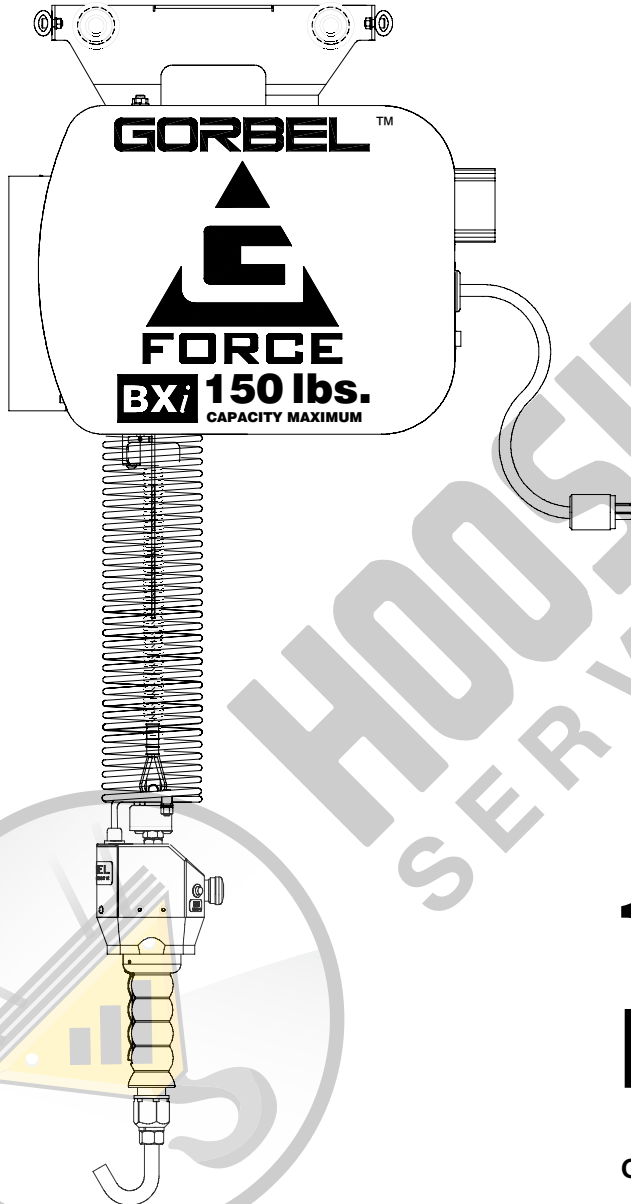


# Installation, Operation, & Maintenance Manual



U.S. PATENT NO'S:  
5,865,426, 6,386,513,  
& 6,886,812  
OTHER PATENTS  
PENDING



## 150/300/380 lbs. BXi Series

Gorbel® Dealer: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Gorbel® Customer Order No.: \_\_\_\_\_

Date: \_\_\_\_\_

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# SAFE HOIST OPERATING GUIDELINES

## General

There is no one single factor that is more important for minimizing the possibility of personal injury to the operator and those working in the area, or damage to property, equipment, or material, than being familiar with the equipment and using Safe Operating Practices.

Hoists/trolleys are designed for lifting and transporting of material only. Under no circumstances, either during initial installation or in any other use, should the hoist be used for lifting or transporting personnel.

No operator should be permitted to use the equipment that is not familiar with its operation, is not physically or mentally fit, or has not been schooled in safe operating practices. The misuse of hoists can lead to certain hazards which cannot be protected against by mechanical means; hazards which can only be avoided by the exercise of intelligence, care, and common sense.

Safe Operating Practices also involve a program of periodic inspection and preventative maintenance (covered in separate section). Part of the operator's training should be an awareness of potential malfunctions/hazards requiring adjustments or repairs, and bringing these to the attention of supervision for corrective action.

Supervision and management also have an important role to play in any safety program by ensuring that a maintenance schedule is adhered to, and that the equipment provided for the operators is suitable for the job intended without violation of one or more of the rules covering safe operating practices and good common sense.

The Safe Operating Practices shown are taken in part from the following publications:

- American National Standard Institute (ANSI)
- Safety Standards for Crane, Derricks, Hoists
- ANSI B30.2 - Overhead and Gantry Cranes
- ANSI B30.16 - Overhead Hoist

## Do's and Don'ts (Safe Operation of Hoists)

The following are Do's and Don'ts for safe operation of overhead hoists. A few minutes spent reading these rules can make an operator aware of dangerous practices to avoid and precautions to take for his own safety and the safety of others. Frequent examinations and periodic inspections of the equipment as well as a conscientious observance of safety rules may save lives as well as time and money.

## DON'TS - HOISTS

1. Never lift or transport a load until all personnel are clear and do not transport the load over personnel.
2. Do not allow any unqualified personnel to operate hoist.
3. Never pick up a load beyond the capacity rating appearing on the hoist. Overloading can be caused by jerking as well as by static overload.
4. Never carry personnel on the hook or the load.
5. Do not operate hoist if you are not physically fit.

6. Do not operate hoist to extreme limits of travel of cable without first checking for proper limit switch action.
7. Avoid sharp contact between two hoists or between hoist and end stops.
8. Do not tamper with or adjust any parts of the hoist unless specifically authorized to do so.
9. Never use the load cable as a sling.
10. Do not divert attention from load while operating hoist.
11. Never leave a suspended load unattended.
12. Do not use limit switch(es) for normal operating stop(s). These are safety devices only and should be checked on a regular basis for proper operation.
13. Never operate a hoist that has an inherent or suspected mechanical or electrical defect.
14. Do not use load cable as a ground for welding. Never touch a live welding electrode to the load cable.
15. Do not jog controls unnecessarily. Hoist motors are generally high torque, high slip types. Each start causes an inrush of current greater than the running current and leads to overheating and heat failure, or burnout, if continued to excess.
16. Do not operate hoist if load is not centered under hoist.
17. Do not operate hoist if cable is twisted, kinked, or damaged.
18. Do not remove or obscure label.
19. Do not permanently activate dead man's switch.

## DO'S - HOISTS

1. Read and follow manufacturer's instruction, installation, and maintenance manuals. When repairing or maintaining a hoist, use only manufacturer's recommended parts and materials.
2. Read and follow all instruction and warning information on or attached to a hoist.
3. Remove the hoist from service and thoroughly inspect and repair, as necessary, if unusual performance or visual defects (such as peculiar noise, jerky operations, travel in improper direction, or obviously damaged parts) are noticed.
4. Establish a regular schedule of inspection and maintain records for all hoists with special attention given to hooks, load cables, brakes, and limit switches.
5. Check operation of brakes for excessive drift.
6. Never lift loads over people, etc.
7. Check for damaged hooks and load cable.
8. Keep load cable clean and well maintained.
9. Check the load cable for improper seating, twisting, kinking, wear, or other defects before operating the hoists.
10. Make sure a load clears neighboring stockpiles, machinery, or other obstructions when raising, lowering, or traveling the load.
11. Center hoist over the load before operating.
12. Avoid swinging of load or load hook when traveling the hoist.
13. Be sure the load attachment is properly seated in the saddle of the hook. Balance load properly before handling. Avoid hook tip loading.
14. Pull in a straight line, so that neither hoist body nor load cable are angled around an object.
15. Take up slack slowly.
16. Know the hand signals for hoisting, cross travel, and crane travel if working with cab-operated hoists or cranes. Operators should accept the signals of only those persons authorized to give them.

### **WARNING**

Check Wire Rope for improper seating, twisting, kinking, wear, or defects before operating.

### **WARNING**

Center Bxi G-Force® over the load before lifting. DO NOT end or side load the Bxi G-Force®. End or side loading will seriously reduce the life of the Wire Rope and lead to premature failure. The Wire Rope should never exceed an out of vertical angle greater than 20°, under any circumstances.

### **WARNING**

Avoid swinging of load or load hook when traveling with the Bxi G-Force®.

### **WARNING**

Check the Coil Cord for improper seating, twisting, kinking, wear or defects before operating. Any of the described conditions will seriously reduce the life of the Coil Cord and lead to premature failure.

### **WARNING**

Press Float Mode (option) button with only the load weight hanging from the unit. Additional external forces applied to the load during initiation of Float Mode will result in the load drifting.

### **WARNING**

Do not repeatedly impact the Bxi G-Force® into the end stops. This condition will seriously reduce the life of the Controls and could lead to premature failures. If the unit impacts the end stop more than 10 times in a single shift, contact Gorbel® Customer Service for alternative end stop options.

### **WARNING**

The Bxi G-Force® ILD does not meet “Wash-down” environment requirements. The Bxi G-Force® ILD does not meet “Explosion Proof” requirements.

### **WARNING**

Ensure that the Load Cell is properly mounted in Remote Mount Handle applications with Float Mode (reference Figure I4, page 72).

### **WARNING**

Ensure that the Handle is supported properly in Remote Mount Handle applications by attaching to tooling at both the Top and Bottom mounting points (reference Figures H1, I3 & I4, on pages 68, 71 & 72).

### **WARNING**

Do not mount any objects to the sliding portion of the G-Force® Handle (i.e. switches). Additional objects may interfere with the travel of the sliding Handle and affect the overall speed and functionality of the unit.

### **WARNING**

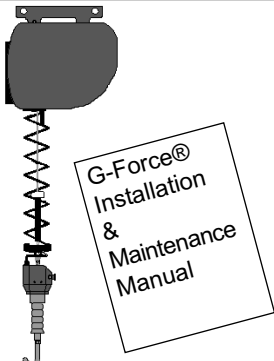
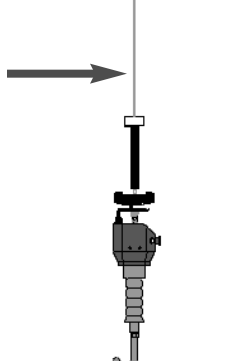
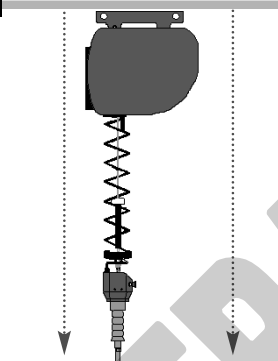
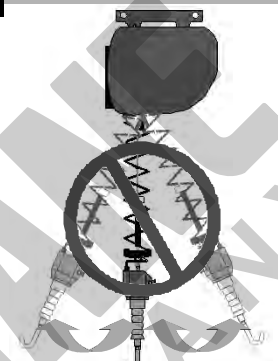
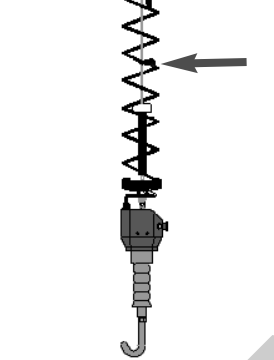
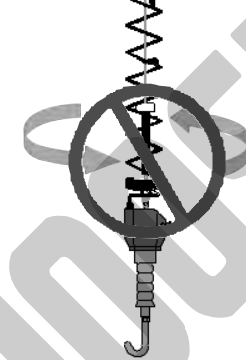
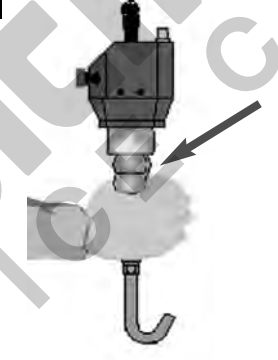
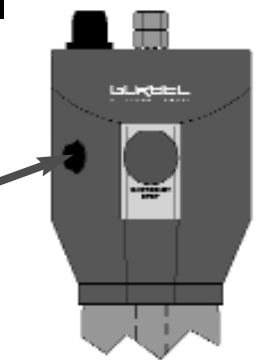
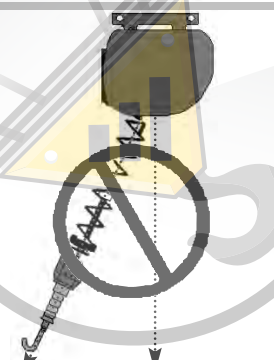
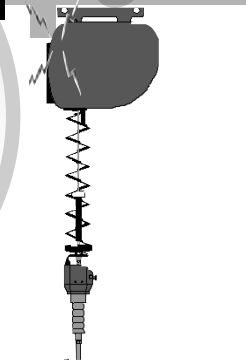
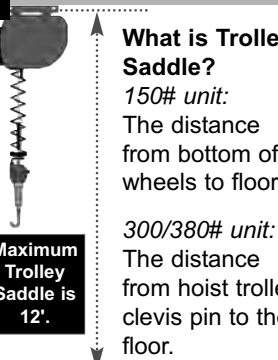
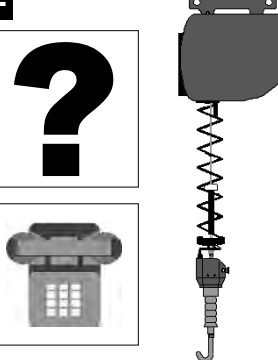
Do not mount any load bearing components to the Blue Poly-carbonate housings of the G-Force® Handle or Actuator assembly.





## G-Force® Operational Guidelines

All operators should read the G-Force® Instruction, Installation and Maintenance Manuals before operating the unit. Please follow the instructions contained in these manuals for your safety and for optimum trouble-free operation of your G-Force®. When repairing or maintaining a G-Force®, use only Gorbel® recommended parts and materials.

|   |  |  |  |
|---|--|--|--|
| <p><b>1</b></p>  <p>G-Force®<br/>Installation<br/>&amp;<br/>Maintenance<br/>Manual</p> | <p><b>2</b></p>           | <p><b>3</b></p>    | <p><b>4</b></p>                         |
| <p>Read &amp; follow all instruction &amp; warning information on or attached to the G-Force®.</p>  | <p>Check Wire Rope for improper seating, twisting, kinking, wear or defects before operating.</p>          | <p>Center G-Force® over the load before lifting a load. Do not end or side load.</p>   | <p>Avoid swinging of load or load hook when traveling with the G-Force®.</p>   |
| <p><b>5</b></p>   | <p><b>6</b></p>          | <p><b>7</b></p>   | <p><b>8</b></p>                        |
| <p>Check the coil cord for improper seating, twisting, kinking, wear or defects before operating.</p>   | <p>Do not over-twist coil cable assembly (&gt;360°). Damage and/or failure could occur.</p>                | <p>The Operator Present switch should be depressed the entire time the G-Force® is in use.</p>   | <p>Press Float Mode Button with only the load weight hanging from unit. Applying other force will cause unit to drift.</p> |
| <p><b>9</b></p>    | <p><b>10</b></p>        | <p><b>11</b></p>  <p><b>What is Trolley Saddle?</b><br/>150# unit:<br/>The distance from bottom of wheels to floor.<br/>300/380# unit:<br/>The distance from hoist trolley clevis pin to the floor.<br/>Maximum Trolley Saddle is 12'.</p> | <p><b>12</b></p>                      |
| <p>The wire rope should never be more than 20° out of vertical while the G-Force® is in use.</p>  | <p>Do not bang the G-Force® into end stops repeatedly or at a speed faster than a normal walking pace.</p> | <p>Maximum Trolley Saddle for the G-Force® is 12'. See drawing for Trolley Saddle definitions by unit size.</p>  | <p>Questions about G-Force®? Call Gorbel® Customer Service at (800) 821-0086 or your local Gorbel® distributor.</p>        |

## INTRODUCTION

Thank you for choosing a Gorbel® G-Force® BXi Intelligent Lifting Device (ILD)\*\* to solve your material handling needs. The innovative design and heavy-duty construction of the G-Force® BXi ILD will provide a superior quality product that will offer years of long term value. A Gorbel® G-Force® BXi ILD will provide many years of dependable service by following the installation and maintenance procedures described herein.

\*\* U.S. PATENT NO'S: 5,865,426, 6,386,513, & 6,886,812, OTHER PATENTS PENDING

***Dimensions contained in this installation manual are for reference only and may differ for your particular application.***

**Normal safety precautions:** These included, but are not limited to:

- Checking for obstructions in crane and hoist travel.

### WARNING

Only competent erection personnel familiar with standard fabrication practices should be employed to install the G-Force® ILD because of the necessity of properly interpreting these instructions. Gorbel is not responsible for the quality of workmanship employed in the installation of this hoist according to these instructions. Contact Gorbel, Inc., at 600 Fishers Run, P.O. Box 593, Fishers, New York 14453, 1-585-924-6262, for additional information, if necessary.

### WARNING

Equipment described herein is not designed for, and should not be used for, lifting, supporting, or transporting humans. Failure to comply with any one of the limitations noted herein can result in serious bodily injury and/or property damage. Check Federal, State and Local regulations for any additional requirements.

### WARNING

Prior to installation, consult a qualified structural engineer to determine if your support structure is adequate to support the loadings created during normal operation of the G-Force® ILD.

### WARNING

Reference American Institute of Steel Construction (AISC) Manual of Steel Construction (9th edition), Part 5, Specification for Structural Joints using ASTM A325 or A490 Bolts (section 8.d.2) for proper procedure to follow when using any torque tightening methods.

### WARNING

Do not field modify the G-Force® BXi ILD in any way. Any modification, without the written consent of Gorbel, Inc., will void warranty.

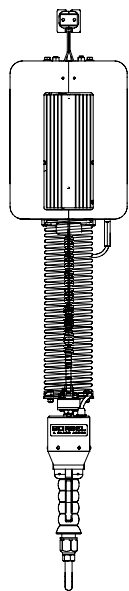
### WARNING

The unique serial number for this unit can be found on the front cover of this manual or on the ID nameplate sticker attached to the back bottom of the G-Force® ILD Actuator assembly cover. Always have this serial number available during all correspondence regarding your G-Force® BXi ILD, or when ordering repair parts.

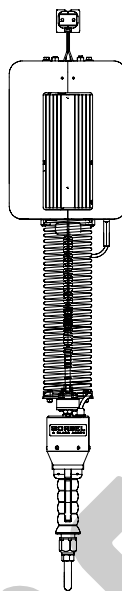
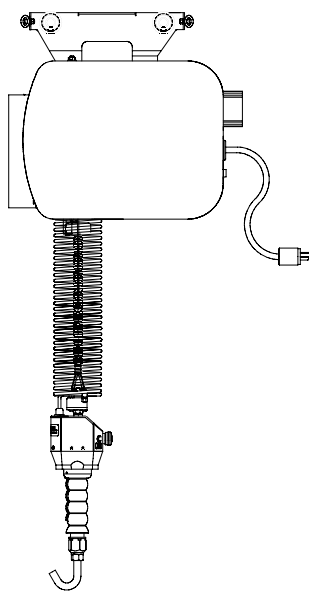
### WARNING

The Jog Switch buttons are for system maintenance and load testing use only, and should not be manipulated during normal operation of the G-Force® BXi ILD. Operation of the Jog Switch buttons during normal operation increases the risk of personal injury to the operator.

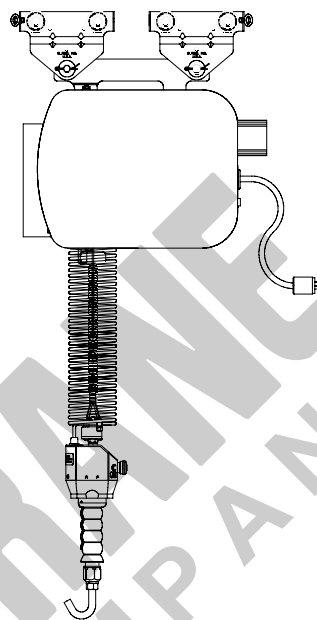
## CORRECT G-FORCE® INSTALLATION ORIENTATION



150# BXi G-Force®



300/380# BXi G-Force®



### WARNING

The BXi G-Force® was designed and fully life tested in the installation orientation shown above. Any modification to the installation orientation of the BXi G-Force® without the written consent from Gorbels, Inc. Engineering will immediately void the warranty. Please contact the factory if a modification to the installation orientation shown above is desired.

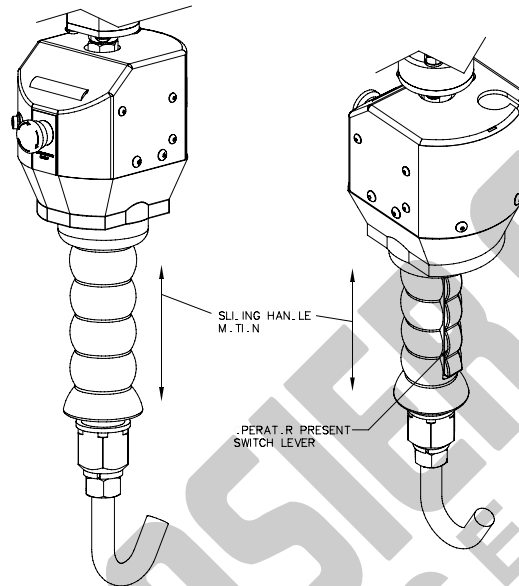
## G-FORCE® BXi ILD MAIN ASSEMBLY COMPONENT DESCRIPTION

**Standard Assembly:** The G-Force® BXi ILD consists of three (3) main assemblies and they are as follows:

- 1) **Actuator:** The Actuator assembly contains the main lifting power transmission of the G-Force® BXi ILD. The drive assembly of the Actuator consists of the ServoMotor with failsafe brake, Gearbox, Main Drum Pulley, and Controls. The Actuator assembly also contains the Upper and Lower Limit Switches. **See the Lift Functionality and Controls Interface Feature sections for additional details.**
- 2) **Coil Cord:** The Coil Cord assembly carries the signals from the Handle back to the Controls in the Actuator assembly. The Coil Cord carries signals back to the Controls for lift speed, lift direction, E-Stop, and Float Mode (if equipped). Caution must be taken to not over-rotate the Handle, as serious damage can occur when the Coil Cord binds up around the wire rope.
- 3) **Handle:** The Handle is the main interface between the operator and the lifting device. The Handle comes standard equipped with a lifting hook. The supplied lifting hook can be removed and replaced with customer tooling. Tooling must meet the guidelines set forth by Gorbels, Inc. Improper tooling integration will result in degraded performance and premature failure of the G-Force® BXi ILD. **See the Lift Functionality and Controls Interface Feature sections for additional functionality located at the Handle.**

## LIFT FUNCTIONALITY

**Standard Operation:** The Gorbel® G-Force® Bxi ILD is a servomotor driven, high speed, ergonomic materials handling device. When the device is in the standard operational mode, the sliding handle of the hand controller commands the z-axis direction and speed of the lift (**reference Diagram A**). The handle has a center neutral position and can slide up and down to provide up and down speed commands to the control system. The further the handle is displaced from the neutral position the faster the servo movement to lift or lower the load. The operator lifts or lowers the load by grasping the handle and moving it up or down as if it were an extension of the operator's arm. The lift moves slightly slower when a heavy load is lifted, thereby giving the operator some feel for the weight of the load and thus reducing inertial forces. When depressed, the operator present switch in the handle activates the servomotor (**reference Diagram A**). Depressing the operator present switch also releases an electrically operated mechanical failsafe holding brake in the motor.



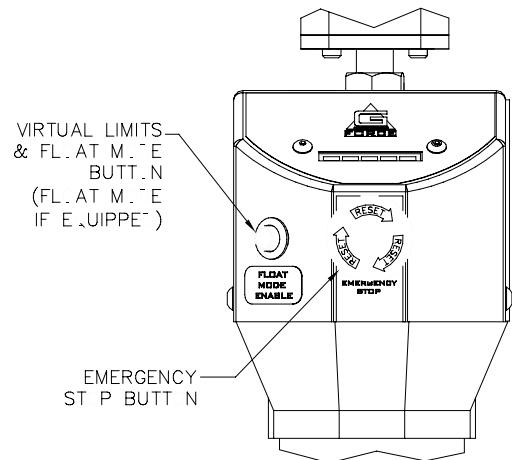
**Diagram A.** Sliding Handle - Operator Present Switch Lever.

**Float Mode (System Option):** This mode is initiated by simply pressing the Float Mode Enable button on the hand controller. In this mode, the operator can simply handle the load directly with either one or two hands and cause the load to raise or lower by applying either an upward or downward force on the load. This mode overrides the need to depress the operator present switch. The greater the force applied, the faster the load will move. There is a standard setting in the controls that safely limits the maximum speed of travel in Float Mode. Actuating the operator present switch while in Float Mode will cause the unit to exit float. While in Float Mode, the load cannot be increased or decreased because this may cause unwanted motion. Float Mode must be reinitiated each time the weight of the live load is changed. The Float Mode enable button is located on the face of the handle (**reference Diagram B**).

**Virtual Limits and Speed Reduction Points:** Five different settings can be used to limit or reduce the speed and/or vertical lift of a Bxi model G-Force®. These settings are referred to as Virtual Limits and Speed Reduction Points. Following is a description of each of these five settings.

The **UPPER LIMIT** acts as a software-controlled limit switch, preventing the handle from traveling above the defined point.

The **LOWER LIMIT** acts as a software-controlled limit switch, preventing the handle from traveling below the defined point.



**Diagram B.** E-Stop, Virtual Limit, and Float Mode (optional) Buttons.

Three different settings are included for Speed Reduction.

The **UPWARD SPEED REDUCTION POINT** reduces the speed of the G-Force® to a speed that is 25% of the maximum speed the G-Force® is set to. The G-Force® will travel at the reduced speed above the point which the Upward Speed Reduction Point is set.

#### WARNING

If the Upward Speed Reduction Point is being used to reduce the impact of engaging the load “on the fly” (i.e. catching the load with a hook while the G-Force® is already in motion in the upward direction), care must be taken to ensure the speed reduction takes place before the load is engaged. Depending on the upward speed of the G-Force®, it may take several inches of travel for the unit to fully decelerate to the reduced speed.

The **UPWARD RESUME SPEED POINT** is used in conjunction with the Upward Speed Reduction Point to create a defined zone within which the G-Force® will travel in the upward direction at the reduced speed. When an Upward Speed Reduction Point is set, the Upward Resume Speed Point will allow the G-Force® to continue traveling at normal speed above the point which the Upward Resume Point is set.

#### WARNING

A minimum of up to two inches must be allowed between the **UPWARD SPEED REDUCTION POINT** and the **UPWARD RESUME SPEED POINT** in order for the G-Force® to fully decelerate before resuming full speed.

The **DOWNWARD SPEED REDUCTION POINT** reduces the speed of the G-Force® to a speed that is 25% of the maximum speed the G-Force® is set to. The G-Force® will travel at the reduced speed below the point which the Downward Speed Reduction Point is set.

#### WARNING

If the Downward Speed Reduction Point is being used to reduce the impact of setting down the load, care must be taken to ensure the speed reduction takes place before the load impacts the surface it is being set down on. Depending on the downward speed of the G-Force®, it may take several inches of travel for the unit to fully decelerate to the reduced speed.

**Emergency Stop Button:** When depressed, the Emergency Stop (E-Stop) button cuts off all power to the Controls, and sets the mechanical fail-safe brake. The E-Stop button is located on the face of the handle (*reference Diagram B*, page 7). The G-Force® can't operate until the E-Stop has been reset.

**Overload:** The servo controller will prevent the lift from moving upward if loaded beyond the maximum capacity of the G-Force® BXi ILD. When an overload condition is sensed the Overload indicator is illuminated and the lift is prevented from moving upward. The lift may be moved down to allow for the safe removal of the load. Releasing and reactivating the operator present switch resets the overload condition.

**Limit Switches:** The G-Force® is equipped with both mechanical Upper and Lower Limit switches, located in the Actuator assembly. When the Upper Limit switch is triggered, the upward motion of the lift stops quickly at a controlled deceleration rate. The controlled deceleration rate guarantees the load cannot come off the hook. When the Upper Limit is triggered the lift will move down but not up. The lower limit is set so that a minimum of two full wraps of wire rope remain on the drum pulley at all times. When the Lower Limit switch is triggered, the downward motion of the lift stops quickly at a controlled deceleration rate. When the Lower Limit is triggered, the lift will only move up and not down.

**Slack Switch:** The G-Force® is equipped with a pair of Slack Switches that sense tension in the wire rope and trips when the wire rope develops slack. The switches are located inside the Actuator assembly. When the Slack Switches sense slack in the wire rope, downward movement of the lift is stopped to minimize the amount of wire rope unwound from the drum pulley. When slack in the wire rope is sensed, the lift will only move up but not down.



**Remote Mount Handle (System Option):** The lifting device is capable of operating with the handle displaced from the wire rope (not in-line with the wire rope). For example, if an end user has tooling that is too large for the operator to safely reach and operate the handle in the standard position, remote mounting the handle is recommended. The tooling must be mounted (and balanced) on the end of the wire rope, while the handle can be remote mounted. The tooling **must** be attached to the end of the wire rope with a swivel assembly (supplied by Gorbel, Inc.). Failure to mount the tooling with a swivel assembly can result in premature failure of both the wire rope and the coil cord. The remote mounted handle is linked to the coil cord via extension cables and connectors. The handle operates exactly the same as if it were mounted in-line. If the device is equipped for Float Mode, a load cell assembly is provided that must also be mounted between the tooling and the end of the wire rope. The handle is linked to the load cell via an extension cable and connectors. \*\*The end user must supply Gorbel with the required length of the extension cables such that they can be safely routed and clamped to the tooling. Always include the distance for bends and turns, when providing the extension length.

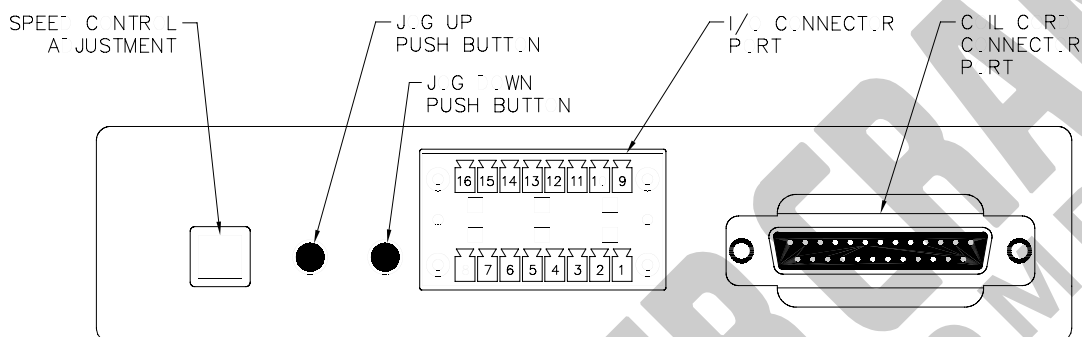


Diagram C. Controls Interface Display.

## CONTROLS INTERFACE FEATURES

1. **Jog Switch Push Buttons:** The Jog Switch Buttons allow qualified personnel to replace the wire rope (load cable) on the system. To effectively operate the Jog Switch Buttons, all electrical cables must be connected and power on. Depressing the “Up” jog switch button will enable the motor and cause the system to reel the wire rope into the actuator and onto the main pulley. Depressing the “Down” jog switch button will enable the motor and cause the system to pay out the wire rope from the actuator and off of the main pulley. The handle and operator present switch are not to be operated during use of the Jog Switch Buttons.

### WARNING

The Jog Switch buttons are for system maintenance and load testing use only, and should not be manipulated during normal operation of the G-Force® BXi ILD. Operation of the Jog Switch buttons during normal operation increases the risk of personal injury to the operator.

2. **Speed Control Adjustment:** The 10 position Speed Control adjustment switch allows the operator to adjust the speed of the lifting device with a small flathead screwdriver.
3. **Power Up Diagnostic Mode:** When the “E-stop” button is released and power is applied to the lift, the servo motor controller goes into a power up diagnostic mode test. The following are the sections to the diagnostic mode test:

- a) **LED Indicator Test:** The purpose of this test is to verify the five (5) indicator LEDs are functional. When the E-stop button is released, the yellow “Power On” LED comes on immediately, indicating the internal 24 volt power is operational. After the servo controller completes a series of self-tests, it turns on the four (4) remaining LEDs for two (2) seconds to simply verify functionality.

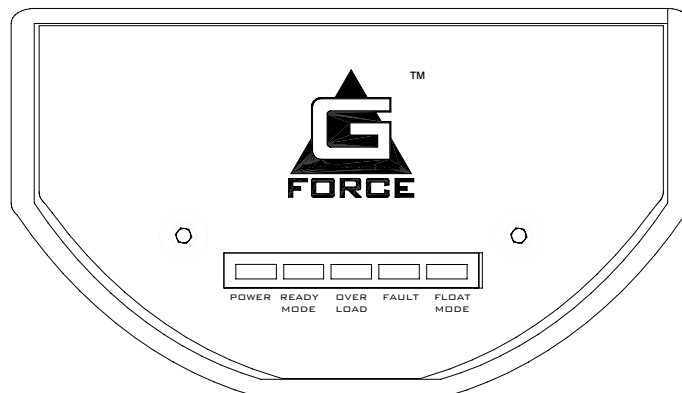


Diagram D. BXi Handle LED Display.



- b) **Switch Test:** After completion of the indicator test, a system switch test is started. The purpose of this test is to display the state of the “Slack” switches and “Upper and Lower Limit” switches. During the switch test, the orange “Overload” LED will flash if the “Upper Limit” switch is triggered (up limit state) and the red “System Fault” LED will flash if the “Slack” switches are triggered (wire rope slack). Once the operator present switch or jog switch is activated the servo motor controller exits the power up diagnostic mode and goes into normal operation.

**NOTE:** The yellow Power On indicator will remain on during the power up diagnostic mode test.

4. **Power On LED (Yellow):** The “Power On” LED illuminates when the required 220VAC, single-phase power has been correctly applied to the system, and the E-Stop button has been released.
5. **Standard Mode LED (Green):** The “Standard Mode” LED illuminates when all system initialization is complete and the operator present switch is depressed, thus activating the standard mode of operation.
6. **Capacity Overload LED (Orange):** The “Capacity Overload” LED illuminates when a load or impact greater than the capacity of the hoist has been detected by the system. When this LED illuminates, the controller will allow the operator to lower the load, but it will inhibit the operator from raising the load prior to “resetting” the system. To clear the overload fault and “reset” the system, released the switch for approximately 1 to 2 seconds. Once the LED turns off, the system can again be operated.
7. **Float Mode LED (Blue):** If the unit is equipped with Float Mode (system option), the “Float Mode” enabled LED will illuminate when the Float Mode button is pressed on the hand controller and Float Mode has been initiated.
8. **System Fault LED (Red):** The “System Fault” LED flashes when basic faults have been detected by the control system. If a fault has occurred, the “Standard Mode” or “Float Mode” (if equipped) LED’s will turn off.



