



# SERVICE AND PARTS MANUAL

## Titan Boom 60-S



ART\_4201

Serial Number Range  
12500001 - Up

Part #92973  
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Date	Reason for Update
08/2013	New Release

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## NOTES:

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# INTRODUCTION

This manual consists of Service and Illustrated Parts sections.

The Service Section of this manual is designed to provide you, the customer, with the instructions needed to properly maintain the MEC self-propelled aerial work platform. When used in conjunction with the Illustrated Parts Section and the Operators Manual (provided separately), this manual will assist you in making necessary adjustments and repairs, and identifying and ordering the correct replacement parts.

All parts represented here are manufactured and supplied in accordance with MEC quality standards.

We recommend that you use genuine MEC parts to ensure proper operation and reliable performance.

To obtain maximum benefits from your MEC Aerial Work Platform, always follow the proper operating and maintenance procedures. Only trained, authorized personnel should be allowed to operate or service this machine. Service personnel should read and study the Operator's, Service and Parts Manuals in order to gain a thorough understanding of the unit prior to making any repairs.

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# MACHINE SPECIFICATIONS - TITAN BOOM 60-S

TITAN Boom™ 60-S				
Working Height*	66 ft	20 m		
Maximum Platform Height	60 ft	18.3 m		
Maximum Drive Height	40 ft	12.2 m		
Maximum Forward Reach w/ outriggers	48 ft	14.6 m		
Maximum Horizontal Translation	75 ft @ 24 ft elevation	23 m @ 7.3 m elevation		
Maximum Rearward Platform	10 ft	3 m		
Machine Weight** (Unloaded)	39,700 lb	18,000 kg		
Lift Capacity	Total	3000 lb	1350 kg	
	Load Zone	2000 lb	900 kg	
	Personnel & Tools Evenly Distributed	1000 lb	450 kg	
Maximum Occupants		4		
Stowed Height	Rails Up	128 in	3.27 m	
	Rails Folded Down	94 in	2.4 m	
Length	In Use	23 ft	7 m	
	Ladder Removed	22 ft 6 in	6.9 m	
Width	Outriggers Stowed	102 in	2.6 m	
	Outriggers Set	144 in	3.7 m	
	Shipping Width (outrigger pads removed)	91 in	2.3 m	
Wheel Base		160 in	4.06 m	
Wheel Track		84 in	2.13 m	
Platform Dimensions	Length	22 ft	6.7 m	
	Platform Width	90 in	2.28 m	
	Loading Height	80 in	2 m	
Turning Radius, (4 Wheel Steer)	Inside	10 ft	3 m	
	Outside	24 ft	7.3 m	
Ground Clearance	Under Axles	16 in	41 cm	
	Under Center of Machine	18 in	46 cm	
Boom Lift Speed		60 seconds		
Boom Extend Speed		60 seconds		
Boom Lift/Extend Combined Speed		75 seconds		
Platform Translation Speed		20 seconds		
Drive Speed	Stowed	0-4 mph	0-6.4 km/h	Maximum Vibration
(Proportional)	Raised or extended	0-.5 mph	0-.8 km/h	does not exceed 2.5 m/sec <sup>2</sup> at operator's position
Gradeability		40%/22°		Ambient Operating Range
Approach Angle		36%/20°		-30° C minimum; 50° C maximum
Breakover Angle		40%/22°		
Platform Rotation		180° (+90°, -90°)		Fuel Type
Frame Level		10° each side		Diesel
Maximum Operating Wind Speed		28 mph	12.5 m/sec (45 km/h)	Engine
				Kubota V3800-T Turbo 100 hp Diesel
Ground Pressure/Wheel (Maximum)		185 psi	12.8 kg/cm <sup>2</sup>	Fuel Capacity
Maximum Wheel Load		14550 lbs	6600 kg	50 gal
Tire Size		41 in. od	1.03 m od	190 liter
Wheel Lug Nut Torque		150 ft/lb	203 Nm	Alternator
Hydraulic Pressure	Drive System	4650 psi	320 bar	90 amp
	Main System	3200 psi	220 bar	Battery
Hydraulic Fluid Capacity		60 gal	227 liter	Two 1000 CCA 12V
				Sound Pressure At Workstation
				80 dB(A)
				Sound Power Level
				86 dB @ 1m
				Control System
				12V DC
				Brakes
				4 wheel multi disc
*Working Height adds 6 feet (2 m) to platform height. **Weight may increase with certain options.				



# MEC OPERATOR POLICY

**NOTE:** The best method to protect yourself and others from injury or death is to use common sense. If you are unsure of any operation, don't start until you are satisfied that it is safe to proceed and have discussed the situation with your supervisor.

Service personnel and machine operators must understand and comply with all warnings and instructional decals on the body of the machine, at the ground controls, and platform control console.



***MODIFICATIONS OF THIS MACHINE FROM THE ORIGINAL DESIGN AND SPECIFICATIONS WITHOUT WRITTEN PERMISSION FROM MEC ARE STRICTLY FORBIDDEN. A MODIFICATION MAY COMPROMISE THE SAFETY OF THE MACHINE, SUBJECTING OPERATOR(S) TO SERIOUS INJURY OR DEATH.***

MEC's policies and procedures demonstrate our commitment to Quality and our relentless ongoing efforts towards Continuous Improvement, due to which product specifications are subject to change without notice.

Any procedures not found within this manual must be evaluated by the individual to assure oneself that they are "proper and safe."

Your MEC Aerial Work Platform has been designed, built, and tested to provide many years of safe, dependable service. Only trained, authorized personnel should be allowed to operate or service the machine.

MEC, As Manufacturer, Has No Direct Control Over Machine Application And Operation. Proper Safety Practices Are The Responsibility Of The User And All Operating Personnel.

**If there is any question regarding application and/or operation contact:**



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## SAFETY SYMBOLS

To help you recognize important safety information, we have identified warnings and instructions that directly impact on safety with the following signals:



***“DANGER” INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY. THIS SIGNAL WORD IS LIMITED TO THE MOST EXTREME SITUATIONS.***



**“WARNING” INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.**



**“CAUTION” indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.**



**“Caution” without alert symbol indicates a situation which, if not avoided, may result in property damage.**



## GENERAL SAFETY TIPS

Regular inspection and conscientious maintenance is the key to efficient, economical operation of your aerial work platform. It will help to assure that your equipment will perform satisfactorily with a minimum of service and repair.

The actual operating environment of the machine governs the inspection schedule. Correct lubrication is an essential part of the preventative maintenance to minimize wear on working parts and ensure against premature failure. By maintaining correct lubrication, the possibility of mechanical failure and resulting downtime is reduced to a minimum.

## MAINTENANCE TIPS

- Never leave hydraulic components or hoses open. They must be protected from contamination (including rain) at all times.
- Never open a hydraulic system when there are contaminants in the air.
- Always clean the surrounding area before opening hydraulic systems.
- Use only recommended lubricants. Improper lubricants or incompatible lubricants may be as harmful as no lubrication.
- Watch for makeshift “fixes” which can jeopardize safety as well as lead to more costly repair.



# SETTING THE MAINTENANCE CHOCK



**NEVER PERFORM WORK OR INSPECTION ON THE MACHINE WITH THE PLATFORM ELEVATED WITHOUT FIRST BLOCKING THE BOOM ASSEMBLY WITH THE MAINTENANCE CHOCK.**

**THE PLATFORM MUST BE UNLOADED OF ALL PERSONNEL, MATERIAL, EQUIPMENT AND TOOLS BEFORE THE MAINTENANCE CHOCK IS USED.**

**THE MAINTENANCE CHOCK IS HEAVY. HOLD IT SECURELY DURING THE INSTALLATION AND REMOVAL PROCESS.**

**THE MAINTENANCE CHOCK MAY ROTATE AROUND THE CYLINDER ROD DURING MACHINE MOVEMENT AND MAY FALL IF IT IS NOT HELD SECURELY IN PLACE DURING INSTALLATION AND REMOVAL.**

The Maintenance Chock fits over the lift cylinder rod, between the rod end and the end of the cylinder barrel.

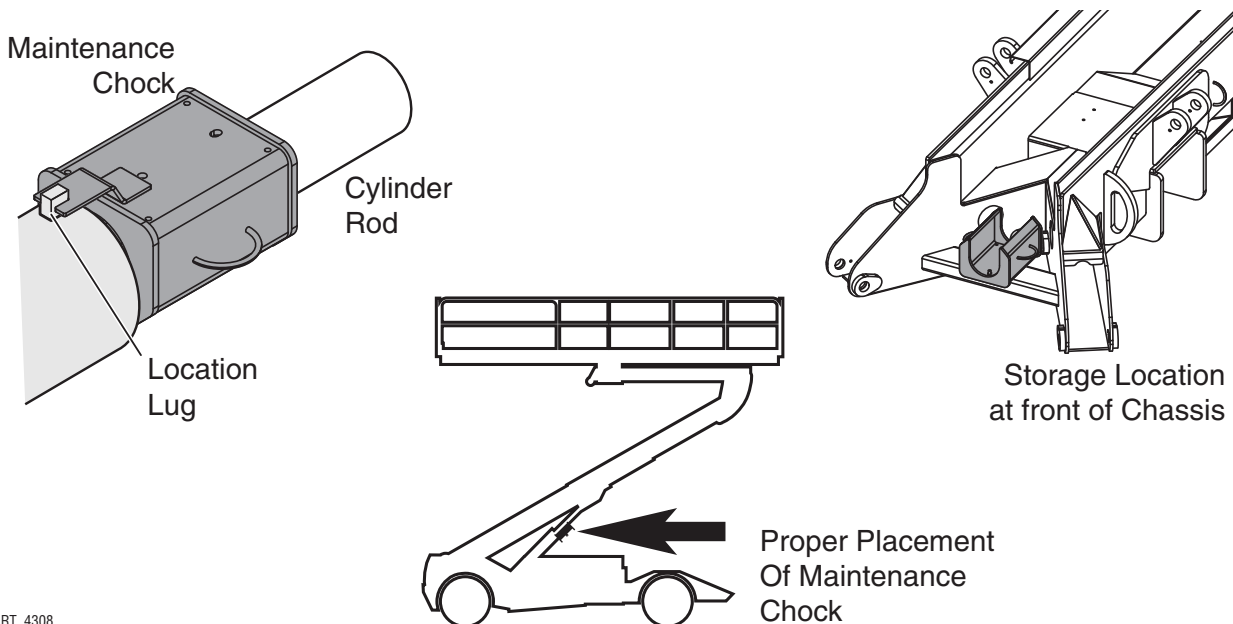
## INSTALLATION

- Remove the Maintenance Chock from the storage location on the front outrigger brace tube (See Workplace Inspection on page 14).
- Using the Boom Lift/Lower function, raise the platform to approximately 16 feet (5 m).
- Place the Maintenance Chock over the cylinder rod above the cylinder barrel. Align the tab with the stud on the cylinder barrel to keep it properly positioned while lowering the platform.
- Using the Boom Lift/Lower function, slowly lower the boom until the Maintenance Chock is secure between the cylinder rod end and the cylinder barrel.

## REMOVAL

- Using the Boom Lift/Lower function, raise the platform to approximately 16 feet (5 m) until the Maintenance Chock moves freely.
- Remove the Maintenance Chock from the cylinder rod.
- Store the Maintenance Chock in the storage location on the front outrigger brace tube. Secure it with the provided fasteners.

**Figure 1-1: Maintenance Chock Installation**



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## HYDRAULIC SYSTEM



### WARNING

HYDRAULIC FLUID UNDER PRESSURE CAN PENETRATE AND BURN SKIN, DAMAGE EYES, AND MAY CAUSE SERIOUS INJURY, BLINDNESS, AND EVEN DEATH.

CORRECT LEAKS IMMEDIATELY.



### CAUTION

Hydraulic fluid leaks under pressure may not always be visible. Check for pin hole leaks with a piece of cardboard, not your hand.

## ELECTRICAL SYSTEM

### CAUTION

To prevent damage to battery and/or electrical system:

- Always disconnect the negative battery cable first.
- Always connect the positive battery cable first.

When the negative cable is installed, a spark will occur if contact is made between the positive side of the battery and a metal surface on the machine. This can cause electrical system damage, battery explosion, and personal injury.

## TOTAL SYSTEM



### WARNING

ENGINE COOLANT LEVEL MUST BE CHECKED ONLY AFTER ENGINE HAS COOLED. IF RADIATOR CAP IS REMOVED WHILE THE COOLANT IS AT NORMAL OPERATING TEMPERATURE, PRESSURE WITHIN THE COOLANT SYSTEM WILL FORCE HOT LIQUID OUT THROUGH THE FILLER OPENING AND MAY CAUSE SEVERE SCALDING.



### CAUTION

Failure to perform preventive maintenance at recommended intervals may result in the unit being operated with a defect that could result in injury or death of the operator.

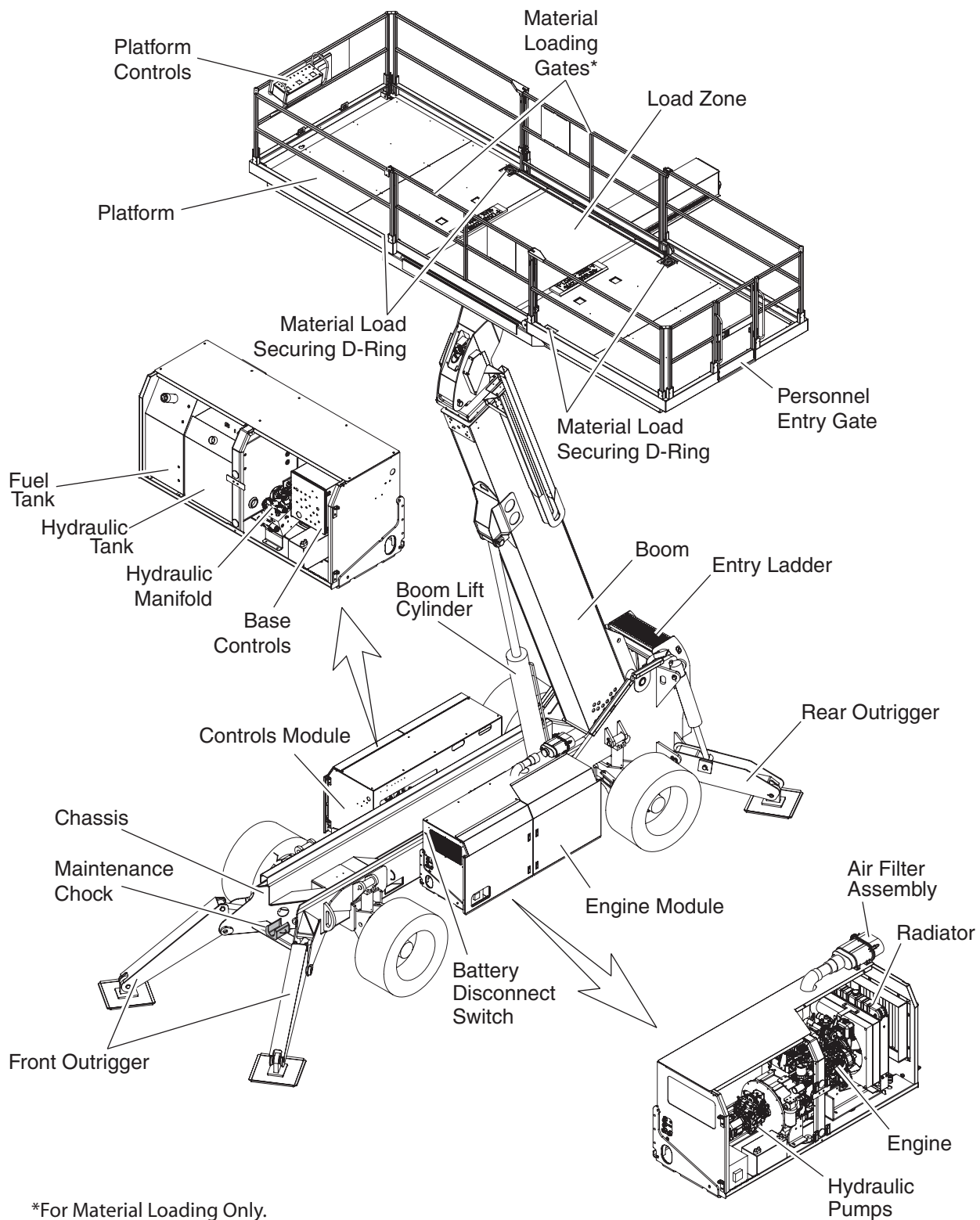
Immediately report to your supervisor any defect or malfunction. Any defect shall be repaired prior to continued use of the aerial work platform.

Inspection and maintenance should be performed by qualified personnel familiar with the equipment.



# PRIMARY MACHINE COMPONENTS

Figure 1-2: Component Locations









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# TORQUE SPECIFICATIONS

## FASTENERS

Use the following values to apply torque unless a specific torque value is called out for the part being used.

AMERICAN STANDARD CAP SCREWS									METRIC CAP SCREWS								
SAE GRADE	5				8				METRIC GRADE	8.8				10.9			
CAP SCREW SIZE - inches -									CAP SCREW SIZE - millimeters -	 				 			
	TORQUE				TORQUE					TORQUE				TORQUE			
	FT. LBS		Nm		FT. LBS		Nm			FT. LBS		Nm		FT. LBS		Nm	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
1/4 - 20	6.25	7.25	8.5	10	8.25	9.5	11	13	M6 X 1.00	6	8	8	11	9	11	12	15
1/4 - 28	8	9	11	12	10.5	12	14	16	M8 X 1.25	16	20	21.5	27	23	27	31	36.5
5/16 - 18	14	15	19	20	18.5	20	25	27	M10 X 1.50	29	35	39	47	42	52	57	70
5/16 - 24	17.5	19	23	26	23	25	31	34	M12 X 1.75	52	62	70	84	75	91	102	123
3/8 - 16	26	28	35	38	35	37	47.5	50	M14 X 2.00	85	103	115	139	120	146	163	198
3/8 - 24	31	34	42	46	41	45	55.5	61	M16 X 2.50	130	158	176	214	176	216	238	293
7/16 - 14	41	45	55.5	61	55	60	74.5	81	M18 X 2.50	172	210	233	284	240	294	325	398
7/16 - 20	51	55	69	74.5	68	75	92	102	M20 X 2.50	247	301	335	408	343	426	465	577
1/2 - 13	65	72	88	97.5	86	96	116	130	M22 X 2.50	332	404	450	547	472	576	639	780
1/2 - 20	76	84	103	114	102	112	138	152	M24 X 3.00	423	517	573	700	599	732	812	992
9/16 - 12	95	105	129	142	127	140	172	190	M27 X 3.00	637	779	863	1055	898	1098	1217	1488
9/16 - 18	111	123	150	167	148	164	200	222	M3 X 3.00	872	1066	1181	1444	1224	1496	1658	2027
5/8 - 11	126	139	171	188	168	185	228	251	<div>Torque values apply to fasteneers as received from the supplier, dry or when lubricated with normal engine oil. If special graphite grease, molydisulphide grease, or other extreme pressure lubricants are used, these torque values <i>do not</i> apply.</div>								
5/8 - 18	152	168	206	228	203	224	275	304									
3/4 - 10	238	262	322	255	318	350	431	474									
3/4 - 16	274	302	371	409	365	402	495	544									
7/8 - 9	350	386	474	523	466	515	631	698									
7/8 - 14	407	448	551	607	543	597	736	809									
1 - 8	537	592	728	802	716	790	970	1070									
1 - 14	670	740	908	1003	894	987	1211	1137									

## HYDRAULIC COMPONENTS TORQUE TABLE

**NOTE:** Always lubricate threads with clean hydraulic fluid prior to installation.

Use the following values to torque hydraulic components when a specific value is not available. Always check for torque values in the following places before relying on the Hydraulic Components Torque Table:

- parts drawings and service instructions in this manual.
- packaging and instruction sheets provided with new parts.
- instruction manuals provided by the manufacturer of the component being serviced.

TYPE: SAE PORT SERIES	CARTRIDGE POPPET		FITTINGS		HOSES	
	FT. LBS	Nm	FT. LBS	Nm	FT. LBS	Nm
#4	N/A	N/A	N/A	N/A	135 - 145	15 - 16
#6	N/A	N/A	10 - 20	14 - 27	215 - 245	24 - 28
#8	25 - 30	31 - 41	25 - 30	34 - 41	430 - 470	49 - 53
#10	35 - 40	47 - 54	35 - 40	47 - 54	680 - 750	77 - 85
#12	85 - 90	115 - 122	85 - 90	115 - 122	950 - 1050	107 - 119
#16	130 - 140	176 - 190	130 - 140	176 - 190	1300 - 1368	147 - 155





# EMERGENCY SYSTEMS AND PROCEDURES



**IF THE CONTROL SYSTEM FAILS WHILE THE PLATFORM IS ELEVATED, HAVE AN EXPERIENCED OPERATOR USE THE EMERGENCY LOWERING PROCEDURE TO SAFELY LOWER THE PLATFORM.**

**DO NOT ATTEMPT TO CLIMB DOWN ELEVATING ASSEMBLY.**

## EMERGENCY STOP

*Figure 1-3:* Emergency Stop Switch

The machine is equipped with an EMERGENCY STOP switch on both control panels.

- Press the EMERGENCY STOP switch at any time to stop all machine functions.
- Turn switch *clockwise* to reset.



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### SELECTOR SWITCH SET TO PLATFORM

- Either switch will stop all machine functions.
- Both switches must be reset or machine will not operate.

### SELECTOR SWITCH IS SET TO BASE

- The upper controls are locked out.
- The lower controls switch must be reset or the machine will not operate.
- The machine will operate from the lower controls if the upper controls switch is tripped.



## EMERGENCY LOWERING



### WARNING

**IF THE CONTROL SYSTEM FAILS WHILE THE PLATFORM IS ELEVATED, USE THE EMERGENCY LOWERING PROCEDURE TO SAFELY LOWER THE PLATFORM.**

**DO NOT CLIMB DOWN THE BOOM ASSEMBLY OR EXIT THE PLATFORM.**

The Emergency Lowering System is used to lower the platform in case of power failure. To lower the platform, activate the Emergency Power Switch to run the Emergency Down auxiliary hydraulic pump.

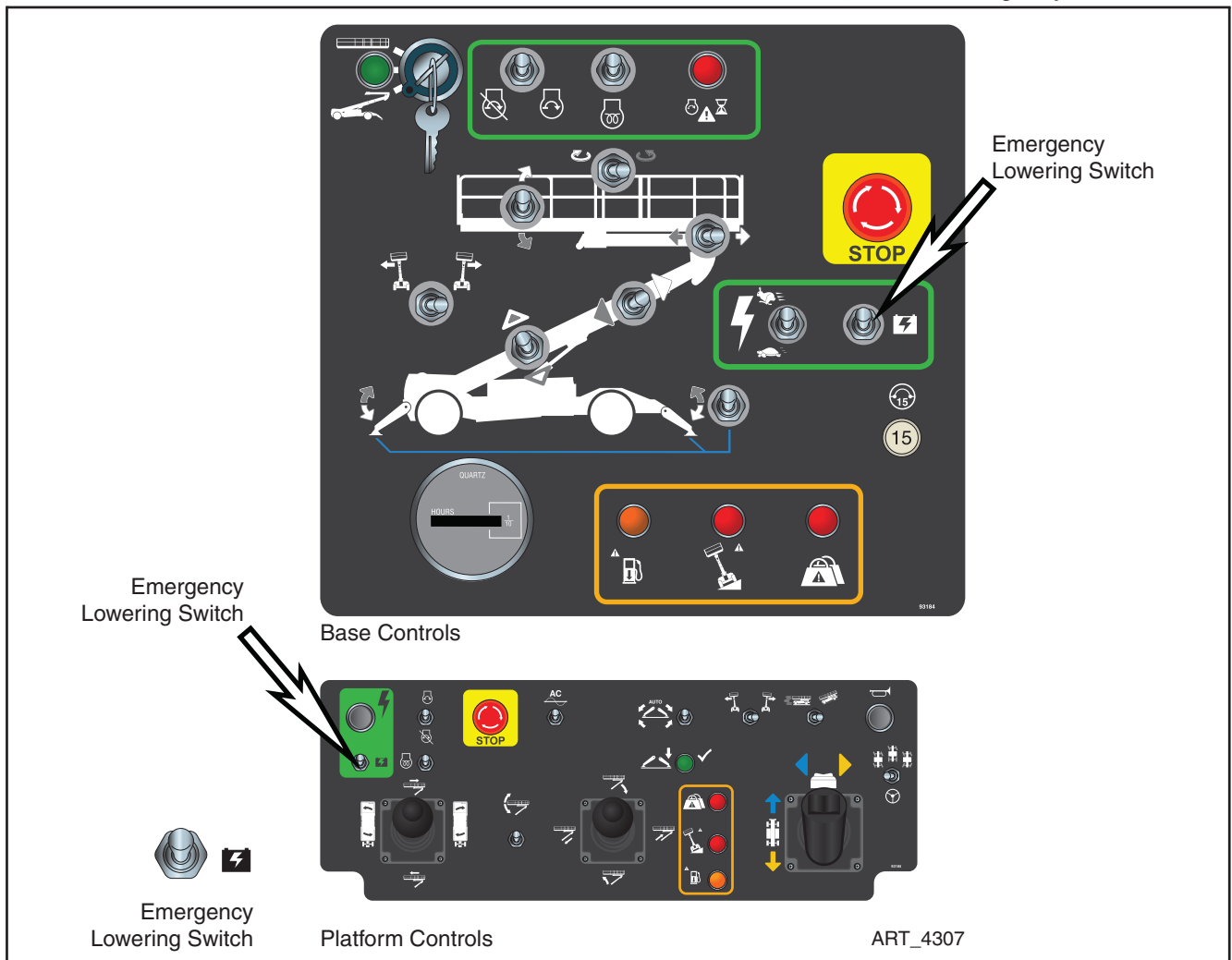
This function uses battery power from the auxiliary battery to lower the platform.

- Push and hold the Emergency Power Switch, then use the Boom Extend/Retract function to retract the boom.
- Continue to hold the Emergency Power Switch, then use the Boom Lift/Lower function to lower the boom.

**NOTE:** The Emergency Lowering System overrides the engine function. The engine will shut off when the Emergency Power Switch is engaged.

The Emergency Power Switch serves as an enable switch. It is not necessary to use the primary function enable switch.

Figure 1-4: Emergency Power Switch





# LIFT AND SUPPORT THE MACHINE



**DEATH OR SERIOUS PERSONAL INJURY MAY RESULT FROM THE USE OF SUBSTANDARD LIFTING DEVICES AND/OR JACK STANDS. ENSURE THAT ALL LIFTING DEVICES AND JACK STANDS ARE OF ADEQUATE CAPACITY AND IN GOOD WORKING CONDITION BEFORE USE.**

**BE SURE THAT THE SURFACE BENEATH THE MACHINE IS CAPABLE OF SUPPORTING THE JACK AND JACK STANDS.**

**REMOVE ALL MATERIAL, TOOLS AND PERSONNEL FROM THE PLATFORM BEFORE LIFTING.**

The following are needed to safely lift and support the machine;

- a jack with a lifting capacity of ten (10) tons or more.
- jack stands with a rating of ten (10) tons or more.

## **TO RAISE THE MACHINE**

1. Move machine to a firm level surface capable of supporting the weight of the machine.
2. Chock the tires on the end of machine opposite the end to be raised.
3. If wheel is to be removed, break loose but **do not remove** lug nuts before raising the machine.
4. Position a jack at the end of the machine to be lifted, under a solid lifting point in the center of the frame.
5. Raise the machine and place two (2) suitable jack stands under solid support points at the outer ends of the frame.
6. Lower the machine to rest on the jack stands and inspect for stability.

## **TO LOWER THE MACHINE**

1. Tighten lug nuts to hold the wheel snug to the hub. Do not torque the lug nuts at this time.
2. Raise machine slightly and remove jack stands.
3. Lower the machine and remove the jack.
4. Tighten lug nuts to proper torque (refer to machine specifications).
5. Remove chocks.



# TRANSPORTING THE MACHINE

## SAFETY INFORMATION



THIS INFORMATION IS PROVIDED FOR REFERENCE AND DOES NOT SUPERSEDE ANY GOVERNMENT OR COMPANY POLICY REGARDING THE LOADING, TRANSPORT OR LIFTING OF MEC MACHINERY.

DRIVERS ARE RESPONSIBLE FOR LOADING AND SECURING MACHINES, AND SHOULD BE PROPERLY TRAINED AND AUTHORIZED TO OPERATE MEC MACHINERY.

DRIVERS ARE ALSO RESPONSIBLE FOR SELECTING THE CORRECT AND APPROPRIATE TRAILER ACCORDING TO GOVERNMENT REGULATIONS AND COMPANY POLICY.

DRIVERS MUST ENSURE THAT THE VEHICLE AND CHAINS ARE STRONG ENOUGH TO HOLD THE WEIGHT OF THE MACHINE (SEE THE SERIAL NUMBER PLATE FOR MACHINE WEIGHT).

## FREE-WHEEL CONFIGURATION FOR WINCHING OR TOWING

The machine can be winched or moved short distances in case of power failure at speeds not to exceed 5 MPH (8.05 km/h). Before towing or winching the machine, it is necessary to release the brake. Reset the brakes after winching or towing.



**RUNAWAY HAZARD!**

**AFTER RELEASING THE BRAKES THERE IS NOTHING TO STOP MACHINE TRAVEL. MACHINE WILL ROLL FREELY ON SLOPES.**

**ALWAYS CHOCK THE WHEELS BEFORE MANUALLY RELEASING THE BRAKES.**

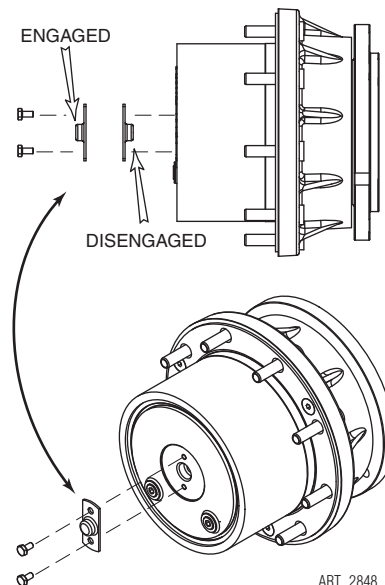
## DISENGAGE BRAKES BEFORE TOWING OR WINCHING

- Chock the wheels.
- Remove the Brake Engage Cap and reinstall with the bump facing inward on all four (4) hubs.

## ENGAGE BRAKES BEFORE DRIVING

- Remove the Brake Engage Cap and reinstall with the bump facing outward on all four (4) hubs.

Figure 1-5: Brake Release





# DRIVING OR WINCHING ONTO OR OFF OF A TRANSPORT VEHICLE

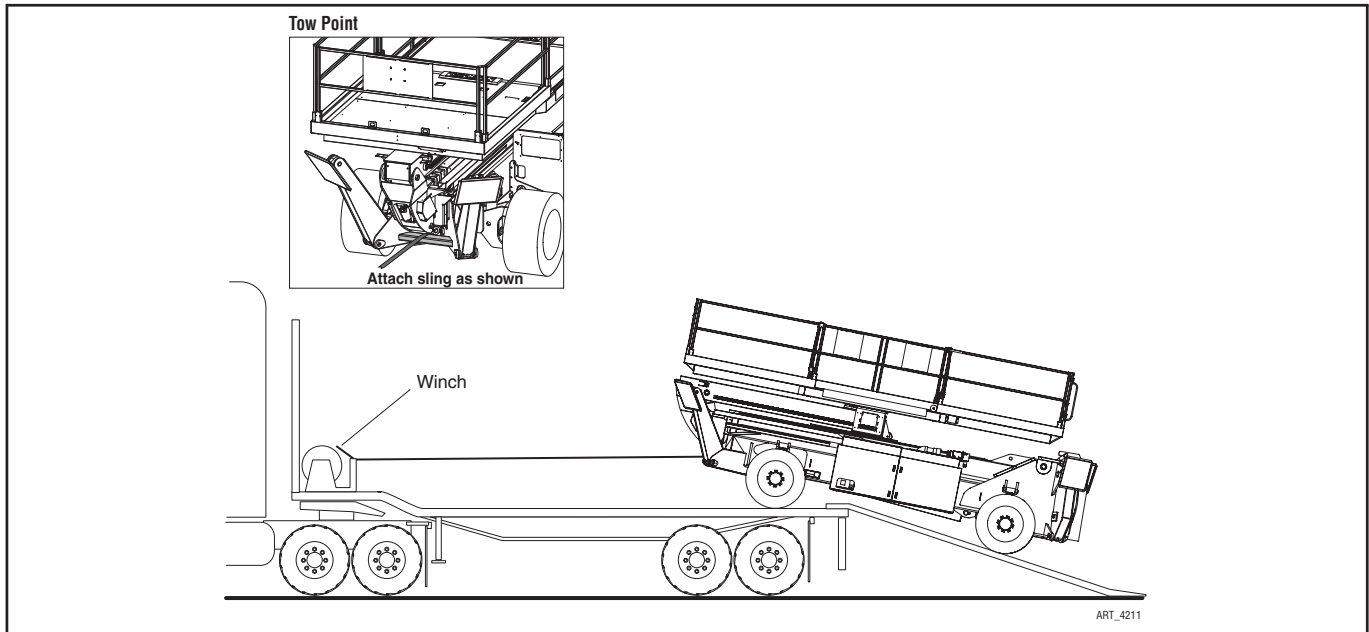


## WARNING

**MEC DOES NOT RECOMMEND UNASSISTED LOADING OR UNLOADING. ALWAYS ATTACH THE MACHINE TO A WINCH WHEN LOADING OR UNLOADING FROM A TRUCK OR TRAILER BY DRIVING.**

Refer to the Operator's Manual for loading, unloading, driving and operating instructions.

*Figure 1-6: Loading the Machine*



## LIFTING INSTRUCTIONS

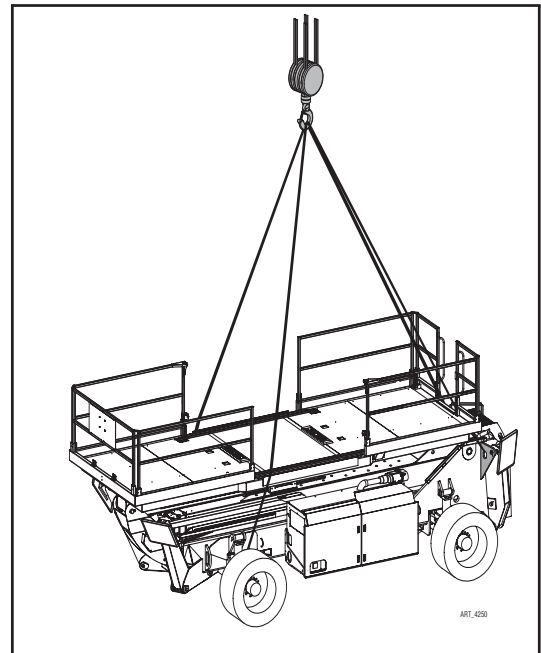


## WARNING

- ONLY QUALIFIED RIGGERS SHOULD RIG AND LIFT THE MACHINE.
- ENSURE THAT THE CRANE CAPACITY, LOADING SURFACES AND STRAPS ARE SUFFICIENT TO WITHSTAND THE MACHINE WEIGHT. SEE THE SERIAL PLATE FOR THE MACHINE WEIGHT.
- ENSURE THAT THE PLATFORM IS UNLOADED AND THAT ALL MATERIAL AND TOOLS HAVE BEEN REMOVED.

Refer to the Operator's Manual for lifting instructions.

*Figure 1-7: Lifting the Machine*







# Section 1

## HYDRAULIC SYSTEM

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## NOTES:

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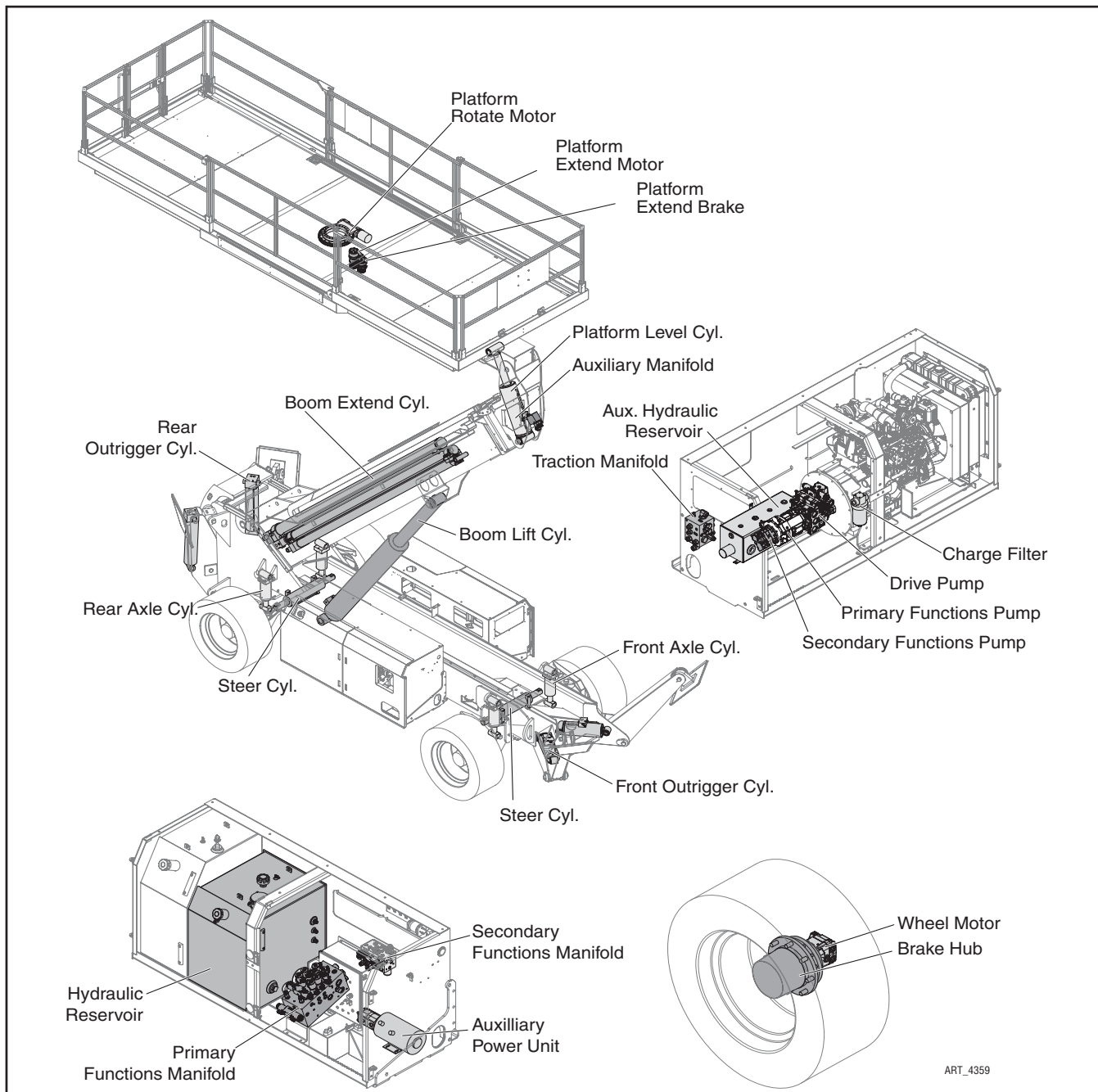
## HYDRAULIC SYSTEM – GENERAL

The hydraulic system is designed to control all or part of machine functions by integrating various hydraulic cartridge valves into three manifolds to provide directional, pressure, flow, and load control.

The hydraulic system is a feedback, load-sensing type. Hydraulic fluid is provided by a variable displacement, axial piston-type Drive Pump coupled to the engine, a variable-displacement piston-type Primary Functions pump, and a fixed displacement gear-type Secondary Functions Pump mounted to the back of the piston pumps. As the engine turns, the hydraulic pumps draw fluid from the reservoir and pump this fluid to the valve manifolds.

Each function has a maximum pressure control limit set by pressure relief valves.

**Figure 1-1:** Hydraulic System





## HYDRAULIC ROADMAP

### HYDRAULIC RESERVOIR

Hydraulic fluid is held in the reservoir for delivery to the pumps and is returned to the reservoir after use. Returning hydraulic fluid is routed through a filter before entering the reservoir. The reservoir also serves as the oil cooling device.

### AUXILIARY HYDRAULIC RESERVOIR

The Auxiliary Hydraulic Reservoir takes fluid in from the Hydraulic Tank and sends it out the Drive Pump and Function Pumps.

### DRIVE PUMP

The closed-loop hydrostatic piston-type Drive Pump with infinitely variable proportional control delivers hydraulic fluid under pressure to the Traction Manifold.

### PRIMARY FUNCTIONS PUMP

The piston-type Primary Functions Pump delivers hydraulic fluid under pressure to the Primary Functions Manifold and powers the outrigger, steering and boom cylinders.

### SECONDARY FUNCTIONS PUMP

The gear-type Secondary Functions Pump delivers hydraulic fluid under pressure to the Secondary Functions Manifold and provides pressure to the platform functions, in addition to controlling the axle cylinders and the brakes.

### TRACTION MANIFOLD

The Traction Manifold directs hydraulic fluid to the Wheel Motors and contains valve circuitry that improves performance on slippery surfaces.

### AUXILIARY MANIFOLD

The Auxiliary Manifold provides hydraulic control to the Platform Level, Rotate and Slide functions.

### PRIMARY FUNCTIONS MANIFOLD

The Primary Functions Manifold directs the hydraulic fluid to the Boom Lift, Boom Extend, Outrigger and Steering Cylinders through the use of electronically-operated solenoid valves.

### SECONDARY FUNCTIONS MANIFOLD

The Secondary Functions Manifold directs the hydraulic fluid to the Auxiliary Manifold, the front and rear Axle Cylinders, the Brake Release function and the 2-Speed Pilot function through the use of electronically-operated solenoid valves.

### WHEEL MOTORS/BRAKE HUBS

There are four 2-speed hydraulic wheel motors to provide power to all four wheels. The wheel motors turn planetary hubs with integral spring-applied, hydraulically-released brakes. The brakes are released by hydraulic pressure from the Secondary Functions Manifold. The drive system is hydrostatic; deceleration is provided by the drive motor.

### AXLE CYLINDERS

Four hydraulic cylinders control angle of the axles relative to the frame. The front axle cylinders move freely and allow the front axle to float when driving over rough terrain when the platform is stowed. When platform is elevated, all of the axle cylinders lock in place to increase machine stability. The rear axle cylinders are used to level the frame before elevating. Each cylinder has an integral counterbalance valves for load-holding.



**STEERING CYLINDERS**

This machine has two Steering Cylinders that control three steering modes: 2-wheel, 4-wheel and Crab steer. Steering is not self-centering, and the rear wheels must be centered before selecting 2-wheel mode.

If the front and rear wheels become out of phase, place the machine in Crab steering mode, then press and hold the steering button until all four wheels are turned fully in one direction. Return the wheels to center before switching to 2-wheel or 4-wheel mode.

**OUTRIGGER CYLINDERS**

Four hydraulic Outrigger Cylinders (two at the front and two at the rear) stabilize the machine during elevated operation.

**BOOM LIFT CYLINDER**

One hydraulic lift cylinder raises and lowers the boom.

**BOOM EXTEND CYLINDERS**

An assembly of three cylinders are used to extend and retract the boom. No sequencing cables or chains are used.

**PLATFORM LEVEL CYLINDER**

One hydraulic cylinder levels the platform as needed as the boom is raised and lowered.

**PLATFORM ROTATE MOTOR**

One hydraulic motor turns a worm gear swing bearing to rotate the position of the platform relative to the chassis.

**PLATFORM EXTEND MOTOR**

One hydraulic motor slides the platform fore-and-aft along the platform beam using a spur gear and rack drive system.

**PLATFORM EXTEND BRAKE**

This brake unit prevents the platform from moving when the Platform Extend Motor is not in use.

**AUXILIARY POWER UNIT**

The Auxiliary Power Unit provides hydraulic fluid power to lower the platform in the event of engine failure or emergency.

**GENERATOR SYSTEM -- OPTIONAL**

If equipped, the generator is driven by a hydraulic motor which receives hydraulic fluid directly from the pressure port of the Primary Functions Pump.



# HYDRAULIC FLUID

## HANDLING PRECAUTIONS



PERSONS IN REGULAR CONTACT WITH MINERAL-BASED HYDRAULIC FLUID NEED TO BE AWARE OF THE IMPORTANCE OF THOROUGH HYGIENE AND THE PROPER METHODS FOR HANDLING MINERAL OILS, IN ORDER TO AVOID POTENTIAL HAZARDS TO HEALTH.

IF MINERAL-BASED HYDRAULIC FLUID IS SPLASHED INTO THE EYES, IT MUST BE WASHED OUT THOROUGHLY USING ABUNDANT QUANTITIES OF WATER. SEEK MEDICAL ATTENTION IF IRRITATION PERSISTS.

HYDRAULIC FLUID UNDER PRESSURE CAN PENETRATE AND BURN SKIN, DAMAGE EYES, AND MAY CAUSE SERIOUS INJURY OR BLINDNESS.

FLUID LEAKS UNDER PRESSURE MAY NOT ALWAYS BE VISIBLE.

## FLUID RECOMMENDATIONS

MEC recommends only the use of the **Chevron** hydraulic fluids listed in the chart below, and each only in the operating temperatures listed in the chart. Do not substitute other fluids as pump damage may result, and use only the fluid appropriate to the ambient operating temperature.

**Table 1-1:** Hydraulic Fluid

Recommended Hydraulic Fluid	
> 30° F (0° C)	Chevron 1000THF
0° F (-18° C) ~ 30° F (0° C)	Chevron Rando Premium MV
< 0° F (-18° C)	Chevron Rando Premium MV

## SYSTEM FLUSHING PROCEDURE

1. With boom fully lowered and retracted, drain hydraulic fluid from hydraulic reservoir into a clean, empty container.
2. When the hydraulic reservoir is empty, remove suction strainer and hoses.
3. Remove the filter elements.
4. Flush the hoses with clean hydraulic fluid.
5. Discard old filter elements and replace.
6. Flush out the reservoir with hoses removed from the hydraulic reservoir.
7. Reinstall all hoses removed in the previous steps.
8. Fill hydraulic reservoir with filtered, fresh hydraulic fluid. Use only the appropriate hydraulic fluid as recommended in "Fluid Recommendations" on page 1-7.
9. Loosen the plug fittings on the Auxiliary Hydraulic Reservoir to flood with hydraulic fluid. Tighten plugs.



10. Loosen the output hose fittings at the Functions Pumps to flood with hydraulic fluid. Tighten fittings.
11. Perform the "Drive Pump Start-Up Procedure" on page 1-12.



**DO NOT operate the Drive Pump until you have completed the "Drive Pump Start-Up Procedure" on page 1-12. Severe damage will occur.**

12. Start up the machine. Briefly operate all functions. Two or three complete cycles may be necessary to purge all air from Boom Lift and Boom Extend cylinder(s).
13. When the above procedures have been completed, lower the platform to the stowed position, completely retract the stabilizers, then fill hydraulic reservoir to the full mark on sight gauge.
14. Check for leaks and correct as necessary. Machine is now ready to be placed into operation.

## HYDRAULIC FLUID RESERVOIR

The Hydraulic Fluid Reservoir Assembly consists of the reservoir, a lockable filler cap with breather, a drain plug, a sight gauge, and a bypass filter with a 10 micron filter element.

- Check reservoir for signs of leakage weekly.

## HYDRAULIC FILTERS



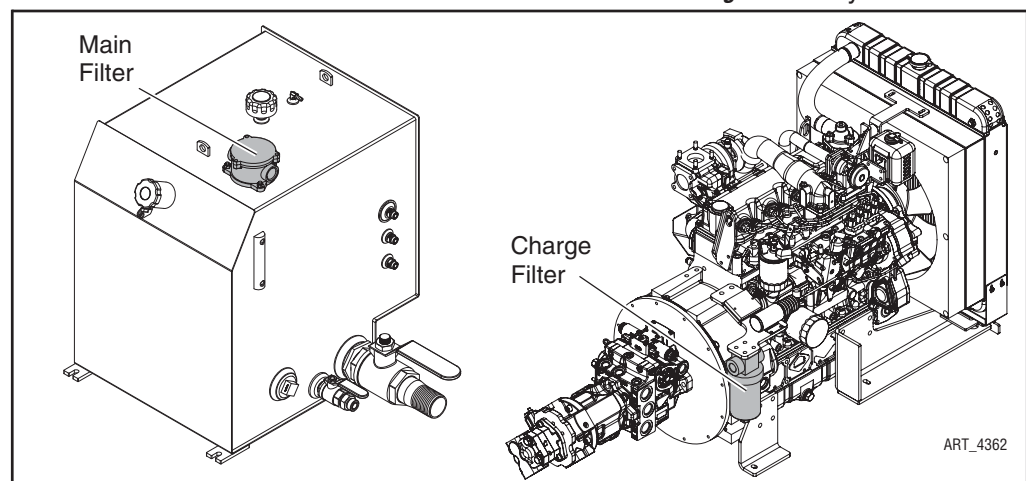
**BEWARE OF HOT FLUID. CONTACT WITH HOT FLUID MAY CAUSE SEVERE BURNS.**

The Hydraulic Fluid Reservoir contains a filter. Additionally, all machines have a Charge Filter Assembly attached to the engine.

When the filter is clogged, hydraulic flow bypasses the filter element.

Replace all filter elements every six (6) months or 500 hours. Extremely dirty conditions may require that the filter be replaced more often.

*Figure 1-2: Hydraulic Filters*





# HYDRAULIC PUMPS

**NOTE:** Refer to *Parts Section E*.

An internal combustion engine drives the Drive Pump and the Functions Pumps.

The Drive Pump is a variable displacement axial piston pump that provides hydraulic power to the Drive Motors. This is a hydrostatic drive system.

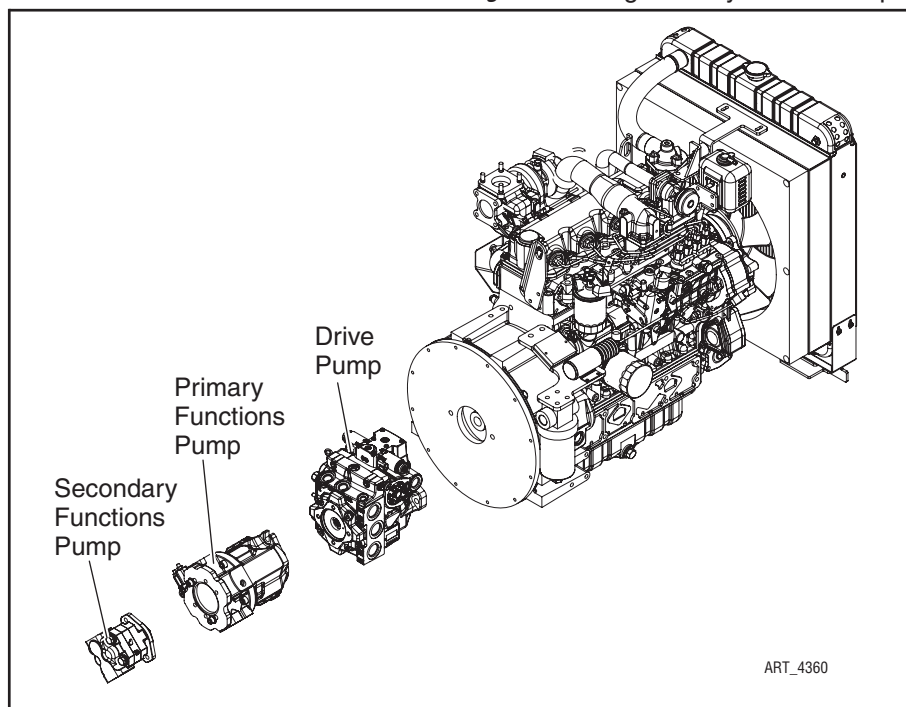
The Primary Functions Pump is a variable displacement piston pump that provides hydraulic power to the Primary Functions Manifold.

The Secondary Functions Pump is a gear pump that provides hydraulic power to the Secondary Functions Manifold.

**Figure 1-3:** Engine & Hydraulic Pumps

## REMOVE

1. Turn the Battery Disconnect Switch (inside Control Module) to the OFF position.
2. Place a large container under the engine and pump to catch fluid that will be lost during pump replacement. Dispose of used fluid properly.
3. Close the ball valve on the Hydraulic Tank to prevent fluid loss when the hoses are removed.
4. Tag and disconnect hydraulic hoses, and IMMEDIATELY cap or cover the openings to prevent contamination.
5. Remove the two (2) bolts that secure the Secondary Functions Pump. Remove the pump.
6. Remove the two (2) bolts that secure the Primary Functions Pump. Remove the pump.
7. Remove the two (2) bolts that hold the Drive Pump to the engine. Remove the piston pump.



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8. Installation is reverse of removal. Apply one (1) drop of Loctite® 242 or equivalent to each mounting bolt.
9. Open the ball valve on the Hydraulic Tank.



**Failure to open the ball valve on the Hydraulic Tank will result in damage to the pumps.**

**DO NOT operate the Drive Pump until you have completed the "Drive Pump Start-Up Procedure" on page 1-12.**

**Severe damage will occur.**

10. Perform the "Drive Pump Start-Up Procedure" on page 1-12.

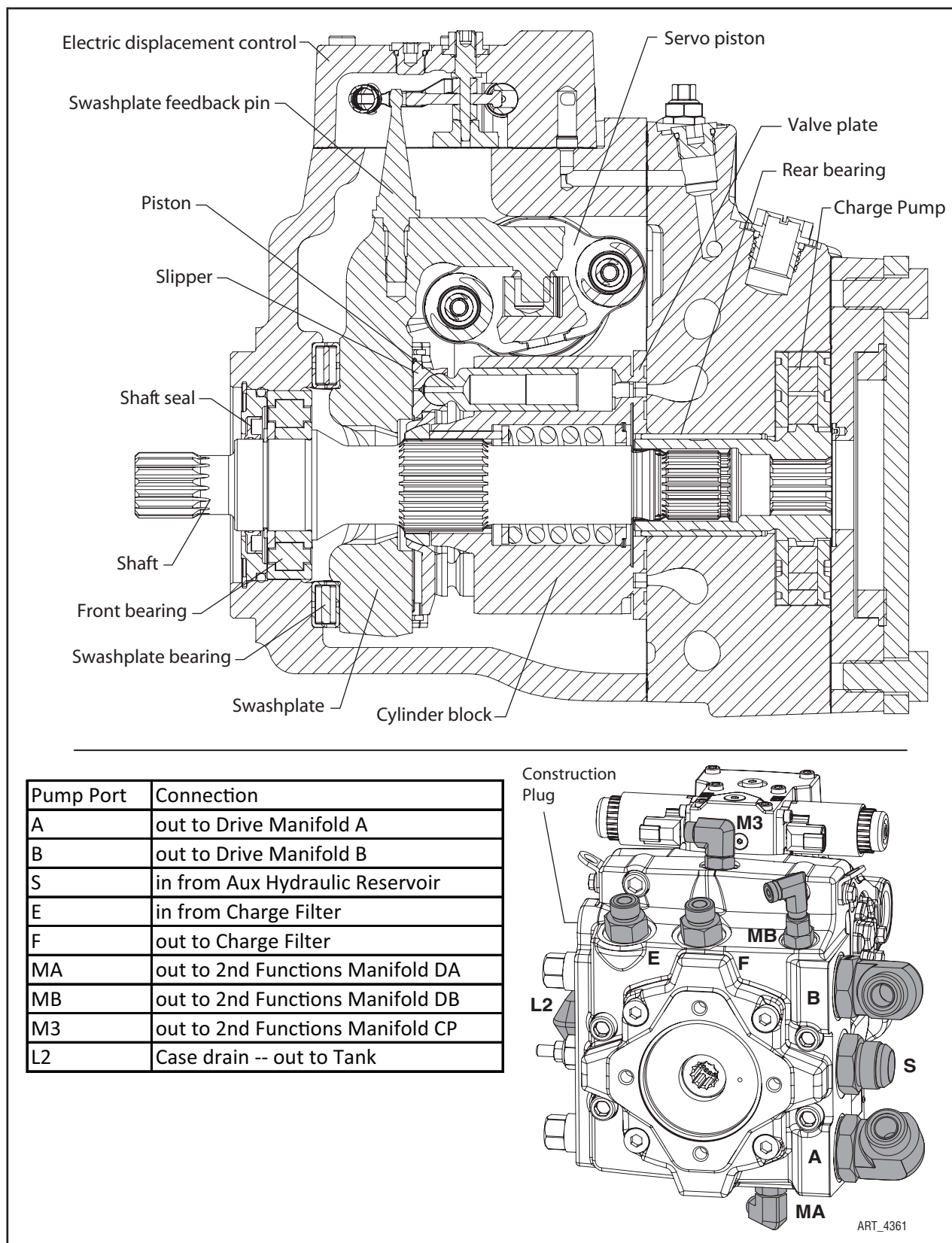


**DO NOT operate the Drive Pump until you have completed the "Drive Pump Start-Up Procedure" on page 1-12.**

**Severe damage will occur.**

11. Perform the appropriate startup procedures for the Primary and Secondary Functions Pumps.



**DRIVE PUMP****Figure 1-4: Drive Pump**



## DRIVE PUMP START-UP PROCEDURE

Follow this procedure when restarting a machine on which the Drive Pump has been:

- Removed and re-installed, or
- Drained of fluid for any reason.



**UNINTENDED MOVEMENT OF THE MACHINE OR MECHANISM MAY CAUSE INJURY. CHOCK THE WHEELS SECURELY BEFORE PERFORMING THIS PROCEDURE.**

Inspect the pump for damage prior to installation. Use only the appropriate hydraulic fluid as recommended in "Fluid Recommendations" on page 1-7.

1. Ensure that the machine's hydraulic oil and system components (reservoir, hoses, valves, fittings, and heat exchanger) are clean and free of any foreign material.
2. Install new system filter element(s) if necessary. Check that inlet line fittings are properly tightened and that there are no air leaks.
3. Install the pump. Do not yet connect the hose between port L2 and the hydraulic fluid tank.
4. Install a 1000 psi (50 bar) gauge in the pressure gauge port GCP on the Functions Manifold.
5. Fill the housing by adding filtered hydraulic fluid in port L2. Open the Construction Plug to assist in air bleed.
6. Fill the reservoir with hydraulic fluid. Use a 10-micron filler filter. Fill the inlet line from reservoir to pump.
7. Fill the hydraulic hoses that connect ports E and F to the charge filter.
8. Connect the hose between port L2 to the hydraulic fluid tank. Close the Construction Plug removed in step 4.



**After start-up the fluid level in the reservoir may drop due to system components filling. Damage to hydraulic components may occur if the fluid supply runs out. Ensure reservoir remains full of fluid during start-up.**

**Air entrapment in oil under high pressure may damage hydraulic components. Check carefully for inlet line leaks.**

**Do not run at maximum pressure until system is free of air and fluid has been thoroughly filtered.**

9. Disable the engine to prevent it from starting by disconnecting the fuel shutoff solenoid. Crank the starter for several seconds. Do not to exceed the engine manufacturer's recommendation. Wait 30 seconds and then crank the engine a second time as stated above. This operation helps remove air from the system lines. Refill the reservoir to recommended full oil level.
10. When the gauge begins to register charge pressure, reconnect the fuel shutoff solenoid, then start engine. Let the engine run at low idle for a minimum of 30 seconds to allow the remaining air to work itself out of the system. Check for leaks at all line connections and listen for cavitation. Check for proper fluid level in reservoir.



11. When charge pressure rises above 160 psi (11 bar), increase engine speed to normal operating rpm to further purge residual air from the system.
12. Shut off the engine. Connect the pump control signal wires. Start the engine, checking to be certain pump remains in neutral. Run the engine at normal operating speed and carefully check for forward and reverse control operation.
13. Continue to cycle between forward and reverse for at least five minutes to bleed all air and to flush system contaminants out of loop.

**NOTE:** Normal charge pressure fluctuation will occur during forward and reverse operation.

14. Check that the reservoir is full. Remove the pressure gauge.
15. The pump is now ready for operation.

### DRIVE PUMP SERVICE

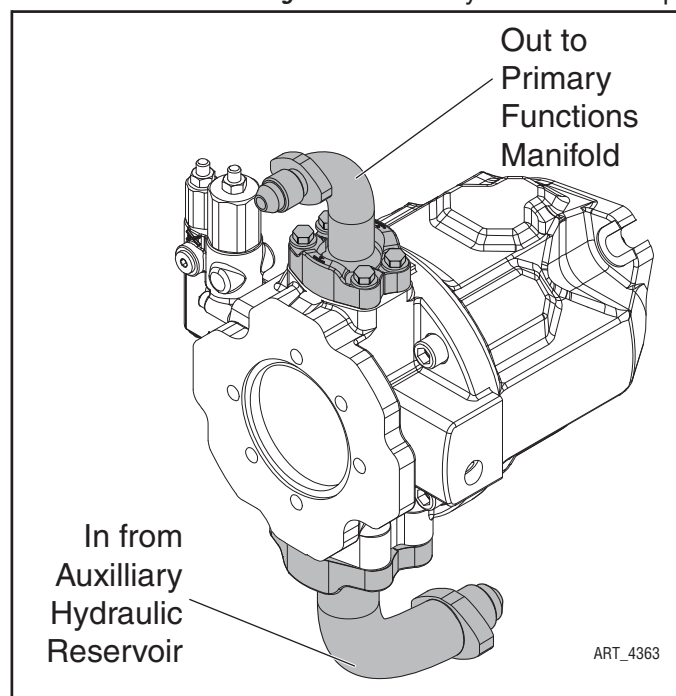
MEC does not recommend end-user maintenance or repair of the Sauer Danfoss hydraulic pump. Contact MEC or Sauer Danfoss for the nearest service provider.

## PRIMARY FUNCTIONS PUMP

The Primary Functions Pump is a variable-displacement piston pump. Power to functions is controlled by the ports in the Primary Functions Manifold.

The pump housing must be filled with fluid and all air bleed out before the first startup following maintenance, repair or long periods of inactivity.

*Figure 1-5: Primary Functions Pump*



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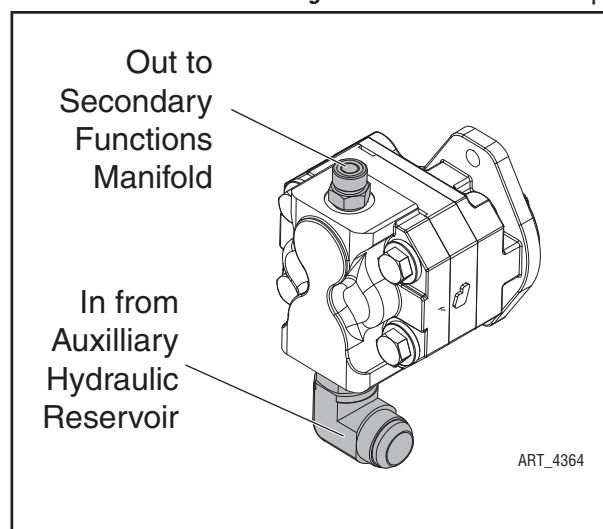


## SECONDARY FUNCTIONS PUMP

The Secondary Functions Pump is a fixed-displacement gear pump. Power to functions is controlled by the proportional valves, and unused pressure is returned to the tank.

The pump housing must be filled with fluid and all air bleed out before the first startup following maintenance, repair or long periods of inactivity.

**Figure 1-6:** Functions Pump





# HYDRAULIC MANIFOLDS

**NOTE:** Refer to *Parts Section E*.

This machine has four hydraulic manifolds: the Primary and Secondary Functions Manifolds, the Auxiliary Manifold and the Traction Manifold.



- **Clean all fittings before disconnecting hoses.**
- **Tag all hoses and wiring for proper reassembly.**
- **Plug all openings immediately to prevent contamination.**
- **Replace any O-rings and inspect all hoses for crack and damage before reassembly.**

## REMOVAL

1. Disconnect the negative battery terminal.
2. Close the ball valve on the Hydraulic Tank to prevent fluid loss when the hoses are removed.
3. Tag and disconnect the solenoid valve electrical leads.
4. Tag and disconnect hydraulic hoses. Immediately cap the openings to prevent contamination.
5. Remove the bolts that hold the manifold to the mounting bracket.
6. Remove the manifold block.

## DISASSEMBLY

1. Remove coils from solenoid valves.
2. Mark and remove valves.
3. Mark and remove fittings, plugs, springs, balls, and orifices.

## CLEANING AND INSPECTION

1. Wash the manifold in cleaning solvent to remove built-up contaminants, then blow out all passages with clean compressed air.
2. Inspect the manifold for cracks, thread damage and scoring where O-rings seal against internal and external surfaces.
3. Wash and dry each component and check for thread damage, torn or cracked O-rings, and proper operation.
4. Replace defective parts and O-rings.



## ASSEMBLY

**NOTE:** Lubricate all O-rings before installation to prevent damage to the O-ring. Seat balls in manifold block by lightly tapping on the ball with a brass drift punch.

1. Install fittings, plugs, springs, balls, and orifices. Use one drop of Loctite 242 or equivalent thread locker on each screw-in orifice.
2. Install valves.

## INSTALLATION

1. Attach manifold assembly to mounting plate with mounting bolts.
2. Connect solenoid leads as previously tagged.
3. Connect hydraulic hoses as previously tagged. Be certain to tighten hoses.
4. Open the ball valve on the Hydraulic Tank.



**Failure to open the ball valve on the Hydraulic Tank will result in damage to the pumps.**

5. Connect the battery.
6. Operate each hydraulic function and check for leaks and for proper operation.
7. Adjust valve pressures.



## HYDRAULIC PRESSURE ADJUSTMENT

- Before attempting to check and/or adjust pressure relief valves, operate the machine for 15 minutes or long enough to sufficiently warm the hydraulic fluid.
- Insert a 0-5000 psi gauge onto the appropriate pressure test port using gauge adapter fitting MEC part no. 50974
- When checking pressure at Ports GD, GLS and GCP, it is necessary to connect a test hose directly to the manifold after removing the existing cap. No test adapter is provided at these ports.

**Table 1-2:** Hydraulic Pressure Settings

Titan Boom 60-S Pressure Settings				
System	Setting		Adjustment	Gauge Port
Primary Manifold	3100 psi	213 bar	@ Primary Functions Pump	GP1
Standby Pressure	250 psi	17 bar	@ Primary Functions Pump	GLS
Extend	2000 psi	137 bar	RV1	GP1
Auxiliary Power	3200 psi	220 bar	RV2	GP1
Secondary Manifold	3200 psi	220 bar	RV3	GP2
Drive Charge Pressure	348 psi	24 bar	@ Drive Pump	GCP
Drive System	4500 psi	310 bar	@ Drive Pump	GD
Steer System	1500 psi	103 bar	CR1, CR2	GP1
Traction Manifold Oil Supply	DO NOT ADJUST		RV4	--
Axle Float	DO NOT ADJUST		PR1	--



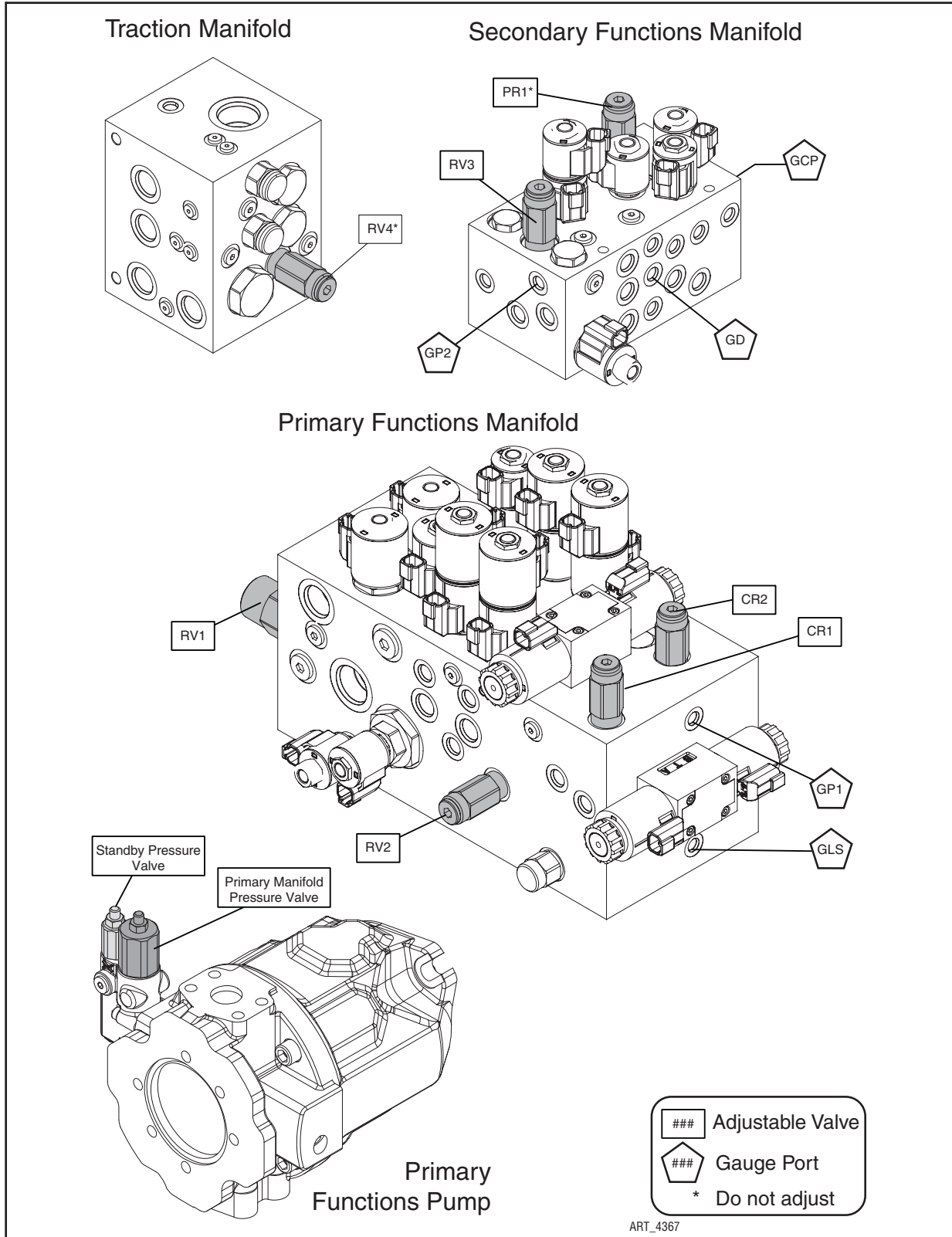
# ADJUSTING RELIEF VALVES



## CAUTION

Do not operate pump with tamper proof caps removed. Fluid will emit under pressure.

Figure 1-7: Adjustable Valves Location





## ADJUSTMENTS

System pressures should be checked and adjusted during routine maintenance to ensure proper machine performance

### COUNTERBALANCE VALVES

The counterbalance valves located on many of the cylinders of the Titan Boom are set by the manufacturer and should not be adjusted for any reason.

Replace any counterbalance valve that shows evidence of adjustment or tampering.

### PRIMARY MANIFOLD PRESSURE

#### Primary Manifold Pressure Valve

Park the machine on a firm level surface free from overhead obstructions.

Primary Manifold Pressure should be set to 3100 psi (213 bar).

- Insert a 0-5000 psi gauge into the port GP1 of the Primary Functions Manifold.
- Loosen the lock nut on the Primary Manifold Pressure Valve on the Primary Functions Pump.
- **With no load on platform**, use the Boom Lower function to lower the boom completely.
- Press and hold the Boom Lower switch for 10 seconds to get an accurate reading on the pressure gauge.
- If pressure is LOW, adjust lift relief valve ¼ turn clockwise and recheck.
- If pressure is HIGH, adjust lift relief valve ¼ turn counterclockwise and recheck.
- Repeat until correct.
- Tighten the lock nut on the valve.

### PRIMARY MANIFOLD STANDBY PRESSURE

#### Primary Manifold Pressure Valve

Primary Manifold Standby Pressure should be checked during routine maintenance to ensure proper machine performance.

To check Primary Manifold Pressure setting, park the machine on a firm level surface free from overhead obstructions.

Primary Manifold Pressure should be set to 250 psi (17 bar).

- Insert a 0-1000 psi gauge into the port GLS of the Primary Functions Manifold.
- Loosen the lock nut on the Standby Pressure Valve on the Primary Functions Pump.
- Start the engine.
- With the engine at idle speed and no functions activated, read the pressure gauge.
- If pressure is LOW, adjust lift relief valve ¼ turn clockwise and recheck.
- If pressure is HIGH, adjust lift relief valve ¼ turn counterclockwise and recheck.
- Repeat until correct.
- Tighten the lock nut on the valve.



## BOOM EXTEND RELIEF

### RV1

It is necessary to remove the cap from the relief valve if adjustment is necessary. REMOVING THE CAP WHILE THE ENGINE IS RUNNING WILL RESULT IN FLUID LEAKAGE.

Park the machine on a firm level surface free from overhead obstructions.

The Boom Extend Relief Valve (RV1) should be set to 2000 psi (137 bar).

- Insert a 0-5000 psi gauge into the port GP1 of the Functions Manifold.
- **With no load on platform**, use the Boom Extend function to extend the boom completely.
- Press and hold the Boom Extend switch for 10 seconds to get an accurate reading on the pressure gauge.
- If pressure is LOW, adjust steering relief valve ¼ turn clockwise and recheck.
- If pressure is HIGH, adjust steering relief valve ¼ turn counterclockwise and recheck.
- Repeat until correct.

## AUXILIARY POWER RELIEF

### RV2

It is necessary to remove the cap from the relief valve if adjustment is necessary. REMOVING THE CAP WHILE OPERATING THE AUXILIARY POWER UNIT WILL RESULT IN FLUID LEAKAGE.

To check the Auxiliary Power Relief Valve setting, park the machine on a firm level surface free from overhead and forward obstructions.

The Auxiliary Power Relief Valve (RV2) should be set to 3200 psi (220 bar).

- Insert a 0-5000 psi gauge into the port GP1 of the Functions Manifold.
- **With the boom completely lowered and retracted and the engine turned OFF**, use the Auxiliary Power switch to enable the Boom Down function.
- Press and hold the Boom Down switch for 10 seconds to get an accurate reading on the pressure gauge.
- If pressure is LOW, adjust steering relief valve ¼ turn clockwise and recheck.
- If pressure is HIGH, adjust steering relief valve ¼ turn counterclockwise and recheck.
- Repeat until correct.



## SECONDARY MANIFOLD PRESSURE

### RV3

It is necessary to remove the cap from the relief valve if adjustment is necessary. REMOVING THE CAP WHILE THE ENGINE IS RUNNING WILL RESULT IN FLUID LEAKAGE.

Park the machine on a firm level surface free from obstructions.

Secondary Manifold Pressure should be set to 3200 psi (220 bar).

- Insert a 0-5000 psi gauge into the port GP2 of the Secondary Functions Manifold.
- Ensure that the platform is empty and that the boom is completely lowered and retracted.
- **With no load on platform**, use the Frame Level function to tilt the frame completely to the right.
- Press and hold the Frame Level switch to the right for 10 seconds to get an accurate reading on the pressure gauge.
- If pressure is LOW, adjust lift relief valve ¼ turn clockwise and recheck.
- If pressure is HIGH, adjust lift relief valve ¼ turn counterclockwise and recheck.
- Repeat until correct.
- Tighten the lock nut on the valve.

## STEERING CROSS PORT RELIEF VALVES

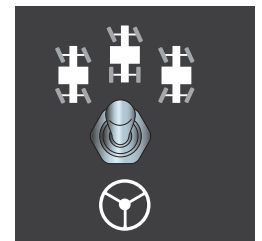
### CR1, CR2

It is necessary to remove the cap from the relief valve if adjustment is necessary. REMOVING THE CAP WHILE THE ENGINE IS RUNNING WILL RESULT IN FLUID LEAKAGE.

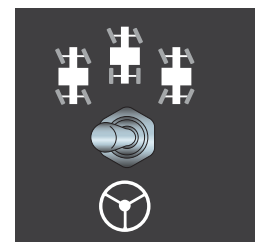
Park the machine on a firm level surface free from obstructions.

The Steering Cross Port Relief Valves (CR1 & CR2) should be set to 1500 psi (103 bar).

- Insert a 0-5000 psi gauge into the port GP1 of the Primary Functions Manifold.
- Use the steering function to center all wheels.
- Place the machine in 2-WHEEL steer mode (center position).
- Steer the wheels fully left. Hold the switch for 10 seconds. This is the reading for CR2.
- If pressure is LOW, adjust Valve CR2 ¼ turn clockwise and recheck.
- If pressure is HIGH, adjust Valve CR2 ¼ turn counterclockwise and recheck.
- With the front wheels fully left, place the machine in CRAB steer mode (left position). Steer the machine fully left. The front wheels won't move, as they are already turned fully left.
- The rear wheels should turn until they are pointed fully left. If the rear wheels do not turn, Valve CR1 is set below the setting of Valve CR2
  - Adjust Valve CR1 1/8 turn clockwise and retry. Continue until wheels just begin to steer left.
- Steer the wheels fully left. Hold the switch 10 seconds. This is the reading for CR1.
- If pressure is HIGH, adjust Valve CR2 1/8 turn counterclockwise and recheck.



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## DRIVE PUMP

Refer to *Section 3* for Remove and Install instructions.

Refer to *Parts Section E*.

### DRIVE PUMP ADJUSTMENTS

This section offers instruction on inspection and adjustment of pump components. Read through the entire topic before beginning a service activity.



**Contamination can damage internal components and void your warranty. Take precautions to ensure system cleanliness when removing and reinstalling system lines.**

#### ***Standard Procedures***

1. With the engine off, thoroughly clean the outside of the pump.
2. If removing the pump, tag each hydraulic line. When you disconnect hydraulic lines, immediately cap them and plug each open port to prevent contamination.
3. Ensure the surrounding area is clean and free of contaminants like dirt and grime.
4. Inspect the system for contamination.
5. Check the hydraulic fluid for signs of contamination: oil discoloration, foam in the oil, sludge, or metal particles.
6. If there are signs of contamination in the hydraulic fluid, replace all filters and drain the hydraulic system. Flush the lines and refill the reservoir with the correct filtered hydraulic fluid.
7. Before re-installing the pump, test for leaks.
8. See "Drive Pump Start-Up Procedure" on page 1-12 for start-up instructions



## Charge Pressure Relief Valve Adjustment

This procedure explains how to check and adjust the charge pressure relief valve.

1. Install a 1000 psi (50 bar) pressure gauge in charge pressure gauge port GCP on the Secondary Functions Manifold. This gauge shows charge pressure.
2. Install a 100 psi (10 bar) gauge at case pressure port L1, L2, or L3. This gauge shows case pressure.
3. Operate the system with the pump in neutral (zero displacement) when measuring charge pressure.

**NOTE:** Ensure charge pressure is properly set before checking pressure limiter. See Section 1.

4. The charge pressure relief valve setting for this pump is 348 psi (24 bar). This pressure assumes 1800 rpm pump speed, charge flow of 7 gal/min. (26.5 l/min.), and reservoir temperature of 120°F (50°C). The charge pressure references case pressure.

**NOTE:** At higher pump speeds or higher charge flows the charge pressure will rise over the rated setting.

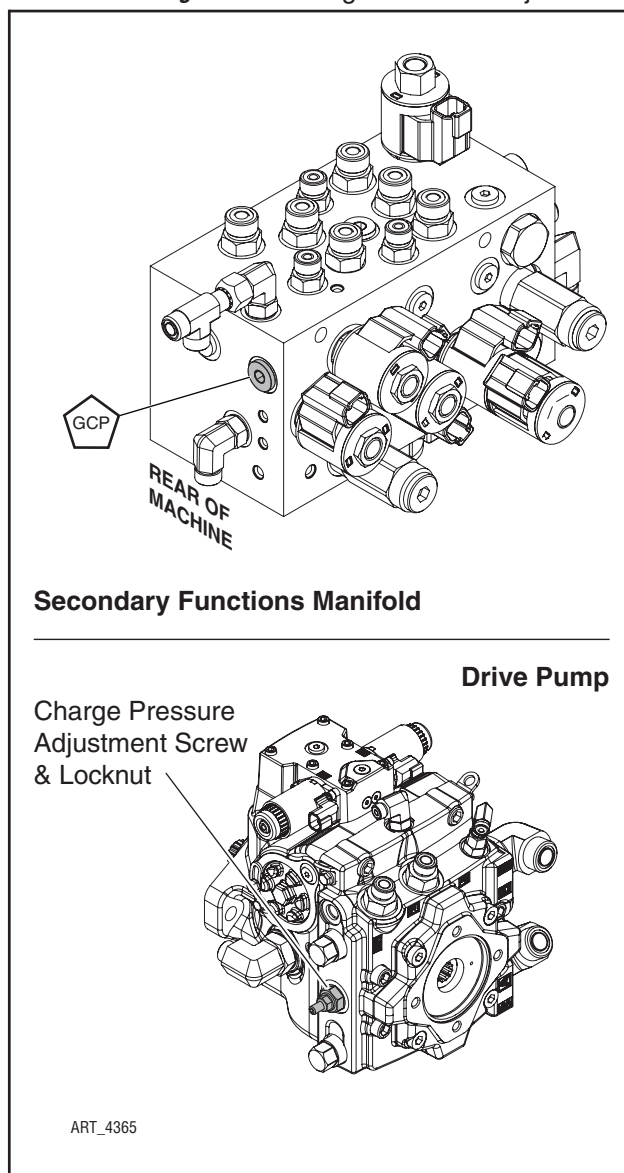
Figure 1-8: Charge Pressure Adjustment

5. Rotate the adjusting screw clockwise to increase pressure, counter clockwise to decrease pressure.

**Subtract the case pressure reading from the charge pressure reading to compute the actual charge pressure.**

**NOTE:** Pressure change per turn is dependant on charge flow entering pump.

6. Hold the adjusting screw stationary while tightening the locknut to 13 lb-ft. (17 Nm).
7. When you achieve the desired charge pressure setting, remove the gauges and plug the ports.



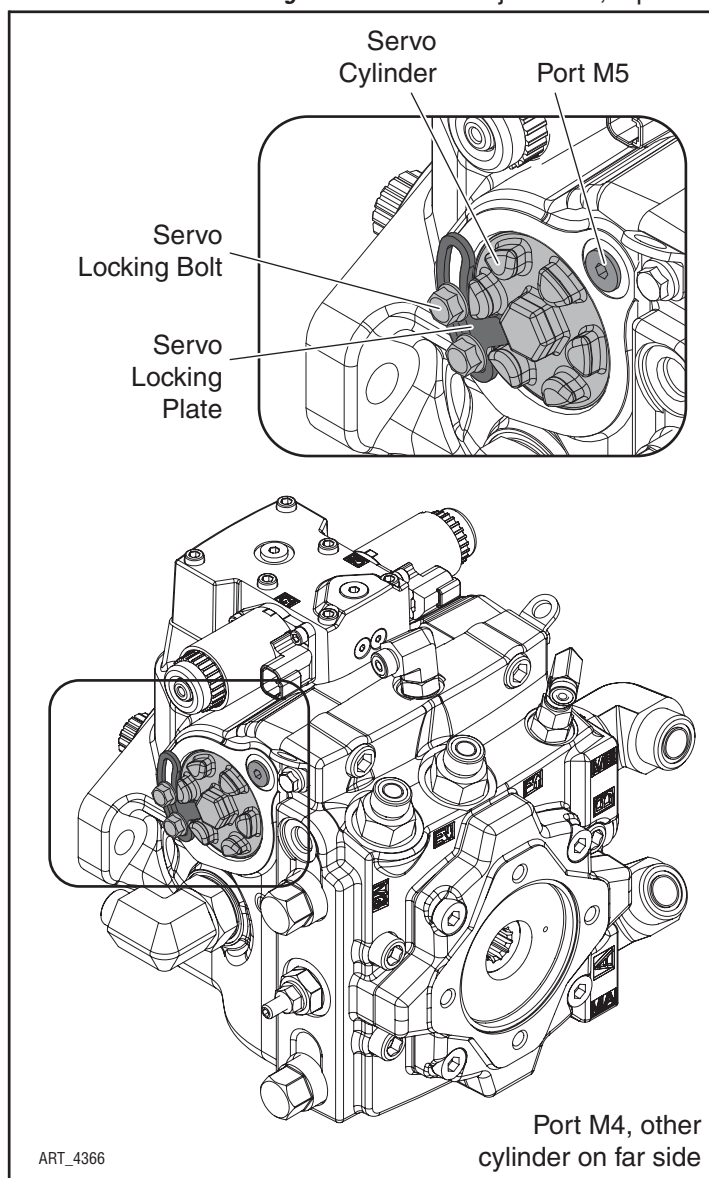


## SERVO ADJUSTMENT

Servo adjustment should not be performed unless the pump is confirmed to be out of adjustment. Check all other possibilities before performing this procedure. Refer to Chapter 4 -- Troubleshooting.

1. Install a 1000 psi (50 bar) gauge in each of the two servo gauge ports (M4 and M5). Disconnect the external control input (electrical connections) from the control solenoids. Start the engine and operate at idle speed.
2. Run engine at 1800 rpm.
3. Check the servo pressure gauges. Ensure the differential between M4 and M5 is less than 22 psi (1.5 bar).
4. Using a 3/4 in hex deep socket, unthread both servo cylinders 2-3 turns. This step ensures the servo cylinders have no contact with the servo piston.
5. Stroke the pump by supplying current to solenoid C1, until the servo pressure at port M4 is 14–29 psi (1 to 2 bar) greater than at port M5 and the system pressure gauges indicate displacement. Pressure should be greater at port MB. This also indicates the servo piston is in contact with the servo cylinder on side M5.
6. Slowly thread the servo cylinder on the M5 side in until the system pressure differential starts to decrease. Maintain servo pressure differential between 14–29 psi (1 to 2 bar) during this step. Continue turning the servo cylinder in until the system pressure differential (between ports MA/MB) is less than 22 psi (1.5 bar). This procedure sets the servo and swash plate to mechanical neutral on the M5 side.
7. Repeat steps 1-5 but stroke the pump in the opposite direction by turning the eccentric screw in the opposite direction, or by supplying current to solenoid C2. Reverse gauge locations (M4 for M5, MB for MA) from those stated above since the pump is now stroking the other direction.
8. Remove all gauges and replace gauge port plugs.

**Figure 1-9:** Servo Adjustment, top view





## WHEEL MOTOR STARTUP PROCEDURE

Follow this procedure when restarting a machine on which the Drive Motors have been:

- Removed and re-installed, or
- Drained of fluid for any reason.



**UNINTENDED MOVEMENT OF THE MACHINE OR MECHANISM MAY CAUSE INJURY. SECURE THE MACHINE BEFORE PERFORMING THIS PROCEDURE.**



**If oil has drained from the Drive Pump, DO NOT operate the Drive Pump until you have completed the "Drive Pump Start-Up Procedure" on page 1-12. Severe damage will occur.**

Inspect each Drive Motor for damage prior to installation. Use only the appropriate hydraulic fluid as recommended in "Fluid Recommendations" on page 1-7.

1. Fill the reservoir with the appropriate hydraulic fluid as recommended in "Fluid Recommendations" on page 1-7. Always filter fluid through a 10 micron filter when pouring into the reservoir. Never reuse hydraulic fluid.
2. Fill the inlet line leading from the pump to the reservoir. Check the inlet line for properly tightened fittings and be certain it is free of restrictions and air leaks.
3. Fill the pump and motor housing with clean hydraulic fluid. Pour filtered oil directly into the upper most case drain port.
4. To ensure the pump and motor stay filled with oil, install case drain lines into the upper-most case drain ports.
5. Install a 0 to 35 bar [0 to 500 psi] gauge in the pressure gauge port (M3) of the pump to monitor system pressure during start up.
6. Follow recommendations in the machine operator's manual for engine start up procedures.
7. While watching the pressure gauge, jog the engine or run at the lowest possible speed until system pressure builds to normal levels (minimum 11 bar [160 psi]). Once system pressure is established, increase to full operating speed. If system pressure is not maintained, shut down the engine, determine cause, and take corrective action.



8. Operate the hydraulic system for at least fifteen minutes under light load conditions.
9. Check and adjust pump control settings as necessary after installation.
10. Shut down the engine and remove the pressure gauge. Replace hose and fitting at the pressure gauge port.
11. Check the fluid level in the reservoir; add clean filtered fluid if necessary.
12. The motor is now ready for operation.

**REPAIR**

MEC does not recommend end-user maintenance or repair of the Titan Boom 60-S drive motors. Contact MEC for the nearest service provider.

