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Owner's Manual Hayabusa 6K & 10K Remote Hooks


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Applicable Equipment Part Numbers

528-045-00
528-046-00

[Please check our web site www.onboardsystems.com](http://www.onboardsystems.com)
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RECORD OF REVISIONS

Revision	Date	Page(s)	Reason for Revision
0	07/12/13	All	Initial release.
1	07/19/13	All	Revised format, added storage instructions.
2	08/28/13	26	Added JIS-Z-2320, JIS-Z-2343, ISO 9934-1, and EN571-1 as acceptable non-destructive inspection standards.
3	12/19/13	24, 25, 29, 30, 35, 37-39, 41, 43 & 52	Updated illustrated parts list to show new keeper springs. Added corrosion preventive compound to toggle side plate holes. Updated disassembly and assembly instructions to reflect new part numbers. Added ATP toggle bearing run in procedure.
4	02/04/14	5, 9, 16, 41, & 51	Changed keeper lock load specification to an average of 75-200 lbs. Changed 291-715-00 to 291-715-01 & 517-023-00 to 517-128-00. Added reference to ATP 180-230-00.
5	05/16/14	35, 40-53	Changed 517-128-00 to 517-023-00. Changed 291-715-01 to 291-715-00. Removed the requirement to rotate the load beam roller between keeper lock tests. Rearranged ATP steps to perform rated load releases before keeper lock test. Decreased the number of rated load releases. Added load beam roller bushing preparation instructions to re-assembly instructions.
6	03/20/15	12	Corrected overall hook lug thickness in Figure 4.2.
7	05/13/16	All	Added Service Bulletins section (3.0) and listed Service Bulletin 159-038-00. Updated Pushrod Interlock to P/N 291-722-01. Corrected inspection criteria for ID wear on bushings (4.5, 5.10). Added Figure 12.1. Added P/N 291-751-00 to Overhaul Kit. Added Mobil grease 28 as an alternative lubricant for bushings (7.9).
8	09/30/17	5, 9, 16, & 42	Changed range of Keeper lock force to 75 – 500 Lbs.

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1.0 Introduction

1.1 Scope

This owner's manual contains instructions for installation, operation, and maintenance of Hayabusa 6K and 10 Remote Hooks (P/N's 528-045-00 and 528-046-00).

1.2 Capability

The instructions contained in this document are provided for the benefit of experienced aircraft maintenance personnel and facilities that are capable of carrying out the procedures.

1.3 Safety labels

The following definitions apply to safety labels used in this manual.



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.




Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Draws the reader's attention to important or unusual information not directly related to safety.



Used to address practices not related to personal injury.

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2.0 Referenced Documents

180-229-00 Acceptance Test Procedure

159-038-00 Service Bulletin

3.0 Service Bulletins

The cargo hooks are subject to the following service bulletin(s). Service bulletin documents may be obtained from the Onboard Systems web site. Verify compliance with all service bulletins prior to maintenance. If in possession of a cargo hook with an unincorporated service bulletin, please contact the factory for additional guidance.

Service Bulletin No.	Description	P/N Applicability	S/N Applicability
159-038-00	Keeper Lock. The Pushrod Interlock which serves as part of the Keeper lock mechanism was re-designed, its P/N changed from P/N 291-722-00 to P/N 291-722-01. A cargo hook that is compliant with this service bulletin is identified with "AMDT A" on its Serial Number Plate.	528-045-00	00025 through 00056
		528-046-00	00025 through 00119

4.0 System Overview

4.1 Description

The remote hook provides the means to attach and secure an external load at the end of the helicopter long line. These remote hooks are intended as secondary hooks which are to be suspended via the long line from the primary cargo hook on the belly of the helicopter.

An external load is attached to the remote hook by inserting a load ring past the spring-loaded keeper and onto the load beam (refer to Figure 4.1 and Figure 4.2 for remote hook overview). To provide additional load security the keeper is automatically locked when an average load of 75 – 500 lbs (34-227 kg), or heavier, is suspended from the remote hook.

To release the load, the remote hook features an electrical release system using a rotary solenoid which is powered from the aircraft electrical system. The solenoid actuates the remote hook's internal mechanism (see Figure 4.3) to release the load. When the load is released electrically, and the switch is held for a long enough time, a secondary solenoid actuates to unlock the keeper to allow the next load to be attached. The keeper can also be unlocked by ground personnel by manually rotating a lever on the side of the remote hook. The external load can also be released from the hook by ground personnel by rotating the manual release knob.

To provide the pilot with information on the state of the remote hook load beam and keeper position, limit switches are mounted within the remote hook's electrical compartment. The switches may provide an indication of "hook locked" and "keeper locked". Additionally a ground crewman can verify that the load beam and the keeper are locked through mechanical indications on the side of the remote hook.

Figure 4.1 Remote Hook Overview, Manual Release Side (P/N 528-045-00 shown)

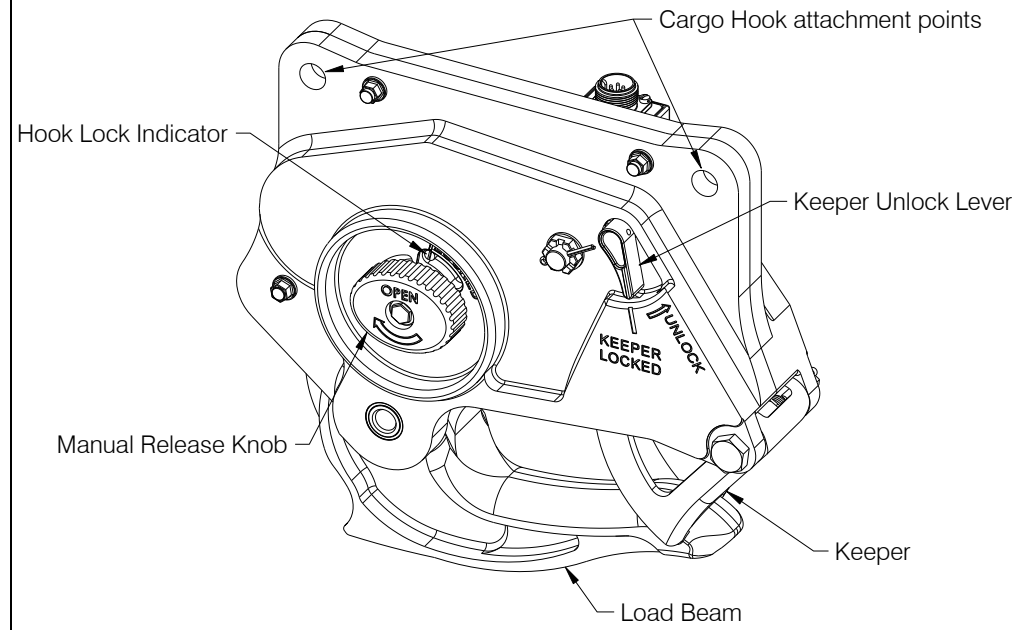
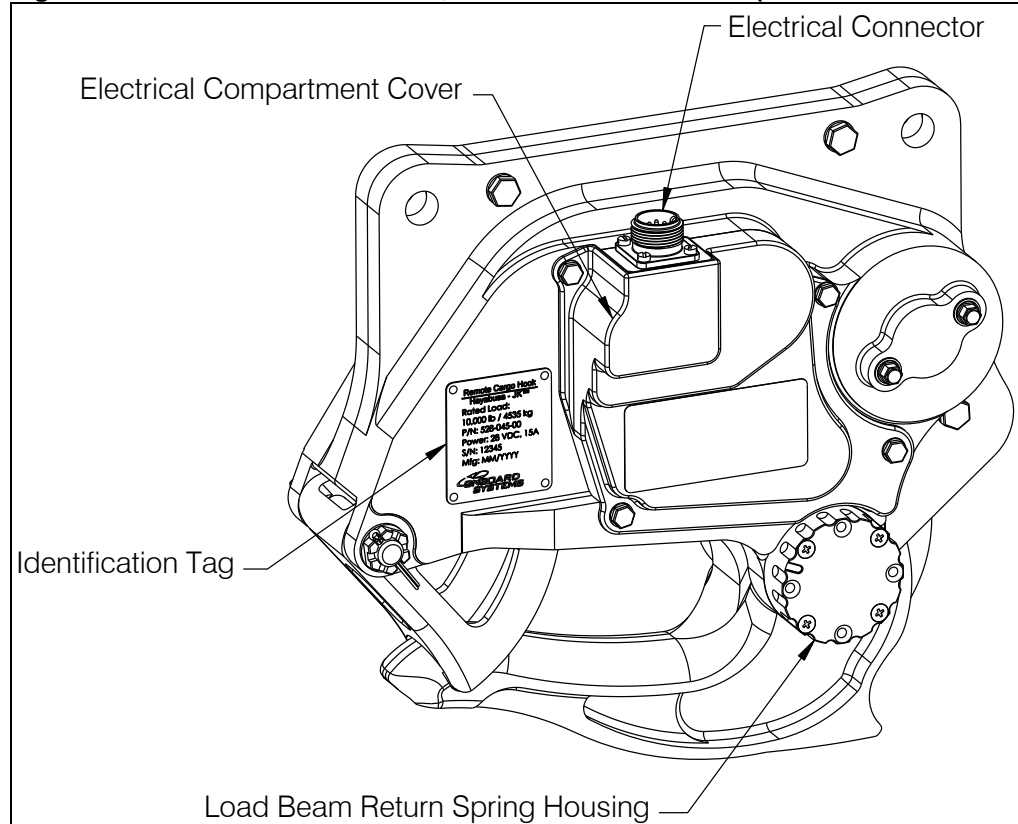
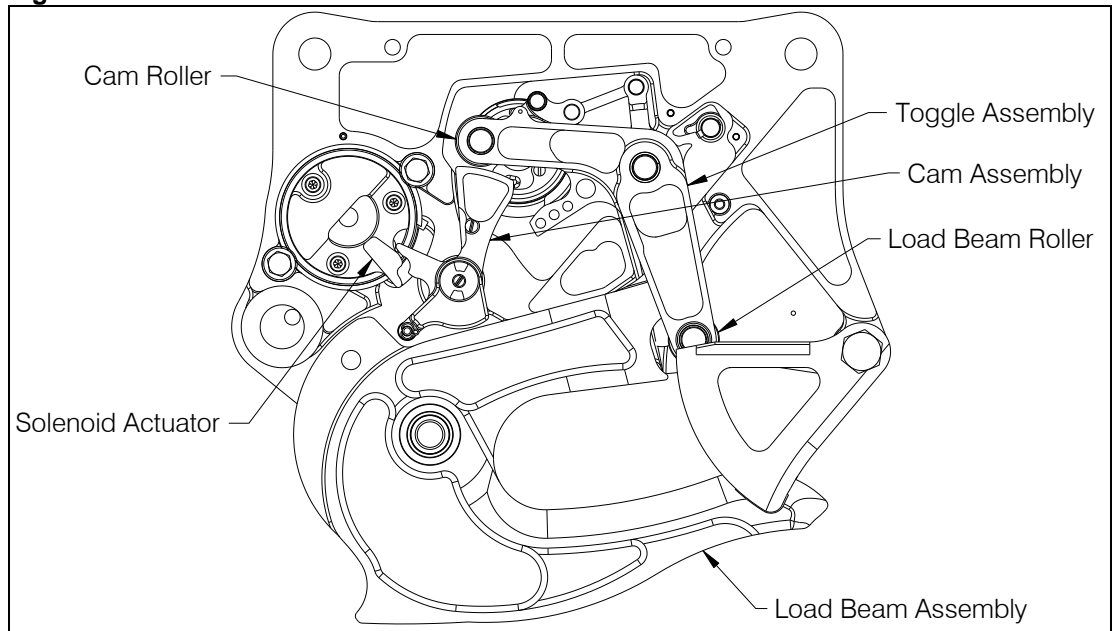


Figure 4.2 Remote Hook Overview, Electrical Release Side (P/N 528-045-00 shown)



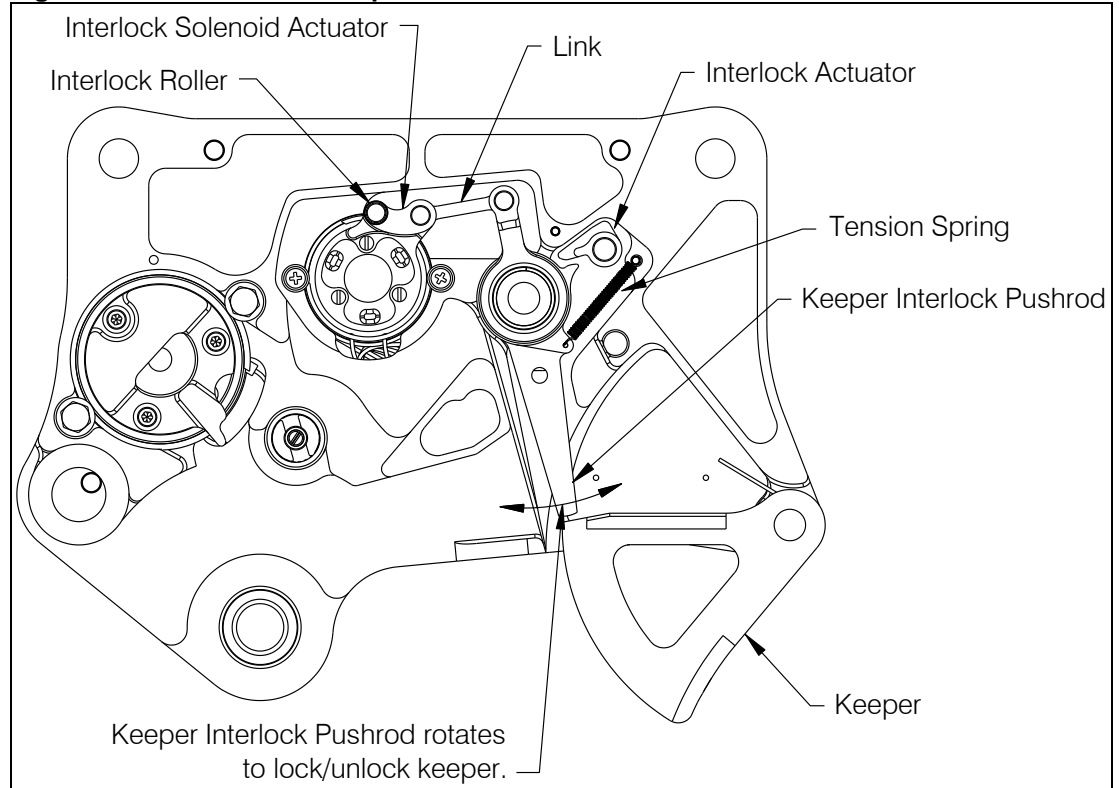
To release the load, the internal mechanism's cam is rotated in the clockwise direction by the action of the electrical solenoid through the solenoid actuator or by rotating the manual release knob (see Figure 4.3). As the cam rotates, the cam roller rides on its surface until it reaches the load release point. At the load release point, the cam roller drops over the edge of the cam surface and the toggle assembly is free to rotate. As the cam continues its rotation it contacts the "kicker arm" on the toggle and drives the toggle to the release position. This allows the load beam to be released from its locked position at the Load Beam Roller interface. The load then is able to pull the load beam open and fall free.


