SHERMAN+REILLY™

Sherman + Reilly™ Revolution Series

DDHX Underground Puller

Operator's Manual

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Revolution Series

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OPERATOR'S MANUAL

Important Safety Notice

Before using a Sherman + Reilly™ Revolution Series DDHX Puller, operators must read and understand all procedures and safety instructions. Note all safety information and specific safety requirements as explained in this manual.

Failure to follow these instructions could result in damage to the machine, serious personal injury, or death.

Advertencia

Por favor, lea atentamente todas las instrucciones operacionales y de seguridad antes de operar esta maquinaria. Si no entiende las instrucciones, por favor consulte a su supervisor antes de utilizar esta maquinaria. El uso inadecuado de estas instrucciones puede resultar en lesiones graves o en muerte.

Save this operator's manual for future reference.

 Information is provided for the purpose of product usage and maintenance descriptions only. The descriptions and specifications in this manual are subject to change without notice, and to the best of our knowledge, are accurate at the time of printing. The information contained may not be specific to all models or units, and must not be construed as warranted characteristics in the legal sense. The information does not relieve users from the duty of conducting their own inspections and evaluations. The information contained represents the best practices for the safest use and maintenance of the machine/unit, and does not cover every situation. With regard to situations not covered in this manual, the operator is responsible to ensure the safe operation of the machine and should ask questions or make inquiries if uncertainty exists prior to the operation of the machine or unit. Sherman + Reilly™ Inc. reserves the right to continually improve and expand our product line. It is our policy to improve our products whenever it is possible and practical to do so. We reserve the right to make changes or improvements at any time without incurring any obligation to install such changes on products previously sold. As our products are subject to continual improvement, we reserve the right to amend the product specifications, maintenance steps, and all information contained in this manual. Some product improvements may have taken place after this manual was published.

Communication with the Manufacturer

For information on Sherman + Reilly™ products, contact us by phone at **(423) 756-5300** or **800-251-7780** or via email at **help@sherman-reilly.com** or at 400 W. 33rd Street, Chattanooga, TN 37410; www.sherman-reilly.com .

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1 Introduction

1.1 Terms of Use

It is important that every machine is operated in a safe manner. To properly, safely operate this machine, it is required that operators and service people read and understand the information in this and the engine manufacturer's manual. ANYONE working around the machine should read the safety precautions in the manuals. Be aware each warning and precaution is to help protect against injury. Taking unnecessary risks and ignoring warnings is the primary cause of personal injury and fatal accidents in the work place. If you have any questions regarding operation or safety of a procedure or situation, contact the Sherman+ Reilly™ Customer Service Manager at 800-251-7780 or via email at help@sherman-reilly.com

Publication of this manual and the safety precautions in it does not in any way represent an all-inclusive list. It is the operator's responsibility to make sure the machine is operated in accordance with all state and local safety requirements and codes, including all applicable OSHA- (Occupational Safety and Health Administration) and EPA- (Environmental Protection Agency) regulations, as well as ANSI- (American National Standards Institute) accredited standards.

Should a problem or unsafe condition arise, shut the machine down using the normal shut-down procedure. In the event of an emergency, use the emergency stop procedure described in this manual, and then notify the proper authorities or follow your employer's prescribed procedure for an emergency situation.

Sherman + Reilly™ strongly recommends that only persons who have a full understanding of the provided manual and who are knowledgeable in the use of overhead line pulling and tensioning machines, including all applicable laws, regulations, and safety standards, be allowed to operate this machine. There are significant hazards inherent to the use of this machine; therefore, all operators should be educated on all functions, procedures, and safety measures outlined in this manual prior to their use or maintenance of this machine.

Sherman + Reilly™ strongly recommends that only personnel that are literate in the English language and who verbally understand the English language be considered as operators or service personnel for this machine.

Sherman + Reilly™ also recommends following applicable guidance published by the Institute of Electrical and Electronics Engineers (IEEE), and specifically IEEE Standard 524 – Guide to the Installation of Overhead Transmission Line Conductors (IEEE 524-2003 or subsequent).

This manual was prepared to help the operator use and service the machine in a safe manner. Responsibility for safety during operation and service rests with the person(s) performing the work. Being alert of surroundings and observing all safety precautions, and all rating requirements and standards is required to help reduce the possibility of an accident. This manual is of no value if the operator does not read and understand the instructions and precautions- before starting or trying to operate the machine. The operator must be aware of the machine's capacities and limitations. It is the operator's responsibility to watch for situations and conditions which could affect the normal performance of the machine and the safety of the operating/work environment.

Sherman + Reilly™ Pullers are powered, hydraulically actuated machines. This machine has variable speed and line tension controls; however, if tensioning multiple conductors using a running board, the total line pull applied from all conductors must not exceed the capacity of the machine.

2 Safety

2.1 Hazard Overview

Familiarize yourself with the following symbols before operating machinery.

These safety alert symbols are used to alert you to potential hazards.

Indicates an imminently hazardous situation which **WILL** result in death or serious injury if not avoided

Indicates a potentially hazardous situation which **COULD** result in death or serious injury if not avoided

Indicates a potentially hazardous situation which **MAY** result in minor or moderate injury and property damage if not avoided. It may also be used to alert against unsafe practices.

Indicates a potentially hazardous situation which **MAY** result in property damage if not avoided. It may also be used to alert against unsafe practices.

2.2 Common ISO Symbols:

Not all symbols apply to all machines

High voltage hazard

Electrical shock hazard

Pinch point and/or entanglement hazard

Cutting and/or crushing hazard

Crushing of body hazard

Crushing of Toes or Foot Hazard

Hot Surface Hazard

Eye and/or Ear Hazard

Risk of Explosion Hazard

Toxic Hazard

Flammable Material Hazard

Automatic Start-Up Hazard

Carcinogen Hazard

Operator Safety Precautions

CAUTION

Do not place any part of the body into a potential pinch point. The machine should be turned off and locked out in accordance with OSHA regulations before attempting to correct a problem, work on the machine, or perform preventive maintenance.

Do not attempt to operate any Sherman + Reilly™ equipment without proper instruction, including reading and understanding the provided manual.

Obey and enforce all warnings including OSHA requirements and ANSI standards.

Never allow anyone to ride on the unit while it is being towed.

Always wear proper safety equipment as required by employer.

Never bypass safety switches or operate equipment with faulty safety devices.

Be sure all guards and access covers are in place and secured when the machine is being operated.

Be aware of people in the work area who may be at risk during operation.

Know all emergency shutdown procedures.

Do not obstruct controls or fire extinguisher and make sure fire extinguisher is fully charged.

Never operate equipment while under the influence of any substance which could impair ability or judgment.

Do not operate equipment if work ability is impaired by fatigue, illness, or other causes.

Always use employer approved grounding procedures when operating the machine.

Never use hands to check for hydraulic system leaks. Hydraulic fluid escaping under pressure can cause personal injury.

Avoid contact with pumps, cylinders, hoses, engine components, and exhaust system.

Do not refuel unit while the engine is running or hot.

Keep all body parts, to include head and limbs, away from all moving parts.

Refer to engine manufacturer's manual for all additional safety precautions which relate to engine operation and service.

Know location and function of all controls, gauges, instruments, and protective devices.

Never use unit to tow or winch another vehicle.

Never use controls or hoses for hand holds.

Do not exceed unit specifications and limitations, to include weight.

Know where to get help in the event of an emergency or injury.

When towing this machine/unit trailer, the driver should use caution and adjust speed based on road, weather, and terrain conditions, as well as applicable laws and speed limits.

Do not make physical contact with rope or pulling cable as it enters or leaves the machine or drum.

To prevent the possibility of electrocution, do not enter or leave the unit while it is operating or allow anyone to touch or lean on the machine when in use.

Avoid direct inhalation of engine exhaust gases.

2.2.1 Employer Safety Precautions

CAUTION

This guideline is intended to assist owners, employers, job site supervisors, and operators in ensuring that the equipment is operated in a safe manner. Each job site may have additional situations and conditions which need consideration. Information in this manual applies to all the operators charged with the use and/or maintenance of the machine. This manual is not a training manual. This manual must be kept with the machine for the entire life the machine in order to be available to all potential users and operators. This manual should be kept in a sheltered dry place.

Monitor the operators to be sure they observe and practice safety procedures and operate the support equipment as outlined in this manual.

Establish a regular inspection program which includes malfunction reports, inspection, and service records. This inspection should cover the machine condition, adjustment, and ensure all safeguards are in place and functional. Additionally, all pre/post-operation inspections should be conducted at prescribed intervals.

Make sure that any malfunction or breakdown affecting the safe operation of the equipment is properly corrected or repaired before returning the machine to service.

The employer must provide training and instruction in chemical safety and safe methods of work before assigning workers to operate, service, or repair the machine and equipment. A record of training dates, employee names, and level of training shall be maintained. Only persons who have a full understanding of the provided manual- *(provided in English only)*, and who are competent in the use of overhead pulling and tensioning machines; to include all applicable laws, regulations, and safety standards, should be allowed to operate this machine. There are significant hazards inherent to the use of this machine, therefore all operators should be educated on all functions, procedures, and safety measures outlined in this manual- prior to their use or maintenance of this machine.

Employer must utilize a lock-out/tag-out procedure which complies with OSHA Standard, Part 1910.147, Title 29 of the Code of Federal Regulations or subsequent. This procedure must include control of all keys.

The employer should specifically inspect all safety equipment and protective devices on the equipment to ensure they are not bypassed or disabled. Operation of equipment should not be permitted unless all safety devices are in place and functional. The employer should meet all appropriate information dissemination and protection requirements for the workers.

Operators and maintenance/service personnel should take appropriate precautions, to include wearing all (PPE)-Personal Protection Equipment, prior to the operation, maintenance, or service of the machine. Operators should wear suitable clothing to reduce the possibility of entanglement in the machines moving parts. Operators should not wear chains or other jewelry for the same reason.

CAUTION

2.2.2 Chemical Safety

Exposure to chemicals during normal operation of the machine is limited; however, chemical exposure may be encountered through preventive maintenance and repair. Operators and maintenance/service personnel should take appropriate precautions, to include wearing all (PPE)-Personal Protection Equipment, prior to the operation, maintenance, or service of the machine. All Material Safety Data Sheets (MSDS's) or Safety Data Sheets (SDS's) for OEM chemicals present upon initial manufacture/shipment of machine can be made available upon request to Sherman + Reilly™.

Any additional chemicals introduced to the machine or used in conjunction with maintenance or repair of the machine are required by federal regulations to have a MSDS/SDS available, and are the responsibility of the operator's employer or the organization providing the maintenance. All chemical handling and disposal should be done in accordance with environmental, federal, state, and local laws and regulations. Sherman + Reilly™ is not liable for the mishandling, misuse, or improper disposal of chemicals, with regard to the use or maintenance of Sherman + Reilly™ machines or equipment.

All responsibilities, including but not limited to: handling and disposal of chemicals, availability and maintenance of MSDS's/SDS's, labeling of chemical containers, and training of employees and operators, should be fulfilled in accordance with the Hazard Communication Act, Hazardous Materials Transportation Act, Occupational Safety and Health Administration's Hazard Communication Standard- (29 CFR) Part 1910.1200, and all applicable Environmental Protection Agency Standards and Regulations- *(additional standards may apply)*. For further information on safety standards regarding chemicals see OSHA and EPA websites.

2.2.3 Temperature Limits for Hydraulic Oil

WARM-UP HYDRAULIC FLUID. For safe operations, it is recommended that the hydraulic fluid be allowed to warm-up to a working temperature prior use of any hydraulic functions. Cold hydraulic fluid can damage the machine. (See Warm-Up instructions in Handling and Operation section).

2.2.4 Before Starting Operations

CAUTION

- Only trained and authorized personnel can operate and maintain the machine.
- Follow all safety, precautions, and instructions in this manual when operating or performing inspection or maintenance on the machine.
- If you are not feeling well, of if you are under the influence of alcohol or medication, your ability to safely operate or repair your machine may be severely impaired, putting yourself and everyone else on your job site in danger.
- When working with another operator if with the person on the worksite traffic duty, discuss the content of the operation beforehand and use the determined signals when performing the operation.

2.2.5 Understand the Machine

- Before operating the machine, read this manual thoroughly. If there is any place in this manual that you do not understand, ask the person in charge of safety for explanation.
- If you find any problem in the machine during operation or maintenance (noise, vibration, smell, incorrect gauges, smoke, oil leakage, etc., or any abnormal display on the warning devices or monitor), report the problem(s) to the person in charge and take the necessary action. Do not operate the machine until the problem has been corrected.

2.2.6 Preparations for Safe Operation

Preparations for Safety Related Equipment

- Be sure that all guards, covers, and safety devices are in their proper position. Repair them immediately if they are damaged.
- Understand the application of safety-related devices and use them properly.
- Never remove any safety-related devices. Always keep them in good operating condition.

Wear Well-Fitting Cloths and Personal Protective Equipment (PPE)

- Do not wear loose clothes or any accessories. If any of these catch the control levers or protruding parts, it may cause the machine to engage unexpectedly.
- Always wear appropriate PPE: hard hat, safety shoes; protective eyeglasses, ear plugs, gloves, and/or face shield, depending on the work.
- Long hair hanging down could become entangled in the machine. Tie the hair up and be careful that it is not caught in the machine.
- Check that all personal protective items function properly before using them.

Keep the Machine Clean

- If you get on or off the machine or perform inspection and maintenance on the machine with mud or oil on your footwear or hands or on the machine, you may slip and fall. Wipe off any mud or oil from the machine. Always keep the machine clean.
- If water gets into the electrical system it could cause systems malfunctions which could cause the unit to engage unexpectedly and could cause serious personal injury or death. When washing the machine with water or steam, do not allow the water or steam to come into direct contact with electrical components.
- If high-pressure water us sprayed directly onto electrical fittings, hydraulic fittings, hydraulic pistons, and hydraulic manifolds may cause failure. When cleaning, do not allow the high-pressure water to get into these components directly. Wipe off any dirt with soft cloth.

Precautions for Inside the Cab

- Do not leave tools or machine parts lying around inside the operator's compartment. If tools or parts get into the control devices, it may obstruct operation and cause the machine to move unexpectedly, resulting in serious personal injury or death.
- Do not stick suction pads to the window glass. Suction pads can act as a lens and may cause fire.
- Do not use a cellular phone when operating the machine. This may lead to mistakes in operation and may be cause serious personal injury or death.
- Never bring any dangerous objects such as flammable or explosive items into the operator's compartment.

Precautions to Prevent Fire

- Do not bring any open flame close to flammable substances such as fuel, oil, coolant, or window washer fluid. There is a danger that they may catch fire.
- Do not smoke or use an open flame near fuel or other flammable substances.
- Shut down the engine before adding fuel.
- Do not leave the machine when adding fuel or oil.
- Tighten all the fuel and oil caps securely.
- Be careful not to spill fuel on overheated surfaces or on parts of the electrical system.
- After adding fuel or oil, wipe up any spilled fuel or oil.
- Put greasy rags and other combustible materials into a safe container to maintain safety at the workplace.
- When washing parts with oil, use non-flammable oil. Do not use diesel fuel or gasoline. There is a danger that they may catch fire.
- Do not weld or use a cutting torch to cut any pipes or tubes that contain combustible liquids.
- Determine well-ventilated areas for storing oil and fuel. Keep the oil and fuel in the specified place and do not allow unauthorized person to enter.
- When performing grinding or welding work on the machine, move any flammable materials to a safe place before starting.
- Remove any dry leaves, chips, pieces of paper, dust, or any other combustible materials accumulated or affixed around the engine exhaust manifold, muffler, battery, or cowling.
- To prevent fires from spreading sparks or burning particles from other fires, remove any combustible materials such as dry leaves, chips, pieces of paper, or any other combustible materials accumulated around the cooling system (radiator, oil cooler) or inside the undercover.
- Short circuits in the electrical system can cause fires. Check to see that all power cables and wirings are in good condition. Keep all electrical connections clean. Bare wire or frayed insulation can cause a dangerous electrical shock and personal injury.
- Keep all the electric wiring connections clean and securely tightened.
- Check the wiring every day for looseness or damage. Reconnect any loose connectors or refasten wiring clamps. Repair or replace any damaged wiring.
- Check that all the hose and tube clamps, guards, and cushions are securely fixed in position. If they are loose, they may vibrate during operation and rub against other parts. There is danger that this may lead to damage to the hoses and cause high-pressure oil to spurt out, leading to fire and serious personal injury.