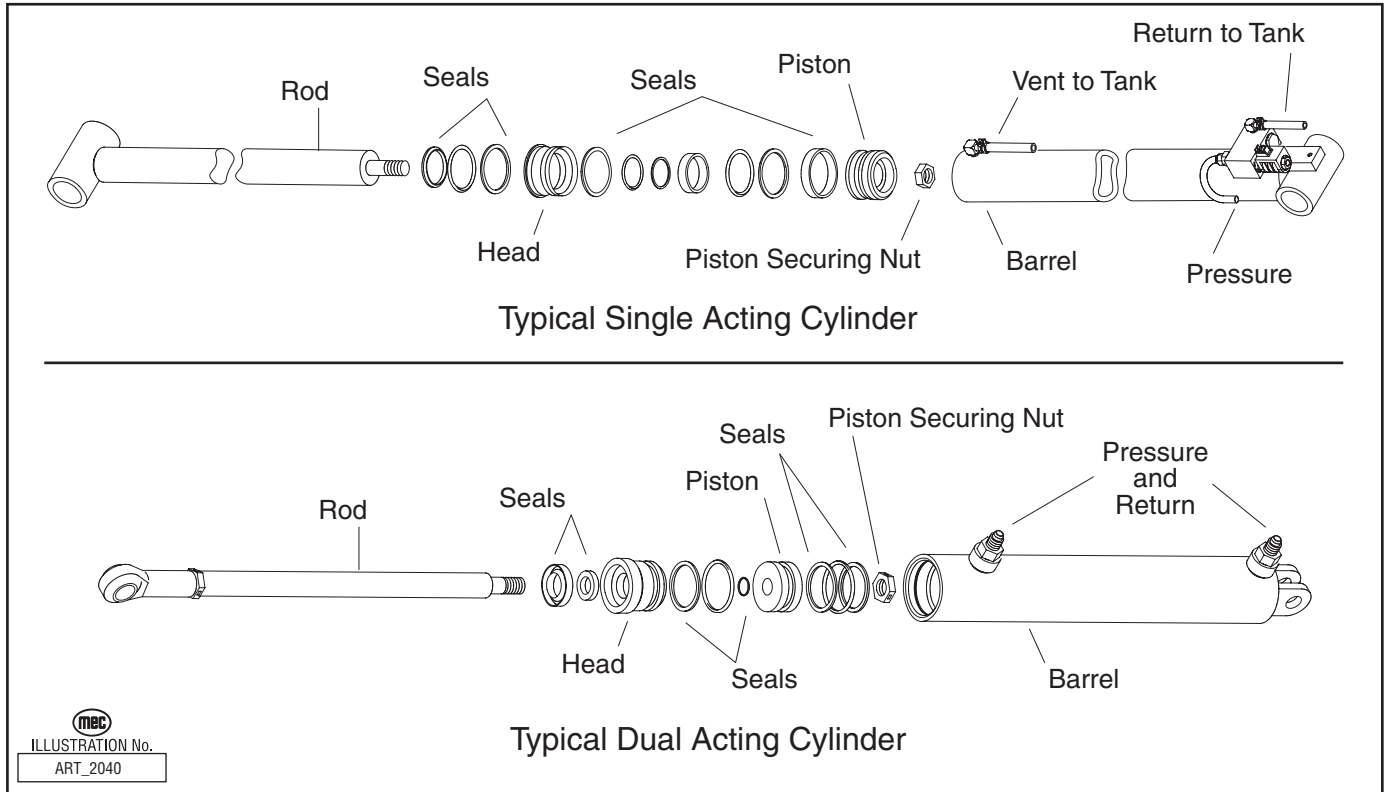


# GENERAL CYLINDER REPAIR



**CYLINDERS ARE HEAVY. SUPPORT CYLINDERS BEFORE REMOVING HARDWARE THAT SECURES THE CYLINDER TO THE MACHINE.**

*Figure 1-10: Typical Cylinders, Exploded View*



## REMOVAL

**NOTE:** Refer to *Section 3* for Remove and Replace instructions, and the *Parts Manual* for a list of hardware specific to the cylinder being repaired.

1. Tag hoses for proper reassembly.
2. Disconnect hoses and **IMMEDIATELY** cap the openings to prevent contamination.
3. Remove cylinder from the machine as described in *Section 3*.



## PREPARATION



**Take precautions to protect the rod surface. Guard against dirt or other foreign objects entering system.**

1. Drain all fluid from cylinder.
2. Clean all dirt and grit from outside of cylinder.
3. Insert cylinder into vise.



**DO NOT overtighten the vise. Overtightening may damage the cylinder.**

## CYLINDER DISASSEMBLY

1. Remove solenoid valves or counterbalance valves, if the cylinder is equipped with them.
2. Remove the head from the cylinder body.
3. Remove the shaft assembly from the barrel, pulling in a straight line, so as not to scar the internal parts.
4. Insert shaft into a **soft jawed** vise so that the head and piston can be removed. Be sure the shaft and vise are both clean before using.
5. Remove nut at the end of the shaft and pull head and piston off of the rod.
6. Remove all seals from the head and piston using a non-sharp seal tool. These tools are available from various seal suppliers.
7. Clean all fluid and debris off of the head, piston, shaft, collar and barrel using solvent, rags, and an air hose.
8. Inspect parts for scratches, pits or polishing. Check seal grooves and sealing surfaces.
  - a. Scratches or pits deep enough to catch the fingernail are unacceptable; replace the cylinder.
  - b. Polishing is a sign of uneven loading. Check for roundness. If a polished surface is not round within .007 in. (0.18 mm) replace the cylinder.



## CYLINDER ASSEMBLY

### CAUTION:

- To ensure a quality repair, cylinder parts must be thoroughly cleaned, dry, and free of solvents, and assembly must be performed in a clean area free of dust and contamination.
  - Do not use sharp edged tools during seal replacement. After installing seals wait at least one hour before assembling the cylinder to allow the seals to return to their original shape.
  - Torque all hardware according to the Hydraulic Components Torque Table unless otherwise specified.
1. Lubricate all components with clean hydraulic fluid.
  2. Install new seal kit components. Install all seals on the head and piston using the non-sharp seal tool.
  3. Place a small amount of fluid on the inside head seals. Reinstall the head on the shaft by slipping head over the piston end of the shaft. Be very careful not to damage the inside seals.
  4. Place a small amount of fluid on the inside seals of the piston. Reinstall the piston on the shaft by slowly twisting the piston onto the threads of the shaft. Be very careful not to damage the inside seals.
  5. Reinstall the shaft nut. Torque 1 ½" nut to 160 ft. lbs. (216 Nm).
  6. Grease the outside seals of the head and piston.
  7. Reinstall the shaft into the barrel of the cylinder and push in until groove of the head lines up with the slot in the barrel.
  8. Reinstall the cylinder retainer. Installation is reverse of removal.
  9. Reinstall any solenoid valves or counterbalance valve removed during disassembly.
  10. Cycle the cylinder using air to check for proper operation.

**NOTE:** Keep all parts clean when working with hydraulic cylinders. Even one small piece of dirt or grit can damage the cylinder.









## Section 2

# ELECTRICAL SYSTEM

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## ELECTRICAL SYSTEM – GENERAL

The electrical control system consists of lower controls located on the machine base and upper controls located on the machine platform. Emergency lowering controls are located at each control station.

### LOWER CONTROLS

The lower controls operate all functions except the steer and drive functions.

### UPPER CONTROLS

The upper controls operate all machine functions. A momentary bi-directional rocker switch on the drive control handle provides the steering function. The control system for operation of drive, steer, lift, and lower is electric-over-hydraulic type. The lift, extend, rotate, slide and drive system is a proportional and is controlled by position and direction of the upper controls joysticks.

### EMERGENCY STOP

There are two red Emergency Stop switches: One located on the upper controls and one on the lower controls. Activation of either Emergency Stop switch will immediately cut electrical power to all controls, thereby stopping all machine functions. Press the switch to stop all electrical power and turn the switch clockwise to reset.

When both Emergency Stop switches are “set”, the controls have electrical power and the machine will operate.

*Figure 2-1: Emergency Stop Switch*

**NOTE:** Both switches must be set or the machine will not operate.

The electric Emergency Lowering switch will continue to function when the Emergency Stop switches are depressed.



### EMERGENCY LOWERING

The Emergency Lowering System is used to lower the platform in case of power failure. To lower the platform, activate the Emergency Power Switch to run the Emergency Down auxiliary hydraulic pump.

This function uses battery power from the auxiliary battery to lower the platform.

- Push and hold the Auxiliary Power switch, then use the Boom Extend/Retract function to retract the boom.
- Continue to hold the Auxiliary Power switch, then use the Boom Lift/Lower function to lower the boom.

**NOTE:** The Emergency Lowering System is disabled when the engine is running.

The Emergency Power switch serves as an enable switch. It is not necessary to use the primary function enable switch.

### DIAGNOSTIC LED & ONBOARD EZ-CAL DIAGNOSTIC TOOL

If the machine fails to operate, check the onboard EZ-Cal diagnostic tool located inside the Lower Controls Box. Also, check the diagnostic LED of the GP400 Module, located inside the control box. The LED on the module should be *ON*.

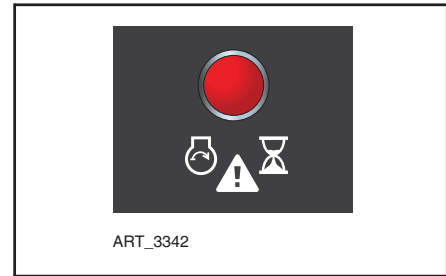
If the EZ-Cal has an error message, or if the LED is *OFF* or *FLASHING*, see Section 4 of this manual for assistance in troubleshooting.



## STARTER CIRCUIT CUTOUT

To protect the starter motor, power cuts off to the starter circuit when the starter motor has run continuously for 10 seconds without starting the engine. The Starter Circuit Cutout indicator light on the Lower Controls Box will turn on during this time. Power to the starter circuit reengages after 30 seconds.

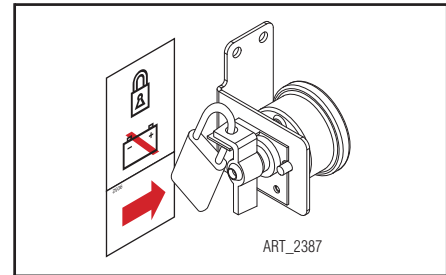
**Figure 2-2:** Master Disconnect Switch



## BATTERY DISCONNECT SWITCH

All electrical power is routed through the Master Disconnect switch located in the Control Module. The switch can be locked in the OFF position with a padlock to prevent unauthorized use.

**Figure 2-3:** Master Disconnect Switch





# BATTERIES



## CAUTION

Discharged batteries can freeze, causing damage to the battery and/or battery case. A broken battery case will allow electrolyte to leak out.



## WARNING

**BATTERIES UNDER CHARGE CREATE EXPLOSIVE HYDROGEN GAS. KEEP SPARKS, FLAMES AND SMOKING MATERIALS AWAY FROM BATTERIES.**

**ALWAYS WEAR SAFETY GLASSES WHEN WORKING WITH BATTERIES.**

**BATTERY FLUID IS CORROSIVE. THOROUGHLY RINSE SPILLED FLUID WITH CLEAN WATER.**

**REPLACE ONLY WITH MANUFACTURER-APPROVED BATTERIES.**

**BEFORE DISCONNECTING THE BATTERY NEGATIVE (–) LEAD, MAKE SURE THAT ALL SWITCHES ARE OFF. IF ON, A SPARK WILL OCCUR AT THE GROUND TERMINAL THAT COULD IGNITE HYDROGEN GAS OR FUEL VAPORS.**

Two (2) battery (12 Volts DC) -- one supplies the electrical power required to start the engine and to operate the electrical circuits, while a second battery provides power for the Emergency Down power unit.

## BATTERY MAINTENANCE (IN STORAGE)

Follow these procedures for maintenance of battery on a machine not in use:

- Keep battery clean. Electrolyte of batteries should be checked regularly and kept at proper level.
- Never stack one battery directly on top of another because post or container damage can result. If batteries are stored individually, place supporting boards between layers. Rotate stock so that the oldest batteries are used first.
- Batteries should be kept fully charged. A battery, while in storage, should be recharged to full charge at recommended intervals.

### A BATTERY FULLY CHARGED (100%) AT 80°F (26.6°C)

- drops to 65% at 32°F (0°C)
- drops to 40% at 0°F (-32°C)

**Table 2-1:** Recommended Battery Charge Intervals

If Stored At	Recharge
Below 40°F (4°C)	Every week
40°-60°F (4°-15°C)	Every 2 weeks
Above 60°F (15°C)	Every month



## BATTERY MAINTENANCE (IN USE)

Check battery and surrounding area for signs of damage or corrosion.

Check battery terminals for:

- **Corrosion:** Regularly clean connections and apply a nonmetallic grease or protective spray to retard corrosion.
- **Loose connections:** Be sure all cable connections are tightly secured, and that good contact is made with terminals.
- **Broken or frayed cables:** Be sure all connections are good and that no loose or broken wires are exposed. Replace as necessary.

Check battery electrolyte level. Replenish the electrolyte, if necessary. Remove vent caps before filling, and **USE ONLY DISTILLED WATER. DO NOT OVERFILL.** Fill to level indicator (or ½ inch over the top of separators, if there is no level indicator). Fill after charging to prevent overflow of acid due to expansion. Do not use a hose to add water to batteries.

Allowing the electrolyte level to drop below the top of the separators will lead to shortened battery life.

Excessive water usage can indicate that a battery has been overcharged, has been subjected to excessively high temperatures, or is nearing the end of its service life.

### BATTERY PREVENTATIVE MAINTENANCE

During quarterly maintenance (after battery has been charged), check the specific gravity of two or more cells. A fully charged battery should indicate 1.28 specific gravity. If low readings are noted, check the following:

- Check terminals for corrosion, loose connections and broken or frayed cables.
- Check all cells with a hydrometer for variance in specific gravity. A variation of 0.03 points or more between cells is a cause for concern. Mark the low cells.

Recheck specific gravity of all cells after recharging. Wash the top of the battery, making sure all vents are in place. Do not allow cleaning water or other foreign matter to enter the cells. Use a solution of bicarbonate soda (5 tsp. of baking soda per quart of warm water) and water to wash the battery if there is an accumulation of acid.

**Table 2-2:** Battery Specific Gravity and Voltage

Specific Gravity		Volts DC		
	Each Cell	Per Cell	6V Battery	12V Battery
Fully Charged	1.280	2.10	6.30	12.60
Fully Discharged	1.130	1.75	5.19	10.50



## BATTERY REPLACEMENT



### WARNING

**TURN OFF THE BATTERY DISCONNECT SWITCH BEFORE REMOVING ANY BATTERY FROM THE MACHINE.**

### CAUTION

**Prevent damage to the battery and/or electrical system;**

- **Always disconnect the negative battery cable first.**
- **Always connect the positive battery cable first.**

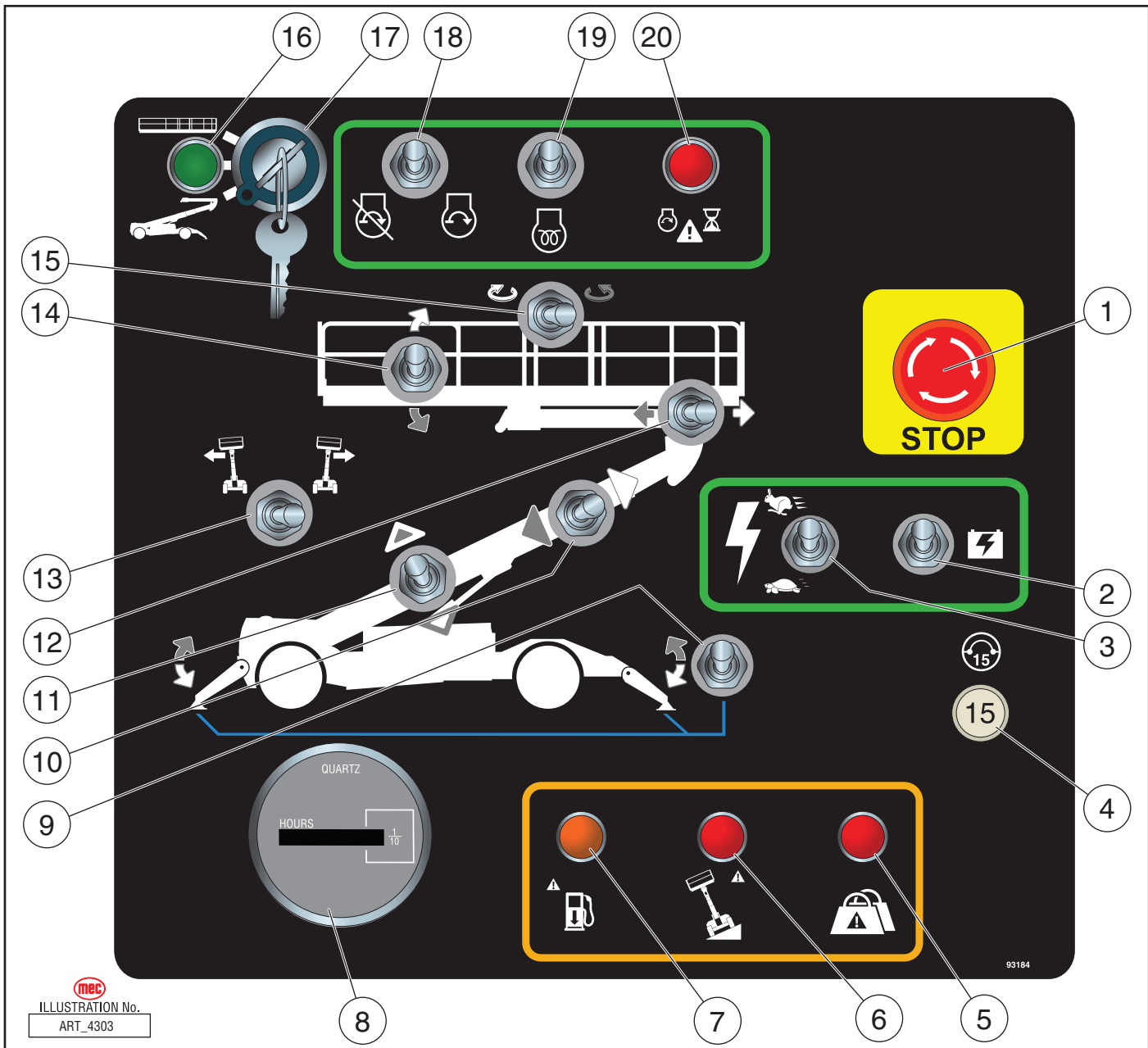
#### **TO REMOVE A BATTERY:**

1. Turn the Battery Disconnect switch to OFF.
2. Disconnect the battery cables and remove battery hold-down hardware.
3. Lift the battery from the compartment, put the battery aside and dispose of properly.

#### **TO INSTALL A BATTERY:**

1. Position the battery in the compartment and secure with hold-down hardware.
2. Connect battery cables.



**CONTROLS****LOWER CONTROLS***Figure 2-4: Lower Controls***WARNING**

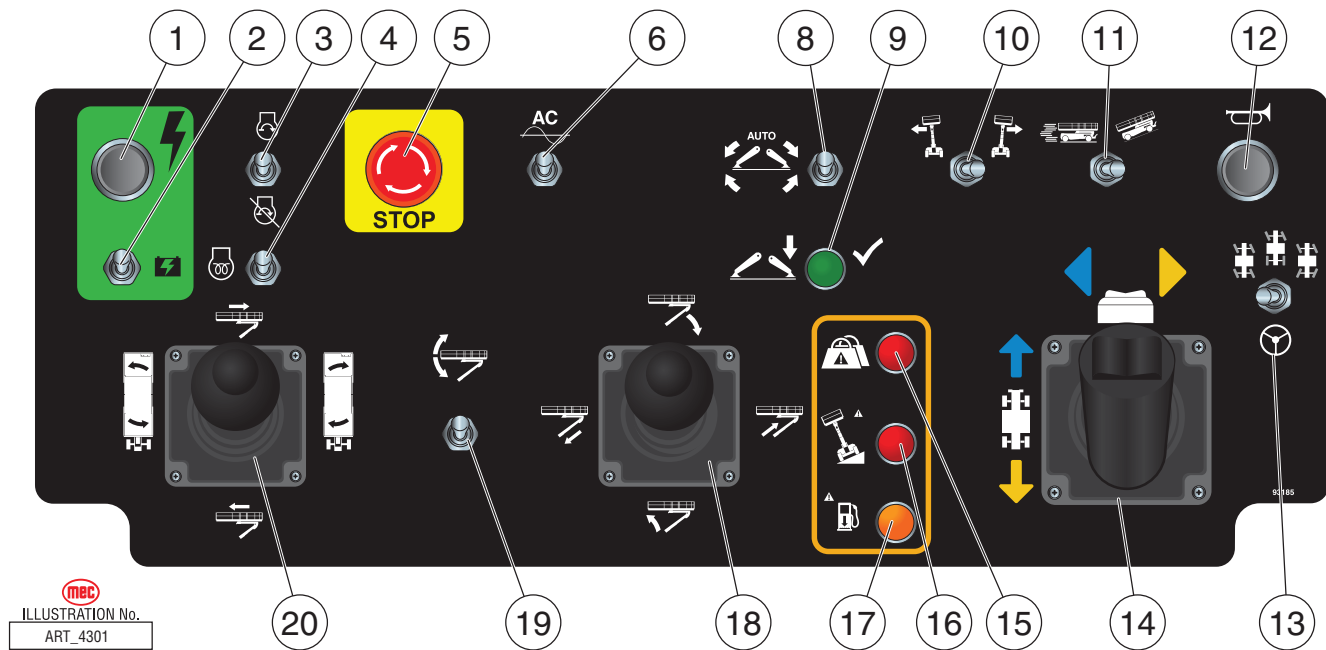
**ALWAYS BE AWARE OF THE MACHINE'S POSITION AND OF YOUR SURROUNDINGS BEFORE ACTIVATING ANY CONTROL FUNCTION.**



CONTROL		DESCRIPTION
1	Emergency Stop Switch	Press the EMERGENCY STOP switch at any time to stop all machine functions. Turn switch <i>clockwise</i> to reset
2	Emergency Power Switch	If normal power fails, press and hold while using boom retract and boom lower functions.
3	Function Enable Switch	Press and hold this switch to enable boom, platform, frame level and stabilizer operations. Press down to operate the controls at slow speed. Press up to operate the controls at higher speed.
4	Circuit Breaker	Trips when there is excessive electrical load. Push to reset.
5	Overload Indicator Light (option)	Light ON indicates too much weight on the platform. An audible alarm will sound and all machine function will stop. Remove weight from the platform to restore function and continue.
6	Tilt Indicator Light	When this red light is illuminated, the machine is not level. Carefully retract the boom, then lower the boom, before leveling the machine, or move the machine to a firm, level surface.
7	Low Fuel Indicator Light	When this amber light is illuminated, the fuel level is low. Refuel soon.
8	Hour Meter	Indicates total elapsed time of machine operation.
9	Outrigger Switch	Move and hold down until automatic outrigger deployment stops automatically. Move and hold up to retract outriggers.
10	Boom Extend/Retract	Move this switch right to extend the boom. Move this switch left to retract the boom.
11	Boom Lift/Lower	Move this switch up to lift the boom. Move this switch down to lower the boom.
12	Platform Slide Forward/Rearward	Move this switch right to move the platform forward along the platform support beam. Move this switch left to move the platform rearward along the platform support beam.
13	Frame Level Switch	Move this switch left to manually adjust the level position of the frame to the left. Move this switch right to manually adjust the level position of the frame to the right.
14	Platform Level Switch	Move this switch up to manually level the rear of the platform upward. Move this switch down to manually level the rear of the platform downward.
15	Platform Rotate Switch	Move this switch left to rotate the platform clockwise. Move this switch right to rotate the platform counterclockwise.  The Platform Rotate function will stop when the platform reaches its detent center position. To continue to rotate the platform, return the switch to the neutral position, then push the switch to rotate the platform in the desired direction.
16	Power On Indicator Light	When this green light is illuminated, the Selector Switch (#17) is set to either platform or chassis. This light is not illuminated when the key is turned to the center (off) position or when an Emergency Stop Switch is pushed in.
17	Selector Switch	PLATFORM      Select to operate from the platform control panel.
		BASE            Select to operate from the base control panel.
		OFF             Select to stop operation from either control panel.
18	Start/Stop Switch	Push switch up to start engine. Push switch down to stop engine.
19	Glow Switch	Press this switch up to activate glow plugs prior to starting.
20	Starter Time-out Indicator	When this red light is illuminated, the starter circuit is temporarily disabled. The starter circuit times out if the starter is run continuously for 10 seconds without the engine starting. The starter functions resets after 30 seconds.





**PLATFORM CONTROLS****WARNING**

**ALWAYS BE AWARE OF THE MACHINE'S POSITION AND OF YOUR SURROUNDINGS BEFORE ACTIVATING ANY CONTROL FUNCTION.**

CONTROL		DESCRIPTION
1	Function Enable Button	Press and hold this button to enable platform level, frame level and stabilizer operations.
2	Emergency Power Switch	If normal power fails, press and hold while using boom retract and boom lower functions.
3	Start/Stop Switch	Move this switch up to start engine. Press this switch down to stop engine.
4	Glow Switch	Move this switch up to activate glow plugs prior to cold starting the engine.
5	Emergency Stop Switch	Press the EMERGENCY STOP switch at any time to stop all machine functions. Turn switch <i>clockwise</i> to reset
6	Generator Switch (Optional Equipment)	Turn switch ON to engage optional AC generator. Generator switches off in any other function is enabled.
7	--	--
8	Outrigger Switch	Move and hold this switch up until outrigger deployment stops automatically. Move and hold this switch down to retract outriggers.
9	Outriggers Set Indicator Light	Green light illuminates when the outriggers are fully deployed and the full range of boom functions are enabled.
10	Frame Level Switch	Move this switch left or right to manually adjust the level position of the frame.
11	Speed/Torque Switch	Move this switch to the left for high speed drive. Push this switch to the right for high torque drive.
12	Horn Button	Press to sound warning horn.



CONTROL		DESCRIPTION	
13	Steering Mode Switch	Use this switch to set the steering mode: Left position: Crab Steer -- All four wheel turn in the same direction. Center position: 2-Wheel Steer -- Only the front two wheels steer. Right position: 4-Wheel Steer -- The front and rear wheels steer in opposite directions.	
14	Drive/Steer Control Lever	Depending on the placement of the control box and the orientation of the platform, the machine may move in unexpected directions when the Drive and Steer functions are activated. The color- and shape-coded arrows on the joystick decal correspond to similar arrow decals on the machine. Be sure to check the arrows on the machine before using the Drive or Steer functions.	
		Drive Function	Push the control lever forward to go in the direction of the blue arrows on the machine, or backward to go in the direction of the yellow arrows on the machine.
		Steer Function	Press the thumb switch on top of the control lever left to steer in the direction of the blue arrow on the machine, or right to steer in the direction of the yellow arrow on the machine.
15	Overload Indicator Light (option)	Light ON indicates too much weight on the platform. An audible alarm will sound and all machine function will stop. Remove weight from the platform to restore function and continue.	
16	Tilt Indicator Light	If this red light is illuminated, the machine is not level. Carefully retract the boom, then lower the boom, before leveling the machine, or move the machine to a firm, level surface.	
17	Low Fuel Indicator Light	If this amber light is illuminated, the fuel level is low. Refuel soon.	
18	Boom Function Control Lever	Boom Lift/Lower Function	Depress the enable button on top of the control lever, then pull the joystick backward to lift the boom. Depress the enable button on top of the control lever, then push the joystick forward to lower the boom.
		Boom Extend/Retract Function	Depress the enable button on top of the control lever, then push the control lever right to extend the boom. Depress the enable button on top of the control lever, then push the control lever left to retract the boom.
19	Platform Level Switch	Press this switch up to manually level the rear of the platform upward. Press this switch down to manually level the rear of the platform downward.	
20	Platform Function Control Lever	Platform Slide Forward/Rearward Function	Press the enable button on top of the control lever, then push the control lever forward to slide the platform forward along the platform support beam. Press the enable button on top of the control lever, then pull the control lever backward to slide the platform rearward along the platform support beam.
		Platform Rotate Function	Press the enable button on top of the control lever, then push the control lever left to rotate the platform counterclockwise. Press the enable button on top of the control lever, then push the control lever right to rotate the platform clockwise.  The Platform Rotate function will stop when the platform reaches its detent center position. To continue to rotate the platform, return the joystick to the neutral position, then push the joystick to rotate the platform in the desired direction.



# SENSORS, RELAYS & ALARMS

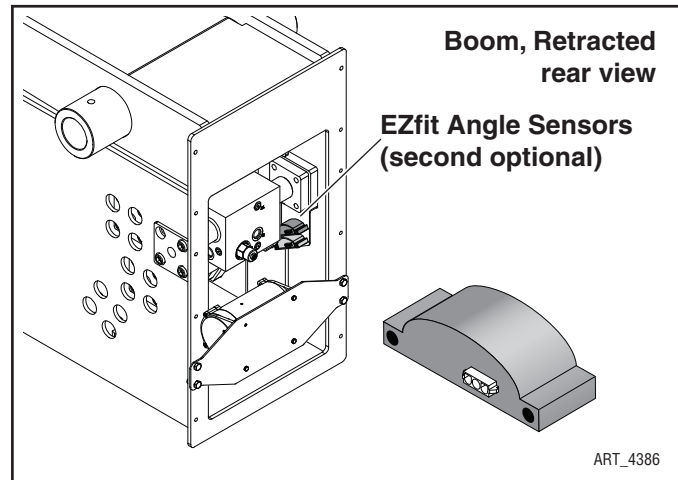
## SENSORS

### EZfit ANGLE SENSOR

There is one EZfit Angle Sensor located at the base of the boom. A second redundant EZfit Angle Sensor is present on machines equipped with the optional Overload Sensing System.

The EZfit Angle Sensor measures the absolute angle of the boom and compensates for the fore-and-aft angle of the chassis.

*Figure 2-5: EZfit Angle Sensor*

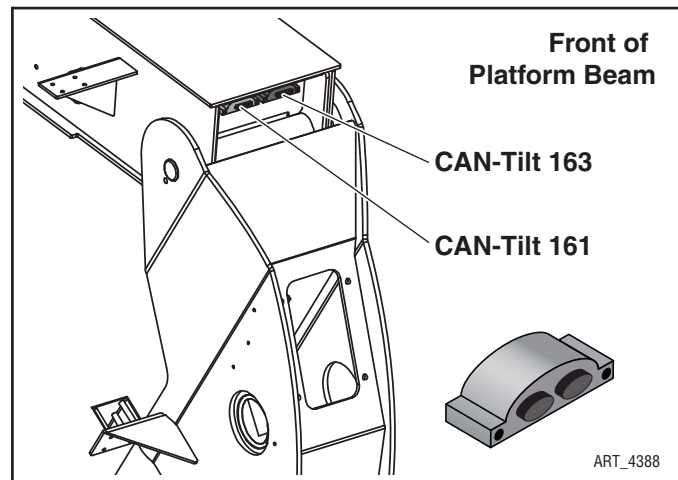


### CAN-TILT ANGLE TRANSDUCERS

There are four (4) CAN-Tilt Angle Transducers on this machine. CAN-Tilt Angle Transducers **are not** interchangeable. Each is identified by number for communication with the GP400 Module. If removed, be sure that each returns to its original location. If replaced, be sure that the replacement has the same number as the original.

*Figure 2-6: Platform Beam CAN-Tilts*

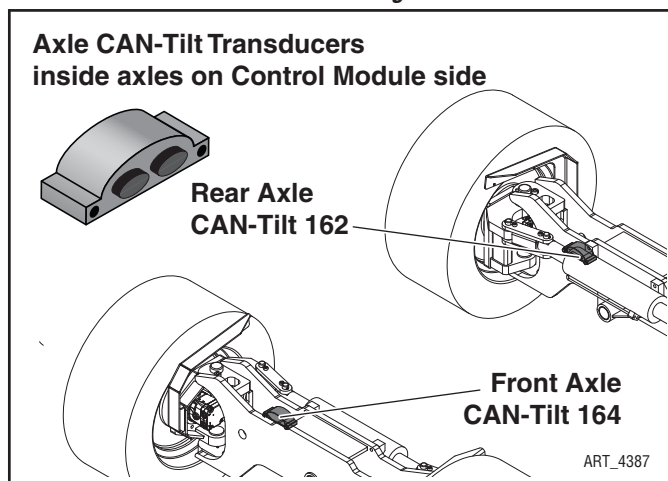
Two CAN-Tilt Angle Transducers are located side-by-side at the front of the the Platform Beam. These measure the angle of the beam both fore-and aft and side-to-side.





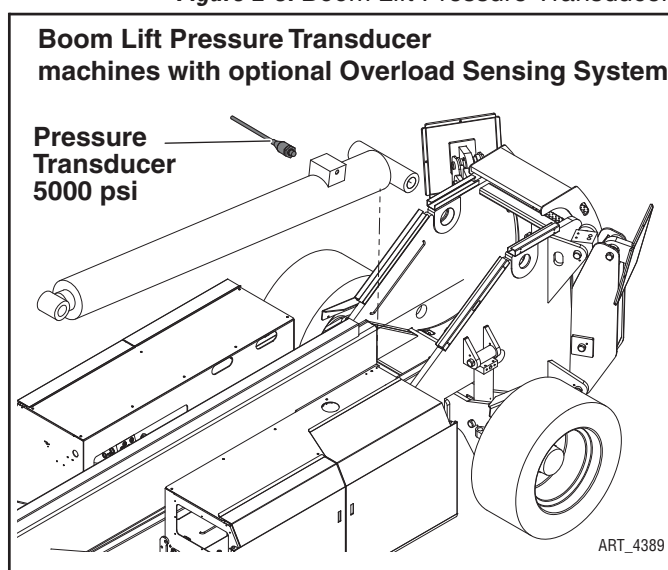
**Figure 2-7: Axle CAN-Tilts**

Each axle has a CAN-Tilt Angle Transducers mounted on the Control Module side. These measure the angle of their respective axle relative each other and to the GP400 module in the Base Controls Box.

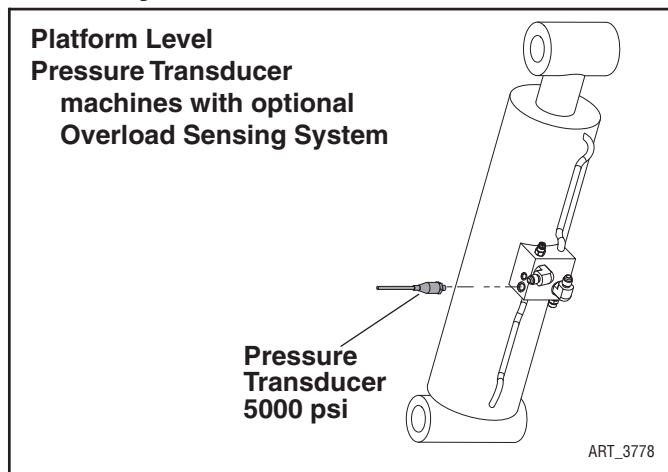


## PRESSURE TRANSDUCERS

The Boom Lift Cylinder is equipped with one 5000 psi Pressure Transducer on machines equipped with the optional Overload Sensing System.

**Figure 2-8: Boom Lift Pressure Transducer****Figure 2-9: Platform Level Pressure Transducer**

The Platform Level Cylinder is equipped with one 5000 psi Pressure Transducer on machines equipped with the optional Overload Sensing System.





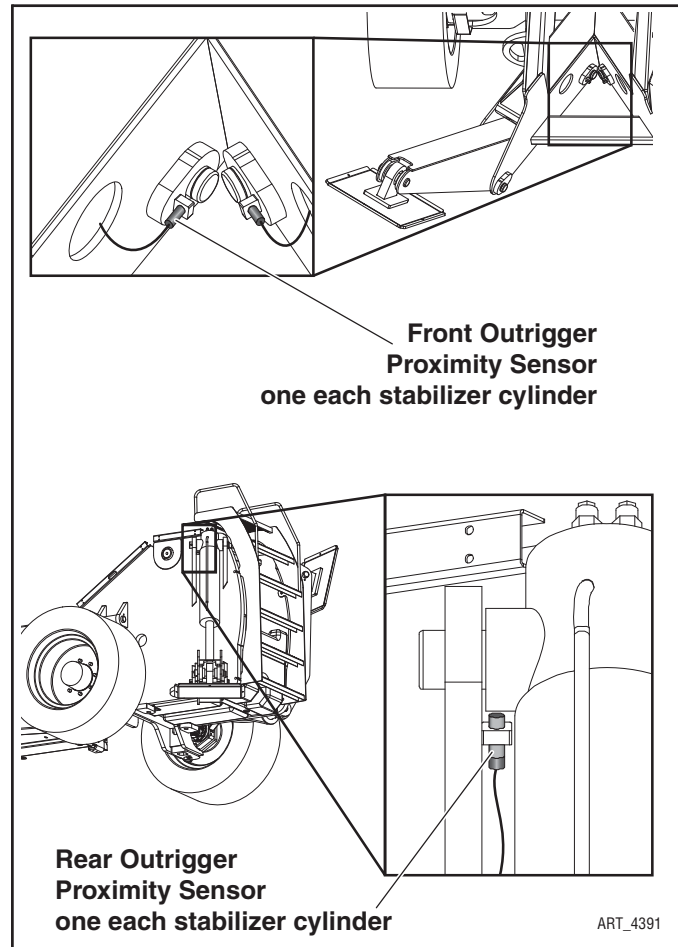
## PROXIMITY SENSORS

This machine uses Proximity Sensors to determine when the outriggers are set. The pin at the barrel-end of each outrigger cylinder is mounted in a slotted hole. When the cylinder is holding weight, the pin slides away from the Proximity Sensor.

The Proximity Sensors for the front outriggers are mounted between the bases of the outrigger cylinders, outside the outrigger tubes.

The Proximity Sensors for the rear outriggers are mounted just inside the forward upper mounting point of the rear outrigger cylinders.

**Figure 2-10: Stabilizer Proximity Sensors**

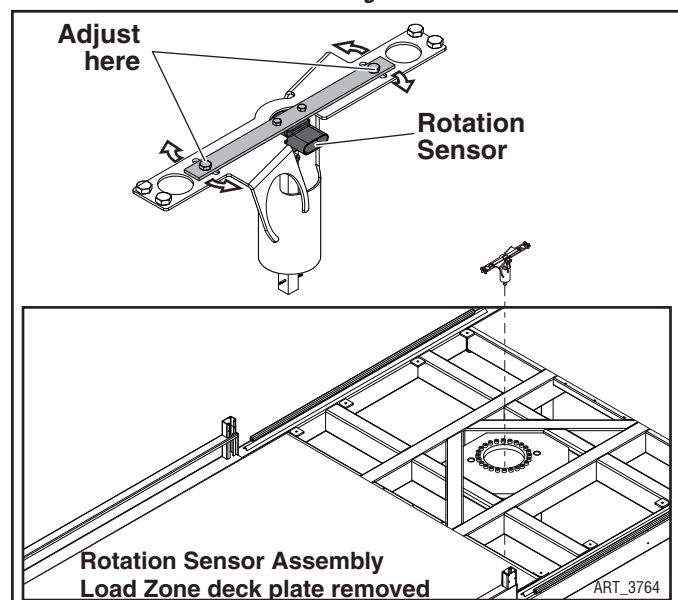


## ROTATION SENSOR

The Rotation Sensor tracks the platform's position relative to centered, and cuts out Frame Level and Stabilizer functions when the platform is more than 10° out of centered position.

When rotating towards the centered position, the Rotation Sensor slows the platform as it approaches center, then stops rotation as the platform reaches center. Release the control handle, then re-engage it again to continue rotation.

**Figure 2-11: Rotation Sensor**





## Rotation Sensor Adjustment

1. Center the platform manually over the boom and platform beam so that the platform entrance aligns directly with the personnel ladder.
2. Remove the Load Zone Deck Plate.
3. Access the onboard EZ-Cal Diagnostic Tool mounted inside the Lower Control Box and proceed to DIAGNOSTICS>ANALOGS>GP440 ANALOGS>P8-1.

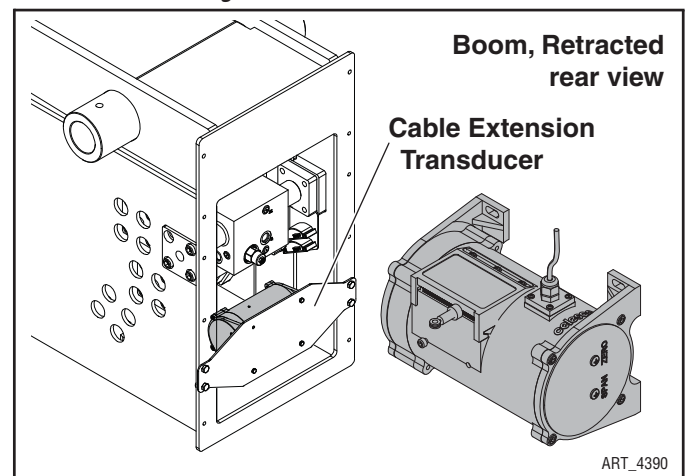
**NOTE:** See Section 4 of this manual for EZ-Cal navigation instructions.

4. With the platform centered, the reading on P8-1 should read 2.51V. If the reading is not 2.51V, adjust the Rotation Sensor Assembly by loosening the adjustment bolts and turning the assembly until it reads correctly. Tighten the adjustment bolts.
5. Rotate 90° in each direction, then return the platform to the centered position. The platform should automatically stop at the centered position.

## CABLE EXTENSION TRANSDUCER

The Cable Extension Transducer measures boom extension and is mounted at the rear of the boom.

**Figure 2-12:** Cable Extension Transducer



## RELAYS

### ENGINE RELAYS

The Engine Relays are located beside the engine on the rear wall of the Engine Module. These relays reduce the current flow supplied by the GP400 Control Module. Refer to the Section 5 for relay functions and interconnect.

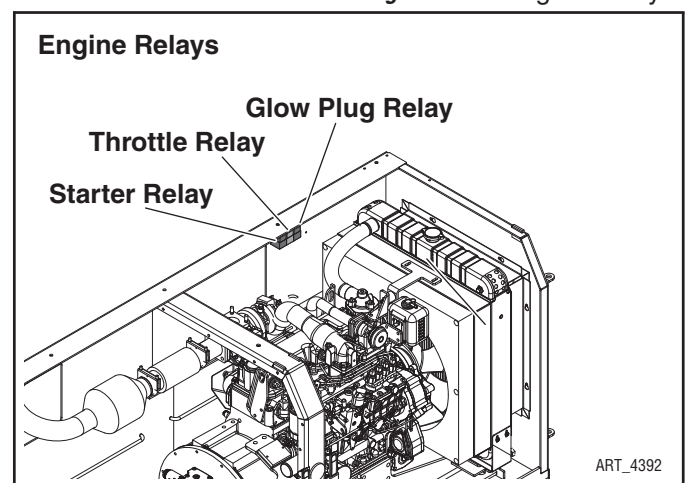
#### Start Relay

Provides power to the starter solenoid.

#### Throttle Relay

Provides power to the electric throttle solenoid.

**Figure 2-13:** Engine Relays





## Glow/Preheat Relay

Provides power to the diesel engine glow plugs.

### CHARGE ISOLATION RELAY

The Charge Isolation Relay allows the alternator to charge the Emergency Power Battery while the engine is running and prevent the battery from discharging when the engine is off.

Figure 2-14: Charge Isolation Relay

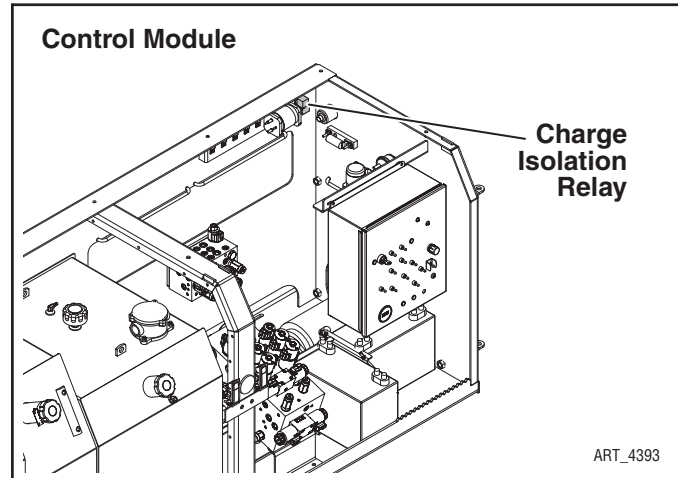
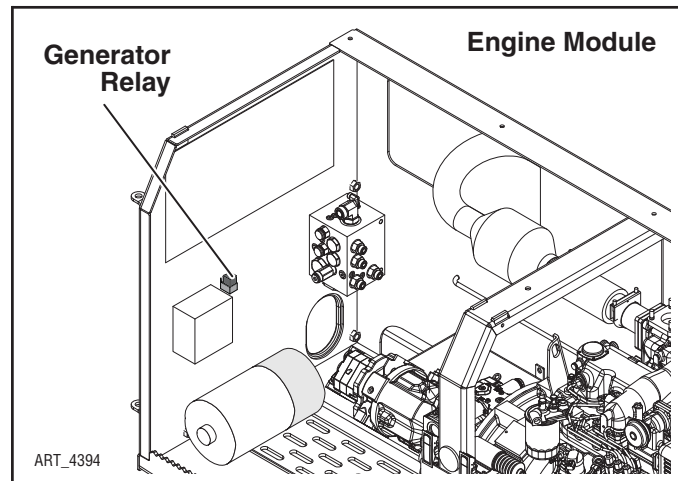


Figure 2-15: Generator Relay

### GENERATOR RELAY

On machines equipped with the optional 3kVA Generator, this relay controls the solenoid valve that turns the generator on and off. It also provides power to the exciter for the generator.



## ALARMS

### TILT ALARM

The Tilt Alarm is a dual-tone alarm that sounds at the Base Controls Box when the angle of the platform is outside of acceptable levels of operation (as measured by the two CAN-Tilt Angle Transducers mounted at the front of the platform beam).

**To Correct:** – Use the Platform Level control switch to level the platform fore-and-aft. If the alarm continues to sound, the platform may be out of level side-to-side. If this is the case, center the platform, then retract and lower the boom until the platform is in the stowed position. Make sure the stabilizer pad is supported by a firm surface, then re-deploy the stabilizers before repositioning the platform.

### OVERLOAD ALARM

On machines equipped with the optional Overload Sensing System, the Overload Alarm is a dual-tone alarm that sounds at the Base Controls Box when the control system senses an overload situation. The Overload Alarm is installed on machines equipped with the optional Overload Sensing System.

**To Correct:** – Remove weight from the platform before operation can continue.



## OUTRIGGER ALARM

The Outrigger Alarm is a single-tone alarm that sounds at the Upper Controls Station when the proximity sensors on the outrigger cylinders sense a lost signal when the boom is elevated and/or extended. When this alarm is sounding, movement is restricted to centering the platform, boom retraction, platform slide and lift 5% above current position. The boom will lower once it is fully retracted.

**To Correct:** – First retract and then lower the boom and move the platform as necessary to bring the platform to the stowed position. Reset the outriggers and/or reposition the machine until the green Outriggers Set indicator illuminates at the Upper Controls Station.

## ALERT SOUNDS

- The Platform Descent Alarm is optional but may be required in certain areas of operation. This alarm sounds from the Base Controls Box.
- The All-Motion Alarm is optional and sounds at the Base Controls Box.
- The Horn is activated by button from the Upper Controls Station and sounds from the Base Controls Box.



# DEUTSCH CONNECTORS

Deutsch connectors used on MEC equipment are designed so that individual parts may be replaced without replacing the entire component. Special tools and detailed instructions are provided in Deutsch Connector field kits, MEC part no. 84091.

**Figure 2-16:** Deutsch Connectors

## MALE PLUG CONNECTOR

- Use the flat end of the Removal Tool or a flat blade screwdriver to pry the locking wedge from the connector, taking care not to damage the Sealing Gasket.
- Inspect and replace damaged parts.
- Replace or re-crimp wires and contacts.

## FEMALE RECEPTACLE CONNECTOR

- Use the notched end of the removal tool or a wire hook to pull the locking wedge from the connector
- Replace worn or damaged parts
- Replace or re-crimp wires and contacts.

## LOCKING FINGERS

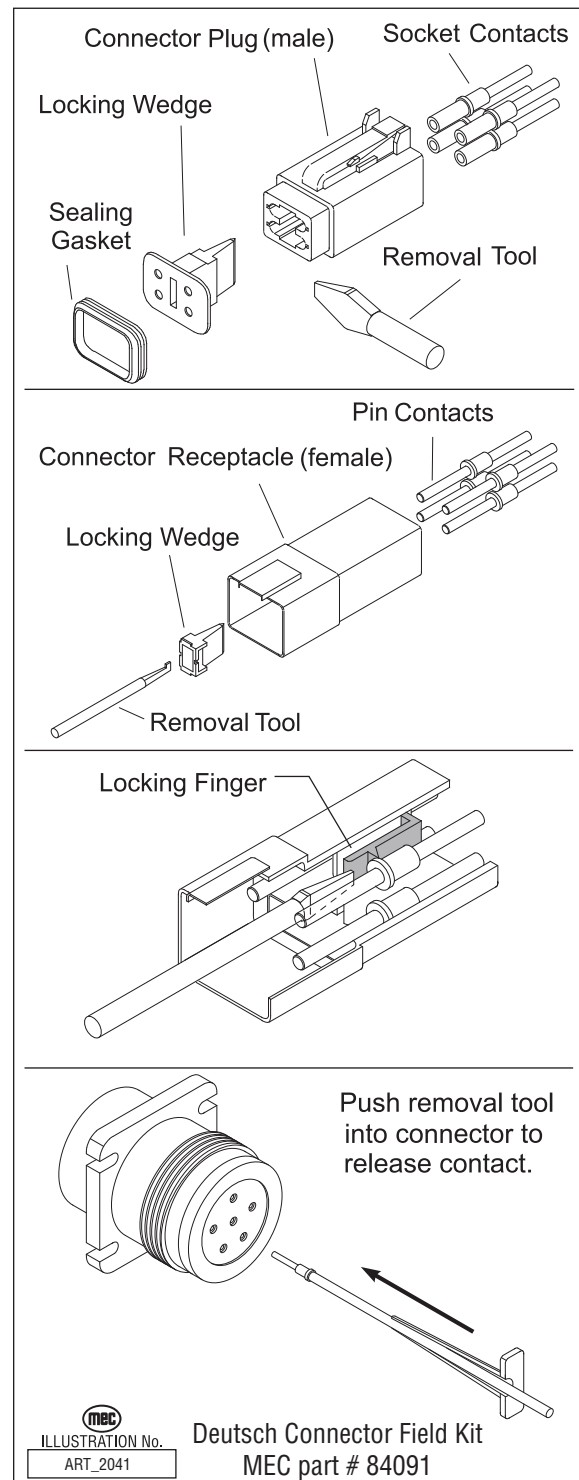
- Remove the locking wedge as outlined above.
- Using the removal tool or a flat blade screwdriver, push the Locking Fingers aside to release the contact.
- Pull the wire and contact out of the connector.

## HEAVY DUTY PLUG

- Slide the removal tool along the wire to be replaced and push into the connector to release the contact.
- Pull the wire and contact out of the plug.

## CRIMPING

- Strip 1/4 in. (6 mm) insulation from the wire.
- Insert the contact into the crimping tool and insert the stripped wire into the contact making sure no wires are outside the contact barrel.
- Close the handles of the crimping tool, then release the handles to remove the crimped contact.



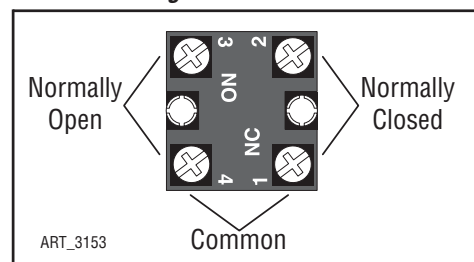


# CONTINUITY CHECKS

## SELECTOR SWITCH – ON-OFF

- Disconnect wires.
- Connect first probe of ohm meter to *common* terminal.
- Connect second probe to any normally open terminal.
- With switch OFF (open) there should be no reading.
- With the switch ON (closed) there should be a low resistance reading.
- Repeat for each normally open terminal.

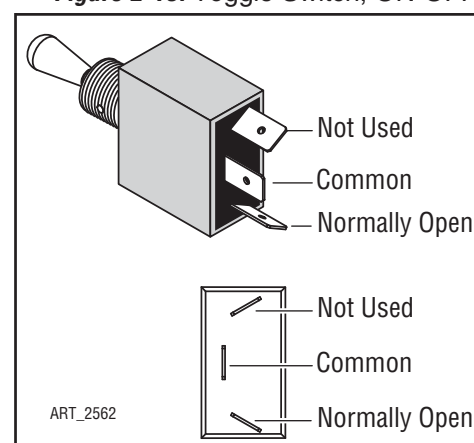
Figure 2-17: Selector Switch



## TOGGLE SWITCH – ON-OFF

- Disconnect wires.
- Connect first probe of ohm meter to *common* terminal.
- Connect second probe to normally open terminal.
- With the switch turned OFF there should be no reading.
- With the switch turned ON there should be a low resistance.

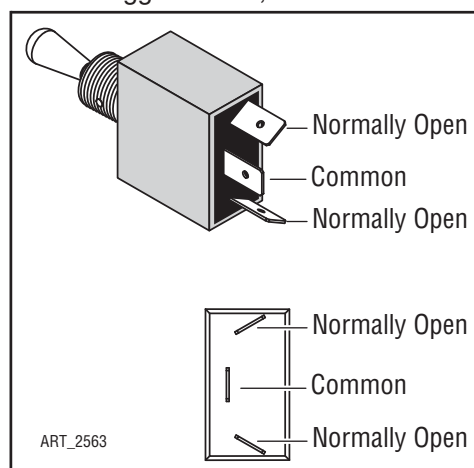
Figure 2-18: Toggle Switch, ON-OFF



## TOGGLE SWITCH – 1-POLE 2-POSITION

- Disconnect wires.
- Connect first probe of ohm meter to *common* terminal.
- Connect second probe to *top* normally open terminal.
- With toggle DOWN there should be no reading.
- With the toggle UP there should be a low resistance.
- Move second probe to *bottom* normally open terminal.
- With toggle UP there should be no reading.
- With the toggle DOWN there should be a low resistance.

Figure 2-19: Toggle Switch, 1-Pole 2-Position

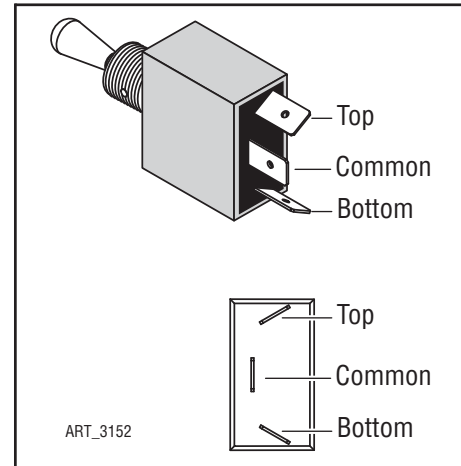




## TOGGLE SWITCH – 1-POLE 3-POSITION

- Disconnect wires.
- Connect first probe of ohm meter to *common* terminal.
- Connect second probe of ohm meter to *top* terminal.
- With the toggle UP or MIDDLE there should be a low resistance.
- Move second probe to *bottom* terminal.
- With the toggle DOWN or MIDDLE there should be a low resistance.
- Connect first probe of ohm meter to *top* terminal.
- Connect second probe of ohm meter to *bottom* terminal.
- With toggle in ANY POSITION there should be no reading.

**Figure 2-20:** Toggle Switch, 1-Pole 3-Position



## TOGGLE MOMENTARY SWITCH

- Disconnect wires.
- Connect first probe of ohm meter to common terminal.

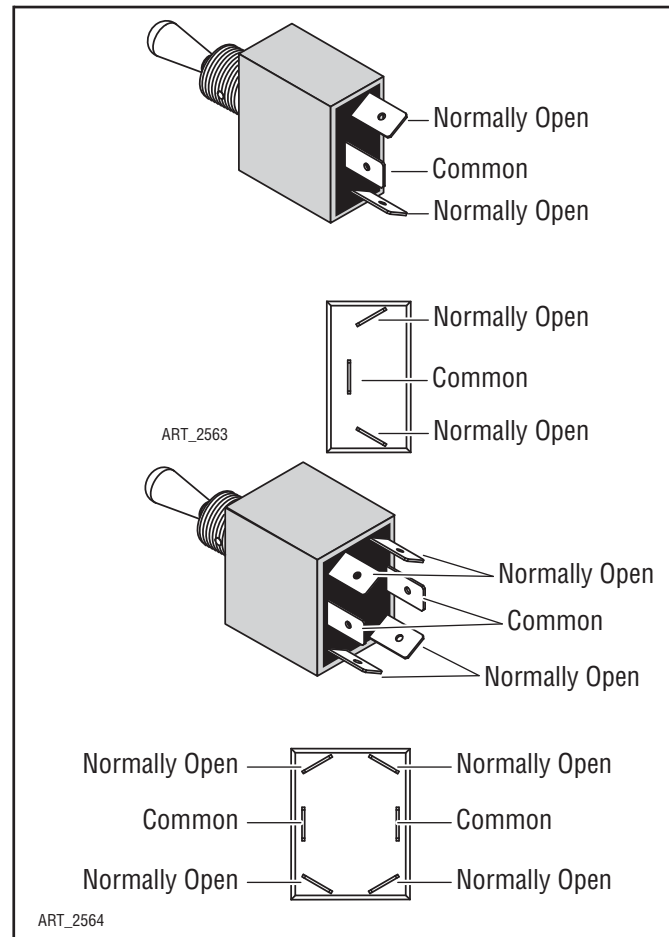
### Test top position

- Connect second probe to *top* normally open terminal.
- With the toggle in the neutral (open) position there should be no reading.
- With the toggle UP (closed) there should be a low resistance.
- With the toggle DOWN (closed) there should be no reading.

### Test bottom position

- Move second probe to *bottom* normally open terminal.
- With the toggle in the neutral (open) position there should be no reading.
- With the toggle DOWN (closed) there should be a low resistance.
- With the toggle UP (closed) there should be no reading.
- Repeat for both rows of two-row switch.

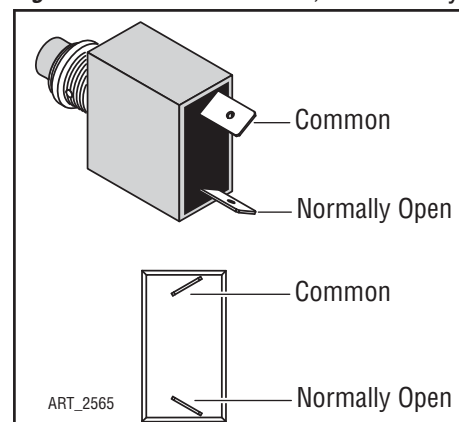
**Figure 2-21:** Toggle Switch, Momentary



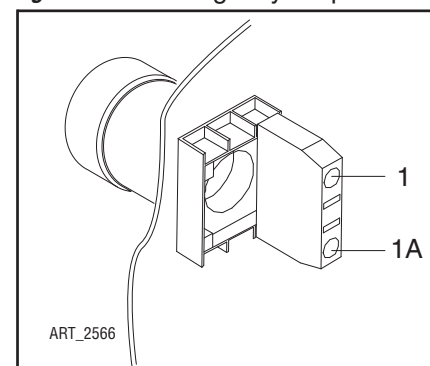


**Figure 2-22:** Button Switch, Momentary**MOMENTARY BUTTON SWITCH**

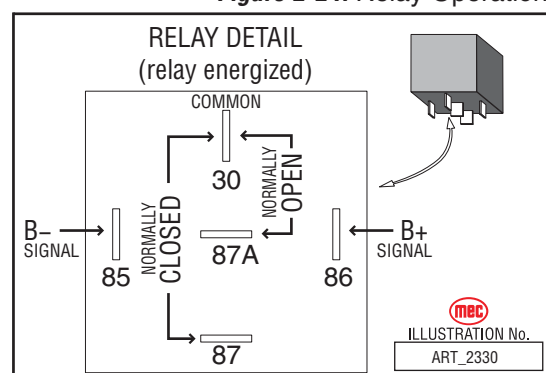
- Disconnect wires.
- Connect one probe of ohm meter each terminal.
- With the button in the neutral (open) position there should be no reading.
- With the button pushed (closed) there should be a low resistance

**Figure 2-23:** Emergency Stop Switch**EMERGENCY STOP BUTTON**

- Disconnect wires.
- Connect one probe of ohm meter each terminal.
- With the button PRESSED there should be no reading.
- With the button RESET there should be a low resistance.

**Figure 2-24:** Relay Operation**RELAY**

- With the #85 terminal grounded, apply voltage to #86 terminal connection.
- Confirm normally closed (#87A) contacts are opening. Continuity with #30 will be broken.
- Confirm normally open (#87) contacts are closing. Continuity with #30 will be made.





## CONTROL SYSTEM

The GP400 Control System uses a variety of components and sensors to maintain proper and safe operation of the machine. This machine may be sold into many different countries that require a variety of monitoring equipment.

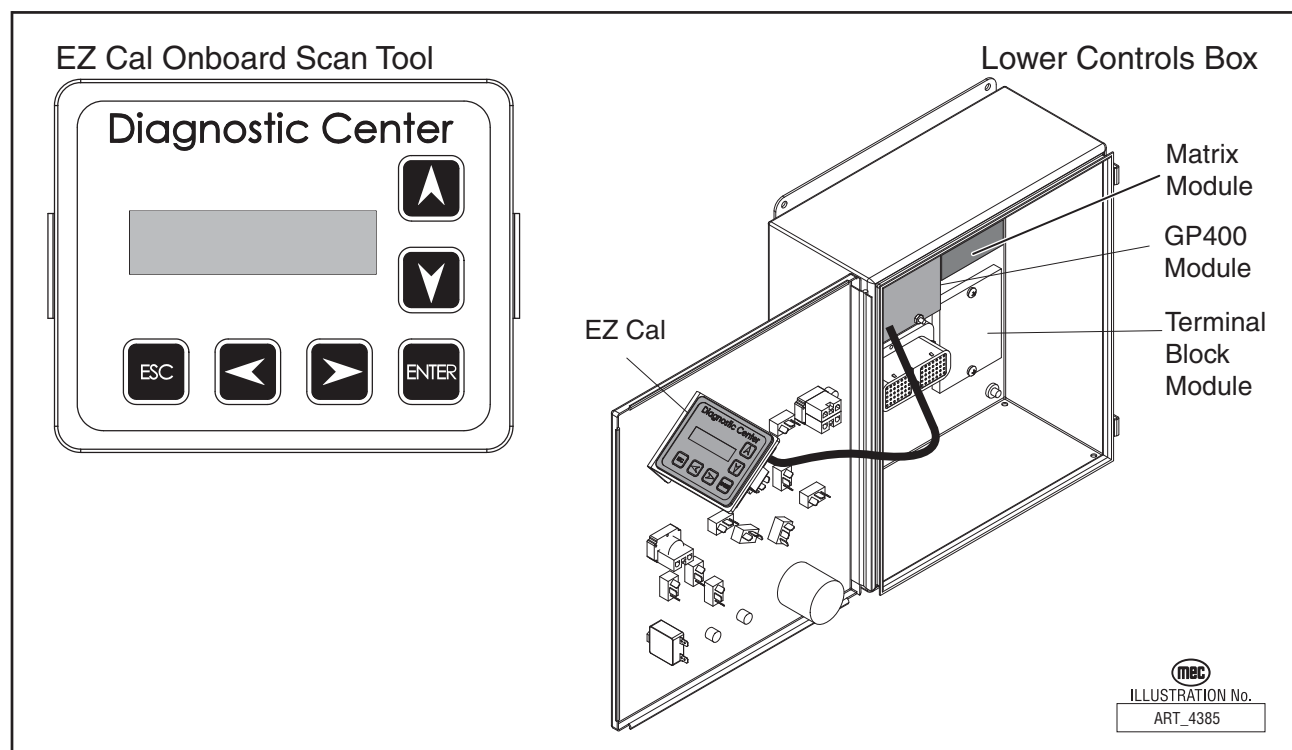
### COMPONENTS & LOCATIONS

- GP400 Control Module processor -- Lower Controls Box
- GP440 Module -- Upper Controls Box
- Valve Current Control Module (VCCM) -- Inside forward end of boom
- Matrix Module -- inside Lower Controls Box

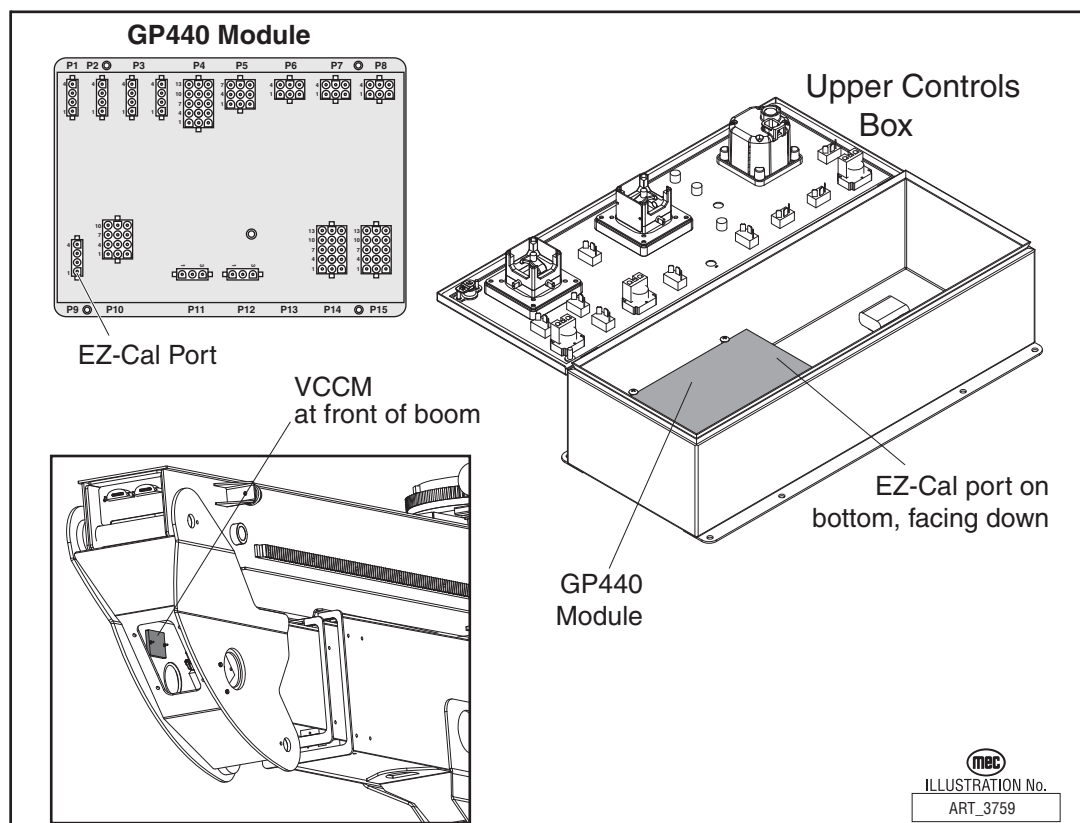
Diagnostic information can be found in *Section 4: Troubleshooting*.

Wiring information can be found in *Section 5: Schematics*.

**Figure 2-25:** GP400 Control Module Location





**Figure 2-26:** GP440 Module & VCCM Locations

## GP400 CALIBRATION

This machine has an onboard EZ-Cal Diagnostic Tool mounted inside the Lower Controls Box. Use this to access the GP400 for troubleshooting and calibration.

The GP400 processor relies on angle sensor(s) to monitor platform elevation at all times. These sensors send varied voltages to the GP400 that relate directly to their respective position. The calibration process is the means by which the GP400 equates these voltages to actual platform elevation.

For example, the Angle Transducer, used to monitor platform elevation, varies its output between 1 and 4 volts through 140 degrees of rotation. During calibration the GP400 may learn that 1.8 volts (fictional number used for explanation) represents the fully lowered position and 3.6 volts represents the fully elevated position and therefore voltages between those figures relate to various heights in between.

All machines are calibrated at the factory and should not require calibration unless the GP400 is replaced or displays a code that alerts to the need to recalibrate.

If the calibration procedure is performed incorrectly or if there is a failure in one of the monitored circuits during the calibration, the GP400 will not allow the operator to continue with the calibration process. An error message will display on the EZ-cal indicating the reason for the interruption.

Additional details of these error messages can be found at the end of the calibration instructions.



## GP400 CALIBRATION PROCEDURE



***IMPROPER CALIBRATION OF THE TITAN CONTROL SYSTEM CAN RESULT IN MACHINE INSTABILITY LEADING TO DEATH OR SERIOUS PERSONAL INJURY. THE FOLLOWING OPERATION MUST BE PERFORMED IN ITS ENTIRETY AS DESCRIBED HEREIN TO PREVENT IMPROPER MACHINE OPERATION.***

**ONLY TRAINED AND AUTHORIZED PERSONNEL SHALL BE PERMITTED TO CALIBRATE THE PLATFORM OVERLOAD SENSING SYSTEM.  
READ ALL INSTRUCTIONS CLOSELY BEFORE ATTEMPTING EACH STEP OF THE CALIBRATION PROCEDURE.**

In the event of a GP400 replacement, the GP400 must be calibrated before it will operate properly. Calibration is the process by which the GP400 receives points of reference of all the machine sensors or how it becomes acquainted with the machine.

Three calibrations must be performed for all models:

1. Level Sensor Calibration
2. Height Sensor Calibration
3. Extension Sensor Calibration

Machines equipped with the optional Overload Sensing System must perform two additional calibrations:

4. Load Calibration

These and other procedures require the use of the onboard EZ-Cal Diagnostic Tool located inside the Lower Controls Box. If the EZ-Cal is missing please contact MEC Aerials parts department to purchase one.

### **PRE-CALIBRATION SETUP**

Park the machine on an absolute flat and level surface free from overhead obstructions that will prevent full boom elevation. Lower the boom completely into its cradle.

Level Sensors calibration must be performed first. When calibrating the level sensors, be aware that the following sensors are all calibrated simultaneously:

- GP400 Control Module's Integral Level Sensor that measures chassis angles
- Two dual-axis CAN-Tilt Angle Transducers that measure platform angle; both mounted at the front of the Platform Beam.
- Two single-axis CAN-Tilt Angle Transducers measuring axle position relative to the chassis; one on each of the axles.

Therefore, before calibration can begin:

- Park the machine on a flat level surface to allow the axles to be parallel with each other and square to the chassis.
- The PLATFORM must be leveled both fore-and-aft and side-to-side through the use of a framers or spirit level placed on the top or bottom side of the platform toe boards. Use the Platform Level toggle function to level the platform fore-and-aft. Use the Frame Level function to level the platform side-to-side.



After the platform has been confirmed to be absolutely level, proceed to the Level Sensors Calibration instructions.

The sensors used on the Titan are very sensitive and can detect even the slightest movement of the parts that they monitor. Therefore it is absolutely mandatory that the previous steps be performed with utmost care and precision before calibration.

### **LEVEL SENSORS CALIBRATION**

1. Park machine on flat level surface and ensure that the chassis and platform are level, as described in Pre-Calibration Setup. Turn the engine off using the Start/Stop toggle switch.
2. Open the control module door, then open the lower control box door to access the Onboard EZ-Cal.
3. Power up the Titan control system by turning the Key Switch on the lower controls to Base. The EZ-cal display will read HELP PRESS ENTER.
4. Press the right arrow twice until the display reads, "ACCESS LEVEL 3". Press ENTER
5. Using the up arrow and right arrow, enter the numbers 1775, then press ENTER. The display should now read "ACCESS LEVEL 2"
6. Press the right arrow twice until the display reads "SETUPS". Press ENTER.
7. Press the right arrow once until the display reads "TILT SETUPS". Press ENTER.
8. The display will read "CALIBRATE LEVEL YES: ENTER NO: ESC"
9. Press ENTER, then press ENTER again. The State-of-Level indicator should now read 0.0 - 0.0 or within .1 degrees.

Level calibration is complete. Proceed to Height Calibration.

### **HEIGHT SENSOR CALIBRATION**

1. If not already done, perform Pre-Calibration Set-up as described in the beginning of these instructions and the Level Sensors Calibration before proceeding.
2. With the EZ-cal menu remaining in the Level Calibration, press ESC once until the display reads "TILT SETUPS" or to start from the beginning follow steps 1 - 6 above of the Level Sensors Calibration procedure.
3. Press the right arrow until the display reads "HEIGHT SETUPS" and press ENTER.
4. Press the right arrow once until the display reads "CALIBRATE HEIGHT". Press ENTER. You will be asked if the boom is fully lowered. Press ENTER when it is.
5. Follow the instructions on the display exactly and operate lift and lower only when the display instructs to do so. DO NOT interrupt lifting or lowering during calibration, as doing so will result in a bad calibration or possible fault.  
You will be instructed to operate Boom Up to full elevation then back down to fully stowed position. When the boom reaches full elevation and stops you must release the toggle switch before the calibration instructions can continue. This is also true when the boom reaches full stowed position. You will not be instructed to release the toggle switch.
6. After following the EZ-cal instructions and Height Calibration is complete, you will be prompted to enter the calibration date. Use the up arrow and right arrow to enter the day's date.
7. Once the CAL DATE has been entered, calibration is complete. Press ESC 3 times and/or turn off the machine.





Height calibration is complete. Proceed to Extension Calibration.

### EXTENSION SENSOR CALIBRATION

1. If not already done, perform Pre-Calibration Set-up as described in the beginning of these instructions and the Level Sensors and Height Sensor Calibrations before proceeding with Extension Sensor Calibration.
2. Access the EZ-cal by opening the Control Module door, then opening the Lower Control Box door. Attached to the Lower Control Box Door is an EZ-Cal interface display which will be used to perform the calibration.
3. Power the Titan system up. The EZ-cal display will read HELP PRESS ENTER.
4. Press the right arrow twice until the display reads, "ACCESS LEVEL 3".
5. Using the up arrow and right arrow, enter the numbers 1775 then press ENTER. The display should now read "ACCESS LEVEL 2"
6. Press the right arrow twice until the display reads "SETUPS". Press ENTER.
7. Press the right arrow three times until the display reads "EXTENSION SETUPS". Press ENTER.
8. Follow the instructions on the display exactly and operate extend and retract only when the display instructs to do so. You will be instructed to operate Boom Extend to full extension then back to the fully retracted position. When the boom reaches full extension and stops you must release the toggle switch before the calibration instructions can continue. This is also true when the boom reaches the fully retracted position. You will not be instructed to release the toggle switch.
9. After following the EZ-cal instructions and Extension Calibration is complete, you will be prompted to enter the calibration date. Use the up arrow and right arrow to enter the day's date. Once the CAL DATE has been entered, calibration is complete, press ESC 3 times and/or turn off the machine.

The following calibration procedure must and should only be performed on machines equipped with the optional Overload Sensing System.

Perform the previous calibration procedures before performing these.

### LOAD CALIBRATION

Weight required for Load Calibration:

(1) 1360 kg (3000 lbs)

1. If not already done, perform Pre-Calibration Set-up as described in the beginning of these instructions and the Level Sensors, Height and Extension Sensor Calibrations before proceeding with Load Calibration.
2. Place the machine on firm level ground, with the stabilizers deployed (green Stabilizers Set light will illuminate at Upper Controls box).
3. Load the 1360 kg (3000 lbs) weight in the center of the Load Zone and secure it from movement using the 4 tie-down points located in the platform floor.
4. Extend the boom horizontally to maximum outreach, then use the Platform Slide function to slide the platform fully forward. Do not elevate the boom.
5. Access the EZ-cal by opening the Control Module door, then opening the Lower Control Box door. Attached to the Lower Control Box Door is an EZ-Cal interface display which will be used to perform the calibration.
6. Power the Titan system up. The EZ-cal display will read HELP PRESS ENTER.



7. Press the right arrow twice until the display reads, "ACCESS LEVEL 3". Press ENTER.
8. Using the up arrow and right arrow, enter the numbers 1775 then press ENTER. The display should now read "ACCESS LEVEL 2"
9. Press the right arrow twice until the display reads "SETUPS". Press ENTER.
10. Press the right arrow until the display reads "LOAD SETUPS". Press ENTER.
11. Press the right arrow until the display reads "CALIBRATE LOAD". Press ENTER.
12. Follow the instructions on the EZ-cal display through a series of lift lower cycles. At the end of each lift and lower the switch must be released for procedure to continue.
13. The first calibration is the DYNAMIC calibration which is one complete lift and lower cycle.
14. After the DYNAMIC calibration is complete, the next calibration is the LOADED calibration. During this procedure the platform will lift to full elevation but will stop at various points along the lift and lower cycle to take static measurements.
15. After the LOADED calibration is complete, **DO NOT** do the EMPTY calibration. Escape out of the calibration. You will see an error message stating the calibration is not complete.
16. Retract the boom to the stowed position. Leave the platform in the forward-most position (platform at the front of the platform beam). Then retract the stabilizers so the machine is resting back on all four tires.
17. Go back into the SETUPS -> LOAD SETUPS -> CALIBRATE LOAD menu. The system will ask if you want to rerun the DYNAMIC and LOADED calibration, press ENTER until the display reads "REDO EMPTY?". Select YES (ENTER). Calibration will go through another lift and lower cycle, stopping at various points to take static measurements.
18. Once the calibration is complete, a screen should appear to enter the date. Enter the date that the machine was successfully calibrated and hit ENTER. You should now see "FINISHED!" appear on the screen. The machine is now calibrated and ready to be used.



## CALIBRATION PROBLEMS

### FAILURE MESSAGES

Various problems can be detected by the EZ-Cal that prevent successful calibration. These problems are reported with a flashing message including an “F” code. The following descriptions are helpful in solving the problem. References in parentheses refer to electrical schematic points.

#### F01:CANNOT RUN

There is a shut-down fault on the controller. “EVERYTHING OK” *does not* show up when you try to calibrate.

Check HELP message for more information.

#### F02:NOT GROUND MODE

This message is given if the base/platform selector switch is not in ground mode (P7-2 must be high). Calibration can only be carried out in ground mode.

#### F03:NOT STOPPED

This message is given if any function switch is closed. Check DIAGNOSTICS / SWITCHES to see which function switch is closed.

#### F04:TILTED

This message is given if the machine is tilted. Calibration must be carried out with the machine level. If the machine is level, perform the Level Sensors Calibration procedure above.

#### F05:BAD HEIGHT

This message is given if the height sensor output (P8-2 and P8-6) is out of range at the start of calibration. The height sensor output must be between 1.0V and 4.0V. Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.

#### F06:CHECK ELEV

This message is given if the elevation switch (P7-5) is open at the start of calibration, when the operator has confirmed the “PLATFORM DOWN?” question.

(The Titan does not have an elevation switch)

#### F07:BAD HEIGHTS

The two Height Sensors are not in agreement at the end of Height Calibration (only on machines equipped with the optional Overload Sensing System).

#### F08:CHECK ELEV

This message is given if the elevation switch (P7-5) is closed at the end of the DYNAMIC lift, when the platform should be fully raised.

This message would occur if the UP switch was accidentally opened near the start of the DYNAMIC lift.

If the platform is fully raised, check the elevation switch wiring.

#### F09:BAD HEIGHT1

#### F09:BAD HEIGHT2

This message is given if the height sensor output (P8-2) is out of range at the start of the DYNAMIC lift. The height sensor output must be between 1.0V and 4.0V. Check DIAGNOSTICS / SYSTEM (2a-7) to see the output. This is usually due to a wiring problem.



**F10:BAD HEIGHT1**  
**F10:BAD HEIGHT2**

This message is given if the height sensor output (P8-2) is out of range at the end of the DYNAMIC lift. The height sensor output must be between 1.0V and 4.0V. Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.

**F11:NOT UP**  
**F11:NOT DOWN**

This message occurs at the start of the DYNAMIC lift if the operator selects a function other than UP.

**F12:TOO MANY**

This message occurs if the DYNAMIC lift takes too long.

This message could occur if the UP switch was not released at the end of the dynamic lift.

**F13:LOW HEIGHT RANGE**

This message occurs at the end of the DYNAMIC lift if the height sensor output did not change sufficiently to give a reasonably accurate platform height estimate. DIAGNOSTICS / ANALOGS can be used to check the height sensor output (P8-2) when the platform is fully lowered and fully raised; a difference of at least 1V is to be expected.

This message could occur if the UP switch was accidentally opened too early (when the platform is not fully raised).

**F14:BAD HEIGHT1**

This message occurs if EZfit#1 output is out of range during the DYNAMIC lift. The height sensor output must be between 1.0V and 4.0V. Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.

**F15:CHECK ELEV**

This message is given if the elevation switch (P7-5) is open when the platform has been fully lowered after the DYNAMIC lift.

This message would occur if the DOWN switch was accidentally opened before the platform was fully lowered.

If the platform is fully lowered, check the elevation switch. (The Titan has no elevation switch; check that the boom is fully retracted)

**F16:LOW ELEV.OPEN**

This message is given if the elevation switch (P7-5) opened during lift at too low of a height (below 5%). Check CALIBRATIONS / HEIGHT CALS. The "ElevUp" value shows the recorded height where the switch opened. (The Titan has no elevation switch; check that the boom is fully retracted)

**F17:HIGH ELEV.OPEN**

This message is given if the elevation switch (P7-5) opened during lift at a too high height (above 25%).

Check CALIBRATIONS / HEIGHT CALS; the "ElevUp" value shows the recorded height where the switch opened. (The Titan has no elevation switch; check that the boom is fully retracted)

**F18:LOW ELEV.CLOSE**

This message is given if the elevation switch (P7-5) closed during lower at a too low height (below 5%).



Check CALIBRATIONS / HEIGHT CALS; the “ElevDown” value shows the recorded height where the switch opened. (The Titan has no elevation switch; check that the boom is fully retracted)

**F19:HIGH ELEV.CLOSE**

This message is given if the elevation switch (P7-5) closed during lower at a too high height (above 25%).

Check CALIBRATIONS / HEIGHT CALS; the “ElevUp” value shows the recorded height where the switch opened. (The Titan has no elevation switch; check that the boom is fully retracted)

**F20:HEIGHT1<>0%****F20:HEIGHT2<>0%**

This message occurs if the platform height is not 0% after the platform has been fully lowered at the end of a calibration step. The platform must return to the same height each time it is fully lowered.

Check DIAGNOSTICS / SYSTEM to check the height.

**F22:HEIGHT1<>100%****F22:HEIGHT2<>100%**

This message occurs if the platform height is not 100% after the platform has been fully raised during a calibration step. The platform must return to the same height each time it is fully raised. Check DIAGNOSTICS / SYSTEM to check the height.

**F24:TOO MANY**

This message occurs if too many static measurements are taken during a calibration step. In the rare event that this occurs, please call MEC for assistance.

**F27:BAD HEIGHT**

This message indicates a problem with the height sensor output (P8-2) during the STATIC calibration phases.

The height sensor output must be between 1.0V and 4.0V at all times.

Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.

**F30:BAD HEIGHTS**

This message indicates that the recorded heights are not increasing during STATIC lift, or are not decreasing during STATIC lower.

This problem may be caused by repeatedly opening and closing the UP or DOWN switch during the STATIC phases.

**F34:REJECT CURVE**

The DYNAMIC pressure curve is unacceptable.

There is not enough difference between the initial pressure peak and the minimum pressure.

Check for proper weight in the platform and check pressure sensor and lift cylinder hydraulics.

**F40:REJECT DELTA DOWN @****F40:REJECT DELTA UP @**

This message indicates that there is not enough difference between the loaded & empty pressure.



This message could occur if the platform were not properly loaded during the STATIC LOADED phase, or if the platform were not properly empty during the STATIC EMPTY phase.

This message could also occur if the wrong pressure sensor was fitted (e.g.: a 5000psi sensor when a 3000psi one is needed).

Check CALIBRATIONS / HEIGHT CALS; the “Height” indicates the first height at which there was insufficient difference and the “Up” and “Down” values show the loaded pressure (first) and the difference between loaded and empty pressure (second).

#### **F42:LOW PRESSURE**

This message indicates that the pressure is too low (0.5V or less) when the elevation switch opens during the DYNAMIC lift.

This message would occur if the pressure sensor was disconnected, or if there were some other wiring error.

Check DIAGNOSTICS / SENSORS to check the pressure.

#### **F43:HIGH PRESSURE**

This message indicates that the pressure is too high (4.5V or more) when the elevation switch opens during the DYNAMIC lift.

This message would occur if the wrong pressure sensor was fitted, or if there were some other wiring error.

Check DIAGNOSTICS / SENSORS to check the pressure.

#### **F44:LOW PRESSURE**

This message indicates that the pressure is too low (0.5V or less) at a STATIC measurement point.

This message would occur if the pressure sensor was disconnected, or if there were some other wiring error.

Check DIAGNOSTICS / SENSORS to check the pressure.

#### **F45:HIGH PRESSURE**

This message indicates that the pressure is too high (4.5V or more) at a STATIC measurement point.

This message would occur if the wrong pressure sensor was fitted, or if there were some other wiring error.

Check DIAGNOSTICS / SENSORS to check the pressure.

#### **F46:CHECK ELEV**

This message indicates that the elevation switch opened more than once during the DYNAMIC lift.

#### **F47:CHECK ELEV**

This message indicates that the elevation switch closed more than once during the DYNAMIC lower.

#### **F48:BAD PRESSURE**

This message is given if the pressure sensor output is out of range at the start of calibration.

The sensor output must be between 0.5V and 4.5V.

Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.



**F49:TOO FEW**

The minimum number of static calibration points was not achieved.

**F52:NOT CALIBRATED**

This message is a catch-all code which indicates an improper calibration sequence or that one of the phases of calibration was not completed. The skipped phase must be completed or the calibration sequence must be passed through in proper sequence before this message will clear. Re-start the calibration sequence and proceed through each sequence in the specified order.

A "Redo" prompt will appear before each sequence. Answer "NO" if there is no reason to repeat or "YES" if the phase must be completed.

**F60:BAD EXTENSION**

Extension has not been calibrated or is faulty at the start of Load Calibration.

**F61:BAD EXTENSION**

Extension is out of range at the start of Extension Calibration.

**F62:BAD EXTENSION**

Extension is out of range at the start of Extension Calibration.

**F63:BAD EXTENSION**

Extension is out of range at the end of Extension Calibration.

**F64:BAD EXTENSION**

Problem at the end of Extension Calibration -- not enough difference between start and end points

**F65:BAD EXTENSION**

Use Boom Extend function to calibrate extension.

**INFORMATION MESSAGES**

During calibration the following messages will be displayed. They are informational prompts only and do not indicate a failure.

**BUILDING TABLES**

This message indicates that the STATIC measurements are being used to build calibration data - the process should take no more than 5s.

**CALDATE:**

This message is prompting for the date to be entered; it is stored to identify when the machine was calibrated.

The last calibrate date can be viewed in DIAGNOSTICS / LOG.

Press LEFT & RIGHT to select the flashing digits.

Press UP & DOWN to change the flashing digits.

Press ENTER when the entry is complete.

IMPORTANT: The date 00/00/00 is not allowed!

**FINISHED**

This message confirms that calibration is complete and successful.

**GO DOWN MORE!**

This message occurs if the DOWN switch is released during either STATIC lowering phase, when more measurements are needed (before the platform is fully lowered).



**GO UP MORE!**

This message occurs if the UP switch is released during either STATIC lifting phase, when more measurements are needed (before the platform is fully raised).

**LIFT EMPTY**

This message is displayed during the STATIC empty phase while the platform is being raised to the next measurement height.

**LIFT LOADED**

This message is displayed during the STATIC loaded phase while the platform is being raised to the next measurement height.

**LIFTING**

This message is displayed during the DYNAMIC phase while the platform is being raised.

**LOWER EMPTY**

This message is displayed during the STATIC empty phase while the platform is being lowered to the next measurement height.

**LOWER LOADED**

This message is displayed during the STATIC loaded phase while the platform is being lowered to the next measurement height.

**LOWERING**

This message is displayed during the DYNAMIC phase while the platform is being lowered.

**MEASURING #**

This message is displayed when the platform is stopped during either STATIC phase, when the GP400 takes a measurement.

There will be a short delay while the machine is allowed to stabilize after movement is stopped.

**MUST GO DOWN!**

This message occurs if the wrong switch is operated when the GP400 is waiting for the platform to be lowered.

**MUST GO UP!**

This message occurs if the wrong switch is operated when the GP400 is waiting for the platform to be raised.

**PLATFORM DOWN?**

This message is prompting for confirmation that the platform is fully lowered. If necessary the DOWN switch can be activated to lower the platform.

Press ENTER to confirm when the platform is fully lowered.

**PLATFORM EMPTY?**

This message is prompting for confirmation that the platform is completely empty.

Press ENTER to confirm when the platform is empty.

