



# EDGE STRING

## Owner's Manual



Original Instructions Written in English

[www.qubicaamf.com](http://www.qubicaamf.com)

QubicaAMF Worldwide Technical Support  
(International) 804.569.1000 ♦ (Domestic) 1.866.460.7263 option 3  
Copyright © 2021 QubicaAMF Worldwide, 8100 AMF Dr., Mechanicsville, VA 23111

400-051-202-01 Rev. B  
November 2021



## **ALL RIGHTS RESERVED**

All rights to this manual, including the diagrams, figures, and technical specifications, are the property of QubicaAMF Worldwide. Reproduction or transmission of any of the material contained in this manual without the prior written permission of QubicaAMF Worldwide is strictly prohibited. All of the product information in this manual was carefully prepared based on the latest information available and was believed to be correct at the time of printing. While every effort has been made to ensure accuracy, this publication may inadvertently contain typographical errors, inaccuracies, or errors of omission. QubicaAMF Worldwide cannot be held responsible for any claims resulting from these errors.

## **DOCUMENT UPDATES**

This manual supersedes all previous versions of the EDGE String Owner's Manual. QubicaAMF Worldwide reserves the right to revise and/or update this manual at any time without obligation to notify any person or entity of such revision. The document number, revision level, and date below indicate the edition of this manual.

## **TRADEMARK NOTICES**

QubicaAMF and the QubicaAMF logo are the trademarks of QubicaAMF Worldwide.

## **CONDITIONAL INFORMATION**

This manual assumes that the QubicaAMF equipment and/or software has been installed by a QubicaAMF-authorized technician and is functional in every aspect. Should you encounter problems in operating the equipment, follow the instructions in this manual before contacting QubicaAMF Worldwide for service under warranty.

## **QUBICAAMF WORLDWIDE TECHNICAL SUPPORT**

Technical Support: (International) 804.569.1000 ♦ (Domestic) 1.800.460.7263 option 3

QubicaAMF Worldwide Headquarters  
8100 AMF Dr.  
Mechanicsville, VA 23111

Copyright © 2021 QubicaAMF Worldwide  
Document # 400-051-202-01 Rev. B  
Issued: 11/12/2021





## EDGE String

### Owner's Manual, 400-051-202-01 Rev. B

#### Summary of Changes

<b>Change No.</b>	<b>ECR No.</b>
Rev. A	21-0097
Rev. B	21-0097-02

#### List of Effective Pages

<b>Page</b>	<b>Change No.</b>	<b>Effective Date</b>
All	Revision A	08/23/2021
2-15 thru 2-18, 2-23, 4-16, 5-46, 5-65, B-3, B-4	Revision B	11/12/2021



## Table of Contents





## Table of Contents

Section 1 Safety.....	1-1
1.1. Safety .....	1-3
1.2. Safety Labels Overview .....	1-4
1.3. Safety Definitions .....	1-5
1.4. Safety Tools.....	1-7
1.5. Product Configurations & Guard/Cover Locations .....	1-8
1.5.1. Machine Pair (Config. #: 612-051-112 Rev. L or later).....	1-9
1.5.2. Single Odd Machine (Config. #: 612-051-113 Rev. H or later).....	1-11
1.5.3. Single Even Machine (Config. #: 612-051-114 Rev. H or later).....	1-13
1.5.4. Extra-Wide Machine Pair (Config. #: 612-051-117 Rev. E or later) .....	1-15
1.6. Safety Label Locations.....	1-17
1.6.1. Machine Boundary Safety Labels.....	1-17
1.6.2. Pinspotter Safety Labels .....	1-18
1.6.3. Chain Lift Safety Labels .....	1-19
Section 2 Operation .....	2-1
2.1. Section Overview .....	2-3
2.2. Major Components & Subassemblies .....	2-3
2.2.1. Pinspotter Pair .....	2-3
2.2.2. Pinspotter.....	2-4
2.2.3. Brake/Encoder Assembly .....	2-4
2.2.4. Reel Arm Assembly .....	2-4
2.2.5. Reel Arm.....	2-4
2.2.6. Drawbar Assembly .....	2-5
2.2.7. Drawbar Pulley.....	2-5
2.2.8. Pulley Flip Bracket.....	2-5
2.2.9. Tangle Switch Emitter Board .....	2-5
2.2.10. String Comb.....	2-5
2.2.11. String Tray.....	2-6
2.2.12. Gearmotor .....	2-6
2.2.13. Control Box .....	2-6
2.2.14. Upper Table .....	2-6
2.2.15. Table Pulley.....	2-7
2.2.16. Lower Table.....	2-7
2.2.17. Pin Centering Ring.....	2-7
2.2.18. Kickback .....	2-7
2.2.19. Kickback Nose Block.....	2-7
2.2.20. Machine Support .....	2-8
2.2.21. Chain Lift .....	2-8
2.2.22. Ball Lifter Assembly.....	2-8
2.2.23. Double Division Rail Assembly .....	2-8
2.2.24. Cross Sweep .....	2-9
2.2.25. Down Sweep .....	2-9
2.2.26. Shield/Pitlight Assembly .....	2-9
2.2.27. Pitlight Fixture.....	2-9
2.2.28. Ball Detector .....	2-10
2.2.29. Pit Assembly.....	2-10



2.2.30. Pit Floor Assembly .....	2-10
2.2.31. Pit Curtain .....	2-10
2.2.32. Pit Cushion .....	2-11
2.2.33. Pit Cushion Block.....	2-11
2.2.34. Pit Cushion Shock.....	2-11
2.2.35. Pit Rear Guard.....	2-11
2.2.36. Double Division Guard .....	2-11
2.2.37. Chain Lift/Machine Guards .....	2-12
2.2.38. Pit Hinged Top Cover .....	2-12
2.2.39. Machine Rear Cover.....	2-12
2.2.40. Pinspotter Top Guard.....	2-13
2.2.41. Reel Arm Cover .....	2-13
2.2.42. Pinspotter Sprocket Guard .....	2-13
2.2.43. System Controller .....	2-13
2.2.44. Wireways .....	2-14
2.2.45. 10-Pin Bowling .....	2-14
2.3. System Controller.....	2-15
2.3.1. Port Layout.....	2-16
2.3.2. Port Descriptions .....	2-17
2.3.3. Machine Activation.....	2-19
2.3.4. Emergency Stop (E-Stop) .....	2-19
2.3.5. Keypad .....	2-20
2.3.6. Display.....	2-21
Section 3 Maintenance .....	3-1
3.1. Section Overview .....	3-3
3.2. Level 1 Interventions – Lockout/Tagout (LOTO) Not Required.....	3-4
3.2.1. Clear Pin Tangle .....	3-4
3.2.2. Clear Stuck Ball on Pit Floor or Pindeck .....	3-4
3.2.3. Clear Ball Jam or Stuck Ball in Double Division .....	3-4
3.2.4. Clean Pindeck and Pit OR Clean Lane with Lane Machine.....	3-4
3.2.5. Perform String Adjustment.....	3-5
3.3. Level 2 Interventions – Lockout/Tagout (LOTO) Required .....	3-6
3.3.1. Clear Stuck Ball at Chain Lift .....	3-7
3.3.2. Repair Worn String Above Pin .....	3-7
3.3.3. Replace Pin and/or String Sleeve .....	3-8
3.3.4. Replace Pin String .....	3-10
3.3.5. Rotate Pins.....	3-11
3.4. Reference Tables.....	3-14
3.4.1. Bolt Torque Table.....	3-14
3.4.2. String Length Table .....	3-14
Section 4 Troubleshooting .....	4-1
4.1. Section Overview .....	4-3
4.2. System Controller Error Codes.....	4-4
4.3. Machine Control Box Operation/Troubleshooting .....	4-10
4.4. Chain Lift Control Box Operation/Troubleshooting .....	4-11
4.5. Additional Troubleshooting Cases .....	4-12
4.5.1. Ball Not Returned to Bowler .....	4-12
4.5.2. Chain Lift Runs Continuously at Slow Speed.....	4-13



4.5.3. Chain Lift Stops in Wrong Location.....	4-13
4.5.4. Shield Panel Does Not Actuate Correctly.....	4-13
4.5.5. Machine Does Not Cycle When Ball is Thrown.....	4-14
4.5.6. Machine Cycles When Ball is Not Thrown.....	4-14
4.5.7. Pins Do Not Settle on Pindeck at Same Time.....	4-14
4.5.8. Pins Fell Over When Being Spotted.....	4-14
4.5.9. System Controller Keypad Non-Responsive.....	4-15
4.5.10. Machine Not Scoring Correctly.....	4-15
4.5.11. Foul Detector Not Functioning Correctly.....	4-15
4.5.12. Mask Lights Not Functioning Correctly.....	4-16
4.5.13. Pitlight Not Functioning Correctly.....	4-16
Section 5 Drawings & Parts Lists.....	5-1
5.1. Kickbacks.....	5-3
5.2. 10-Pin Bowling Pin.....	5-4
5.3. Pinspotter (Frame).....	5-5
5.4. Pinspotter (Top Guard & Side).....	5-6
5.5. Pinspotter (Underside).....	5-7
5.6. Pulley Flip Bracket Assembly.....	5-8
5.7. Gearmotor & Control Box.....	5-10
5.8. Gearmotor & Control Box Parts List.....	5-11
5.9. Drawbar Tensioner.....	5-12
5.10. Drawbar Assembly & Chain Drive.....	5-13
5.11. Drawbar & Pulley Assembly.....	5-14
5.12. Drawbar Pulley Assembly.....	5-15
5.13. Drawbar Carriage Assembly.....	5-16
5.14. Brake/Encoder Assembly.....	5-17
5.15. Brake/Encoder Unit Assembly.....	5-18
5.16. Reel Arm Assembly.....	5-19
5.17. Tables Assembly.....	5-20
5.18. Shield Mounting Assembly.....	5-22
5.19. Shield/Pitlight Assembly.....	5-24
5.20. Shield/Pitlight Assembly Parts List.....	5-25
5.21. Odd Machine Pit Floor Assembly.....	5-26
5.22. Odd Machine Back End Assembly.....	5-28
5.23. Odd Machine Pit Cushion Assembly.....	5-30
5.24. Even Machine Pit Floor Assembly.....	5-31
5.25. Even Machine Back End Assembly.....	5-32
5.26. Even Machine Pit Cushion Assembly.....	5-34
5.27. Pit Cushion Shock Assembly.....	5-35
5.28. Pit Cushion Block (7 Pin Side).....	5-36
5.29. Pit Cushion Block (10 Pin Side).....	5-37
5.30. Chain Lift Control Box.....	5-38
5.31. Chain Lift Assembly.....	5-39
5.32. Chain Lift – Upper Assembly Detail.....	5-40
5.33. Chain Lift Upper Sprocket Assembly.....	5-43
5.34. Chain Lift Lower Sprocket Assembly.....	5-44
5.35. Chain Lift Chain Assembly.....	5-45
5.36. Double Division Rail Assembly.....	5-46



5.37. Cross Sweep Assembly .....	5-47
5.38. Ball Wiper .....	5-48
5.39. Double Division & Pit Rear Guards (Pair) .....	5-49
5.40. Double Division & Pit Rear Guard (Single) .....	5-50
5.41. System Controller & Mounting Bracket .....	5-52
5.42. Chain Lift & Side Guards (Odd) .....	5-53
5.43. Chain Lift & Side Guards (Even) .....	5-54
5.44. Machine Rear Cover .....	5-56
5.45. Wireways .....	5-58
5.46. Safety Labels (Rear) .....	5-59
5.47. Safety Labels (Front) .....	5-60
5.48. EDGE String Tool Kit .....	5-62
5.49. Cables .....	5-65
Appendix A. Lockout/Tagout (LOTO) Procedure .....	A-1
Appendix B. Declaration of Conformity .....	B-1
B 1. EU Declaration of Conformity .....	B-3
B 2. UK Declaration of Conformity .....	B-4
Appendix C. Blank .....	C-1
Appendix D. Preventive Maintenance (PM) .....	D-1
Appendix E. Non-Routine Maintenance Procedures .....	E-1
E 1. Section Overview .....	E-3
E 2. Reference Tables .....	E-26
Appendix F. EDGE String Product Matrix .....	F-1



## Section 1 Safety





## 1.1. Safety

### Section Overview

This section contains important safety information pertaining to EDGE String. All operators must review and understand the contents of this manual in its entirety before operating this equipment.

Important safety labels and safety-related terms are defined in this section. Operator(s) should refer to these definitions when performing routine operation and maintenance tasks. This section also explains the proper use of specialized safety tools provided with this machine, including pin hooks, lane barriers, and Lockout/Tagout components. Lastly, all required machine guards and covers are identified for each of the three product configurations under which the EDGE String is sold (machine pair, single Odd machine, and single Even machine).



### Read This First

The following notes and safety guidelines apply throughout this manual and whenever operating this equipment:

- All operators must review and understand the contents of this manual in its entirety before operating this equipment. Failure to follow all safety precautions outlined in this manual can result in personal injury.
- All operators must be approved by owner or facility manager for operation and maintenance tasks (both Level 1 and Level 2 interventions). Machine access must be limited to approved operators only.
- All equipment must be installed, tested, and checked for function by certified QubicaAMF personnel.
- Safety labels are placed at the machine boundary and describe potential hazards. All labels must always be in place while operating this equipment.
- Guards and covers prevent operator access to major hazards. All guarding components must always be in place while operating this equipment.
- All electrical cables must be properly connected before turning on power to this equipment.
- Level 1 interventions outlined in Section 3 (Maintenance) may be performed outside the machine boundary by approved operators only. A pin hook may be used for some Level 1 interventions.
- Level 2 interventions outlined in Section 3 (Maintenance) require Lockout/Tagout (LOTO). Lane barriers must be used on both lanes of a machine pair when performing Level 2 interventions.
- All operator access areas must have sufficient ambient lighting for performing machine operation and maintenance tasks. Level 2 interventions may require additional temporary lighting.
- Steel-toed shoes are recommended when performing machine maintenance tasks.



- Noise levels may reach up to 110dBA while using this equipment. Hearing protection should be used when performing machine operation and maintenance tasks.
- Declaration of Conformity (Appendix B) provided by QubicaAMF is fulfilled only if the following safety requirements are observed when using this equipment.
- This manual is part of the EDGE String product and must be kept near the machine(s) at all times.
- Training Sign-Off (400-051-208) and Installation Sign-Off (400-051-210) must be filled out before operating this equipment.

## 1.2. Safety Labels Overview

### Warnings at Machine Boundary



#### Warning

Hazard exists; use caution. Failure to follow all safety guidelines in this manual may result in personal injury.



#### Electrical Hazard Warning

Indicates electrical shock hazard. Follow safety guidelines in this manual.



#### No Access – Approved Operator Only

Indicates machine boundary. Only approved operators may use equipment or proceed beyond machine boundary. Follow safety guidelines in this manual.



#### No Step

Do not step on indicated surface.



#### Do Not Remove Hardware

Do not remove hardware from indicated assembly. Only approved operators may use this equipment. Follow safety guidelines in this manual.



#### Read the Manual

Follow all instructions in this manual.



#### Use Pin Hook

Use pin hook to move pins or balls while standing outside machine boundary.



### Additional Warnings Inside Machine or in Manual



#### Automatic Machine Operation

Machine may start or cycle automatically without warning. **DO NOT** pass machine boundary unless LOTO is used.



#### Entanglement Hazard

Entanglement hazard exists beyond guarding. **DO NOT** pass machine boundary unless LOTO is used. Use caution when servicing equipment.



#### Slip Hazard

Indicates slip hazard. Use caution.



#### Trip Hazard

Indicates trip hazard. Use caution.



#### Do Not Remove Guarding

Guarding protects against hazards. LOTO must be used if guarding is removed for maintenance. Re-install all guarding components before putting machine(s) back into service.



#### Use Lockout/Tagout (LOTO)

LOTO must be used for all Level 2 interventions and whenever operator is within machine boundary. See LOTO procedure (Appendix A).



#### Disconnect the Power Source

Disconnect the power source before servicing or repairing electrical equipment



#### Use Lane Barriers

Use lane barriers on both lanes of a machine pair to protect operator from thrown bowling balls and to alert players that maintenance is being performed.



#### Use Hearing Protection

Indicates high noise levels present. Use hearing protection to avoid hearing loss.

### 1.3. Safety Definitions

The following section defines common terms related to the safe operation of this equipment. These terms are found throughout this manual. Operator(s) must understand all terms as they are defined below before performing any machine operation or maintenance tasks. See Section 2 (Operation) for additional product definitions.



**Cover:** Fixed or movable panel that prevents or limits Operator access to machine components or machine boundary. Can be moved temporarily for some Level 1 Interventions. Removal does not require tools or LOTO.

**Facility Manager:** Person who has authority to train and approve actions of Operator(s). This person may also be an Operator.

**Guard:** Fixed protective panel that prevents Operator access to a hazard. Removal requires tools and LOTO.

**Lane Barrier:** Rigid barrier that adheres to lane surface. Prevents a thrown ball from contacting Operator when used during maintenance interventions. Required for all Level 2 Interventions. Use Lane Barriers on both lanes of a Machine pair.

**Level 1 Intervention:** Maintenance action required to restore Machine to proper operating condition. LOTO and Lane Barriers not required. Operator must remain outside Machine Boundary.

**Level 2 Intervention:** Maintenance action required to restore Machine to proper operating condition. LOTO and Lane Barriers required.

**Lockout/Tagout (LOTO):** Process to remove electrical power from Machine so that it cannot be re-energized by anyone except Operator who performed LOTO. Required for all Level 2 Interventions or whenever Operator crosses Machine Boundary. See LOTO instructions (Appendix A).

**Machine:** Full product assembly including Pinspotter, System Controller, Chain Lift, Guards, Covers, and all additional components.

**Machine Boundary:** Envelope of Machine formed by components and Guards. Limits access of Operator to safe zones. Operator must perform LOTO before crossing Machine Boundary.

**Operator Access Area:** Area behind Machine Boundary where Operator can access System Controller and can perform Level 1 Interventions.

**Operator:** Any person trained and qualified to operate or perform maintenance on Machine. May also be referred to as a mechanic.

**Owner:** Person who receives installed Machine and is responsible for safe Machine operation. This person may also be a Facility Manager.

**Pin Hook:** Required tool for some Level 1 Interventions. Use Pin Hook to detangle pins and strings or to clear a ball jam near pit ball door.

**Player:** Person who is playing the 10-Pin bowling game. Also called a Bowler. **ALL PLAYERS MUST BE PROHIBITED FROM ACCESSING MACHINE BOUNDARY.**



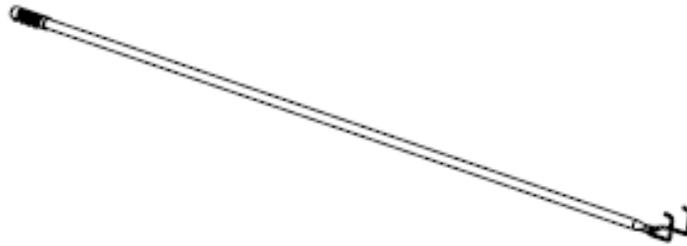
## 1.4. Safety Tools

The following tools are provided with the EDGE String and are required for the safe execution of Level 1 and Level 2 interventions. Operator(s) must use these tools whenever indicated by the following labels located throughout this manual and on the machine.



### Pin Hook

Required tool for some Level 1 interventions. Use Pin Hook to detangle pins and strings or to clear a ball jam near pit ball door. Operator must always remain outside machine boundary while using Pin Hook. Do not reach below pit hinged top cover when clearing a ball jam. Always keep end of Pin Hook away from face.



**Figure 1-1, Pin Hook**



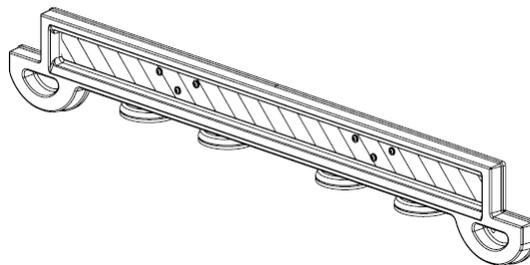
### Lockout/Tagout (LOTO)

Process to remove electrical power from machine so that it cannot be re-energized by anyone except operator who performed LOTO. Required for all Level 2 interventions or whenever operator crosses machine boundary. See LOTO instructions (Appendix A).



### Lane Barrier

Rigid barrier that adheres to lane surface. Prevents a thrown ball from contacting operator when used during maintenance interventions. Required whenever operator is working in front of machine(s) or inside machine boundary. Use Lane Barriers on both lanes of machine pair. Install Lane Barriers 10 ft [3m] in front of each machine when in use.



**Figure 1-2, Lane Barrier**

## 1.5. Product Configurations & Guard/Cover Locations

This manual applies to the following product configurations:

- Machine Pair (Configuration #: 612-051-112)
- Single Odd Machine (Configuration #: 612-051-113)
- Single Even Machine (Configuration #: 612-051-114)
- Extra-Wide Machine Pair (Configuration #: 612-051-117)

Descriptions, specifications, and guard/cover component locations of each configuration are listed below. See Appendix F for a complete product matrix. Guards/covers and the physical limits of the machine protect the operator from potential hazards. See Section 2 (Operation) for additional component descriptions. Fixed guards are located around the chain lift, common division kickbacks and at the rear of the machine. Hinged covers on top of each pit and at the rear of each pinspotter frame allow limited access for Level 1 interventions. Operator(s) must use LOTO if any guard is removed for maintenance. Do not reach over guarding or into machine boundary during machine operation. See Section 3 (Maintenance) for instructions on specific intervention cases. All guards, covers, product labels, and safety labels must be in place to operate the machine.



### 1.5.1. Machine Pair (Config. #: 612-051-112 Rev. L or later)

#### Detail A, Model Label



8100 AMF DR, MECHANICSVILLE, VA 23111 USA

EDGE STRING

MODEL # 051-202-000 (10-PIN PAIR)

INSTALL WITH 612-051-112 OR 612-051-117

WT/MASS, PINSPOTTER & TABLES: 316 lb [143kg]

SYSTEM DOCUMENT: 400-051-202-01

SCHEMATIC # 051-200-278-01

110dB USE EAR PROTECTION

IP3X

S/N: YYYMMDDXXXX

YEAR OF MANUFACTURE : 20YY

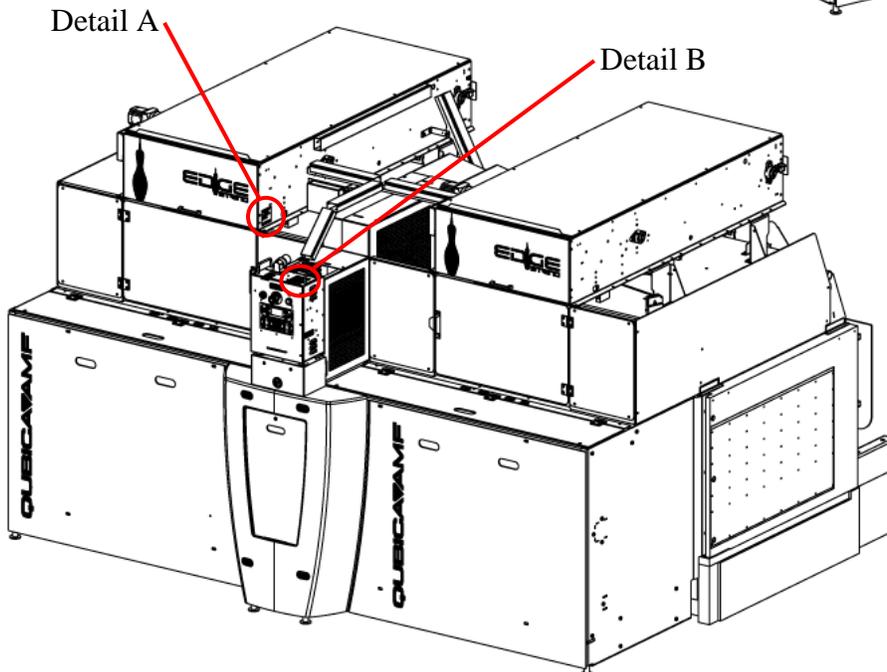
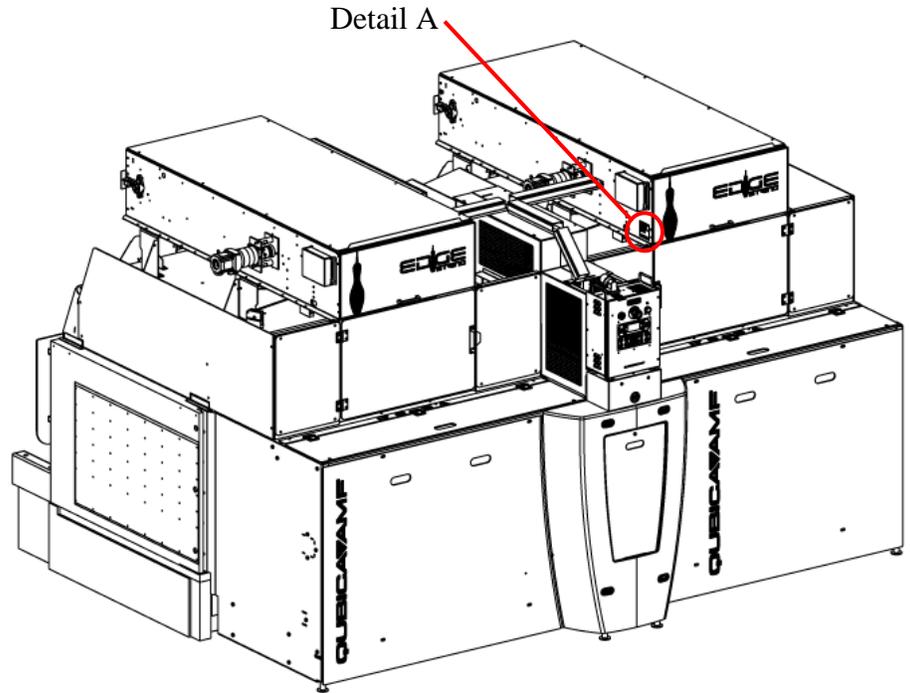
051-200-614-01\_A



#### Description

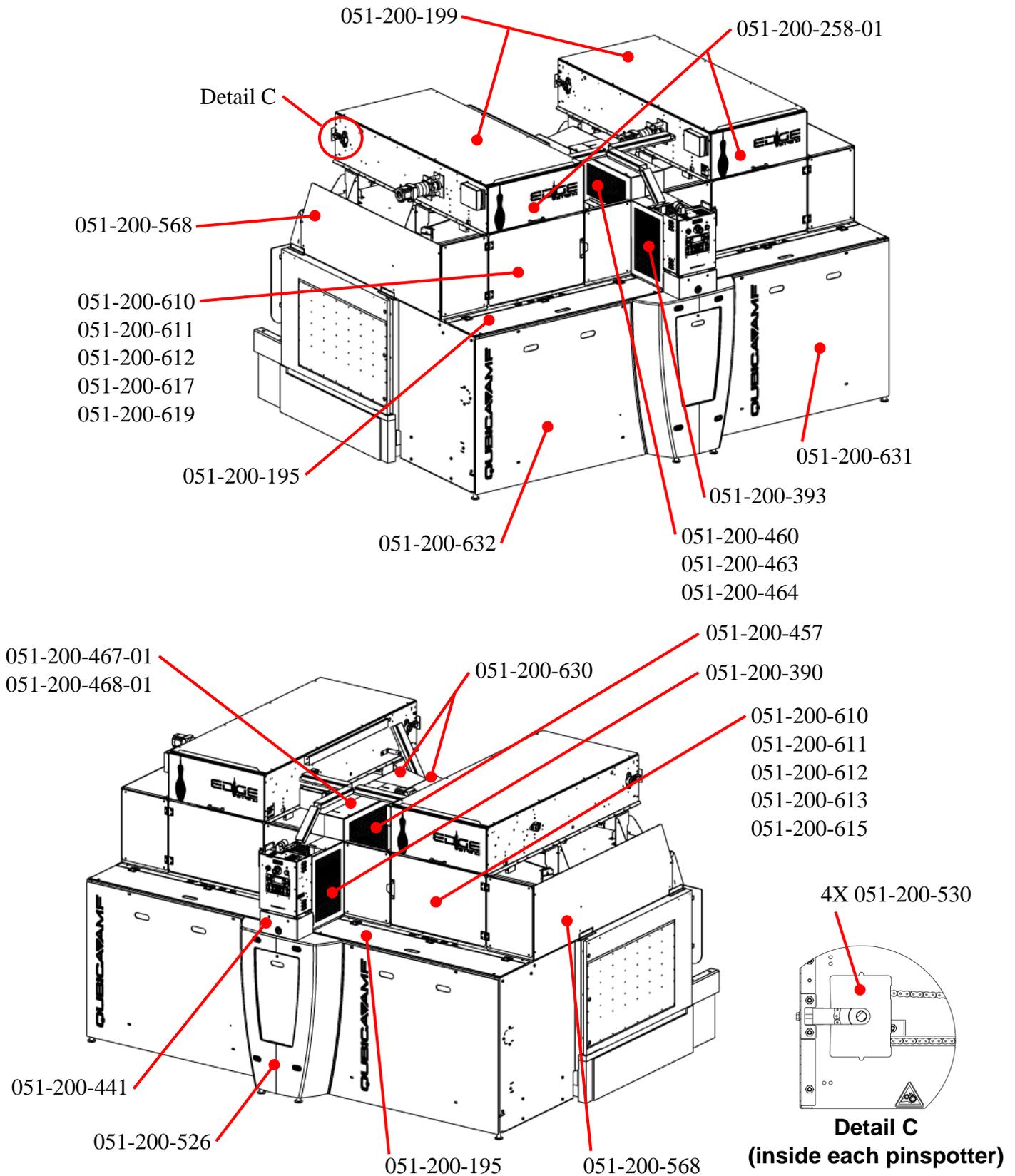
Pinspotter pair installation used for 10-Pin bowling game. Machines mounted together on adjacent Odd and Even lanes (e.g. 1/2, 3/4, ...). Machines share a common chain lift mounted in double division between machines.

Machines to be installed per local electrical codes.



#### Detail B, System Controller Label





## 1.5.2. Single Odd Machine (Config. #: 612-051-113 Rev. H or later)

### Detail A, Model Label

**QUBICAAMF**  
8100 AMF DR, MECHANICSVILLE, VA 23111 USA  
EDGE STRING  
MODEL# 051-202-001 (10-PIN SINGLE, ODD)  
INSTALL WITH 612-051-113

WT/MASS, PINSPOTTER & TABLES: 316 lb [143kg]  
SYSTEM DOCUMENT: 400-051-202-01  
SCHEMATIC # 051-200-278-01

110dB USE EAR PROTECTION  
IP3X

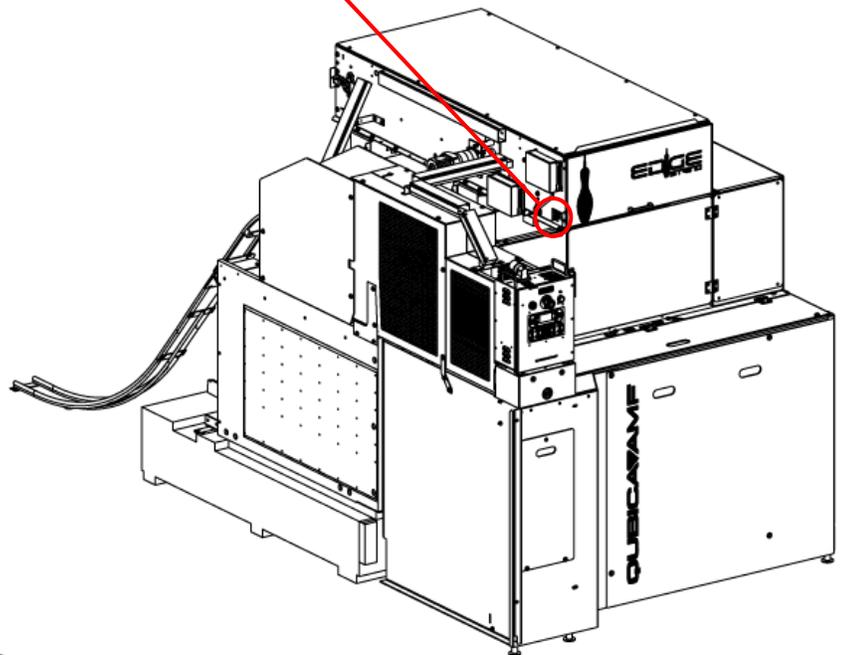
S/N: YYYMMDDXXXX **CE**  
YEAR OF MANUFACTURE: 20YY  
051-200-515-01\_A

### Description

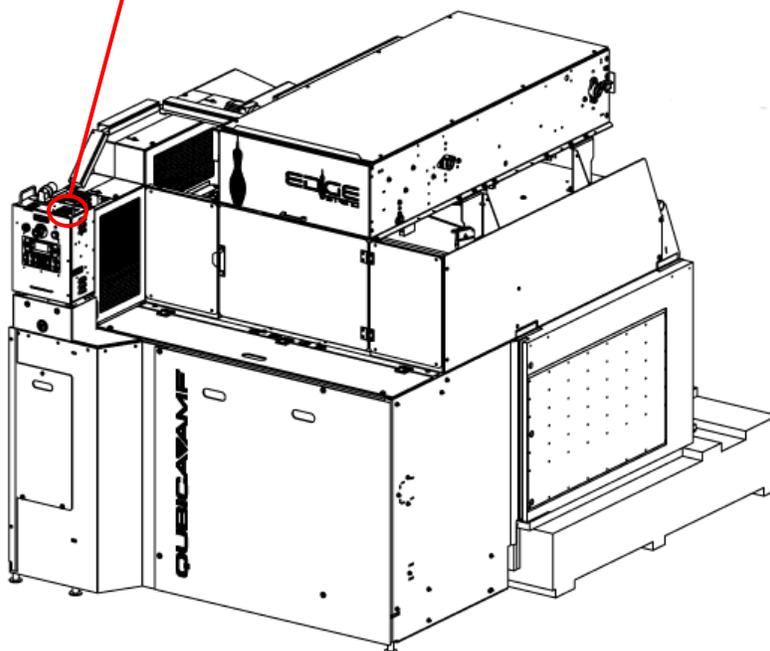
Single pinspotter installation used for 10-Pin bowling game. Mounted on an Odd lane (e.g. 1, 3, 5, ...). Machine uses a chain lift mounted in double division on 10-pin side.

Machines to be installed per local electrical codes.

Detail A

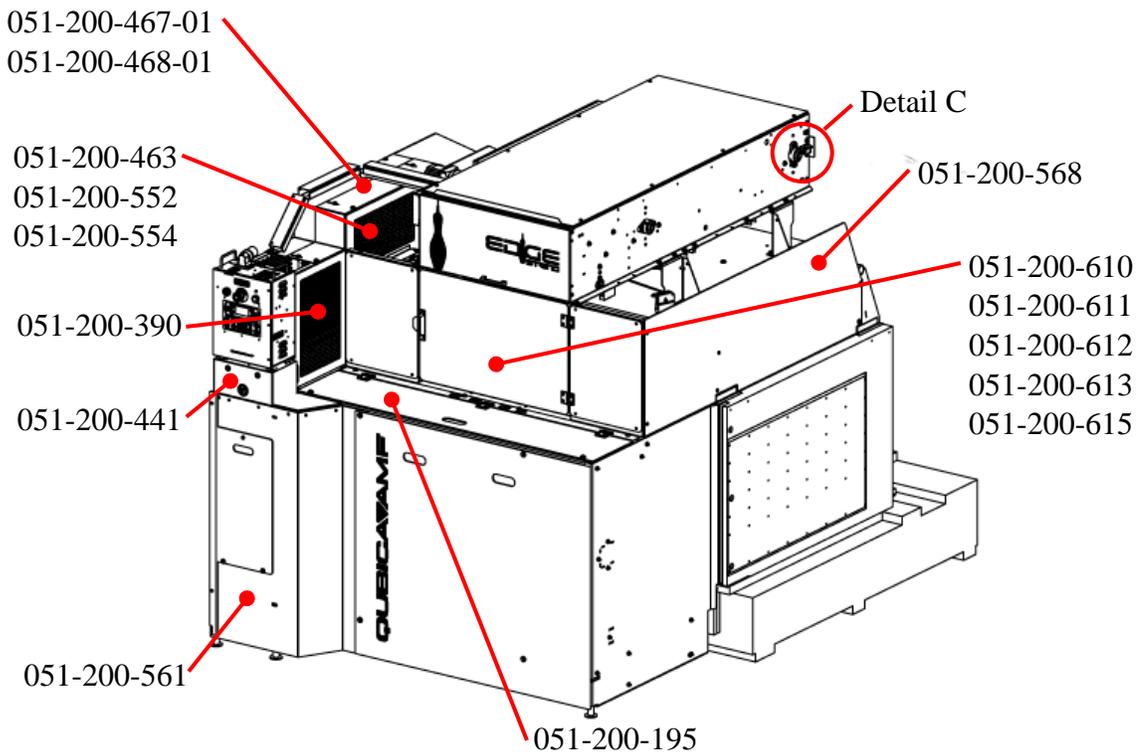
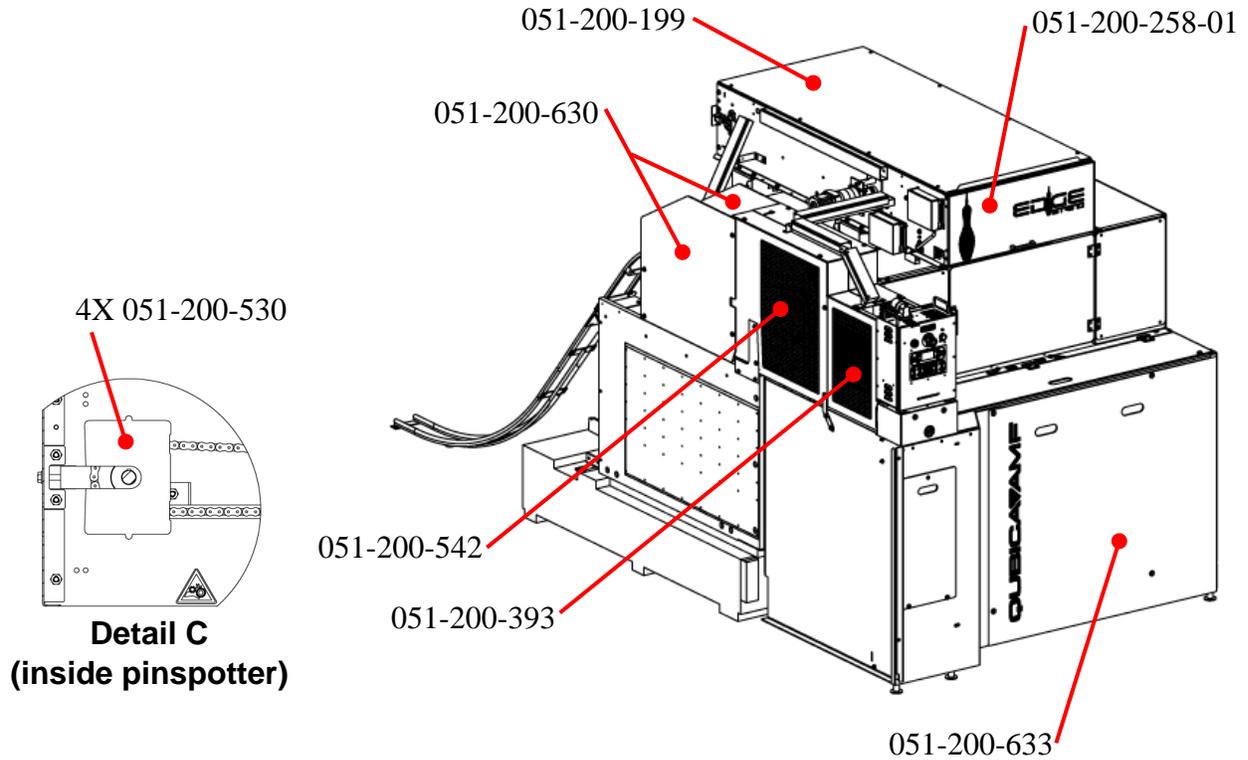


Detail B



Detail B, System Controller Label





### 1.5.3. Single Even Machine (Config. #: 612-051-114 Rev. H or later)

#### Detail A, Model Label

**QUBICAAMF**  
8100 AMF DR, MECHANICSVILLE, VA 23111 USA  
EDGE STRING  
MODEL # 051-202-002 (10-PIN SINGLE, EVEN)  
INSTALL WITH 612-051-114

WT/MASS, PINSPOTTER & TABLES: 316 lb [143kg]  
SYSTEM DOCUMENT: 400-051-202-01  
SCHEMATIC # 051-200-278-01

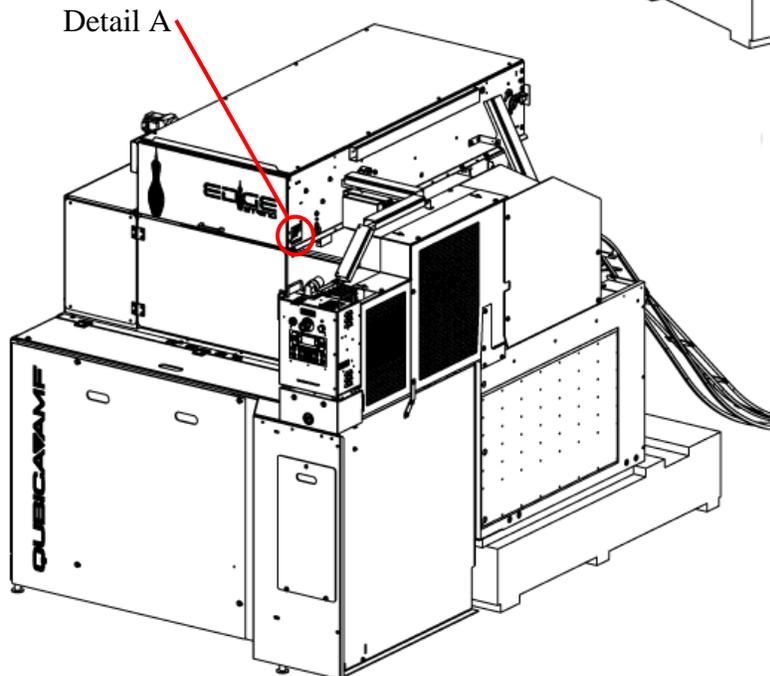
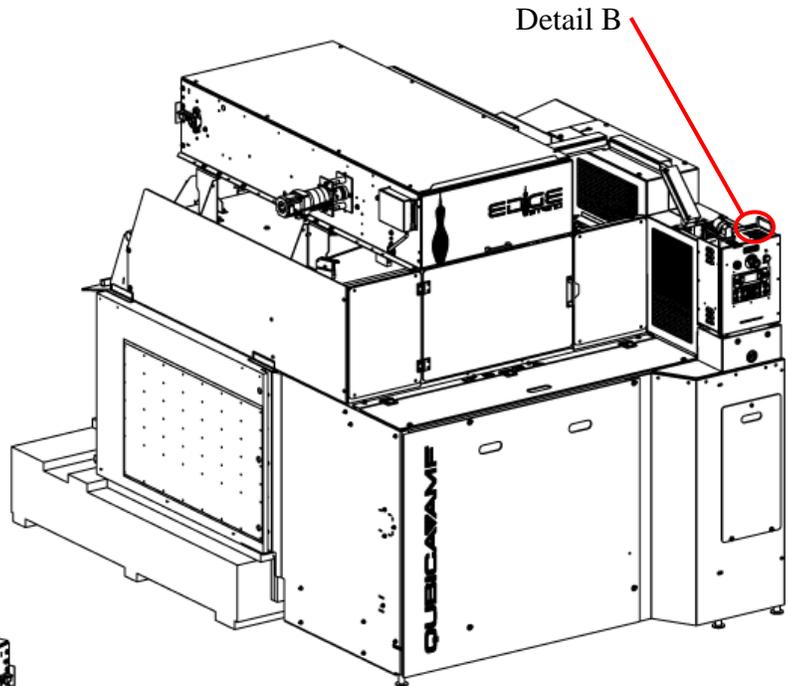
110dB USE EAR PROTECTION  
IP3X

S/N: YYYMMDDXXXX **CE**  
YEAR OF MANUFACTURE: 20YY  
051-200-516-01\_A

#### Description

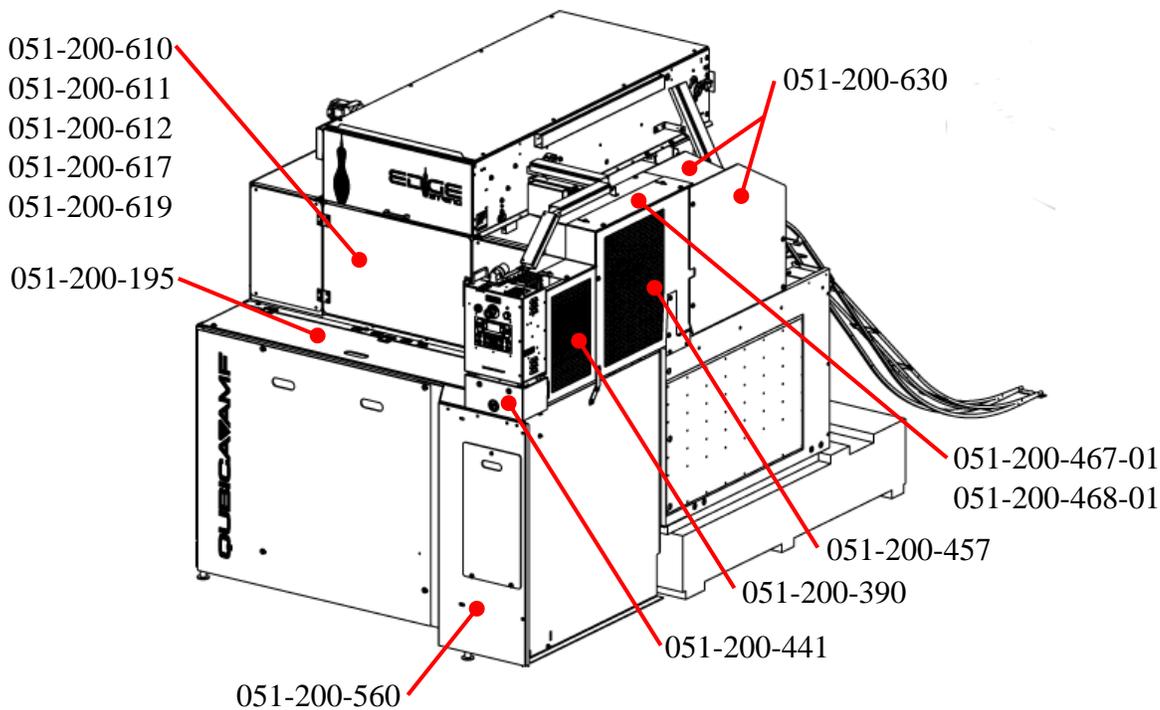
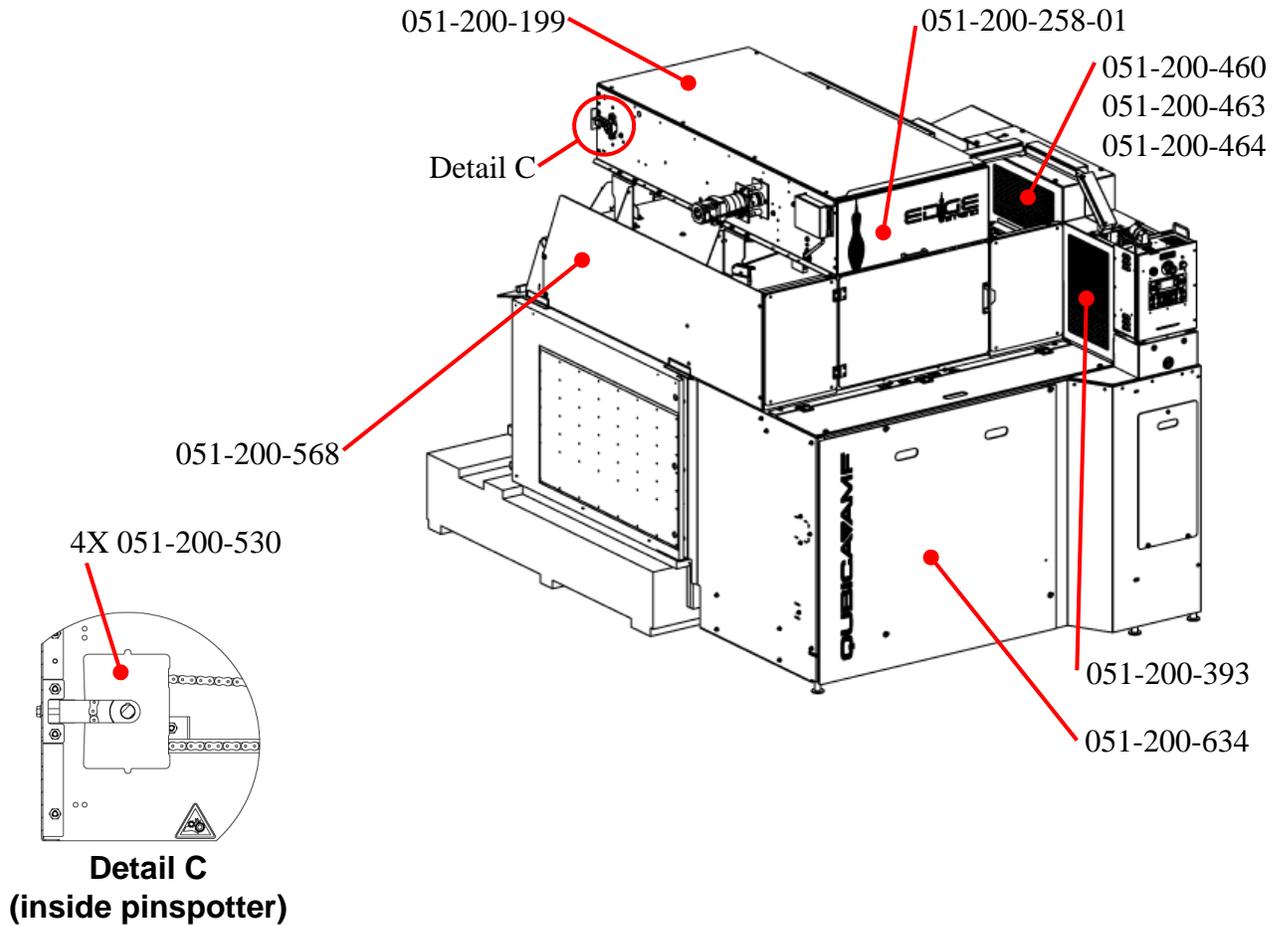
Single pinspotter installation used for 10-Pin bowling game. Mounted on an Even lane (e.g. 2, 4, 6, ...). Machine uses a chain lift mounted in double division on 7-pin side.

Machines to be installed per local electrical codes.



Detail B, System Controller Label





### 1.5.4. Extra-Wide Machine Pair (Config. #: 612-051-117 Rev. E or later)

#### Detail A, Model Label

**QUBICAAMF**  
8100 AMF DR, MECHANICSVILLE, VA 23111 USA

EDGE STRING  
MODEL # 051-202-000 (10-PIN PAIR)  
INSTALL WITH 612-051-112 OR 612-051-117

WT/MASS, PINSPOTTER & TABLES: 316 lb [143kg]  
SYSTEM DOCUMENT: 400-051-202-01  
SCHEMATIC # 051-200-278-01

110dB USE EAR PROTECTION  
IP3X

S/N: YYYMMDDXXXX  
YEAR OF MANUFACTURE: 20YY

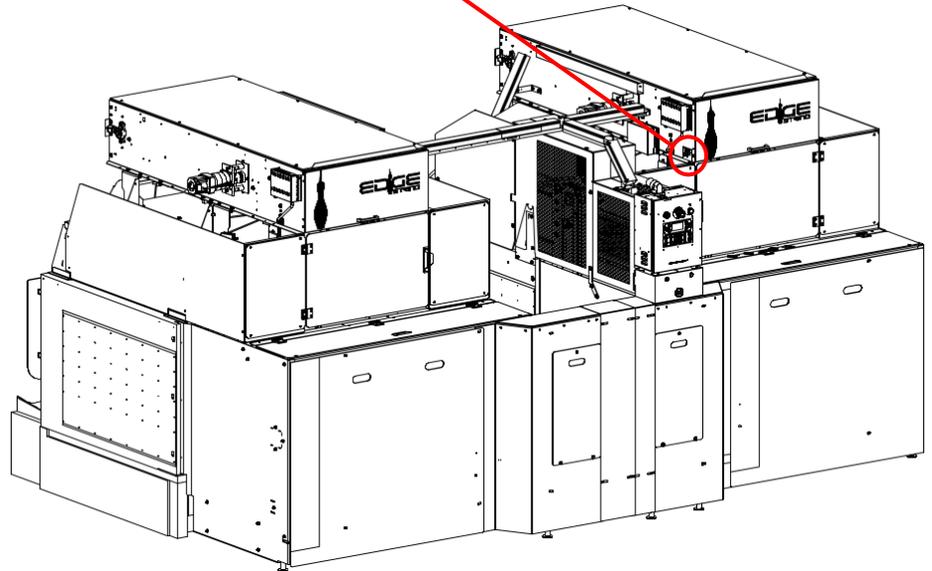
051-200-514-01\_A



#### Description

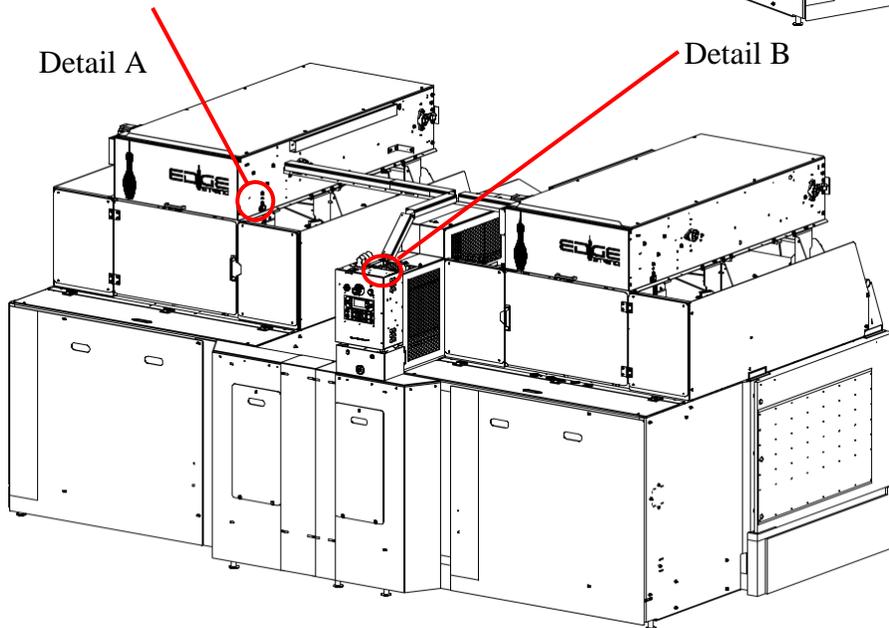
Extra-wide pinspotter pair installation used for 10-Pin bowling game. Machines mounted together on adjacent Odd and Even lanes (e.g. 1/2, 3/4, ...) with additional separation distance between lanes. Machines share a common chain lift mounted in double division between machines.

