

**Zedi SilverJack™ 8000**  
**Installation Guide**  
**For Concrete Pad Models**  
Version 1.1

Zedi

Zedi.60

*Zedi SilverJack™ 8000 Installation Guide*

*Zedi Canada Inc. Zedi SilverJack 8000 User Guide*

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- US 20120148418

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Your relationship with Zedi doesn't end once your order is completed. We're committed to providing you with the support and training you need to get the most out of your Zedi experience. Our 24/7 support team will successfully guide you through any issue that may arise. We pride ourselves on our reliable service, and will ensure that you have access to what you need, when you need it.

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## **SECTION 1: SAFETY**

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### **In This Section**

- Manual Layout
- Warning
- Personal Protective Equipment
- General Safety Considerations
- Mechanical Safety Considerations
- Electrical Safety Considerations
- Lubricants Safety Considerations
- Hazardous Zone
- Recommended Control Measures

## Manual Layout

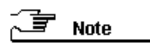
**Warning, caution** and **note** symbols appear throughout this manual to draw your attention to important operational and safety information.



A “**WARNING**” safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very close attention to all warnings that apply to your application.



A “**CAUTION**” safety alert appears with information that is important for protecting your equipment and performance.



A “**NOTE**” marks a short message to alert you to an important detail.

## Warning

**ANY PERSON WORKING WITH THIS PRODUCT SHOULD CAREFULLY REVIEW THIS SAFETY SECTION. FAILURE TO DO SO MAY RESULT IN SERIOUS OR LIFE THREATENING INJURY.**

ANY DEVIATION FROM THE GUIDANCE SPECIFIED HEREIN MAY CREATE A HAZARDOUS OR DANGEROUS ENVIRONMENT. ZEDI DOES NOT APPROVE SILVERJACK INSTALLATIONS THAT DO NOT FOLLOW THE PROCEDURES SET OUT HEREIN. FAILURE TO FOLLOW THESE PROCEDURES MAY RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT FOR WHICH ZEDI ACCEPTS NO LIABILITY. THE OWNER OR OPERATOR OF THE WELL SITE ACCEPTS AND ASSUMES ALL LIABILITY FOR INJURY, DAMAGES, LOSS AND COSTS THAT MAY ARISE FROM SILVERJACK INSTALLATION, OPERATION OR MAINTENANCE THAT DO NOT COMPLY WITH THE PROCEDURES SET OUT HEREIN.

LOCAL REGULATIONS MUST BE FOLLOWED IN THE INSTALLATION, OPERATION AND MAINTENANCE OF COMPONENTS. The procedures herein will not supersede or override any policies that are currently in place by either a governmental authority or such policies and procedures that are currently practiced by a company or agency in regard to oil and gas operations. These procedures will supplement all governmental or industrial regulations that cite safety and environmental recommendations or best practice policies including regulations from:

- Any Federal, State, local County, Provincial or Municipal code which may regulate or cite such oil and gas operations, health, safety, electricity, electrical standards, hydraulic controls, hydraulic standards and the environment.
- Any company or end-user standing operating procedure, policy manual, memorandums, bulletins or other correspondence that covers oil and gas operations, health, safety, electrical standards, hydraulic standards and the environment.

## Personal Protective Equipment

The following personal protective equipment should be worn on site during the installation, operation or maintenance of a SilverJack.

- Safety glasses with side shields
- CSA approved steel toed boots
- Hard hat
- Nomex fire retardant coveralls
- Hearing protection
- Work gloves (Impact)
- 4-head gas monitor (H<sub>2</sub>S, CO, O<sub>2</sub>, Methane)

## General Safety Considerations

Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment. When working with a SilverJack unit, consider the following precautionary measures:

- Surface temperatures of motors may reach temperatures that can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When working with a SilverJack system, protection should be used to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.
- Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.
- Avoid extended exposure to machinery with high noise levels. Hearing protection must be worn during the operation of a SJ unit.
- Do not smoke, carry lighted tobacco or use a lighted flame of any type when working on or near any fuel related component. Highly flammable air-fuel mixtures may be present and can be ignited causing personal injury.
- Do not allow LPG (propane) to contact the skin. LPG is stored in the fuel tank as a liquid. When LPG contacts the atmosphere it immediately expands into a gas, resulting in a refrigeration effect that can cause severe burns to the skin.
- Do not allow LPG to accumulate in areas below ground level such as in a service pit or underground ventilation systems. LPG is heavier than air and can displace oxygen, creating a dangerous condition.

## Mechanical Safety Considerations

When working with mechanical systems, consider the following precautionary measures:

- Before performing any motor or pump maintenance procedures, be sure that the equipment connected to the shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the shaft before maintenance is performed. Unexpected mechanical rotation of the motor or pump parts can cause injury or mechanical damage.
- After performing any motor or pump maintenance procedures, be sure the pump is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.
- Guards must be properly installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. These should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.
- When performing maintenance on the engine, turn the ignition off and disconnect the battery negative cable to avoid injury or damage to the engine.



- Do not remove the cooling system pressure cap (radiator cap) when the engine is hot. Allow the engine to cool and then remove the cap slowly to allow pressure to vent. Hot coolant under pressure may discharge violently.

### Electrical Safety Considerations

This equipment contains high voltage. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment. Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. When working with electrical systems, consider the following precautionary measures:

- Do not touch electrical connections before you first ensure that power has been disconnected.
- Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor.
- Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed.
- UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.
- Magnetic and electromagnetic fields in the vicinity of current carrying conductors and permanent magnet motors can result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay away from the area surrounding a permanent magnet motor.

### Lubricants Safety Considerations

When operating units filled with lubricants such as hydraulic oil, engine oil, coolant or grease, consider the following precautionary measures:

- Prolonged skin contact with the lubricants is to be avoided. Careful skin cleansing of sticky fluid and regular changing of lubricant soiled work clothes is required.
- Should lubricant get into your eyes, rinse them thoroughly with drinking water and see a doctor if necessary.
- Skin contact with fluid or with heated unit parts is to be avoided, especially at temperatures over 60 °C [140 °F].
- Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury and/or infection. This fluid may also be hot enough to cause burns. Use caution when dealing with hydraulic fluid under pressure. Relieve pressure in the system before removing hoses, fittings, gauges, or components. Never use your hand or any other body part to check for leaks in a pressurized line. Seek medical attention immediately if you are cut by hydraulic fluid.
- Lubricants must not seep into the ground or get into the sewer system.
- Old or unusable fluids are to be collected and disposed of according to local regulations.

### Hazardous Zone

The SilverJack system must meet applicable regulatory requirements such as those regarding hazardous locations. Certain installation practices must therefore be followed to ensure compliance. See document “MNL-SJ-01 SilverJack Installation – Distance Considerations for Hazardous and Non-Hazardous Locations” for safe installation practices in hazardous locations. Local regulations must be considered in the installation.

### Recommended Control Measures

The following are potential hazards commonly found on a SilverJack site along with recommended control measures to help reduce these hazards.

Potential Hazard	Recommended Control Measures
Communication break down	<ul style="list-style-type: none"> <li>• All workers must attend the Client’s site and area specific safety orientations.</li> <li>• Conduct a Pre-job Safety Meeting/Field Level Risk Assessment (FLRA) or Critical Task Analysis (as required) to ensure everyone is familiar with the job scope, procedures and hazards.</li> <li>• Ensure daily FLRA/tool box talks are held.</li> <li>• All FLRA/meetings are to be documented, dated and signed off by all personnel.</li> <li>• Conduct post-job debriefing.</li> </ul>
Positioning of mobile equipment	<ul style="list-style-type: none"> <li>• Ensure a spotter is utilized when moving any mobile equipment. Pay particular attention to positioning equipment where clearances (i.e. tight areas and overhead hazards) are a concern.</li> <li>• Wear high visible clothing &amp; use proper hand signals.</li> <li>• Use proper 3-point contact when entering and exiting vehicles.</li> </ul>
Overhead hazards (Power lines, electrical trays, pipe galleys/flow lines)	<ul style="list-style-type: none"> <li>• Ensure a spotter is utilized when moving any mobile equipment.</li> <li>• Keep in mind the safe limit of approach distances from overhead power lines for persons and equipment is to remain a minimum of 10 meters away from lines.</li> <li>• An employer must contact the power line operator before work is done or equipment is operated within 7.0 meters of an energized overhead power line in order to determine the voltage of the power line and to establish the appropriate safe limit of approach distance.</li> </ul>
Electrical sources	<ul style="list-style-type: none"> <li>• Ensure the proper use of GFIs (Ground Fault Interrupters), as required.</li> <li>• Explosion proof/intrinsically safe equipment must be used.</li> </ul>
Lock out / tag out	<ul style="list-style-type: none"> <li>• Ensure proper lock out / tag out procedures are followed.</li> <li>• Ensure required documentation is completed and available for audit purposes.</li> <li>• Ensure all sources (electrical/pressure etc.) are properly locked out in conjunction with client.</li> </ul>
Gas and lower explosive limit (LEL) levels	<ul style="list-style-type: none"> <li>• Gas monitoring must be done prior to start up.</li> <li>• A self-contained breathing apparatus (SCBA) is on standby and located in strategic locations as required.</li> </ul>

## SECTION 2: INSTALLATION

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### **In This Section**

- Responsibilities
- Personal Protective and Safety Equipment
- Hydraulic Oil Management
- Site Preparation Prior to Zedi Arrival
- Gravel Pad Preparation Prior to Zedi Arrival
- Concrete Pad and Support Structure Installation
- Lift System Installation
- N2 Storage System Installation
- Powerpack Installation
- N2 Pressure Balancing
- Configuration
- Removal of Lift System for Workovers and Maintenance



Only qualified personnel should attempt the following installation procedures. Closely follow procedure and be aware of the potential hazards. Failure to follow procedure may result in serious injury to personnel and/or damage to equipment. Read Section 1: Safety before proceeding.



When installing AC powerpacks, do not make any changes to the AC panel (enclosure that houses AC main 460V power, AC-to-DC converters, fuses and the motor contactor) without approval from Zedi. Electrical shock can cause serious or fatal injury.



For longer hydraulic hose life, replace the ground hoses with shielded hoses or hard pipe. Consult local regulations as hard pipe between the Powerpack, N2 Storage System and Lift System may be required.

