

Training Tutorial

MRWS Vs. 1.2

Mobile, Remote Welding System

RTT: Robotic Technologies of Tennessee, LLC

Phone: 1-615-390-8723

Fax: 1-931-854-0774

info@robotictechn.com

<http://www.robotictechn.com/>

2560 Nova Circle, Cookeville, Tennessee, USA 38501

Mobile Robotic Welding System Training Tutorial

Outline

Part 0: Overview of training tutorial and schedule

Part I: System Overview

Part II: Hardware Overview

Part III: Safety

Part IV: Setting up

Part V: Operation

Part VI: Take down

Part VII: Regular maintenance schedule

Part VIII: Preferred operating practice

Part IX: Advanced operations

Part 0: Overview of training tutorial

This training tutorial will serve as an outline to provide instruction on the safe and proper use of the MRWS system. The training process should take approximately 4 hours. As each section is completed, the student acknowledges that they have completed and understand that section as:

I have completed the review of Part IV. System Setup and understand the important points of this section

Name

Date

Part 0: Schedule of training tutorial

The following table suggests an initial training schedule for this tutorial.

Section	Notes duration (min.)	Video duration (min.)	Practice duration (min.)	Total (min)
Part I: System Overview	10	-	-	10
Part II: Hardware Overview	10	10	-	20
Part III: Safety	10	10	-	20
Part IV: Setting up	20	10	60	90
Part V: Operation	20	10	60	90
Part VI: Take down	10	10	60	80
Part VII: Regular maintenance schedule	15	-	-	15
Part VIII: Preferred operating practice	15	10	-	25
Part IX: Advanced operations	-	-	-	-
	120 min	60 min	180 min	6 hours

Part I: System Overview – MRWS 3.0

I.1 The MRWS 100 consists of several components

- a. Tractor tracks and chassis component
- b. torch manipulator
- c. torch
- d. wire-feed
- e. controller
- f. torch hood
- g. wire spool
- h. Power supply (black pelican case)

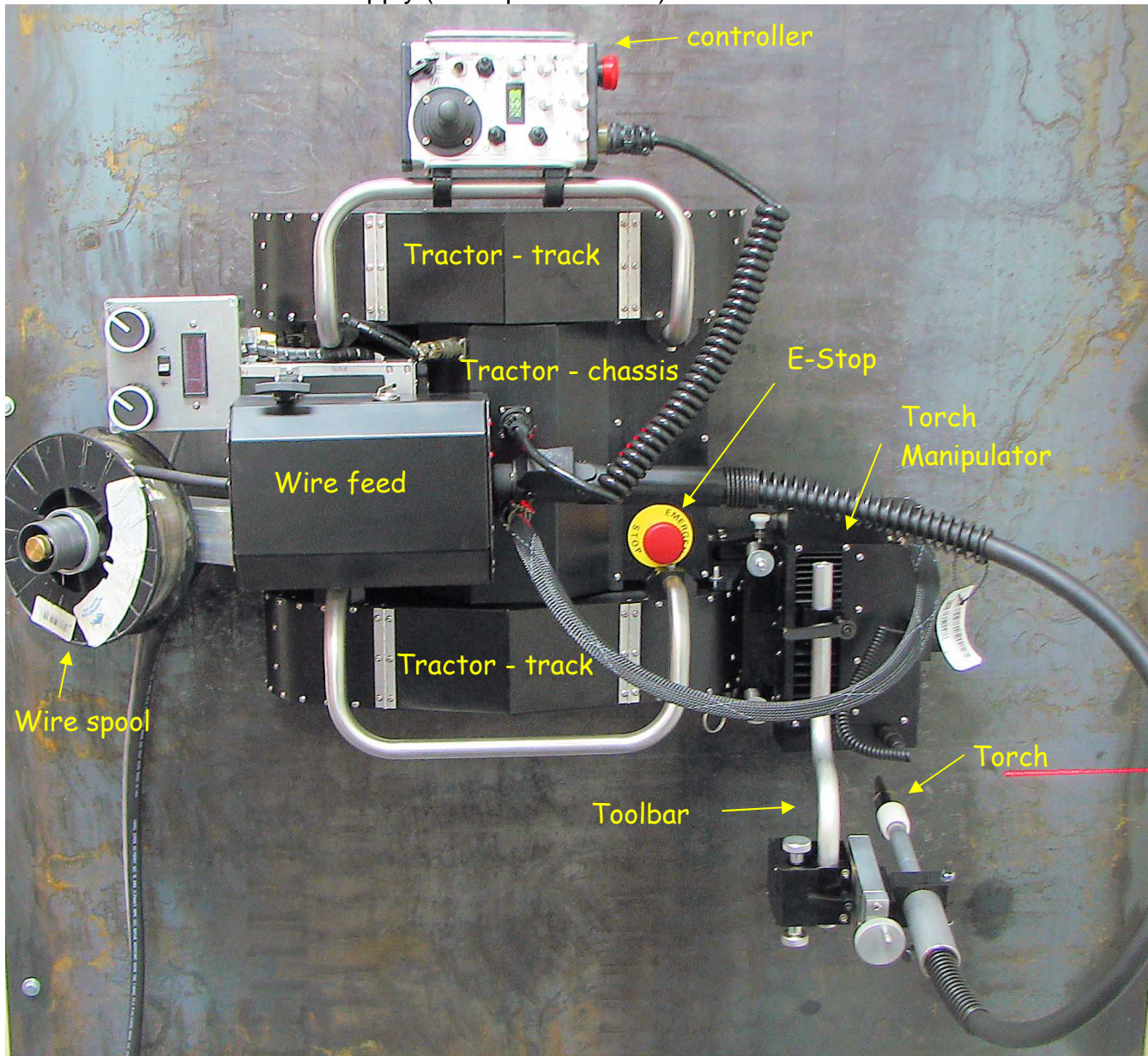


Figure 1: System Overview



Figure 2: Power Supply

I have completed the review of Part I. System Overview and understand the important points of this section

Name

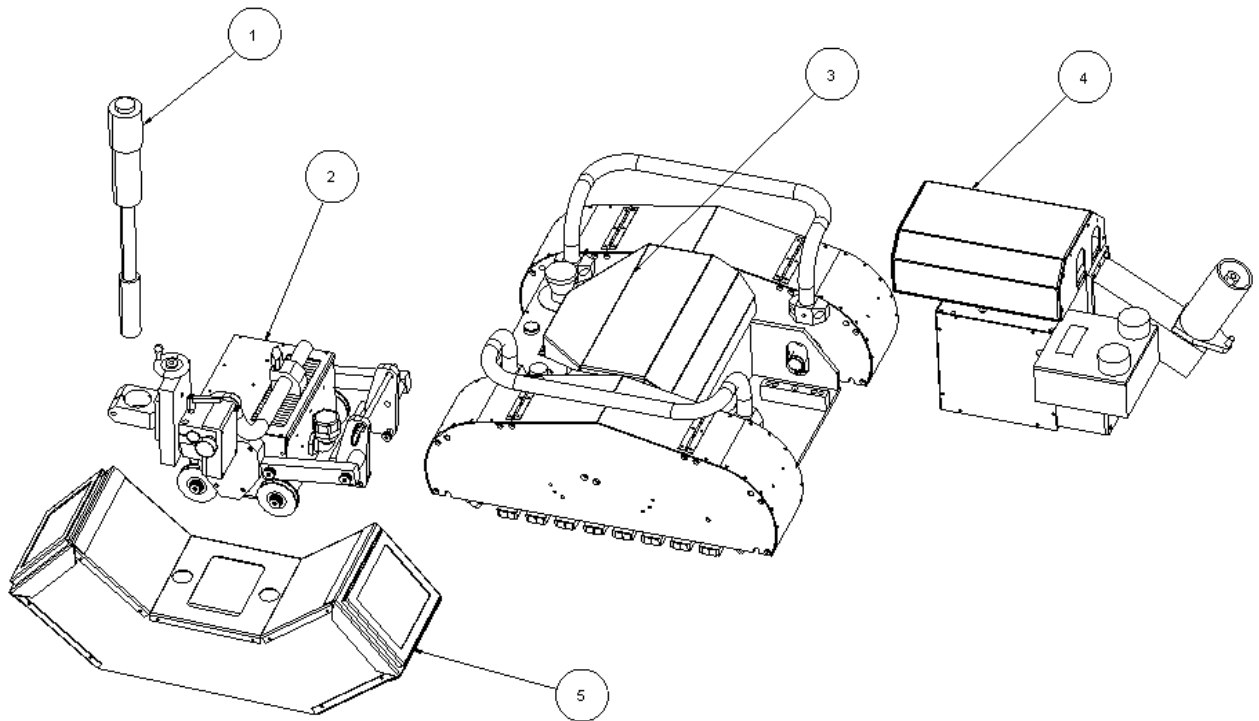
Date

Part II: Hardware Overview

The MRWS 3.0 system consists of a series of components, detailed in the diagram below. A summary of these parts are given:

- 1) MRWS 3.0 platform – (item 3 below)
 - a. Commonly called the tractor, platform, mobile platform or mobile robot.
 - b. This system is driven using the system joystick and provides motion on the climbing surface
- 2) Torch Manipulator (item 2 below)
 - a. The torch manipulator attaches to the MRWS platform
 - b. It controls three degrees of freedom:
 - i. Torch depth
 - ii. Work angle
 - iii. Travel angle
 - c. The torch manipulator cancels undesired motions from the mobile platform
- 3) Torch (item 1 below)
 - a. Provided as a standard welding torch – machine or hand held torch
- 4) Wire feed (item 4 below)
 - a. The wire feed mounts onto the MRWS 3.0. This is based on a commercial unit and can have feed and voltage controls with readout attached.
 - b. A 10-14 # spool can be attached on the wire feed
 - c. Wire can also be pulled to the wire feed from a drum or roll placed on the ground using an approved wire sheath.
- 5) Torch Enclosure (item 5 below)
 - a. The torch enclosure surrounds the torch and allows one or more view ports
 - b. The torch enclosure is an option provided with the system

MRWS-3.0-SYSTEM COMPONENTS



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	MRWS-3.0-B-ACD501DF5HM	Bernard automatic welding torch
2	1	MRWS-3.0-WEAVER	Torch oscillator assembly
3	1	MRWS-3.0-CRAWLER	MRWS 3.0 crawler assembly
4	1	MRWS-3.0-M24A	Miller 24A wire feeder unit assembly
5	1	MRWS-3.0-ARCENCL	Arc enclosure assembly

Part III: Safety

III.1: Safety overview:

- 1) Protect yourself and others from serious injury or death.
- 2) Be sure that all installation, operation, maintenance and repair procedures are performed only by qualified individuals.