Figure 4.3 Remote Hook Internal Mechanism



To unlock the keeper after the release of a load, the keeper interlock solenoid rotates the keeper interlock pushrod out of the way of the keeper through the link and interlock solenoid actuator (see Figure 4.4). The keeper interlock pushrod is retained in this position by the toggle (not shown) acting on the interlock roller. When a load is applied to the hook the toggle shifts downward freeing the interlock roller to move and allowing the tension spring to shift the pushrod to lock the keeper. When the keeper unlock lever (not shown) on the outside of the cargo hook is manually actuated, it rotates the interlock actuator to rotate the keeper interlock pushrod.

Figure 4.4 Remote Hook Keeper Interlock Mechanism



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4.2 Specifications

Table 4.1 Remote Hook Specifications

Specification	10K Remote Hook P/N 528-045-00	6K Remote Hook P/N 528-046-00
Rated Load	10,000 lbs (4,535 kg)	6,000 lbs (2,721 kg)
Limit Load	25,000 lbs. (11,335 kg)	15,000 lbs. (6,804 kg)
Ultimate Load	50,000 lbs. (22,680 kg)	30,000 lbs. (13,608 kg)
Primary Release Capacity	10,000 lbs. (4,535 kg)	6,000 lbs. (2,721 kg)
Equipment Weight	24.5 lbs. (11.1 kg)	22.3 lbs. (10.1 kg)
Equipment Dimensions	Defined by Interface Drawing 145-115-00.	Defined by Interface Drawing 145-116-00.
Primary Release Means	Electrical	Electrical
Groundcrew Release Means	Knob	Knob
Knob Torque	25 in-lbs (2.8 Nm) max.	25 in-lbs (2.8 Nm) max.
Minimum Releasable Load (w/ steel load ring)	15 lbs. (6.8 kg)	15 lbs. (6.8 kg)
Average Keeper Locking Load	75 – 500 lbs (34 – 227 kg)	75 – 500 lbs (34 – 227 kg)
Throat	Throat opening: ≥ 1.9 in (48.2 mm) Throat size: 1.9 x 3.8 in	Throat opening: ≥ 1.9 in (48.2 mm) Throat size: 1.9 x 3.8 in
Power Requirements	22-30 VDC, ≤15 A	22-30 VDC, ≤15 A
Operating Temperature Range*	-40 °F – 160 °F (-40 °C - 71 °C)	-40 °F – 160 °F (-40 °C - 71 °C)
Storage Temperature Range	-67 °F – 185 °F (-55 °C - 85 °C)	-67 °F – 185 °F (-55 °C - 85 °C)
Time Between Overhaul (TBO)	5 years / 1000 hours**	5 years / 1000 hours**



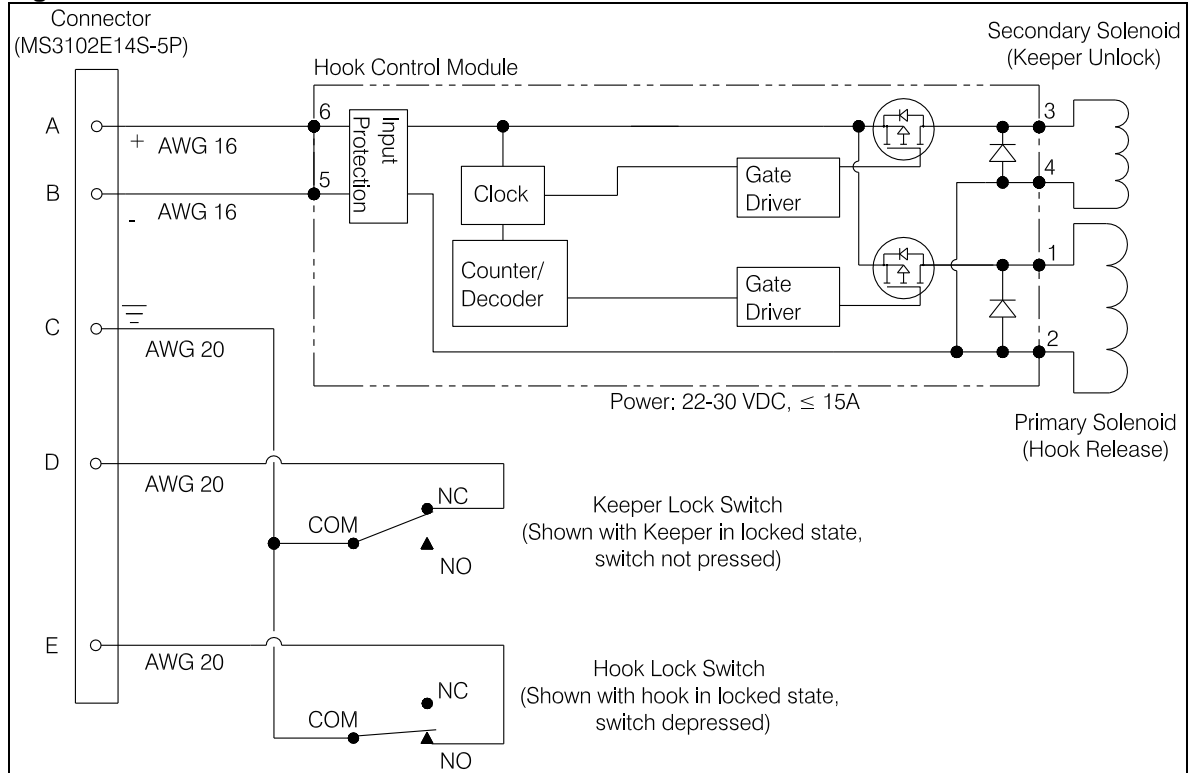
**Remote hooks are not to be used in icing conditions.*



*** Hours of external load operations should be interpreted to be (1) anything is attached to the remote hook (whether or not a useful load is being transported) and (2) the aircraft is flying. If these conditions are NOT met, time does not need to be tracked.*

4.3 Electrical Schematic

Figure 4.5 Electrical Schematic



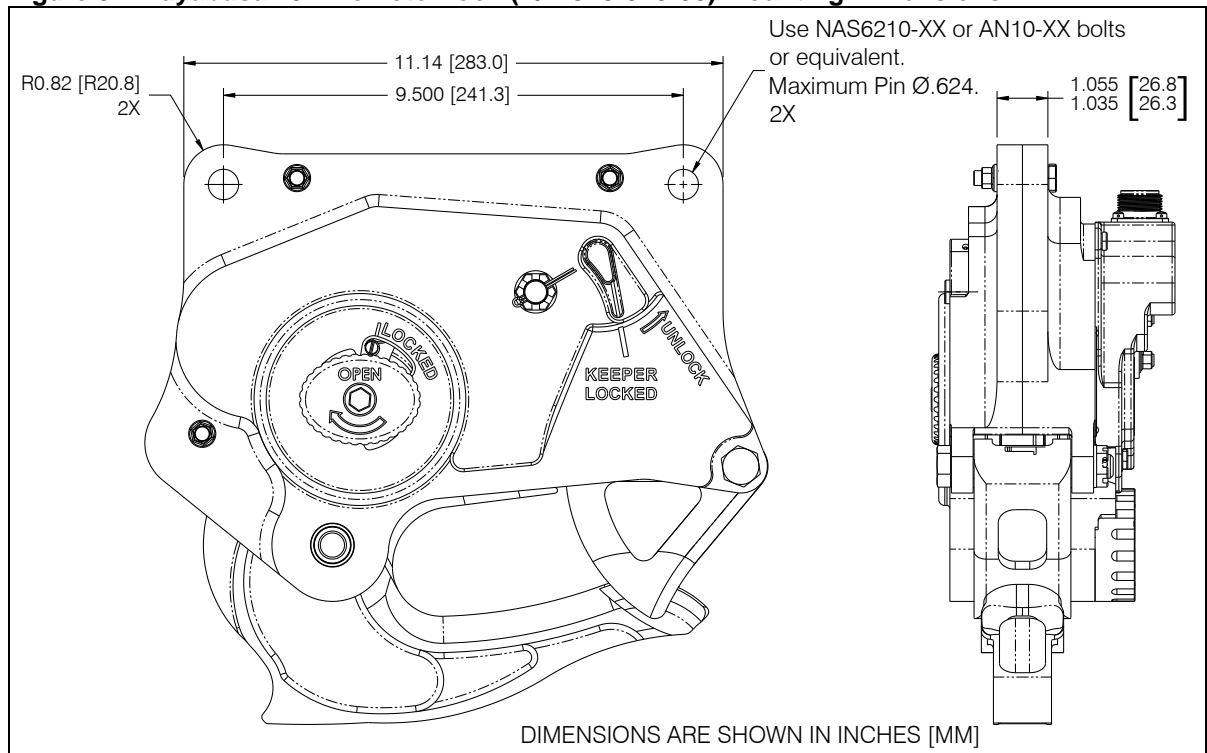
5.0 Installation

The remote hook is intended for attachment at the end of a long line and it is recommended that it be mounted within a protective cage such as a welded steel tubular frame.

5.1 10K Remote Hook Installation

The 10K remote hook (P/N 528-045-00) should be mounted with two .624" +.000/-.005" diameter bolts, AN10 or NAS6210 series or equivalent. The interface dimensions of the remote hook are shown in Figure 5.1 below.

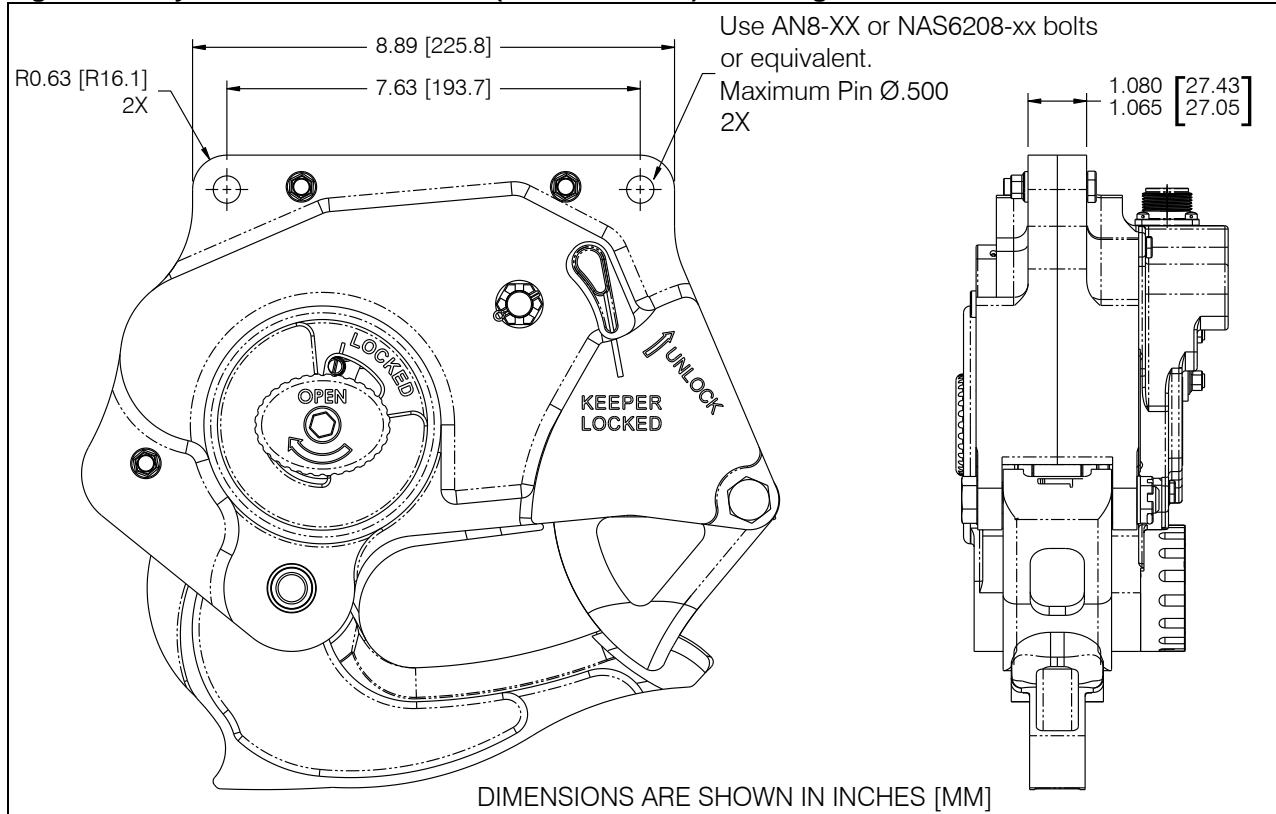
Figure 5.1 Hayabusa 10K Remote Hook (P/N 528-045-00) Mounting Dimensions



5.2 6K Remote Hook Installation

The 6K remote hook (P/N 528-046-00) should be mounted with two .500" +.000/-.005" diameter bolts, AN8 or NAS6208 series or equivalent. The interface dimensions of the remote hook are shown in Figure 5.2 below.

Figure 5.2 Hayabusa 6K Remote Hook (P/N 528-046-00) Mounting Dimensions




It is recommended that an electric swivel be included between the remote hook and the cargo hook on the belly of the helicopter to accommodate spinning sling loads.



Spinning sling loads may wind up the long line and then suddenly reverse: spinning the remote hook and causing an un-commanded load release.


Connect the mating electrical connector from the long line to the remote hook connector. The remote hook is equipped with an MS3102E14S-5P electrical connector, refer to Figure 4.5 for electrical schematic.

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5.3 Post Installation Check-Out

After installation of the remote hook, perform the following functional checks.

1. Ensure that the electrical harness has enough slack to accommodate movement of the remote hook and is protected from chafing and snagging.
2. Apply approximately 15 pounds (6.8 kg) to the remote hook load beam and energize the remote hook electrical release circuit. The load beam should release. Ensure the load beam re-latches after release and ensure the Hook Locked indication light in the cockpit illuminates.
3. Re-open the load beam and hold it in the open position and ensure the Hook Locked indication light in the cockpit goes out.
4. Manually lock the keeper by pushing down on the load beam tip. Ensure the Keeper Lock indication light in the cockpit is illuminated and that the keeper is locked.
5. Manually unlock the keeper with the lever on the side of the remote hook. Ensure Keeper Lock indication light goes out.