## TECHNICAL SPECIFICATIONS

| <b>BX Series</b>  | <b>150 lbs.</b>  | <b>300 lbs.</b>  | <b>380 lbs.</b>  |
|---|--|--|--|
| Maximum Capacity (Load & Tool)                                | 150 lbs.   | 300 lbs.   | 380 lbs.   |
| Max Lifting Speed<br>Unloaded (feet per minute)               | 275 fpm  | 138 fpm  | 98 fpm   |
| Max Lifting Speed<br>Fully Loaded (feet per minute)           | 200 fpm  | 100 fpm  | 71 fpm   |
| Max Float Mode (Option) Lifting<br>Speed (feet per minute)    | 131 fpm  | 88 fpm   | 63 fpm   |
| Max Lift Stroke   | 7 ft   | 7 ft   | 7 ft   |
| Primary Lift Voltage  | 220 VAC (1 Phase)<br>+ 20%, - 20%                                | 220 VAC (1 Phase)<br>+ 20%, - 20%                                | 220 VAC (1 Phase)<br>+ 20%, - 20%                                |
| Amps  | 5  | 5  | 5  |
| Capacity Overload Safety                                      | Yes  | Yes  | Yes  |
| LED Indicator Lights  | Yes  | Yes  | Yes  |
| Anti-Recoil   | Yes  | Yes  | Yes  |
| Failsafe Brake  | Yes  | Yes  | Yes  |
| Float Mode Capable  | Yes (Option)   | Yes (Option)   | Yes (Option)   |
| Inertia Management  | Yes  | Yes  | Yes  |
| Precision Lift Capability                                     | Yes  | Yes  | Yes  |
| Drive/Control System  | Servo  | Servo  | Servo  |
| Speed Adjustment  | Yes  | Yes  | Yes  |
| Jogging Capability  | Yes  | Yes  | Yes  |
| Media   | Wire Rope  | Wire Rope  | Wire Rope  |
| Duty Cycle  | H5   | H5   | H5   |
| Virtual Limits (Upper Limit, Power<br>Limit, Speed Reduction) | Yes  | Yes  | Yes  |
| Weight Readout / Output                                       | Yes (Option)   | Yes (Option)   | Yes (Option)   |
| Cycle Counting  | Yes (Option)   | Yes (Option)   | Yes (Option)   |
| Capacity Overload Threshold<br>Adjustability                  | Yes (Option)   | Yes (Option)   | Yes (Option)   |
| User Accessible Inputs / Outputs                              | (4) 24VDC Inputs<br>(4) Relay Outputs<br>(1) E-Stop Relay Output | (4) 24VDC Inputs<br>(4) Relay Outputs<br>(1) E-Stop Relay Output | (4) 24VDC Inputs<br>(4) Relay Outputs<br>(1) E-Stop Relay Output |
| DeviceNet Data Output   | Yes (Option)   | Yes (Option)   | Yes (Option)   |
| Power Available for Tooling                                   | 24 VDC, 0.5 Amps   | 24 VDC, 0.5 Amps   | 24 VDC, 0.5 Amps   |

## INSTALLATION

### STEP 1 - UNPACKING THE G-FORCE® BXI ILD

➡ **TIP:** Packing list can be found in plastic pocket attached to shipping box.

1.1 Carefully remove all items from the box.

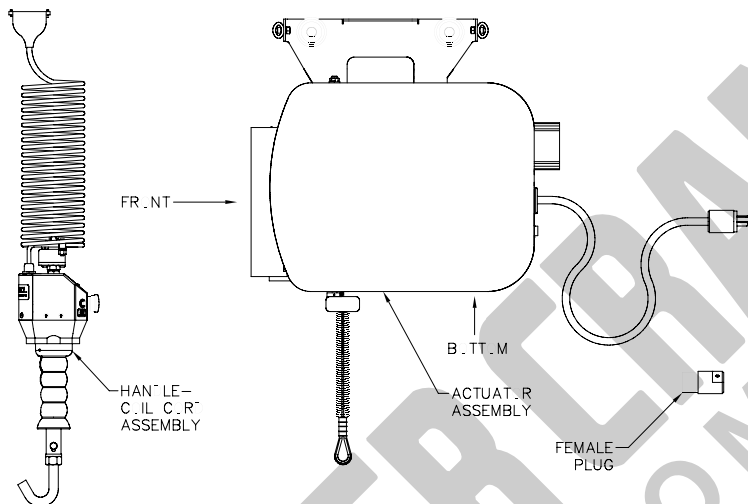


Diagram 1A. 150# BXi series shipped components.

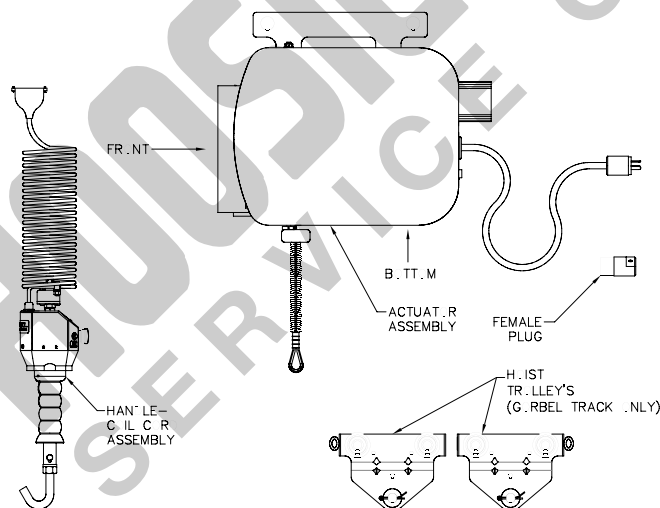


Diagram 1B. 300/380# BXi series shipped components.

1.2 Verify that all components listed on the packing slip are included.

1.3 If any items are missing or were damaged during shipping, please contact Gorbel® Customer Service immediately.

## STEP 2 - PRE-ASSEMBLY

- 2.1 Read entire installation manual **before** beginning installation of the G-Force® BXi ILD.
- 2.2 Tools and materials typically needed to install/assemble a G-Force® BXi ILD are as follows:
- Hand tools
  - Plastic cable tie straps
  - Ladders/man lifts
- 2.3 Prior to installing the G-Force® BXi ILD, it is a good idea to familiarize yourself with the main components.
- Reference the following layout drawings:
    - **Figure I1**, page 69 - 150# BXi Standard Inline Component Layout
    - **Figure I2**, page 70 - 300/380# BXi Standard Inline Component Layout
    - **Figure I3**, page 71 - Standard Remote Mount Component Layout
    - **Figure I4**, page 72 - Float Mode Remote Mount Component Layout

## STEP 3 - HANDLE-COIL CORD INSTALLATION (STANDARD INLINE)

➡ **TIP:** This step is best completed on a workbench, prior to installation of the Actuator into the bridge system.

**Note:** For Standard Remote Mounted Handle-Coil Cord Installation, go to Step 3A, page 14.  
For Float Mode Remote Mounted Handle-Coil Cord Installation, go to Step 3B, page 15.

- 3.1 Remove the Cotter and Clevis Pin from the Handle swivel assembly.
- 3.2 Feed the wire rope from the Actuator assembly through the center of the Coil Cord. Slide the looped end of the wire rope assembly into the yoke of the Handle swivel assembly (**reference Diagram 3A**).
- 3.3 Re-insert the Clevis and Cotter Pin capturing the wire rope assembly in the Handle swivel assembly (**reference Diagram 3A**).
- 3.4 Remove the Coil Cord mounting clamps from the bottom side of the Actuator assembly (**reference Diagram 3B**, page 14).
- 3.5 Assemble the Coil Cord to the clamps by capturing the cord in the opening in the clamp (**reference Diagram 3B**, page 14).
- 3.6 Re-assemble the Coil Cord mounting clamps to the bottom side of the Actuator assembly (**reference Diagram 3B**, page 14).
- 3.7 Adjust the Coil Cord in the clamps so that the Coil Cord Connector is conveniently located on the proper side of the Actuator assembly (**reference Diagram 3B**, page 14).

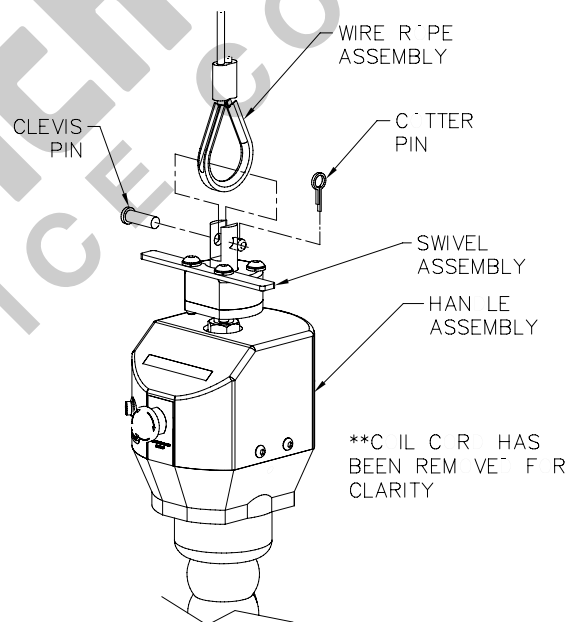
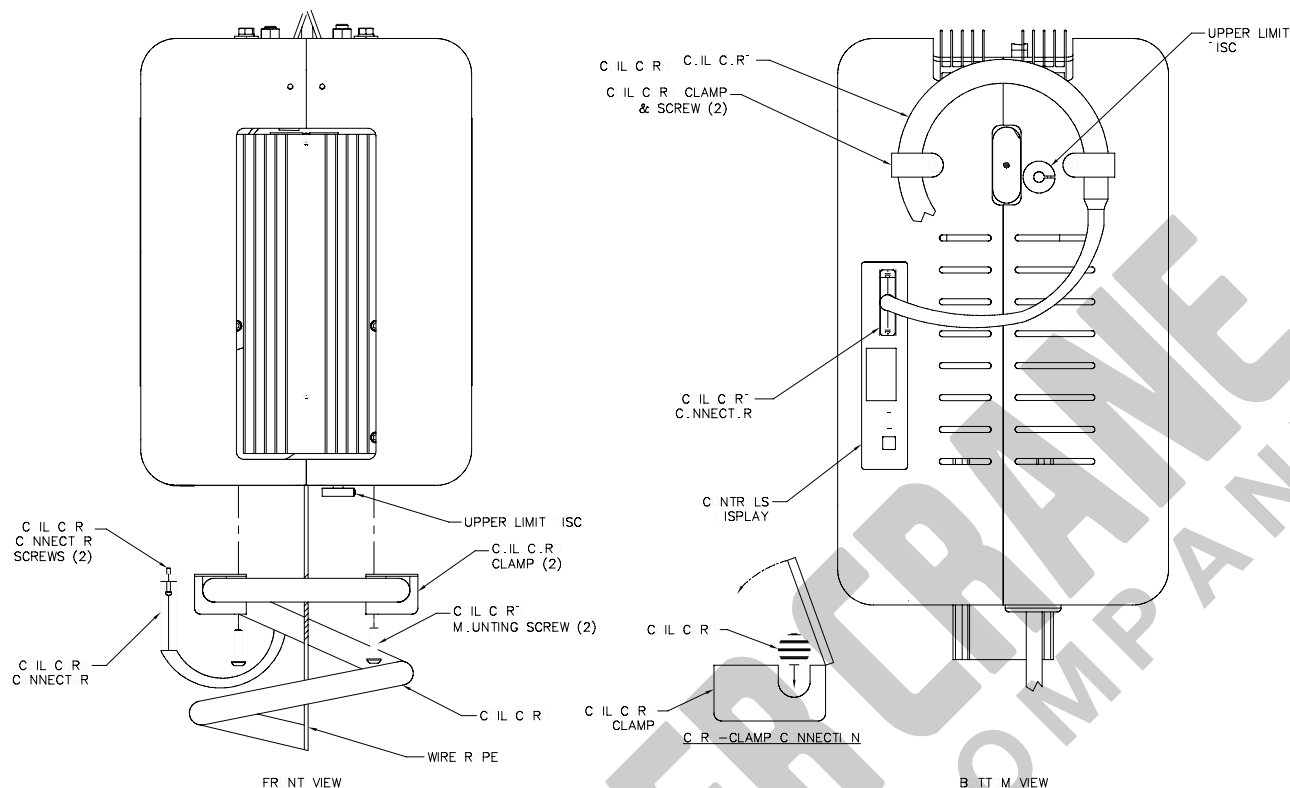


Diagram 3A. Handle to Wire Rope assembly.

- 3.8 Connect the Coil Cord Connector to the plug on the Control's Interface located on the bottom side of the Actuator assembly (**reference Diagram 3B**, page 14).
- 3.9 Assure that the coils of the Coil Cord are centered around the wire rope when properly installed. When the proper alignment of the Coil Cord has been achieved finish clamping the hardware to fix the Coil Cord in place (**reference Diagram 3B**, page 14).

Continue to Step 4 on Page 16.



**Diagram 3B.** *Coil Cord to Actuator assembly.*

### STEP 3A - HANDLE-COIL CORD INSTALLATION (STANDARD REMOTE MOUNTED)

➡ **TIP:** This step is best completed on a workbench, prior to installation of the Actuator into the bridge system.

- 3A.1** Attach the wire rope Swivel assembly directly to the end tooling (**reference Figure I3**, page 71).
- 3A.2** Remove the Cotter and Clevis Pin from the Swivel assembly.
- 3A.3** Feed the wire rope from the Actuator assembly through the center of the Remote Mount Coil Cord. Slide the looped end of the wire rope assembly into the yoke of the Swivel assembly (**reference Diagram 3A**, page 13). The Handle in **Diagram 3A**, page 13, will be replaced by the customer end tooling.
- 3A.4** Re-insert the Clevis and Cotter Pin capturing the wire rope assembly in the Swivel assembly (**reference Diagram 3A**, page 13). The Handle in **Diagram 3A**, page 13, will be replaced by the customer end tooling.
- 3A.5** Remove the Coil Cord mounting clamps from the bottom side of the Actuator assembly (**reference Diagram 3B**).
- 3A.6** Assemble the Remote Mount Coil Cord to the clamps by capturing the cord in the opening in the clamp (**reference Diagram 3B**).
- 3A.7** Re-assemble the Remote Mount Coil Cord mounting clamps to the bottom side of the Actuator assembly (**reference Diagram 3B**).
- 3A.8** Adjust the Remote Mount Coil Cord in the clamps so that the Coil Cord Connector is conveniently located on the proper side of the Actuator assembly (**reference Diagram 3B**).
- 3A.9** Connect the Coil Cord Connector to the plug on the Control's Interface located on the bottom side of the Actuator assembly (**reference Diagram 3B**).

- 3A.10** Assure that the coils of the Remote Mount Coil Cord are centered around the wire rope when properly installed. When the proper alignment of the Remote Mount Coil Cord has been achieved, finish clamping the hardware to fix the Remote Mount Coil Cord in place (**reference Diagram 3B**, page 14).
- 3A.11** Attach the Standard Remote Mount Handle to the Tooling, being sure to mount at both the top and bottom of the Remote Mount Handle assembly (**reference Figure 13**, page 71). Assure that the mounting arrangement does not effect the operating function of the Handle.

#### WARNING

**Remote Mount G-Force® BXi Handles must be mounted at both the top and bottom of the Handle assembly. Failure to mount the Remote Mount Handle at top and bottom can result in undesirable performance and/or premature component failure.**

- 3A.12** Connect the Remote Mount Coil Cord Extension cable from the Remote Mount Handle to the Remote Mount Coil Cord. Securely clamp the Remote Mount Coil Cord Extension cable to the tooling as needed (**reference Figure 13**, page 71).

Continue to Step 4 on page 16.

### STEP 3B - HANDLE-COIL CORD INSTALLATION (FLOAT MODE REMOTE MOUNTED)

➡ **TIP:** This step is best completed on a workbench, prior to installation of the Actuator into the bridge system.

- 3B.1** Attach the Load Cell - Swivel assembly directly to the end tooling (**reference Figure 14**, page 72).
- 3B.2** Remove the Cotter and Clevis Pin from the Swivel assembly.
- 3B.3** Feed the wire rope from the Actuator assembly through the center of the Remote Mount Coil Cord. Slide the looped end of the wire rope assembly into the yoke of the Swivel assembly (**reference Diagram 3A**, page 13). The Handle in **Diagram 3A**, page 13, will be replaced by the customer end tooling.
- 3B.4** Re-insert the Clevis and Cotter Pin capturing the wire rope assembly in the Swivel assembly (**reference Diagram 3A**, page 13). The Handle in **Diagram 3A**, page 13, will be replaced by the customer end tooling.
- 3B.5** Remove the Coil Cord mounting clamps from the bottom side of the Actuator assembly (**reference Diagram 3B**, page 14).
- 3B.6** Assemble the Remote Mount Coil Cord to the clamps by capturing the cord in the opening in the clamp (**reference Diagram 3B**, page 14).
- 3B.7** Re-assemble the Remote Mount Coil Cord mounting clamps to the bottom side of the Actuator assembly (**reference Diagram 3B**, page 14).
- 3B.8** Adjust the Remote Mount Coil Cord in the clamps so that the Coil Cord Connector is conveniently located on the proper side of the Actuator assembly (**reference Diagram 3B**, page 14).
- 3B.9** Connect the Coil Cord Connector to the plug on the Control's Interface located on the bottom side of the Actuator assembly (**reference Diagram 3B**, page 14).
- 3B.10** Assure that the coils of the Remote Mount Coil Cord are centered around the wire rope when properly installed. When the proper alignment of the Remote Mount Coil Cord has been achieved finish clamping the hardware to fix the Remote Mount Coil Cord in place (**reference Diagram 3B**, page 14).
- 3B.11** Attach the Standard Remote Mount Handle to the Tooling, being sure to mount at both the top and bottom of the Remote Mount Handle assembly (**Figure 14**, page 72). Assure that the mounting arrangement does not affect the operating function of the Handle.



## WARNING

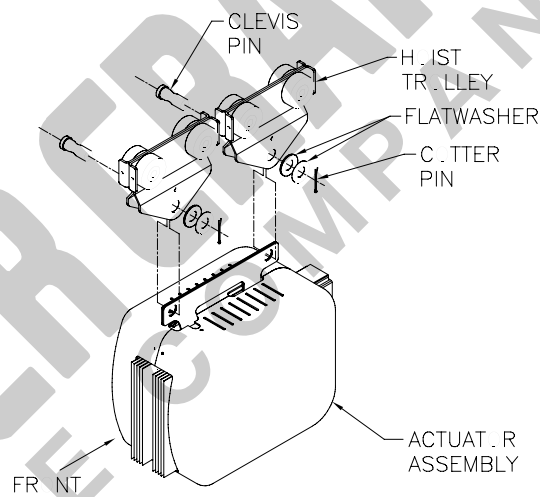
**Remote Mount G-Force® BXi Handles must be mounted at both the top and bottom of the Handle assembly. Failure to mount the Remote Mount Handle at top and bottom can result in undesirable performance and/or premature component failure.**

- 3B.12** Connect the Remote Mount Coil Cord Extension cable from the Remote Mount Handle to the Remote Mount Coil Cord. Connect the Float Mode Extension cable from the Remote Mount Handle to the Remote Mounted Load Cell assembly. Securely clamp the Remote Mount Coil Cord Extension and Float Mode Extension cables to the tooling as needed (*reference Figure 14*, page 72).

## STEP 4 - INSTALLING THE ACTUATOR ASSEMBLY

- 4.1** Verify that the G-Force® BXi ILD trolley wheels are correct for the style and capacity track that the unit is being installed on. **Note:** Standard 150# G-Force® BXi ILDs come with the wheels pre-assembled to the Actuator Trolley. Standard 300 and 380# G-Force® BXi ILDs are supplied with an assembled Actuator Adapter Trolley and two (2) properly sized Hoist Trolleys when being installed in a Gorbel® Bridge system. The customer must provide two (2) Hoist Trolleys when the unit will run in a non-Gorbel® Bridge system. 150# G-Force® BXi ILDs can also be supplied with an Actuator Adapter Trolley, similar to that of the 300 and 380# units.

- 4.2 300 and 380# G-Force® BXi ILD:** Assemble the Hoist Trolleys to the Actuator Adapter Trolley. Remove the Clevis Pin and flat washers from the Hoist Trolleys. Slide the Trolley legs over the Adapter Trolley and align the holes. Re-assemble the Clevis Pin and washers to the Hoist Trolleys (*reference Diagram 4A*).



**Diagram 4A.** 300/380# BXi Actuator-Hoist Trolley Assembly.

- 4.3** Remove the end stop from the Bridge and install the G-Force® Actuator into the track. Immediately re-install the end stops. Roll the Actuator assembly along the full length of the Bridge to assure that the travel is smooth throughout.

## STEP 5 - ELECTRICAL POWER CONNECTION

**TIP:** Do not connect to main power until all assembly is complete.

### STANDARD

- 5.1** Prior to final wiring, inspect the entire system to assure that all connections are seated properly and are without kinks or bends. Verify the following connections:
- a) Coil Cord to Handle
  - b) Coil Cord to Actuator Assembly
- 5.2** Connect a 220 VAC single-phase power source through a Disconnect Switch (by others) to the festooned power cabling (not provided with G-Force® BXi ILD).

## WARNING

**Source power to the BXi G-Force® unit is to measure 220 VAC (1 Phase) +/- 20%. Minimum Voltage = 176 VAC. Maximum Voltage Must NOT Exceed 264 VAC. Voltages greater than 264 VAC will result in premature Controls failure.**

- 5.3** Wire the Female Turnlock Power Plug (provided) to the end of the festooned power cable.

- 5.4 After verifying the Disconnect Switch is turned **OFF**, connect the newly installed receptacle to the Male Plug at the G-Force® BXi ILD.

## STEP 6 - AIR CONNECTION (OPTION)

➡ **TIP:** G-Force® BXi ILD units (Standard Inline or Remote Mounted) that are ordered with Air power have a 3/8" ID Nycoil air hose integrated into the full length of the Coil Cord. The Coil Cord is provided with two (2) Male fittings located at both ends of the air hose. Gorbels also provides both mating Female fittings for 3/8" ID air hose.

- 6.1 Assemble one of the Female fittings (provided) to the end of the input air hose (not provided).
- 6.2 Assemble the other Female fitting (provided) to the end of the tooling airline (not provided).
- 6.3 Connect both fittings to the respective ends of the Nycoil air hose in the Coil Cord.
- 6.4 Release the valve supplying air to the G-Force® BXi ILD. Inspect and assure that all connections are properly made, and there are no air leaks.

## STEP 7 - INITIAL POWER-UP

➡ **TIP:** Do not depress the operator present switch on the Handle during startup.

- 7.1 Turn on the Disconnect Switch (by others) to apply power to the G-Force® BXi ILD.
- 7.2 Disengage the Emergency Stop (E-stop) button located on the front face of the handle.
- 7.3 The system will complete the "Power Up Diagnostic Test" described in the "Controls Interface Features" section of this manual on pages 9 & 10.
- 7.4 When the "Power Up Diagnostic Test" has been successfully completed the unit is ready for operation.
- 7.5 Standard Operation: Depress the operator present switch on the Handle and run the unit up and down several times (at least 20 times in each direction) to assure that there is no mechanical binding in the lift system or electrical connection issues.
- ➡ **TIP:** The operator should always keep the operator present switch depressed while operating the unit in Standard Mode. Frequent pressing and releasing of the operator present switch (which is common for first time users) will result in jerky movement, and is not recommended.
- 7.6 Float Mode (if equipped): Lift up a load greater than 20 lbs. Settle the Load and depress the "Float Mode Enabled" button. \*\*\*Do not hold onto the part while initiating Float Mode.\*\*\* This will give the unit a false reading and cause excessive drift. Grasping the load, run the unit up and down several times (at least 20 times in each direction) to assure proper operation. Float Mode should provide a nice smooth feel.
- 7.7 Finally test the operation of any special tooling that may have been integrated to the G-Force® BXi ILD.

### WARNING

Gorbels, Inc., does not provide integrated tooling for the G-Force® BXi ILD. All tooling related questions should be directed to the tooling manufacturer or supplier.

## STEP 8 - ADJUSTING LIFT SPEED

- 8.1 Take note of the speed of the unit as it is raised and lowered during Step 7. The speed of the G-Force® BXi ILD can be adjusted using the 10 position Speed Selector switch located at the Controls Interface back at the bottom face of the Actuator assembly.

- 8.2 Using a small flat-head screwdriver, the position of the switch can be turned to any of the positions that are numbered from 0 to 9. If a slower speed is desired, position the switch to a smaller number (towards 0). If a faster speed is desired, position the switch to a larger number (towards 9).

## STEP 9 - SETTING VIRTUAL LIMITS AND SPEED REDUCTION POINTS

- 9.1 Move the handle to the point at which you would like to define a Virtual Limit or Speed Reduction Point.

### WARNING

Ensure the G-Force® is in standby mode **WITHOUT** the Operator Present Switch engaged and Float Mode must be off.

- 9.2 Press and hold the Float Mode Enable button for 2 seconds, or until all of the LEDs on the handle are illuminated. This sets the G-Force® to Program Mode.
- 9.3 Release the Float Mode Enable button. You are now in Program Mode (assuming the LEDs are still illuminated).
- 9.4 Press and release the Float Mode Enable button the number of times that correspond to the point you want to set (see table below).
- 9.5 Once the selected point is set, the LEDs will turn off and the G-Force® is ready for operation.

**NOTE: Program Mode must be entered before defining each point.**

| Number of Button Presses | Function   |
|--------------------------|--|
| 1                        | Sets the <b>UPPER LIMIT</b>                          |
| 2                        | Sets the <b>LOWER LIMIT</b>                          |
| 3                        | Sets the <b>DOWNWARD SPEED REDUCTION POINT</b>       |
| 4                        | Clears all Virtual Limits and Speed Reduction Points |
| 5                        | Sets the <b>UPWARD SPEED REDUCTION POINT</b>         |
| 6                        | Sets the <b>UPWARD SPEED RESUME POINT</b>            |

## STEP 10 - FLOAT MODE (OPTION)

- 10.1 Lift and steady the load.
- 10.2 Without applying any external forces to the load, press the Float Mode Button for one (1) second. When done correctly the "Blue" LED light will turn on (the "Yellow" LED will remain on as well).

### WARNING

If external forces are applied to the load while Float Mode is being initiated, the G-Force® will calculate a baseline weight that is higher or lower than the actual weight being lifted. When the external force is removed, the load will begin to drift in the opposite direction of the load that was applied.

- 10.3 The direction and speed of travel is now being controlled by the amount of force that the operator exerts directly onto the load. To move the load down, put vertical pressure on the load in down direction. To move the load up, lift up on the load in the vertical up direction. The higher the force exerted on the load, the faster the unit moves.

### WARNING

NEVER remove the load from the G-Force® while still in Float Mode. The drive will interpret the removal of the load as operator intent to lift the load. Therefore, the Handle will begin to drift up. The speed of the Handle drift directly correlates to the weight that was removed from the unit. The heavier the weight, the faster the Handle will travel.

## STEP 11 - FINAL STEPS

➡ **TIP:** Gorbel® Customer Service is available from 7am to 7pm Eastern Time Monday - Thursday and 7am to 5pm Eastern Time Friday.

**11.1** Please contact the Gorbel® factory (585-924-6262) if any of the following occur. **DO NOT ATTEMPT TO REPAIR UNIT YOURSELF.**

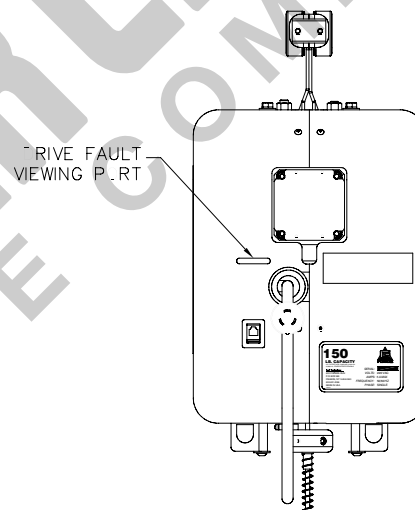
- Excessive noise
- Unexpected operation
- Change in performance
- Damage or excessive wear to unit components
- Questions about the unit arise

Please do not be limited by these items only.

**11.2** Keep Packing List, Installation Manual, Drawings, and any other inserts filed together in a safe place.

### DRIVE FAULT TROUBLESHOOTING CHART

A fault occurs when there is a flashing “Red” LED on the Handle after the diagnostic check is completed. Two short flashes, followed by a long pause indicates that a Drive Fault has occurred. The Servo Drive in the BXi G-Force® ILD is equipped with a Drive Status LED Display. This is a 5-Digit seven-segment display, which indicates the current status of the driver. A fault on the drive would be represented by AL-## which indicates an alarm with an associated two digit number. These Alarm Codes are listed in the charts on the next couple of pages. The Alarm Codes can be viewed from outside the G-Force® by looking through the Drive Fault Viewing Port located on the backside of the Actuator Assembly (as shown to the right). Three short “Red” flashes followed by a long pause indicates a “Following Error”. This specific error can occur when the applied motor parameters are not well tuned, and result in the large following error. All standard G-Force® units are setup with properly tuned motor settings for standard handles. Therefore, following errors are more likely to occur with custom G-Force® units or one with specialized tooling. Please contact Gorbel for further information.



| ALARM CODE                              | DESCRIPTION   | RECOVERY STEPS   |
|---|---|--|
| AL-01<br>Internal Power<br>Module Error | Driver has detected the following: <ul style="list-style-type: none"><li>• Overcurrent</li><li>• Overheat</li><li>• Gate voltage drop</li></ul> | 1. Verify the ambient temperature is not over 55° C.<br>2. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.   |
| AL-02<br>Overvoltage                    | DC power bus exceeds 420 VDC.   | 1. Verify the power supply is within 176 VAC to 264 VAC.<br>2. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.   |
| AL-03<br>Undervoltage                   | DC power bus below 200 VDC.   | 1. Verify the power supply is within 176 VAC to 264 VAC.<br>2. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.   |
| AL-06<br>Resolver Open                  | Resolver feedback signal drops below 0.34 VAC.  | 1. Verify that the resolver connection between the motor and drive is not damaged or disconnected.<br>2. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced. |
| AL-07<br>Power Stage<br>Error           | Main control unit identifies a fault in the power stage of the driver.  | 1. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.   |

| ALARM CODE                                  | DESCRIPTION   | RECOVERY STEPS  |
|---|---|---|
| AL-09<br>Regen Resistor<br>Over Temperature | Excessive regen energy being dissipated by the internal or external regeneration resistor.      | <ol style="list-style-type: none"> <li>1. Verify the power supply is within 176 VAC to 264 VAC.</li> <li>2. Verify the handled load is within the limits of the hoist.</li> <li>3. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol>               |
| AL-12<br>Watchdog Timer                     | Internal CPU clock has stopped.   | <ol style="list-style-type: none"> <li>1. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol>  |
| AL-14<br>Brake Alarm                        | Sequencing of the static or dynamic brake is faulty.  | <ol style="list-style-type: none"> <li>1. Verify all connections (ribbon cables) between the servo drive and the interface board on the side of the control module.</li> <li>2. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol>                  |
| AL-15<br>Excessive<br>Current               | Motor current exceeds the rating by 120%.   | <ol style="list-style-type: none"> <li>1. Verify the hoist mechanics are not jammed and are working properly.</li> <li>2. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol>  |
| AL-16<br>Speed Amp<br>Saturated             | Internal speed loop is saturated and maximum torque is applied for more than 3 seconds.         | <ol style="list-style-type: none"> <li>1. Verify the hoist mechanics are not jammed and are working properly.</li> <li>2. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol>  |
| AL-17<br>Motor Overload                     | Calculated motor temperature exceeds rating 110%.   | <ol style="list-style-type: none"> <li>1. Verify the hoist mechanics are not jammed and are working properly.</li> <li>2. Verify the handled load is within the limits of the hoist.</li> <li>3. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol> |
| AL-18<br>Driver Overload                    | Motor current exceeds intermittent rating of driver. The driver rating is specified as follows: | <ol style="list-style-type: none"> <li>1. Verify the hoist mechanics are not jammed and are working properly.</li> <li>2. Verify the handled load is within the limits of the hoist.</li> <li>3. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol> |
| AL-19<br>Resolver Error                     | Resolver feedback error.  | <ol style="list-style-type: none"> <li>1. Verify that the resolver connection between the motor and drive is not damaged or disconnected.</li> <li>2. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol>  |
| AL-20<br>Overspeed                          | Motor speed exceeds maximum rating by 120%.   | <ol style="list-style-type: none"> <li>1. Verify that the resolver connection between the motor and drive is not damaged or disconnected.</li> <li>2. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol>  |
| AL-21<br>Deviation<br>Counter Overflow      | Motor is unable to follow the commanded profile. Deviation counter exceed +/- 2 <sup>21</sup> . | <ol style="list-style-type: none"> <li>1. Verify the hoist mechanics are not jammed and are working properly.</li> <li>2. Verify the handled load is within the limits of the hoist.</li> <li>3. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol> |
| AL-26<br>Parameter<br>Setting Error         | Motor code is not set or is set improperly.   | <ol style="list-style-type: none"> <li>1. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced.</li> </ol>  |

| ALARM CODE  | DESCRIPTION   | RECOVERY STEPS   |
|---|---|--|
| AL-32<br>Absolute Home<br>Position Not Set          | Absolute Home Position has not been established. Also set with AL-6, 19, 22, 23.                | 1. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced. |
| AL-33<br>Absolute Home<br>Position Setting<br>Error | Absolute Home setting procedure is not correctly completed. Also set with AL-6, 19, 22, 23, 27. | 1. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced. |
| AL-36<br>Battery Missing                            | Battery has been disconnected when the power was OFF.   | 1. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced. |
| AL-44<br>Battery Low                                | Absolute battery voltage has fallen below 2.8 V.  | 1. Contact Gorbel® Customer Service if problem persists, as the servo drive may need to be replaced. |





## WIRE ROPE INSPECTION

---

### 1) Frequent Inspection

The operator or other designated person should visually inspect all ropes at the start of each shift. These visual observations should be concerned with discovering gross damage, such as listed below, which may be an immediate hazard:

- (a) distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion;
- (b) general corrosion;
- (c) broken or cut strands;
- (d) number, distribution, and type of visible broken wires. [See next section on rope replacement]

When such damage is discovered, the rope shall either be removed from service or given an inspection as detailed in the next section.

### 2) Periodic Inspection

The inspection frequency shall be determined by a qualified person and shall be based on such factors as expected rope life as determined by experience on the particular installation or similar installations; severity of environment; percentage of capacity lifts; frequency rates of operation; and exposure to shock loads. Inspections need not be at equal calendar intervals and should be more frequent as the rope approaches the end of its useful life.

A designated person shall perform periodic inspections. This inspection shall cover the entire length of rope. The individual outer wires in the strands of the rope shall be visible to this person during the inspection. Any deterioration resulting in appreciable loss of original strength, such as described below, shall be noted, and determination shall be made as to whether further use of the rope would constitute a hazard:

- (a) points listed in previous section on frequent inspection;
- (b) reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires;
- (c) severely corroded or broken wires at end connections;
- (d) severely corroded, cracked, bent, worn, or improperly applied end connections.

