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PACLINE QUALITY STATEMENT

ADOPTED JANUARY 2001

It is Pacline's policy to Design and Install overhead conveyor systems that meet and exceed our customer's expectations for quality and price.

An extensive part of Pacline's Quality System is a process for continuous improvement. This process is documented and adhered to, and includes the annual establishment of quality objectives and their subsequent review.

Pacline is committed to providing a positive and productive work environment that fosters a high level of employee contribution and work satisfaction. Day-to-day operations are based on the underlying values of integrity, fairness and consistency. Pacline's engineers fully support our customer's before, during and after installation of our systems. Pacline's installation personnel perform their work in a safe and efficient manner, ensuring that Pacline systems are installed as specified.

Through the continual upgrading of our CAD systems and software, customers are assured of accurate and modern layout and installation drawings. Continuous product development ensures that Pacline can provide state of the art designs. Quality control procedures are in place to reduce errors, with the ultimate goal of eliminating them. Together, these influences result in increased productivity and efficiencies for our customers.

PACLINE CORPORATE HISTORY

Pacline Corporation was founded in 1979 by Lorne and Paul Geddes. During the early years, Pacline concentrated on the sales and marketing of several product lines but it became evident that overhead conveyors would be the focus of their effort. The constant development of new markets for their overhead conveyor products has led to a diverse customer and installation base amounting to millions of feet of conveyor in all regions of the world.

Pacline was purchased by Karl Scholz in 2005 and under his direction has grown sales and expanded product offerings. Today, Pacline occupies a modern building in Mississauga with crane-serviced bays, a product and equipment testing area and enhanced manufacturing capabilities. Pacline manufactures several styles of conveyor and is constantly engaged in product development. Some recent new products include the Pac-Trak™ towline floor conveyor and the Pac-Rak™ vertical carousel.

Pacline's Management team remains committed to maintaining a competitive advantage for the benefit of our employees and customers.

KARL SCHOLZ
PRESIDENT

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OVERHEAD CONVEYOR APPLICATIONS

Production Lines	Distribution Systems
Assembly Lines	Material Handling
Overhead Storage	Finishing Systems
Garment Handling	Automotive Industry - Plastics
Automotive Industry – Metal	Ceramic Industry
Dip Line Metal Treatment	Wood Finishing
Die Casting	Instrument Assembly
Empty Carton Handling	Trash Handling
Tote Return	Laundry Automation
Order Fulfillment	Food Preparation
Furniture Manufacturing	Plastic Injection Moulding
Metal Stamping	Electronics
Door Manufacturing	Agricultural Equipment
Degreasers	Industrial Ovens
Appliance Manufacturing	Plating Operations
Textile Mills	Die Storage
Gas Tanks	Propane Tanks
Consumer Goods	Sporting Goods
Investment Casting	Aircraft Industry
Foot Wear	Post Offices
Rubber Industry	Glass Products

Overhead conveyors represent the most economical method of conveying.

Handling product through processing such as spray-painting, dip painting, bonderizing, washing, degreasing, drying, cooling, sand blasting, and heat-treating.

Move incoming parts and new materials from receiving docks to storage, and outgoing parts to shipping docks, carrying parts between storage and manufacturing, or from one department to another.

Carry work in process of being manufactured, from one operation to another, and through assembly, inspection and packaging.

Mobile storage (using free air space) in warehouses and overhead spaces. Storage of parts between operations.

Transportation between buildings and over long distance, as from one plant to another.

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GUIDELINES FOR PREPARING YOUR LAYOUT

PACLINE engineers are specialists in Overhead Conveyor design. After a thorough analysis of your requirements, **PACLINE** prepares detailed layout drawings for your approval. However, should you wish to prepare your own layout drawing, please use the following as a guideline.

1. Locate conveyor path. Keep parallel conveyor paths as close as possible to simplify installation.
2. Locate equipment, workstations, aisles, columns, walls, load and unload areas, etc.
3. Make material flow diagram indicating quantity of material to be handled per minute or hour.
4. Determine the most convenient weight and/or number of pieces to be handled per carrier to establish tentative carrier size and shape.
5. Determine number of carriers per minute or hour.
6. Determine method of attaching conveyor or supports to your building.
7. Determine maximum incline angle for vertical curves.
8. Select horizontal curve radius. (Curves 24” radius or larger will reduce chain pull)
9. Verify all clearances, both horizontal and vertical.
10. Select tentative track elevations with respect to bottom of track.
11. Draw layout to largest possible scale. Indicate north direction.
12. Allow a minimum of 8” straight between tangent and vertical and/or horizontal bends.
13. Calculate total chain length. For calculation of chain length on horizontal plane, compute straight dimensions to include all curves. For calculation of chain length in vertical inclines, refer to elevation change charts.
14. Always position your drive at the highest elevation to **pull** the load.
15. Always position the take-up at a low point directly after the drive, and try to avoid curves between the drive and the take-up.
16. Always allow a safety margin when choosing hanging centers.

GUIDE TO ORDERING COMPONENTS

CHAIN 1. Calculate total length of chain including horizontal and vertical curves.

TRACK 2. Calculate total length of track. The following guide should be used:
Total track = total chain length
Less: chain in drive unit, chain in take-up and chain in all curves

DRIVE 3. For variable speed specify actual maximum speed required.

CURVES 4. Specify radius and degree of curves, both horizontal and vertical.

TAKE-UP 5. Specify spread width required. Spring, screw or air type.

INSPECTION 6. Track Inspection Sections: number required (usually 1 every 200 feet).

CONNECTIONS 7. Specify total number of:

a) Track joining flanges

b) Track hanger clamps

c) Sway braces

d) Beam clamps, etc.

LUBRICATION 8. Determine best method of lubrication for your system.

CLEARANCE 9. Advise Pacline of the size and weight of the largest and heaviest products to be conveyed and on what centers. We will make a plan view of all horizontal and vertical curves to confirm clearances.

10. Installation – By customer or Pacline.

11. Conditions – Advise general operating conditions.

12. Return Pacline questionnaire found on page 4.

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CONVEYOR SPECIFICATIONS

Please fill in and return to **PACLINE**

Company Name:_____

Date:_____

Speed Range:_____

Length of Conveyor:_____feet

Total Carriers:_____

Percent Loaded:_____

Carrier Weight:_____lbs.

Parts per Carrier:_____

Product Weight:_____lbs.

Product Dimensions___w___lg___ht

Product Description:_____

Suspension Method:_____

Production Rate:_____

Chain Pull:_____lbs.

Drive Horsepower:_____

Reducer:_____to 1 ratio

Sprockets:____tooth &____tooth

Power Supply:_____V_____PH_____Hz

Controller Type:_____

Overload Protection:_____

Emergency Stops:_____

Lubricator:_____

Lubricant:_____

Conveyor Guarding:_____

Unionized or Non-union Installation:_____

Installation By:_____

Roof Truss Construction:_____

Roof Truss Spacing:_____feet

Truss Orientation to Conveyor:_____

Support Steel:_____

Header Steel:_____

Horizontal Radius:_____inches

Vertical Radius:_____inches

Maximum Temperature:_____F

Process Description:_____
_____
_____
_____

Special Requirements: _____
_____

CHAIN PULL AND H.P. CALCULATIONS

Conservative figures for chain pull can be calculated by the method such as in the following example of an average conveyor with a total length of 400'-0", 30 lb. parts on 24" centers, and 7 lb carriers.

Total length of conveyor 400'-0" x 1.5 lbs. (chain weight per foot)	=	600 lbs.
Total weight of all carriers in system (400' / 2' centers x 7 lbs)	=	1,400 lbs.
Total weight of payload in system(100% loaded) (400' / 2' centers x 30lbs)	=	6,000 lbs.
		8,000 lbs.

A) Chain pull due to rolling friction 3% x 8000 = 240 lbs. (The percentage factor can range from 2% to 7 1/2%, see chart on the following page for anticipated friction.)

B) If vertical load in an incline does not balance with that of a declining load, added chain pull should be computed, as in the following example with a vertical load rising 10'-0". Keep in mind worst case scenario is unbalanced load (i.e. at start of work shift)

Total payload in the system = 6000 ÷ 400 = 15 lbs per foot.

Chain pull due to payload carried against gravity = 15 lbs x 10'-0" = 150 lbs.

C) Total chain pull

=	(A)	240 lbs.
+	(B)	150 lbs.
		390 lbs.

NOTE: Maximum chain pull allowed per drive is 600 lbs. If value is higher, two drives must be included in layout design.

HP CALCULATION

Conveyor speed in "feet per minute" will determine the horsepower requirements. The following formula illustrates how to calculate required horsepower, (based on above conveyor traveling at 15 FPM with a chain pull of 390 lbs.)

(390 lbs x 15 FPM) ÷ 33,000 ft-lbs per minute ÷ 0.7 efficiency (conservative) = 0.25 horsepower

Pacline would recommend that a 1/2 HP motor be used. It is always recommended to oversize the drive in order to overcome inefficiencies in the gear reducer as well as the static friction of the chain during startup.

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FRICTION CHART FOR CHAIN PULL CALCULATIONS

Pacline engineers have calculated the following values for rolling friction to be used during horsepower calculation. **Good operating conditions** include a lubricated conveyor, a clean environment and normal temperatures. **Poor operating conditions** include a poorly lubricated conveyor, dirty operating conditions, or temperatures above or below ambient temperature.

SYSTEM SPECIFICATIONS	GOOD OPERATING CONDITIONS	POOR OPERATING CONDITIONS
Single elevation conveyor with no more than equivalent (**8**) eight 90° horizontal turns.	2.0%	3.0%
Multiple elevation conveyor with no more than equivalent (**16)** sixteen 90° horizontal turns or (**4**) four compound vertical bends.	2.5%	3.5%
Multiple elevation conveyor with no more than equivalent (**32**) thirty-two 90° horizontal turns or (**8**) eight compound vertical bends.	3.5%	5.0%
Multiple elevation conveyor with no more than equivalent (**64**) sixty-four 90° horizontal turns or (**16**) sixteen compound vertical bends.	5.5%	7.5%

CHAIN RUN IN: It is very important to "break-in" the chain sufficiently prior to putting the system into production. The longer the line and heavier the loading the more critical this becomes.

Steps to Follow:

1. Lubricate the conveyor chain completely. This may require lubricating manually with a brush. An automatic lubricator takes many revolutions to completely lubricate the chain.

2. It is recommended that the system be allowed to run for several days before any load is put on the system.

3. During this "break-in" period the functioning of the take-up should be observed. Any excess accumulation of conveyor chain can be observed at the outlet side of the drive unit. **Important**: Remove any excess chain from the system to prevent a jam up at the drive.

4. It is recommended that there is drive protection with a current overload in the control panel this will also prevent chain damage in the event of a jam up.

5. Refer to the **Installation Manual** for additional installation details.

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CONVEYOR SPEED CHART SHOWING NORD REDUCER & SPROCKET SIZES

Speed FPM	Reducer Sprocket	Drive Sprocket	Speed FPM	Reducer Sprocket	Drive Sprocket	Speed FPM	Reducer Sprocket	Drive Sprocket
100:1 Reducer			**60:1 Reducer**			**30:1 Reducer Cont…**		
5.0	11	30	11.0	11	23	27.0	11	19
5.5	11	28	11.5	13	26	28.0	11	18
6.0	12	28	12.0	12	23	29.0	13	21
6.5	13	28	12.5	11	21	30.0	11	17
7.0	13	26	13.0	13	23	31.0	12	18
7.5	11	21	13.5	11	19	32.0	11	16
8.0	12	21	14.0	11	18	33.0	13	18
8.5	11	18	14.5	13	21	34.0	11	15
9.0	11	17	15.0	11	17	35.0	12	16
80:1 Reducer			15.5	12	18	**20:1 Reducer**		
8.0	13	28	16.0	11	16	30.0	12	28
8.5	13	26	16.5	12	17	31.0	13	29
9.0	12	23	17.0	11	15	32.0	12	26
9.5	13	23	**30:1 Reducer**			33.0	13	28
10.0	11	19	18.0	11	28	34.0	11	23
10.5	11	18	18.5	12	30	35.0	13	26
11.0	12	19	19.0	12	29	37.0	11	21
11.5	12	18	19.5	11	26	40.0	11	19
12.0	11	16	20.0	12	28	42.5	11	18
12.5	13	18	21.0	13	29	45.0	11	17
13.0	12	16	22.0	11	23	47.5	13	19
13.5	11	14	23.0	13	26	50.0	13	18
14.0	12	15	24.0	12	23	55.0	11	14
14.5	11	13	25.0	11	21	60.0	12	14
15.0	13	15	26.0	13	23	65.0	13	14

* 10:1 Ratio Multiplier can be coupled to the reducers to achieve additional speed reduction. However, with a ratio multiplier, motor size is restricted to max ½ HP.
** 5:1 Ratio Multiplier is used for Canimex, Ringball and Chenta reducers

Speeds shown are maximum attainable speeds for ratios listed.
For sprocket combinations or speeds not shown on this table, please consult **Pacline.**
Minimum speeds for AC variable speed drives are 20% of the maximum listed.
Minimum speeds for AC variable speed drive with inverter duty motors are 10% of the maximum listed.