**PLATFORM LOADED?**

This message is prompting for confirmation that the platform is loaded to rated load: For the Titan Boom 60-S, this is 2000 lbs (900 kg) in the Load Zone, and 1000 lb (450kg) at the front of the platform (100% of the load rating listed on the serial plate).

Press ENTER to confirm when the platform is loaded.

**PLEASE LIFT ...**

This message is prompting for the platform to be raised.





The UP switch should be operated.

**PLEASE LOWER ...**

This message is prompting for the platform to be lowered.

The DOWN switch should be operated.

**PLEASE WAIT**

This message indicates that the is busy; the delay will be short (no more than 5s).

**REDO DYNAMIC:**

This message is displayed if the DYNAMIC phase of load calibration has previously been completed.

Press ENTER when “NO” is displayed if there is no need to redo the DYNAMIC phase.

Press UP or DOWN to display “YES” then press ENTER if it is necessary to redo the DYNAMIC phase.

If the previous DYNAMIC calibration was in error, or if the height or pressure sensor is replaced, it will be necessary to redo the DYNAMIC phase.

**REDO EMPTY:**

This message is displayed if the EMPTY phase of load calibration has previously been completed.

Press ENTER when “NO” is displayed if there is no need to redo the EMPTY phase.

Press UP or DOWN to display “YES” then press ENTER if it is necessary to redo the EMPTY phase.

If the previous EMPTY calibration was in error, or if the pressure sensor is replaced, it will be necessary to redo the EMPTY phase.

**REDO LOADED:**

This message is displayed if the LOADED phase of load calibration has previously been completed.

Press ENTER when “NO” is displayed if there is no need to redo the LOADED phase.

Press UP or DOWN to display “YES” then press ENTER if it is necessary to redo the LOADED phase.

If the previous LOADED calibration was in error, or if the pressure sensor is replaced, it will be necessary to redo the LOADED phase.

**TOTAL DATA:**

This message is displayed at the end of each phase, to confirm the number of measurements recorded by the GP400. No operator input is required during this process.





## Section 3

# MECHANICAL COMPONENTS

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**NOTES:**

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## MECHANICAL COMPONENTS

This section describes the major components of the machine and the steps required to service them.

### BASE



**When steam cleaning or pressure washing the base/undercarriage, cover electrical components to prevent water penetration.**

Steam clean the base as necessary, and inspect all welds and brackets. Check for cylinder pins that have turned in their mounting, which may indicate sheared retaining pins.

### TIRES & WHEELS

Inspect for cuts, chunking, side-wall damage, or abnormal wear. Any tire faults **MUST BE CORRECTED** before further machine operation. Refer to Parts sections for replacement tires.



**FAILURE TO USE APPROVED PARTS MAY CAUSE DEATH OR SERIOUS PERSONAL INJURY.**

**REPLACE TIRES WITH THE CORRECT TIRES TO MAINTAIN THE RATING OF THE EQUIPMENT.**

**FOAM FILLED TIRES WERE FITTED AS ORIGINAL EQUIPMENT ON THIS MACHINE. TIRES MUST BE REPLACED WITH EQUIVALENT SPECIFICATION TIRES AND FOAM-FILL WEIGHT. CONTACT MEC SERVICE.**

### CHANGING TIRES

Refer to “Lift and Support The Machine” in the *Introduction* section for instructions and safety precautions.



**Always block the wheels before lifting the machine.**

1. Chock tires on the end of machine opposite the tire to be changed.
2. Break loose but **do not remove** lug nuts before raising the machine.
3. Lift the end of machine requiring a tire change and support with jackstands of adequate capacity.
4. Remove lug nuts and pull the wheel off.
5. Install the replacement wheel.
6. Install lug nuts and tighten.
7. Lower the machine.
8. Tighten lug nuts to proper torque (Refer to machine specifications).
9. Remove the chocks.



# PLATFORM REMOVAL & INSTALLATION



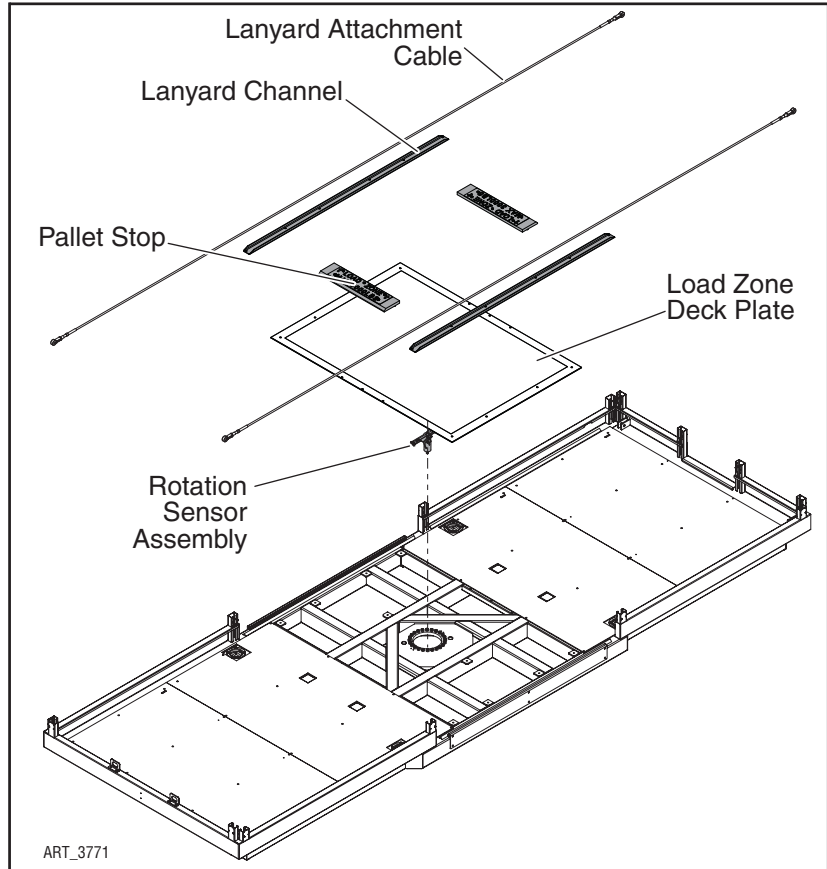
## WARNING

**THIS PROCESS REQUIRES SPECIFIC REPAIR SKILLS AND EXPERIENCE, APPROPRIATE LIFTING EQUIPMENT AND A PROPER WORKPLACE. DEATH, SERIOUS INJURY OR SIGNIFICANT MACHINE DAMAGE COULD OCCUR IF YOU ATTEMPT THIS PROCESS WITHOUT THE APPROPRIATE SKILLS AND EQUIPMENT.**

*Figure 3-1: Platform Removal*

### REMOVAL

1. Remove all guard rails and gates.
2. Remove the Lanyard Attachment Cables, the Lanyard Channels and the Pallet Stops.
3. Remove the Load Zone Deck Plate.
4. Unplug the cable connecting to the Rotation Sensor Assembly, then remove the Rotation Sensor Assembly.
5. Connect an overhead crane or appropriate lifting device to the platform. Do not lift at this time.
6. Tag all cables that connect the platform to the boom for proper reassembly, then disconnect the cables.
7. Break loose but do not remove the socket-head cap screws that secure the platform to the carriage.
8. Apply slight lifting pressure.
9. Remove the socket-head bolts that secure the platform to the carriage.
10. Carefully lift the platform away from the Platform Rotate Drive Unit assembly.

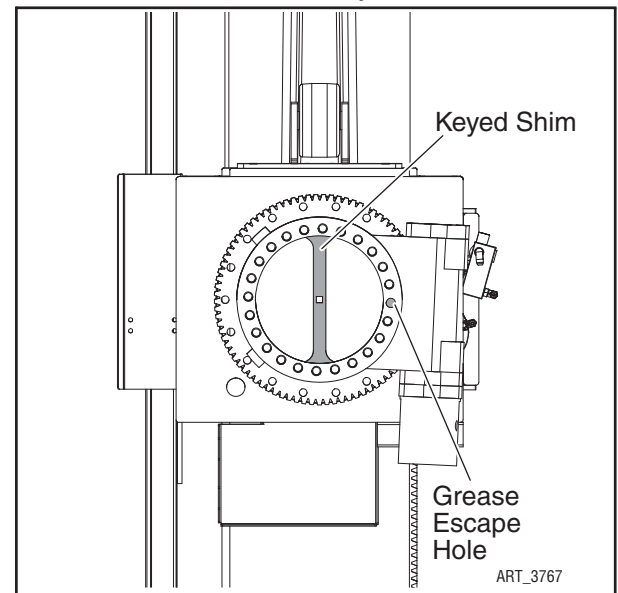




## INSTALLATION

1. If the Platform Rotate Drive Unit was removed from the carriage, be sure that the Keyed Shim was installed parallel to the Boom and Platform Beam. Make sure the Drive Unit is correctly positioned relative to the Boom.

**Figure 3-2: Keyed Shim Orientation**

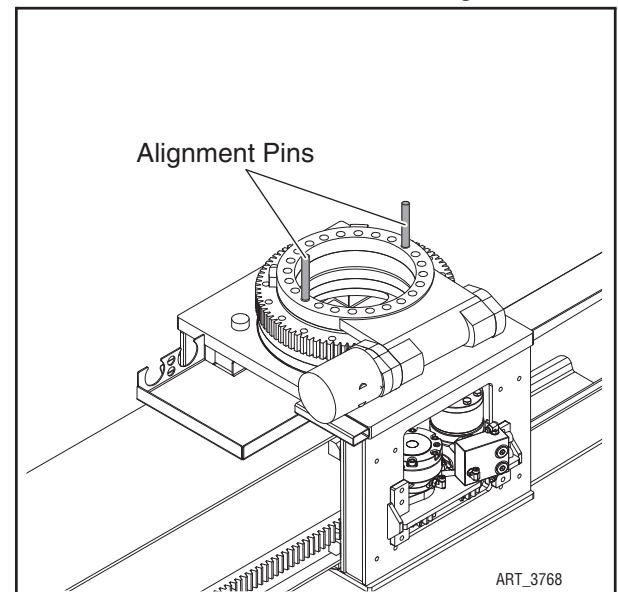


2. Thread in two Alignment Pins into the holes aligned with the Keyed Shim.

**NOTE:** Alignment pins may be made by cutting the heads off two M16-2.0 x 150 bolts.  
**DO NOT** remove the Alignment pins until instructed to do so.

3. Carefully lower the Platform onto the Alignment Pins. Be sure the Platform is in line with the Boom.
4. Use Loctite® 242 or equivalent on all socket-head cap screws. Hand-thread the M16-2.0 x 110 socket-head cap screws and M16 hardened washers into all open holes except for the Grease Escape Hole, shown in Figure 3-2.

**Figure 3-3: Alignment Pins**



### **DO NOT USE STANDARD WASHERS.**

5. Snug the bolts with a wrench, then remove the alignment pins and replace them with M16-2.0 x 110 socket-head cap screws and M16 hardened washers.
6. Using a rotating criss-cross pattern, torque all socket-head cap screws to 285 lb/ft. (387 Nm).
7. Install the Rotation Sensor Assembly. Be sure that the square tip fits into the key hole on the Keyed Shim. **DO NOT** replace the Load Zone Deck Plate at this time.
8. Re-install all cables that connect the platform to the boom.
9. Start the machine and perform the adjustment procedure for the Rotation Sensor (see Section 2 of this manual).



10. Replace the Load Zone Deck Plate and all other platform components. Tighten all fasteners to proper torque.

## PLATFORM ROTATE DRIVE UNIT



**THIS PROCESS REQUIRES SPECIFIC REPAIR SKILLS AND EXPERIENCE, APPROPRIATE LIFTING EQUIPMENT AND A PROPER WORKPLACE. DEATH, SERIOUS INJURY OR SIGNIFICANT MACHINE DAMAGE COULD OCCUR IF YOU ATTEMPT THIS PROCESS WITHOUT THE APPROPRIATE SKILLS AND EQUIPMENT.**

The Platform Rotate Drive Unit is located between the Platform and the Platform Carriage.

The Platform Rotate Drive Unit is normally removed only for repair or replacement.

A overhead hoist or fork lift is needed for this procedure. Two slings capable of lifting 1500 lbs (681 kg) are also needed.

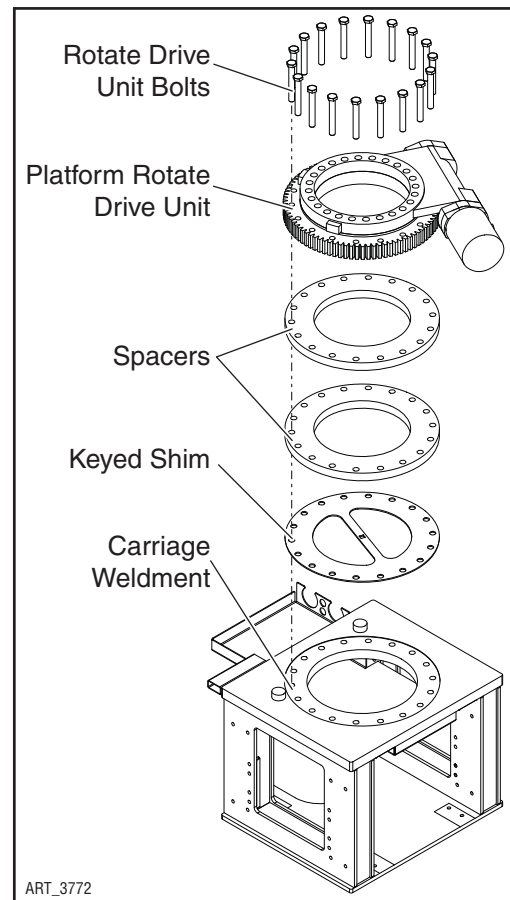
### REMOVAL

Park the machine on a firm level surface.

Remove the Platform (see "Platform Removal & Installation" on Page 3-4).

1. Clean all hydraulic fittings, then tag all hoses for proper reassembly.
2. Disconnect all hydraulic hoses. Immediately plug and cap all openings to prevent contamination.
3. Remove the Rotate Drive Unit Bolts.
4. Lift the Platform Rotate Drive Unit by threading two M16-2.0 eyebolts into the threaded holes around the inner ring.

**NOTE:** Unit is heavy--use a lifting device of adequate capacity to move.



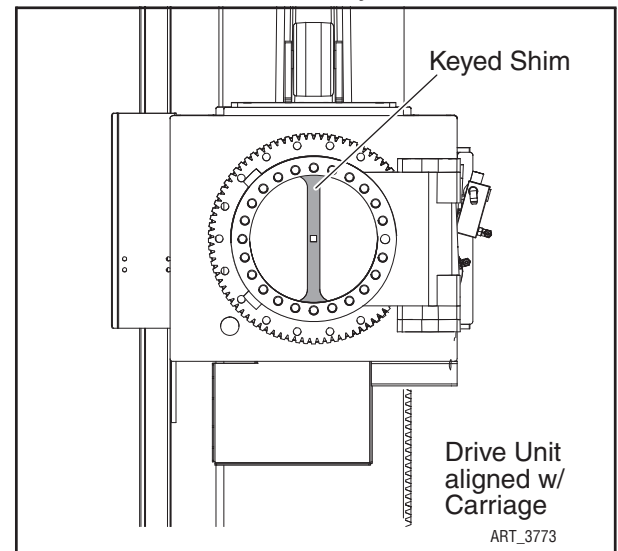


## INSTALLATION

Installation is the reverse of the Removal procedure above, with the following items of note:

- Apply one (1) drop of Loctite 242 or equivalent to mounting bolts.
- Torque the Rotate Drive Unit Bolts to 285 lb/ft. (387 Nm).
- Make sure the Keyed Shim is oriented as shown in Figure 3-4.
- Set the Platform Rotate Drive Unit so that the edge of the hydraulic motor is aligned with and parallel to the side of the Carriage.

**Figure 3-4:** Keyed Shim Orientation



## PLATFORM CARRIAGE



**THIS PROCESS REQUIRES SPECIFIC REPAIR SKILLS AND EXPERIENCE, APPROPRIATE LIFTING EQUIPMENT AND A PROPER WORKPLACE. DEATH, SERIOUS INJURY OR SIGNIFICANT MACHINE DAMAGE COULD OCCUR IF YOU ATTEMPT THIS PROCESS WITHOUT THE APPROPRIATE SKILLS AND EQUIPMENT.**

The Platform Carriage is located between the Platform and the Platform Beam. Its purpose is to move the Platform forwards and backwards in line with the Boom.

It is not necessary to remove the Platform Rotate Drive Unit.

### REMOVAL

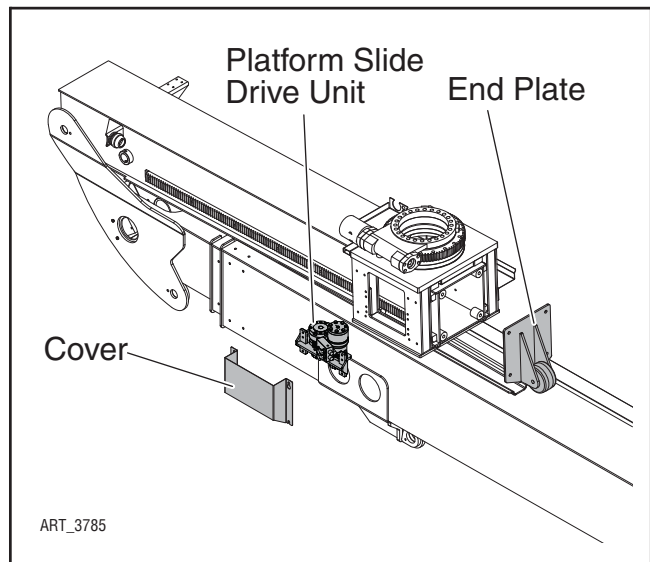
Park the machine on a firm level surface.

Remove the Platform (see "Platform Removal & Installation" on Page 3-4).

1. Start the machine and use the Platform Slide function to slide the carriage all the way to the rear of the Platform Beam.
2. Use the Platform Level function to lift the rear end of the Platform Beam until the roller no longer touches the boom.
3. Clean all hydraulic fittings, then tag all hoses for proper reassembly.
4. Disconnect all hydraulic hoses. Immediately plug and cap all openings to prevent contamination.



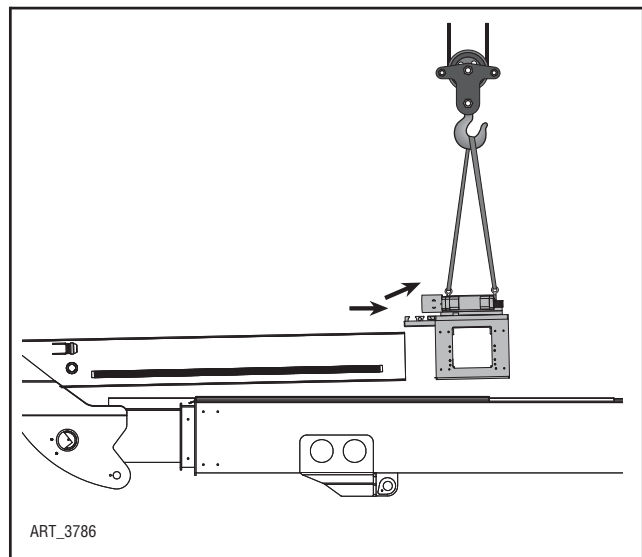
5. Remove the platform beam end plate.
6. Thread two M16-2.0 eyebolts into the threaded holes around the inner ring of the Platform Rotate Drive Unit. Attach lifting slings to these eyebolts.



7. Position an overhead hoist over the carriage and attach the slings. Apply just enough lifting force to tighten the slings.
8. Remove the Platform Slide Drive Unit and cover.

**WARNING**

**BE SURE THAT SUFFICIENT LIFT FORCE EXERTED BY THE CRANE TO PREVENT THE CARRIAGE FROM SLIDING. THE PLATFORM SLIDE DRIVE UNIT CONTAINS THE BRAKE, WHICH PREVENTS THE CARRIAGE FROM SLIDING FREELY. REMOVING THIS UNIT WILL REMOVE THE BRAKE.**



9. Move the overhead hoist towards the read of the machine until the carriage is free of the beam.
10. Installation is reverse of removal. Apply one (1) drop of Loctite 242 or equivalent to mounting bolts. See the Introduction section of this manual for proper torque specifications.

**IMPORTANT! Perform the following Shim Procedure before returning the machine to service.**



**PLATFORM CARRIAGE/PLATFORM SLIDE DRIVE UNIT SHIM PROCEDURES**

Before adjusting the slide carriage, it is necessary to locate the point on the Platform Beam where the wear pads are the tightest. To do so, operate the Platform Slide function in 3-4 inch (7-10 cm) increments and inspect the clearance between the side wear pads and side of the beam, and between the bottom wear pads and the bottom of the beam. Once the location of tightest clearance is identified, make note of the location(s) by marking the beam.

**Carriage**

1. Using regular machine controls, move the Carriage to the location where the SIDE wear pads are the tightest.
2. Remove the Platform Slide Drive Unit cover to gain access to the motor and brake assembly.
3. Loosen the mounting bolts that retain the Platform Slide Drive Unit to the carriage. This will prevent the motor or the brake from interfering with lateral shim adjustment.
4. Measure the clearance between the wear pads and the beam and record the measurements.
5. Add or remove shims to acquire a total clearance (both measurements added together) of .030" to .050" (.76-1.25 mm) space between the wear pads and the beam.

Carriage Shims -- Side	
22188	Shim, .060
22194	Shim, .030

6. Loosen the wear pad mounting bolts enough to slide the shim between the wear pad and the Carriage. Apply one (1) drop of Loctite 242 or equivalent to mounting bolts. See the Introduction section of this manual for proper torque specifications.
7. Perform Motor/Brake Pinion Depth Adjustment immediately following this section.
8. Using regular machine controls, move the Carriage to the location where the BOTTOM wear pads are the tightest.
9. Add or remove shims to acquire a .030" to .050" space between the wear pad and the beam.

Carriage Shims -- Lower	
18235	Shim, .060
18236	Shim, .030

10. Loosen the wear pad mounting bolts enough to slide the shim between the wear pad and the Carriage. Apply one (1) drop of Loctite 242 or equivalent to mounting bolts. See the Introduction section of this manual for proper torque specifications.

**Motor/Brake Pinion Depth Adjustment**

1. Turn Engine off and turn the Battery Disconnect Switch off.
2. Remove the Platform Slide Drive Unit cover.



3. Loosen the four bolts that retain the Carriage Slide Motor/Brake and remove all but one shim on each side. Re-tighten all four bolts to proper torque.
4. Attempt to manually rotate the gears on both the motor and the brake. They should move a small amount freely. If the small amount of free play is observed on both the motor and the brake unit, adjustment is complete; skip to Step 6.
5. If no free play is observed, loosen all four bolts and add one more shim (**MEC part #22195**) on each side. Tighten all four bolts to proper torque and attempt to manually rotate the gears on both the motor and the brake. They should move a small amount freely. If the small amount of free play is observed on both the motor and the brake unit, adjustment is complete, move on to Step 6. If no free play is observed, repeat Step 5 until there is a small amount of free play in both the motor and the brake.
6. Apply one (1) drop of Loctite 242 or equivalent to mounting bolts. See the Introduction section of this manual for proper torque specifications.
7. Operate the Platform Slide function repeatedly in both direction to ensure proper slide action without slowing or sticking.
8. Install the Platform Slide Drive Unit cover.



## PLATFORM BEAM & PLATFORM LEVEL CYLINDER



### WARNING

**THIS PROCESS REQUIRES SPECIFIC REPAIR SKILLS AND EXPERIENCE, APPROPRIATE LIFTING EQUIPMENT AND A PROPER WORKPLACE. DEATH, SERIOUS INJURY OR SIGNIFICANT MACHINE DAMAGE COULD OCCUR IF YOU ATTEMPT THIS PROCESS WITHOUT THE APPROPRIATE SKILLS AND EQUIPMENT.**

### REMOVAL

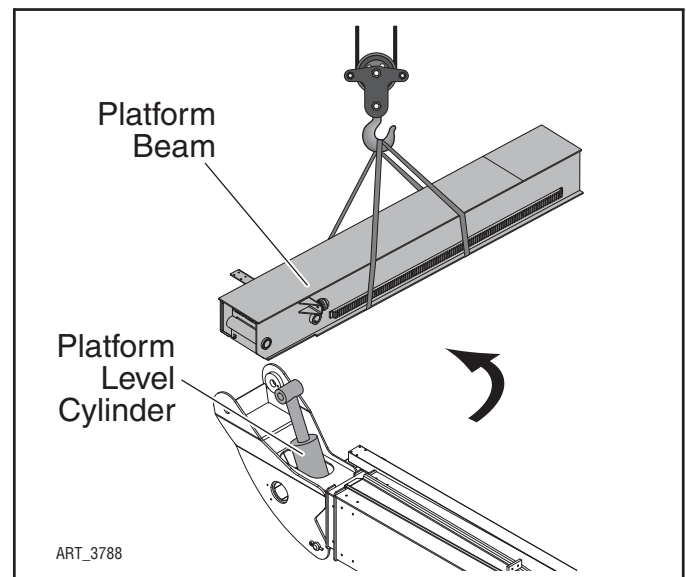
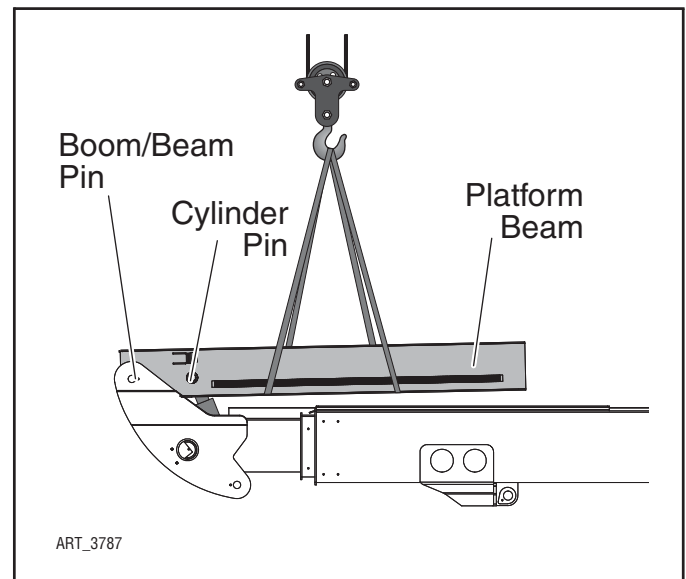
Park the machine on a firm level surface.

Remove the Platform (see “Platform Removal & Installation” on Page 3-4).

Remove the Platform Carriage (see “Platform Carriage” on Page 3-7)

A overhead hoist or fork lift is needed for this procedure. Two slings 16 feet (5 m) long capable of lifting 1500 lbs (681 kg) are also needed.

1. Position an overhead hoist over the carriage and attach the slings. Apply slight lifting pressure.
2. Clean all hydraulic fittings, then tag all hoses for proper reassembly.
3. Disconnect all hydraulic hoses. Immediately plug and cap all openings to prevent contamination.
4. Upper Platform Level Cylinder pin: remove the cylinder pin retainer, then remove the pin.
5. Boom/Platform Beam pivot pin: remove the cylinder pin retainer, then remove the pin.
6. It is necessary to turn the beam for the rod-end pin boss of the cylinder to clear the hole in the bottom of the Platform Beam. Carefully lift and turn the Platform beam while moving the overhead hoist forward and to the side of the machine.
7. When turned sufficiently, lift the beam off of the cylinder head.
8. Position the overhead hoist over the Platform lift cylinder and securely attach the sling. Apply slight lifting pressure.





9. Lower Platform Level Cylinder pin: remove the cylinder pin retainer, then remove the pin.
10. Carefully lift the Platform Level Cylinder out of the boom. It may be necessary to turn the cylinder slightly to allow the lower pin boss to fit through the hole in the boom.
11. Installation is reverse of removal. Apply one (1) drop of Loctite® 242 or equivalent to bolts securing the pin retainers. See the Introduction section of this manual for proper torque specifications.



## ENGINE MAINTENANCE

For complete service information consult the engine manual that came with the machine.



**Always wear protective eye-wear when working with fuel and oil.**

**Engine should be OFF when replacing filter elements.**

**Do not run the engine with the air filter element removed.**

### OIL AND OIL FILTER

**Dispose of used oil and filters properly.**

Engine oil should be checked daily prior to machine use. Oil should be changed after the first 50 hours of service, and every 500 hours thereafter.

Engine oil should be MIL-L-2104C or have properties of API classification CF or higher.

Oil used with this engine must have proper API and SAE Engine Oil classification according to ambient temperatures as shown below:

Above 77° F (25° C)	SAE30, SAE10W-30 or SAE15-40
32° ~ 77° F (0 ~ 25° C)	SAE20, SAE10W-30 or SAE15-40
Below 32° F (0° C)	SAE10W, SAE10W-30 or SAE15-40

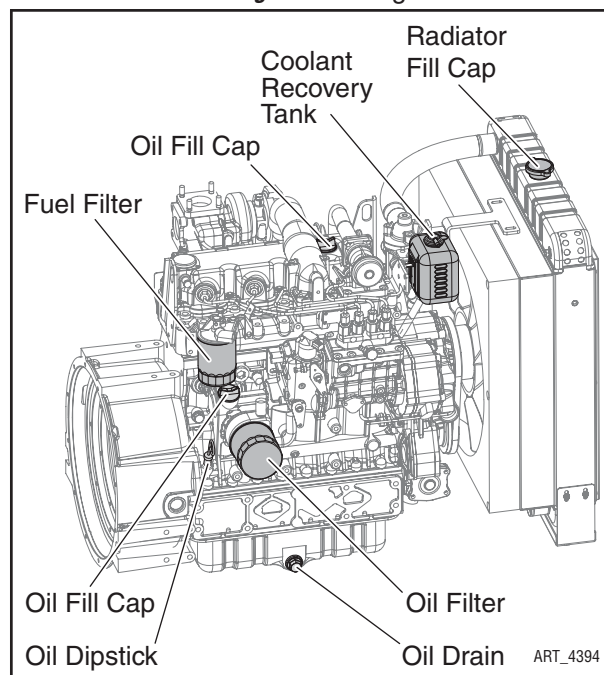
1. Use a suitable container to catch drained oil. Remove the drain plug. After oil has drained, replace the drain plug.
2. Remove the old filter and wipe the filter seal contact surface with a clean towel.
3. Coat the seal on the new filter with clean oil, then install and tighten by hand.
4. Fill engine with appropriate motor oil until the dipstick indicates FULL. This engine has 2 filling points--one on top of the engine and the second above the oil filter. Either may be used.  
Capacity is 14 US quarts (13.2 L).
5. Recheck dipstick after running engine.  
Fill as necessary.

### AIR FILTER ELEMENT

The Air Filter is located outside and at the rear of the Engine Module.

1. Clean the air filter canister before opening.
2. Remove the cap to the air filter canister.
3. Remove old filter and replace with a new filter.

**Figure 3-5: Engine Maintenance**



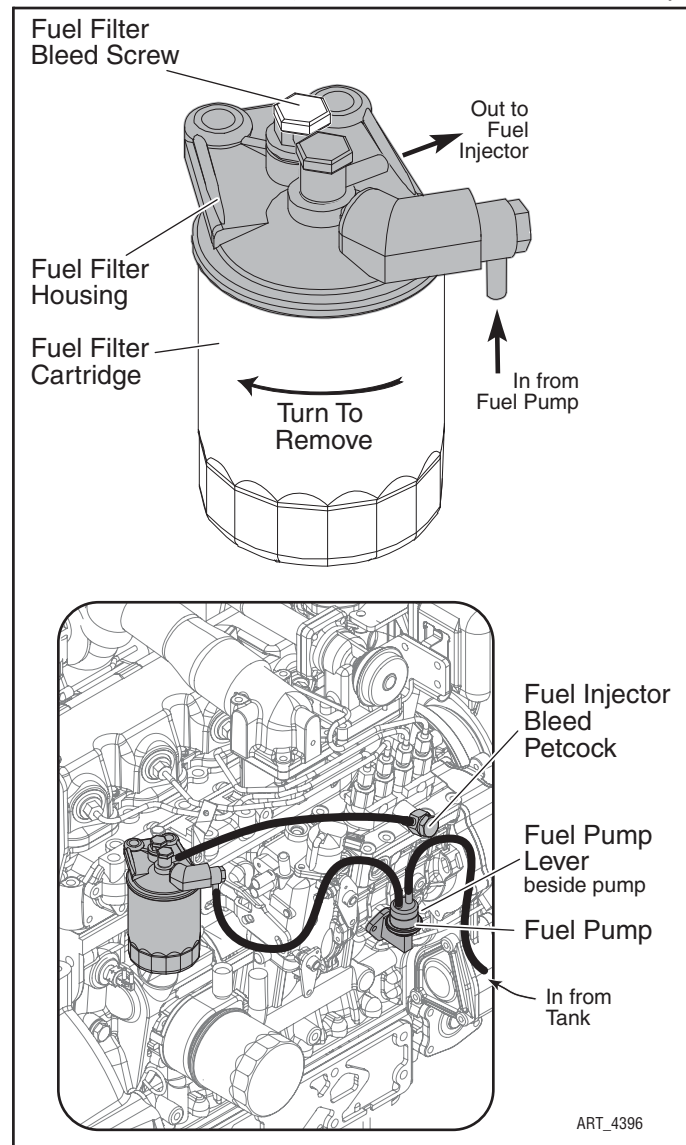


4. Replace the cap to the air filter canister.

## FUEL FILTER

1. Turn OFF valve on bottom of fuel tank and clean the filter area before removing the filter.
2. Place a suitable container beneath the fuel filter assembly to catch spilled fuel.
3. Turn filter cartridge counterclockwise to remove. Wipe the filter seal contact surface with a clean towel
4. Coat the seal on the new filter with clean oil, then install and tighten by hand.
5. Open valve at fuel tank and check for leaks.
6. Purge the air from the fuel system as follows;
  - Fill fuel tank to the fullest extent. Open valve on bottom of fuel tank.
  - Loosen Fuel Filter Bleed Screw on top of fuel filter housing a few turns. Close the bleed screw when fuel flows steadily and there are no more bubbles.
  - Open the Fuel Injector Bleed Petcock on the fuel injector pump.
  - Crank the engine for about 10 seconds, then stop it, **or** move the fuel feed pump lever by hand.
  - Start the engine. Close the Fuel Injector Bleed Petcock when the engine idles smoothly.

**Figure 3-6:** Fuel Filter & Fuel Pump



**NOTE:** The engine will crank for up to 10 seconds before the starter is cut out for a mandatory 30-second starter cool-down cycle. A red light will illuminate on the Base Control Station during the cool-down cycle.



## THROTTLE ADJUSTMENT

Figure 3-7: Throttle Linkage

### IDLE SPEED ADJUSTMENT

1. Bring engine to operating temperature.
2. Slow engine to complete idle.
3. Adjust the Idle Speed Screw until the RPM is 1100. Adjust slightly up or down to avoid vibrations.
4. Hold the Idle Speed Screw while tightening the jam nut to prevent change in adjustment.

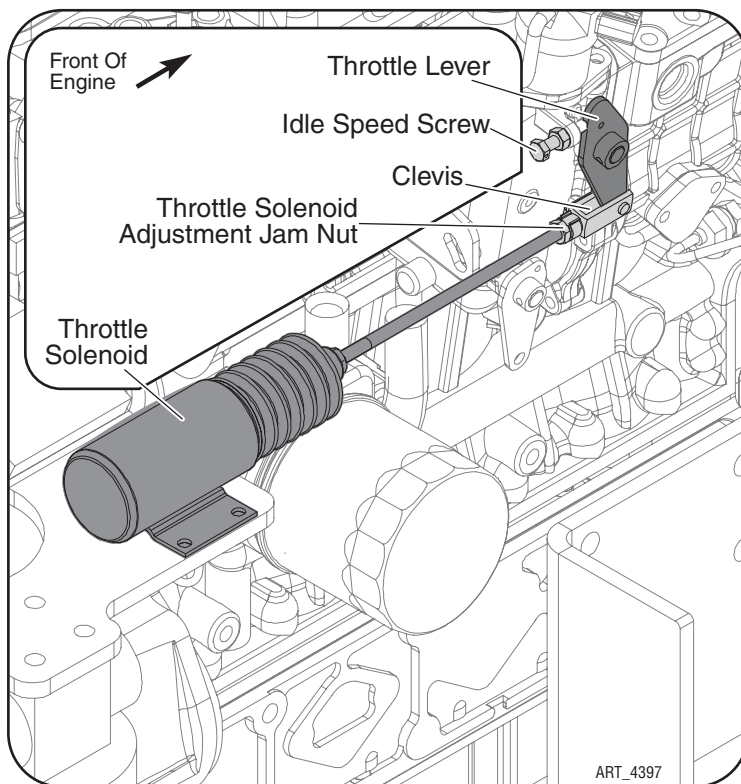
### THROTTLE SOLENOID ADJUSTMENT

**IMPORTANT:** – This final adjustment must be made after all other throttle speed adjustments. The solenoid must be free to retract fully in order to turn OFF the High Amperage Pull Circuit. Improper adjustment will result in solenoid failure and may damage the electrical system.

1. With the engine OFF, disconnect the Clevis from the Throttle Lever.
2. Manually retract the Throttle Solenoid by grasping the piston, just ahead of the boot, and pull to the fully retracted position.

**NOTE:** The solenoid must retract and extend smoothly.

3. Have a second person rotate the Throttle Lever as far as it will go.
4. With the Throttle Solenoid piston fully retracted, adjust the Clevis until its hole lines up with the hole on the fully-rotated Throttle Lever. Reconnect the Clevis to the Throttle Lever.
5. Tighten the Throttle Solenoid Jam Nut.





# LUBRICATION POINTS

## BOOM WEAR PADS

Lower the stabilizers and extend the boom completely. Spread a thin, even coat of lithium-based grease on the areas where the wear pads rub -- top, bottom and sides of the internal sections of the boom.

## PLATFORM SLIDE CARRIAGE WEAR PADS

Spread a thin even coat of with lithium-based grease on the areas where the slide pads rub -- top, bottom and sides of Platform Beam.

## PLATFORM ROTATE DRIVE UNIT

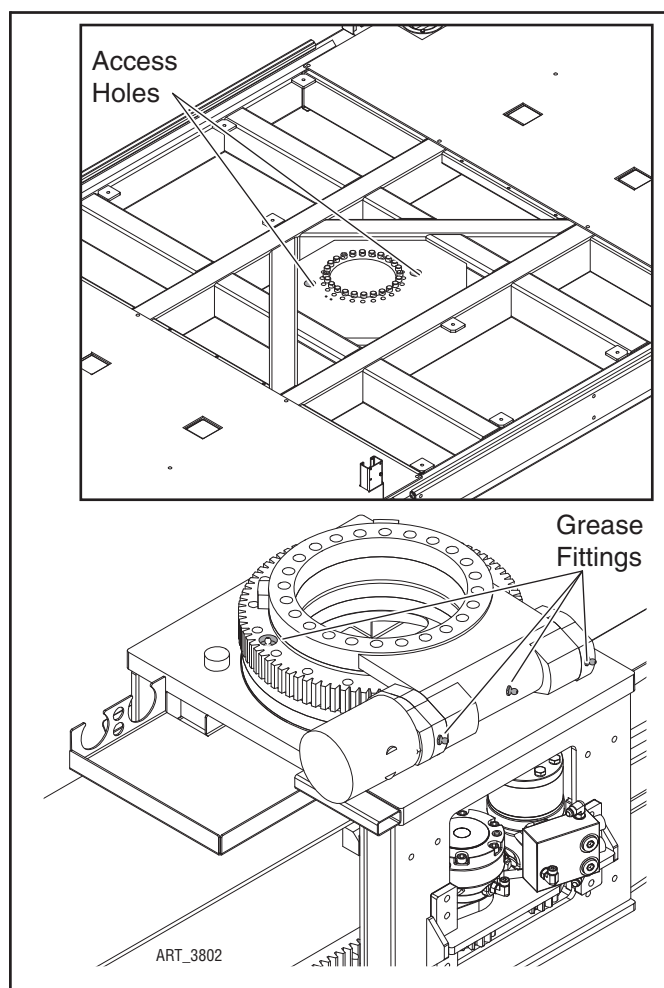
- Apply small amounts of lithium-based grease to approximately every 3rd tooth of the ring gear.
- Apply grease to 3 fittings located on the side of the Platform Rotate Drive Unit.
- Ring Gear Bearing: Remove the Load Zone Deck Plate. Rotate the platform until the access hole aligns with the grease fitting in the ring gear.

## CABINET LATCHES AND HINGES

Apply spray lubricant to latches and hinges. Wipe off excess lubricant.

## ENGINE

Apply spray lubricant to throttle solenoid linkage pivot points. See Figure 3-7 on page 3-15.







## Section 4

# TROUBLESHOOTING

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## GENERAL TROUBLESHOOTING TIPS

### HYDRAULIC FLUID PUMP

The hydraulic Drive Pump and Primary Functions Pump used in this model are variable displacement, axial piston type pumps. Proper adjustment is critical for normal operation of the machine. Refer to Section 1 of this manual.

The Secondary Functions pump is a fixed-displacement gear-type pump attached to the rear of the Primary Functions Pump.

#### ***Common Causes of Electrical System Malfunctions:***

- Battery switch is turned OFF (located at the front of the engine module).
- Battery connections are loose or corroded
- Battery is not fully charged.
- Emergency Stop buttons are pushed (OFF position).
- Circuit breaker is tripped (OFF position).

#### ***Common Causes of Hydraulic System Malfunctions:***

- Hydraulic fluid level is too low.
- Incompatible hydraulic fluids mixed, destroying the additives and causing varnish build up, resulting in the valves sticking.
- Water in the hydraulic fluid due to a damp climate.
- Improper hydraulic fluid used. Viscosity too high in cold climates. Viscosity too low in warm climates.
- Hydraulic fluid contaminated with debris - filter change interval neglected.

**NOTE:** MEC uses a multiple viscosity fluid that is light enough for cold climates and resists thinning in warm climates. Use only the recommended hydraulic fluid. Substituting a lower grade fluid will cause the machine to operate incorrectly and may lead to pump and drive motor failure. Refer to "Lubrication" in Section 1 of this manual.

**NOTE:** Contamination always causes failure in any hydraulic system. It is very important to be careful not to introduce any contamination into hydraulic system during the assembly procedures. Make sure all ports and cavities of the manifold and cylinders are properly covered/plugged during maintenance activities.



## ELECTRICAL SYSTEM TROUBLESHOOTING

The electronic control system used on this machine was designed for low maintenance and long, trouble-free operation. The system consists of two microprocessor based modules: the GP440 Module in the upper controls box and the GP400 Processor, located in the lower controls box. They communicate through a low voltage digital signal called CAN-Bus communication.

To protect against part failure or incorrect plug connections, the modules are fully short circuit and reverse polarity protected. All electrical plug connections are waterproof to promote longer trouble free operation and to increase terminal life.



**NEVER ATTEMPT TO SUPPLY BATTERY POWER, OR VOLTAGE HIGHER THAN 12 VOLTS TO ANY PART OR MODULE IN THIS SYSTEM, AS CATASTROPHIC FAILURE OF THE MODULES MAY RESULT.**

**USE OF HIGH PRESSURE WASHING EQUIPMENT DIRECTLY ON THE MODULES CAN FORCE WATER INTO SEALED CONNECTION AND CAN CAUSE A TEMPORARY SYSTEM SHUT-DOWN. HIGH PRESSURE WASHING WITHIN THE VICINITY OF THE MODULES IS HIGHLY DISCOURAGED.**



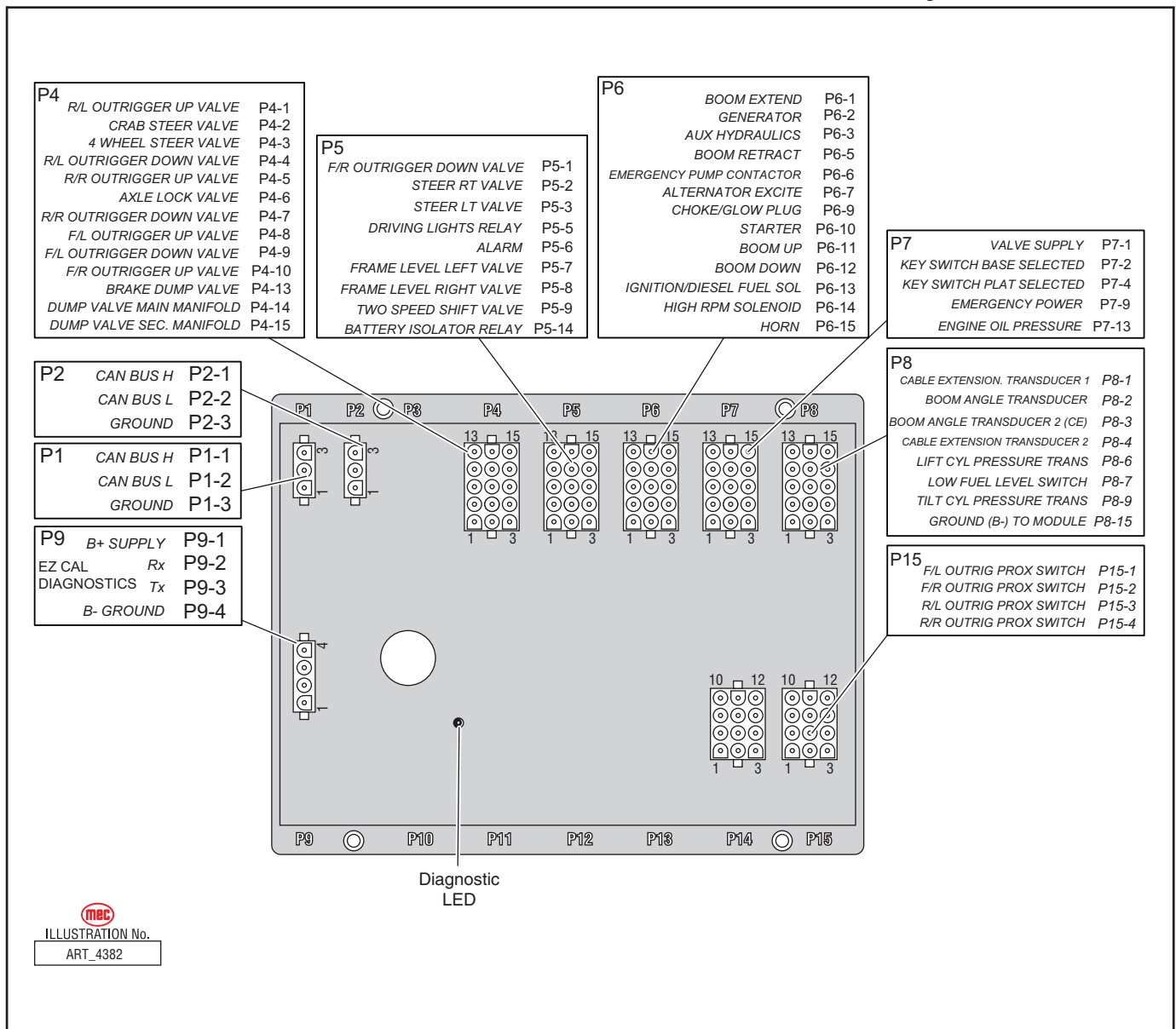
## GP400 MODULE

The GP400 module is “the brains” of the system. It receives and processes a variety of inputs both from the machine and the operator, then controls all the operative functions of the machine. It also has a feature that allows the technician to access and monitor all functionality of the system, along with a technician-friendly series of fault messages that can be accessed through the use of the onboard EZ-Cal scan tool. Flash codes are also provided in case an EZ-Cal scan tool is not available.

Such information can be used for preventative maintenance and troubleshooting should a problem arise. A comprehensive list of EZ-Cal accessible information can be found later in this section.

The GP400 operates on 12 volts DC and should never be probed or operated with voltage higher than 14 volts DC

**Figure 4-1:** GP400 Module

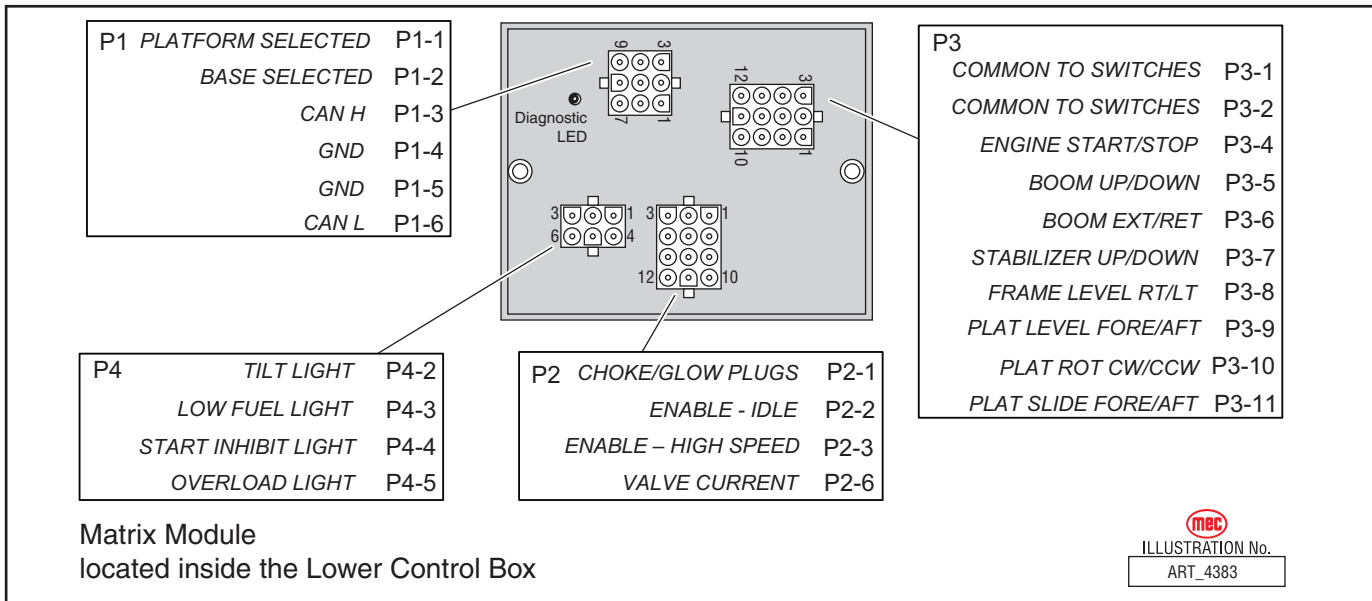




## MATRIX MODULE

The Matrix Module is an auxiliary module located inside the lower control box. It received inputs from the operator and relays them to the GP400.

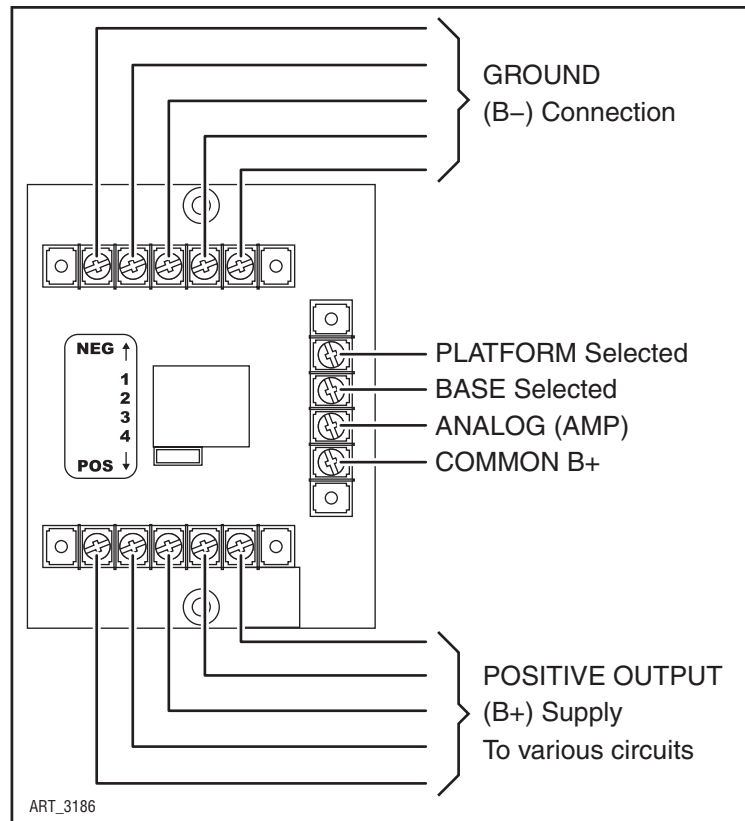
**Figure 4-2: Matrix Module**



## TERMINAL BLOCK MODULE (TBM)

**Figure 4-3: Terminal Block Module (TBM)**

The Terminal Block Module (TBM) is a module inside the lower control box that provides terminal point connections for both positive and ground circuits. A signal from the Emergency Stop circuit activates a load-reduction relay within the TBM that provides ample power to the B+ (positive) terminal strip. This arrangement protects the system against voltage drop conditions that can be detrimental to the electrical system.

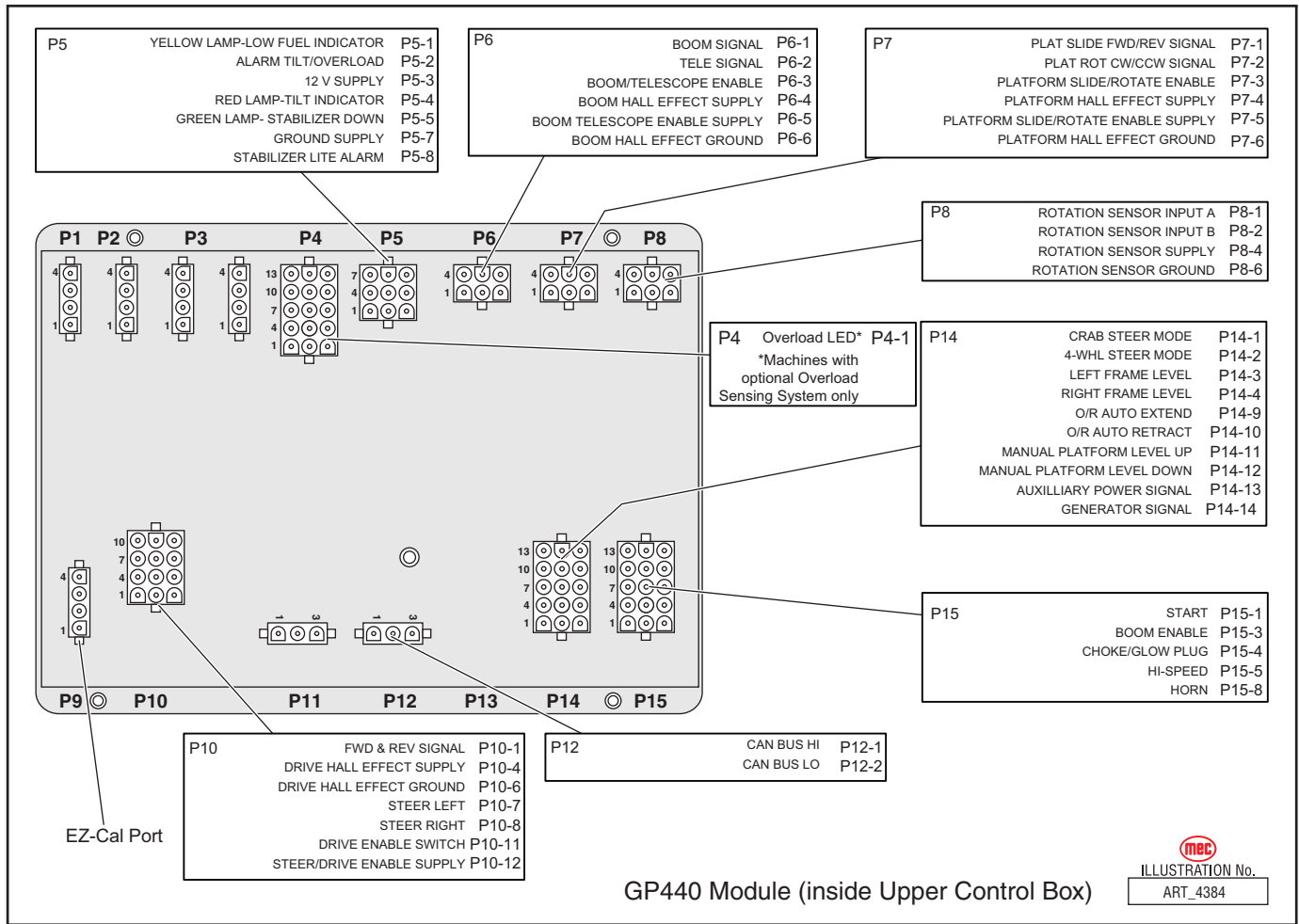




## GP440 MODULE

The GP440 Module is the remote module located inside the upper control box. It received inputs from the operator and relays them to the GP400.

**Figure 4-4:** GP440 Module





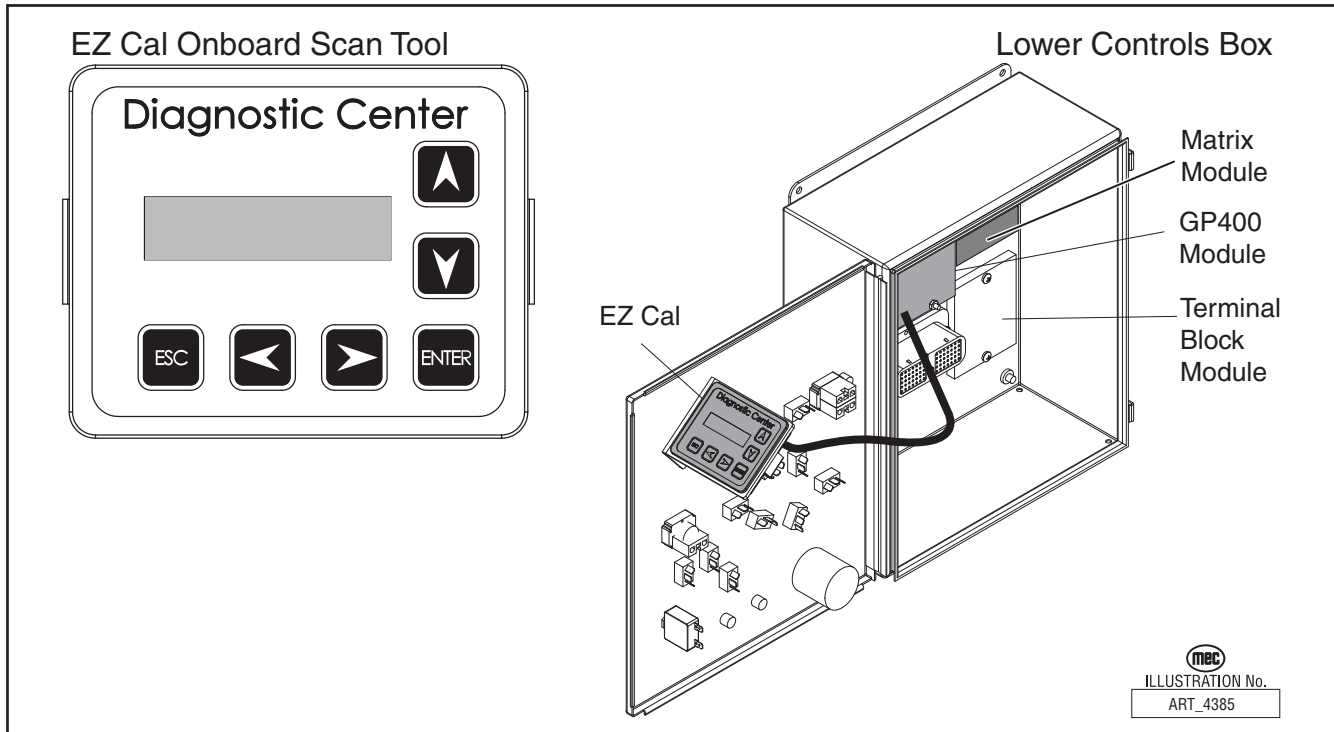
## EZ-CAL SCAN TOOLS

The EZ-Cal Scan Tools interface with the machine's control system to provide system information and to allow adjustment. The EZ-Cal receives its power from the GP400 or GP440. The system must be powered up by closing the battery disconnect switch and pulling out both Emergency Stop Switches. You must also select Base or Platform depending on the station from which you will operate.

### ONBOARD EZ-CAL -- LOWER CONTROLS BOX

To use and operate the onboard EZ-Cal, set the Base/Platform Key switch to Base, then open the door to the Lower Controls Box. The onboard EZ-Cal scan tool provides the same functionality as the hand-held unit.

**Figure 4-5:** Onboard EZ-Cal Scan Tool & GP400 Module





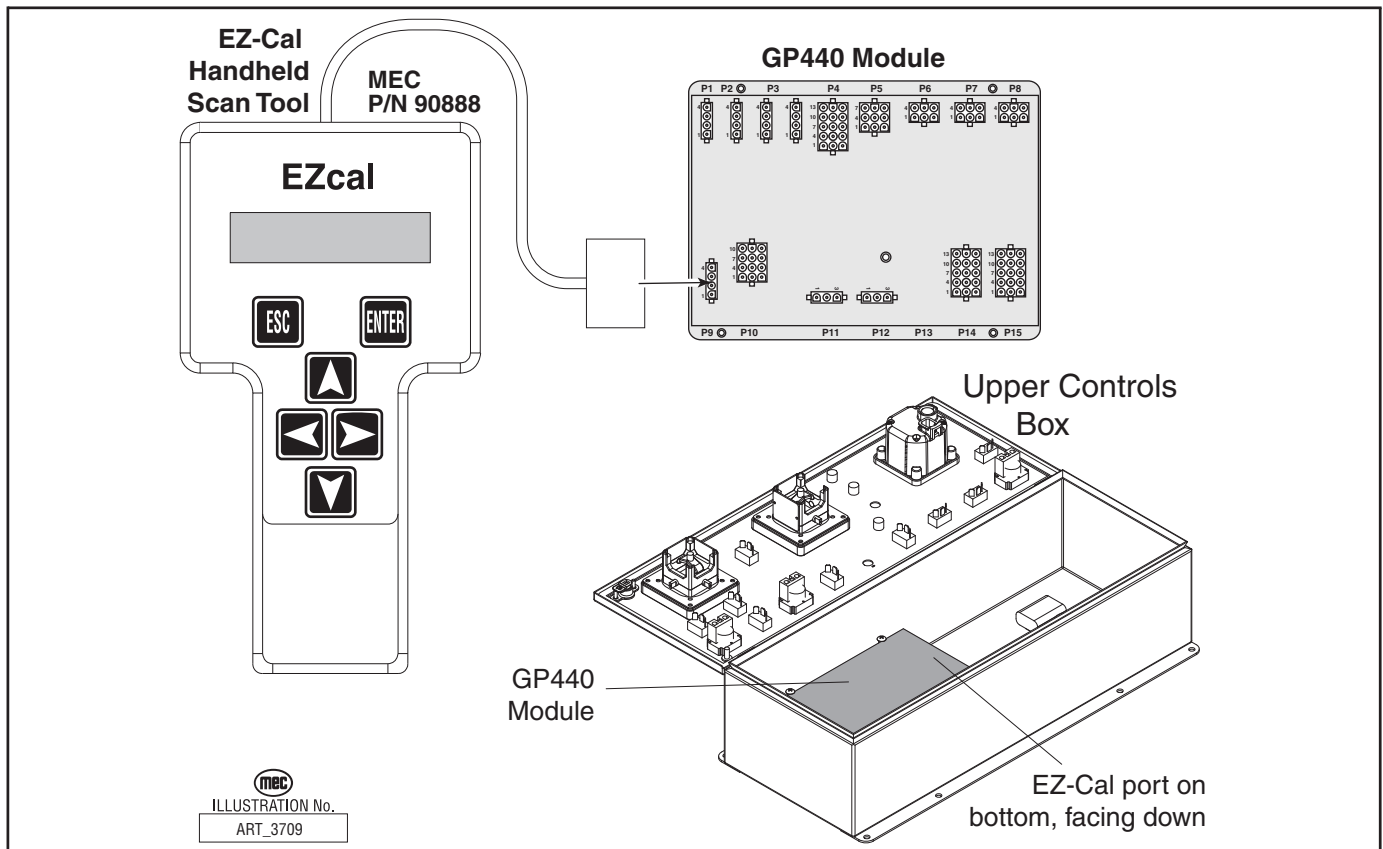
## HANDHELD EZ-CAL -- UPPER CONTROLS BOX

The handheld EZ-Cal is not provided with the machine and is available from the MEC parts department (part #90888).

To use and operate the handheld EZ-Cal at the upper controls station:

- Set the Base/Platform Key Switch to Platform
- Open the lid to the Upper Controls Box
- Plug the EZ-Cal into port P9 of the GP440 module. This plug is on the right side of the module, facing down.

Figure 4-6: Handheld EZ-Cal Tool & GP440



## USING THE EZ-CAL SCAN TOOL

- Once, powered up, the EZ-Cal display will illuminate and read "HELP: PRESS ENTER". From this point, use the right and left arrows to scroll through the base menus.
- Once the desired base menu is obtained (i.e. *ADJUSTMENTS*) press Enter to access sub menus.
- Use the right and left arrows to scroll through sub menus, then press Enter again to choose a sub menu.
- The up/down arrows are used to change settings only.

Press ESC to back up one level.

Figure 4-7: EZ-Cal Buttons

SYMBOL	KEY FUNCTIONS
	<b>ESC/ENTER BUTTONS</b> To move back and forth between menu and sub-menu
	<b>LEFT/RIGHT BUTTONS</b> Select menus and setting to be adjusted
	<b>UP/DOWN BUTTONS</b> Adjust setting values

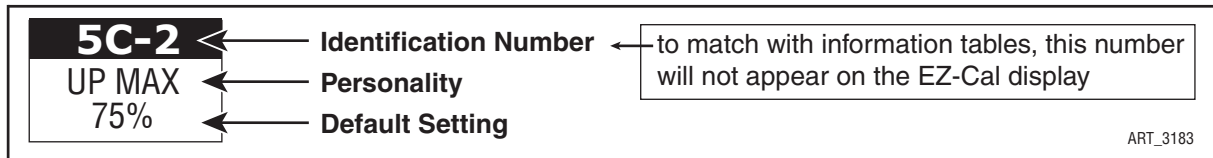
ART\_3710



## USING THE EZ-CAL WITH THE FLOW CHARTS

Use the EZ-Cal Flow Charts as a guide to locate diagnostic information and make adjustments. Each box in the flow chart will have 3 bits of information.

**Figure 4-8:** EZ-Cal Display Example



**The IDENTIFIER (5c2):** – Used to locate this specific personality in the informational charts. Here you can obtain specific information on the individual personalities.

**The PERSONALITY (Up Max):** – Identifies the individual personalities.

**The DEFAULT SETTING:** – The factory setting. If adjustments are made, they must be returned to default setting.



**ACCESS LEVEL 1 PROVIDES ACCESS TO CHANGE PERSONALITIES NORMALLY PRESET AT THE FACTORY TO PROVIDE PROPER MACHINE MOVEMENT AT SAFE SPEEDS. PERSONALITIES MUST NOT BE CHANGED WITHOUT PRIOR AUTHORIZATION FROM MEC AND MAY ONLY BE RETURNED TO FACTORY SPECIFICATION AS LISTED IN THE FOLLOWING TABLES.**

## ERROR MESSAGES

To obtain error messages from the EZ-Cal, access the EZ-Cal as mentioned above. The display will read, “HELP:PRESS ENTER”. Press Enter to display the current error message. If an error message is present, use the following list of error messages to better understand the fault. If an error message is not present, the display will show the last operation performed.

Pressing Enter twice will provide a log of previous errors and operations that may have occurred within recent operation. The first message will be the most recent.

## FLASH CODES

Flash Codes, provided from the GP400 red LED, will also assist in the event an EZ-Cal is not available. However, the EZ-Cal yields considerably more relevant information. Refer to “EZ-Cal Messages” on page 4-22 for flash coded error messages.



Figure 4-9: EZ-Cal Flow Chart: Adjustments and Setup

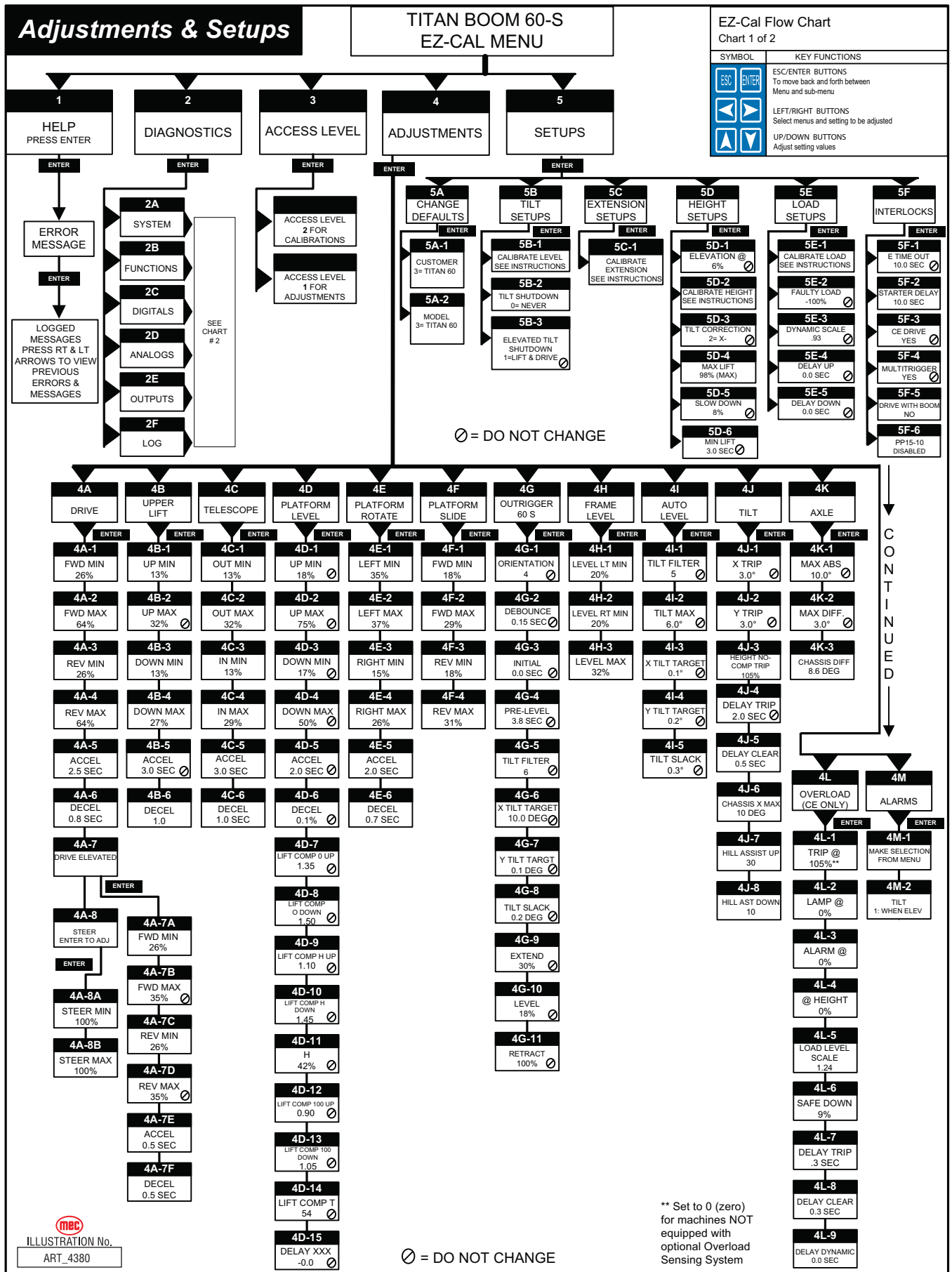
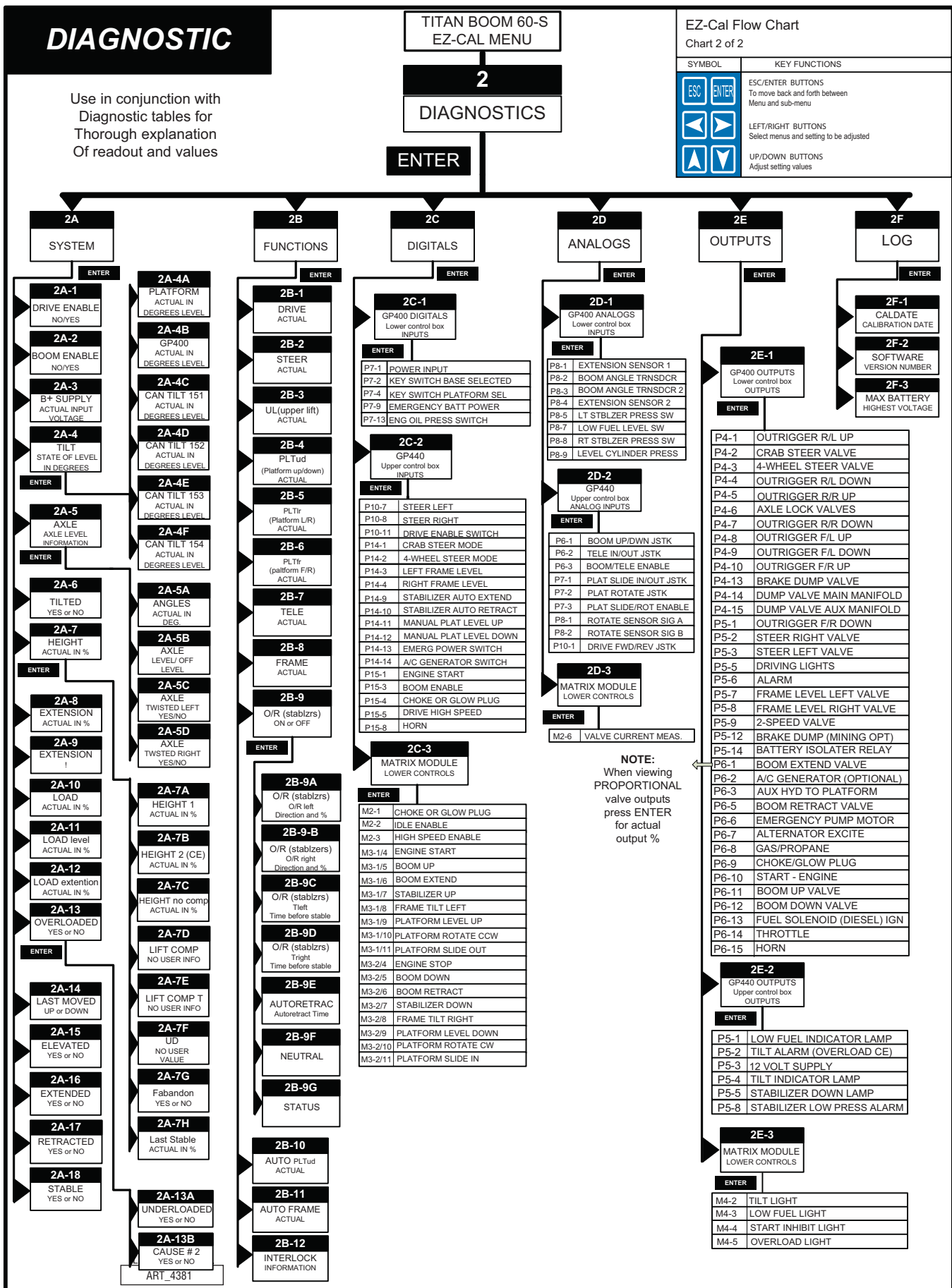




Figure 4-10: EZ-Cal Flow Chart: Diagnostic





## EZ-CAL ADJUSTMENT

Refer to "Using the EZ-Cal Scan Tool" on page 4-9.

Adjustments are possible in Access Level 1 Only.

Before changing personalities, ensure that the correct customer and model have been selected in the SETUPS menu. Any changes to settings will be lost when the model or customer is changed.

To reach ADJUSTMENTS, first access Level 1, then press --> for ADJUSTMENTS.

Press Enter, then press --> to scroll through the sub-menus.

Once the desired sub-menu is found, press Enter again, then --> to scroll through the personalities. Press the Up or Down arrows to change the personality. Press ESC to go back one or more levels to reach other sub-menus.

**Table 4-1:** EZ-Cal Adjustment Table

OPERATION	ID	PERSONALITY	Factory Setting	Explanation
<b>4A DRIVE Platform Stowed</b>	4A1	Fwd Min	26%	Slowest speed threshold
	4A2	Fwd Max	64%	Maximum speed setting
	4A3	Rev Min	26%	Slowest speed possible
	4A4	Rev Max	64%	Maximum speed potential
	4A5	Accel	2.5 sec.	Ramp up time to maximum
	4A6	Decel	.8 sec.	Ramp down to time stop
<b>Platform elevated</b>	4A7	DRIVE ELEVATED	Sub Menu	Press ENTER to access elev. drive settings
	4A7a	Fwd Min	26%	Slowest speed threshold
	4A7b	Fwd Max	35%	DO NOT CHANGE
	4A7c	Rev Min	26%	Slowest speed possible
	4A7d	Rev Max	35%	DO NOT CHANGE
	4A7e	Accel	0.5 sec.	Ramp up time to maximum
	4A7f	Decel	0.5 sec.	Ramp down to time stop
	4A8	STEER	Sub Menu	Press ENTER to access steer settings
	4A8a	Steer Min	100%	Steering speed adjustment
	4A8b	Steer Max	100%	Steering speed adjustment
<b>4B UPPER LIFT Controls main Boom lift cylinder</b>	4B1	Up Min	13%	Slowest speed threshold
	4B2	Up Max	32%	DO NOT CHANGE
	4B3	Down Min	13%	Slowest speed threshold
	4B4	Down Max	27%	Maximum speed setting
	4B5	Accel	3.0 sec.	DO NOT CHANGE
	4B6	Decel	1.0 sec.	Ramp down time to stop
<b>4C TELESCOPE</b>	4C1	Out Min	13%	Slowest speed threshold
	4C2	Out Max	32%	Maximum speed setting
	4C3	In Min	13%	Slowest speed threshold
	4C4	In Max	29%	Maximum speed setting
	4C5	Accel	3.0 sec.	Ramp up time to maximum
	4C6	Decel	1.0 sec.	Ramp down time to stop



OPERATION	ID	PERSONALITY	Factory Setting	Explanation
<b>4D PLATFORM LEVEL</b>	4D1	Up Min	18%	DO NOT CHANGE
	4D2	Up Max	75%	DO NOT CHANGE
	4D3	Down Min	17%	DO NOT CHANGE
	4D4	Down Max	50%	DO NOT CHANGE
	4D5	Accel	2.0 sec.	DO NOT CHANGE
	4D6	Decel	0.1 sec.	DO NOT CHANGE
	4D7	Lift Comp 0 up	1.35	DO NOT CHANGE
	4D8	Lift Comp 0 Down	1.50	DO NOT CHANGE
	4D9	Lift Comp H Up	1.10	DO NOT CHANGE
	4D10	Lift Comp H Down	1.45	DO NOT CHANGE
	4D11	H	42%	DO NOT CHANGE
	4D12	Lift Comp 100 Up	.90	DO NOT CHANGE
	4D13	Lift Comp 100 Down	1.05	DO NOT CHANGE
	4D14	Lift Comp T	54	DO NOT CHANGE
	4D15	Delay XXX	0	DO NOT CHANGE
<b>4E PLATFORM ROTATE</b>	4E1	Left Min	35%	Slowest speed threshold
	4E2	Left Max	37%	Maximum speed setting
	4E3	Right Min	15%	Slowest speed threshold
	4E4	Right Max	26%	Maximum speed setting
	4E5	Accel	2.0 sec.	Ramp up time to maximum
	4E6	Decel	0.7 sec.	Ramp down time to stop
<b>4F PLATFORM SLIDE</b>	4F1	Fwd Min	18%	Slowest speed threshold
	4F2	Fwd Max	29%	Maximum speed setting
	4F3	Rev Min	18%	Slowest speed threshold
	4F4	Rev Max	31%	Maximum speed setting
<b>4G OUTRIGGERS</b>	4G1	Orientation	4	Position of GP400 relative to machine
	4G2	Debounce	0.15 sec	delay before reading switches
	4G3	Initial	0.0 sec.	Not used
	4G4	Pre-level	3.8 sec	time lifting machine before leveling
	4G5	Tilt Filter	6	DO NOT CHANGE
	4G6	X Tilt Target	10 deg	For-aft tilttarget
	4G7	Y Tilt Target	0.1 deg	Side-side tilt target
	4G8	Tilt Slack	0.2 deg	Variance
	4G9	Extend	30%	Speed of legs before touching ground
	4G10	Level	18%	Speed of legs when leveling
	4G11	Retract	100%	Speed of legs in raise mode
<b>4H FRAME LEVEL</b>	4H1	Level LEFT Min	20%	Slowest speed threshold left
	4H2	Level RIGHT MIN	20%	Slowest speed threshold right
	4H3	Level Max	32%	Maximum speed setting



OPERATION	ID	PERSONALITY	Factory Setting	Explanation
<b>4I AUTO-LEVEL</b> controls level when manual leveling frame and platform	4I1	Tilt Filter	5	DO NOT CHANGE
	4I2	Tilt Max	6.0 deg	DO NOT CHANGE
	4I3	X Tilt Target	.1 deg	DO NOT CHANGE
	4I4	Y Tilt Target	.2 deg	DO NOT CHANGE
	4I5	Tilt Slack	.3 deg	DO NOT CHANGE
<b>4J TILT</b> Controls Alarm and interlocks related to frame or platform level	4J1	X Trip	3.0 deg	For-Aft maximum angle of operation
	4J2	Y Trip	3.0 deg	Side-Side maximum angle of operation
	4J3	Height No Comp trip	105%	Maximum boom angle no Comp.
	4J4	Delay Trip	2.0 sec.	Time before out-of-level shutdown
	4J5	Delay Clear	0.5 sec	Time before clear out-of-level shutdown
	4J6	Chassis X Max	10 deg	Maximum side tilt
	4J7	Hill Assist Up	30	assists elevated drive up grades
	4J8	Hill Assist Down	10	reduces elevated drive down grades
<b>4K AXLE</b> Axle monitoring	4K1	MAX ABS	10.0 deg	Limit of side level
		Max Differential	3.0 deg	Max axle difference - interlock elev. drive
	4K2	Chassis Differential	8.6 deg%	Max axle difference - interlock Y level
<b>4L OVERLOAD --</b> optional Overload Sensing System only	4L1	Trip @	0% * 105% **	% over rated capacity that overload trip *machine NOT equipped with optional Overload Sensing System **machine equipped with optional Overload Sensing System
	4L2	Lamp @	0%	0% setting will follow Trip@
	4L3	Alarm@	0%	0% setting will follow Trip@
	4L4	@ Height	0%	0% follows Elevation@ setting
	4L5	Load Level Scale	1.24	Scaling factor for tilt cyl pressure
	4L6	Safe Down	9%	allows lowering when overload trips
	4L7	Delay Trip	0.3sec	Delay before trip
	4L8	Delay Clear	0.3 sec.	Delay before clear once load reduced
	4L9	Delay Dynamic	0.0 sec.	Not used
<b>4M ALARMS</b>	4M1	Motion	Variable	Select alarm setting to indiv. requirement
	4M2	Tilt Alarm	1: When Elevated	selects when tilt alarm sounds



## EZ-CAL SETUP

Changes to Setups are possible in Access Level 1 only. Calibrations are possible in access level 2.



**SEE "CALIBRATION INSTRUCTIONS" BEFORE ATTEMPTING CALIBRATIONS. INCORRECT CALIBRATION CAN CAUSE MACHINE INSTABILITY.**

**NOTE:** Changing CUSTOMER (5a1) or MODEL (5a2) will return all settings and Adjustments to their default value possibly causing the machine to operate differently than desired (see Adjustment Flow Charts for default values)

Only authorized personnel have access to, and may make changes to personalities. The ID numbers are provided as a means to match personalities in the EZ-Cal Flow Chart and tables, they will not appear on the EZ-Cal display

**Table 4-2:** EZ-Cal Setup Menu

OPERATION	ID	FUNCTION	Factory Setting	Explanation
5a CHANGE DEFAULTS	5a1	Customer	3=TITAN 60%	Identifies Base Model - Must be set when GP400 is Replaced. CE denotes optional Overload Sensing System.
	5a2	Model	3=TITAN 60 ANSI 4=TITAN 60 CE	Select from these choices. Titan, CE = optional Overload Sensing System
5b TILT SETUPS	5b1	Calibrate Level? Y=ENTER, N=ESCAPE		Pressing enter twice will calibrate all level sensors
	WARNING! Refer to Tilt Sensor Calibration instructions before attempting calibration			
	5b2	Tilt Shutdown	0 = never	Function disabled when tilted (STOWED)
	5b3	Elevated Tilt Shutdown	1 = Lift and Drive	Function disabled when tilted (ELEVATED)
5c EXTENSION SETUPS	5c1	Calibrate Extension? Y=ENTER, N=ESCAPE		ENTER to begin calibration of extension sensor
	WARNING! Refer to Extension Calibration instructions before attempting calibration			
5d HEIGHT SETUP	5d1	Elevation @	6%	Level sensor active, outriggers disabled, slow drive
	5d2	Calibrate Height? Y=ENTER, N=ESCAPE		ENTER to begin calibration of height sensors
	WARNING! Refer to Height Calibration instructions before attempting calibration			
	5d3	Tilt Correction	2=X -	Axis for boom height calculation less chassis
	5d4	Max Lift	98%	DO NOT SET ABOVE 98%
	5d5	Slow down	8%	% below max lift adjustment for boom slow down
	5d6	Min Lift	3.0 sec	For load calibration procedure
5e LOAD SETUPS (optional Overload Sensing System only)	2e1	Calibrate Load? Y=ENTER N=ESCAPE		ENTER to begin calibration of CE load sense system
	WARNING! Refer to Load Calibration instructions before attempting calibration			
	5e2	Faulty Load	-100%	Not used
	5e3	Dynamic Scale	.98	Scaling factor for load while lifting
	5e4	Delay Up	0.0 sec	Lift delay (after down) to help reduce press spikes
	5e5	Delay Down	0.0 sec	Down delay (after up) to help reduce press spikes



OPERATION	ID	FUNCTION	Factory Setting	Explanation
5f INTERLOCKS	5f1	E Time Out	10 Seconds	time enable can be active before interlock
	5f2	Starter Delay	10 Seconds	Qty of time starter will operate before 30 sec cool down
	5f3	CE Drive	YES	Yes= no drive possible while boom is operated
	5f4	MultiTrigger	YES	Allows use of all enable triggers for any function
	5f5	Drive with boom	NO	setting for foot switch arrangement
	5f6	PP15-10	Disabled	For mining option only



## EZ-CAL DIAGNOSTICS

The EZ-Cal Diagnostics menu provides the ability to view and test individual circuits for irregularities. Whether diagnosing a failure or testing functions during preventative maintenance, the *Diagnostics Menu* provides a quick view at the inputs and outputs as registered by the GP400 Control Module **in real time**. Using the EZ-Cal Diagnostic Flow Chart, compare ID number to this menu for circuit identification and result.

To reach DIAGNOSTICS menu from HELP;

- Press the right arrow and scroll to DIAGNOSTICS and press ENTER.
- Locate the desired sub menu and press ENTER.
- Press the right arrow to scroll through the test points.

**NOTE:** The ID number will not appear on the EZ-Cal display. It is shown in the *Diagnostics Menu* for reference only.

Using the ID number, match specific personalities from the Diagnostic Flow Charts with this table for additional information.

Press **ESC** to go back one level (necessary to change selection).

**Table 4-3:** EZ-Cal Diagnostics Menu

SELECTION	ID #	EZ-cal Readout	Explanation
2A SYSTEM	2A1	Drive Enable Y or N	Drive enable switch open or closed
	2A2	Boom Enable Y or N	Boom enable switch open or closed
	2A3	B+ Supply (actual)	Supply voltage at GP200
	2A4	Tilt (actual in degrees)	Platform tilt angle as read by 4-way can tilt
Sub Menu Press ENTER	2A4a	Platform (actual in degrees)	Platform tilt angle as read by 4-way can tilt
	2A4b	GP400 (actual in degrees)	Chassis tilt angle as read by GP400
	2A4c	CAN TILT 151	Reading from Can Tilt in front of boom (Left)
	2A4d	CAN TILT 152	Reading from Can Tilt on Front axle
	2A4e	CAN TILT 153	Reading from Can Tilt in front of boom (Right)
	2A4f	CAN TILT 154	Reading from Can Tilt on Rear axle
	2A5	AXLE	Axle level information
Sub Menu Press ENTER	2A5A	Angle - in degrees	Axle angle compared to GP400 angle
	2A5b	Axle level/off level	Yes= no drive elevated
	2A5d	Axle Twisted left	Axle difference excessive - no add. frame level possible
	2A5c	Axle Twisted right	Axle difference excessive - no add. frame level possible
	2A6	Tilted Y or N	Tilted beyond trip angles
	2A7	Height (actual in deg)	As measured by rear angle transducer
Sub Menu Press ENTER	2A7a	Height 1	As measured by rear angle transducer #1
	2A7b	Height 2 (CE Cert only)	As measured by rear angle transducer #2
	2A7c	Height No Comp	Height measurement not compensated for chassis angle
	2A7d	Lift Comp	Formula used for controlling platform auto-level
	2A7e	Lift Comp T	Formula used for controlling platform auto-level
	2A7f	Platform UD	Actual output controlling auto-level
	2A7g	F Abandon	Platform angle point when auto-level is abandoned
	2A7h	Last Stable	Last recorded height when stabilizers were set.



