGMA #8 COMPOUND (NON-E.P.)				ISO 1000 AGMA #8A COMPOUND (NON-E.P.)				MANUFACTURER
BRAND NAME	#VI	P.P.°C	CST @ 40°C	BRAND NAME	#VI	P.P.°C	CST @ 40°C	BRAND NAME	#VI	P.P.°C	CST @ 40°C	
■ Energol DC-C 460	97	6°	420					■ Energol DC-C 1000	100	6°	1000	BP Oil
Steam Cyl. Oil 130	95	-15°	432	Steam Cyl. Oil 150	95	-15°	588	Steam Cyl. Oil 250	93	-12°	864	Bel-Ray Company, Inc.
Cyl. Oil 400-5	95	-9°	390	Cyl. Oil 680-7	95	-9°	632					Citgo Petroleum Corp.
Inca Oil 460	98	-7°	455	Inca Oil 680	95	-1°	680	Inca Oil 1000	85	2°	1000	Conoco Inc.
DSL DH-167	91	-4°	379	DSL DH-210 HO Super Cyl. Oil	88	-1°	627	DSL DH-210 Heavy Super Cyl. Oil	87	2°	882	Davis-Howland Oil Corp.
Cylessso TK 460	99	-7°	429	Cylessso TK 680	97	-7°	627	Cylessso TK 1000	93	-1°	925	Exxon Company
Lubriplate CP-7	99	-12°	470	Lubriplate CP-8	90	-6°	640	Lubriplate CP-8A	90	-2°	900	Fiske Brothers Refining Co.
				***Lubriplate SPO-288	99	-7°	650					Fiske Brothers Refining Co.
***NOTE: Emery-2843 Synthetic Industrial Gear Lubricant 460 For All Three Conditions				"Approved PowerDrive and AccuDrive Lubricant"								Henkel Corp. - Emery Group
PQ-AGMA #7	90	-12°	418	PQ-AGMA #8	90	-12°	585					Hüls
Cylessso TK460	90	3°	460	Cylessso TK680	90	3°	680	Cylessso TK1000	90	3°	925	Imperial Oil Ltd. - Esso
				▲Kendco 155 Comp.	100	-4°	557	▲Kendco 206 Comp.	97	2°	882	Kendall Refining Company
Keygear K-600	100	7°	402									Keystone/Atochem
***NOTE: Keystone KSL-367 Synthetic Lubricant Acceptable For All Three Conditions				"Approved PowerDrive and AccuDrive Lubricant"								Keystone
				680 Almasol	95	-9°	690					Lubrication Engineers
600 W Cylinder Oil	99	-9°	375	600 W Super Cylinder Oil	95	-12°	465	Extra Hecla Super Cyl. Oil	90	-7°	675	Mobil Oil Corp.
***NOTE: Mobil SHC-634 Synthetic Lubricant Acceptable For All Three Conditions				"Approved PowerDrive and AccuDrive Lubricant"								Mobil Oil Corp.
Valvata Oil 460	94	-9°	457	Valvata Oil 680	94	-7°	650					Shell Oil Company
Tribol 1105/7C	99	-15°	413	Tribol 1105/8C	95	-12°	608					Tribol

NOTE #1: Major oil companies, not on the above list, do not have products which meet the requirements of AGMA 250.

NOTE #2: Extreme Pressure (E.P.) lubricants or cylinder oils with sulphur-phosphorus additives are not acceptable and should not be used in Cone Drive speed reducers.

NOTE #3: Recommended lubricant change - every 2500 hours or 6 months, whichever comes first. If a synthetic lubricant is used, the lubricant should be changed every 5000 hours or one year, whichever comes first.

NOTE #4: Recommended Bearing Grease - high quality lithium base NLGI #2 or NLGI #3.

*.....Available in Canada

**...Available Worldwide

***...Special - not an AGMA compound

▲.....Not available in Canada

*.....ISO viscosity in centistokes @ 40° Centigrade

■.....Not available in United States

Installation, Operation & Maintenance Instructions For Cone Drive Speed Reducers

Cone Drive double enveloping worm gear speed reducers are used throughout industry to provide smooth and quiet speed

reduction. When properly selected, applied and maintained, they will provide optimum performance.

IMPORTANT: When a Cone Drive reducer is used in an application where failure of any drive train component can result in injury to personnel or damage to property on, around or below

the driven equipment, the system must be equipped with a fail-safe device located after the drive train that will stop and hold the load in the event of a power or drive train failure.

THE FOLLOWING INFORMATION IS FOR YOUR PROTECTION. PLEASE READ CAREFULLY.

1. Do not attempt to install or operate this reducer until all of these instructions are read and thoroughly understood. If you have any questions, please contact Cone Drive.
2. The horsepower or output torque capacity of this reducer and the service factor (maximum allowable operating cycle) are stamped on the reducer nameplate. **These values are not to be exceeded as overloading can result in reducer failure.**
Exceeding the rating and duty cycle will void the warranty. Please contact Cone Drive with any questions regarding rating and service factors.
3. Each reducer is specifically arranged to operate at the input speed and service factor specified on the nameplate. If the input speed is not specified by the customer, it is set up for 1750 RPM and service factor 1.0. Do not operate the reducer at speeds or under service other than specified on the nameplate without contacting Cone Drive for specific instructions on oil level location and bearing settings.
4. Do not alter the reducer in any way without approval from Cone Drive.
5. This reducer has moving mechanical components and connected electrical devices, operating under high voltage to achieve its intended purpose. Operation and repair should only be done by qualified personnel.
6. Before servicing a speed reducer, the main electrical disconnect must be moved to and **locked** in the off-position. The person performing the work should **post on that disconnect a warning to others not to turn on the power.**
7. It is normal for the reducer to operate at a housing temperature of up to 200° F. To prevent burns, proper guards or shields must be provided by the purchaser or user to prevent personnel from touching the reducer.
8. Cone Drive products are furnished without guard covers. It is the responsibility of the purchaser or user to provide guards for all exposed shafting, couplings, sprockets, sheaves, belts, chains, clutches, and any other moving parts in accordance with current OSHA requirements.
9. Failure to follow the instructions contained in this bulletin may result in unit failure, property damage or personal injury.

A Finish Coat Painting

Cone Drive speed reducers are furnished with a prime coat of paint on exterior housing surfaces. The reducer should be painted with a finish coat to protect the housing exterior, particularly if subjected to outdoor service, periodic wash-down or harsh environments.

Mask all shafts, oil seals, tags, name plates, oil level stickers, breathers, gauges etc. before painting. (Painting seal lips can result in oil leakage.)

Installation

IMPORTANT: All Cone Drive speed reducers are shipped without oil and must be filled to the oil level gage or plug with the **proper** oil before start-up. See the following section on lubrication.

1. The speed reducer must be securely mounted to a rigid flat foundation or base plate. If necessary, shim under the reducer feet to provide a flat mounting surface.
2. Bolt the reducer to the foundation or mounting base using the largest diameter bolt that will fit through the foot holes of the reducer. **At least four (4) mounting bolts are required on all reducers** and the larger reducers will require more. **Be sure to use a bolt in all mounting feet holes.** If the re-
- ducer will be subjected to heavy chain pull or thrust loading, **heat treated** mounting bolts must be used to prevent stretching and loosening of the bolts.
3. The input and output shafts of the reducer should be coupled to the motor and driven shafts with flexible couplings and the reducer aligned with these shafts within $\pm .001"$. Solid or rigid couplings should be avoided. Failure to properly align shafts and the use of solid couplings can result in excessive coupling and bearing wear, shaft deflection and eventual failure of one (1) or more of the components.
4. Couplings, sheaves and sprockets should be mounted on the reducer shafts carefully. Do not pound or hammer them onto the shafts as this will damage bearings and oil seals.

5. Sprockets and sheaves should be mounted as close to the reducer as possible and "V" belts and chains adjusted to the proper tension to keep bearing loading and shaft deflection to a minimum. Too much tension in belts and improper location of sheaves and sprockets will lead to excessive chain pull, bearing wear and shaft deflection. For specific information on chain pull capacity, shaft stress and bearing life please contact Cone Drive.
6. **Before starting motor** review motor rotation, reducer rotation and required direction of driven machine to insure that the motor is wired for proper direction of rotation. In many instances a machine must run in one direction and failure to wire the motor properly can result in damage to the driven machine.

7. IMPORTANT: Fill unit to proper level with recommended oil. Grease all fittings with recommended grease (see section on lubrication). In the case of double or triple reduction reducers, be sure to fill each reduction stage to the proper oil level.

NOTE: All reducers are built for **one** mounting position, i.e.; floor mounted or wall mounted with worm vertical up or ceiling mounted, etc. If the reducer is to be mounted in any position other than the position for which it was furnished, contact Cone Drive for information on relocating oil level, grease packing bearings, etc., before start-up. If a reducer is operated in a mounting position other than the position for which it was assembled, reducer failure may occur from improper oil level or grease fitting location resulting in lack of lubrication to the gearset and bearings.

Start-Up

1. After the reducer has been properly mounted, aligned **and lubricated**, it is ready for start-up.
2. Make sure driven machine is clear of all obstructions and all safety guards and covers are in place. If possible, turn motor shaft by hand to confirm drive system is operating freely and in correct direction of rotation.
3. Jog motor to confirm proper rotation.
4. Operate reducer with minimum load for approximately 15 minutes (in both directions if applicable) to seat gears, bearings, and oil seals.

Operation

1. All reducers require a few hours of "run-in" under load to achieve optimum efficiency. During this initial run-in the reducer will probably run warmer than normal and draw more current than after the run-in period. Reducers operating at a very low load or speed will take much longer to run-in and even if operated continuously at low load or speed may never achieve the efficiency that they would if operated at or near their catalog rating.

2. IMPORTANT: Normal reducer operating temperature measured on the oil sump area of the housing should not exceed 100° F above ambient temperature or 200° F. If the reducer operating temperature exceeds 200° F, shut down the unit and contact Cone Drive. Excessive oil sump temperature is indicative of overloading, misalignment, or improper or marginal lubrication. Continuous operation of the reducer with the oil sump temperature above 200° will result in breakdown of the oil and failure of the reducer.

Maintenance

1. The reducer oil level should be checked weekly and the recommended oil added as required to maintain the proper oil level.
2. The oil should be changed as outlined in the lubrication section.
3. All grease fittings should be lubricated with the recommended grease once per month.
4. The reducer, particularly finned areas and fan covers, should be kept clean to allow maximum heat dissipation.
5. All reducer and foundation bolts should be checked for tightness after three (3) months of service and annually thereafter.
6. If a reducer has to be repaired, contact Cone Drive for detailed instructions, blueprints, parts lists, etc. If it is necessary field service is available.
7. If a reducer is to be returned, contact Cone Drive for instructions and a returned material authorization (RMA) number.

Storage Recommendations For Cone-Drive Speed Reducers

If a reducer is to be stored or shut down for more than 30 days, it should be protected from water condensation and corrosion as follows:

Any enclosed system of gearing is subject to water condensation on the inside of the reducer caused by fluctuating ambient temperatures. This condensation can cause severe rusting of the worm and bearings which could lead to premature failure of the reducer. However, this condition can

be easily prevented by following the recommendations outlined below for various storage conditions. If the reducer is furnished with a motor — follow the motor manufacturers recommendations for motor preservation.

1. **Standard Shipping Procedure — Protection for Maximum Storage Duration of 30 Days.**
Cone Drive speed reducers are run-in tested using a rust

inhibiting oil, drained, painted with one coat of primer, and all exposed shafting coated with a rust preventative prior to shipment. This procedure is intended to protect the reducers during shipment and short term inside storage for a maximum period of thirty (30) days after shipment.

2. Long Term Storage (Indoors) for Periods up to One Year.

(a) Fill the reducer completely full with one of the lubricants shown on our approved list of lubricants. A copy of this lubricant list is shipped with each unit. (b) Rotate the wormshaft and gearshaft at least once per month to keep the seals from sticking to the wear rings and/or shafts. (c) If it is not practical to rotate the wormshaft periodically we recommend purchasing a spare set of oil seals to have on hand in the event of seal leakage at start-up. (d) Before putting the reducer into service, lower the oil in the reducer to the proper operating oil level.

3. Long Term Storage (Outdoors) for Periods Up to One Year.

Proceed as in (2) above with the following additions. (a) After filling the unit with oil, plug the breather hole with a pipe plug and wire the breather to the unit. (b) Paint the outside of the unit with a finish coat of paint. (Reducer from the factory is prime coated only.) (c) Coat all exposed shafting with a long term rust preventative.

4. Extended Storage Periods Exceeding One Year.

(a) Immediately after receipt of the reducer blow approximately 1/3 oz. of #260 "VPI" powder into the unit thru the breather hole. Plug the breather hole with a pipe plug and wire the breather to the unit. (b) Paint the exterior of the unit with a finish coat of paint. (c) Coat all exposed shafting with a long term rust preventative. (d) Place the unit in a heavy plastic bag and put approximately 1/2 oz. #260 "VPI" powder in the bag. Seal the bag air tight. (e) Crate the unit and cover the crate to keep out water. (f) Purchase a spare set of oil seals to have on hand at start-up.

Lubrication Data

Note: Lubrication is very important for successful operation of Cone Drive gearsets and speed reducers. Inadequate lubrication can result in increased power consumption, added maintenance and gearset failure. Please review the following recommendations and the "Approved List of Lubricants" shipped with all Cone Drive gearsets and speed reducers. Cone Drive recommends only those lubricants listed or any lubricant which meets all the requirements of AGMA 250 "Lubrication of Industrial Enclosed Gear Drives" as it applies to double enveloping worm gearing. Use of other lubricants can result in gearset failure which will not be covered under warranty.

1. Type of Oil

Lubricating oils for use in gear units should be high quality well refined steam cylinder petroleum oils. They must not be corrosive to gears, to ball, roller or sleeve bearings; they must be neutral in reaction; free from grit or abrasives; and have good defoaming properties. As they may be subject to high operating temperatures, they must have good resistance to oxidation.

For worm-gears additions of 3 percent to 10 percent of acidless tallow or similar animal fats are desirable.

2. Ambient Temperature

The oils shown on the list of approved lubricants shipped with all Cone Drive gearsets and speed reducers are for use in an ambient temperature range of approximately 15° to 100° F with the low end of the range depending on the pour point of the specific oil used. If the ambient temperature will be below or above this range please contact Cone Drive for specific recommendations on proper lubricant as well as proper oil seal and shim materials.

3. Sludge

It is necessary that the oil be clean and free from sludge at all times to obtain long life from gear unit.

Sludge in gear units may be caused by excessive heat, from dust and dirt and other contaminants and by the presence of moisture or chemical fumes. Therefore, every precaution should be taken to prevent water and foreign particles from entering the gear case.

4. Cone Drive Reducers Are Shipped Without Oil

After assembly all reducers are test run with rust inhibiting oil and drained. This oil coats all internal parts and will protect the reducer for a period of 30 days. If the unit is to be stored longer than 30 days, see long term storage instructions.

5. Oil Change

If an approved synthetic lubricant is used, it should be changed

after 5000 hours of operation or once per year, whichever occurs first. If a recommended steam cylinder oil is used, the change interval should be after 2500 hours of operation or every six months, whichever occurs first. These change intervals are recommended for units operating under favorable conditions. Where operating conditions are severe, such as a rapid rise and fall in temperature of the gear case with accompanied sweating of the inside walls and resulting formation of sludge, or where operation is in moist or dusty atmospheres, or in the presence of chemical fumes or extended running at sump temperatures in excess of 180° F., it may be necessary to change the oil at intervals of one to three months. It is recommended, a sampling program be established with your lubricant manufacturer where reducers are exposed to the severe operating conditions, mentioned above.

6. Oil Level

Cone Drive reducers are furnished with a bronze colored hex head pipe plug to indicate oil level. An oil level tag is affixed to the unit near the oil level indicator. Oil level should **always** be checked with the unit stopped. Estimated oil capacities for standard reducers are listed on the following page.

7. Double & Triple Reduction Reducers

These units utilize separate housings and are furnished with **separate** oil sumps. It is important that all sumps are filled to the proper oil level.

8. Grease Packed Bearings

Bearings that are at least partially submerged in oil or oiled by internal oil scoops do not require special maintenance. However, bearings that are not lubricated as above require grease lubrication. Grease fittings and internal retainers are furnished when required. They should be greased with a high quality lithium base NLGI #2 or NLGI #3 bearing grease at normal maintenance intervals depending on the duty cycle of the reducer.

Oil Capacities

Approximate Capacities in Quarts & Gallons

SINGLE REDUCTION REDUCERS - FLOOR MOUNTED POSITION																
UNIT SIZE		20	25	30	35	40	50	60	70	80	100	120	150	180	220	240
WORM OVER GEAR	HO SHO	1 Qt.	1½ Qt.	2½ Qt.	1 Gal.	1½ Gal.	2½ Gal.	3¾ Gal.	6½ Gal.	10½ Gal.	19 Gal.	45 Gal.				
	ALT OIL LEVEL	½ Qt.	1 Qt.	1½ Qt.	2½ Qt.	1 Gal.	1¾ Gal.	2½ Gal.	4 Gal.	6½ Gal.	12½ Gal.	26 Gal.				
WORM UNDER GEAR	HU	½ Qt.	1 Qt.	1½ Qt.	3½ Qt.	1½ Gal.	2¼ Gal.	3½ Gal.	5¼ Gal.	7¾ Gal.	15 Gal.	30 Gal.	45 Gal.	70 Gal.		
	SHU															
VERTICAL OUTPUT SHAFT	HV SHV	1 Qt.	1 Qt.	1½ Qt.	2½ Qt.	1 Gal.	1¾ Gal.	2¾ Gal.	5 Gal.	6½ Gal.	14 Gal.	26 Gal.	50 Gal.	80 Gal.		

DOUBLE REDUCTION REDUCERS - FLOOR MOUNTED POSITION															
UNIT SIZE	20 30	20 35	25 40	25 50	30 60	30 70	35 70	40 70	40 80	50 100	60 120	70 150	80 180	100 220	100 224
OO-UO-VO OOS-UOS-VOS	3 Qt.	1½ Gal.	1¾ Gal.	2¾ Gal.	4¾ Gal.	7 Gal.	7¼ Gal.	7½ Gal.	11½ Gal.	20¾ Gal.	47½ Gal.				
OU-UU-VU	2½ Qt.	1 Gal.	1¾ Gal.	2½ Gal.	4 Gal.	5¼ Gal.	5½ Gal.	6 Gal.	8½ Gal.	16 Gal.	30 Gal.	50 Gal.	76 Gal.		
OUS-UUS-VUS			1¼ Gal.	2 Gal.	3¼ Gal.	6¼ Gal.	6½ Gal.	7 Gal.	9¾ Gal.	18½ Gal.	34 Gal.				
OV-UV-VV OVS-UVS-VVS	2 Qt.	3 Qt.													

GEARMOTORS & HELICAL/WORM REDUCERS - ALL POSITIONS											
UNIT SIZE		25	30	35	40	50	60	70	80	100	120
ALL MODELS MOUNTED WITH WORM UNDER GEAR	STANDARD SHAFT	2 Qt.	2½ Qt.	1¼ Gal.	2¼ Gal.	3 Gal.	4¼ Gal.	7 Gal.	8½ Gal.		
	HOLLOW SHAFT										
ALL MODELS MOUNTED WITH WORM OVER GEAR		1½ Qt.	1¼ Gal.	2 Gal.	2¼ Gal.	4 Gal.	5 Gal.	9 Gal.	11 Gal.		
ALL MODELS MOUNTED WITH VERTICAL OUTPUT SHAFT		2½ Qt.	3½ Qt.	1½ Qt.	2¼ Gal.	3 Gal.	3¾ Gal.	8 Gal.	10½ Gal.		
ALL MODELS MOUNTED WITH INPUT END UP		4 Qt.	1¼ Gal.	2¼ Gal.	3 Gal.	5¼ Gal.	6¾ Gal.	13½ Gal.	16 Gal.		
ALL MODELS MOUNTED WITH INPUT END DOWN		3½ Qt.	1 Gal.	1¾ Gal.	2½ Gal.	3½ Gal.	4¾ Gal.	8¾ Gal.	10½ Gal.		

IMPORTANT: Do not overfill units. Fill to center line of oil gauge or to pipe plug identified with oil level sticker. Oil capacities will vary due to mounting positions or type of gearshaft mounting used, such as solid shaft, hollow shaft or spread bearings.

Cone Drive

Cone Drive Operations Inc./Subsidiary of Textron Inc.
240 E. 12th Street, P.O. Box 272
Traverse City, MI 49685-0272
Phone: 616-946-8410
Fax: 616-946-0235

Cone Drive

TEXTRON
CONE DRIVE OPERATIONS INC./
SUBSIDIARY OF TEXTRON INC.
120 E. 12th Street, P.O. Box 272
Traverse City, MI 49685-0272
PH: 616-946-8410 • FAX: 616-946-0235

APPROVED LIST OF LUBRICANTS FOR CONE DRIVE DOUBLE-ENVELOPING WORM GEAR SPEED REDUCERS & GEARSETS

(SEE BACK FOR "WORLDWIDE" LIST)

CENTER DISTANCE	WORM SPEED (RPM)	† AMBIENT TEMPERATURE		(H) WORM SPEED ABOVE (RPM)	† AMBIENT TEMPERATURE	(H) MAXIMUM INPUT SPEED			AGMA LUBRICANT NUMBER	VISCOSITY RANGE		
		-10°C to +10°C (14°F to 50°F)	+10°C to +50°C (50°F to 125°F)			CENTER DISTANCE	RPM			ASTM SYSTEM	ISO GRADE	
						INCH	MM			SUS @ 210°F	SUS @ 100°F	CST @ 40°C
Up to 6" inclusive	0-700	8 Comp.	8A Comp.	700	8 Comp.	2.0 thru 3.5	up to 89	3600	7 Comp.	125 - 150	1919 - 2346	ISO460 (414-506)
Over 6" to 12"	0-450	8 Comp.	8A Comp.	450	8 Comp.	4.0	102	3000	8 Comp.	150 - 190	2837 - 3467	ISO680 (612-748)
Over 12" to 18"	0-300	8 Comp.	8A Comp.	300	8 Comp.	5.0	127	2400	8A Comp.	190 - 250	4171 - 5098	ISO1000 (900-1100)
Over 18" & above	0-200	8 Comp.	8A Comp.	200	8 Comp.	6.0 thru 8.0	152 thru 203	1750				
						10.0	254	1150				
						12.0 thru 15.0	305 thru 381	870				
						18.00	457	720				
Extracted from AGMA Standard 250 "Lubrication" (American Gear Manufacturers Association)						For input speed above the maximums listed contact Cone Drive Engineering.			Above oils are compounded with 3 to 10 percent of acidless tallow or other suitable animal fats.			

†Pour Point of the oil used should be 5°C (9°F) less than the minimum ambient temperature expected. For special temperature or operating conditions, contact Cone Drive Engineering Department for the proper lubricant selection.

†Worm gears operating at a sliding velocity in excess of 10 m/s (2000 feet per minute) may require force feed lubrication. The ISO460 (AGMA #7) compounded oils are only for use with a force feed lubrication system. See maximum recommended input rpm chart. To determine sliding velocity, see Cone Drive catalog general information section under "Lubrication Data".

‡AGMA specifications require a viscosity index (VI) of 90 (min.). However, lubricants listed with a VI of less than 90 may be used if a recommended lubricant with a VI of 90 (min.) is not available.

If a Cone Drive reducer is to be operated at an input rpm other than that shown on the name tag, contact Cone Drive Engineering Department for recommendations.

For double and triple reduction reducers an ISO1000 (AGMA #8A) lubricant can be used in primary as well as the final reduction stages.

All PowerDrive Reducers Must Use An "Approved PowerDrive Lubricant".

Cone Drive recommends only those lubricants listed or any lubricant which meets all the requirements of AGMA 250 "Lubrication of Industrial Enclosed Gear Drives" as it applies to double enveloping worm gearing. Use of other lubricants can result in gearset failure which will not be covered under warranty.

AGMA #7 COMPOUND (NON-E.P.)				AGMA #8 COMPOUND (NON-E.P.)				AGMA #8A COMPOUND (NON-E.P.)				MANUFACTURER
BRAND NAME	VI	P.P.°F	SUS @ 210°F	BRAND NAME	VI	P.P.°F	SUS @ 210°F	BRAND NAME	VI	P.P.°F	SUS @ 210°F	
				Uptime™ 600 W Super Cyl. Oil	95	10°	155	Uptime™ Extra Hecla Super Cyl. Oil	90	20°	198	Distributed by Cone Drive/Textron, Inc. expressly from Mobil Oil Corp.
NOTE: Uptime™ SHC 634 Synthetic Lubricant Acceptable For All Three Conditions				Approved PowerDrive and AccuDrive Lubricant								American Lubricants Co.
Alubco Safe Gear D.F.	95	15°	155	Safe Gear D.F. 8	95	15°	200					Amoco Oil Company
*Cyl. Oil 460	94	15°	147	*Cyl. Oil 680	91	15°	185	*Cyl. Oil 1000	95	15°	243	BP Oil
■ Energol DC-C 460	97	43°	*420 CST					■ Energol DC-C 1000	100	43°	*1000 CST	Bel-Ray Company, Inc.
**Steam Cyl. Oil 130	95	5°	135	**Steam Cyl. Oil 150	95	5°	167	**Steam Cyl. Oil 250	93	10°	205	Bel-Ray Company, Inc.
				No-Tox Steam Cylinder Oil (Food Grade)	117	0°	179					Cato Oil and Grease Co.
Steam Cyl. Oil 600	103	10°	*438 CST	Steam Cyl. Oil H-600	109	5°	*632 CST	Steam Cyl. Oil XH600	114	5°	*974 CST	Century Lubricating Oils, Inc.
				*Garwal 680	90	35°	182					Certified Laboratories
Certified Compound Oil #7	99	20°	146	Certified Compound Oil #8	97	20°	183	Certified Compound Oil #8A	93	30°	228	Chevron U.S.A., Inc.
*Cylinder Oil W-ISO 460	87	0°	*441 CST	*Cylinder Oil W-ISO 680	99	10°	*675 CST	*Cylinder Oil W-ISO 1000	102	10°	*945 CST	Citgo Petroleum Corp.
**Cyl. Oil 400-5	95	16°	137	**Cyl. Oil 680-7	95	18°	193					Conoco Inc.
**Inca Oil 460	98	20°	151	**Inca Oil 680	95	30°	184	**Inca Oil 1000	85	35°	224	Davis-Howland Oil Corp.
**DSL DH-167	91	25°	135	**DSL DH-210 HO Super Cyl. Oil	88	30°	160	**DSL DH-210 Heavy Super Cyl. Oil	87	35°	200	Dryden Oil Company
Special Cyl. Oil 460	99	19°	147	Super 600 Strm. Cyl. Oil	98	20°	179					Engineered Lubricants Co.
Enlulob SCO-135	108	15°	*455 CST	Enlulob SCO-3400	115	15°	*666 CST	Enlulob 193	100	15°	*1050 CST	Exxon Company
**Cylastic TK 460	99	20°	147	**Cylastic TK 680	97	20°	184	**Cylastic TK 1000	93	30°	227	Fina Oil Company
Cylan Cyl. Oil ISO 460	95	10°	140	Cylan Cyl. Oil ISO 680	93	20°	175					Fiske Brothers Refining Co.
**Lubriplate CP-7	99	10°	145	**Lubriplate CP-8	90	22°	160	**Lubriplate CP-8A	90	35°	230	Fiske Brothers Refining Co.
				**Lubriplate SPO-288	99	20°	173					Henkel Corp. - Emery Group
***NOTE: Emery-2843 Synthetic Industrial Gear Lubricant 460 For All Three Conditions				Approved PowerDrive and AccuDrive Lubricant								Höls
**PQ-AGMA #7	90	10°	135	**PQ-AGMA #8	90	10°	175					Imperial Oil Ltd. - Esso
**Cylisso TK460	90	37°	*460 CST	**Cylisso TK680	90	37°	*680 CST	**Cylisso TK1000	90	37°	*925 CST	Kendall Refining Company
				▲Kendco 155 Comp.	100	25°	177	▲Kendco 206 Comp.	97	35°	229	Keystone/▲Atochem
**Keygear K-600	100	45°	145									Lubrication Engineers
***NOTE: Keystone KSL-367 Synthetic Lubricant Acceptable For All Three Conditions				Approved PowerDrive and AccuDrive Lubricant								
				680 Almasol	95	15°	195					

NOTE #1: Major oil companies, not on the above list, do not have products which meet the requirements of AGMA 250.

NOTE #2: Extreme Pressure (E.P.) lubricants or cylinder oils with sulphur-phosphorus additives are not acceptable and should not be used in Cone Drive speed reducers.

NOTE #3: Recommended lubricant change - every 2500 hours or 6 months, whichever comes first. If a synthetic lubricant is used, the lubricant should be changed every 5000 hours or one year, whichever comes first.

NOTE #4: Recommended Bearing Grease - high quality lithium base NLGI #2 or NLGI #3.

*.....Available in Canada

**.....Available Worldwide

***.Special - not an AGMA compound

▲.....Not available in Canada

*.....ISO viscosity in centistokes @ 40° Centigrade

■.....Not available in United States

(CONTINUED ON REVERSE SIDE)

APPROVED LIST OF LUBRICANTS CONTINUED

All PowerDrive Reducers Must Use An "Approved PowerDrive Lubricant".

Cone Drive recommends only those lubricants listed or any lubricant which meets all the requirements of AGMA 250 "Lubrication of Industrial Enclosed Gear Drives" as it applies to double enveloping worm gearing. Use of other lubricants can result in gearset failure which will not be covered under warranty.

AGMA #7 COMPOUND (NON-E.P.)				AGMA #8 COMPOUND (NON-E.P.)				AGMA #8A COMPOUND (NON-E.P.)				MANUFACTURER
BRAND NAME	#VI	P.P.°F	SUS @ 210°F	BRAND NAME	#VI	P.P.°F	SUS @ 210°F	BRAND NAME	#VI	P.P.°F	SUS @ 210°F	
				Modoc 175	85	30°	175					Lyondell Petrochemical Co.
**600 W Cylinder Oil	99	15°	142	**600 W Super Cylinder Oil	95	10°	155	**Extra Hecla Super Cyl. Oil	90	20°	198	Mobil Oil Corp.
***NOTE: Mobil SHC-634 Synthetic Lubricant Acceptable For All Three Conditions				"Approved PowerDrive and AccuDrive Lubricant"								Mobil Oil Corp.
Cylinder Oil #5	96	15°	*460 CST	*Cylinder Oil #6	96	30°	*680 CST	Cylinder Oil 1000	96	30°	250	Pennzoil Products
Cylinder Oil #4	94	10°	*470 CST	*Cylinder Oil #6-NR	87	35°	*680 CST					Pennzoil Products
*Senate 460	88	30°	140	*Senate 680	85	25°	173	*Senate 1000	86	25°	201	Petro Canada
Hector 460 S	95	10°	134	Hector 630 S	90	5°	166					Phillips 66 Co.
243 Cylinder Oil #7	95	15°	142					243 Cylinder Oil #8A	95	15°	220	Primrose Oil Company
				*#147 Steam Cylinder Oil	98	10°	190					Schaeffer Mfg. Company
**Valvata Oil 460	94	15°	142	**Valvata Oil 680	94	20°	177					Shell Oil Company
*Sulflo AGMA #7 Comp.	101	20°	160	*Sulflo AGMA #8 Comp.	95	25°	190	*Sulflo AGMA #8A Comp.	90	25°	250	Sulflo, Inc.
Vanguard Cyl. Oil 460	94	10°	142	Honor Cyl. Oil 680	97	20°	190	650 "T" Cyl. Oil 1000	90	25°	220	Texaco Lubricant Co.
**Tribol 1105/7C	99	5°	144	**Tribol 1105/8C	95	10°	178					Tribol

WORLDWIDE APPROVED LIST OF LUBRICANTS

ISO 460 AGMA #7 COMPOUND (NON-E.P.)				ISO 680 AGMA #8 COMPOUND (NON-E.P.)				ISO 1000 AGMA #8A COMPOUND (NON-E.P.)				MANUFACTURER
BRAND NAME	#VI	P.P.°C	CST @ 40°C	BRAND NAME	#VI	P.P.°C	CST @ 40°C	BRAND NAME	#VI	P.P.°C	CST @ 40°C	
■ Energol DC-C 460	97	6°	420					■ Energol DC-C 1000	100	6°	1000	BP Oil
Steam Cyl. Oil 130	95	-15°	432	Steam Cyl. Oil 150	95	-15°	588	Steam Cyl. Oil 250	93	-12°	864	Bel-Ray Company, Inc.
Cyl. Oil 400-5	95	-9°	390	Cyl. Oil 680-7	95	-9°	632					Citgo Petroleum Corp.
Inca Oil 460	98	-7°	455	Inca Oil 680	95	-1°	680	Inca Oil 1000	85	2°	1000	Conoco Inc.
DSL DH-167	91	-4°	379	DSL DH-210 HO Super Cyl. Oil	88	-1°	627	DSL DH-210 Heavy Super Cyl. Oil	87	2°	882	Davis-Howland Oil Corp.
Cyllesso TK 460	99	-7°	429	Cyllesso TK 680	97	-7°	627	Cyllesso TK 1000	93	-1°	925	Exxon Company
Lubriplate CP-7	99	-12°	470	Lubriplate CP-8	90	-6°	640	Lubriplate CP-8A	90	-2°	900	Fiske Brothers Refining Co.
				***Lubriplate SPO-288	99	-7°	650					Fiske Brothers Refining Co.
***NOTE: Emery-2843 Synthetic Industrial Gear Lubricant 460 For All Three Conditions				"Approved PowerDrive and AccuDrive Lubricant"								Henkel Corp. - Emery Group
PQ-AGMA #7	90	-12°	418	PQ-AGMA #8	90	-12°	585					Hüls
Cyllesso TK460	90	3°	460	Cyllesso TK680	90	3°	680	Cyllesso TK1000	90	3°	925	Imperial Oil Ltd. - Esso
				▲Kendco 155 Comp.	100	-4°	557	▲Kendco 206 Comp.	97	2°	882	Kendall Refining Company
Keygear K-600	100	7°	402									Keystone/Atochem
***NOTE: Keystone KSL-367 Synthetic Lubricant Acceptable For All Three Conditions				"Approved PowerDrive and AccuDrive Lubricant"								Keystone
				680 Almasol	95	-9°	690					Lubrication Engineers
600 W Cylinder Oil	99	-9°	375	600 W Super Cylinder Oil	95	-12°	465	Extra Hecla Super Cyl. Oil	90	-7°	675	Mobil Oil Corp.
***NOTE: Mobil SHC-634 Synthetic Lubricant Acceptable For All Three Conditions				"Approved PowerDrive and AccuDrive Lubricant"								Mobil Oil Corp.
Valvata Oil 460	94	-9°	457	Valvata Oil 680	94	-7°	650					Shell Oil Company
Tribol 1105/7C	99	-15°	413	Tribol 1105/8C	95	-12°	608					Tribol

NOTE #1: Major oil companies, not on the above list, do not have products which meet the requirements of AGMA 250.

NOTE #2: Extreme Pressure (E.P.) lubricants or cylinder oils with sulphur-phosphorus additives are not acceptable and should not be used in Cone Drive speed reducers.

NOTE #3: Recommended lubricant change - every 2500 hours or 6 months, whichever comes first. If a synthetic lubricant is used, the lubricant should be changed every 5000 hours or one year, whichever comes first.

NOTE #4: Recommended Bearing Grease - high quality lithium base NLGI #2 or NLGI #3.

*.....Available in Canada

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◆.....ISO viscosity in centistokes @ 40° Centigrade

■.....Not available in United States



**Integral Horsepower
AC Induction Motors
ODP Enclosure
TEFC Enclosure
Explosion Proof**

Installation & Operating Manual

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Section 1

General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

Limited Warranty

1. Baldor Electric motors are warranted for a period of one (1) year, from date of shipment from the factory or factory warehouse against defects in material and workmanship. To allow for stocking and/or fabrication period and to provide one year of actual service, the warranty period is extended for an additional period of six (6) months for a total of eighteen (18) months from the original date of shipment from the factory or factory warehouse stock. In no case will the warranty period be extended for a longer period. Baldor extends this limited warranty to each buyer of the electric motor for the purpose of resale and to the original purchaser for use.
2. Baldor will, at its option repair or replace a motor which fails due to defects in material or workmanship during the warranty period if:
 - a. the purchaser presents the defective motor at or ships it prepaid to, the Baldor plant in Fort Smith, Arkansas or one of the Baldor Authorized Service Centers and
 - b. the purchaser gives written notification concerning the motor and the claimed defect including the date purchased, the task performed by the Baldor motor and the problem encountered.
3. Baldor will not pay the cost of removal of any electric motor from any equipment, the cost of delivery to Fort Smith, Arkansas or a Baldor Authorized Service Center, or the cost of any incidental or consequential damages resulting from the claimed defects. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you.) Any implied warranty given by laws shall be limited to the duration of the warranty period hereunder. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.)
4. Baldor Authorized Service Centers, when convinced to their satisfaction that a Baldor motor developed defects in material or workmanship within the warranty period, are authorized to proceed with the required repairs to fulfill Baldor's warranty when the cost of such repairs to be paid by Baldor does not exceed Baldor's warranty repair allowance. Baldor will not pay overtime premium repair charges without prior written authorization.
5. The cost of warranty repairs made by centers other than Baldor Authorized Service Centers **WILL NOT** be paid unless first authorized in writing by Baldor.
6. Claims by a purchaser that a motor is defective even when a failure results within one hour after being placed into service are not always justified. Therefore, Baldor Authorized Service Centers must determine from the condition of the motor as delivered to the center whether or not the motor is defective. If in the opinion of a Baldor Authorized Service Center, a motor did not fail as a result of defects in material or workmanship, the center is to proceed with repairs only if the purchaser agrees to pay for such repairs. If the decision is in dispute, the purchaser should still pay for the repairs and submit the paid invoice and the Authorized Service Center's signed service report to Baldor for further consideration.
7. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Note that **Baldor Super-E® Premium Efficiency** electric motors are warranted for a period of three (3) years. All other terms and conditions of the Limited Warranty statement apply.

Safety Notice:

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.

WARNING: Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.

WARNING: This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.

WARNING: Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.

WARNING: Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.

WARNING: Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.

WARNING: Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.

WARNING: Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.

WARNING: Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.

WARNING: Do not use these motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.

Safety Notice Continued

- WARNING:** Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate.
- Specific service conditions for these motors are defined in NEC 70-599.
- WARNING:** UL rated motors must only be serviced by authorized Baldor Service Centers if these motors are to be returned to a flammable and/or explosive atmosphere.
- Caution:** To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.
- Caution:** Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load from the motor shaft before moving the motor.
- Caution:** If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.
- Caution:** To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.
- Caution:** If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG-1 and MG-2 standards to avoid equipment damage.

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Storage

If the motor is not put into service immediately, the motor must be stored in a clean, dry and warm location. Several precautionary steps must be performed to avoid motor damage during storage.

1. Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
2. Do not lubricate bearings during storage. Motor bearings are packed with grease at the factory. Excessive grease can damage insulation quality.
3. Rotate motor shaft at least 10 turns every two months during storage (more frequently if possible). This will prevent bearing damage due to storage.
4. If the storage location is damp or humid, the motor windings must be protected from moisture. This can be done by applying power to the motors' space heater (if available) while the motor is in storage.

Unpacking

Each Baldor motor is packaged for ease of handling and to prevent entry of contaminants.

1. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
2. When the motor has reached room temperature, remove all protective wrapping material from the motor.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft.
2. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift using the motor lugs or eye bolts provided.

If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Section 2 Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

The motor should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. Exposure to these can reduce the operating life and degrade performance. Be sure to allow clearance for ventilation and access for cleaning, repair, service and inspections. Ventilation is extremely important. Be sure the area for ventilation is not obstructed. Obstructions will limit the free passage of air. Motors get warm and the heat must be dissipated to prevent damage.

These motors are not designed for atmospheric conditions that require explosion proof operation. They must **NOT** be used in the presence of flammable or combustible vapors or dust.

1. ODP motors are suitable only for indoor applications.
2. TEFC motors are suitable for indoor or outdoor standard service applications.

Mounting

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important.

1. Direct Coupling

For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.

2. End-Play Adjustment

The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.

3. Pulley Ratio

The pulley ratio should not exceed 8:1.

4. Belt Drive

Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Caution: Do not over tension belts.

Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

Power Connection

Conduit Box

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ease of making connections, an oversize conduit box is provided. The box can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

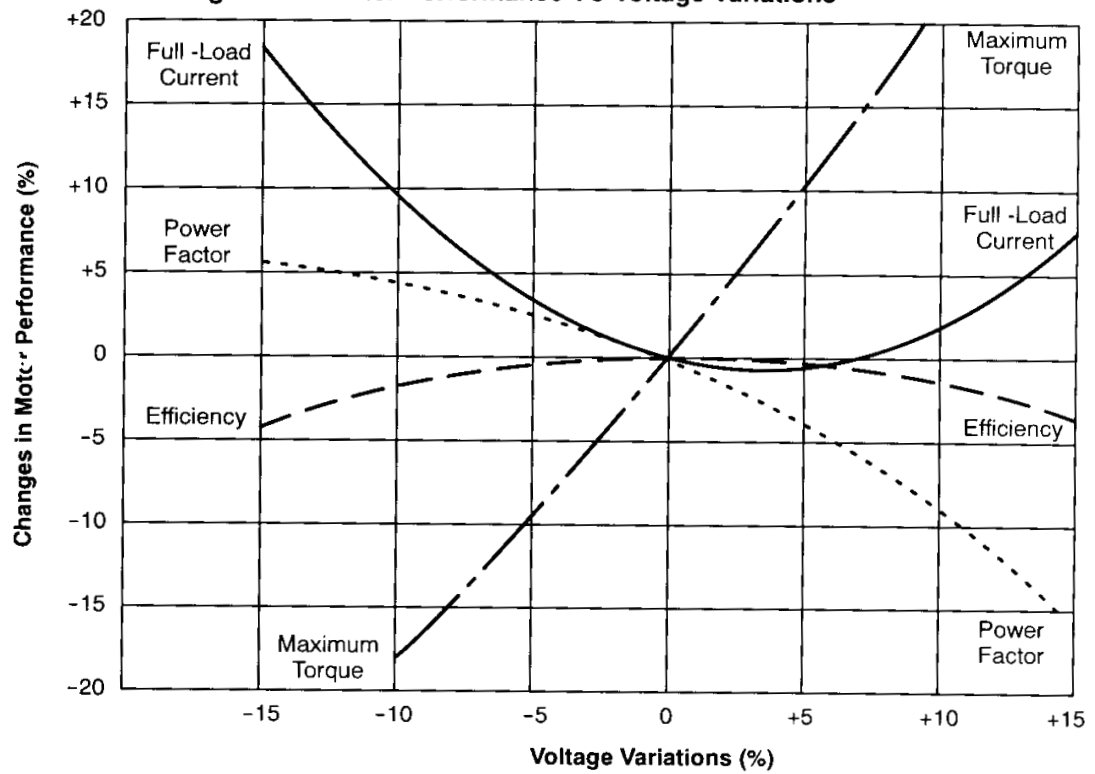
AC Power

Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within $\pm 10\%$ of rated voltage with rated frequency. (See motor name plate for ratings).
OR
2. AC power is within $\pm 5\%$ of rated frequency with rated voltage.
OR
3. A combined variation in voltage and frequency of $\pm 10\%$ (sum of absolute values) of rated values, provided the frequency variation does not exceed $\pm 5\%$ of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-1.

Figure 2-1 Motor Performance VS Voltage Variations



First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity with a Megger.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the to load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor through the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Section 3 Maintenance & Troubleshooting

WARNING: UL rated motors must only be serviced by authorized Baldor Service Centers if these motors are to be returned to a flammable and/or explosive atmosphere.

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Lubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease

A high grade ball or roller bearing grease should be used. Recommended greases for standard service conditions are:

Chevron SRI (Factory Installed) or Shell Dolium R.

Lubrication Intervals

Recommended lubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use. **Refer to additional information contained in Tables 3-2 and 3-3.**

Table 3-1 Lubrication Intervals

NEMA / (IEC) Frame Size	Rated Speed - RPM			
	3600	1800	1200	900
Up to 210 incl. (132)	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 5800 incl. (300)	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Bearings in 360 through 5000 frame, 2 pole motors are either 6313 or 6314 bearings and lubrication interval is shown in the table. If roller bearings are used, the bearings must be lubricated more frequently, divide the listed lubrication interval by 2.

Table 3-2 Service Conditions

Severity of Service	Ambient Temperature Maximum	Atmospheric Contamination	Type of Bearing
Standard	40° C	Clean, Little Corrosion	Deep Groove Ball Bearing
Severe	50° C	Moderate dirt, Corrosion	Ball Thrust, Roller
Extreme	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion	All Bearings
Low Temperature	<-30° C **		

* Special high temperature grease is recommended (Darmex 707). Note that Darmex 707 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Lubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)					
	Bearing	OD D mm	Width B mm	Weight of Grease to add oz (Grams)	Volume of grease to be added	
					in ³	tea- spoon
Up to 210 incl. (132)	6307	80	21	0.30 (8.4)	0.6	2.0
Over 210 to 280 incl. (180)	6311	120	29	0.61 (17.4)	1.2	3.9
Over 280 to 360 incl. (225)	6313	140	33	0.81 (23.1)	1.5	5.2
Over 360 to 449 incl. (280)	NU319	200	45	2.12 (60.0)	4.1	13.4
Over 5000 to 5800 incl. (355)	NU328	300	62	4.70(133.2)	9.2	30.0

Weight in grams = .005 DB

Lubrication Procedure

Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

With Grease Outlet Plug

1. Clean all grease fittings.
2. Remove grease outlet plug.
3. If motor is stopped, add the recommended amount of grease.
If motor is to be greased while running, a slightly greater quantity of grease will have to be added. Add grease slowly until new grease appears at shaft hole in the endplate or purge outlet plug.
4. Re-install grease outlet plug.

Without Grease Outlet Plug

1. Disassemble motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)

Note: Bearing is 1/3 full when only one side of bearing is completely full of grease.

3. Assemble motor.

Sample Lubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-3 lists a multiplier value of 0.5 for Severe conditions.
4. Table 3-4 shows that 1.2 in³ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Accessories

The following is a partial list of accessories available from Baldor.
Contact your Baldor distributor for availability and pricing information.

Note: Space heaters and RTD's are standard on some motors.

Bearing RTD

RTD (Resistance Temperature Detector) devices are used to measure or monitor the temperature of the motor bearing during operation.

Bearing Thermocouples

Used to measure or monitor bearing temperatures.

Bearing Thermostat

Temperature device that activates when bearing temperatures are excessive. Used with an external circuit to warn of excessive bearing temperature or to shut down a motor.

Conduit Boxes

Optional conduit boxes are available in various sizes to accommodate accessory devices.

Cord & Plug Assembly

Adds a line cord and plug for portable applications.

Drains and Breathers

Stainless steel drains with separate breathers are available.

Drip Covers

Designed for use when motor is mounted in a vertical position. Contact your Baldor distributor to confirm that the motor is designed for vertical mounting.

Fan Cover & Lint Screen

To prevent build-up of debris on the cooling fan.

Nameplate

Additional stainless steel nameplates are available.

Roller Bearings

Recommended for belt drive applications with a speed of 1800 RPM or less.

Rotation Arrow Labels

Rotation arrows are supplied on motors designed to operate in one direction only. Additional rotation arrows are available.

Space Heater

Added to prevent condensation of moisture within the motor enclosure during periods of shut down or storage.

Stainless Hardware

Stainless steel hardware is available. Standard hardware is corrosion resistant zinc plated steel.

Winding RTD

RTD (Resistance Temperature Detector) devices are used to measure or monitor the temperature of the motor winding during operation.

Winding Thermocouples

Used to measure or monitor winding temperatures.

Winding Thermostat

Temperature device that activates when winding temperatures are excessive. Used with an external circuit to warn of excessive winding temperature or to shut down a motor.

Note: On some motors, leads for accessory devices are brought out to a separate conduit box located on the side of the motor housing (unless otherwise specified).

Table 3-5 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings. Tighten "Thru Bolts".
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $\frac{3}{4}$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $\frac{3}{4}$ filled.
Vibration	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.
	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked and repaired at your Baldor Service Center.
Noise	Resonance.	Tune system or contact your Baldor Service Center for assistance.
	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.



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Per qualsiasi difficoltà Vi preghiamo contattare l'organizzazione della MGM e prendere visione delle istruzioni d'uso e manutenzione nella versione più completa e aggiornata sul nostro sito web (www.mgmrestop.com)

Should any difficulty arise please contact MGM organization and download the 'Use and Maintenance' in its last and complete version directly from our web site (www.mgmrestop.com)

Si vous avez des difficultés, contactez l'organisation M.G.M. et consultez les instructions de mise en route et de maintenance détaillées et à jour sur notre site (www.mgmrestop.com)

Por cualquier tipo de dificultad, les rogamos ponerse en contacto con la organización de M.G.M. y coger las instrucciones des uso y manutención en las versión mas completa y actualizada en nuestra página web (www.mgmrestop.com)

Sollten Schwierigkeiten jeglicher Art auftreten, setzen Sie sich bitte mit dem M.G.M.-Stammhaus in Verbindung und sehen Sie die ausführlichen Betriebs- und Wartungsanleitungen auf unserer Web.Site (www.mgmrestop.com) ein.

ITALIANO

SERIE BA



Le attività di manutenzione devono essere svolte solo da personale qualificato e solo dopo aver scollegato l'impianto o il motore dalla rete di alimentazione elettrica.

La carenza di ispezioni e manutenzione può causare gravi danni a persone o cose.

Manutenzione



Le attività di manutenzione devono essere eseguite da personale qualificato (IEC 60364) solo dopo aver preventivamente scollegato l'impianto o il motore dalla rete (compreso eventuali ausiliari e in particolare le scaldiglie anticondensa) e aver verificato che all'albero motore non risulti applicato

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nessun carico. Per motivi di sicurezza la vite di sblocco del freno e la chiave a "T" non devono essere mai lasciate inserite sul motore ma rimosse e custodite dal responsabile della manutenzione dell'impianto dopo ogni intervento. **La chiave a "T" deve essere utilizzata soltanto quando il motore è scollegato dalla rete di alimentazione e solo dopo aver verificato che all'albero motore non risulti applicato nessun carico.** Dopo ogni intervento sul gruppo freno verificare sempre la chiusura della cuffia (26) attraverso un adeguato serraggio della vite TE (27). Di seguito sono elencate le attività che devono essere svolte periodicamente per assicurare il corretto funzionamento del motore autofrenante MGM. La frequenza delle ispezioni dipende dalla particolare applicazione del motore (numero di avviamenti, momento di inerzia applicato, condizioni ambientali etc.). Si consiglia di effettuare le prime ispezioni a distanza di alcune settimane di funzionamento e di redigere conseguentemente un programma di manutenzione periodica. Si raccomanda comunque di programmare le ispezioni successive con frequenza non inferiore a 2 volte all'anno. Per eventuali informazioni contattare l'organizzazione della M.G.M. motori elettrici S.p.A.

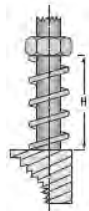
- Verificare periodicamente che il motore funzioni correttamente senza rumori o vibrazioni anomale e che le aperture per il passaggio dell'aria per la ventilazione non siano ostruite.
- Verificare il corretto serraggio dei cavi di alimentazione del motore e del freno e del conduttore di terra.
- Verificare che, per effetto dell'usura della guarnizione di attrito del disco freno, il traferro non sia al di fuori dei valori indicati nella tabella 1. Si consideri che l'usura è maggiore durante la fase di rodaggio. Per la regolazione del traferro seguire le indicazioni riportate nel paragrafo "Regolazione del Traferro".
- Verificare lo stato di usura della superficie di attrito da entrambe le parti del disco freno (per i motori serie BAPV da una sola parte) assicurandosi che lo spessore non scenda al di sotto di 2 mm. Verificare inoltre l'assenza di danneggiamenti sulla superficie del disco ed in particolare nella dentatura del mozzo. (Per l'eventuale sostituzione consultare il paragrafo "Sostituzione del Disco Freno"). Per i dischi con pista di attrito rivettata verificare che la superficie frenante non abbia raggiunto il livello dei rivetti; verificare inoltre che non ci sia gioco tra il mozzo e il disco in corrispondenza dei chiodi.
- Verificare periodicamente che la coppia frenante sia adeguata. Se necessario procedere alla regolazione secondo quanto indicato nel paragrafo "Regolazione coppia frenante".
- Verificare periodicamente lo stato di usura delle colonnette di guida (19-42) e il loro saldo ancoraggio sul convogliatore (17).
- Tutti i componenti del gruppo freno e in particolare il disco freno (23, 39-41 per BAF, 45 per BAPV) e le colonnette di guida (19, 42 per BAF-BAPV) sono componenti soggetti ad usura. In considerazione della funzione di sicurezza svolta è necessario effettuare, come manutenzione preventiva, la sostituzione periodica. La frequenza dipende dal tipo di lavoro svolto dal motore (numero di avviamenti, momento di inerzia applicato, condizioni ambientali etc.); si raccomanda comunque di provvedere alla sostituzione con una frequenza non superiore ai 18 mesi.
- Verificare periodicamente lo stato di usura della dentatura dell'albero dove scorre il disco freno.

Regolazione Coppia Frenante



La coppia frenante è proporzionale alla compressione delle molle (18) che può essere variata agendo sui dadi (20). Nella tabella 2 e 3 sono riportati i valori di compressione standard (H std) delle molle.

La coppia frenante corrispondente alla regolazione standard della compressione delle molle riportata in tabella è solitamente inferiore a quella massimo riportata sulla targa del motore, soprattutto per i gruppi freno con elettromagnete AC. Dopo aver effettuato la registrazione verificare sempre che la coppia frenante sia idonea per l'utilizzo previsto. Se alimentando il freno l'elettromagnete non riuscisse a richiamare l'ancora mobile (24) con un colpo secco e a tenerla attratta senza vibrazioni, verificare l'esatta regolazione del traferro (60) e, se l'inconveniente persiste, allentare i dadi (20) e riprovare sino ad ottenere il funzionamento corretto. Per motori che possono essere provvisti di 3 oppure 6 molle (serie BA 160÷225) porre attenzione alla diversa regolazione della compressione delle molle necessaria per il raggiungimento della coppia frenante desiderata. Verificare sempre a fine intervento che la coppia frenante registrata sia adeguata. Non superare mai il valore di coppia frenante massimo riportato in targa. Si consiglia di evitare di regolare la coppia frenante a valori inferiori al 30% del valore massimo..



Elettromagnete AC

Tabella 2

Tipo	71	80	90	100	112	132 ³	160 ¹	180 ¹	200 ¹	225 ¹
H std (mm)	12,5	12,0	15,5	15,0	15,5	17,0	20,5	35,5	35,5	34,0

Elettromagnete DC

Tabella 3

Tipo	71	80	90	100	112	132 ³	160 ²	180 ²	200 ²	225 ²
H std (mm)	13,2	12,5	16,0	15,0	16,0	17,0	18,0	32,0	32,0	32,0

- 1) i gruppi freno dei motori serie BA, BAF 160÷225 con elettromagnete AC hanno 6 molle;
- 2) i gruppi freno dei motori della serie BA 160÷225 con elettromagnete DC hanno 3 molle. Le molle devono essere disposte su 3 colonnette poste a 120° per garantire un'azione frenante uniforme. Le altre 3 colonnette sono senza molle.
- 3) i gruppi freno dei motori serie BA, BAPV, BAF 132 con elettromagnete AC hanno le molle di colore giallo. I gruppi freno dei motori serie BA, BAPV 132 con elettromagnete DC hanno le molle di colore nero.

Sostituzione del Disco Freno



Svitare la vite T.E. (27), togliere la cuffia (26) e svitare i dadi (22), sfilare l'elettromagnete (25) dalle colonnette (19), togliere i dadi (20-21) e le molle (18). Estrarre l'ancora mobile (24) dalle colonnette (19), togliere il disco freno (23) vecchio ed inserire il disco nuovo. Procedere a ritroso per il successivo montaggio. Si raccomanda di maneggiare il disco freno con le mani pulite perché ogni traccia di grasso diminuisce la capacità frenante e aumenta la rumorosità. Nei motori BAF rispetto alla versione BA ci sono due dischi freno (39-41), con interposta la pista di attrito ausiliaria (40). Dopo aver montato l'elettromagnete (25) procedere alla regolazione del traferro. Per i motori della serie BAPV per la sostituzione dei dischi volano (45) attenersi alle istruzioni specifiche.

Sostituzione dell'Elettromagnete



Svitare la vite T.E. (27), togliere la cuffia (26), scollegare i connettori dell'elettromagnete (25), svitare i dadi (22) e sfilare dalle colonnette (19) l'elettromagnete (25). Ricollocare sulle colonnette il nuovo elettromagnete e i dadi ed effettuare il collegamento elettrico avendo cura di disporre i connettori nella posizione che rende possibile l'innesto. Prima di rimontare la cuffia di protezione freno (26) verificare che i connettori e i relativi cavi siano ben ancorati. Procedere con la regolazione del traferro (vedere relativo paragrafo). Verificare che l'elettromagnete funzioni regolarmente; alimentando il freno l'elettromagnete (25) deve richiamare l'ancora mobile (24) con un colpo secco e tenerla attratta senza alcuna vibrazione o rumorosità. Se l'ancora mobile (24) tendesse a vibrare occorre verificare che i terminali siano accoppiati correttamente.

Regolazione del Traferro



Il traferro (60), ossia la distanza tra i due nuclei magnetici dell'elettromagnete (25) e dell'ancora mobile (24), deve rimanere entro i valori indicati nella tabella 1. E' necessario non oltrepassare tali valori, per evitare vibrazioni dell'ancora mobile, rumorosità eccessiva, l'eventuale bruciatura delle bobine dell'elettromagnete o il danneggiamento del gruppo freno. Il traferro tende ad aumentare per effetto dell'usura del disco freno. Si consideri che l'usura del disco freno è maggiore durante la fase di rodaggio (alcune migliaia di frenate). Per riportare il traferro al valore richiesto occorre agire sulle coppie di dadi (21-22) che fermano l'elettromagnete (25) facendolo avanzare verso l'ancora mobile (24). Non è corretto serrare i dadi (22) di blocco dell'elettromagnete su una delle colonnette prima di aver ultimato la regolazione della posizione dell'elettromagnete su tutte le colonnette. Non si deve pertanto modificare la posizione dell'elettromagnete agendo su un dado interno (21), per fare una regolazione in corrispondenza di una colonnetta, se non sono stati allentati precedentemente i dadi esterni (22) su tutte le colonnette. Il traferro deve essere uniforme allo scopo di garantire il corretto funzionamento ed evitare sollecitazioni meccaniche dovute al cattivo allineamento. Per gruppi freno con 6 colonnette (19-42) effettuare inizialmente la regolazione della posizione dell'elettromagnete (agendo sui dadi 21-22) solo su 3 colonnette poste a 120°. Dopo aver registrato il traferro sulle prime 3 colonnette completare l'operazione sulle rimanenti 3 colonnette accostando prima i 3 dadi (21) a contatto con l'elettromagnete e serrando quindi i 3 dadi (22). Ad operazione conclusa verificare l'uniformità del traferro e il serraggio dei dadi (21-22).