Detail A



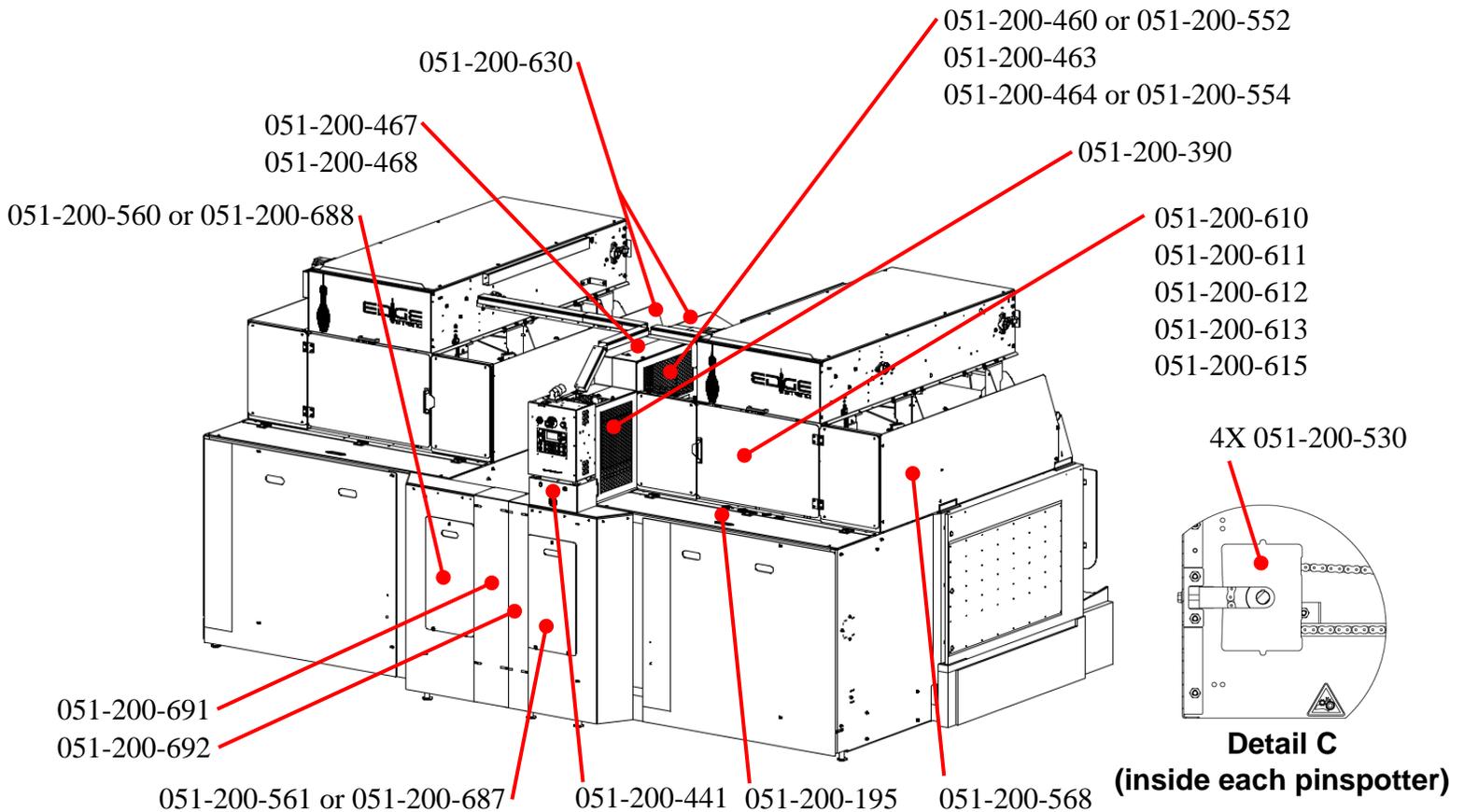
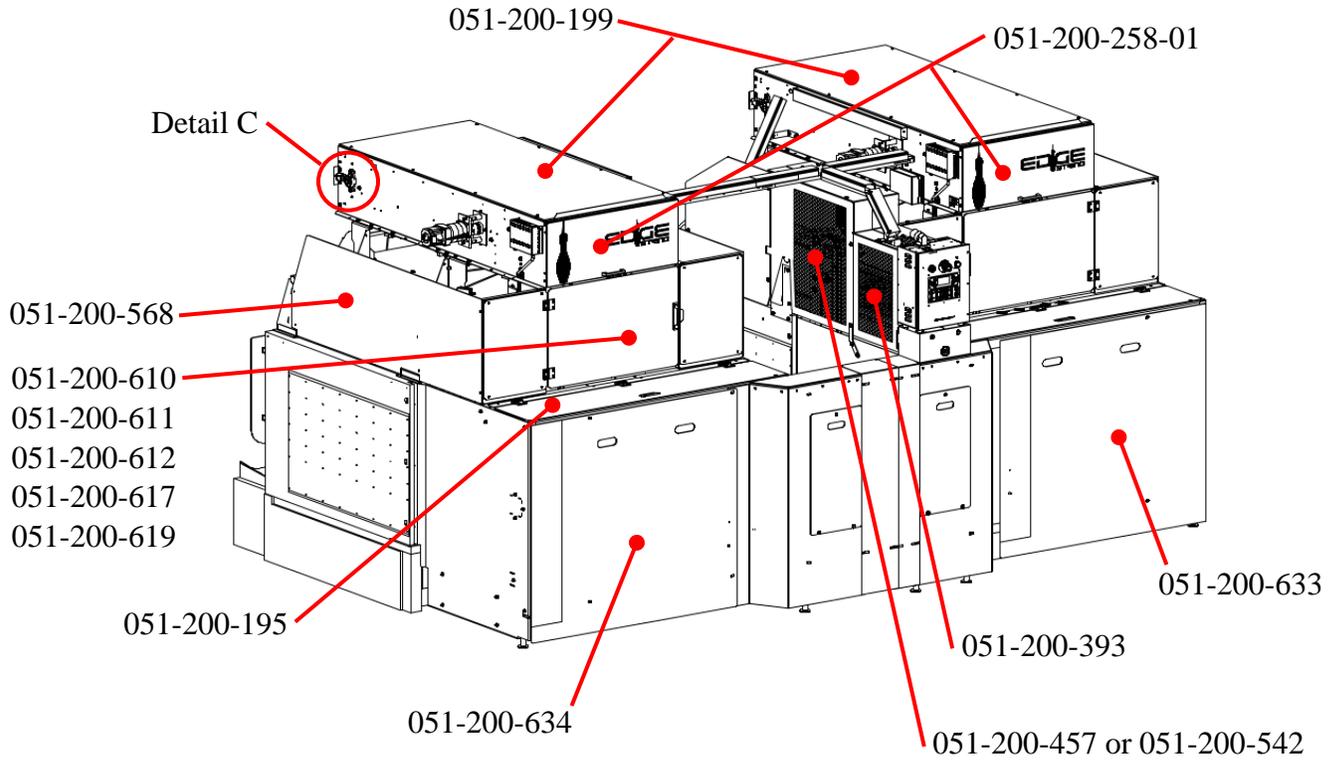
Detail A

Detail B



Detail B, System Controller Label

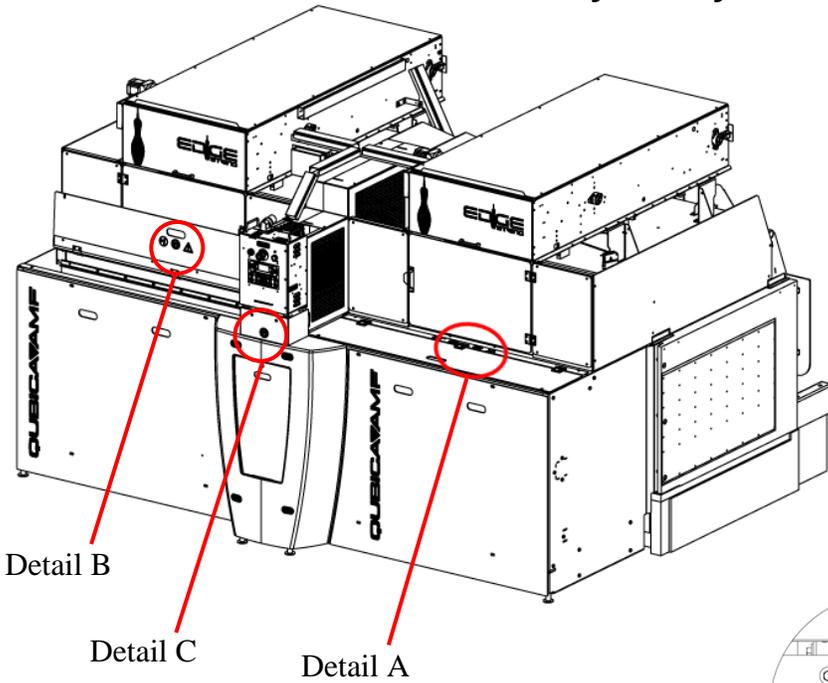




## 1.6. Safety Label Locations

Safety labels are placed on the machine to warn operator(s) of potential hazards. Part numbers and locations of all safety labels for a machine pair are shown below. The same label placement applies for an Odd or Even single machine or extra-wide machine pair installation. All safety labels must be in place during machine operation.

### 1.6.1. Machine Boundary Safety Labels



Detail B

Detail C

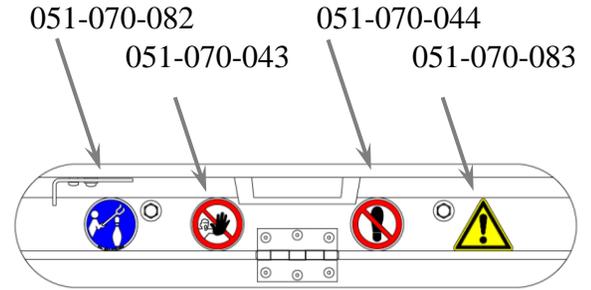
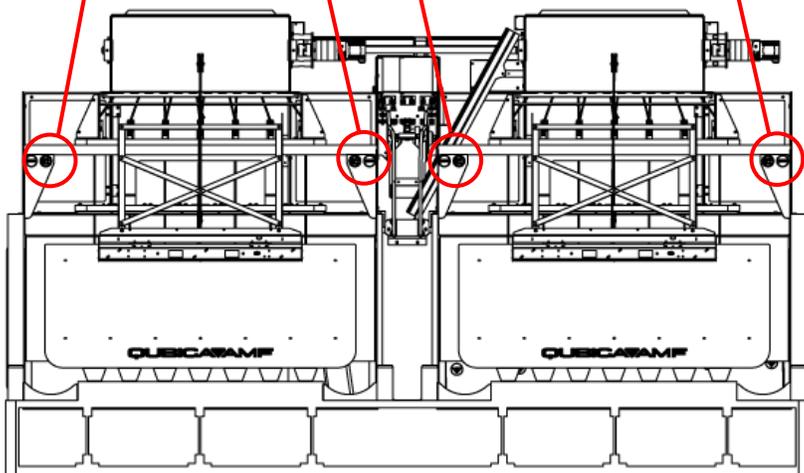
Detail A

Detail D

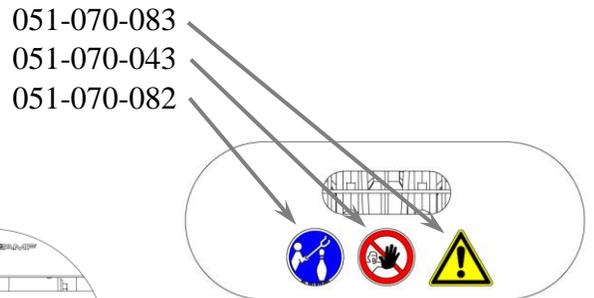
Detail E

Detail D

Detail E



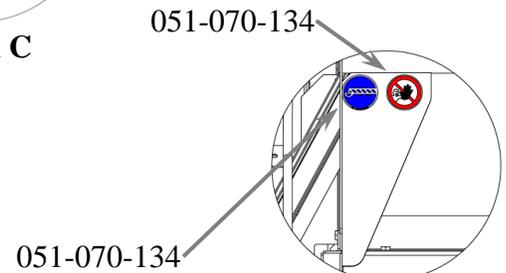
Detail A (Each Machine)



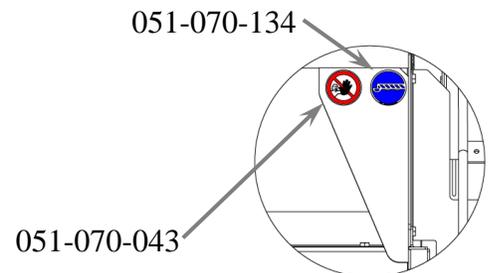
Detail B (Each Machine)



Detail C



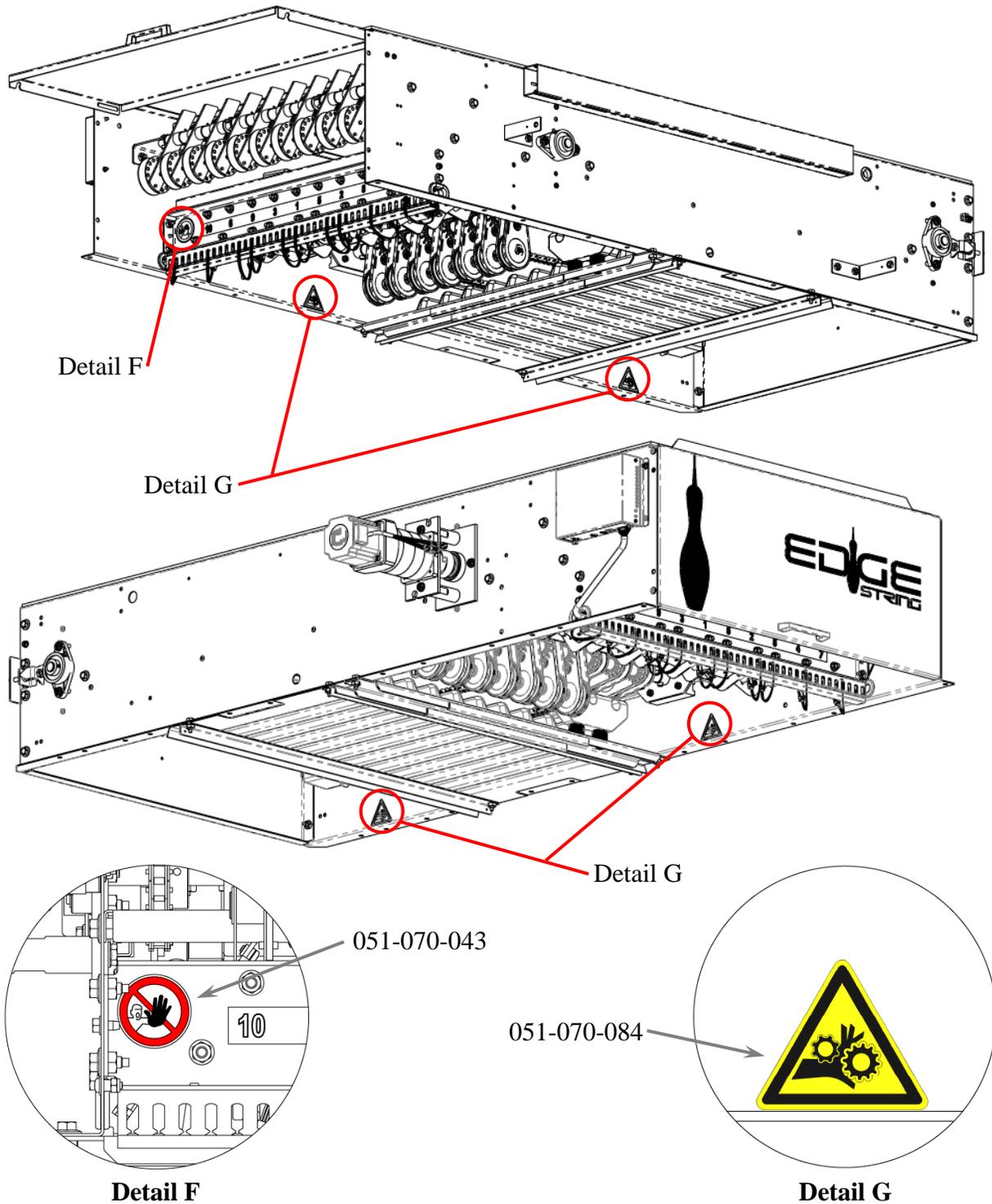
Detail D



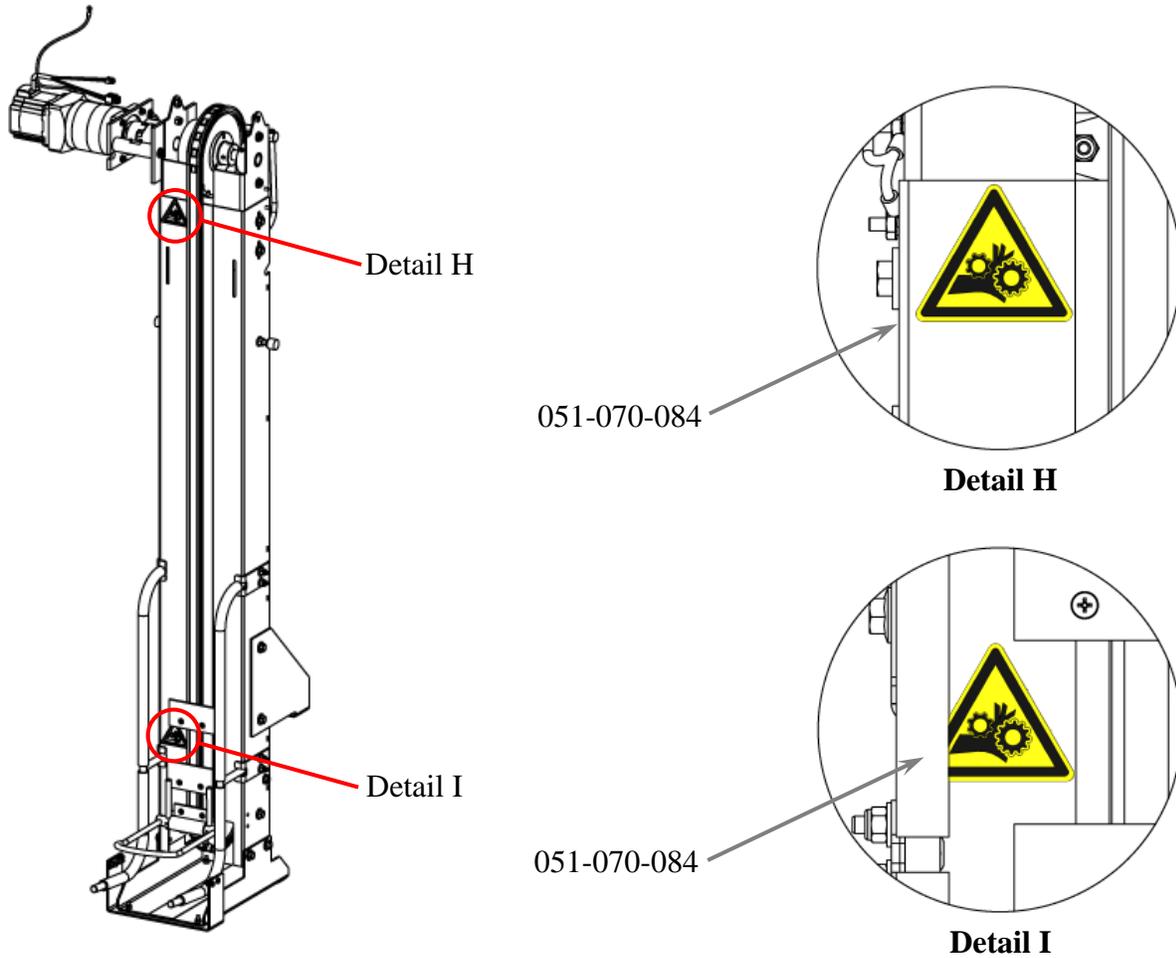
Detail E



### 1.6.2. Pinspotter Safety Labels



### 1.6.3. Chain Lift Safety Labels





## Section 2 Operation

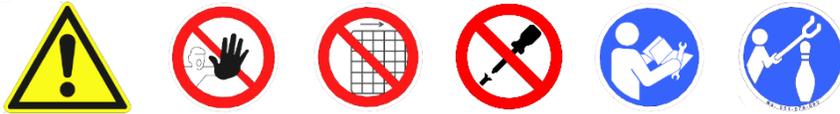




## 2.1. Section Overview

This section provides an overview of the EDGE String, including descriptions of the major components/sub-assemblies, user-configurable settings, diagnostics tools, and machine operation. It also explains how to use the system controller keypad/display, the primary user interface for machine operation and routine maintenance tasks.

### Applicable Safety Warnings



## 2.2. Major Components & Subassemblies

Figure 2-1 shows the EDGE String installed in a pinspotter pair configuration. Both pair and single pinspotter configurations are available. The following section outlines the major machine components/subassemblies with brief descriptions of each item.

### 2.2.1. Pinspotter Pair

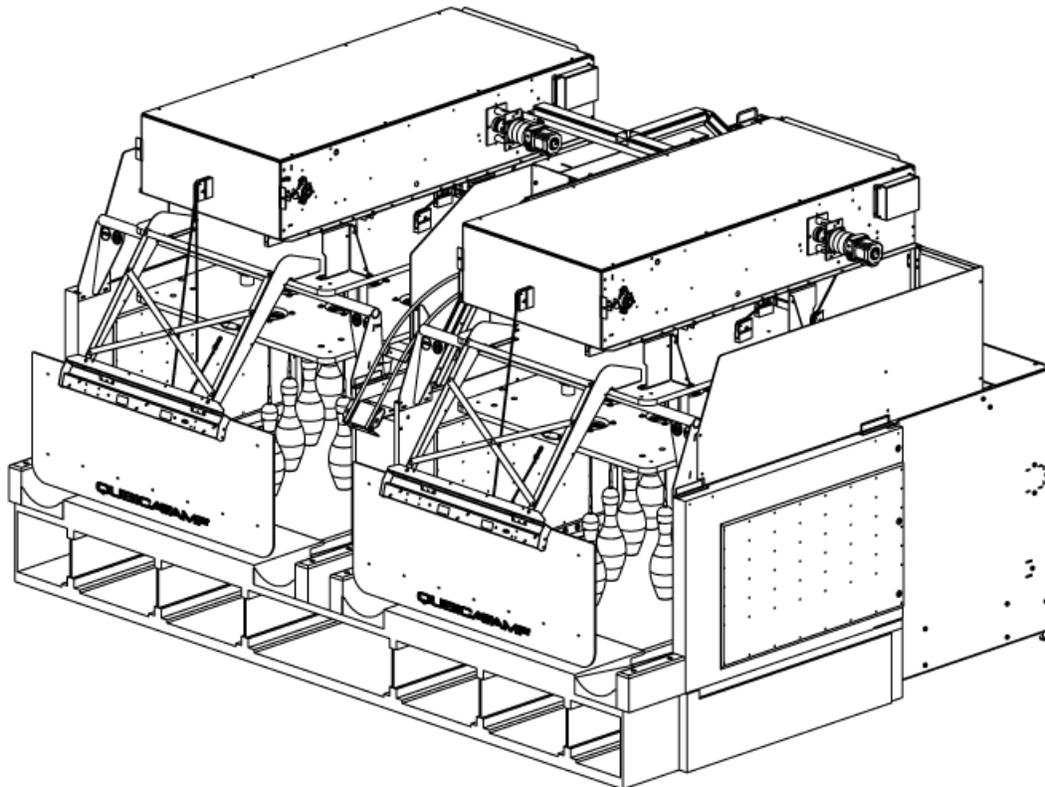


Figure 2-1, EDGE String Pinspotter Pair



### 2.2.2. Pinspotter

Assembly consisting of reel arm assembly, brake/encoder assemblies, drawbar assembly, pulley flip bracket, drawbar gearmotor, machine control box, upper and lower table assemblies, string comb, string pan, top guard, and reel arm cover. Performs bowling operations of lifting and setting pins. See Figure 2-2.

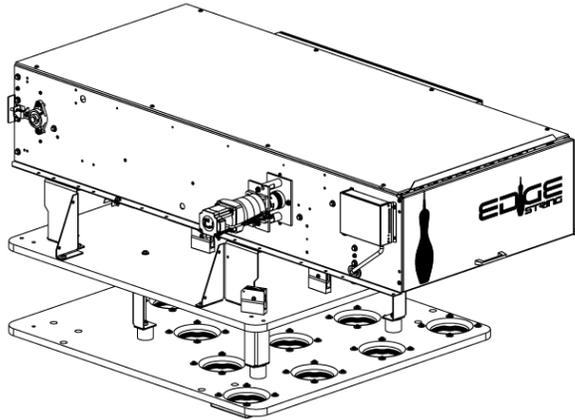


Figure 2-2, Pinspotter

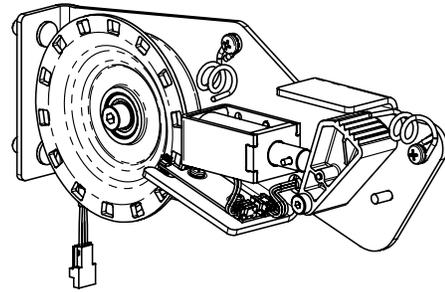


Figure 2-3, Brake/Encoder Assembly

### 2.2.3. Brake/Encoder Assembly

Pinspotter assembly consisting of sheet metal mounting plate, brake pawl, encoder pulley, and brake/encoder circuit board. Senses string movement and holds scored pins in brake position. Pinspotter uses one assembly per pin. See Figure 2-3.

### 2.2.4. Reel Arm Assembly

Pinspotter assembly consisting of sheet metal mounting bracket, reel arm shaft, and ten spring-loaded reel arms. Reel arms serve as attachment point for each pin string and provide additional string storage. They also rotate to relieve string tension during pin impacts and string tangles. See Figure 2-4

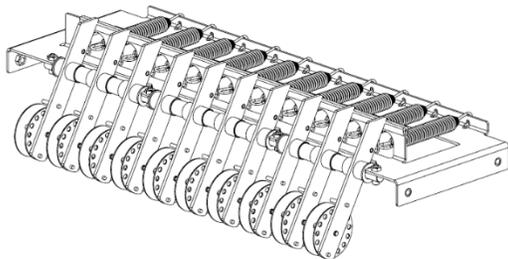


Figure 2-4, Reel Arm Assembly



Figure 2-5, Reel Arm

### 2.2.5. Reel Arm

Spool mechanism for attaching pin string to pinspotter and storing excess string. Rotates about reel arm shaft to relieve string tension during pin impacts and string tangles. Arm rotation trips optical tangle switch during string tangle to activate pinspotter detangle function. Pinspotter uses one reel arm per pin. See Figure 2-5.



## 2.2.6. Drawbar Assembly

Pinspotter assembly consisting of chain drive, guide blocks, sheet metal bracket, drawbar shaft, and ten drawbar pulleys. Assembly is driven by drawbar gearmotor to lift and lower pins. See Figure 2-6.

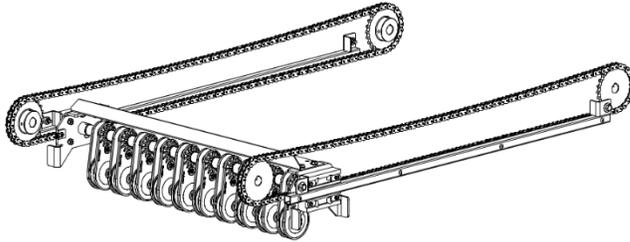


Figure 2-6, Drawbar Assembly

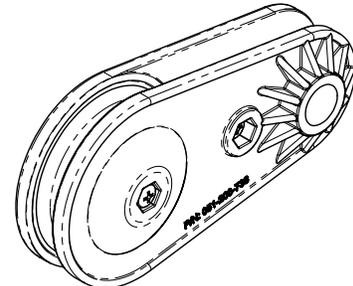


Figure 2-7, Drawbar Pulley

## 2.2.7. Drawbar Pulley

Molded plastic pulley that rotates about drawbar shaft as pinspotter lifts and lowers pins. Pinspotter uses one drawbar pulley per pin. See Figure 2-7.

## 2.2.8. Pulley Flip Bracket

Pinspotter assembly consisting of sheet metal bracket, plastic block, rubber isolators, and stabilizing springs. Flips three drawbar pulleys closest to ball door, reducing available string slack and preventing pins from entering ball door. See Figure 2-8.

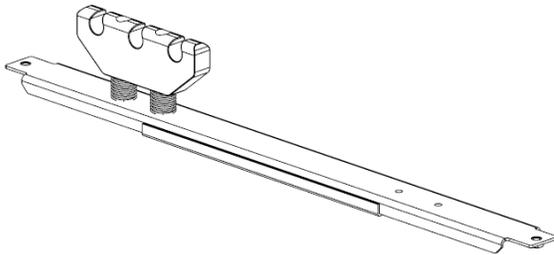


Figure 2-8, Pulley Flip Bracket

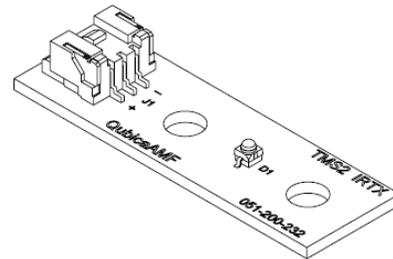


Figure 2-9, Tangle Switch Emitter Board

## 2.2.9. Tangle Switch Emitter Board

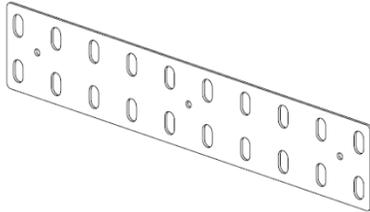
Circuit board equipped with infrared LED transmitter. Mounted inside pinspotter frame next to reel arm assembly. Functions together with pinspotter control box to create optical beam that senses reel arm rotation during string tangles and activates pinspotter detangle function. See Figure 2-9.

## 2.2.10. String Comb

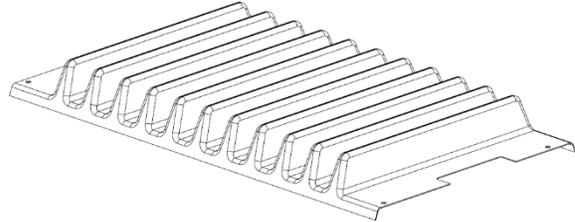
Plastic plate that guides pin strings into brake/encoder assemblies. Prevents string tangles inside pinspotter frame. See Figure 2-10.

### 2.2.11. String Tray

Molded plastic pan that supports slack string inside pinspotter frame. Prevents string tangles inside pinspotter frame. See Figure 2-11.



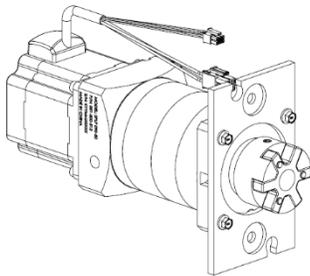
**Figure 2-10, String Comb**



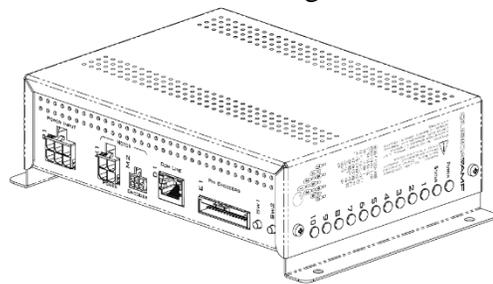
**Figure 2-11, String Tray**

### 2.2.12. Gearmotor

Assembly consisting of DC brushless motor, planetary gearbox, shaft coupling, and mounting bracket. A 50:1 drive ratio gearmotor powers the pinspotter drawbar assembly. A 25:1 drive ratio gearmotor powers the chain lift. See Figure 2-12.



**Figure 2-12, Gearmotor**



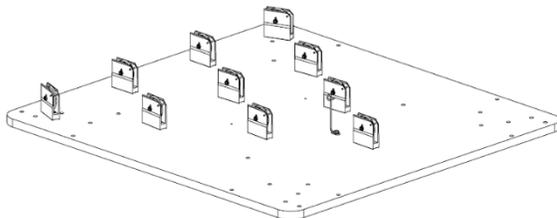
**Figure 2-13, Control Box**

### 2.2.13. Control Box

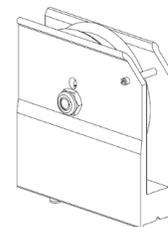
Electronic control board used to drive pinspotter and chain lift gearmotors. Transmits data signals between pinpotters, chain lift, and system controller. Each gearmotor requires its own dedicated control box. See Figure 2-13.

### 2.2.14. Upper Table

Pinspotter assembly consisting of plywood panel and ten table pulleys. See Figure 2-14.



**Figure 2-14, Upper Table**



**Figure 2-15, Table Pulley**

## 2.2.15. Table Pulley

Assembly consisting of aluminum mounting block and molded plastic pulley. Directs pin strings from pinspotter to each pin spot on pindeck. Pinspotter uses one pulley assembly per pin. See Figure 2-15.

## 2.2.16. Lower Table

Pinspotter assembly consisting of plywood panel and ten pin centering rings. See Figure 2-16.

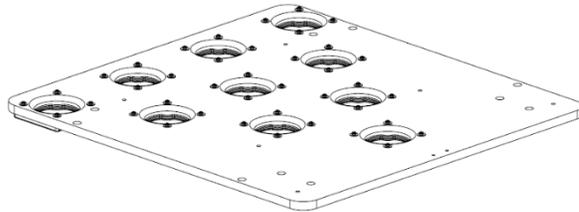


Figure 2-16, Lower Table

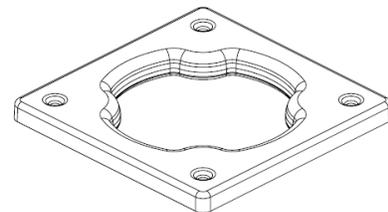


Figure 2-17, Pin Centering Ring

## 2.2.17. Pin Centering Ring

Molded plastic ring mounted to underside of lower table assembly. Stabilizes pins when pins are lifted off pindeck. Pinspotter uses one pin centering ring per pin. See Figure 2-17.

## 2.2.18. Kickback

Plywood panel that encloses pindeck area. Supports pinspotter and upper/lower table assemblies. Common division kickbacks (see Figure 2-18) are 70mm thick. Double division kickbacks (see Figure 2-19) are 24mm thick.

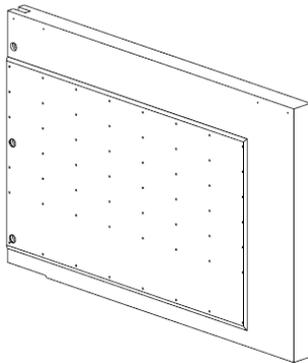


Figure 2-18, Common Division Kickback

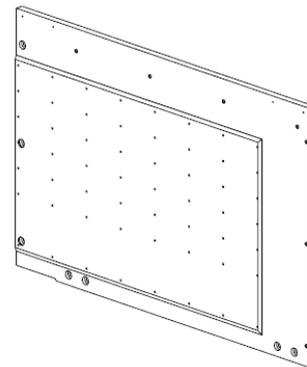
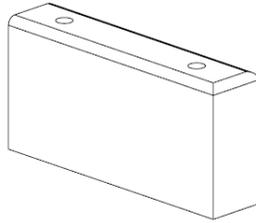


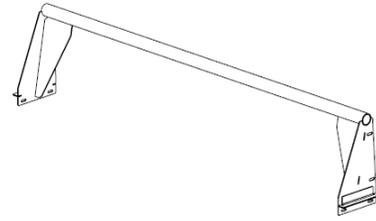
Figure 2-19, Double Division Kickback

## 2.2.19. Kickback Nose Block

Plywood block installed in front of each kickback. Protects leading edge of kickbacks from ball impacts. See Figure 2-20.



**Figure 2-20, Kickback Nose Block**



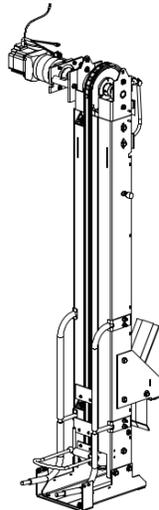
**Figure 2-21, Machine Support**

### 2.2.20. Machine Support

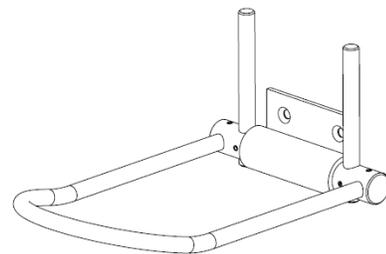
Sheet metal weldment that supports pinspotter and upper/lower table assemblies on top of kickbacks. See Figure 2-21.

### 2.2.21. Chain Lift

Assembly consisting of sheet metal frame, ball stop rails, gearmotor, sprocket/shaft assemblies, chain drive, and two ball lifter assemblies. Lifts balls from double division rails to cross sweep for returning balls to bowlers. See Figure 2-22.



**Figure 2-22, Chain Lift**



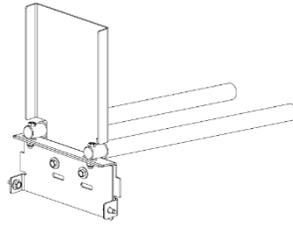
**Figure 2-23, Ball Lifter Assembly**

### 2.2.22. Ball Lifter Assembly

Chain lift assembly consisting of bent hoop, mounting bracket, shaft, and stabilizer posts. Mounts to chain lift chain loop for lifting balls. Two per chain lift. See Figure 2-23.

### 2.2.23. Double Division Rail Assembly

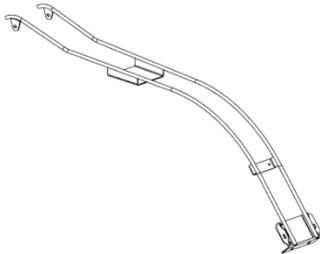
Assembly consisting of two ball rails, rail covers, mounting brackets, and ball stop plate. Guides balls from ball door to chain lift. Ball stop plate prevents balls from rolling backwards, away from chain lift. See Figure 2-24.



**Figure 2-24, Double Division Rail Assembly**

### 2.2.24. Cross Sweep

Welded rod assembly joining chain lift to down sweep. Guides balls from chain lift to down sweep to return balls to bowlers. See Figure 2-25.



**Figure 2-25, Cross Sweep**



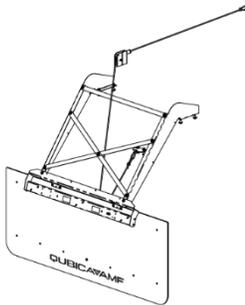
**Figure 2-26, Down Sweep**

### 2.2.25. Down Sweep

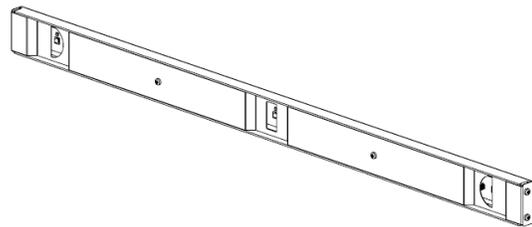
Welded rod assembly joining cross sweep to under-lane ball track. Guides balls from cross sweep to under-lane ball track to return balls to bowlers. See Figure 2-26.

### 2.2.26. Shield/Pitlight Assembly

Assembly consisting of shield, pitlight fixture, sheet metal frame, shield actuation string, and shield hard-stop string. Shield assembly is driven by drawbar assembly. Shield rotates up and down to alert players when lane is ready to bowl. See Figure 2-27.



**Figure 2-27, Shield/Pitlight Assembly**



**Figure 2-28, Pitlight Fixture**

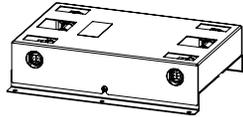
### 2.2.27. Pitlight Fixture

LED light fixture that illuminates pindeck area. See Figure 2-28.



### 2.2.28. Ball Detector

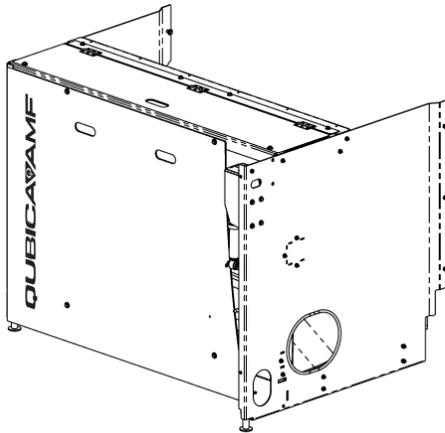
Assembly consisting of sheet metal enclosure, optical sensors, and reflectors. Senses thrown ball and triggers pinspotter to cycle. See Figure 2-30.



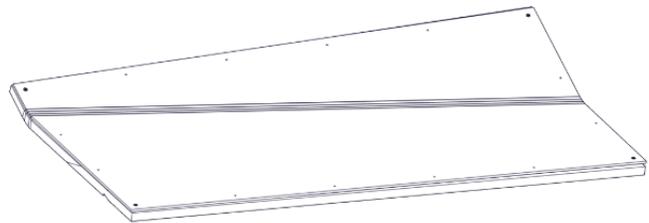
**Figure 2-30, Ball Detector**

### 2.2.29. Pit Assembly

Assembly consisting of sheet metal side frames, cross braces, pit floor, pit curtain, pit cushion, pit cushion blocks, pit cushion shock, rear guard, and hinged top cover. See Figure 2-31.



**Figure 2-31, Pit Assembly**



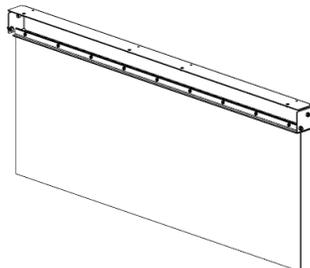
**Figure 2-32, Pit Floor Assembly**

### 2.2.30. Pit Floor Assembly

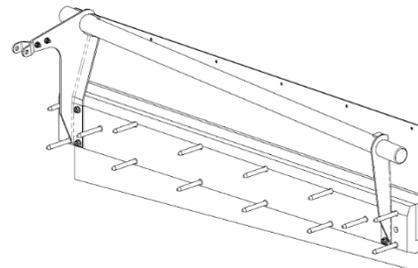
Pit assembly consisting of sheet metal joists, plywood base, wedge supports, and plastic top panel. Catches fallen pins and guides balls to ball door. See Figure 2-32.

### 2.2.31. Pit Curtain

Pit assembly consisting of sheet metal support and rubberized fabric panel. Prevents pin damage and deflects pins to pit floor. See Figure 2-33.



**Figure 2-33, Pit Curtain**



**Figure 2-34, Pit Cushion**

### 2.2.32. Pit Cushion

Pit assembly consisting of welded sheet metal support, cushion plank, cushion pads, and cushion cover. Stops a thrown ball. See Figure 2-34.

### 2.2.33. Pit Cushion Block

Pit assembly consisting of sheet metal bracket, plastic bearing block and shield disc. Supports pit cushion assembly on side frames. Block assemblies for 7-pin and 10-pin sides are not interchangeable. See Figure 2-35.

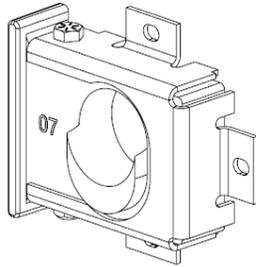


Figure 2-35, Pit Cushion Block

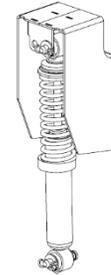


Figure 2-36, Pit Cushion Shock

### 2.2.34. Pit Cushion Shock

Pit assembly consisting of sheet metal mounting bracket and shock absorber. Absorbs energy of ball impact against pit cushion. See Figure 2-36.

### 2.2.35. Pit Rear Guard

Tool-removable plastic guarding panel mounted to rear of pit assembly. Defines machine boundary and protects operator during machine operation. See Figure 2-37.

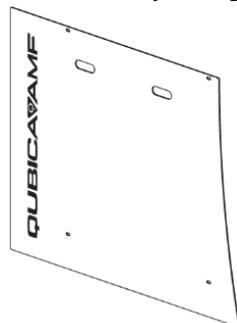


Figure 2-37, Pit Rear Guard

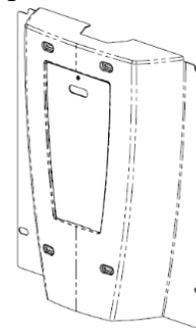


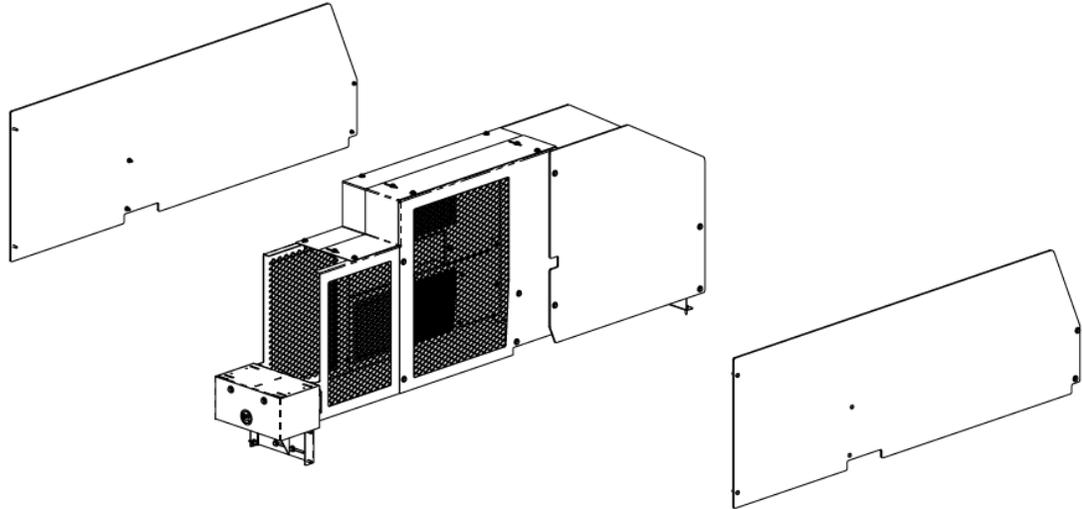
Figure 2-38, Double Division Guard

### 2.2.36. Double Division Guard

Thermo-formed plastic guarding assembly mounted to rear of double division. Defined machine boundary and protects operator during machine operation. Tool-removable polycarbonate access panel allows limited access to chain lift area for maintenance interventions. See Figure 2-38.

### 2.2.37. Chain Lift/Machine Guards

Tool-removable sheet metal and polycarbonate guarding assembly mounted around chain lift, common divisions, and double division. Defines machine boundary and protects operator during machine operation. See Figure 2-39.



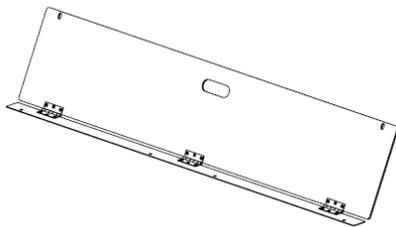
**Figure 2-39, Chain Lift/Machine Guards**

### 2.2.38. Pit Hinged Top Cover

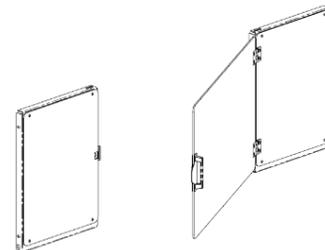
Hinged plastic panel mounted on top of pit assembly. Defines machine boundary and allows limited access to pit area for maintenance interventions. See Figure 2-40.

### 2.2.39. Machine Rear Cover

Sheet metal and polycarbonate assembly with hinged access door. Defines machine boundary and allows limited access to pindeck area for maintenance interventions. See Figure 2-41.



**Figure 2-40, Pit Hinged Top Cover**



**Figure 2-41, Machine Rear Cover**

### 2.2.40. Pinspotter Top Guard

Tool-removable hardboard panel fastened to top of pinspotter frame. Defines machine boundary, protects operator during machine operation, and keeps dust/debris out of pinspotter frame. See Figure 2-42.

### 2.2.41. Reel Arm Cover

Hinged sheet metal panel located at the rear of pinspotter frame. Defines machine boundary and allows limited access to reel arms and brake/encoder units for maintenance interventions. See Figure 2-43.

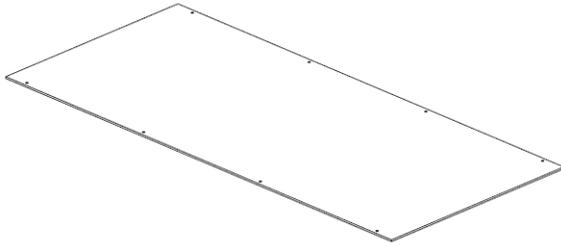


Figure 2-42, Pinspotter Top Guard

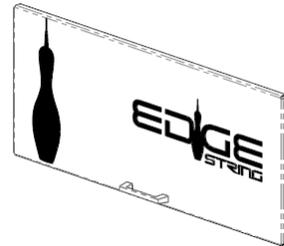


Figure 2-43, Reel Arm Cover

### 2.2.42. Pinspotter Sprocket Guard

Tool-removable molded plastic guard mounted inside pinspotter frame. Prevents operator from contacting drawbar drive sprockets during maintenance interventions. Four guards per pinspotter. See Figure 2-44.

### 2.2.43. System Controller

Primary control module for pair of pinspotters. Includes control board, power supply, ON/OFF switch, E-Stop button, keypad, and display. Converts high voltage main power supply to 24VDC and distributes power to pinspotters and chain lift. Handles communication tasks among all machine subsystems. Primary user interface for machine operation and routine maintenance tasks. See Figure 2-45.

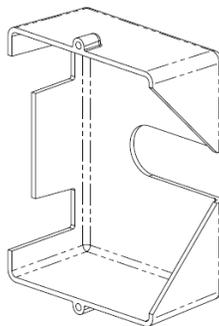


Figure 2-44, Pinspotter Sprocket Guard

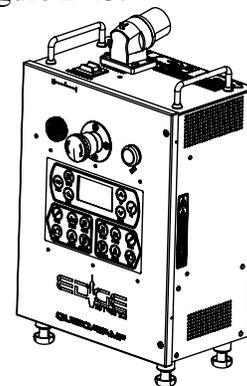
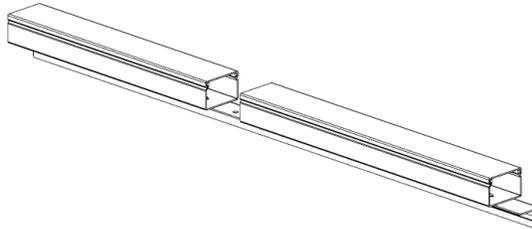


Figure 2-45, System Controller



## 2.2.44. Wireways

Plastic and sheet metal wire ducts for routing electrical cables within the machine boundary. See Figure 2-46.



**Figure 2-46, Wireways**

## 2.2.45. 10-Pin Bowling

Bowling game using full-sized ball (8.5" [216mm] diameter) and ten full-sized pins (15.0" [381mm] height).



## 2.3. System Controller

The system controller is the primary control module for a pair of pinspotters and can be used with or without a scoring system. It is located above the double division ball return area at the rear of the machines.

This device must only be used indoors to protect all the electrical components from any outdoor weather conditions. It must also be used in temperatures between 0-40°C and at a maximum altitude of 3000mt.

Main electrical power (208-230VAC) is supplied from a center's main service distribution panel limited to 20A current and is routed to the main power inlet connector on the top of the system controller. Operating current is 3.2A. **Warning:** Proper protective grounding of the product is required.

An ON-OFF switch is located next to the main power inlet connector. This switch controls power to a pinspotter pair and is used to shut down/re-boot all machine systems. A power supply inside the system controller converts the main supply power to 24VDC which is distributed to the control boxes of the pinspotters and chain lift. The system controller also handles communication tasks among all machine subsystems, including the pinspotter control boxes, chain lift control box, pit light, mask lights, ball detector, foul detector, ball lift control box, and scoring system.

The system controller is the primary user interface for machine operation and routine maintenance tasks.

A display and pushbutton keypad are located on the front face of the unit for accessing machine functions, user-configurable settings, and system diagnostics tools.

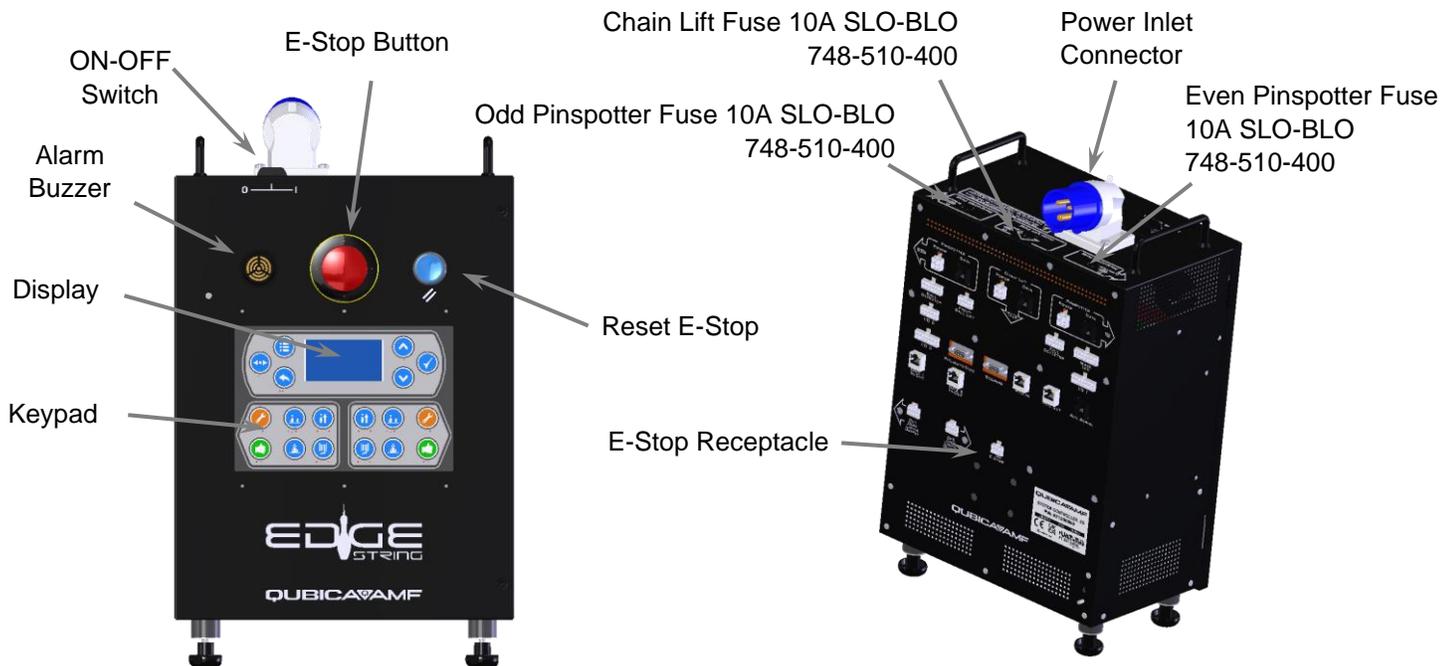


Figure 2-47, System Controller

### 2.3.1. Port Layout

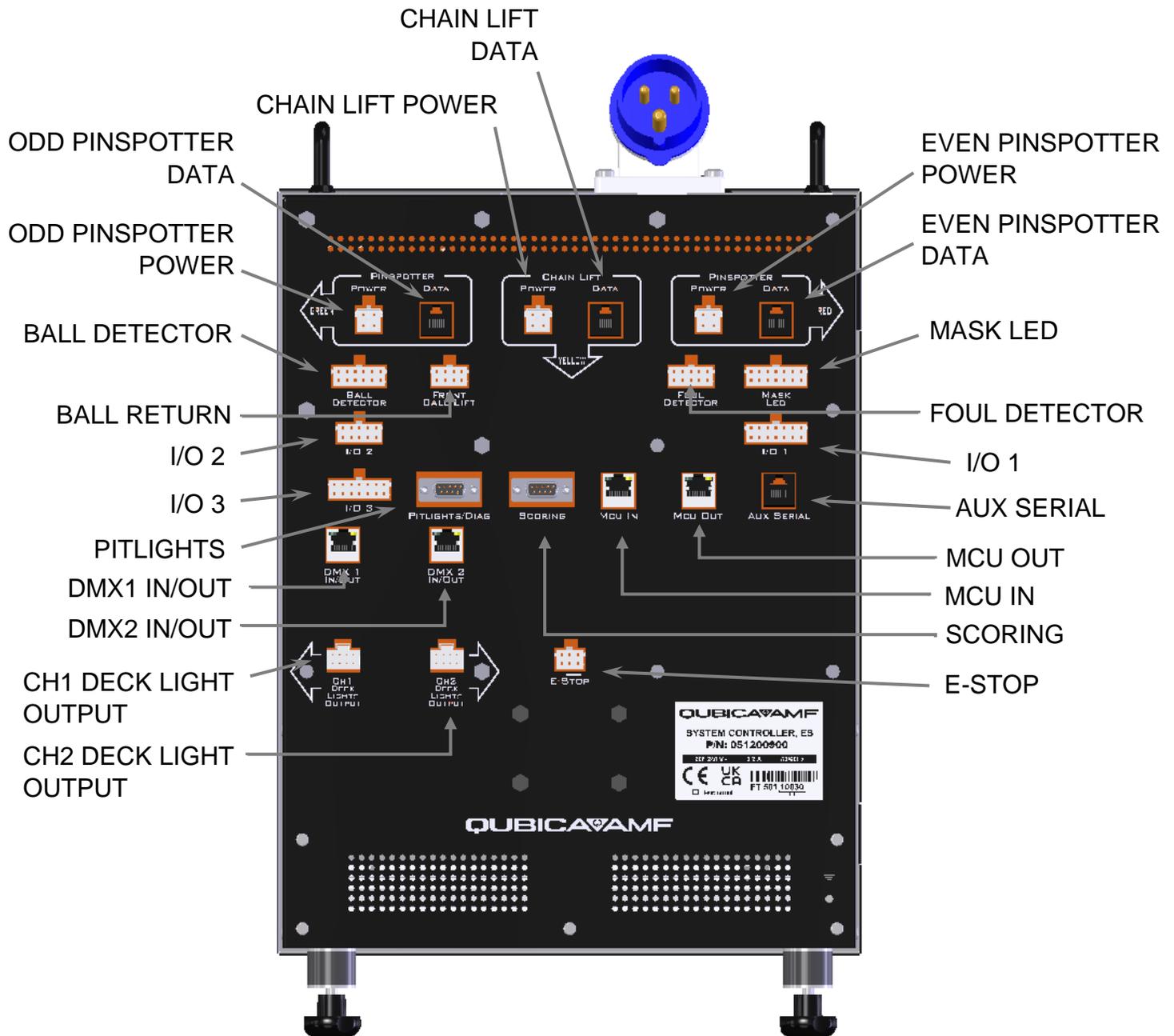


Figure 2-48, System Controller Plug Layout



### 2.3.2. Port Descriptions

PORT	COMPATIBILITY	DESCRIPTION
GREEN PINSPOTTER POWER	Only with QubicaAMF Devices: 051-200-299-03 – EDGE String Control Box (or equivalent)	This port supplies +24V power to the ODD EDGE String Control Box unit. The EDGE String Control Box Unit drives the machines motors, encoders, solenoids and sensors
GREEN PINSPOTTER DATA		This port is for data communication between the ODD EDGE String Control Box Unit and the EDGE String System Controller.
YELLOW PINSPOTTER POWER	Only with QubicaAMF Devices: 051-200-299-03 – EDGE String Control Box (or equivalent)	This port supplies +24V power to the CHAIN LIFT EDGE String Control Box Unit. The EDGE String Control Box Unit drives the machines Chain Lift Motor
YELLOW PINSPOTTER DATA		This port is for data communication between the CHAIN LIFT Control Box and the EDGE String System Controller.
RED PINSPOTTER POWER	Only with QubicaAMF Devices: 051-200-299-03 – EDGE String Control Box (or equivalent)	This port supplies +24V power to the EVEN EDGE String Control Box Unit. The EDGE String Control Box Unit drives the machines motors, encoders, solenoids and sensors
RED PINSPOTTER DATA		This port is for data communication between the EVEN EDGE String Control Box Unit and the EDGE String System Controller.
BALL DETECTOR	Only with QubicaAMF Devices: 051-200-761 ES BLACK BALL TRIGGER (or equivalent)	This port supplies power to the photocells that are inside the ES BLACK BALL TRIGGER (or equivalent QubicaAMF product) and receives the signals that confirms the ball passage on both Odd and Even Lanes.
FRONT BALL LIFT	Only with QubicaAMF Devices: 252-003-100-02 BALL LIFT CONTROL UNIT (or equivalent)	This port interfaces with the BALL LIFT CONTROL UNIT (or equivalent QubicaAMF product), to drive the front Ball Return system.
FOUL DETECTOR	Only with QubicaAMF Devices: 088-000-222-01 XLi FOUL DETECTOR (or equivalent)	This port supplies power to the photocells that are inside the XLi FOUL DETECTOR (or equivalent QubicaAMF product) and receives the signals that check if the player has stepped beyond the foul line on the ODD or EVEN Lane.
MASK LED	Only with QubicaAMF Devices: 260-001-157 MASK 1BALL/2BALL LIGHTS (or equivalent)	This port supplies power to the MASK 1BALL/2BALL LIGHTS (or equivalent QubicaAMF product) that shows the games frame status to the player, by LED or LIGHT display.
I/O1	Only with QubicaAMF Devices	This port is provided to maintain compatibility with obsolete QubicaAMF's pinspotter systems and accessories.
I/O2	Only with QubicaAMF Devices	This port is provided to maintain compatibility with obsolete QubicaAMF's pinspotter systems and accessories.
I/O3	Only with QubicaAMF Devices	This port is provided to maintain compatibility with obsolete QubicaAMF's pinspotter systems and accessories.
PITLIGHTS/DIAG	Only with QubicaAMF Devices	This is a serial port used only by QubicaAMF operators to program and read machine status.