III.2: Electrical Shock Hazard

ELECTRIC SHOCK CAN KILL

1. The equipment is not waterproof. Using the unit in a wet environment may result in serious injury. Do not touch the equipment when wet or standing in a wet location.
2. Never open the equipment without first unplugging the power cord or serious injury may result.
3. Verify the power connections are made in accordance with all applicable local and national electric safety codes. If none exist, use International Electric Code (IEC) 950.
4. Never Remove or bypass the equipment power cord ground. Verify the equipment is grounded in accordance with all applicable local and national electric safety codes. If none exist, use International Electric Code (IEC) 950.

III.3: Falling Hazard

FALLING EQUIPMENT CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH AND EQUIPMENT DAMAGE

1. Only install and operate equipment when properly protected by approved fall protection equipment.
2. Only operate equipment from a location that is protected from falling material.
3. Faulty or careless user operation is possible. As a result, never stand, walk or pass underneath equipment.

III.4: Keep Equipment in proper operating order

EQUIPMENT DAMAGE POSSIBLE

1. Do not leave the equipment unattended. Remove from the worksite and store in a safe location when not in use.
2. Equipment operation is to be performed only by qualified individuals.

III.5: Safety Around Mechanical Components
MOVING PARTS CAN CAUSE SERIOUS INJURY

1. Do not operate equipment with any protective panels, covers or guards removed.
2. Never try to stop or stabilize equipment except by removing power or the STOP control.

I have completed the review of Part III. Safety Overview and understand the important points of this section

Name

Date

Part IV: System Setup

IV.1 MRWS Platform Assembly:

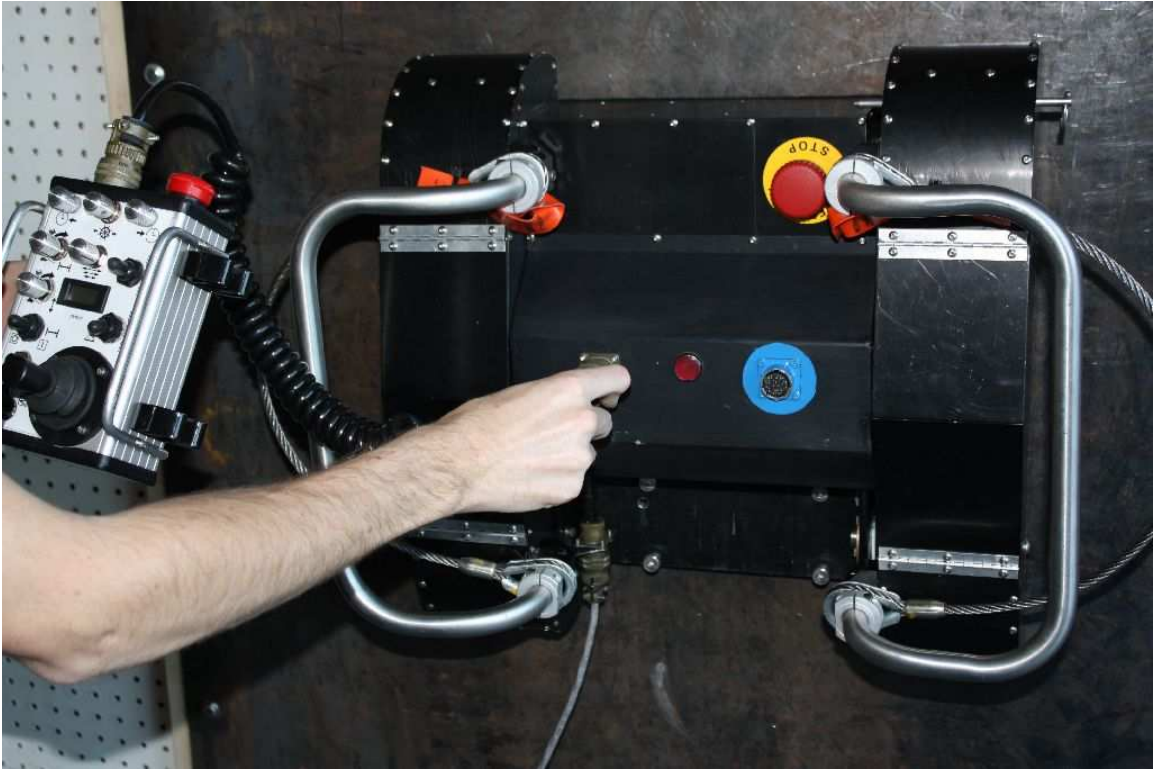
1. Refer to the MRWS component list provided in System Overview and Fig. 1
2. Place the tractor tracks and chassis component on a flat section of the steel surface as shown below.



3. Connect the power supply to the tractor chassis as shown below



4. Connect the hand-held controller to the tractor chassis as shown below.



5. Plug the power supply into a 120V outlet with ground



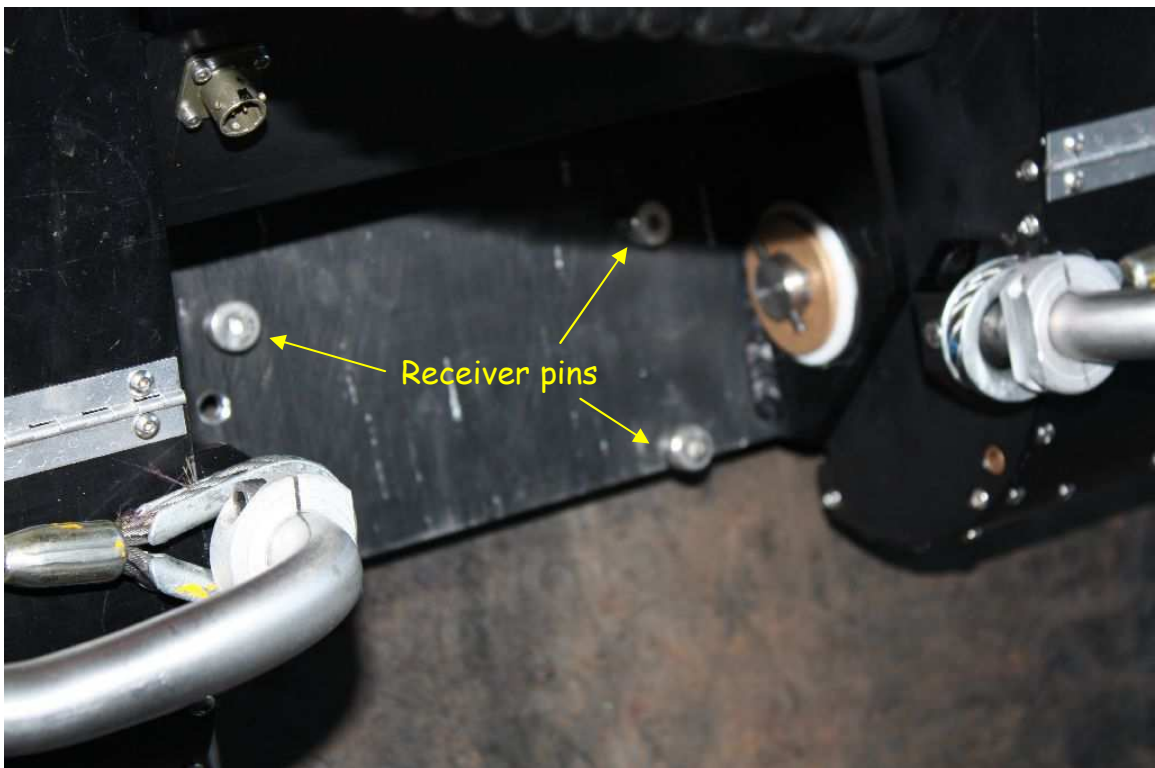
6. The tractor can now be driven using the handheld controller. The system is now ready for Weld setup

