

# AVR User's Manual

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- 
- **Purpose: Idler Angular Alignment Measurement**

The Alignment Verification Rig (AVR) is designed to indicate if the conveyor idler is perpendicular to the direction of belt movement. The quick and easy measurement allows correction of idler alignment during initial installation, for re-adjustment or as a measurement for justification of the additional work of resetting the idlers.

## Benefits and Consequences

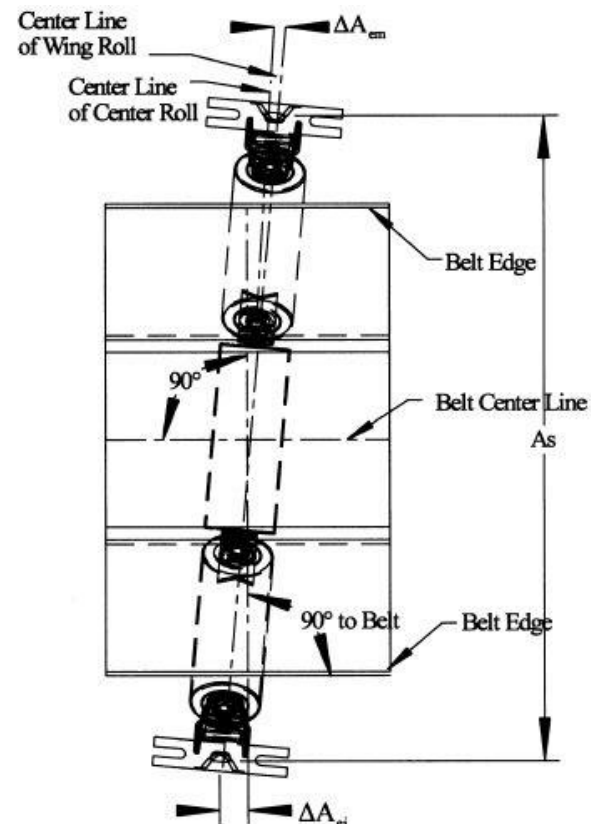
There are multiple specific benefits to having idler axes being perpendicular to the belt but is one fundamental element of a stable long term trough for the conveyor belt to run in. We focus here on idler alignment but benefits from it and overall reliable operation are best seen if the conveyor structure is level and flat. Corrections to these are recommended before idlers are aligned. Various brands of idlers can be combined but elevations should be checked and shimmed if necessary so consistent contact is made for all of the idlers.

## Energy and Wear

When idler rolls are misaligned to the belt direction, the belt is forced to slide sideways. This requires energy and wears both the roller and belt. Shiny rollers are a strong indicator to this occurring. The AVR is mounted to the center roll for best benefit since most of the material weight rests on it. A spreadsheet is available on our website to calculate the electricity cost and improvement to be expected from realigning the conveyor idlers.

## Tracking

Idler alignment affects belt tracking but may not have the major influence. Unless done in conjunction with the other causes of mistracking, realigning



ref: CEMA's Belts for Bulk Materials Conveyor 6,7th Ed.

Idlers may upset the existing balance of forces and worsen the current stability. In particular, if the conveyor structure is twisted or not level along its length, steering the belt by idler alignment may have been done intentionally. This is especially true with single roll return rolls. Shimming these idlers so that they are level may be practical and result in significantly improved tracking in conjunction with realignment of the idlers using the AVR. Carry side tracking problems due to loading the belt off center are unlikely to be affected by idler alignment. Likewise with mistracking due to belt defects. There are many references and instructions available to fix tracking problems both from conveyor equipment manufacturers, CEMA and on the web.

### *All Idlers*

The **benefits of the AVR can be obtained only if all or most idlers are in alignment**. The carry idlers when loaded consume the most energy so they should be the highest priority for alignment with measurements of the AVR but the return idlers also add tension and power and are the most sensitive to tracking problems from misalignment. In both cases though, you will want to check and reset all idlers, **it is prudent to do only a portion, say every third or fourth idler, and then test run** the conveyor to assure that no poor running behaviors result before resetting another percentage of the idlers distributed along the length of the conveyor and run testing etc. Each idler is usually aligned independent of each other so this procedure does not add significantly to the time required.

### **Basic Operation and Accuracy of Idler Angular Alignment with the AVR**



The AVR shown here works by **comparing the location of an imaginary laser plane to the belt edge at two places spaced along the belt length**. The plane is defined by the rotational sweep of the laser after being set to coincide with one point on the belt edge. It is perpendicular to the center roll of the idler thanks to the construction and precision of the AVR. The belt edge can be replaced by the conveyor structure or a temporary line set up for that purpose. The idler may be realigned while the AVR is installed or the misalignment angle may be calculated and the idler reset later. If you adjust as you go,

you will not have to reset the AVR if the first point and therefore the reference plane are established when the laser is near vertical. This practice may be suitable but not the most accurate. The distance between the initial set point and the second point should be far apart for better accuracy. An initial assessment of misalignment may use a point less than an idler spacing away and the result quite suitable for significant power improvement. The **AVR is configured for a particular belt width**. It may be used for wider belts but some accuracy may be lost since the roll may have a slight bow to it which throws the beam off perpendicularity to the roll centerline. Basically, the AVR part number in inches indicates for which belt width it is constructed i.e. AVR-42 is designed for a 42 inch belt width but can be used on a 48 inch belt. In addition, special combinations of components can be ordered for special circumstances. Actual dimensions are provided in the Parts section of this manual.

