

Reliance Industries, LLC

Installation, Operation, Inspection and Maintenance Instructions for the ARFAS Aluminum Rail Fall Arrest System



Reliance Industries, LLC

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US Patents Pending



Important Instructions!

These instructions must be kept on file and available for the users reference at all times. The users must read and full understand these instructions or have the instructions explained in detail before using this equipment. Failure to observe these instructions could result in serious injury or death.

Prior to use, all workers must be trained in the proper use of all systems and equipment.

A Training and Instruction review should be repeated at regular intervals.

A rescue plan must be prepared; the workers must be trained in its use, and rescue equipment must be on hand prior to any use of this horizontal rail system.

Any questions regarding these instructions should be directed to:

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Important OSHA Regulations Covering the Use of Horizontal Rigid Rail Systems

OSHA 1910.66 (b):

"Qualified Person" means one with a recognized degree or professional certificate and extensive knowledge and experience in the subject field who is capable of design, analysis, evaluation, and specifications in the subject work, project, or product.

OSHA 1910.66 (b):

"Competent Person" means a person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as in their application and use with related equipment

OSHA 1910.66:

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<u>Personal fall arrest systems shall be rigged such that an employee can neither free-fall more than 6-ft. nor contact any lower surface.</u>

<u>OSHA Standards, Interpretations and Compliance Letters, 02/09/1995-Criteria for personal fall arrest systems:</u>

The free-fall distance is limited to 6 feet. The deceleration distance must not exceed 42 inches; lifeline elongation is not included in deceleration distance; and the total fall distance is unregulated except that the employee cannot make contact with a lower level...The safety factor of two should be applied based on the anticipated maximum arrest force, not the fall energy.

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System Description and Design Parameters

The ARFAS Aluminum Rail Fall Arrest System is designed for use as a permanently installed horizontal rail system. The Rail, Splice Sections and Hangers are constructed from durable aluminum alloys. The Trolley is made from forged Stainless Steel with UHMW wheels with sealed ball bearings. The various Adapter brackets are made from Carbon Steel with corrosion resistant zinc plating. The system is designed to enable the user to attach to overhead anchor points, eliminating catenary loading of typical horizontal lifelines. The ARFAS system, in general, is designed for use by up to 2 persons at the same time, and have no limits to continuous span distances. Because the ARFAS design separates the anchor points from the rail track, the trolley is free to traverse the entire length of the system uninterrupted.

The anchor point loads require a 2 to 1 Safety Factor on the intended usage loads. Because there is no amplification of the loads, required anchor point strengths are calculated at 1,800 pounds for a single user system or 3,600 pounds for a two user system.

This system design is predicated on the use of a full-body harness for the worker, and a self-retracting lanyard (SRL) with 900 lb. maximum arrest force. Retractables that do not have "slip-clutch" type internal 900 lb. MAF shock absorbers are **NOT** allowed for use as vertical lifelines on this system. Any attachment to the ARFAS must transfer fall arrest forces to the body through the dorsal d-ring of the full body harness only. Harness side and chest d-rings are not allowable retractable connection points.

ARFAS Installation parameters are as follows:

- 1. Maximum unsupported span:
 - Rail P/N 1700100-1, 16-ft continuous
 - Rail P/N 1700200-1, 20-ft continuous
 - Rail P/N 1700300-1, 25-ft continuous
- 2. Maximum Cantilever of a continuous rail is 5 feet.

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- 3. Maximum distance from an anchorage point to a splice is 5 feet.
- 4. Maximum arrest force per user is 900 lbf.
- 5. Maximum number of users is 2.

Anchorage Points

The minimum strength of ARFAS anchorage points must be at least two times the anticipated fall arrest loads of 1,800 pounds for a single user system or 3,600 pounds for a two user system. This anchorage

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strength must be certified by a qualified person and must be verifiable by either calculation or testing. If in question, consult Reliance Industries Engineering for proper design requirements.