**Table 4-3:** EZ-Cal Diagnostics Menu

SELECTION	ID #	EZ-cal Readout	Explanation
	2A8	Extension (CE Cert Only)	As measured by Cable Extension Transducer (boom ext)
	2A9	Extension !	
	2A10	Load (actual in %)	State of load on platform (CE cert. only)
	2A11	Load Level	Load calculation based on level cylinder pressure
	2A12	Load Extension	Load calculation based on ext & lift cylinder pressures
	2A13	Overloaded Y or N	Y when excessive weight in platform CE only
Sub Menu Press ENTER	2A13a	Underloaded Y or N	Y when lift cyl pressure is below minimum
	2A13b	Cause #2 Y or N	Level cylinder tripped overload
	2A14	Last Moved U or D	Operation working when overload tripped
	2A15	Elevated Y or N	Y when elevated above elevation @ setting
	2A16	Extended Y or N	Y when extended beyond 8 feet (2.6m)
	2A17	Retracted Y or N	Y when boom fully retracted
	2A18	Stable Y or N	Y when Stabilizers down and set
2B FUNCTIONS	2B1	DRIVE	Actual state, direction and %
	2B2	STEER	Actual state, direction and %
	2B3	UL (upper Lift)	Actual state, direction and % main lift
	2B4	PLT ud (platform level)	Actual state, direction and %
	2B5	PLT lr	Actual state, direction and % platform rotate
	2B6	PLT fr	Actual state, direction and % platform slide
	2B7	TELE	Actual state, direction and % telescope
	2B8	FRAME	Actual state, direction and % frame level
	2B9	Outriggers 40	Actual state, direction and % outriggers
Sub Menu Press ENTER	2B9a	Outriggers 40 Outrigger left	Actual state, direction and % left outrigger
	2B9b	Outriggers 40 outrigger right	Actual state, direction and % right outrigger
	2B9c	Outriggers 40 T right	Time before stable
	2B9d	Outriggers 40 T right	Time before stabile
	2B9e	Outriggers 40 Auto-retract	Time that outriggers auto-retract during initial drive.
	2B9f	Outriggers 60 Neutral	
	2B9g	Outriggers 60 Status	
	2B10	AUTO PLT ud	NOT USED
	2B11	AUTO FRAME	Actual state, direction and % frame level when Auto-leveling
	2B12	INTERLOCK	Information on interlocks (shut downs)



**Table 4-3:** EZ-Cal Diagnostics Menu

SELECTION	ID #	EZ-cal Readout	Explanation
2C DIGITALS	2C1	GP400 DIGITAL INPUTS	Enter to view switch Inputs from lower controls
		Individual input not listed separately	Display change from OFF to On when operations are selected
	2C2	GP440 DIGITAL INPUTS	Enter to view switch Inputs from upper controls
		Individual input not listed separately	Display change from OFF to On when operations are selected
	2C3	MATRIX DIGITAL INPUTS (CE Cert Only)	Enter to view switch Inputs from lower controls
		Individual input not listed separately	Display change from OFF to On when operations are selected
2D ANALOGS	2D1	GP400 ANALOG INPUTS	Enter to view inputs from chassis sensors and switches
	2D1a	P8-2 Boom Angle Transducer	Actual position of boom elevation in %
	2D1b	P8-3 Outrigger Auto-Extend Switch	Battery voltage when switch selected
	2D1c	P8-4 Outrigger Auto-Retract Switch	Battery voltage when switch selected
	2D1d	P8-5 Left Stabilizer Down Press Sensor	Actual pressure indicated between 1.5 and 4.5 volts
	2D1e	P8-7 Low Fuel Level Sensor	On - off output from fuel tank sensor
	2D1f	P8-8 Right outrigger Down Press Sensor	Actual pressure indicated between 1.5 and 4.5 volts
	2D1g	P8-9 Level Cylinder pressure measure	Output from level cylinder pressure transducer in volts
	2D2	GP440 ANALOG INPUTS	Enter to view inputs from upper controls joysticks & switches



**Table 4-3:** EZ-Cal Diagnostics Menu

SELECTION	ID #	EZ-cal Readout	Explanation
Sub Menu Press ENTER	2D2a	P6-1 Boom Up/ Down variable input	Actual position of Boom joystick between 1 and 5 volts
	2D2b	P6-2 Tele in/out variable input	Actual position of Telescope joystick between 1 and 5 volts
	2D2c	P6-3 Boom/Tele enable input	On - off output from Boom/Telescope joystick button
	2D2d	P7-1 Platform Slide in/out variable input	Actual position of Plat Slide joystick between 1 and 5 volts
	2D2e	P7-2 Platform Rotate variable input	Actual position of Rotate joystick between 1 and 5 volts
	2D2f	P7-3 Platform Slide/Rot enable input	On - off output from Slide/Rotate joystick button
	2D2g	P8-1 Rotation Sensor A input	States position of platform rotation in voltage ~2.5v = centered
	2D2h	P8-2 Rotation Sensor B Input	States position of platform rotation in voltage ~2.5v = centered
	2D2i	P10-1 Drive fwd/ Rev variable input	Actual position of Drive joystick between 1 and 5 volts
	2D3	MATRIX ANALOG INPUTS (CE Cert Only)	Enter to view inputs from chassis sensors and switches
	M2-6	Valve Current Measurement	Currently not available
2E OUTPUTS	2E1	GP400 OUTPUTS	Enter to view outputs from Lower control module
		Individual input not listed separately	Display changes from OFF to On when power signal is sent
	2E2	GP440 OUTPUTS	Enter to view outputs from Upper control module
		Individual input not listed separately	Display changes from OFF to On when power signal is sent
	2E3	MATRIX OUTPUTS (CE Cert Only)	Enter to view outputs from Lower control module
		Individual input not listed separately	Display changes from OFF to On when power signal is sent
2F LOG	2F1	Cal Date	Date entered after last calibration completed
	2F2	Software	Software revision number
	2F3	Max Battery	Maximum battery voltage recorded.



## EZ-CAL MESSAGES

"Help Messages" will appear on the EZ-Cal scan tool as a means of explaining operating and non-operating function(s) and system errors or interruptions that are accompanied by flash codes. It can also be used for verifying system operation. On Titan models, the EZ-Cal is conveniently located inside the lower control box. Refer to the EZ-Cal Instruction page for additional help with EZ-Cal operation.

To access messages, power the system up, (it is not necessary to have the engine running) the EZ-Cal display will illuminate and read "HELP - PRESS ENTER". Press ENTER to view current message. Press ENTER a second time then use right and left arrow buttons to access up 30 logged messages from the memory. Many messages simply detail operations being performed by the GP400; other messages detail occurrences that also take place during operation either normal or may be symptomatic of a malfunction.

## OPERATIONAL MESSAGES

The following messages appear as result of normal operation and usually do not represent a problem.

**EVERYTHING OK** \_\_\_\_\_ **Flash Code: None**

- All circuits performing properly, no current operation performed.

**GROUND MODE ACTIVE** \_\_\_\_\_ **Flash Code: None**

- Base/Platform selector switch set to base control station.

**STARTUP** \_\_\_\_\_ **Flash Code: None**

- GP400 performing start up procedure, normally a short sequence.

**MOVING FRAME** \_\_\_\_\_ **Flash Code: None**

- Chassis level in progress.

**MOVING PLATFORM** \_\_\_\_\_ **Flash Code: None**

- Platform level in progress

**TELESCOPING** \_\_\_\_\_ **Flash Code: None**

- Boom extend/retract (telescope) in progress

**LIFTING** \_\_\_\_\_ **Flash Code: None**

- Boom lift up in progress

**LOWERING** \_\_\_\_\_ **Flash Code: None**

- Boom Lower down in progress

**DRIVING** \_\_\_\_\_ **Flash Code: None**

- Drive forward or reverse in progress

**VEHICLE TILTED** \_\_\_\_\_ **Flash Code: None**

- Chassis is tilted beyond pre-set maximum. Use auto-level feature to level chassis or re-position the machine.

## CAN BUS RELATED MESSAGES

CAN bus communication system is the network by which the control modules and CAN Tilt modules communicate with the GP400.



**NO DATA FROM CAN TILT #1** \_\_\_\_\_ **Flash Code: None**

- CAN Tilt module mounted to front of main boom (located behind panel, Left Module) has malfunctioned or wiring is damaged.

**NO DATA FROM CAN TILT #2** \_\_\_\_\_ **Flash Code: None**

- CAN Tilt module mounted to Front axle has malfunctioned or wiring is damaged.

**NO DATA FROM CAN TILT #3** \_\_\_\_\_ **Flash Code: None**

- CAN Tilt module mounted to front of main boom (located behind panel, Right Module) has malfunctioned or wiring is damaged.

**NO DATA FROM CAN TILT #4** \_\_\_\_\_ **Flash Code: None**

- CAN Tilt module mounted to Rear axle has malfunctioned or wiring is damaged.

**FAULT: CAN BUS!** \_\_\_\_\_ **Flash Code: 6/6**

- The CAN bus cable may be damaged or disconnected from one or more of the modules. All modules must be connected to the CAN bus for machine operation.

**CALIBRATION RELATED MESSAGES**

The following messages appear when the GP400 microprocessor has not been calibrated or was improperly calibrated.

**FACTORY OVERRIDE** \_\_\_\_\_ **FAST FLASH**

- GP400 is shipped in this condition to allow temporary operation of the machine without interruption from the safety system so that calibration procedures can be performed. The GP400 must be prepared for the machine to which it will be installed, including calibration and Customer/model selection. See "GP400 Setup" for instructions. Once Calibrated, Factory Override is gone forever.



**ALL SAFETY SETTINGS ARE INACTIVE WHEN THE GP400 IS IN FACTORY OVERRIDE, NEVER OPERATE MACHINE IN FACTORY OVERRIDE EXCEPT TO CALIBRATE THE GP400.**

**NOT CALIBRATED** \_\_\_\_\_ **Flash Code: 1/1**

- The GP 400 microprocessor has not been calibrated. Operation will be restricted until calibration is completed. Refer to "Set up procedures" in this section for calibration information and instructions.

**HEIGHT NOT CALIBRATED** \_\_\_\_\_ **Flash Code: 1/1**

- The Height portion of the calibration has not been completed. Operation will be restricted until calibration is completed. Refer to "Set up procedures" in this section for calibration information and instructions.

**FUNCTIONS LOCKED - NOT CALIBRATED** \_\_\_\_\_ **Flash Code: 1/1**

- The GP 400 microprocessor has not been calibrated. Operation will be restricted until calibration is completed. Refer to "Set up procedures" in this section for calibration instructions.

**FAULT: CUSTOMER** \_\_\_\_\_ **Flash Code: 1/1**

- Customer vs. Model settings not correct. Using the EZ-Cal, go to SETUPS/CHANGE DEFAULTS/CUSTOMER to correct. Changing customer or model will require access level 1 code. NOTE: all adjustments and settings return to default value when Customer or Model is changed, ensure proper settings and adjustments after changing Customer or Model.



## INTERLOCK MESSAGES

The following messages appear as result of perceived improper operation, machine positioning, or other incorrect operation. Interlock messages may be the result of a part failure if the part in question provides incorrect information to the GP400.

### **FUNCTIONS LOCKED - LIMIT REACHED** \_\_\_\_\_ **Flash Code: 2/2**

- Rotating platform not centered; Certain operations require centered platform

Rotating platform at extreme CW or CCW; no further rotation possible in that direction

### **FUNCTIONS LOCKED - TEST MODE SELECTED** \_\_\_\_\_ **Flash Code: 2/2**

- Calibration in progress or internal test mode active. Cycle EMS to clear.

### **FUNCTIONS LOCKED - OUTRIGGERS** \_\_\_\_\_ **Flash Code: 2/2**

- Stabilizers must be set before operation is allowed.

### **FUNCTIONS LOCKED - OVERLOADED** \_\_\_\_\_ **Flash Code: 2/2**

- Platform overloaded - reduce weight in platform until alarms stop (Overload option only)

### **FUNCTIONS LOCKED - UNDERLOADED** \_\_\_\_\_ **Flash Code: 2/2**

- Overload system detects less than normal lift cylinder pressure. Platform resting atop a fixed object, possible pressure switch failure or not calibrated correctly.

### **FUNCTIONS LOCKED - TILTED** \_\_\_\_\_ **Flash Code: 2/2**

- Platform sensors indicate platform out of level; level platform or chassis until alarm stops or re-position machine

### **FUNCTIONS LOCKED - AUTO PLATFORM LEVEL** \_\_\_\_\_ **Flash Code: 2/2**

- Auto Platform Level operation running, wait until completed to operate other functions.

### **FUNCTIONS LOCKED - TOO HIGH** \_\_\_\_\_ **Flash Code: 2/2**

- Elevation sensor indicating elevation beyond 98%. Height Calibration performed incorrectly; Angle Transducer loose or remounted incorrectly or extend proximity switch/s failure. Use EZ-Cal in conjunction with EZ-Cal Flow Charts to identify GP400 or GP440 for sensor's inputs to check sensor readings.

### **FUNCTIONS LOCKED - EXTERNAL SHUTDOWN** \_\_\_\_\_ **Flash Code: 2/2**

- Boom not retracted or axle/s off level. Boom must be retracted to allow frame level, drive or outrigger operation. Axles must be centered before drive is allowed when the platform is elevated. Also, drive will be interrupted if Stabilizer pressure sensor output is below 0.2 volts (possible sensor failure or sensor wiring issue).

### **CHECK DRIVE/STEER SWITCHES** \_\_\_\_\_ **Flash Code: 2/2**

- Drive joystick output without enable or during power up. Check drive joystick analog output and steer switch digital output using the EZ-Cal.

### **CHECK LIFT SWITCHES** \_\_\_\_\_ **Flash Code: 2/2**

- Lift joystick or toggle switch movement without enable or during power up. Check joystick analog output using the EZ-Cal.

### **CHECK PLATFORM SWITCHES** \_\_\_\_\_ **Flash Code 2/2**

- Platform Rotate/slide joystick or toggle switch movement without enable or during power up. Check joystick analog output and switch digital outputs using the EZ-Cal.



**CHECK TELE SWITCHES** *Flash Code 2/2*

- Telescope joystick or toggle switch movement without enable or during power up. Check joystick analog output and switch digital output using the EZ-Cal.

**RELEASE ENABLE SWITCH** *Flash Code 2/2*

- One or more enable switches activated for extended period of time without corresponding function or during start up. Check enable switches digital outputs using the EZ-Cal.

**OTHER MESSAGES**

The following messages are the result of various possible failures or occurrences which may result in machine interruption.

**FUNCTIONS LOCKED - NO VALVE SUPPLY!** *Flash Code 2/3*

- GP400 detects no power on P7-1 of the GP400. Check wiring to plug connection; possible GP400 internal failure.

**FAULT: ENERGIZED VALVE** *Flash Code: 3/2*

- Power on valve output wire at GP400 plugs P4, P5 or P6. Unplug these connectors and cycle e-stop switch to clear code. Plug in one-at-a-time until code reappears then isolate the circuit (with voltage) within that plug. If code does not clear, possible GP400 failure. EZ-Cal not useful for this procedure.

**FAULT: VALVE FEEDBACK HIGH!** *Flash Code: 3/2*

- On start-up GP400 p-5 pin voltage incorrect, check P5-X wiring for voltage feed back. Possible GP400 internal fault

**FAULT: BAD INTERNAL SAFETY SWITCH!** *Flash Code: 3/4*

- At startup, internal feedback of output incorrect, possibly failed output driver; check wiring to P6-12/13/14/15; possible GP400 internal failure

**FAULT: LOW OIL PRESSURE!** *Flash Code: 4/1*

- Oil pressure switch opened during operation or time out. Check oil pressure, pressure switch, wiring. Message will appear if engine stops running for reasons other than normal shut down.

**FAULT: BAD INTERNAL SLAVE!** *Flash Code: 4/2*

- Malfunction within the GP400 possibly caused by a short circuit in the wiring or high voltage surge. Replace GP400

**FAULT: BAD INTERNAL 5 VOLTS!** *Flash Code: 4/2*

- 5 volt circuit that provides voltage to sensors had failed. Possible short in the wiring or high voltage surge on supply.

**FAULT: BATTERY VOLTAGE TOO LOW!** *Flash Code: 4/4*

- Charge battery and battery connections, check charging system and voltage source connections.

**FAULT: BATTERY VOLTAGE TOO HIGH!** *Flash Code: 4/4*

- GP400 input voltage should be 12 volts. Check battery and battery connections, alternator output.

**FAULT: CHECK HEIGHT 2 SENSOR!** *Flash Code 6/1*

- Height 2 sensor output over 4.5 volts or under .5 volts. Check height 2 sensor output using the EZ-Cal (height 2 sensor on CE option only). Possible sensor failure or wire connection failure.



**FAULT: CHECK HEIGHT 1 SENSOR! \_\_\_\_\_ Flash Code 6/1**

- Height 1 sensor output over 4.5 volts or under .5 volts. Check height 1 sensor output using the EZ-Cal. Possible sensor failure or wire connection failure.

**FAULT: CHECK HEIGHT SENSORS! \_\_\_\_\_ Flash Code 6/1**

- Voltage from Height sensors out of range, should be .5 volts to 4.5 volts

**FAULT: CHECK PRESSURE SENSOR! \_\_\_\_\_ Flash Code 6/2**

- Voltage from Pressure sensor out of range, should be .5 to 4.5 volts (Overload option only).

**FAULT: CHECK ELEVATION SWITCH! \_\_\_\_\_ Flash Code 6/3**

- This message should not occur on Titan models; check for incorrect GP 400 part.

**FAULT: SOME BIG BAD PROBLEM! \_\_\_\_\_ Flash Code 9/9**

A failure happened that has no message associated with it. This should never occur.



## TROUBLESHOOTING CHART

The following chart describes the possible causes for inoperation of the different functions of the Titan Boom 60-S. The *Causes* and *Solutions* columns list various points of references that can be found in the Hydraulic, Electrical, Schematics and Troubleshooting sections of this manual.

The majority of electrical troubleshooting on this model will require the use of the on-board EZ-Cal scan tool, located inside the lower control box door. Please refer to "EZ-Cal Scan Tools" on page 4-8 for further instructions on the use of the EZ-Cal scan tool.

Perform a full assessment of machine operations prior to troubleshooting this model and using this chart. This model is operated by a Microprocessor Control System equipped with a variety of built-in safety interlocks to prevent continued operation in the event of a failure or misoperation. Some interlocks may only be detected through the use of the EZ-Cal.

**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
General Power Issue		
No operation from upper or lower control station	Main battery switch turned off	Located left of lower control box
	Emergency stop switch pushed in; Ignition switch turned off; Faulty switches	Upper or lower e-stop switch or ignition switch will cut all power as will the ignition switch in the platform control box
	Battery discharged or faulty cables	Will receive 4-4 or 7-7 flash on GP400. Clean, service and charge battery - repair cables
	Circuit breaker tripped	Located in lower control box. Look for short circuit and/or damage in wiring or high amperage draw at valve coils or engine actuators.
	Damaged upper control box harness-- Should be able to operate from Lower Controls Box	Inspect the harnesses and harness plugs for damage or broken wires - May receive 6-6 flash code on GP-400 (CAN-bus) or no power at all
	Blown supply fuse	Locate source of short circuit. Inspect/replace fuse located just below Main Battery Switch.
	Other fault in system monitored by GP400	Check Help message on EZ-Cal or check flash code for error
Operates from lower controls but not from upper controls	Base/Platform select switch not set to Platform position or switch malfunction	Ensure that the switch is in the Platform position; Check switch function.
	Interlock switch (joystick)	Check power to red wire (power to switch) and power to purple wire (power out of switch) at joystick plug
	Damaged upper control box harness	Inspect the harnesses and harness plugs for damage or broken wires.
	Malfunctioning Matrix Module-- machines with optional Overload Sensing System only	Check help messages using the EZ-Cal tool. Also check for joystick inputs (see 2b1 - 2b7 in diagnostic chart)
	System interlock	Check EZ-Cal HELP messages for interlock



**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
ENGINE RELATED ISSUES		
Starter will not crank from upper or lower stations	Battery discharged or faulty cables	Will receive 4-4 or 7-7 flash on GP400. Clean, service and charge battery; repair cables.
	Malfunctioning start relay or fuse	Test/replace relay located on left hand side of engine and fuse located near starter.
	Malfunctioning starter	Test/replace starter.
	Faulty start switch either location	Test; replace as necessary.
	Oil pressure switch failure	Check that oil pressure switch is not shorted, closed.
	Starter interrupt system initiated	Check for red "Start Disable" light on lower panel Starter may be operated for 10 seconds before a 30 second "cool down" is initiated. See "Starter cranks but engine will not start" below.
	Poor ground on GP400	Check wiring and connections; replace
Starter cranks but engine will not start	Low fuel	Check/fill fuel reservoir.
	Air trapped in the fuel system	Purge air from the fuel system (see section 3 of this manual for instructions).
	Restriction in the fuel system	Replace Fuel Filter; Check fuel supply hoses .
	Malfunctioning fuel solenoid	Check/replace fuel solenoid located on the front of the engine, accessed from right hand side.
	Malfunctioning Glow plugs (cold climates)	Test/replace glow plug relay, fuse and glow plugs.
	Obstructed air filter	Clean/replace air filter.
	Contaminated fuel	Test/replace fuel.
	Other engine issues	See engine manufacturers troubleshooting guide.
No high throttle	Malfunctioning Throttle Relay, Solenoid or blown fuse	Test/replace throttle relay and/or throttle solenoid and fuse.
	Restriction in the fuel system	Replace Fuel Filter; Check fuel supply hoses.
	Obstructed air filter	Clean/replace air filter.
	Other engine issues	See engine manufacturers troubleshooting guide.



**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
BOOM LIFT/LOWER Platform will not raise	Excessive weight on platform	Reduce weight to specified platform capacity
	Boom extended excessively with outriggers not deployed	Retract boom until boom up/down operates.
	Main Relief Valve out of adjustment	Adjust Main Relief Valve to rated platform capacity located on function manifold - see hydraulic section.
	Lift Valve SVD1 not energized	Check wiring to lift valve, Check for EZ-Cal message or flash code.
	Lift Valve SVD1 not shifting	Clean debris, Check for damage, replace.
	Proportional valve SP1 not energizing	Check wiring to lift valve, Check for EZ-Cal message or flash code.
	Proportional valve SP1 not shifting	Clean debris; Check for damage; Replace.
	Solenoid Valve SV1 (load sense dump) not energized	Check wiring to valve; Check EZ-Cal ref. P4-14 for output.
	Solenoid Valve SV1 (load sense dump) not shifting	Clean debris; Check for damage; Replace.
	Level sensor out of level (platform elevated above 10 ft. (3m))	Reposition or level platform using platform level toggle. Check level sensor signal using EZ-Cal ID#s 2a6 and 2a4.
	Main system pressure is inadequate	Check pump output flow and pressure.
	Lift/Lower joystick inoperative	Check joystick output using EZ-Cal ref. 2d-2, P6-1 for analog output signal.
	Battery discharged/No charge output	Check battery voltage, alternator output (14.5 volts). Check GP400 for 4-4 flash code.
	System interlock	Check EZ-Cal HELP messages for interlock.
Platform will not lower or lowers slowly	Maintenance lock in maintenance position	Return maintenance lock to the stowed position.
	Boom extended excessively with stabilizers not deployed	Retract boom until boom up/down operates .
	Lowering valve SVD1 not energized	Check wiring to lowering valve located inside control module - see Section 1 of this manual for exact location.
	Lowering valve SVD1 not shifting	Clean debris; Check for damage; Replace.
	System interlock	Check EZ-Cal HELP messages for interlock.
Emergency Lowering not working	Emergency Battery discharged/not charging	Check/charge battery; Check charge Isolator relay and fuse; Check alternator output (14.5 volts).
	Auxiliary power unit malfunction	Check Auxiliary power unit, located below lower control box.
	Emergency Down switch failure	Check/replace switch.
	Lowering valve not shifting	Clean debris; Check for damage; Replace.
	Battery discharged/No charge output	Check battery voltage, alternator output (14.5 volts); Clean, service and charge battery.



**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
BOOM EXTEND/ RETRACT		
No Boom Extension	Excessive weight on Platform	Reduce weight to specified platform capacity.
	Boom extended too far without stabilizer deployment (Boom extension beyond approximately 8 ft. * (3m) * requires deployment) *7 ft (2.1 m) on machines equipped with optional Overload Sensing System.	Return boom to fully stowed position and deploy stabilizers before attempting to extend boom further.
	Level sensor out of level (platform elevated above 10 ft. (2.45 m)	Reposition or level platform using platform level toggle. Check level sensor signal using EZ-Cal ID#s 2a7 and 2a4.
	Extend Relief Valve RV1 out of adjustment	Adjust Extend relief valve (see Section 1 - Hydraulics) located on function manifold.
	Proportional Valve SP2 not energized	Check wiring to lift valve, Check for EZ-Cal message or flash code.
	Solenoid Valve SV1 (load sense dump) not energized	Check wiring to valve, Check EZ-Cal ref.P4-14 for output.
	Proportional Valve SP2 not shifting	Clean debris; Check for damage; Replace.
	Ext/Retract joystick inoperative	Check Joystick output using EZ-Cal ref. 2d-2, P6-2 for upper control analog output signal.
	Battery discharged/No charge output	Check battery voltage, alternator output (14.5 volts) Check GP400 for 4-4 flash code.
	System interlock	Check EZ-Cal HELP messages for interlock.
Boom extends/retracts slowly	Excessive weight on Platform	Reduce weight to specified platform capacity.
	Extend Relief Valve RV1 out of adjustment	Adjust Extend Relief Valve (see hydraulics section) located on function manifold.
	Proportional Valve SP2 not shifting completely	Clean debris; Check for damage; Replace.
	Flow Control Valve EP2 not shifting completely	Clean debris; Check for damage; Replace.
	Joystick output restricted	Check Joystick output using EZ-Cal ref. 2d-2, P6-2 for upper control analog output signal.
No Boom Retract	Proportional Valve SP2 not energized	Check wiring to lift valve; Check for EZ-Cal message or flash code.
	Proportional valve SP2 not shifting	Clean debris; Check for damage; Replace.
	Solenoid Valve SV1 (load sense dump) not energized	Check wiring to valve; Check EZ-Cal ref. P4-14 for output.
	Solenoid Valve SV1 (load sense dump) not shifting	Clean debris; Check for damage; Replace.
	Ext/Retract joystick inoperative	Check Joystick output using EZ-Cal ref. 2d-2, P6-2 for upper control analog output signal.
	Battery discharged/No charge output	Check battery voltage, alternator output (14.5 volts) Check GP400 for 4-4 flash code.
	System interlock	Check EZ-Cal HELP messages for interlock.



**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
<b>PLATFORM AUTO-LEVEL</b>		
Platform will not remain level while elevating or lowering platform (level cylinder not moving at all)	Platform Level solenoid valve not energized	Check wiring to valve, Check EZ-Cal ref. 2e1, P4-4 (up) and P4-5 (down) for output.
	Platform Level solenoid valve not shifting	Clean debris; Check for damage; Replace.
	Platform Level proportional valve SP7 not energized	Check wiring to valve from Valve Constant Current Module (VCCM).
	Platform Level proportional valve SP7 not shifting	Clean debris; Check for damage; Replace.
	Counterbalance valve CBV19 or CBV20 faulty	CBV15 (extend) CBV16 (retract) must not be adjusted, replace if suspected.
	Flow Compensator valve EP3 not shifting	Clean debris; Check for damage; Replace. Use GLS port on secondary manifold to test valve signal pressure.
	Flow Regulator valve EPFR1 not shifting	Clean debris; Check for damage; Replace. Use GLS port on secondary manifold to test valve signal pressure.
	Obstruction in Platform Level Valve	Clean debris; Check for damage; Replace.
	Platform Level Valve not energized	Check wiring to valve.
	Platform in excess of 7° out of level	Use the Manual Platform Level function to return the platform to level.
Platform will not remain level while elevating or lowering platform (level cylinder moving slowly)	Excessive weight on platform	Reduce weight to specified platform capacity.
	Low Flow Relief Valve RV3 out of adjustment	Adjust low flow relief valve (see Section of this manual) located on function manifold.
	Platform Level solenoid valve SP7 not shifting completely	Clean debris; Check for damage; Replace.
	Flow Compensator valve EP3 not shifting completely	Clean debris; Check for damage; Replace. Use GLS port on secondary manifold to test valve signal pressure.
	Flow regulator valve EPFR1 not shifting completely	Clean debris; Check for damage; Replace. Use GLS port on secondary manifold to test valve signal pressure.
	Pump P3 faulty	Test; replace pump.
	Obstruction in Platform Level Valve	Clean debris; Check for damage; Replace.
	Platform Level Valve not energized	Check wiring to valve.
	Platform in excess of 7° out of level	Use the Manual Platform Level function to return the platform to level.
<b>PLATFORM MANUAL LEVEL</b>		
Platform level operates automatically but not manually	Platform Level toggle switch inoperative	Check output from toggle using EZ-Cal --Lower Controls -- see I.D. #2c-1, P15-3 (up) or 2c-1, P15-6 (down) --Upper Controls -- see I.D. #2c-2, P14-11 (up) or 2c2, P14-12 (down)
	System Interlock	Check EZ-Cal HELP message for interlock .



**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
<b>PLATFORM ROTATE</b>		
Platform will not rotate either direction	Rotate Valve SP8 not energizing	Check wiring to valve from Valve Constant Current Module (VCCM).
	Rotate Valve SP8 not shifting	Clean debris; Check for damage; Replace.
	Mechanical interference in rotator	Inspect, clean or repair.
	Flow Compensator valve EP3 not shifting	Clean debris; Check for damage; Replace. Use GLS port on secondary manifold to test valve signal pressure.
	Flow Regulator valve EPFR1 not shifting	Clean debris; Check for damage; Replace. Use GLS port on secondary manifold to test valve signal pressure.
	System interlock	Check EZ-Cal HELP messages for interlock.
Platform will rotate in one direction only	Rotate Valve SP8 not energizing	Check wiring to valve from Valve Constant Current Module (VCCM).
	Rotate Valve SP8 not shifting	Clean debris; Check for damage; Replace.
	Mechanical interference in rotator	Inspect, clean or repair.
	System interlock	Check EZ-Cal HELP messages for interlock.
<b>PLATFORM SLIDE</b>		
Platform will not slide either direction	Excessive weight in platform or weight not distributed correctly	Reduce weight or redistribute weight in platform, not to exceed 3000 lbs in the load zone and 1000 lbs distributed evenly outside the load zone.
	Slide Valve SP9 not energizing	Check wiring to valve from Valve Constant Current Module (VCCM)
	Slide Valve SP9 not shifting	Clean debris; Check for damage; Replace.
	Mechanical interference on slide path	Inspect, clean or repair.
	Slide Brake BR5 not releasing	Check for hydraulic pressure to brake; Check brake unit for mechanical issue
	Flow Compensator valve EP3 not shifting	Clean debris; Check for damage; Replace. Use GLS port on secondary manifold to test valve signal pressure.
	Flow regulator valve EPFR1 not shifting	Clean debris; Check for damage; Replace. Use GLS port on secondary manifold to test valve signal pressure.
	System interlock	Check EZ-Cal HELP messages for interlock
	Shims too tight	Check shim clearance of Platform Carriage; should be .030" (.762 mm) total clearance top-to-bottom and side-to-side
Platform will slide in one direction only	Excessive weight in platform or weight not distributed correctly	reduce weight or redistribute weight in platform not to exceed 3000 lbs in the load zone and 1000 lbs distributed evenly
	Slide Valve SP9 not energizing	Check wiring to valve from Valve Constant Current Module (VCCM)
	Slide valve SP9 not shifting	Clean debris; Check for damage; Replace.
	Mechanical interference in slide path	Inspect, clean or repair
	System interlock	Check EZ-Cal HELP messages for interlock
	Shims too tight	Check shim clearance of Platform Carriage; should be .030" (.762 mm) total clearance top-to-bottom and side-to-side



**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
<b>DRIVE</b>		
No drive operation NOTE: Drive function on the Titan 60-S cuts out when the boom is extended beyond 14 feet (4.2 m).	Stabilizers not raised off of ground	Return Boom to stowed position and raise stabilizers
	Stabilizer pressure sensor/s inoperative	Check Stabilizer pressure sensors using EZ-Cal (see EZ-Cal I.D.# 2d1, P8-5 and 2d1, P8-8. Should should read 0.0 volts each.
	Planetary hub bypass engaged	Check bypass plates located in the center of each planetary hub, should be convex - turn over.
	Drive Valve (on drive pump) not shifting	Check drive output from GP400 (see EZ-Cal chart ID#s 2e1, P5-7 and P5-8). Check connections at valve located on top of drive pump. Check drive valve for contamination.
	Brakes not releasing	Check brake valve and brake pressure (see hydraulic diagram for location).
	Drive joystick output failure	Check drive joystick output from GP400 (see 2d2, P10-1) check joystick enable trigger operation, Check wire connections.
	System interlock	Check EZ-Cal HELP messages for interlock.
	Low pump stand-by pressure	Check at main manifold port GCP, (See Hydraulics section of this manual). Should be 300 PSI (21 bar) - Adjust stand-by pressure.
	Incorrectly adjusted or worn hydraulic drive pump	See Hydraulics section of this manual for pump adjustment, inspect or replace pump.
No drive with platform elevated NOTE: Drive function on the Titan 60-S cuts out when the boom is extended beyond 14 feet (4.2 m).	Unit out of level	Lower boom and operate on more level surfaces.
	Outriggers deployed	Lower platform and retract outriggers.
	Low pump stand-by pressure	Check at main manifold port GCP, (See Hydraulics section of this manual). Should be 300 PSI (21 bar) - Adjust stand-by pressure.
	System interlock	Check EZ-Cal HELP messages for interlock.
Slow drive with Platform in stowed position	Slow speed enabled	Check speed switch in platform box; check 2-speed valve located on the main manifold (see Schematics section of this manual).
	Low pump stand-by pressure	Check at main manifold port GCP, (see Hydraulics section of this manual). Should be 300 PSI (21 bar) - Adjust stand-by pressure.
	FWD MAX, REV MAX setting incorrect	Reset drive speeds using EZ-Cal.
	Wheel motor not functioning correctly	Inspect wheel motors for damage or wear.
Poor Gradeability or Drive performance	High Speed enabled	Check Speed Switch.
	Wheel motor not functioning correctly	Inspect wheel motors for excessive bypass.
	Planetary hub bypass engaged	Check bypass plates located in the center of each planetary hub, should be convex - turn over.
	Low pump stand-by pressure	Check at main manifold port GCP, (see Hydraulics section of this manual). Should be 300 PSI (21 bar) - Adjust stand-by pressure.
	Incorrectly adjusted or worn hydraulic drive pump	See Hydraulics section of this manual for pump adjustment; inspect or replace pump.
Drive in one direction only	Drive valve not energizing in one direction	Check 12 volts to coil, check coil, check valve function (located on top of drive pump).
	No output from GP400	Check switch position output from GP400 (see EZ-Cal ID# 2e1, P5-7 and P5-8).



**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
No High Speed	Speed selector switch inoperative	Check continuity through Speed Select switch with wires disconnected.
	2-speed valve SV7 not functioning	Check for 12 volts and ground to valve; check for faulty valve spool; check switch position output from GP400 (See EZ-Cal ID# 2e1, P5-9).
Variable elevated speed	Variable hydraulic oil temperature	Out of the stowed position, each machine is set to drive 10m (33 ft) in 30 seconds with the hydraulic oil at 50° C (122° F), at a speed of .33 m/s (.74 mph). Through testing, this setting causes the speed to increase to 10m in 25 seconds [.40 m/s (.9 mph)] at an oil temperature of 20° C (68° F), and 10m in 18 seconds [.55 m/s (1.23 mph)] at an oil temperature of 0° C (32° F). Although colder ambient temperatures are likely, once the engine has started and hydraulic oil has been circulating, it very quickly reaches 0° C (32° F) and therefore the elevated driving speed should not exceed .7 m/s (1.57 mph).
<b>STEER</b>		
No steer in either direction (2-wheel steer mode)	Stabilizers not raised off of ground	Return Boom to stowed position and raise stabilizers.
	Joystick rocker switch inoperative	Check continuity through micro-switch inside joystick handle using wires outside the handle.
	Steering valve inoperative	Check steering valve for power. Check for damage and contamination. check output from GP400 (see EZ-Cal ID # 2e1, P5-2 and P5-3).
	Hoses connected incorrectly	See Chapter 1 -- Hydraulics for correct connection.
	Steer Cross-Port Relief valve/s CR1 and CR2 set too low	Set steer relief valves to 1500 PSI (103 bar) (see hydraulic diagram for relief valves location).
	System interlock	Check EZ-Cal HELP messages for interlock.
Steer in one direction only	Steering Valve inoperative or stuck	Inspect and/or replace Steering Valve.
	No power to steering coil	Check for power and ground in both directions; repair wiring; check output from GP400 (see EZ-Cal I.D. #S. 2f-11 right & 2f-12 left).
	System interlock	Check EZ-Cal HELP messages for interlock.
Will steer but not fully, or slow steering	Failure of one or both steering cylinder internal seals	Check steering cylinder seals, replace.
	Steer Cross-Port Relief valve(s) set too low	Set steer relief valves to 1500 PSI (103 bar) (see hydraulic diagram for relief valves location).
	King pin(s) seizing in the bore	Disassemble and inspect, replace bushings.
	4-wheel steer valve SVD2 not energizing	Check wiring to valve. Check EZ-Cal ref. 2e1, P4-2 and P4-3 for output.
	4-wheel steer valve SVD2 not shifting	Clean debris; Check for damage; Replace.
	Steer Cross-Port Relief valve CR1 defect	Check, adjust, replace.
	Rear axle steer cylinders damaged or internal seals leaking	Check cylinders, repair, replace.
Rear Wheel Steer operates uncommanded	Steer select toggle switch failure	Check toggle switch.
	4-Wheel Steer Valve SVD2 not shifting	Clean debris. Check for damage, replace.



**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
Outrigger, Frame Leveling		
No Outrigger operation Note: Outrigger operation is disabled when the boom is elevated above 6% and when boom is extended more than 1' (300mm).	System senses boom elevated to an angle above 6%	Return the boom to stowed position and try again.  Check elevation status using the EZ-Cal (see I.D. # 2a10). Recalibration of Height may be necessary (see Calibration section for instruction). Also see EZ-Cal I.D. # 2a7 for analog input from height sensor in %.
	System senses boom is extended beyond 12" (300mm)	Retract boom completely and try again.  Check Boom Retract status using the EZ-Cal (see I.D.# 2A-12). Also see # 2C-1 GP400 digitals--go to P14-4 for Retract Sensor output information.
	Unit on too extreme an angle side-to-side (chassis level must complete level cycle before outriggers deploy)	EZ-Cal Help message will read "LEVELING". Relocate machine to a more level surface.
	Outrigger/Auto-level switch inoperative	Check outrigger switch output (in the LOWER control box) using EZ-Cal; scan GP400 for switch inputs (see EZ-Cal I.D.# 2d1)--go to P8-3 and P8-4. Check outrigger switch in the UPPER control box using EZ-Cal, scan GP440 for switch inputs (see EZ-Cal I.D.# 2C-2 go to P14-9 & P14-10).
	Outrigger Valve SP3 or SP4 not energizing	Check wiring to outrigger valve. Check for EZ-Cal message or flash code.
	Outrigger Valve SP3 or SP4 not shifting	Clean debris; Check for damage; Replace.
	Frame Level Valve not functioning (chassis level must complete level cycle before outriggers deploy)	Located on function manifold. Inspect valve for power, inspect for damage, check output from GP400 (see EZ-Cal GP400 Outputs P4-7 (left) and P4-8 (right)).
Frame level operates but frame is not level when cycle is complete	Unit located on too extreme an angle side-to-side	Relocate unit to more level ground.
	Lower control box loose	Tighten four (4) lower control box mounting screws.
	Level sensor not properly calibrated (located inside the GP400).	See Calibration section for level sensor Calibration instructions.



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**NOTES:**

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# Section 5

## SCHEMATICS

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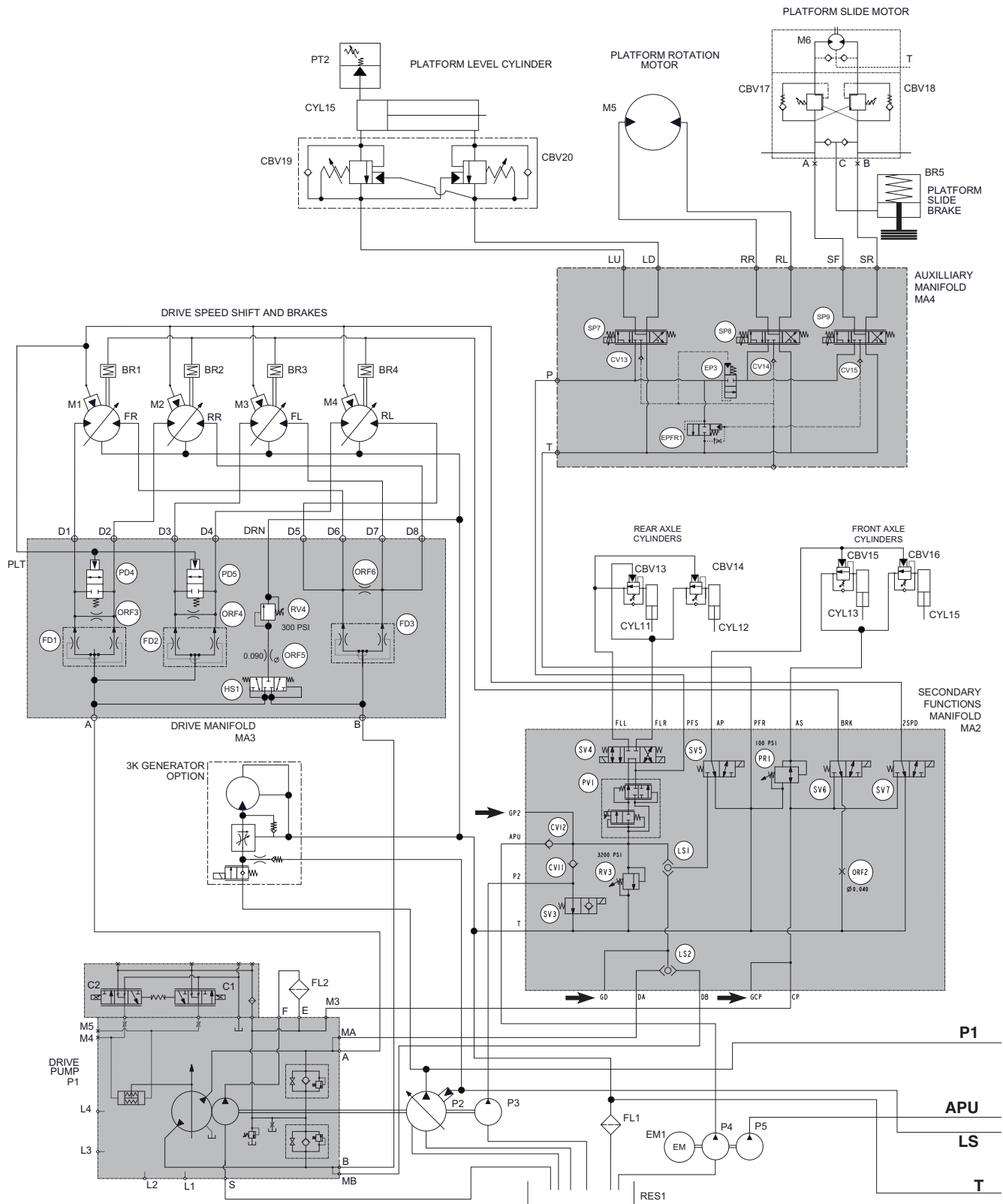
# HYDRAULIC SCHEMATICS

The following table applies to Figure 5-1 through Figure 5-7.

Callout	Description	Callout	Description
BR1-BR4	Wheel Brakes (located in gear hubs)	ORF4	Orifice -- Traction Manifold .052
BR5	Platform Slide Brake	ORF5	Orifice -- Traction Manifold .090
CBV1-CBV20	Counterbalance Valves	ORF6	Orifice -- Traction Manifold .040
CR1-CR2	Cross-Port Relief Valve	P1	Pump -- Drive
CV1	Check Valve -- Backflow Preventer P1	P2	Pump -- Primary Functions
CV2	Check Valve -- Load Sense, Lift/Lower	P3	Pump -- Secondary Functions
CV3	Check Valve -- Load Sense, Ext./Retr.	P4	Pump -- Auxiliary Power
CV4	Check Valve -- Front Outrigger	P5	Pump -- Auxiliary Power
CV5	Check Valve -- Front Outrigger	PD1	Pilot-Operated Valve
CV6	Check Valve -- Rear Outrigger	PD2	Pilot-Operated Valve
CV7	Check Valve -- Rear Outrigger	PD3	Pilot-Operated Valve
CV8	Check Valve -- Steering	PD4	Pilot-Operated Valve
CV9	Check Valve -- Steering	PD5	Pilot-Operated Valve
CV10	Check Valve -- Backflow Preventer APU	PR1	Pressure Reducing Valve
CV11	Check Valve -- Secondary Functions Manif.	PT1	Lift Cylinder Pressure Transducer
CV12	Check Valve -- Aux Power	PT2	Platform Level Cyl. Pressure Transducer
CV13	Check Valve -- Platform Level	PV1	Pilot Valve
CV14	Check Valve -- Platform Rotate	RV1	Relief Valve -- Extend
CV15	Check Valve -- Platform Slide	RV2	Relief Valve -- Auxiliary Power
CYL1	Boom Lift Cylinder	RV3	Relief Valve -- Low Flow
CYL2-CYL4	Boom Extend Cylinders	RV4	Relief Valve -- Traction Manifold
CYL5, CYL6	Front Outrigger Cylinders	SF1	Solenoid Valve -- Boom Retract
CYL7, CYL8	Rear Outrigger Cylinders	SP1	Proportional Valve -- Boom Lift
CYL9, CYL10	Steering Cylinders	SP2	Proportional Valve -- Boom Extend
CYL11, CYL12	Rear Axle Cylinders	SP3	Proportional Valve -- Front Outrigger
CYL13, CYL14	Front Axle Cylinders	SP4	Proportional Valve -- Front Outrigger
CYL15	Platform Level Cylinder	SP5	Proportional Valve -- Rear Outrigger
DC1	Steering Dual Check Valve	SP6	Proportional Valve -- Rear Outrigger
EM1	Electric Motor -- Auxiliary Power	SP7	Proportional Valve -- Platform Level
EP1	Flow Compensator -- Boom	SP8	Proportional Valve -- Platform Rotate
EP2	Flow Compensator -- Extend	SP9	Proportional Valve -- Platform Slide
EP3	Flow Compensator -- Auxiliary Manifold	SV1	Solenoid Valve -- Load Sense Dump
EPFR1	Flow Regulator	SV2	Solenoid Valve -- Boom Ext. Regen.
FD1	Flow Divider -- Traction Manifold	SV3	Solenoid Valve -- Low Flow Dump
FD2	Flow Divider -- Traction Manifold	SV4	Solenoid Valve -- Rear Axle
FD3	Flow Divider -- Traction Manifold	SV5	Solenoid Valve -- Front Axle
FL1	Filter -- Hydraulic Tank	SV6	Solenoid Valve -- Brake
FL2	Filter -- Charge	SV7	Solenoid Valve -- 2-Speed
HS1	Oil Shuttle Valve	SV8	Solenoid Valve -- Boom Up/Down Pilot
LS1	Load Sense Shuttle Valve	SVD1	Directional Valve
LS2	Load Sense Shuttle Valve	SVD2	Directional Valve
M1-M4	Wheel Motors		
M5	Platform Rotate Motor		
M6	Platform Slide Motor		
MA1	Primary Functions Manifold	Gauge Ports	
MA2	Secondary Functions Manifold	GCP	Gauge Port -- Charge Pressure
MA3	Drive Manifold	GD	Gauge Port -- Drive Pressure
MA4	Auxiliary Manifold	GLS	Gauge Port -- Load Sense
ORF1	Orifice -- Steer .090	GLS2	Gauge Port -- Load Sense, Platform
ORF2	Orifice -- Brake Apply .040	GP1	Gauge Port -- High Flow
ORF3	Orifice -- Traction Manifold .052	GP2	Gauge Port -- Low Flow



Figure 5-1: Hydraulic Schematic, 1 of 2

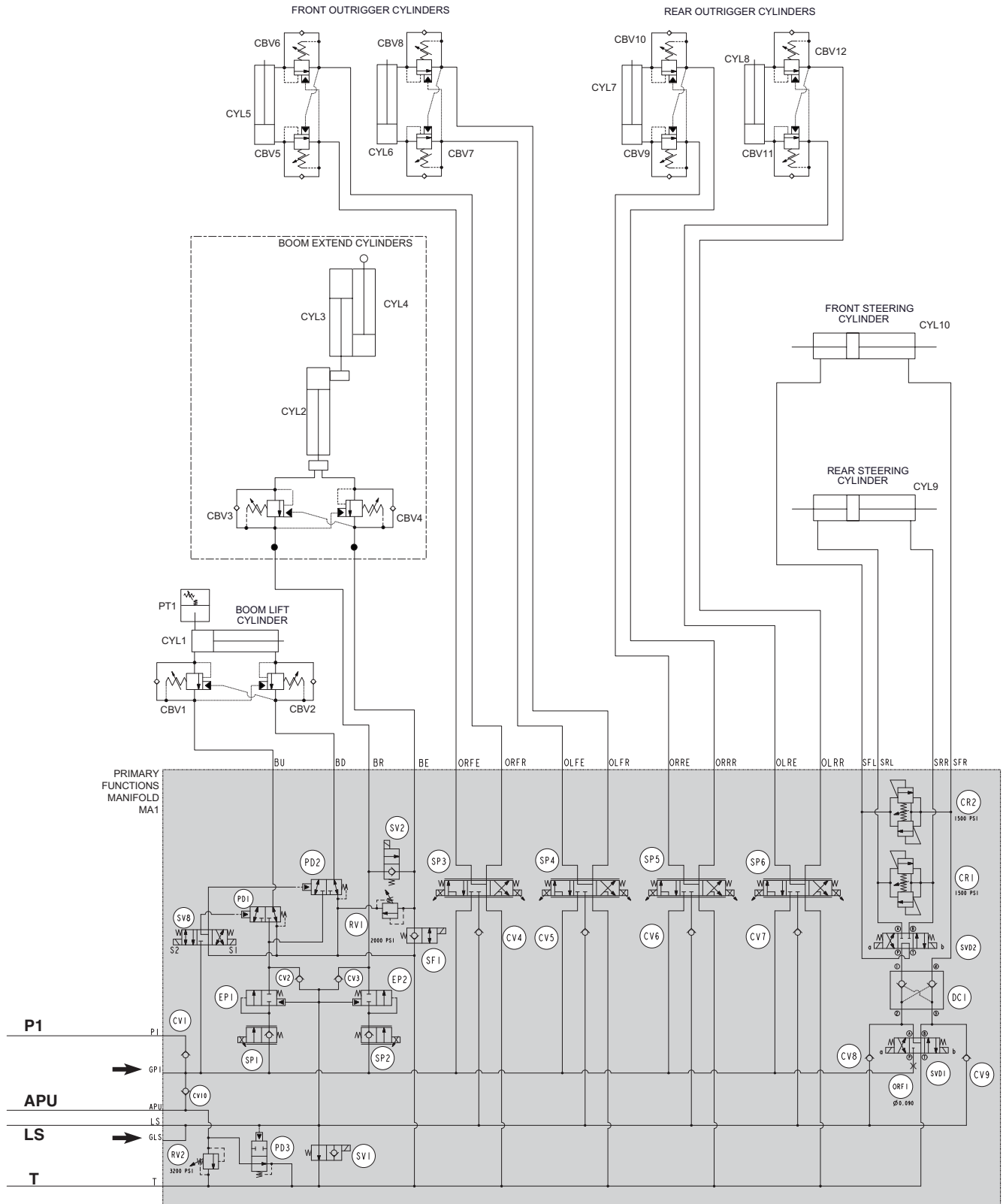


# Titan Boom 60-S HYDRAULIC SCHEMATIC, 1 of 2

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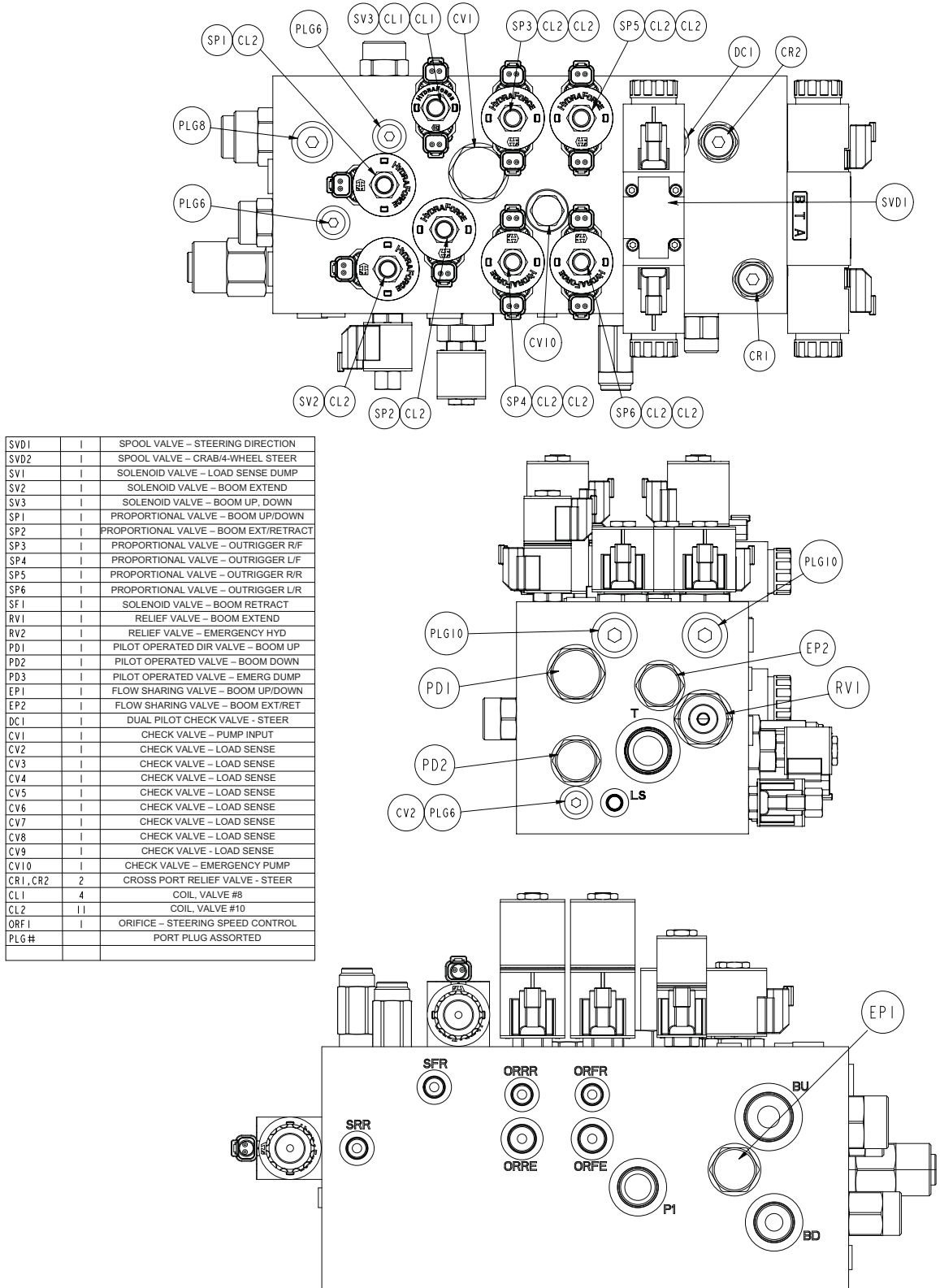
Figure 5-2: Hydraulic Schematic, 2 of 2



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Figure 5-3: Primary Functions Manifold, MA1, 1 of 2

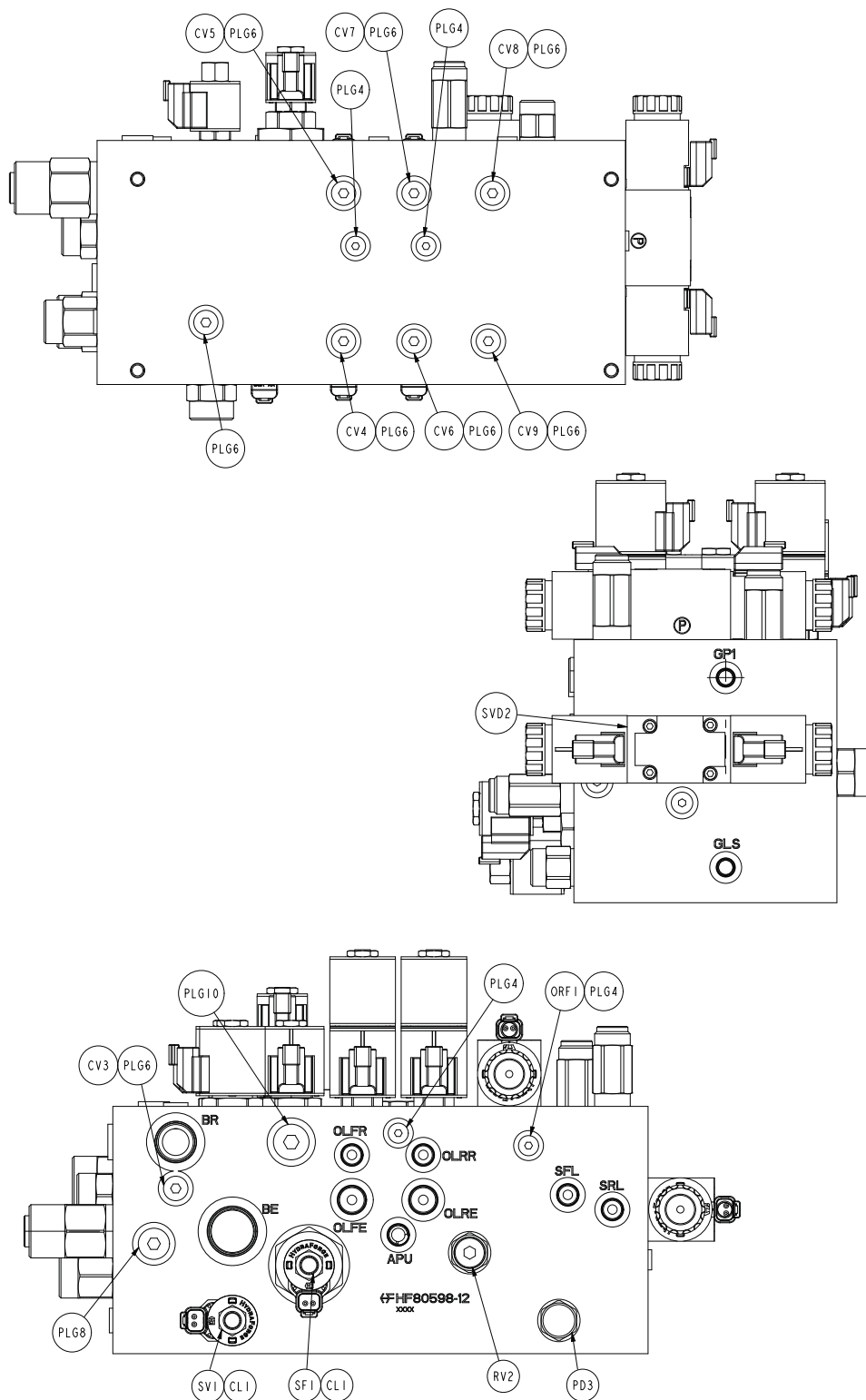


## Titan Boom 60-S

### MA1 -- Primary Functions Manifold Valves, 1 of 2

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ART\_4370



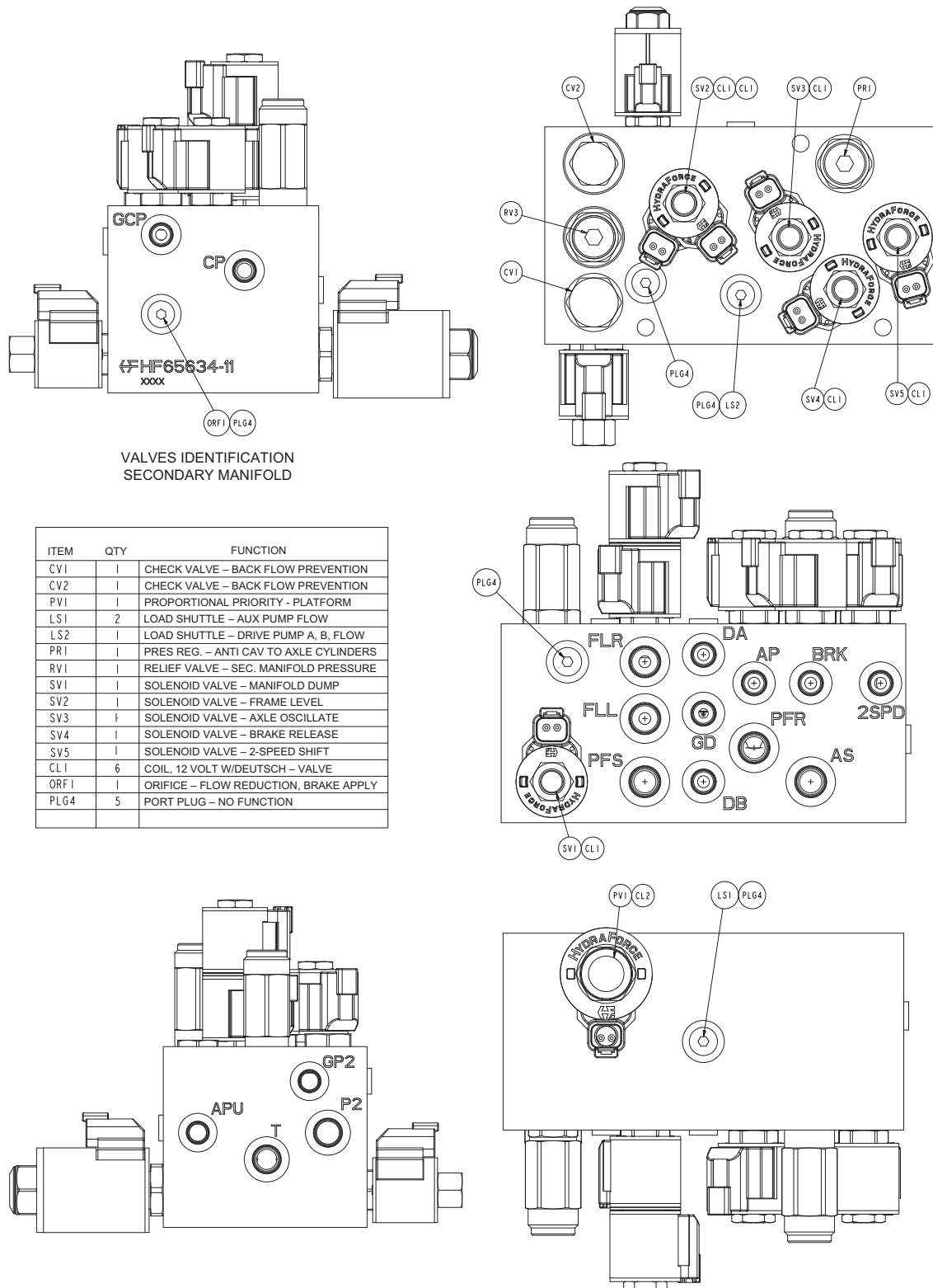
**Figure 5-4:** Primary Functions Manifold, MA1, 2 of 2

## Titan Boom 60-S

MA1 -- Primary Functions Manifold Valves, 2 of 2

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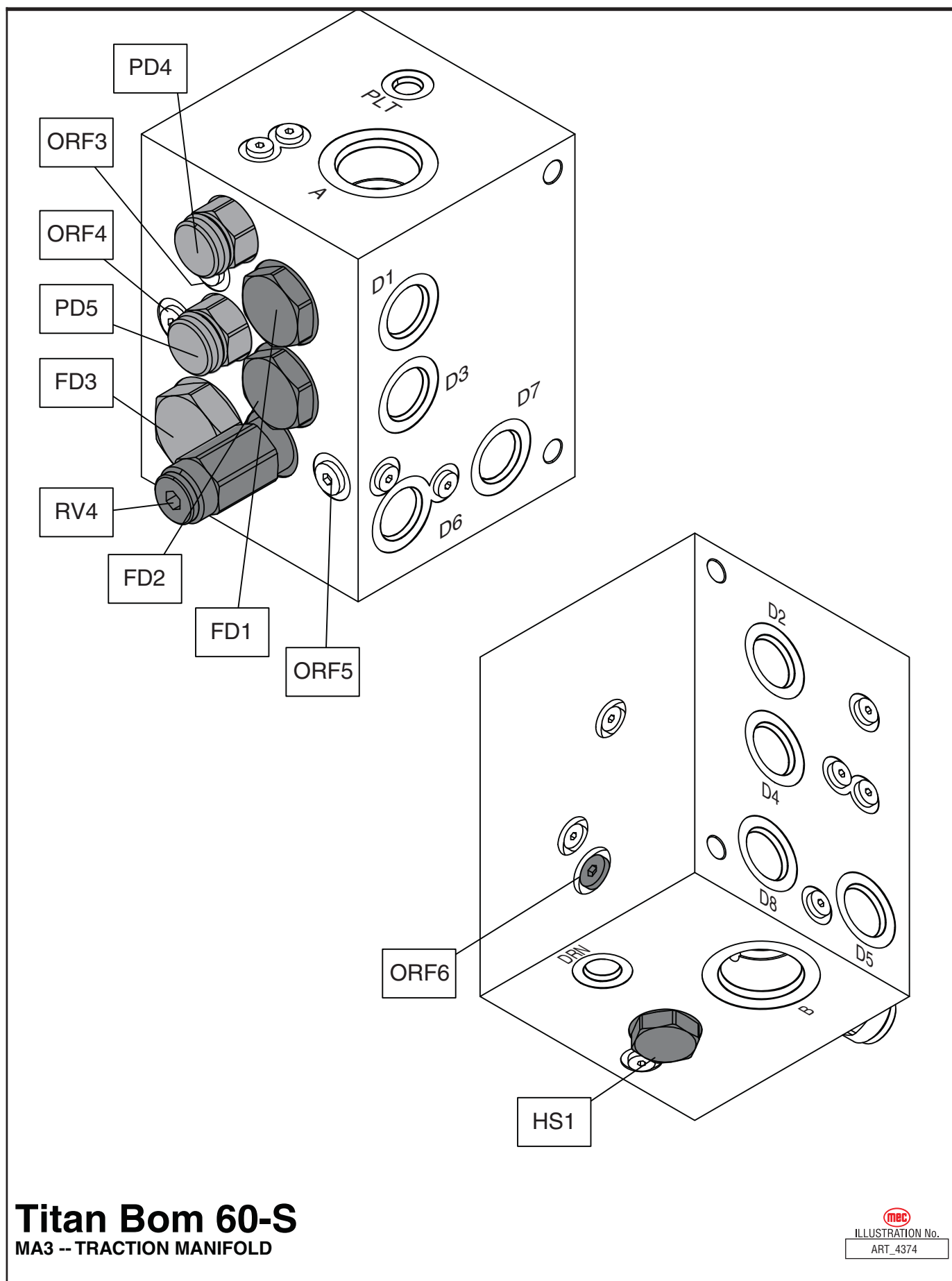
**Figure 5-5: Secondary Functions Manifold, MA2**

## Titan Boom 60-S

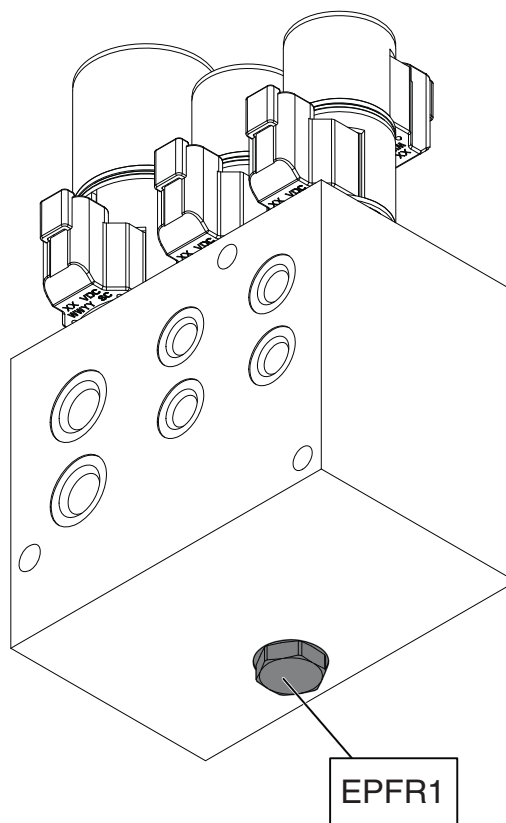
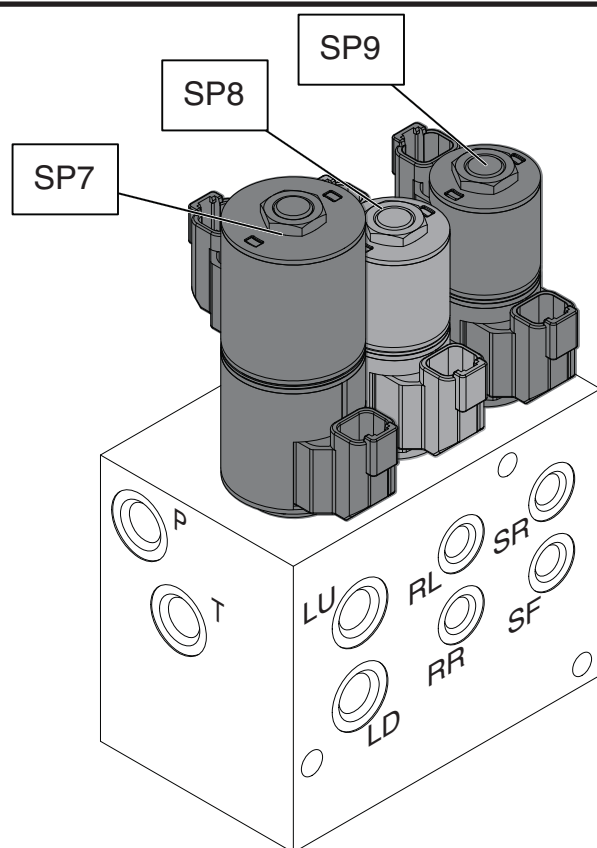
### MA2 -- Secondary Functions Manifold Valves

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**Figure 5-6:** Traction Manifold, MA3





## Titan Boom 60-S

MA4 -- AUXILIARY MANIFOLD

  
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ART\_4373



## ELECTRICAL SCHEMATIC

Figure 5-8: Electric Schematic, Lower Control Box

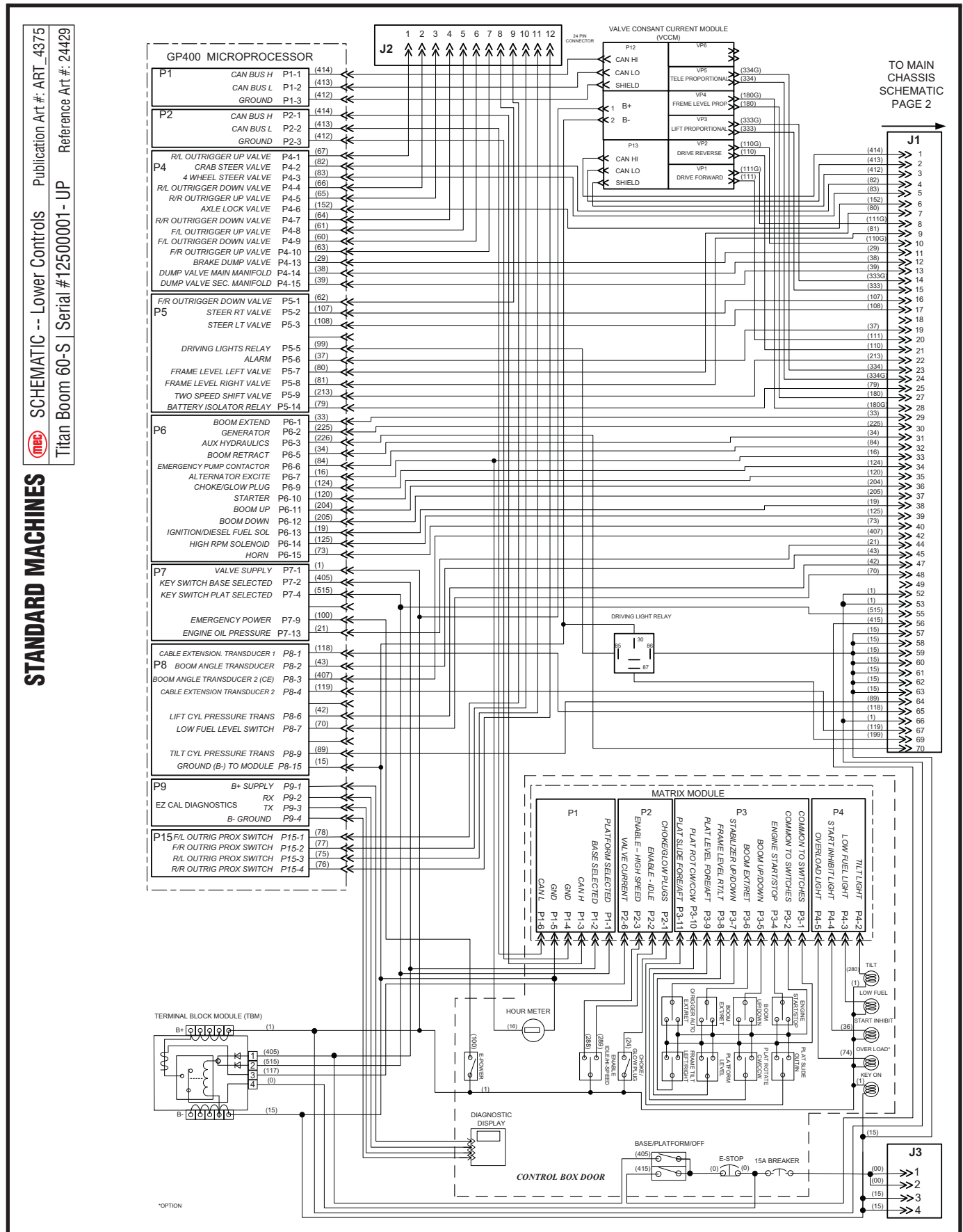


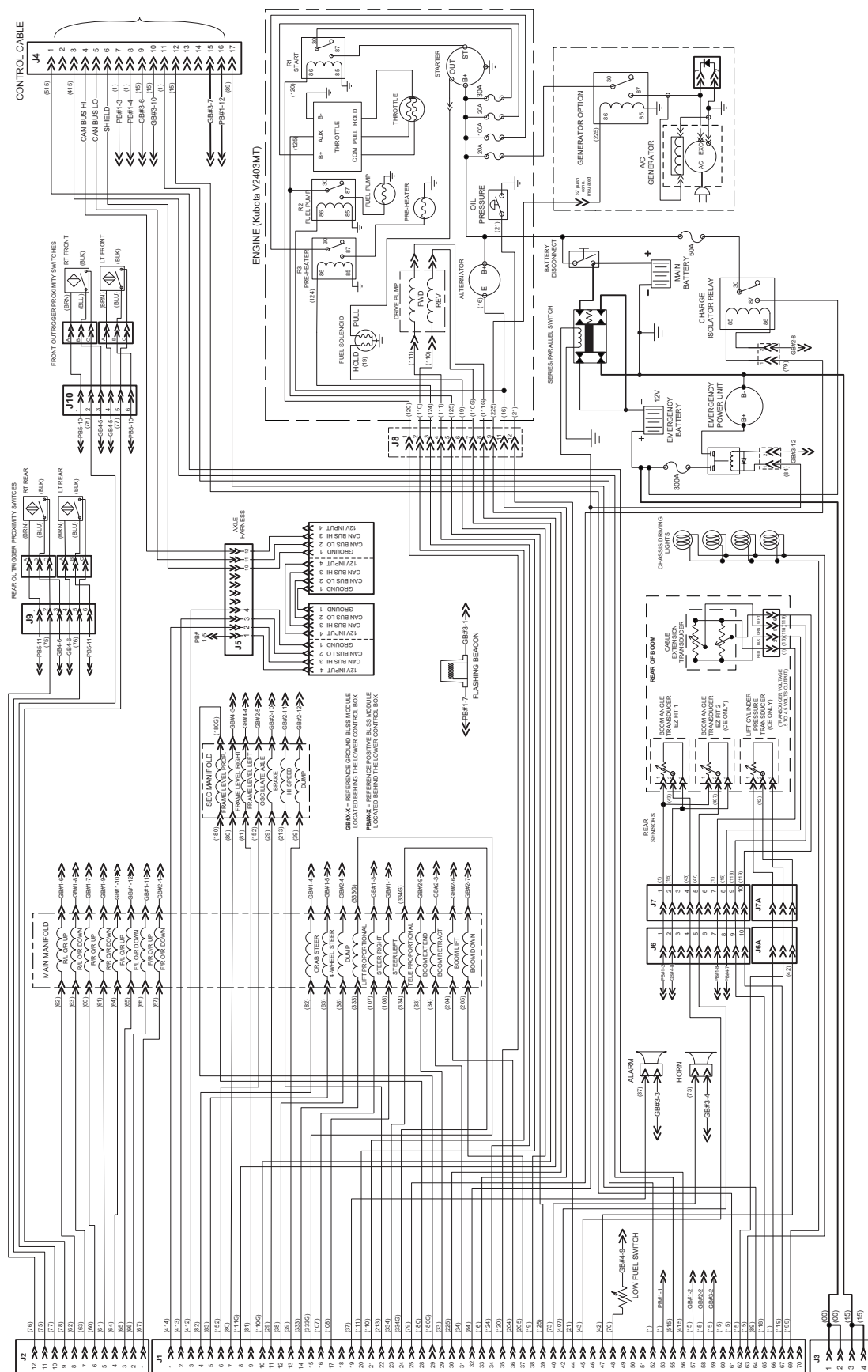


Figure 5-9: Electric Schematic, Chassis

## STANDARD MACHINES

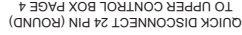
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Titan Boom 60-S Serial #12500001- UP Reference Art #: 24430

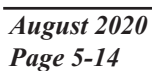




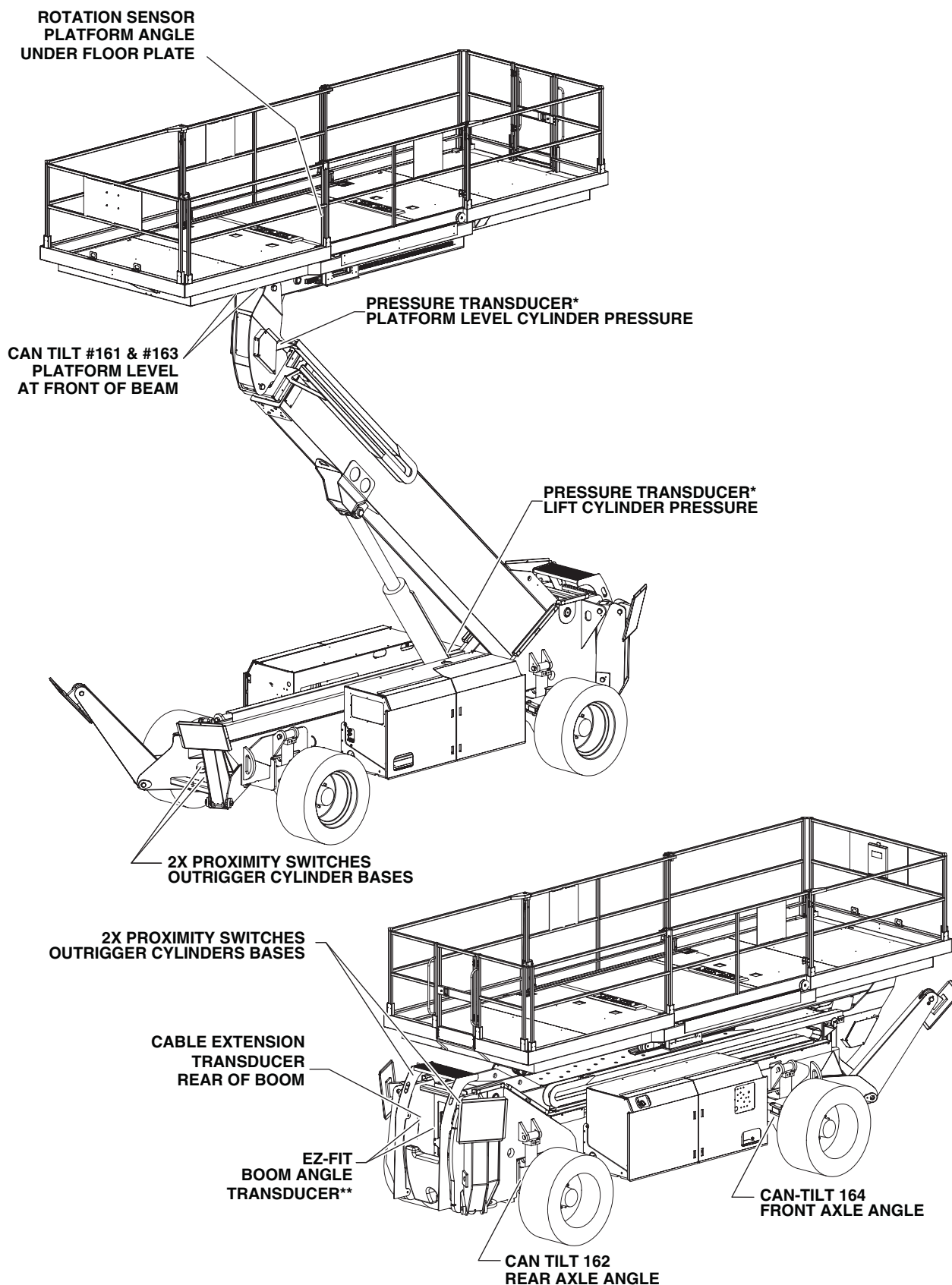
**(MCC)** SCHEMATIC -- Control Cable      Publication Art #: ART\_4377  
Titan Boom 60-S | Serial #12500001- UP      Reference Art #: 24431









**Figure 5-12: Sensor Locations**

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ART\_4379

\*Only in machines equipped with Optional Overload Sensing System  
 \*\*Two (2) present on machines equipped with Optional Overload Sensing System



**NOTES:**

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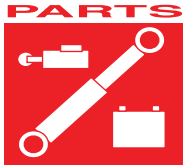
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# SECTION A

## CONTROLS

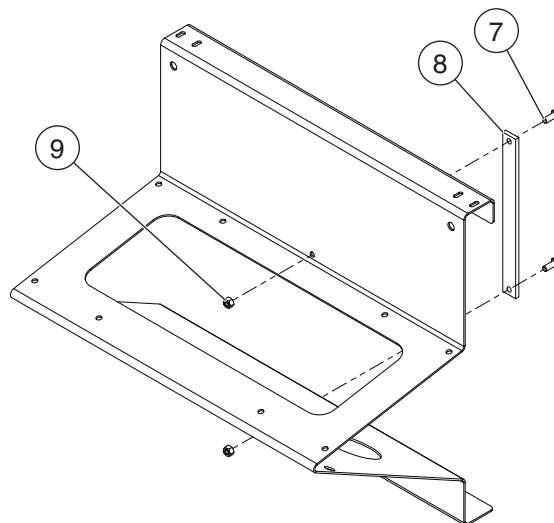
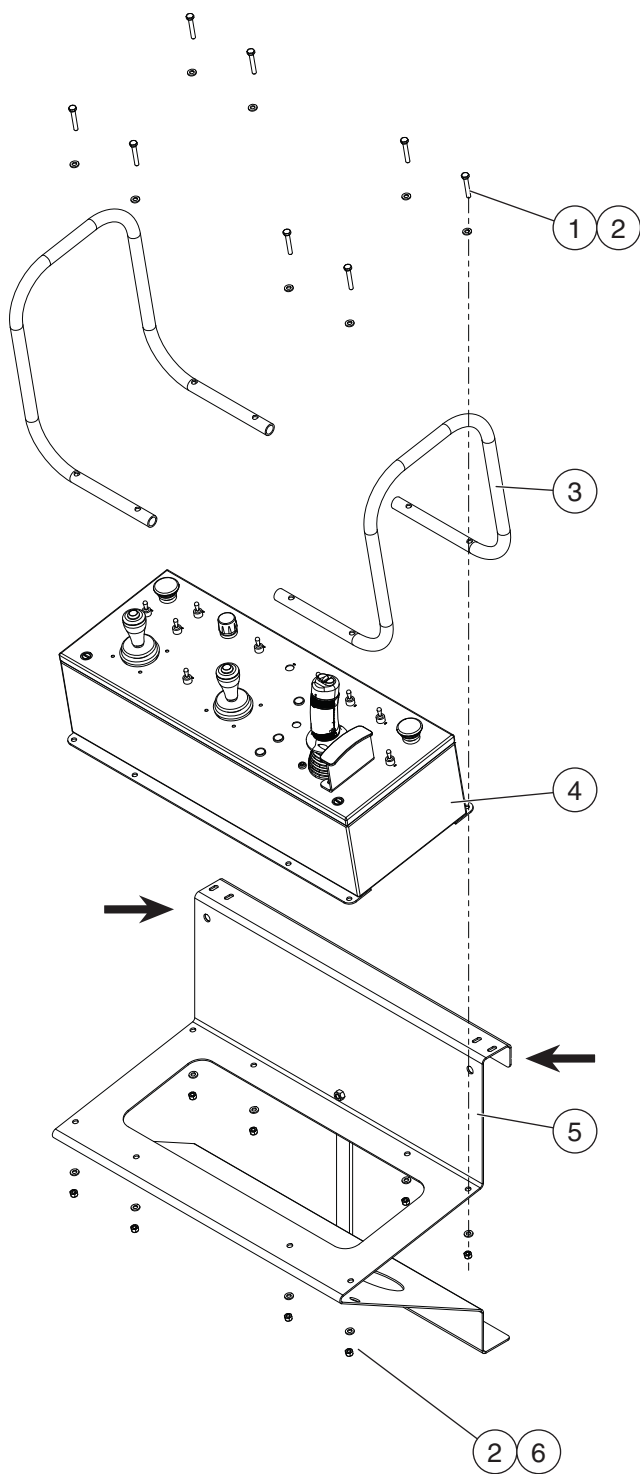
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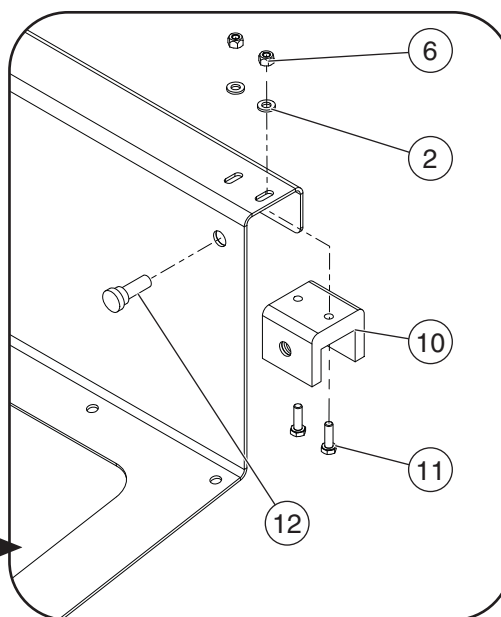
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2 Places



**mecc**  
ILLUSTRATION No.  
ART\_3689

TITAN BOOM

Upper Control Station



## Upper Controls Station

ITEM	PART NO.	QTY	DESCRIPTION
1	50289	8	Bolt, HHCS M6 x 40
2	50000	20	Washer, M6 Std
3	22228	2	Rail, Upper Control Box
4	84184	1	Upper Control Box Assembly
5	22227	1	Bracket, Upper Control Box
6	50047	8	Nut, M6 Nylock
7	50030	2	Bolt, HHCS M8 x 20
8	22384	1	Brace
9	50048	2	Nut, M8 Nylock
10	22397	2	Rail Pad
11	50028	4	Bolt, HHCS M6 x 20
12	92125	2	Thumbscrew, Nylon



