KNIGHT GLOBAL

Rack and Pinion Servo Tractor, Gear Rack Installation and Maintenance Manual

THIS MANUAL CONTAINS IMPORTANT INFORMATION REGARDING INSTALLATION, SAFETY, AND MAINTENANCE OF THE KNIGHT GLOBAL RACK AND PINION SERVO TRACTOR GEAR RACK AND SHOULD BE AVAILABLE TO ALL PERSONNEL RESPONSIBLE FOR INSTALLING THE RACK AND PINION GEAR RACK.

KSTRPGR_20181211_v001

This manual provides important information for all personnel involved in the installation, operation and maintenance of the Knight Global Servo Rack and Pinion Tractor Gear Rack. All personnel must read this document before installing the equipment.

Every effort has been made to provide complete and accurate product information in this manual. However, due to product improvements and changes, discrepancies and omissions may be present. Visit our website at www.knightglobal.com for the updated information on all our products.

It is the responsibility of the end user to exercise common sense and judgment when performing the tasks described in this manual. If any procedure seems inaccurate, incomplete or unsafe please put the equipment in a safe condition and contact Knight Global service department for assistance.

Throughout this manual there are steps and procedures that if not performed correctly can result in personal injury or equipment damage. The following signal words are used to identify the level of potential hazard.

WARNING

Indicates a hazard which will cause severe injury, death or substantial equipment damage.

CAUTION

Indicates a hazard which can or will cause injury or equipment damage.

NOTE

Notifies personnel of installation, operation or maintenance information which is important but not hazard related.

1. SAFETY

Knight Global cannot be aware of or provide for all the procedures by which the gear rack operations or repairs may be conducted and the hazards which may result from each method. If operation or maintenance not specifically recommended by Knight Global is conducted, it must be ensured that product or personnel safety is not endangered by these actions. If not sure of an installation or maintenance procedure or step, personnel should place the Servo Tractor in a safe condition and contact a supervisor and/or Knight Global's service department for technical support.

Modifications to upgrade, re-rate or otherwise alter this equipment shall be authorized only by the original equipment manufacturer.

All personnel that will install, operate, inspect, test or maintain the tractor gear rack assembly should read this manual and be familiar with all applicable portions of the referenced standards.

If clarification of any information in this manual or additional information is required, contact Knight Global. Do not install, operate, inspect, test or maintain the gear rack assembly unless all information is understood.

Personal Protective Equipment such as gloves, safety glasses, safety hard hats and safety shoes are recommended when handling and installing the gear rack.

CAUTION

Prior to placing this unit into service, the owners and users are advised to examine specific local and/or other regulations, including ANSI and OSHA regulations that may apply to the use of this product.

2. INTRODUCTION

2.1 Linear Gear Rack Assembly for Knight Servo Tractors

A modular, bolt on, linear gear rack system that can be expanded to any length required. It is used to run Knight Servo Tractors on 7510 Series Knight Linear Rail or other Knight designed rail systems. The gear rack sections are 72” long and made from hardened 4140HT steel coated in zinc.

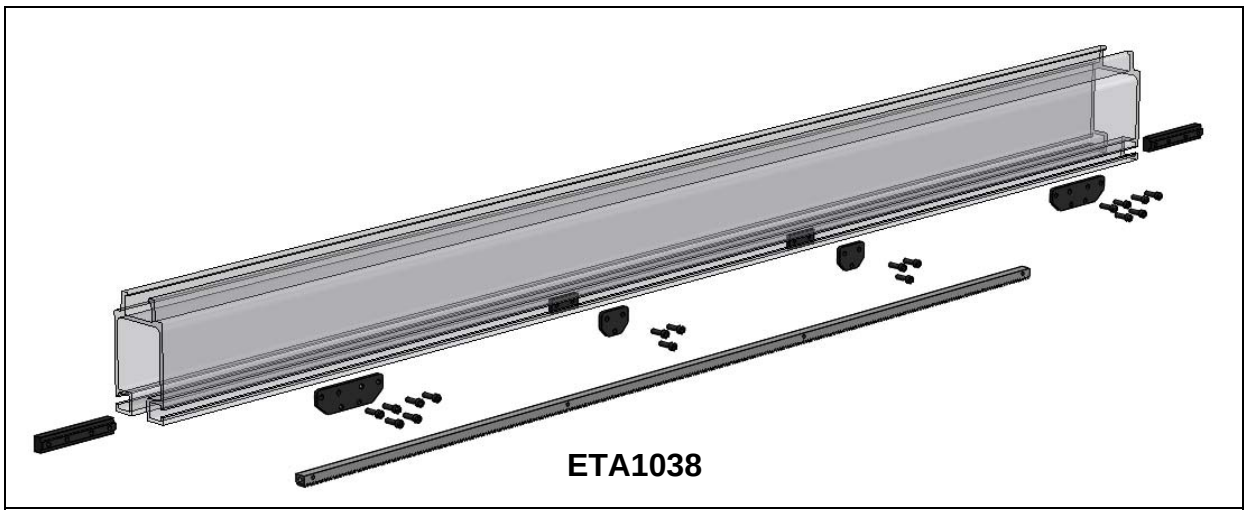
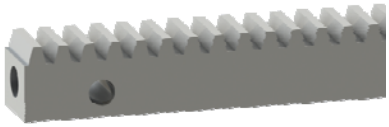
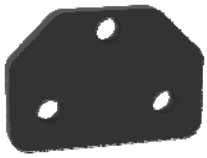
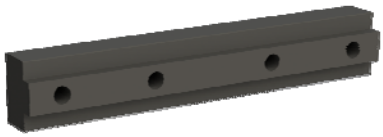