ARFAS Components

The ARFAS Aluminum Rail Fall Arrest System consists of the following standard approved and compatible components:

Part #	Description				
1700100-1	16-ft (5m) Rail Segment, Standard				
1700200-1	20-ft (6m) Rail Segment, Standard				
1700300-1	25-ft (7.6m) Rail Segment, Standard				
1700101-1	Rail Segment, Standard, per ft				
1730100-1	Rigid Rail Trolley, Std., Stainless				
1710200-1	Rail Splice, Standard Segment, 12-in				
1710224-1	Rail Splice, Standard Segment, 24-in				
1710236-1	Rail Splice, Standard Segment, 36-in				
1710600-1	End Stop Assembly				
1710100-1	Rail Hanger, Standard, 4 Pack				
1710101-1	Hanger, Parallel Purlin Bracket				
1710102-1	Hanger, I-Beam Clamp				
1710103-1	Hanger, Purlin Mounting Plate				
1710104-1	Hanger, Bar Joist				
1710105-1	Bracket, Parallel Double Rail				
1710112-1	Arm, Rail Hanger, 12"				
1710124-1	Arm, Rail Hanger, 24"				
1710136-1	Arm, Rail Hanger, 36"				
1710113-1	Hardware Kit, Fixed Hanger Arm				
1710114-1	Hardware Kit, Adjust Hanger Arm				

The actual selection of components and options for the design of an ARFAS Aluminum Rail Fall Arrest System should only be performed by a Reliance Industries Qualified Person, or a state registered Professional Engineer who is experienced in the design and use of safety systems.

The ARFAS Aluminum Rail Fall Arrest System is designed for use with the approved, above listed components only. Substitutions or replacements with non-approved components will endanger the system integrity and may affect the safety and reliability of the total system.

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Personal Fall Arrest Equipment Used with ARFAS

It is of utmost importance to control system input forces during a fall to ensure the system maintains a 2 to 1 safety factor. Only SRLs with 900 lb. maximum arrest force are allowed for use with this system. Install a single SRL only to the ARFAS Trolley, do not make direct connections to the Rail or any supporting brackets.

Care should also be used in selecting harnesses for use with the ARFAS. Harnesses with sewn down back pads can limit as much as 1 ft. of back pad slippage during fall arrest, giving additional clearance for safety. If the system will be used where a worker could encounter a head first free-fall, a non-secured back pad can slide down the webbing to the small of the back, allowing the worker to fall out of the harness through the top by allowing the harness straps to slip over the shoulders. For this reason, we recommend the use of full body, crossover or pullover type harness with sewn down or slip resistant back pads for all installations.

Installation Layout Considerations

The ARFAS Aluminum Rail Fall Arrest System is designed to minimize fall clearances and protect users in areas where free fall is limited. Minimum fall clearances must be calculated based on SRL and harness type selected. The system should be located as centered above the work area as possible, to prevent swing falls and falls over edges. Consult the SRL user instructions for details on swing fall and sharp edge limitations. The system should never be located near energized lines or connections. Clearance from moving or rotating machinery and equipment must be maintained at a safe distance from all anticipated user movement. Locate the ARFAS at a level below any roof top systems such as lighting, conduit, water and utility lines, sprinkler heads and lines, ducting or HVAC systems. The ARFAS and its mounting brackets are designed to put the system at its highest level from the working surface while creating an obstacle free linear travel path for the SRL.

Installation

Installation of ARFAS should be done under the supervision of a Qualified Person trained in their function and use. Use only parts that have been qualified as compatible components by Reliance Industries. Ensure that the minimum anchorage strength is at least 2 times the anticipated fall arrest loads of 1,800 pounds for a single user system or 3,600 pounds for a two user system. Have the anchorages certified by a qualified person and keep documentation on hand. Always install ARFAS horizontally where all end anchorages and bypass supports keep the Rail section level and plum.

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ARFAS Installation Procedures

NOTE: Approved fall protection must be worn during ARFAS installation at all times. Do not use the rigid rail or its anchorages as personal fall protection anchorages until the system has been completely installed, inspected, and approved for use by a Qualified Person.

Rail Elevation Preparation and Installation

From the installation survey, determine the proper elevation for the rail section. Secure the rail to either a lift or forklift suitable to lift the rail section into place. Starting at either the middle of the system or at one end of the system, lift the rail into position and using the bracket installation procedures below, mount one end of the rail to the structure per the installation survey. Checking the rail for plum and true to the working surface or to true level, install the second mounting point per the installation survey. Continue the rail section installation, including splices and mounting brackets per the installation survey ensuring that each subsequent rail section is in line, square and plum with the first rail section.