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



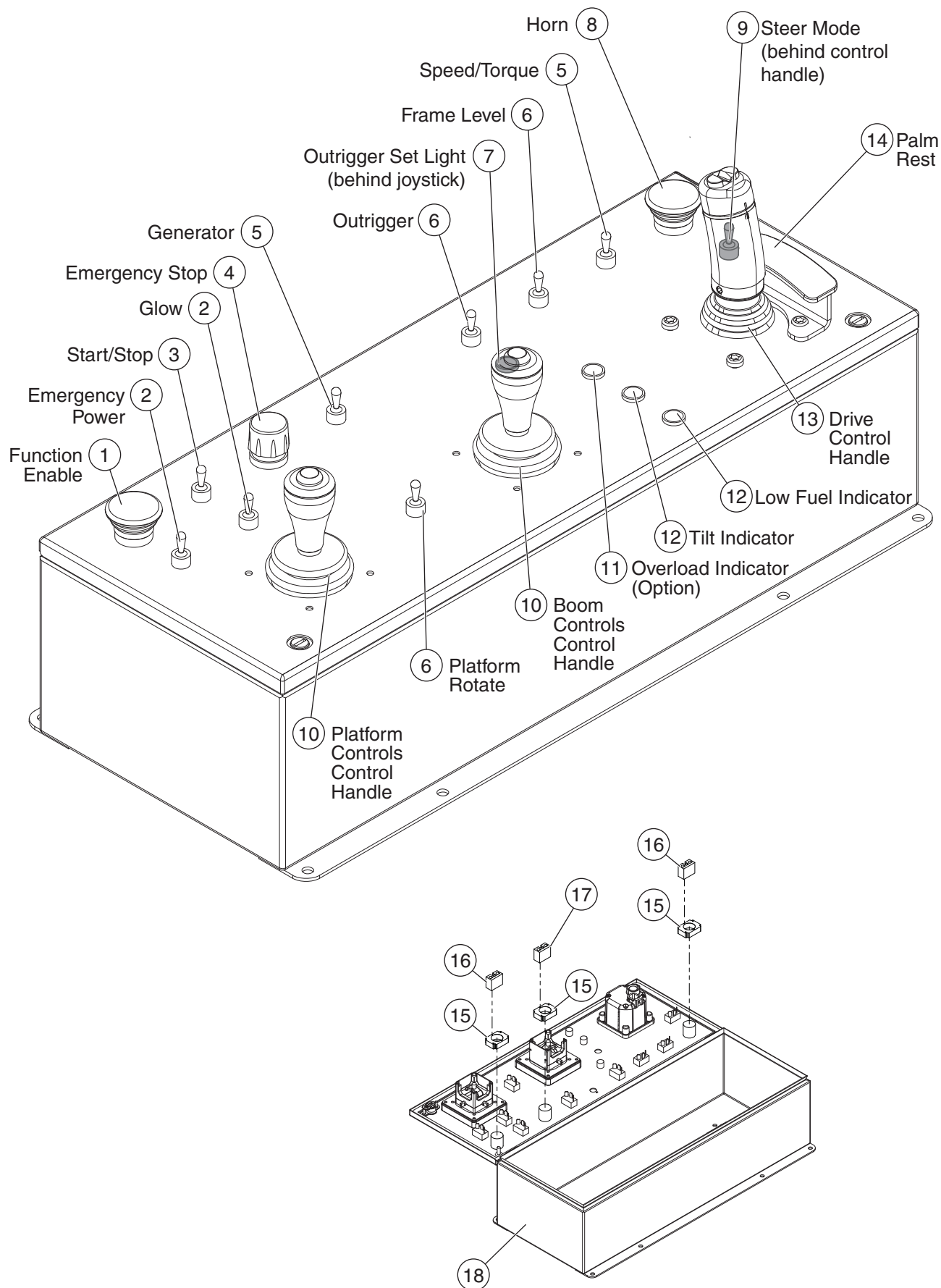


ILLUSTRATION No.  
ART\_4218

TITAN BOOM 60-S

Upper Control Box, 1 of 2



## Upper Controls Box, 1 of 2

ITEM	PART NO.	QTY	DESCRIPTION
--	84184	--	Upper Controls Box Assembly
1	92422	1	Button, Green
2	7423	2	Switch, Toggle, On--Momentary
3	92427	3	Switch, Toggle, Off--On--Momentary
4	7800	1	Emergency Stop Button
5	6234	2	Switch, Toggle, On--On
6	91954	2	Switch, Toggle, Momentary--Off--Momentary
7	92255	1	Indicator Light, Green
8	92421	1	Button, Black
9	6905	1	Switch, Toggle, On--Off--On
10	92165	2	Control Handle
11	92254	1	Indicator Light, Red (Option)
12	92253	2	Indicator Light, Orange
13	92786	1	Drive Control Handle
--	22237	--	Adapter Plate, Drive Control Handle, New Style
14	18494	1	Palm Rest
15	90714	3	Switch/Button Mount
16	8082	2	Contact Block, N.O
17	8083	1	Contact Block, N.C
18	22208	1	Upper Control Box



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



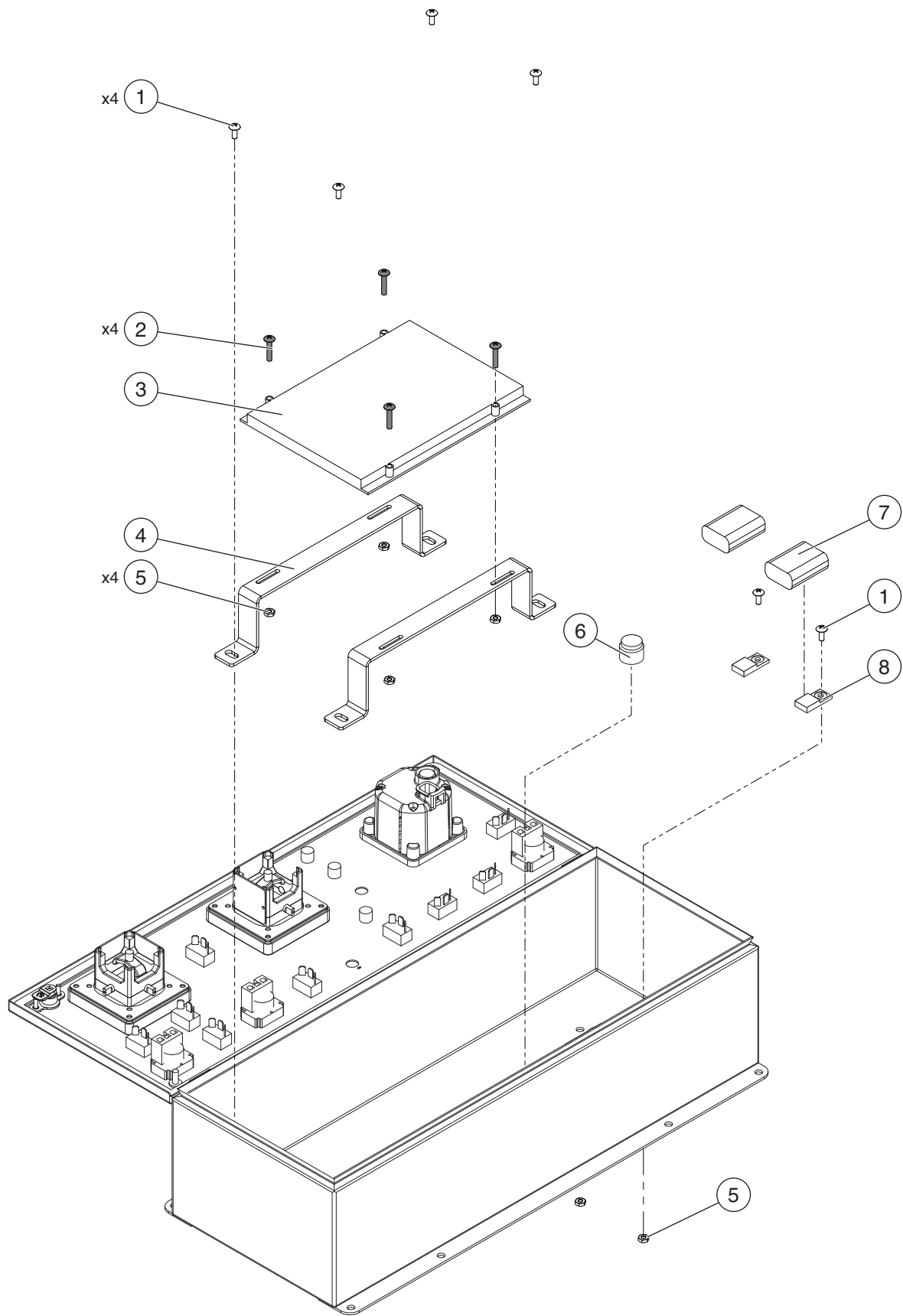


ILLUSTRATION No.  
ART\_3691

TITAN BOOM

Upper Control Box, 2 of 2



## Upper Controls Box, 2 of 2

ITEM	PART NO.	QTY	DESCRIPTION
1	50191	6	Screw, THMS #10-32 x .5
2	50330	4	Screw, THMS #10-32 x 1
3	92027	1	GP440 Module
4	22429	2	Mount, GP440
5	50238	6	Nut, #10-32 Nylock
6	7553	1	Alarm
7	92033	2	Buss
8	91881	2	Relay/Buss Mount



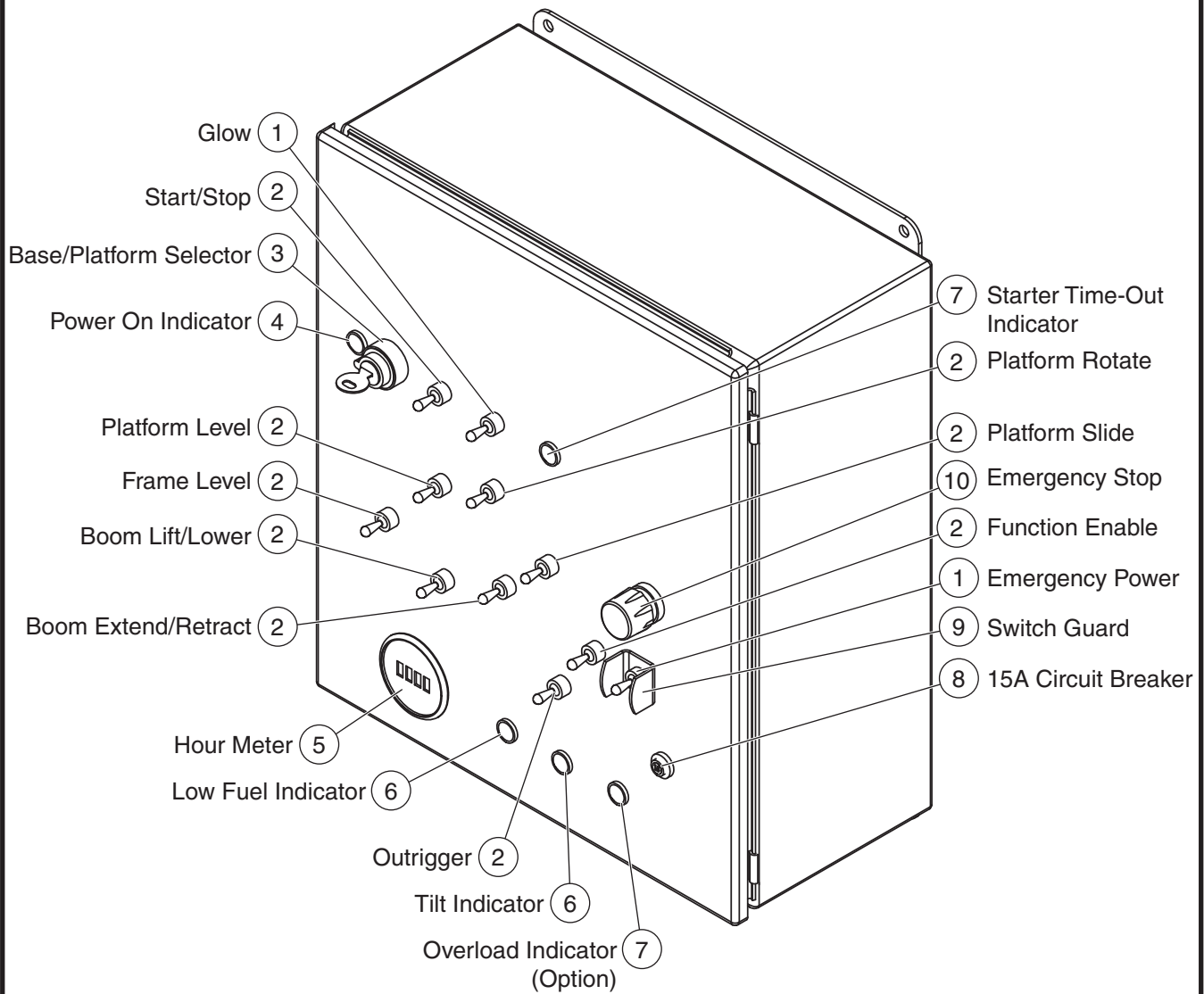
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• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Lower Controls Box, 1 of 2

ITEM	PART NO.	QTY	DESCRIPTION
--	84181	--	Lower Controls Assembly
1	7423	2	Switch, Toggle, On--Momentary
2	91954	9	Switch, Toggle, Momentary--Off--Momentary
3	9549	1	Switch, Keyed Selector
4	92255	1	Indicator Light, Green
5	91704	1	Hour Meter
6	92253	2	Indicator Light, Orange
7	92254	1	Indicator Light, Red
		2	Indicator Light, Red (Option)
8	7235	1	Circuit Breaker, 15 Amp
9	1313	1	Switch Guard
10	7800	1	Emergency Stop Button



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



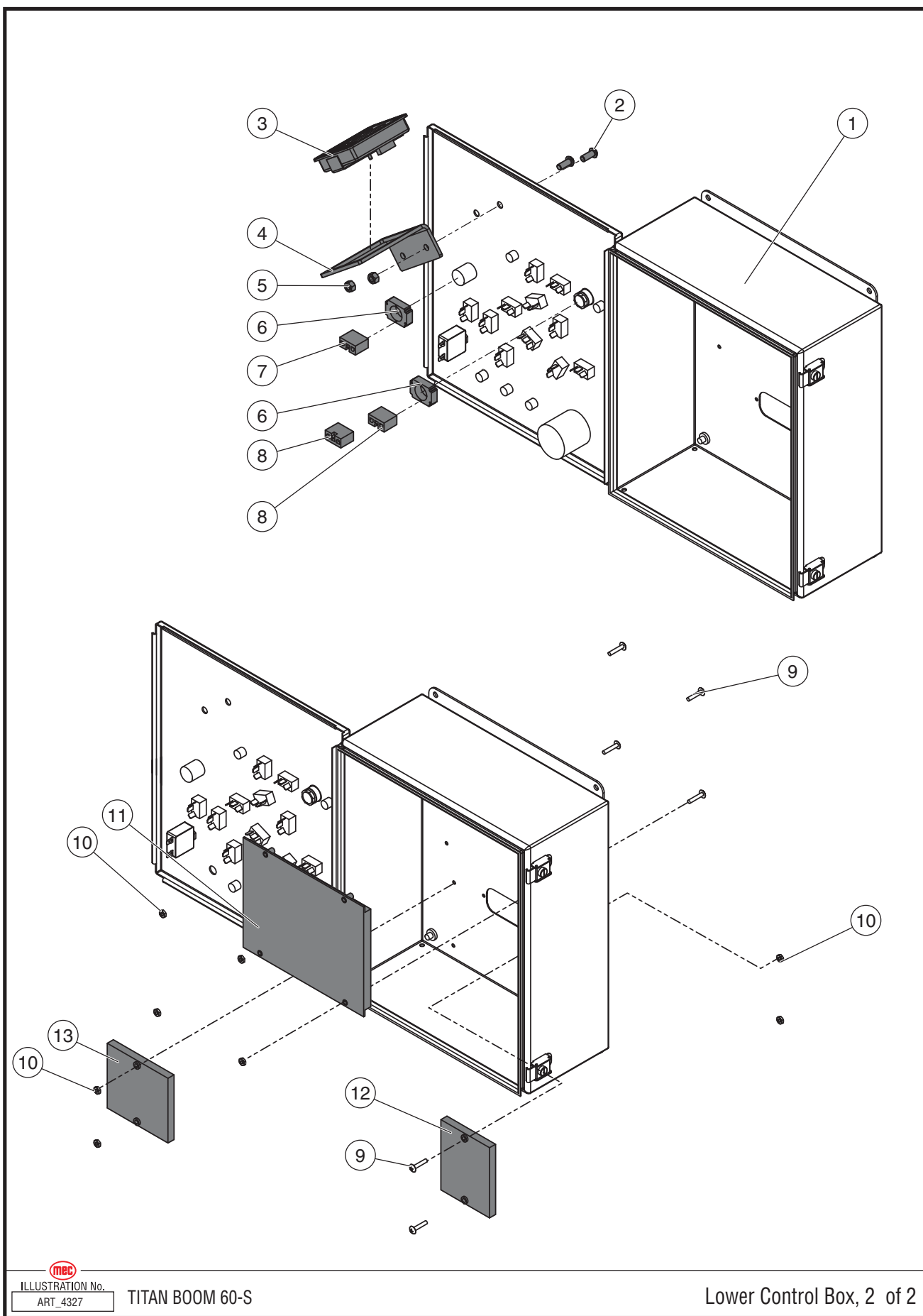


ILLUSTRATION No.  
ART\_4327

TITAN BOOM 60-S

Lower Control Box, 2 of 2





## Lower Controls Box, 2 of 2

ITEM	PART NO.	QTY	DESCRIPTION
1	22252	1	Lower Control Box
2	50124	2	Screw, BHCS M8 x 20
3	92003	1	EZ Cal Diagnostic, Normal type
--	92741	--	EZ Cal Diagnostic, Arctic type
4	22405	1	Bracket, EZ Cal
5	50048	2	Nut, M8 Nylock
6	90714	2	Switch/Button Mount
7	8083	1	Contact Block, N.C.
8	8082	2	Contact Block, N.O.
9	50330	8	Screw, THMS #10-32 x 1
10	50238	8	Nut, #10-32 Nylock
11	92028	1	GP400 Module
12	92838	1	Terminal Block Module
13	93148	1	VCCM Module



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

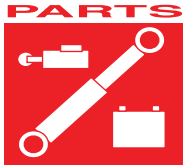
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**NOTES:**

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# SECTION B

## PLATFORM AND RAILS

### CONTENTS

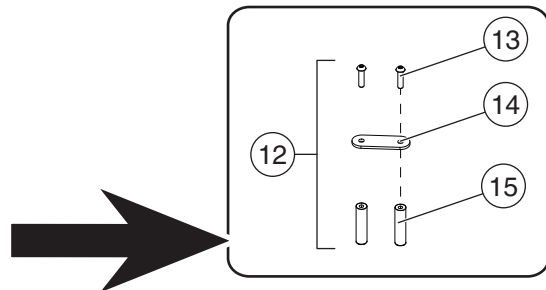
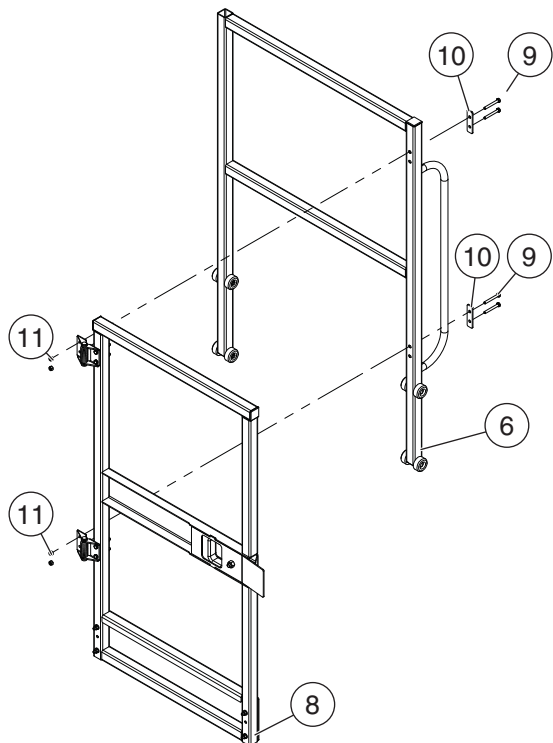
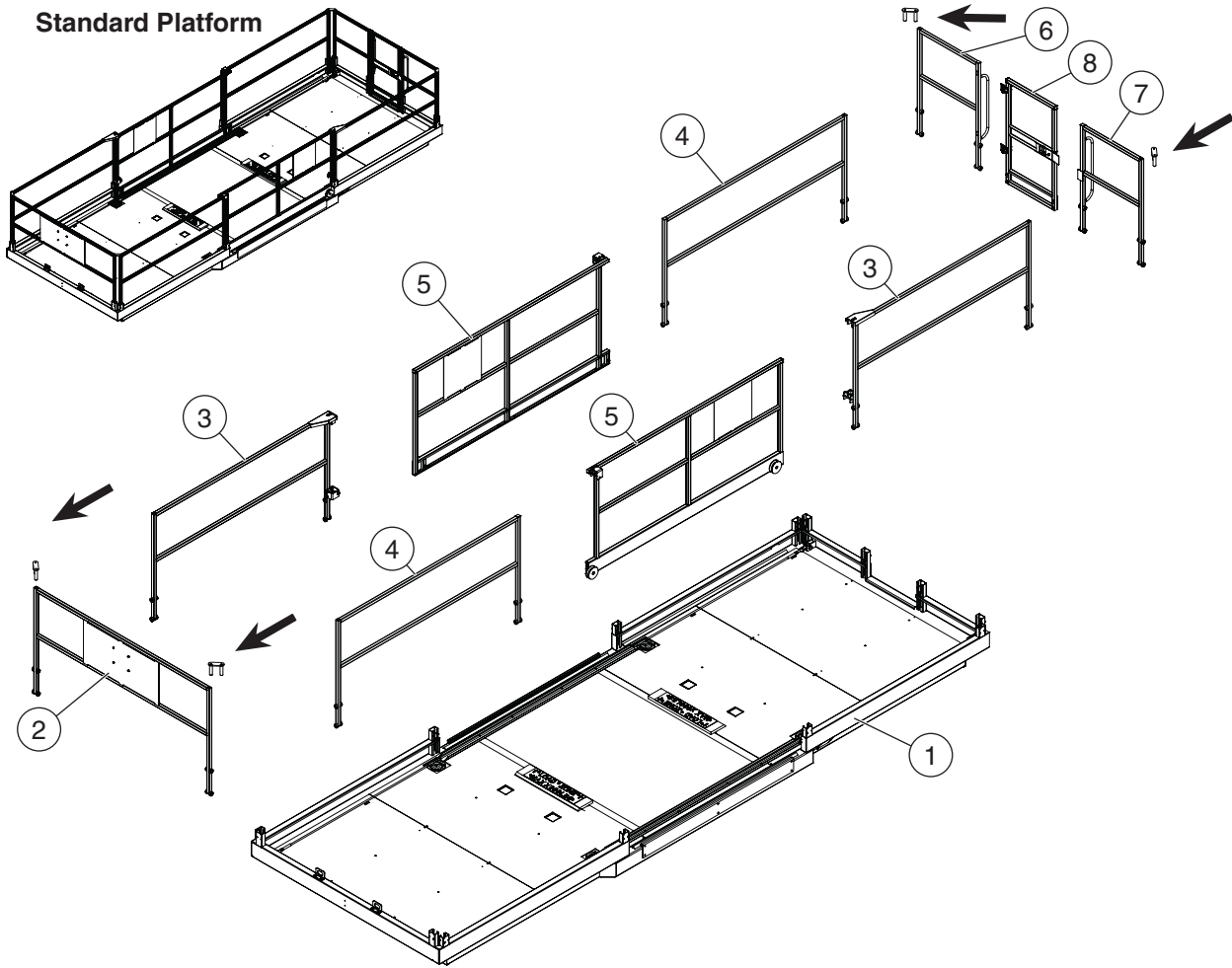
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# Standard Platform



GUARD RAILS



ILLUSTRATION No.  
ART\_3603

TITAN BOOM



## Standard Platform, Guardrails

ITEM	PART NO.	QTY	DESCRIPTION
--	84158	1	Platform/Guardrail Assembly
1	REF	1	Platform
2	84159	1	Front Rail Assembly
3	84160	2	Right Side Rail Assembly
4	84161	2	Left Side Rail Assembly
5	84162	2	Sliding Gate Assembly
6	84164	1	Right Rear Rail Assembly
7	84165	1	Left Rear Rail Assembly
8	84163	1	Personnel Entry Gate Assembly
9	50262	4	Bolt, HHCS M06-1.00 x 050
10	19239	2	Hinge Spacer
11	50047	18	Nut, M06x1.00 08 Zp Nylock
12	84148	4	Rail Corner Reinforcement
13	50286	8	Bolt, BHCS M12-1.75 x 50
14	22458	8	Rail Cap
15	22459	4	Rail Corner



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



# Standard Platform

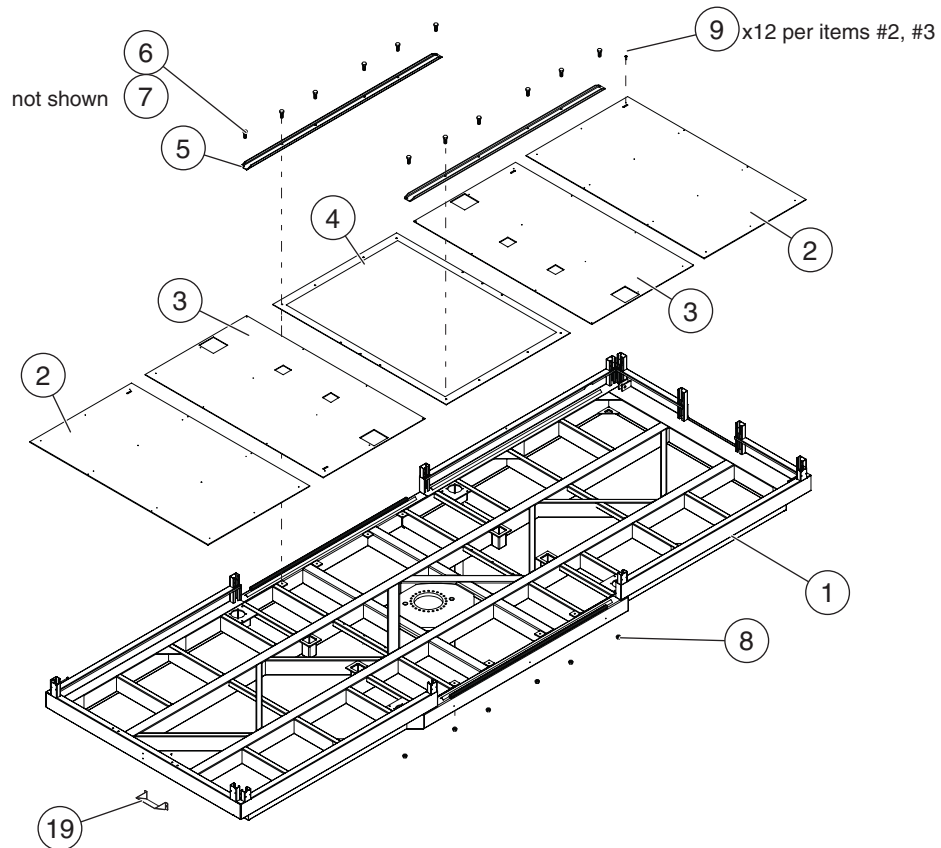
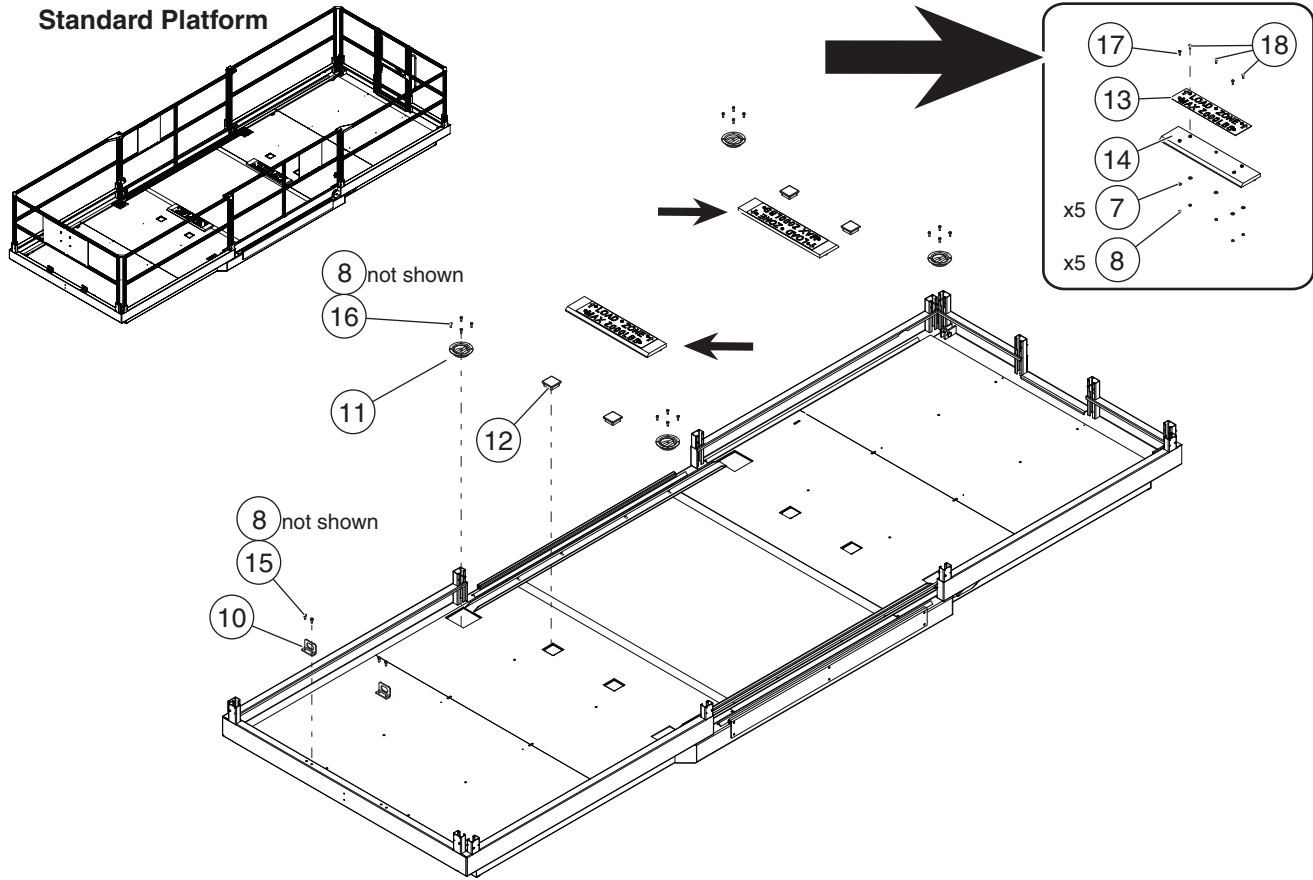


ILLUSTRATION No.  
ART\_4219

TITAN BOOM 60-S

Deck Components, 1 of 2



## Standard Platform, Deck Components, 1 of 2

ITEM	PART NO.	QTY	DESCRIPTION
1	22095	1	Platform Weldment
2	22420	2	Deck Plate, Outer
3	22419	2	Deck Plate, Inner
4	22281	1	Deck Plate, Load Zone
5	22463	2	Channel, Lanyard
6	50309	12	Screw, BHCS M10 x 40
7	50002	17	Washer, M10 Std
8	50049	37	Nut, M10 Nylock
9	92251	48	Rivet, SSB8-8S
10	3923	2	Bracket, Lanyard
11	92090	4	D-Ring, Swivel
12	92454	4	Socket Cap
13	24185	2	Plate, Load Zone
14	22426	2	Stop Block, Load Zone
15	50033	4	Bolt, HHCS M10 x 25
16	50031	16	Bolt, HHCS M8 x 25
17	50036	6	Bolt, HHCS M10 x 50
18	50209	4	Bolt, HHCS M10 x 100
19	19262	1	Platform Cable Cover



• as req: as required

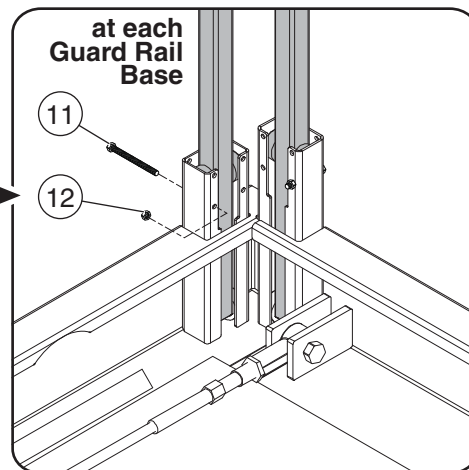
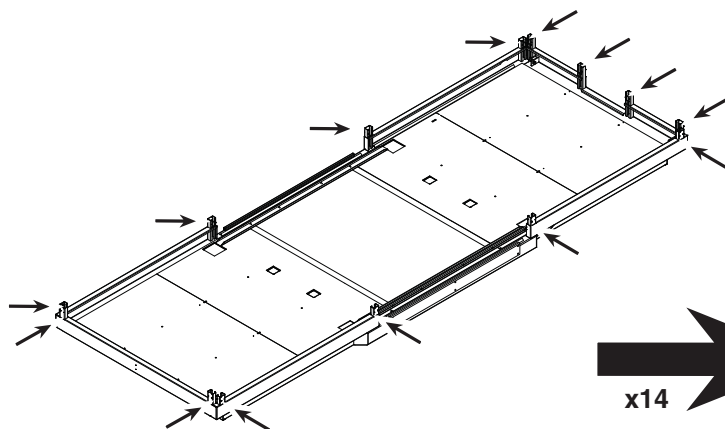
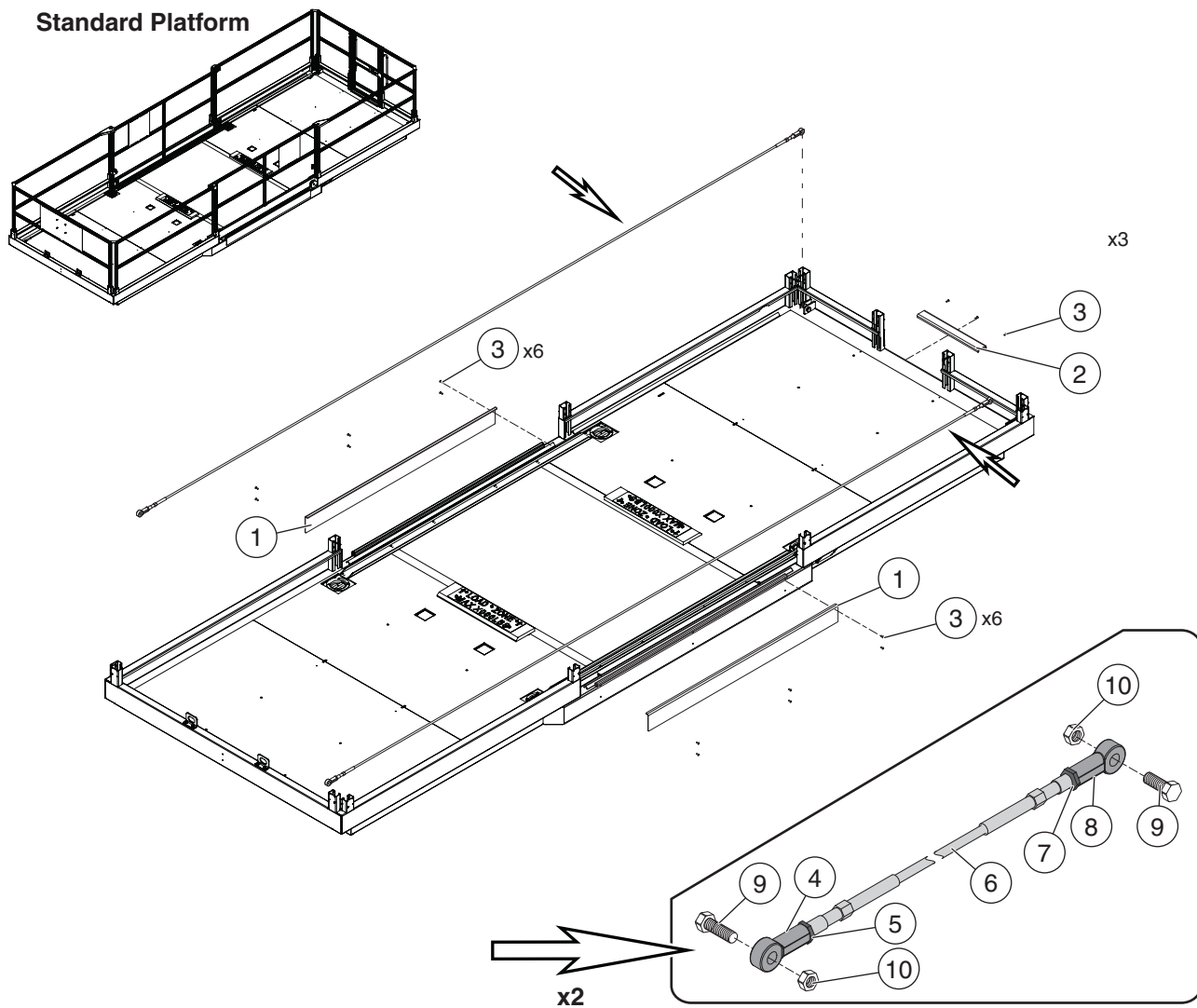
• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



# Standard Platform



Deck Components, 2 of 2

ILLUSTRATION No.  
ART\_3605

TITAN BOOM



## Standard Platform, Deck Components, 2 of 2

ITEM	PART NO.	QTY	DESCRIPTION
1	22379	2	Trim, Loading Gate
2	22545	1	Raised Entry
3	92251	15	Rivet, SSB8-8S
4	92091	2	Heim Joint, 3/4" Right-Hand
5	92094	2	Jam nut, 3/4" Right-Hand
6	92093	2	Cable, Lanyard Attachment
7	92095	2	Jam nut, 3/4" Left-Hand
8	92092	2	Heim Joint, 3/4" Left-Hand
9	50304	4	Bolt, HHCS 3/4" x 2.5"
10	50118	4	Nut, 3/4" Nylock
11	50125	14	Bolt, HHCS M6 x 55
12	50047	14	Nut, M6 Nylock



• as req: as required

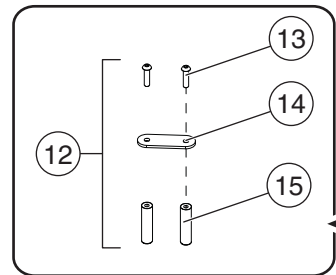
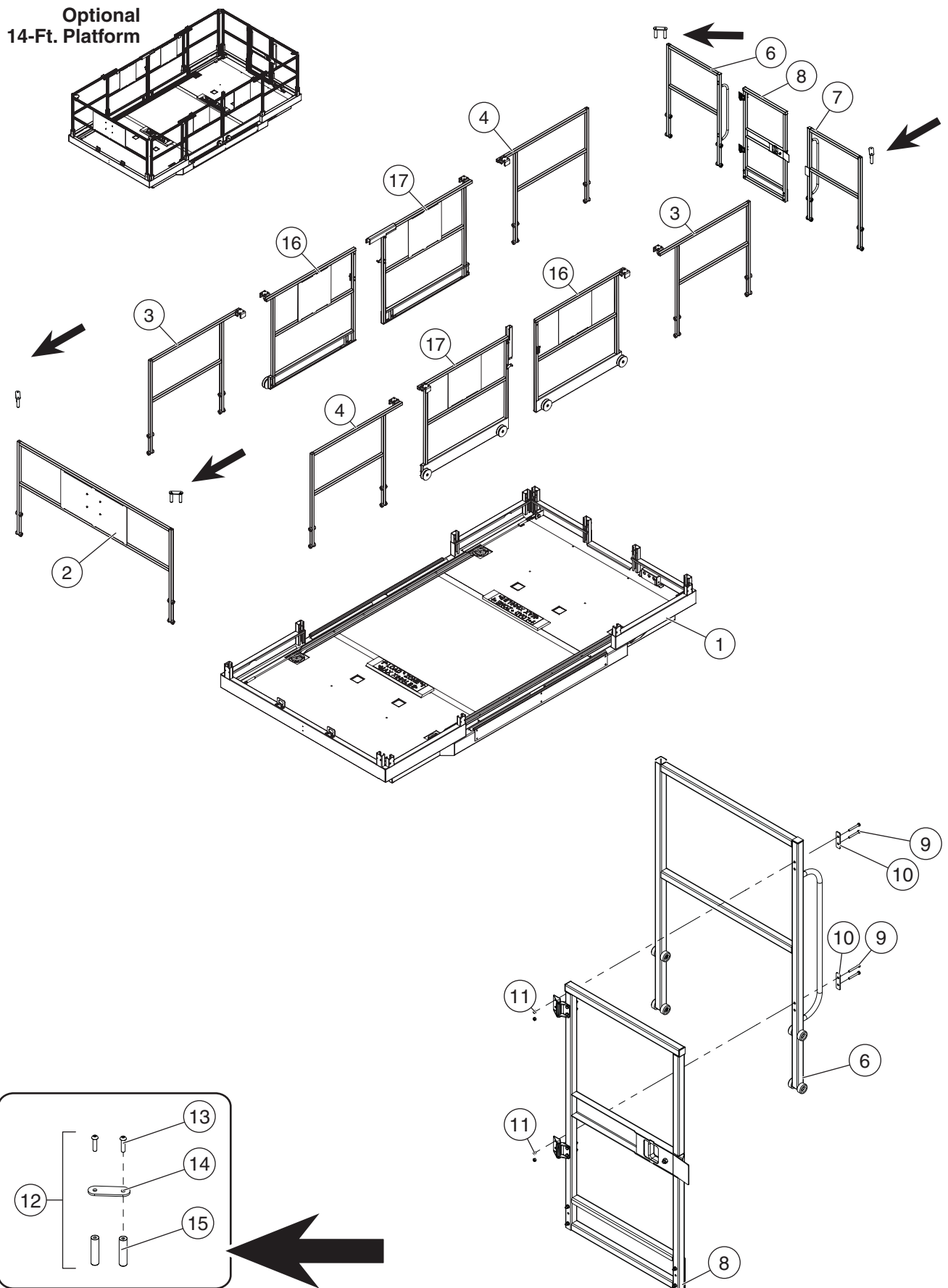
• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



**Optional  
14-Ft. Platform**



**mecc**  
ILLUSTRATION No.  
ART\_4186 TITAN BOOM

OPTION -- 14ft. Platform -- GUARD RAILS



## OPTION -- 14Ft. Platform, Guardrails

ITEM	PART NO.	QTY	DESCRIPTION
--	84224	1	14-Ft. Platform/Guardrail Assembly
1	REF	1	Platform
2	84159	1	Front Rail Assembly
3	84226	2	Right Side Rail Assembly
4	84229	2	Left Side Rail Assembly
5	--	--	--
6	84164	1	Right Rear Rail Assembly
7	84165	1	Left Rear Rail Assembly
8	84163	1	Personnel Entry Gate Assembly
9	50262	4	Bolt, HHCS M06-1.00 x 050
10	19239	2	Hinge Spacer
11	50047	18	Nut, M06x1.00 08 Zp Nylock
12	84148	4	Rail Corner Reinforcement
13	50286	8	Bolt, BHCS M12-1.75 x 50
14	22458	8	Rail Cap
15	22459	4	Rail Corner
16	84227	2	Left Side Gate Assembly
17	84228	2	Right Side Gate Assembly



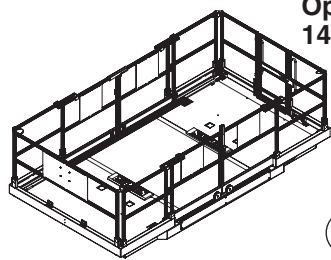
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• NS: Not a Stock item

• REF: Reference only





# Optional 14-Ft. Platform

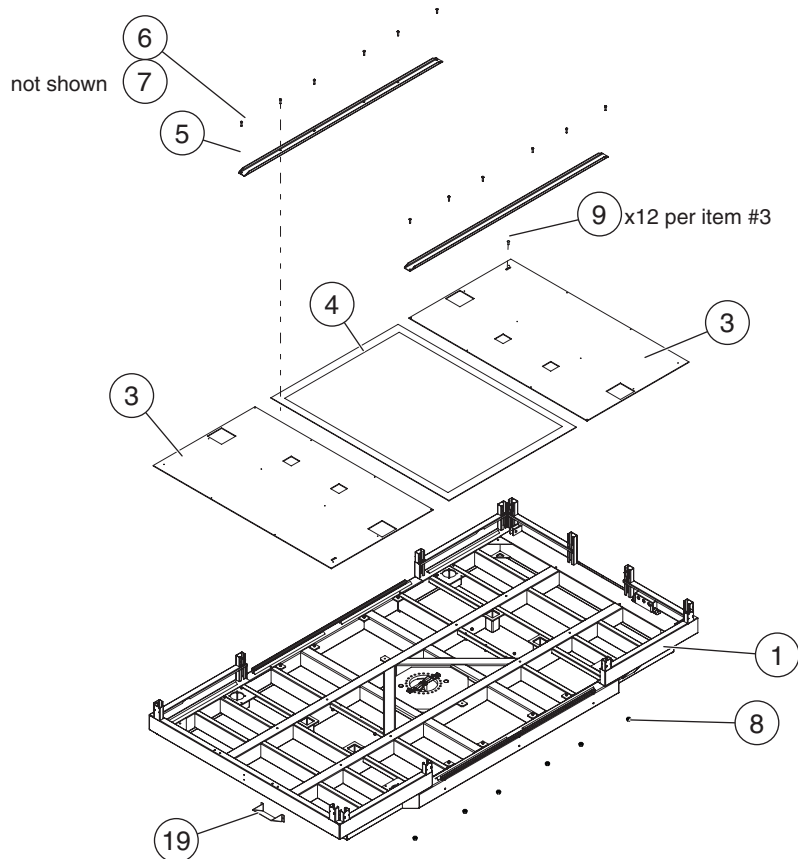
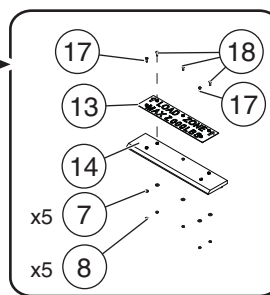
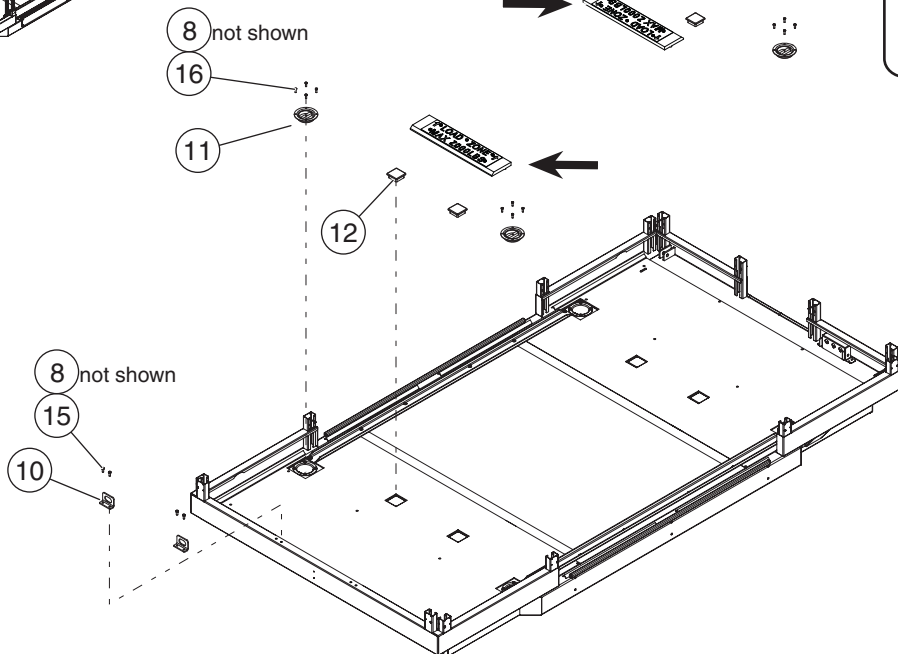


ILLUSTRATION No.  
ART\_4220

TITAN BOOM 60-S

OPTION -- 14ft. Platform -- Deck Components, 1 of 2



## OPTION -- 14Ft. Platform, Deck Components, 1 of 2

ITEM	PART NO.	QTY	DESCRIPTION
1	22701	1	Platform Weldment
2	--	--	--
3	22419	2	Deck Plate
4	22281	1	Deck Plate, Load Zone
5	22463	2	Channel, Lanyard
6	50309	12	Screw, BHCS M10 x 40
7	50002	17	Washer, M10 Std
8	50049	37	Nut, M10 Nylock
9	92251	24	Rivet, SSB8-8S
10	3923	2	Bracket, Lanyard
11	92090	4	D-Ring, Swivel
12	92454	4	Socket Cap
13	24185	2	Plate, Load Zone
14	22426	2	Stop Block, Load Zone
15	50033	4	Bolt, HHCS M10 x 25
16	50031	16	Bolt, HHCS M8 x 25
17	50036	6	Bolt, HHCS M10 x 50
18	50209	4	Bolt, HHCS M10 x 100
19	19262	1	Platform Cable Cover



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



**Optional  
14-Ft. Platform**

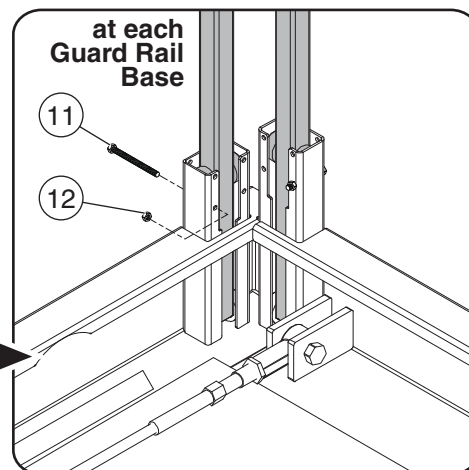
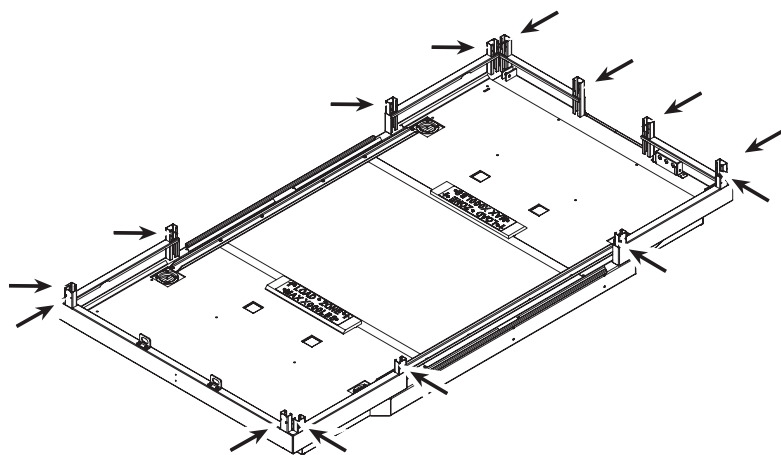
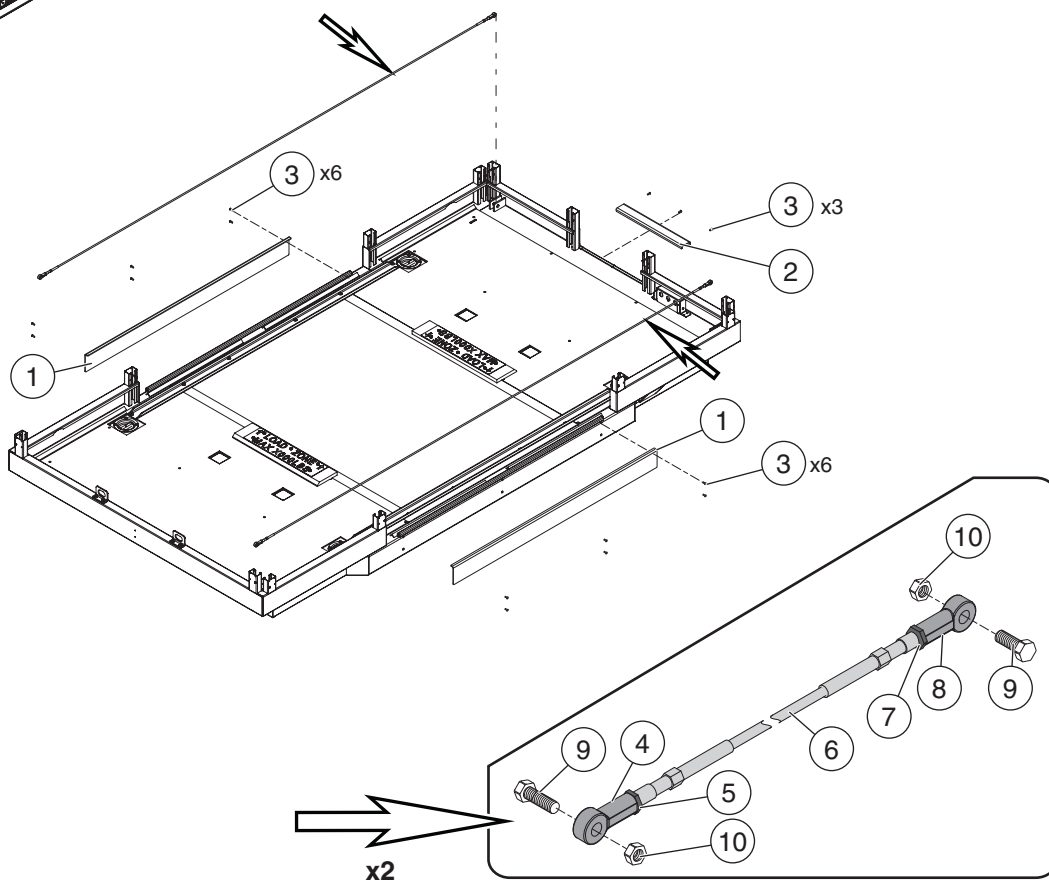
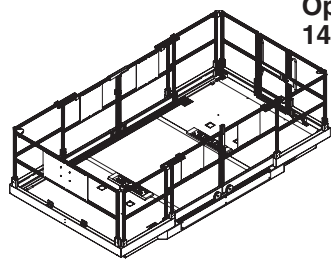


ILLUSTRATION No.  
ART\_4188

TITAN BOOM

OPTION -- 14ft. Platform -- Deck Components, 2 of 2



## OPTION -- 14Ft. Platform, Deck Components, 2 of 2

ITEM	PART NO.	QTY	DESCRIPTION
1	22379	2	Trim, Loading Gate
2	22545	1	Raised Entry
3	92251	15	Rivet, SSB8-8S
4	92091	2	Heim Joint, 3/4" Right-Hand
5	92094	2	Jam nut, 3/4" Right-Hand
6	92862	2	Cable, Lanyard Attachment
7	92095	2	Jam nut, 3/4" Left-Hand
8	92092	2	Heim Joint, 3/4" Left-Hand
9	50304	4	Bolt, HHCS 3/4" x 2.5"
10	50118	4	Nut, 3/4" Nylock
11	50125	14	Bolt, HHCS M6 x 55
12	50047	14	Nut, M6 Nylock



• as req: as required

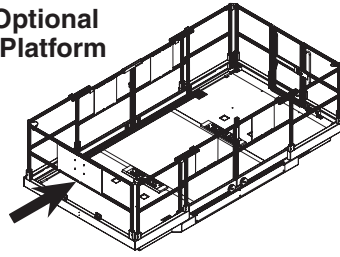
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• NS: Not a Stock item

• REF: Reference only



Optional  
14-Ft. Platform



Standard Platform

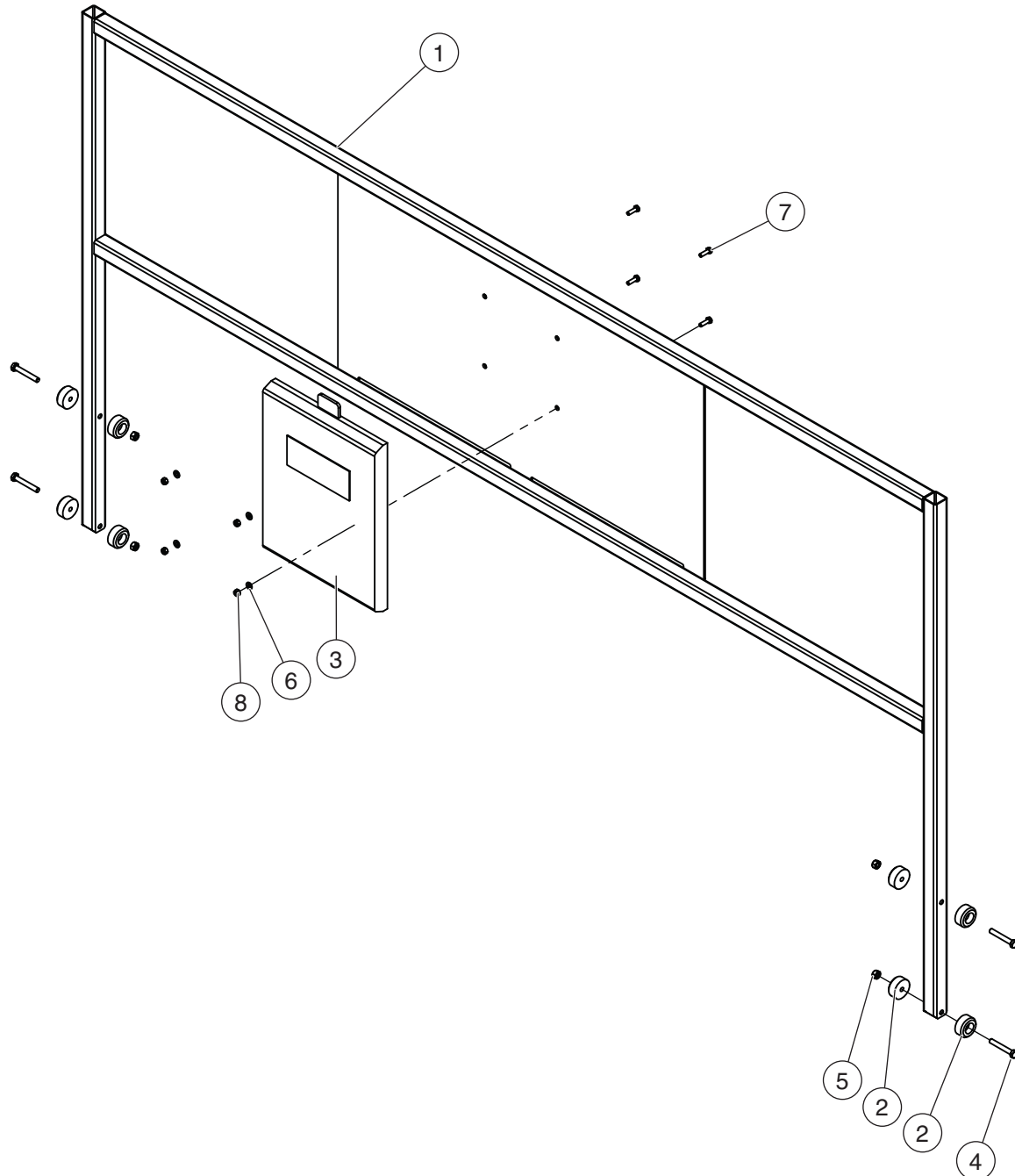
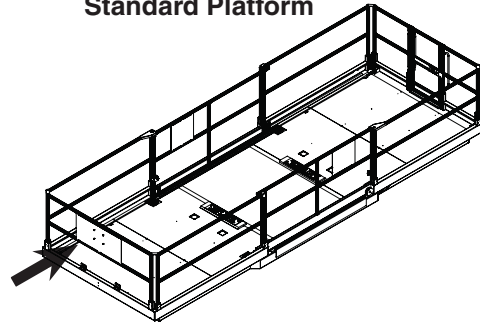


ILLUSTRATION No.  
ART\_3606

TITAN BOOM

Front Rail Assembly



## Front Rail Assembly, All Machines

ITEM	PART NO.	QTY	DESCRIPTION
--	84159	--	Front Rail Assembly
1	22363	1	Front Rail Weldment
2	19131	8	Puck
3	8909	1	Enclosure Service Manual
4	50016	4	Bolt, HHCS M08-1.25X055
5	50048	4	Nut, M08X1.25 Nylock
6	50000	8	Washer, M06 Std
7	50028	4	Bolt, HHCS M06-1.00X020
8	50047	4	Nut, M06X1.00 Nylock



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



Optional  
14-Ft. Platform

Standard Platform

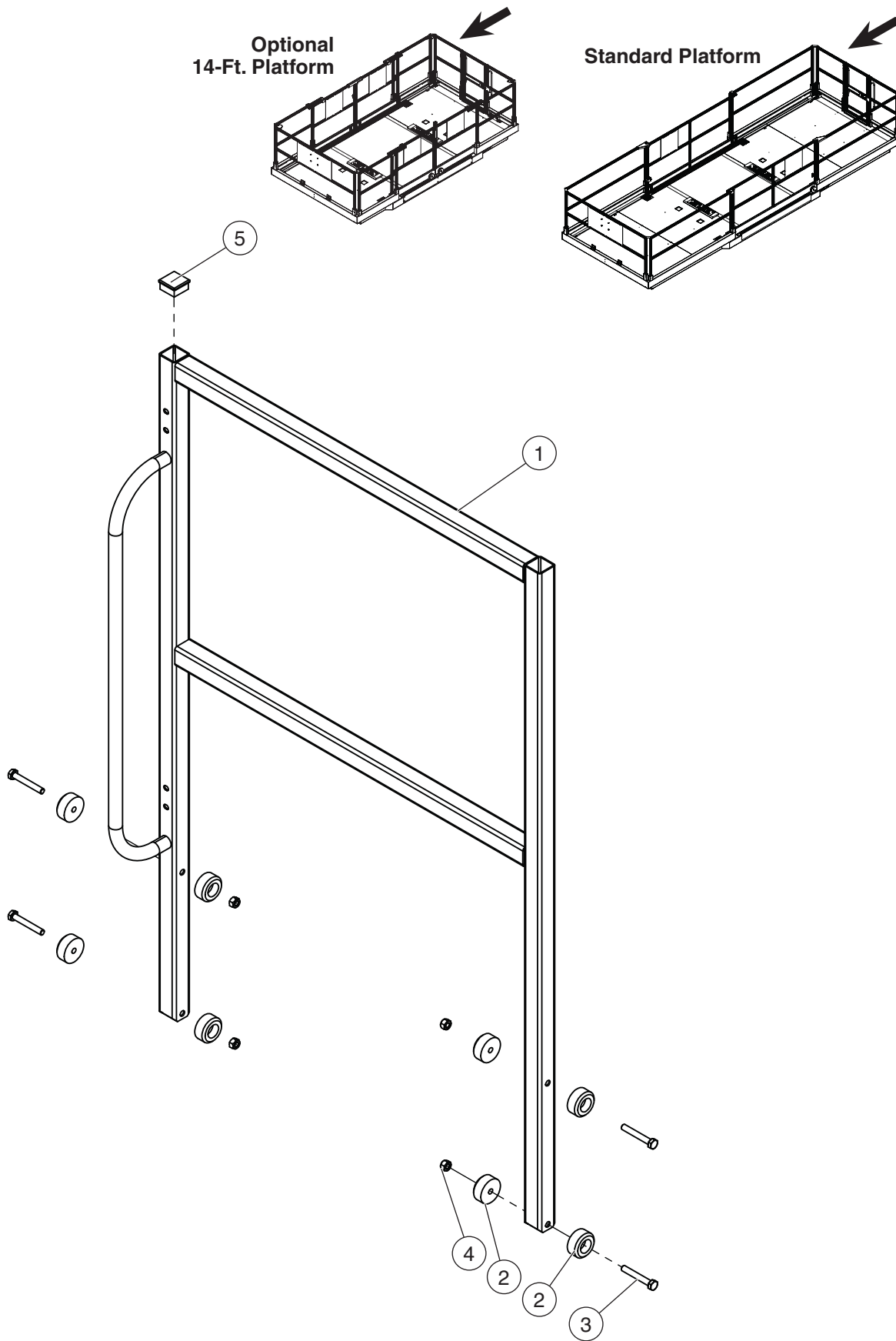


ILLUSTRATION No.  
ART\_3609

TITAN BOOM

Right Rear Rail Assembly



## Right Rear Rail Assembly, All Machines

ITEM	PART NO.	QTY	DESCRIPTION
--	84164	--	Right Rear Rail Assembly
1	22361	1	Right Rear Rail Weldment
2	19131	8	Puck
3	50016	4	Bolt, HHCS M08-1.25x055 08 Zp P
4	50048	4	Nut, M08x1.25 08 Zp Nylock
5	6823	1	Cap Plug 1-1/4" Sq. Tube



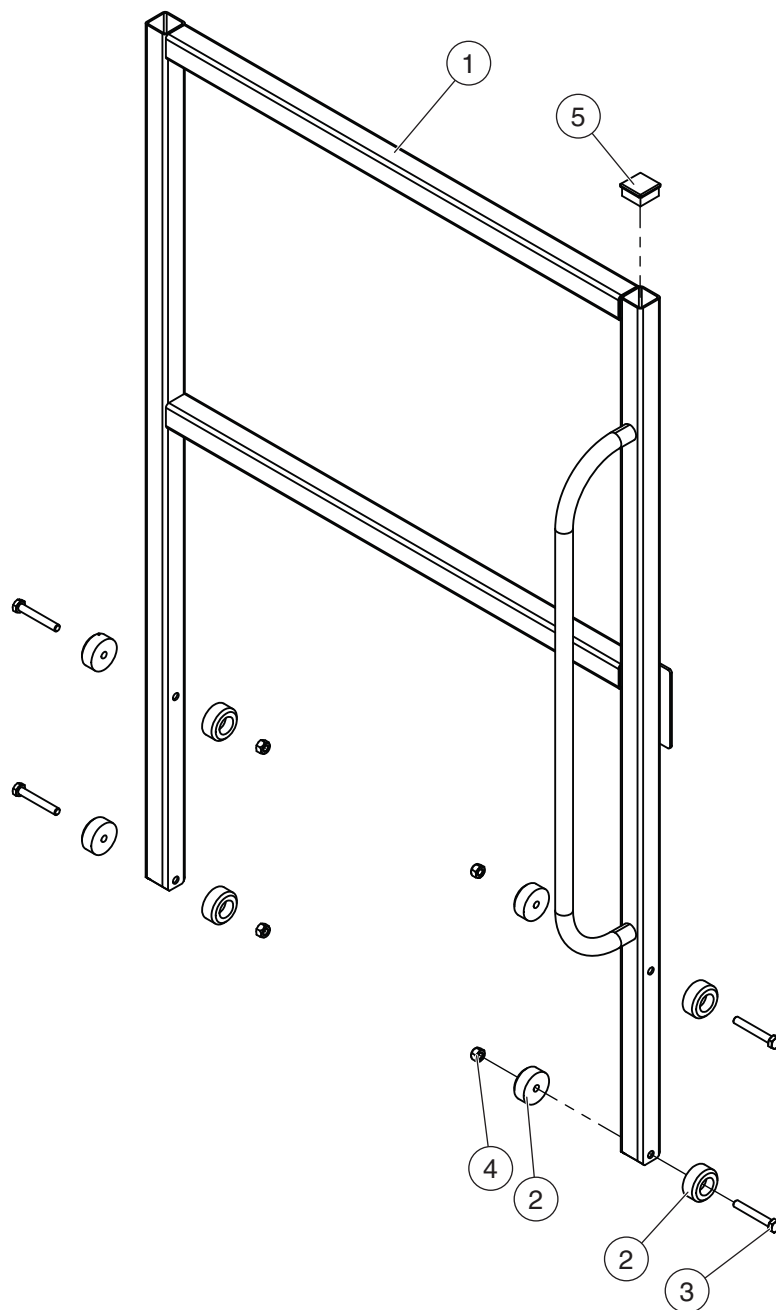
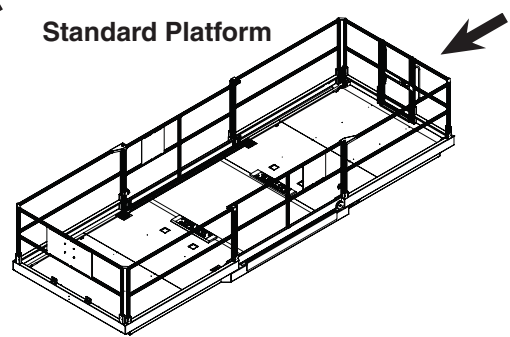
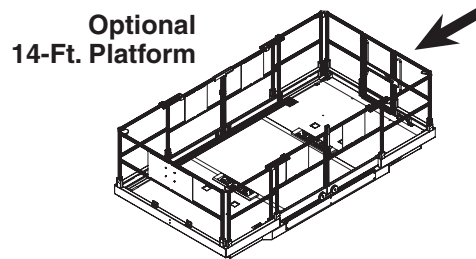
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Left Rear Rail Assembly, All Machines

ITEM	PART NO.	QTY	DESCRIPTION
--	84165	--	Left Rear Rail Assembly
1	22355	1	Left Rear Rail Weldment
2	19131	8	Puck
3	50016	4	Bolt, HHCS M08-1.25x055 08 Zp P
4	50048	4	Nut, M08x1.25 08 Zp Nylock
5	6823	1	Cap Plug 1-1/4" Sq. Tube



• as req: as required

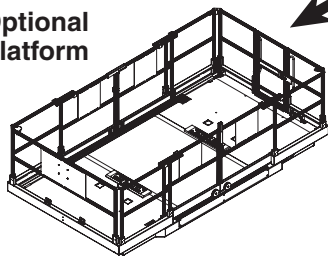
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• NS: Not a Stock item

• REF: Reference only



Optional  
14-Ft. Platform



Standard Platform

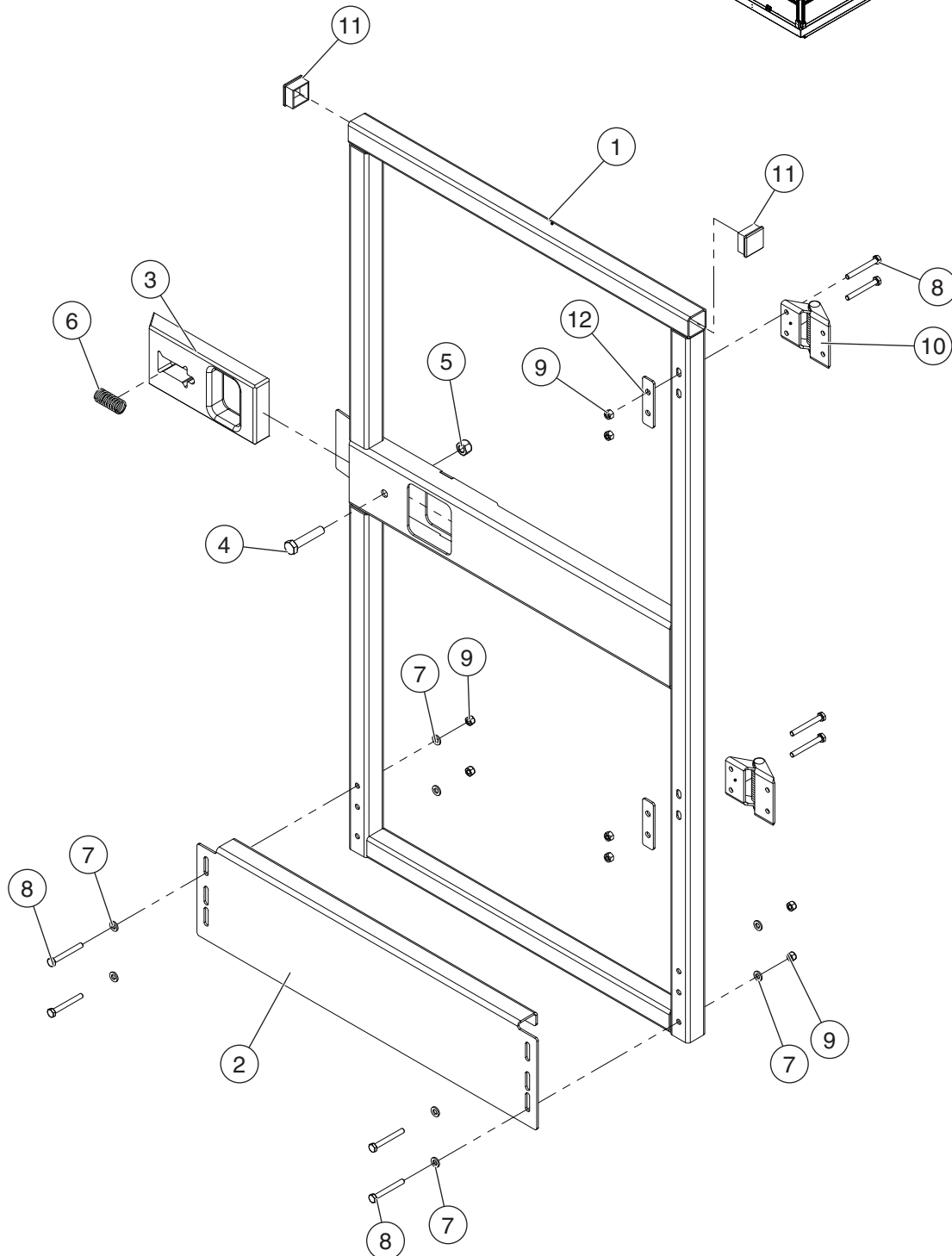
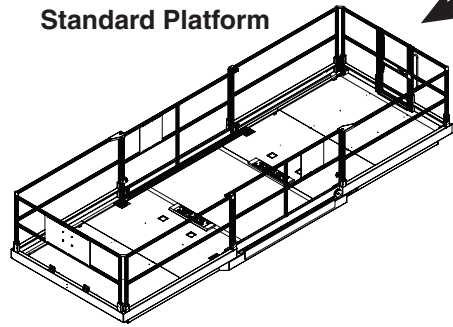


ILLUSTRATION No.  
ART\_3611

TITAN BOOM

Personnel Entry Gate Assembly



## Personnel Entry Gate Assembly, All Machines

ITEM	PART NO.	QTY	DESCRIPTION
--	84163	--	Entry Gate Assembly
1	22366	1	Weldment, Entry
2	22372	1	Formed, Entry
3	16799	1	Gate Latch
4	50036	1	Bolt, HHCS M10-1.50x050 08 Zp F
5	50049	1	Nut, M10x1.50 08 Zp Nylock
6	7408	1	Spring
7	50000	8	Washer M06 Zp Standard Flat
8	50262	8	Bolt, HHCS M06-1.00x050 08 Zp F
9	50047	8	Nut, M06x1.00 08 Zp Nylock
10	91629	2	Gate Hinge
11	6823	2	Cap Plug 1-1/4" Sq. Tube
12	19239	2	Hinge Spacer



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



Standard Platform

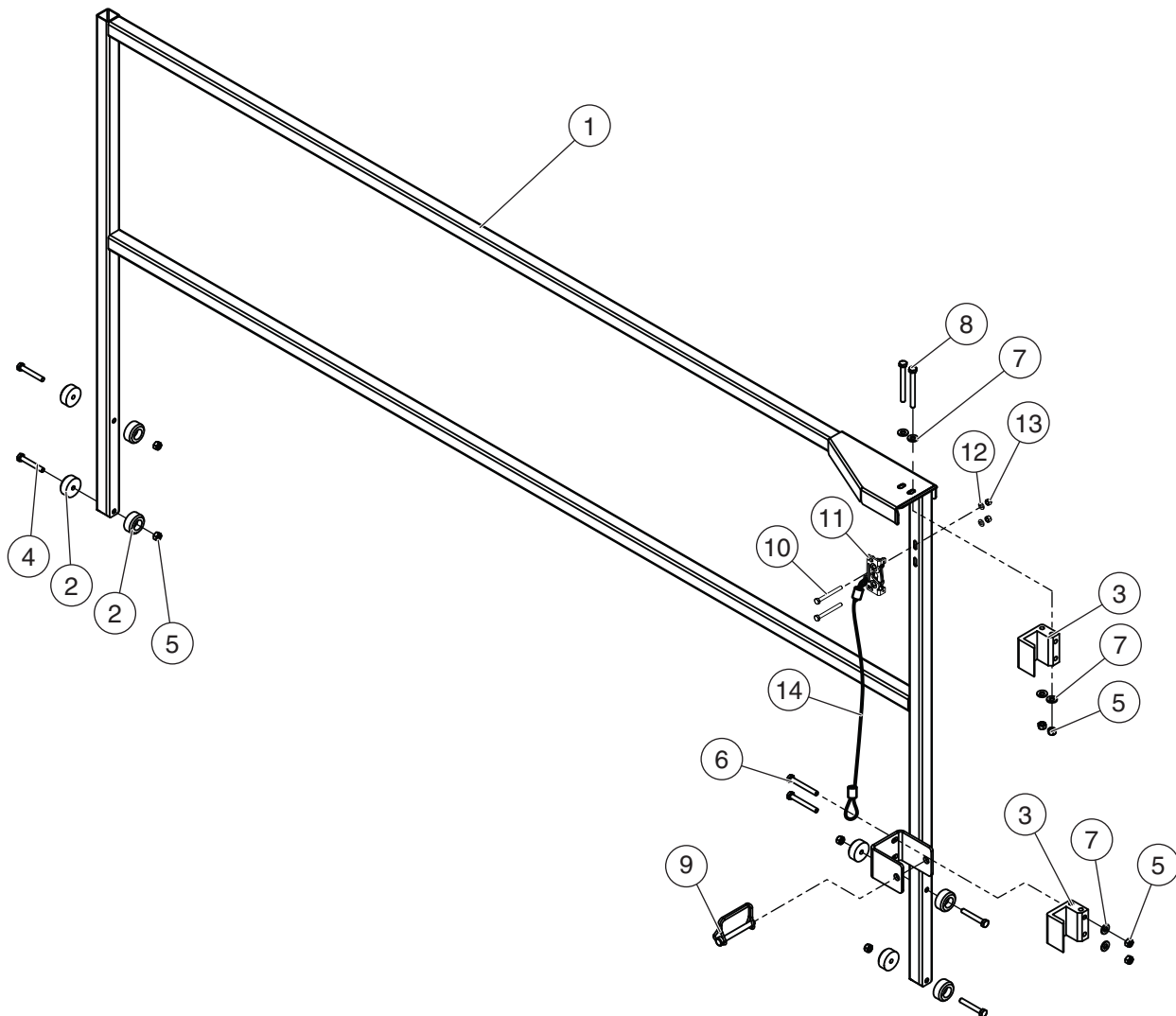
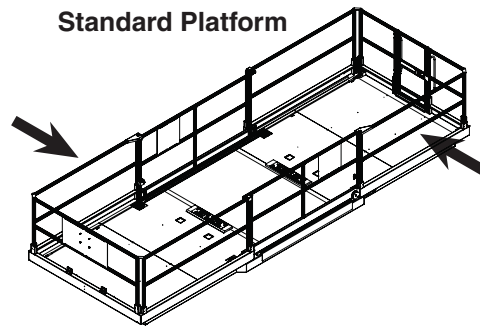


ILLUSTRATION No.  
ART\_3607

TITAN BOOM

Right Rail Assembly



## Right Side Rail Assembly, Standard Platform

ITEM	PART NO.	QTY	DESCRIPTION
--	84160	--	Right Side Rail Assembly
1	22354	1	Right Side Rail Weldment
2	19131	8	Puck
3	22318	2	Load Gate Guide
4	50016	4	Bolt, HHCS M08-1.25X055
5	50048	8	Nut, M08x1.25 Nylock
6	50251	2	Bolt, HHCS M08-1.25x065
7	50001	8	Washer, M08 Std
8	50018	2	Bolt, HHCS M08-1.25x080 08
Machines will have either Item #9 or Items #10-#14			
9	50186	1	Pin Wire Lock 0.375 X 3.25
10	50125	2	Bolt, BHCS M6 x 55
11	92302	1	Door Catch
12	50000	2	Washer, M6 Std
13	50047	2	Nut, M6 Nylock
14	22628	1	Cable



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



Standard Platform

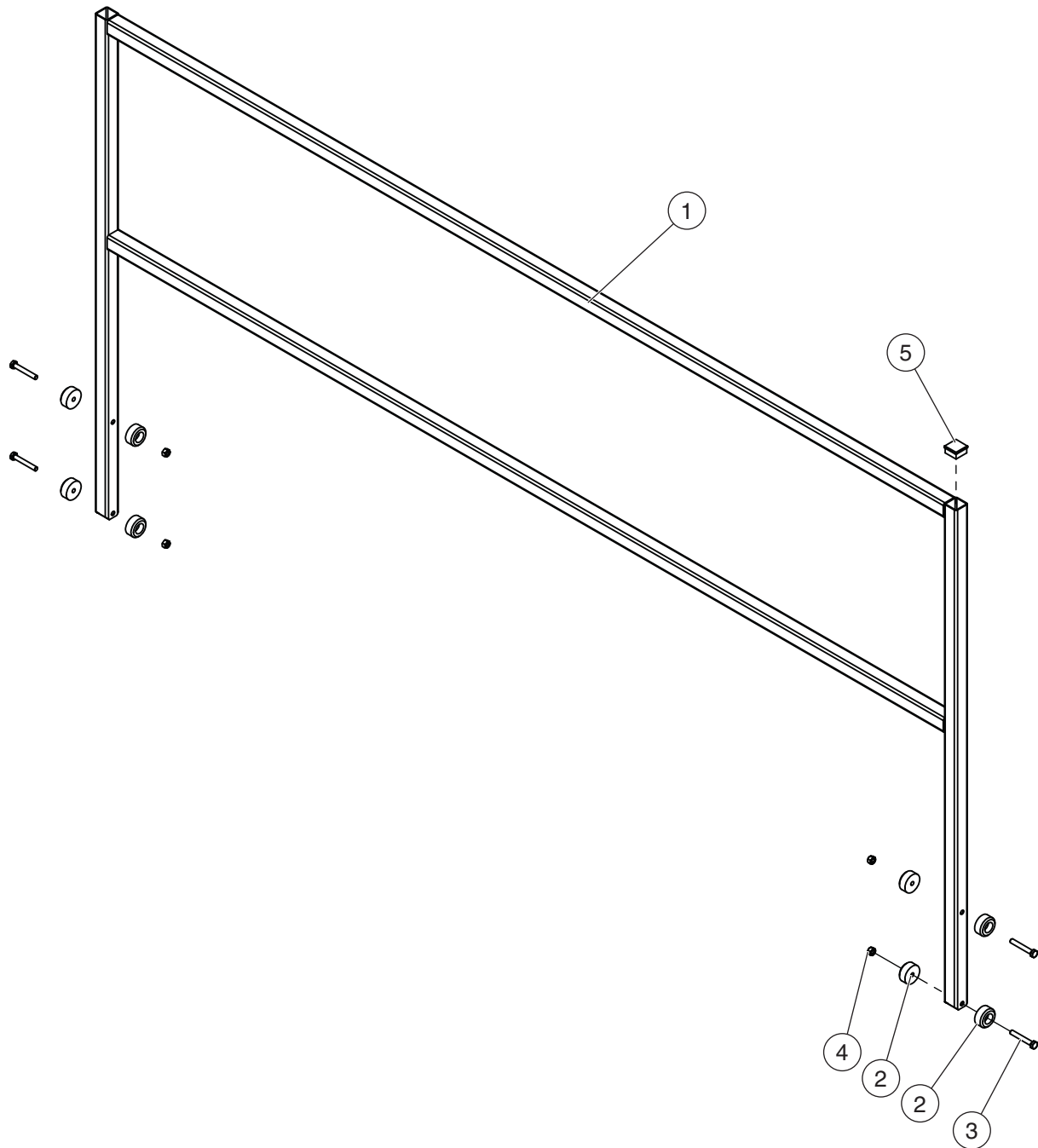
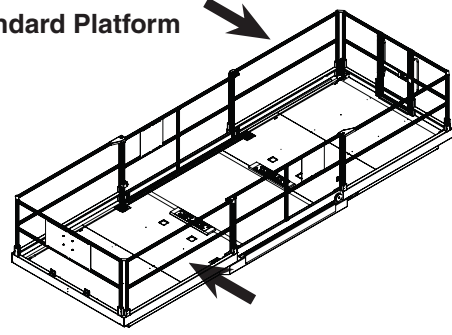


ILLUSTRATION No.  
ART\_3608

TITAN BOOM

Left Rail Assembly



## Left Side Rail Assembly, Standard Platform

ITEM	PART NO.	QTY	DESCRIPTION
--	84161	--	Left Side Rail Assembly
1	22350	1	Weldment, Side
2	19131	8	Puck
3	50016	4	Bolt, HHCS M08-1.25x055 08
4	50048	4	Nut, M08x1.25 08 Zp Nylock
5	6823	1	Cap Plug 1-1/4" Sq. Tube



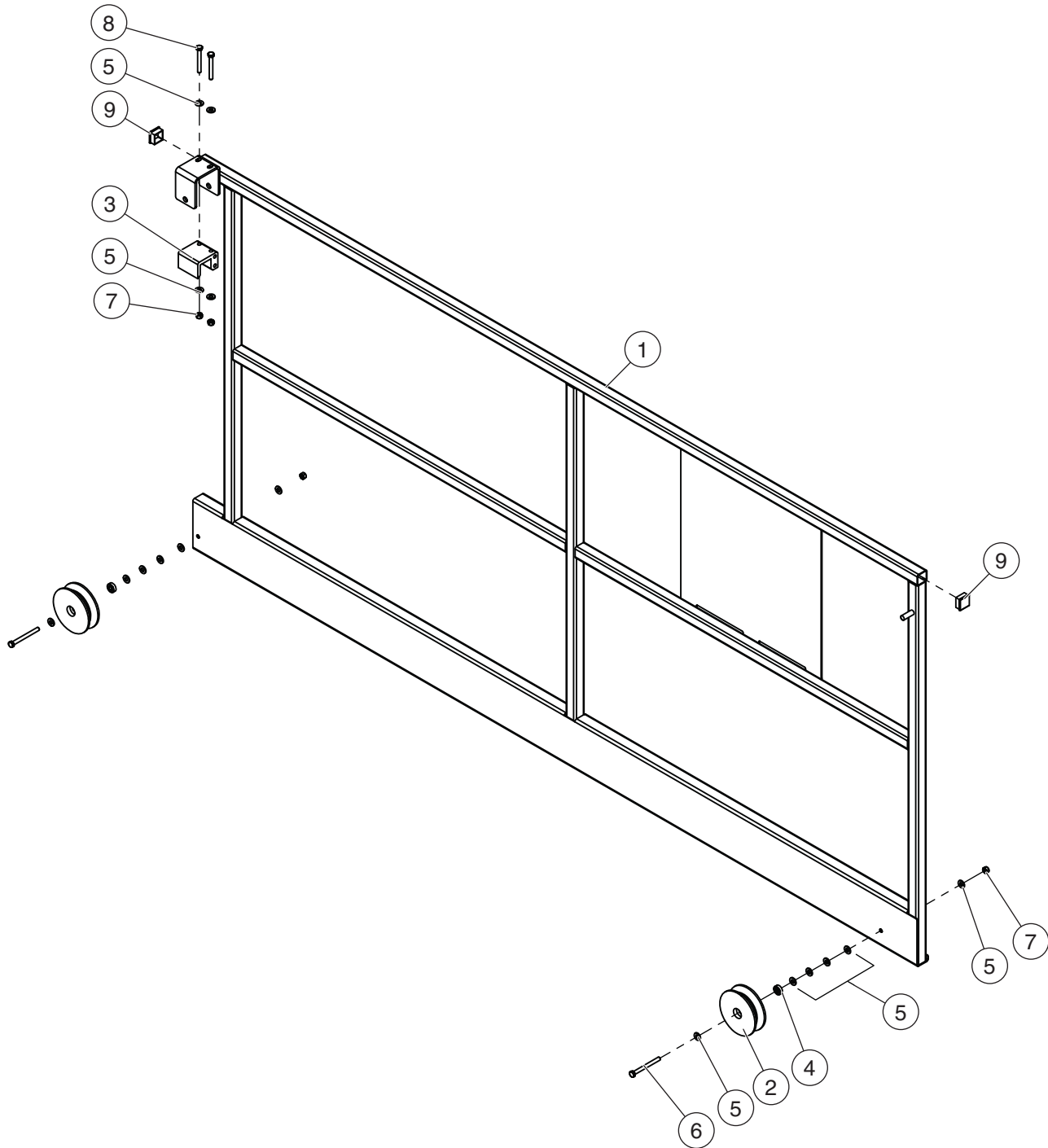
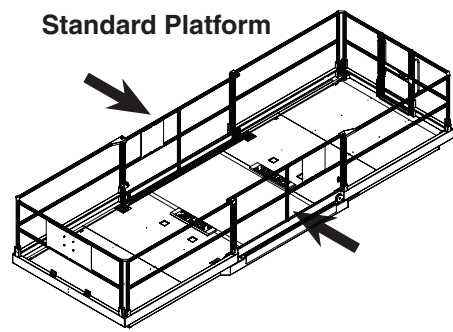
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Sliding Gate Assembly, Standard Platform