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6.0 Operation Instructions


6.1 Pre-Flight Functional Checks

Prior to external load operations perform the following functional checks of the remote hook. If these procedures are not successful, do not use the remote hook until the problem is resolved.

1. Check the remote hook electrical release function by energizing its electrical release circuit. The main solenoid and keeper unlock solenoid should fire repeatedly until the electrical release switch is released. With a 15 lb or greater load applied, the remote hook's load beam must release and re-latch after release and the keeper should be unlocked.

NOTICE

The release switch must be held until the remote hook re-latches in order for the keeper to be unlocked and ready to load.

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- Verify that the hook lock indicator on the side of the remote hook returns to the fully locked position (see Figure 6.1) and that the “hook locked” light in the cockpit extinguishes and illuminates properly.

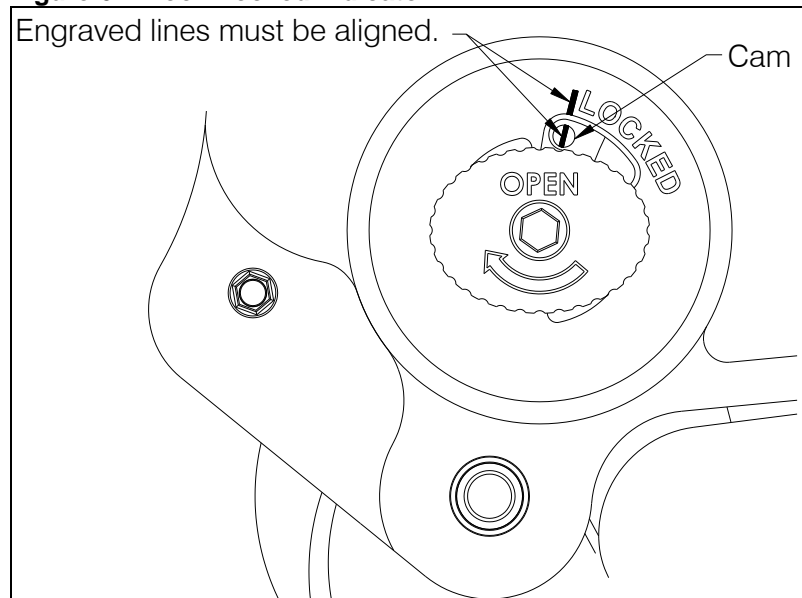
CAUTION


The solenoid in the hook is not rated for continuous duty. Continuous power applied to the solenoid for longer than 30 seconds may damage it.

! CAUTION

Ensure the remote hook is in the locked position by ensuring the engraved line on the cam is aligned with the line on the side plate (see Figure 6.1). If these lines are not aligned, the hook is not locked and an inadvertent load release can occur.

Figure 6.1 Hook Locked Indicator



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3. Check the release function using the manual release knob on the side of the remote hook. Rotate the knob clockwise while pulling on the load beam. The mechanism should operate smoothly and the load beam should open and then re-latch after releasing it.



Accumulated dust, dirt and grime will cause unreliable re-latch of the remote hook. Remove immediately from service for disassembly and cleaning if re-latch performance is sluggish.



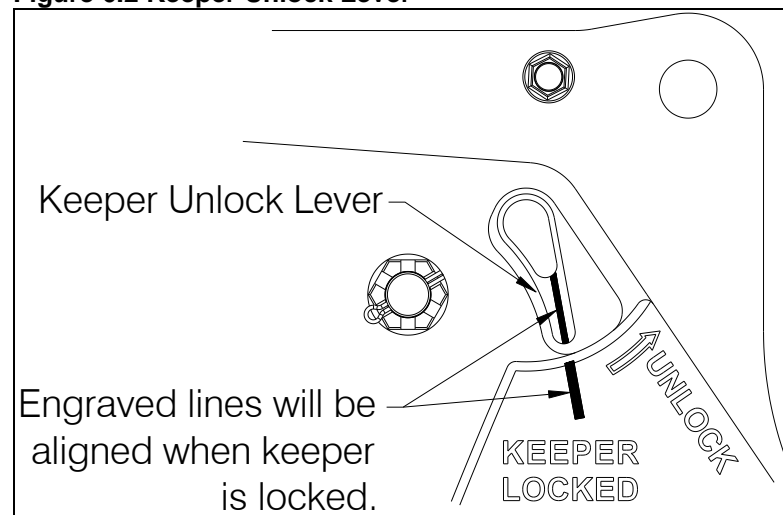
The remote hook is not to be used in icing conditions.


4. Check the operation of the keeper. Rotate the keeper up into the hook and release it. The keeper should snap back into position and should operate smoothly.



The spring loaded keeper is free to open until an average load of 75 - 500 lbs (34 - 227 kg), or greater, is applied to the load beam. When the load is applied the keeper will lock. The keeper can be unlocked either by opening the load beam or via the keeper unlock lever (see Figure 6.2).

Figure 6.2 Keeper Unlock Lever



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6.2 Rigging

Extreme care must be exercised in rigging a load to the remote hook. Steel primary load rings are recommended to provide consistent release performance and resistance to fouling. When using steel load rings, verify that the load ring and the rigging attached to it will freely slide off the load beam when it is opened. If using wire or fiber ropes on the load beam, refer to the limitations in this section.

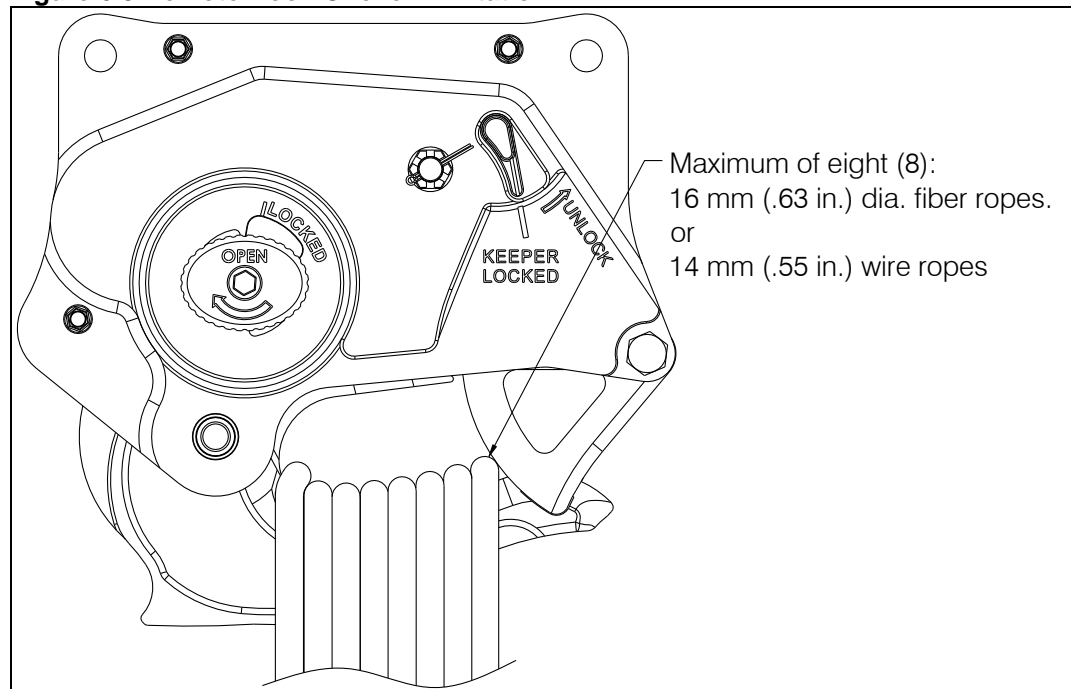


It is the responsibility of the operator to ensure the remote hook will function and release properly with each individual rigging configuration.



Up to eight 14 mm wire ropes or eight 16 mm fiber ropes may be loaded into the remote hook at one time (see Figure 6.3).

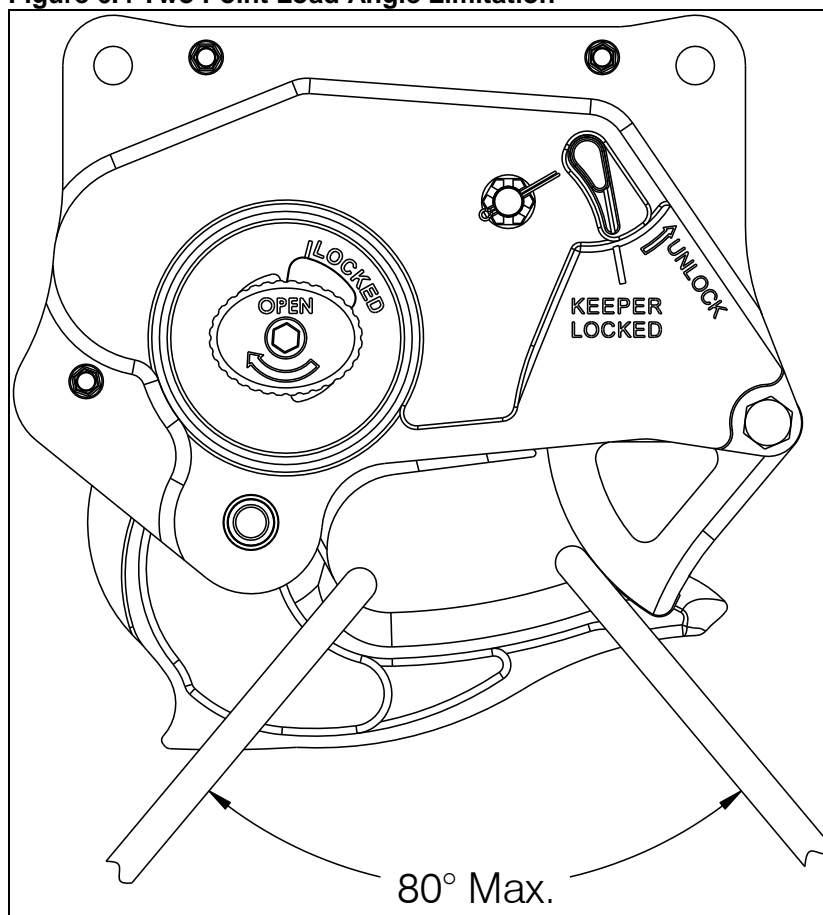
Figure 6.3 Remote Hook Choker Limitation



WARNING

For a two (2) point load attachment, limit the maximum angle formed by the load attachments to 80 degrees as shown in Figure 6.4. Loads with greater spread may not be releasable, or may cause damage to the hook.

Figure 6.4 Two Point Load Angle Limitation

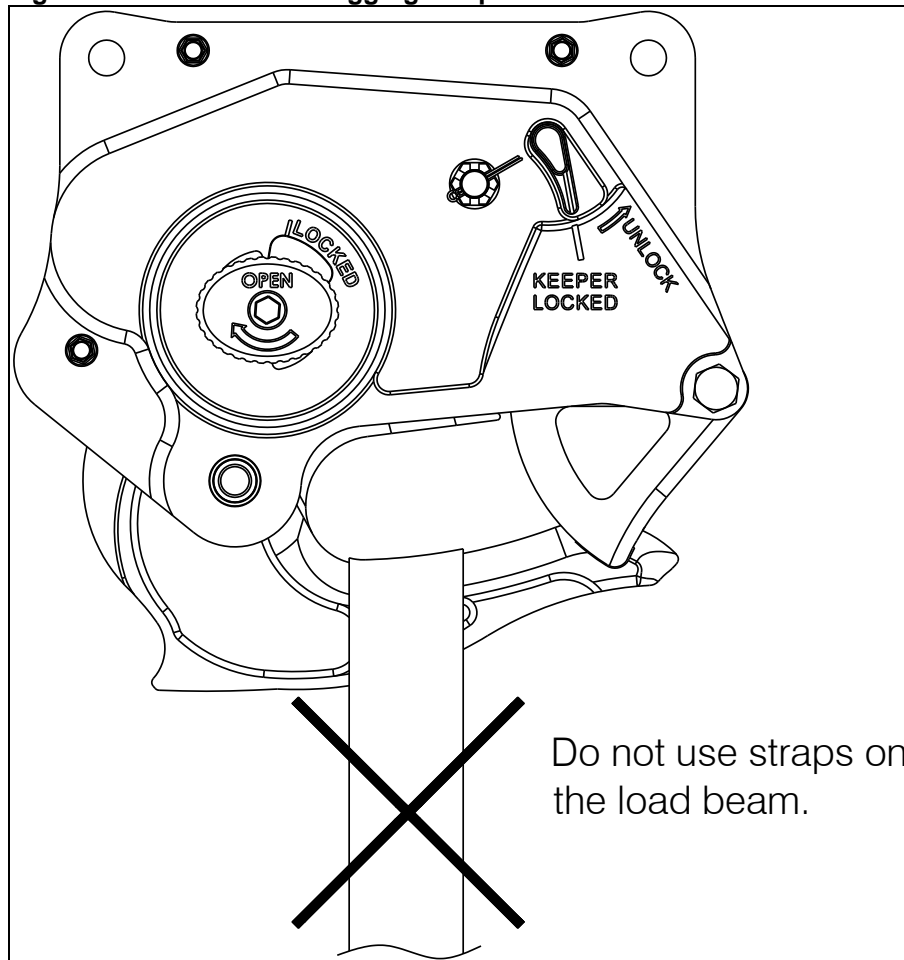





WARNING

Webbing or straps are not allowed directly on the remote hook load beam (see Figure 6.5).

Figure 6.5 Remote Hook Rigging Strap Limitation



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7.0 Maintenance



Failure to follow all equipment maintenance instructions and component inspection criteria may result in serious injury, death or immediate loss of flight safety.

7.1 Storage

1. The remote hook may be stored in its original factory sealed bag and box for up to 2 years from its date of manufacture or last factory overhaul. If stored in its original factory sealed bag and box for less than 2 years, it may be used without any additional activity. If the period of storage in its original packaging is greater than 2 years the remote hook must be subjected to the acceptance test procedures (ATP) described herein before being used.
2. If the remote hook is to be removed from service, store it in indoors. If it is to be stored longer than 6 months perform the following. Prepare the remote hook for storage by thoroughly cleaning and drying the exterior, liberally applying ACF-50 corrosion preventative compound inside and out, sealing it in a plastic bag with a desiccant, and labeling it with the date of storage. If stored in this condition for less than 2 years, it may be used without any additional activity. If the period of storage exceeds 2 years the remote hook must be subjected to the acceptance test procedures (ATP) described herein before being used.
3. Time Between Overhaul criteria still apply regardless of storage conditions and time.

