



OPERATOR'S/SAFETY MANUAL

2020

PREFACE

Thank you for choosing the Nuhn Lagoon Crawler. This product has exceeded the industry standards through superior design. We anticipate your satisfaction in using the Crawler for your liquid manure management.

The Owner's Manual is provided to assist you in learning about the proper use and maintenance of your new Nuhn Lagoon Crawler. Please read your manual carefully now, and whenever you have a question about your Crawler.

Nuhn Industries Ltd.

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2 INTRODUCTION

2.1 AFTER-SALES SERVICE

It is the owner's responsibility to ensure that the Lagoon Crawler receives the proper maintenance at various service levels.

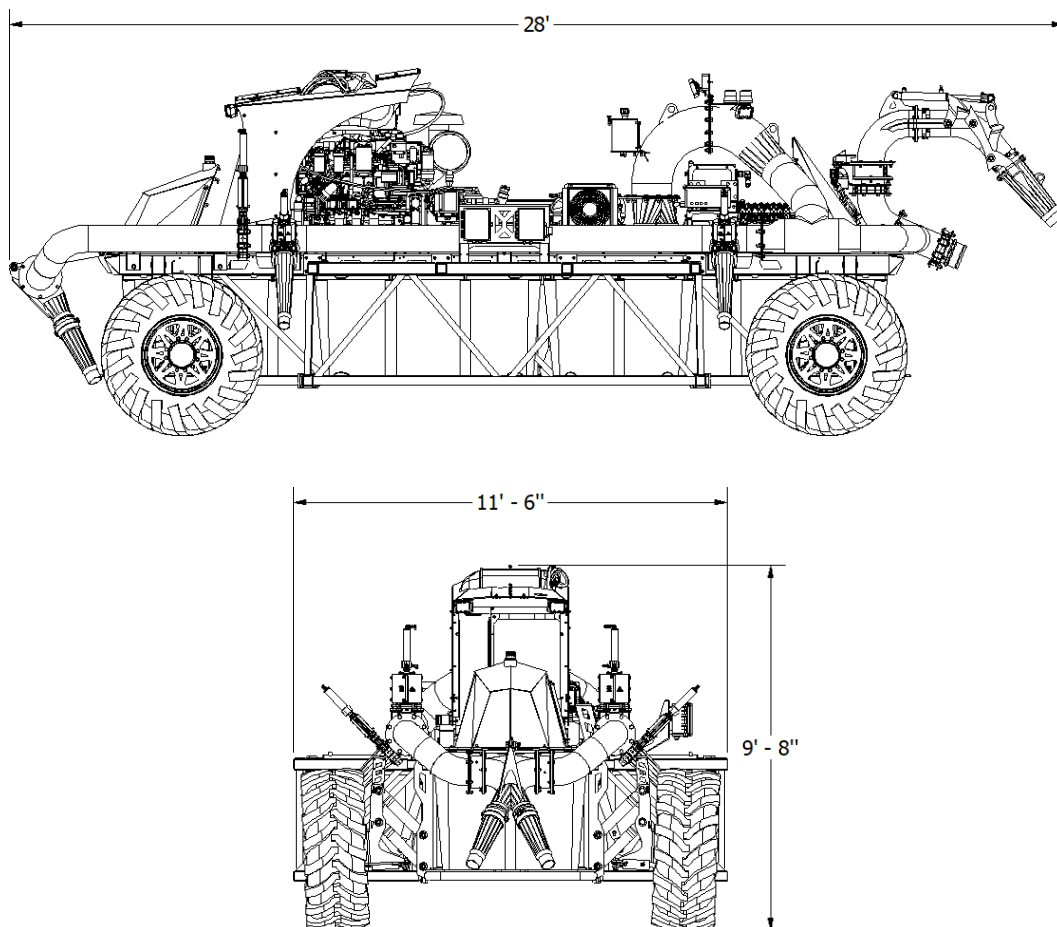
Your primary contact for After-Sales Service is your local Nuhn Dealer. If further assistance is needed, you can contact Nuhn Industries. Specific maintenance on the engine should be performed by an authorized Caterpillar dealer.

2.2 WARRANTY

The warranty section contains detailed information about the warranties made by Nuhn Industries and your obligations under these warranties.

This Owner's Manual contains additional information pertaining to the proper use and maintenance of your new Nuhn Lagoon Crawler.

2.3 GENERAL DIMENSIONS



2.4 TECHNICAL SPECIFICATIONS

Engine	CAT Diesel Tier 4 Motor Max. Power: 302HP, 225kW Max. Torque: 935lb-ft @ 1400rpm, 1268Nm @ 1400rpm Emissions: U.S. EPA Tier 4 Final Nonroad
Centrifugal Pump	12" Tri Port Header Pump 12,000GPM capacity 14" pump inlet 12" pump discharge 21" diameter impeller 3 outlets off of pump housing Tungsten carbide mechanical seal <i>Designed to work in the harshest sand environments</i> <i>Oil bath assembly - requires very little operator maintenance</i> Specifically designed for harsh lagoon environment <i>Pump is submerged in lagoon so it will not lose its prime</i> <i>Semi-open impellor design allows large foreign material to pass through pump</i>
User Interface	Complete Wireless Control All of the machine operation functions are controlled through the remote 50 hour battery life Functions: <i>Boat forward/reverse, as well as speed control</i> <i>Boat rotate left/right</i> <i>Boat shift left/right</i> <i>Drive forward/reverse</i> <i>Steer left/right</i> <i>Axle raise/lower</i> <i>Agitation gun movements</i> <i>Engine start/stop</i> <i>Engine throttle increase/decrease</i> <i>Clutch engage/disengage</i>
Drive System	Off-Road Independent A-Arm Suspension Four-Wheel Drive Four-Wheel Steering System 750/50 R24 Radial Tires Two Speed Hydraulic Wheel Drives High torque mode for crawling out of lagoons High speed mode for transporting on land
Agitation	7 Agitation Jets 1x 6" nozzle on front 2x 4" nozzles on rear 4x 3" nozzles on sides for steering

3 GENERAL OPERATION

3.1 GENERAL SAFETY MEASURES

This chapter contains important information, tips, and suggestions for safe operation. Please make certain that you follow the suggestions and heed the warnings given. It is in your own interest and the interest of the people and property around you. However, please note that important safety information regarding your Crawler and its operation will be found in all other chapters of this owner's manual. Please be sure that this manual always remains with your Crawler whenever you lend, or sell it to another individual. Remember – safety first!

Safety First!

Your safety and the safety of surrounding people and property should not be left to chance. Safe operation of this equipment is key. Safety is everyone's responsibility.



Warning!

Never ride on this machine. This is not a passenger vehicle.
Never operate beyond the limits of your skill and experience.
Only maintain or service machine with the main power disconnected!
Always use in accordance with prevailing weather, environmental, and traction conditions.

Always ensure no one is near the Crawler upon starting. The operator should be familiar with the controls and surrounding environment.

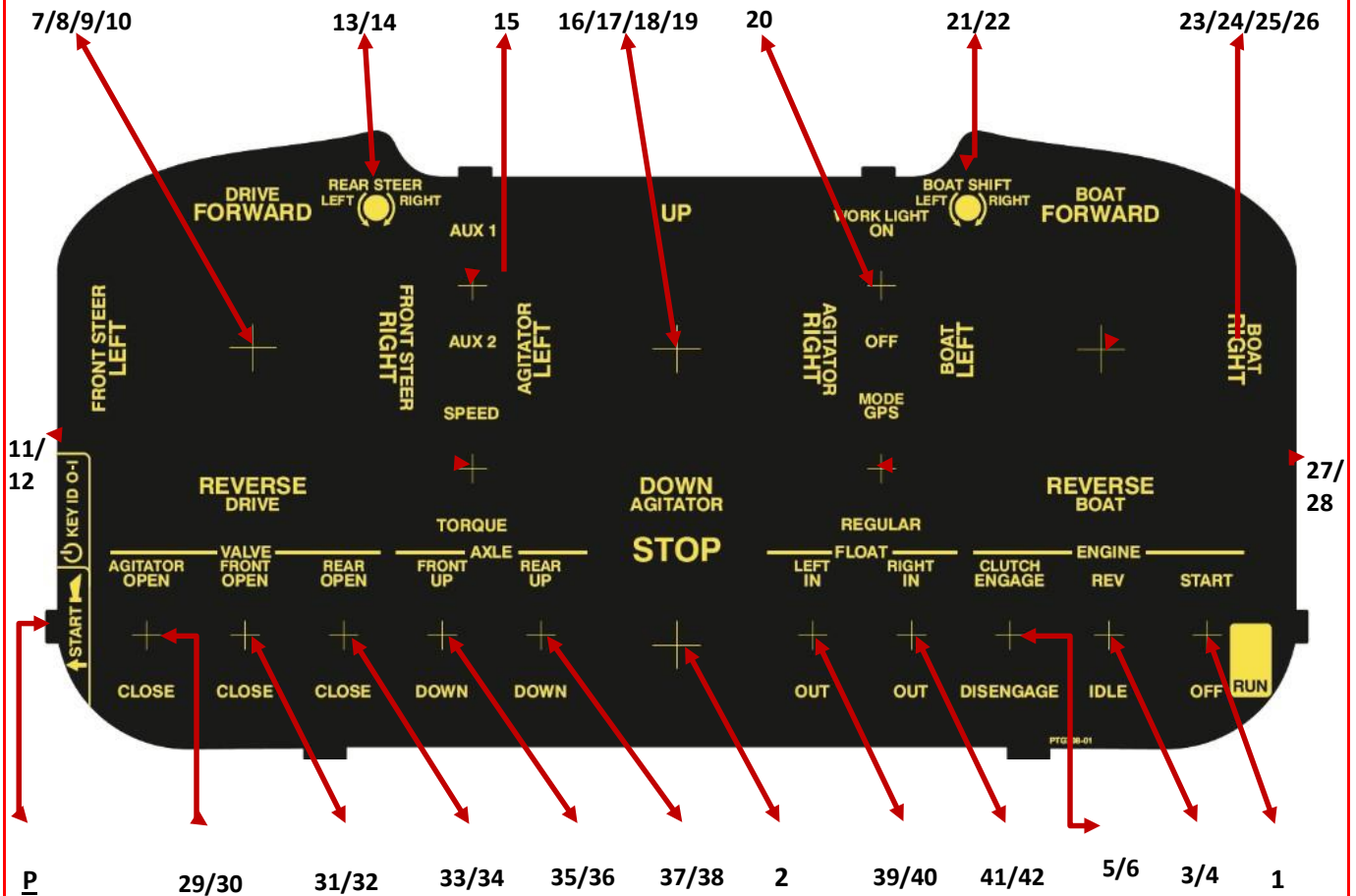
This is an over-width piece of equipment and should not be operated on narrow roads, or in high traffic areas. Be aware of your local road regulations.

Breaking in a new engine: See the Engine Manual

For the first 100 hours, the engine should be run at half speed or for short periods at full power.

3.2 BELLY PACK CONTROLLER OVERVIEW

3.2.1 QUICK REFERENCE GUIDE



ID	Name	Function
P	Power	The blue dial turns the remote on and off. This should be the primary method for turning the remote on/off.
1	Engine Start	Press the start button once to turn the receiver on, and start the fuel pump. Pressing and holding the start button a second time will start the machine.
2	Engine Stop	When activated, the engine will shutdown.
3	Engine Rev	When pressed, the engine will throttle up several hundred RPM. When the button is held, the engine will continuously throttle up, until the button is released.
4	Engine Idle	When pressed, the engine will throttle down several hundred RPM. When held, the engine will continuously throttle down, until the button is released.
5	Clutch Engage	This output engages the hydraulic clutch.
6	Clutch Disengage	This output disengages the hydraulic clutch.
7	Drive Forward	When the Drive joystick is pushed forward, the Crawler will drive in the direction of the main cannon. This feature is proportional, so the more the joystick is away from center, the faster the Crawler will drive.
8	Drive Reverse	When the Drive joystick is pushed in reverse, the Crawler will drive in the direction of the main cannon. This feature is proportional, so the more the joystick is away from center, the faster the Crawler will drive.
9	Drive Left	Moving the Drive joystick to the left will steer the front axle to the left.
10	Drive Right	Moving the Drive joystick to the right will steer the front axle to the right.
11	Speed	When pressed, the Crawler will move forward in its highest speed mode. This should only be pressed when driving on flat, open land.
12	Torque	When the Speed/Torque toggle is the Torque position, the drive speed of the Crawler will be slower, but will have more torque to climb out of steep manure pits.
13	Rear Steer Left	Twisting the joystick to the left will steer the rear axle to the right
14	Rear Steer Right	Twisting the joystick to the right will steer the rear axle to the left
15	Work Light On/Off	This toggle switch turns the working lights on and off.
16	Agitator Up	Pulling back on the joystick will raise the agitator cannon.
17	Agitator Down	Pushing forward on the joystick will lower the agitation cannon.
18	Agitator Left	Moving the joystick left will aim the agitator nozzle to the left. DO NOT USE FOR STEERING
19	Agitator Right	Moving the joystick right will aim the agitator nozzle to the right. DO NOT USE FOR STEERING
20	Auxiliary Switch	No function – available for future development.
21	Boat Shift Left	Twisting the joystick to the left will shift the boat to the left.
22	Boat Shift Right	Twisting the joystick to the right will shift the boat to the right.
23	Boat Forward	Rotates the rear nozzles, propelling the Crawler forward when it is submerged in the lagoon. Even when the button is released, the Crawler will continue to move at that speed.
24	Boat Reverse	Rotates the rear nozzles, propelling the Crawler backwards when it is submerged in the lagoon. Even when the button is released, the Crawler will continue to move at that speed.
25	Boat Rotate Left	Moving the joystick to the left rotates the Crawler to the left while in the lagoon
26	Boat Rotate Right	Moving the joystick to the right rotates the Crawler to the right while in the lagoon
27	GPS Mode On	This activates GPS mode on the Crawler. A good fence must be already in place, and the Crawler must be within the fenced zone for GPS mode to activate.
28	Regular Mode	Turns off GPS mode.
29	Agitator Valve Open	This switch will open the agitator valve. Press and hold this button for approx. five seconds to completely open the valve.
30	Agitator Valve Close	This switch will close the agitator valve. Press and hold this button for approx. five seconds to completely close the valve.
31	Front Valve Open	This toggle will open the auxiliary valve.
32	Front Valve Close	This toggle will close the auxiliary valve.
33	Rear Valve Open	This toggle will open the rear valves for the boat forward/reverse. Press and hold this button for approx. five seconds to completely open the valve.
34	Rear Valve Close	This toggle will close the rear valves for the boat forward/reverse. Press and hold this button for approx. five seconds to completely close the valve.
35	Front Axle Up	This toggle will raise the height of the front axle.

ID	Name	Function
36	Front Axle Down	This toggle will lower the height of the front axle.
37	Rear Axle Up	This toggle will raise the height of the rear axle.
38	Rear Axle Down	This toggle will lower the height of the rear axle.
39	Left Float In	This toggle brings the left floats in
40	Left Float Out	This toggle extends the left toggle
41	Right Float In	This toggle brings in the right floats
42	Right Float Out	This toggle extends the right floats

3.2.2 SYNCHRONIZE REMOTE

When first starting the Lagoon Crawler, the blue dial on the remote will need to be turned forward. This will power up the remote. The green button will need to be pressed and held for approximately 1 second in order to sync the remote to the receiver.

If the remote is not synced, the Crawler and the transmitter will start beeping to notify you that COM has been lost. To stop the Crawler from beeping, simply press and hold the green button.

3.3 IDENTIFICATION LIGHTS

There are two indicator lights on top of the Crawler near the pump – an amber light and a red light. The amber light means that the receiver has power. The red light means that there is a problem with the Lagoon Crawler. When the red light is on there will be an indicator light lit up on the electrical box on the side of the Crawler to help with further diagnosis.

3.4 REMOTE DISPLAY NAVIGATION

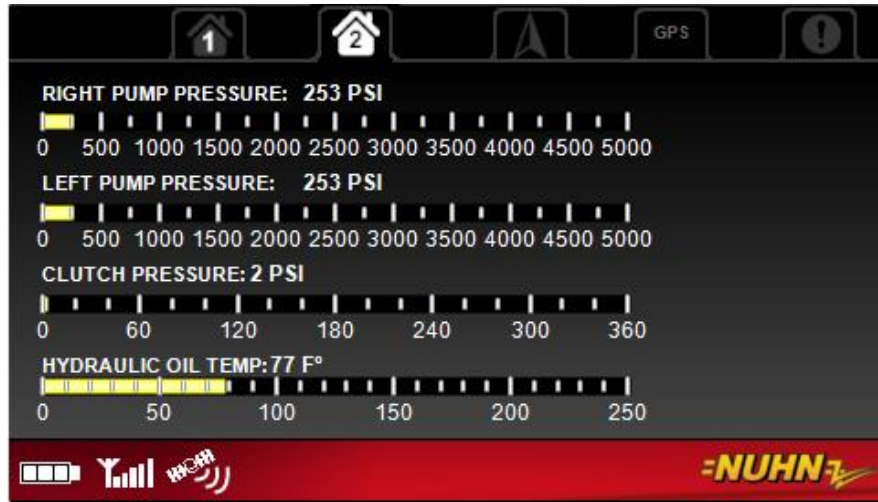
3.4.1 MAIN PAGE



Screen top buttons from left to right:

- 1 - Toggle Screen Brightness (or silence alarm when popup)
- 2 - Home Screen 1 (rpm)
- 3 - Home Screen 2 (hydraulic pressure/temp)
- 4 - Compass Info
- 5 - GPS Screen
- 6 - Alarm Screen

3.4.2 HYDRAULIC INFORMATION SCREEN

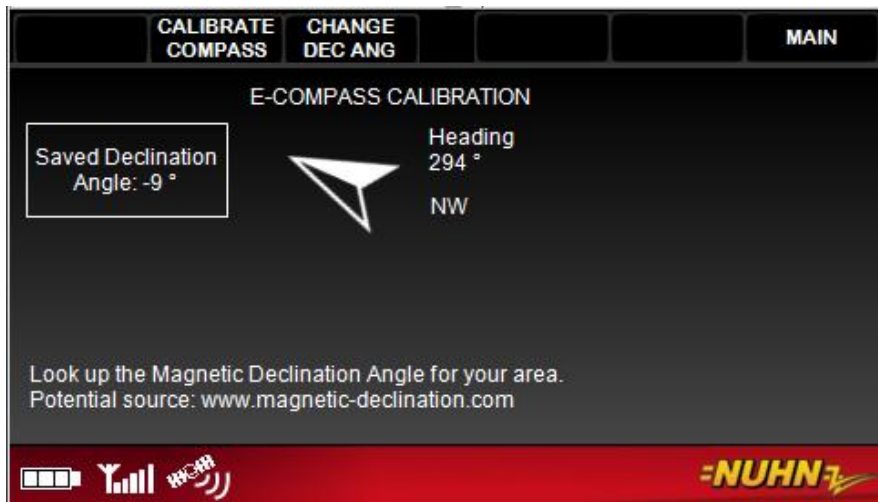


Right pump connects to the hydraulic valves on the panel side.