Precautions regarding highly heated exhaust gas

- The machine is equipped with Diesel Particulate Filter (hereafter DPF).
- DPF is a device to purify the soot in the exhaust gas. Exhaust gas temperature may increase during the filter cleaning/purification process (regeneration / ReGen). Do not bring any combustible material close to the outlet of the exhaust pipe. Be aware of nearby combustible materials that may be inadvertently heated by exhaust gases.
- When there is brush, trees, dry leaves or other combustible matter near the job site, be aware that the DPF regeneration may present a fire hazard. The system can be set to disable DPF ReGen if necessary.

2.2.7 Pre-Towing Checklist

____ 1. Make certain tow vehicle has the capacity and rating to tow machine safely.

____ 2. Inspect pintle eye for excessive wear, corrosion, cracked welds or structural damage. Check the bolts holding the pintle eye in place.

____ 3. Inspect tow vehicle hitch and ensure hitch.

____ 4. Make sure trailer brakes are operable.

____ 5. Make sure the unit is safe for towing with tires in good condition and properly inflated.

____ 6. Make sure there are no tools, objects, or trash items which could fall off during transport.

____ 7. Chock wheels on both sides of the machine/unit trailer, then start machine/unit engine- (*See Operator Controls and Start-Up Procedure)*.

____ 8. Make sure the right and left bumper jacks are fully retracted- (*See Jack Controls)*.

____ 9. Open the tow vehicle hitch and back vehicle into position. Set tow vehicle parking brake.

____ 10. Slowly retract trailer tongue jack, so that the pintle eye rests correctly in hitch strike plate.

____ 11. Ensure the hitch is secured. Connect the safety changes. The safety chains should be crossed and short enough to prevent the tongue from digging into the ground, should the unit unintentionally become disconnected. The chains should be no longer than necessary to allow slack for turning – crossing the chains provides directional control.

____ 12. After the trailer is secured to the vehicle, stop the machine/unit engine, and remove the key from the ignition key switch.

____ 13. Connect the electrical plug to the tow vehicle and check:
- Clearance lights
- Brake Lights
- Turn Signals
- Brakes

____ 14. Remove and store the wheel chocks.

2.2.8 In the Event a Fire Occurs

CAUTION

Most Sherman + Reilly™ equipment comes standard with a fire extinguisher mounted somewhere on the equipment for quick access by the operator. However, should a fire occur with S+R equipment; the **operator should only utilize the provided fire extinguisher, if trained in its use, if safe to do so, if in accordance with employer policy, and in these described situations**:

a. To save your own life, if in jeopardy from fire.
b. To save someone else's life, if in jeopardy as a result of a fire- but only if safe to do so.
c. To put out small equipment fires to avoid further damage to equipment or prevent a dangerous explosion- but only if safe to do so.

- Turn the starting switch to OFF position, and stop the engine.
- Use the handrails and steps to escape from the machine.
- The fume generated by a fire contains harmful materials which have a bad influence on your body when they are inhaled.
- Do not breathe the fumes.
- After a fire, harmful compounds may be left. If it touches your skin, it may have a bad influence on your body.
- Be sure to wear rubber gloves when handling the materials left after the fire. The material of the gloves, which is recommended as polychloroprene (Neoprene) or polyvinyl chloride (in the lower temperature environment).
- When wearing cotton work gloves, wear rubber gloves under them.

CAUTION: Operators should exercise caution when attempting to put out fires, as **the provided extinguisher is only intended to suppress small localized fires**, and is not intended to put out or "fight" large scale fires, should one occur.

With the presence of flammable fluids and other operational environment factors, even small fires can grow out of control quickly- operators must maintain awareness of these factors.

Proper training must also be provided by employer before engaging in any firefighting efforts. Should a fire occur with Sherman + Reilly™ equipment, the operator should **not** use the equipment until it has been inspected for safety and approved to be returned to service-

2.3.1 Emergency Stop Procedure

In the event of an emergency, the operator must be aware of how to shut down the machine so as to avoid any additional injuries or equipment damage. In these emergency situations, the lives of lineman, work crews, surrounding bystanders, as well as the operator may become at risk- dependent upon the severity of the situation. As an operator in these situations, the level of operating knowledge and proficiency can be tested. These factors alone make this procedure one of the most important to know.

1. The first step of an emergency shut down during operations is to de-energize the drive system/engine and stop all equipment rotation and power as quickly as possible. This is done by **pushing one of the installed Emergency Stop Buttons** located on the machine or control panel.

2. If the Emergency Stop Button is pushed during operations and other machines/operators are being utilized in tandem or sync with your machine, notify them as quickly as possible that an emergency has occurred and advise to halt rotations.

3. Quickly assess situation and assist any injured personnel to get free from hazards- only if safe to do so.

4. Notify proper authorities and get help.

5. Follow all employer emergency procedures.

CAUTION

2.3.2 Unauthorized Modifications

- Sherman + Reilly will not be responsible for any personal injuries, product failures, physical loss or damage, or impacts to the environment resulting from modifications made without written authorization from Sherman + Reilly.
- Any modifications made without written authorization from Sherman + Reilly can create hazards. Before making any modifications, consult Sherman + Reilly.
- Any modifications made without authorization from Sherman + Reilly will void any written or implied warranty.

2.3.3 Precautions When Running Engine Inside Building

- The engine exhaust gas contains substances that may damage your health and even cause death. Start or operate the engine in a place where there is good ventilation. If the engine or machine must be operated inside a building or underground, where the ventilation is poor, take steps to ensure that the engine exhaust gas is removed and that ample fresh air is brought in.

2.3.4 Investigate and Confirm Jobsite Conditions

- On the jobsite, there can be various hidden dangers that may lead to serious personal injury or death. Before starting operations, always check the following to confirm that there is no danger on the jobsite:
- Always be careful when performing operations near materials such as shingled roofs, dry timber, dry leaves, or dry grass because they are easily combustible and may cause fire.
- Check the terrain and condition of the ground at the jobsite, and determine the safest method of operation. Do not operate in a dangerous area where landslides or falling rock may occur.
- If water lines, gas lines, or high-voltage electrical lines may be buried under the jobsite, contact the appropriate authority to identify their locations, and take care not to damage any of these lines.
- In particular, if you need to operate on a road, protect pedestrian and cars by designating a person for jobsite traffic duty or by installing fences around the jobsite.

2.3.5 Precautions When Working On Loose Ground

- Avoid operating the machine near the edge of cliffs, bluffs, road edges, and deep ditches. The ground may be weak in such areas. If the ground should collapse under the weight or vibration of the machine, there is a hazard that the machine may fall or tip over. Remember that the soil is weak in these areas, especially after heavy rain, blasting, or earthquakes.
- When working on embankments or near excavated ditches, there is a hazard that the weight and vibration of the machine will cause the soil to collapse. Before starting operations, take steps to ensure that the ground is safe and to prevent the machine from rolling over or falling.

2.3.6 Precautions related to Radio Control

General

Radio controlled equipment operates in several directions. Quite frequently, the equipment is operated in areas where people are working in close proximity to the equipment. **The operator should exercise extreme caution at all times. Workers should constantly be alert to avoid accidents.** The following recommendations have been included to indicate how careful and thoughtful actions may prevent injuries, damage to equipment, or even save a life.

Persons Authorized to Operate Radio Control

Only properly trained persons designated by management should be permitted to operate radio controlled equipment.

Radio controlled equipment should not be operated by any person who cannot read or understand signs, notices and operating instructions that pertain to the equipment.

Radio controlled equipment should not be operated by any person with insufficient eyesight or hearing or by any person who may be suffering from a disorder or illness, is taking any medication that may cause loss of equipment control, or is under the influence of alcohol or drugs.

Safety Information and Recommended Training for Radio Controlled Equipment Operators.

Anyone being trained to operate radio controlled equipment should possess as a minimum the following knowledge and skills before using the radio controlled equipment.

The operator should:

- have knowledge of hazards pertaining to equipment operation.
- have knowledge of safety rules for radio controlled equipment.
- have the ability to judge distance of moving objects.
- know how to properly test prior to operation.
- be trained in the safe operation of the radio transmitter as it pertains to the equipment being operated.
- have knowledge of the use of equipment warning lights and alarms.
- have knowledge of the proper storage space for a radio control transmitter when not in use.
- be trained in transferring a radio control transmitter to another person.
- be trained how and when to report unsafe or unusual operating conditions.
- test the transmitter emergency stop and all warning devices prior to operation; testing should be done on each shift, without a load.
- be thoroughly trained and knowledgeable in proper and safe operation of the equipment that utilizes the radio control.
- know how to keep the operator and other people clear of hazardous areas.
- know and follow the local lockout and tag-out procedures when servicing radio controlled equipment.
- know and follow all applicable operating and maintenance manuals, safety procedures, regulatory requirements, and industry standards and codes.

The operator shall not:

- operate the equipment if the direction of travel or function engaged does not agree with what is indicated on the controller.
- operate any damaged or malfunctioning equipment.
- change any settings or controls without authorization and proper training.
- remove or obscure any warning or safety labels or tags.
- leave power on the radio controlled equipment when the equipment is not in operation.
- operate any equipment using a damaged controller because the unit may be unsafe.

WARNING: The operator should not attempt to repair any Radio Controller if any product performance or safety concerns are observed; the equipment should immediately be taken out of service and be reported to the supervisor. Damaged and inoperable radio controller equipment should be returned to S+R or Magnetek for evaluation and repair. Failure to follow this warning could result in serious injury or death and damage to equipment.

Transmitter Unit

Transmitter switches should never be mechanically blocked ON or OFF. When not in use, the operator should turn the transmitter OFF. A secure storage space is provided for the transmitter unit, and the transmitter unit should always be placed there when not in use. This precaution will help prevent unauthorized people from operating the material handling equipment.

Spare transmitters should be stored in a secure storage space and only removed from the storage space after the current transmitter in use has been turned OFF, taken out of the service area and secured.

Pre- Operation Test of the Remote Control

At the start of each work shift, or when a new operator takes control of the equipment, operators should do, as a minimum, the following steps before operation of equipment:

- Test all direction and speed controls.
- Test all functions.
- Test the transmitter machine stop.

Handling Batteries

WARNING: Know and follow proper battery handling, charging and disposal procedures. Improper battery procedures can cause batteries to explode or do other serious damage. Failure to follow this warning could result in serious injury or death and damage to equipment.

- Use only batteries approved by Magnetek for the specific product.
- Do not dispose of a battery pack in fire; it may explode.
- Do not attempt to open the battery pack.
- Do not short circuit the battery.
- Keep the battery pack environment cool during storage (i.e., not in direct sunlight or close to a heating source).

Optional Rechargeable Battery Recharging

For those transmitters equipped with rechargeable batteries and battery chargers, all users shall be familiar with the instructions of the charger before attempting to use.

- Do not attempt to charge non-rechargeable battery packs in the charger.
- Avoid charging partially discharged rechargeable batteries to help prolong battery cycle life.
- Do not charge batteries in a hazardous environment.
- Keep the battery pack environment cool during charging (i.e., not in direct sunlight or close to a heating source).
- Do not short the charger.
- Do not attempt to charge a damaged battery.
- Use only Magnetek approved chargers for the appropriate battery pack.
- Do not attempt to use a battery that is leaking, swollen or corroded.
- Charger units are not intended for outdoor use. Only use charger units indoors.

Battery Disposal

Before disposing of batteries consult local and governmental regulatory requirements for proper disposal procedure.

3 Controls

3.1 General Overview

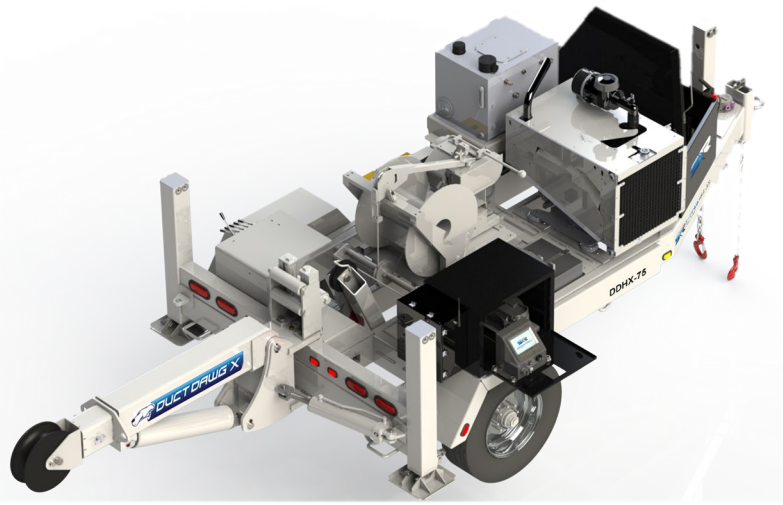
The Sherman + Reilly™ Duct Dawg DDHX 75/100 is an underground puller capable pulling 7500 lb or 10,000 lb respectively. This underground unit simplifies jobsite setup with a fully articulated, self-supported 3-axis boom capable of performing a wide horizontal swing arc (>50° left/right), 90° vertical arc (up/down), 24-inch telescoping (in/out) with a sheave head that swivels ~60° as well, allowing for ~10° adjustments within this range. The short length also makes setup easy.

Primary operational control is provided via a remote control which allows the operator complete locational flexibility. This also lowers the risk of "touch potential" when pulling in proximity to energized environments. The remote controller's graphic system displays relevant pull information, including direction, line tension, line footage, and speed, as well as battery and connectivity strength. CANbus technology provides for accurate real time display readouts of the machine system status.

The 3-speed gearbox allows for smooth operation with potential pulling and payout speeds between 0 to 120 feet per minute and an on demand payout of up to 285 feet per minute. All on the continuous welded, heavy-duty frame, the pulling backbone is provided by hydraulically driven twin capstan 6-inch bullwheels (5 and 6 groove) with forward, reverse, and demand payout capabilities in each gear.

The control system and remote control are located in a lockable control box to prohibit unauthorized use. A custom toolbox insert organizes, secures, and protects air adapters and dies, while still providing room for sheaves and other tools.

