ENGINEERING

LIFT-N-LOCK®

HYDRAULIC BOOM GANTRY

800 SERIES

OPERATING & MAINTENANCE MANUAL

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LIFT-N-LOCK HYDRAULIC BOOM GANTRY SPECIFICATIONS

MODEL # L801-4-27

DESCRIPTION	SPECIFICATIONS
LIFT HOUSING WEIGHT	12,400 LBS. / 5,625 KG.
LIFT HOUSING LENGTH	84ò (7ô) / 2,134 mm
LIFT HOUSING WIDTH	51" / 1,295 mm
RETRACTED HEIGHT	140" (11ô-8") / 3,557 mm
MANUAL EXTENDED	232" (19ô-4") / 5,893 mm
1st STAGE EXTENDED	232" (19ô-4") / 5,893 mm
1st STAGE & MANUAL EXTENDED TO THE 1st SET OF PINNING HOLES	288" (24ô-0") / 7,315 mm
1st STAGE & MANUAL EXTENDED TO THE 2nd SET OF PINNING HOLES	330ò (27ô-0") / 8,230 mm
MANUAL CAPACITY / 4 LIFT HOUSINGS	440 TON / 400 METRIC TON
1st STAGE CAPACITY / 4 LIFT HOUSINGS	440 TON / 400 METRIC TON
WHEEL SPECIFICATION	8" (203 mm) DIA. x 4ò (102 mm) WIDE
WHEEL QUANTITY	8 WHEELS PER LIFT HOUSING
WHEEL GUIDE ROD CENTERS	36" (914 mm)
WHEEL BASE (CENTER TO CENTER)	71" (1829 mm)
TWO SPEED SHIFTING SYSTEM	1100 TO 1200 PSI

Control Module – 4 Bank

DESCRIPTION	SPECIFICATIONS
WEIGHT	4,800 LBS. / 2,177 KG.
HYDRAULIC OIL VOLUME	225 GALLONS / 852 L.
CONTROL MODULE POWER	GM ENGINE ï PROPANE FUEL
ENGINE SPECIFICATIONS	3 LITER ï 4 CYLINDER

MODEL L801-4-27

LIFT-N-LOCK®

TELESCOPIC BOOM GANTRY

1. Maximum hydraulic pressure is 3,000 P.S.I.
2. Hydraulic pressures are theoretical and may vary due to frictional and temperature factors.
3. Capacities are maximum and 2,000 pounds per ton.
4. Supporting surfaces under the gantry wheels must be able to support the load and gantry system.
5. Gantry supporting surfaces must be level within ¼ of a degree or 3/16 inches per 4 feet.
6. Learn operating procedures before operating.
7. Do not leave suspended loads unattended.
8. Loads must be equally shared by each lift housing to lift maximum capacities.
9. Lift beam strength must be calculated for each lift or consult the factory.
10. Lifting beams must be horizontal and secured at all times while lifting.

THE ABOVE GUIDELINES ARE ONLY SOME OF THE SAFE OPERATING PRACTICES FOR OPERATING HYDRAULIC GANTRIES. THEY ARE NOT INTENDED TO CONSTITUTE THE COMPLETE SAFETY CRITERIA FOR USING THE HYDRAULIC GANTRIES.

TWO HOUSING

LIFT CAPACITY PRESSURE CHART
RETRACTED HEIGHT 11' - 8"

FIRST STAGE
MAXIMUM HEIGHT
MANUAL RETRACTED 19' - 4"
MANUAL EXTENDED
1st SET OF PIN HOLES 24' - 0"
2nd SET OF PIN HOLES 27' - 0"

P.S.I.	MAX. LOAD
3000	220 TON
2500	183 TON
2000	146 TON
1500	110 TON
1000	73 TON
500	37 TON

FOUR HOUSING

LIFT CAPACITY PRESSURE CHART
RETRACTED HEIGHT 11' - 8"

FIRST STAGE
MAXIMUM HEIGHT
MANUAL RETRACTED 19' - 4"
MANUAL EXTENDED
1st SET OF PIN HOLES 24' - 0"
2nd SET OF PIN HOLES 27' - 0"

P.S.I.	MAX. LOAD
3000	440 TON
2500	366 TON
2000	292 TON
1500	220 TON
1000	146 TON
500	74 TON

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SPECIALIZED LIFTING AND TRANSPORTATION EQUIPMENT

MODEL L801-4-27

LIFT-N-LOCK®

TELESCOPIC BOOM GANTRY

1. Maximum hydraulic pressure is 3,000 P.S.I.
2. Hydraulic pressures are theoretical and may vary due to frictional and temperature factors.
3. Capacities are maximum and 1,000 Kgs per M ton.
4. Supporting surfaces under the gantry wheels must be able to support the load and gantry system.
5. Gantry supporting surfaces must be level within ¼ of a degree or 4 mm per 1 meter.
6. Learn operating procedures before operating.
7. Do not leave suspended loads unattended.
8. Loads must be equally shared by each lift housing to lift maximum capacities.
9. Lift beam strength must be calculated for each lift or consult the factory.
10. Lifting beams must be horizontal and secured at all times while lifting.

THE ABOVE GUIDELINES ARE ONLY SOME OF THE SAFE OPERATING PRACTICES FOR OPERATING HYDRAULIC GANTRIES. THEY ARE NOT INTENDED TO CONSTITUTE THE COMPLETE SAFETY CRITERIA FOR USING THE HYDRAULIC GANTRIES.

TWO HOUSING

LIFT CAPACITY PRESSURE CHART
RETRACTED HEIGHT 3.557 M

FIRST STAGE MAXIMUM HEIGHT MANUAL RETRACTED 5.893 M MANUAL EXTENDED 1st SET OF PIN HOLES 7.315 M 2nd SET OF PIN HOLES 8.230 M	
P.S.I.	**MAX. LOAD**
3000	200 M TON
2500	166 M TON
2000	133 M TON
1500	100 M TON
1000	66 M TON
500	33 M TON

FOUR HOUSING

LIFT CAPACITY PRESSURE CHART
RETRACTED HEIGHT 3.557 M

FIRST STAGE MAXIMUM HEIGHT MANUAL RETRACTED 5.893 M MANUAL EXTENDED 1st SET OF PIN HOLES 7.315 M 2nd SET OF PIN HOLES 8.230 M	
P.S.I.	**MAX. LOAD**
3000	400 M TON
2500	332 M TON
2000	266 M TON
1500	200 M TON
1000	132 M TON
500	66 M TON

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SPECIALIZED LIFTING AND TRANSPORTATION EQUIPMENT

SECTION I

INTRODUCTION

1.0 GENERAL

This manual provides safe operation, maintenance and parts information as well as schematic and trouble shooting information for the 800 Series LIFT-N-LOCK® hydraulic boom gantries.

The information, specifications and illustrations in this publication are based on the information in effect at the time this manual was printed. Continuing improvement and advancement of product design may cause changes to the Gantries which may not be included in this publication. Each publication is reviewed and revised, as required, to update and include these changes in later editions.

Whenever a question arises regarding the Gantries, or this publication, please consult J&R Engineering for the latest available information.

All LIFT-N-LOCK® Gantries are operated before shipment to assure their proper operating condition. At this time, all necessary adjustments are made and an overall physical inspection is conducted. After the units are delivered, some final minor adjustments and inspections may be necessary prior to placing the units in service. These functions are outlined in the inspection and checkout instructions in the operation section of this manual. Consult J&R Engineering if there are any questions on any necessary adjustments.

2.0 SAFETY

It is of the utmost importance that operators and maintenance personnel read and be familiar with the information in this manual and are knowledgeable in proper rigging techniques before operating or servicing this machine, both for personal protection and for the safety of other workmen and bystanders.

Improper usage of the equipment covered in this manual may result in serious personal injury. It is imperative that this manual be completely read and understood prior to starting any operations involving this equipment.

3.0 WARNINGS, CAUTIONS, AND NOTES

WARNINGS, CAUTIONS, and NOTES are used throughout this manual to emphasize important and critical instructions. For the purpose of this manual WARNINGS, CAUTIONS, and NOTES are defined as follows:

*** * * WARNING * * ***

An operating procedure, practice, etc., which, if not strictly followed, could result in personal injury or loss of life.

*** CAUTION ***

An operating procedure, practice, etc., which, if not strictly observed, could result in damage to, or destruction of equipment.

NOTE

An operating practice, condition, etc., which is essential to highlight.

4.0 WARRANTY

The terms under which these Gantries are guaranteed are clearly defined in SECTION XI - WARRANTY at the end of this manual.

Briefly, the WARRANTY does not cover any damage to the equipment caused by failure to follow operating instructions, abuse (including operation of the Gantries in excess of their rated capacity), improper maintenance, accident or unauthorized modification to the equipment.

SECTION II

EQUIPMENT DESCRIPTION

1.0 GENERAL

The LIFT-N-LOCK® GANTRY is a mobile, self-propelled, variable height, hydraulic lifting frame. It is primarily controlled from a remote, self-contained power module that is positioned away from the Gantries. The Gantries are designed to be operated on smooth surfaces (steel plate or track) and must be within one quarter (1/4) degree of true level for proper and safe operation.

The control module incorporates an electric motor, diesel or propane fueled engine as the primary power source. All hydraulic valves and controls for all cylinders and the propel system are operated manually, without electro-hydraulic systems. The pressure compensated operator control valve will direct an equal amount of oil flow (GPM) to each gantry, regardless of unequal load or pressure (PSI), when the control levers are moved evenly. This feature makes all gantries lift and propel as equally as possible, regardless of loading. Gantries are connected to the power module by light-weight, twin line hose assemblies that are engaged with quick couplers. Each gantry has the capability to be individually controlled via one lever per gantry on the Control Module.

2.0 PRIMARY SYSTEMS

The LIFT-N-LOCK® hydraulic boom Gantries offer features and reliability that are unmatched by any other mobile hydraulic lifting equipment.

A definition of these systems follows:

2.1 CAM LOCK SAFETY SYSTEM automatically holds suspended loads indefinitely, when engaged with or without the assistance of lift cylinders. This is done mechanically with eccentric cam locks, cast of high strength steel alloy, that bite into the walls of the booms. This system allows the gantries to be locked into place at any extended position, without leaving the lift cylinder pressurized. The cams are cast of high strength alloy steel and are automatically held open hydraulically when the gantry booms are being either raised or lowered. A coil spring engages the locks when the control lever is returned to neutral or if there is ever a loss of system pressure.

2.2 TELESCOPIC BOOM is made of square steel tubing with solid steel bars attached on two sides. The heavy steel walls and boom overlap ensure that the lift cylinders will not be hindered by any side loading forces. The steel booms protect the cylinders from side loading pressures (which cause them to leak, deteriorate and eventually fail), as well as protecting it from exterior damage to the chromed rods. Nylatron slider pads are fitted in the booms sections to ensure a tight fit and smooth operation by avoiding steel on steel friction.

2.3 The BEAM HEADER PLATE that firmly holds the lifting beam is mounted on a horizontal spherical bearing. This allows full 360 degree rotation and side to side oscillation. If the lifting legs are at different heights or if the surface that is supporting the gantries is not perfectly level, the gantries will still firmly hold the lifting beams.

2.4 CONTROL VALVING is pressure compensated with proportional controls for inching. This means that when the control levers are activated to the same position, the flow (GPM) is equalized to each cylinder, regardless of pressure or load on each cylinder. Therefore the lifting beam will remain level when a load is imbalanced. The two-speed system alerts the operator that the load is being applied to the gantry and at the same time reduces the speed at which the gantry extends.

2.5 BOOM LIFT CYLINDERS are power up and down, and are designed to eliminate the use of troublesome hose reels. Double locking valves built into the lower base of the cylinders and are not subject to any hydraulic hose or tubing failures. An equalized pressure system is created by matching the load rating with maximum system pressure. All sections are allowed to operate at the same hydraulic pressure. This ensures that the gantries cannot be overloaded. If a load is over the specified capacity, the system will simply not allow the gantry to lift the load. The design also guarantees that the lift cylinders will never mis-stage. Mis-staging occurs on the cylinder-only type gantries when a smaller section extends before the next larger section is fully extended. If a load is lifted and the gantry is mis-staged, the load can suddenly descend. This is due to the differential in cylinder section areas.

2.6 PLANETARY SELF PROPEL system is integrally built into each housing and is operated from the control module. This allows the gantry to be propelled on flat plate or simple channel track. There is no need for special track for push cylinders or add-on propel wheels. This drive system can easily be disengaged to become free-wheeling for tip downs or load centering.

FIGURE 2-1
Gantry Lift Housing Component Locations

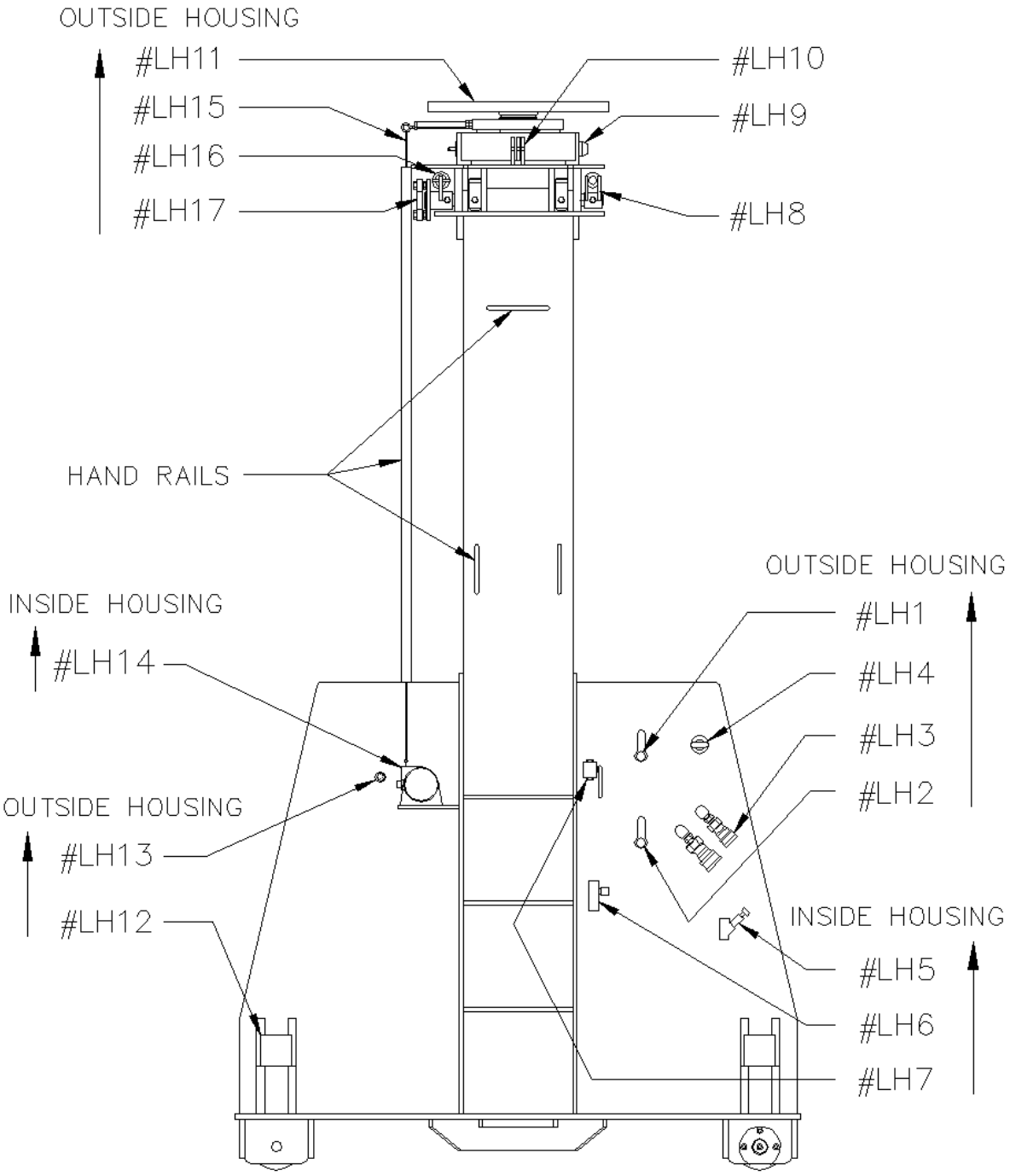


TABLE 2-2
(REFERENCE FIGURE 2-1)

GANTRY LIFT HOUSING - OPERATING INSTRUCTIONS

ITEM #	*NAME & (Part Number)*	*FUNCTION*
LH1	MAIN POWER SELECTOR VALVE (2-00-10100)	• DOWN POSITION, FOR LIFT CYLINDER POWER • UP POSITION, FOR PROPEL SYSTEM POWER
LH2	PROPEL SYSTEM SELECTOR VALVE (OPTIONAL) (2-00-10120)	• DOWN POSITION FOR LIFT HOUSING PROPEL • UP POSITION FOR POWERLINK POWER • THIS VALVE IS INCLUDED IN ALL FOUR LIFT HOUSINGS, BUT IS NOT OPERATIONAL.
LH3	1/2ò & 3/4ò NPT HYDRAULIC QUICK COUPLINGS (2-40-10160 AND -10161)	MAIN HYDRAULIC POWER FOR LIFTING AND PROPELLING THE LIFT HOUSINGS. CONNECTS TO THE CONTROL MODULE. **NOTE** **ENSURE THAT THE NUMBERS ON THE LIFT HOUSING MATCH THE NUMBERS ON THE CONTROL MODULE.**
LH4	LIFT HOUSING PROPEL/FREEWHEEL VALVE (2-00-10140)	TO BE USED WHEN GANTRIES ARE TO FREEWHEEL OR CENTER OVER THE LOAD. • PUSH RING ñINò, FOR LIFT HOUSING PROPEL OR HYDRAULIC DRIVE BRAKE. • PULL RING OUT FOR LIFT HOUSING FREE WHEEL OR COASTING.
LH5	LIFT HOUSING PROPEL SPEED CONTROL VALVES (2-VALVES; 2-00-10180)	GANTRY PROPEL SPEED IS FACTORY SET. IF VALVES ARE READJUSTED OR TAMPERED WITH THEY MUST BE RESET BEFORE LIFTING AND PROPELLING WITH A LIVE LOAD. • TURNING KNOB COUNTER CLOCKWISE, INCREASES PROPEL SPEED. • TURNING THE KNOB CLOCKWISE DECREASES THE PROPEL SPEED. **NOTE** **TURNING KNOBS TOO TIGHTLY CLOCKWISE CAN STOP THE LIFT HOUSING'S PROPEL.**

LH6	LIFT CYLINDER RETRACT SPEED CONTROL (2-00-10220)	DESCENT SPEED IS FACTORY SET. THIS CONTROL SETS THE MAXIMUM SPEED THAT THE LIFT BOOM CAN RETRACT AND SHOULD BE THE SAME FOR ALL LIFT HOUSINGS. • TURNING CONTROL KNOB CLOCKWISE DECREASES THE SPEED OF THE BOOMôS DESCENT. • TURNING CONTROL KNOB COUNTER-CLOCKWISE INCREASES THE SPEED OF THE BOOMôS DESCENT. **NOTE** **TURNING THIS KNOB TOO TIGHTLY CLOCKWISE CAN STOP THE LIFT BOOM'S DESCENT.**
LH7	CAM LOCK SHUT OFF VALVE (2-00-10200)	• DOWN POSITION, FOR NORMAL OPERATION • UP POSITION, FOR HOLDING CAM LOCKS OFF (USED ONLY FOR SPECIAL TESTING OR IF THE CAM LOCKS ENGAGE WHILE RETRACTING THE LOAD). **(SEE SECTION II, 6.0 - OPERATIONAL PROCEDURES FOR CAM LOCK SYSTEM)**
LH8	CAM LOCK CYLINDER (2-15-14040)	THE CAM LOCK SYSTEM IS A REDUNDANT SAFETY SYSTEM TO THE LIFT CYLINDERôS LOCK VALVES. CAMS ARE HELD OPEN DURING LIFT CYLINDER OPERATION AND ARE AUTOMATICALLY ENGAGED WHEN OPERATING LEVER IS RETURNED TO CENTER POSITION OR IF THERE IS A LOSS OF SYSTEM HYDRAULIC PRESSURE (FOR PROPER OPERATION OF THE CAM LOCK SYSTEM, THE LIFT CYLINDERS SHOULD BE EXTENDED UNTIL THE CAM LOCK CYLINDER IS EXTENDED AND THE CAMS ARE ñOFFò; THEN SMOOTHLY PUSH THE LEVERS FORWARD TO RETRACT THE LIFT BOOMS, CAM LOCK CYLINDER MUST REMAIN EXTENDED).
LH9	POWER MANUAL BOOM PINS (3-15-14000)	TO USE THE MANUAL BOOM THE THREE PINS MUST FIRST BE REMOVED FROM THE BOOMS **SEE SECTION II, 5.0 OPERATING PROCEDURES FOR MANUAL BOOM OPERATION.**

LH10	BOOM HOLD DOWN PLATES	OCCASIONALLY DURING THE PROCEDURE OF EXTENDING THE MANUAL BOOM A SIDE LOAD IS CREATED. THIS SIDE LOAD MAY TRY TO PULL THE NEXT BOOM STAGE UP WITH THE MANUAL BOOM. TO STOP THIS FROM OCCURING, INSERT A 3/8 BOLT OR THE MANUAL PINôS RETENSION PIN THROUGH THE HOLES IN THE HOLD-DOWN PLATES. **NOTE** **PRIOR TO EXTENDING THE NEXT BOOM STAGE, THIS PIN MUST BE REMOVED OR IT WILL INSTANTLY SHEAR OFF DUE TO THE FORCE OF THE LIFT CYLINDER.**
LH11	LIFT BEAM HEADER PLATE (3-90-13580)	THE LIFT BEAM IS ATTACHED TO THE GANTRY BY BOLTING THE CAPTURE PLATE SYSTEM TO THE HEADER PLATE. THIS WILL SECURE THE LIFT BEAM TO THE HEADER PLATE. THE HEADER PLATE SWIVELS AND OSCILLATES TO ACCOUNT FOR MISALIGNMENTS IN TRAVEL SPEED OR LIFT HEIGHT OF THE BOOMS.
LH12	LIFT HOUSING CONNECTOR TUBE POCKETS	THIS POCKET ALLOWS THE LIFT HOUSINGS TO BE TIED TOGETHER, END TO END, WITH 3ò SQUARE TUBING. TUBING LENGTH VARIES WITH EACH PROJECT.
LH13	LIFT BOOM HEIGHT INDICATING CABLE COUPLING (1-05-10240)	12 VOLT D.C. SIGNAL CABLE CONNECTION FOR THE LIFT BOOM HEIGHT INDICATING SYSTEM. THE HEIGHT INDICATING SYSTEM IS LOCATED ON ALL HOUSINGS. **NOTE** **CARE SHOULD BE TAKEN TO ENSURE THAT THE NUMBERS MATCH ON BOTH THE HOUSINGS AND THE CONTROL MODULE. THE HEIGHT INDICATING SYSTEM CABLE THAT CONNECTS THE HOUSING TO THE MODULE IS 100’ (30.5 M) LONG.**
LH14	LIFT BOOM HEIGHT INDICATING TRANSDUCER AND ENCODER MODULE. (1-80-11570)	THE MODULE HAS THE LINEAR TRANSDUCER, CABLE REEL, AND ENCODER BUILT INTO IT. THE MODULE IS LOCATED INSIDE OF THE STORAGE COMPARTMENT OF THE LIFT HOUSING.

LH15	LIFT BOOM HEIGHT INDICATING SENSOR CABLE	**NOTE** **CARE SHOULD BE TAKEN TO ENSURE THAT THE CABLE IS NOT INTERFERED WITH DURING GANTRY LIFTING OR PROPELLING.**
LH16	CAM LOCK SPRING (3-06-13740)	PROVIDES THE CLOSING ACTION OF THE CAM LOCK SYSTEM.
LH17	EQUALIZER BAR (3-90-14080)	PROVIDES THE MECHANISM TO PIVOT BOTH CAM LOCK SHAFTS AT EQUAL RATES.

4.0 OPERATIONAL CONTROLS FOR CONTROL MODULE

FIGURE 2-3 Control Module - Component Locations

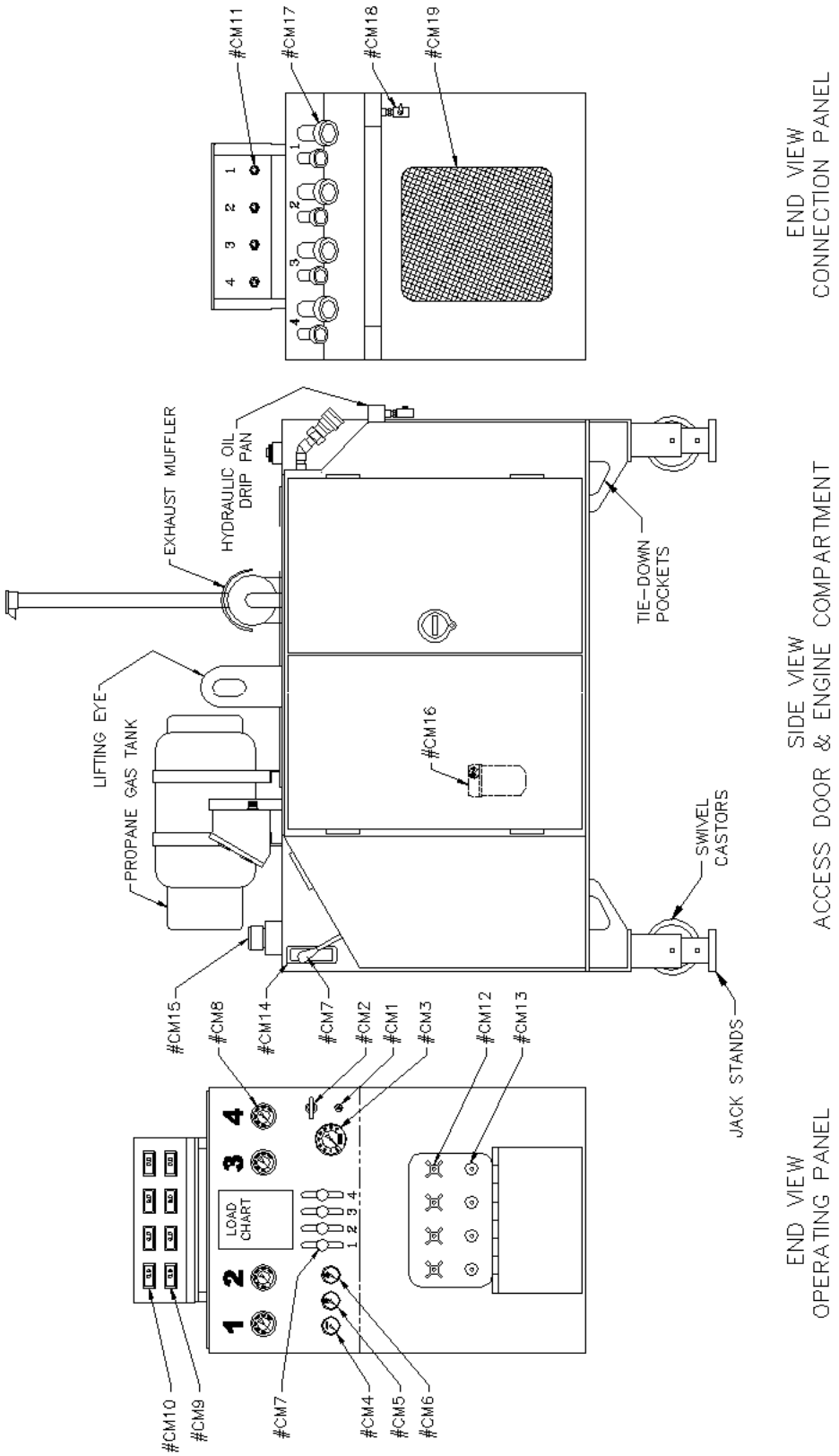


TABLE 2-4
(REFERENCE FIGURES 2-3)

CONTROL MODULE - OPERATING INSTRUCTIONS

ITEM #	*NAME & (Part Number)*	*FUNCTION*
CM1	ENGINE STOP / RUN / START KEY SWITCH (1-00-21100)	**POWER TO GAUGES (WITHOUT ENGINE RUNNING)**: INSERT KEY, TURN KEY CLOCKWISE UNTIL IT ñCLICKSò INTO THE FIRST POSITION. IF ENGINE BEGINS TO TURN OVER, RELEASE KEY. **ENGINE START**: TURN KEY CLOCKWISE AS FAR AS IT WILL GO, AND HOLD UNTIL ENGINE STARTS. AFTER ENGINE STARTS RELEASE KEY. **ENGINE STOP**: TURN KEY COUNTERCLOCKWISE TO STOP THE ENGINE. NOTE THAT ALL FUNCTIONS STOP AT THIS TIME.
CM2	ENGINE THROTTLE CONTROL (3-90-21120)	WHEN STARTING ENGINE, THE CONTROL HANDLE SHOULD BE PUSHED ñINò ALL THE WAY (THIS IS THE LOW RPM POSITION)
CM3	ENGINE TACHOMETER AND HOUR METER (3-75-21140 & 3-75-21160)	THE TACHOMETER SHOWS THE ENGINE SPEED IN REVOLUTIONS PER MINUTE (RPM). THE HOUR METER KEEPS TRACK OF THE TOTAL NUMBER OF HOURS THAT THE UNIT HAS BEEN RUNNING. THIS IS THE METER THAT SHOULD BE REFERENCED TO DETERMINE WHEN THE POWER UNIT SHOULD BE SERVICED.
CM4	ENGINE VOLT GAUGE (1-70-21180)	THIS GAUGE SHOWS THE VOLTAGE BEING PROVIDED BY THE ENGINEôS CHARGING SYSTEM
CM5	ENGINE OIL PRESSURE GAUGE (3-75-21200)	THIS GAUGE SHOWS THE OIL PRESSURE INSIDE THE ENGINE. **CAUTION** **IF ENGINE OIL PRESSURE IS TOO LOW, ENGINE DAMAGE MAY OCCUR. ENGINE MUST BE SHUT DOWN IMMEDIATELY UPON LOW OIL PRESSURE INDICATION.** **NOTE** **THIS IS NOT THE SAME AS THE HYDRAULIC OIL PRESSURE IN THE LIFT CYLINDERS**

CM6	ENGINE TEMPERATURE GAUGE (3-75-21220)	THIS GAUGE SHOWS THE OPERATING TEMPERATURE OF THE ENGINE. **CAUTION** **IF ENGINE TEMPERATURE GETS TOO HIGH, ENGINE MUST BE SHUT DOWN IMMEDIATELY TO AVOID DAMAGE TO ENGINE.**
CM7	GANTRY LEG CONTROL LEVERS (3-07-20120)	PULLING LEVER TOWARDS OPERATOR: • RAISES THE LIFT BOOM IF THE SELECTOR VALVES ARE IN THE LIFT CYLINDER MODE. • PROPELS LIFT HOUSING TOWARDS THE CONTROL MODULE, IF THE SELECTOR VALVES ARE IN PROPEL MODE AND IF THE GANTRY SYSTEM IS LAYED OUT AS DESCRIBED IN THE SET UP SECTION OF THE OPERATING MANUAL. • PROPELS THE POWERLINK FORWARD PUSHING LEVER AWAY FROM OPERATOR: • LOWERS THE LIFT BOOM IF THE SELECTOR VALVES ARE IN LIFT CYLINDER MODE. • PROPELS LIFT HOUSING AWAY FROM THE CONTROL MODULE, IF THE SELECTOR VALVES ARE IN PROPEL MODE AND IF THE GANTRY SYSTEM IS LAID OUT AS DESCRIBED IN THE SET UP SECTION OF THE OPERATING MANUAL. • PROPELS THE POWERLINK THE OPPOSITE DIRECTION.
CM8	HYDRAULIC LOAD INDICATING PRESSURE GAUGES (2-35-20040)	GAUGES GIVE HYDRAULIC PRESSURE READOUT IN POUNDS PER SQUARE INCH (PSI) FOR EACH INDIVIDUAL GANTRY. FOR ACCURATE INDICATION OF LOAD, TAKE THE AVERAGE PRESSURE OF ALL LIFT HOUSINGS IN OPERATION AND COMPARE THIS AVERAGE TO THE LOAD CHART.

CM9	LIFT BOOM DIGITAL HEIGHT METER (1-20-21260)	THIS METER SHOWS THE AMOUNT OF ***STROKE***, (Not the height of the load), THAT EACH OF THE FOUR INDIVIDUAL BOOMS HAVE BEEN EXTENDED. THE METERS READOUT IS IN INCHES, WITH 1/10TH OF AN INCH ACCURACY. TO ñZEROò THE METER, PUSH THE BUTTON LABELED ñRESò. THIS METER SHOULD BE ZEROED WHEN ALL LIFT HOUSINGS ARE AT A DESIRED STARTING POINT TO BEGIN A LIFT.
CM10	LIFT BOOM DIGITAL HEIGHT METER (1-20-21260)	THIS METER SHOWS THE AMOUNT OF ***STROKE***, (Not the height of the load), THAT EACH OF THE FOUR INDIVIDUAL BOOMS HAVE BEEN EXTENDED. THE METERS READOUT IS IN INCHES, WITH 1/10TH OF AN INCH ACCURACY. TO ñZEROò THE METER, PUSH THE BUTTON LABELED ñRESò. THIS METER SHOULD BE ZEROED AFTER THE HOUSINGS ARE SET IN POSTION AND ARE FULLY RETRACTED. THIS WILL GIVE THE READOUT OF THE ACTUAL STROKE AND IS USED AS A BENCHMARK FOR MULTIPLE LIFT SET-UPS.
CM11	LIFT BOOM HEIGHT INDICATING CABLE COUPLING (1-05-20380)	12 VOLT D.C. SIGNAL CABLE CONNECTION FOR THE LIFT BOOM HEIGHT INDICATING SYSTEM. THE HEIGHT INDICATING SYSTEM IS LOCATED IN EACH OF THE FOUR HOUSINGS. CARE SHOULD BE TAKEN TO ENSURE THAT THE NUMBERS ON THE HOUSINGS MATCH THE NUMBERS ON THE CONTROL MODULE. THE HEIGHT INDICATING SYSTEM CABLE THAT CONNECTS THE HOUSING TO THE MODULE IS 100ô (30.5 M) LONG.

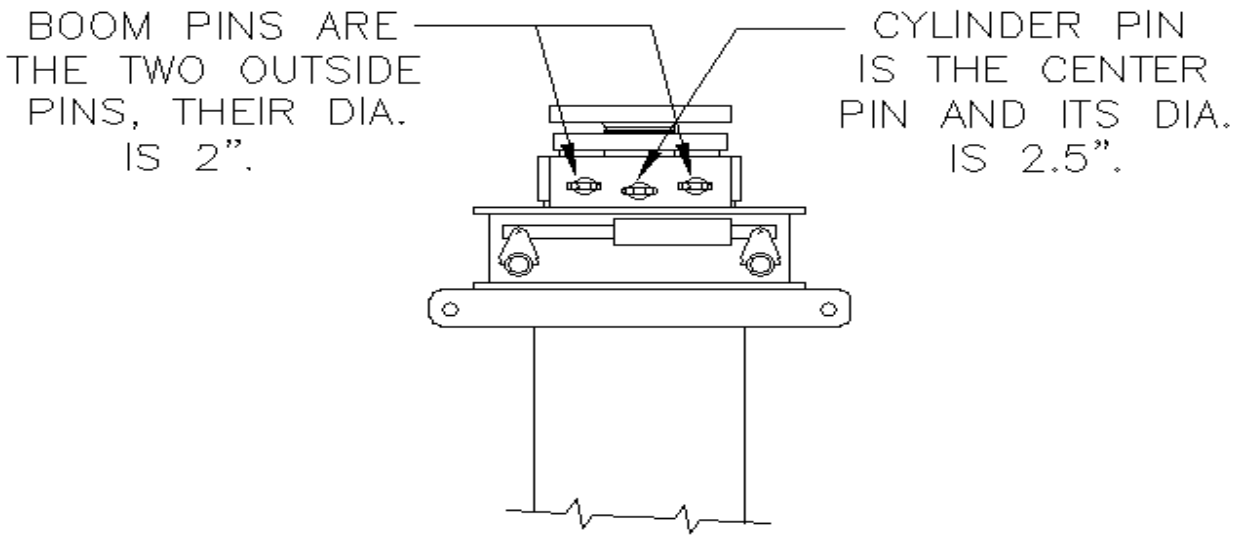
CM12	TWO SPEED SYSTEM SHUT-OFF VALVE (2-00-20200)	SHUTS OFF REDUCED SPEED EXTENSION OF THE LIFT BOOM. LIFT BOOMS WILL OPERATE AT THE MAXIMUM SPEED WHEN THIS VALVE IS SHUT OFF. THIS MAY RESULT IN A LOSS OF ENGINE / MOTOR HORSEPOWER AND / OR A STALL CONDITION. THIS SHOULD BE USED ONLY AT SPECIAL TESTING OR IF THE TWO SPEED SYSTEM MALFUNCTIONS.
CM13	TWO SPEED SYSTEM PRESSURE CONTROL VALVE (2-00-20220)	SETS THE PRESSURE LEVEL THAT THE TWO SPEED SYSTEM ENGAGES AND DESTROKES THE VALVE. **NOTE** **THIS COMPONENT IS FACTORY SET. DO NOT ADJUST UNLESS INSTRUCTED TO DO SO BY THE FACTORY.**
CM14	HYDRAULIC OIL RESERVOIR FILL GAUGE (2-35-20080)	OIL MUST APPEAR IN THE SIGHT GAUGE PRIOR TO PLACING THE GANTRY INTO SERVICE. (i.e. BEFORE EXTENDING THE LIFT CYLINDERS.)
CM15	HYDRAULIC OIL RESERVOIR FILL & VENT PORT (3-90-20060)	RECOMMENDED OIL IS AW-46 GRADE. **NOTE** **DO NOT OVER FILL. HYDRAULIC OIL CAN EXPAND WITH TEMPATURE FLUCTUATIONS.**
CM16	HYDRAULIC OIL FILTER AND GAUGE (2-40-20320 & 2-35-20300)	THE GAUGE INDICATES BACK PRESSURE IN THE FILTER CANISTER AND HAS A *NORMAL OPERATING ZONE* THAT IS GREEN. TO TEST THE FILTER GAUGE, CONNECT ALL THE CONTROL MODULE COUPLINGS TO THE GANTRIES AND EXTEND CYLINDERS. AT THE SAME TIME LOOK AT THE GAUGE: IF THE NEEDLE MOVES INTO THE YELLOW ZONE, THE FILTER SHOULD BE REPLACED. IF THE NEEDLE MOVES INTO THE RED ZONE, THE OIL WILL BY-PASS THE FILTER AND GO DIRECTLY TO THE TANK WITHOUT BEING FILTERED. (SEE MAINTENANCE SECTION OF MANUAL FOR FURTHER INSTRUCTIONS) *** CAUTION *** **OIL THAT IS ALLOWED TO BY-PASS THE FILTER WILL EVENTUALLY CAUSE SIGNIFICANT DAMAGE TO THE HYDRAULIC SYSTEM AND COMPONENTS INCLUDING THE MAIN LIFT CYLINDERS.**

CM17	CONTROL MODULE HYDRAULIC QUICK COUPLINGS (2-40-10160 & -10161)	MAIN HYDRAULIC POWER CONNECTION FOR LIFTING AND PROPELLING THE LIFT HOUSINGS. CONNECTS TO THE LIFT HOUSING. ALWAYS CHECK TO ENSURE FULL ENGAGEMENT OF COUPLINGS, PRIOR TO OPERATION OF GANTRY. **NOTE** **CARE SHOULD BE TAKEN TO ENSURE THAT THE QUICK COUPLING NUMBERS ON THE POWER UNIT MATCH TO THE LIFT HOUSINGS.** **WARNING** **IF COUPLINGS ARE NOT FULLY ENGAGED, OPERATIONAL PROBLEMS WILL OCCUR AND LIFT CYLINDER DAMAGE MAY RESULT.**
CM18	QUICK COUPLING DRIP PAN DRAIN VALVE (3-90-20440)	SHUT-OFF VALVE FOR DRAINING THE QUICK COUPLING DRIP PAN.
CM19	ENGINE COOLING AIR INTAKE PORT	INTAKE PORT FOR ENGINE COOLING AIR. ALWAYS KEEP THE PORT FACING A WELL-VENTILATED AREA OR KEEP DOORS OPEN DURING OPERATION.

5.0 800 SERIES POWER MANUAL BOOM OPERATING PROCEDURES

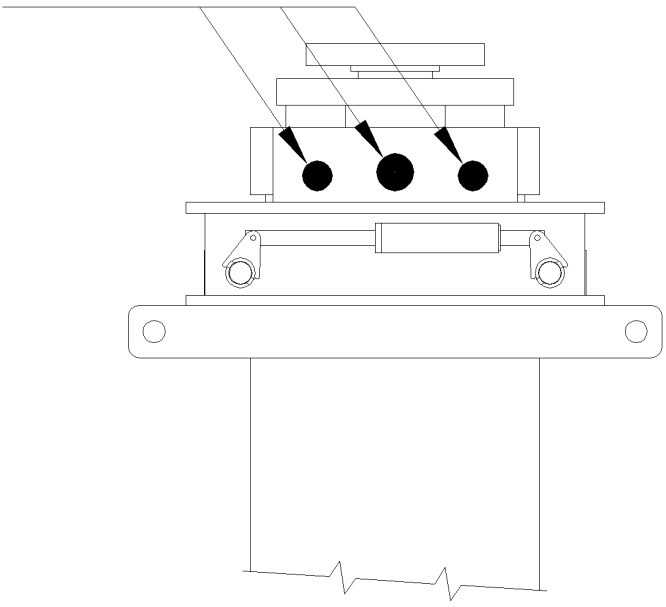
The 800 Series Lift-N-Lock Hydraulic Boom Gantry is equipped with a powered manual boom section. This section of boom has been designed to carry the full capacity of the gantry. The following figures show the component locations and the proper operational procedures for use of the powered manual boom section.

POWERED MANUAL BOOM SECTION PIN LOCATIONS



OPERATIONAL PROCEDURES
STEP 1

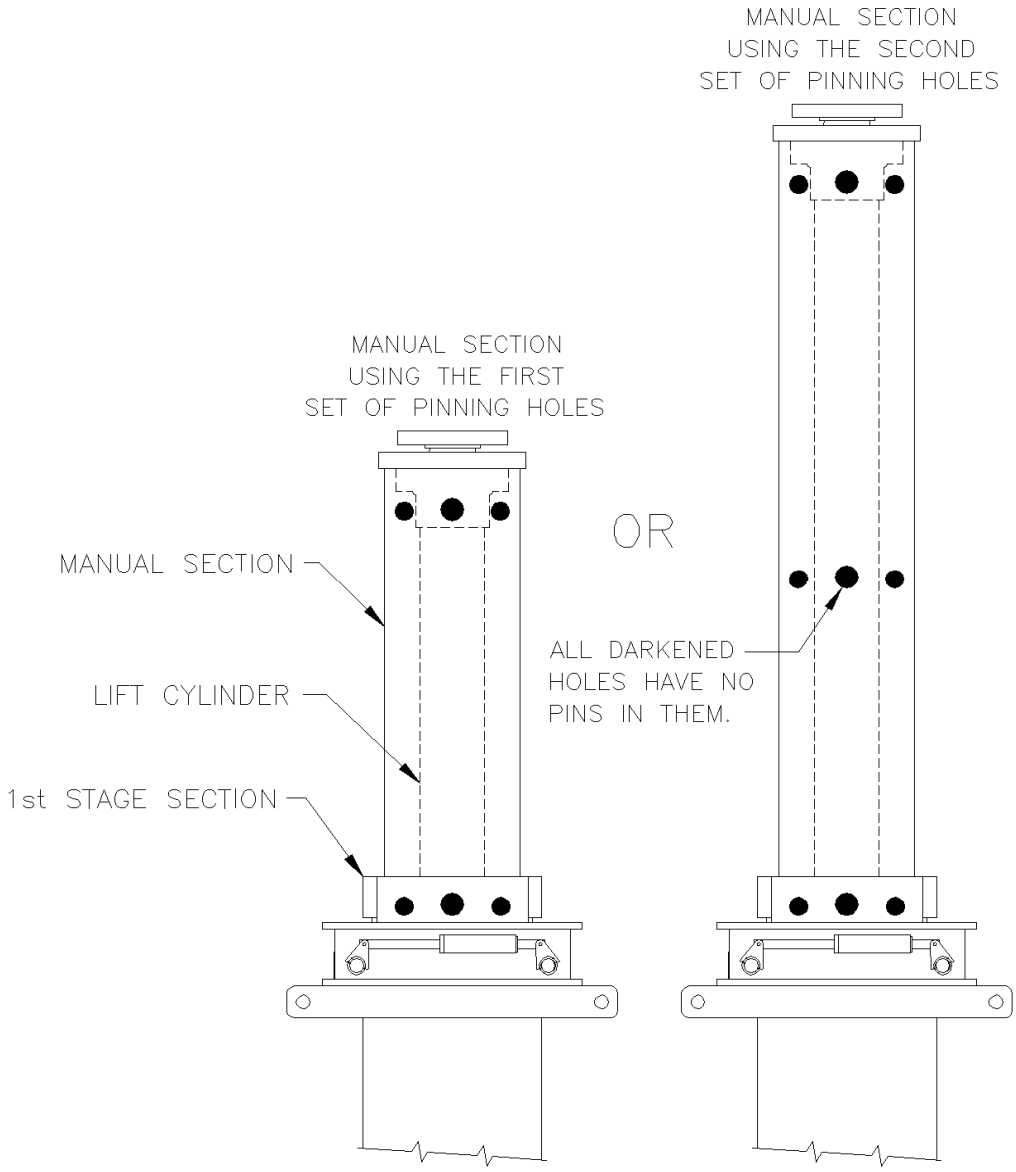
1. WHILE LIFT BOOM IS FULLY RETRACTED, REMOVE ALL THREE PINS. THE CENTER (CYLINDER PIN) MAY REQUIRE THE BOOM TO BE EXTENDED A SMALL AMOUNT SO THAT THE HOLES BECOME ALIGNED.