It should be understood that **no measurement is absolutely perfect** but, nonetheless, accuracy is only limited by the amount of effort expended. The AVR is designed for reasonable accuracy balancing visibility with discrimination compatible with the variability inherent to construction with structural steel framework and rubber belts. A spreadsheet to aid in understanding the effect of precision on power and is available on the website. A different laser may help if added accuracy is justified for your application. Ultimately, balancing accuracy with effort must be made by you, the user. (To obtain the spreadsheet directly or to discuss an alternate laser specification email [info@AVR4idler.com](mailto:info@AVR4idler.com)).

#### *Laser beam spread*

The light in a laser originates at a point in the cylindrical laser body. To be able to see it, it has to travel out of the laser body and have some width. Lenses within your laser widen the laser light as well as create the cross hairs. The cross hairs are two thin lines. The thickness of the lines is what makes them visible. Beam widening occurs from the beam diverging or tapering outward. The AVR taper angle of .07 degrees was selected so the beam is wide enough to be visible a foot away. This means the crosshair lines become thicker, as well as longer, at greater distance which can limit the precision of the measurement, especially if spotting the belt where only half of the beam cross section is to be seen. A target with a vertical line on it is provided with your AVR. It is hung on the belt edge at a distance further from the idler. This allows centering of the target in the width of the vertical line of the cross hair as another benefit of using the target. (The target also hangs below the idler wing roll making a measurement to the belt edge possible where it wouldn't be in the laser's line of sight for some conveyors.)

#### *Distance along the belt*

The idler misalignment angle is measured to be the distance the laser is from the belt edge ( $y$ ) at the second measuring point divided by the distance between two measuring points ( $x$ ) along the belt width. (it is fine to think of this ratio  $y/x$  rather than using the arcsine to convert to degrees since idler adjustment is easier applied as the ratio times the stringer and idler bolt spacing). The smaller the ratio, the better the alignment and dividing by a larger spread between the two measuring points gives better precision. Though requiring more effort, the measuring precision will be improved if the two measuring points are upstream and downstream at the limits of visibility and discrimination of the laser crosshairs. (Consider using low power binoculars under cloudy skies to improve both)

#### *Effect of belt width on alignment accuracy*

The relevance of the measurement accuracy varies with the belt width since the measured misalignment ( $y/x$ ) is multiplied by the stringer and idler bolt spacing ( $w$ - typically Belt Width + 9 inches per CEMA) for the amount one idler footpad is moved along the conveyor stringer. It may not be practical to adjust the footpad closer than 1/32-1/16 in (.03-.06 in). Dividing this by idler bolt spacing is equivalent to the measured misalignment ( $y/x$ ) and dividing by a larger number means wider belts are inherently more accurate while aligning and at the same time less sensitive to the same footpad location accuracy.

## Safety- Read this section completely before using the AVR

Specific safety hazards are noted in this manual  
on the right side of the page with this triangular symbol



Conveyors have hazards that should be recognized by everyone working them. In addition, the AVR's laser can be hazardous to the user's eyes. Both of these are discussed below.

**This manual is not intended to identify all of the safety hazards** nor the protective measures that should be taken, but only to bring the most likely to your attention. Hazards and recommended practices are covered more comprehensively and completely in the list that follows. AVERDSN LLC **recommends full use of these** and defers any contradictions to specific instructions in this manual or other company literature to these or other industry recognized references or to your company's official practices.

OSHA 2120	Hazardous Energy Lockout/Tagout
OSHA 29 CFR 1926.01	Safety and Health Regulations for Construction; Duty to have fall protection
ASME B20.1	Safety Standard for Conveyors and Related Equipment
MSHA BP-49	Conveyor Safety Tips for Mechanics
CEMA Safety Information	<a href="http://www.cemanet.org/cema-safety-program-2/">http://www.cemanet.org/cema-safety-program-2/</a>
OSHA Instruction TED 01-00-015 [TED 1-0.15A] Section III : Chapter 6 Laser Hazards	<a href="https://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_6.html#2">https://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_6.html#2</a>
ANSI Z136.1—2007	American National Standard for Safe Use of Lasers

For possible magnet hazards, see <http://www.kjmagnetics.com/safety.asp>

**Note: This list may not be complete or current for all agencies or standards.**



**Do not use the AVR without discussing your intended work and what practices are necessary for your safety with your safety officer or safety engineer.**

### General Conveyor Hazards

Conveyors are moving machines that are difficult to guard fully. Using the AVR involves contact with the belt and idlers which are normally moving in operation. **The conveyor must not be moving when using the AVR.** In addition, conveyors are often elevated creating **fall and drop hazards**. In particular, even though a walkway is commonly available on one side of the conveyor, realigning the idler usually requires **access to both sides of the conveyor so work without stable footing or handrail may be required**. Some of the recommended safety practices are discussed below

### Accessibility

Most stationary conveyors have at least one walkway and much of the use of the AVR can be done from one side of the conveyor so the idler alignment can typically be done relatively conveniently and safely

from either side of the conveyor. In addition, the AVR is easily carried and manipulated. Nonetheless, **various reaching movements and dropping tools can result in injury** to the user or others on site if not care is not taken to prevent unintended consequences.

## Specific Hazards and



## Practices- read and follow all of them

### *Falling Hazards*

When walkways are not available or if only one exists and the idlers may have to be adjusted, and the **user will have to work more than six feet from the ground** or other operating platform, provision should be made for a guarded manlift, or safety harness and fall arrest system before work begins.

### *Lockout/Tagout*

The conveyor belt need not be moved when using the AVR. **Power must be switched off** and the switchgear tested and guarded with a personal padlock as well as tagged to identify the user's reliance on the conveyor belt not moving per normal industry practice. In addition, blocks may be placed on both sides of a pulley as another level of safety to **prevent inadvertent movement**.