SCORING	Only with QubicaAMF Devices: 288-250-025-02 - 5HD-HUB-02 (or equivalent).	This is a serial port that interfaces with the 5HD-HUB-02 to communicate with the Front Desk (the main center's PC where the QubicaAMF bowling management program is installed). Essentially it takes orders for example to open a lane for a game, and gives all machine status information.
MCU IN	Only with QubicaAMF Devices: 290-002-105 - MCU (or equivalent).	This is a serial port that is either connected to QubicaAMF's USB-RS486 adapter (MCU) that is connected to a PC or to another EDGE String System Controller MCU Out port. Pinspotter functions are controlled through this port.
MCU OUT	Only with QubicaAMF Devices: 290-002-105 - MCU (or equivalent).	This is a serial port that can be connected in cascade configuration to the next EDGE String System Controller MCU IN port.
AUX SERIAL	Only with QubicaAMF Devices	This is a serial port that is normally not used, but is provided to give some custom functions when required.
DMX 1 IN/OUT	With QubicaAMF Devices: 275-002-032 – EFFECTS SERVER X) or equivalent) With Customer's Devices: Compatible only with devices that use the DMX communication.	This is a DMX port that can be connected with QubicaAMF's EFFECTS SERVER X or any customers DMX device port.
DMX 2 IN/OUT	With QubicaAMF Devices: 275-002-032 – EFFECTS SERVER X) or equivalent) With Customer's Devices: Compatible only with devices that use the DMX communication.	This is a DMX port that can be connected with QubicaAMF's EFFECTS SERVER X or any customers DMX device port. Daisy Chain CAT5 cable from/to System Controller. Last System Controller needs terminator (p/n TOOTCS120TER).
CH1 DECK LIGHTS OUTPUT	Only with QubicaAMF Devices: 275-002-001-01 ODD CP DECK LIGHT FIXTURE (or equivalent).	This port supplies power and drives the QubicaAMF CP DECK LIGHT FIXTURE, which is basically an RGBW LED Lamp.
CH2 DECK LIGHTS OUTPUT	Only with QubicaAMF Devices: 275-002-001-01 EVEN CP DECK LIGHT FIXTURE (or equivalent).	This port supplies power and drives the QubicaAMF CP DECK LIGHT FIXTURE, which is basically an RGBW LED Lamp.
E-STOP	Only with QubicaAMF Devices	This port can be connected to a QubicaAMF plug, that serves like a security key, or to a QubicaAMF E-STOP Device. If nothing is connected, the system goes into E-STOP error mode, which won't allow the machine to turn on or the motors to run.



**WARNING:**



- **High voltage is present inside the system controller. Use caution when operating or handling this equipment. Refer to Section 4 (Troubleshooting) of this manual for instructions on performing maintenance tasks involving the system controller.**



- **The system controller contains no user-serviceable parts.**
- **The system controller includes a tamper indicator. Opening the system controller enclosure will void the warranty.**

### 2.3.3. Machine Activation

Use the following procedure to activate the pinspotter pair from a power OFF condition:

1. Switch system controller main power switch to ON.
2. Press **RESET E-STOP** button.
3. Wait until system controller restarts and both pinspotters and chain lift stop moving.
4. If resetting AC power during a game, proceed to Step 5. Otherwise, machine activation is complete.
5. Set Odd lane *Chassis Mode* to BOWL (see Page 2-20).
6. Set Even lane *Chassis Mode* to BOWL (see Page 2-20).
7. On Odd lane keypad controls, press **FULL SET**, then press **PLAY** to reconnect Odd lane with facility scoring system (if installed).
8. On Even lane keypad controls, press **FULL SET**, then press **PLAY** to reconnect Even lane with facility scoring system (if installed).

### 2.3.4. Emergency Stop (E-Stop)

An emergency stop (E-Stop) pushbutton is located on the front of the system controller (see Figure 2-47). Activating the E-Stop will immediately remove all electrical power from the pinspotter pair and chain lift gearmotors. The E-Stop should be used only in emergency situations requiring an immediate removal of electrical power to the machines and chain lift. The E-Stop is not to be used as a substitute for LOTO or to perform any maintenance. See Appendix A for LOTO procedure.

Use the following procedure to restart the pinspotter pair from an E-Stop condition:

1. Rotate E-Stop pushbutton clockwise until red knob pops out.
2. Press **RESET E-STOP** button.
3. Wait until system controller restarts and both pinspotters and chain lift stop moving.
4. Press **PLAY** on Odd lane keypad controls.
5. Press **PLAY** on Even lane keypad controls.



### 2.3.5. Keypad

The keypad is used to enter and view settings, check machine status, change operating modes, clear error messages, and perform machine functions. Keypad layout and pushbutton functions are explained below.

As shown in Figure 2-49, pushbuttons on the upper portion of the keypad are used for general machine control and keypad navigation. They are not specific to a lane.

Pushbuttons on the lower portion of the keypad are split into two groups and are used to perform various machine functions. The right group controls the Odd machine. The left group controls the Even machine.



Figure 2-49, System Controller Keypad

#### 2.3.5.1. Keypad Pushbuttons

Table 2-1, Keypad Pushbuttons

General Machine Control/Keypad Navigation		
	<b>LANE</b>	Alternates control between Odd and Even lanes.
	<b>MENU</b>	Press once for <i>Settings/Functions/Counters</i> . Press twice for <i>Diagnostics</i> .
	<b>BACK</b>	Return to previous menu.
	<b>UP</b>	Scroll up.
	<b>DOWN</b>	Scroll down.

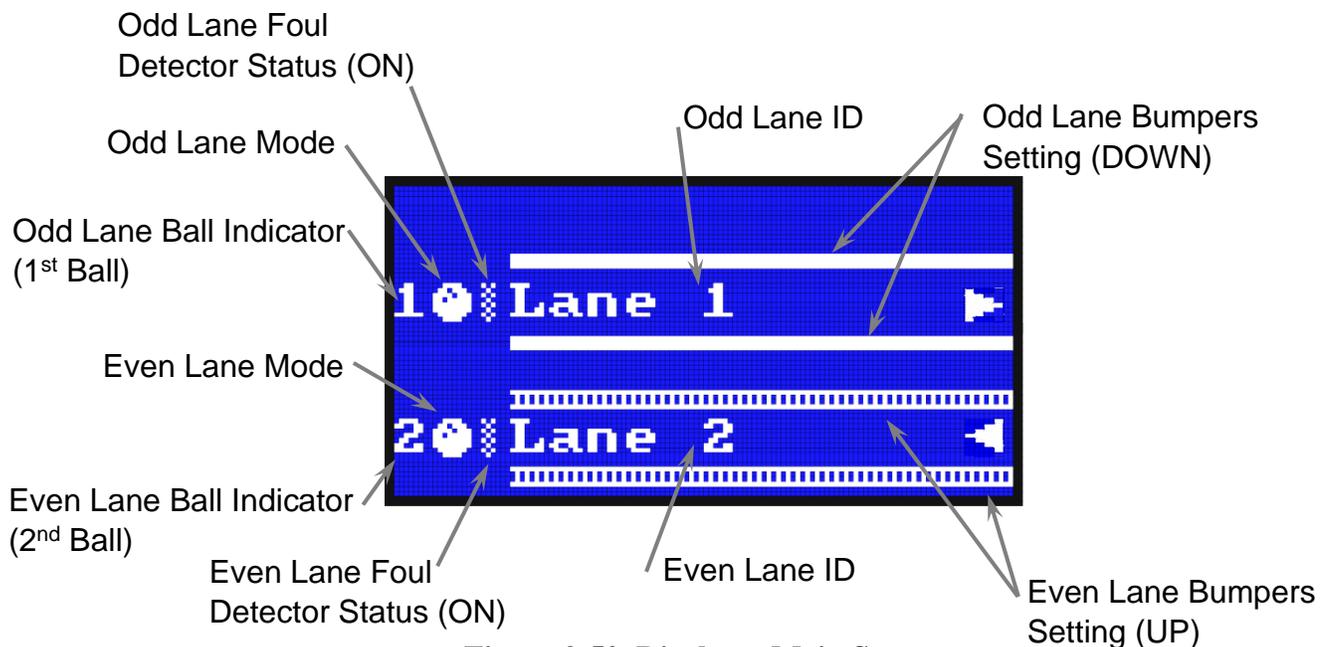


	<b>OK</b>	Enter next menu. Set user-configurable setting.
<b>Lane-Specific Machine Controls</b>		
	<b>WORK</b>	Place pinspotter into MECHANIC mode. Acknowledges TCS error.
	<b>PLAY</b>	Exits MECHANIC mode. Clears an error.
	<b>RE-SPOT</b>	Sets last known pin combination onto pindeck.
	<b>PINS UP</b>	Lifts and holds all pins in brake position and shield in UP position.
	<b>FULL SET</b>	Places all pins onto pindeck.
	<b>STRING ADJ</b>	Initiates string adjustment function.

### 2.3.6. Display

The system controller includes a display for accessing machine functions, user-configurable settings, and system diagnostics tools. Figure 2-50 shows an example of the default main screen displayed during normal machine operation.

#### 2.3.6.1. Main Screen



**Figure 2-50, Display – Main Screen**



The lane ID's of the Odd and Even lanes are displayed along with status icons indicating lane mode, ball number, foul detector status and bumpers setting.

The *Odd/Even Lane Mode* icons indicate the current operating mode of the given lane. As indicated in Figure 2-50, a "1" to the left of the lane ID indicates a 1<sup>st</sup> Ball play condition. A "2" to the left of the lane ID indicates a 2<sup>nd</sup> Ball play condition.

The following table lists all possible display icons and their meanings. Note that the display is permanently unlocked and cannot be password-protected.

### 2.3.6.2. Display Icons

**Table 2-2, Display Icons**

<b>Chassis Modes</b>		
	BOWL	Machine is ON and waiting for ball to enter machine. Machine cycles when ball is thrown. Pinfall data is sent to scoring system.
	STANDBY	Machine is idle and ready for game to start. Machine will not cycle if a ball is thrown, but will respond to certain keypad commands.
	MECHANIC mode	Machine is ready for adjustment/maintenance/test. Machine will not respond to thrown ball.
	CONTINUOUS CYCLE	Machine cycles every 10 seconds. Used for testing.
<b>Foul Detector Status</b>		
	<i>Foul Detector</i> setting set to ON	
	<i>Foul Detector</i> setting set to WARNING	
	Foul detector activated	
<b>Bumper Settings</b>		
	Bumpers down	
	Bumpers up	



### 2.3.6.3. MCU Menu

The system controller *MCU* menu contains sub-menus for *Settings*, *Functions*, *Ball Counters*, and *Frame Counters*. Options within these sub-menus can be used for daily machine operation, troubleshooting, and preventive maintenance. Press **MENU** once to access the *MCU* menu. Then, scroll down to the desired sub-menu and press **OK** to access its available options. Press **BACK** to return to the previous screen or continue pressing **BACK** to return to the home screen.

#### 2.3.6.3.1. Settings Sub-Menu

The *Settings* sub-menu includes several user-configurable settings which the operator can set based on operational preferences, bowling center layout, and equipment configuration. All available settings are described below.

**Table 2-3, Settings Sub-Menu**

Parameter	Possible Settings	Additional Information
<i>Low Lane ID</i>	1, 2, 3, 4, 5 ...127	Set to lowest lane number of the pair. For single lanes, set to that lane number.
<i>Chassis Mode</i>	BOWL, STANDBY	See page 2-20 for definitions of machine modes. MECHANIC mode is automatically set by pressing any of the lane-specific machine control pushbuttons.
<i>Auto Ball Return Shutoff</i>	ON, OFF	Recommended setting is ON.
<i>Ball Return Select</i>	QAMF, OTHER	Set for brand of front ball return installed.
<i>Foul Type</i>	Xli, XL	Set to Xli for use with Radaray Xli or Radaray Plus. Set to XL for use with Radaray XL.
<i>Foul Detector</i>	ON, WARNING, OFF	Select ON for warning buzzer and score penalty. Select WARNING for buzzer only (no score penalty). Select OFF for no warning buzzer or score penalty.
<i>Game</i>	10PINS, DUCKPIN, HIGHWAY66	Set to 10PINS for Tenpin use.
<i>Mask Lights</i>	AS BALL NUMBER, AS BOWL/NO BOWL	Set to AS BALL NUMBER for 10-Pin use.
<i>Pin Data Delay</i>	2.0, 2.3, 2.6, 3.0, 3.3, 3.6, 4.0, 4.3, 4.6, 5.5	Time (in seconds) after ball is detected before pin fall data is collected. Recommended setting is 3.0. Increasing value will score delayed pin falls but will delay start of next machine cycle.
<i>Pin Detect Count</i>	4, 5, 6...15	Relative string movement required to register a fallen pin. Recommended setting is 12.
<i>Pin Park State</i>	UP, DOWN, PINS/SHEILD UP	Sets pin parking position when machine is turned OFF.
<i>Pit Light</i>	WHITE, COLOR	Select WHITE for white light. Select COLOR for light color.
<i>Scoring System</i>	SCORING, STANDALONE, BASIC	Select SCORING for use with QubicaAMF scoring system. Select STANDALONE for no scoring. Select BASIC for use with other manufacturer's scoring system.
<i>Tenth Frame Switch</i>	Full, PARTIAL, OFF	Determines machine response when tenth frame switch (if installed on front ball return) is pressed. Select Full for full pin set, PARTIAL for partial pin set, or OFF for no response.



<b><i>Inhibit Pin Errors</i></b>	ON, OFF	Machine will ignore errors associated with individual pins (brake error, pin encoder error, etc.). Recommended setting is OFF.
----------------------------------	---------	--

### 2.3.6.3.2. Functions Sub-Menu

The *Functions* sub-menu includes several user-controllable functions that the Operator can use for troubleshooting and maintenance tasks. All available functions are described below.

<b>Function</b>	<b>Explanation</b>
Pins Full Set	Sets all pins onto pindeck.
Pins Partial Set	Sets last known pin combination onto pindeck.
Pins Up	Lifts and holds all pins in brake position and shield in UP position.
Pins Down	Sets last known pin combination onto pindeck.
Brake Adjust	Not applicable
String Adjust	Activates string adjustment operation.
Continuous Cycle with Random Pins	Operates machine in continuous cycle with random pin setting.
Reset Bowling Ball Counters	Resets ball counter for balls thrown with machine in BOWL mode.
Reset Mechanic Ball Counters	Resets ball counter for balls thrown with machine in MECHANIC mode.
Reset Bowling Frame Counters	Resets frame counter for frames played with machine in BOWL mode.
Reset Mechanic Frame Counters	Resets frame counter for frames played with machine in MECHANIC mode.



### 2.3.6.3.3. Counters Sub-Menus

The *Ball Counters* and *Frame Counters* sub-menus display ball and frame counters for use in documenting trouble calls and scheduling preventive maintenance. In either counter menu, the upper three numbers are the total counts since manufacture and cannot be reset. The lower three numbers are the total counts since the counter was last reset using the *Functions* menu. Figures 2-51 and 2-52 show each counter's display for a given lane.

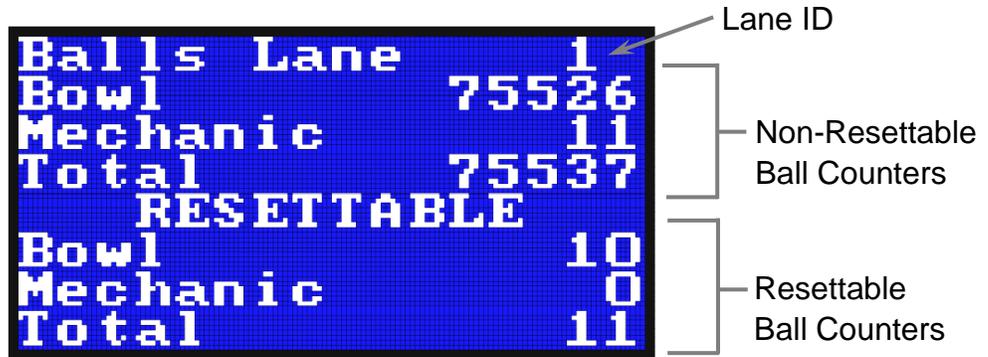


Figure 2-51, Display – Ball Counters Screen

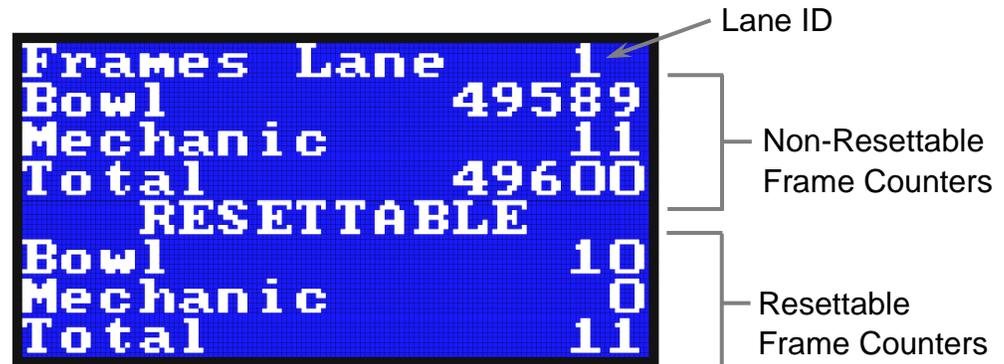


Figure 2-52, Display – Frame Counters Screen

### 2.3.6.4. Diagnostics Menu

The system controller Diagnostics menu contains sub-menus for *Text*, *Graphics*, and *Hardware*. Options within these sub-menus can be used for daily machine operation, troubleshooting, and preventive maintenance. Press **MENU** twice to access the *Diagnostics* menu. Then, scroll down to the desired sub-menu and press **OK** to access its available options. Press **BACK** to return to the previous screen or continue pressing **BACK** to return to the home screen.



### 2.3.6.4.1. Text Sub-Menu

The *Text* sub-menu displays a list of critical machine components that are monitored by the system controller during normal operation. This menu can be useful when troubleshooting a machine error. Table 2-4 lists all monitored components and their possible states.

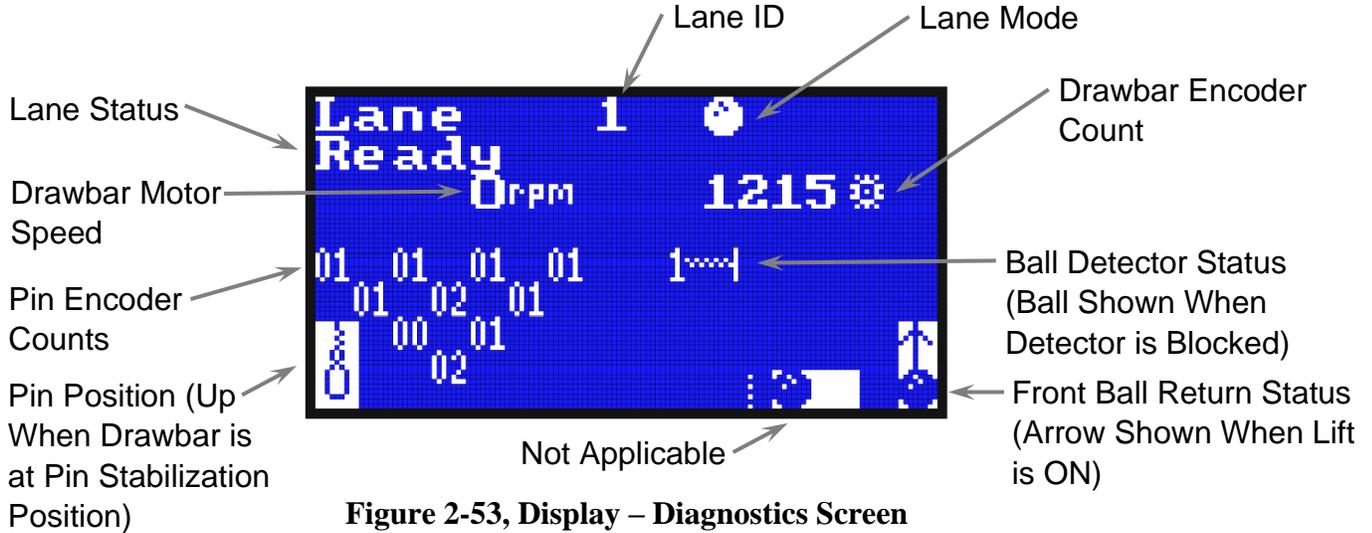
**Table 2-4, Text Sub-Menu**

Component	Possible States	Additional Information
Backend Breaker	OK, Tripped	Not applicable
Backend Motor	On, Off, Asleep	Not applicable
Ball Detector	Ball, No Ball	Displays current input state to system controller from ball detector
Ball Lift	On, Off, Asleep	Displays current input state to system controller from front ball return. Asleep is a state in which ball lift motor turns off after a period of inactivity.
Ball Sensor	-	Not applicable
Drive Encoder	0 to 1250/Valid/Invalid	Displays current drawbar motor encoder count. Invalid indicates either an out-of-range value or home position has not been set.
Encoder Sensors	-	Not applicable
Drive RPM/CMD	-900 to 1800	Displays rotational speed that machine controller is asking drawbar motor to operate.
E-Stop Loop	Closed, Open	Displays current E-Stop loop status.
Foul Detector	Foul, No Foul	Displays current input state to system controller from foul detector
Home (LOS)	Home, Not Home	Indicates whether drawbar is at pin stabilization position
Lane Breaker	OK, Tripped	Not applicable
Mask Light On	BALL 1, BALL1/BALL2	Displays current output state from system controller to mask light unit
Mechanic Call	On, Off	On if Mechanic Call button is pressed
Pin Encoder	XX, XX, XX, XX, XX, XX, XX, XX, XX, XX	Displays current count of all pin string encoders
Software	VX.XX	Displays installed software version
Stack Lights Grn =      Red =	-	Not applicable
Tenth Frame	On, Off	On if Tenth Frame button is pressed



### 2.3.6.4.2. Graphics Screen

The *Graphics* screen uses a graphical interface to display the status of multiple machine functions in real-time. Figure 2-53 shows the display while using this tool.



**Figure 2-53, Display – Diagnostics Screen**

### 2.3.6.4.3. Hardware Sub-Menu

The *Hardware* sub-menu contains several tools for testing and monitoring various hardware components internal to the system controller.

1. The *Keypad* tool allows the user to test the functionality of all pushbuttons on the system controller keypad. Figure 2-54 shows the keypad display while using this tool. After accessing this tool, press any pushbutton to test its functionality. Pressing a properly functioning pushbutton will result in “Valid Key!” on the display. A countdown will begin after pressing any pushbutton. Press any other pushbutton to continue testing. Otherwise, wait for the countdown to expire to exit the *Keypad* tool.



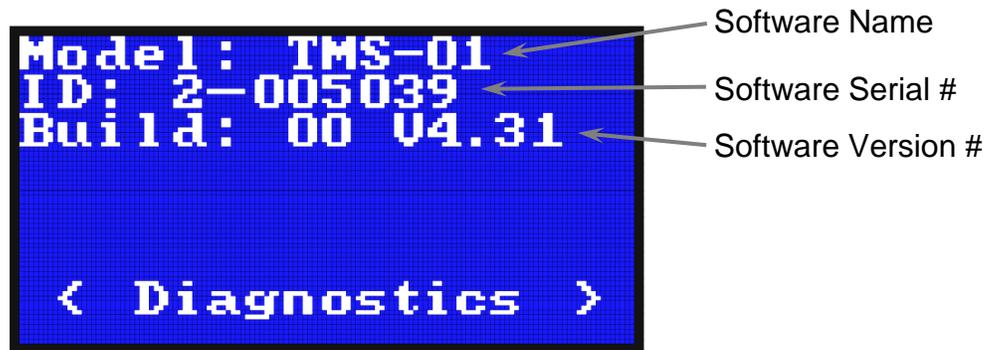
**Figure 2-54, Display – Keypad Test Screen**



**Table 2-5, Keypad Pushbutton ID**

		Drive	Input	Number			Drive	Input	Number			Drive	Input	Number
General Machine Control/Keypad Navigation		1	1	1	Even Lane Machine Control		2	1	7	Odd Lane Machine Control		3	1	13
		1	2	2			2	2	8			3	2	14
		1	3	3			2	3	9			3	3	15
		1	4	4			2	4	10			3	4	16
		1	5	5			2	5	11			3	5	17
		1	6	6			2	6	12			3	6	18

- The *Configuration* tool displays information about the system controller software version. Figure 2-55 shows the keypad display while using this tool. “Model” displays the name of the installed software. “ID” displays the serial number of the system controller main board. “Build” displays the software version number of the installed software.



**Figure 2-55, Display – Configuration Screen**

- The *Tasks* tool displays processes currently running on the system controller. This tool can be used as a task manager for certain troubleshooting operations.



## Section 3 Maintenance





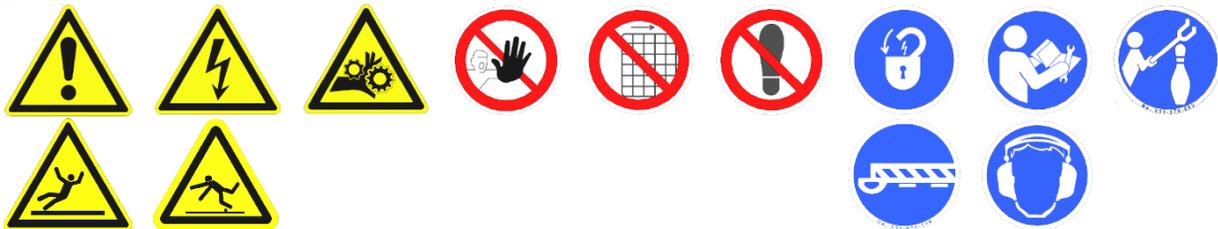
### 3.1. Section Overview

This section contains information and instructions about maintenance interventions for the EDGE string. These instructions are classified as Level 1 and Level 2 interventions as defined below.

**LEVEL 1 INTERVENTIONS** may be performed without shutting off system controller (LOTO not required). Follow instructions and precautions carefully, especially regarding prohibition of bowling play during maintenance.

**LEVEL 2 INTERVENTIONS** require Lockout/Tagout (see Appendix A) and lane barriers (see Page 1-7) during maintenance.

### Applicable Safety Warnings



### Tools

In addition to safety tools described in Section 1 (Safety), other tools may be required for specific tasks. See each intervention for list of tools needed.

### WARNING:



- **High voltage is present inside the system controller. Use caution when operating or handling this equipment. Implement lockout/tagout (LOTO) before servicing any electrical components (see Appendix A). The main circuit breaker must always be OPEN, or the power plug DISCONNECTED, prior to performing any service/repair to electrical systems.**



- **The system controller contains no user-serviceable parts.**
- **The system controller includes a tamper indicator. Opening the system controller enclosure will void the warranty.**



### 3.2. Level 1 Interventions – Lockout/Tagout (LOTO) Not Required

- **CAUTION.** Thrown balls and scattering pins can cause injury if bowling play is allowed during an operator intervention. Operator is responsible for performing required safety procedures. Operator may implement lane barriers if needed to protect against thrown balls during maintenance.
- Keep end of pin hook away from face in case a ball is thrown during intervention.
- Do not reach into machine boundary with arms or body.

#### 3.2.1. Clear Pin Tangle



1. Press **WORK**.
2. Open machine rear cover.
3. Untangle pins using pin hook.
4. Close machine rear cover.
5. Press **PLAY**.

#### 3.2.2. Clear Stuck Ball on Pit Floor or Pindeck



1. Press **WORK**.
2. Open pit hinged top cover or machine rear cover to access stuck ball(s).
3. Move ball(s) into ball door with grip end of pin hook.
4. If any pins fell while moving ball, press **RE-SPOT** to re-spot them.
5. Close all open covers.
6. Press **PLAY**.

#### 3.2.3. Clear Ball Jam or Stuck Ball in Double Division



1. Press **WORK**.
2. Open pit hinged top cover or machine rear cover to access stuck ball(s).
3. Pass grip end of pin hook through ball door to clear ball jam.
4. If ball(s) cannot be cleared, follow “Clear Stuck Ball at Chain Lift” (see Page 3-7).
5. Close all open covers.
6. Press **PLAY**.

#### 3.2.4. Clean Pindeck and Pit OR Clean Lane with Lane Machine



**NOTE:** If entering pit for cleaning, LOTO and lane barriers are required.

1. Press **PINS UP**.
2. If cleaning or oiling lane, run lane machine.
3. Open machine rear cover and clean pindeck with soft mop or broom.
4. Open pit hinged top cover and clean pit floor with soft mop or broom.
5. Close all open covers.
6. Press **PLAY**.



### 3.2.5. Perform String Adjustment

1. Press **STRING ADJ.**
2. Open reel arm cover.
3. Adjust strings. Pull spool on each reel arm and rotate as needed to tighten or loosen strings (see Figure 3-1).
4. Adjust each spool until top of reel arm is just off of hard-stop bracket, then loosen spool by one hole.
5. Press **FULL SET** to check string adjustment.
  - a. Once machine spots pins on pindeck, machine control box 1 – 10 pin indicator LEDs will light red after a few seconds.
  - b. If all LEDs are OFF, string adjustment is correct.
  - c. If any LEDs are *solid* ON, the corresponding strings are too loose.
  - d. If any LEDs are *blinking* ON, the corresponding strings are too tight.
  - e. String adjustment is required immediately for any strings that are too tight.
6. If further adjustment is necessary, press **STRING ADJ** and continue adjustment.
7. When finished, close reel arm cover and press **PLAY**.

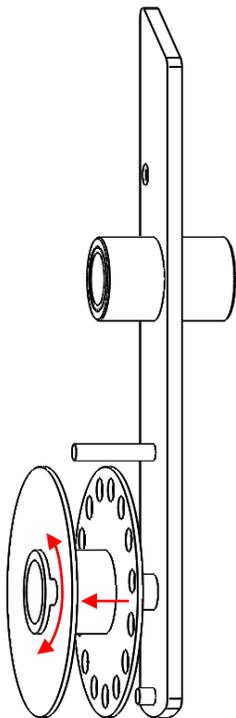


Figure 3-1, Reel Arm Spool

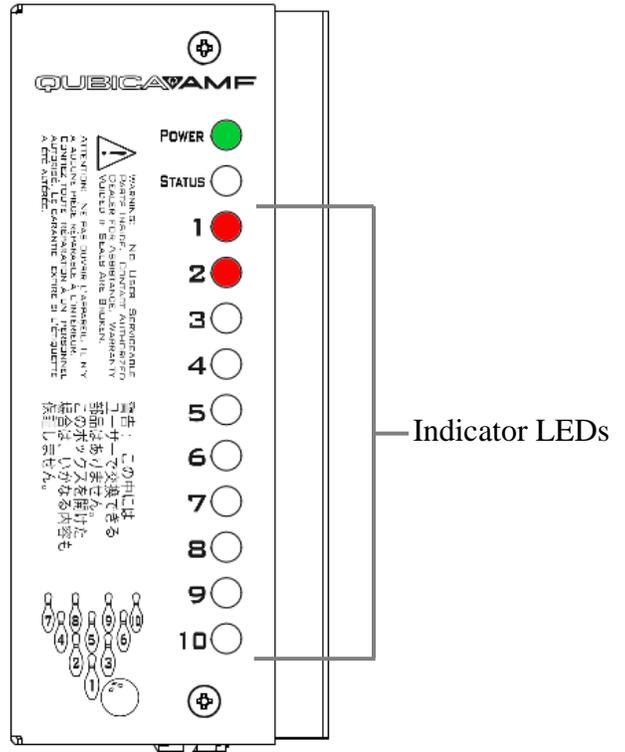


Figure 3-2, Machine Control Box Lights



### 3.3. Level 2 Interventions – Lockout/Tagout (LOTO) Required

#### CAUTION



- **LOCKOUT/TAGOUT PROCEDURE MUST BE PERFORMED** whenever an operator crosses machine boundary to perform maintenance. Ensure that all power is off and machine cannot re-energize. Lockout/Tagout operation protects against potential entanglement and potential electrical hazard. See Appendix A.
- Thrown balls and scattering pins can cause injury if bowling play is allowed during an operator intervention. Operator is responsible to perform all required safety procedures. Deploy lane barriers to protect against thrown balls during maintenance (see Page 1-7).
- Level 2 interventions may only be performed by qualified personnel. Owner/facility manager must verify that operators are trained to work safely and perform required safety tasks.

### Bolt Torque Table

Table 3-1 shows typical bolt tightening torque values for reference in inch-pounds, foot-pounds and Newton-meters. If a different torque value is specified in this or another manual, then follow the specification given.

**Table 3-1, Bolt Torques**

Bolt Size	lb-in	lb-ft	Nm
# 10	20 – 30	1.6 – 2.5	2.2 – 3.4
1/4"	144 – 180	12 – 15	16 – 20
5/16"	216 – 240	18 – 20	24 – 27
3/8"	276 – 300	23 – 25	31 – 34
1/2"	336 – 360	28 – 30	38 – 41



### 3.3.1. Clear Stuck Ball at Chain Lift



**Precautions:** LOTO, Lane Barriers

**Tools:**

- Ratchet or Impact Driver
- ½” Socket
- Pin Hook

**Location:** Operator Access Area (behind machine)

**Est. Time:** 10 min

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove pit rear guards and double division guard.
3. Use pin hook or reach with hand to clear ball jam and remove any foreign objects.
4. Reinstall double division guard and pit rear guards.
5. Remove LOTO and lane barriers. Return machine to service.

### 3.3.2. Repair Worn String Above Pin



**Precautions:** LOTO, Pin Hook, Lane Barriers

**Tools:**

- #2 Phillips Screwdriver
- Diagonal Cutters
- Pin Hook

**Location:** Operator Access Area (behind machine)

**Est. Time:** 5 min

**Note:**

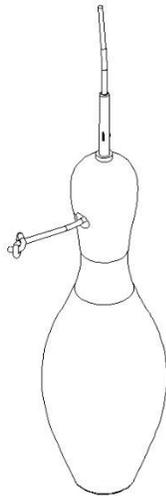
- A string adjustment may be needed after this procedure.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Open machine rear cover.
3. Retrieve pin with pin hook and place on top of pit hinged top cover.
4. Insert screwdriver into small hole on side of pin. Push string knot out through large hole on side of pin.
5. Pull string through pin until all worn or frayed sections have been pulled through.
6. Cut off worn section of string.
7. Tie a “Figure 8” knot at end of string and pull knot into pin. See Figure 3-4.
8. Return pin to pit.
9. Open reel arm cover.
10. Unwind string from reel arm spool. Unwound string length should be equal to length of worn string that was cut.
11. Close reel arm cover and machine rear cover.



12. Remove LOTO and lane barriers. Return machine to service.



**Figure 3-3, String Routing**



**Figure 3-4, "Figure 8" Knot**

### 3.3.3. Replace Pin and/or String Sleeve



**Precautions:** LOTO, Pin Hook, Lane Barriers

**Tools:**

- #2 Phillips Screwdriver
- Pin Hook
- String Sleeve Tool (051-200-700)

**Location:** Operator Access Area (behind machine)

**Est. Time:** 5 min for 1 Pin OR 30 min for All

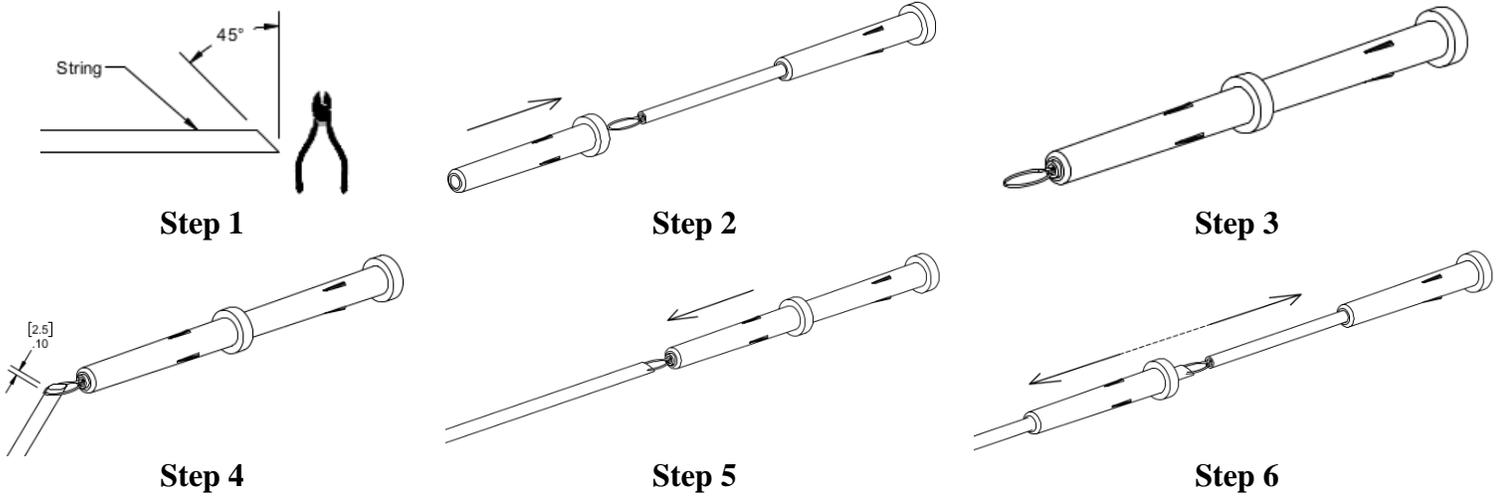
**Note:**

- A string adjustment may be needed after this procedure.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Open machine rear cover.
3. Retrieve pin with pin hook and place on top of pit hinged top cover.
4. Insert screwdriver into small hole on side of pin. Push string knot out through large hole on side of pin.
5. Untie knot and remove pin from string. Remove string sleeve if it needs to be replaced.
6. Install new sleeve (if applicable) on string using string sleeve tool. See Figure 3-5.
7. Pass string through hole on top of pin and out through large hole on side of pin. See Figure 3-3.
8. Tie a "Figure 8" knot at end of string and pull knot into pin. See Figure 3-4.
9. Return pin to pit.
10. Close machine rear cover.
11. Remove LOTO and lane barriers. Return machine to service.





**Figure 3-5, String Sleeve Tool Procedure**





### 3.3.4. Replace Pin String

**Precautions:** LOTO, Pin Hook, Lane Barriers

**Tools:**

- #2 Phillips Screwdriver
- Diagonal Cutters
- Pin Hook
- Electrical Tape
- String. See String Length Table below for length and part numbers
- String Sleeve Tool (051-200-700)

**Location:** Operator Access Area (behind machine)

**Est. Time:** 10 min for 1 Pin OR 60 min for All

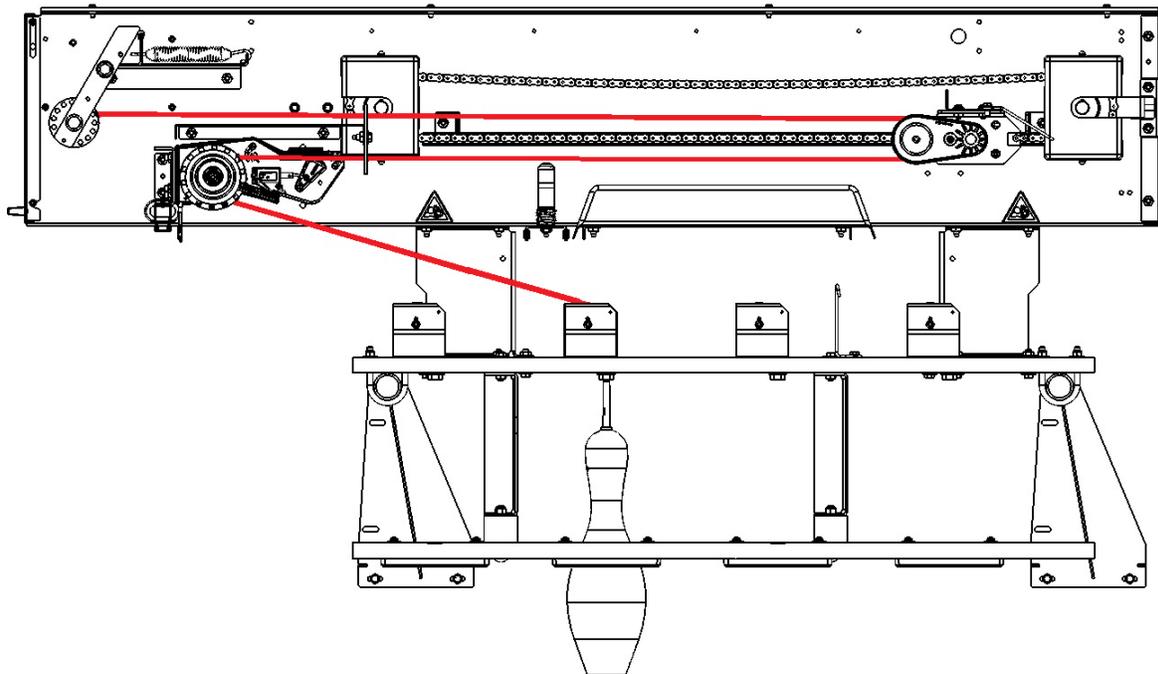
**Note:**

- This procedure assumes string has not broken inside pinspotter frame.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Open machine rear cover.
3. Retrieve pin with pin hook and place on top of pit hinged top cover.
4. Insert screwdriver into small hole on side of pin. Push string knot out through large hole on side of pin.
5. Untie knot and remove pin and sleeve from string.
6. Tape end of new string to end of old string. String ends must be aligned end-to-end.
7. Open reel arm cover. Unwind string from reel arm spool, untie string knot, and remove string from spool.
8. Pull old string gently to route new string through machine. Stop when taped connection is reached.
  - a. If significant resistance is felt or taped connection comes apart, stop and locate snag or taped connection. New string may have to be routed through machine by hand.
9. Remove old string and tape.
10. Route end of new string through “D”-shaped hole in reel arm spool and tie a “Figure 8” knot. See Figure 3-4.
11. Install sleeve onto new string using string sleeve tool. See Figure 3-5.
12. Pass string through hole on top of pin and out through large hole on side of pin. See Figure 3-3.
13. Tie a “Figure 8” knot at end of string and pull knot into pin. See Figure 3-4.
14. Return pin to pit.
  - a. Wait until performing string adjustment to wind string onto reel arm spool.
15. Remove LOTO.
16. Perform a string adjustment.
17. Close all open covers.
18. Remove lane barriers. Return machine to service.





**Figure 3-6, String Path (5-Pin Shown in Red)**



### 3.3.5. Rotate Pins

It is possible that unequal pin wear can occur on EDGE String pinspotters. This is due to the pins on these machines always being set on the same pin spot. As a result, some pins (especially the 1, 2, and 3 pins) will wear more quickly than other pins, due to more frequent ball strikes.

It is recommended to replace or rotate pins as needed as part of the preventive maintenance (PM) schedule. The recommended pin rotation sequence frequency is every 25,000 frames/3 months. After completing the three rotations shown below (Figure 3-7), continue repeating the rotation sequence or replace pins as needed.

**Precautions:** LOTO, Pin Hook, Lane Barriers

**Tools:**

- #2 Phillips Screwdriver
- Pin Hook
- String Sleeve Tool (051-200-700)

**Location:** Operator Access Area (behind machine)

**Est. Time:** 15 min for 3 Pins

**Note:**

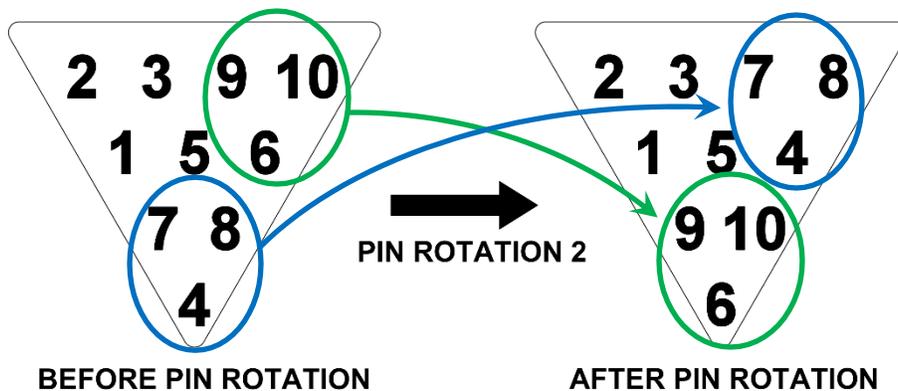
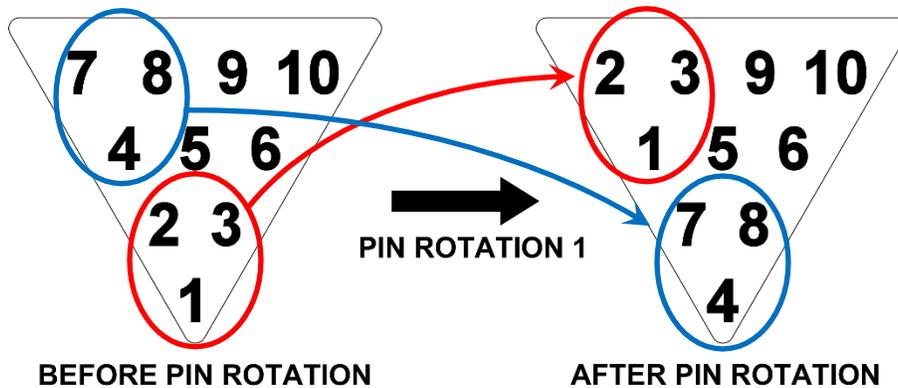
- A string adjustment may be needed after this procedure.

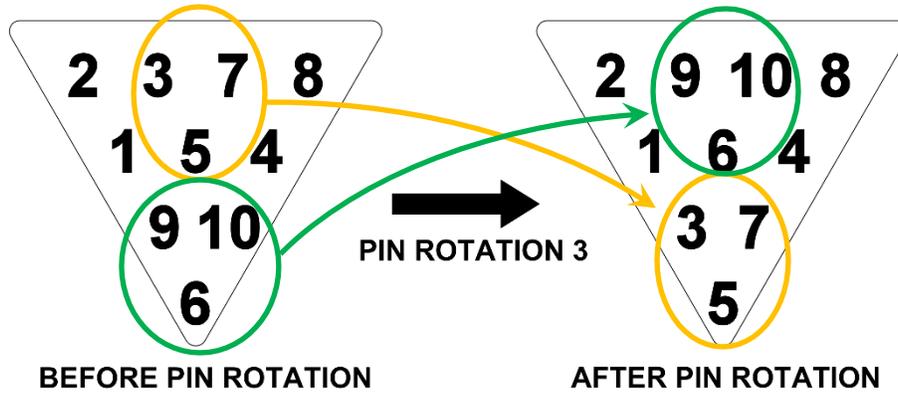


**Procedure:**

12. Implement LOTO and deploy lane barriers.
13. Open machine rear cover.
14. Retrieve pin with pin hook and place on top of pit hinged top cover.
15. Insert screwdriver into small hole on side of pin. Push string knot out through large hole on side of pin.
16. Untie knot and remove pin from string. Remove string sleeve if it needs to be replaced.
17. Install new sleeve (if applicable) on string using string sleeve tool. See Figure 3-5.
18. Pass string through hole on top of pin and out through large hole on side of pin. See Figure 3-3.
19. Tie a "Figure 8" knot at end of string and pull knot into pin. See Figure 3-4.
20. Return pin to pit.
21. Close machine rear cover.
22. Remove LOTO and lane barriers. Return machine to service.

**Recommended Pin Rotation Sequence**





**Figure 3-7, Pin Rotation Sequence**



### 3.4. Reference Tables

#### 3.4.1. Bolt Torque Table

Table 3-1 shows typical bolt tightening torque values for reference in inch-pounds, foot-pounds and Newton-meters. If a different torque value is specified in this or another manual, then follow the specification given.

**Table 3-1, Bolt Torques**

Bolt Size	lb-in	lb-ft	Nm
# 10	20 – 30	1.6 – 2.5	2.2 – 3.4
1/4"	144 – 180	12 – 15	16 – 20
5/16"	216 – 240	18 – 20	24 – 27
3/8"	276 – 300	23 – 25	31 – 34
1/2"	336 – 360	28 – 30	38 – 41

#### 3.4.2. String Length Table

String length is different for each row of pins as follows:

**Table 3-2, String Lengths**

Pin	String Length	QubicaAMF Part Number
1	15'8" [478 cm]	051-200-301
2, 3	14'11" [455 cm]	051-200-302
4, 5, 6	14'2" [432 cm]	051-200-303
7, 8, 9, 10	13'5" [409 cm]	051-200-304

String is wound on each reel arm to be used as spare string.



## Section 4 Troubleshooting

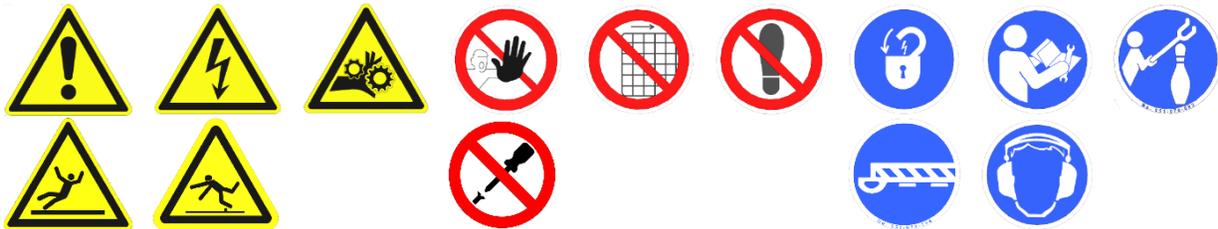




## 4.1. Section Overview

This section contains information that will help the user identify and correct common problems that might occur during normal machine operation. It also outlines the diagnostic tools available in the EDGE String system controller. In addition to displaying common error codes, the system controller also includes text-based and graphics-based diagnostic menus that display several machine parameters during operation. These tools can help the user quickly restore normal machine operation in the event of a malfunction.

### Applicable Safety Warnings



#### WARNING:



- **High voltage is present inside the system controller. Use caution when operating or handling this equipment. Implement lockout/tagout (LOTO) before servicing any electrical components (see Appendix A). The main circuit breaker must always be OPEN, or the power plug DISCONNECTED, prior to performing any service/repair to electrical systems.**



- **The system controller contains no user-serviceable parts.**
- **The system controller includes a tamper indicator. Opening the system controller enclosure will void the warranty.**

### Read This First

If you have a problem with your EDGE String, always verify the following points before replacing system components or consulting QubicaAMF technical support.

- Check that the main electrical power at the system controller is ON. Verify that the main breaker has not been tripped.
- Check that the system controller is set to BOWL mode.
- Restart the system controller by cycling the main breaker OFF and then ON.
- Check that all power and signal cables are securely connected. Confirm that all electrical contacts are fully inserted in their respective connectors.
- Reset any customized settings on the system controller back to factory defaults.
- Verify that the ball detector functions properly. The assembly should be activated ONLY when the light beam is obstructed.



- Review all troubleshooting items in this section.

## 4.2. System Controller Error Codes

In the event of a machine malfunction, the system controller screen will display an error code. These codes will be displayed in either constant or flashing text. Table 4-1 lists all possible error codes and explains possible causes for each one. Refer to Section 2 (Operation) for instructions on how to navigate the system controller menu structure and how to clear an error using the keypad.

When troubleshooting an error, perform only one check/alteration/adjustment at a time. The solutions shown below for each error code are listed in the intended troubleshooting order. Begin with the first solution listed for a given error. If the error persists, move on to the next suggested solution. Note that some errors require the operator to press **PLAY** to clear the error. If that is the case, press **PLAY** after each troubleshooting step to verify whether the error has been resolved.

Error codes that recur frequently should be noted and investigated further as they may be an indication of an incorrect machine setting or of equipment that should be replaced/adjusted.

The system controller displays separate error codes for both the odd and even lanes. When viewing a screen showing information for only one lane, only error codes associated with that lane will be displayed. Press **LANE** to switch between odd and even lanes. Multiple error codes on one lane will display one at a time. Clearing one will display the next.

**Table 4-1, System Controller Error Codes**

<b>Error Code</b>	<b>Explanation/Solution</b>
<b>BALL DET.</b>	Both ball detector sensors are blocked for longer than 10s. Press <b>WORK</b> then <b>PLAY</b> to clear error. Check for any obstructions between detector and reflector. Check detector and reflector alignment. Check electrical connections between detector and system controller. Replace electrical cable if needed. Replace detector/reflector if needed.
<b>BALL RETURN</b>	The front ball return is in an error state, is powered off, or the signal cable to the system controller is disconnected. Reset any anomaly at ball return. If using a non-QubicaAMF ball return controller, check that <i>Ball Return Select</i> is set to OTHER in system controller settings. Check all electrical connections between ball return control box and system controller. Replace electrical cable if needed. Code will clear automatically once error is resolved.
<b>CTRL COM ##</b>	Communication error (1-9). Operating system or system controller malfunction. Restart power to system controller. Reload system controller software. Replace system controller if needed.