IV.2 MRWS Platform Set-up – Video
Review the setup / operational video

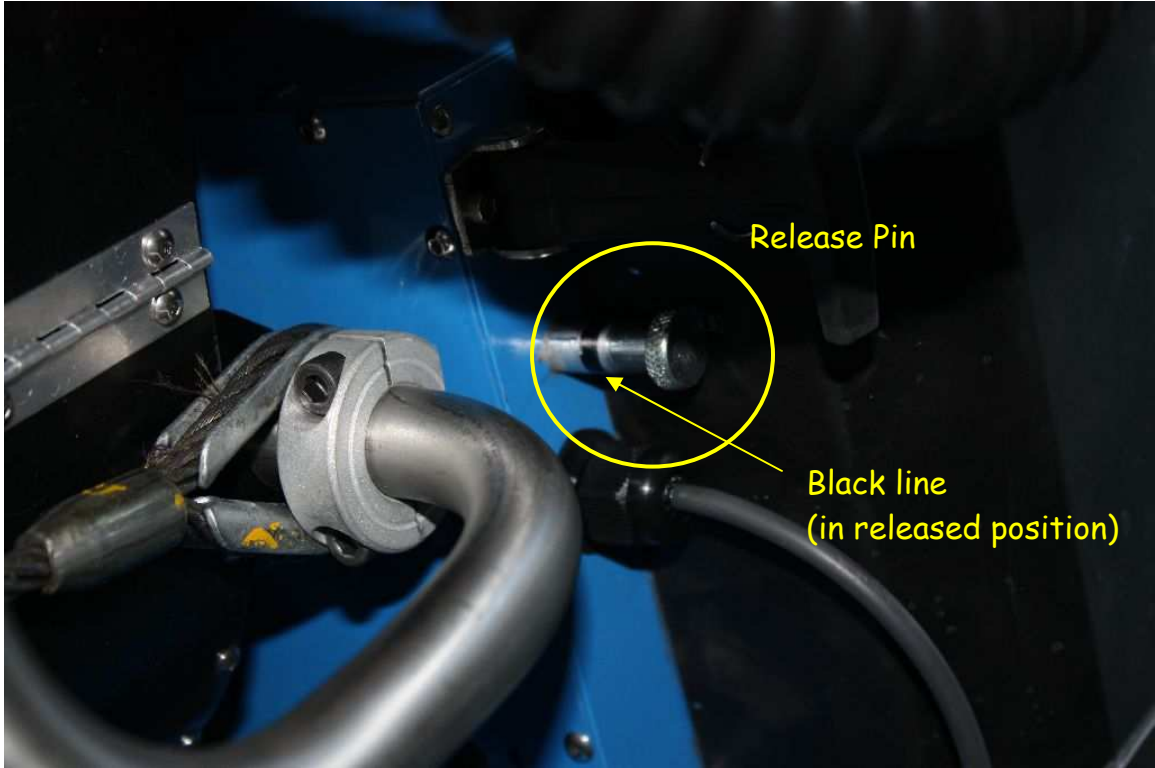
IV.3 MRWS Platform Set-up – Practice
Practice System setup / Basic platform operation

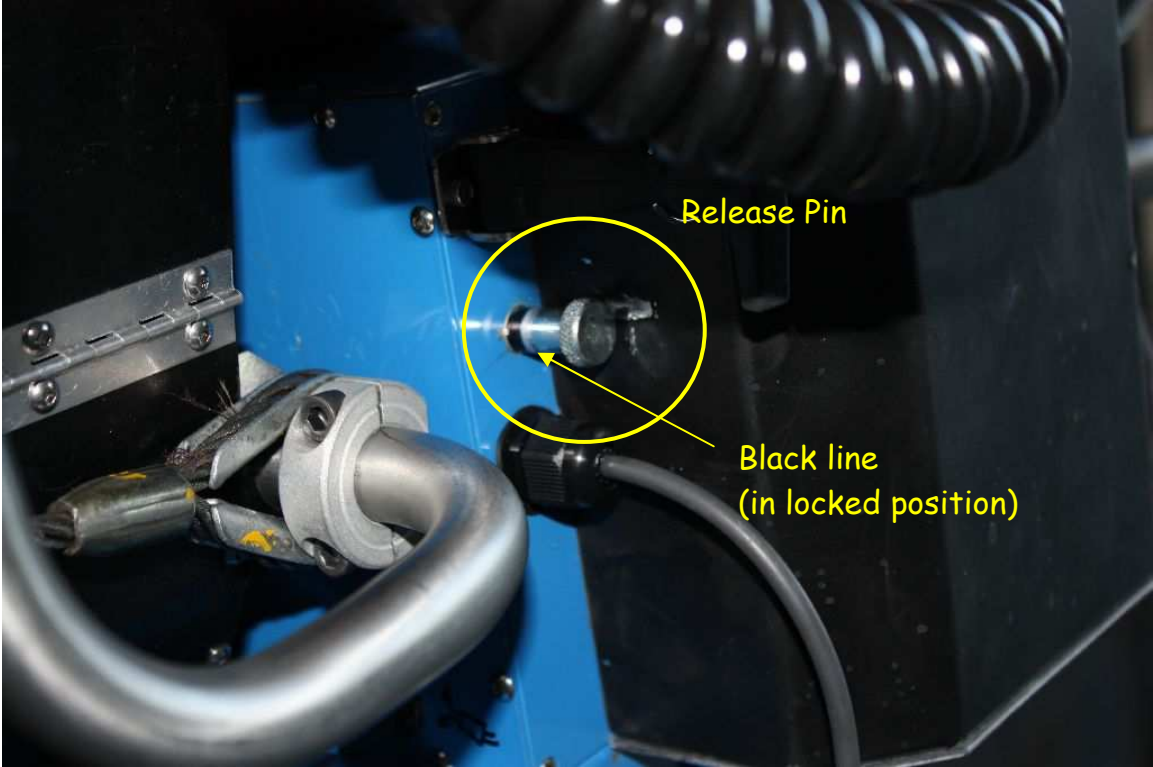
IV.2 MRWS Weld Assembly:

1. Connect the wire feed unit to the tractor as shown below. Place the wire feed with large receiver holes aligned over the receiver pins on the tractor chassis. Hold the unit down and pull back to lock the wire feed unit in place.

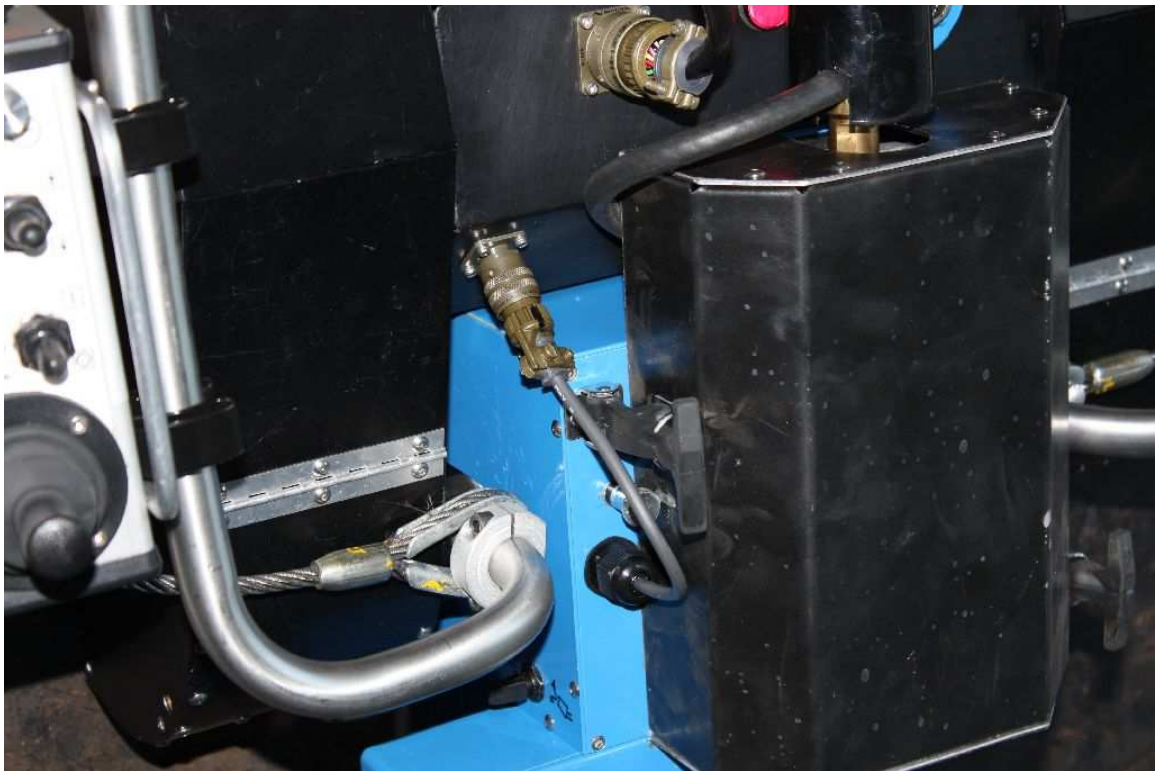
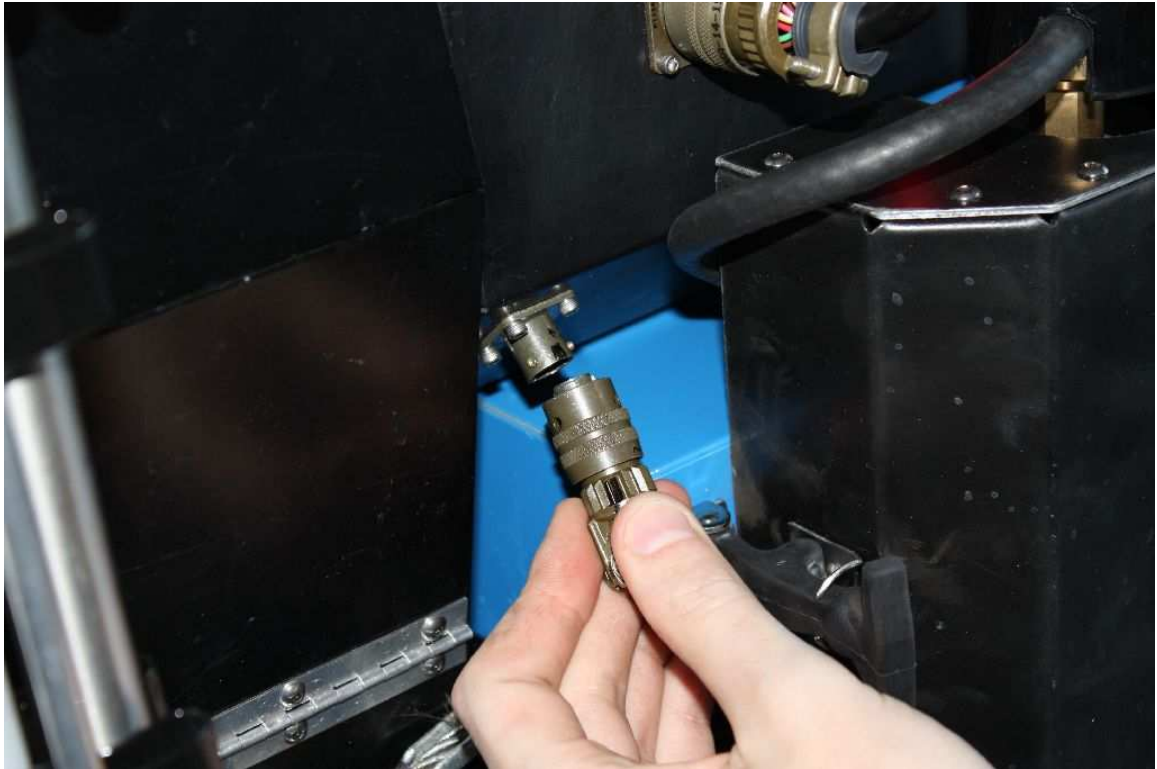