STEP 2

2. THE LIFT CYLINDER MAY NOW BE EXTENDED UNTIL THE DESIRED SET OF PINNING HOLES IS REACHED. NOTE: THE MANUAL SECTION WILL ALSO EXTEND AT THIS TIME.

- THE MANUAL BOOM SECTION HAS THREE (3) SETS OF PINNING HOLES LOCATED AT DIFFERENT HEIGHTS.
- THE FIRST SET OF HOLES (MANUAL SECTION FULLY RETRACTED) IS FOR STORAGE OF MANUAL SECTION.
- THE SECOND (OR MIDDLE) SET OF HOLES IS FOR PINNING THE MANUAL BOOM SECTION AT A REDUCED LIFT HEIGHT. CHECK LOAD CHART FOR LIFT HEIGHT CAPACITIES OF THE TWO PINNING LOCATIONS.
- THE THIRD (OR BOTTOM) SET OF PINNING HOLES IS FOR FULL EXTENSION OF THE MANUAL BOOM.
- ALL THREE SETS OF HOLES ARE RATED FOR FULL GANTRY CAPACITY.



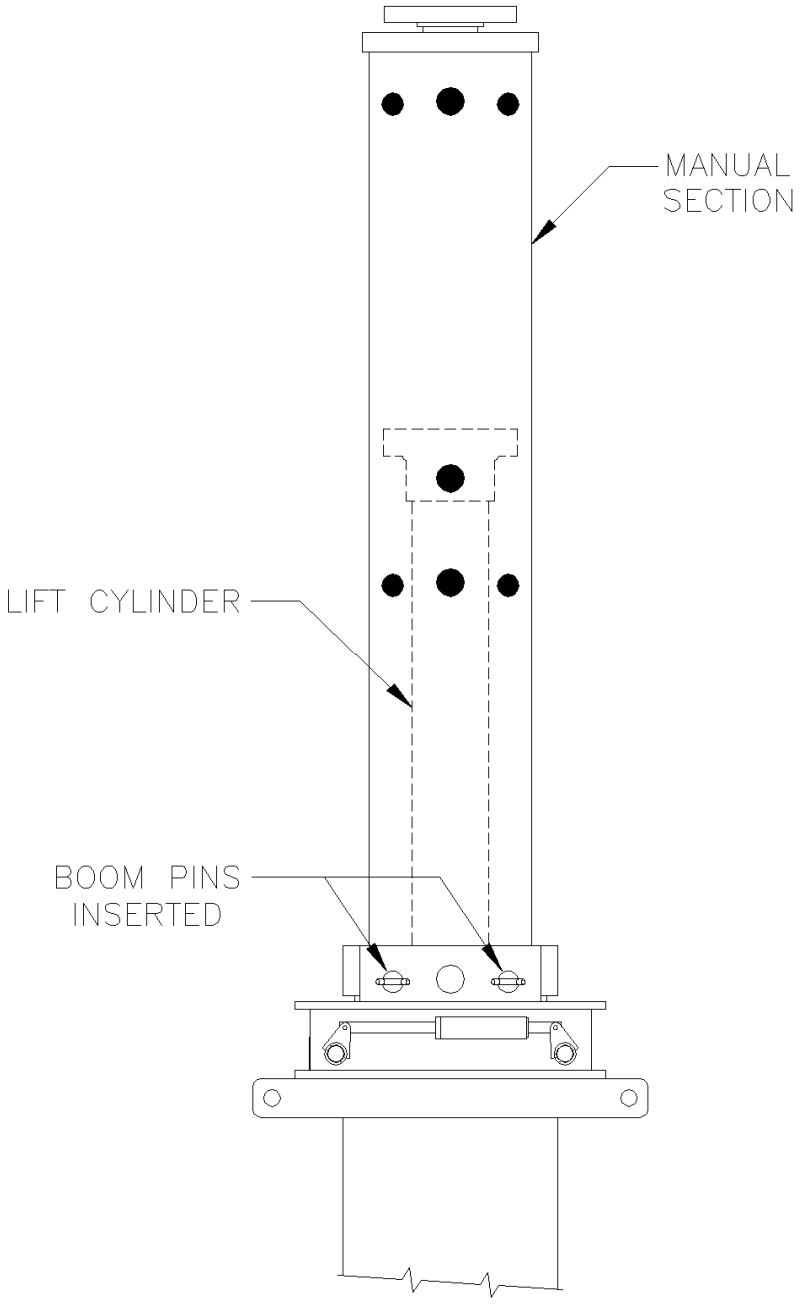
STEPS 3 & 4

3. WHEN THE DESIRED SET OF PINNING HOLES IS ALIGNED WITH THE 1ST STAGE PINNING BLOCKS, THE BOOM PINS ARE INSERTED INTO THE TWO OUTSIDE HOLES.

*** CAUTION ***

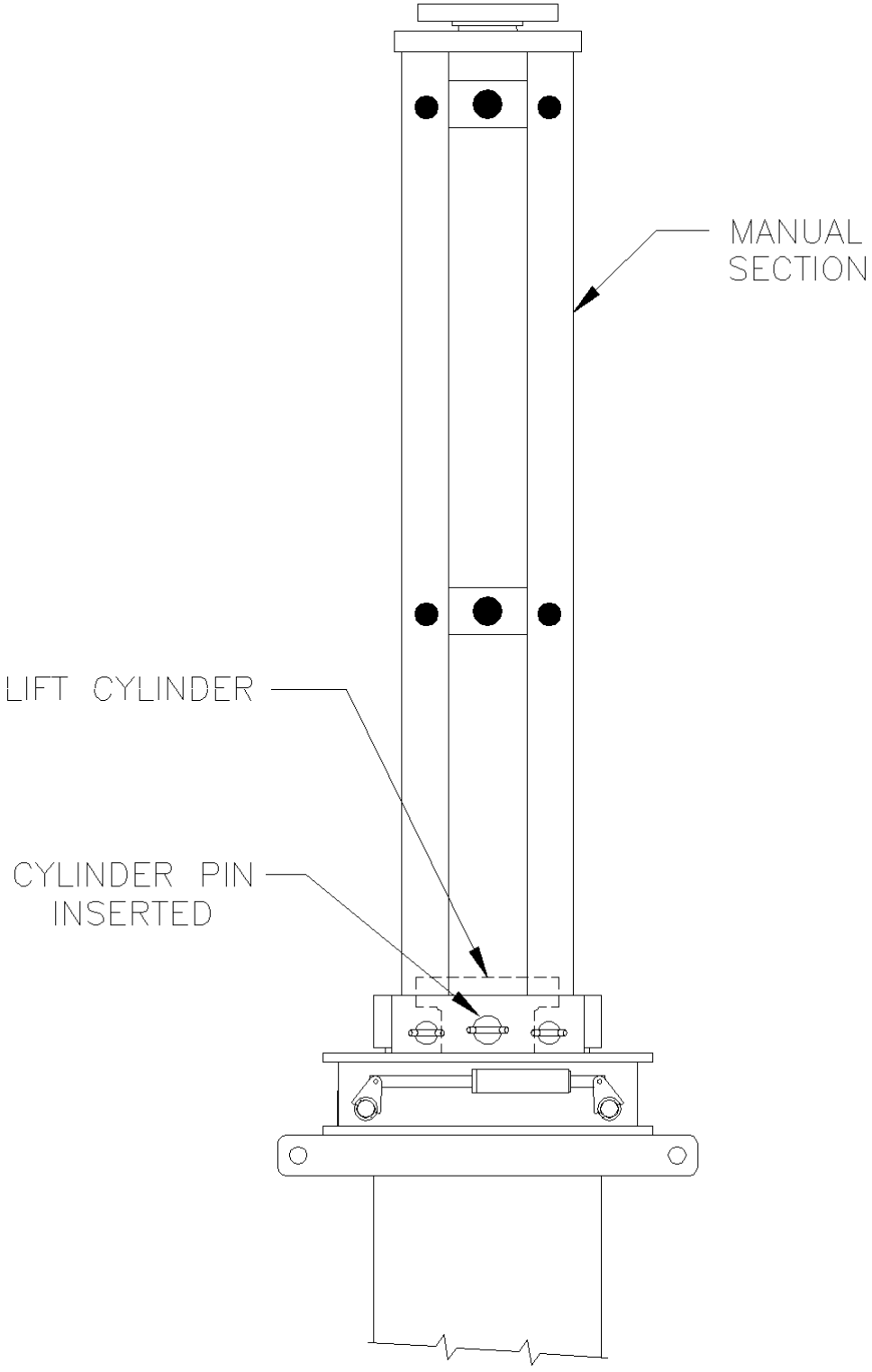
- **DO NOT INSERT THE CENTER CYLINDER PIN AT THIS TIME!**
- **CARE SHOULD BE TAKEN TO ENSURE THAT ONLY THE BOOM PINS ARE FULLY INSERTED THROUGH BOTH SIDES OF THE BOOM!**

4. THE LIFT CYLINDER CAN NOW BE RETRACTED. AS THE CYLINDER IS LOWERING, THE MANUAL SECTION WILL REMAIN EXTENDED.



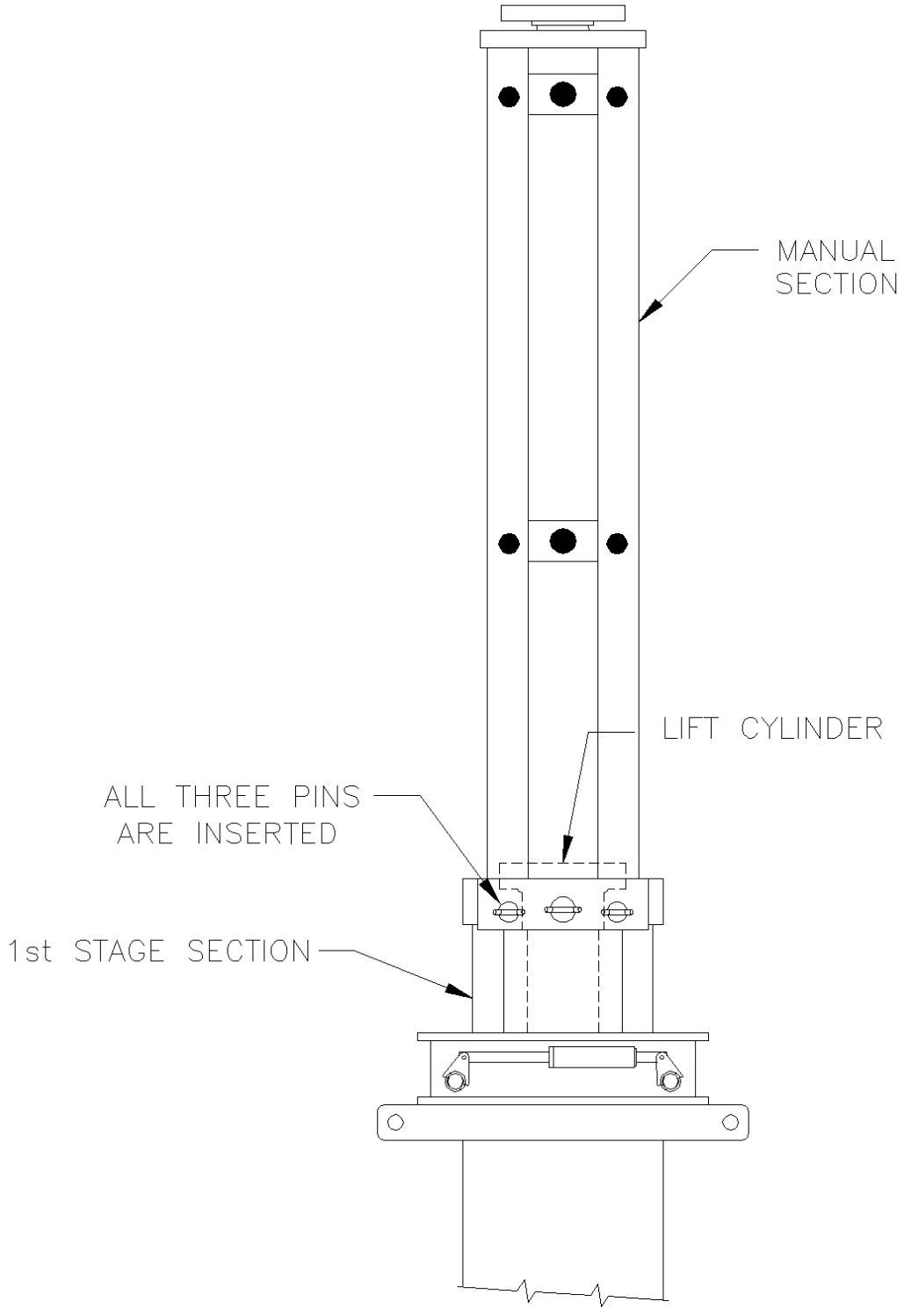
STEP 5

5. AFTER THE LIFT CYLINDER IS FULLY RETRACTED AND THE CYLINDER PINNING HOLE IS ALIGNED, THE CENTER CYLINDER PIN IS INSERTED THROUGH THE BOOM.



STEP 6

6. THE 1ST STAGE IS NOW READY TO BE EXTENDED.



STEP 7
LOWERING THE MANUAL BOOM SECTION

THE PROCEDURE TO LOWER THE MANUAL BOOM SECTION IS THE REVERSE OF THE ORDER OF EXTENSION.

THE FOLLOWING IS THE ORDER IN WHICH THE MANUAL BOOM SECTION IS RETRACTED:

1. RETRACT THE 1ST STAGE UNTIL THE CENTER CYLINDER PIN IS LOOSE IN ITôS HOLE.

2. PULL THE CENTER CYLINDER PIN COMPLETELY OUT OF THE BOOM.

3. FULLY EXTEND THE LIFT CYLINDER UNTIL THE BOOM PINS ARE LOOSE IN THEIR HOLES.

4. PULL THE BOOM PINS COMPLETELY OUT OF THE BOOM.

5. FULLY RETRACT THE LIFT CYLINDER UNTIL ALL THREE HOLES ARE ALIGNED.

6. AFTER THE CYLINDER IS RETRACTED TO THE POINT WHERE ALL OF THE PINNING HOLES ARE ALIGNED, INSERT BOTH BOOM PINS AND THE CYLINDER PIN.

6.0 OPERATIONAL PROCEDURES FOR CAM LOCK SYSTEM

The cam lock system is a redundant load drop prevention feature of the Lift-N-Lock Hydraulic Boom Gantry. The cam lock system becomes the primary load holding mechanism in the event of a lift cylinder failure.

The following procedures and Figures provide the necessary instructions for proper operation of the cam lock system. Reference Figures 2-5 and 2-6 for cam lock ñONò and ñOFFò positions, and Figure 2-8 for cam lock operations.

6.1 RAISING A LOAD

- While raising a load with the gantries, the cam locks are automatically rotated away from the booms to the ñOFFò position and therefore no additional operator action is necessary.

6.2 LOWERING A LOAD

Once the load is lifted and needs to be set down, the following procedure is recommend:

- Before the lift cylinder can be retracted, the cam locks MUST be open (OFF). Following is the correct procedure for retracting the lift cylinder either with or without a load on the gantry:
  1. Pull control levers towards operator. This will open the cam locks and also begin to extend the lift cylinder.
  2. After the cam lock cylinder has fully opened, gently push the control levers forward until the lift cylinder begins to retract.
  3. Hold the control levers in that position until the desired height is achieved.
  4. If the process is stopped for any reason, repeat steps 1 ï 3.

- As an alternative to the above procedure, the cam locks can be turned ñOFFò to make lowering easier. The Lift-N-Lock hydraulic boom gantries are equipped with a cam lock shut-off valve. When this valve is closed, the cam locks will remain open until the cam lock shut-off valve is opened. **SEE FIGURE 2-9.**

*** * * WARNING * * ***
THE CAM LOCK SYSTEM SHOULD BE SHUT OFF ONLY BY EXPERIENCED OPERATORS THAT ARE THOROUGHLY KNOWLEDGEABLE OF THE LIFT-N-LOCK HYDRAULIC BOOM GANTRIES.

Figure 2-5
Cam Lock ñONò Position

THE CAMS ARE **“ON”** WHEN THE CAM LOCK CYLINDER IS RETRACTED AND THE CYLINDER MOUNTS ARE TILTED **TOWARDS** THE CENTER OF THE BOOM

THIS SECTION VIEW SHOWS THE CAMS IN THE **“ON**ò POSITION. THE CAMS ARE TILTED **TOWARDS** THE BOOM AS WELL.

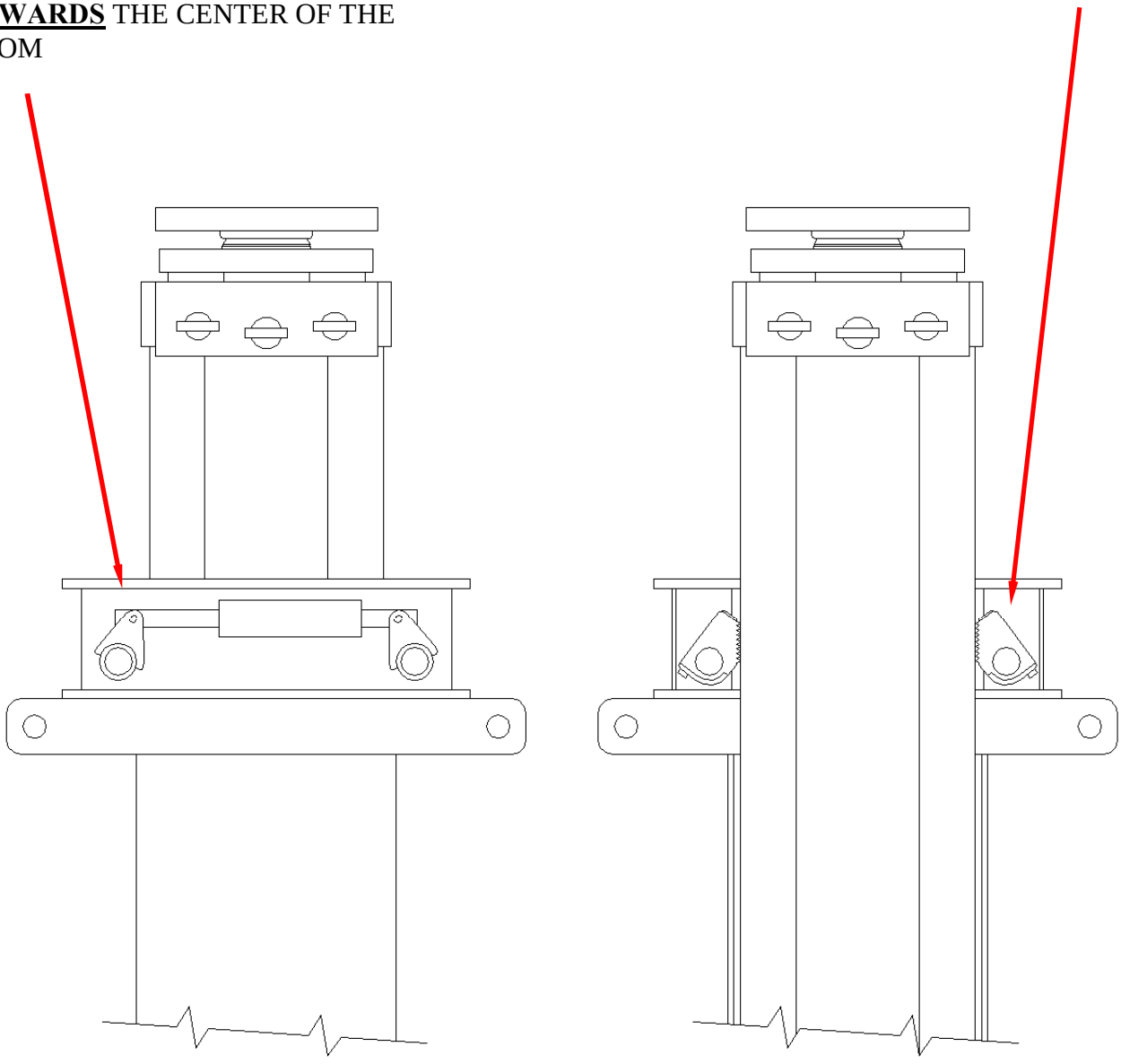


Figure 2-6
Cam Lock ñOFFò Position

THE CAMS ARE **“OFF”** WHEN THE CAM LOCK CYLINDER IS EXTENDED AND THE CYLINDER MOUNTS ARE TILTED **AWAY** FROM THE CENTER OF THE BOOM

THIS SECTION VIEW SHOWS THE CAMS IN THE **“OFF”** POSITION. THE CAMS ARE TILTED **AWAY** FROM THE BOOM AS WELL. THE BACK OF THE CAMS ARE VISIBLE AND ARE VERTICAL WHEN CAMS ARE ñOFFò

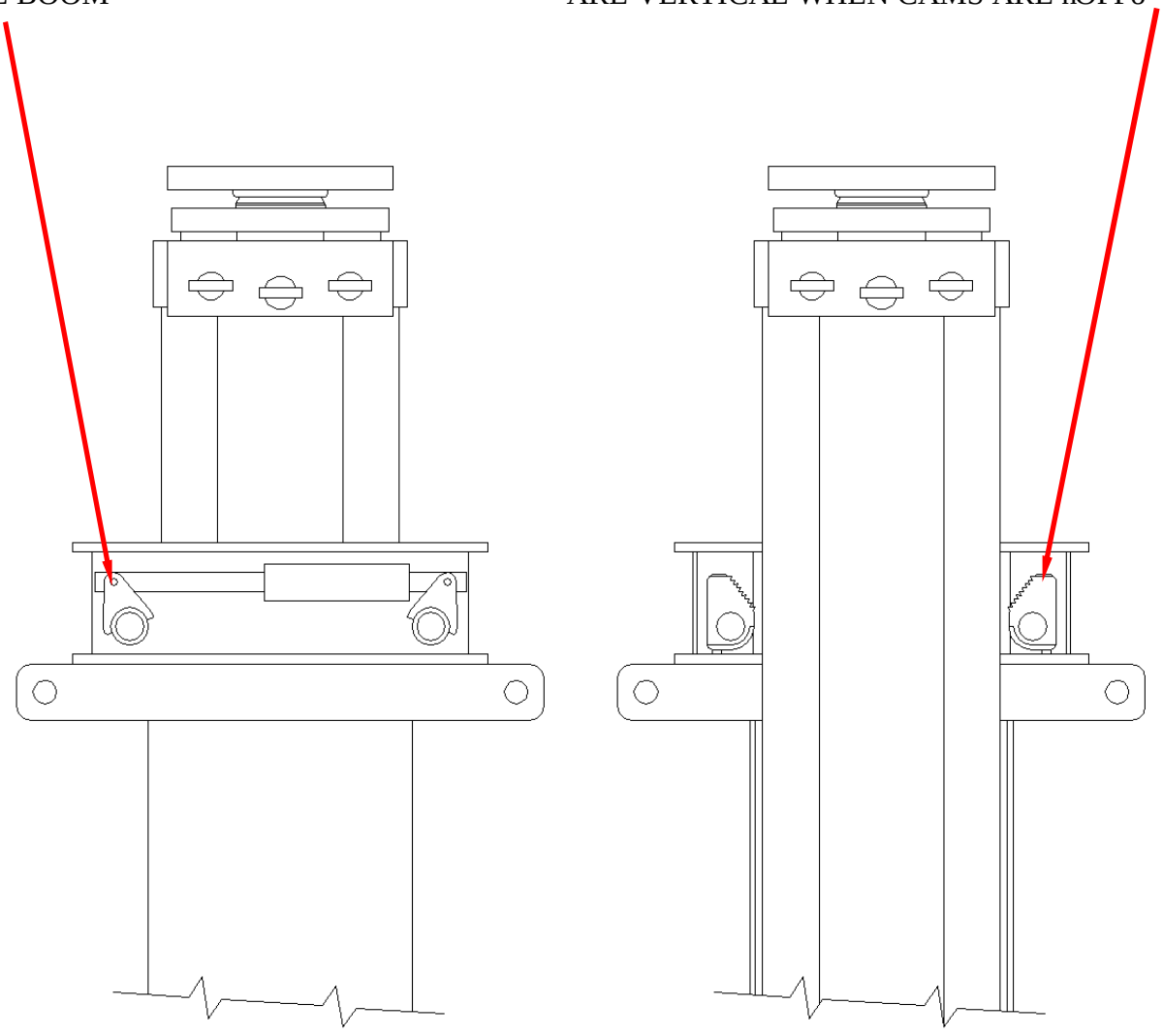


Figure 2-7
Cam Lock Shut-Off Valve Location

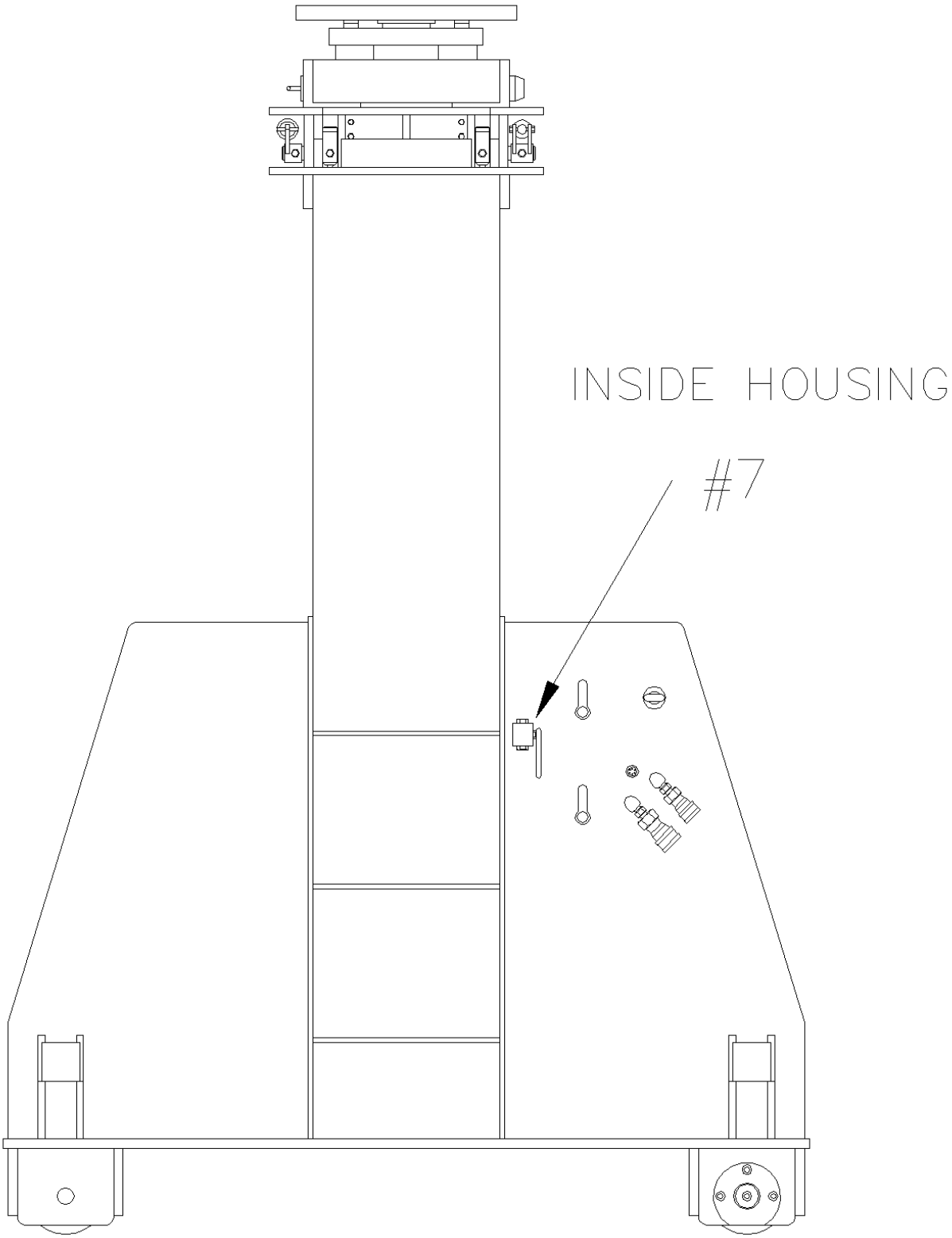
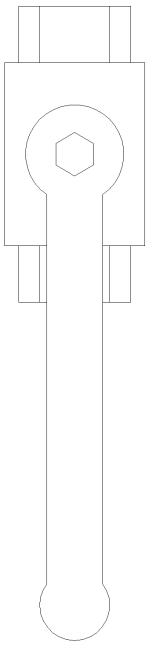
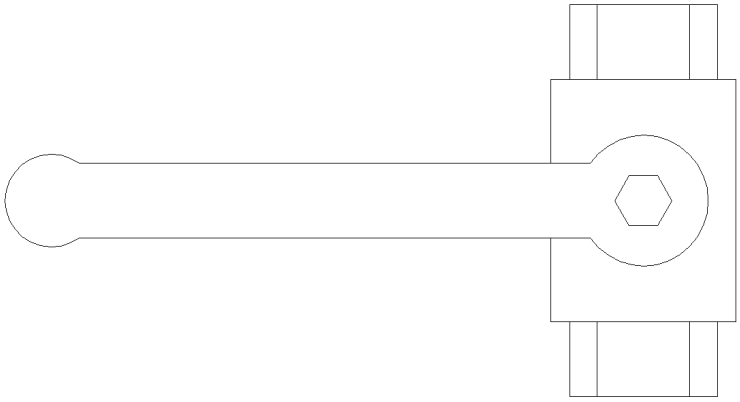


Figure 2-8
Cam Lock Shut-Off Valve (Item #7)

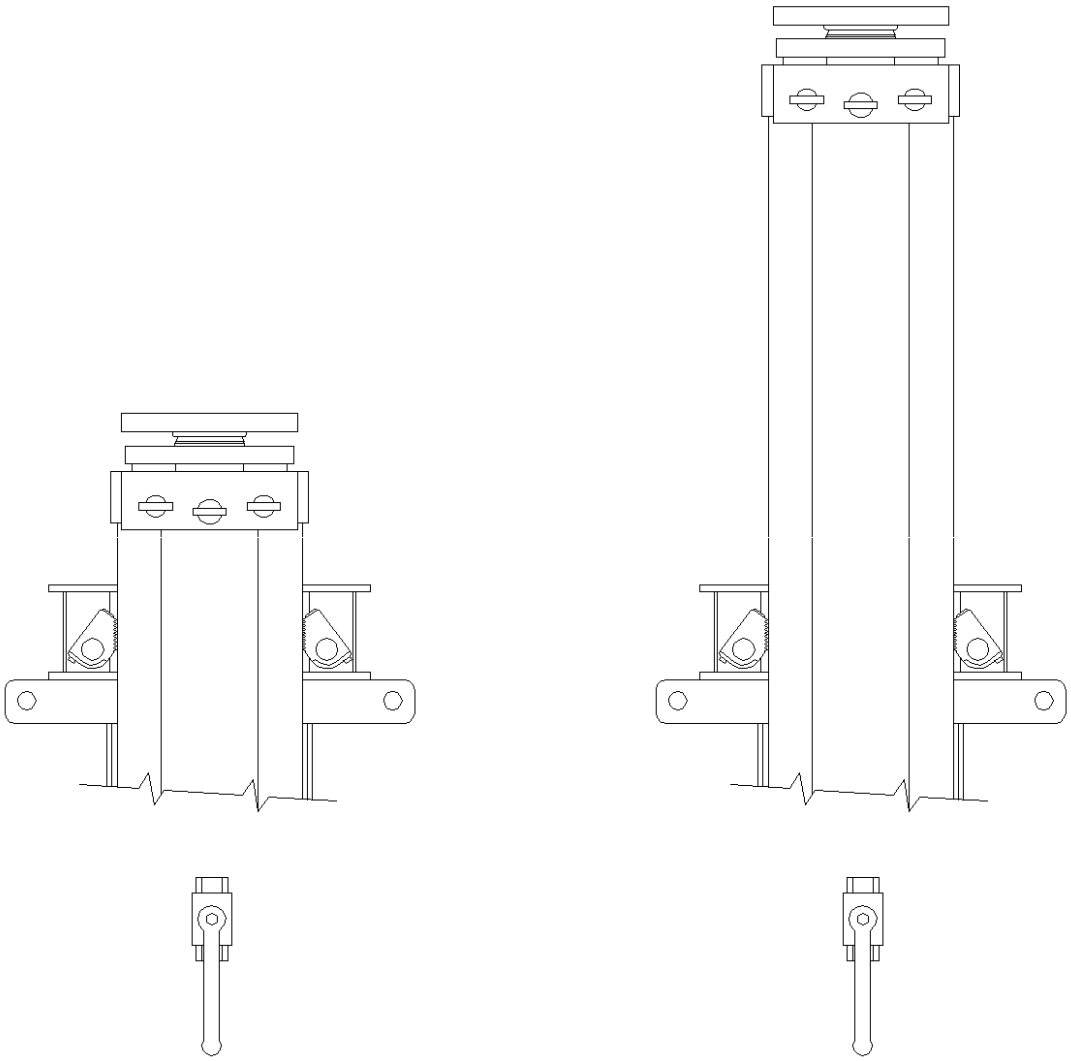


- DOWN POSITION ï VALVE OPEN (CAMS ñONò) LEAVES THE CAM LOCK SYSTEM ENGAGED. THE CAMS WILL OPEN AND CLOSE WITH CONTROL LEVER OPERATION.



- UP POSITION ï VALVE CLOSED (CAMS ñOFFò) LEAVES THE CAM LOCK SYSTEM DISENGAGED. THE CAMS WILL OPEN ONCE SYSTEM IS PRESSURIZED AND WILL REMAIN FULLY OPEN UNTIL VALVE IS TURNED TO THE DOWN POSITION.

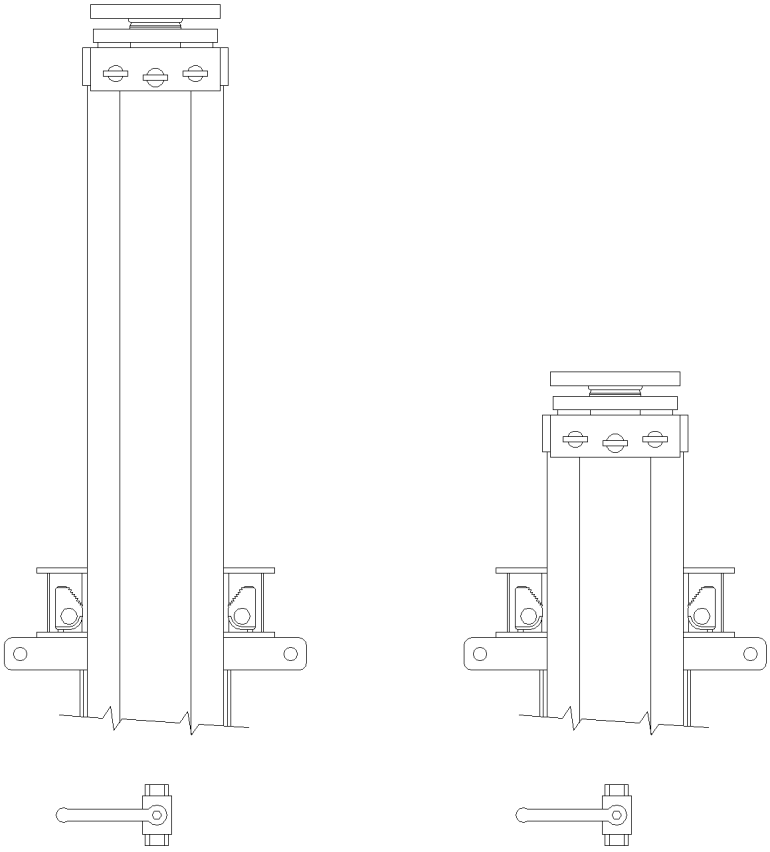
Figure 2-9
Cam Lock Operations



BEGIN THE LIFT WITH THE CAM LOCKS IN THE ñONò POSITION AND THE CAM LOCK SHUT-OFF VALVE IN THE ñOPENò POSITION AS SHOWN ABOVE.

LEAVE THE CAM LOCK SHUT-OFF VALVE OPEN (CAM LOCK SYSTEM ñONò) THROUGH THE DURATION OF THE LIFT. WHEN THE GANTRY NEEDS TO BE LOWERED, ALWAYS EXTEND THE GANTRY BOOM UPWARDS UNTIL THE CAM LOCKS TILT AWAY FROM THE BOOM AND THEN START THE GANTRY BOOM DOWN.

Figure 2-10
Cam Lock System Shut-Off Procedure



ONCE THE LOAD IS LIFTED AND NEEDS TO BE SET DOWN, THE CAM LOCKS CAN MANUALLY BE TURNED OFF IN SELECT CIRCUMSTANCES. PLEASE NOTE THAT EXTRA CAUTION SHOULD BE USED WHEN EMPLOYING THIS TECHNIQUE. CONSULT THE FACTORY IF UNSURE ABOUT A PARTICULAR CIRCUMSTANCE. THE MANUAL SHUTOFF PROCEDURE IS AS FOLLOWS:

1. TURN THE SHUT-OFF VALVE UP (CAMS OFF)
2. EXTEND THE GANTRY BOOM UPWARDS A SMALL AMOUNT; THIS WILL PRESSURIZE THE CAM SYSTEM AND FULLY OPEN THE CAMS. ONLY A SMALL AMOUNT OF UPWARD MOVEMENT IS NEEDED TO DISENGAGE THE CAM LOCK SYSTEM.

ONCE THE SYSTEM IS PRESSURIZED, THE SHUT-OFF VALVE HOLDS THE CAMS OPEN. THE CAMS CAN BE TURNED BACK ON AT ANY TIME (AND SHOULD BE TURNED BACK ON AT THE FIRST OPPORTUNITY) AND MUST BE TURNED BACK ON WHEN LOWERING IS COMPLETED, THE GANTRY IS LEFT UNATTENDED OR WHEN A LOAD IS SUSPENDED FOR ANY PERIOD OF TIME.

7.0 LIFT BOOM SEQUENCING

LIFT-N-LOCK Hydraulic Boom Gantries have a specific order in which the various boom ***stages*** must extend and retract to ensure safe gantry operations. Gantry operators and crews must monitor the lift booms to ensure that they operating in accordance with the sequence below:

- ***Power Manual Booms*** are extended first and retracted last (If they are to be used in a lift)
- ***Small Booms*** must extend before any larger boom
- ***Large Booms*** must retract before any smaller boom

7.1 CORRECTING AN OUT-OF-SEQUENCE CONDITION

If the Lift Booms become out of sequence as listed above, the project must be stopped and the sequencing corrected. Improper sequencing is caused by incomplete cam lock disengagement from the lift boom.

To correct the lift boom sequencing, the booms must be extended until all cam locks are fully open. At this point, the lift booms can be retracted.

SECTION III

LOADING, UNLOADING & TRANSPORTATION

1.0 UNLOADING GANTRIES

Before unloading your LIFT-N-LOCK Hydraulic Gantries and control module, inspect for any physical damage. Note any such damage on the freight bill and report the same to carrier.

1.1 UNLOADING WITH A FORK TRUCK

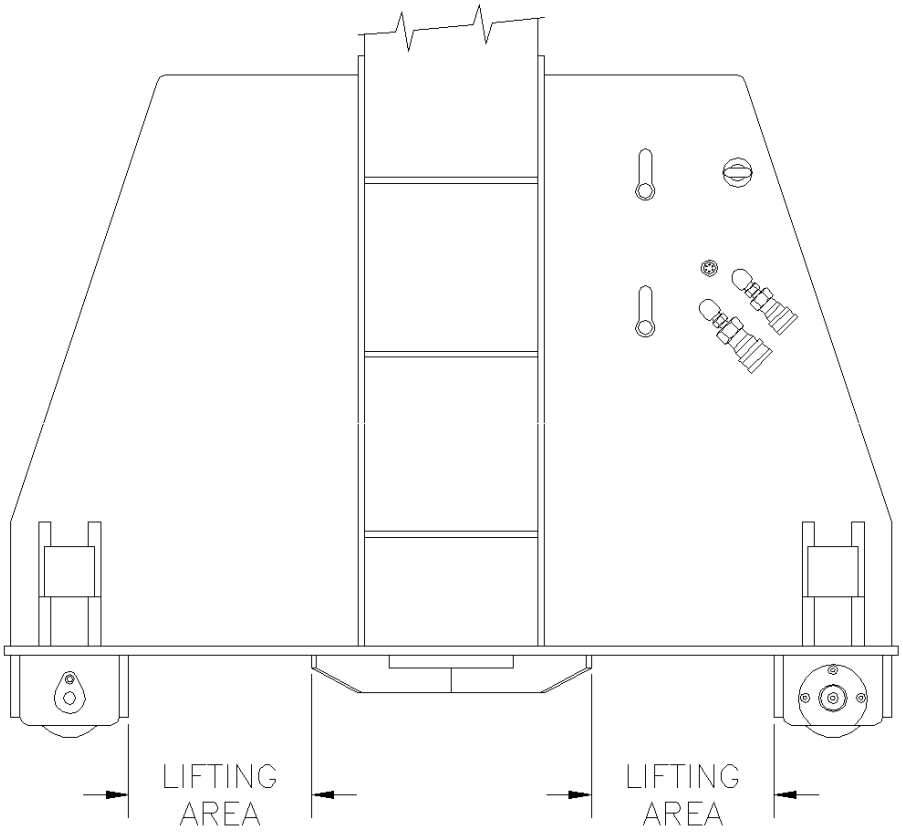
Gantries should be lifted from the side. Care should be taken to ensure that the forks are resting firmly on the bottom of the base of the housing and not on the reinforcing gussets that are centrally located under the housing. See Figure 3-1.

*** * * WARNING * * ***

DO NOT ATTEMPT TO LIFT THE GANTRY IN EITHER OF THE FOLLOWING WAYS, AS DOING SO WILL RESULT IN AN UNSTABLE LIFT:

1. **IF ONE OR BOTH OF THE FORKS ARE RESTING ON THE UNDERLYING REINFORCING GUSSETS.**
2. **FROM THE END, EITHER UNDER OR ABOVE THE LIFT HOUSING.**

FIGURE 3-1
BOTTOM LIFTING OF GANTRY HOUSING



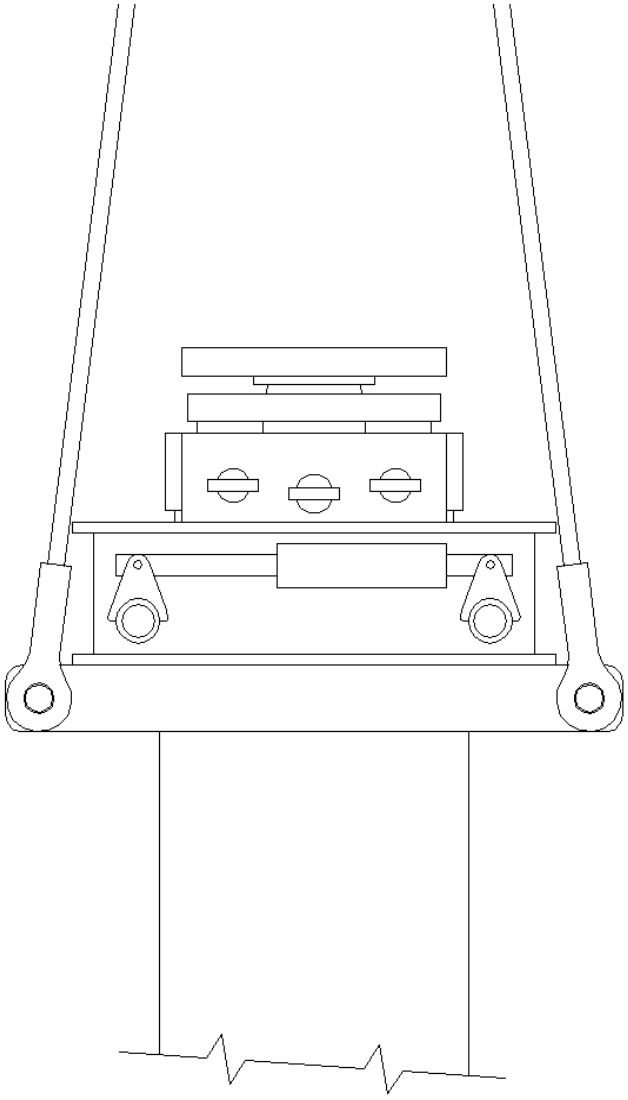
1.2 UNLOADING A GANTRY WITH A CRANE, BOOM TRUCK OR OVERHEAD CRANE

Gantries should be lifted from the lifting eyes located on the base boom sections, towards the top of the lift boom. See Figure 3-2.