Key Features



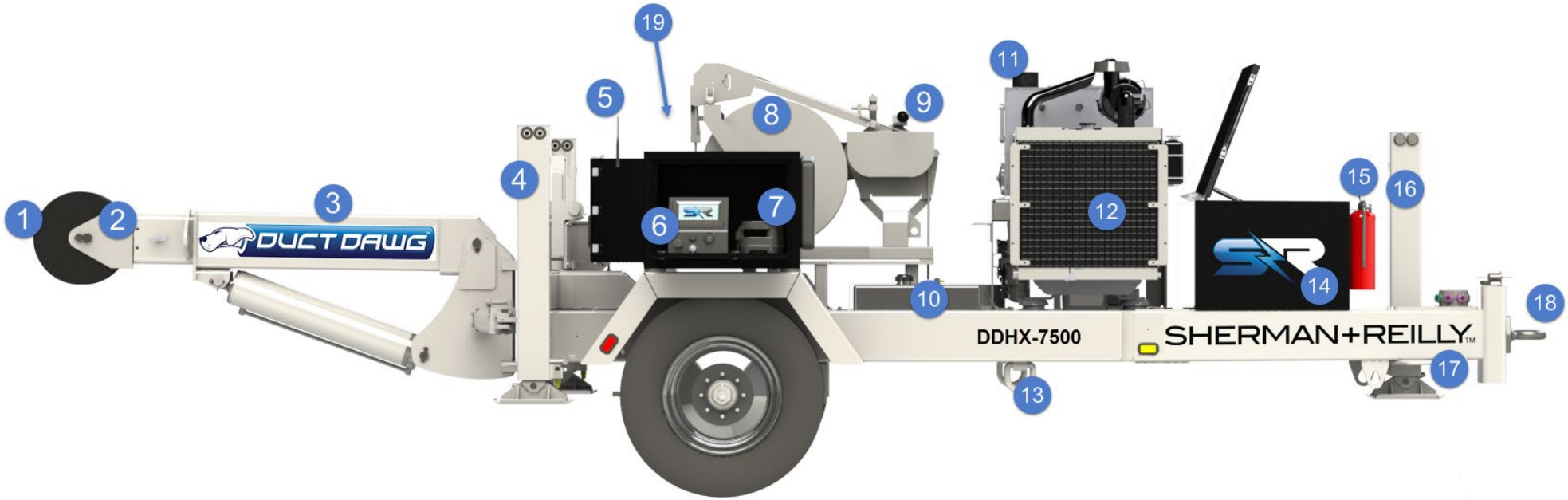
- Self-supporting articulated boom
- Remote Controlled
- 3-speed, 0 to 285 fpm
- Short footprint: 15.5 ft.
- CANbus technology
- Hydraulic direct drive system

3.2 Specifications DDHX-RC

Pulling Capacity Max:	**DDHX-75** = 7,500 lb	**DDHX-100** = 10,000 lb
Bullwheels:	Twin capstan, 6in. Diameter, 5-groove followed by 6-groove	
Gearbox & Line Speed:	1st gear 0-60 fpm @ 7,500 lb	1st gear 0-60 fpm @ 10,000 lb
with demand payout.	2nd gear 0-120 fpm @ 3,500 lb	2nd gear 0-120 fpm @ 5000 lb
	3rd: 0-285 fpm @ 1500 lb.	
Drive System:	Hydraulic	
Hydraulic Fluid:	ISO Grade 32	
Hydraulic Reservoir:	25 Gallons (Cold weather package optional)	
Engine:	49 hp, Diesel, water-cooled, electric start	
Fuel Capacity:	13 Gallons	
Pulling Rope:	3/8 in., 6 x 25 XIP IWRC steel wire rope, 2,000 ft.	7/16 in., 6 x 25 XIP IWRC steel wire rope, 2,000 ft.
Boom:	Hydraulic, joystick controlled, 3-axis, >50° swing arc 17-inch Sheave w/ ~60° swivel head	
Levelwind:	Dual automatic fairlead sheaves	
Puller Mounted Controls:	Hydraulic overrides; Jacks, Boom	
Puller Wireless Controls:	CANbus controller w/ radio controlled remote 300ft. Max	
Footage Counter:	Electronic, actual footage, pay-in & pay-out	
Hydraulic Tool Circuit:	N/A	
Pulling Connectors:	Rotation-resistant: (1) rated at 3,000 lb & (1) rated at 8,000 lb	
Frame Construction	Steel tubing, continuous-weld	
Length, overall, nominal:	15 ft., 6 in.	
Width, overall, nominal:	7 ft, 10 3/16 in	
Height, overall, nominal:	9 ft, 6 in., boom stored.	
Weight, nominal	5,000 lb w/out rope 7,200 lb with rope	5,200 lb w/out rope 7,400 lb with rope
GVWR:	8,800 lb	
Axle Configuration / Suspension	Single / Leaf Spring	
Wheel Configuration & Tires:	Single, LT235/75R17.5	
Brakes, trailer:	Electric, with safety break-away switch	
Towing Attachment:	3 in. adjustable pintle eye	
Safety Chains:	2 ea., with hooks	
Tie-Downs:	5/8 in. diameter steel D-Rings	
Front/Nose Jack:	Hydraulic, with shoe 1	
Stabilizing Jacks:	Hydraulic, with shoe at rear comers	
Electrical System:	12 VDC, 60 Amp alternator	
Lights, navigation:	US DOT LED, 12 VDC	
Battery:	12 V	
Grounding:	3/4 in. dia. Copper-clad steel ground loops, (4)	
Fire Extinguisher:	ABC	

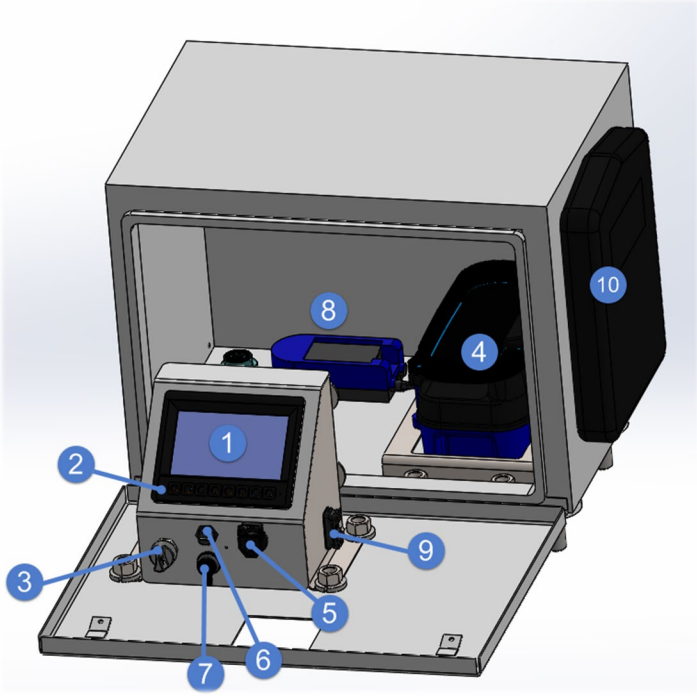
3.1 Terms to Know

1. Boom Sheave
2. Swivel Head
3. Boom
4. Bumper (Rear) Jacks
5. Antenna
6. System Control Panel
7. Remote Control
8. Reel / Winch
9. Gear shift lever
10. Fuel tank
11. Hydraulic Tank
12. Engine
13. Tie-downs
14. Tool Box
15. Fire Extinguisher
16. Tongue (front) Jack
17. Grounding Loops (4)
18. Pintle Eye
19. Block Rack (not visible)



3.2 Operator Controls

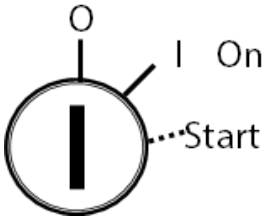
3.2.1 Control Panel on the Unit



1. Control Screen
2. Control Buttons
3. Key Switch
4. Remote Control
5. 12 v DC outlet
6. USB Port for Data Log
7. Programing Port
8. Battery Charger
9. USB Accessory Charger
10. Document Holder

Master Power Key Switch

This switch is used to control power to the operator controls and engine.



CAUTION: Always ensure that the master power key switch is turned to the [OFF] position when the machine is not in use. If the machine is to be left unattended, remove key from the key switch and stow in a secure place, while also securing the operators cab to prevent any unauthorized access to the controls or operation of the machine.

CAUTION: Before starting the machine or engaging any machine component, read and observe all safety precautions and operational procedures listed in this manual.

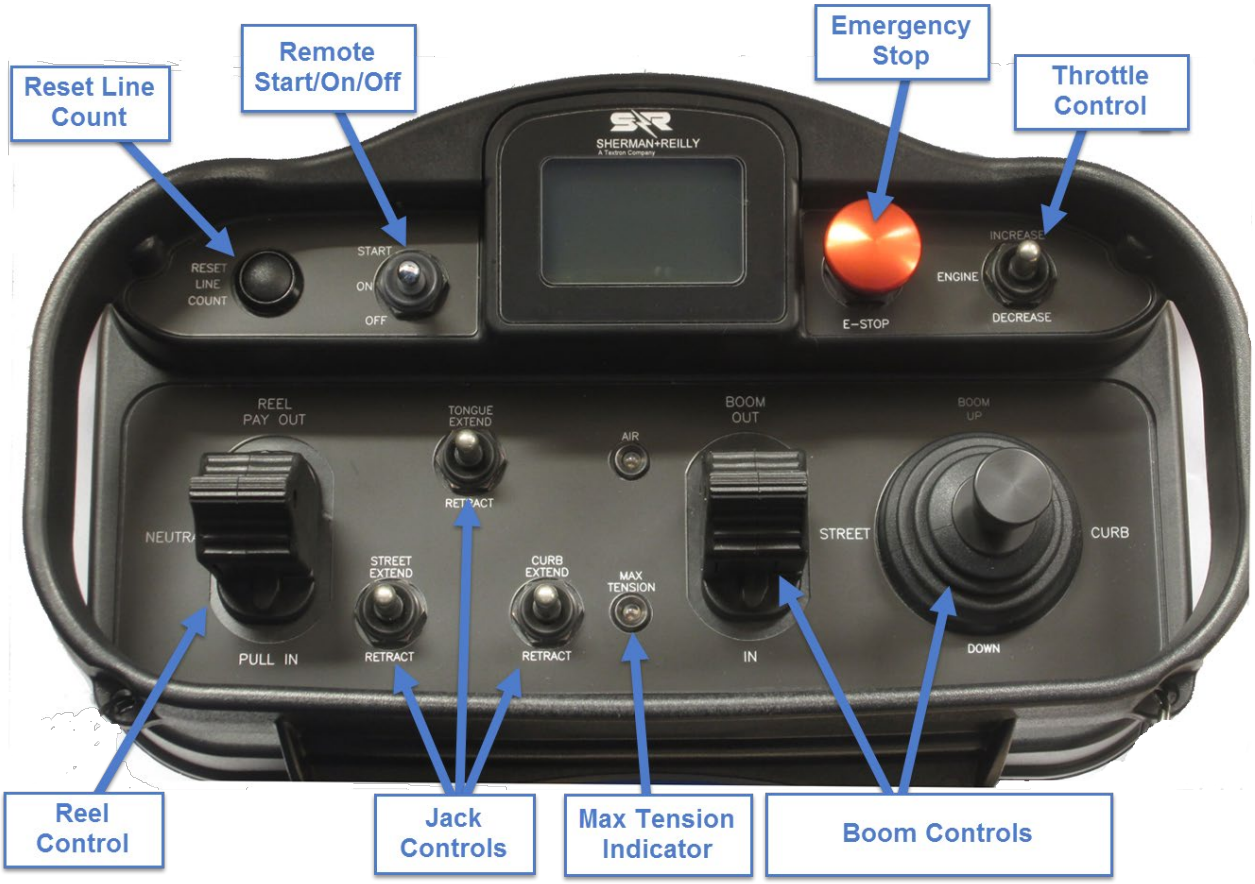
Emergency Stop Button

When pushed, this red push button stops all operation functions, turning off system and engine power, while disengaging all controls. After being depressed, the button must be rotated and released to the disengaged position to restore power to the system and re-engage operator controls.

NOTE: The emergency stop button should only be used to stop the machine in an emergency situation where there poses a risk of injury or death to personnel or to prevent equipment or property damage. When this button is pushed, line tensions can change rapidly. For more information on emergency shutdown situations- (*see the Emergency Stop Procedure).*

3.2.2 Remote Control

The DDHX is designed to by operated using the included Remote Control. After the DDHX is ON with the engine running, the operator can switch on the Remote Control to connect it to the control system.



Installing Battery Pack(s)

NiMH Rechargeable Battery Pack (BT128)

The rechargeable battery pack BT128 is a sealed battery pack that has no user-serviceable components within the battery pack.

NOTE: If using the optional rechargeable battery pack BT128, review and become familiar with the rechargeable battery charger manual prior to use. (See Appendix).

Figure 1: BT128 Battery Pack

The rechargeable battery pack BT128 is shipped from the factory with a minimal charge and will need to be charged prior to use for the first time with the specified charger. A charger is mounted on the DDHX in the Control box.

NOTE: When utilizing the optional tether mode on the XLTX transmitter, the battery packs will not be recharged from the tether power feed. The rechargeable battery pack only can be recharged using the specified charger, included on the DDHX.

When placing the battery pack into the XLTX battery pocket, orient the battery pack so that the sticker is facing out.

Figure 2: Installation of battery.

After installing the battery pack, install the battery cover over the battery and secure by tightening the thumbscrew at the end of the battery cover (see Figure 3).

NOTE: For the battery level indicator on the XLTX display to display the correct battery level, the battery type dip switch settings need to be set for the battery pack being used.
See Setting Battery Type Dip Switches.

Figure 3: Install battery cover.

Spare Battery Storage Compartment

The XLTX transmitter features a spare battery compartment to store a second battery pack. The second battery pack allows for quick replacement of the primary battery pack when the battery level gets low.

The spare battery storage compartment is the battery compartment with USB/IR cover inside the battery compartment.

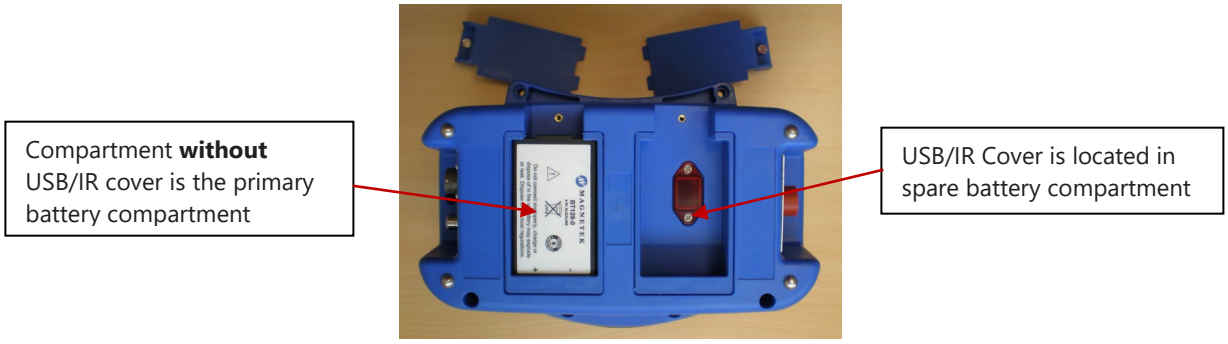


Figure 4: Spare Battery Compartment Location

NOTE: The spare battery compartment features battery spring contacts like the primary battery compartment. These spring contacts in the spare battery compartment have no electrical connection and are used to secure the spare battery pack inside the compartment to prevent rattling.

Setting Battery Type Dip Switches

For proper indication of the battery level on the battery level indicator on the XLTX display, the battery type dip switch settings need to be set for the battery pack being used in the transmitter.

NOTE: The dip switch settings are set at the factory for the battery type ordered with the system. These settings will only need to be changed if the battery type changes. The unit ships from Sherman+Reilly with a NiCad battery - #BT128-0.