2. The unit is locked in place when the release pin is fully engaged (black line touches the surface of the blue housing)
To remove the wire feed, pull the release pin, slide the unit up and remove from the tractor.

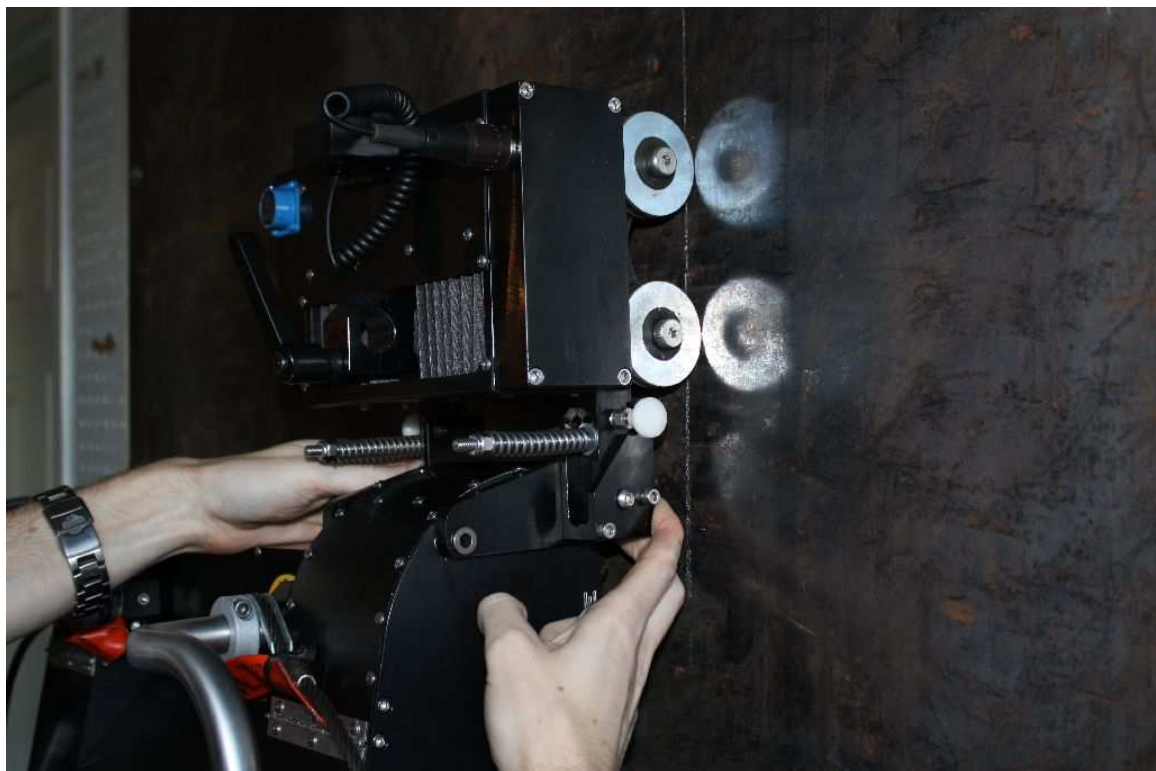
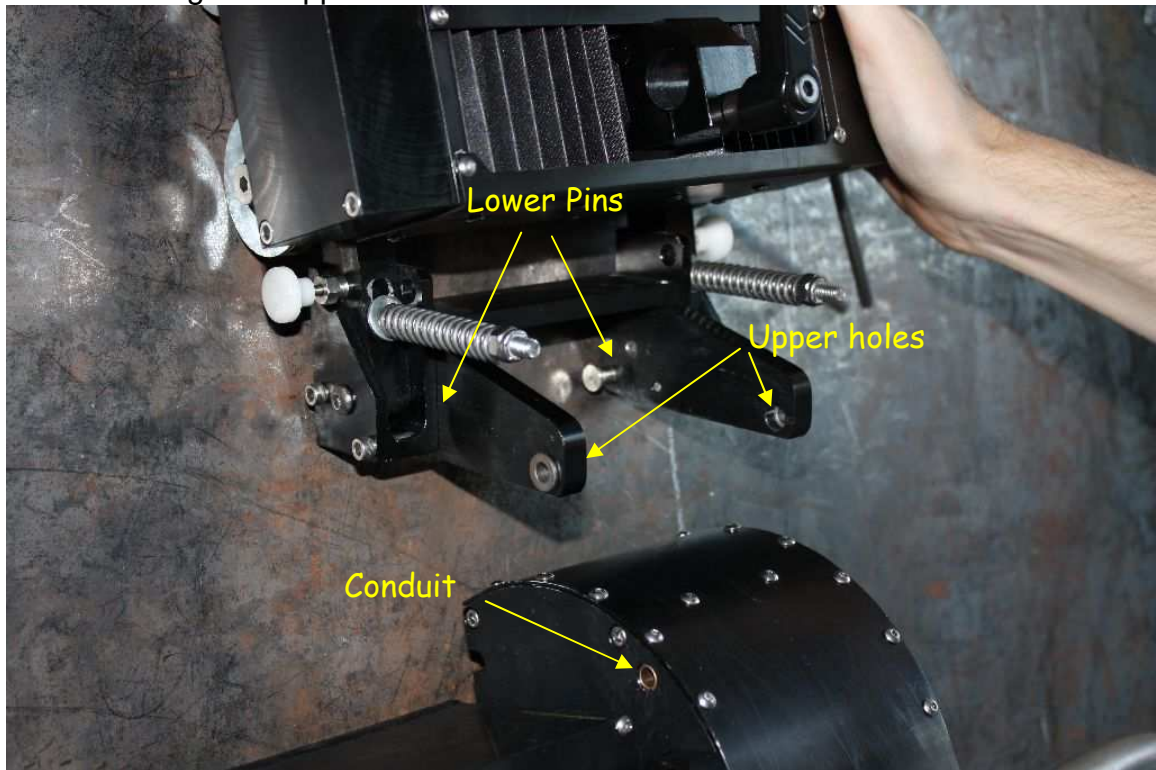




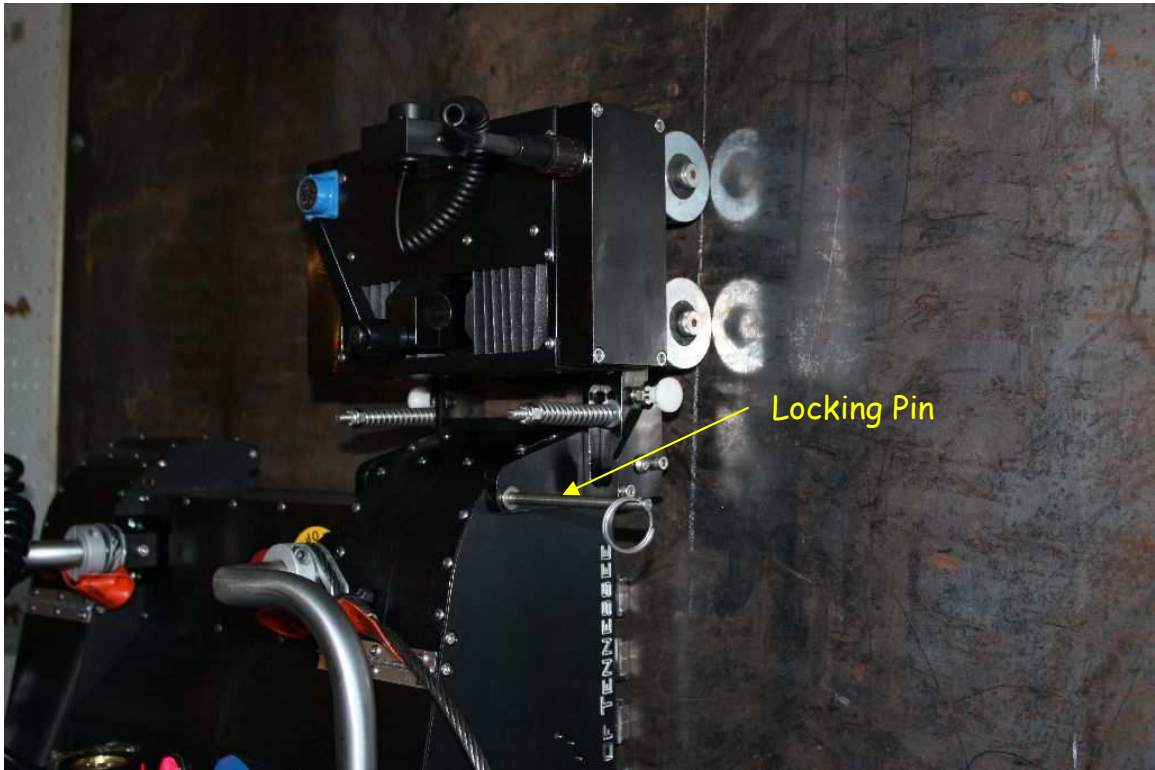
3. Connect the electric plug from wire feed to tractor chassis as shown below.