*** * * WARNING * * ***

WHEN LIFTING THE GANTRY FROM ABOVE, ALL FOUR LIFTING POINTS SHOULD BE USED. IF LIFTING IS ATTEMPTED USING ONLY TWO LIFTING POINTS, AN UNSTABLE LIFT WILL RESULT.

FIGURE 3-2
TOP LIFT OF GANTRY HOUSING



2.0 UNLOADING CONTROL MODULE

2.1 BOTTOM LIFTING

The control module should be lifted from the side only, between the tie-down eyes.

*** * * WARNING* * ***
DO NOT ATTEMPT TO LIFT THE CONTROL MODULE IN THE FOLLOWING WAYS:
1. **FROM UNDER THE END OF THE MODULE**
2. **FROM ABOVE ON THE END OR SIDE OF THE MODULE**

DOING SO WILL RESULT IN AN UNSTABLE LIFT

2.2 TOP LIFT

When lifting the control module from above, the center lifting eye should be used. A shackle and cable of the appropriate strength and condition will work satisfactorily. If a lifting hook (from a crane) fits into the lifting eye on the control module, this method will also work. When lifted from the top, the control module may lift in a tilted manner.

*** * * WARNING * * ***
ATTEMPTING TO LIFT THE CONTROL MODULE FROM ABOVE IN ANY OTHER WAY WILL RESULT IN AN UNSTABLE LIFT.

3.0 TRANSPORTING GANTRIES BY TRUCK

ORIENTATION & CHAINING

The Gantries should be oriented on a truck in one of the following two ways, and cross chaining the lift housings is recommended:

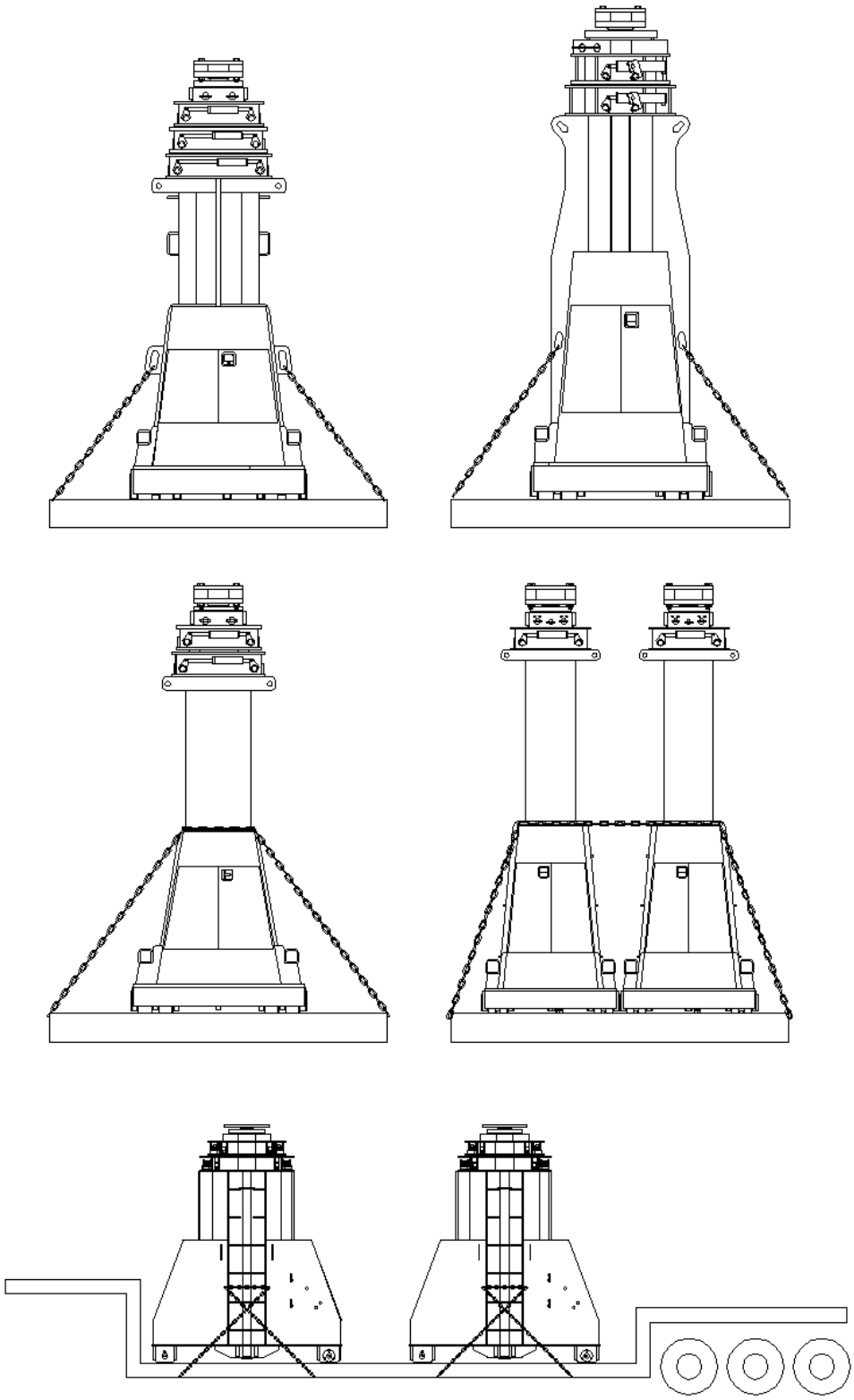
*** CAUTION ***
CHAIN SOFTENERS SHOULD BE USED TO PROTECT THE GANTRY REGARDLESS OF THE CHAINING METHOD CHOSEN BELOW

1. The first is end to end and centered on the truck bed. When this orientation is chosen, chaining them to the truck can be done in one of two ways:
   A. The first method is the most common and that is chaining through the slots that are provided in the steel lift housing. (the same method should be used on both sides of the gantries).
   B. The second method is chaining over the top of the housing base.

2. The second orientation is side by side with the inside edge of the housing in the center of the truck. When housings are arranged in this way, chaining them to the truck can be done in only one way. That is by chaining them over the tops of the housing bases.

See Figure 3-3 for all of the above situations on transporting the lift housings.

FIGURE 3-3
CHAINING OF LIFT HOUSINGS FOR TRANSPORTATION



4.1 ORIENTATION

The control module has a significantly sized hydraulic oil reservoir. Care should be taken to ensure that the orientation of the control module provides the most amount of tipover resistance.

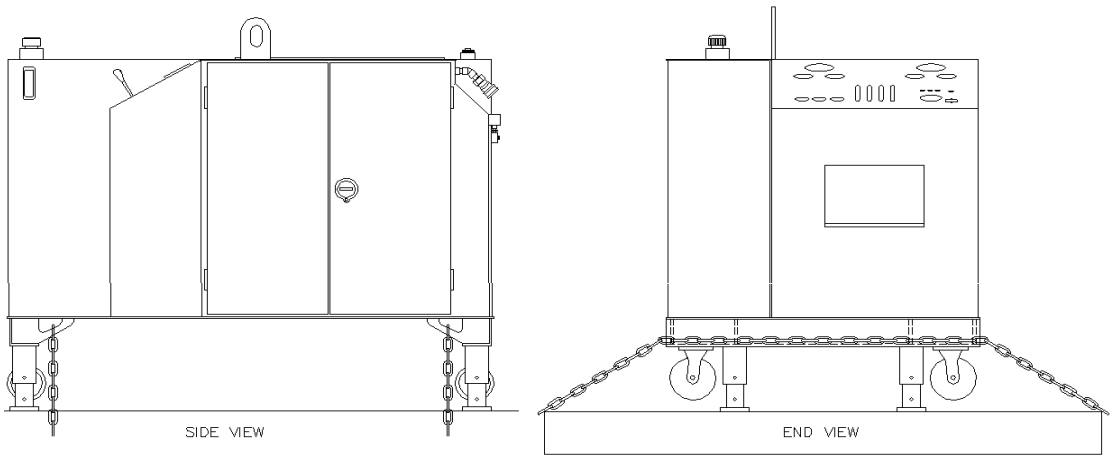
4.2 CHAINING

The gantry control module has openings built into the frame under the base for chaining purposes and has extendable jack stands for transportation. Cross chaining the control module is not necessary. See Figure 3-4.

*** CAUTION ***
IF JACK STANDS ARE NOT EXTENDED FOR TRANSPORTATION, THE CASTER WHEELS MAY EXPERIENCE DAMAGE.

NOTE:
THE JACK STANDS CAN BE RETRACTED ONCE THE CONTROL MODULE IS AT THE JOB SITE. THESE WHEELS ARE FOR THE CONVENIENCE OF THE OPERATOR SO AS TO ALLOW EASY MOVEMENT INTO THE BEST VANTAGE POINT TO MONITOR THE GANTRY SYSTEM DURING THE LIFT.

FIGURE 3-4
CHAINING OF CONTROL MODULE FOR TRANSPORTATION



SECTION IV

PRESET-UP CHECKS

1.0 GENERAL

Before setting the gantries up, and each shift thereafter, the following safety and maintenance checks must be made.

*** * * WARNING * * ***
DO NOT OPERATE THE GANTRIES IF ANY OF THE ITEMS BELOW ARE DAMAGED OR FUNCTIONING INCORRECTLY. MAKE NECESSARY REPAIRS AND ADJUSTMENTS BEFORE OPERATING, CONSULT J&R ENGINEERING IF REPAIR PARTS OR SERVICE IS REQUIRED.

Check the following items after equipment is unloaded at the job site prior to set-up:

1.1 For physical damage to gantry, or control module.

- Broken or leaking hydraulic hoses or tubing.
- Broken electrical cords, if electric powered.
- Leaking fittings or valving.
- Structural abnormalities in gantry, or hydraulic reservoir.
- Physical damage to control module, control console, and operating levers.
- Lifting beam for structural abnormalities, especially for bowing or twisting.

*** * * WARNING * * ***
DO NOT OPERATE IF GANTRY IS LEAKING HYDRAULIC OIL. STOP AND FIX ANY LEAKS PRIOR TO OPERATING.

1.2 The hydraulic reservoir, located in the control module, must be checked when all gantries are fully retracted. At this time, oil should appear in the sight gauge. Hydraulic oil should be added at this time until it appears in the sight gauge. (See maintenance section of manual for oil specifications)

*** CAUTION ***
DO NOT OPERATE CONTROL MODULE IF RESERVOIR IS LOW, PUMP OR MOTOR DAMAGE MAY RESULT.

1.3 Before starting module, the isolation valves for the hydraulic reservoir should be checked to ensure that both are in the ñOPENò position. (This can be verified by ensuring the valve handles are in line with the hose assemblies. If handles are perpendicular, they are in the ñCLOSEDò position and must be turned to the ñOPENò position)

NOTE:
THESE ISOLATION VALVES ARE ONLY TO BE USED BY A QUALIFIED SERVICE TECHNICIAN WHEN SERVICING THE MODULE AND SHOULD OTHERWISE REMAIN IN THE OPEN POSITION.

*** * * WARNING * * ***
IF HYDRAULIC RESERVOIR ISOLATION VALVES ARE IN THE "OFF" POSITION WHEN POWER MODULE IS STARTED, THE HYDRAULIC OIL FILTER CANISTER MAY BE BLOWN OFF OF THE FILTER HEAD AT A HIGH VELOCITY AND MAY CAUSE IRREPAIRABLE DAMAGE TO THE PUMP.

1.4 Control Moduleøs Power Source (Propane or Diesel fueled)
If the control module is powered by a propane or diesel engine, check engine to be certain that it is has all of the necessary fluids for proper operation; including engine oil, coolant, and fuel. (Skip step 1.5 below).

1.5 Control Moduleøs Power Source (Electric Power)
Before wiring or plugging in power cord, be sure amperage and voltage rating are compatible to the motors nameplate. After power cord has been connected to the electrical power source, the direction of the pump rotation must be tested. The following is a method for testing:

- Take the cover plate off of the pump bell housing to make the shaft couplings visible.
- Start and immediately stop the electric motor. While the shafts are still spinning, check the direction of rotation. If the power cord has been wired correctly, the direction of rotation will match the arrow on the side of the pump. If the direction of rotation is not the same as this arrow, the power cord must be rewired.

*** * * WARNING * * ***
DISCONNECT THE POWER CORD FROM THE ELECTRICAL SOURCE BEFORE ATTEMPTING TO REWIRE!

- After disconnecting the cord from the power source, rewiring can be accomplished by switching any two wires. After two wires have been switched, repeat rotation testing procedure.

*** CAUTION ***
IF PUMP ROTATION DOES NOT MATCH THE DIRECTION OF THE ARROW ON THE PUMP HOUSING OR HYDRAULIC OIL LEVEL IS LOW, PUMP FAILURE MAY OCCUR.

1.6 After the proper motor rotation has been achieved, start the Control Module by pressing the START button or by starting the engine. Be sure module is running normally and listen for any unusual sounds.

*** CAUTION ***
AN UNUSUAL PUMP NOISE USUALLY MEANS THAT THE HYDRAULIC OIL LEVEL IS LOW OR THAT THE PUMP ROTATION IS BACKWARD. IF EITHER OF THESE OCCUR, THE CONTROL MODULE SHOULD BE SHUT DOWN IMMEDIATELY UNTIL PROBLEM HAS BEEN RECTIFIED.

1.7 Before connecting hydraulic power lines, check control valve for maximum system pressure. Stroke valve lever and build pressure to maximum setting. This is done for each valve section and in both directions. This maximum pressure is set at the factory and should be approximately 3000 psi. If all valve sections perform satisfactorily, control module is ready for operation.

SECTION V

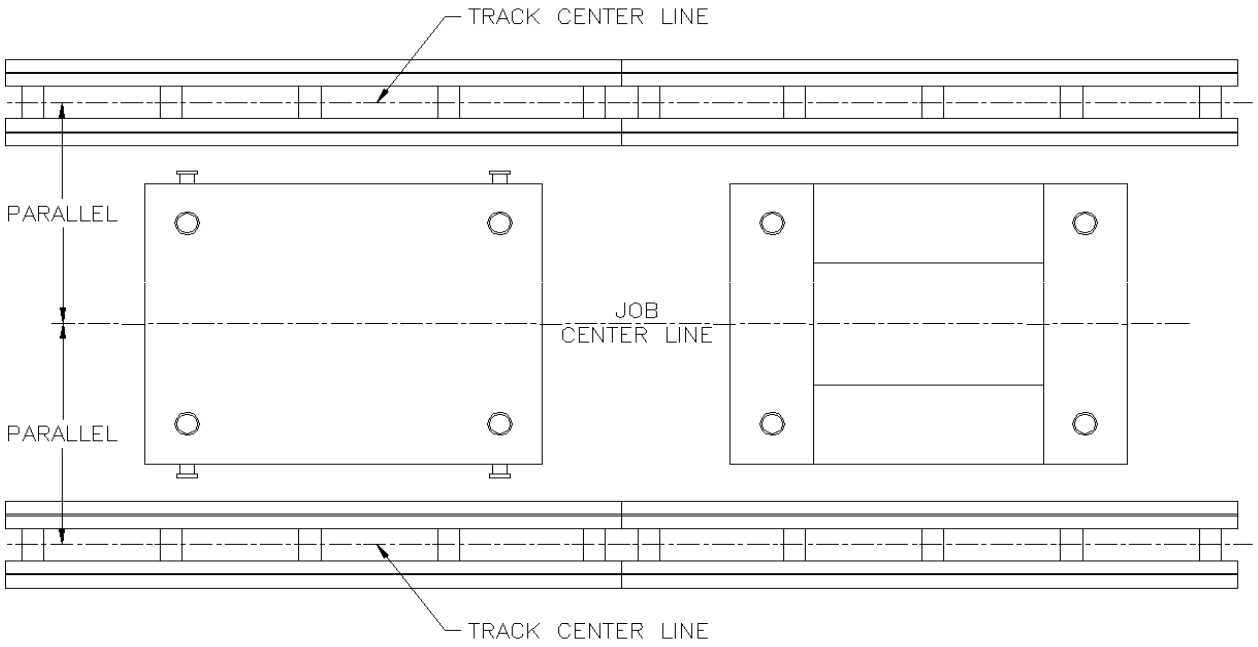
SET-UP, INSPECTION & TESTING

1.0 OVERALL SITE CLEANLINESS

Check all areas where track will be set up to be sure these areas are free of any oil, fuel or foreign objects (i.e. rags, stones, tools, steel scrap, etc.)

2.0 TRACK OR STEEL PLATE - ALIGNMENT

This is an extremely important part of set-up. Proper alignments are crucial for successful lifts. After the area is free of debris, the first step is to lay down a chalk line that is parallel to the component that is to be lifted. This chalk line is for alignment and can be for the inside or outside edge of the track. After the first line is on the floor, the second line can be laid down. Care should be taken in setting the second line so that it is parallel to the first. This is done by measuring from the first line to where the second line is to be laid down. Measuring should be done at the extreme ends of where the tracks are to be placed. As a verification of alignment, measurements should be taken at several locations along the length of the track to ensure the distances between the tracks are identical. Below is an example of a typical track layout:



*** * * WARNING * * ***
GANTRY AND FLOOR CAPACITIES MUST BE COMPUTED PRIOR TO SETTING THESE TRACKS SO AS TO DETERMINE THE PROPER LIFTING CENTERS. FAILURE TO DO SO MAY RESULT IN AN UNSTABLE CONDITION WHICH MAY RESULT IN A CATASTROPHIC FAILURE OR DROPPING OF THE LOAD.

After both lines are on the floor, the track can be aligned to the lines. As track is being placed into position, care should be taken to ensure that they are parallel. Measuring should now be done from between the guide rails, on each side of the track, while still measuring both ends of the track. This ensures that the gantry will travel in a straight path and not become bound up on a guide rail.

NOTE
ALTHOUGH USING CHALK LINES FOR TRACK ALIGNMENT IS A COMMON PRACTICE, THERE ARE MANY OTHER METHODS FOR ACCOMPLISHING THIS TASK.

3.0 TRACK - LEVEL

Gantry track should be as level as possible in both axisô(length and width). It is recommended that the track be within (1/4) of one degree of true level on both axisô. In terms of measurement, the following criteria should be met:

TRACK WIDTH

- Within 1/8 inch (3.175mm) per 3 feet (.9144M)
- Within 3/16 inch (4.763mm) per 4 feet (1.2192 M)

TRACK LENGTH

- Within 3/8 inch (9.525mm) per 10 feet (3.048 M)
- Within 3/4 inch (19.05 mm) per 20 feet (6.096 M)

Correcting track that is out of level can be accomplished in a number of ways. Shimming or cribbing low spots or grading the surface, where possible, are only a few options. Gaps under level track should be shimmed to assure that track will not move or deflect as the load passes over that area. Always be aware that whatever is used to level or crib the track must be able to support the total load.

*** * * WARNING * * ***
IF TRACK <u>WIDTH</u> IS OUT OF LEVEL MORE THAN ONE QUARTER (1/4) DEGREE, AN UNSTABLE LIFT CONDITION MAY RESULT.

*** * * WARNING * * ***

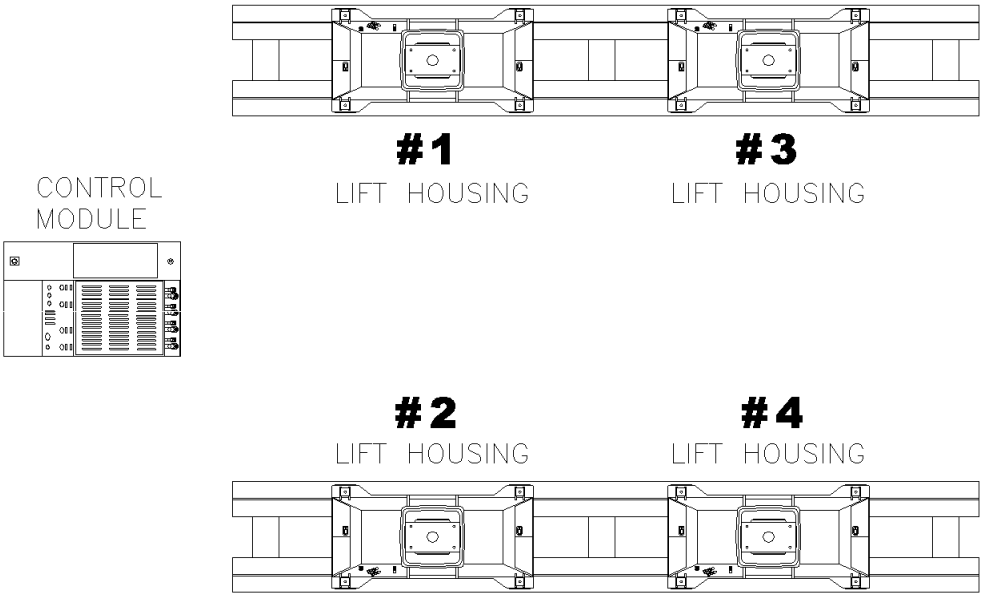
THE GANTRIES ARE EASILY MOVED IN THE FORWARD AND REVERSE DIRECTIONS WHILE UNDER HEAVY LOAD. EXTREME CARE SHOULD BE TAKEN TO PREVENT GANTRIES FROM OPERATING ON A DOWNHILL CONDITION. ALTHOUGH THE HYDRAULIC DRIVE SYSTEM DOES HAVE A HYDRAULIC BRAKING SYSTEM, THE LENGTH OF TRACK BEING OUT OF LEVEL MORE THAN (1) ONE DEGREE WILL CAUSE THE VALVE TO BY-PASS AND MOVEMENT MAY OCCUR. THIS BY-PASS IS NECESSARY IN ORDER TO PROTECT THE HYDRAULIC DRIVE UNIT.

The above procedures for track layout are critical for load movement. If the load is simply being raised and then lowered, without gantry movement, keeping the track parallel is less critical. **REGARDLESS, THE TRACK IS THE SUPPORTING SURFACE OF THE GANTRY AND MUST ALWAYS BE ABLE TO SUPPORT THE LOAD AND MUST BE LEVEL.**

4.0 GANTRY AND CONTROL MODULE SET-UP

Gantry set-up is equally as important as track layout, but the correct setup is dependent on the track layout. If the track is properly leveled, gantry setup is very easy. Once Gantries are set, both the track and Gantries should be checked to ensure levelness.

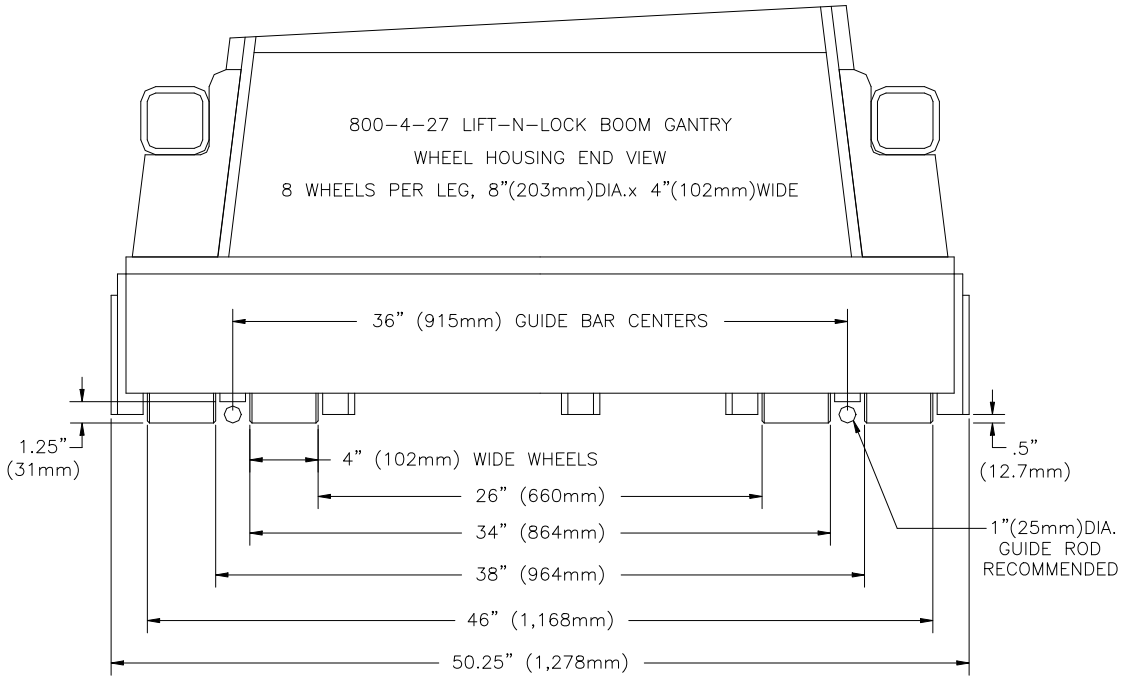
As set-up of gantries begins, attention should be given to individual gantry locations. The most common lift housing arrangement is shown below:



NOTE
THIS ARRANGEMENT OF LIFT HOUSINGS IS THE BEST BECAUSE INDIVIDUAL HOUSING LOCATIONS CORRESPONDS TO THE OPERATING LEVERS ON THE CONTROL MODULE.

At this time, gantry levelness should be rechecked. Again, this should be as close to level as possible, as stated in the track setup section above. Refer to this section for optimal level tolerances.

When housings are being lifted onto the track or plate, attention should be given to aligning the guide rails into their proper locations which is between the housing wheels per the following drawing:



NOTE
THE SPACE BETWEEN THE WHEELS IS LARGER THEN THE 1"(25mm) DIAMETER BAR STOCK THAT IS USED FOR GUIDING THE GANTRIES. THIS IS TO ALLOW FOR VARIANCES IN THE LOCATION OF THE GUIDE BARS. HOWEVER, CARE SHOULD BE TAKEN DURING SET-UP TO ENSURE THAT THE BARS ARE LAID OUT IN THE ABOVE MANNER. ONLY ONE BAR IS REQUIRED PER EACH SIDE FOR THE GANTRY ALIGNMENT. LIFT HOUSINGS SHOULD BE SET SO THAT THERE IS EVEN SPACING ON BOTH SIDES OF THE RAILS.

At this time, gantry levelness should be checked. Again, this should be as close to level as possible, as stated in the track set-up section of the manual. Refer to this section for optimal tolerance.

*** * * WARNING * * ***
IF GANTRIES ARE OUT OF LEVEL MORE THAN ONE (1) DEGREE (OR MORE THAN ONE QUARTER {1/4} DEGREE IF OTHER FACTORS INVOLVED IN THE LIFT DICTATE), DAMAGE AND/OR AN UNSTABLE LIFT CONDITION MAY RESULT.

5.0 HYDRAULIC POWER HOSE CONNECTIONS

Once all Gantries are placed on the tracks and levelness has been checked, the control module and the hydraulic pressure hoses for the cylinders, drive system and cam locks can be laid out.

The control module must be placed in an area that gives the gantry operator the best possible view of the lift. The best location is centralized in front or on the side of the load. When Gantries are going to be traveling with a load, they should travel towards the control module and operator.

*** * * WARNING * * ***
THE CONTROL MODULE SHOULD BE SET UP IN A LOCATION THAT WILL ALLOW THE GANTRY OPERATOR AN ESCAPE PATH AWAY FROM THE LOAD, IN THE EVENT OF AN EMERGENCY.

Before connecting the hydraulic pressure hoses to the control module, all system checks should be completed on the module. (See Section IV - Pre Set-up Checks).

After it has been determined that the control module is running normally, the hydraulic pressure hoses can be ***routed*** to the module. Care must be taken in routing the hoses to ensure safety and to prevent damage.

*** CAUTION ***
HYDRAULIC PRESSURE HOSES SHOULD NOT BE ROUTED THROUGH HEAVY TRAFFIC AREAS AND SHOULD NEVER BE DRIVEN OVER BY ANY VEHICLE. DAMAGED HOSES WILL CAUSE OIL LEAKAGE AND A LOSS OF SYSTEM PRESSURE TO THE GANTRIES.

If gantry travel is required, ensure adequate hose length prior to beginning the lift.

Gantry pressure hoses should be engaged in their respectively numbered coupling on the control module. Care must be taken in the routing of the hoses to ensure safety and to prevent hose damage.

EXAMPLE: Number one (#1) housing to #1 set of couplings on the control module.

At this point, the hydraulic pressure hoses with quick couplers can be engaged.

Three types of hydraulic pressure hose couplers are used on the gantry system; ***Threaded-wing*** type, ***Push-lock*** type and ***Push-lock & twist*** type. Their respective engagement techniques are as follows:

1. **Threaded-wing type**: This type of coupler requires close inspection prior to connecting.
    a. First, ensure that no threads are damaged.
    b. Second, turn the female wing coupling onto its male counterpart.
    c. Third, ensure that the female winged coupler is completely threaded onto the male coupling. This needs to be tightened with a wrench to make proper connection.

2. **Push-lock type**: This type of coupling requires first that the female coupling shoulder be retracted. Next, the male coupling inserted into its female counterpart and pushed until it bottoms out. The connection is complete when the female coupling shoulder returns to its original position. After the couplers are thought to be engaged, a simple check can be made to ensure the connection. Grasp the pressure hose and firmly pull away from the couplers. If the couplers separate, repeat engaging technique. If the couplers remain engaged, the connection has been made.

3. **Push-lock & twist type:** This type of coupling is the same as the coupling above, with the exception that it has a positive lock. This coupling locks by twisting the major outer diameter

Both types of couplings provide positive shut-off of the hydraulic system on both sides of the coupling upon disconnection.

NOTE

- **QUICK COUPLERS MUST BE CLEANED AND UNDAMAGED TO BE PROPERLY ENGAGED.**
- **CARE MUST BE TAKEN WHILE ENGAGING THE COUPLERS TO ENSURE PROPER CONNECTION**

NOTE

IF THE QUICK COUPLINGS ARE NOT FULLY ENGAGED THE LIFT CYLINDER RELIEF VALVE WILL VENT HYDRAULIC OIL ONTO THE GROUND. IF THIS OCCURS THE QUICK COUPLINGS ON THAT GANTRY MUST BE CHECKED FOR ENGAGEMENT. ONCE THE COUPLING IS ENGAGED THE RELIEF VALVE SHOULD RESET AND STOP DISCHARGING OIL. THE RELIEF VALVE MAY DRIP A SMALL AMOUNT OF OIL, BUT SHOULD EVENTUALLY STOP.

6.0 PRE-OPERATIONAL TESTING

Once all gantries are connected to the control module, and prior to attaching the beam or a load, a systems test should be made on each gantry. These tests must be carried out while the system is NOT under load.

NOTE
THE CONTROL MODULE IS EQUIPPED WITH DIRECTIONAL VALVES AND LEVERS FOR THE CONTROL AND OPERATION OF EACH GANTRY. BECOME FAMILIAR WITH THE DIRECTION OF EACH LEVER AND IT'S EFFECT ON THE LIFT HOUSING BEFORE OPERATING YOUR GANTRY SYSTEM.

6.1 INDIVIDUAL GANTRY TESTING

Each gantry should have the following tests before attaching the beam or a load:

- Each lift boom should be extended about three (3) feet (1 meter) and then retracted to itôs starting position..
- The gantryôs propel system should then be tested by propelling each gantry in both directions.

IF A PROBLEM IS ENCOUNTERED DURING THESE TESTS, CHECK THE FOLLOWING:
1. CHECK FOR PROPER ORIENTATION OF SELECTOR VALVE HANDLES.
2. CHECK TO ENSURE THAT ALL OF THE HYDRAULIC COUPLERS ARE PROPERLY ENGAGED.
3. CHECK TO BE CERTAIN HYDRAULIC PRESSURE HOSES ARE CONNECTED TO PROPER GANTRY AND COUPLINGS ON CONTROL MODULE.

IF PROBLEMS PERSIST, A MORE INVOLVED CHECK MUST BE MADE FOR EACH TYPE OF PROBLEM AS FOLLOWS:

1. IF THE PROBLEM IS IN RETRACTING THE LIFT BOOM:

   A. CHECK THE DESCENT CONTROL VALVE. THE CONTROL KNOB MAY HAVE BEEN TURNED TOO TIGHTLY IN THE CLOCKWISE DIRECTION, WHICH WOULD STOP THE FLOW OF OIL. OPENING THE VALVE (COUNTER CLOCK-WISE) UNTIL THE SPEED MATCHES THE OTHER GANTRIES WILL REMEDY THE PROBLEM. THIS VALVE IS FACTORY SET AND HAS A SET SCREW LOCATED ON THE SIDE OF THE KNOB.

   B. IF THE BOOM STILL WILL NOT RETRACT, CHECK THE CAM LOCKS TO BE SURE THAT THEY ARE NOT ENGAGED. THE GREEN CAM OPEN INDICATOR LIGHT SHOULD BE LIT ON THE CONTROL PANEL OF THE CONTROL MODULE, AND THE BACKSIDE OF THE CAM

SHOULD BE VERTICAL WHEN THEY ARE IN THE OPEN POSITION.

C. IF THE CAMS ARE ENGAGED, THEY WILL BE ANGLED TOWARD THE BOOM. THIS IS CORRECTED BY EXTENDING THE BOOM UNTIL THE CAMS HAVE DISENGAGED. THIS SITUATION HAPPENS VERY SELDOM, AND IS MORE LIKELY TO HAPPEN IF THE GANTRY HAS BEEN UNDER LOAD FOR AN EXTENDED PERIOD OF TIME WITH THE CAMS ENGAGED (IN THE CLOSED POSITION). CREWS AND OPERATORS SHOULD BE AWARE OF THE POTENTIAL OF THIS SITUATION.

2. IF THE PROBLEM IS ONLY IN PROPELLING THE GANTRIES:

A. CHECK TO BE SURE THAT THE COAST VALVE IS IN THE PROPEL POSITION.
B. CHECK THE SPEED CONTROL TO BE SURE IT HAS NOT BEEN TURNED TOO TIGHTLY. TRY TURNING THE KNOB TO INCREASE THE SPEED. THEN RECHECK GANTRY PROPEL.
C. CHECK FOR ANY FOREIGN OBJECTS THAT MAY HAVE BECOME LODGED BETWEEN THE DRIVE SPROCKETS AND CHAIN. IF AN OBJECT IF FOUND, REMOVE IT AND RETRY THE PROPEL SYSTEM.

6.2 LIFT BOOM DESCENT CONTROL

If the lift boom descent control has been tampered with or retract speeds seem mismatched, the control will need adjusting. Setting this control in each housing should be done by using the following method:

- SET #1 HOUSINGôS DESCENT CONTROL TO A MAXIMUM RETRACT SPEED THAT YOU ARE COMFORTABLE WITH.
- SET #2 HOUSING'S DESCENT CONTROL SO THAT IT MATCHES #1 HOUSING'S RETRACT SPEED.
- SET #3 HOUSING'S DESCENT CONTROL SO THAT IT MATCHES #1 HOUSING'S RETRACT SPEED.
- SET #4 HOUSINGôS DESCENT CONTROL SO THAT IT MATCHES #3 HOUSINGôS RETRACT SPEED

7.0 LIFT BEAM SET-UP

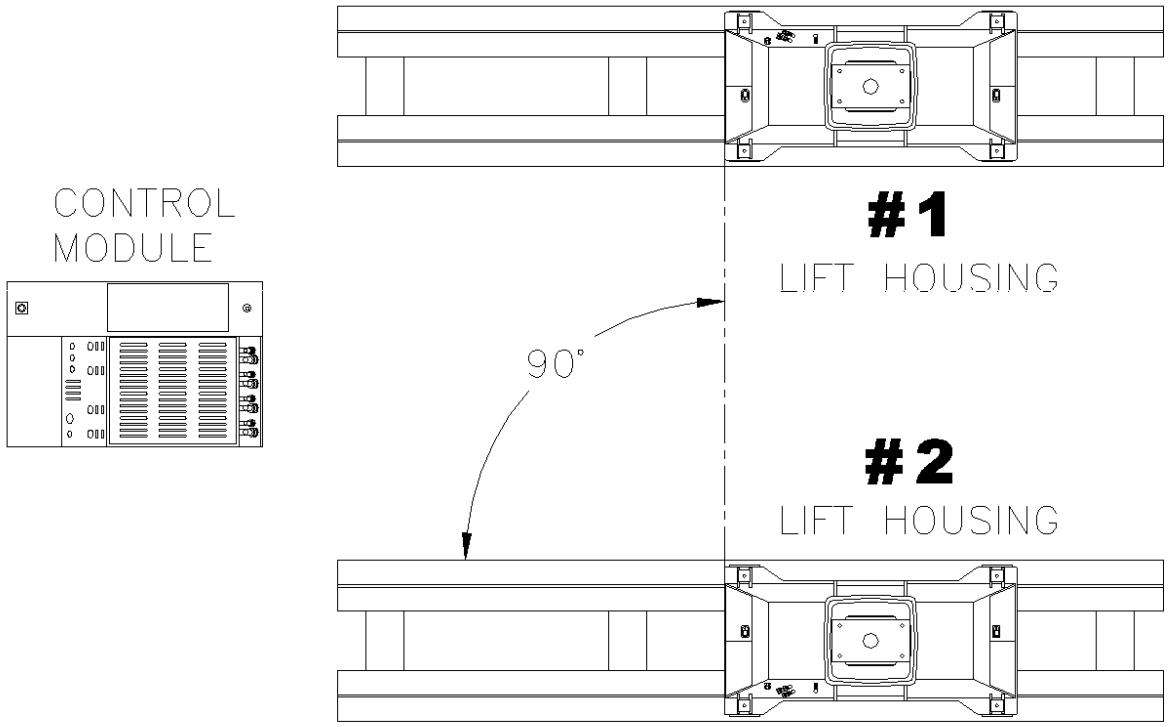
Once the Gantries have been individually tested and while all the booms are fully retracted, the gantries should be readied for the beams.

Propel each housing into itôs desired position, either in front of the load or over the load, for both types of beam configurations

7.1 LIFT BEAM SET-UP: *IN FRONT OF THE LOAD*

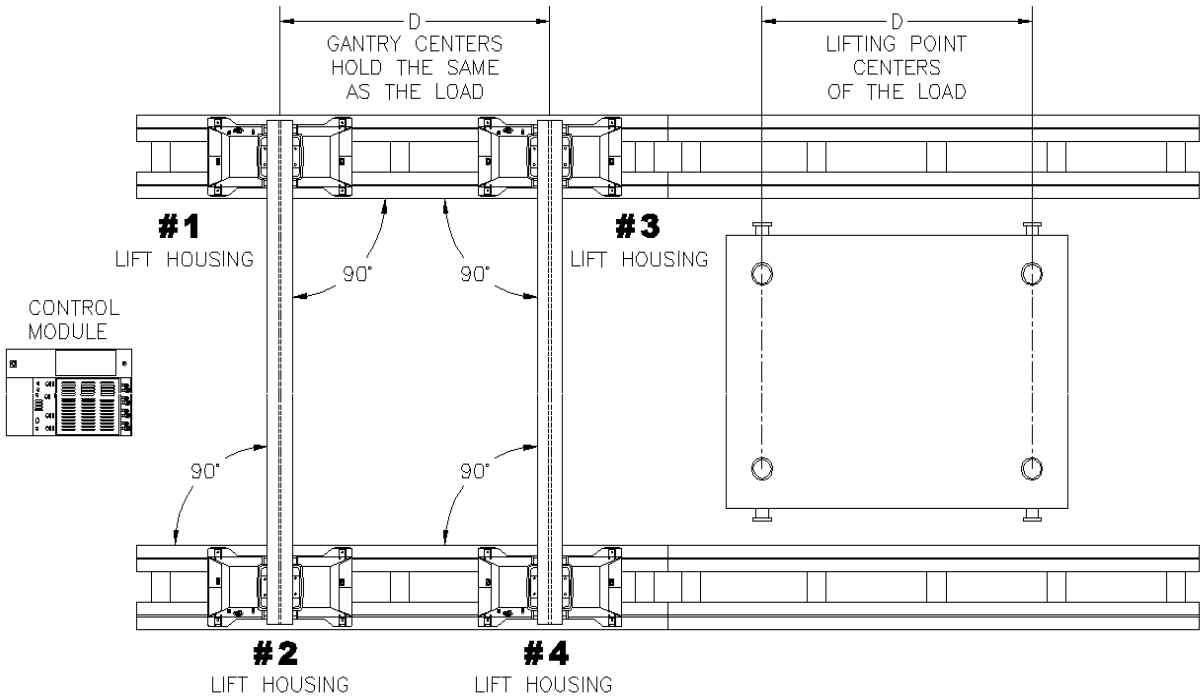
Position the pair of housings that are to be tied together by beams, so that they are parallel to the track and straight across from one another. This is so that when the beam or beams are set on the header plates, the housings will be in their proper alignment for the lift.

This type of beam configuration is used the majority of the time.



7.2 CONNECTING BEAM and LIFT BEAMS SET-UP: *IN FRONT OF THE LOAD*

When this beam configuration is used, all four lift housings must be placed into the position that is identical to the final lifting position. Maintain the dimension between the loadôs lifting point centers and the **D** dimension for housing set up. This case being similar to the previous set-up but all four housings must be parallel and straight across from one another. If the connecting beams are not being used with a four housing lift, the **D** dimension on the drawing below does not have to be identical to the final lifting position. Without the connection beams this dimension can be adjusted as each pair of housings are being positioned over the load. For both types of lifts, aligning the housings in front of the load will allow room for boom alignment.



7.3 SET UP FOR EITHER BEAM CONFIGURATION: *OVER THE TOP OF THE LOAD*

<u>This type of set up should be avoided, if possible</u>. The methods described above still apply, but the lift booms will have to be extended above the load. Before beams are set atop the headers, clearances between the load, the beams and the lift links should be thoroughly checked. The danger of setting up in this fashion is that the work crews have to guide and secure the beams at an elevated height. When this method is used, it is mandatory that the beam capture plates be attached to the headers.

7.3.1 ATTACHING THE BEAM CAPTURE PLATE SYSTEM is the next step. These plates are bolted to the top of the lift housing header plates and are required to secure the beams to the headers. Capture plates should be attached to the headers prior to the setting of beams. This is so they form a cup that will hold the beam, as the beam is being set on the headers. These capture plate systems can vary with each beam that is used. A capture plate system for your main beams has been included with the gantry.

Before lifting beams can be set, when using the standard three hole lift links or the single beam power lift links, they must be slipped over the beam. As the beam is being lifted for the final placement on the headers, these lift links should be slipped over the ends of the beam and slid toward the center. Also, at this time any other rigging can be attached-shackles, chokers, or any other special attachments, as long as there is enough clearance between the rigging and the load.

NOTE
WHEN SETTING BEAMS ONTO THE HEADER PLATES, IT IS RECOMMENDED THAT SPACER PLATES AND BOLTS BE SECURED TO THE HEADERS. THIS IS A SAFETY PRECAUTION BECAUSE IT MAKES A CUP FOR THE BEAMS TO BE SET IN AND WILL NOT ALLOW THE BEAMS TO SLIP OR BE BUMPED OFF OF THE HEADER PLATES.

7.4 INSTALLATION OF BEAMS ON HEADER PLATES

7.4.1 Beams can now be placed on the header plates.

- If using connecting beams, they must be placed and secured prior to setting lifting beams on top of them. Refer to the previous reference on connecting beams.

- When possible, leave an even amount of beam overhang on both sides of the header plates. Before doing so check clearances between these beams and other structures outside your gantry system.

*** * * WARNING * * ***
CONNECTING BEAMS HAVE TO BE BOLTED TIGHTLY TO THE HEADER PLATES PRIOR TO THE SETTING OF THE LIFTING BEAMS ON TOP OF THEM SO THAT THE CONNECTING BEAMS DO NOT SHIFT AND CHANGE ALIGNMENTS DURING LIFTING BEAM PLACEMENT.

7.4.2 When the connecting beams and/or lift beams are set into place on the header plates and secured, the lift links should be moved into position before extending the lift booms. The following are the techniques for each type of lifting link:

* Standard three hole lift links must be slipped over the lift beam before the beam is set atop of the lift housing header plate. The links should be slid along the beam, so that each link is in line with each lifting point on the desired load.