### *Laser*

The Class IIIA laser used in the AVR was selected for safety and visibility.

Per OSHA Technical Manual Section III : Chapter 6 Laser Hazards

“C. Class I, Class II, Class I.A., and Class IIIA Lasers.

Accident data on laser usage have shown that Class I, Class II, Class I.A., and **Class IIIA** lasers are normally not considered hazardous from a radiation standpoint unless illogically used.

This current version of the BFA is intended for use in open, fresh air atmospheres. **It is not intended for use underground or in other confined spaces.**

**Direct exposure on the eye by a beam of laser light should always be avoided with any laser, no matter how low the power.”**

Nonetheless, also per the above reference, your “Laser Safety Officer” may determine that additional precautions are appropriate and they should be followed before or while using the AVR.

While considered safe even from as near as 4 inches, **the laser should be powered off** when not being aimed at the belt or target to limit the possibility of incidental exposure.

### *Magnets*

The AVR uses strong neodymium magnets that carry possible hazards as outlined below.

#### *Pacemaker*

- Magnets could affect the functioning of pacemakers and implanted heart defibrillators.
- A pacemaker could switch into test mode and cause illness.
- A heart defibrillator may stop working.
- If you wear these devices keep sufficient distance from the AVR.
- Warn others who wear these devices from getting too close to the AVR.

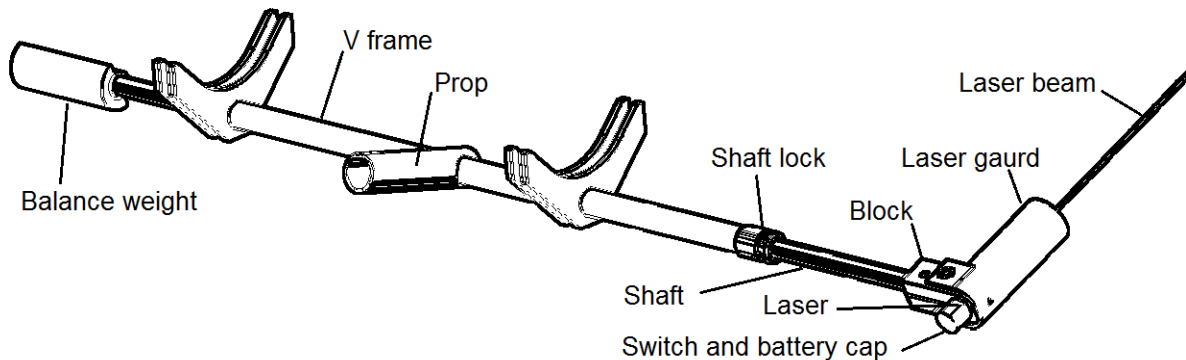


## Magnetic field

- Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers.
- Keep the AVR away from devices and objects that could be damaged by strong magnetic fields.

## AVR Parts

The AVR comes in a heavy plastic case to protect it from accidental damage and excess dirt. It is built of heavy steel and the laser is guarded to maintain accuracy but it is recommended to transport and store in this case as appropriate for a precision instrument. In the case are the AVR, a belt edge target, a spare battery and this manual. The AVR uses magnets so only works on idlers with steel rolls.



### V frame

The V frame comes installed on the AVR. It is composed of two pairs of V plates welded to an outer tube. Each pair has magnets sandwich between them so the magnetic attraction is transferred to attract the V plates to the idler roll. The V plates are designed to mount to most steel idler rolls including diameters from 4 to 7 inch. The spacing of the V plate pairs varies with the intended belt width of the AVR so the V plates contact near the end of the center roll. **The spacing should be around 80% of the length of the length of the center roll.** Use of the AVR on belts significantly wider than it was designed for may affect accuracy of the measurement and alignment.

### Prop

An adjustable (rotate) prop is provided on the V frame to prevent the magnetized V frame from sliding on the roller periphery. It may be shortened with a saw or tin snips if needed to fit the specific idler.

### Laser Assembly

The laser comes preassembled to the shaft and aligned. An aluminum block clamps the laser to the shaft with bolts. Loosening them may affect accuracy. Do not attempt to reset. The laser is equipped with lenses to project a green cross for visibility.

**Do not look into the laser or point the laser at anyone's head to prevent eye damage or irritation.**



The cross diverges so it will be larger and thicker with increasing distance. The cross hairs are set to be perpendicular to the shaft so one of its lines will stay in line with the shaft. The laser beam itself has also been adjusted to be perpendicular to the shaft. **Do not attempt to reset.** Contact AVERDSN LLC through the website [avr4idlers.com](http://avr4idlers.com) if concerns exist about the accuracy of the laser calibration.

### *Shaft*

A shaft slides and rotates in the tube of the V frame so that laser can be positioned to aim the laser beam as desired. It is made of stainless steel to prevent to prevent corrosion and sticking to the tube. **Light oiling from both ends of the tube is recommended to prevent corrosion and pitting of the tube.** The shaft may be removed from the V frame and replaced with a longer or shorter shaft as part of a different laser assembly but **the laser should never be removed from the shaft.**

### *Shaft lock*

The shaft lock is provided to stop the shaft from sliding into the tube more than desired. This is important when the laser is set to the first position along the belt. It is also convenient when carrying the AVR a longer distance. The lock collar will slide away from the laser but its **spring loaded collar must be pulled to move it closer to the laser.**

### *Laser Guard*

The black plastic guard is provided to prevent loss of accuracy from light and incidental bumps to the laser.