The dip switches are accessed through the USB/IR cover inside the spare battery compartment on the XLTX transmitter (see Figure).

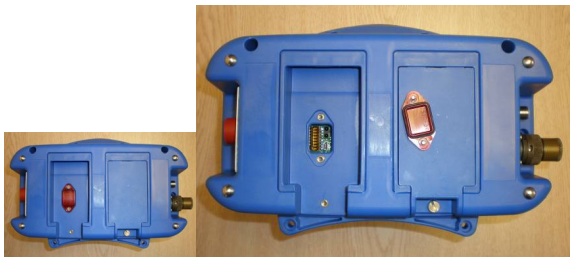


Figure 5: USB/IR Cover Location and Cover Removal

Figure 6: Dip Switch Block as Viewed through USB/IR Port

Use the following table to properly set the dip switches for the battery type (see Figure for dip switch view):

Battery P/N	Battery Type	Dip switch 1	Dip switch 2
BT129-0	4.5V Alkaline	Off	Off
BT128-0*	**3.6V NiMH**	**Off**	**On**

**The unit ships from Sherman+Reilly with a NiCad battery - #BT128-0.*

NOTE: The dip switch block switches are oriented so that the Off position is next to the number designator and the ON position is up or away from the number designator.

Turning the Transmitter ON and OFF

The XLTX uses both a three position toggle switch labeled OFF-ON-START and an Emergency Stop switch to turn the transmitter on or off.

Figure 7: Machine Stop Switch and OFF-ON-START Toggle

Turning On the Transmitter

1) First, engine must be running and the Emergency Stop switch on the transmitter must be in the raised position (pulled out).
2) The REEL PAYOUT / PULL IN paddle must be in the central/neutral position.
3) Next, make sure the OFF-ON-START toggle switch is in the OFF position.
4) Then, push this toggle switch to the ON position, release it. The unit will perform a routine initialization.
5) The message “RX Signal Error” will appear. If the DDHX control system display is on, push the Remote toggle switch to START and the transmitter will connect.

NOTE: If the transmitter does not initiate, push the toggle to off and wait a few seconds before retrying. Also, if the remote should disconnect from being tilted, or delayed use, toggle to OFF, then ON then START.

During initialization, the XLTX scans for any switches or motions that may be on during power up. If any switches or commands are on, the failure will be displayed on the screen, and then the transmitter will power itself down.

After a successful initialization, the XLTX will enter the Normal Operation Mode and display the normal operating screen.

NOTE: Holding the OFF-ON-START toggle in the START position for more than 5 seconds will put the device into Setup Mode. For normal use release the START toggle once the Magnetek logo appears. See the appendix for more information on the Setup Mode. Changes to the setup may affect the connectivity and function of the transmitter and should only be made by Sherman + Reilly.

NOTE: The transmitter could be turned off but be in the ON position in the following circumstances:

1) The REEL PAYOUT / PULL IN is not in neutral. This must be in neutral to start the transmitter.
2) If there has been an Emergency Stop.
3) Due to no command inputs, the transmitter timed out and shut down.
4) The transmitter battery dies.
5) The drop/tilt safety feature turned off the transmitter.

Turning Off the Transmitter

The transmitter can be turned off by pressing the OFF-ON-START toggle switch down to the OFF position.

Emergency Stop Switch on Remote Control

NOTE: Depressing the Emergency Stop switch will also turn the transmitter

When the Emergency Stop switch is depressed, the Machine Stop relay in the receiver is immediately opened.

Under normal operating conditions, the Emergency Stop switch must be in the raised position or the transmitter and system will not operate.

NOTE: The Emergency Stop Switch is to be used for emergency stopping only, not for normal system shut down.

To reset the Emergency Stop, pull up on it.

Graphic User Interface

The LCD screen located at the center of the device provides visual information during the operation of the XLTX transmitter. It is used to change configuration settings, confirm commands being operated, provide two-way feedback, and display transmitter diagnostic information such as battery life and signal strength.

Normal Operating Mode

In normal operating mode, the XLTX displays real time information relating to the operation of the transmitter on the XLTX graphic user interface. Information may include Command Confirmation, Battery Life, Signal Strength, Two-Way Feedback, etc.

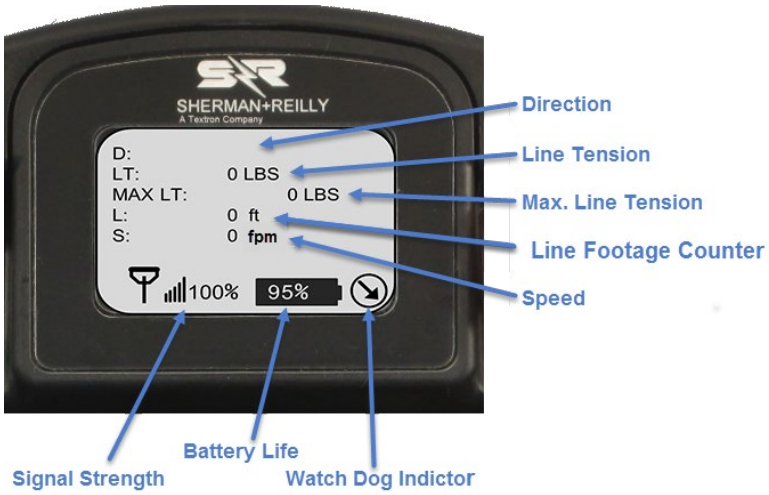


Figure 8: Normal Operating Screen on XLTX Graphic User Interface

Watch Dog Indicator (Spinning Arrow)

The spinning arrow represents the watch dog timer within the CPU of the unit.

NOTE: The arrow should be continuously spinning at all times. If the arrow is not spinning the transmitter will need to be rebooted to operate properly.

Command Confirmation

Each time the user operates a control on the transmitter, a message will be displayed on the graphic user interface screen confirming what is being operated.

For example, if the second paddle is moved to its 4th position in the UP direction the display will show 'MTN2 D1 SP=4'. This translates to 'Motion 2, Direction 1, Speed 4'.

Battery Life Indicator

Remaining battery life is displayed in the bottom left hand corner of the graphic user interface screen. Battery life is displayed in 5% increments.

NOTE: If using a different battery pack than what the unit originally shipped with, the battery life indicator will be inaccurate unless the dip switch settings are set to the correct battery type being used. See section "Setting Battery Type Dip Switches" for details to properly set the dip switches.

NOTE: The battery display is only shown when the battery is powering the device. When the device is powered through the optional tethered connection the battery indicator is not displayed and a plug icon is display instead.

NOTE: The battery life indictor will only show accurate battery life when using Magnetek approved battery packs.

Signal Strength Indicator

The Signal Strength Indicator shows the radio signal strength at the receiver.

The Signal Strength Indicator is only available in systems equipped for Two-Way feedback (systems utilizing the 433 MHz frequency band do not have Two-Way feedback available). For such systems, Signal Strength is displayed at the bottom of the graphic user interface screen.

Signal Strength is displayed in 5% increments.

NOTE: On 433 MHz systems, the signal strength indicator will either show minimum signal strength regardless of the actual signal strength (systems utilizing the 433 MHz frequency band do not have Two-Way feedback) or not show the signal meter at all.

Joystick and Paddles/Levers

- To activate the desired motor functions, operate the Joystick or Paddle/Lever that corresponds to the desired motion.
- To activate higher speed functions for those transmitter models so equipped, operate the Joystick or Paddle/Lever further to activate the desired speed.

Transmitter Setup

The transmitter may have settings changed. Changes may affect connectivity and functionality and should only be made by Sherman + Reilly. For more information about setting changes, see the Magnetek manual.

WARNING: Two (2) operational transmitters with the same access codes operating at the same time is a definite safety hazard. Failure to follow this warning could result in serious injury or death and damage to equipment.

Federal Communications Commission Statements

Compliance Statement (Part 15.19)

This device complies with Part 15 of FCC rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance should void the user's authority to operate the equipment.

This portable transmitter with its antenna complies with FCC's RF exposure limits for general population/uncontrolled exposure.

3.2.3 Battery Charger for Remote Control

For complete information regarding the battery charger, see Magnetek Battery Charger Instruction Manual in the appendix.

- Please familiarize yourself with these instructions before attempting to use.
- Use of this charging device is intended ONLY for BT128-0 and BT126-0 rechargeable battery packs. **The unit ships from Sherman+Reilly with a NiCad battery - #BT128-0.**
- Do not attempt to charge alkaline or other non-rechargeable batteries.
- Do not expose batteries to excessive heat or fire. Failure to do so could lead to an explosion and cause serious personal injury.
- Do not charge batteries or operate the charger in a hazardous environment.
- Do not short circuit battery or charger terminals.
- Do not attempt to charge a damaged battery.
- For indoor use only. The charger unit is not intended for outdoor use.
- Keep the environment between 50-104º Fahrenheit (10-40º Celsius) during charging operations. Do not operate charger in direct sunlight or close to a heating source.
- Do not store batteries in the charger.
- Store batteries between 0-85º Fahrenheit (-20-30º Celsius)
- Always dispose of used batteries in accordance with appropriate regulations.
- Use only with approved Magnetek products. Not for use with other manufacturer's products. Do not attempt to manually discharge battery packs.
- For the longest battery life, rechargeable batteries should be recharged at least every 6 months, even when in storage.
- For best performance of the battery, avoid charging the battery pack for more than 24 hours at a time. Failure to do so may negatively impact battery life.
- Recharging a battery only after it is fully discharged will prolong its life.
- Avoid recharging battery when fully or near fully charged.

NOTE: Batteries must be between 50º and 104º (10-40 ºC) in order to charge. These batteries contain a thermistor that prohibits them from being charge outside this parameter. In conditions of cold (<50ºF) or extremely hot (>104ºF) ambient outside temperatures, batteries will need to be charged indoors with the provided 110 VAC charger.

Battery Charger Instructions

1) Plug charger power supply adapter into 100-240VAC 47-63Hz power source. Plug the adapter jack in the charger base connection labeled “IN”. The “POWER” light will come on BLUE, indicating the unit is receiving power.
2) Insert the battery into the slot until the battery settles firmly in place. The battery label MUST be facing upward with the tab facing out, as shown below.

3) Once in place, the Status LED will turn RED, indicating the battery is charging.

4) When the battery is fully charged, the Status LED will turn GREEN. The battery will be charged within 3 hours.

5) **If an error has occurred with the charging process, the Status LED will flash RED**. Remove the battery from the charger and try again. (See **Table** for more troubleshooting instructions)

6) For best battery performance, avoid charging the battery pack for more than 24 hours at a time.

NOTE: All new rechargeable battery packs must be charged before usage.
Battery life ≈ 40 hours / 500 charges

Troubleshooting Battery Charging

Problem	Possible Reasons	Suggestions
Status LED flashes Red	Batteries too hot/cold	A battery must be from 50-104ºF (10-40ºC) to charge. Charging will resume when the battery gets back to its specified temperature range.
	Wrong battery type	If the wrong type of battery is placed in the charger, it will not charge. Make sure the correct battery type is used. **ONLY USE BATTERIES PROVIDED BY MAGNETEK!**
	Battery contacts are dirty or damaged	Inspect battery contacts. If dirty, wipe with Isopropyl alcohol. **DO NOT SUBMERGE**. If damaged, replace battery pack.
	Battery has not indicated full charge in allotted time	Various environmental conditions may elicit the charger to fail to recognize a full charge condition. In this case, the charger will stop charging after a pre-programmed time and indicate a fault. If this happens repeatedly, contact Magnetek Inc. as the charger may require service.
	Charger too hot/cold	Re-locate charger to an environment that does not exceed 50-104ºF (10-40ºC).

Table 1.0

NOTE: Batteries must be between 50º and 104º (10-40 ºC) in order to charge. These batteries contain a thermistor that prohibits them from being charge outside this parameter. In conditions of cold (<50ºF) or extremely hot (>104ºF) ambient outside temperatures, batteries will need to be charged indoors with the provided 110 VAC charger.

The on-board battery charger will only function when the engine is running in order to prevent depleting the charge of the starting battery.

Use the 110 VAC wall charger in cold temperatures and when the DDHX is not in use.

CAUTION: Do not store a battery on the charger.

4 Handling and Operation

4.1 Pre-Operation Inspection

Perform the following checks before starting the engine. At the beginning of the day's work to ensure that there is no problem with the operation of the machine. If these checks are not performed properly, problems may occur with the operation of the machine, and there is a danger which may lead to serious personal injury or death.

1. **Check the engine radiator coolant level**, by opening the radiator cap. CAUTION: Ensure radiator cap is reinstalled and tightened prior to operations.
2. **Check for proper engine oil level**. After checking oil level, wipe dipstick clean of any debris prior to reinserting into spout.
3. **Check hydraulic fluid reservoir level**, by viewing the sight gauge on the side of the tank.
4. **Check inside engine compartment for debris.** Open all engine compartments, while inspecting compartment latches. NOTE: Be sure the engine covers are replaced and latched in position properly before transport or operating the machine.
5. **Inspect bullwheel surfaces** for signs of damage or excessive wear.
6. **Inspect hydraulic systems** - pump, drive motors, and hoses for loose fittings, leaking fluid, and damaged hoses.
7. **Inspect the battery, terminals, and wires** for any signs of corrosion or damage.
8. **Close and re-secure all latches**, engine compartments, and panels.
9. **Inspect for damage**, bent or broken parts, cracked or broken welds, missing pins and retainers.
10. **Inspect all equipment grounds** for any signs of damage.
11. **Inspect all jacks** for damage or leaking hydraulic components.
12. **Inspect connected** reel stands, drive motors, drive bars, drive pins, and reel shaft couplings to ensure they are secure and that there are no obvious signs of damage- if damaged do not operate, service may be required.
13. **Inspect fairleads and rollers** for any obvious signs of damage, and ensure rollers move freely.
14. **Check fuel level and battery charge**- With key inserted in master power key switch, turn key to the ON position to activate the display. The fuel level will show on the engine information screen.
15. **Check surrounding area**
    a. Check that there is no combustible material that could be ignited by high temperature exhaust during operations, especially during regeneration of a diesel particulate filter.
    b. Check that the ground where the machine is located is stable.
    c. Check that there are no persons in the area around the machine.
16. **Conduct towing readiness inspection.**

a. Inspect all trailer connections, and ensure that the hitch is secured, and air supply/electrical hoses and trailer lighting are connected.

b. Inspect tail lights to ensure all lights work- replace bulbs as needed. If none of the lights work, inspect vehicle fuses and trailer wiring for corrosion.

c. Ensure that trailer brakes work and that wheel chocks are available.

d. Check tire pressure- tire pressures are posted on the tire sidewall.

e. If tire pressure slow, inspect tire for damage or punctures. If damaged or punctured, have repaired or replace.

f. Ensure that all jacks are raised and that trailer is clean and free from trash or debris.

17. **Inspect Fire Extinguisher.**

a. Inspect fire extinguisher charge, and ensure that gauge shows within charge limits.

b. Inspect the physical condition of the extinguisher- (cylinder, hose/cone assembly, etc.), for any signs of damage or corrosion.

c. Ensure that hinge pin is in place, to prevent accidental discharge.

d. Ensure that the plastic safety seal is secured to hinge pin, and that it has not been removed.

e. Inspect mounting strap/bracket assembly to ensure extinguisher is secured to structure.

CAUTION: Unless operating in an extreme heat environment, ensure all engine compartment panels are re-secured and latched in position properly before operating or transporting the machine.

4.2 Start Up and Set Up Procedure

1) Perform all pre-operation inspections.