Right pump controls agitator left/right and the gate valves

Left pump controls the agitator up/down and the rest of the cylinder functions

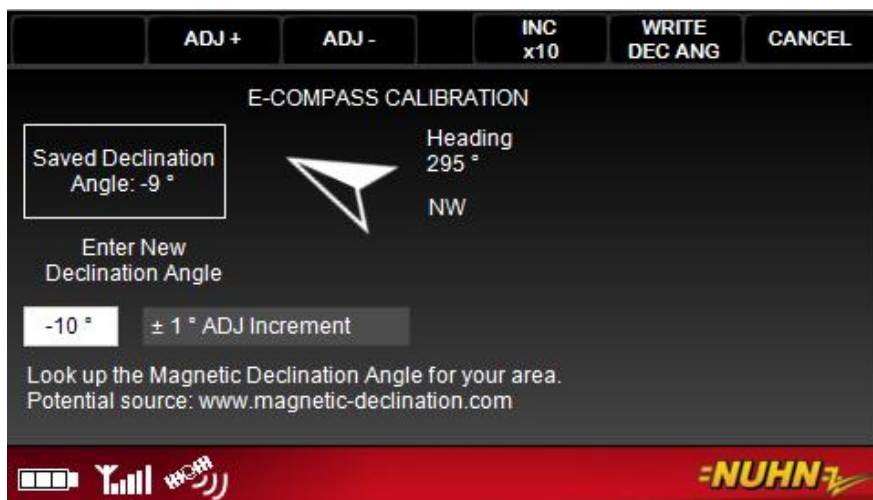
3.4.3 COMPASS SCREEN



Compass should be calibrated prior to first use of GPS mode, and could be calibrated again if heading readout erratic while in GPS mode

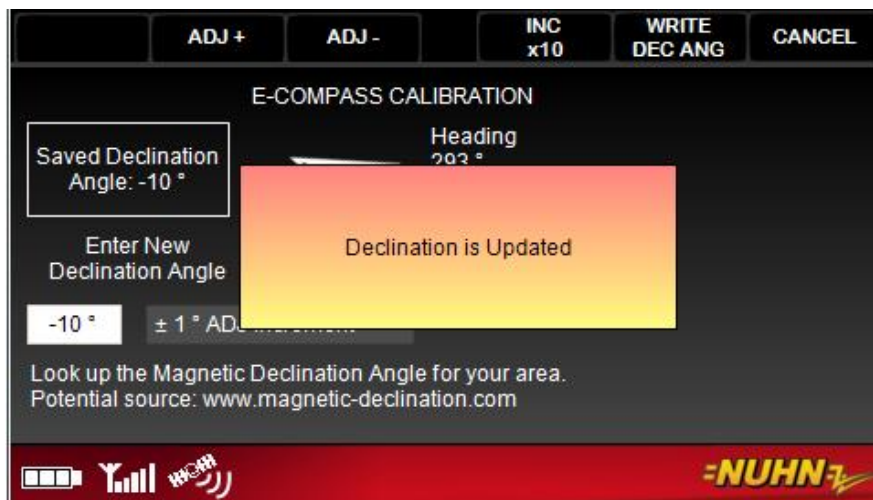
Saved declination angle box shows current declination value saved in the compass. The declination angle should be set based on your geographic area.

3.4.4 CHANGING DECLINATION ANGLE

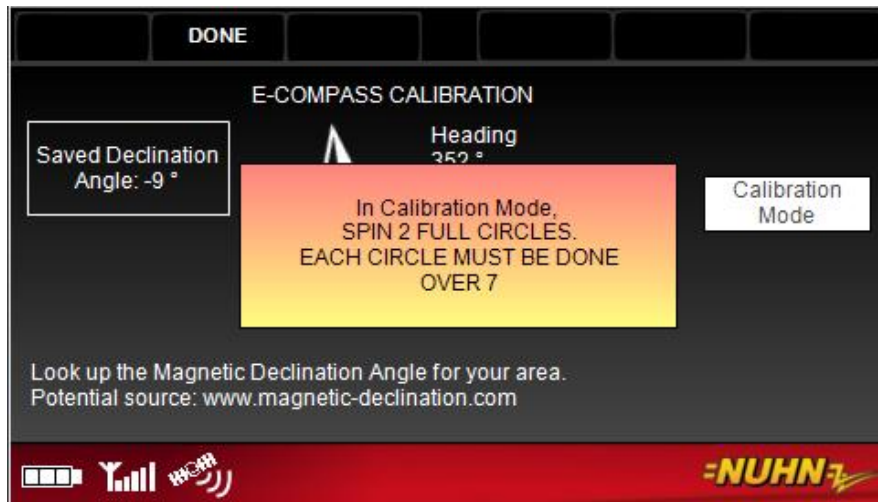


Use ADJ +/- buttons to enter a new declination angle.
Use WRITE DEC ANGLE button to send it to the compass.

Once declination has been updated correctly, verify value in saved declination angle box.



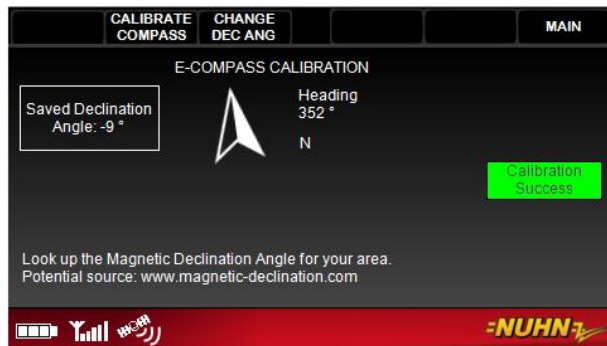
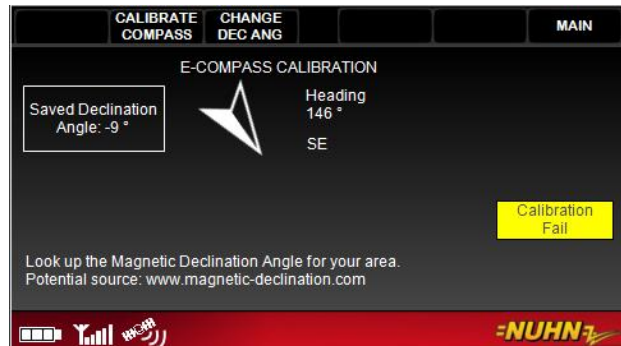
3.4.5 CALIBRATE COMPASS SCREEN



Compass calibration has been started (calibrate compass button)

Drive the machine to make 2 full circles. This is easiest to do while in the water. This process cannot be faster than 7 seconds for the 2 full circles.

After the Crawler has completed two full circles, press done. If the calibration was completed successfully, the calibration page will display CALIBRATION SUCCESS. If the process failed, the screen will display CALIBRATION FAIL



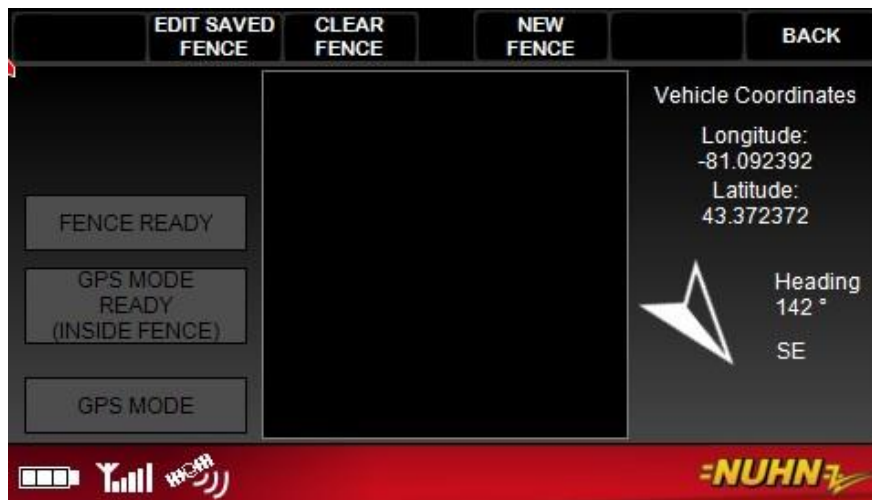
3.4.6 GPS SCREEN



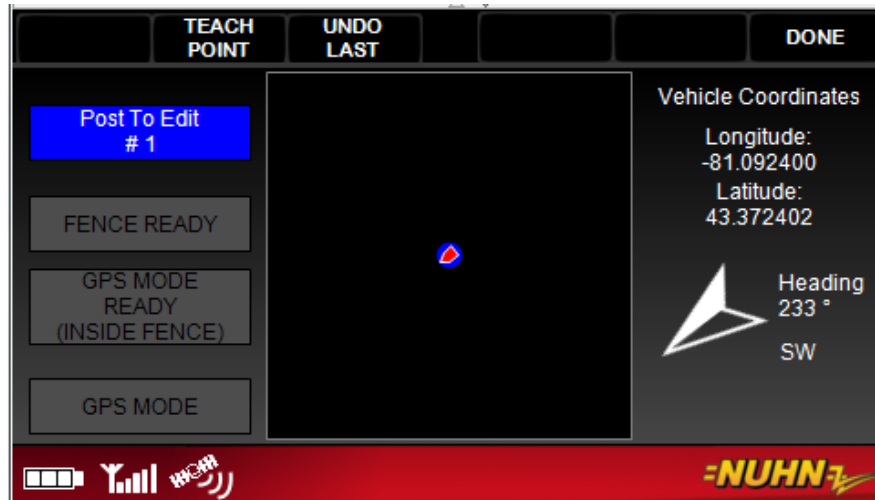
Main GPS Screen

3.4.7 CREATING A NEW FENCE

In order to operate in GPS Mode, you will need to create a boundary for the Crawler to operate within. First press the MODIFY FENCE button within the GPS menu. That will take you to the MODIFY FENCE PAGE. From here to create a new fence, press the NEW FENCE button.

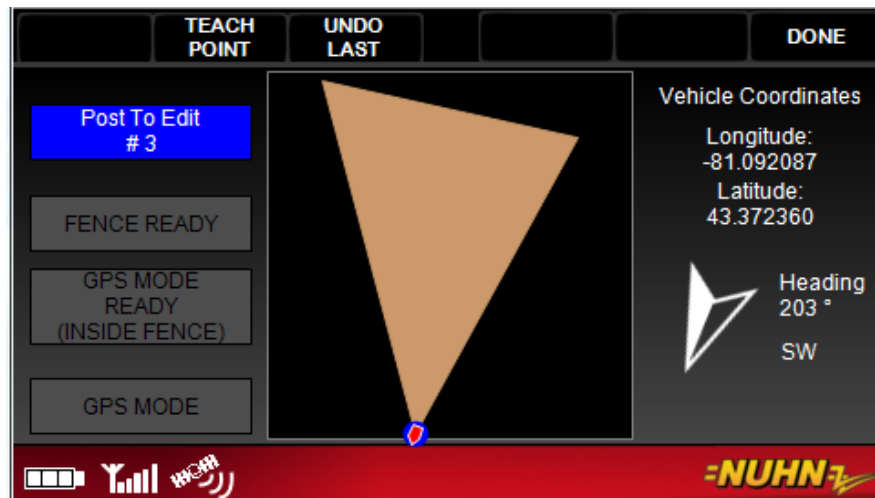


Modify Fence Screen



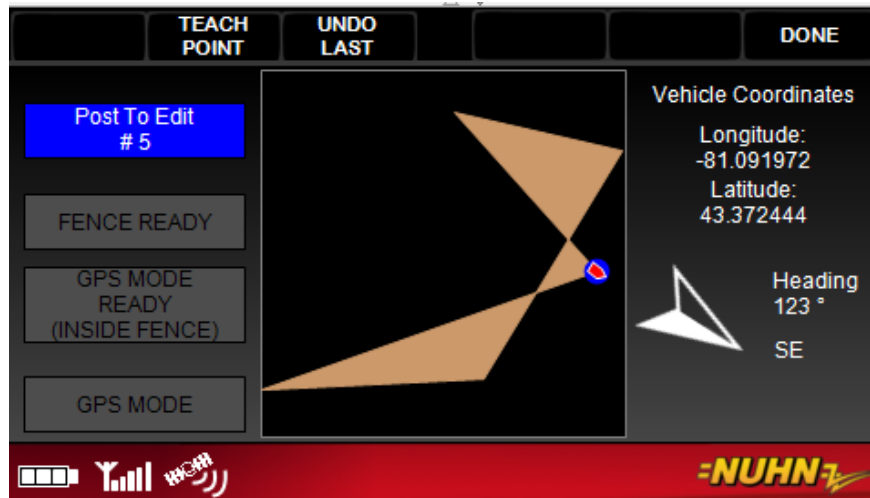
New Fence Screen

While on the New Fence Screen, drive the Crawler to where you want to set your first point. NOTE – be mindful about where you set your points. You should set your point at least 15ft away from an obstacle in case the Crawler goes out of bounds for a brief moment. When you want to set the point, hit TEACH POINT.



Continue driving (boating) the machine around perimeter of area and use teach point to create the GPS fence positions. The representation of fence shape will be created and updated as you continue to create the shape.

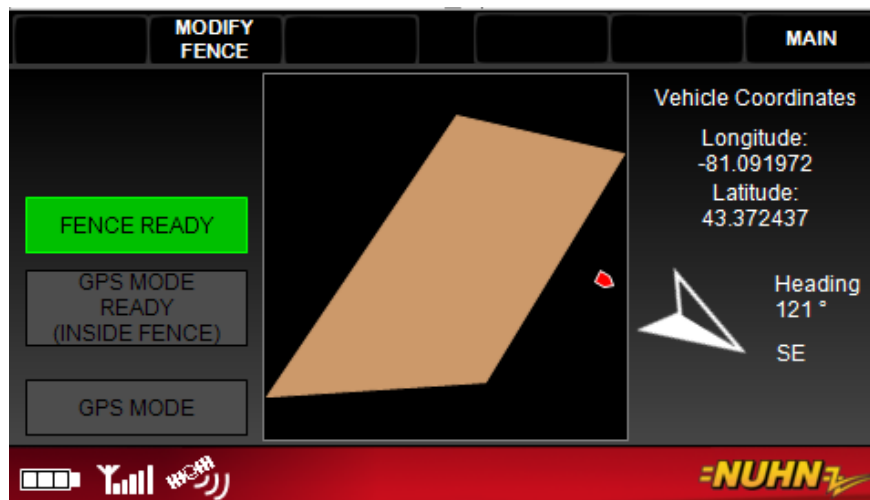
Note that it may take several moments for the shape graphic to update



Example of incorrect shape

NOTE – Do not make shapes that cross such as the figure above.

NOTE – Avoid shapes with very small sections (less than several machine lengths)

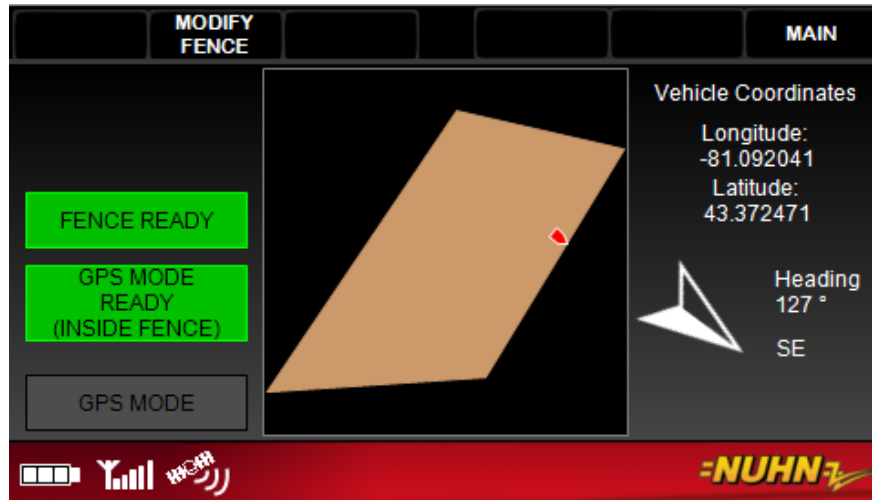


Fence Ready Screen

Once finished you are satisfied with your shape, press DONE. When not in edit mode, and at least 3 posts taught, the fence will be ready.

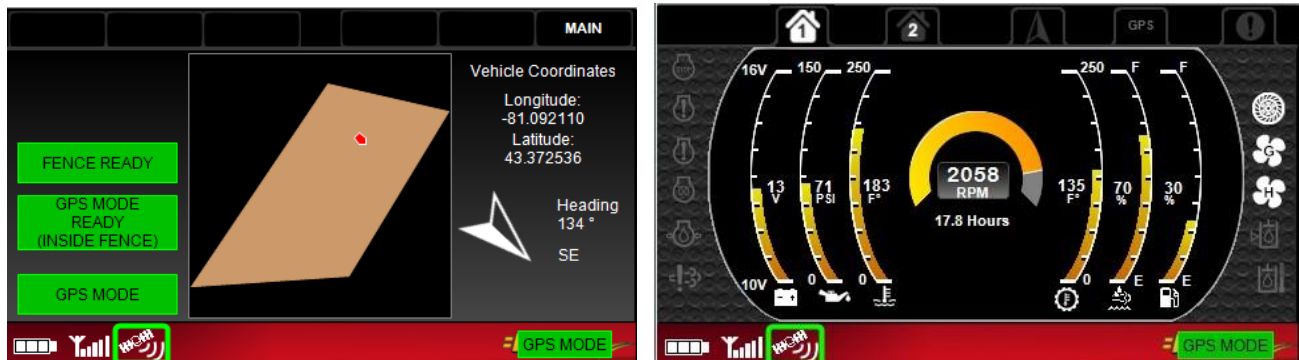
NOTE – It is up to user to make sure they do not make a crossing fence, which will result in unpredictable behavior.

3.4.8 ENTERING GPS MODE



GPS Mode Ready

When the fence has been successfully created, and the FENCE READY icon is illuminated, you are ready to go into GPS mode. To do this, drive the Crawler within the fenced area. Once machine is inside the fence, (assuming it has good GPS data and fence is ok) you can put the machine in GPS mode by holding the switch on the remote in the GPS MODE position.



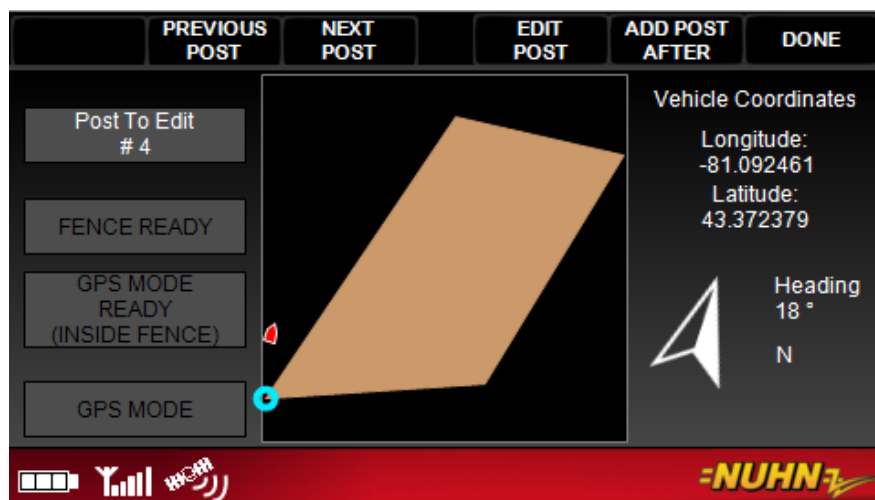
Once operating in GPS mode, it will be indicated to the user by the GPS MODE icon illuminated on the GPS page.