Nord reducer shaft is a1-1/8” diameter, and drive shaft diameter is 1-¼”
Legacy (Canimex, Ringball, Chenta) reducer shafts are 1-3/8” diameter

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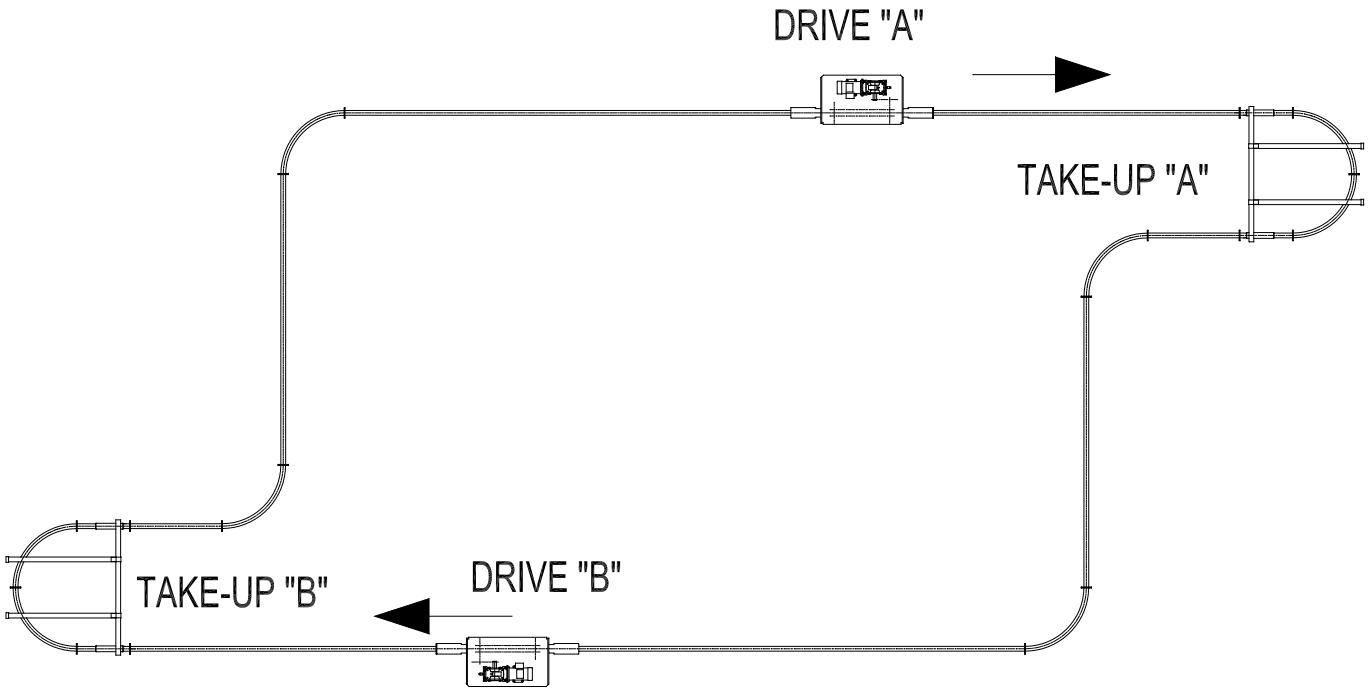
MULTIPLE DRIVE UNITS

There are two main reasons that a system may require multiple drive units. The most critical is **excessive chain pull**. When two or more drives are installed, the chain pull is distributed as equally as possible between them, therefore, the maximum amount of chain pull occurring on any given length of chain is divisible by the number of drives. The other reason is **excessive length**. A conveyor chain is an "elastic body" that stretches. Within limits, this stretch causes no problems. As the chain length increases, however, this stretch causes the chain to surge. For this reason, Pacline's Engineering Department has calculated the following guideline figures. We do not recommend exceeding the following limits unless a certain amount of surge can be tolerated. These figures are guidelines only and represent an average system. As expected, a layout containing many curves regardless of load may need to have less chain per drive unit.

LIGHT LOADS	-	600' - 650'
MEDIUM LOADS	-	400' – 550'
HEAVY LOADS	-	200' – 350'

NOTE: using multiple drives can increase Conveyor lengths. If length is 600 feet with one drive, the length can be increased to 1,200 feet with two drives and so on. Do not neglect to include one take-up for each extra drive unit.



For detailed engineering of your system requirements, do not hesitate to contact **Pacline**. In all multiple drive installations, it is recommended that a Pacline representative be on hand for the commissioning of the line.

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PACLINE L-275, L-375 & L-475 BRUSH LUBRICATOR

These lubricators are designed to be a dependable and economical method of applying the necessary amount of lubricant to the conveyor chain.

ADVANTAGES

- Simple and economical
- Safe operation
- Long lasting
- Low maintenance
- Clean and effective

SPECIFICATIONS

MOUNTING:	Can be bolted easily to any standard track inspection port.	
POWER:	L-275:	not required
	L-375:	115 or 230 VAC, 50/60 Hz, or 24 VDC
	L-475:	115 VAC, 60 Hz
WARRANTY:	One year	
DELIVERY:	Stock	

OPERATION

The L-275 Brush Lubricator, comes complete with a long life, stainless steel brush which applies lubricant to the chain quietly and efficiently. The flow is metered by a needle valve and monitored through a sight glass. A transparent reservoir allows a visual check of the oil supply at all times. The L-375 model has the extra feature of a control solenoid, which opens and closes the oiler valve as required. The solenoid may be wired simply to a switch or timer for control. The L-475 model is available with a total of 3 nylon brushes. This design ensures quicker and a more even coverage of the conveyor chain. A 1-gallon reservoir extends the period between refills. An integrated control panel with a photo sensor and a programmable timer ensures accurate lubrication intervals on the L-475 oiler.

Note: Because each system differs in length/speed/loads/temps etc, the amount of lubrication must be determined through trial and error.

See Pacline Drawings No. 123, 123A & 123B.

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CHAIN LUBRICATION (LUBRICATOR MODEL L-475)

PURPOSE: To ensure proper lubrication of conveyor chain at system startup and ongoing preventative maintenance.

APPLICABLE PRODUCTS: Pac-Line (round track). Not for use on systems where chain temperature is greater than 70 C (158 F) due to use of nylon brushes.

PROCEDURE: For L-475 automatic lubricator with PLC & reservoir style lubricator with three (3) nylon brushes:

1. Refer to Pac-Line Engineering Manual drawings #123B for general installation arrangement of lubricator unit & mounting bracket at an inspection section.
2. Use the nuts on the vertical threaded rods to lower the brushes until the bristles contact the surfaces as shown in Figure 1.
3. Fill the lubricator reservoir with Pacline supplied oil (PL-30 or Food Grade).
4. Use VFD to set system to run at 30 FPM for initial **Commissioning Cycle** lubrication application upon installation completion. (NOTE: If system is designed for max speed lower than 30 FPM, refer to Figure 2 for drip rates)
5. **Hang a flag or marker on one chain pendant.** ***With the chain running***, turn the lubricator "Mode" switch to ON.
6. Turn the thumb screw on each of the three (3) brushes to open the flow and fill the sight glasses (Figure 1).
7. Once the sight glasses are filled, turn thumb screws to decrease the Commissioning Drip Rate to the rates shown in Figure 2.
8. Run the system for 3-5 complete chain revolutions.
    a. Use the flag/marker from Step #5 to monitor & count the chain revolutions.
    b. Upon completion of each revolution:
        i. Visually check the chain for lubrication application at an inspection port (cover removed) with a flashlight. Surfaces that appear shiny & reflective have oil on them while dull surfaces are still unlubricated. Refer to surfaces indicated in Figure 3.
        ii. From underside of track, just downstream from the lubricator, visually check for signs of oil markings on the chain pendants. Examples are shown in Figure 4.
9. Once surfaces are lubricated and signs of oil markings are present OR you have completed 5 complete chain revolutions, use the thumb screw to decrease the drip rate to the **Typical Operation** drip rate shown in Figure 2.
10. Without adjusting the speed, continue to run the system for an additional 1-2 complete chain revolutions.
    a. Continue to visually check chain per Step 8b-i & 8b-ii.
11. Once surfaces are lubricated and signs of oil markings are present OR you have completed 2 complete chain revolutions (at the Typical Operation drip rate), turn the lubricator "Mode" switch to AUTO. AUTO mode will then monitor & count the chain pendants and restart the lubrication cycle as per the parameters it has been programmed with.
12. Allow the system to run continuously for 3-6 hours to allow the lubricant to work its way into the bearings and joints. During this time, oil drips may fall from the chain pendants and require some cleanup of the floor and wiping of excess oil from the chain pendants.
13. When the conveyor system is running during production, monitor the chain at an inspection port (cover removed) every 2-3 days per Step 8b-i only. Once you note dull chain surfaces, it is time to lubricate the chain for 1-2 revolutions at the **Typical Operation** drip rate (***recheck final operational speed if other than 30 FPM and re-adjust drip rates per Figure 2***). This interval (measured in operational days or hours) is considered the recommended interval at which the system must be lubricated to maintain adequate chain lubrication and avoid premature wear of the chain componentry.

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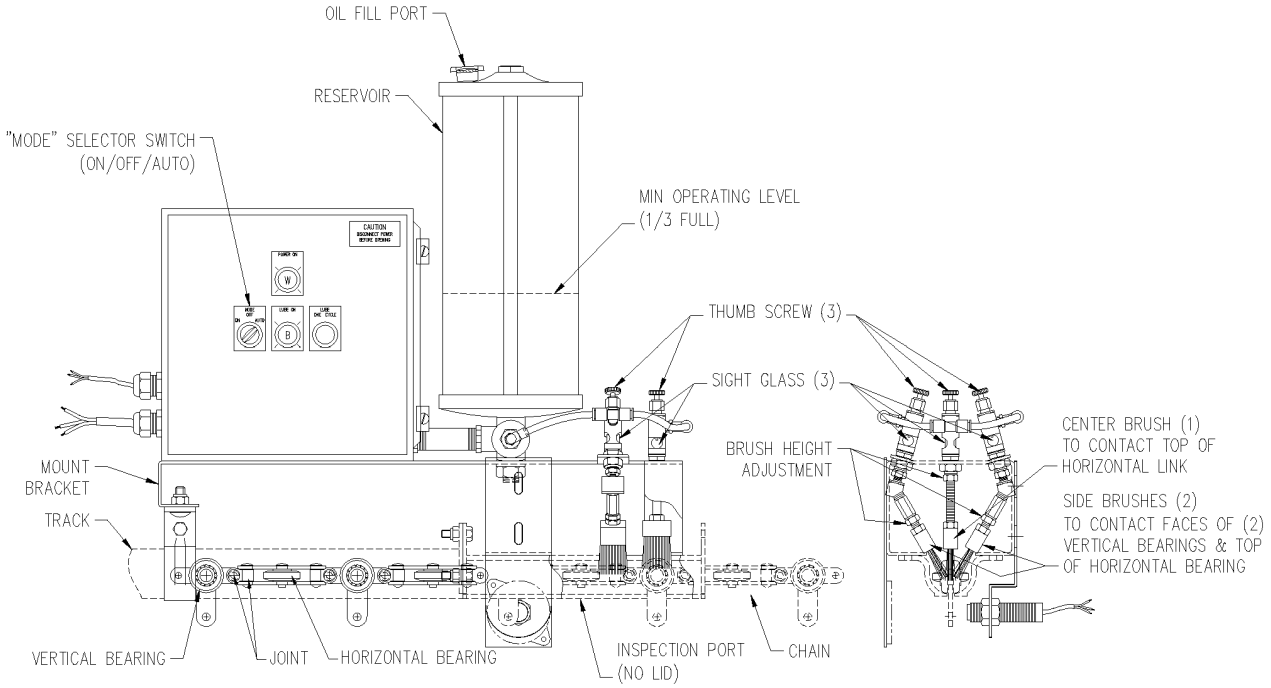
OTHER NOTES & CONSIDERATIONS

- As lubricant will evaporate with time:
  - Infrequent use of the conveyor may require lubrication intervals to be established based on a combination of run time AND stopped time. Intervals should be reviewed based on Step 8b-i.
  - Long periods of no use (3-4 weeks) may require thorough re-lubrication of chain similar to Steps 4 through 12 as outlined above.
- As you become familiar with the typical operation of the system, there are other signs to watch and listen for which will assist you in determining lubrication intervals:
  - If chain is squeaking, it requires lubrication!
  - If you hear increased noise from rolling bearings, it requires lubrication!
  - If chain & carriers are surging (i.e. swaying in-line due to pulsing chain), it requires lubrication!
  - If you see dripping on floor, decrease lubrication interval and/or drip rate!
- For consistent drip rate with gravity style lubricators, maintain oil level between full and 1/3.

FIGURE 1: Lubricator arrangement & height adjustment of brushes



Model L-475 (example shown with PL-30 oil)

FIGURE 2: Drip rate reference chart for (1) Center Brush & (2) Side Brushes**

Chain Speed (FPM)	Commissioning Cycle Drip Rate	Typical Operation Drip Rate
60	*reduce speed to 30 FPM and refer to rates @ 30 FPM*	CENTER & SIDES: 1 drip every 7-8 seconds
50		CENTER & SIDES: 1 drip every 8-9 seconds
40		CENTER & SIDES: 1 drip every 9-10 seconds
30	CENTER: 1 drip every 2 seconds SIDES: 1 drip every 3 seconds	CENTER & SIDES: 1 drip every 11-12 seconds
20	CENTER: 1 drip every 3 seconds SIDES: 1 drip every 4 seconds	CENTER & SIDES: 1 drip every 15-18 seconds

** NOTE: Typical Operation Drip Rates will vary based on environmental conditions (air quality, dusty environment, humidity, ambient temperature). ***Monitor chain and adjust PLC parameters (refer to excel parameter file SW-Eng-00008-PL and the L-475 Lubricator Manual) as necessary to ensure adequate lubrication is applied to all moving chain components.***