Figure 2-1

The ETA1038 Assembly includes:

- (1) ETD1130 Gear Rack Section
- (2) MRAD7566 T-Block
- (2) ETD1347 Splice Plate
- (2) ETD1310 Mounting Plate
- (2) ETD1231 Retainer Key
- (1) Ø5/16 X 3/4” Lg. Dowel
- (18) M8x1.25x25mm Socket Head Cap Screw

2.2 Major Components of Gear Rack

Part Number	Description	
ETD1130	72” (1828.8mm) Gear Rack Section	
ETD1310	Mounting Plate	
ETD1347	Splice Plate	
MRAD7566	T-Block	
ETD1231	Retainer Key	
M8x1.25x25mm	Socket Head Cap Screws	
ETA1062	*****Right Hand End Mount Assembly	
ETA1063	*****Left Hand End Mount Assembly	
Ø5/16 X 3/4” Lg.	*****Dowel (For Alignment Assistance)	

** Found on later versions (Manufactured after 06/28/2017)*

3. PLANNING

NOTE

For best results, Layout Design by Knight Global Engineering is recommended. Call (248) 377-4950 for more information.

3.1 Hanger Spacing and Deflection

- Design layout to ensure the runway and bridge rail deflection is as small as possible. Refer to the Knight Global Rail Operation and Maintenance manual for proper installation of Knight Global rail. *(For best results, Layout Design by Knight Engineering is recommended)*
- Knight's recommended allowable deflection for the rail system is .22" or less per 10' of rail when mounting a linear gear rack assembly for use with a Knight Servo Tractor.
- Keep the rail system as rigid as possible to minimize sway for more accurate servo positioning.
- Better results will be obtained by using low profile hangers. (Hangers may require shims to level.)

3.2 Layout and Joint Spacing

Place all gear rack splice joints at least 12" from any rail joint. Refer to Figure 3-1.

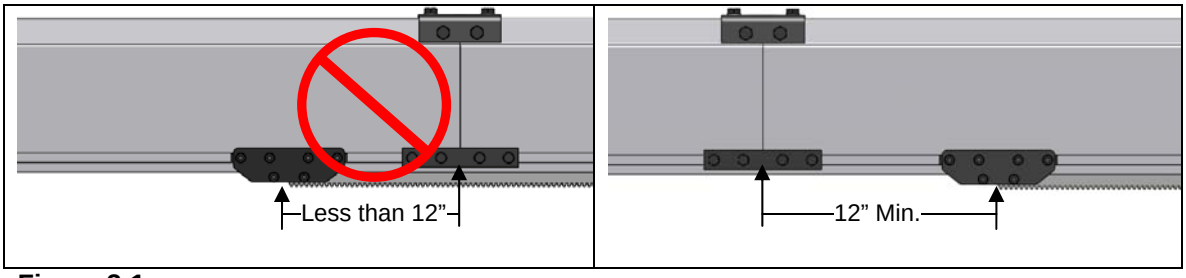


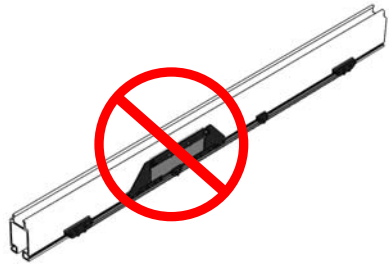
Figure 3-1

3.3 Inspection Gate Positioning And Spacing

- Whenever possible, do not place inspection gates in the same rail span as the gear rack assembly.
- If inspection gates must be place in the same rail section as the gear rack assembly, the gate itself must be on the side of the rail opposite the gear rack. Refer to Figure 3-2.
- The gear rack splice should never be placed across from an inspection gate. The inspection gate opening should be placed opposite or near opposite the middle of a gear rack section. *(Treat the inspection gate opening like a rail splice)*. Refer to Figures 3-3 and 3-4.

Gear rack installed on opposite side of rail of inspection gate. (Rail Shown Transparent)

Figure 3-2



Gear rack installed on same side of rail of inspection gate.

Figure 3-3

Gear rack splice installed on opposite side of rail of inspection gate.