It will also display GPS mode on the main screen.

3.4.9 EDITING THE FENCE

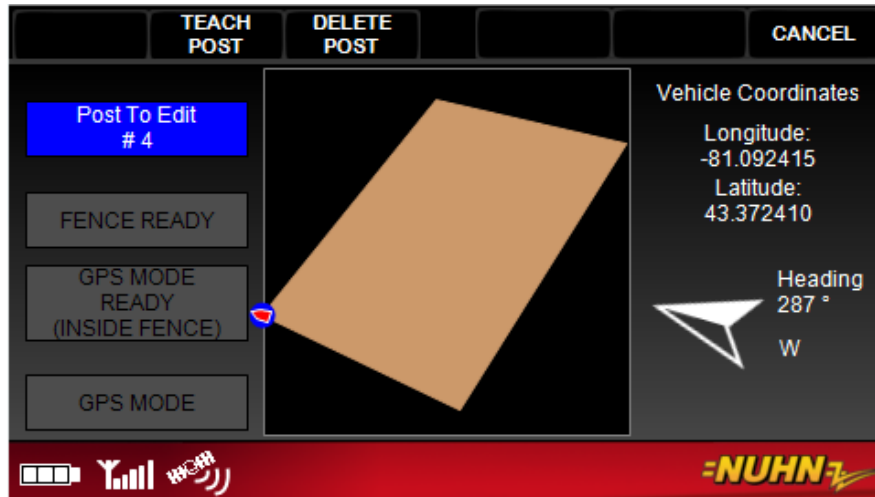


Use the EDIT SAVED FENCE feature to modify an existing fence.



Use the PREVIOUS POST and NEXT POST buttons to determine which post to edit. Note the blue circle, and POST TO EDIT # indicates with fence post is being edited.

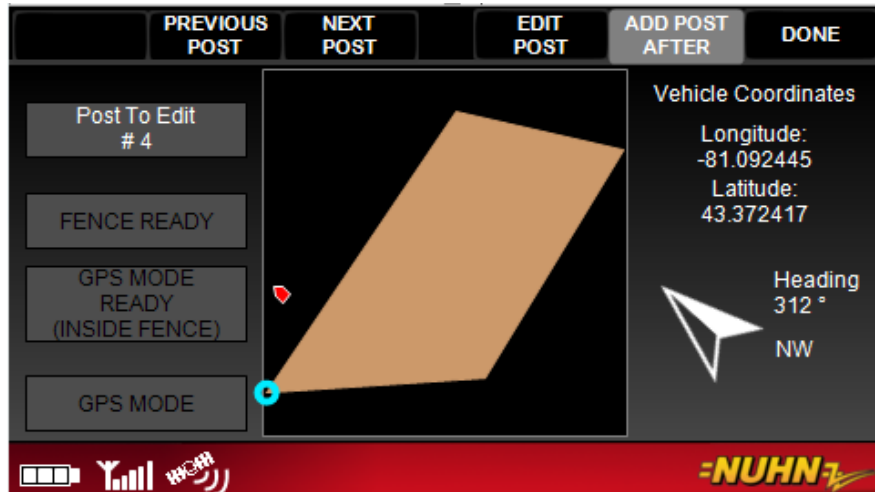
Once the desired post you want to alter is selected, press the EDIT POST button.



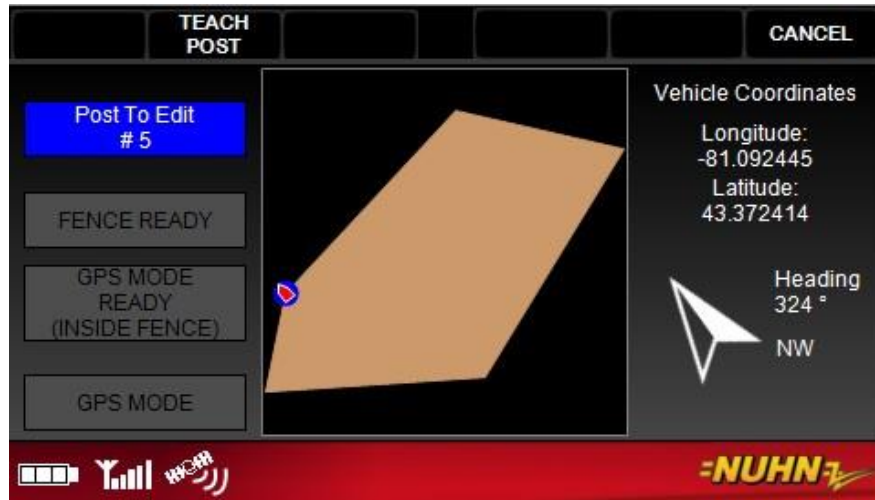
While in edit mode, the post will be moved to where the Lagoon Crawler is located. This may take a moment to properly re-draw shape display.

Move the vehicle to where you want the post to be. Note circle is dark blue when in edit mode (as is the post to edit box).

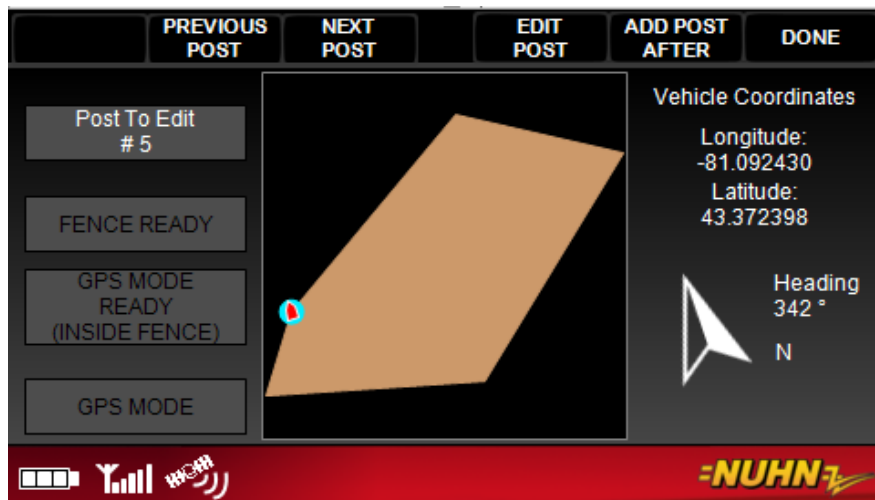
3.4.10 ADDING A FENCE POST TO AN EXISTING SHAPE



From the EDIT SAVED FENCE page, it is possible to add additional posts. The ADD POST AFTER button will insert a post after the post to edit (in this case it will add a post after number 4)

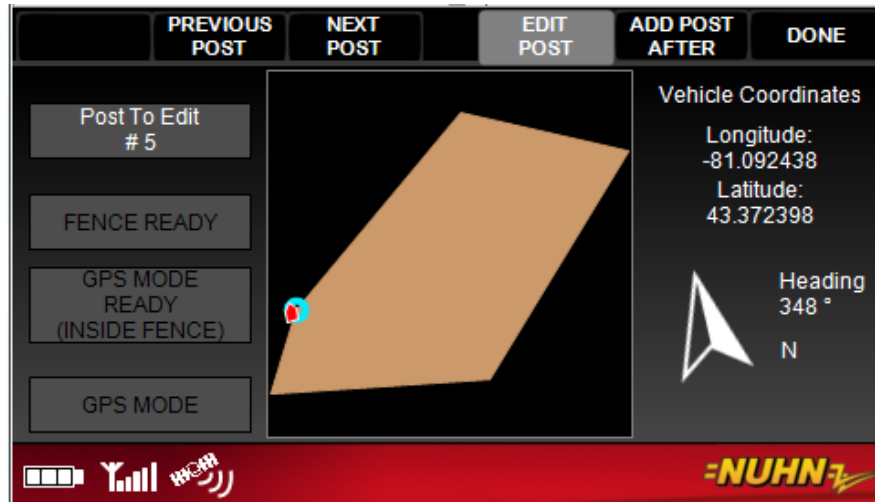


Inserted post is where the Lagoon Crawler is. Use the TEACH POST button to teach this post at the present vehicle location.

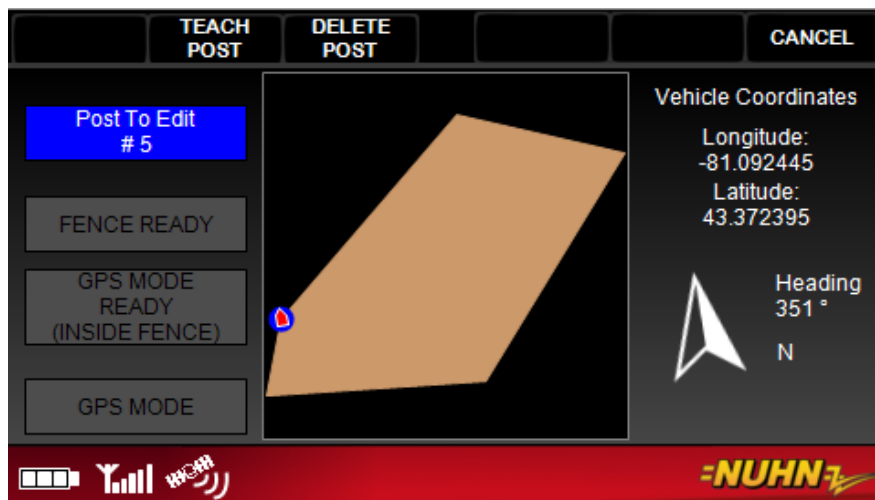


After the additional post is taught, it is returned to the EDIT FENCE page.

3.4.11 DELETING A FENCE POST



To delete a post, select the post you want to delete and then use the edit post button to enter edit post mode.



While in edit post mode, the post being edited is always where the vehicle is.

Pressing CANCEL will stop editing the post and the post will be where it was before you started to edit.

Pressing the DELETE POST button will remove the selected post.

3.4.12 ALARMS ON THE REMOTE



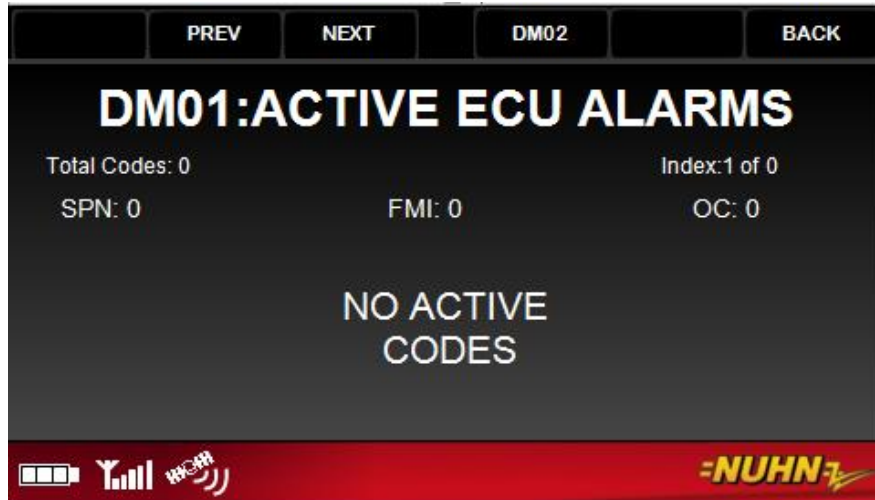
When alarm is present, holding the top left button for 1 second will initiate horn silence of both the transmitter, and the horn on the Lagoon Crawler (assuming they are connected and communicating).

After silence, indicator still present (as is red strobe) but buzzer/horn is silenced.

HISTORY		
ACK ALL		
ECU ALARM		
MAIN		
ACTIVE ALARMS		
	Description	Eng Hr
0	REMOTE COM LOST	17.90

Pressing on the alarm screen will take you to the active alarm table.

ACK ALL (Acknowledge All) button will clear any alarms. If condition exists, the alarms will re-populate.



ECU Alarm Page

ECU Alarm Page shows active engine codes.

			ACTIVE	ACK ALL	SCROLL	ECU ALARM	MAIN
HISTORICAL ALARMS							
	Description	Eng Hr					
0	RADIO RECIEVER COMM ERROR	15.05					
1	COM TO CRAWLER LOST	15.05					
2	COM TO CRAWLER LOST	15.05					
3	COM TO CRAWLER LOST	15.05					
4	COM TO CRAWLER LOST	15.05					
5	COM TO CRAWLER LOST	17.15					
6	COM TO CRAWLER LOST	17.15					
7	COM TO CRAWLER LOST	17.15					

HISTORY Page

Alarm history lists historical alarm data.

3.5 STARTING THE CRAWLER

Pressing the start toggle on the Crawler once will 'wake' the system up and turn on the fuel pump. After waiting a few seconds, press and hold the start toggle again to initiate the crank sequence.

Caution

To prevent damage to the starting motor, do not engage the starting motor more than 10 seconds. Wait 10 seconds between each attempt to start.

If the engine does not start after three attempts, check the fuel supply system. Absence of blue or white exhaust smoke during cranking indicates no fuel is being delivered.

Caution

The engine must have adequate oil pressure within 15 seconds after starting. If the WARNING lamp on the engine indicating low oil pressure has not gone out or there is no oil pressure indicated on a gauge within 15 seconds, shut off the engine immediately to avoid engine damage.

Idle the engine 3 to 5 minutes before operating the Crawler under load or in a lagoon.

After starting a cold engine, increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize (around 1100 rpm).

Caution

Do not operate engine at low idle for long periods with engine coolant temperature below the minimum specification in Maintenance Specifications of the engine operating manual. This can result in the following:

- **Fuel dilution of the lubricating oil**
- **Carbon buildup in the cylinder**
- **Cylinder head valve sticking**
- **Reduced performance**
- **DEF system failure**

3.5.1 JUMP STARTING

**Warning!**

Batteries can emit explosive gases. To avoid personal injury, always ventilate the compartment before servicing the batteries. To avoid arcing, remove the negative (-) battery cable first and attached the negative (-) battery cable last.

Caution

When using an external electrical source to start the engine, turn the disconnect switch to the OFF position. When using jumper cables to start the engine: use a 12V source, and be sure to connect the cables in parallel (to one battery).

To avoid damage to engine parts, do not connect jumper starting or battery charging cable to any fuel system or electronic component.

3.5.2 COLD WEATHER STARTING

Caution

To reduce the possibility of damage to the lubricating oil pan, due to the composite materials used in the manufacture of the lubricating oil pan, under no circumstances should an external heat source be applied directly, or indirectly to the lubricating oil pan.

Use the block heater on the engine to keep the temperature warm enough to start in cold weather. Keep block heater plugged in a day in advance for cold start. Allow 20 minute warm up on high idle (1100 rpm) before operating.

3.6 DRIVING THE CRAWLER

**Warning!**

When driving into or out of the lagoon, the Crawler should be as low to the ground as possible. A lower center of gravity reduces the risk of rollover.

Machine should enter and exit the lagoon at a 90° angle to the shoreline to reduce the risk of rollover.

When driving on land, the machine may be driven in any direction, using the four drive buttons: 'Drive Forward' and 'Drive Reverse' make the machine move forward and in reverse; 'Left' and 'Right' steer the wheels accordingly.

Note: If the wheels become misaligned from each other (left from right), steer all wheels so that the steering cylinders are all at the end of their stroke. This will realign the wheels.

'Drive Forward' and 'Drive Reverse' are slow-speed, high-torque drive controls, and should be used when driving on steep slopes.

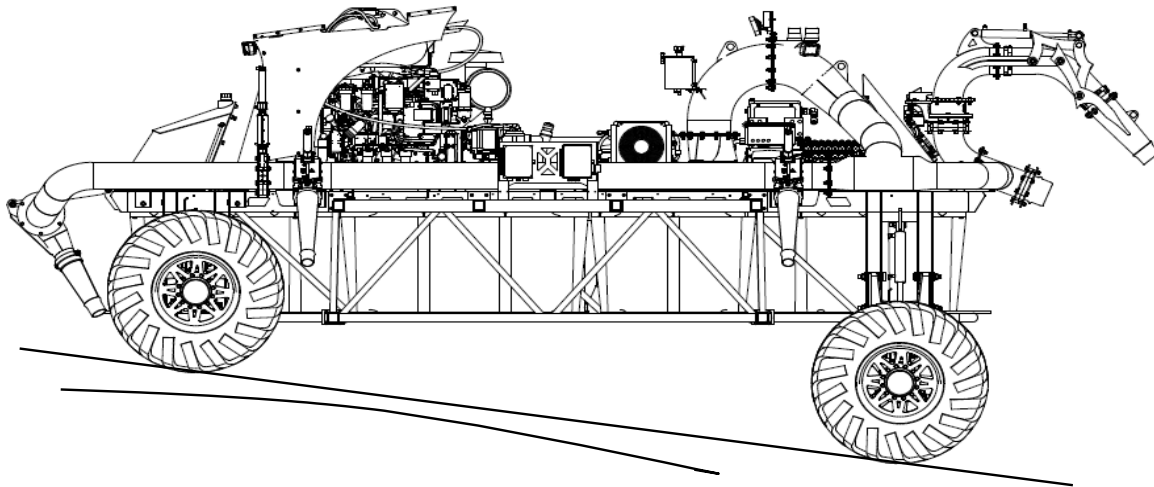
'High Speed Fwd' and 'High Speed Rev' are high-speed, low-torque drive controls, and should be used when driving the vehicle in large, open areas (i.e. obstacle-free).

The 'Front Axle' and 'Rear Axle' heights can be controlled independently of one another. When controlling height, always have the machine level or have the oil tank higher than the pump (back higher than the front). If the front is higher than the rear, low hydraulic oil levels can result in cavitation of the hydraulic pumps. There is also a risk of running out of fuel on inclines if the engine comes out first.

**** ENGINE SHOULD ALWAYS GO IN LAST AND COME OUT FIRST****

3.6.1 DRIVING INTO THE LAGOON

When *entering* the lagoon, the machine must be driven engine-side **last** into the pit. The oil tank always needs to be above the motor to avoid cavitation of the pumps and loss of power. Drive the machine down the start of the slope, then raise the front axle's height completely to reduce the angle of the machine. The clutch should remain disengaged, and the side floats should be extended before entering the lagoon for greatest stability. Drive in slowly using the "Drive Forward" mode. **See figure below.**



Once the machine is in the lagoon the wheels should be steered straight and fully retracted, and the clutch can be engaged. The drive wheels should only be used as necessary.