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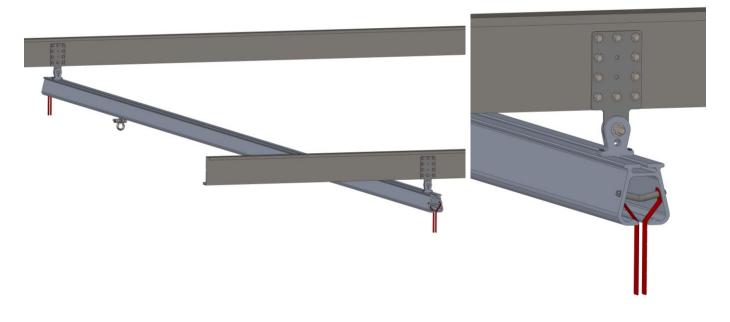
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Purlin Direct Mount Installation

Test fit the purlin bracket to the rail hangers and rail. Clamp the purlin bracket to the purlin and check the back of the purlin for any obstructions or conduit lines. There are 12 screw holes in the bracket, but only 9 screws are required for each bracket. The extra holes are to allow for avoiding any back side obstructions on the purlin. Clamp the purlin bracket to the purlin and pre-drill two holes with an 11/64" diameter drill. Insert and attach the #14 x 1-1/2" self-drilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Pre-drill the remaining 7 holes with an 11/64" diameter drill. Insert and attach the remaining 7, #14 x 1-1/2" self-drilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Tighten the mounting bolt connecting the rail hangers to the purlin brackets and the set screws in the rail hangers to the rail section, keeping the rail section plum and true to the working surface.



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Purlin Twin Arm Mount Installation

Twin arm bracket lengths should be chosen by length or a combination of lengths to create a rail elevation to miss any obstacles as described in the site evaluation. When using two twin arms in the adjustable configuration, connect the arms with the included 1/4" bolt, nut and washers. Place the arms such that the included angle between them is less than 120 degrees.

Test fit the purlin brackets with twin arm brackets to the rail hangers and rail. Clamp the purlin brackets to the purlin and check the back of the purlin for any obstructions or conduit lines. There are 12 screw holes in each bracket, but only 9 screws are required for each bracket. The extra holes are to allow for avoiding any back side obstructions on the purlin. Verify clamp pressure of the first purlin bracket to the purlin and pre-drill two holes with an 11/64" diameter drill. Insert and attach the #14 x 1-1/2" selfdrilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Verify clamp pressure of the second purlin bracket to the purlin and pre-drill two holes with an 11/64" diameter drill. Insert and attach the #14 x 1-1/2" self-drilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Pre-drill the remaining 7 holes with an 11/64" diameter drill. Insert and attach the remaining 7, #14 x 1-1/2" selfdrilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Return to the first purlin bracket and pre-drill the remaining 7 holes with an 11/64" diameter drill. Insert and attach the remaining 7, #14 x 1-1/2" self-drilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Tighten the mounting bolt connecting the rail hangers to twin arm brackets, and to the purlin brackets to the twin arm brackets, the adjustable twin arm bracket bolts where applicable, and the set screws in the rail hangers to the rail section, keeping the rail section plum and true to the working surface.

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Parallel Purlin Twin Arm Mount Installation

Twin arm bracket lengths should be chosen by length or a combination of lengths to create a rail elevation to miss any obstacles as described in the site evaluation. When using two twin arms in the adjustable configuration, connect the arms with the included 1/4" bolt, nut and washers. Place the arms such that the included angle between them is less than 120 degrees. Use the parallel purlin bracket to mate the twin arms at 90 degrees from the purlin bracket.

Test fit the purlin brackets and parallel purlin brackets with twin arm brackets to the rail hangers and rail. Clamp the purlin brackets to the purlin and check the back of the purlin for any obstructions or conduit lines. There are 12 screw holes in each bracket, but only 9 screws are required for each bracket. The extra holes are to allow for avoiding any back side obstructions on the purlin. Verify clamp pressure of the first purlin bracket to the purlin and pre-drill two holes with an 11/64" diameter drill. Insert and attach the #14 x 1-1/2" self-drilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Verify clamp pressure of the second purlin bracket to the purlin and pre-drill two holes with an 11/64" diameter drill. Insert and attach the #14 x 1-1/2" self-drilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Pre-drill the remaining 7 holes with an 11/64" diameter drill. Insert and attach the remaining 7, #14 x 1-1/2" self-drilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Return to the first purlin bracket and pre-drill the remaining 7 holes with an 11/64" diameter drill. Insert and attach the remaining 7, #14 x 1-1/2" self-drilling, self-threading screws (not included) to the pre-drilled holes until the screws are tight to the bracket surface. Tighten the mounting bolt connecting the rail hangers to twin arm bracket, and to the purlin bracket and parallel purlin bracket to the twin arm bracket, the adjustable twin arm bracket bolts where applicable, and the set screws in the rail hangers to the rail section, keeping the rail section plum and true to the working surface.





