

TC1/HDU Installation Manual for Kubota M5 Series (Non-Steer Ready)

016-5035-038 Rev. A

1/2020

E34163



DISCLAIMER

While every effort has been made to ensure the accuracy of this document, Raven Industries assumes no responsibility for omissions and errors. Nor is any liability assumed for damages resulting from the use of information contained herein.

Raven Industries shall not be responsible or liable for incidental or consequential damages or a loss of anticipated benefits or profits, work stoppage or loss, or impairment of data arising out of the use, or inability to use, this system or any of its components. Raven Industries shall not be held responsible for any modifications or repairs made outside our facilities, nor damages resulting from inadequate maintenance of this system.

As with all wireless and satellite signals, several factors may affect the availability and accuracy of wireless and satellite navigation and correction services (e.g. GPS, GNSS, SBAS, etc.). Therefore, Raven Industries cannot guarantee the accuracy, integrity, continuity, or availability of these services and cannot guarantee the ability to use Raven systems, or products used as components of systems, which rely upon the reception of these signals or availability of these services. Raven Industries accepts no responsibility for the use of any of these signals or services for other than the stated purpose.

Chapter 1	Important Safety Information.....	1
Hydraulic		2
General		2
Instructions for Hose Routing		2
Electrical		3
General		3
Instructions for Wire Routing		3
Chapter 2	Introduction.....	7
Introduction		7
Preparing for Installation		7
Recommendations		7
Tools Needed		8
Point of Reference		8
Updates		8
Kit Contents		8
Chapter 3	Hydraulic System Installation.....	13
Install Fittings in the Hydraulic Steering Valve		14
Install Fittings in the Dual POCl Valve		15
Mount the Hydraulic Steering and Dual POCl Valves		16
Dual POCl to Steering Valve Lines		19
Install the Pressure, Excess Flow, and Tank Lines		20
Equipment without Loader		20
Equipment with Loader		22
Install the Left and Right Steering Hoses		24
Hydraulic Diagram		26
Chapter 4	Cab Component and Sensor Installation.....	27
Install Wheel Angle Sensor		27
Wheel Angle Sensor Brackets		27
Wheel Angle Sensor		29
Mount TC1 and HDU ECU		30
Connect The TC1 and HDU Cable		32
In Cab		32
Mount Foot Switch		34
Assemble and Mount the Master Engage Switch		34
Outside of Cab		35
Chapter 5	Startup Procedures	39
Verify the System Installation		39

CHAPTER

1

IMPORTANT SAFETY INFORMATION

NOTICE

Read this manual and the operation and safety instructions included with your implement and/or controller carefully before installing the TC1/HDU system.

- Follow all safety information presented within this manual.
- If you require assistance with any portion of the installation or service of your Raven equipment, contact your local Raven dealer for support.
- Follow all safety labels affixed to the TC1/HDU system components. Be sure to keep safety labels in good condition and replace any missing or damaged labels. To obtain replacements for missing or damaged safety labels, contact your local Raven dealer.

When operating the machine after installing TC1/HDU observe the following safety measures:

- Be alert and aware of surroundings.
- Do not operate TC1/HDU or any agricultural equipment while under the influence of alcohol or an illegal substance.
- Remain in the operator's position or a safe working distance away from the booms at all times when TC1/HDU is engaged.
- Disable TC1/HDU when exiting from the operator's seat and machine.
- Do not drive the machine with TC1/HDU enabled on any public road.
- Determine and remain a safe working distance from other individuals. The operator is responsible for disabling TC1/HDU when the safe working distance has diminished.
- Ensure TC1/HDU is disabled prior to starting any maintenance work on TC1/HDU or the machine.

WARNING

- When starting the machine for the first time after installing TC1/HDU be sure that all persons stand clear in case a hose has not been properly tightened.

CAUTION

HYDRAULIC

GENERAL

- Raven Industries recommends that appropriate protective equipment be worn at all times when working on the hydraulic system.
- Never attempt to open or work on a hydraulic system with the equipment running. Care should always be taken when opening a system that has been previously pressurized.
- When disconnecting the hydraulic hoses or purging is required, be aware that the hydraulic fluid may be extremely hot and under high pressure. Caution must be exercised.
- Any work performed on the hydraulic system must be done in accordance with the machine manufacturer's approved maintenance instructions.
- When installing TC1/HDU hydraulics or performing diagnostics, maintenance, or routine service, ensure that precautions are taken to prevent any foreign material or contaminants from being introduced into the hydraulic system. Objects or materials that are able to bypass the hydraulic filtration system will reduce performance and possibly damage the TC1/HDU hydraulic valve.

INSTRUCTIONS FOR HOSE ROUTING

The word "hose" is used to mean all flexible fluid carrying components. Follow existing hoses as much as possible and use these guidelines:

Hoses should not contact or be attached to:

- Components with high vibration forces
- Components carrying hot fluids beyond component specifications

Avoid contact with any sharp edge or abrading surfaces such as, but not limited to:

- Sheared or flame cut edges
- Edges of machined surfaces
- Fastener threads or cap screw heads
- Ends of adjustable hose clamps

Routing should not allow hoses to:

- Hang below the unit
- Have the potential to become damaged due to exposure to the exterior environment. (i.e. tree limbs, debris, attachments)
- Be placed in areas of or in contact with machine components which develop temperatures higher than the temperature rating of hose components
- Hoses should be protected or shielded if it needs to route near hot temperatures beyond hose component specifications

Hoses should not have sharp bends

Allow sufficient clearance from machine component operational zones such as:

- Drive shafts, universal joints and hitches (i.e. 3-point hitch)
- Pulleys, gears, sprockets
- Deflection and backlash of belts and chains
- Adjustment zones of adjustable brackets
- Changes of position in steering and suspension systems
- Moving linkages, cylinders, articulation joints, attachments
- Ground engaging components

For hose sections that move during machine operation:

- Allow sufficient length for free movement without interference to prevent: pulling, pinching, catching or rubbing, especially in articulation and pivot points
- Clamp hoses securely to force controlled movement to occur in the desired hose section
- Avoid sharp twisting or flexing of hoses in short distances

Protect hoses from:

- Foreign objects such as rocks that may fall or be thrown by the unit
- Buildup of dirt, mud, snow, ice, submersion in water and oil
- Tree limbs, brush and debris
- Damage where service personnel or operators might step or use as a grab bar
- Damage when passing through metal structures
- High pressure wash

ELECTRICAL

GENERAL

- Always verify that the power leads are connected to the correct polarity as marked. Reversing the power leads could cause severe damage to the equipment.
- Ensure that the power cable is the last cable to be connected.
- A minimum of 12 VDC is required for system operation with a maximum of 15 VDC.

INSTRUCTIONS FOR WIRE ROUTING

The word "harness" is used to mean all electrical leads and cables, bundled and unbundled. When installing harness, secure it at least every 30 cm (12in) to the frame. Follow existing harness as much as possible and use these guidelines:

Harness should not contact or be attached to:

- Lines and hoses with high vibration forces or pressure spikes
- Lines and hoses carrying hot fluids beyond harness component specifications

Avoid contact with any sharp edge or abrading surfaces such as, but not limited to:

- Sheared or flame cut edges
- Edges of machined surfaces
- Fastener threads or cap screw heads

- Ends of adjustable hose clamps
- Wire exiting conduit without protection, either ends or side of conduit
- Hose and tube fittings

Routing should not allow harnesses to:

- Hang below the unit
- Have the potential to become damaged due to exposure to the exterior environment. (i.e. tree limbs, debris, attachments)
- Be placed in areas of or in contact with machine components which develop temperatures higher than the temperature rating of harness components
- Wiring should be protected or shielded if it needs to route near hot temperatures beyond harness component specifications

Harnessing should not have sharp bends

Allow sufficient clearance from machine component operational zones such as:

- Drive shafts, universal joints and hitches (i.e. 3-point hitch)
- Pulleys, gears, sprockets
- Deflection and backlash of belts and chains
- Adjustment zones of adjustable brackets
- Changes of position in steering and suspension systems
- Moving linkages, cylinders, articulation joints, attachments
- Ground engaging components

For harness sections that move during machine operation:

- Allow sufficient length for free movement without interference to prevent: pulling, pinching, catching or rubbing, especially in articulation and pivot points
- Clamp harnesses securely to force controlled movement to occur in the desired harness section
- Avoid sharp twisting or flexing of harnesses in short distances
- Connectors and splices should not be located in harness sections that move

Protect harnesses from:

- Foreign objects such as rocks that may fall or be thrown by the unit
- Buildup of dirt, mud, snow, ice, submersion in water and oil
- Tree limbs, brush and debris
- Damage where service personnel or operators might step or use as a grab bar
- Damage when passing through metal structures

IMPORTANT:

- Avoid directly spraying electrical components and connections with high pressure water. High pressure water sprays can penetrate seals and cause electrical components to corrode or otherwise become damaged. When performing maintenance:
 - Inspect all electrical components and connections for damage or corrosion. Repair or replace components, connections, or cable as necessary.
 - Ensure connections are clean, dry, and not damaged. Repair or replace components, connections, or cable as necessary.
 - Clean components or connections using low pressure water, pressurized air, or an aerosol electrical component cleaning agent.