Special care should be taken when inspecting sections of rapid deterioration, such as the following:

- (a) sections in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited;
- (b) sections of rope at or near terminal ends where corroded or broken wires may protrude;
- (c) sections subject to reverse bends;
- (d) sections of ropes that are normally hidden during visual inspection, such as parts passing over sheaves.

## WIRE ROPE MAINTENANCE

---

- 1) Rope should be stored to prevent damage or deterioration.
- 2) Rope shall be unreeled or uncoiled in a manner to avoid kinking of or inducing a twist in the rope.
- 3) Before cutting rope, means shall be used to prevent unlaying of the strands.
- 4) During installation, care should be observed to avoid dragging of the rope in dirt or around objects that will scrape, nick, crush, or induce sharp bends.

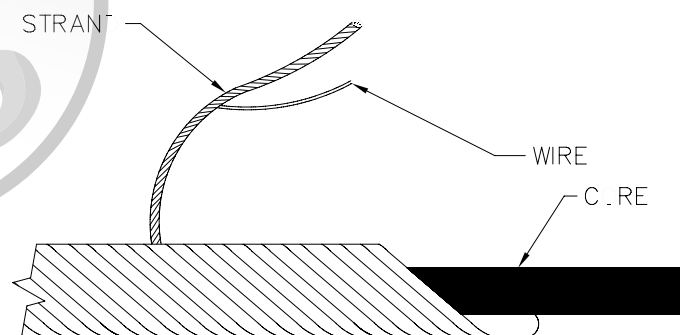
- 5) Rope should be maintained in a well-lubricated condition. Gorbelt recommends using Chain and Cable Penetrating oil for lubrication. Lubricant applied as part of a maintenance program shall be compatible with the original lubricant. Lubricant applied shall be of the type that does not hinder visual inspection. Immediately after inspection, lubricant shall be applied before rope is returned to service. Those sections of rope that are located over sheaves or otherwise hidden during inspection and maintenance procedures require special attention when lubricating ropes. The object of rope lubrication is to reduce internal friction and to prevent corrosion.

## WIRE ROPE REPLACEMENT CRITERIA

- 1) No precise rules can be given for determination of the exact time for rope replacement, since many factors are involved. Once a rope reaches any one of the specified removal criteria, it may be allowed to operate to the end of the work shift, based on the judgement of a qualified person. The rope shall be replaced after that work shift, at the end of the day, or at the latest time prior to the equipment being used by the next work shift.
- 2) Removal criteria for the rope replacement shall be as follows:
  - (a) in running ropes, 12 randomly distributed broken wires in one lay or four broken wires in one strand in one lay (**reference Diagram E**, below);
  - (b) one outer wire broken at the contact point with the core of the rope, which has worked its way out of the rope structure and protrudes or loops out from the rope structure;
  - (c) wear of one-third the original diameter of outside individual wires;
  - (d) kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure;
  - (e) evidence of heat damage from any cause;
  - (f) reductions from nominal diameter greater than those shown below:

| <u>Rope Diameter</u>  | <u>Maximum Allowable<br/>Reduction From<br/>Nominal Diameter</u> |
|-----------------------|--|
| Up to 5/16 in. (8 mm) | 1/64 in. (0.4 mm)  |

- 3) Broken wire removal criteria applies to wire rope operating on steel sheaves and drums. However, results of internal testing have shown that rope replacement follows the same criteria regardless of sheave or drum material.
- 4) Attention shall be given to end connections. Upon development of two broken wires adjacent to a socketed end connection, the rope should be resocketed or replaced. Resocketing shall not be attempted if the resulting rope length will be insufficient for proper operation.
- 5) Replacement rope and connections shall have strength rating at least as great as the original rope and connections furnished by the hoist manufacturer. A rope manufacturer, the hoist manufacturer, or a qualified person shall specify any deviation from the original size, grade, or construction.



**Diagram E. Wire Rope Composition Diagram.**

## WIRE ROPE REPLACEMENT INSTRUCTIONS

➡ **TIP:** Wire rope replacement is to be performed by qualified maintenance personnel only.

**Note:** All reference drawings below are for 150# unit. The procedure remains the same regardless of capacity.

- 1) Depress the Emergency Stop (E-Stop) button on the Handle. Disconnect power from the unit.
- 2) Remove the Covers from the Actuator assembly.
  - a) First, remove the Controls side Cover (Item #3, **Figure A13**, page 34) from the Actuator assembly. To remove this Cover you must first unscrew and remove the Coil Cord Plug from the Controls Interface. Remove the Coil Cord mounting Clamp (Item #10, **Figure A13**, page 34). Remove the three (3) mounting screws (Item #15, **Figure A13**, page 34) from the Controls side Cover only. Finally, remove the Cover mounting bolt (Item #11, **Figure A13**, page 34) at the Actuator Frame. Slide the Cover off of the Actuator assembly.
  - b) Remove the Power Cord side Cover (Item #2, **Figure A13**, page 34) from the Actuator assembly. Slide the Power Cord Grommet out of the slot in the Cover. Remove the Coil Cord mounting Clamp (Item #10, **Figure A13**, page 34). Remove the Upper Limit Switch Disc (Item #8, **Figure A13**, page 34). Finally, remove the Cover mounting bolt (Item #11, **Figure A13**, page 34) at the Actuator Frame. Slide the Cover off of the Actuator.
- 3) Remove three (3) of the Heatsink mounting bolts (Item #8, **Figure A9**, page 32), leaving the lower left bolt in place. Loosen, but do not remove, the lower left mounting bolt and rotate the Heatsink down towards the floor. This will support the Heatsink while wire rope replacement is being performed.
- 4) Remove the Nylon Drum Cover (Item #2, **Figure A8**, page 31) from the Actuator. Remove the six (6) mounting bolts and lockwashers (Item #'s: 3 & 4, **Figure A8**, page 31), and slide the Drum Cover off of the Main Drum Pulley.
- 5) Re-attach the Coil Cord Plug to the Controls Interface, and Power to the unit.
- 6) Release the Emergency Stop (E-Stop) button on the Handle. At the Controls Interface, jog the unit down until the remaining Wire Rope has been payed off of the Main Drum Pulley.
- 7) Depress the Emergency Stop (E-Stop) button on the Handle and disconnect Power to the unit.
- 8) Detach the Wire Rope from the Handle. Remove the cotter and clevis pins from the Handle Swivel assembly. Pull the damaged Wire Rope out of the Swivel assembly.
- 9) Set the Handle down on a secure base while Wire Rope replacement is taking place.
- 10) Remove the Upper Limit Donut (Item #10, **Figure A6**, page 30) from the broken wire rope assembly.
- 11) Remove the Wire Rope termination cover (Item #3, **Figure A6**, page 30) by removing the mounting bolts (Item #14, **Figure A6**, page 30) from the Main Drum Pulley.
- 12) Remove the terminated end of the Wire Rope from the Main Drum Pulley. Do so by simply lifting the terminated end out of the groove in the Drum Pulley. Pull the damaged wire rope completely out of the Actuator assembly.
- 13) Unless otherwise instructed, discard the damaged wire rope.
- 14) Remove the one (1) Extension Spring (Item #5, **Figure A5**, page 29) from the Heatsink side of the Actuator Frame, by unscrewing the shoulder mounting bolt (Item #9, **Figure A7**, page 31) attached to the Idler Guide Plate (Item #3, **Figure A7**, page 31).
- 15) Remove the two (2) Snap Rings (Item #8, **Figure A7**, page 31) from the Idler Pulley Shafts (Item #4, **Figure A7**, page 31) and remove the Idler Pulley Guide Plate (Item #3, **Figure A7**, page 31).

16) Unscrew the **TOP** Idler Pulley Shaft (Item #4, **Figure A7**, page 31) only, using a 5/16" open-end wrench.

17) Feed the new wire rope assembly, Stop Sleeve terminated end first, through the following path:

- a) Through the Nylon Insert (Item #2, **Figure A1**, page 27) at the bottom of the Actuator Frame.
- b) Over the top of the Idler Pulley going counter-clockwise.
- c) Clockwise around the Main Drum Pulley (Item #2, **Figure A6**, page 30). Terminate the wire rope into the side groove and opening located at the front side of the Main Drum Pulley.
- d) Wind the wire rope on the Main Drum Pulley, until the wire rope is properly seated into all of the grooves up to and including the one that the Pulley Guide Block (Item #1, **Figure A4**, page 28) is located in.

**WARNING**

**ALL slack must be removed from the wire rope and the wire rope must exit the Drum in the groove that contains the Pulley Guide Block in order to function correctly.**

- e) Reconfirm that the wire rope exits the drum in the same groove that contains the Pulley Guide Block, and that all slack has been removed from the wire rope.
- f) Replace the wire rope termination cover (Item #3, **Figure A6**, page 30) on the Main Drum Pulley.

18) Screw the top Idler Pulley Shaft (Item #4, **Figure A7**, page 31) back into the Threaded Hole Guide Plate (Item #2, **Figure A7**, page 31) located on the backside of the Actuator Frame assembly. Tighten using a 5/16" open-ended wrench.

19) Re-assemble the Idler Guide Plate (Item #3, **Figure A7**, page 31) to the Idler Pulley Shafts (Item #4, **Figure A7**, page 31), and replace the two (2) Snap Rings (Item #8, **Figure A7**, page 31).

20) Re-assemble the Extension Spring (Item #5, **Figure A5**, page 29) to the Idler Guide Plate (Item #3, **Figure A7**, page 31), by securing the Shoulder bolt (Item #9, **Figure A7**, page 31) in place.

21) Attach the Upper Limit Donut (Item #10, **Figure A6**, page 30) from Step 10, to the new wire rope assembly.

22) Re-attach the Handle to the new wire rope assembly.

23) Plug the Coil Cord Connector into the Controls Interface, and reconnect power to the unit.

24) Release the Emergency Stop button on the Handle, and grasp the operator present switch. Run the unit up and down several times to assure proper operation.

25) After operation is verified, you must reset the Software Lower Limit. This Software Lower Limit is independent of the Virtual Lower Limit described earlier and can not be turned off. Complete the following steps:

- a) Run the Handle down until the hard lower limit switch is activated. At this point there must be AT LEAST two (2) complete wraps of wire rope on the Main Drum Pulley.
- b) Press and hold the "Virtual Limit-Float Mode" button until all of the LEDs are illuminated.
- c) Release the button. If all LEDs remain illuminated, then you are now in "Program Mode". If all LEDs are not illuminated, then repeat Step 25b.
- d) Press and release the "Virtual Limit-Float Mode" button ten (10) times. If set correctly, all of the LEDs except the "Yellow" Power-On LED should turn off.

**WARNING**

**If the Software Lower Limit is not reset during wire rope replacement, problems such as no downward motion or possible wire rope failures may occur.**

26) Depress the Emergency Stop button on the Handle and disconnect the power.

27) Assemble the Nylon Drum Cover (Item #2, **Figure A8**, page 31) over the Main Drum Pulley.

28) Properly re-assemble the Heatsink (Item #2, **Figure A9**, page 32) to the Actuator Frame.

29) Replace the Covers on the Actuator assembly.

- a) Re-assemble the Power Cord side Cover (Item #2, **Figure A13**, page 34) to the Actuator assembly. Slide the Cover onto the Actuator assembly. Re-assemble the Cover mounting bolt (Item #11, **Figure A13**, page 34) at the Actuator Frame. Re-assemble the Upper Limit Switch Disc (Item #8, **Figure A13**, page 34). Re-assemble the Coil Cord mounting Clamp (Item #10, **Figure A13**, page 34). Slide the Power Cord Grommet back into the slot in the Cover.
- b) Now, re-assemble the Controls side Cover (Item #3, **Figure A13**, page 34) to the Actuator assembly. Slide the Cover onto the Actuator assembly. Re-assemble the Cover mounting bolt (Item #11, **Figure A13**, page 34) at the Actuator Frame. Re-assemble the Coil Cord mounting Clamp (Item #10, **Figure A13**, page 34). Re-assemble the three (3) mounting screws (Item #15, **Figure A13**, page 34) to the Controls side Cover. Re-assemble the Coil Cord Plug to the Controls Interface.

30) Reconnect power to the unit.

31) Release the Emergency Stop button on the Handle, and grasp the operator present switch. Run the unit up and down several times to assure proper operation.

32) Continue normal operation.



APPENDIX A - 150# BXI ACTUATOR ASSEMBLY DRAWINGS

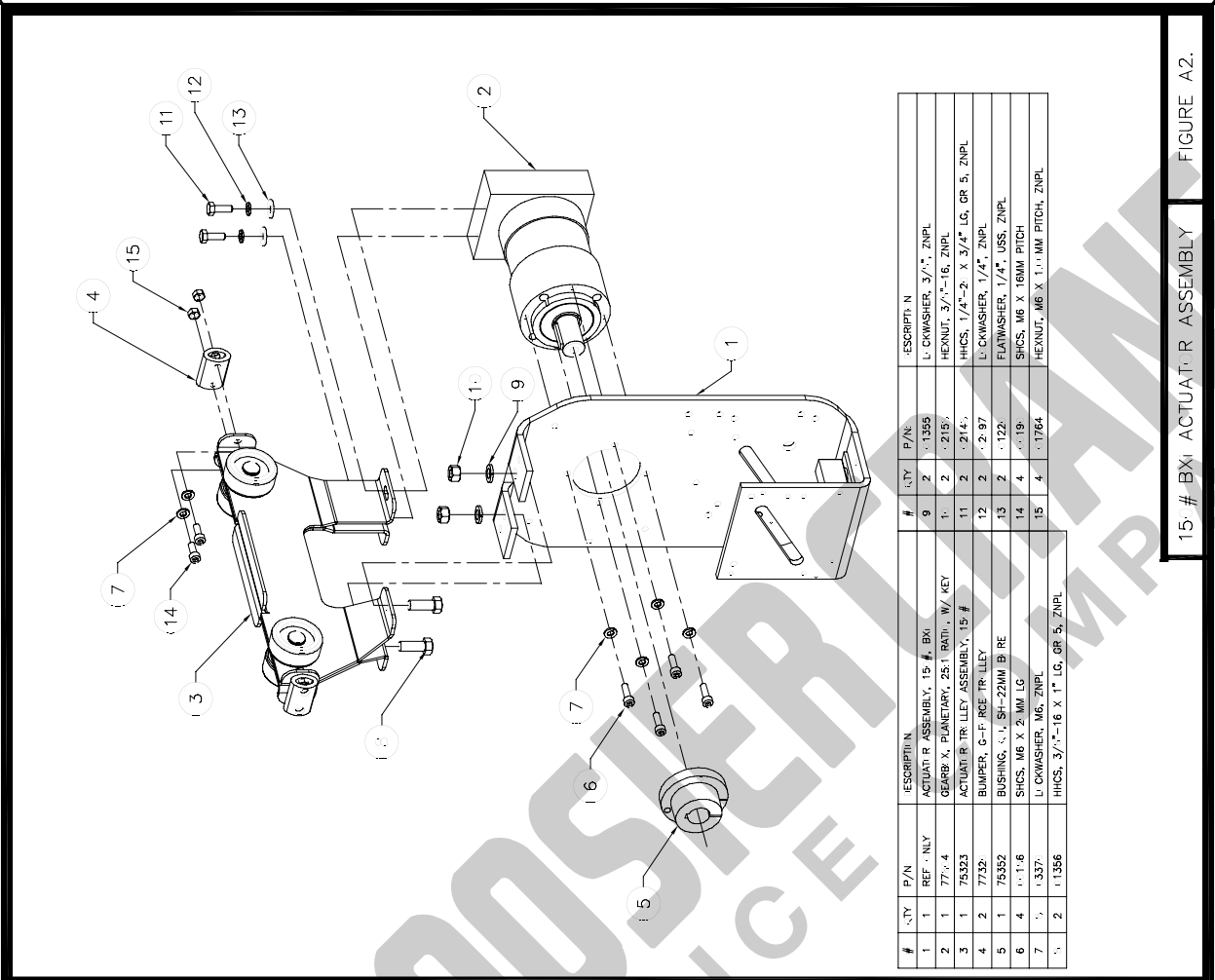
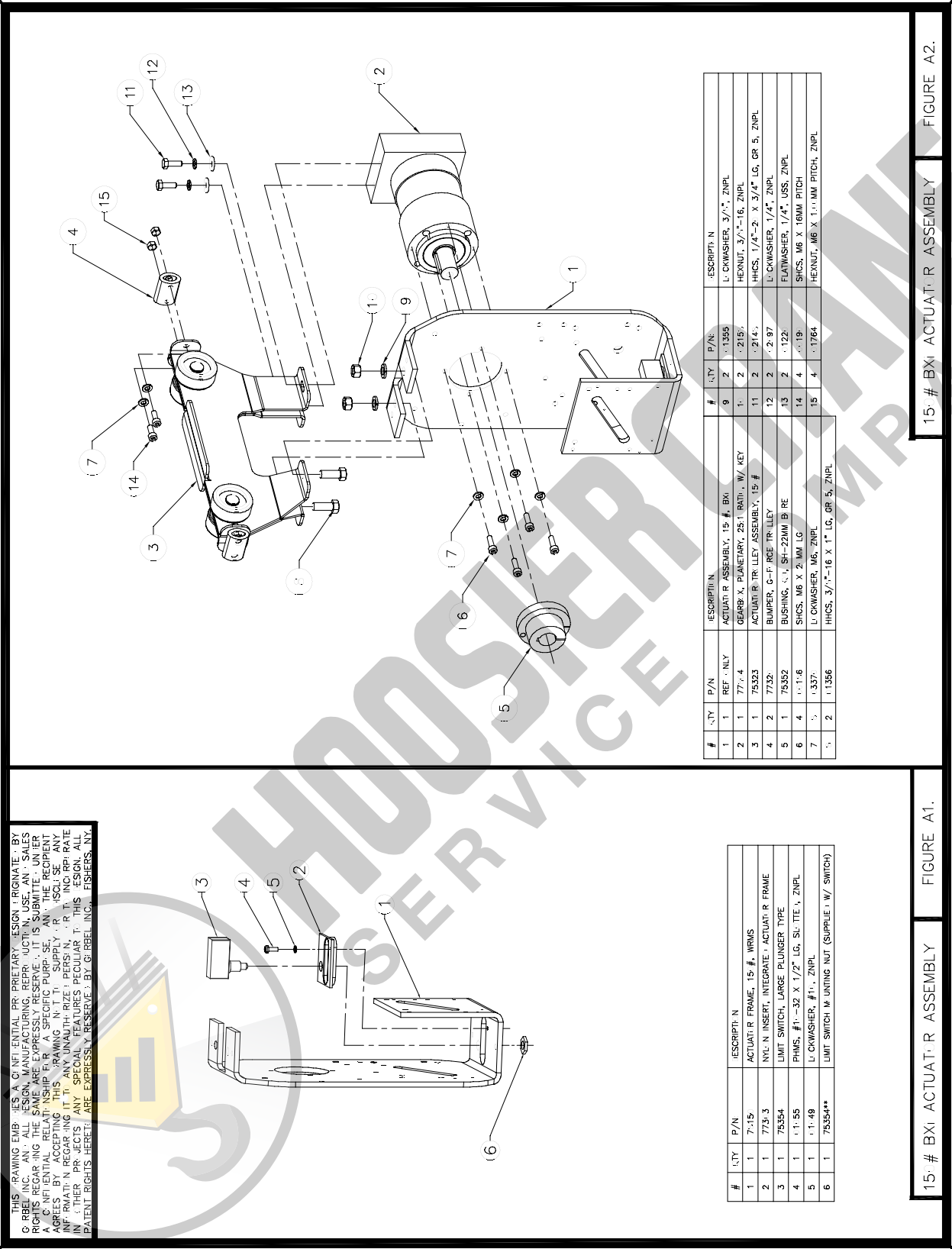
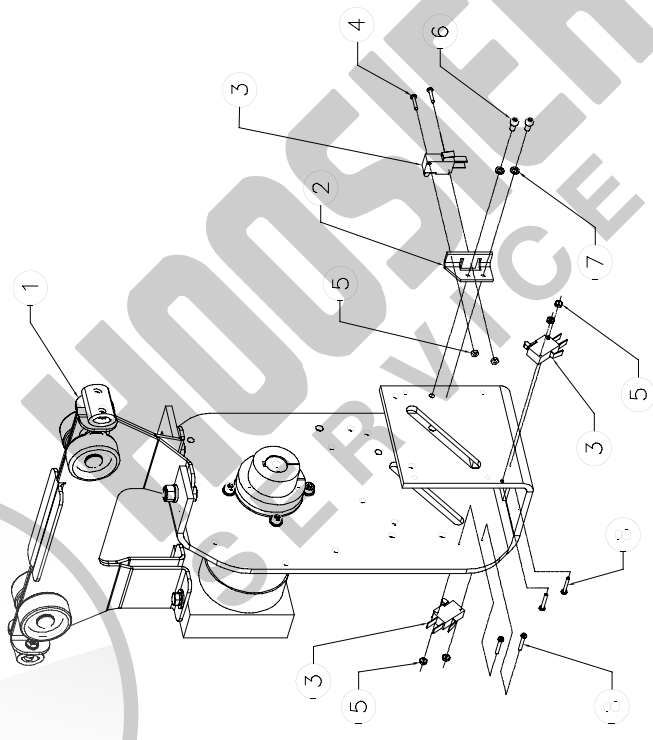


Figure A1 (bottom) & Figure A2 (top). 150# BXi Actuator Assembly.

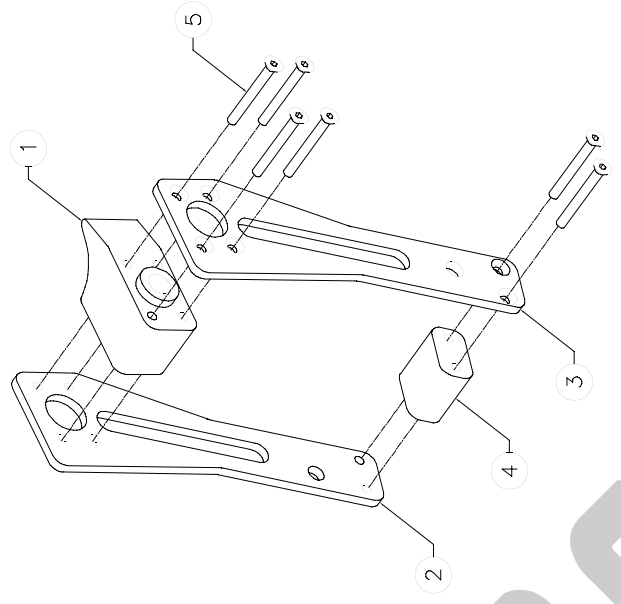


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| # | QTY | P/N      | DESCRIPTION                               |
|---|-----|----------|---|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY                         |
| 2 | 1   | 77551    | LIMB LIMIT SWITCH BRACKET                 |
| 3 | 3   | 77114    | LIMIT SWITCH, ROLLER ARM ACTUATOR, FORM C |
| 4 | 2   | 71123    | SLRHS, #4-40 X 3/4" LG, ZNPL              |
| 5 | 6   | 2992     | NYLOCK NUT, #4-40, ZNPL                   |
| 6 | 2   | 3135     | SHCS, #1-24 X 3/8" LG                     |
| 7 | 2   | 1149     | LOCKWASHER, #1-11, ZNPL                   |
| 8 | 4   | 1149     | SLPH, #4-40 X 7/8" LG, ZNPL               |

150# Bxi Actuator Assembly      Figure A3.

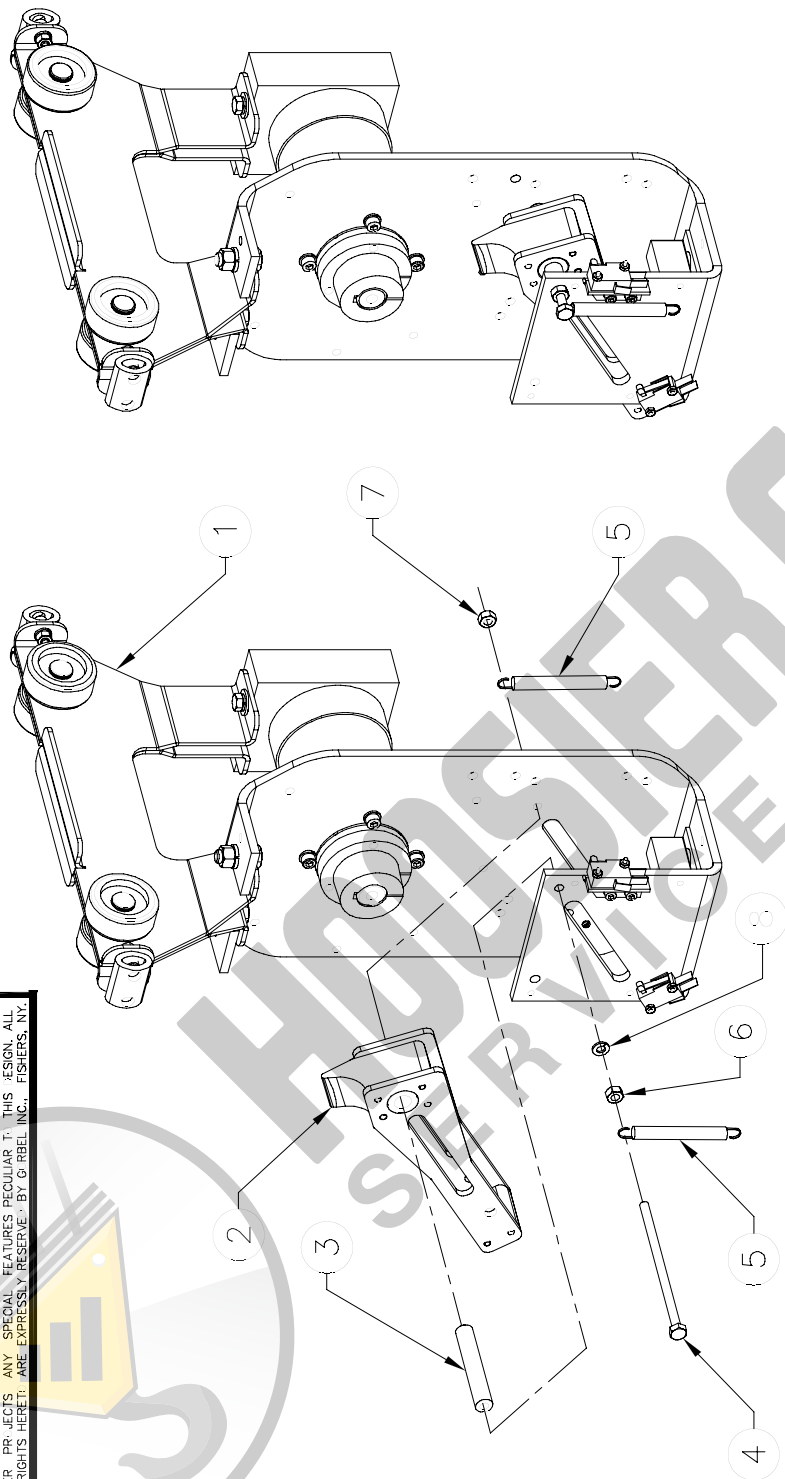


| # | QTY | P/N   | DESCRIPTION                   |
|---|-----|-------|-------------------------------|
| 1 | 1   | 7399  | GUIDE BLOCK                   |
| 2 | 1   | 77553 | GUIDE PLATE, TAPPE, HLES      |
| 3 | 1   | 77554 | GUIDE PLATE, C-UNTERSUNK HLES |
| 4 | 1   | 77555 | SPACER BLOCK                  |
| 5 | 6   | 11313 | PHCS, #1-32 X 1-3/4" LG       |

150# Bxi Actuator Assembly      Figure A4.

Figure A3 (bottom) & Figure A4 (top). 150# Bxi Actuator Assembly.

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| # | QTY | P/N      | DESCRIPTION                         |
|---|-----|----------|-------------------------------------|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY                   |
| 2 | 1   | REF ONLY | PULLEY GUIDE MECHANISM              |
| 3 | 1   | 2916     | LIMIT SWITCH SPACER SHAFT           |
| 4 | 1   | 633      | HHCS, 1/4"-2" X 5" LG, GR 5, ZNPL   |
| 5 | 2   | 77572    | EXTENSION SPRING, 3/16" X 1-1/2" LG |
| 6 | 1   | 1221     | HEX NUT, 1/4"-2", ZNPL              |
| 7 | 1   | 1177     | NYLOCK NUT, 1/4"-2", ZNPL           |
| 8 | 1   | 1297     | LOCKWASHER, 1/4", ZNPL              |

150# BXi ACTUATOR ASSEMBLY FIGURE A5.

Figure A5. 150# BXi Actuator Assembly.

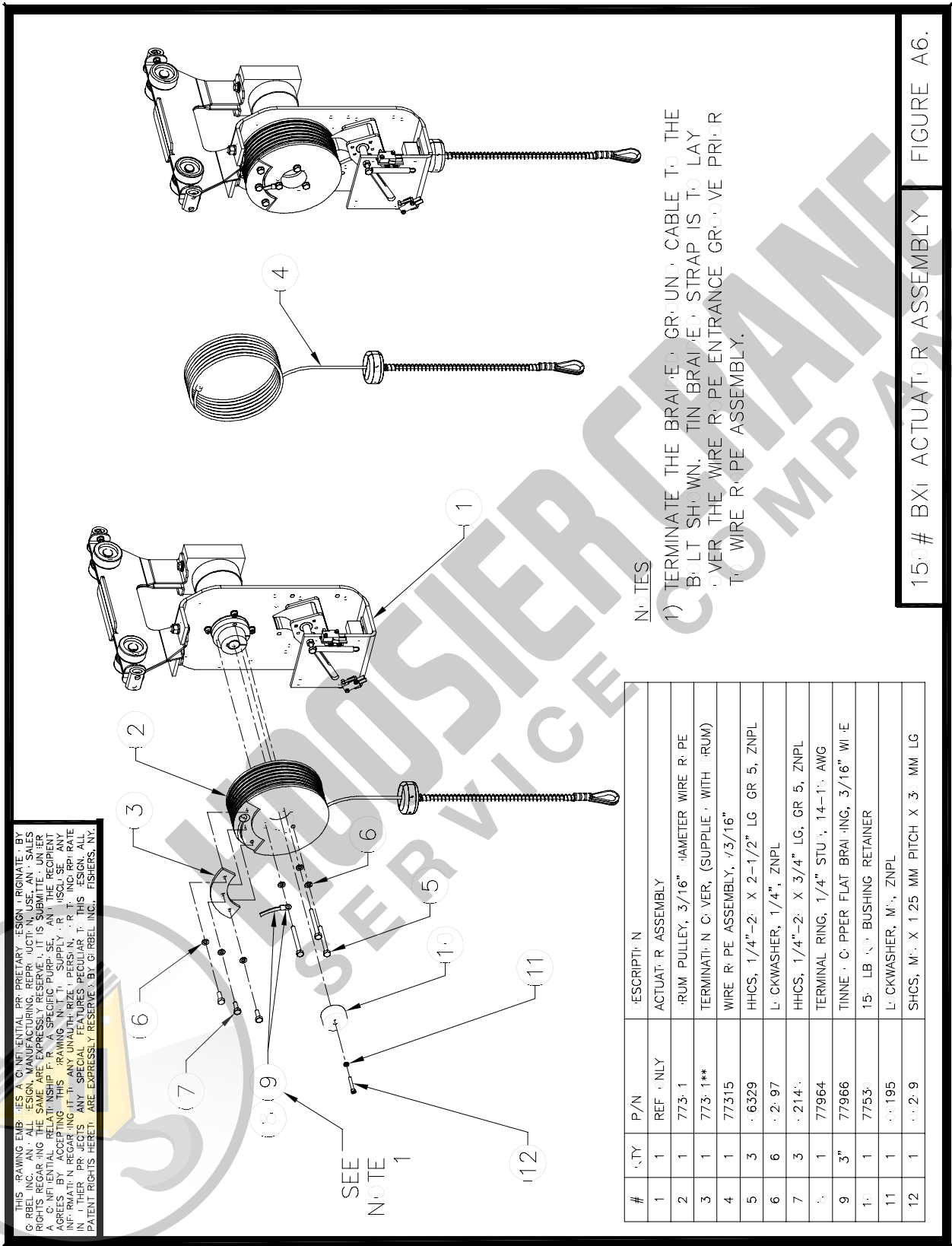
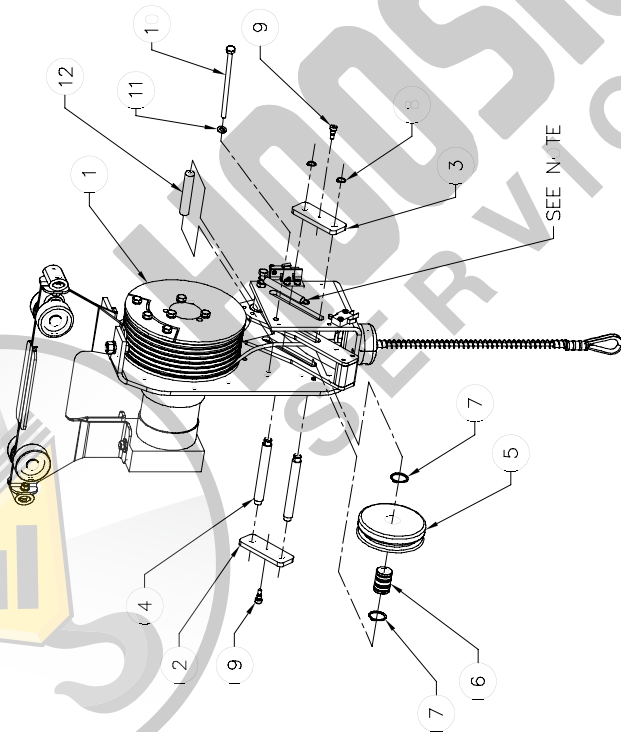


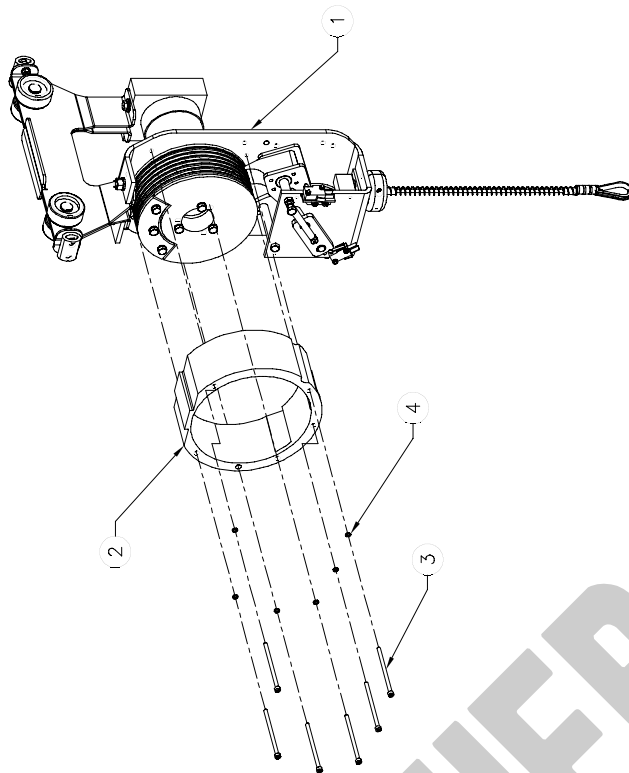
Figure A6. 150# BXi Actuator Assembly.