4. Connect torch manipulator to chassis on the desired corner. To connect, slide the lower pins of torch manipulator under the corner of the tractor and then lift to align the upper holes with conduit on tractor.



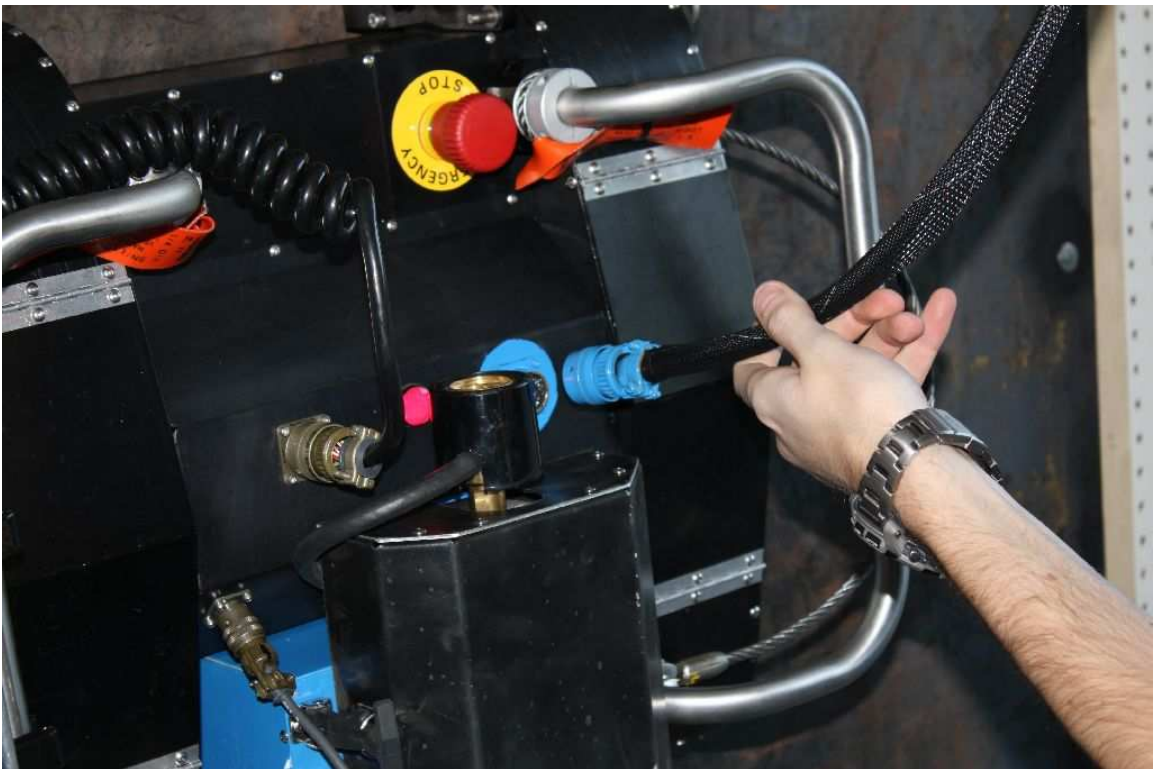
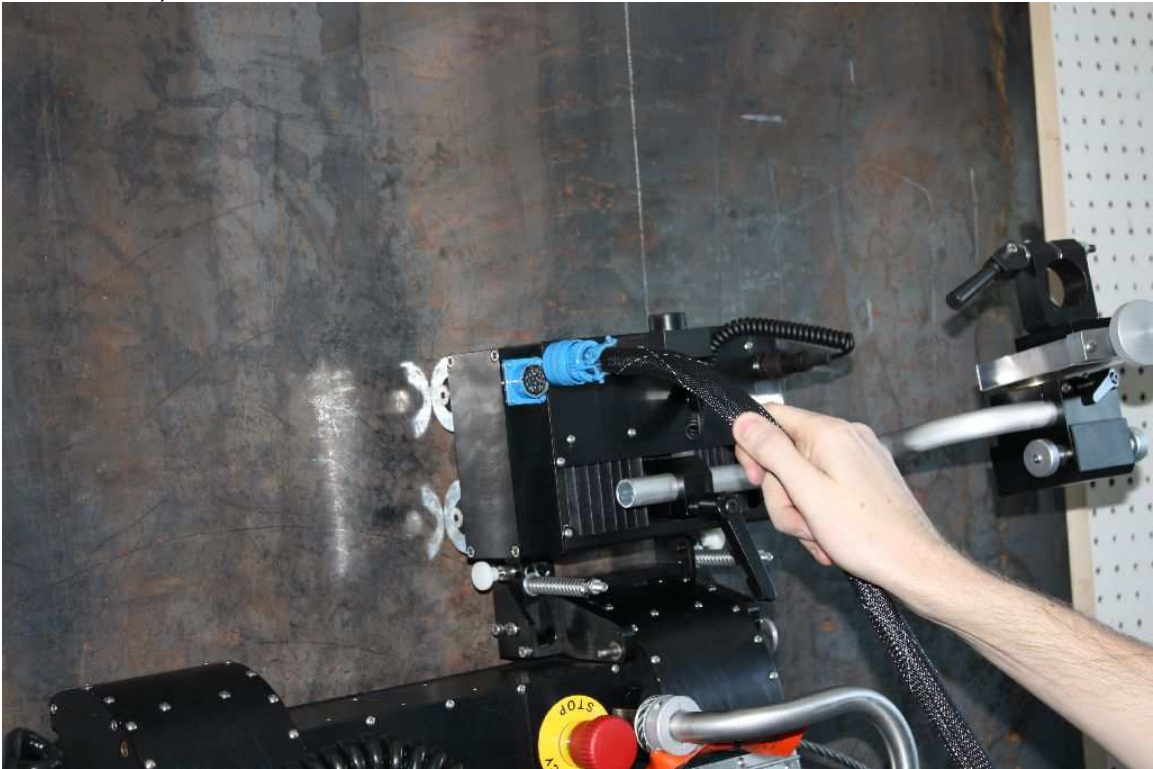
5. Insert locking pin through upper holes on torch manipulator and conduit on tractor.



6. Insert torch tool bar on torch manipulator, adjust to desired position and tighten clamp bolt. Tighten sufficiently to hold in place. Do not over tighten.



7. Connect torch manipulator to tractor with cable (identified by two blue end connectors).



8. Install Torch: connect to Wirefeed and place in torch clamp. Tighten torch clamp sufficient to hold torch secure. Do not over-tighten. Torch is adjusted according to requirements of weld process.

9. Complete connections between the wire feed and welding power supply

10. Inspect that all connections are secure and fastened with the proper hardware.

The system is now ready for weld operation.

I have completed the review of Part IV. System Setup and understand the important points of this section

Name

Date

Part V: Operation

Quick Start Operation Instructions: Tractor

1. Be sure the tractor is off (red E-STOP button on tractor pushed in)
2. Turn on the power supply (switch located on the power supply)
3. Hold tractor controller in hand.
4. Turn on the controller (turn red E-Stop knob clockwise)
5. Turn on the tractor (turn red E-STOP knob on tractor clockwise).
6. Enable the joystick (joystick Enable switch on controller, see figure below)
7. Move Joystick to move tractor (joystick on the controller).
8. Drive the tractor straight forward until the tractor is completely off the assembly/removal guides. These guides may be left on the wall or taken off and stored.
9. Only drive tractor on generally smooth areas of steel surface. Do not drive tractor over cables, etc. or any obstacle taller than 3/8 inch. Do not allow any leads attached to the tractor to be pulled tight. Do not drive tractor off the steel surface.