ITEM	PART NO.	QTY	DESCRIPTION
--	84162	--	Sliding Gate Assembly
1	22115	1	Sliding Gate
2	22325	2	Gate Guide
3	22318	1	Load Gate Guide
4	92250	2	Bearing
5	50001	16	Washer, M08 Zp Standard Flat
6	50019	2	Bolt, HHCS M08-1.25x085 08 Zp P
7	50048	4	Nut, M08x1.25 08 Zp Nylock
8	50251	2	Bolt, HHCS M08-1.25x065 08 Zp P
9	6823	2	Cap Plug 1-1/4" Sq. Tube



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



**Optional  
14-Ft. Platform**

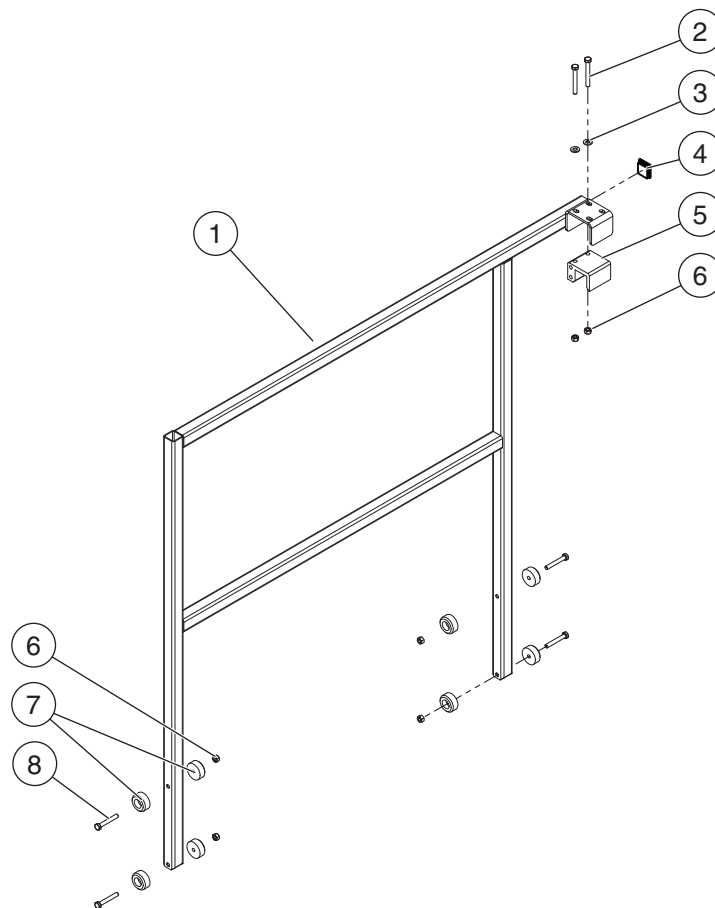
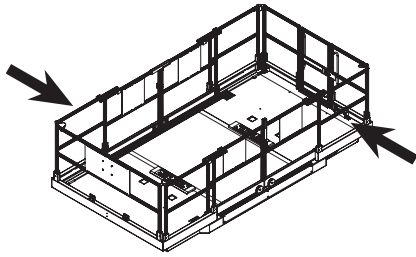


ILLUSTRATION No.  
ART\_4189

TITAN BOOM

Right Side Rail Assembly, Optional 14ft. Platform



## Right Side Rail Assembly, Optional 14-Ft. Platform

ITEM	PART NO.	QTY	QTY PER MACH	DESCRIPTION
--	84226	1	2	Right Side Rail Assembly
1	22711	1	2	Right Side Rail Weldment
2	50251	2	4	Bolt, HHCS M8 x 65
3	50001	2	4	Washer, M8 Std.
4	6823	1	2	Cap, 1.25" square
5	22318	1	2	Guide, Load Gate
6	50048	6	12	Nut, M8 Nylock
7	19131	4	8	Puck
8	50016	4	8	Bolt, HHCS M8 x 55



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



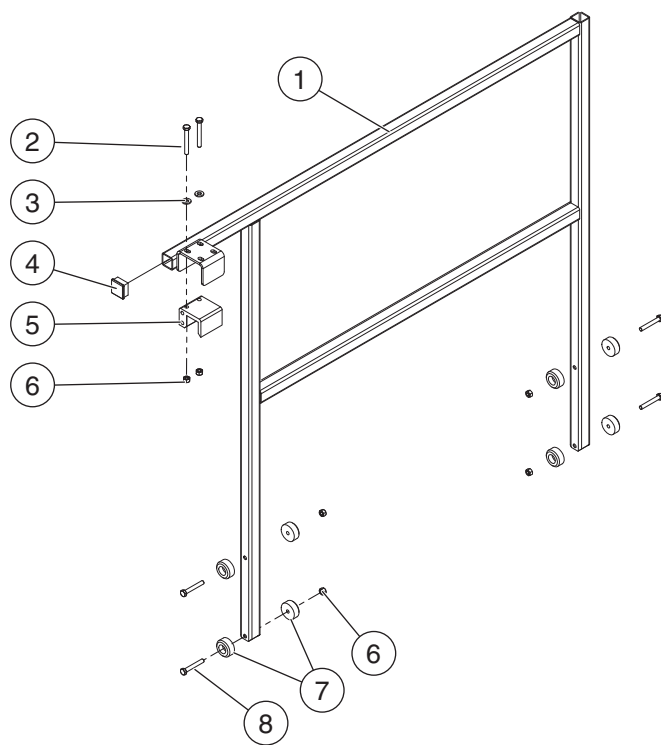
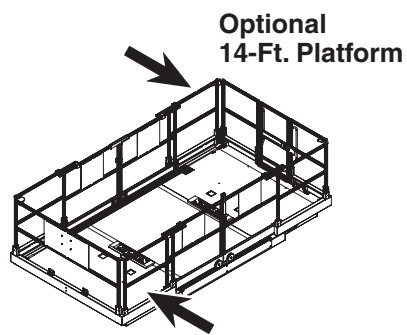


ILLUSTRATION No.  
ART\_4190

TITAN BOOM

Left Side Rail Assembly, Optional 14ft. Platform



## Left Side Rail Assembly, Optional 14-Ft. Platform

ITEM	PART NO.	QTY	QTY PER MACH	DESCRIPTION
--	84229	1	2	Left Side Rail Assembly
1	22700	1	2	Left Side Rail Weldment
2	50251	2	4	Bolt, HHCS M8 x 65
3	50001	2	4	Washer, M8 Std.
4	6823	1	2	Cap, 1.25" square
5	22318	1	2	Guide, Load Gate
6	50048	6	12	Nut, M8 Nylock
7	19131	4	8	Puck
8	50016	4	8	Bolt, HHCS M8 x 55



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



**Optional  
14-Ft. Platform**

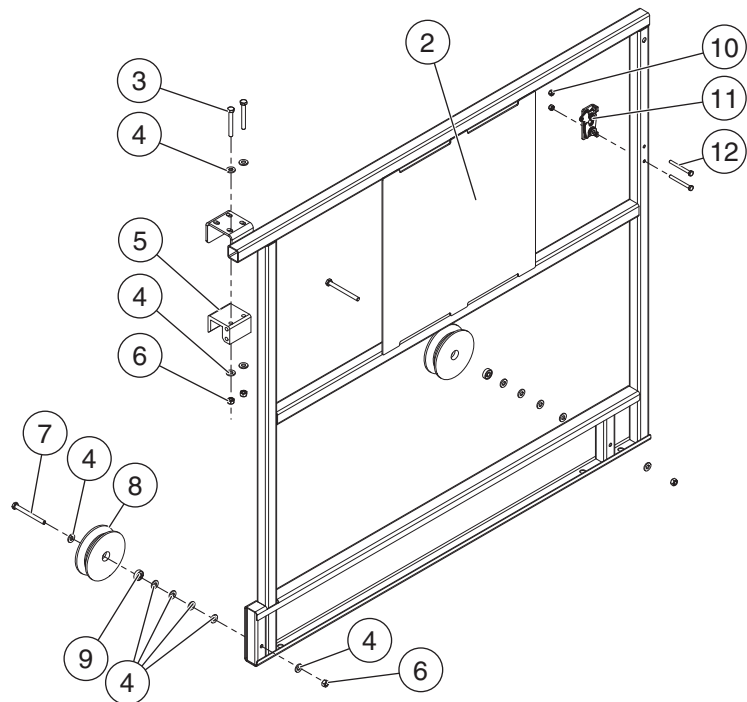
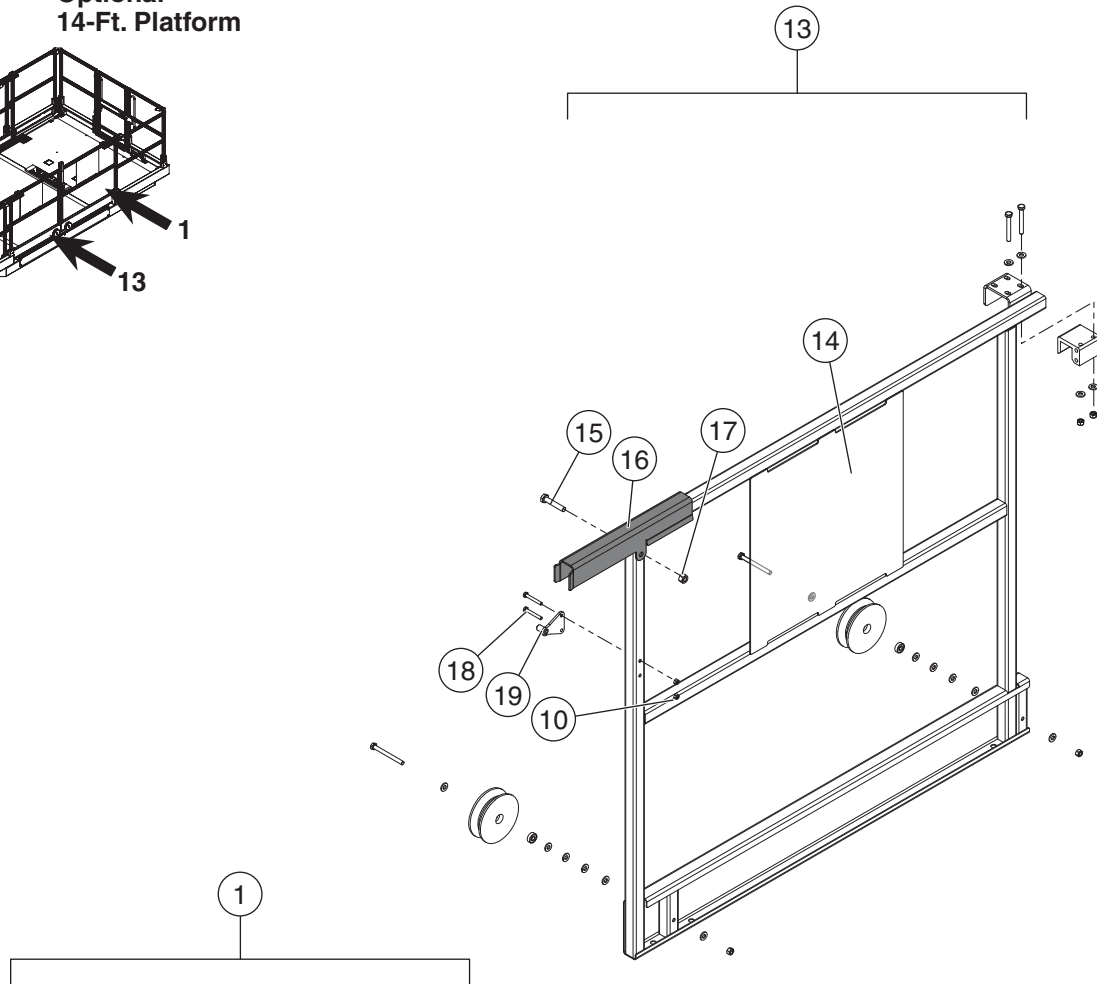
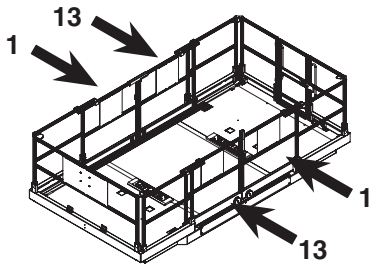


ILLUSTRATION No.  
ART\_4191

**TITAN BOOM**

**Sliding Gate Assemblies, Optional 14ft. Platform**



## Sliding Gate Assemblies, Optional 14-Ft Platform

ITEM	PART NO.	QTY	QTY PER MACH	DESCRIPTION
1	84227	1	2	Left Side Gate Assembly
2	22712	1	2	Left Side Gate Weldment
3	50251	4	8	Bolt, HHCS M8 x 65
4	50001	32	64	Washer, M8 Std
5	22318	2	4	Load Gate Guide
6	50048	8	16	Nut, M8 Nylock
7	50019	4	8	Bolt, HHCS M8 x 85
8	22325	4	8	Guide Roller
9	92250	4	8	Bearing
10	50047	4	8	Nut, M6 Nylock
11	92302	1	2	Gate Latch
12	50028	2	4	Bolt, HHCS M6 x 20
13	84228	1	2	Right Side Gate Assembly
14	22722	1	2	Right Side Gate Weldment
15	50021	1	2	Bolt, HHCS M10 x 55
16	22724	1	2	Gate Support
17	50049	1	2	Nut, M10 Nylock
18	50294	2	4	Bolt, HHCS M6 x 45
19	22719	1	2	Gate Striker



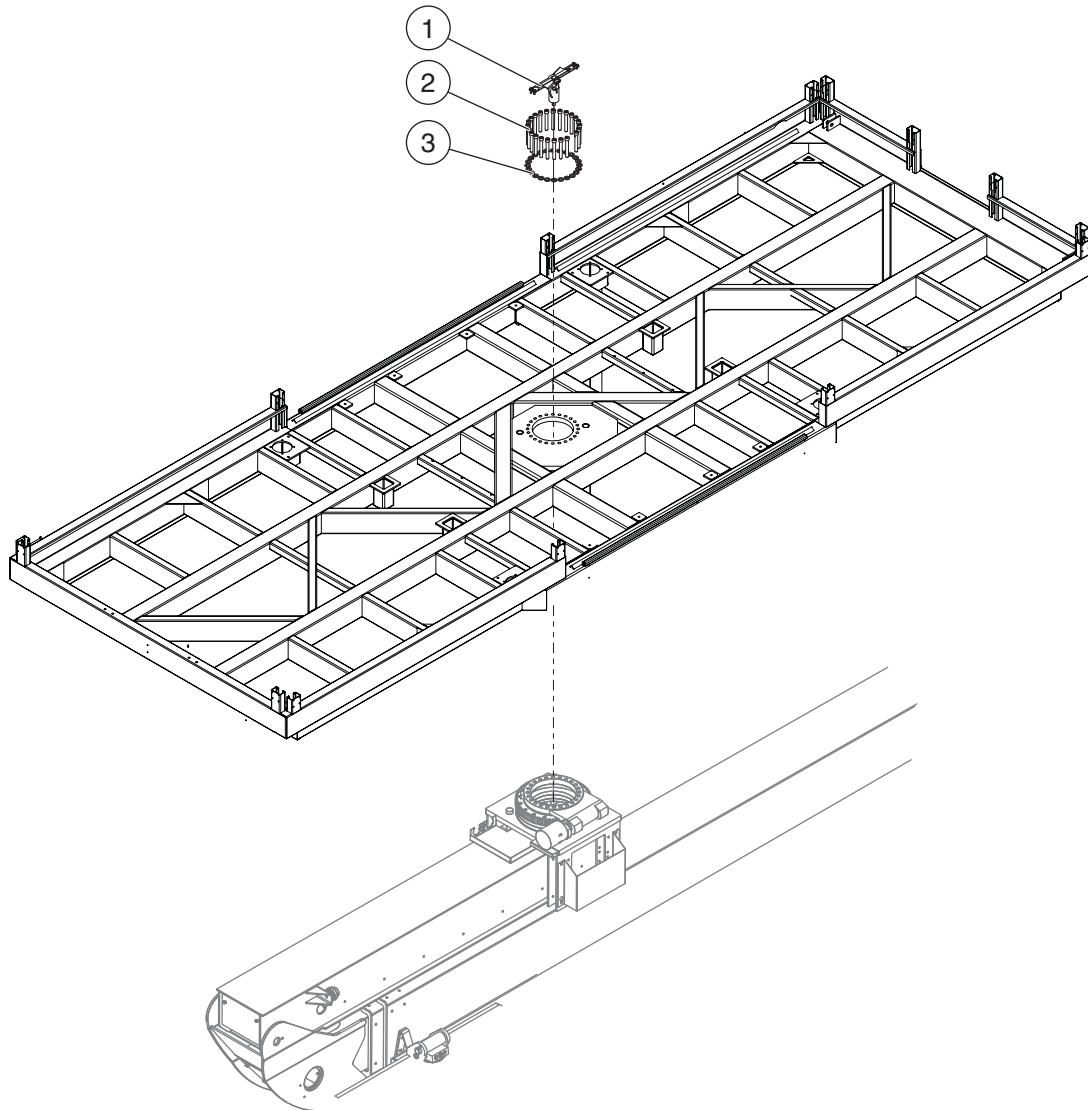
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only





Deck components removed for clarity.  
It is only necessary to remove the central  
Load Zone plate to access these parts.

  
ILLUSTRATION No.  
ART\_3627

TITAN BOOM

Platform/Cantilever Assembly



## Platform/Cantilever Assembly, All Machines

ITEM	PART NO.	QTY	DESCRIPTION
1	REF	1	Rotation Sensor Assembly -- See page 37
2	50263	23	Bolt, SHCS M16-2.00 x 110
3	50261	23	Washer, M16 Hardened



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



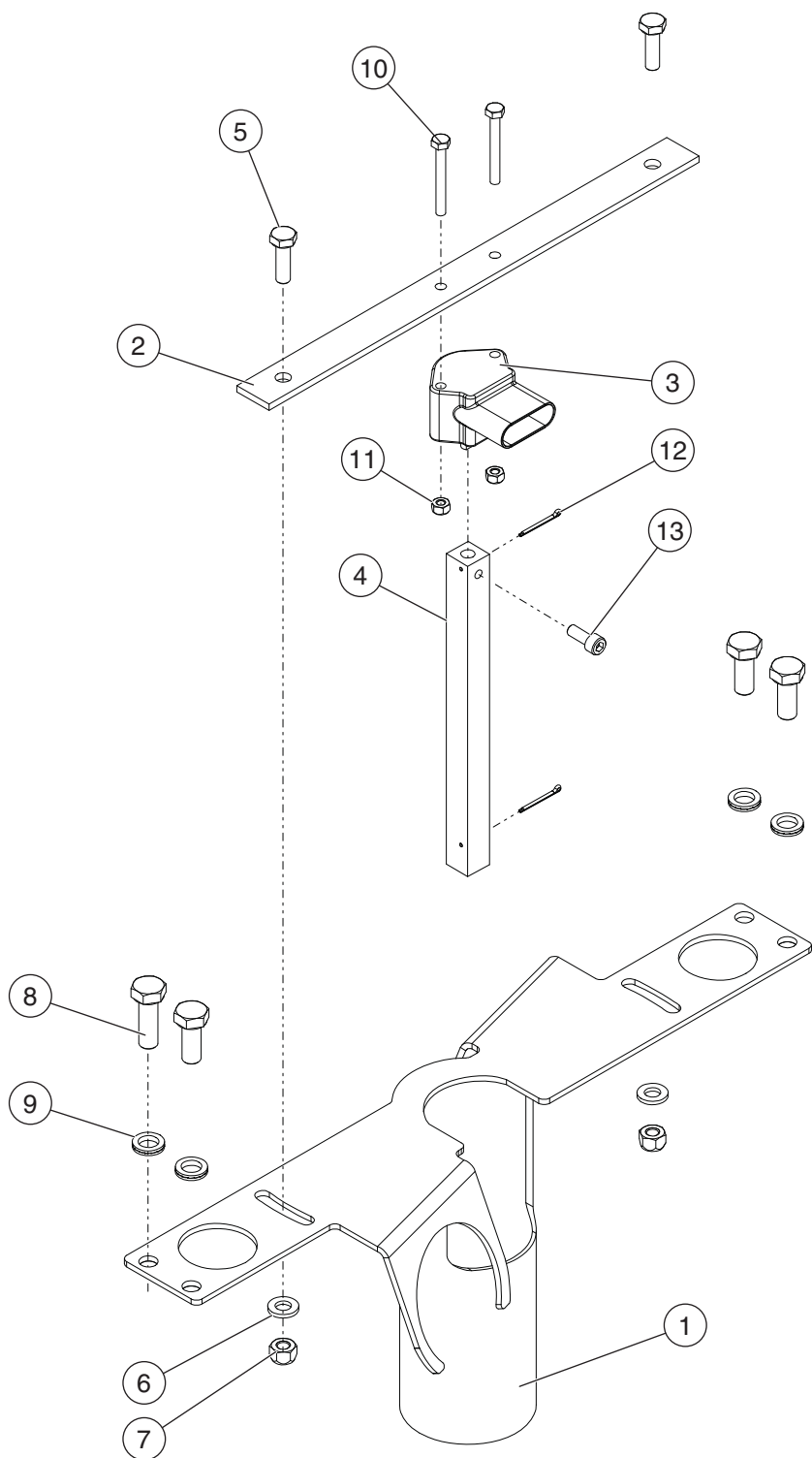


ILLUSTRATION No.  
ART\_3613

TITAN BOOM

Rotational Sensor Assembly



## Rotation Sensor Assembly, All Machines

ITEM	PART NO.	QTY	DESCRIPTION
1	22533	1	Rotation Wire Guide Weldment
2	22536	1	Rotation Sensor Mount
3	92220	1	Rotation Position Sensor
4	22537	1	Rotation Shaft
5	50028	8	Bolt, HHCS M06-1.00x020
6	50000	26	Washer, M06 Zp Standard Flat
7	50047	16	Nut, M06x1.00 Nylock
8	50030	5	Bolt, HHCS M8-1.25 X 20
9	50200	9	Washer, M08 Zp Nordlock
10	50307	2	Bolt, HHCS M04-0.70x035
11	50285	2	Nut, M04x0.70 08 Zp Nylock
12	92276	2	Cotter Pin, 1/16" x 0.75"
13	50326	1	Bolt, SHCS #10-32 X 0.5"



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

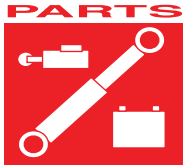
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**NOTES:**

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# SECTION C

## ELEVATING ASSEMBLY

### CONTENTS

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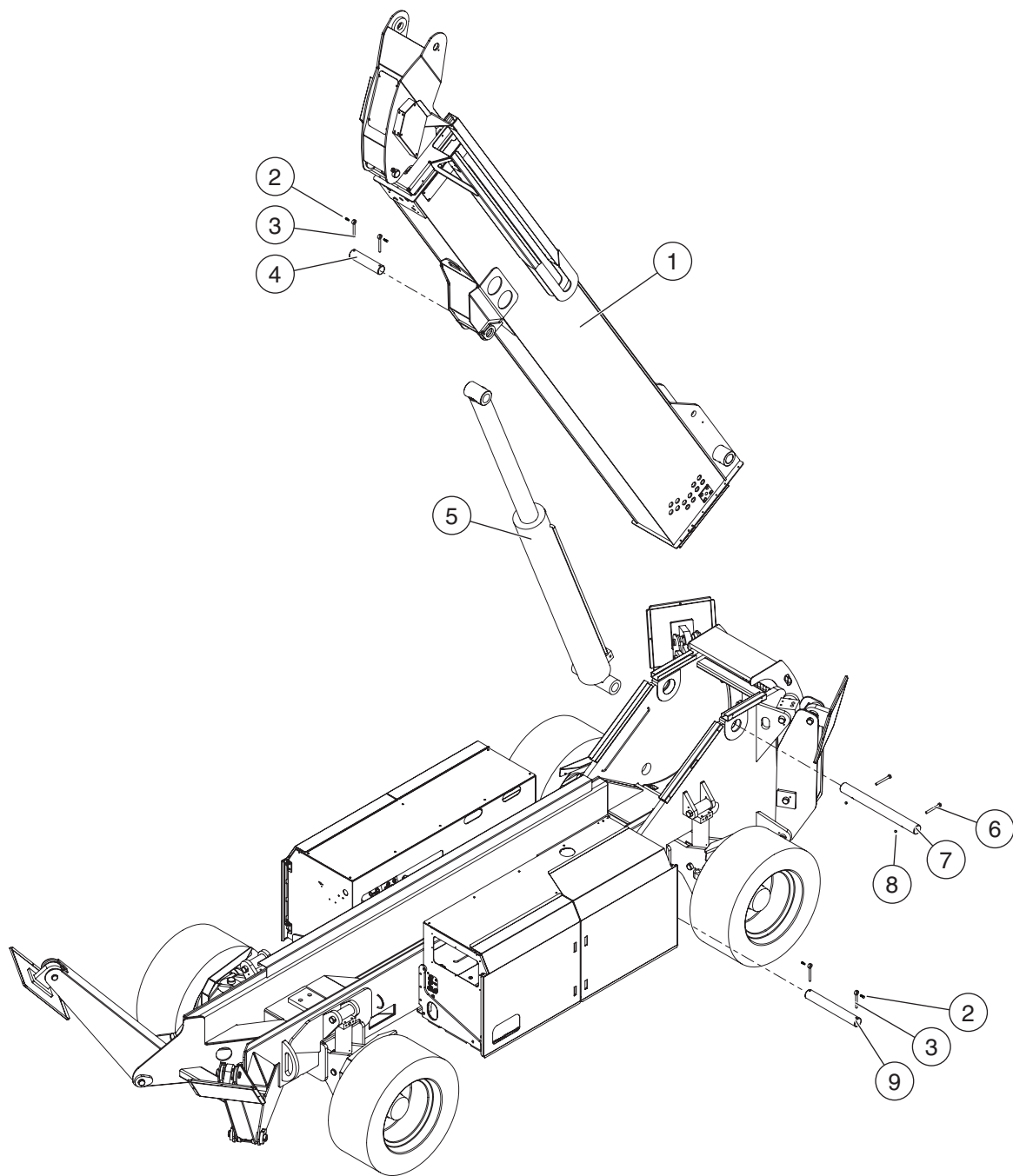


ILLUSTRATION No.  
ART\_4319

TITAN BOOM 60-S

Boom/Chassis Installation



## Boom/Chassis Installation

ITEM	PART NO.	QTY	DESCRIPTION
1	24399	1	Boom Assembly
2	50236	4	Bolt, M12 x 40
--	50007	4	Washer, M12 Nordlock (not shown)
3	18152	4	Retainer Pin
4	24316	1	Pin, Boom/Cylinder
5	24151	1	Boom Lift Cylinder
6	50339	2	Bolt, M16 x 150
7	24162	1	Boom Pivot Pin
8	50051	2	Nut, M16 Nylock
9	24160	1	Pin, Chassis/Cylinder



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



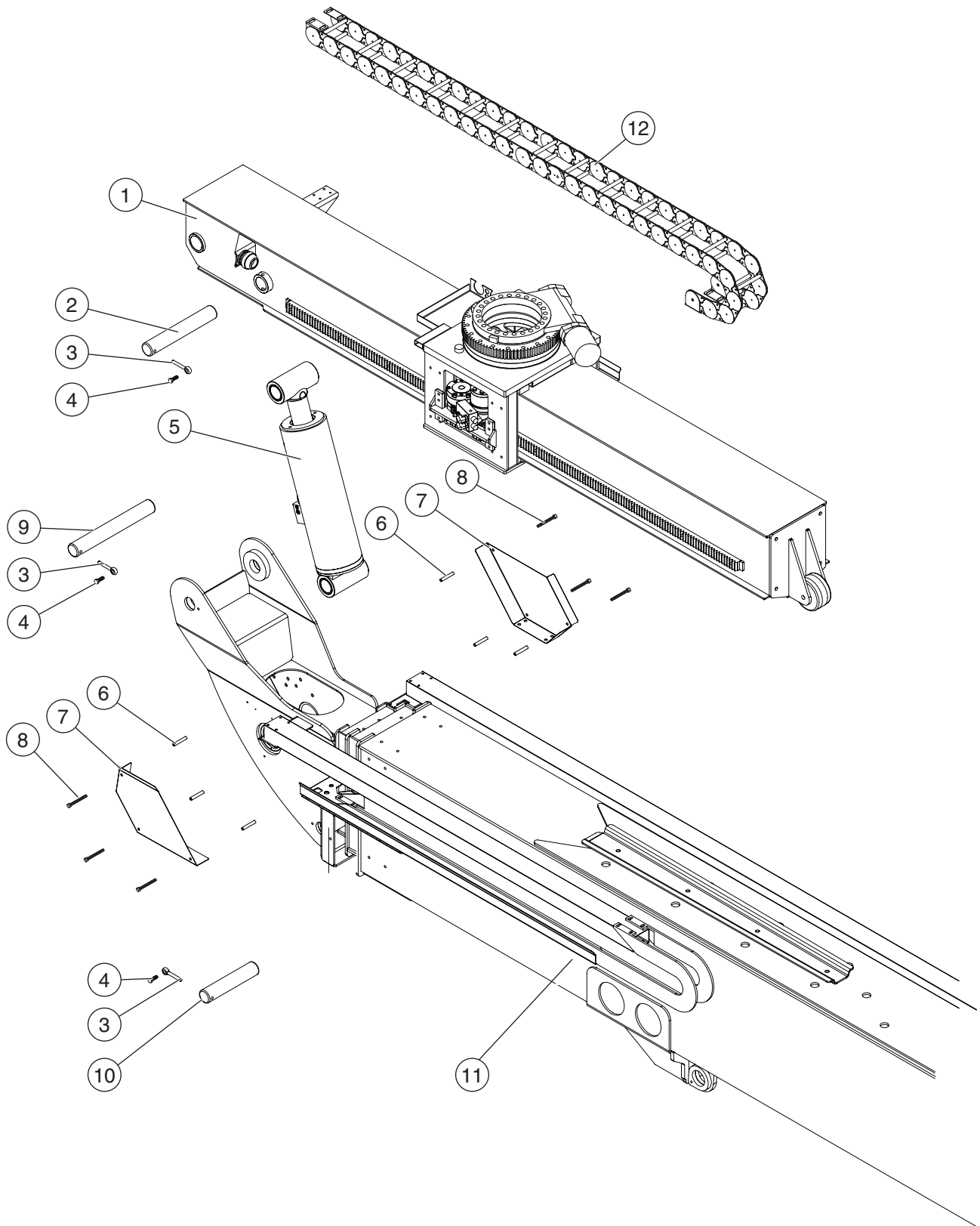


ILLUSTRATION No.  
ART\_4320

TITAN BOOM 60-S

Cantilever Beam Installation



## Cantilever Beam Installation

ITEM	PART NO.	QTY	DESCRIPTION
1	24249	1	Cantilever Beam Assembly
2	24170	1	Pin, Cylinder/Cantilever Beam
3	18152	3	Retainer Pin
4	50236	3	Bolt, M12 x 40
--	50007	3	Washer, M12 Nordlock (not shown)
5	24157	1	Platform Level Cylinder
6	22385	6	Spacer Tube
7	22321	2	Hose Cover
8	50237	6	Bolt, M8 x 100
9	24171	1	Pin, Boom/Cantilever Beam
10	24172	1	Pin, Cylinder/Cantilever Beam
11	24399	1	Boom Assembly
12	92998	1	Cable Track
--	22386	8	Spacer Tube (not shown)
--	50237	8	Bolt, M8 x 100 (not shown)
--	50001	8	Washer, M8 std. (not shown)
--	50048	8	Nut, M8 Nylock (not shown)



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



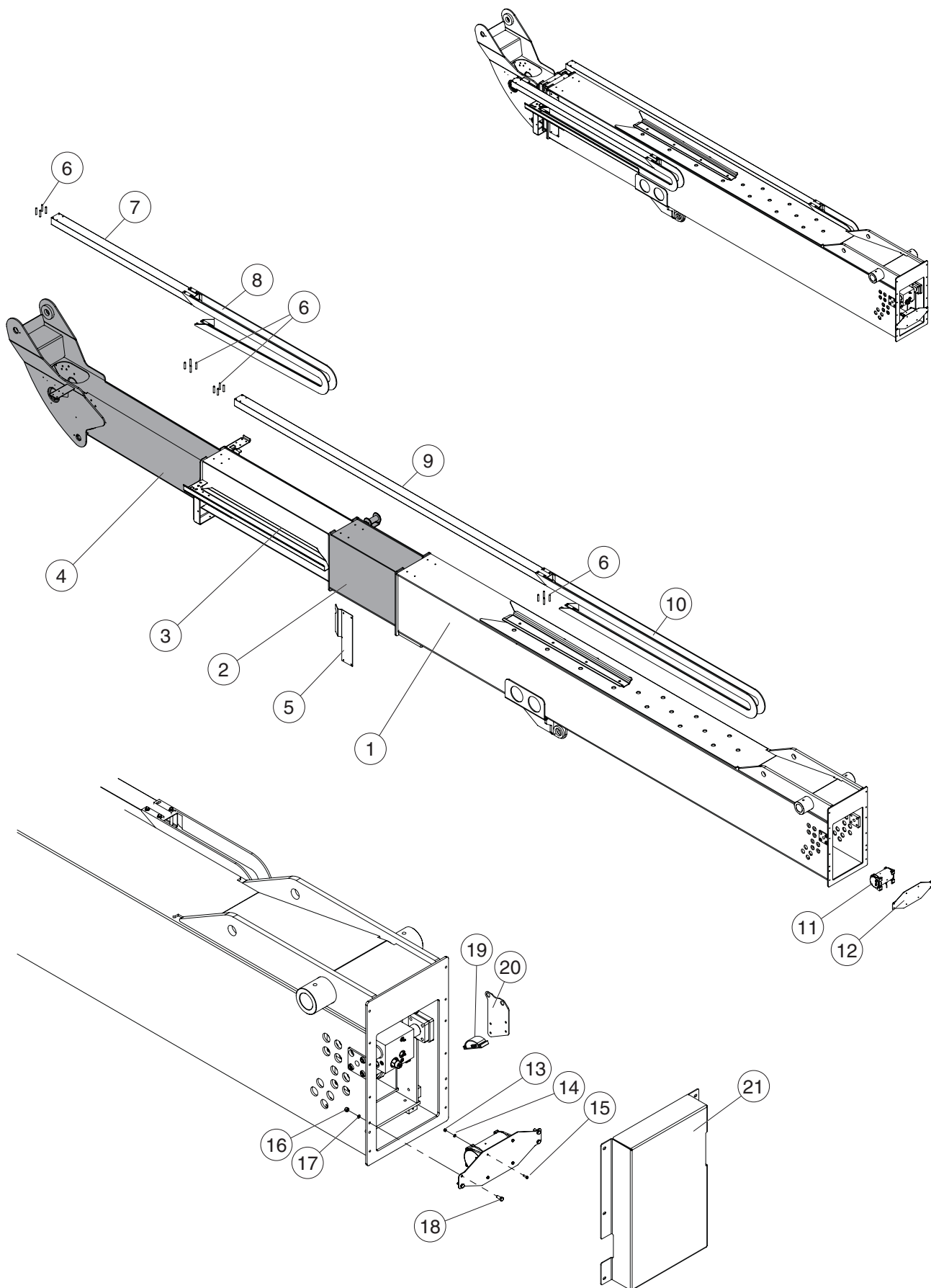


ILLUSTRATION No.  
ART\_XXXX

TITAN BOOM 60-S

Boom Assembly, 1 of 2



## Boom Assembly, 1 of 2

ITEM	PART NO.	QTY	DESCRIPTION
--	84176	--	Boom Assembly
1	24398	1	Base Boom Section
2	24397	1	First Inner Boom Section
3	24396	1	Second Inner Boom Section
4	24237	1	End Boom Section
5	24412	1	Deflector
6	22386	16	Spacer Tube
--	50237	16	Bolt, M8 x 100 (not shown)
--	50001	16	Washer, M8 std. (not shown)
--	50048	16	Nut, M8 Nylock (not shown)
7	24268	1	Cable Tube, Short
8	92997	1	Cable Track, Short
9	24262	1	Cable Tube, Long
10	92996	1	Cable Track, Long
11	93000	1	Cable Transducer
12	24211	1	Mounting Bracket, Cable Transducer
13	50047	4	Nut, M6 Nylock
14	50000	4	Washer, M6 std.
15	50117	4	Bolt, M6 x 25
16	50049	4	Nut, M10 Nylock
17	50002	4	Washer, M10 Std.
18	50034	4	Bolt, M10 x 30
19	90844	1*	Angle Transducer
20	24340	1	Angle Transducer Mounting Plate
21	24407	1	Boom Rear Cover

\*2 present on machines equipped with optional Overload Sensing System.



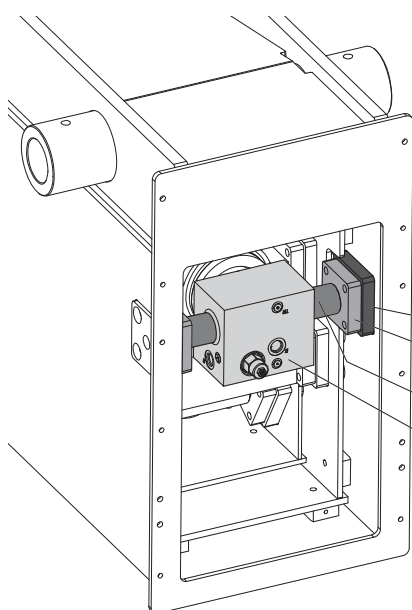
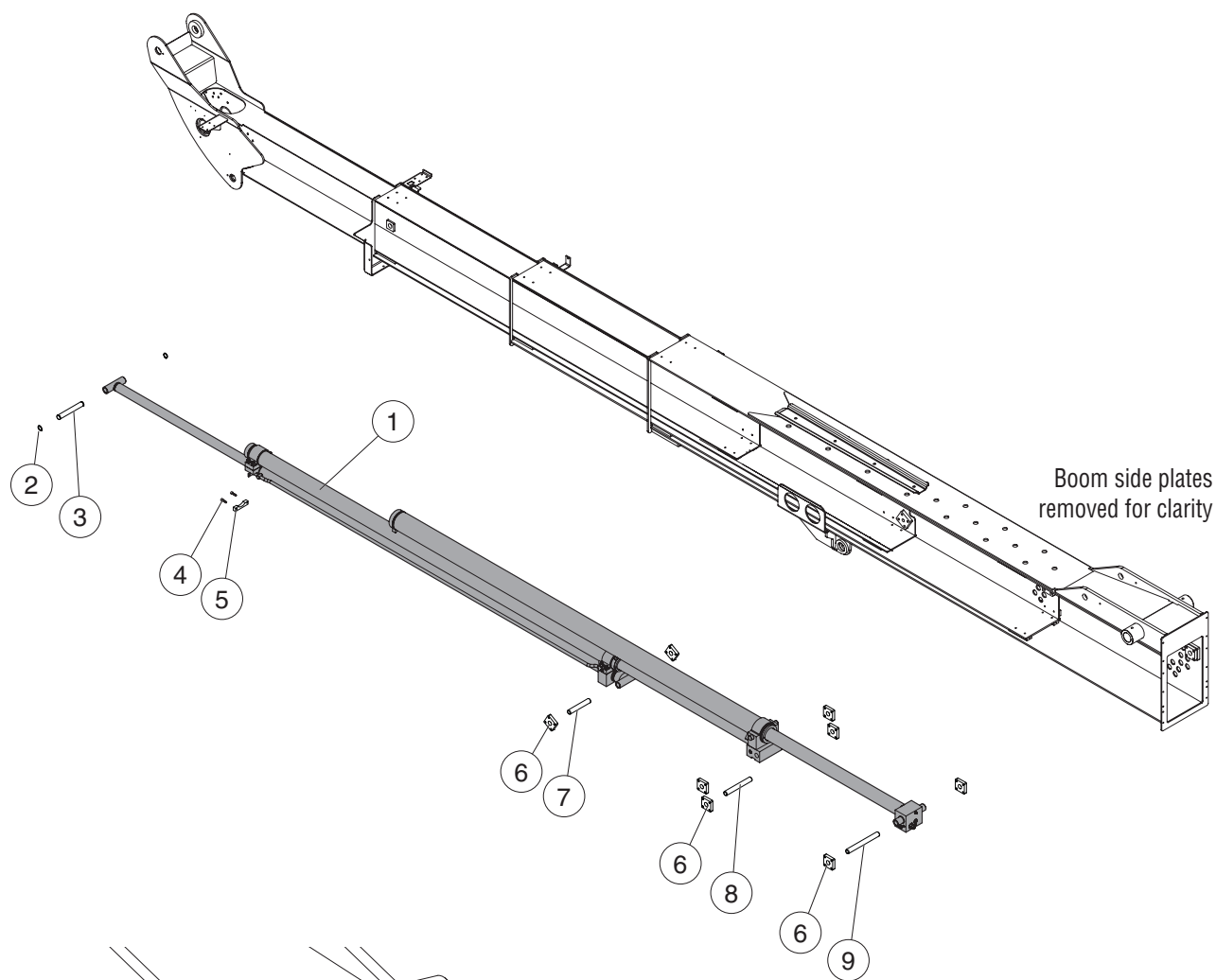
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only





### Assembled Pin Joint

- 10 Socket Head Bolts
- 11 Socket Head Bolts
- Pin Keeper Mount
- 6 Pin Keeper
- Pin
- 1 Cylinder



ILLUSTRATION No.  
ART\_4322

TITAN BOOM 60-S

Boom Assembly, 2 of 2





## Boom Assembly, 2 of 2

ITEM	PART NO.	QTY	DESCRIPTION
--	84176	--	Boom Assembly
1	24156	1	Extend Cylinder
2	92243	2	Snap Ring
3	24183	1	Pin, 10.688
4	50014	2	Bolt, M8 x 40
--	50200	2	Washer, M8 Nordlock (not shown)
--	50048	2	Nut, M8 Nylock (not shown)
5	24272	1	Cylinder Slide Block
6	24229	6	Pin Keeper
7	24390	1	Pin, 9.25"
8	24391	1	Pin, 11.40"
9	24293	1	Pin, 14.00"
10	50503	24	Bolt, Socket Head M16 x 75
11	50249	24	Washer, M16 Nordlock



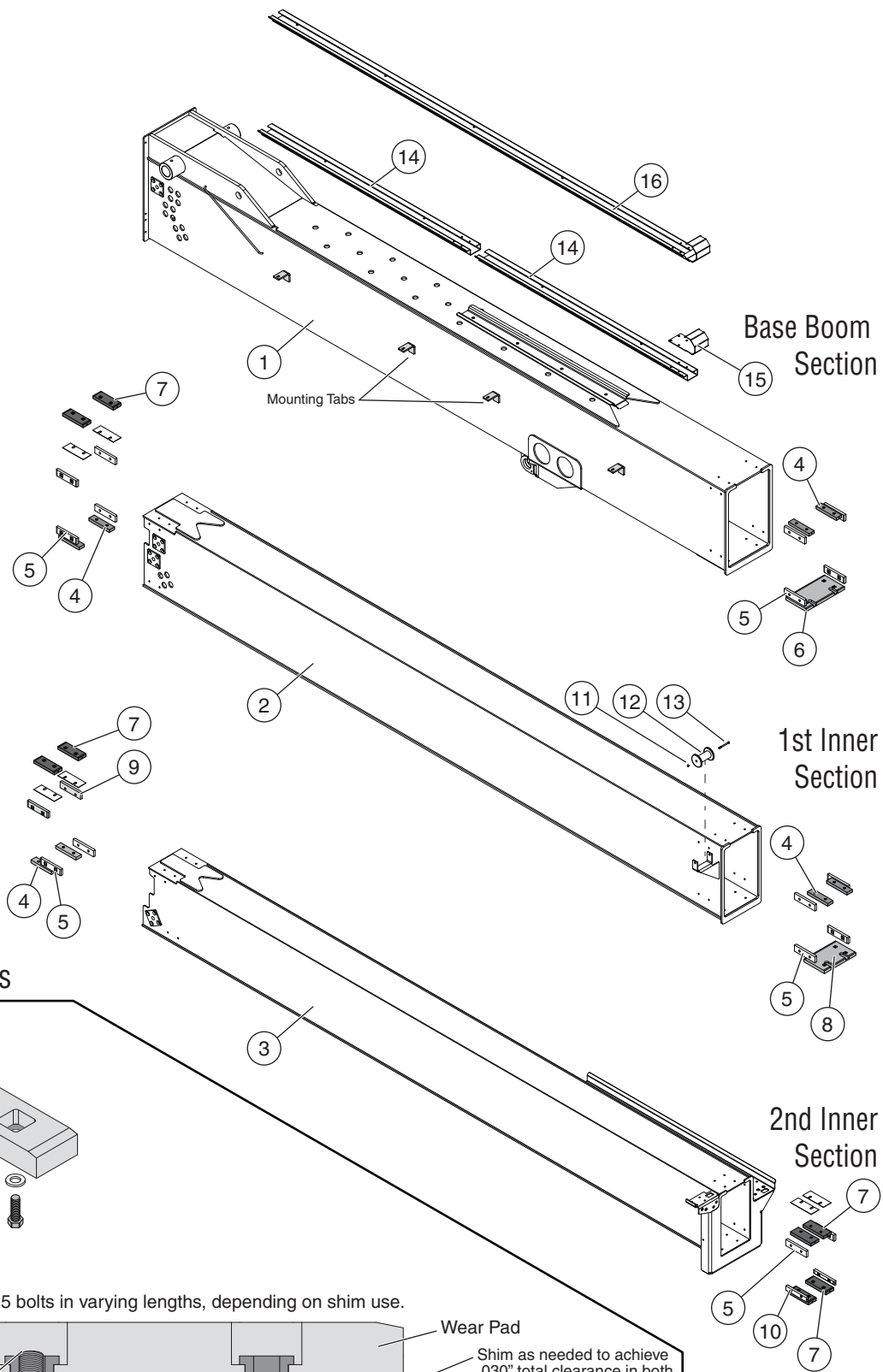
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• INCL: Included with assembly

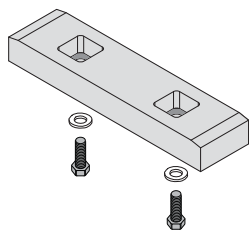
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• REF: Reference only

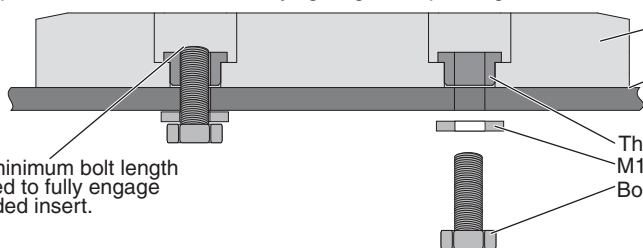




## Wear Pad Bolts



Wear pads use M10-1.5 bolts in varying lengths, depending on shim use.



Use minimum bolt length needed to fully engage threaded insert.

Wear Pad

Shim as needed to achieve .030" total clearance in both side-to-side and top-to-bottom directions.

Threaded Insert  
M10 Nordlock Washer  
Bolt

MEC  
ILLUSTRATION No.  
ART\_4323

TITAN BOOM 60-S

Boom Sections, 1 of 2



## Boom Sections, 1 of 2

ITEM	PART NO.	QTY	DESCRIPTION
1	24395	1	Base Boom Section
2	24394	1	1st Inner Boom Section
3	24393	1	2nd Inner Boom Section
4	11861978	6	Wearpad*
--	22224	as req.	Wearpad Shim (.02)
--	11861977	as req.	Wearpad Shim (1mm)
--	11861981	as req.	Wearpad Shim (3mm)
--	11861982	as req.	Wearpad Shim (5mm)
--	11861983	as req.	Wearpad Shim (10mm)
5	24339	16	Side Wear Pad
6	24223	1	Front Lower Wear Pad, Base Boom
7	24371	10	Offset Wearpad*
--	22574	2	Offset Wearpad Shim
8	24260	1	Front Lower Wear Pad, 1st Inner Boom
9	24335	2	Offset Side Wear PAd
10	24380	2	Narrow Side Wear Pad
11	50054	1	Nut, M12 Nylock
12	18338	1	Roller
13	50381	1	Bolt, M12 x 180
14	24438	2	Cable Track Carrier**
15	24379	1	Hose Wrap Forming**
16	24264	1	<b>Early Machines</b> -- Cable Track Carrier, Single Piece**

### Wear Pad Bolts

Wear pads use M10-1.5 bolts in varying lengths, depending on shim use. Use minimum bolt length needed to fully engage threaded insert.

Wear pad bolts must be installed with M10 Nordlock washers.

--	50033	--	Bolt, M10 x 25
--	50034	--	Bolt, M10 x 30
--	50332	--	Bolt, M10 x 35
--	50035	--	Bolt, M10 x 40
--	50036	--	Bolt, M10 x 50
--	50021	--	Bolt, M10 x 55
--	50006	96	Washer, M10 Nordlock

\*Boom sections must be shimmed to a total clearance of .030 inch (.762mm) in both side-to-side and top-to-bottom directions when the boom is in its tightest section.

\*Early machine used a single-piece Cable Track Carrier (Item #16) instead of the multi-part version (Items #14 and #15) used in current production. These early machines are distinguishable from later machines in that there are only three (3) mounting tabs welded to the side of the Base Boom Section. Later machines have four (4) tabs.



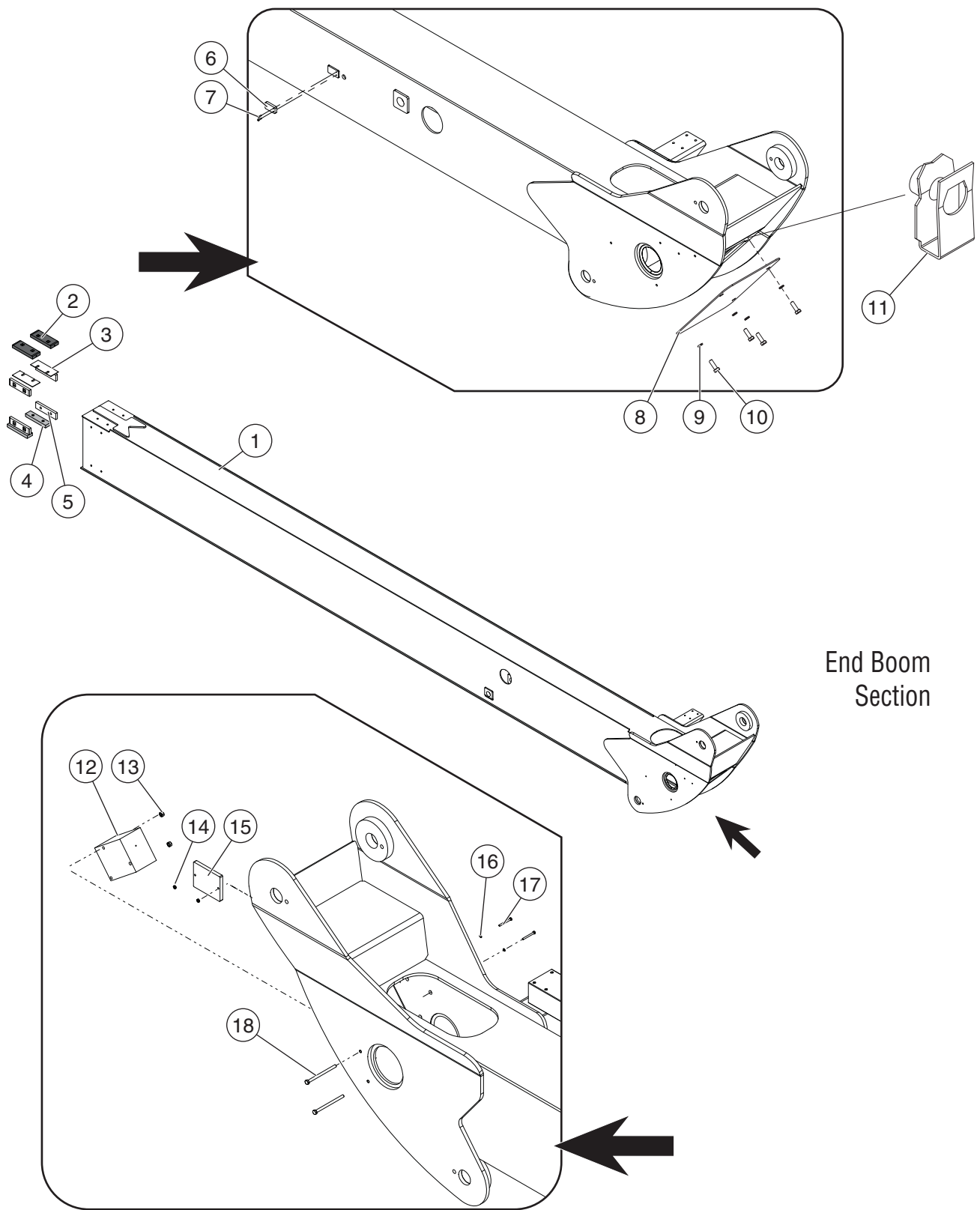
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only





### Wear Pad Bolts

See illustration detail on previous page.



## Boom Sections, 2 of 2

ITEM	PART NO.	QTY	DESCRIPTION
1	24238	1	Tip Boom Weldment
2	24371	2	Offset Wearpad
3	22574	2	Shim, Offset Wearpad
4	11861978	2	Bearing Pad*
--	22224	as req.	Wearpad Shim (0.02)
--	11861977	as req.	Wearpad Shim (1mm)
--	11861981	as req.	Wearpad Shim (3mm)
--	11861982	as req.	Wearpad Shim (5mm)
--	11861983	as req.	Wearpad Shim (10mm)
5	24339	4	Side Wearpad
6	92097	1	Tip Boom Extension Sensor
7	50155	2	Bolt, 6/32 x .5" Socket Head
8	22309	1	Cover Plate
9	50002	4	Washer, M10 Std.
10	50033	4	Bolt, M10 x 25
11	92098	4	Clip Nut, M10-1.5

### Wear Pad Bolts

Wear pads use M10-1.5 bolts in varying lengths, depending on shim use. Use minimum bolt length needed to fully engage threaded insert.

Wear pad bolts must be installed with M10 Nordlock washers.

--	50033	--	Bolt, M10 x 25
--	50034	--	Bolt, M10 x 30
--	50332	--	Bolt, M10 x 35
--	50035	--	Bolt, M10 x 40
--	50036	--	Bolt, M10 x 50
--	50021	--	Bolt, M10 x 55
--	50006	16	Washer, M10 Nordlock

\*Boom sections must be shimmed to a total clearance of .030 inch (.762mm) in both side-to-side and top-to-bottom directions when the boom is in its tightest section.



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



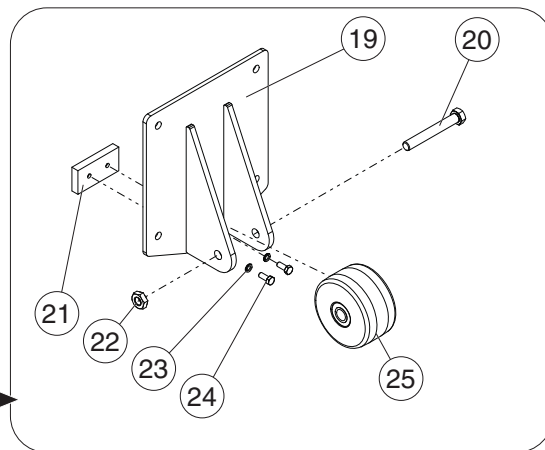
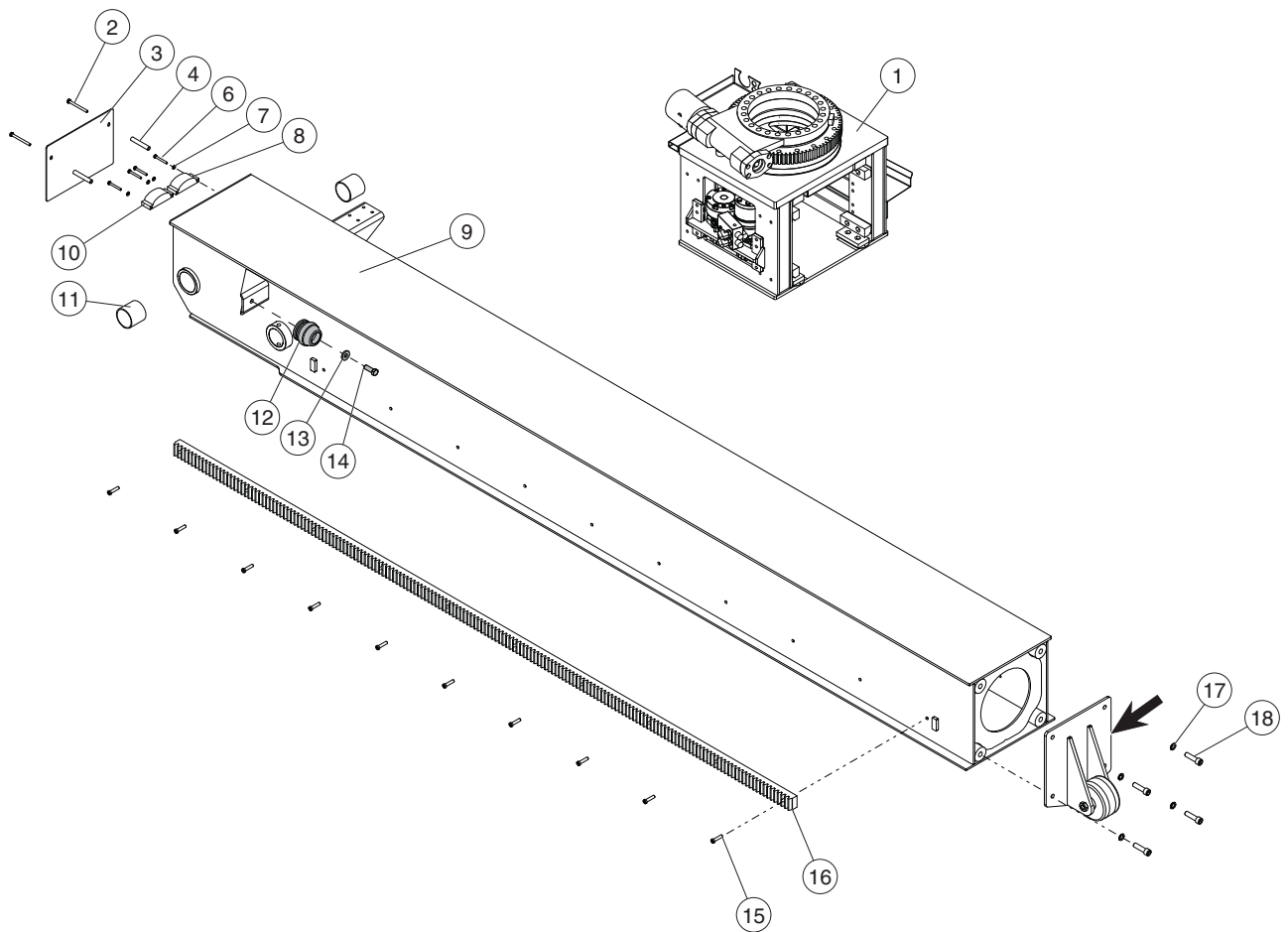


ILLUSTRATION No.  
ART\_4325

TITAN BOOM 60-S

Cantilever Beam



## Cantilever Beam Assembly

ITEM	PART NO.	QTY	DESCRIPTION
--	24249	--	Cantilever Assembly, without Carriage Assembly
1	84171	1	Carriage Assembly
2	50327	2	Bolt, M8 x 100
3	22077	1	Cover Plate
4	22385	2	Spacer
5	--	--	--
6	50262	4	Bolt, M6 x 50
7	50000	4	Washer, M6
8	92009	1	Can Tilt 151
9	24250	1	Cantilever Beam Weldment
10	91960	1	Can Tilt 153
11	92611	2	Bearing
12	92096	1	Bumper
13	22473	1	Bumper Washer
14	50040	1	Bolt, M12 x 35
15	50260	10	Bolt, Socket Head M8 x 35
16	24257	1	Rack Gear
17	50011	4	Washer, M16 Nordlock
18	50011	4	Bolt, Socket Head M16 x 60
19	22506	1	Carriage Stop Weldment
20	50059	1	Bolt, 3/4 x 5.5"
21	22425	1	Slide Block
22	50118	1	Nut, 3/4
23	50006	2	Washer M10 Nordlock
24	50033	2	Bolt, M10 x 25
25	19047	1	Roller



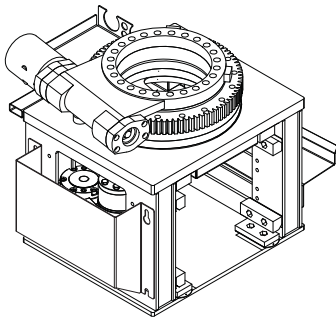
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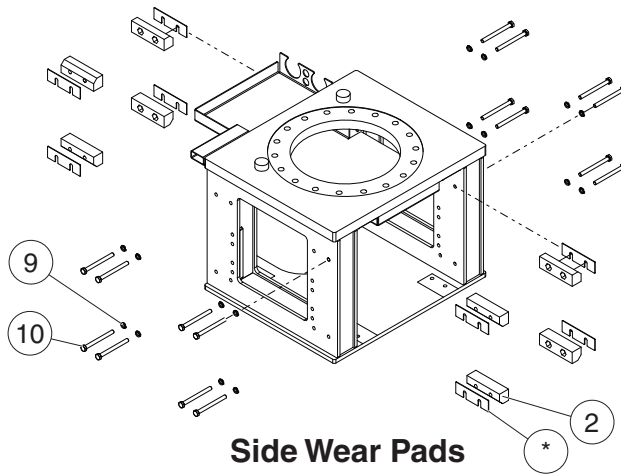
• NS: Not a Stock item

• REF: Reference only

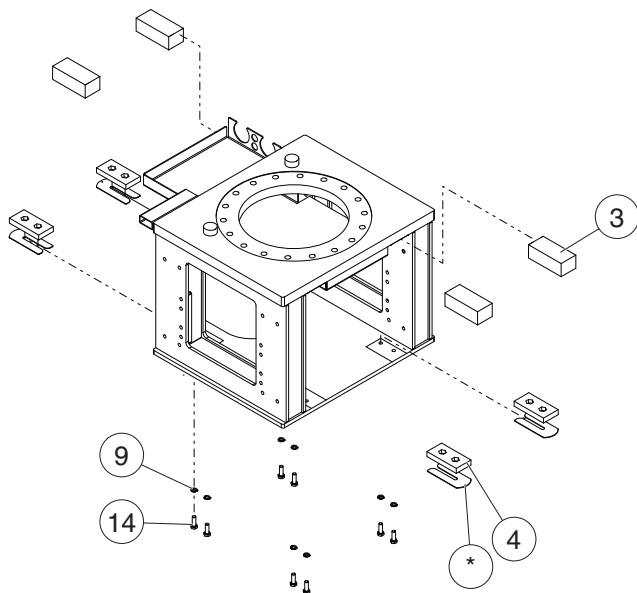




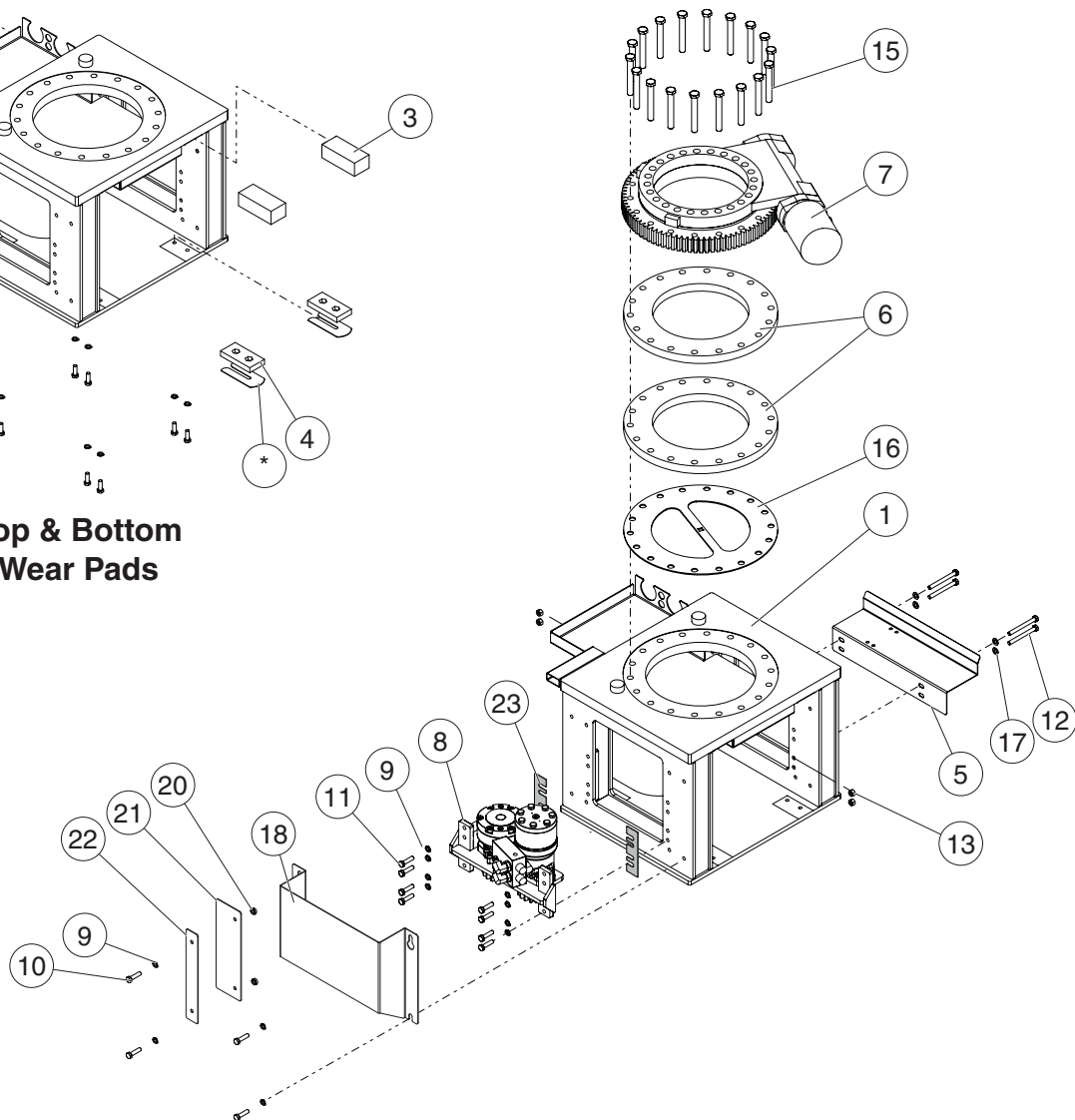
**Assembled**



**Side Wear Pads**



**Top & Bottom  
Wear Pads**



**Carriage Assembly**



ILLUSTRATION No.  
ART\_4326

**TITAN BOOM 60-S**



## Carriage Assembly

ITEM	PART NO.	QTY	DESCRIPTION
--	84171	--	Carriage Assembly
1	22495	1	Carriage Weldment
2	22248	8	Carriage Side Wearpad*
--	22188	-	Carriage Wearpad Shim (0.06)
--	22194	-	Carriage Wearpad Shim (0.03)
3	22504	4	Carriage Top Wearpad
4	18138	4	Carriage Lower Wearpad*
--	18235	-	Small Wear Pad Shim (0.06)
--	18236	-	Small Wearpad Shim (0.03)
5	22138	1	Carriage Track Mount
6	22289	2	Slew Drive Spacer
7	REF	1	Slew Drive -- See Section E
8	84173	1	Carriage Motor Assembly
9	50006	36	Washer, M10 Zp Nordlock
10	50257	20	Bolt, HHCS M10-1.50x110 08 Zp P
11	50035	8	Bolt, HHCS M10-1.50x040 08 Zp F
12	50209	4	Bolt, HHCS M10-1.50x100 08 Zp P
13	50049	4	Nut, M10x1.50
14	50034	8	Bolt, HHCS M10-1.50x030 08 Zp F
15	50299	18	Outer Swing Bearing Bolt --
16	22539	1	Platform Rotation Keyed Shim Plate
17	50002	4	Washer, M10 Zp Standard Flat
18	22326	1	Carriage Motor Cover
19	--	--	--
20	22620	2	Spacer
21	22618	1	Carriage Guard Flap-- CE option package only
22	22619	1	Bracket, Carriage Guard Flap-- CE option package only
23	22195	As needed	Carriage Drive Shim -- Shim as needed so that the end of the gear teeth do not contact bottom of the teeth on the Cantilever Beam Rack Gear (Item #16 on page C-15)
*Carriage must be shimmed to a total clearance of .030 inch (.762mm) in both side-to-side and top-to-bottom directions when the carriage is in the tightest section of the platform beam.			



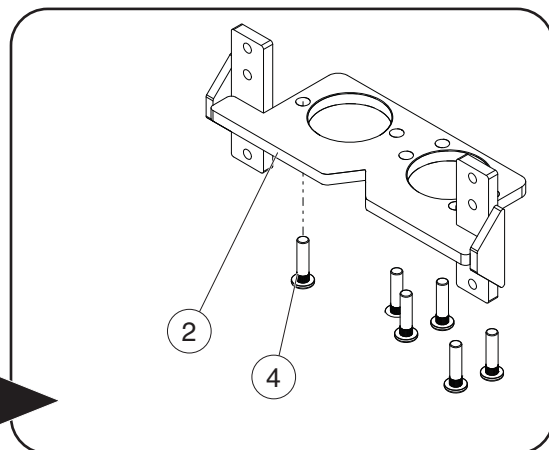
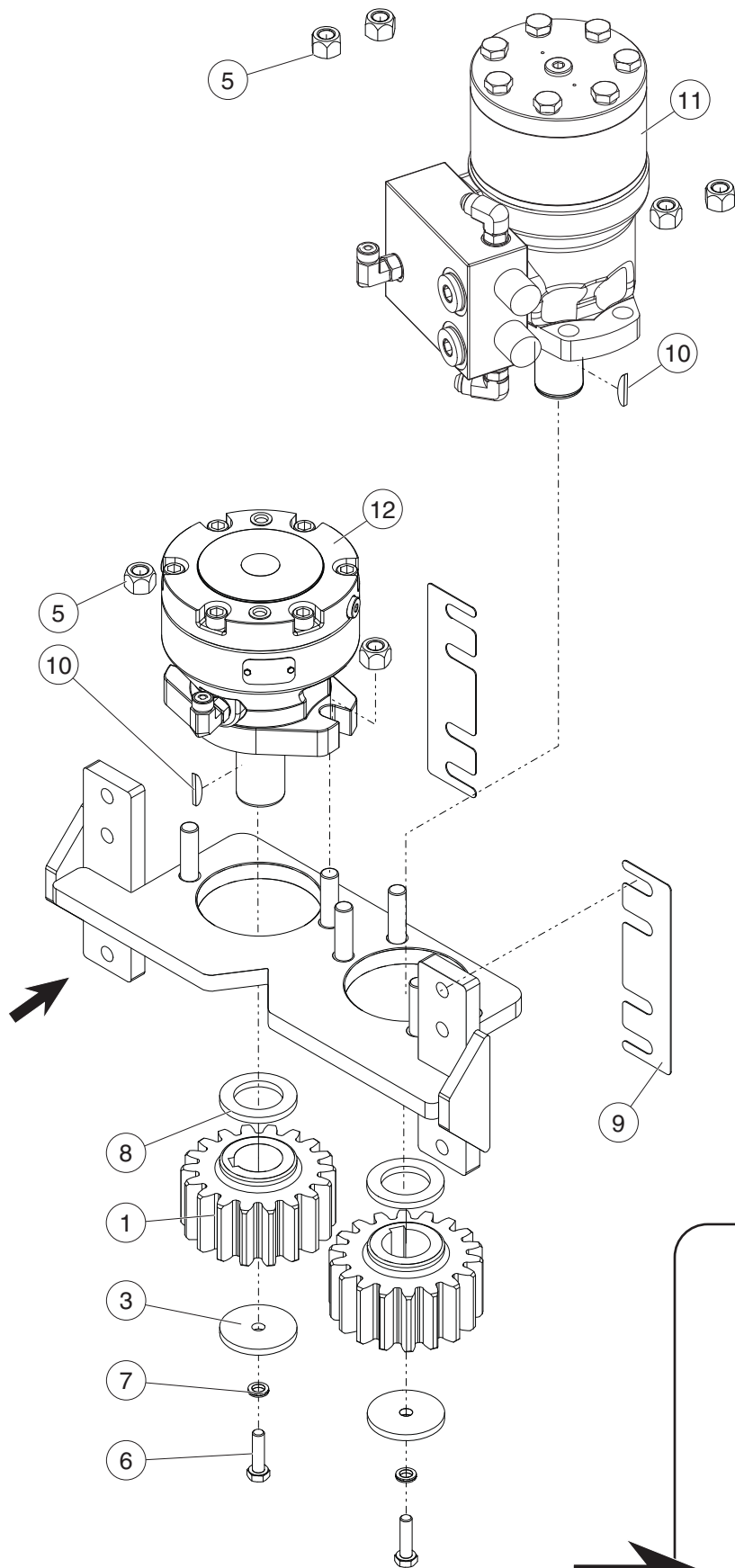


  
 ILLUSTRATION No.  
 ART\_3622

TITAN BOOM

Carriage Motor Assembly



## Carriage Motor Assembly

ITEM	PART NO.	QTY	DESCRIPTION
--	84173	--	Carriage Motor Assembly
1	22141	2	Pinion Gear
2	22086	1	Carriage Drive Mounting Plate
3	22320	2	Pinion Retaining Washer
4	92407	6	M12-1.5x045 Wheel Stud
5	50305	6	Nut, M12x1.50 08 Zp Nylock
6	50032	2	Bolt, HHCS M08-1.25x030 08 Zp F
7	50200	2	Washer M08 Zp Nordlock
8	22322	2	Pinion Spacer
9	22195	As needed	Carriage Drive Shim -- Shim as needed so that the end of the gear teeth do not contact bottom of the teeth on the Cantilever Beam Rack Gear (Item #16 on page C-15)
10	92658	2	Shaft Key
11	REF	1	Carriage Motor -- See Section E
12	REF	1	Carriage Brake -- See Section E



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



**NOTES:**

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• as req: as required

• INCL: Included with assembly

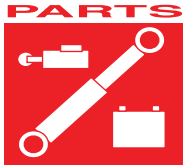
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# SECTION D

## AXLES

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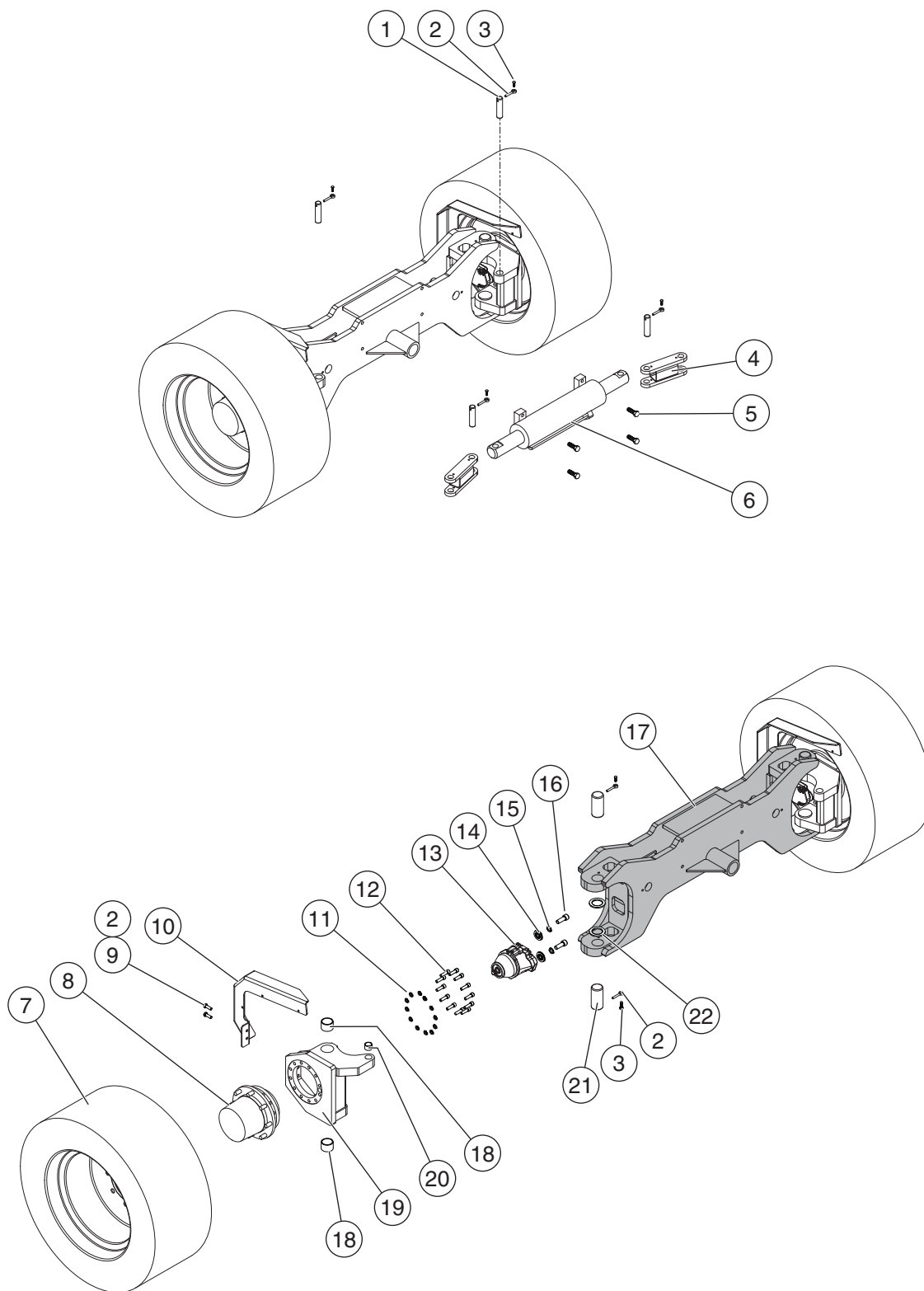


ILLUSTRATION No.  
ART\_4317

TITAN BOOM 60-S

Axle Assembly



## Axle Assembly

Two complete assemblies per machine.

ITEM	PART NO.	QTY PER ASSY.	QTY PER MACHINE	DESCRIPTION
--	--	1	2	Axle Assembly
1	24166	4	8	Pin, Steering Cylinder Linkage
2	18152	8	16	Retainer Pin
3	50236	12	24	Bolt, M12 x 40
--	50007	8	16	Washer, M12 Nordlock (not shown)
4	24122	2	4	Steering Link
5	50503	4	8	Bolt, Socket Head M16-2.0 x 75
6	24153	1	2	Cylinder, Steering
7	92649	1	2	Tire/Wheel Assembly, Left Side
	92648	1	2	Tire/Wheel Assembly, Right Side
8	92513	2	4	Gear Hub
9	50003	4	8	Washer, M12 Std.
10	24376	1	2	Hose Guard, Left Front / Right Rear Wheel
	24377	1	2	Hose Guard, Right Front / Left Rear Wheel
11	50249	24	48	Washer, M16 Nordlock
12	50492	24	48	Bolt, Socket Head M16 x 55
13	92514	2	4	Wheel Motor
14	11176	4	8	Washer, M12 Hardened
15	50007	4	8	Washer, M12 Nordlock
16	50473	4	8	Bolt, Socket Head Cap
17	24105	1	2	Axle Weldment
18	92610	4	8	Bearing
19	24121	1	2	Steering Yoke Weldment, Left Front / Right Rear Wheel
	24113	1	2	Steering Yoke Weldment, Right Front / Left Rear Wheel
20	92695	2	4	Bearing
21	24165	4	8	Pin, Steering Yoke
22	93146	4	8	Thrust Bearing



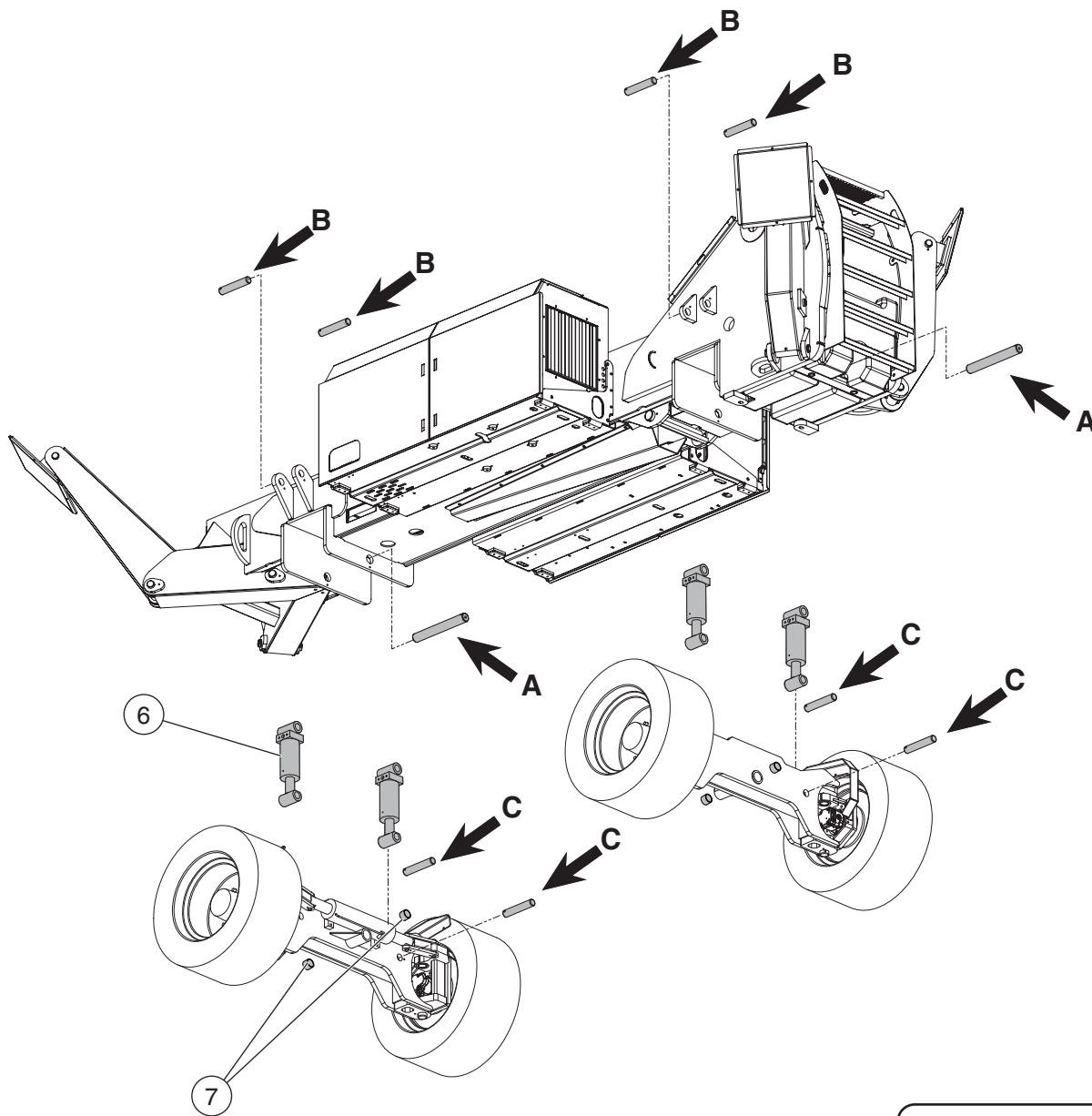
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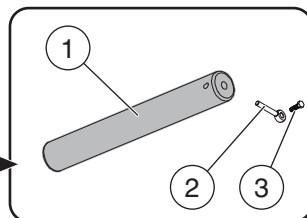
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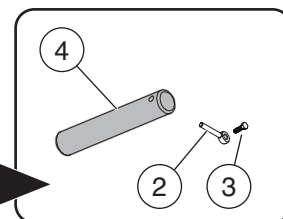




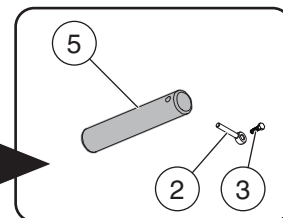
**A**  
4 places



**B**  
4 places



**C**  
4 places





## Axle/Chassis Assembly

ITEM	PART NO.	QTY	DESCRIPTION
1	24161	2	Pin, Chassis / Axle
2	18152	10	Retainer Pin
3	50236	10	Bolt, M12 x 40
--	50007	10	Washer, M12 Nordlock (not shown)
4	24163	4	Pin, Chassis / Upper Frame Level Cylinder
5	24164	4	Pin, Chassis / Lower Frame Level Cylinder
6	24152	4	Cylinder, Frame Level
7	92611	4	Bearing



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

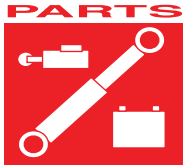
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**NOTES:**

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# SECTION E

## HYDRAULICS

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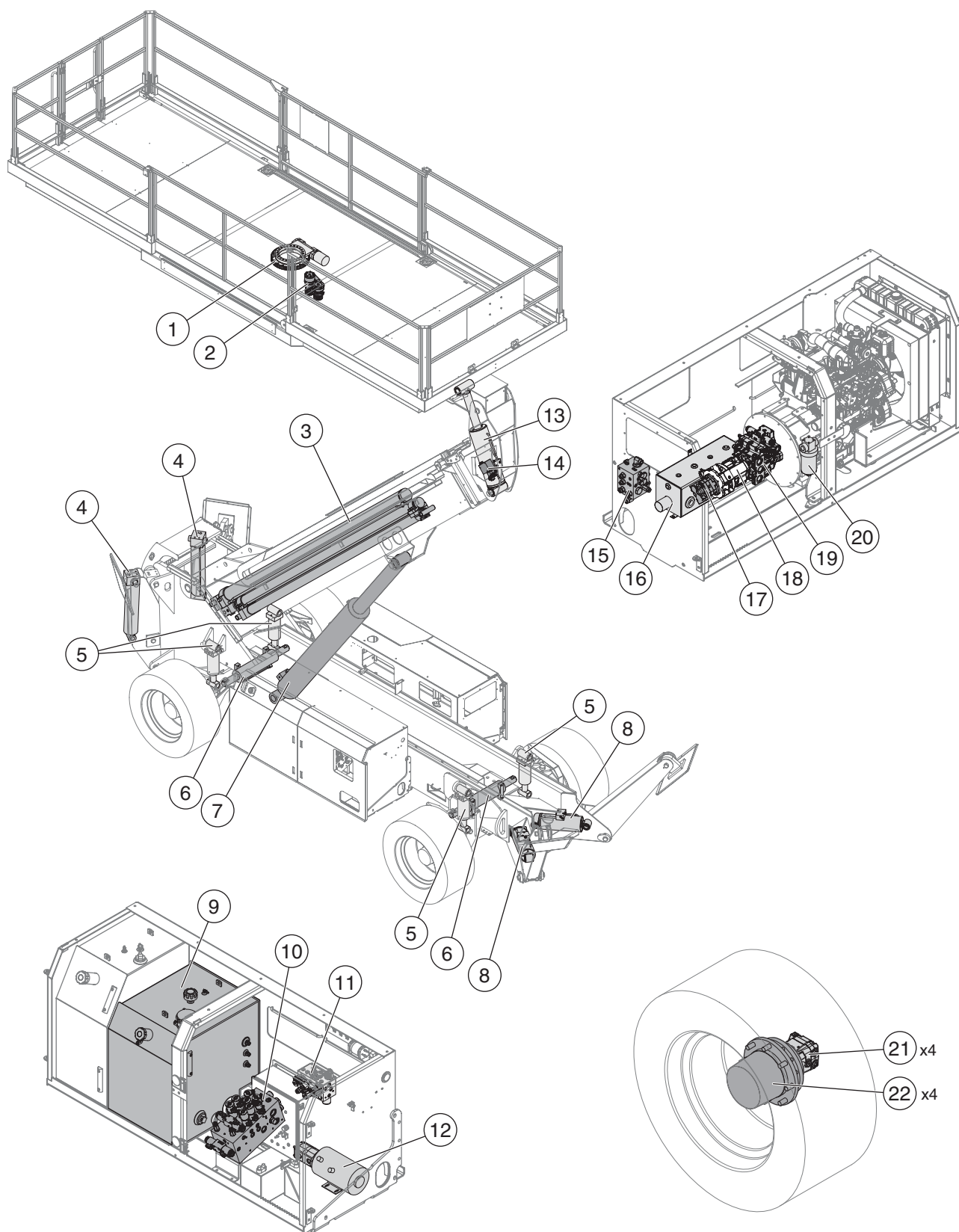


ILLUSTRATION No.  
ART\_4341

TITAN BOOM 60-S

Hydraulic Components



## Hydraulic Components -- Chassis

ITEM	PART NO.	QTY	DESCRIPTION
1	92018	1	Platform Rotate Drive Unit
2	92005	1	Carriage Slide Motor
	91894	1	Carriage Brake
3	24156	1	Boom Extend Cylinder Assembly
4	24155	2	Rear Outrigger Cylinder
5	24152	4	Frame Level Cylinder
6	24153	2	Steer Cylinder
7	24151	1	Boom Lift Cylinder
8	24154	2	Front Outrigger Cylinder
9	24173	1	Hydraulic Tank Weldment
10	92882	1	Primary Functions Manifold
11	92881	1	Secondary Functions Manifold
12	92999	1	Emergency Power Motor
	93135	1	Emergency Power Pump
13	24157	1	Platform Level Cylinder
14	92082	1	Auxiliary Functions Manifold
15	92167	1	Traction Manifold
16	24362	1	Auxiliary Hydraulic Tank
17	92938	1	Secondary Gear Pump
18	92937	1	Primary Gear Pump
19	92592	1	Piston Pump
20	92072	1	Charge Filter
21	92514	4	Wheel Motor
22	92513	4	Gear Hub/Brake Unit

Component Fittings not show or listed on this page.