<b>DETANGLING</b>	Machine is performing a detangle routine. Code will clear automatically once all pin strings are detangled or once detangle routine times out. A detangling routine can be stopped by pressing <b>WORK</b> .
<b>DISABLED</b>	System controller could not initialize all system components during start-up. Restart power to system controller. Check all electrical connections between system controller and control box. Replace electrical cable(s) if needed. Replace system controller and/or control box if needed. Note, code will always be displayed for missing lane of a single lane installation.
<b>DRAWBAR 1</b>	Drawbar movement is restricted. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to machine control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check that drawbar drive system is not jammed (drive chains too tight, internal string tangle, worn components, etc.). Check all electrical connections between control box and motor. Replace motor control box and/or motor if needed. Check coupling hubs for loose setscrews and key/keyway wear.
<b>DRAWBAR 2</b>	Expected drawbar motor encoder count was not reached within the pre-programmed time. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to machine control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check that drawbar drive system is not jammed (drive chains too tight, internal string tangle, worn components, etc.). Check all electrical connections between control box and motor. Replace control box and/or motor if needed.
<b>DRIVE ERR 1</b>	Machine control box does not recognize drawbar motor. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check all electrical connections between control box and motor. Replace control box and/or motor if needed.
<b>DRIVE ERR 2</b>	Machine control box over-voltage condition. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check all electrical connections between control box and drawbar motor. Replace control box and/or motor if needed.
<b>DRIVE ERR 3</b>	Machine control box over-temperature condition. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check that drawbar drive system is not jammed (drive chains too tight, internal string tangle, worn components, etc.). Check all electrical connections between control box and motor. Replace control box and/or motor if needed.



<b>DRIVE ERR 4</b>	Machine control box internal voltage measurement error. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check all electrical connections between control box and motor. Replace control box and/or system controller if needed.
<b>DRIVE ERR 5</b>	The actual value of the 24VDC output from the power supply is outside a specified range.
<b>DRIVE ERR 6</b>	System controller cannot find drawbar hard stop closest to reel arms (zero mark). Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to machine control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check that drawbar drive system is not jammed (drive chains too tight, internal string tangle, worn components, etc.). Check that drawbar drive shaft coupling does not slip. Check that drawbar motor-to-gearbox coupling does not slip. Check all electrical connections between control box and motor. Replace control box and/or motor if needed.
<b>DRIVE ERR 7</b>	Machine could not perform drawbar calibration at start-up. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to machine control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check that drawbar drive system is not jammed (drive chains too tight, internal string tangle, worn components, etc.). Check that drawbar drive shaft coupling does not slip. Check that drawbar motor-to-gearbox coupling does not slip. Check all electrical connections between control box and motor. Replace control box and/or motor if needed.
<b>DRIVE ERR13</b>	Machine control box software update failed. Ensure that system controller E-Stop switch is not activated. Restart power to system controller, press <b>FULL SET</b> , then press <b>PLAY</b> .
<b>DRIVE ERR14</b>	Pinspotter fuse in system controller is blown or missing (see Page 2-15). Replace fuse. Restart power to system controller, press <b>FULL SET</b> , then press <b>PLAY</b> .
<b>DRIVE ERR15</b>	Machine control box not properly grounded. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check electrical connection between machine and center's main grounding bus. Check that grounding screws are present and fully tightened between control box and pinspotter. Check that all other machine grounding screws are present and fully tightened. Replace control box if needed.



<b>DRV CAL ERR</b>	Drawbar failed to reach end of travel during first pinspotting cycle following machine startup or string adjustment procedure. Press <b>WORK</b> then <b>PLAY</b> to clear error. Check that strings are not too tight and loosen strings if needed. Restart power to machine control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check that drawbar drive system is not jammed (drive chains too tight, internal string tangle, worn components, etc.). Check all electrical connections between control box and motor. Replace control box and/or motor if needed.
<b>E-STOP</b>	Machine is shut down in emergency stop condition. <b>E-STOP</b> pushbutton has been pressed. Follow standard procedure to reset E-Stop. Check that E-Stop jumper is securely connected in rear of system controller. Replace system controller if needed.
<b>KEYPAD ERR</b>	Stuck button on system controller keypad. Replace system controller.
<b>LIFT ERR 1</b>	Chain lift control box does not recognize chain lift motor. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check all electrical connections between control box and motor. Replace control box and/or motor if needed.
<b>LIFT ERR 2</b>	Chain lift control box over-voltage condition. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check all electrical connections between control box and chain lift motor. Replace control box and/or motor if needed.
<b>LIFT ERR 3</b>	Chain lift control box over-temperature condition. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check that chain lift drive system is not jammed (drive chain too tight, lifter assembly caught, worn components, etc.). Check all electrical connections between control box and motor. Replace control box and/or motor if needed.
<b>LIFT ERR 4</b>	Chain lift control box internal voltage measurement error. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check all electrical connections between control box and motor. Replace control box and/or system controller if needed.
<b>LIFT ERR 6</b>	Chain lift did not cycle after 30s of being instructed to operate. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to chain lift control box (chain lift should re-calibrate). Check that chain lift drive system is not jammed (drive chain too tight, lifter assembly caught, worn components, etc.). Check all electrical connections between control box and motor. Replace control box and/or motor if needed.
<b>LIFT ERR 7</b>	Invalid chain lift configuration set on the configuration jumpers.



<b>LIFT ERR13</b>	Chain lift control box software update failed. Ensure that system controller E-Stop switch is not activated. Restart power to system controller, press <b>FULL SET</b> , then press <b>PLAY</b> .
<b>LIFT ERR 14</b>	Chain lift fuse in system controller is blown or missing (see Page 2-15). Replace fuse. Restart power to system controller, press <b>FULL SET</b> , then press <b>PLAY</b> .
<b>LIFT ERR 15</b>	Chain lift control box not properly grounded. Press <b>WORK</b> then <b>PLAY</b> to clear error. Restart power to control box, press <b>FULL SET</b> , then press <b>PLAY</b> . Check electrical connection between machine and center's main grounding bus. Check that grounding screws are present and fully tightened between control box and mounting bracket and between mounting bracket and pinspotter. Check that all other machine grounding screws are present and fully tightened. Replace control box if needed.
<b>LIFT INIT</b>	System Controller unable to communicate with the chain lift controller. To clear, press <b>PLAY</b> on both lanes.
<b>MAIN ERR ##</b>	Subsystem error (1-10). Operating system or system controller malfunction. Restart power to system controller. Reload system controller software. Replace system controller if needed.
<b>PIN BRAKE##</b>	Pin # (1-10) string movement after brake solenoid activation. Machine made several attempts but failed to set brake. Press <b>WORK</b> then <b>PLAY</b> to clear error. Replace brake/encoder unit if needed. Replace any worn string(s). Check all electrical connections between machine control box and brake/encoder unit. Replace electrical cable(s) if needed. Replace control box if needed.
<b>PIN ENC. ##</b>	Pin # (1-10) string encoder could not sense string movement when pin was raised/lowered. Press <b>WORK</b> then <b>PLAY</b> to clear error. Check that strings are not adjusted too tight. Replace brake/encoder unit if needed. Check for any string path anomalies. Check all electrical connections between machine control box and brake/encoder unit. Replace electrical cable(s) if needed. Replace control box and/or system controller if needed.
<b>PIN FELL</b>	One or more pins fell over while being set on pindeck. Machine made several attempts but failed to set pins. Press <b>WORK</b> then <b>PLAY</b> to clear error. Check for foreign objects on pindeck. Check for damaged/worn pin bases and pin centering rings. Check that strings are not too loose. Increase value of system controller <i>Stabilize Time</i> setting (factory default is 2.0). Replace machine control box if needed.
<b>SYS ERR 1</b>	Internal subsystem error. Operating system or system controller malfunction. Restart power to the system controller. Reload system controller software. Replace system controller if needed. Report error to QubicaAMF technical support.

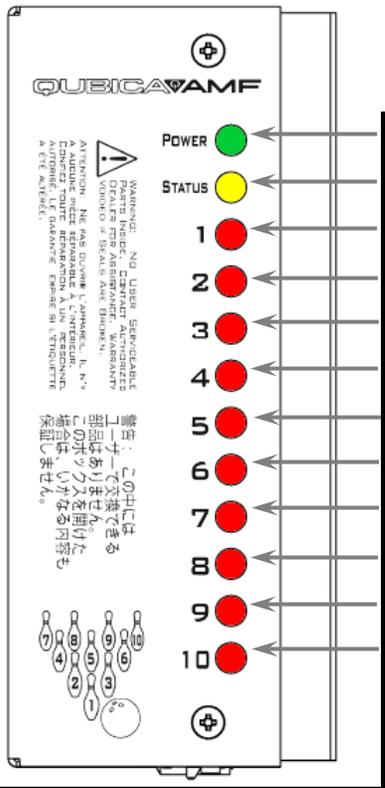


<b>SYS ERR 2</b>	Machine control box sensed string encoder pulses with all pins resting on pindeck. Press <b>WORK</b> then <b>PLAY</b> to clear error. Check string adjustment. Check that string support wire (Item 5, Page 5-7) is properly installed. Use string encoder counts on <i>Diagnostics Graphics</i> screen (Figure 2-24, Page 2-25) to identify a possible faulty brake/encoder unit. Replace brake/encoder unit.
<b>SYS ERR 3</b>	Internal subsystem error. Operating system or system controller malfunction. Restart power to the system controller. Reload system controller software. Replace system controller if needed. Report error to QubicaAMF technical support.
<b>SYS ERR 4</b>	Ball detector triggered before machine/scoring was ready for next ball (HWY66 configuration only). Check that system controller <b>Game</b> setting is set to 10PINS. Report error to QubicaAMF technical support.
<b>TANGLED</b>	Machine failed to detangle pins after several attempts. Manually detangle pin strings using pin hook. Press <b>WORK</b> then <b>PLAY</b> to clear error. Check for any string path anomalies. Check that strings are not adjusted too tight. Replace tangle switch emitter board if needed. Replace machine control box if needed. Check electrical connection between control box and tangle switch emitter board. Replace electrical cable if needed.
<b>T-SENSOR</b>	Optical tangle switch activated for longer than 20 seconds. Press <b>WORK</b> then <b>PLAY</b> to clear error. Replace tangle switch emitter board if needed. Replace machine control box if needed. Check electrical connection between control box and tangle switch emitter board. Check for any string path anomalies. Check for any broken reel arm springs.



### 4.3. Machine Control Box Operation/Troubleshooting

Each pinspotter is powered by a machine control box (P/N 051-200-299-XX). This unit powers all pinspotter subsystems including the drawbar motor, string brake/encoder boards, and tangle switch emitter board. It also handles all communication tasks between these subsystems and the system controller. The following chart outlines the functionality of the control board LED indicators during various operating conditions.



**Machine Control Box (051-200-299-XX) LED Indicators**

GREEN - Always ON when power is applied							
YELLOW						Flashing	ON
Flashing	OFF	ON	Flashing	ON	ON		
Flashing	OFF	ON	Flashing	ON	OFF		
Flashing	OFF	ON	Flashing	ON	ON		
Flashing	OFF	ON	Flashing	OFF	OFF		
Flashing	OFF	ON	Flashing	OFF	ON		
Flashing	OFF	ON	Flashing	OFF	OFF		
Flashing	OFF	ON	Flashing	OFF	ON		
Flashing	OFF	ON	Flashing	ON	OFF		
Flashing	OFF	ON	Flashing	ON	ON		
Flashing	OFF	ON	Flashing	ON	OFF		

Flashing as the strings move during normal bowling play.

# of LEDs illuminated indicates string adjustment quality	All LEDs OFF after string adjust indicates string adjustment is correct.
	LED(s) <i>solid</i> ON indicates corresponding string(s) too loose.
	LED(s) <i>blinking</i> ON indicates corresponding string(s) too tight. Adjust immediately.

Machine control box not properly grounded.

Machine control box internal communication failure

The number of flashes indicates a specific drive error. Error will also display on the system controller.

Steady ON indicates a string tangle.



### 4.4. Chain Lift Control Box Operation/Troubleshooting

The chain lift is also powered by a chain lift control box (P/N 051-200-299-XX), independent from the Odd and Even machine control boxes. This unit powers the chain lift drive motor and the ball detection sensors. It also handles all communication tasks between these subsystems and the system controller. The following chart outlines the functionality of the control board LED indicators during various operating conditions.

<b>POWER</b> (Green)	<b>GREEN</b> - Always ON when power is applied	
<b>STATUS</b> (Yellow)	<b>YELLOW</b> - Normally OFF	
<b>1</b> (Red)	<b>RED</b> - Normally ON; OFF when ball is detected	ON / ON
<b>2</b> (Red)	<b>RED</b> - Always ON when power is applied	ON / OFF
<b>3</b> (Red)	<b>RED</b> - Always ON when power is applied	ON / ON
<b>4</b> (Red)	<b>RED</b> - Always ON when power is applied	OFF / OFF
<b>5</b> (Red)	Normally OFF	OFF / ON
<b>6</b> (Red)	Normally OFF	OFF / OFF
<b>7</b> (Red)	Normally OFF	OFF / ON
<b>8</b> (Red)	Normally OFF	ON / OFF
<b>9</b> (Red)	Normally OFF	ON / ON
<b>10</b> (Red)	<b>RED</b> - On when lanes are in BOWL mode OFF when lanes are in STANDBY mode	ON / OFF

Machine control box not properly grounded.

Machine control box internal communication failure.

The number of flashes indicates a specific drive error. Error will also display on the system controller.

LED 6 Flashing - BALL LIFT IS WAITING FOR COMM – Waiting for communications from the system controller. Once communication is established, it will then begin calibration.

LED 6 & 7 Flashing – BALL LIFT IS CALIBRATING – Calibration attempt in progress. Once calibrated, these LED's turn off.

LED 6, 7 & 8 Flashing – BALL LIFT IS IN SAFE MODE – Calibrations failed. Must power cycle to correct.



## 4.5. Additional Troubleshooting Cases

This section covers additional scenarios which may not trigger a system controller error code but must be addressed to restore normal machine operation. For each scenario, possible causes are listed in the order of highest likelihood, beginning with the most likely root cause.

### 4.5.1. Ball Not Returned to Bowler

**Cause 1:** Ball stuck in pit

**Solution:** Open hinged pit cover and clear ball from pit using pin hook (see Page 3-4).

**Cause 2:** Ball jam on double division rail system leading to chain lift

**Solution:** Open hinged pit cover and clear ball jam using pin hook through ball door. If access is not available through ball door, remove double division cover and clear ball using pin hook (see Page 3-7; LOTO required). Check for damage/wear on double division rail covers.

**Cause 3:** Chain lift electrical/mechanical problem

**Solution:** Check all electrical connections between chain lift control box and chain lift motor and between control box and system controller. Check all electrical connections to ball sensors at bottom of chain lift. Check that ground screws are fully tightened between control box and mounting bracket and between mounting bracket and machine. Replace control box and/or motor if needed. Remove chain lift from machine (see Page E-20) and inspect for any mechanical issues (slipping drive shaft coupling, damaged lifter assembly, damaged sprocket, loose chain). Replace components as needed.

**Cause 4:** Improper cross sweep-to-downsweep connection

**Solution:** Check that all hardware at cross sweep-to-downsweep junction is in place and fully tightened. Verify smooth transition between cross sweep and downsweep. Adjust as needed.

**Cause 5:** System controller *Auto Backend Shutoff* and/or *Auto Ball Return Shutoff* settings set to ON

**Solution:** Set system controller *Auto Ball Return Shutoff* settings to OFF (see Page 2-21).

**Cause 6:** Chain lift fuse in system controller is blown (lanes will be in STANDBY mode).

**Solution:** Replace chain lift fuse in system controller (see Page 2-15).



## 4.5.2. Chain Lift Runs Continuously at Slow Speed

**Cause 1:** Defective chain lift ball sensor

**Solution:** Check all electrical connections between chain lift control box and ball sensors at bottom of chain lift. Remove chain lift from machine (see Page E-20) and replace ball sensor(s)/cables if needed. Replace control box if needed.

**Cause 2:** Slipping gearmotor shaft coupling

**Solution:** Check that both coupling hubs are fully tightened to drive shaft with keys in place. Check condition of coupling spider. Replace if needed.

**Cause 3:** Defective chain lift gearmotor

**Solution:** Replace gearbox and/or motor (see Page E-19).

## 4.5.3. Chain Lift Stops in Wrong Location

**Cause 1:** Chain lift control box improper calibration

**Solution:** Clear all balls from double division rail system. Restart power to control box. Chain lift will power up and begin calibration process automatically (lift will cycle several revolutions at slow speed). Chain lift should stop with one lifter assembly at bottom of lift and other lifter assembly at top of lift.

**Cause 2:** Slipping gearmotor shaft coupling

**Solution:** Check that both coupling hubs are fully tightened to drive shaft with keys in place. Check condition of coupling spider. Replace if needed.

**Cause 3:** Defective chain lift gearmotor

**Solution:** Replace gearbox and/or motor (see Page E-19).

## 4.5.4. Shield Panel Does Not Actuate Correctly

**Cause 1:** Actuation string/hard-stop string out of adjustment

**Solution:** Adjust actuation string length so that shield panel is horizontal when drawbar is fully toward rear of machine (see Page E-15). Adjust hard-stop string so that string is tight and shield panel is vertical when drawbar is fully toward front of machine (see Page E-15).

**Cause 2:** Improper string connection at drawbar and/or shield panel

**Solution:** Check that actuation string/carabiner is securely connected to drawbar and middle hole in shield panel bracket.



#### 4.5.5. Machine Does Not Cycle When Ball is Thrown

- Cause 1:** System controller *Chassis Mode* setting not set correctly for given lane  
**Solution:** Set system controller *Chassis Mode* setting to BOWL (see Page 2-21).
- Cause 2:** System controller error code (machine has shut down)  
**Solution:** See Table 4-1 for complete list of system controller error codes and troubleshooting tips.
- Cause 3:** Ball detector malfunction/out of alignment  
**Solution:** Check ball detector/reflector alignment. Check for any damage or dust on reflector and sensor. Check all electrical connections between ball detector and system controller. In the *Text* or *Graphics* sub-menus of the system controller *Diagnostics* menu, verify that *Ball Detector* status alternates between BALL and NO BALL while passing object through detector beam (see Pages 2-24, 2-25). Restart power to system controller. Replace components as needed.

#### 4.5.6. Machine Cycles When Ball is Not Thrown

- Cause 1:** Ball detector malfunction/out of alignment or is dirty  
**Solution:** Check ball detector/reflector alignment. Check for any damage or dust on reflector and sensor. Check all electrical connections between ball detector and system controller. In the *Text* or *Graphics* sub-menus of the system controller *Diagnostics* menu, verify that *Ball Detector* status alternates between BALL and NO BALL while passing object through detector beam (see Pages 2-24, 2-25). Restart power to system controller. Replace components as needed.
- Cause 2:** Shield panel interrupting ball detector beam  
**Solution:** Reposition ball detector/reflector so that shield panel does not interrupt beam during normal operation.

#### 4.5.7. Pins Do Not Settle on Pindeck at Same Time

- Cause 1:** Strings are too tight/loose.  
**Solution:** Perform a string adjustment (see Page 3-5).

#### 4.5.8. Pins Fell Over When Being Spotted

- Cause 1:** Strings are too loose.  
**Solution:** Perform a string adjustment (see Page 3-5).
- Cause 2:** Bottom of pin is damaged.  
**Solution:** Replace pin (see Page 3-9).



**Cause 3:** Foreign object on playing surface.

**Solution:** Clean pindeck (see Page 3-4).

#### 4.5.9. System Controller Keypad Non-Responsive

**Cause 1:** Faulty keypad/system controller

**Solution:** Using the *Keypad Test* tool in the system controller *Diagnostics* menu (see Page 2-25) test any non-functioning pushbuttons. Restart power to system controller. Replace system controller if needed.

#### 4.5.10. Machine Not Scoring Correctly

**Cause 1:** System controller *Scoring System* setting not set correctly

**Solution:** If operating with QubicaAMF scoring, set system controller *Scoring System* setting to SCORING. If operating with non-QubicaAMF scoring, set to BASIC or STANDALONE. See Page 2-21.

**Cause 2:** System controller *Game* setting not set correctly.

**Solution:** Set system controller *Game* setting to 10 PINS (see Page 2-21).

**Cause 3:** System controller *Inhibit Pin Errors* setting not set correctly

**Solution:** Set system controller *Inhibit Pin Errors* setting to OFF (see Page 2-22). System controller will now output pin encoder and pin brake errors (if applicable), which can then be addressed.

**Cause 4:** System controller *Pin Data Delay* setting not set correctly

**Solution:** Factory default setting is 3.0 seconds. (see Page 2-21). Increasing value will provide more time for pin action to settle before frame is scored but will delay start of next machine cycle.

**Cause 5:** System controller *Pin Detect Count* setting not set correctly

**Solution:** Recommended setting is 12 (see Page 2-21). Increasing value will allow for greater pin shift (off-spotting) during play but may not score a pin correctly if value is set too high.

#### 4.5.11. Foul Detector Not Functioning Correctly

**Cause 1:** Foul detector malfunction

**Solution:** Check foul detector/reflector alignment. Check for any damage or dust on reflector and sensor. Check all electrical connections between foul detector and system controller. In the *Text* sub-menu of the system controller *Diagnostics* menu, verify that *Foul Detector* status alternates between FOUL and NO FOUL while passing object through detector beam (see Page 2-24, 2-



25). Restart power to system controller. Replace components as needed.

**Cause 2:** System controller *Foul Detector* setting not set correctly

**Solution:** Set system controller *Foul Detector* setting to ON to allow foul detector activation to control scoring. Set to WARNING for warning only (no effect on scoring). Set to OFF to deactivate foul detector (see Page 2-21).

#### 4.5.12. Mask Lights Not Functioning Correctly

**Cause 1:** Mask light unit malfunction

**Solution:** Check all electrical connections between mask light unit and system controller. In the *Text* sub-menu of the system controller *Diagnostics* menu, verify that *Mask Light On* status alternates between BALL 1 and BALL 1/BALL 2 for each frame (see Page 2-24). Restart power to system controller. Replace components as needed.

**Cause 2:** System controller *Mask Lights* setting not set correctly

**Solution:** Set system controller *Mask Lights* parameter to AS BALL NUMBER (see Page 2-21).

#### 4.5.13. Pitlight Not Functioning Correctly

**Cause 1:** Pitlight/system controller malfunction

**Solution:** Restart power to system controller. Check all electrical connections between system controller and pit light (including ground wire). If operating with CenterPunch Effects Server, check electrical connections to adjacent system controllers and refer to manual 400-275-000 for proper effects server installation/operation.

**Cause 2:** System controller *Pit Light* setting not set correctly

**Solution:** Set system controller *Pit Light* setting to WHITE for white light only. Set to COLOR for alternative light color.



## Section 5 Drawings & Parts Lists

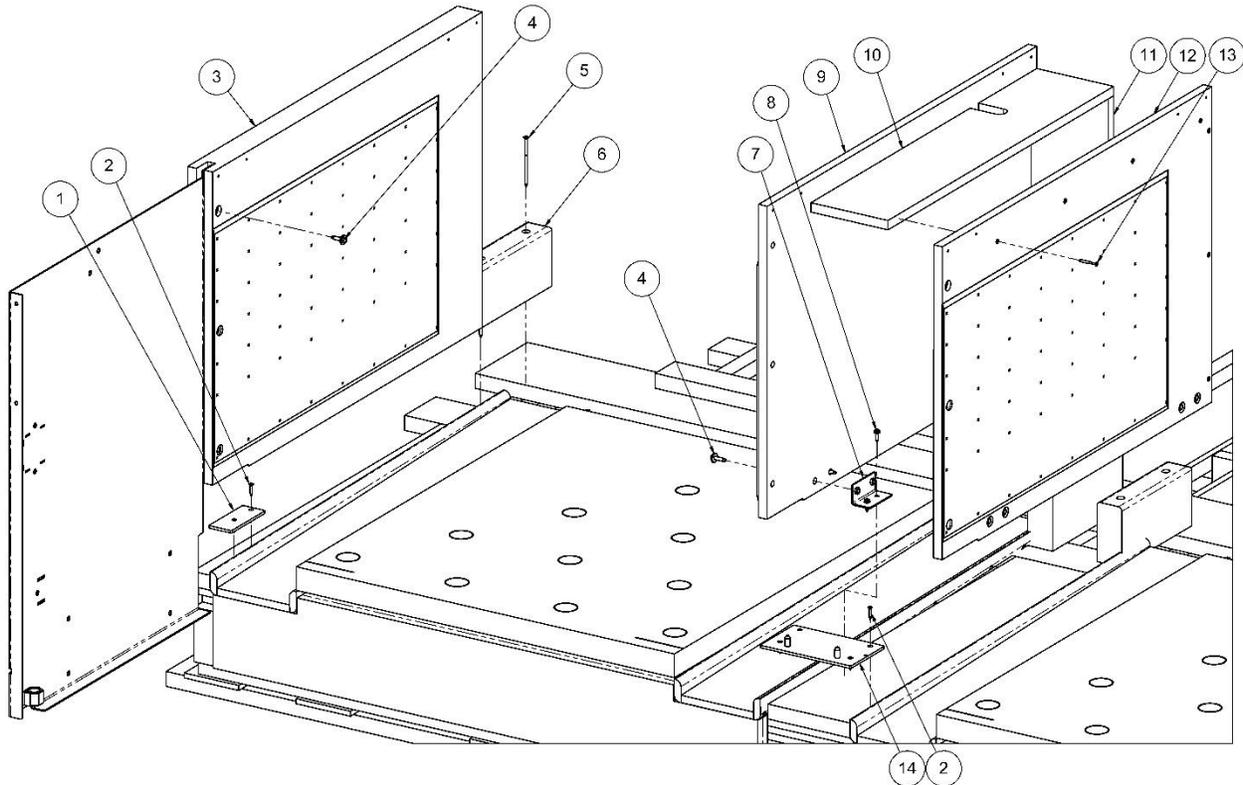
### General Notes

- Any part number shown in **BOLD** type in a parts list indicates that there is an exploded view drawing for that item on the following pages.
- Some part numbers are listed as ###-###-###-XX, where “-XX” represents -01 though -99 for revisions. Please contact QubicaAMF for help with ordering replacement parts.
- This section does not cover items specific to extra-wide machine pair installations. See EDGE String Installation Manual (400-051-204), Appendix A for reference.





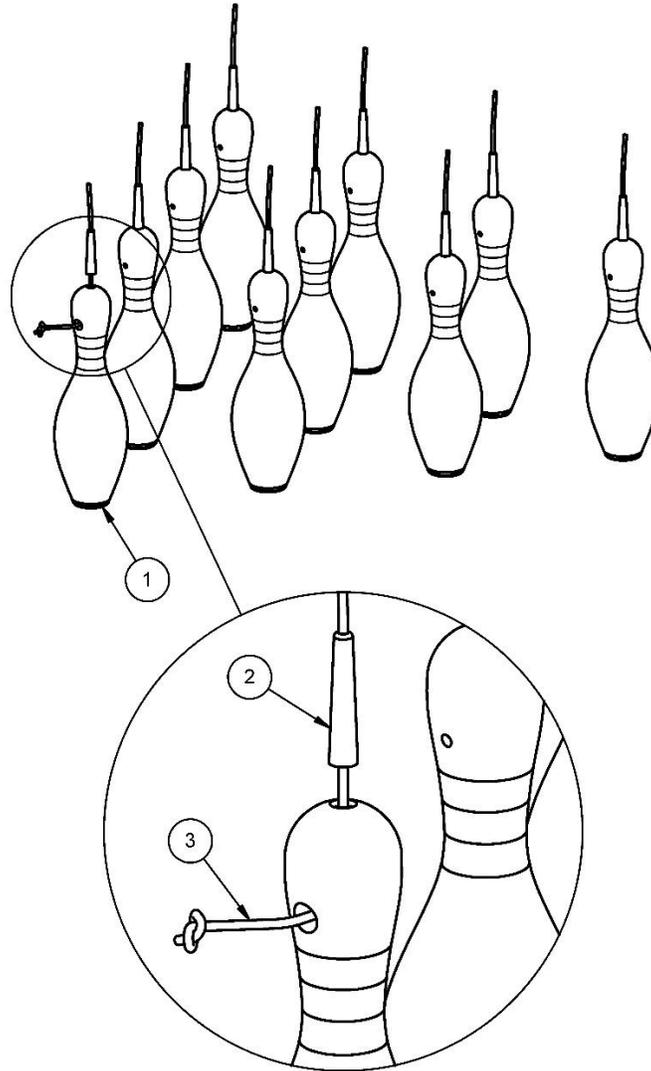
## 5.1. Kickbacks



Item	Part Number	Description
1	051-200-079	SIDE FRAME SPRT PLATE CMN
2	829-642-202	SCREW, FHPTS 12 X 1.25 ZN TY17
3	051-200-220	ASM, KICKBACK, COMMON
4	817-157-201	SCREW, HHMS <sup>5</sup> / <sub>16</sub> -18 X 1.25 BP SEMS DP
5	814-852-802	SCREW, FHPWS 16 X 5.00 ZN
6	051-200-504	KICKBACK NOSE BLOCK
7	051-200-229	WDMT, KICKBACK DBL DIV, BRKT
8	859-048-167	SCREW, FBL ¼ X 1.00 ZN
9	051-200-225	ASM, KICKBACK, 07P
10	051-200-228	KICKBACK DBL DIV, FILL TOP
11	051-200-227	KICKBACK DBL DIV, FILL FRNT
12	051-200-223	ASM, KICKBACK, 10P
13	049-006-531	SCREW, FHPWS 10 X 2.00 ZN
14	051-200-075	WDMT, CHAIN LIFT MOUNT



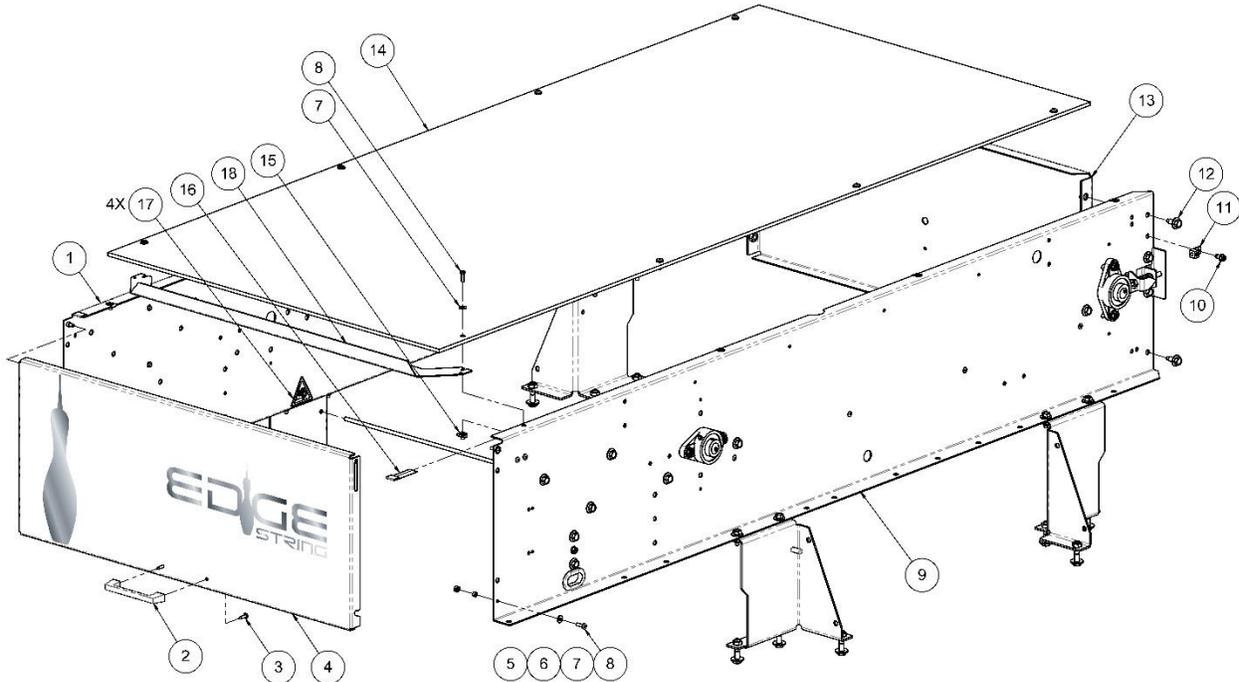
## 5.2. 10-Pin Bowling Pin



Item	Part Number	Description
1	031-480-335-01	PIN, EDGE STRING LOGO
2	051-160-014	PIN SLEEVE
3	051-200-300	STRING
4	031-480-335	SET OF 10 PINS, EDGE STRING LOGO



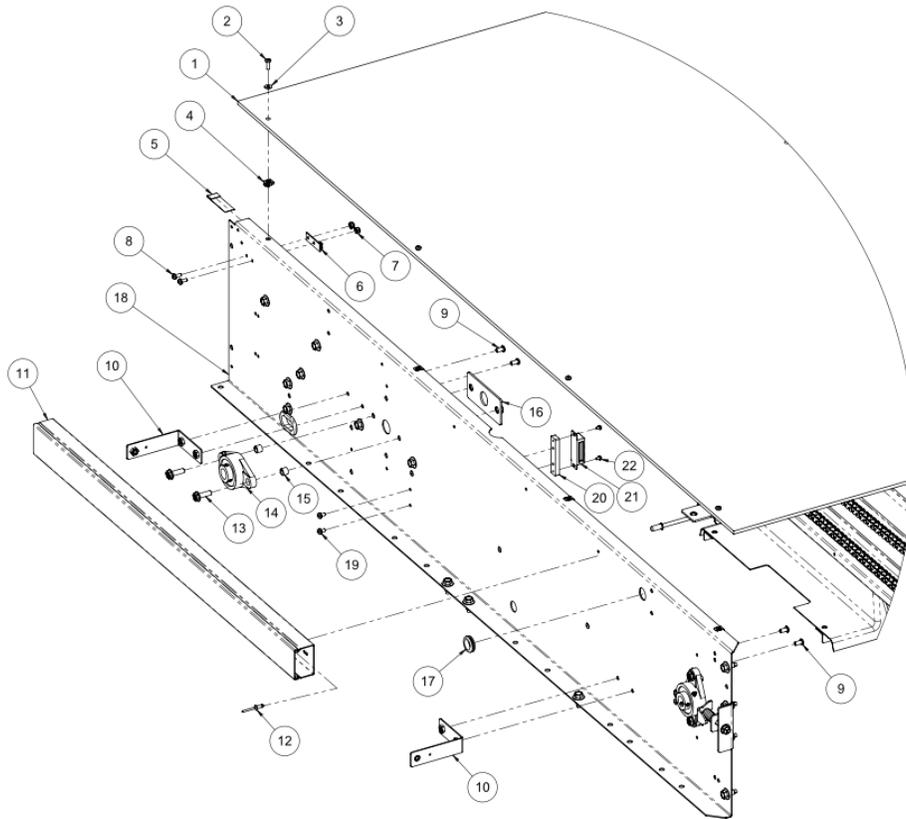
### 5.3. Pinspotter (Frame)



Item	Part Number	Description
1	051-200-005	SIDE FRAME, LEFT
2	051-200-259	PULL HANDLE
3	7024-710800-075	SCREW, THPTS 8 X 0.75 ZN TYA
4	051-200-258-01	REEL ARM COVER PANEL
5	838-740-002	NUT, HLN 10-32 ZN NM
6	722-501-100	SPACER, SFR 0.19 X 0.19 X 0.31 NY
7	7050-021050-006	WASHER, FW 10 SAE ZN
8	7016-411032-062	SCREW, PHPMS 10-32 X 0.63 ZN
9	051-200-006	SIDE FRAME, RIGHT
10	823-449-117	SCREW, HWFTS ¼-20 X 0.50 ZN TY1
11	051-200-455	LUG TERMINAL
12	818-757-121	SCREW, HWMS 5/16-18 X 0.75 BP DP
13	051-200-007	WDMT, END PANEL
14	051-200-199	MACHINE TOP COVER
15	724-511-136	U-CLIP, CON U 10-32 TPH NS
16	051-200-252	PAINT PROTECTION STRIP
17	051-070-084	DECAL, ENTANGLEMENT - GEARS
18	051-200-609	MACHINE COVER STIFFENER



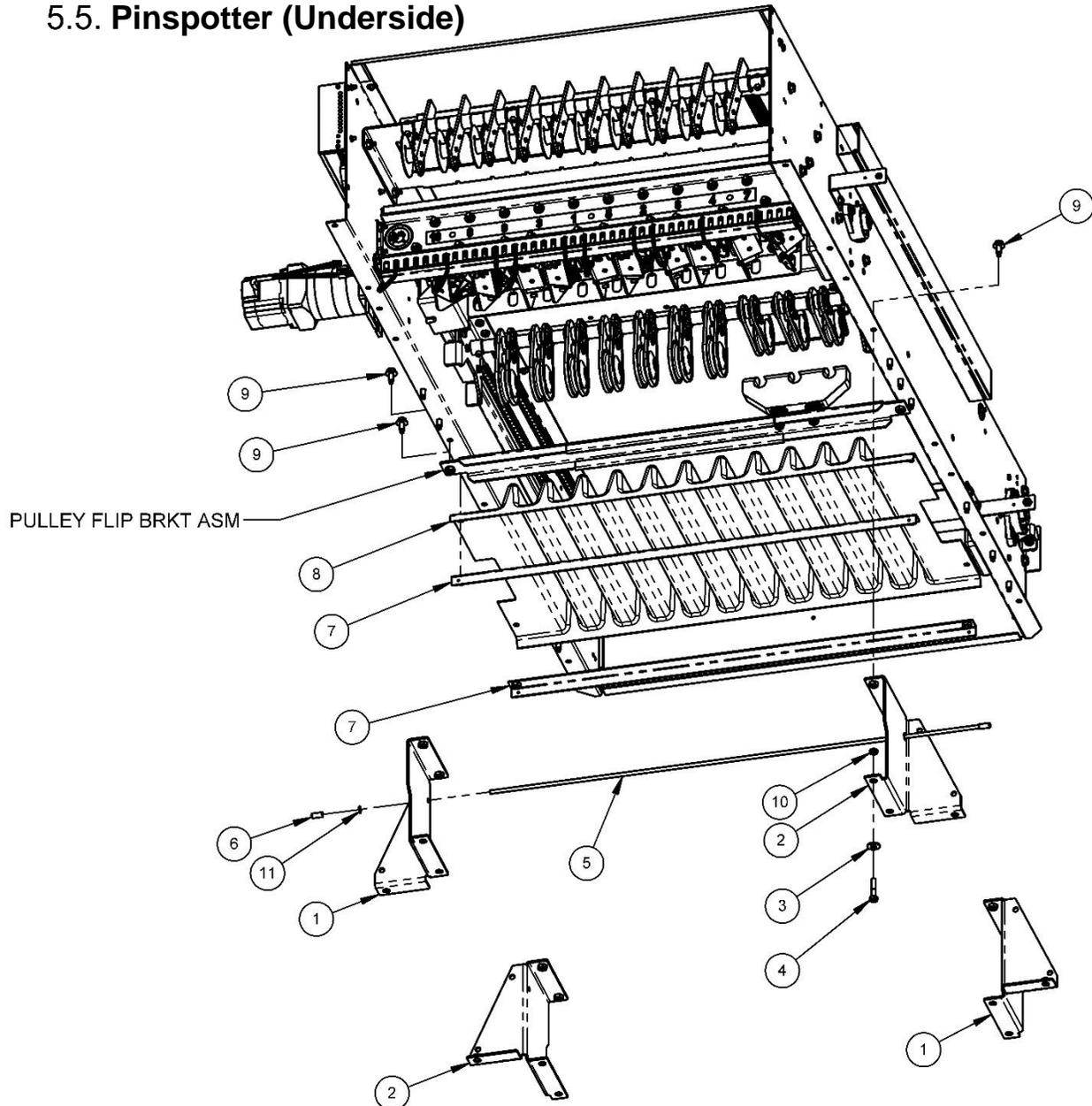
### 5.4. Pinspotter (Top Guard & Side)



Item	Part Number	Description
1	051-200-199	PINSPOTTER TOP GUARD
2	7016-411032-062	SCREW, PHPMS 10-32 X 0.63 ZN
3	7050-021050-006	WASHER, FW 10 SAE ZN
4	724-511-136	U CLIP, CON U 10-32 TPH NS
5	051-200-252	PAINT PROTECTION STRIP
6	051-200-232	IR TRANSMITTER
7	838-740-002	NUT, HLN 10-32 ZN NM
8	818-240-082	SCREW, PHPMS 10-32 X 0.50 ZN SEMS
9	808-549-080	SCREW, BHSCS ¼-20 X 0.50 BO
10	051-200-414	WDMT, MACHINE CONNECTOR
11	051-200-419	WIRE DUCT, MACHINE
12	7108-401800-050	RIVET, RVT BLD 0.19 X 0.43 AL
13	801-757-160	SCREW, FBSCS 5/16-18 X 1.00 GR8 BO
14	701-424-000	FLANGE BEARING
15	722-504-010	SPACER, SFR 0.38 X 0.48 X 0.375
16	051-200-028	WDMT, FLG BEARING NUT PL
17	711-506-000	GROMMET, GPI 0.75 X 0.88 X 0.09 RB 1
18	051-200-006	SIDE FRAME, RIGHT
19	818-240-062	PHPMS 10-32 X 0.38 ZN SEMS
20	051-200-734	DRAWBAR MAGNET SUPPORT
21	051-200-608	MAGNETIC LATCH 40LB
22	813-227-047	PHPMS 6-32 X 0.25 ZN SEMS



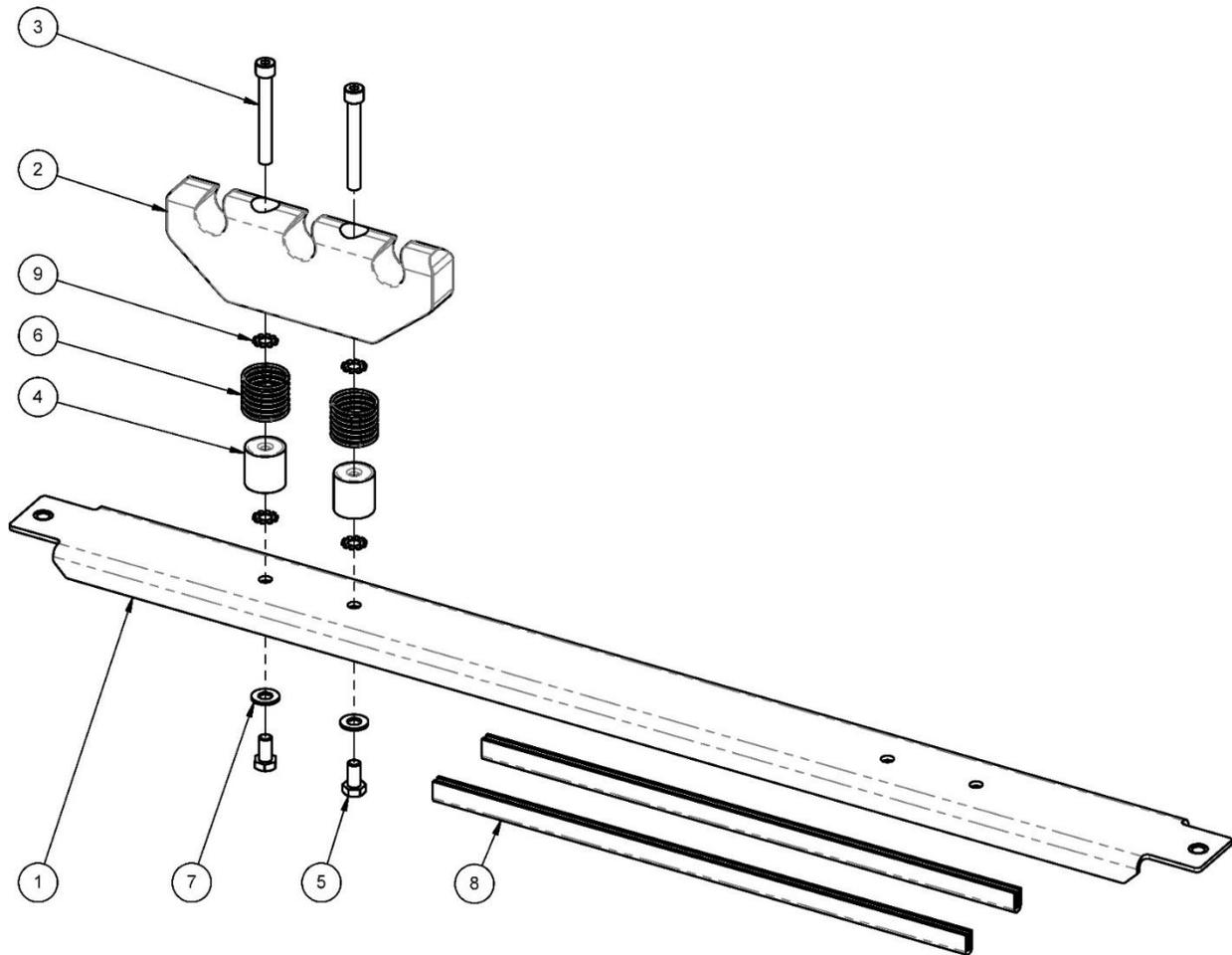
### 5.5. Pinspotter (Underside)



Item	Part Number	Description
1	051-200-086	WDMT, MACH MOUNT RH
2	051-200-085	WDMT, MACH MOUNT LH
3	01-065	WASHER, FW <sup>5</sup> / <sub>16</sub> USS ZN
4	809-857-245	SCREW, HHCS <sup>5</sup> / <sub>16</sub> -18 X 1.50 GR8 PB
5	051-200-315	STRING SUPPORT WIRE, 0.25
6	711-001-003	CAP
7	051-200-362	WDMT, STRING TRAY SUPPORT
8	051-200-198	STRING TRAY
9	818-757-121	SCREW, HWMS <sup>5</sup> / <sub>16</sub> -18 X 0.75 BP DP
10	835-557-003	NUT, HFJN <sup>5</sup> / <sub>16</sub> -18 BO
11	919-005-001	RNG SE 0.238 X 0.035 BP



### 5.6. Pulley Flip Bracket Assembly



Item	Part Number	Description
1	051-200-047	WDMT, PULLEY FLIP BRACKET
2	051-200-049	FLIP CHAN STRING GUIDE
3	810-257-400	SCREW, SHSCS $\frac{5}{16}$ -18 X 2.50 BO
4	R0141	VIBRO SHCK MNT FEM
5	809-857-100	SCREW, HHCS $\frac{5}{16}$ -18 X 0.63 GR8 BO
6	722-993-407	COMPRESSION SPRING
7	948-722-111	WASHER, FW $\frac{5}{16}$ SAE BO
8	051-200-298	EDGE TRIM
9	957-056-007	WASHER, ETLW $\frac{5}{16}$ ZN



## ORDER PARTS ONLINE

[eshop.qubicaamf.com](http://eshop.qubicaamf.com)

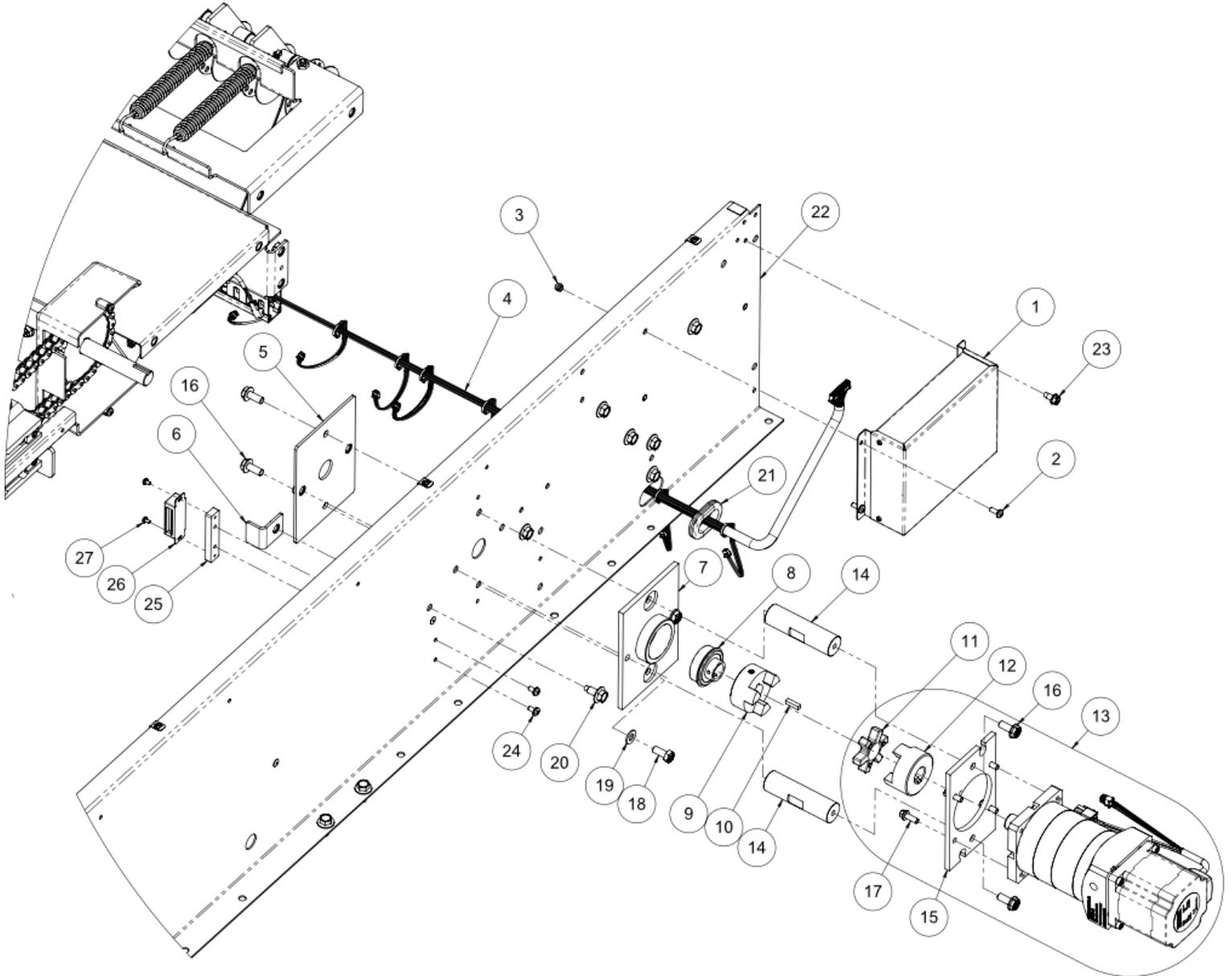
### BENEFITS

- ▶ Drill Down Menu by Machine Type
- ▶ Assembly Drawings with Hotspots
- ▶ Up-To-Date Cross-References
- ▶ Quick Order Form
- ▶ Thousands of High-Quality Photographs

QubicaAMF  eShop  
AMAZINGLY EASY



### 5.7. Gearmotor & Control Box

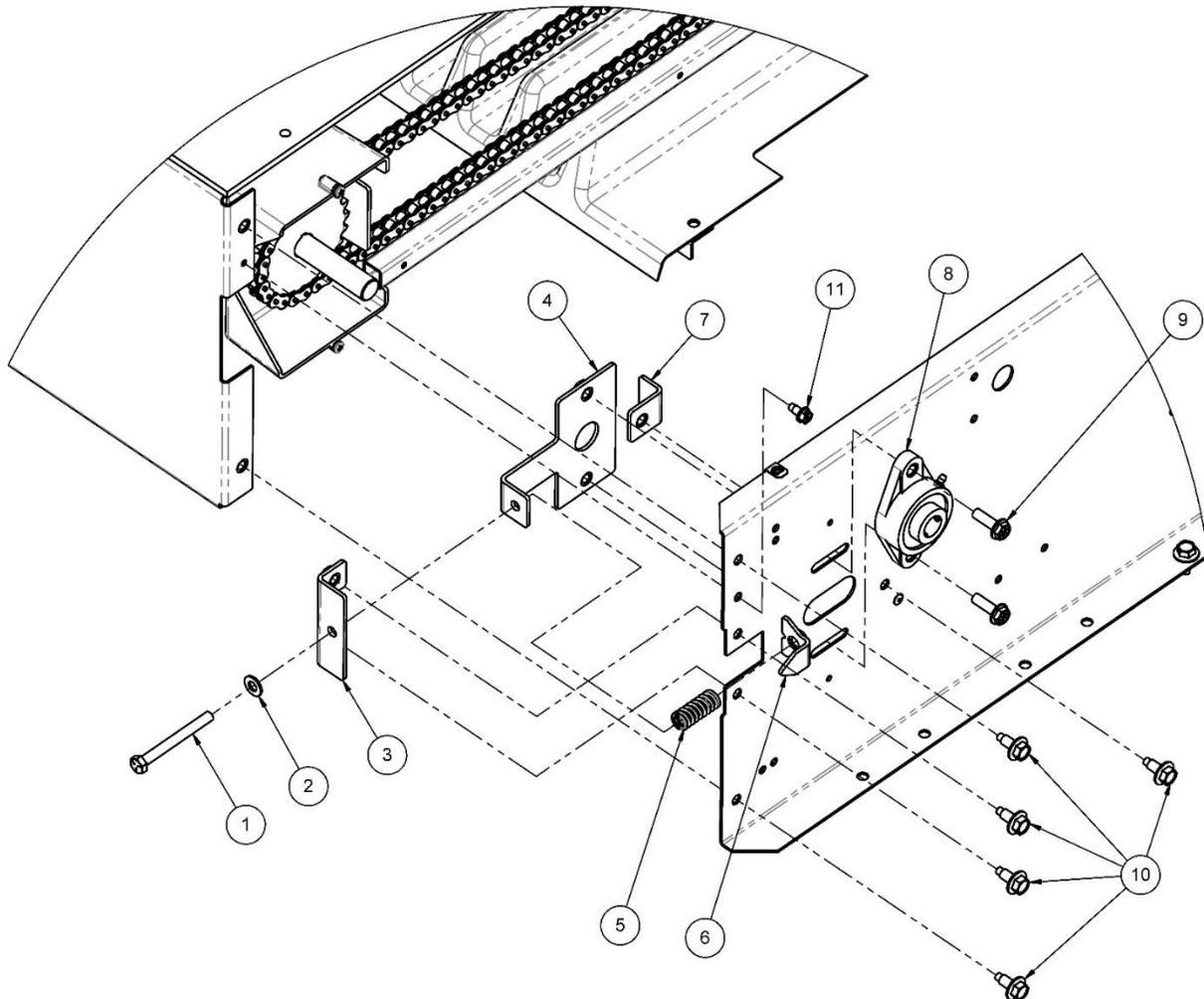


## 5.8. Gearmotor & Control Box Parts List

Item	Part Number	Description
1	051-200-299-XX	ASM, CONTROL BOARD
2	818-240-082	SCREW, PHPMS 10-32 X 0.50 ZN SEMS
3	858-640-032	NUT, AVK 10-32 .027-.165 OR
4	051-200-073	MACHINE WIRE HARNESS
5	051-200-313	WDMT, DRIVE SIDE NUT PLATE
6	051-200-364	WDMT, DRAWBAR STOP
7	051-200-308	WDMT, INLINE GB MOUNT BACK
8	701-024-032	BEARING
9	785-501-786	COUPLING HUB
10	907-200-800	KEY, SQ 0.19 X 0.72 Q
11	785-501-787	COUPLING SPIDER
12	785-501-785	COUPLING HUB
13	051-200-310-01	ASM, GEARMOTOR, DRAWBAR
14	051-200-312	MOTOR MOUNT, SPACER
15	051-200-311	INLINE GB MOUNT FACE
16	801-757-121	SCREW, FBGS $\frac{5}{16}$ -18 X 0.75 GR5 BP PA
17	860-006-200	SCREW, HHCS M6-1 X 20 CL8.8 DIN BO
18	809-857-125	SCREW, HHCS $\frac{5}{16}$ -18 X 0.75 GR8 PB
19	948-722-111	WASHER, FW $\frac{5}{16}$ SAE BO
20	818-757-121	SCREW, HWMS $\frac{5}{16}$ -18 X 0.75 BP DP
21	711-508-034	GROMMET, GPI 1.25 X 1.50 X 0.09 RB 1
22	051-200-005	SIDE FRAME, LEFT
23	823-449-117	SCREW, HWFTS $\frac{1}{4}$ -20 X 0.50 ZN TY1
24	818-240-062	PHPMS 10-32 X 0.38 ZN SEMS
25	051-200-734	DRAWBAR MAGNET SUPPORT
26	051-200-608	MAGNETIC LATCH 40LB
27	813-227-047	PHPMS 6-32 X 0.25 ZN SEMS