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7.2 Daily

1. Check all fasteners to ensure that they are in place and secure.
2. Check the electrical connection for damage and security.
3. Check the case and covers for cracks and damage.
4. Check the load beam for gouges and cracks.
5. Cycle the electrical and manual release mechanisms to ensure proper operation.
6. Verify keeper lock function.
7. Verify hook locked indicator aligns consistently when remote hook is cycled.

7.3 Monthly

1. Remove accumulated soils from the exterior with a soft bristle brush and mild solvent/cleaner
2. In corrosive environments, apply a corrosion preventative compound such as ACF-50 to all exterior surfaces.

7.4 Annually


1. Annually or 100 hours of external load operations, whichever comes first, thoroughly clean the exterior with a soft bristle brush and mild solvent/cleaner and visually inspect for cracks, gouges, dents, nicks, corrosion, and missing or loose fasteners.

7.5 Overhaul

1. Overhaul the remote hook in accordance with the overhaul schedule and instructions contained here-in.


7.6 Repair

1. Repair the remote hook in accordance with the repair instructions contained here-in.

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8.0 Repair Instructions

- 8.1** It is recommended that only minor repairs be attempted by anyone other than the factory. The following procedures and information are provided for the benefit of experienced aircraft maintenance facilities and trained maintenance and inspection personnel capable of carrying out the procedures. They must not be attempted by those lacking the necessary expertise and suitable equipment to acceptance test the cargo hook after maintenance. See Section 17.0 instructions for returning equipment to the factory.
- 8.2** Reference numbers throughout this manual shown in parentheses () refer to Table 16.1 and Figure 16.1 through Figure 16.7.
- 8.3** Follow these steps to repair the Cargo Hook, referring to the applicable sections in this manual.
1. Disassemble as required.
 2. Inspect disassembled parts.
 3. Obtain required replacement parts.
 4. Re-assemble.
 5. Acceptance test.
 6. Inspect for return to service.


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9.0 Overhaul Schedule

- 9.1** The Cargo Hook shall be overhauled every 1000 hours of external load operations or 5 years, whichever comes first.
- 9.2** Hours of external load operations should be interpreted to be (1) anything is attached to the primary cargo hook (whether or not a useful load is being transported) and (2) the aircraft is flying. If these conditions are not met, time does not need to be tracked.

10.0 Overhaul Instructions

- 10.1** It is recommended that only minor repairs be attempted by anyone other than the factory. The following procedures and information are provided for the benefit of experienced aircraft maintenance facilities and trained maintenance and inspection personnel capable of carrying out the procedures. They must not be attempted by those lacking the necessary expertise and suitable equipment to acceptance test the cargo hook after overhaul. See Section 17.0, instructions for returning equipment to the factory.
- 10.2** Overhaul kit P/N 212-036-00 is recommended to complete the Cargo Hook overhaul. The overhaul kit contains all recommended items to be replaced at time of overhaul. Table 16.1 lists detail parts contained in the overhaul kit.
- 10.3** Follow these steps to overhaul the Cargo Hook, referring to the applicable sections in this manual:
1. Obtain Overhaul kit P/N 212-036-00.
 2. Completely disassemble.
 3. Discard all items that are to be replaced by an item in Overhaul Kit P/N 212-036-00 listed in Table 16.1 (springs, bearings, roll pins, cotter pins, fasteners, nuts and washers).
 4. Inspect disassembled parts.
 5. Obtain required replacement parts.
 6. Reassemble.
 7. Acceptance test.
 8. Inspect for return to service.

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11.0 Disassembly Instructions

Reference numbers throughout this manual shown in parentheses () refer to Table 16.1 and Figure 16.1 through Figure 16.7.



Failure to follow all equipment maintenance instructions and component inspection criteria may result in serious injury, death or immediate loss of flight safety.

- 11.1 Remove cotter pin (29), castellated nut (30), and washer (17) from the keeper pivot bolt (32). Leave the bolt in place.
- 11.2 Remove cotter pin (29), castellated nut (30), and washer (17) from the manual release side of the hook. Remove three self-locking nuts (16) and washers (20) from the manual release side of the hook. Remove bolts.
- 11.3 Remove the electrical compartment cover (10) by removing four bolts (21) and washers (41).
- 11.4 Remove cotter pin (24), nut (28), washer (19), Hook Locked Cam (13) with spring (34) from the manual release knob pivot bolt (33). Remove the bolt, washer (18), and Knob Spacer (15), Release Knob Assembly (9), and Knob Spring (39).




Use caution when removing the Release Knob Assembly as the Knob Spring is pre-loaded.

- 11.5 Note the position of the indicator mark on the Clock Spring Retainer (12) and remove the four screws (22) that secure it to the Slide Plate Assembly (5) and remove it along with its Torsion Spring (40).



Use caution when removing the Clock Spring Retainer and Torsion Spring as the Torsion Spring is pre-loaded.

- 11.6 The side plate assemblies (4, 5) can now be separated. Separate the assemblies with the manual release side down, which will allow the internal components to maintain their position.


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- 11.7 Remove the load beam bumper (35).
- 11.8 Slide the cam spring (36) off the roll pin in the side plate assembly and remove the cam assembly (8).
- 11.9 Slide the toggle spring (7.11) off the roll pin in the side plate assembly and remove the toggle assembly (7)
- 11.10 Remove the load beam assembly (6).
- 11.11 Slide the Keeper (11) off of its pivot bolt and remove the torsion springs (37 & 38).



Use caution when removing the Keeper as the Torsion Springs are pre-loaded.

- 11.12 The Solenoid Actuator (5.5) may be removed from the Hook Release Solenoid (5.12) by cutting safety wire, removing screws (5.14), and washers (5.13). If necessary, apply localized heat (~250°C) to screws to remove.
- 11.13 The hook release solenoid (5.12) may be removed from the side plate (5.4) by removing screws (5.19) and washers (5.23) and prying out the Wedge Ring (5.2) and removing two nuts (5.17) and two washers (5.30) from the opposite side and de-soldering the wires from the hook control module (5.1). If necessary apply localized heat (~250°C) to screws to remove.
- 11.14 Detach the interlock solenoid actuator (5.6) from the keeper unlock solenoid (5.11) by cutting safety wire and removing three screws (5.21). If necessary, apply localized heat (~250°C) to screws to remove. Disengage spring (5.36) from roll pin (5.29). This will remove the assembly of the actuator, pushrod interlock (5.7) and link (5.8) from the side plate assembly.
- 11.15 The keeper unlock solenoid may be removed from the side plate (5.4) by removing screws (5.26) and washers (5.35) and prying out the Wedge Ring (5.9) and removing two nuts (5.25) and two washers (5.15) from opposite side and de-soldering the wires from the hook control module (5.1). If necessary, apply localized heat (~250°C) to screws to remove.
- 11.16 Remove the Electrical Subassembly (5.41) by cutting safety wire and removing two screws (5.32) securing each switch plate (5.41.1) to the side plate, removing the two screws (5.20) securing the connector bracket (5.41.2) to the side plate, and removing the two screws (5.31) securing the hook control module to the side plate. Do not typically disassemble this Electrical Subassembly further unless components need to be replaced.
- 11.17 Bushings, bearings, and pins may be removed from detail parts and assemblies by conventional means.
- 11.18 Do not typically disassemble the Load Beam Assembly (6).

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12.0 Inspection Instructions

12.1 Thoroughly clean all parts to be inspected using a soft bristle brush and mild solvent/cleaner.

12.2 If the Cargo Hook is being overhauled, perform non-destructive inspection as follows:

Perform magnetic particle inspection (wet fluorescent) in accordance with ASTM E1444, JIS-Z-2320 or ISO 9934-1 on the parts listed below. Flaw size acceptance criteria is per MIL-STD-1907, Grade A.

- Cam (8.2)
- Cam Roller Pin (7.5)
- Load Beam Roller Pin (7.4)
- Load Beam Assembly (6)
- Toggle (7.2)
- Keeper (11)

Perform fluorescent penetrant inspection in accordance with ASTM E1417, JIS-Z-2343 or EN 571-1 on the parts listed below. Flaw size acceptance criteria is per MIL-STD-1907, Grade A.

- Side Plate, Solenoid (5.4)
- Side Plate, Manual (4.1)

12.3 Carefully inspect detail parts in accordance with the instructions in Table 12.1. Inspect the parts in a clean, well-lighted room using standard dimensional measuring tools and visual methods. Repair parts found within inspection limits. Replace any part found beyond limits.



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Table 12.1 Cargo Hook Inspection Criteria

Seq	Component	Inspection Criteria & Limit	Repair Action	Finish	Replace at Overhaul.
1.	Solenoid Actuator (5.5)	Corrosion – 0.010 in. (0.254 mm) deep.	Glass bead blast at less than 30 PSI (2.11 KGF/CM ²) to remove corrosion.	Passivate per AMS-QQ-P-35 or ASTM A967.	No
2.	Load Beam Assembly (6)	Corrosion – 0.010 in. (0.254 mm) deep.	Glass bead blast at less than 30 PSI (2.11 KGF/CM ²) to remove corrosion.	If plating is completely removed exposing base metal, apply zinc chromate primer to affected surfaces or electroless nickel plate per SAE-AMS 2404 Class 1 (thickness to be .0015-.0018 in.).	No
3.	Side Plate (4.1, 5.4),	Dents, nicks, gouges, scratches and corrosion – See Figure 11.1	Glass bead blast at less than 30 PSI (2.11 KGF/CM ²) to remove corrosion. Blend at 10:1 ratio as required to provide smooth transitions.	Apply Alodine (MIL-DTL-5541) and zinc chromate primer (MIL-PRF-23377 or similar) to affected surfaces – see Note 1	No
4.	Pushrod Interlock (5.7), Link (5.8), Interlock Solenoid Actuator (5.6)	Dents, nicks, cracks, gouges, scratches and corrosion – 0.020 in. (0.51 mm) deep.	Glass bead blast at less than 30 PSI (2.11 KGF/CM ²) to remove corrosion. Blend at 10:1 ratio as required to provide smooth transitions.	Apply Alodine (MIL-DTL-5541) and zinc chromate primer (MIL-PRF-23377 or similar) to affected surfaces – see Note 1	No
5.	Electrical Compartment Cover (10), Clock Spring Retainer (12)	Dents, nicks, cracks, gouges, scratches and corrosion – 0.040 in. (1.0 mm) deep.	Blend at 10:1 ratio as required to provide smooth transitions.	Apply Alodine (MIL-DTL-5541) & zinc chromate primer (MIL-PRF-23377 or similar) to affected surfaces – see Note 1.	No
6.	Self-lubricating bearings (4.14, 5.43, 5.44, 5.45, 7.8, 7.9, 8.3, 9.2, 5.37, 5.38)	Wear – more than 50% copper showing.	None. Replace.	N/A	Yes
7.	Bearings (4.15, 5.40, 7.10)	Roughness, binding, looseness, or corrosion.	None. Replace.	N/A	Yes
8.	Bushings (4.5, 5.10).	Roughness, binding, or corrosion.	None. Replace	N/A	No
9.	Bushings (4.5, 5.10)	Wear on ID - .763 in. (19.38 mm).	None. Replace	N/A	No



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Seq	Component	Inspection Criteria & Limit	Repair Action	Finish	Replace at Overhaul.
10.	Bumper (35)	Denting, cuts or abrasions – 0.060 in. (1.52 mm) deep.	None. Replace.	N/A	Yes
11.	Keeper (11)	Gouges and nicks – 0.050 in. (1.27 mm) deep. No visible cracks.	Blend at 10:1 ratio as required to provide smooth transitions. Replace if visibly cracked.	Passivate per AMS-QQ-P-35 or ASTM A967	No
12.	Cam Assembly (8)	Visible wear or dents on bearing surface.	None. Replace.	N/A	No
13.	Cam Assembly (8)	Roughness, binding or looseness of the Interlock Roller (8.1).	Replace Clevis Pin (8.4), Interlock Roller (8.1), and Self-lubricating Bushings (8.3).	N/A	No
14.	Toggle Assembly (7)	Roughness, binding or looseness of the Load Beam Roller (7.3).	Replace Pin (7.4), Load Beam Roller (7.3), and Self-lubricating Bushings (7.9).	N/A	No
15.	Toggle Assembly (7)	Roughness, binding or looseness of the Cam Roller Tire (7.1).	Replace Pin (7.5), Roller Tire (7.1), and Bearing (7.10).	N/A	No
16.	Load Beam (6.1)	Wear, gouges and nicks – 0.060 in. (1.52 mm) deep.	Blend at 10:1 ratio as required to provide smooth transitions and ensure load rings will not hang up on load beam during release.	Apply zinc chromate primer to affected surfaces or electroless nickel plate per SAE-AMS 2404 Class 1 (thickness to be .0015-.0018 in.).	No
17.	Release Solenoid (5.12)	Shorted or open electrical circuit. Resistance $1.9 \pm .3$ ohms.	None. Replace.	N/A	No
18.	Keeper Unlock Solenoid (5.11)	Shorted or open electrical circuit. Resistance $3.5 \pm .5$ ohms.	None. Replace.	N/A	No
19.	Electrical connector (5.41.6)	Loose, missing, or mutilated contact pins, cracked case, or worn insulator.	None. Replace.	N/A	No
20.	Serial Number Plate (1)	Damage or illegible.	None. Replace.	N/A	No



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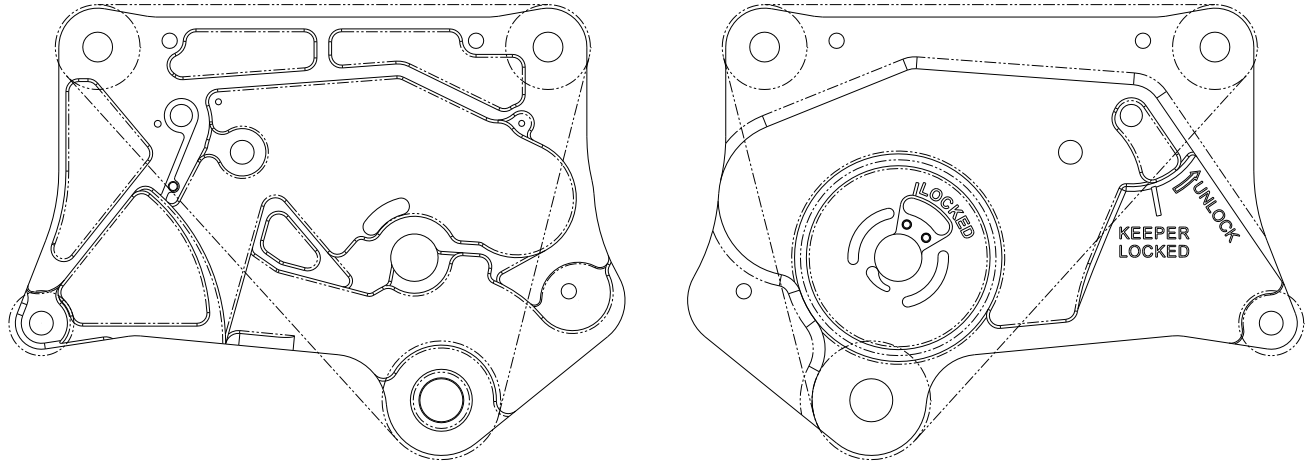
Seq	Component	Inspection Criteria & Limit	Repair Action	Finish	Replace at Overhaul.
21.	Warning Label (2), Schematic Decal (3)	Damage or illegible.	None. Replace.	N/A	Yes
22.	Springs (4.13, 5.42, 34, 36, 37, 38)	Cracks or deformation.	None. Replace.	N/A	Yes
23.	Springs (39, 40)	Cracks or deformation.	None. Replace	N/A	No
24.	Electrical wiring	Deterioration.	None. Replace.	N/A	No
25.	Switches (5.41.3)	Fails to open or close.	None. Replace	N/A	No
26.	All remaining nuts, bolts, roll pins, cotter pins, washers, heli-coils.	Wear, corrosion or deterioration.	None. Replace.	N/A	Yes

Note 1 – For service at Onboard Systems, optional finish: black anodize per MIL-A-8625 Type II, Class 2 after nondestructive inspection. Prepare for anodize by using standard methods.