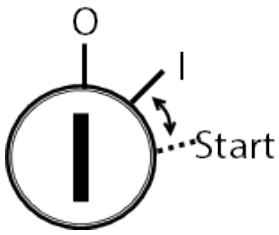
2) Position the machine in a suitable location for the pull. The machine should be positioned centered on the lead block, and parallel to the line being pulled prior to beginning operations. Wheels should be chocked to prevent the unit from rolling.

3) Ensure that all controls (levers, switches, etc.) are in the neutral and disengaged position (see Operator Controls section). NOTE: The Engine will not start unless the Remote Control transmitter controls are in a neutral position, if connected.

4) With the key inserted, turn master power key switch to the POWER ON / ENGINE START position and release.

5) The main control screen will flash the S+R logo, then the HOME screen will be visible with all the potential error message indicators.

6) Once the error messages clear, the HOME screen is visible, press the [START ENGINE] toggle switch to start the engine.



7) View the control panel screen to ensure there are no warning or fault messages.

8) WARM-UP HYDRAULIC FLUID. For safe operations, it is recommended that the hydraulic fluid be allowed to warm-up to a working temperature prior to use of any hydraulic functions. Cold hydraulic fluid can damage the machine.

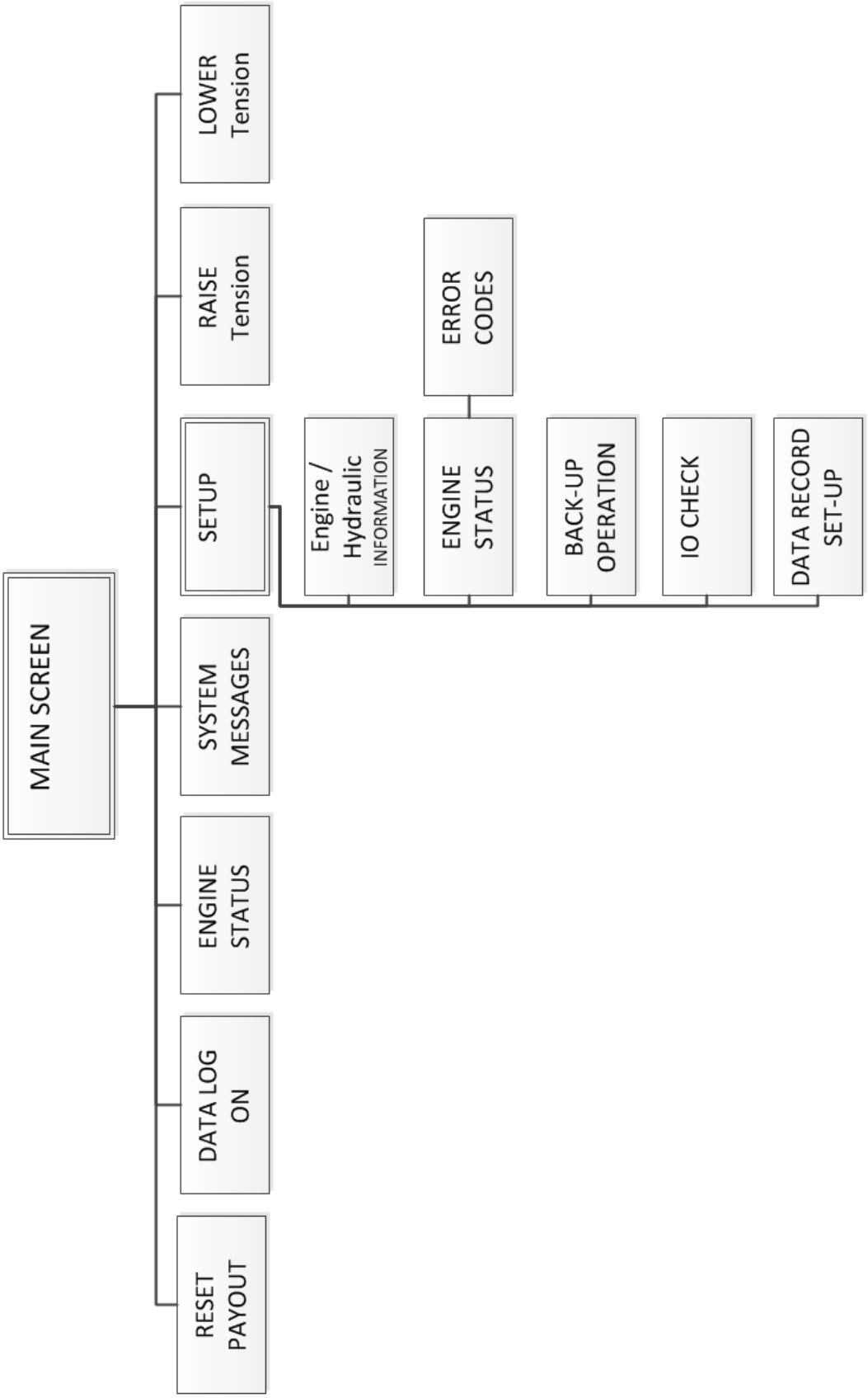
9) Level and stabilize the machine using the available hydraulic jacks- (see Jack Controls section).

10) Properly ground and anchor the machine to prevent the machine from moving under tension or line load.

CAUTION: All jacks must be extended for stabilization, and the machine must be leveled, anchored, and properly grounded prior to conduction operations.

4.3 Control Screens

4.3.1 Screen Map

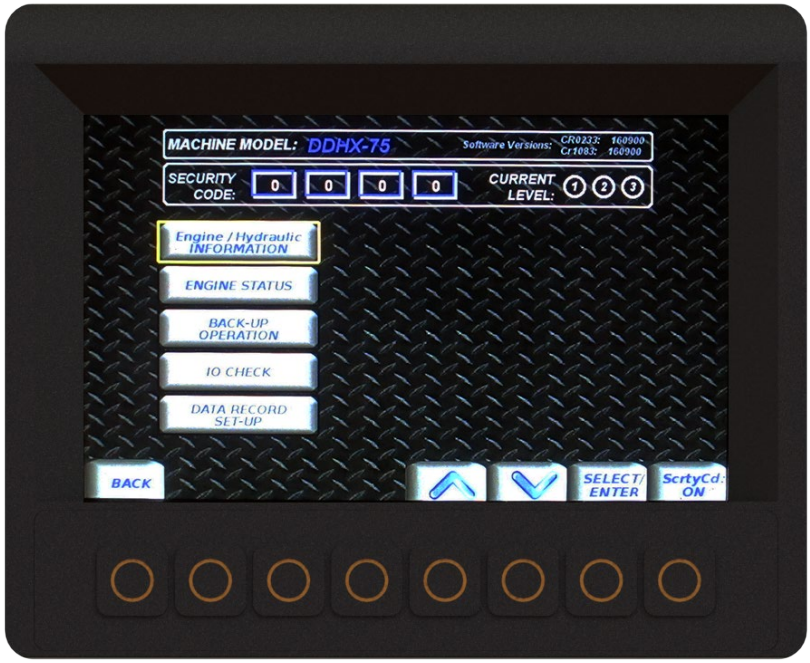


4.3.2 Main Screen

The Main Screen visible on the System Control Panel when the machine is first turned on shows the main system parameters that are of interest to an operator: Line Speed, Line Tension, Reel Direction, Engine Load, Fuel Level, and Reel Throttle % (percentage of maximum reel speed capability). The labels at the bottom of the screen are associated with the control panel soft keys.

4.3.3 Setup Screen

The Setup Screen provides access to additional information and functions of the DDHX including: Engine Information, Engine Status, Back-up Operation, IO Check, and Data Record Setup. Using the arrow keys, the operator can navigate to a function (highlighted with a yellow box) and hit SELECT/ENTER to switch to that function.



4.3.4 Engine / Hydraulic INFORMATION Screen

This Screen provides access to information about the engine and hydraulic system.

4.3.5 ENGINE STATUS Screen

This Screen provides access to information about the engine including RPM, percent load, coolant temperature, alternator voltage, hours, fuel level, DPF soot load, and DPF ReGeneration.

4.3.6 Error Codes

This screen will display J1939 engine error codes. A list of engine error codes in available from Sherman + Reilly or the engine manufacturer.

4.3.7 IO CHECK

The I/O Check Screen is for setting up or troubleshooting the electronic functions by the manufacturer's service technician.

4.3.8 BACK UP OPERATION

In the event that there is a failure with the Remote Control operation, the DDHX is equipped with a Back Up Operation screen. This screen mimics the remote control and only works if the Remote Control is OFF and only functions if the engine is running. If the remote control is on or the engine is off the TURN ON button is greyed out.

Using the soft key associated with the arrow keys at the bottom of the screen  , the operator can navigate to and highlight the various operational functions. Pressing SELECT/ENTER soft-key will momentarily activate that function, except the REEL PAY OUT /PULL IN control which is ON/OFF.

4.3.9 GEAR SHIFT MODE

To facilitate changing gears on the winch, the control system has a GEAR SHIFT MODE.

- ☐ To shift gears, use the GEAR SHIFT Mode, located on the MAIN/AIR/BACKUP screen of the on-board System Control Display.

- ☐ Depress GEAR SHIFT button on the display screen.

NOTE: The engine will be brought to idle speed and all other functions are disabled, except Emergency Stop.

- ☐ Move the REEL CONTROL to PAY OUT on the remote control or backup screen

- ☐ Apply 5-10 lbs force to the shift knob.

- ☐ An audible alarm on both the Remote Control and main unit beeps when the unit is in GEAR SHIFT MODE and the REEL CONTROL lever is moved to PAY OUT. If the audible alarm stops, it indicates that the REEL CONTROL requires re-centering.

NOTE: Shifting into and out of 3rd gear requires re-centering of the REEL CONTROL. This error message will indicate on the system control screen.

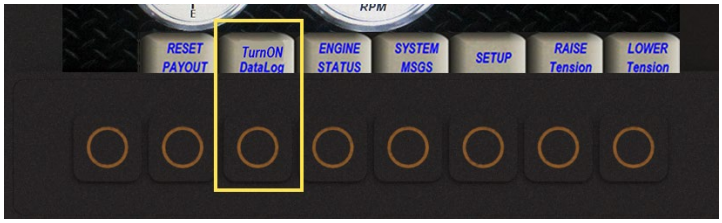
- ☐ Press GEAR SHIFT button to exit GEAR SHIFT Mode.

4.3.10 DATA RECORD SET-UP

The control system is designed to record operations information to an external USB drive.

To setup data recording:

1. Press the SETUP key.
2. Plug in a USB drive to the DATA LOG port.
3. From the SETUP screen, select and highlight the DATA RECORD SET-UP and press SELECT/ENTER.
4. Using the arrow soft keys, the operator can navigate around the alpha-numeric screen to select and enter a filename.
5. Press SAVE NEW FILE
6. Using the BACK key, return to the Main Screen. The operator can see that DATA LOG: ON is now blue and the associated soft key is operable for command input. Data logging can be turned ON/OFF by pressing the associated soft key.
    - Press **TurnON DataLog** to ENABLE data logging.
    - Press **TurnOFF DataLog** to DISABLE data logging.



7. After operations, eject the USB drive:
    a. From the SETUP screen, select and highlight the DATA RECORD SET-UP and press SELECT/ENTER.
    b. Press Remove USB stick.

USB Drive in DATA LOG port.

Setup Screen

Data Record Set Up Screen

Data Recording Indicator

4.4 Jack Controls

The engine must be running for the jacks to function. All the jacks can be operated from the Remote Control transmitter or from the System Control Panel. The tongue (front) jack can be operated via a switch located adjacent to it.

NOTE: It is important for the machine to be level in order for the levelwind to work properly.

4.5 Engine Throttle Control

The RPM on the engine can be increased or decreased from the Remote Control transmitter or from the System Control Panel depending upon the power demands of the pull. If the toggle is held in either direction for 2 seconds, the engine will go to maximum or idle RPM respectively.

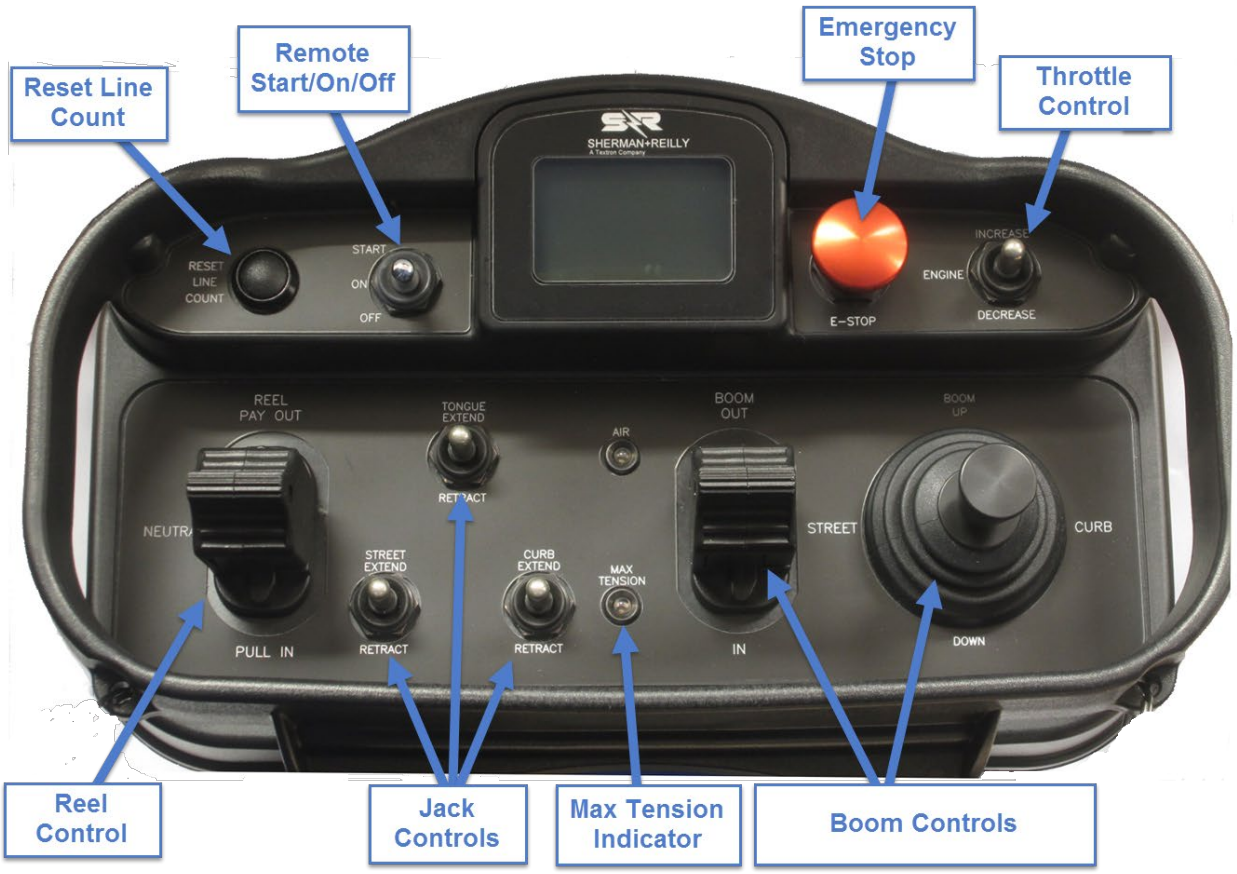
4.6 Boom Control

The Boom can be controlled from the Remote Control transmitter or from the System Control Panel.

4.7 Reset Payout

This Reset Payout on the Control System and the Reset Line Count button on the remote both resets the line counter. This counter does not go negative.