Tipo motore	71-80	90-100	112-132	160-200	225
Traferro (mm)	0,25 ÷ 0,5	0,3 ÷ 0,6	0,4 ÷ 0,8	0,5 ÷ 1,0	0,6 ÷ 1,2
ATTENZIONE Il traferro deve rimanere entro i valori indicati in tabella per evitare possibili danneggiamenti del gruppo freno.					

Tabella 1

BA SERIES



Maintenance operations must be carried out only by qualified personnel and only after having disconnected the plant or the motors from the electrical supply. Inadequate inspections and maintenance can produce personal injury or property damage.

Maintenance



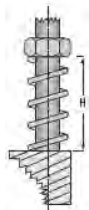
Maintenance operations must be carried out by qualified personnel (IEC 60364), and only after having disconnected the plant or the motor from the electrical supply (including any possible auxiliaries and especially anti-condensation heaters) and after having checked that no load is applied to the driveshaft. For security reasons the hand release (49) and the hexagonal "T" key (51) never must be fitted on the motor but removed and kept by the plant maintenance responsible after every intervention. **The hexagonal "T" key must be used only after having disconnected the motor from the electrical supply and after having checked that no load is applied to the drive shaft.** After any operation on brake assembly, verify that the end protection cover (26) is firmly held in place by the hexagonal rear nut (27). The operations which must be carried out periodically in order to ensure the correct functioning of the MGM brake motor are listed further on. The frequency of inspection depends on the particular motor duty (number of start/stop, applied moment of inertia, environment conditions and so on). Generally it's advisable to proceed to the first inspection after few weeks of working and to draw up a periodical maintenance plan. Anyway it's recommended to provide inspections at least twice a year. For specific information pls contact the M.G.M. motori elettrici S.p.A. organization.

- Periodically check that the motor operates correctly without noise or strange vibrations and that the openings for ventilation are not obstructed.
- Verify that all motor and brake supply terminals are property tightened to the terminal board as well as the earthing terminal to the motor frame.
- As a result of normal wear of the brake disc lining, check that the air gap does not exceed the values shown on table 1. Please note that the brake linings wear is greater during the run-in. (few thousands stops). For the air gap adjustment, follow the instructions given into the paragraph "Air Gap Adjustment".
- Check the wear on both friction surfaces of the brake disc (on one side only for BAPV series) to be sure that their thickness is not less than 2 mm. Verify also that there are no damages on disc surfaces and, in particular, in the hub toothing. (For replacement, refer to the paragraph "Brake Disc Replacement"). For those brake disc with rivets on disc lining verify that braking surface has not reached the rivets; moreover check that no play should be between the brake disc and the brake disc hub in correspondence of the hub nails.
- Verify periodically that the braking torque is suitable. If needed, proceed to its adjustment as stated in the paragraph "Braking torque adjustment".
- Verify regularly the brake adjuster (19-42) wear conditions and their steady fastening on the rear cover brake surface (17).
- All brake assembly components, in particular the brake disc (23, 39-41 for BAF series, 45 for BAPV) and the brake adjusters (19, 42 for BAF-BAPV series) are subject to wear. In consideration of safety it's needed to replace them periodically. The replacement frequency comes from the motor duty (number of start/stop, applied moment of inertia, environment conditions and so on), we recommend however to replace them at least every 18 months.
- Periodically check and verify the shaft splines wear, exactly where the disc slides.

Braking Torque Adjustment



The brake torque is proportional to the spring (18) compression. The compression of the springs must be as uniform as possible. On the table 2 and 3 are shown the standard compression values (H std) of the brake springs. The corresponding brake torque of the standard compression values stated on the table are less than the maximum braking torque stated on the motor nameplate, especially for AC brake assembly. Please verify that the braking torque is suitable for your application. If the brake coil (25) isn't able to call the brake moving element (24) back with a quick stroke and keep it attracted without vibrations, verify the exact air gap adjustment and, if this inconvenience still persists, loosen the locknut (20) and try it again until desired functioning is obtained. Some types of motors (BA series 160÷225) can have 3 or 6 springs (18). Pay attention to the different adjustment of the spring compression to reach the brake torque value required. After every intervention pls verify that the braking torque is that



required. Never exceed the maximum braking torque value stated on the motor name plate. It's recommended to avoid adjusting the braking torque to values lower than 30% of the maximum value.

AC brake coil

Type	71	80	90	100	112	132 ³	160 ¹	180 ¹	200 ¹	225 ¹
H std (mm)	12,5	12,0	15,5	15,0	15,5	17,0	20,5	35,5	35,5	34,0

DC brake coil

Table 2

Type	71	80	90	100	112	132 ³	160 ²	180 ²	200 ²	225 ²
H std (mm)	13,2	12,5	16,0	15,0	16,0	17,0	18,0	32,0	32,0	32,0

Table 3

- 1) The brake assembly of motor series BA, BAF 160+225 with AC brake has 6 springs.
- 2) The brake assembly of motor series BA160+225 with DC brake has 3 springs. The 3 springs must be put on 3 brake adjusters situated at 120° to assure an uniform braking action.
- 3) The brake assembly of motor series BA, BAPV, BAF 132 with AC brake coil have the springs yellow coloured. The brake assembly of motor series BA, BAPV 132 with DC brake coil have the springs black coloured.

Brake Disc Replacement

Loosen the rear nut (27), remove the end cover (26) and unscrew the locknuts (22). Take off the brake coil (25) from the brake adjusters (19), remove the nuts (20-21) and the springs (18). Remove the brake moving element (24) sliding it through the brake adjusters (19). Take off the old brake disc (23) and put in the new one. For re-assembling, proceed backwards. We recommend that the new brake disc must be handled with clean hands, because even a small trace of grease will decrease the braking performance and also increase noise. In the BAF series otherwise than in the BA series there are 2 brake discs (39-41) with an intermediate brake moving element (40) in between. After the brake coil (25) replacement, proceed to the airgap adjustment (see the pertinent paragraph). For the flywheel (45) replacement on the BAPV series, follow up the specific instructions.

Brake Coil Replacement

Loosen the rear nut (27), remove the end cover (26), disconnect the brake coil (25). Unscrew the locknuts (22) and pull off the brake coil (25) from brake adjusters (19). Reassemble the new brake coil on the brake adjusters (19) and reconnect the electrical connectors. Pay attention to place the electrical connectors in the right position so that to allow their insertion. Before reassemble the end cover (26) and the nuts verify that the connections and relative cables are properly tightened. Proceed with the air gap adjustment as stated in the respective paragraph. Verify that the brake coil functions correctly: when the brake is energized, the brake coil (25) should attract the brake moving element (24) with a quick stroke, and hold it without any vibration or noise. In case of any vibration, check that terminal connectors are coupled correctly and tightly.

Air Gap Adjustment

The air gap (60) i.e. the distance between the two magnetic cores of the brake coil (25) and the brake moving element (24), must be as shown on table 1. It's strongly unadvisable to exceed these values in order to avoid vibrations of the brake moving element, prominent noise, the burning of the brake coil or the brake assembly damaging. It's advisable to check periodically the air gap, because by the wear of the brake disc linings, it tends to increase. Please note that brake linings wear is greater during the run-in (few thousands stops). In order to set the airgap back to the required value, operate on the nuts (21-22) to obtain the brake coil forward displacement towards the brake moving element (24). It's strongly recommended to avoid to tighten the locknut (22) located on one brake adjuster (19, 42 for BAPV-BAF series motors) before having completed the positioning of the brake coil (25) on all the brake adjusters. Therefore don't regulate the position of the brake coil adjusting the nut (21) on one brake adjuster, if previously you didn't loose the locknuts (22) on all the brake adjusters (19, 42 for BAPV-BAF series motors). This wrong operation could stress the air gap adjusters. Please verify that the airgap is uniform. The air gap must be uniform to guarantee the right working and avoid mechanical stresses

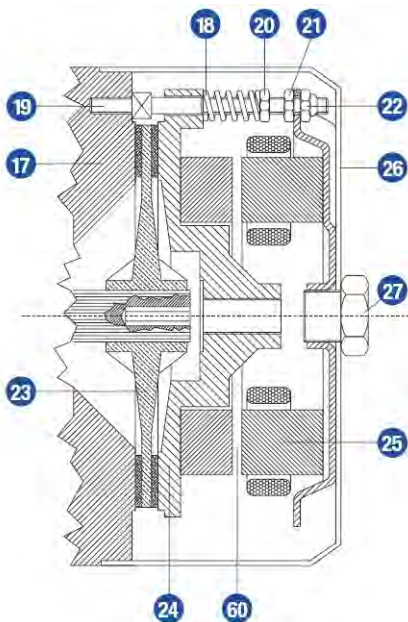
due to a wrong alignment. When the air gap adjustment has been settled, the locknuts (22) should be tightened. For brake assembly with 6 brake adjusters (19, 42 for BAPV-BAF series motors), as first step regulate the brake coil position only on three brake adjusters at 120° by the nuts 21-22. After having adjusted the position on these 3 brake adjusters, to complete the operation go on with the other 3 brake adjusters and first bring the air gap adjusting nuts (21) close to the brake coil and then tighten the locknuts (22). When the operations has been settled, verify that the airgap is uniform and the nuts (21-22) are tightened.

Motor type	71-80	90-100	112-132	160-200	225
Air gap (mm)	0,25 ÷ 0,5	0,3 ÷ 0,6	0,4 ÷ 0,8	0,5 ÷ 1,0	0,6 ÷ 1,2



WARNING The airgap must be as indicated on the table. Don't exceed this range to avoid any damage on the brake assembly.

Table 1



- 17 - Convogliatore con pista d'attrito
- 18 - Molla freno
- 19 - Colonna di guida (42- colonna di guida per motori della serie BAPV o BAF)
- 20 - Dado autobloccante registro molla
- 21 - Dado blocco interno elettromagnete
- 22 - Dado blocco esterno elettromagnete
- 23 - Disco freno
- 24 - Ancora mobile con triangolo di guida
- 25 - Elettromagnete
- 26 - Cuffia protezione freno
- 27 - Vite a testa esagona con foro
- 60 - Traferro

- 17 - Rear cover (brake surface)
- 18 - Spring
- 19 - Brake adjuster (42- brake adjuster for BAPV-BAF series motors)
- 20 - Braking torque adjusting locknut
- 21 - Air gap adjusting nut
- 22 - Locknut
- 23 - Brake disc
- 24 - Brake moving element
- 25 - Brake coil
- 26 - End cover
- 27 - Hexagonal rear nut
- 60 - Air gap



ADDITIONAL INSTRUCTIONS FOR USA & CANADA INSTRUCTIONS COMPLÉMENTAIRES POUR USA ET CANADA ISTRUZIONI AGGIUNTIVE PER USA E CANADA

In the following instructions you can find additional information about the motor wiring. We recommend you to read carefully these additional information which must be preserved together with the 'Use and Maintenance' booklet supplied with the motor. For any clarifications please contact the M.G.M. motori elettrici SpA organization.

Les instructions suivantes sont des instructions complémentaires relatives au branchement électrique. Nous vous recommandons de lire attentivement ces instructions qui doivent être conservées avec le manuel de mise en route et de manutention du moteur. Pour toutes les éventuelles précisions, veuillez contacter l'organisation de M.G.M. motori elettrici S.p.A.

Le seguenti istruzioni riportano informazioni aggiuntive per il collegamento elettrico. Vi raccomandiamo di leggere attentamente queste istruzioni aggiuntive che devono essere conservate insieme al libretto d'uso e manutenzione del motore. Per qualsiasi chiarimento contattare l'organizzazione della M.G.M. motori elettrici S.p.A.



Before connecting the motor to the power supply it is necessary to connect the earth wire in accordance with the standards and regulations in force by trained personnel to prevent serious electrical shocks.



Avant de brancher le moteur au secteur d'alimentation, il est nécessaire de mettre le moteur à la terre en accord aux normes en vigueur. Celui-ci doit être installé par un personnel qualifié afin de prévenir tout incident électrique

Prima di collegare il motore alla rete di alimentazione deve essere fatto il collegamento a terra in accordo alle norme e regolamentazioni vigenti. L'installazione deve essere fatta da personale qualificato allo scopo di prevenire possibili gravi danni a persone o cose.

BA SERIES

**BRAKE MOTORS - MOTEURS FREIN - MOTORI AUTOFRENANTI
SINGLE SPEED - SIMPLE VITESSE SINGOLA VELOCITA'**

BA

**330/575V 60Hz (Y) 265/460V 60Hz(Y)
AC brake - Frein AC - Freno AC**

Motor and brake are connected in Y connection.

On the nameplate is written the input voltage required (575V 60Hz or 460V 60Hz). The motor and brake input voltages are the same ($V_b = V_m$).

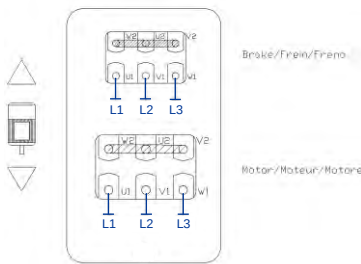
Input voltage in U1, V1, W1 as showed in the drawing. Interchange any two line leads to reverse rotation.

Le moteur et le frein sont connectés à Y.

La tension d'alimentation demandée (575V 60 Hz ou 460V 60 Hz) est indiquée sur la plaque du moteur. Alimenter les bornes U1, V1, W1 suivant le schéma. La tension d'alimentation du moteur et du frein est la même ($V_b = V_m$). Pour changer le sens de rotation du moteur, inverser deux phases de l'alimentation.

Il motore e il freno sono collegati a Y.

La tensione di alimentazione richiesta (575V 60Hz oppure 460V 60Hz) è indicata sulla targa del motore. Alimentare i morsetti U1, V1, W1 secondo quanto illustrato nello schema. La tensione di alimentazione del motore e del freno sono uguali ($V_b = V_m$). Per cambiare il senso di rotazione del motore invertire due fasi dell'alimentazione.



BA

**230/460V 60Hz (YY/Y)
DC brake - Frein DC - Freno DC**

The motor is connected for 230V(YY).

To change from 230V (YY) to 460V (Y) remove the links connecting U2, V2, W2 and move only the wires marked with 7 (violet marker), - 8 (grey marker) - 9 (white marker) from U1, V1, W1 to W2, U2, V2.

Input voltage in U1, V1, W1.

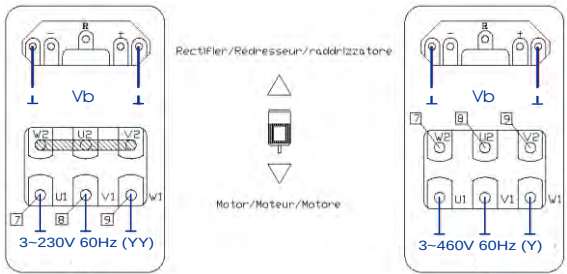
Interchange any two line leads to reverse rotation.

The brake must be fed through the rectifier at the single phase voltage (V_b) stated on the name plate.

Le moteur est connecté pour l'alimentation à 230V (YY).

Pour passer du branchement à 230V à celui à 460V enlever les barrets qui relient les bornes U 2,V2,W2 et déplacer seulement les trois câbles marqués avec le numéro 7 (marque câble violette), 8 (marque câble grise), 9 (marque câble blanche) de U1, V1, W1 à W2, U2, V2.
Alimenter les bornes U1, V1, W1.
Pour changer le sens de rotation, inverser deux phases de l'alimentation.
La tension d'alimentation du redresseur doit être celle mono (Vb) indiquée sur la plaque du moteur.

Il motore è collegato per essere alimentato a 230V 60Hz (YY).
Per passare dal collegamento a 230V (YY) a 460V (Y) rimuovere i ponticelli che uniscono i terminali U2,V2,W2 e spostare solo i tre cavi marcati con il numero 7 (marca cavo viola), - 8(marca cavo grigio) - 9(marca cavo bianco) da U1,V1,W1 a W2,U2,V2.
Alimentare i morsetti U1,V1,W1.
Per cambiare il senso di rotazione invertire due fasi dell'alimentazione.
Il freno deve essere alimentato, attraverso il raddrizzatore, alla tensione monofase (Vb) indicata sulla targa.

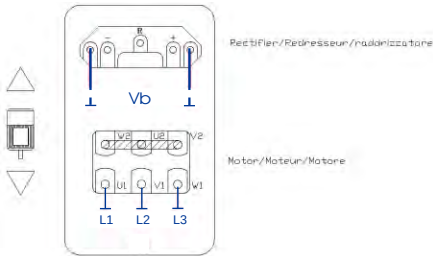


BA
330/575V 60Hz (/ Y)
DC brake - Frein DC - Freno DC

The motor is connected for 575V 60Hz (Y).
Input voltage in U1, V1, W1 as showed in the drawing. Interchange any two line leads to reverse rotation.
The brake must be fed through the rectifier at the single phase voltage (Vb) stated on the name plate.

Le moteur est connecté pour l'alimentation à 575V 60Hz (Y).
Alimenter les bornes U1, V1, W1. Pour changer le sens de rotation, inverser deux phases de l'alimentation.
La tension d'alimentation du redresseur doit être celle mono (Vb) indiquée sur la plaque du moteur.

Il motore è collegato per essere alimentato a 575V 60Hz (Y).
Alimentare i morsetti U1, V1, W1 secondo quanto indicato nello schema.
Per cambiare il senso di rotazione invertire due fasi dell'alimentazione.
Il freno deve essere alimentato, attraverso il raddrizzatore, alla tensione monofase (Vb) indicata sulla targa.



BM SERIES
BRAKE MOTORS - MOTEURS FREIN - MOTORI AUTOFRENANTI
SINGLE SPEED - SIMPLE VITESSE - SINGOLA VELOCITÀ

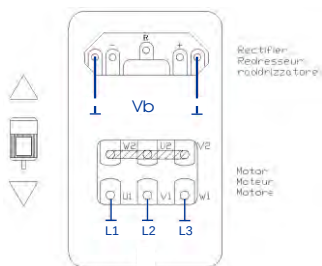
BM
330/575V 60Hz (/ Y) 265/460V 60Hz (/ Y)
DC brake - Frein DC - Freno DC

The motor is connected in Y connection (575V 60 Hz or 460V 60Hz as stated on the nameplate).
Input voltage in U1, V1, W1 as showed in the drawing. Interchange any two line leads to reverse rotation.
The brake must be fed through the rectifier at the single phase voltage (Vb) stated on the name plate.

Le moteur est connecté à Y (575V 60 Hz ou 460V 60Hz comme indiqué sur la plaque du moteur).
Alimenter les bornes U1, V1, W1. Pour changer le sens de rotation, inverser deux phases de l'alimentation.
La tension d'alimentation du redresseur doit être celle mono (Vb) indiquée sur la plaque du moteur.

Il motore è collegato a Y (575V 60 Hz o 460V 60Hz secondo come indicato sulla targa)
Alimentare i morsetti U1, V1, W1 secondo quanto indicato nello schema. Per cambiare il senso di rotazione invertire due fasi dell'alimentazione.

Il freno deve essere alimentato, attraverso il raddrizzatore, alla tensione monofase (Vb) indicata sulla targa.



BM
230/460V 60Hz (YY/Y)
DC brake - Frein DC - Freno DC

The motor is connected for 230V(YY).

To change from 230V (YY) to 460V (Y) remove the links connecting U2,V2,W2 and move only the wires marked with 7 (violet marker), - 8(grey marker) - 9(white marker) from U1,V1,W1 to W2,U2,V2.

Input voltage in U1,V1,W1.

Interchange any two line leads to reverse rotation.

The brake must be fed through the rectifier at the single phase voltage (Vb) stated on the name plate.

Le moteur est connecté pour l'alimentation à 230V (YY).

Pour passer du branchement à 230V à celui à 460V enlever les barrets qui relient les bornes U 2,V2,W2 et déplacer seulement les trois câbles marqués avec le numéro 7 (marque câble violette), 8 (marque câble grise), 9 (marque câble blanche) de U1, V1, W1 à W2, U2, V2.

Alimenter les bornes U1, V1, W1.

Pour changer le sens de rotation, inverser deux phases de l'alimentation.

La tension d'alimentation du redresseur doit être celle mono (Vb) indiquée sur la plaque du moteur.

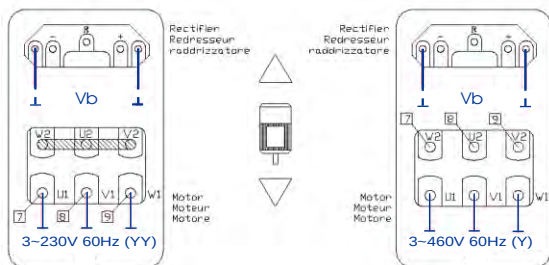
Il motore è collegato per essere alimentato a 230V 60Hz (YY).

Per passare dal collegamento a 230V (YY) a 460V (Y) rimuovere i ponticelli che uniscono i terminali U2,V2,W2 e spostare solo i tre cavi marcati con il numero 7 (marca cavo viola), - 8(marca cavo grigio) - 9(marca cavo bianco) da U1,V1,W1 a W2,U2,V2.

Alimentare i morsetti U1,V1,W1.

Per cambiare il senso di rotazione invertire due fasi dell'alimentazione.

Il freno deve essere alimentato, attraverso il raddrizzatore, alla tensione monofase (Vb) indicata sulla targa.



BM 56
230/460V 60Hz (YY/Y)
DC brake 230V - Frein DC 230V - Freno DC 230V

The motor is connected for 230V(YY).

To change from 230V (YY) to 460V (Y) remove the links connecting U2,V2,W2, move only the wires marked with 7 (violet marker), - 8(grey marker) - 9(white marker) from U1,V1,W1 to W2,U2,V2 and move the white rectifier's leads from V1,W1 to U2,V2.

Input voltage in U1,V1,W1.

Interchange any two line leads to reverse rotation.

Le moteur est connecté pour l'alimentation à 230V (YY).

Pour passer du branchement à 230V à celui à 460V enlever les barrets qui relient les bornes U 2,V2,W2, déplacer seulement les trois câbles marqués avec le numéro 7 (marque câble violette), 8 (marque câble grise), 9 (marque câble blanc) de U1, V1, W1 à W2, U2, V2 et déplacer les deux câbles blanc du redresseur de V1, W1 à U2, V2.

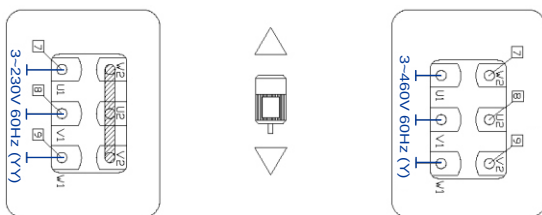
Alimenter les bornes U1, V1, W1.

Pour changer le sens de rotation, inverser deux phases de l'alimentation.

Il motore è collegato per essere alimentato a 230V 60Hz (YY).

Per passare dal collegamento a 230V (YY) a 460V (Y) rimuovere i ponticelli che uniscono i terminali U2,V2,W2, spostare solo i tre cavi marcati con il numero 7 (marca cavo viola), - 8(marca cavo grigio) - 9(marca cavo bianco) da U1,V1,W1 a W2,U2,V2 e spostare i cavi di colore bianco del raddrizzatore da V1,W1 a U2,V2.

Alimentare i morsetti U1,V1,W1.
Per cambiare il senso di rotazione invertire due fasi dell'alimentazione.



SM-SMX SERIES

SM-SMX 330/575V 60Hz (/Y)

Single speed motor - 6 leads motors (/Y)

Moteurs à une vitesse - 6 câbles d'enclenchement (/Y)

Motore a singola velocità - 6 cavi di collegamento (/Y)

The motor is connected for 575V 60Hz (Y).

Input voltage in U1,V1,W1.

Interchange any two line leads to reverse rotation.

Le moteur est connecté pour l'alimentation à 575V 60Hz (Y).

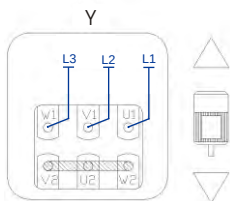
Alimenter les bornes U1, V1, W1.

Pour changer le sens de rotation, inverser deux phases de l'alimentation.

Il motore è collegato per l'alimentazione a 575V 60Hz (Y).

Alimentare i terminali U1,V1,W1.

Per cambiare il senso di rotazione invertire due fasi dell'alimentazione.



Warning: On motors type **SM 56** the position of the terminal block is 90° rotated in comparison with the drawing.

Sur les moteurs type **SM 56** la position de la boîte à bornes est tournée de 90° en rapport à la figure ci-dessus.

Sui motori tipo **SM 56** la posizione della morsettiere è ruotata di 90° rispetto a quanto raffigurato sul disegno.

SM-SMX 230/460V 60Hz

Single speed motor - 9 leads motors (YY/Y)

Moteurs à une vitesse - 9 câbles d'enclenchement (YY/Y)

Motore a singola velocità con 9 cavi di collegamento (YY/Y)

The motor is connected for 230V (YY).

To change from 230V (YY) to 460V (Y) remove the links connecting U2,V2,W2 and move only the three wires marked with 7 (violet marker), - 8 (grey marker) - 9 (white marker) from U1,V1,W1 to W2,U2,V2.

Input voltage in U1,V1,W1.

Interchange any two line leads to reverse rotation.

Le moteur est connecté pour l'alimentation à 230V (YY).

Pour passer du branchement à 230V à celui à 460V enlever les barrets qui relient les bornes U 2,V2,W2 et déplacer seulement les trois câbles marqués avec le numéro 7 (marque câble violette), 8 (marque câble grise), 9 (marque câble blanche) de U1, V1, W1 à W2, U2, V2.

Alimenter les bornes U1, V1, W1.

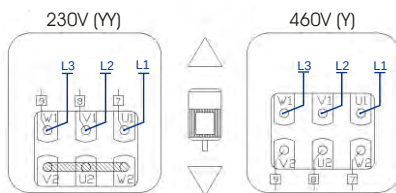
Pour changer le sens de rotation, inverser deux phases de l'alimentation.

Il motore è collegato per l'alimentazione a 230V (YY).

Per passare dal collegamento a 230V (YY) a 460V (Y) rimuovere i ponticelli che uniscono i terminali U2,V2,W2 e spostare solo i tre cavi marcati con il numero 7 (marca cavo viola), - 8 (marca cavo grigio) - 9 (marca cavo bianco) da U1,V1,W1 a W2,U2,V2.

Alimentare i terminali U1,V1,W1.

Per cambiare il senso di rotazione invertire due fasi dell'alimentazione



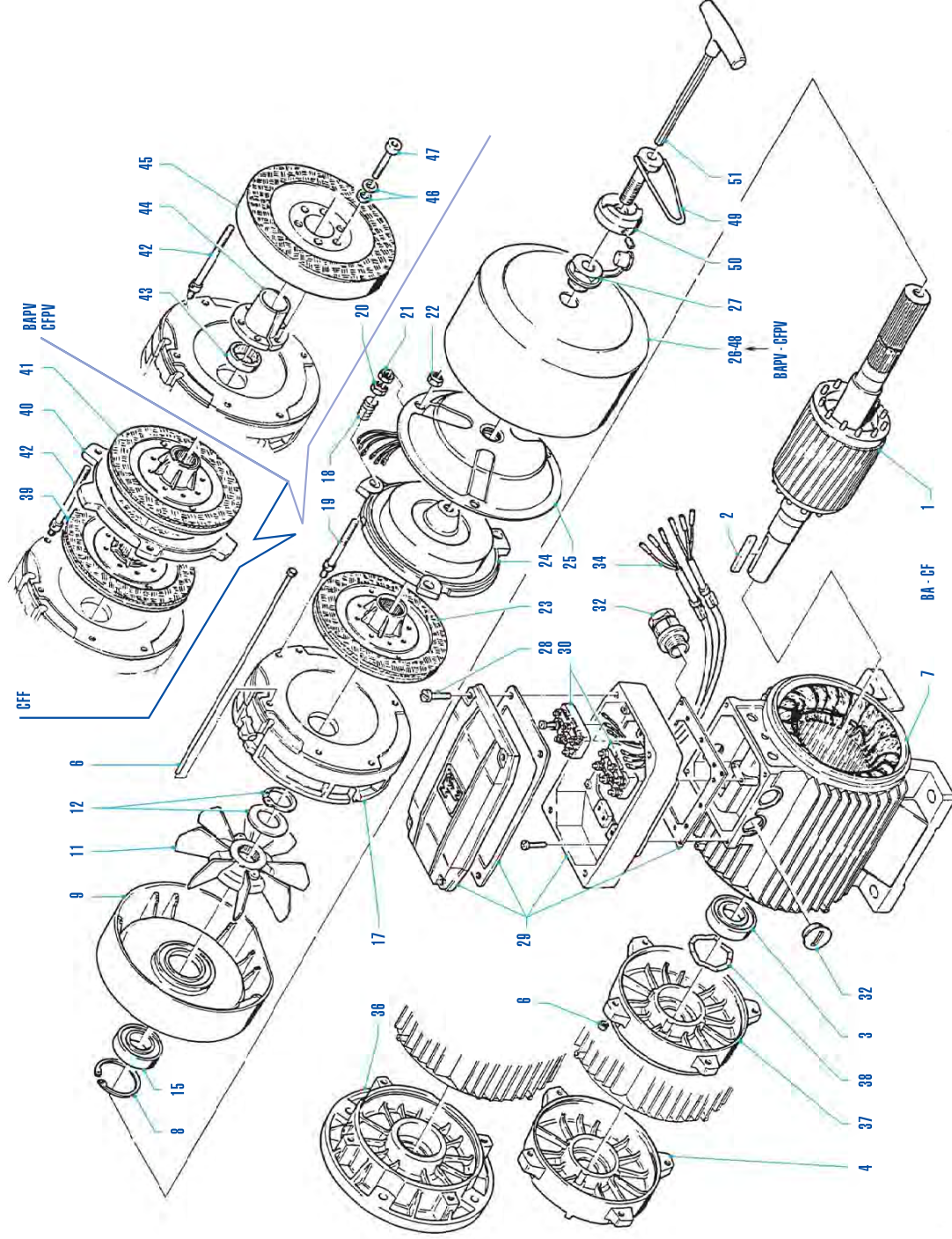
Warning: On motors type **SM 56** the position of the terminal block is 90° rotated in comparison with the drawing.

Sur les moteurs type **SM 56** la position de la boîte à bornes est tournée de 90° en rapport à la figure ci-dessus.

Sui motori tipo **SM 56** la posizione della morsettiere è ruotata di 90° rispetto a quanto raffigurato sul disegno.

Spare Parts

M.G.M. motori elettrici S.p.A. is present in more than 40 countries around the world with sales/parts outlets and customer service. Please contact MGM customer assistance to find further information about MGM in the world. To clearly identify a spare part it is necessary to provide the item number (shown on the drawing below), the motor type, the rated voltage and frequency supply for electric parts such as the stator, the brake coil and the rectifier.



Spare Parts

- 1 Complete rotor
- 2 Key
- 3 Bearing Drive End side
- 4 Endshield Drive End (front cover)
- 5 Tie rod assembly
- 6 Stator frame
- 7 Circclip
- 8 Endshield brake side (rear cover)
- 9 Fan
- 10 Fan fixing accessories
- 11 Bearing Non Drive Side
- 12 Brake Friction Surface
- 13 Spring
- 14 Brake adjuster
- 15 Brake torque adjuster locknut
- 16 Air gap adjusting nut
- 17 Brake coil locknut
- 18 Brake Disc
- 19 Brake Moving Element
- 20 Brake Coil
- 21 Brake Cover (BA-CF)
- 22 Hexagonal Rear Nut (socket head nut)
- 23 Terminal Box Screws
- 24 Terminal Box (single or double)
- 25 Terminal Board
- 26 Cable Gland
- 27 Brake Coil Connection Cables
- 28 Flange B5 (Flange Mounting)
- 29 Flange B14 (Face Mounting)
- 30 Elastic Washer
- 31 Brake Disc (BAF-CFF)
- 32 Additional Brake surface (BAF-CFF)
- 33 Additional Brake Disc (BAF-CFF)
- 34 Long Brake Adjuster (BAPV-BAF-CFF-CFPV)
- 35 Spacer (BAPV-CFPV)
- 36 Taper Bush (BAPV-CFPV)
- 37 Flywheel (BAPV-CFPV)
- 38 Elastic Washer (BAPV-CFPV)
- 39 Taper bush fixing screws (BAPV-CFPV)
- 40 Brake Cover (BAPV-BAF-CFF-CFF)
- 41 Brake Release Screw
- 42 Fulcrum Hub for brake release (on request only)
- 43 Allen key for manual shaft rotation (on request only)

Martin

Stock "QD" Bushings

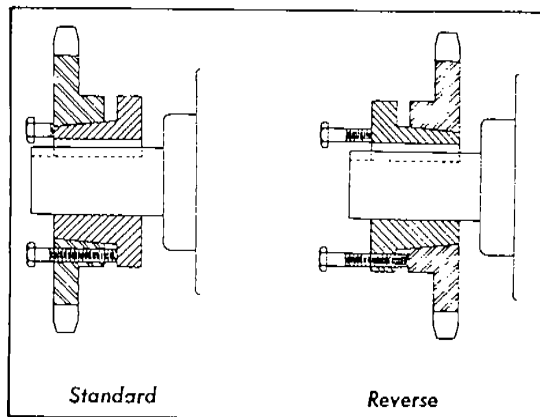
The taper-bored "QD" Sprocket easily fits over the tapered hub and tightening of the cap screws produces a tight press fit on the shaft. The sprocket is easily removed from the hub by using the pull-up bolts as jack screws in the holes tapped in the rim of the sprocket. All hubs "JA" through "J" are drilled for REVERSE MOUNTING.

INSTALLATION

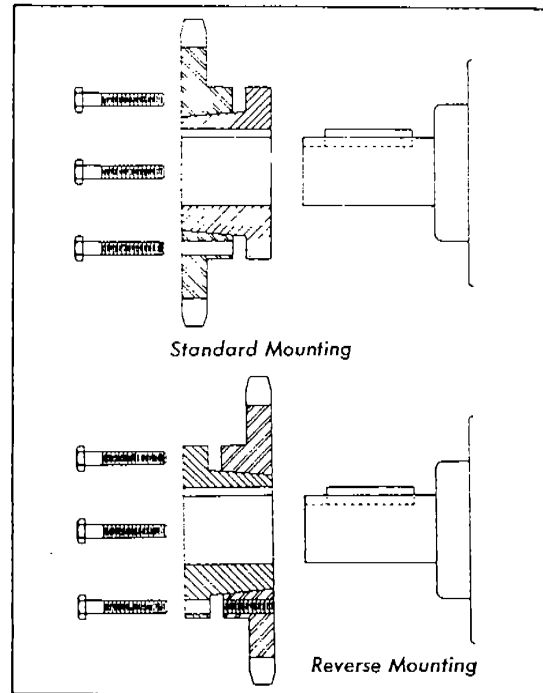
1. Be sure the tapered cone surfaces of the bushing and the inside of sprocket hub are clean.
2. Place bushing in sprocket.
3. Place cap screws and lock washers loosely in pull-up holes. Bushing remains fully expanded to assure sliding fit on shaft.
4. With key on shaft, slide sprocket to desired position on shaft. Be sure heads of capscrews are on outside.
5. Align sprocket. Tighten screws alternately and progressively — until they are pulled up tight. To increase leverage, use wrench or length of pipe (see wrench torque chart at far right). Do not allow sprocket to be drawn in contact with flange of bushing; there should be a gap from $\frac{1}{8}$ to $\frac{1}{4}$ inch.

REMOVAL

1. Loosen and remove cap screws.
2. Insert cap screws in tapped removal holes.
3. Tighten inserted screws until sprocket is loose on shaft.
4. Remove sprocket from shaft.



CAUTION: When mounting screws, apply pressure by hand only. If extreme tightening forces are applied, bursting pressures will be created in the sprocket hub. There should be a gap of $\frac{1}{8}$ " to $\frac{1}{4}$ " between the face of the sprocket hub and the flange of the QD bushing. **This gap must not be closed.** If the gap is closed under normal tightening, the shaft is seriously undersized.



BUSHING INSTALLATION TORQUE

When a wrench or length of pipe is used to increase leverage in tightening bushing screws, it is imperative to adhere to the wrench torque values given in the chart below.

This adherence is important—because, in mounting the bushing, the tightening force on the screws is multiplied many times by the wedging action of the tapered surface. This action compresses the bushing for a snug fit on the shaft. The bushing screws should always be tightened alternately and progressively.

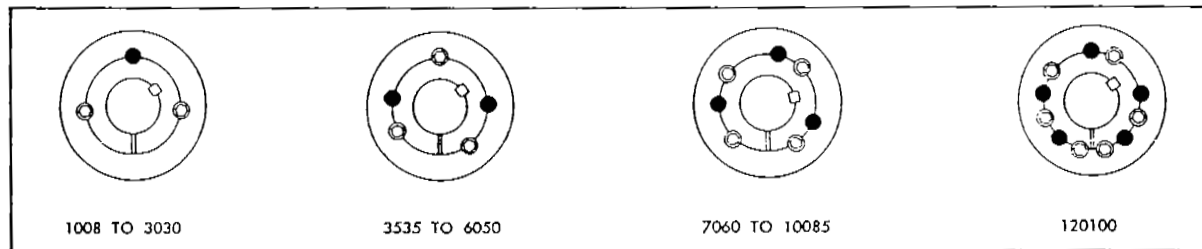
WRENCH TORQUE VALUES FOR TIGHTENING BUSHINGS

Bushing	Wrench Torque (In.-Lbs.)	Wrench Length (Inches)	Wrench Pull (Pounds)
JA	60	4	15
SH	108	4	27
SDS	108	4	27
SD	108	4	27
SK	180	6	30
SF	360	6	60
E	720	12	60
F	900	12	75
J	1350	12	113
M	1800	15	120
N	2250	15	150
P	3300	18	183
W	4000	24	167
S	5000	30	167

Martin

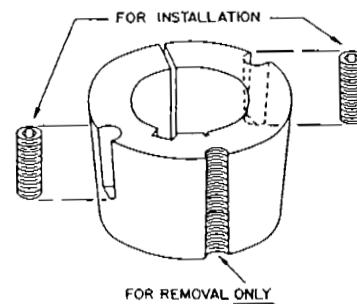
Tapered Bushings

IMPORTANT: Follow all instructions in this manual carefully. This is necessary to insure satisfactory performance.



TO INSTALL:

1. Clean shaft, bore and outside of bushing, and bore of hub (taking bushing from hub if already assembled). Remove any oil, lacquer or dirt. Place bushing in hub and match half holes to make complete holes (each complete hole will be threaded on one side only).
2. Oil thread and point of set screws or thread and under head of cap screws. Place screws loosely in holes that are threaded on hub side (shown thus  in diagram).
3. Make sure bushing is free in hub. Slip assembly onto shaft and locate in position desired.
4. Tighten screws (see note*) alternately and evenly until all are pulled up very tightly. Use a piece of pipe on wrench to increase leverage. (See table for wrench torque on reverse side).
5. Hammer against large end of bushing using hammer and block or sleeve to avoid damage. Screws can now be turned a little more using the specified wrench torque. Repeat this alternate hammering and screw re-tightening until the specified wrench torque no longer turns the screws after hammering. Fill other holes with grease to exclude dirt.



Recommended Wrench Torque

Bushing No.	Screws	Wrench Torque▲ (Pounds-Inches)
1008	1/4" Set Screws	55
1210	3/8" Set Screws	175
1610	3/8" Set Screws	175
2012	3/16" Set Screws	280
2517	1/2" Set Screws	430
3020, 3030	5/8" Set Screws	800
3535	1/2" Cap Screws	1,000
4040	3/8" Cap Screws	1,700
4545	3/4" Cap Screws	2,450
5050	7/8" Cap Screws	3,100
6050, 7060, 8065	1 1/4" Cap Screws	7,820
10085, 120100	1 1/2" Cap Screws	13,700

▲When torque wrench is not available it is possible to approximate these values by using an ordinary wrench and piece of pipe on wrench. For example, to obtain 100 pound-inches wrench torque, pull 100 pounds at 10" distance from center of pull to center of screw, or pull 50 pounds at a 20" distance, etc.

To Remove

1. Remove all screws. Oil thread and point of set screws or thread and under head of cap screws.
2. Insert screws in holds that are threaded on bushing side (shown thus  in diagram). In sizes where washers are found under screw heads, be sure to use these washers. Note that one screw in each hub is left over and is not used in this loosening operation.
3. Tighten screws alternately until bushing is loosened in hub. If bushing does not loosen immediately, tap on hub.

When ordering Bushings Give: Number stamped on large end of bushing, bore, and quantity.

*If two bushings are used in the same sheave, pulley or other unit member, tighten one bushing on shaft per steps 4 and 5 before starting to tighten screws in other bushing.

LOCKING ASSEMBLIES SERIES B103 & B106

FEATURES

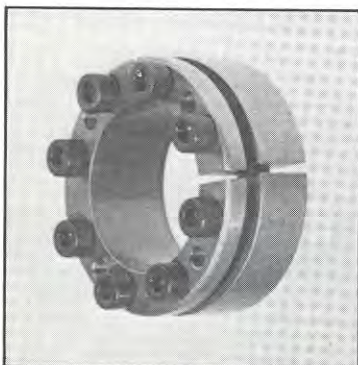
- Shallow taper design provides for efficient conversion of locking screw clamp loads into radial contact pressures of these single taper locking assemblies.
- Self-locking taper assures transmission of substantial reversing bending moments without imposing dynamic loads on locking screws. Generously sized number of push-off threads—fitting screws of unit assures positive dismounting even after prolonged service periods.
- Combination of shallow taper with relatively wide contact lengths provides for exceptionally concentric fits without the need for pre-centering hub sections or shaft steps, allowing for simple and economical designs with straight bored and narrow hubs.
- Increased face flange of series B106 units eliminates axial hub movement during installation, common for other single taper locking devices.

EXPLANATIONS Refer also to "Selection Criteria on page 4 for M_t and other information.

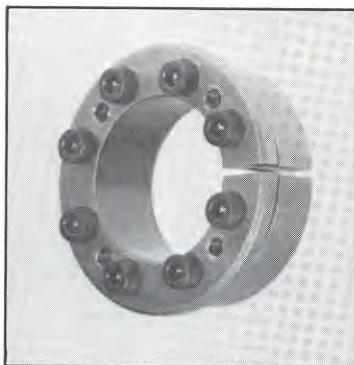
- T = allowable machining tolerance for shaft and hub bore.
 Shaft diameter to be specified = d per table—plus zero/minus T .
 Hub bore diameter to be specified = D per table—minus zero/plus T .
 p = shaft contact pressure
 p_H = hub bore contact pressure

Ordering information:

Specify size and series, e.g. Locking Assembly 4^{15/16} / B106-IN



B-LOC B103 Series



B-LOC B106 Series

INSTALLATION

Locking assemblies are supplied ready for installation.

The frictional torque capacity of these devices is based on lightly oiled screw, taper, shaft and bore contact areas with a coefficient of friction $\mu = 0.12$.

Therefore, it is important *not* to use Molybdenum Disulfide, e.g., Molykote, Never-Seeze or similar lubricants in any locking assembly installation.

- 1 Make sure taper, shaft and bore contact areas as well as screw threads and head contact surfaces are clean and sufficiently oiled.
- 2 Loosen all locking screws by a minimum of two turns and transfer at least (3) screws to the clamp flange-push-off threads in order to keep parts (1) and (2) spaced apart for easy insertion of Locking Assembly. See Fig. 29.
- 3 Relocate locking screws used for separating parts (1) and (2).
- 4 Hand tighten connection and assure that collar item no. 1 is parallel with face of part to be attached to shaft.
- 5 Use torque wrench and set it approximately 5% higher than specified tightening torque M_A . Torque screws in either a clockwise or counter clockwise sequence, using only 1/4 turns (it is not necessary to tighten in a diametrically opposite pattern) for several passes until 1/4 turns can no longer be achieved.
- 6 Still apply overtorque for 1 or 2 more passes. This is required to compensate for a system-related relaxation of locking screws since tightening of a given screw will always relax adjacent screws. Without overtightening, an infinite number of passes would be needed to reach specified tightening torque.

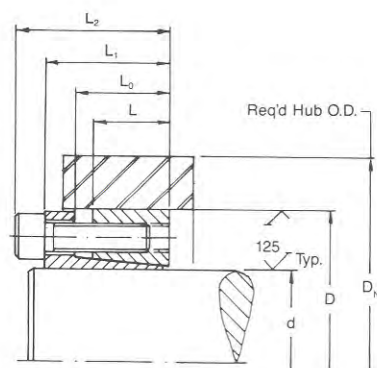


FIG. 27
Typical hub layout
Series B103 installation

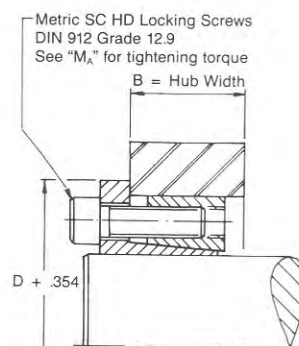


FIG. 28
Typical hub layout
Series B106 installation

- 7 Reset torque wrench to specified torque and check all locking screws. No screw should turn at this point, otherwise repeat step "6" for 1 or 2 more passes. It is not necessary to re-check tightening torque after equipment has been in operation.

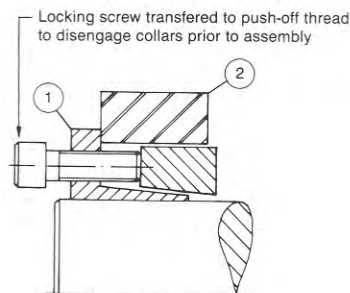


FIG. 29

REMOVAL

- 1 Relax all locking screws by approximately 4 turns and transfer screws to all push-off threads provided in face of inner ring part (1).
- 2 Release connection by progressively tightening all push-off screws in a diametrically opposite sequence.

LOCKING ASSEMBLIES SERIES B103 & B106

METRIC SERIES B103/B106			INCH SERIES B103-IN/B106-IN			METRIC & INCH SERIES												
Size	d	D	Size	d	D	T	L	L ₀ inches	L ₁	L ₂	Mt ft-lb	p psi	P _H psi	Qty	LOCKING Size	SCREWS M _A [ft-lbs] Series B103 B106		Weight lbs
20x47	.787	1.850	3/4	.750	1.850	.002	.669	.866	1.102	1.339	214	31300	13220			5	M6x20	
22x47	.866	1.850	7/8	.875	1.850	.002	.669	.866	1.102	1.339	236	28450	13220	5	M6x20	10	12	.55
24x50	.945	1.969				.002	.669	.866	1.102	1.339	273	28440	13650	5	M6x20	10	12	.60
25x50	.984	1.969	1	1.000	1.969	.002	.669	.866	1.102	1.339	332	27300	15640	6	M6x20	10	12	.60
28x55	1.102	2.165	1 1/8	1.125	2.165	.002	.669	.866	1.102	1.339	369	28440	14220	6	M6x20	10	12	.80
30x55	1.181	2.165	1 3/16	1.1875	2.165	.002	.669	.866	1.102	1.339	400	27020	14220	6	M6x20	10	12	.77
35x60	1.378	2.362	1 1/4	1.250	2.362	.002	.669	.886	1.102	1.339	563	29720	15600	8	M6x20	10	12	.77
			1 3/8	1.375	2.362	.002	.669	.866	1.102	1.339	620	27020	15600	8	M6x20	10	12	.75
			1 7/16	1.4375	2.559	.002	.669	.866	1.102	1.339	678	28200	14930	8	M6x20	10	12	.86
40x65	1.575	2.559	1 1/2	1.500	2.559	.002	.669	.866	1.102	1.339	708	27020	14930	8	M6x20	10	12	.84
			1 5/8	1.625	2.953	.002	.787	.984	1.299	1.614	1290	32700	19200	7	M8x25	25	30	1.4
			1 11/16	1.6875	2.953	.002	.787	.984	1.299	1.614	1228	34330	19200	7	M8x25	25	30	1.8
45x75	1.772	2.953	1 3/4	1.750	2.953	.002	.787	.984	1.299	1.614	1274	33110	19200	7	M8x25	25	30	1.8
50x80	1.969	3.150	1 7/8	1.875	3.150	.002	.787	.984	1.299	1.614	1355	31390	18400	7	M8x25	25	30	2.0
			1 5/8	1.9375	3.150	.002	.787	.984	1.299	1.614	1380	29900	18400	7	M8x25	25	30	1.5
55x85	2.165	3.346	2	2.000	3.150	.002	.787	.984	1.299	1.614	1423	29900	18400	7	M8x25	25	30	1.5
			2 1/8	2.125	3.346	.002	.787	.984	1.299	1.614	1755	31470	19200	8	M8x25	25	30	1.6
			2 3/16	2.1875	3.346	.002	.787	.984	1.299	1.614	1806	30570	19200	8	M8x25	25	30	1.6
60x90	2.362	3.543	2 1/4	2.250	3.543	.002	.787	.984	1.299	1.614	1895	28360	17700	8	M8x25	25	30	2.2
			2 3/8	2.375	3.543	.002	.787	.984	1.299	1.614	1990	27020	17700	8	M8x25	25	30	1.7
			2 7/16	2.4375	3.740	.002	.787	.984	1.299	1.614	2230	29860	19200	9	M8x25	25	30	1.9
65x95	2.559	3.740	2 1/2	2.500	3.740	.002	.787	.984	1.299	1.614	2290	29110	19200	9	M8x25	25	30	2.3
			2 5/8	2.5625	3.740	.002	.787	.984	1.299	1.614	2345	28440	19200	9	M8x25	25	30	1.8
			2 11/16	2.6875	4.331	.002	.945	1.181	1.575	1.969	3590	32090	19900	8	M10x30	60	50	3.9
70x110	2.756	4.331	2 3/4	2.750	4.331	.002	.945	1.181	1.575	1.969	3686	31300	19900	8	M10x30	50	60	3.0
75x115	2.953	4.528	2 7/8	2.875	4.528	.002	.945	1.181	1.575	1.969	3760	29210	18400	8	M10x30	50	60	4.0
			2 5/8	2.9375	4.528	.002	.945	1.181	1.575	1.969	3870	28440	18400	8	M10x30	50	60	3.1
80x120	3.150	4.724	3	3.000	4.724	.002	.945	1.181	1.575	1.969	4130	27020	17700	8	M10x30	50	60	3.3
			3 1/4	3.250	4.921	.003	.945	1.181	1.575	1.969	4830	29280	19200	8	M10x30	50	60	4.6
85x125	3.346	4.921	3 3/8	3.375	4.921	.003	.945	1.181	1.575	1.969	4980	28440	19200	9	M10x30	50	60	3.4
90x130	3.543	5.118	3 7/16	3.4375	5.118	.003	.945	1.181	1.575	1.969	5230	27020	18400	9	M10x30	50	60	3.6
			3 1/2	3.500	5.118	.003	.945	1.181	1.575	1.969	5160	27350	18400	9	M10x30	50	60	4.8
			3 3/4	3.750	5.315	.003	.945	1.181	1.575	1.969	6160	28440	19900	10	M10x30	50	60	3.8
100x145	3.937	5.709	3 5/8	3.9375	5.709	.003	1.024	1.260	1.732	2.205	7600	29860	20600	8	M12x30	90	105	5.8
110x155	4.331	6.102	4	4.000	5.709	.003	1.024	1.260	1.732	2.205	7720	29390	20600	8	M12x30	90	105	5.7
			4 7/16	4.4375	6.102	.003	1.024	1.260	1.732	2.205	8290	27020	18400	8	M12x30	90	105	6.2
120x165	4.724	6.496	4 3/4	4.750	6.496	.003	1.024	1.260	1.732	2.205	10250	29860	20600	9	M12x30	90	105	6.6
130x180	5.118	7.087	4 5/8	4.9375	7.087	.003	1.339	1.575	2.047	2.520	14750	27020	19900	12	M12x30	90	105	10.2
140x190	5.512	7.480	5 1/8	5.4375	7.480	.003	1.339	1.575	2.126	2.677	16400	25600	18400	9	M14x40	135	166	10.8
150x200	5.906	7.874	5 5/8	5.9375	7.874	.003	1.339	1.575	2.126	2.677	19390	27020	19900	10	M14x40	135	166	11.5
160x210	6.299	8.268				.003	1.339	1.575	2.126	2.677	22860	27020	20600	11	M14x40	135	166	12.1
170x225	6.693	8.858	6 7/16	6.4375	8.858	.003	1.732	1.969	2.520	3.071	26470	21400	16300	12	M14x40	135	166	17.1
180x235	7.087	9.252	6 5/8	6.9375	9.252	.003	1.732	1.969	2.520	3.071	28020	20600	15600	12	M14x40	135	166	18.0
190x250	7.480	9.843	7 1/16	7.4375	9.843	.003	1.732	1.969	2.520	3.071	36940	24200	18400	15	M14x40	135	166	20.9
200x260	7.874	10.236	7 5/8	7.9375	10.236	.003	1.732	1.969	2.520	3.071	38930	22750	17700	15	M14x40	135	166	21.8
220x285	8.661	11.220				.003	1.969	2.205	2.835	3.465	47560	20600	15600	12	M16x40	219	256	28.5
240x305	9.449	12.008				.003	1.969	2.205	2.835	3.405	64880	23500	18400	15	M16x40	219	256	29.5
260x325	10.236	12.795				.004	1.969	2.205	2.835	3.405	84050	25600	20600	18	M16x40	219	256	34.1
280x355	11.024	13.976				.004	2.362	2.598	3.307	4.016	97320	21300	17000	16	M18x50	290	350	50.4
300x375	11.811	14.764				.004	2.362	2.598	3.307	4.016	117200	22750	17700	18	M18x50	290	350	79.5
320x405	12.598	15.945				.004	2.913	3.189	3.976	4.764	162200	21400	17000	18	M20x50	420	500	79.5
340x425	13.386	16.732				.004	2.913	3.189	3.976	4.764	200100	24900	19200	21	M20x50	420	500	84.5
360x455	14.173	17.913				.004	3.386	3.701	4.567	5.433	227100	19900	15600	18	M22x60	560	675	101.6
380x475	14.961	18.701				.004	3.386	3.701	4.567	5.433	279400	22000	17700	21	M22x60	560	675	121
400x495	15.748	19.488				.004	3.386	3.701	4.567	5.433	294200	21300	17000	21	M22x60	560	675	134.2

Additional inch & metric sizes are available on request.

SPECIFICATIONS FOR SHRINK DISCS

HUB LAYOUT

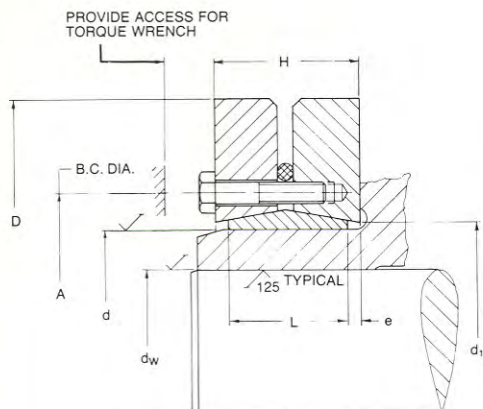


FIG. 40

SPLIT SHRINK DISC

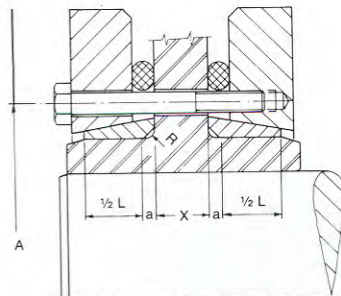


FIG. 44

HALF SHRINK DISCS

Type HT
Outer ring of Shrink Disc
has threaded holes

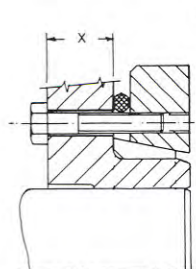


FIG. 45

Type HC
Outer ring of Shrink Disc
has clearance holes

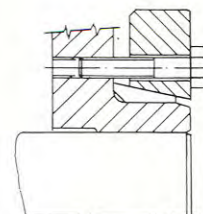


FIG. 46

POSSIBLE HUB CONFIGURATIONS FOR AXIAL POSITIONING OF SHRINK DISC

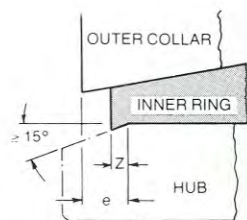


FIG. 41

A) Integrated Hub Stop

The advantages of this recommended configuration are:

1. Defined axial Shrink Disc position;
2. Shrink Disc can be located away from hub face to provide generous hub relieve radius without undercut.

To order Shrink Disc with integrated hub stop simply add suffix "A" to Shrink Disc designation.

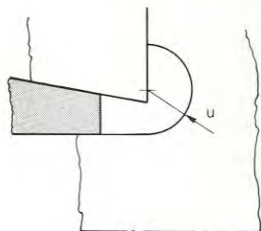


FIG. 42

B) Locating against hub face

This configuration—except in light duty applications where a common relieve radius of $r = e$ is sufficient—requires a hub undercut with $u \geq e$ for smooth hub transition.

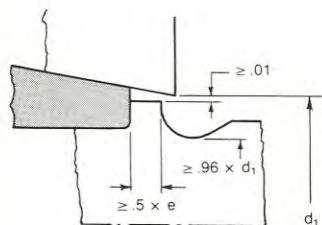


FIG. 43

C) Locating against hub step

This configuration should be considered only if integrated hub stop or undercut relieve radius is undesirable.

EXPLANATIONS

M_t = transmissible torque with all locking screws torqued to specified tightening torque " M_A ," based on a coefficient of friction $\mu = 0.15$ and specified tolerances and clearances.

Torque capacities for connections using shaft diameters between minimum and maximum sizes listed, can be obtained by interpolation.

Since normally inner ring of Shrink Disc and hub are not split, transmissible torques decrease if:

1. Tolerances and clearances are larger than specified.
2. Hollow shafts with bores exceeding 35% of shaft dia. are used.

Simultaneous transmission of torque and thrust requires calculating a resultant torque

$$M_{t_{res}} = \sqrt{T^2 + \left(F \times \frac{d}{2}\right)^2} \quad \text{With } \begin{array}{l} T = \text{peak drive torque (ft lbs)} \\ F = \text{peak axial thrust load (lbs)} \\ d = \text{shaft dia. (ft)} \end{array}$$

The resultant torque should not exceed rated torque capacity " M_t "

$$F_{ax} = \text{transmissible axial thrust} = \frac{M_t \times 24}{d_w} \quad d_w = \text{shaft dia. (inches)}$$

d_w = shaft diameter. Any dia. between listed minimum and maximum size may be selected.

d = nominal Shrink Disc I.D. and hub O.D. determined to provide adequate polar section modulus for transmission of rated torque capacities.

T_H = machining tolerance for hub O.D. (d)

T_w = maximum permissible diametrical clearance between shaft and hub bore (d_w)

H, e = these dimensions represent theoretical values for a Shrink Disc in a relaxed condition and can be larger by approx. 5%.

Shaft and Hub Material

Listed specifications are based on steel with a modulus of elasticity of approx. 30×10^6 psi and a yield point of at least 45000 psi.

Cast iron hubs are well suited for compressive stresses exerted by Shrink Discs. However, lower torsional hub strength generally requires selection of a Shrink Disc at least one size larger than listed if full rated torque—applicable to a steel hub—is to be transmitted.

Ordering information

Simply specify size and series of Shrink Disc selected, add suffix "A" if integrated hub stop or add suffix "Split" and web thickness "X" if a split Shrink Disc or Half Shrink Disc is required.