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| #  | QTY | P/N      | DESCRIPTION                            |
|----|-----|----------|--|
| 1  | 1   | REF ONLY | ACTUATOR ASSEMBLY                      |
| 2  | 1   | 77561    | THREADED HOLE GUIDE PLATE              |
| 3  | 1   | 77557    | ROLLER GUIDE PLATE                     |
| 4  | 2   | 77566    | THREADED ROLLER SHAFT                  |
| 5  | 1   | 77559    | OFFSET ROLLER PULLEY                   |
| 6  | 1   | 75312    | BEARING, LINEAR, SELF-LUBRICATING      |
| 7  | 2   | 21125    | SNAP RING, EXTERNAL, 7/16" ID          |
| 8  | 2   | 77571    | SNAP RING, EXTERNAL, 412" ID           |
| 9  | 2   | 12431    | SHOULDER BOLT, 1/4" SHOULDER X 1/4" LG |
| 10 | 1   | 16332    | HHCS, 1/4"-20 X 4" LG, GR 5, ZNPL      |
| 11 | 1   | 1297     | LOCKWASHER, 1/4" ZNPL                  |
| 12 | 1   | 12916    | SPACER SHAFT, G-FRICE                  |

150# BXi ACTUATOR ASSEMBLY FIGURE A7.



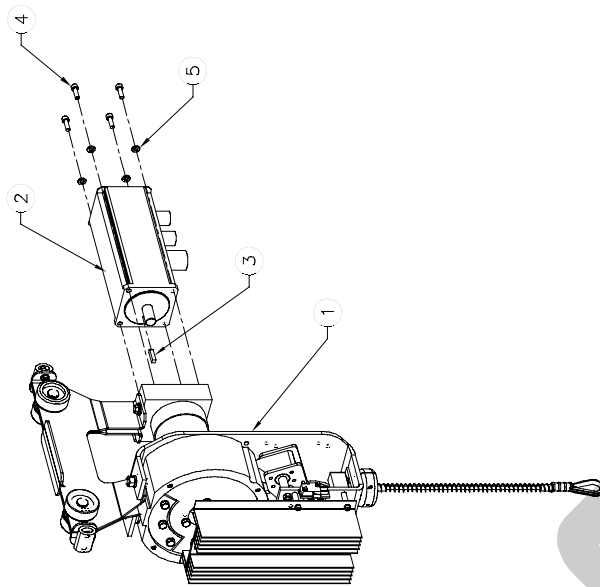
| # | QTY | P/N      | DESCRIPTION                          |
|---|-----|----------|--------------------------------------|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY                    |
| 2 | 1   | 77565    | NYLON RUM PULLEY COVER               |
| 3 | 6   | 11314    | SHCS, #10-24 X 3-1/2" LG, ALL-Y ZINC |
| 4 | 6   | 11149    | LOCKWASHER, #10, ZNPL                |

150# BXi ACTUATOR ASSEMBLY FIGURE A8.

Figure A7 (bottom) & Figure A8 (top). 150# BXi Actuator Assembly.

Technical drawing of a mechanical assembly, likely a pump or motor component, showing various parts labeled with numbers 1 through 9. The drawing includes a perspective view of the main assembly and a detailed view of a component labeled 2. The main assembly shows a circular housing (1) with internal components, a shaft (2) with a pulley (3), and a series of parallel plates or vanes (4). The detailed view of component 2 shows a stack of plates with internal features labeled 5, 6, 7, 8, and 9. The drawing is a technical illustration with dashed lines indicating hidden internal features.

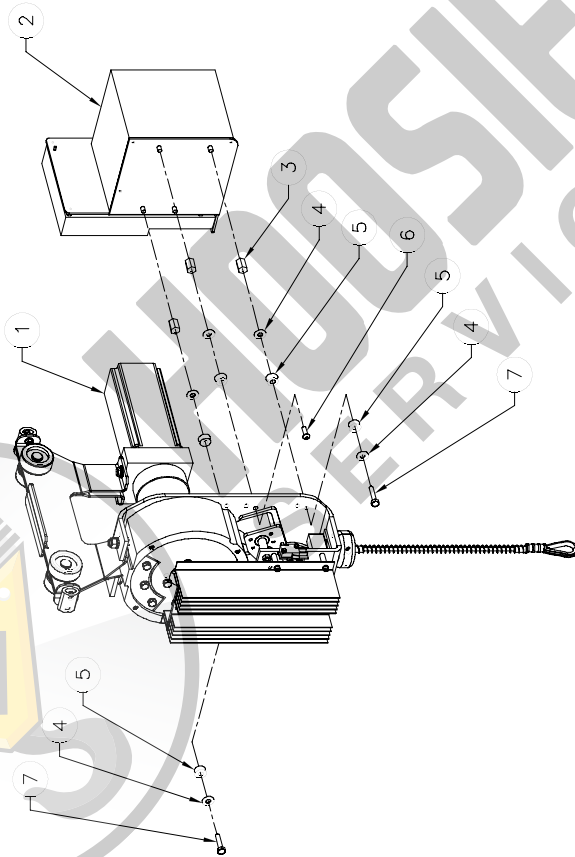
| # | QTY | P/N      | DESCRIPTION                  |
|---|-----|----------|------------------------------|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY            |
| 2 | 1   | 753-3    | HEATSINK, ACTUATOR           |
| 3 | 1   | 771-6    | REGEN RESISTOR, 300 OHM      |
| 4 | 4   | 77562    | HEATSINK SPACER, 1" LG       |
| 5 | 2   | 753-373  | SHCS, #10-24 X 1/2" LG       |
| 6 | 6   | 753-149  | LOCKWASHER, #10, ZNPL        |
| 7 | 2   | 753-175  | FLATWASHER, #10, ZNPL        |
| 8 | 4   | 753-36   | SHCS, #10-24 X 1-3/4" LG, SS |
| 9 | 4   | 753-175  | FLATWASHER #10, ZNPL         |



| # | QTY | P/N      | DESCRIPTION                               |
|---|-----|----------|---|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY                         |
| 2 | 1   | 77635    | M/T, R, SERV- W/ BRAKE, BX SERIES, W/ C/N |
| 3 | 1   | 77621    | KEYST-OK, 5MM S-X, X-777" LG, ZNPL        |
| 4 | 4   | 77616    | SHCS, M6 X 2MM LG                         |
| 5 | 4   | 77637    | LOCKWASHER, M6, ZNPL                      |

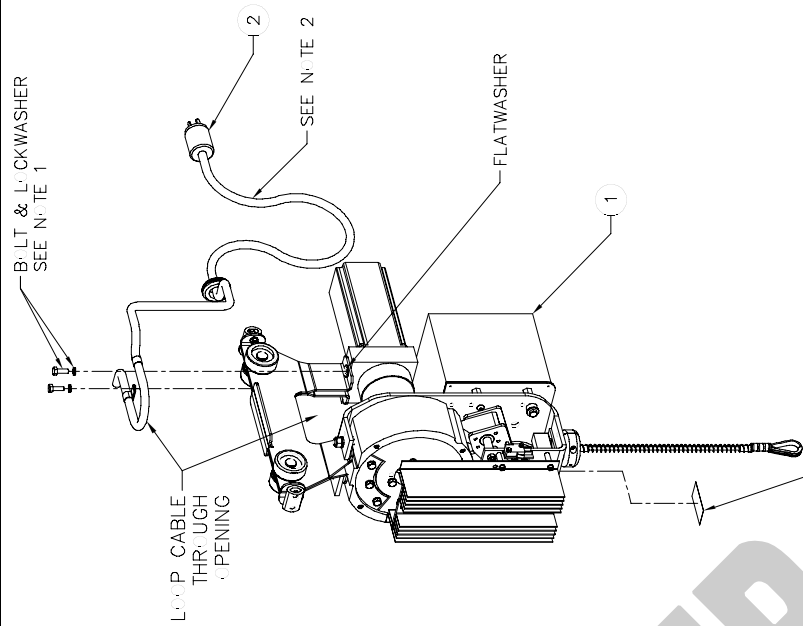
|           |                   |             |
|-----------|-------------------|-------------|
| 15. # BX1 | ACTUATOR ASSEMBLY | FIGURE A9.  |
| 15. # BX1 | ACTUATOR ASSEMBLY | FIGURE A10. |

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| # | QTY | P/N      | DESCRIPTION                           |
|---|-----|----------|---------------------------------------|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY                     |
| 2 | 1   | 71165    | CENTRAL ASSEMBLY, G-F RCE, GEN 4      |
| 3 | 3   | 75333    | STANDARD, HEX THREADED, 1/4"-2        |
| 4 | 5   | 1220     | FLATWASHER, 1/4", USS, ZNPL           |
| 5 | 5   | 75334    | WASHER, VIBRATION DAMPING, 1/4" ID    |
| 6 | 1   | 197      | BHCS, 1/4"-20 X 3/4" LG               |
| 7 | 2   | 227      | HHCS, 1/4"-20 X 1-1/4" LG, GR 5, ZNPL |

15# BXi ACTUATOR ASSEMBLY FIGURE A11.



- NOTES
- 1) REMOVE THE HARDWARE NUTS AT A TIME. RE-ASSEMBLE THE HARDWARE THROUGH THE RUBBER CUSHIONING STEEL LAMP STRAPS AS SHOWN.
  - 2) ROUTE CABLE AS SHOWN.

| # | QTY | P/N      | DESCRIPTION                  |
|---|-----|----------|------------------------------|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY            |
| 2 | 1   | 71155    | POWER COIL ASSEMBLY, G-F RCE |
| 3 | 1   | 77600    | ACTUATOR TAG MATRICE STICKER |

15# BXi ACTUATOR ASSEMBLY FIGURE A12.



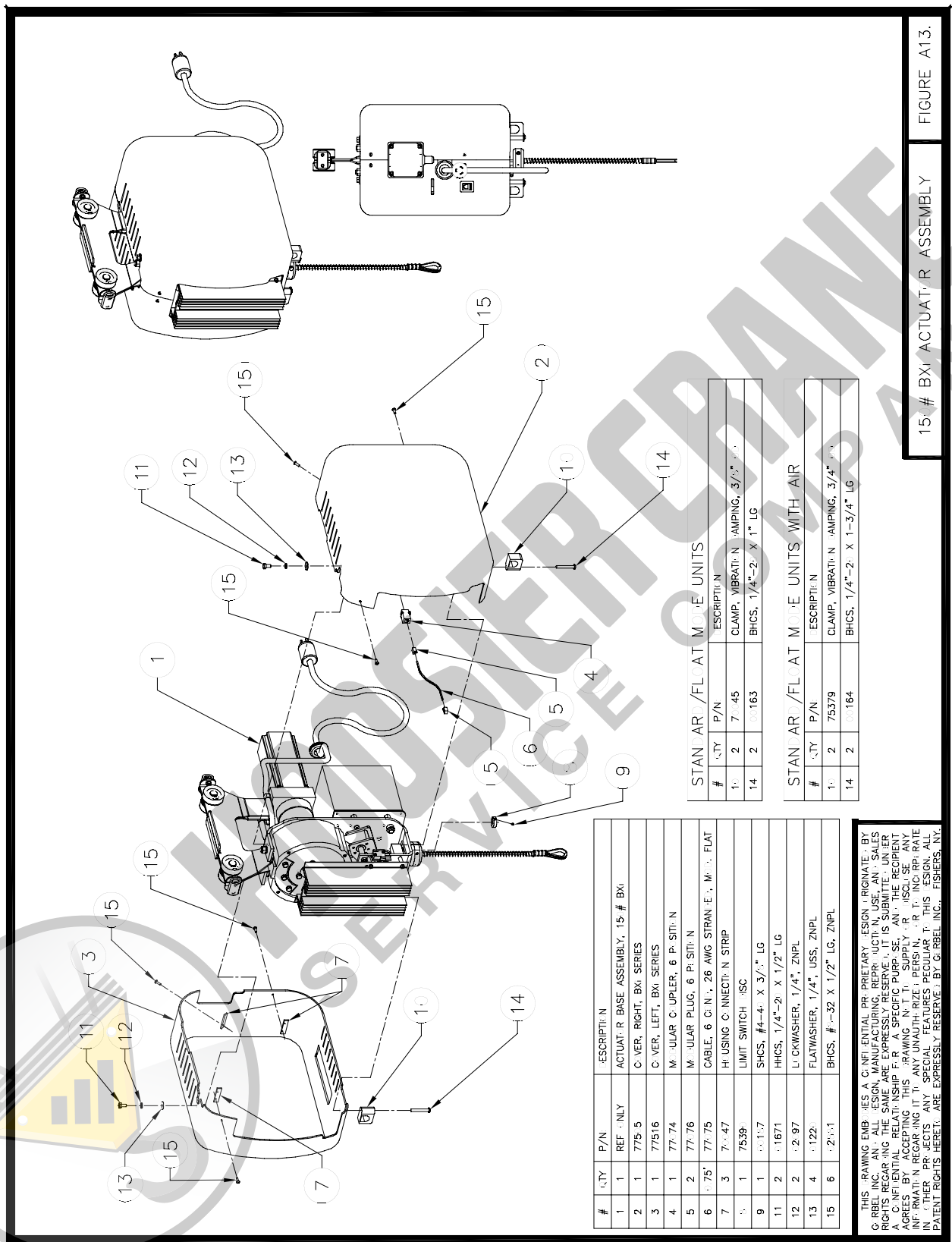
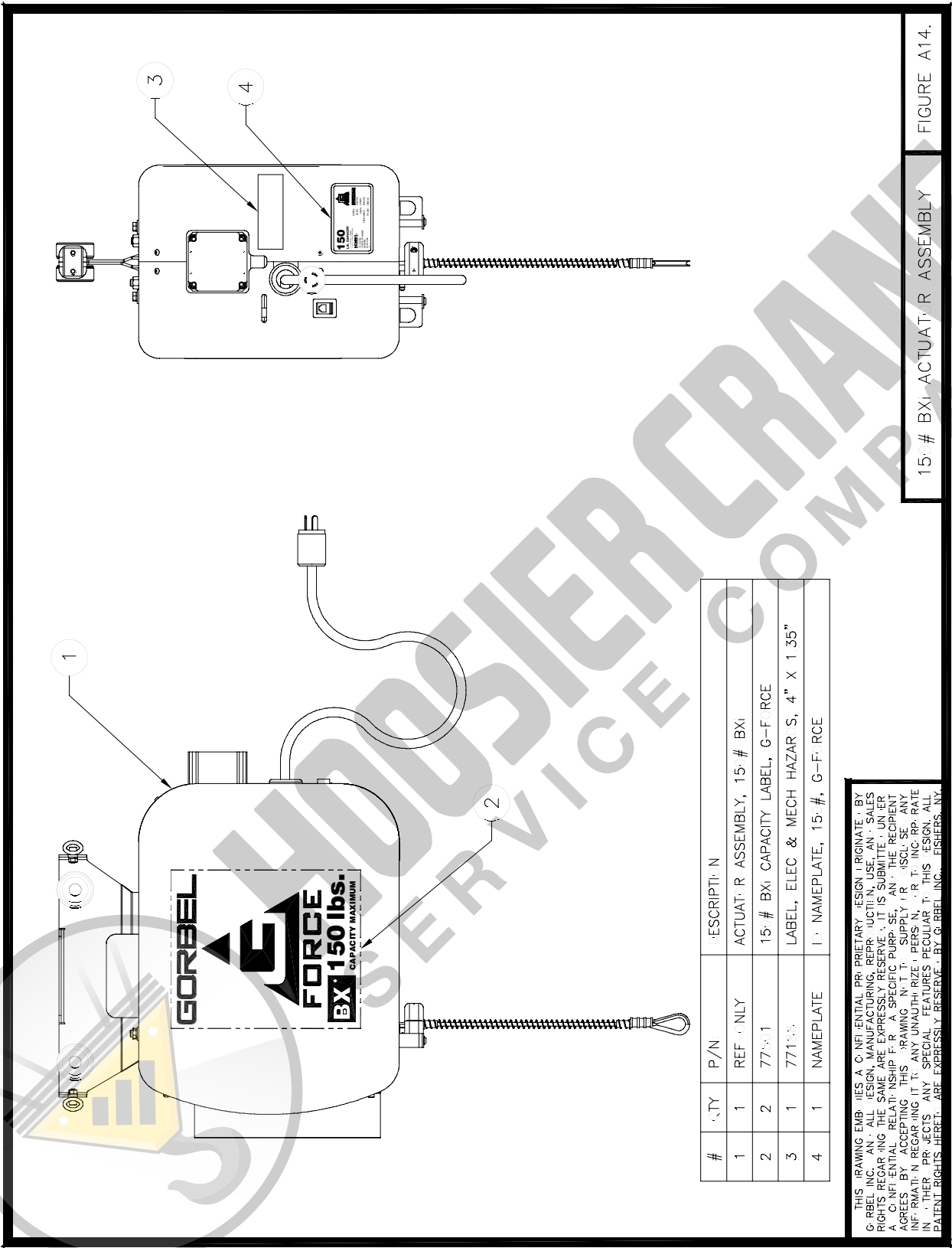


Figure A13. 150# Bxi Actuator Assembly.

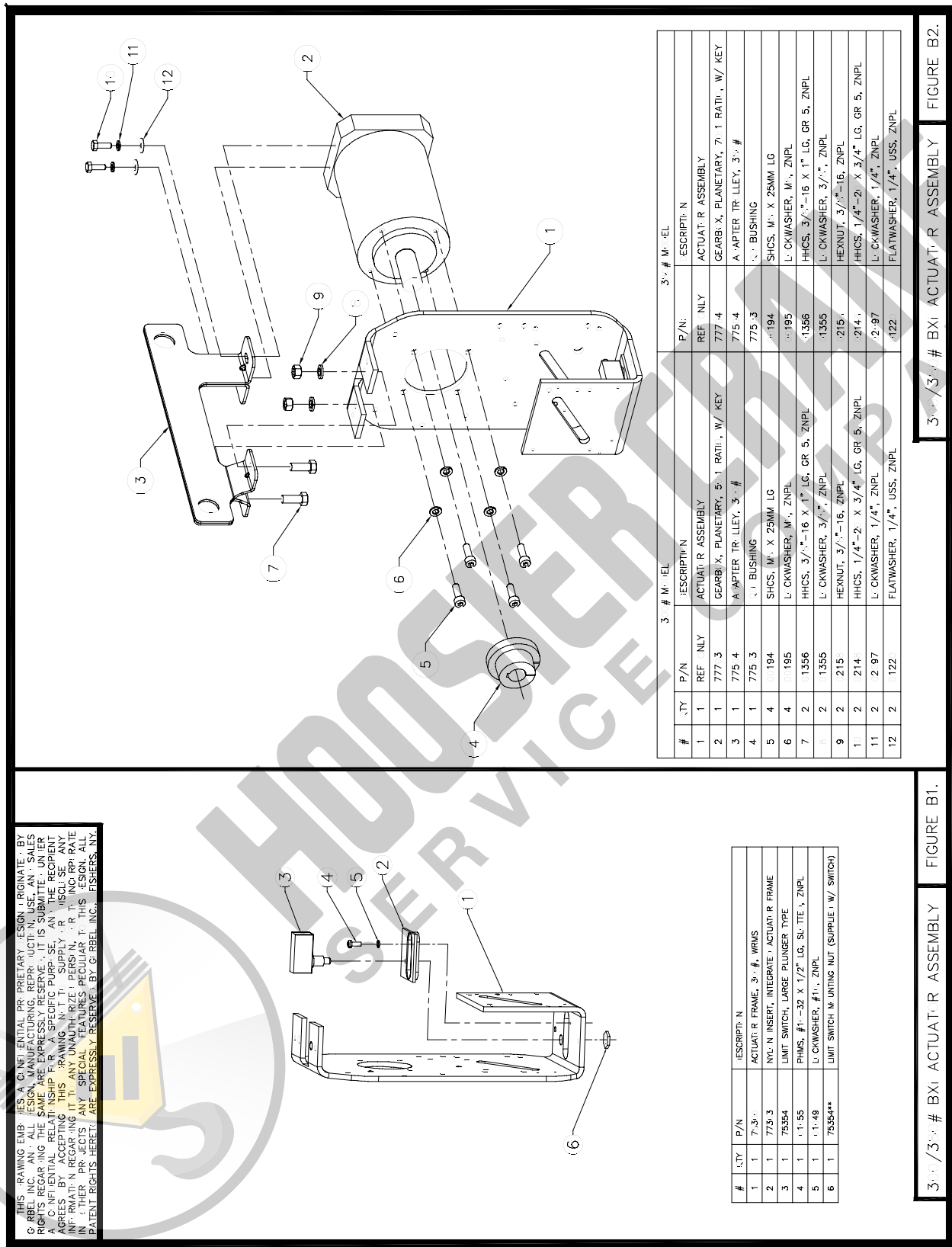


15# BXi ACTUATOR ASSEMBLY

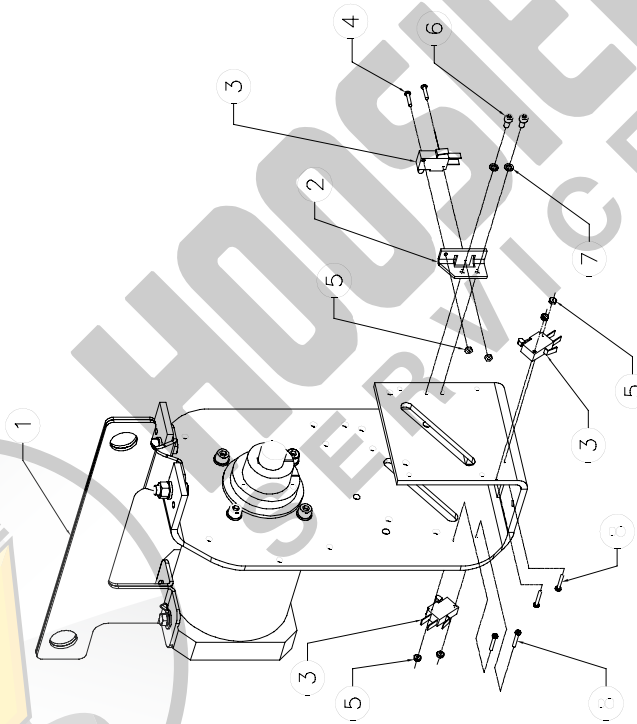
FIGURE A14.

Figure A14. 150# BXi Actuator Assembly.

APPENDIX B - 300/380# BXI ACTUATOR ASSEMBLY DRAWINGS

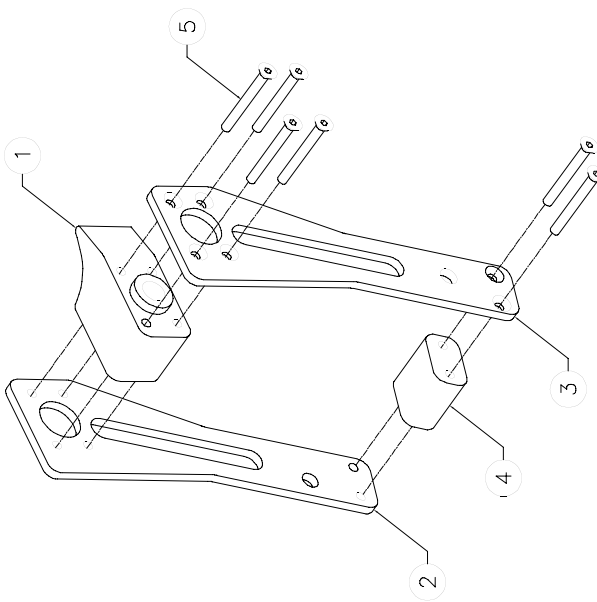


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| # | QTY | P/N      | DESCRIPTION                               |
|---|-----|----------|---|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY                         |
| 2 | 1   | 77551    | LOWER LIMIT SWITCH BRACKET                |
| 3 | 3   | 77554    | LIMIT SWITCH, ROLLER ARM ACTUATOR, FORM C |
| 4 | 2   | 77523    | SLRH, #4-40 X 3/4" LG, ZNPL               |
| 5 | 6   | 2992     | NYLOCK NUT, #4-40, ZNPL                   |
| 6 | 2   | 2935     | SHCS, #1-24 X 3/8" LG                     |
| 7 | 2   | 2949     | LOCKWASHER, #1, ZNPL                      |
| 8 | 4   | 2949     | SLPH, #4-40 X 7/8" LG, ZNPL               |

300/380# BXi Actuator Assembly FIGURE B3.



| # | QTY | P/N   | DESCRIPTION                    |
|---|-----|-------|--------------------------------|
| 1 | 1   | 77556 | GUIDE BLOCK                    |
| 2 | 1   | 77553 | GUIDE PLATE, TAPPEL HILES      |
| 3 | 1   | 77554 | GUIDE PLATE, COUNTERSUNK HILES |
| 4 | 1   | 77555 | SPACER BLOCK                   |
| 5 | 6   | 2933  | SHCS, #1-32 X 1-3/4" LG        |

300/380# BXi Actuator Assembly FIGURE B4.

Figure B3 (bottom) & Figure B4 (top). 300/380# BXi Actuator Assembly.

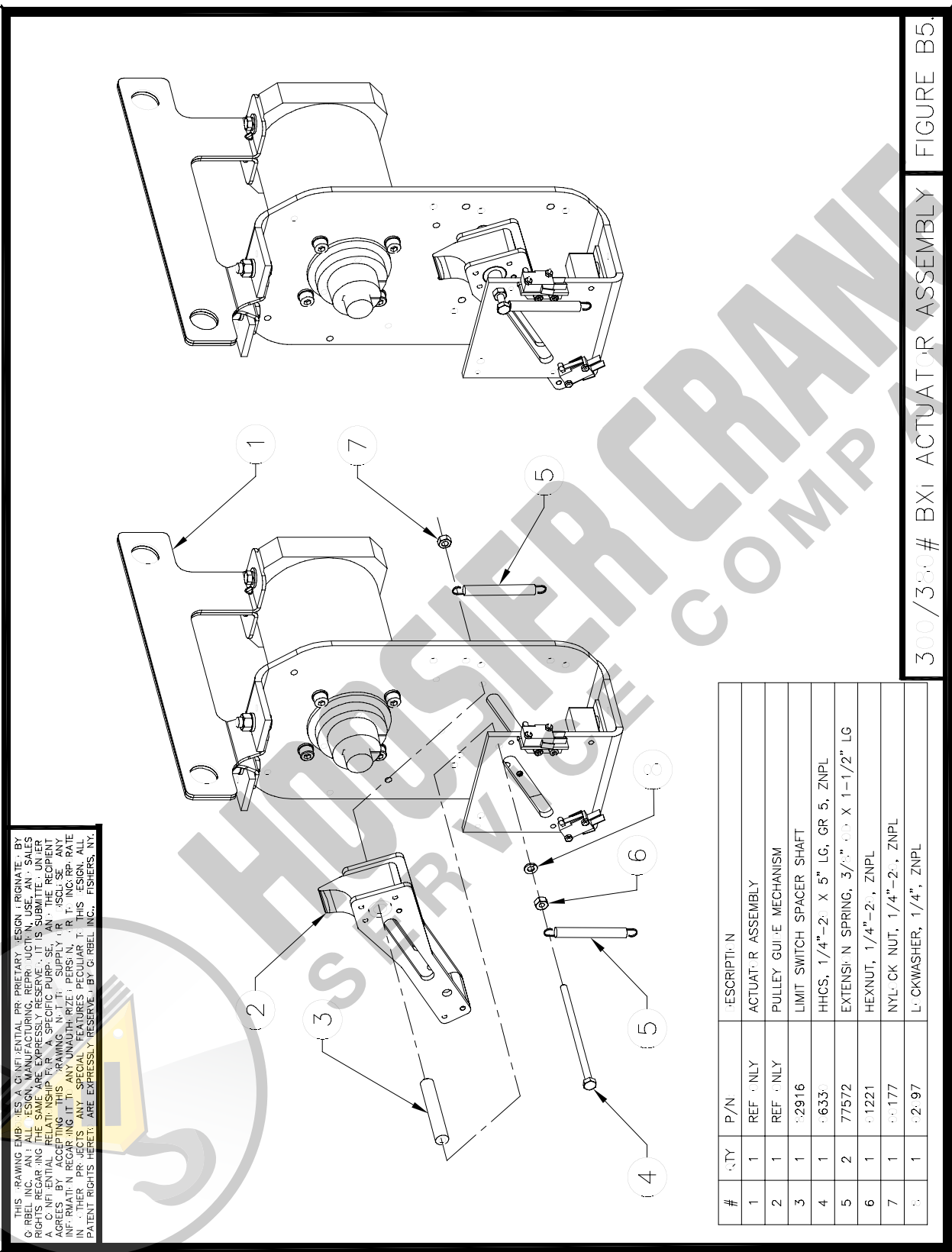
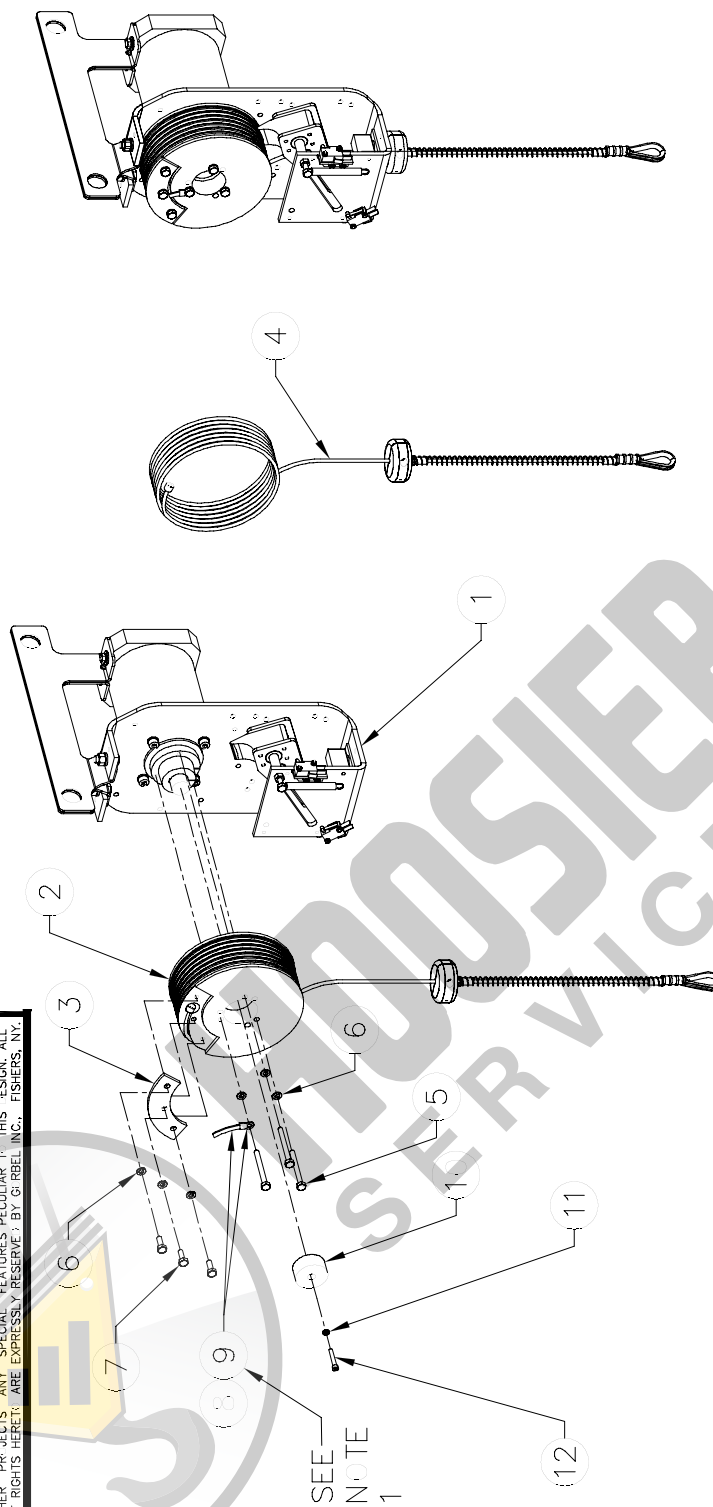


Figure B5. 300/380# BXi Actuator Assembly.

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| #  | QTY | P/N     | DESCRIPTION                             |
|----|-----|---------|---|
| 1  | 1   |         | ACTUATOR ASSEMBLY                       |
| 2  | 1   | 773-1   | DRUM PULLEY, 3/16" DIAMETER WIRE ROPE   |
| 3  | 1   | 773-1** | TERMINATION COVER, (SUPPLIED WITH DRUM) |
| 4  | 1   | 77315   | WIRE ROPE ASSEMBLY, 1/3/16"             |
| 5  | 3   | 6329    | HHCS, 1/4"-2" X 2-1/2" LG GR 5, ZNPL    |
| 6  | 6   | 2197    | LOCKWASHER, 1/4", ZNPL                  |
| 7  | 3   | 2145    | HHCS, 1/4"-2" X 3/4" LG, GR 5, ZNPL     |
| 8  | 1   | 77964   | TERMINAL RING, 1/4" STU, 14-15 AWG      |
| 9  | 3   | 77966   | TINNE COPPER FLAT BRAIDING, 3/16" WIE   |
| 10 | 1   | 77531   | 300 LB BUSHING RETAINER                 |
| 11 | 1   | 214     | LOCKWASHER, M10, ZNPL                   |
| 12 | 1   | 21      | SHCS, M10 X 15 MM PITCH X 3.15 MM LG    |

#### NOTES

- 1) TERMINATE THE BRAIDED GROUND CABLE TO THE BOLT SHOWN. THE BRAIDED STRAP IS TO LAY OVER THE WIRE ROPE ENTRANCE GROOVE PRIOR TO WIRE ROPE ASSEMBLY.