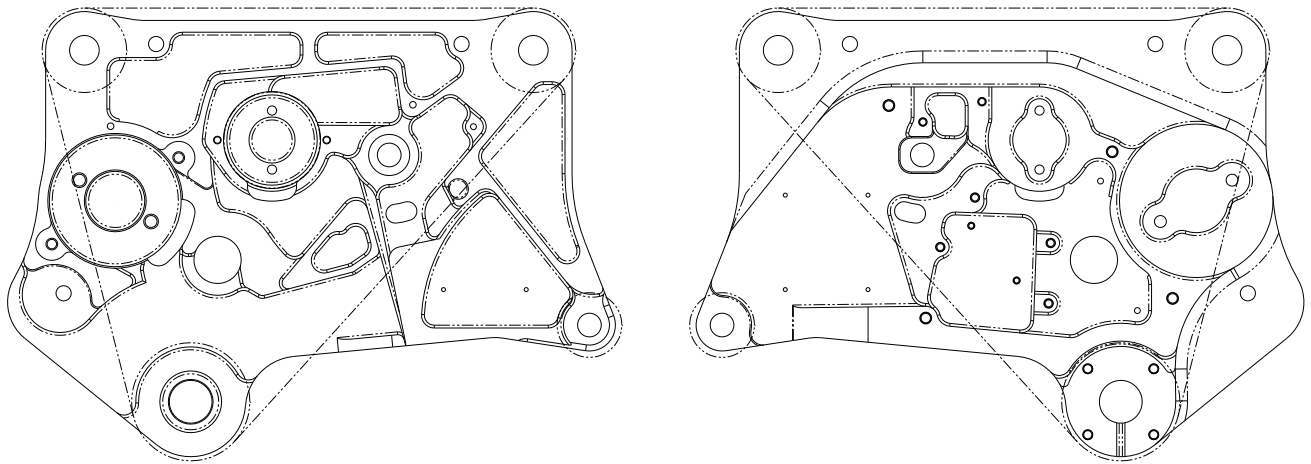
Note 2 – If entry for Replace at Overhaul is “Yes” it is recommended that the item be replaced at time of overhaul.

Figure 12.1 Side Plate Inspection Criteria

Side Plate, Manual (4.1)




Side Plate, Solenoid (5.4)



Inspection Criteria and Limits

Inside dashed circles – Dents, nicks, gouges, and scratches – 0.020 in (0.51 mm) deep.
 Inside dashed lines – Dents, nicks, gouges, scratches, and corrosion – 0.040 in (1.02 mm) deep.
 Outside dashed lines – Dents, nicks, gouges, scratches, and corrosion – 0.100 in (2.54 mm) deep.

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13.0 Re-assembly Instructions

- 13.1 Replace all parts found to be damaged with serviceable parts.
- 13.2 Press in self-lubricating bushings and roller bearings after applying zinc chromate primer (TT-P-1757 or equivalent) to the outside diameter.
- 13.3 Press in load beam pivot bushings using Loctite 7471 primer and Loctite 640 retaining compound.

Apply thin layer of grease (MIL-PRF-81322 or equivalent) to the side plates around the faying surfaces with the toggle, cam, keeper and load beam (areas shown circled in the photo below).



- 13.4 Apply Cor-ban 27L or Mastinox 6856H to toggle pivot holes on both side plates.


- 13.5** Attach solenoid actuator (5.5) to solenoid (5.12) with three screws (5.14) and washers (5.13). Prior to installation, apply Loctite 262 to screw threads. Tighten screws to 20-40 in-lbs and safety wire together. Place wedge ring (5.2) on solenoid, beveled edge down, with the opening on the same side as the wires. Align solenoid actuator (5.5) as shown.



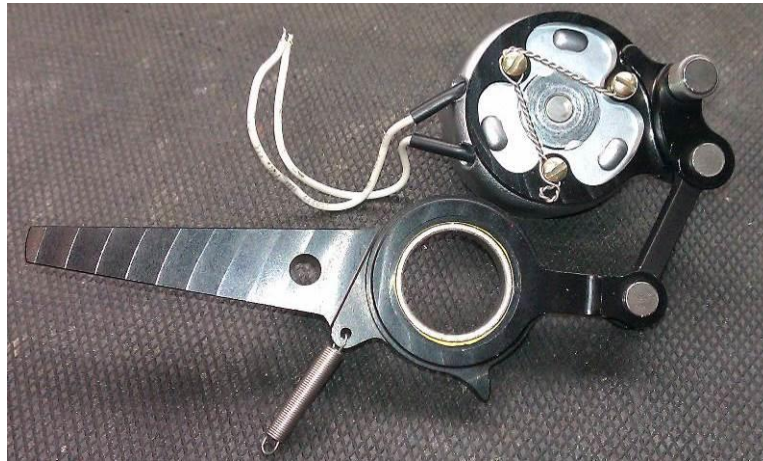
- 13.6** Install hook release solenoid (5.12) into side plate and secure wedge ring (5.2) with washers (5.23) and screws (5.19). Apply Loctite 262 to screw threads.



- 13.7** Secure hook release solenoid (5.12) with two washers (5.30) and nuts (5.17). Tighten nuts to 50-70 in-lbs.

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- 13.8** Attach interlock solenoid actuator (5.6) to keeper unlock solenoid (5.11) with three screws (5.21). Prior to installation, apply Loctite 262 to screw threads. Tighten screws and safety wire together.
- 13.9** Re-assemble keeper interlock linkage (5.6, 5.7 and 5.8) with pins (5.34) washers (5.24) and cotter pins (5.22).
- 13.10** Assemble Roller (5.3) with bearing (5.39) onto interlock solenoid actuator with pin (5.33) and cotter pin (5.22).
- 13.11** Place wedge ring (5.9) around keeper interlock solenoid (5.11).



- 13.12** Place assembly in side plate (5.4) as shown below and position interlock over the hub on the side plate and secure solenoid with two screws (5.26) and washers (5.35). Apply Loctite 262 to screw threads prior to installation.



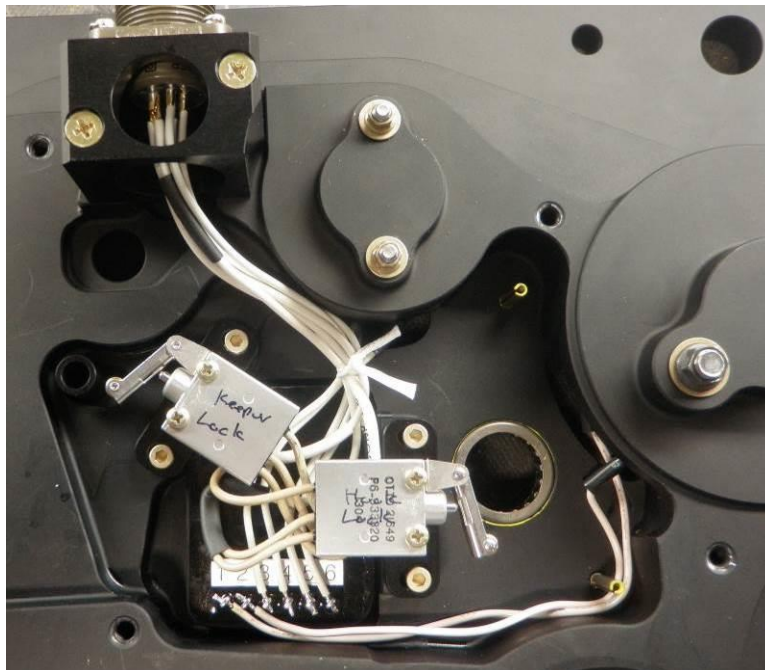
- 13.13** Secure the keeper interlock solenoid into the side plate with two nuts (5.30) and washers (5.20). Tighten nuts to 12-15 in-lbs.

13.14 Stretch spring (5.36) over roll pin (5.29).



13.15 Re-install electrical sub-assembly by securing control module in position and securing with two screws (5.31) and Loctite 242 and positioning the two switch plates (5.41.1) with switches as shown and loosely securing with two screws (5.32) at each. These will be fully tightened after adjustment in a later step. Secure the connector bracket with two screws (5.20) and Loctite 242.

13.16 Solder solenoid wires to hook control module. Refer below for routing of electrical wires and to schematic for termination points.



13.17 Set aside the solenoid side plate assembly.

13.18 Apply grease to the outside diameter of the load beam shaft.

13.19 Place the Load Beam Assembly (6) onto the Manual Release Side Plate (4).



13.20 Hook one end of the spring (36) on the Cam Assembly post and place the Cam Assembly into position on the Manual Release Side Plate and hook the other end of the spring to the roll pin in the Manual Release Side Plate.



- 13.21** If load beam roller bushings (7.9) have been replaced they must be sized and run-in for a consistent keeper lock force. After installing the bushings into the load beam roller (7.3), press a $\text{Ø}502$ ball through the bearings. Lubricate I.D. and edges of bushings with PTFE*. Install onto toggle and run-in by rolling the roller on a soft surface such as rubber while applying force.

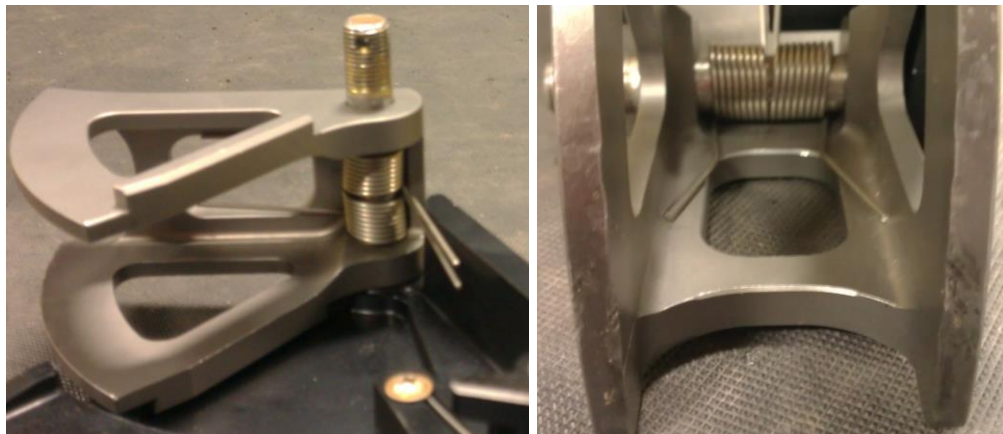
*Alternatively, lubricate bushings (7.9) with Mobile grease 28, especially if keeper lock force is high.


- 13.22** Position the Toggle Assembly (7) on the manual side plate and connect the Toggle spring (7.11) to the roll pin in the Manual Release Side Plate located just above the toggle pivot point.



- 13.23** Insert the keeper pivot bolt (32) up from underneath the manual release side plate.

- 13.24** Rotate the load beam out of the way, position the springs (37 and 38) within the keeper and install the keeper over the keeper pivot bolt as shown. Lift the toggle as necessary to position it between the keeper. Bend opposite spring legs towards keeper legs as shown.



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13.25 Install toggle pivot bolt (31).



13.26 Position the solenoid side plate assembly (5) over the manual release side plate assembly, align all the holes and mate these two plates together. The keeper unlock lever should be rotated to the "keeper locked" position to allow the internal keeper lock to clear the solenoid side plate.

13.27 Install the remaining bolts securing the side plates together. These include the two clamping bolts (25) with washers (20) and nuts (16) and the bolt (26) through the load beam bumper (35).

13.28 Align side plates using suitable pins or bolts in the attachment holes.

13.29 Tighten the toggle pivot bolt, keeper pivot bolt, and bumper bolt just enough to fully seat the bolts. Continue rotating the keeper and toggle nuts until the next slot in the nut lines up with the cotter pin hole.

13.30 Torque the clamping bolts (25) to 100-140 in-lbs.

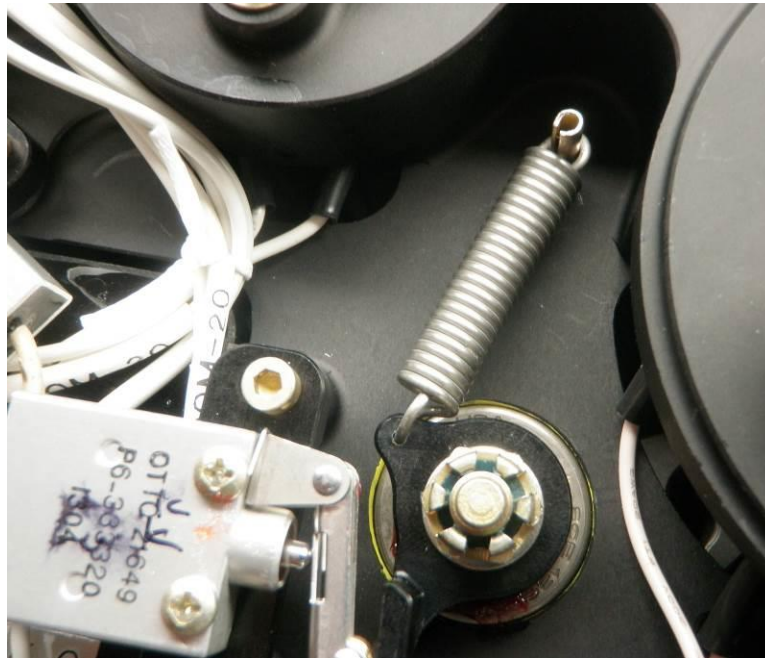
- 13.31** Liberally apply Mobilgrease 28 to the load beam spring (40), housing (12) and the mating surfaces on the side plate.
- 13.32** Place the load beam spring (40) and housing (12) over the load beam shaft in the orientation shown below, aligning and inserting the inner leg of the spring into the slot in the load beam shaft.