To Turn off Tractor: Push red E-STOP button located on the tractor

Quick Start Instructions – Controlling the torch

1. The switches/dials on the controller are used to move the torch. These are shown on the label figured below.

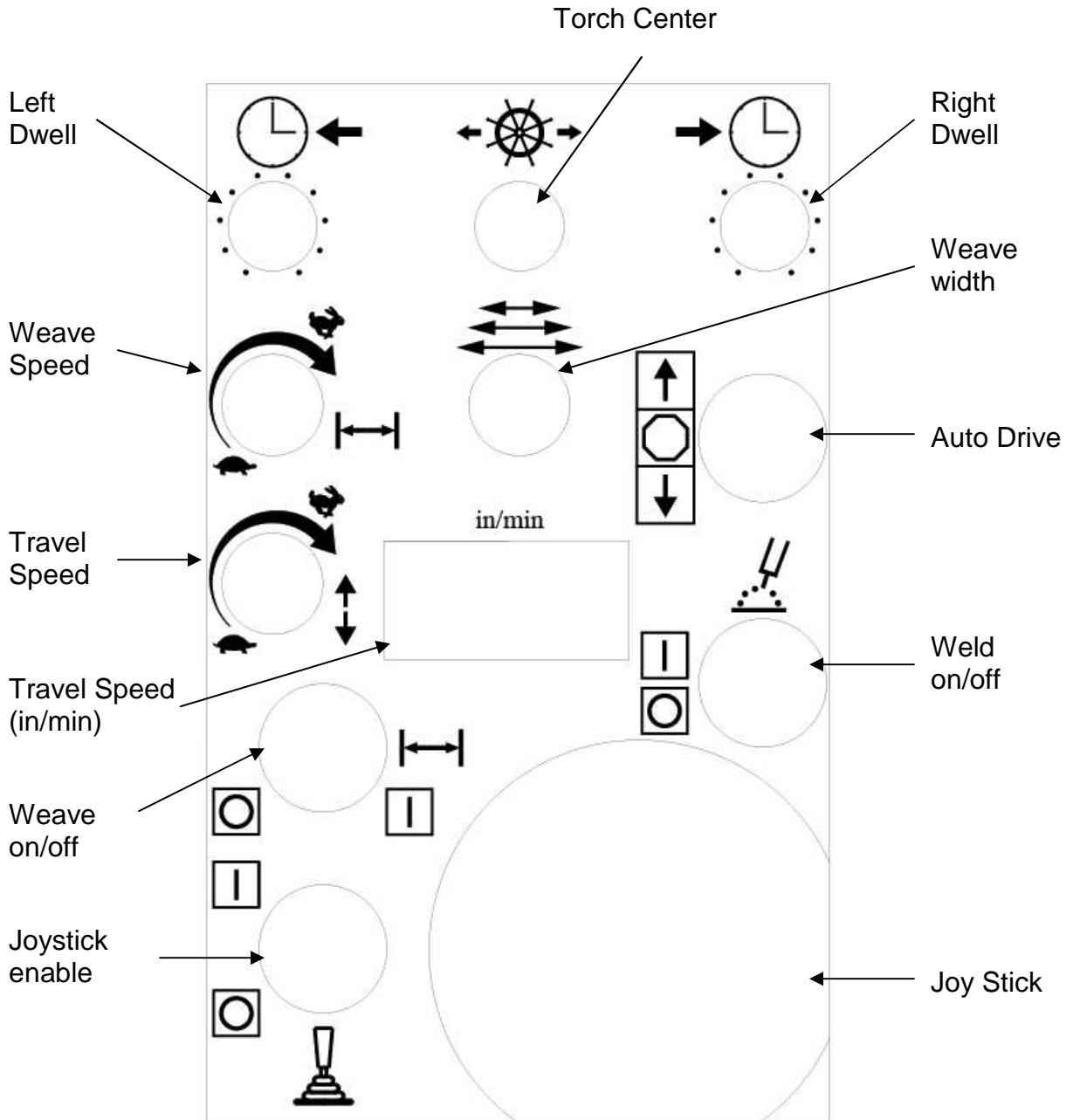


Figure 6: Controller

	Switch	Function	Range
	Left Dwell	Controls the time of dwell on the left side of torch motion	0-0.5 sec.
	Right Dwell	Controls the time of dwell on the right side of torch motion	0-0.5 sec.
	torch center	Moves the center of the torch weave pattern from left to right	+/- 2 inches
	Weave speed	Controls the weave speed of the torch	0 – xx in/s
	Weave width	Controls the width of the weave motion	0-3 inches
	Travel speed	Controls the travel speed of the tractor (forward or reverse)	0-100 ips
	Weave on/off	Turns weaving motion on/off	On/off
	Joystick enable	Enables the joystick	
	Auto Drive	Puts tractor into auto drive moving at set travel speed, turns off the welding torch when in the off position	
	Weld on/off	Turns on the welding torch	



Figure 7: Controller

Setting up a weld Instructions

1. Follow assembly and quick-start operation instructions, Tractor, Torch
2. Position the tractor centrally over the desired weld. Align tractor with weld seam using red line – parallel with weld.
3. With the weave turned off, adjust torch depth, travel, work angle.
4. Using the Controller, adjust the Torch center, weave width, weave speed, left dwell, right dwell to desired amounts.
5. Select the desired weld pattern
6. Adjust the travel speed using the readout on the controller
7. Test the weld motion: push auto-drive switch forward, make sure weld contactor is turned off.
8. Adjust torch motion parameters as desired
9. To end the test, put auto-drive switch to off position
10. Return tractor to beginning of weld seam.

Conducting a Weld.

1. Follow assembly, quick start operation instructions
2. Follow setting up a weld instructions
3. With the tractor fully adjusted and tested, push auto-drive switch forward. Turn on weld at appropriate weld position.
4. Adjust torch motion parameters as desired.
5. At end of weld, turn off weld contactor.
6. Turn off auto-drive switch.
7. Return tractor to desired position.

I have completed the review of Part V. Operation and understand the important points of this section

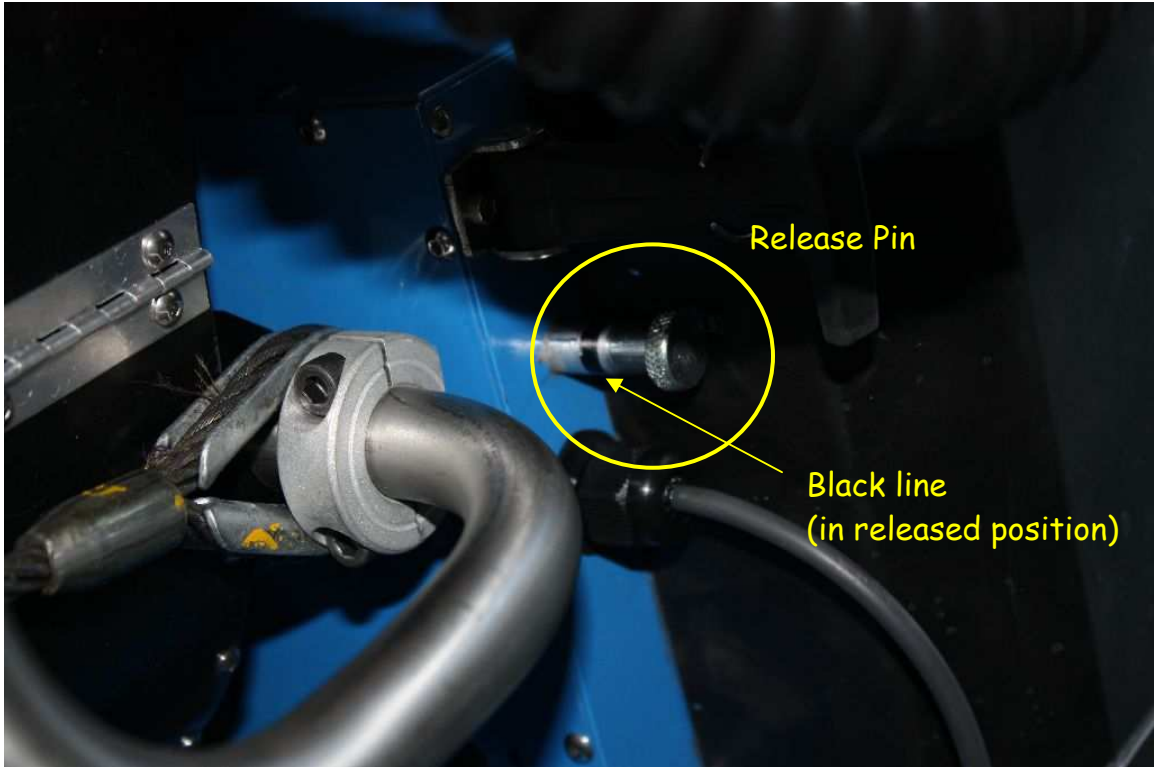
Name

Date

Part VI: Take down

V.1 MRWS Disassembly:

1. Turn off power to Weld system
2. Drive the robot to a convenient location for disassembly.
3. Turn off robot power by pressing red E-stop button.
4. Remove all supply cables to the wire feeder
5. Disconnect the Torch and put away.
6. Disconnect the wire feed unit in the reverse manner from assembly. To remove the wire feed, pull the release pin, slide the unit up and remove from the tractor.