- Remove visible surface water from components, connections, or seals using pressurized air or an aerosol electrical component cleaning agent. allow components to dry completely before reconnecting cables.

INTRODUCTION

Thank you for selecting the Raven TC1/HDU steering system. The TC1/HDU system is designed to provide hands-free steering of agricultural equipment using Global Navigation Satellite System (GNSS) position data.

This manual applies to the following machines:

MAKE: Kubota
MODEL: M5-091, M5-111
YEAR: 2019 & Newer

PREPARING FOR INSTALLATION

Before installing TC1/HDU park the machine where the ground is level, clean, and dry. Leave the machine turned off for the duration of the installation process.

During the installation process, follow good safety practices. Be sure to carefully read the instructions in this manual as you complete the installation process.

RECOMMENDATIONS

Raven Industries recommends the following best practices before installing or operating the TC1/HDU system for the first time, at the start of the season, or when moving the TC1/HDU system to another machine:

- Ensure the hydraulic filters have been recently changed and there are no issues with the hydraulic system (e.g., pump issues, faulty hydraulic motors, fine metal deposits in the hydraulic hoses, etc.).
- Operate each of the hydraulic functions on the machine (i.e., tilt, fold, center rack, tongue extension, turning the steering wheel to the left and right steering locks, or other hydraulic valve functions) three times to ensure the hydraulic valve is using fresh oil and debris is flushed from the hydraulic hoses, valves, and filters.

Raven Industries recommends the following best practices when installing the TC1/HDU system.

- Use part numbers to identify the parts.
- Do not remove the plastic wrap from a part until it is necessary for installation.
- Do not remove plastic caps from a part until it is necessary for installation.

TOOLS NEEDED

The following tools are recommended for installation of the TC1/HDU system:

- SAE and metric wrenches and sockets
- Cable ties
- Set of tools

POINT OF REFERENCE

The instructions in this manual assume that you are standing behind the machine, looking toward the cab.

UPDATES

Software and manual updates are available on the Raven Applied Technology website:

<http://www.ravenhelp.com>

At Raven Industries, we strive to make your experience with our products as rewarding as possible. One way to improve this experience is to provide us with feedback on this manual.

Your feedback will help shape the future of our product documentation and the overall service we provide. We appreciate the opportunity to see ourselves as our customers see us and are eager to gather ideas on how we have been helping or how we can do better.

To serve you best, please send an email with the following information to

techwriting@ravenind.com

- TC1/HDU Installation Manual for Kubota M5 Series (Non-Steer Ready)
- 016-5035-038 Rev. A
- Any comments or feedback (include chapter or page numbers if applicable).
- Let us know how long have you been using this or other Raven products.

We will not share your email or any information you provide with anyone else. Your feedback is valued and extremely important to us.

Thank you for your time.

KIT CONTENTS

This section contains a list of the components that are included in the TC1/HDU kit. Before beginning the TC1/HDU installation, compare the items in the TC1/HDU kit with the components on this list. If you have questions about the kit, contact your local Raven dealer.

FIGURE 1. TC1/HDU Installation Kit for Kubota M5 (P/N 117-5035-038 Rev. C)

QTY	PART #	DESCRIPTION
1	053-0159-197	BOX, SHIPPING
1	116-0159-844	WELDMENT, VALVE BRACKET, KUBOTA M5 MY19
1	107-0172-661	BRACKET, VALVE SUPPORT, KUBOTA M5 MY19
1	107-0172-662	BRACKET, TC1/HDU CAB MOUNT, KUBOTA M5 MY19
1	107-0172-663	BRACKET, CYLINDER GUARD LEFT, KUBOTA M5 MY19
1	107-0172-664	BRACKET, CYLINDER GUARD RIGHT, KUBOTA M5 MY19
1	107-0172-665	BRACKET, CYLINDER GUARD CONNECTOR, KUBOTA M5 MY19
1	107-0172-666	BRACKET, WAS CYLINDER MOUNT, KUBOTA M5 MY19
1	416-0001-054	SENSOR, LINEAR, NON-CONTACT, 350MM
1	422-0000-086	TRANSDUCER, PRESSURE, 0-3000 PSI
1	115-4010-152	CABLE, SC1/HDU, KUBOTA M5 TRACTOR
1	115-4010-153	CABLE, VALVE, KUBOTA M5 TRACTOR
1	115-4010-032	CABLE, M12 WAS TO 4 PIN
1	115-4010-028	CABLE, CAB SWITCH
1	063-0173-961	ASSEMBLY, SWITCH, MASTER RS1
1	063-0173-887	NODE, HDU
1	063-0174-070	ECU, ISO, TC1, LOW SPEED STEERING
1	334-0003-090	VALVE, HYDRAULIC, SMARTRAX, OPEN CENTER
1	334-0003-099	VALVE, HYD DUAL POCI
1	063-0172-470	ENGAGE FOOT SWITCH
1	117-0199-009	KIT, HYDRAULIC, STEERING, KUBOTA M5 MY19+
		CONT..

FIGURE 2. TC1/HDU Installation Kit for Kubota M5 (P/N 117-5035-038 Rev. C)

QTY	PART #	DESCRIPTION
		PREV..
1	053-0159-015	ENVELOPE, PLASTIC
1	311-0070-010	BOLT, HEX HEAD, M6 X 1.0 X 20 MM, ZINC PLATED, GRADE 8.8
6	311-0052-103	BOLT, HEX HEAD, 5/16-18 UNC-2A X 3/4" LG
2	311-0052-112	BOLT, HEX HEAD, 5/16-18 UNC-2A X 2-3/4" LG
2	311-4051-186K	HEX BOLT, DIN931, M8 X 55MM LG, 10.9 STEEL, CLASS II
2	311-0054-105	BOLT, HEX HEAD, 3/8-16 UNC-2A X 1" LG
2	311-4051-177K	HEX BOLT, DIN931, M8 X 16MM LG, 10.9 STEEL, CLASS II
2	311-4046-120K	HEX BOLT, DIN961, M12 X 1.25 X 35MM LG, 10.9 STEEL, CLASS II
2	311-4051-229K	HEX BOLT, DIN931, M10 X 55MM LG, 10.9 STEEL, CLASS II
1	435-3003-059	CLAMPING U-BOLT 2"
1	313-6000-010	WASHER DIN125 - ZN - M6
4	313-2300-310	1/4 INCH WASHER
8	313-2300-012	5/16 WASHERS, 0.1IN THICK
2	313-6000-014	M8 FENDER WASHER
2	313-2300-014	3/8 WASHER, STEEL, FLAT
2	313-6000-017	M10 FLAT FENDER WASHER
4	312-4000-057	1/4-20 LOCK NUT
6	312-1001-034	HEX NUT, 5/16-18, STEEL, ZINC PLATED
2	312-4000-168	LOCK NUT, HEX, 3/8"
2	312-6002-042K	HEX NUT, THIN, DIN439, M10, CLASS 8, CLASS II
2	312-1002-035	NUT, JAM, M10X1.5MM PITCH
2	104-1000-276	SPACER, 0.75 OD, M8 CLEAR HOLE, 1.63 LONG
1	104-1000-277	SPACER, 0.75 OD, M10 CLEAR HOLE, 0.75 LONG
1	104-1000-278	SPACER, 0.75 OD, M10 CLEAR HOLE, 15MM LONG
2	103-0001-029	MOUNT, SENSOR SWIVEL END (BALL)
1	118-0159-056	HOUSING, ROCKER SWITCH, BASE
1	118-0159-057	HOUSING, ROCKER SWITCH, COVER
4	311-0008-027	SCREW 4-40 UNC X 1/2" PHILLIPS

FIGURE 3. Hydraulic Steering Kit for Kubota M5 Series (P/N 117-0199-009 Rev. A)

QTY	PART #	DESCRIPTION
2	333-0012-233	-10 ORING (M) TO -6 FF (M)
2	333-0012-304	-10 ORING (M) TO -8FF(M)
1	333-0012-246	-10 ORING (M) TO -10 JIC (M)
1	333-0012-108	-10 JIC 90 ELBOW (M TO F)
1	333-0012-113	-10 JIC STREET TEE (M, M, F)
6	333-0012-199	-8 ORING (M) TO -6 FF(M)
2	333-0012-065	-6 FF 90 ELBOW (M TO F)
4	333-0012-051	-4 ORING PLUGS (M)

HYDRAULIC HOSES

	PART # / LABEL	END 1	SIZE	END2	LENGTH
1	214-1001-211	-8 FF (F) 90	-8	-10 JIC (F)	24"
1	214-1001-212	-10 JIC (F)	-8	-08 FF(F) 90	36"
2	214-1001-213	-4 19 BSPP (F)	-4	-6 FF (F) 45	48"
2	214-1001-214	-4 19 BSPP (M)	-4	-6 FF (F) 45	18"
2	214-1001-215	-06 FF (F) 90	-4	-06 FF (F) 90	24"
1	214-1001-216	-10 JIC (F) 90	-8	-08 JIC (F)	32"

CHAPTER

3

HYDRAULIC SYSTEM INSTALLATION



WARNING

Hydraulics are under pressure. Care should always be taken with a system that has been pressurized.