## Responsibilities

### ZEDI INC.

- Organize shipping of the SJ8000 (Lift System, Support Structure, Concrete Pad, N2 Storage System and Powerpack)
- Supply Zedi Field Technicians for installation of all SJ8000 equipment onsite
- Install the SJ8000
- Torque all fasteners to manufacturer's specifications
- Hook up all hoses and cables
- If Customer ordered an AC Electric Powerpack, bump test electric motor with electrician onsite
- Charge and balance N2 Storage System with hydraulic oil and N2
- Function test all systems (Presco and other shutdowns)
- Commission site onto Zedi Access
- Go over operating procedures with Customer

### THE CLIENT

The Client must supply/conduct the following:

- Site specific safety orientation/induction
- Crane with operator
- One or two additional operators to assist in installation
- Prepare the site and gravel pad according to the specifications in the following procedures
- High line pressure switch(es) (if required)
- Certified electrician on site for high line pressure shut down switch installation and calibration
- Certified electrician for AC power wiring, if at an AC Powerpack
- Rod clamps

## Personal Protective and Safety Equipment

### PERSONAL PROTECTIVE EQUIPMENT

The following personal protective equipment must be worn during installation.

- Safety glasses with side shields
- Steel toed boots
- Hard hat
- Fire retardant coveralls
- Hearing protection
- Work gloves
- 4-head gas monitor (H<sub>2</sub>S, CO, O<sub>2</sub>, Methane)

### SAFETY EQUIPMENT

The following safety equipment shall be available for this project.

- Fire extinguishers; located in all Zedi service vehicles
- Emergency first aid kit; located in all Zedi service vehicles
- Emergency eye wash and shower; to be supplied by the Client as required
- Gas detection equipment; to be supplied by Zedi as required
- SCBA (self-contained breathing apparatus); to be supplied by the Client as required

## Hydraulic Oil Management

It is very important to take extra care when managing hydraulic oil and hydraulic equipment that comes in direct contact with the hydraulic oil. Even a small amount of contaminants in the hydraulic oil could damage the Zedi SilverJack equipment, so the following measures should be taken to prevent contamination.

- Handle hoses carefully during installation, maintenance, repairs and swaps. All hoses ends and fitting ends must be covered and managed carefully. If any amount of dirt or debris gets on a hose end or fitting end, clean it with brake clean and clean rags. It is important to stop and take the time to clean all debris off any hydraulic oil fittings or hose ends.
- Before removing the access port lid off the hydraulic tank to add hydraulic oil, completely clean the entire lid and surrounding area with clean rags.
- When using pumps and hoses to transfer oil from barrels or pails, clean the hose ends before and after use. Store the hose ends of the transfer pumps properly to prevent contamination of this equipment as well.
- During storage and transportation of the hoses used on the Zedi SilverJack systems, carefully manage the hoses by wrapping or covering the hose ends to prevent contamination.
- Replace hydraulic filters on the recommended schedule as per maintenance procedures (typically every two months).



Do not mix different kinds of hydraulic oil. This may negatively impact viscosity causing mechanical problems and drastically shortened equipment life. Consult the Maintenance Guide or your Zedi Field Technician for proper hydraulic oil.

## Site Preparation Prior to Zedi Arrival

Prior to Zedi arrival on site, the Client must prepare the site to the following requirements.

- Clear all obstacles around the wellhead and work area to accommodate the SJ8000 and to ensure a safe work area. This may include the following.
  - Chemical tanks must be moved away from gravel pad area so the gravel pad and concrete pad can be placed by the wellhead.
  - All existing artificial lift equipment (such as pumpjack, ESP or PCP) must be removed. This includes the cable trays and controls.
  - Portable walks around the wellhead must be removed.
- A gravel pad is constructed to the specifications laid out in the [Gravel Pad Preparation Prior to Zedi Arrival](#) section below. Failure to follow proper gravel pad preparations may result in equipment issues and damage.
- Ensure that the appropriate SJ8000 Support Structure (Concrete Pad Version) will be installed.
  - If the **wellhead height is 5' or less**, then a gravel pad must be prepared for the SJ8000 **Short Support Structure** for Concrete Pad.
  - If the **wellhead height is between 5' to 9'**, then a gravel pad must be prepared for the SJ8000 **Tall Support Structure** for Concrete Pad.
  - If the wellhead is over 9' tall, then do not construct the gravel pad as instructed in this manual. Instead, install four piles along with the SJ8000 Support Structure for Piles. Contact your Zedi representative for more information.
  - If the wellhead is inside a well cellar, then do not construct the gravel pad as instructed in this manual. Instead, install four piles along with the SJ8000 Wide Support Structure for Piles. Contact your Zedi representative for more information.
- The rest of the location must be graded downhill from the gravel pad to allow proper runoff. This ensures that the gravel pad does not wash away in the event of rain or snow melt.
- Leave 3 to 6 feet of polished rod stickup above the wellhead assembly. This may be above the stuffing box or polished rod liner clamps, depending on the wellhead.
- If the Client ordered an AC Electric Powerpack, prepare the power on site. 3-phase 480V AC power is required for the SJ8000 starter panel. Provide a certified electrician for the wiring during SJ8000 installation.
- If the Client ordered a Gas (Multi-Fuel) Powerpack:
  - Provide propane, pressure regulator and propane hose on site; or
  - Provide pressure regulator and labour to plumb fuel gas line into the Powerpack during SJ8000 installation.
- Provide 2 proper sized rod clamps.

## Gravel Pad Preparation Prior to Zedi Arrival

Ensure that the ground beside the wellhead where the SJ8000 Support Structure will be constructed is solid and compacted. If the ground has been disturbed or is not native ground, then compact the ground using a tamping machine or compactor to ensure that the ground does not shift or sink during SJ8000 operation.

Depending on the SJ8000 Support Structure model and the height of the wellhead, you may need to prepare a gravel pad.

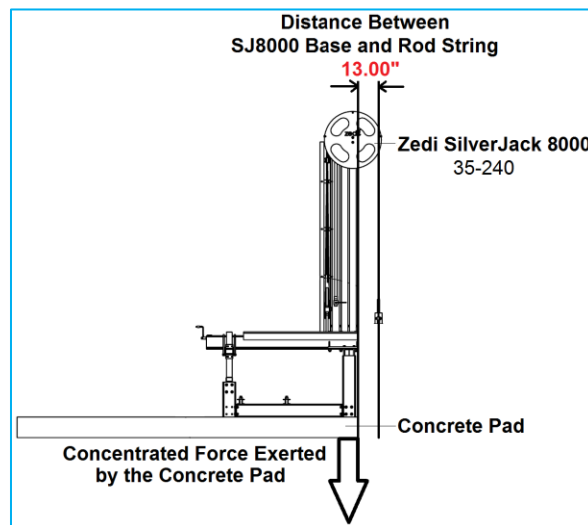
- If you are installing the **Short Support Structure**, then the vertical distance between the ground and the top of the wellhead assembly must be **45" or less**. If the distance is more than 45", then construct a gravel pad to shorten this distance.

## Zedi SilverJack™ 8000 Installation Guide

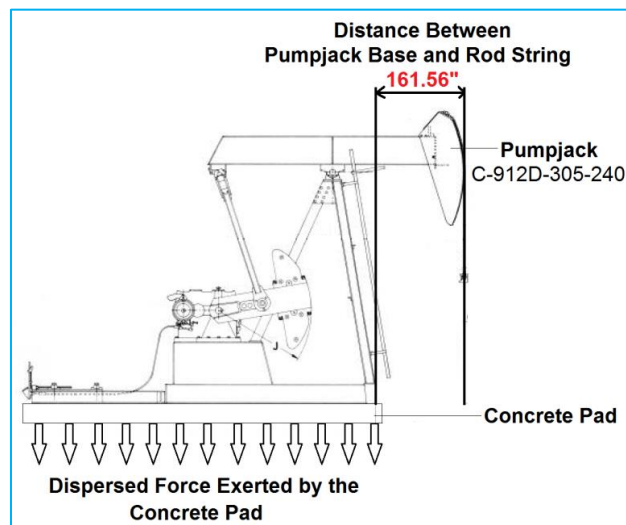
- If you are installing the **Tall Support Structure**, then the vertical distance between the ground and the top of the wellhead assembly must be **85" or less**. If the distance is more than 85", then construct a gravel pad to shorten this distance.

The gravel pad may consist of a mixture of aggregate and earth fines and considered compactable material. It must be solid and properly compacted so that the gravel pad does not slump. Forms may be used to maintain shape and prevent slumping.

The gravel pad must be compacted very well especially on the front edge closest to the wellhead due to the concentrated forces felt only 13" away from the rod string directly below the SJ8000 Lift System. This is not the same as a pad preparation for a pumpjack because a pumpjack is 130" to 170" away from the rod string with its forces dispersed throughout the bottom of its concrete pad (as seen in the following figures). An insufficiently compacted gravel pad may cause the front edge of the concrete pad to sink into the gravel towards the wellhead.



Concentrated downward force below the SJ8000 at only 13" from the rod string



Dispersed downward force below a conventional 912 pumpjack at 161.56" from the rod string

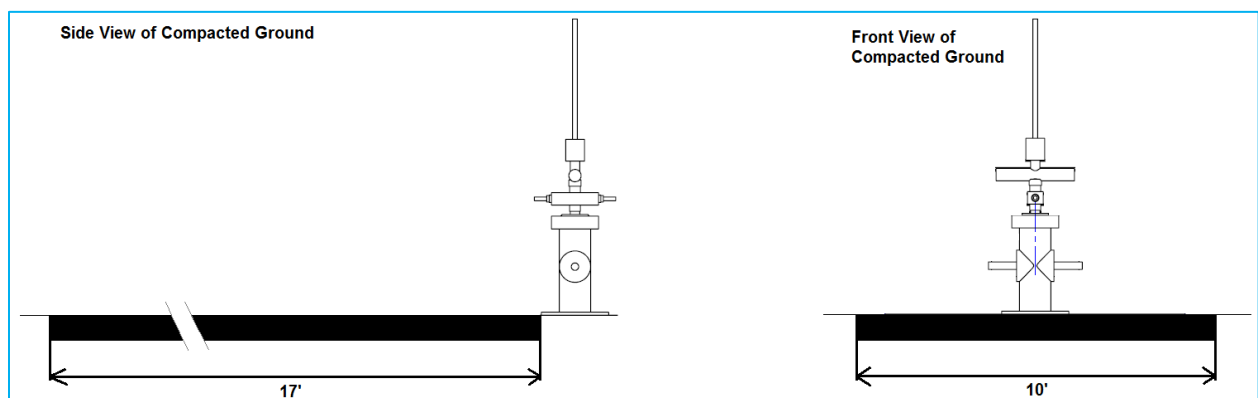
The following section describes a typical gravel pad preparation procedure that may be followed. However, optimal gravel pad preparation may vary in different climates and environments. The following procedure is only a recommendation.

## GRAVEL PAD PREPARATION EXAMPLE



This procedure is an example of a typical gravel pad appropriate for the SJ8000 installation. However, optimal gravel pad preparation may vary in different climates and environments. Consult local regulations and engineering consultants for the ideal gravel pad design for your location.