FIGURE 3: Chain surfaces to check for lubrication

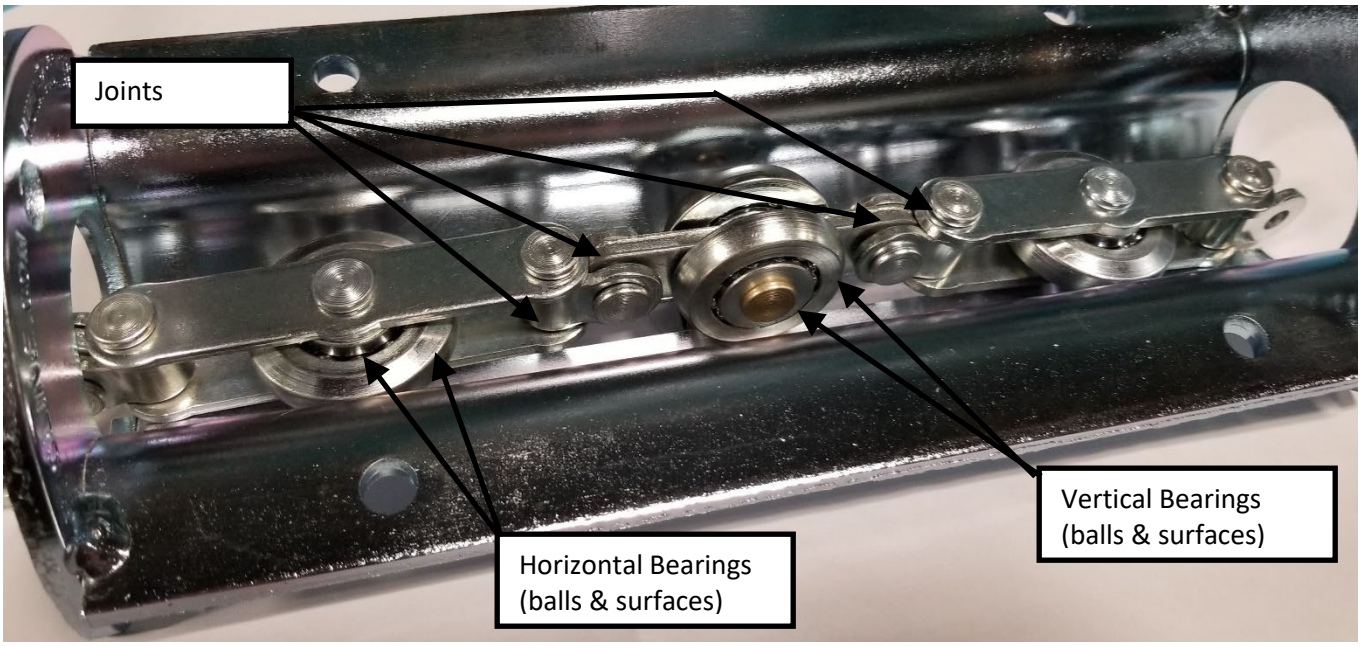
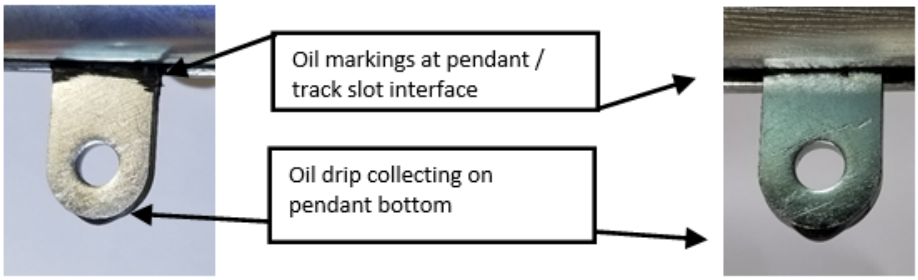


FIGURE 4: Signs of oil markings on chain pendants (typical examples)



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CHAIN LUBRICATION (lubricator models L-275 & L-375)

PURPOSE: To ensure proper lubrication of conveyor chain at system startup and ongoing preventative maintenance.

APPLICABLE PRODUCTS: Pac-Line (round track).

PROCEDURE:

For L-275 & L-375 basic reservoir style lubricators with one (1) round stainless steel brush:

14. Refer to Pac-Line Engineering Manual drawings #123 & #123A for general installation arrangement of lubricator unit & mounting bracket at an inspection section.
15. Use the nuts on the vertical threaded rod to lower the brush until the bristles contact the entire face of the horizontal bearing as shown in Figure 1.
16. Fill the lubricator reservoir with Pacline supplied oil (PL-30, PL-217 or Food Grade).
17. Use VFD to set system to run at 30 FPM for initial **Commissioning Cycle** lubrication application upon installation completion. (NOTE: If system is designed for max speed lower than 30 FPM, refer to Figure 2 for drip rates)
18. **Hang a flag or marker on one chain pendant.** ***With the chain running***, turn the lubricator ON.
    a. Model L-375 = energize to open the solenoid.
    b. Model L-275 = open the air valve inlet on top of the reservoir (Figure 1).
19. Turn the thumb screw to open the flow and fill the sight glass (Figure 1).
20. Once the sight glass is filled, turn thumb screw to decrease the Commissioning Drip Rate to 1 drip every 1 second. (NOTE: If system is designed for max speed lower than 30 FPM, refer to Figure 2 for drip rates)
21. Run the system for 3-5 complete chain revolutions.
    a. Use the flag/marker from Step #5 to monitor & count the chain revolutions.
    b. Upon completion of each revolution:
        i. Visually check the chain for lubrication application at an inspection port (cover removed) with a flashlight. Surfaces that appear shiny & reflective have oil on them while dull surfaces are still unlubricated. Refer to surfaces indicated in Figure 3.
        ii. From underside of track, just downstream from the lubricator, visually check for signs of oil markings on the chain pendants. Examples are shown in Figure 4.
22. Once surfaces are lubricated and signs of oil markings are present OR you have completed 5 complete chain revolutions, use the thumb screw to decrease the drip rate to the **Typical Operation** drip rate shown in Figure 2.
23. Without adjusting the speed, continue to run the system for an additional 1-2 complete chain revolutions.
    a. Continue to visually check chain per Step 8b-i & 8b-ii.
24. Once surfaces are lubricated and signs of oil markings are present OR you have completed 2 complete chain revolutions (at the Typical Operation drip rate), turn the lubricator OFF. Do NOT adjust the thumb screw (drip rate).
25. Allow the system to run continuously for 3-6 hours to allow the lubricant to work its way into the bearings and joints. During this time, oil drips may fall from the chain pendants and require some cleanup of the floor and wiping of excess oil from the chain pendants.
26. When the conveyor system is running during production, monitor the chain at an inspection port (cover removed) every 2-3 days per Step 8b-i only. Once you note dull chain surfaces, it is time to lubricate the chain for 1-2 revolutions at the **Typical Operation** drip rate ***(recheck final operational speed if other than 30 FPM and re-adjust drip rates per Figure 2***). This interval (measured in operational days or hours) is considered the recommended interval at which the system must be lubricated to maintain adequate chain lubrication and avoid premature wear of the chain componentry.

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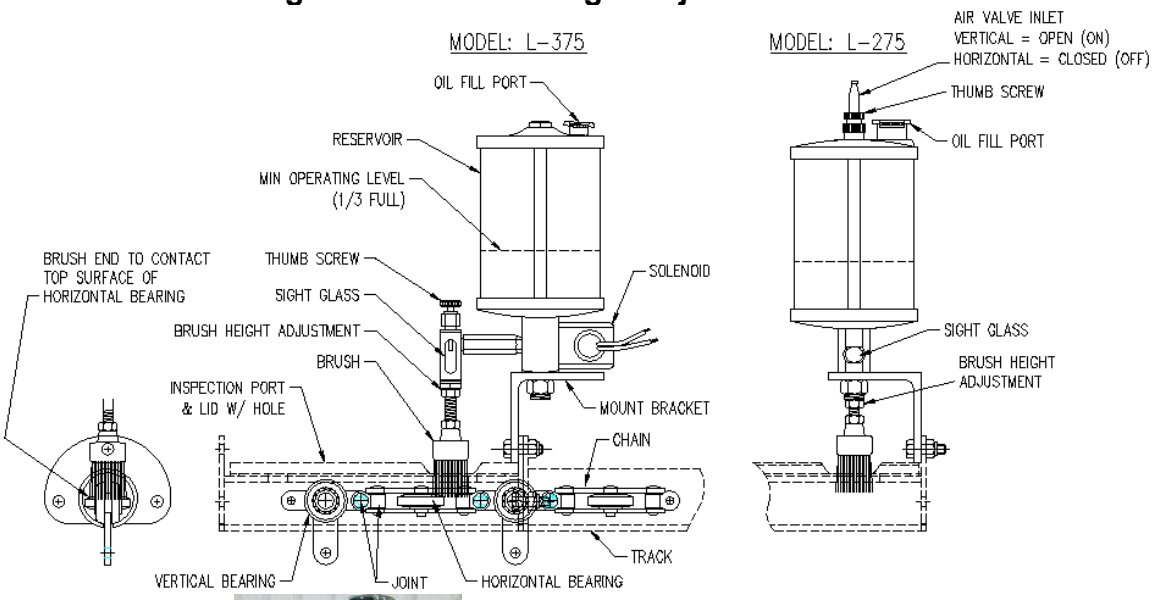
OTHER NOTES & CONSIDERATIONS

- In oven or washer applications, the conveyor may require very frequent or even continuous lubrication whenever the system is running, at a similar, increased or decreased drip rate (compared to the Typical Operation drip rate).
- As lubricant will evaporate with time:
  - Infrequent use of the conveyor may require lubrication intervals to be established based on a combination of run time AND stopped time. Intervals should be reviewed based on Step 8b-i.
  - Long periods of no use (3-4 weeks) may require thorough re-lubrication of chain similar to Steps 4 through 12 as outlined above.
- As you become familiar with the typical operation of the system, there are other telltale signs to watch and listen for which will assist you in determining lubrication intervals:
  - If chain is squeaking, it requires lubrication!
  - If you hear increased noise from rolling bearings, it requires lubrication!
  - If chain & carriers are surging (i.e. swaying in-line due to pulsing chain), it requires lubrication!
  - If you see dripping on floor, decrease lubrication interval and/or drip rate!
- For consistent drip rate with gravity style lubricators, maintain oil level between full and 1/3.

FIGURE 1: Lubricator arrangement & brush height adjustment



Model L-375 (example shown with PL-217 oil)

Model L-275 (example shown with PL-30 oil)

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FIGURE 2: Drip rate reference chart **

Chain Speed (FPM)	Commissioning Cycle Drip Rate	Typical Operation Drip Rate
60	*reduce speed to 30 FPM and refer to rates @ 30 FPM*	1 drip every 3-4 seconds
50		1 drip every 4 seconds
40		1 drip every 5 seconds
30	1 drip every 1 second	1 drip every 7 seconds
25	1 drip every 1.5 seconds (2 drips within 3 seconds)	1 drip every 8 seconds
20	1 drip every 1.5 seconds (2 drips within 3 seconds)	1 drip every 10 seconds
15	1 drip every 2 seconds	1 drip every 14 seconds
10	1 drip every 3 seconds	1 drip every 20 seconds
5	1 drip every 6 seconds	1 drip every 30-40 seconds

** NOTE: Typical Operation Drip Rates will vary based on environmental conditions, (oven, air quality, dusty environment, humidity, ambient temperature, oil type). Monitor chain and adjust as necessary to ensure adequate lubrication is applied to all moving chain components.

FIGURE 3: Chain surfaces to check for lubrication

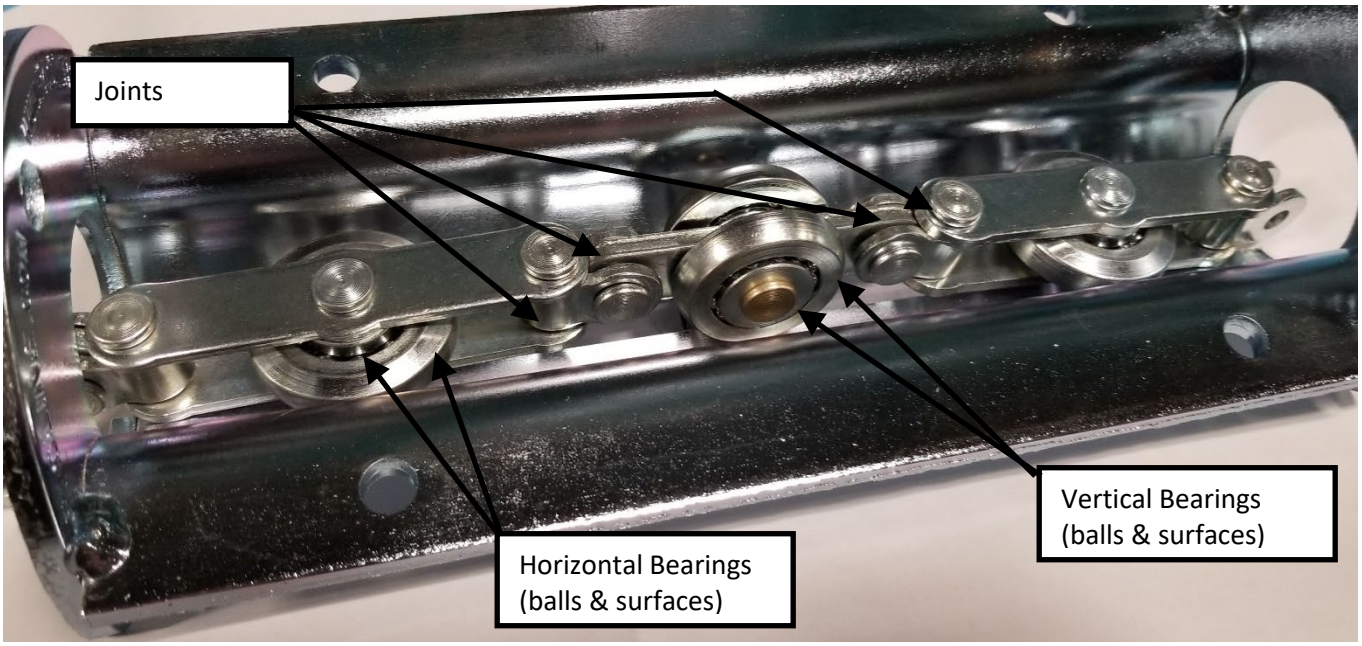
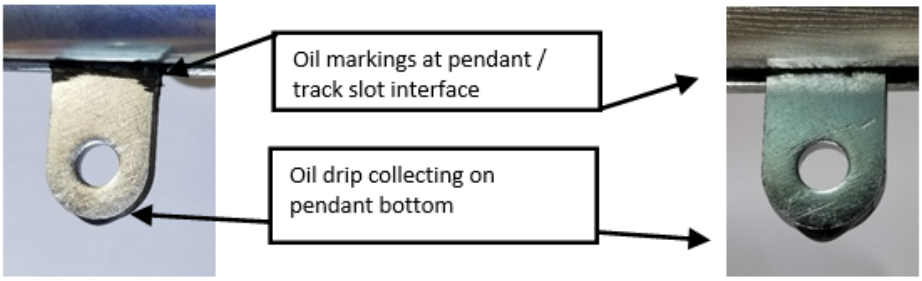


FIGURE 4: Signs of oil markings on chain pendants (typical examples)



PACLINE L-565 SHOT LUBRICATOR

This system can easily be retrofitted into existing systems as well as new overhead conveyor lines. The system effectively delivers a pre-measured shot of lubricant to the conveyor wheel bearings and chain pivot points, without dripping, when properly adjusted.