DIMENSIONS [INCHES] & SPECIFICATIONS FOR SHRINK DISCS

	size & SERIES	d	T _H	min.		T _W	Mt [ft-lb] for		LOCKING SCREWS		D	L	H	e	d _i	Z	a	R	Weight (lb)	
				d _w	d _w		d _w	d _w	Qty	Size										A
MEDIUM DUTY SERIES 10	24-10	.945	↑	.750	.813	.001	296	402	6	M5	1.417	1.97	.551	.71	.078	1.023	.039	.098	1/16	.5
	30-10	1.181	↑	.875	1.000	.0013	331	561	7	M5	1.732	2.36	.629	.79	.078	1.259	.039	.098	1/16	.7
	36-10	1.417	↑	1.063	1.250	↑	516	885	5	M6	2.047	2.83	.700	.87	.078	1.496	.039	.098	1/16	.9
	44-10	1.732	↑	1.313	1.438	.0016	992	1412	7	M6	2.402	3.15	.787	.94	.078	1.850	.039	.098	1/16	1.4
	50-10	1.969	+0	1.500	1.688	↓	1320	1870	8	M6	2.756	3.54	.866	1.02	.078	2.086	.039	.098	1/16	1.8
	55-10	2.165	-.002	1.625	1.875	↓	1370	2110	8	M6	2.953	3.94	.905	1.14	.118	2.283	.039	.098	3/32	2.4
	62-10	2.441	↑	1.875	2.000	↑	2090	2530	10	M6	3.386	4.33	.905	.14	.118	2.598	.039	.098	3/32	2.9
	68-10	2.677	↑	1.938	2.375	↑	1910	3510	10	M6	3.386	4.53	.905	1.14	.118	2.834	.039	.098	3/32	3.0
	75-10	2.953	↑	2.125	2.500	↑	2810	4450	7	M8	3.937	5.43	.984	1.22	.118	3.110	.039	.197	1/8	3.8
	80-10	3.150	↑	2.313	2.750	.0019	3180	5170	7	M8	3.937	5.71	.984	1.22	.118	3.307	.039	.197	1/8	4.2
	90-10	3.543	↑	2.563	2.938	↑	5110	7380	10	M8	4.488	6.10	1.181	1.49	.157	3.700	.039	.197	1/8	7.3
	100-10	3.937	↑	2.750	3.125	↑	6280	8840	12	M8	4.882	6.69	1.338	1.69	.177	4.094	.039	.197	1/8	10.4
	110-10	4.331	↑	2.938	3.500	↑	7695	12210	9	M10	5.354	7.28	1.535	1.93	.197	4.488	.078	.197	1/8	13.0
	125-10	4.921	↑	3.375	3.938	↑	11590	17700	12	M10	6.299	8.46	1.653	2.04	.197	5.275	.078	.197	1/8	18.3
	140-10	5.512	+0	3.750	4.250	↑	15890	22200	10	M12	6.890	9.06	1.811	2.28	.236	5.708	.078	.197	3/16	22.5
	155-10	6.102	-.004	4.125	4.750	.0027	21270	30680	12	M12	7.559	10.35	1.968	2.44	.236	6.496	.078	.197	3/16	31
	165-10	6.496	↑	4.500	5.000	.0027	31080	40520	8	M16	8.268	11.42	2.204	2.67	.236	6.889	.078	.197	3/16	49
	175-10	6.890	↑	4.938	5.313	↑	34760	42120	8	M16	8.661	11.81	2.204	2.67	.236	7.283	.078	.197	3/16	50
	185-10	7.283	↑	5.313	5.688	↑	48010	57400	10	M16	9.291	12.99	2.795	3.34	.236	7.677	.078	.197	3/16	82
	195-10	7.677	↑	5.500	6.063	.0032	59100	76490	12	M16	9.685	13.78	2.795	3.34	.236	8.110	.078	.197	3/16	91
	200-10	7.874	↓	5.875	6.313	↓	68060	81450	12	M16	9.685	13.78	2.795	3.34	.236	8.110	.078	.197	3/16	90
	220-10	8.661	-.002	6.250	6.688	↓	79250	92650	15	M16	10.630	14.57	3.464	4.06	.315	8.897	.157	.295	1/4	119
	240-10	9.449	-.004	6.625	7.500	↓	105850	139530	12	M20	11.614	15.95	3.622	4.22	.315	9.763	.157	.295	1/4	148
	260-10	10.236	↑	7.438	8.313	↑	137950	198150	14	M20	12.638	16.93	4.055	4.69	.315	10.551	.157	.295	1/4	181
	280-10	11.024	↑	8.250	9.063	↑	189580	235900	16	M20	13.622	18.11	4.488	5.20	.354	11.338	.157	.394	5/16	225
	300-10	11.811	-.002	9.000	9.688	.0036	266440	306140	18	M20	14.331	19.10	4.803	5.52	.354	12.125	.157	.394	5/16	260
	320-10	12.598	-.005	9.500	10.250	↑	272020	326110	20	M20	15.197	20.48	4.803	5.52	.354	12.913	.157	.394	5/16	288
	340-10	13.386	↑	9.813	10.625	↓	329090	394530	24	M20	16.063	22.44	5.276	6.14	.394	13.700	.157	.394	5/16	409
	350-10	13.780	↑	10.625	11.250	↑	359710	409510	24	M20	17.008	22.84	5.511	6.30	.394	14.488	.157	.394	5/16	429
	360-10	14.173	↑	11.000	11.625	.004	396840	449500	24	M20	17.008	23.23	5.511	6.30	.394	14.488	.157	.394	5/16	449
	380-10	14.961	↑	11.375	12.250	↓	490980	575850	20	M24	18.031	25.40	5.669	6.46	.394	15.276	.157	.394	5/16	526
	390-10	15.354	↓	11.875	12.625	↓	526240	607250	21	M24	18.425	25.99	5.669	6.46	.394	15.629	.157	.492	3/8	572
	420-10	16.535	↑	12.688	13.750	↑	681340	796290	24	M24	19.843	27.17	6.456	7.25	.394	16.929	.236	.492	3/8	630
	440-10	17.323	↑	13.375	14.188	.0045	700340	800230	24	M24	20.748	29.53	6.771	7.56	.394	17.716	.236	.492	3/8	835
	460-10	18.110	-.003	14.125	14.938	↓	755120	856680	24	M24	21.535	30.32	6.771	7.56	.394	18.425	.236	.492	3/8	924
	480-10	18.898	-.006	14.938	15.750	↓	1024550	1152110	30	M24	22.441	31.50	7.401	8.39	.492	19.291	.236	.591	1/2	1110
	500-10	19.685	↓	15.750	16.563	.005	1151610	1288210	24	M27	23.228	33.57	7.401	8.39	.492	19.999	.236	.591	1/2	1265
LIGHT DUTY SERIES 20	125-20	4.921	↑	3.683	4.188	.0027	9040	13340	8	M10	6.220	7.48	1.535	2.05	.236	5.078	.078	.197	1/8	13
	140-20	5.512	+0	4.250	4.939	.0027	14640	22130	10	M10	6.889	8.67	1.535	2.05	.236	5.669	.078	.197	1/8	18
	155-20	6.102	-.004	5.000	5.500	↑	23040	29900	12	M10	7.559	9.65	1.535	2.05	.236	6.259	.078	.197	1/8	22
	165-20	6.496	↑	5.313	5.750	↑	28820	36950	10	M12	8.267	10.24	1.811	2.44	.314	6.653	.078	.197	3/16	31
	175-20	6.890	↑	5.688	6.125	.0032	32460	39650	10	M12	8.661	10.83	1.811	2.44	.314	7.047	.078	.197	3/16	35
	185-20	7.283	↑	6.063	6.500	↑	43040	51480	12	M12	8.858	11.62	1.811	2.44	.314	7.440	.078	.197	3/16	44
	195-20	7.677	↑	6.438	6.938	↑	57950	70130	15	M12	9.330	12.40	2.204	2.84	.314	7.834	.078	.197	3/16	60
	220-20	8.661	+0	7.000	7.875	↑	74130	100660	10	M16	10.433	13.59	2.598	3.31	.354	8.818	.157	.197	3/16	77
	240-20	9.449	-.004	7.813	8.500	↑	104990	129520	12	M16	11.417	14.57	2.598	3.31	.354	9.606	.157	.295	1/4	97
	260-20	10.236	↑	8.625	9.250	.0036	118310	141270	12	M16	12.204	15.55	2.834	3.63	.354	10.433	.157	.295	1/4	106
	280-20	11.024	↑	9.063	9.875	↑	148040	181450	16	M16	13.110	16.74	3.307	4.10	.393	11.220	.157	.295	1/4	132
	300-20	11.811	↑	9.813	10.625	↑	186340	224650	18	M16	14.094	18.11	3.307	4.10	.393	12.007	.157	.295	1/4	165
	320-20	12.598	-.002	10.563	11.438	↑	204560	244690	18	M16	14.881	19.49	3.307	4.18	.433	12.795	.157	.295	1/4	185
	340-20	13.386	-.005	11.375	12.063	.004	252430	286570	20	M16	15.826	21.07	3.307	4.18	.433	13.582	.157	.295	1/4	220
	360-20	14.173	↑	11.813	12.625	↑	318810	371380	16	M20	16.653	21.85	3.937	4.81	.433	14.370	.157	.394	5/16	275
	390-20	15.354	↓	12.688	13.750	↑	433130	507410	20	M20	17.795	23.43	4.409	5.36	.472	15.629	.157	.394	5/16	344
	420-20	16.535	-.003	13.750	14.625	.0045	457280	524340	20	M20	19.094	24.81	4.724	5.67	.472	16.810	.236	.394	5/16	407
	460-20	18.110	-.006	14.688	16.375	↓	606750	722510	24	M20	20.747	26.97	5.196	6.22	.511	18.425	.236	.492	3/8	517
	500-20	19.685	↓	16.438	17.375															

QD BUSHING INSTALLATION INSTRUCTIONS

Important: Follow all instructions carefully. This is necessary to insure satisfactory performance of both pulley and bushings. For units that have had the shaft installed at the factory, retighten the capscrews with a torque wrench set at the proper value, as stated in Table 1 and explained in Step 7.

Installation:

Diagram 1

1. Before installing the bushing, polish the following components:
 - a. Surface of shaft.
 - b. Bore of the bushing.
 - c. Tapered inside diameter of the QD hub.
 - d. Tapered outside diameter of the QD bushing.

Remove all burrs and foreign material, any particles left on the mating surfaces may cause improper installation.

NOTE: Do Not Lubricate Mating Surfaces

2. If the pulley is to be keyed to the shaft, make sure both the bushing keyway and the shaft keyseats are clean, smooth and free from burrs. Check for proper key size in both bushings and shaft keyways. Keys should be placed into shaft keyseats at this time. Pulley bushings require that both shaft keyseats be in line with each other for proper bushing to hub installation.
3. Place shaft into pulley and locate in the desired position. Be careful not to damage the bore of the hubs or the surface of the shaft.
4. Carefully inset a wedge in the bushing split and tap lightly to expand the bushing. (Use caution as excessive expansion will cause the bushins to split.) Slide the bushing onto the shaft and into the hubs. Align the unthreaded holes in the bushing with the threaded holes in the hub.
5. Place capscrews with locking washers into the unthreaded holes of each bushing, and hand tighten capscrews into the threaded holes of the hubs.
6. Remove the wedge from the bushing split.

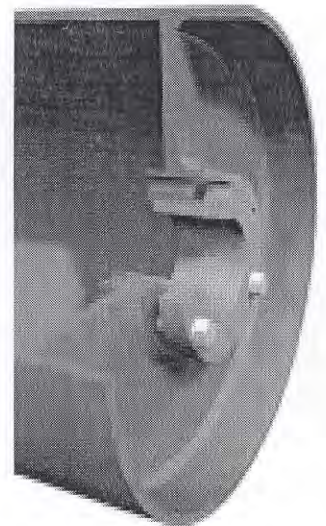
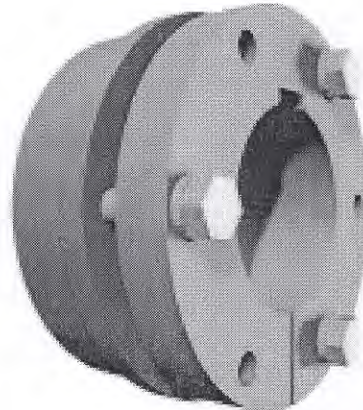
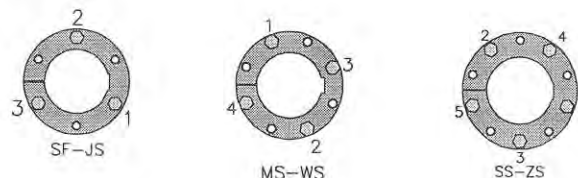


Table 1
Recommended QD Capscrew Torque

HUB	NUMBER AND SIZE OF CAP SCREWS				WRENCH TORQUE (IN. LBS.)
JA	3 (10	-	24 NC	x 1)	72
SH	3 (1/4	-	20 NC	x 1 3/8)	108
SD	3 (1/4	-	20 NC	x 1 7/8)	108
SDS	3 (1/4	-	20 NC	x 1 3/8)	108
SK	3 (5/16	-	18 NC	x 2)	180
SF	3 (3/8	-	16 NC	x 2)	360
E	3 (1/2	-	13 NC	x 2 3/4)	720
F	3 (9/16	-	12 NC	x 3 5/8)	900
JS	3 (5/8	-	11 NC	x 2 1/2)	1,620
MS	4 (3/4	-	10 NC	x 3)	2,700
NS	4 (7/8	-	9 NC	x 3 1/2)	3,600
PS	4 (1	-	8 NC	x 4 1/2)	5,400
WS	4 (1 1/8	-	7 NC	x 5)	7,200
ZS	5 (1 1/2	-	7 NC	x 5)	7,200
SS	5 (1 1/4	-	7 NC	x 5)	9,000

Diagram 2



Maintenance:

Inspect the bushings and check the torque setting before startup and once a week for the first month of operation. Thereafere, repeat at periodic maintenance intervals.

Removal:

1. Clean the exposed shaft ends.
2. Remove all capscrews.
3. Insert the capscrews into all threaded jacking screw holes in the bushing flange.
4. Turn the capscrews against the flange of the hub alternately and evenly in one bushing. A few turns on each screw and the bushing will break loose, releasing the grip of the bushing on the shaft. Do not apply excessive torque on jacking holes adjacent to the bushing split. If bushing does not break loose immediately, tap the hub with a soft hammer.
5. Remove bushing from the shaft. If necessary, carefully insert a wedge in the bushing split to expand the bushing bore.
6. Repeat Steps 1 thru 5 for the remaining bushing.
7. Using an accurate torque wrench, tighten each capscrew per numbered sequence given in Diagram 2 alternatively and evenly in on bushing only; applying no more pressure than recommended in Table 1. Using a hammer, as specified in Table 1, and a heavy steel or bronze bar, drift on the face of the bushing, starting opposite the split. Avoid drifting outside of the bolt circle to prevent damage to the bushing. Continue drifting in clockwise and counterclockwise directions from the point opposite the split around the bushings until you reach the specified torque on all capscrews. For JS or larger bushings, repeat this procedure until the specified torque no longer turns the capscrews after drifting.
8. Tighen the second bushing per Step 7. When two bushings are used, complete tightening of one bushing before proceeding to tighten the second bushing.
9. Do not overtighten the capscrews. The bushing should not pull tight (bottom out) against the hub. Clearance must be maintained. The gap between hub and bushings should be uniform at all locations; surfaces on both sides of the bushing split should be even. Check for undersized shafting, if the bushing flange contacts the face of the hub.

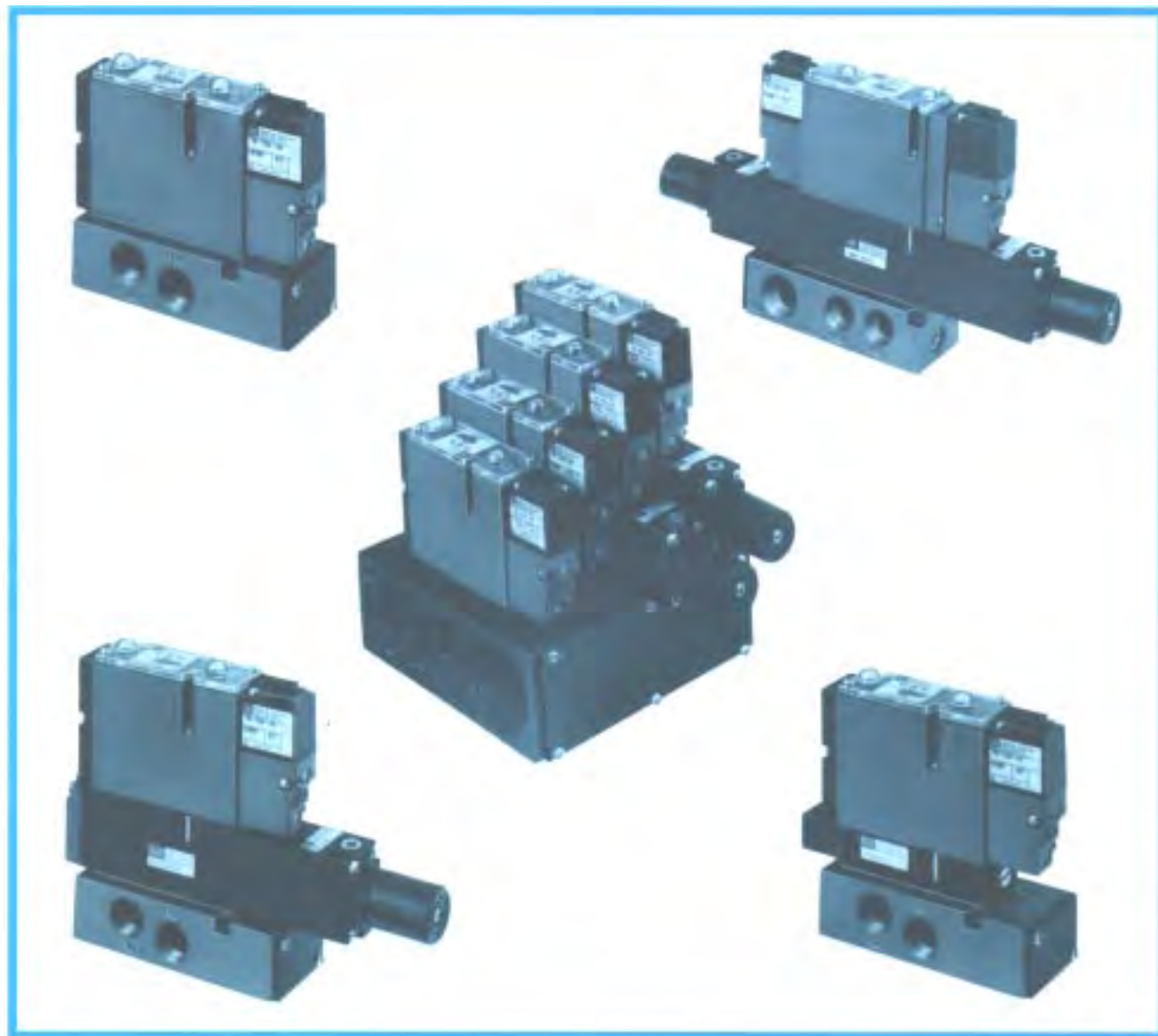
MAC[®] 92 SERIES

**4-WAY SOLENOID PILOT OPERATED
(4-WAY PILOT) PLUG-IN SUB-BASE
AND CIRCUIT BAR™ MANIFOLD MOUNT**
1/8", 1/4" and 3/8"

Cv UP TO 1.0

Pressure Range vacuum to 120 PSI

Patents and Patents Pending



VALVE CONFIGURATIONS AVAILABLE

- 2-position, single or double solenoid.
- 3-position, double solenoid, open center, closed center, and pressure center.
- Extended or recessed manual operators.
- Single pressure and dual pressure.
- Individual base or add-a unit circuit bar™ manifold.
- Plug-in, sandwich, single and dual pressure regulators for both individual and manifold valves.
- Plug-in, sandwich, meter-out exhaust flow controls for both individual and manifold valves.
- Internal pilot supply for applications of 20 PSI to 120 PSI.
- External pilot supply for main valve pressures of vacuum to 20 PSI.
- 4-way pilot valve is fed by an internal or external pilot supply.
- Manifolds – common inlet and dual common exhaust.

MAC LARGE 4 WAYS

Patents and Patents Pending

OPERATING SPECIFICATIONS

FLUIDS: Air or inert gases

LUBRICATION: Not required, but if used, a medium aniline point (180° F to 210° F) oil is recommended.

SAFE OPERATING AMBIENT TEMPERATURE RANGE: 0° F - 120° F (-18° C to 50° C)

For UL & CSA purposes 104° F (40° C) max.

PRESSURE RANGE (PSI)

(pressures shown are maximum and minimum safe working pressures)

MAIN VALVE	SOLENOID PILOT OPERATED SINGLE	DOUBLE	REMOTE AIR PILOT SIGNAL SINGLE	DOUBLE
VACUUM – 150 82, 6000, 1300 & ISO SERIES	25 – 150	10 – 150	25 – 150	10 – 150
VACUUM – 120 (92 SERIES)	20 – 120	20 – 120	N/A	N/A

1. Minimum pilot pressure for 3 position valves is 25 PSI except for the 92 series which is 35 PSI. Minimum pilot pressure for memory spring (92 series) is 30 PSI.
2. Remote air signal pressure must be at least equal to main valve pressure.
3. External pilot pressure for air/spring must be equal to or less than remote pilot signal pressure.

ELECTRICAL	92 SERIES	82 SERIES	6000, 1300 and ISO SERIES
120/60 INRUSH	7.6 VOLT-AMPS .063 AMPS	10.9 VOLT-AMPS 0.09 AMPS	14.8 VOLT-AMPS 0.12 AMPS
120/60 HOLDING	4.8 VOLT-AMPS .04 AMPS	7.7 VOLT-AMPS 0.06 AMPS	10.9 VOLT-AMPS 0.09 AMPS
24 VOLT D.C.	12.7 to 1.0 W	12.7 to 1.8 W	17.1 to 1.0 W

ABOVE COILS: General purpose Class A continuous duty, encapsulated. Class F coils available on request.

COIL LEADS: #18 AWG X 18" (6000, 1300, ISO).

#22 AWG X 18" (82, 92)

Other lead lengths available on request.

D4

FLOW: Cv (average all ports: individual base & manifold)

	92	82	6200	6300	6500	6600	1300	ISO 1	ISO 2	ISO 3
2 POSITION	1/8" — 1.0 — 0.9									
	1/4" — 1.1 — 1.30		1.5	2.0				1.6		
	3/8" — 1.2 — 1.35		1.6	2.6	4.5			1.6	3.0	
	1/2" —			3.0	5.0				3.0	6.3
	3/4" —				5.1	9.0	11.5			6.3
	1" —					9.6	13.7			
	1 1/4" —						15.4			
	1 1/2" —						15.9			
3 POSITION	1/8" — 0.8 — 0.9									
	1/4" — 0.8 — 1.0		1.1	1.7				1.4		
	3/8" — 1.0 — 1.0		1.2	2.1	2.8			1.4	2.7	
	1/2" —			2.4	2.9				2.7	5.8
	3/4" —				3.0	7.0	10.8			5.8
	1" —					7.2	12.8			
	1 1/4" —						14.3			
	1 1/2" —						14.3			

SPECIAL APPLICATION INSTRUCTIONS

On all valves except ISO, energizing the "A" operator (solenoid or remote air) supplies pressure to Cylinder Port "A" and energizing the "B" operator supplies pressure to Cylinder Port "B". On ISO valves energizing the "14" operator connects the inlet port #1 to cylinder port #4 and energizing the "12" operator connects the inlet port #1 to cylinder port #2.

For the following applications, additional piping considerations are required.

EXTERNAL PILOT APPLICATIONS (82, 6000, 1300, ISO) — An External Pilot Supply is only required when the main valve is less than 25 psi on single operators (solenoid or remote air) or 3 position valves and 10 psi on 2 position double operated valves. Pipe the External Pilot supply to the External Pilot Port supplied in the valve base or manifold.

EXTERNAL PILOT APPLICATIONS (92 SERIES) — Required for all solenoid pilot operated models when main valve pressures are below 20 psi on single solenoid or double solenoid 2-position models. For memory spring, external pilot is required when main valve pressures are below 30 psi. For 3-position external pilot is required when main valve pressures are below 35 psi.

VACUUM APPLICATIONS — (2-Pos. Valves Only) — Use an External Pilot model as described above and also connect the vacuum source to the Exhaust Port and leave the Inlet Port open to atmosphere. (The inlet port may also be connected to a pressure source to provide a selector application (vacuum/pressure).

SELECTOR APPLICATIONS — Use an External Pilot model as described above if both pressures are below the minimum, otherwise use an Internal Pilot model and connect the higher pressure to the Inlet Port and the lower pressure to the Exhaust Port.

SELECTOR MANIFOLDS — Pressure selector manifolds with sandwich type regulators are available for 82, 6300 and 6500 Series. Either of two pressures from this manifold is supplied to connecting manifolds. See schematic in each series section. For the 92 series a special circuit bar* is required—consult factory.

Consult "Precautions" on inside back cover before use, installation or service of MAC Valves

MAC[®] 92 SERIES

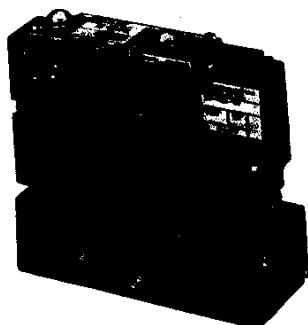
Patents and Patents Pending

**4-WAY SOLENOID PILOT OPERATED (4-WAY PILOT),
PLUG-IN SUB-BASE MOUNTED**
1/8", 1/4" and 3/8", C_v UP TO 1.2
Pressure Range vacuum to 120 PSI

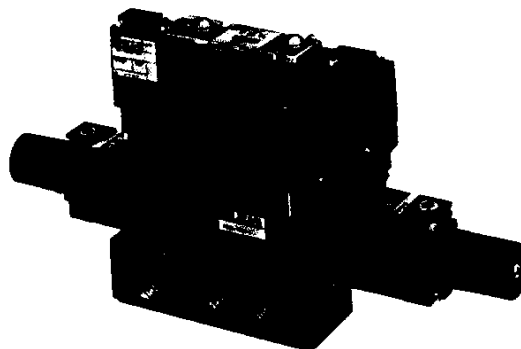
92 SERIES - SOLENOID PILOT OPERATED VALVES

SINGLE SOLENOID 2-POSITION	DOUBLE SOLENOID 2-POSITION	SINGLE PRESSURE INTERNAL PILOT NPTF PORTS	DBL. SOL. 3-POS. CLOSED CENTER	DBL. SOL. 3-POS. OPEN CENTER	DBL. SOL. 3-POS. PRESSURE CENTER
92B-AAF-000-DM-DDAP-1DM	92B-BAF-000-DM-DDAP-1DM	Valve Only	92B-EAF-000-DM-DDAP-1DM	92B-FAF-000-DM-DDAP-1DM	92B-GAF-000-DM-DDAP-1DM
92B-AAF-AAA-DM-DDAP-1DM	92B-BAF-AAA-DM-DDAP-1DM	1/8" Base	92B-EAF-AAA-DM-DDAP-1DM	92B-FAF-AAA-DM-DDAP-1DM	92B-GAF-AAA-DM-DDAP-1DM
92B-AAF-BAA-DM-DDAP-1DM	92B-BAF-BAA-DM-DDAP-1DM	1/4" Base	92B-EAF-BAA-DM-DDAP-1DM	92B-FAF-BAA-DM-DDAP-1DM	92B-GAF-BAA-DM-DDAP-1DM
92B-AAF-CAA-DM-DDAP-1DM	92B-BAF-CAA-DM-DDAP-1DM	3/8" Base	92B-EAF-CAA-DM-DDAP-1DM	92B-FAF-CAA-DM-DDAP-1DM	92B-GAF-CAA-DM-DDAP-1DM
92B-AAF-BKA-DM-DDAP-1DM	92B-BAF-BKA-DM-DDAP-1DM	1/4" Manifold	92B-EAF-BKA-DM-DDAP-1DM	92B-FAF-BKA-DM-DDAP-1DM	92B-GAF-BKA-DM-DDAP-1DM
92B-AAF-CKA-DM-DDAP-1DM	92B-BAF-CKA-DM-DDAP-1DM	3/8" Manifold	92B-EAF-CKA-DM-DDAP-1DM	92B-FAF-CKA-DM-DDAP-1DM	92B-GAF-CKA-DM-DDAP-1DM

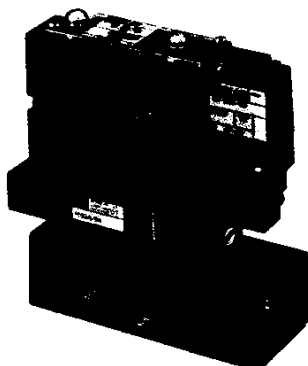
- Valve codes shown are for 24 VDC (5.4w), with suppression diode and light located in body of valve.
- Codes also indicate a non-locking recessed manual operator with a muffled pilot.
- Valve codes shown are for single pressure internal pilot with NPTF ports.



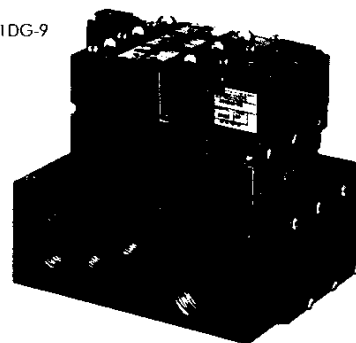
92B-AAF-CAA-DM-DDAP-1DM



92B-EAF-CAA-DM-DDAP-1DM-9
PR92B-KEAA-9



92B-AAF-CAA-DM-DDAP-1DM-9
FC92B-AA-9



2 X 92B-AAF-CAA-DM-DDAP-1DM
1 X 92B-BAB-CAA-DM-DDAP-1DM
1 X M-92004-01

D5

HOW TO ORDER 92 SERIES FLOW CONTROL MODULE*

FC 92B-AA	PLUG-IN FLOW CONTROL ASSY. SGL. SOL.
FC 92B-BA	PLUG-IN FLOW CONTROL ASSY. DBL. SOL.
FC 92B-CA	NON PLUG-IN FLOW CONTROL ASSY.

Note: If a flow control assembly is used with the dual pressure regulator option, only the flow control on the "B" end is functional. (Controls both cylinder ports.)

* If flow control module is to be installed between valve and base or valve and manifold at the factory, add -9 after the flow control model number, i.e., FC92B-AA-9. The flow control model numbers should follow the valve model number on which is to be installed.

Consult "Precautions" on inside back cover before use, installation or service of MAC Valves.

FOR CIRCUIT BAR® VERSION
OF THIS SERIES, SEE SECTION E.

MAC 92 SERIES

HOW TO ORDER

Patents and Patents Pending

92B - X X X - X X X - X X - D X X X - X X X

Valve Function	Body Type & Exhaust Options	Body Electrical Options	Port Size & Thread Type	Indiv. Base & Manifold Configurations	Int/Ext Pilot
O - Base only A - Sgl. oper. sgl.-press. B - Dbl. oper. sgl.-press. C - Sgl. oper. dual press. D - Dbl. oper. dual press. E - 3 pos. closed center F - 3 pos. open center G - 3 pos. sgl.-press. press. center - Spools With Memory Spring - L - Sgl. oper. sgl.-press. M - Dbl. oper. sgl.-press. N - Sgl. oper. dual press. P - Dbl. oper. dual press.	O - Base only A - Plug-in st'd exh. * B - Non plug-in w/st'd exh. † C - Plug-in w/pilot exh. to main exh. †*D - Non plug-in w/pilot exh. to main exh. * Use with body electrical option "A" only † Must use "DU" pilot body. Main valve exhaust cannot be restricted. Available on single pressure valve only.	O - Base only A - No light in top B - W/light F - W/supp. blocking diode & light H - W/M.O.V. & light K - W/A.C. rectification & light	O - Valve only A - 1/8 NPTF B - 1/4 NPTF C - 3/8 NPTF D - 1/8 BSPPL E - 1/4 BSPPL F - 3/8 BSPPL G - 1/8 BSPTR H - 1/4 BSPTR J - 3/8 BSPTR	O - Valve only - Individual Base - A - Side ports B - Bottom ports (1/8" only) C - Side & Bottom ports (1/8") D - Side IN & EXH Bottom Cylinders (1/8" only) - Manifold Base - J - Side cyl. ports K - Bottom cyl. ports only (no side cyls.) - Non Plug-In - G - Internal pilot H - External pilot	O - Valve only - Plug-In Internal Pilot Models - A - No light in base B - W/sgl. light in base C - W/dbl. light in base - Plug-In External Pilot Models - D - No light in base E - W/sgl. light in base F - W/dbl. light in base - Non Plug-In - G - Internal pilot H - External pilot

Note: Manifold bases available in 1/4" & 3/8". Must be internal pilot models.

If lights are in top body cover, use option "A" or "D"

PILOT VALVE OPTIONS: X X - D X X X - X X X

Pilot Style	Voltage	Lead Wire Length	Manual Operator	Electrical Connection
DM-- Muffled Exhaust DP -- Piped Exhaust DU -- Universal Pilot, Pilot exhaust out main exhaust. * Mod. clsf. only. Note: For solenoids 30 volts or above, a ground wire is required	JA - 120/60, 110/50 (2.9 w) JB - 240/60, 220/50 (2.9 w) JC - 24/60, 24/50 (3.7 w) JD - 100/50/60, 110/60 (3.9 w) JE - 220/60 (3.4 w) JF - 240/50 (2.8 w) JG - 200/60, 200/50 (3.9 w) DA - 24 VDC (5.4 w) DB - 12 VDC (5.4 w) DC - 12 VDC (7.5 w) DD - 24 VDC (7.3 w) *DE - 12 VDC (12.7 w) *DF - 24 VDC (12.7 w) FA - 12 VDC (18 w) FB - 24 VDC (18 w) FE - 12 VDC (2.4 w) FF - 24 VDC (2.4 w)	- Plug-In Valve/Base - P - Plug-in 1 - 18" 2 - 24" 3 - 36" 4 - 48" 5 - 72" 6 - 96" - Non Plug-In Valve Base - * O - No wires A - 18" B - 24" C - 36" D - 48" E - 72" F - 96" **J - 6" * Used only w/BM, BN, BP, BG, BH & BJ electrical connection **Lead wire length for external plug-in connectors must be "J".	0 - No operator 1 - Recessed non-locking oper 2 - Recessed locking oper. 3 - Extended non-locking oper 4 - Extended locking oper	- Non plug-In Valve/Base - BA - Grommet BK - Grommet w/diode BL - Grommet w/M.O.V. BM - Flying leads BN - Flying leads w/diode BP - Flying leads w/M.O.V. BG - Flying leads w/ground BH - Flying leads w/diode & ground BJ - Flying leads w/M.O.V. & ground CA - Conduit 1/2" NPS CM - Metal conduit 1/2" NPS CN - Metal conduit w/grd. 1/2" NPS - Plug-In Valve/Base - DM - Plug-in DN - Plug-in w/diode DP - Plug-in w/M.O.V. DG - Plug-in w/ground DH - Plug-in w/diode & ground DJ - Plug-in w/M.O.V. & ground - External Plug-In Valve - JB - Rect. plug-in JD - Rect. plug-in w/light JM - Rect. male only KA - Mini plug-in *KB - Mini plug-in w/diode *KC - Mini plug-in w/M.O.V. *KD - Mini plug-in w/light *KE - Mini plug-in w/light & diode *KF - Mini plug-in w/light & M.O.V. KG - Mini plug-in w/led & diode KJ - Mini plug-in male only KK - Mini plug-in male only w/diode KL - Mini plug-in male only w/M.O.V. * M.O.V., diode & light are in female connector in these options.

D6

MANIFOLD ACCESSORIES

MANIFOLD END PLATE KITS - For each gang, one kit is required.

ISOLATORS - Sections of a gang may be isolated permitting different pressures to be fed to either end of the gang.

TO ORDER - Select the appropriate part number from the table.

PART NO.	DESCRIPTION
M-92004-01	(NPTF) Manifold End Plate Kit - Internal Pilot
M-92004-01P	(BSPPL) Manifold End Plate Kit - Internal Pilot
M-92004-02	(NPTF) Manifold End Plate Kit - External Pilot
M-92004-02P	(BSPPL) Manifold End Plate Kit - External Pilot
28413	Inlet and Exhaust Isolator Disc
M-92002	Blank Station Cover Plate
M-92002-01	Blank Station Cover Plate Single Pressure Inlet to "B" Port
M-92002-02	Blank Station Cover Plate Dual Pressure Inlet to "A" and "B" Ports

Consult "Precautions" on inside back cover before use, installation or service of MAC Valves.

MAC[®] 92 SERIES

HOW TO ORDER

SANDWICH REGULATORS

PR92B - X X X X - X

ADJUSTMENT METHOD	CONFIGURATION	GAGES	PRESSURE RANGE	ASSEMBLED
- Manual Adjust W/Screw Driver Slot - A - Plug-in sgl. solenoid B - Plug-in dbl. solenoid C - Non plug-in D - Regulator only - Air Pilot Adjust - E - Plug-in sgl. solenoid F - Plug-in dbl. solenoid G - Non plug-in H - Regulator only - Manual Adjust W/Knob - J - Plug-in sgl. solenoid K - Plug-in dbl. solenoid L - Non plug-in M - Regulator only - Manual Adjust W/Scr. Driver Slot W/Lock Nut - N - Plug-in sgl. solenoid P - Plug-in dbl. solenoid R - Non plug-in S - Regulator only	O - Regulator only A - Regulator "A" end single pressure B - Regulator "B" end single pressure C - Regulator "A" end with by-pass end plate "B" end D - Regulator "B" end with by-pass end plate "A" end E - Regulators both ends P - Select to "A" port regulator A end by-pass B end R - Select to "B" port regulator B end by-pass A end S - Select to "A" port regulators both ends A end low pressure B end high pressure T - Select to "B" port regulators both ends A end high pressure B end low pressure	A - Gage port only (plugged) B - Gage w/face perpendicular to manual operator C - Gage w/face parallel to manual operator	A - 0 to 120 PSI B - 0 to 80 PSI C - 0 to 30 PSI D - 0 to 120 PSI on "A" end 0 to 80 PSI on "B" end E - 0 to 120 PSI on "B" end 0 to 80 PSI on "A" end F - 0 to 120 PSI on "A" end 0 to 30 PSI on "B" end G - 0 to 120 PSI on "B" end 0 to 30 PSI on "A" end H - 0 to 80 PSI on "A" end 0 to 30 PSI on "B" end J - 0 to 80 PSI on "B" end 0 to 30 PSI on "A" end	9 - Regulator block is assembled to valve

Notes:

- ① N-92006-01 Gage kit, option "A" above 0-120 PSI
N-92006-02 Gage kit, option "B" above 0-80 PSI
N-92006-03 Gage kit, option "C" above 0-30 PSI
- ② Must be used with dual pressure valves.
- ③ Must be used with single pressure valves.

REPLACEMENT PARTS:

R-92003 Regulator end plate kit.
R-92003-01 Regulator by-pass end plate kit.

ORDERING EXAMPLE: PR92A-JEAA Plug-in single solenoid with knob adjustment, regulators on both ends, plugged gage port and pressure range 0-120 PSI

CONFIGURATION EXAMPLES

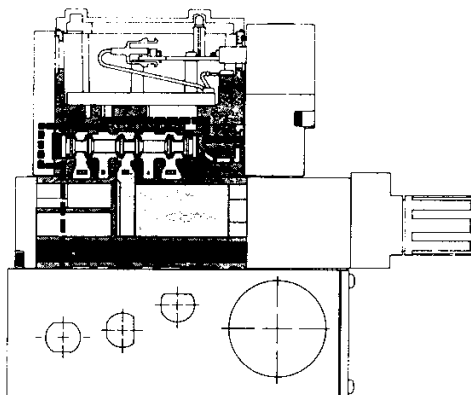
SINGLE REGULATOR - SINGLE PRESSURE

Pressure supplied to the individual or manifold base passes through the regulator. Regulated pressure is supplied to the pressure path of the valve.

DUAL REGULATOR - DUAL PRESSURE

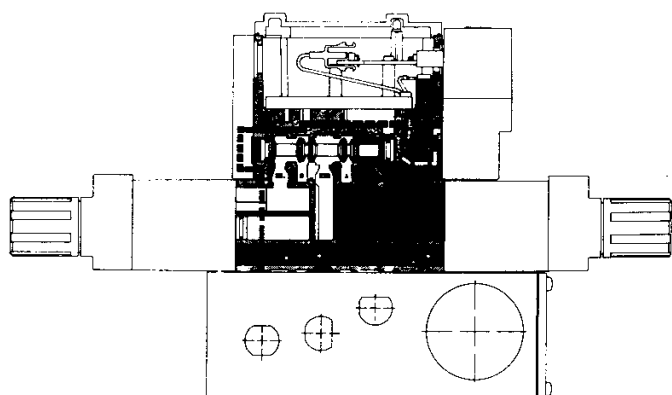
Pressure supplied from each regulator is divided in the block. Regulated pressure from "A" regulator supplies cylinder port "A". Regulated pressure from "B" regulator supplies cylinder port "B". Dual pressure regulators require dual pressure spool in valve.

D7



MANIFOLD W/REGULATOR
SINGLE PRESSURE

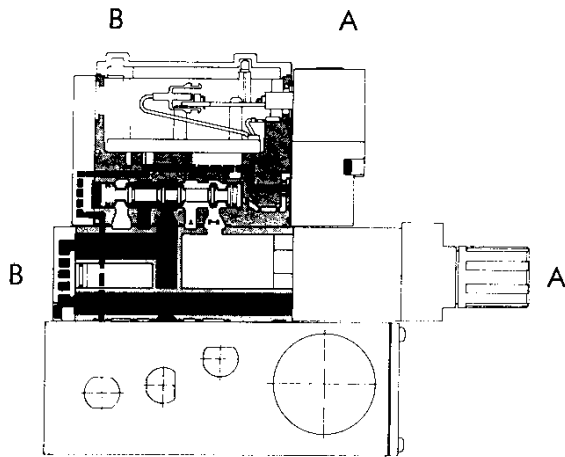
OPTION A, ABOVE



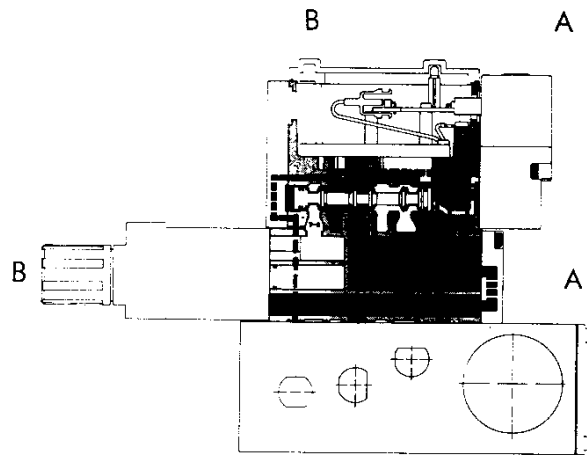
MANIFOLD W/REGULATOR
DUAL PRESSURE

OPTION E, ABOVE

Note: For both single and dual pressure, air supply to the pilot system is never regulated



SINGLE REGULATOR DUAL PRESSURE
 SELECT TO THE "A" CYL. PORT
 OPTION P, OPPOSITE PAGE



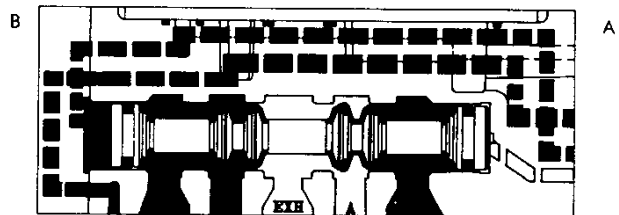
SINGLE REGULATOR DUAL PRESSURE
 SELECT TO THE "B" CYL. PORT
 OPTION R, OPPOSITE PAGE

SPOOL CONFIGURATIONS

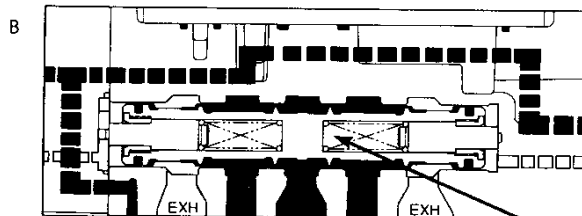
D8



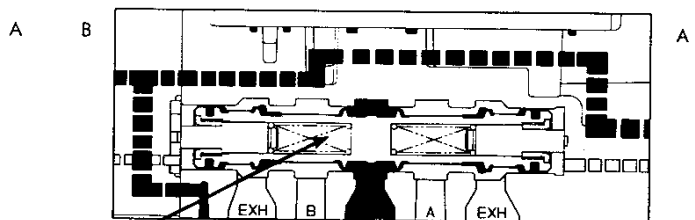
2 POSITION SINGLE PRESSURE
 SHOWN WITH "B" OPERATOR ENERGIZED



2 POSITION DUAL PRESSURE
 SHOWN WITH "B" OPERATOR ENERGIZED

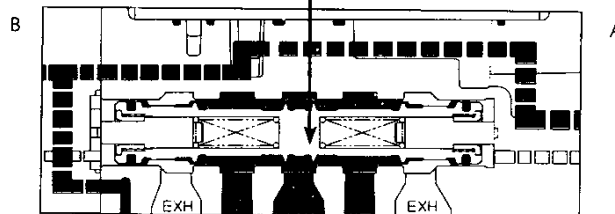


3 POSITION CLOSED CENTER

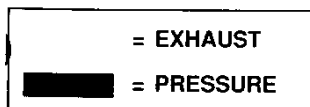


3 POSITION OPEN CENTER

SPRING
 CENTERING



3 POSITION SINGLE PRESSURE, PRESSURE CENTER



QUBE R75

Installation and Maintenance Instructions

The QUBE R75 Pressure Regulator is a specialized control valve which reduces the upstream supply pressure level to a specified constant downstream pressure. Pneumatic equipment that is operated at a higher-than-recommended pressure levels wastes the energy which generates that pressure, creates a potential safety hazard, and wears prematurely. The QUBE R75 is a balanced poppet, diaphragm style regulator available in either reliving (standard) or non-relieving (K suffix after part number) design. It is recommended that a QUBE F75 or similar filter be installed upstream of the R75 regulator to ensure contaminant free air.

Installation:

All QUBE components are individually tapped (NPT) to allow direct mounting to piping. Also, each QUBE FRL component comes equipped with the necessary screws and O-rings to enable connection to other QUBE components of the same series without the need for pipe nipples or special adaptors. Before installing, blow out pipe line to remove scale and other foreign matter. This unit has DRYSEAL pipe threads; use pipe compound or tape sparingly to male threads only. Install units in pipeline so that flow is with the arrows as indicated on faces of body. Install as near as possible to equipment serviced.

Reduced Pressure Adjustment: To adjust reduced pressure settings, pull knob out and turn knob clockwise to increase pressure setting and counter clockwise to lower setting. Push knob in to lock adjustment. With relieving-type regulators the reduced pressure follows adjustment of the screw, with non-relieving regulators adjustment for lower reduced pressure will not be obtained until the reduced pressure system is "bled-off" or until air flow starts.

Maintenance - Cleaning NOTE: To clean, it is not necessary to remove regulator from line. Refer to drawing as guide in reassembly. If the air supply is kept clean the regulator should provide long periods of uninterrupted service. Erratic regulator operation or loss of regulation is most always due to dirt in the disc area. To clean, shut off air line pressure and disassemble the regulator. Refer to drawing as a guide to disassembly and subsequent reassembly. Clean parts with household soap and blow out body with compressed air. When reassembling make sure the seat is firmly in place and that the disc stem fits into the center hole of the diaphragm assembly. Tighten bonnet slightly more than hand tight (60 to 70 inch pounds torque).

Note:

This regulator is designed for use with compressed air in industrial applications. For other applications consult factory before use.

Standard Features:

Push/Pull locking adjusting knob
Reduced pressure ranges available:
"A" := 0-25 psi
"B" := 0-60 psi
"C" := 0-125 psi

Supply pressure: 300 psig maximum
Temperature range: 40°-120°F
Body Material: Zinc

Diaphragm Material: Buna-N
Relieving (standard) or
Non-Relieving ("K" suffix on part number)
Innervolve: Brass w/Buna-N O-rings
Bottom Plug & Spring cage: Glass-filled acetal
Weight := .65 lbs. per unit
18.7 lbs. per 24-unit master pack



Adjusting Knob: R35-0541P (1016021)

Adjusting Screw Assy: SAR55-0532 (1053707)

Adjusting Spring:

"A" Range (0-25 Psi): Spr-53 (0756053)

"B" Range (0-60 Psi): Spr-54 (0756054)

"C" Range (0-125 Psi): Spr-55 (0756055)

Spring Cage: R75-0151P (1075006)

Spacer Ring: R55-0081 (1008001)

Diaphragm Assy:

Relieving: SAR75-0201 (1075009)

Non-Relieving: SAR75-0202 (1075010)

Body:

1/4" R75-02-0011 (0000756)

3/8" R75-03-0011 (0000758)

1/2" R75-04-0011 (0000757)

Innervolve Assy: SAR75-0751P (1075013)

Bottom Spring: SPR 391-1 (0012973)

Gasket: F55-1011 (1101005)

Bottom Plug: R55-0021P (1002004)

Options:

Gauge:

0-60 psi: = 274Z60 WS (0729034)

0-125 psi: = 274Z160 WS (0730575)

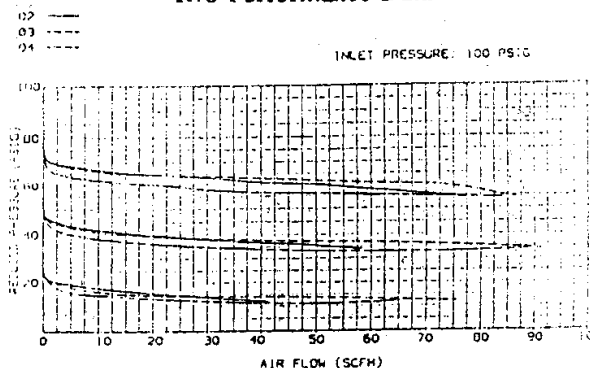
Panel Mount Nut:

Requires 1-1/4" hole (1-3/16-18 UNEF-2B)

Acetal Plastic Nut: = R05X51 (0584245)

Aluminum: = R05X51-A (0584246)

R75 Performance Data



Watts FluidAir 9 Cutts Rd., Kittery, ME 03904 Tel (207) 439-9511, Fax (207) 439-5632

Robertshaw Controls Co. 5785 Kennedy Road, Mississauga, Ont., L4Z 2G3 Tel. (416) 890-5811, Fax (416) 890-6098 **LIMITED WARRANTY** - the Company warrants this product against defects in material and workmanship for a period of one year from the date of original shipment. In event of such defects within the warranty period, the Company will, at its option, replace or recondition the product without charge. This shall constitute the exclusive remedy for breach of warranty, and the Company shall not be responsible for any incidental or consequential damages, including without limitation damages or other costs resulting from labor charges, delays, vandalism, negligence, fouling caused by foreign material, damage from adverse air conditions, chemicals, or any other circumstances over which the Company has no control. This warranty shall be invalidated by any abuse, misuse, misapplication or improper installation of the product.

THE COMPANY MAKES NO OTHER WARRANTY. ALL OTHER WARRANTIES, ORAL OR WRITTEN, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A SPECIFIC PURPOSE ARE HEREBY EXCLUDED AND DISCLAIMED. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. The Company reserves the right to make changes without prior notification.

The liability of the Company for all loss or damage resulting from non-conforming goods or tender, including breach of any and all warranties, shall be limited to refund of the purchase price of the particular goods with respect to which the loss or damage occurred.

QUBE Wraparound Sightglass Bulletin

The following is a list of chemical categories and their compatibilities with the Isoplast Polyurethane resin used to manufacture the QUBE Wraparound Sightglasses. In most cases the sightglasses are compatible with hydrocarbon based synthetic lubricants.

Water	Excellent
Salt Solutions	Excellent
Inorganic Acids, Weak	Excellent
Inorganic Acids, Strong	Excellent
Inorganic Acids, Concentrated	Fair-Poor
Inorganic Bases, Weak	Excellent
Inorganic Bases, Strong	Excellent
Oxidizing Solutions	Excellent
Soaps and Detergents	Excellent
Hydrocarbons, Aliphatic	Excellent
Hydrocarbons, Aromatic	Excellent
Hydrocarbons, Chlorinated	
Non-Polar	Excellent
Polar	Fair-Poor
Organic Acids	Excellent
Alcohols	Fair-Poor
Ketones	Poor

Contact factory for information regarding use with compounds not listed above.

LIMITED WARRANTY - the Company warrants each product against defects in material and workmanship for a period of one year from the date of original shipment. In event of such defects within the warranty period, the Company will, at its option, replace or recondition the product without charge. This shall constitute the exclusive remedy for breach of warranty, and the Company shall not be responsible for any incidental or consequential damages, including without limitation damages or other costs resulting from labor charges, delays, vandalism, negligence, fouling caused by foreign material, damage from adverse air conditions, chemicals, or any other circumstances over which the Company has no control. This warranty shall be invalidated by any abuse, misuse, misapplication or improper installation of the product.

THE COMPANY MAKES NO OTHER WARRANTY. ALL OTHER WARRANTIES, ORAL OR WRITTEN, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A SPECIFIC PURPOSE ARE HEREBY EXCLUDED AND DISCLAIMED. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. The Company reserves the right to make changes without prior notification.

The liability of the Company for all loss or damage resulting from non-conforming goods or tender, including breach of any and all warranties, shall be limited to refund of the purchase price of the particular goods with respect to which the loss or damage occurred.

Columbia Palletizer Parts

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EZ-SCREEN® Type 2 Light Screen

Instruction Manual

Original Instructions
122452 Rev. C
20 May 2014



122452

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1 About This Document

1.1 Important . . . Read This Before Proceeding!

It is the responsibility of the machine designer, controls engineer, machine builder, and/or maintenance electrician to apply and maintain this device in full compliance with all applicable regulations and standards. The device can provide the required safeguarding function only if it is properly installed, properly operated, and properly maintained. This manual attempts to provide complete installation, operation, and maintenance instruction. *Reading the manual in its entirety is highly recommended.* Please direct any questions regarding the application or use of the device to Banner Engineering.

For more information regarding U.S. and international institutions that provide safeguarding application and safeguarding device performance standards, see [Standards and Regulations](#) on page 58.



WARNING: User Responsibility

The user is responsible to:

- Carefully read, understand, and follow the information in all documentation for this device.
- Perform a risk assessment of the specific machine guarding application. See ISO 12100 or ANSI B11.0.
- Determine what safeguarding devices and methods are appropriate per the requirements defined in ISO 13849-1, ANSI B11.19, and other appropriate standards.
- Create and confirm each configuration and then verify that the entire safeguarding system (including input devices and output devices) is operational and working as intended.
- Periodically re-verify, as needed, that the entire safeguarding system is working as intended.

Failure to follow any of these responsibilities may potentially create a dangerous condition that may lead to serious injury or death.

1.1.1 Use of Warnings and Cautions

This manual contains numerous WARNING and CAUTION statements:

- **Warnings** refer to potentially hazardous situations which, if not avoided, may lead to serious injury or death.
- **Cautions** refer to potentially hazardous situations which, if not avoided, which may lead to minor or moderate injury or potential damage to equipment. Cautions are also used to alert against unsafe practices.

These statements are intended to inform the machine designer and manufacturer, the end user, and maintenance personnel, how to avoid misapplication and effectively apply the EZ-SCREEN Type 2 Light Screen to meet the various safeguarding application requirements. These individuals are responsible to read and abide by these statements.

1.1.2 EC Declaration of Conformity (DOC)

Banner Engineering Corp. herewith declares that the **EZ-SCREEN Type 2 Light Screen** are in conformity with the provisions of the Machinery Directive 2006/42/EC and all essential health and safety requirements have been met.

Representative in EU: Peter Mertens, Managing Director Banner Engineering Europe. Address: Park Lane, Culliganlaan 2F, 1831 Diegem, Belgium.

2 Introduction

2.1 Features



- An optoelectronic safeguarding device
- Creates a screen of synchronized, modulated infrared sensing beams. Choose from 10 sizes, in 150 mm (6 in) increments: defined areas from 150 mm to 1.8 m (6 in. to 71 in)
- Compact package for smaller production machines
- Models available with Trip or Latch output operation (automatic or manual start/restart)
- 30 mm (1.18 in) resolution
- Remote Test input terminals for simulating a "blocked" condition
- Operating range up to 15 m (50 ft)
- Type 2 per IEC 61496-1/-2; Category 2 PLd per EN ISO 13849-1
- FMEA tested according to IEC 61496-1, Type 2 requirements
- Receiver LEDs provide system status and emitter/receiver alignment indications
- Highly immune to EMI, RFI, ambient light, weld flash, and strobe light
- Two-piece design
- Vibration-tolerant, factory burned-in emitter and receiver circuitry for toughness and dependability

2.2 System Description



NOTE: This manual refers to an emitter and its receiver, and their cabling as "a System".

Banner EZ-SCREEN Type 2 emitters and receivers provide a redundant, microprocessor-controlled, opposed-mode optoelectronic "curtain of light", or "light screen". EZ-SCREEN Type 2 typically is used for point-of-operation safeguarding, and is suited to safeguard a variety of lower-risk machinery.

The EZ-SCREEN Type 2 is a two-piece (two-box) system comprising an emitter and a receiver, but no external controller. The external device monitoring (EDM) function ensures the fault detection capability required by EN ISO 13849-1 Category 2.

The EZ-SCREEN Type 2 emitters have a row of synchronized modulated infrared (invisible) light-emitting diodes (LEDs) in a compact metal housing. Receivers have a corresponding row of synchronized photodetectors. The light screen created by the emitter and receiver is called the defined area; its width and height are determined by the length of the sensor pair and the distance between them. The maximum range is 15 m (50 ft), which decreases if corner mirrors are used. Resolution is 30 mm (1.18 in).

Both emitter and receiver feature LEDs to provide continuous indication of the System's operating status, alignment and error conditions.

In typical operation, if any part of an operator's body (or any opaque object) of more than a pre-determined cross section is detected, the solid-state Output Signal Switching Device (OSSD) safety outputs turn OFF. These safety outputs are connected to the guarded machine's Final Switching Devices (FSDs) that control the machine primary control elements (MPCEs), which immediately stop the motion of the guarded machine.

Both OSSD outputs must be connected to the machine control so that the machine's safety-related control system interrupts the circuit or power to the MPCEs (Machine Primary Control Elements), resulting in a non-hazardous condition. Each OSSD is capable of sourcing 0.5A at +24V dc.

The OSSD safety outputs are not capable of performing a “handshake” communication with the Muteable Safety Stop Interface (MSSI) or Universal Safety Stop Interface (USSI) found on other Banner Engineering safety products.

EZ-SCREEN Type 2 is extensively FMEA (Failure Mode and Effects Analysis) tested to IEC 61496-1/-2 requirements. The design of the EZ-SCREEN Type 2 has considered all single faults such that a loss of a critical safety function will result in a stop command and a lockout condition. In the event of an accumulation of undetected faults, a remote external test (or check) is required to maintain the safety function.

Electrical connections are made through M12 (or Euro-style) quick-disconnects. An optional hookup that provides sensor interchangeability (or “swapability”) – the ability to install either sensor at either QD connection – is possible. Using a parallel connection (color-for-color), the emitter cable can be connected to the receiver cable, providing the ability to swap the emitter and receiver position, similar to a popular feature of Banner MINI-SCREEN® safety light screens. This hookup option provides advantages during installation, wiring, and troubleshooting.