Before beginning the TC1 hydraulic installation, turn off the machine and relieve pressure by turning the steering wheel left and right.

Never work on a hot machine. Always allow it to cool before performing diagnostics, maintenance, or routine service.

When disconnecting or purging hydraulic hoses, be aware that the hydraulic fluid within the system may be extremely hot and under high pressure.


Tampering with hydraulic valves may cause serious injury or death, and will void the warranty.



CAUTION

When installing TC1 hydraulics or performing diagnostics, maintenance, or routine service, ensure precautions are taken to prevent any foreign material from being introduced into the hydraulic system.

Objects or materials that are able to bypass the hydraulic filtration system will reduce performance and possibly damage the TC1 hydraulic valve.



NOTICE

The appearance of the TC1 hydraulic valve may vary slightly from the images contained in this manual. However, the fittings, hose connections, and cable connections remain the same.

INSTALL FITTINGS IN THE HYDRAULIC STEERING VALVE

Before mounting the hydraulic steering valve (P/N 334-0003-090) on the machine, install the proper fittings in the valve. This prepares the valve for installation and simplifies the hose connection process later in the procedure. Refer to the following table to install the fittings in the appropriate ports of the hydraulic steering valve.

FIGURE 1. Fittings Installed in Hydraulic Steering Valve



TABLE 1. Steering Valve Fitting Installation

Fitting	Part Number	Port
Fitting - -10 SAE O-Ring (M) to -6 ORFS (M)	333-0012-233	A, B
Fitting - -10 SAE O-Ring (M) to -8 ORFS (M)	333-0012-304	P, T
Fitting - -10 SAE O-Ring (M) to -10 JIC (M)	333-0012-246	EF

INSTALL FITTINGS IN THE DUAL POCI VALVE

Before mounting the dual POCI valve (P/N 334-0003-099) on the machine, install the proper fittings in the valve. This prepares the valve for installation and simplifies the hose connection process later in the procedure. Refer to Figure 2 and the table below to install fittings on the dual POCI valve.

FIGURE 2. Fittings Installed on Dual POCI Valve

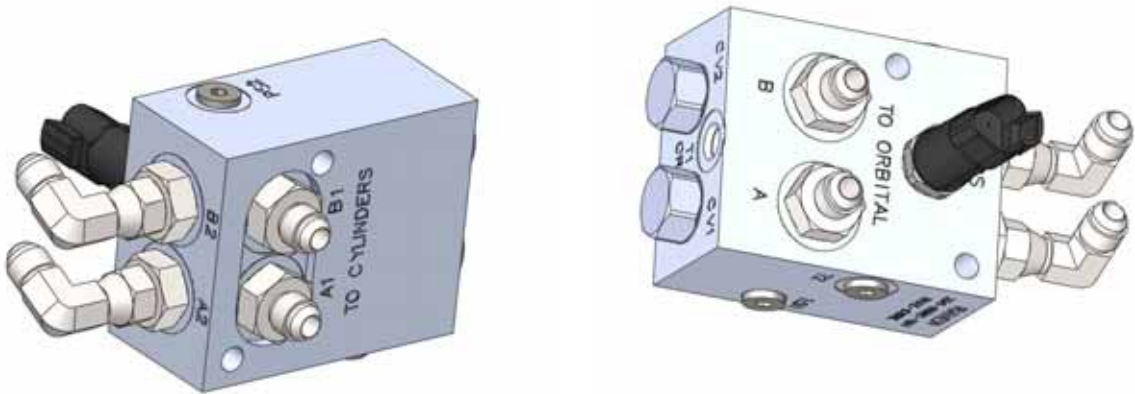


TABLE 2. Dual POCI Valve Fitting Installation

Fitting	Part Number	Port
Fitting - -8 SAE O-Ring (M) to -6 ORFS (M) Straight Adapter	333-0012-199	A, B, A1, B1, A2, B2
Fitting - -6 ORFS 90° Swivel Elbow	333-0012-065	A2, B2
Fitting - -4 SAE O-Ring Plug	333-0012-051	PS2, T2, LS1
Fitting - -Pressure Transducer	442-0000-086	PS



MOUNT THE HYDRAULIC STEERING AND DUAL POCI VALVES

1. Remove the right side step for easier access to the hydraulic valve by removing the 4 bolts.

FIGURE 3. Remove Side Step



2. If the tractor is equipped with a loader, remove the gray shield around the loader hydraulic valve.

FIGURE 4. Remove Hydraulic Valve Shield



3. Remove the black shield by removing two bolts shown in the figure.

FIGURE 5. Remove Shield



4. Mount the valve bracket (P/N 116-0159-844) using 2 included M8x16mm bolts in the threaded holes from the shield removed in step 3.

FIGURE 6. Steering Valve Bracket Mounted



5. Partially thread the four 5/16"x0.75" bolts and four 5/16" washers into the steering valve (P/N 334-0003-090).
6. Align the bolts with the notches, lower the valve to align the bolts in the bottom notches, and tighten the bolts to secure the steering valve to the valve bracket.

NOTE: Make sure the washers are between the bolt head and bracket, not between the bracket and valve.

FIGURE 7. Dual POCI Valve Bracket Mounted



7. Remove the right side bolts from the cab mount bracket.
8. Install the valve support bracket (P/N 107-0172-661) to the cab support bracket using the supplied M12x35mm bolts.
9. Using the included 3/8"x1" bolts, washers, and nuts, secure the valve bracket to the valve support bracket.
10. Mount the DPOCI (P/N 334-0003-099) to the valve support bracket using the 5/16"x3" bolts and nuts.

FIGURE 8. Dual POCI and Steering Valves Mounted



DUAL POCI TO STEERING VALVE LINES

1. Using the supplied hoses (P/N 214-1001-215), connect port A on the steering valve to A1 on the dual POCI valve.
2. Connect port B on the steering valve to port B1 on the dual POCI valve.

FIGURE 9. Hoses Connected to the Dual POCI and Steering Valve



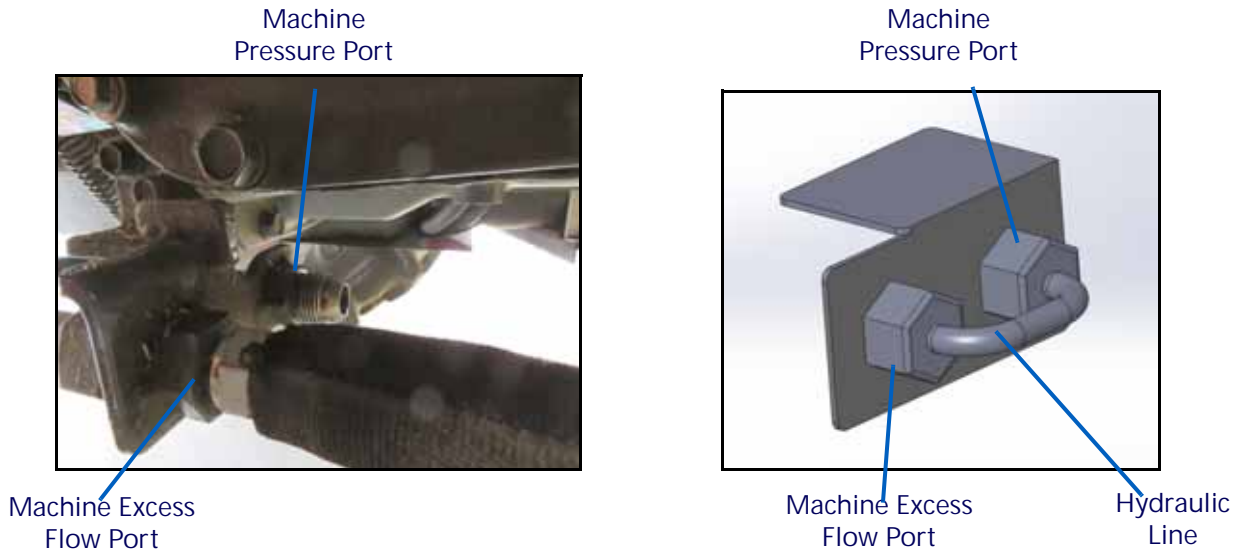
3. Tighten the hose connections.