* Single beam power lift link must also be slipped over the lift beam prior to its

placement atop of the header. At this time care should be taken in aligning the beam guide bearings on each side of the beam, so that they are not damaged and so that each bearing has even spacing between the beam. After the beams are secured, each linkôs speed should be set. They should be set so that all links propel at the same speed. The links should then be propelled into position, in line with each lifting point on the desired load.

* Double beam power lift links differ from the previous types. They must be placed atop of the lift beams after the beams are secured to the headers. The lifting shaft and lug must be guided between both lifting beams as the link is lowered into position. At this time care should be taken in aligning the beam guide bearings between the beams, so that they are not damaged and so that each bearing has even spacing between the beam. After all links are set into place, their speeds should be set. They should be set so that all links propel at the same speed. The links should then be propelled into position, in line with each lifting point on the load.

NOTE
POSITIONING OF LIFT LINKS AND THE ATTACHING OF THE BEAM CAPTURE PLATE SYSTEM IS DONE PRIOR TO LIFT BOOM EXTENSION. THIS IS DONE AT THE LOWEST POSSIBLE HEIGHT TO ENSURE THE SAFETY OF THE WORK CREW.

7.5 INSTALLATION OF STABILIZER BARS

The stabilizer bar system provides additional protection to laterally imposed forces by the load. The stabilizer bar system is equally effective when used with either the manual section or the first stage boom section.

It is strongly recommended that the stabilizer bars be used during the following lifting scenarios:

- Lifts requiring the use of exceptionally long slings/rigging.
- Lifts performed with the load on TOP of the lift beams.
- Lifts performed with softer ground conditions
- With load movement across lift beam with Powerlinks or any other load sideshifting system.
- Any other lifts that would benefit from increased lateral load damping.

*** CAUTION ***
THE STABILIZER BARS MUST BE INSTALLED ONLY AFTER THE BEAMS HAVE BEEN PROPERLY SECURED TO THE HEADER PLATES.

Proper installation of the stabilizer bar system is shown in the following figures:

Figure 5-1
Stabilizer Components

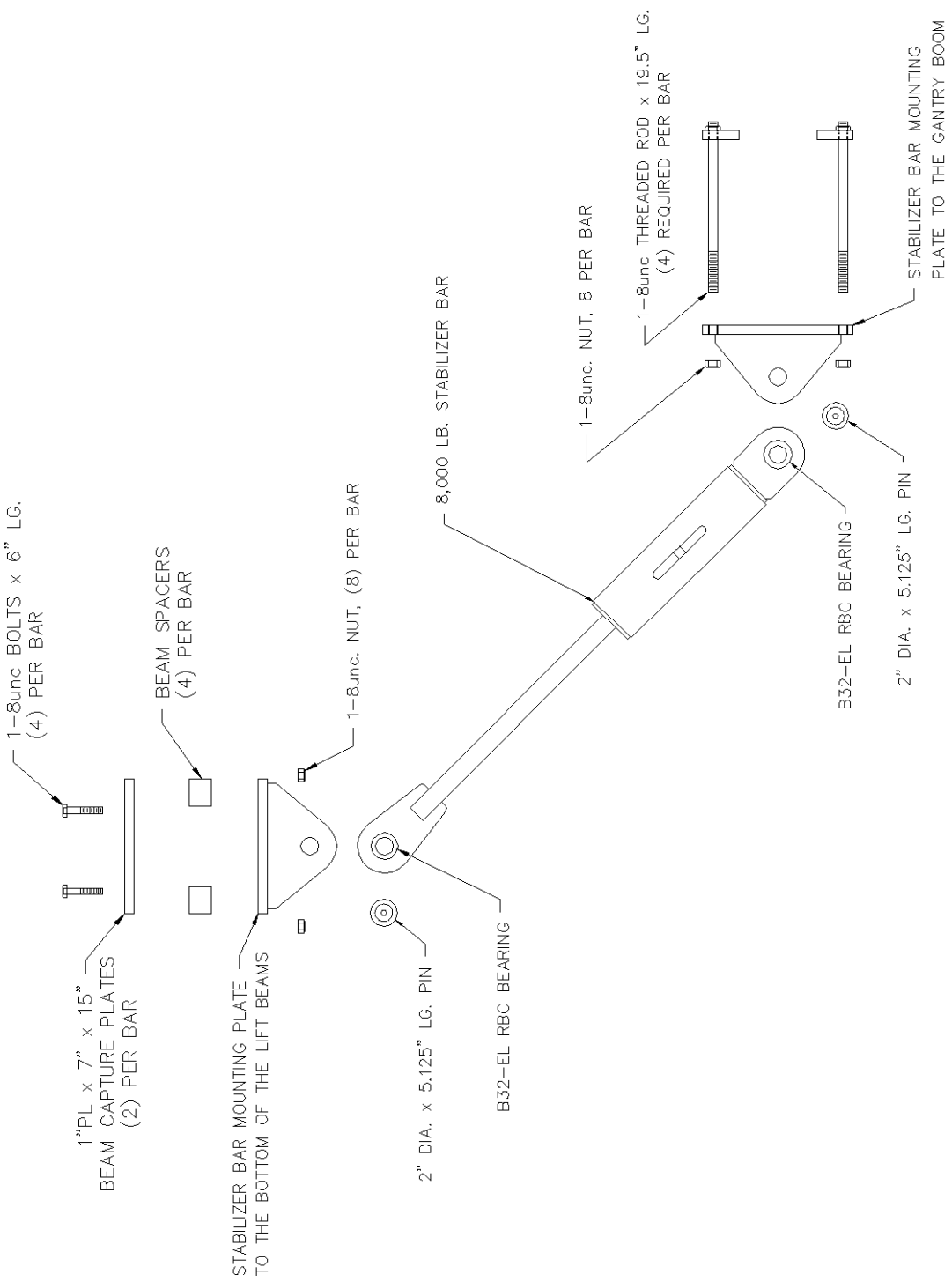
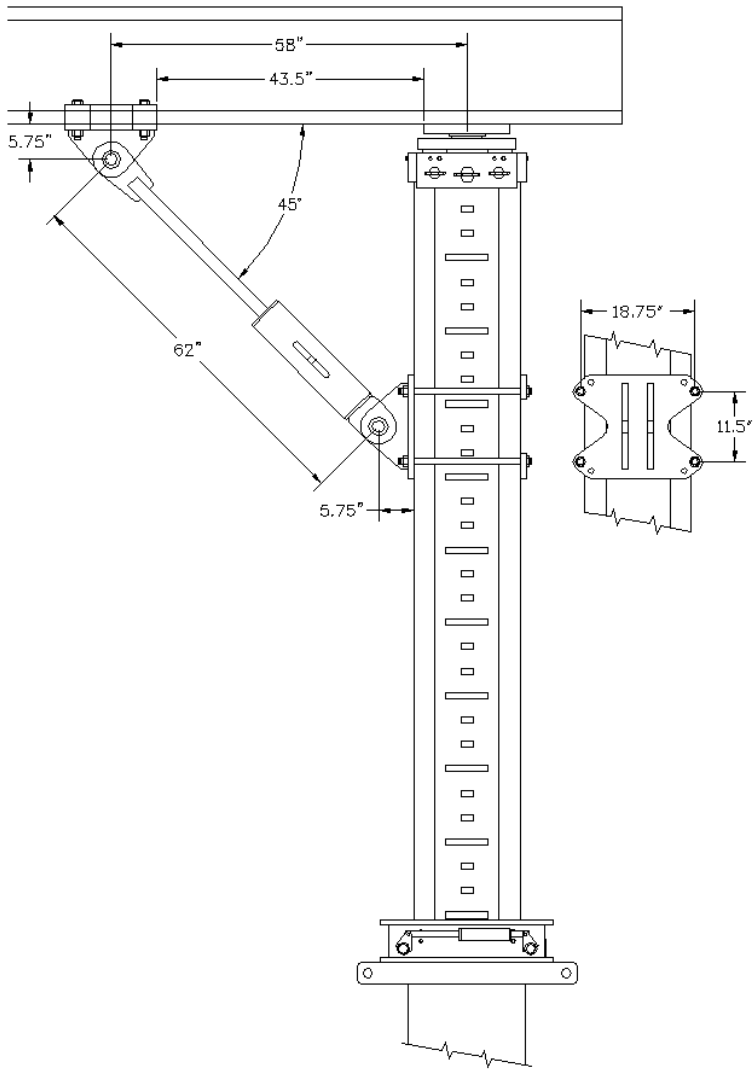


Figure 5-2
Assembled View of Stabilizer Bar
for 800 Series Gantry

Recommended operating range when used with **1st Stage Boom Section:**



Recommended operating range when used with **Manual Boom Section:**

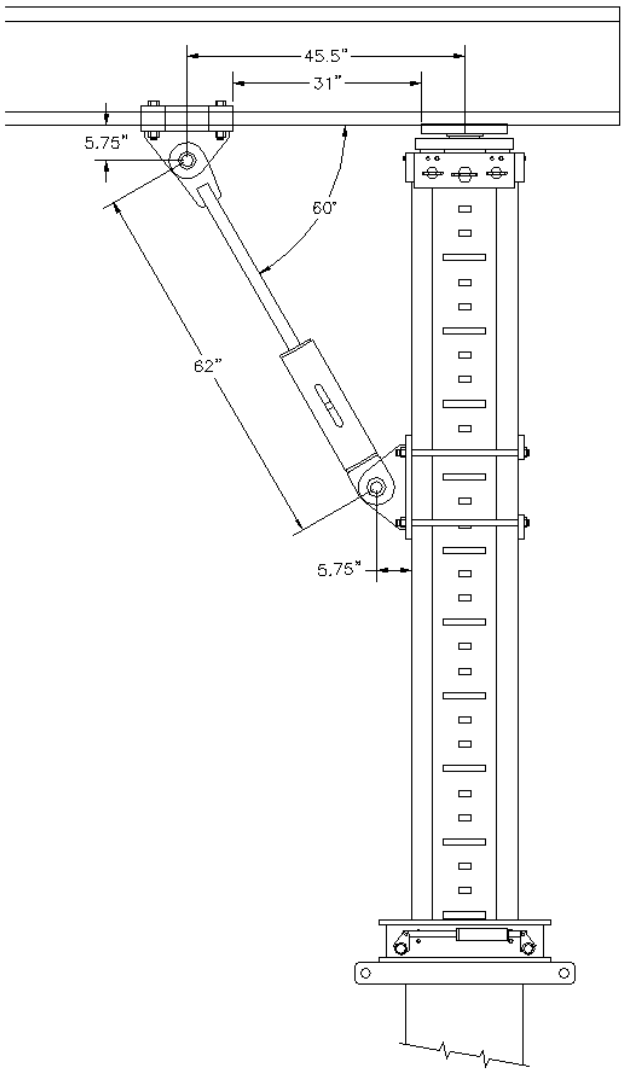
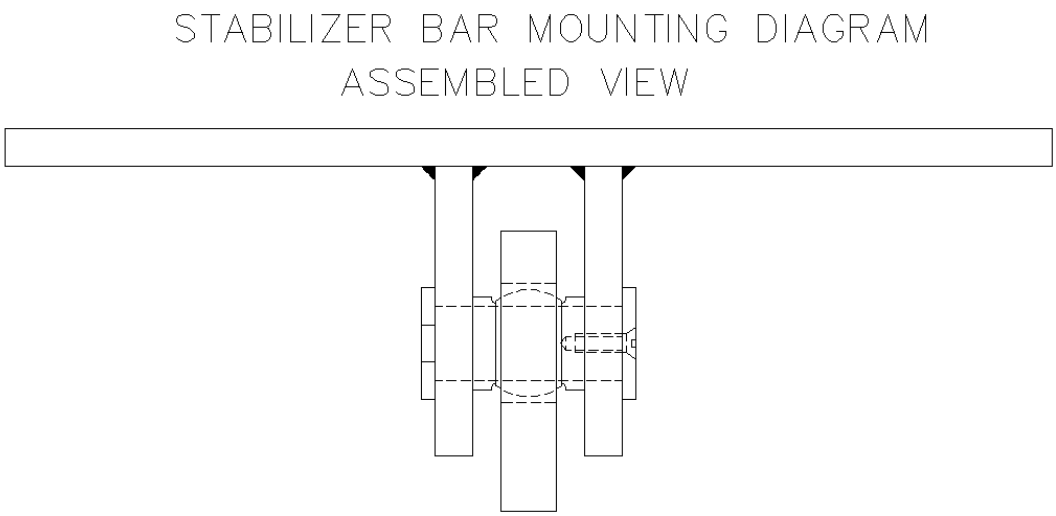
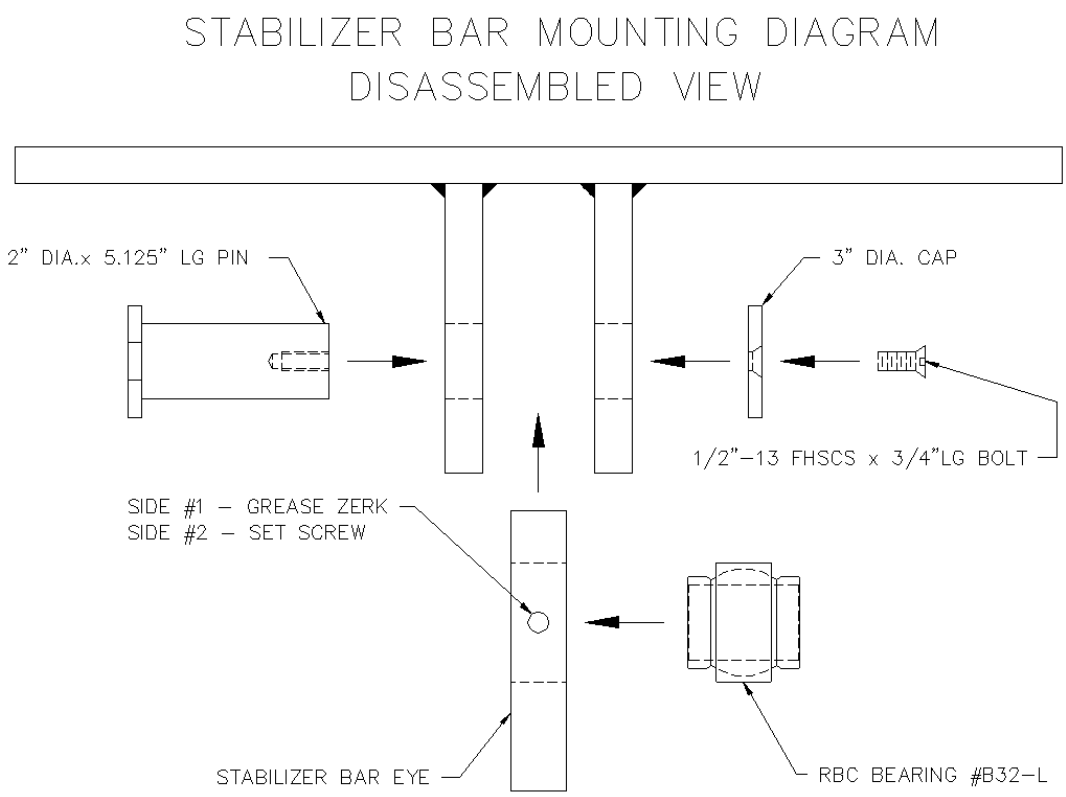


Figure 5-3
Assembled View





7.6 FINAL POSITIONING OF GANTRIES

All lift housings are then propelled into their final lifting position, which is straddling the load with the lift links directly over the lifting points on the load. While propelling with the lift housing, constant attention must be given to housing relationships. Housings must stay straight and parallel to one another at all times.

When four lift housings are being utilized to travel with load, it is recommended that the housings be connected together. Referring to the housing arrangement drawing, #1 housing is connected to #3 housing and #2 housing is connected to #4 housing. This can be accomplished by using three inch square tubing, with at least a .375 inch wall. The length of these tubes will vary with different projects. Bolting the connecting tubes to the tubes on the sides of the housings will secure the connection.

NOTE
THE BEST METHOD FOR TRAVELING WITH FOUR HOUSINGS IS TO ALLOW THE FRONT PAIR (THE PAIR TOWARDS THE DIRECTION OF TRAVEL) TO PULL THE BACK PAIR. THIS IS ACCOMPLISHED BY PLACING THE BACK PAIR OF HOUSINGS INTO THE COAST MODE AND POWERING ONLY THE FRONT PAIR OF HOUSINGS. ONE PAIR OF HOUSINGS WILL, IN MOST CASES, BE CAPABLE OF PULLING THE ENTIRE LOAD.

The rigging, chokers or shackles can now be attached to the lift links and to the load.

*** * * WARNING * * ***
CHOKERS OR RIGGING MUST ALWAYS BE SET UP AND REMAIN PLUM AND PARALLEL TO THE LIFT BOOMS. NONPARALLEL HITCHES WILL RESULT IN BOOM SIDE LOADING AND/OR THE LOAD SHIFTING UPON LIFTING. LOAD SHIFTING CAN RESULT IN HOUSING TIP-OVERS.

When lift links are secured to the load, the lift booms can be extended to a point before the rigging becomes tight.

Before lifting the load, a walk-around inspection is the most efficient method of checking the gantry. The purpose behind such an inspection is to insure that all systems are ñgoò.

SECTION VI

GANTRY USAGE

1.0 OVERVIEW

The hydraulic Gantries can be used in combinations of two or four gantry arrangements. With each combination, certain operating guidelines must be followed to ensure the safety of all personnel involved as well as for the protection of the lifting equipment and components being lifted and/or moved. Following are operational guidelines that will assist the user in performing a safe and accident free lift. To ensure a safe lift and/or move, the operator must be familiar with and understand all previous sections of this manual before starting any lifting operation.

*** CAUTION ***
OPERATIONS INVOLVING A LOAD MUST NOT BE ATTEMPTED UNTIL ALL PREVIOUS SECTIONS OF THIS MANUAL HAVE BEEN READ, UNDERSTOOD AND COMPLETED. THE USE OF THIS SECTION TO MAKE AN ACTUAL LIFT CAN BE ONLY BE FOLLOWED AFTER TESTING WITHOUT A LOAD HAS BEEN COMPLETED, AND ALL OPERATIONS APPEAR NORMAL.

2.0 GANTRY AND CONTROL MODULE OPERATIONS

After testing without a load has been completed, and all operations appear to be normal, the load may be applied.

*** CAUTION ***
GANTRY OPERATOR AND CREW SHOULD CONSTANTLY MONITOR THE LIFT BEAMS' HEIGHT BY MONITORING THE BOOM MARKS AND BEAM LEVEL OR HEIGHT READOUTS TO ENSURE THAT GANTRY SYSTEM IS EXTENDING EVENLY AND LEVEL.

2.1 POWER MANUAL BOOM OPERATIONS

Once all previous instructions are carried out and all units appear to be running normally, the lift booms may be extended. While constantly monitoring beam levelness, the booms are then extended to a height that will clear the top of the load. Once beams and rigging are at a height that will clear this load, the housings are switched from the lifting mode to the propel mode.

2.2 OPERATIONS FOR LIFT WITH ONLY TWO (2) LIFT HOUSINGS

It is recommended that the load originally be lifted only a small amount. The operator should return the control levers to neutral (center position) at the first sign of load swing or side shifting. The load should never be moving sideways as it is being raised. When the load is originally raised only a small amount, the ground or surface that is supporting the load will act as a brake for this sideways movement. Repeat this procedure until you

can see daylight under the load. Once the load is no longer touching the ground and is stable (is not moving), the operator should then stop for safety and stability checks to the gantry system as well as all beams and rigging, to ensure that the load is being held safely. At this time, it is also necessary to double-check the rigging to ensure that it has remained plum and parallel to the lift booms. If the rigging is not plum, the load should be set back down and the rigging repositioned.

2.3 OPERATIONS FOR LIFT WITH FOUR (4) LIFT HOUSINGS

As with two lift housings, it is recommended that the load originally be lifted only a small amount. The operator should return the control levers to neutral (center position) at the first sign of load swing or side shifting. When four lift housings are being used for the lift, it is recommended that the load be lifted a small amount by each pair of housings separately. An example of this would be: lift with the front pair of housings (#1 & #2) a small amount and stop if sideways load movement occurs. Then lift with the back pair of lift housings (#3 & #4) an equal amount and again stop as soon as sideways load movement occurs. Now again lift with the front pair of housings and repeat procedure until you can see daylight under the load. Once the load is no longer touching the ground and is stable (is not moving), the operator should then stop for safety and stability checks to the gantry system as well as all beams and rigging, to ensure that the load is being held safely. At this time, it is also necessary to double-check the rigging to ensure that it has remained plum and parallel to the lift booms. If the rigging is not plum, the load should be set back down and the rigging repositioned.

*** * * WARNING * * ***
WATCH BEAMS AND RIGGING CONSTANTLY FOR SIGNS OF DEFLECTION OR SIGNS OF EXCESSIVE LOADING.

3.0 TRAVELING WITH LOAD AND COMPLETING THE OPERATIONS

After the load is in a stable and satisfactory state, the load may then be lifted to the desired height. This is to occur only if sufficient personnel are available and communications established to adequately monitor the gantry system as per the above WARNING.

When the load is at its desired height and there is sufficient clearance over all objects that it will be passing over, the system may then be transferred to the travel function.

PRIOR TO MOVING THE LOAD WITH THE GANTRIES, RECHECK THE FOLLOWING:

1. BEAM LEVELNESS, FRONT TO BACK AND SIDE TO SIDE.
2. GANTRY POSITION TO ENSURE THAT THEY HAVE REMAINED STRAIGHT AND PARALLEL TO EACH OTHER.
3. PROPEL SYSTEM SELECTOR VALVES, IN THE HOUSINGS, ARE IN THE LIFT HOUSING PROPEL POSITION.

4. OPERATOR IS AWARE OF THE DIRECTION OF THE GANTRY TRAVEL AND THE APPROPRIATE DIRECTION IN WHICH THE OPERATOR CONTROL LEVER MOVEMENT SHOULD BE.

Upon completion of the above steps, the load may then be propelled to its desired position. The gantry operator and their crew must constantly monitor all previously noted inspections throughout the course of the lift.

*** * * WARNING * * ***
GANTRIES MUST ALWAYS TRAVEL STRAIGHT AND PARALLEL TO ONE ANOTHER. INCONSISTENT RELATIONSHIPS BETWEEN GANTRIES WHEN TRAVELING MAY CREATE TORQUE IN THE BEAMS AND LOAD. THIS CAN CREATE AN UNSTABLE LIFT CONDITION.

After the housings have traveled the distance required, lowering of the load is the next operation. Prior to lowering the load, a walk-around inspection should be done. The Cam Lock system must be in the ñOPENò or ñOFFò position.

As with lifting a load, lowering of a load should be closely watched. This is to ensure that all gantries, rigging, etc. remain plum and level throughout the duration of the descent. It is recommended that the operation of lowering the load be the same as the operation of lifting the load. By following these steps the gantry operator will have better control.

Once the load is completely removed from gantries, the gantries can be removed. This can be accomplished by simply reversing the order of assembly.

SECTION VII

AN OVERVIEW OF THINGS TO WATCH AND DO DURING OPERATION

- **ALWAYS** check the load chart against the pressure gauge reading - never take someoneôs word for what a load weighs. If the pressure gauge readout and the chart say that the load is more than the lift was originally planned for, do not attempt to lift the load until the new weight of the load and itôs effect on the gantry and beams can be accurately calculated.

- **ALWAYS** use beam level indicating readouts, boom marks or hand held level to determine if the gantries and load are plumb and level.

- **ALWAYS** check all rigging, shackles, chokers and other lifting equipment to make sure they will handle the specific load that is to be lifted.

- **ALWAYS** have beams checked by a qualified engineer or the factory for verification of their strength capacities.

- **ALWAYS** understand all the operating procedures, including the safety procedures, before operating your gantry.

- **ALWAYS** perform a complete systems check before each start up.

- **ALWAYS** keep rigging, i.e.: chokers, cables, shackles or powerlink lift shafts, vertical and plum with the lift boom.

- **ALWAYS** be alert to clearances required between the gantry booms or beams and any building structures or equipment that is in the area of the project.

- **ALWAYS** alert overhead crane operators if working in their area.

- **CAUTION** must be taken, at all times, to prevent anything from interfering with the operational controls on the gantry or the control module. If your control module is equipped with the two-speed system, the lever will automatically destroke. Allow this lever movement to occur as this reduces the speed of the booms upward movement.

- **ALWAYS** have enough man power so that one crew member can:
    1. Operate each gantry by switching the levers or by adjusting the speed controls.
    2. Guide the cable and or hose assemblies so that they are not run over or become snagged while the gantries are traveling with or without the load.
    3. Watch and monitor the gantryôs levelness.

- **ALWAYS** route the hydraulic pressure hoses to avoid the heavy traffic lanes.

- **ALWAYS** be aware of any electrical lines and never bring a gantry, beam, track or control module within fifteen (15) feet of high voltage power lines.

- **ALWAYS** ensure that no personnel are allowed to be under a load that is suspended by only the gantry unless safety stands of suitable strength are placed between the load and itôs landing surface.

SECTION VIII

AN OVERVIEW OF THINGS NEVER TO DO DURING OPERATION

- **NEVER** set up the control module in any of the following ways:

    1. **NEVER** set up the control module on unstable ground.

    2. **NEVER** set up the control module in a position that does not allow the operator to clearly see the gantry or load.

    3. **NEVER** set up the control module under a live stationary load.

    4. **NEVER** set up the control module in a heavy traffic lane.

    5. **NEVER** set up the control module in an area that does not allow the operator an escape path away from the load in the event of an emergency.

- **NEVER** allow any unauthorized or unskilled personnel to operate the gantry system.

- **NEVER** lift a load when the rigging is not vertical. If a load is lifted and the rigging is not vertical, the load will swing and an unstable lift condition could result.

- **NEVER** allow the load to be unlevel, to compensate for any rigging that is of different length or to tip the load for any reason.

- **NEVER** jerk or pull operating levers quickly. Always activate levers in a smooth and even manner. If your control module is equipped with the two-speed system, NEVER force the levers down while the valve is destroking itself. This can result in damage to the levers. This will also make the lift booms extend too quickly for the operator to monitor all system checks that must be performed during load movement.

- **NEVER** leave equipment unattended while holding a load unless the cam lock system is ñONò (closed) and the load is properly cribbed or blocked for safety.

- **NEVER** operate the equipment without performing all the necessary system checks, tests and inspections.

- **NEVER** operate a malfunctioning unit; shut it down and seek qualified assistance.

- **NEVER** overload beams, the rigging or the supporting surfaces.

- **NEVER** overload the gantry. If the load is over the capacity of the gantry, the gantry will simply not lift the load. The gantry can be overloaded if an over capacity load is placed on top of the system when it is already extended.

SECTION IX

MAINTENANCE AND INSPECTION SCHEDULE
FOR THE J&R ENGINEERING LIFT-N-LOCK BOOM GANTRY

1.0 LIFT HOUSINGS AND LIFT BEAM

COMPONENT	CHECK BEFORE EACH STARTUP	MAINTENANCE ITEM
PLANETARY GEAR DRIVE (See Section 3.0 Below)	OIL LEVEL VIA SIGHT BUBBLE	CHANGE OIL ANNUALLY
DRIVE CHAIN	FOR BROKEN OR DEFORMED LINKS	GREASE BEFORE USE, REPLACE BROKEN OR DEFORMED LINKS
WHEEL GREASE		GREASE VIA FITTINGS EVERY SIX (6) MONTHS
HYDRAULIC LINES OR HOSES	LEAKING OR DAMAGED LINES MUST BE TIGHTENED OR REPLACED	TIGHTEN OR REPLACE AS NECESSARY
FUNCTION SELECTOR VALVES	DAMAGED OR MALFUNCTIONING LEVERS	REPAIR WHEN NECESSARY
SPEED CONTROLS	DAMAGED OR MALFUNCTIONING KNOBS	REPAIR OR REPLACE WHEN NECESSARY
CAM LOCK SYSTEM	WHEN POWER IS APPLIED TO THE HOUSING CAM LOCKS OPEN AND THEN CLOSE WHEN POWER IS DEACTIVATED	
HEADER PLATE	HAS FULL RANGE OF MOTION, PIVOTING AND ROTATING	HEADER PLATE MUST BE REMOVED ANNUALLY AND THE BEARING CUP PACKED WITH GREASE
LEVEL INDICATING SYSTEM	WHEN SYSTEM IS ENGAGED AND THE HEADER PLATE IS MOVED, SIGNAL IS RECEIVED BY INDICATOR ON CONTROL MODULE	
LIFT CYLINDER	WHEN POWER IS APPLIED, THE BOOM EXTENDS AND RETRACTS	
PROPEL SYSTEM	WHEN POWER IS APPLIED, DOLLIES PROPEL FORWARD AND BACKWARD	
MANUAL LOCK COLLAR AND PINS	DAMAGE OR STEEL ABNORMALITIES	REPLACE AS NECESSARY
LIFT BEAM FASTENING BOLTS	DAMAGE TO BOLT THREADS OR PLATES	REPLACE AS NECESSARY
LIFT LINKS AND LIFT BEAMS	DAMAGE OR STEEL ABNORMALITIES	REPLACE AS NECESSARY
HOUSING AND BOOM STRUCTURES	DAMAGE OR STEEL ABNORMALITIES	REPLACE AS NECESSARY

2.0 CONTROL MODULE

COMPONENT	CHECK BEFORE EACH STARTUP	MAINTENANCE ITEM
MOTOR OIL*	OIL LEVEL VIA THE ENGINE DIPSTICK	CHANGE EVERY 100 HOURS OF OPERATING TIME
MOTOR OIL FILTER*		CHANGE EVERY 100 HOURS
ENGINE COOLANT*	COOLANT LEVEL VIA RADIATOR CAP	USE ANTIFREEZE FOR COLD WEATHER APPLICATIONS
ENGINE AIR FILTER*		CHANGE ANNUALLY
HYDRAULIC OIL	OIL LEVEL VIA TANK SIGHT GAUGE	CHANGE IF OIL BECOMES MILKY OR WATER SATURATED
HYDRAULIC OIL FILTER (See Section 4.0 Below)	CHECK GAUGE	CHANGE IF NEEDLE IN GAUGE PASSES INTO OR BEYOND THE YELLOW AREA
HYDRAULIC LINE OR HOSES	LEAKING OR DAMAGED LINES MUST BE TIGHTENED OR REPLACED	TIGHTEN OR REPLACE AS NECESSARY
HYDRAULIC OIL RESERVIOR	OIL LEAKS OR STRUCTURAL DAMAGE TO STEEL FRAME	REPAIR AS NECESSARY
CONTROL VALVE	CONTROL LEVERS HAVE FULL RANGE OF MOTION AND WHEN LEVERS ARE ENGAGED, SYSTEM P.S.I. BUILDS TO 3000 PSI	
BOOM HEIGHT & LEVEL INDICATING SYSTEM	INDICATING PANEL HAS POWER	

* Does not apply to Control Modules with electric motors.

3.0 HYDRAULIC PLANETARY GEAR REDUCING PROPEL SYSTEM

3.1 LUBRICATION OF GEAR BOX HOUSING - The first oil change should be made after approximately 50-100 working hours. The same oil can be used again, provided that is carefully filtered to remove any small metal particles resulting from the breaking-in process. Before filling the gear case again flush it with fluid recommended for this purpose by the lubricant manufacturer. Subsequent oil changes should be made every 2,500 working hours, or at least once a year. The oil should be changed when hot to prevent build up of sludge deposits. In the cases of heavy duty cycles (high loads, shocks or wet environments) even shorter interval should be kept between changes.

- It is advised to check the oil level at least once per month. If more than 10% of the total oil capacity has to be added, check for oil leaks. Do not mix oils of different types. For wide temperature changes, synthetic lubricants with EP additives are recommended (minimum viscosity index of 165, viscosity class VG 150 of VG 320). Never mix mineral and synthetic oils. Failure to comply with these recommendations may result in premature wear and or failure of the gearbox or its components.

3.2 MAINTENANCE OF GEARBOX - Periodically check for bolt tightness and good alignment between the gearbox and the driveshaft. Check the magnetic plugs and clean them on a regular basis. If you should notice heavy particle deposits, contact the factory. It is necessary to rotate the input sprocket every month to lubricate the gears and the bearings; protecting them from corrosion. For longer period spent out of service, (i.e. greater than one month), the gearbox housings should be completely filled with oil.

3.3 OIL SPECIFICATION - Any oil which meets EP Gear Lubricant specifications.

3.4 OIL CHANGE - After the initial 50 hours, and thereafter every 2,500 hours or one year, whichever comes first.

3.5 OIL FILL LEVEL - Gearbox housing must be half full.

3.6 OIL TYPE - EP 90, Viscosity Index 95 minimum, per ISO 3448.

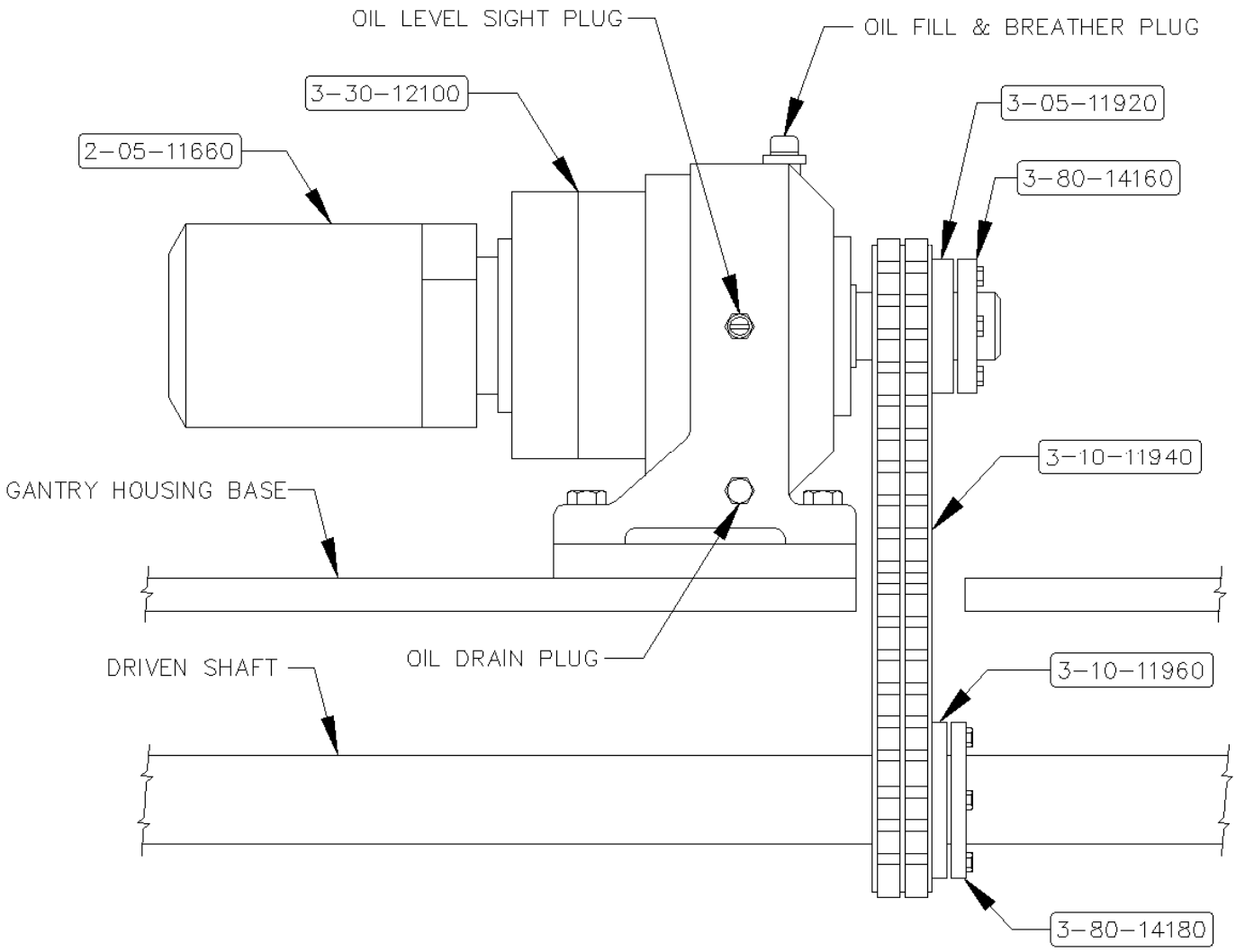
3.7 OIL TEMPERATURE - Should not exceed 180 degrees Fahrenheit.

3.8 CHOICE OF LUBRICANTS

- SAE J 306
- ISO 3448
- MIL-L-2105C

OIL MANUFACTURER	TRADE NAME
Sohio (Boron)	Gearep 85
Castrol	Alpha AP 150
Mobile	Mobilgear 629
Shell	Spirax HD 80W-90
Exxon	Spartan EP 150
Gulf	EP HD 150
Texaco	Meropa 150
Kendall	NS-MP Hypoid 75W, 80/90

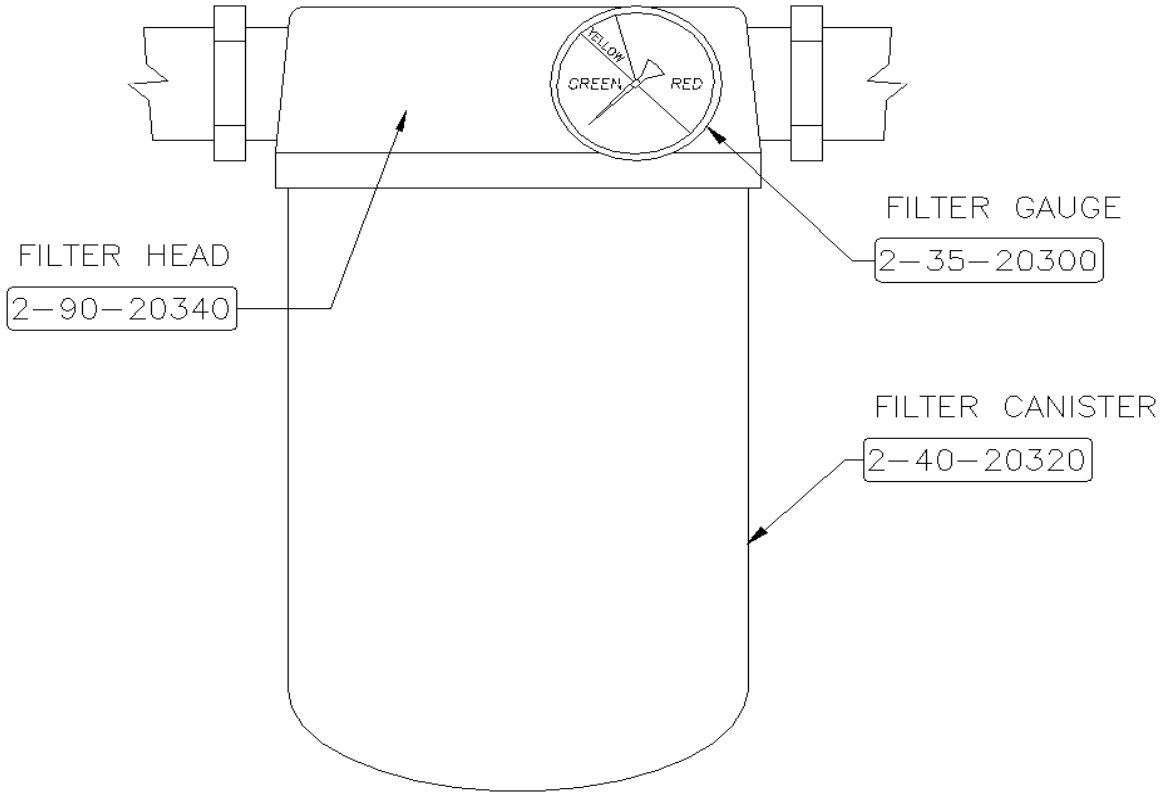
PLANETARY GEARBOX HOUSING

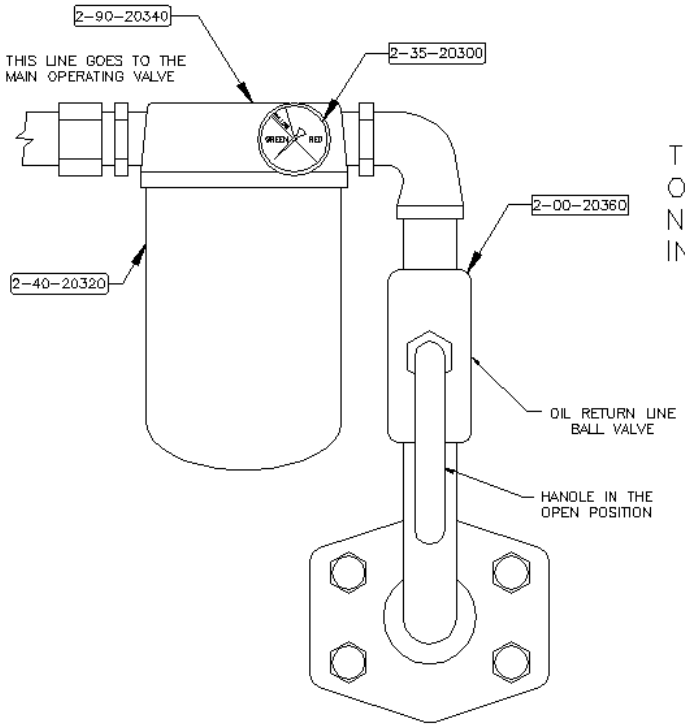


4.0 HYDRAULIC OIL FILTER MAINTENANCE

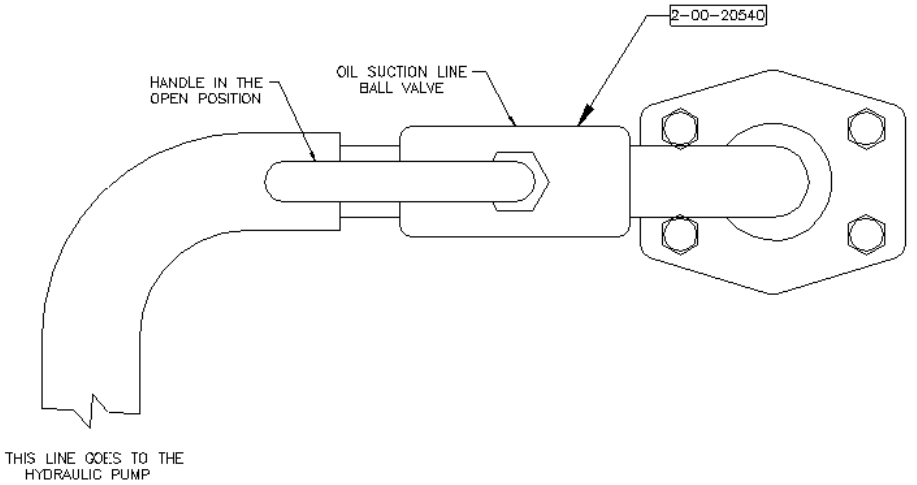
It is extremely important to keep the hydraulic oil used in the gantry system clean and free from contamination. To ensure the filtration system is working properly, a filter gauge has been installed that will provide an indication of proper operation. It is essential for long-term use of the gantry system that the filter maintenance provided in this section be followed.