### *Laser*

The laser in the AVR was selected for safety and good visibility. A push button on the end switches it off and on. Removing the cap (~1/4" long exposed end of laser) by rotating counterclockwise allows the battery to be replaced. Specifications of the laser follow;

Laser Form Factor	<b>GGE</b>
Output Power (mW)	<b>&gt;3, &lt;5</b>
FDA Safety Class	<b>IIIa</b>
Central Wavelength (nm)	<b>531.65</b>
Divergence (mrad, full angle)	<b>&lt;1.2</b>
Beam Dimensions (mm, 1/e <sup>2</sup> )	<b>ø1.5</b>
Transverse Mode	<b>TEM00</b>
Longitudinal Modes	<b>Multiple</b>
Approximate Peak Power (W)	<b>5</b>
Operating Temperature Range (°C)	<b>+15 to +35</b>
Storage Temperature Range (°C)	<b>-10 to +50</b>
Total Power Consumption (W)	<b>2</b>
Max. Power Input Duty Cycle	<b>100%</b>
Cooling Method	<b>Passive Air</b>
Standard Warranty (months)	<b>6</b>
MTTF (operational hours)	<b>5000</b>
Weight of Laser Head (kg)	<b>0.08</b>
Laser Head Dimensions (mm)	<b>118 (l) x 20 (d)</b>
Power Supply	<b>1 x CR123A Battery</b>

The CR123A battery is commonly available and a spare is provided with the AVR. Buy additional spares after using it to avoid downtime. The battery is installed negative end (flat end) first.

### *Balance weight*

The balance weight serves the dual purpose of shaft collar and a counterbalance to the offset weight of the laser assembly. It may be removed and replaced or repositioned with the hex setscrews. When reinstalling, rotate the heavy side to be 180 degrees from the direction the laser points. Tighten the set screws securely.

### Lanyard (see photo)

A lanyard is provided for protection of workers under the conveyor and to the AVR calibration and accuracy while installing and removal of the AVR. **Attach before installing the AVR and remove only after AVR is in a stable location.** The lanyard may be replaced with preferred design of your company.



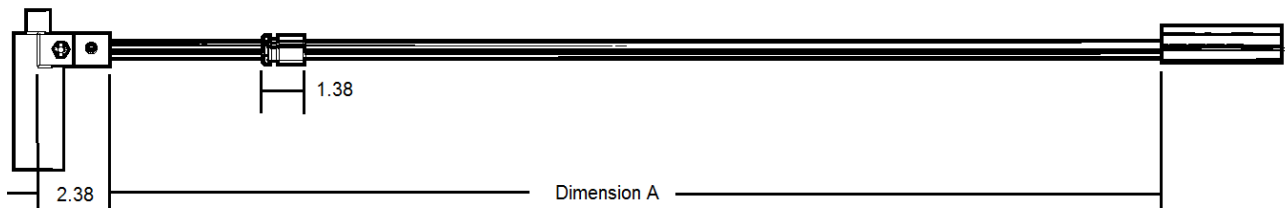
### Target (see photo)

A separate target is provided if more accuracy is desired than that obtained using a single idler space for both of the two laser locations needed for the AVR alignment indication. It is commonly needed because the idler wing rolls block the laser from the belt edge. It may be used for both of the two laser locations for maximum spacing and accuracy. The target has a slit in it to visually bisect the beam for better centerline detection. The target pointer is draped over the edge of the belt while the weight rests on the belt to support it. Keeping the suspended portion of the strap short in windy conditions improves its stability.

### Part Numbering and Dimensions

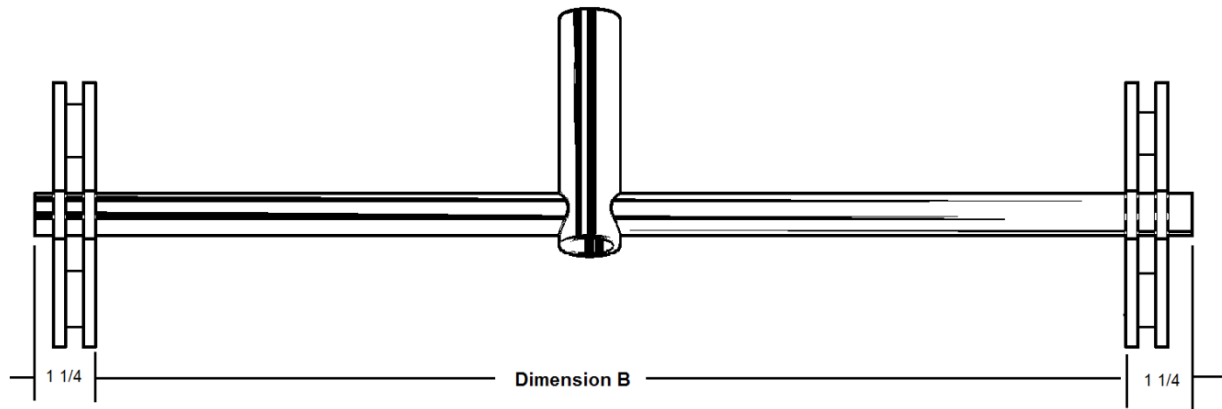
The V frame and shaft assembly are matched for typical applications but may be mixed and matched for specific needs and applications. The dimensions shown here are provided to evaluate and assemble as needed. This is easily done after removing the balance hub.