Figure 3-4

3.4 Gear Rack Plate Positioning

When designing the gear rack assembly, ensure the gear rack splice plates and mounting plates do not line up with any rail or inspection gate hardware. Gear rack splice plates and mounting plates should be installed at a minimum of 1/4” (6.35mm) away from any rail hardware. Refer to Figures 3-5 and 3-6.

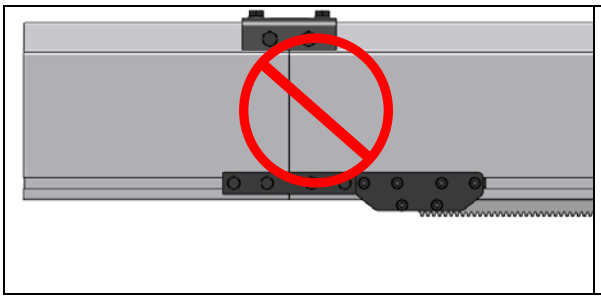


Figure 3-5

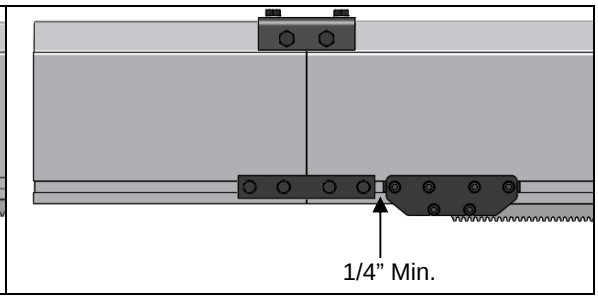


Figure 3-6

3.5 Gear Rack Start, End, and Middle Section Positioning

- On runways and other long runs it is a good practice to extend the gear rack assembly 3' past the expected end of travel or the tractor.
- Gear rack assembly installation drawings should include (Refer to Figure 3-7):
  - Distance dimension from end of rail to start and end of gear rack assembly
  - Distance dimension from end of rail to either end of center gear rack section
  - A view displaying all mounting plates and splices.

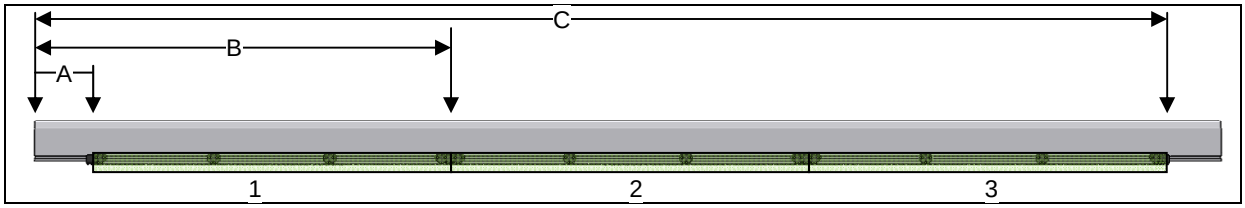


Figure 3-7

CAUTION

If a gear rack section must be cut, it must be placed at the end of the assembly. The cut end cannot be placed back-to-back with other sections of the gear rack. A best practice is to paint cut ends red. Refer to Figure 3-8.