ADVANTAGES

- Saves on oil consumption
- Safe operation
- Can operate completely automatically
- Low maintenance
- Extended conveyor life

SPECIFICATIONS

- Mounting Can be mounted easily to any standard track inspection port
- Power 110 – 130 VAC 50/60 HZ
- Warranty One year
- Delivery 4 ~ 5 weeks
- Requires Shop air

OPERATION

The L-565 Shot Lubricator can be controlled by an on/off switch (not included). The L-565 Shot Lubricator is a self-contained unit and is recommended for long lines or where high temperature ovens are used on paint lines.

An electric timer can also be installed to run the lubricator (supply by others). A timer allows for lubrication at set intervals.

See Pacline Drawing No. 124

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SERVICE LUBRICATION GUIDE

In general, short conveyor systems operating with light loads under normal temperatures require moderate lubrication, which can be applied manually or with a brush type lubricator. It is recommended, however, that shot type lubricators be used on long lines or when operating the system through paint booths, washers, ovens, etc.

In addition to the conveyor chain, the drive unit requires periodic lubrication. Gear reducers are generally shipped with oil. Some reducers need to be refilled periodically with the proper gear oil, as required, (see "Speed Reducer Lubrication" section). In-line drive chains and sprockets should be periodically lubricated. It is recommended to use the same lubricant that is used for the conveyor chain to avoid incompatibility problems. Placing the conveyor chain lubricator on the in-feed side of the drive unit may offer the in-line drive chain adequate coverage.

The sliding members of the take-up unit require greasing at periodic intervals. It is not recommended to locate the take-up in an area below 30°F or above 190°F.

Lubricant specifications are divided into three stages, depending on operating temperature. These stages, however, are simply general recommendations and may vary depending on the layout and application of the conveyor. For unusual applications or complicated layouts, please consult **Pacline** as to the most suitable lubricant.

LUBRICATION CHART

Lubricant Number	PL-30
Temperature Range	5° ~ 120°C (41° ~ 248°F)
Description	This is a high quality standard duty chain lubricant designed to cling to metal parts to prevent dripping onto products being conveyed.
Specifications	ISO 100, Viscosity: >101 cSt at 40°C/104°F
Lubricant Number	PL-217
Temperature Range	93° ~ 316°C (200° ~ 600°F)
Description	Blended with non-petroleum, anti-wear based synthetics". No sludge, deposits or residue left behind. Protects against rust and corrosion with very high flash point.
Specifications	ISO 100-150, Viscosity: 137 cSt at 40°C/104°F
Temperature Range	600°F – 800°F - **CONSULT PACLINE**

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SPEED REDUCER – INSTALLATION, MAINTENANCE & LUBRICATION

INSTALLATION

When installing reducers, make sure to have rigid mounting to maintain alignment. This is recommended to minimize bearing and gear wear caused by misalignment. Mounting of reducers on bases, subject to vibration, should be avoided. Be sure vent plug is installed and not blocked to allow oil and air inside with heat expansion.

STARTING UP

Nord universal worm gear reducers are lightweight and compact with aluminum alloy housing. The unit comes with lubricating oil and is sealed for life. On Canimex, Ringball, Chenta style reducers, remove shipping plug from breather hole and install air vent cap prior to operating. It may take some hours of operation, under full load, for the gears to reach their highest efficiency. The gear may, if necessary, be put to work under full load immediately. However, it is better for the ultimate life of the gear to be run under gradually increasing loads (reaching the full load after about 20 to 40 hours). Reasonable precautions should be taken to avoid overloads in the early stage of running. Temperature rise on the initial run will be higher than the temperature eventually reached after the gear is fully run-in.

MAINTENANCE

With the sealed aluminum housing, Nord gear reducers are very quiet and maintenance free; therefore, oil top up is not required. On Canimex, Ringball, Chenta style reducers, check the oil level at least once a month. Never mix two different types of oil, if uncertain change the lubricant. False reading will be avoided by examining the oil level on stationary gears. To maintain free ventilation of the unit, the breather hole in the filter plug (air-vent) should be kept clear at all times. Inspect regularly the setscrew and reducer mounting bolts for tightness because loose fasteners can cause misalignment and excessive wear.

CHANGING LUBRICANT

On Canimex, Ringball, Chenta style reducers, oil should be changed at least every 2,500 operating hours or every 6 months, whichever occurs first. Never mix two different types of oil. Be sure to drain and wash before using another type of oil. Oil level in reducer should be up to red dot on sight glass and no more, as it will overheat.

SELECTION OF LUBRICANT

Lubricating oil must have a viscosity sufficient to reduce friction and allow the speed reducer to operate smoothly under high load and impact. Consult table below for the choice of lubricant. Where a wide temperature range is expected, the synthetic oil EXXON SHC 629 is recommended.

Lubrication (Canimex, Ringball, Chenta only)

Room Temperature ©	Operating Temperature ©	Oil Grade	Texaco	Shell	Exxon	
-30 to 0	under 70	80W90	Mepora 150	Omala 150	Spartan EP 150	SHC 629
	70 to 100	80W110	Mepora 320	Omala 320	Spartan 320	
0 to 25	under 70	80W110	Mepora 320	Omala 320	Spartan 320	
	70 to 100	80W110	Mepora 320	Omala 320	Spartan 320	
Over 25	under 70	80W140	Mepora 460	Omala 460	Spartan 460	
	70 to 100	80W140	Mepora 460	Omala 460	Spartan 460	

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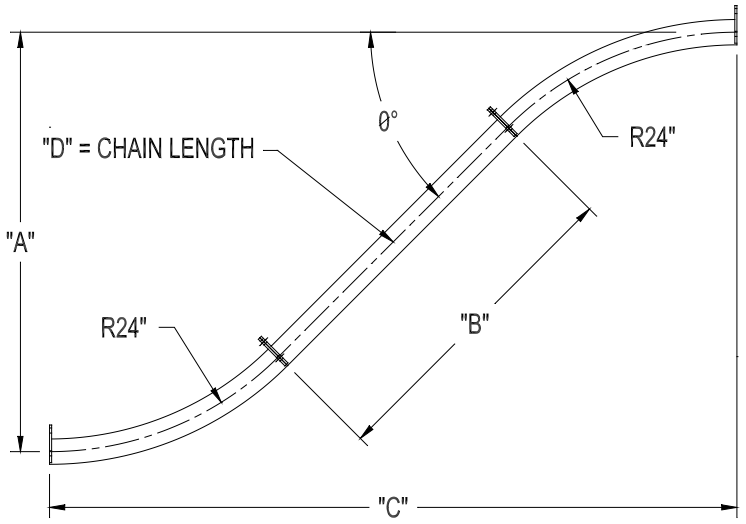
ELEVATION CHANGE CHART FOR 24" RADIUS VERTICAL CURVES

(values are the same for 24" radius horizontal offsets)



USE OF CHARTS

ADD	A	B	C	D
From 15° Chart 1	6'-0"	22'-7 7/8"	22'-11 1/16"	23'-8 7/16"
From 15° Chart 2	0'-9"	2'-10 ¾"	2'-9 5/8"	2'-10 ¾"
Required Dimensions	6'-9"	25'-6 5/8"	25'-8 11/16"	26'-7 3/16"

For values not shown in the charts use the following formulas:

B = A÷SINυ - 2RTAN(υ ÷ 2) **where:** υ = angle of incline

C = 2RTAN(υ ÷ 2) + (A ÷ TAN υ) **A** = elevation change in inches

D = B + (υ ÷ 90°)πR **B** = straight section required in inches

C = horizontal distance for change in Inches

D = Total Chain Length in Inches

R = Radius in Inches

CHART 1			ANGLE – 15°	CHART 2			
A	B	C	D	A	ADD TO B	ADD TO C	ADD TO D
0'-1 5/8"	---------	1'-3/8"	1'-9/16"	1"	0'-3 7/8"	0'-3 ¾"	0'-3 7/8"
1'-0"	3'-4 1/6"	4'-3 1/8"	4'- 4 5/8"	2"	0'-7 ¾"	0'-7 ¾"	0'-7 ¾"
2'-0"	7'-2 7/16"	7'-11 7/8"	8'-3"	3"	0'-11 5/8"	0'-11 ¼"	0'-11 5/8"
3'-0"	11'-3/4"	11'-8 11/16"	12'-1 5/16"	4"	1'-3 ½"	1'-2 7/8"	1'-3 ½"
4'-0"	14'-11 1/8"	15'- 1 ½"	15'-11 11/16"	5"	1'7 3/8"	1'-6 5/8"	1'-7 3/8"
5'-0"	18'-9 ½"	19' 1 ¼"	19'-10/16"	6"	1'-11 1/8"	1'-10 3/8"	1'-11 1/8"
6'-0"	22'-7 7/8"	22'-11 1/16"	23'-8 7/16"	7"	2'-3"	2'-2 1/8"	2'-3"
7'-0"	26'-6 ¼"	26'-7 13/16"	27'-6 13/16"	8"	2'-6 7/8"	2'-5 7/8"	2'-6 7/8"
8'-0"	30'-4 5/8"	30'-4 5/8"	31'-5 3/16"	9"	2'-10 3/4'"	2'-9 5/8"	2'-10 ¾"
9'-0"	34'-3"	33'-1 3/8"	35'-3 9/16"	10"	3'-2 5/8"	3'-1 3/8"	3'-2 5/8"
10'-0"	38'-1 5/16"	37'-10 3/16"	39'-1 7/8"	11"	3'-6 ½"	3'-5"	3'-6 ½"
11'-0"	41'-11 7/8"	41'-7"	43'-1/4"	12'	3'-10 3/8"	3-8 ¾"	3'-10 3/8"

Note: Charts for estimating purposes only.

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ELEVATION CHANGE CHART FOR 24" RADIUS VERTICAL CURVES *Continued*

(values are the same for 24" radius horizontal offsets)

CHART 1			ANGLE = 30°		CHART 2		
A	B	C	D	A	ADD TO B	ADD TO C	ADD TO D
0'-6 7/8"	----------	2'-0"	2'-1 1/8"	1"	0-2"	0'-1 ¾"	0'-2"
1'-0"	0'-11 1/8"	2'-9 5/8"	3'-1/4"	2"	0'-4"	0'-3 ½"	0'-4"
2'-0"	2'-11 1/8"	4'-6 7/16"	5'- ¼"	3"	0'-6"	0'-5 ¼"	0'-6"
3'-0"	4'-11 1/8"	6'-3 ¼"	7'-1/4"	4"	0'-8"	0'-6 7/8"	0'-8"
4-0"	6'-11 1/8"	8'-0"	9'-1/4"	5"	0'-10"	0'-8 5/8"	0'-10"
5'-0"	8'-11 1/8"	9'-8 13/16"	11'-1/4"	6"	1'-0"	0'-10 3/8"	1'-0"
6'-0"	10'-11 1/8"	11'-5 9/16"	13'-1/4"	7"	1'-2"	1'-1/8"	1"-2"
7'-0"	12'-11 1/8"	13'-2 3/8"	15'-1/4"	8"	1'-4"	1'-1 7/8"	1'-4"
8'-0"	14'-11 1/8"	14'-11 1/8"	17'-1/4"	9"	1'-6"	1'-3 5/8"	1'-6"
9'-0"	16'-11 1/8"	16'-7 15/16"	19'-1/4"	10"	1'-8"	1'-5 3/8"	1'-8"
10'-0"	18'-11 1/8"	18'-4 ¾"	21'-1/4"	11"	1'-10"	1'-7"	1'-10"
11'-0"	20'-11 1/8"	20'-1 ½"	23'-1/4"	12"	2'	1'-8 ¾"	2'

CHART 1			ANGLE – 45°		CHART 2		
A	B	C	D	A	ADD TO B	ADD TO C	ADD TO D
1'-2 1/16"	----------	2'-9 15/16"	3'-1 11/16"	1"	0'-1 3/8"	0'-1"	0'-1 3/8"
2'-0"	1'2 1/16"	3'-7 7/8"	4'-3 ¾"	2"	0'-2 7/8"	0'-2"	0'-2 7/8"
3'-0"	2'-7 1/16"	4'-7 7/8"	5'-8 ¾"	3"	0'-4 ¼"	0'-3"	0'-4 ¼"
4'-0"	4'-0"	5'7 7/8"	7'-1 ¾"	4"	0'-5 5/8"	0'-4"	0'-5 5/8"
5'-0"	5'-5"	6'-7 7/8"	8'-6 11/16"	5"	0'-7 1/8"	0'-5"	0'-7 1/8"
6'-0"	6'-9 15/16"	7'-7 7/8"	9'-11 11/16"	6	0'-8 ½"	0'-6"	0'-8 ½"
7'-0"	8'2 15/16"	8'-7 7/8"	11'-4 5/8"	7"	0'-9 7/8"	0'-7"	0'-9 7/8"
8'-0"	9'-7 7/8"	9'-7 7/8"	12'-9 5/8"	8"	0'-11 3/8"	0'-8"	0'-11 3/8"
9'-0"	11'-7/8"	10'7 7/8"	14'-2 9/16"	9"	1'- ¾"	0'-9"	1'- 3/4"
10'-0"	12'-5 13/16"	11'-7 7/8"	15'-7 ½"	10"	1'-2 1/8"	0'-10"	1'-2 1/8"
11'-0"	13'-10 13/16"	12'-7 7/8"	17'-1/2"	11"	1'-3 ½"	0'-11"	1'-3 ½"
12'-0"	15'-3 ¾"	13'-7 7/8"	18'-5 ½"	12"	1'-4 7/8"	1'-0"	1'-4 7/8"