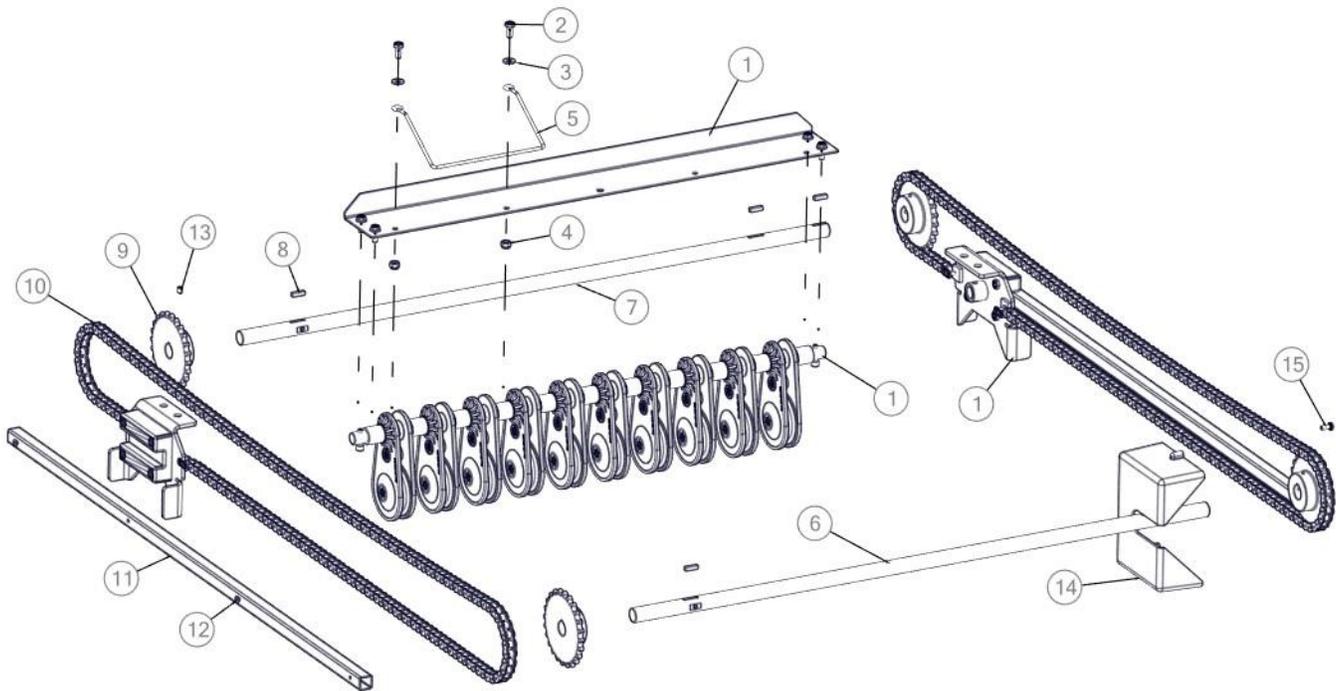
## 5.9. Drawbar Tensioner



Item	Part Number	Description
1	809-857-487	SCREW, HHCS $\frac{5}{16}$ -18 X 3.00 GR5 ZN FT
2	948-722-111	WASHER, FW $\frac{5}{16}$ SAE BO
3	051-200-318	WDMT, DRIVE TENSIONER BRKT
4	051-200-317	WDMT, DRIVE TENSIONER
5	088-001-823	COMPRESSION SPRING
6	051-200-319	WDMT, TENSIONER, ADJ. ARROW
7	051-200-364	WDMT, DRAWBAR STOP
8	701-424-000	FLANGE BEARING
9	801-757-160	SCREW, FBBS $\frac{5}{16}$ -18 X 1.00 GR8 BO
10	818-757-121	SCREW, HWMS $\frac{5}{16}$ -18 X 0.75 BP DP
11	823-449-117	SCREW, HWFTS $\frac{1}{4}$ -20 X 0.50 ZN TY1

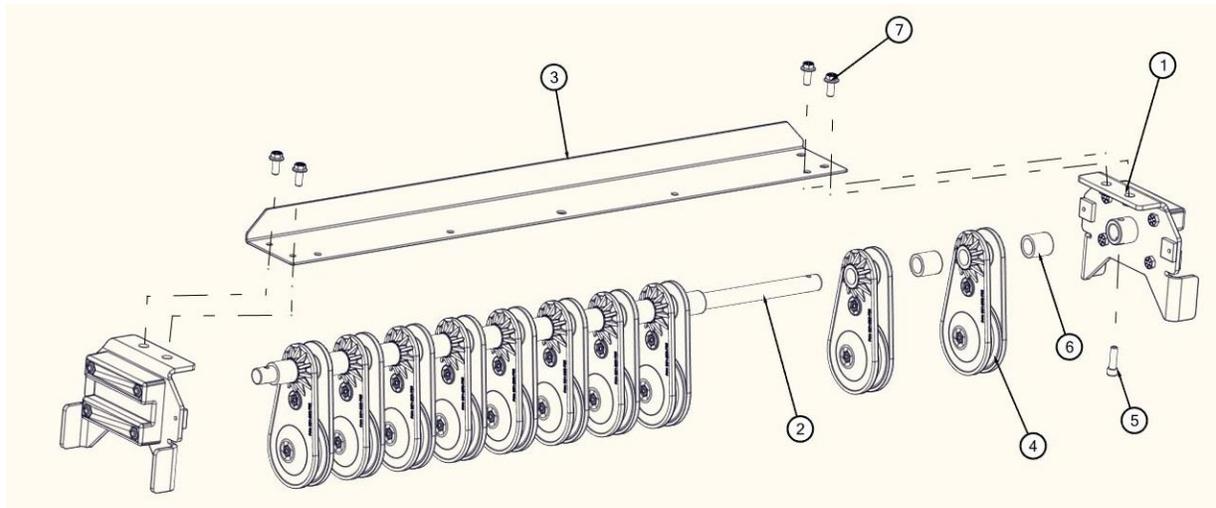


## 5.10. Drawbar Assembly & Chain Drive



Item	Part Number	Description
1	051-200-012-01	<b>DRAWBAR &amp; PULLEY ASM</b>
2	809-849-100	SCREW, HHCS ¼-20 X 0.63 GR8 BO
3	948-753-101	WASHER, FW ¼ SAE BO
4	838-549-002	NUT, HLN ¼-20 ZN NE
5	051-200-043	STRING RETAINER, DRAWBAR
6	051-200-017	DRIVE SHAFT, FRONT
7	051-200-016	DRIVE SHAFT, REAR
8	907-200-800	KEY, SQ 0.19 X 0.72 Q
9	9102092	SPROCKET
10	051-200-022	DRAWBAR DRIVE CHAIN
11	051-200-169	BAR, DRAWBAR GUIDE
12	01-122	RIVET, RVT BLD 0.19 X 0.55 ZN
13	070-001-909	SET SCREW, SSS ¼-20 X 0.31 CUP BO PA
14	051-200-530	SPROCKET GUARD
15	818-240-082	SCREW, PHPMS 10-32 X 0.50 ZN SEMS
	M0690011	MASTER LINK #40 CHAIN (not shown)

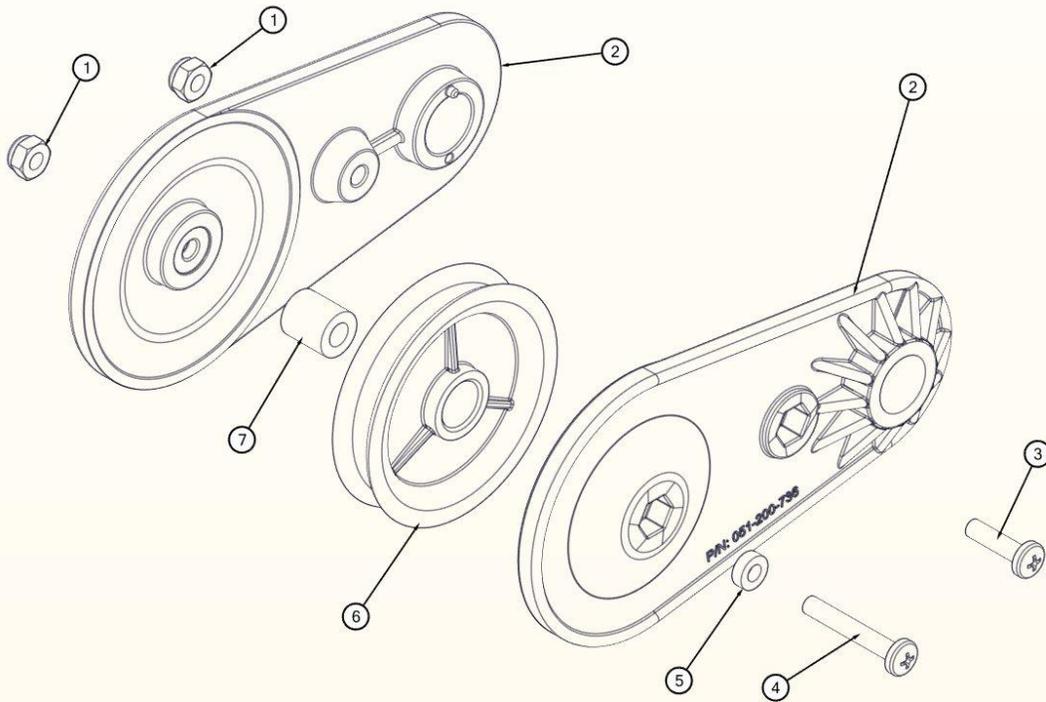
### 5.11. Drawbar & Pulley Assembly



Item	Part Number	Description
1	051-200-184-01	ASM, DRAWBAR CARRIAGE
2	051-200-013	DRAWBAR SHAFT
3	051-200-020	DRAWBAR PULLEY, SHIELD, ANGLE
4	051-200-735	ASM, DRAWBAR PULLEY
5	7018-002520-087	SCREW, SHSCS ¼-20 X 0.88 NS
6	051-200-034	SPACER
7	801-749-562	SCREW, FCBS ¼-20 X 0.63 GR8 BO

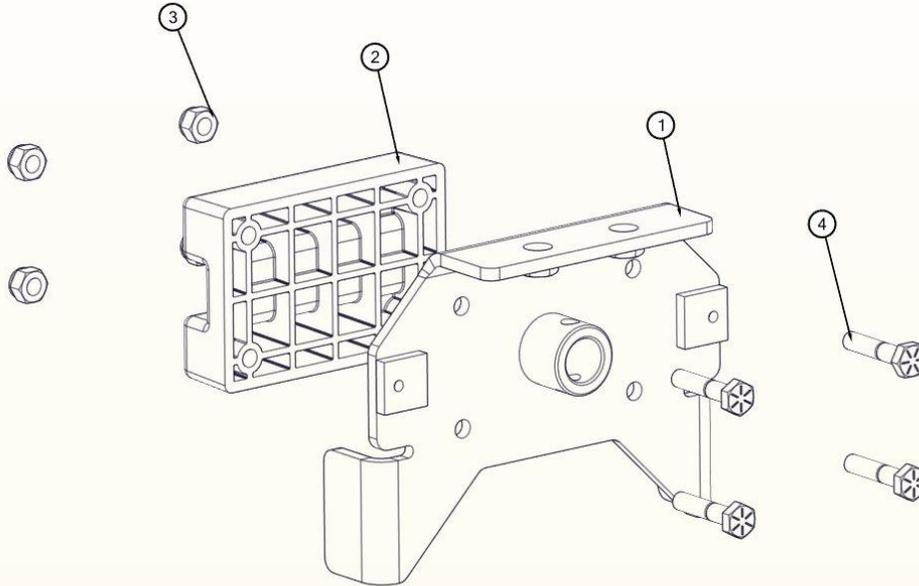


## 5.12. Drawbar Pulley Assembly



Item	Part Number	Description
1	7036-001032-000	NUT, HLN 10-32 ZN NM
2	051-200-736	DRAWBAR PULLEY PLATE
3	7016-411032-075	SCREW, PHPMS 10-32 X 0.75 ZN
4	7016-411032-125	SCREW, PHPMS 10-32 X 1.25 ZN
5	9103071	SPACER, SFR 0.188 X 0.38 X 0.13 NY
6	P-016A	PULLEY
7	M-0100B	BUSHING

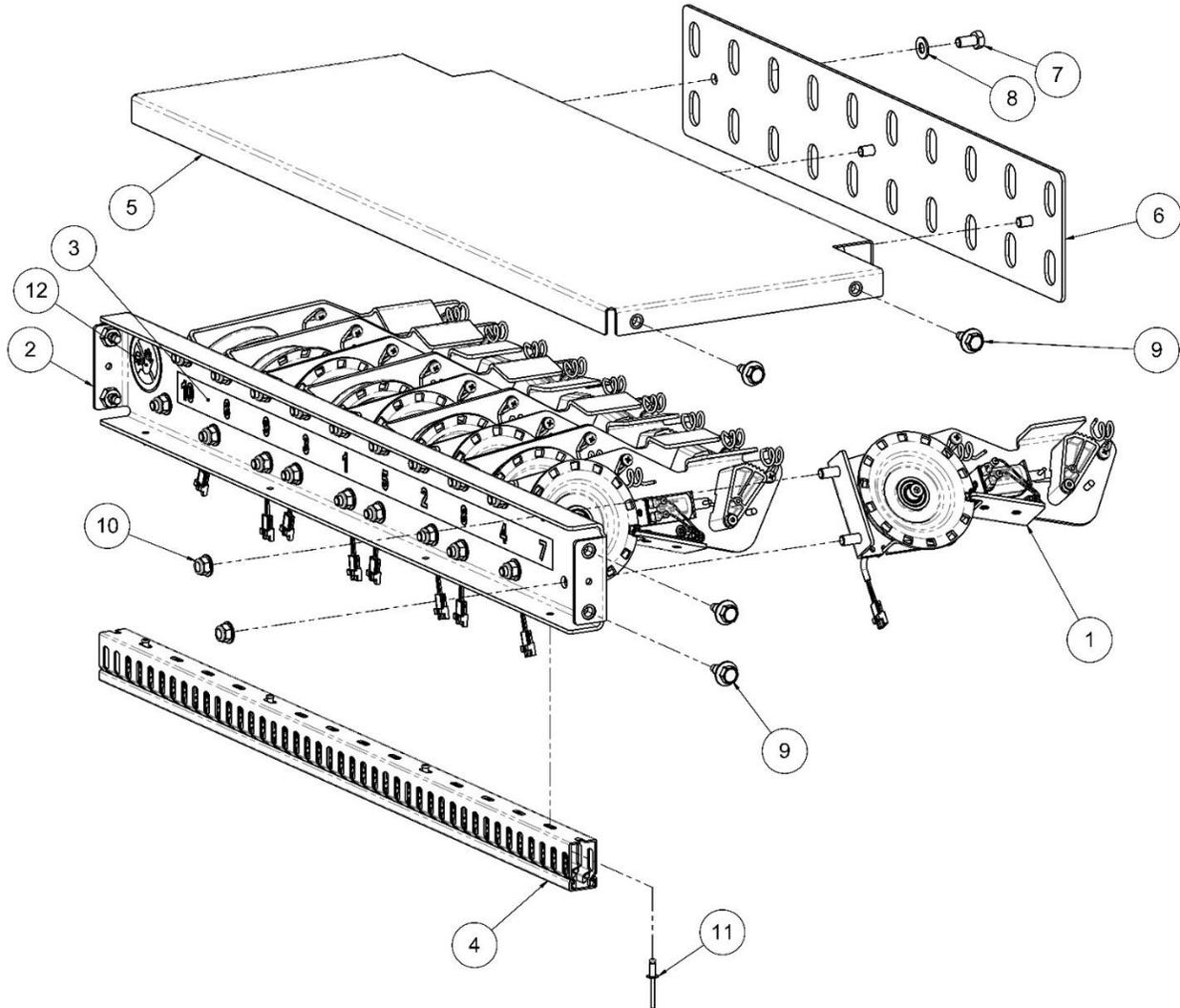
### 5.13. Drawbar Carriage Assembly



Item	Part Number	Description
1	051-200-041	WDMT, DRAWBAR CARRIAGE ANGLE
2	051-200-737	DRAWBAR GUIDE
3	838-549-002	NUT, HLN ¼-20 ZN NE
4	809-849-205	SCREW, HHCS ¼-20 X 1.25 GR8 BO



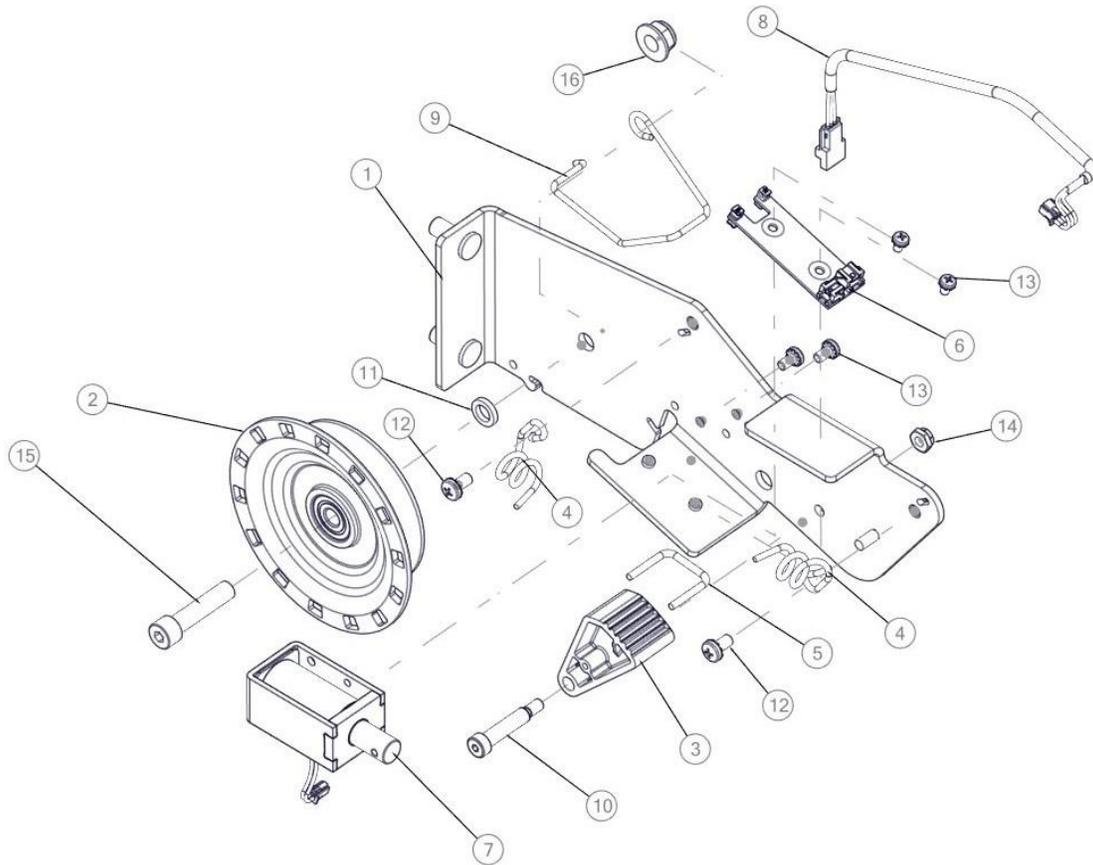
### 5.14. Brake/Encoder Assembly



Item	Part Number	Description
1	051-200-050-02	ASM, BRAKE/ENCODER UNIT
2	051-200-030	WDMT, B/E SUPPORT CHANNEL 10PIN
3	051-200-255	PIN ID DECAL, 10PIN
4	051-200-235	BRAKE ENCODER WIRE DUCT
5	051-200-039	WDMT, STRING GUARD
6	051-200-068	STRING COMB PLATE
7	809-857-100	SCREW, HHCS $\frac{5}{16}$ -18 X 0.63 GR8 BO
8	948-722-111	WASHER, FW $\frac{5}{16}$ SAE BO
9	818-757-121	SCREW, HWMS $\frac{5}{16}$ -18 X 0.75 BP DP
10	856-057-007	NUT, HFLN $\frac{5}{16}$ -18 ZN NE GR5
11	7108-401800-050	RIVET, RVT BLD 0.19 X 0.43 AL
12	051-070-043	DECAL, NO ACCESS UNAUTHORIZED



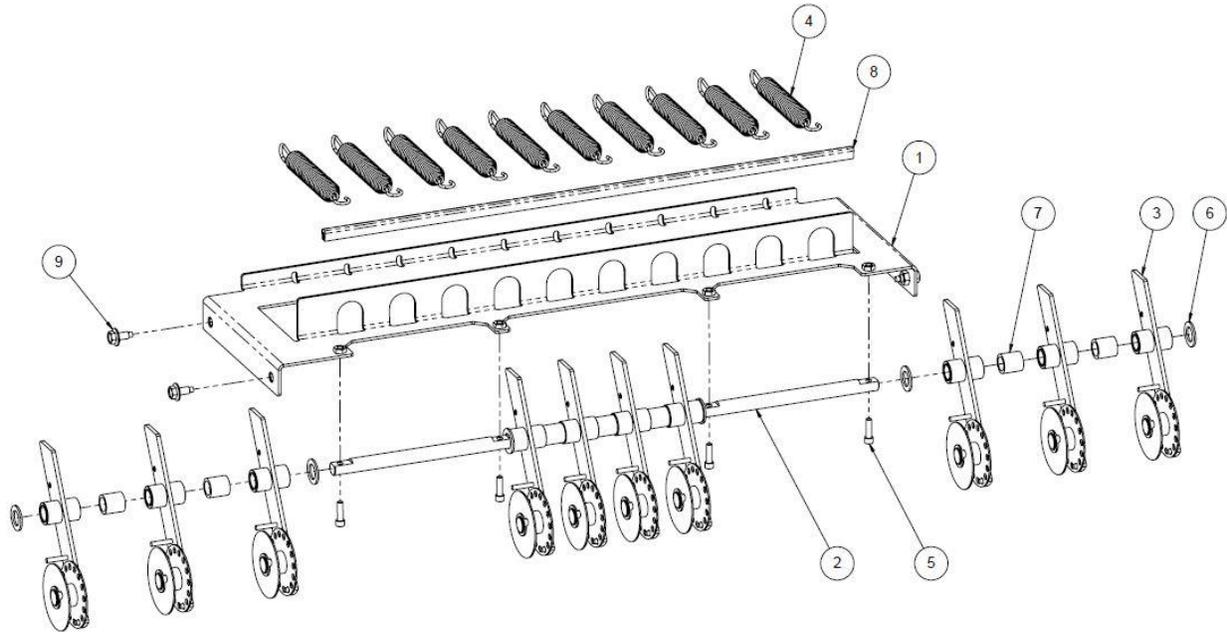
## 5.15. Brake/Encoder Unit Assembly



Item	Part Number	Description
1	051-200-052-01	ASM, B/E SUPPORT PLATE
2	051-200-055	ASM, ENCODER PULLEY
3	051-200-053	BRAKE PAWL
4	051-200-056	STRING GUIDE
5	051-200-715	BRAKE PAWL LINKAGE
6	051-200-058	BRAKE/ENCODER BOARD
7	051-200-777	SOLENOID
8	051-200-059	BRAKE/ENCODER CABLE
9	051-200-281	STRING RETENTION WIREFORM
10	880-149-161	BOLT, SHSSB 1/4 X 1.00 BO
11	722-505-003	SPACER, SFR 0.32 X 0.50 X 0.09 AL
12	818-240-062	SCREW, PHPMS 10-32 X 0.38 ZN SEMS
13	813-227-047	SCREW, PHPMS 6-32 X 0.25 ZN SEMS
14	840-039-002	NUT, HLN 10-24 FLX CAD L/T
15	810-257-221	SCREW, SHSCS 5/16-18 X 1.38 BO
16	856-057-007	NUT, HFLN 5/16-18 ZN NE GR5



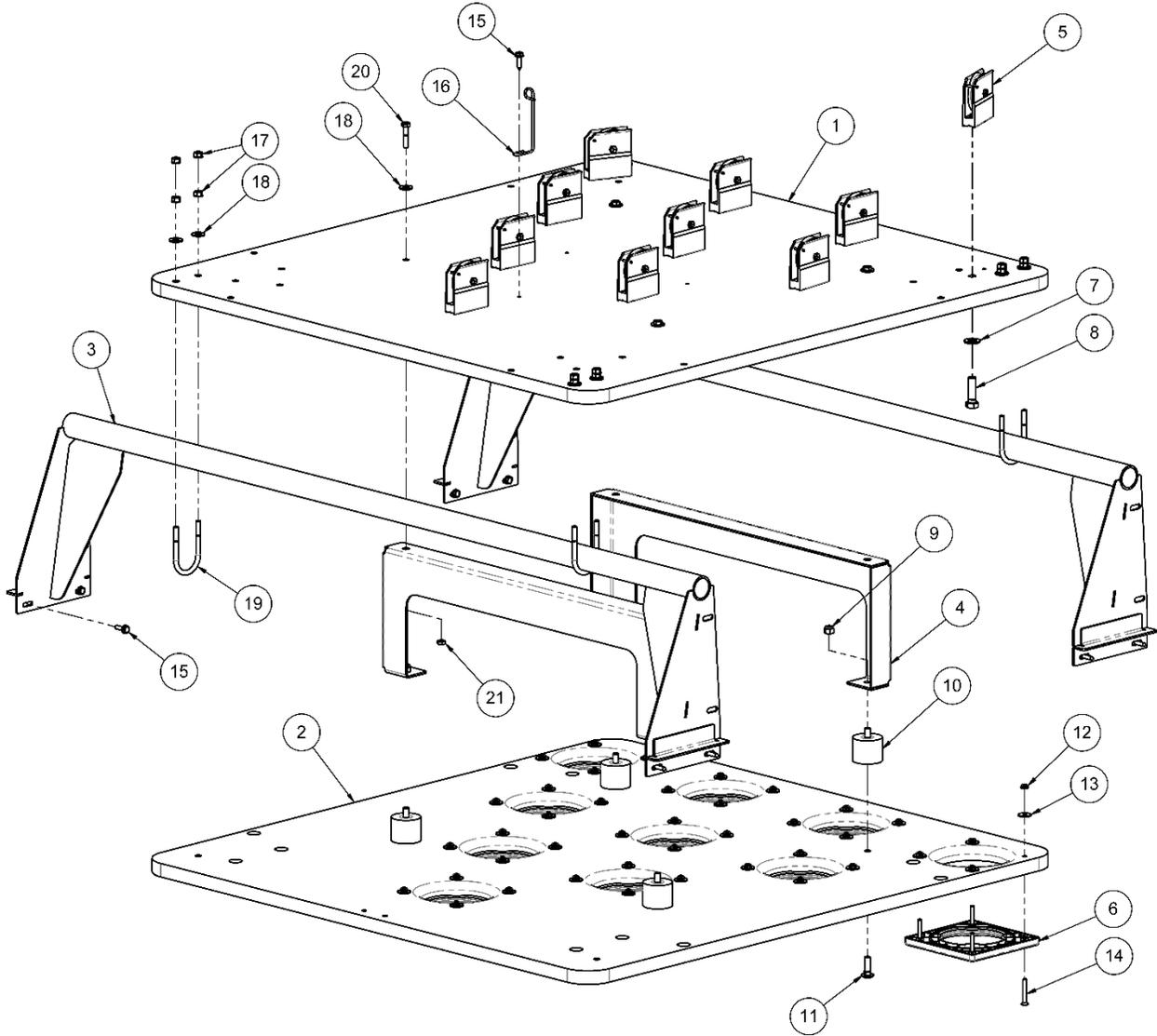
## 5.16. Reel Arm Assembly



Item	Part Number	Description
1	051-200-037	WDMT, REEL ARM FRAME
2	051-200-036	REEL ARM SHAFT
3	051-200-286	ASM, REEL ARM
4	S-080	EXTENSION SPRING
5	7018-002520-087	SCREW, SHSCS 1/4-20 X 0.88 NS
6	948-884-187	WASHER, FW 0.68 X 1.13 X 0.08 ZN
7	051-200-034	SPACER
8	051-200-257	UHMW EDGE WEAR STRIP
9	818-757-121	SCREW, HWMS 5/16-18 X 0.75 BP DP



### 5.17. Tables Assembly

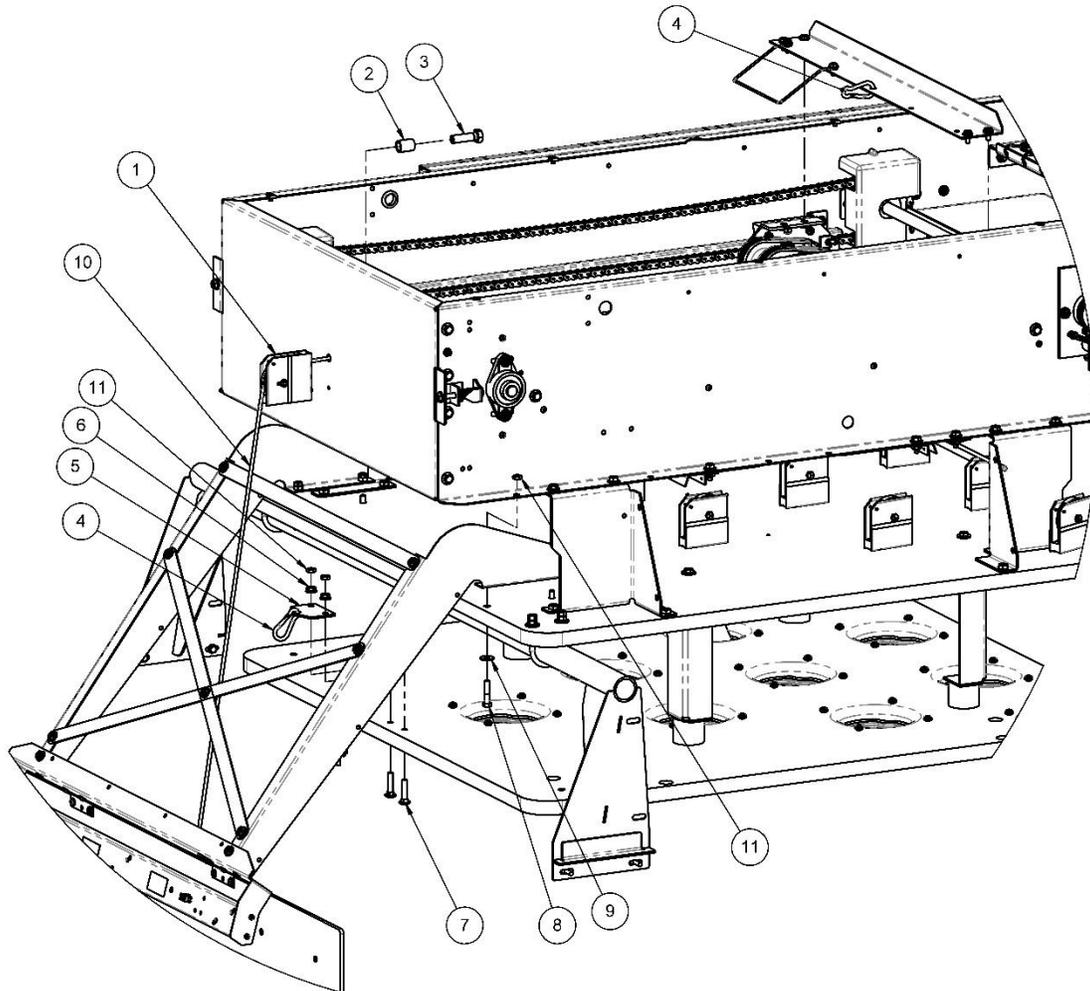


## Tables Assembly Parts List

Item	Part Number	Description
1	051-200-064	UPPER TABLE, 10PIN
2	051-200-061	LOWER TABLE, 10PIN
3	051-200-080	WDMT, MACHINE SUPPORT
4	051-200-067	WDMT, LWR TABLE MOUNT
5	051-200-062	ASM, TABLE PULLEY
6	051-200-027	10PIN CENTERING RING
7	7050-050106-009	WASHER, FW 12 SAE ZN
8	M-0041	SCREW, HHCS 1/2-20 X 1.75 ZN SP
9	7036-003716-000	NUT, HLN 3/8-16 ZN NE
10	721-508-029	ISOLATOR, VIBR MT 1.63 X 0.38 M-F
11	801-265-248	BOLT, CB 3/8-16 X 1.50 SS
12	838-849-007	NUT, HLN 1/4-20 ZN NTE
13	000-026-865	WASHER, FW 0.25 X 0.88 X 0.06 ZN
14	811-949-287	SCREW, FHPMS 1/4-20 X 1.75 ZN
15	859-048-168	SCREW, FBLS 5/16 X 1.00 HG
16	051-200-069	STRING GUIDE, HEAD PIN
17	7038-003118-000	NUT, KN 5/16-18 ZN
18	01-065	WASHER, FW 5/16 USS ZN
19	7030-003118-325	U BOLT, UB 5/16-18 X 3.25 NS
20	809-857-245	SCREW, HHCS 5/16-18 X 1.50 GR8 PB
21	835-557-003	NUT, HFJN 5/16-18 BO



## 5.18. Shield Mounting Assembly



Item	Part Number	Description
1	051-200-062	ASM, TABLE PULLEY
2	722-501-098	SPACER, SFR 0.51 X 0.75 X 1.00 AL
3	M-0041	SCREW, HHCS ½-20 X 1.75 ZN SP
4	051-070-025	CARABINER SHIELD
5	051-200-213	HARD STOP BRACKET
6	01-519	NUT, HFLN 5/16-18 ZN SER
7	801-257-248	BOLT, CB 5/16-18 X 1.50 SS
8	809-857-245	SCREW, HHCS 5/16-18 X 1.50 GR8 PB
9	01-065	WASHER, FW 5/16 USS ZN
10	051-200-214	ACTUATION STRING
11	835-557-003	NUT, HFJN 5/16-18 BO

## ORDER PARTS ONLINE

[eshop.qubicaamf.com](http://eshop.qubicaamf.com)

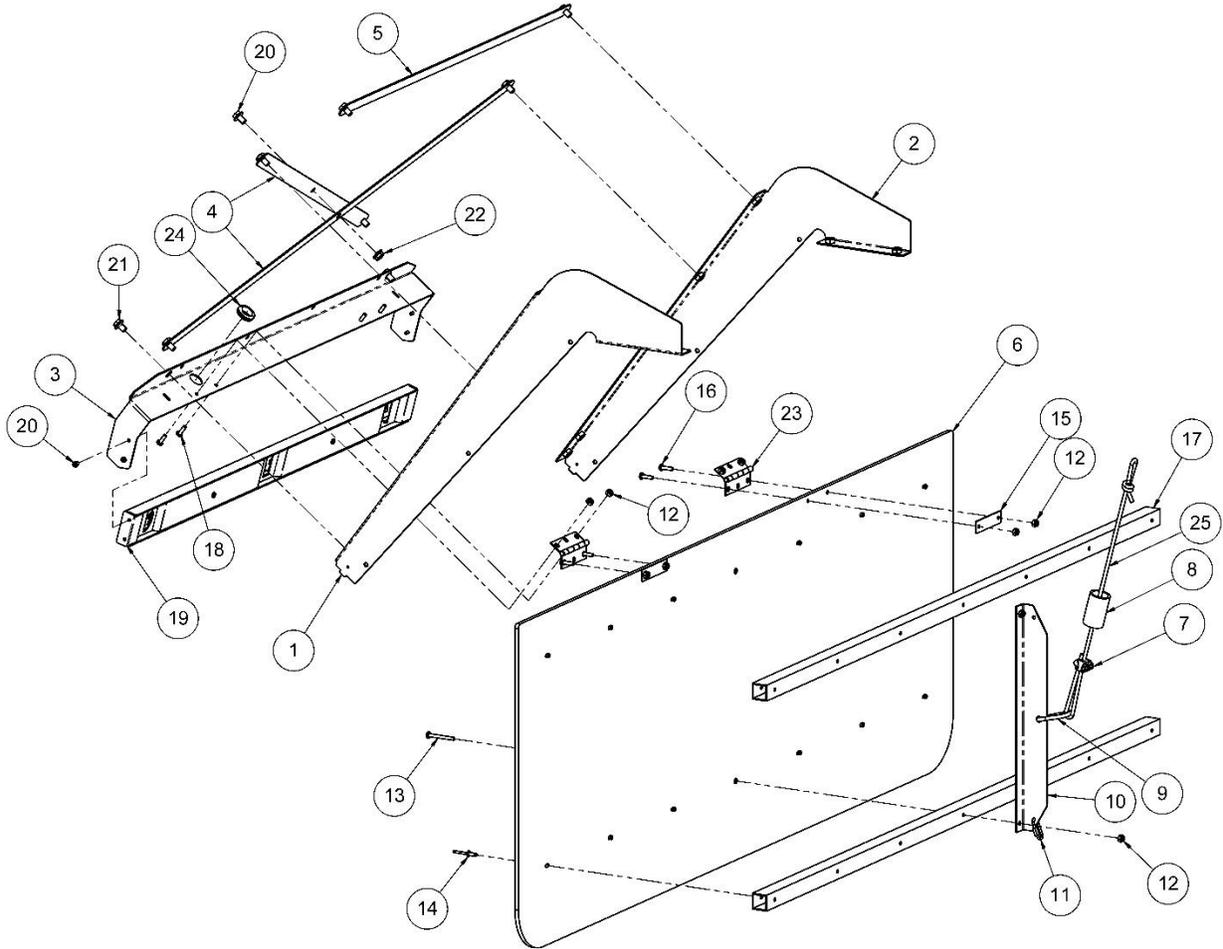
### BENEFITS

- ▶ Drill Down Menu by Machine Type
- ▶ Assembly Drawings with Hotspots
- ▶ Up-To-Date Cross-References
- ▶ Quick Order Form
- ▶ Thousands of High-Quality Photographs

QubicaAMF  eShop  
AMAZINGLY EASY



### 5.19. Shield/Pitlight Assembly

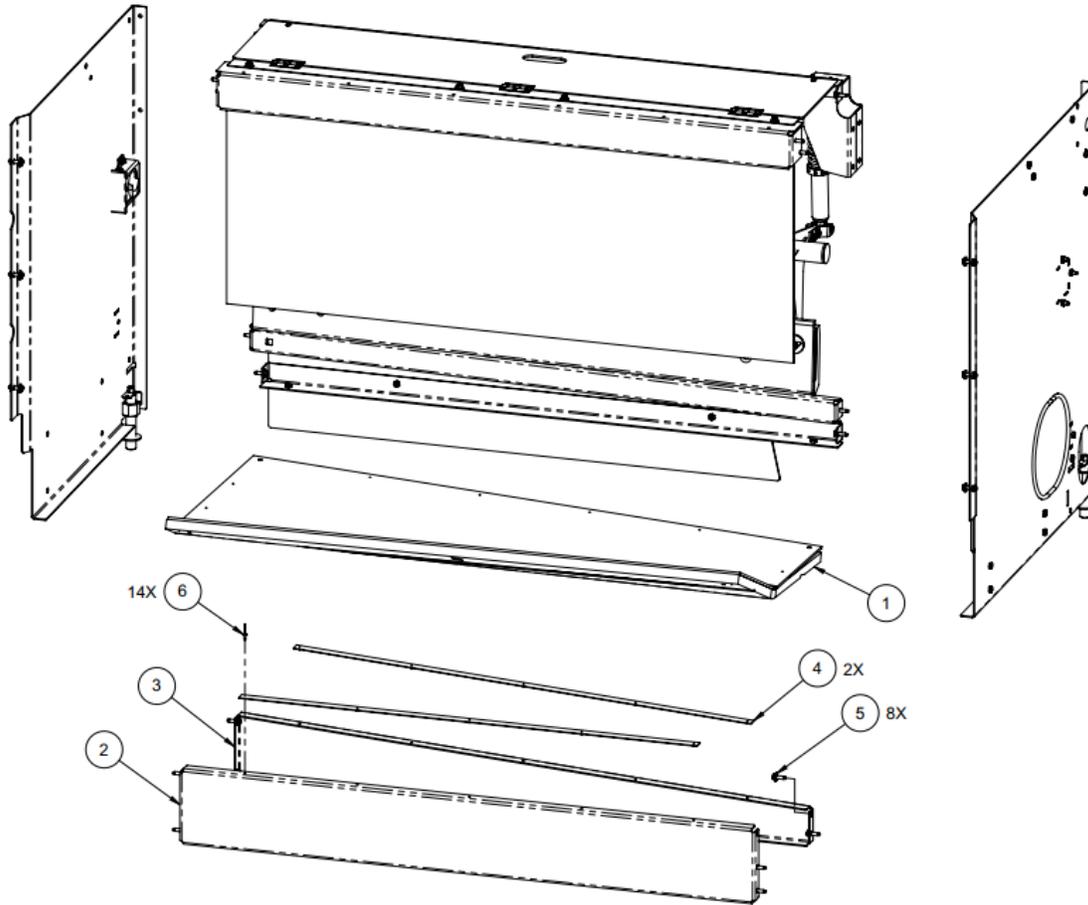


## 5.20. Shield/Pitlight Assembly Parts List

Item	Part Number	Description
1	051-200-202	WDMT, SHIELD/PITLIGHT BKT, 10P
2	051-200-204	WDMT, SHIELD/PITLIGHT BKT, 07P
3	051-200-205	HANGER BRACKET
4	051-200-206	CROSS BRACE, LONG
5	051-200-207	CROSS BRACE, SHORT
6	051-200-209	SHIELD PANEL
7	051-200-216	ROPE CLAMP
8	051-200-217	TUBE
9	051-070-025	CARABINER SHIELD TMS
10	051-200-212	STRING ATTACHMENT BRACKET
11	051-200-218	THREADED QUICK LINK
12	838-740-002	NUT, HLN 10-32 ZN NM
13	01-392	SCREW, PHPMS 10-32 X 1.75 ZN
14	7108-401800-062	3/16 X 5/8 ALUM POP RIVET DH
15	051-200-210	HINGE BACKING PLATE
16	7016-411032-075	SCREW, PHPMS 10-32 X 0.75 ZN
17	051-200-211	SHIELD REINFORCEMENT TUBE
18	7016-411032-062	SCREW, PHPMS 10-32 X 0.63 ZN
19	275-002-001-01	CP DECK LIGHT FIXTURE
20	863-040-087	SCREW, PHPMS M4-0.7 X 8 ZN
21	801-757-081	SCREW, FBSC $\frac{5}{16}$ -18 X 0.50 GR5 BP PA
22	01-519	NUT, HFLN $\frac{5}{16}$ -18 ZN SER
23	M-0700-51	HINGE
24	711-506-000	GROMMET, GPI 0.75 X 0.88 X 0.09 RB 1
25	051-200-215	HARD STOP STRING



## 5.21. Odd Machine Pit Floor Assembly



### Odd Machine Pit Floor Assembly Parts List

Item	Part Number	Description
1	051-200-729	PIT FLOOR ASSEMBLY, ODD
2	051-200-730	PIT FLOOR SUPPORT
3	051-200-731	PIT FLOOR SUPPORT, ANGLED
4	051-200-762	PIT FLOOR STRIP, LOOP
5	818-757-161	SCREW, HWMS 5/16-18 X 1.00 GR8 BP DP
6	7108-401800-050	RIVET, RVT BLD 0.19 X 0.43 AL



## ORDER PARTS ONLINE

[eshop.qubicaamf.com](http://eshop.qubicaamf.com)

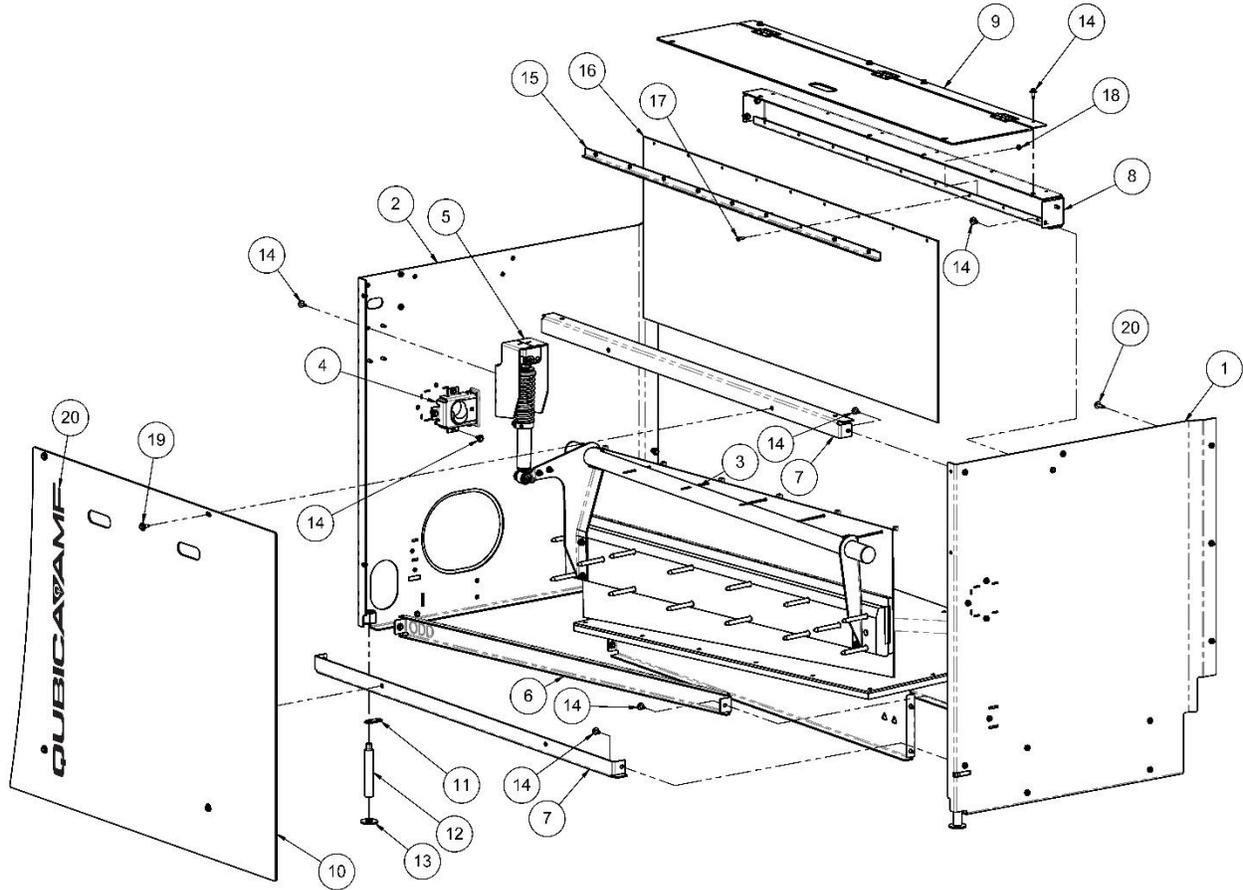
### BENEFITS

- ▶ Drill Down Menu by Machine Type
- ▶ Assembly Drawings with Hotspots
- ▶ Up-To-Date Cross-References
- ▶ Quick Order Form
- ▶ Thousands of High-Quality Photographs

QubicaAMF  eShop  
AMAZINGLY EASY



## 5.22. Odd Machine Back End Assembly

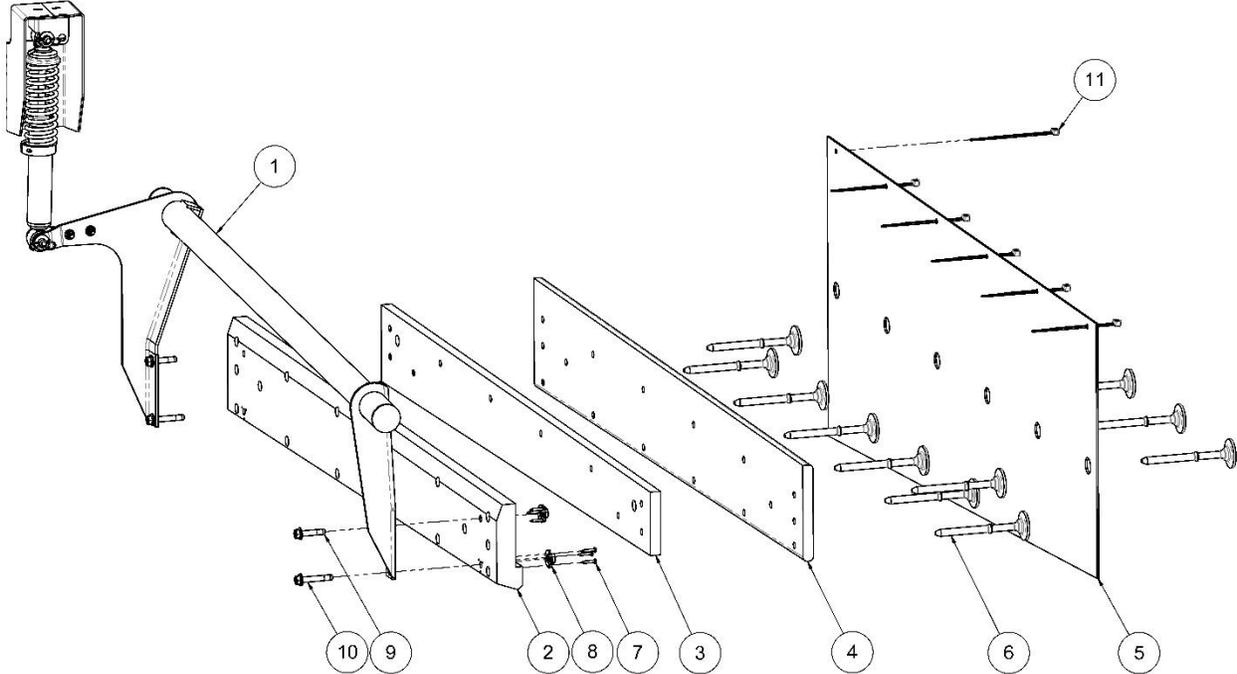


## Odd Machine Back End Assembly Parts List

Item	Part Number	Description
1	051-200-151	WDMT, SIDEFAME, ODD 07P
2	051-200-163	WDMT, SIDEFAME, ODD 10P
3	<b>051-200-181</b>	<b>ASM, CUSHION, ODD</b>
4	<b>051-200-193</b>	<b>ASM, CUSHION MNT BOX 10P</b>
5	051-200-174	WDMT, SHOCK MOUNT
6	051-200-379	PIN STOP CHANNEL, ODD
7	051-200-173	PIT CROSS SUPPORT
8	051-200-186	WDMT, PIT CURTAIN, GUARD, SPRT
9	051-200-536	ASM, PIT COVER, TOP
10	051-200-631	ASM, PIT REAR GUARD, ODD
11	088-002-276	LOCKING TAB
12	088-002-275	JACK SCREW
13	946-688-322	WASHER, FW 0.81 X 2.00 X 0.16 ZN
14	818-757-121	SCREW, HWMS $\frac{5}{16}$ -18 X 0.75 BP DP
15	051-200-188	PIT CLAMP CURTAIN, L
16	051-200-189	PIT CURTAIN
17	809-849-125	SCREW, HHCS $\frac{1}{4}$ -20 X 0.75 GR8 BO
18	838-549-002	NUT, HLN $\frac{1}{4}$ -20 ZN NE
19	817-157-151	SCREW, HHMS $\frac{5}{16}$ -18 X 0.94 BP SEMS DP
20	051-200-589	DECAL, PIT REAR GUARD



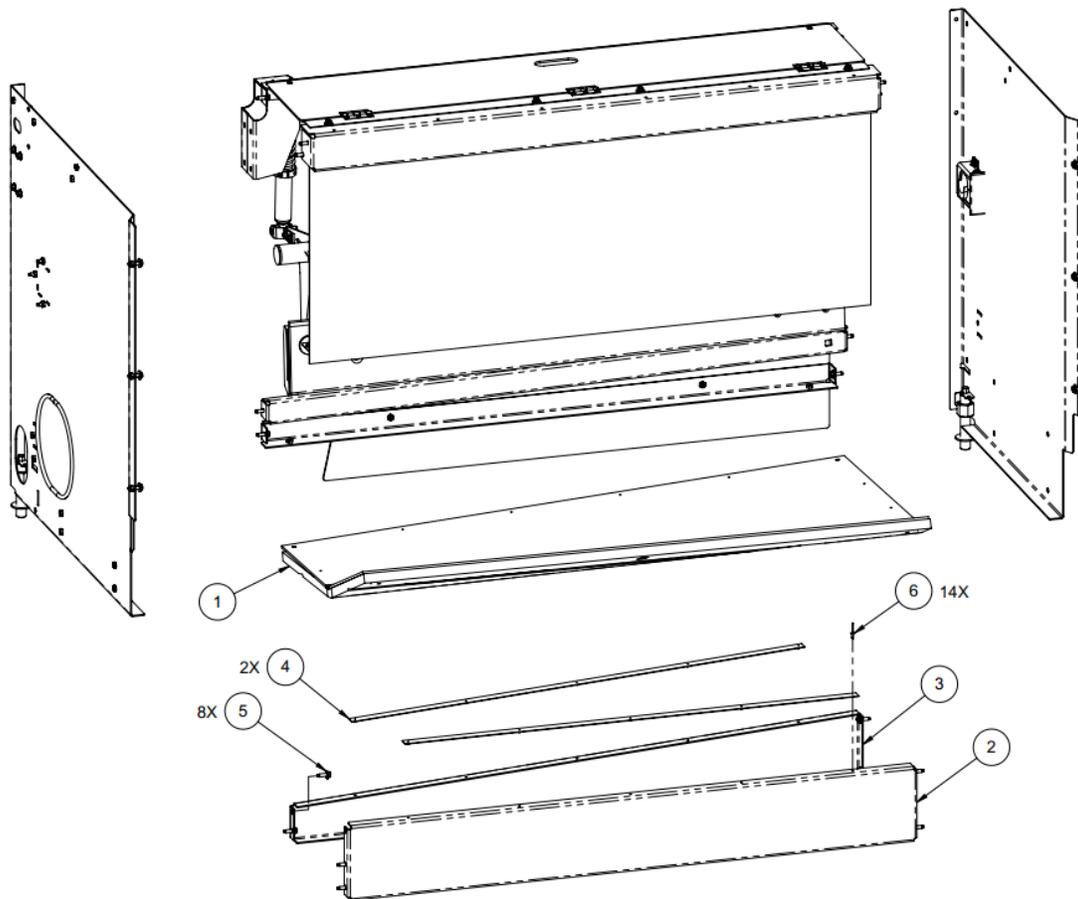
### 5.23. Odd Machine Pit Cushion Assembly



Item	Part Number	Description
1	070-002-050	CUSHION TUBE WLDMT, ODD
2	000-024-796	PLANK ODD, CUSHION ASM ODD
3	000-022-770	SPONGE PAD, CUSHION ASM
4	000-024-807	CUSHION RUBBER, ODD
5	051-200-254	CUSHION CVR, EXTENDED, 6-HOLE
6	000-028-529	RIVET, CUSHION ASM
7	7023-410800-100	SCREW, PHPPS 8 X 1.00 BO
8	000-024-750	CUSHION MOUNT WELDNUT
9	801-865-287	SCREW, FBCS $\frac{3}{8}$ -16 X 1.75 GR5 ZN PAS
10	801-865-367	SCREW, FBCS $\frac{3}{8}$ -16 X 2.25 GR5 ZN PAS
11	770-011-232	CABLE TIE, CBT 14.0 X 4.00 X 120 BLK