INSTALL THE PRESSURE, EXCESS FLOW, AND TANK LINES

EQUIPMENT WITHOUT LOADER

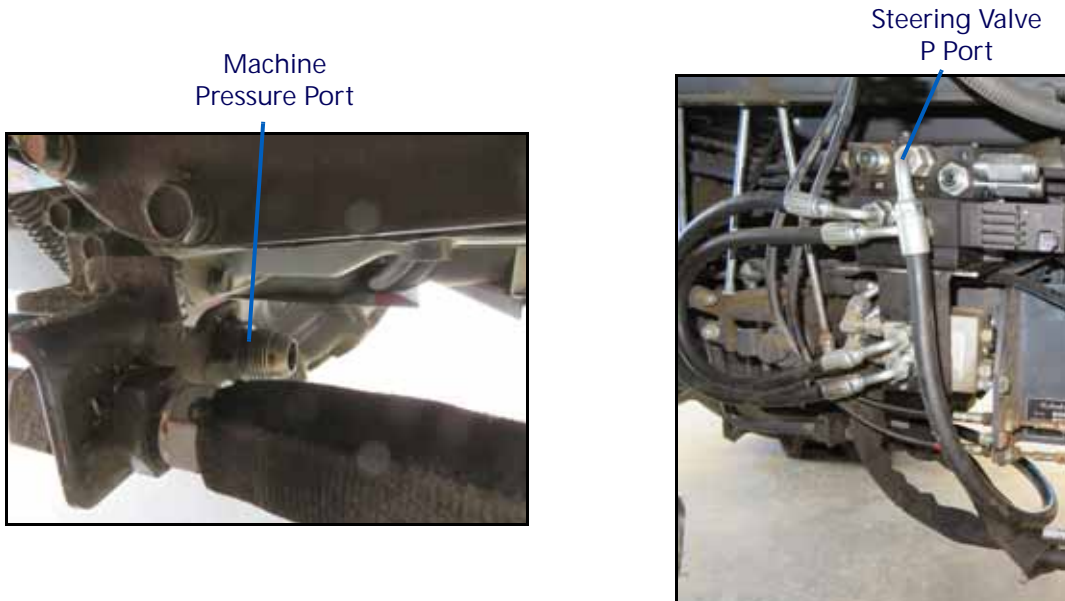
1. Remove the hydraulic line between the machine pressure port and the machine excess flow port.

FIGURE 10. Machine Pressure Port and Machine Excess Flow Port



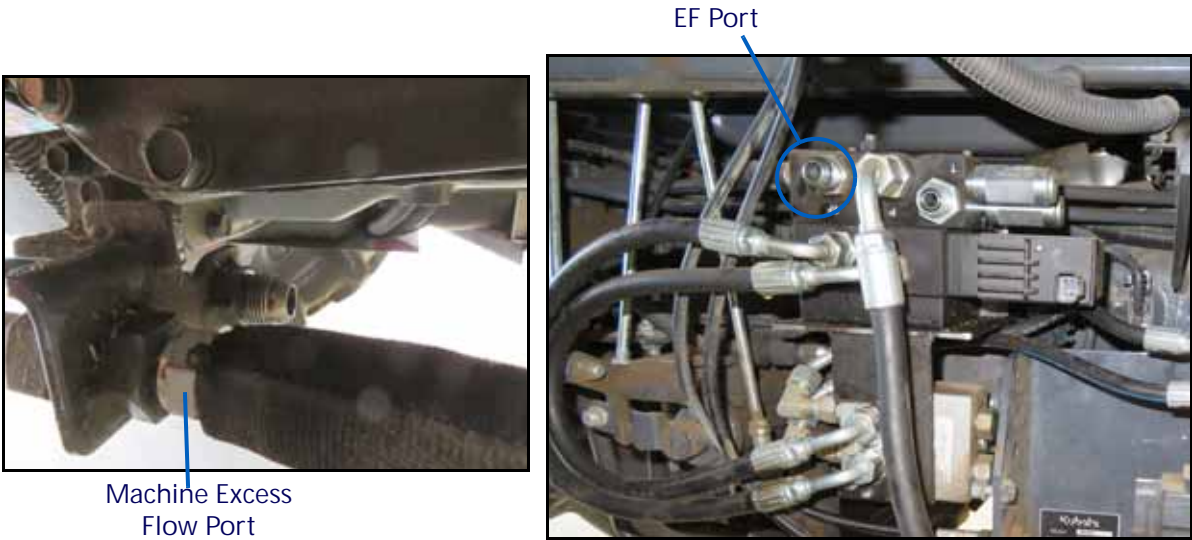
2. Connect the machine pressure port and the steering valve P port using the 214-1001-212 hose.

FIGURE 11. Machine Pressure Port and Steering Valve P Port



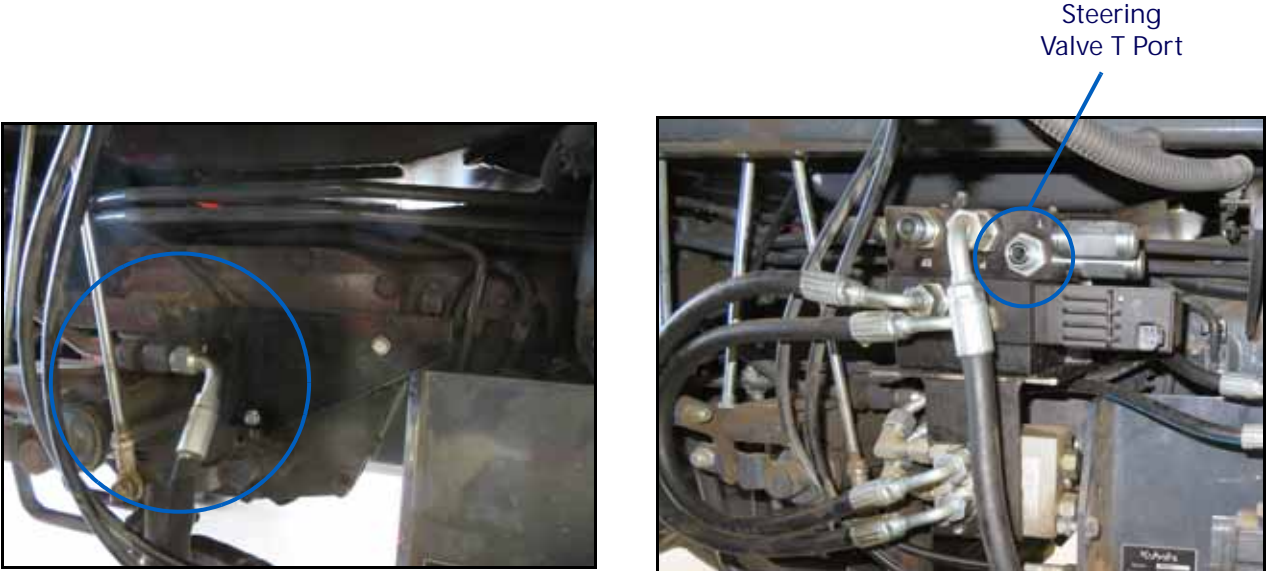
3. Connect the machine excess flow port and the steering valve EF port using the 214-1001-216 hose.

FIGURE 12. Machine Excess Flow Port and Steering Valve EF Port



- 4. Connect the machine tank port to the steering valve T port using the 214-1001-211 hose.

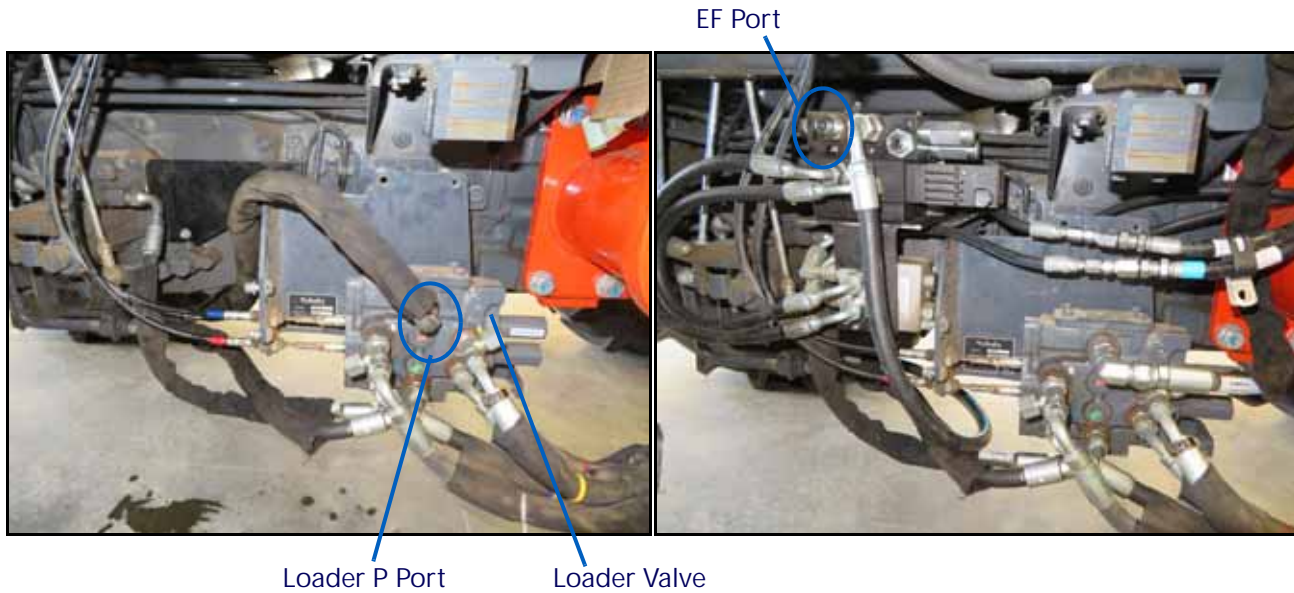
FIGURE 13. Machine Tank Port to the Steering Valve T Port



EQUIPMENT WITH LOADER

1. Find the existing machine hose with a 90° end connected to the P port on the loader valve.

FIGURE 14. Reroute Existing Pressure Hose



2. Disconnect the hose from the loader valve and route to EF port on the steering valve.

NOTE: Do not tighten the EF port until the connections to the P and T ports are completed in the following steps.