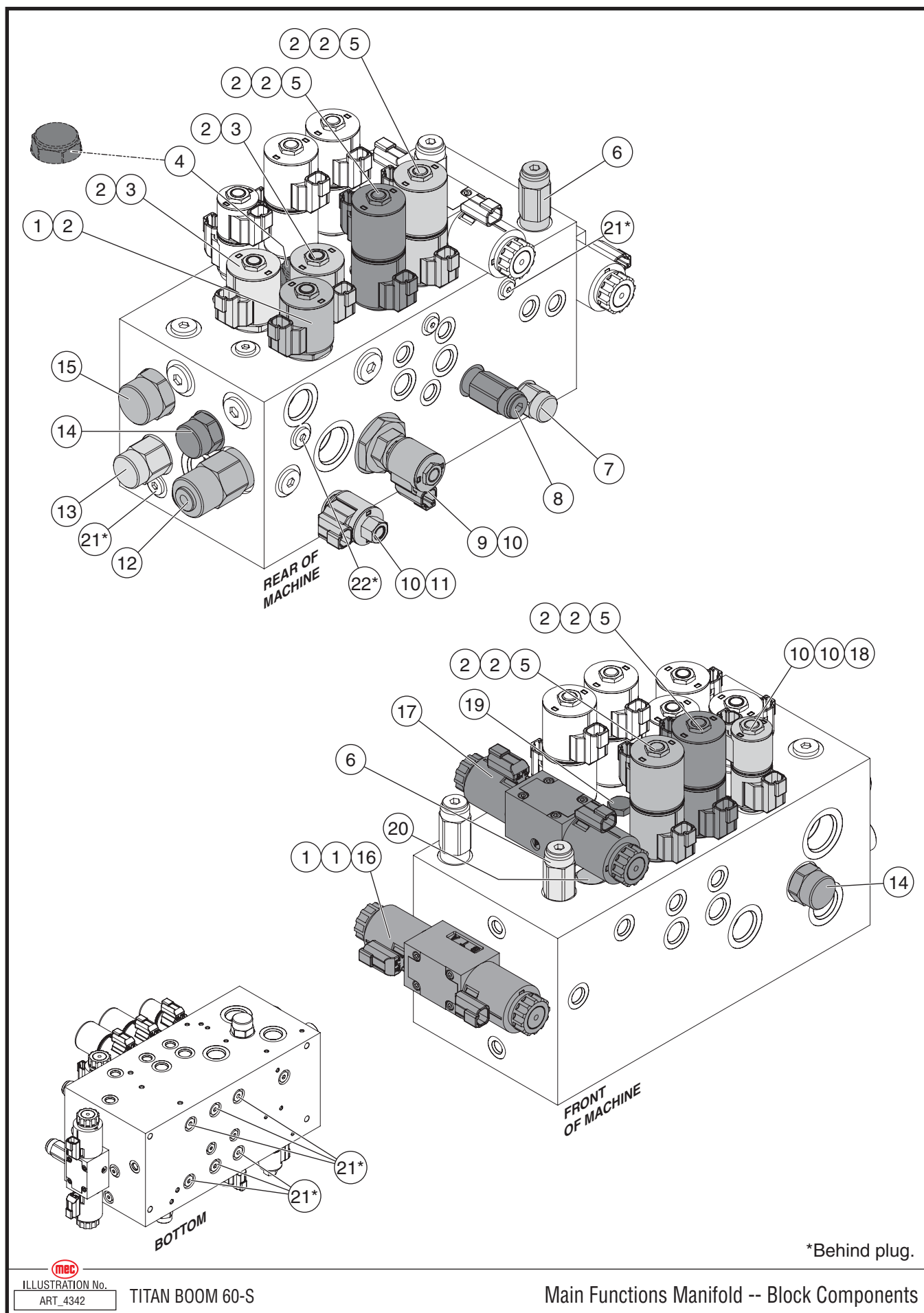
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• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Main Functions Manifold -- Block Components

ITEM	PART NO.	QTY	DESCRIPTION
--	92882	--	Primary Functions Manifold, without fittings
1	93293	1	Valve, Solenoid
2	92114	11	Coil
3	93294	2	Valve, Proportional
4	93302	1	Valve, Check
5	92581	4	Valve, Proportional
6	92576	1	Valve, Cross-Port Relief
7	93299	1	Valve, Pilot-Operated
8	92582	1	Valve, Relief
9	93295	1	Valve, Solenoid
10	92173	4	Coil
11	92572	1	Valve, Solenoid
12	93296	1	Valve, Relief
13	93298	1	Valve, Pilot-Operated
14	93300	2	Flow Compensator
15	93297	1	Valve, Pilot-Operated
16	92573	1	Valve, Directional
17	91144	1	Valve, Directional
18	93292	1	Valve, Solenoid
19	91477	1	Valve, Check
20	93301	1	Valve, Dual PO Check
21	93303	8	Valve, Check
22	91144	1	Orifice



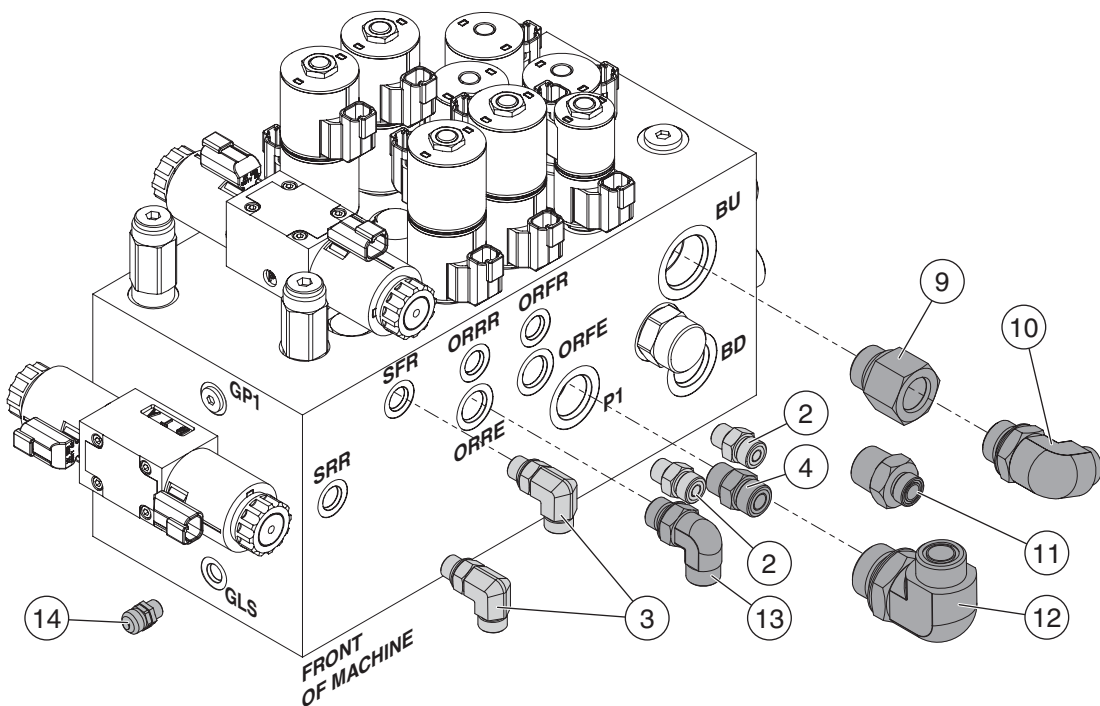
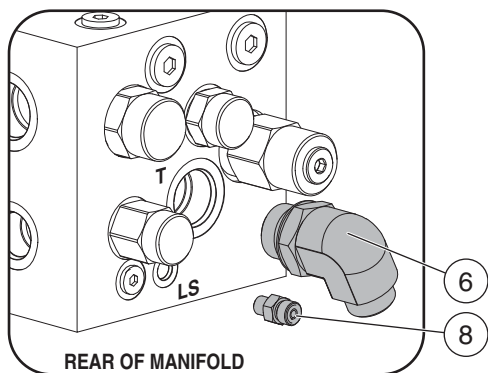
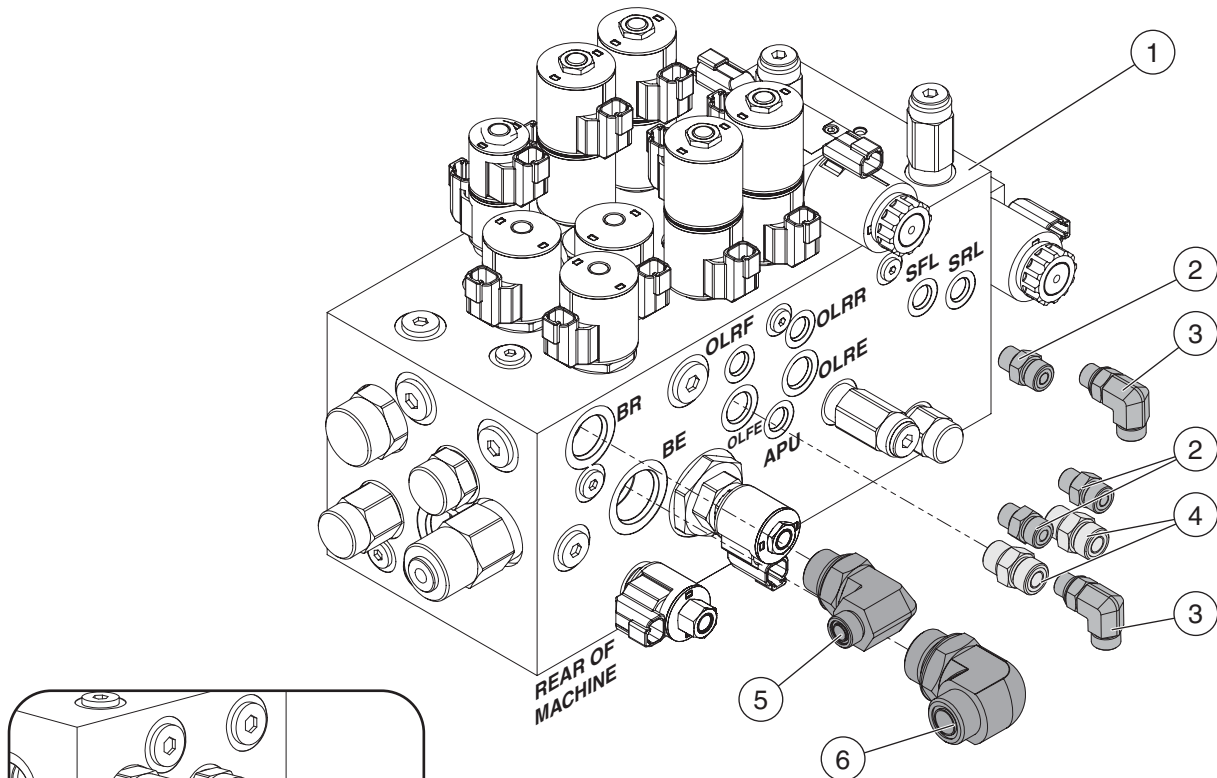
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• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Main Functions Manifold -- Fittings

ITEM	PART NO.	QTY	DESCRIPTION
1	92882	1	Primary Functions Manifold, without fittings
2	50835	6	Fitting, MFFOR-MB-6-6
3	50674	4	Fitting, MFFOR-MB90- 6-6
4	50841	3	Fitting, MFFOR-MB-8-8
5	50849	1	Fitting, MFFOR-MB 90°-8-12
6	50844	2	Fitting, MFFOR-MB 90°- 12-16
7	--	--	--
8	50831	1	Fitting, MFFOR-MB-4-4
9	51101	1	Fitting, MB-FB-16-12
10	51066	1	Fitting, MFFOR-MB 90°- 10-12
11	50838	1	Fitting, MFFOR-MB-8-12
12	50845	1	Fitting, MFFOR-MB 90°- 16-12
13	50850	1	Fitting, MFFOR-MB 90°- 8-8
14	50974	1	Fitting, TPO-4 GAUGE PORT



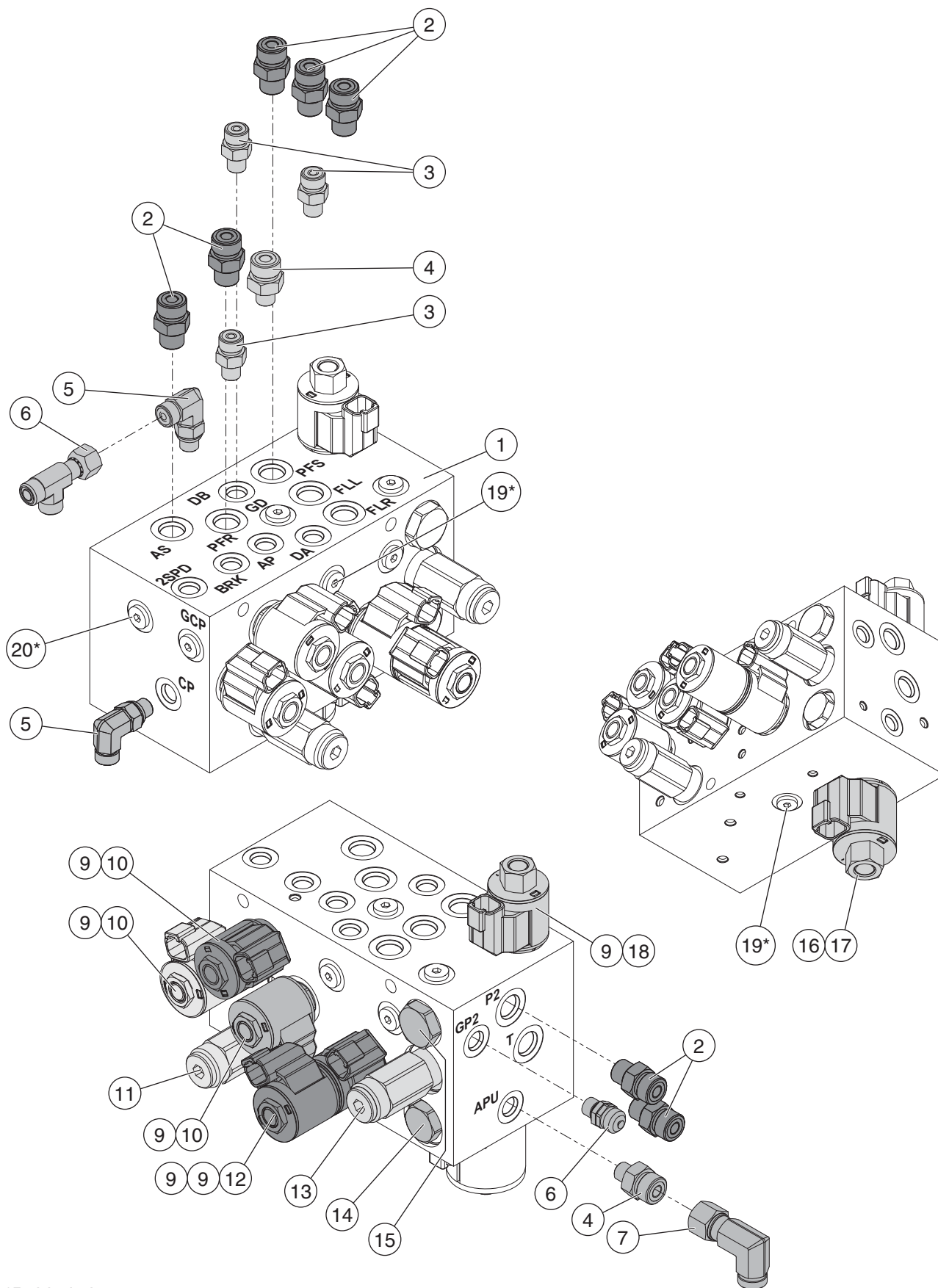
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• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only





\*Behind plug.



ILLUSTRATION No.  
ART\_4343

TITAN BOOM 60-S

Secondary Functions Manifold



## Secondary Functions Manifold

ITEM	PART NO.	QTY	DESCRIPTION
1	92881	1	Secondary Functions Manifold
2	50835	7	Fitting, MFFOR-MB-6-6
3	50831	3	Fitting, MFFOR-MB-4-4
4	50820	2	Fitting, MFFOR-MB - 6-4
5	50673	2	Fitting, MFFOR-MB 90°- 4-4
6	50809	1	Fitting, MFFOR-FFORX-MFFOR-4
7	50672	1	Fitting, MFFOR-FFORX 90°- 6-6
8	--	--	--
9	92173	6	Coil
10	93290	3	Valve, Solenoid
11	92575	1	Valve, Pressure Reducing
12	92578	1	Valve, Solenoid
13	92582	1	Valve, Relief
14	91477	1	Valve, Check
15	92751	1	Valve, Check
16	92650	1	Coil
17	93248	1	Valve, Pilot Operated
18	92572	1	Valve, Solenoid
19	91154	2	Valve, Shuttle
20	91475	1	Orifice



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



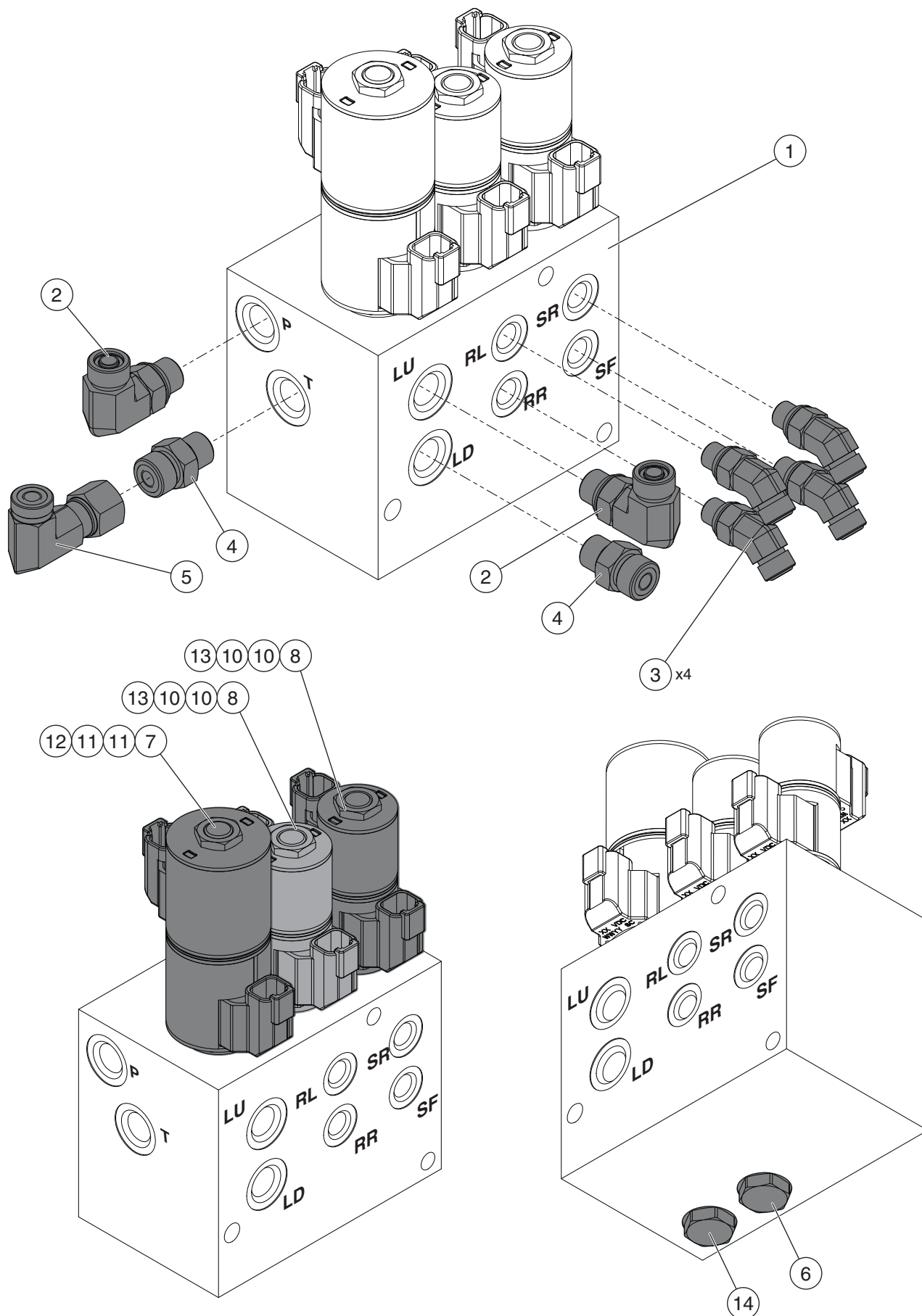


ILLUSTRATION No.  
ART\_3653

TITAN BOOM

Auxilliary Manifold



## Auxiliary Manifold

ITEM	PART NO.	QTY	DESCRIPTION
1	92082	1	Platform Function Manifold
2	50674	2	Fitting, MFFOR-MB90-06-06
3	50675	4	Fitting, MFFOR-MB45-04-04
4	50835	2	Fitting, MFFOR-MB-6-6
5	50672	1	Fitting, MFFOR-FFORX90-06-06
6	92864	1	Valve, Piloted
7	92581	1	Valve, Solenoid
8	92600	2	Valve, Solenoid
9	--	--	--
10	92173	4	Coil
11	91143	2	Coil
12	92398	1	Check Valve Disk
13	92399	2	Check Valve Disk
14	92669	1	Valve Flow Regulator



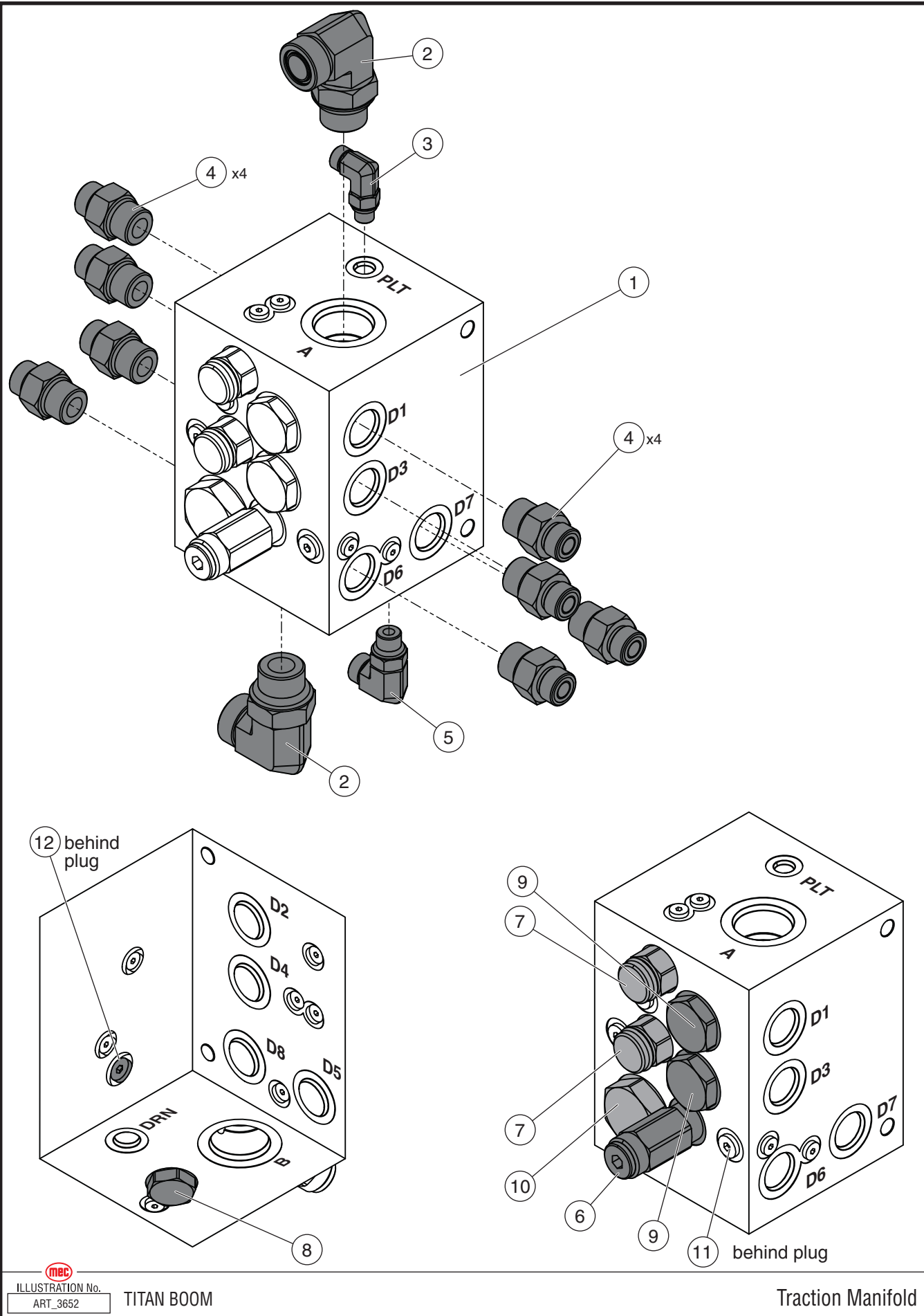
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• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Traction Manifold Assembly

ITEM	PART NO.	QTY	DESCRIPTION
1	92167	1	Traction Manifold, complete block without fittings
2	50843	2	Fitting, MFFOR-MB90-12-12
3	50673	1	Fitting, MFFOR-MB90 4-4
4	50837	8	Fitting, MFFOR-MB-8-10
5	50674	1	Fitting, MFFOR-MB90-06-06
6	92602	1	Valve, Relief
7	92603	2	Valve, Piloted
8	92604	1	Valve, Oil Shuttle
9	92605	2	Flow Divider
10	92606	1	Flow Divider
11	92607	1	Orifice Plug, .090"
12	91017	1	Orifice Plug, .040"
13	92608	2	Orifice Plug, .052"



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



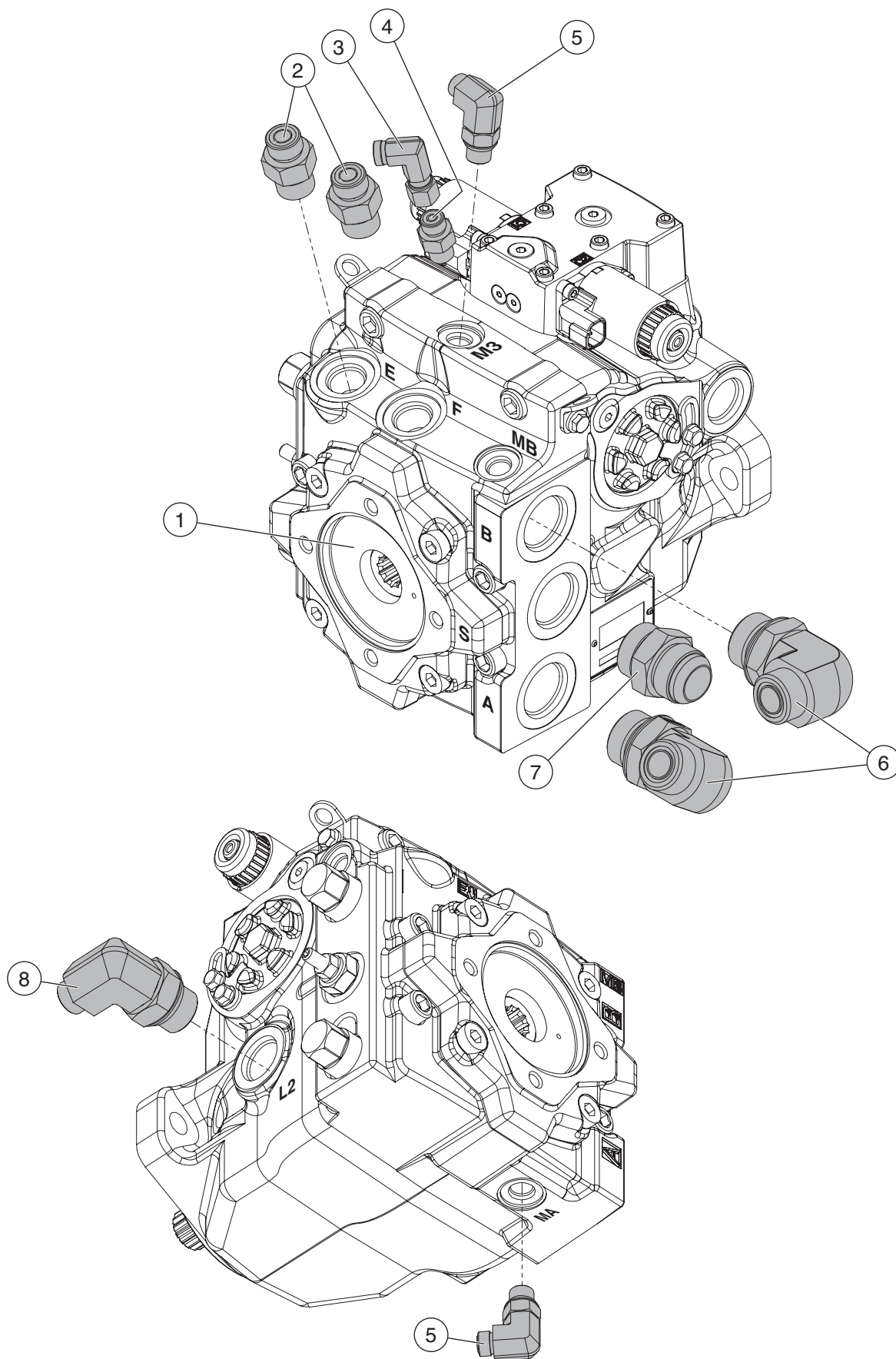


ILLUSTRATION No.  
ART\_4344

TITAN BOOM 60-S

Piston Pump



## Hydraulic Pumps

ITEM	PART NO.	QTY	DESCRIPTION
1	92592	1	Piston Pump, without fittings
2	50837	2	Fitting, MFFOR-MB-8-10
3	50671	1	Fitting, MFFOR-FFORX 90°- 4-4
4	50832	1	Fitting, MFFOR-MB-4-6
5	50656	2	Fitting, MFFOR-MB 90°-4-6
6	50844	2	Fitting, MFFOR-MB 90°- 12-16
7	50765	1	Fitting, MB-MJ-16-16
8	50849	1	Fitting, MFFOR-MB 90°-8-12



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



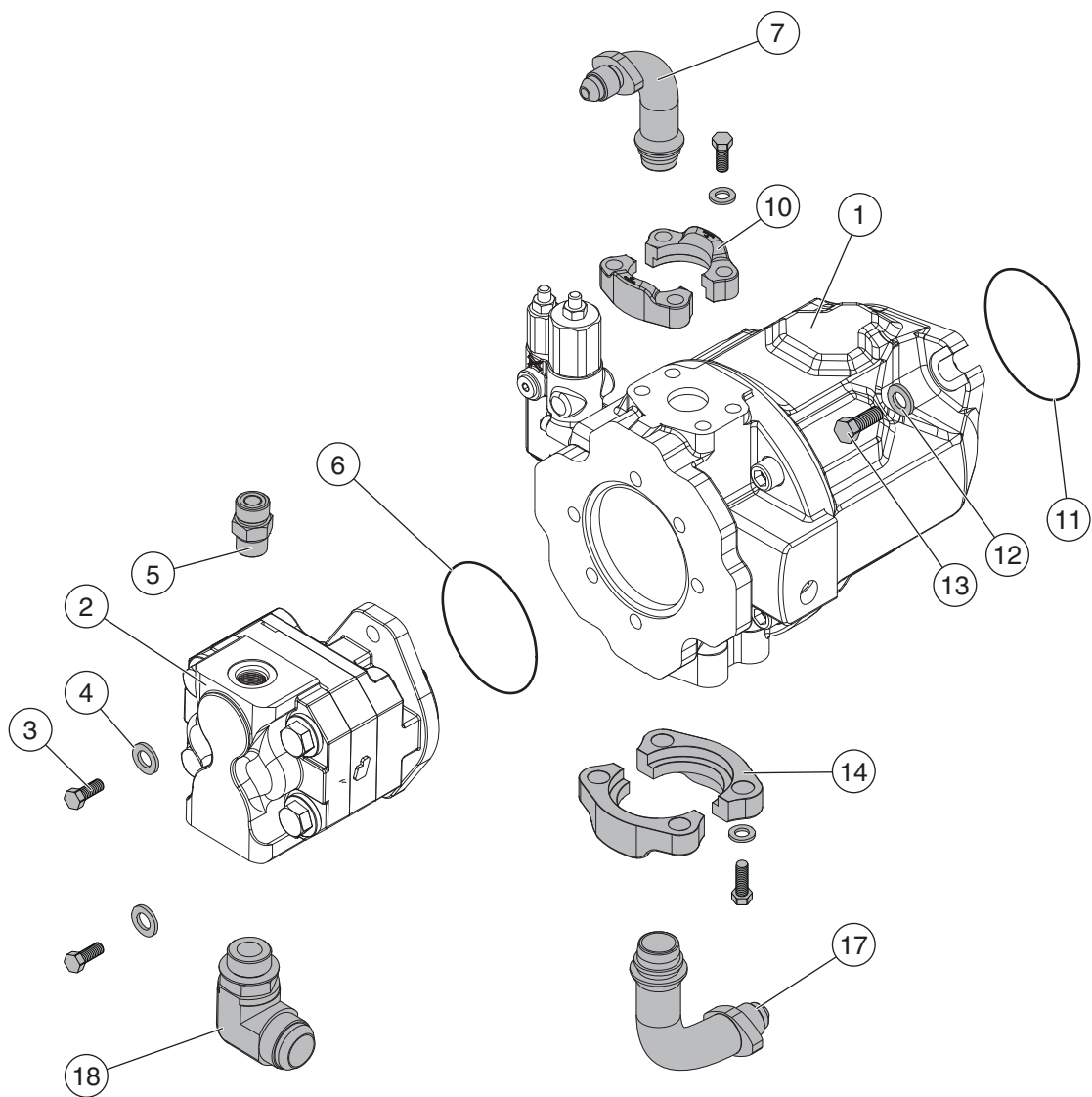


ILLUSTRATION No.  
ART\_4357

TITAN BOOM 60-S

Functions Pumps



## Functions Pumps

ITEM	PART NO.	QTY	DESCRIPTION
1	92937	1	Primary Functions Pump
2	92938	1	Secondary Functions Pump
3	50033	2	Bolt, M10 x 25
4	50006	2	Washer, M10 Nordlock
5	50841	1	Fitting, MFFOR-MB-8-8
6	17971	1	O-Ring
7	51012	1	Fitting, FL-MJ 90° 16-16
8	--	--	--
9	--	--	--
10	91161	1	Flange, 16SFO (includes bolt and washer)
11	93318	1	O-Ring
12	50069	2	Bolt, 1/2-13 x 1.5 GR8
13	50007	4	Washer, 1/2 Nordlock
14	93192	1	Flange, 24SFO (includes bolt and washer)
15	--	--	--
16	--	--	--
17	51099	1	Fitting, FL-MJ 90° 24-24
18	50783	1	Fitting, MB-MJ 90°-12-16



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



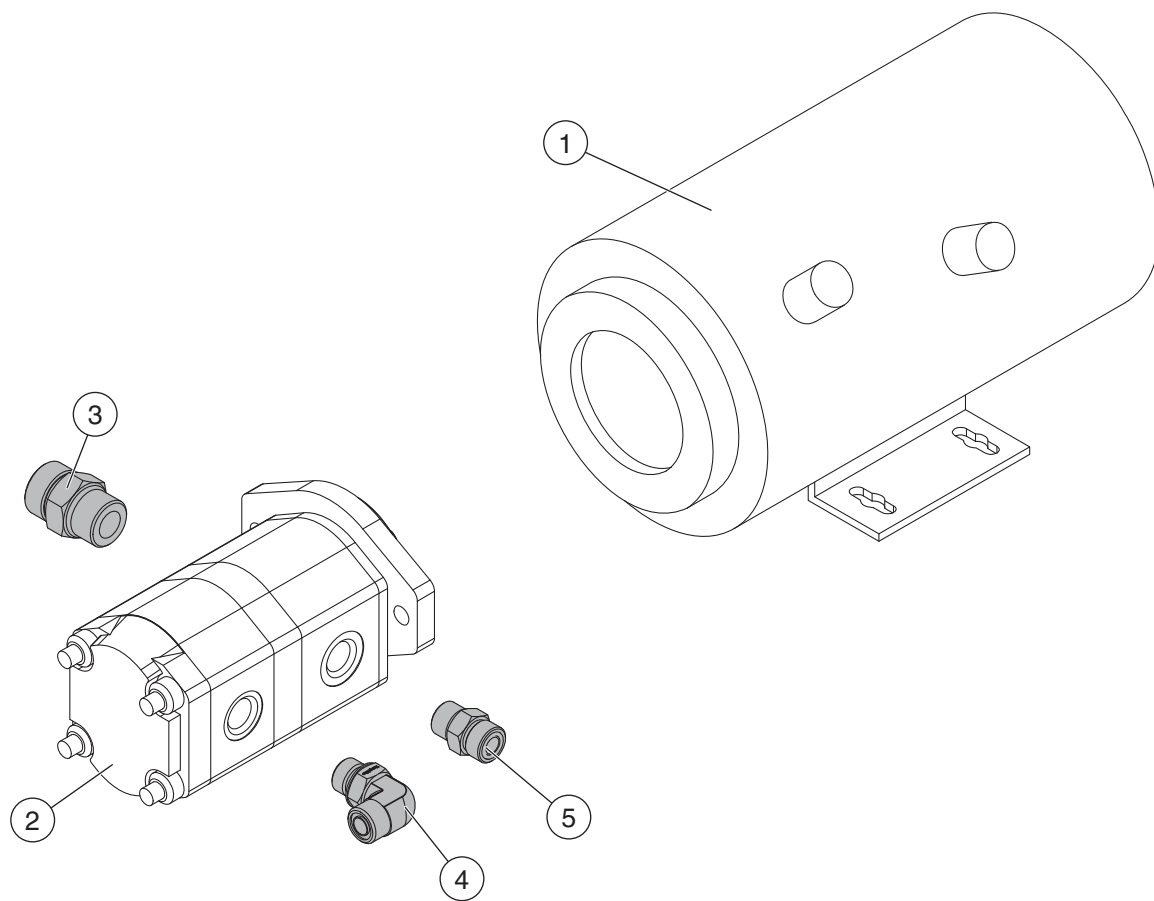


ILLUSTRATION No.  
ART\_4346

TITAN BOOM 60-S

Emergency Power Unit



## Emergency Power Unit

ITEM	PART NO.	QTY	DESCRIPTION
1	92999	1	Emergency Power Motor
2	93135	1	Emergency Power Pump
3	50826	1	Fitting, MFFOR-MB- 12-12
4	50858	1	Fitting, MFFOR-MB 90°- 8-8
5	50841	1	Fitting, MFFOR-MB-8-8



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



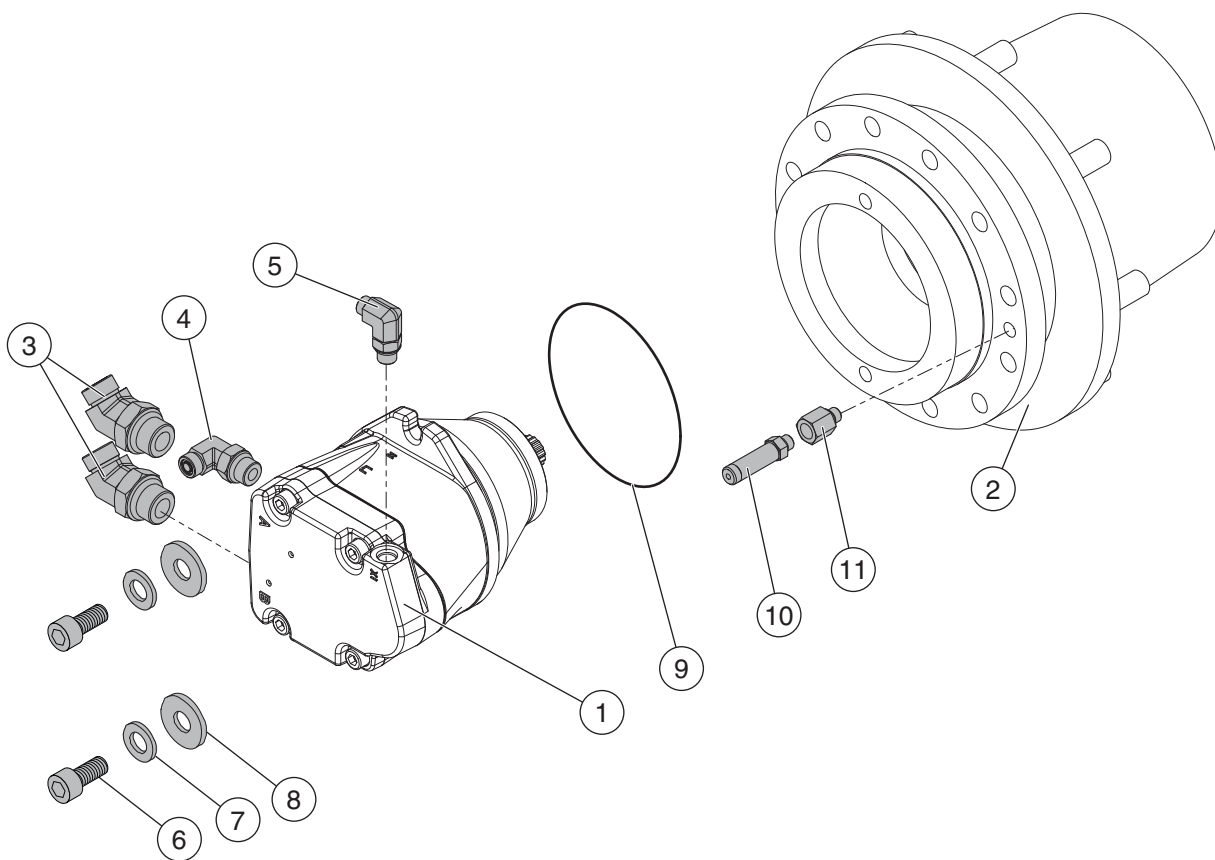


ILLUSTRATION No.  
ART\_4347

TITAN BOOM 60-S

Wheel Motors & Hubs



## Wheel Motors & Planetary Hubs

ITEM	PART NO.	QTY PER WHEEL	QTY PER MACHINE	DESCRIPTION
1	92514	1	4	Wheel Motor
2	92513	1	4	Gear Hub/Brake Unit
3	50957	2	8	Fitting, MFFOR-MB 45°- 10-12
4	50847	1	4	Fitting, MFFOR-MB 90° 6-8
5	50656	1	4	Fitting, MFFOR-MB 90°-4-6
6	50473	4	8	Bolt, Socket Head Cap
7	50007	4	8	Washer, M12 Nordlock
8	11176	4	8	Washer, M12 Hardened
9	92166	1	4	O-Ring
10	51085	1	4	Fitting, FB-MBSPP-4-4
11	51086	1	4	Fitting, MFFOR-MB-L-4-4



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



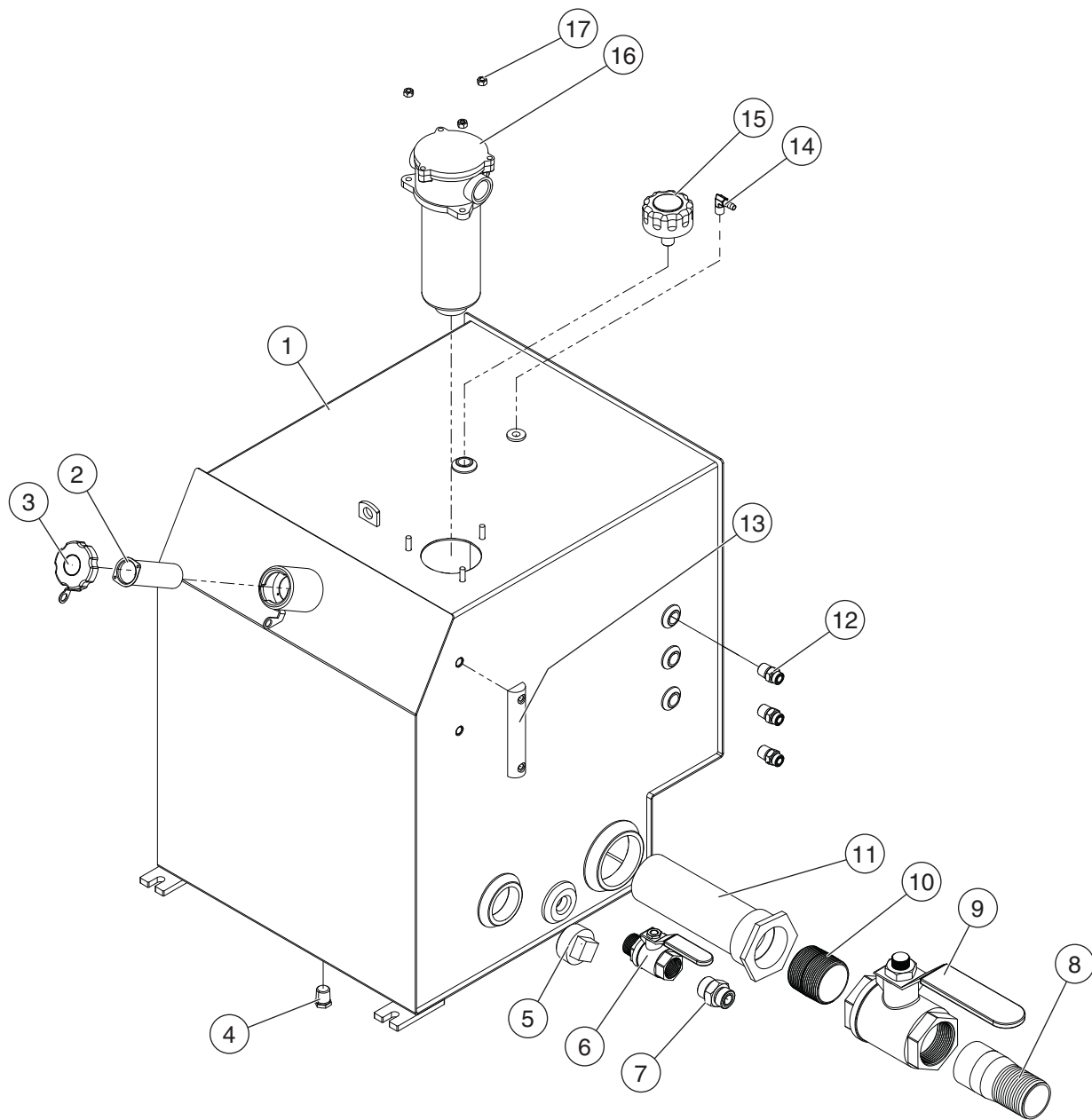


ILLUSTRATION No.  
ART\_4338

TITAN BOOM 60-S

Hydraulic Tank Assembly



## Hydraulic Tank Assembly

ITEM	PART NO.	QTY	DESCRIPTION
1	24173	1	Hydraulic Tank Weldment
2	92929	1	Filler Screen
3	92478	1	Filler Cap
4	51098	1	Plug, MB-08
5	51003	1	Plug, MP-32
6	93123	1	Valve, 1" Ball
7	50827	1	Fitting, MFFOR-MB-12-16
8	93136	1	Pipe Nipple
9	93134	1	Valve, 2.5" Ball
10	93138	1	Pipe Nipple
11	93137	1	Strainer, 3"
12	50876	3	Fitting, MFFOR-MP-8-8
13	9370	1	Site Gauge
14	HDW6727	1	Fitting, 1/4" NPT to 5/16 Hose
15	92357	1	Breather Cap
16	92366	1	Filter Assembly
--	92397	--	Filter Element
17	50048	3	Nut, M8 Nylock



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



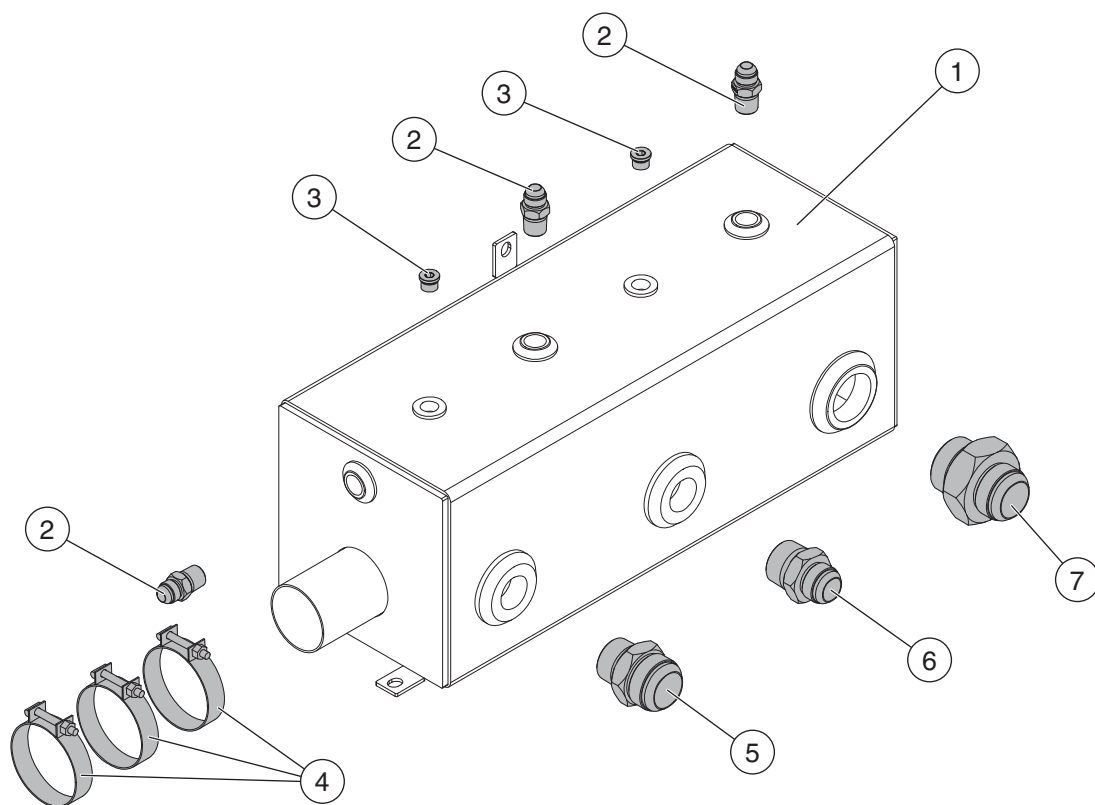


ILLUSTRATION No.  
ART\_4348

TITAN BOOM 60-S

Auxilliary Hydraulic Tank



## Auxiliary Hydraulic Tank Assembly

ITEM	PART NO.	QTY	DESCRIPTION
1	24362	1	Hydraulic Tank Weldment
2	51022	3	Fitting, MJ-MP-8-8
3	51102	2	Fitting, MP-06-PLUG
4	93139	3	T-Bolt Clamp, 3"
5	51097	1	Fitting, MJ-MP- 24-20
6	50909	1	Fitting, MJ-MP- 16-20
7	90911	1	Fitting, MJ-MP -24-24



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



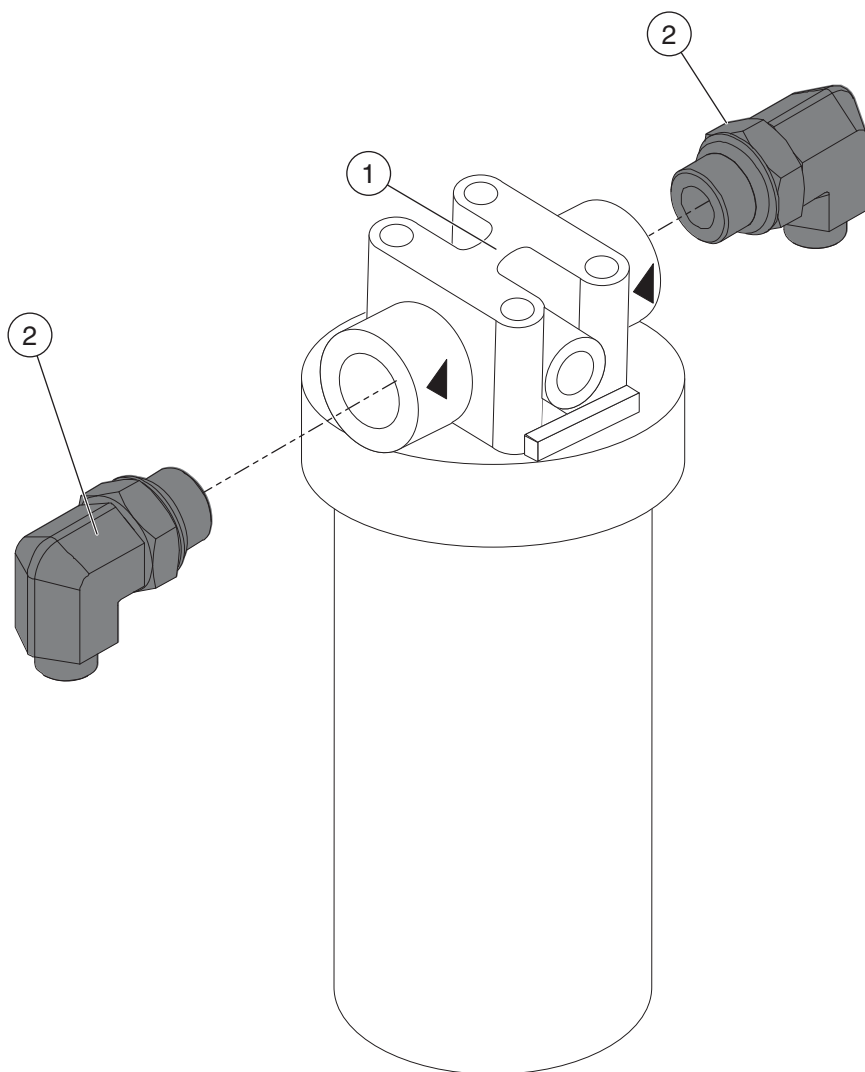


ILLUSTRATION No.  
ART\_3656

TITAN BOOM 40-S

Charge Filter Assembly



## Charge Filter Assembly

ITEM	PART NO.	QTY	DESCRIPTION
1	92072	1	Charge Filter Assembly, without fittings
--	92169	--	Filter Element
2	50849	2	Fitting, MFFOR-MB90-8-12



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



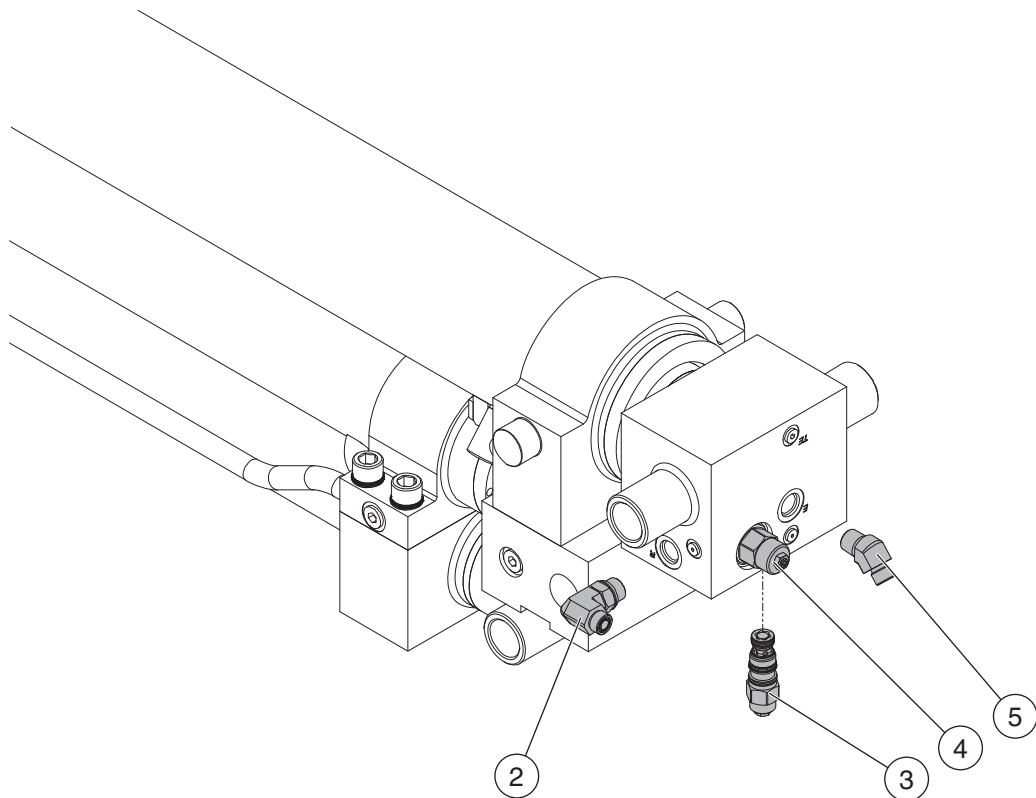
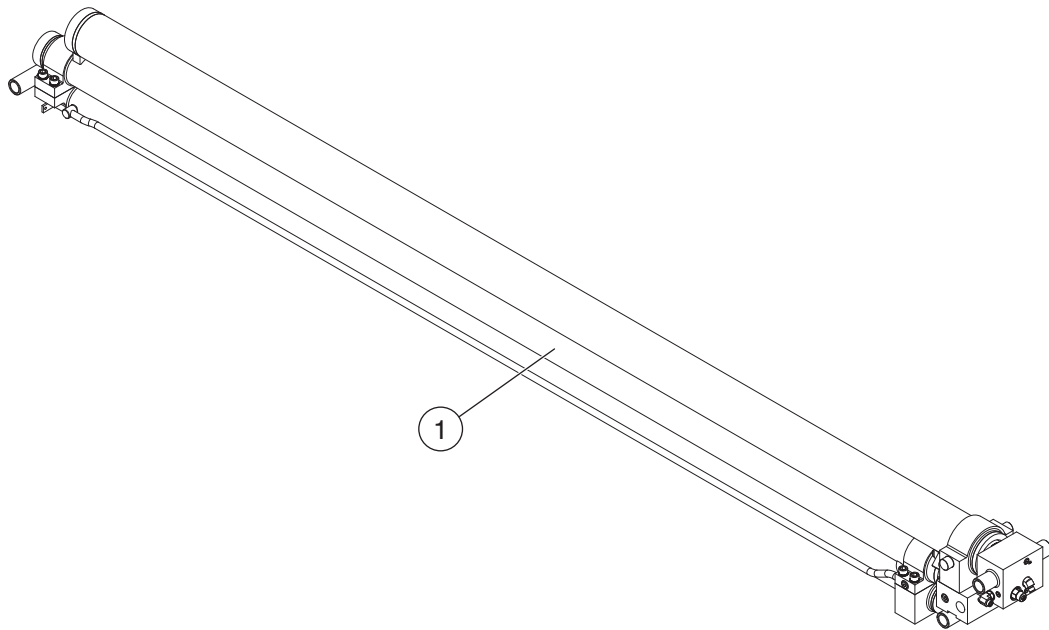


ILLUSTRATION No.  
ART\_4349

TITAN BOOM 60-S

Boom Extend Cylinder



## Boom Extend Cylinder

ITEM	PART NO.	QTY	DESCRIPTION
1	24156	1	Extend Cylinder, without fittings
--	93330	--	Seal Kit, Top Cylinder
--	93331	--	Seal Kit, Middle Cylinder
--	93332	--	Seal Kit, Bottom Cylinder
2	50848	1	Fitting, MB-MFFOR90-8-10
3	93229	1	Valve, Counterbalance
4	93333	1	Valve, Counterbalance
5	51091	1	Fitting, MB-MFFOR45-12-10-



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



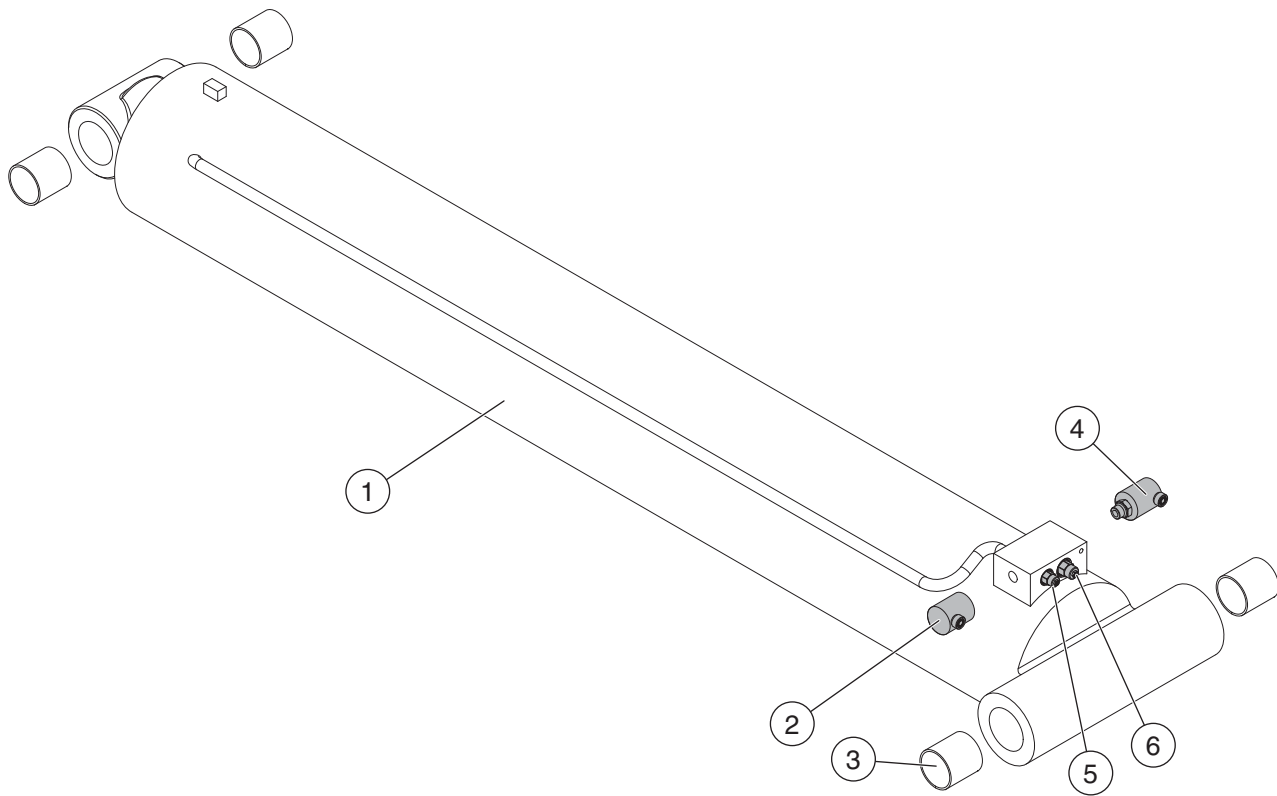


ILLUSTRATION No.  
ART\_4354

TITAN BOOM 60-S

Lift Cylinder



## Boom Lift Cylinder

ITEM	PART NO.	QTY	DESCRIPTION
1	24151	1	Boom Lift Cylinder, without fittings
--	93328	--	Seal Kit
2	93163	1	Fitting, MB-MFFOR90-8-8 LIVE SWIVEL
3	93329	4	Bearing
4	93162	1	Fitting, MB-MFFOR90 -10-10 LIVE SWIVEL
5	92623	1	Valve, Counterbalance
6	92624	1	Valve, Counterbalance



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



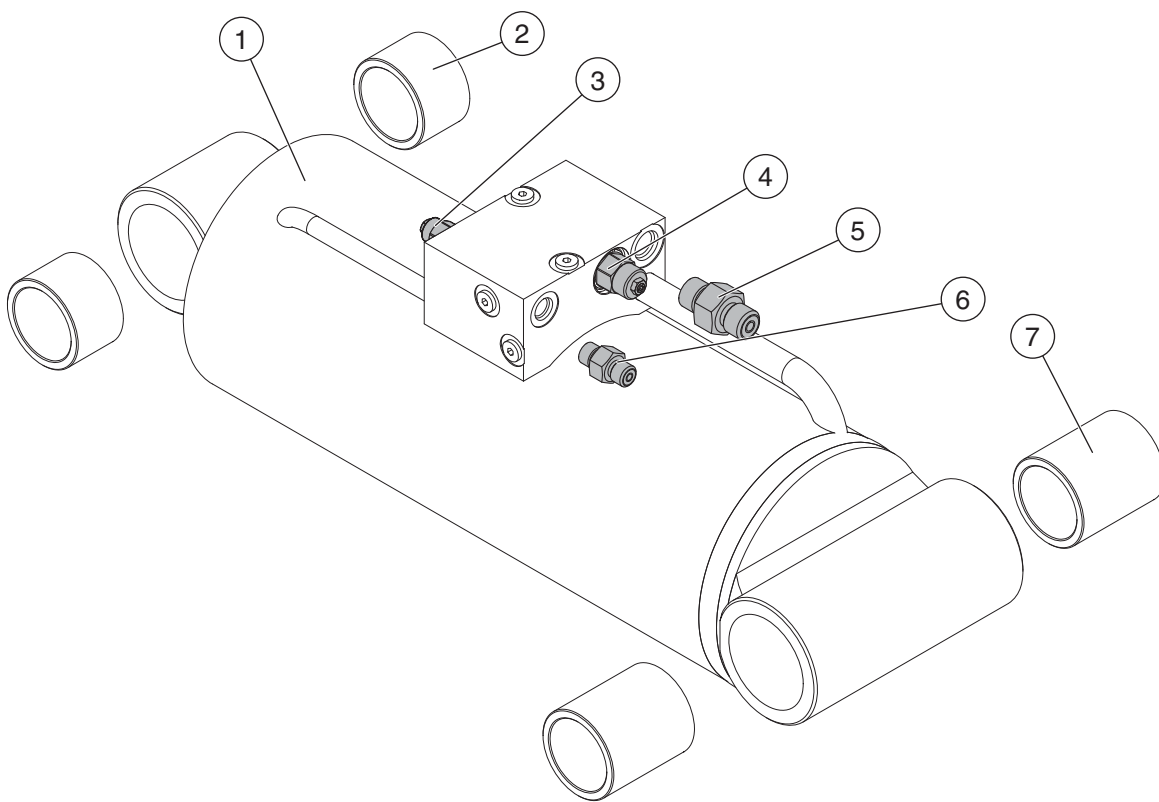


ILLUSTRATION No.  
ART\_4351

TITAN BOOM 60-S

Front Outrigger Cylinders



## Front Outrigger Cylinders

ITEM	PART NO.	QTY PER LOCATION	QTY PER MACHINE	DESCRIPTION
1	24154	1	2	Front Outrigger Cylinder, without fittings
--	93324	--	--	Seal Kit
2	93326	2	4	Bearing
3	92019	1	2	Valve, Counterbalance
4	93327	1	2	Valve, Counterbalance
5	50841	1	2	Fitting, MFFOR-MB-8-8
6	50835	1	2	Fitting, MFFOR-MB-6-6
7	93325	2	4	Bearing



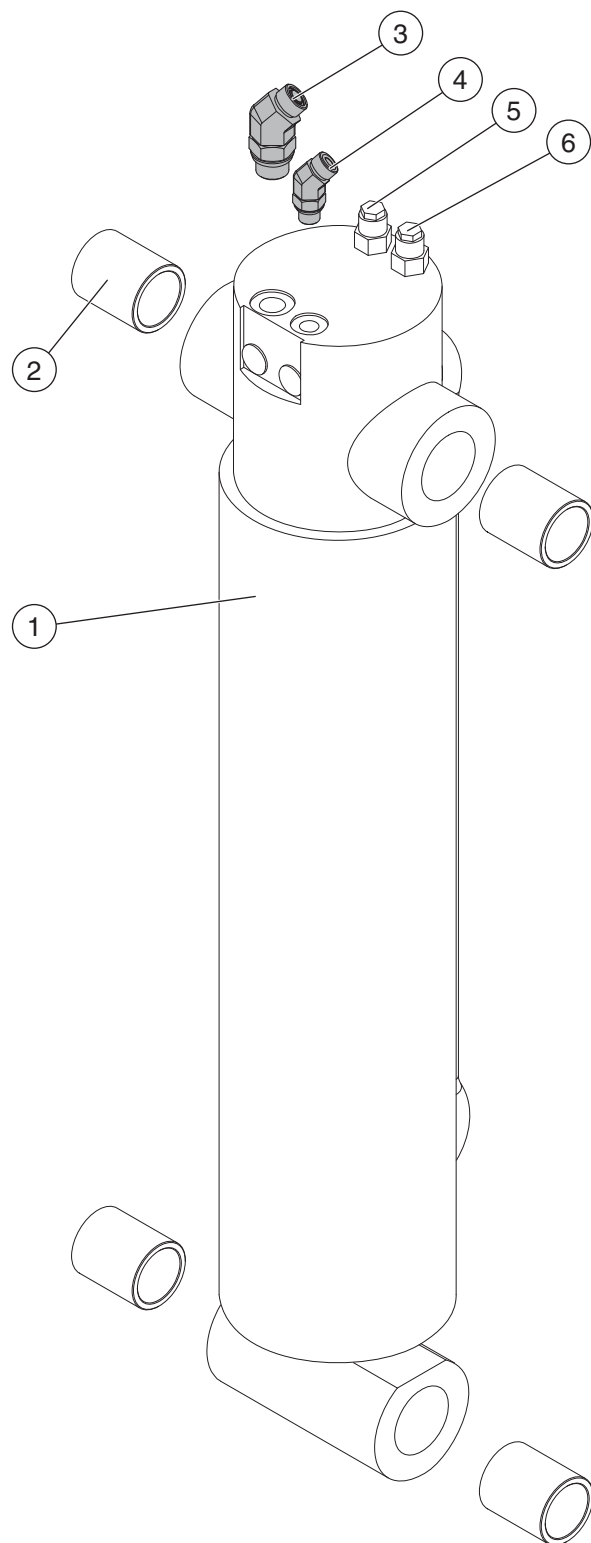
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Rear Outrigger Cylinders

ITEM	PART NO.	QTY PER LOCATION	QTY PER MACHINE	DESCRIPTION
1	24155	1	2	Rear Outrigger Cylinder, without fittings
--	93323	--	--	Seal Kit
2	92631	4	8	Bearing
3	50819	1	2	Fitting, MFFOR-MB 45° - 8-8
4	50676	1	2	Fitting, MFFOR-MB 45° 6-6
5	92623	1	2	Valve, Counterbalance
6	92019	1	2	Valve, Counterbalance



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



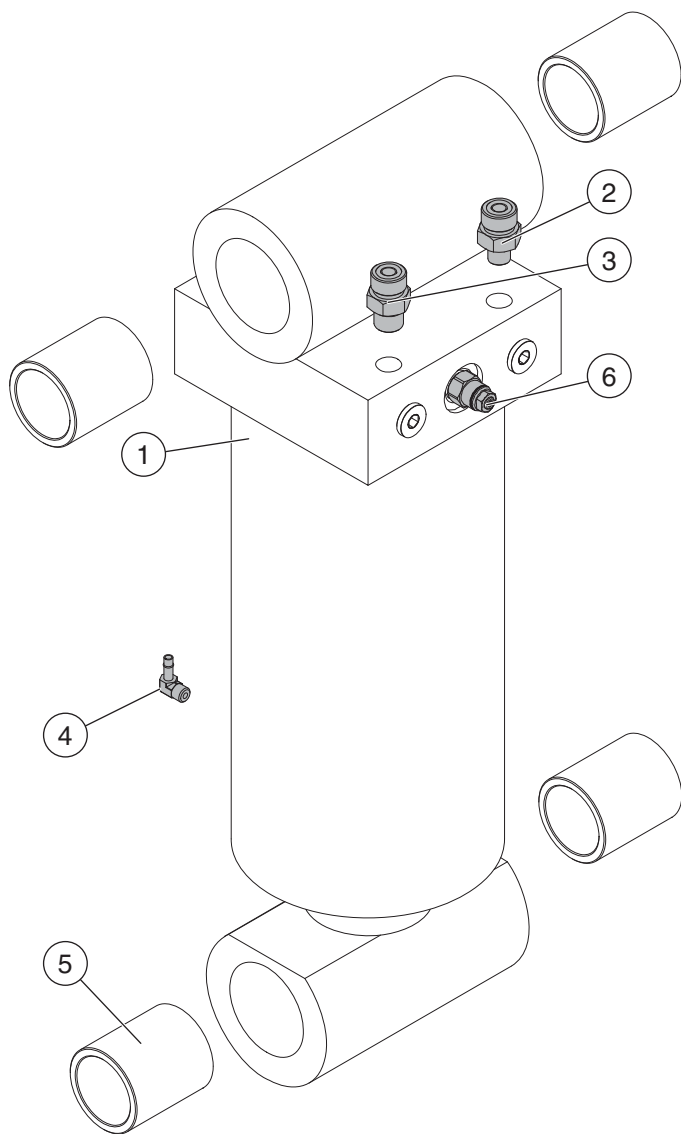


ILLUSTRATION No.  
ART\_4352

TITAN BOOM 60-S

Frame Level Cylinder



## Frame Level Cylinder

ITEM	PART NO.	QTY PER LOCATION	QTY PER MACHINE	DESCRIPTION
1	24152	1	4	Frame Level Cylinder, without fittings
--	93321	--	--	Seal Kit
2	50820	1	4	Fitting, MFFOR-MB-4-6
3	50835	1	4	Fitting, MFFOR-MB-6-6
4	51095	1	4	Fitting, HB-MP90-05-02
5	93322	4	16	Bearing
6	92522	1	4	Valve, Counterbalance



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



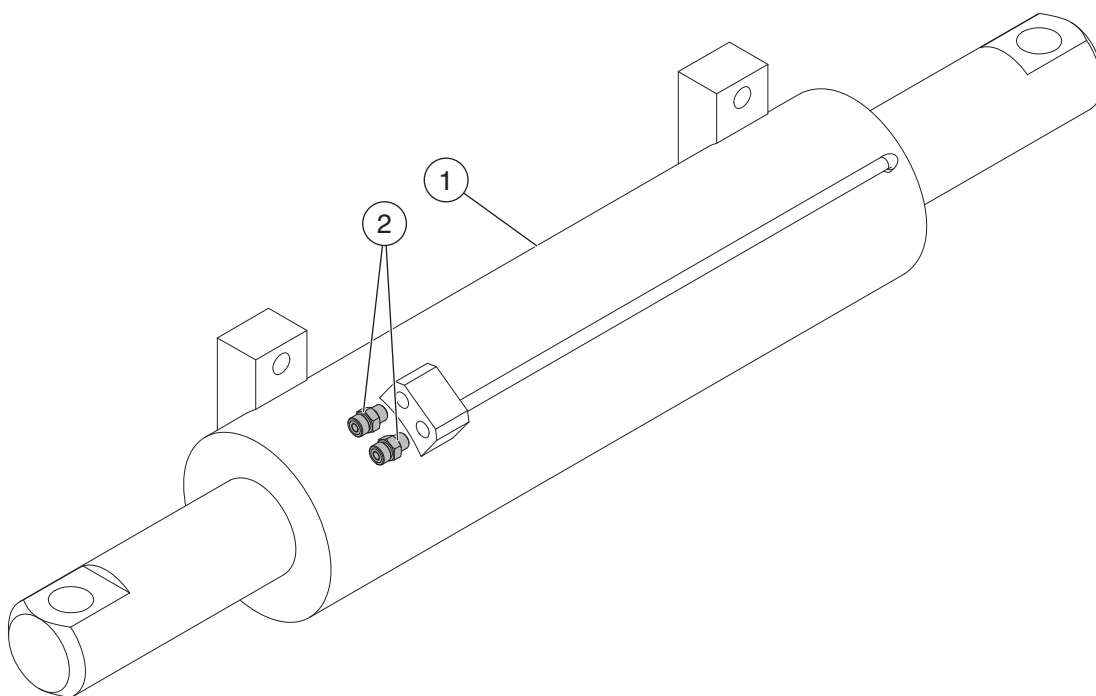


ILLUSTRATION No.  
ART\_4353

TITAN BOOM 60-S

Steer Cylinders



## Steer Cylinder

ITEM	PART NO.	QTY PER LOCATION	QTY PER MACHINE	DESCRIPTION
1	24153	1	2	Steer Cylinder, without fittings
--	93320	--	--	Seal Kit
2	50835	2	4	Fitting, MB-MFFOR-6-6



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



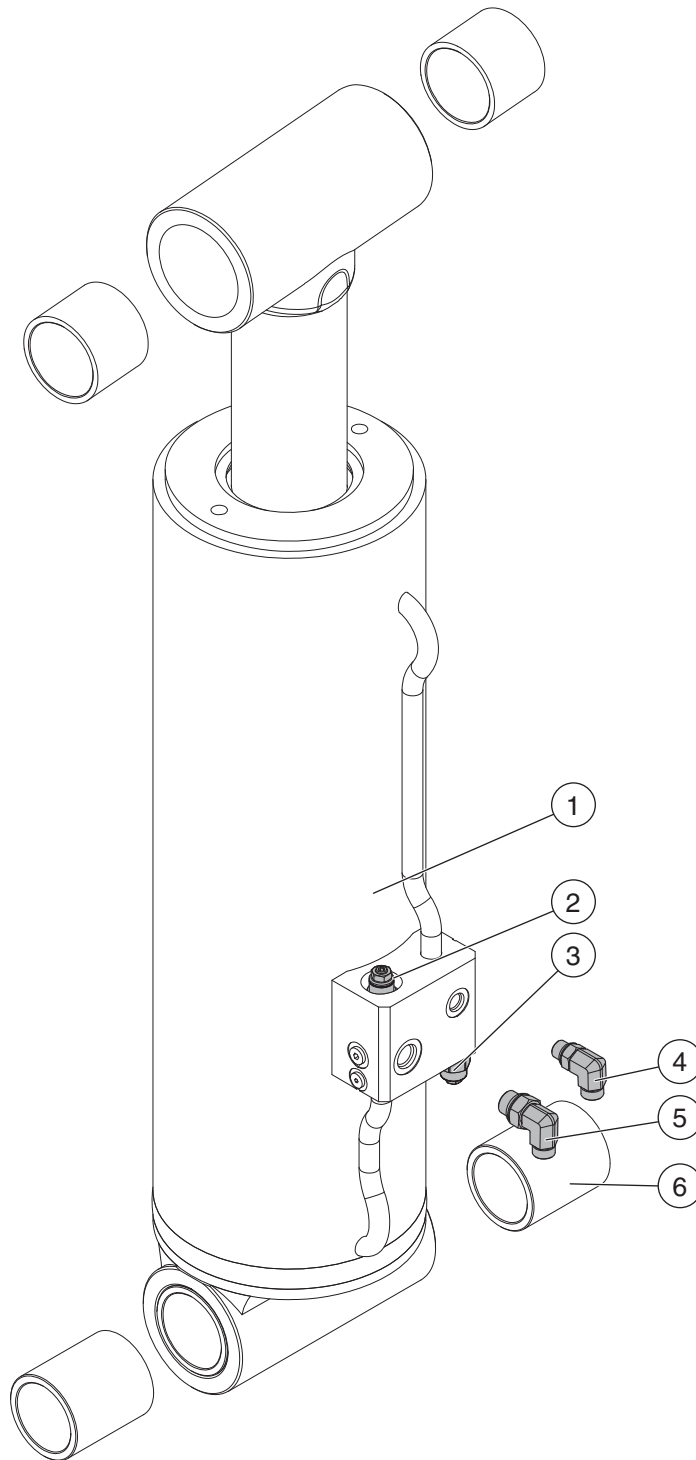


ILLUSTRATION No.  
ART\_4355

TITAN BOOM 60-S

Platform Level Cylinder



## Platform Level Cylinder

ITEM	PART NO.	QTY	DESCRIPTION
1	24157	1	Platform Level Cylinder, without fittings
--	93319	--	Seal Kit
2	92627	1	Valve, Counterbalance
3	92628	1	Valve, Counterbalance
4	50674	1	Fitting, MFFOR-MB 90°- 6-6
5	50847	1	Fitting, MFFOR-MB 90° 6-8
6	92630	4	Bearing



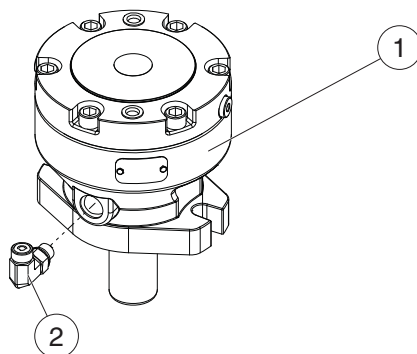
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only





## Carriage Brake

## Carriage Motor

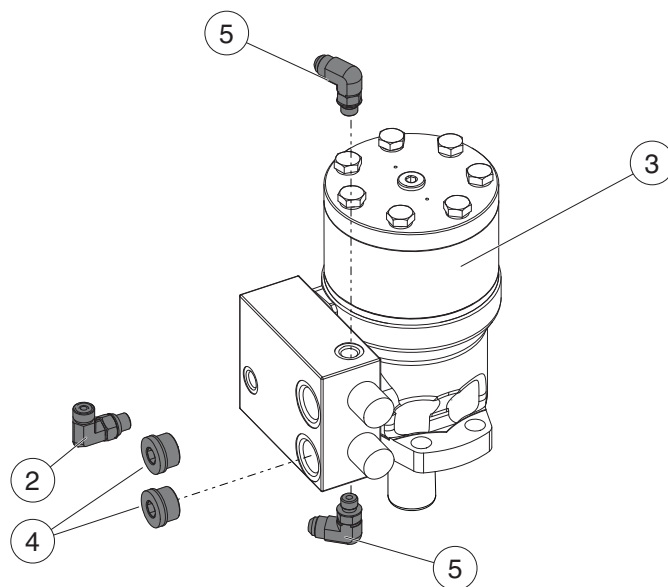


ILLUSTRATION No.  
ART\_4358

TITAN BOOM 60-S

Carriage Motor & Brake



## Carriage Motor & Brake

ITEM	PART NO.	QTY	DESCRIPTION
1	91894	1	Brake
2	50673	2	Fitting, MFFOR-MB90 4-4
3	92005	1	Hydraulic Motor
--	92657	--	Motor only; no block
--	92658	--	Shaft Key
4	HDW90952	2	Fitting, MB-10 Plug
5	50986	2	Fitting, MB-MJ90-04-06



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



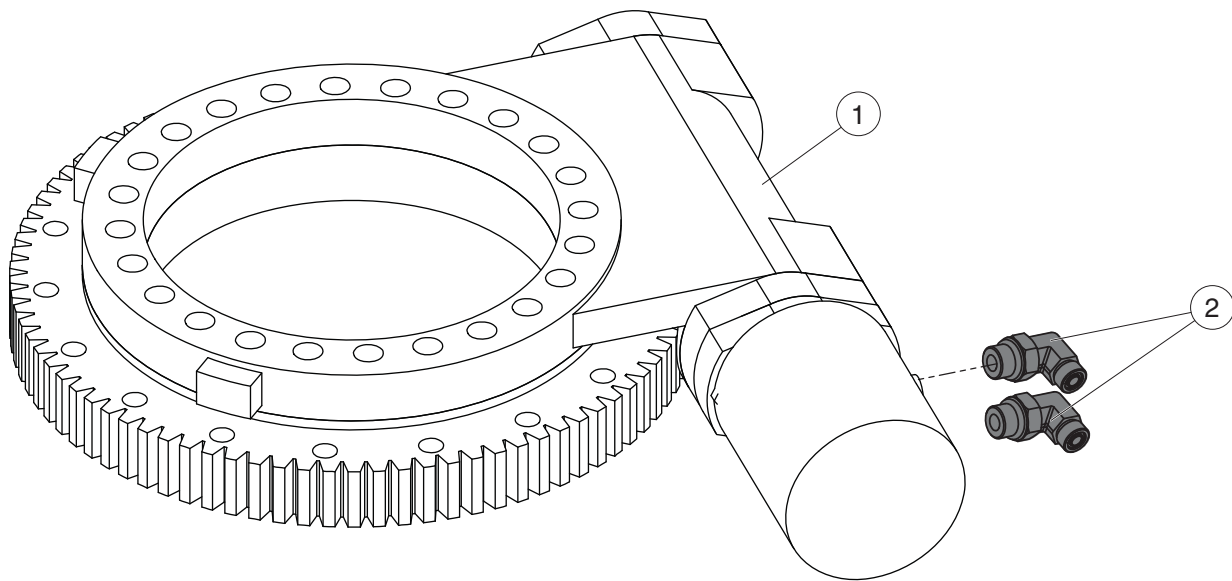


ILLUSTRATION No.  
ART\_3666

TITAN BOOM 40-S

Platform Rotate Drive Unit



## Platform Rotate Drive Unit

ITEM	PART NO.	QTY	DESCRIPTION
1	92018	1	Platform Rotate motor, without fittings
2	50665	2	Fitting, MB-MJ90-04-04