CHART 1			ANGLE – 60°		CHART 2		
A	B	C	D	A	ADD TO B	ADD TO C	ADD TO D
2'-0"	---------	3'-5 9/16"	4'-2 ¼"	1"	0'- 1 1/8"	0'-5/8"	0'-1 1/8"
3'-0"	1'-1 7/8"	4'- ½"	5'-4 1/8"	2"	0'-2 ¼"	0'-1 5/8"	0'-2 ¼"
4'-0"	2'-3 ¾"	4'-7 7/16"	6'-6"	3"	0'-3 ½"	0'-1 ¾"	0'-3 ½"
5'-0"	3'-5 9/16"	5'-2 3/8"	7'-7 7/8"	4"	0'-4 5/8"	0'-2 ¼"	0'-4 5/8"
6'-0"	4'-7 7/16"	5'-9 7/16"	8'-9 11/16"	5"	0'5 ¾"	0'-2 7/8"	0'-5 ¾"
7'-0"	5'-9 5/16"	6'-4 ¼"	9'-11 9/16"	6	0'-6 7/8"	0'-3 ½"	0'-6 7/8"
8'-0"	6'-11 1/8"	6'-11 1/8"	11'-1 7/16"	7"	0'-8 1/8"	0'-4"	0'-8 1/8"
9'-0"	8'-1"	7'-6 1/16"	12'-3 ¼"	8"	0'-9 ¼"	0'-4 5/8"	0'-9 ¼"
10'-0"	9'-2 7/8"	8'-1"	13'-5 1/8"	9"	0'-10 3/8"	0'-5 ¼"	0'-10 3/8"
11'-0"	10'-4 ¾"	8'-7 15/16"	14'-7"	10"	0'-11 ½"	0'-5 ¾"	0'-11 ½"
12'-0"	11'-6 9/16"	9'-2 7/8"	15'-8 7/8"	11"	1'-0 ¾"	0'-6 3/8"	1'-0 ¾"
13'-0"	12'-8 7/16"	9'-9 13/16"	16'-10 11/16"	12"	1'-1 7/8"	0'-7"	1'-1 7/8"

Note: Charts for estimating purposes only.

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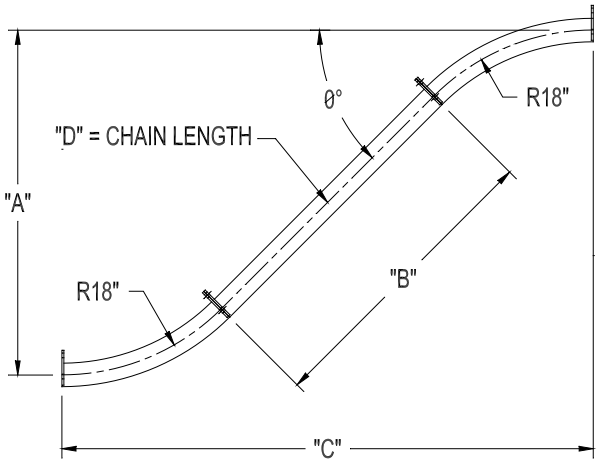
ELEVATION CHANGE CHART FOR 18" RADIUS VERTICAL CURVES

(values are the same for 18" radius horizontal offsets)



USE OF CHARTS

ADD	A	B	C	D
From 15° Chart 1	6'-0"	22'-9 7/16"	22'-9 7/16"	23'-6 7/8"
From 15° Chart 2	0'-9"	2'-10 ¾"	2'-9 5/8"	2'-10 ¾"
Required Dimensions	6'-9"	25'-8 3/16"	25'-7 1/16"	26'-5 5/8"

For values not shown in the charts use the following formulas:

B = A÷SINυ - 2RTAN(υ ÷ 2) **where:** υ = angle of incline

C = 2RTAN(υ ÷ 2) + (A ÷ TANυ) **A** = elevation change in inches

D = B + (υ ÷ 90°)πR **B** = straight section required in inches

C = horizontal distance for change in Inches

D = Total Chain Length in Inches

R = Radius in Inches

CHART 1			ANGLE – 15°		CHART 2		
A	B	C	D	A	ADD TO B	ADD TO C	ADD TO D
0'-1 ½"	----------	0'-9 5/16"	0'-9 3/8"	1"	0'-3 7/8"	0'-3 ¾"	0'-3 7/8"
1'-0"	3'5 5/8"	4'-1 ½"	4'-3 1/16"	2"	0'-7 ¾"	0'-7 ¾"	0'-7 ¾"
2'-0"	7'-4"	7'-10 5/16"	8'-1 7/16"	3"	0'-11 5/8"	0'-11 ¼"	0'-11 5/8"
3'-0"	11'-2 3/8"	11'-7 1/8"	11'-11 13/16"	4"	1'-3 ½"	1'-2 7/8"	1'-3 ½"
4'-0"	15'-3/4"	15'-3 7/8"	15'-10 3/16"	5"	1'-7 3/8"	1'-6 5/8"	1'-7 3/8"
5'-0"	18'-11 1/8"	19'-11/16"	19'-8 9/16"	6"	1'-11 1/8"	1'-10 3/8"	1'-11 1/8"
6'-0"	22'-9 7/16"	22'-9 7/16"	23'-6 7/8"	7"	2'-3"	2'-2 1/8"	2'-3"
7'-0"	26'-7 13/16"	26'-6 ¼"	27'-5 ¼"	8"	2'-6 7/8"	2'-5 7/8"	2'-6 7/8"
8'-0"	30'-6 ¼"	30'-3"	31'-3 11/16"	9"	2'-10 ¾"	2'-9 5/8"	2'-10 ¾"
9'-0"	34'-4 9/16"	33'-11 13/16"	35'-2"	10"	3'-2 5/8"	3'-1 3/8"	3'-2 5/8"
10'-0"	38'-2 7/8"	37'-8 9/16"	39'- 5/16"	11"	3'-6 ½"	3'-5"	3'-6 ½"
11'-0"	42'-1 1/4"	41'-5 3/8"	42'- 10 11/16"	12"	3'-10 3/8"	3'-8 ¾"	3'-10 3/8"

Note: Charts for estimating purposes only.

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ELEVATION CHANGE CHART FOR 18" RADIUS VERTICAL CURVES *Continued*

(values are the same for 18" radius horizontal offsets)

CHART 1			ANGLE = 30°		CHART 2		
A	B	C	D	A	ADD TO B	ADD TO C	ADD TO D
0'-4 7/8"	----------	1'-6"	1'-6 7/8"	1"	0-2"	0'-1 ¾"	0'-2"
1'-0"	1'-2 3/8"	2'-6 7/16"	2'-9 ¼"	2"	0'-4"	0'-3 ½"	0'-4"
2'-0"	3'-2 3/8"	4'-3 ¼"	4'-9 ¼"	3"	0'-6"	0'-5 ¼"	0'-6"
3'-0"	5'-2 3/8"	6'-0"	6'-9 ¼"	4"	0'-8"	0'-6 7/8"	0'-8"
4'-0"	7'-2 3/8"	7'-8 ¾"	8'-9 ¼"	5"	0'-10"	0'-8 5/8"	0'-10"
5'-0"	9'-2 3/8"	9'-5 9/16"	10'-9 ¼"	6"	1'-0"	0'-10 3/8"	1'-0"
6'-0"	11'-2 3/8"	11'-2 3/8"	12'-9 ¼"	7"	1'-2"	1'-1/8"	1'-2"
7'-0"	13'-2 3/8"	12'-11 1/8"	14'-9 ¼"	8"	1'-4"	1'-1 7/8"	1'-4"
8'-0"	15'-2 3/8"	14'-7 15/16"	15'-9 ¼"	9"	1'-6"	1'-3 5/8"	1'-6"
9'-0"	17'-2 3/8"	16'-4 11/16"	18'-9 ¼"	10"	1'-8"	1'-5 3/8"	1'-8"
10'-0"	19'-2 3/8"	18'-1 ½"	20'-9 ¼"	11"	1'-10"	1'-7"	1'-10"
11'-0"	21'-2 3/8"	19'-10 ¼"	22'-9 ¼"	12"	2'	1'-8 ¾"	2'

CHART 1			ANGLE – 45°		CHART 2		
A	B	C	D	A	ADD TO B	ADD TO C	ADD TO D
0'-10 ½"	----------	2'-1 ½"	2'-4 ¼"	1"	0'-1 3/8"	0'-1"	0'-1 3/8"
1'-0"	0'-2 1/16"	2'-2 15/16"	2'-6 5/16"	2"	0'-2 7/8"	0'-2"	0'-2 7/8"
2'-0"	1'-7"	3'-2 15/16"	3'-11 ¼"	3"	0'-4 ¼"	0'-3"	0'-4 ¼"
3'-0"	3'-0"	4'-2 15/16"	5'-4 ¼"	4"	0'-5 5/8"	0'-4"	0'-5 5/8"
4'-0"	4'-5"	5'-2 15/16"	6'-9 ¼"	5"	0'-7 1/8"	0'-5"	0'-7 1/8"
5'-0"	5'-9 15/16"	6'-2 15/16"	8'-2 3/16"	6"	0'-8 ½"	0'-6"	0'-8 ½"
6'-0"	7'-2 15/16"	7'-2 15/16"	9'-7 3/16"	7"	0'-9 7/8"	0'-7"	0'-9 7/8"
7'-0"	8'-7 7/8"	8'-2 15/16"	11'- 1/8"	8"	0'-11 3/8"	0'-8"	0'-11 3/8"
8'-0"	10'- 7/8"	9'-2 15/16"	12'-5 1/8"	9"	1'- ¾"	0'-9"	1'- ¾"
9'-0"	11'-5 13/16"	10'-2 15/16"	13'-10 1/16"	10"	1'-2 1/8"	0'-10"	1'-2 1/8"
10'-0"	12'-10 13/16"	11'-2 15/16"	15'-3 1/16"	11"	1'-3 ½"	0'-11"	1'-3 ½"
11'-0"	14'-3 ¾"	12'-2 15/16"	16'-6"	12"	1'-4 7/8"	1'-0"	1'-4 7/8"

CHART 1			ANGLE – 60°		CHART 2		
A	B	C	D	A	ADD TO B	ADD TO C	ADD TO D
1'-6"	----------	2'-7 1/8"	3'-1 5/8"	1"	0'-1 1/8"	0'-5/8"	0'-1 1/8"
2'-0"	0'-6 15/16"	2'-10 5/8"	3'-8 5/8"	2"	0'-2 ¼"	0'-1 5/8"	0'-2 ¼"
3'-0"	1'-8 13/16"	3'-5 9/16"	4'-10 ½"	3"	0'-3 ½"	0'-1 ¾"	0'-3 ½"
4'-0"	2'-10 5/8"	4'-1/2"	6'-3/8"	4"	0'-4 5/8"	0'-2 ¼"	0'-4 5/8"
5'-0"	4'-1/2"	4'-7 7/16"	7'-2 3/16"	5"	0'-5 ¾"	0'-2 7/8"	0'-5 ¾"
6'-0"	5'-2 3/8"	5'-2 3/8"	8'-4 1/16"	6"	0'-6 7/8"	0'-3 ½"	0'-6 7/8"
7'-0"	6'-4 ¼"	5'-9 5/16"	9'-5 15/16"	7"	0'-8 1/8"	0'-4"	0'-8 1/8"
8'-0"	7'-6 1/16"	6'-4 ¼"	10'-7 ¾"	8"	0'-9 ¼"	0'-4 5/8"	0'-9 ¼"
9'-0"	8'-7 15/16"	6'-11 1/8"	11'-9 5/8"	9"	0'-10 3/8"	0'-5 ¼"	0'-10 3/8"
10'0"	9'-9 ¾"	7'-6 1/16"	12'-11 ½"	10"	0'-11 ½"	0'-5 ¾"	0'-11 ½"
11'-0"	10'-11 5/8"	8'-1"	14'-1 3/8"	11"	1'-0 ¾"	0'-6 3/8"	1'-0 ¾"
12'-0"	12'-1 ½"	8'-7 15/16"	15'-3 3/16"	12"	1'-1 7/8"	0'-7"	1'-1 7/8"

Note: Charts for estimating purposes only.

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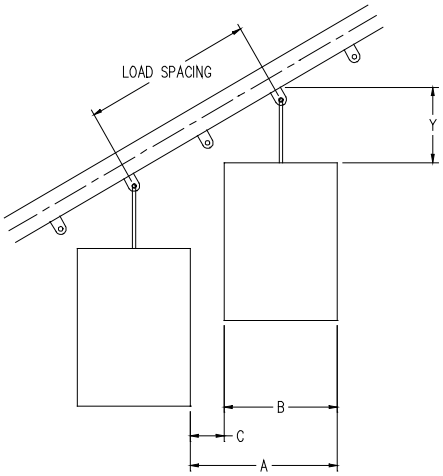

VERTICAL CLEARANCES

The following chart will give you the required incline and head clearances for single point suspension. Because of carrier swing, extra clearance must be provided between top of carrier and track.