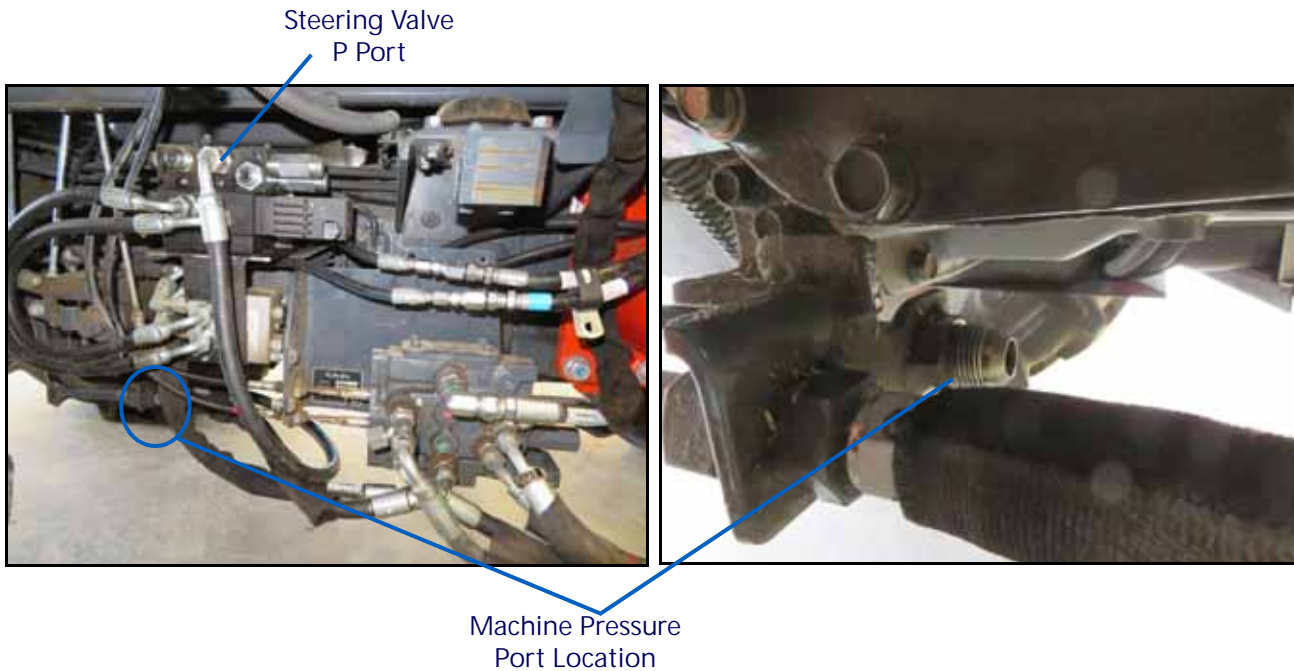
3. Trace this hose to the other end and disconnect from the machine P port.
4. Disconnect this end of the hose and reconnect to the loader valve where the other end was originally connected.

FIGURE 15. Existing Pressure Hose Connected to Steering Valve



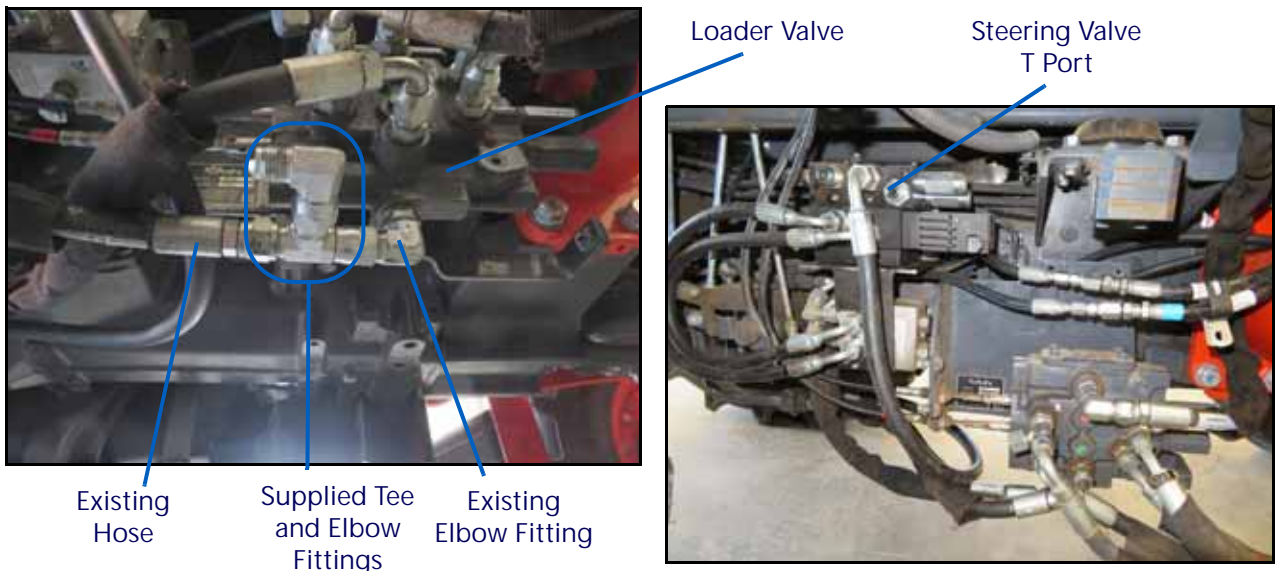
5. Connect the straight end of the hydraulic hose (P/N 214-1001-212) to the machine P port under the tractor where the hose was disconnected in step 3.
6. Route the 90° end to the P port on the steering block.

FIGURE 16. Excess Flow Rerouting



- 7. Disconnect the Tank hose on the bottom of the loader valve from the existing 90° swivel elbow.
- 8. Connect the run tee (P/N 333-0012-113) to the existing 90° swivel elbow and reconnect the existing hydraulic hose to the through port of the tee fitting.

FIGURE 17. Steering Valve Tank Port Connection



- 9. Connect the supplied 90° swivel elbow (P/N 333-0012-108) to the open branch of the tee fitting.
- 10. Attach the straight end of the supplied hose (P/N 214-1001-211) to the elbow fitting and route to the T port on the steering valve.
- 11. Tighten all hose connections on the steering valve and fittings and connections in the P, T, and EF lines.



INSTALL THE LEFT AND RIGHT STEERING HOSES

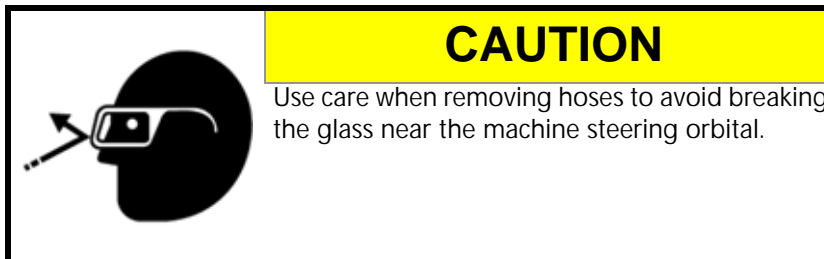
1. Locate the left and right steering lines on the orbital under the hood. Both hoses have twisted protective plastic and the top hose (left) should have a blue marking.

FIGURE 18. Machine Orbital from Right Side of Machine



Disconnect Hoses
from Machine
Orbital

2. Remove the lines from the orbital using a crowfoot wrench and extensions.



3. Connect the Left and Right steering lines removed from the orbital to the supplied hoses (P/N 214-1001-214).
4. Route these hoses toward the dual POCI valve.

NOTE: Leave the dust caps on the opposite end of the supplied hoses until instructed to connect to the dual POCI valve to avoid dirt and debris from contaminating the hydraulic system.

5. Connect the straight end of the supplied hoses (P/N 214-1001-213) to both ports of the machine orbital.
6. Route the hose connected to the top port of the orbital to port A on the dual POCI valve. Route the hose connected to the bottom port of the orbital to port B on the dual POCI.

FIGURE 19. Ports A and B on the Dual POCI Valve



7. Route and connect the hydraulic line with the blue marking to port A2 on the dual POCI valve and the remaining line to port B2 on the dual POCI valve.