## 5.24. Even Machine Pit Floor Assembly

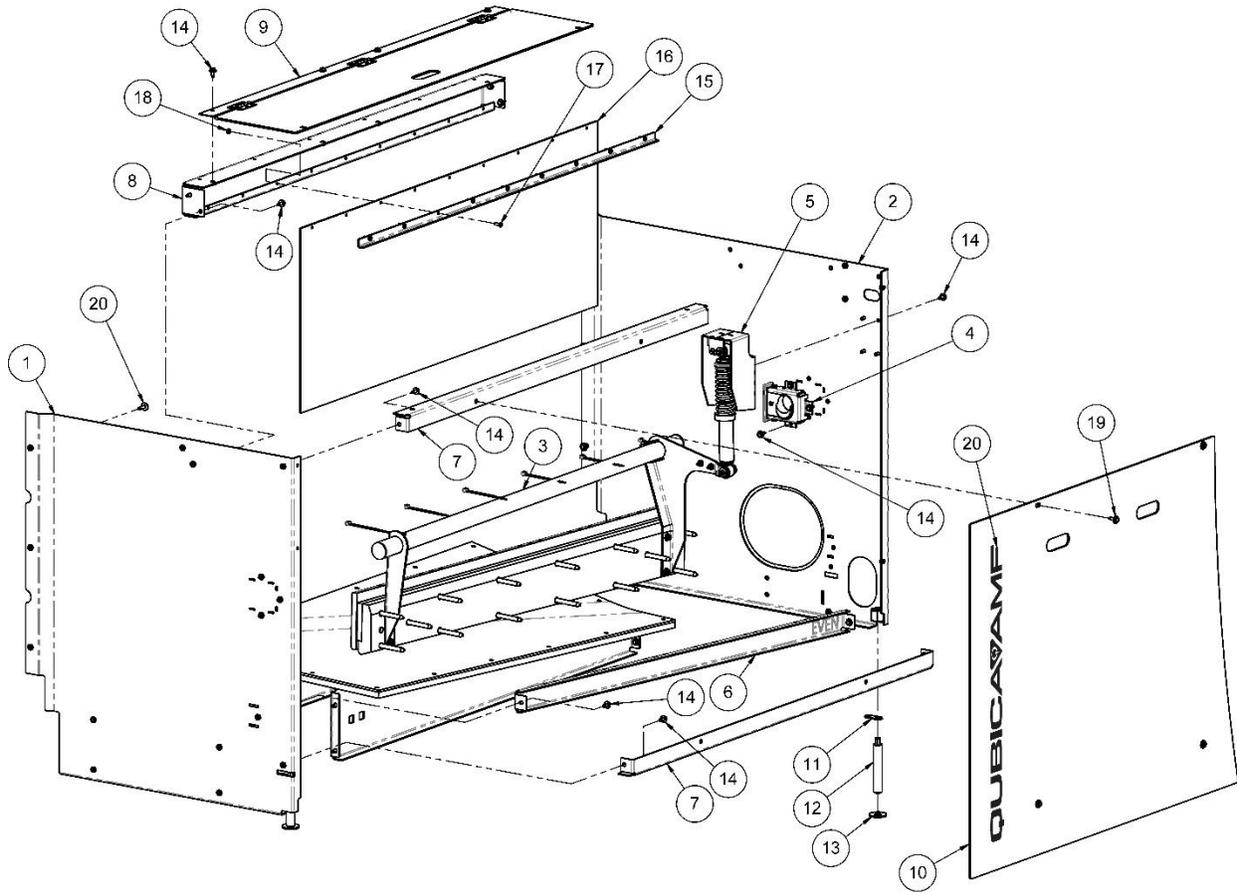


### Even Machine Pit Floor Assembly Parts List

Item	Part Number	Description
1	051-200-728	PIT FLOOR ASSEMBLY, EVEN
2	051-200-730	PIT FLOOR SUPPORT
3	051-200-731	PIT FLOOR SUPPORT, ANGLED
4	051-200-762	PIT FLOOR STRIP, LOOP
5	818-757-161	SCREW, HWMS 5/16-18 X 1.00 GR8 BP DP
6	7108-401800-050	RIVET, RVT BLD 0.19 X 0.43 AL



### 5.25. Even Machine Back End Assembly

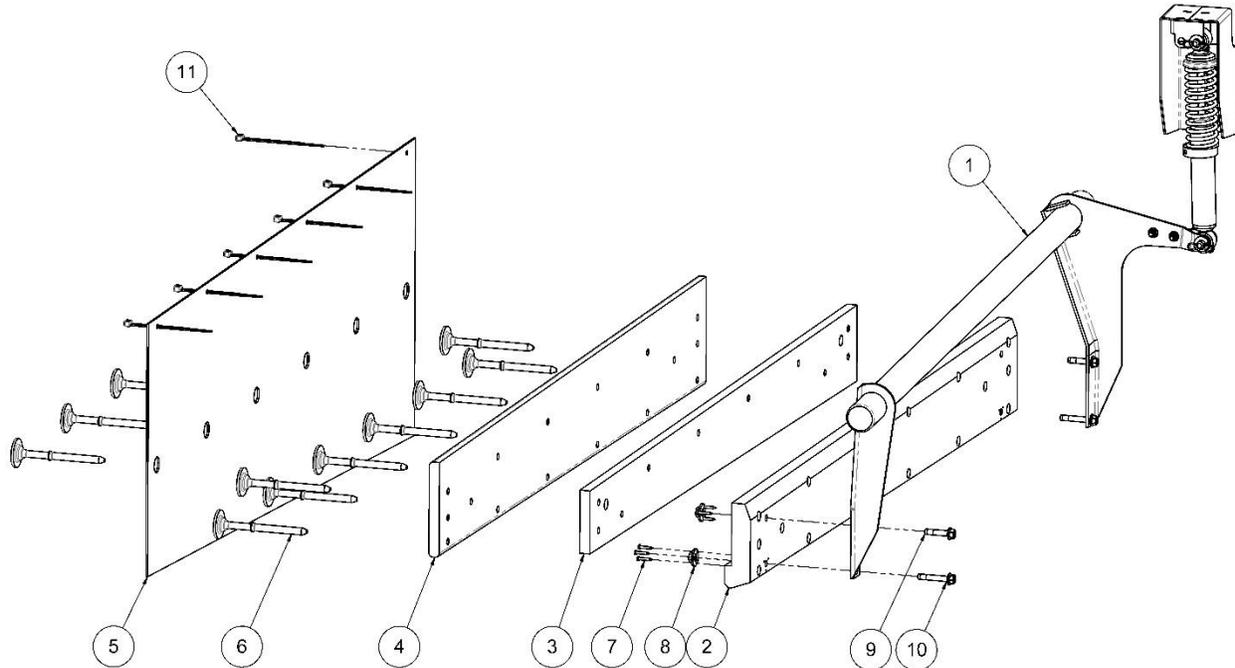


## Even Machine Back End Assembly Parts List

Item	Part Number	Description
1	051-200-163	WDMT, SIDEFAME, EVN 10P
2	051-200-161	WDMT, SIDEFAME, EVN 07P
3	<b>051-200-182</b>	<b>ASM, CUSHION, EVN</b>
4	<b>051-200-192</b>	<b>ASM, CUSHION MNT BOX 07P</b>
5	051-200-174	WDMT, SHOCK MOUNT
6	051-200-378	PIN STOP CHANNEL, EVN
7	051-200-173	PIT CROSS SUPPORT
8	051-200-186	WDMT, PIT CURTAIN, GUARD, SPRT
9	051-200-536	ASM, PIT COVER, TOP
10	051-200-632	ASM, PIT REAR GUARD, EVN
11	088-00-276	LOCKING TAB
12	088-002-275	JACK SCREW
13	946-688-322	WASHER, FW 0.81 X 2.00 X 0.16 ZN
14	818-757-121	SCREW, HWMS <sup>5</sup> / <sub>16</sub> -18 X 0.75 BP DP
15	051-200-188	PIT CLAMP CURTAIN, L
16	051-200-189	PIT CURTAIN
17	809-849-125	SCREW, HHCS ¼-20 X 0.75 GR8 BO
18	838-549-002	NUT, HLN ¼-20 ZN NE
19	817-157-151	SCREW, HHMS <sup>5</sup> / <sub>16</sub> -18 X 0.94 BP SEMS DP
20	051-200-589	DECAL, PIT REAR GUARD

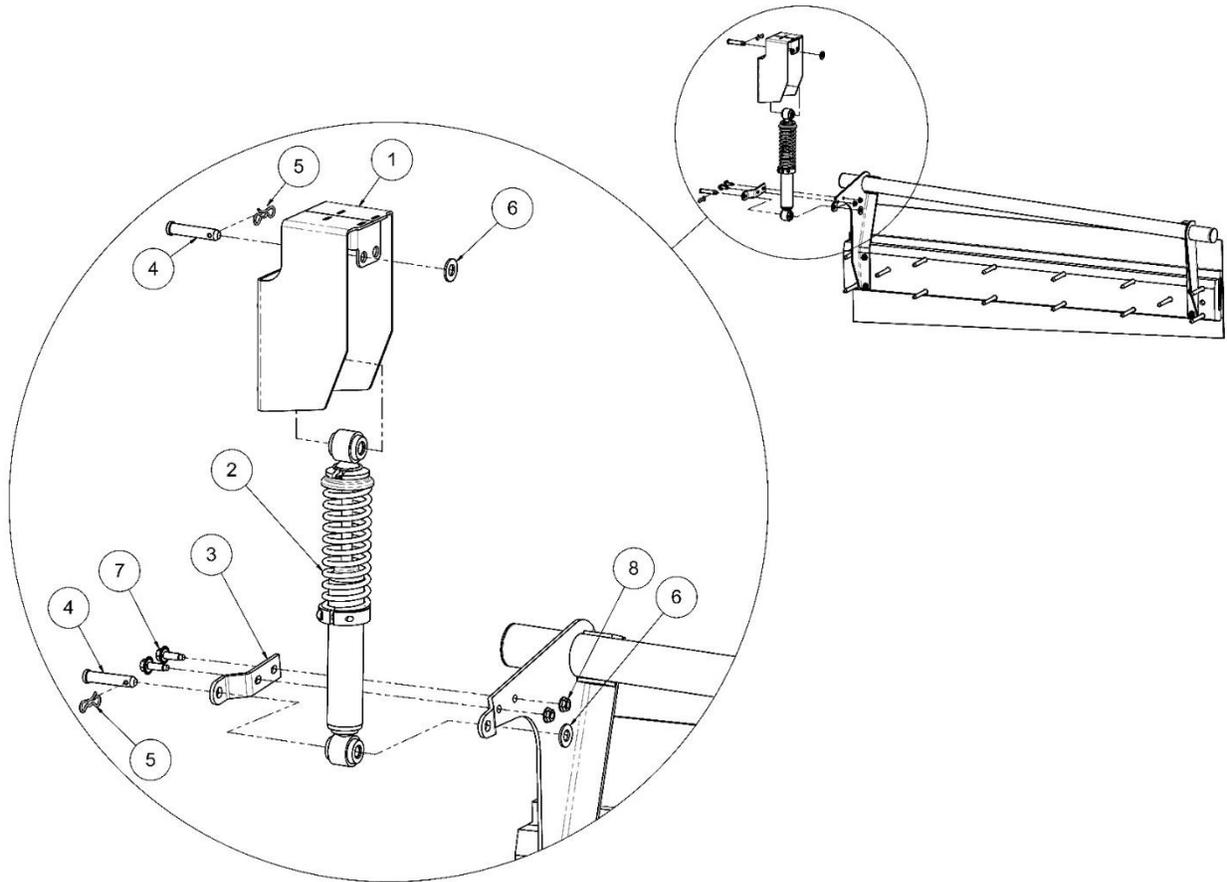


## 5.26. Even Machine Pit Cushion Assembly



Item	Part Number	Description
1	070-002-252	CUSHION TUBE WLDMT, EVEN
2	000-024-795	PLANK EVEN, CUSHION ASM EVEN
3	000-022-770	SPONGE PAD, CUSHION ASM
4	000-024-808	CUSHION RUBBER, EVEN
5	051-200-254	CUSHION CVR, EXTENDED, 6-HOLE
6	000-028-529	RIVET, CUSHION ASM
7	7023-410800-100	SCREW, PHPPS 8 X 1.00 BO
8	000-024-750	CUSHION MOUNT WELDNUT
9	801-865-287	SCREW, FBCS $\frac{3}{8}$ -16 X 1.75 GR5 ZN PAS
10	801-865-367	SCREW, FBCS $\frac{3}{8}$ -16 X 2.25 GR5 ZN PAS
11	770-011-232	CABLE TIE, CBT 14.0 X 4.00 X 120 BLK

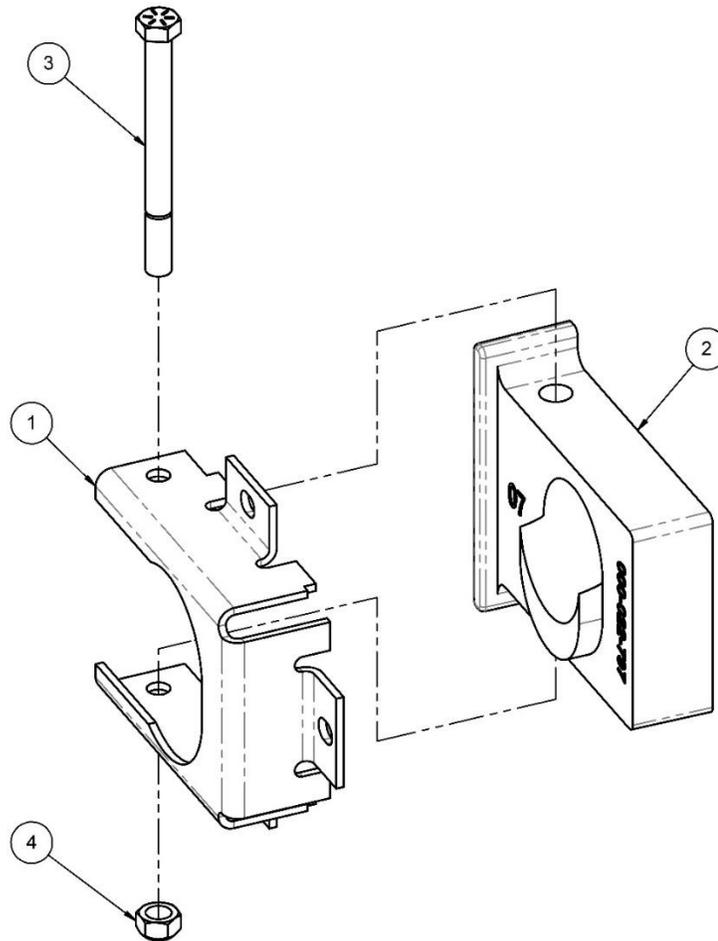
## 5.27. Pit Cushion Shock Assembly



Item	Part Number	Description
1	051-200-174	WDMT, SHOCK MOUNT
2	000-022-824	SHOCK ASB ASM, CUSHION
3	000-024-534	EAR HANGER, CUSHION ASM
4	051-200-349	CLEVIS PIN, PIN CL 0.50 X 2.05
5	911-073-307	BOWTIE PIN, PIN BC 0.09 X 1.88 ZN
6	948-975-172	WASHER, FW 0.53 X 1.06 X .10 NS
7	818-757-161	SCREW, HWMS $\frac{5}{16}$ -18 X 1.00 GR8 BP DP
8	01-519	NUT, HFLN $\frac{5}{16}$ -18 ZN SER



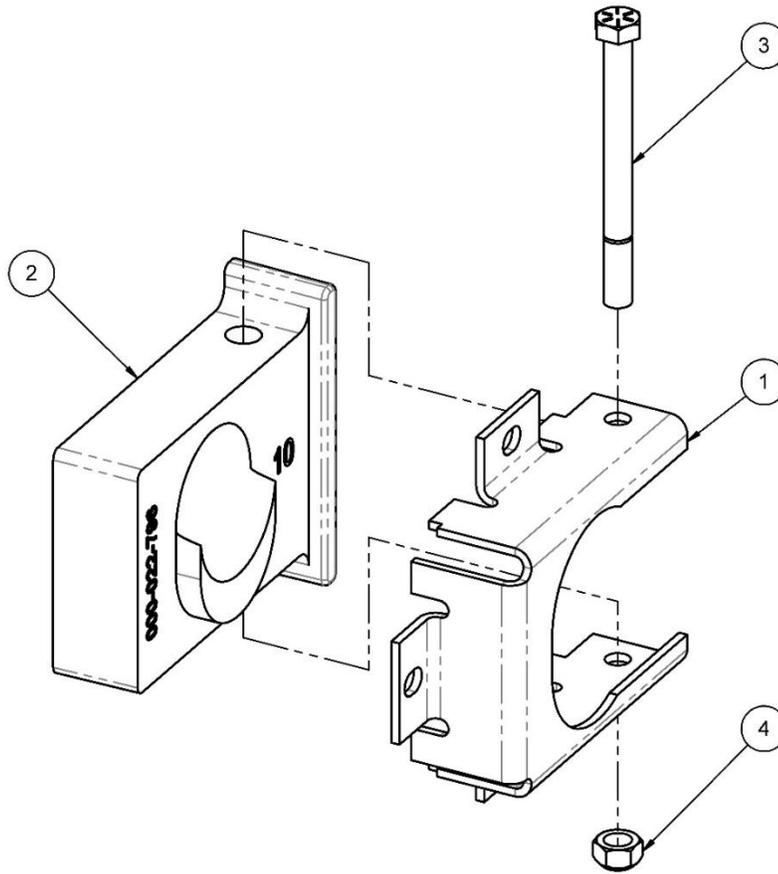
### 5.28. Pit Cushion Block (7 Pin Side)



Item	Part Number	Description
1	051-200-178	CUSHION BOX SUPPORT
2	000-022-797	BLOCK SUPPORT 07P
3	809-257-640	SCREW, HHCS $\frac{5}{16}$ -18 X 4.00 GR8 BO
4	844-057-002	NUT, HLN $\frac{5}{16}$ -18 CAD STV



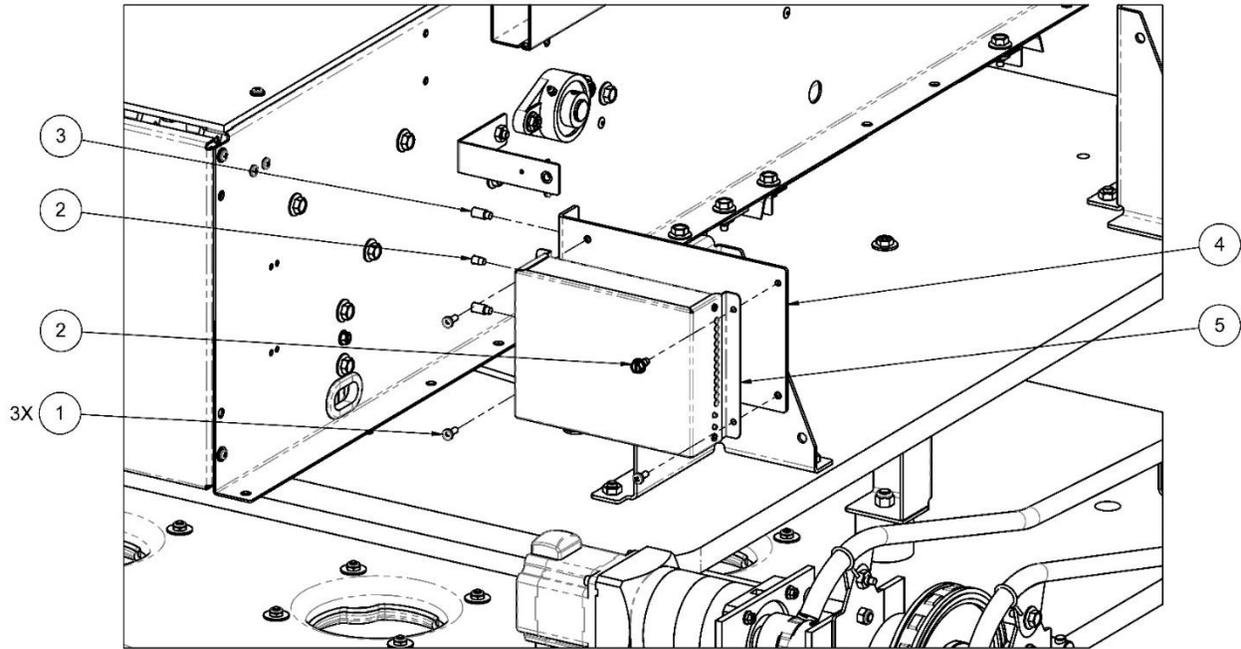
### 5.29. Pit Cushion Block (10 Pin Side)



Item	Part Number	Description
1	051-200-178	CUSHION BOX SUPPORT
2	000-022-796	BLOCK SUPPORT 10P
3	809-257-640	SCREW, HHCS $\frac{5}{16}$ -18 X 4.00 GR8 BO
4	844-057-002	NUT, HLN $\frac{5}{16}$ -18 CAD STV



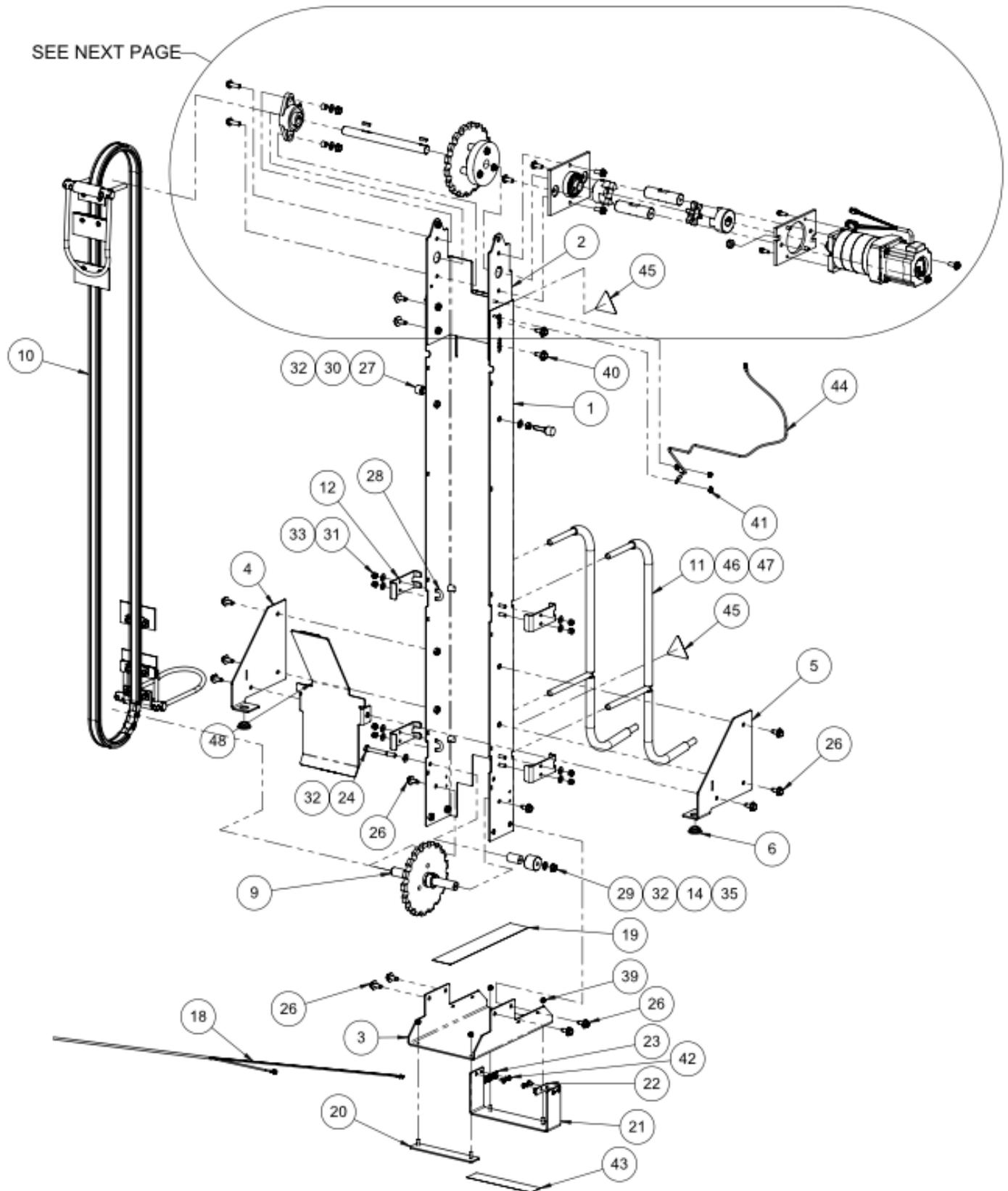
### 5.30. Chain Lift Control Box



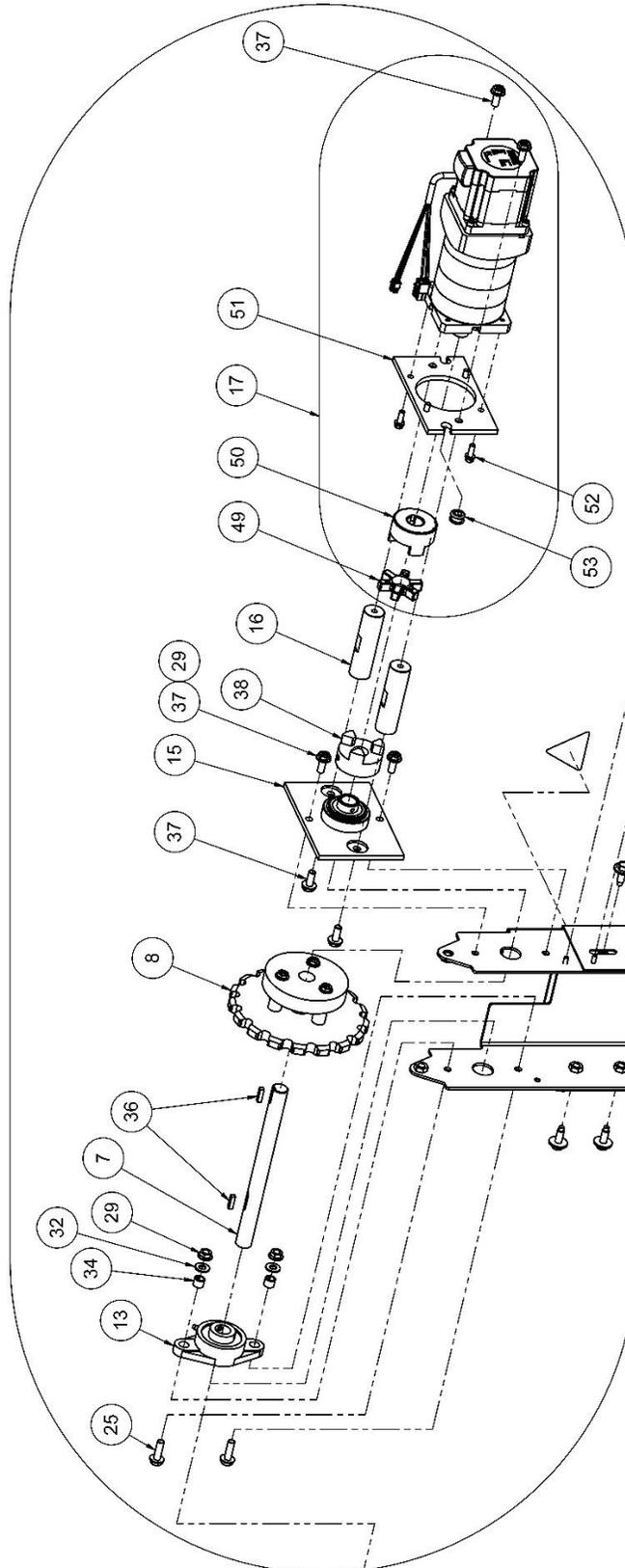
Item	Part Number	Description
1	818-240-082	SCREW, PHPMS 10-32 X 0.50 ZN SEMS
2	823-449-117	SCREW, HWFTS ¼-20 X 0.50 ZN TY1
3	818-757-121	SCREW, HWMS 5/16-18 X 0.75 BP DP
4	051-200-446	WDMT, C LIFT CTRL BOX BRKT
5	051-200-299-XX	ASM, CONTROL BOX



### 5.31. Chain Lift Assembly



### 5.32. Chain Lift – Upper Assembly Detail



## Chain Lift Assembly Parts List

Item	Part Number	Description
1	051-200-116	ASM, CHAIN LIFT BODY, LOWER
2	051-200-139	WDMT, CHAIN LIFT HEAD
3	051-200-105	LIFTER PAN
4	051-200-655	MOUNT, CHAIN LIFT, ODD
5	051-200-654	MOUNT, CHAIN LIFT, EVN
6	051-200-108	BUSHING, BALL LIFT MOUNT
7	051-200-111	CHAIN LIFT, DRIVE SHAFT
<b>8</b>	<b>051-200-112</b>	<b>ASM, CHAIN LIFT, SPROCKET</b>
<b>9</b>	<b>051-200-117</b>	<b>ASM, CHAIN LIFT IDLER</b>
<b>10</b>	<b>051-200-120</b>	<b>ASM, CHAIN LIFT, CHAIN</b>
11	051-200-130	WDMT, REST RAIL
12	051-200-132	REST RAIL RETAINER
13	701-424-000	FLANGE BEARING
14	051-200-142	CHAIN LIFT, CAM
15	051-200-309	ASM, INLINE GB MOUNT BACK
16	051-200-312	MOTOR MOUNT SPACER
17	051-200-433-01	ASM, GEARMOTOR, CHAIN LIFT
18	051-200-274	CABLE, CHAIN LIFT BALL SENSOR
19	051-200-479	LIFTER WEAR STRIP
20	051-200-481	ASM, C LIFT STUD PLATE
21	051-200-483	ASM, C LIFT STUD SENSOR BRKT
22	051-200-232	IR TRANSMITTER
23	051-200-272	IR RECEIVER
24	809-857-485	SCREW, HHCS $\frac{5}{16}$ -18 X 3.00 GR8 BO
25	801-757-160	SCREW, FBCS $\frac{5}{16}$ -18 X 1.00 GR8 BO
26	818-757-121	SCREW, HWMS $\frac{5}{16}$ -18 X 0.75 BP DP
27	051-200-449	METAL CORE BUMPER
28	804-549-207	U BOLT, UB $\frac{1}{4}$ -20 X 0.56 X 1.25 ZN
29	01-519	NUT, HFLN $\frac{5}{16}$ -18 ZN SER
30	834-557-002	NUT, HLN $\frac{5}{16}$ -18 ZN
31	838-549-002	NUT, HLN $\frac{1}{4}$ -20 ZN NE
32	948-722-111	WASHER, FW $\frac{5}{16}$ SAE BO
33	948-753-101	WASHER, FW $\frac{1}{4}$ SAE BO
34	722-504-010	SPACER, SFR 0.38 X 0.48 X 0.375
35	722-501-102	SPACER, SFR 0.32 X 0.75 X 1.25 AL
36	907-200-800	KEY, SQ 0.19 X 0.72 Q
37	801-757-121	SCREW, FBCS $\frac{5}{16}$ -18 X 0.75 GR5 BP PA
38	785-501-786	COUPLING HUB
39	838-740-002	NUT, HLN 10-32 ZN NM
40	817-157-151	SCREW, HHMS $\frac{5}{16}$ -18 X 0.94 BP SEMS DP
41	843-140-002	NUT, KN 10-32 ZN
42	818-240-062	SCREW, PHPMS 10-32 X 0.38 ZN SEMS
43	051-200-499	SENSOR CABLE TAPE
44	051-200-529	GROUNDING CABLE, CHAIN LIFT
45	051-070-084	DECAL, ENTANGLEMENT - GEARS
46	051-200-129	REST RAIL, COVER, LOWER
47	051-200-131	REST RAIL, COVER, UPPER
48	051-200-258	ASM, LIFTER CONTROL

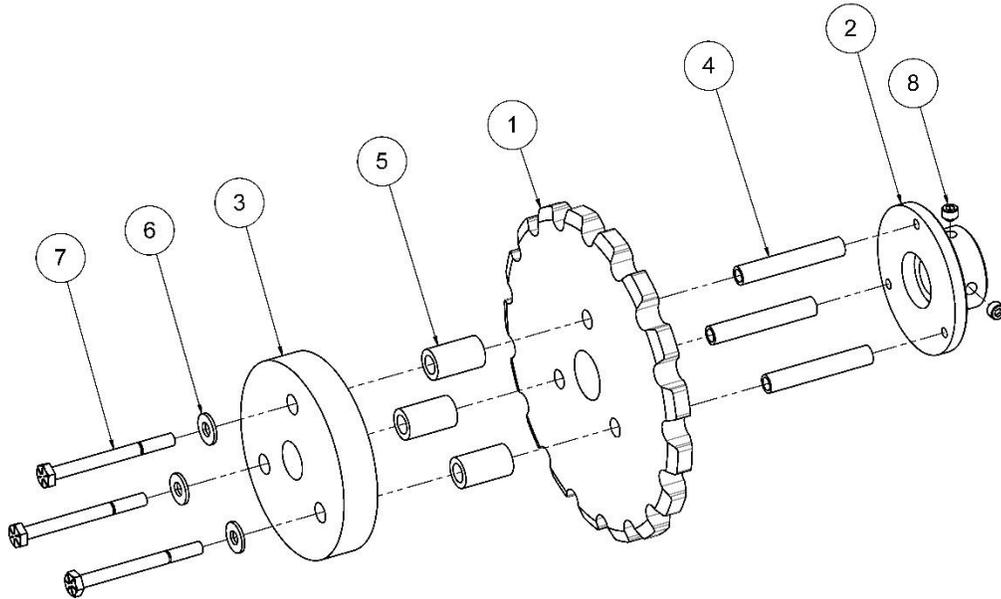


## Chain Lift Assembly Parts List cont.

Item	Part Number	Description
49	785-501-788	COUPLING SPIDER
50	785-501-786	COUPLING HUB
51	051-200-311	GEARMOTOR MOUNT PLATE
52	827-006-167	SCREW, HWMS M6-1 X 16 ZN FT
53	711-520-013	GROMMET, GPI 0.31 X 0.50 X 0.25 RB



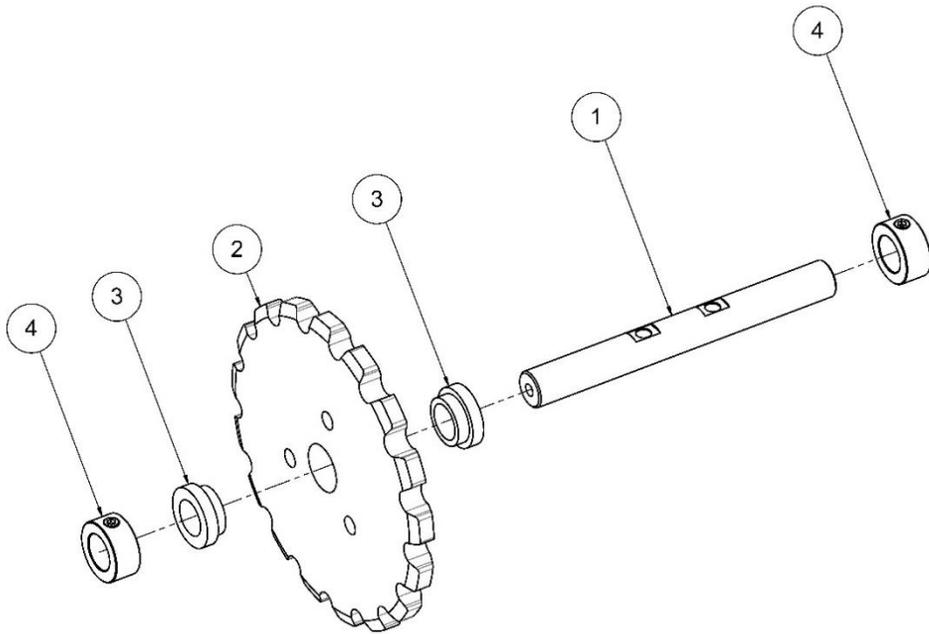
### 5.33. Chain Lift Upper Sprocket Assembly



Item	Part Number	Description
1	051-200-113	CHAIN LIFT, PLATE SPROCKET
2	051-200-114	CHAIN LIFT, SPROCKET DRIVE HUB
3	051-200-115	UPPER LIFTER CAM
4	051-200-456	SPACER, SFR 0.25 X 0.38 X 2.28 ZN
5	722-501-097	SPACER, SFR 0.38 X 0.63 X 1.06 AL
6	948-753-101	WASHER, FW 1/4 SAE BO
7	809-849-445	SCREW, HHCS 1/4-20 X 2.75 GR8 BO
8	7014-003118-025	SET SCREW, SSS 5/16-18 X 0.25 CUP BO



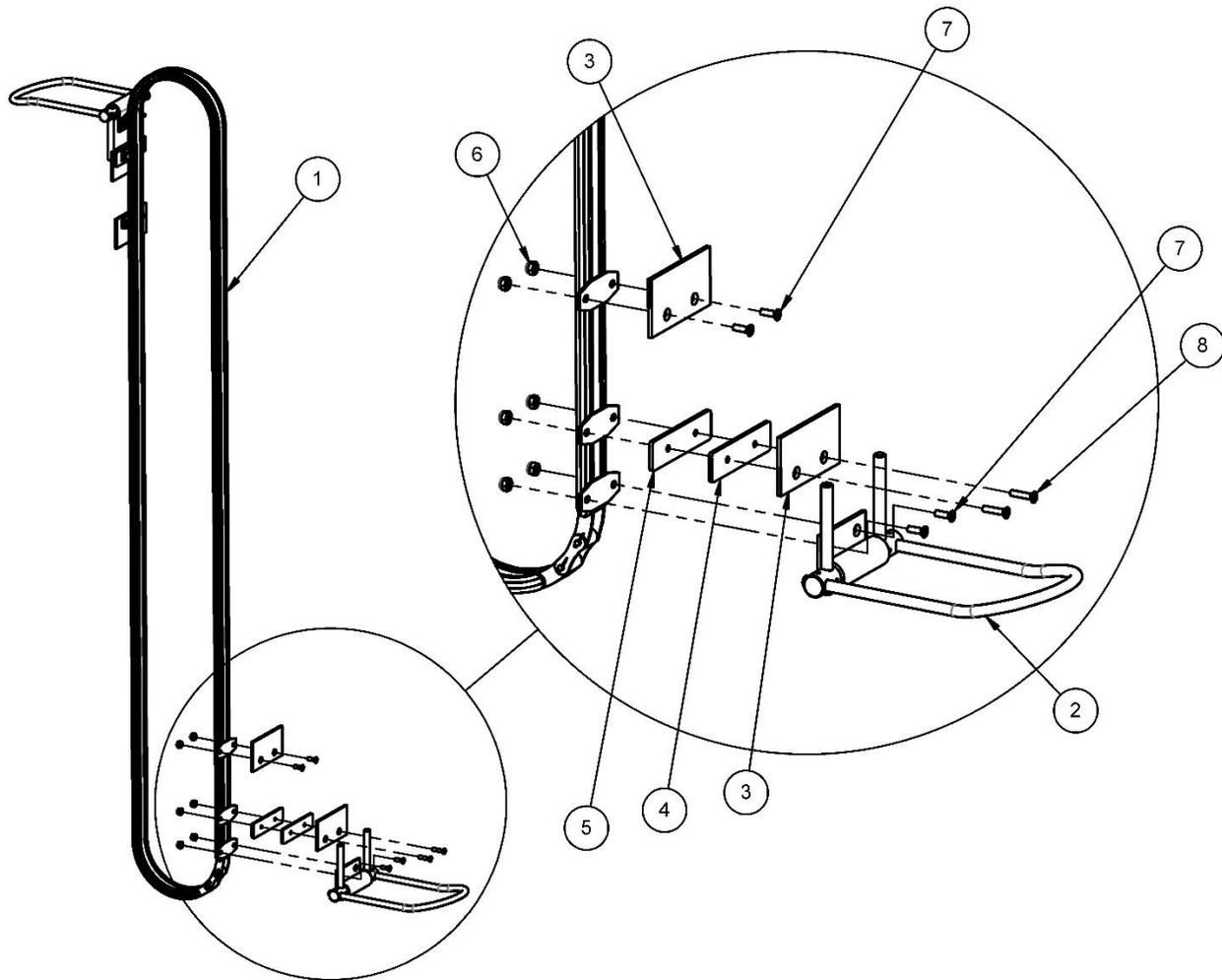
### 5.34. Chain Lift Lower Sprocket Assembly



Item	Part Number	Description
1	051-200-118	CHAIN LIFT, IDLER SHAFT
2	051-200-113	CHAIN LIFT, PLATE SPROCKET
3	051-200-180	CHAIN LIFT IDLER BEARING
4	901-100-111	COLLAR, CLLR SLD 0.75 X <sup>5</sup> / <sub>16</sub> -18 ZN



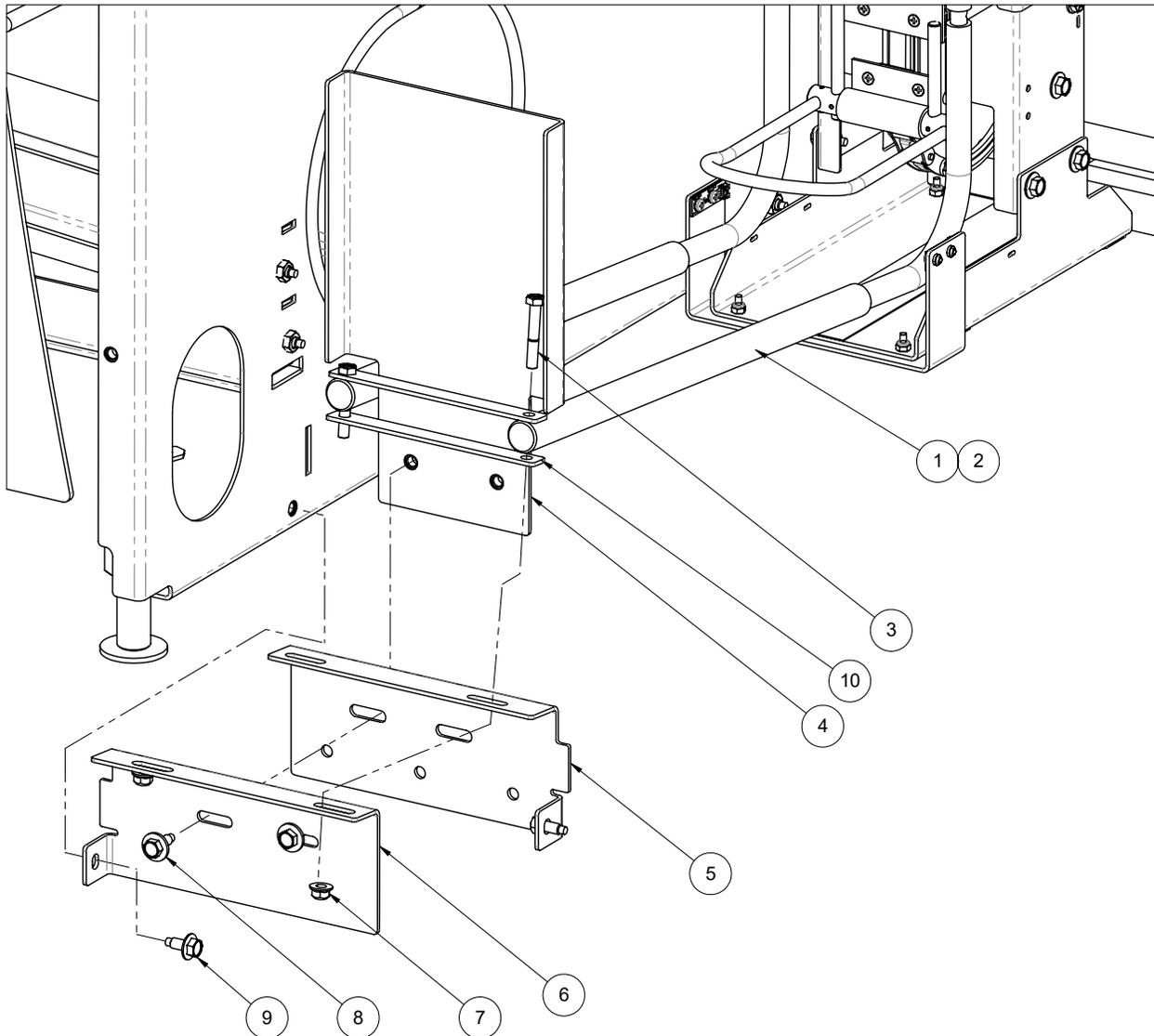
### 5.35. Chain Lift Chain Assembly



Item	Part Number	Description
1	051-200-121	CHAIN
2	051-200-124	LIFTER ASM
3	051-200-123	LIFTER PAD
4	051-200-122	LIFTER STOP BAR
5	051-200-138	STOP BAR WEAR PAD
6	838-740-002	NUT, HLN 10-32 ZN NM
7	01-123	SCREW, FHPMS 10-32 X 0.63 ZN
8	811-940-147	SCREW, FHPMS 10-32 X 0.88 ZN



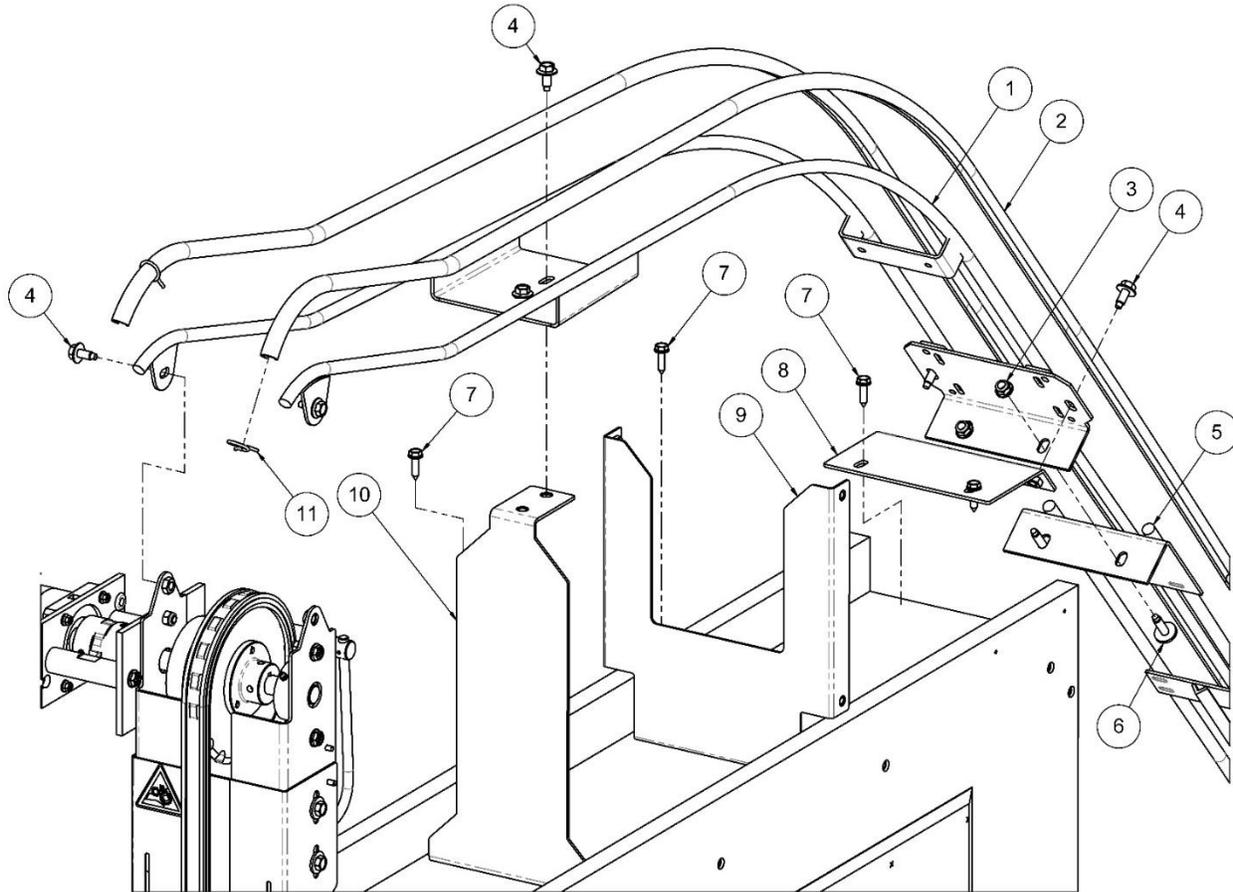
### 5.36. Double Division Rail Assembly



Item	Part Number	Description
1	051-200-143	RAMP RAIL
2	051-200-673	REINFORCED RAMP RAIL COVER
3	809-857-325	SCREW, HHCS $\frac{5}{16}$ -18 X 2 GR8 BO
4	051-200-145	WDMT, RAMP BALL DEFLECTOR
5	051-200-147	RAMP RAIL SUPPORT ODD
6	051-200-146	RAMP RAIL SUPPORT EVEN
7	856-157-001	$\frac{5}{16}$ -18 HFLN BO STV
8	817-157-151	SCREW, HHMS $\frac{5}{16}$ -18 X 0.94 BP SEMS DP
9	818-757-121	SCREW, HWMS $\frac{5}{16}$ -18 X 0.75 BP DP
10	051-200-807	RAMP RAIL STRAP



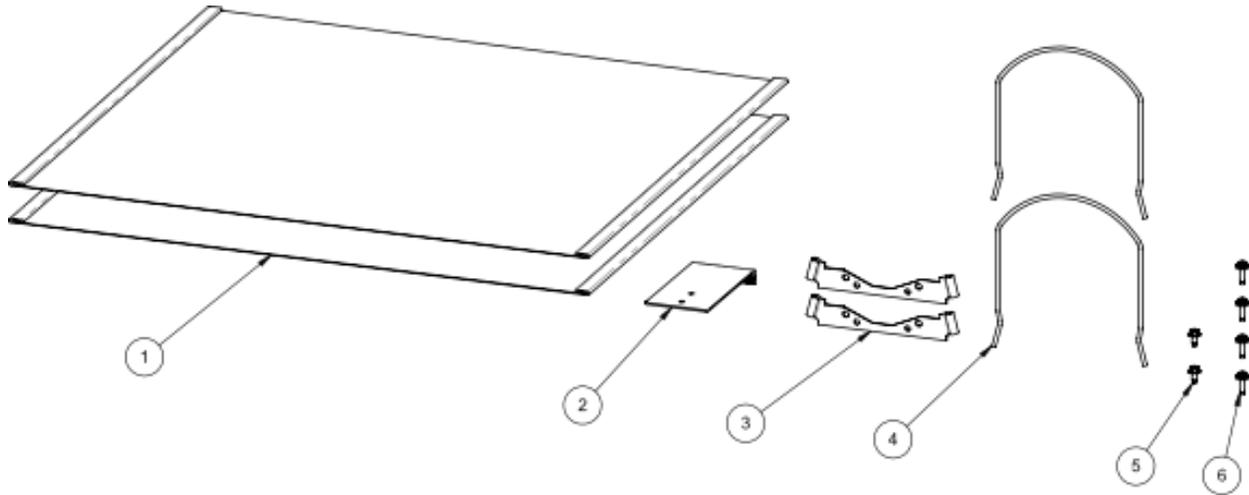
### 5.37. Cross Sweep Assembly



Item	Part Number	Description
1	051-200-090	WDMT, CROSS SWEEP
2	051-200-503	BALL RAIL WEAR COVER
3	856-057-007	NUT, HFLN $\frac{5}{16}$ -18 ZN NE GR5
4	818-757-121	SCREW, HWMS $\frac{5}{16}$ -18 X 0.75 BP DP
5	049-006-353	RAIL DOWNSWEEP WDMT
6	817-157-201	SCREW, HHMS $\frac{5}{16}$ -18 X 1.25 BP SEMS DP
7	859-048-167	SCREW, FBL $\frac{1}{4}$ X 1.00 ZN
8	051-200-096	WDMT, CROSS SWEEP, FRONT BRKT
9	051-200-491	WDMT, DBLDIV SIDE GUARDS, BRKT
10	051-200-098	WDMT, CROSS SWEEP, CENTER BRKT
11	744-102-058	HOSE CLAMP



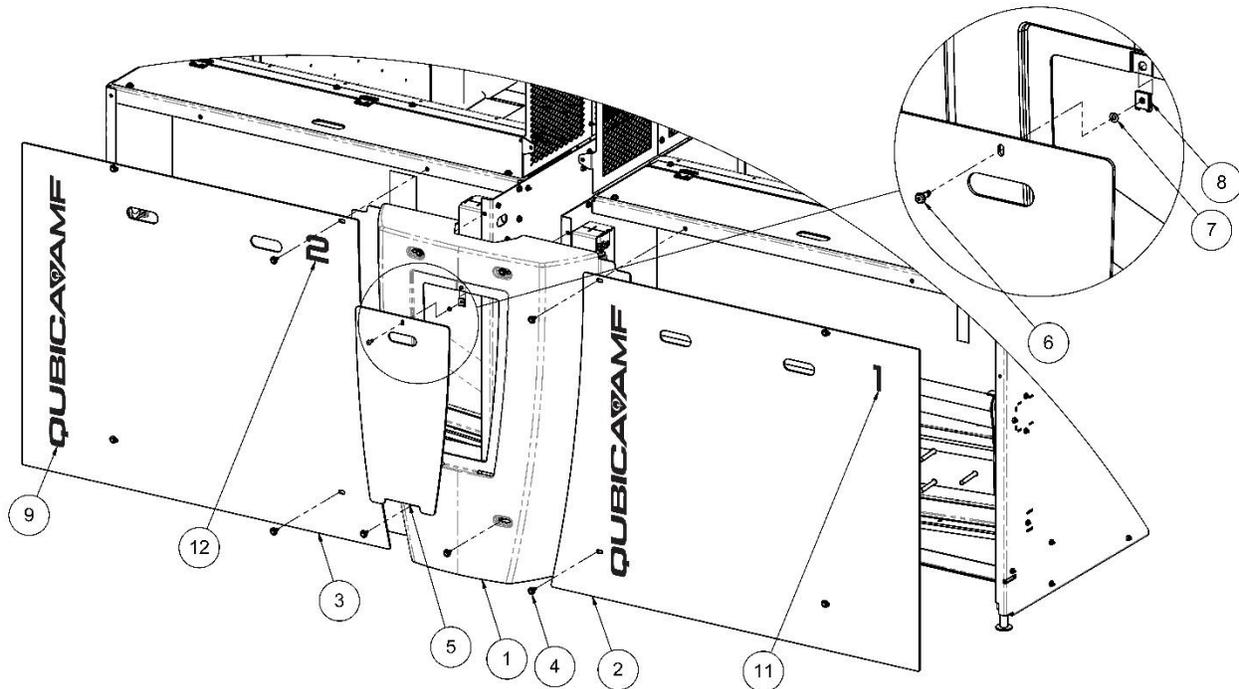
### 5.38. Ball Wiper



Item	Part Number	Description
1	070-004-869	CLOTH BALL WIPER
2	051-200-759	BALL RAIL WEAR COVER
3	000-021-813	SUPPORT - WIPE
4	000-021-820	WIPER CLOTH RING, NEW
5	818-757-121	HWMS 5/16-18 X .75 BP DP
6	817-157-201	SCREW, HHMS 5/16-18 X 1.25 BP SEMS DP



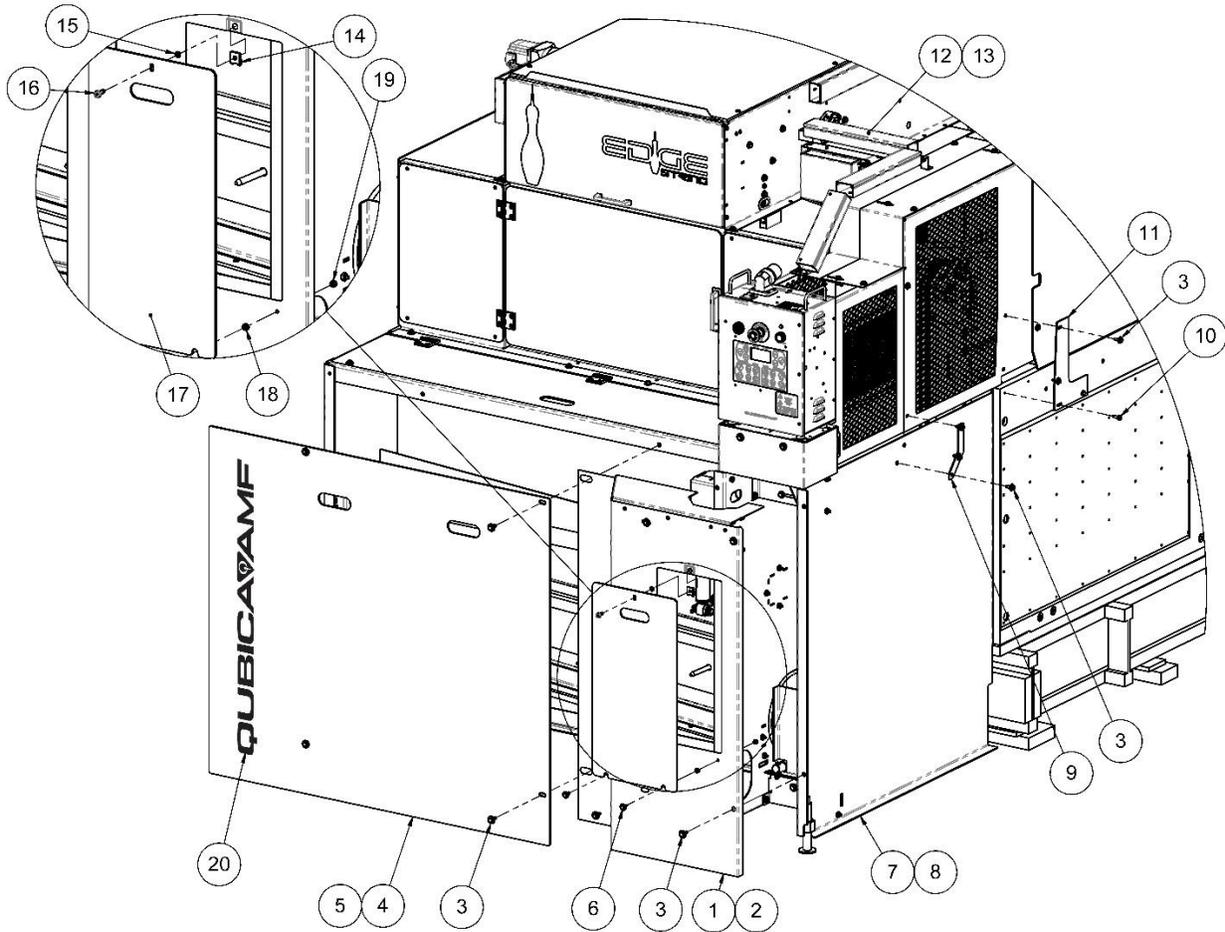
### 5.39. Double Division & Pit Rear Guards (Pair)