3.6.2 EXITING A LAGOON WITH A GRADUAL SLOPE

When *exiting*, then the engine-side is to be brought out **first**. The operator must first position the Crawler so that it is 90° with the shoreline. You must back straight out. Leave the floats extended out, and the boat direction in reverse to protect the rear jets from being damaged or clogged. Using the boat shift left/right functions will be very helpful to get the Crawler lined up with the exit driveway.

The back axle of the unit (the first one to drive out) should be retracted the front axle should be completely extended. Once the axle makes contact with the ground, the clutch can be disengaged and the Crawler can be driven out of the lagoon. Steering the wheels must be utilized at this point to avoid having the Crawler skid sideways and roll over.

3.6.3 EXITING A LAGOON WITH A STEEP SLOPE OR WHERE TRACTION IS LIMITED

The procedure for driving out of a steep lagoon is the same as exiting a lagoon with a gradual slope, then the engine-side is to be brought out **first**. In addition to driving out of the lagoon, the Crawler will need assistance with a tow cable:

- There are three pull points on the back of the Crawler where a tow cable can be hooked to pull the unit out of a lagoon.
- Even though the Crawler is being towed, the operator must still use the remote to help drive out, otherwise the wheels will lock up.

3.7 AGITATING THE LAGOON

When in the lagoon, the Crawler is propelled using the main 12" header pump. To get power to this pump, the clutch must be engaged. To engage the clutch, simply press 'Clutch Eng'. Ensure that the engine is idling when engaging or disengaging the clutch, in order to prevent damage to the machinery.

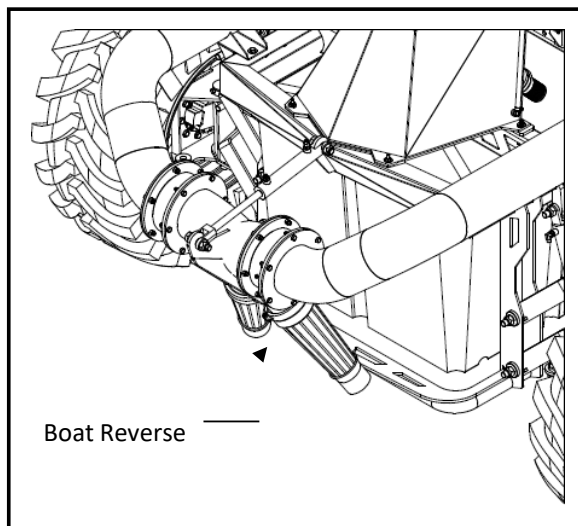
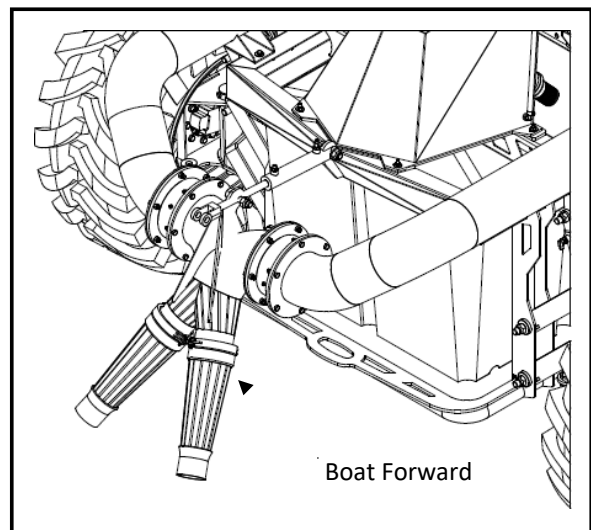
Ensure proper clutch function and maintain as necessary before entering lagoon.

The 'Rear Valve Open' and 'Rear Valve Close' buttons control the gate valve's position. In order to manoeuvre the lagoon, the rear valves must be open. Always leave the rear valve open when engaging or disengaging the pump to prevent pressure build up or damage to the pump.

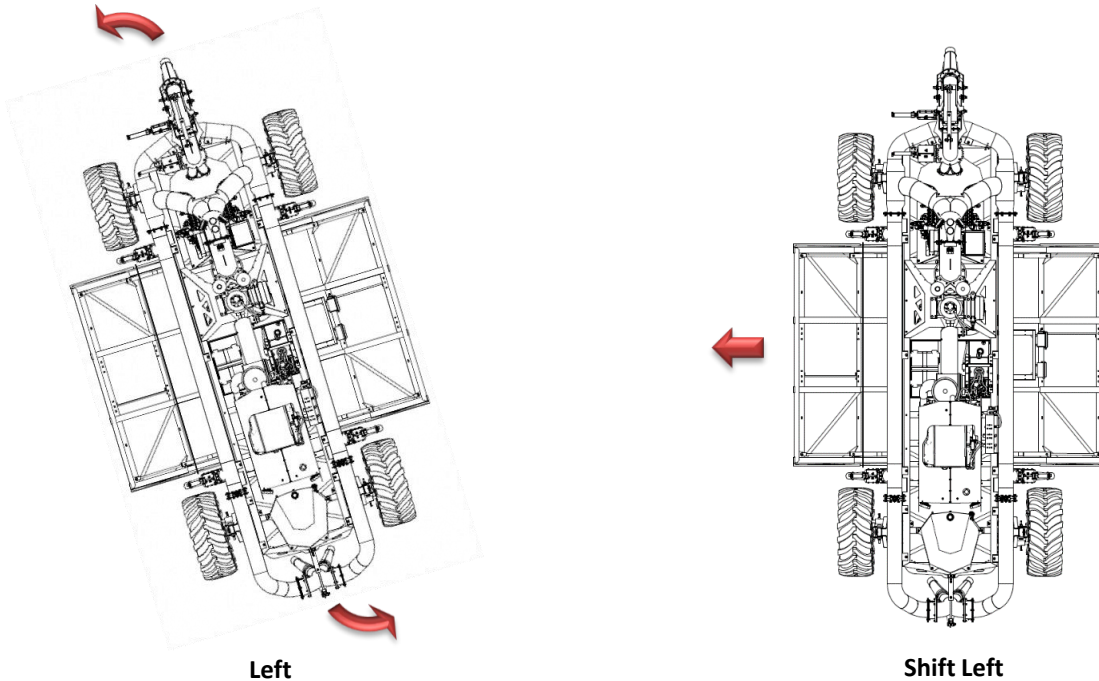
The rear jets on the Crawler are used for propelling the vehicle forward or reverse. By pressing the 'Boat Forward' and 'Boat Reverse' buttons on the controller, the Crawler's speed can be controlled by the angle of the nozzle. Best sub-surface agitation occurs when the jets are aimed straight down and the vehicle is moving forward slowly.

Warning!

Staying in one position for an extended period of time can result in excessive erosion of the lagoon bottom.



The Boat Direction buttons 'Left' and 'Right' are used to rotate the machine in that direction. The 'Shift Left' and 'Shift Right' buttons are used to move the entire machine sideways in that direction. The diagram below shows the difference between 'Left' and 'Shift Left'.



In order to use the front cannon, the agitator valve must be open. The agitator valve can be opened by pressing the 'Agitator Open' button, and closed using the 'Agitator Close' button.

The Agitator joystick moves the Agitator nozzle in the corresponding directions of up, down, left, and right. **Do not use the Agitator to steer and drive the Crawler, use the correct dedicated controls for boat maneuvering.**

Note: When the agitator valve is open, more volume is being pumped to the front. This leaves less volume to push the Crawler from side to side for maneuvering the lagoon, and decreases the Crawler's overall speed.

Warning!

Do not use the front agitation cannon to spin the Crawler in circles! Using the agitator cannon to spin the Crawler greatly increases the risk of rollover.



Warning!

If you are using the rear double jets, you should run either the agitation cannon, or the nozzle below the cannon at the same time to level out the Crawler. If you just use the rear agitation jets, the pressure from the pump can raise the engine end of the Crawler significantly higher than the cannon end. By running jets on both sides of the boat, it will level out and increase stability.

3.8 REFUELING

Use low sulphur diesel fuel, dyed or not dyed.

There is one central fuel tank on the Crawler. Shut the engine off first. In cold weather conditions, add diesel anti-freeze. If you run out of fuel, always prime the engine before restarting. The primer is on the fuel filter base.

Ensure you do not run out of fuel while in the lagoon. Watch for the low fuel warning light and pull the Crawler out of the lagoon for refueling.

3.9 DEF SYSTEM (TIER 4 ONLY)

3.9.1 DEF FLUID

Add DEF during refueling to avoid interruptions during operation.

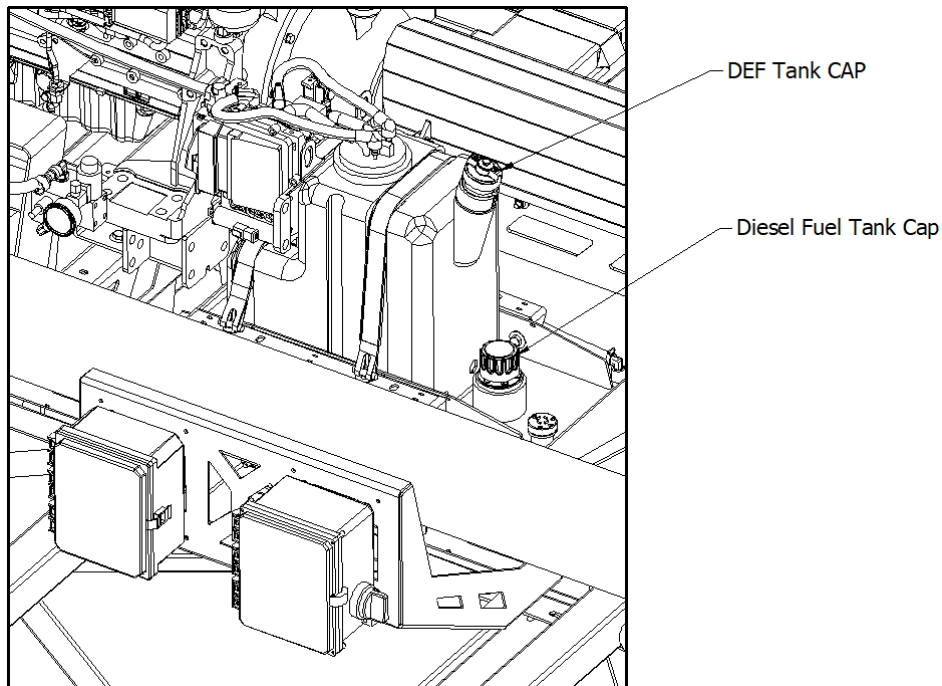


Warning!

Do not switch off the Main Battery Disconnect until the Red Light beside it has turned off. FAILURE TO DO THIS VOIDS YOUR ENGINE WARRANTY. The red light turns off when the DEF lines have successfully been purged.

3.9.2 ADDING DEF FLUID

The DEF Fluid Tank is a separate plastic tank with a blue cap, located on top of the fuel tank.



4 MAINTENANCE

4.1 GENERAL SAFETY MEASURES

- All maintenance should be carried out while the engine is off, and the electrical to the engine disconnected!
- Take the time to read and understand all maintenance schedules. Please contact Nuhn Industries if you have any questions.
- Work in an area that is dry, well lit, ventilated, and free from clutter, loose tools, parts, ignition sources and hazardous substances. Be aware of hazardous conditions that can exist.
- Always wear protective glasses and protective shoes when working.
- Rotating parts can cause cuts, mutilation or strangulation.
- Do not wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery (negative cable first) and discharge any capacitors before beginning any repair work. Disconnect the air starting motor if equipped to prevent accidental engine starting. Put a "Do Not Operate" tag in the operator's compartment or on the controls.
- Use ONLY the proper engine barring techniques for manually rotating the engine. Do not attempt to rotate the crankshaft by pulling or prying on the fan. This practice can cause serious personal injury, property damage, or damage to the fan blade(s) causing premature fan failure.
- If an engine has been operating and coolant is hot, allow the engine to cool before slowly loosening the filler cap to relieve the pressure from the cooling system.
- Always use blocks or proper stands to support the product before performing any service work. Do not work on anything that is supported ONLY by lifting jacks or a hoist.
- Relieve all pressure in the air, oil, fuel, and cooling systems before any lines, fittings, or related items are removed or disconnected. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do not check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- To reduce the possibility of suffocation and frostbite, wear protective clothing and ONLY disconnect liquid refrigerant (Freon) lines in a well-ventilated area. To protect the environment, liquid refrigerant systems must be properly emptied and filled using equipment that prevents the release of refrigerant gas (fluorocarbons) into the atmosphere. Federal law requires capturing and recycling refrigerant.
- To reduce the possibility of personal injury, use a hoist or get assistance when lifting components that weigh 23kg (50lb) or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. Always use a spreader bar when necessary. The lifting hooks must not be side-loaded.

- Corrosion inhibitor, a component of SCA and lubricating oil, contains alkali. Do not get the substance in your eyes. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged or repeated contact with skin. In case of contact, immediately wash skin with soap and water. Do not swallow internally. In the event that substance is ingested, IMMEDIATELY CALL A PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.
- Naphtha and Methyl Ethyl Ketone (MEK) are flammable materials and must be used with caution. Follow the manufacturer's instructions to provide complete safety when using these materials. KEEP OUT OF REACH OF CHILDREN.
- To reduce the possibility of burns, be alert for hot parts on products that have just been turned off, exhaust gas flow, and hot fluids in lines, tubes, and compartments.
- Always use tools that are in good condition. Make sure you understand how to use the tools before performing any service work. Always use the same fastener part number (or equivalent) when replacing fasteners. Do not use a fastener of lesser quality if replacements are necessary.
- When necessary, the removal and replacement of any guards covering rotating components, drives, and/or belts should only be carried out by a trained technician. Before removing any guards, the engine must be turned off and any starting mechanisms must be isolated. All fasteners must be replaced on re-fitting the guards.
- Do not perform any repair when fatigued or after consuming alcohol or drugs that can impair your functioning.
- Some state and federal agencies in the USA have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapours, ingestion, and prolonged contact with used engine oil.
- Do not connect the jumper starting or battery charging cables to any ignition or governor control wiring. This can cause electrical damage to the ignition or governor.
- Always torque fasteners and fuel connections to the required specifications. Over tightening or under tightening can allow leakage. This is critical to the natural gas and liquefied petroleum gas fuel and air systems.
- Always test for fuel leaks as instructed, as odorant can fade.
- Close the manual fuel valves prior to performing maintenance and repairs, and when storing the vehicle inside.
- Coolant is toxic. If not reused, dispose of in accordance with local environmental regulations.
- The catalyst reagent contains urea. Do not get the substance in your eyes. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water. Do not swallow internally. In the event the catalyst reagent is ingested, contact a physician immediately.
- The catalyst substrate contains Vanadium Pentoxide. Vanadium Pentoxide has been determined by the State of California to cause cancer. Always wear protective gloves and eye protection when handling the catalyst assembly. Do not get the catalyst material in your eyes. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water.

- It is the owner's responsibility to ensure that the proper maintenance is performed on the Crawler.
- Before each use, check fluid levels.

4.2 LUBRICATION

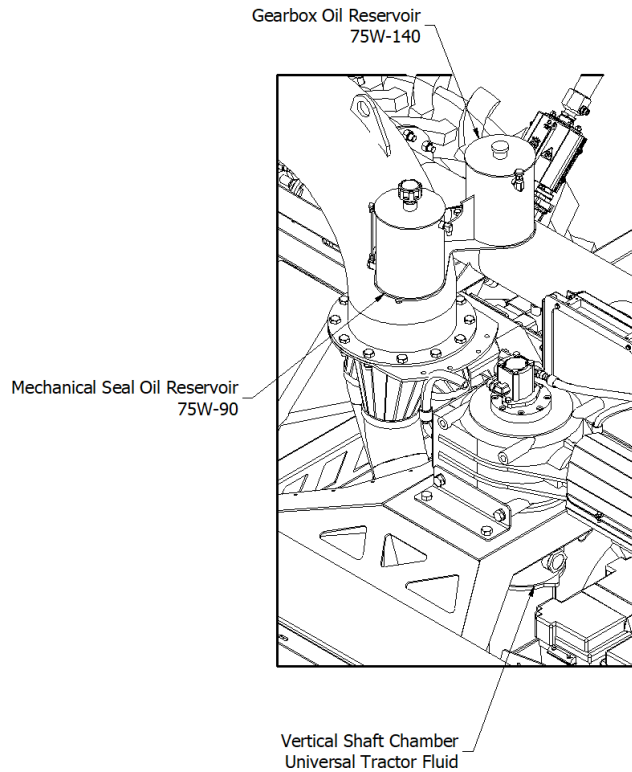
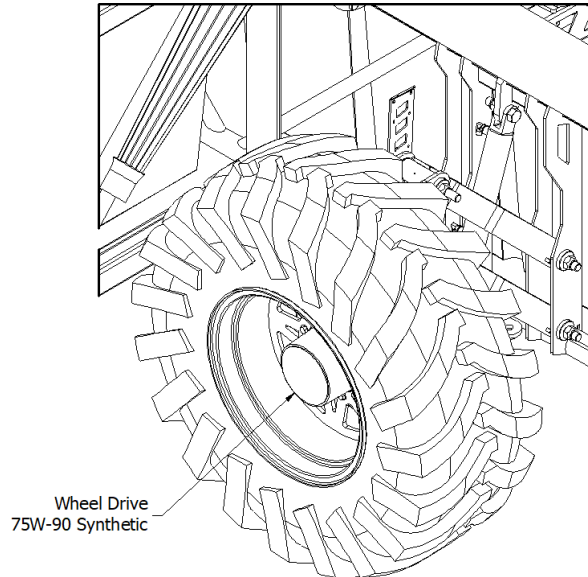
4.2.1 LUBRICATION SCHEDULE

Check engine operator's manual for maintenance schedules pertaining to the engine.

Description	Replacement Interval	Nuhn Part #	CAT Part #	Qty per Crawler
CAT Engine - Engine Oil Filter- T3 and T4	Every 500hrs, or once/year	106-631	462-1171	1
CAT Engine – Primary Fuel Filter - T3 (Water Separator)	Every 500hrs, or once/year	106-632	439-5037	1
CAT Engine – Primary Fuel Filter – T4 (Water Separator)	Every 500hrs, or once/year	106-636	479-4131	1
CAT Engine – Secondary Fuel Filter - T3 and T4	Every 500hrs, or once/year	106-633	360-8960	T3: 1 T4: 2
CAT Engine - Inline Fuel Filter – T4 ONLY	Every 500hrs, or once/year	106-637	525-6205	1
CAT Engine - Primary Engine Air Filter - T4	Red Indicator, or once/year	106-638	130-4678	1
CAT Engine - Secondary Engine Air Filter - T4	Red Indicator, or once/year	106-639	130-4679	1
Hydraulic Replacement Filter Element	After first 50hrs, then every 500hrs, or once/year	104-258-1	---	2017.5 - 2019: 3 2020+: 2

Component	Interval	Oil Type, Quantity	Fill Level
Main Drive Gear Box	First change: 50 hours Second and after: 500 hours or 1 year	75W-140 Synthetic 29 US QT	Halfway up Sight Tube
Wheel Drive Hubs	First change: 200 hours or 2 months Second and after: 1000 hours or 2 year	75W-90 Synthetic 1.1 US QT (each)	Fill to Middle Plug
Mechanical Seal Bearing Unit	First change: 50 hours Second and after: Each pumping season	75W-90 Synthetic 7.5 US QT	Halfway up Sight Tube
Vertical Drive Shaft Tube	Change every 3 years or as necessary	Universal Tractor Fluid 17 US QT	Half of Sight Glass
Hydraulic System	Change every 1500 hrs	Universal Tractor Fluid, 88 US gal	Top of Oil Tank Sight Line

Note: To avoid sludge deposit, change oil while it is still warm after stopping the machine.