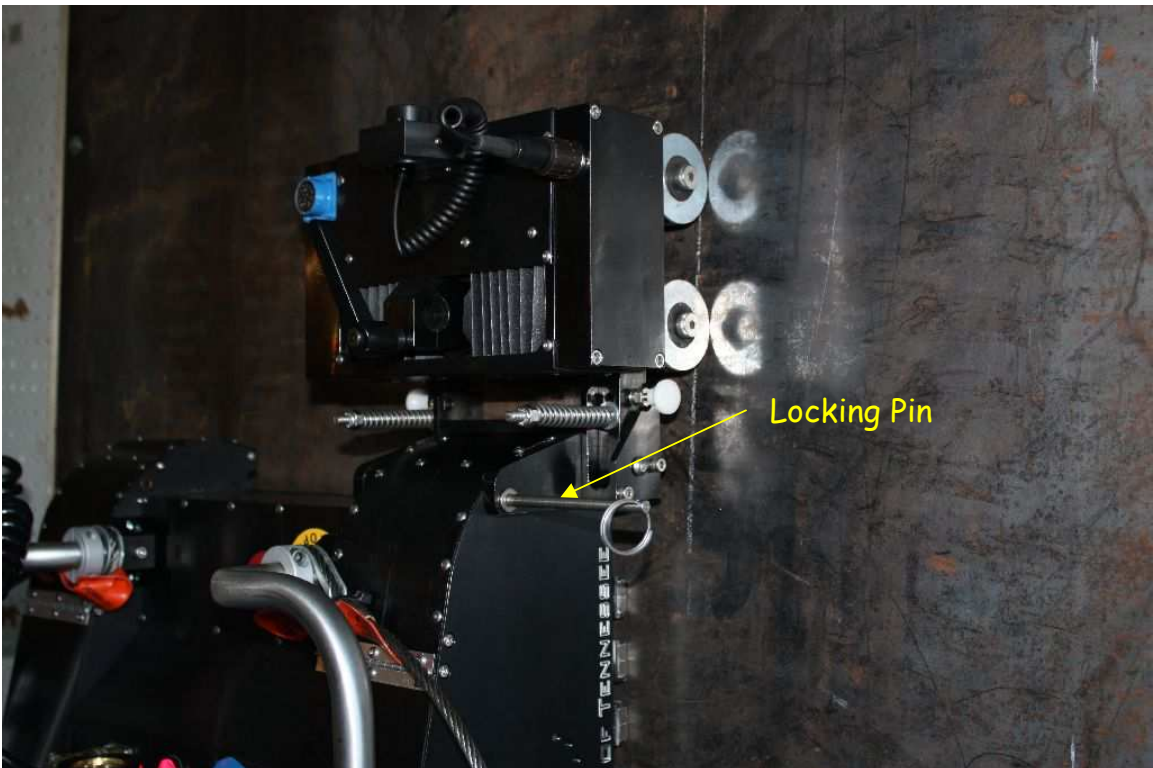


Put the wire feed unit in its storage location.

7. Disconnect the torch tool bar and place into storage location



8. Disconnect the power line to the torch manipulator, remove the torch manipulator and place in storage location



9. Now the MRWS base unit is ready to be removed from the surface. Power the unit back on by turning the E-stop to the right. Take the supplied black rubber mat and carefully place under the lower edge of the MRWS. Slowly back the MRWS onto the black plastic, while supporting the MRWS at the handles.

* KEEP HANDS AWAY FROM TRACK OR ANY OTHER MOVING POINT ON THE MRWS WHEN DRIVING ON THE MAT

* MAINTAIN FIRM HOLD ON THE MRWS WHEN DRIVING ONTO THE BLACK MAT, THE ROBOT WILL RELEASE FROM THE WALL DURING THIS PROCESS.

10. when the MRWS releases from the wall, turn off the MRWS by pressing the E-STOP button. Place the MRWS in storage, along with the operator pendant, power supply and cable.

VI.2 MRWS Disassembly: Video

VI.3 MRWS Disassembly: Practice

I have completed the review of Part VI. System Disassembly and understand the important points of this section

Name

Date

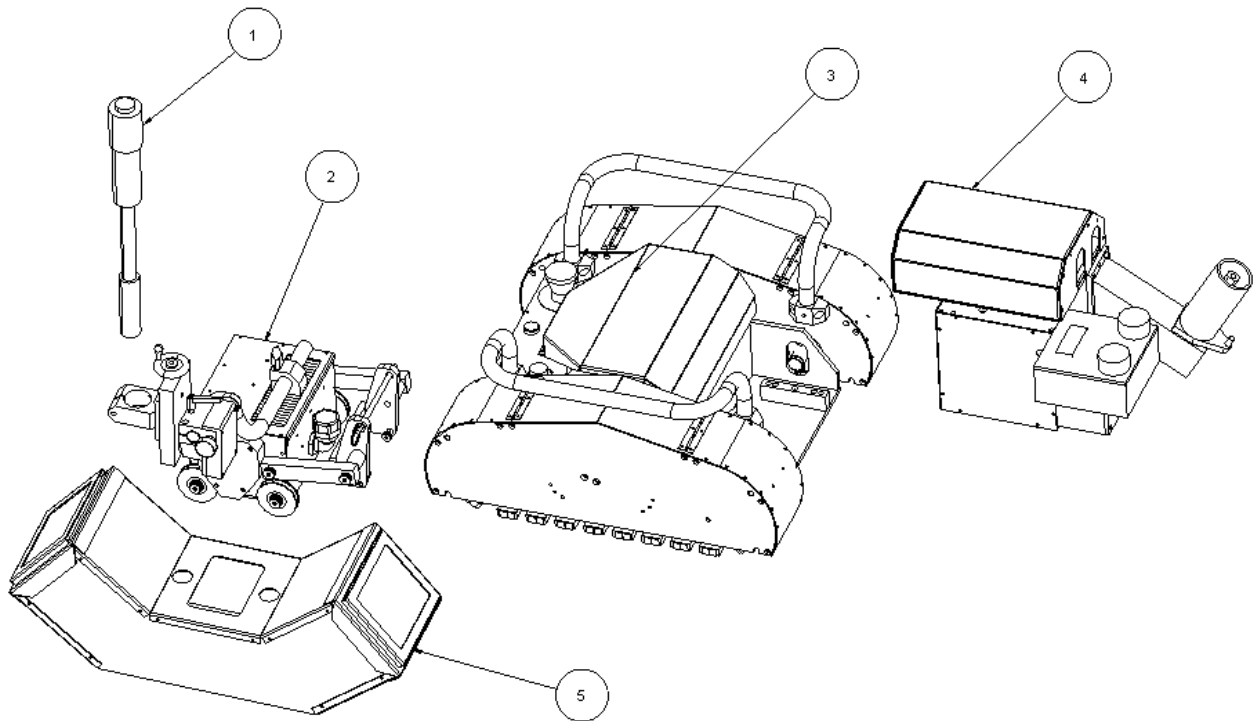
Part VII: Regular maintenance schedule

Regular maintenance and repair are covered in this section. The table below defines the regular maintenance operations. The following section gives parts breakdown of the MRWS system for repair and ordering parts.

Maintenance Schedule

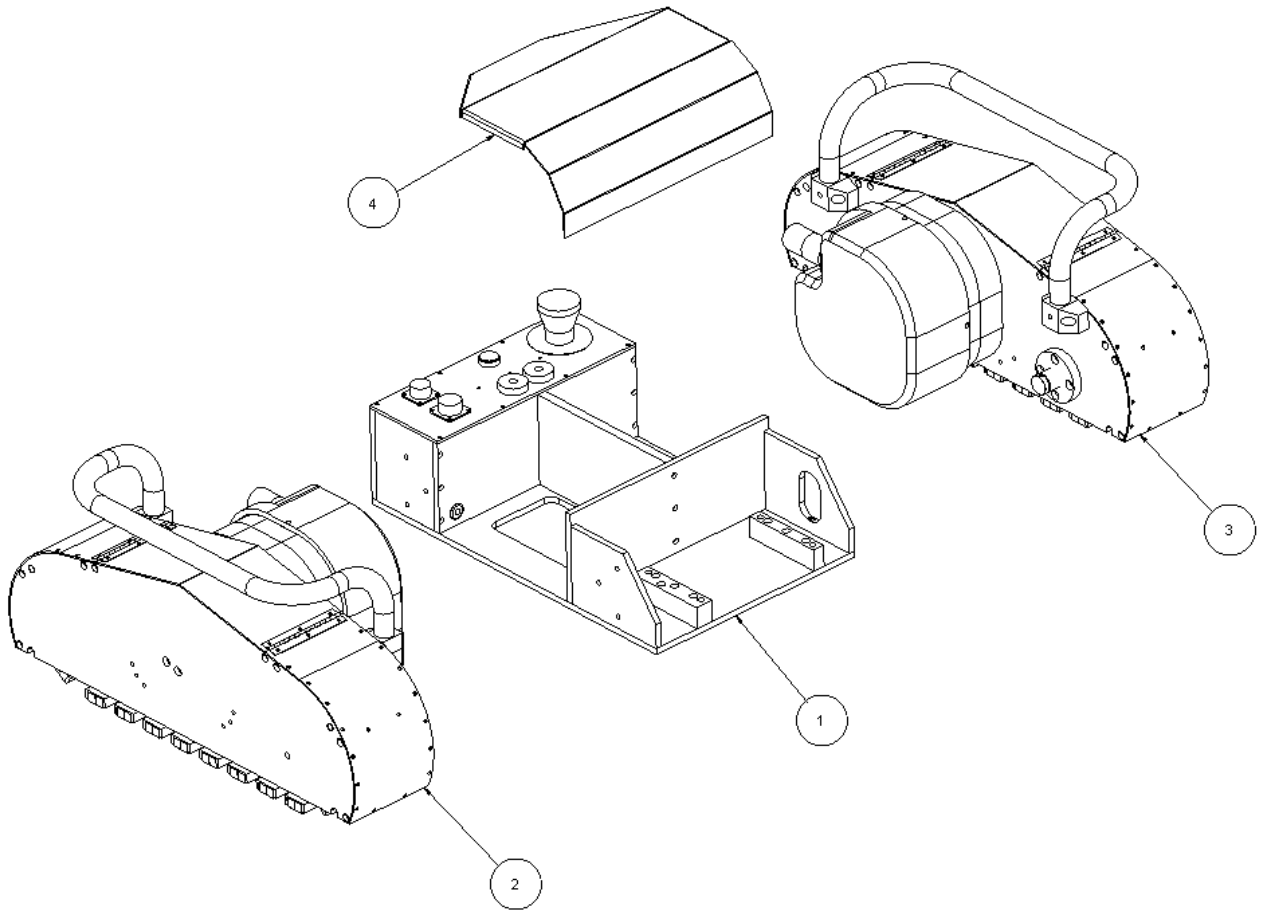
Item	Description	Frequency
System operation check	Inspect system for loose or broken components	Every use
Fall arrest attachments	Inspect fall arrest for any signs of wear or loose connections	Every 300 hours, replace if any load condition occurs
Magnetic tracks	Clean large debris from tracks	Every use or if debris builds up during use
Magnetic tracks	Clean in and around tracks – remove material using a cloth with a slide and squeeze maneuver	Every 300 hours