	BW=	24	30	36	42	48	54	60	72	84
	A=	17.875	21.875	25.875	29.875	33.875	37.875	41.875	49.875	57.875
	B=	6	8	10	12	14	16	18	22	26
max range										
-beam to belt centerline		16	19	22	25	28	31	34	40	46
min range										
-beam to belt centerline		8	9	10	11	12	13	14	16	18
ref -Belt Width/2		12	15	18	21	24	27	30	36	42
ref -to frame slots		16.5	19.5	22.5	25.5	28.5	31.5	34.5	40.5	46.5
max range with next larger shaft assembly LR option										
-beam to belt centerline		20	23	26	29	32	35	42	48	
-to reach to the conveyor stringer or for use with a wider range of belts with the next longer shaft										



Shaft Assembly dimensions





### V Frame dimensions

Example: for 42 inch belt width, order AVR-42, for normal use on 42-48 in belt.

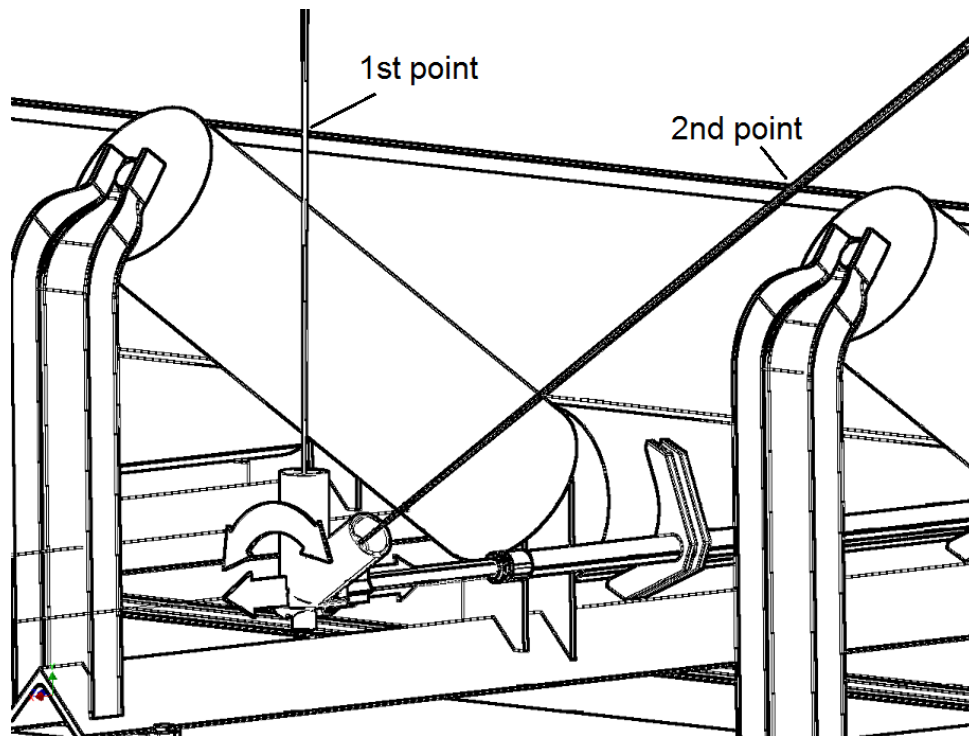
To measure to stringer (next larger A) or for 42" to 54" belts, order AVR-42LR

For two steps larger A order AVR-42LR2 etc.

Note: Less accuracy may be seen with increasing A for use on wider belts

### Operation

There are a number of ways to use the Alignment Verification Rig (AVR) but all shift the laser to a first point on a line parallel to belt movement and then use the sweeping rotation of the laser to compare the location of the laser beam at two points in the direction of belt travel.



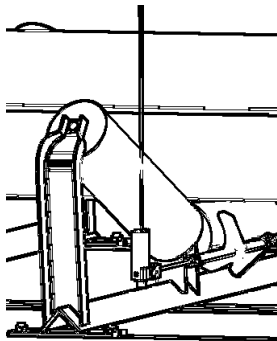
Note: The above points shown for reference only. They may not provide the desired accuracy

Before beginning, a **general plan should be developed** for how the AVR will be used. A **preliminary check for fit, access, belt condition** etc. on the conveyor is recommended as part of this planning process before the routine measurement and adjustment process proceeds. Read and understand the AVR operation as described below first and follow **all safety recommendations**.

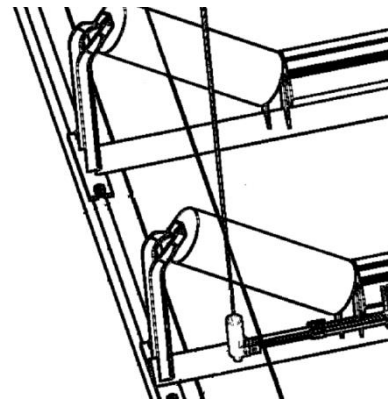


The following are questions that should be answered before work progresses.

- 1) What will be used to reference the **direction of belt** movement? The belt edge is a convenient and reliable line to use in existing applications if it is in



good shape. In particular, **inspect the belt** for cupping (belt does not lie flat on idler wing roll), bad splices and worn sections of belt edge. It may be useful to measure the distance from the belt edge to the roll edge for adjacent idler to assess the belt edge as an accurate reference, even to the



point of doing this measurement for every idler as part of the plan. The belt may have to be jogged to avoid splices or worn sections of the belt edge. **Planning ahead will allow this to be done efficiently and safely.** If the belt is **cupping**, a clamp or weight such as a sand bag may be used to force contact between the belt roll (measurements at belt edges near the idlers is recommended).

In new installations a wire or laser may be set up in a similar location. If a wire is to be strung, it should be shiny for best visibility. Detection of the intersection of two laser beams and even with a wire may require use of a hand held reflection plate to see the otherwise invisible beams. The conveyor structure or straightedge positioned along it may also be used if constructed consistently. (A special construction of the AVR may be necessary for this approach- see parts section.)