All models require a supply voltage of +24V dc $\pm$ 20%.

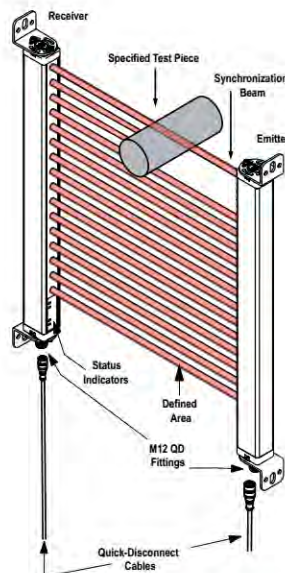


Figure 1, Banner EZ-SCREEN Type 2: emitter, receiver, and two interconnecting cables

2.3 Appropriate Applications and Limitations



WARNING: Read this Section Carefully Before Installing the System

If all mounting, installation, interfacing, and checkout procedures are not followed properly, the Banner device cannot provide the protection for which it was designed. The user has the responsibility to ensure that all local, state, and national laws, rules, codes, or regulations relating to the installation and use of this control system in any particular application are satisfied. Ensure that all legal requirements have been met and that all technical installation and maintenance instructions contained in this manual are followed.

The user has the sole responsibility to ensure that this Banner device is installed and interfaced to the guarded machine by Qualified Persons, in accordance with this manual and applicable safety regulations.

The Banner EZ-SCREEN Type 2 Light Screen is intended for lower-risk machine guarding and other safeguarding applications, as determined by a risk assessment. It is the user's responsibility to verify whether the safeguarding is appropriate for the application and is installed, as instructed by this manual, by a Qualified Person (as defined in the [Glossary](#) on page 60).

The EZ-SCREEN Type 2 ability to perform its safeguarding function depends upon the appropriateness of the application and upon its proper mechanical and electrical installation and interfacing to the guarded machine. **If all mounting, installation, interfacing, and checkout procedures are not followed properly, the EZ-SCREEN Type 2 cannot provide the protection for which it was designed.**

**CAUTION: Install System Only on Appropriate Applications**

Banner EZ-SCREEN Type 2 is for use only on machinery that can be stopped immediately after a stop signal is issued at any point in the machine's stroke or cycle, such as part-revolution clutched machines. Under no circumstances may the EZ-SCREEN Type 2 be used on full-revolution clutched machinery or in unsuitable applications as those listed. **If there is any doubt about whether or not your machinery is compatible with the EZ-SCREEN Type 2, contact Banner Engineering.**

**CAUTION: Use of EZ-SCREEN Type 2**

EZ-SCREEN Type 2 meets the Type 2 requirements of IEC 61496 and Category 2 PLd requirements of EN ISO 13849-1. DO NOT use EZ-SCREEN Type 2 unless it is installed, tested, and inspected in accordance with this manual. DO NOT use EZ-SCREEN Type 2 where Control Reliability is required, or where Category 3, Category 4, or Type 4 AOPD (active opto-electronic protective device) have been mandated, or where a risk assessment has determined that frequent access by personnel to the hazard could result in an irreversible or serious injury (for example, OSHA reportable injury).

Typical use is for safeguarding in situations where the consequence of an accident will result in only slight (normally reversible) injuries that are typically treated by the normal healing processes and minor medical treatment (that is, first aid, as defined by OSHA 29CFR1904.7).

Failure to follow these instructions could result in serious bodily injury or death.

2.3.1 Examples: Appropriate Applications

EZ-SCREEN Type 2 are typically used for, but is not limited to, the following applications (dependent on machine risk assessment):

- Small assembly equipment
- Automated production equipment
- "Table-top" robotic work cells
- Component insertion/"pick-and-place" machines
- Small packaging machines
- Equipment and process protection (non-personnel safety)
- Applications that could result in only slight (normally reversible) injuries (such as bump, bruise, knock-down, trapping but not crushing, minor cuts and abrasions, etc.)

2.3.2 Examples: Inappropriate Applications

Do not use EZ-SCREEN Type 2 in the following applications:

- As a primary safeguard in frequently accessed hazardous situations that could result in serious injuries (normally irreversible, including death)
- In any case where Control Reliability, Category 3, Category 4, or Type 4 AOPD (active opto-electronic protective device) have been mandated. See EN ISO 13849-1, IEC 61496-1, or other appropriate standard
- With any machine that cannot be stopped immediately after a stop signal is issued, such as single-stroke (or full-revolution) clutched machinery
- With any machine with inadequate or inconsistent machine response time and stopping performance
- With any machine that ejects materials or component parts through the defined area
- In any environment that is likely to adversely affect photoelectric sensing efficiency. For example, corrosive chemicals or fluids or unusually severe levels of smoke or dust, if not controlled, may degrade sensing efficiency
- As a tripping device to initiate or reinstate machine motion (PSDI applications), unless the machine and its control system fully comply with the relevant standard or regulation (see ISO 12100, IEC 60204-1, IEC 61496-1, or other appropriate standard)

If an EZ-SCREEN Type 2 is installed for use as a perimeter guard (where a pass-through hazard may exist), the dangerous machine motion can be initiated by normal means only after the safeguarded area is clear of individuals and the EZ-SCREEN Type 2 has been manually reset.

2.4 Control Reliability and Safety Categories

To summarize the expected safety circuit performance in high-risk situations, requirements of Control Reliability (OSHA 29CFR1910.217, ANSI B11.19, and ANSI/RIA R15.06) and Category 3 and Category 4 (EN ISO 13849-1) demand that a reasonably foreseeable, single failure does not lead to the loss of the safety function, and does not prevent a normal or immediate stop from occurring. The failure or the fault must be detected at or before the next demand of safety (e.g., at the beginning or end of a cycle, or when a safeguard is actuated). The safety-related part of the control system then must issue an immediate stop command, or prevent the next machine cycle or hazardous situation until the failure or fault is corrected.

The effect of ANSI/RIA R15.06, ANSI B11.19, and EN ISO 13849-1 is to set a baseline for situations in which a minimum level of performance has been mandated or in cases where a risk assessment has determined a need for Control Reliability, Category 3 or Category 4 level of performance.

In lower-risk safety applications, safeguards and safety circuits do not require the level of performance and fault tolerance described by Control Reliability, Category 3 or Category 4. Applications involving situations that could result in a slight or normally reversible injury (e.g., only requiring first aid, as defined by OSHA 29CFR1904) can be solved by EN ISO 13849-1 Category 2.

EN ISO 13849-1 Category 2 does not require the same level of performance and fault tolerance as required by Control Reliability, Category 3 or Category 4. Safety-related parts of control systems designed to Category 2 "shall be designed so that their function(s) are checked at suitable intervals by the machine control system." This allows a single fault to lead to the loss of the safety function between the check [test] of the system, but the loss of safety function is detected by the check. By comparison, in a system designed to EN ISO 13849-1 Category 4, a single fault or an accumulation of faults will not lead to a loss of the safety function.

While EN ISO 13849-1 generally applies to the machine level, IEC61496-1/-2 specifies requirements for the design, construction and testing for two levels or "types" of active opto-electronic protective devices (AOPDs) or light curtains (light screens). "Type 2" and "Type 4" describe differing requirements to ensure that appropriate safety-related performance is achieved. The appropriate type is dependent on the overall degree of risk reduction, as determined by the machine's Risk Assessment (see ISO 14121, ANSI B11.19, ANSI/RIA R15.06).

A Type 2 AOPD relies on periodic testing to detect a failure to danger. Between tests, a single fault can result in the loss of the safety function. While this level of performance and fault tolerance is generally not allowed in Category 4 situations, it is acceptable in the lower-risk situations described by Category 2.

While the EZ-SCREEN Type 2 conducts continual internal self-tests and all single faults have been considered, the installation should provide an additional periodic test/check of the EZ-SCREEN Type 2 and its interface to ensure the integrity of the safety function (see [Manual Reset/Remote Test Input and EDM](#) on page 31). A component failure detected by periodic test/check must cause a "stop" signal to be sent to the guarded machine and put the System into a Lockout condition.

Recovery from this type of Lockout condition requires:

- Replacement of the failed component (to restore the safety function)
- The appropriate reset procedure.

2.5 Operating Features

The Banner EZ-SCREEN Type 2 Light Screen models described by this manual feature standard functions:

- Trip or Latch Output (depending on model)
- External Device Monitoring (EDM) via the Test/Retest input

The System Response Time (T_r) can be determined by the model number on the emitter and receiver.

2.5.1 Trip/Latch Output

Whether a receiver features Trip or Latch Output determines whether the System will enter RUN mode automatically after power-up, or if it will require a manual reset first. If the System has Trip Output, other measures must be taken to prevent a pass-through hazard.

For Latch Output models, the EZ-SCREEN Type 2 requires a manual reset for the OSSD outputs to turn ON, after power is applied and all beams are clear.

- For Trip Output models, the OSSD outputs will turn ON after power is applied and the receiver passes its internal self-test/synchronization and recognizes that all beams are clear. Trip Output models will also turn on after all beams are cleared following a blocked beam.
- For Latch Output models, the EZ-SCREEN Type 2 requires a manual reset for the OSSD outputs to turn ON, whenever power is applied and all beams are clear.

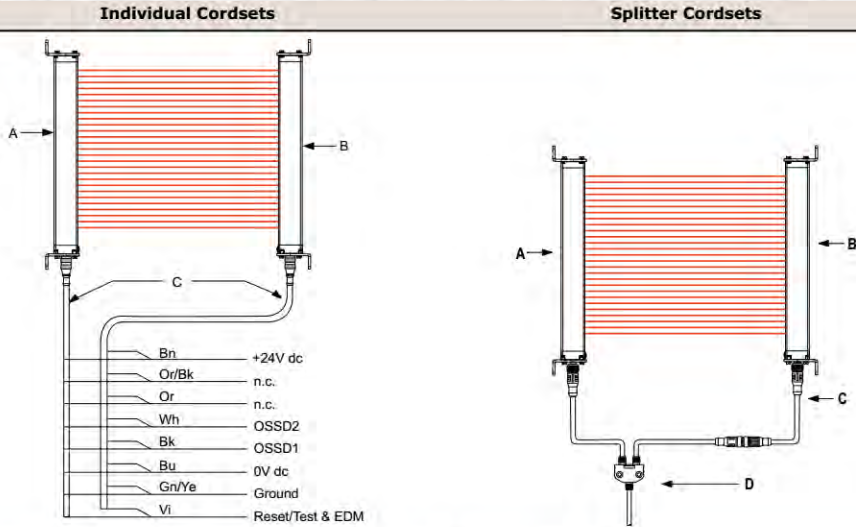


WARNING: Use of Trip/Latch Output

Application of power to the Banner device, the clearing of the defined area, or the reset of a Latch condition **MUST NOT** initiate dangerous machine motion. Machine control circuitry must be designed so that one or more initiation devices must be engaged (in a conscious act) to start the machine – in addition to the Banner device going into Run mode. **Failure to follow these instructions may result in serious bodily injury or death.**

2.5.2 Wiring Options for Emitter/Receiver Swapability

Each EZ-SCREEN Type 2 sensor can be connected to its own power supply or, color-for-color to the other sensor's cable. The color-for-color hookup allows the emitter and receiver positions to be interchanged without rewiring (functionality known as sensor "swapability"). Model CSB.. splitter cordsets and DEE2R.. double-ended cables facilitate interconnection between an EZ-SCREEN Type 2 receiver and emitter, providing a single "homerun" cable for optional swapable hookup.



Key	Description
A	Emitter
B	Receiver
C	QDE-8..D Cordsets

Key	Description
A	Emitter
B	Receiver
C	DEE2R.. Cordsets
D	CSB.. Cordsets

2.5.3 Manual Reset/Remote Test Input and EDM

A single input provides the means to reset the system from a latch or lockout condition, to externally test the light screen and its interface, and to monitor external devices (EDM) for proper operation. If the System is in Run condition with outputs ON, operating the switch results in a test. If the System is Latched or Locked Out, operating the switch results in a reset.

External Device Monitoring (EDM)

This feature allows the EZ-SCREEN Type 2 system to monitor the status of external devices such as MPCEs. The EDM used in this system is similar to Power Monitoring employed by MINI-SCREEN safety light screens. A normally closed and a normally open contact from each monitored device are wired in series-parallel to detect if one of the devices fails.

2.5.4 Status Indicators

Status indicators on both the emitter and receiver are clearly visible on each sensor's front panel.



Figure 2. EZ-SCREEN Type 2 emitter and receiver status indicators

3 Mechanical Installation

The EZ-SCREEN Type 2 system performance as a safety guarding device depends on:

- The suitability of the application
- The proper mechanical and electrical installation and interfacing to the guarded machine



WARNING: Read this Section Carefully Before Installing the System

If all mounting, installation, interfacing, and checkout procedures are not followed properly, the Banner device cannot provide the protection for which it was designed. The user has the responsibility to ensure that all local, state, and national laws, rules, codes, or regulations relating to the installation and use of this control system in any particular application are satisfied. Ensure that all legal requirements have been met and that all technical installation and maintenance instructions contained in this manual are followed.

The user has the sole responsibility to ensure that this Banner device is installed and interfaced to the guarded machine by Qualified Persons, in accordance with this manual and applicable safety regulations.

3.1 Mechanical Installation Considerations

The two primary factors that influence the layout of the EZ-SCREEN Type 2 system mechanical installation are the Safety Distance (Minimum Distance) (see [Calculating the Safety Distance \(Minimum Distance\)](#) on page 11) and the supplemental safeguarding/eliminating pass-through hazards (see [Reducing or Eliminating Pass-Through Hazards](#) on page 14). Other considerations include:

- [Emitter and Receiver Orientation](#) on page 17
- [Adjacent Reflective Surfaces](#) on page 16
- [Use of Corner Mirrors](#) on page 16
- [Installation of Multiple Systems](#) on page 18



WARNING: Position Components Carefully

The emitter and receiver must be positioned such that the hazard cannot be accessed by reaching over, under, around, or through the sensing field. Additional and supplemental guarding may be required.

3.1.1 Calculating the Safety Distance (Minimum Distance)

Safety Distance (Ds), also called Minimum Distance (S), is the minimum distance required between the defined area and the closest reachable hazard point. The distance is calculated so that when an object or a person is detected (by blocking a sensing beam), the EZ-SCREEN Type 2 sends a stop signal to the machine, causing it to stop by the time the object or person can reach any machine hazard point.

The distance is calculated differently for U.S. and European installations. Both methods take into account several factors, including a calculated human speed, the total system stopping time (which itself has several components), and the depth penetration factor. After the distance has been determined, record the calculated distance on the Daily Checkout Card.



WARNING: Safety Distance (Minimum Distance)

The Banner emitters and receivers must be mounted at a distance from the nearest hazard such that an individual cannot reach the hazard before cessation of the hazardous motion or situation. This distance can be calculated using the formulas in this section, as described by ANSI B11.19 and ISO 13855, and must be greater than 100 mm (4 in) regardless of calculated value. **Failure to establish and maintain the safety distance (minimum distance) may result in serious bodily injury or death.**

Reduced Resolutions increases Dpf (or C). **Increase the depth penetration factor to calculate proper minimum distance whenever Reduced Resolution is used.** Always turn Reduced Resolution Off when the larger minimum object detection size is not required.

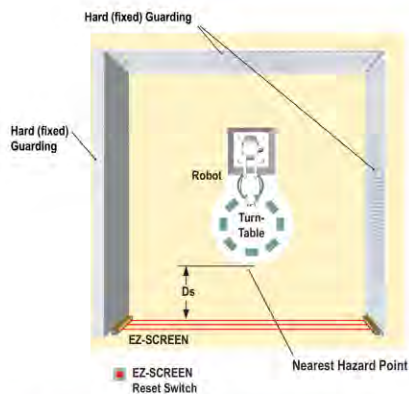


Figure 3. Safety distance and hard (fixed) guarding

EZ-SCREEN Type 2 Models With Response Times

Models (see note below)	Defined Area Height	Number of Beams	Response Time (Tr)
LS2..30-150Q8	150 mm (5.9 in)	8	11 ms
LS2..30-300Q8	300 mm (11.8 in)	16	13 ms
LS2..30-450Q8	450 mm (17.7 in)	24	14 ms
LS2..30-600Q8	600 mm (23.6 in)	32	16 ms
LS2..30-750Q8	750 mm (29.5 in)	40	17 ms
LS2..30-900Q8	900 mm (35.4 in)	48	19 ms
LS2..30-1050Q8	1050 mm (41.3 in)	56	21 ms
LS2..30-1200Q8	1200 mm (47.2 in)	64	22 ms
LS2..30-1350Q8	1350 mm (53.1 in)	72	24 ms
LS2..30-1500Q8	1500 mm (59 in)	80	25 ms
LS2..30-1650Q8	1650 mm (65 in)	88	27 ms
LS2..30-1800Q8	1800 mm (70.9 in)	96	29 ms



NOTE: The .. in the model numbers is one of the following:

- **E** = Emitter
- **TR** = Trip-Output Receiver
- **LR** = Latch-Output Receiver
- **TP** = Trip-Output Emitter/Receiver Pair
- **LP** = Latch-Output Emitter/Receiver Pair

Pair model numbers end in **88** (for example, **LS2TP30-150Q88**) to indicate that both the transmitter and receiver have an 8-pin connector.

Formula and Examples

U.S. Applications

The Safety (Separation) Distance formula for U.S. applications:

$$D_s = K \times (T_s + T_r) + D_{pf}$$

D_s

the Safety Distance, in inches

K

1600 mm per second (or 63 in per second), the OSHA 29CFR1910.217, and ANSI B11.19 recommended hand-speed constant (see Note 1 below)

T_s

the overall stop time of the machine (in seconds) from the initial stop signal to the final ceasing of all motion, including stop times of all relevant control elements (for example, IM-T... Interface Modules) and measured at maximum machine velocity (see Note 3 below)

T_r

the maximum response time, in seconds, of the EZ-SCREEN Type 2 emitter/receiver pair (depending on model)

D_{pf}

the added distance due to the depth penetration factor as prescribed in OSHA 29CFR1910.217, and ANSI B11.19 for U.S. applications.

European Applications

The Minimum Distance formula for European applications:

$$S = (K \times T) + C$$

S

the Minimum Distance, in mm, from danger zone to light screen center line; minimum allowable distance is 100 mm (175 mm for non-industrial applications), regardless of calculated value

K

hand-speed constant (see Note 2 below); **2000 mm/s** (for Minimum Distances ≤ 500 mm) **1600 mm/s** (for Minimum Distances > 500 mm)

T

the overall machine stopping response time (in seconds), from the physical initiation of the safety device and the machine coming to a stop (or the hazard removed). This can be broken down into two parts: **T_s** and **T_r** where **T = T_s + T_r**

C

the additional distance, in mm, based on intrusion of a hand or object towards the danger zone prior to actuation of a safety device. Calculate using the formula:

$$C = 8 \times (d - 14)$$

where *d* is the resolution of the light curtain (for *d* < 40 mm). For EZ-SCREEN Type 2, *d* = 30 mm and *C* = 128 mm (5 in).

Notes:

1. The OSHA-recommended hand speed constant **K** has been determined by various studies and, although these studies indicate speeds of 1600 mm/sec. (63 in/sec.) to more than 2500 mm/sec. (100 in/sec.), they are not conclusive determinations. Consider all factors, including the physical ability of the operator, when determining the value of **K** to be used.
2. The recommended hand speed constant **K**, derived from data on approach speeds of the body or parts of the body as stated in ISO 13855.
3. **T_s** is usually measured by a stop-time measuring device. If the machine manufacturer's specified stop time is used, at least 20% should be added to allow for possible clutch/ brake system deterioration. This measurement must take into account the slower of the two MPCE channels, and the response time of all devices or controls that react to stop the machine.



WARNING: Determine Correct Stop Time

Stop time (T_s) must include the response time of all devices or controls that react to stop the machine. If all devices are not included, the calculated safety distance (D_s or S) will be too short. This can lead to serious bodily injury or death. Be sure to include the stop time of all relevant devices and controls in your calculations.

If required, each of the two Machine Primary Control Elements (MPCE1 and MPCE2) must be capable of immediately stopping the dangerous machine motion, regardless of the state of the other. These two channels of machine control need not be identical, but the stop time performance of the machine (T_s, used to calculate the safety distance) must take into account the slower of the two channels.

Examples

Example: U.S. Applications, Model

K	= 63 in. per second (the hand speed constant set by OSHA)
Ts	= 0.32 (0.250 second is specified by the machine manufacturer; plus 20% safety factor; plus 20 ms for interface module IM-T-9A response time)
Tr	= 0.016 seconds (the specified response time of an LS2..30-600 EZ-SCREEN Type 2)
Dpf	= 3 in

Substitute the numbers into the formula as follows:

$$Ds = K \times (Ts + Tr) + Dpf$$

Mount the EZ-SCREEN Type 2 emitter and receiver so that no part of the defined area will be closer than 24.2 in. to the closest reachable hazard point on the guarded machine.

Example: European Applications, Model

K	= 1600 mm per second
T	= 0.336 (0.250 second specified by machine manufacturer; plus 20% safety factor; plus 20 ms interface module response time), plus 0.016 seconds (the specified LS2..30-600 response time)
C	= 8 x (30 - 14) = 128 mm (14 mm resolution)

Substitute the numbers into the formula as follows:

$$S = (K \times T) + C$$

$$S = (1600 \times 0.336) + 128 = 665.6 \text{ mm}$$

Mount the EZ-SCREEN Type 2 emitter and receiver so that no part of the defined area will be closer than 665.6 mm to the closest reachable hazard point on the guarded machine.

3.1.2 Reducing or Eliminating Pass-Through Hazards

A *pass-through* hazard is associated with applications where personnel may pass through a safeguard (which issues a stop command to remove the hazard), and then continues into the guarded area, such as in perimeter guarding. Subsequently, their presence is no longer detected, and the related danger becomes the unexpected start or restart of the machine while personnel are within the guarded area.

In the use of light screens, a pass-through hazard typically results from large safety distances calculated from long stopping times, large minimum object sensitivities, reach-over, reach-through, or other installation considerations. A pass-through hazard can be generated with as little as 75 mm (3 in) between the defined area and the machine frame or hard (fixed) guarding.

Eliminate or reduce pass-through hazards whenever possible. While it is recommended to eliminate the pass-through hazard altogether, this may not be possible due to machine layout, machine capabilities, or other application considerations.

One solution is to ensure that personnel are continually sensed while within the hazardous area. This can be accomplished by using supplemental safeguarding, such as described by the safety requirements in ANSI B11.19 or other appropriate standards.

An alternative method is to ensure that once the safeguarding device is tripped it will latch and will require a deliberate manual action to reset. This method of safeguarding relies upon the location of the reset switch as well as safe work practices and procedures to prevent an unexpected start or restart of the guarded machine.



WARNING: Use of the Banner device for Perimeter Guarding

If a Banner device is installed in an application that results in a pass-through hazard (for example, perimeter guarding), either the Banner device System or the Machine Primary Control Elements (MPCEs) of the guarded machine must cause a Latched response following an interruption of the defined area.

The reset of this Latched condition may only be achieved by actuating a reset switch that is separate from the normal means of machine cycle initiation.

Lockout/Tagout procedures per ANSI Z244.1 may be required, or additional safeguarding, as described by ANSI B11.19 safety requirements or other appropriate standards, must be used if a passthrough hazard cannot be eliminated or reduced to an acceptable level of risk. **Failure to observe this warning may result in serious bodily injury or death.**

3.1.3 Supplemental Safeguarding

As described in *Calculating the Safety Distance (Minimum Distance)* on page 11, the EZ-SCREEN Type 2 must be properly positioned such that an individual cannot reach through the defined area and access the hazard point before the machine has stopped.

Additionally, the hazard cannot be accessible by reaching around, under, or over the defined area. To accomplish this, supplemental guarding (mechanical barriers, such as screens or bars), as described by ANSI B11.19 safety requirements or other appropriate standards, must be installed. Access will then be possible only through the defined area of the EZ-SCREEN Type 2 System or through other safeguarding that prevents access to the hazard (see *Figure 4* on page 15).

The mechanical barriers used for this purpose are typically called "hard (fixed) guarding"; there must be no gaps between the hard (fixed) guarding and the defined area. Any openings in the hard (fixed) guarding must comply with the safe opening requirements of ANSI B11.19 or other appropriate standard.

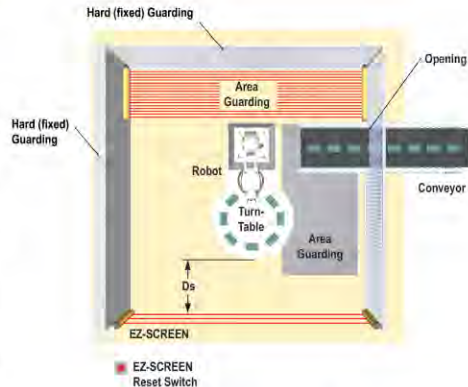


Figure 4. An example of supplemental safeguarding

Figure 4 on page 15 shows an example of supplemental safeguarding inside a robotic work cell. The EZ-SCREEN Type 2, in conjunction with the hard (fixed) guarding, is the primary safeguard. Supplemental safeguarding (such as a horizontal-mounted safety light screen as an area guard) is required in areas that cannot be viewed from the reset switch (for example, behind the robot and the conveyor). Additional supplemental safeguarding may be required to prevent clearance or trapping hazards (for example, a safety mat as an area guard between the robot, the turntable, and the conveyor).



WARNING: The Hazard Must Be Accessible Only through the Defined Area

The installation of the EZ-SCREEN Type 2 must prevent any individual from reaching around, under, over or through the defined area and into the hazard without being detected. Mechanical barriers (for example, hard (fixed) guarding) or supplemental safeguarding may be required to comply with this requirement, and is described by ANSI B11.19 safety requirements or other appropriate standards.

3.1.4 Other Considerations

Reset Switch Location

The reset switch must be mounted at a location that complies with the warning and guidelines below. If any hazardous areas are not in view from the switch location, additional means of safeguarding must be provided. The switch should be protected from accidental or unintended actuation (for example, through the use of rings or guards).

A key-actuated reset switch provides some operator or supervisory control, as the key can be removed from the switch and taken into the guarded area. However, this does not prevent unauthorized or inadvertent resets due to spare keys in the possession of others, or additional personnel entering the guarded area unnoticed. When considering where to locate the reset switch, follow the guidelines below.



WARNING: Reset Switch Location

When considering where to locate the reset switch, you must follow the guidelines outlined in this section.

If any areas within the guarded area are not visible from the reset switch, additional safeguarding must be provided, as described by the ANSI B11.19 series or other appropriate standards.

Failure to follow these instructions could result in serious injury or death.

All reset switches must be:

- Outside the guarded area

- Located to allow the switch operator a full, unobstructed, view of the entire guarded area while the reset is performed
- Out of reach from within the guarded area
- Protected against unauthorized or inadvertent operation (such as through the use of rings or guards).



Important: Resetting a safeguard must not initiate hazardous motion. Safe work procedures require a start-up procedure to be followed and the individual performing the reset to verify that the entire hazardous area is clear of all personnel before each reset of the safeguard is performed. If any area cannot be observed from the reset switch location, additional supplemental safeguarding must be used: at a minimum, visual and audible warnings of machine start-up.

Adjacent Reflective Surfaces



WARNING: Avoid Installation Near Reflective Surfaces

Avoid locating the defined area near a reflective surface; it could reflect sensing beam(s) around an object or person within the defined area, and prevent its detection by the EZ-SCREEN Type 2. Perform the trip test, as described in this manual, to detect such reflection(s) and the resultant optical short circuit. **Failure to prevent reflection problems will result in incomplete guarding and could result in serious injury or death.**

A reflective surface located adjacent to the defined area may deflect one or more beams around an object in the defined area. In the worst case, an optical short circuit may occur, allowing an object to pass undetected through the defined area (see [Figure 5](#) on page 16).

This reflective surface may result from shiny surfaces or glossy paint on the machine, the workpiece, the work surface, the floor, or the walls. Beams deflected by reflective surfaces are discovered by performing the trip test and the periodic checkout procedures. To eliminate problem reflections:

- If possible, relocate the sensors to move the beams away from the reflective surface(s), being careful to maintain adequate separation distance
- Otherwise, if possible, paint, mask, or roughen the shiny surface to reduce its reflectivity
- Where these are not possible (as with a shiny workpiece or machine frame), determine the worst-case resolution resulting from the optical short circuit and use the corresponding depth penetration factor (Dpf or C) in the Safety Distance (Minimum Distance) formula; or mount the sensors in such a way that the receiver's field of view and/or the emitter's spread of light are restricted from the reflective surface
- Repeat the trip test (see [Trip Test](#) on page 28) to verify that these changes have eliminated the problem reflection(s). If the workpiece is especially reflective and comes close to the defined area, perform the trip test with the workpiece in place

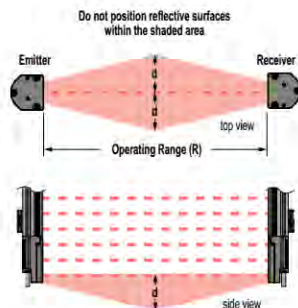


Figure 5. Adjacent Reflective Surfaces

Use of Corner Mirrors

EZ-SCREEN Type 2 may be used with one or more corner mirrors. Mirrors are not allowed for applications that would allow undetected personnel access into the safeguarded area. The use of glass-surface corner mirrors reduces the maximum specified emitter/receiver separation by approximately 8 percent per mirror, as follows:

SSM and MSM Series Glass-Surface Mirrors	
Corner Mirrors	Max. Emitter / Receiver Range
1	13.8 m (45 ft)
2	12.7 m (42 ft)
3	11.7 m (38 ft)
4	10.8 m (35 ft)

If mirrors are used, the difference between the angle of incidence from the emitter to the mirror and from the mirror to the receiver must be between 45° and 120° (see [Figure 6](#) on page 17). If placed at a sharper angle, an object in the light screen may deflect beam(s) to the receiver, preventing the object from being detected, also known as false proxing. Angles greater than 120° result in difficult alignment and possible optical short circuits.



WARNING: Avoid Retroreflective Installation

Do not install emitters and receivers in "retroreflective" mode, with less than a 45° angle of incidence, as shown. **Sensing may be unreliable in this configuration and result in a serious bodily injury or death.**

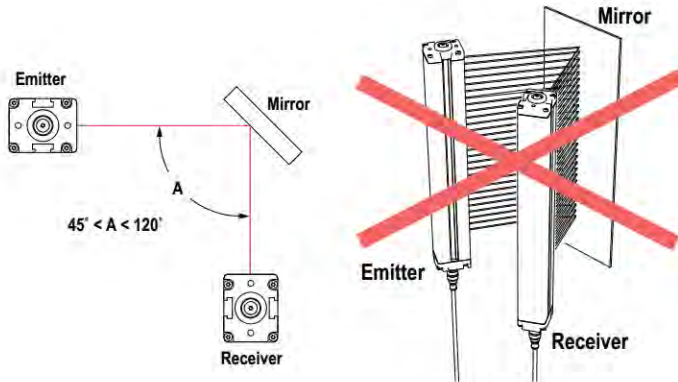


Figure 6. Using EZ-SCREEN Type 2 sensors in a retroreflective mode

Emitter and Receiver Orientation

The emitter and receiver must be mounted parallel to each other and aligned in a common plane, with both cable ends pointing in the same direction. Never mount the emitter with its cable end oriented in the opposite direction of the cable end of the receiver. If this occurs, voids in the light screen may allow objects or personnel to pass through the defined area undetected.

The emitter and receiver may be oriented in a vertical or horizontal plane, or at any angle between horizontal and vertical, as long as they are parallel to each other and their cable ends point in the same direction. Verify that the light screen completely covers all access to the hazard point that is not already protected by hard (fixed) guarding or other supplemental guarding.


WARNING: Proper Orientation of System Emitters and Receivers

EZ-SCREEN Type 2 emitters and receivers must be installed with their corresponding cabled ends pointing in the same direction (for example, both cabled ends facing up). **Failure to orient them properly will impair the performance of the EZ-SCREEN Type 2 System and will result in incomplete guarding, and could result in serious bodily injury or death.**

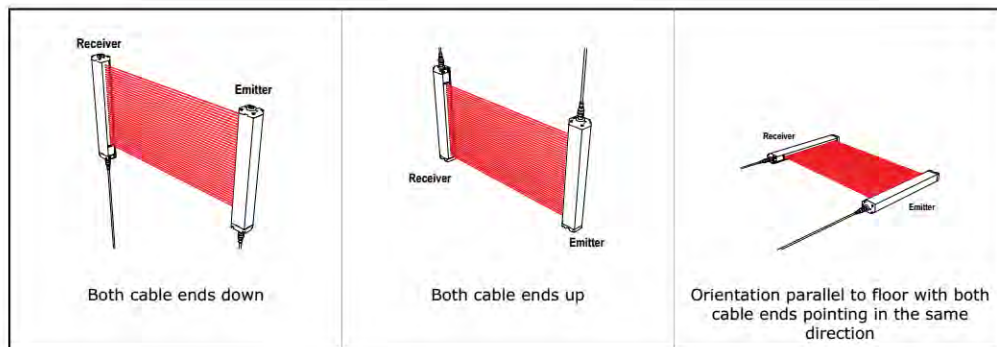


Figure 7. Examples of Correct Emitter/Receiver Orientation

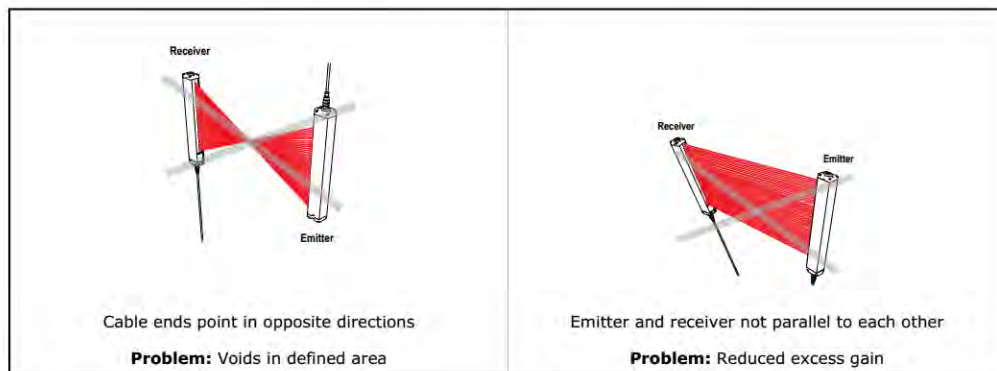


Figure 8. Examples of Incorrect Emitter/Receiver Orientation

Installation of Multiple Systems

Whenever two or more EZ-SCREEN Type 2 emitter and receiver pairs are adjacent to one another, optical crosstalk may take place between the systems. To minimize optical crosstalk, alternate the positions of the emitters and receivers (see [Figure 9](#) on page 19).

When three or more systems are installed in the same plane (as shown in [Figure 9](#) on page 19), optical crosstalk may occur between sensor pairs whose emitter and receiver lenses are oriented in the same direction. In this situation, eliminate optical crosstalk by mounting these sensor pairs exactly in line with each other within one plane, or by adding a mechanical barrier between the pairs.

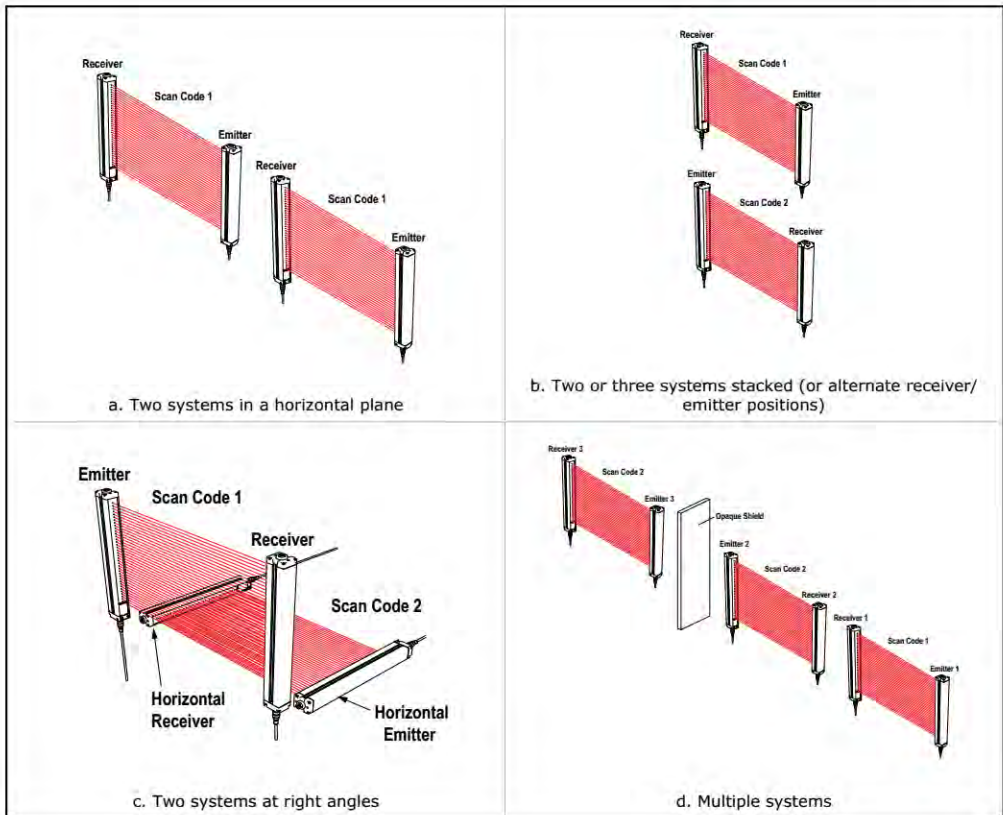


Figure 9. Installation of Multiple Systems

**WARNING: Multiple Pairs of Sensors**

Do not connect multiple pairs of sensors to one Interface Module (for example, IM-T-9A/-11A) or otherwise parallel OSSD outputs. **Connection of multiple OSSD safety outputs to a single device may result in serious bodily injury or death, and is prohibited.**

**WARNING: Proper Orientation of System Emitters and Receivers**

EZ-SCREEN Type 2 emitters and receivers must be installed with their corresponding cabled ends pointing in the same direction (for example, both cabled ends facing up). **Failure to orient them properly will impair the performance of the EZ-SCREEN Type 2 System and will result in incomplete guarding, and could result in serious bodily injury or death.**

**WARNING: Synchronization**

In situations where multiple systems are mounted closely together, or where a secondary emitter is in view (within $\pm 5^\circ$), within range of an adjacent receiver; a receiver may synchronize to the signal from the wrong emitter, reducing the safety function of the light screen.

3.2 Mounting System Components

3.2.1 Overview of Emitter/Receiver Mounting Hardware

Mounting Hardware

The EZ-SCREEN standard end-cap mounting bracket hardware is supplied with each emitter and receiver. Brackets are designed to mount directly to MSA Series stands using the hardware with the supplied stands.

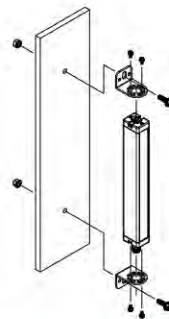


Figure 10. Emitter and Receiver End-Cap Mounting Brackets

Using Center Mounting Brackets

Center mounting brackets are supplied with longer sensors and must be used whenever the sensors are subject to shock or vibration. The sensors are designed to be mounted with up to 450 mm (18 in) distance between brackets:

- Sensors 600 to 900 mm (24 in to 36 in) long are supplied with one center bracket, which should be centered on the sensor.
- Sensors 1050 to 1350 mm (42 in to 54 in) long are supplied with two center brackets, which should be positioned 1/3 of the sensor's length from each sensor end.
- Sensors 1500 to 1800 mm (59 in to 71 in) long are supplied with three center brackets

To install each bracket:

1. Spread the clamp and snap over the back of the sensor so that the clamp is securely fastened to the sensor without blocking any beams.
2. Compress the foam spacer and slide the clamp along the length of the sensor housing to align the clamp with the center mounting bracket as shown in [Figure 11](#) on page 20. Three separate mounting holes are provided on the clamp to allow for all possible mounting configurations.
3. Connect the clamp to the center bracket using the M3 screw supplied.
4. Loosen all the mounting screws to the sensor, align the sensors and then tighten the end screws. Finally, tighten the M3 screw joining the clamp to the center mounting bracket.

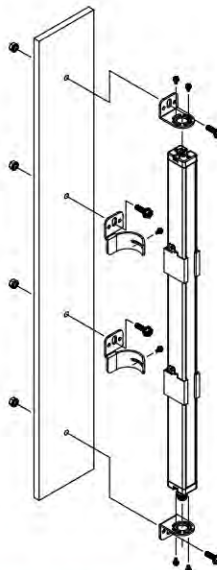


Figure 11. Emitter and Receiver Center Mounting Brackets

3.2.2 Mounting and Initial Alignment of Emitter/Receiver Pairs

Emitter/receiver pairs may be spaced from 0.2 to 15 m (8 in to 50 ft) apart. The maximum distance between an emitter and its receiver is reduced if corner mirrors are used. The supplied brackets (when mounted to the sensor end caps) allow $\pm 30^\circ$ rotation.

To mount each emitter/receiver pair:

1. From a common point of reference (ensuring the calculated safety distance), make measurements to locate the emitter and receiver in the same plane with their midpoints directly opposite each other.



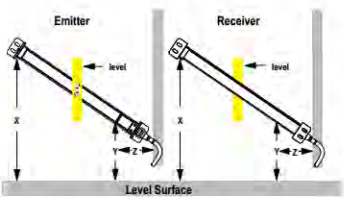
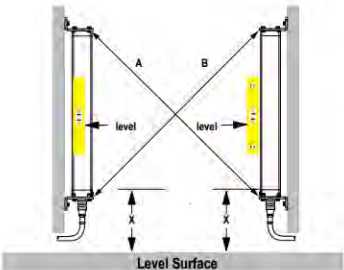
Important: The connector ends of both sensors must point in the same direction (see [Emitter and Receiver Orientation](#) on page 17).

2. Mount the emitter and receiver mounting brackets using the supplied M6 bolts and Keps nuts, or user-supplied hardware.
3. Mount the emitter and receiver in their brackets; position their windows directly facing each other.
4. Measure from a reference plane (for example, a level building floor) to the same point(s) on the emitter and receiver to verify their mechanical alignment.
5. Use a carpenter's level, a plumb bob, or the optional LAT-1 Laser Alignment Tool or check the diagonal distances between the sensors, to achieve mechanical alignment.

Verifying Initial Emitter/Receiver Alignment

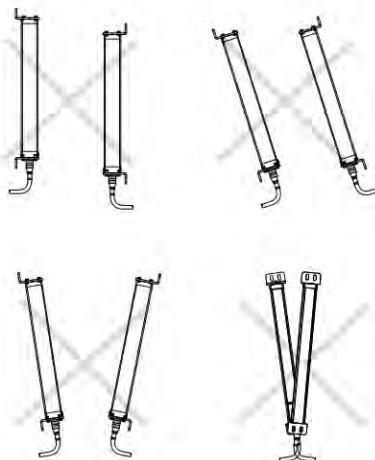
As you mount the sensors, make sure that

- The emitter and receiver are directly opposite each other.
- Nothing is interrupting the defined area (marked on the sensors).
- The defined area is the same distance from a common reference plane for each sensor.
- The emitter and receiver are in the same plane and are level/plumb and square to each other (vertical, horizontal, or inclined at the same angle).

Angled or Horizontal Installations	Vertical Installations
Verify that the • Distance X at the emitter and receiver are equal. • Distance Y at the emitter and receiver are equal. • Distance Z at the emitter and receiver are equal from parallel surfaces. • Vertical face (that is, the lens) is level/plumb. • Defined area is square. Check diagonal measurements if possible; see Vertical Installations, at right. 	Verify that the • Distance X at the emitter and receiver are equal. • Both sensors are level/plumb (check both the Distance Z at the emitter and receiver are equal from side and face). • Defined area is square. Check diagonal measurements if possible (Diagonal A = Diagonal B). 



NOTE: Make sure that the emitter and receiver are not tilted front-to-back or side-to-side as shown.



4 Electrical Installation and Testing



WARNING: Read this Section Carefully Before Installing the System

If all mounting, installation, interfacing, and checkout procedures are not followed properly, the Banner device cannot provide the protection for which it was designed. The user has the responsibility to ensure that all local, state, and national laws, rules, codes, or regulations relating to the installation and use of this control system in any particular application are satisfied. Ensure that all legal requirements have been met and that all technical installation and maintenance instructions contained in this manual are followed.

The user has the sole responsibility to ensure that this Banner device is installed and interfaced to the guarded machine by Qualified Persons, in accordance with this manual and applicable safety regulations.

The following are the main steps to electrically install the EZ-SCREEN Type 2 components and interface with the guarded machine:

1. Apply power to each emitter/receiver pair (see [Initial Electrical Connections](#) on page 24)
2. Perform and Initial Checkout Procedure (see [Initial Checkout Procedure](#) on page 25)
3. Make all electrical interface connections to the guarded machine (see [Electrical Connections to the Guarded Machine](#) on page 29)
4. Perform a commissioning checkout procedure (see [Commissioning Checkout](#) on page 33)

4.1 Routing Cordsets

Connect the QD connectors and route the sensor cables to the junction box, electrical panel, or other enclosure in which the Interface Module, the redundant mechanically linked interposing relays, FSDs, or other safety-related parts of the control system are located. This must be done per local wiring code for low-voltage dc control cables and may require installation of electrical conduit. See [Cordsets](#) on page 50 for selection of Banner-supplied cordsets.

The EZ-SCREEN Type 2 is designed and manufactured to be highly resistant to electrical noise and to operate reliably in industrial settings. However, extreme electrical noise may cause a random Trip or Latch condition; in extreme cases, a Lockout is possible. Emitter and receiver wiring is low voltage; routing the sensor wires alongside power wires, motor/servo wires, or other high-voltage wiring may inject noise into the EZ-SCREEN Type 2 System. It is good wiring practice (and may be required by code) to isolate emitter and receiver cables from high-voltage wires, avoid routing cables close to "noisy" wiring, and provide a good connection to earth ground.

Sensor QD cabling and any interconnect wiring should meet the following specifications. The wires used should have an insulation temperature rating of at least 90 °C (194 °F).

Table 1: Maximum Machine Interface cable length versus total current draw (including both OSSD loads)

Cable Size	Current Draw			
	0.5A	0.75A	1.0A	1.25A
0.823 mm ² (18 AWG)	375 ft	250 ft	188 ft	148 ft
0.518 mm ² (20 AWG)	240 ft	160 ft	120 ft	95 ft
0.326 mm ² (22 AWG)*	150 ft	100 ft	75 ft	59 ft



NOTE: Cable length includes power (+24 V dc) and return (0V dc) wires at +25 °C, and is intended to ensure that adequate power is available to the EZ-SCREEN Type 2 System when the supply is operating at +24 V dc - 10%.

4.2 Initial Electrical Connections



WARNING: Proper Electrical Hookup

Electrical hookup must be made by Qualified Personnel and must comply with NEC (National Electrical Code) and local standards. **Make no more connections to the EZ-SCREEN Type 2 System than are described in this manual. Connection of other wiring or equipment to the EZ-SCREEN Type 2 System could result in serious bodily injury or death.**

Lockout/tagout procedures may be required (refer to OSHA1910.147, ANSI Z244-1, ISO 14118, or the appropriate standard for controlling hazardous energy). Following relevant electrical standards and wiring codes, such as the NEC, NFPA79 or IEC60204-1, always connect the earth ground (green/yellow wire). **Do not operate the EZ-SCREEN Type 2 without an earth ground connection.**

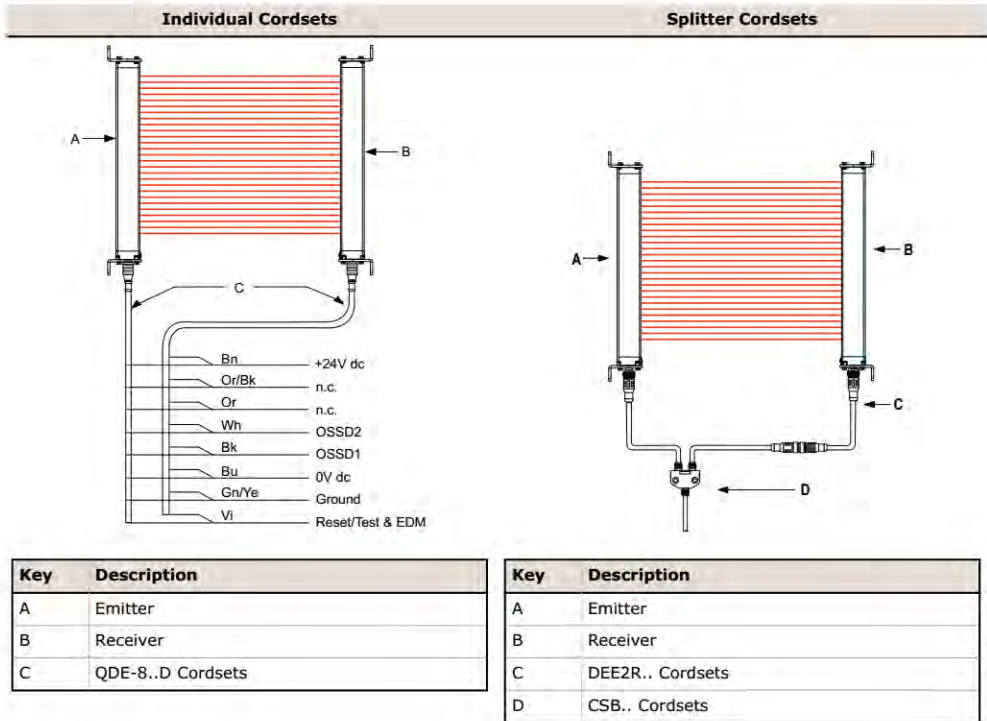
Make the electrical connections in the order described in this section. Do not remove end-caps; no internal connections are to be made. All connections are made through the M12 Euro-style quick-disconnects.

Emitter Cordset	Receiver Cordset
EZ-SCREEN Type 2 emitters have an 8-pin cordset, but only three conductors are required: • Brown = +24V dc • Blue = 0V dc • Green/Yellow = GND	Do not connect any wires to the machine control circuits (that is, OSSD outputs) at this time. For the initial checkout, only the following EZ-SCREEN Type 2 receiver conductors should be connected: • Brown = +24V dc • Blue = 0V dc • Green/Yellow = GND Additionally, connect the external reset switch, if used, or test signal contact to the Reset/Test wire (violet) and to 24V dc.



NOTE: The reset switch must be a normally closed switch that is held open for approximately 1/4 second, then closed to accomplish the reset. The switch must be capable of switching 10 to 30V dc at 30 mA.

The other wires are for an optional hookup that allows for parallel connection (color-for-color) to the receiver cable. This optional hookup provides for sensor interchangeability (or swapability) that facilitates installing either sensor at either QD connection. Besides providing similar cabling, this wiring scheme is advantageous during installation, wiring, and troubleshooting.



4.3 Initial Checkout Procedure

The initial checkout procedure must be performed by a Qualified Person. It must be performed only after configuring the System and after connecting the emitter and receiver.

The procedure is performed on two occasions:

- To ensure proper installation when the System is first installed
- To ensure proper System function whenever any maintenance or modification is performed on the System or on the machinery that is guarded by the System.

4.3.1 Configuring the System for Initial Checkout

For the initial checkout, the EZ-SCREEN Type 2 System must be checked without power available to the guarded machine. Final interface connections to the guarded machine cannot take place until the light screen system has been checked out. This may require lockout/tagout procedures (refer to OSHA1910.147, ANSI Z244-1, ISO 14118, or the appropriate standard for controlling hazardous energy). These connections will be made after the initial checkout procedure has been successfully completed.

Verify that:

- Power has been removed from (or is not available to) the guarded machine and its controls or actuators
- The machine control circuit or the Interface Module is not connected to the OSSD outputs at this time (permanent connections will be made later)

4.3.2 Initial Power-Up

1. Inspect the area near the light screen for reflective surfaces, including work pieces and the guarded machine. Reflective surfaces may cause light beams to reflect around a person in the light screen, preventing the person from being detected and not stopping the machine motion (see [Adjacent Reflective Surfaces](#) on page 16).
2. Eliminate the reflective surfaces as much as possible by relocating, painting, masking, or roughening them. Remaining problem reflections will become apparent during the trip test.
3. Verify that power is removed from the EZ-SCREEN Type 2 System and from the guarded machine and that the OSSD safety outputs are not connected.
4. Remove all obstructions from the light screen.
5. Leaving power to the guarded machine Off, make power and earth ground connections on both the emitter and receiver cables (see [Generic Emitter Wiring Diagram](#) on page 34).
6. Power up the EZ-SCREEN Type 2 System only.
7. Verify that the input power is present to both the emitter and the receiver. At least one indicator on both the emitter and the receiver should be On and the start-up sequence should cycle.
8. Watch both the emitter and the receiver LED indicators to determine the light screen alignment status.

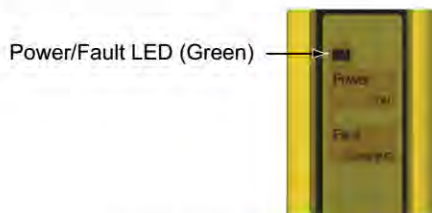


Figure 12. Emitter Status Indicators

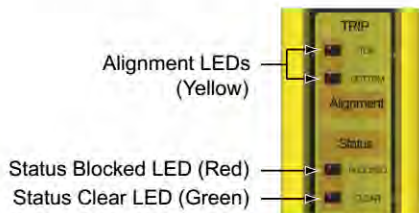


Figure 13. Receiver Status Indicators

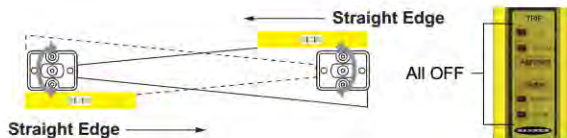
- **Lockout Condition** —on the emitter, the green Power indicator is flashing or on the receiver, the red Status Blocked indicator is flashing. See [Troubleshooting and Lockout Conditions](#) on page 41 for diagnostic information.
- **Normal Operating Mode** —to the emitter, the green Power indicator is ON.
- **Test Mode, input fault:** On the receiver, the red Status Blocked indicator is On and the green Status Clear indicator is On. Test input open at power-up.
- **Receiver Latch Condition, all optical beams clear** —on the receiver, the red Status Blocked indicator is On and both yellow Alignment indicators are flashing. For Latch Output receivers, the outputs are On only when all beams are clear and after a manual reset. If a reset routine can cause a Clear (Run) condition, optimize the alignment as described in [Optical Alignment](#) on page 26. If a Clear (Run) condition cannot be achieved, see "Blocked condition" below.
- **Clear (Run) Condition** —on the receiver, the green Status Clear indicator is On Green, and both yellow Alignment indicators are On. To optimize alignment and maximize excess gain, slightly loosen the four sensor mounting screws and rotate one sensor left and right, noting the positions where the red Status Blocked indicator turns On; repeat with the other sensor (see [Optical Alignment](#) on page 26). Center each sensor between those two positions and tighten the end cap mounting screws, making sure to maintain the positioning as the screws are tightened. The sensor lenses should directly face each other. Proceed to [Trip Test](#) on page 28 once optimum optical alignment is verified.
- **A Blocked Condition** —on the receiver, the red Status Blocked indicator is On, and both yellow Alignment indicators are On or Off. To remedy, perform the [Optical Alignment](#) on page 26 procedure.

4.3.3 Optical Alignment



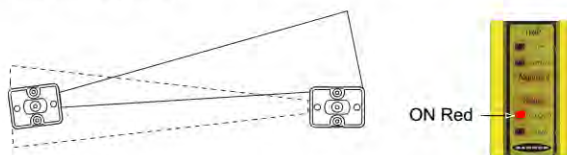
CAUTION: Ensure that no individuals are exposed to any hazard if the OSSD outputs turn ON when the emitter and receiver become aligned.

1. Verify the sensor mounting.
2. Verify the optimal alignment, adjusting sensor rotation with power ON:
 - a. Verify that the emitter and the receiver are pointed squarely at each other. Use a straight edge (for example, a level) to determine the direction the sensor is facing. The sensor face must be perpendicular to the optical axis.

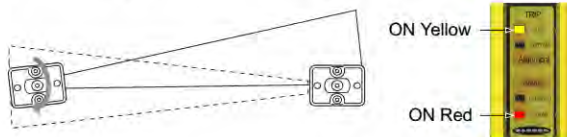


NOTE: At power-up, all indicators are tested (flash).

- b. If the synchronization beam is not aligned, the Status Blocked indicator is Red and both Alignment Indicators will be OFF.

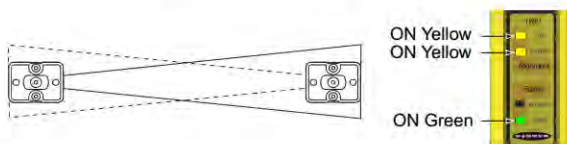


- c. If the Green Status and Yellow Alignment indicators are On, go to step "d". If not, rotate each sensor (one at a time) left and right until the Status Clear indicator comes ON Green. As the sensor rotates out of alignment, the Status Blocked indicator will turn solid Red.

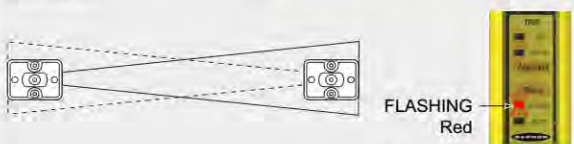


- d. To optimize alignment, note the position where the Status Blocked indicator comes On Red when the sensor is rotated both left and right. Center the sensor between the two positions, and tighten the end cap mounting screws, making sure the positioning does not drift as the screws are tightened.

For situations where alignment is difficult, a LAT-1-LP Laser Alignment Tool can be used to assist or confirm alignment by providing a visible red dot along the sensor's optical axis.



NOTE: If at any time the Red Status Blocked Indicator begins to flash steadily, the System has entered a Lockout condition. See [Troubleshooting and Lockout Conditions](#) on page 41 for further information.



4.3.4 Optical Alignment Procedure with Mirrors

EZ-SCREEN Type 2 sensors may be used with one or more corner mirrors for guarding more than one side of an area. The MSM-... and SSM-... rear-surface glass mirrors are rated at 85% efficiency. Thus, excess gain and sensing range are reduced when using mirrors; see [Use of Corner Mirrors](#) on page 16.

In addition to the standard optical alignment procedure, verify:

1. That the emitter, receiver, and all mirrors are level and plumb.
2. The middle of the defined area and the center point of the mirrors are approximately the same distance from a common reference point, such as the same height above a level floor. Ensure that there are equal amounts of mirror surface above and below the defined area such that the optical beams are not passing below or above the mirror.

During any adjustments, allow only one individual to adjust any one item at any one time.



NOTE: A LAT-1-LP Laser Alignment Tool is very helpful by providing a visible red dot along the optical axis. See [Figure 14](#) on page 28 and Banner Safety Applications Note SA104 (p/n 57477) for further information.