1. Ensure that the ground beside the wellhead where the gravel pad will be constructed is solid and compacted. If the ground has been disturbed in any way or is not native ground then follow these steps to compact the ground with a tamping machine or compactor before starting construction of the gravel pad.
  - a. If the natural ground soil is not a well compacting earth then consider installing piles with the SJ8000 Support Structure designed for piles. Another option is to remove the non-compactable or weak compacting soil until you reach earth that is suitable for good compaction.
  - b. Apply moisture to the ground.
  - c. Apply a tamping machine or compactor over the entire footprint of the gravel pad location. This ground should be compacted a minimum of 2' wider and longer than the SJ8000 Concrete Pad, which will be placed on top of the gravel pad.
    - i. If you are installing the **Short Support Structure**, then compact a **minimum 10'x17' footprint** (with the 10'-side beside and centered to the wellhead). The SJ8000 Concrete Pad for the Short Support Structure has an 8'x15' footprint.
    - ii. If you are installing the **Tall Support Structure**, then compact a **minimum 10'x20'9" footprint** (with the 10'-side beside and centered to the wellhead). The SJ8000 Concrete Pad for the Tall Support Structure has an 8'x18'9" footprint.
  - d. Add soil as required in the tamping or compacting process to fill in large holes or depressions.
  - e. Ensure that the compacted ground is as close to the wellhead as possible.

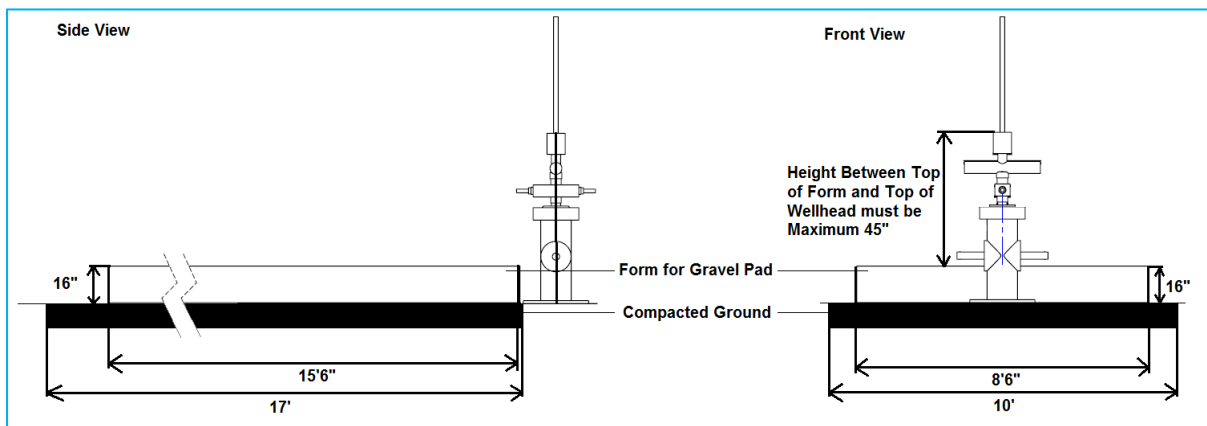


Minimum Compacted Ground Footprint for the Short Support Structure

2. Ensure that the surrounding ground is sloped downhill from the compacted ground and wellhead so that rain and snow melt drain away from the wellhead and gravel pad.



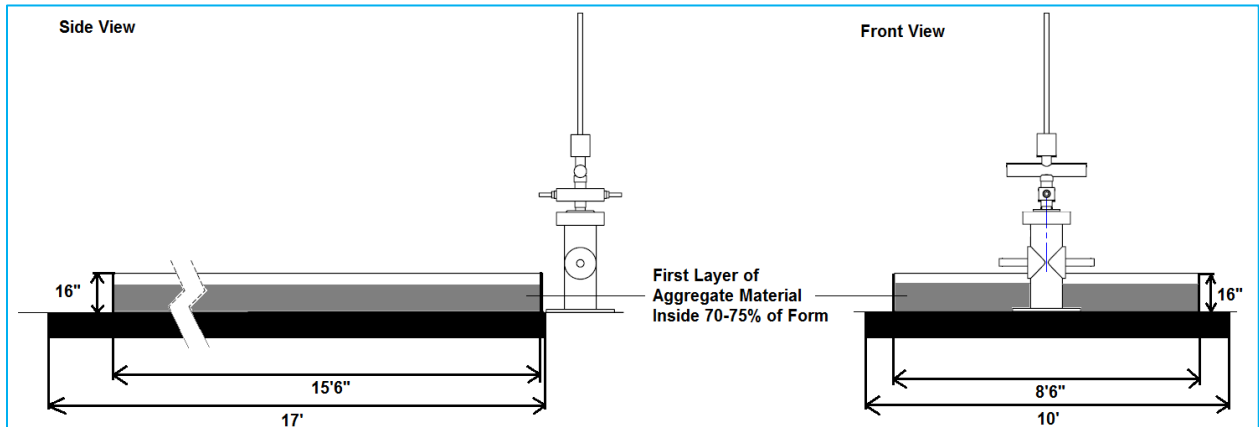
3. Build a form on the compacted ground to contain the gravel pad.
  - a. Build the form to the same height as the gravel pad. The form ensures that the gravel (compactable aggregate with earth fines) stays underneath the SJ8000 Concrete Pad and does not spread or move.
  - b. Build the form with a **maximum height of 16"**. If the gravel pad is already at 16" and one of the following criteria is not met, then ground piles should be considered for the installation instead of the gravel pad.
    - i. If you are installing the **Short Support Structure**, then the top of the wellhead (beginning of polished rod stickup) is **within 45"** from the top of the form.
    - ii. If you are installing the **Tall Support Structure**, then the top of the wellhead (beginning of polished rod stickup) is **within 85"** from the top of the form.
  - c. Build the form so that the gravel pad is a minimum of 6" wider and longer than the SJ8000 Concrete Pad allowing a minimum of 3" of gravel pad surrounding the SJ8000 Concrete Pad. This ensures good integrity underneath the SJ8000 Concrete Pad at all times.
    - i. If you are installing the **Short Support Structure**, then the gravel pad must be a **minimum 8'6"x15'6"** (with the 8'6" edge centered to the wellhead). Its SJ8000 Concrete Pad has an 8'x15' footprint.
    - ii. If you are installing the **Tall Support Structure**, then the gravel pad must be a **minimum 8'6"x19'3"** (with the 8'6" edge centered to the wellhead). Its SJ8000 Concrete Pad has an 8'x18'9" footprint.
  - d. Build the form next to the wellhead so that it is **not more than 2"** away from the bottom wellhead flange. The concrete pad will be placed on top of the gravel pad at a maximum 2" away from the wellhead flange.



Example Form Dimensions for the Short Support Structure (Drawing Not to Scale)

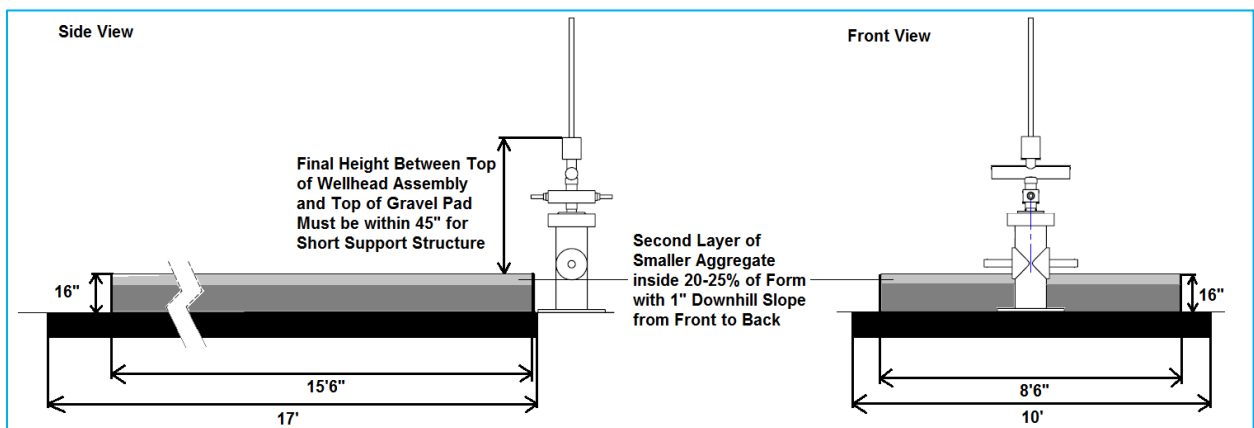
4. Ensure that the forms are built securely so that during the gravel compacting process, the form sides stay rigid and do not push out or bend. This can be done by the following.
  - a. The forms can be wired from side to side and from front to back so that the width and length of the forms maintain their structure when gravel is compacted inside the form.
  - b. The forms can be secured from the outside of the forms with several solid stakes pounded into the ground.
  - c. If during the compacting process the forms push out, then the staking or wiring must be repeated or changed to maintain the integrity of the form's shape.
  - d. If forms are nailed together, then add reinforcements at the nailed edges outside of the form so that the nails do not push out thus collapsing the form once compacting has been completed.

5. Build the first layer of gravel pad inside the form using an aggregate material.
  - a. The first layer should be 70% to 75% of the overall gravel pad height. For example, a 12"-high gravel pad should have 9" of this first layer of aggregate.
  - b. The aggregate material is fractured or crushed rock (not round) and is compactable containing earth fines such as dirt, silt, loam and clay.
    - i. The fractured or crushed stones in this aggregate mix should be between 2" to 3" in diameter. This layer of large stones is optimal to distribute weight and prevent sinking into the compacted ground below.
  - c. Using a tamping machine or compactor, compact the aggregate at every 2" layer of added aggregate.



First Layer of Gravel Pad Containing Large Aggregate

6. Build the second layer of gravel pad filling the rest of the form as follows.
  - a. The second layer should be 20 to 25% of the overall gravel pad height.
  - b. The aggregate material is fractured or crushed rock (not round) and is compactable containing earth fines such as dirt, silt, loam and clay.
    - i. The fractured or crushed stones in this aggregate mix optimally should be  $\frac{3}{4}$ " in diameter.
  - c. Using a tamping machine or compactor, compact the aggregate at every 2" layer of added aggregate.
7. Grade the top surface of the gravel pad so that there is a 1" downhill slope from the front (wellhead side) to the back.