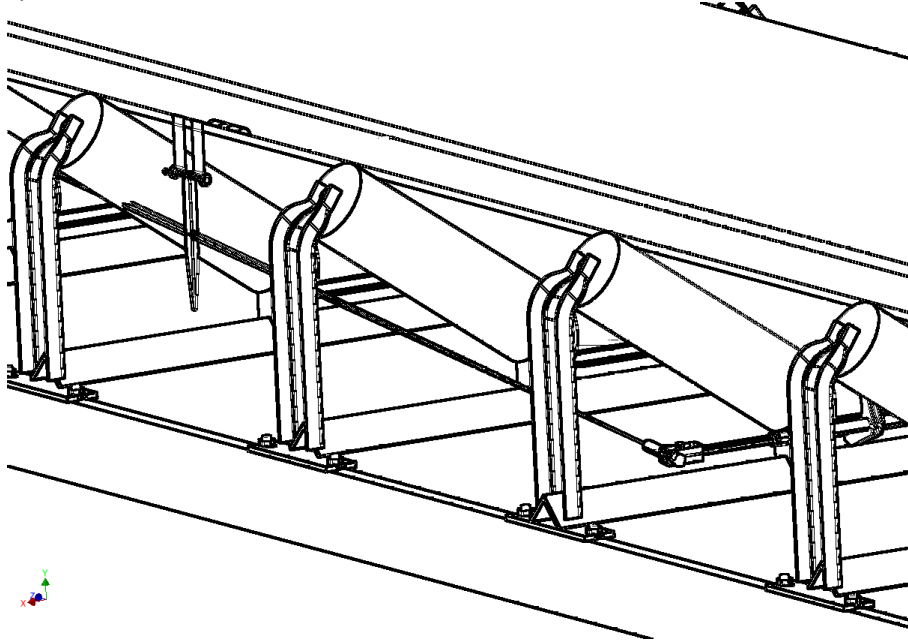
- 2) Does a **walkway** exist to easily access the idler and belt edge? If not, alternate **safe access** method must be developed. This applies to return idlers as well but the walkway is often not sufficient for safe access.
- 3) Will the **idlers be adjusted** as you go from one idler to the next while the AVR is attached?



- a. If yes, there must be a way to access the mounting bolts on both sides of the conveyor. A visual check or quick test may useful to check that they can be easily loosened and you have the right tools if your conveyor operates in a corrosive environment.
  - b. If no, measurements may be taken to justify the added work of adjustment. These measurements may be used for future adjustment but will likely not be as accurate.
- 4) Do you have the **right size AVR** for the belt widths? The spacing of the V plates should not be less than a couple of inches shorter than the center idler roll for the best accuracy. This is not as important for return idlers since they carry less weight. Aligning to the conveyor structure may require a special AVR with a longer rotating shaft.
- 5) What **two locations and spacing** of measurement points will be used? The quickest is to stay within the idler spacing that the AVR is mounted in as shown above as 1<sup>st</sup> and 2<sup>nd</sup> points. Almost

as easy is to use the adjacent idler spacing if the laser is not obstructed by the wing roll. More accuracy will be expected by using the target, described below, at the maximum visible distance.

The most accuracy is possible when the target is used upstream and downstream between measurements or if two targets are used. See Ordering in [avr4idlers.com](http://avr4idlers.com) for a second target. The choice of target locations depends on how accurate you wish to be. The AVR Calculator spreadsheet available at [avr4idlers.com](http://avr4idlers.com) is useful for that.



Target mounted to belt edge to extend measuring range

In addition, the 'Belt on Idler Alignment Friction' section of Chapter 6 in CEMA's Belt Conveyors for Bulk Materials (6<sup>th</sup> or 7<sup>th</sup> edition) is a good reference. A starting point is to consider laser beam discrimination as 1/32<sup>th</sup> to 1/16<sup>th</sup> of an inch and that total conveyor friction ranges from .01 to .03. Considering .02 for a typical conveyor and desiring misalignment friction to be only 5% of the total, allowable misalignment is 5% of .02 or .001. Comparing this to the beam discriminations suggests the distance between measuring locations to be 32 to 60 inches. Increasing the distance reduces power loss from friction even more. Locating both measurement points to be the same distance from the idler is recommended in case there is appreciable belt sag.

The same distance applies to the return belt but sag should not affect accuracy.

The following steps for the use of the AVR are listed in general order but may vary and are provided as guidance until its use becomes well understood. The first three may be incorporated as part of the above planning. Read all before beginning.

- 1) Review the AVR and your plan for its use with your safety officer or supervisor.**
- 2) Inspect conveyor, belt and belt edge or install alignment wire.**



The belt should consistently lie in and contact the idlers. Precise belt centering is not necessary. The belt edge should not be smooth and straight even if worn. If necessary, jog the belt so a better section of the belt is near the idler. Avoid or verify straightness of belt splices in the near vicinity of the idler being checked. If the conveyor structure is to be used for alignment, it should be straight and without offsets at nearby joints.

### 3) Inspect the idler

The idler roll that the AVR are attached to should be relatively unworn and free of buildup and cleaned if necessary. The idler should be level before realigning, especially in the return strand, in case it was intentionally misaligned to offset gravity effects.