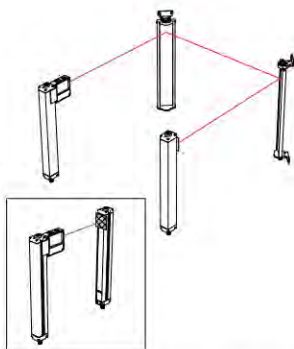


Figure 14. Optical alignment using the LAT-1-LP

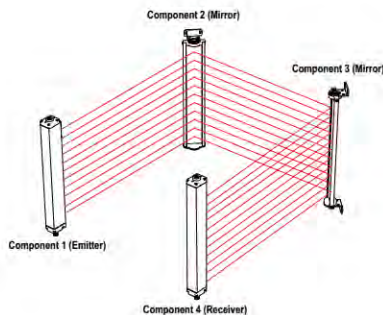


Figure 15. Corner Mirror Alignment

4.3.5 Trip Test

After optimizing the optical alignment, perform the trip test to verify the detection capability of the EZ-SCREEN Type 2 System. This test will also verify correct sensor orientation and identify optical short circuits. Once the installation has passed the trip test, the safety outputs may be connected and the commissioning checkout may be performed (initial installations only).

1. Use the 30 mm (1.18 in) diameter specified test piece supplied with the receiver .
2. Verify that the System is in Run mode, the Status Clear indicator is ON steady Green (or flashing if reduced resolution is enabled), all Zone indicators are Green, and the Yellow Status indicator is ON. A manual reset may be required in Latch mode.
3. Pass the specified test piece through the defined area in three paths: near the emitter, near the receiver, and midway between the emitter and receiver.

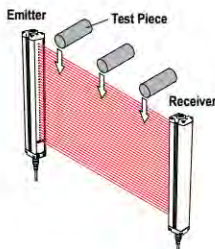


Figure 16. Trip Test

4. During each pass, while the test piece is interrupting the defined area, at least one Zone Indicator **must be Red. The Red Zone Indicator must change with the position of the test piece within the defined area.**
- Trip Output Operation: The Status Blocked indicator must turn ON Red and remain ON for as long as the test piece remains in the defined area (and the Status Clear indicator OFF during the same time). If not, the installation has failed the trip test. When the test piece is removed from the defined area, the Status Clear indicator must turn ON Green and the Status Blocked indicator must go OFF.
 - Latch Output Operation: The Status Blocked indicator must turn ON Red and remain ON for as long as the test piece remains in the defined area (and the Status Clear indicator OFF during the same time). Both Yellow indicators must remain ON steady, unless the top or bottom beam is blocked. If the top (synch) beam is blocked, both Alignment indicators will go OFF.

If the Yellow Alignment indicators begin to flash at any time while the test piece is interrupting the defined area, the installation has failed the trip test. Check for correct sensor orientation and reflective surfaces. Do not continue until the situation is corrected. In Latch Output Operation, the Status Blocked indicator will remain ON until a manual reset is performed (both Yellow Alignment indicators will be flashing).



WARNING: If Trip Test Indicates a Problem

If the EZ-SCREEN Type 2 System does not respond properly to the trip test, do not attempt to use the System. If this occurs, the System cannot be relied on to stop dangerous machine motion when a person or object enters the defined area. **Serious bodily injury or death could result.**

5. If mirrors are used in the application: Test the defined area on each leg of the sensing path (for example, emitter to mirror, between mirror and receiver, see [Figure 17](#) on page 29).

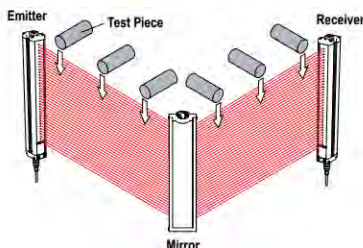


Figure 17. Trip Test with Corner Mirror

6. If the EZ-SCREEN Type 2 System passes all checks during the trip test, go on to [Electrical Connections to the Guarded Machine](#) on page 29.

4.4 Electrical Connections to the Guarded Machine

Verify that power has been removed from the EZ-SCREEN Type 2 and the guarded machine. Make the permanent electrical connections as described in [OSSD Output Connections](#) on page 30 and [FSD Interfacing Connections](#) on page 30 as required by each individual application.

Lockout/tagout procedures may be required (refer to OSHA 1910.147, ANSI Z244-1, ISO 14118, or the appropriate standard for controlling hazardous energy). Follow relevant electrical standards and wiring codes, such as the NEC, NFPA79 or IEC 60204-1.

Supply power and the external reset switch should already be connected. The EZ-SCREEN Type 2 must also have been aligned and passed the Initial Checkout, as described in [Initial Checkout Procedure](#) on page 25.

The final connections to be made are:

- OSSD outputs
- FSD interfacing
- MPCE/EDM



CAUTION: Shock Hazard

Always disconnect power from the Banner device and the guarded machine before making any connections or replacing any component. **Use extreme caution to avoid electrical shock at all times.**

4.4.1 OSSD Output Connections

Refer to the output specifications in [Receiver Specifications](#) on page 47 and the warning below before making OSSD output connections and interfacing the EZ-SCREEN Type 2 to the machine.



WARNING: Interfacing of Both OSSDs

Both OSSD (Output Signal Switching Device) outputs must be connected to the machine control so that the machine's safety-related control system interrupts the circuit to the machine primary control element(s), resulting in a non-hazardous condition.

Never wire an intermediate device(s) (for example, PLC, PES, or PC) that can fail in such a manner that there is the loss of the safety stop command, OR in such a manner that the safety function can be suspended, overridden, or defeated, unless accomplished with the same or greater degree of safety.



WARNING: OSSD Interfacing

To ensure proper operation, the Banner device output parameters and machine input parameters must be considered when interfacing the Banner device OSSD outputs to machine inputs. Machine control circuitry must be designed so that the maximum load resistance value is not exceeded and that the maximum specified OSSD Off-state voltage does not result in an On condition.

Failure to properly interface the OSSD Outputs to the guarded machine may result in serious bodily injury or death.

4.4.2 FSD Interfacing Connections

FSDs (Final Switching Devices) takes many forms. The most common are forced-guided, mechanically linked relays, or interface modules. The mechanical linkage between the contacts allows the device to be monitored by the External Device Monitoring circuit for certain failures.

Depending on the application, the use of FSDs can facilitate controlling voltage and current that differs from the OSSD outputs of the EZ-SCREEN Type 2. FSDs can also be used to control an additional number of hazards by creating multiple safety stop circuits.

Protective Stop (Safety Stop) Circuits

A protective stop (safety stop) allows for an orderly cessation of motion for safeguarding purposes, which results in a stop of motion and removal of power from the MPCEs (assuming this does not create additional hazards). A protective stop circuit typically comprises a minimum of two normally open contacts from forced-guided, mechanically linked relays, which are monitored through External Device Monitoring to detect certain failures in order to prevent the loss of the safety function. Such a circuit can be described as a "safe switching point". Typically, protective stop circuits are either single-channel, which is a series connection of at least two normally open contacts; or dual-channel, which is a separate connection of two normally open contacts. In either method, the safety function relies on the use of redundant contacts to control a single hazard. If one contact fails On, the second contact arrests the hazards and prevents the next cycle from occurring.

The interfacing of the protective stop circuits must be accomplished so that the safety function cannot be suspended, overridden, or defeated, unless accomplished in a manner of the same or greater degree of safety as the machine's safety related control system that includes the EZ-SCREEN Type 2.

The normally open safety outputs from an interface module provide a series connection of redundant contacts that form protective stop circuits for use in either single-channel or dual-channel control.

Dual-Channel Control

Dual-channel control provides the ability to electrically extend the safe switching point beyond the FSD contacts. With proper monitoring, this method of interfacing is capable of detecting certain failures in the control wiring between the safety stop circuit and the MPCEs. These failures include a short-circuit of one channel to a secondary source of energy or voltage, or a loss of the switching ability of one of the FSD outputs. Such failures may lead to a loss of redundancy, or to a complete loss of safety, if not detected and corrected.

The possibility of a failure to the wiring increases as the physical distance between the FSD safety stop circuits and the MPCEs increases, as the length or the routing of the interconnecting wires increases, or if the FSD safety stop circuits and the MPCEs are located in different enclosures. For this reason, dual-channel control with EDM monitoring should be used in any installation where the FSDs are located remotely from the MPCEs.

Single-Channel Control

Single-channel control uses a series connection of FSD contacts to form a safe switching point. After this point in the machine's safety-related control system, failures can occur that would result in a loss of the safety function (such as a short-circuit to a secondary source of energy or voltage). For this reason, single-channel control interfacing should be used only in installations where FSD safety stop circuits and the MPCEs are mounted within the same control panel, adjacent to each other, and are directly connected to each other; or where the possibility of such a failure can be excluded. If this cannot be achieved, then dual-channel control should be used.

Methods to exclude the possibility of these failures include, but are not limited to:

- Physically separating interconnecting control wires from each other and from secondary sources of power
- Routing interconnecting control wires in separate conduit, runs, or channels
- Locating all elements (modules, switches, and devices under control) within one control panel, adjacent to each other, and directly connected with short wires
- Properly installing multi-conductor cabling and multiple wires through strain relief fittings. Over-tightening of a strain-relief can cause short-circuits at that point.
- Using positive-opening or direct-drive components, installed and mounted in a positive mode

4.4.3 Machine Primary Control Elements and EDM Input

Each of the two Machine Primary Control Elements (MPCE1 and MPCE2) must be capable of immediately stopping the dangerous machine motion, irrespective of the state of the other. These two channels of machine control need not be identical, but the stop time performance of the machine (Ts, used to calculate the safety distance, see [Calculating the Safety Distance \(Minimum Distance\)](#) on page 11) must take into account the slower of the two channels. Some machines offer only one Primary Control Element. For such machines, it may be necessary to duplicate the circuit of the single MPCE, by adding a second. Refer to [Generic Wiring to FSDs \(manual reset\)](#) on page 35 and [Generic Wiring — Interface Module \(2-Channel EDM, Manual Reset\)](#) on page 36, or consult the machine manufacturer for additional information.

4.4.4 Manual Reset/Remote Test Input and EDM

A means is provided for the connection of an external remote test switch or contact (typically a normally open, held closed). Cycling this switch "turns Off" both OSSD outputs.

A single input provides the means to reset the system from a latch or lockout condition, to externally test the light screen and its interface, and to monitor external devices (EDM) for proper operation. If the System is in Run condition with outputs On, operating the switch results in a test. If the System is Latched or Locked Out, operating the switch results in a reset. If this input is connected to 0V dc or left floating, the System goes to a lockout condition on power-up. (See [Troubleshooting and Lockout Conditions](#) on page 41 for clearing lockouts.)

Connect the receiver's reset/test wire (pin 8) to the supply voltage (see [Generic Wiring to FSDs \(manual reset\)](#) on page 35 and [Generic Wiring — Interface Module \(2-Channel EDM, Manual Reset\)](#) on page 36) via the reset switch. The switch should be a normally closed (N.C.) reset switch, or contacts of the Machine Control Test circuit (typically a normally open contact held or energized closed), or the monitoring contacts of the external device(s) being verified. One switch could be used for the Reset and Test functions, or they can be separate switches. However, all switches should be mounted as specified for a reset switch (see [Reset Switch Location](#) on page 15).

Manual Reset/System Test Procedure

To operate the switch (and perform a manual reset or a system test), open the normally closed (N.C.) switch for a minimum of 1/4 second and then close it.

Manual Reset

From a Latched or Lockout condition, operating the switch results in a manual reset. Safe work procedures must require that a start-up procedure is followed and that the individual performing the reset of the guarding device verifies that the entire hazardous area is clear of all personnel, before performing each reset. If any area can not be observed from the reset switch location, additional supplementary guarding must be used: at minimum, visual and audible warnings of machine start-up.

Resetting a safe guarding device must not initiate hazardous motion.

Remote (External) Test

When in RUN mode, opening this switch for more than 1/4 second will initiate a Test cycle that turns OFF the OSSD outputs and generates an internal self-test.

- Automatic (Machine) Test: An external switch, typically a normally open contact that is held closed, is used to externally generate a test cycle of the EZ-SCREEN Type 2 and its interface. Depending on the application this switch can be a limit-style switch, a hard contact from a relay, or an output from the machine control logic.
- Manual Test: A normally closed (N.C.) momentary type switch used for manual reset can also be used to manually initiate a test cycle. This remote Test input may be useful for EZ-SCREEN Type 2 System setup and to verify machine control circuit operation.



WARNING: Test Function

A machine or automatic test of the EZ-SCREEN Type 2 and its interface may be required as determined by a risk assessment and appropriate standard (for example, ISO 14121 and EN ISO 13849-1). **Failure to test the safeguarding function at appropriate intervals may lead to the loss of the safety function.**

External Device Monitoring Hookup

It is strongly recommended that one normally closed and one normally open, forced-guided monitoring contact of each FSD and MPCE be connected to the Monitoring circuit (see [Generic Wiring to FSDs \(manual reset\)](#) on page 35 and [Generic Wiring — Interface Module \(2-Channel EDM, Manual Reset\)](#) on page 36). If this is done, proper operation of the MPCEs will be verified.

Receiver quick disconnect pin 8 provides connection for external device monitoring. External Device Monitoring (EDM) must be wired in one of two configurations: Power Monitoring or No EDM.

- Power Monitoring is a series-parallel connection of monitor contacts that are forced-guided (mechanically linked) from each device controlled by the EZ-SCREEN. The monitoring contacts should transition within 200 milliseconds of the OSSD outputs switching ON or OFF. If the transition results in an open condition on pin 8 (Reset/Test input) longer than 200 ms, a Test cycle will turn OFF the OSSD outputs. Refer to [Generic Wiring to FSDs \(manual reset\)](#) on page 35 and [Generic Wiring — Interface Module \(2-Channel EDM, Manual Reset\)](#) on page 36 for Power Monitoring hookup.
- No Monitoring. Use this configuration initially, in order to perform the initial checkout; see [Initial Checkout Procedure](#) on page 25. If No Monitoring is selected, the user must ensure that any single failure of the external devices does not result in a hazardous condition and, in such a case, a successive machine cycle will be prevented. To configure the System for No Monitoring, simply do not interface the Power Monitoring circuit (i.e., the four forced-guided normally open contacts from each device) and connect directly to +24V dc.



CAUTION: EDM Monitoring

If the system is configured for "No Monitoring," it is the user's responsibility to ensure that this does not create a hazardous situation.

4.4.5 Preparing for System Operation

After the initial trip test has been accomplished, and the OSSD safety outputs and EDM connections have been made to the machine to be controlled, the EZ-SCREEN Type 2 is ready for testing in combination with the guarded machine.

The operation of the EZ-SCREEN Type 2 with the guarded machine must be verified before the combined System and machine may be put into service. To do this, a Qualified Person must perform the Commissioning Checkout Procedure described in [Commissioning Checkout](#) on page 33.

4.4.6 Commissioning Checkout



WARNING: Do Not Use Machine Until System Is Working Properly

If all of these checks cannot be verified, do not attempt to use the safety system that includes the Banner device and the guarded machine until the defect or problem has been corrected. Attempts to use the guarded machine under such conditions may result in serious bodily injury or death.

Perform this checkout procedure as part of the System installation after the System has been interfaced to the guarded machine, or whenever changes are made to the System (either a new configuration of the EZ-SCREEN Type 2 or changes to the machine). A Qualified Person must perform the procedure. Checkout results should be recorded and kept on or near the guarded machine as required by applicable standards.

To prepare the System for this checkout:

1. Examine the guarded machine to verify that it is of a type and design compatible with the EZ-SCREEN Type 2 System. See [Examples: Inappropriate Applications](#) on page 7 for a list of misapplications.
2. Verify that the EZ-SCREEN Type 2 is configured for the intended application.
3. Verify that the safety distance (minimum distance) from the closest danger point of the guarded machine to the defined area is not less than the calculated distance, per [Calculating the Safety Distance \(Minimum Distance\)](#) on page 11.
4. Verify that:
 - Access to any dangerous parts of the guarded machine is not possible from any direction not protected by the EZ-SCREEN Type 2 System, hard (fixed) guarding, or supplemental safeguarding, and
 - It is not possible for a person to stand between the defined area and the dangerous parts of the machine, or
 - Supplemental safeguarding and hard (fixed) guarding, as described by the appropriate safety standards, are in place and functioning properly in any space (between the defined area and any hazard) which is large enough to allow a person to stand undetected by the EZ-SCREEN Type 2.
5. Verify that all reset switches are mounted outside and in full view of the guarded area, out of reach of anyone inside the guarded area, and that means of preventing inadvertent use is in place.
6. Examine the electrical wiring connections between the EZ-SCREEN Type 2 OSSD outputs and the guarded machine's control elements to verify that the wiring meets the requirements stated in [Electrical Connections to the Guarded Machine](#) on page 29.
7. Inspect the area near the defined area (including work pieces and the guarded machine) for reflective surfaces (see [Adjacent Reflective Surfaces](#) on page 16). Remove the reflective surfaces if possible by relocating them, painting, masking or roughening them. Remaining problem reflections will become apparent during the Trip Test.
8. Verify that power to the guarded machine is Off. Remove all obstructions from the defined area. Apply power to the EZ-SCREEN Type 2 System. Latch Output models: (Manual Power-Up), both Alignment indicators will be flashing Yellow. Perform a manual reset (open the reset switch for 1/4 second, then close it).
9. Observe the Status and Alignment indicators:
 - **Lockout:** Status Blocked flashing Red
 - **Blocked:** Status Blocked On Red Alignment indicators On, Off, or one of each Status Clear Off
 - **Clear:** Status Clear On Green Alignment indicators both On Status Blocked Off
 - **Latch:** (defined Status Blocked On Red Alignment indicators flashing Yellow area clear) Status Clear Off
10. A Blocked condition indicates that one or more of the beams is misaligned or interrupted. See the Alignment procedure in [Optical Alignment](#) on page 26 to correct this situation.
11. After the Green and Yellow Status indicators are On, **perform the trip test** ([Trip Test](#) on page 28) on each sensing field to verify proper System operation and to detect possible optical short circuits or reflection problems. **Do not continue until the EZ-SCREEN Type 2 passes the trip test.**



Important: Do not expose any individual to any hazard during the following checks.

**WARNING: Before Applying Power to the Machine**

Verify that the guarded area is clear of personnel and unwanted materials (such as tools) before applying power to the guarded machine. Failure to do so may result in serious bodily injury or death.

12. Apply power to the guarded machine and verify that the machine does not start up.
13. Interrupt (block) the defined area with the supplied test piece and verify that it is not possible for the guarded machine to be put into motion while the beam(s) is blocked.
14. Initiate machine motion of the guarded machine and, while it is moving, use the supplied test piece to block the defined area. Do not attempt to insert the test piece into the dangerous parts of the machine. Upon blocking any beam, the dangerous parts of the machine must come to a stop with no apparent delay.
15. Remove the test piece from the beam; verify that the machine does not automatically restart, and that the initiation devices must be engaged to restart the machine.
16. Remove electrical power to the EZ-SCREEN Type 2. Both OSSD outputs should immediately turn Off, and the machine must not be capable of starting until power is re-applied to the EZ-SCREEN Type 2.
17. Test the machine stopping response time, using an instrument designed for that purpose, to verify that it is the same or less than the overall system response time specified by the machine manufacturer. A Banner Applications Engineer can recommend a suitable instrument.

Do not continue operation until the entire checkout procedure is complete and all problems are corrected.

4.5 Reference Wiring Diagrams

4.5.1 Generic Emitter Wiring Diagram

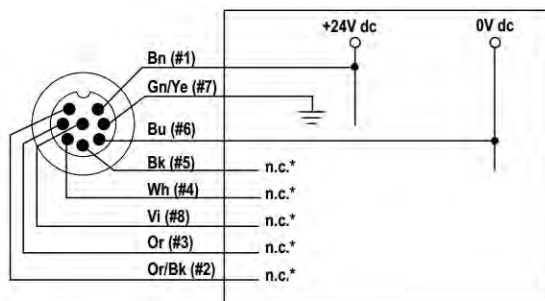
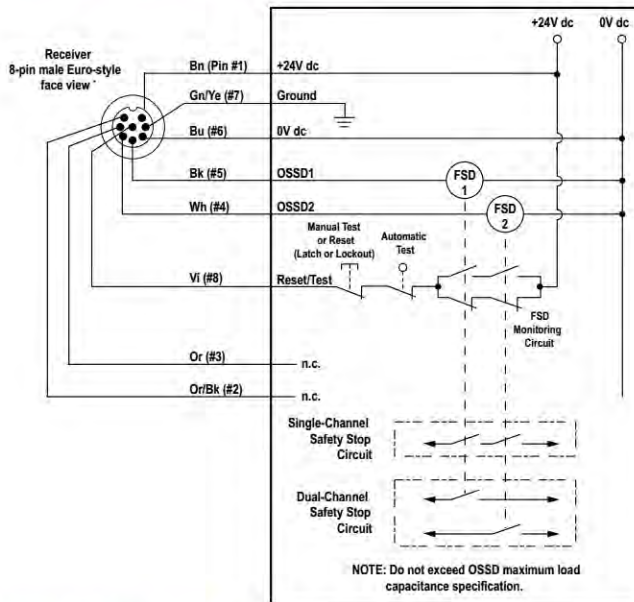


Figure 18. Emitter—Generic Wiring Diagram



NOTE: *Pins 2, 3, 4, 5, and 8 are not connected or are connected in parallel to the same color wire from the receiver cable.

4.5.2 Generic Wiring to FSDs (manual reset)



*See *Single-Ended (Machine Interface) Cordsets* on page 50 for available cordsets.

Figure 19. Generic Wiring to FSDs (manual reset)



NOTE: Pins 2 and 3 are not connected, or are connected in parallel to the same color wire from the emitter cordset and properly terminated.

4.5.3 Generic Wiring — Interface Module (2-Channel EDM, Manual Reset)

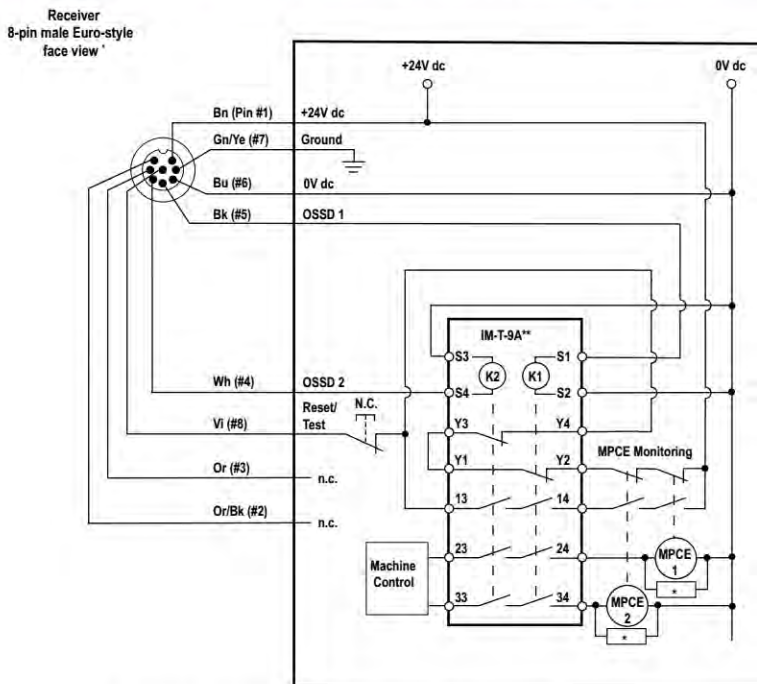


Figure 20. Generic Wiring — Interface Module (2-Channel EDM, Manual Reset)



NOTE:

- Pins 2 and 3 are not connected, or are connected in parallel to the same color wire from the emitter cordset and properly terminated.
- Installation of transient (arc) suppressors across the coils of MPCE1 and MPC2 is recommended.
- See [Single-Ended \(Machine Interface\) Cordsets](#) on page 50 for available cordset information

Other interfacing modules and solutions are available, see [Accessories](#) on page 50.



WARNING: Use of Transient Suppressors

If transient suppressors are used, they MUST be installed across the coils of the machine control elements. NEVER install suppressors directly across the contacts of the IM-T-...A Module. It is possible for suppressors to fail as a short circuit. If installed directly across the contacts of the IM-T-...A Module, a short-circuit suppressor creates an unsafe condition.

5 System Operation

5.1 Security Protocol

Certain procedures for installing, maintaining, and operating the EZ-SCREEN Type 2 must be performed by either Designated Persons or Qualified Persons.

A **Designated Person** is identified and designated in writing, by the employer, as being appropriately trained and qualified to perform system resets and the specified checkout procedures on the EZ-SCREEN Type 2. The Designated Person is empowered to:

- Perform manual resets and hold possession of the reset key (see [Reset Procedures](#) on page 37)
- Perform the Daily Checkout Procedure

A **Qualified Person**, by possession of a recognized degree or certificate of professional training, or by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve problems relating to the installation of the EZ-SCREEN Type 2 System and its integration with the guarded machine. In addition to everything for which the Designated Person is empowered, the Qualified Person is empowered to:

- Install the EZ-SCREEN Type 2 System
- Perform all checkout procedures
- Make changes to the internal configuration settings
- Reset the System following a Lockout condition

5.2 Reset Procedures

System resets are performed using an external reset switch. This switch must be located outside the guarded area, and must not be within reach from within the guarded area (see [Reset Switch Location](#) on page 15). Its location should provide a clear view of the entire safeguarded area. If any hazardous areas are not in view from the switch location, additional means of safeguarding must be provided. The switch should be protected from accidental or unintended actuation (for example, through the use of rings or guards).

If supervisory control of the reset switch is required, a key switch may be used, with the key kept in the possession of a Designated or Qualified Person. Using a key switch provides some level of personal control, since the key may be removed from the switch. This hinders a reset while the key is under the control of an individual, but must not be relied upon solely to guard against accidental or unauthorized reset. Spare keys in the possession of others or additional personnel entering the safeguarded area unnoticed may create a hazardous situation.

5.2.1 Receiver Resets

The EZ-SCREEN Type 2 receiver has a Reset input, pin 8 (violet wire), that provides for a manual reset input signal.

Receiver manual resets are required in the following situations:

- Trip Output operation – only after a Lockout (see [Troubleshooting and Lockout Conditions](#) on page 41 for causes).
- Latch Output operation – at power-up, after each Latch condition occurs, or after a Lockout.

Reset Routine

To reset the receiver, close the reset switch for 1/4 to 2 seconds, then open it. An alternative method to reset either component is to power the sensor down, then power it up.



NOTE: Closing the reset switch too long will cause the sensor to ignore the reset request; the switch must be closed from 1/4 seconds to 2 seconds, but no longer.

5.2.2 Emitter Resets

In the rare occurrence that an emitter requires a reset, power the sensor down, then power it up. Emitter resets are needed only if a Lockout occurs.

5.3 Status Indicators

The emitter has one LED and the receiver has four, to provide an ongoing indication of light screen and system operation. In normal operation, the status indicators are as described below and as shown in [Figure 21](#) on page 38. Additional LED condition combinations indicate errors or faults; refer to [Troubleshooting and Lockout Conditions](#) on page 41.

5.3.1 Receiver

Alignment Indicators

Two Yellow Alignment indicators (Top and Bottom) tell the alignment status of the top and bottom beams in the light screen. This is helpful for sensor alignment: first align the Top beam (the sync beam), then the bottom beam. The Alignment indicators also flash together to indicate a manual reset is needed (Latch output models).

Indicator	Color	On	Flashing	Off
Top Alignment	Yellow	Top (sync) beam is aligned and clear	(Both together) System is aligned; waiting for manual reset (Latch models)	Top (sync) beam is blocked or misaligned
Bottom Alignment	Yellow	Bottom beam is aligned and clear		Bottom beam is blocked or misaligned; sync beam possibly blocked

Status Indicators

Two Status indicators (Blocked and Clear) work together to indicate the status of the light screen.

Indicator	Color	On	Flashing	Off
Clear Status	Green	Light screen aligned and clear; outputs On	Test mode (with Red On)	Light screen blocked; outputs Off
Blocked Status	Red	Light screen blocked; outputs Off	Lockout	Light screen aligned and clear; outputs On

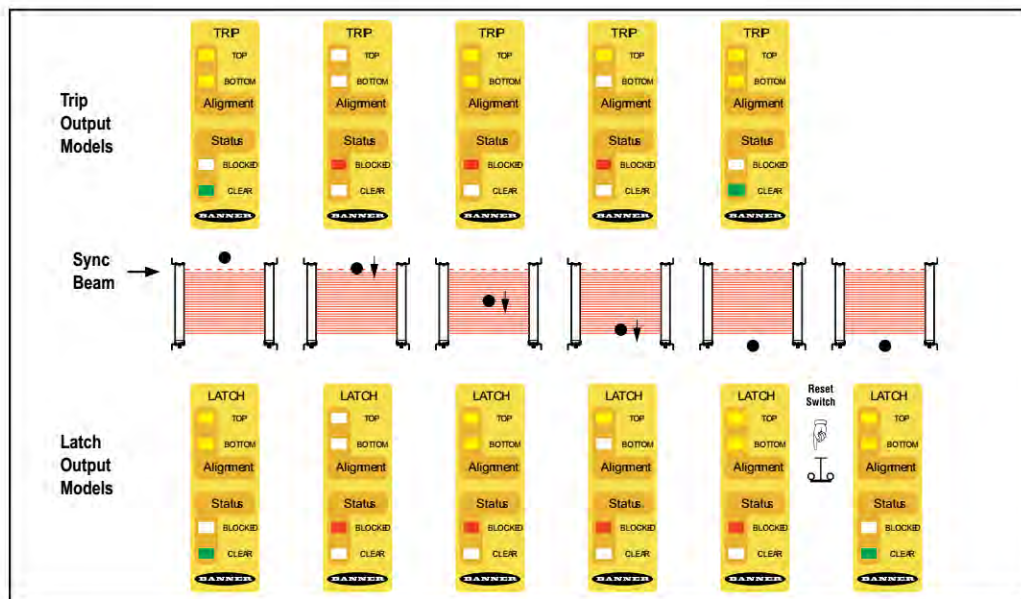


Figure 21. Status Indicator behavior during the trip test

5.3.2 Emitter

Power/Fault Indicator: Green LED indicates whether power is applied or a Fault condition exists.

Emitter				
Indicator	Color	ON	Flashing	OFF
Power/Fault	Green	Power is applied	Fault indication	No Power

5.4 Normal Operation

5.4.1 System Power-Up

Apply power and verify that the Status Blocked LED is OFF, and Status Clear LED is ON Green.

Trip Output Systems: When power is applied, each sensor will conduct self-tests to detect critical internal faults and prepare for operation. If either sensor detects a critical fault, scanning ceases, the receiver outputs remain Off and diagnostic information is displayed via the LEDs; see [Troubleshooting and Lockout Conditions](#) on page 41). If no faults are detected, the receiver will look for an optical sync pattern from the emitter. If the receiver is aligned and receiving the proper sync pattern, it enters Run mode and begins scanning to determine the blocked or clear status of each beam. No manual reset operation is required.

Latch Output Systems: When power is applied, each sensor will conduct self-tests to detect critical internal faults and prepare for operation. If either sensor detects a critical fault, scanning ceases, the receiver outputs remain Off and diagnostic information is displayed via the LEDs; see [Troubleshooting and Lockout Conditions](#) on page 41). If no faults are detected, the receiver will look for an optical sync pattern from the emitter. If the receiver is aligned and receiving the proper sync pattern, it begins scanning to determine the blocked or clear status of each beam. When all beams are aligned, the Yellow Alignment indicators will flash to indicate the System is waiting for a manual reset. After a valid manual reset, the System enters Run mode and begins scanning.

5.4.2 Run Mode

Trip Output Systems: If any beams become blocked while the System is running, the receiver outputs turn Off within the stated System response time (see [EZ-SCREEN Type 2 Models With Response Times](#) on page 12). When all the beams become clear, the receiver outputs come back ON. No resets of any kind are needed. All required machine control resets are provided by the machine control circuit.

Latch Output Systems: If any beams become blocked while the System is running, the receiver outputs turn Off within the stated System response time (see [EZ-SCREEN Type 2 Models With Response Times](#) on page 12). When all the beams become clear, the receiver Clear Status indicator be ON Green and the Alignment indicators will flash, indicating the System is waiting for a manual latch reset. When a valid reset signal is received and all beams remain clear, the receiver outputs turn ON.

Internal Faults (Lockouts): If either sensor detects a critical fault, scanning ceases, the receiver outputs turn Off and diagnostic information is displayed via the LEDs. See [Troubleshooting and Lockout Conditions](#) on page 41 for resolution of error/fault conditions.

5.4.3 Manual Reset Procedure

Open the reset switch for at least 1/4 second, then close it.

5.5 Periodic Checkout Requirements

To ensure continued reliable operation, the System must be checked out periodically.

At every shift change, power-up, and machine setup change, the Daily Checkout should be performed; this checkout may be performed by a Designated or Qualified Person.

Semi-annually, the System and its interface to the guarded machine should be thoroughly checked out; this checkout must be performed by a Qualified Person (see [Checkout Procedure Schedule](#) on page 45). A copy of these test results should be posted on or near the machine.

Whenever changes are made to the System (either a new configuration of the EZ-SCREEN Type 2 System or changes to the machine), the Commissioning Checkout should be performed (see [Commissioning Checkout](#) on page 33).



NOTE: Verify Proper Operation

The EZ-SCREEN Type 2 can operate as it is designed only if it and the guarded machine are operating properly, both separately and together. It is the user's responsibility to verify this, on a regular basis, as instructed in [Checkout Procedure Schedule](#) on page 45 . Failure to correct such problems can result in an increased risk of harm.

Before the System is put back into service, verify that the EZ-SCREEN Type 2 System and the guarded machine perform exactly as outlined in the checkout procedures and any problem(s) are found and corrected.

6 Troubleshooting and Maintenance

6.1 Troubleshooting and Lockout Conditions

Evaluate status indicators per [Status Indicators](#) on page 37 .

A Lockout condition causes all of the EZ-SCREEN Type 2 OSSD outputs to turn or remain OFF, sending a stop signal to the guarded machine. Each sensor provides diagnostic information, via the LEDs, to assist in the identification of the cause(s) of lockouts. Lockout conditions are indicated as shown in [Table 2](#) on page 42.

6.2 Recovery Procedures

To recover from a Lockout condition, correct all errors and perform sensor resets as indicated below.

6.2.1 Receiver (System Reset)

Open the Reset switch for 1/4 second and then close it, or (for Trip Output models not using a reset button) power the sensor down, wait a second or two, then power it up.

6.2.2 Emitter Reset

Power the sensor down, wait a second or two, and then power it up (in the unlikely event that an emitter reset is needed).

**WARNING: Lockouts and Power Failures**

Power failures and Lockout conditions are indication of a problem and must be investigated immediately by a Qualified Person. Attempts to continue to operate machinery by bypassing the EZ-SCREEN Type 2 System or other safeguards is dangerous and could result in an increased risk of harm.

**WARNING: Shut Down Machinery Before Servicing**

The machinery to which the EZ-SCREEN Type 2 System is connected must not be operating at any time during major service or maintenance. This may require lockout/tagout procedures (refer to OSHA1910.147, ANSI Z244-1, ISO 14118, or the appropriate standard for controlling hazardous energy). Servicing the EZ-SCREEN Type 2 while the hazardous machinery is operational could result in serious bodily injury or death.

Table 2: Troubleshooting

Display	LED Status	Possible Cause and Appropriate Action
Emitter		
Power/Fault	Green flashing	Emitter Failure • Check power supply for low or erratic voltage, or excessive electrical noise. • Verify that the sensor has a good earth ground. If condition continues, contact Factory.
Power/Fault	Green OFF	Power Supply Failure • Check power supply.
Receiver		
Alignment Top Bottom Status Blocked Clear	Yellow flashing Yellow flashing Red flashing Green OFF	Output Fault • Check output connections. • Check for a short between OSSD1 and OSSD2 or to a secondary source of power. • In the event of connection to a capacitive load greater than 0.1 μF, contact Factory. • Open Reset/Test for at least 1/4 second and close. If condition continues, contact Factory
Alignment Top Bottom Status Blocked Clear	Yellow flashing Yellow OFF Red flashing Green OFF	Optical Fault • Open Reset/Test for at least 1/4 second and close. • Check for optical interference or noise. If condition continues, contact Factory.
Alignment Top Bottom Status Blocked Clear	Yellow OFF Yellow OFF Red flashing Green OFF	Internal Fault • Open Reset/Test for at least 1/4 second and close. • Check power supply for low or erratic voltage, or excessive electrical noise. • Verify that the sensor has a good earth ground. If condition continues, contact Factory.
Alignment Top Bottom Status Blocked Clear	Yellow OFF Yellow OFF Red ON Green ON	Reset/Test Input Fault • Reset/Test input open at power-up. • Switch device OFF, verify Reset/Test input is connected to +24V dc (e.g., the reset button or switch is closed) and reapply power.
Alignment Top Bottom Status Blocked Clear	Yellow OFF Yellow OFF Red ON Green flashing	Test Mode • Reset/Test input is open.
Alignment Top Bottom Status Blocked Clear	Yellow OFF Yellow OFF Red OFF Green OFF	Power Supply Failure • Check power supply.

6.3 Electrical and Optical Noise

The EZ-SCREEN Type 2 is designed and manufactured to be highly resistant to electrical and optical noise and to operate reliably in industrial settings. However, serious electrical and/or optical noise may cause a random In very extreme electrical noise cases, a Lockout is possible. To minimize the effects of transitory noise, the EZ-SCREEN Type 2 responds to noise only if the noise is detected on multiple consecutive scans.

If random nuisance Trips occur, check the following:

- Poor connection between the sensor and earth ground
- Optical interference from adjacent light screens or other photoelectrics
- Sensor input or output wires routed too close to noisy wiring

6.3.1 Sources of Electrical Noise

Checking for sources of electrical noise: It is very important that the light screen sensors have a good earth ground. Without this, the System can act like an antenna and random Trips and Lockouts can occur.

All EZ-SCREEN Type 2 wiring is low voltage; running these wires alongside power wires, motor/servo wires, or other high-voltage wiring, can inject noise into the EZ-SCREEN Type 2 System. It is good wiring practice (and may be required by code) to isolate EZ-SCREEN Type 2 wires from high-voltage wires.

The Banner model BT-1 Beam Tracker (see [Alignment Aids](#) on page 57) is a very good tool for detecting electrical noise. It can be used to detect electrical transient spikes and surges. Cover the lens of the BT-1 with electrical tape to block optical light from entering the receiver lens. Press the RCV button on the BT-1 and position the Beam Tracker on the wires going to the EZ-SCREEN Type 2 or any other nearby wires. The noise caused by switching of the inductive loads should be addressed by installing proper transient suppression across the load.

6.3.2 Sources of Optical Noise

Checking for sources of optical noise: Turn off the emitter, completely block the emitter, or open the Test input, then use a Banner BT-1 Beam Tracker (see [Alignment Aids](#) on page 57) to check for light at the receiver. Press the RCV button on the BT-1 and move it across the full length of the receiver's sensing window. If the BT-1's indicator lights, check for emitted light from other sources (other safety light screens, screens or points, or standard photoelectric sensors).

6.4 Servicing and Maintenance

6.4.1 Cleaning

EZ-SCREEN Type 2 emitters and receivers are constructed of aluminum with a yellow painted finish and are rated IP65. Lens covers are acrylic. Emitters and receivers are best cleaned using mild detergent or window cleaner and a soft cloth. Avoid cleaners containing alcohol, as they may damage the acrylic lens covers.

6.4.2 Banner Engineering Corp Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp.

6.4.3 Warranty Service

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.



Important: If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

6.4.4 Manufacturing Date

Every EZ-SCREEN Type 2 produced is marked with a code that defines the week of manufacture and manufacturing location.

The code format (U.S. Standard format) is:

YYWWL

- YY = year of manufacture, 2 digits
- WW = week of manufacture, 2 digits
- L = manufacturing location, 1 digit

Example: 1135H = 2011, week 35, Huron

6.4.5 Disposal

Devices that are no longer in use should be disposed of according to the applicable national and local regulations.

7 Checkout Procedure Schedule

This section lists the schedule of checkout procedures and describes where each procedure is documented. Checkouts must be performed as described. Results should be recorded and kept in the appropriate place (for example, near the machine, and/or in a technical file).

7.1 Schedule of Checkouts

Checkout cards and this manual can be downloaded at <http://www.bannerengineering.com>.

Checkout Procedure	When to Perform	Where to Find the Procedure	Who Must Perform the Procedure
Trip Test	- At Installation - Any time the System, the guarded machine, or any part of the application is altered.	<i>Trip Test</i> on page 28	Qualified Person
Commissioning Checkout	- At Installation - Whenever changes are made to the System (for example, either a new configuration of the EZ-SCREEN Type 2 or changes to the guarded machine).	<i>Commissioning Checkout</i> on page 33	Qualified Person
Shift/Daily Checkout	- At each shift change - Machine setup change - Whenever the System is powered up During continuous machine run periods, this checkout should be performed at intervals not to exceed 24 hours.	Daily Checkout Card (Banner p/n 122450) A copy of the checkout results should be recorded and kept in the appropriate place (for example, near or on the machine, in the machine's technical file).	Designated Person or Qualified Person
Semi-Annual Checkout	Every six months following System installation, or whenever changes are made to the System (either a new configuration of the EZ-SCREEN Type 2 or changes to the machine).	Semi-Annual Checkout Card (Banner p/n 122451) A copy of the checkout results should be recorded and kept in the appropriate place (for example, near or on the machine, in the machine's technical file).	Qualified Person

8 Specifications and Accessories

An EZ-SCREEN Type 2 System includes a compatible emitter and receiver (equal length; available separately or in pairs), and two cables. Mounting hardware is included with each emitter and receiver. Interfacing solutions include IM-T-.. modules, or redundant positively guided contactors; see [Interface Modules](#) on page 52.

8.1 Specifications

8.1.1 General Specifications

Short Circuit Protection

All inputs and outputs are protected from short circuits to +24 V dc or dc common

Electrical Safety Class

III (per IEC 61140: 1997)

Safety Rating

Type 4 per IEC 61496-1, -2
Category 4 PL e per EN ISO13849-1
SIL3 per IEC 61508; SIL CL3 per IEC 62061

Operating Range

0.2 to 15 m (8 in. to 50 ft) — Range decreases with use of mirrors and/or lens shields:

- Lens shields — approx 10% less range per shield
- Glass-surface mirrors — approx 8% less range per mirror

See the specific mirror datasheet for more information.

Resolution

14 mm or 25 mm, depending on model (Reduced Resolution Off)

Effective Aperture Angle (EAA)

Meets Type 4 requirements per IEC 61496-2, Section 5.2.9

Ambient Light Immunity

10,000 lux at 5° angle of incidence

Operating Conditions

Temperature: 0 °C to +55 °C (+32 °F to +131 °F)
Humidity: 95% maximum relative humidity (non-condensing)

Strobe Light Immunity

Totally immune to one Federal Signal Corp. "Fireball" model FB2PST strobe

Response Time

Dependent on number of beams (see [EZ-SCREEN Type 2 Models With Response Times](#) on page 12)

Enclosure

Extruded aluminum housing with yellow polyester powder finish standard and well-sealed, rugged die-cast zinc end caps, acrylic lens cover, copolyester access cover

Environmental Rating

IP65

Shock and Vibration

Components have passed vibration and shock tests according to IEC 61496-1. This includes vibration (10 cycles) of 10-55 Hz at 0.35 mm (0.014 in) single amplitude (0.70 mm peak-to-peak) and shock of 10 g for 16 milliseconds (6,000 cycles).

Mounting Hardware

None listed

Cables and Connections

None listed

Certifications



Safety Rating

Type 2 per IEC 61496-1, -2; Category 2 PLd per EN ISO 13849-1; SIL2 per IEC 61508

	8 Beams	96 Beams
MTTF _d (EN ISO 13849-1)	284.14 yr.	47.65 yr.
Mission Time, T _m	20 years	
PFH (h ⁻¹) (IEC 61508)	6.9 x 10 ⁻⁸	6.5 x 10 ⁻⁷

8.1.2 Emitter Specifications

Supply Voltage at the Device

24 V dc ±20% (use a SELV-rated power supply according to EN IEC 60950). The external voltage supply must be capable of buffering brief mains interruptions of 20 ms, as specified in IEC/EN 60204-1.

Supply Current

60 mA max. exclusive of Fault Out load

Wavelength of Emitter Elements

Infrared LEDs, 850 nm at peak emission

8.1.3 Receiver Specifications

Supply Voltage at the Device

24 V dc $\pm 15\%$ (use a SELV-rated power supply according to EN IEC 60950).

Residual Ripple

N/A

Supply Current (no load)

150 mA max., exclusive of OSSD1 and OSSD2 loads (up to additional 0.5 A each) and Aux Out load (up to 0.25 A)

Response Time

N/A

EDM Input

+24 V dc signals from external device contacts can be monitored (one-channel or no monitoring) via EDM1 terminal in the receiver.

Reset Input

Reset input must be high for $\frac{1}{4}$ to 2 seconds and then low to reset the receiver

Auto Reset (Trip Output) Models: Test/Reset

Manual Reset (Latch Output) Models: Test/Restart/Reset

Output Signal Switching Devices (OSSDs)

Two redundant solid-state 24 V dc, 0.5 A max. sourcing OSSD (Output Signal Switching Device) safety outputs. (Use optional interface modules for ac or larger dc loads.) Capable of the Banner "Safety Handshake".

ON-State voltage: $\geq V_{in} - 1.5V$ dc

OFF-State, maximum allowed voltage: 1.7V dc max.

Max. load capacitance: 1.0 μF

Min. load inductance: 10 H

Leakage Current: 0.50 mA max.

OSSD test pulse width: 100 to 300 microseconds typical

OSSD test pulse period: 10 ms to 22 ms (varies with number of beams)

Auxiliary Output Switching Capacity (OSSD/Fault)

Current-sourcing (PNP) solid-state output, 24 V dc at 250 mA max.

Controls and Adjustments

Scan Code selection: 2-position switch (code 1 or 2). Factory default position is code 1

Trip/Latch Output selection: Redundant switches. Factory default position is T (trip).

Reduced Resolution: Redundant switches. Factory default position is Off.

Aux./Fault: 2-position switch. Factory default position is Aux.

Invert Display: 2-position switch. Factory default position is Off (standard display).

Status Indicators

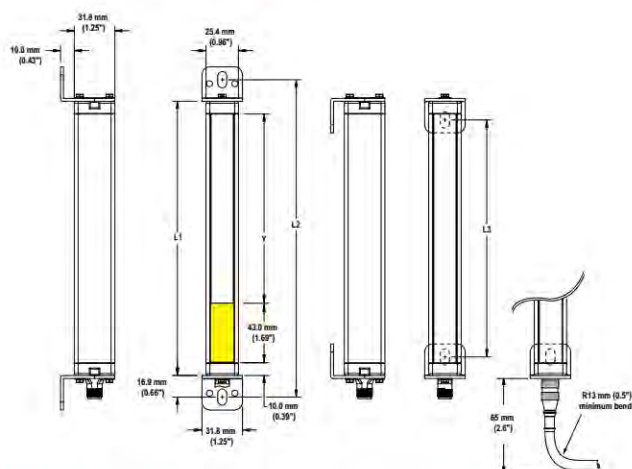
Yellow Reset Indicator: Indicates whether the System is ready for operation or requires a reset

Bi-color (Red/Green) Status indicator: indicates general system and output status

Bi-color (Red/Green) Zone Status indicators: indicate condition (clear or blocked beam) of a defined group of beams

7-Segment Diagnostic indicator (1 digit): indicates proper operation, scan code, error code, or total number of blocked beams

8.1.4 Emitter and Receiver Dimensions



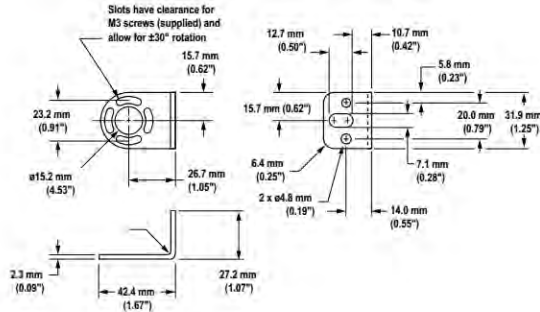
Emitter or Receiver Model	Housing Length L1	Distance Between Bracket Holes L2 L3		Defined Area† Y
LS2...-150	215 mm (8.5 in)	249 mm (9.8 in)	186 mm (7.3 in)	150 mm (5.9 in)
LS2...-300	365 mm (14.4 in)	349 mm (13.7 in)	336 mm (13.2 in)	300 mm (11.8 in)
LS2...-450	515 mm (20.3 in)	549 mm (21.6 in)	486 mm (19.1 in)	450 mm (17.7 in)
LS2...-600	665 mm (26.2 in)	699 mm (27.5 in)	636 mm (25.0 in)	600 mm (23.6 in)
LS2...-750	815 mm (32.1 in)	849 mm (33.4 in)	786 mm (30.9 in)	750 mm (29.5 in)
LS2...-900	964 mm (38.0 in)	998 mm (39.3 in)	935 mm (36.8 in)	900 mm (35.4 in)
LS2...-1050	1114 mm (43.9 in)	1148 mm (45.2 in)	1085 mm (42.7 in)	1050 mm (41.3 in)
LS2...-1200	1264 mm (49.8 in)	1298 mm (51.1 in)	1235 mm (48.6 in)	1200 mm (47.2 in)
LS2...-1350	1414 mm (55.7 in)	1448 mm (57.0 in)	1385 mm (54.6 in)	1350 mm (53.1 in)
LS2...-1500	1563 mm (61.5 in)	1597 mm (62.9 in)	1534 mm (60.4 in)	1500 mm (59.1 in)
LS2...-1650	1713 mm (67.4 in)	1747 mm (68.8 in)	1684 mm (66.3 in)	1650 mm (65.0 in)
LS2...-1800	1863 mm (73.3 in)	1897 mm (74.7 in)	1834 mm (72.2 in)	1800 mm (70.9 in)

8.1.5 Bracket Dimensions

The following are end cap and center bracket dimensions for brackets supplied with each EZ-SCREEN Type 2 emitter or receiver. All brackets have a thickness of 2.3 mm, and are black zinc plated with a chromate dip finish. Bracket mounting hardware is included.

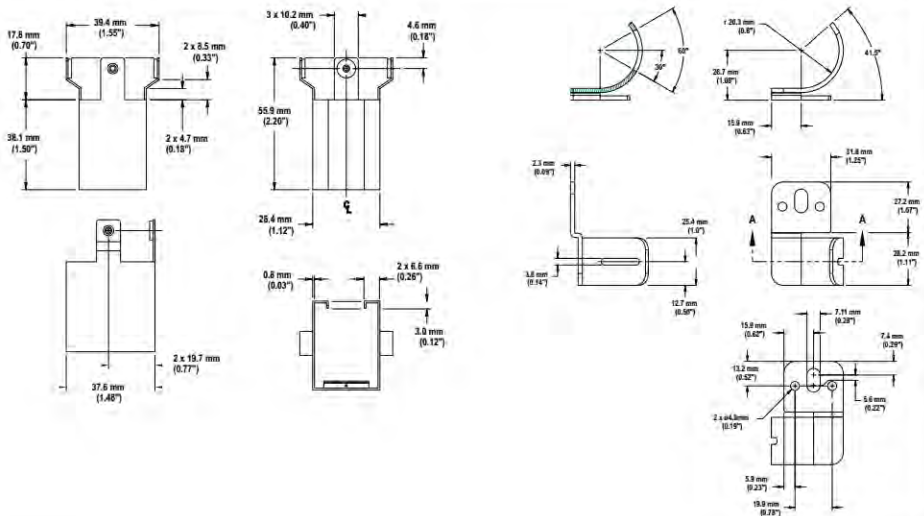
Standard End Cap Brackets

Model USMB-1



Standard Center Brackets

Model Number	Description
USCMB-1	1 bracket is included for sensors 600-900 mm long
USCMB-2	2 brackets are included for sensors 1050-1350 mm long
USCMB-3	3 brackets are included for sensors 1500-1800 mm long



8.2 Accessories

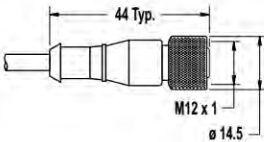
Additional interfacing solutions and accessories continue to be added; refer to <http://www.bannerengineering.com> for a current list.

8.2.1 Cordsets

Single-Ended (Machine Interface) Cordsets

Single-Ended (Machine Interface) Cordsets (one cable for each emitter and receiver).

Overmold and cables are PVC-jacketed. Cables are unterminated on one end to interface with guarded machine.

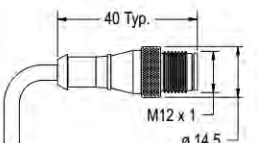
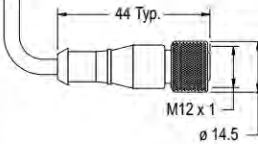
8-Pin Threaded M12/Euro-Style Cordsets				
Model	Length	Style	Dimensions	Pinout
QDE-815D	4.57 m (15 ft)	Straight		
QDE-825D	7.62 m (25 ft)			
QDE-850D	15.2 m (50 ft)			
QDE-875D	22.9 m (75 ft)			
QDE-8100D	30.5 m (100 ft)			
				1 = Brown 2 = Or/Bl 3 = Orange 4 = White 5 = Black 6 = Blue 7 = Gn/Ye 8 = Violet

QDE-8..D Pinout/Color Code			European M12 Specification ¹			Connector (female face view)
Pin	Color	Function	Pin	Color	Function	
1	Bn	+24V dc	1	Wh	+24V dc	
2	Or/Bk	n.c.	2	Bn	n.c.	
3	Or	n.c.	3	Gn	n.c.	
4	Wh	OSSD #2	4	Ye	OSSD #2	
5	Bk	OSSD #1	5	Gy	OSSD #1	
6	Bu	0V dc	6	Pk	0V dc	
7	Gn/Ye	Gnd/Chassis	7	Bu	Gnd/Chassis	
8	Vi	Reset	8	Rd	Reset	

¹ The European M12 Specification pin assignment and color codes are listed for reference only. You must verify the suitability of these cables for each application.

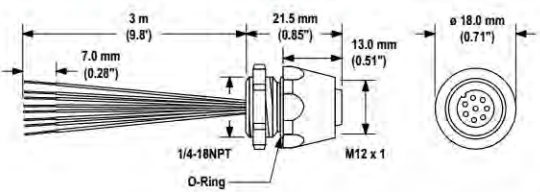
Double-Ended Cables

Double-ended cables are generally used to interconnect with a bulkhead connector (see below). They are also useful for extending either the branch or trunk cables of a model CSB splitter cordset (see [Splitter Cordsets](#) on page 51).

8-Pin Threaded M12/Euro-Style Cordsets—Double Ended				
Model (8-pin/8-pin) ²	Length	Style	Dimensions	Pinout
DEE2R-81D	0.31 m (1 ft)	Female Straight/ Male Straight		Female  Male  1 = White 5 = Gray 2 = Brown 6 = Pink 3 = Green 7 = Blue 4 = Yellow 8 = Red
DEE2R-83D	0.91 m (3 ft)			
DEE2R-88D	2.44 m (8 ft)			
DEE2R-815D	4.57 m (15 ft)			
DEE2R-825D	7.62 m (25 ft)			
DEE2R-850D	15.2 m (50 ft)			
DEE2R-875D	22.9 m (75 ft)			
DEE2R-8100D	30.5 m (100 ft)			

Bulkhead Connector

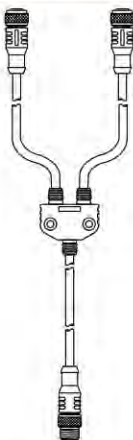
Connector for panel connection of EZ-SCREEN Type 2 emitter and receiver cables.

Model	Connection	Dimensions
PMEF-810D	8-pin Euro-style female connector 3 m (10 ft) wires, cut to length (Banner color code); 22 AWG/0.33 mm ² .	

Splitter Cordsets

Model CSB splitter cordsets allow easy interconnection between an EZ-SCREEN Type 2 8-pin receiver and its 8-pin emitter, providing a single "homerun" cable for the optional "swappable" connection. The model DEE2R-... double-ended cables described on page 8 may be used to extend the lengths of the QD trunk, branch #1, or branch #2. Branch #1 and branch #2 cable sections are 300 mm/1 ft long. The model QDE-8-...D single-ended cables may be used to extend the QD trunk for cut-to-length applications.

² Standard cordsets are yellow PVC with black overmold. For black PVC and overmold, add suffix "B" to model number (example, **DEE2R-81DB**).

Model Number	Length	Wire	
CSB-M1281M1281	0.3 m (1 ft) Trunk	22 AWG/ 0.33 mm ²	
CSB-M1288M1281	2.44 m (8 ft) Trunk		
CSB-M12815M1281	4.57 m (15 ft) Trunk		
CSB-M12825M1281	7.62 m (25 ft) Trunk		
CSB-UNT825M1281	7.62 m (25 ft) Trunk (unterminated)		

Pin #1 (+24V dc)	Pin #1 (+24V dc)
Pin #2 (n.c.)	Pin #2 (n.c.)
Pin #3 (n.c.)	Pin #3 (n.c.)
Pin #4 (OSSD#2)	Pin #4 (OSSD#2)
Pin #5 (OSSD#1)	Pin #5 (OSSD#1)
Pin #6 (0V dc)	Pin #6 (0V dc)
Pin #7 (GND)	Pin #7 (GND)
Pin #8 (RESET)	Pin #8 (RESET)
M12 Male	M12 Female
or	
unterminated	Pin #1 (+24V dc)
	Pin #2 (n.c.)
	Pin #3 (n.c.)
	Pin #4 (OSSD#2)
	Pin #5 (OSSD#1)
	Pin #6 (0V dc)
	Pin #7 (GND)
	Pin #8 (RESET)
	M12 Female

8.2.2 Interface Modules

Interface modules provide forced-guided, mechanically-linked relay (safety) outputs for the EZ-SCREEN Type 2 System. See Banner data sheet p/n 62822 for more information.

Model	Description
IM-T-9A	Interface module, 3 N.O. redundant-output 6 amp contacts
IM-T-11A	Interface module, 2 N.O. redundant-output 6 amp contacts, plus 1 N.C. auxiliary contact

8.2.3 Contactors

If used, two contactors per EZ-SCREEN Type 2 System are required.

Model	Description
11-BG00-31-D-024	10 amp positive-guided contactor, 3 N.O., 1 N.C.
BF1801L024	18 amp positive-guided contactor, 3 N.O., 1 N.C. (N.C. contact rated at 10 amps)

8.2.4 Muting Module

Provides muting capability for the EZ-SCREEN Type 2 See Banner EZ-SCREEN Type 2 muting module manual, p/n 123894 for more information and additional cabling options

MM2-TA-12B		Muting module (2 OSSD outputs, 2 or 4 muting inputs, USSI, override input)
DESE5-508D	2.5 m (8 ft)	Cable to interface EZ-SCREEN Type 2 Receiver with MM2-TA-12B Muting Module – 22 Ga, 8-pin Euro-style (M12) female connector to 7-pin Mini-style male connector; double-ended
DESE5-515D	5 m (15 ft)	
DESE5-525D	8 m (25 ft)	

8.2.5 Lens Shield

Constructed of 1.5 mm (0.06 in) clear polycarbonate; attach to sensor using supplied adhesive-backed Neoprene foam strips.



NOTE: The total range decreases by approximately 10% per shield.