4.3 CLUTCH

There is a maintenance plate attached to the clutch.

The clutch equipped on the Lagoon Crawler is a hydraulically activated, self adjusting clutch. The clutch pressure regulator is beside the high-pressure oil filters by the engine. You should periodically do a test on land by engaging the clutch and ensuring the clutch pressure is set at 200PSI.

Warning!
Make sure no one is near impeller, or rotating driveshafts when checking clutch pressure!



Warning!
Do not run the pump out of water for longer than 10 seconds. Running the mechanical seal dry can cause damage to the seal!

Grease the main bearing with one shot of NLGI NO2 Lithium grease.

1 shot of grease every 10 hours or operation.

Grease the engaging shaft every 100 hours or 3 months.

4.4 BATTERY

Keep battery posts free from corrosion. There are two 12-volt batteries connected in parallel. This is 12-volt system. Maintain the acid levels in the batteries.

4.4.1 REPLACING THE BATTERY

Replace the batteries with 1250 cranking amps.

4.4.2 CHARGING THE BATTERY

Any 12-volt charger will charge the battery. Do not charge with the battery charger set to engine crank. Connect the cables to a single battery.

4.5 CRAWLER TOWING

Entering and Exiting a Steep Lagoon Bank:

There are two tow hooks on the rear of the Crawler. It is recommended that a tow rope be attached as a safety line. When entering a lagoon, the tow rope helps prevent sliding out of control. When exiting the lagoon, go rear first, and use the remote to help drive out, otherwise the wheels will lock.

Towing on flat land is not recommended, as it can cause damage to drive hubs.

4.6 WINTERIZING

Before storing Lagoon Crawler away for the winter do the following:

1. Leave the valves open to drain all the pipes around the frame of the machine
2. Wash thoroughly to make sure all manure is cleaned off
3. Clean off hydraulic radiators, engine radiator, and hydraulic lines
4. Spray all electrical plugs, solenoid coils, and electrical contacts with an electrical safe corrosion inhibitor spray.
5. If the Crawler is stored in a cold place, either remove the batteries or turn on the Crawler about once a month to let it warm up to protect the batteries

Suggested: Spray Crawler with an automotive undercoating spray or equivalent to prevent corrosion.

5 ELECTRICAL SYSTEM

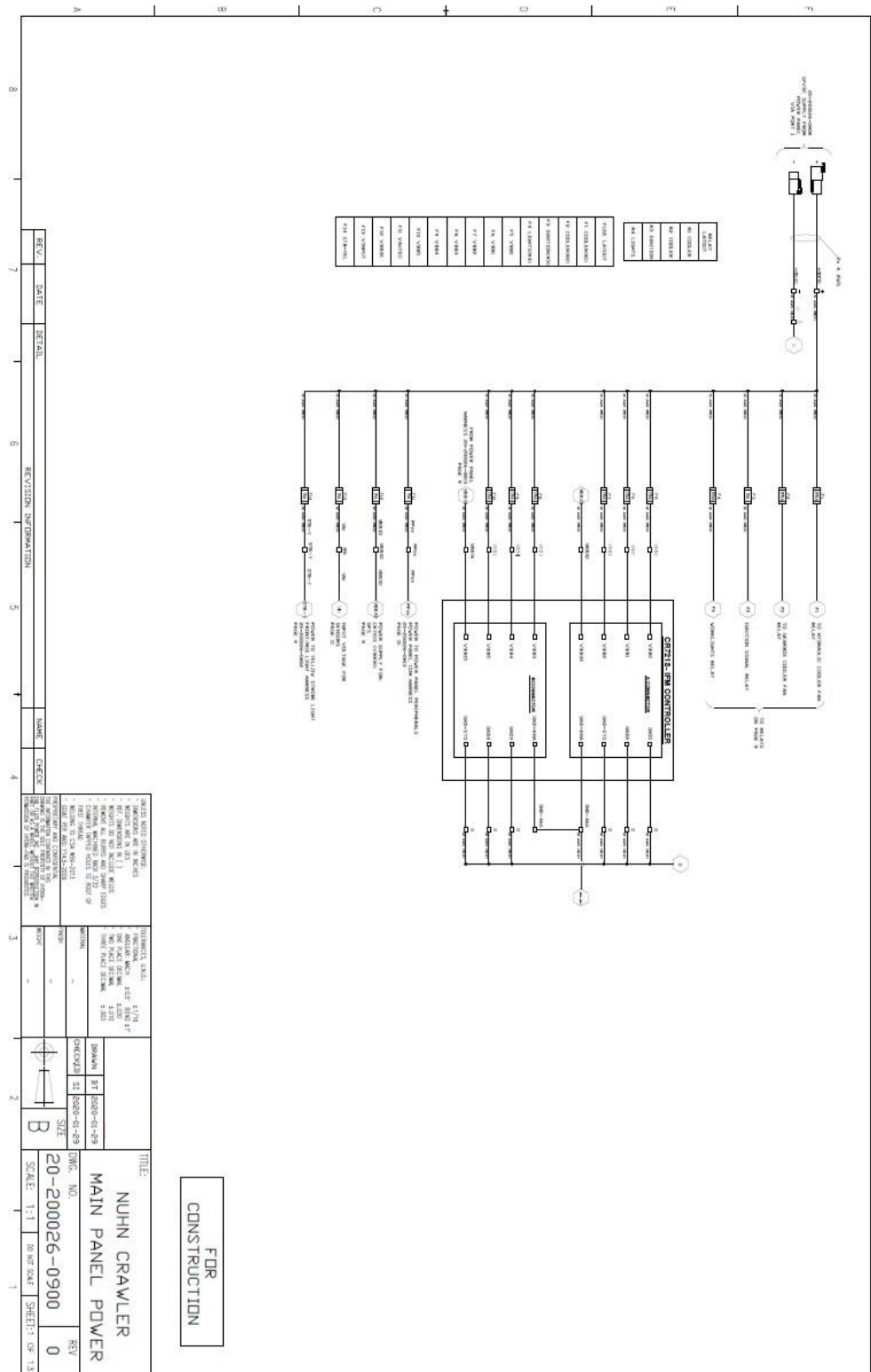
5.1 SERVICING ELECTRICAL

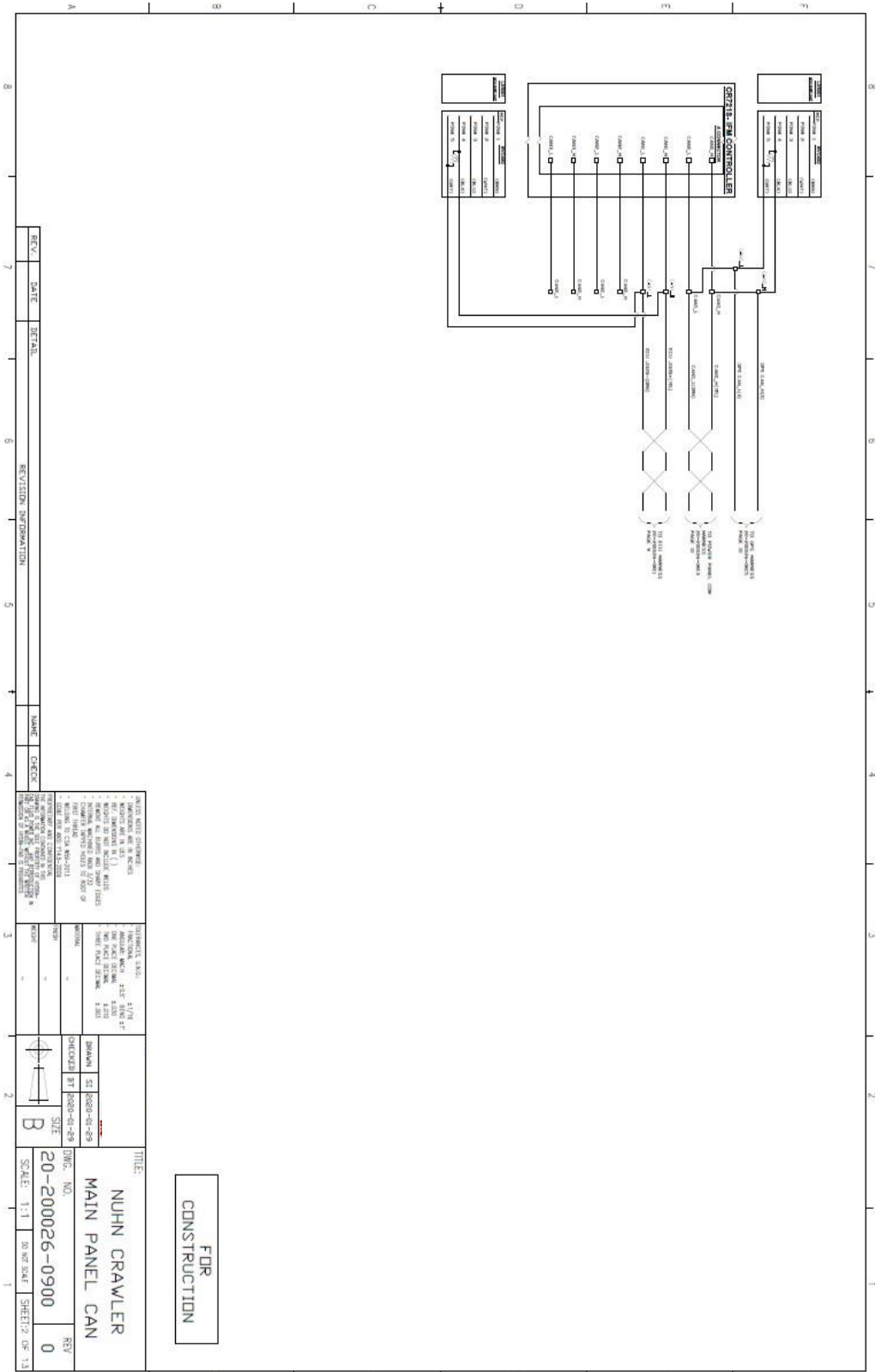
After each pumping season or 2 times annually:

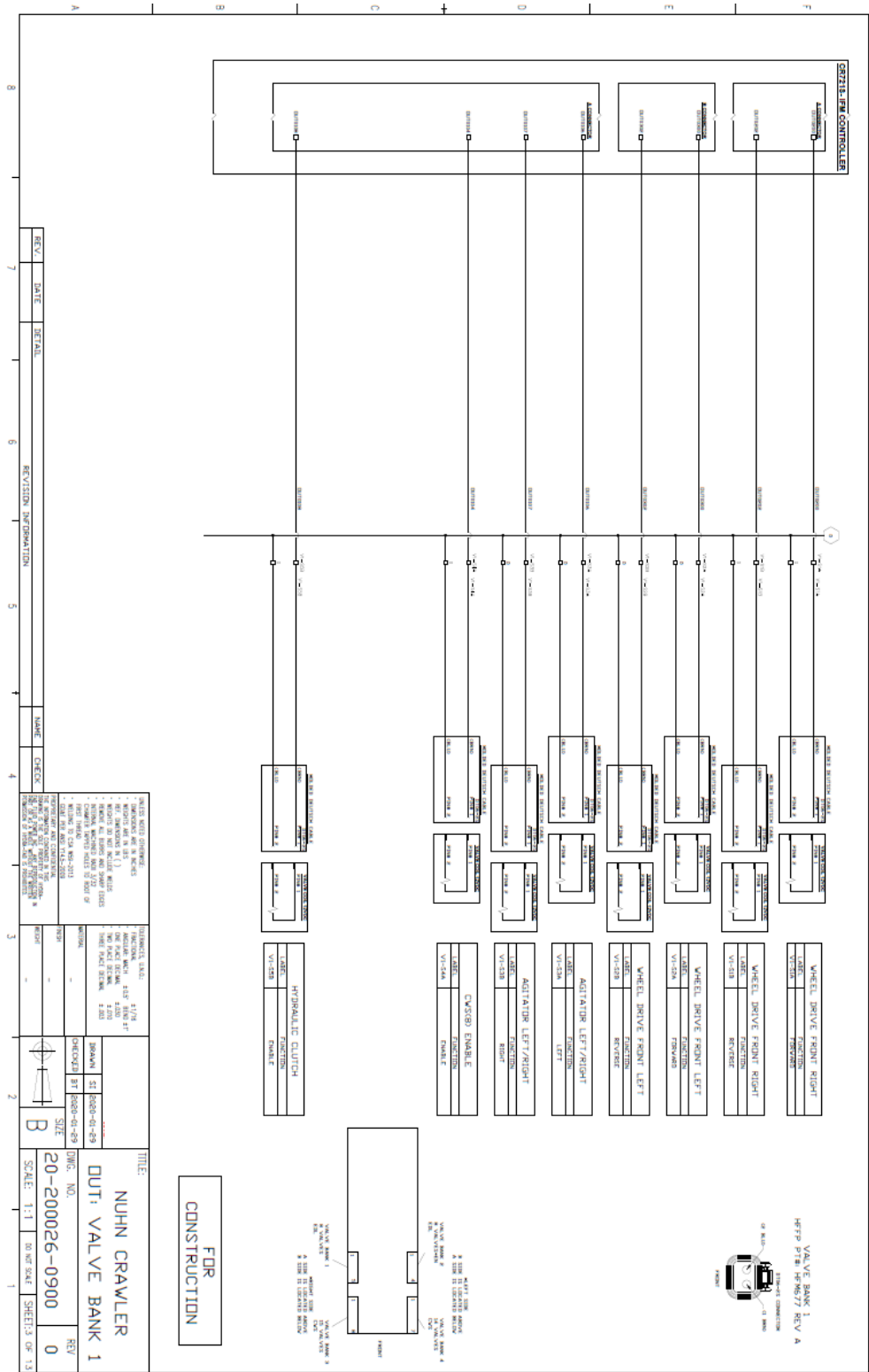
- Open electrical box and remove any moisture
- Spray a generous coating of electrical safe corrosion inhibitor, dielectric grease on all terminals, relays and fuses
- Pull each solenoid magnet off (one at a time) and clean stems and spray with corrosion inhibitor then replace the magnet.
- Remove each DIN connector (plug on the magnet) one at a time and spray with corrosion inhibitor and replace connectors

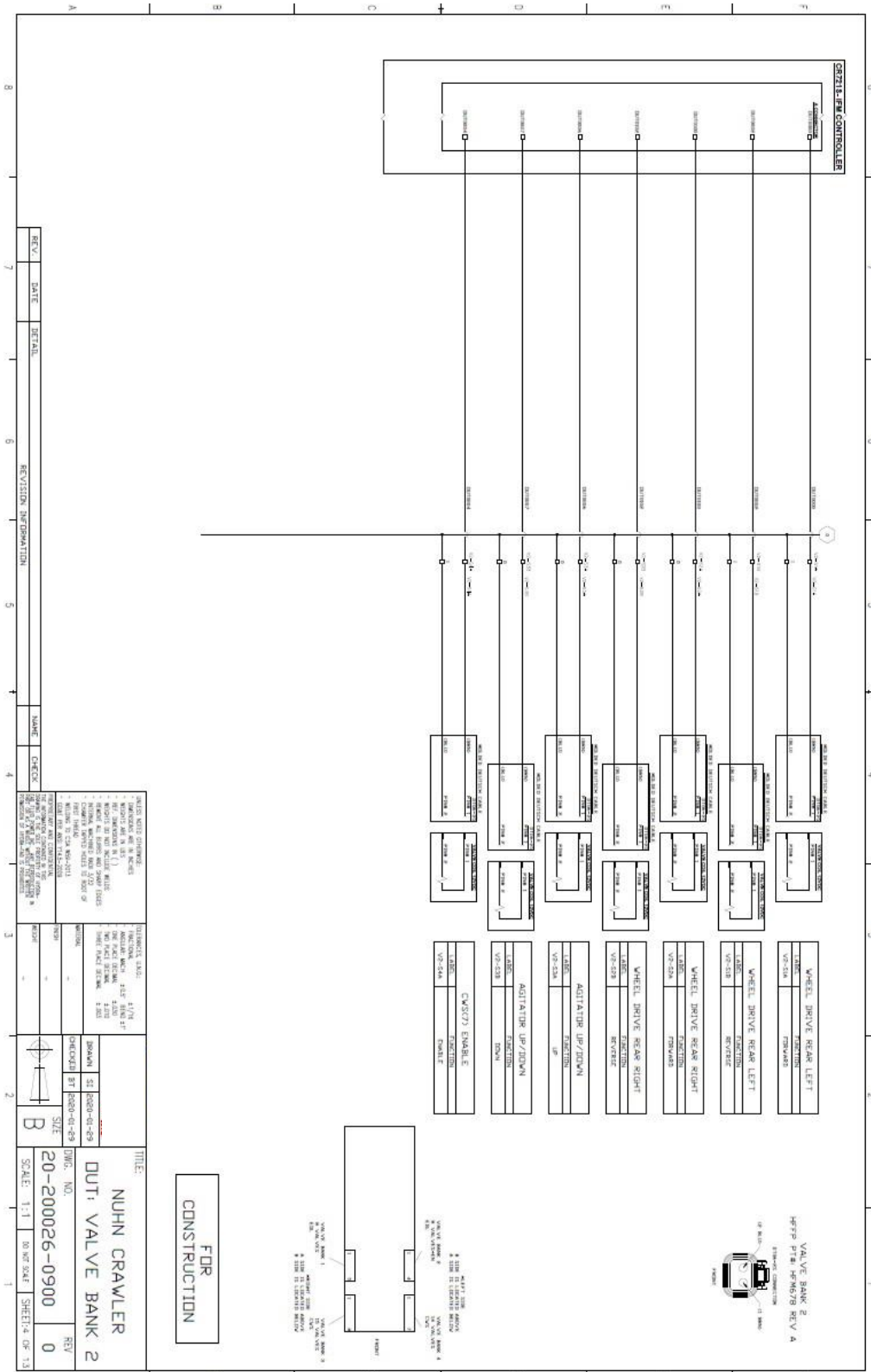
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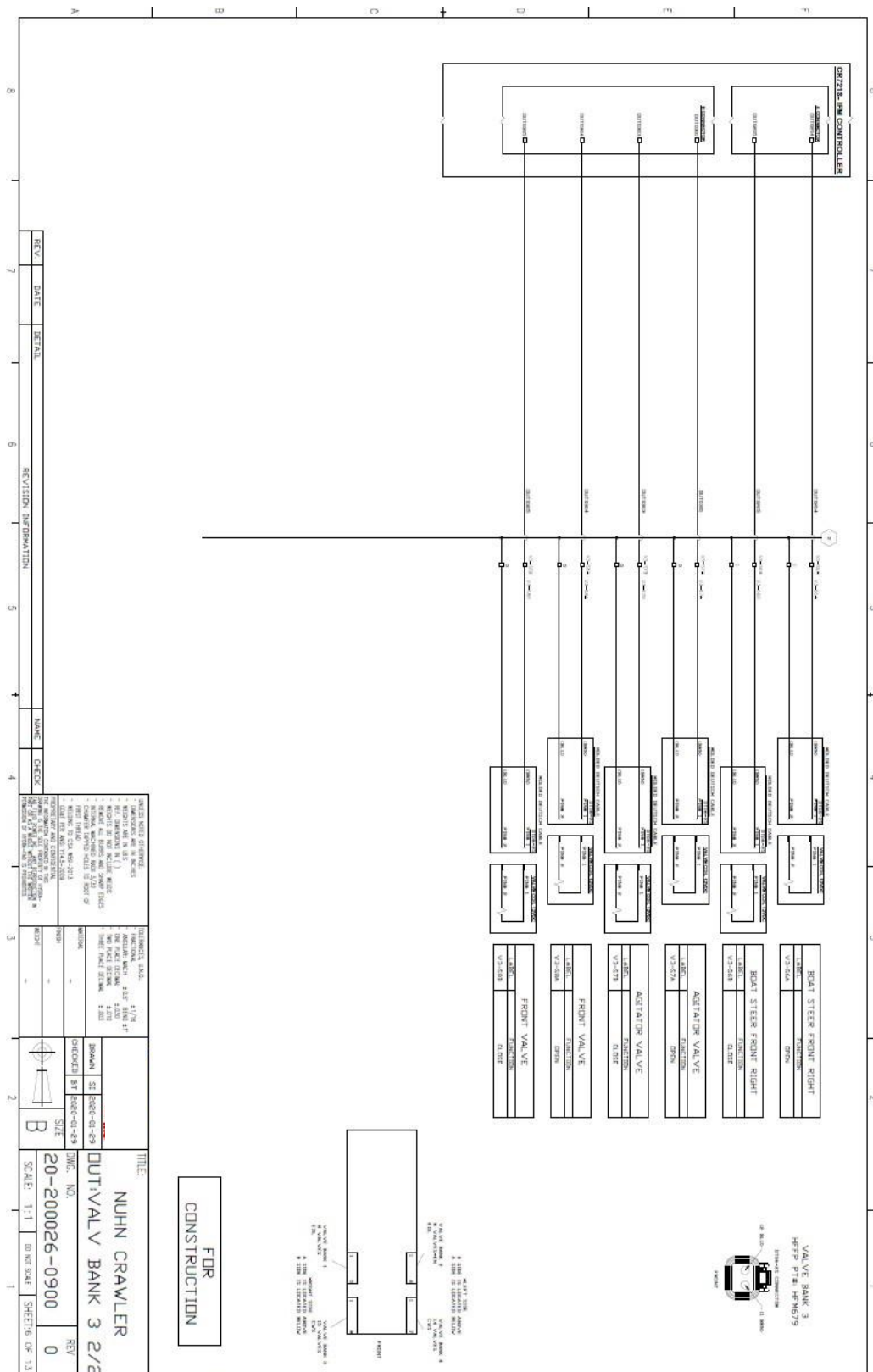