FIGURE 20. Existing Steering Cylinder Lines Connected to Supplied Hoses

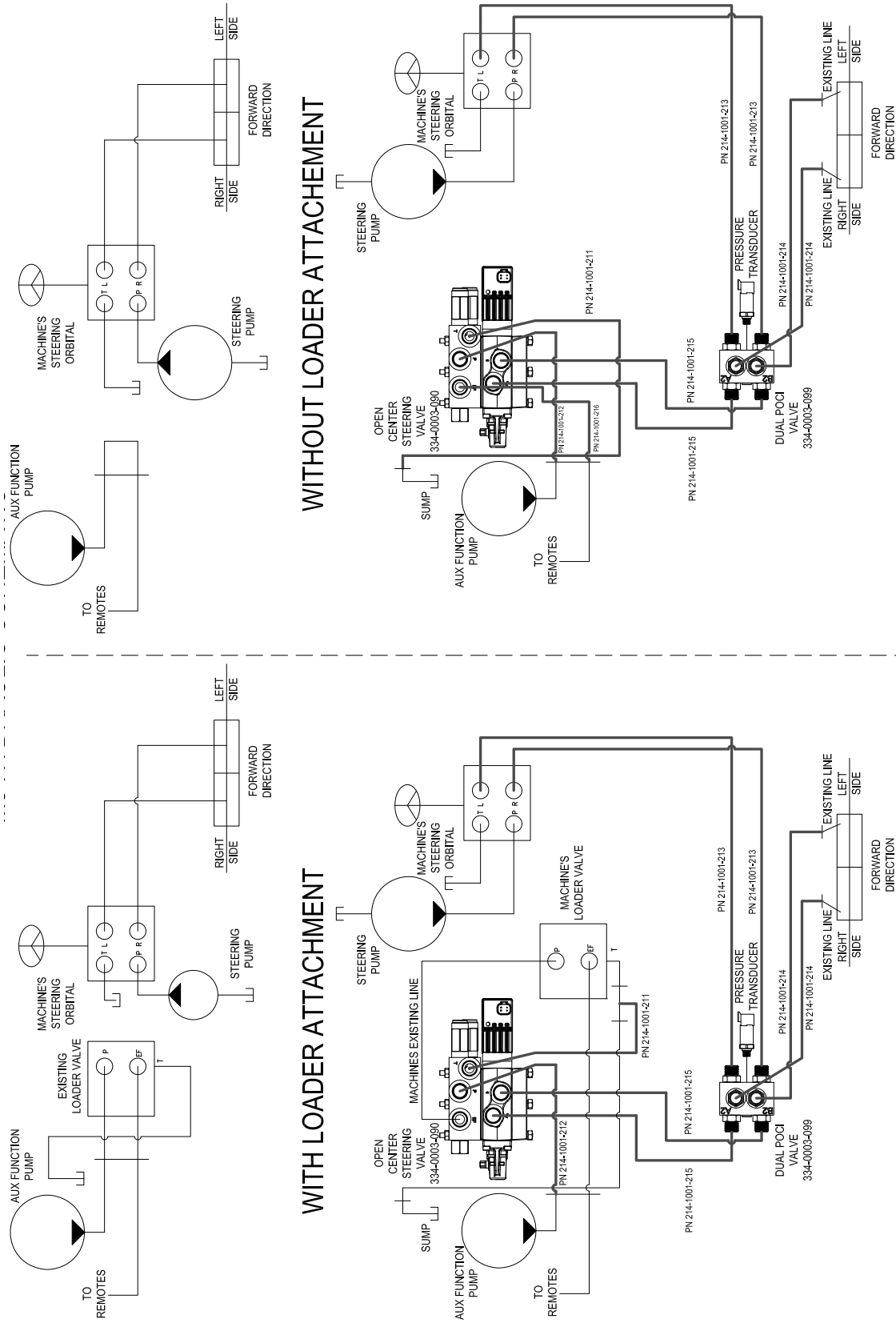


8. Reinstall the shield for the loader hydraulic valve and reinstall the right side step.
9. Tighten all hose connections on the orbital and fittings and connections in the left and right steering lines.

NOTE: Hose (P/N 214-1001-216) is included in the kit and is used only if the loader valve is removed or is not present.

HYDRAULIC DIAGRAM

FIGURE 21. Hydraulic Steering Installation Diagram



CHAPTER

4

CAB COMPONENT AND SENSOR INSTALLATION

INSTALL WHEEL ANGLE SENSOR

WHEEL ANGLE SENSOR BRACKETS

1. Remove the existing hydraulic cylinder shields on the front of the tractor.

FIGURE 1. Remove Cylinder Shields on Front Axle



2. Using bracket (P/N 107-0172-666), U-Bolt (P/N 435-3003-059), and two 5/16" nuts, install the cylinder bracket assembly on the cylinder rod end so the clamp sits in the groove on the gray rod end piece and face the bracket toward the front of the machine.

FIGURE 2. Angle Sensor Bracket



3. Install the new right cylinder guard (P/N 107-0172-664) using the existing bolts from the old shield on the outside holes and using one M8x55mm bolt and one (P/N 104-1000-276) spacer to hold the inside of the bracket.

FIGURE 3. New Cylinder Shield



4. Repeat step 3 to install the new left cylinder guard (P/N 107-0172-663).

WHEEL ANGLE SENSOR

1. Install the linear wheel angle sensor (P/N 416-0001-054) Find the following components: (P/N 103-0001-029) tie rod ends, M10 jam nuts, M10 nuts, M10 washer, M10x55mm bolt, (P/N 104-1000-277) spacer, and (P/N 104-1000-278) spacer.

FIGURE 4. Angle Sensor Bracket



2. Thread the jam nut and the tie rod end (P/N 103-0001-029) to each end of the wheel angle sensor and tighten.
3. Insert the wheel angle sensor from the bottom of the bracket with the electrical connector at the left side of the machine.
4. On the cylinder end of the wheel angle sensor, secure the sensor using the included M10x55mm bolt, spacer (P/N 104-1000-277), and nut.

FIGURE 5. Cylinder End of the Wheel Angle Sensor Mounted

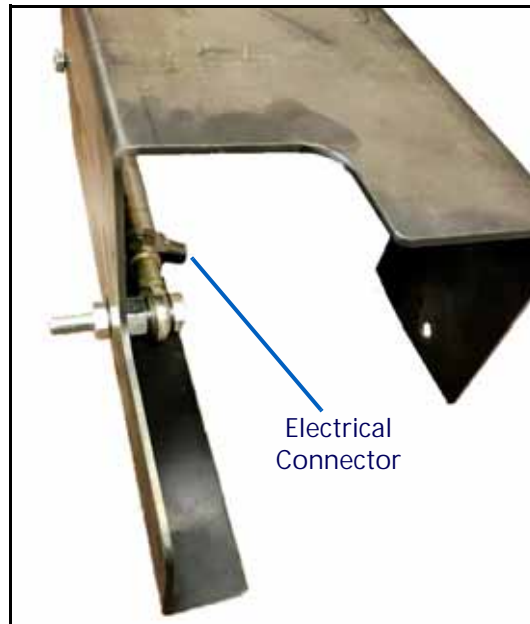


5. On the sensor end of the wheel angle sensor, place a washer on either side of the cylinder bracket with the nut on the front side of the sensor.
6. Secure using the included M10x55mm bolt, spacer (P/N 104-1000-278), and nut.

NOTE: Make sure the electrical connector does not contact the bracket, If the connector does contact the bracket, adjust the jam nut and swivel end on the base of the wheel angle sensor.

A washer is not necessary between the head of the bolt and the tie rod end on the wheel angle sensor.

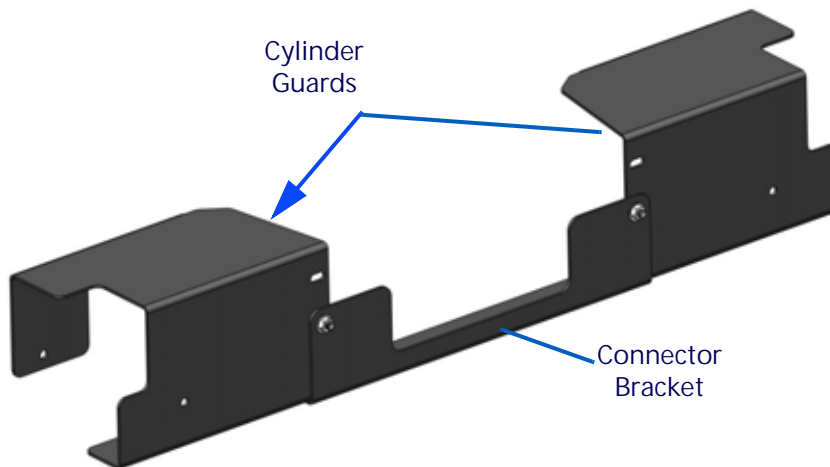
FIGURE 6. Cylinder End of the Wheel Angle Sensor Mounted



7. Install the connector bracket (P/N 107-0172-665) between the two cylinder guards using the included 5/16"x0.75" bolts, washers, and nuts.

NOTE: The nut will be mounted to the front of the machine.

FIGURE 7. Cylinder End of the Wheel Angle Sensor Mounted



MOUNT TC1 AND HDU ECU

1. Locate and remove the 2 bolts in the floor pan behind the seat in the cab.

FIGURE 8. ECU Bracket Mounting Location



2. Secure the cab bracket (P/N 107-0172-662) to the floor using the existing bolts removed in the previous step and the included M5 bolt.
3. Secure the HDU (P/N 063-0173-887) and the TC1 (P/N 063-0174-070) ECUs to the bracket with the studs and included washers and 1/4" nuts.