Lens Shield Model	Sensor Defined Area Height	Lens Shield Length
LSS-150	150 mm (5.9 in)	210 mm (8.3 in)
LSS-300	300 mm (11.8 in)	360 mm (14.2 in)
LSS-450	450 mm (17.7 in)	510 mm (20.1 in)
LSS-600	600 mm (23.6 in)	660 mm (26.0 in)
LSS-750	750 mm (29.5 in)	810 mm (31.9 in)
LSS-900	900 mm (35.4 in)	959 mm (37.8 in)
LSS-1050	1050 mm (41.3 in)	1109 mm (43.7 in)
LSS-1200	1200 mm (47.2 in)	1259 mm (49.6 in)
LSS-1350	1350 mm (53.1 in)	1409 mm (55.5 in)
LSS-1500	1500 mm (59.1 in)	1558 mm (61.3 in)
LSS-1650	1650 mm (65.0 in)	1708 mm (67.2 in)
LSS-1800	1800 mm (70.9 in)	1858 mm (73.1 in)



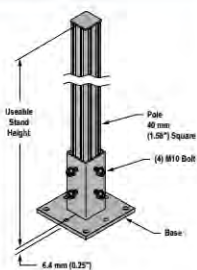
8.2.6 EZ-LIGHT® for EZ-SCREEN®

Provides clear, 360° indication of the of the EZ-SCREEN receiver's output status. Use with a CSB splitter cable and optional DEE2R double-ended cables. See data sheet p/n 121901 for more information.

Models	Construction	Connector/LED Function/Inputs
 M18RGX8PQ8 ³	Nickel-plated brass housing, M18x1 thread; thermoplastic lens Fully encapsulated IP67	8-pin Euro-style Integral QD Red/Green indication follows OSSD output of the EZ-SCREEN receiver ON Red: Power ON Beam Blocked or Lockout ON Green: Power ON Beam Clear PNP (Sourcing)
 T18RGX8PQ8	Thermoplastic polyester housing, thermoplastic lens Fully encapsulated IP67	
 T30RGX8PQ8		
 K30LRGX8PQ8	Polycarbonate housing, 30 mm thermoplastic dome, 22 mm base mount Fully encapsulated, IP67	PNP (Sourcing)
 K50LRGX8PQ8	Polycarbonate housing, 50 mm thermoplastic dome, 30 mm base mount Fully encapsulated, IP67	
 K80LRGX8PQ8	Polycarbonate housing, 50 mm thermoplastic dome, flat or DIN mount Encapsulated electronics, IP67	

8.2.7 MSA Series Stands

Base included. Available without a base by adding the suffix **NB** to the model number (for example, **MSA-S42-1NB**).

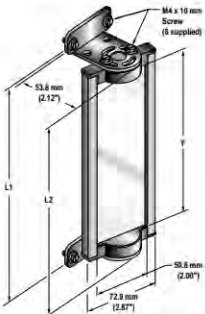
Stand Model	Pole Height	Useable Stand Height	Overall Stand Height	
MSA-S24-1	610 mm (24 in)	483 mm (19 in)	616 mm (24.25 in)	
MSA-S42-1	1067 mm (42 in)	940 mm (37 in)	1073 mm (42.25 in)	
MSA-S66-1	1676 mm (66 in)	1550 mm (61 in)	1682 mm (66.25 in)	
MSA-S84-1	2134 mm (84 in)	2007 mm (79 in)	2140 mm (84.25 in)	

³ Available in a kit that includes one M18 EZ-LIGHT, one SMB18A mounting bracket, and hardware for mounting to the side channel of an EZ-SCREEN housing (kit model number **EZA-M18RGX8PQ8**).

8.2.8 MSM Series Corner Mirrors

Rear-surface glass mirrors are rated at 85% efficiency. The total sensing range decreases by approximately 8% per mirror.

See mirror data sheet p/n 43685 or <http://www.bannerengineering.com> for further information.

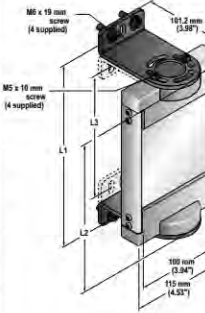
Mirror Model	Defined Area Length	Reflective Area Y	Mounting L1	Mounting L2	
MSM8A	150 mm (5.9 in)	267 mm (10.5 in)	323 mm (12.7 in)	292 mm (11.5 in)	 Diagram of MSM Series Corner Mirror showing dimensions L1, L2, and mounting hardware. The diagram includes labels for M4 x 10 mm Screw (4 supplied), 53.8 mm (2.12"), 50.8 mm (2.00"), and 72.3 mm (2.84").
MSM12A	300 mm (11.8 in)	356 mm (14 in)	411 mm (16.2 in)	381 mm (15 in)	
MSM20A	450 mm (17.7 in)	559 mm (22 in)	615 mm (24.2 in)	584 mm (23 in)	
MSM24A	600 mm (23.6 in)	660 mm (26 in)	716 mm (28.2 in)	686 mm (27 in)	
MSM32A	750 mm (29.5 in)	864 mm (34 in)	919 mm (36.2 in)	889 mm (35 in)	
MSM36A	900 mm (35.4 in)	965 mm (38 in)	1021 mm (40.2 in)	991 mm (39 in)	
MSM44A	1050 mm (41.3 in)	1168 mm (46 in)	1224 mm (48.2 in)	1194 mm (47 in)	
MSM48A	1200 mm (47.2 in)	1270 mm (50 in)	1326 mm (52.2 in)	1295 mm (51 in)	

8.2.9 SSM Series Corner Mirrors

- Rear-surface glass mirrors are rated at 85% efficiency. The total sensing range decreases by approximately 8% per mirror. See mirror data sheet p/n 61934 or <http://www.bannerengineering.com> for further information.
- Stainless steel reflective surface models are also available. See datasheet p/n 67200.
- Robust construction, two mounting brackets and hardware included.
- EZA-MBK-2 adapter bracket is required for use with MSA Series stand, see [Accessory Mounting Brackets](#) on page 56.



NOTE: Brackets may be inverted from the positions shown, decreasing dimension L1 by 58 mm (2.3 in).

Mirror Model ⁴	Defined Area Length	Reflective Area Y	Mounting L1	Mounting L2	
SSM-200	150 mm (5.9 in)	200 mm (7.9 in)	278 mm (10.9 in)	311 mm (12.2 in)	 Diagram of SSM Series Corner Mirror showing dimensions L1, L2, and mounting hardware. The diagram includes labels for M6 x 10 mm screw (4 supplied), 101.2 mm (3.98"), 100 mm (3.94"), 115 mm (4.53"), and 72.3 mm (2.84").
SSM-375	300 mm (11.8 in)	375 mm (14.8 in)	486 mm (19.1 in)	453 mm (17.8 in)	
SSM-550	450 mm (17.7 in)	550 mm (21.7 in)	661 mm (26.0 in)	628 mm (24.7 in)	
SSM-675	600 mm (23.6 in)	675 mm (26.6 in)	786 mm (31.0 in)	753 mm (29.6 in)	
SSM-825	750 mm (29.5 in)	825 mm (32.5 in)	936 mm (36.9 in)	903 mm (35.6 in)	
SSM-975	900 mm (35.4 in)	975 mm (38.4 in)	1086 mm (42.8 in)	1053 mm (41.5 in)	
SSM-1100	1050 mm (41.3 in)	1100 mm (43.3 in)	1211 mm (47.7 in)	1178 mm (46.4 in)	
SSM-1275	1200 mm (47.2 in)	1275 mm (50.2 in)	1386 mm (54.6 in)	1353 mm (53.3 in)	
SSM-1400	1350 mm (53.1 in)	1400 mm (55.1 in)	1511 mm (59.5 in)	1478 mm (58.2 in)	
SSM-1550	1500 mm (59.0 in)	1550 mm (61.0 in)	1661 mm (65.4 in)	1628 mm (64.1 in)	
SSM-1750	1650 mm (65.0 in)	1750 mm (68.9 in)	1861 mm (73.3 in)	1828 mm (72.0 in)	
SSM-1900	1800 mm (70.9 in)	1900 mm (74.8 in)	2011 mm (79.2 in)	1978 mm (77.9 in)	

⁴ Stainless steel reflective surface models are available by adding model number suffix "-S" (for example, **SSM-375-S**); range reduction for these models is approximately 30% per mirror. See datasheet p/n 67200.

8.2.10 Accessory Mounting Brackets

See Section 2.4 for standard brackets. Contact factory for more information. Order one EZA-MBK-... bracket per sensor, two per pair.

USMB-5

- Retrofit mounting bracket for STI MPT21.
- 2.3 mm (0.09 in) thickness, black zinc-plated, chromate dip finish.
- Mounting hardware included: 1 kit required per emitter or receiver.



USMB-6

- Universal mounting bracket kit.
- 2.3 mm (0.09 in) thickness, black zinc-plated, chromate dip finish.
- Mounting hardware included: 1 kit required per emitter or receiver.



EZA-MBK-2

Adapter bracket for SSM series mirror and MSA series stands



USMB-8

- Mounting plate for 90° sensor direction.
- Low profile.
- Black anodized aluminum.
- Uses two M4 screws (user supplied) for through-hole mounting.
- 1 kit required per emitter or receiver.



8.2.11 Alignment Aids

Model	Description	
LAT-1-LP	Self-contained visible-beam laser tool for aligning any EZ-SCREEN Type 2 emitter/receiver pair. Includes retroreflective target material and mounting clip.	
LPA-LAT-2	Replacement adaptor (clip) hardware for EZ-SCREEN Type 2 models	
LPA-LAT-1	Clip-on retroreflective LAT target	
BRT-THG-2-100	2 in retroreflective tape, 100 ft	
BT-1	Beam Tracker	

8.2.12 Replacement Parts

Model Number	Description
MGA-KSO-1	Keyed reset switch
MGA-K-1	Replacement key
STP-14	30 mm (1.2 in) test piece
USMB-1	Standard end bracket kit with hardware (includes 2 end brackets and hardware to mount to MSA Series stands.
USCMB-1	1 bracket, for 600–900 mm (23.6–35.4 in) long sensors
USCMB-2	Center bracket kit (includes bracket(s) and hardware to mount to MSA Series stands
USCMB-3	2 brackets, for 1050–1500 mm (41.3–59.1 in) long sensors
	3 brackets, for 1650–1800 mm (65.0–70.9 in) long sensors

8.2.13 Documentation

Part Number	Description
122452	EZ-SCREEN Type 2 System Instruction Manual
122450	Checkout Procedure Card (Daily)
122451	Checkout Procedure Card (Semi-Annual)

9 Standards and Regulations

The list of standards below is included as a convenience for users of this Banner device. Inclusion of the standards below does not imply that the device complies specifically with any standard, other than those specified in the Specifications section of this manual.

9.1 Applicable U.S. Standards

ANSI B11.0 Safety of Machinery, General Requirements, and Risk Assessment	ANSI B11.16 Metal Powder Compacting Presses
ANSI B11.1 Mechanical Power Presses	ANSI B11.17 Horizontal Extrusion Presses
ANSI B11.2 Hydraulic Power Presses	ANSI B11.18 Machinery and Machine Systems for the Processing of Coiled Strip, Sheet, and Plate
ANSI B11.3 Power Press Brakes	ANSI B11.19 Performance Criteria for Safeguarding
ANSI B11.4 Shears	ANSI B11.20 Manufacturing Systems
ANSI B11.5 Iron Workers	ANSI B11.21 Machine Tools Using Lasers
ANSI B11.6 Lathes	ANSI B11.22 Numerically Controlled Turning Machines
ANSI B11.7 Cold Headers and Cold Formers	ANSI B11.23 Machining Centers
ANSI B11.8 Drilling, Milling, and Boring	ANSI B11.24 Transfer Machines
ANSI B11.9 Grinding Machines	ANSI/RIA R15.06 Safety Requirements for Industrial Robots and Robot Systems
ANSI B11.10 Metal Sawing Machines	ANSI NFPA 79 Electrical Standard for Industrial Machinery
ANSI B11.11 Gear Cutting Machines	ANSI/PMMA B155.1 Package Machinery and Packaging-Related Converting Machinery — Safety Requirements
ANSI B11.12 Roll Forming and Roll Bending Machines	
ANSI B11.13 Single- and Multiple-Spindle Automatic Bar and Chucking Machines	
ANSI B11.14 Coil Slitting Machines	
ANSI B11.15 Pipe, Tube, and Shape Bending Machines	

9.2 OSHA Regulations

OSHA Documents listed are part of: Code of Federal Regulations Title 29, Parts 1900 to 1910

OSHA 29 CFR 1910.212 General Requirements for (Guarding of) All Machines

OSHA 29 CFR 1910.147 The Control of Hazardous Energy (lockout/tagout)

OSHA 29 CFR 1910.217 (Guarding of) Mechanical Power Presses

9.3 International/European Standards

ISO 12100 Safety of Machinery – General Principles for Design — Risk Assessment and Risk Reduction	ISO 14119 (EN 1088) Interlocking Devices Associated with Guards – Principles for Design and Selection
ISO 13857 Safety Distances . . . Upper and Lower Limbs	IEC 60204-1 Electrical Equipment of Machines Part 1: General Requirements
ISO 13850 (EN 418) Emergency Stop Devices, Functional Aspects – Principles for Design	IEC 61496 Electro-sensitive Protection Equipment
ISO 13851 (EN 574) Two-Hand Control Devices – Functional Aspects – Principles for Design	IEC 60529 Degrees of Protection Provided by Enclosures
IEC 62061 Functional Safety of Safety-Related Electrical, Electronic and Programmable Control Systems	IEC 60947-1 Low Voltage Switchgear – General Rules
ISO 13849-1 (EN 954-1) Safety-Related Parts of Control Systems	IEC 60947-5-1 Low Voltage Switchgear – Electromechanical Control Circuit Devices
ISO 13855 (EN 999) The Positioning of Protective Equipment in Respect to Approach Speeds of Parts of the Human Body	IEC 60947-5-5 Low Voltage Switchgear – Electrical Emergency Stop Device with Mechanical Latching Function
	IEC 61508 Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems

9.4 Contact Us

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10 Glossary

The following terms are used in this manual. Where possible, definitions are from the U.S. and international product performance standards that govern the design of the Banner device. For more definitions, visit www.bannerengineering.com.

A

ANSI (American National Standards Institute)

Acronym for the American National Standards Institute, an association of industry representatives that develops technical standards (including safety standards). These standards comprise a consensus from a variety of industries on good practice and design. ANSI standards relevant to application of safety products include the ANSI B11 Series, and ANSI/RIA R15.06. See [Standards and Regulations](#) on page 58.

Automatic Reset

The safety input device control operation setting where the assigned safety output will automatically turn on when all of its associated input devices are in the Run state. No manual reset operation is required for the safety output to turn on when controlled only by safety input devices configured for Automatic Reset. When Automatic Reset is selected, the input device may be said to be configured to run in Trip mode.

C

CE

Abbreviation for "Conformité Européenne" (French translation of "European Conformity"). The CE mark on a product or machine establishes its compliance with all relevant European Union (EU) Directives and the associated safety standards.

Change of State (COS)

The change of an input signal when it switches from Run-to-Stop or Stop-to-Run state. Dual-channel input signals, have two possible configurable COS settings describe the signal disparity limits that can exist between channels before a fault condition is registered: simultaneous and concurrent. If simultaneity is a requirement or a concern for the application, the user has to ensure that he made the right selection during configuration.

Closed-Open Debounce Time

The time it takes to bridge a jittery input signal or bouncing of the input contacts to prevent nuisance tripping of the Controller. Adjustable from 6 ms to 100 ms. The default value is 6 ms (50 ms for mute sensors). A longer closed-open debounce time will also affect and increase the response time of the system and/or the machine response time.

Code Validation

The configuration code file inspection process automatically performed by the Controller to verify that the configuration code has not been corrupted or altered in any way.

Commissioning

The process of operationally checking a Safety Controller installation on a working machine, in order to verify that the control system is working properly.

Complementary Contacts

Two sets of contacts which are always in opposite states.

Concurrent

The setting that permits an indefinite signal disparity between channels, without going into a fault condition. A fault condition is created if the Stop signal changes back to a Run signal before its allied signal changes to the Stop state. Both signals must change from the STOP state to the RUN state before the dual-channel device is considered to be in the RUN state.

Configurable

Describes a control device that has pre-defined and pre-tested operational parameters that can be selected or enabled, in order to accommodate a variety of control application requirements.

Configuration

A selected set of pre-defined and pre-tested input and output device properties and logic relationships that define the operating algorithm that the Safety Controller uses to control hazardous machine motion.

Confirmation

The two-step process where a new or modified configuration is sent to a Controller for code validation, and a copy of the validated code is sent back from the Controller to the PCI for manual parameter (I/O and System settings) verification.

D

Defined Area

The "screen of light" generated by a safety light screen system, defined by the height and the safety distance (minimum distance) of the emitter and receiver. When the defined area is interrupted by an opaque object of a specified cross section, a Trip or Latch condition results.

Designated Person

A person or persons identified and designated in writing, by the employer, as being appropriately trained and qualified to perform a specified checkout procedure.

Diverse-Redundancy

The practice of using components, circuitry or operation of different designs, architectures or functions to achieve redundancy and to reduce the possibility of common mode failures.

Dual-Channel

Having redundant signal lines for each safety input or safety output.

E

Emitter

The light-emitting component of a safety light screen system, consisting of a row of synchronized modulated LEDs. The emitter, together with the receiver (placed opposite), creates a "screen of light" called the defined area.

Enable a Mute Time Limit

As soon as a mute sensor is mapped to a safety input device, a default time limit of 30s will show up in the properties window. This time limit can be disabled by unchecking the "Enable Time Limit" box. This extends the time for the mutable safety device to be muted to infinite.

External Device Monitoring (EDM)

A means by which a safety device (such as a safety light screen) actively monitors the state (or status) of external devices that may be controlled by the safety device. A lockout of the safety device will result if an unsafe state is detected in the external device. External device(s) may include, but are not limited to: MPCEs, captive contact relays/contactors, and safety modules.

F

Failure to Danger

A failure which delays or prevents a machine safety system from arresting dangerous machine motion, thereby increasing risk to personnel.

Final Switching Device (FSD)

The component of the machine's safety-related control system that interrupts the circuit to the machine primary control element (MPCE) when the output signal switching device (OSSD) goes to the OFF-state.

FMEA (Failure Mode and Effects Analysis)

A testing procedure by which potential failure modes in a system are analyzed to determine their results or effects on the system. Component failure modes that produce either no effect or a Lockout condition are permitted; failures which cause an unsafe condition (a failure to danger) are not. Banner safety products are extensively FMEA tested.

H

Hard (Fixed) Guard

Screens, bars, or other mechanical barriers affixed to the frame of the machine intended to prevent entry by personnel into the hazardous area(s) of a machine, while allowing the point of operation to be viewed. The maximum size of the openings is determined by the applicable standard, such as Table O-10 of OSHA 29CFR1910.217, also called a "fixed barrier guard."

Harm

Physical injury or damage to the health of people, which may result through direct interaction with the machine or through indirect means, as a result of damage to property or to the environment.

Hazard Point

The closest reachable point of the hazardous area.

Hazardous Area

An area that poses an immediate or impending physical hazard.

I

IEC

International Electrotechnical Commission

Internal Lockout

A Lockout condition that is due to an internal safety system problem. Generally, indicated by the red Status indicator LED (only) flashing. Requires the attention of a Qualified Person.

K

Key Reset (Manual Reset)

A key-operated switch used to reset a safety light screen system to Run mode following a Lockout condition, or to enable machine operation following a Latch condition. Also refers to the act of using the switch.

L

Latch Condition

The response of the safety light screen safety outputs (for example, OSSDs) when an object equal to or greater than the diameter of the specified test piece enters the defined area. In a Latch condition, safety outputs simultaneously de-energize and open their contacts. The contacts are held (latched) open until the object is removed from the defined area and a manual reset is performed. A latching output is used most often in perimeter guarding applications. (See *Trip Condition*.)

Lockout Condition

A safety light screen condition that is automatically attained in response to certain failure signals (an internal lockout). When a Lockout condition occurs, the safety light screen's safety outputs turn Off; the failure must be corrected and a manual reset is required to return the system to Run mode.

M

Machine Primary Control Element (MPCE)

An electrically powered element, external to the safety system, which directly controls the machine's normal operating motion in such a way that the element is last (in time) to operate when machine motion is either initiated or arrested.

Machine Response Time

The time between the activation of a machine stopping device and the instant when the dangerous parts of the machine reach a safe state by being brought to rest.

Minimum Object Sensitivity (MOS)

The minimum-diameter object that a safety light screen system can reliably detect. Objects of this diameter or greater will be detected anywhere in the defined area. A smaller object can pass undetected through the light if it passes exactly midway between two adjacent light beams. Also known as MODS (Minimum Object Detection Size). See also *Specified Test Piece*.

Muting

The automatic suspension of the safeguarding function of a safety device during a non-hazardous portion of the machine cycle.

O

Off State

The state in which the output circuit is interrupted and does not permit the flow of current.

On State

The state in which the output circuit is complete and permits the flow of current.

Open-Closed Debounce Time

The time it takes to bridge a jittery input signal or bouncing of the input contacts to prevent an unwanted start of the machine. Adjustable from 10 ms to 500 ms. The default value is 50 ms. A longer open-closed debounce time will also affect the recovery time of the Controller.

OSHA (Occupational Safety and Health Administration)

A U.S. Federal agency, Division of the U.S. Department of Labor, that is responsible for the regulation of workplace safety.

P

Pass-Through Hazard

A pass-through hazard is associated with applications where personnel may pass through a safeguard (which issues a stop command to remove the hazard), and then continues into the guarded area, such as in perimeter guarding. Subsequently, their presence is no longer detected, and the related danger becomes the unexpected start or restart of the machine while personnel are within the guarded area.

PELV

Protected extra-low voltage power supply, for circuits with earth ground. Per IEC 61140: "A PELV system is an electrical system in which the voltage cannot exceed ELV (25 V ac rms or 60 V ripple free dc) under normal conditions, and under single-fault conditions, except earth faults in other circuits."

Point of Operation

The location of a machine where material or a workpiece is positioned and a machine function is performed upon it.

PSDI (Presence-Sensing Device Initiation)

An application in which a presence-sensing device is used to actually start the cycle of a machine. In a typical situation, an operator manually positions a part in the machine for the operation. When the operator moves out of the danger area, the presence sensing device starts the machine (no start switch is used). The machine cycle runs to completion, and the operator can then insert a new part and start another cycle. The presence sensing device continually guards the machine. Single-break mode is used when the part is automatically ejected after the machine operation. Double-break mode is used when the part is both inserted (to begin the operation) and removed (after the operation) by the operator. PSDI is commonly confused with "Trip Initiate." PSDI is defined in OSHA CFR1910.217. Banner safety light screen systems may not be used as PSDI devices on mechanical power presses, per OSHA regulation 29 CFR 1910.217.

Q

Qualified Person

A person who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.

R

Receiver

The light-receiving component of a safety light screen system, consisting of a row of synchronized phototransistors. The receiver, together with the emitter (placed opposite), creates a "screen of light" called the defined area.

Reduced Resolution

A feature that allows a safety light screen system to be configured to produce an intentionally disabled light beam(s) within the light screen, which increases the minimum object sensitivity. The disabled beam(s) appears to move up and down ("float") in order to allow the feeding of an object through the defined area at any point without tripping the safety outputs (for example, OSSDs) and causing a Trip or Latch condition. Sometimes called "Floating Blanking."

Reset

The use of a manually operated switch to restore the safety outputs to the On state from a lockout or a Latch condition.

Resolution

See *Minimum Object Sensitivity*

Run Signal

The input signal monitored by the Controller that, when detected, causes one or more safety outputs to turn On if their other associated input signals are also in the Run state. In this manual, either the input device or the device signal is said to be in the Run state.

S

Safety-Rated Device

A device that is designed to an applicable safety standard and when properly applied, reduces the level of risk.

Self-Checking (Circuitry)

A circuit with the capability to electronically verify that all of its own critical circuit components, along with their redundant backups, are operating properly. Banner safety light screen systems and safety modules are self-checking.

Separation Distance (Safety Light Screen)

The minimum distance required to allow the machine's hazardous motion to stop completely, before a hand (or other object) can reach the nearest hazard point. Measured from the midpoint of the defined area to the nearest hazard point. Factors that influence minimum separation distance include the machine stop time, the light screen system response time, and the light screen minimum object detection size.

Simultaneous

The setting that permits a signal disparity between channels within the input device for a limited time, without going into a fault condition. If a signal disparity exists for more than 3 seconds, then a fault condition occurs.

Single-Channel

Having only one signal line for a safety input or safety output.

Specified Test Piece

An opaque object of sufficient size used to block a light beam to test the operation of a safety light screen system. When inserted into any part of the defined area, it will place a system into a Trip or Latch condition. Banner supplies specified test pieces with each system. See also *Minimum Object Sensitivity*.

Start Up Test

For certain safety devices, like safety light screens or safety gates, it can be an advantage to test the device on power up at least one time for proper function. If 'Start up Test' has been selected for a safety light screen and the light screen is clear at power up, it would be necessary to cycle the light screen one time (from On to Off and back to On), even if the Controller has been configured for auto power up.

Supplemental Guarding

Additional safeguarding device(s) or hard guarding, used to prevent a person from reaching over, under, through or around the primary safeguard or otherwise accessing the guarded hazard.

Stop Signal

The input signal monitored by the Controller that, when detected, causes one or more safety outputs to turn Off. In this manual, either the input device or device signal is said to be in the Stop state.

System Reset

A configurable reset of one or more safety outputs to turn On after Controller power-up, when set for manual power-up, or lockout (fault detection) situations.

T**Test Piece**

An opaque object of sufficient size used to block a light beam to test the operation of a safety light screen system.

Trip Condition

The response of the safety outputs (for example, OSSDs) of a safety light screen system when an object equal to or greater than the diameter of the specified test piece enters the defined area. In a Trip condition, the OSSDs simultaneously de-energize. A Trip condition clears (resets) automatically when the object is removed from the defined area. (See *Latch Condition*.)

Trip Initiate

The resetting of a safeguard causing the initiation of machine motion or operation. Trip Initiate is not allowed as a means to initiate a machine cycle per NFPA 79 and ISO 60204-1, and is commonly confused with PSD1.

U**UL (Underwriters Laboratory)**

A third-party organization that tests products for compliance with appropriate standards, electrical codes, and safety codes. Compliance is indicated by the UL listing mark on the product.

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IMPORTANT!
DO NOT DESTROY

¡IMPORTANTE!
NO DESTRUIR



Installation and Maintenance Manual

**with Safety Information
and Parts List**

RECOMMENDED SPARE PARTS HIGHLIGHTED IN GRAY

Manual de Instalación y Mantenimiento

***con Información sobre Seguridad
y Lista de Partes***

LAS PARTES DE REPUESTO RECOMENDADAS SE RESALTAN EN GRIS

Model 25/26-CRR

Effective February 2012

Bulletin No. 639



25/26-CRR

HYTROL CONVEYOR CO., INC.

Jonesboro, Arkansas

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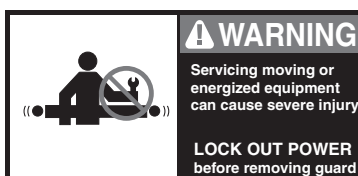
● Warning Signs

In an effort to reduce the possibility of injury to personnel working around HYTROL conveying equipment, warning signs are placed at various points on the equipment to alert them of potential dangers. Please check equipment and note all warning signs. Make certain your personnel are alerted to and obey these warnings. Shown below are typical signs that are attached to this equipment.

WARNING!
DO NOT START CONVEYOR
UNTIL PERSONNEL ARE CLEAR

PLACED ON ALL POWERED CONVEYORS
NEAR DRIVE AND/OR CONTROLS.

COLOCADA EN TODOS LOS
TRANSPORTADORES MOTORIZADOS
CERCA AL MOTOR Y/O LOS CONTROLES



PLACED NEXT TO DRIVE, BOTH SIDES.
COLOCADA JUNTO A LA UNIDAD MOTRIZ, EN
AMBOS LADOS.



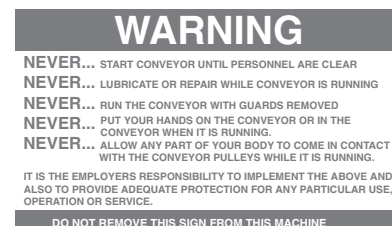
PLACED ON 20 FT. INTERVALS, BOTH SIDES.
COLOCADA EN INTERVALOS DE 20 PIES, A AMBOS LADOS.



PLACED ON ALL CHAIN GUARDS.
COLOCADA EN TODAS LAS GUARDA CADENAS.



PLACED ON TERMINATING ENDS.
COLOCADA EN LOS EXTREMOS.



PLACED AT DRIVE OF ALL POWERED CONVEYORS.
COLOCADA EN LA UNIDAD MOTRIZ DE TODOS LOS
TRANSPORTADORES MOTORIZADOS.

NOTE: BILINGUAL (SPANISH) LABELS AVAILABLE UPON REQUEST.
NOTA: ETIQUETAS BILINGÜES (ESPAÑOL) SERÁN PROVEÍDAS BAJO PETICIÓN.



ADVERTENCIA
NUNCA... acercarse al transportador antes de que todo el personal esté alejado.
NUNCA... cercarse a la unidad motriz o al transportador antes de mantenimiento.
NUNCA... hacer mantenimiento al transportador cuando el equipo esté en movimiento.
NUNCA... tocar partes eléctricas o partes en movimiento.
NUNCA... permitir que cualquier parte de su cuerpo entre en contacto con las partes expuestas en movimiento.
ES RESPONSABILIDAD DE LOS EMPLEADORES IMPLEMENTAR LAS MEDIDAS ADECUADAS Y PROPORCIONAR LA ADECUADA PROTECCIÓN PARA CUALQUIERA USO, OPERACIÓN O SERVICIO.
NO REMOVER ESTA SEÑAL DE LA MAQUINA.



INTRODUCTION

INTRODUCCION



This manual provides guidelines and procedures for installing, operating, and maintaining your conveyor. A complete parts list is provided with recommended spare parts highlighted in gray. Important safety information is also provided throughout the manual. For safety to personnel and for proper operation of your conveyor, it is recommended that you read and follow the instructions provided in this manual.

Este manual provee las pautas y los procedimientos para instalar, operar y mantener su transportador. Se proporciona una lista completa de partes, con partes de repuesto recomendadas que se resaltan en gris. También se proporciona información importante de seguridad a lo largo de este manual. Para seguridad del personal y para un funcionamiento apropiado del transportador, se recomienda que lean y sigan las instrucciones proporcionadas en este manual.

● Receiving and Uncrating

1. . . Check the number of items received against the bill of lading.
2. . . Examine condition of equipment to determine if any damage occurred during shipment.
3. . . Move all crates to area of installation.
4. . . Remove crating and check for optional equipment that may be fastened to the conveyor. Make sure these parts (or any foreign pieces) are removed.

NOTE: If damage has occurred or freight is missing, see the "Important Notice" attached to the crate.

● Recepción y Desembalaje

1. . . Verifique el número de partes recibidas con respecto al conocimiento de embarque.
2. . . Examine las condiciones del equipo con el fin de determinar si algún daño ha ocurrido durante el transporte.
3. . . Traslade todo el equipo al área de instalación.
4. . . Remueva todos los empaques y verifique si hay partes opcionales que puedan estar atadas al equipo. Asegúrese de que estas partes (u otras partes externas) sean removidas.

NOTA: Si algún daño ha ocurrido o falta cargamento, vea las "Notas Importantes" adheridas al embalaje.

INSTALLATION

INSTALACION

● Installation Safety Precautions for Conveyors and Related Equipment

● Medidas de Seguridad al Instalar Transportadores y Equipos Relacionados

GUARDS AND GUARDING

Interfacing of Equipment. When two or more pieces of equipment are interfaced, special attention shall be given to the interfaced area to insure the presence of adequate guarding and safety devices.

Guarding Exceptions. Wherever conditions prevail that would require guarding under these standards, but such guarding would render the conveyor unusable, prominent warning means shall be provided in the area or on the equipment in lieu of guarding.

Guarded by Location or Position. Where necessary for the protection of employees from hazards, all exposed moving machinery parts that present a hazard to employees at their work station shall be mechanically or electrically guarded, or guarded by location or position.

When a conveyor passes over a walkway, roadway, or work station, it is considered guarded solely by location or position if all moving parts are at least 8 ft. (2.44 m) above the floor or walking surface or are otherwise located so that the employee cannot

GUARDAS Y PROTECCIONES

Unión del Equipo. Cuando dos o más piezas del equipo van unidas, debe ponerse especial atención al área de unión para asegurar que las guardas adecuadas y los dispositivos de seguridad estén presentes.

Excepciones de Protección. Dondequiera que las guardas sean necesarias, pero que la colocación de las mismas inhabilite el uso del transportador, se proporcionarán señales de advertencia visibles en el área o en el equipo en vez de las guardas.

Protección dada por Posición o Ubicación. Cuando sea necesaria la protección de los empleados contra posibles riesgos, todas las partes del equipo que estén expuestas y en movimiento, y que puedan presentar un peligro para ellos en sus puestos de trabajo, serán protegidas mecánicamente o eléctricamente, o protegidas por su posición o ubicación.

Cuando el transportador está instalado sobre pasillos, corredores o puestos de trabajo, se considera que está protegido

inadvertently come in contact with hazardous moving parts.

Although overhead conveyors may be guarded by location, spill guard, pan guards, or equivalent shall be provided if the product may fall off the conveyor for any reason and if personnel would be endangered.

HEADROOM

When conveyors are installed above exit passageways, aisles, or corridors, there shall be provided a minimum clearance of 6 ft. 8 in. (2.032 m) measured vertically from the floor or walking surface to the lowest part of the conveyor or guards.

Where system function will be impaired by providing the minimum clearance of 6 ft. 8 in. (2.032 m) through an emergency exit, alternate passageways shall be provided.

It is permissible to allow passage under conveyors with less than 6 ft. 8 in. (2.032 m) clearance from the floor for other than emergency exits if a suitable warning indicates low headroom.

únicamente por localización o posición si todas las partes en movimiento están mínimo a 8 pies (2.44m) de altura del piso, o si está localizado de tal manera que el empleado no pueda entrar en contacto inadvertidamente con dichas partes.

A pesar de que los transportadores aéreos pueden estar protegidos por su localización, guardas laterales e inferiores deben ser proporcionadas para evitar que el producto se caiga del transportador y así mantener al personal fuera de peligro.

UBICACION SUPERIOR

Cuando los transportadores son instalados sobre pasillos o corredores de salida, debe dejarse un espacio libre de mínimo 6 pies 8 pulgadas (2,032m) de extensión, medido verticalmente desde el piso o área de tránsito hasta la parte más baja del transportador o de las guardas.

Si se proporcionan señales de advertencia adecuadas indicando baja altura; es posible dejar espacio libre con menos de 6 pies 8 pulgadas (2.032m) de extensión entre el piso y el transportador en los pasillos que no sean salidas de emergencia.

● Support Installation

1. . . Turn conveyor sections upside down and position them in proper sequence per match-marked numbers at each end. (Figure 6A).
2. . . Attach supports to both ends of drive section and to one end of intermediate or tail sections (Figure 6B). Hand tighten bolts only at this time.
3. . . Adjust elevation to required height.
4. . . Assemble Knee braces as shown in Figures 6B and 6C.

● Instalación de los Soportes

1. . . Voltee las secciones del transportador y posicíonelas en la secuencia adecuada de acuerdo a las "Etiquetas de Secuencia de Armado". (Figura 6A).
2. . . Fije los soportes a ambos extremos de la sección motriz y a un extremo de las secciones intermedias o de retorno (Figura 6B). Apriete los tornillos manualmente.
3. . . Ajuste la elevación a la altura requerida.
4. . . Ensamble los refuerzos de los soportes como se muestra en las figuras 6B y 6C.

FIGURE 6A

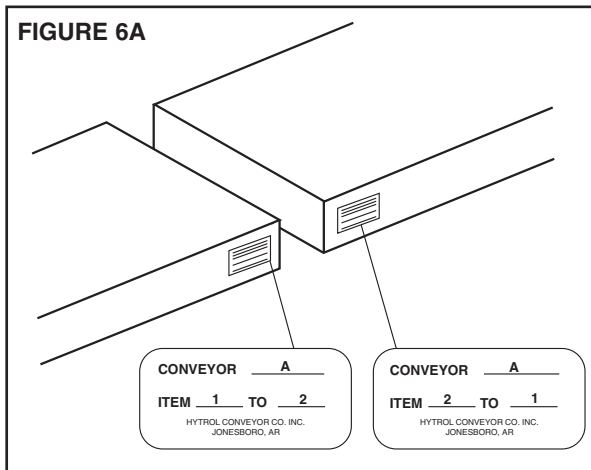


FIGURE 6B

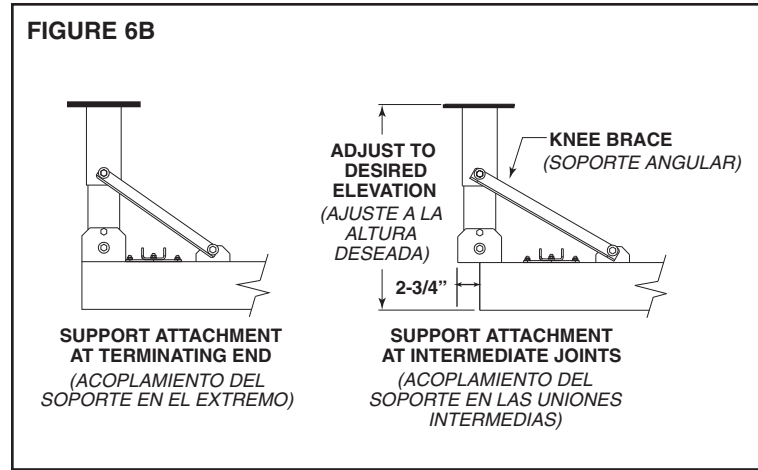
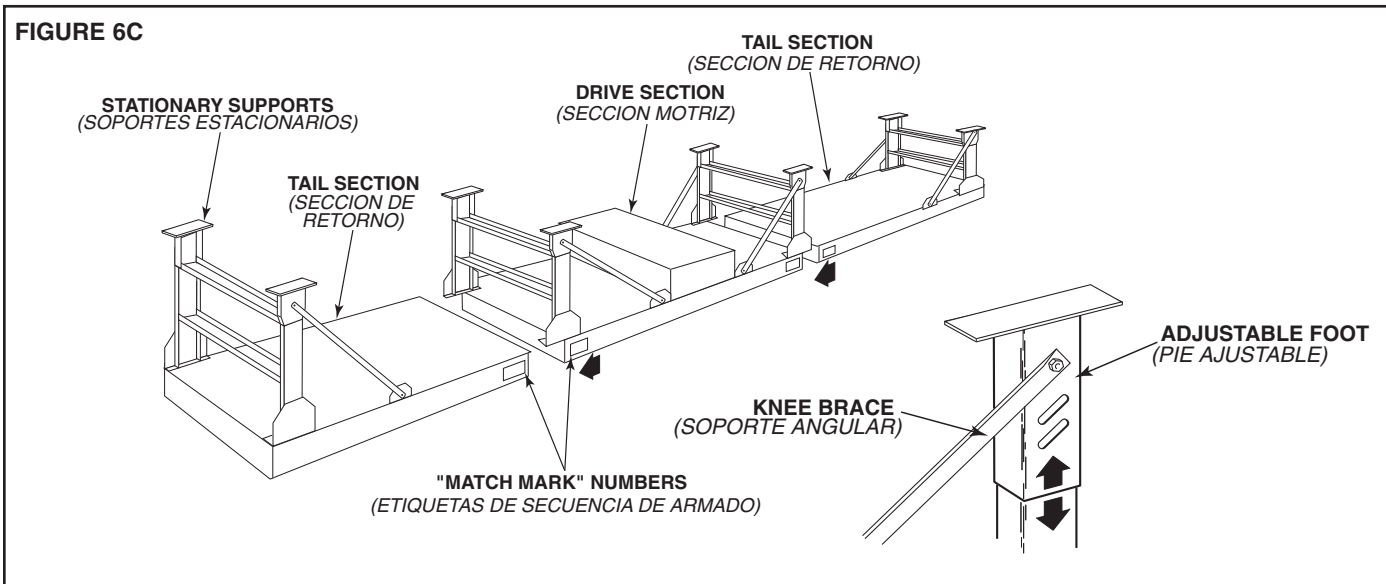


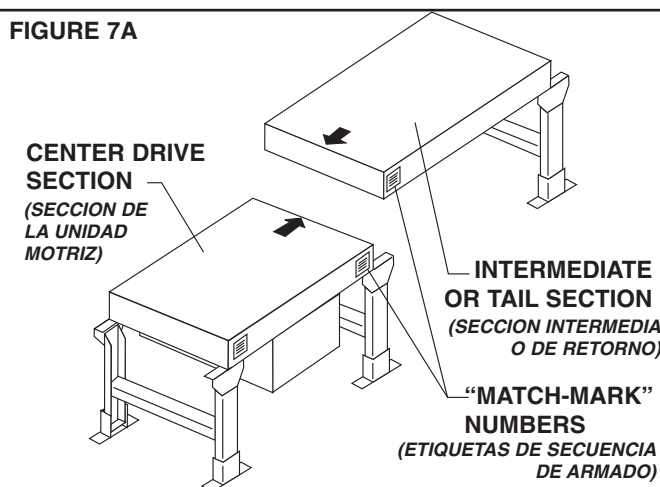
FIGURE 6C



● Conveyor Set-Up

- 1... Mark a chalk line on floor to locate center of the conveyor.
- 2... Place the drive section in an upright position.
- 3... Turn remaining sections upright placing end without support on extended pivot plate of previous section (Figure 7A). Check "Match-Mark" Numbers to see that adjoining sections are in proper sequence.
- 4... Fasten sections together with butt couplings and pivot plates (Figure 7B). Hand tighten bolts.
- 5... Connect chains at section joints (Figure 7C).
- 6... Check to see that conveyor is level across width and length of unit. Adjust supports as necessary.
- 7... Tighten all butt couplings and support mounting bolts and lag conveyor to floor.
- 8... Install electrical controls and wire motor. See page 8.

FIGURE 7A



● Montaje del Transportador

- 1... Marque con tiza una línea en el suelo para ubicar el centro del transportador.
- 2... Coloque la sección motriz en posición.
- 3... Instale las secciones restantes, colocando el extremo sin soporte en la placa pivote del soporte de la sección anterior. (Figura 7A). Revise las "Etiquetas de Secuencia de Armado" para verificar que las secciones están en la secuencia adecuada.
- 4... Asegure las secciones con placas de unión y placas pivote (Figura 7B). Apriete los tornillos manualmente.
- 5... Conecte las cadenas en las secciones unidas (Figura 7C)
- 6... Revise que el transportador este a nivel a lo largo y ancho de la unidad. Ajuste los soportes si es necesario.
- 7... Apriete todos los tornillos de unión y montaje y ancle el transportador al piso.
- 8... Instale los controles eléctricos y conecte el motor. Ver página 8.

FIGURE 7B

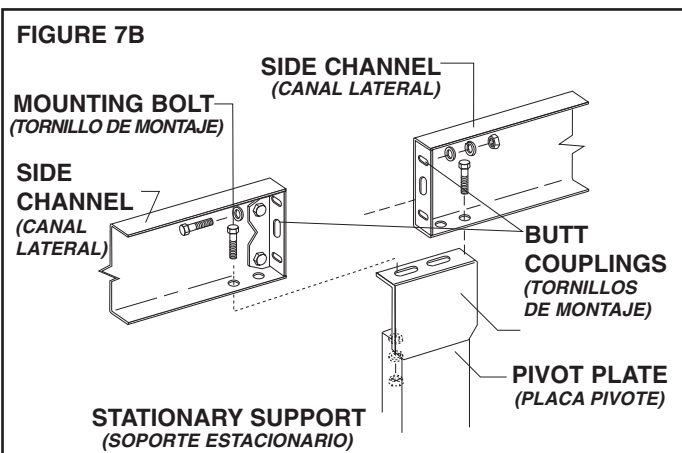
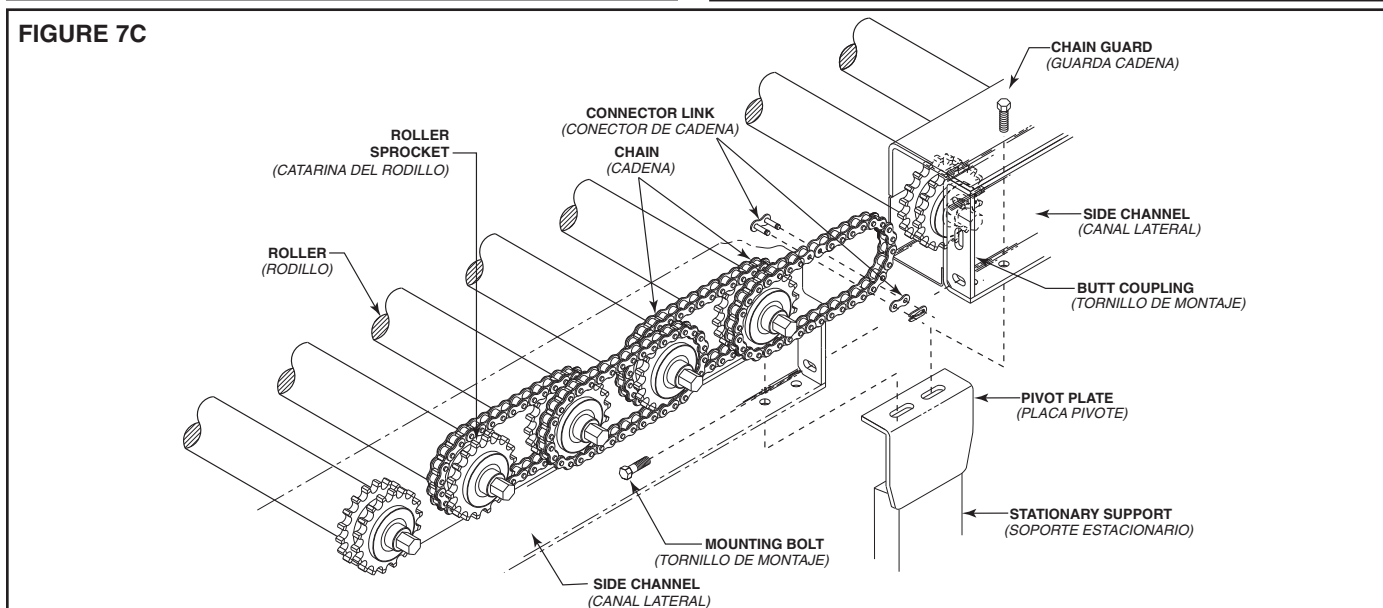


FIGURE 7C



● Electrical Equipment

WARNING!

Electrical controls shall be installed and wired by a qualified electrician. Wiring information for the motor and controls are furnished by the equipment manufacturer.

CONTROLS

Electrical Code: All motor controls and wiring shall conform to the National Electrical Code (Article 670 or other applicable articles) as published by the National Fire Protection Association and as approved by the American Standards Institute, Inc.

CONTROL STATIONS

A) Control stations should be so arranged and located that the operation of the equipment is visible from them, and shall be clearly marked or labeled to indicate the function controlled.

B) A conveyor which would cause injury when started shall not be started until employees in the area are alerted by a signal or by a designated person that the conveyor is about to start.

When a conveyor would cause injury when started and is automatically controlled or must be controlled from a remote location, an audible device shall be provided which can be clearly heard at all points along the conveyor where personnel may be present. The warning device shall be actuated by the controller device starting the conveyor and shall continue for a required period of time before the conveyor starts. A flashing light or similar visual warning may be used in conjunction with or in place of the audible device if more effective in particular circumstances.

Where system function would be seriously hindered or adversely affected by the required time delay or where the intent of the warning may be misinterpreted (i.e., a work area with many different conveyors and allied devices), clear, concise, and legible warning shall be provided. The warning shall indicate that conveyors and allied equipment may be started at any time, that danger exists, and that personnel must keep clear. The warnings shall be provided along the conveyor at areas not guarded by position or location.

C) Remotely and automatically controlled conveyors, and conveyors where operator stations are not manned or are beyond voice and visual contact from drive areas, loading areas, transfer points, and other potentially hazardous locations on the conveyor path not guarded by location, position, or guards, shall be furnished with emergency stop buttons, pull cords, limit switches, or similar emergency stop devices.

● Equipo Eléctrico

¡ADVERTENCIA!

Los controles eléctricos deben ser conectados e instalados por un electricista calificado. La información sobre el cableado del motor y los controles será proporcionada por el fabricante del equipo.

CONTROLES

Código Eléctrico: Todos los controles del motor y las conexiones deben ajustarse al "National Electrical Code" (Artículo 670 u otros artículos aplicables) como fue publicado por la "National Fire Protection Association" y aprobado por el "American Standards Institute, Inc."

ESTACIONES DE CONTROL

A) Las estaciones de control deberán estar arregladas y ubicadas en lugares donde el funcionamiento del equipo sea visible y deberán estar claramente marcadas o señaladas para indicar la función controlada.

B) Un transportador que pueda causar lesiones cuando es puesto en marcha, no deberá ponerse a funcionar hasta que los trabajadores en el área sean alertados por una señal o por una persona designada que indique que el transportador está a punto de arrancar.

Cuando un transportador pueda causar lesiones al arrancar y es automáticamente controlado, o tiene que ser controlado desde una ubicación lejana, se deberá proporcionar un dispositivo sonoro el cual pueda ser escuchado claramente en todos los puntos a lo largo del transportador donde el personal pueda estar presente. El dispositivo de advertencia deberá ser activado por el dispositivo de arranque del transportador, y deberá continuar sonando por un determinado periodo de tiempo antes de que el transportador empiece a funcionar. Una luz intermitente o una advertencia visual similar puede ser utilizada con o en lugar del dispositivo sonoro si es más efectivo en circunstancias particulares.

Donde el funcionamiento del sistema pudiera ser seriamente obstruido o adversamente afectado por el tiempo de retardo requerido, o donde el intento de advertencia pueda ser mal interpretado (ej., un área de trabajo con diversas líneas de transportadores y los dispositivos de advertencia relacionados), advertencias claras, concisas y legibles deberán ser proporcionadas. Las advertencias deberán indicar que los transportadores y los equipos relacionados pueden ser puestos en marcha en cualquier momento, que existe un peligro y que el personal debe mantenerse alejado. Estas advertencias deben ser proporcionadas a lo largo del transportador en áreas que no sean protegidas por la posición o la ubicación.

C) Los transportadores controlados automáticamente o desde estaciones lejanas, y los transportadores donde las

All such emergency stop devices shall be easily identifiable in the immediate vicinity of such locations unless guarded by location, position, or guards. Where the design, function, and operation of such conveyor clearly is not hazardous to personnel, an emergency stop device is not required.

The emergency stop device shall act directly on the control of the conveyor concerned and shall not depend on the stopping of any other equipment. The emergency stop devices shall be installed so that they cannot be overridden from other locations.

D) Inactive and unused actuators, controllers, and wiring should be removed from control stations and panel boards, together with obsolete diagrams, indicators, control labels, and other material which serve to confuse the operator.

SAFETY DEVICES

A) All safety devices, including wiring of electrical safety devices, shall be arranged to operate in a "Fail-Safe" manner, that is, if power failure or failure of the device itself would occur, a hazardous condition must not result.

B) *Emergency Stops and Restarts.* Conveyor controls shall be so arranged that, in case of emergency stop, manual reset or start at the location where the emergency stop was initiated, shall be required of the conveyor(s) and associated equipment to resume operation.

C) Before restarting a conveyor which has been stopped because of an emergency, an inspection of the conveyor shall be made and the cause of the stoppage determined. The starting device shall be locked out before any attempt is made to remove the cause of stoppage, unless operation is necessary to determine the cause or to safely remove the stoppage.

Refer to ANSI Z244.1-1982, American National Standard for Personnel Protection – Lockout/Tagout of Energy Sources – Minimum Safety Requirements and OSHA Standard Number 29 CFR 1910.147 "The Control of Hazardous Energy (Lockout/Tagout)."

estaciones de funcionamiento no estén controladas por una persona, o estén mas allá del alcance de la voz y del contacto visual de las áreas de conducción, áreas de carga, puntos de transferencia y otros sitios potencialmente peligrosos localizados en la trayectoria del transportador que no tengan protección, ya sea dada por posición, ubicación, o guardas, deberán ser equipados con interruptores de parada de emergencia, cordones de parada de emergencia, interruptores de límite o dispositivos similares para paradas de emergencia.

Todos estos dispositivos de parada de emergencia deberán ser fácilmente identificables en las cercanías inmediatas a estos puntos potencialmente peligrosos, a no ser que estén protegidos dada su ubicación, posición o protegidos con guardas. Donde el diseño, el funcionamiento, y la operación de tales transportadores no represente un claro peligro para el personal, un dispositivo de parada de emergencia no es requerido.

El dispositivo de parada de emergencia deberá actuar directamente en el control del transportador concerniente y no deberá depender de la parada de cualquier otro equipo. Los dispositivos de parada de emergencia deberán ser instalados de tal forma que no puedan ser anulados desde otras localidades.

D) *Los dispositivos, controles desactivados o en desuso y las conexiones, deberán ser removidos de las estaciones de control y de los tableros de mando, junto con los diagramas, indicadores, etiquetas de control y otros materiales obsoletos, los cuales se prestan para confundir al operador.*

DISPOSITIVOS DE SEGURIDAD

A) *Todos los dispositivos de seguridad, incluyendo la conexión de dispositivos eléctricos, deben estar dispuestos para operar en una manera de "autoprotección"; es decir, si se presenta una pérdida de corriente o un fallo en el mismo dispositivo, esto no debe resultar en una situación peligrosa.*

B) *Paradas de Emergencia y Reactivadores.* Los controles del transportador deberán estar dispuestos de tal manera que, en caso de una parada de emergencia, se requerirá un activador o arrancador manual en la ubicación donde la parada de emergencia se presentó para reanudar la operación del transportador o transportadores y el equipo asociado.

C) *Antes de reiniciar un transportador que ha sido detenido por una emergencia, debe realizarse una revisión del transportador y determinarse la causa de la parada. El dispositivo de arranque deberá ser bloqueado antes de intentar corregir el problema, a no ser que la operación del transportador sea necesaria para determinar la causa de la parada o para solucionar el problema.*

Refiérase a ANSI Z244.1-1982, "American National Standard for Personnel Protection" - "Lockout/Tagout of Energy Sources - Minimum Safety Requirements and OSHA Standard Number 29 CFR 1910.147" "The Control of Hazardous Energy (Lockout/Tagout)."

● Operation Safety Precautions

- A)** Only trained employees shall be permitted to operate conveyors. Training shall include instruction in operation under normal conditions and emergency situations.
- B)** Where employee safety is dependent upon stopping and/or starting devices, they shall be kept free of obstructions to permit ready access.
- C)** The area around loading and unloading points shall be kept clear of obstructions which could endanger personnel.
- D)** No person shall ride the load-carrying element of a conveyor under any circumstances unless that person is specifically authorized by the owner or employer to do so. Under those circumstances, such employee shall only ride a conveyor which incorporates within its supporting structure, platforms or control stations specifically designed for carrying personnel. Under no circumstances shall any person ride on any element of a vertical conveyor. Owners of conveyors should affix warning devices to the conveyor reading **Do Not Ride Conveyor**.
- E)** Personnel working on or near a conveyor shall be instructed as to the location and operation of pertinent stopping devices.
- F)** A conveyor shall be used to transport only material it is capable of handling safely.
- G)** Under no circumstances shall the safety characteristics of the conveyor be altered if such alterations would endanger personnel.
- H)** Routine inspections and preventive and corrective maintenance programs shall be conducted to insure that all safety features and devices are retained and function properly.
- I)** Personnel should be alerted to the potential hazard of entanglement in conveyors caused by items such as long hair, loose clothing, and jewelry.
- J)** As a general rule, conveyors should not be cleaned while in operation. Where proper cleaning requires the conveyor to be in motion and a hazard exists, personnel should be made aware of the associated hazard.

● Conveyor Start-Up

Before conveyor is turned on, check for foreign objects that may have been left inside conveyor during installation. These objects could cause serious damage during start-up. After conveyor has been turned on and is operating, check motors, reducers, and moving parts to make sure they are working freely.

CAUTION!

Because of the many moving parts on the conveyor, all personnel in the area of the conveyor need to be warned that the conveyor is about to be started.

● Medidas de Seguridad en la Operación

- A)** Solo se debe permitir operar los transportadores a empleados entrenados. El entrenamiento debe incluir instrucciones de operación bajo condiciones normales y en situaciones de emergencia.
- B)** Cuando la seguridad de los trabajadores depende de dispositivos de parada y/o arranque, tales dispositivos deben mantenerse libres de obstrucciones para permitir un acceso rápido.
- C)** El área alrededor de los puntos de carga y descarga debe mantenerse libre de obstrucciones, las cuales podrían poner en peligro al personal.
- D)** Ninguna persona debe montarse en la parte de conducción de carga de un transportador bajo ninguna circunstancia a menos que esta persona esté específicamente autorizada por el dueño o por el supervisor. Bajo estas circunstancias, el empleado deberá montarse solamente en un transportador que tenga incorporado en su estructura, plataformas o estaciones de control especialmente diseñadas para el traslado de personal. Bajo ninguna circunstancia, persona alguna debe subirse a cualquier parte de un transportador vertical. Los dueños de los transportadores deben añadir señales de advertencia al transportador con el texto: "No Montarse en el Transportador".
- E)** El personal que esté trabajando en, o cerca al transportador, debe ser instruido en cuanto a la ubicación y operación de los dispositivos pertinentes de parada.
- F)** Un transportador deberá ser utilizado para transportar solamente los productos que sea capaz de manejar en forma segura.
- G)** Bajo ninguna circunstancia deberán ser alteradas las características de seguridad de un transportador, si tales alteraciones pudieran poner en peligro al personal.
- H)** Inspecciones rutinarias deberán llevarse a cabo al igual que programas de mantenimiento preventivo y correctivo, con el fin de asegurar que todos los dispositivos y medidas de seguridad se conserven en buen estado y funcionen correctamente.
- I)** El personal deberá ser advertido de causas de peligros potenciales tales como enredos en transportadores por llevar cabello largo, ropa suelta o joyas.
- J)** Como regla general, los transportadores no deberán limpiarse mientras estén en funcionamiento. Cuando se requiera limpiar el transportador estando en movimiento y exista posibilidad de peligro, el personal deberá ser advertido de este peligro asociado.

● Arranque del Transportador

Antes de poner en marcha el transportador, revise si hay objetos ajenos que puedan haber sido dejados dentro del transportador durante la instalación. Estos objetos pueden causar serios daños en el arranque. Después de poner en marcha el transportador, cuando esté operando, revise los motores, reductores y partes en movimiento para estar seguro de que están trabajando libremente.

¡PRECAUCION!

Debido a la cantidad de partes en movimiento en el transportador, todo el personal en el área del transportador necesita ser advertido de que este está a punto de ponerse en marcha.

● Maintenance Safety Precautions

- A)** Maintenance, such as lubrication and adjustments, shall be performed only by qualified and trained personnel.
- B)** It is Important that a maintenance program be established to insure that all conveyor components are maintained in a condition which does not constitute a hazard to personnel.
- C)** When a conveyor is stopped for maintenance purposes, starting devices or powered accessories shall be locked or tagged out in accordance with a formalized procedure designed to protect all person or groups involved with the conveyor against an unexpected start.
- D)** Replace all safety devices and guards before starting equipment for normal operation.
- E)** Whenever practical, **DO NOT** lubricate conveyors while they are in motion. Only trained personnel who are aware of the hazard of the conveyor in motion shall be allowed to lubricate.

SAFETY GUARDS

Maintain all guards and safety devices **IN POSITION** and **IN SAFE REPAIR**.