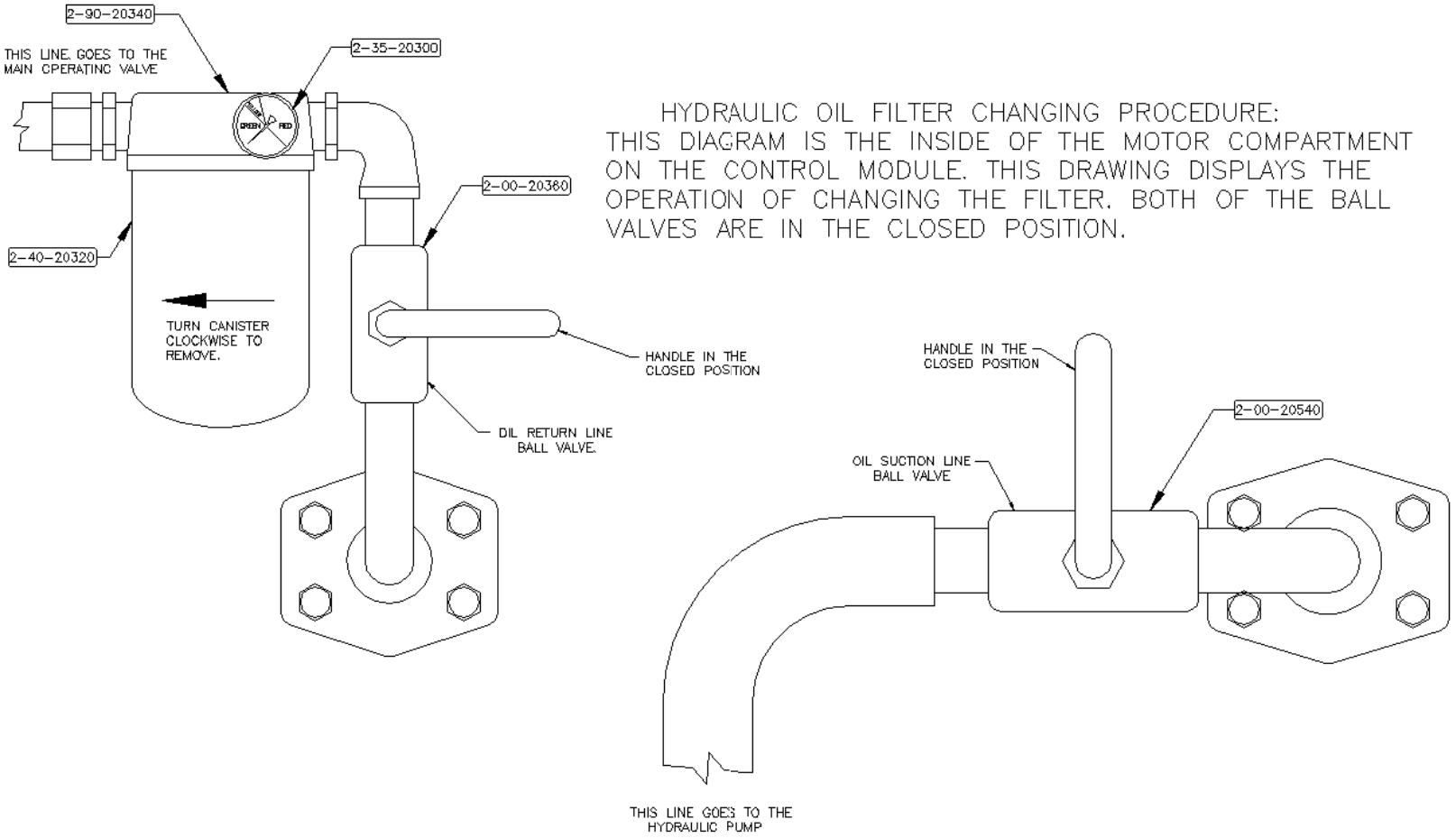
HYDRAULIC OIL FILTER & GAUGE:
THE GAUGE INDICATES BACK PRESSURE IN THE FILTER CANISTER AND HAS A NORMAL OPERATING ZONE THAT IS GREEN. WHEN THE NEEDLE MOVES INTO THE YELLOW ZONE, IT IS TIME TO CHANGE THE FILTER CANISTER. THIS MUST BE CHECKED WHEN THE CONTROL MODULE IS RUNNING AND ALL OPERATING LEVERS ARE FULLY ENGAGED. IF THE NEEDLE IS ALLOWED TO PASS INTO THE RED ZONE, THE HYDRAULIC OIL WILL SIMPLY BYPASS THE FILTER AND GO DIRECTLY INTO THE HYDRAULIC TANK WITHOUT BEING FILTERED. FOLLOW THE FILTER CHANGING PROCEDURE FOR REPLACING THE CANISTER.





HYDRAULIC OIL FILTER CHANGING PROCEDURE:
THIS DIAGRAM IS THE INSIDE OF THE MOTOR COMPARTMENT ON THE CONTROL MODULE. THE DRAWING DISPLAYS THE NORMAL OPERATING MODE. BOTH OF THE BALL VALVES ARE IN THE OPEN POSITION.





HYDRAULIC OIL FILTER CHANGING PROCEDURE:
THIS DIAGRAM IS THE INSIDE OF THE MOTOR COMPARTMENT ON THE CONTROL MODULE. THIS DRAWING DISPLAYS THE OPERATION OF CHANGING THE FILTER. BOTH OF THE BALL VALVES ARE IN THE CLOSED POSITION.

Table 9-1

800 Series Gantries

GANTRY LIFT HOUSING PARTS LIST

Part #: 1-xx-xxxxx = Electrical; 2-xx-xxxxx = Hydraulic; 3-xx-xxxxx = Mechanical

Part #	Qty/Leg	Description
1 - 05 -10240	1	LIFT BOOM INDICATING SENSOR CABLE RECEPTACLE
1 - 10 -10260	1	100ôSHIELDED ENCODER 5-WIRE CONTROL CABLE
1 - 10 -11640	1	ENCODER 5-WIRE CONTROL CABLE (W/FEMALE END)
1 - 80 -11560	1	LIFT BOOM HGT INDICATOR TRNSDR & ENCODER MODULE
2 - 00 -10100	1	MAIN POWER SELECTOR VALVE
2 - 00 -10120	1	PROPEL SYSTEM SELECTOR VALVE
2 - 00 -10140	1	LIFT HOUSING PROPEL/FREEWHEEL VALVE
2 - 00 -10180	2	LIFT HOUSING PROPEL SPEED CONTROL VALVE
2 - 00 -10200	1	CAM LOCK SHUT-OFF VALVE
2 - 00 -10220	1	LIFT CYLINDER RETRACT SPEED CONTROL VALVE
2 - 00 -13281	1	CAM LOCK SEQUENCE VALVE
2 - 00 -10840	1	PROPEL MOTION CONTROL VALVE
2 - 00 -10860	1	CAM LOCK CHECK VALVE
2 - 00 -10900	1	CAM LOCK SHUTTLE VALVE
2 - 00 -14140	1	CYLINDER PRESSURE RELIEF VALVE
2 - 00 -10980	1	LIFT CYLINDER EXTEND LOCK VALVE
2 - 00 -11000	1	LIFT CYLINDER RETRACT LOCK VALVE
2 - 00 -14120	1	DUAL LOCK VALVE BLOCK ï 800 SERIES
2 - 05 -11660	1	PROPEL HYDRAULIC DRIVE MOTOR
2 - 15 -14040	1	CAM LOCK CYLINDER
2 - 15 -13360	1	LIFT CYLINDER ï 800 SERIES
2 - 40 -10160	1	1/2" NPT POWER HOSE QUICK COUPLING (FEMALE)
2 - 40 -10161	1	3/4" NPT POWER HOSE QUICK COUPLING (FEMALE)
2 - 90 -11320	2	LEVER MOUNT
2 - 90 -11340	2	LEVER LINKAGE
2 - 90 -11360	2	LEVER
3 - 00 -13620	1	HEADER PLATE BEARING OUTER CUP
3 - 00 -11780	8	IDLER WHEEL BEARINGS (2 PER WHEEL)
3 - 00 -11800	7	DRIVE WHEEL BEARINGS
3 - 00 -13600	1	HEADER PLATE BEARING INNER CONE
3 - 00 -13560	1	HEADER PLATE INNER BEARING SPACER
3 - 00 -13540	1	HEADER PLATE INNER BEARING
3 - 00 -13520	1	HEADER PLATE INNER BEARING RETAINING HUB
3 - 00 -13500	1	HEADER PLATE INNER BEARING RETAINING WASHER
3 - 05 -11920	1	GANTRY LEG DRIVE SPROCKET

3 - 06 -13740	1	EXTERNAL CAM LOCK SPRING
3 - 06 -14060	1	EXTERNAL CAM LOCK SPRING LINKAGE
3 - 10 -11940	1	GANTRY LEG DRIVE CHAIN
3 - 10 -11960	1	GANTRY LEG DRIVEN SPROCKET
3 - 15 -11980	1	POWER MANUAL CENTER CYLINDER BOOM PIN (Large Dia)
3 - 15 -14000	2	POWER MANUAL BOOM PINS (Small Diameter)
3 - 20 -12000	2	IDLER WHEEL SHAFT NUT
3 - 20 -12020	2	IDLER WHEEL SHAFT WASHER
3 - 20 -13480	1	HEADER PLATE BOLT
3 - 20 -12060	4	CAM BOLT
3 - 20 -13700	4	CAM LOCK CYLINDER PIVOT SHAFT BOLT
3 - 20 -13720	2	CAM LOCK CYLINDER ROD BOLT
3 - 20 -13780	8	SLIDER PAD BOLT
3 - 20 -14020	8	LIFT CYLINDER MOUNTING BOLTS
3 - 30 -12100	1	PLANETARY DRIVE GEAR BOX
3 - 45 -12120	4	CAMS
3 - 45 -13660	2	CAM LOCK CYLINDER MOUNT
3 - 45 -12160	1	CAM LOCK SPRING MOUNT ï RIGHT HAND
3 - 45 -12180	1	CAM LOCK SPRING MOUNT ï LEFT HAND
3 - 95 -14100	2	CAM LOCK MOUNTING SHAFT
3 - 50 -12200	4	GANTRY LEG DRIVE WHEELS
3 - 50 -12220	4	GANTRY LEG IDLER WHEELS
3 - 55 -12240	8	IDLER WHEEL SPACERS - STEEL
3 - 55 -12260	8	DRIVE WHEEL SPACERS - NYLON
3 - 73 -12280	2	DRIVE WHEEL RETAINER WASHER
3 - 73 -12300	2	IDLER WHEEL RETAINER PLATE (TEAR DROP)
3 - 80 -14160	1	BUSHING ï DRIVE SPROCKET
3 - 80 -14180	1	BUSHING ï DRIVEN SPROCKET
3 - 90 -12320	1	MANUAL LOCK COLLAR
3 - 90 -13580	1	HEADER PLATE ï LIFT BEAM
3 - 90 -12360	1	HEIGHT INDICATOR CABLE SUPPORT ARM
3 - 90 -10720	11	GREASE FITTINGS (ZERKS)
3 - 90 -14080	1	CAM LOCK EQUALIZER BAR
3 - 90 -13460	1	HEADER PLATE BEARING COVER
3 - 95 -12400	2	IDLER WHEEL SHAFT
3 - 95 -12420	1	DRIVE WHEEL SHAFT
3 - 95 -12440	1	DRIVE SHAFT

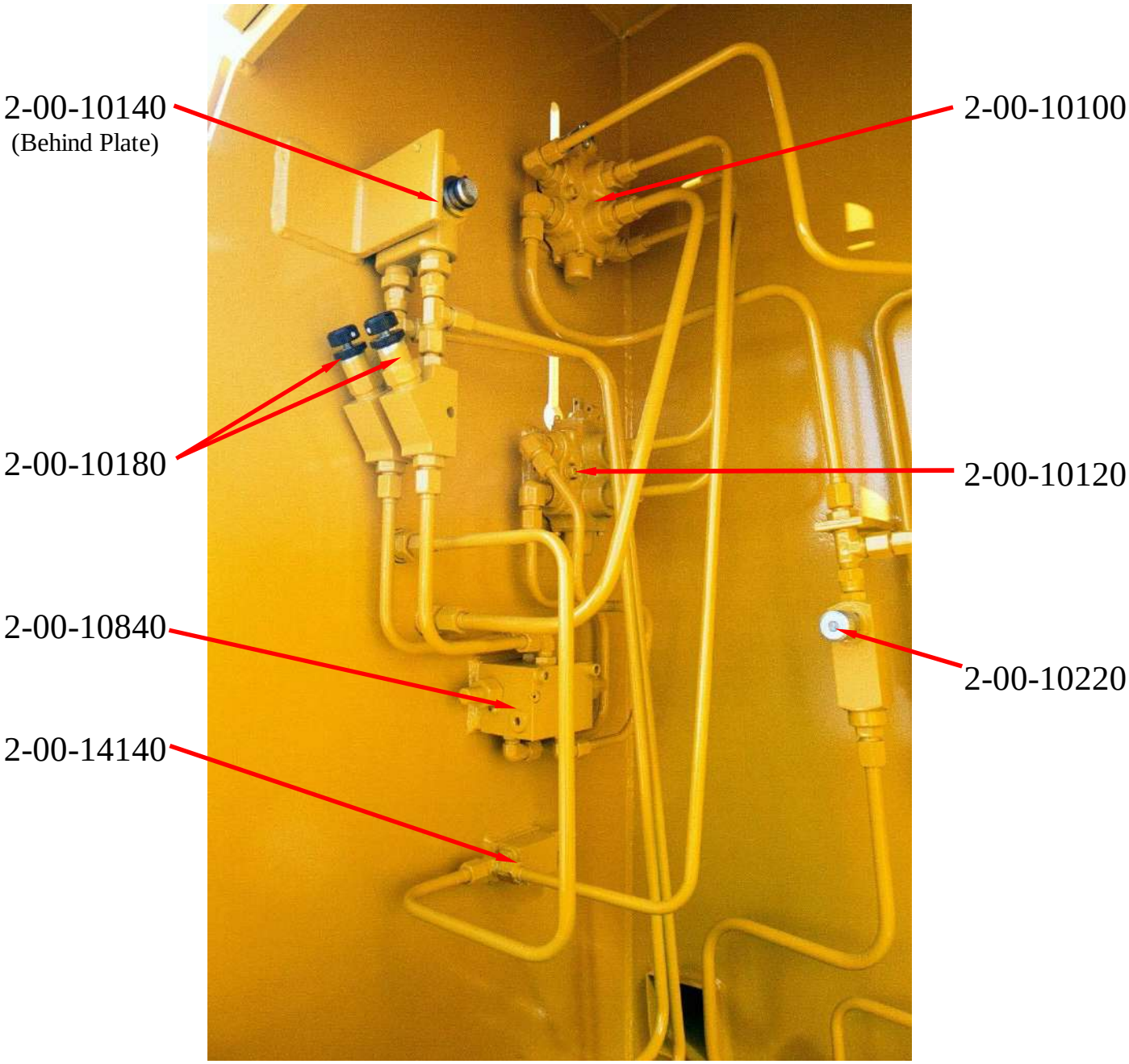
Pictures 9-2

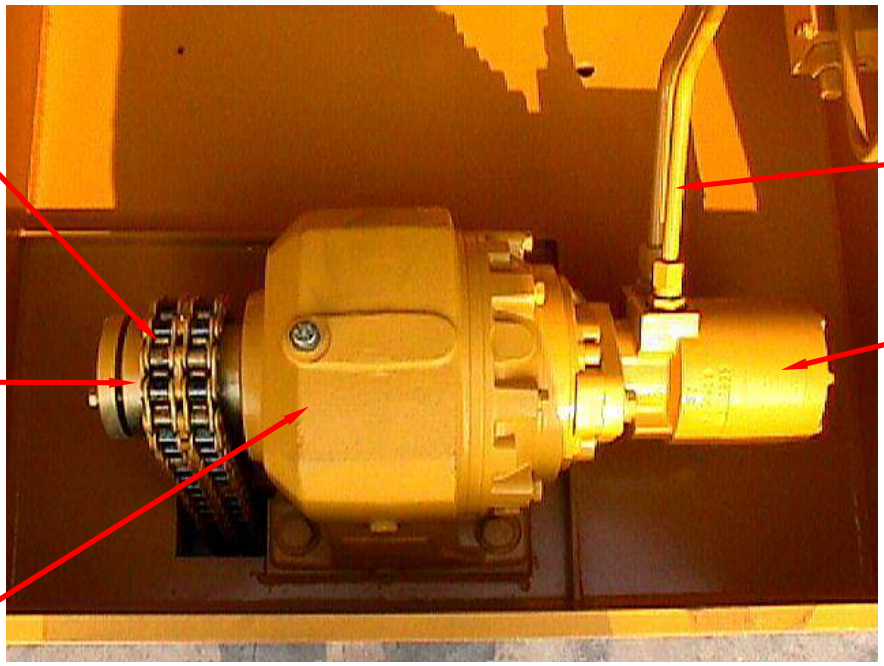
Pictorial and Numerical Nomenclature of Parts and Components on the J&R Engineering 800 Series LIFT-N-LOCK Hydraulic Boom Gantries

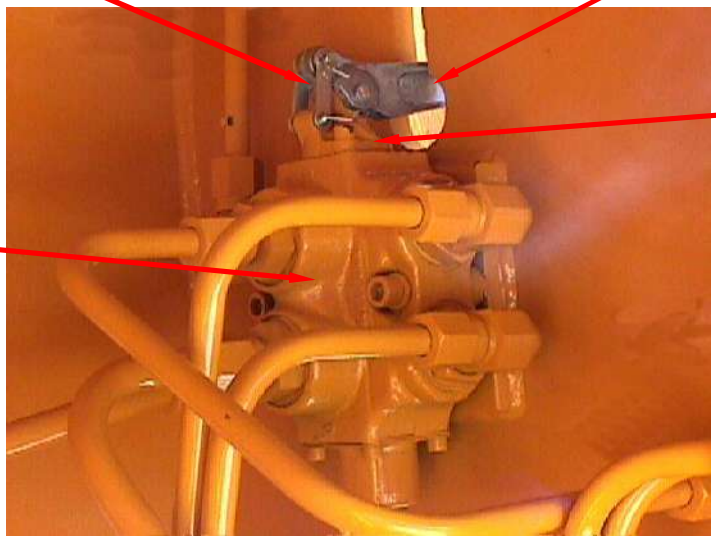
Model L801-4-27

GANTRY LEG EXTERIOR COMPONENTS

GANTRY LEG INTERIOR COMPONENTS

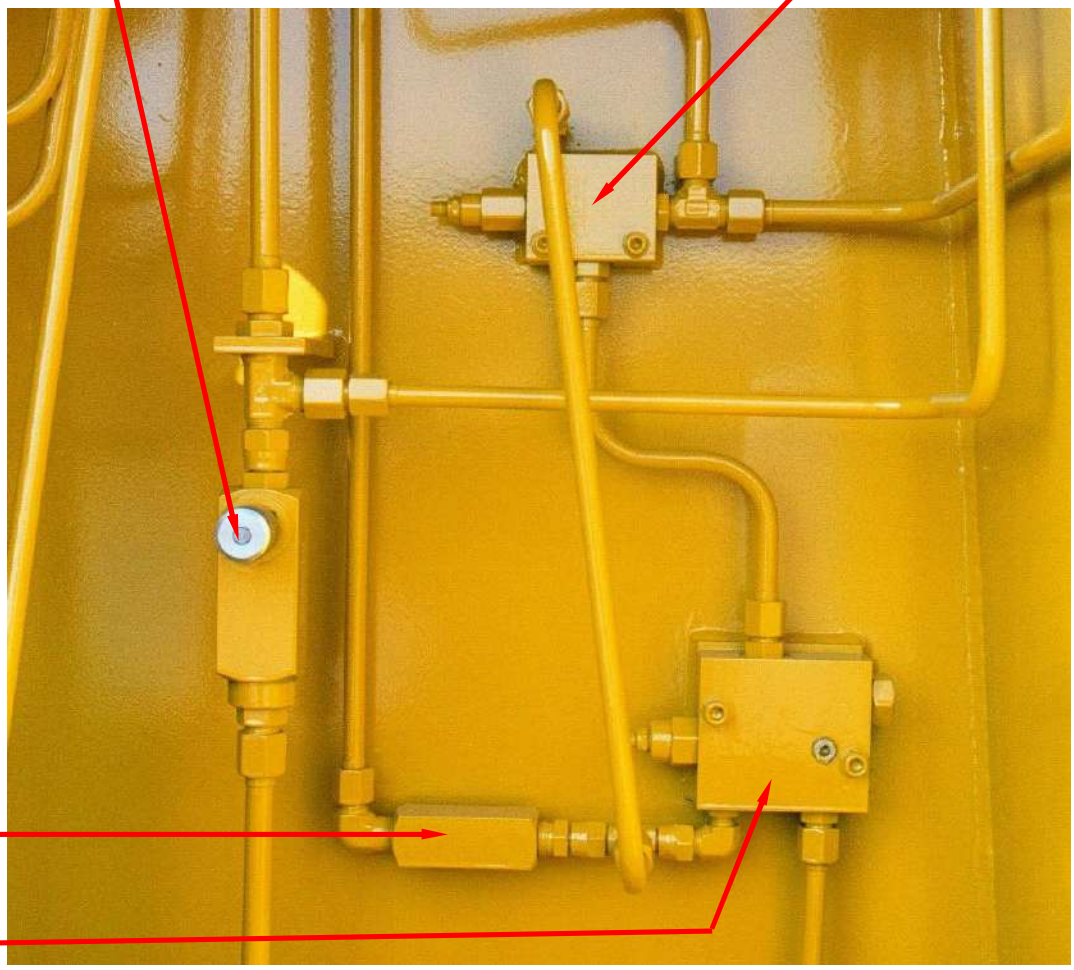



3-05-11920
3-10-11940
3-30-12100
Drive Motor Hydraulic Supply & Return Lines
2-05-11660


LEVER LINKAGE
2-90-11340
LEVER
2-90-11360
LEVER MOUNT
2-90-11320
MAIN POWER SELECTOR VALVE
2-00-10100

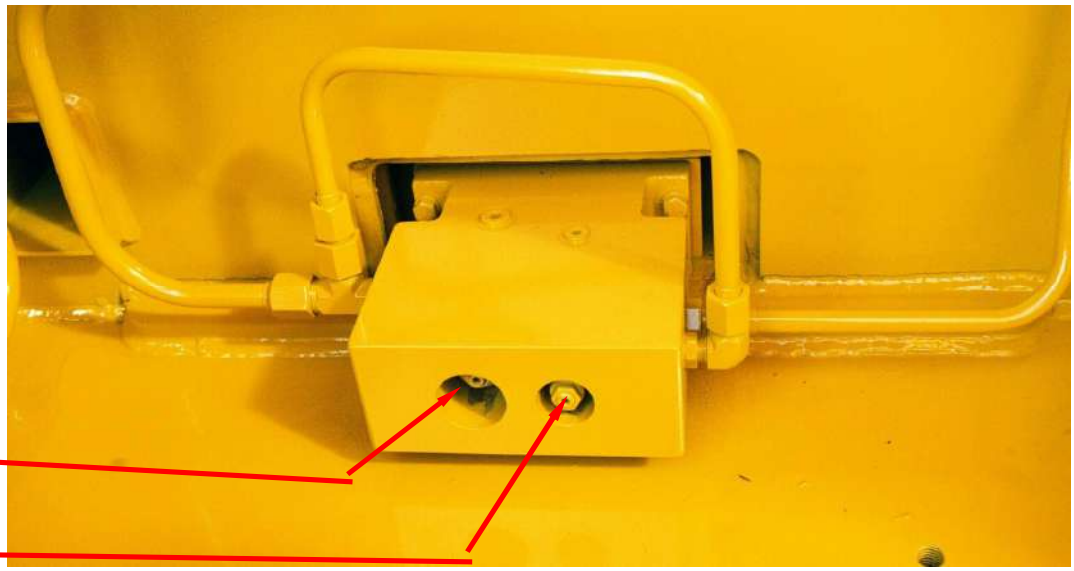
Lift Cylinder Retract Speed Control Valve
2-00-10220

Cam Lock Sequence Valve
2-00-13281



2-00-14200

2-00-14220



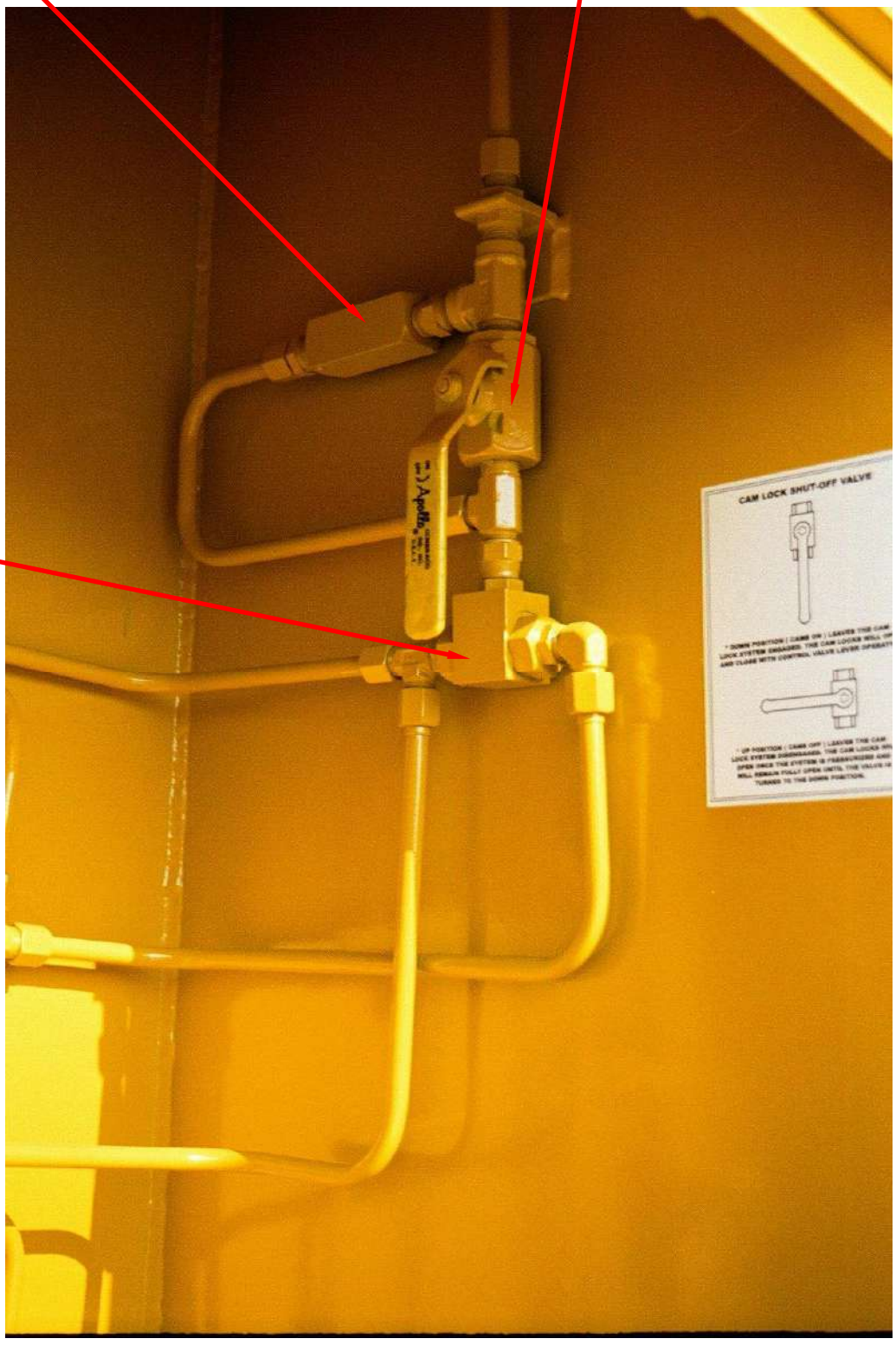
2-00-10980

2-00-11000

Cam Lock Check Valve
2-00-10860

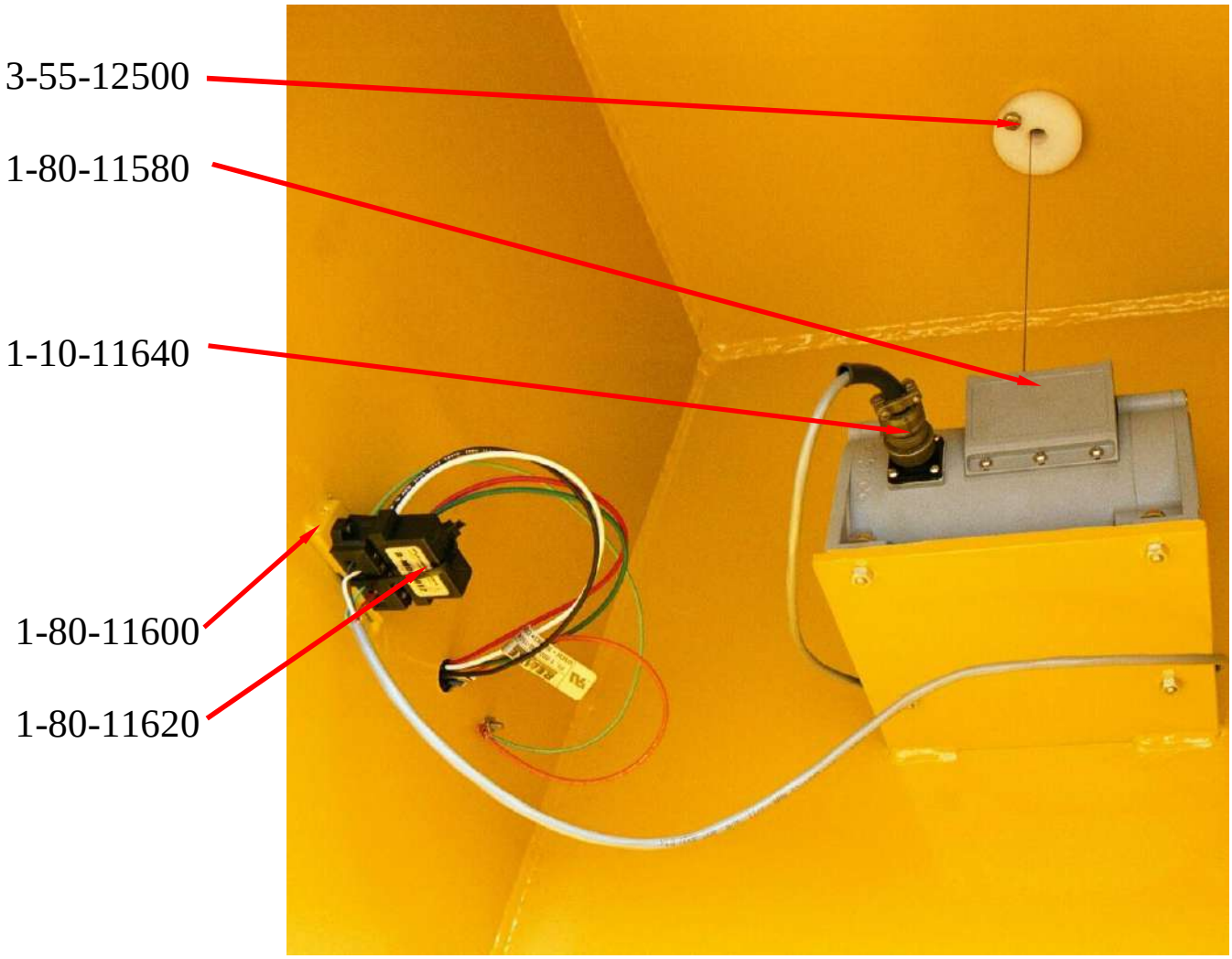
Cam Lock Shut-off Valve
2-00-10200

Cam Lock
Shuttle Valve
2-00-10900

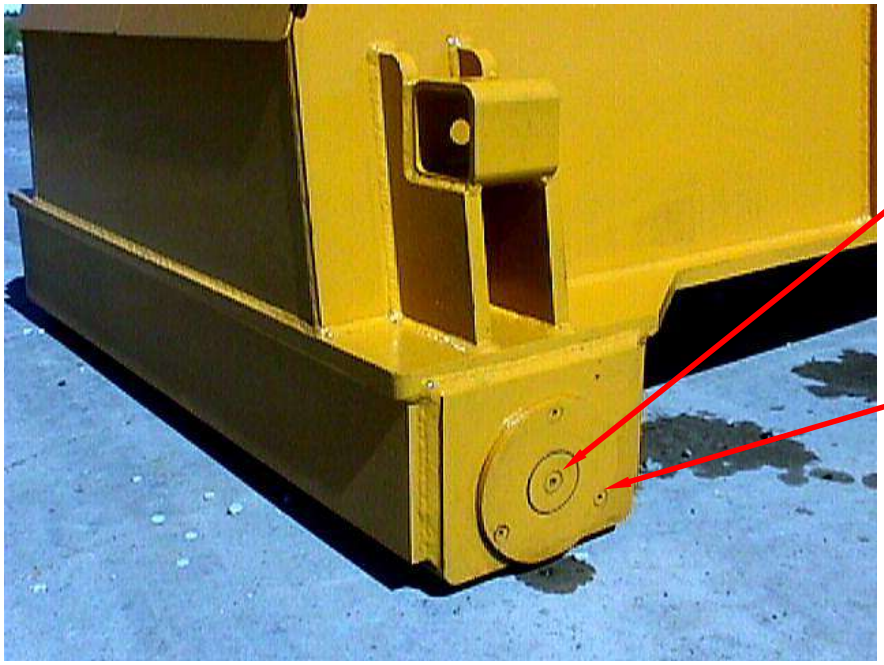


LIFT BOOM HEIGHT INDICATING SYSTEM

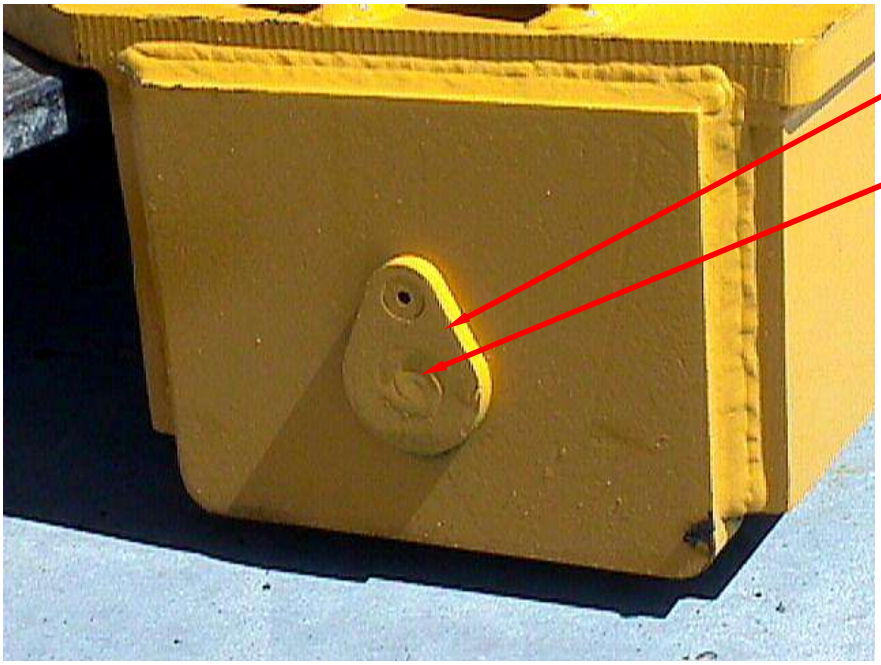
(Located in Gantry Leg Housing)



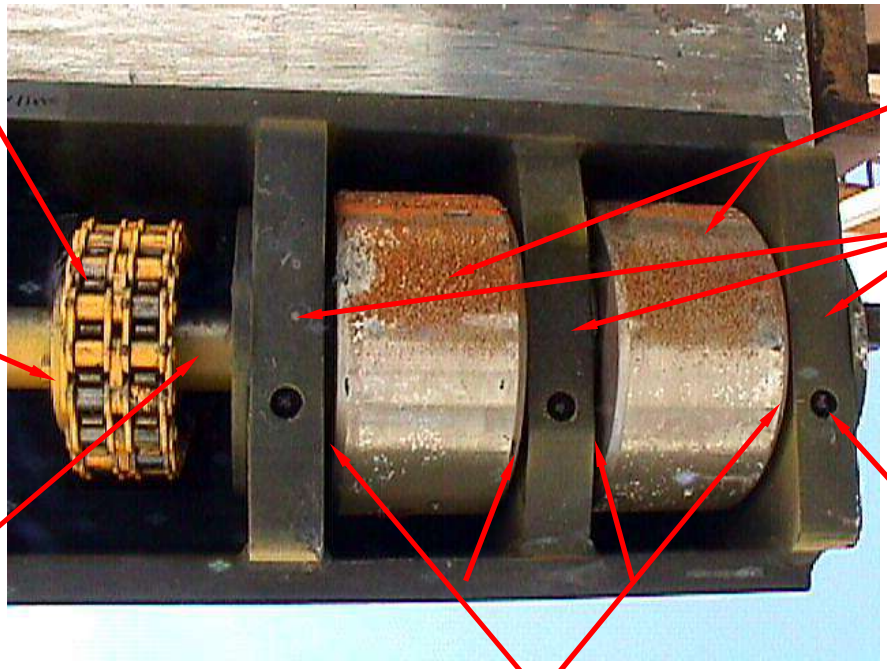
SIDE VIEW OF GANTRY - DRIVE WHEEL END



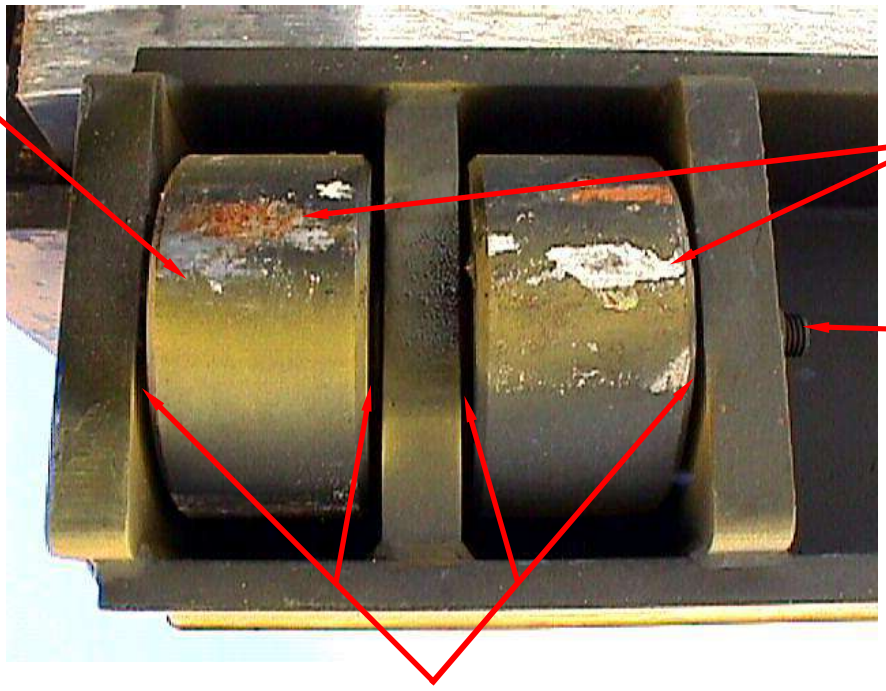
SIDE VIEW OF GANTRY - IDLER WHEEL END



VIEW OF GANTRY UNDERSIDE - DRIVE WHEEL END

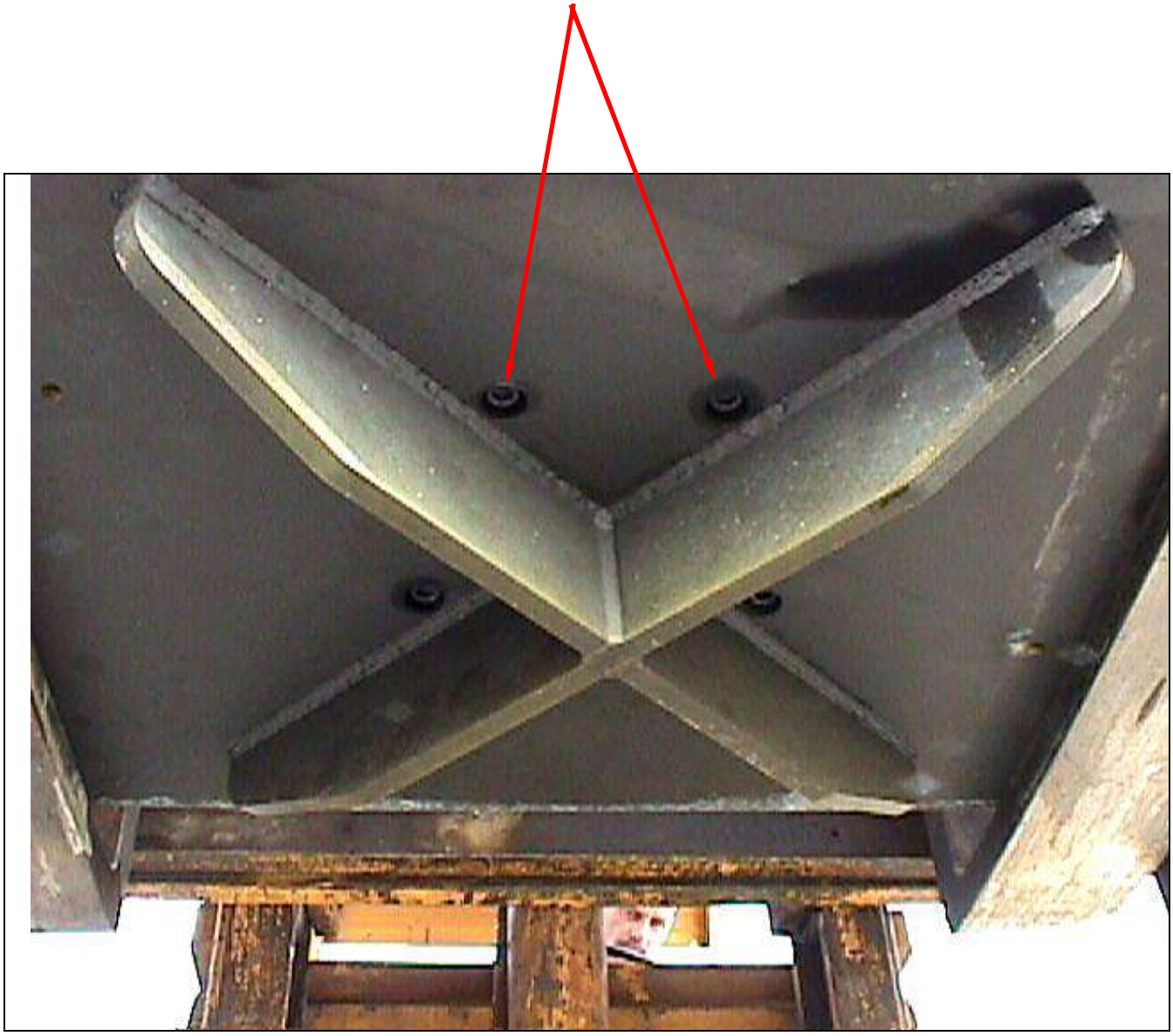


VIEW OF GANTRY UNDERSIDE - IDLER WHEEL END

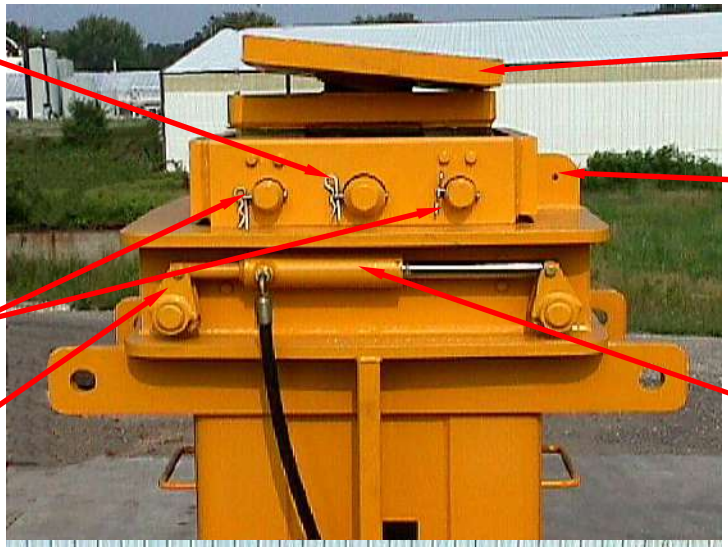


UNDERSIDE OF GANTRY LEG

LIFT CYLINDER MOUNTING BOLTS
3-20-14020



TOP OF GANTRY LEG



Cylinder Pin
(Large Dia)
3-15-11980

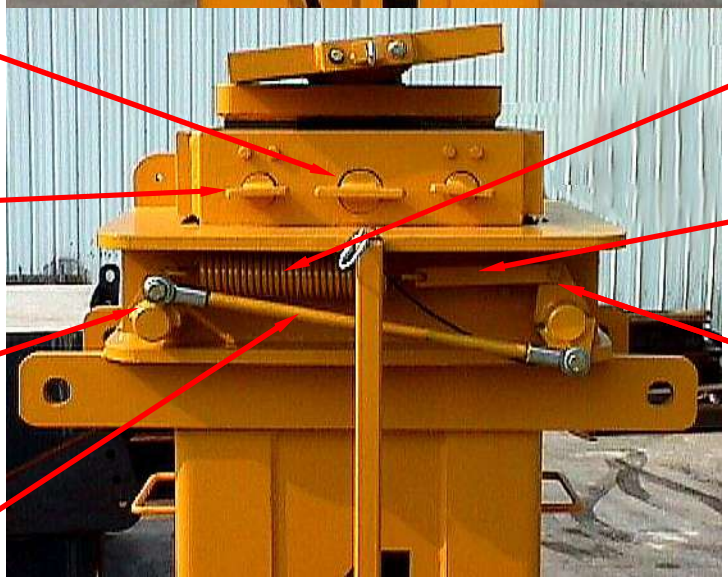
Manual Pins
(Small Dia)
3-15-14000

Cam Lock
Cylinder Mount
3-45-13660

Header Plate
3-90-13580

1ST Stage Hold
Down Bracket

2-15-14040



Cylinder Pin
3-15-11980

Manual Pins
3-15-14000

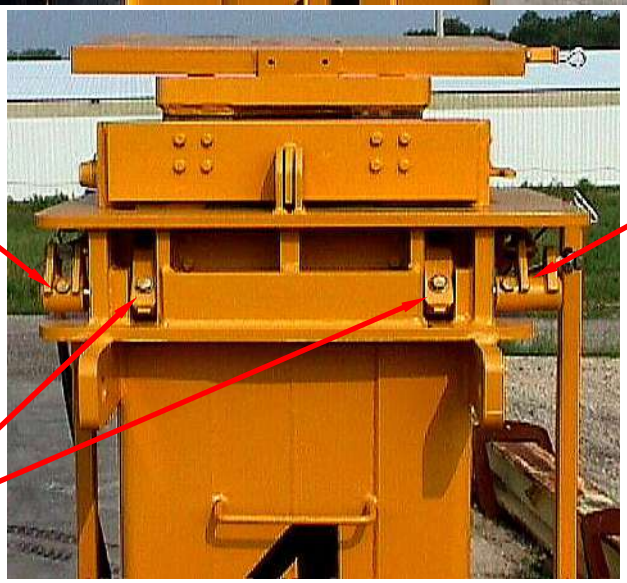
Cam Lock
Spring Mount
(Left Hand)
3-45-12180