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I-Beam Direct Mount Installation

Test fit the I-Beam bracket to the rail hangers and rail. Depending on application, attach the drop link to the parallel I-Beam hole, or the perpendicular I-Beam hole of the bracket. The I-Beam bracket must be perpendicular to the edge of the I-Beam flange, and the inside edge of the "C" of the bracket must be flush with the edge of the I-Beam flange. Hand tighten the tension bolt to the flange of the I-Beam and check alignment of the drop link, hanger bracket and rail. Torque the tension bolt to 65 ft/lbs, tighten jam nut to the bracket to lock the tension bolt in place. Tighten the drop link bolt, drop link to hanger bolt, and the set screws in the rail hangers to the rail section, keeping the rail section plum and true to the working surface.



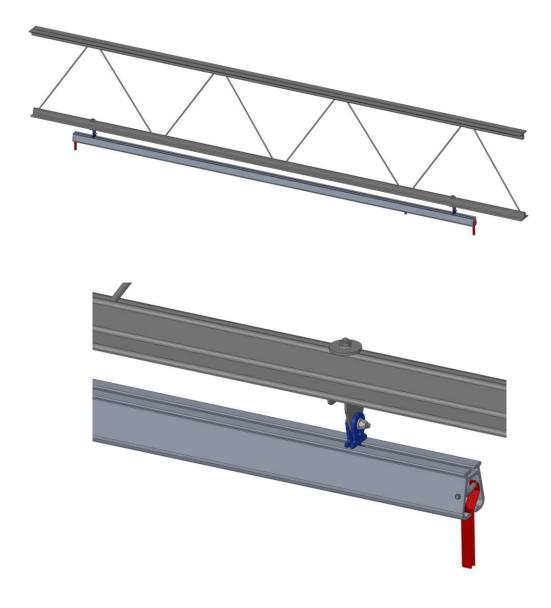
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Bar Joist Direct Mount Installation

Test fit the Bar Joist bracket to the rail hangers and rail. Ensure the large load washers sandwich the bar joist. Depending on application, the bar joist bracket can be parallel to the bar joist, perpendicular to the bar joist, or any position between them. Tighten the bar joist bracket bolt, mounting bolt connecting the rail hangers to the bar joist bracket and the set screws in the rail hangers to the rail section, keeping the rail section plum and true to the working surface.



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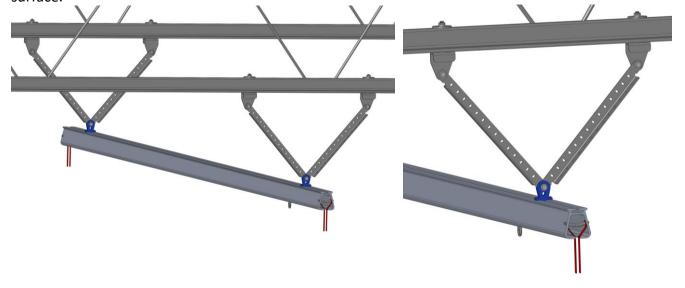
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Bar Joist Twin Arm Mount Installation

Twin arm bracket lengths should be chosen by length or a combination of lengths to create a rail elevation to miss any obstacles as described in the site evaluation. When using two twin arms in the adjustable configuration, connect the arms with the included 1/4" bolt, nut and washers. Place the arms such that the included angle between them is less than 120 degrees.

Test fit the Bar Joist brackets with twin arm brackets to the rail hangers and rail. Ensure the large load washers sandwich the bar joist. Depending on application, the bar joist bracket can be parallel to the bar joist, perpendicular to the bar joist, or any position between them. Tighten the bar joist bracket bolts, tighten the mounting bolt connecting the rail hangers to twin arm brackets, and to the bar joist brackets to the twin arm brackets, the adjustable twin arm bracket bolts where applicable, and the set screws in the rail hangers to the rail section, keeping the rail section plum and true to the working surface.