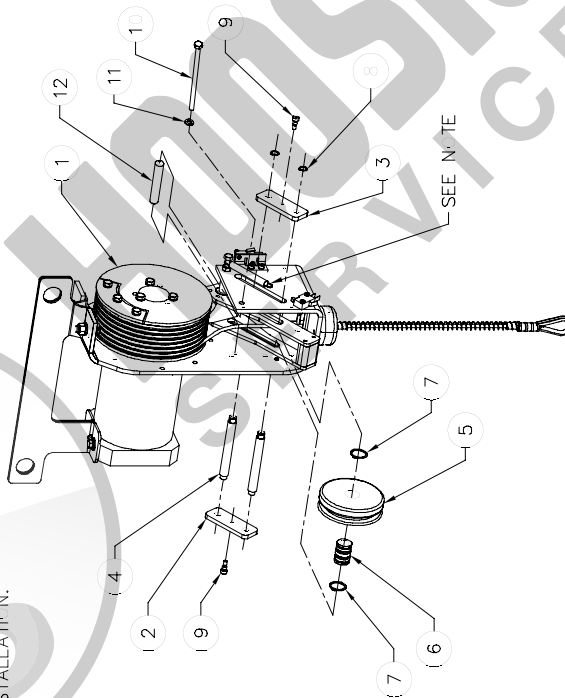
300/380# Bxi ACTUATOR ASSEMBLY FIGURE B6.

Figure B6. 300/380# Bxi Actuator Assembly.



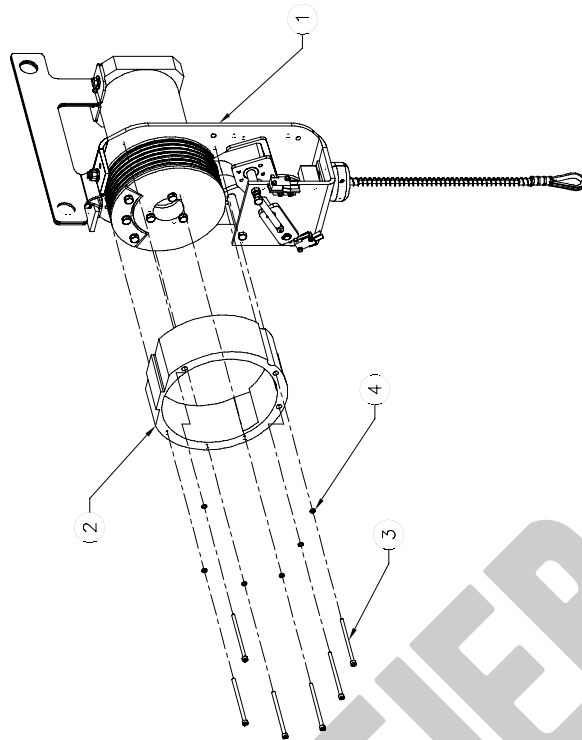
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NOTE: CONNECT LINE ENDS OF EXTENSION SPRINGS (2) TO THE SHULDER BOLTS DURING INSTALLATION.



| #  | QTY | P/N      | DESCRIPTION                            |
|----|-----|----------|--|
| 1  | 1   | REF ONLY | ACTUATOR ASSEMBLY                      |
| 2  | 1   | 77561    | THRUST PLATE                           |
| 3  | 1   | 77557    | THRUST PLATE                           |
| 4  | 2   | 7756     | THRUST PLATE                           |
| 5  | 1   | 77559    | THRUST PLATE                           |
| 6  | 1   | 7532     | BEARING, LINEAR, SELF-LUBRICATING      |
| 7  | 2   | 21125    | SNAP RING, EXTERNAL, 7/8" ID           |
| 8  | 2   | 77571    | SNAP RING, EXTERNAL, 412" ID           |
| 9  | 2   | 243      | SHOULDER BOLT, 1/4" SHOULDER X 1/4" LG |
| 10 | 1   | 6332     | HHCS, 1/4"-20 X 4" LG, GR 5, ZNPL      |
| 11 | 1   | 297      | LOCKWASHER, 1/4" ZNPL                  |
| 12 | 1   | 2916     | SPACER SHAFT, 6-F RCE                  |

300/380# Bxi Actuator Assembly FIGURE B7.

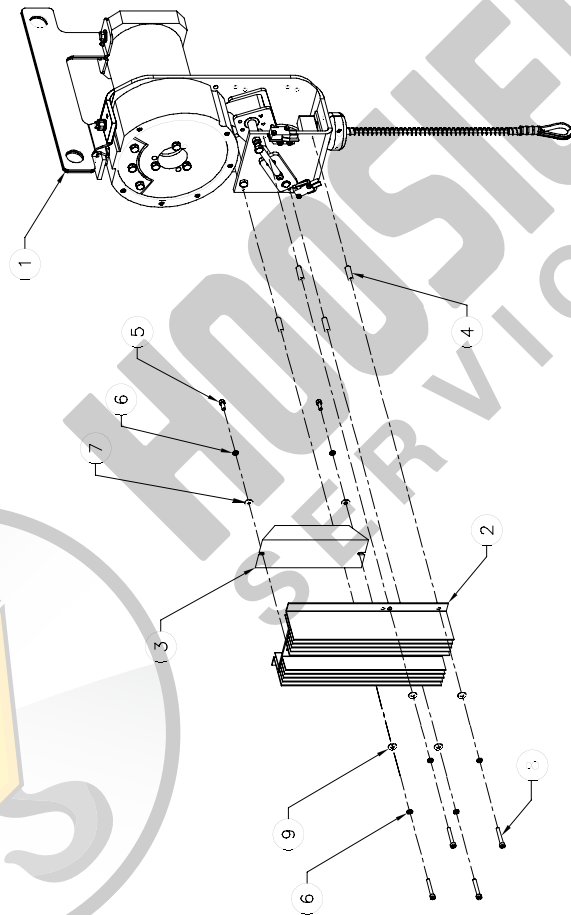


| # | QTY | P/N      | DESCRIPTION                          |
|---|-----|----------|--------------------------------------|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY                    |
| 2 | 1   | 77565    | NYLON RUM PULLEY COVER               |
| 3 | 6   | 34       | SHCS, #10-24 X 3-1/2" LG, ALL Y ZINC |
| 4 | 6   | 149      | LOCKWASHER, #10, ZNPL                |

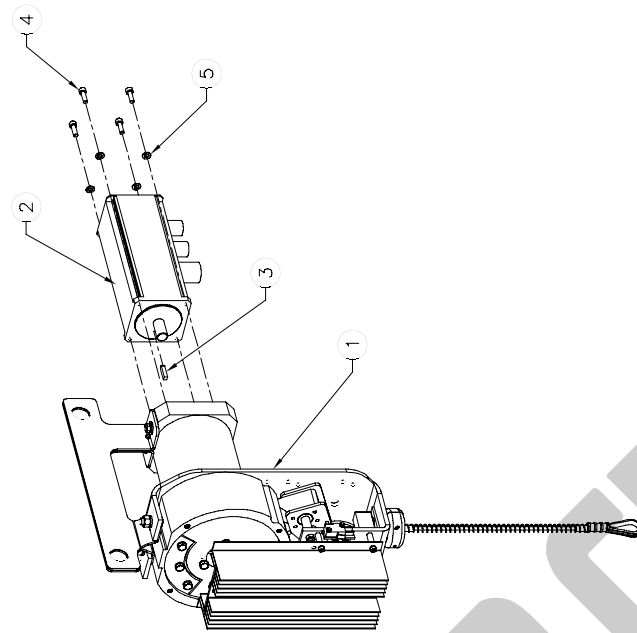
300/380# Bxi Actuator Assembly FIGURE B8.

Figure B7 (bottom) & Figure B8 (top). 300/380# Bxi Actuator Assembly.

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| # | QTY | P/N      | DESCRIPTION                  |
|---|-----|----------|------------------------------|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY            |
| 2 | 1   | 753-3    | HEATSINK, ACTUATOR           |
| 3 | 1   | 771-6    | REGEN RESISTOR, 300HM        |
| 4 | 4   | 77562    | HEATSINK SPACER, 1" LG       |
| 5 | 2   | 77373    | SHCS, #10-24 X 1/2" LG       |
| 6 | 6   | 771-49   | LOCKWASHER, #10, ZNPL        |
| 7 | 2   | 77175    | FLATWASHER, #10, ZNPL        |
| 8 | 4   | 773-6    | SHCS, #10-24 X 1-3/4" LG, SS |
| 9 | 4   | 77175    | FLATWASHER #10, ZNPL         |

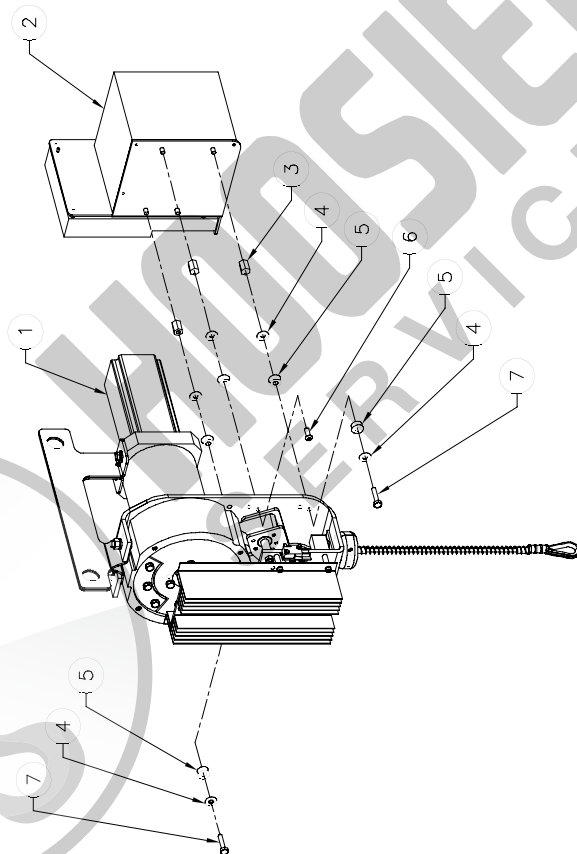


| # | QTY | P/N      | DESCRIPTION                              |
|---|-----|----------|--|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY                        |
| 2 | 1   | 77635    | SERV MOTOR W/ BRAKE, BX SERIES, W/ 0.11N |
| 3 | 1   | 77621    | KEYSTOCK, 5MM DIA X 1.777" LG, ZNPL      |
| 4 | 4   | 771-16   | SHCS, M6 X 2MM LG                        |
| 5 | 4   | 77337    | LOCKWASHER, M6, ZNPL                     |

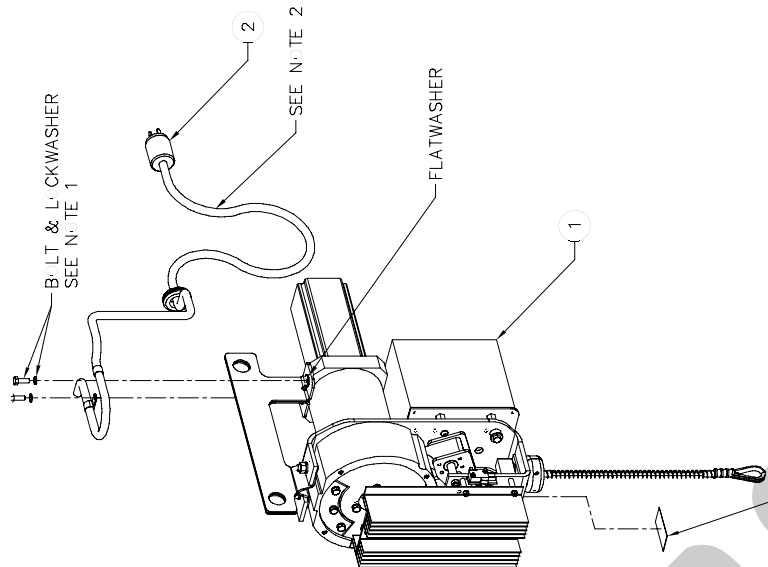
300/380# BXi Actuator Assembly      300/380# BXi Actuator Assembly      Figure B10

Figure B9 (bottom) & Figure B10 (top). 300/380# BXi Actuator Assembly.

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| # | QTY | P/N      | DESCRIPTION                           |
|---|-----|----------|---------------------------------------|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY                     |
| 2 | 1   | 71165    | CONTROLLER ASSEMBLY, G-F RCE, GEN 4   |
| 3 | 3   | 75311    | STANDARD, HEX THREADED, 1/4"-20       |
| 4 | 5   | 1221     | FLATWASHER, 1/4", USS, ZNPL           |
| 5 | 5   | 75314    | WASHER, VIBRATION DAMPING, 1/4" ID    |
| 6 | 1   | 197      | BHCS, 1/4"-20 X 3/4" LG               |
| 7 | 2   | 227      | HHCS, 1/4"-20 X 1-1/4" LG, GR 5, ZNPL |



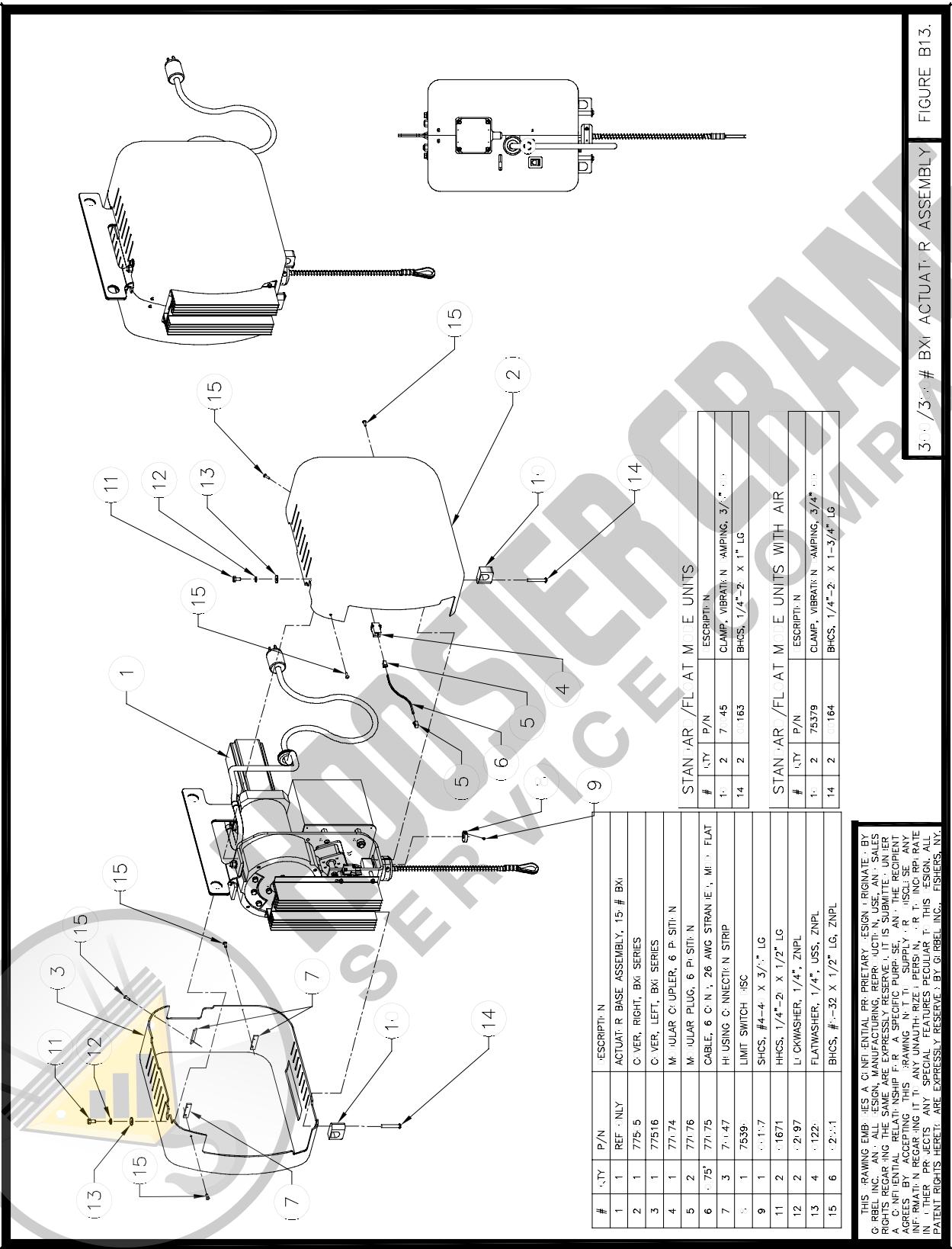
- NOTES
- 1) REMOVE THE HARDWARE, ONE SIDE AT A TIME. RE-ASSEMBLE THE HARDWARE THROUGH THE RUBBER CUSHIONING STEEL LAMP STRAPS (AS SHOWN).
  - 2) ROUTE CABLE AS SHOWN.

| # | QTY | P/N      | DESCRIPTION                     |
|---|-----|----------|---------------------------------|
| 1 | 1   | REF ONLY | ACTUATOR ASSEMBLY               |
| 2 | 1   | 71155    | POWER CIRCUIT ASSEMBLY, G-F RCE |
| 3 | 1   | 77611    | ACTUATOR TAG MATRICE STICKER    |

300/380# BXi Actuator Assembly FIGURE B11.

300/380# BXi Actuator Assembly FIGURE B12.

Figure B11 (bottom) & Figure B12 (top). 300/380# BXi Actuator Assembly.



300/380# BXi ACTUATOR ASSEMBLY      FIGURE B13.

| #  | QTY | P/N      | DESCRIPTION                              |
|----|-----|----------|--|
| 1  | 1   | REF ONLY | ACTUATOR BASE ASSEMBLY, 15 # BXi         |
| 2  | 1   | 775-5    | C-VER, RIGHT, BXi SERIES                 |
| 3  | 1   | 77516    | C-VER, LEFT, BXi SERIES                  |
| 4  | 1   | 77174    | MODULAR COUPLER, 6 POSITION              |
| 5  | 2   | 77176    | MODULAR PLUG, 6 POSITION                 |
| 6  | 75  | 77175    | CABLE, 6 CON, 26 AWG STRANDED, MIN. FLAT |
| 7  | 3   | 71147    | HUSING CONNECTION STRIP                  |
| 8  | 1   | 7539     | LIMIT SWITCH -ISC                        |
| 9  | 1   | 117      | SHCS, #4-4 X 3/4" LG                     |
| 11 | 2   | 1671     | HHCS, 1/4"-20 X 1/2" LG                  |
| 12 | 2   | 2197     | L1 C/WASHER, 1/4", ZNPL                  |
| 13 | 4   | 122      | FLATWASHER, 1/4", USS, ZNPL              |
| 15 | 6   | 211      | BHCS, #1-32 X 1/2" LG, ZNPL              |

| #  | QTY | P/N  | DESCRIPTION                      |
|----|-----|------|----------------------------------|
| 1  | 2   | 7145 | CLAMP, VIBRATION AMPING, 3/4" LG |
| 14 | 2   | 163  | BHCS, 1/4"-20 X 1" LG            |

| #  | QTY | P/N   | DESCRIPTION                      |
|----|-----|-------|----------------------------------|
| 1  | 2   | 75379 | CLAMP, VIBRATION AMPING, 3/4" LG |
| 14 | 2   | 164   | BHCS, 1/4"-20 X 1-3/4" LG        |

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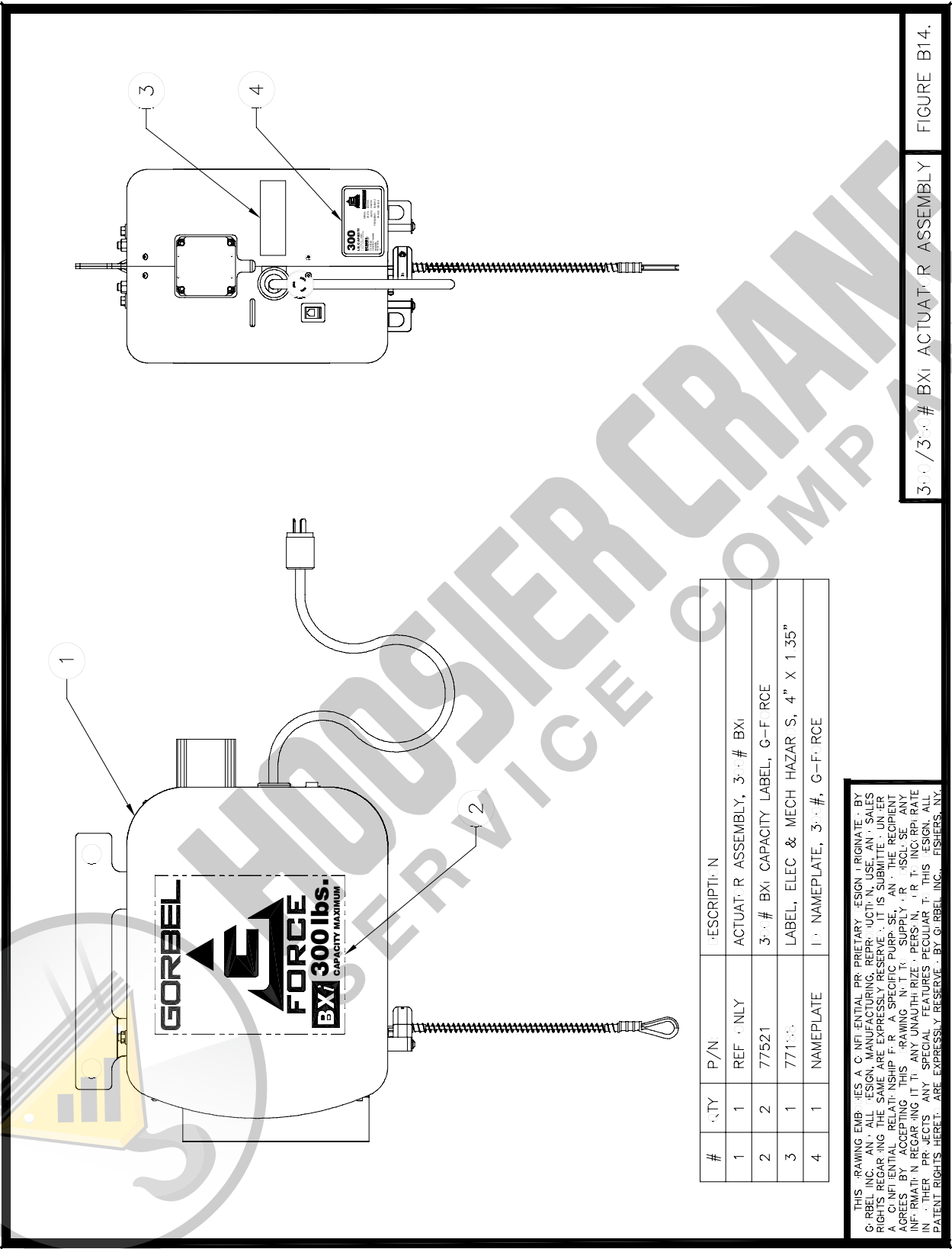


Figure B14. 300/380# BXi Actuator Assembly.

APPENDIX C - BXI STANDARD HANDLE ASSEMBLY DRAWINGS

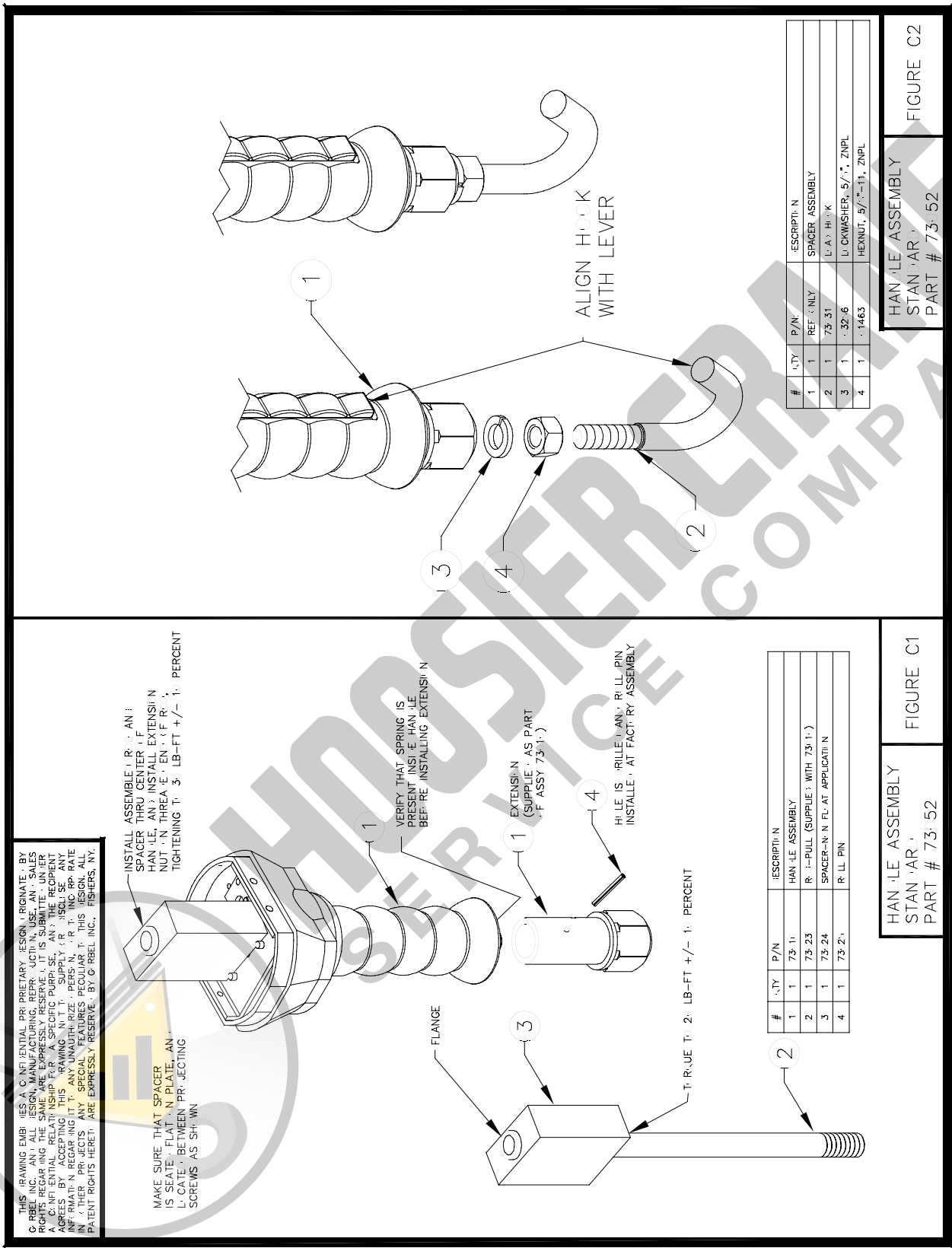
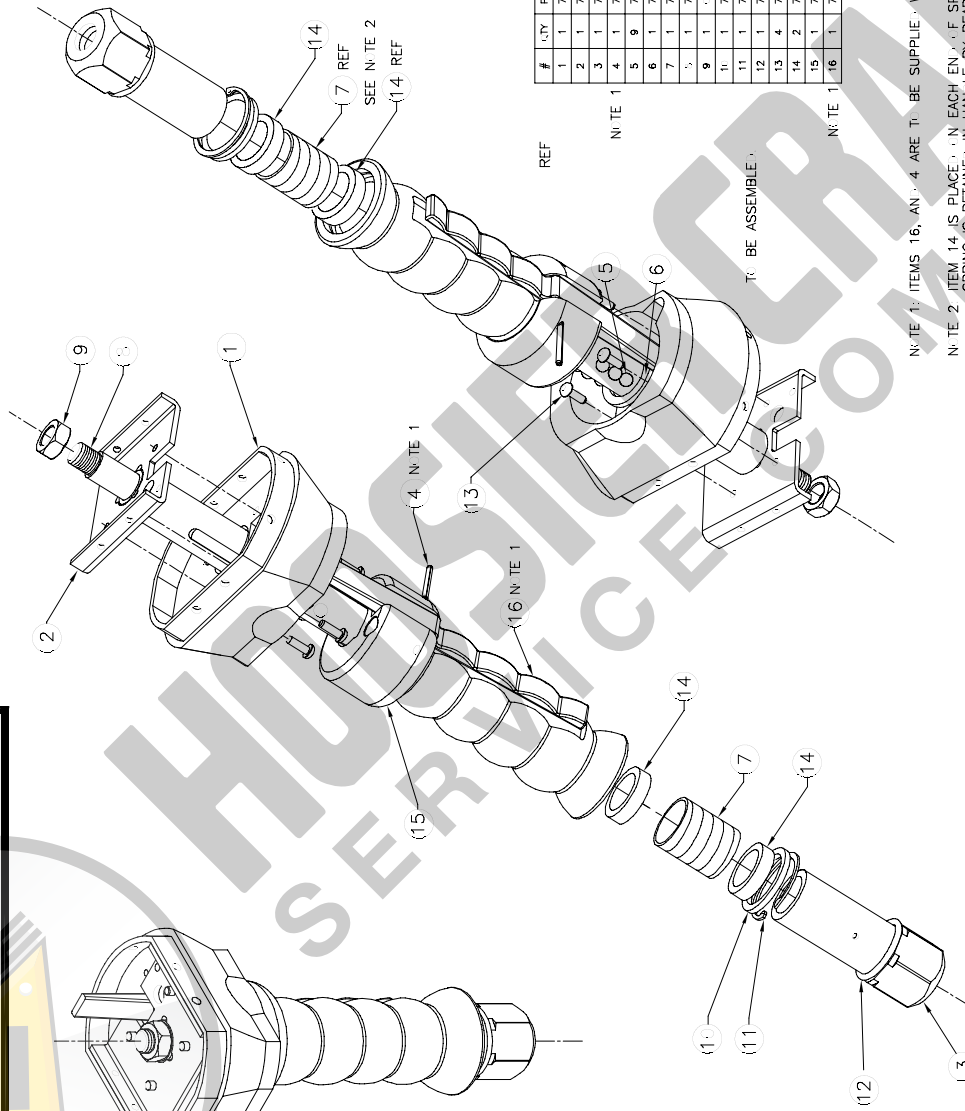


Figure C1 (bottom) & Figure C2 (top). Standard Handle Assembly.



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| #  | QTY | P/N   | DESCRIPTION             |
|----|-----|-------|-------------------------|
| 1  | 1   | 73-17 | BASE                    |
| 2  | 1   | 73-20 | PLATE ASSEMBLY          |
| 3  | 1   | 73-15 | EXTENSION               |
| 4  | 1   | 73-25 | RILL PIN                |
| 5  | 9   | 73-93 | BEARING BALL 25-14      |
| 6  | 1   | 73-16 | BUFFER                  |
| 7  | 1   | 73-19 | HANDLE SPRING           |
| 8  | 1   | 73-23 | RILL PIN                |
| 9  | 1   | 1985  | 1/2-20 UNF NUT-ZN PLATE |
| 10 | 1   | 73-14 | WASHER-NUT N            |
| 11 | 1   | 73-84 | RETAINING RING          |
| 12 | 1   | 73-29 | 1-RING                  |
| 13 | 4   | 73-32 | 1-32 X .5 BHS           |
| 14 | 2   | 73-33 | BEARING                 |
| 15 | 1   | 73-34 | HANDLE                  |
| 16 | 1   | 73-35 | LEVER                   |

NOTE 1: ITEMS 16, AND 4 ARE TO BE SUPPLIED WITH ASSEMBLY 73-17, BUT ARE NOT

NOTE 2: ITEM 14 IS PLACED IN EACH END OF SPRING (ITEM 7) SPRING IS RETAINED IN HANDLE BY BEARING (14) AND ITEM 1.

G-FORCE HANDLE BASE

FIGURE C3

Figure C3. Standard Handle Assembly.