A = SPACING, B = LOAD WIDTH.
C = CLEARANCE - (in inches)

EXAMPLE:
Load Clearance – 12" wide loads at 24" spacing on 45° incline.
Determine value of A from chart: A = 16 7/8"
Clearance formula: A-B=C or 16 7/8" – 12" = 4 7/8" (note if C is zero or negative, parts will hit one another)
Head Clearance – using above example and looking at Series 250 chart; Load Length = 12"; for 45° incline, Y = 8°

LOAD CLEARANCE CHARTS ON INCLINED TRACK – SERIES 250

Load Spacing	Maximum Values of "A" for Angle of Incline			
	15°	30°	45°	60°
6"	5-3/4"	5-1/8"	4-1/8"	3"
12"	11-1/2"	10-3/8"	8-3/8"	6"
18"	17-3/8"	15-1/2"	12'5/8"	9"
24"	23-1/8"	20-3/4"	16-7/8"	12"
30"	28-7/8"	25-7/8"	21-1/8"	15"
36"	34-3/4"	31-1/8"	25-3/8"	18"
42"	40-1/2"	36-3/8"	29-5/8"	21"
48"	46-1/4"	41-1/2"	33-7/8"	24"
54"	52-1/8"	46-3/4"	38-1/8"	27"
60"	57-7/8"	51-7/8"	42-3/8"	30"

A= (Load Spacing) x (Cosine of the Angle) where Cos 15° = .96592 Cos 30° = .86603 Cos 45° = .70711 Cos 60° = .50000

HEAD CLEARANCE CHARTS ON INCLINED TRACK – SERIES 250

Load Width B	Maximum Values of "Y" for Angle of Incline			
	15°	30°	45°	60°
6"	2-7/8"	3-3/4"	5"	7-1/4"
9"	3-1/4"	4-5/8"	6-1/2"	9-7/8"
12"	3-5/8"	5-1/2"	8"	12-1/2"
15"	4-1/8"	6-3/8"	9-1/2"	15"
18"	4-1/2	7-1/4"	11"	17-5/8"
21"	4-7/8"	8-1/8"	12-1/2"	20-1/4"
24"	5-1/4"	9"	14"	22-7/8"
27"	5-5/8"	9-7/8"	15-1/2"	25-1/2"
30"	6-1/8"	10-3/4"	17"	28"
33"	6-1/2"	11-5/8"	18-1/2"	30-5/8"

Y = (1/2 Load Length) x (Tangent of the Angle) + 2" where tan 15° = .2679 tan 30° = .5774 tan 45° = 1.0000 tan 60° = 1.7321

Note: Charts for estimating purposes only.

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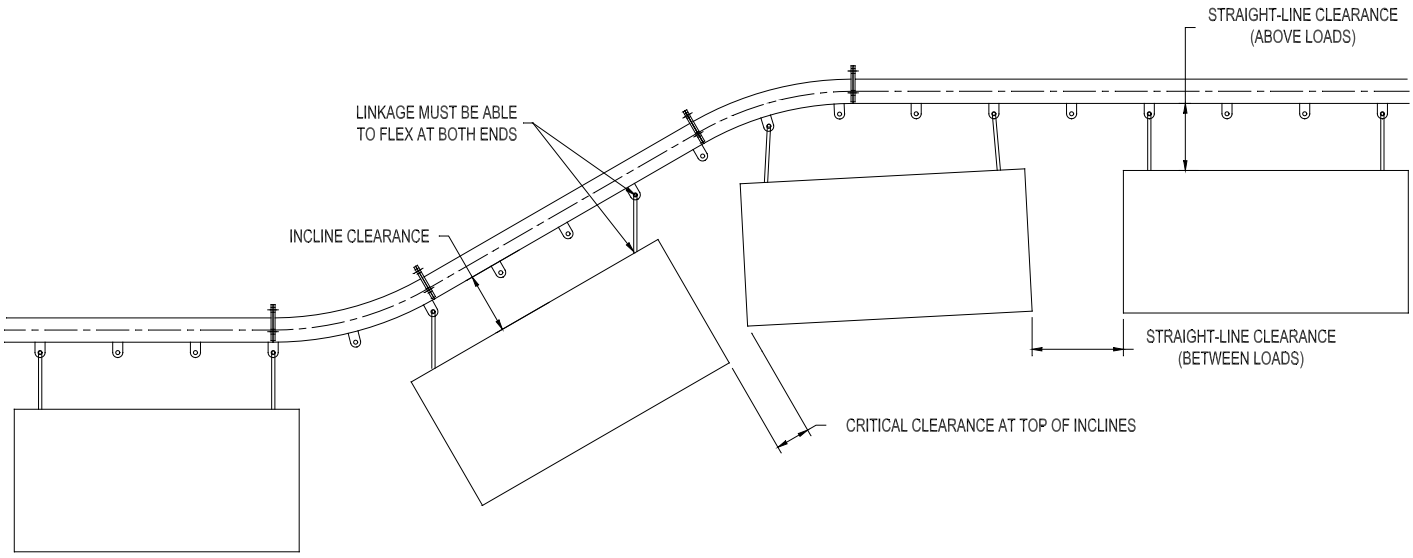
TWO POINT SUSPENSION VERTICAL

Incline clearance should be calculated if product spacing is limited. Keep angle of incline to a minimum as the sharper the inclines the more the weight of the load shifts to the higher suspension point. A scale drawing can be very useful in calculating critical clearance at the top of the inclines (see drawing below). When using inclines greater than 30°, P-701B load bars should be incorporated into the carrier design.



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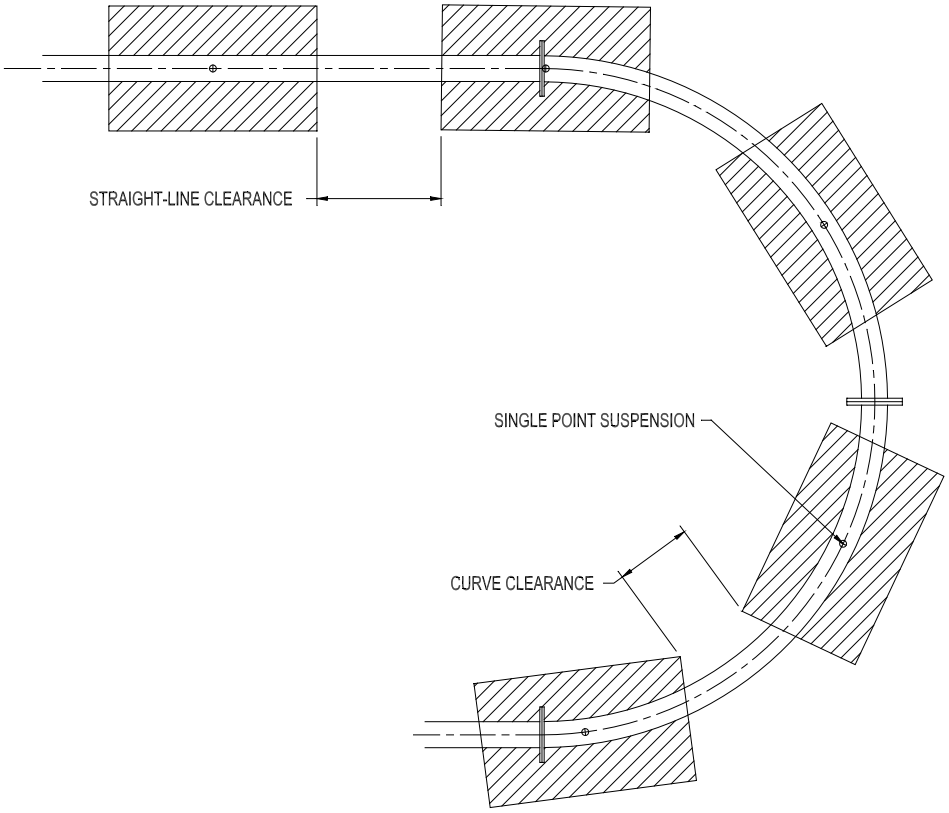
SINGLE POINT SUSPENSION HORIZONTAL

When suspending from a single point on a horizontal curve the most important factor to consider is the curve clearance (see drawing).



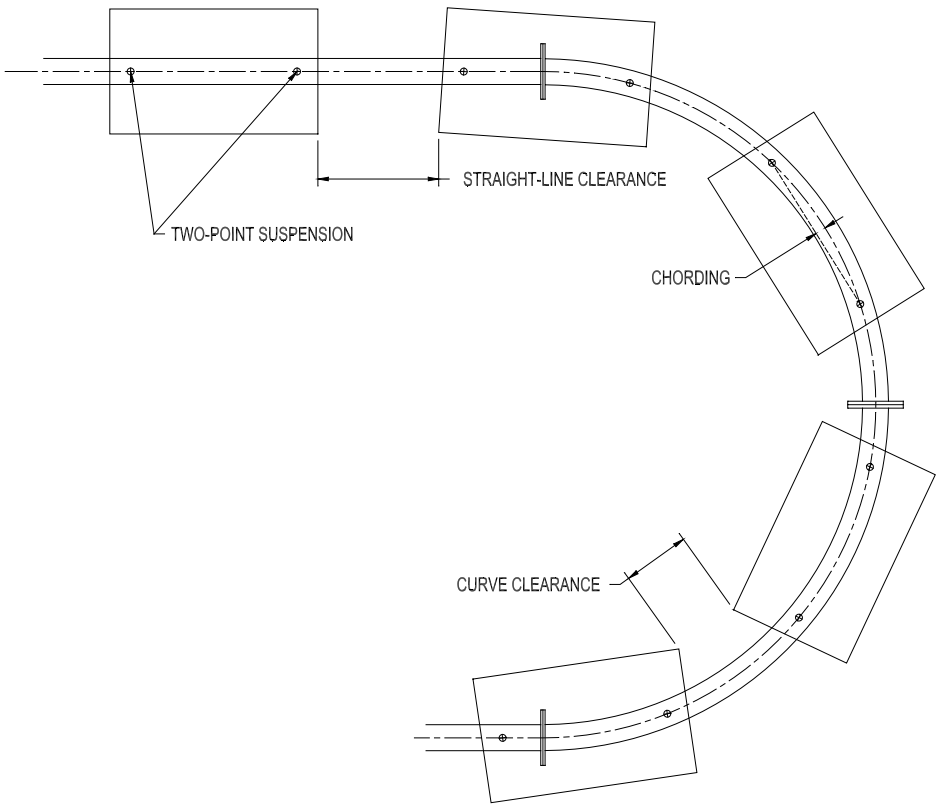
TWO POINT SUSPENSION HORIZONTAL

When suspending from two points the horizontal curve radius should not be less than the center distance of the two suspension points.

Allow flexible linkage when designing your product carrier.
If product clearance is critical a scale drawing should be made.
Pacline would be pleased to perform this engineering for you upon request.

NOTE: If hanging centers are greater than the radius of the curve, chording will cause a binding of the conveyor chain in the curve and could be a contributing factor in chain surging and increased chain pull.

Ensure that there is some flexibility in the attachment of the product to the conveyor system.



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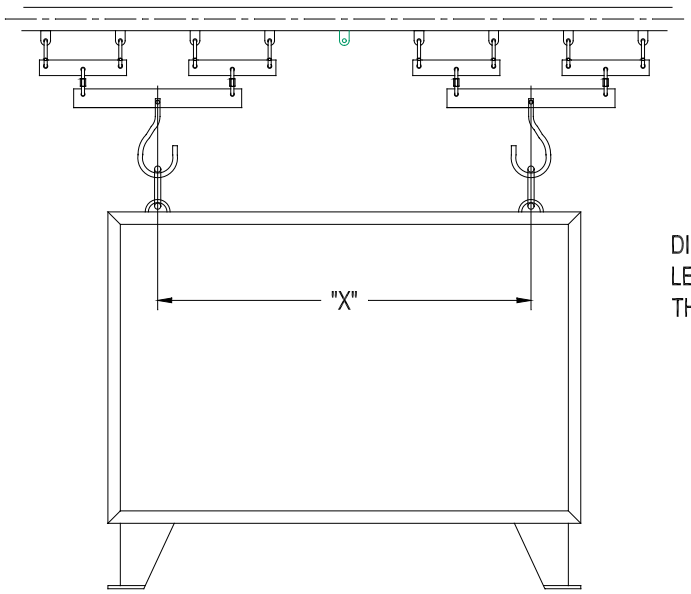
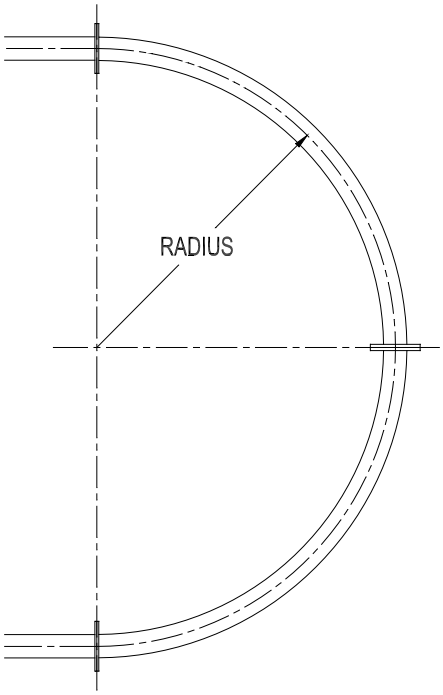
TWO POINT SUSPENSION HORIZONTAL continued



DIMENSION "X" HAS TO BE LESS THAN OR EQUAL TO THE CURVE RADIUS



Minimum Curve Radius For 2-Point Suspension

IMPORTANT! READ THIS!
INSTALLATION WARNINGS

Fasteners:

It is strongly recommended that all fasteners attaching a direct load to the conveyor chain, be installed with GRADE 8 fasteners and appropriate lock nuts. Other conveyor components require a minimum of GRADE 5 hardware.

All bolted connections should be checked on a regular basis.

A professional engineer should approve the bolted connections for strength and wear resistance.

Welding of Components:

Any conveyor track that is installed on elevation changes should have it's support clamps welded to it, to avoid having the track clamps slide along the track. This should be done with two small welds, one on each side of the clamp.

Conveyor sections that are loaded with more than 30 lbs. per foot, should have it's track clamps welded.

Dump devices on the conveyor, used to dump carriers having scrap product on them, should have their attaching clamps welded to the conveyor track once the device is positioned correctly.

All carriers being fabricated to carry product supported on the conveyor should have all their welds checked for soundness, to ensure they do not fail when they are suspended on the conveyor.