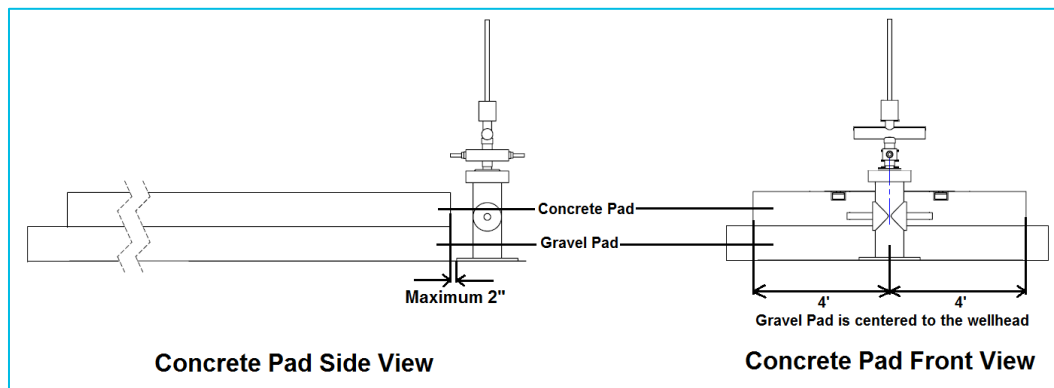
Second Layer of Gravel Pad with 1" Downhill Slope from Front to Back

8. The gravel pad must be level from side to side. The only slope present must be the 1" slope from the front to the back.
9. Once the gravel pad is complete and the concrete pad is placed on top of the gravel pad (centered to the wellhead and level side to side), pour additional gravel around the outside of both the gravel pad and cement pad. Slope this additional gravel away from top of concrete pad to the ground so that water will run away from the concrete and gravel pad.

Ultimately there will be some final settling of the gravel pad once the concrete pad is applied and the SJ8000 is operational. Adjustments to the system to accommodate 1" of settling can be managed by the Height Adjusting Beams on the back of the SJ8000 Support Structure. Any more settling may require reworking the gravel pad beneath the concrete pad. This is why forms must be used contain the rock thus keeping the gravel pad contained and beneath the concrete pad.

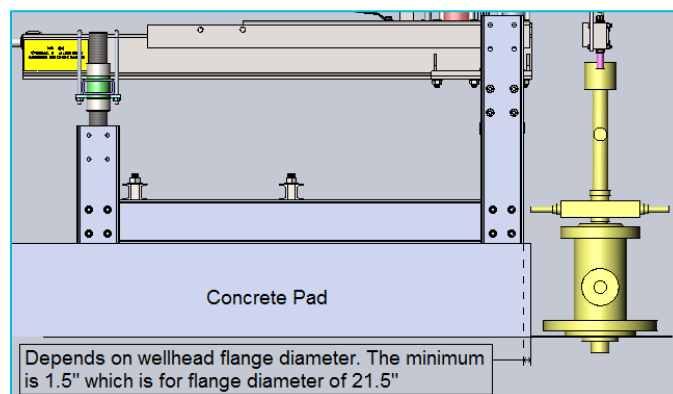
### Concrete Pad and Support Structure Installation

1. Using a crane, place the Concrete Pad on top of the gravel pad and centered to the wellhead. The front of the Concrete Pad must be **2" or less** from the edge of the bottom wellhead flange.

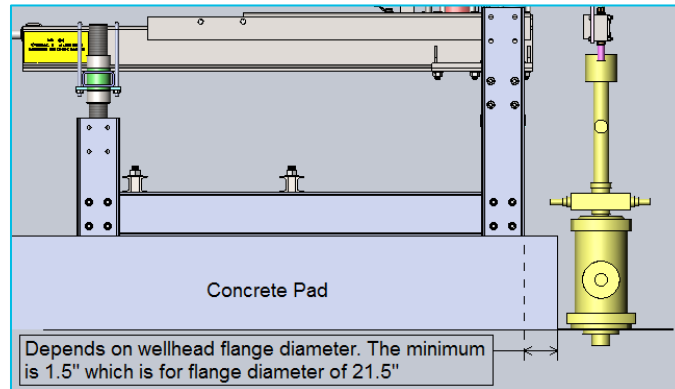


Concrete Pad placement

2. Using a crane or forklift, place the Support Structure on top of the Concrete Pad.
3. Ensure that the Support Structure is **centered to the wellhead**.
4. Ensure that the Support Structure columns are **1-1/2" or more** from the front of Concrete Pad. The placement of the Support Structure on the Concrete Pad depends on the size of the wellhead and the distance of the Concrete Pad to the polished rod stickup.

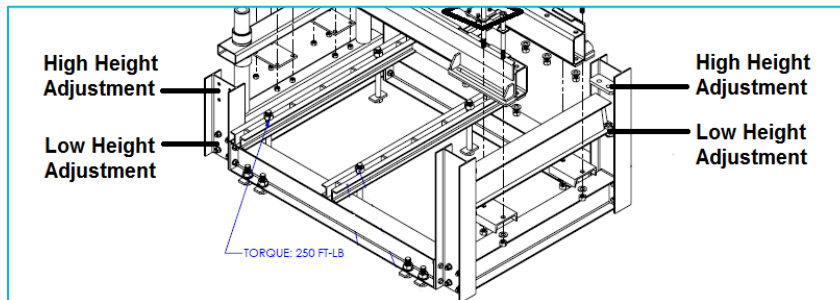


Example Short Support Structure placement with a 21.5" diameter wellhead flange



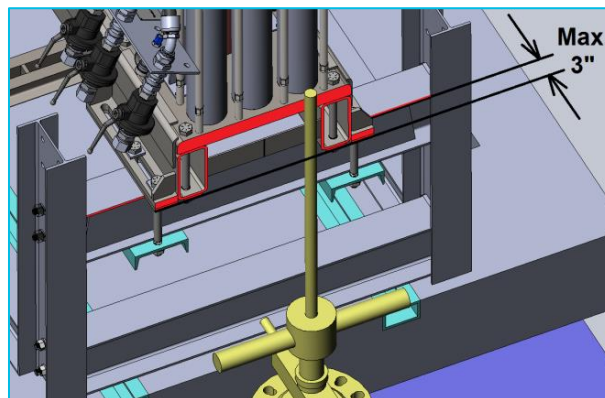
Example Short Support Structure placement with a narrow wellhead flange

5. For the **Short Support Structure**, there are the following two height adjustment options. There is a 12” difference between the low and high height adjustments.
  - a. If the height of the wellhead (from the top of the gravel pad) is between 3 feet and 4 feet (0.91 m and 1.22 m), then bolt the Support Structure’s Height Adjustment Beams on its higher height adjustment.
  - b. If the height of the wellhead assembly is less than 3 feet, bolt the Support Structure’s Height Adjustment Beams on the lower height adjustment.



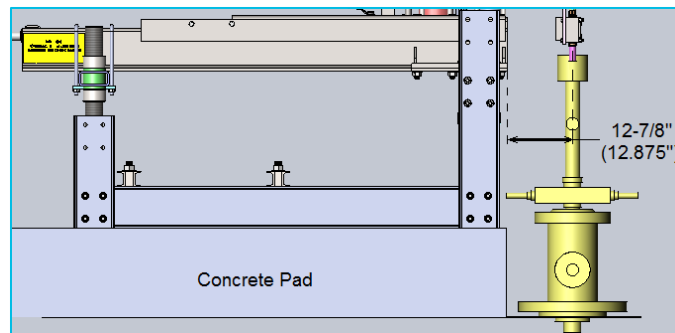
Height Adjustment Beams low and high options

6. Ensure that the Support Structure’s Top Assembly has **3” or less of overhang** over the front of the Support Structure’s crossbeam. If required, loosen the Top Assembly bolts and move the Top Assembly forward or backward to meet this specification. **Torque the Top Assembly’s back U-bolts to 200 ft-lb (271 Nm) and the front bolts to 250 ft-lb (339 Nm).**



Maximum 3” of overhang of the Top Assembly on top of the Height Adjustment Beam

7. Move the entire Support Structure so that the Top Assembly is at an ***exact perpendicular distance of 12-7/8"*** from the center of the polished rod. This is an exact distance to ensure the vertical alignment of the Lift System Cables to the wellhead.



Top Assembly is exactly 12-7/8" from the center of the polished rod and wellhead



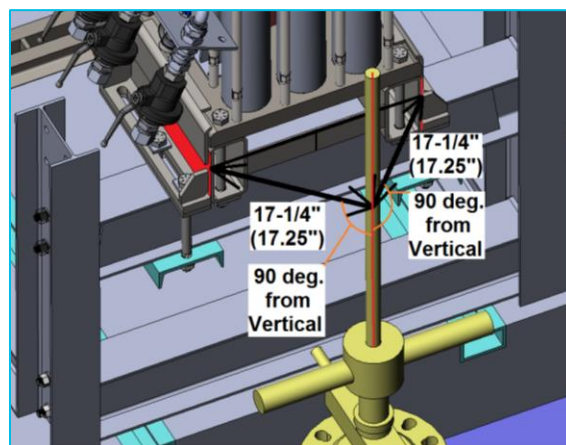
CAUTION

When moving the Support Structure to meet the 12-7/8" between the Top Assembly and the center of the polished rod, ensure that the previous installation measurements are followed:

- a. The Support Structure columns are 1-1/2" or more from the front edge of the Concrete Pad.
- b. The Top Assembly overhang is 3" or less from the Height Adjustment Beam.

Failure to follow these specifications may damage equipment and void warranty.

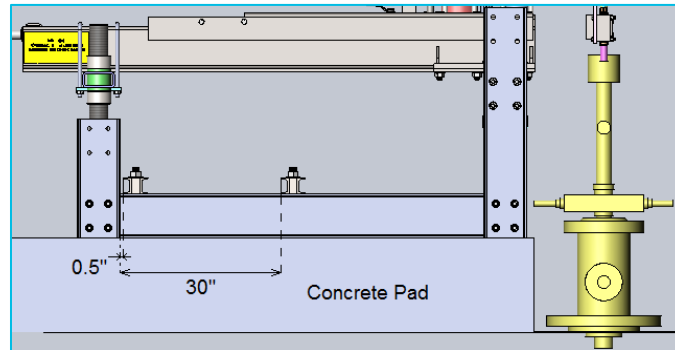
8. Check the alignment and centering by ensuring that front-outer edges of the Top Assembly's channels are ***exactly 17-1/4"*** from the center of the polished rod. This confirms that the Support Structure is correctly aligned and centered to the polished rod and wellhead.