1

2

3

DRILL THRU WITH 1/8" DRILL BIT

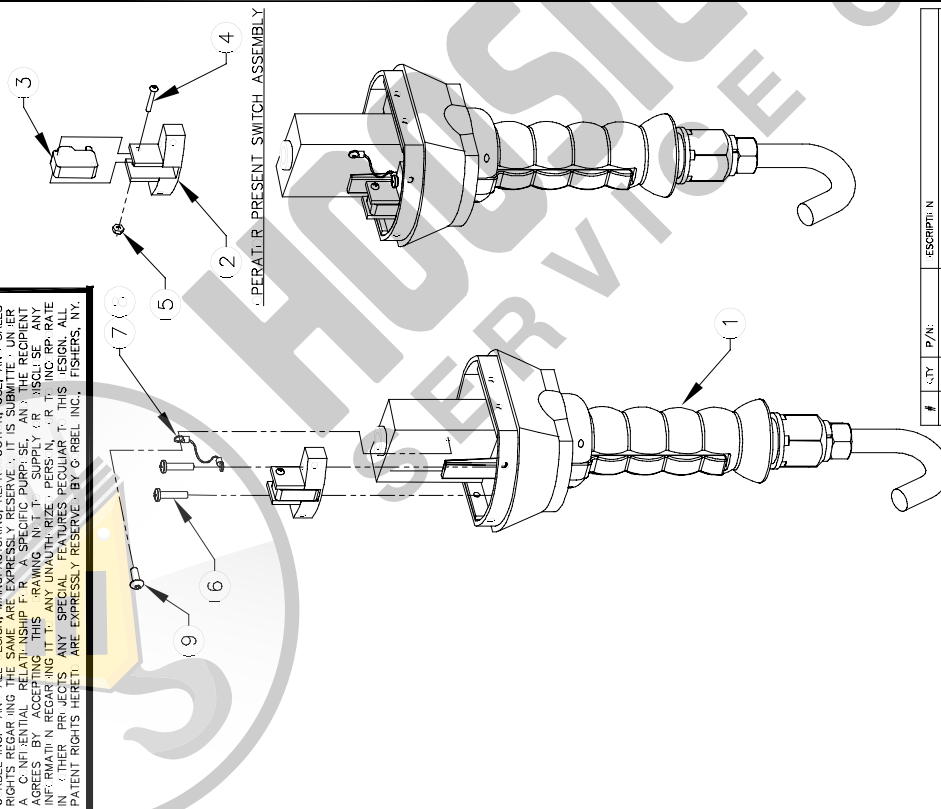
RING

1. PUSH HANDLE OF ASSEMBLY FULLY INTO BASE, EXPOSING PILOT HOLE IN ONE SIDE OF EXTENSION.
2. PLACE IN FIXTURE, WITH HOLE UP.
3. DRILL COMPLETELY THRU EXTENSION AND REMOVE ANY CHIPS, AND BURRS FROM BOTH ENDS OF HOLE.
4. PRESS SPRING PIN THRU EXTENSION, MAKING SURE THAT BOTH ENDS ARE FLUSH TO SLIGHTLY BELOW FLUSH, AND THAT THERE ARE NO BURRS.
5. PERATE HANDLE SEVERAL TIMES THRU FULL TRAVEL RANGE TO ENSURE THAT NO BINDING CAN BE DETECTED.

| # | QTY | P/N      | DESCRIPTION     |
|---|-----|----------|-----------------|
| 1 | 1   | REF ONLY | HANDLE ASSEMBLY |
| 2 | 1   | 73-2     | ROLL PIN        |

HANDLE PIN OPERATION

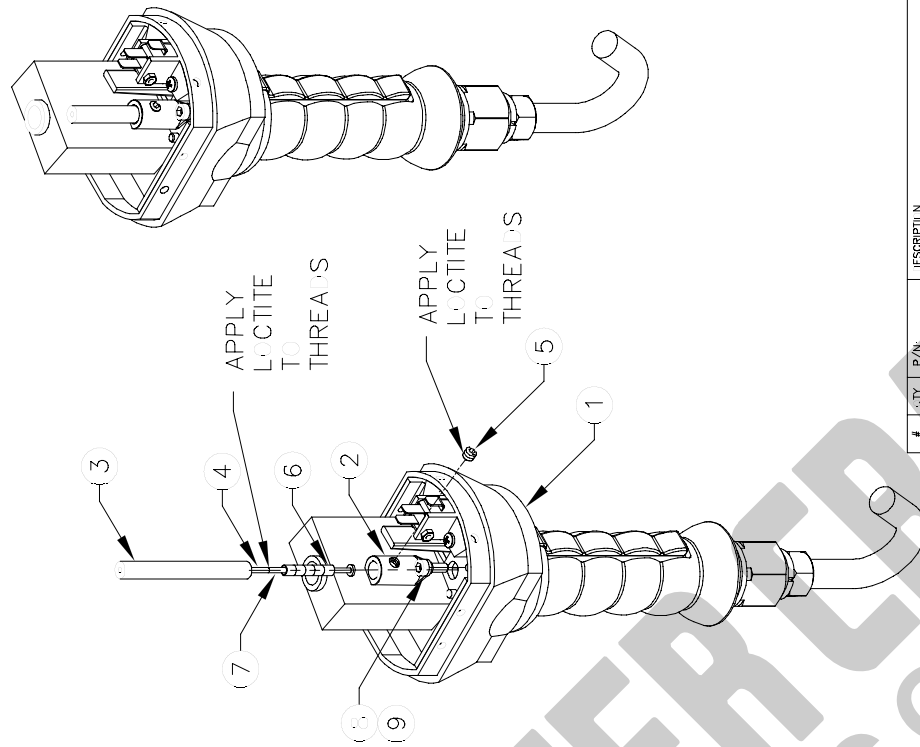
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| # | QTY | P/N      | DESCRIPTION                           |
|---|-----|----------|---------------------------------------|
| 1 | 1   | REF ONLY | HANDLE ASSEMBLY                       |
| 2 | 1   | 77-11    | OPERATOR PRESENT SWITCH INSERT        |
| 3 | 1   | 77-14    | LIMIT SWITCH ROLLER ARM ACT. FR. M.C. |
| 4 | 1   | 77-23    | SUITE, #4-6 X 3/4" LG. ZNPL           |
| 5 | 1   | 77-24    | HEX NUT, #4-4, ZNPL                   |
| 6 | 2   | 77-26    | PHMS, #1 X 3/4" LG. STAINLESS         |
| 7 | 3   | 77-53    | H.C. KUP WIRE, 24 AWG, GRN/YEL        |
| 8 | 2   | 77-56    | RING TERMINAL, #12-26 AWG             |
| 9 | 1   | 77-171   | PHMS #12-26 X 3/4" LG. SUITE, ZNPL    |

HANDLE ASSEMBLY  
STANDARD  
PART # 73-52

FIGURE C5



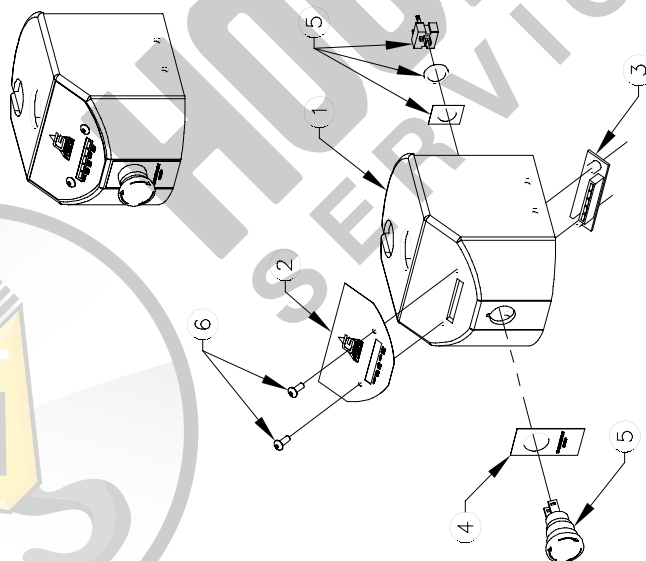
| # | QTY | P/N      | DESCRIPTION                               |
|---|-----|----------|---|
| 1 | 1   | REF ONLY | HANDLE ASSEMBLY                           |
| 2 | 1   | 77-22    | LVIT, +/- 1/2" STR. KE. 5 WIRE            |
| 3 | 1   | 77-99    | LVIT C RE-SUPPLY 1 W/LVIT                 |
| 4 | 1   | 77-36    | SET-SCREW, 1/4"-2" X 1/4" LG. ALL Y STEEL |
| 5 | 1   | 73-26    | SPRING-LVIT                               |
| 6 | 1   | 73-25    | EXTENSIBLE-LVIT Q RE                      |
| 7 | 1   | 73-3     | 1"-32 X 3" SHCS                           |
| 8 | 1   | 71-49    | 1" ID OR WASHER                           |

HANDLE ASSEMBLY  
STANDARD  
PART # 73-52

FIGURE C6

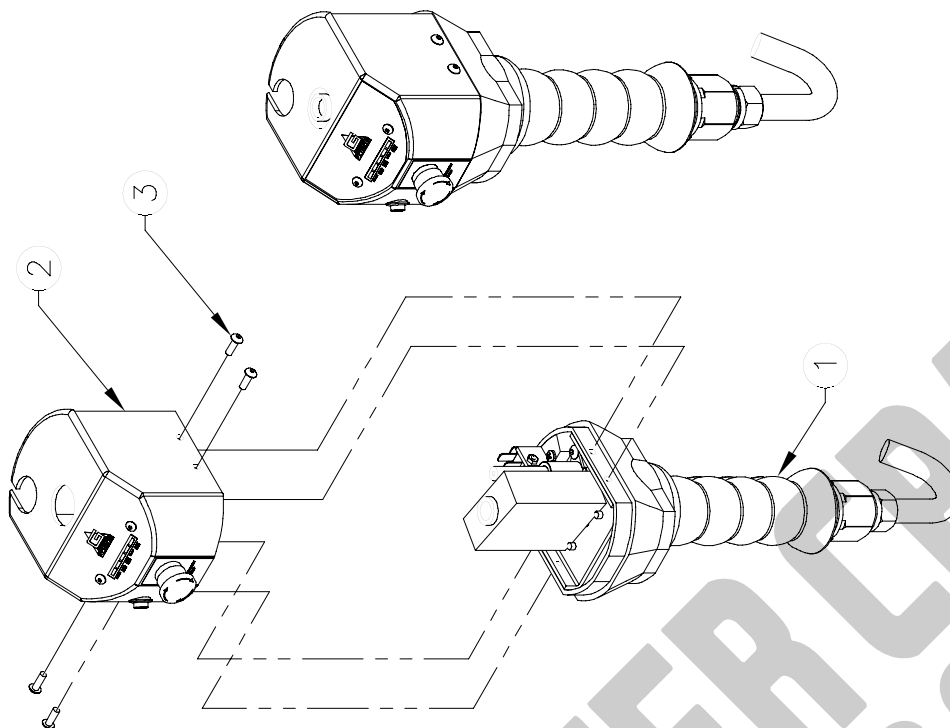
Figure C5 (bottom) & Figure C6 (top). Standard Handle Assembly.

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| # | TY | P/N    | DESCRIPTION                |
|---|----|--------|----------------------------|
| 1 | 1  | 7-1-42 | H <sub>2</sub> USING T: P  |
| 2 | 1  | 7-1-29 | LE: B                      |
| 3 | 1  | 771-7  | LE: B AR: PCB, 5 O: L R    |
| 4 | 1  | 7-1-31 | E-ST: P LABEL              |
| 5 | 1  | 771-91 | SWITCH, E-ST: P, 16MM      |
| 6 | 2  | 7-1-45 | BUFC, 46, 30, 2, 6, 1, 1 C |

HANDLE ASSEMBLY  
STANDARD  
PART # 73-52

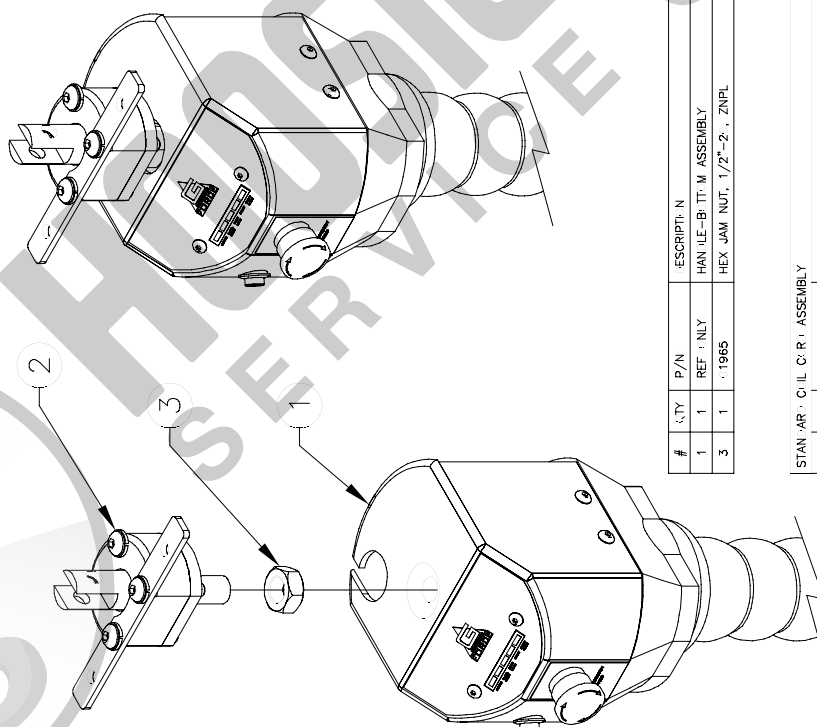


| # | QTY | P/N      | DESCRIPTION                    |
|---|-----|----------|--------------------------------|
| 1 | 1   | REF ONLY | HANDLE-BOTTOM ASSEMBLY         |
| 2 | 1   | REF ONLY | H- USING TOP ASSEMBLY          |
| 3 | 4   | REF ONLY | BOLTS #8-32 X 1/2" (CONTAINER) |

HANDLE ASSEMBLY  
STANDARD  
PART # 73-52

**Figure C7 (bottom) & Figure C8 (top).** *Standard Handle Assembly.*

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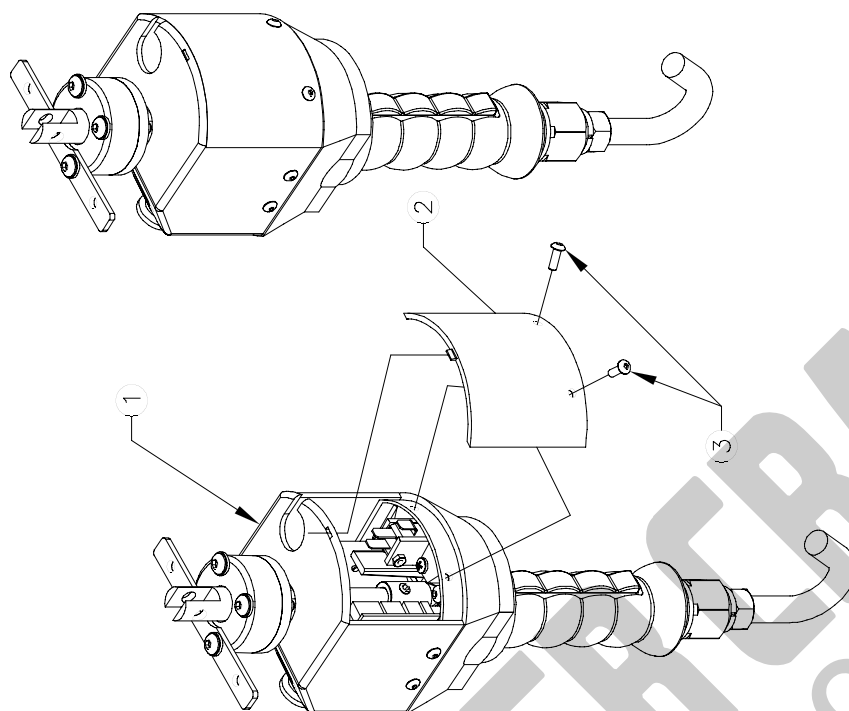


| # | QTY | P/N      | DESCRIPTION               |
|---|-----|----------|---------------------------|
| 1 | 1   | REF: NLY | HANDLE-BOTTOM ASSEMBLY    |
| 3 | 1   | 1965     | HEX JAM NUT, 1/2"-2, ZNPL |

| # | QTY | P/N   | DESCRIPTION               |
|---|-----|-------|---------------------------|
| 2 | 1   | 7-1-6 | SWIVEL ASSEMBLY, STANDARD |

| # | QTY | P/N   | DESCRIPTION             |
|---|-----|-------|-------------------------|
| 2 | 1   | 7-1-7 | SWIVEL ASSEMBLY, AIRHSE |

FIGURE C9  
HANDLE ASSEMBLY  
STANDARD  
PART # 73-52

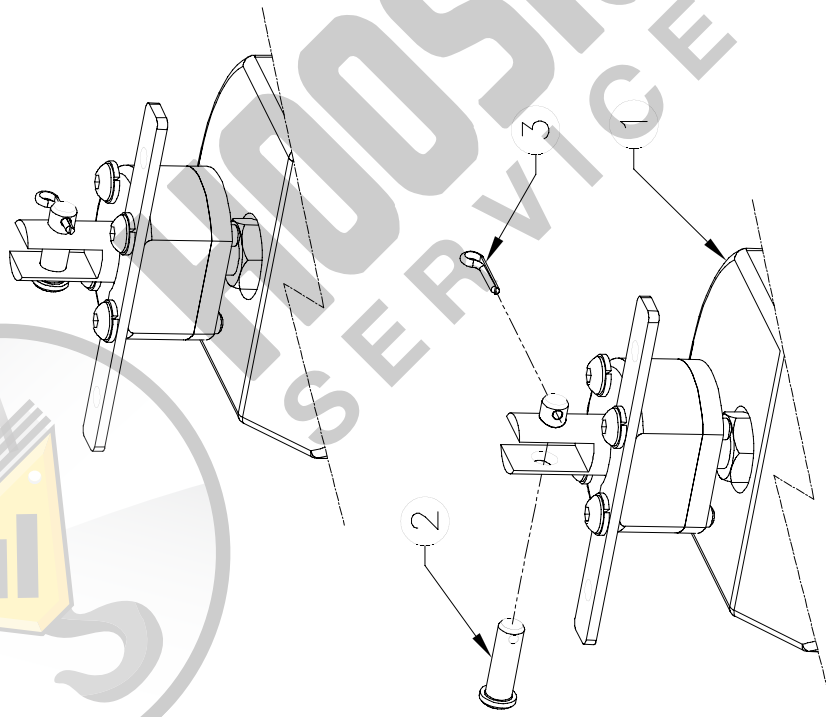


| # | QTY | P/N      | DESCRIPTION                 |
|---|-----|----------|-----------------------------|
| 1 | 1   | REF: NLY | HANDLE ASSEMBLY             |
| 2 | 1   | 7-1-1    | H- USING FR-NT              |
| 3 | 2   | 2-1-1    | BHCS, #1-32 X 1/2" LG, ZNPL |

FIGURE C10  
HANDLE ASSEMBLY  
STANDARD  
PART # 73-52

Figure C9 (bottom) & Figure C10 (top). Standard Handle Assembly.

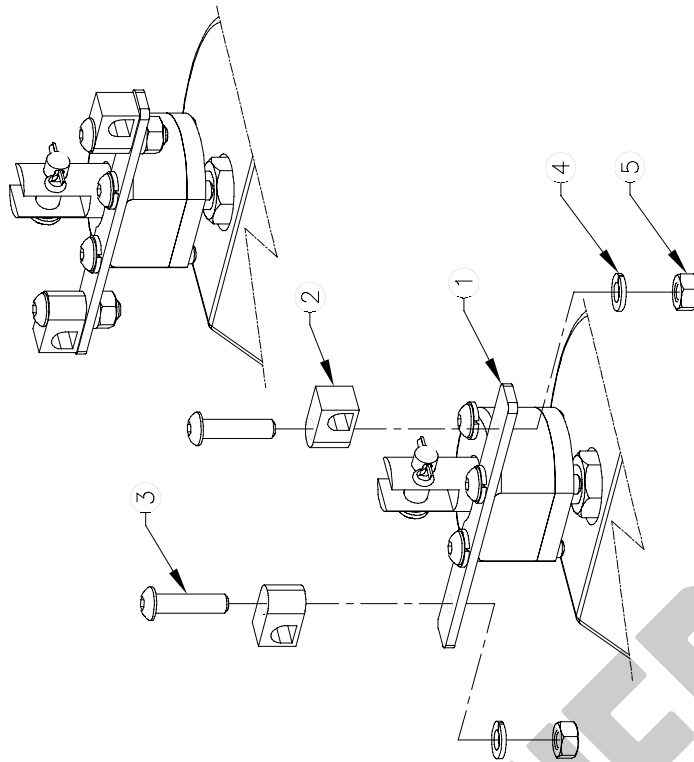
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| # | QTY | P/N      | DESCRIPTION                            |
|---|-----|----------|--|
| 1 | 1   | REF ONLY | HANDLE ASSEMBLY                        |
| 2 | 1   | 7-63     | CLEVIS PIN (**C MES WITH CLEVIS PIN**) |
| 3 | 1   | 7-63     | CLEVIS PIN (**C MES WITH CLEVIS PIN**) |

HANDLE ASSEMBLY  
STANDARD  
PART # 73-52

FIGURE C11



| # | QTY | P/N      | DESCRIPTION                     |
|---|-----|----------|---------------------------------|
| 1 | 1   | REF ONLY | HANDLE ASSEMBLY                 |
| 2 | 2   | 7-63     | CLAMP, VIBRATION DAMPING, 5/16" |
| 3 | 2   | 1-183    | BKCS, 1/4"-2" X 1" LG           |
| 4 | 2   | 12-97    | LOCKWASHER, 1/4", ZNPL          |
| 5 | 2   | 11221    | HEX NUT, 1/4"-2", ZNPL          |

| # | QTY | P/N      | DESCRIPTION                    |
|---|-----|----------|--------------------------------|
| 1 | 1   | REF ONLY | HANDLE ASSEMBLY                |
| 2 | 2   | 75379    | CLAMP, VIBRATION DAMPING, 3/4" |
| 3 | 2   | 1-164    | BKCS, 1/4"-2" X 1-3/4" LG      |
| 4 | 2   | 12-97    | LOCKWASHER, 1/4", ZNPL         |
| 5 | 2   | 11221    | HEX NUT, 1/4"-2", ZNPL         |

HANDLE ASSEMBLY  
STANDARD  
PART # 73-52

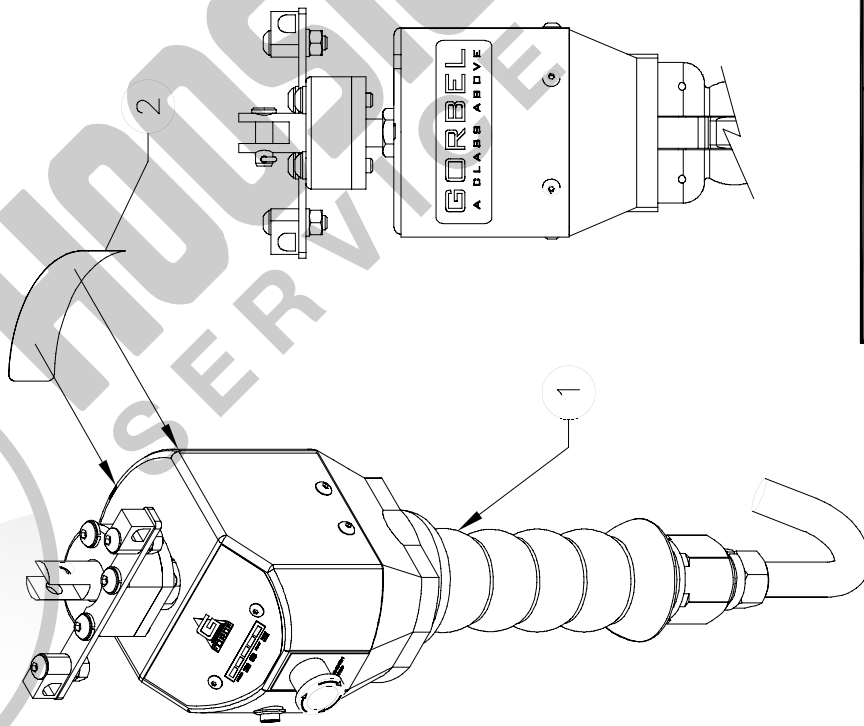
FIGURE C12

Figure C11 (bottom) & Figure C12 (top). Standard Handle Assembly.



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| # | QTY | P/N      | DESCRIPTION        |
|---|-----|----------|--------------------|
| 1 | 1   | REF ONLY | HANDLE ASSEMBLY    |
| 2 | 1   | 71132    | FRONT GORBEL LABEL |



HANDLE ASSEMBLY  
STANDARD  
PART # 7352

FIGURE C13

Figure C13. Standard Handle Assembly.

APPENDIX D - BXI FLOAT MODE HANDLE ASSEMBLY DRAWINGS

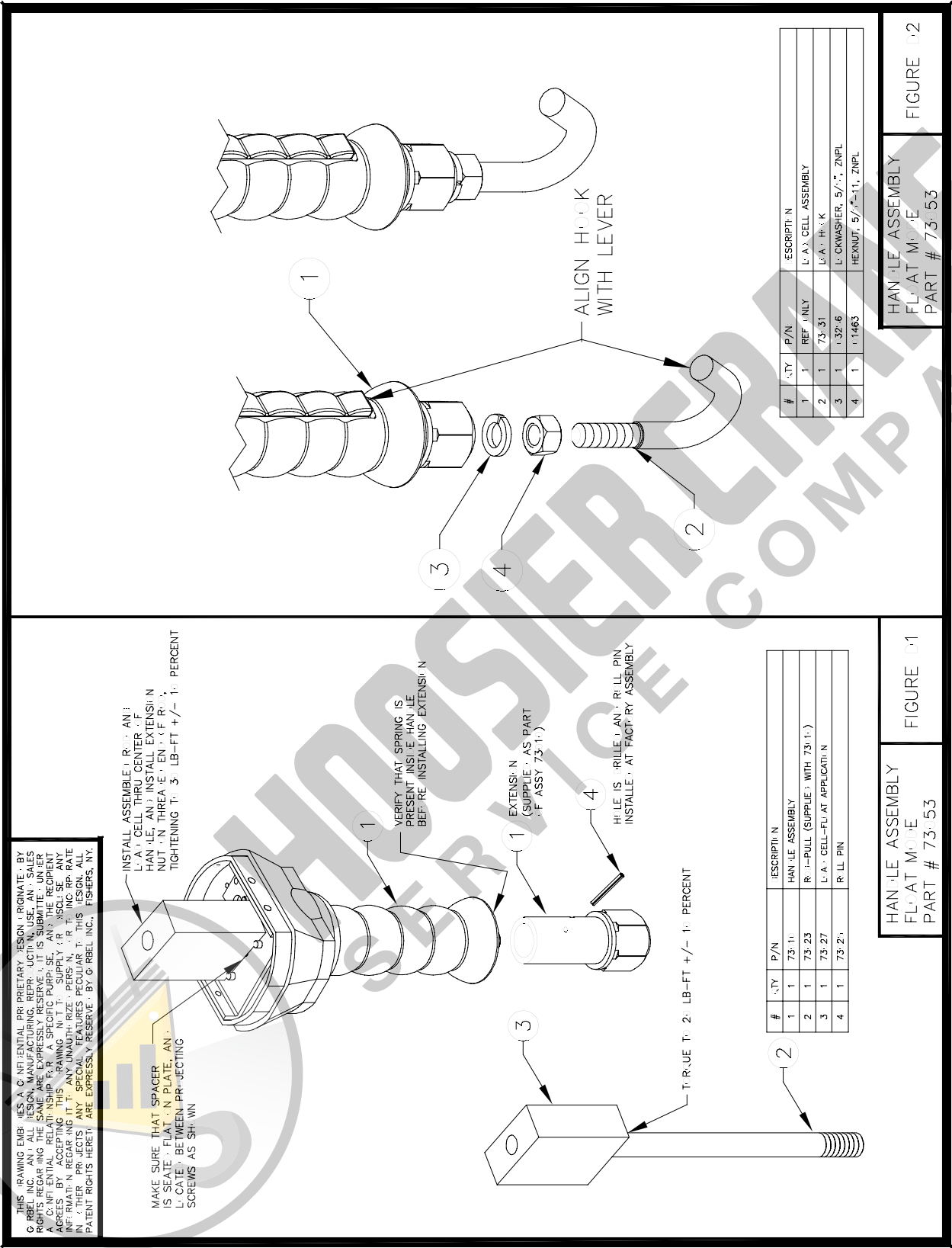
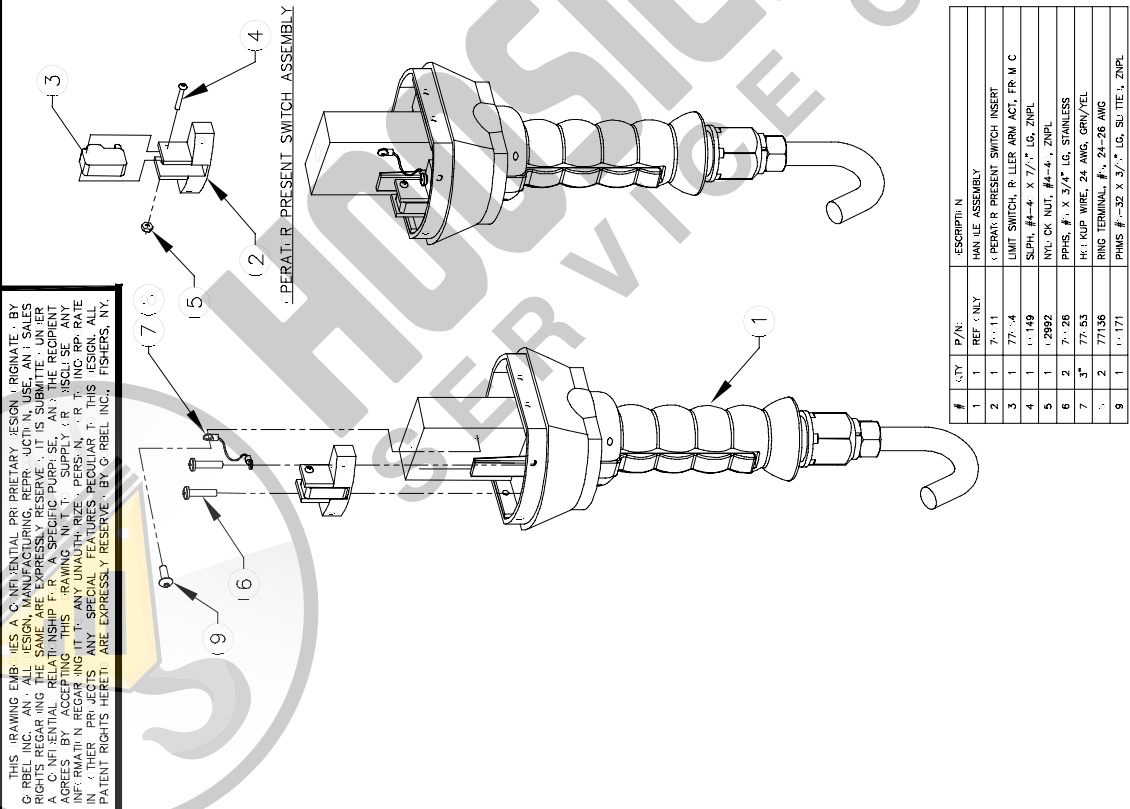


Figure D1 (bottom) & Figure D2 (top). Float Mode Handle Assembly.

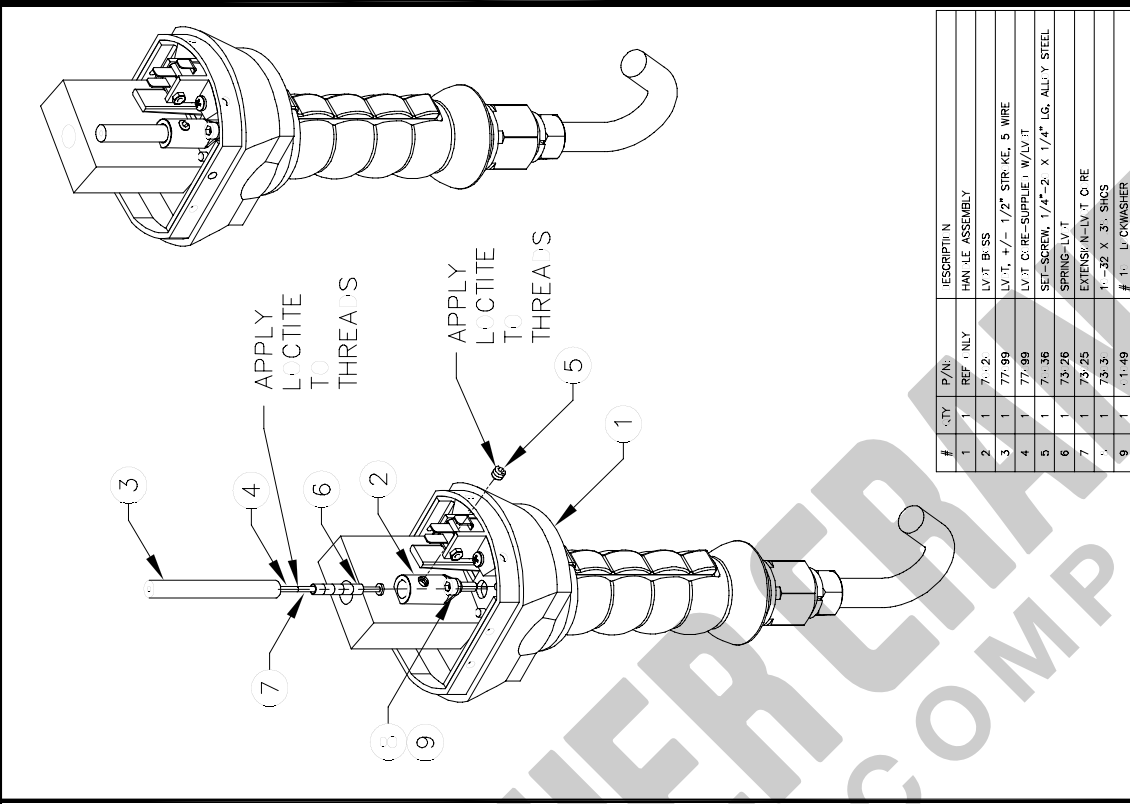
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| # | QTY | P/N    | DESCRIPTION                          |
|---|-----|--------|--------------------------------------|
| 1 | 1   | 77-11  | HANDLE ASSEMBLY                      |
| 2 | 1   | 77-14  | OPERATOR PRESENT SWITCH INSERT       |
| 3 | 1   | 77-14  | LIMIT SWITCH, ROLLER ARM ACT, FR M C |
| 4 | 1   | 1-149  | SLIP, #4-4 X 7/16 LG, ZNPL           |
| 5 | 1   | 1-2992 | NYLON NUT, #4-4, ZNPL                |
| 6 | 2   | 77-26  | PPHS, #1 X 3/4 LG, STAINLESS         |
| 7 | 3   | 77-53  | HET KUP WIRE, 24 AWG, GRN/YEL        |
| 8 | 2   | 77-36  | RING TERMINAL, #1, 24-28 AWG         |
| 9 | 1   | 1-171  | PHMS #1-32 X 3/4 LG, SU TITE, ZNPL   |

HANDLE ASSEMBLY  
FLOAT MODE  
PART # 73-53

FIGURE D3



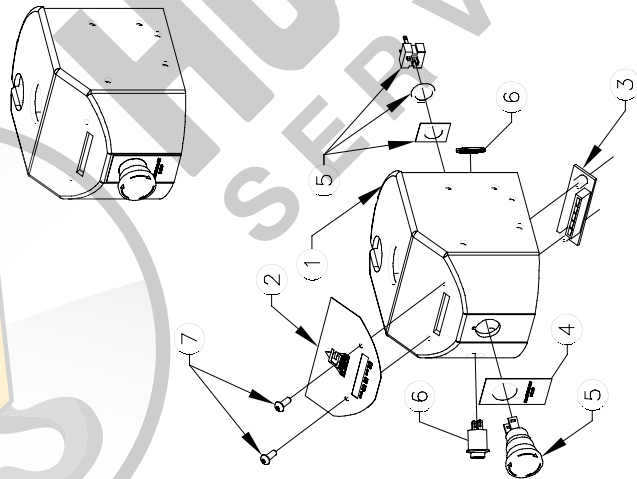
| # | QTY | P/N   | DESCRIPTION                             |
|---|-----|-------|---|
| 1 | 1   | 77-11 | HANDLE ASSEMBLY                         |
| 2 | 1   | 77-2  | LV-T B-SS                               |
| 3 | 1   | 77-99 | LV-T, +/- 1/2" STRIKE, 5 WIRE           |
| 4 | 1   | 77-99 | LV-T, C-RE-SUPPLIER W/LV-T              |
| 5 | 1   | 77-36 | SET-SCREW, 1/4"-2 X 1/4" LG, ALLY STEEL |
| 6 | 1   | 73-26 | SPRING-LV-T                             |
| 7 | 1   | 73-25 | EXTENSION-LV-T Ø RE                     |
| 8 | 1   | 73-3  | 1"-32 X 3" SHCS                         |
| 9 | 1   | 1-149 | #1-1/2 CRWASHER                         |

HANDLE ASSEMBLY  
FLOAT MODE  
PART # 73-53

FIGURE D4

Figure D3 (bottom) & Figure D4 (top). Float Mode Handle Assembly.