WARNING SIGNS

Maintain all warning signs in a legible condition and obey all warnings. See Page 3 of this manual for examples of warning signs.

● Medidas de Seguridad en el Mantenimiento

- A)** El mantenimiento, tal como lubricación y ajustes, debe ser realizado solamente por personal calificado y entrenado.
- B)** Es importante que se establezca un programa de mantenimiento para asegurar que todos los componentes del transportador sean mantenidos en condiciones que no constituyan un peligro para el personal.
- C)** Cuando un transportador está parado por razones de mantenimiento, los dispositivos de arranque o accesorios motorizados deberán ser asegurados o desconectados conforme a un procedimiento formalizado, diseñado para proteger a toda persona o grupos involucrados con el transportador de un arranque inesperado.
- D)** Antes de poner en marcha el equipo en una operación normal vuelva a colocar todos los dispositivos de seguridad y las guardas.
- E)** Siempre que sea práctico, **NO** lubrique los transportadores mientras se encuentren en movimiento. Solo el personal entrenado, que tenga conocimiento de los peligros del transportador en movimiento, se le permitirá hacer la lubricación.

PROTECCIONES DE SEGURIDAD

Mantenga todas las guardas y dispositivos de seguridad **EN SU POSICION** y **EN BUENAS CONDICIONES**.

SEÑALES DE ADVERTENCIA

Mantenga todas las señales de advertencia en buenas condiciones y obedézcalas. Remítase a la página 3 de este manual para ver ejemplos de señales de advertencia.

● Lubrication

The drive chain is pre-lubricated from the manufacturer by a hot dipping process that ensures total lubrication of all components. However, continued proper lubrication will greatly extend the useful life of every drive chain.

Drive Chain lubrication serves several purposes including:

- Protecting against wear of the pin-bushing joint
- Lubricating chain-sprocket contact surfaces
- Preventing rust or corrosion

For normal operating environments, lubricate every 2080 hours of operation or every 6 months, whichever comes first. Lubricate with a good grade of non-detergent petroleum or synthetic lubricant (i.e., Mobile 1 Synthetic). For best results, always use a brush to generously lubricate the chain. The proper viscosity of lubricant greatly affects its ability to flow into the internal areas of the chain. Refer to the table below for the proper viscosity of lubricant for your application.

Ambient Temperature Degrees F	SAE	ISO
20-40	20	46 or 68
40-100	30	100
100-120	40	150

The drive chain's lubrication requirement is greatly affected by the operating conditions. For harsh conditions such as damp environments, dusty environments, excessive speeds, or elevated temperatures, it is best to lubricate more frequently. It may be best, under these conditions, to develop a custom lubrication schedule for your specific application. A custom lubrication schedule may be developed by inspecting the drive chain on regular time intervals for sufficient lubrication. Once the time interval is determined at which the chain is not sufficiently lubricated, lubricate it and schedule the future lubrication intervals accordingly.

● Lubricación

La cadena motriz ha sido pre-lubricada por el fabricante mediante un proceso de sumersión caliente que asegura una lubricación total de todos sus componentes. Sin embargo, una lubricación apropiada y continua extenderá su vida útil considerablemente.

La lubricación de la cadena motriz cumple varios propósitos:

- *Proteger contra el desgaste de la unión de pines de la cadena*
- *Lubricar las superficies de contacto entre la cadena y la catarina*
- *Prevenir la oxidación o corrosión.*

En operaciones bajo condiciones ambientales normales, lubrique cada 2080 horas de operación o cada 6 meses, lo que ocurra primero. Lubrique con un lubricante sintético (ej. Mobile 1 sintético) o basado en petróleo no-detergente de buen grado. Para mejores resultados, siempre utilice una brocha para lubricar la cadena generosamente. La viscosidad apropiada del lubricante afecta enormemente el fluido del mismo hacia las áreas internas de la cadena. Refiérase a la siguiente tabla para consultar la viscosidad de lubricante adecuada para su aplicación.

Temperatura Ambiente (Grados F°) (Grados C°)	SAE	ISO
20-40 -07 – 04	20	46 o 68
40-100 04 – 38	30	100
100-120 38 – 49	40	150

El requerimiento de lubricación de la cadena motriz se vé afectado considerablemente por las condiciones de operación. En condiciones difíciles tales como: ambientes húmedos, ambientes con polvo, velocidades excesivas, o temperaturas elevadas, se recomienda lubricar la cadena con más frecuencia. Lo mejor sería que bajo estas condiciones se establezca un programa de lubricación específico para su aplicación. Este programa específico puede desarrollarse mediante la inspección de la lubricación suficiente de la cadena motriz en intervalos regulares de tiempo. Una vez se ha determinado el intervalo en el cual la cadena no se encuentra suficientemente lubricada, lubríquela y programe los siguientes intervalos de acuerdo al intervalo anterior.

● Drive Chain Alignment and Tension

The drive chain and sprockets should be checked periodically for proper tension and alignment. Improper adjustment will cause extensive wear to the drive components.

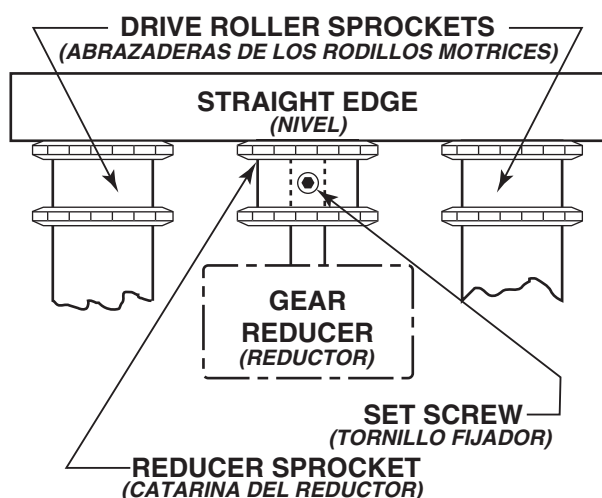
TO MAKE ADJUSTMENTS

1. . . Remove chain guard.
2. . . Check sprocket alignment by placing a straightedge across the face of both sprockets (Figure 13A). Loosen set screws and adjust as needed. Re-tighten set screws.
3. . . To adjust chain tension, loosen four bolts that fasten motor base to drive support channels (two on each side) and allow the drive assembly to slide downward. The weight of the drive will normally apply enough tension for proper operation. (Figure 13B). Re-tighten mounting bolts.
4. . . Lubricate chain per lubrication instructions.
5. . . Replace chain guard so that it does not interfere with drive.

CAUTION!

Never remove chain guards while the conveyor is running. Always replace guards after adjustments are made.

FIGURE 13A



● Alineación y Tensión de la Cadena Motriz

La cadena motriz y las catarinas deberán ser revisadas periódicamente para mantener su apropiada tensión y alineación. Ajustes incorrectos causarán un desgaste excesivo a los componentes de la transmisión.

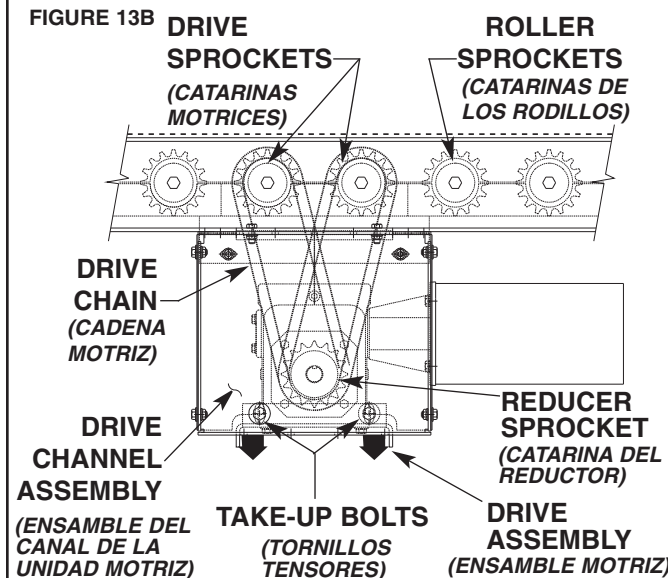
PARA HACER AJUSTES

1. . . Remueva la guarda cadena.
2. . . Verifique la alineación de las catarinas colocando un nivel sobre las caras de ambas catarinas. (Figura 13A). Afloje los tornillos candados y ajuste tanto como sea necesario. Apriete los tornillos candados.
3. . . Para ajustar la tensión de la cadena, afloje los cuatro tornillos que unen la base del motor a los canales de soporte del motor (dos en cada lado) y deje que el ensamble del motor se deslice hacia abajo. El peso del motor normalmente aplicará la presión suficiente para una operación apropiada. (Figura 13B). Asegure los tornillos de montaje.
4. . . Lubrique la cadena de acuerdo a las instrucciones de lubricación.
5. . . Coloque la guarda de cadena para que no interfiera con la transmisión.

¡PRECAUCION!

Nunca remueva la guarda de cadena mientras el transportador esté en funcionamiento. Siempre vuelva a colocar las guardas después de que se hayan hecho los ajustes.

FIGURE 13B



● Trouble Shooting

The following chart list possible problems that may occur in the operation of the conveyor.

TROUBLE	CAUSE	SOLUTION
Conveyor will not start or motor quits frequently.	1) Motor is overloaded or drawing too much current.	1) Check for overloading of conveyor. 2) Check heater or circuit breaker and change if necessary.
Drive chain and sprockets wear excessively.	1) Lack of lubrication on chain causing chain stretch which creates improper chain to sprocket mesh. 2) Sprockets are out of alignment. 3) Improper chain tension.	1) Replace chain and sprockets. Provide adequate lubrication. 2) Align sprockets. (See "Drive Chain Alignment and Tension") 3) See "Drive Chain Alignment and Tension"
Loud popping or grinding noise in bearing.	1) Defective bearing. 2) Loose set screws.	1) Replace bearing. 2) Tighten set screw.
Motor or reducer overheating.	1) Conveyor is overloaded. 2) Low voltage to motor. 3) Low lubricant level in reducer.	1) Check capacity of conveyor and reduce load to recommended level. 2) Have electrician check and correct as necessary. 3) Relubricate per manufacturer's recommendations. For HYTROL reducer, refer to separate manual.

● Resolviendo Problemas

Los siguientes cuadros describen posibles problemas que pueden ocurrir en la operación de un transportador motorizado.

PROBLEMA	CAUSA	SOLUCION
El transportador no arranca o el motor se detiene frecuentemente.	1) El motor está sobrecargado o pasa demasiada corriente.	1) Revise si hay sobrecarga del transportador. 2) Revise los circuitos e interruptores de protección y sobrecarga, y cámbielos si es necesario.
Desgaste excesivo de la cadena motriz y las catarinas.	1) Falta de lubricación en la cadena causando su alargamiento lo cual crea una cadena inapropiada. 2) Los catarinas están desalineados. 3) La cadena está floja.	1) Reemplace la cadena y las catarinas. Proporcione una adecuada lubricación. 2) Alinee catarinas. Vea "Alineación y Tensión de Cadena Motriz". 3) Vea "Alineación y Tensión de Cadena Motriz".
Funcionamiento muy ruidoso.	1) Rodamientos defectuosos. 2) El tornillo candado está flojo.	1) Reemplace los rodamientos. 2) Apriete el tornillo candado.
Motor o reductor recalentado.	1) Transportador está sobrecargado. 2) Bajo voltaje al motor. 3) Bajo nivel de lubricante en reductor.	1) Revise la capacidad del transportador y reduzca la carga al nivel recomendado. 2) Un electricista debe revisar y corregir si es necesario. 3) Vuelva a lubricar de acuerdo a las recomendaciones del fabricante. Para el reductor HYTROL, refiérase al manual adjunto.

● Preventive Maintenance Checklist

The following is a general maintenance checklist which covers the major components of your conveyor.

This will be helpful in establishing a standard maintenance schedule.

COMPONENT	SUGGESTED ACTION	SCHEDULE		
		Weekly	Monthly	Quarterly
MOTOR	Check Noise			
	Check Temperature			
	Check Mounting Bolts			
REDUCER	Check Noise			
	Check Temperature			
	Check Oil Level			
DRIVE CHAIN	Check Tension			
	Lubricate Chain			
	Check For Wear			
SPROCKETS AND ROLLERS	Check Sprocket Alignment			
	Check For Wear			
	Check Noise (Bearings)			
	Check Bearing Lubrication			
STRUCTURAL	General Check: All loose bolts, etc., tightened			

NOTE: Check Set Screws after the first 24 Hours of operation.

● Lista del Plan de Mantenimiento Preventivo

La siguiente es una lista de verificación del mantenimiento preventivo la cual cubre principales componentes de su

transportador. Esta será útil para establecer un programa de mantenimiento estándar.

COMPONENTE	REMEDIO	HORARIO		
		Semanal	Mensual	Trimestral
MOTOR	Revisar Ruido			
	Revisar la Temperatura			
	Revisar los Tornillos de Montaje			
REDUCTOR	Revisar Ruido			
	Revisar la Temperatura			
	Revisar el Nivel de Aceite			
CADENA MOTRIZ	Revisar la Tensión			
	Lubricar la Cadena			
	Revisar el Desgaste			
CATARINAS Y RODILLOS	Revisar la Alineación de las Catarinas			
	Revisar el Desgaste			
	Revisar Ruido (Rodamientos)			
	Revisar la Lubricación de los Rodamientos			
ESTRUCTURAL	Revisión General: Tornillos flojos, etc.			

NOTA: Revisar los tornillos después de las primeras 24 horas de operación.

● How to Order Replacement Parts

Included in this manual are parts drawings with complete replacement parts lists. Minor fasteners, such as nuts and bolts, are not included.

When ordering replacement parts:

1. . . Contact Dealer from whom conveyor was purchased or nearest HYTROL Distributor.
2. . . Give Conveyor Model Number and Serial Number or HYTROL Factory Order Number.
3. . . Give Part Number and complete description from Parts List.
4. . . Give type of drive. Example—8" End Drive, 8" Center Drive, etc.
5. . . If you are in a breakdown situation, tell us.



**HYTROL Serial Number
(Located near Drive on
Powered Models).**

● Como Ordenar Partes de Repuesto

Dibujos de las partes con listas completas de las refacciones están incluidos en este manual. Aseguradores menores, como tornillos y tuercas no están incluidos.

Para ordenar partes de repuesto:

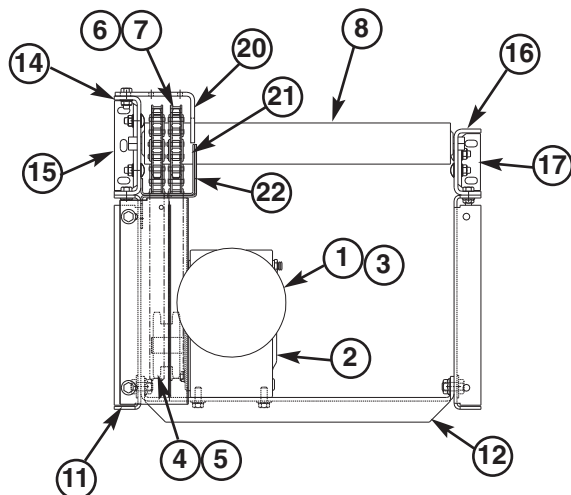
1. . . Contacte el vendedor del transportador o el distribuidor de Hytrol más cercano.
2. . . Proporcione el Modelo del Transportador y el Número de Serie o Número de la Orden de Planta.
3. . . Proporcione el Número de las partes y descripción completa que aparece en la Lista de Partes.
4. . . Proporcione el tipo de motor. Ejemplo— Unidad Motriz en Extremo de 8", Unidad Motriz Central de 8", etc.
5. . . Si está en una situación crítica, comuníquenoslo inmediatamente.



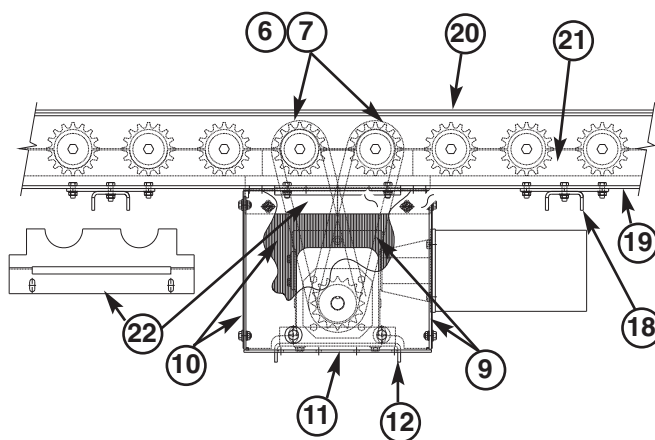
**Número de Serie HYTROL
(Localizado cerca de la
Unidad Motriz en
modelos motorizados).**

● Notes/Notas

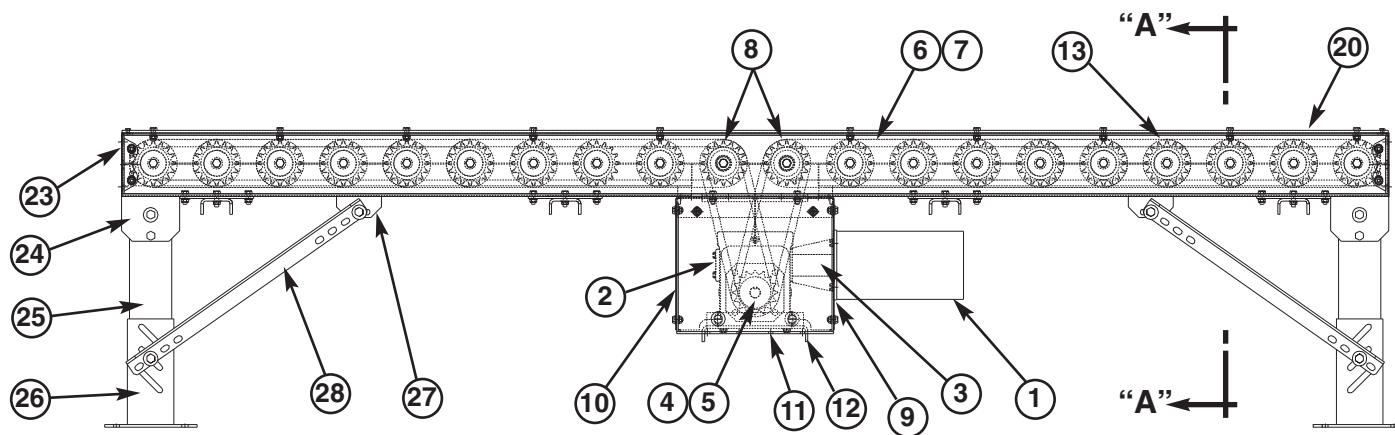
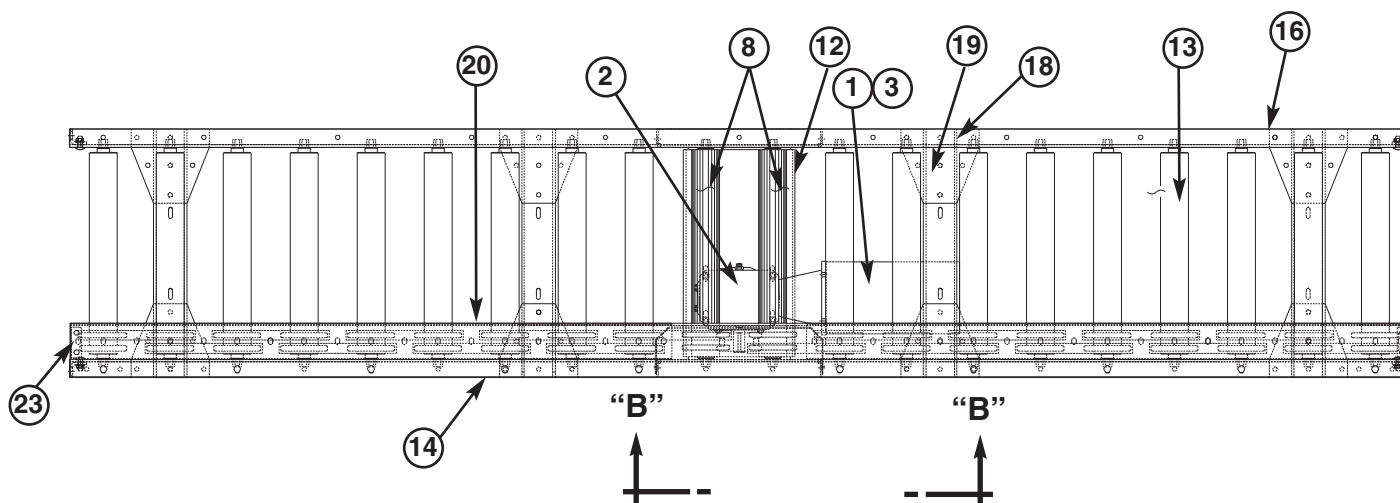
● **Model 25/26-CRR Parts Drawing** *(Modelo 25/26-CRR Dibujo de Partes)*



SECTION "A-A"
 (SECCION "A-A")

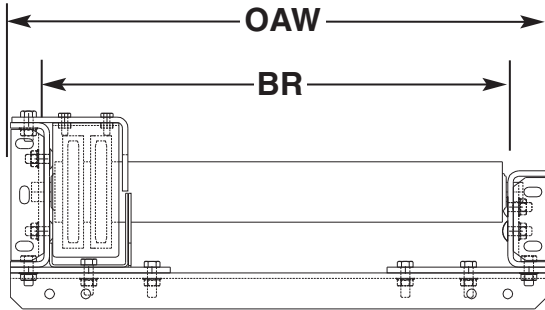


SECTION "B-B"
 (SECCION "B-B")



● Model 25/26-CRR Parts List

(Modelo 25/26-CRR Lista de Partes)



See Page 16 for Information on How To Order
Replacement Parts
(Vea la página 16 para información sobre como
ordenar partes de repuesto.)

Recommended Spare Parts List Highlighted In Gray

(Partes de Repuesto Recomendadas se Resaltan en Gris.)

Ref No.	Part No	Description
1	---	Motor - C-Face
---	030.7324	1 HP 230/460 VAC-3Ph.- 60 Hz. - TEFC
---	030.7534	2 HP 230/460 VAC-3Ph.- 60 Hz. - TEFC
2	---	Speed Reducer
---	R-00153-30R	4AC-RH-30:1 Ratio (#40 Chain)
---	R-00153-40R	4AC-RH-40:1 Ratio (#50 Chain)
---	R-00164-30R	5AC-RH-30:1 Ratio (#40 Chain)
---	R-00164-40R	5AC-RH-40:1 Ratio (#50 Chain)
---	R-00173-40R	5AC-RH-40:1 Ratio (#60 Chain)
3	---	Coupling Kit-Motor to Reducer
---	052.145	1 HP
---	052.146	2 HP
4	---	Sprocket-Reducer 2.5 Drive Roller
---	026.121	40B16 x 1 in. Bore (4AC w/#40 Drive Chain)
---	026.122	40B16 x 1-1/4 in. Bore (5AC w/#40 Drive Chain)
---	028.604	50DS19 x 1 in. Bore (4AC w/#50 Drive Chain)
---	B-07556-19	50DS19 x 1-1/4 in. Bore (5AC w/#50 Drive Chain)
---	028.624	60DS17 x 1-1/4 in. Bore (5AC w/#60 Drive Chain)
---	---	Sprocket-Reducer 2.6 Drive Roller
---	026.121	40B16 x 1 in. Bore (4AC w/#40 Drive Chain)
---	026.122	40B16 x 1-1/4 in. Bore (5AC w/#40 Drive Chain)
---	028.603	50DS18 x 1 in. Bore (4AC w/#50 Drive Chain)
---	B-07556-18	50DS18 x 1-1/4 in. Bore (5AC w/#50 Drive Chain)
---	028.623	60DS16 x 1-1/4 in. Bore (5AC w/#60 Drive Chain)
5	090.203	Shaft Key-1/4 in. Sq. x 1 in Long
6	---	Chain
---	029.100	#40 Riveted Roller Chain
---	029.101	#50 Riveted Roller Chain
---	029.102	#60 Riveted Roller Chain
7	---	Connector Link
---	029.200	#40 Roller Chain
---	029.201	#50 Roller Chain
---	029.202	#60 Roller Chain
8	---	Drive Roller
---	S-05732	2.5 in. Dia. #40 Chian (Specify BR)
---	S-05733	2.5 in. Dia. #50 Chian (Specify BR)
---	S-05734	2.5 in. Dia. #60 Chian (Specify BR)
---	S-05735	2.6 in. Dia. #40 Chian (Specify BR)
---	S-05736	2.6 in. Dia. #50 Chian (Specify BR)
---	S-05737	2.6 in. Dia. #60 Chian (Specify BR)
9	PT-074966-L	Chain Guard-Left Side 4 in. Thru 7-1/2 in. Roller Centers
10	PT-074966-R	Chain Guard-Right Side 4 in. Thru 7-1/2 in. Roller Centers
11	PT-075045	Drive Channel Assembly
12	---	Motor Base Plate
---	B-07481	19 in. thru 21 in. BR (Specify)
---	B-07482	23 in. thru 67 in. BR (Specify)
13	---	Tread Roller
---	B-15261	2.5 in. Dia. #40 Chian (Specify BR)
---	B-03805	2.5 in. Dia. #50 Chian (Specify BR)
---	B-04925	2.5 in. Dia. #60 Chian (Specify BR)
---	B-16809	2.6 in. Dia. #40 Chian (Specify BR)
---	B-03816	2.6 in. Dia. #50 Chian (Specify BR)
---	B-04926	2.6 in. Dia. #60 Chian (Specify BR)

Ref No.	Part No	Description
14	---	Drive Side Channel (6 in. Tall Channel)
---	PT-074749	4 in. Roller Centers (Specify Length)
---	PT-077118	5 in. Roller Centers (Specify Length)
---	PT-077439	6 in. Roller Centers (Specify Length)
---	P-00523	7-1/2 in. Roller Centers (Specify Length)
15	PT-074759	Butt Coupling (6 in. Tall Channel)
16	---	Side Channel (4 in. Tall Channel)
---	PT-074758	4 in. Roller Centers (Specify Length)
---	PT-077119	5 in. Roller Centers (Specify Length)
---	PT-077440	6 in. Roller Centers (Specify Length)
---	P-00524	7-1/2 in. Roller Centers (Specify Length)
17	PT-074760	Butt Coupling (4 in. Tall Channel)
18	B-25354	Bed Spacer Channel (Specify BR)
19	B-25355	Brace Plate
20	---	Chain Guard
---	P-00513	4 in. Roller Centers (Specify Length)
---	P-00514	5 in. Roller Centers (Specify Length)
---	P-00518	6 in. Roller Centers (Specify Length)
---	P-00522	7-1/2 in. Roller Centers (Specify Length)
21	---	Chain Return
---	B-22917	4 in. Roller Centers (Specify Length)
---	PT-077120	5 in. Roller Centers (Specify Length)
---	B-25353	6 in. Roller Centers (Specify Length)
---	P-00525	7-1/2 in. Roller Centers (Specify Length)
22	---	Chain Return Cover
---	PT-074931	4 in. Roller Centers
---	PT-077124	5 in. Roller Centers
---	PT-077442	6 in. Roller Centers
---	PT-077526	7-1/2 in. Roller Centers
23	---	Chain Guard End Cap
---	B-17615	4 in. Roller Centers
---	B-03815	5 Thru 7-1/2 in. Roller Centers
24	---	HSA Type Pivot Plate 1-11/16 in. Flange
---	B-11848	2-1/4 in. High
---	B-11491	4-1/2 in. High
25	---	Floor Support Frame
---	G-00608	4-1/2 in. High (Specify OAW)
---	G-00609	6 in. High (Specify OAW)
---	G-00610	9 in. High (Specify OAW)
---	G-00616	12 in. High (Specify OAW)
---	G-00617	15 in. High (Specify OAW)
---	G-00618	18 in. High (Specify OAW)
---	G-00619	24 in. High (Specify OAW)
---	G-00620	30 in. High (Specify OAW)
---	G-00621	42 in. High (Specify OAW)
---	G-00622	54 in. High (Specify OAW)
---	G-00623	66 in. High (Specify OAW)
---	G-00624	78 in. High (Specify OAW)
26	---	Adjustable Foot Assembly
---	G-00612	3-3/4 in. High
---	G-00611	5-1/8 in. High
---	G-00613	7-1/4 in. High
---	G-00614	10-1/4 in. High
---	G-00615	18-3/8 in. High
27	G-00793	Knee Brace Bracket
28	G-00794	Knee Brace Angle (Specify Length)



A : 2020 HYTROL STREET
JONESBORO, ARKANSAS 72401

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F:	(870) 931.1877

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Interroll Portec SG/SL Belt Power Curve

Installation and Owner's Manual



Conveyor Location: _____

Model Number: _____

Serial Number: _____

Year of Manufacture: _____

Interroll Engineering West, Inc.

(formerly known as PORTEC)

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Belt power curve**Tool list for installation, maintenance and belt replacement**

Tool	Used For
10 mm, 15 mm, 17 mm or 9/16" wrench	Bearing tensioners
15 mm, 1/2" or 9/16" wrench or socket	Bearing housing 1-3/16" (30 mm) shaft or smaller
18 mm or 3/4" wrench or socket	Bearing housing 1-7/16" (35 mm) shaft or larger
13 mm or 1/2" wrench or socket	Chain cover—Sideguards—End caps
13 mm or 1/2" wrench or socket	Return guide extrusion
15 mm, 17 mm, 9/16" or 3/4" wrenches 5/16" Allen wrench (2" sq. tubing connector)	Floor supports
Socket wrench set	Drive and mount
Small powered drill with 1/8" (3.2 mm), 5/64" (1.98mm) and 7/64" (2.8 mm) drill bits and rivet gun with 1/8" (2.8 mm) rivets	Upper chain guide strips
5/32" (4 mm) Allen wrench	End rolls
3/16" (5 mm) Allen wrench	Sprocket set screws
5/32" (4 mm) Allen wrench	Bearing set screws 1-7/16" (35mm) shaft or larger
1/8" (3 mm) Allen wrench	Bearing set screws 1-3/16" (30mm) shaft or smaller
3/32" (2.5 mm) Allen wrench	Return wheels
Electricians nut driver set or adjustable wrench	Electrical motor connections
Flat blade screwdriver	Chain guide strips
Needle nose pliers and side cutters	Conveyor belt lacing
Rubber mallet	Chain tension adjustment
Grease gun	Lubricate chain
Seam lacing machine	Seam lacing
Chain breaker tool	Attachment links

Note: Only trained personnel should perform all required work on the conveyor to prevent any danger to the operators or other persons, and to prevent damage to the conveyor.

WARNING: Disconnect and lock-out power before performing any installation or maintenance procedures. All guards must be in place before startup of con-

Note: Do not lift a conveyor by the drive shaft extension. This can cause damage, such as a bent shaft.

WARNING: Observe all safety precautions when working under hoisting equipment.

Note: To ensure proper installation and safety, only qualified mechanics and electricians should install conveyors.

Portec does not install conveyors, therefore, it is the responsibility of the contractor, installer, owner and user to install, maintain and operate the conveyor, components and conveyor assemblies in such a manner as to comply with all national, state and local laws and ordinances, including all National Occupational Safety and Health Codes and applicable Lockout/Tagout codes.

In order to avoid an unsafe or hazardous condition, the conveyors or parts must be installed and operated in accordance with the following minimum provisions.

1. Conveyors shall not be operated unless all covers and/or guards for the conveyor and drive unit are in place. If the conveyor is to be opened for inspection cleaning, maintenance or observation, the electric power to the motor driving the conveyor must be LOCKED OUT/TAGGED OUT in such a manner that the conveyor cannot be restarted by anyone; however remote from the area, until conveyor cover or guards and drive guards have been properly replaced.
2. If the conveyor must have an open housing as a condition of its use and application, the entire conveyor is then to be guarded by a railing or fence in accordance with the current National Safety Standard.
3. Do not attempt any maintenance or repairs of the conveyor until power has been LOCKED OUT/TAGGED OUT.
4. Always operate conveyor in accordance with these instructions and those contained on the caution labels affixed to the equipment.
5. Do not place hands, feet, or any part of your body, in the conveyor.
6. Never climb, sit, stand or work from a conveyor, or walk on conveyor covers or guards. When requested by the customer, some conveyors are equipped with safety handrails, which are to be used for maintenance purposes only. If the safety handrails are necessary for maintenance, they are to be used only after ensuring that the power has been LOCKED OUT/TAGGED OUT. The safety handrails must be removed before restoring power to the conveyor.
7. Do not use conveyor for any purpose other than that for which it was intended.
8. Do not poke or prod material into the conveyor with a bar or stick inserted through the openings.
9. Keep the area around conveyor drive and control station free of debris and obstacles.
10. Eliminate all sources of stored energy (materials or devices that could cause conveyor components to move without power applied) before opening the conveyor.
11. Do not attempt to clear a jammed conveyor until power has been LOCKED OUT/TAGGED OUT.
12. Do not attempt field modification of conveyor or components without prior approval of Portec.
13. Conveyors are not normally manufactured or designed to handle materials that are hazardous to personnel. These hazardous materials include those that are explosive, flammable, toxic or otherwise dangerous to personnel. Conveyors may be designed to handle these materials. If hazardous materials are to be conveyed, Portec should be consulted prior to any modifications.
14. When two or more conveyors are interfaced or joined together, make sure there is adequate guarding, pinch point protection and safety devices.
15. Only trained operators should be permitted to operate and maintain conveyors. Training needs to include instruction in operation under normal conditions and emergency conditions.
16. All starting and stopping devices should be clearly marked and the immediate area kept clear of obstructions to permit ready access.
17. The areas around loading and unloading points should be kept clear of any obstructions.
18. A person should NOT BE PERMITTED TO RIDE on any conveyor not specifically designed and approved to convey people.
19. Workers working around or operating conveyors should be shown the location of the starting and stopping devices and instructed how to use them to stop the conveyor in an emergency.

20. Do not use a conveyor for any purpose other than that for which it was intended. A conveyor should only be used to transport material it is capable of handling safely. Under no circumstances should safety guarding or labels attached to the conveyor be altered or removed without written permission from the owner/manufacturer. If the labels attached to the equipment become illegible, order replacement warning labels from Portec.
22. Routine inspections and Preventive and Corrective maintenance programs should be conducted to ensure that all safety features and devices are in place and functioning properly.
23. Employees should be alerted to the potential hazard of entanglement in conveyors caused by items such as long hair, loose clothing, and jewelry.
24. As a general rule, conveyors should not be cleaned while in operation. Where proper cleaning requires the conveyor to be in motion and a hazard exists, personnel should be made aware of all associated hazards as indicted above and take proper precautions.

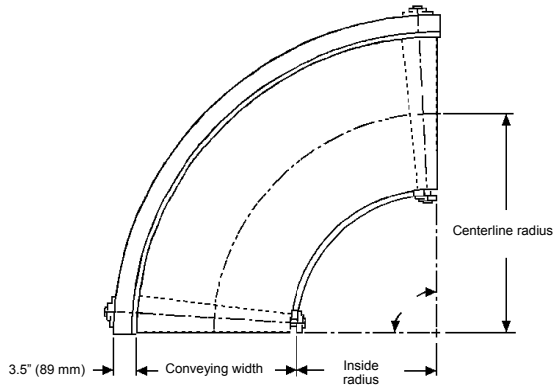
Additional Safety Notes:

Disconnecting and locking out the power to the motor driving the unit provides the only real protection against injury. Secondary safety devices are available; however, the decision as to their need and the type required must be made by the owner-assembler as Portec has no information regarding plant wiring, plant environment, the interlocking of the conveyor with other equipment, extent of plant automation, etc. Other devices should not be used as a substitute for locking out the power prior to removing guards or covers. We caution that use of the secondary devices may cause employees to develop a false sense of security and fail to lock out power before removing covers or guards. This could result in a serious injury should the secondary device fail or malfunction.

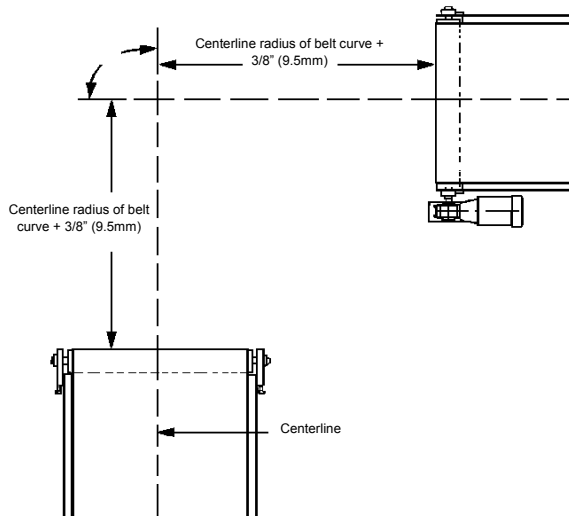
Electrical controls, machinery guards, railings, walkways, arrangement of installation, training of personnel, etc., are necessary ingredients for a safe working place. It is the responsibility of the contractor, installer, owner and user to supplement the materials and services provided by Portec to make the conveyor installation comply with the law and accepted standards.

Examples of Safety Labels used on conveyors:





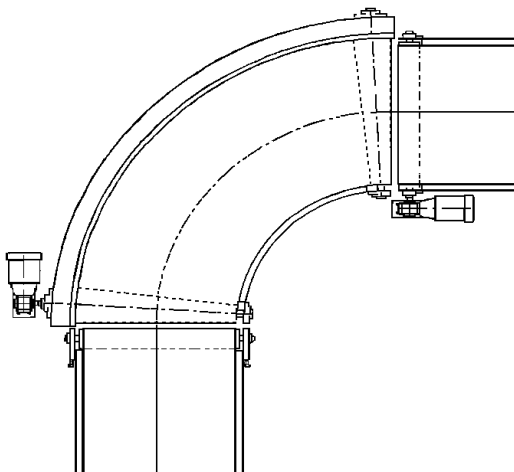
The objective is to get the sideguards to match up. The "Conveying Width" on a belt curve is equivalent to the "Between Sideguard Width" on a straight belt conveyor. The outside radius frame, chain cover and both sideguards on the belt curve extend $3/8"$ (9.5 mm) past the true angle. The inside radius frame length matches the true angle.



The ends of two straight conveyors should be positioned so they are both the same distance from the centerline intersection point as the "Centerline Radius" of the belt curve plus $3/8"$ (9.5 mm). The outside arc of the two belt centerlines should be identical to the arc of the belt curve.

When the following factors are correct, the belt curve will fit perfectly:

1. "Conveying Width" of the belt curve is equal to the "Between Sideguard Width" of the straight conveyors.
2. The arc of the belt curve is the same as the outside arc of the two straight conveyor centerlines.
3. The two straight conveyors are set back the same distance from the belt centerline intersection as the "Centerline Radius" of the belt curve plus $3/8"$ (9.5 mm).





Belt curves are normally built with a one-piece frame. Large-sized belt curves may be built in multiple sections and will require additional assembly during installation.

Notes:

Minor inspection is suggested during uncrating of a conveyor. Contact the shipping carrier immediately if shipping damage is suspected. **Please carefully check the crate or skid to ensure all parts are removed before beginning installation.**

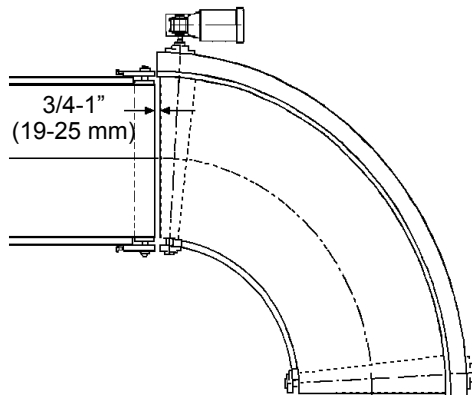
If floor supports, sideguards (12" (305mm) or higher), or drive unit are provided by Portec, they are normally removed from the belt curve for shipping. The brackets or holes for mounting to the frame are provided. All hardware and fasteners for mounting are included.

Section 5: Belt Curve Installation Instructions



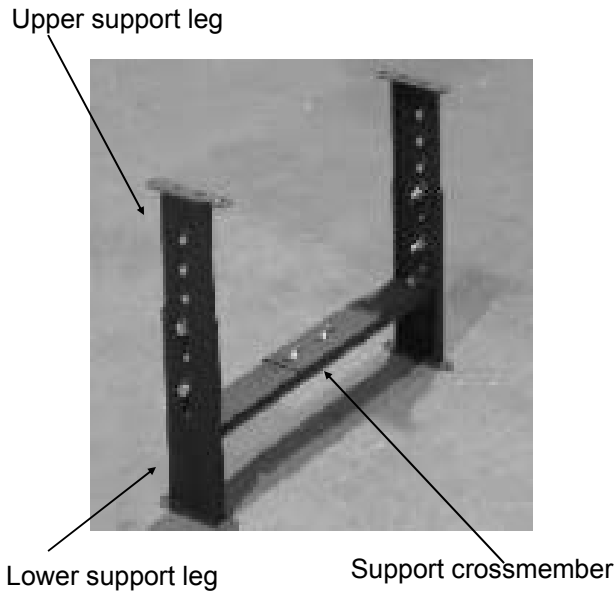
1. Position the conveyor between the adjoining conveyors.
2. Attach floor supports or ceiling hangers under the conveyor. See Section 5 (Floor Supports) or Section 6 (Ceiling Hangers) for instructions.
3. Attach sideguards (if required). See Section 7 for instructions.
4. Install underguarding. See Section 8 for instructions.
5. Install drive unit. See Section 9 for Shaft-Mount Gear-motor Installation Instructions.
6. Visually inspect:
 - Motors
 - Sideguard to belt clearance
 - Belt tension
 - Drive mounting and alignment
 - Return wheel assembly
7. Connect power to the drive unit and test run to assure the proper belt movement direction.

During the initial 40-hour run-in period, listen for any noises that may indicate that something is out of alignment or loose in the conveyor.



Note: The belt curve end rolls are adjusted at the factory so there is an approximately 3/4-1" (19-25 mm) gap between the belt on the end roll of the curve and the adjoining conveyor frame. The gap between end rolls can be less than 3/4" (19 mm) if the end roll on the adjoining conveyor is extended beyond the conveyor frame.

Low Floor Support

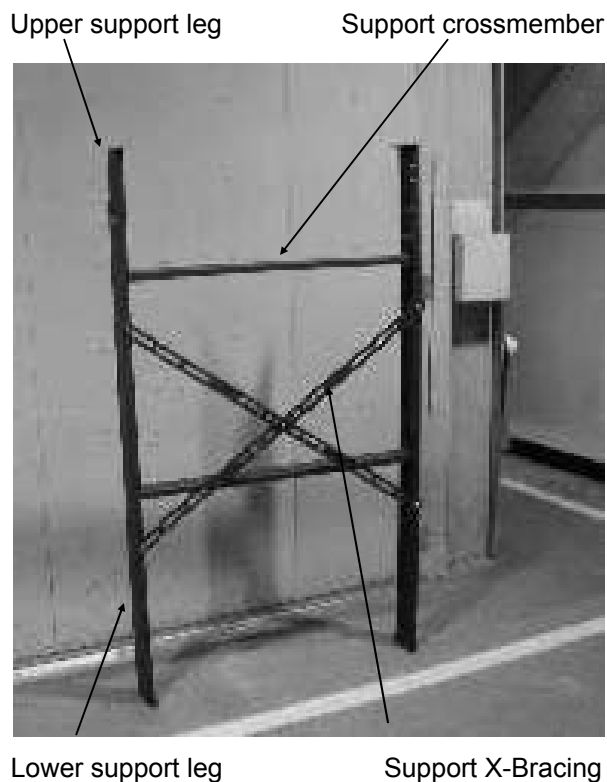


Assembly Instructions for Adjustable Height Supports

The support assemblies are adjustable for height and width using slots and holes.

1. Assemble the upper and lower support legs. Ensure that the support leg is the proper length before tightening the fasteners. Two heavy duty flange bolts and nuts must be used on each vertical leg to ensure support of the conveyor.
2. Assemble the support crossmembers using two heavy duty flange bolts and flange nuts. Ensure that the support crossmembers are the proper length before tightening the fasteners.
3. Assemble the support assembly using two legs and one or two crossmembers.
4. High supports may require an X-brace. Attach the X-brace to both the vertical legs and the crossmembers.

High Floor Support with X-Bracing





Installation Instructions for Adjustable Height Floor Supports

1. Stand the assembled floor supports under the conveyor. Attach to the bottom flange of the conveyor. Leave the fasteners slightly loose.
2. Lower the conveyor into position with the support feet on the floor.
3. Check to ensure that the conveyor is level across and along the belt surface (end to end). It is acceptable for one end to be slightly higher than the opposite end, but the conveyor frame must not be twisted.
4. Check to ensure that the support legs are vertical.
5. Check the conveyor height in relation to the adjoining conveyors. To make slight adjustments to the height, loosen the bolts that hold the upper and lower legs together. For large height adjustments, remove the bolts that hold the upper and lower legs together. Slide the upper and lower legs until the leg is at the required height and install and tighten the bolts.
6. Tighten all fasteners in the support legs, including the fasteners that attach the support legs to the conveyor.
7. Fasten the conveyor to the floor using floor anchors.

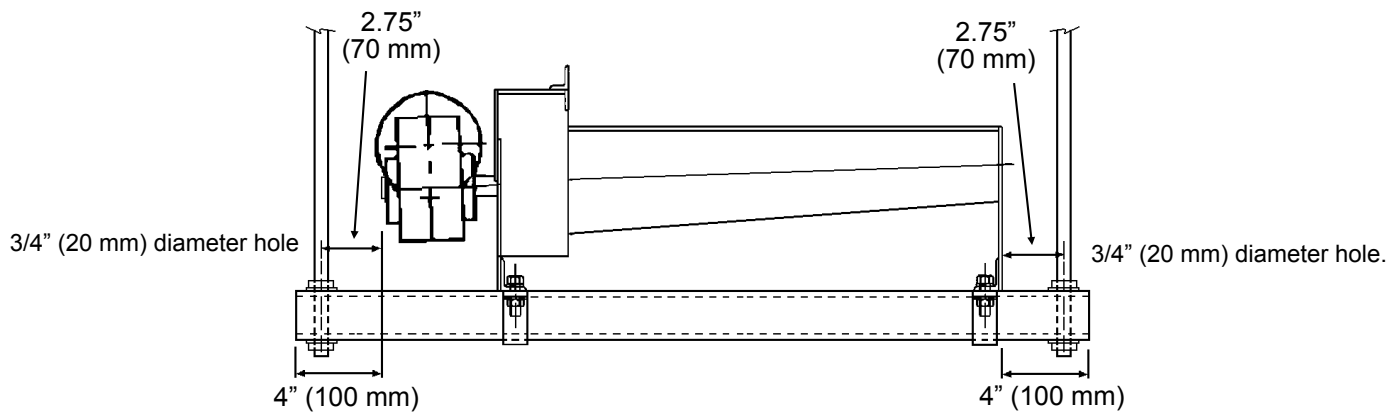
WARNING: Observe all safety precautions when working under hoisting equipment.

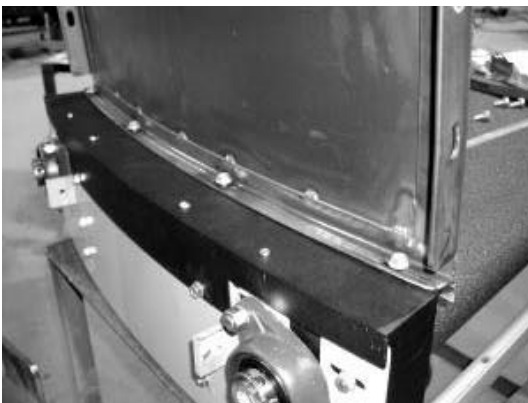
1. Raise the conveyor and attach the ceiling hanger supports to the bottom flange of the conveyor.
2. Move the conveyor to the required position.
3. Hang threaded rods securely from an overhead structure. Install jam nut near the bottom end of each threaded rod.
4. Insert the ends of the threaded rods through the pre-drilled holes in the ceiling hangers and install a second jam nut on each rod under the support hangers.
5. Adjust the jam nuts until the conveyor is positioned correctly at the right elevation. Check to ensure that the conveyor is level across and along the belt surface (end to end). It is acceptable for one end to be slightly higher than the opposite end, but the conveyor frame must not be twisted. Tighten all jam nuts to secure the conveyor in position.

Standard ceiling support hanger extends 4" (100 mm) past the conveyor frame. The hole center for the hanger rod is 2.75" (70 mm) from the frame.

A ceiling support hanger under a drive unit is longer. The support hanger extends 4" (100 mm) beyond the drive shaft extension. The hole center for the hanger rod is 70 mm beyond the end of the drive shaft extension.

The standard hole diameter for the hanger rod is 3/4" (20 mm).





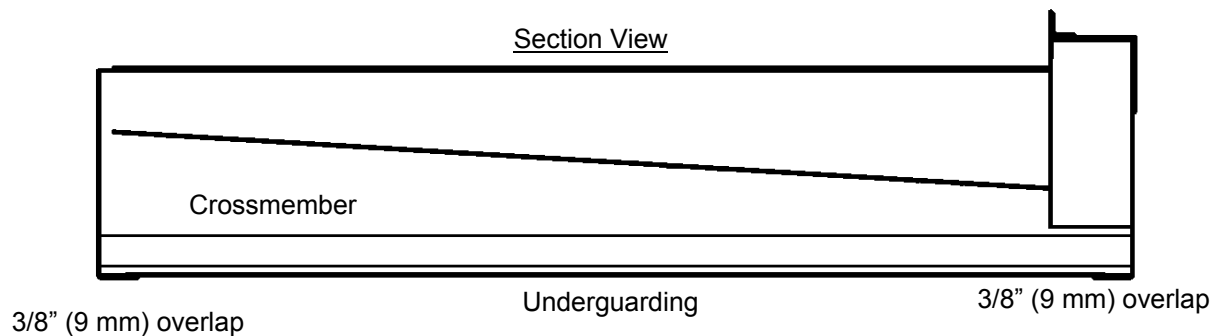
Sideguards for Portec curves are designed for quick, easy installation. Sideguards are installed at the factory prior to shipment. The sideguards may be removed for shipment. Portec uses cage nut inserts and slots to avoid loss of loose fasteners and to make installation and adjustment fast and easy.

1. Begin installation of the inside radius sideguard by loosening the bolts on the inside radius side frame. The bolts should be backed out 1/8-3/16" (3-5 mm).
2. Place the inside radius sideguard against the inside radius curved side frame above the loosened bolts. Align the slots in the lower edge of the sideguard with the bolts and lower the sideguard down onto the bolts.
3. Align the sideguard so it extends past the frame by an equal amount on each end of the side frame. The inside radius sideguard is designed to extend 3/8" (10 mm) past the end of the inside radius frame. Tighten the bolts.
4. Place the outside radius sideguard on top of the outside radius curved chain cover. Align the slots in the lower mounting flange with the studs in the top of the chain cover.
5. Align the outside radius sideguard so the end is flush with the end of the chain cover.
6. Fasten the sideguard to the chain cover.
7. Check the clearance between the bottom of the sideguard and the top of the conveyor belt. There should be 1/8-3/16" (3-5 mm) of clearance. Do not allow the sideguard to contact the belt.
8. If the sideguards are equipped with end flanges, attach the end flanges to the end flanges on the ad-

WARNING: Sideguards are not designed to support any weight from above. If the outside radius sideguard is pushed down, it may contact and damage the conveyor belt. It is extremely dangerous to temporarily support a conveyor by hanging it from its sideguards. The sideguards can be pulled loose and allow the conveyor to drop.

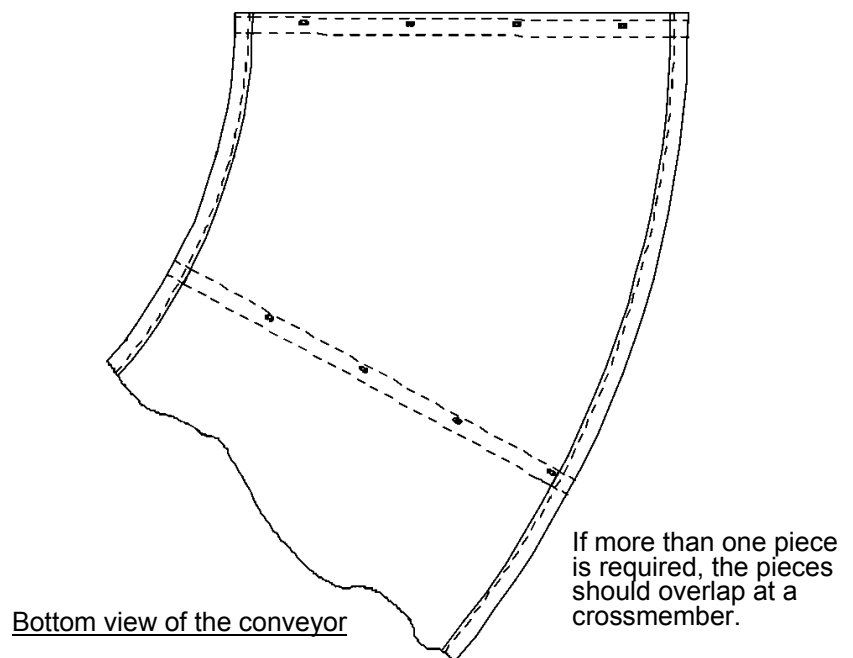
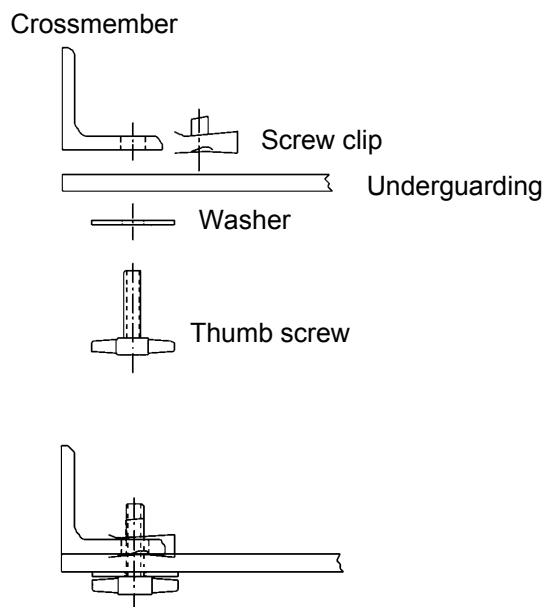
Section 8: Solid Metal or Plastic Mesh Underguarding

- The underguarding is attached with thumb screws to the angle steel crossmembers under the conveyor frame.
- If more than one piece is required, the pieces should overlap over a crossmember.
- Underguarding should be above the bottom flange of the conveyor frame and overlap by 3/8" (9 mm).



Align the holes in the underguarding with the slots in the crossmembers before attaching with fasteners.

Fasteners for underguarding



Section 9: Shaft-Mounted Gearmotor Installation Instructions (SEW used as typical example)



SEW gearmotors have a torque arm that requires a special bracket to enable the arm to be fastened to the conveyor.

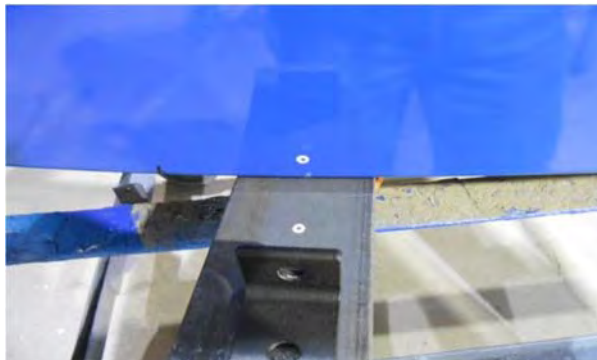
The photo shows an SEW gearmotor in the vertical position. It also may be mounted in a horizontal position.



Install the gearmotor onto the drive shaft and level from side to side.

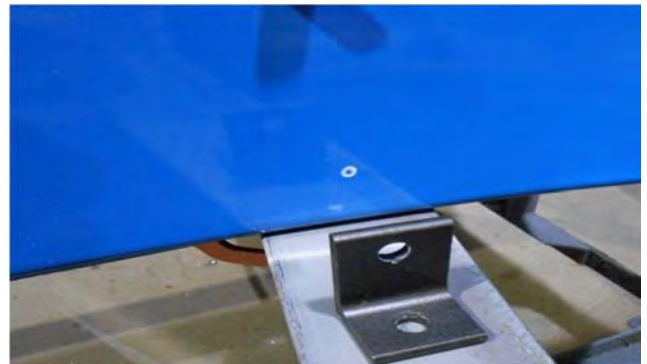


Install the turn buckle to the gearmotor. Position the cross angle under the conveyor so the turn buckle aligns on top of it.



Temporarily secure the cross angle to the conveyor foot rail with clamps.

Position the mounting angle and mark the mounting locations on the frame side and cross angle.





Install the saddle onto the turn buckle and clamp into position centered from side to side on the cross angle.



Weld all sides of the saddle onto the cross angle.



Radius all sharp edges.



Deburr and remove all debri.



Paint all bare metal.



Reassemble the drive mount.

After installing a Portec curve conveyor, check the following:

- ◆ Sideguards match up with adjoining conveyors.
- ◆ Elevation of conveyor belt match up with adjoining conveyors. They should be level or a small water-fall in the direction of travel.
- ◆ No guards or other metal edge contacting the conveyor belt.
- ◆ Floor supports anchored to the floor.
- ◆ Floor supports all are equally carrying the weight of the conveyor.
- ◆ All fasteners properly tightened.
- ◆ The conveyor belt is loose around the end roll.
- ◆ Drive mount is not rigid.
- ◆ Rotating shafts and pinch zones are protected with a guard.

PORTEC CURVE INSTALLATION- CRITICAL ITEMS

Review the Portec installation manuals regarding system layout. It is critical to have the BSG (between side guards) centerline in alignment with adjoining conveyor centerlines.

- When staging curves for installation do not stack unless there is blocking from curve slider-bed on lower unit to bottom frame on upper unit. No weight must reside on the side guards or chain cover.
- Insure that side guards are square to slider-bed and that **spacing between belt and side guard** on the outside radius, has not been altered from factory setting (1/8"-3/16"), before connecting to adjoining conveyors. If this factory setting has been altered, typically this means that excessive force has bent the chain cover. Place a pry bar between the belt and the side guard and lift up until the spacing is back to the factory setting.
- Portec either furnishes or can provide standard recommendations for the number of supports for a curve. In no case should the quantity of supports be less than 2 per curve located at the entry and exit. This applies to floor supported and ceiling hung curves.
- When using a forklift to position curves for installation the forks must extend from inside radius frame to outside radius frame. This may require the use of extensions for larger curves. Damage to critical components will occur if forks enter into the under side of the curve.
- Do not lift curves using the drive shaft extensions. Use the frame and a minimum of 4 points for even safe lifting.
- When mounting the inside and outside radius side guards to the conveyor ensure that the guard is centered on the conveyor prior to tightening them down. (Ref: TB-1223)
- Make sure that the spirals are installed at the correct entry and exit elevations from the floor. Also confirm that the conveying surface of the curve is level from side to side.
- Do not alter the position of the chain cover by raising it up to achieve a different side guard top of belt height. Leave the chain cover mounted in its correct position from the factory and loosen up the side guard end flange bolts and raise the side guard up off of the belt. Tighten the end flange mounting bolts.
- Insure that the return wheels/rolls are operating at the proper position prior to start up of the conveyor. If the return wheel/roll assembly has been pushed up severely into the belt at the outside radius, pull down on the shaft until the wheels/rolls are clear of the belt, then push up slightly until the wheel makes contact with the belt. (Ref: TB-1222 for set screw torque on wheels)
- Make sure that there is proper wear guide lubrication and chain tension during the commissioning phase and prior to turning the equipment over to the end user. (Ref. TB-1208 for lubrication/ TB-1212 for chain tension)
- Ensure that there is sufficient clearance between curve and straight conveyors to allow for future curve end pulley/bearing adjustment. Conveyors too close to the curve ends will impede the end user from adjusting to the proper belt chain tension as chain and guides wear. Do not adjust factory set bearings to achieve smaller gap at transfer. This may result in chain and/or belt tension being too high and curve failure.