NOTE: Sherman + Reilly recommends that the counter not be reset unless the line is pulled in all the way. The counter will not go below or lower than "zero" - into negative numbers. If the counter is reset with line paid out, the operator will not know how many feet to pull in to reach "zero."



4.8 Hydraulic Manual Override

This exterior hydraulic control manifold, located on the rear street side, provides the operator with an emergency hydraulic override control for the jacks and boom. The engine must be running for the hydraulics to operate. A set of handles is provided in the toolbox in the event the manual overrides need to be used to operate the machine. See the decal on the machine for additional instruction.

This manifold also provides a tool circuit and warm-up circuit.

4.9 Tool Circuit

The DDHX is equipped with a hydraulic tool circuit that allows the operator to power portable hydraulic tools. The system pressure is 2500psi with a flow rate up to 7gpm. The coupling and nipple for the tool circuit are 3/8 inch.

4.10 Hydraulic Warm-Up

For safe operations, it is recommended that the hydraulic fluid be allowed to warm-up to a working temperature prior use pulling. Sherman + Reilly units ship with ISO 32 hydraulic fluid.

To warm up the hydraulic fluid on the DDHX has a Warm-Up hydraulic circuit located on the hydraulic manifold at the rear street side of the machine. This circuit is actuated by a detented lever. First, start the engine, then activate this Warm-Up circuit by bringing this lever up to the vertical position.

CAUTION: Do not operate the Warm-Up circuit for more than 30 minutes at one time.

Cold hydraulic fluid can damage the machine. This blue temperature icon on the System Control Panel indicates that the oil temperature is below 60 ° F (16 °C). It will disappear once the hydraulic oil exceeds 60 °F (16 °C).

The current temperature of the hydraulic oil can be viewed on the Engine/Hydraulic Information Screen from the Setup menu screen.

4.11 Pay Out

1. With the engine running, switch to GEAR SHIFT MODE. Move the "gear selector" to "1st, 2nd, or 3rd gear.

Do not attempt to change gears with the rope under tension. Use the GEAR SHIFT Mode.

2. Exit GEAR SHIFT MODE by pressing the mode button.

NOTE: In GEAR SHIFT MODE, all other functions are disabled (except E-Stop.)

3. Increase the engine RPM by using the THROTTLE toggle switch on the remote control.

4. Increase speed slightly by moving the REEL CONTROL – REEL PAY OUT lever.

5. During on demand payout, the line must be pulled or attached to a "bird" being blown.

6. When PAY OUT is complete, return the REEL CONTROL lever to center/neutral.

CAUTION: If the rope is removed from the storage drum mechanically by a winch, the bullwheel payout speed must be greater than the pull aid. The gear selector may be placed in "N" neutral to eliminate any payout speed synchronization requirements.

Always leave the last full layer of rope on the rope storage drum. Never payout all of the rope from the drum.

Allowing the pulling cable to stand idle while the bullwheels are rotating will cause cable damage. Put the gearbox in neutral at the completion of the payout or pulling function.

NOTE: GEAR SHIFT [MODE] - To shift gears, use the GEAR SHIFT MODE, located on the HOME/AIR/BACKUP screen of the on-board System Control Display. See the decal with "INSTRUCTIONS FOR SHIFTING GEARS". An audible alarm on both the Remote Control and main unit sounds when the unit is placed in GEAR SHIFT MODE.

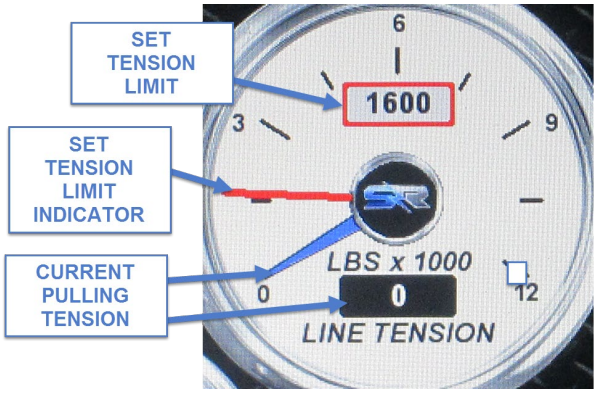
4.12 **Pull In**

1. With the engine running, switch to GEAR SHIFT MODE. Move the "gear selector" to "1st, or 2nd gear. **NOTE**: **Do not use 3rd gear for pulling.**

Do not attempt to change gears with the rope under pull tension. Use the GEAR SHIFT Mode.

NOTE: In GEAR SHIFT MODE, all other functions are disabled (except E-Stop.)

2. Set the desired pulling tension for the pull on the Main Screen of the control panel.



3. When pulling, the RPM of the engine must be controlled manually using the THROTTLE toggle on the remote control.

4. Use the REEL CONTROL - PAY OUT/PULL IN lever on the remote (or the System Control Panel) to pull in the line at the desired speed.

5. To Stop, move the REEL CONTROL - PAY OUT/PULL IN lever back to neutral.

NOTE: If it is necessary to change gears during the pull, move the PAY OUT / PULL IN lever to NEUTRAL Apply pressure to the gear selector lever. Do not force the lever. If the lever does not move freely, slight jog or rotate the reel as you apply pressure to the lever.

CAUTION: Allowing the pulling cable to stand idle while the bullwheels are rotating will cause cable damage. Put the gearbox in neutral at the completion of the payout or pulling function.

4.13 Diesel Particulate Filter (DPF) Re-Generation

DDHX may employ a T4 Diesel Engine that utilizes a Diesel Particulate Filter (DPF) to remove soot and undesired combustion gas from the exhaust system. This filter must be periodically cleaned. During normal operation, the regeneration (ReGen) of the DPF occurs automatically. However, under certain conditions (particularly when the engine is lightly loaded for long periods of time) or the unit was shut down before ReGen was completed, the operator may have to instruct the control system to perform a manual cleaning of the DPF system.

A DPF Icon is the initial warning that soot levels are rising in the diesel particulate filter (DPF) ReGen should occur automatically without interference to operations.

If, however, the engine is shut down before ReGeneration is completed, the next time the engine is started, ReGeneration will be required, and can be initiated by pressing the key associated with the ReGen icon. For ANY regeneration to take place, the coolant temperature must be at or above 160°F (71°C). If not, the ReGen will not take place.

There are three (3) types of regeneration modes:

1) PASSIVE – This means the engine is working hard enough to create sufficient exhaust temperatures so that regeneration is taking place without any external assistance. This goes on without any operator intervention; in fact, the operator may not even be aware of it unless he notices the high exhaust temperature light illuminated.
2) ACTIVE – In this situation, the conditions are close to being correct for a ReGen but the exhaust temp is not quite high enough so the ECU injects some fuel into the exhaust stream to raise the temperature and allow ReGen. Again, this goes on without the need for any outside intervention from external controls and would only be noticed by someone monitoring the exhaust gas temp light.
3) PARKED – This is the one that requires “special conditions” be met for the ReGen to occur. The engine must be at DPF level 2, 3 or 4 and the park and neutral signals must be sent so the ECU knows the engine is not under any load. (The engine may need to be at LOW idle, which varies from engine to engine). Once those conditions are met, the operator must press the active ReGen button and the control system starts the ReGen.

If an automatic ReGen has not occurred or completed, the operator should immediately perform a Parked, Manual REGEN. DPF level must be at Level 2, 3 or 4 to perform a Parked Regeneration.

CAUTION: Do not operate the unit during a Parked ReGen, this will abort the process.

4.13.1 DPF and Engine Icons

CAUTION: HIGH EXHAUST TEMPERATURES:
Active ReGen - Hot Exhaust warning.
Be sure that exhaust will not come into contact with any combustible materials.

DPF Auto ReGen Active

DPF Regen Inhibited

Engine Warning Icon

Engine Stop Icon

Engine Malfunction Indicator

DPF LEVEL	Inhibit Switch	Active ReGen (High Exhaust Temp) Lamp	ReGen Needed/Request Lamp	MIL Lamp
				
LEVEL 1: Active ReGen				
ReGen Not Needed	ON	OFF	OFF	OFF N/A
ReGen Not Needed	OFF	OFF	OFF	OFF N/A
LEVEL 1: Active ReGen				
Active ReGen Needed	ON	OFF	SOLID LIGHTING	OFF N/A
Active ReGen Occurring	OFF	SOLID LIGHTING	SOLID LIGHTING	OFF N/A
LEVEL 2: Active or Parked ReGen				
Active ReGen Needed Parked ReGen Needed	ON	OFF	BLINKING LIGHT	OFF N/A
Active ReGen Occurring Parked ReGen Occurring	OFF	SOLID LIGHTING	SOLID LIGHTING	OFF N/A
LEVEL 3: De-rating Power & Speed				
Parked ReGen Needed	ON	OFF	BLINKING LIGHT	ON
Parked ReGen Occurring	OFF	SOLID LIGHTING	SOLID LIGHTING	ON
LEVEL 4: De-rating Power & Speed				
Parked ReGen Needed	ON	OFF	BLINKING LIGHT	ON
Parked ReGen Occurring	OFF	SOLID LIGHTING	SOLID LIGHTING	ON
LEVEL 5: ENGINE STOP				
DPF Service Required (Active & Parked ReGen Disabled)	ON	OFF	BLINKING LIGHT	ON
DPF Service Required (Active & Parked ReGen Disabled)	OFF	OFF	BLINKING LIGHT	ON

4.14 System Control Error Icons

ESTOP REMOTE	Emergency Stop switch on the Remote Control is activated. When activated, all control power output is off - the engine and hydraulic system are shut down.	Remote CommErr	Indicates that the main system control computer and the remote control are not communicating. Check that remote transmitter is connecting to system receiver; check components for damage, loose, or frayed wires/connections. See remote control instruction manual for additional instructions. The engine may shut down.
ESTOP CONSOLE	One of the Emergency Stop switch on the Trailer is activated. When activated, all control power output is off - the engine and hydraulic system are shut down.	LOW HYD OIL	Indicates that the hydraulic oil is low. Check hydraulic oil/fluid level and inspect hydraulic system components. Continued operation with low oil can result in damage to the hydraulic pump and valves and consequent loss of machine's operational functions.
ESTOP CONSOLE	Emergency Stop switch on the Console is activated. When activated, all control power output is off - the engine and hydraulic system are shut down.	HIGH HYD Temp	Indicates that the hydraulic oil's temperature is elevated. Check hydraulic fluid temperature and inspect hydraulic system components. Continued operation with overheated oil can result in damage to the hydraulic system and consequent loss of machine's operational functions.
Controller CommErr	Indicates that the System Control Panel and the main computer are not communicating. The display will not update. There may be loss of machine functions and engine may shut off. Ongoing operations (Pull/Payout) will continue only until stopped. Check system components for damage, loose, or frayed wires/connections.	SYSTEM MSG	Indicates that there is a System Message. See the System Msgs screen. 
Engine CommErr	Indicates that the main computer and the engine control unit (ECU) are not communicating. Check system components for damage, loose, or frayed wires/connections. See service and repair section for additional instructions. The engine may shut down.	Remote PwrDown	See System Messages screen for details. Remote power off, or possible battery, initialization failure, or excessive tilt. Restart.

NOTE: If the display screen simultaneously displays all the fault codes, there may be a display connectivity issue. Check the connections of the system control display unit.

4.15 Underground Connectors

The underground pulling connectors (E-35D: 3000lb and the E-49D: 8000lb) are designed to restrict the rotation and unwinding of the pulling cable. The more load the pulling cable sees, the more resistance the connector sees, thus restricting the rotation of the wire rope. Wire rope cable is made in a spiral or helix, and as tension is applied, the pulling cable tries to unwind. After tension is released, the pulling cable has a memory and tries to return to its original straight design; however, if it goes past its original design, this causes twisting and kinking.

CAUTION: Do not attempt to use overhead line stringing swivels to install underground cable. Not using the correct underground connector will cause damage to the pulling line, and may cause personal injury if the line fails.

Underground Connectors:
E-35D: 3000 lb and E-49D: 8800 lb

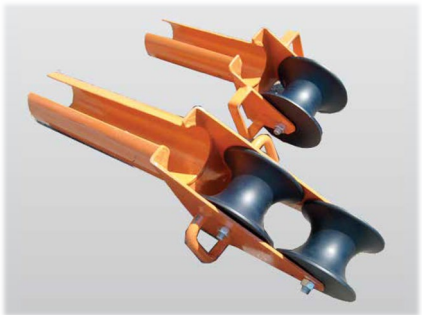
Birdcaging and twisted pulling cable can be caused by several factors:

- ☐ Wire rope pulling cable specifications not in compliance with puller manufacturer recommendations regarding RBS (rated breaking strength), MWL (maximum working load), and pitch (length of strands at the twist).
- ☐ Using overhead swivels and/or using worn underground pulling connectors.
- ☐ Pulling cable over too small of a radius sheave (minimum of 15 times the cable diameter) or edge of vault lip.
- ☐ Rapid unloading of pulling tension on the pulling cable.
- ☐ Overstressing the pulling cable's recommended working load.
- ☐ Using pulling grips with built-in swivels (use flex-eye type grips).

Recommended items to improve pulling cable life and Puller operation:
OEM specifications used when replacing pulling cable. Sherman & Reilly has developed a testing procedure and specification assurance with a wire rope manufacturer. This pulling cable is available from stock at Sherman & Reilly at a competitive price.

Our **standard** wire rope pulling cable for the DDHX-75 is 3⁄8-inch steel pulling cable and has an ultimate rating of 15,100 lb. The specification is 3⁄8" – 6 x 25 XIP (extra improved plowsteel) I.W.R.C. (independent wire rope center) RRL (regular right lay). The DDHX-100 is equipped with 7/16-inch steel pulling cable.
Domestic U.S. manufactured cable only.

When the recommended working load of the pulling cable is exceeded, twisting and birdcaging occurs.
We recommend using the specified pulling cable to ensure the pulling cable working load is not exceeded when pulling in underground conductors.



Underground Blocks: UG-71 and UG-72

4.16 Post-Operation Inspection Checklist

- ☐ When parking the machine, the wheels should be chocked
- ☐ Check engine oil, radiator coolant, and hydraulic fluid levels- to ensure no leakage after operations.
- ☐ Store all grips, blocks, and other tools/equipment used during operations back into the tool box. Then close and lock tool box.
- ☐ Secure all rope/conductor ends to the reel using a tie- off rope around the reel or an industrial zip tie.
- ☐ Remove the keys from the control panel, and shut and lock the control panel box.
- ☐ Lock all engine panels.
- ☐ Remove any trash, rags, or other loose material from the machine.

Storage:

For periods of extended storage without use, the batteries will need to be periodically charged. A low amperage "trickle" charger can be used periodically to maintain proper battery charge during periods of extended storage.

During extended storage, the trailer tire pressures should be periodically monitored, as heavy trailer weight on low tires can create permanent buckling of the tire sidewall resulting in the need for tire replacement. Always see the specified air psi. ratings listed on the tire sidewall.

The Boom should be horizontal if the unit is to be stored outside for extended periods in order to help prevent water intrusion into the hydraulic cylinders.

NOTE: It is necessary to open the engine covers to check the fluid levels. Be sure all covers are closed and latched in position properly before transport or operating the machine. If machine is to be parked in a publicly accessible area, the engine compartments must be secured.

NOTE: Post-operation checklist should be conducted in accordance with OSHA requirements, to include OSHA Standard- 29 CFR, Part 1926.600.