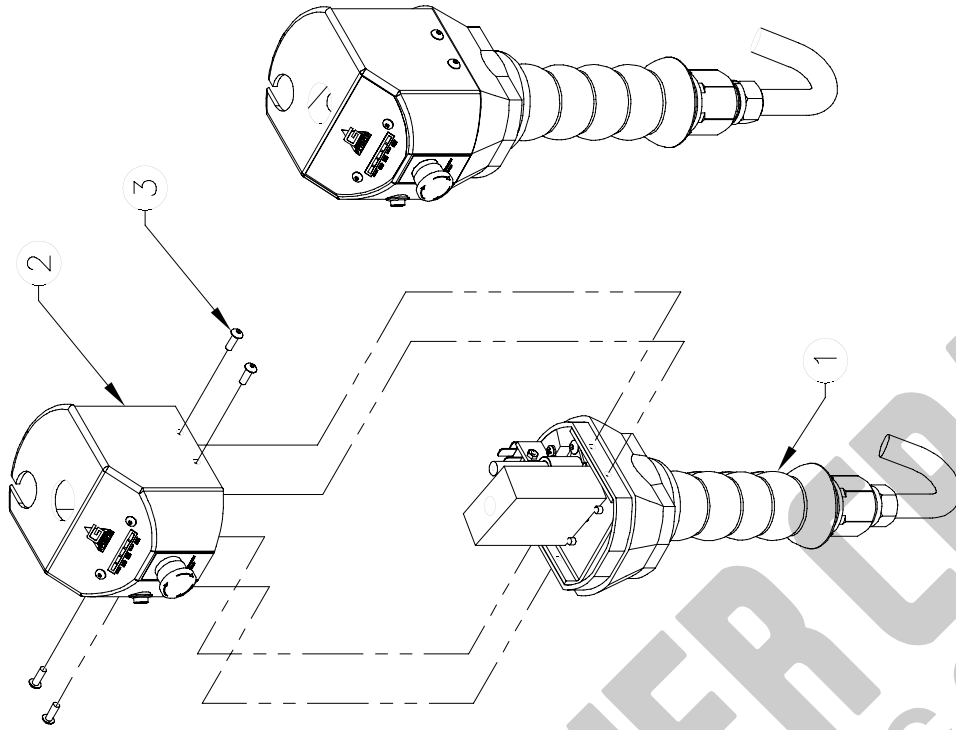
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| # | QTY | P/N    | DESCRIPTION             |
|---|-----|--------|-------------------------|
| 1 | 1   | 71-42  | H- USING T: P           |
| 2 | 1   | 71-29  | LE: LABEL               |
| 3 | 1   | 771-7  | LE: BAR, PCB, 5 O: L: R |
| 4 | 1   | 71-31  | E- ST: P LABEL          |
| 5 | 1   | 771-91 | SWITCH, E- ST: P, 16MM  |
| 6 | 1   | 76-12  | SWITCH, PUSHBUTTON      |
| 7 | 2   | 71-46  | BHCS, #6-32 X 3/4" LG   |

HANDLE ASSEMBLY  
FLOAT MODE  
PART # 73-53

FIGURE D5



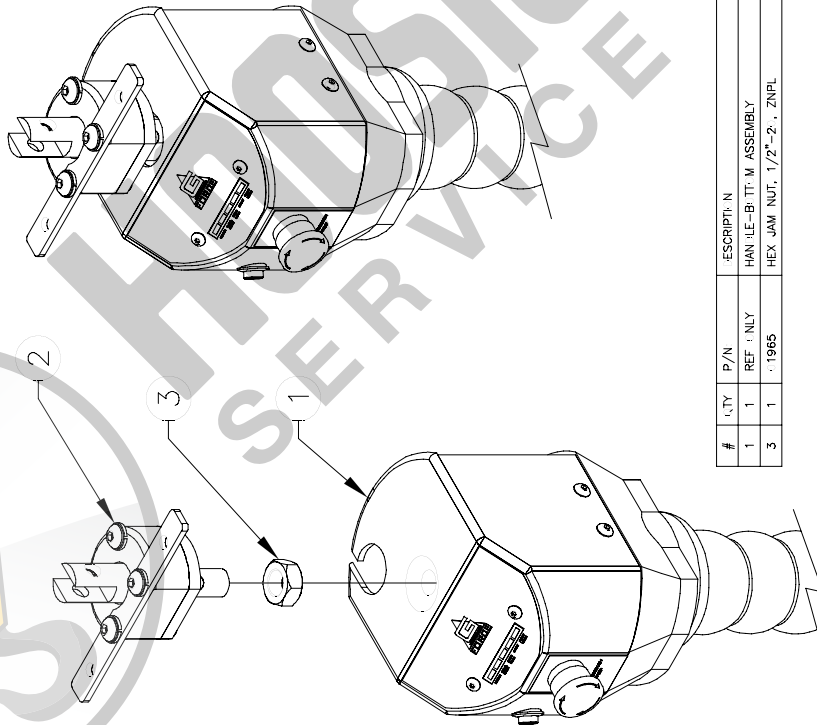
| # | QTY | P/N      | DESCRIPTION                 |
|---|-----|----------|-----------------------------|
| 1 | 1   | REF: NLY | HANDLE-B-TT: M ASSEMBLY     |
| 2 | 1   | REF: NLY | H- USING T: P ASSEMBLY      |
| 3 | 4   | 72-11    | BHCS, #6-32 X 1/2" LG, ZNPL |

HANDLE ASSEMBLY  
FLOAT MODE  
PART # 73-53

FIGURE D6

Figure D5 (bottom) & Figure D6 (top). Float Mode Handle Assembly.

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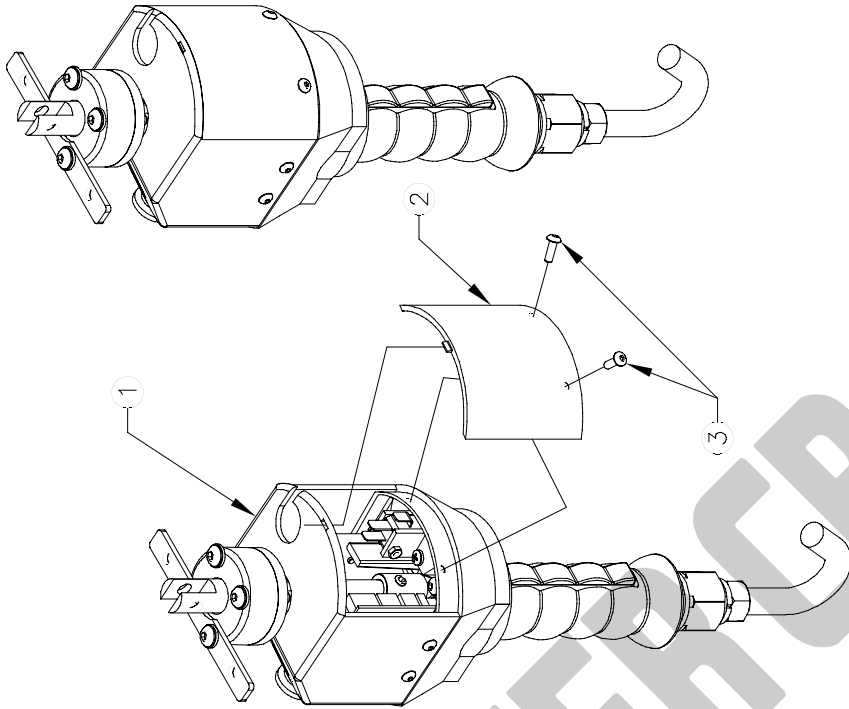


| # | QTY | P/N       | DESCRIPTION               |
|---|-----|-----------|---------------------------|
| 1 | 1   | REF: ONLY | HANDLE-BOTTOM ASSEMBLY    |
| 3 | 1   | 1965      | HEX JAM NUT, 1/2"-2, ZNPL |

| STANDARD CIL C/R: ASSEMBLY |   |       |                           |
|----------------------------|---|-------|---------------------------|
| 2                          | 1 | 7-176 | SWIVEL ASSEMBLY, STANDARD |

| AIRHSE CIL C/R: ASSEMBLY |   |       |                         |
|--------------------------|---|-------|-------------------------|
| 2                        | 1 | 7-177 | SWIVEL ASSEMBLY, AIRHSE |

FIGURE D7  
HANDLE ASSEMBLY  
FLOAT MODE  
PART # 73-53



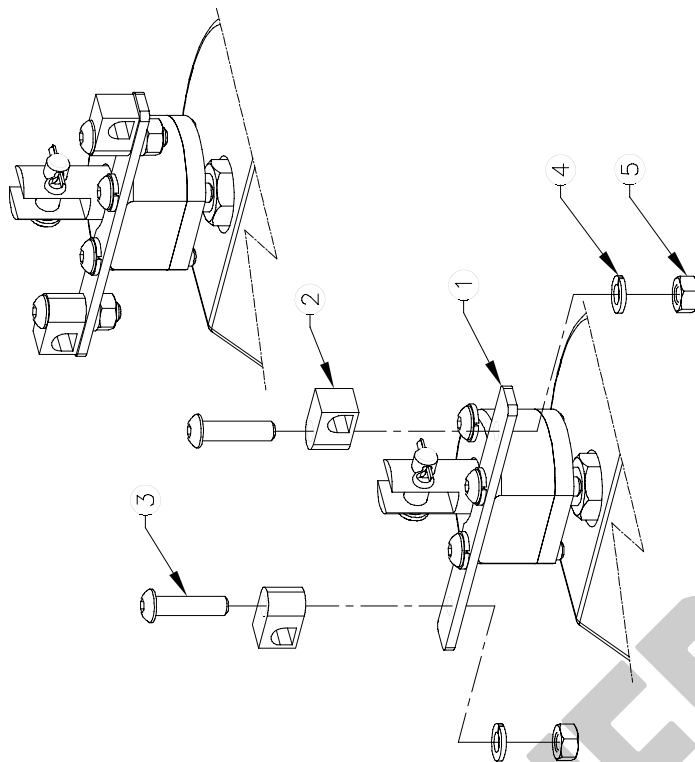
| # | QTY | P/N       | DESCRIPTION               |
|---|-----|-----------|---------------------------|
| 1 | 1   | REF: ONLY | HANDLE ASSEMBLY           |
| 2 | 1   | 7-171     | WASHER, 1/2"-13, ZNPL     |
| 3 | 2   | 7-221     | BHCS, #32 X 1/2" LG, ZNPL |

FIGURE D8  
HANDLE ASSEMBLY  
FLOAT MODE  
PART # 73-53

Figure D7 (bottom) & Figure D8 (top). Float Mode Handle Assembly.

| # | TYPE | P/N:     | DESCRIPTION                            |
|---|------|----------|--|
| 1 | 1    | REF ONLY | HANDLE ASSEMBLY                        |
| 2 | 1    | 7-163    | CLEVIS PIN (**C MES WITH C TTER PIN**) |
| 3 | 1    | 7-163    | C TTER PIN (**C MES WITH CLEVIS PIN**) |

FIGURE D.9

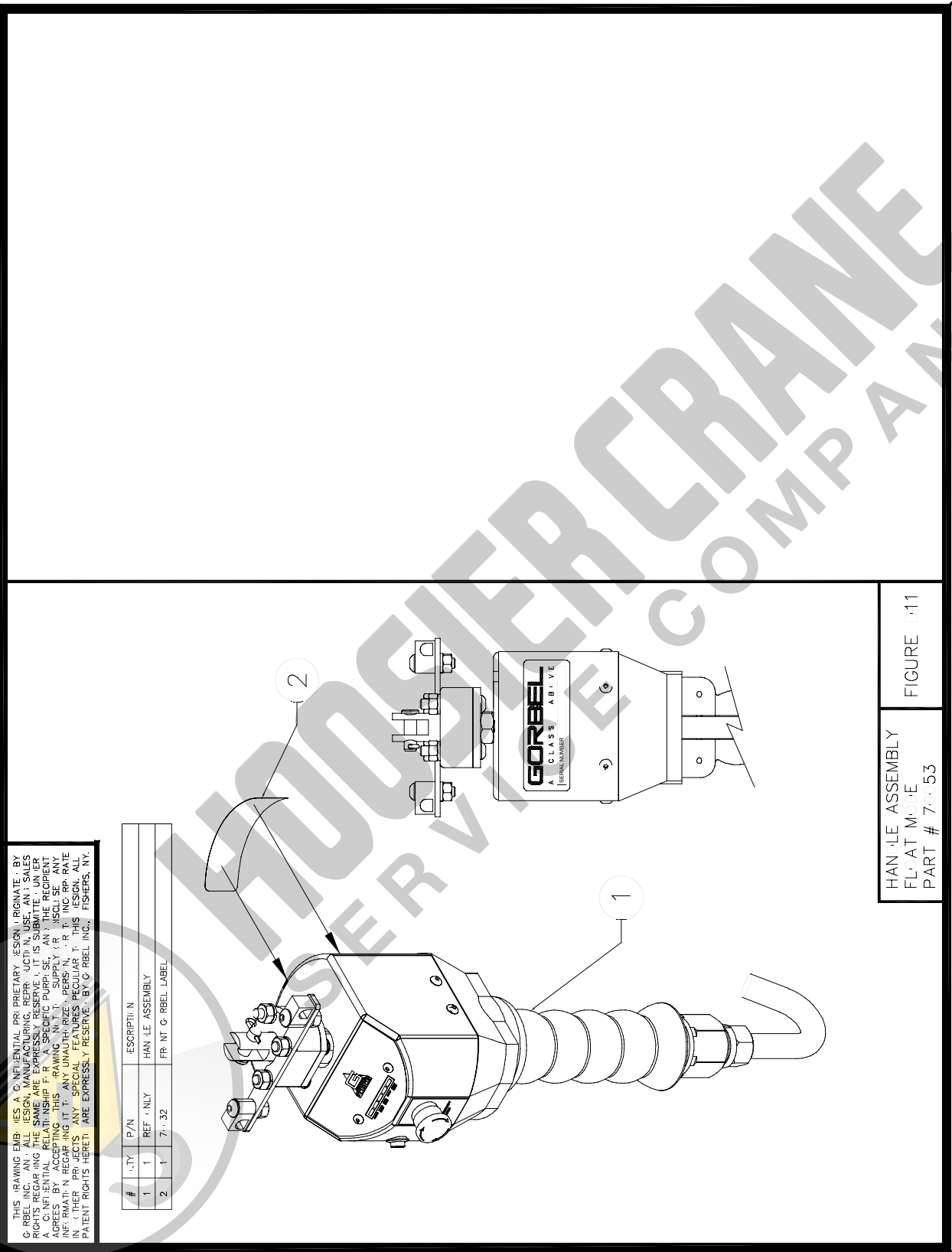


| # | QTY | P/N       | DESCRIPTION             |
|---|-----|-----------|-------------------------|
| 1 | 1   | REF. ONLY | HAN. L. ASSEMBLY        |
| 2 | 2   | 7-100     | CLAMP, VIBRATION, 5/16" |
| 3 | 2   | 1-183     | BHCS, 1/4"-20, 1" LG    |
| 4 | 2   | 2-97      | L. CKWASHER, 1/4", ZNPL |
| 5 | 2   | 1291      | HPXKIT, 1/4"-20, ZNPL   |

| # | ITY | P/N       | DESCRIPTION                         |
|---|-----|-----------|-------------------------------------|
| 1 | 1   | REF. ONLY | HAN. LE ASSEMBLY                    |
| 2 | 2   | 75379     | CLAMP, VIBRATION TAMPING, 3/4" I.D. |
| 3 | 2   | 1164      | BHCS, 1/4"-20, X-1-3/4" LG          |
| 4 | 2   | 2-97      | L. KWASHER, 1/4" ZNPL               |
| 5 | 2   | 1921      | HEXNUT, 1/4"-20, ZNPL               |

FIGURE D10





APPENDIX E - COIL CORD ASSEMBLY - SCHEMATIC DRAWINGS

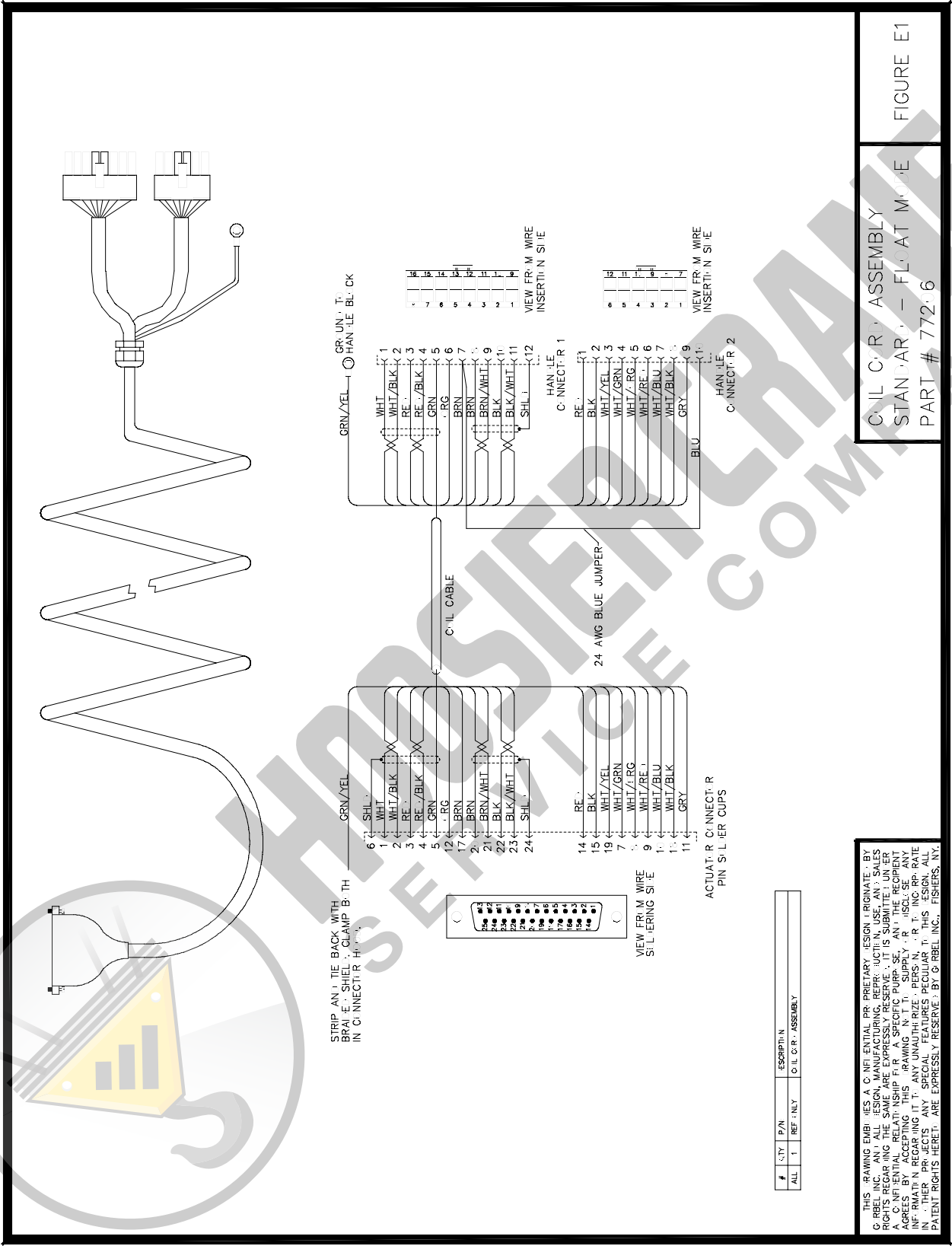
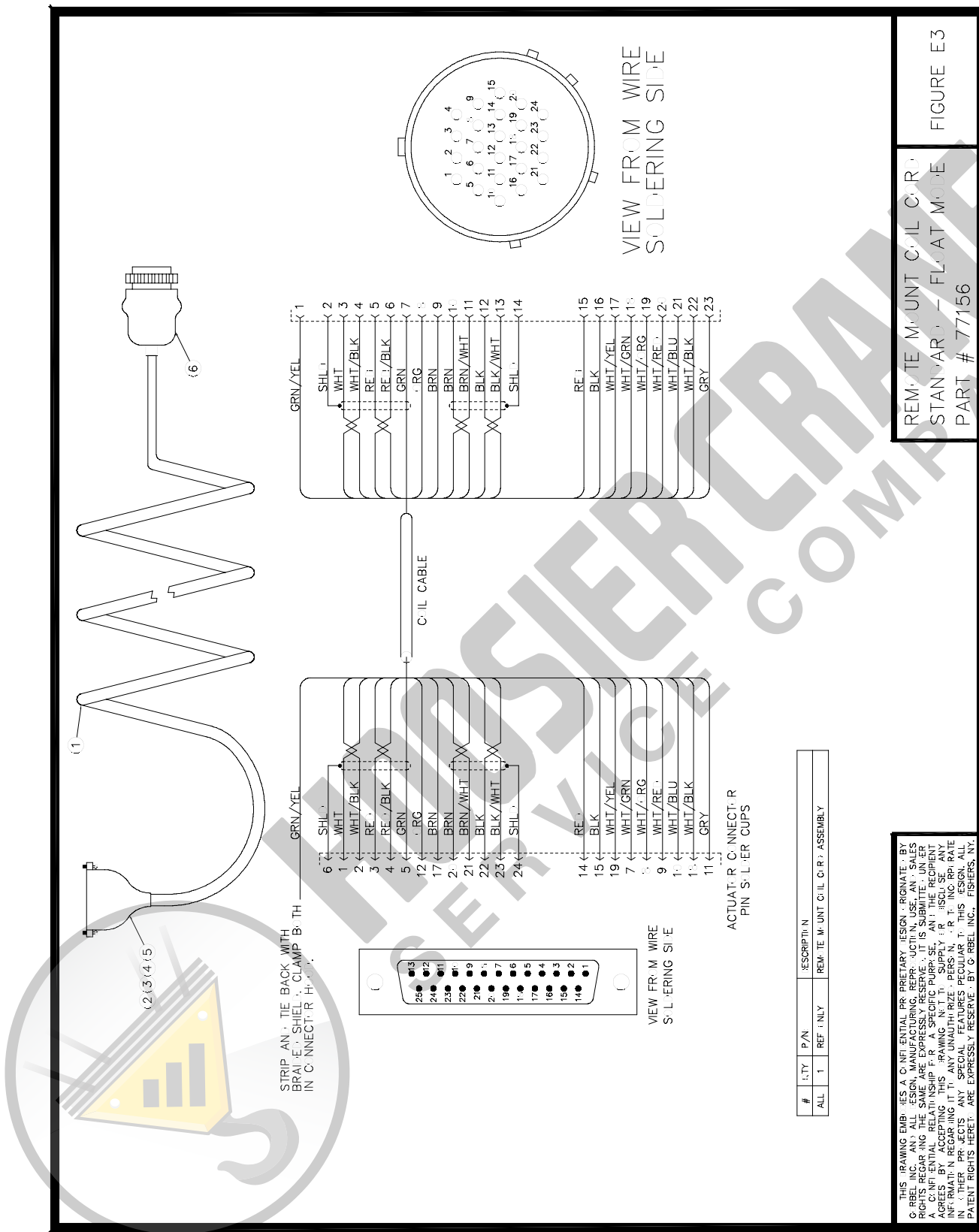


Figure E1. Coil Cord Assembly Standard - Float Mode.



Figure E3. Remote Mount Coil Cord Standard - Float Mode.



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APPENDIX F - CONTROLS SCHEMATIC DRAWINGS

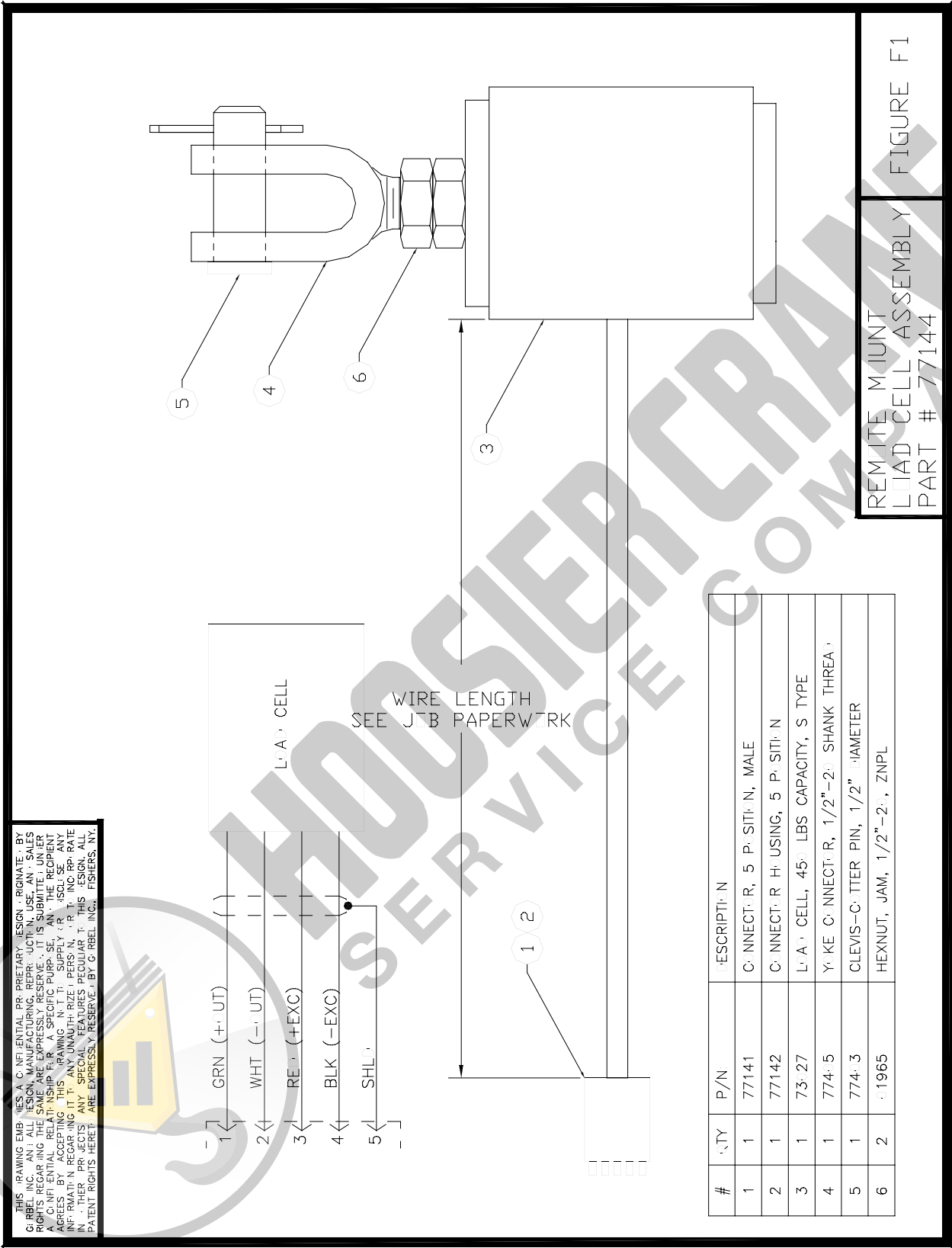


Figure F1. Remote Load Cell Assembly.





FIGURE F3  
BXi INTERNAL WIRING SCHEMATIC

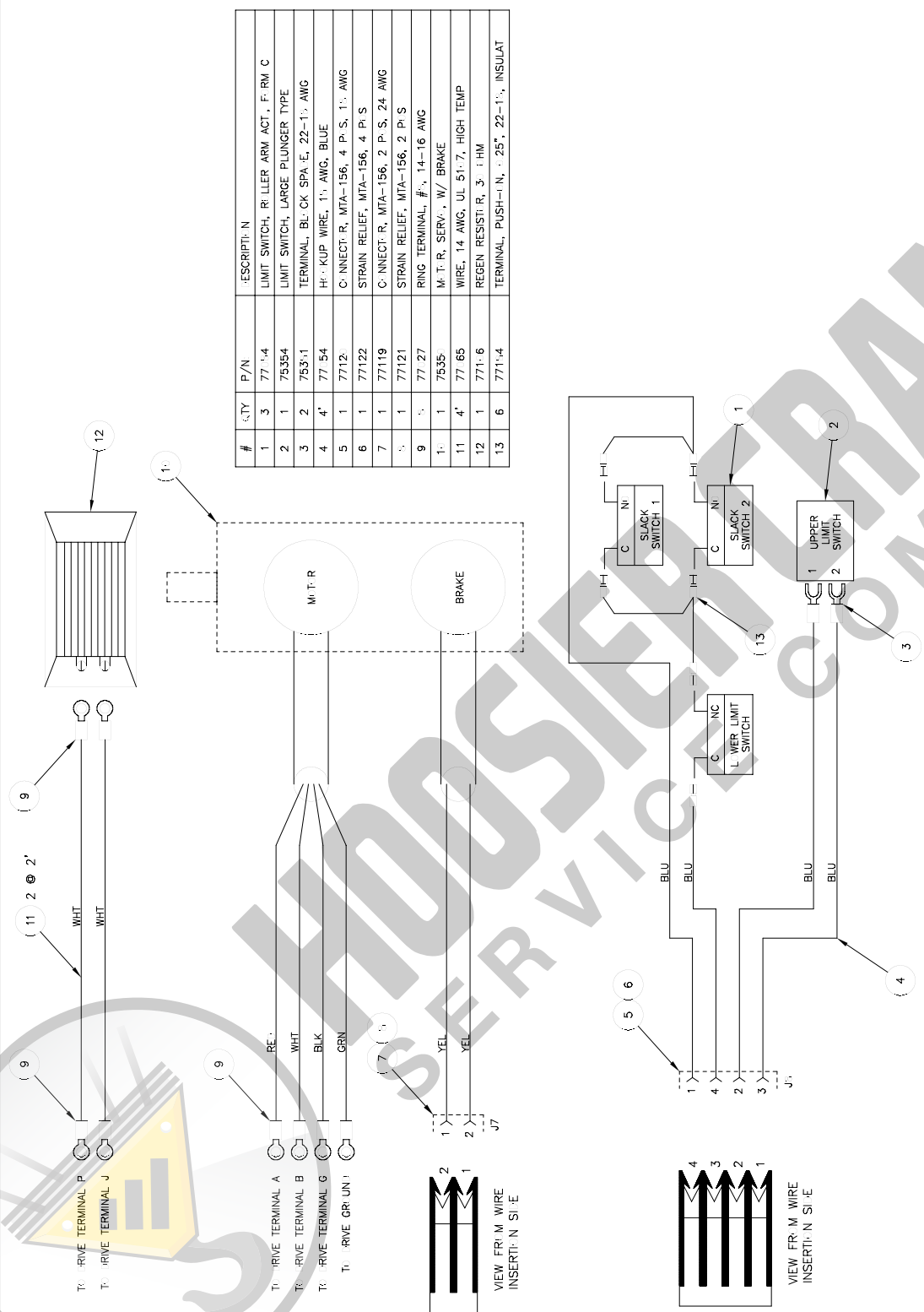


Figure F3. BXi Internal Wiring Schematic.

# APPENDIX G - OVERALL G-FORCE® REFERENCE DIMENSIONS

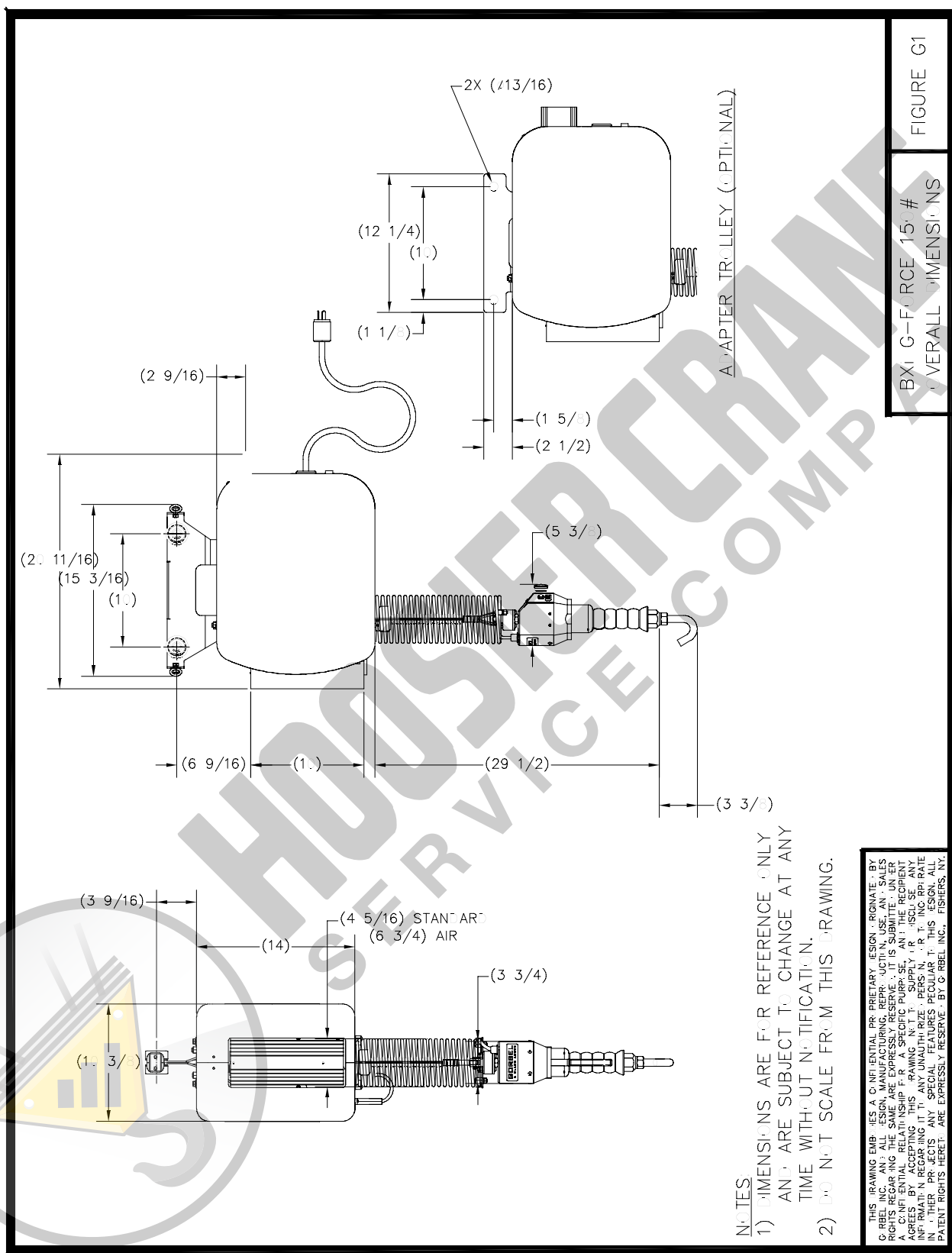


Figure G1. BXi G-Force® 150# Overall Dimensions.