Item	Part Number	Description
1	051-200-526	ASM, DBL DIV GUARD
2	051-200-631	ASM, PIT REAR GUARD, ODD
3	051-200-632	ASM, PIT REAR GUARD, EVN
4	817-157-151	SCREW, HHMS <sup>5</sup> / <sub>16</sub> -18 X 0.94 BP SEMS DP
5	051-200-528	DBL DIV ACCESS PANEL
6	709-002-050	¼ TURN FASTENER - MALE
7	709-002-051	WASHER, QTB RT 85-34-301-12
8	709-002-022	¼ TURN FASTENER - FEMALE
9	051-200-589	DECAL, REAR PIT GUARD
10	051-200-590	DECAL, MACHINE NUMBER 0
11	051-200-591	DECAL, MACHINE NUMBER 1
12	051-200-592	DECAL, MACHINE NUMBER 2
13	051-200-593	DECAL, MACHINE NUMBER 3
14	051-200-594	DECAL, MACHINE NUMBER 4
15	051-200-595	DECAL, MACHINE NUMBER 5
16	051-200-596	DECAL, MACHINE NUMBER 6
17	051-200-597	DECAL, MACHINE NUMBER 7
18	051-200-598	DECAL, MACHINE NUMBER 8
19	051-200-599	DECAL, MACHINE NUMBER 9



### 5.40. Double Division & Pit Rear Guard (Single)

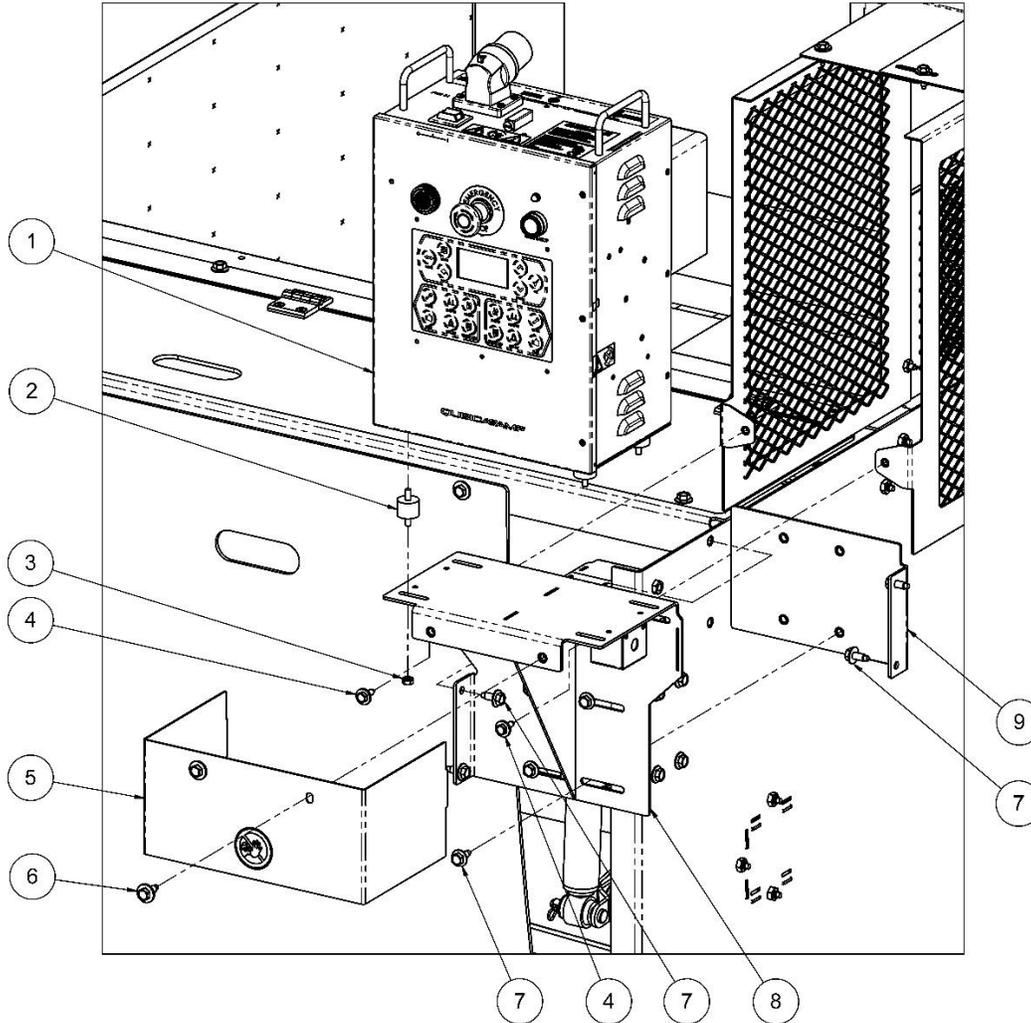


## Double Division & Pit Rear Guard - Single Lane Parts List

Item	Part Number	Description
1	051-200-560	ASM, GUARD, DBL DIV, SINGLE EVEN
2	051-200-561	ASM, GUARD, DBL DIV, SINGLE ODD
3	817-157-151	SCREW, HHMS $\frac{5}{16}$ -18 X 0.94 BP SEMS DP
4	051-200-634	ASM, PIT REAR GUARD, EVEN, SINGLE
5	051-200-633	ASM, PIT REAR GUARD, ODD, SINGLE
6	817-149-141	SCREW, HHMS $\frac{1}{4}$ -20 X 0.88 BP SEMS DP
7	051-200-580	WDMT, SIDE FRAME, SINGLE EVEN
8	051-200-581	WDMT, SIDE FRAME, SINGLE ODD
9	051-200-556	SIDE FRAME CL GUARD BRKT
10	859-048-167	SCREW, FBLs $\frac{1}{4}$ X 1.00 ZN
11	051-200-557	KICKBACK CL GUARD BRKT
12	051-200-549	ASM, WW, SINGLE, EVEN
13	051-200-547	ASM, WW, SINGLE, ODD
14	709-002-022	$\frac{1}{4}$ TURN FASTENER - FEMALE
15	709-002-051	WASHER, QTB RT 85-34-301-12
16	709-002-050	$\frac{1}{4}$ TURN FASTENER - MALE
17	051-200-567	DBL DIV ACCESS PANEL, XW-SINGLE
18	088-200-278	SPACER, SFR 0.25 X 0.50 X 0.19 ZN
19	838-549-002	NUT, HLN $\frac{1}{4}$ -20 ZN NE
20	051-200-589	DECAL, REAR PIT GUARD



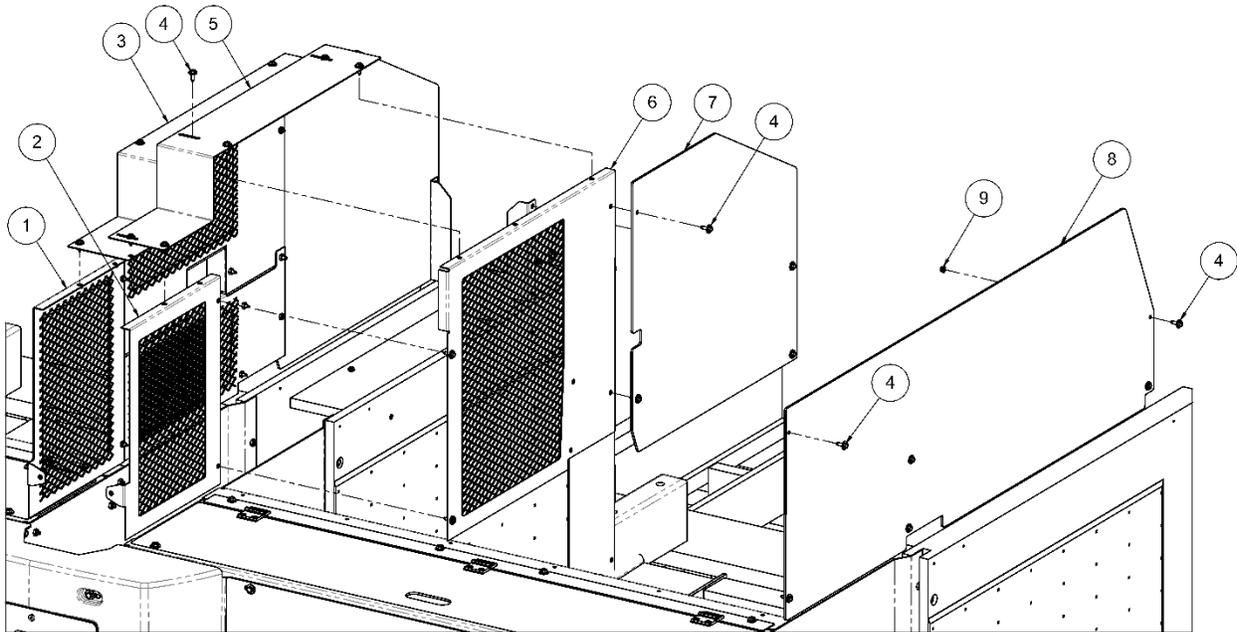
### 5.41. System Controller & Mounting Bracket



Item	Part Number	Description
1	051-200-243-T	SYSTEM CONTROLLER
2	051-000-043	ISOLATOR, M-M, 1/4-20, RB
3	843-149-002	NUT, KN 1/4-20 ZN
4	817-149-141	SCREW, HHMS 1/4-20 X 0.88 BP SEMS DP
5	051-200-441	SYSTEM CONTROLLER GUARD
6	817-157-151	SCREW, HHMS 5/16-18 X 0.94 BP SEMS DP
7	818-757-121	SCREW, HWMS 5/16-18 X 0.75 BP DP
8	051-200-366	WDMT, CONTROLLER MOUNT EVN
9	051-200-368	WDMT, CONTROLLER MOUNT ODD

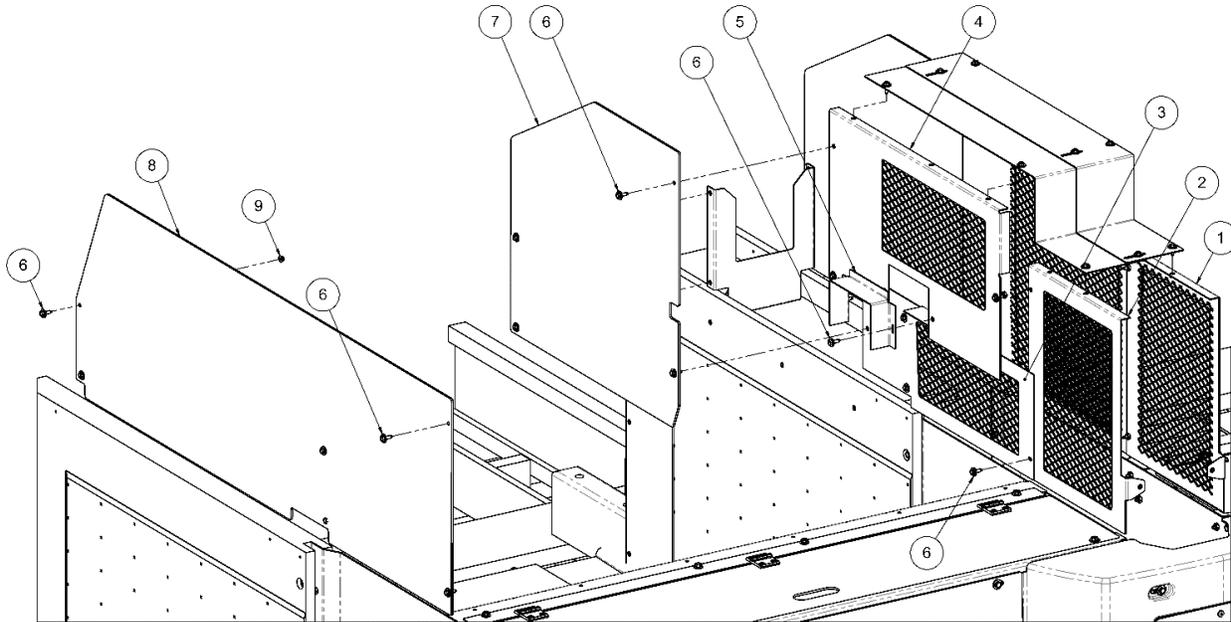


## 5.42. Chain Lift & Side Guards (Odd)



Item	Part Number	Description
1	051-200-393	WDMT, GUARD, BALL RETURN, EVEN
2	051-200-390	WDMT, GUARD, BALL RETURN, ODD
3	051-200-468-01	WDMT, C LIFT GUARD, TOP EVEN
4	817-149-141	SCREW, HHMS ¼-20 X 0.88 BP SEMS DP
5	051-200-467-01	C LIFT GUARD, TOP ODD
6	051-200-457	WDMT, C LIFT GUARD, ODD
7	051-200-630	CROSS SWEEP SIDE GUARD
8	051-200-568	SIDE GUARD, COMMON DIV
9	856-149-001	NUT, HFLN ¼-20 BO STV

### 5.43. Chain Lift & Side Guards (Even)



Item	Part Number	Description
1	051-200-390	WDMT, GUARD, BALL RETURN, ODD
2	051-200-393	WDMT, GUARD, BALL RETURN, EVEN
3	051-200-460	WDMT, C LIFT GUARD, EVN BTM
4	051-200-464	WDMT, C LIFT GUARD, EVN TOP
5	051-200-463	C LIFT, COUPLING GUARD
6	817-149-141	SCREW, HHMS ¼-20 X 0.88 BP SEMS DP
7	051-200-630	CROSS SWEEP SIDE GUARD
8	051-200-568	SIDE GUARD, COMMON DIV
9	856-149-001	NUT, HFLN ¼-20 BO STV



## ORDER PARTS ONLINE

[eshop.qubicaamf.com](http://eshop.qubicaamf.com)

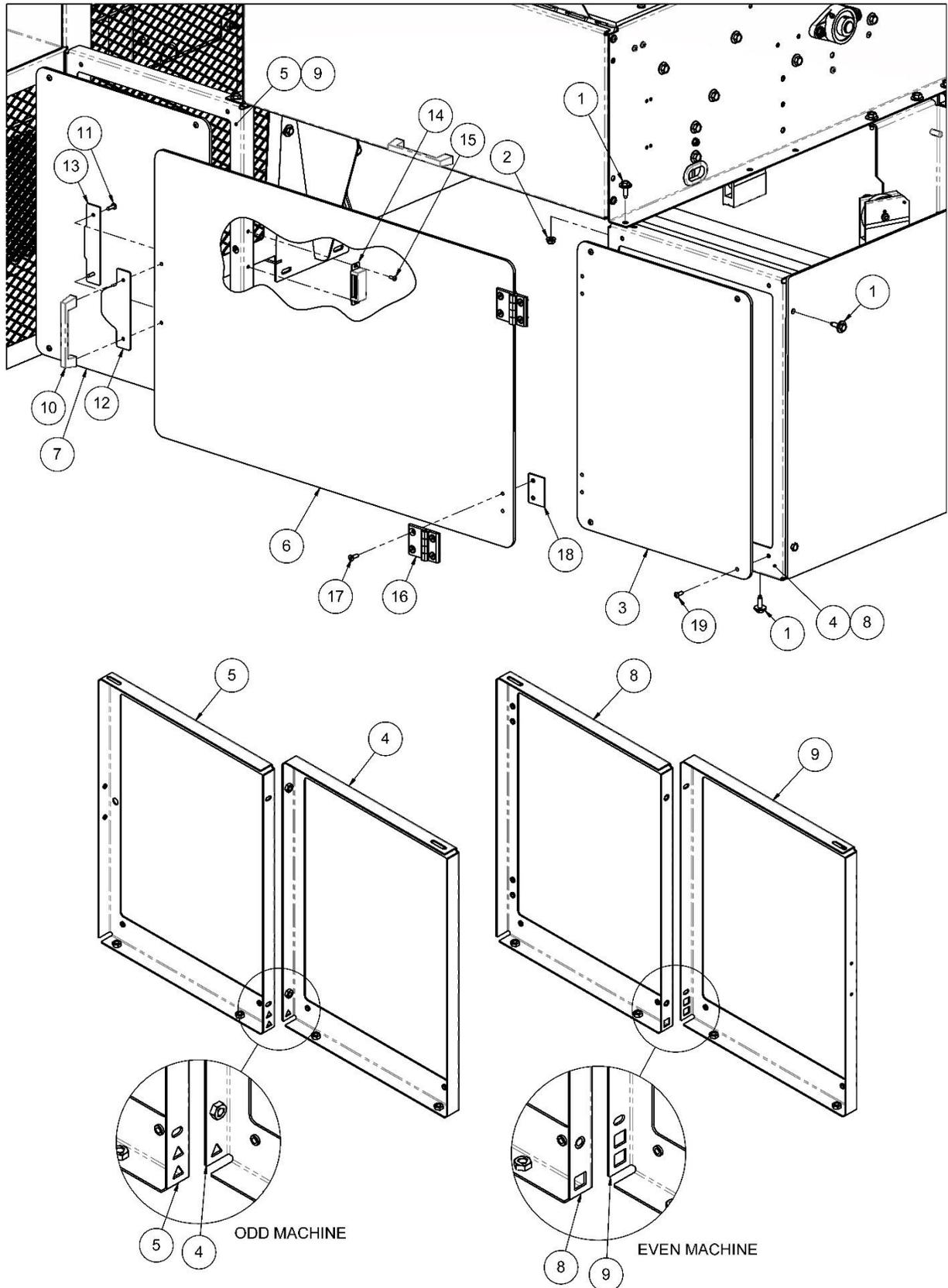
### BENEFITS

- ▶ Drill Down Menu by Machine Type
- ▶ Assembly Drawings with Hotspots
- ▶ Up-To-Date Cross-References
- ▶ Quick Order Form
- ▶ Thousands of High-Quality Photographs

QubicaAMF  eShop  
AMAZINGLY EASY



### 5.44. Machine Rear Cover

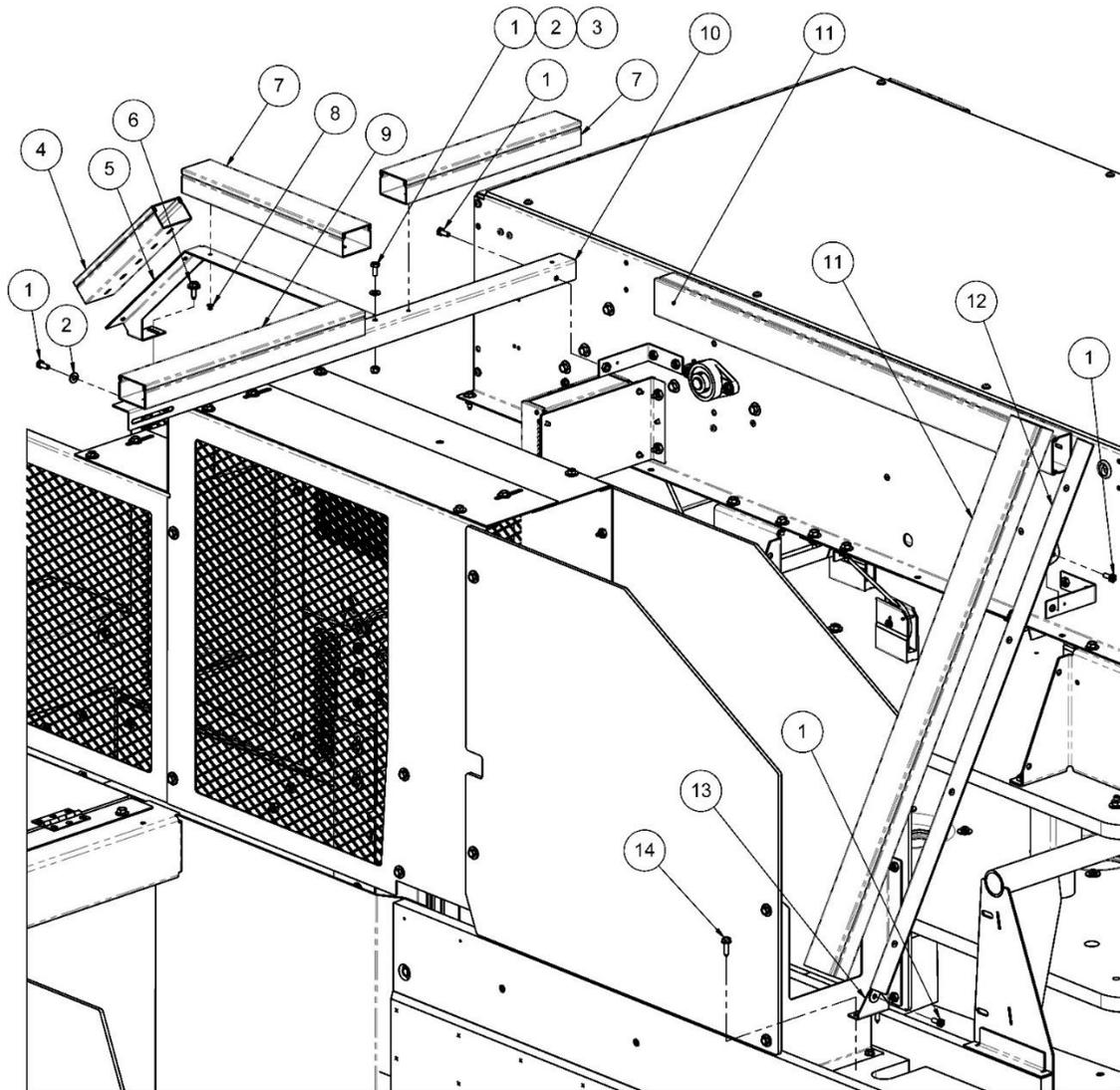


## Machine Rear Cover Parts List

Item	Part Number	Description
1	817-149-141	SCREW, HHMS ¼-20 X 0.88 BP SEMS DP
2	856-149-001	NUT, HFLN ¼-20 BO STV
3	051-200-611	PC, SIDE PANEL, HINGE
4	051-200-613	WDMT, PC PNL FRAME, HINGE, ODD
5	051-200-615	WDMT, PC PNL FRAME, CATCH, ODD
6	051-200-610	PC DOOR PANEL
7	051-200-612	PC SIDE PANEL, CATCH
8	051-200-619	WDMT, PC PNL FRAME, HINGE, EVN
9	051-200-617	WDMT, PC PNL FRAME, CATCH, EVN
10	051-200-259	PULL HANDLE
11	7024-710800-075	SCREW, THPTS 8 X 0.75 ZN TYA
12	051-200-621	LATCH STRIKE BRKT, DOOR
13	051-200-622	DOOR, LATCH BACKER
14	051-200-608	MAGNETIC LATCH
15	813-227-062	SCREW, PHPMS 6-32 X 0.38 ZN
16	051-200-601	HINGE
17	808-549-108	SCREW, FBSCS 10-32 X 0.63 BO
18	051-200-623	ASM, PC, HINGE PLATE
19	808-540-081	SCREW, BHSCS 10-32 X 0.50 BO



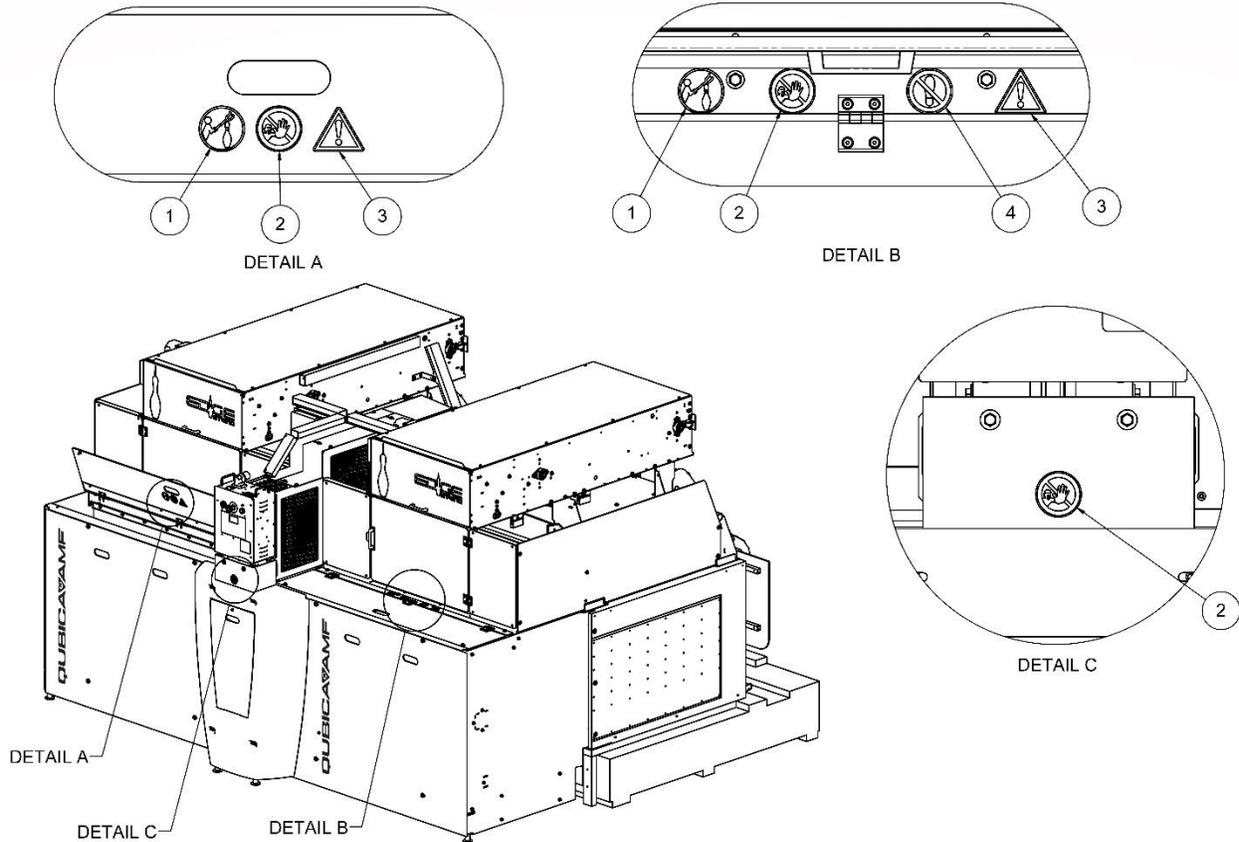
### 5.45. Wireways



Item	Part Number	Description
1	809-849-100	SCREW, HHCS ¼-20 X 0.63 GR8 BO
2	948-753-101	WASHER, FW ¼ SAE BO
3	838-549-002	NUT, HLN ¼-20 ZN NE
4	051-200-500	WIRE DUCT, CONTROLLER, SHORT
5	051-200-484	WW SUPPORT, CONTROLLER
6	817-149-141	SCREW, HHMS ¼-20 X 0.88 BP SEMS DP
7	051-200-416	WIRE DUCT, CROSS MACH, SHORT
8	7108-401800-050	RIVET, RVT BLD 0.19 X 0.43 AL
9	051-200-417	WIRE DUCT, CROSS MACH, LONG
10	051-200-415	WW SUPPORT, CROSS MACHINE
11	051-200-419	WIRE DUCT, MACHINE
12	051-200-422	WW SUPPORT, DOUBLE DIV
13	051-200-421	WDMT, DOUBLE DIV WW BRKT
14	859-048-167	SCREW, FBL S ¼ X 1.00 ZN



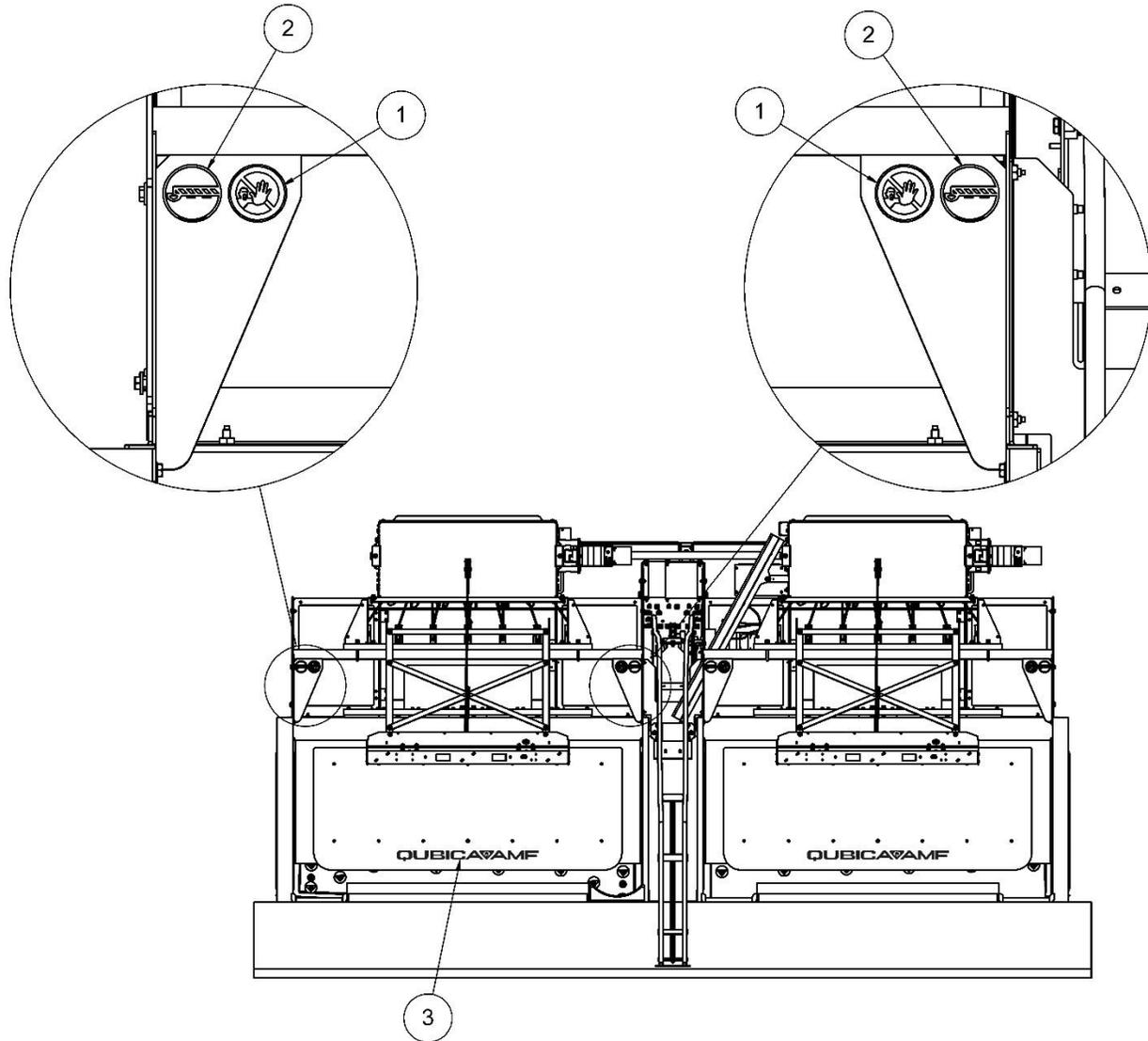
### 5.46. Safety Labels (Rear)



Item	Part Number	Description
1	051-070-082	DECAL, PIN HOOK
2	051-070-043	DECAL, NO ACCESS UNAUTHORIZED
3	051-070-083	DECAL, WARNING
4	051-070-044	DECAL, NO STEP



### 5.47. Safety Labels (Front)



Item	Part Number	Description
1	051-070-043	DECAL, NO ACCESS UNAUTHORIZED
2	051-070-134	DECAL, LANE BARRIER
3	051-200-587	DECAL, SHIELD



## ORDER PARTS ONLINE

[eshop.qubicaamf.com](http://eshop.qubicaamf.com)

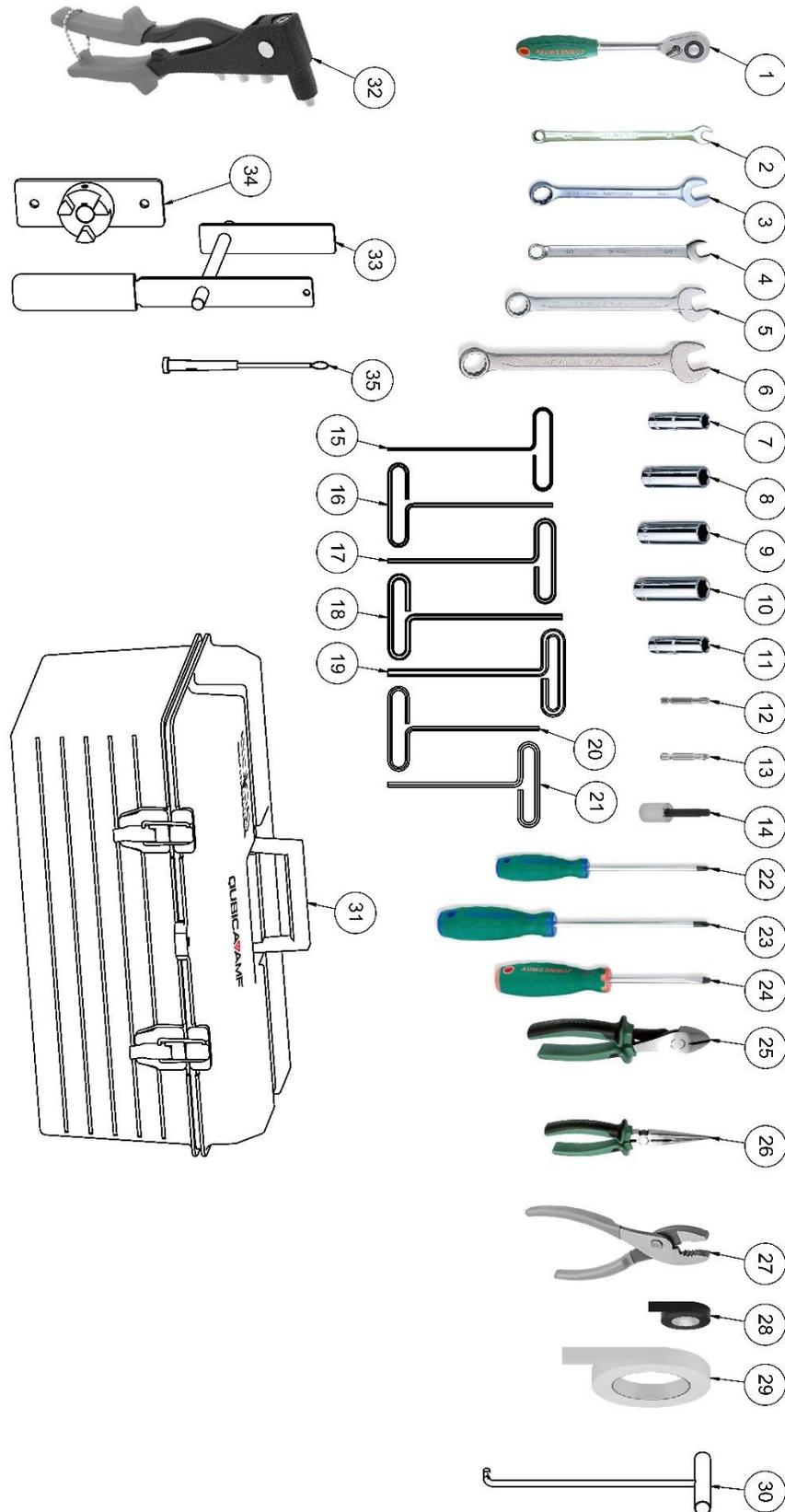
### BENEFITS

- ▶ Drill Down Menu by Machine Type
- ▶ Assembly Drawings with Hotspots
- ▶ Up-To-Date Cross-References
- ▶ Quick Order Form
- ▶ Thousands of High-Quality Photographs

QubicaAMF  eShop  
AMAZINGLY EASY



### 5.48. EDGE String Tool Kit



## EDGE Sting Tool Kit Parts List

Item	Part Number	Description
1	789-505-008	$\frac{3}{8}$ DRIVE RATCHET
2	793-506-022	$\frac{3}{8}$ COMBINATION WRENCH
3	793-506-023	$\frac{7}{16}$ COMBINATION WRENCH
4	793-506-024	$\frac{1}{2}$ COMBINATION WRENCH
5	793-506-025	$\frac{9}{16}$ COMBINATION WRENCH
6	793-506-050	$\frac{3}{4}$ COMBINATION WRENCH
7	789-509-033	$\frac{3}{8}$ DEEP SOCKET, $\frac{3}{8}$ DRIVE
8	789-509-018	$\frac{7}{16}$ DEEP SOCKET, $\frac{3}{8}$ DRIVE
9	789-509-030	$\frac{1}{2}$ DEEP SOCKET, $\frac{3}{8}$ DRIVE
10	789-509-019	$\frac{9}{16}$ DEEP SOCKET, $\frac{3}{8}$ DRIVE
11	789-510-057	8mm DEEP SOCKET, $\frac{3}{8}$ DRIVE
12	792-004-006	PHILLIPS BIT, #3
13	792-004-003	PHILLIPS BIT, #2
14	780-501-010	$\frac{3}{16}$ HEX BIT SOCKET, $\frac{3}{8}$ DRIVE
15	793-502-061	$\frac{3}{32}$ ALLEN WRENCH
16	793-502-062	$\frac{1}{8}$ ALLEN WRENCH
17	793-502-063	$\frac{5}{32}$ ALLEN WRENCH
18	793-502-064	$\frac{3}{16}$ ALLEN WRENCH
19	793-502-065	$\frac{1}{4}$ ALLEN WRENCH
20	793-516-001	4mm ALLEN WRENCH
21	793-516-005	5mm ALLEN WRENCH
22	789-001-002	#2 PHILLIPS SCREWDRIVER
23	789-001-003	#3 PHILLIPS SCREWDRIVER
24	789-006-008	$\frac{1}{4}$ SLOTTED SCREWDRIVER
25	786-504-004	DIAGONAL CUTTING PLIERS
26	786-502-002	NEEDLE NOSE PLIERS
27	786-503-003	SLIP JOINT PLIERS
28	724-001-012	ELECTRICAL TAPE ROLL
29	724-008-013	MASKING TAPE ROLL
30	792-505-036	SPRING PULLER
31	792-005-061	TOOL BOX
32	792-524-001	POP RIVET TOOL
33	051-200-472	CHAIN TENSIONER TOOL
34	051-200-532	CHAIN LIFT SERVICE LOCK
35	051-200-700	STRING SLEEVE TOOL



## ORDER PARTS ONLINE

[eshop.qubicaamf.com](http://eshop.qubicaamf.com)

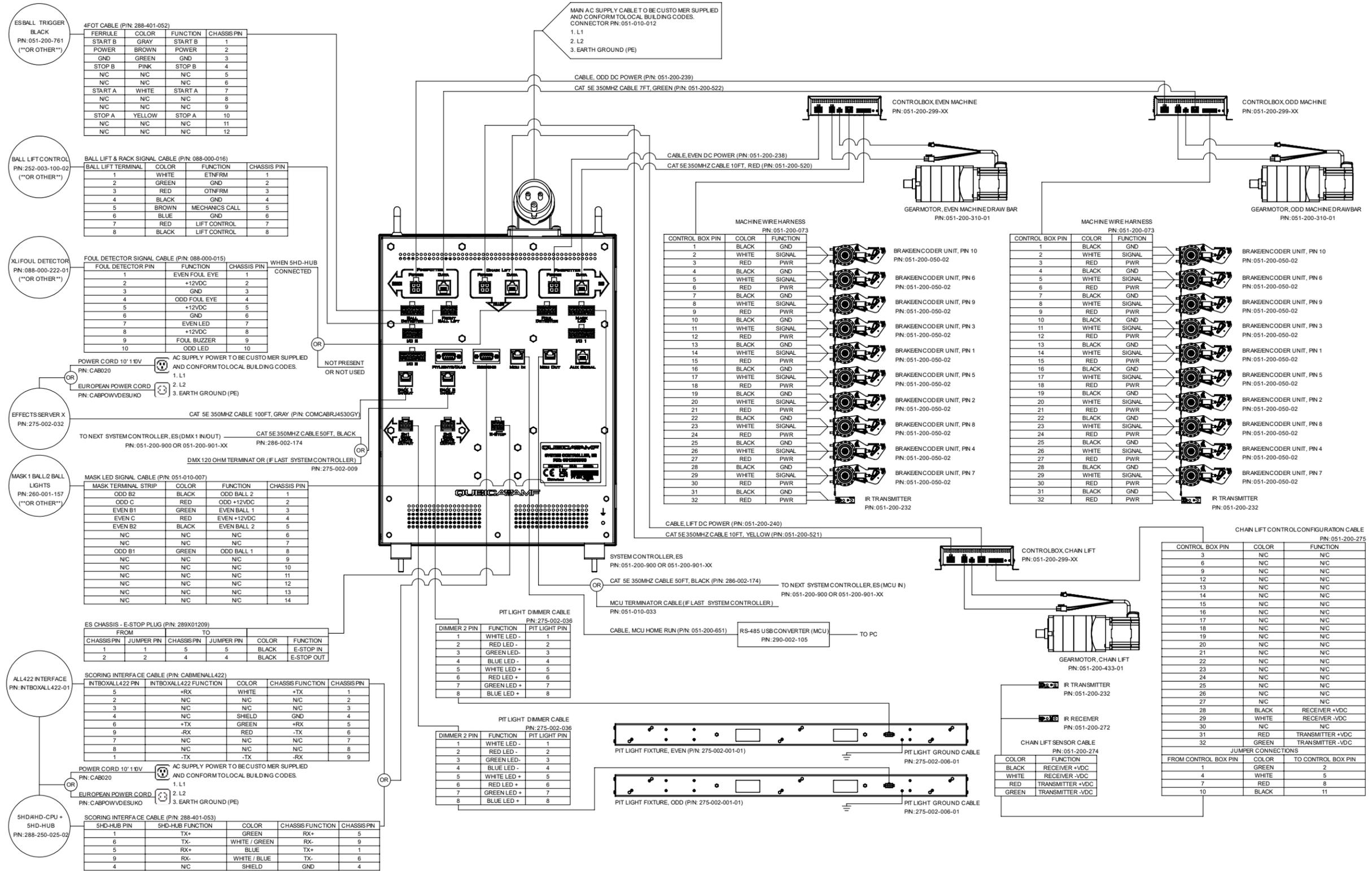
### BENEFITS

- ▶ Drill Down Menu by Machine Type
- ▶ Assembly Drawings with Hotspots
- ▶ Up-To-Date Cross-References
- ▶ Quick Order Form
- ▶ Thousands of High-Quality Photographs

QubicaAMF  eShop  
AMAZINGLY EASY



### 5.49. Cables





## Appendix A. Lockout/Tagout (LOTO) Procedure

**Note:** The following appendix is a copy of document 400-051-203, current revision.





# EDGE String Lockout/Tagout (LOTO) Procedure

## Document Overview

This document outlines the recommended lockout/tagout (LOTO) supplies and procedures for the EDGE String. This information should be used to supplement a facility's existing LOTO program. Please note that the facility is responsible for creating and maintaining a LOTO program in compliance with applicable safety standards. This document alone does not constitute a regulation-compliant LOTO program.

## Owner/Facility Manager Responsibilities

Under national law in the USA and EU countries, it is the responsibility of the owner/facility manager to provide a safe workplace. A safe working environment includes training on the proper use of LOTO procedures and devices.

### WARNING:



- **High voltage is present inside the system controller. Use caution when operating or handling this equipment. Implement lockout/tagout (LOTO) before servicing any electrical components. The main circuit breaker must always be OPEN, or the power plug DISCONNECTED, prior to performing any service/repair to electrical systems.**



- **The system controller contains no user-serviceable parts.**
- **The system controller includes a tamper indicator. Opening the system controller enclosure will void the warranty.**

## I. LOTO Overview

Potential for serious injury exists if an operator attempts to work inside the machine boundary of an energized machine. A machine is considered energized whenever it is connected to a main power supply. Energized machines may cycle automatically. Machine components could move without warning and injure an operator attempting to work inside the machine boundary. No person should ever attempt to work inside the machine boundary of an energized machine!

Lockout/Tagout (LOTO) includes a set of supplies and procedures for temporarily de-energizing a machine. With LOTO implemented, a machine's main electrical power is physically removed and can only be restored by the same operator who de-energized the equipment. This also prevents anyone from restoring electrical power inadvertently. LOTO is a crucial aspect of workplace safety when performing troubleshooting and maintenance tasks.

### Note

- A machine is energized if main electrical power is physically connected to a machine AND the machine's main power supply circuit breaker is ON.



- A machine may be energized even if its system controller power switch is set to OFF.
- A machine may be energized even if it is not operating.

## II. LOTO Supplies

### A. LOTO Device Overview

There is a wide variety of LOTO supplies depending on the application. Several common LOTO items are shown below. Note that some, but not all of these items are supplied with the EDGE String. The owner/facility manager is responsible for selecting and procuring additional LOTO supplies based on the specific operational requirements of a given facility.



**Padlocks**



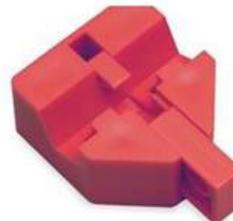
**Plug Lockout**



**Lock Tags**



**Plug Lockout**



**Circuit Breaker Lockout**



**All manufacturer-supplied decals must be applied to LOTO supplies before use. All decals must be in place at all times.**



**Lockout Hasp for Multiple Padlocks**



**Lockout Hasp for Multiple Padlocks**



## B. Distribution of LOTO Padlocks and Lock Tags

The owner/facility manager is responsible for the availability and safe distribution of all LOTO padlocks and lock tags. Below are two suggested procedures for managing this responsibility. Note, these are recommended procedures only. The owner/facility manager is responsible for defining all LOTO procedures based on the specific operational requirements of a given facility.

### I. Padlock/Lock Tag Procedure 1

The owner/facility manager issues padlocks and lock tags directly to each operator permitted to work on the machine(s). Each operator should be issued a minimum of three lock tags. Each operator must mark his/her name on each lock tag using a permanent marker or label maker. Each operator must always keep all assigned padlocks and lock tags in his/her possession while on duty.

Operator padlocks and lock tags may be used together with a plug lockout, circuit breaker lockout, or lockout hasp to implement LOTO on a machine. These supplies should be kept in one secure area accessible to all operators. While LOTO is implemented, the operator must place his/her personal lock tag on the LOTO device. The operator must keep his/her key in his/her possession until all work is completed and LOTO is removed.

Once LOTO is removed, the operator should retrieve his/her personal lock tag and return all used LOTO supplies to the facility's designated safety center. An operator's personally assigned padlocks and lock tags should be stored in the facility's safety center while that operator is off duty.

### II. Padlock/Lock Tag Procedure 2

The owner/facility manager issues a minimum of three lock tags directly to each operator permitted to work on the machine(s). Each operator must mark his/her name on each lock tag using a permanent marker or label maker. Each operator must always keep all assigned lock tags in his/her possession while on duty.

The owner/facility manager shall determine all required LOTO supplies (padlocks, plug lockouts, circuit breaker lockouts, lockout hasps, etc.) and shall locate these supplies at each machine.

While LOTO is implemented, the operator must place his/her personal lock tag on the LOTO device. The operator must keep the padlock key in his/her possession until all work is completed and LOTO is removed.

Once LOTO is removed, the operator should retrieve his/her personal lock tag and return all used LOTO supplies to the designated safety center for that machine. An operator's personally assigned lock tags should be stored in the facility's safety center while that operator is off duty.



### III. EDGE String LOTO Procedure

Below are recommended LOTO procedures for various machine/facility configurations. Note, these are recommended procedures only. The owner/facility manager is responsible for defining all LOTO procedures based on the specific operational requirements of the facility.

#### Read This First

- All operators must be trained on a facility's safety rules and practices (including LOTO) before performing any operation or maintenance tasks.
- Operators may perform required operation and maintenance tasks only under the supervision of a facility manager. Only a facility manager is authorized to conduct operator training.
- The operator who implements LOTO (as evidenced by lock tag) is the only person permitted to remove the LOTO. Under no circumstances is an operator allowed to unlock a LOTO device that was implemented by another operator. This includes, but is not limited to, cutting off padlocks or otherwise bypassing an LOTO device to restore machine power. Only a facility manager may grant authority to cut off a padlock after ensuring the machine is safe to energize.
- LOTO must be implemented before any machine guards are removed.
- All machine guards must be installed before a machine is energized.
- Never reach into or cross over the machine boundary of an energized machine.
- An energized machine may be observed from another machine to which LOTO has been applied.
- If a machine will be down overnight, turn off main power to the machine pair and leave a note for the next shift. LOTO is not required overnight if an operator is not inside the machine boundary. LOTO must be implemented when maintenance resumes.

#### A. LOTO at System Controller

The system controller main power plug is the primary location for LOTO of a machine pair. Follow the steps below.

1. Turn off main power to the machine pair by switching the system controller main power switch to OFF.
2. Remove the system controller main power plug.
3. Implement LOTO by placing the main power plug in a plug lockout. Lock the plug lockout using a padlock and secure a lock tag through the padlock shackle. See Figure A-1. Note, the lock tag must be labeled with the name of the operator implementing the LOTO.





**Figure A-1, Single Operator LOTO**



**Figure A-2, Multiple Operator LOTO**

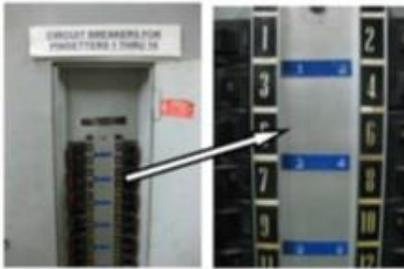
4. If more than one operator will be working on the machine(s), each operator must place a padlock and lock tag on the plug lockout. Additional padlocks can be locked directly through the plug lockout (if the lockout has multiple lock holes) or can be used in combination with a multi-hole lockout hasp. See Figure A-2.
5. **TEST.** Verify that the machine pair is de-energized by switching the system controller main power switch to ON. Wait 10 seconds. If the system controller display remains off (blank) and there are no signs of machine activation (e.g. beeping, clicking, LEDs on, etc.), the machine pair is de-energized. Otherwise, LOTO has not been implemented correctly. Repeat Steps 1-4 to ensure LOTO is implemented correctly. After a successful test, switch the system controller main power switch back to OFF.
6. Perform all required maintenance, troubleshooting, cleaning tasks.
7. Once all work is complete, ensure that all personnel and tools are out of the machine boundary.
8. Remove all LOTO devices and re-insert the main power plug into the system controller.
9. Switch system controller main power switch to ON.
10. Press **RESET E-STOP** button on system controller.
11. Wait for system controller to finish booting up.
12. Set Odd and Even lane *Chassis Mode* to BOWL.
13. Press **FULL SET**, then **PLAY** for each lane to reconnect both lanes with facility scoring system (if installed).



## B. LOTO at Circuit Breaker Service Panel

LOTO may also be implemented at a facility's circuit breaker service panel. This method should be used for hard-wired equipment or devices that cannot be otherwise unplugged or turned off with a lockable switch. Note, all circuit breakers must be properly marked with the machine/device that they power (see Figure A-3). Follow the steps below.

1. Turn off main power to the machine pair by switching the system controller main power switch to OFF.
2. Turn off the service panel circuit breaker that powers the machine pair.
3. Place a circuit breaker lockout over the appropriate circuit breaker. Lock the circuit breaker lockout using a padlock and secure a lock tag through the padlock shackle. See Figure A-4. Alternatively, a padlock may be used to lock the service panel door. Lock the door using a padlock and secure a lock tag through the padlock shackle. See Figure A-5. In either case, the lock tag must be labeled with the name of the operator implementing the LOTO.



**Figure A-3, Circuit Breaker Labels**



**Figure A-4, Circuit Breaker LOTO**



**Figure A-5, Service Panel LOTO**

4. If more than one operator will be working on the machine(s), each operator must place a padlock and lock tag on the lockout device. Additional padlocks can be locked directly through the circuit breaker lockout (if the lockout has multiple lock holes) or can be used in combination with a multi-hole lockout hasp.
5. **TEST.** Verify that the machine pair is de-energized by switching the system controller main power switch to ON. Wait 10 seconds. If the system controller display remains off (blank) and there are no signs of machine activation (e.g. beeping, clicking, LEDs on, etc.), the machine pair is de-energized. Otherwise, LOTO has not been implemented correctly. Repeat Steps 1-4 to ensure LOTO is implemented



- correctly. After a successful test, switch the system controller main power switch back to OFF.
6. Perform all required maintenance, troubleshooting, cleaning tasks.
  7. Once all work is complete, ensure that all personnel and tools are out of the machine boundary.
  8. Remove all LOTO devices and switch the service panel circuit breaker to ON.
  9. Switch system controller main power switch to ON.
  10. Press **RESET E-STOP** button on system controller.
  11. Wait for system controller to finish booting up.
  12. Set Odd and Even lane *Chassis Mode* to BOWL.
  13. Press **FULL SET**, then **PLAY** for each lane to reconnect both lanes with facility scoring system (if installed).

### C. LOTO of Groups of Machines

It may sometimes be necessary to de-energize a large group of machines or all machines in a facility. Follow the steps below.

1. Turn off main power to each machine pair by switching the system controller main power switch to OFF.
2. Turn off all service panel circuit breakers that power the machines to be de-energized.
3. Close the service panel door. Lock the door using a padlock and secure a lock tag through the padlock shackle. See Figure A-5. The lock tag must be labeled with the name of the operator implementing the LOTO.
4. If more than one operator will be working on the machine, each operator must place a padlock and lock tag on the service panel door. Additional padlocks can be locked directly through the door (if the door has multiple lock holes) or can be used in combination with a multi-hole lockout hasp.
5. **TEST.** Verify that each machine pair is de-energized by switching the system controller main power switch to ON. Wait 10 seconds. If the system controller display remains off (blank) and there are no signs of machine activation (e.g. beeping, clicking, LEDs on, etc.), the machine pair is de-energized. Otherwise, LOTO has not been implemented correctly. Repeat Steps 1-4 to ensure LOTO is implemented correctly. After a successful test, switch each system controller main power switch back to OFF.
6. Perform all required maintenance, troubleshooting, cleaning tasks.
7. Once all work is complete, ensure that all personnel and tools are out of the machine boundary.



8. Remove all LOTO devices and switch the service panel circuit breakers to ON.
9. Switch each system controller main power switch to ON.
10. Press **RESET E-STOP** button on each system controller.
11. Wait for each system controller to finish booting up.
12. Set Odd and Even lane *Chassis Mode* to BOWL for each system controller.
13. Press **FULL SET**, then **PLAY** for each lane to reconnect all lanes with facility scoring system (if installed).

#### D. LOTO of Auxiliary Equipment

LOTO must be implemented on any device before performing maintenance tasks. Note that implementing LOTO on a machine pair does not de-energize all related auxiliary equipment, including the front ball return.

Depending on the design of the equipment to be LOTO, follow one of the above procedures to de-energize the device. Devices equipped with a main power plug can be LOTO using a plug lockout. Hard-wired devices must be LOTO at the circuit breaker powering the equipment. Always test to ensure that a device is fully de-energized before performing any maintenance tasks. After all work is complete, remove all LOTO devices, re-energize the equipment, and test for proper operation.

### IV. LOTO Inspection Procedure

The facility manager must conduct periodic inspections of the facility's machine guards, LOTO procedures, and LOTO supplies. This inspection must cover the requirements and procedures of this document [and 29 CFR 1910.147(c) in USA]. The purpose of this inspection is to ensure that all operators understand and follow such requirements and procedures and that all machine guards and LOTO supplies are present and in working order.