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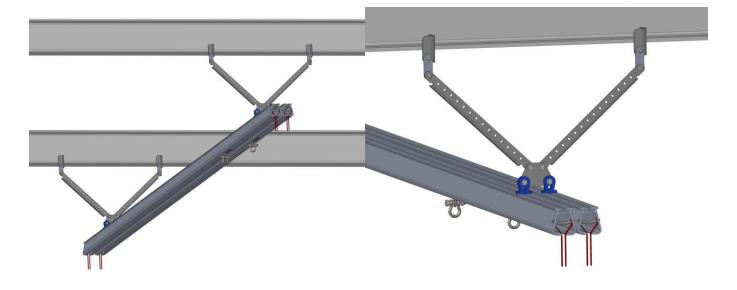
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Parallel Rail Installation

Parallel rail installation requires the use of twin arm brackets to counteract the off axis loading of two parallel rails. Twin arm bracket lengths should be chosen by length or a combination of lengths to create a rail elevation to miss any obstacles as described in the site evaluation. When using two twin arms in the adjustable configuration, connect the arms with the included 1/4" bolt, nut and washers. Place the arms such that the included angle between them is less than 120 degrees.

Use the appropriate mounting brackets, either purlin or bar joist mount, and assemble with the parallel rail brackets upper two narrow with holes, one each respectively attached to each of two twin arms. Install purlin or bar joist brackets in accordance to instructions above after test fitting the purlin or bar joist brackets with twin arm brackets to the parallel rail bracket, rail hangers and rails. After completing the purlin or bar joist bracket installation, tighten the upper bolts to the twin arm brackets, the adjustable twin arm bracket bolts where applicable, the lower twin arm bolts to the parallel bracket, the parallel bracket to the rail hangers on each of the two rails, and the set screws in the rail hangers to the rail sections, keeping the rail section plum and true to the working surface.



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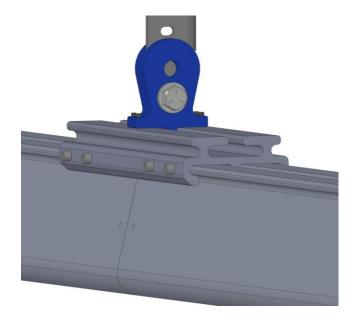
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Splice Installation

Rail Hangers are compatible with the slots in the top of the splice section. When using the rail hangers in the splice, a second hole closer to the rail hanger "T" protrusion is intended for use in a system with fixed overhead installation such as a bar joist. The rail hanger is locked into place using the set screws as it would in the rail section itself.



Loosen the (8) socket head cap screws to the point that the end is flush with the inside of the inverse "T" slots in the splice section. Slide the splice onto the top of the rail, with double "T" of the rail mating to the inverse "T" slots in the splice section. Locate the end of the splice 6 inches past the end of the rail. Hand tighten the (4) socket head cap screws to the rail. Torque the (4) socket head cap screws to 10 ft/lbs.

This first operation can be done while the beam is on the ground or after it is suspended.

Slide the connecting rail section into the splice, with a maximum gap of 1/8" between rails. Hand tighten the (4) socket head cap screws to the rail and adjust for rail alignment. Torque the (4) socket head cap screws to 10 ft/lbs.

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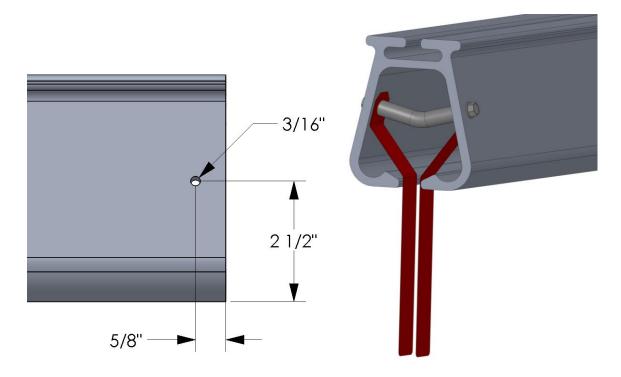
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End Stop Installation

Layout and measure the pre-drill holes for the included $1/4" \times 1-1/2"$ long self-drilling, self-threading screws. Locate and mark the pre-drill holes at 5/8" from the end of the rail, and 2-1/2" from the bottom of the rail on each side of the rail. Pre-drill with a 3/16" drill, keeping the drill perpendicular to the side of the rail. Drill and thread the $1/4" \times 1-1/2"$ long self-drilling, self-threading screws until the head is tight to the outside rail surface. Loosen the screws until 3/8" of the screw tip is extended from the inside edge of the rail section. Assemble the grommet of the label and one end of the stop tube to the first screw, and assemble the grommet of the second label to the second screw, and manipulate the stop tube over the end of the second screw ensuring the label is captured between the end of the stop tube and the inside wall of the rail. Tighten both screws to the outer surface of the rail ensuring the screws properly thread through the stop tube.