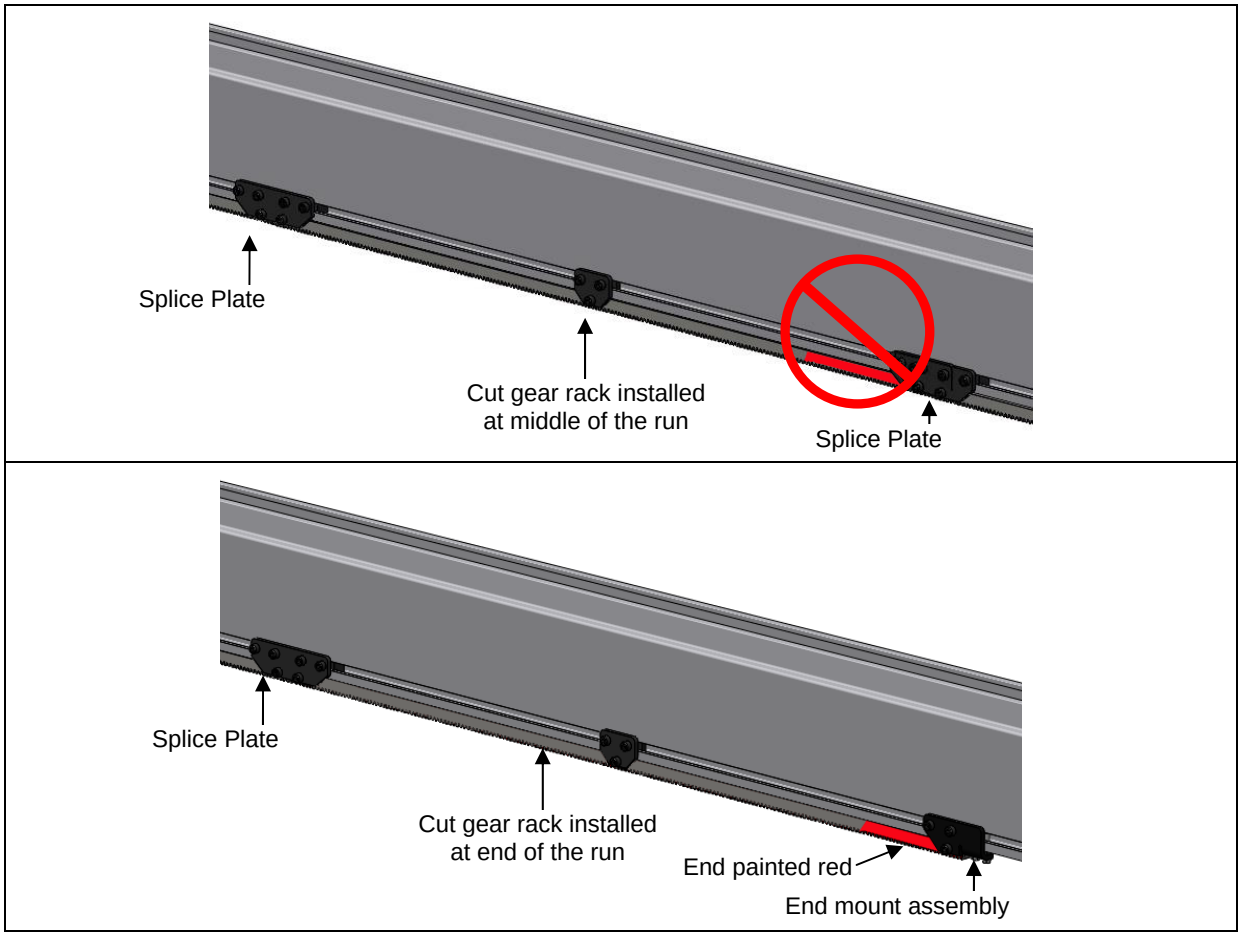


Figure 3-8

4. PREPARATION

4.1 General Tool List

	Metric Allen Wrench Set	Metric Impact Socket Set
	Bubble Level	Metric Drive Socket Set
	Metric Combination Wrench Set	Heavy Polyurethane Mallet
	Drill Motor	Ladder, Scaffolding, or Man Lift
	Drill Bits	Tape Measure
	Impact Wrench	Laser Level

4.1.1 Custom Tool List

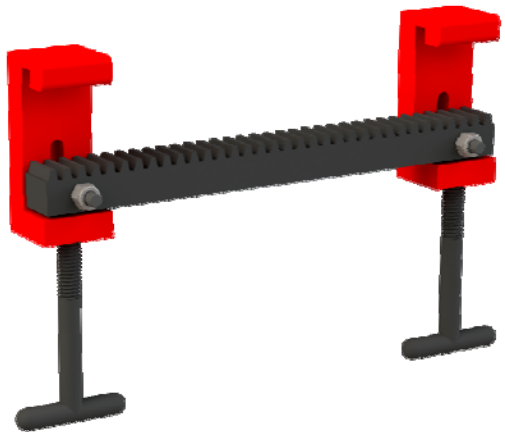
	(2) ETA1045 Knight Gear Rack Clamp Tools. When engaged in the lower T-Slot of Knight Rail, this tool is used to press the ETD1130 gear rack section firmly to the bottom of the rail. When used across abutted ETD1130 gear rack sections, it is used to align the gear pitch of both sections.

Figure 4-1

4.2 Level Rail System

Prior to mounting the gear rack assembly, the rail system should be flat and level from end to end and side to side. It is highly recommended that a laser level be used for this purpose. Recommended rail tolerance is +/- 1.5mm when high precision is required.

4.3 Clean Rail and Smooth Joints

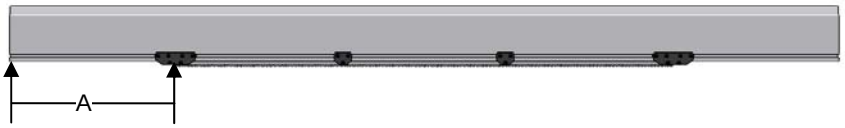
It is very important that the entire rail surface that the gear rack assembly is to be mounted to is clean, smooth, and free of any burs or debris. This is to ensure that the gear rack sections can be mounted flat and secure to the bottom of the rail.

5. INSTALLATION

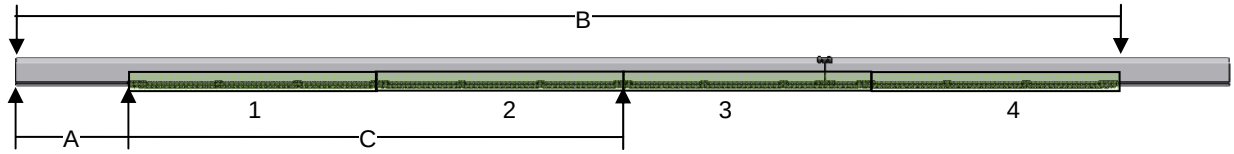
NOTE
For best results, it is recommended that a Knight Global Service Representative be present during installation. Call (248) 377-4950 for more information.