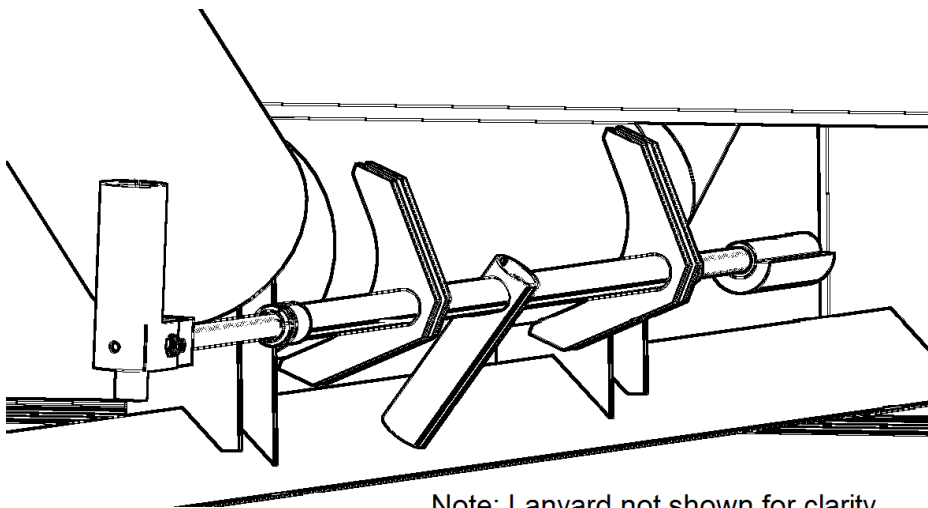
### 4) Attach free end of lanyard to idler frame

Looping the carabiner end around the angle frame under the wing roll and clipping to itself is usually convenient and close enough for the carry idler. If necessary, add a short rope or chain to reach the conveyor structure or idler bracket for return idlers so the AVR can be mounted near the middle of the belt.

### 5) Mount AVR

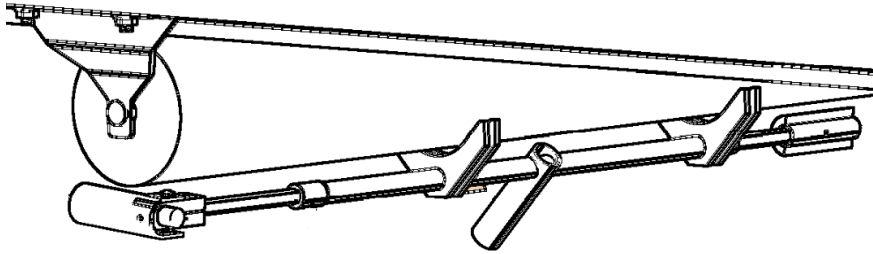
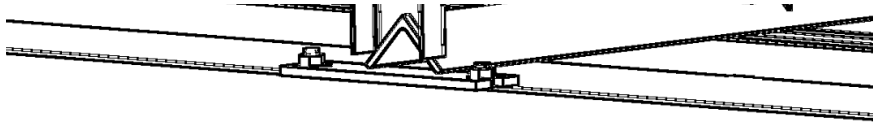
First, orient the prop close to where it will be needed. **While supporting yourself with one hand**, grasp the tube between the V plates with the other hand and reach under the belt to the idler roll and straddle the Vs of the V plates over the roll.

- Locate on the center roll near the 3:00 or 9:00 position depending on if you are using your right hand (3:00) or left hand (9:00) and adjust the prop to rest against the idler frame to prevent the roll from further rotating or the V plates from sliding.



Note; Lanyard not shown for clarity

- Locate near the center of single return roll idlers at 6:00. The prop is not used in this case



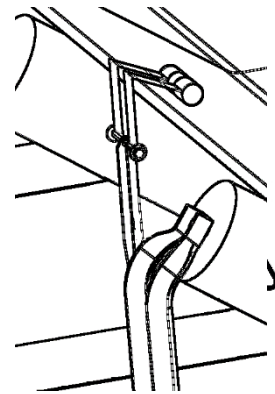
Note; Lanyard not shown for clarity

#### 6) Mount target per the plan, if applicable

With the weight lying on the belt, hang the tapered pointer over the belt edge. If it is windy, the target should be hung high to minimize sway.

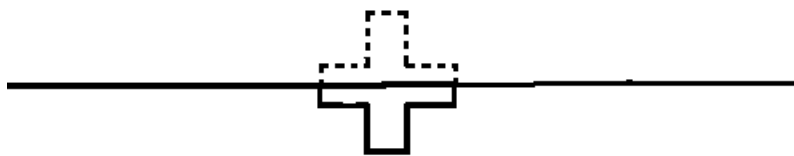
#### 7) Turn laser on

**Use care not to look into the laser or point the laser at anyone's head to prevent eye damage or irritation.** Point the long end of the laser toward the nearest belt edge by sliding and rotating the shaft in the V frame tube. It may be necessary to move the shaft lock to allow enough sliding. See directions for its use in 9) below. Turn the laser on by pushing rubber button on short exposed end of laser. **Turn off for safety** and battery life when not being used by pushing the button again.



#### 8) Locate and align laser beam to initial belt edge location-typically belt edge but may be the target.

Rotate and slide the laser further to **center the laser crosshair as precisely as possible** on the outermost belt edge corner at the initial or first of the two measuring locations per the measurement plan. It may be convenient to make a chalk mark on the belt at this location before or after this step.