FIGURE 9. TC1 and HDU ECUs Installed



CONNECT THE TC1 AND HDU CABLE

IN CAB

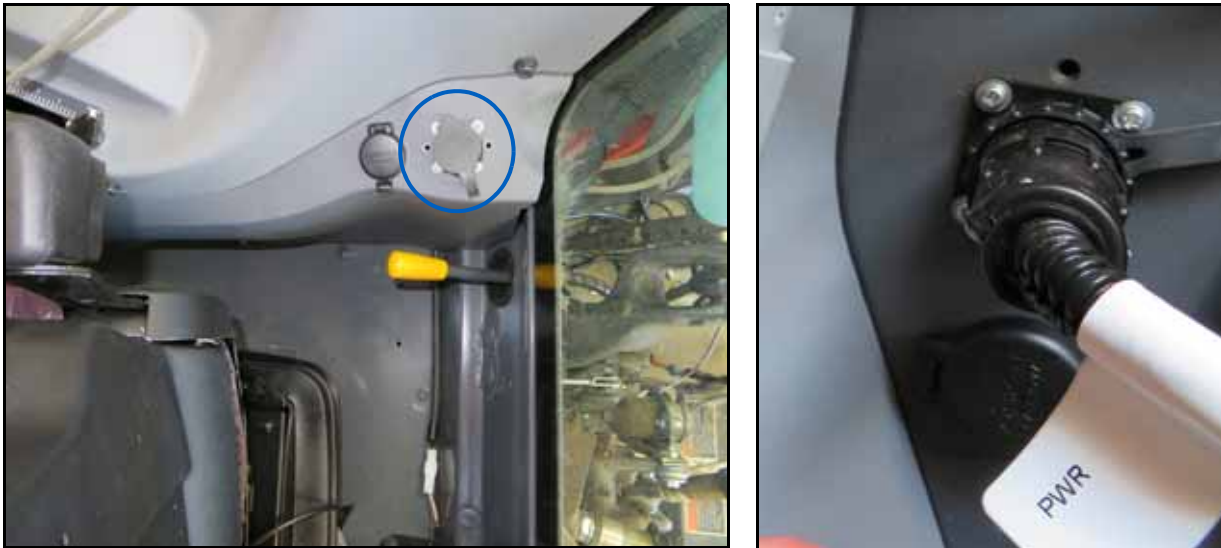
1. Connect the two 12-pin connectors labeled "SC1" on the TC1 cable (P/N 115-4010-152) into the TC1.
2. Connect the two 12-pin connectors labeled "HDU" on the TC1 cable (P/N 115-4010-154) into the HDU.

FIGURE 10. TC1 Cable Connection



3. Locate the universal power connection in the right rear of the cab. Connect the mating connector labeled PWR.

FIGURE 11. Power Terminal Location



4. Locate the round connector labeled Field Computer. Connect to appropriate field computer harness.

FIGURE 12. Switched Power and Field Computer Connections



5. Locate the 8-pin connector labeled CAB SWITCH HARNESS on the Tractor Harness cable (P/N 115-4010-152) previously installed.

FIGURE 13. Cab Switch Harness Connection



6. Connect mating connector on HDU Cab Switch Breakout Cable (P/N 115-4010-028) to the CAB SWITCH HARNESS connection.

MOUNT FOOT SWITCH

1. Route the Engage Foot Switch (P/N 063-0172-470) to the mating connector on the Breakout Cable (P/N 115-4010-028).

FIGURE 14. Resume Foot Switch Connection



2. Select a suitable location for the foot switch (P/N 063-0172-470) to be mounted.

NOTE: The foot switch should be installed in a location where the operator has easy access to it and is able to fully press the pedal.

3. Using the holes in the foot switch as a template, drill holes in the floor of the cab.
4. Secure the foot switch to the floor by installing the supplied screws in each of the mounting holes.

ASSEMBLE AND MOUNT THE MASTER ENGAGE SWITCH

1. Secure the Master Switch (P/N 063-0173-961) between the two switch enclosure halves (P/N 118-0159-056 and 118-0159-057) and locate an appropriate location to mount the master switch assembly.
2. Connect the supplied master switch (P/N 063-0173-961) to the mating connector on the Breakout Cable (P/N 115-4010-028).

FIGURE 15. Master Switch Connection



OUTSIDE OF CAB

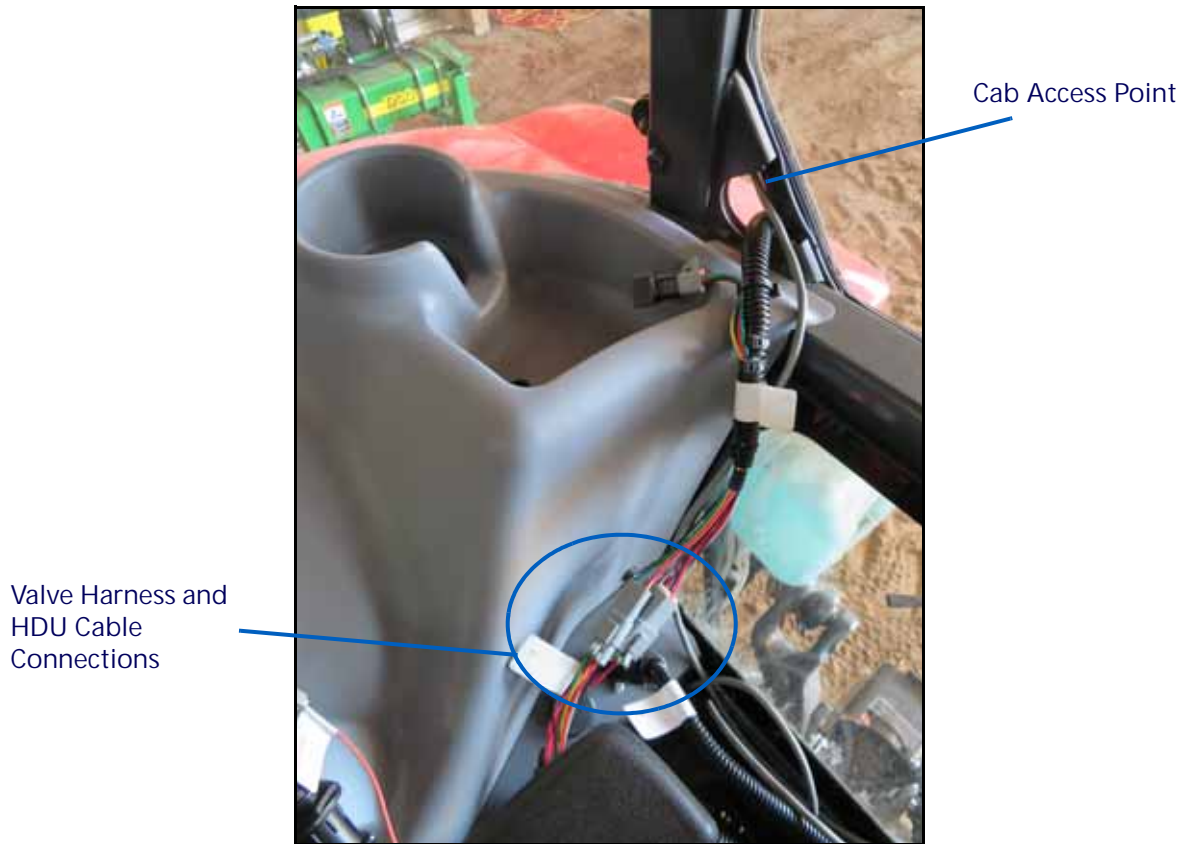
NOTE: On the HDU Cable (P/N 115-4010-152), the connector labeled "Serial GPS" has the following pinouts: A-GPS TX, B-GPS RX, C-GPS GND.

On the same HDU Cable (P/N 115-4010-152), the connector labeled "GPS PWR" has the following pinouts: 1-12V Switched Power, 2-Ground.

A serial connection to a GPS receiver needs to be connected.

1. Locate the 12-pin and 4-pin connectors on the Valve Harness Cable (P/N 115-4010-153) and route them into the cab through the cab access port at the bottom, right corner of the rear window.
2. Connect the Valve Harness Cable (P/N 115-4010-153) to the mating connectors on the HDU Cable (P/N 115-4010-152) inside the machine cab.

FIGURE 16. Cab Access Point



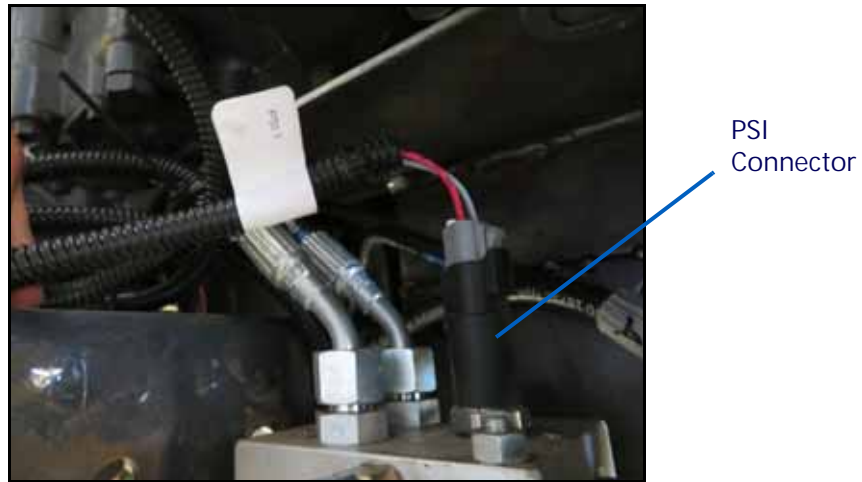
3. Route the 4-pin connector labeled VALVE to the steering valve mounted below the side step below the front, right corner of the cab.
4. Connect the VALVE connector to the mating port on the steering valve.