Confirming proper alignment and centering of Support Structure to polished rod

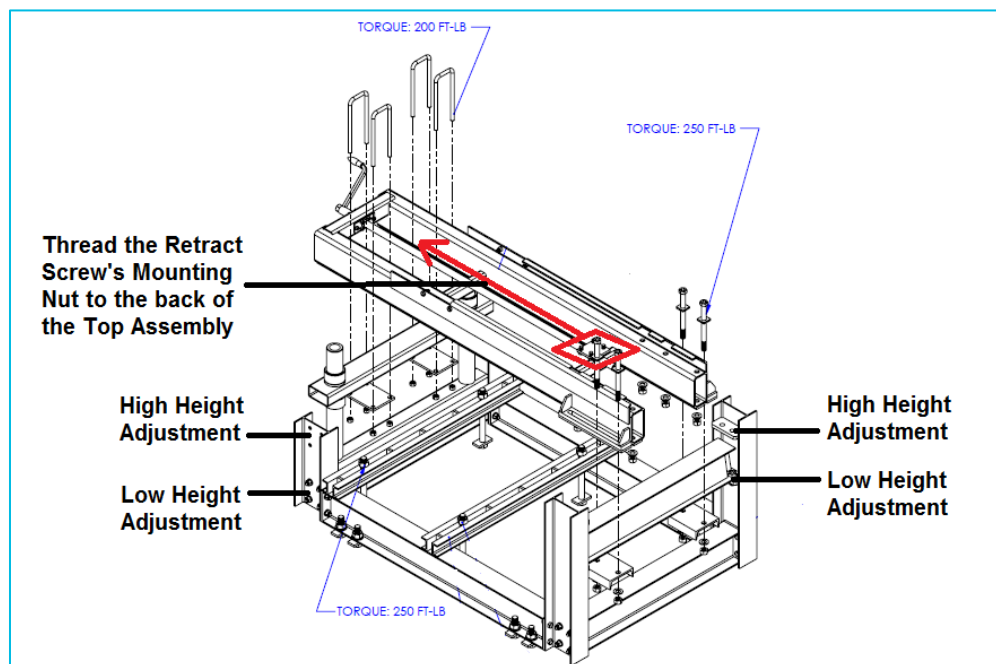
9. Secure the Support Structure to the Concrete Pad using the two Hold Down Cross Beams and four 14" T-bolts.
  - a. Place one Hold Down Cross Beam across the bottom of the Support Structure at ***exactly 1/2"*** from the Support Structure's rear columns.

- b. Place the second Hold Down Cross Beam across the bottom of the Support Structure at **exactly 30"** from the Support Structure's rear columns.
- c. Secure the Hold Down Cross Beams with the provided 14" T-bolts and nuts. **Torque to 250 ft-lb (339 Nm).**



Hold down cross beams

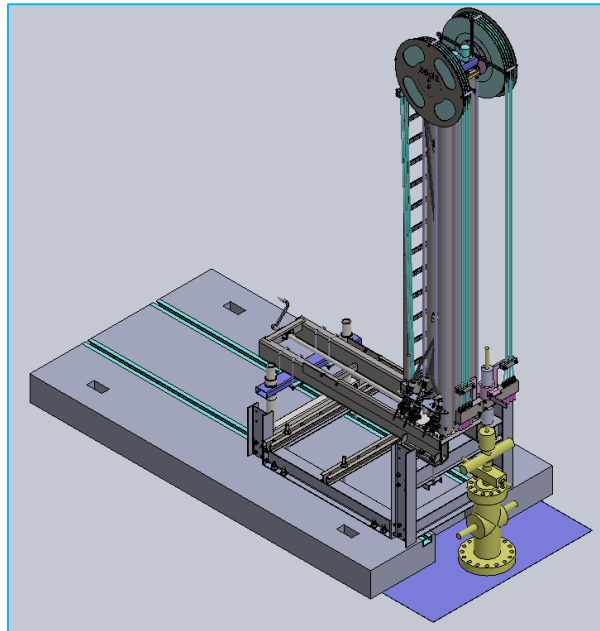
- 10. Thread the Retract Screw's Mounting Nut towards the back of the Top Assembly. This positions the Mounting Nut so that it can be bolted to the Bottom Manifold of the Lift System in the following Lift System Installation procedure.



Torque ratings, Height Adjustments, Top Assembly and Retract Screw Mounting Nut

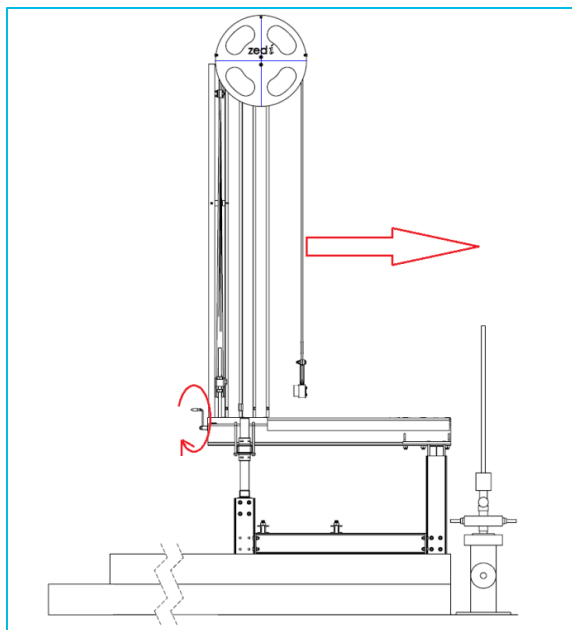
The Concrete Pad and Support Structure installation is now complete.

## Lift System Installation



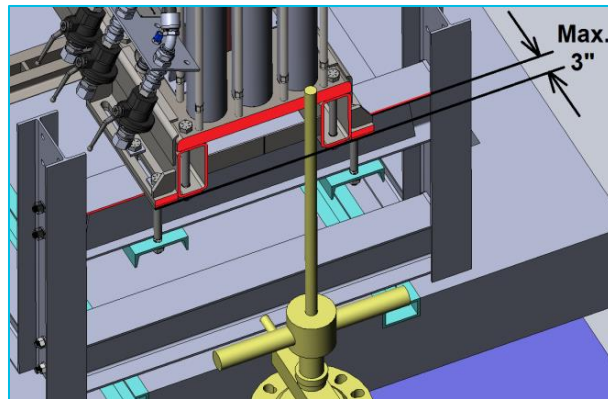
A complete Lift System installed on a well

1. Using a crane or a picker, place the Lift System on the back of the Support Structure. The Carrier Bar must face the wellhead. See figure in step 3.
2. Bolt the Retract Screw's Mounting Nut to the Lift System's Bottom Manifold with the provided four bolts.
3. Turn the Retract Screw's Crank Handle to move the Lift System towards the wellhead.



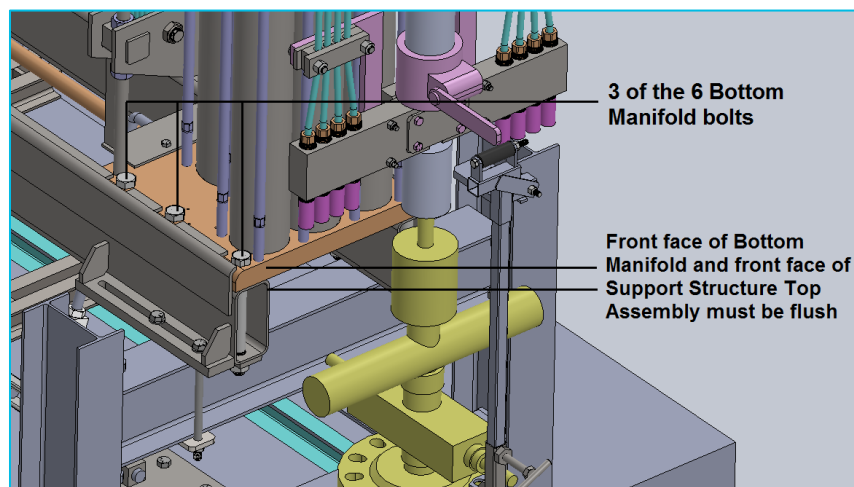
Move the Lift System to the front of the Support Structure using the Retract Screw Crank

4. Ensure the front face of the Bottom Manifold is **flush** against the front face of the Support Structure's Top Assembly and is at **3" or less of overhang** on top of the Support Structure crossbeam.



Bottom Manifold flush against the Top Assembly

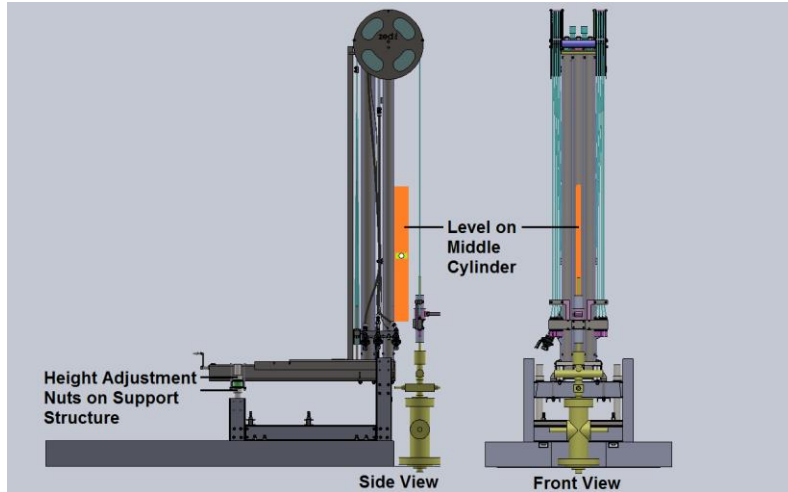
5. Bolt the Bottom Manifold to the Support Structure with the six pairs of nuts and bolts provided (three on each side of manifold). **Torque the bolts to 350 ft-lb (475 Nm).**



Bottom Manifold positioning

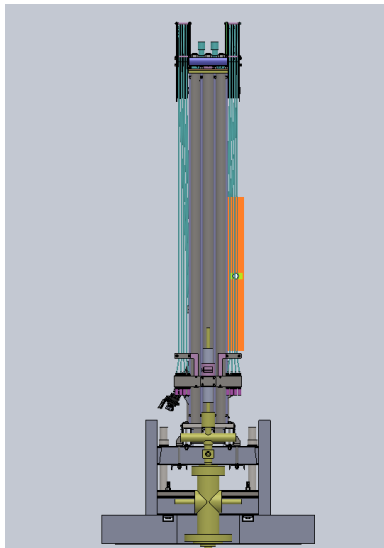
6. Place a level (4' to 6' in length) against the front of the middle cylinder to ensure the Lift System is level to the ground from front to back. This also indicates if the Concrete Pad has moved or sank. If the Lift System is not level, turn the Height Adjustment Nuts on the back of the Support Structure to adjust the tilt of the Lift System. If the Height Adjustment Nuts are unable to level the Lift System, the ground or gravel pad underneath may have to be leveled and compacted again. See the [Gravel Pad Preparation Prior to Zedi Arrival](#) section for details.