- 13.33** Insert a mounting screw (22) into the 4 o'clock position and with the housing against the alignment ridge, rotate the housing ~180 degrees clockwise until the screw lines up with the hole at the 10:30 position and thread the screw into the side plate. Install remaining three screws and torque to 12-15 in-lbs.




- 13.34** Install the window (14) with two screws (27).
- 13.35** Apply a light coating of grease to the manual release knob spring (39) and knob (9.1) faying surfaces.
- 13.36** Assemble the washer (18), bolt (33), spacer (15), knob and spring and insert the bolt through the mounting hole in the cam.
- 13.37** Before fully seating the knob on the side plate, engage the spring to the tab on the side plate and wind up the spring until the "OPEN" label is at the top and the stops are in their slots.
- 13.38** Install spring (34) onto hook locked cam (13).
- 13.39** Install hook locked cam and spring in place using a washer (19) and nut (28). Tighten the nut just enough to fully seat the bolt, continue rotating the nut until the next slot lines up with the cotter pin hole in the bolt and install cotter pin.
- 13.40** Attach hook locked cam spring (34) to roll pin (located between the two solenoids, on the outside of the side plate).



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- 13.41** Install cotter pins in keeper pivot and toggle pivot bolts.
- 13.42** Adjust "hook open" and "keeper lock" switches to actuate when required and tighten screws to 20-25 in-lbs and secure with safety wire.
- 13.43** Install electrical compartment cover (10) using four bolts (21) and washers (41). Tighten bolts to 20-25 in-lbs.
- 13.44** Check for free operation and automatic re-latch of the load beam by opening it with the manual release knob and allowing it to close.
- 13.45** Perform Acceptance Test Procedures as listed in this manual.

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14.0 Acceptance Test Procedure

After the remote hook has been overhauled, repaired or stored for an extended period of time (see section 6.0) it must be subjected to the Acceptance Test Procedure (ATP) as follows. To facilitate the performing of the ATP it is recommended that an electrical test box with a release switch and lights to indicate the status of the keeper lock and hook lock be constructed.

- 14.1 Examine the remote hook externally for security of the lock wire, cotter pins and fasteners.
- 14.2 Suspend the hook from a test rig capable of loading the remote hook to 20,000 pounds. Use a steel ring to apply the load to the load beam.
- 14.3 With the hook unloaded, rotate the release knob. Verify that the "Hook Locked" light goes out. Unlock keeper using the lever on the side of the hook.
- 14.4 Hang a 15 lb test weight on the load beam. Using a suitable torque wrench rotate the manual release knob to release the remote hook. The torque should not exceed 25 in-lbs (2.8 N-m). The load beam should drop the test weight and automatically re-latch. Unlock keeper.
- 14.5 Connect an adjustable 22 - 28 VDC supply capable of 15 amps, with a momentary release switch wired into the positive wire, to the connector located on top of the solenoid housing. Connect the negative lead to pin B and the positive lead to pin A.
- 14.6 Hang a 15 lb (6.8 kg) test weight on the load beam. With the voltage set at 22 VDC release the remote hook with the electrical release system. The load beam should drop the test weight and automatically re-latch. Hold the release switch for several seconds and verify the keeper is unlocked.


CAUTION

Damage to the release solenoid can occur if the release switch is operated for more than 30 seconds continuously.

- 14.7 Gradually load the remote hook to 20,000 lbs if testing P/N 528-045-00 or 12,000 lbs if testing P/N 528-046-00. Hold the load for 30 seconds. The load beam shall hold the load without unlatching. Reduce the load to zero. Unlock keeper with Keeper Unlock lever.

WARNING

Do not release the proof test load electrically or manually. Decrease the load gradually, using the test machine, after completion of the proof load test.

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- 14.8** Gradually load the remote hook to 10,000 lbs if testing P/N 528-045-00 or 6,000 lbs if testing P/N 528-046-00. Verify the keeper is locked by viewing the position of the interlock override lever, and by checking that the keeper locked light is on. With the voltage set to 22 VDC, release the remote hook with the electrical release button. The load should release and the load beam should re-latch after release. Repeat this step 1 time for a total of 2 cycles.
- 14.9** Install a suitable load ring within the load beam and using a load cell or spring scale, etc. to record the force, apply a test load until the keeper locks. Record the load required to lock the keeper. Verify that the keeper is locked by attempting to manually actuate the keeper, checking that the interlock override lever is in the "Locked" position, and by verifying that the "Keeper Locked" light is on. Unlock keeper with Interlock Override Lever. Repeat this test for a total of 10 trials. Compute the average value. The average force required to lock the keeper should be between 75 - 500 lbs (34 -227 kg).



If the keeper lock average force is too high, the bushings (7.9) may need to be lubricated with Mobil grease 28.

- 14.10** The remote hook contains a solid state electrical controller. Verify the operation of the controller by doing the following. With no load attached to the remote hook, depress and hold the electrical release button. Audibly verify that the two solenoids are activated in rapid succession after an on-delay of approximately 1/2 second. The keeper solenoid should remain activated and the release solenoid should be activated repeatedly until the button is released. The remote hook release solenoid should not activate with a very short button depression.
- 14.11** End of acceptance test procedure.
- 14.12** For service at Onboard Systems, optionally use the following Onboard Systems factory acceptance test procedure(s):

Acceptance Test Procedure	Applicable P/Ns
180-229-00	528-045-00
180-230-00	528-046-00



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15.0 Troubleshooting

Symptom	Probable Cause	Remedy
Remote hook does not operate electrically, manual release operates normally.	Open electrical circuit, faulty wiring, circuit breaker, switch or solenoid.	Disconnect electrical release cable connection from aircraft. Remove electrical compartment cover and using multi-meter, check for 1.9 +/- .25 ohms between the two release solenoid wires (pins 1 and 2 of the hook control module). If open indication is obtained, replace solenoid.
Remote hook does not operate electrically or manually.	Defective internal mechanism.	Disassemble, and inspect internal mechanism for binding, jamming, and worn or broken parts. Repair as necessary.
Remote hook operates electrically, but not manually. Load beam fails to re-latch.	Defective latch mechanism.	Check manual release knob. Disassemble, and inspect internal mechanism for binding, jamming, and worn or broken parts. Repair as necessary.
Load beam re-latch unreliable or re-latch is sluggish.	Accumulated dust, dirt and grime.	Remove immediately from service for disassembly and cleaning.
Remote hook manual release knob torque exceeds 25 in-lbs. with no load on hook.	Defective internal mechanism.	Check manual release knob. Disassemble and inspect internal mechanism for binding, jamming, and worn or broken parts. Repair as necessary.
Circuit breaker opens when remote hook is energized.	Short in the system, faulty wiring, circuit breaker or solenoid.	Check for shorts to ground. Check solenoid, repair or replace defective parts.
Remote hook releases electrically, but keeper does not unlock.	Cockpit release switch not held until load beam is re-latched. Faulty wiring, defective solenoid.	Remove electrical compartment cover and using multi-meter, check for 3.5 +/- .5 ohms between the two solenoid wires (pins 3 and 4 of the hook control module). If open indication is obtained, replace solenoid.
Keeper is locked after electrical release of load.	Cockpit electrical release switch was not held down long enough.	Hold release switch down longer to allow keeper interlock solenoid to actuate.
Keeper Lock light in cockpit fails to illuminate.	Defective switch, switch is out of adjustment or faulty wiring.	Disconnect electrical release cable connection from aircraft. Check for continuity across pins C and D of connector with the keeper locked. If open indication is obtained, remove electrical compartment cover and adjust or replace switch or repair as necessary.
Hook Locked light in cockpit fails to illuminate.	Defective switch, switch is out of adjustment or faulty wiring.	Disconnect electrical release cable connection from aircraft. Check for continuity across pins C and E of connector with the hook locked. If open indication is obtained, remove electrical compartment cover and adjust or replace switch or repair as necessary.