Equalizer Bar
3-90-14080

Cam Lock Spring
3-06-13740

Cam Lock Spring
Linkage
3-06-14060

Cam Lock Spring
Mount (Right Hand)
3-45-12160

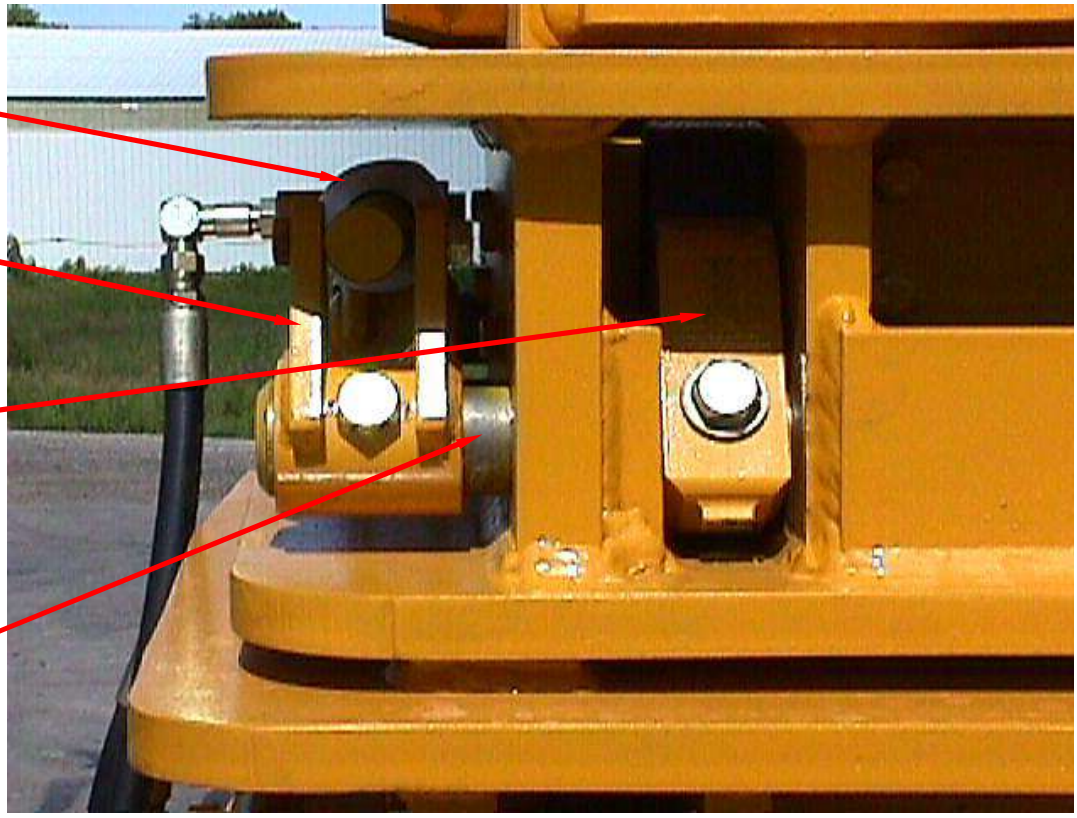


Cam Lock
Cylinder Mount
3-45-12140

3-45-12120

Cam Lock Spring
Mount (Left Hand)
3-45-12180

CAM LOCKS & CYLINDERS



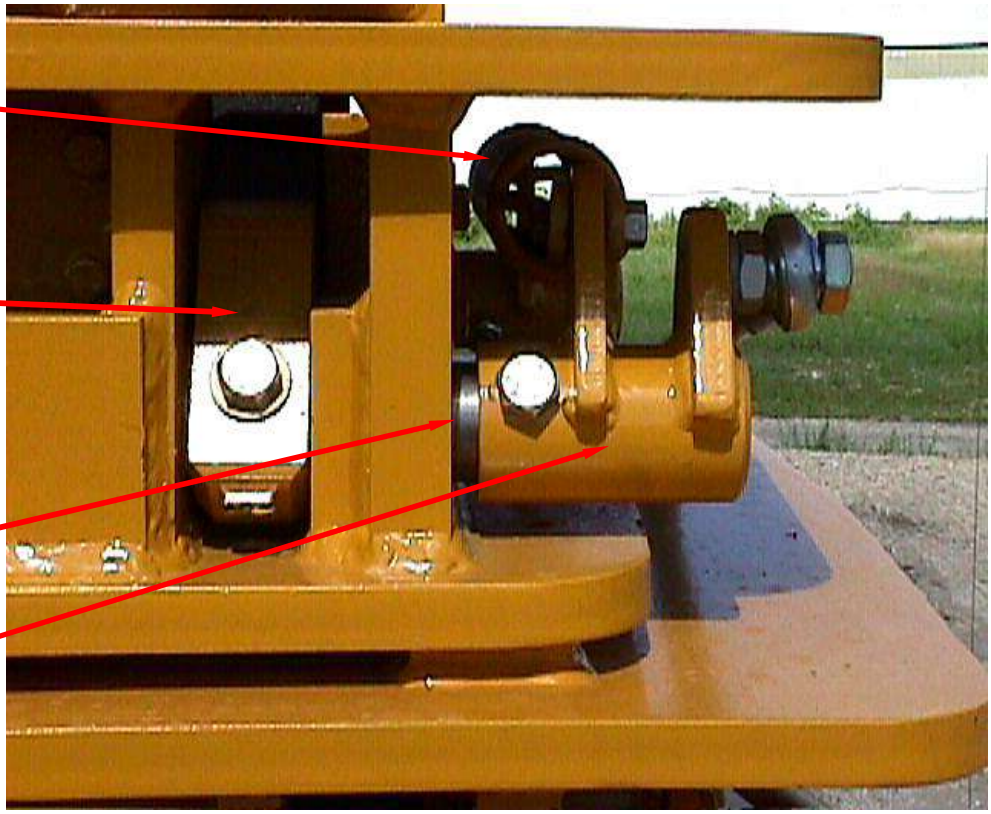


Figure 9-3
Header Plate Components

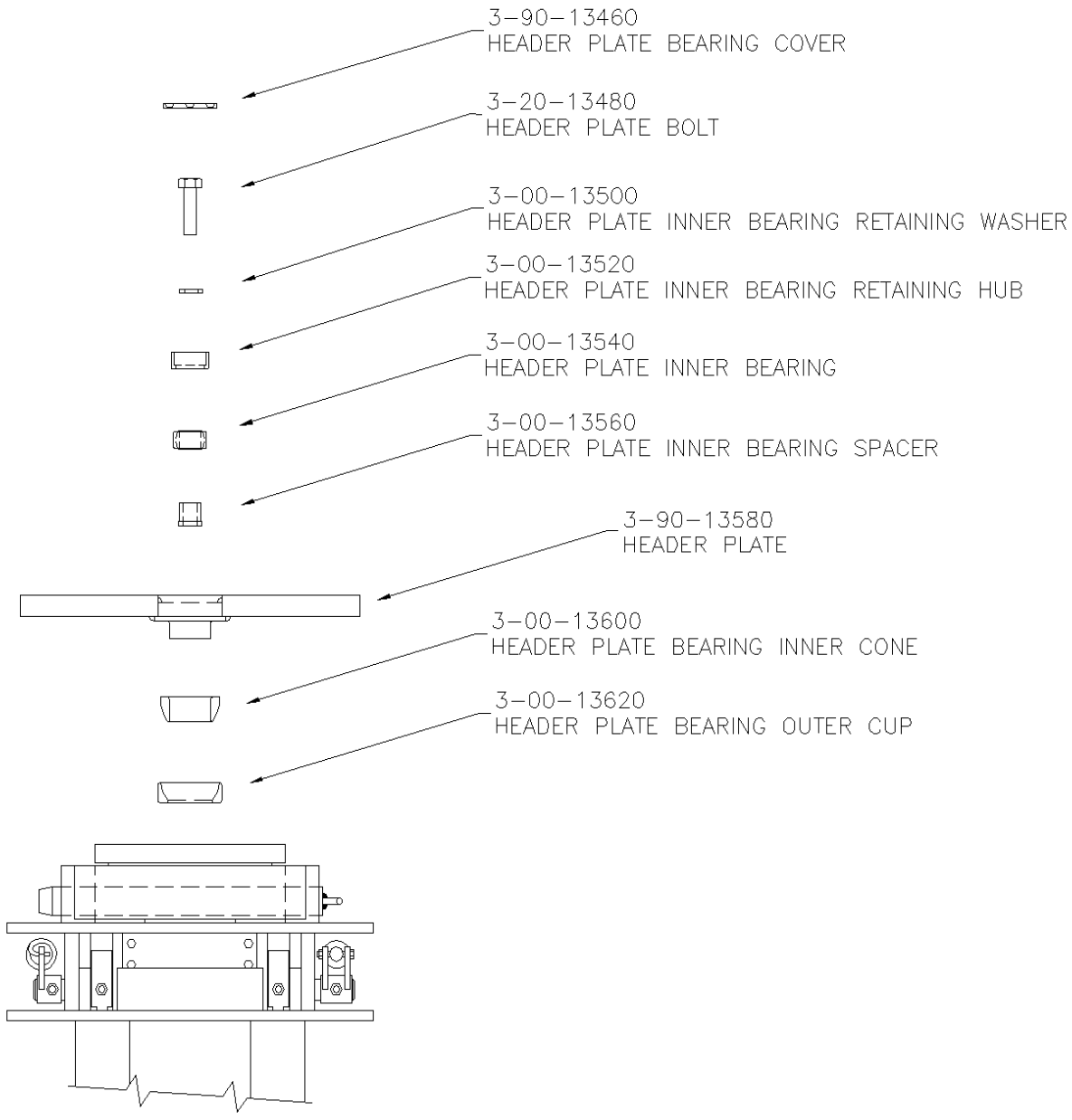
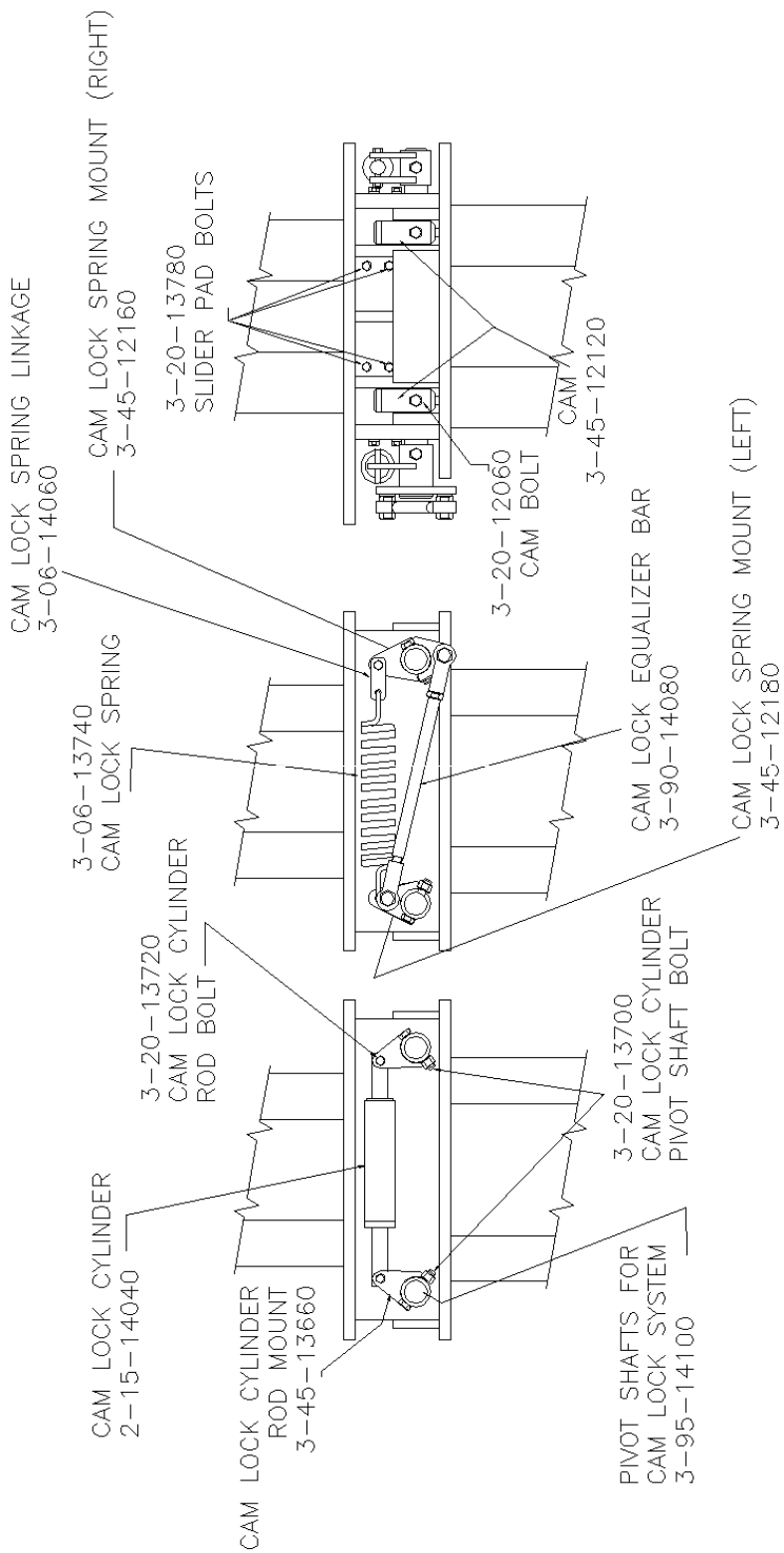


Figure 9-4
Cam Lock System Components



5.0 CONTROL MODULE PARTS LIST

Table 9-1

Part #: 1-xx-xxxxx = Electrical; 2-xx-xxxxx = Hydraulic; 3-xx-xxxxx = Mechanical

Part #	Qty	Description
1 - 00 -21100	1	ENGINE STOP / RUN / START KEY SWITCH
1 - 00 -21240	1	OIL PRESSURE OVERRIDE SWITCH BUTTON
1 - 05 -20380	1	LIFT BOOM HEIGHT INDICATING SENSOR CABLE (FEMALE)
1 - 05 -21360	1	TERMINAL BLOCK
1 - 20 -21260	8	LIFT BOOM DIGITAL HEIGHT METER
1 - 40 -21441	1	ENGINE RUN LIGHT
1 - 75 -21320	1	12 VOLT BATTERY
2 - 00 -20200	4	TWO SPEED SYSTEM SHUT-OFF VALVE
2 - 00 -20220	4	TWO SPEED SYSTEM PRESSURE CONTROL VALVE
2 - 00 -20360	1	RETURN HYDRAULIC OIL ISOLATION VALVE
2 - 00 -20540	1	PUMP SUCTION ISOLATION VALVE
2 - 00 -20560	1	CONTROL VALVE HANDLE ASSEMBLY
2 - 00 -20590	1	CONTROL VALVE
2 - 00 -20620	1	TWO SPEED ACTUATOR
2 - 10 -21080	1	VARIABLE VOLUME PISTON HYDRAULIC PUMP
2 - 25 -20800	1	POWER HOSE 5/8" DIA
2 - 25 -20820	1	POWER HOSE 1/2" DIA
2 - 25 -20840	2	1/2" NPT POWER HOSE QUICK COUPLING (MALE)
2 - 25 -20860	2	3/4" NPT POWER HOSE QUICK COUPLING (MALE)
2 - 25 -20880	1	POWER HOSE SLEEVE
2 - 25 -21400	1	3/8òNPT POWER HOSE QUICK COUPLING (MALE)
2 - 25 -21420	1	TWINLINE POWERLINK POWER HOSE
2 - 35 -20040	4	HYDRAULIC LOAD INDICATING PRESSURE GAUGE
2 - 35 -20080	1	HYDRAULIC OIL RESERVOIR FILL GAUGE
2 - 35 -20300	1	HYDRAULIC OIL FILTER PRESSURE GAUGE
2 - 40 -10160	4	1/2" NPT POWER HOSE QUICK COUPLING (FEMALE)
2 - 40 -10161	4	3/4" NPT POWER HOSE QUICK COUPLING (FEMALE)
2 - 40 -20320	1	HYDRAULIC OIL FILTER CANISTER
2 - 40 -20780	1	SUCTION FILTER
2 - 90 -20340	1	OIL FILTER HEAD
3 - 07 -20120	4	GANTRY LEG CONTROL LEVERS
3 - 36 -21020	1	ENGINE EXHAUST MUFFLER
3 - 37 -21300	1	ENGINE INTAKE AIR PREFILTER
3 - 38 -21281	1	PROPANE FUEL TANK
3 - 40 -20161	4	CASTER, DUAL WHEEL, PNEUMATIC

3 - 90 -20060	1	HYDRAULIC OIL RESERVOIR FILL/VENT CAP
3 - 90 -20440	1	QUICK COUPLING DRIP PAN DRAIN VALVE
3 - 90 -20600	1	ACTUATOR MOUNT

Pictures 9-7

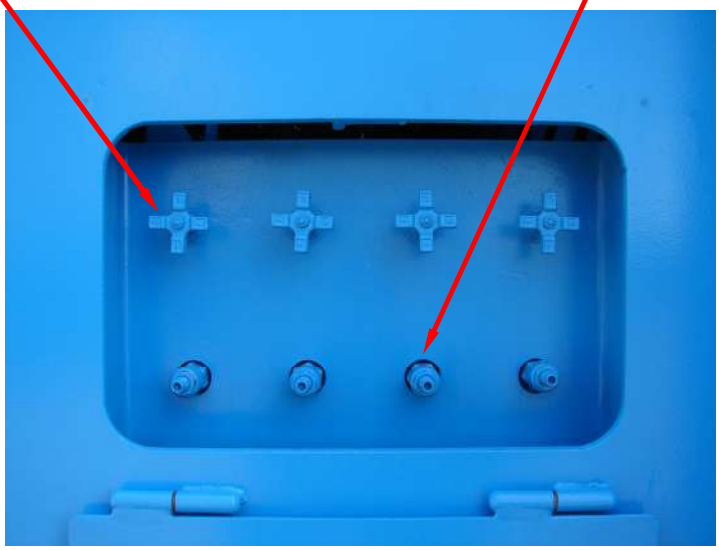
Pictorial and Numerical Nomenclature of Parts and Components on the J&R Engineering 800 Series Control Module

Model CMP-225-4

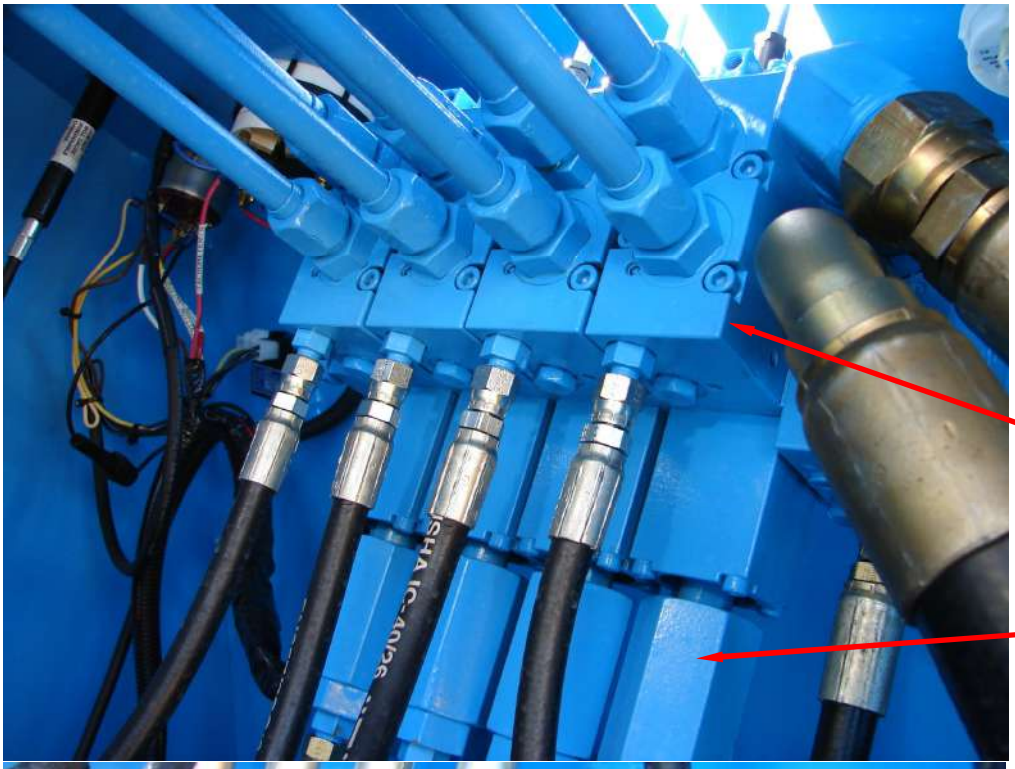
Control Panel

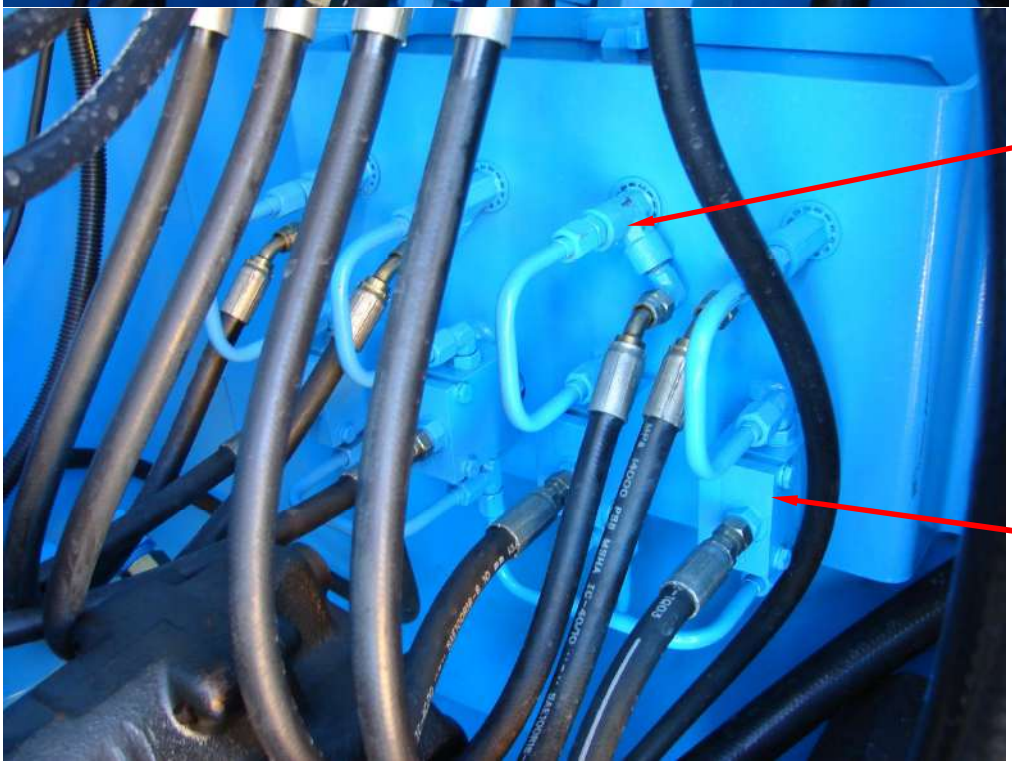
TWO SPEED SHUT-OFF VALVES 2-00-20200

TWO SPEED SEQUENCE VALVES 2-00-20220



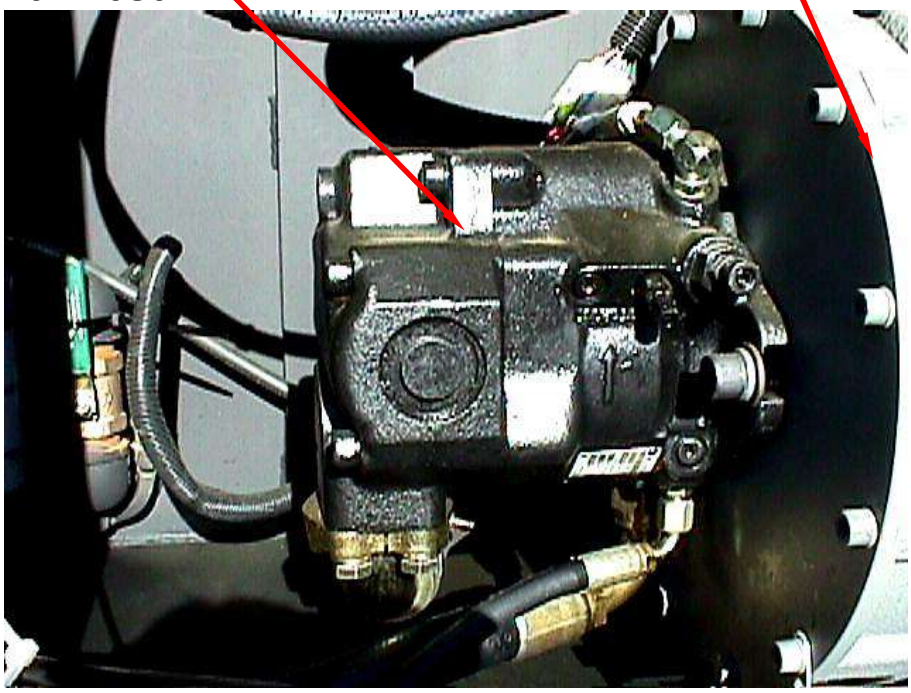
INSIDE VIEW OF CONTROL MODULE





HYDRAULIC PUMP
2-10-21080

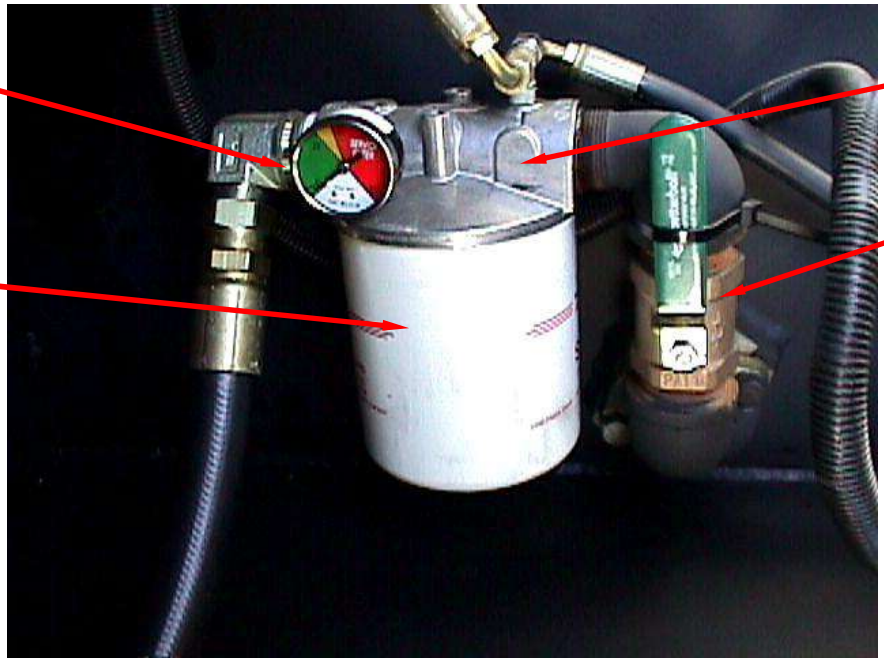
GM PROPANE ENGINE
3-35-21001



HYDRAULIC OIL FILTRATION COMPONENTS

2-35-20300

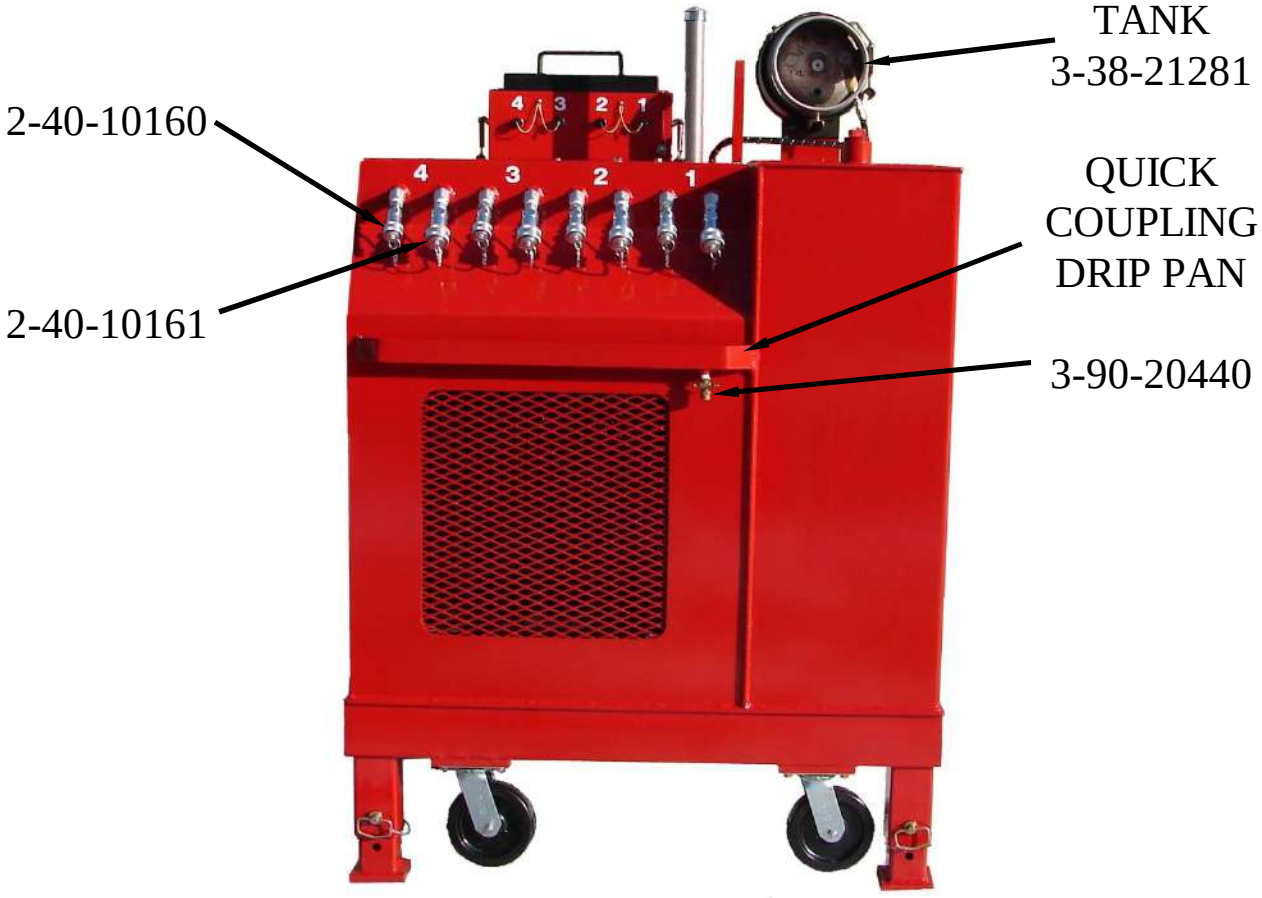
2-40-20320



2-90-20340

2-00-20360

CONTROL MODULE EXTERIOR COMPONENTS



(SEE 3.0 L ENGINE SERVICE MANUAL FOR FURTHER DETAILS)

Figure 9-8
Gantry Lift Housing - Hydraulic Schematic

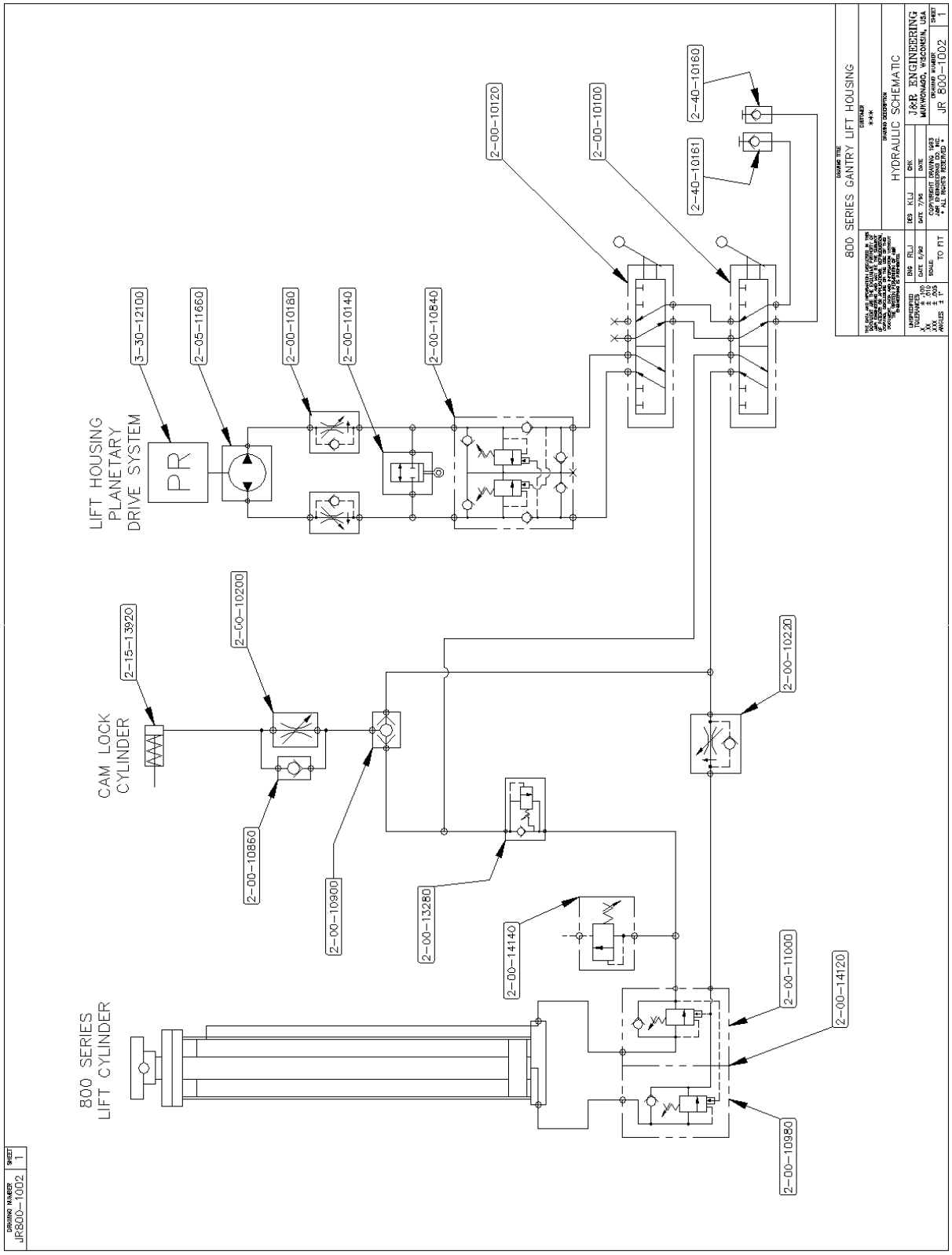
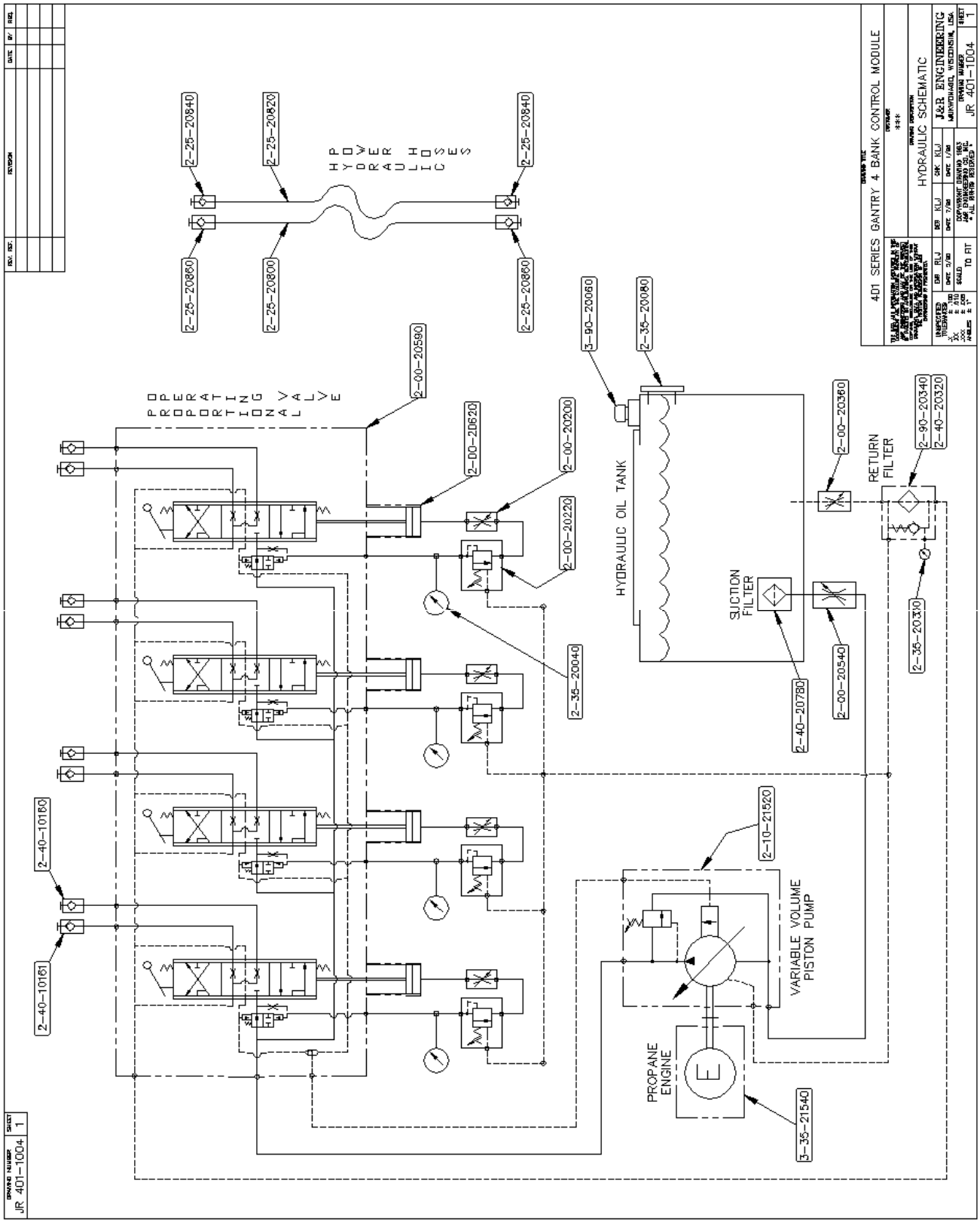


Figure 9-9
Control Module Hydraulic Schematic
4-BANK



7.0 BOOM HEIGHT INDICATION SYSTEM

7.1 General Description

The height indication system for the J&R Engineering hydraulic boom gantries consists of a CELESCO Digital Position Transducer and a miniature electronic 8-digit dual counter & rate indicator called the CUB5. Together the Digital Position Transducer and the CUB5 provide the gantry user with accurate information of the booms exact and relative strokes.

7.1.1 Digital Position Transducer

CELESCO-PT9150 Digital Position Transducers (Optical Encoder Type), are designed to provide a digital output signal, with an accuracy of 0.05%(±1 pulse) FS. The transducer operates from a variable voltage source of 4.75 Vdc to 30 Vdc @ 50 mA maximum. The two output channels "A" & "B" are TTL/CMOS compatible, single ended (Open Collector). The output signal current is 20 mA maximum, with an internal 4.7K resistor, thereby eliminating line drivers for long electrical connections. The transducer also offers optional complementary output signal.

7.1.2 MODEL CUB5

The CUB5 provides the user the ultimate in flexibility, from its complete user programming to the optional setpoint control and communication capability. The meter can be programmed as a single or dual counter with rate indication capability. The display can be toggled either manually or automatically between the selected displays.

The counter is programmable for one of eight different count modes, including bi-directional and quadrature. When programmed as a dual counter, each counter has a separate scale factor and decimal points. In the counter/rate indicator mode, each have their own scaling and decimal point red-outs in different engineering units. The internal batch counter can be used to count setpoint output activations.

The meter has two separate inputs which provide different functions depending on which operating mode is selected. Input A accepts the signal for the Count and/or Rate displays, while Input B accepts the signal for the Count display or direction control. In the anti-coincidence mode, both inputs are monitored simultaneously so that no counts are lost. The resulting display can be chosen as the sum or difference of the two inputs. The Rate Indicator has programmable low (minimum) and high (maximum) update times to provide optimal display response at any input frequency. There is a programmable user input that can be programmed to perform a variety of functions.

7.2 Basic Specifications

Digital Position Transducer

Performance

Ranges: 0 - 2ò through 400ò
Accuracy: 0.05% (+/- 1 Pulse) FS

Encoder Frequency

Response: 500 kHz maximum

Electrical

Excitation: 4.75 Vdc to 30 Vdc @ 50mA max.

Output @4.75 Vdc $V_{low} \leq 0.5$ V @ 20 mA sink
$V_{high} \leq 2.5$ V @ 20 mA source
@ 30 Vdc $V_{low} \leq 0.5$ V @ 20 mA sink
$V_{high} \leq 2.5$ V @ 20 mA source

Environmental

Temperature: 20° - 200° F
Humidity: 90% RH @ 95° F
Vibration: 10g to 2 kHz

CUB5 8-Digit Dual Counter & Rate Indicator

* * See Section 7.4 for full CUB5 specifications * *

7.3 Simplified Programming for the CUB5 Digital Meter (Reference Figure 9-9)

The following procedure and Menu Selections should be used/made while preparing the CUB5 for use with J&R Engineering Hydraulic Boom Gantries:

NOTE
THE CUB5 HAS BEEN PREPROGRAMMED AT THE J&R ENGINEERING FACILITY. THE CUB5 WILL ONLY NEED TO BE REPROGRAMMED IN THE EVENT OF A LOSS OF PREPROGRAMMED SETTINGS.

NOTE
To change numerical values: The RESET button increments the numerical value of the flashing digit. Momentarily pressing the SELECT button advances to the next digit. Pressing and holding the SELECT button for more than two seconds exits the MODE and advances to the next MODE.

Step 1: Connect Power Supply to Height Indicating System

Step 2: Turn on power; digital display window should light up.

Step 3: Press and hold ñSELò until ñPro CodEò, alternating with ñ000ò displays on screen

Note: If "Pro" displays on the screen at this point, skip to step 11 to complete settings. However, it is strongly recommended that you consult with the factory for assistance in resetting the override code in order to prevent inadvertent programming changes in the field. J&R uses the override code of 222.

NOTE: Steps 4 through 10 are not illustrated in Figure 9-9

Step 4: Press ñRSTò and the far right digit will flash on-off

Step 5: Press ñRSTò two times to change the digit to 2

Step 6: Press ñSELò to select the center digit

Step 7: Press ñRSTò two times to change the digit to 2

Step 8: Press ñSELò to select the left digit

Step 9: Press ñRSTò two times to change the digit to 2

Step 10: Press and hold ñSELò, ñPROò and ñNOò will alternately display in window

Step 11: Press ñRSTò, ñ1-INPutò will display in window.

Step 12: Press ñSELò, ñINP A-bò and ñAlt Cnt udò will alternately display in window.

Step 13: Press ñRSTò until ñqUAd 1ò displays in window.

Step 14: Press ñSELò, ñCntA dPò will display in window.

Step 15: Press ñRSTò once and the window will read 0.0.

Step 16: Press ñSELò and the display will alternately flash ñCntA ScF and ñ01.0000ò

Note: the desired Standard (English) setting for this screen is 00.0995 inches, and the desired Metric setting for this screen is 00.2540 CM.