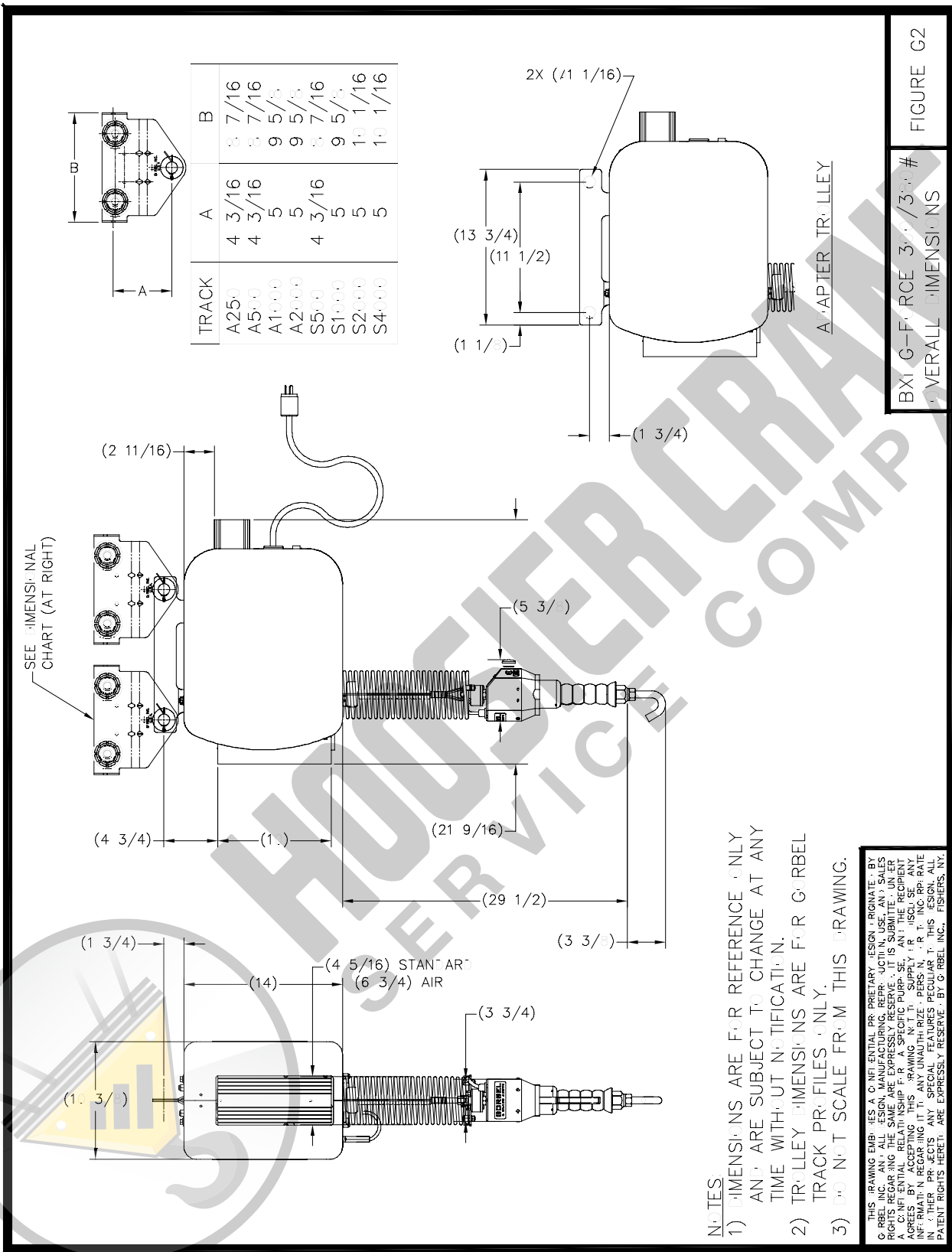


FIGURE G2

BXi G-Force 300#  
OVERALL DIMENSIONS

Figure G2. BXi G-Force® 300# Overall Dimensions.

# APPENDIX H - BXi G-FORCE® HANDLE REFERENCE DIMENSIONS

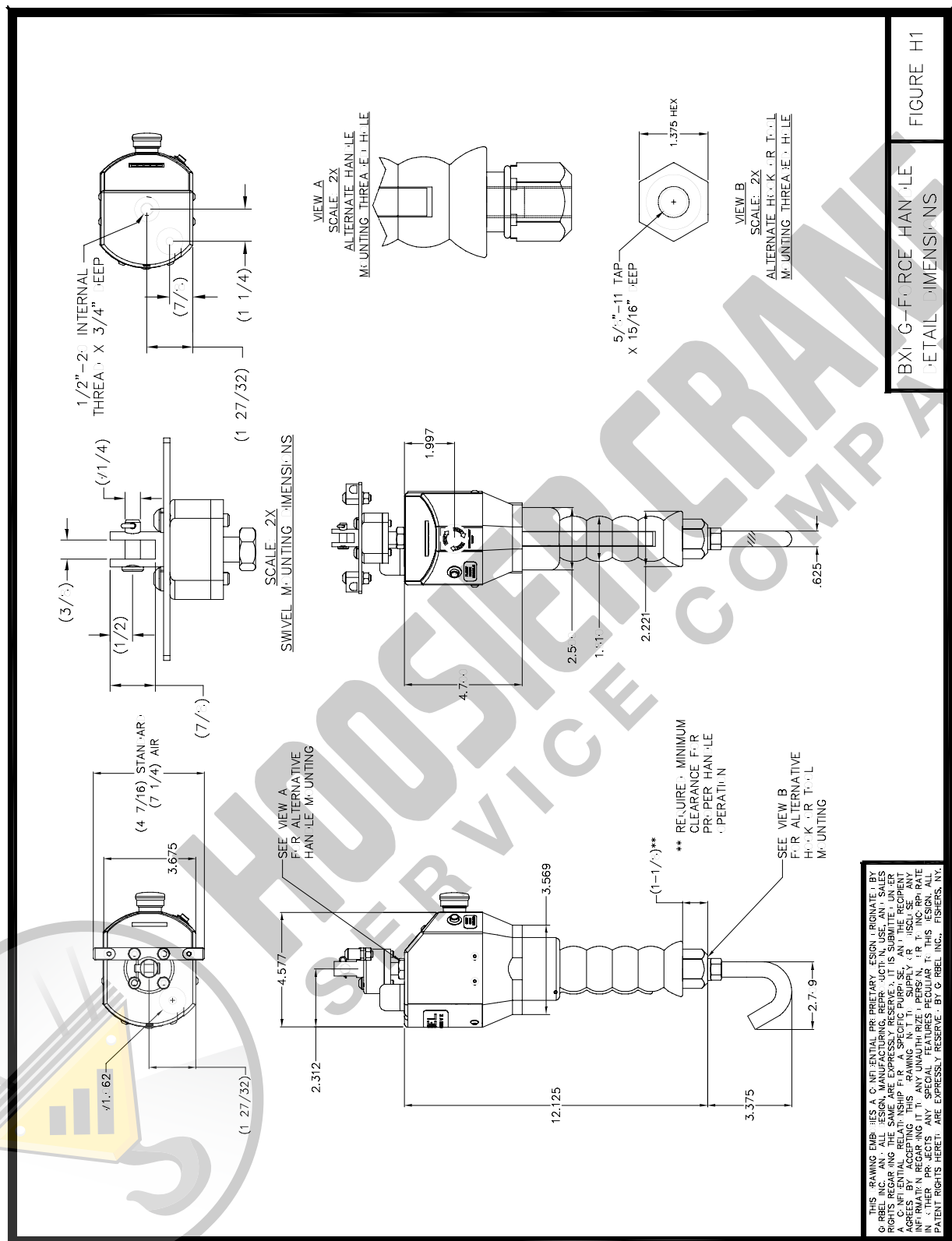


Figure H1. BXi G-Force® Handle Detail Dimensions.

# APPENDIX I - COMPONENT LAYOUT DRAWINGS

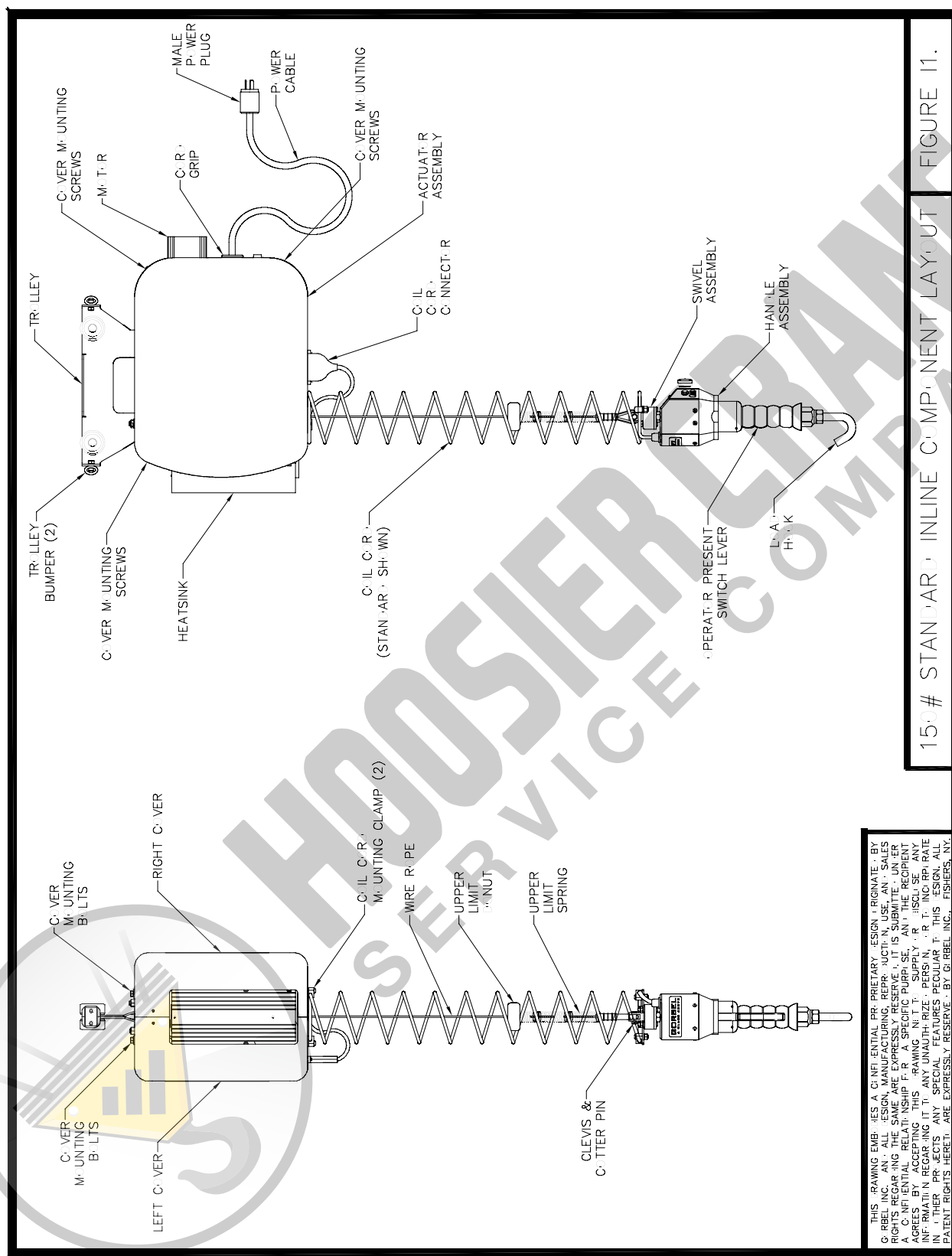


Figure 11. 150# Standard Inline Component Layout.

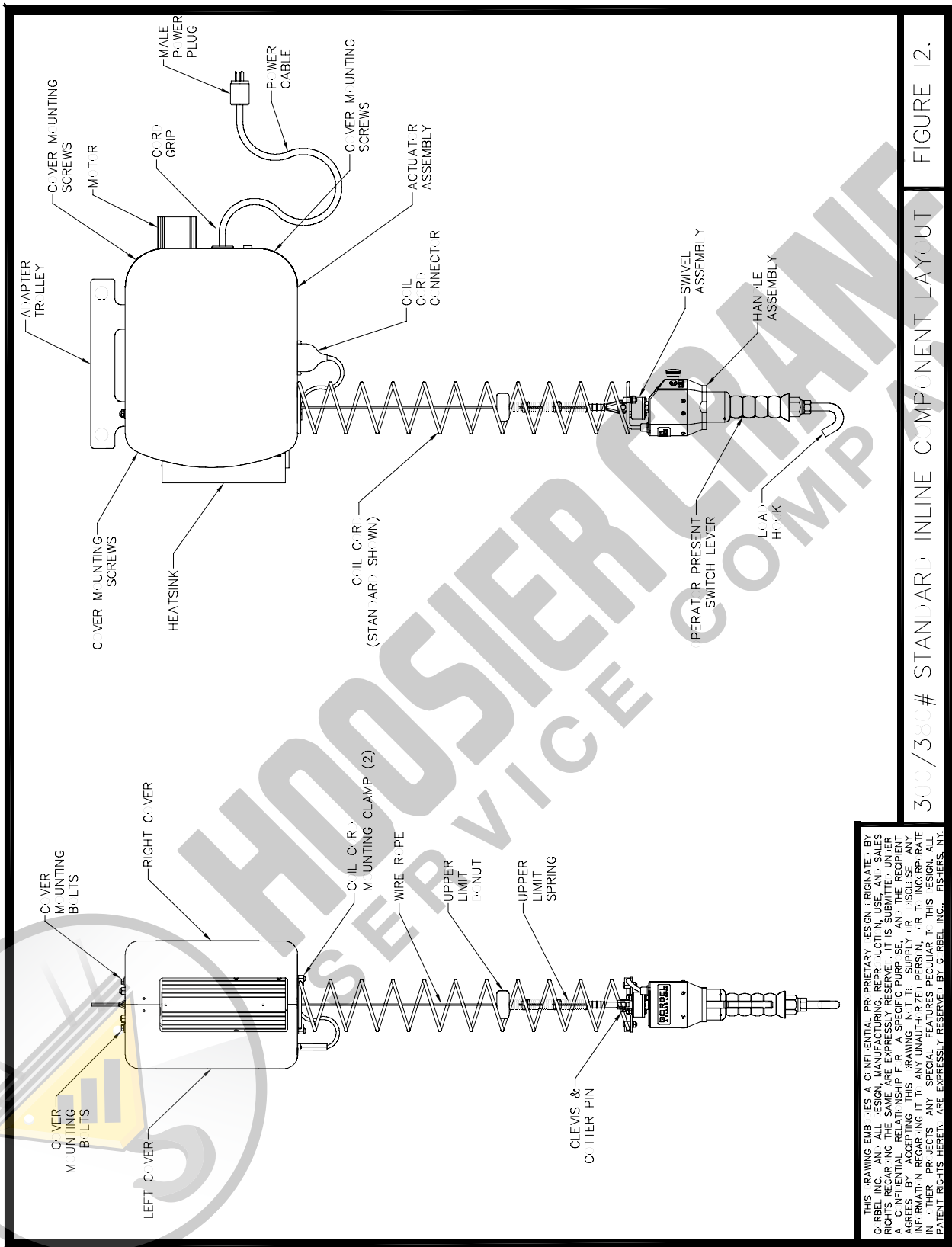
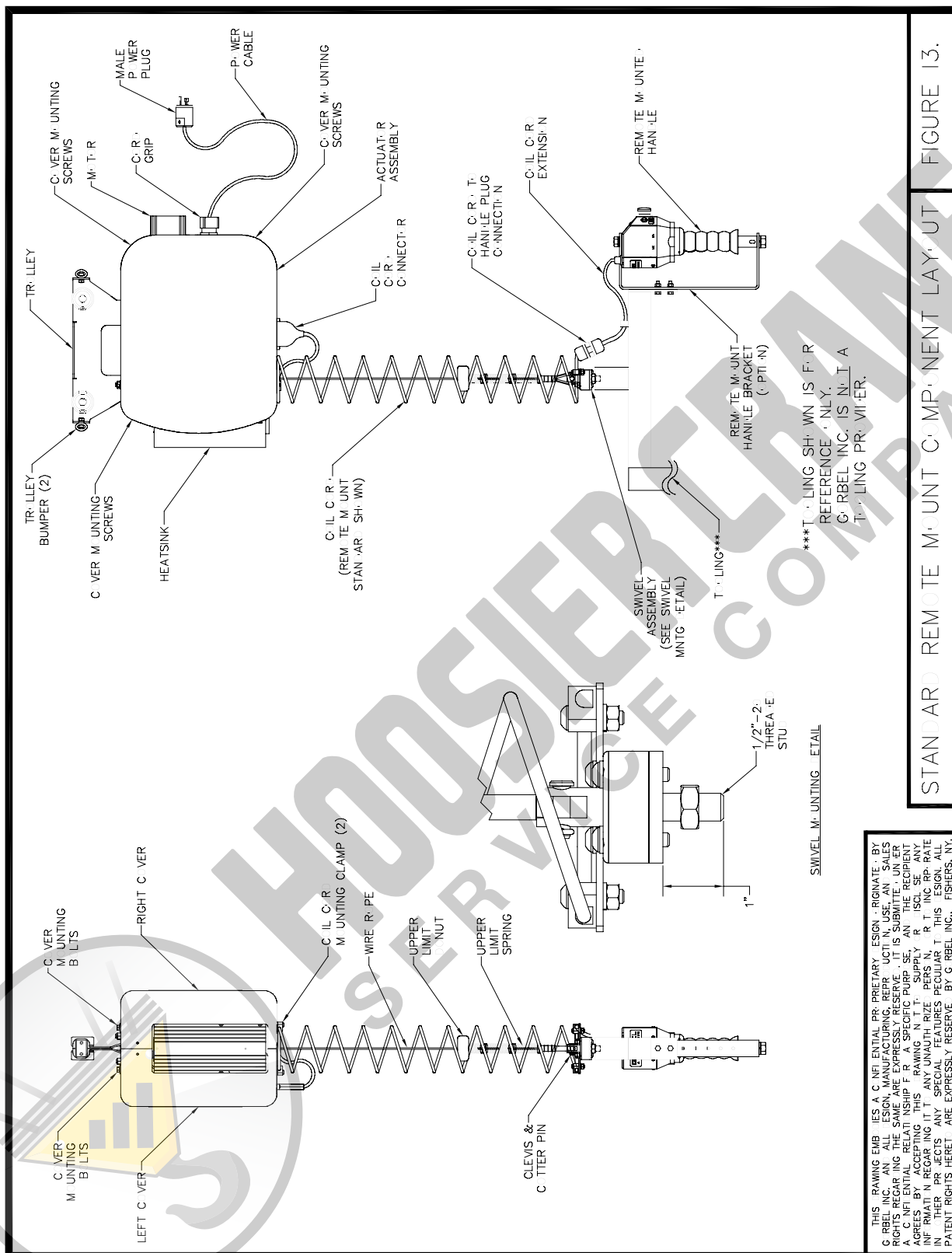


Figure 12. 300/380# Standard Inline Component Layout.





**Figure I3.** *Standard Remote Mount Component Layout.*

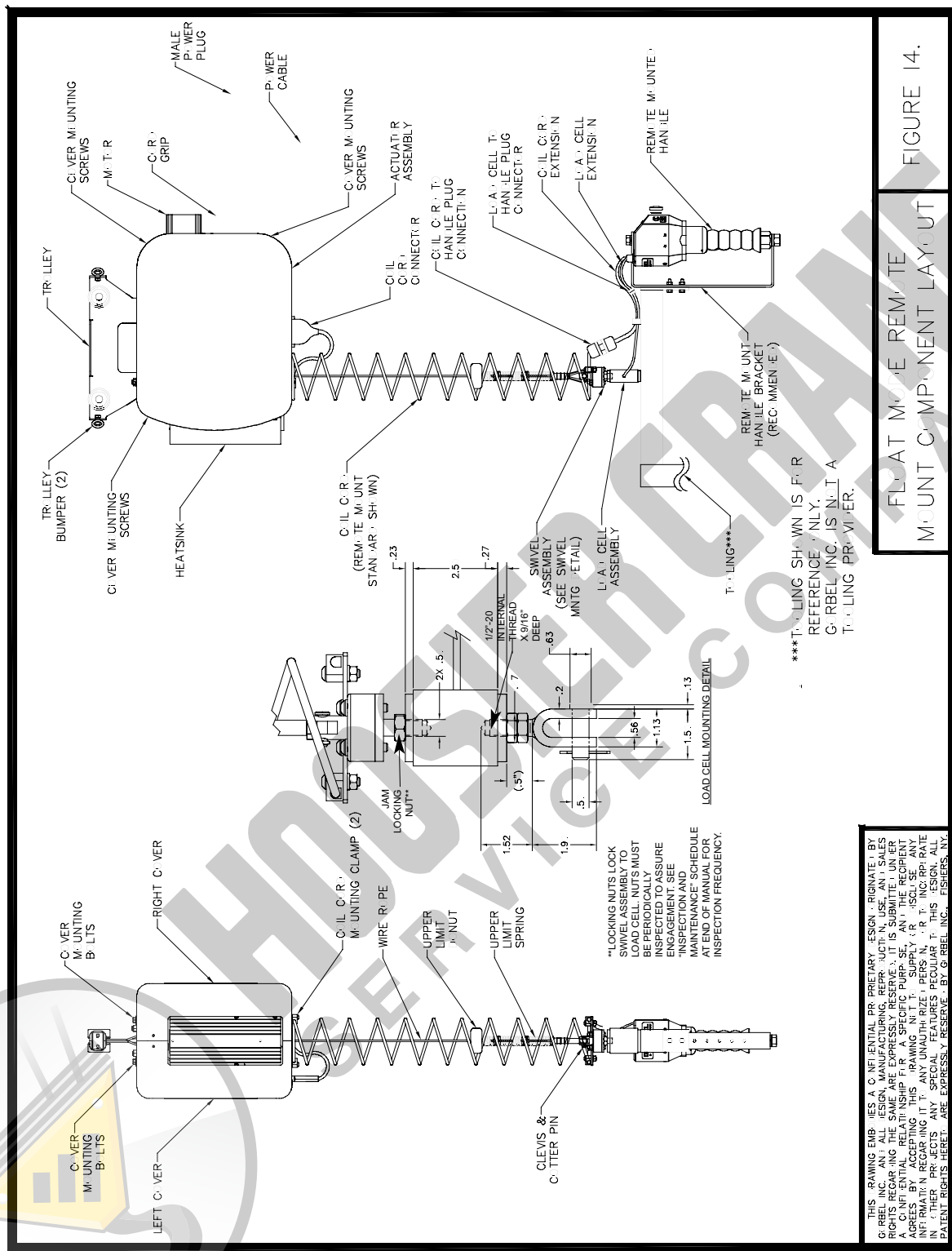


Figure 14. Float Mode Remote Mount Component Layout.

## RECOMMENDED SPARE PARTS LIST

| <u>Item #</u> | <u>Part #</u> | <u>Description</u>  | <u>Qty</u> |
|---------------|---------------|---|------------|
| 1             | 73052.ASM     | Handle-Coil Cord Assembly, Inline, 150, 300, & 380#, Standard   | 1          |
| 2             | 73053.ASM     | Handle-Coil Cord Assembly, Inline, 150, 300, & 380#, Float Mode   | 1          |
| 3             | 73652.ASM     | Handle-Coil Cord Assembly with Air, Inline, 150, 300, & 380#, Standard                                      | 1          |
| 4             | 73653.ASM     | Handle-Coil Cord Assembly with Air, Inline, 150, 300, & 380#, Float Mode                                    | 1          |
| 5             | 73052         | Handle ( <b>only</b> ), 150, 300, & 380#, Standard, Inline, <b>Must specify Air option</b>                  | 1          |
| 6             | 73053         | Handle ( <b>only</b> ), 150, 300, & 380#, Float Mode, Inline, <b>Must specify Air option</b>                | 1          |
| 7             | 73145         | Handle ( <b>only</b> ), 150, 300, & 380#, Remote Mount, Standard, <b>Must specify remote mount length</b>   | 1          |
| 8             | 73147         | Handle ( <b>only</b> ), 150, 300, & 380#, Remote Mount, Float Mode, <b>Must specify remote mount length</b> | 1          |
| 9             | 77206         | Coil Cord ( <b>only</b> ), 150, 300, & 380#, Standard & Float Mode  | 1          |
| 10            | 77640         | Coil Cord ( <b>only</b> ) with Air, 150, 300, & 380#, Standard & Float Mode                                 | 1          |
| 11            | 77156         | Coil Cord, Remote Mount, 150, 300, & 380#, Standard & Float Mode  | 1          |
| 12            | 77660         | Coil Cord, Remote Mount with Air, 150, 300, & 380#, Standard & Float Mode                                   | 1          |
| 13            | 77315         | Wire Rope Replacement Assembly, 150, 300, & 380#  | 1          |
| 14            | 73099         | Idler Pulley Guide Block, 150, 300, & 380#  | 1          |
| 15            | 75354         | Upper Limit Switch, 150, 300, & 380#  | 1          |
| 16            | 77084         | Lower Limit/Slack Switch, 150, 300, & 380#  | 3          |
| 17            | 77559         | Offset Idler Pulley, 150, 300, & 380#   | 1          |
| 18            | 77104         | Control System, G-Force®, Gen 4   | 1          |
| 19            | 78020         | BXi G-Force® Universal Miscellaneous Hardware Kit   | 1          |

Contact Gorbel® Customer Service for Spare Parts pricing and availability.

## LIMITED WARRANTY

It is agreed that the equipment purchased hereunder is subject to the following LIMITED warranty and no other. Gorbel Incorporated ("Gorbel"), warrants the manual push-pull Work Station Cranes, Jib Crane, and Gantry Crane products to be free from defects in material or workmanship for a period of five years or 10,000 hours use from date of shipment. Gorbel warrants the Motorized Work Station Cranes and Jib Crane products to be free from defects in material or workmanship for a period of two years or 4,000 hours use from the date of shipment. Gorbel warrants the G-Force® and Easy Arm™ products to be free from defects in material or workmanship for a period of one year or 2,000 hours use from the date of shipment. This warranty shall not cover failure or defective operation caused by operation in excess of recommended capacities, misuses, negligence or accident, and alteration or repair not authorized by Gorbel. No system shall be modified after manufacture without the written authorization of Gorbel, Inc. Any field modification made to the system without the written authorization of Gorbel, Inc. shall void Gorbel's warranty obligation. OTHER THAN AS SET FORTH HEREIN, NO OTHER EXPRESS WARRANTIES, AND NO IMPLIED WARRANTIES, ORAL OR WRITTEN, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE BY GORBEL WITH RESPECT TO ITS PRODUCTS AND ALL SUCH WARRANTIES ARE HEREBY SPECIFICALLY DISCLAIMED. GORBEL SHALL NOT BE LIABLE UNDER ANY CIRCUMSTANCES FOR ANY INCIDENTAL, SPECIAL AND/OR CONSEQUENTIAL DAMAGES WHATSOEVER, WHETHER OR NOT FORESEEABLE, INCLUDING BUT NOT LIMITED TO DAMAGES FOR LOST PROFITS AND ALL SUCH INCIDENTAL, SPECIAL AND/OR CONSEQUENTIAL DAMAGES ARE HEREBY ALSO SPECIFICALLY DISCLAIMED. Gorbel's obligation and Purchaser's or end user's sole remedy under this warranty is limited to the replacement or repair of Gorbel's products at the factory, or at the discretion of Gorbel, at a location designated by Gorbel. Purchaser or end user shall be solely responsible for all freight and transportation costs incurred in connection with any warranty work provided by Gorbel hereunder. Gorbel will not be liable for any loss, injury or damage to persons or property, nor for damages of any kind resulting from failure or defective operation of any materials or equipment furnished hereunder. Components and accessories not manufactured by Gorbel are not included in this warranty. Purchaser's or end user's remedy for components and accessories not manufactured by Gorbel is limited to and determined by the terms and conditions of the warranty provided by the respective manufacturers of such components and accessories.

**A) DISCLAIMER OF IMPLIED WARRANTY OF MERCHANTABILITY**

Gorbel and Purchaser agree that the implied warranty of merchantability is excluded from this transaction and shall not apply to the goods involved in this transaction.

**B) DISCLAIMER OF IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE**

Gorbel and Purchaser agree that the implied warranty of fitness for particular purpose is excluded from this transaction and shall not apply to the goods involved in this transaction.

**C) DISCLAIMER OF EXPRESS WARRANTY**

Gorbel's agents, or dealer's agents, or distributor's agents may have made oral statements about the machinery and equipment described in this transaction. Such statements do not constitute warranties, and Purchaser agrees not to rely on such statements. Purchaser also agrees that such statements are not part of this transaction.

**D) DISCLAIMER OF SPECIAL, INCIDENTAL AND CONSEQUENTIAL DAMAGES**

Gorbel and Purchaser agree that any claim made by Purchaser which is inconsistent with Gorbel's obligations and the warranty remedies provided with Gorbel's products, and in particular, special, incidental and consequential damages, are expressly excluded.

**E) DEALER OR DISTRIBUTOR NOT AN AGENT**

Gorbel and Purchaser agree that Purchaser has been put on notice that dealer or distributor is not Gorbel's agent in any respect for any reason. Gorbel and Purchaser also agree that Purchaser has been put on notice that dealer or distributor is not authorized to incur any obligations or to make any representations or warranties on Gorbel's behalf other than those specifically set forth in Gorbel's warranty provided in connection with its product.

**F) MERGER**

This warranty agreement constitutes a final and complete written expression of all the terms and conditions of this warranty and is a complete and exclusive statement of those terms.

**G) PAINTING**

Every crane (excluding components) receives a quality paint job before leaving the factory. Unfortunately, no paint will protect against the abuses received during the transportation process via common carrier. We have included at least one (1) twelve ounce spray can for touchup with each crane ordered (unless special paint was specified). If additional paint is required, contact a Gorbel® Customer Service Representative at 1-800-821-0086 or 1-585-924-6262.

**Title and Ownership:**

Title to the machinery and equipment described in the foregoing proposal shall remain with the Gorbel and shall not pass to the Purchaser until the full amount herein agreed to be paid has been fully paid in cash.

**Claims and Damages:**

Unless expressly stated in writing, goods and equipment shall be at Purchaser's risk on and after Seller's delivery in good shipping order to the Carrier. Gorbel shall in no event be held responsible for materials furnished or work performed by any person other than it or its authorized representative or agent.

**Cancellations:**

If it becomes necessary for the purchaser to cancel this order wholly or in part, he shall at once so advise Gorbel in writing. Upon receipt of such written notice all work will stop immediately. If the order entails only stock items, a flat restocking charge of 15% of the purchase price will become due and payable by Purchaser to Gorbel. Items purchased specifically for the canceled order shall be charged for in accordance with the cancellation charges of our supplier plus 15% for handling in our factory. The cost of material and/or labor expended in general fabrication for the order shall be charged for on the basis of total costs to Gorbel up to the time of cancellation plus 15%.

**Returns:**

No equipment, materials or parts may be returned to Gorbel without express permission in writing to do so.

Extra Charge Delay: If Purchaser delays or interrupts progress of Seller's performance, or causes changes to be made, Purchaser agrees to reimburse Gorbel for expense, if any, incident to such delay.

**Changes and Alterations:**

Gorbel reserves the right to make changes in the details of construction of the equipment, as in its judgment, will be in the interest of the Purchaser; will make any changes in or additions to the equipment which may be agreed upon in writing by the Purchaser; and Gorbel is not obligated to make such changes in products previously sold any customer.

**Third Party Action:**

Should Gorbel have to resort to third party action to collect any amount due after there (30) days from date of invoice, the Purchaser agrees to pay collection costs, reasonable attorney's fees, court costs and legal interest.

**OSHA Responsibilities:**

Gorbel agrees to fully cooperate with Purchaser in the design, manufacture or procurement of safety features or devices that comply with OSHA regulations. In the event additional equipment or labor shall be furnished by Gorbel, it will be at prices and standard rates then in effect, or as may be mutually agreed upon at the time of the additional installation.

**Equal Employment Opportunity:**

Gorbel agrees to take affirmative action to ensure equal employment opportunity for all job applicants and employees without regard to race, color, age, religion, sex, national origin, handicap, veteran, or marital status. Gorbel agrees to maintain non-segregated work facilities and comply to rules and regulations of the Secretary of Labor or as otherwise provided by law or Executive Order.

# INSPECTION AND MAINTENANCE SCHEDULE

| <b>G-FORCE® BXI ILD INSPECTION AND MAINTENANCE SCHEDULE</b> |                                |   |  |
|---|--------------------------------|---|--|
| <b>ITEM</b>   | <b>COMPONENT</b>               | <b>MAINTENANCE</b>  | <b>FREQUENCY*</b>  |
| 1   | Wire Rope                      | Check for distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion. General Corrosion, broken or cut strands, and number, distribution, and type of visible broken wires.  | Start of each Shift  |
| 2   | Wire Rope                      | Maintenance listed in (1), as well as reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires. Severely corroded or broken wires at end connections. Severely corroded, cracked, bent, worn, or improperly applied end connections. | Periodically (to be determined by qualified persons only)                      |
| 3   | Coil Cord Assembly             | Check to make sure there is no excessive wearing of the coil cable sleeving caused by the wire rope. Check for excessive bends or pinching. Check that Mating Connector is secured to the Actuator properly. Assure the Strain Relief at the Handle is properly tightened.  | Start of each Shift  |
| 4   | Handle                         | Check for smooth operation of sliding handle. Check "Operator Present Switch" for correct operation. Verify proper handle Swivel functionality.   | Start of each Shift  |
| 5   | G-Force® Assembly              | Conduct a visual inspection of the entire BXi G-Force® unit.  | Start of each Shift  |
| 6   | Pulleys                        | Inspect the Slack-Idler Pulley for excessive wear. Replace Pulleys immediately if excessive wear or damage is present.  | Every 90 Days  |
| 7   | Limit Switches                 | Verify that the Upper and Lower Limit Switches are operating properly. Verify that the Slack Switch is operating properly. Replace Switches immediately if they are damaged.  | Every 90 Days  |
| 8   | Slack Switch Sliding Mechanism | Verify that the Slack Switch Sliding Mechanism is functioning properly. Replace Slack Switch sliding Mechanism if not operating correctly.  | Every 90 Days  |
| 9   | Wheels                         | Check for cracks, pits, and/or grooves. All of these increase pull forces. If any of these conditions exist, wheels should be replaced.   | Every 2000 Hours or Yearly   |
| 10  | Handle                         | Perform general cleaning of the Handle, being sure to remove all debris and foreign substances that may exist. Specifically, take care to remove all debris and foreign substances from the back side of the OPS Lever.   | Periodically based on Application (to be determined by qualified persons only) |
| 11  | Hardware                       | Perform routine inspection of all hardware connections, verifying that all lockwashers are compressed and nuts tightened to manufacturer's specifications. Be sure to verify the jam nuts located between the swivel assembly and handle/tooling are properly torqued.  | Every 90 Days  |

\* Federal, state and local codes may require inspection and maintenance checks more often. Please check the federal, state and local code manuals in your area.

## WARNING

**Any changes in rotating effort or unusual noises must be immediately identified and corrected.**

## WARNING

**DO NOT TWIST COIL CABLE ASSEMBLY. OVER TWISTING OF THE HANDLE WILL CAUSE SHORTING IN COIL CABLE ASSEMBLY, THEREFORE CAUSING PREMATURE UNIT FAILURE. KEEP ROTATIONS OF HANDLE TO LESS THAN 360 DEGREES.**

**GORBEL®**

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