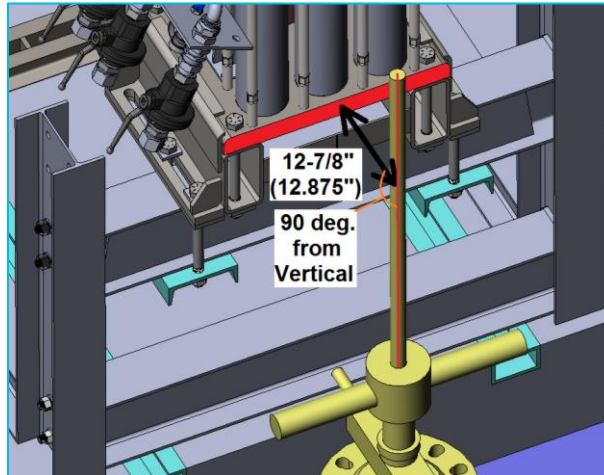
Ensure that the Lift System is level from front to back

7. Place the level (4' to 6' in length) against the left and right sides of the cylinder assembly to ensure the Lift System is level from side to side. This also indicates if the Concrete Pad has moved or sank. If the Lift System is not level, the ground or gravel pad underneath may have to be leveled and compacted again. See the [Gravel Pad Preparation Prior to Zedi Arrival](#) section for details.



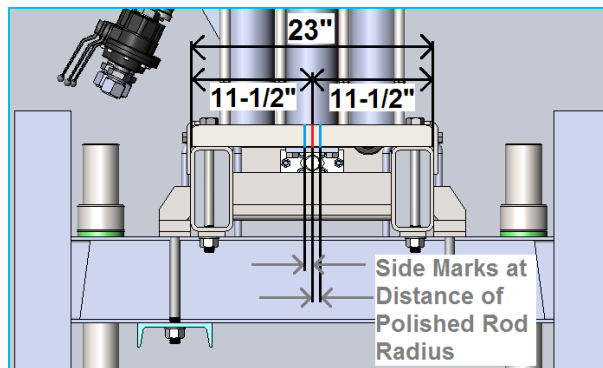
Front view of Lift System; Ensure that the Lift System is level from side to side

8. Like the Support Structure's Top Assembly, ensure that the Bottom Manifold is **exactly 12-7/8"** from the center of the rod string.



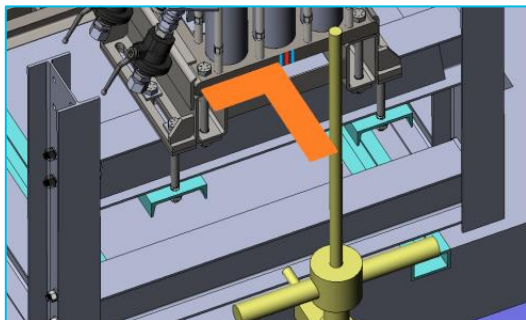
Bottom Manifold is 12-7/8" from the center of the rod string or wellhead

9. Center the Lift System to the polished rod by doing the following.
  - a. Make a vertical mark on the center of the Bottom Manifold.
  - b. Measure the radius of the polished rod.
  - c. Make a vertical mark on each side of the center mark at a distance of the polished rod radius.

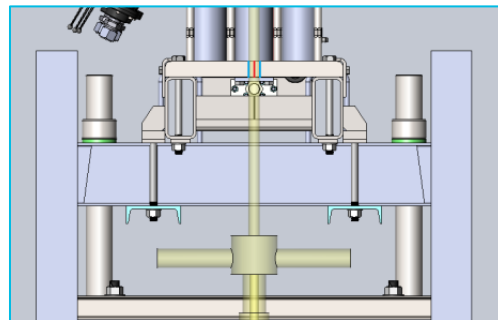


Mark where to align the polished rod on the Bottom Manifold

- d. Place a framing square against the polished rod and each side mark of the Bottom Manifold. The side marks on the Bottom Manifold should be exactly aligned to the sides of the polished rod.

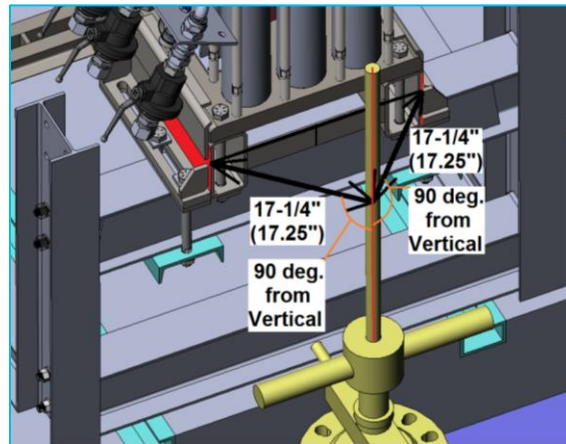


Center the Lift System to the polished rod using a framing square



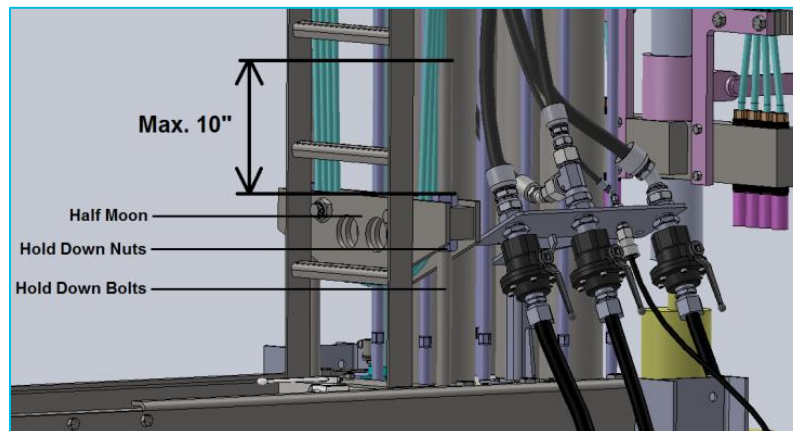
Front view of the Lift System centered to the polished rod

- e. If required, loosen the Top Assembly's bolts and move the Top Assembly with Lift System left or right in order to center the Lift System to the polished rod. When centered, **torque the Top Assembly's back U-bolts to 200 ft-lb (271 Nm) and the front bolts to 250 ft-lb (339 Nm).**
- f. The front-outer edges of the Top Assembly's channels are **exactly 17-1/4"** from the center of the rod string. This confirms that the Lift System is correctly aligned and centered to the polished rod.



Confirm proper alignment and centering of Lift System to polished rod

10. On the Tie Down Assembly at the back of the lift system, thread the four Hold Down Nuts so that there is **10" or less** between the top of the Hold Down Bolts and the top of the Hold Down Nuts. Ensure that the Half Moon is **perfectly level** and the Hold Down Nuts are flush against the top and bottom of the Half Moon. This prevents the Tie Down Assembly from moving up and down during operation.

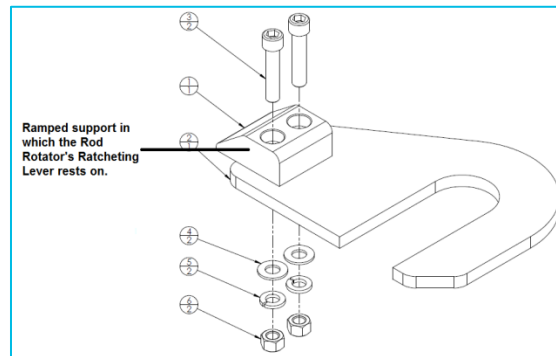


Secure Tie Down Assembly at back of Lift System (Half Moon, Hold Down Nuts and Hold Down Bolts)



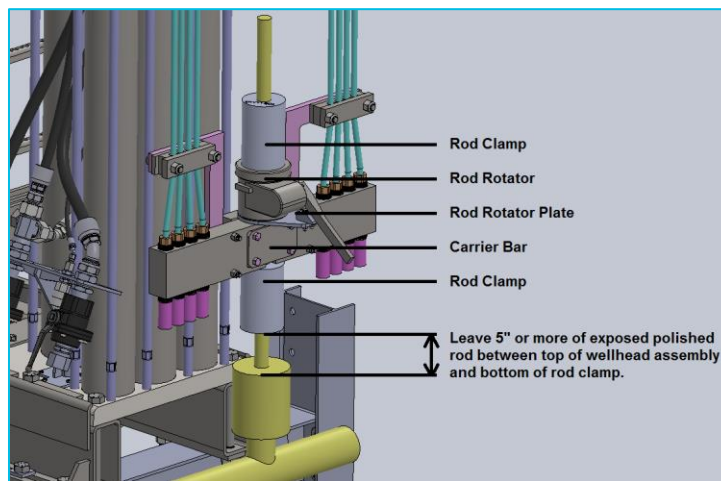
Ensure that the Half Moon is perfectly level. If not level, the Hold Down Bolts will experience side loading and may damage equipment.

11. Insert the polished rod into the Carrier Bar and secure with the provided plate and nuts. See the figure in step 15.
12. Clamp a polished rod clamp underneath and flush against the Carrier Bar. There must be **5" or more** of polished rod stickup exposed between the bottom of the rod clamp and the top of the wellhead assembly. See the figure in step 15.
13. Place the slotted Rod Rotator Plate on top of the Carrier Bar and through the polished rod with the ramped support facing away from the Lift System. See the figure below and in step 15.



Slotted Rod Rotator Plate

14. Clamp the Rod Rotator on top of the Rod Rotator Plate. Ensure the Rod Rotator Ratcheting Lever is on top the Rod Rotator Plate's ramped support and facing away from the Lift System as seen in the figure above. See the figure in step 15.
15. Clamp a polished rod clamp on top of the Rod Rotator. See the figure of the final Carrier Bar Assembly below.




Final Carrier Bar Assembly on polished rod stickup

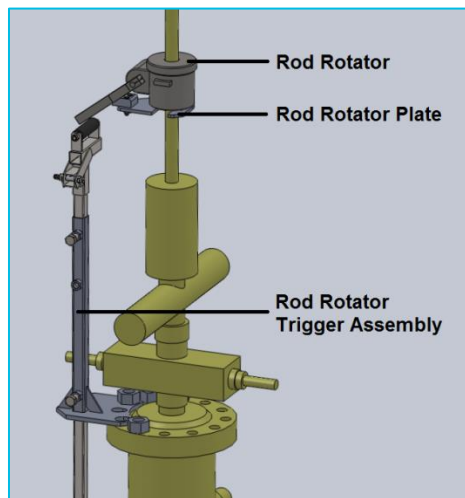


If the bottom of the lower Rod Clamp is 5 inches away from the top of the wellhead assembly and the cables are still slack, then you must tighten the cables by lowering the Cable Tie Down Assembly at the rear of the Lift System. Thread the Hold Down Nuts to lower the Half Moon thus tightening the cables. See step 10 above. Slack cables may damage equipment.