- 1. Once the system passes all checks by the competent person, the system may be approved for use, and the ARFAS ID label on the end stop must be punched with the appropriate date of installation.
- 2. After each inspection the end stop label shall be punched indicating date of last inspection by the competent person.

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Training

It is the responsibility of the employer to train all workers prior to using this system (per OSHA 1926.503 (a)(1)). The employer shall provide a training program for each employee who might be exposed to fall hazards. The program shall enable each employee to recognize the hazards of falling and shall train each employee in the procedures to be followed in order to minimize these hazards. The employer shall assure that, as necessary, each employee has been trained by a competent person qualified in the following areas:

- a. OSHA regulations governing the use of fixed rail systems.
- b. Ability to recognize potential fall and workplace hazards.
- c. Method of inspection of safety equipment.
- d. Rescue procedures.

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e. Installation and removal techniques.

Planning for Rescue

Prior to system use, a rescue plan must be prepared, the workers must be trained in its use, and the rescue equipment must be on hand to implement it in case of a fall.

Typical rescue plans include (but are not limited to) the following items:

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- 1. List of equipment that must be readily accessible in the event of an emergency and the names of those workers certified to use or operate that equipment.
- 2. Emergency contact phone numbers (ambulance, hospital, fire department...) and a means to contact them (cell phone, emergency radio).
- 3. List of employees on the site, and the specific tasks they will perform to effect the rescue.

The equipment that will be used to aid in the rescue of any worker must be attached to structural anchorages independent of those used for the horizontal lifeline system. During installation of horizontal lifeline anchorages, tie-off and equipment attachment hardpoints should be attached, and also clearly marked in such a manner as to provide a means to rescue a worker in any position along the lifeline system.

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Inspection

Prior to each use, the worker must inspect the system for any physical damage, wear, corrosion, or malfunctioning parts. Check the rail section for deformation or evidence of fall arrest loading. Check that the end stops are in place and end stop labels are installed and visible from the working surface. Check that the trolley rolls smoothly in the rail and shows no deformation of the connection hole. All mounting brackets and hardware should be tight and free of corrosion. If an inspection reveals a problem or unsafe condition, remove the entire system from service until it can be re-certified by a competent person.

The worker should verify the presence of the ARFAS ID End Stop Label attached to the end stop. A formal inspection must be carried out a minimum of once each year, and be formally documented and kept on file with the system installation documents.

Servicing

A qualified person trained in the inspection and servicing of system components must carry out servicing of this system. The company's safety officer should maintain a record log of all servicing and inspection dates. The system and all components must be withdrawn from service if subjected to fall arrest forces. Those components may be returned to service only after being certified by a qualified person. Only original Reliance Industries equipment and replacement parts are approved for use in this system. Contact Reliance Industries Engineering with questions and when in need of assistance.

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Warnings and Limitations

Proper care should always be taken to visually scan the work area prior to use. Remove any obstruction, debris, and other materials from, and beneath the work area that could cause injuries or interfere with the operation of this system. Be cautious of swing fall hazards if working horizontally to the side of the ARFAS. Be cautious of energized sources that the SRL could contact in the intended path of usage. Keep away from rotating or moving machines or vehicles in and around the work area.

Users should be familiar with pertinent regulations governing the use of this system and its components. Only trained and competent personnel should install and supervise the use of this system.

Do not exceed manufacturers' maximum number of people on the ARFAS.

Use only Reliance Industries supplied or qualified compatible components.

If you have any questions regarding the correct installation or use of this product <u>DO NOT USE</u>. Call Reliance Industries, LLC Engineering at Ph. (303) 424-8650 or Fax (303) 424-8670.

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Inspection Log for ARFAS Systems

Company:	Location: ARFAS Log No.:		Date:						
Describes and a section of the secti									
Describe non-conforming conditions	Missing	elow: Labels		Deformed	Cracked Parts/	Excessive			
Inspection Criteria	Parts	Readable	Corrosion	Parts	Broken wires	Loading			
ARFAS ID End Stop Label?									
Trolley Label?									
Trolley?									
End Stops?									
Splice(s) Screws?									
Rail Sections?									
Mounting Brackets and Hardware?									
Hanger Brackets and Screws?									
Has a Rescue Plan been prepared?									
Is Rescue Equipment on hand?									
Have workers been trained in the Re	scue Procedur	es and been give	en a copy of the	Rescue Plan?					