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



## Hydraulic Hoses

PART NUMBER	QTY.	HOSE NAME	DESCRIPTION
Drive Motor Circuit, from front Drive Motors to Traction Manifold			
52350	1	D2-RF-A	Hose Assy, 1/2 x 108.25 inch, 08G-10FFORX-08G-08FFORX
52351	1	D8-RF-B	Hose Assy, 1/2 x 109.75 inch, 08G-10FFORX-08G-08FFORX
52352	1	D5-LF-A	Hose Assy, 1/2 x 78.25 inch, 08G-10FFORX-08G-08FFORX
52353	1	D2-LF-B	Hose Assy, 1/2 x 73.75 inch, 08G-10FFORX-08G-08FFORX
Drive Motor Circuit, from rear Drive Motors to bulkhead fittings			
52354	1	D1-RR-A	Hose Assy, 1/2 x 121 inch, 08G-10FFORX-08G-08FFORX
52355	1	D6-RR-B	Hose Assy, 1/2 x 115 inch, 08G-10FFORX-08G-08FFORX
52356	1	D7-LR-A	Hose Assy, 1/2 x 72.75 inch, 08G-10FFORX-08G-08FFORX
52357	1	D3-LR-B	Hose Assy, 1/2 x 77 inch, 08G-10FFORX-08G-08FFORX
Drive Motor Circuit, from bulkhead fittings to Traction Manifold			
52358	4	D(1,3,6,7) RR,LR	Hose Assy, 1/2 x 72 inch, 08G-08FFORX -08G-08FFORX
Steering Circuit, from front Steer Cylinder to Primary Functions Manifold			
52359	1	STEER	Hose Assy, 3/8 x 92 inch, 06G-06FFORX-06G-08FFORX
52360	1	STEER	Hose Assy, 3/8 x 93 inch, 06G-06FFORX-06G-06FFORX90S
Steering Circuit, from rear Steer Cylinder to Primary Functions Manifold			
52361	2	STEER	Hose Assy, 3/8 x 125 inch, 06G-06FFORX-06G-08FFORX
Auxiliary Pump Hoses			
52362	1	AUX PUMP	Hose Assy, 1/2 x 25 inch, 08G-08FFORX-08G-06FFORX
52363	1	AUX PUMP	Hose Assy, 3/8 x 16.5 inch, 06G-06FFORX-06G-08FFORX90
52364	1	AUX PUMP	Hose Assy, 3/4 x 25 inch, 12G-12FJX-12G-12FFORX 90
2-Speed & Brake Circuits, from Drive Motors to T fitting			
52365	1	2SPD	Hose Assy, 1/4 x 91 inch, 04G-04FFORX-04G-04FFORX
52366	1	BRK	Hose Assy, 1/4 x 101.5 inch, 04G-04FFORX-04G-04FFORX
52367	1	2SPD	Hose Assy, 1/4 x 130.75 inch, 04G-04FFORX-04G-04FFORX
52368	1	BRK	Hose Assy, 1/4 x 139.75 inch, 04G-04FFORX-04G-04FFORX
52046	1	2SPD	Hose Assy, 1/4 x 103 inch, 04G-04FFORX-04G-04FFORX
52369	1	BRK	Hose Assy, 1/4 x 109.75 inch, 04G-04FFORX-04G-04FFORX
52370	1	2SPD	Hose Assy, 1/4 x 133 inch, 04G-04FFORX-04G-04FFORX
52371	1	BRK	Hose Assy, 1/4 x 144 inch, 04G-04FFORX-04G-04FFORX
Case Drain Circuit, from Drive Motors to T fitting			
52372	1	CASE DRN	Hose Assy, 3/8 x 89.25 inch, 06G-06FFORX-06G-06FFORX90S
52373	1	CASE DRN	Hose Assy, 3/8 x 126 inch, 06G-06FFORX-06G-06FFORX90S
52007	1	CASE DRN	Hose Assy, 3/8 x 99 inch, 06G-06FFORX-06G-06FFORX90S
52374	1	CASE DRN	Hose Assy, 3/8 x 131.5 inch, 06G-06FFORX-06G-06FFORX90S
2-Speed & Brake Circuits, from T fitting to T fitting			
52375	4	2SPD, BRK	Hose Assy, 1/4 x 29.5 inch, 04G-04FFORX-04G-04FFORX
Case Drain Circuit, from T fitting to T fitting			
52376	2	CASE DRN	Hose Assy, 3/8 x 29.5 inch, 06G-06FFORX-06G-08FFORX
2-Speed & Brake Circuits, from T fitting to Primary Functions Manifold			
52377	2	2SPD, BRK	Hose Assy, 1/4 x 32.5 inch, 04G-04FFORX-04G-04FFORX90S
Case Drain Circuit, from T fitting to Hydraulic Tank			
52378	1	CASE DRN	Hose Assy, 3/8 x 19.5 inch, 06G-06FFORX-06G-08FFORX
Frame Level Circuit, from Rear Axle Cylinders to T fitting			
52379	1	FLR-RR-R	Hose Assy, 3/8 x 83.5 inch, 06G-06FFORX-06G-08FFORX
52380	1	FLL-RR-E	Hose Assy, 3/8 x 84.75 inch, 06G-06FFORX-06G-08FFORX
52381	1	FLR-LR-E	Hose Assy, 3/8 x 115 inch, 06G-06FFORX-06G-08FFORX
52382	1	FLL-LR-R	Hose Assy, 3/8 x 117 inch, 06G-06FFORX-06G-08FFORX
Axle Lock Circuit, from Front Axle Cylinders to T fitting			
52383	2	RF-APR, RF-AS	Hose Assy, 3/8 x 67.25 inch, 06G-06FFORX-06G-08FFORX
52384	2	LF-AP, AS R&E	Hose Assy, 3/8 x 95 inch, 06G-06FFORX-06G-08FFORX



PART NUMBER	QTY.	HOSE NAME	DESCRIPTION
Frame Level & Axle Lock Circuits, from T fitting to Secondary Functions Manifold			
52385	1	AXLE LOCK	Hose Assy, 3/8 x 79.25 inch, 06G-06FFORX-06G-08FFORX
52386	1	AXLE LOCK	Hose Assy, 3/8 x 78 inch, 06G-06FFORX-06G-08FFORX
52387	2	AXLE LOCK	Hose Assy, 3/8 x 30 inch, 06G-06FFORX-06G-06FFORX90L
Front Outrigger Circuit, from Outriggers to Bulkhead Fitting			
52388	1	ORF-R	Hose Assy, 3/8 x 27.75 inch, 06G-06FFORX-06G-08FFORX
52389	1	ORF-E	Hose Assy, 1/2 x 27.5 inch, 08G-08FFORX-08G-08FFORX
52390	1	OLF-R	Hose Assy, 3/8 x 34.5 inch, 06G-06FFORX-06G-08FFORX
52391	1	OLF-E	Hose Assy, 1/2 x 34.25 inch, 08G-08FFORX-08G-08FFORX
Front Outrigger Circuit, from Bulkhead Fitting to Primary Functions Manifold			
52392	2	OUTRIGGER	Hose Assy, 3/8 x 127 inch, 06G-06FFORX-06G-06FFORX90L
52393	1	OUTRIGGER	Hose Assy, 1/2 x 126 inch, 08G-08FFORX-08G-08FFORX90S
52394	1	OUTRIGGER	Hose Assy, 1/2 x 126 inch, 08G-08FFORX-08G-08FFORX90L
Rear Outrigger Circuit, from Outriggers to Primary Functions Manifold			
52395	1	OUTRIGGER	Hose Assy, 3/8 x 186 inch, 06G-06FFORX-06G-06FFORX90L
52396	1	OUTRIGGER	Hose Assy, 1/2 x 185 inch, 08G-08FFORX-08G-08FFORX
52397	1	OUTRIGGER	Hose Assy, 3/8 x 230 inch, 06G-06FFORX-06G-06FFORX90L
52398	1	OUTRIGGER	Hose Assy, 1/2 x 227 inch, 08G-08FFORX-08G-08FFORX90L
Other Hoses			
52399	1	DRV BLK/TANK	Hose Assy, 1/2 x 198 inch, 08G-08FFORX-08G-08FFORX
52400	1	REX/TANK	Hose Assy, 1/2 x 15.75 inch, 08G-08FFORX-08G-08FFORX
52401	1	DRV PUMP	Hose Assy, 1/2 x 228.5 inch, 08G-08FFORX-08G-08FFORX90S
52402	1	H1/2SPD	Hose Assy, 1/4 x 193.5 inch, 04G-04FFORX-04G-04FFORX90S
52403	1	H1/2SPD	Hose Assy, 1/4 x 198.75 inch, 04G-04FFORX-04G-04FFORX90L
52404	1	H1/2SPD	Hose Assy, 1/4 x 186.25 inch, 04G-04FFORX-04G-04FFORX
52405	1	CHFILT/H1	Hose Assy, 1/2 x 29.75 inch, 08G-08FFORX-08G-08FFORX90S
52406	1	CHFILT/H1	Hose Assy, 1/2 x 24.5 inch, 08G-08FFORX-08G-08FFORX90L
52407	1	H1/TANK	Hose Assy, 1/2 x 15.75 inch, 08G-08FFORX-08G-08FFORX
52408	1	REX/2SPD	Hose Assy, 1/4 x 188.25 inch, 04G-04FFORX-04G-04FFORX
52409	1	2SPD/TANK	Hose Assy, 1/2 x 64.5 inch, 08G-08FFORX-08G-12FFORX
52410	1	DRV BLK/2SPD	Hose Assy, 1/4 x 210.5 inch, 04G-04FFORX-04G-04FFORX
52411	1	GEAR PUMP SUC	Hose Assy, 1 x 14.25 inch, 16G-16FJX-16G-16FJX90S
52412	1	H1/SUCT TANK	Hose Assy, 1 x 26.25 inch, 16G-20FJX-16G-16FJX90S
52413	1	H1/ DRV BLOCK	Hose Assy, 3/4 x 28.25 inch, 12G-12FFORX-12G-12FFORX
52414	1	H1/ DRV BLOCK	Hose Assy, 3/4 x 33 inch, 12G-12FFORX-12G-12FFORX
52415	1	REX/MAIN BLK	Hose Assy, 1 x 114.5 inch, 16G-16FJX-16G-16FFORX90S
52416	1	M BLK/TANK	Hose Assy, 3/4 x 29 inch, 12G-12FFORX-12G-12FFORX 90
52417	1	REX/SUC MAN	Hose Assy, 1-1/2 x 14 inch, 24G-24FJX -24G-24FJX
52418	1	LIFT CYL UP	Hose Assy, 1/2 x 116 inch, 08G-08FFORX -08G-08FFORX90S
52419	1	LIFT CYL DOWN	Hose Assy, 5/8 x 116 inch, 10G-10FFORX-10G-10FFORX45
52420	1	BULK	Hose Assy, 3/8 x 46 inch, 06G-06FFORX45-06G-06FFORX90S
52421	1	BULK	Hose Assy, 3/8 x 49.5 inch, 06G-06FFORX90S-06G-06FFORX90S
52422	2	TIP BLK/M BLK	Hose Assy, 3/8 x 226 inch, 06G-06FFORX-06G-08FFORX
52423	1	LVL CYL/BLK UP	Hose Assy, 3/8 x 12.5 inch, 06G-06FFORX-06G-08FFORX
52424	1	LVL CYL/BLK DN	Hose Assy, 3/8 x 12.5 inch, 06G-06FFORX-06G-06FFORX90S
52425	2	ROT MOT/BLK R	Hose Assy, 1/4 x 270 inch, 04G-04FFORX-04G-06FFORX
52426	2	SLIDE MOT/BLK	Hose Assy, 1/4 x 241 inch, 04G-04FFORX-04G-06FFORX
52427	1	TIP BLK/M BLK	Hose Assy, 3/8 x 59.5 inch, 06G-06FFORX-06G-06FFORX90S
52428	1	TIP BLK/M BLK	Hose Assy, 3/8 x 59.5 inch, 06G-06FFORX-06G-06FFORX90L

• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

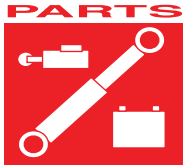
• REF: Reference only





PART NUMBER	QTY.	HOSE NAME	DESCRIPTION
52429	1	BOOM EXT	Hose Assy, 3/4 x 151 inch, 12G-12FFORX-12G-12FFORX45
52430	1	BOOM RET	Hose Assy, 1/2 x 155.75 inch, 08G-08FFORX-08G-08FFORX45S
52431	1	MAIN SUCTION	Hose Assy, 2.5 x 110 inch
52432	1	TANK/TANK	Hose Assy, 1/2 x 131 inch, 08G-08FFORX-08G-12FFORX
OPTION -- Oil Cooler			
52433	1	OIL COOLER	Hose Assy, 1/2 x 77 inch, 08G-08FFORX - 08G-12FFORX
52434	1	OIL COOLER	Hose Assy, 1/2 x 54 inch, 08G-08FFORX - 08G-08FFORX90S
OPTION -- Generator			
52435	1	GEN LS	Hose Assy, 1/4 x 12 inch, 4G-4FJX - 04G-04FJX90
52436	1	GEN AUX	Hose Assy, 1/4 x 16 inch, 4G-4FJX - 4G-4FJX
52437	1	GEN SUP	Hose Assy, 1/2 x 15.5 inch, 08G-08FFORX - 08G-08FFORX90S
52438	1	GEN RETURN	Hose Assy, 1/2 x 16.5 inch, 08G-08FFORX - 08G-08FJX





# SECTION F

## BASE

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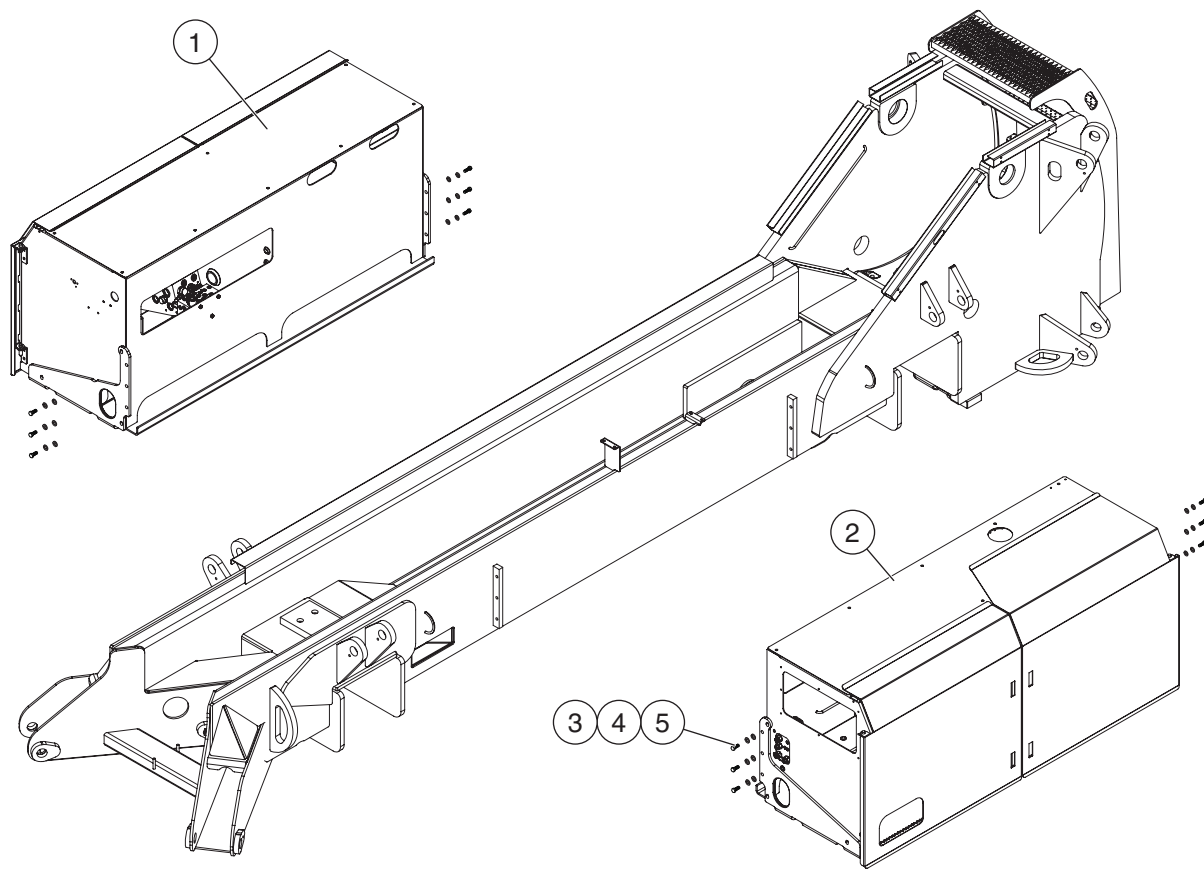


ILLUSTRATION No.  
ART\_4328

TITAN BOOM 60-S

Axle Assembly



## Module Installation

ITEM	PART NO.	QTY	DESCRIPTION
1	REF	1	Control Module
2	REF	1	Engine Module
3	50043	12	Bolt, HHCS M16 x 40
4	50249	12	Washer, M16 Nordlock
5	50261	12	Washer, M16 Std



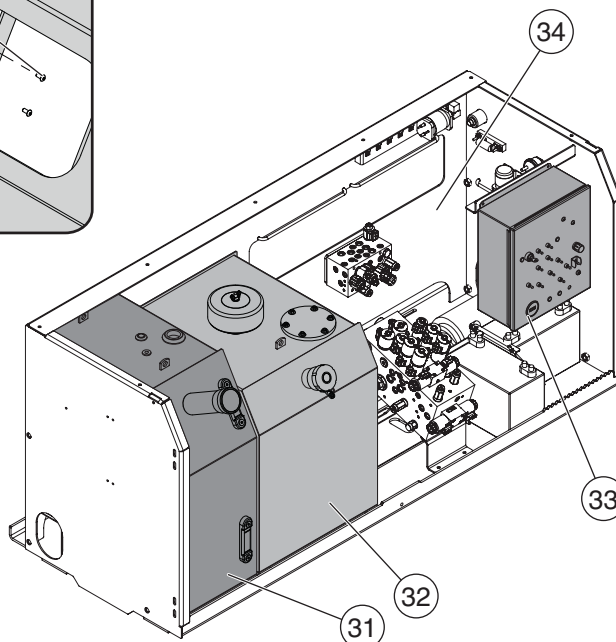
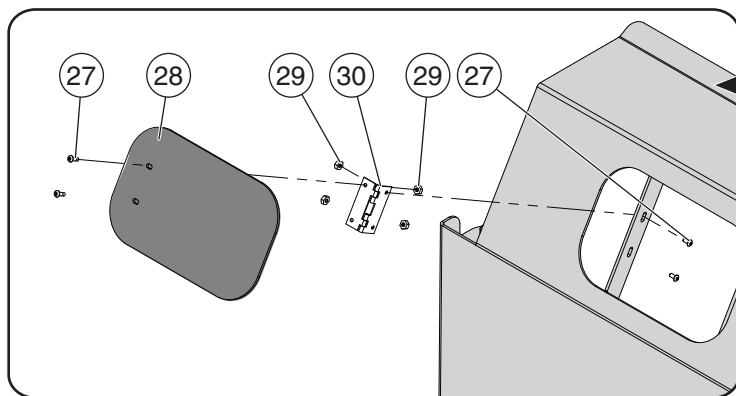
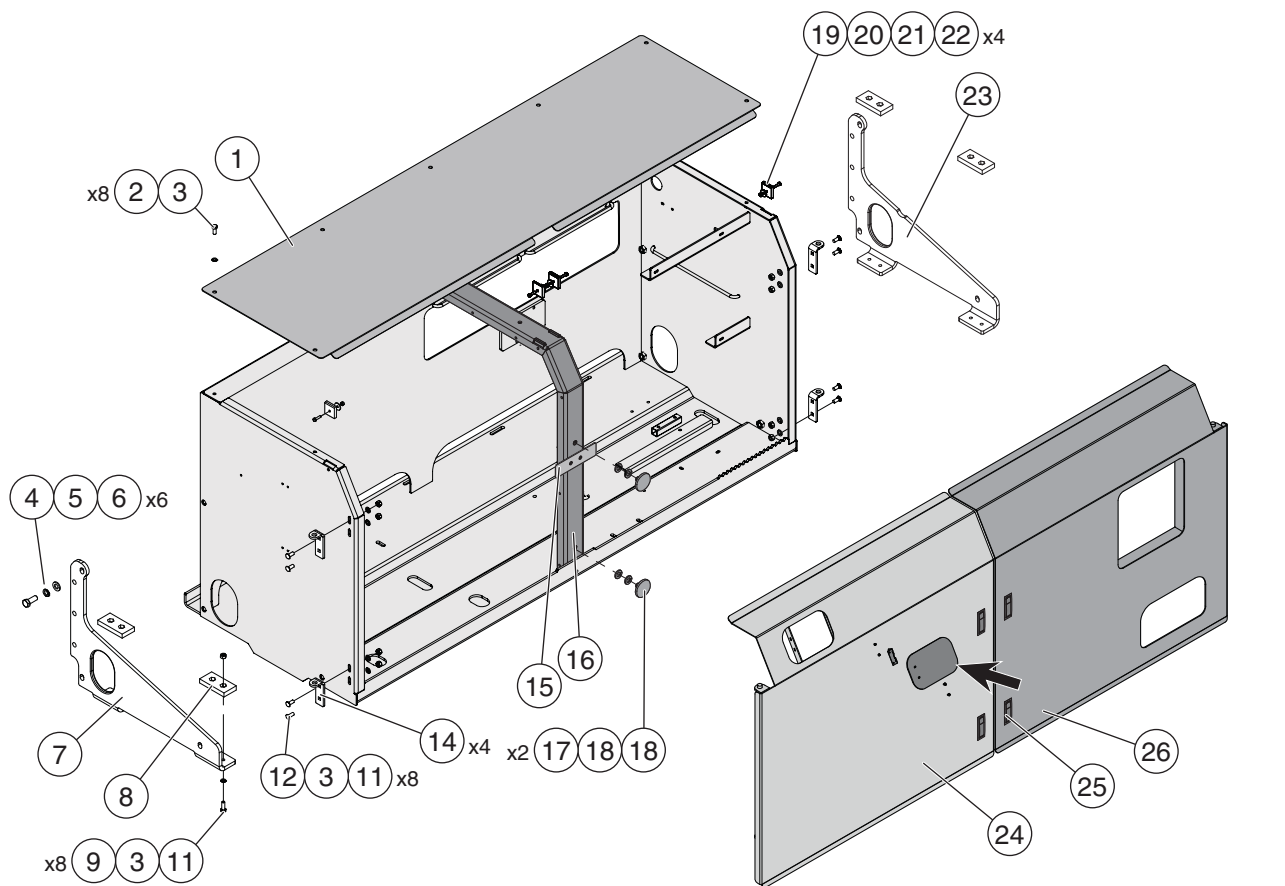
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Control Module Assembly, Drawing 1 of 2

ITEM	PART NO.	QTY	DESCRIPTION
--	84214	--	Control Module
1	24093	1	Control Module Top
2	50033	8	Bolt, M10 x 25
3	50006	14	Washer, M10 Nordlock
4	50043	6	Bolt, HHCS M16 x 40
5	50249	6	Washer, M16 Nordlock
6	50261	6	Washer, M16 Std
7	24043	1	Module Bracket, Left Side
8	22425	4	Mount Block
9	50034	8	Bolt, M10 x 30
10	--	--	--
11	50049	16	Nut, M10 Nylock
12	50342	8	Carriage Bolt, M10 x 25
13	--	--	--
14	24146	4	Door Mount
15	22225	1	Latch Plate
16	24091	1	Module Support
17	25429	2	Door Spacer
18	50004	4	Washer, M16 Std.
19	14896	4	Door Slide Block
20	50117	4	Bolt, M6 x 25
21	50068	4	Washer, M6 Fender
22	50047	4	Nut, M6 Nylock
23	24042	1	Module Bracket, Right Side
24	24103	1	Control Module Door, Left Side
25	8386	4	Door Latch
26	24101	1	Control Module Door, Right Side
27	50328	4	Screw, 6-32 x .325 Stainless
28	22400	1	Fuel Door
29	50329	4	Nut, 6/32 Nylock
30	92213	1	Hinge
31	84217	1	Fuel Tank Assembly
32	REF	1	Hydraulic Tank Assembly -- See Section E of this manual
33	24085	1	Control Module Weldment
34	24085	1	Control Module Weldment



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



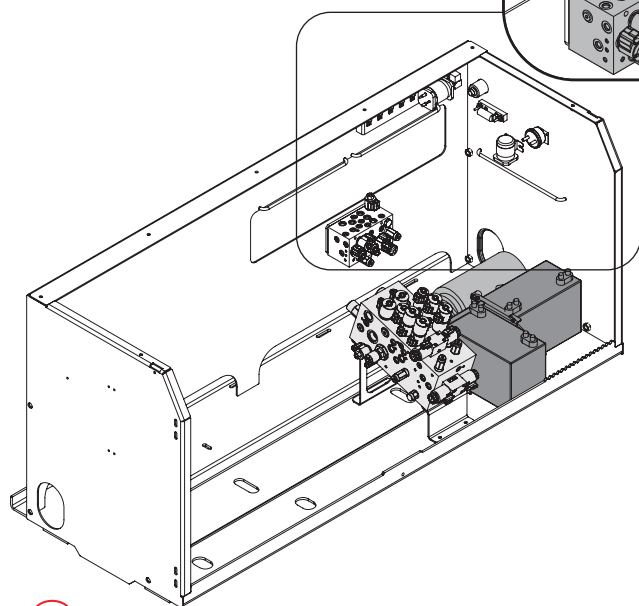
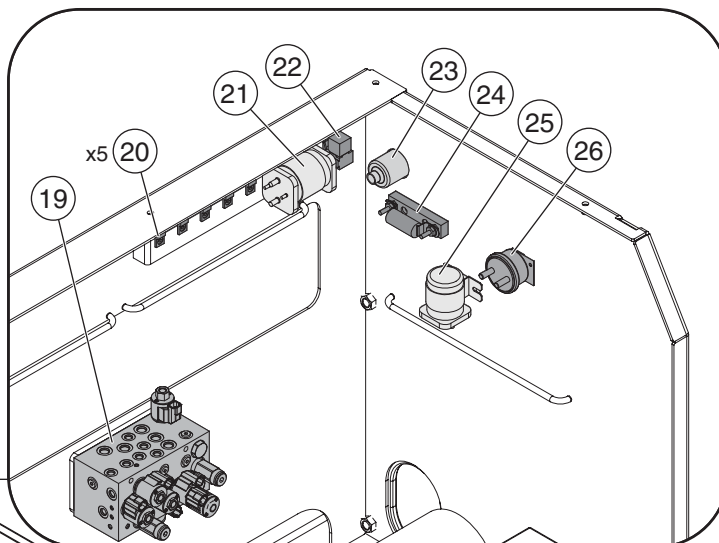
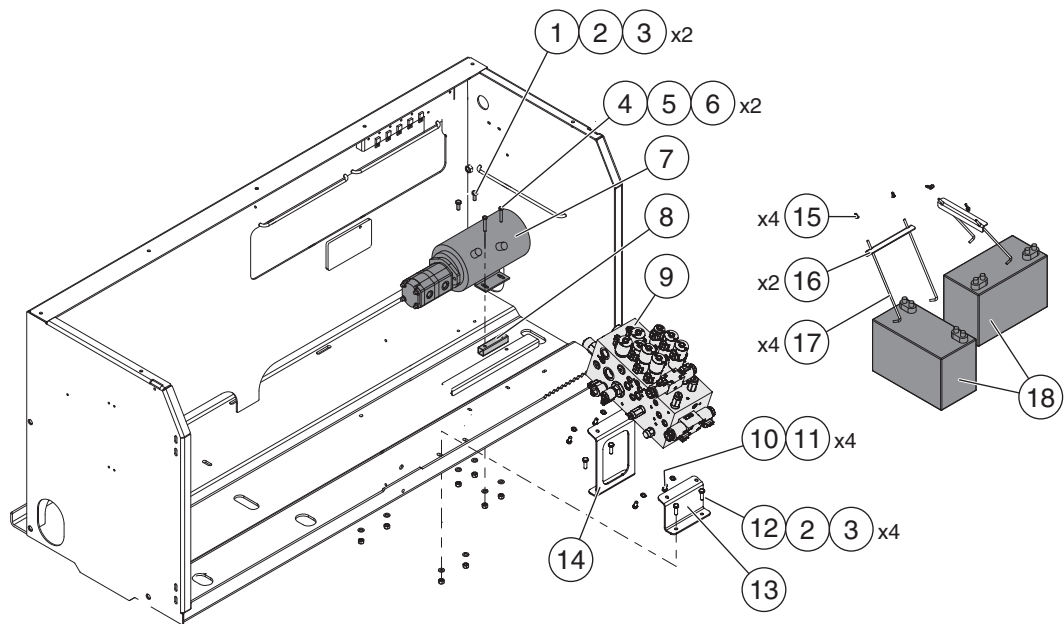


ILLUSTRATION No.  
ART\_4330

TITAN BOOM 60-S

Control Module Assembly, 2 of 2



## Control Module Assembly, Drawing 2 of 2

ITEM	PART NO.	QTY	DESCRIPTION
1	50033	2	Bolt, M10 x 25
2	50002	6	Washer, M10 Std.
3	50049	6	Nut, M10 Nylock
4	50015	2	Bolt, M8 x 50
5	50001	2	Washer, M8 Std.
6	50048	2	Nut, M8 Nylock
7	92999	1	E-Down Electric Motor
	93135	1	E-Down Hydraulic Pump
8	24309	1	Spacer
9	92882	1	Hydraulic Functions Manifold
10	50219	4	Bolt, 3/8 x .75
11	50006	4	Washer, M10 Nordlock
12	50034	4	Bolt, M10 x 30
13	24315	1	Front Bracket, Functions Manifold
14	24314	1	Rear Bracket, Functions Manifold
15	HDW6110	4	Wingnut, 1/4-20
16	22421	2	Battery Hold Down
17	22536	4	J-Bolt
18	17966	2	Battery
Mounting hardware for the following items is not shown, but is listed below each item in this table.			
19	92881	1	Secondary Functions Manifold
--	50268	3	M8 x 120
20	91881	5	Relay/Buss Mount
--	50191	5	Screw, 10-32 x .5
--	50238	5	Nut, 10-32 Nylock
21	93169	1	Series/Parallel Switch
--	50191	2	Screw, 10-32 x .5
--	50238	2	Nut, 10-32 Nylock
22	92400	1	Relay
--	92103	1	Relay Base
23	90749	1	Power To Platform Plug
24	91709	1	300-Amp Fuse
--	19471	1	Fuse Base
--	50194	2	Screw, 1/4 x 1
--	50168	2	Nut, 1/4 Nylock
25	91745	1	Contact, 12V
--	50028	2	Bolt, M6 x 20
--	50000	2	Washer, M6 Std.
--	50047	2	Nut, M6 Nylock
26	8841	1	Battery Disconnect Switch



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



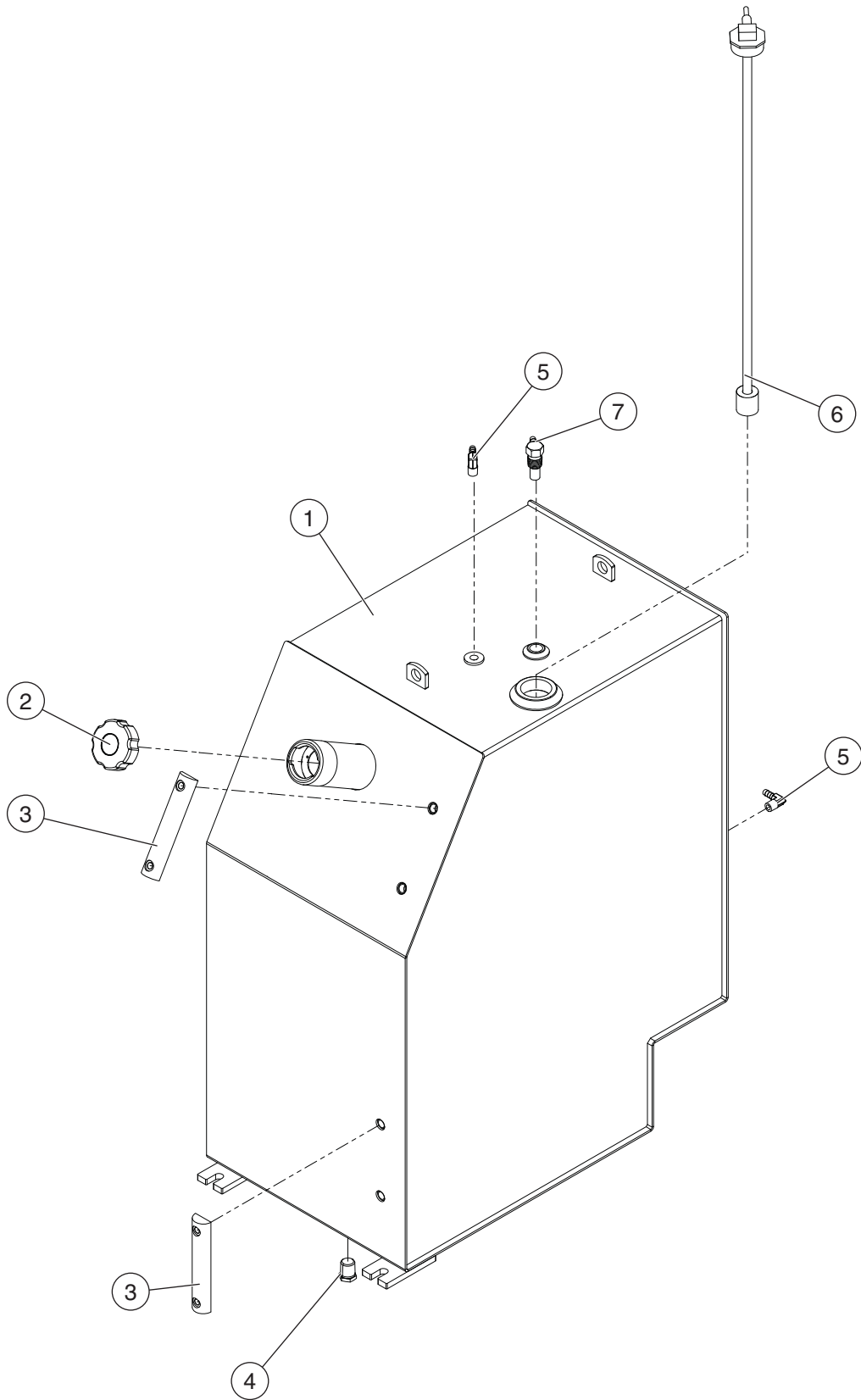


ILLUSTRATION No.  
ART\_4339

TITAN BOOM 60-S

Fuel Tank Assembly



## Fuel Tank Assembly

ITEM	PART NO.	QTY	DESCRIPTION
1	24177	1	Fuel Tank Weldment
2	92699	1	Fuel Cap
3	9370	2	Site Gauge
4	51098	1	Plug, MB-08
5	HDW6727	2	Fitting, 1/4" NPT to 5/16 Hose
6	92069	1	Fuel Sending Unit
7	92699	1	Fitting, 1/2 NPT Vent



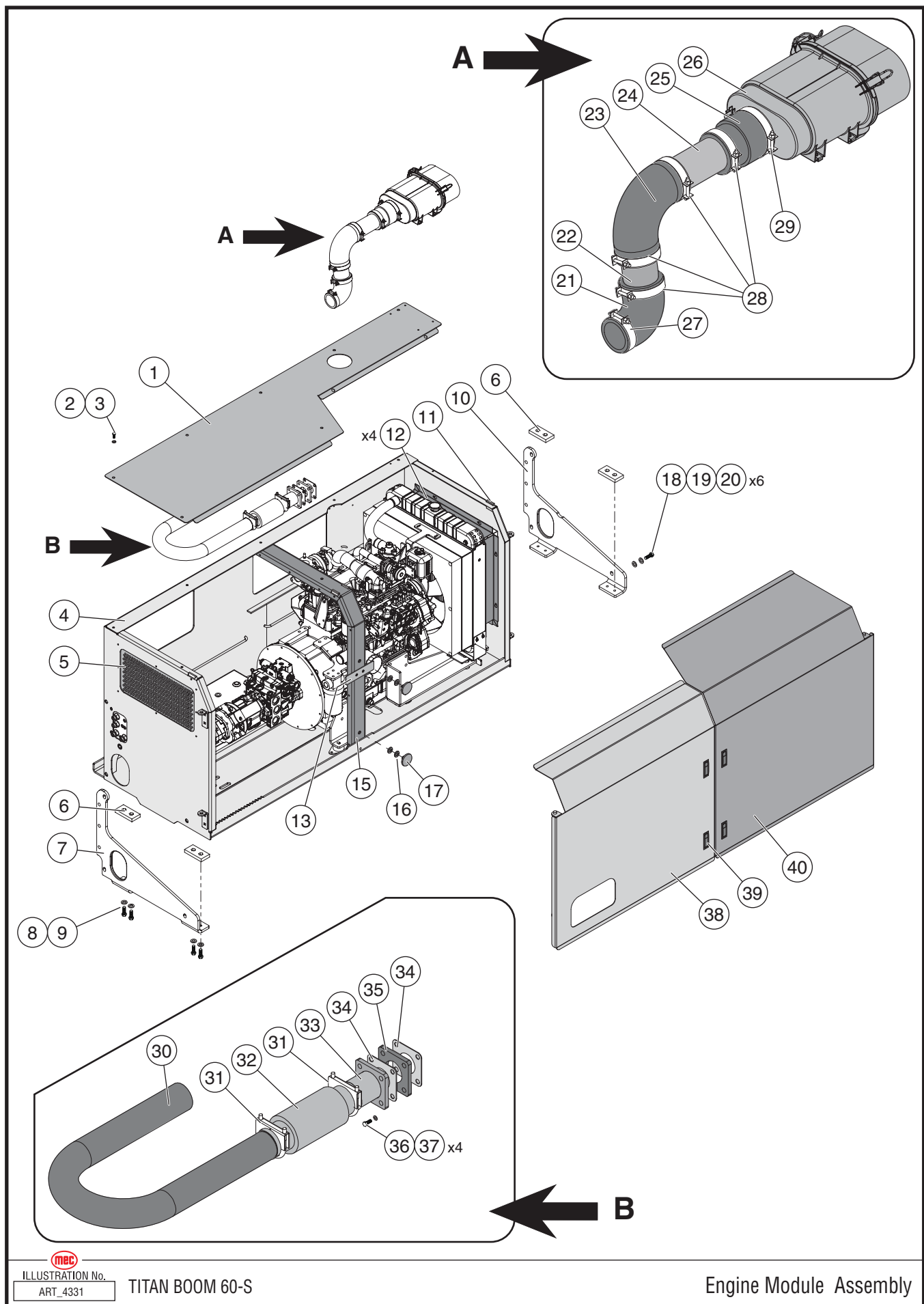
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Engine Module Assembly

ITEM	PART NO.	QTY	DESCRIPTION
--	24426	--	Engine Module Assembly
1	24092	1	Engine Module Top Panel
2	50033	8	Bolt, M10 x 25
3	50006	8	Washer, M10 Nordlock
4	24080	1	Engine Module Weldment
5	24072	1	Vent Screen
6	22425	4	Mount Block
7	24043	1	Module Bracket, Left Side
8	50034	8	Bolt, M10 x 30
9	50006	8	Washer, M10 Nordlock
--	50049	8	Nut, M10 Nylock
10	24042	1	Module Bracket, Right Side
11	14896	4	Door Slide Block
--	50117	4	Bolt, M6 x 25
--	50068	4	Washer, M6 Fender
--	50047	4	Nut, M6 Nylock
12	22462	4	Radiator Shroud Forming
13	22255	1	Latch Plate
14	--	--	--
15	24091	1	Module Support
16	50004	4	Washer, M16 Std.
17	25429	2	Door Spacer
18	50043	6	Bolt, HHCS M16 x 40
19	50249	6	Washer, M16 Nordlock
20	50261	6	Washer, M16 Std
21	92897	1	Reducing Elbow
22	24299	1	Short Intake Tube
23	92899	1	3" X 3" Elbow
24	24298	1	Long Intake Tube
25	92898	1	3-1/2" X 3" Reducer
26	92900	1	Intake Air Cleaner, Horizontal Mount
--	93341	--	Primary Filter Element
--	93342	--	Safety Filter Element
27	93262	1	T-bolt Clamp 3-1/8"
28	93263	4	T-bolt Clamp 3-3/4"
29	93264	1	T-bolt Clamp 4-1/4"
30	24292	1	Exhaust U-bend
31	91883	2	2.5" U-bolt Clamp
32	92894	1	2.5 Id, 6" Center Flex, 10" O.a.l.
33	24291	1	Turbo Outlet Weldment
34	92935	2	Exhaust Flange Gasket
35	24337	1	Exhaust Sealing Flange
36	50430	4	Bolt, M10-1.25 x 45
37	50006	4	Washer, M10 Nordlock
38	24098	1	Engine Module Left Door
39	8386	4	Door Latch
40	24094	1	Engine Module Right Door

• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only





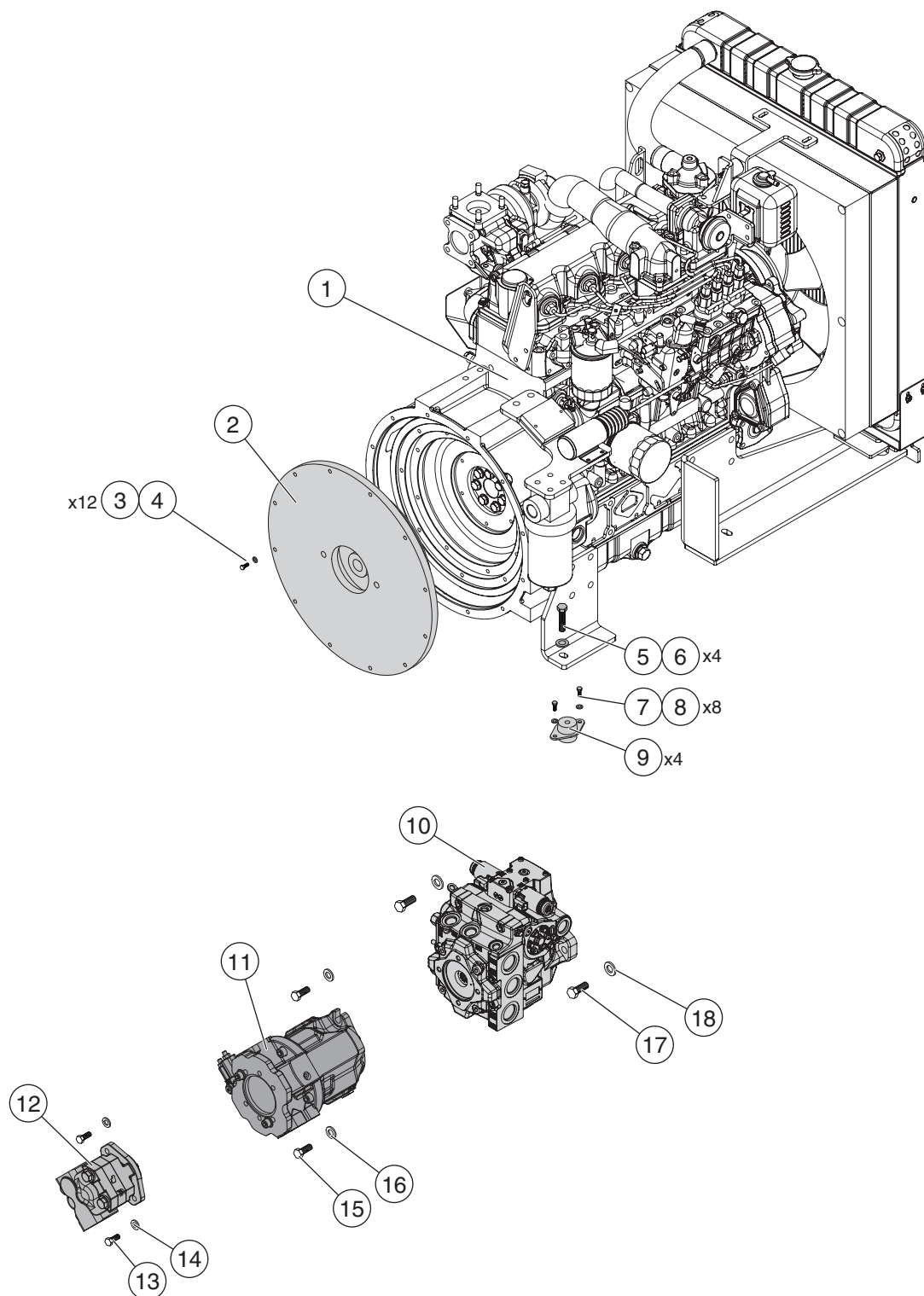


ILLUSTRATION No.  
ART\_4332

TITAN BOOM 60-S

Engine Assembly



## Engine Assembly

ITEM	PART NO.	QTY	DESCRIPTION
1	24425	1	Kubota V3800 Engine Assembly
2	93144	1	Bell Housing Cover/Engine Coupling Assembly
3	50275	12	Bolt, 3/8 x 1
4	50200	12	Washer, M8 Nordlock
5	50264	4	Bolt, M12 x 60
6	50003	4	Washer, M12 Std.
7	50035	8	Bolt, M10 x 40
8	50006	8	Washer, M10 Nordlock
9	92597	4	Engine Mount
10	92592	1	Piston Pump
11	92937	1	Gear Pump
12	92938	1	Gear Pump
13	50033	2	Bolt, M10 x 25
14	50006	2	Washer, M10 Nordlock
15	50236	2	Bolt, M12 x 40
16	50007	2	Washer, M12 Nordlock
17	50069	2	Bolt, 1/2 x 1.5 G8
18	50249	2	Washer, M16 Nordlock



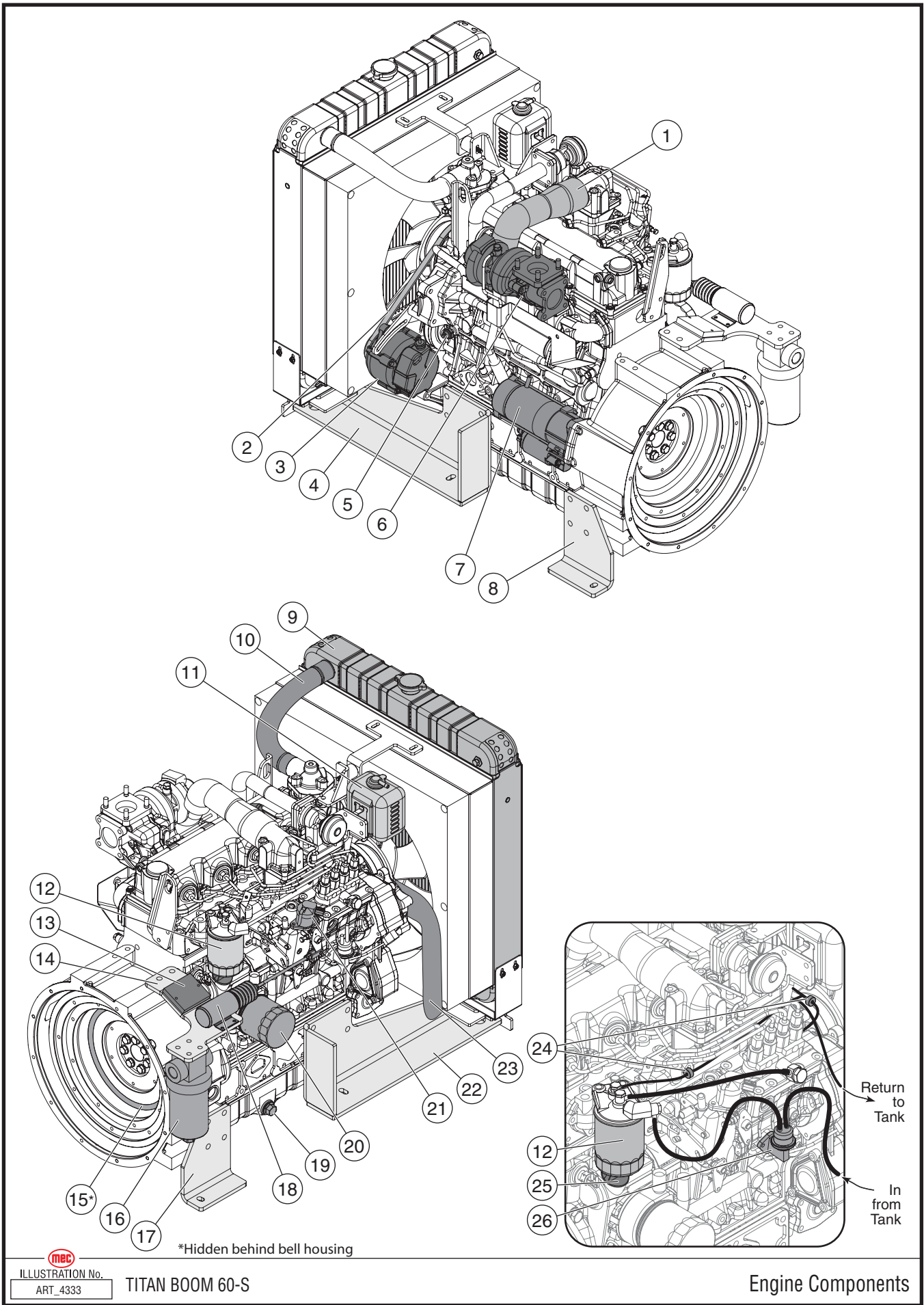
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only







## Engine Components

ITEM	PART NO.	QTY	DESCRIPTION
1	93305	1	Intake Tube
2	93309	1	Fan Belt
3	93306	1	Alternator
4	24075	1	Left Front Mounting Bracket
5	91175	1	Oil Pressure Switch
6	93307	1	Turbo Assembly
7	93308	1	Starter Assembly
8	24158	1	Left Rear Mounting Bracket
9	93334	1	Radiator Assembly
10	93335	1	Upper Radiator Hose
11	93340	1	Coolant Overflow Bottle
12	93311	1	Fuel Filter
13	92940	1	Solenoid Controller
14	24313	1	Bracket
15	93315	1	Ring Gear (mounted to flywheel, hidden by bell housing in illustration)
16	92072	1	Charge Filter Assembly
--	92169	1	Filter Element
17	24076	1	Left Rear Mounting Bracket
18	92939	1	Throttle Solenoid
--	24424	1	Throttle Link
--	91117	1	Throttle Linkage Clevis
19	93314	1	Engine Oil Drain Plug
20	93310	1	Engine Oil Filter
21	93312	1	Fuel Solenoid
22	24074	1	Left Front Mounting Bracket
23	93336	1	Lower Radiator Hose
24	91114	2	Fuel Check Valve
25	93316	2	Oil Filler Cap
26	93147	1	Fuel Pump



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



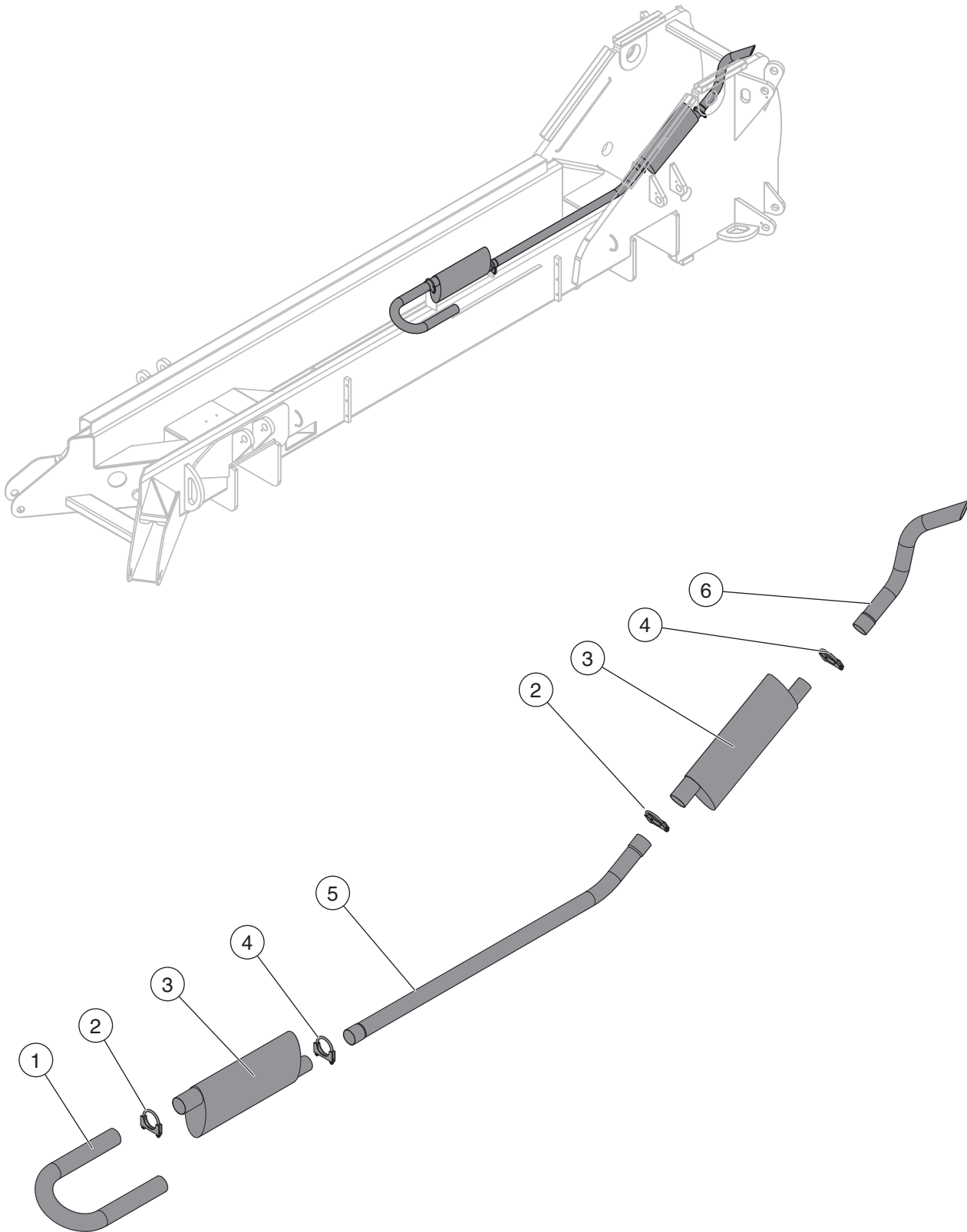


ILLUSTRATION No.  
ART\_4337

TITAN BOOM 60-S

Engine Exhaust Components



## Engine Exhaust Components

ITEM	PART NO.	QTY	DESCRIPTION
1	24292	1	Exhaust U-bend
2	91883	2	2.5" Clamp
3	92896	2	Muffler
4	92892	2	2.25" Clamp
5	24295	1	Mid Pipe
6	24297	1	End Pipe



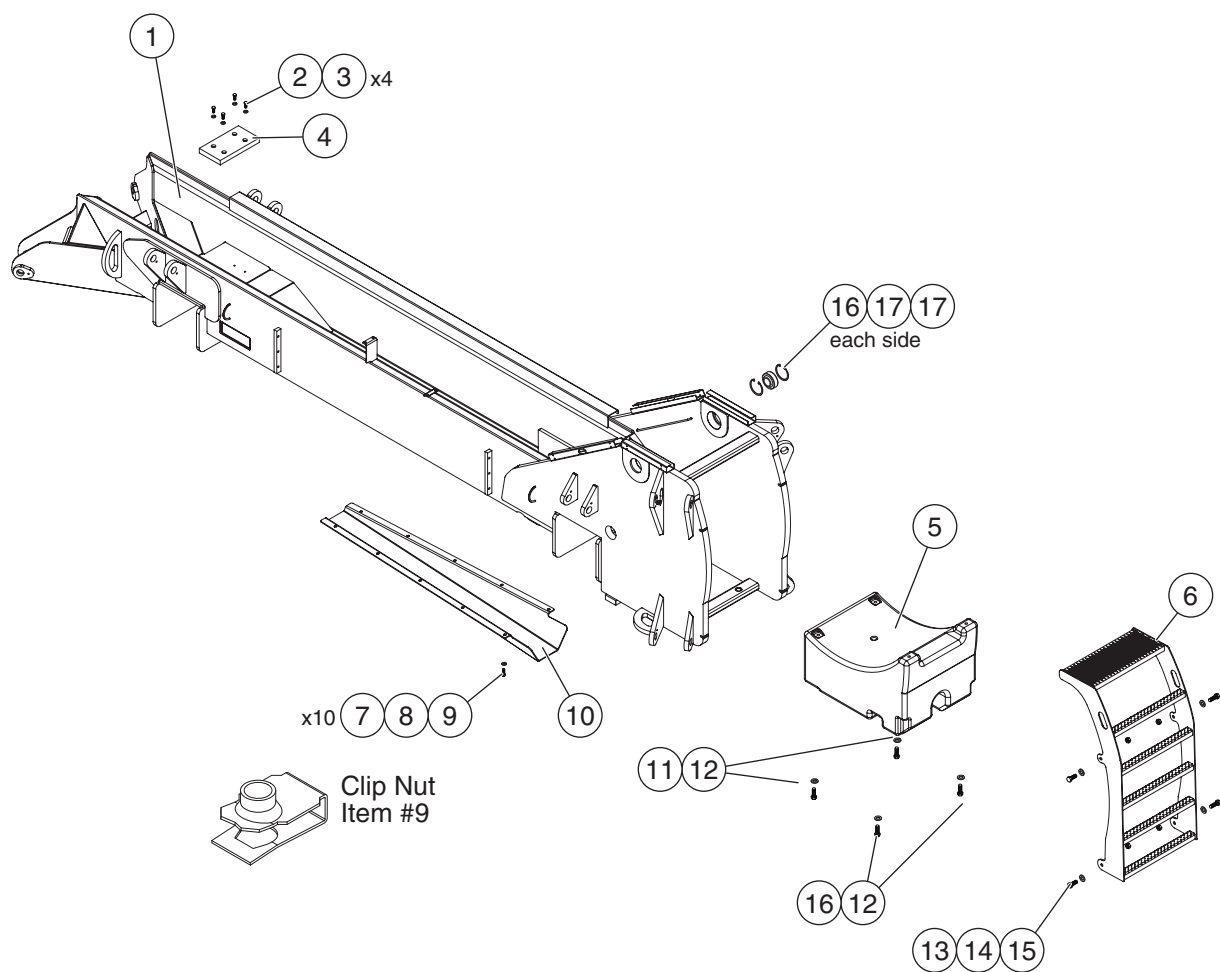
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only





See Section C of this manual for Lift Cylinder and associated linkage parts.

**mecc**  
ILLUSTRATION No.  
ART\_4334

TITAN BOOM 60-S

Chassis Components



## Chassis Components

ITEM	PART NO.	QTY	DESCRIPTION
1	24001	1	Chassis Weldment
2	50038	4	Bolt, M12 x 25
3	50007	4	Washer, M12 Nordlock
4	24370	1	Landing Pad
5	24100	1	Counterweight
6	24147	1	Entry Ladder
7	50034	10	Bolt, M10 x 30
8	50006	10	Washer, M10 Nordlock
9	92098	10	Clip, Nut, M10
10	24062	1	Cylinder Cover Plate
11	50464	2	Bolt, M24 x 70
12	50255	4	Washer, M24 HArdened
13	50377	4	Bolt, M16 x 80
14	50051	4	Nut, M16 Nylock
15	--	--	--
16	50465	2	Bolt, M24 x 80



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



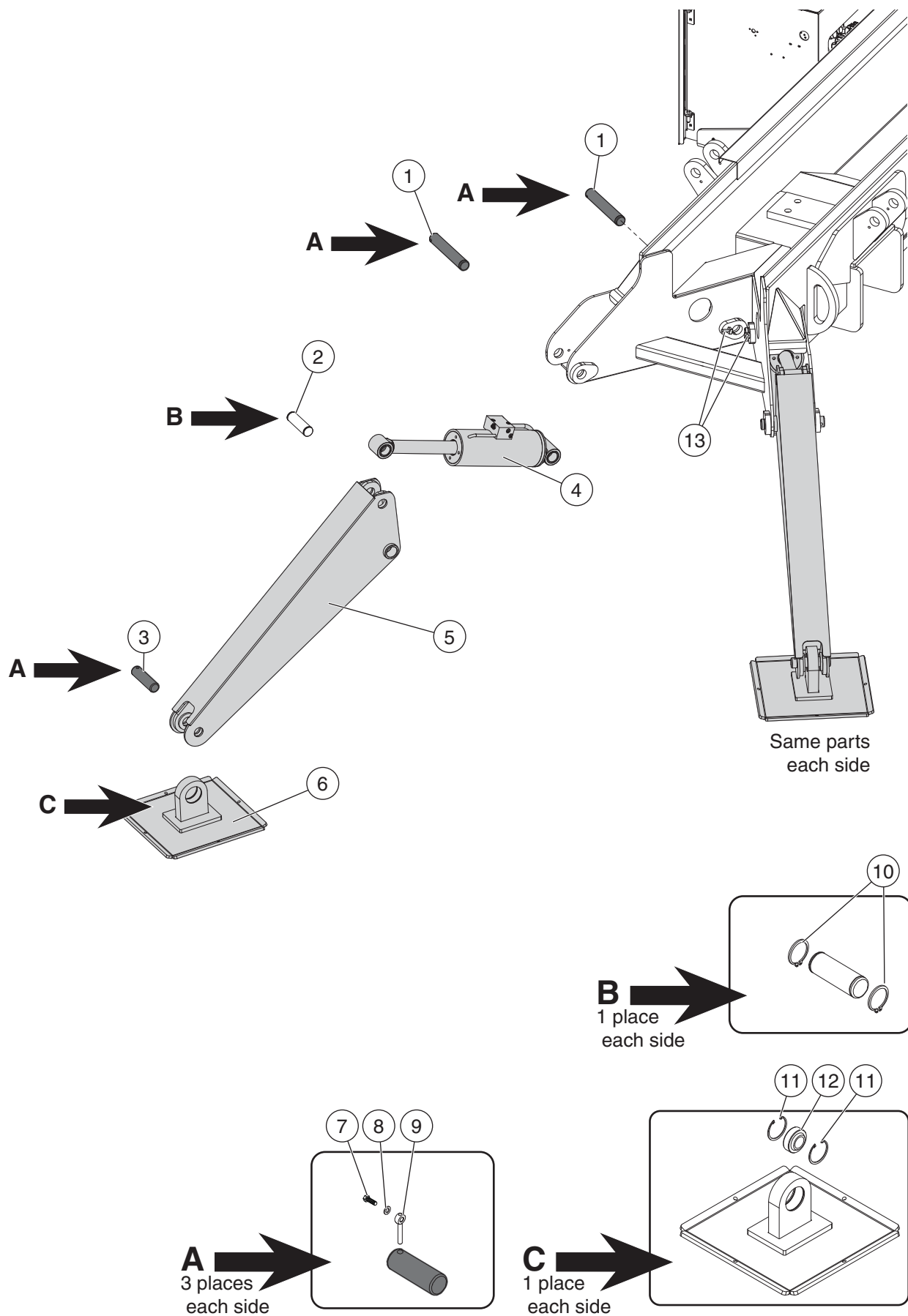


ILLUSTRATION No.  
ART\_XXXX

TITAN BOOM 60-S

Front Outrigger Components



## Front Outrigger Components

ITEM	PART NO.	QTY	DESCRIPTION
1	24372	4	Pin
2	24167	2	Pin
3	24168	2	Pin
4	24154	2	Outrigger Pad
5	24056	2	Front Outrigger Arm
6	24065	2	Front Outrigger Cylinder
7	50246	2	Bolt, M12 x 40
8	50007	2	Washer, M12 Nordlock
9	18152	2	Retainer Pin
10	6701	4	External Snap Ring
11	92590	4	Internal Snap Ring
12	92571	2	Spherical Bearing
13	93029	2	Proximity Sensor



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only



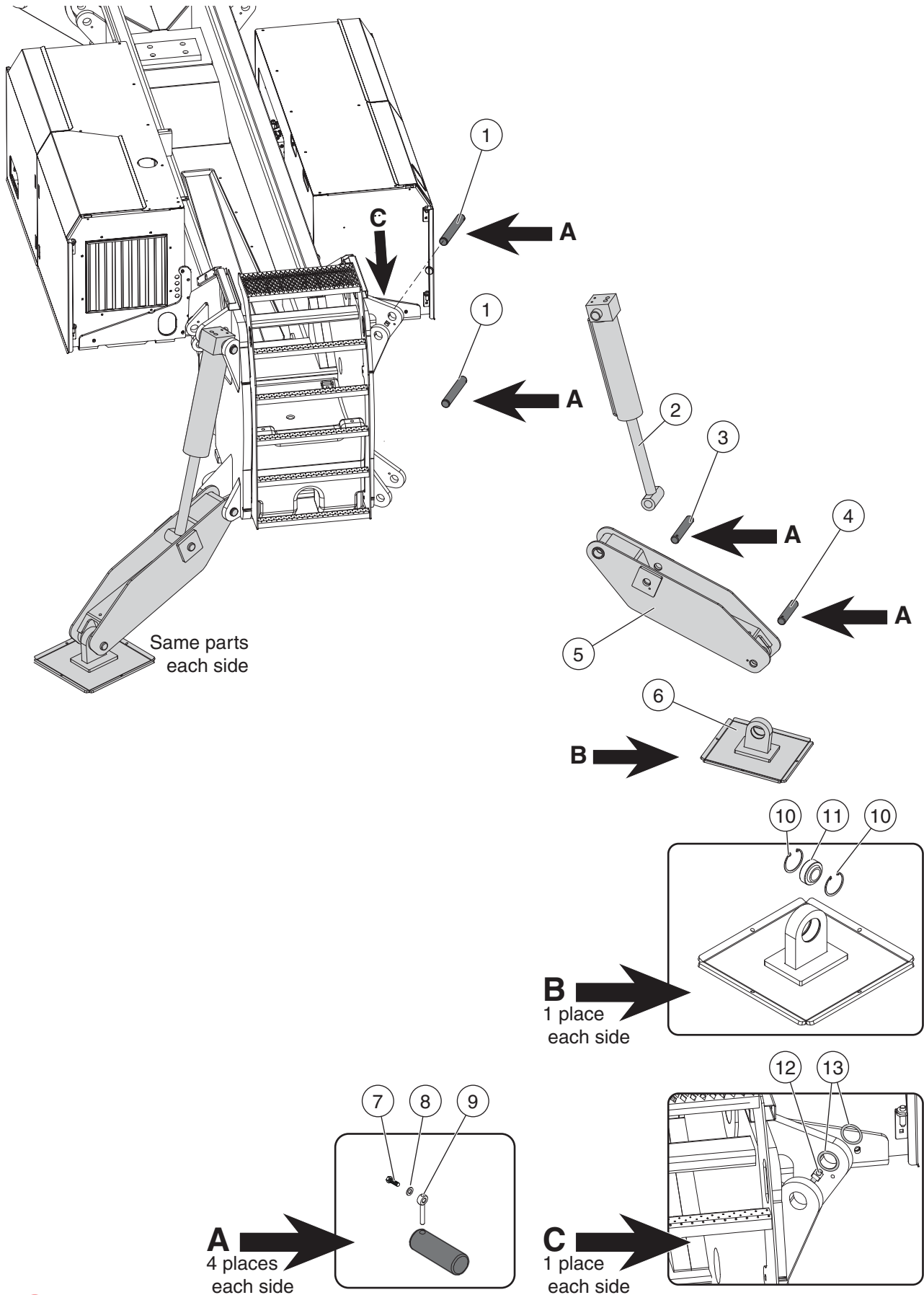


ILLUSTRATION No.  
ART\_XXXX

TITAN BOOM 60-S

Rear Outrigger Components



## Rear Outrigger Components

ITEM	PART NO.	QTY	DESCRIPTION
1	24384	4	Pin
2	24155	2	Rear Outrigger Cylinder
3	24163	2	Pin
4	24169	2	Pin
5	24135	2	Rear Outrigger Arm
6	24065	2	Outrigger Pad
7	50246	2	Bolt, M12 x 40
8	50007	2	Washer, M12 Nordlock
9	18152	2	Retainer Pin
10	92590	4	Internal Snap Ring
11	92571	2	Spherical Bearing
12	92934	2	Proximity Sensor
13	93029	4	Dust Cover



• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only

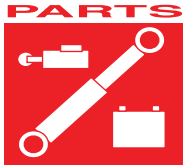


## Wiring Harness Components

Harness plug designations (J#) and components listed in parentheses correspond to locations listed on the Electrical Schematics. See Section 5 of the Service portion of this manual.

ITEM	PART NO.	QTY	DESCRIPTION
<b>CHASSIS</b>			
1	22604	1	Harness, Transducer Extension (J6, J7)
2	24445	1	Harness, Transducer (J7, Sensors at rear of boom)
3	24451	1	Harness, Chassis Complete (J8, J9, J10)
4	24453	1	Harness, Control Cable, Lower (J4, J11)
5	24455	1	Harness, Axle Can-tilt (J5, Axle CAN-Tilt Modules)
6	24459	1	Harness, Lower Control Box Complete (Interior of Lower Control Box--J1, J2, J3)
7	22624	1	Harness, Line Contactor to Main Harness Adaptor
8	22625	1	Harness, Lower Control Box Power Harness
9	22626	1	Harness, Internal Ez Cal
10	24452	1	Harness, Engine (J8, Engine)
11	22553	1	Harness, Charge Isolator Relay
12	24457	1	Harness, Pressure Transducer Extension Lower
13	24458	1	Harness, Pressure Transducer, Cylinder
14	24456	2	Harness, Outrigger Sensors
<b>BOOM &amp; PLATFORM</b>			
15	24453	1	Harness, Control Cable, Lower (J4, J11)
16	22607	1	Harness, End Boom (J14, CAN-Tilt, VCCM)
17	24467	1	Harness Control Cable, Intermediate (J11, J12, J14)
18	22611	1	Harness, Control Cable, Upper (J12, J13, J15)
19	22614	1	Harness, Upper Control Box, Complete (J13, interior of control box)
20	22622	1	Harness, Rotational Sensor (J16, Rotation Sensor)
21	22627	1	Harness, Rotational Sensor Extension Harness (J15, J16)
22	22607	1	Harness, VCCM/Aux Manifold (VCCM, Aux. Manifold)
23	9441	112 ft.	Cable, Power To Platform (not shown; follows path similar to Item #1)





# SECTION G

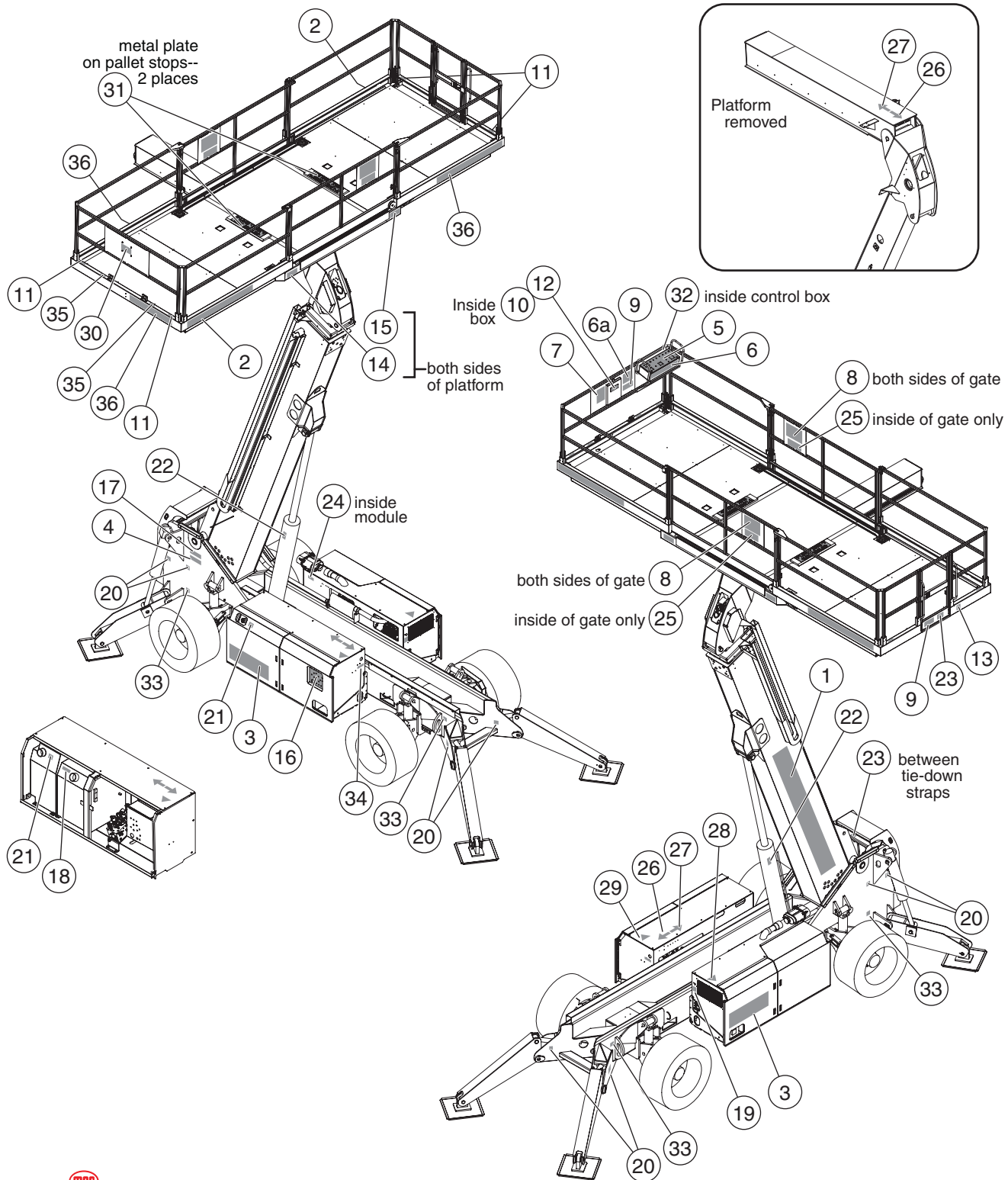
## DECALS, ANSI

### CONTENTS

### PAGE

Decals, Titan Boom 60-S ANSI .....	G-3
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**mec**  
ILLUSTRATION No.  
ART\_4200



## Decals, Titan Boom 60-S ANSI

ITEM	PART NO.	QTY	DESCRIPTION
1	92958	1	Decal, MEC TITAN BOOM 60-S, Boom
2	92959	2	Decal, MEC TITAN BOOM 60-S, Toeboard
3	92960	2	Decal, MEC TITAN BOOM 60-S, Module
4	92054	1	Decal, Patents Pending
5	93024	1	Decal, Platform Controls
6	92056	1	Decal, Instructions
6a	92233	1	Decal, Instructions
7	92055	1	Decal, Danger
8	93016	4	Decal, Load Zone
9	92057	2	Decal, Personnel
10	90718	1	Decal, Inspection
11	92116	4	Decal, Lanyard Cable
12	8911	1	Decal, Manuals Case
13	90739	1	Decal, Made In USA
14	93017	2	Decal, Load Zone Capacity
15	92058	2	Decal, Material Gates
16	92957	1	Decal, Base Controls
17	92230	1	Decal, Serial Number
18	92117	1	Decal, Hydraulic Fluid Range
19	9052	1	Decal, Master Disconnect
20	91850	2	Decal, Crush Hazard
21	91975	2	Decal, Diesel Fuel
22	92118	2	Decal, Maintenance Chock
23	92120	2	Decal, Tie-Down Straps
24	92119	1	Decal, Relays
25	92114	2	Decal, Material Loading Gates
26	91971	1	Decal, Arrow, Forward
27	91972	1	Decal, Arrow, Reverse
28	91981	1	Decal, Arrow, Left
29	91982	1	Decal, Arrow, Right
30	90719	1	Decal, MEC Oval
31	24185	2	Plate, Load Zone
32	92236	1	Decal, EZ Cal Port
33	11026730	4	Decal, Tie-Down Point
34	90751	1	Decal, Power To Platform
35	92542	1	Decal, Lanyard Point
36	92416	3	Decal, Website



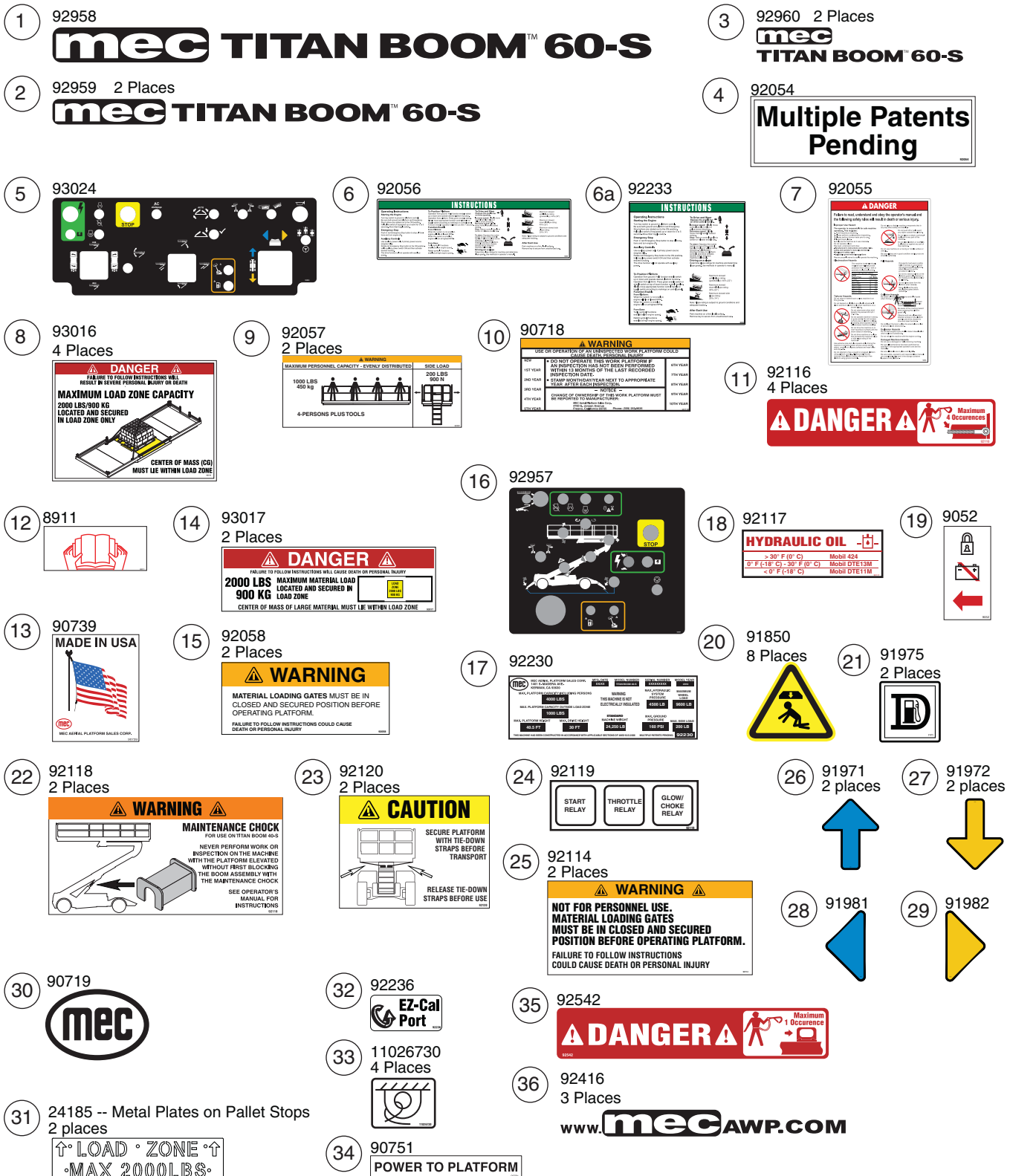
• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

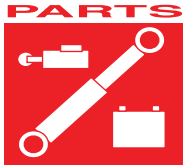
• REF: Reference only





**mec**  
ILLUSTRATION No.  
ART\_4216





# SECTION H

## DECALS, CE

### CONTENTS

### PAGE

Decals, Titan Boom 60-S CE .....	H-3
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## Decals, Titan Boom 60-S CE

ITEM	PART NO.	QTY	DESCRIPTION
1	92958	1	Decal, MEC TITAN BOOM 60-S, Boom
2	92959	2	Decal, MEC TITAN BOOM 60-S, Toeboard
3	92960	2	Decal, MEC TITAN BOOM 60-S, Module
4	92054	1	Decal, Patents Pending
5	93024	1	Decal, Platform Controls
6	92056	1	Decal, Instructions
6a	92233	1	Decal, Instructions
7	92411	1	Decal, Danger
8	93202	4	Decal, Load Zone
9	92298	2	Decal, Personnel
10	92542	1	Decal, Lanyard Point
11	92116	4	Decal, Lanyard Cable
12	8911	1	Decal, Manuals Case
13	90739	1	Decal, Made In USA
14	93203	2	Decal, Load Zone Capacity
15	92058	2	Decal, Material Gates
16	92957	1	Decal, Base Controls
17	92235	1	Decal, Serial Number
18	92117	1	Decal, Hydraulic Fluid Range
19	9052	1	Decal, Master Disconnect
20	91850	2	Decal, Crush Hazard
21	91975	2	Decal, Diesel Fuel
22	93201	2	Decal, Maintenance Chock
23	92120	2	Decal, Tie-Down Straps
24	92119	1	Decal, Relays
25	92114	2	Decal, Material Loading Gates
26	91971	1	Decal, Arrow, Forward
27	91972	1	Decal, Arrow, Reverse
28	91981	1	Decal, Arrow, Left
29	91982	1	Decal, Arrow, Right
30	90719	1	Decal, MEC Oval
31	24188	2	Plate, Load Zone
32	92236	1	Decal, EZ Cal Port
33	11026730	4	Decal, Tie-Down Point
34	90751	1	Decal, Power To Platform
35	7982	4	Decal, Safety Tape
36	92416	3	Decal, Website
37	91388	1	Decal, 86 dB
38	90717EUR	2	Decal, Maintenance Block
39	91325	1	Decal, Electrical Clearance (Australia only)
40	92549	1	Decal, Personnel Entry Gate
41	93189	4	Decal, Wheel Load
42	93190	2	Decal, Stabilizer Load
43	9910	4	Decal, Pinch Point

• as req: as required

• INCL: Included with assembly

• NS: Not a Stock item

• REF: Reference only





2 92959 2 Places **mec TITAN BOOM™ 60-S**

5 93024

6a

92233

INSTRUCTIONS

**Operating Instructions**

**WARNING** Read and understand the following instructions before using the product. Failure to follow these instructions may result in injury or property damage.

1. Always use the product in a well-ventilated area.

2. Do not use the product near flammable or combustible materials.

3. Do not use the product near water or other liquids.

4. Do not use the product if you are pregnant or nursing.

5. Do not use the product if you are under the influence of alcohol or drugs.

6. Do not use the product if you are experiencing any medical conditions.

7. Do not use the product if you are taking any medications.

8. Do not use the product if you are feeling dizzy or lightheaded.

9. Do not use the product if you are feeling fatigued or tired.

10. Do not use the product if you are feeling any other symptoms of illness.

**Preparation**

1. Remove the top cover of the product.

2. Add the appropriate amount of material to the container.

3. Secure the lid and mix the contents thoroughly.

4. Allow the mixture to settle for the recommended time.

5. Remove the lid and pour the mixture into the desired container.

6. Replace the top cover and secure it.

**Application**

1. Use the product in a well-ventilated area.

2. Apply the product to the surface using the appropriate tool.

3. Allow the product to dry for the recommended time.

4. Repeat the application process as needed.


**Storage**

1. Store the product in a cool, dry place.

2. Keep the product away from children and pets.

3. Do not use the product after the expiration date.

4. Dispose of the product properly.



**Diagram Labels:**

- Top Cover
- Container
- Lid
- Mixing Tool
- Application Tool

8 93202  
4 Places

**DANGER**  
NEVER TRY TO FOLLOW INSTRUCTIONS OR USE  
EQUIPMENT TO EXCEED PERSONAL ABILITY OR WEIGHT

**MAXIMUM LOAD ZONE CAPACITY**  
**900 KG**  
LOCATED AND  
SECURED IN LOAD  
ZONE ONLY

CENTER OF MASS (CG)  
MUST BE WITHIN LOAD ZONE

9 92298  
2 Places

HAERLEIN PLATFORM CAPACITY  
MAXIMUM WEIGHT  
450 kg  
4 PERSONS PLUS TOOLS

HAERLEIN  
MAXIMUM  
100 (400)  
600 N


10 92542  
2 Places

**⚠ DANGER ⚠**  Maximum Sécurité

11 92116  
4 Places

**⚠ DANGER ⚠**  Maximum 4 Occurrences

12 8911



13

90739  
MADE IN US

  
REC  
REC HYBRID PLATFORM SALES CO

14 93203  
2 Places

**DANGER**  
FAILURE TO FOLLOW INSTRUCTIONS WILL CAUSE DEATH OR PERSONAL INJURY  
**900 KG**  
**MAXIMUM MATERIAL LOAD**  
**LOCATED AND SECURED IN**  
**LOAD ZONE**  
CENTER OF MASS OF LOADED MATERIAL MUST BE WITHIN LOAD ZONE

**15** 92058  
2 Places

**WARNING**


**MATERIAL LOADING GATES MUST BE IN CLOSED AND SECURED POSITION BEFORE OPERATING PLATFORM.**

**FAILURE TO FOLLOW INSTRUCTIONS COULD CAUSE DEATH OR PERSONAL INJURY**




16 92957

The diagram shows the 92957 locomotive with various components labeled with numbers in circles. The labels are: 1 (Locomotive body), 2 (Front bogie), 3 (Front bogie wheel), 4 (Front bogie axle), 5 (Front bogie frame), 6 (Front bogie motor), 7 (Front bogie suspension), 8 (Front bogie spring), 9 (Front bogie damper), 10 (Front bogie brake), 11 (Front bogie motor), 12 (Front bogie suspension), 13 (Front bogie spring), 14 (Front bogie damper), 15 (Front bogie brake), 16 (Front bogie motor).

[illegible]

18	92117
<b>HYDRAULIC OIL</b> 	
> 30° F (0° C)	Mobil 424
0° F (-18° C) - 30° F (0° C)	Mobil DTE13M
< 0° F (-18° C)	Mobil DTE11M

19 9052

20 91850  
8 Places



21 91975  
2 Places

24 92119

START RELAY	THROTTLE RELAY	GLOW/ CHOKE RELAY
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**(25)** 92114  
2 Places

**⚠ WARNING ⚠**

**NOT FOR PERSONNEL USE.  
MATERIAL LOADING GATES  
MUST BE IN CLOSED AND SECURED  
POSITION BEFORE OPERATING PLATFORM.**

**FAILURE TO FOLLOW INSTRUCTIONS  
COULD CAUSE DEATH OR PERSONAL INJURY**

26 91971  
2 places



27 91972  
2 places



30 90719  
mec

31 24188 -- Metal Plates  
on Pallet Stops  
2 places

↑ · LOAD · ZONE · ↑  
· MAX 900 KG ·

32 92236

33 11026730  
4 Places

35 7982  
4 Places


36 92416  
3 Places

**WWW.MECAWP.COM**

28 91981

29 91982

37 91388

 LWA

86 dB

**38** 90717EUR  
2 Places

 **MAINTENANCE LOCK**  
**ENSURE LOCK IS IN PLACE**  
**BEFORE DOING MAINTENANCE**  
**ON ELEVATED WORK PLATFORM**

39

# 91325

## Australia only



**DANGER**

THIS MACHINE IS NOT DESIGNED TO BE USED IN AREAS REQUIRING WORK NEAR OR UNDER OR IN PROXIMITY TO HIGH-VOLTAGE ELECTRICAL EQUIPMENT. ALWAYS MAINTAIN THE MINIMUM CLEARANCES FROM POWER LINES. ALWAYS WEAR YOUR SAFETY BELT AND WEAR YOUR PROTECTIVE GEAR.


**OVERHEAD POWER LINES AND POLES**  


**OVERHEAD POWER LINES AND TRANSFORMERS**  


41 93189  
4 Places

 **MAX**  
14550 lbs  
6600 kg

42 93190  
4 Places

 MAX  
14550 lbs  
6600 kg

43 9910  
4 Places



  
ILLUSTRATION No.  
ART 4309





## Service Parts Order Form

### Fax to 559-263-9631

Please fill out completely

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

Ordered By: \_\_\_\_\_

Account: \_\_\_\_\_

Your Fax No.: \_\_\_\_\_

Bill to: \_\_\_\_\_

Ship to: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Purchase Order Number** \_\_\_\_\_

**Ship VIA** \_\_\_\_\_

\*\*All orders MUST have a Purchase Order Number

\*\*Fed Ex shipments require Fed Ex account number

Part Number	Description	Quantity	Price

All backordered parts will be shipped when available via the same ship method as original order unless noted below:

- Ship complete order only - no backorders
- Ship all available parts and contact customer on disposition of backordered parts
- other (please specify)

\_\_\_\_\_



**NOTES:**

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## Limited Owner Warranty

MEC Aerial Platform Sales Corp. warrants its equipment to the original purchaser against defects in material and/or workmanship under normal use and service for one (1) year from date of registered sale or date the unit left the factory if not registered. MEC Aerial Platform Sales Corp. further warrants the structural weldments of the main frame and scissor arms to be free from defects in material or workmanship for five (5) years from date of registered sale or date unit left the factory if not registered. Excluded from such warranty is the battery(s) which carries a ninety (90) day warranty from described purchase date. Warranty claims within such warranty period shall be limited to repair or replacement, MEC Aerial Platform Sales Corp.'s option, of the defective part in question and labor to perform the necessary repair or replacement based on MEC Aerial Platform Sales Corp.'s then current flat rate, provided the defective part in question is shipped prepaid to MEC Aerial Platform Sales Corp. and is found upon inspection by MEC Aerial Platform Sales Corp. to be defective in material and/or workmanship. MEC Aerial Platform Sales Corp. shall not be liable for any consequential, incidental or contingent damages whatsoever. Use of other than factory authorized parts; misuse, improper maintenance, or modification of the equipment voids this warranty. The foregoing warranty is exclusive and in lieu of all other warranties, express or implied. All such other warranties, including implied warranties of merchantability and of fitness for a particular purpose, are hereby excluded. No Dealer, Sales Representative, or other person purporting to act on behalf of MEC Aerial Platform Sales Corp. is authorized to alter the terms of this warranty, or in any manner assume on behalf of MEC Aerial Platform Sales Corp. any liability or obligation which exceeds MEC Aerial Platform Sales Corp.'s obligations under this warranty.





## **Aerial Platform Sales Corp.**

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