Track Alignment:

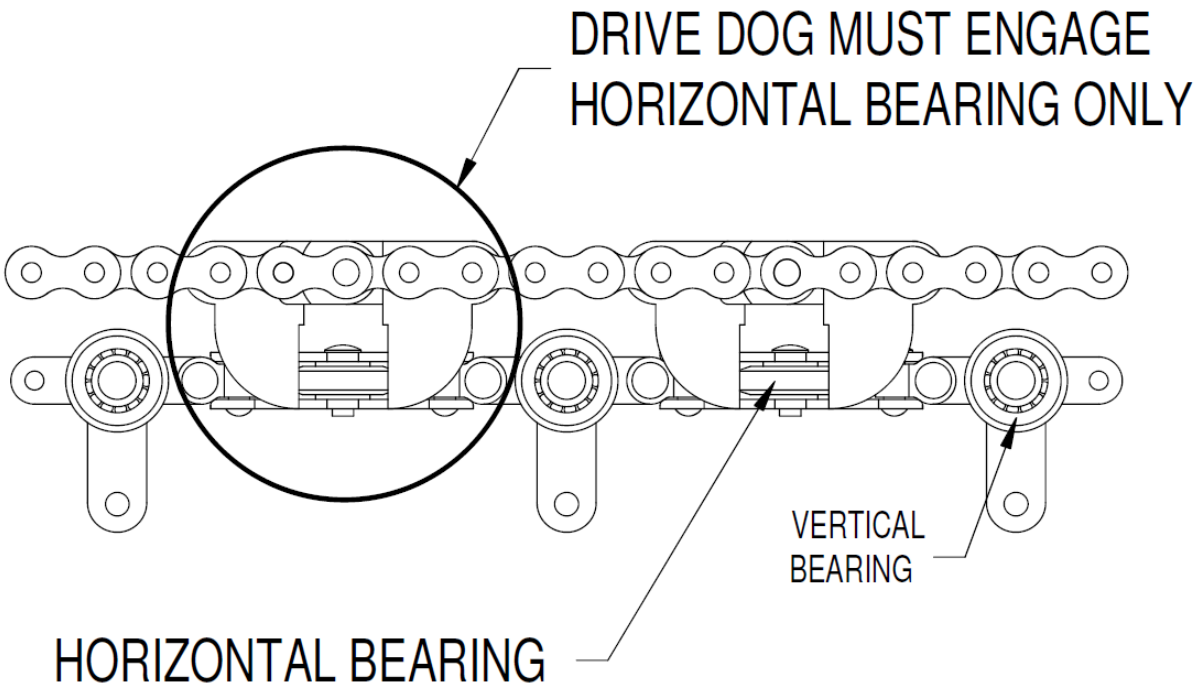
Always ensure that the conveyor track is installed with the chain slot parallel with the ground. Slots that are not parallel with the ground will cause the chain to wear the slot prematurely. Ensure all joints are smooth to allow the chain to transition them without any catching.

Drive Unit Caterpillar Chain:

Always ensure that the drive dogs are engaged on the horizontal bearings of the conveyor chain. If these are installed on the vertical bearings, damage will occur.

DRIVE DOG POSITION

The **Pacline** in-line drive unit transfers power from the drive motor to the conveyor chain. This is accomplished with the drive dogs. These drive dogs are specially designed and built to engage the horizontal chain bearings (see diagram below). It is extremely important the drive dogs not be positioned to engage the vertical, (or double), chain bearings. Improper positioning may result in drive dog, drive plate, and conveyor chain failure. Always verify drive dog position before starting the conveyor for the first time, or after servicing the chain or drive unit.



WELDING SPECIFICATIONS PACLINE CONVEYOR TRACK

1)	Welding Type	-	GMAW (MIG)
2)	Flange Thickness	-	3/16”, Mild Steel
3)	Welding Wire	-	ER70S6035
4)	Wire Feed Speed	-	360 ~ 380 ipm
5)	Amperage Range	-	180 ~ 190 Amps
6)	Voltage Range	-	24 ~ 25V
7)	Gas Type	-	92% Argon
			8% C02
8)	Weld Leg Size	-	Approx. 5/16”
9)	Weld Angle	-	45 deg. At 10 o’clock position

Curves are heat treated to RC 55-60, with 0.012” to 0.016” case depth

All tracks and curves have zinc plated finish.

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PACLINE INSTALLATION CHECKLIST

The Pacline Overhead Conveyor Systems can be properly installed by carefully following the Pacline Instruction Manual shipped with each system. Upon completion of the installation ensure that the following steps have been taken:

1)	Check that **all** installation attachments have been tightened and secured with bolts or welds.	
2)	Ensure that track hanger clamps have been tack welded where appropriate. (Never inside ovens).	
3)	Test run the conveyor system for a minimum of one hour.	
	A. Ensure that drive dogs engage horizontal bearing.	
	B. Ensure that the chain lubricator is properly set up and filled with lubricant.	
	C. Adjust chain tension at take-up assembly, make sure there is no slack chain at any point in the system.	
	D) Check that chain pendant does not catch on any track joints.	
4)	Note any changes to layout drawing and inform Pacline engineering.	
5)	Instruct the end user on safe operation of the system.	
6)	Instruct the end user in the proper loading of the system.	
	A) The system should first be run in for minimum one revolution of entire chain before the product carriers are installed.	
	B) The system should be run for one revolution of entire chain after the product carriers are installed.	
	C) When loading the system for the first time only every other carrier should be loaded for the first revolution of entire chain.	
	D) Ensure chain pendants do not rub on track slot due to carriers having unbalanced loading. Advise the end user if off centre loading may be a concern.	

Note: The longer the system and the heavier the load, the more critical it is that the run in sequence be followed and the duration of each run-in cycle should be extended accordingly.

To: Date:

From:

Attached for your reference is Pacline's Preventative Maintenance Schedule, which should be followed in conjunction with the Pacline engineering information supplied with the system.

The maintenance requirements of the Pacline Overhead Conveyor System will vary depending on the operating environment and load being conveyed. The length and complexity also are a factor in maintenance scheduling.

This Preventative Maintenance Checklist is a list of standard maintenance procedures, which should be carried out regularly.

We recommend that all points be checked at time of installation, after 500 hours of operation and then every 2,000 hours of operation.

If you have any specific questions do not hesitate to contact our engineering department at the following:

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PACLINE PREVENTIVE MAINTENANCE CHECKLIST

Customer:_____Date:_____

Plant Location:_____Conveyor #:_____

Service Performed By:_____Job N^{O}:_____

	Conveyor Drive: Check **ALL** hardware is tight.	**COMMENTS**	**CKD**
a)	Check that drive-dogs are engaged on horizontal bearing wheel.		
b)	Check drive-dog springs: Lift one half of drive dog off of the pressure plate and release. If the drive-dog snaps back the springs are operating properly, if not, they must be replaced.		
c)	Check that the drive-dog rollers spin freely. If not, replace.		
d)	Check drive-dogs along edges (beside rollers) where dog contacts pressure plate, align if necessary.		
e)	Check drive-dogs for wear at the point where the dog contacts the horizontal bearing wheel. If wear is excessive replace drive-dogs.		
f)	If uneven wear is present on the drive-dog faces, the drive-dog chain and the conveyor chain are out of alignment. Re-align if necessary.		
g)	Pressure Plate: Part No. DP-903	Wear	
		Alignment	
h)	Check pillow block bearings for wear, cracks in seals or housing, bolts and set screws being tight. Apply grease if needed.		
i)	Check tension of drive-dog chain assembly. Total chain deflection should be approximately 1".		
j)	Check tension of drive chain between reducer and drive shaft. Chain deflection should be 1/8" per foot.		
k)	Check motor for excessive noise. Clean fan & vents.		
l)	Sprockets:	Alignment	
		Wear	
		Lubrication	
		Set Screws - Tight	
m)	Wear Strips:	Wear	
		Fasteners	
		Lubrication	
n)	Drive Plate:	Tighten all bolts	
		Condition of chain slot for wear.	
		All stickers in place	
o)	Reducer: Check gearbox for proper oil level. Change oil after 2000 hours of operation. Check reducer for excessive noise.	Check Seals Motor secured properly Motor shaft has key in it.	
p)	Misc. Drive	Drive dog pins straight	
		Drive dog roller spring pin's slot must face up.	

PACLINE PREVENTIVE MAINTENANCE CHECKLIST

	Track & Chain:	COMMENTS	CKD
a)	Check for broken or damaged pendants	Rectify cause.	
b)	If track slot exceeds 3/8” to 1/2" that portion of track should be replaced. Check slot alignment throughout system.		
c)	Check chain tension, 1/8" to 1/4" movement in direction of travel.		
d)	Chain inspection. Remove cover from inspection port. While the conveyor is operating observe the chain for any visible defects or irregularities. Make sure bearings turn freely and easily. Check for wear indicated by excessive play in bearing raceway.		
e)	Check for loose hardware, including support structure.		
f)	Is any contaminant reaching the chain surface.		
g)	Measure & record centers of 10 ft. section of chain.		
h)	Curves: Horizontal	Flattening or wear on inside radius or excessive slot width.	
i)	Curves: Vertical	Any opening of vertical slot.	
j)	Track:	Any bent or damaged sections	
k)	Track & Beam Clamps:	All hardware tight, bolted & welded securely	
l)	Flanges:	Welded & tightened correctly	
	Lubricator:		
a)	Make sure chain is being properly lubricated. Top-up lubricant.		
b)	Operational	Set up properly & operational.	
c)	Record:	Type of Lubricator:	
		Type of Lubricant:	
	Take-up Unit:		
a)	Check for adequate remaining adjustment		
b)	Alignment:		
c)	Springs:		
d)	Grease sleeves:		
	Carriers:		
a)	Check for damage and note:		
	Safety Guarding:		
a)	Check for proper installation		
b)	Check for product clearance		
c)	Safety signs in place		
d)	Padding at lower level		

MULTI-DRIVE CHAIN ADJUSTMENT

This document will discuss two generic methods of removing slack chain from an enclosed track conveyor system. Every conveyor system is unique; therefore the method of removing slack chain may vary. Access points for the motors, inspection sections and take-ups can influence and determine the method of removing slack chain.

Ensuring the chain is tight throughout the conveyor system will allow for increased operational life and reduce the likelihood of downtime.

METHOD 1

This method requires access to the following:
- All drive units
- All take-up units
- One inspection section preferably located at a low elevation
- Two load bars (recommended)
- Chain lever hoist/ puller (recommended)

Method 1 requires all drive chains to be disconnected but only requires chain to be removed from a single inspection section. Figure 1 illustrates a generic multi-drive system and the location of the key components.

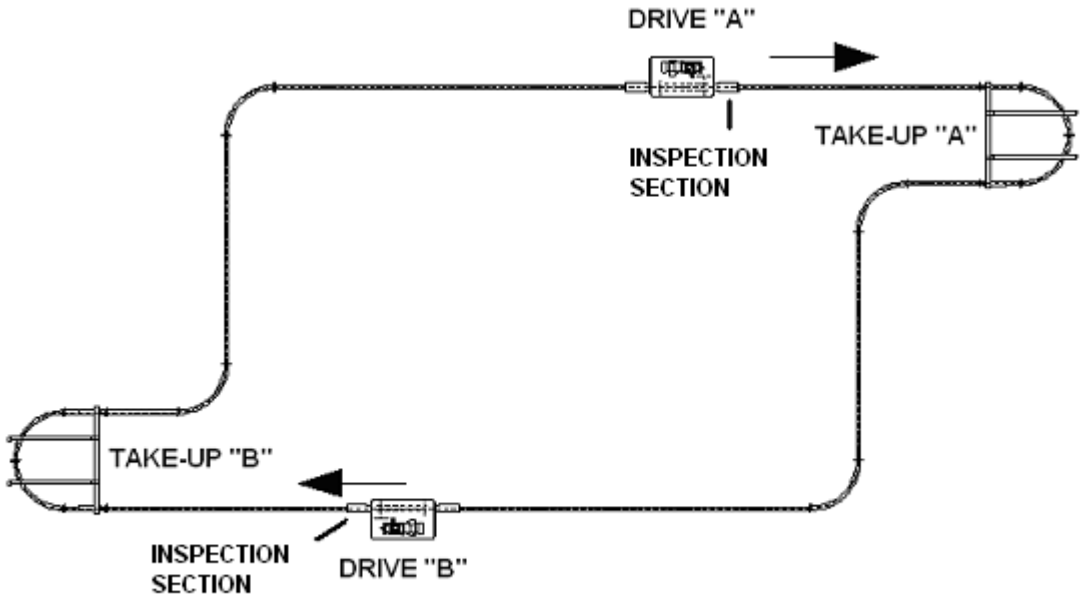

Figure 1. Multi- drive system

Procedure for removing slack chain:

1. Locate an inspection section to remove slack chain. Slack chain is preferably removed in a low elevation plane as chain commonly accumulates in the lower areas of a conveyor system.

2. a. (Recommended method) Attach two load bars with side plates to two pendants. The load bars should be positioned on either side of the inspection section illustrated in Figure 2. This method does not require any take-up adjustment. If an inspection section is available at a low area of the conveyor system, remove chain there.

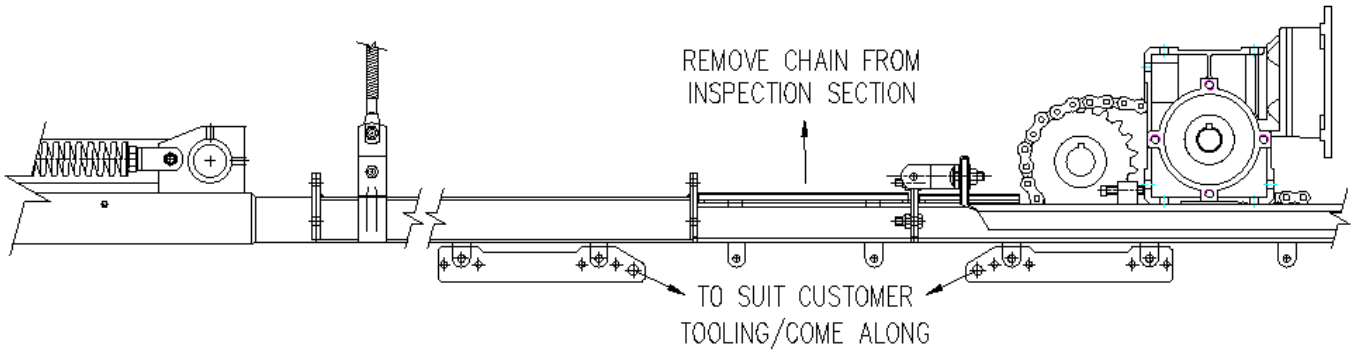

Figure 2. Load bars

b. (Alternative method if two load bars cannot be fabricated and a chain lever hoist/ puller is not available) Fully tighten each shipping nut on the take-up. This should be performed on each take-up unit on the conveyor system. Tightening the shipping nut will fully collapse the take-up unit releasing the tension on the chain in the system. Figure 3 illustrates a typical spring take-up unit.