5.1 Measuring Starting Position of Gear Rack

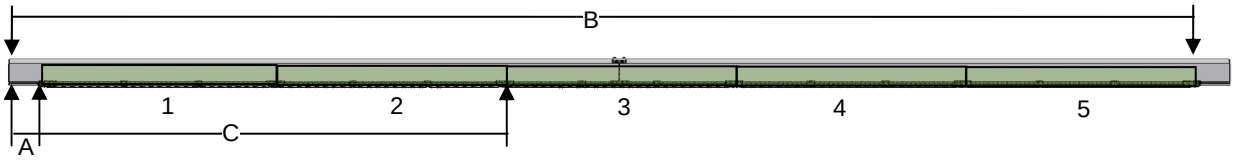
- For runs of 30’ or less, measure from the end of the rail to the first full section of gear rack. Mark this position as it will be the starting point of the installation. Refer to Figure 5-1.
- For runs greater than 30’ with an even number of sections, measure from the rail to the middle of the run. This should have been identified in the planning stage of the installation. This will be the starting point of the installation. Ensure that the gear rack mounting plate does not line up with rail splice hardware. Refer to Figure 5-2.
- For runs greater than 30’ with an odd number of sections, measure from the rail to one end of the gear rack section at the middle of the run. This should have been identified in the planning stage of the installation. This will be the starting point of the installation. Ensure that the gear rack mounting plate does not line up with rail splice hardware. Refer to Figure 5-3.



Gear Rack installed on less than 30’ run.
Figure 5-1



Gear Rack installed on more than 30’ run and even amount of gear racks.
Figure 5-2



Gear Rack installed on more than 30’ run and odd amount of gear racks.
Figure 5-3

5.2 Installation of the Knight Global Gear Rack Assembly

1. When installing the rail; ensure to install the appropriate number of ETD1231 retainer keys and MRAD7566 T-blocks in their approximate positions prior to installing the rail splice kits. (Approximate positions should be shown on installation drawings as described in section 3.5.)
2. If the rail splice kits are already installed, it may be necessary to remove the lower T-slot portion of the rail splice on the gear rack assembly side of the rail. Then install the ETD1231 retainer keys and MRAD7566 T-blocks in their approximate positions. (Approximate positions should be shown on installation drawings as described in section 3.5.) Refer to Figure 5-4.

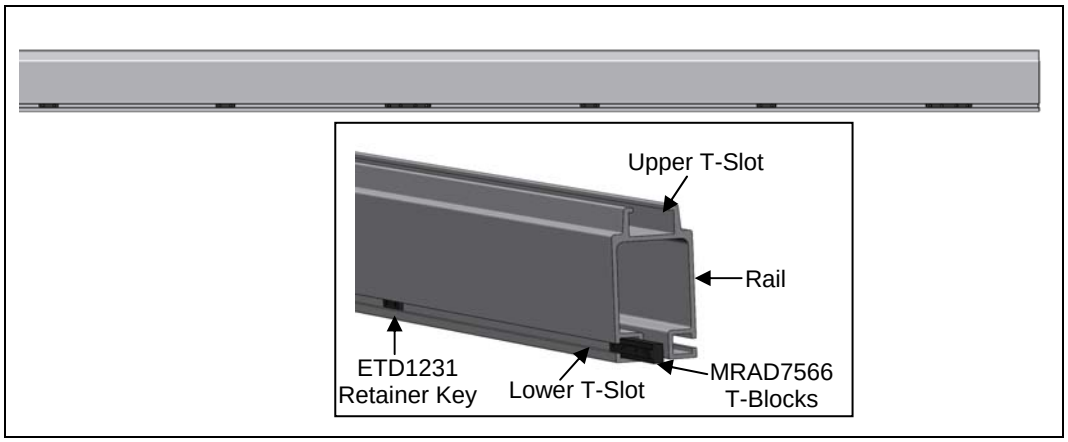


Figure 5-4

3. Once the ETD1231 retainer keys and MRAD7566 T-Blocks are installed in their approximate positions of the T-slot, secure the rail splices. (Visually inspect the mounting surface to make sure it is smooth and flat as each rail joint is transitioned.)
4. Loosely attach the ETD1310 mounting plates and ETD1347splice plates with the M8x1.25 x 25mm SHCS. Refer to Figure 5-5.
    - ETD1347 splice plates are attached to MRAD7566 T-blocks.
    - ETD1310 mounting plates are attached to ETD1231 retainer keys.