NOTE: In order to help prevent rust on the unit, it is important to regularly apply a corrosion inhibitor / lubricant like TC-11 Corrosion Inhibitor or equivalent to exposed metal as well as fairlead rollers and pins. If the unit is stored outdoors, the product should be reapplied every 6 months. The product should also be reapplied if a visual inspection indicates that surface areas are no longer glossy. The friction between the cable and the surface of the reel and rollers can accelerate the degradation of any corrosion inhibiting coating, therefore, the reel and rollers should be examined after each use to determine if reapplication would be beneficial.

5 Troubleshooting

Quick Tips

ENGINE WILL NOT START OR RUN

- ☐ Dead battery- could be caused by pulled breakaway switch.
- ☐ No fuel- check fuel gauge.
- ☐ Other- Refer to engine manufacturer's manual.

DRUM WILL NOT ROTATE

- ☐ Low system pressure drum clutch not releasing.
- ☐ Drum clutch out of adjustment.
- ☐ Obstruction between drum and frame.
- ☐ Existing line tension in excess of line tension limit setting.

HYDRAULIC JACK CREEPS DOWN

- ☐ If motor is running, control valve seals are bad.
- ☐ Motor off, or holding valve on jack is malfunctioning.

UNIT WILL NOT BUILD MAXIMUM HYDRAULIC SYSTEM PRESSURE

- ☐ Control valve blocked or malfunctioning.
- ☐ Pump relief valve malfunctioning.
- ☐ Pump failure.
- ☐ System pressure relief valve at the pump out of adjustment or malfunctioning.
- ☐ Contamination in hydraulic system.
- ☐ Wiring damage to pump actuators.

HYDRAULIC FLUID TEMPERATURE IS ABOVE NORMAL

- ☐ Drum clutch not fully releasing.
- ☐ Contamination in hydraulic system.
- ☐ Wiring damage to the hydraulic cooling system- fan, wiring, coil, or sensor.

TRAILER LIGHTS DO NOT WORK AFTER CONNECTED TO VEHICLE

- ☐ Check vehicle/trailer wire connectors for damage or corrosion.

5.1 PULLING FORCE Testing / Adjustment

The reel is driven by a friction disk. The reel drive friction keeps the wire rope under continuous tension, thereby ensuring an even spooling from the beginning to the end of reel. The tension is proportional to the line pull of the capstan winch. This reel drive friction must therefore be adjusted and check regularly. The pulling force must be set correctly for the machine to operate properly when pulling and paying out.

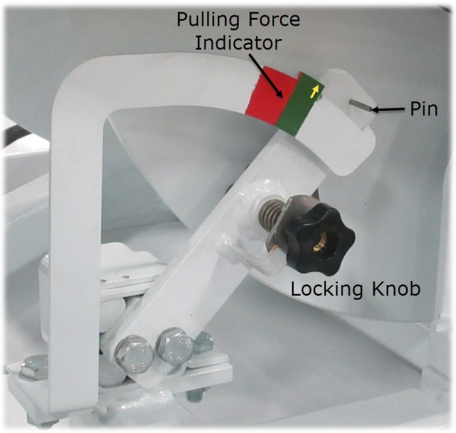
Operating the machine with the "Pulling Force" set too high can cause damage to the machine and will void the warranty.

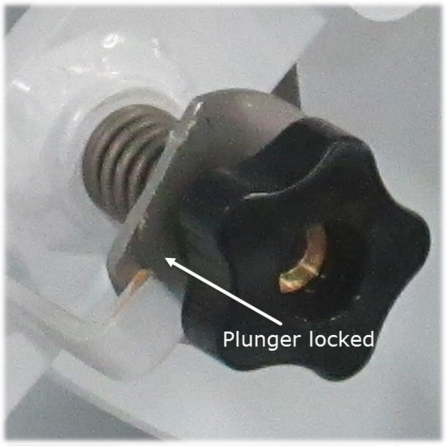
TESTING THE PULLING FORCE FRICTION

The pulling force indicator is located under the pulling drum on the street side (left side) of the machine, opposite the operator control panel.

Check and set the reel drive friction when the system is at working temperature.

- ☐ Push the locking knob in and rotate to latch in the lock or test position.
- ☐ Start the engine and set the engine speed at a high idle.
- ☐ Place the gear selector in first gear and slowly move the speed control to turn the drum. The rubber pad attached to the side of the drum will engage the pulling force indicator.
- ☐ When the machine is correctly set, the pin on the pulling force indicator will be on the low side of the green bar.
- ☐ If the pulling force is correct, slightly rotate the drum in the opposite direction to remove the pressure and stop. Rotate the locking knob and allow it to return to the operating position.



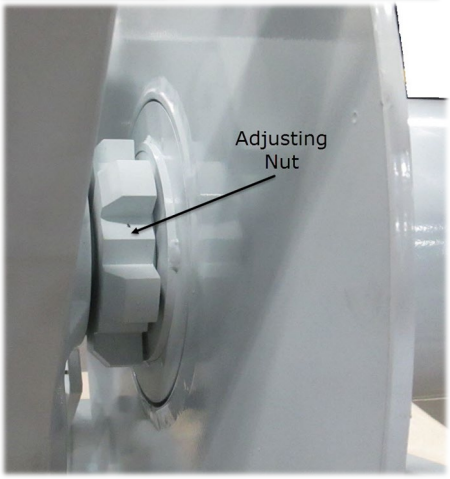


ADJUSTING THE PULLING FORCE FRICTION

The friction or pulling force is adjusted with the adjusting nut located on the left side of the drum, opposite the operator control.

CAUTION: The machine must be shut down prior to

- ☐ Use a spanner wrench to rotate the adjusting nut clock- wise to increase pulling force, or counter-clockwise to decrease pulling force.
- ☐ Adjust as necessary.
- ☐ After adjustment, restart and use the pulling force indicator and instructions above to recheck the pulling force each time adjustments are made.



5.2 Preventive Maintenance Schedule (Page 1)

NOTE: All preventive maintenance steps detailed in this sections are in addition to the required pre/post-operation inspection steps.

NOTE: All Preventive Maintenance should be conducted in accordance with OSHA requirements, to include OSHA Standard- 29 CFR, Part 1910.147.

WARNING: System must be tagged/locked out prior to removing any machine guarding, removing any system component, or performing any maintenance outside of basic visual inspections.

Reference Manufacturer's Manual
Please refer to the engine manufacturer's manual for complete maintenance schedule and instructions. **(Failure to do so may result in engine damage, inoperability, and potential voiding of warranty)** For all axle and brake assembly models please refer to manufacturer's manual for complete maintenance schedule and instructions.

Break-In Period	
First 25 hours	Replace Hydraulic Oil Filters- change filter(s).
First 30 hours	Winch gearbox oil should be changed after 30 hours of operation. Use SAE 90 weight oil.
First 50 hours	Replace the Engine Oil and Oil Filter- *See Hydraulic Power Engine section*.
	Check Battery for Proper Charge, Corrosion of Battery Terminals.
	Check for Leaks in the Fuel System.
First 25 miles	Check Trailer Wheel Lug Nut Torque- *See Trailer Wheels section*
First 50 miles	Check Trailer Wheel Lug Nut Torque- *See Trailer Wheels section*
First 100 miles	Check Trailer Wheel Lug Nut Torque- *See Trailer Wheels section*
First 200 miles	Adjust Brakes- *See Brake section.*

Preventive Maintenance Schedule (Page 2)

NOTE: All preventive maintenance steps detailed in this sections are in addition to the required pre/post-operation inspection steps.

NOTE: All Preventive Maintenance should be conducted in accordance with OSHA requirements, to include OSHA Standard- 29 CFR, Part 1910.147.

WARNING: System must be tagged/locked out prior to removing any machine guarding, removing any system component, or performing any maintenance outside of basic visual inspections.

Weekly/Routinely	
Inspect Drum and Drive Motor and Coupler Assemblies	Inspect drum, drive motor and coupler for obvious signs of damage, and loose or missing bolts/screws/parts. If damage or loose, do not operate machine, as service may be required.
Inspect Bullwheels and cable.	Make sure bullwheels and cable remain clean and free from grease and oil at all times. Clean as necessary. *(see Bullwheels section)*.
Drive chain	Check chain and chain tensioner for tightness.
Reel Drive Friction	The friction disk on the reel drive should be checked and adjusted as necessary to maintain the correct pulling force. (See Pulling Force Testing).
Inspect Trailer Axle Assembly	Inspect for alignment, broken or damaged spring leaves.
Inspect Axle Drum Oil Level	Fill to just below drum plug- (*see Axle Drum Oil section).*
Check Battery	For proper charge.
Check Tire Inflation	Check tire air pressure- *(see Tires section)*.
Open Evacuator Valve on Engine Air Filter Housing	Open the evacuator valve on the engine air filter housing to purge any large particles of dust or debris.

Every 50 Hours of Use or 3 months/3,000 miles (whichever comes first)	
Inspect Tire Condition	Inspect tires for wear and damage every 3 months/3,000 miles- *(see Tires section).*
Check Torque on Wheel Nuts and Bolts	Tighten to specified torque values every 3 months/3,000 miles- *(see Trailer Wheels section).*
Adjust Trailer Brakes	Every 3 months/3,000 miles- *(see Brake section).*
Inspect Fuel Lines and Clamps	Inspect all fuel lines from for damage/leaks. Also, inspect fuel line hose clamps and ensure they are tight.
Drain the Fuel Water Separator	*(If Applicable)* Drain the fuel water separator to purge any accumulated water from the diesel fuel lines.
Check chain and chain tensioner	The chain should be lubricated and the chain tensioner checked and adusted if needed.

Preventive Maintenance Schedule (Page 3)

NOTE: All preventive maintenance steps detailed in this sections are in addition to the required pre/post-operation inspection steps.

NOTE: All Preventive Maintenance should be conducted in accordance with OSHA requirements, to include OSHA Standard- 29 CFR, Part 1910.147.

WARNING: System must be tagged/locked out prior to removing any machine guarding, removing any system component, or performing any maintenance outside of basic visual inspections.

Every 100 Hours of Use or 6 months/6,000miles (whichever comes first)	
Replace Hydraulic Fluid Filters	Replace hydraulic fluid filter(s) every 100 hours, or sooner if indicated by the system- *(see Replacing Hydraulic Filter and Fluid section).* **NOTE:** Filters can be changed sooner dependent upon conditions and if indicated by the system. The system is designed to monitor fluid and filter life/flow.
Inspect Trailer Braking Components	Brake Magnets and Brake Controller- *(see Brake section).*
Inspect Trailer Suspension	Inspect for bending, loose fasteners, and wear.
Inspect Wheels	Inspect wheels for damage, (i.e. cracks, dents, or distortions).
Grease Spider System Fairlead Locking Pin	Use Lithium Grade 2 All-Purpose Grease- *(see Spider System Assembly section).*
Grease Pillow Block Bearing	Use Lithium Grade 2 All-Purpose Grease- *(see Drum/Reel Drive Assembly section).*
Clean Engine Air Filter Element	Clean filter element every 100 hours, and only use less than 30 psi compressed air.
Drain the Fuel Water Separator	*(If Applicable)* Drain the fuel water separator to purge any accumulated water from the diesel fuel lines.
Clean Engine Fuel Filter	*(See Engine Manual.)*
Check Engine Fan Belt	Check engine fan belt for proper tightness- (s*ee Engine Manual).*
Apply corrosion inhibitor to exposed metal	In order to help prevent rust on the unit, it is important to regularly apply a corrosion inhibitor / lubricant like TC-11 Corrosion Inhibitor or equivalent to exposed metal as well as fairlead rollers and pins. If the unit is stored outdoors, the product should be reapplied every 6 months.

Preventive Maintenance Schedule (Page 4)

NOTE: All preventive maintenance steps detailed in this sections are in addition to the required pre/post-operation inspection steps.

NOTE: All Preventive Maintenance should be conducted in accordance with OSHA requirements, to include OSHA Standard- 29 CFR, Part 1910.147.

WARNING: System must be tagged/locked out prior to removing any machine guarding, removing any system component, or performing any maintenance outside of basic visual inspections.

Every 200 Hours of Use or *12 months/12,000 trailer miles (whichever comes first- *unless otherwise specified)	
Inspect Trailer Brake Lines	Inspect air/hydraulic lines for damage or leaks- if equipped.
Inspect Trailer Brake Linings	Replace when at or below **1/16 inch** thickness- (*see Brake section).*
Inspect Trailer Brake Wiring	Inspect for damage or corrosion- (*see Trailer Wiring section).*
Inspect Wheel Hubs/Drums	Inspect for abnormal wear and scoring.
Inspect Wheel Bearings and Cups	Inspect for wear or corrosion. Clean and repack or lubricate bearings- *(see Trailer Wheels section).*
Inspect Axle/Trailer seals	Inspect for leaks. Replace as needed- *(see Manufacturer's Manual).*
Replace Engine Oil	Replace engine oil every 200 hours in accordance with manufacturer specifications- *(see Engine Manual)*.
Replace Engine Air Filter Element	*(Replace annually up to 600 hours/six cleanings.) Replace sooner if damaged or heavily discolored- *(see Engine Manual).*
Check Engine Coolant Hoses and Clamps	Inspect radiator hoses and clamps for signs of damage, wear, and leaks. Also ensure they are secured- *(see Engine Manual).*
Check of Engine Air Intake	Inspect air intake lines for the engine, and ensure no damage or obstructions.
Inspect Electrical Wiring	Inspect electrical wiring and connections for damage or loose connections.
Replace Engine Oil	*(Replace annually up to 500 hours.) Replace oil in accordance with manufacturer specifications- *(see Engine Manual)*.
Replace Engine Air Filter Element	*(Replace annually up to 1,500 hours/six cleanings.) Replace sooner if damaged or heavily discolored- *(see Engine Manual).*
Replace Winch Gearbox Oil	Change the gearbox oil every 200 hours of operation or once per year, whichever comes first. Use SAE 90 weight oil.
Check the chain and chain tensioner	Every 200 hours of service or once per year the chain and the chain tensioner should be checked for excessive wear and replaced if necessary.

Preventive Maintenance Schedule (Page 5)

NOTE: All preventive maintenance steps detailed in these sections are in addition to the required pre/post-operation inspection steps.

NOTE: All Preventive Maintenance should be conducted in accordance with OSHA requirements, to include OSHA Standard- 29 CFR, Part 1910.147.

WARNING: System must be tagged/locked out prior to removing any machine guarding, removing any system component, or performing any maintenance outside of basic visual inspections.

Every 250 Hours of Use	
Check Battery	For Proper Charge and Corrosion of Battery Terminals.
Grease Safe-Zone™ Cab, Tool Box, and Engine Compartment Hinges and Latches	Use any all-purpose grease, to prevent rust, corrosion, and sticking of hinges, and allow for easy smooth opening of compartment.
Clean Hydraulic Fluid Cooler	Clean the outside of the hydraulic oil cooler radiator fins. Use only low pressure water- (no higher than 30 psi). **NOTE:** Water pressure over 30 psi may penetrate electric cooling fan seals.
Clean and Inspect Outside of Fuel Tank	Clean dirt or contaminates from around filler hole and inspect tank for leaks.

Every 400 Hours of Use	
Replace Engine Fuel Filter Cartridge	*(See Engine Manual.)*
Clean Engine Fuel Water Separator	*(If Applicable) See Engine Manual.*
Replace Engine Oil Filter	Replace oil filter cartridge every 400 hours (4.88in. deep oil pan).

Preventive Maintenance Schedule (Page 6)

NOTE: All preventive maintenance steps detailed in this sections are in addition to the required pre/post-operation inspection steps.