During the inspection, the facility manager must confirm that every authorized operator understands and can demonstrate how to conduct all applicable LOTO procedures. This aspect of the inspection must be documented in the LOTO Procedure Inspection Form (see Page A-11).

The facility manager must note any deviations or inadequacies and develop a plan to correct those deviations or inadequacies through training, improved supervision, device replacement, or otherwise.

The facility manager must certify that he/she performed the inspection using the LOTO Procedure Inspection Form. The facility manager must sign and date this form, note the center name, address, and phone number, equipment type(s), all defects or deficiencies and the plan to correct them, and the names of all operators who participated in the inspection.

Inspection frequency is set by the facility manager and depends on the center's safety and operator training programs.



<b>LOTO Procedure Inspection Form</b>	
<b>Inspector's Full Name:</b>	
<b>Center Name:</b>	<b>Center Address:</b>
<b>Center Phone Number:</b>	
<b>Bowling Equipment Type(s):</b>	
<b>Correction Plan for any Deviations or Inadequacies Identified During Inspection:</b>	
<b>Operator Name(s):</b>	<b>Demonstrates understanding of all LOTO procedures, including proper use of all LOTO devices. (Yes/ No)</b>
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
<p>I hereby certify that I have conducted the LOTO Procedure Inspection to ensure that all LOTO procedures and the requirements of this section [and 29 CFR 1910.147(c) in USA] are being followed.</p> <p><b>Inspector's Signature:</b> _____</p> <p><b>Date of Inspection:</b> _____</p>	





## Appendix B. Declaration of Conformity

**Note:** The following appendix is a copy of documents 400-051-237 and 400-051-238, current revision.

400-051-202-01 Rev. B

WORLDWIDE HEADQUARTERS  
8100 AMF Drive - Mechanicsville, Va 23111 - USA  
Tel: (804) 569-1000



EUROPEAN HEADQUARTERS  
Via della Croce Coperta, 15 - 40128 Bologna - Italy  
Tel: +39 051.4192.611

Page B-1



## B 1. EU Declaration of Conformity

**Document Number: 400-051-237\_A**  
**Original Document in English**

 <b>EU DECLARATION OF CONFORMITY</b> <b>(According to Machinery Directive 2006/42/EC, Annex 2A)</b>	
<p>We hereby declare that the machinery described below complies with the essential machine health and safety requirements of Directive 2006/42/EC and the electromagnetic compatibility requirements of Directive 2014/30/EU.</p>	
<i>Conforming Machinery:</i>	EDGE String
<i>Type/Function:</i>	Bowling machine / String Pinspotter
<i>Model Number:</i>	051-202-000, 051-202-001, 051-202-002
<i>Manufacturer:</i>	QubicaAMF Worldwide, LLC 8100 AMF Drive Mechanicsville, Virginia 23111 USA
<i>Subject Authorized to Compile the Technical File:</i>	QubicaAMF Europe S.p.A. Via della Croce Coperta 15 40128 Bologna, Italy
<i>Authorized Representative:</i>	QubicaAMF Europe S.p.A. Via della Croce Coperta 15 40128 Bologna, Italy
<i>Date of Issue:</i>	August 27, 2021
<i>Place of Issue:</i>	Via della Croce Coperta 15 40128 Bologna, Italy
<i>Signed:</i>	
<i>Signatory:</i>	Roberto Vaioli Technical Director



## B 2. UK Declaration of Conformity

**Document Number: 400-051-238\_A**  
**Original Document in English**

 <b>UKCA DECLARATION OF CONFORMITY</b>	
<p>We hereby declare that the machinery described below complies with the Essential machine Health and Safety Requirements of UK Supply of Machinery (Safety) Regulations 2008 as amended by the Product Safety and Metrology Regulations 2019 and UK Electromagnetic Compatibility Regulations 2016 as amended by the Product Safety and Metrology Regulations 2019.</p>	
<i>Conforming Machinery:</i>	EDGE String
<i>Type/Function:</i>	Bowling machine / String Pinspotter
<i>Model Number:</i>	051-202-000, 051-202-001, 051-202-002
<i>Manufacturer:</i>	QubicaAMF Worldwide, LLC 8100 AMF Drive Mechanicsville, Virginia 23111 USA
<i>Conforms with Designated Standards:</i>	BS EN ISO 12100:2010, BS EN IEC 62368-1:2019, BS EN IEC 60204-1:2016, BS EN 55011:2009, BS EN IEC 61000-6-1:2007
<i>Date of Issue:</i>	August 27, 2021
<i>Place of Issue:</i>	QubicaAMF Europe S.p.A. Via della Croce Coperta 15 40128 Bologna, Italy
<i>Signed:</i>	
<i>Signatory:</i>	Roberto Vaioli Technical Director



## Appendix C. Blank

**Note:** This section intentionally left blank.





## Appendix D. Preventive Maintenance (PM)





# Preventive Maintenance (PM)

## Section Overview

This section defines the recommended preventive maintenance intervals for the EDGE String. Preventive maintenance intervals are 25,000 frames/quarterly, 50,000 frames/bi-annually and 100,000 frames/annually. Preventive maintenance should be performed at the stated frame count or time interval, whichever comes first. All preventive maintenance tasks are grouped into three main services (A, B, C & D) with the corresponding service specified for each interval.

## Manufacturer's Recommendations

- Always use original QubicaAMF parts with your equipment.
- Always order parts by part number and description. See Section 5 (Parts).
- Always have your equipment's serial number available when placing an order.

## Preventive Maintenance Chart Usage

- PM charts should be posted in a visible location in the machine area.
- PM charts can be laminated and filled in using a grease pencil or dry erase marker.
- When filling out PM charts, operators should make note of all component replacements and checks. Note, a component may not be sufficiently worn to warrant replacement at the time of inspection. Keep track of any worn components as they may require replacement before the next stated preventive maintenance inspection.



## I. Preventive Maintenance Intervals

Perform preventive maintenance tasks according to the following chart. Recommended service intervals are specified for the first 500,000 frames/5 years of machine operation. Re-use this chart for the next 500,000 frames/5 years of machine operation.

All preventive maintenance intervals should be performed at the stated frame count or time interval, whichever comes first.

Maintenance Interval	Service
25,000 Frames / 3 Months	D
50,000 Frames / 6 Months	A, D
75,000 Frames / 1 ¼ Years	D
100,000 Frames / 1 Year	B, D
125,000 Frames / 1 ¾ Years	D
150,000 Frames / 1 ½ Years	A, D
175,000 Frames / 1 ¾ Years	D
200,000 Frames / 2 Years	B, D
225,000 Frames / 2 ¼ Years	D
250,000 Frames / 2 ½ Years	A, D
275,000 Frames / 2 ¾ Years	D
300,000 Frames / 3 Years	B, D
325,000 Frames / 3 ¼ Years	D
350,000 Frames / 3 ½ Years	A, D
375,000 Frames / 3 ¾ Years	D
400,000 Frames / 4 Years	B, D
425,000 Frames / 4 ¼ Years	D
450,000 Frames / 4 ½ Years	A, D
475,000 Frames / 4 ¾ Years	D
500,000 Frames / 5 Years	C, D

**Table D-1, Preventive Maintenance Intervals**



## II. Service Type Definitions

Perform the following service types as specified in Table D-1.

Maintenance Task	Component Reference	Instruction Reference	Service			
			A	B	C	D
• Check string adjustment. Perform string adjustment if needed.	-	p. 3-5	√**	√**	√**	
• Check drawbar chain tension. Adjust as needed.	-	p. E-7		√	√	
• Check chain lift chain tension. Adjust as needed.	-	p. E-18		√	√	
• Lubricate drawbar chains.	-	p. E-25		√	√	
• Lubricate chain lift chain and lifter assemblies.	-	p. E-25		√	√	
• Check all pins for wear. Replace or rotate pins as needed.	Item 1 (p. 5-4)	p. 3-9, 3-11		√	√	√
• Check all string sleeves for wear. Replace as needed.	Item 2 (p. 5-4)	p. 3-9		√	√	
• Check all pin strings for wear. Replace as needed.	Item 3 (p. 5-4)	p. 3-8; 3-10		√	√	
• Check double division rail covers for wear. Replace or rotate as needed.	Item 2 (p. 5-49)	p. E-24		√	√	
• Check cushion rivets for wear. Replace as needed.	Item 6 (p. 5-30); Item 6 (p. 5-36)	p. E-23		√	√	
• Check shield actuation & hard-stop string adjustment. Adjust as needed.	Item 10 (p. 5-22); Item 25 (p. 5-24)	p. E-15		√	√	
• Check pit cushion assembly (including cushion facing) for worn components. Replace as needed.	All Items (p. 5-30 & 5-36)	p. E-22			√	
• Check pit cushion blocks for wear. Replace as needed.	Item 2 (p. 5-38); Item 2 (p. 5-39)	p. E-21			√	
• Check pit cushion shocks for proper operation. Replace as needed.	Item 2 (p. 5-37)	p. E-21			√	
• Check pit curtain for wear or curling. Replace as needed.	Item 16 (p. 5-28); Item 16 (p. 5-34)	p. E-23			√	
• Check pit floor assembly for worn components. Replace as needed.	All Items (p. 5-26 & 5-32)	p. E-24			√	
• Check chain lift rest rail covers for wear. Replace as needed.	Items 46 & 47 (p. 5-42)	p. E-20			√	
• Check chain lift lifter assembly wear pads for wear. Replace as needed.	Item 5 (p. 5-48)	p. E-20			√	
• Check chain lift lower sprocket bushings for wear. Replace as needed.	Item 3 (p. 5-47)	p. E-20			√	
• Check chain lift lower cam roller for wear. Replace as needed.	Item 14 (p. 5-42)	p. E-20			√	
• Check cross sweep rail covers for wear. Replace as needed.	Item 2 (p. 5-50)	-			√	
• Check reel arm assemblies for excess play. Replace bushings or assemblies as needed.	Item 3 (p. 5-19)	p. E-5			√	
• Check drawbar and chain lift coupling spiders for wear. Replace as needed.	Item 11 (p. 5-10); Item 49 (p. 5-43)	p. E-10; E-19			√	
• Check upper table pulleys for wear. Replace as needed.	Item 5 (p. 5-20)	p. E-12			√	

\*\*If the machine control box indicates that a string is too tight (indicator LED blinking), string adjustment must be performed immediately. If the machine control box indicates that a string is too loose (indicator LED ON), string adjustment can be performed according to Table D-1, above.





## Appendix E. Non-Routine Maintenance Procedures





## E 1. Section Overview

This section contains information and instructions about non-routine maintenance interventions for the EDGE string.

### Applicable Warnings



### Tools

In addition to safety tools described in Section 1 (Safety), other tools may be required for specific tasks. See each intervention for list of tools needed.

### WARNING:



- **High voltage is present inside the system controller. Use caution when operating or handling this equipment. Implement lockout/tagout (LOTO) before servicing any electrical components (see Appendix A). The main circuit breaker must always be OPEN, or the power plug DISCONNECTED, prior to performing any service/repair to electrical systems.**



- **The system controller contains no user-serviceable parts.**
- **The system controller includes a tamper indicator. Opening the system controller enclosure will void the warranty.**

- **LOCKOUT/TAGOUT PROCEDURE MUST BE PERFORMED** whenever an operator crosses machine boundary to perform maintenance. Ensure that all power is off and machine cannot re-energize. Lockout/Tagout operation protects against potential entanglement and potential electrical hazard. See Appendix A.
- Thrown balls and scattering pins can cause injury if bowling play is allowed during an operator intervention. Operator is responsible to perform all required safety procedures. Deploy lane barriers to protect against thrown balls during maintenance (see Page 1-7).
- Level 2 interventions may only be performed by qualified personnel. Owner/facility manager must verify that operators are trained to work safely and perform required safety tasks.



## Bolt Torque Table

Table E-1 shows typical bolt tightening torque values for reference in inch-pounds, foot-pounds and Newton-meters. If a different torque value is specified in this or another manual, then follow the specification given.

**Table E-1, Bolt Torques**

Bolt Size	lb-in	lb-ft	Nm
# 10	20 – 30	1.6 – 2.5	2.2 – 3.4
1/4"	144 – 180	12 – 15	16 – 20
5/16"	216 – 240	18 – 20	24 – 27
3/8"	276 – 300	23 – 25	31 – 34
1/2"	336 – 360	28 – 30	38 – 41





### E.1.1. Replace Reel Arm Assembly

**Precautions:** LOTO, Lane Barriers

**Tools:**

- Ratchet or Impact Driver
- ½" Socket
- Diagonal Cutters
- Masking Tape
- Permanent Marker

**Location:** Operator Access Area (behind machine)

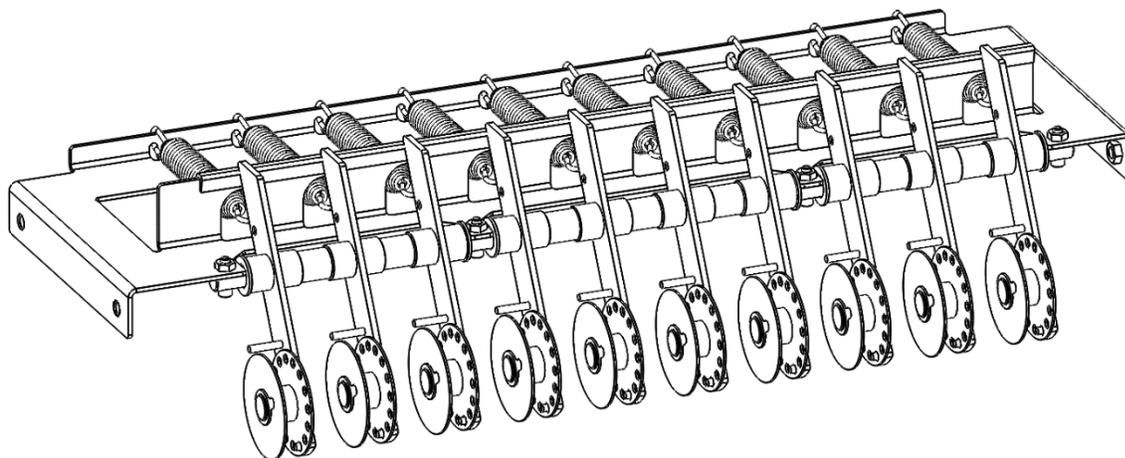
**Est. Time:** 15 min

**Note:**

- Replace all removed cable ties before returning machine to service.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Open reel arm cover.
3. Unwind strings from reel arm spools, untie retaining knots, and label strings using masking tape and marker.
4. Unplug cable to tangle switch emitter board and cut cable ties holding cable to side frame.
5. Remove bolts (4) attaching reel arm assembly to pinspotter frame.
6. Slide reel arm assembly out of pinspotter frame.
  - a. If repairing reel arm assembly, remove springs with spring puller before disassembling unit.
7. Follow above steps in reverse order to install reel arm assembly.
8. Remove LOTO and lane barriers. Return machine to service.



**Figure E-1, Reel Arm Assembly**



## E.1.2. Replace Brake/Encoder Unit

**Precautions:** LOTO, Lane Barriers

**Tools:**

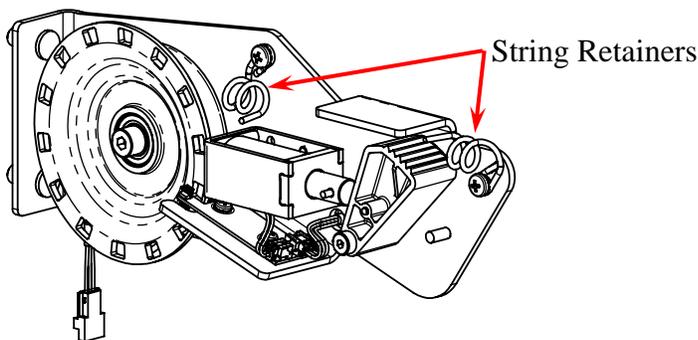
- Ratchet or Impact Driver
- ½" Socket

**Location:** Operator Access Area (behind machine)

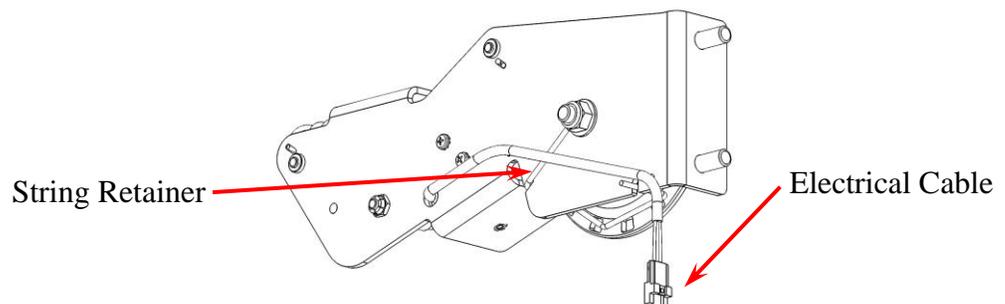
**Est. Time:** 5 min

### Procedure:

1. Before implementing LOTO, press **FULL SET**.
2. Implement LOTO and deploy lane barriers.
3. Open reel arm cover and locate brake/encoder unit number on C-channel.
4. Disconnect brake/encoder electrical cable (see Figure E-3).
5. Using a ratchet or impact driver with a ½" socket, remove flange nuts (2) holding brake/encoder unit to C-channel. While removing second nut, hold brake/encoder unit to prevent unit from falling.
6. Holding brake/encoder unit, remove string from all string retainers (see Figures E-2, E-3).
7. Follow above steps in reverse order to install brake/encoder unit.
8. After installation, remove LOTO and press **PINS UP**. Wait for machine to lift pins, then press **FULL SET** to confirm pin brake is operating correctly.
9. Remove lane barriers and return machine to service.



**Figure E-2, Brake/Encoder String Retainers**



**Figure E-3, Brake/Encoder String Retainer & Electrical Cable**





### E.1.3. Adjust Drawbar Chain Tension

**Precautions:** LOTO, Lane Barriers, Slip Hazard, Trip Hazard

**Tools:**

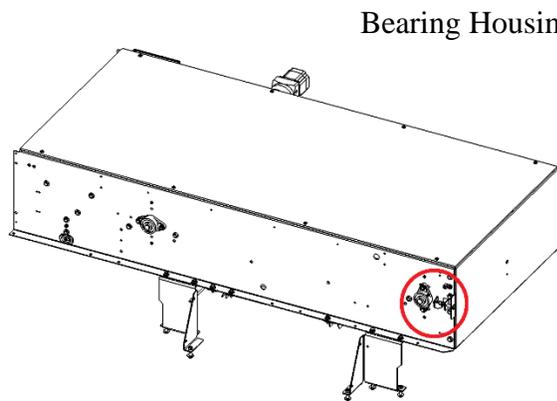
- ½” Wrench

**Location:** Front of Machine

**Est. Time:** 10 min

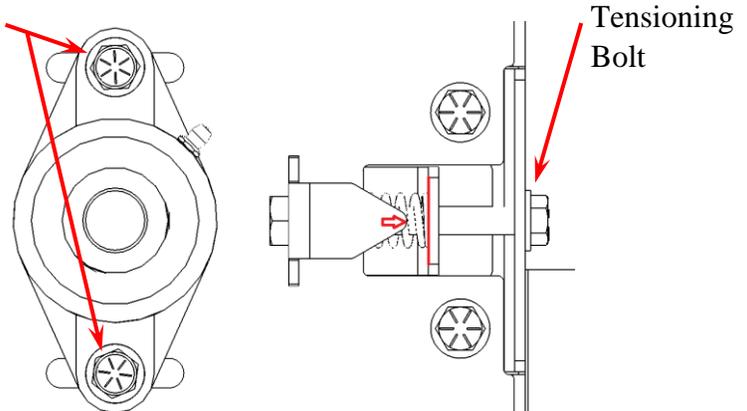
#### Procedure:

1. Implement LOTO and deploy lane barriers.
2. On one side of pinspotter, loosen bolts (2) holding bearing housing to side of pinspotter. Do not remove bolts. Repeat on opposite side. See Figure E-4.
  - a. Drawbar tension is now maintained only by tensioning bolts and spring tension.
3. Turn tensioning bolt to compress spring until arrow tip lines up with straight flange. See Figure E-5.
  - a. Bearing housing may be stuck to painted side frame. If so, loosen tensioning bolt and push on bearing housing to free from pinspotter side frame.
4. Repeat Step 3 on opposite side of pinspotter.
5. Tighten bearing housing bolts on both sides of pinspotter.
6. Remove LOTO and lane barriers. Return machine to service.



**Figure E-4, Bearing Housing**

Bearing Housing Bolts



**Figure E-5, Chain Tension Adjustment**





### E.1.4. Replace Drawbar Chains

**Precautions:** LOTO, Lane Barriers, Slip Hazard, Trip Hazard

**Tools:**

- Ratchet or Impact Driver
- $\frac{3}{8}$ " and  $\frac{1}{2}$ " Sockets
- #2 Phillips Screwdriver
- Needle-Nose Pliers

**Location:** Operator Access Area (behind machine), Front of Machine

**Est. Time:** 60 min

**Note:**

- Both drawbar chains should be replaced as a set.

**Procedure:**

1. Before implementing LOTO, press **PINS UP**.
2. Implement LOTO and deploy lane barriers.
3. Remove drawbar gearmotor and set aside.
4. At front of machine, reach under pinspotter front panel and unclip shield panel carabiner from drawbar.
5. Loosen bearing housing bolts (4) and tensioning bolts (2) to relieve drawbar chain tension.
6. Remove ground screws (2) and mounting bolts (4) for pinspotter front panel.
7. Remove pinspotter front panel and set aside.
8. Remove all sprocket guards (4) inside pinspotter.
  - a. Sprocket guard mounting screws are removed from outside of pinspotter.
9. Using needle-nose pliers, remove locking clip from all chain master links (4) and remove master link side plates.
  - a. There are 2 master links for each drawbar chain.
  - b. Reposition drawbar at any time if better access is required.
  - c. The body of each master link will be trapped between drawbar carriage and drawbar guide bar.
10. Remove both chains from master links by sliding chain off master link pin.
11. Remove drawbar chains from sprockets. Inspect sprockets for wear.
12. Follow above steps in reverse order to install replacement drawbar chains.
  - a. Both drawbar chains must be properly seated in sprockets for drawbar to move correctly. Drawbar must be square to pinspotter side frame. If drawbar is angled, chains are not seated correctly.
13. Remove LOTO and lane barriers. Return machine to service.





### E.1.5. Replace Drawbar

**Precautions:** LOTO, Lane Barriers, Slip Hazard, Trip Hazard

**Tools:**

- Ratchet or Impact Driver
- $\frac{3}{8}$ " and  $\frac{1}{2}$ " Sockets
- Needle-Nose Pliers
- Masking Tape
- Permanent Marker

**Location:** Operator Access Area (behind machine), Front of Machine

**Est. Time:** 60 min

**Notes:**

- It is recommended to have replacement chain master links (P/N: M0690011) available. Locking clip or master link may be damaged or lost during removal.

**Procedure:**

1. Before LOTO, press **PINS UP**.
2. Implement LOTO and deploy lane barriers.
3. Unwind all strings from reel arm spools, untie retaining knot, and label strings using masking tape and marker.
4. At front of machine, reach under pinspotter front panel and unclip shield panel carabiner from drawbar.
5. Loosen bearing housing bolts (4) and tensioning bolts (2) to relieve drawbar chain tension.
6. Remove ground screws (2) and mounting bolts (4) for pinspotter front panel.
7. Remove pinspotter front panel and set aside.
8. Pull all strings through drawbar pulleys to remove them from drawbar.
9. Using needle-nose pliers, remove locking clip from all chain master links (4) and remove master link side plates.
  - a. There are 2 master links for each drawbar chain.
  - b. Reposition drawbar at any time if better access is required.
  - c. The body of each master link will be trapped between drawbar carriage and drawbar guide bar.
10. Remove both chains from master links by sliding chain off master link pin.
11. Remove drawbar by pushing one end away and pulling on other end. Drawbar will slide off drawbar guide bars. Set aside all chain master links, locking clips, and side plates.
12. Follow above steps in reverse order to install drawbar.
13. Remove LOTO and lane barriers. Return machine to service.





### E.1.6. Replace Drawbar Gearmotor

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- ½" Socket
- Diagonal Cutters

**Location:** Pit

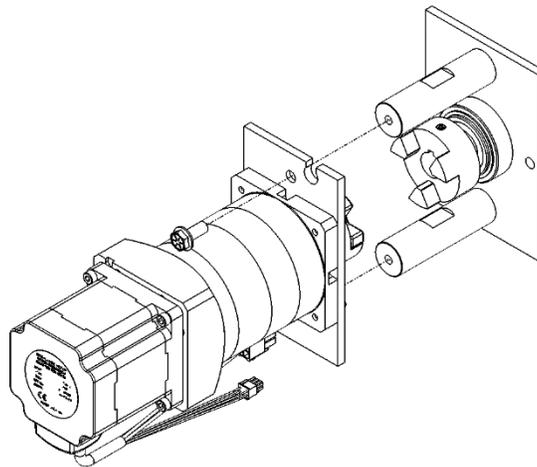
**Est. Time:** 20 min

**Note:**

- Replace all removed cable ties before returning machine to service.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Disconnect drawbar motor plugs from machine control box.
3. Cut all cable ties holding motor cable to machine.
4. Remove bolts (2) from gearmotor mounting plate. Support gearmotor as needed.
5. Remove gearmotor. Inspect coupling spider for wear.
6. Follow above steps in reverse order to install drawbar gearmotor.
7. Remove LOTO and lane barriers. Return machine to service.



**Figure E-6, Drawbar Gearmotor**





### E.1.7. Replace Gearmotor Drive Coupling

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- ½” Socket
- 1/8” Allen Key
- Diagonal Cutters

**Location:** Pit

**Est. Time:** 30 min

**Note:**

- It is recommended to have replacement shaft keys (P/N: 907-237-080) available. Shaft keys may be lost during removal.
- Replace all removed cable ties before returning machine to service.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove all cable ties holding gearmotor cable to machine. Unplug gearmotor cables from control box.
3. Remove bolts (2) from gearmotor mounting plate. Support gearmotor as needed.
4. Remove gearmotor and set aside. Inspect coupling spider for wear.
5. Loosen coupling hub setscrew and remove coupling hub. Keep track of shaft key.
6. Follow above steps in reverse order to install replacement drive coupling.
  - a. Gearmotor coupling hub must sit against output shaft shoulder.
  - b. Inside face of drive shaft coupling hub must be flush with shaft end.
  - c. Install coupling hub set screws with threadlocker.
7. Remove LOTO and lane barriers. Return machine to service.

### E.1.8. Replace Pulley Flip Bracket

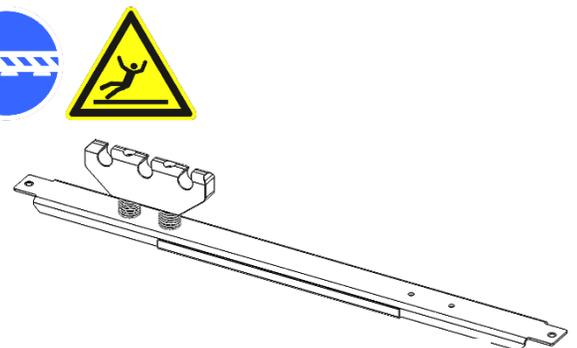
**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- ½” Socket

**Location:** Pit

**Est. Time:** 20 min



**Figure E-7, Pulley Flip Bracket**

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove bolts (2) to remove pulley flip bracket from pinspotter side frames.
3. Follow above steps in reverse order to install replacement pulley flip bracket.
4. Remove LOTO and lane barriers. Return machine to service.



### E.1.9. Replace Table Pulley

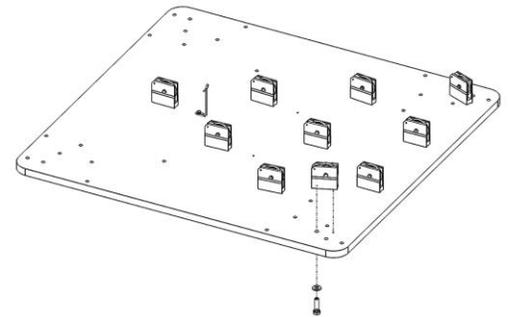
**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- 3/4" Wrench OR 3/4" Socket and Ratchet
- #3 Phillips Screwdriver

**Location:** Pindeck

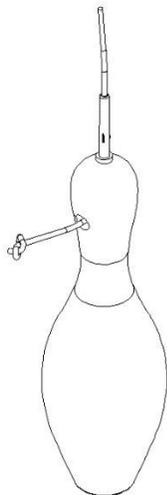
**Est. Time:** 30 min



**Figure E-8, Table Pulley Hardware**

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Insert screwdriver into small hole on side of pin. Push string knot out through large hole on side of pin.
3. Untie knot. Remove pin and sleeve from string.
4. Remove pin and sleeve from string.
5. Pull string up and out of table pulley.
6. Remove bolt holding table pulley to upper table.
7. Remove table pulley.
8. Follow above steps in reverse order to install table pulley. Align pin in table pulley to hole in upper table. See Figure E-8.
9. Route string around table pulley and through table pulley bolt.
10. Re-install sleeve on string. Pass string through hole on top of pin and out through large hole on side of pin. See Figure E-9.
11. Tie a "Figure 8" knot at end of string and pull knot into pin. See Figure E-10.
12. Remove LOTO and lane barriers. Return machine to service.



**Figure E-9, String Routing**



**Figure E-10, "Figure 8" Knot**





### E.1.10. Rotate Pin Centering Ring

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- $\frac{7}{16}$ " Wrench
- #3 Phillips Screwdriver OR #3 Phillips Bit and Impact Driver

**Location:** Pindeck

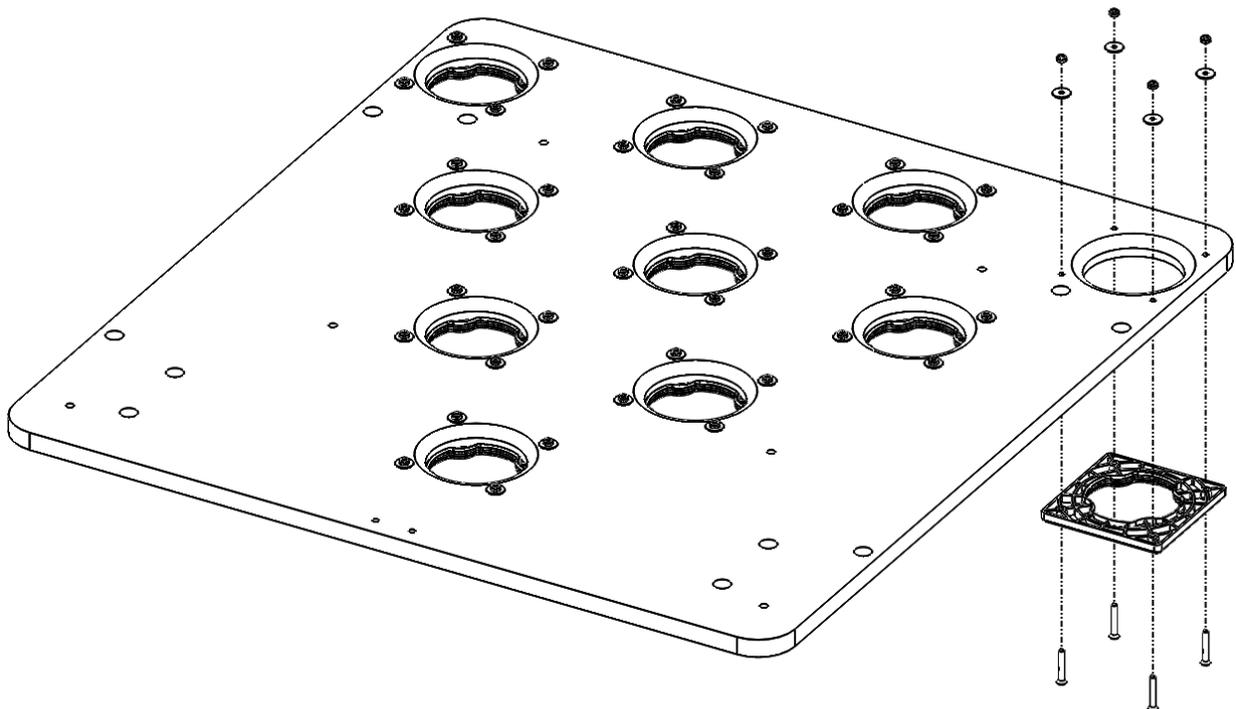
**Est. Time:** 5 min for 1 Centering Ring OR 30 min for All

**Note:**

- The estimated time assumes an impact driver is used.
- Centering rings may be rotated in 90° increments if wear is observed to extend service life.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove hardware holding centering ring to lower table.
3. Rotate centering ring to a new position.
4. Reinstall hardware.
5. Remove LOTO and lane barriers. Return machine to service.



**Figure E-11, Centering Ring Hardware**





### E.1.11. Replace Pin Centering Ring

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- $\frac{7}{16}$ " Wrench
- #3 Phillips Screwdriver OR #3 Phillips Bit and Impact Driver

**Location:** Pindeck

**Est. Time:** 10 min for 1 Centering Ring OR 60 min for All

**Note:**

- The estimated time assumes an impact driver is used.
- A string adjustment may be needed after this procedure.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Insert screwdriver into small hole on side of pin. Push string knot out through large hole on side of pin.
3. Untie knot and remove pin from string. Sleeve can remain on string.
4. Remove hardware holding centering ring to lower table.
5. Replace centering ring.
6. Reinstall hardware.
7. Pass string through hole on top of pin and out through large hole on side of pin. See Figure E-9.
8. Tie a "Figure 8" knot at end of string and pull knot into pin. See Figure E-10.
9. Remove LOTO and lane barriers. Return machine to service.





### E.1.12. Adjust Shield Strings

**Precautions:** LOTO, Lane Barriers, Slip Hazard, Trip Hazard

**Tools:**

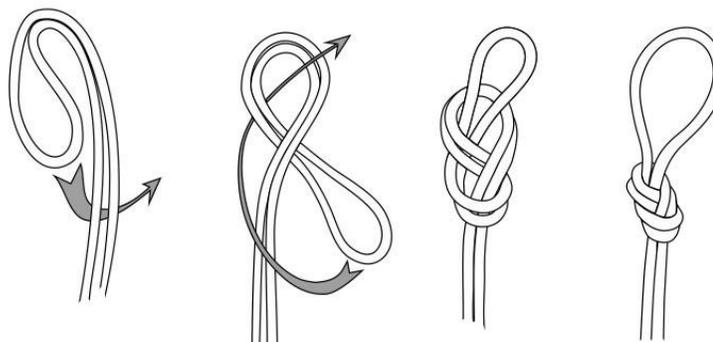
- 7/16" Wrench

**Location:** Front of Machine

**Est. Time:** 15 min

#### Procedure:

1. Before LOTO, press **PINS UP**.
2. Implement LOTO and deploy lane barriers.
3. Slide clear tubing off actuation and hard-stop string clamps.
4. Loosen nuts on clamps.
5. Adjust length of actuation string by sliding string through clamp. Shield panel must be horizontal with drawbar fully rearward (toward reel arms). See Figure E-13. Tighten rope clamp after adjustment.
6. Detach (unclip) actuation string from shield carabiner.
7. Adjust length of hard-stop string by sliding string through clamp. Shield panel must be vertical with hard-stop string tight. See Figure E-14. Tighten rope clamp after adjustment.
  - a. Check if shield panel can swing past vertical. If so, shorten hard-stop string to avoid damage to pitlight.
8. Attach (clip) actuation string to shield carabiner.
9. Remove LOTO and lane barriers. Return machine to service.



**Figure E-12, "Double Figure 8" Knot**





### E.1.13. Replace Shield Actuation String

**Precautions:** LOTO, Lane Barriers, Slip hazard, Trip Hazard

**Tools:**

- 7/16" Wrench

**Location:** Front of Machine

**Est. Time:** 30 min

**Procedure:**

1. Before LOTO, press **PINS UP**.
2. Implement LOTO and deploy lane barriers.
3. Slide clear tubing off actuation string clamp.
4. Loosen nuts on clamp and remove string from clamp and shield carabiner.
5. At front of machine, reach under pinspotter front panel and unclip shield panel carabiner from drawbar. It may be necessary to pull drawbar closer to front of pinspotter for access.
6. Untie actuation string from drawbar carabiner.
7. Pull actuation string through pinspotter front panel pulley.
8. Follow above steps in reverse order to install new actuation string. Adjust length of actuation string by sliding string through clamp.
  - a. Use a "Double Figure 8" knot to attach actuation string to drawbar carabiner. See Figure E-12.
  - b. Bottom of shield panel must align with nose block forward mounting hole. See Figure E-14.
9. Remove LOTO and lane barriers. Return machine to service.

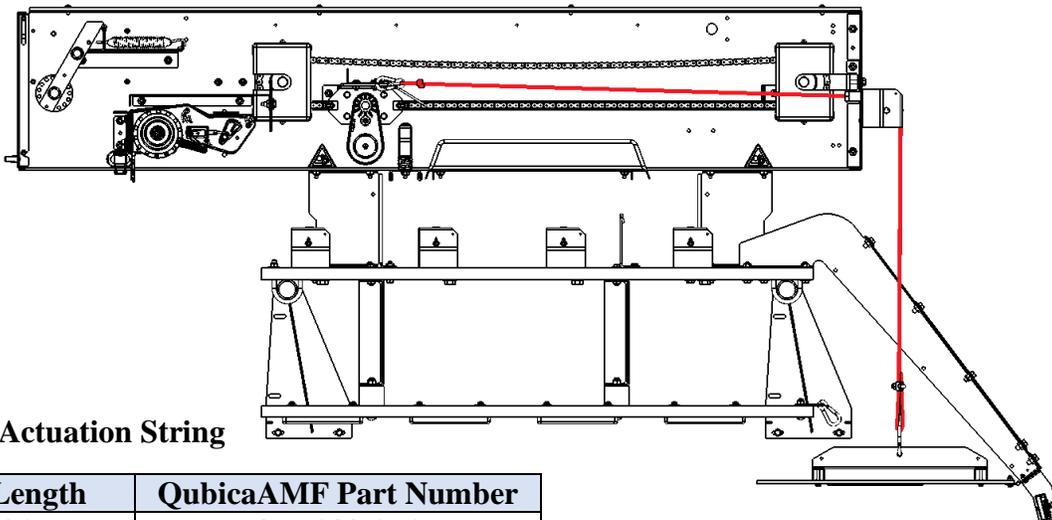


Table E-2, Actuation String

String Length	QubicaAMF Part Number
7'0" [2134 cm]	051-200-214

Figure E-13, Shield Actuation String Path (Shown in Red)





### E.1.14. Replace Shield Hard-Stop String

**Precautions:** LOTO, Lane Barriers, Slip Hazard, Trip Hazard

**Tools:**

- 7/16" Wrench

**Location:** Front of Machine

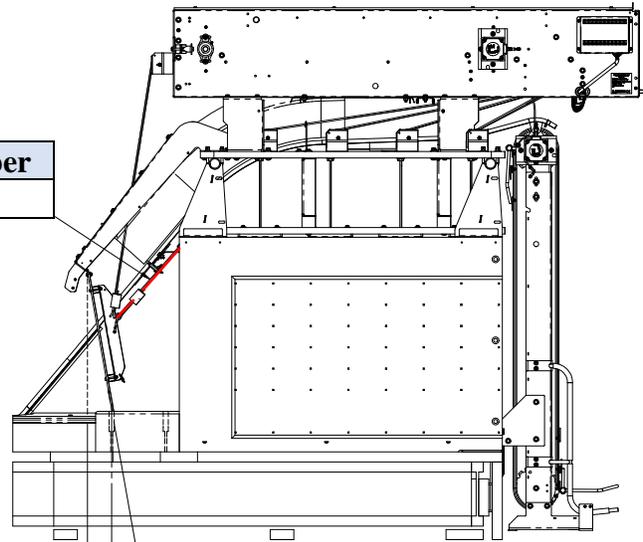
**Est. Time:** 30 min

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Slide clear tubing off hard-stop string clamp.
3. Loosen nuts on clamp and remove string from clamp and shield carabiner.
4. Detach (unclip) actuation string from shield carabiner.
5. Adjust length of hard-stop string by sliding string through clamp. Bottom of shield panel must align with nose block forward mounting hole. See Figure E-14. Tighten clamp after adjustment.
  - a. Check if shield panel can swing close to vertical. If so, shorten hard-stop string to avoid ball detect errors.
6. Attach (clip) actuation string to shield carabiner.
7. Remove LOTO and lane barriers. Return machine to service.

**Table E-3, Hard-Stop String**

String Length	QubicaAMF Part Number
3'0" [914 cm]	051-200-215



SHIELD RESTING ANGLE ( 10° )

ALIGN BOTTOM OF SHIELD WITH NOSE BLOCK FORWARD MOUNTING HOLE

**Figure E-14, Shield Stop String Path (Shown in Red)**





### E.1.15. Replace Shield Panel

**Precautions:** LOTO, Lane Barriers, Slip Hazard, Trip Hazard

**Tools:**

- 3/8" Wrench
- #2 Phillips Screwdriver

**Location:** Front of Machine

**Est. Time:** 15 min

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Unclip carabiner from back of shield panel.
3. Remove hardware securing shield hinges to hanger bracket.
4. To install shield panel, reinstall hardware and clip carabiner to shield panel.
5. Remove LOTO and lane barriers. Return machine to service.

### E.1.16. Adjust Chain Lift Chain Tension

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

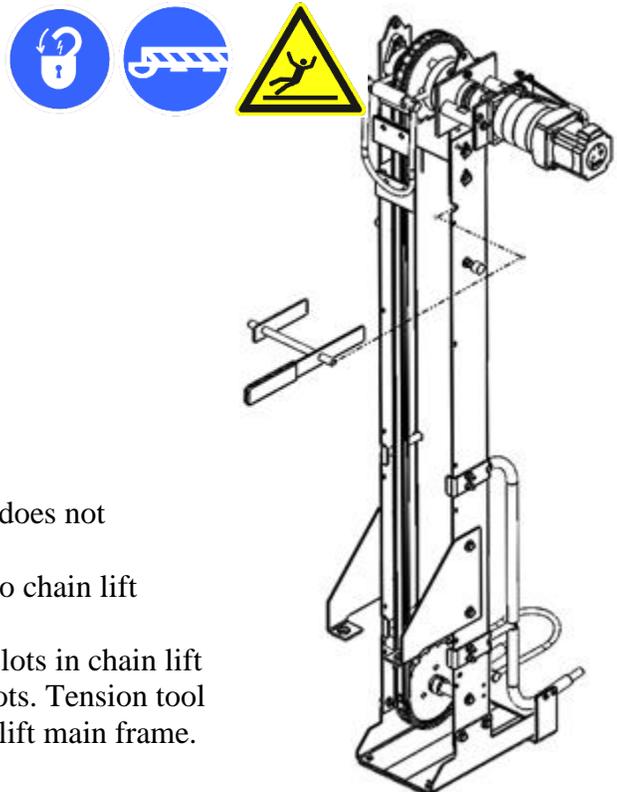
- 1/2" Wrench
- Chain Lift Tension Tool (051-200-472)

**Location:** Pit

**Est. Time:** 30 min

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove chain lift guarding side panels.
3. If lifter assembly is in the way, move chain so it does not interfere with tensioning tool.
4. Loosen bolts (4) that hold chain lift main frame to chain lift upper frame.
5. Insert chain lift tension tool (051-200-472) into slots in chain lift main frame. Dual levers must extend through slots. Tension tool rod must be positioned between chain and chain lift main frame. See Figure E-15.
6. Push tension tool lever down to lift chain lift upper frame. Tighten bolts (4) while maintaining proper chain tension.
7. Re-install all guarding.
8. Remove LOTO and lane barriers. Return machine to service.



**Figure E-15, Chain Lift Tension Tool**





### E.1.17. Replace Chain Lift Gearmotor

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- ½" Socket
- Diagonal Cutters

**Location:** Pit

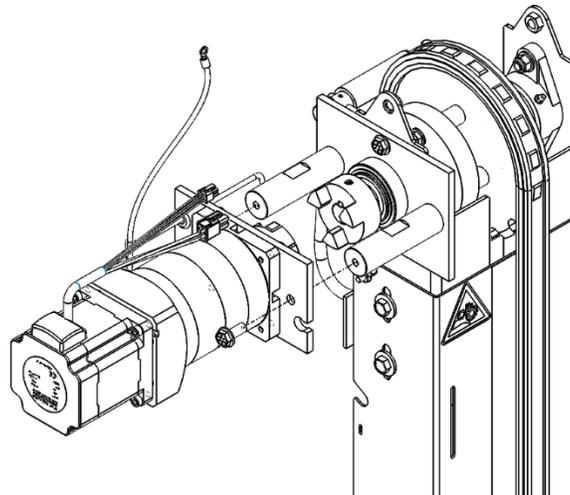
**Est. Time:** 10 min

**Note:**

- Replace all removed cable ties before returning machine to service.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Disconnect chain lift motor plugs from chain lift control box.
3. Cut all cable ties holding motor cable to chain lift ground wire.
4. Remove bolts (2) from gearmotor mounting plate. Support gearmotor as needed.
5. Remove gearmotor. Inspect coupling spider for wear.
6. Follow above steps in reverse order to install chain lift gearmotor.
7. Remove LOTO and lane barriers. Return machine to service.



**Figure E-16, Chain Lift Gearmotor**





### E.1.18. Replace Chain lift

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- $\frac{7}{16}$ " and  $\frac{1}{2}$ " Sockets
- $\frac{7}{16}$ " and  $\frac{1}{2}$ " Wrenches
- #2 Phillips Screwdriver
- Chain Lift Service Lock (051-200-532)

**Location:** Operator Access Area (behind machine), Pit

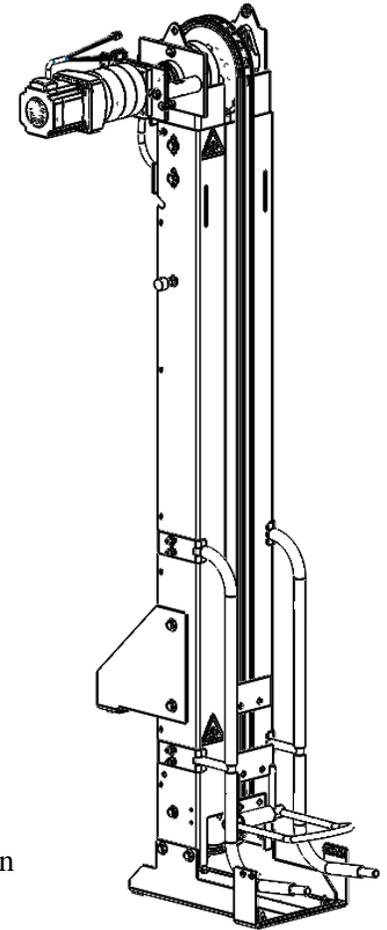
**Est. Time:** 90 min

**Note:**

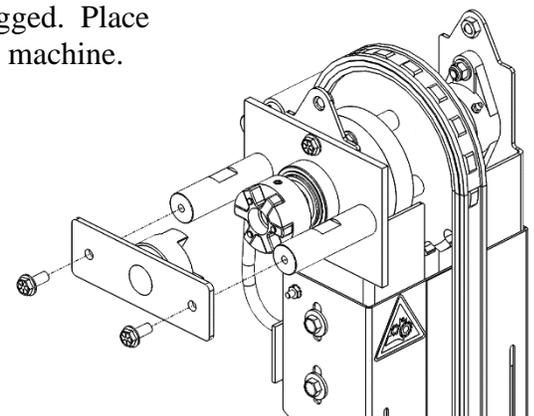
- The estimated time assumes an impact driver is used.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove pit rear guards (both pits) and double division guard.
3. Remove ball rails, ball stop, and support bracket.
4. Remove system controller guard.
5. Disconnect chain lift gearmotor cable from chain lift control box.
6. Remove chain lift ground wire from chain lift control box.
7. Remove bolts (2) from gearmotor mounting plate and remove chain lift gearmotor.
8. Install chain lift service lock (051-200-532). See Figure E-18.
9. Remove chain lift guarding.
10. Loosen nut and bolt connecting system controller wireway to cross machine wireway. Do not remove hardware.
11. Remove system controller from its mount and set aside.
  - a. System controller cables do not need to be unplugged. Place system controller on pit hinged top cover of even machine.
12. Remove system controller mount.
13. Wrap ground wire around gearmotor mount.
14. Remove bolts (2) attaching cross sweep to top of chain lift. Support chain lift as needed.
15. Lift up on chain lift to slide it off foundation posts (2).
16. Carefully carry or slide chain lift out from between pit side frames.
  - a. If chain is stuck or caught on something, do not pull. Free any obstruction first.
  - b. Use caution to avoid damaging chain lift ball sensors and cables.
17. Follow above steps in reverse order to install chain lift.
18. Remove LOTO and lane barriers. Return machine to service.



**Figure E-17, Chain Lift**



**Figure E-18, Chain Lift Service Lock**





### E.1.19. Replace Pit Cushion Block

**Precautions:** LOTO and Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- ½” Socket
- ½” Wrench

**Location:** Operator Access Area (behind machine), Pit

**Est. Time:** 10 min

**Note:**

- The estimated time assumes an impact driver is used.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove pit rear guard.
3. Unclip bowtie cotter pin from bottom of cushion shock. Remove pin and flat washer and set aside.
4. Remove bolt and nut retaining each cushion block.
5. Slide cushion blocks and cushion forward. Set cushion assembly on pit floor.
6. Replace cushion block and reinstall following above steps in reverse order. Ensure shield plate is installed in each cushion block.
7. Remove LOTO and lane barriers. Return machine to service.



### E.1.20. Replace Pit Cushion Shock

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- ½” Socket

**Location:** Operator Access Area (behind machine), Pit

**Est. Time:** 5 min

**Note:**

- The estimated time assumes an impact driver is used.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove pit rear guards (both pits) and double division guard.
3. Unclip bowtie cotter pins from cushion shock.
4. Remove pins and flat washers at top and bottom of shock and set aside.
5. Follow above steps in reverse order to install cushion shock.
6. Remove LOTO and lane barriers. Return machine to service.





### E.1.21. Replace Pit Cushion Assembly

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- ½" Socket
- ½" Wrench

**Location:** Operator Access Area (behind machine), Pit

**Est. Time:** 20 min

**Note:**

- The estimated time assumes an impact driver is used.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove pit rear guards (both pits) and double division guard.
3. Unclip bowtie cotter pin from bottom of shock and remove pin attaching shock to cushion. Set hardware aside.
4. Remove bolt and nut retaining opposite ball door side cushion block.
5. Slide cushion block and cushion forward.
6. Set aside cushion block and shield plate.
7. Rotate cushion to pull out of other cushion block.
8. Remove cushion assembly from pit.
9. Follow above steps in reverse order to install cushion assembly. Ensure shield plate is installed in each cushion block.
10. Remove LOTO and lane barriers. Return machine to service.





### E.1.22. Replace Pit Cushion Rivet

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- ½” Socket
- Diagonal Cutters
- Channel Locks

**Location:** Operator Access Area (behind machine), Pit

**Est. Time:** 5 min

**Note:**

- Replace all removed cable ties before returning machine to service.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove pit rear guard.
3. Use channel locks to pull end of rivet. Cut rivet underneath barb.
4. Remove pieces of rivet and install a new rivet.
5. Use channel locks to pull barb of rivet through cushion plank.
6. Cut off tail of rivet about 2” [50mm] past barb.
7. Reinstall pit rear guard and double division guard.
8. Remove LOTO and lane barriers. Return machine to service.



### Replace Pit Curtain

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- 7/16” Socket
- 7/16” Wrench

**Location:** Operator Access Area (behind machine), Pit

**Est. Time:** 15 min

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Open pit hinged top cover.
3. Loosen and remove nuts and bolts holding pit curtain and clamp bar to support.
4. Remove pit curtain and clamp bar.
5. Follow above steps in reverse order to install pit curtain and clamp bar.
6. When installing pit curtain, smooth side faces toward lane, and textured side faces toward cushion.
7. Remove LOTO and lane barriers. Return machine to service.





### E.1.23. Replace Pit Floor

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- Flat Pry Bar(s)
- ½” Socket

**Location:** Operator Access Area (behind machine), Pit

**Est. Time:** 20 min

**Note:**

- The estimated time assumes an impact driver is used.

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove pit rear guards (both pits) and double division guard.
3. Remove cushion assembly (see Page E-21).
4. Remove Pit Floor assembly by using lifting the assembly from the metal pit joists. The flat pry bars may need to be used for additional leverage.
5. Check condition of sheet metal joists while pit floor is out. Check and tighten hardware. Inspect Velcro attachment to joists.
6. Follow above steps in reverse order to install pit floor.
7. Remove LOTO and lane barriers. Return machine to service.



### E.1.24. Replace Double Division Rail Covers

**Precautions:** LOTO, Lane Barriers

**Tools:**

- Silicone Lubricant
- Chamois Swab
- 1.5” PVC Spacer
- Utility Knife
- Degreaser/Shop Towels
- Ratchet or Impact Driver
- ½” Socket
- ½” Wrench

**Location:** Operator Access Area (behind machine)

**Est. Time:** 20 min

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove pit rear guards (both pits) and double division guard.
3. Loosen and remove nut and bolt holding ball rail to support bracket.
4. Pull ball rail off chain lift rest rail.



5. Using a utility knife, remove vinyl tubing from ball rail.
6. Follow procedure outlined in document 400-051-223 to install new ramp rail tubing.
7. Remove LOTO and lane barriers. Return machine to service.



### E.1.25. Lubricate Drawbar Chain

**Precautions:** LOTO, Lane Barriers, Slip Hazard, Trip Hazard

**Tools:**

- Ratchet or Impact Driver
- $\frac{3}{8}$ " and  $\frac{1}{2}$ " Sockets
- #2 Phillips Screwdriver
- General Purpose Bearing Grease (NLGI 1) and Brush
- Shop Towel or Paper Towel

**Location:** Pindeck, Front of Machine

**Est. Time:** 30 min

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove ground screws (2) and mounting bolts (4) for pinspotter front panel.
3. Remove pinspotter front panel and set aside.
4. Remove sprocket guards (2) on front end of pinspotter.
  - a. Sprocket guard mounting screws are removed from outside of pinspotter.
5. Use brush to apply grease to both drawbar chains. Remove any excess grease.
6. Reposition drawbar as needed to access and grease entire chain.
7. Reinstall sprocket guards and end panel.
8. Remove LOTO and lane barriers. Return machine to service.



### E.1.26. Lubricate Chain Lift Chain & Lifter Assemblies

**Precautions:** LOTO, Lane Barriers, Slip Hazard

**Tools:**

- Ratchet or Impact Driver
- $\frac{1}{2}$ " Socket
- General Purpose Bearing Grease (NLGI 1) and Brush
- Shop Towel or Paper Towel

**Location:** Pit

**Est. Time:** 30 min

**Procedure:**

1. Implement LOTO and deploy lane barriers.
2. Remove chain lift gearmotor (see Page E-19).
3. Remove side panel of chain lift guarding.
4. Use brush to apply grease to chain links and lifter hinges. Remove any excess grease.
5. Move chain manually to lubricate entire chain and both lifter hinges.



6. Reinstall guarding and gearmotor.
7. Remove LOTO and lane barriers. Return machine to service.

## E 2. Reference Tables

### E.2.1. Bolt Torque Table

Table E-1 shows typical bolt tightening torque values for reference in inch-pounds, foot-pounds and Newton-meters. If a different torque value is specified in this or another manual, then follow the specification given.

**Table E-1, Bolt Torques**

Bolt Size	lb-in	lb-ft	Nm
# 10	20 – 30	1.6 – 2.5	2.2 – 3.4
1/4"	144 – 180	12 – 15	16 – 20
5/16"	216 – 240	18 – 20	24 – 27
3/8"	276 – 300	23 – 25	31 – 34
1/2"	336 – 360	28 – 30	38 – 41



## Appendix F. EDGE String Product Matrix





# EDGE String Product Matrix

## Section Overview

The following product matrix outlines all released EDGE String product models along with associated descriptions and certifications. Installation manual information is also included for each product model.

**Table F-1, EDGE String Product Matrix**

Product Model			Operator's Manual		Installation Manual	
Part Number	Description	Certification	Part Number	Rev.	Part Number	Rev.
051-200-002	10-Pin, Pair	CE/UKCA	400-051-202-01	A or later	400-051-204	D
051-202-001	10-Pin, Single, Odd	CE, UKCA	400-051-202-01	A or later	400-051-204	D
051-202-002	10-Pin, Single, Even	CE, UKCA	400-051-202-01	A or later	400-051-204	D