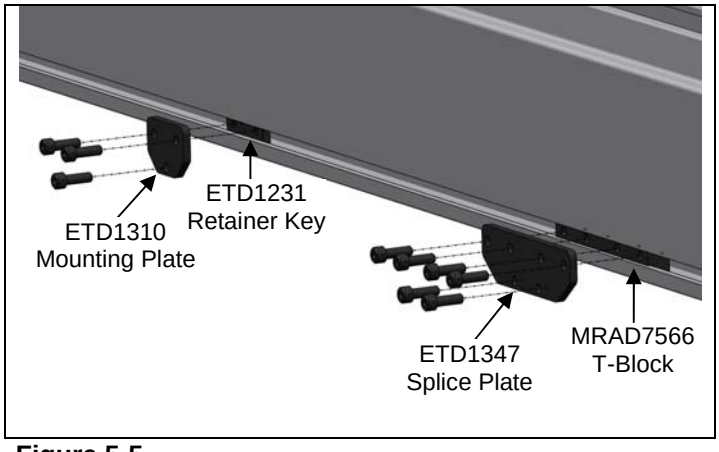


Figure 5-5

5. Loosely attach (1) ETD1130 gear rack section at the start point. Refer to Figure 5-6.
    - For latest versions of gear rack, install (1) Ø5/16 X 3/4" Lg. dowel in the end of the gear rack section, to assist with alignment.
    - If starting from the end, loosely attach (3) more ETD1130 gear rack sections and dowels if required. If starting from the middle, attach (3) in each direction.

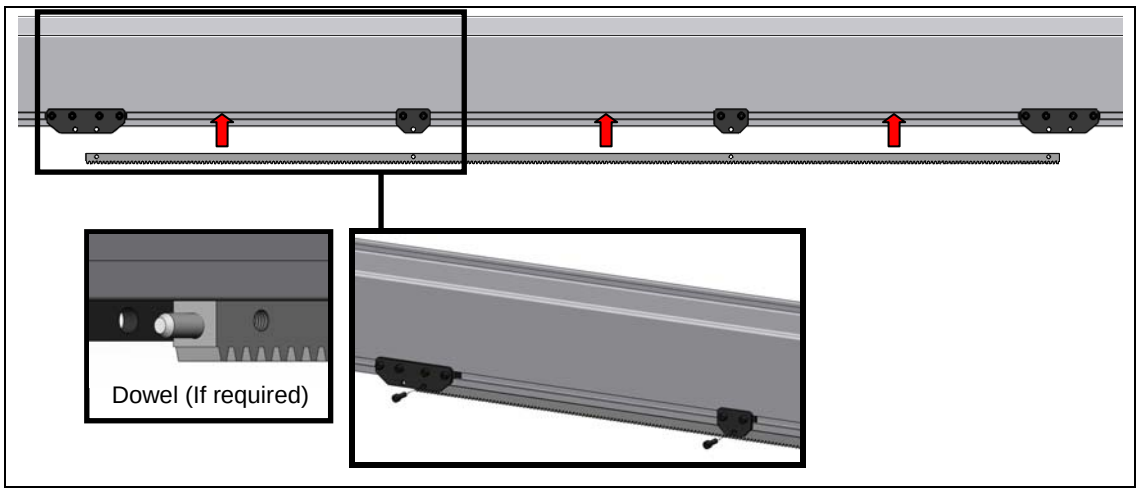


Figure 5-6

6. Using (2) gear rack installation tools, ETA1045, clamp the first EDT1130 gear rack section to the bottom of the rail. (One tool over each gear rack mounting plate). Ensure the gear rack is tight to the rail and then secure each ETD1310 mounting plates using blue lock tight 243. (Torque Spec. 31-38 ft./lbs.) Refer to Figure 5-7.