FIGURE 17. Valve Harness Connected to the Hydraulic Steering Valve



5. Connect the 3-pin connector labeled PSI to the pressure transducer on the dual POCL valve.

FIGURE 18. Pressure Transducer Connection



6. Route the remaining branch of the cable along the hydraulic hose lines near the orbital to the left side of the tractor.
7. Connect the wheel angle sensor cable (P/N 115-4010-032) to the wheel angle sensor and route along existing wiring on the left hand side of the hood toward the machine cab.

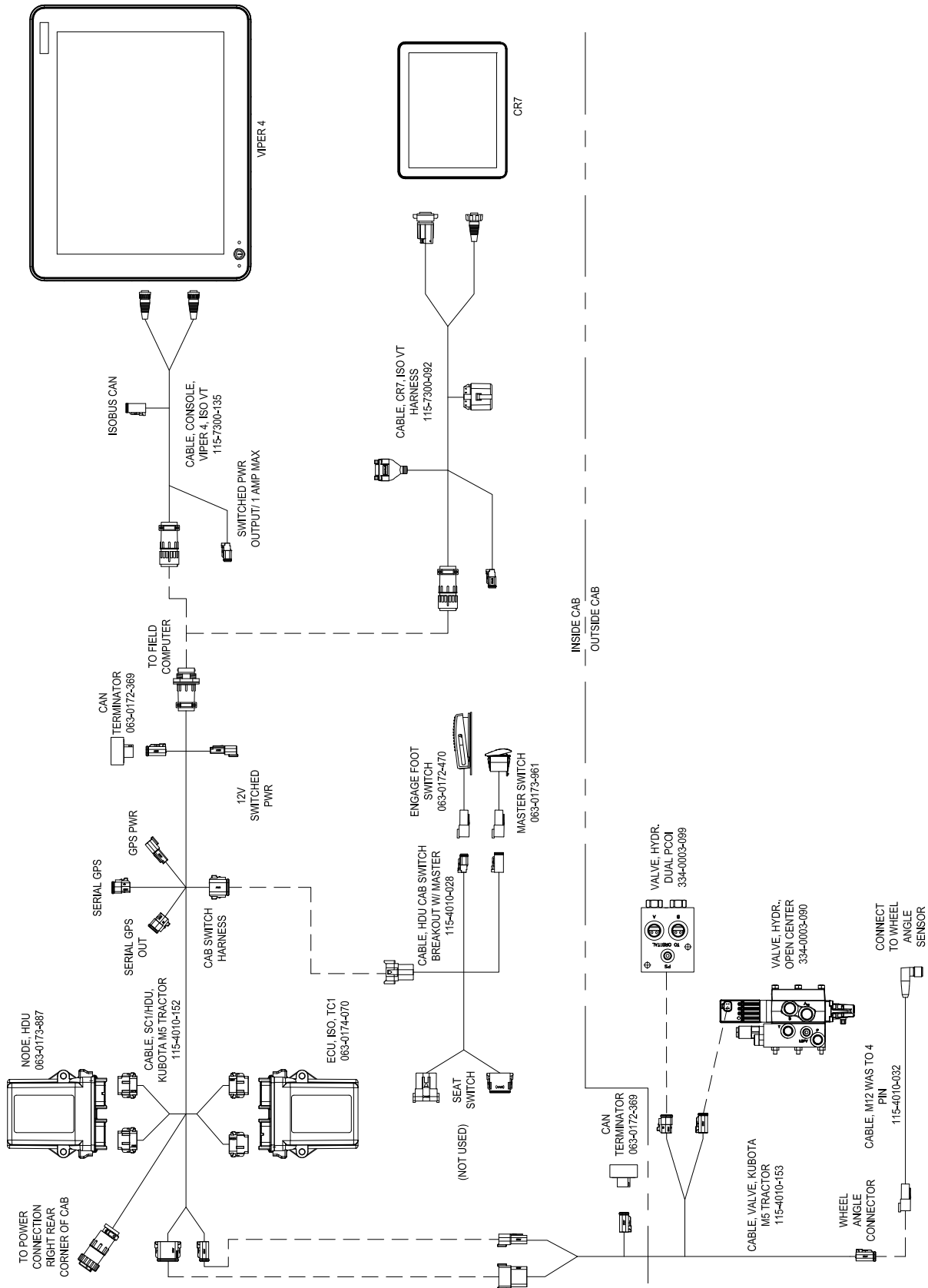
NOTE: Be sure to allow slack in the cable when tying the cable down for the front axle to articulate over terrain.


FIGURE 19. Wheel Angle Sensor Cable Routing



8. Follow the cable harness to the front axle of the tractor on the left side like pictured and plug in the connector on the wheel angle sensor adapter cable.

FIGURE 20. Valve Harness Wiring Diagram (P/N 054-5035-005 Rev. A)





WARNING

When starting the machine for the first time after installing TC1 be sure that all persons stand clear in case a hose has not been properly tightened.



WARNING

Do not use hands to check for leaks. Hydraulic fluid under pressure can penetrate the skin and cause serious injury or death.

VERIFY THE SYSTEM INSTALLATION

1. Turn on the machine.
2. Double-check all fitting and hose connections to ensure that:
 - Hoses are not rubbing on or interfering with moving parts.
 - Hydraulic fluid is not leaking from the system.
3. Turn the wheels fully from side to side repeatedly to remove air from the hydraulic system.

NOTE: During the system installation, whenever the hydraulic system is purged for maintenance, or when fittings are loosened to disconnected, air is introduced into the lines of the hydraulic system. If air pockets are present, the wheels may not move consistently when the steering wheel is turned.

4. Continue turning the wheels until they move steadily and smoothly when the steering wheel is turned.

NOTE: If there are issues with the system, turn off the machine and correct them immediately. For additional assistance, refer to the TC1 Calibration and Operation Manual (P/N 016-4010-005) or contact your local Raven dealer.

C

Cab Component and Sensor Installation 27

E

Electrical Safety 3

H

Hydraulic Safety 2

Hydraulic System Installation

Dual POCI Valve Hoses 19

Installing Fittings in the Hydraulic Steering Valve 14

Installing the Left and Right Steering Hoses 24

Installing the Pressure and Tank Hoses 20

Mounting the Hydraulic Steering and Dual POCI
Valves 16

I

Important Safety Information

Electrical Safety 3

General 3

Instructions for Wire Routing 3

Hydraulic Safety 2

General 2

Instructions for Hose Routing 2

Introduction

Kit Contents 8

Preparing or Installation 7

Point of Reference 8

Recommendations 7

Tools Needed 8

Updates 8

K

Kit Contents 8

P

Preparing for Installation 7

S

Startup Procedures

Verify the System Installation 39

LIMITED WARRANTY

WHAT DOES THIS WARRANTY COVER?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service when used for intended purpose.

HOW LONG IS THE COVERAGE PERIOD?

Raven Applied Technology products are covered by this warranty for 12 months from the date of retail sale. In no case will the Limited Warranty period exceed 24 months from the date the product was issued by Raven Industries Applied Technology Division. This warranty coverage applies only to the original owner and is non-transferable.

HOW CAN I GET SERVICE?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries.

WHAT WILL RAVEN INDUSTRIES DO?

Upon confirmation of the warranty claim, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

WHAT IS NOT COVERED BY THIS WARRANTY?

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit, labor, or other damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.

EXTENDED WARRANTY

WHAT DOES THIS WARRANTY COVER?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service when used for intended purpose.

DO I NEED TO REGISTER MY PRODUCT TO QUALIFY FOR THE EXTENDED WARRANTY?

Yes. Products/systems must be registered within 30 days of retail sale to receive coverage under the Extended Warranty. If the component does not have a serial tag, the kit it came in must be registered instead.

WHERE CAN I REGISTER MY PRODUCT FOR THE EXTENDED WARRANTY?

To register, go online to www.ravenhelp.com and select Product Registration.

HOW LONG IS THE EXTENDED WARRANTY COVERAGE PERIOD?

Raven Applied Technology products that have been registered online are covered for an additional 12 months beyond the Limited Warranty for a total coverage period of 24 months from the date of retail sale. In no case will the Extended Warranty period exceed 36 months from the date the product was issued by Raven Industries Applied Technology division. This Extended Warranty coverage applies only to the original owner and is non-transferable.

HOW CAN I GET SERVICE?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries. In addition, the words "Extended Warranty" must appear on the box and all documentation if the failure is between 12 and 24 months from the retail sale.

WHAT WILL RAVEN INDUSTRIES DO?

Upon confirmation of the product's registration for the Extended Warranty and the claim itself, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

WHAT IS NOT COVERED BY THE EXTENDED WARRANTY?

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit, labor, or other damages. Cables, hoses, software enhancements, and remanufactured items are not covered by this Extended Warranty. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.