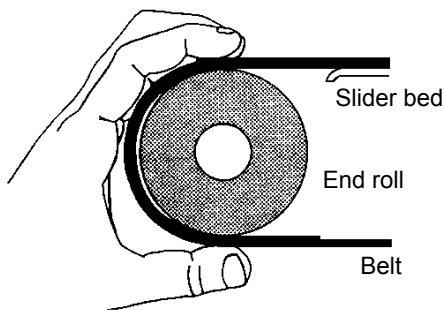
Perform a complete curve inspection after the first 40 hours of operation.

- Check belt drive chain alignments to the sprockets and guides, and check the chain slack.
- Check drive components for alignment and check that all fasteners are secure.

A Portec belt curve may be provided with regreaseable bearings (4) at the drive and idler end rolls. Lubricate these bearings at the same time as other system conveyors, which are typically on a quarterly service interval. A lithium based grease of a NLGI #2 consistency is recommended for most situations. Maintain the lubrication of the gearbox and drive chain (if equipped) according to the manufacturer's recommendations. Keep the area between the curve belt and bedplate relatively free from debris. Excessive debris may cause premature belt wear.

WARNING: Always disconnect the power and perform the appropriate lock-out/tag-out procedures before beginning service or maintenance on the curve.

Component(s)	Service Interval	Task(s)	Comments
Curve	Monthly	Check belt chain alignment to sprockets and guides. (listen for ticking noise at sprockets)	Adjust position if required and grease the chain.
		Check belt chain slack on unloaded side of sprocket. (listen for fluttering noise on entry end during operation)	To tighten chain, use jack bolt at outside radius.
		Visually check belt condition	Observe overall condition.
		Check drive components alignment/performance.	Adjust if required.
		Check that all fasteners and hardware are secure.	Tighten if required. Do not operate unless secure.
		Check that all guards are securely in place and properly adjusted.	Readjust for clearances and secure.
Belt & Components	Annually	Check for belt and seam damage. Check belt to chain attachments.	Repair or replace as needed.
End Roll Assemblies	Annually	Check end roll bearings for noise and lubrication.	Lubricate or replace as needed.
		Check end roll alignment in relation to sprocket and chain guide.	Adjust if required and grease the chain.
		Check end roll assembly set screws to ensure they are tight.	Adjust/tighten if required.
		Check that both end caps are non-damaged and properly adjusted.	Readjust for clearances and secure.
		Check shaft for condition with no visible damage.	If shaft is damaged from spinning in loose bearing collar or sprocket, replace as needed.
		Check sprockets for tooth wear.	Adjust or replace as needed.
Drive Arrangement	Quarterly	Check drive sprockets/chain or belt for wear.	Replace as needed.
		Check motor/reducer or gearmotor for noise.	Adjust if required or replace as needed.
		Check chain or belt tension.	Adjust if required.
		Check gear box lubrication level.	Refer to manufacturer's specifications.
Chain Guides	Annually	Check upper and lower chain guide strips for wear.	Lubricate and/or replace as needed.
Return Wheels	Semi-Annually	Check return wheels for noise.	Replace as needed.
		Check to ensure that return wheels are in contact with belt.	Adjust if required.
		Check that return wheels turn freely when in contact with belt.	Replace as needed.

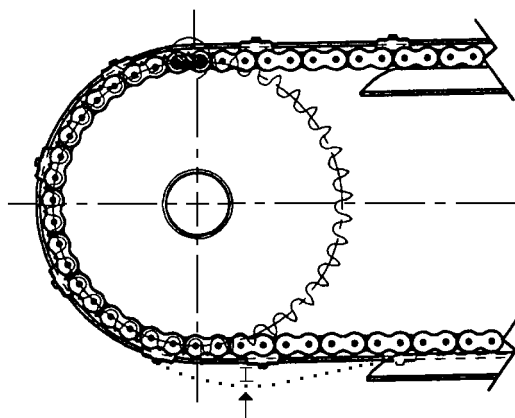


Squeeze and pull -- 1/8-1/4" (3.2-6.35 mm) gap
(AT THE INSIDE RADIUS END OF THE END ROLL)

NOTE: The belt should **NEVER** be adjusted tight against the end roll. **HIGH** belt tension is **NOT** required for optimum performance and can cause damage or premature failure.

1. Check the belt tension at the inside radius of the end roll by the "squeeze-pull" method as shown.
2. If belt is too tight or too loose, adjust the belt tension at the inside radius by moving the end roll bearing.
3. Loosen the bearing housing fasteners on the inside radius end of the end roll.
4. Tighten (or loosen) the belt by tapping against the bearing housing with a rubber mallet.
5. Tighten the fasteners of the bearing housing and check the gap by the "squeeze-pull" method.

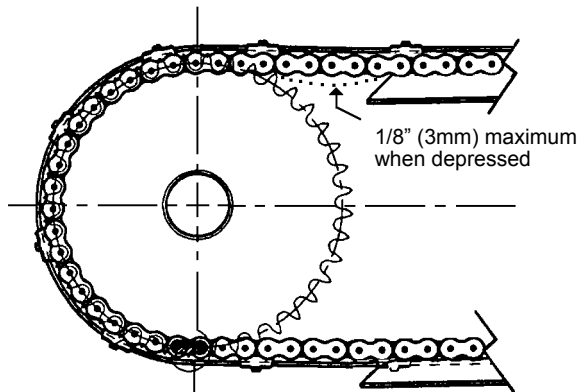
Section 11C: Belt Chain Tension Adjustment



1/8" (3.2mm) minimum 3/8" (9.5mm) maximum
CHECK TENSION

NOTE: Chain slack may develop during the initial run-in period while the chain seats on the chain guides or after a long period of operation.

1. Check chain slack on the bottom of the sprocket on the discharge end of the conveyor. Chain slack within the 1/8-3/8" (3.2-9.5 mm) range is acceptable.
2. Loosen the bearing housing fasteners on the outside radius end of the end roll. Chain tension can be adjusted at either end of the conveyor.



ADJUST TENSION

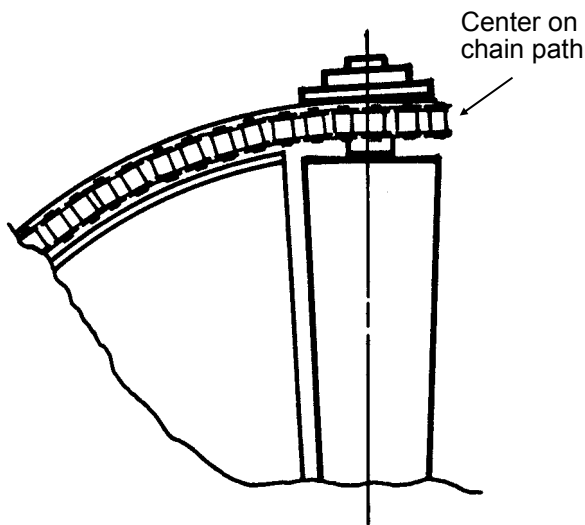
4. Use the jack bolt next to the bearing housing to move the end roll assembly. Move the outside radius end of the end roll assembly until the chain may be depressed 3 mm between the sprocket and the chain guide.

5. Tighten the backing nut used on the jack bolt and the bearing housing fasteners.

6. Check the alignment of the chain sprocket and the chain guides. If adjustment is necessary, see the Chain Sprocket Adjustment Procedures.

7. Replace the chain cover, end caps, and sideguard. Move the end caps close to the end roll without touching the conveyor belt.

Section 11D: Belt Chain Sprocket Alignment



NOTE: Chain “rattle” or “popping” as the chain engages or disengages the end roll sprocket may indicate that the sprockets need to be aligned.

1. Remove the outside radius sideguard, chain cover and end caps.

2. Check the condition of the sprocket teeth. Excessive uneven wear on the teeth indicate misalignment of the sprocket. Replace sprocket.

3. Check the alignment of the chain, sprocket, and chain guides. The sprocket should be centered in the chain path.

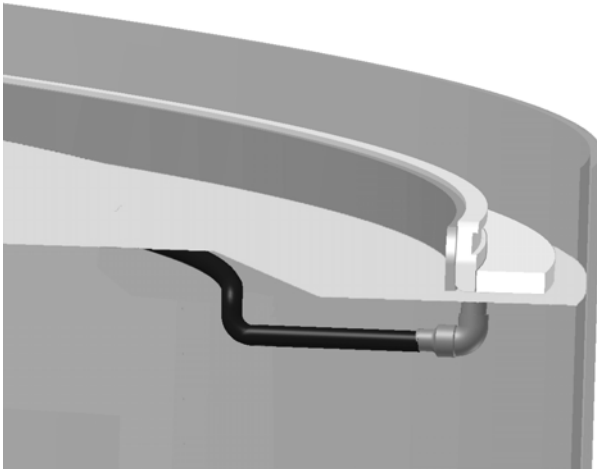
4. Loosen the set screws in the end roll bearings.

5. Move the end roll assembly with the shaft and sprocket until the sprocket is in the correct position. As the conveyor is operating, you should be able to see light between the sprocket side and the chain on each side of the bottom of the sprocket.

6. Tighten set screws in the end roll bearings.

7. Test run the conveyor and listen for the rattle or popping noise.

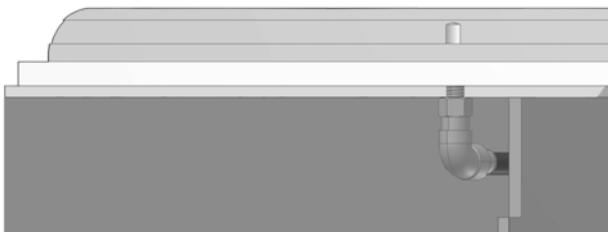
8. Install chain cover, end caps, and sideguard. Move the end caps close to the end roll without touching the conveyor belt.



The belt attachment chain is a “lubricated for life” chain. Under normal operating conditions further lubrication should not be required. When chain tension is adjusted properly the chain guide strips have a long life expectancy without lubrication.

When replacing a belt assembly and/or the chain guides, a light film of grease can be applied to the guides. This will replicate the initial application of grease that is applied to new belt curves at the factory.

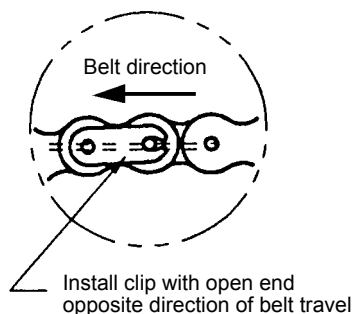
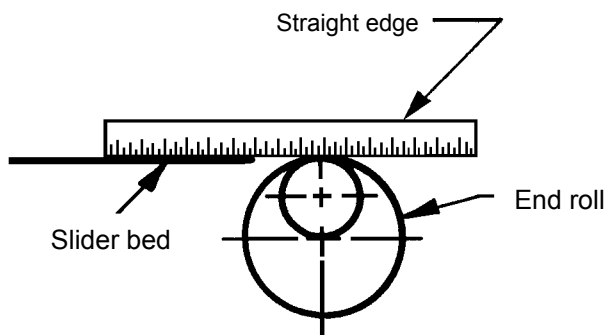
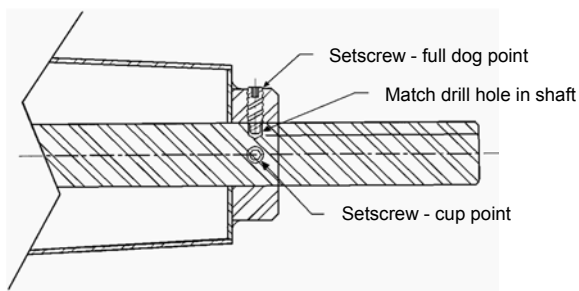
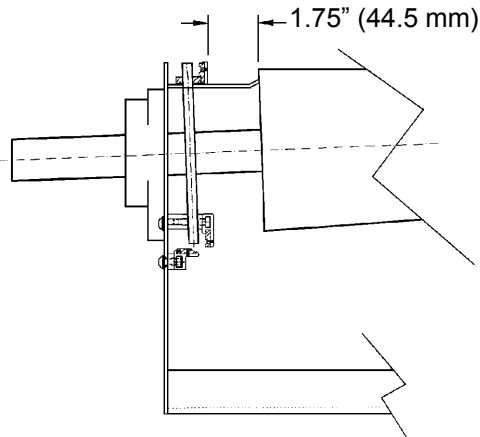
No more than a 1/8” bead should be applied. We recommend using Lubriplate Mo-Lith #2 grease or an equivalent moly-lithium, multi-purpose, extreme pressure, water resistant industrial grease.



Lubrication can be applied at other times as a fitting is supplied for this purpose. Typically it will be only needed on heavy loads, high speeds and certain environmental conditions.

The grease fitting is located at the charge (in-feed) end of the curve on the side of the conveyor frame. This can be used, as needed, to grease the chain guides while operating and between the changing of components.

Note: If the conveyor is operating in a food application, refer to the appropriate government regulation for the correct type of food-grade grease.



NOTE: The Portec engineered tapered end roll permits the belt to travel radially accommodating the differences in belt speed from the inside radius to the outside radius without scuffing (wearing) the bottom side of the belt as is common with cylindrical end roll variations of other systems. End roll lagging IS NOT required because the belt is powered by the positive mechanical belt/chain drive and NOT by a friction drive dependent on high belt tension against the end pulley common to other systems.

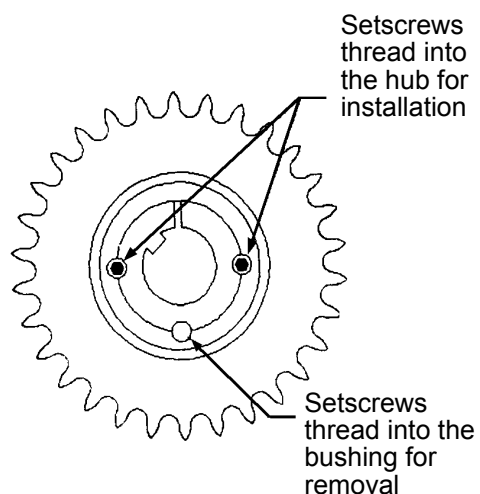
1. Remove the outside radius sideguard, chain cover, and end caps.
2. Move the belt assembly until the laced belt seam with the chain connecting link is on top of the conveyor bed and near the end roll that requires alignment.
3. Remove the chain connecting-link and clip, and the belt seam-lacing pin. Lay the belt back to expose the end roll.
4. The end roll position in relation to the sprocket is set at the factory (2.5" (63.5mm) to center of sprocket). The end roll should not be moved on the shaft. The end roll position in relation to the upper chain guide should only be set when the end roll is being replaced.
5. Loosen the bearing housing fasteners and raise (or lower) the end roll until the top of the end roll is at the same height as the slider bed. Tighten the bearing housing fasteners.
6. Install the chain-connecting link to reconnect the chain

NOTE: Install the connecting link clip on the outer side of the chain with the open end of the clip opposite the direction of belt travel.

7. Reinstall the lacing pin. Bend the lacing pin over on the outside radius and insert the end of the lacing pin into the lacing hooks. Ensure that at least 1/2" (13 mm) of lacing pin is inserted into the lacing hooks. Pull the lacing pin taut on the inside radius, bend the lacing pin back and insert the end of the lacing pin into the lacing hooks. The lacing pin may have to be cut to length so that about 1/2" (13 mm) of lacing pin is inserted into the lacing hooks.

8. Replace the chain cover, end caps, and sideguard. Move the end caps close to the end roll without touching the conveyor belt.

Section 11G: Taper-Lock Bushings in End Rolls and Sprockets (if equipped)



1. Loosening taper lock bushings: Remove the set screws and insert one into the hole which is threaded in the bushing only, using it as a jack screw. This will disengage the bushing for removal.

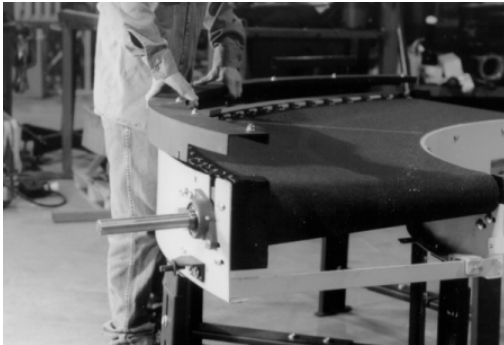
2. Tightening taper lock hubs: Insert both set screws in opposing half thread holes with the bushing hole pattern matching the hub pattern. Alternately tighten both set screws. Lightly tap the bushing to ensure proper seating and re-tighten both set screws.

Torque Required for Installation		
Bushing No.	Torque	
1610	175 Lb In	19.9 Nm
2012	280 Lb In	31.8 Nm
2517	430 Lb In	48.8 Nm



1. Disengage or remove the drive unit so the conveyor belt can move around the conveyor. A shaft-mount reducer will require complete removal. V-belt or chain/sprocket drive can be disengaged by removal of v-belt or chain.

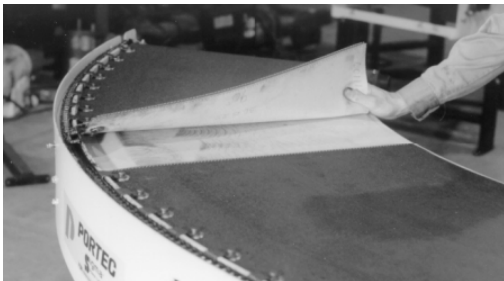
2. Remove the outside radius sideguard, chain cover, and end caps. Move the conveyor belt until the chain-connecting link is on top of the conveyor bed.



3. Loosen the bearing housing fasteners on the end rolls. Loosen the jack bolts on the outside radius frame. Push the end roll assemblies in towards slider bed to loosen the belt tension.

4. Remove the connecting-link and clip from the belt chain. Remove the seam-lacing pin from the conveyor belt.

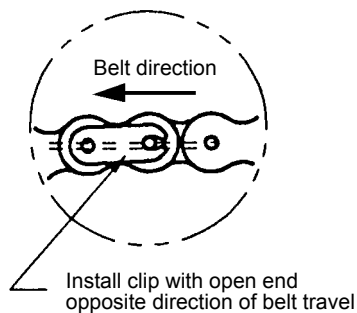
5. Lay one end of the belt back from the opened seam to expose the conveyor bed.





6. Place the new belt assembly on the exposed bed. Attach one end of the new belt to the end of the old belt using the connecting link and lacing pin.

7. Pull the old belt off the conveyor at the same time as the new belt is pulled around the bottom of the conveyor.



WARNING: Do not “power” the new belt onto the curve. This is extremely unsafe and can damage the chain guides and conveyor belt.

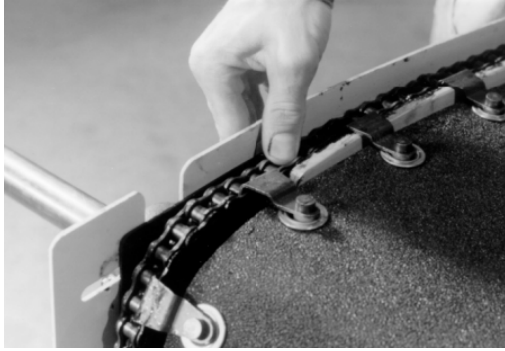
8. Disconnect the old belt from the new belt. Discard the old belt. Place the belt chain in the chain guide. Connect the two ends of the new belt chain together using the connecting-link and clip.



NOTE: Install the connecting link clip on the outer side of the chain with the open end of the clip opposite the direction of travel.

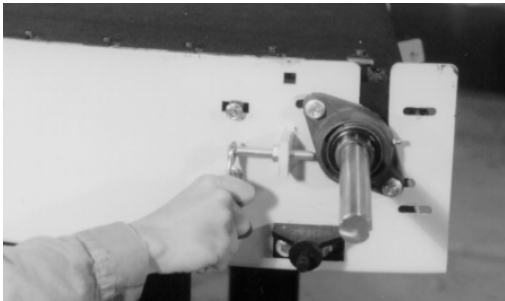
9. Put both ends of belt together, align the outside edges of the belt, and install the lacing pin. Bend the lacing pin over on the outside radius and insert the end of the lacing pin into the lacing hooks. Ensure that at least 13 mm of lacing pin is inserted into the lacing hooks. Pull the lacing pin taut on the inside radius, bend the lacing pin back and insert the end of the lacing pin into the lacing hooks. The lacing pin may have to be cut to length so that about 13 mm of lacing pin is inserted into the lacing hooks.





10. Adjust the chain tension so that the chain can be depressed 1/8" (3 mm) maximum between the end roll sprocket and the chain guide. Use the jack bolt next to the bearing housing to move the end roll assembly. The end rolls at the inside radius should remain loose.

11. Tighten the backing nuts on the jack bolts and the bearing housing fasteners.



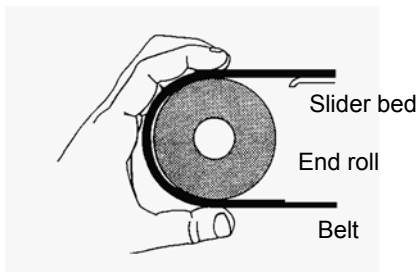
12. Check the alignment of the chain, sprockets, and chain guides. Pull chain out of upper guide and apply a 3 mm bead of Lubriplate Mo-Lith #2 grease or equivalent moly-lithium, multi-purpose, extreme pressure, water resistant industrial grease in the groove of the upper chain guide and chain.

13. Adjust the belt tension on the inside radius by moving the bearing housing of the end roll. Use a rubber mallet to move the bearing housing.

14. Tighten the bearing housing fasteners and recheck the gap between the end roll and belt by the "squeeze-pull" method.

15. Replace the chain cover, end-caps, and sideguard. Move the end caps close to the end roll without touching the conveyor belt.

16. Reengage or reinstall the drive unit. Install all safety guards and test run.

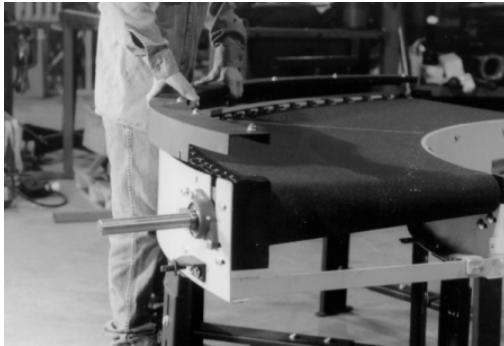


Squeeze and pull -- 1/8-1/4" (3.2-6.35 mm) gap
(AT THE INSIDE RADIUS END OF THE END ROLL)



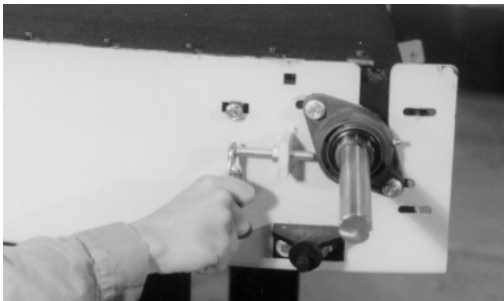
1. Disengage or remove the drive unit so the conveyor belt can move around the conveyor. A shaft-mount reducer will require complete removal. V-belt or chain/sprocket drives can be disengaged by removal of v-belt or chain.

2. Remove the sideguards, chain cover and end caps.



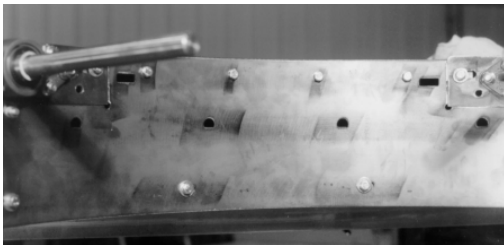
3. Move the conveyor belt until the connecting-link is on top of the conveyor bed.

4. Loosen all fasteners on the end roll bearings. Loosen the jack bolts on the outside radius frame. Push the end-rolls in to loosen the belt tension.



5. Remove the connecting-link from the belt chain.

6. Cut the conveyor belt from the outside radius to the inside radius using a sharp utility knife. Start the cut next to the chain ends.



7. Remove the old conveyor belt from the conveyor.

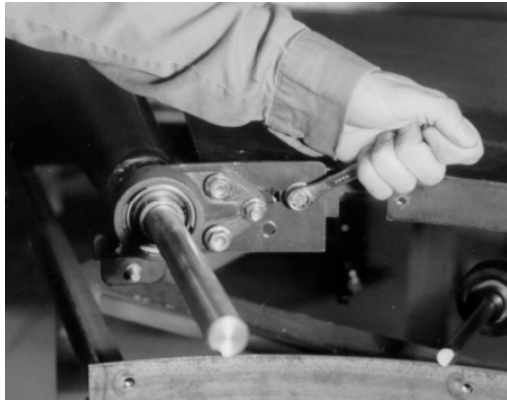
8. Remove the fasteners that attach the inside radius frame to the slider bed and foot rail.



9. Remove the nut from the stud that attaches the bearing plate to the inside radius frame.



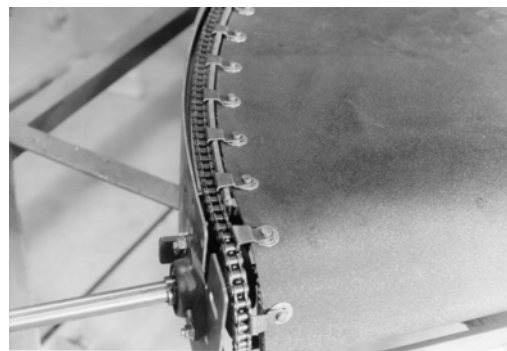
10. Remove the inside radius frame. The return roll assemblies will fall out when the inside radius frame is removed.



11. Loosen the bolt that attaches each bearing plate on the inside radius to the slider bed. Push the bearing plate as far as possible away from the end and tighten the bolts.



12. Install the new conveyor belt on the slider bed. Make sure one side of the belt is above the slider bed and one side is below the slider bed. The chain ends should be positioned near an end roll sprocket.



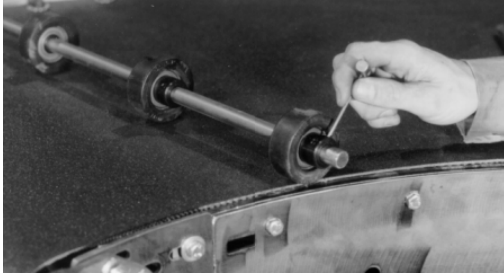
Note: Conveyor applications with food products may require a food-grade grease.

13. Pull the belt completely over the conveyor slider bed and put the belt chain into the upper chain guide and over the end roll sprockets. The lower side of the belt chain assembly will be outside of the lower chain guide.

14. Put the inside radius frame into position. Install the center fasteners that attach the inside radius frame to the slider bed. **DO NOT TIGHTEN AT THIS TIME.** Continue to install fasteners as you move from the center to the end roll.



15. Loosen the bolt holding each bearing plate on the inside radius. Move the bearing plates out and tighten the bolts.



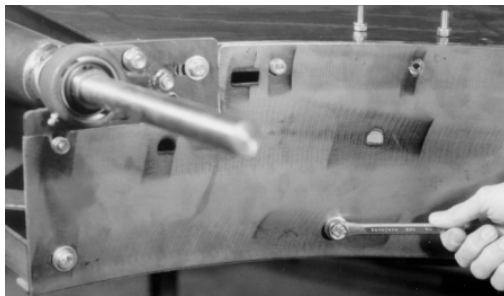
16. Move the return roller on the return roll shaft on the outside end of the shaft. The outside end of the shaft is opposite the end that has a flat side. Loosen the set-screw that attaches the return roller to the shaft and move the roller slightly away from the end.



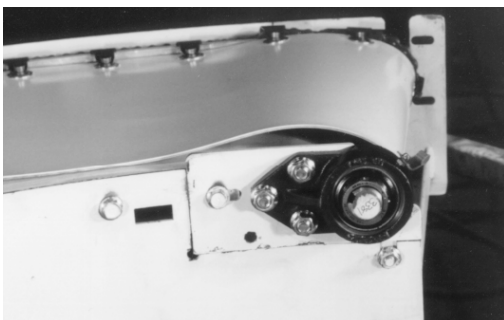
17. Put the outside end of each return roll shaft into its bracket on the outside radius. Put the inside radius end of the return roll shaft into the holes in the inside radius frame. When the return roll assembly is in position, move the return roller on the outside radius to the outside radius bracket. Tighten the set-screws on the hub of the return roll to hold the return roll assembly in position.



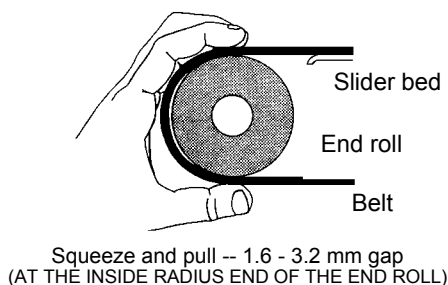
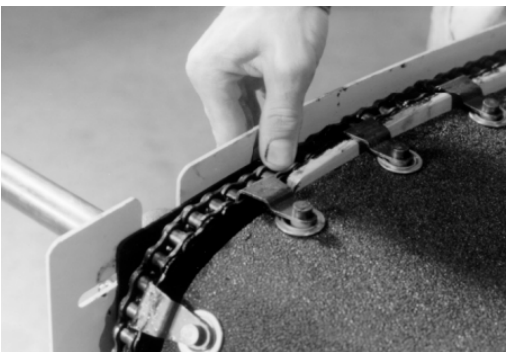
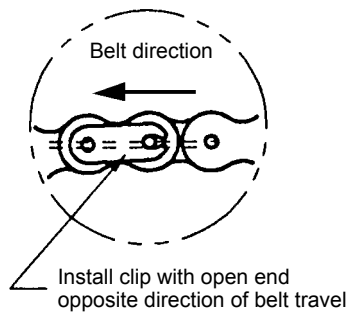
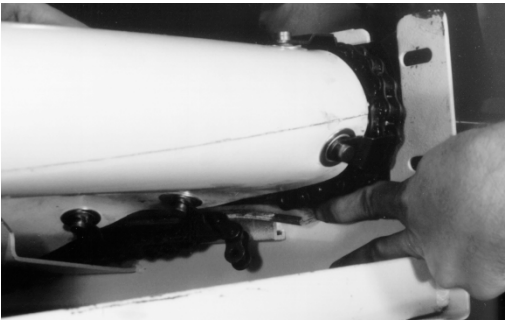
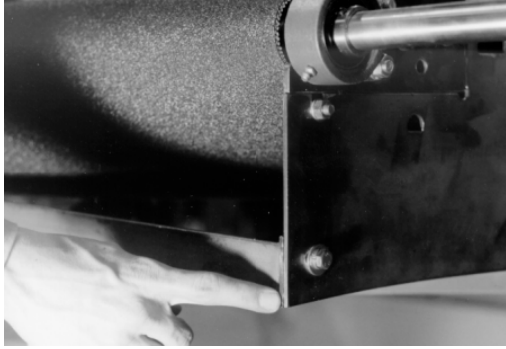
18. Put the fasteners through the bottom of the inside radius frame and into the foot rail. DO NOT TIGHTEN AT THIS TIME.



19. Loosen the bolts that attach the bearing plates on the inside radius to the slider bed. Align the stud with the slot in the inside radius frame. Install the nut on the stud. DO NOT TIGHTEN AT THIS TIME.



20. Align the inside radius frame so the distance from each end to the end of the slider bed is the same. Tighten the fasteners along the top of the inside radius frame and bearing plates.



21. Make sure that the end of the foot rail is even with the bottom of the inside radius frame. Tighten the fasteners along the bottom of the inside radius frame.

22. Move the disconnected ends of the belt chain to the lower side of the end-roll sprocket and put the end of the belt chain into the end of the lower chain guide. Pull the chain off of the upper guide and apply a 1/8" (3 mm) bead of Lubriplate Molith #2 grease or equivalent moly-lithium, multi-purpose, extreme pressure, water resistant industrial grease in the groove in the upper chain guide and chain

23. Move the conveyor belt around the conveyor and at the same time move the end of the belt chain through the lower chain guide. Move the conveyor belt until the end of the belt chain is on top of the conveyor.

24. Connect the two ends of the belt chain by installing the connecting-link

NOTE: Install the connecting link clip on the outer side of the chain with the open end of the clip opposite the direction of belt travel.

25. Adjust the chain tension so that the chain can be depressed 1/8" (3 mm) maximum between the end roll sprocket and the chain guide. Use the jack bolt next to the bearing housing to move the end roll assembly. As you move the end roll assembly inward, the chain tension will be reduced. The end rolls at the inside radius should remain loose.

26. Adjust the belt tension on the inside radius by moving the bearing housing to the end roll. Use a rubber mallet to move the bearing housing.

27. Tighten the bearing housing fasteners and recheck the gap between the end roll and the belt by the "squeeze -pull" method.

28. Install the chain cover, sideguards and end caps. Position the end caps close to the end roll without touching the conveyor belt.

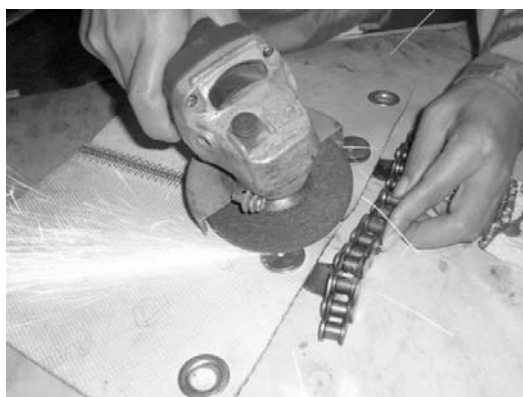
29. Reengage or reinstall the drive unit. Install all safety guards and test run.



Chain Breaker



Angle Grinder



The belt attachment link is used to attach the belt chain to the belt along the outside radius. This provides a positive belt-driven system not attainable by other systems that use extreme belt tension of a friction drive.

Belt Attachment-Link Replacement

1. Remove the outside radius sideguard, chain cover and end caps.
2. Rotate the conveyor belt until the damaged attachment-link is on top of the conveyor bed.
3. Loosen the bearing housing fasteners on the outside radius at the non-drive end. Loosen the jack bolt and move the bearing assembly in to relieve the belt chain tension.
4. Lift the chain from the chain guide near the damaged attachment-link. Break the belt chain on each side of the damaged attachment-link. A chain breaker is a good tool to break the chain, but it is also possible to grind off the chain rivet head using an angle grinder to break the chain.
5. Bend the edge of the conveyor belt over to expose the bottom. Grind off the rivet head that attaches the attachment-link to the conveyor belt. Remove the damaged attachment-link.

WARNING: Observe all appropriate safety precautions while using grinding tools to avoid personal injury.

NOTE: Do not contaminate the chain guides with metal particles or damage the conveyor belt while grinding.

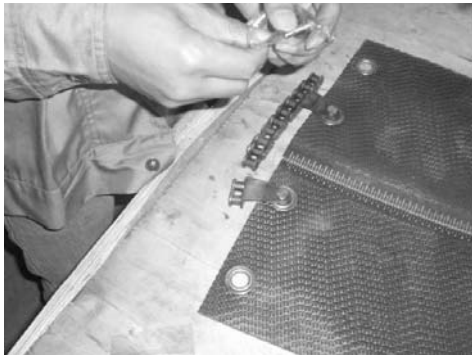


6. Install a new attachment-link in the belt chain using two connecting-links.

NOTE: Install the connecting-link clip on the outer side of the chain with the open ends of the clip opposite the direction of belt travel.



7. Inspect the condition of the belt grommet. Replace if worn or damaged.



8. Use a new rivet, washer, and bushing and attach the new attachment-link to the conveyor belt. Support the rivet with a flat metal block while peening the rivet "button" against the washer. Make sure the washer is tight and does not rotate on the rivet.

NOTE: Make sure you do not damage the bushing, the conveyor belt or the conveyor bed during the peening process.



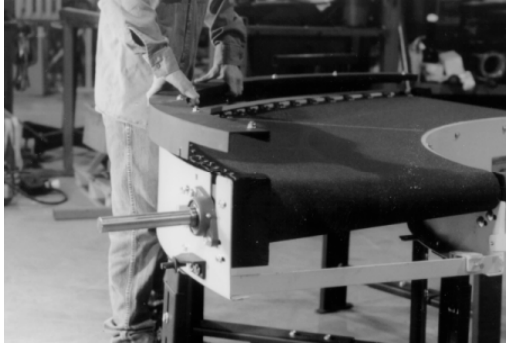
9. Put the belt chain into the chain guide.



10. Adjust the belt chain tension.

11. Install the chain cover, end caps, and sideguard. Move the end caps close to the end roll without touching the conveyor belt.

NOTE: A threaded rivet and cap screw is an alternative to the peened rivet head. They are available from the Portec Parts Department. Use Loctite® or equivalent permanent thread locking adhesive on the threads of a threaded rivet. Part #900808



Belt segment replacement (belt with laced seams):

If the belt is damaged in only one spot, it may be possible to replace only the damaged segment instead of the entire belt. Belt segments are specified by the required number of grommets. The segment is typically provided with lacing on both ends and two (2) master connecting links to fit into existing belt.

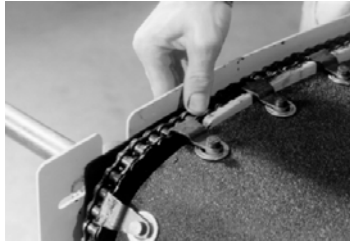
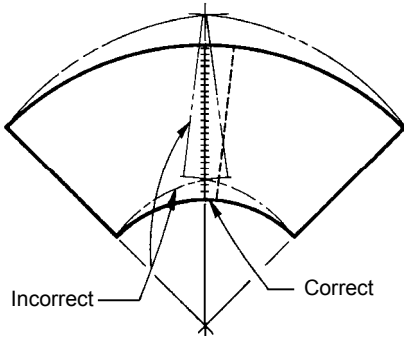
Replacement is as follows:



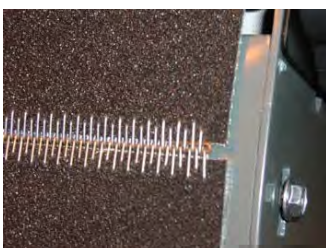
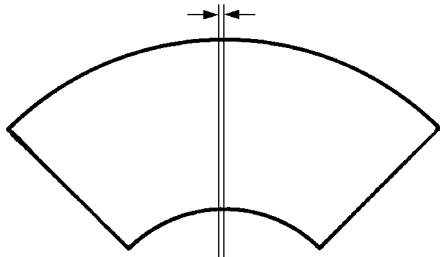
Chain Breaker

1. Remove the chain cover.
2. Disconnect the drive unit by removing the gearmotor (shaft mounted) or removing the chain between the drive shaft and gearmotor (chain or belt driven).
3. Loosen all end roll bearing mounting bolts and slide the end rolls to their minimum adjustment positions.
4. Move the belt assembly until the damaged area (segment) is on top side of the conveyor.
5. Break the chain at both sides of the damaged segment by using a chain breaker or grind off the chain rivet heads using an angle grinder.
6. Remove the damaged segment of belt by removing the lace pins.
7. Place the new belt segment on the conveyor and attach the ends of the new segment of chain to the old chain with two connecting links. Skip to step 14 to install lace pin on both sides connecting new segment to old belt.

Note: If belt segment is not laced follow steps 8-15.



5/16" (7.9 mm) space between ends of belt



8. Pull the inner radius ends of the belt together so that the ends overlap each other and the inside curvature matches along the lap. Usually, this will occur with the belt lying on the conveyor bed in a relaxed state.

Note: Sidebow connecting links must be used joining the chain ends. Standard roller chain links will not fit properly and will tend to work loose or stiffen the chain.

Note: The connecting link clip must be placed on the outer side of the chain with the open end facing away from the direction of travel.

9. Adjust the chain tension by moving both end rolls until the chain deflection is 1/8" (3 mm). The inside radius end of the end rolls should remain loose.

10. Using the end of one belt as a guide, draw a line on the end of the belt to be joined. Measure back 5/16" (7.9 mm) (to leave a 5/16" (7.9 mm) gap between ends) from that line and cut using a straight edge and razor knife.

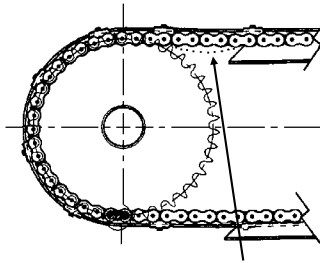
Note: Place a piece of scrap material under the belt to prevent the slider bed from being marred.

11. Disconnect the chain at the seam to be laced.

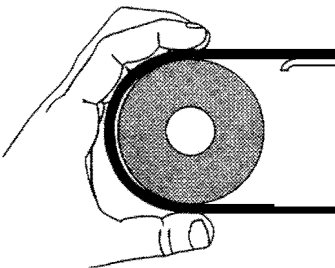
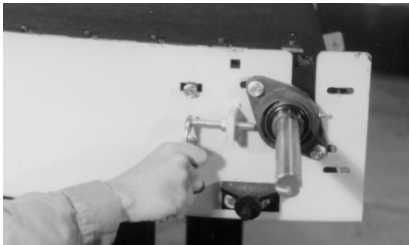
12. Install the belt lacing hooks in both belt ends using a vise lacing machine or other small lacing machine.

13. Rejoin the chain ends by reinstalling the chain connecting link.

14. Put both ends of belt together, align the outside edges of the belt, and install the lacing pin. Bend the lacing pin over on the outside radius and insert the end of the lacing pin into the lacing hooks. Ensure that at least 1/2" (13 mm) of lacing pin is inserted into the lacing hooks. Pull the lacing pin taut on the inside radius, bend the lacing pin back and insert the end of the lacing pin into the lacing hooks. The lacing pin may have to be cut to length so that about 1/2" (13 mm) of lacing pin is inserted into the lacing hooks.



Adjust chain tension until the chain can be depressed 1/8" (3 mm)



Squeeze and pull 1/8-1/4" (2.3-6.35 mm) gap

15. Repeat the process of cutting the belt and installing lacing on the second seam.

16. Adjust the chain tension so that the chain can be depressed 1/8" (3 mm) maximum between the end roll sprocket and the chain guide. Use the jack bolt next to the bearing housing to move the end roll assembly. As you move the end roll assembly inward, the chain tension will be reduced. The end rolls at the inside radius should remain loose.

17. Tighten the backing nuts on the jack bolts and the bearing housing fasteners.

18. Check the alignment of the chain, sprockets, and chain guides.

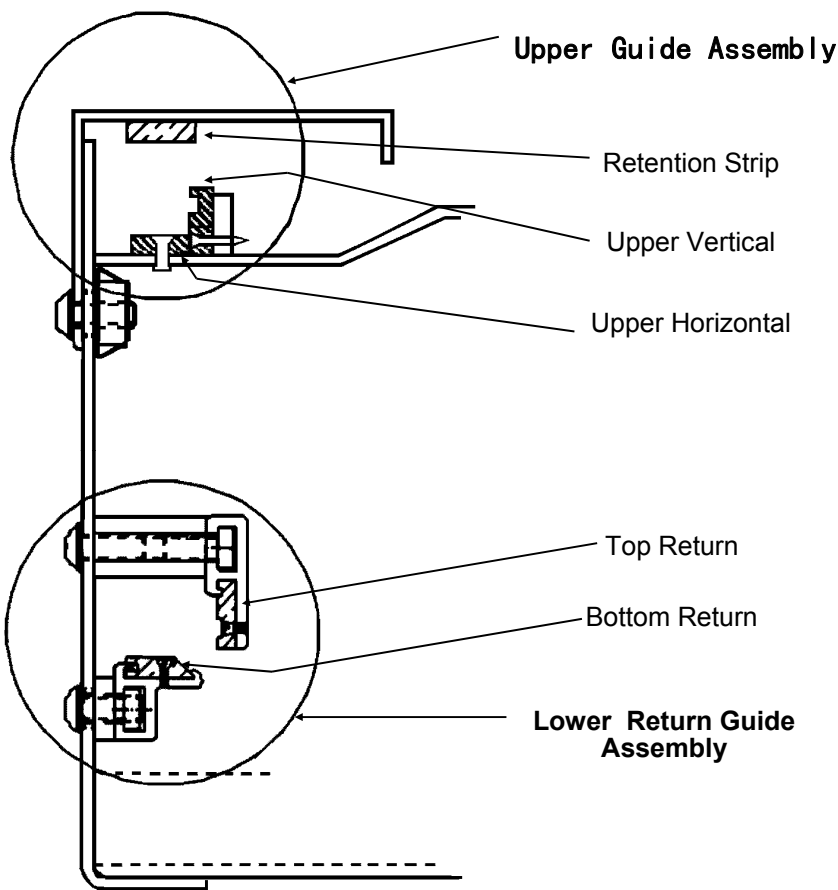
19. Adjust the belt tension on the inside radius by moving the bearing housing of the end roll. Use a rubber mallet to move the bearing housing.

20. Tighten the bearing housing fasteners and recheck the gap between the end roll and belt by the "squeeze-pull" method.

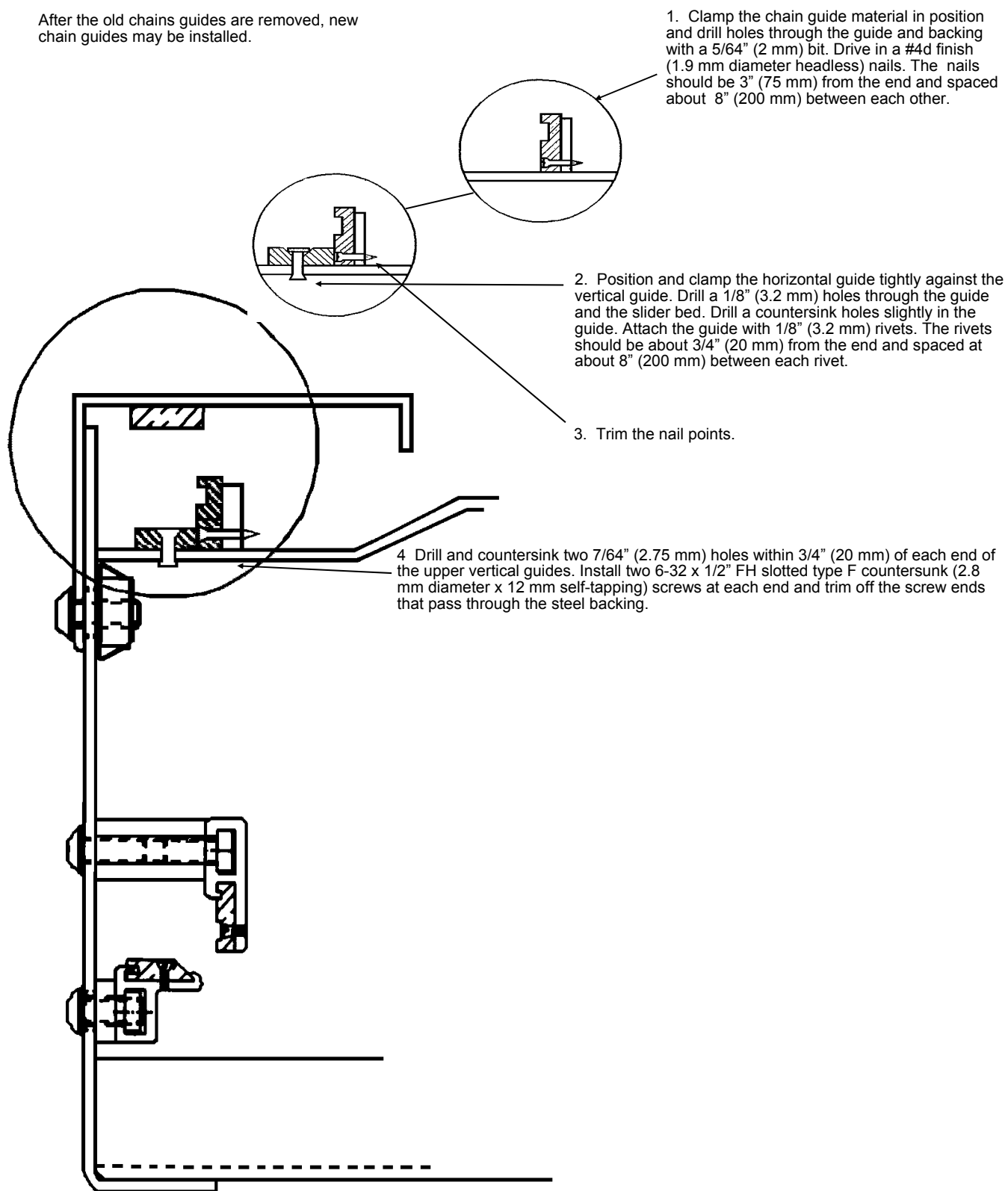
21. Replace the chain cover, end-caps, and sideguard. Move the end caps close to the end roll without touching the conveyor belt.

22. Reengage or reinstall the drive unit. Install all safety guards and test run.

Chain Guide Styles



After the old chain guides are removed, new chain guides may be installed.



Return Guide Replacement:

1. Remove upper row of fasteners along the lower side of the outside radius frame to disconnect the top return guide bracket. Slide the top return guide bracket out one end of the conveyor. The top return guide bracket with chain guide must be replaced as a unit.

2. Remove the M3.5-0.6 x 13mm flat head screws at both ends of the bottom return guides.

3. Slide the worn or damaged guide out of the guide bracket.

4. Slide the new guide(s) into the guide bracket(s) to the correct position and install one M3.5-0.6 x 13mm screw at each end.

5. If not already bent, slightly bend the ends of the bottom guide and bracket down to ease the entry or exit of the chain.

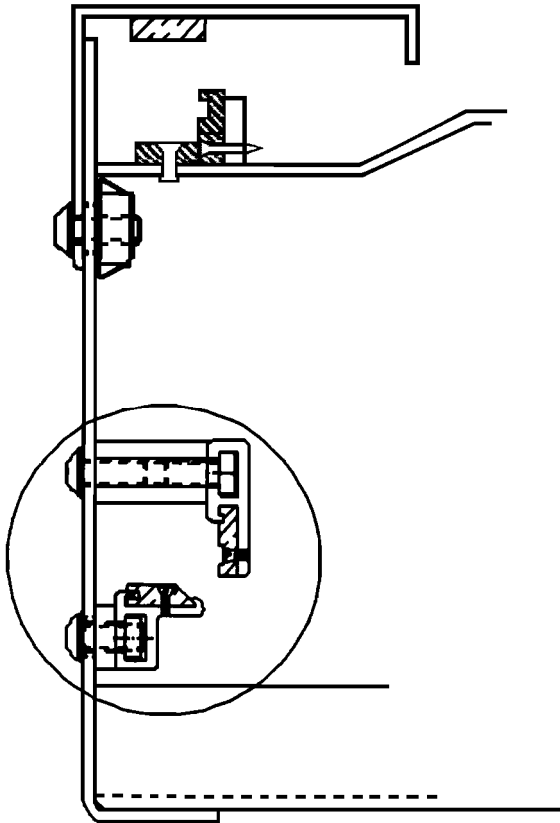
6. Slide the top guide bracket into position under the conveyor. Install the fasteners and tighten. Put the belt chain in this assembly.

7. Reassemble the belt chain using the connecting-link and the belt lacing pin.

8. Check the alignment of the belt chain and sprockets to the new chain guides. Adjust the sprocket position if necessary.

9. Replace chain cover and side guard. Move the end caps close to the end roll without touching the conveyor belt.

Note: For conveyors with endless belts — The belt does not need to be removed to replace the chain guides. Follow the above procedures except that the belt does not have a laced belt seam.



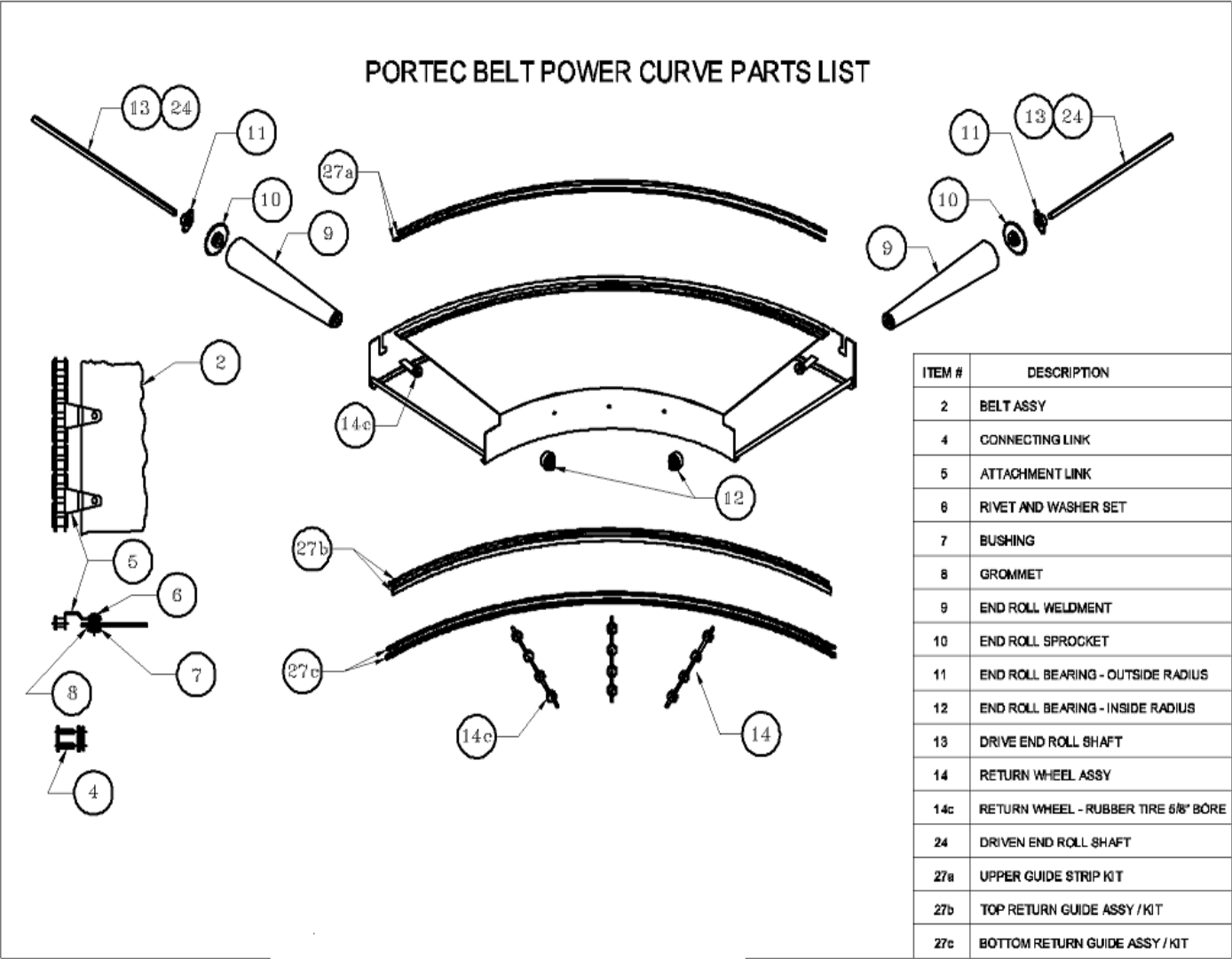
Problems	Causes - Solutions
Belt lacing pulling out at the inside radius	1) Belt tension on inside radius too tight SOLUTION: Adjust inside radius end roll position. 2) Damaged belt from jam. SOLUTION: Replace belt assembly. 3) Excessively worn belt SOLUTION: Replace belt assembly.
Grommets pulling out	1) Belt tension on inside radius too tight. SOLUTION: Adjust inside radius end roll position. 2) Foreign object rubbing against belt. SOLUTION: Remove foreign object. Repair grommet or replace belt.
Belt drive chain jumping the sprocket teeth	1) Chain tension too loose. SOLUTION: Adjust belt chain tension 2) Worn teeth on sprocket SOLUTION: Replace sprocket
Rumbling or ticking noise near end of conveyor	1) End roll sprocket out of position. SOLUTION: Adjust position of the sprocket. 2) Worn sprocket. SOLUTION: Replace sprocket. 3) Worn chain guides. SOLUTION: Replace chain guides.
Loose end roll and shaft	1) Loose end roll bearing collars. SOLUTION: Adjust end roll position and lock bearing collars. 2) End roll bearing failure. SOLUTION: Replace end roll bearing.
High frequency noise under the conveyor	1) Frozen return roll bearing. SOLUTION: Replace return roll. 2) Foreign object stuck between return roll and belt. SOLUTION: Remove foreign object.
Abnormal wear of return wheel rubber covers and curved marks on the top surface of the conveyor belt	1) Bent return wheel shaft or mounting bracket SOLUTION: Replace bent shaft and/or bend mounting bracket back into position. 2) Bearing failure SOLUTION: Replace return wheel.
Cut conveyor belt underneath the outside radius sideguard or chain cover	1) Heavy load on the top of the sideguard or chain cover pushed the bottom of the sideguard or chain cover down into the conveyor belt. SOLUTION: Replace the damaged chain cover.

- The list below is Portec's spare parts stocking recommendation for facilities with 1 to 5 Portec belt curves. The recommended quantities are for typical conveyor installations and provide the spare parts necessary to repair damage caused by a product jam. Portec belt curves are very durable and the components should not wear out for years. Actual service life of the conveyor components will depend upon the type of application.
- Use genuine Portec spare parts to ensure a perfect fit and top performance. Genuine Portec spare parts are supported by Portec's product warranty.
- When ordering, please provide the serial number and model number from the name plate on the inside radius of the curve (or the specific part number, if known) for accuracy in parts replacement.

Recom- mended Quantity	Portec Item #	Part Description
1	2**	Conveyor belt with chain
20	4*	Chain connecting link (#50)
10	5*	Chain attachment link (#50)
10	6*	Rivet and washer set
10	7*	Nylon bushing
10	8*	Grommet
1	9	End roll; tapered
1	10	Sprocket; end roll
1	11	End roll bearing; outside radius
1	12	End roll bearing; inside radius
1	13	End roll shaft; drive
1	14	Return wheel assembly
1	14c	Return wheel
1	27a	Upper chain guide strip set
1	27b	Top return guide assy/kit
1	27c	Bottom return guide assy/kit

* These parts are universal on all sizes. #4,5,6,7,8— can be purchased as set under p/n 452112

** Belts with laced seams will have lacing installed in both ends unless otherwise specified.



PD-127 08/10

2	Conveyor belt with chain
2b	Belt seam lacing with pin
4	Chain connecting link (#50)
5	Chain attachment link (#50)
6	Rivet and washer set
7	Nylon bushing
8	Grommet
9	End roll; tapered
10	Sprocket; end roll
11	End roll bearing; outside radius
12	End roll bearing; inside radius
13	End roll shaft; drive
14	Return wheel assembly
14a	Return wheel shaft
14c	Return wheel
24	End roll shaft; non-drive
25	Sideguard; outside radius
26	Sideguard; inside radius
27	Chain guide set
27a	Upper chain guide set
27b	Top return chain guide assembly
27c	Bottom return chain guide assembly