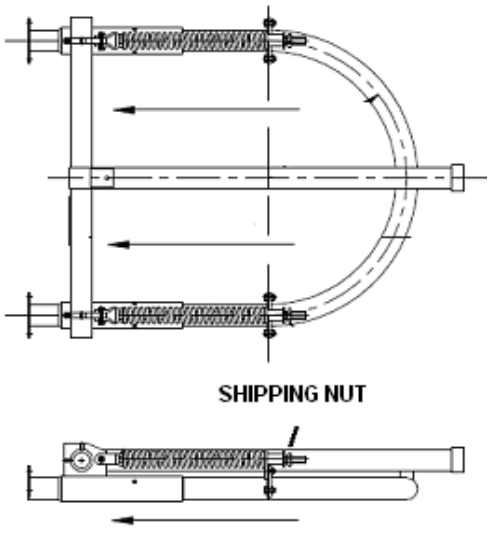

Figure 3. Adjust take-up in the direction of the arrow

3. Disconnect the drive chain from all drive units. If there are elevation changes in the system, one drive unit may remain connected to prevent unbalanced loads on any inclines from rolling downhill. Figure 4 illustrates the location of the drive chain.

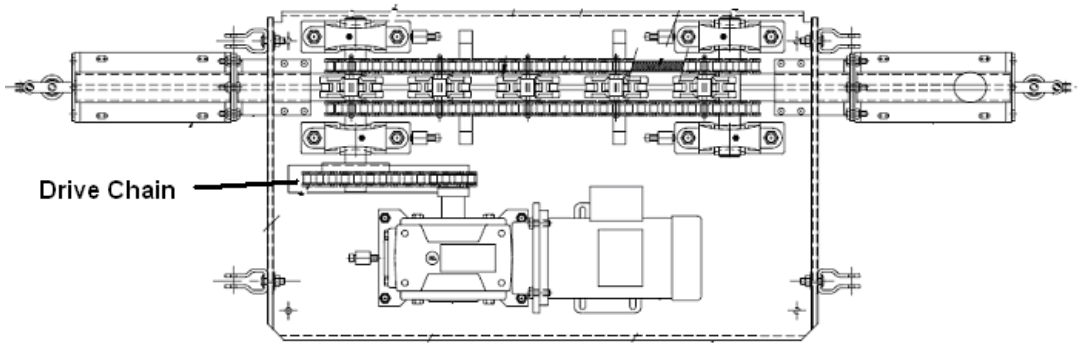

Figure 4. Drive unit

4. Disconnect the drive chain by removing the connecting link as shown in Figure 5.

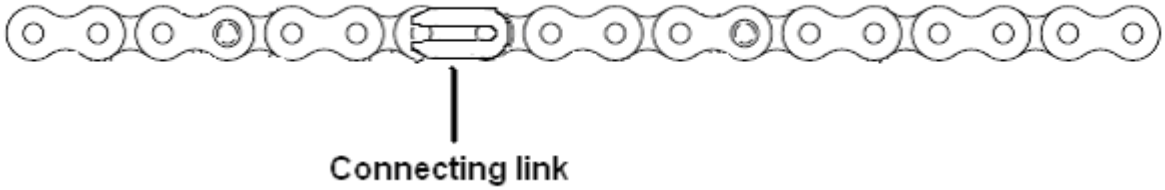

Figure 5. Drive chain connecting link

5. a. i. (Recommended method) Attach chain lever hoist/ puller to both load bars. Tighten the chain lever hoist/ puller to ensure the take-up slides are fully collapsed. Then remove chain in 6 inch increments through the inspection section. To disconnect the chain, remove the joining rivets shown in Figure 6. Ensure the joining rivets are removed in 6-inch increments to allow for a male to female connection point.

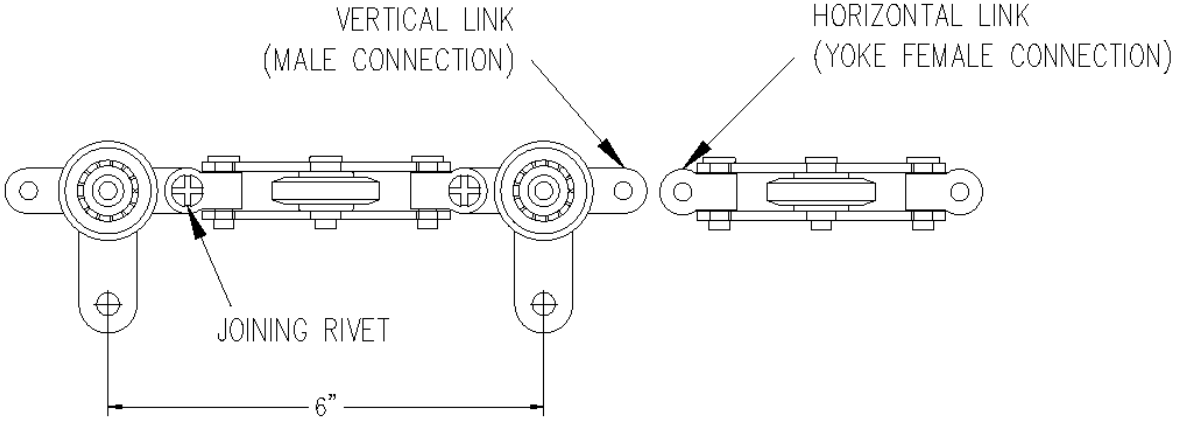

Figure 6. Removing Pacline chain

ii. DO NOT remove all slack chain. Some slack is required between drive units after the system settles down so that take ups are not fully compressed. For example, if 36” slack is present, only remove 24”.

iii. Once the slack chain has been removed from the system, use joining rivets (Part # PJ-009) complete with a cotter pin to secure the male to female connection. Figure 7 illustrates the joining rivet used to re-connect the chain.

Figure 7. Part# PJ-009

5. b. i.(Alternative method if chain lever hoist/ puller is not available) Repeat steps 5a I, ii, and iii by removing chain in 6 inch increments by hand.

6. Extend the take-up unit to apply the correct tension on the chain.

7. Re-connect all drive chains.

8. Test run system and allow leftover slack chain to redistribute itself. If system is jamming often, you may need to re-insert 6” to 12” of chain back into the system.

METHOD 2

This method requires access to the following:
- All take-up units in the system
- Inspection section preferably located at a low elevation in between all drive units
- Two load bars (recommended)
- Chain lever hoist/ puller (recommended)

Method 2 does not require the drive chain to be disconnected however, chain must be removed at an inspection section located between **ALL** drive units. Figure 8 illustrates a generic multi-drive system broken into two areas, area “A” and area “B”. Chain should be removed preferably at a low elevation inspection section between drive units.

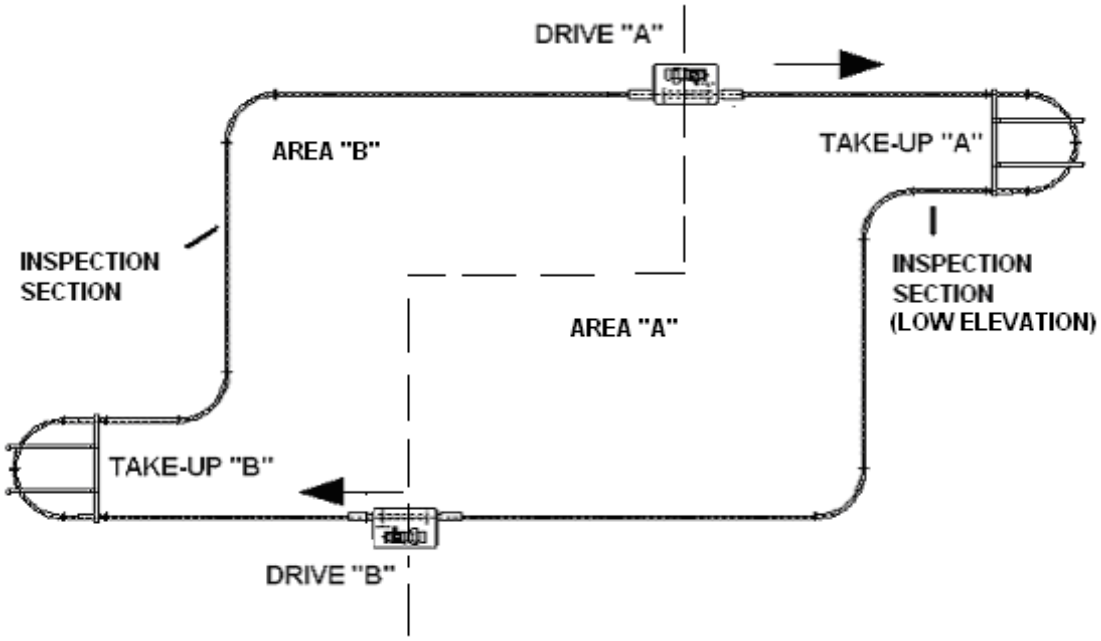

Figure 8. Conveyor system areas

Procedure for removing slack chain:

1. Locate an inspection section between each take-up and drive unit. The inspection section is typically located at the exit area of the drive unit as shown in Figure 1.

2. a. (Recommended method) Attach two load bars with side plates to two pendants. The load bars should be positioned on either side of the inspection section illustrated in Figure 2. This method does not require any take-up adjustment.

   b. (Alternative method if two load bars cannot be fabricated and a lever hoist/ puller is not available) Fully tighten each shipping nut on the take-up unit. This should be performed on each take-up unit in the conveyor system. Tightening the shipping nut will fully collapse the take-up unit releasing the tension on the chain in the system. Figure 3 illustrates a typical spring take-up unit.

3. Remove inspection section cover to expose the chain.

4. a. i. (Recommended method) Attach the lever hoist/ puller to both load bars. Tighten the lever hoist/ puller and remove chain in 6 inch increments through the inspection section. To disconnect the chain, remove the joining rivets shown in Figure 6. Ensure the joining rivets are removed in 6-inch increments to allow for a male to female connection point.

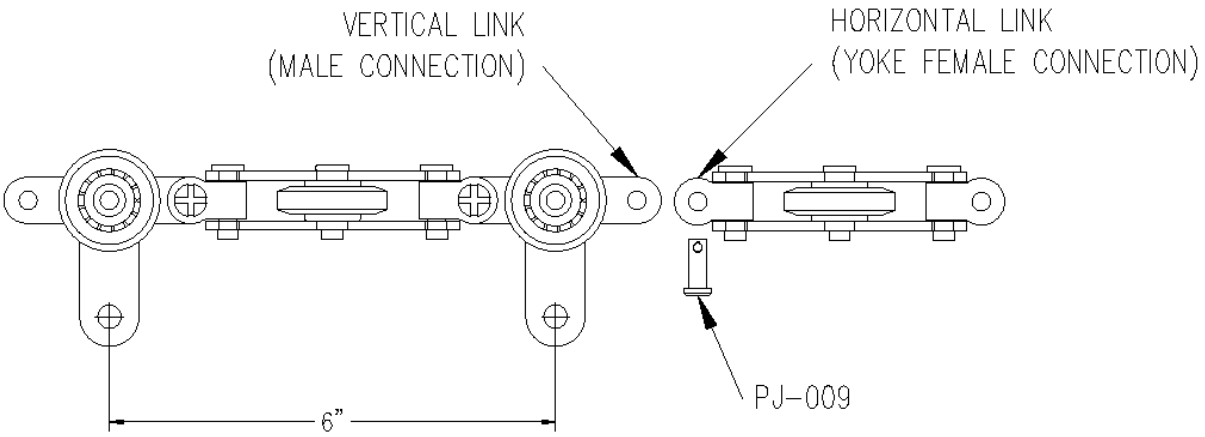

Figure 9. Reconnecting Pacline chain

ii. Once the slack chain has been removed from the system, use joining rivets (Part # PJ-009) shown in Figure 7, complete with a cotter pin to secure the male to female connection. Figure 9 illustrates how the joining rivet is used to re-connect the chain.

4. b. i. (Alternative method if lever hoist/ puller is not available) Repeat steps 4a i and ii and remove chain in 6 inch increments by hand.

5. Repeat steps 1 to 4 at each inspection section located at the exit of each drive unit in the system.

6. (Alternative method only) Extend each take-up to apply the correct tension on the chain.

Please contact a Pacline Installation Supervisor if you have any questions or concerns.

CATERPILLAR CHAIN REPLACEMENT

AS OF NOVEMBER 2006

Effective immediately, the older style CC-500 Caterpillar Chain assembly, and any of the parts making it up, will no longer be available. The most common of these parts are the DP-900 Drive Dog Pin and the DP-901 Drive Dog Spring c/w Insert Bushing.
If any of these parts are required by a customer, they will need to replace the complete Caterpillar Chain with the new style CC-2000 Caterpillar Chain assembly. This new assembly is an improved design, with larger Drive Dog Pins, and improved Drive Dog Springs. After initial extensive testing, it has been seen that there are far fewer problems with broken or bent Pins, and broken Springs. This improved assembly will be far superior in performance to the predecessor, and will provide much greater "up" time for the customer, and much less maintenance.
The initial investment cost for this new assembly will soon be offset by the improved performance it will provide.

CATERPILLAR CHAIN INSTALLATION:

It is very important that when replacing or installing a new Caterpillar Chain assembly, that it be correctly put onto the D-500 Drive Unit.

The Drive Dogs must be located so as to encompass the single horizontal bearing of the conveyor chain, not the two tapered vertical chain pendant bearings. Please refer to the section in the manual on *Drive Dog Position*.

PACLINE, AN ISO 9001:2015 REGISTERED COMPANY, IS DEDICATED TO THE SUPPLY OF QUALITY PRODUCTS, TOGETHER WITH A HIGH LEVEL OF CUSTOMER SERVICE.

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