16. Level the Carrier Bar by doing the following.

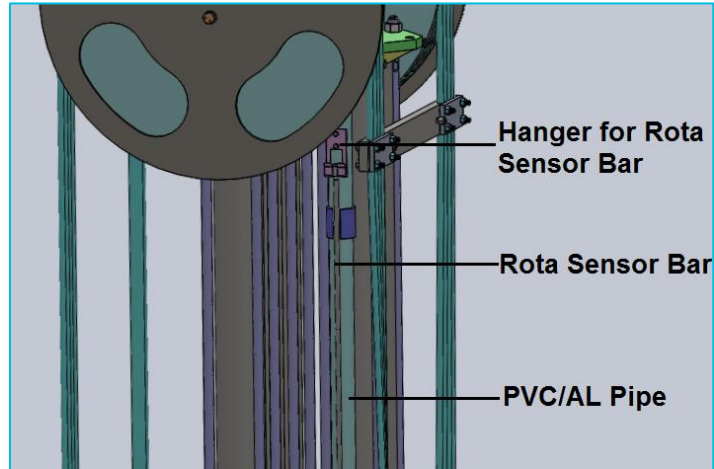
 <b>Note</b>	The following steps are only possible if the powerpack is installed and operating. If the powerpack is not yet installed, return to these steps after performing the procedure found in the <a href="#">Powerpack Installation</a> section.
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- a. Slightly upstroke and hold the Lift System so that there is rod string weight on the Carrier Bar.
  - b. Place a level across the bottom of the Carrier Bar to check if it is level.
  - c. If not level, move the bottom rod clamp to a lower position.
  - d. Lower the Lift System so that the bottom rod clamp is resting on the wellhead and holding the rod string weight. The cables should now be slack.
  - e. At the back of the cylinder above the Half Moon, pull and adjust the cables to level the Carrier Bar.
  - f. When the Carrier Bar is level, raise and hold the Lift System and return the bottom rod clamp so that it is flush against the bottom of the Carrier Bar.
  - g. Lower the Lift System to the bottom of its stroke. There should 5” or more of exposed polished rod between the bottom rod clamp and the top of the wellhead.
17. Bolt the Rod Rotator Trigger Assembly onto the wellhead on the opposite side of the Lift System and underneath the Rod Rotator Ratcheting Lever. The wellhead bolts may have to be replaced with longer bolts in order bolt the Rod Rotator Trigger Assembly onto the wellhead. Adjust the height of the trigger bar so that the Rod Rotator ratchets at the bottom of each stroke.



**Rod Rotator Trigger Assembly on wellhead (Carrier Bar not shown)**

18. Install the Rota Sensor Bar on its hanger found on the PVC/aluminum pipe. Secure it to the PVC/aluminum pipe and Lift System Tie Rods using zip ties.

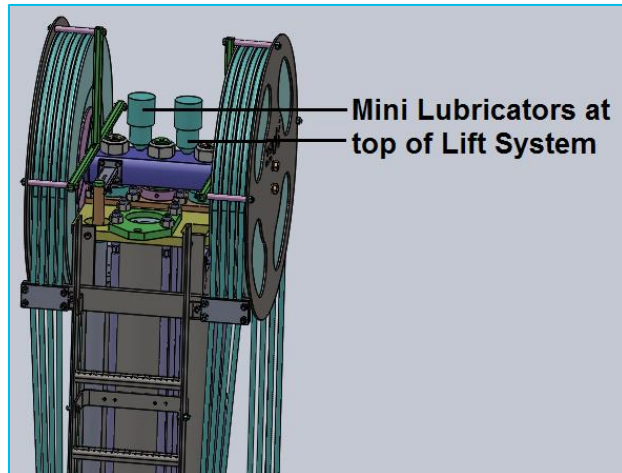


Rota Sensor Bar installation

19. Set the two Mini Lubricators to lubricate every 12 months (360 days) and install them into the 1/4" NPT ports on the sheave shaft. There is one Mini Lubricator for each sheave bearing. Climb the ladder at the back of the Lift System to access the Mini Lubricator ports on the sheave shaft.



Mini Lubricator setting to lubricate every 12 months (360 days)



Mini Lubricators at top of Lift System



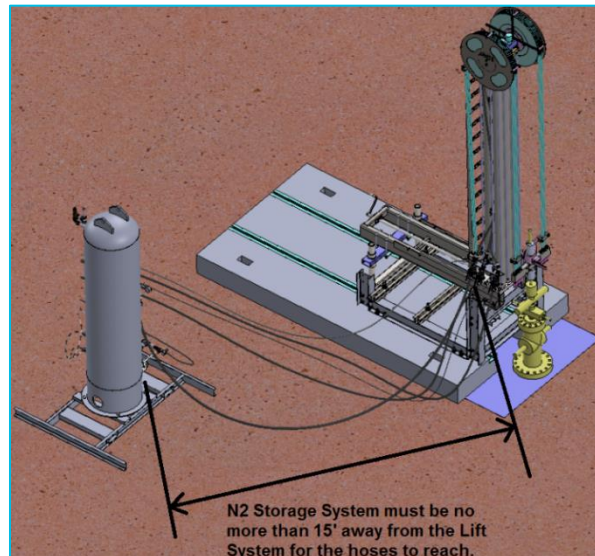
**WARNING**

Use a safety harness when climbing the ladder on the Lift System to prevent a fall that could cause a serious or fatal injury.

The Lift System installation is now complete.

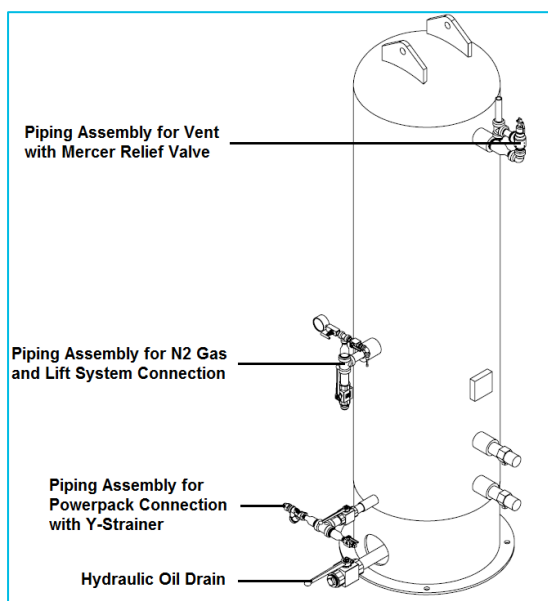
## N2 Storage System Installation

1. Using a crane or picker, place the N2 Storage System (vessel and skid) on level ground, to the right side of the Concrete Pad and behind the Lift System. Place the N2 Storage System must be on the same side (right side) as the Lift System's hose bulkhead. The 2" NPT ports for the Level Switch Assemblies must be facing the Lift System. The N2 Storage System must be at a distance of **15 feet or less** from the Lift System for the hydraulic hose to reach.

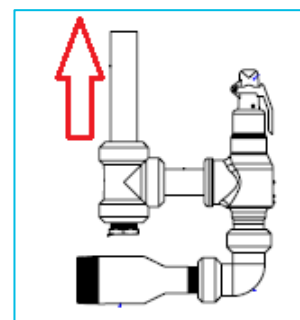


N2 Storage System placement

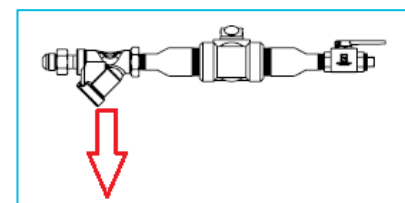
2. Thread the Piping Assemblies and Mercer Relief Valve onto the vessel. The Vent of the Mercer Relief Valve must be pointing up. The Y-Strainer on the Powerpack Connection must be pointing down.



N2 Piping Assemblies

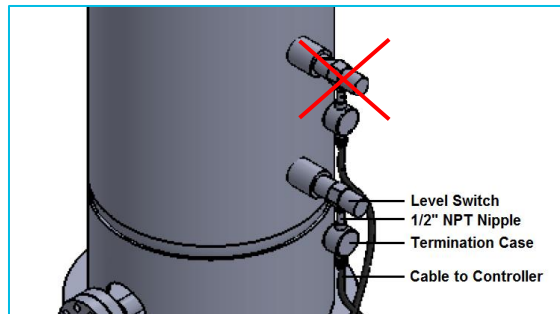


Vent must point up



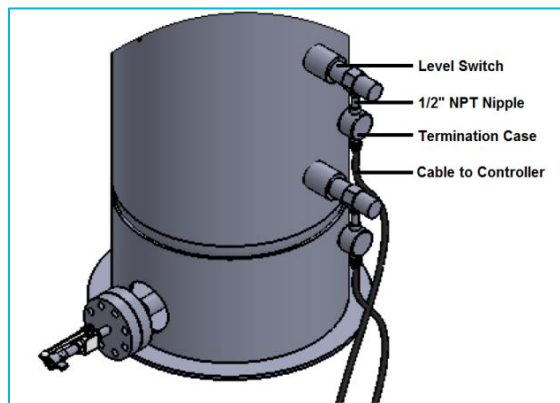
Y-Strainer must point down

3. Install the Bottom Level Switch Assembly onto the lower 2" NPT port. Ensure you install the Bottom Level Switch Assembly onto the N2 Vessel before installing the Top Level Switch Assembly.



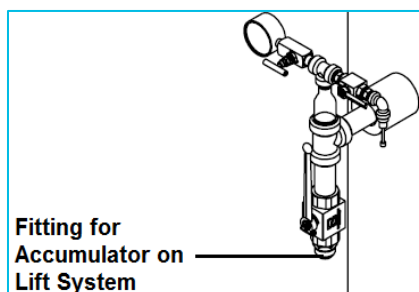
Install the Bottom N2 Level Switch Assembly before installing the Top Level Switch

4. Fill the N2 Vessel with hydraulic oil through the higher 2" NPT port (for the Top Level Switch) until the Bottom Level Switch Assembly is reached and is floating.
5. Install the Top Level Switch Assembly onto the higher 2" NPT port. See figure below for completed Level Switch Assembly installation.