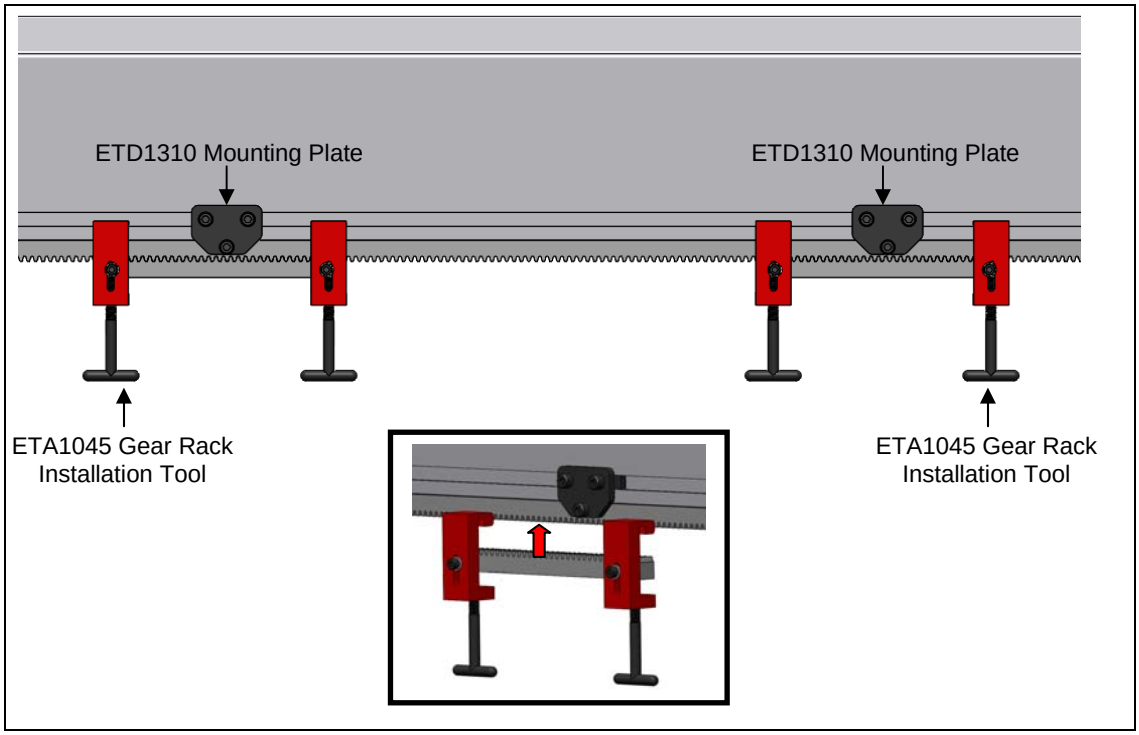


Figure 5-7

7. Remove the Knight Tool ETA1045 clamp that was furthest from the first gear rack splice, clamp across the splice between the first and second ETD1130 gear rack section. (Make sure the teeth in the tool and the teeth in the gear rack are fully engaged.)
8. Secure the ETD1347 splice plate with blue lock tight 243. (Torque Spec. 31-38 ft./lbs.)
9. Secure the next (2) ETD1310 mounting plates as the first section of gear rack, leap frogging the ETA1045 tools down the assembly, one mount or splice at a time. Refer to Figure 5-8.

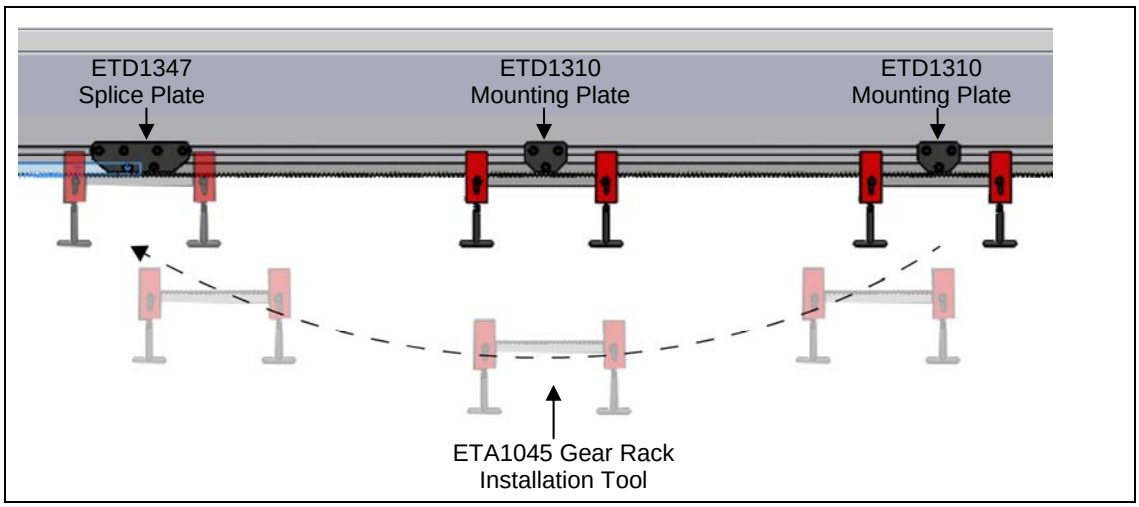


Figure 5-8

10. Repeat this process until there is only (1) loose section of gear rack.
11. Add (2) more sections of loose ETD1130 gear rack and then go back to tightening.
12. Repeat until all ETD1130 gear rack sections are secure, up to the last connection point.
13. Using only the M8x1.25 x 25mm long Socket Head Cap Screws, secure the right and left hand ETA1062 and ETA1063 end mount assemblies with blue lock tight 243. (Torque Spec. 31-38 ft./lbs.) Refer to Figure 5-9.