16.0 Illustrated Parts List

Figure 16.1 Remote Hook Parts

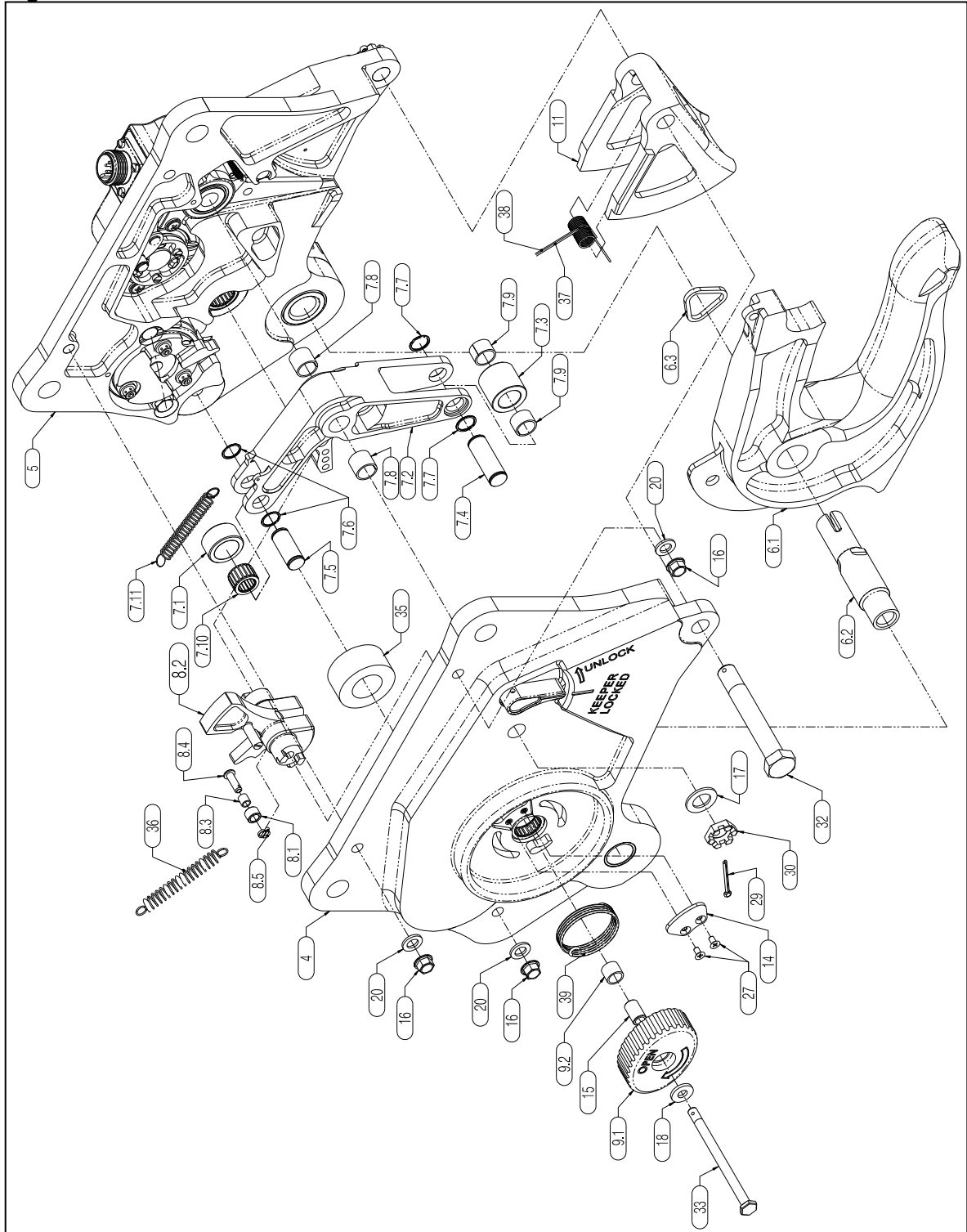


Figure 16.2 Remote Hook Parts

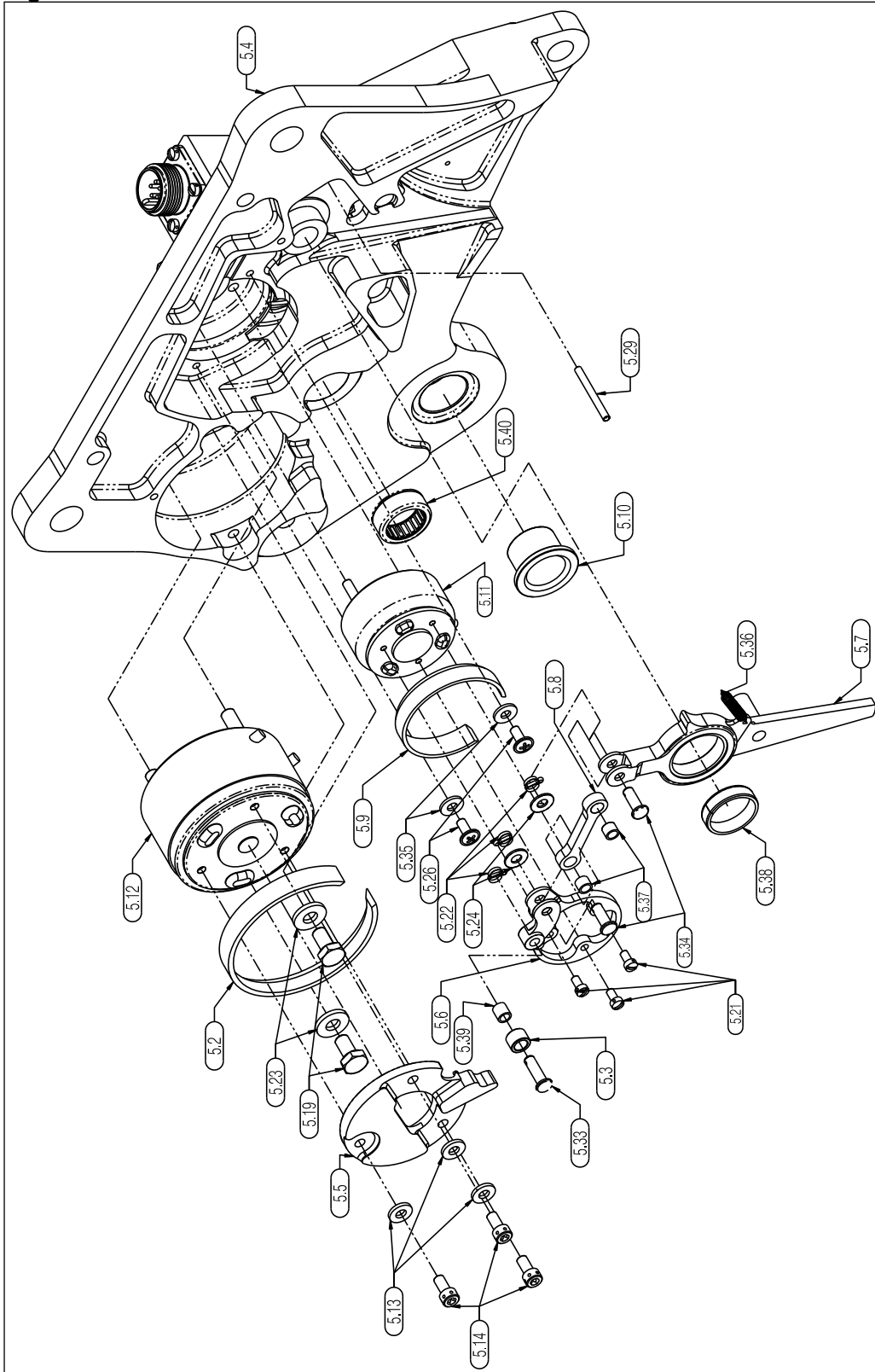


Figure 16.3 Remote Hook Parts

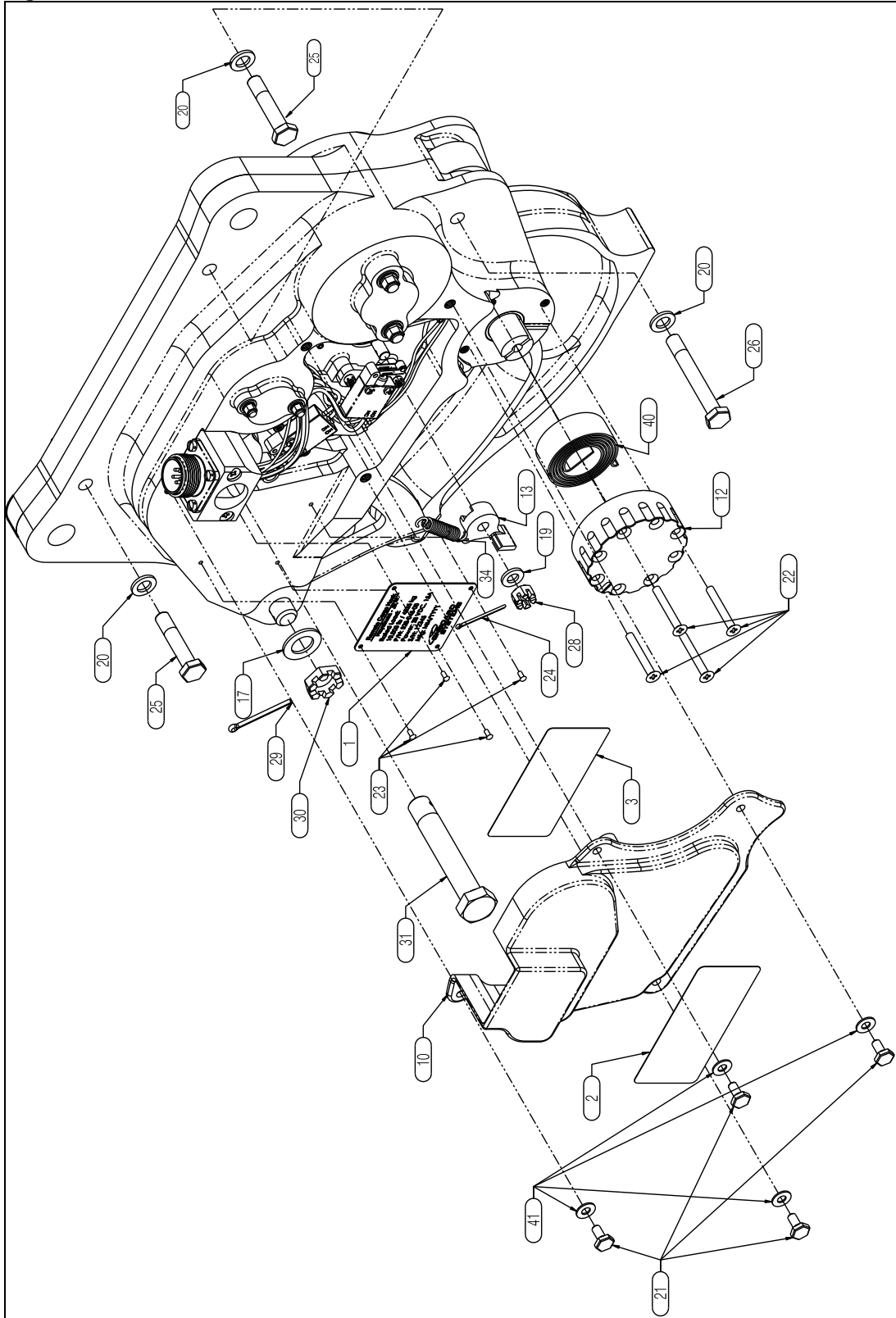


Figure 16.4 Remote Hook Parts

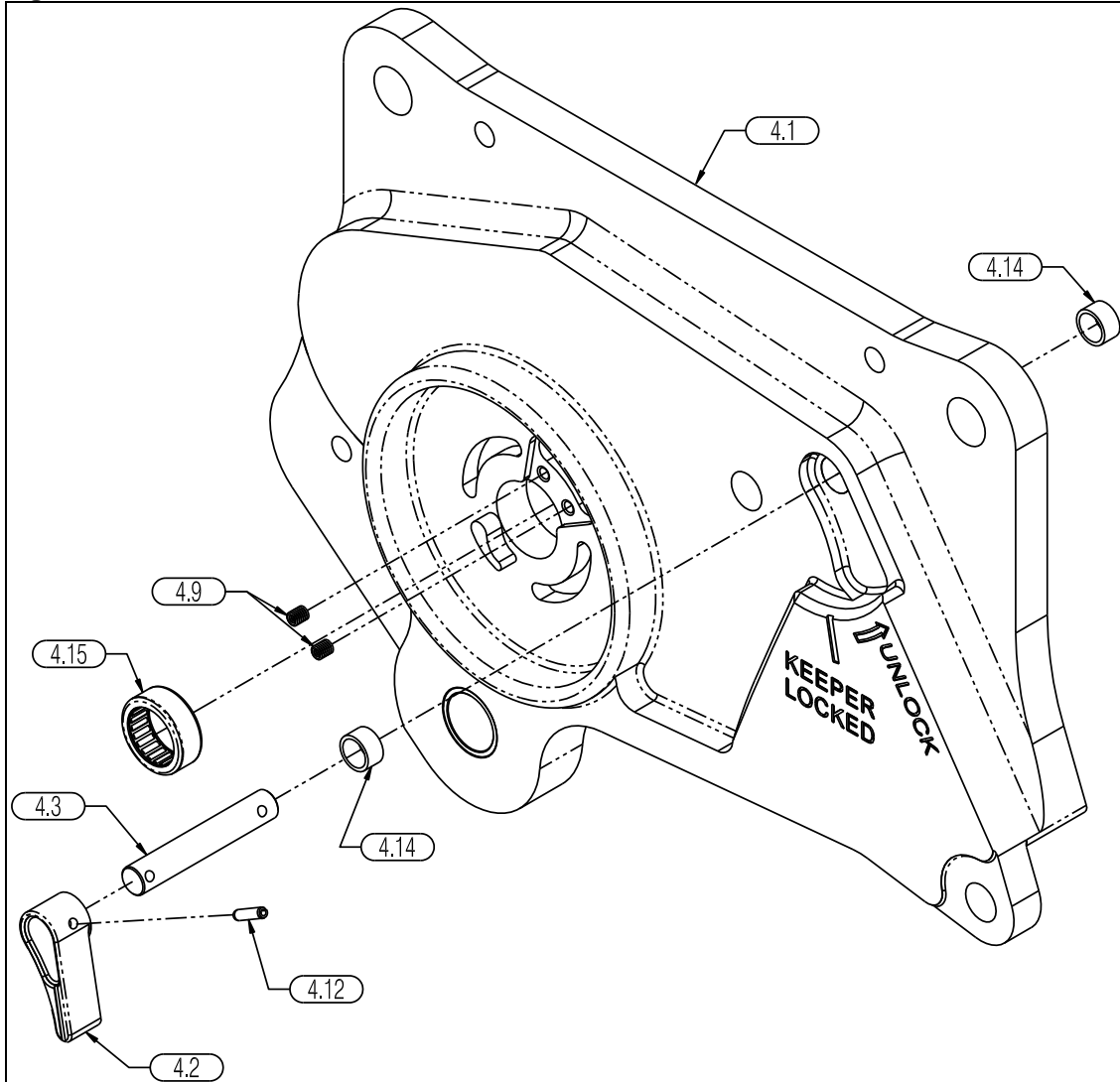


Figure 16.5 Remote Hook Parts

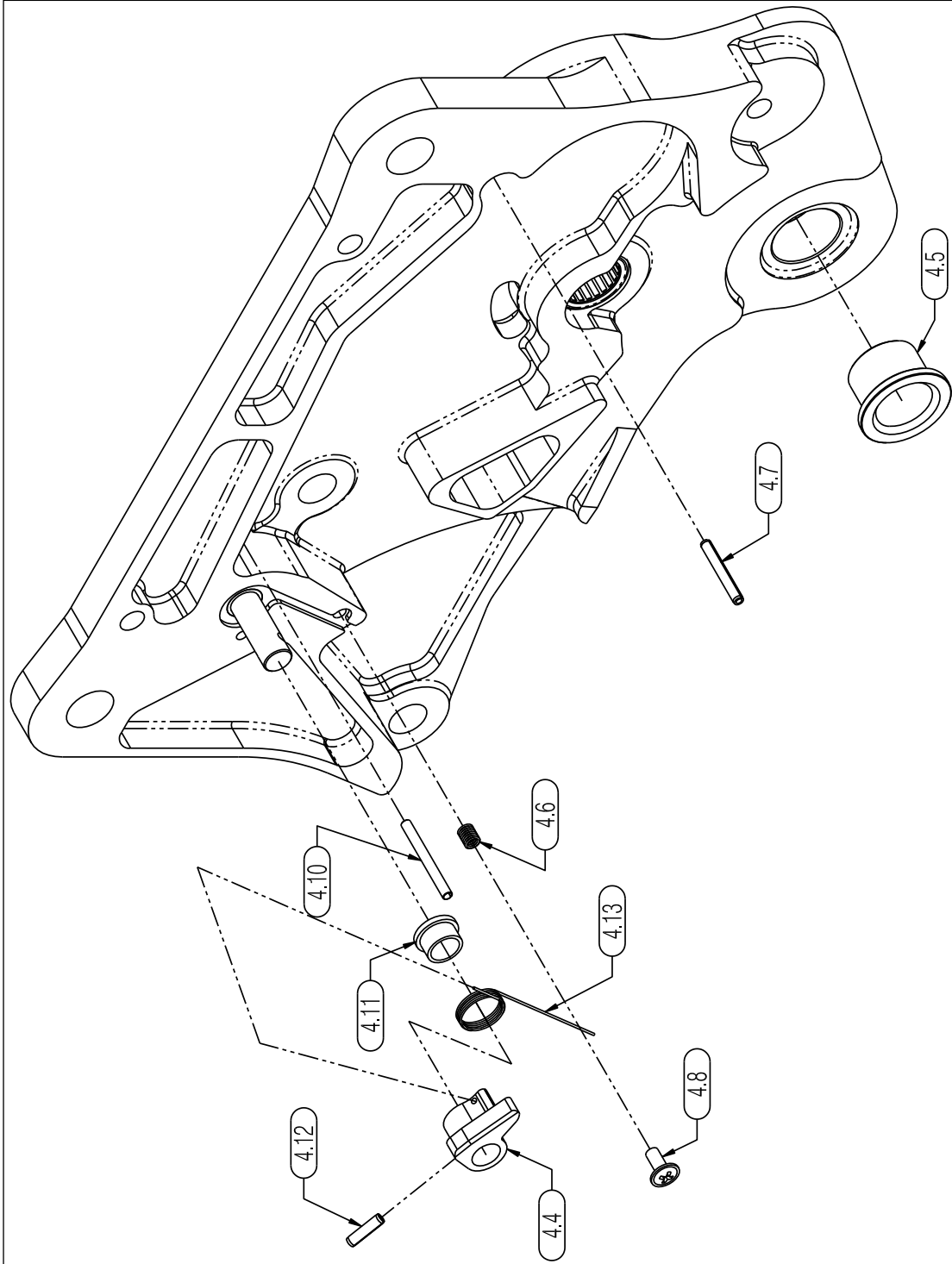


Figure 16.6 Remote Hook Parts

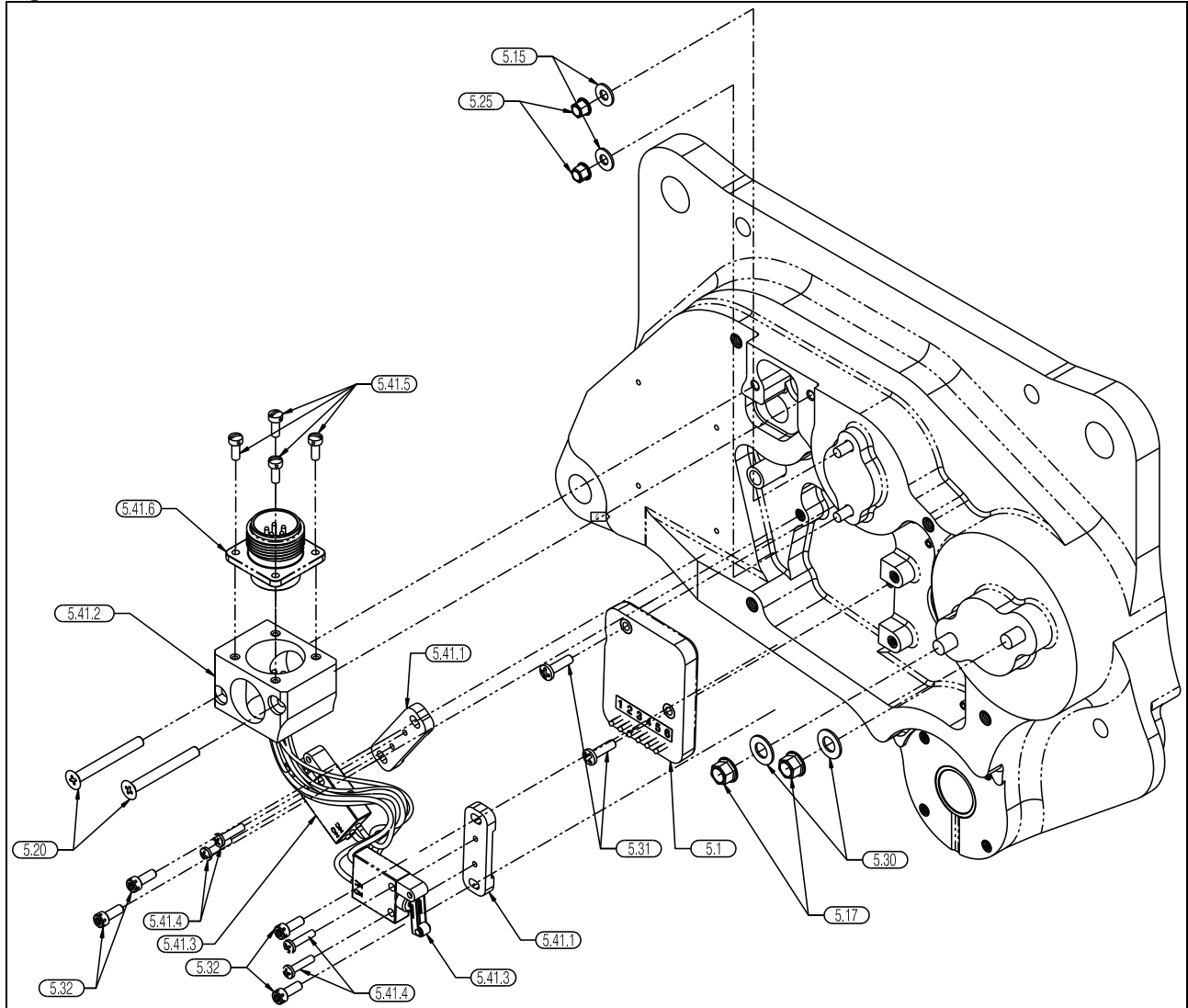
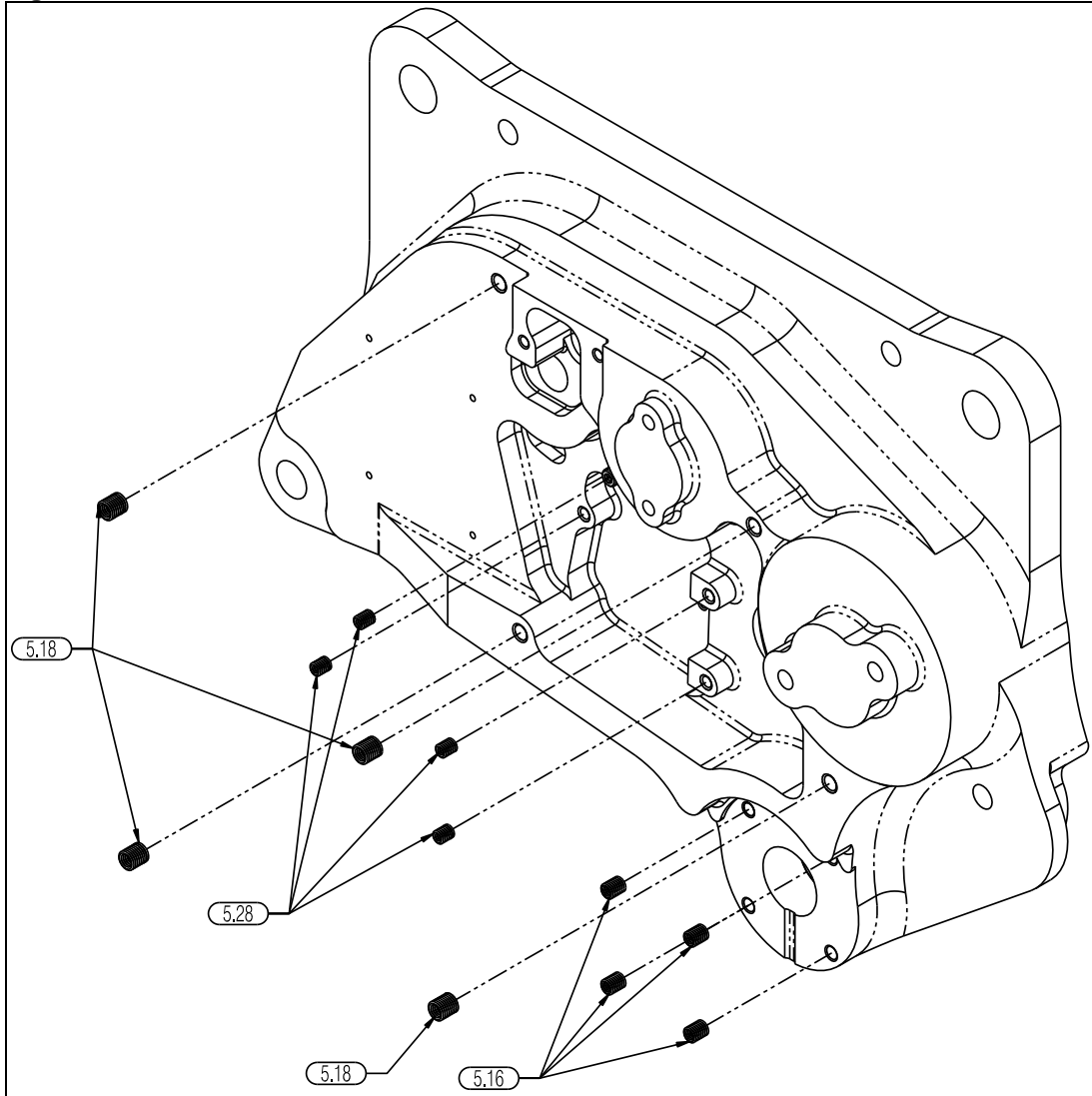


Figure 16.7 Remote Hook Parts





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Table 16.1 Remote Hook Parts

Item	Part No.	Description	Qty 528-045-00	Qty 528-046-00	Qty Overhaul Kit P/N 212-036-00
1	215-288-00	Serial Number Plate	1	1	-
2	215-291-00	Warning Label	1	1	1
3	215-300-00	Schematic Decal	1	1	1
4 ¹	232-581-00	Side Plate Assembly, Manual	1	-	-
	232-618-00	Side Plate Assembly, Manual	-	1	-
4.1	291-710-00	Side Plate, Manual Release	1	-	-
	291-755-00	Side Plate, Manual Release	-	1	-
4.2	291-723-00	Interlock Override Lever	1	1	-
4.3	291-741-00	Interlock Actuator Shaft	1	1	-
4.4	291-745-00	Interlock Actuator	1	1	-
4.5	291-747-00	Bushing	1	1	-
4.6	510-210-00	Helicoil	1	1	1
4.7	510-427-00	Roll Pin	1	1	1
4.8	510-640-00	Screw	1	1	1
4.9	510-669-00	Helicoil	2	2	2
4.10	510-690-00	Roll Pin	1	1	1
4.11	291-823-00	Spacer	1	1	-
4.12	511-047-00	Roll Pin	2	2	2
4.13	514-116-00	Spring	1	1	1
4.14	517-032-00	DU Bushing	2	2	2
4.15	517-066-00	Needle Bearing	1	1	1
5 ¹	232-582-00	Side Plate Assembly, Solenoid	1	-	-
	232-616-00	Side Plate Assembly, Solenoid	-	1	-
5.1	232-603-00	Hook Control Module	1	1	-
5.2	290-727-00	Wedge Ring	1	1	-
5.3	290-982-00	Interlock Roller	1	1	-
5.4	291-711-00	Side Plate, Solenoid	1	-	-
	291-756-00	Side Plate, Solenoid	-	1	-
5.5	291-719-01	Solenoid Actuator	1	1	-
5.6	291-720-00	Interlock Solenoid Actuator	1	1	-
5.7	291-722-01 ²	Pushrod Interlock	1	1	-
5.8	291-739-00	Link	1	1	-
5.9	291-744-00	Wedge Ring	1	1	-
5.10	291-747-00	Bushing	1	1	-
5.11	455-003-00	Solenoid	1	1	-
5.12	455-010-00	Solenoid	1	1	-
5.13	510-042-00	Washer	3	3	3
5.14	510-156-00	Screw	3	3	3
5.15	510-209-00	Washer	2	2	2
5.16	510-210-00	Helicoil	4	4	4
5.17	510-227-00	Nut	2	2	2
5.18	510-248-00	Helicoil	4	4	4
5.19	511-061-00	Bolt	2	2	2
5.20	510-301-00	Screw	2	2	2
5.21	510-379-00	Screw	3	3	3



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Item	Part No.	Description	Qty 528-045-00	Qty 528-046-00	Qty Overhaul Kit P/N 212-036-00
5.22	510-417-00	Cotter Pin	3	3	3
5.23	510-436-00	Washer	2	2	2
5.24	510-467-00	Washer	2	2	2
5.25	510-514-00	Nut	2	2	2
5.26	510-640-00	Screw	2	2	2
5.27	510-620-00	Roll Pin	2	2	2
5.28	510-669-00	Helicoil	4	4	4
5.29	510-690-00	Roll Pin	1	1	1
5.30	510-737-00	Washer	2	2	2
5.31	510-923-00	Screw	2	2	2
5.32	511-046-00	Screw	4	4	4
5.33	511-039-00	Clevis Pin	1	1	-
5.34	511-051-00	Clevis Pin	2	2	-
5.35	511-059-00	Washer	2	2	2
5.36	514-032-00	Spring	1	1	1
5.37	517-040-00	Bushing	2	2	2
5.38	517-042-00	Bearing	1	1	1
5.39	517-009-00	DU Bushing	1	1	1
5.40	517-066-00	Needle Bearing	1	1	1
5.41 ¹	232-627-00	Electrical Subassembly	1	-	-
	232-630-00	Electrical Subassembly	-	1	-
5.41.1	291-734-00	Switch Plate	2	2	-
5.41.2	291-743-00	Connector Bracket	1	-	-
	291-824-00	Connector Bracket	-	1	-
5.41.3	400-062-00	Switch	2	2	-
5.41.4	510-920-00	Screw	4	4	4
5.41.5	510-132-00	Screw	4	4	4