NOTE: All Preventive Maintenance should be conducted in accordance with OSHA requirements, to include OSHA Standard- 29 CFR, Part 1910.147.

WARNING: System must be tagged/locked out prior to removing any machine guarding, removing any system component, or performing any maintenance outside of basic visual inspections.

Every 500 Hours of Use or *24 months (whichever comes first- *unless otherwise specified)	
Clean Fuel Tank	Remove sediment from fuel tank using the drain at the bottom of the tank. Flush using diesel fuel or other suitable fuel tank cleaning solution. Ensure all fuel and sediment discharges are collected in accordance with environmental and safety regulations. *(See Engine Manual for additional fuel maintenance).* **CAUTION:** Use extreme caution when handling or working around diesel fuel as it is highly flammable and can become unstable if exposed to heat or electrical charge. Serious injury, burns, and even death may result if proper precautions are not taken
Clean Engine Radiator Interior	Clean water jacket (radiator interior)- *(see Engine Manual).*
Replace Engine Coolants	Premix 50/50 before adding- *(see Hydraulic Engine section)*.
Replace Engine Fan Belt	*(See Engine Manual.)*
Replace Engine Radiator Hoses and Clamps	*Replace radiator hoses and clamp bands every two years- *(see Engine Manual).*
Replace Fuel Lines and Clamps	*Replace fuel lines and clamp bands ever two years- *(see Engine Manual).*
Replace Engine Air Intake Line	*Replace air intake lines for the engine every two years- *(see Engine Manual).*
Lubricate Key Tumblers and Switches	Use only graphite powder in key tumblers and switches to lubricate internal keyhole parts and prevent sticking of keys.
Replace Engine Fuel Filter Cartridge	*(See Engine Manual.)*
Replace Engine Oil Filter	Replace oil filter cartridge every 500 hours and in accordance with manufacturer specifications- *(see Engine Manual)*.
Replace Engine Oil	Replace oil (*annually up to 500 hours- whichever comes first) and in accordance with manufacturer specifications- *(see Engine Manual)*.
Clean Engine Fuel Water Separator	*(If Applicable) See Engine Manual.*

Service & Repair

NOTE: For service or repair please contact the Sherman + Reilly™ Parts & Service at **1-800-251-7780** or **(423)756-5300,** via email at help@sherman-reilly.com, or via our website: www.sherman-reilly.com

Equipment Information
Company Name: _____
Date of Purchase: _____
Date of Manufacture: _____
Equipment/Unit Model Number:_____
Equipment/Unit VIN Number: _____
Engine Serial Number: _____

Major Fault:

A "major fault" describes a system malfunction or other system degradation that, by equipment failure, operator error, or other environmental condition, renders that machine inoperable. A major fault can be identified when, through normal operations, the machine would create; an unsafe condition, further or permanent equipment damage, or other situations deemed outside of the operator's ability to effectively and safely operate the machine.

When to send for Service or Repair:

If after troubleshooting an issue or fault that cannot be resolved, or a major fault has been identified, the operator should stop all operation attempts and contact the Sherman + Reilly™ Parts & Service Department at **800-251-7780** or **(423)756-5300,** via email at **help@sherman-reilly.com,** or via our website: www.sherman-reilly.com**.** Further operation should not continue until the issue or fault is resolved.

5.3 Error Codes

#	DISPLAYED MESSAGE / INDICATOR	VARIABLE ACTIVATING MSG	CONDITION	ADDITIONAL NOTES	Failure Mode	Response Guidance
1	ERROR: low controller supply voltage "Check: VDC across wires S.10 / S.20"	ErrVBBSor15	VBBS (pin10) or VBB15 voltage (pin 32) < 9.5VDC	Cr0233 undervoltage < 8VDC; shutdown < 7.5 VDC Cr1083 undervoltage < 10VDC; shutdown < 8VDC	Loss of all power. Engine will shut down. Controller off.	Check connections. Check: VDC across wires S.10 / S.20
2	ERROR: output group #1 [Q00-07] low supply voltage. Outputs are disabled. "Check: > fuse F9; > wire S.19's terminal connection; > VDC across wire S.19 / GND terminal"	ERROR_VBBO	VBBO (pin 19) voltage out of range	No supply power to outputs Q00-Q07. Power must be cycled to reset / unlatch error.	Loss of controller voltage outputs to engine, MCR, RF charger relay, power outlet, and power auxiliary.	Initiate controlled stop. Shut down. Check Fuse 9. Power must be cycled to reset / unlatch error. Check wire S.19's terminal connection; check VDC across wire S.19 / GND terminal
3	ERROR: output group #2 [Q08-15] low supply voltage. Outputs are disabled. "Check: > fuse F3; > wire S.1's terminal connection; > VDC across wire S.1 / GND terminal"	ERROR_VBBR	VBBR (pin 01) voltage out of range	No supply power to outputs Q08-Q15. Power must be cycled to reset / unlatch error.	Loss of power to payout/pull in solenoid at hydraulic pump.	Shut down. Check Fuse 3. Power must be cycled to reset / unlatch error. Check wire S.1's terminal connection; check VDC across wire S.1 / GND terminal
4	WARNING: low supply voltage for outputs [Q00E-23E]. Outputs are disabled. "Check: > wire S.51's terminal connection (1170) > VDC across wire S.51 / GND terminal"	ERROR_VBBREL_E	VBBREL (pin 51E) voltage out of range	No supply power to outputs Q00E-Q23E. Power must be cycled to reset / unlatch error.	Loss of controller voltage (extended side) outputs. All boom and jack functions are disabled.	Operator will need to decide whether to continue or not. There is a loss of all boom and jack functions. Power must be cycled to reset / unlatch error.

5	WARNING: output group #3 [Q00E-07E] low supply voltage. Outputs are disabled. "Check: > fuse F4; > wire E.19's terminal connection; > VDC across wire E.19 / GND terminal"	myERROR_VBB1_E	VBB1_E (pin 19E) voltage < 9.5VDC	No supply power to outputs Q00E-Q07E & Q16E-Q23E. Power must be cycled to reset / unlatch error.	Loss of controller voltage (extended side) outputs. All jack functions are disabled.	Operator will need to decide whether to continue or not. There is a loss of all jack functions. Power must be cycled to reset / unlatch error.
6	WARNING: output group #4 [Q08E-15E] low supply voltage. Outputs are disabled. "Check: > fuse 5 > wire S.1's terminal connection > VDC across wire S.1 / GND terminal"	myERROR_VBB2_E	VBB2_E (pin 01E) voltage < 9.5VDC	No supply power to outputs Q08E-Q15E. Power must be cycled to reset / unlatch error.	Loss of controller voltage (extended side) outputs. All boom functions are disabled.	Operator will need to decide whether to continue or not. There is a loss of all boom functions. Power must be cycled to reset / unlatch error.
7	WARNING: output group #5 [Q16E-23E] low supply voltage. Outputs are disabled. "Check: > fuse 6 > wire E.32's terminal connection; > VDC across wire E.32 / GND terminal"	myERROR_VBB3_E	VBB3_E (pin 32E) voltage < 9.5VDC	No supply power to outputs Q00E-Q07E & Q16E-Q23E. Power must be cycled to reset / unlatch error. Currently disabled since not using any outputs in this group	No effect	
8	WARNING: input [I00 Pin 55]. Input is disabled."Check:> fuse 2, MCR 1;> Load Cell;> 12-24 VDC converter / wiring"	No output	I00 (Pin 55) Load Cell	Load cell not reading / sending correct load data.	Sensor is out. Line speed and tension readout are affected.	Operator will need to decide to continue or not. There has been a loss to one or more sensors providing feedback on Line Speed, Tension, and Payout Feet. Lineman is operating visually only, without some instruments. May initiate controlled stop.

9	WARNING: input [I00 Pin 55] low supply voltage. Input is disabled. "Check: > fuse 2, MCR 1; > Load Cell > 12-24 VDC converter / wiring"	Low Voltage	I00 (Pin 55) Load Cell	Load cell not reading / sending correct load data.	Sensor is not working properly or out of normal operating range. Line speed and tension readout are affected, and may be inaccurate.	Operator will need to decide to continue or not. There has been a loss to one or more sensors providing feedback on Line Speed, Tension, and Payout Feet. Lineman is operating visually only, without some instruments. May initiate controlled stop.
10	WARNING: hyd pressure transducer input signal (I01) lost. "Check: > fuse F2 > connection at transducer > supply voltage across pins 1(+) & 3 (GND) of connector C3A > continuity between ??? pin2 & controller pin 36S"	Hyd_Press.OPEN	Hydraulic Pressure Transducer (I01) signal too low / open	No effect on machine functionality.	Inaccurate display of line tension.	Operator will need to decide to continue or not. There has been a loss to one or more sensors providing feedback on Line Speed, Tension, and Payout Feet. Lineman is operating visually only, without some instruments. May initiate controlled stop.
11	ERROR: 24VDC power lost "Check: > fuse F2 > LED on 24VDC power supply; GRN=ok, RED=FAULT > 24VDC power supply's output voltage > wire S.53's terminal connection (1100)"	Pwr24VDC_Err	24VDC supply power too low (I04)	Either input channel wiring problem or problem with power supply.	Eventual loss of electric power. Engine may shut off automatically.	Check alternator output, battery connections, and fuse F2. Check 24VDC power supply's output voltage; check wire S.53's terminal connection (1100).

12	WARNING: line footage / speed sensor input signal (I08_Pin24 and I09_Pin41) lost. "Check: > fuse F2 > connection at prox sensor (load cell) > supply voltage across pins 1(+) & 3 (GND) of connector C2A > continuity between prox sensor Pin 2 & controller I08_Pin24 or Controller I09_Pin41"	Prox sensor error.	Line footage (I08) / speed (I09) prox		Loss of line footage counter or inaccurate reading.	Operator will need to decide to continue or not. There has been a loss to one or more sensors providing feedback on Line Speed and Payout Feet. Lineman is operating visually only, without some instruments. May initiate controlled stop.
13	WARNING: fuel sensor input signal (I12) out of range "Check: > connection at sensor > continuity between GND at C2A pin 19 & wire S.20 > continuity between ??? pin? & controller pin 22S > ohms across S.12 / GND terminal [range 33-240]"	Fuel_Sender_Err	Fuel sender (I12) input signal out of range	Full = 33 ohm; Empty = 240 ohms	Loss of fuel gauge	Unknown fuel level. Loss of fuel will cause an immediate loss of power and operations. Operator decision to continue or not. Monitor fuel level closely visually or with a dip stick.
14	WARNING: hyd oil temp input signal (I13) out of range "Check: > connection at sensor > continuity between GND at C3A pin 2 & wire S.20 > continuity between ??? pinA & controller pin 39S > ohms across S.39 / GND terminal [range 42-28000]"	HydFluidTemp_Err	Hydraulic Oil Temp. sensor (I13) input signal out of range	< 42 ohms (~ -11F) or > 28k ohms (~ 302F)	Hydraulic oil temperature gauge is disabled.	Hydraulic Oil Temperature gauge is out of range. Could be a failure of the sensor. Check connections. System Control Panel cannot sense temperature of hydraulic oil. Cold oil and overheated oil can damage hydraulic systems, resulting in operational failures.

15	WARNING: alternator problem"Check:> wire E.45's connection> alternator's output voltage> continuity between CN6E pin8 & controller pin 45E"	Alternator_Sig	No 12VDC at I19E, pin 45E.	Indicates alternator failure or wiring problem.	Eventual loss of electric power.	Check connections. Check voltage on Engine Status Screen.
16	WARNING: water in engine's fuel "Check: > fuel seperator"	Wtr_in_Fuel	Water In Fuel signal (I20E)	Water in fuel signal from Kubota harness.	Could cause loss of power, engine shut down.	Check fuel separator/filter.
17	ERROR: engine safety relay signal lost (Q02_16) "Check: > wire Q02_16 connection > VDC across wire Q02_16 / GND terminal > continuity between C3A pin2 & controller pin 16 > relay in engine harness"	SafetyRelay_OK	No 12VDC at Q02_16.	Problem with Safety Relay in Kubota engine harness.	Could cause loss of power, engine may shut down.	Initiate controlled stop. Shut down. Check connections wire Q02_16 connection, VDC across wire Q02_16 / GND terminal, continuity between C3A pin2 & controller pin 16, relay in engine harness.
18	ERROR: Reel Pull In output signal fault (Q08) "Check: > pump solenoid connector > wire S.2's connection > continuity between ??? pin1 & controller pin 2S"	PullIn_Err	Pull In coil's actual current not with acceptable range of command value	Indicates output channel doesn't "see" coil. Could be loose connector, broken wire, miswired, bad coil.	Loss of payout/pull solenoid function at hydraulic pump.	Shut down. Check Fuse 3
19	ERROR: Reel Pay Out output signal fault (Q09) "Check: > pump solenoid connector > wire S.3's connection > continuity between ??? pin1 & controller pin 3S"	PayOut_Err	Pay Out coil's actual current not with acceptable range of command value	Indicates output channel doesn't "see" coil. Could be loose connector, broken wire, miswired, bad coil.	Loss of payout/pull solenoid function at hydraulic pump.	Shut down. Check Fuse 3

20	WARNING: RF remote powered off due to inactivity	RF_PwrDwn_Reason	RF transmitter inactivity time limit exceeded	Transmitter power down message from RF system	Loss of remote control.	Shut down and restart Remote Control. Alternatively, use Override Controls.
21	WARNING: RF remote powered off due to low battery "Replace battery"	RF_PwrDwn_Reason	RF transmitter low battery (0%)	Transmitter power down message from RF system. Replace battery.	Loss of remote control.	Shut down and restart Remote Control.
22	WARNING: RF remote powered off due to receiver communications error "Re-start. Contact S&R if problem persists"	RF_PwrDwn_Reason	RF system no RF messages. Default setting = 3 seconds	Transmitter power down message from RF system. Contact Magnetek if condition occurs on regular basis.	Loss of remote control.	Shut down and restart Remote Control. Alternatively, use Override Controls.
23	WARNING: RF remote powered off due to initialization failure "Re-start. Contact S&R if problem persists"	RF_PwrDwn_Reason	RF transmitter initialization failure	Transmitter power down message from RF system. Contact Magnetek.	Loss of remote control.	Shut down and restart Remote Control. Alternatively, use Override Controls.
24	WARNING: RF remote powered off due to being dropped"Re-start. Contact S&R if problem persists"	RF_PwrDwn_Reason	RF transmitter fall detect	Transmitter power down message from RF system.	Loss of remote control.	Shut down and restart Remote Control. Alternatively, use Override Controls.
25	WARNING: RF remote powered off due to excessive tilt, board error, or switch failure "Re-start. Contact S&R if problem persists"	RF_PwrDwn_Reason	RF system error: excessive tilt, invalid board revision, or switch failure	Transmitter power down message from RF system. Contact Magnetek if not due to excessive tilting.	Loss of remote control.	Shut down and restart Remote Control. Alternatively, use Override Controls.

26	ERROR: lost engine ECU communications "Check: > wire S.28's connection at C3A pin10 > VDC between C3A pin10s (+) & 11 (GND) > VDC between CN6E pins 19 (+) & 16 (GND) > continuity between CN6E pin19 & controller pin 18S > continuity between CN6E pin16 & GND terminal > 120 ohm resistor between terminals 2160 & 2170 > continuity between CN6E pin8 & controller pin 45S > continuity between CN6E pin9 & controller pin 46S"	ECU_Err_Hyd	No J1939 communications with ECU	No engine feedback or throttle control.	Engine may shut off automatically. Initiate controlled stop. Center. Investigate communications error.	Check ECU connections.

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