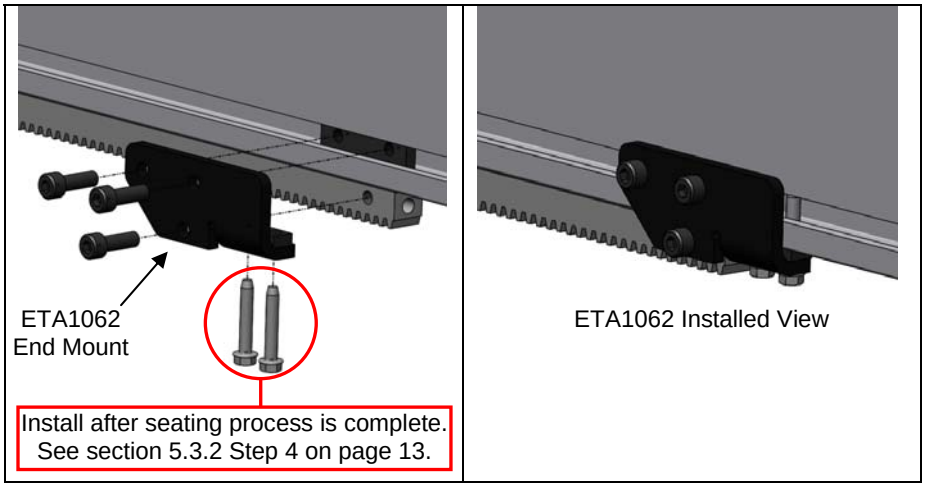


Figure 5-9

14. Finish the installation and startup of the Knight Servo Tractor system.

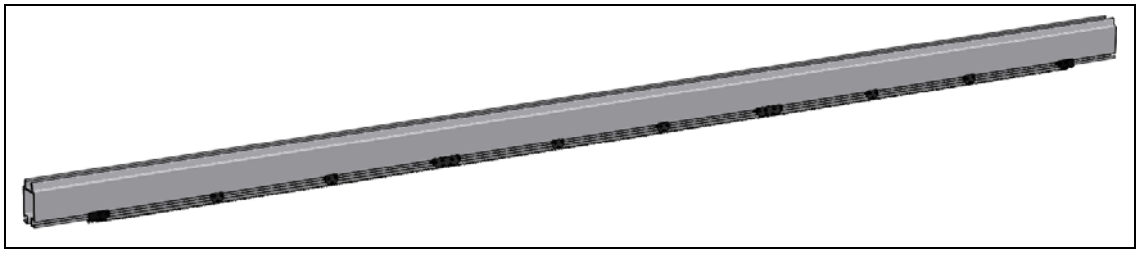


Figure 5-10

5.3 Gear Rack Seating Process

	WARNING
	Knight recommends reseating gear rack at 2,000 cycles and 6,000 cycles in order to properly seat gear rack to aluminum rail system. Avoiding reseating gear rack at these intervals could cause the gear rack to loosen from the aluminum rail and cause damage to the Servo Tractor.

5.3.1 Reseating at 2,000 Cycles

1. Once the initial installation is complete, run the system for 2000 cycles.
2. Inspect the gear rack assembly for any movement or loosening of the system.
3. Starting in the same order as the initial installation, loosen, clamp, and re-torque the gear rack assembly using blue lock tight 243 to the same torque spec. (This will begin the seating process of all of the steel components to the aluminum rail).

5.3.2 Reseating at 4,000 More Cycles

1. Run the system for 4000 more cycles (Total of 6000 cycles).
2. Inspect the gear rack assembly for any movement or loosening of the system.
3. Starting in the same order as the initial installation, loosen, clamp, and re-torque the gear rack assembly using blue Lock Tight 243 to the same torque spec. (This should complete the seating process of all of the steel components to the aluminum rail).
4. At this time add the final four self-tapping 1/4-20 hex head cap screws fasteners to the Knight gear rack (right and left) end mount assemblies ETA1062 and ETA1063. (Pre-drilling for the self-tapping screws is recommended). (Refer to view 5-9 on page 11)

6. MAINTENANCE AND INSPECTIONS

6.1 Installation Maintenance and Inspection Intervals

- After installation and during the seating process inspect the gear rack assembly once a week.
- After conclusion of the seating process inspect the gear rack assembly once a month.

ITEM	MAINTENANCE
Fasteners	Check for missing or loose fasteners in the gear rack assembly. Replace any missing fasteners. Re-tighten any loose fasteners.
Entire System	Check for damage that may hamper free movement.
Mounting Plates or Splice Plates	Check for movement of the gear rack assembly mounting plates or splice plates.
Gear Rack Assembly and Rail	Inspect for visible open gaps between the gear rack assembly and rail.
Gear Rack Sections	Movement of the gear rack sections themselves. Loosen rack sections, align, and re-torque the gear rack assembly using blue Lock Tight 243 to torque. (Torque Spec. 31-38 ft. /lbs.)
Aluminum Rail	Inspect for visible open gaps between aluminum rail splices.

WARNING

If a safety issue is discovered, discontinue operation of the system and call Knight Service at (248) 377-4950 Extension 162 or email service@knightglobal.com

NOTE

For any maintenance issues outside of normal wear, please contact Knight Service at (248) 377-4950 Extension 162 or email service@knightglobal.com.

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