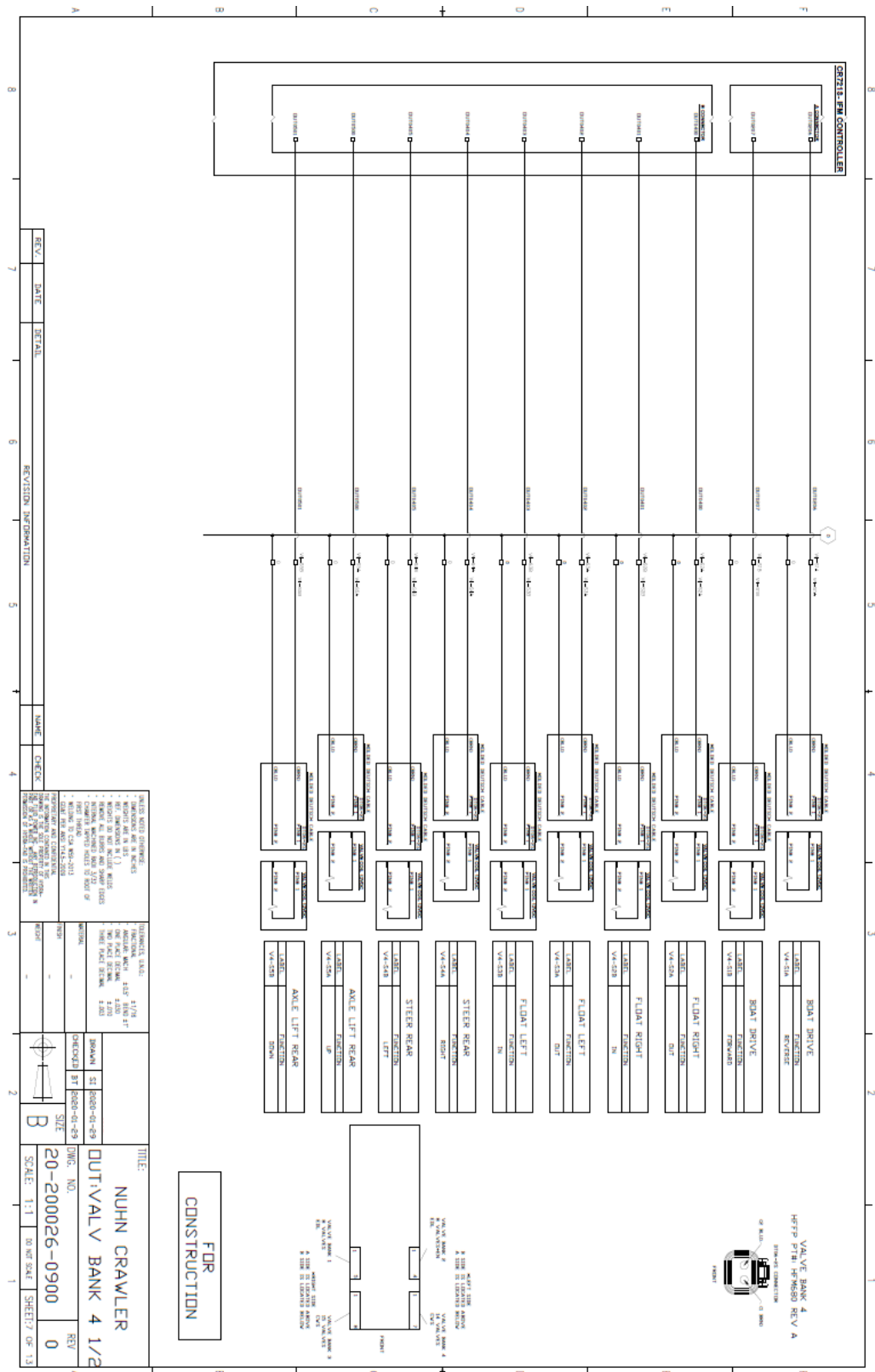


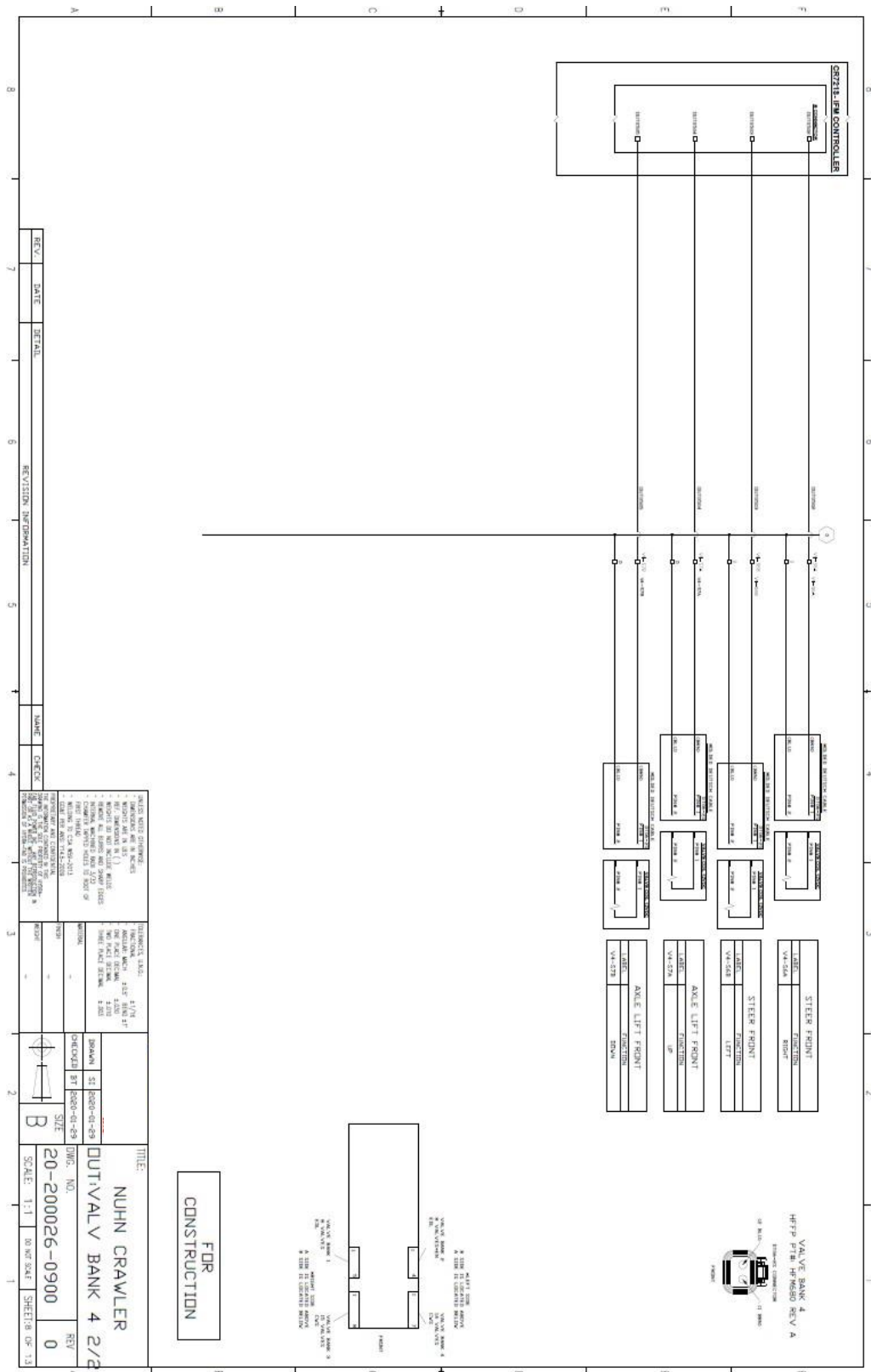


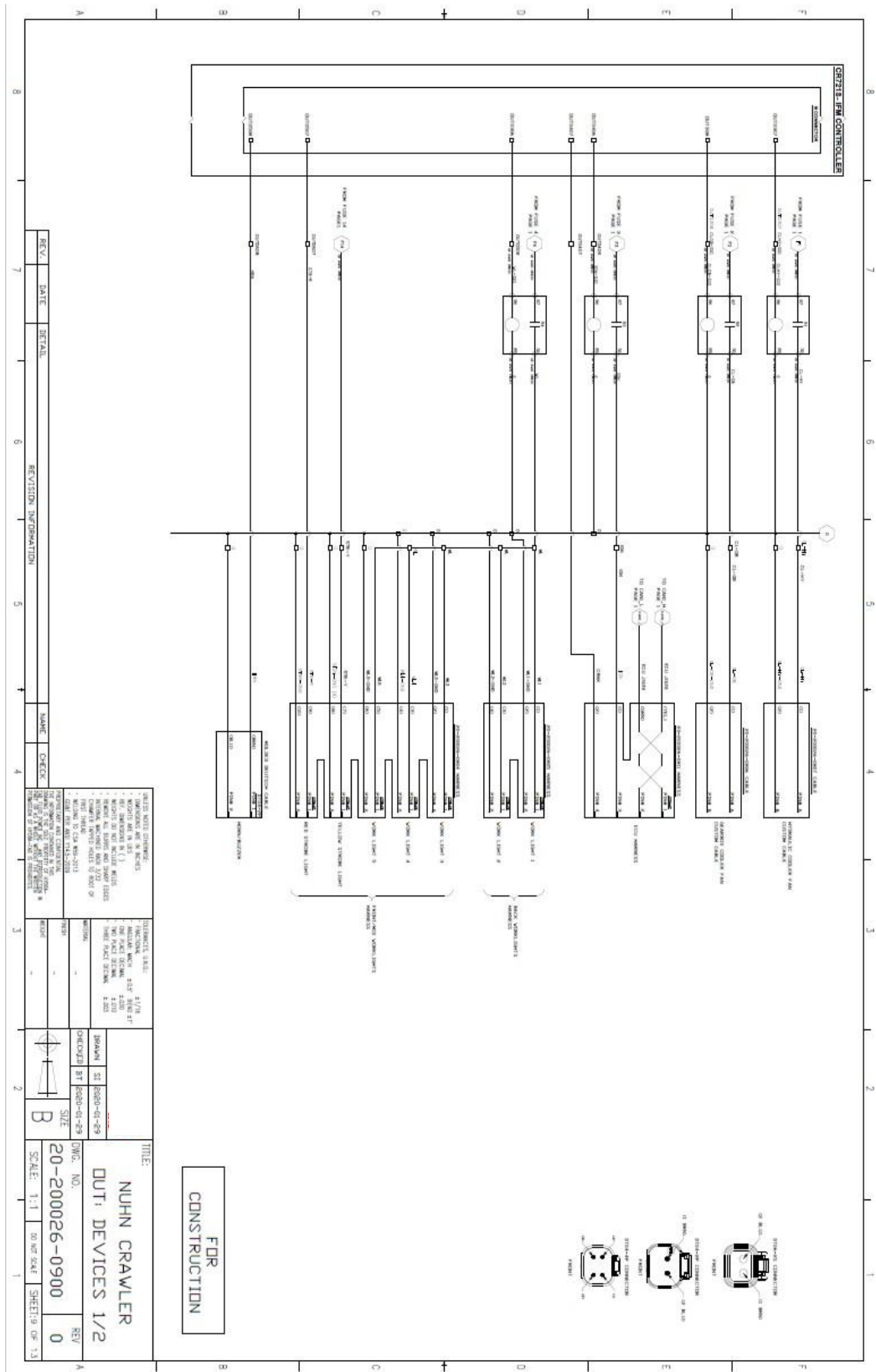


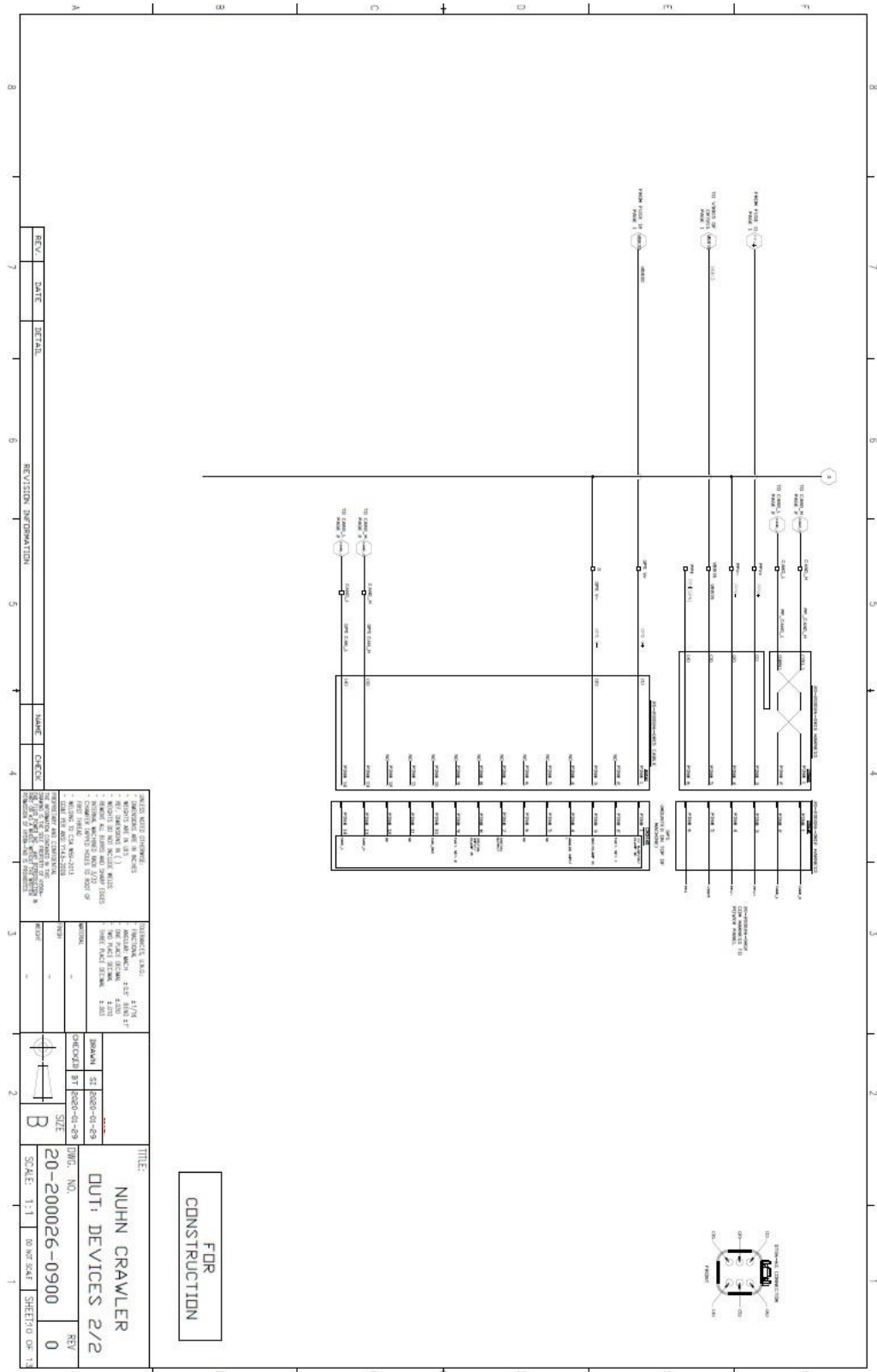


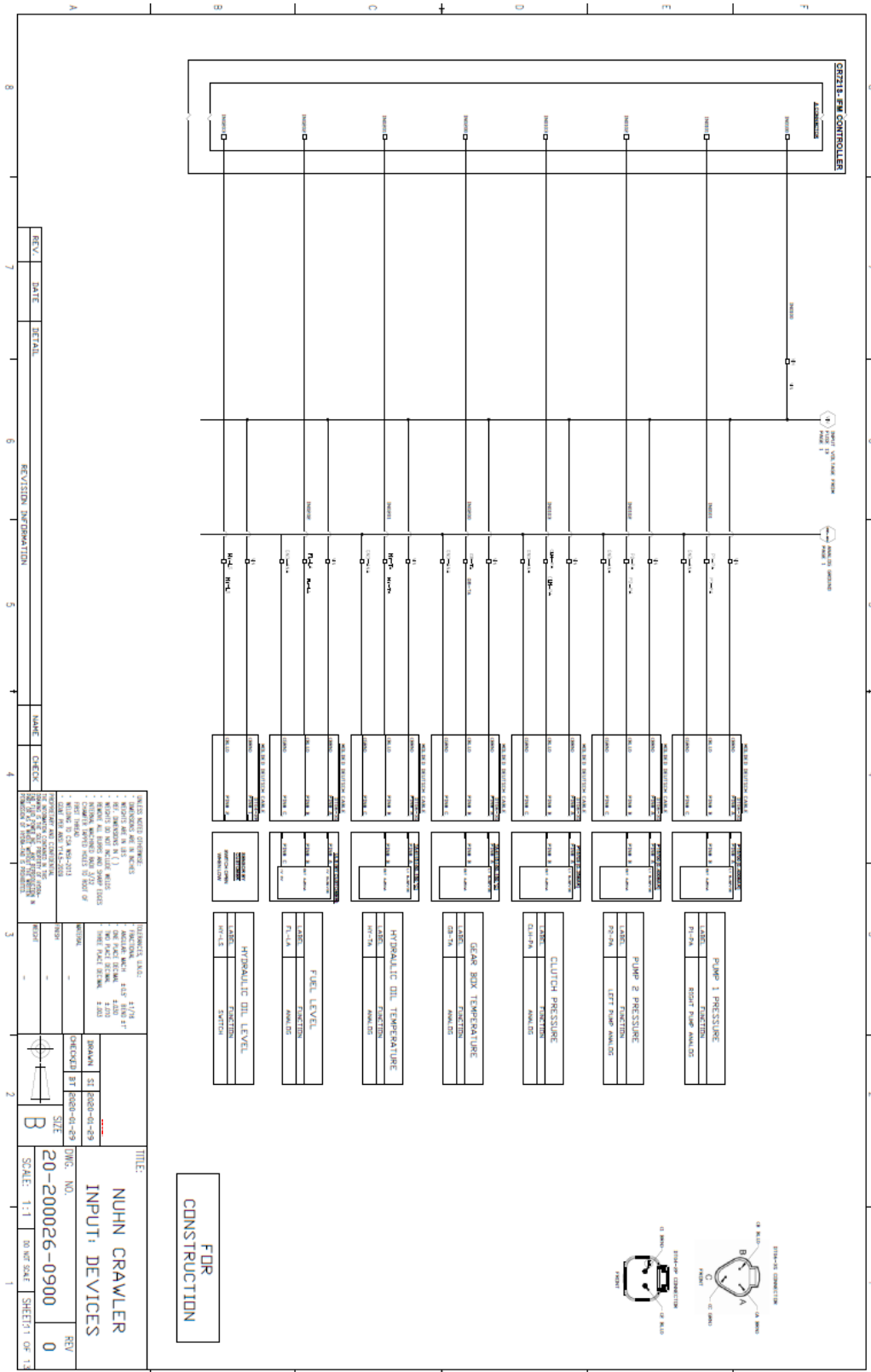


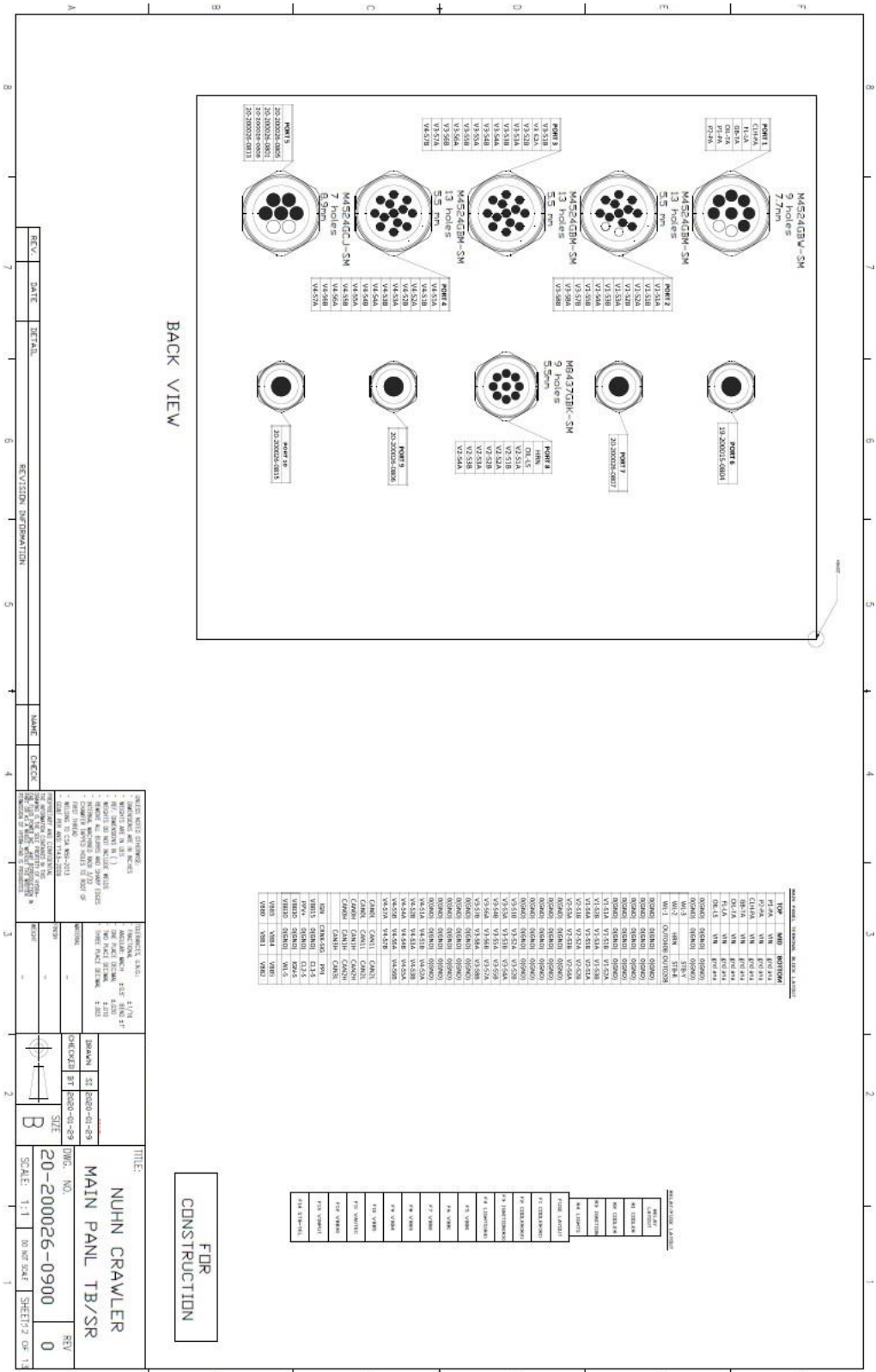


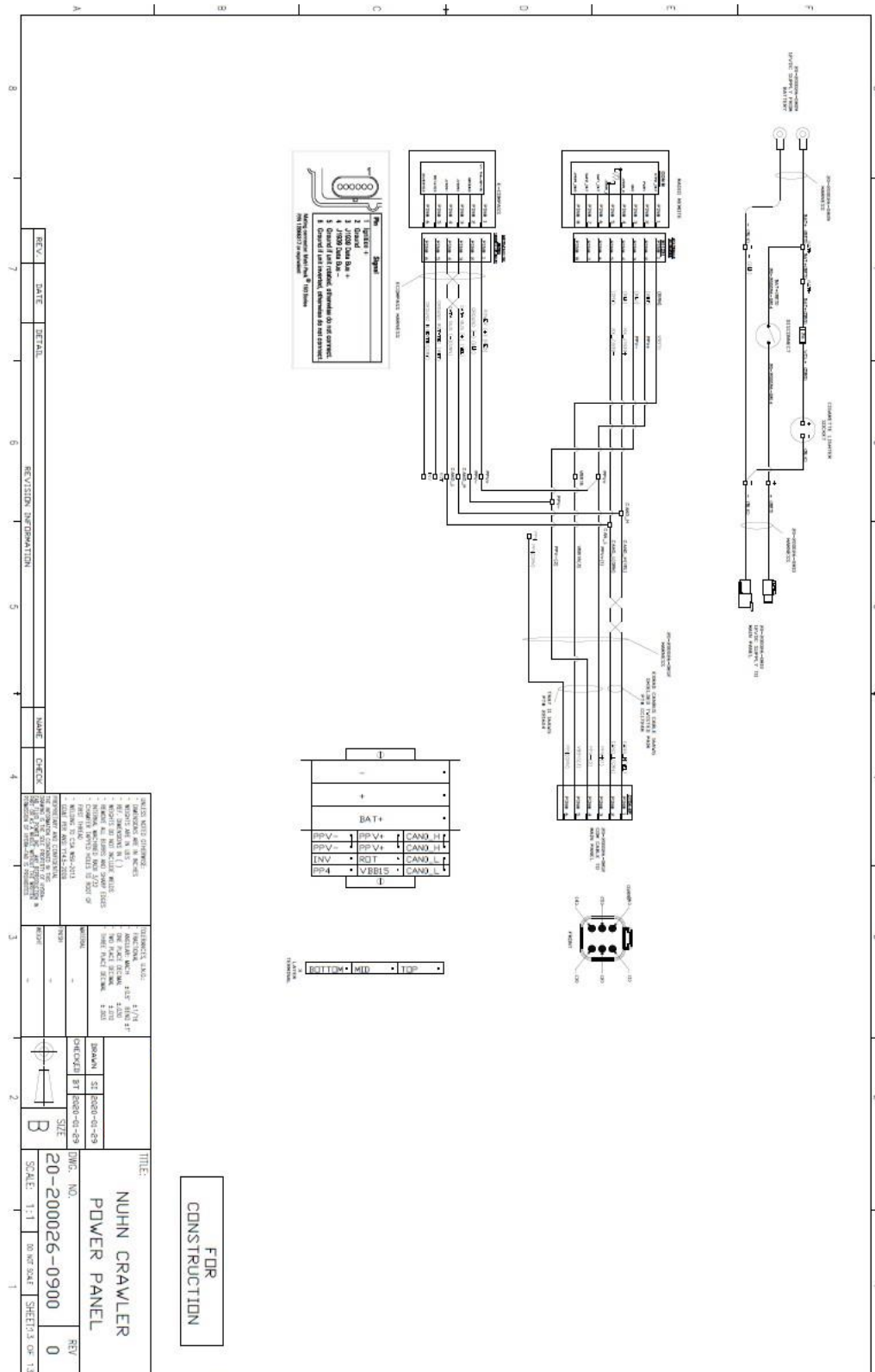






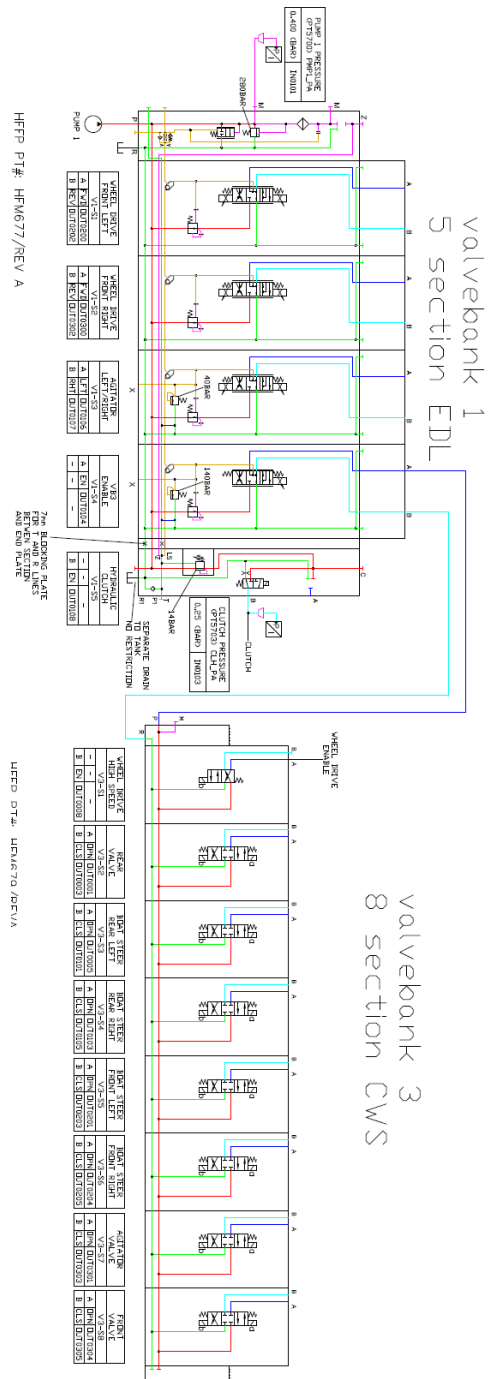




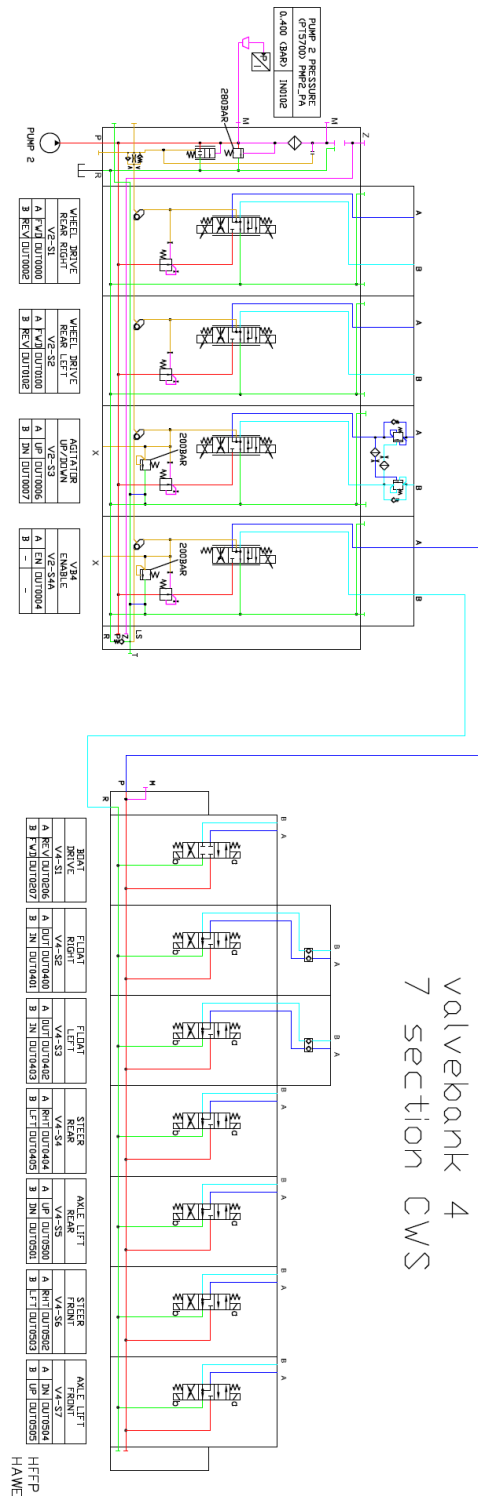


6 HYDRAULIC SCHEMATICS

6.1 RIGHT SIDE SCHEMATIC



6.2 LEFT SIDE SCHEMATIC



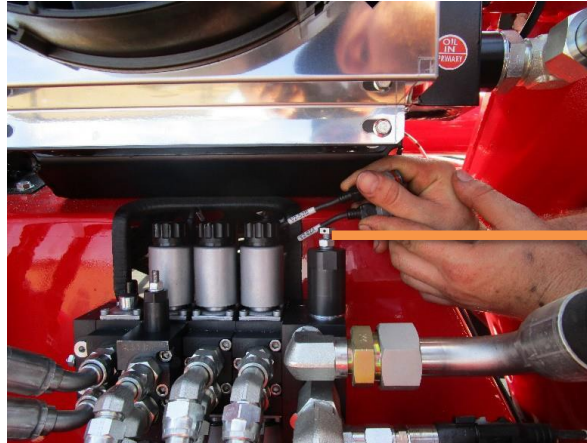
7 SETTING PRESSURES

7.1 SETTING WHEEL DRIVE PRESSURES

SETTING WHEEL DRIVE PRESSURES MUST BE COMPLETED ON CONCRETE/PAVEMENT

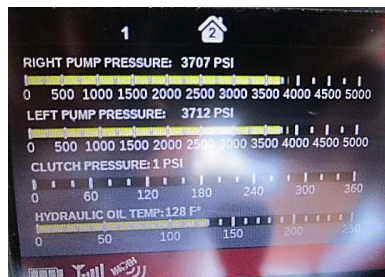
Valve Bank 2

- VB2S 1A/VB2S 1B & VB2S 2A/VB2S 2B
- 2 pin Duetsche Connector needs to be switched/alternated from A to B.

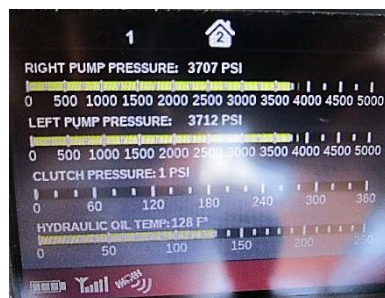


To adjust pressure more or less, turn out on the set screw for less pressure, turn in on the set screw for more pressure. (13mm Wrench)

This will allow the wheel drives to spin opposite of each other and cause the function to “dead-head”. Start Crawler; once started, at idle (800-850RPM), move forward or reverse on Belly Pack Remote to cause wheels to fight one another. On Valve Bank 2, while dead-heading at idle (holding forward/reverse), screen 2 on Belly Pack Remote will read pressure (Max. 3750Psi).