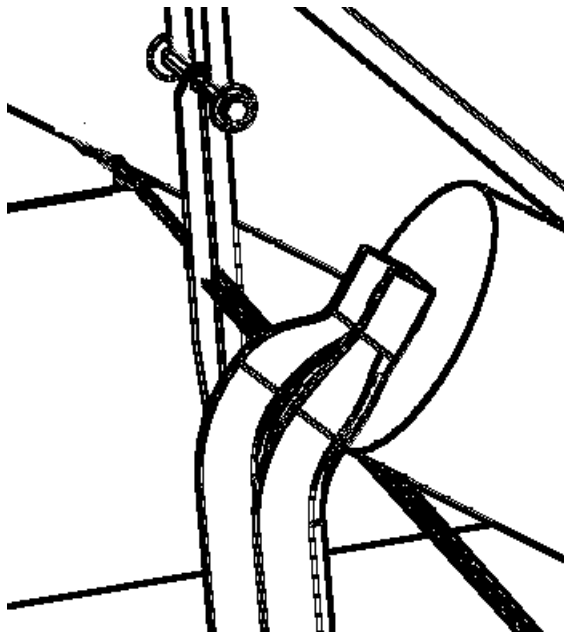
Laser crosshair from under belt at first point- dotted line not visible

### 9) Set lock collar

While holding the laser in position, reach under the belt and **slide the lock collar to abut** against the end of the V frame tube. (Pull on the collar to away from laser when needed). **During the next step**, the measurement should be taken with a light pressure trying to push the laser toward the center of the belt.

### 10) Rotate laser pointer to second location-belt edge or target.

As the laser is rotated, the **beam may move away from the belt edge** as set in step 8. If not noticeable, rotate the beam to the second location on the belt edge to see if and how much the beam is offset from the belt edge. Record total offset. If not, the idler is well aligned. That is, the axis or centerline of the roll that the AVR is mounted to is perpendicular to the belt movement. If the offset during the initial rotation is obvious, this indicates that the idler is badly misaligned. The LH drawing below is aligned while the RH one shows idler misalignment.



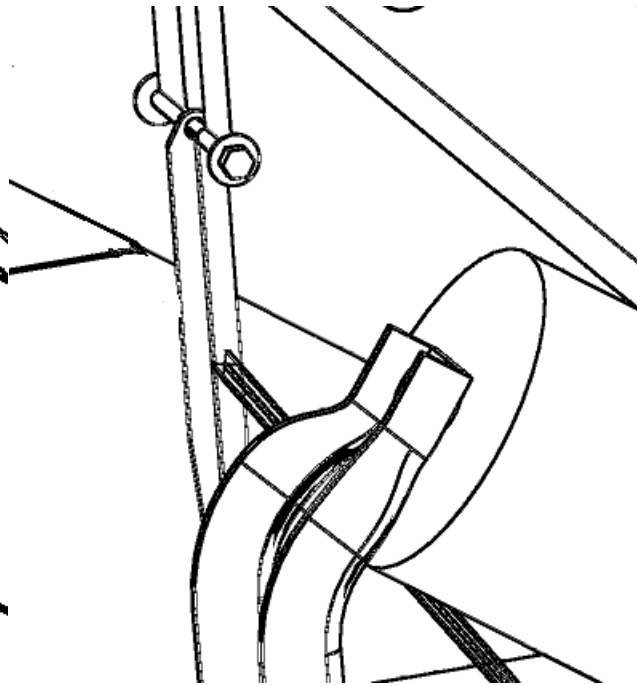
Laser beam on target passes through slot

#### *Identify misalignment direction*

The direction of movement indicates which way the idler footpad would be moved versus to the other to align the idler. If the beam moves away from the belt the footpad should move in the direction of rotation. In the above, the nearby idler footpad should be moved back slightly for improved alignment.

#### *Identify misalignment magnitude*

If an offset is noticeable at the second location it may or may not be a concern. Measure an offset and divide by the distance from the first location to the second location along the belt edge (or other reference you are using) to give the misalignment ratio. (take the arcsine if you want the angle)



Laser beam blocked on misaligned indication.





*Turn laser off before moving to next idler or while preparing to adjust idler*

### 11) Adjust Idler

Angular alignment of the idlers requires **loosening the mounting bolts and shifting one footpad or drop bracket in their slots**. Accessing the bolts on the other side of the conveyor may require special protection if it has no walkway. See previous cautions. The amount of movement is the misalignment ratio defined above divided by the distance from one pair of mounting holes to the other, typically belt width + 9 inches. Before adjusting any idlers, verify that the conveyor is level so that belt tracking is not negatively affected. If needed, shim under the footpad while aligning the idler.



#### *Recheck*

For best alignment, rotate laser to recheck for offset along the reference line at all points on the belt edge or other reference line parallel to the belt movement. **Retighten the bolts.**

### 12) Repeat for all idlers

Especially if significant misalignment is found, realigning in batches of every third idler and running between batches is recommended in case belt tracking is changed and retraining is necessary. See above for details on belt training. Small misalignment of several idlers for steering purposes will not significantly affect power. If the belt tracks well when empty but not when loaded it is likely that the belt is not centrally loaded and changes at the loading point may be needed.

## Maintenance

The AVR should be kept dry and clean and transported and stored in the case provided for protection from incidental jars to the laser calibration.

### Lubrication

The shaft is stainless steel but the tube inner diameter is unprotected steel. A light oiling should be done after use to prevent pitting of its bore for long life smooth and easy movement

### Batteries

If the laser stops working, it is likely due to a worn out battery. A replacement 'off the shelf' CR 123A battery is provided with the AVR. Replacement is done **without removing the laser or guard** via the cap that contains the switch (turn CCW). The CR123A battery is commonly available and a spare is provided with the AVR. The battery is installed **negative end (flat end) first**. See parts page above. It is recommended that spare batteries be kept on hand.

### Inspect lanyard

The lanyard should be inspected before use and replaced if visibly damaged.



### Recalibration

If dropped or otherwise abused, the laser guard may not be able to sufficiently protect the laser from damage. Contact AVERDSN LLC for further information if concerned with accuracy.

### Contact information

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The AVR is pending patented in the US. #10012498B2