Step 17: Press ñRSTò and the far right hand digit will flash on and off. Continue to press ñRSTò until the number 5 displays (or the number 0 if performing metric setup)

Step 18: Press ñSELò and the 2nd digit from the right will flash on and off. Press ñRSTò until the number 9 displays (or the number 4 if performing metric setup)

Step 19: Press ñSELò and the 3rd digit from the right will flash on and off. Press ñRSTò until the number 9 displays (or the number 5 if performing metric setup)

Step 20: Press ñSELò and the 4th digit from the right will flash on and off. Press ñRSTò until the number 0 displays (or the number 2 if performing metric setup)

Step 21: Press ñSELò and the 5th digit from the right will flash on and off. Press ñRSTò until the number 0 displays (for either standard or metric)

Step 22: Press ñSELò and the 6th digit from the right will flash on and off. Press ñRSTò until the number 0 displays (for either standard or metric)

Step 23: Press and hold ñSELò until ñCntArStò is displayed

Step 24: Press ñRSTò until ñto Zeroò is displayed

Step 25: Press ñSELò until ñCntA dirò is displayed

Step 26: Press ñRSTò until ñNorò is displayed

Step 27: Press ñSELò until ñCntA Ldò is displayed

Step 28: Press ñRSTò until ñ000050.0ò is displayed

Step 29: Press ñSELò to exit and screen will alternately display ñRSt P-UPò and ñYES/NOò. Press ñRSTò until ñNOò appears.

Step 30: Press ñSELò, ñUSEr INPò will appear in window. Press ñRSTò until ñrESEtò appears in window.

Step 31: Press ñSELò, ñNOò and ñPROò will flash alternately.

Step 32: Press ñSELò again and ñENDò will appear in window.

Step 33: Turn power off.

Simplified Programming for the Cub5 Digital Meter

Note: Steps 4 through 10 of section 7.3 are not illustrated in this figure

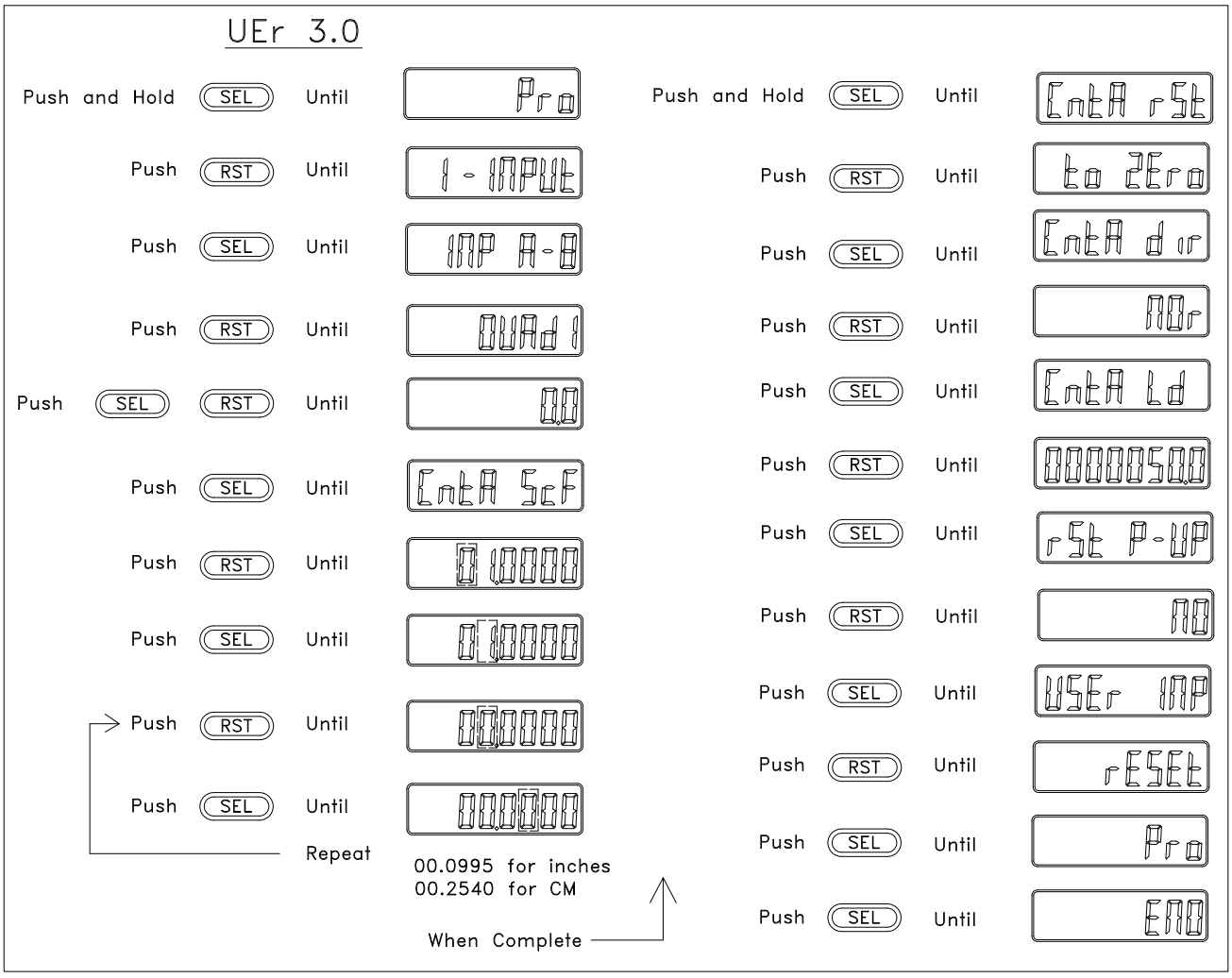
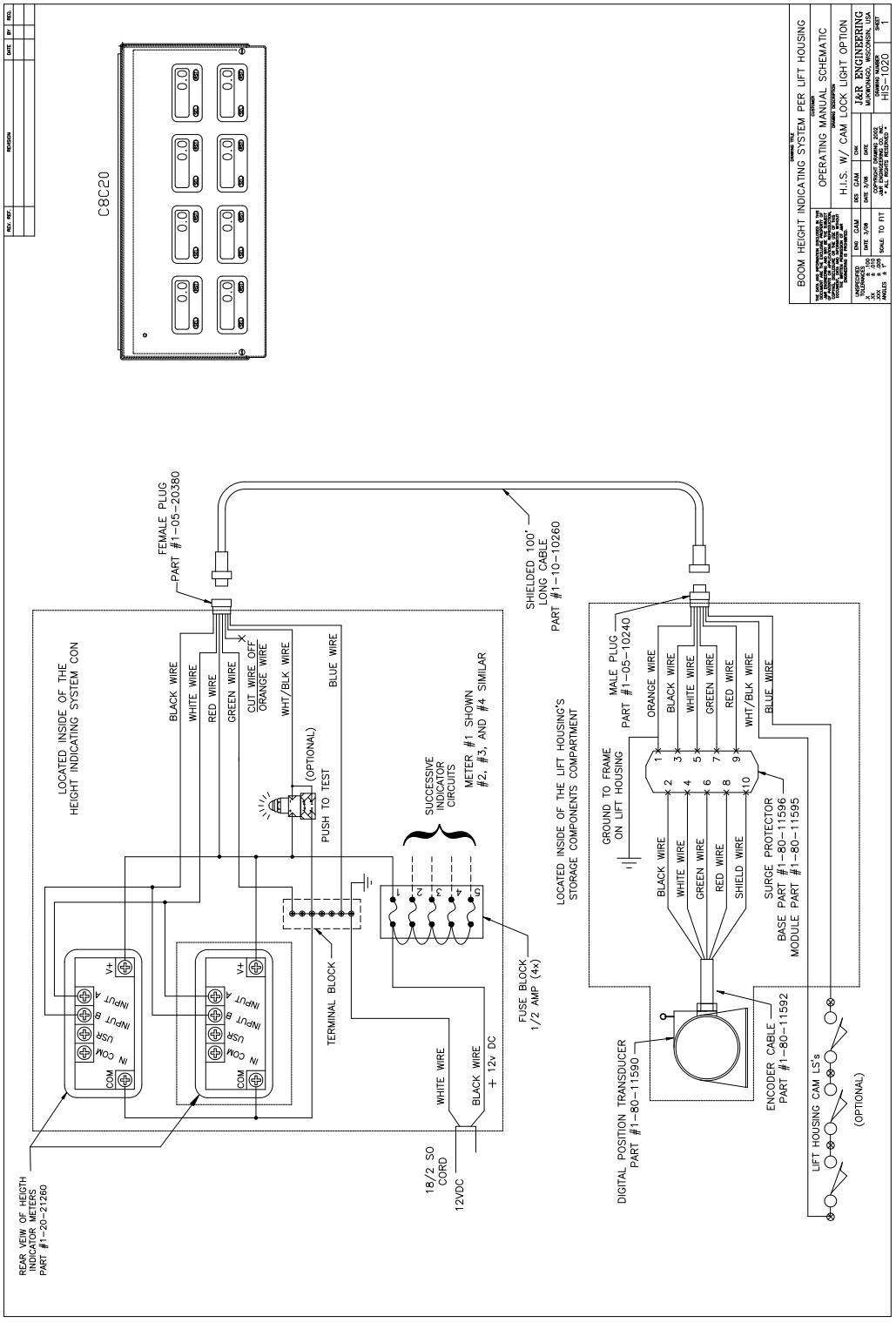


Figure 9-10
Boom Height Indicating System ï Electrical Schematic



7.4 Model CUB5 ï BULLETIN NO. CUB5-G

red lion®
Tel +1 (717) 767-6511
Fax +1 (717) 764-0839
www.redlion.net

Bulletin No. CUB5-G
Drawing No. LP0584
Released 10/08

MODEL CUB5 - MINIATURE ELECTRONIC 8-DIGIT DUAL COUNTER AND RATE INDICATOR

c UL US LISTED
IND. CONT. EQ.
51EB

CE

- LCD, REFLECTIVE OR GREEN/RED LED BACKLIGHTING
- 0.46" (11.7 mm) HIGH DIGITS
- OPTIONAL SETPOINT OUTPUT MODULES
- OPTIONAL SERIAL COMMUNICATIONS MODULE (RS232 or RS485)
- OPERATES FROM 9 TO 28 VDC POWER SOURCE
- PROGRAMMABLE SCALING FOR COUNT AND RATE
- BI-DIRECTIONAL COUNTING, UP/DOWN CONTROL
- QUADRATURE SENSING (UP TO 4 TIMES RESOLUTION)
- BUILT-IN BATCH COUNTING CAPABILITY
- DISPLAY COLOR CHANGE CAPABILITY AT SETPOINT OUTPUT
- NEMA 4X/IP65 SEALED FRONT BEZEL

GENERAL DESCRIPTION

The CUB5 provides the user the ultimate in flexibility, from its complete user programming to the optional setpoint control and communication capability. The meter can be programmed as a single or dual counter with rate indication capability. The display can be toggled either manually or automatically between the selected displays.

The CUB5 display has 0.46" (11.7 mm) high digits. The LCD is available in two versions, reflective (CUB5R000) and backlight (CUB5B000). The backlight version is user selectable for green or red backlighting with variable display intensity.

The counter is programmable for one of eight different count modes, including bi-directional and quadrature. When programmed as a dual counter, each counter has a separate scale factor and decimal points. In the counter/rate indicator mode, each have their own scaling and decimal point read-outs in different engineering units. The internal batch counter can be used to count setpoint output activations.

The meter has two separate inputs which provide different functions depending on which operating mode is selected. Input A accepts the signal for the Count and/or Rate displays, while Input B accepts the signal for the Count display or direction control. In the anti-coincidence mode, both inputs are monitored simultaneously so that no counts are lost. The resulting display can be chosen as the sum or difference of the two inputs. The Rate Indicator has programmable low (minimum) and high (maximum) update times to provide optimal display response at any input frequency. There is a programmable user input that can be programmed to perform a variety of functions.

The capability of the CUB5 can be easily expanded with the addition of option modules. Setpoint capability is field installable with the addition of the single setpoint relay output module or the dual setpoint solid state output module. Serial communications capability for RS232 or RS485 is added with a serial option module.

The CUB5 can be powered from an optional Red Lion Micro-Line/Sensor Power Supply (MLPS1000), which attaches directly to the back of a CUB5. The MLPS1 is powered from 85 to 250 VAC and provides up to 400 mA to drive the unit and sensors.

COUNTER

The CUB5 receives incoming pulses and multiplies them by the Count Scale Factor to obtain the desired reading for the count display. Input A accepts the signal for the count and Input B is used for quadrature, dual counter, anti-coincidence counting, or up/down control counting.

RATE

The rate indicator utilizes the signal at Input A to calculate the rate value using a time interval method (1/tau). The unit counts on the negative edge of the input pulses. After the programmed minimum update time elapses and the next negative edge occurs, the unit calculates the input rate based on the number of edges that occurred during the elapsed time. The input rate is then multiplied by the rate scaling value to calculate the rate display.

At slower rates, averaging can be accomplished by programming the rate minimum update time for the desired response. Extensive scaling capabilities allow practically any desired reading at very slow count rates.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in this literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

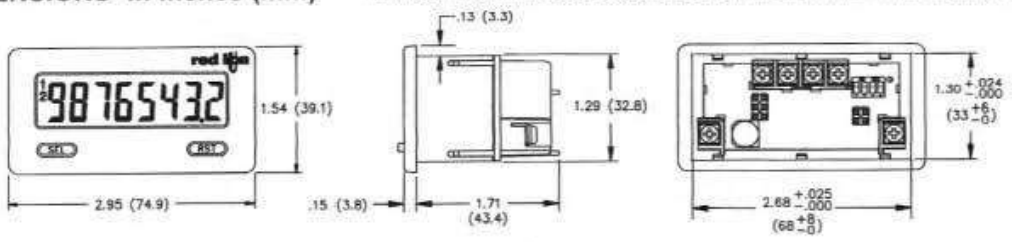
Do not use this meter to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the meter.

CAUTION: Risk of Danger.
Read complete instructions prior to installationand operation of the unit.

CAUTION: Risk of electric shock.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15" (54.6) H x 3.00" (76.2) W.



ORDERING INFORMATION

TYPE	MODEL NO.	DESCRIPTION	PART NUMBER
CUB5	CUB5R	Dual Counter & Rate Indicator with Reflective Display	CUB5R000
	CUB5B	Dual Counter & Rate Indicator with Backlight Display	CUB5B000
Optional Plug-in Cards	CUB5RLY	Single Relay Option Card	CUB5RLY0
	CUB5SNK	Dual Sinking Open Collector Output card	CUB5SNK0
	CUB5COM	RS485 Serial Communications Card	CUB5COM1
		RS232 Serial Communications Card	CUB5COM2
Accessories	MLPS1	Micro-Line Power Supply, 85 to 250 VAC	MLPS1000
	CBLPRO	Programming Cable RS232 (RJ11-DB9)	CBLPROG0
	CBPRO	Programming Cable RS485 (RJ11-DB9)	CBPRO007
	SFCRD	Crimson 2 PC Configuration Software for Windows 98, ME, 2000, XP *	SFCRD200

*Crimson 2 software is available for download from http://www.redlion.net/

GENERAL METER SPECIFICATIONS

1. **DISPLAY**: 8 digit LCD 0.46" (11.7 mm) high digits
   CUB5R000: Reflective LCD with full viewing angle
   CUB5B000: Transmissive LCD with selectable red or green LED backlight, viewing angle optimized. Display color change capability with output state when using an output module.
2. **POWER**: Input voltage range is +9 to +28 VDC with short circuit and input polarity protection. Must use an RLC model MLPS1 or a Class 2 or SELV rated power supply.

MODEL NO.	DISPLAY COLOR	INPUT CURRENT @ 9 VDC WITHOUT CUB5RLY0	INPUT CURRENT @ 9 VDC WITH CUB5RLY0
CUB5R000	---	10 mA	30 mA
CUB5B000	Red (max intensity)	85 mA	115 mA
CUB5B000	Green (max intensity)	95 mA	125 mA

3. **COUNTER DISPLAYS**:
   Counter A: 8-digits, enabled in all count modes
   Display Range: -9999999 to 99999999
   Overflow Indication: Display flashes "OVEr"
   Counter B: 7-digits, enabled in Dual Counter Mode or batch counting
   Display Designator: "b" to the left side of the display
   Display Range: 0 to 9999999 (positive count only)
   Overflow Indication: Display flashes "bOvEr"
   Maximum Count Rates: 50% duty cycle
   Without setpoint option card: 20 KHz (all count modes)
   With setpoint option card: 20 KHz for any count mode except Dual Counter (16 KHz), Quadrature x2 (14 KHz) and Quadrature x4 (13 KHz).
4. **RATE DISPLAY**: 6-digits, may be enabled or disabled in any count mode
   Display Designator: "P" to the left side of the display
   Display Range: 0 to 999999
   Over Range Display: "P OLOLOL"
   Maximum Frequency: 20 KHz
   Minimum Frequency: 0.01 Hz
   Accuracy: ±0.01%
5. **COUNT/RATE SIGNAL INPUTS (INP A and INP B):**
   Input A: DIP switch selectable to accept pulses from a variety of sources. See Section 2.0 Setting the DIP Switches for Input A specifications.
   Input B: Logic signals only
   Trigger levels: V_{IL} = 1.0 V max; V_{IH} = 2.4 V min; V_{MAX} = 28 VDC
   Current sinking: Internal 10KΩ pull-up resistor to +9 to 28 VDC
   Filter (LO Freq.): Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec min.
6. **USER INPUT (USR):** Programmable input. Connect to input common (INP COMM) to activate function. Internal 10KΩ pull-up resistor to +9 to 28 VDC.
   Threshold Levels: V_{IL} = 1.0 V max; V_{IH} = 2.4 V min; V_{MAX} = 28 VDC
   Response Time: 5 msec typ.; 50 msec debounce (activation and release)
7. **MEMORY**: Nonvolatile E^2PROM memory retains all programming parameters and count values when power is removed.
8. **CONNECTIONS**: Wire clamping screw terminals
   Wire Strip Length: 0.3" (7.5 mm)
   Wire Gage: 30-14 AWG copper wire
   Torque: 5 inch-lbs (0.565 N-m) max.
9. **CONSTRUCTION**: This unit is rated for NEMA 4X/IP65 requirements for indoor use. Installation Category I, Pollution Degree 2. High impact plastic case with clear viewing window. Panel gasket and mounting clip included.
10. **ENVIRONMENTAL CONDITIONS**:
    Operating Temperature Range for CUB5R000: -35 to 75°C

Operating Temperature Range for CUB5B000 depends on display color and intensity level as per below:

	INTENSITY LEVEL	TEMPERATURE
Red Display	1 & 2	-35 to 75°C
	3	-35 to 70°C
	4	-35 to 60°C
	5	-35 to 50°C
Green Display	1 & 2	-35 to 75°C
	3	-35 to 65°C
	4	-35 to 50°C
	5	-35 to 35°C

Storage Temperature: -35 to 85°C
Operating and Storage Humidity: 0 to 85% max. relative humidity (non-condensing)
Vibration According to IEC 68-2-6: Operational 5 to 500 Hz, in X, Y, Z direction for 1.5 hours, 5 g's.
Shock According to IEC 68-2-27: Operational 40 g, 11 msec in 3 directions.
Altitude: Up to 2000 meters
11. **CERTIFICATIONS AND COMPLIANCES**:
SAFETY
UL Recognized Component, File #E179259, UL61010A-1, CSA 22.2 No. 61010-1
Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
Type 4X Indoor Enclosure rating (Face only), UL50
IECEE CB Scheme Test Certificate #US/9257C/UL
CB Scheme Test Report #E179259-V01-S02
Issued by Underwriters Laboratories, Inc.
IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
IP65 Enclosure rating (Face only), IEC 529
ELECTROMAGNETIC COMPATIBILITY
Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

Immunity to Industrial Locations:		
Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion A 2 kV power 1 kV signal
Surge	EN 61000-4-5	Criterion A 1 kV L-L, 2 kV L&N-E power
RF conducted interference	EN 61000-4-6	Criterion A 3 V/rms
Power frequency magnetic fields	EN 61000-4-8	Criterion A 30 A/m
Emissions:		
Emissions	EN 55011	Class A

Notes:
1. Criterion A: Normal operation within specified limits.
Refer to EMC Installation Guidelines for additional information.
12. **WEIGHT**: 3.2 oz (100 g)

OPTIONAL PLUG-IN CARDS

ADDING OPTION CARDS

The CUB5 meters can be fitted with optional output cards and/or serial communications cards. The details for the plug-in cards can be reviewed in the specification section below. The plug-in cards, that are sold separately, can be installed initially or at a later date.

WARNING: Disconnect all power to the unit before installing Plug-in card.

SINGLE RELAY OUTPUT CARD (One setpoint only)

Type: Single FORM-C relay
Isolation To Sensor & User Input Commons: 1400 Vrms for 1 min.
Working Voltage: 150 Vrms
Contact Rating: 1 amp @ 30 VDC resistive; 0.3 amp @ 125 VAC resistive
Life Expectancy: 100,000 minimum operations
Response Time:
Turn On Time: 4 msec max.
Turn Off Time: 4 msec max.

DUAL SINKING OUTPUT CARD (One or two setpoints)

Type: Non-isolated switched DC, N Channel open drain MOSFET
Current Rating: 100 mA max.
$V_{DS\ ON}$: 0.7 V @ 100 mA
$V_{DS\ MAX}$: 30 VDC
Offstate Leakage Current: 0.5 mA max.

RS485 SERIAL COMMUNICATIONS CARD

Type: RS485 multi-point balanced interface (non-isolated)
Baud Rate: 300 to 38.4k
Data Format: 7/8 bits; odd, even, or no parity
Bus Address: 0 to 99; max 32 meters per line
Transmit Delay: Selectable, 2 msec min. or 50 msec min.

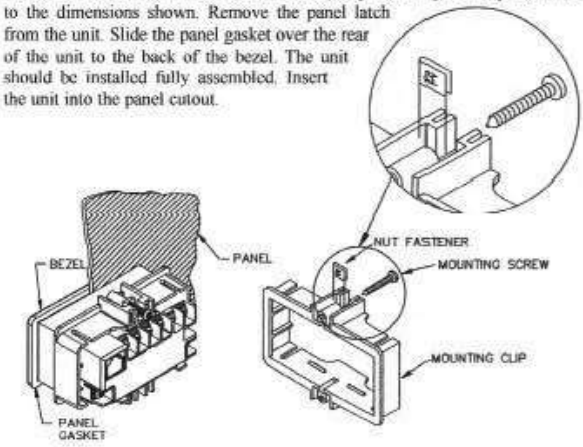
RS232 SERIAL COMMUNICATIONS CARD

Type: RS232 half duplex (non-isolated)
Baud Rate: 300 to 38.4k
Data Format: 7/8 bits; odd, even, or no parity

1.0 INSTALLING THE METER

INSTALLATION

The meter meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.



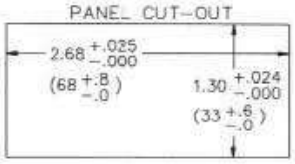
While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approx. 28 to 36 in-oz [0.202 to 0.26 N-m]). Do not over-tighten the screws.

INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.



2.0 SETTING THE DIP SWITCHES

To access the switches, remove the rear cover of the meter as described below. A bank of 4 switches is located in the upper right hand corner. After setting the switches, install any optional plug-in cards before replacing the rear cover (see next section).

Warning: Exposed line voltage exists on the circuit boards. Remove all power to the meter and load circuits before accessing inside of the meter.

REMOVING THE REAR COVER

To remove the rear cover, locate the cover locking tab below the 2nd and 3rd input terminals. To release the tab, insert a small, flat blade screwdriver between the tab and the plastic wall below the terminals. Inserting the screwdriver will provide enough pressure to release the tab locks. To replace the cover, align the cover with the input terminals and press down until the cover snaps into place.

SETTING THE INPUT DIP SWITCHES

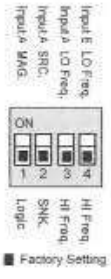
The meter has four DIP switches for Input A and Input B that must be set before applying power.

SWITCH 1

LOGIC: Input A trigger levels V_{IL} = 1.25 V max.; V_{IH} = 2.75 V min.; V_{MAX} = 28 VDC
MAG: 200 mV peak input sensitivity; 100 mV hysteresis; maximum input voltage: ±40 V peak (28 Vrms); Must also have SRC switch ON. (Not recommended with counting applications.)

SWITCH 2

SNK.: Adds internal 7.8 KΩ pull-up resistor to +9 to 28 VDC, I_{MAX} = 3.8 mA.
SRC.: Adds internal 3.9 KΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

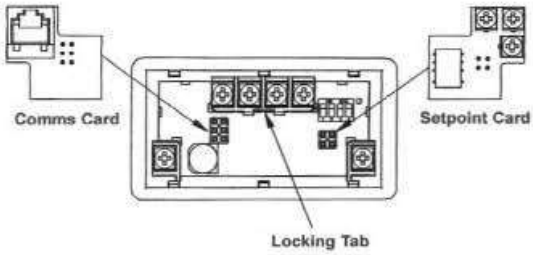


SWITCHES 3 and 4

HI Frequency: Removes damping capacitor and allows max. frequency.
LO Frequency: Adds a damping capacitor for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec.

3.0 Installing Plug-In Cards

The Plug-in cards are separately purchased option cards that perform specific functions. The cards plug into the main circuit board of the meter. After installing the cards, replace the rear cover before wiring the meter.



CAUTION: The Plug-in cards and main circuit board contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.

REPLACING THE REAR COVER

To replace the rear cover, align the cover with the input terminals and press down until the cover snaps into place.

4.0 Wiring the Meter

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

EMC INSTALLATION GUIDELINES

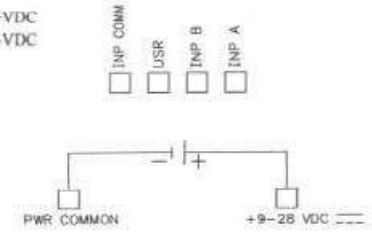
Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC# FCOR0000)
   TDK # ZCAT3035-1330A
   Steward # 28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC# LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom # 1 VR3
   Note: Reference manufacturer's instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubber: RLC# SNUB0000.

4.1 POWER WIRING

DC Power

+9 to +28 VDC: +VDC
Power Common: -VDC

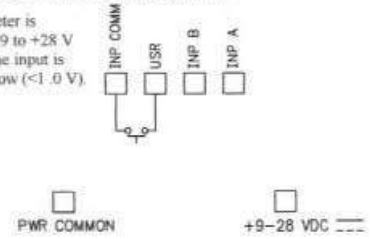


4.2 USER INPUT WIRING

Sinking Logic

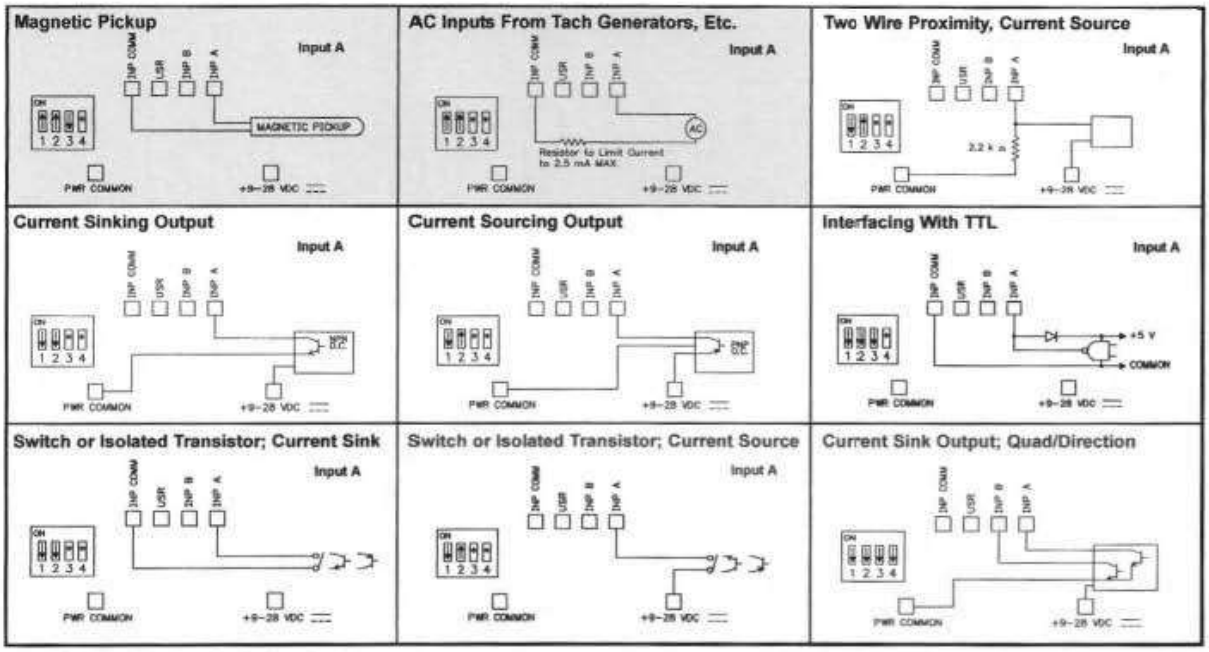
INP COMM } Connect external switching device between the
USR } User Input terminal and Input Common.

The user input of the meter is internally pulled up to +9 to +28 V with 10 K resistance. The input is active when it is pulled low (<1.0 V).



4.3 INPUT WIRING

CAUTION: Power common (PWR COMMON) is NOT isolated from input common (INP COMM). In order to preserve the safety of the meter application, the power common must be suitably isolated from hazardous live earth referenced voltage, or input common must be at protective earth ground potential. If not, hazardous voltage may be present at the Signal or User Inputs and input common terminals. Appropriate considerations must then be given to the potential of the input common with respect to earth ground; and the common of the plug-in cards with respect to input common.

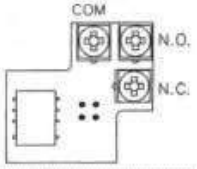


* *Switch position is application dependent.*

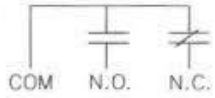
Shaded areas not recommended for counting applications.

4.4 SETPOINT (OUTPUT) WIRING

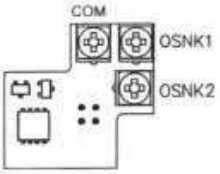
SINGLE SETPOINT RELAY PLUG-IN CARD



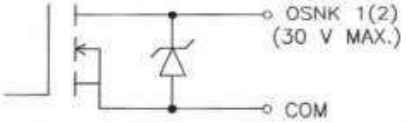
ELECTRICAL CONNECTIONS



DUAL SETPOINT N-FET OPEN DRAIN PLUG-IN CARD



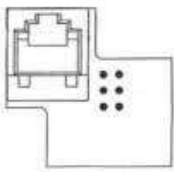
ELECTRICAL CONNECTIONS



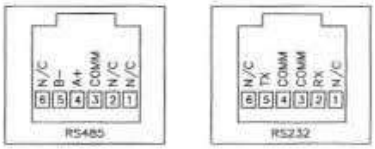
Note: Output Common is not isolated from DC Power Common. Load must be wired between OSNK terminal and V+ of the load supply.

4.5 SERIAL COMMUNICATION WIRING

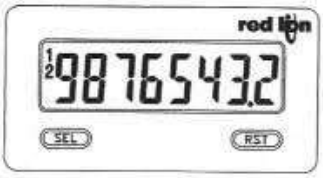
SERIAL COMMUNICATIONS PLUG-IN CARD



RJ11 CONNECTOR PIN OUTS



5.0 Reviewing the Front Buttons and Display



KEY	DISPLAY MODE OPERATION	ENTERING PROGRAM MODE	PROGRAMMING MODE OPERATION
SEL	Index display through enabled values	Press and hold for 2 seconds to activate	Store selected parameter and index to next parameter
RST	Resets count display(s) and/or outputs		Advances through the program menu/ Increments selected parameter value or selection

OPERATING MODE DISPLAY DESIGNATORS

"R" - To the left of the display is the rate value.
- Counter A has no designator.

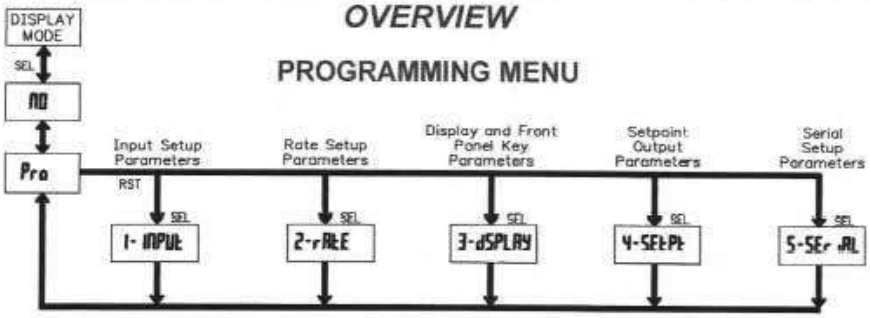
"b" - To the left of the display is the Counter B value (dual count or batch).
"1" and "2" - Indicates setpoint 1 and 2 output status.

Pressing the **SEL** button toggles the meter through the selected displays. If display scroll is enabled, the display will toggle automatically every four seconds between the rate and count values.

6.0 Programming the Meter

OVERVIEW

PROGRAMMING MENU



PROGRAMMING MODE ENTRY (SEL KEY)

It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing and holding the **SEL** key. If it is not accessible then it is locked by either a security code, or a hardware lock.

MODULE ENTRY (SEL & RST KEYS)

The Programming Menu is organized into separate modules. These modules group together parameters that are related in function. The display will alternate between Pro and the present module. The **RST** key is used to select the desired module. The displayed module is entered by pressing the **SEL** key.

MODULE MENU (SEL KEY)

Each module has a separate module menu (which is shown at the start of each module discussion). The **SEL** key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pro nO. Programming may continue by accessing additional modules.

SELECTION / VALUE ENTRY

For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The **RST** key is used to move through the selections/values for that parameter. Pressing the **SEL** key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, press the **RST** key to access the value. The right hand most digit will begin to flash. Pressing the **RST** key again increments the digit by one or the user can hold the **RST** key and the digit will automatically scroll. The **SEL** key will advance to the next digit. Pressing and holding the **SEL** key will enter the value and move to the next parameter.

PROGRAMMING MODE EXIT (SEL KEY)

The Programming Mode is exited by pressing the **SEL** key with Pro nO displayed. This will commit any stored parameter changes to memory and return the meter to the Display Mode. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

PROGRAMMING TIPS

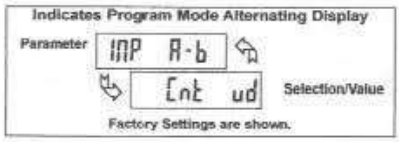
It is recommended to start with Module 1 for counting or Module 2 for rate. When programming is complete, it is recommended to record the parameter programming and lock out parameter programming with the user input or programming security code.

FACTORY SETTINGS

Factory settings may be completely restored in Module 3. This is useful when encountering programming problems.

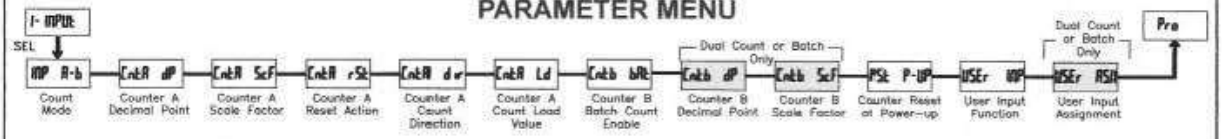
ALTERNATING SELECTION DISPLAY

In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter's factory setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.



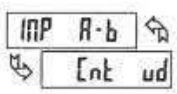
6.1 MODULE 1 - INPUT SETUP PARAMETERS (I- InPUt)

PARAMETER MENU



Shaded area selections only apply when Counter B is enabled (Dual Counter mode or batch counter).

COUNT MODE



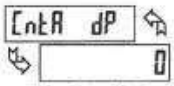
Cnt ud QUAd 1 Add Add
RATE Cnt QUAd 2 Add Sub
dUAL Cnt QUAd 4

Select the count mode that corresponds with your application. The input actions are shown in the boxes below. For simple counting applications, it is recommended to use Count with Direction for the count mode. Simply leave the direction input unconnected.

DISPLAY	MODE	INPUT A ACTION	INPUT B ACTION
Cnt ud	Count with Direction	Counter A	Counter A Direction
RATE Cnt	Rate/Counter	Rate only	Counter A Add
dUAL Cnt	Dual Counter	Counter A Add	Counter B Add
QUAd 1	Quadrature x1	Count A	Quad A
QUAd 2	Quadrature x2	Count A	Quad A
QUAd 4	Quadrature x4	Count A	Quad A
Add Add	2 Input Add/Add	Counter A Add	Counter A Add
Add Sub	2 Input Add/Subtract	Counter A Add	Counter A Subtract

Note: The Rate indicator signal is derived from Input A in all count modes.

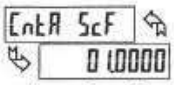
COUNTER A DECIMAL POSITION



0 000 00000
00 0000 000000

This selects the decimal point position for Counter A. The selection will also affect Counter A scale factor calculations.

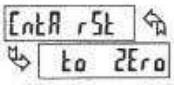
COUNTER A SCALE FACTOR



00000.1 to 999999

The number of input counts is multiplied by the scale factor to obtain the desired process value. A scale factor of 1.0000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of this section.)*

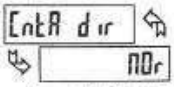
COUNTER A RESET ACTION



to 2Ero to CtLd

When Counter A is reset, it returns to Zero or Counter A Count Load value. This reset action applies to all Counter A resets, except a setpoint generated Counter Auto Reset programmed in Module 4.

COUNTER A COUNT DIRECTION



nOr rEU

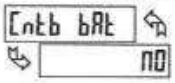
Reverse (rEU) switches the normal Counter A count direction shown in the Count Mode parameter chart.

COUNTER A COUNT LOAD VALUE

-9999999 to 99999999

Counter A resets to this value if Reset to Count Load action is selected.

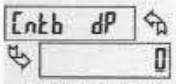
COUNTER B BATCH COUNT ENABLE



nO SP2
SP1 SP1-2

The Counter B batch count function internally counts the number of output activations of the selected setpoint(s). The count source for the batch counter can be SP1, SP2 or both. Batch counting is available in all count modes except Dual Counter, which uses an external input signal for Counter B. This parameter only appears if a Setpoint Output option card is installed.

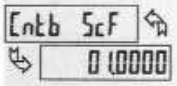
COUNTER B DECIMAL POSITION



0 000 00000
00 0000 000000

This selects the decimal point position for Counter B. The selection will also affect Counter B scale factor calculations.

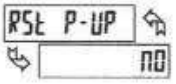
COUNTER B SCALE FACTOR



00000.1 to 999999

The number of input or batch counts is multiplied by the scale factor to obtain the desired process value. A scale factor of 1.0000 will result in the display of the actual number of input or batch counts. (Details on scaling calculations are explained at the end of this section.)*

COUNTER RESET AT POWER-UP



nO nO Count b
YES Count A both A-b

The selected counter(s) will reset at each meter power-up.

* For value entry instructions, refer to selection/value entry in the Programming The Meter section.

SCALING FOR COUNT INDICATION

The CUB5's scale factor is factory set to 1, to provide one count on the display for each pulse that is input to the unit. In many applications, there will not be a one-to-one correspondence between input pulses and display units. Therefore, it is necessary for the CUB5 to scale or multiply the input pulses by a scale factor to achieve the desired display units (feet, meters, gallons, etc.)

The Count Scale Factor Value can range from 00.0001 to 99.9999. It is important to note that the precision of a counter application cannot be improved by using a scale factor greater than one. To accomplish greater precision, more pulse information must be generated per measuring unit. The following formula is used to calculate the scale factor.

$$\text{Scale Factor} = \frac{\text{Desired Display Units}}{\text{Number of Pulses}} \times \text{Decimal Point Position}$$

WHERE:

Desired Display Units: Count display units acquired after pulses that occurred.

Number of Pulses: Number of pulses required to achieve the desired display units.

Decimal Point Position:

0	=	1
0.0	=	10
0.00	=	100
0.000	=	1000
0.0000	=	10000
0.00000	=	100000

EXAMPLE: The counter display is used to indicate the total number of feet used in a process. It is necessary to know the number of pulses for the desired units to be displayed. The decimal point is selected to show the resolution in hundredths.

$$\text{Scale Factor} = \frac{\text{Desired Display Units}}{\text{Number of Pulses}} \times \text{Decimal Point Position}$$

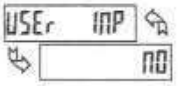
Given that 128 pulses are equal to 1 foot, display total feet with a one-hundredth resolution.

$$\text{Scale Factor} = \frac{1.00}{128} \times 100$$

$$\text{Scale Factor} = 0.007812 \times 100$$

$$\text{Scale Factor} = 0.7812$$

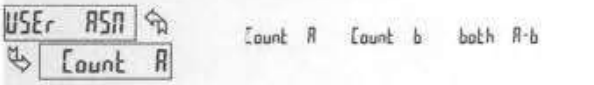
USER INPUT FUNCTION



DISPLAY	MODE	DESCRIPTION
no	No Function	User Input disabled.
Pro Loc	Program Mode Lock-out	See Programming Mode Access chart. (Module 3)
Inhibit	Inhibit	Inhibit counting for the selected counter(s).
rESEt	Maintained Reset	Level active reset of the selected counter(s).
StorE	Store	Freeze display of selected counter(s) while allowing counts to accumulate internally.
Stor-rSt	Store and Reset	Edge triggered reset of the selected counter(s) after storing the count.
d-SELECt	Display Select *	Advance once for each activation
d-LEUEL	Display Intensity Level *	Increase intensity one level for each activation. (backlight version only)
d-COLOr	Backlight Color *	Change backlight color with each activation (backlight version only)
Print	Print Request	Serial transmit of the active parameters selected in the Print Options (Module 5)
Print-rSt	Print and Reset *	Same as Print Request followed by a momentary reset of the selected counter(s).
rESEt-1	Setpoint 1 Reset *	Reset Setpoint 1 output
rESEt-2	Setpoint 2 Reset *	Reset Setpoint 2 output
rESEt-12	Setpoint 1 and 2 Reset *	Reset Setpoint 1 and 2 outputs

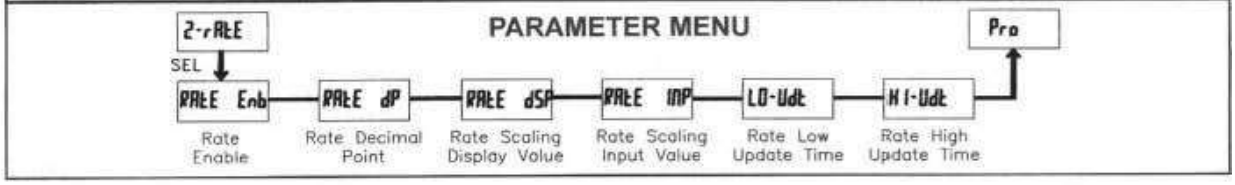
*Note: * indicates Edge Triggered function. Other functions are Level Active (maintained)*

USER INPUT ASSIGNMENT



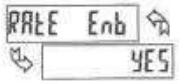
The User Input Assignment is only active when Counter B is enabled and the User Input performs a Reset, Inhibit or Store function on one or both counters.

6.2 MODULE 2 - RATE SETUP PARAMETERS (2-rAtE)



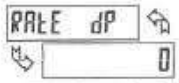
Module 2 is the programming for the rate parameters. For maximum input frequency, Rate Enable should be set to no when not in use. When set to no, the remaining rate parameters are not accessible. The rate value is shown with an annunciator of "P" in the Display Mode.

RATE ENABLE



no YES

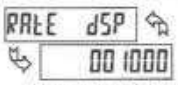
RATE DECIMAL POINT



0 000 00000
00 0000 000000

This selects the decimal point position for the rate display and any setpoint value assigned to rate. This parameter does not affect rate scaling calculations.

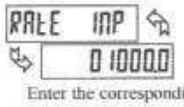
RATE SCALING DISPLAY VALUE



0 to 999999

Enter the desired Rate Display Value for the Scaling Point.*

RATE SCALING INPUT VALUE



0.1 to 999999

Enter the corresponding Rate Input Value for the Scaling Point.*

*For value entry instructions, refer to selection/value entry in the Programming The Meter section.

SCALING FOR RATE INDICATION

To scale the rate, enter a Scaling Display value with a corresponding Scaling Input value. These values are internally plotted to a display value of 0 and input value of 0.0 Hz. A linear relationship is formed between these points to yield a rate display value that corresponds to the incoming input signal rate. The meter is capable of showing a rate display value for any linear process.

SCALING CALCULATION

If a display value versus input signal (in pulses per second) is known, then those values can be entered into Scaling Display (PRLE dSP) and Scaling Input (PRLE INP). No further calculations are needed.