MRWS-3.0-SYSTEM COMPONENTS



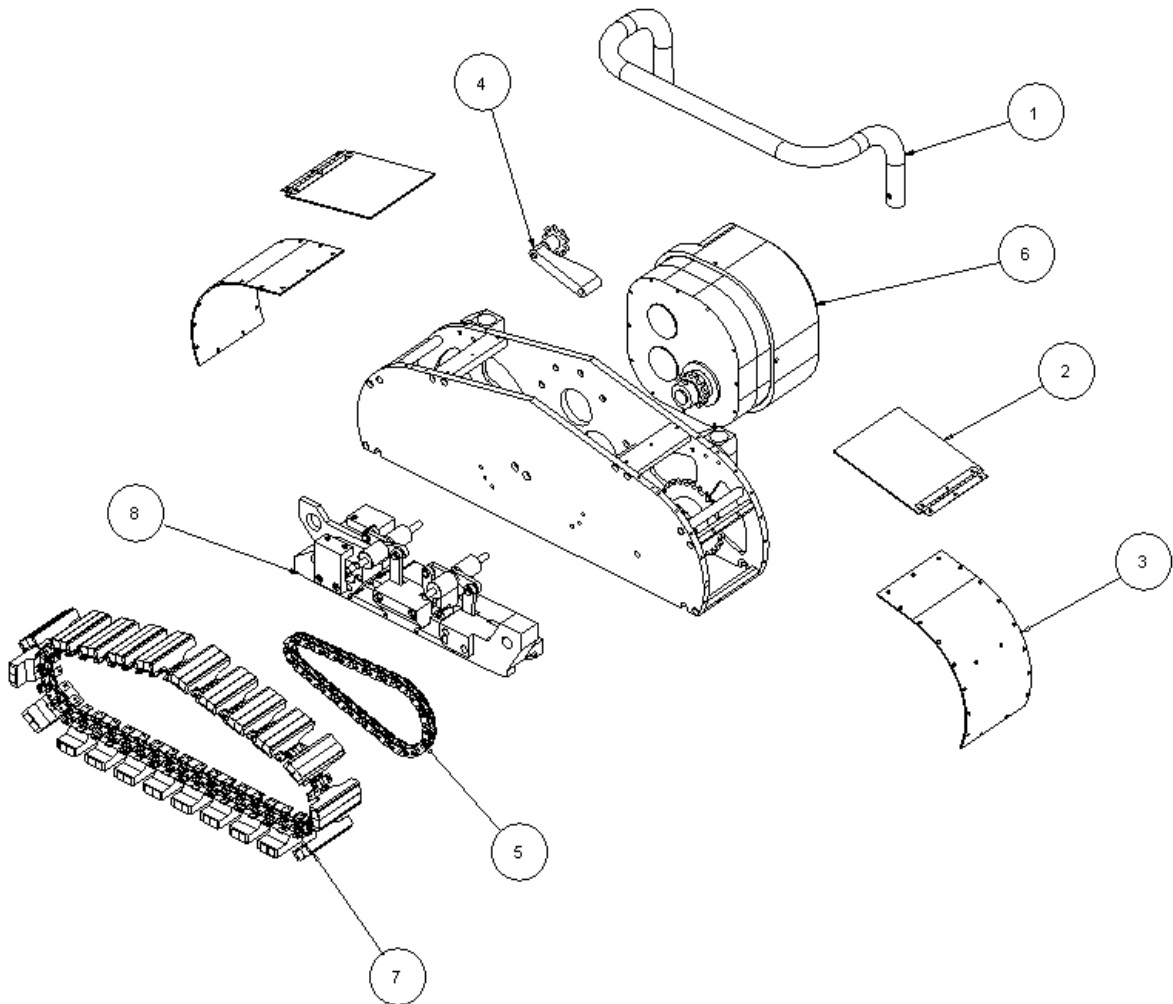
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	MRWS-3.0-B-ACD501DF5HM	Bernard automatic welding torch
2	1	MRWS-3.0-WEAVER	Torch oscillator assembly
3	1	MRWS-3.0-CRAWLER	MRWS 3.0 crawler assembly
4	1	MRWS-3.0-M24A	Miller 24A wire feeder unit assembly
5	1	MRWS-3.0-ARCENCL	Arc enclosure assembly

MRWS-3.0-CRAWLER



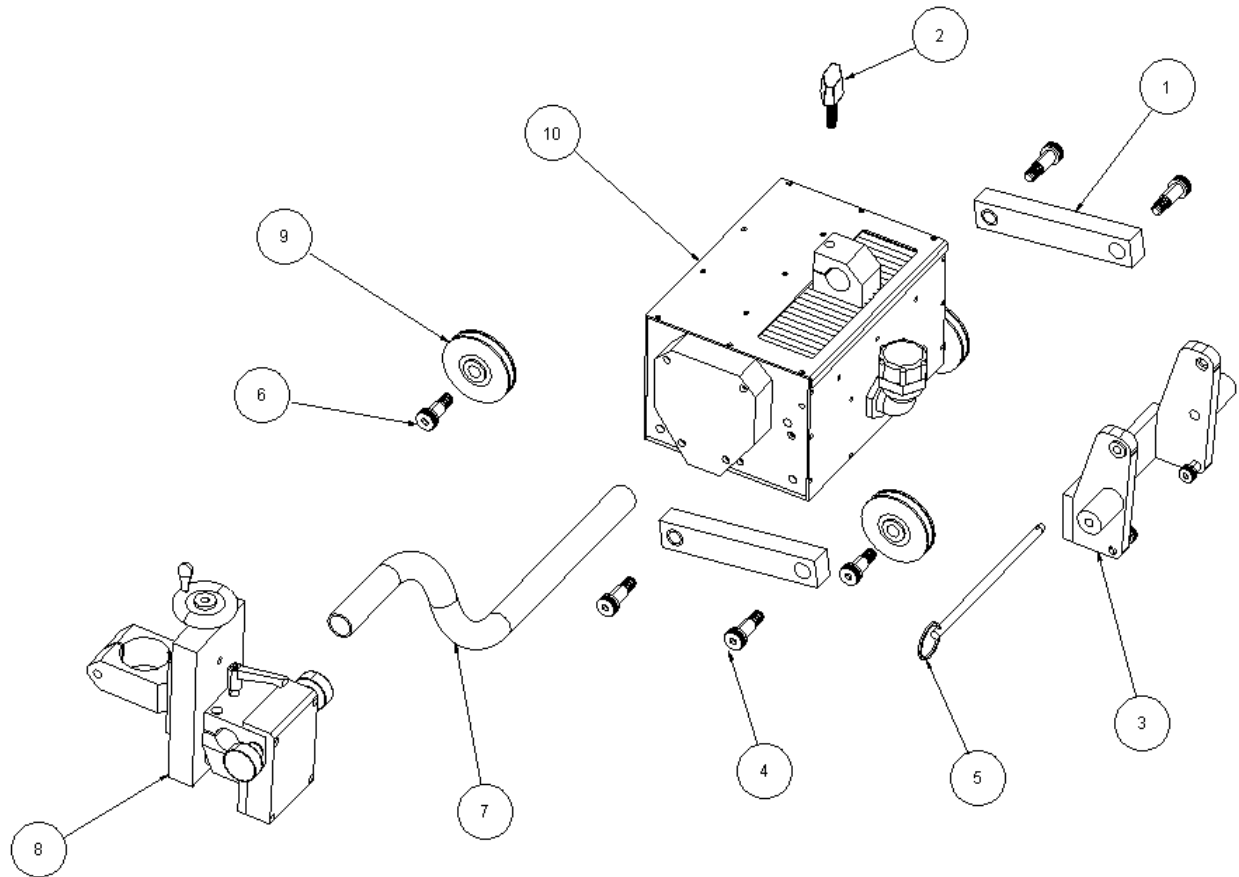
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	C-3.0-CHASSIS	Central chassis assembly
2	1	C-3.0-LT-UNIT	Left crawler track assembly
3	1	C-3.0-RT-UNIT	Right crawler track assembly
4	1	C-3.0-COVER	Center chassis cover

MRWS-3.0-TRACK UNIT ASSEMBLY



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	T-3.0-H-100	Handle
2	2	T-3.0-C-100	Hinged track cover
3	2	T-3.0-C-201	Curved end track cover
4	1	T-3.0-I-100	Idler sprocket assembly
5	1	T-3.0-FDC	Final drive chain assembly
6	1	M-3.0-LH-100	Motor drive unit assembly
7	1	T-3.0-CA	Magnetic track assembly
8	1	T-3.0-G-100	Chain guide assembly

MRWS-3.0-TORCH OSCILLATOR ASSEMBLY



ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	W-3.0-M-201	Arm link with bushings
2	1	W-3.0-C-100	Lever-lock clamp
3	1	W-3.0-M-200	Chassis mounting assembly
4	4	W-3.0-MC90298A621	Shoulder bolt
5	1	W-3.0-MC98404A170	Quick release pin
6	4	W-3.0-MC90298A619	Shoulder bolt
7	1	W-3.0-TA-100	Torch arm
8	1	W-3.0-A-100	Torch angle/depth adjuster assembly
9	4	W-3.0-W-100	Magnetic wheel assembly
10	1	W-3.0-O-100	Linear oscillator assembly

Part VIII: Preferred operating practice

Part IX: Advanced operations