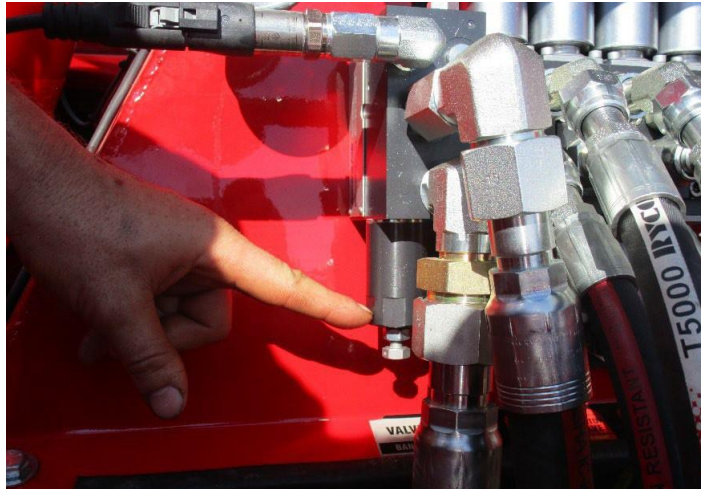
After our Idle pressure is set, now Rev engine to max. (2,200RPM) and adjust (tweak) to 3750Psi **maximum!**



To adjust pressure more or less, turn out for less pressure, turn in for more pressure. (13mm Wrench)

To check that the pressure is adjusted properly, cycle the function (Off/On) while adjusting the pressure to see the new Maximum. This is done while turning the "set screw".

For Valve Bank 1, follow the same order of operations/instructions given for Valve Bank 2.



Wheel drive adjustment screw is on bottom on Valve Bank 1. (See Photo Above)



Do not adjust this set screw on Valve Bank 1 as it can cause Clutch Failure.

- VOIDS WARRANTY

7.1.1 AGITATOR CANNON LEFT/RIGHT ADJUSTMENT GUIDE WITH SL2-/UNF 2DRH

Lagoon Crawlers with the counterbalance valve (shown below) should not require adjustment at the relief on valve bank 1, Section 3 A/B. Relief pressure 650Psi - 850Psi.



Counterbalance Valve



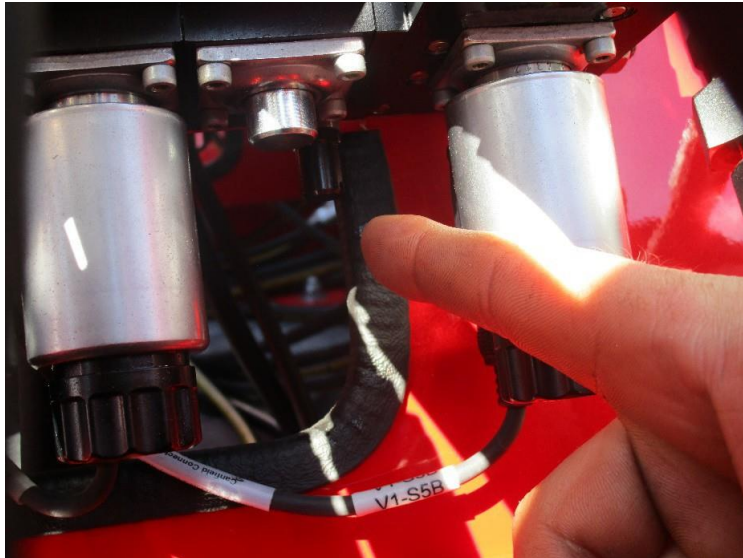
Valve Bank 1, Section 3 A/B

Should pressure need adjusting, remove cap from pressure relief screw using 12mm wrench and 4mm Allen key. Adjust pressure to recommended specification.



To see relief pressure, simply hold agitator left/right joystick while viewing screen 2 right pump pressure on your Bellypack Remote. (Shown above)

7.2 ADJUSTING SUPPLY PRESSURE: VALVE BANK 3, VALVE BANK 4

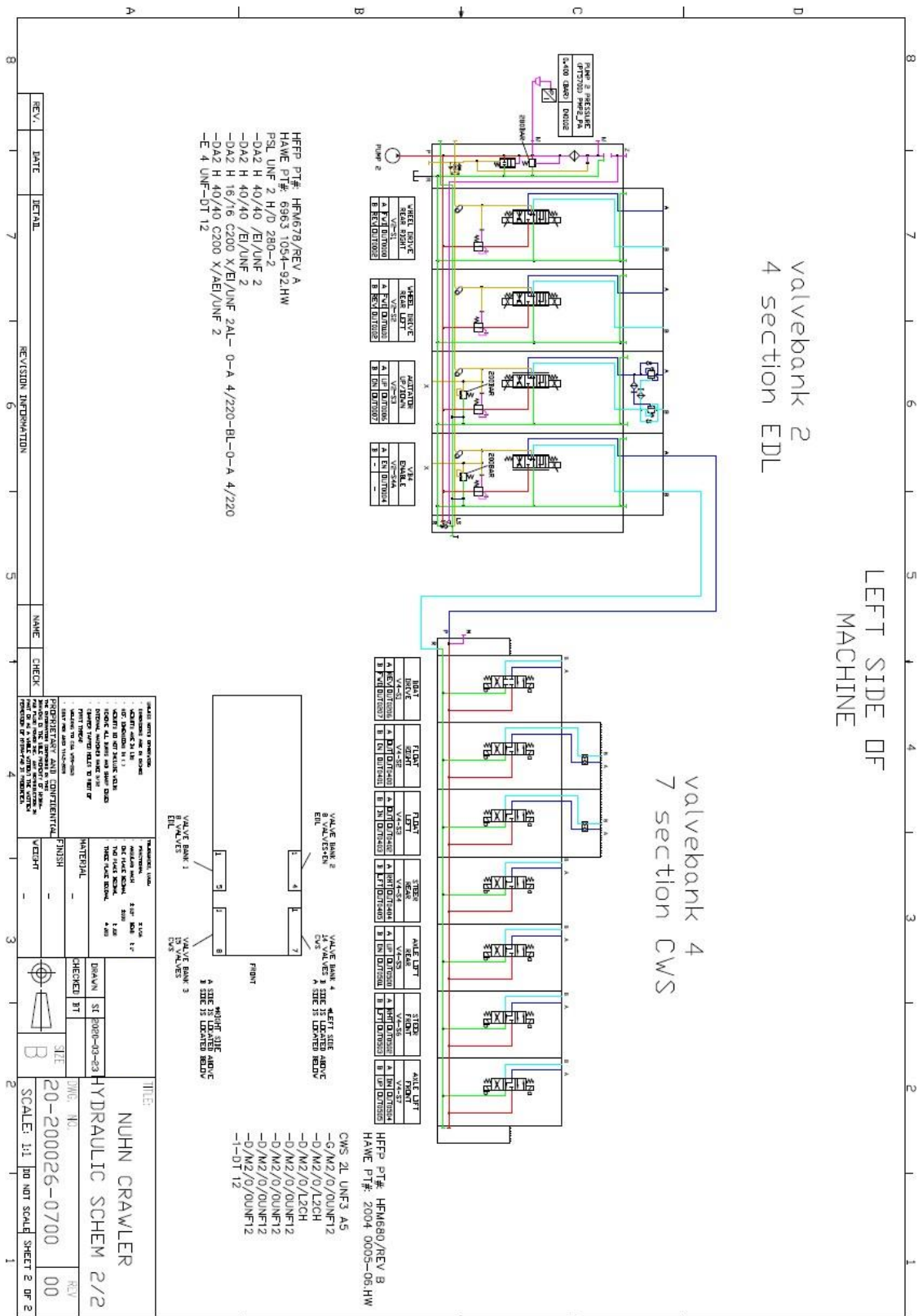


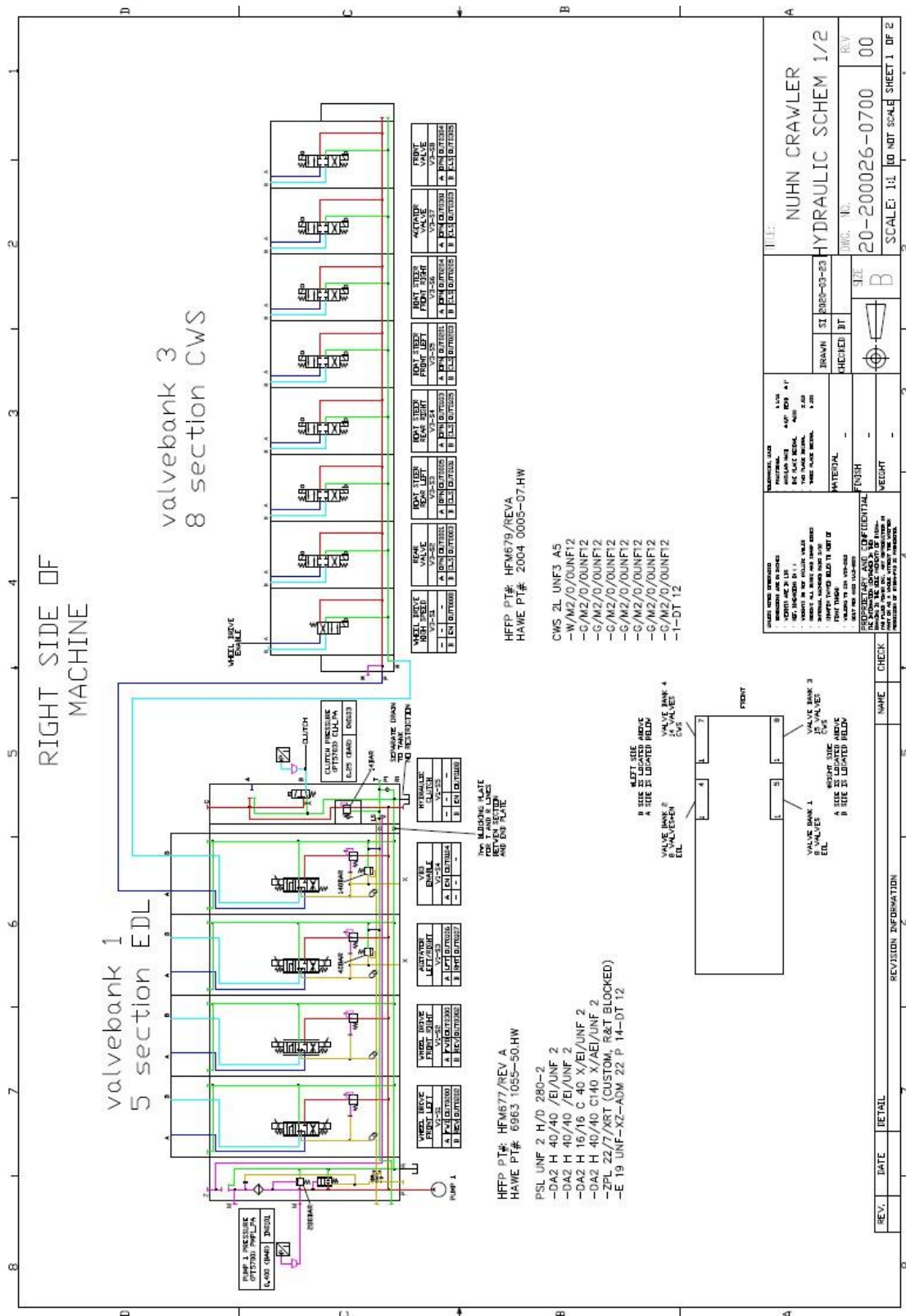
EDL Valve Bank 1 has a pressure limiter for gate valve bank supply section. When gate valve at end of stroke, this will limit the gate valve supply pressure to 2200Psi.



EDL Valve Bank 2 has a pressure limiter for supply on all functions on Valve Bank 4. When functions are at end of stroke, this will limit the supply pressure to 2800Psi.

Use 12mm wrench and 3mm Allen Key to adjust pressure. Turn right in for more pressure, turn left out for less pressure





8 TROUBLESHOOTING

8.1 CRAWLER BREAKDOWN IN A LAGOON

**Warning!**

In the unlikely event that the Crawler breaks down while agitating a lagoon, **DO NOT** enter a lagoon without adequate safety equipment. Life preservers and breathing apparatus should be worn. Contact your local fire department for recommended equipment.

If there is a mechanical failure on the pump driveline that causes loss of pump power, the Crawler can be driven out using the tires to bring itself back to shore. Use the 'Fast Drive' mode to use the tires to slowly propel the Crawler to shore. Steering the tires will steer the Crawler.

In a worst-case scenario, and if there is a lagoon pump nearby, you can **very cautiously** use the lagoon pump's agitation to spray the liquid near the Lagoon Crawler to move it to shore. **Never spray directly on Crawler, and make sure the engine is off.**

9 WARRANTY

9.1 NUHN WARRANTY

The warranty described in this section is provided by Nuhn Industries to the original Purchasers of Products purchased from Nuhn Industries or the Dealer. Under this warranty, Nuhn Industries will repair or replace, at its option, any part covered under this warranty which is found to be defective in material or workmanship under normal use and service during the applicable Warranty Term. Nuhn Industries' obligations under this warranty are limited to repairing or replacing as the company may elect, free of charge, and without charge for installation, any parts that prove, in the company's opinion, to be defective in workmanship and material within 1 year, or 1,000 hours of use after delivery to the original purchaser, and still owned by the original purchaser.

The Product carries a structural warranty of one year, or 1,000 hours of use. The Warranty Term begins on the date of delivery of the Products to the Purchaser. It is a condition of this warranty that the original purchaser must fill out and return the warranty sheet provided by Nuhn Industries immediately. In the event that the owner's sheet has not been returned to Nuhn Industries, the warranty is void.

It is a condition of this warranty that within the aforesaid period of time (one year or 1,000 hours) the equipment, product or parts as alleged to be defective by the original purchaser are to be returned to Nuhn Industries either directly or through a dealer/distributor of Nuhn Industries, with transportation prepaid, or this warranty shall be of no effect and shall be waived by the purchaser. The Purchaser shall be responsible for any service call or transportation of Products to and from the authorized dealer's place of business, or for any service or maintenance not directly related to any defect covered under this warranty. If Nuhn Industries shall find that such returned parts are defective and that such defects are included in and covered by said warranty, then such defective parts shall promptly be replaced without charge to the purchaser, FOB Nuhn Industries.

9.2 NO IMPLIED WARRANTY, REPRESENTATION OF CONDITION

The foregoing warranty shall constitute Nuhn Industries' sole liability and the Purchaser's sole remedy and is in lieu of all other warranties and conditions written or verbal, statutory, express or implied. To the extent permitted by law, fundamental terms, representations, promises, conditions and warranties, express or implied, including implied or statutory conditions or warranties, of merchantability and fitness, quality, performance, freedom from defect, are excluded. The Dealer has no authority to make any representation or promise on behalf of Nuhn Industries or to modify the terms or limitations of this warranty in any way.

9.3 WARRANTY NOT COVERED BY NUHN

Pursuant to the terms of this warranty, Nuhn Industries is not responsible for the following:

- i. Used Products;
- ii. Tires, which are warranted under separate warranty documents provided by the manufacturer of such tires;
- iii. Engines, which are warranted under separate warranty documents provided by the manufacturer of such engines (see owner's manual and details below);
- iv. Any products that have been altered or modified in ways not approved by Nuhn Industries;
- v. Replacement parts for items subject to excessive wear;
- vi. Depreciation or damage caused by normal wear, lack of reasonable and proper maintenance, failure to follow operating instructions or recommendations, misuse, lack of proper protection during storage, vandalism, the elements or collision or accident; or
- vii. Normal maintenance parts and/or service.

9.4 CAT ENGINE WARRANTY INSTRUCTIONS

It is the responsibility of the end user to register their engine for Warranty with CAT.

To register, visit the CAT Website: http://ma-catinfo.com/en_US_engine_warranty_registration

By visiting the link above, you will be directed to the CAT Engine Warranty Registration page, where you will be required to enter information about your CAT Engine.



ENGINE WARRANTY REGISTRATION

[Data Privacy Statement](#)

Caterpillar wishes to thank you for your purchase. We are committed to providing our customers with the finest products and product support available in any market today. To do this, we need to update our database with some specific information. Caterpillar will set the warranty date if you will complete the information below and return this form to us.

You may be entitled to a delivery inspection. To receive the special benefit, ask your servicing Caterpillar dealer if your engine qualifies for a delivery inspection as set forth in the Caterpillar Service Warranty Guide.

NOTE: Authorized Caterpillar Service providers may require further verification of date of delivery.

* denotes required field

ENGINE INFORMATION:

Engine Type:*

Please Select ▼

Engine Sales Model (Example: 3406E):*

Engine Serial Number (8 characters):*

Date of Delivery (MM/DD/YYYY):*

2nd Engine Serial Number (8 characters):

3rd Engine Serial Number (8 characters):

PROFILE INFORMATION:

10 LIABILITY

The Dealer, Nuhn Industries, their officers, directors, agents and servants and their affiliates and their respective officers, directors, agents and servants shall not be liable to the Purchaser nor to any other party for any liability, including, without limitation, strict liability, including liability for loss or damages, whether direct, indirect, special, incidental, consequential, punitive or aggravated, whether in contract, tort or otherwise, due to occurrences or consequences arising out of or related to the manufacture, sale, delivery, resale, repair, replacement or use of the Products or part thereof, whether or not supplied pursuant to this Agreement, except as specifically provided in the warranty provisions herein.

The Dealer, Nuhn Industries, their officers, directors, agents and servants and their affiliates and their respective officers, directors, agents and servants shall not be liable for any injuries, loss of profits, rental of substitute equipment, other commercial or personal loss or damages arising as a result of a fundamental breach or breach of a fundamental term of this Agreement by the Purchaser.

The Purchaser acknowledges and agrees that they are solely responsible for reasonably and properly operating, maintaining, repairing and servicing the Products in accordance with all manuals, warning decals, manufacturer's operating instructions and recommendations, as well as all state, provincial and local statutes, rules and regulations. The Purchaser acknowledges that a failure to do so may result in injuries, damage to property, loss of profits and other commercial or personal loss, together with the cancellation of any warranty coverage provided for herein.

A Nuhn Lagoon Crawler should only be operated by trained professionals. Contact your local Nuhn dealer to obtain training. By operating this Lagoon Crawler, you are acknowledging that you have been trained in the operation of this equipment. The operator understands that this is not a passenger or riding vehicle. Be mindful of surrounding people and property.

Manure gases can cause injury or death. Never enter a lagoon riding on the Crawler as such actions can result in serious injury or death.

Never attempt to enter a lagoon pit for any reason.

Do not leave the Crawler unattended. This is not a toy.

The operator must operate this product in accordance with all surrounding conditions. The following are the complete responsibility of the owner / operator:

- Damage to the equipment
- Harm to the environment
- Damage to the lagoon liner (of any material)
- Harm to property or possessions
- Harm to people or animals

Nuhn Industries will not be responsible for failure to maintain adequate fuel levels, resulting in the Crawler requiring retrieval from a lagoon. Pay attention to fuel consumption rates and operation time to better gauge when the Crawler will need to refuel.

LIABILITY NOTES:

(1) *Extended Meanings:* Words importing the singular number include the plural and vice versa and words importing gender include all genders.

(2) This contract shall be construed and governed according to the laws of Ontario and Canada.

(3) *Severability:* The invalidity or unenforceability of any provision of this agreement shall not affect the validity or enforceability of any other provision hereof.

(4) *Waiver:* No waiver, alteration or modification of these provisions shall be binding upon Nuhn unless made in writing and signed by a duly authorized representative of Nuhn.

Lagoon Crawler Serial No.	
Engine Manufacturer	
Engine Serial No.	

This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, leaving small margins at the top and bottom. There are no vertical margin lines, text, or other markings on the page.