If only the number of pulses per 'single' unit (i.e. # of pulses per foot) is known, then it can be entered as the Scaling Input value and the Scaling Display value will be entered as the following:

RATE PER	DISPLAY (PRLE dSP)	INPUT (PRLE INP)
Second	1	# of pulses per unit
Minute	60	# of pulses per unit
Hour	3600	# of pulses per unit

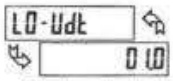
NOTES:

1. If # of pulse per unit is less than 10, then multiply both Input and Display values by 10.
2. If # of pulse per unit is less than 1, then multiply both Input and Display values by 100.
3. If the Display value is raised or lowered, then Input value must be raised or lowered by the same proportion (i.e. Display value for per hour is entered by a third less (1200) then Input value is a third less of # of pulses per unit). The same is true if the Input value is raised or lowered, then Display value must be raised or lowered by the same proportion.
4. Both values must be greater than 0.0.

EXAMPLE:

1. With 15.1 pulses per foot, show feet per minute in tenths. Scaling Display = 60.0 Scaling Input = 15.1.
2. With 0.25 pulses per gallon, show whole gallons per hour. (To have greater accuracy, multiply both Input and Display values by 10.) Scaling Display = 36000 Scaling Input = 2.5.

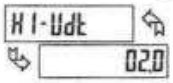
RATE LOW UPDATE TIME



01 to 999 seconds

The Low Update Time is the minimum amount of time between display updates for the rate display. Values of 0.1 and 0.2 seconds will update the display correctly but may cause the display to appear unsteady.

RATE HIGH UPDATE TIME



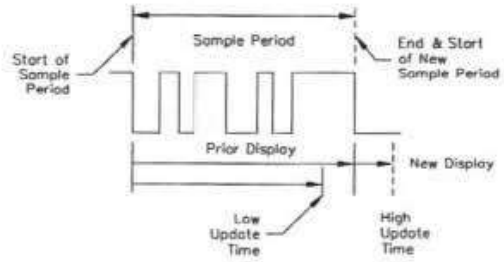
02 to 999 seconds

The High Update Time is the maximum amount of time before the rate display is forced to zero. (For more explanation, refer to Rate Value Calculation.) The High Update Time **must** be higher than the Low Update Time and higher than the desired slowest readable speed (one divided by pulses per second). The factory setting of 2.0, will force the display to zero for speeds below 0.5 Hz or a pulse every 2 seconds.

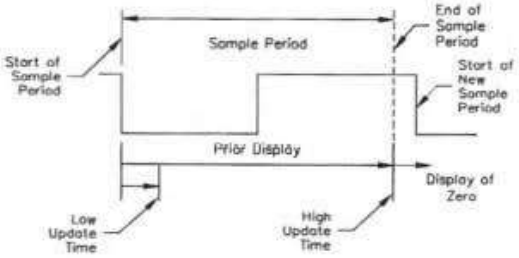
INPUT FREQUENCY CALCULATION

The meter determines the input frequency by summing the number of falling edges received during a sample period of time. The sample period begins on the first falling edge. At this falling edge, the meter starts accumulating time towards Low Update and High Update values. Also, the meter starts accumulating the number of falling edges. When the time reaches the Low Update Time value, the meter looks for one more falling edge to end the sample period. If a falling edge occurs (before the High Update Time value is reached), the Rate display will update to the new value and the next sample period will start on the same edge. If the High Update Time value is reached (without receiving a falling edge after reaching Low Update Time), then the sample period will end but the Rate display will be forced to zero. The High Update Time value must be greater than the Low Update Time value. Both values must be greater than 0.0. The input frequency calculated during the sample period, is then shown as a Rate value determined by the scaling calculation.

RATE VALUE CALCULATED

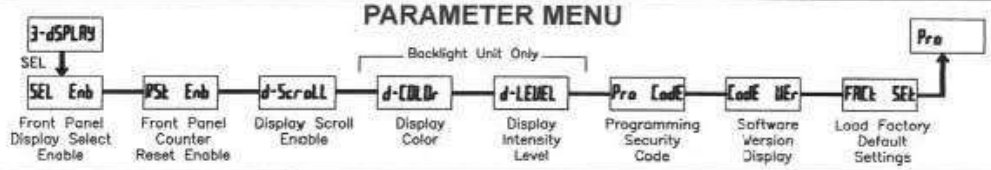


ZERO RATE CALCULATED



6.3 MODULE 3 - DISPLAY AND FRONT PANEL KEY PARAMETERS (3-dSPLAY)

PARAMETER MENU



FRONT PANEL DISPLAY SELECT ENABLE (SEL)

SEL Enb / YES — YES NO

The YES selection allows the **SEL** button to toggle through the enabled displays.

FRONT PANEL COUNTER RESET ENABLE (RST)

RSt Enb / YES — YES, NO, Count A, Count b, both A-b, dSPLAY

The YES selection allows the **RST** button to reset the selected counter(s). The shaded selections are only active when Counter B is enabled (Dual Count mode or batch counter).

DISPLAY SCROLL ENABLE

d-Scroll / NO — YES NO

The YES selection allows the display to automatically scroll through the enabled displays. Each display is shown for 4 seconds.

DISPLAY COLOR (BACKLIGHT UNIT ONLY)

d-COLOr / rEd — rEd Grn

Enter the desired display color, red or green. This parameter is active for backlight units only.

DISPLAY INTENSITY LEVEL (BACKLIGHT UNIT ONLY)

d-LEVEL / 5 — 1 to 5

Enter the desired Display Intensity Level (1-5). The display will actively dim or brighten as levels are changed. This parameter is active for backlight units only.

PROGRAMMING SECURITY CODE

Pro CodE / 000 — 0 to 999

The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (Pro Loc) in the User Input Function parameter (Module 1).

Two programming modes are available. Full Programming mode allows all parameters to be viewed and modified. Quick Programming mode permits only the setpoint output time-out and counter load values (when applicable) to be modified, but allows direct access to these values without having to enter Full Programming mode.

Programming a Security Code other than 0, requires this code to be entered at the Pro CodE prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the Pro CodE prompt appears (see chart).

USER INPUT FUNCTION	USER INPUT STATE	SECURITY CODE	MODE WHEN "SEL" KEY IS PRESSED	FULL PROGRAMMING MODE ACCESS
not Pro Loc	———	0	Full Programming	Immediate Access
		1-99	Quick Programming	After Quick Programming with correct code entry at Pro CodE prompt *
		100-999	Pro CodE prompt	With correct code entry at Pro CodE prompt *
Pro Loc	Active	0	Programming Lock	No Access
		1-99	Quick Programming	No Access
		100-999	Pro CodE prompt	With correct code entry at Pro CodE prompt *
	Not Active	0-999	Full Programming	Immediate Access

** Entering Code 222 allows access regardless of security code.*

SOFTWARE VERSION DISPLAY

CodE VEr / NO — NO YES

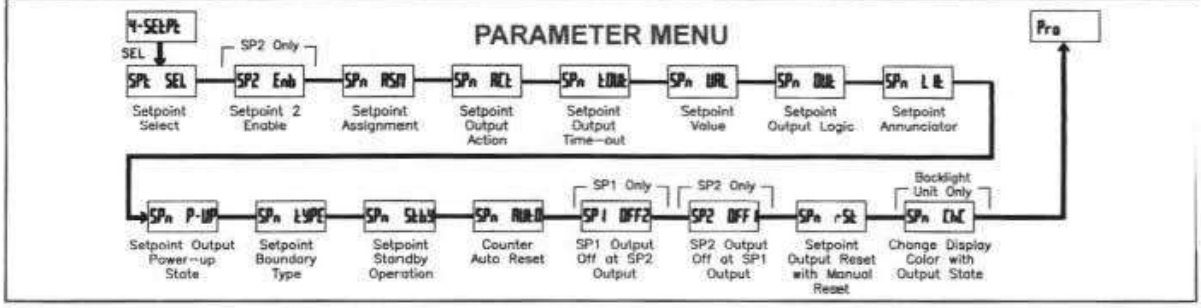
Select YES to momentarily display the meter software version before advancing to the next parameter. The software version is also displayed at power-up.

LOAD FACTORY DEFAULT SETTINGS

FACt SEt / NO — NO YES

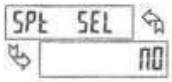
The YES selection will return the meter to the factory default settings. The meter will display rESEt and then return to Pro, at which time all settings have been changed.

6.4 MODULE 4 - SETPOINT OUTPUT PARAMETERS (4-SEtPt)



The Setpoint Output Parameters are only active when an optional Setpoint Output Module is installed in the meter. Some parameters in the menu will not appear depending on the Setpoint Assignment and Setpoint Output Action. The Setpoint Parameter Availability chart below illustrates this.

SETPOINT SELECT

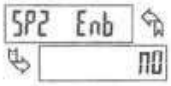


nO SP1 SP2

Select the Setpoint Output to be programmed, starting with Setpoint 1. The "n" in the following parameters reflects the chosen Setpoint number. After Setpoint 1 is completely programmed, the display returns to SPt SEL. Repeat steps for Setpoint 2 if both Setpoints are used in the application.

Select nO to exit the Setpoint programming module. The number of Setpoints available is dependent on the Setpoint option module installed.

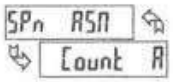
SETPOINT 2 ENABLE (SP2 Only)



nO YES

Select YES to enable Setpoint 2 and access the setup parameters. If nO is selected, the unit returns to SPt SEL and Setpoint 2 is disabled.

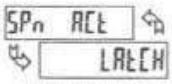
SETPOINT ASSIGNMENT



Count A Count b rAtE

Select the display to which the Setpoint is assigned.

SETPOINT OUTPUT ACTION



LAtCH t-OUt bOUnd

The parameter selects the action of the Setpoint Output as described in the chart. Boundary output action is not applicable for Counter B assignment.

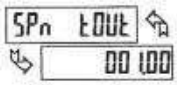
SPT ACTION	DESCRIPTION	OUTPUT ACTIVATES	OUTPUT DEACTIVATES
LAtCH	Latched Output Mode	When Count = Setpoint	At Manual Reset (if SPn rSt=YES)
t-OUt	Timed Output Mode	When Count = Setpoint	After Setpoint Output Time-Out
bOUnd	Boundary Mode (High Acting Type)	When Count ≥ Setpoint	When Count < Setpoint
	Boundary Mode (Low Acting Type)	When Count ≤ Setpoint	When Count > Setpoint

SETPOINT PARAMETER AVAILABILITY

PARAMETER	DESCRIPTION	COUNTER ASSIGNMENT (A or B) *			RATE ASSIGNMENT		
		TIMED OUT t-OUt	BOUNDARY bOUnd	LATCH LAtCH	TIMED OUT t-OUt	BOUNDARY bOUnd	LATCH LAtCH
SPn tOUt	Setpoint Output Time-out Value	Yes	No	No	Yes	No	No
SPn URL	Setpoint Value	Yes	Yes	Yes	Yes	Yes	Yes
SPn OUt	Setpoint Output Logic	Yes	Yes	Yes	Yes	Yes	Yes
SPn L It	Setpoint Annunciator	Yes	Yes	Yes	Yes	Yes	Yes
SPn P-UP	Setpoint Output Power-up State	No	No	Yes	No	No	Yes
SPn tYPE	Setpoint Boundary Type	No	Yes	No	Yes	Yes	Yes
SPn Stby	Standby Operation (Low acting only)	No	Yes	No	Yes	Yes	Yes
SPn AUtO	Counter Auto Reset	Yes	No	Yes	No	No	No
SP1 OFF2	SP1 Output Off at SP2 (SP1 only)	Yes	No	Yes	No	No	No
SP2 OFF1	SP2 Output Off at SP1 (SP2 only)	Yes	No	Yes	No	No	No
SPn rSt	Output Reset with Manual Reset	Yes	No	Yes	Yes	No	Yes
SPn CHC	Change Display Color w/ Output State	Yes	Yes	Yes	Yes	Yes	Yes

** BOUNDARY Setpoint Action not applicable for Counter B Assignment*

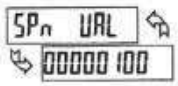
SETPOINT OUTPUT TIME-OUT



001 to 59999 seconds

This parameter is only active if the Setpoint Action is set to time out (t-Out). Enter the value in seconds that the Setpoint output will be active, once the Setpoint Value is reached.

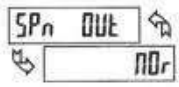
SETPOINT VALUE



Count A: -9999999 to 99999999
Count B: 0 to 9999999
Rate: 0 to 999999

Enter the desired Setpoint value. To enter a negative setpoint value, increment digit 8 to display a "-" sign (Counter A only).

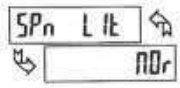
SETPOINT OUTPUT LOGIC



nOr rEU

Normal (nOr) turns the output "on" when activated and "off" when deactivated. Reverse (rEU) turns the output "off" when activated and "on" when deactivated.

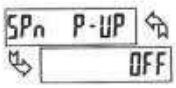
SETPOINT ANNUNCIATOR



nOr rEU

Normal (nOr) displays the setpoint annunciator when the corresponding output is "on". Reverse (rEU) displays the setpoint annunciator when the output is "off".

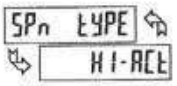
SETPOINT OUTPUT POWER-UP STATE



OFF ON SAVE

SAVE will restore the output to the same state it was at before the meter was powered down. ON will activate the output at power up. OFF will deactivate the output at power up.

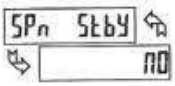
SETPOINT BOUNDARY TYPE



HI-ACt LO-ACt

High Acting Boundary Type activates the output when the assigned display value (SPn ASn) equals or exceeds the Setpoint value. Low Acting activates the output when the assigned display value is less than or equal to the Setpoint.

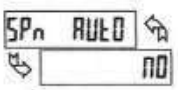
SETPOINT STANDBY OPERATION



nO YES

This parameter only applies to Low Acting Boundary Type setpoints. Select YES to disable a Low Acting Setpoint at power-up, until the assigned display value crosses into the output "off" area. Once in the output "off" area, the Setpoint will then function per the description for Low Acting Boundary Type.

COUNTER AUTO RESET

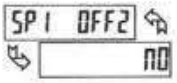


nO ZEro-Str CtLd-Str
ZEro-End CtLd-End

This parameter automatically resets the counter to which the setpoint is assigned (SPn ASn) each time the setpoint value is reached. The automatic reset can occur at output start, or at output end if the Setpoint Output Action is programmed for timed output mode. The Reset-to-Count Load selections ("CtLd-") only apply to Counter A assignment. This reset may be different from the Counter A Reset Action selected in Module 1.

SELECTION	ACTION
nO	No Auto Reset.
ZEro-Str	Reset to Zero at the start of output activation.
CtLd-Str	Reset to Count Load value at the start of output activation.
ZEro-End	Reset to Zero at the end of output activation (timed out only).
CtLd-End	Reset to Count Load value at the end of output activation (timed out only).

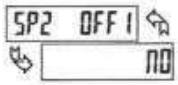
SETPOINT 1 OUTPUT OFF AT SETPOINT 2 (SP1 Only)



nO Out2-Str Out2-End

This parameter will deactivate Setpoint 1 output at the Start or End of Setpoint 2 output (O1 off at O2). The "-End" setting only applies if Setpoint 2 Output Action is programmed for timed output.

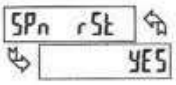
SETPOINT 2 OUTPUT OFF AT SETPOINT 1 (SP2 Only)



nO Out1-Str Out1-End

This parameter will deactivate Setpoint 2 output at the Start or End of Setpoint 1 output (O2 off at O1). The "-End" setting only applies if Setpoint 1 Output Action is programmed for timed output.

SETPOINT OUTPUT RESET WITH MANUAL RESET

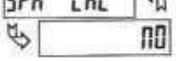


YES nO

Selecting YES causes the Setpoint output to deactivate (reset) when the Setpoint Assigned Counter is reset. The counter reset can occur by the **RST** button, User Input, Counter Reset at Power-up or a serial Reset Counter command.

This output reset will not occur when the Assigned Counter is reset by a Setpoint generated Counter Auto Reset.

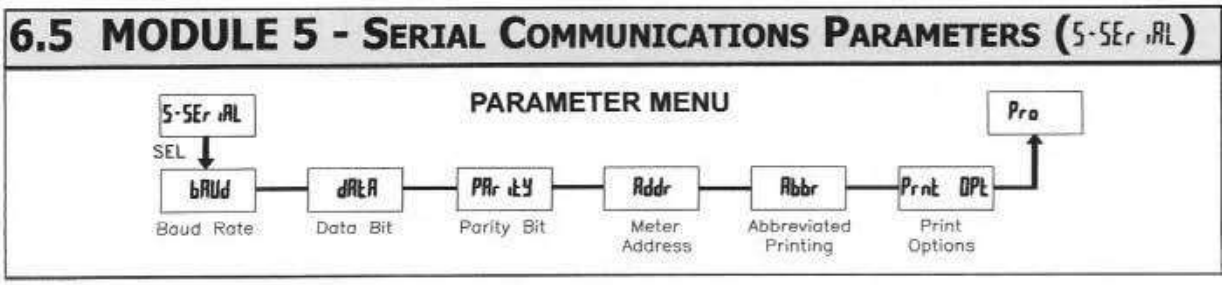
CHANGE DISPLAY COLOR WITH OUTPUT STATE



nO YES

This parameter enables the backlight CUB5 to switch the backlight color when the output state changes. This parameter is only active for the backlight version.

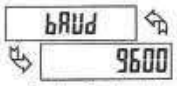
6.5 MODULE 5 - SERIAL COMMUNICATIONS PARAMETERS (5-SEr iAL)



The Serial Communications Parameters are only accessible when an optional RS232 or RS485 serial communications module is installed in the meter.

This section replaces the bulletin shipped with the RS232 and RS485 serial communications plug-in cards. Discard the separate bulletin when using those serial plug-in cards with the CUB5B and CUB5R.

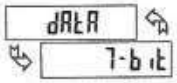
BAUD RATE



300 1200 4800 19200
600 2400 9600 38400

Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting and receiving.

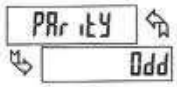
DATA BIT



7-bit 8-bit

Select either 7- or 8-bit data word length. Set the word length to match the other serial communications equipment on the serial link.

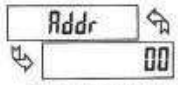
PARITY BIT



no Odd EVEn

This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to no, an additional stop bit is used to force the frame size to 10 bits.

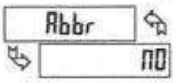
METER ADDRESS



0 to 99

Enter the serial node address. With a single unit, an address is not needed and a value of zero can be used (RS232 applications). Otherwise, with multiple bussed units, a unique address number must be assigned to each meter. The node address applies specifically to RS485 applications.

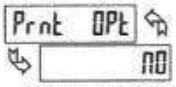
ABBREVIATED PRINTING



no YES

This parameter determines the formatting of data transmitted from the meter in response to a Transmit Value command or a Block Print Request. Select no for a full print transmission, consisting of the meter address, mnemonics, and parameter data. Select YES for abbreviated print transmissions, consisting of the parameter data only. This setting is applied to all the parameters selected in the PRINT OPTIONS. (Note: If the meter address is 0, the address will not be sent during a full transmission.)

PRINT OPTIONS



no YES

This parameter selects the meter values transmitted in response to a Print Request. A print request is also referred to as a block print because more than one parameter can be sent to a printer or computer as a block.

Selecting YES displays a sublist for choosing the meter parameters to appear in the print block. All active parameters entered as YES in the sublist will be transmitted during a block print. Parameters entered as no will not be sent.

The "Print All" (Prnt ALL) option selects all meter values for transmitting (YES), without having to individually select each parameter in the sublist.

Note: Inactive parameters will not be sent regardless of the print option setting. For example, Counter B or Scale Factor B will only be sent if Counter B is enabled (Dual Counter mode or batch count). Likewise, the Setpoint value(s) will not be sent unless an optional setpoint card is installed in the meter.

DISPLAY	DESCRIPTION	FACTORY SETTING	MNEMONIC
Count A	Counter A	YES	CTA
Count b	Counter B	no	CTB
rAtE	Rate Value	no	RTE
CntA ScF	Scale Factor A	no	SFA
Cntb ScF	Scale Factor B	no	SFB
SP1	Setpoint 1	no	SP1
SP2	Setpoint 2	no	SP2
CntA Ld	Counter A Count Load	no	CLD

Sending Serial Commands and Data

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a command terminator character, * or $.

Command Chart

Command	Description	Notes
N	Node (meter) Address Specifier	Address a specific meter. Must be followed by one or two digit node address. Not required when node address = 0.
T	Transmit Value (read)	Read a register from the meter. Must be followed by a register ID character.
V	Value Change (write)	Write to register of the rmeter. Must be followed by a register ID character and numeric data.
R	Reset	Reset a count value or setpoint output. Must be followed by a register ID character
P	Block Print Request (read)	Initiates a block print output. Registers in the print block are selected in Print Options.

Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to illegal commands. The following procedure details construction of a command string:

1. The first 2 or 3 characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the optional address specifier, the next character is the command character.
3. The next character is the register ID. This identifies the register that the command affects. The P command does not require a register ID character. It prints all the active selections chosen in the Print Options menu parameter.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See Command Response Time section for differences in meter response time when using the * and $ terminating characters.

Register Identification Chart

ID	Value Description	MNEMONIC	Applicable Commands	Transmit Details (T and V)
A	Counter A	CTA	T, V, R	8 digit positive/7 digit negative (with minus sign)
B	Counter B	CTB	T, V, R	7 digit, positive only
C	Rate	RTE	T	6 digit, positive only
D	Scale Factor A	SFA	T, V	6 digit, positive only
E	Scale Factor B	SFB	T, V,	6 digit, positive only
F	Setpoint 1 (Reset Output 1)	SP1	T, V, R	per setpoint Assignment, same as Counter or Rate
G	Setpoint 2 (Reset Output 2)	SP2	T, V, R	per setpoint Assignment, same as Counter or Rate
H	Counter A Count Load Value	CLD	T, V	8 digit positive/7 digit negative (with minus sign)

Command String Examples:

1. Node address = 17, Write 350 to the Setpoint 1 value
   String: N17VF350*
2. Node address = 5, Read Counter A, response time of 50 msec min
   String: N5TA*
3. Node address = 0, Reset Setpoint 1 output
   String: RF*
4. Node address = 31, Request a Block Print Output, response time of 2 msec min
   String: N31P$

Transmitting Data to the Meter

Numeric data sent to the meter must be limited to transmit details listed in the Register Identification Chart. Leading zeros are ignored. Negative numbers must have a minus sign. The meter ignores any decimal point and conforms the number to the scaled resolution. (For example: The meter's scaled decimal point position is set for 0.0 and 25 is written to a register. The value of the register is now 2.5. In this case, write a value of 250 to equal 25.0).

Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.

Receiving Data From The Meter

Data is transmitted from the meter in response to either a transmit command (T), a block print request command (P) or a User Input print request. The response from the meter is either a full field transmission or an abbreviated transmission, depending on the selection chosen in Module 5.

Full Field Transmission

Byte	Description
1, 2	2 byte Node Address field [00-99]
3	<SP> (Space)
4-6	3 byte Register Mnemonic field
7-18	12 byte data field; 10 bytes for number, one byte for sign, one byte for decimal point
19	<CR> (carriage return)
20	<LF> (line feed)
21	<SP>* (Space)
22	<CR>* (carriage return)
23	<LF>* (line feed)

** These characters only appear in the last line of a block print.*

The first two characters transmitted are the meter address. If the address assigned is 0, two spaces are substituted. A space follows the meter address field. The next three characters are the register mnemonic, as shown in the Register Identification Chart.

The numeric data is transmitted next. The numeric field (bytes 7 to 18) is 12 characters long. When a requested counter or rate value exceeds the meter's display limits, an * (used as an overflow character) replaces a space in byte 7. Byte 8 is always a space.

The remaining ten positions of this field consist of a minus sign (for negative values), a floating decimal point (if applicable), and eight positions for the requested value. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.

The end of the response string is terminated with a <CR> and <LF>. After the last line of a block print, an extra <SP>, <CR> and <LF> are added to provide separation between the print blocks.

Abbreviated Transmission

Byte	Description
1-12	12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point
13	<CR> (carriage return)
14	<LF> (line feed)
15	<SP>* (Space)
16	<CR>* (carriage return)
17	<LF>* (line feed)

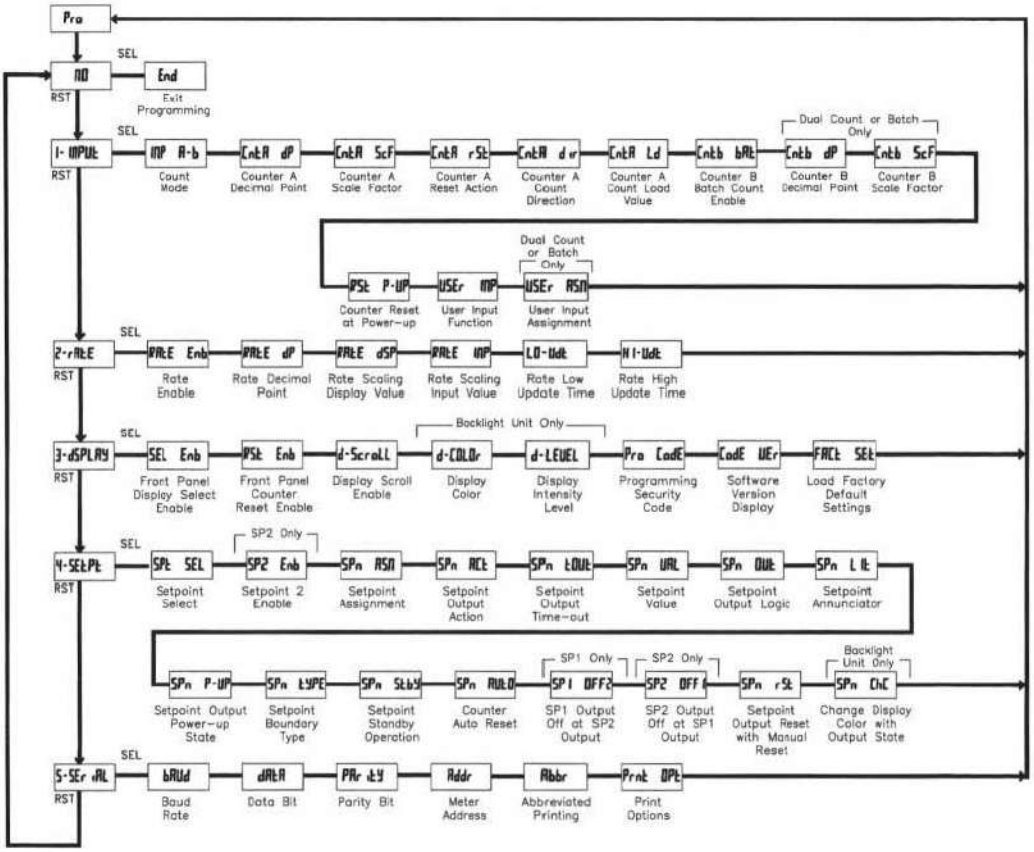
** These characters only appear in the last line of a block print.*

The abbreviated response suppresses the node address and register ID, leaving only the numeric part of the response.

Meter Response Examples:

1. Node address = 17, full field response, Counter A = 875
   17 CTA 875 <CR><LF>
2. Node address = 0, full field response, Setpoint 1 = -250.5
   SP1 -250.5<CR><LF>
3. Node address = 0, abbreviated response, Setpoint 1 = 250, last line of block print
   250<CR><LF><SP><CR><LF>

Press and hold **SEL** key to enter Programming Mode.



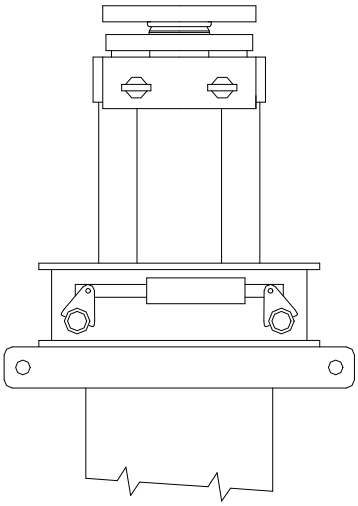
SECTION X

TROUBLESHOOTING GUIDE FOR THE LIFT-N-LOCK HYDRAULIC GANTRY

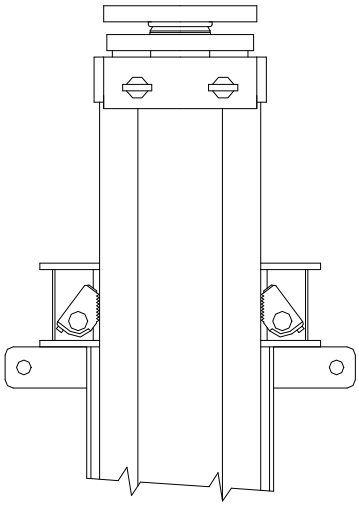
TROUBLE	POSSIBLE CAUSE(S)	SOLUTIONS
LIFT BOOM WILL NOT EXTEND	CONTROL MODULE IS NOT STARTED OR ON.	ENSURE CONTROL MODULE ENGINE OR MOTOR IS OPERATIONAL.
	OPERATING LEVER (3-07-20120) IS NOT ENGAGED IN THE PROPER DIRECTION	PULL OPERATING LEVER **TOWARDS** OPERATOR
	POWER HOSE ROUTED INCORRECTLY	CHECK POWER HOSE ROUTING FROM CONTROL MODULE TO GANTRY: REROUTE POWER HOSE IF NECESSARY
	QUICK COUPLINGS (2-40-10160 & 2-40-10161) ARE NOT FULLY ENGAGED	• REMOVE AND REENGAGE QUICK COUPLINGS ON THE GANTRY AND THE CONTROL MODULE TO ENSURE THEY ARE FULLY ENGAGED. • CHECK FOR FULL ENGAGEMENT OF COUPLINGS BY EXTENDING OR RETRACTING GANTRY.
	MAIN SELECTOR VALVE (2-00-10100) HANDLE LOCATED ON THE GANTRY LEG IS IN THE WRONG POSITION.	MAKE SURE MAIN SELECTOR VALVE HANDLE (2-90-11360) LOCATED ON THE GANTRY LEG IS IN THE **DOWN** POSITION.
	GANTRY LEG MAY BE AT OR EXCEEDING ITôS LIFTING CAPACITY	CHECK PRESSURE GAUGE (2-35-21740), LOCATED ON THE CONTROL PANEL OF THE CONTROL MODULE, WHILE ATTEMPTING TO EXTEND GANTRY LEG. IF GAUGE READS 3000 PSI, THIS LEG IS AT ITôS MAXIMUM CAP. ***LOAD MUST BE REDUCED ON THIS LEG FOR FURTHER EXTENSION***.
	HYDRAULIC PUMP (2-10-21820) OUT OF ADJUSTMENT OR PUMP FAILURE	• CHECK PRESSURE GAUGE (2-35-21740), LOCATED ON THE CONTROL PANEL OF THE CONTROL MODULE, WHILE ATTEMPTING TO EXTEND GANTRY LEG. • IF GAUGE READS LITTLE OR NO PRESSURE, THE HYDRAULIC PUMP MAY NEED ADJUSTING OR REPLACEMENT. ***CONSULT FACTORY IN THIS SITUATION***.

TROUBLE	POSSIBLE CAUSE(S)	SOLUTIONS
GANTRY LIFT BOOM WILL NOT RETRACT	OPERATING LEVER (3-07-20120) IS NOT ENGAGED IN THE PROPER DIRECTION	PUSH OPERATING LEVER **AWAY** FROM OPERATOR
	CAM LOCKS ARE NOT FULLY DISENGAGED	• OBSERVE CAM LOCK CYLINDERS (2-15-14040) ON THE SECTION OF BOOM THAT IS NOT RETRACTING. • IF CAM CYLINDER ROD IS NOT FULLY EXTENDED WITH THE CAMS IN THE ñOFFò POSITION, THE CAMS MAY STILL BE IN THE ñONò POSITION. **SEE FIGURE 10-1** ***(ALSO REFER TO SECTION II, 6.0- CAM LOCK SYSTEM - OPERATIONAL PROCEDURES)*** • IN THIS SITUATION, THE GANTRY LIFT BOOM SHOULD BE EXTENDED SLIGHTLY (APPROXIMATELY 1-2 INCHES) BY PULLING THE CONTROL LEVER TOWARDS THE OPERATOR UNTIL THE CAM CYLINDER ROD IS FULLY EXTENDED. BEFORE THE CAM CYLINDER ROD RETRACTS, GENTLY PUSH THE CONTROL LEVER AWAY FROM THE OPERATOR TO LOWER THE GANTRY LIFT BOOM. **SEE FIGURE 10-2** ***(ALSO REFER TO SECTION II, 6.0- CAM LOCK SYSTEM - OPERATIONAL PROCEDURES)***
	POWER HOSE ROUTED INCORRECTLY	CHECK POWER HOSE ROUTING FROM CONTROL MODULE TO GANTRY: REROUTE POWER HOSE IF NECESSARY
	QUICK COUPLINGS (2-40-10160 & 2-40-10161) ARE NOT FULLY ENGAGED	• REMOVE AND REENGAGE QUICK COUPLINGS ON THE GANTRY AND THE CONTROL MODULE TO ENSURE THEY ARE FULLY ENGAGED. • CHECK FOR FULL ENGAGEMENT OF COUPLINGS BY EXTENDING OR RETRACTING GANTRY.
	MAIN SELECTOR VALVE (2-00-10100) HANDLE LOCATED ON THE OUTSIDE OF THE GANTRY LEG IS IN THE WRONG POSITION.	MAKE SURE MAIN SELECTOR VALVE HANDLE (2-90-11360), LOCATED ON THE GANTRY LEG, IS IN THE **DOWN** POSITION.

Figure 10-1
Cams in the “ON” Position

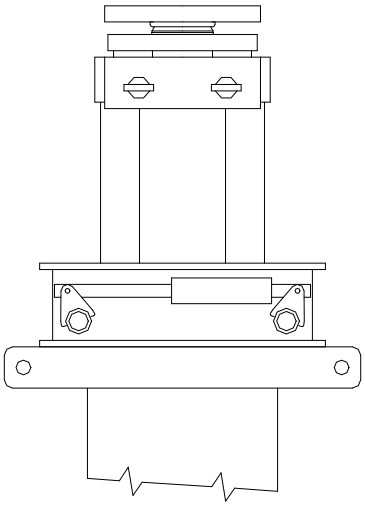


THE CAMS ARE IN THE "OFF" POSITION WHEN THE CAM CYLINDER IS EXTENDED AND THE CYLINDER MOUNTS ARE TILTED AWAY FROM THE CENTER OF THE BOOM.

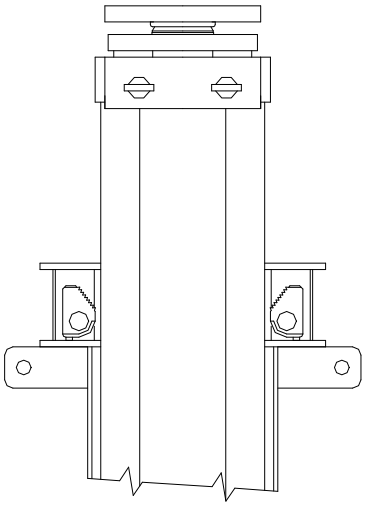


THIS SECTION VIEW SHOWS THE CAMS IN THE "OFF" POSITION. THE CAMS ARE ALSO TILTED AWAY FROM THE CENTER OF THE BOOM. THE CAM LOCK SYSTEM IS ON TWO SIDES OF THE LIFT BOOM.

Figure 10-2
Cams in the “OFF” Position



THE CAMS ARE IN THE "ON" POSITION WHEN THE CAM CYLINDER IS RETRACTED AND THE CYLINDER MOUNTS ARE TILTED TOWARDS THE CENTER OF THE BOOM.



THIS SECTION VIEW SHOWS THE CAMS IN THE "ON" POSITION. THE CAMS ARE ALSO TILTED TOWARDS THE CENTER OF THE BOOM. THE CAM LOCK SYSTEM IS ON TWO SIDES OF THE LIFT BOOM.

TROUBLE	POSSIBLE CAUSE(S)	SOLUTIONS
	LIFT BOOM DESCENT CONTROL VALVE (2-00-10220), LOCATED ON THE INSIDE OF THE GANTRY LEG, IS IMPROPERLY ADJUSTED.	• THE LIFT BOOM DESCENT CONTROL VALVE IS FACTORY SET. • IF IT IS TURNED TO TIGHTLY, IN THE **CLOCKWISE** DIRECTION, THE LIFT BOOM CAN BE STOPPED OR RETRACT AT A VERY SLOW SPEED. • CHECK VALVE TO ENSURE IT IS NOT TURNED TO TIGHT IN THE **CLOCKWISE** DIRECTION. IF TIGHT, SLOWLY TURN IN THE **COUNTERCLOCKWISE** DIRECTION UNTIL THE PROPER RETRACT SPEED IS ACHIEVED.
	HYDRAULIC PUMP (2-10-21820) OUT OF ADJUSTMENT OR PUMP FAILURE	• CHECK PRESSURE GAUGE (2-35-21740), LOCATED ON THE CONTROL PANEL OF THE CONTROL MODULE, WHILE ATTEMPTING TO RETRACT GANTRY LEG. • IF GAUGE READS LESS THAN NORMAL RETRACT OPERATING PRESSURE OR NO PRESSURE, THE HYDRAULIC PUMP MAY NEED ADJUSTING OR REPLACEMENT. ***CONSULT FACTORY IN THIS SITUATION.***
GANTRY LEG WILL NOT PROPEL IN ONE OR BOTH DIRECTIONS	OPERATING LEVER (3-07-20120) IS NOT ENGAGED IN THE PROPER DIRECTION	PULL OPERATING LEVER **TOWARDS** OPERATOR OR PUSH OPERATING LEVER AWAY FROM OPERATOR DEPENDING ON THE DESIRED PROPEL DIRECTION.
	POWER HOSE ROUTED INCORRECTLY	CHECK POWER HOSE ROUTING FROM CONTROL MODULE TO GANTRY: REROUTE POWER HOSE IF NECESSARY
	QUICK COUPLINGS (2-40-10160 & 2-40-10161) ARE NOT FULLY ENGAGED	• REMOVE AND REENGAGE QUICK COUPLINGS ON THE GANTRY AND THE CONTROL MODULE TO ENSURE THEY ARE FULLY ENGAGED. • CHECK FOR FULL ENGAGEMENT OF COUPLINGS BY EXTENDING OR RETRACTING GANTRY.
	MAIN SELECTOR VALVE (2-00-10100) HANDLE LOCATED ON THE GANTRY LEG IS IN THE WRONG POSITION.	MAKE SURE MAIN SELECTOR VALVE HANDLE (2-90-11360), LOCATED ON THE OUTSIDE OF THE GANTRY LEG, IS IN THE **UP** POSITION.

TROUBLE	POSSIBLE CAUSE(S)	SOLUTIONS
	SPEED CONTROL VALVE (2-00-10180), LOCATED ON THE INSIDE OF THE GANTRY LEG, IS IMPROPERLY ADJUSTED.	• THE SPEED CONTROL VALVE IS FACTORY SET. IF IT IS TURNED TO TIGHTLY, IN THE **CLOCKWISE** DIRECTION, THE GANTRY PROPEL CAN BE STOPPED OR TRAVEL AT A VERY SLOW SPEED. • CHECK VALVE TO ENSURE IT IS NOT TURNED TO TIGHT IN THE **CLOCKWISE** DIRECTION. • IF TIGHT, SLOWLY TURN IN THE **COUNTERCLOCKWISE** DIRECTION UNTIL THE PROPER PROPEL SPEED IS ACHIEVED.
	IMPROPER SET-UP OR OBSTRUCTIONS ON TRACK	• INSPECT TRACK FOR OBSTRUCTIONS, SEAMS OR GAPS BETWEEN TRACK SECTIONS WHICH COULD RESTRICT THE GANTRY DRIVE WHEELÕS (3-50-12200) MOVEMENT. • IF DEBRIS BECOMES LODGED UNDER THE DRIVE WHEELS, IT MAY CAUSE THE WHEELS TO STOP ROLLING. IN THIS SITUATION THE DEBRIS MUST BE REMOVED BY EITHER DISLODGING THE OBSTRUCTION OR REVERSING THE DIRECTION OF THE GANTRY UNTIL ACCESS TO THE DEBRIS IS ACHIEVED. • IF GANTRY WHEELS CAN BECOME LODGED IN GAPS OR SEAMS BETWEEN THE TRACK SECTIONS, THE GAPS MUST BE BRIDGED OR SHIMMED SUCH THAT THE WHEELS ONLY TRAVEL OVER A SMOOTH, FLAT SURFACE.
	GANTRY PROPEL DRIVE SYSTEM	• WHILE AN OPERATOR IS ATTEMPTING TO PROPEL THE GANTRY, OBSERVE THE GANTRY LEG PLANETARY GEAR BOX SHAFT (3-30-12100) LOCATED IN THE GANTRY HOUSING, FOR PROPER OPERATION ***CAUTION:*** ***DO NOT STAND IN THE PATH OF THE GANTRY HOUSING WHILE OBSERVING THIS OPERATION***

TROUBLE	POSSIBLE CAUSE(S)	SOLUTIONS
		• IF THE PLANETARY GEAR BOX SHAFT IS TURNING, THE DRIVE SPROCKET (3-05-11920), LOCATED ON THE PLANETARY GEAR BOX SHAFT, SHOULD ALSO BE TURNING. • IF THE SPROCKET IS NOT TURNING WITH THE GEAR BOX SHAFT, THE DRIVE SPROCKET KEYWAY NEEDS TO BE REPAIRED. • IF THE DRIVE SPROCKET AND THE DRIVE CHAIN ARE TURNING, BUT THE WHEELS ARE NOT TURNING, THE DRIVEN SPROCKETõS (3-10-11960) KEYWAY NEEDS TO BE REPAIRED. • IF ALL COMPONENTS ABOVE ARE TURNING, THE WHEELS ARE SLIPPING ON THE TRACK (SEE ABOVE) • IF NONE OF THE ABOVE REFLECT WHAT IS OCCURRING WITH THE GANTRY, TEST ANOTHER GANTRY. • IF THE OTHER LEG PROPELS AND/OR EXTENDS & RETRACTS THEN THE GEAR BOX (3-30-12100) OR THE DRIVE MOTOR (2-05-11660) HAS FAILED. ***CONSULT FACTORY FOR REPLACEMENT PUMP, GEAR BOX OR DRIVE MOTOR***
	HYDRAULIC PUMP (2-10-21820) OUT OF ADJUSTMENT OR PUMP FAILURE	• CHECK PRESSURE GAUGE (2-35-21740), LOCATED ON THE CONTROL PANEL OF THE CONTROL MODULE, WHILE ATTEMPTING TO PROPEL GANTRY LEG. • IF GAUGE READS LESS THAN NORMAL RETRACT OPERATING PRESSURE OR NO PRESSURE, THE HYDRAULIC PUMP MAY NEED ADJUSTING OR REPLACEMENT. PRIOR TO CONTACTING THE ***CONSULT FACTORY IN THIS SITUATION.***

SECTION XI

LIMITED WARRANTY

J&R Engineering Company Inc. (J&R), located at 538 Oakland Avenue, Mukwonago, Wisconsin 53149, warrants each new product to be free from defects in material and workmanship for a period of one (1) year from the date of the shipment by J&R. Warranty applies only to the equipment when properly utilized and maintained in applications consistent with its intended normal use. The warranty herein made is extended only to the original purchaser from J&R. J&R shall have no liability hereunder with respect to the products which have been subjected to misuse, incorrect installment, negligence, accident or other external forces which may have caused or accentuated any apparent failure of such products to conform to the warranty herein made.

Should any product be found under normal use and service during the warranty period to be defective, J&R will, at its option, repair or replace such products f.o.b. Mukwonago, Wisconsin, USA, provided such product is returned to the location designated by J&R. Any replacement provided under this warranty will be warranted for the remainder of the warranty period applicable to the product in which it is installed or which it replaces.

This warranty shall not apply to a product upon which repairs or alterations have been made, unless authorized by J&R. Buyerôs remedy under this warranty is exclusive and is limited to repair or replacement as provided herein. J&R makes no implied warranties of fitness for particular purpose and in no event shall be responsible for or liable to purchaser, purchaserôs agent, assigns, or other legally related parties for any consequential economic damages in contract or tort nor shall J&R be held liable for any expenses, attorneyôs fees, or delays caused by defective material or workmanship. Warranties are limited to cost of parts and labor only for defective material or workmanship for a one (1) year period excluding shipping. Repairs will be made at the Mukwonago, Wisconsin USA plant or any other location designated by J&R. No allowance will be made for repair, replacement or alteration unless made with the written consent of J&R.

THE WARRANTY HEREIN MADE IN LIEU OF ANY OTHER WARRANTIES, WHETHER WRITTEN OR ORAL, EXPRESSED OR IMPLIED. J&R MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF ANY OTHER EXPRESS OR IMPLIED WARRANTY OF ANY KIND. NO PERSON IS AUTHORIZED TO ACT ON BEHALF OF J&R IN MODIFYING THE WARRANTY HEREIN MADE OR IN MAKING ANY ADDITIONAL OR OTHER WARRANTY.

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