5.41.6	410-382-00	Connector	1	1	-
5.41.7	420-082-00	Wire, 16 Ga.	AR	AR	-
5.41.8	450-001-00	Heat Shrink	AR	AR	-
6 ¹	232-583-00	Load Beam Assembly	1	-	-
	232-617-00	Load Beam Assembly	-	1	-
6.1	291-712-01	Load Beam	1	-	-
	291-757-00	Load Beam	-	1	-
6.2	291-713-00	Load Beam Shaft	1	1	-
6.3	291-740-00	Key	1	1	-
7 ¹	232-584-00	Toggle Assembly	1	1	-
7.1	291-751-00	Cam Roller Tire	1	1	1
7.2	291-714-01	Toggle	1	1	-
7.3	291-715-00	Load Beam Roller	1	1	-
7.4	291-737-00	Pin, Load Beam Roller	1	1	-
7.5	291-742-00	Pin, Cam Roller	1	1	-
7.6	515-016-00	Spiral Retaining Ring	2	2	2
7.7	515-017-00	Spiral Retaining Ring	2	2	2
7.8	517-022-00	DU Bushing	2	2	2
7.9	517-023-00	DU Bushing	2	2	2
7.10	517-124-00	Roller Bearing	1	1	1



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Item	Part No.	Description	Qty 528-045-00	Qty 528-046-00	Qty Overhaul Kit P/N 212-036-00
7.11	514-117-00	Spring	1	1	1
8 ¹	232-585-00	Cam Assembly	1	1	-
8.1	290-982-00	Interlock Roller	1	1	-
8.2	291-717-00	Cam	1	1	-
8.3	517-009-00	DU Bushing	1	1	1
8.4	510-540-00	Clevis Pin	1	1	-
8.5	510-417-00	Cotter Pin	1	1	1
9 ¹	232-608-00	Release Knob Assembly	1	1	-
9.1	291-811-00	Release Knob	1	1	-
9.2	517-010-00	DU Bushing	1	1	1
10	291-718-00	Electrical Compartment Cover	1	1	-
11	291-721-00	Keeper	1	1	-
12	291-736-00	Clock Spring Retainer	1	1	-
13	291-748-00	Hook Locked Cam	1	1	-
14	291-750-00	Window	1	1	-
15	291-752-00	Knob Spacer	1	1	-
16	510-104-00	Nut	3	3	3
17	510-182-00	Washer	2	2	2
18	510-436-00	Washer	1	1	1
19	510-219-00	Washer	1	1	1
20	510-220-00	Washer	4	4	4
21	510-243-00	Bolt	4	4	4
22	510-287-00	Screw	4	4	4
23	510-429-00	Drive Screw	4	4	-
24	510-504-00	Cotter Pin	1	1	1
25	510-505-00	Bolt	2	2	2
26	510-578-00	Bolt	1	1	1
27	510-706-00	Screw	2	2	2
28	510-727-00	Nut	1	1	1
29	510-765-00	Cotter Pin	2	2	2
30	511-037-00	Nut	2	2	2
31	511-043-00	Bolt	1	1	1
32	511-050-00	Bolt	1	1	1
33	511-053-00	Bolt	1	1	1
34	514-112-00	Spring	1	1	1
35	514-012-00	Bumper	1	1	1
36	514-071-00	Spring	1	1	1
37	514-119-00	Spring	1	1	1
38	514-120-00	Spring	1	1	1
39	514-105-00	Knob Spring	1	1	-
40	514-106-00	Load Beam Spiral Torsion Spring	1	1	-
41	510-095-00	Washer	4	4	4

¹ Items not illustrated as assemblies.

² Supersedes P/N 291-722-00, refer to Service Bulletin 159-038-00.

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17.0 Instructions for Returning Equipment to the Factory

- 17.1 If an Onboard Systems product must be returned to the factory for any reason (including returns, service, repairs, overhaul, etc.) obtain an RMA number before shipping your return.



An RMA number is required for all equipment returns.

- To obtain an RMA, please use one of the listed methods.
 - Contact Technical Support by phone or e-mail (Techhelp@OnboardSystems.com).
 - Generate an RMA number at our website: <http://www.onboardsystems.com/rma.php>
- After you have obtained the RMA number, please be sure to:
 - Package the component carefully to ensure safe transit.
 - Write the RMA number on the outside of the box or on the mailing label.
 - Include the RMA number and reason for the return on your purchase or work order.
 - Include your name, address, phone and fax number and email (as applicable).
 - Return the components freight, cartage, insurance and customs prepaid to:

Onboard Systems
 13915 NW 3rd Court
 Vancouver, Washington 98685
 USA
 Phone: 360-546-3072