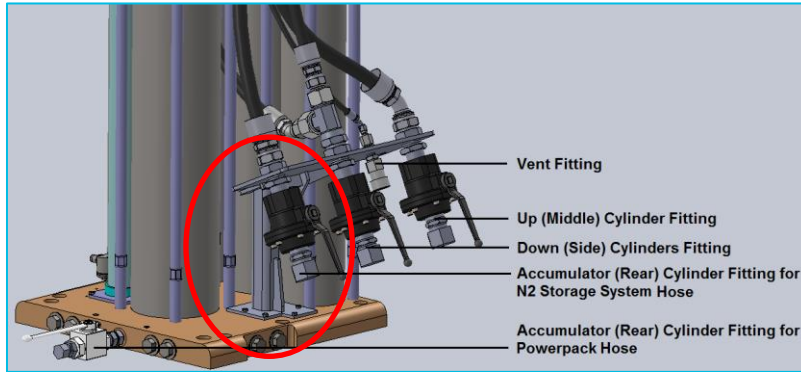
With both Bottom and Top N2 Level Switch Assemblies

6. Connect the 1-1/4" x 25' hose with threaded JIC fittings to the N2 Piping Assembly on the vessel. Connect the other side of the hose to the Accumulator on the Lift System Bulkhead. See figures below.



Connect 1-1/4" hose with threaded JIC fittings here on N2 Piping Assembly





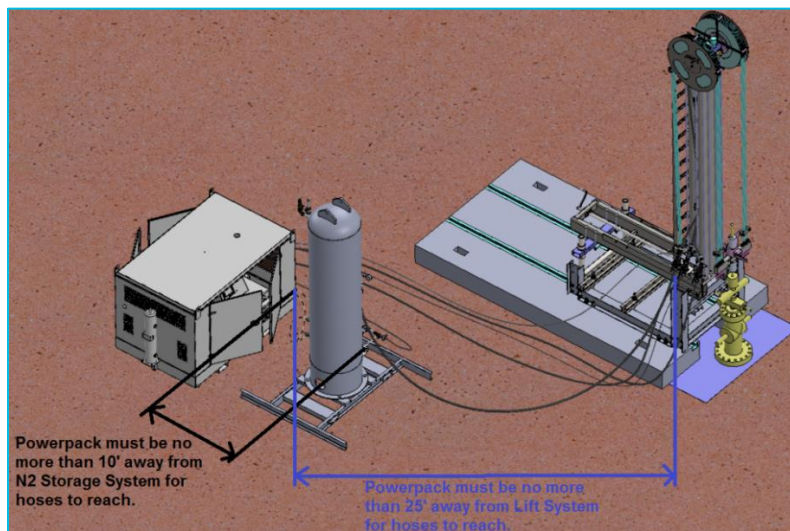
Connect 1-1/4" hose with threaded JIC fittings to the Lift System Bulkhead as shown above

The N2 Storage System installation is now complete. The N2 Storage System must now be filled with nitrogen gas before the SJ8000 can operate. This is done after the Powerpack has been installed and all hose and cables have been connected as seen in the next two sections, Powerpack Installation and N2 Pressure Balancing.

### Powerpack Installation

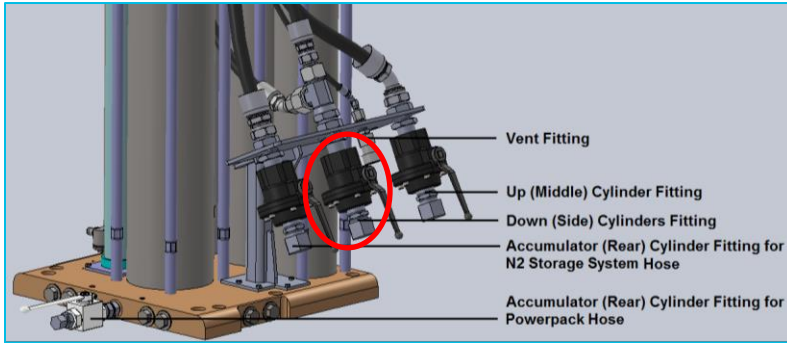
During Powerpack installation, the connection of AC power or fuel gas may occur at the same time. If at an AC Powerpack, a certified electrician must connect AC power to the Powerpack's AC starter panel. If at a Gas Powerpack, the Client must connect the Powerpack's scrubber to the fuel gas line according to local regulations.

1. Using a crane, picker or forklift place the Powerpack on the Bulkhead side of the Lift System (same side as the N2 Vessel), on level ground and square to the Concrete Pad. The Powerpack must be at a distance of **25 feet or less** from the Lift system and **10 feet or less** from the N2 Storage Systems for the hydraulic hoses to reach. The Powerpack must be placed in a non-hazardous area. Depending on local regulations, this may be 10 feet (3 m) away from any fuel gas regulator and relief valve line openings.

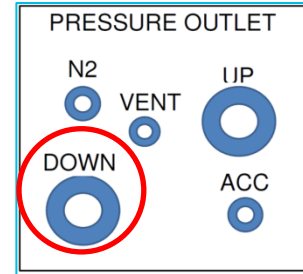


Powerpack placement

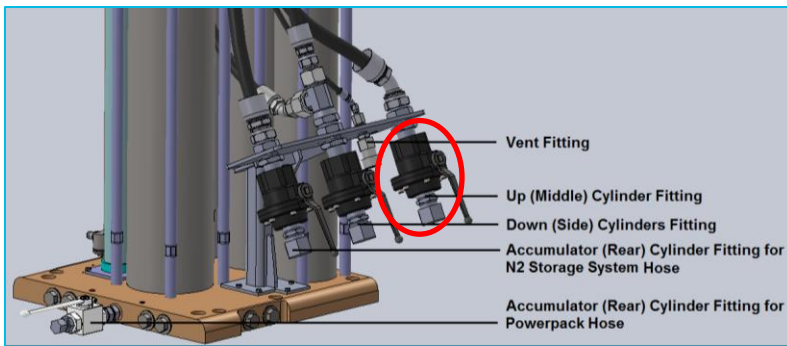
2. Connect the 1-1/4" x 30' hoses with winged couplers to the Down and Up fittings on the Lift System and Powerpack Bulkheads. See the following figures.



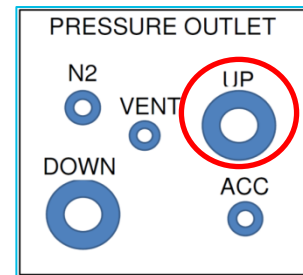
Down fitting on Lift System Bulkhead



Down fitting on Powerpack Bulkhead; View from outside of Powerpack



Up fitting on Lift System Bulkhead

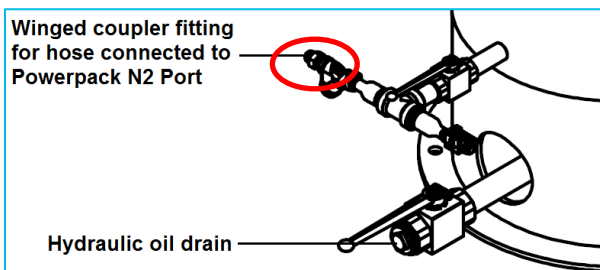


Up fitting on Powerpack Bulkhead; View from outside of Powerpack

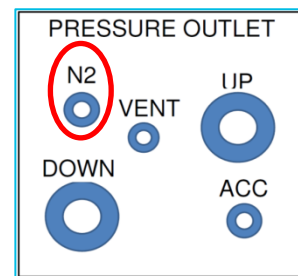


Ensure you are connecting the Down port on the Powerpack to the Down port on the Lift System and the Up port on the Powerpack to the Up port on the Lift System. Making the wrong hose connections may damage equipment.

3. Connect the 3/4" x 12' hose with winged couplers to the N2 Storage System Piping Assembly and to the Powerpack Bulkhead.



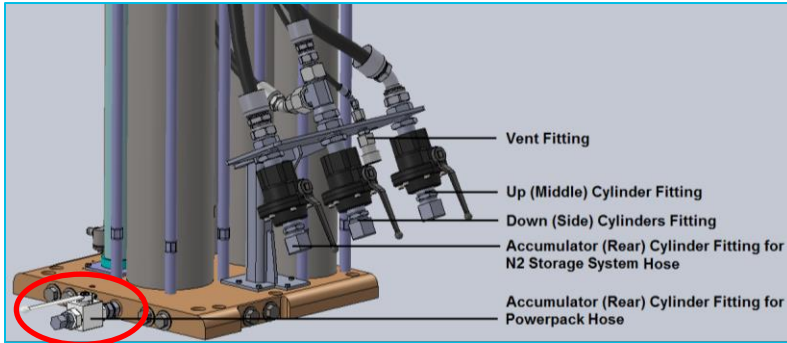
N2 Storage System fitting for hose connection to Powerpack



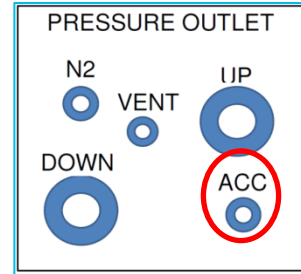
N2 Storage System fitting on Powerpack Bulkhead; View from outside of Powerpack

4. Connect the 3/4" x 30' hose with JIC fitting on one end and winged coupler on the other end to the Accumulator ports on the Powerpack Bulkhead and Lift System Bulkhead. Connect the JIC

end to the Lift System Bulkhead before connecting the winged coupler to the Powerpack Bulkhead to avoid debris from entering the hose.

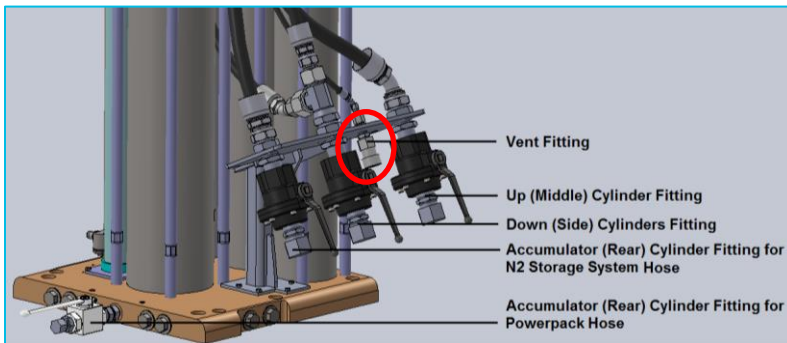


Accumulator JIC fitting on Lift System Bulkhead

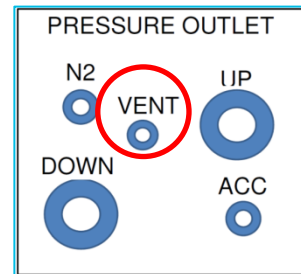


Accumulator winged coupler fitting on Powerpack Bulkhead; View from outside of Powerpack

5. Connect the 1/2" x 30' hose with poppet couplers to the Vent fitting on the Powerpack Bulkhead and Lift System Bulkhead.




Vent poppet coupler fitting on Lift System Bulkhead



Vent poppet coupler fitting on Powerpack Bulkhead; View from outside of Powerpack

6. Connect the Level Switch Cables from the Vessel to the Controller in the Powerpack and terminate the cables. If the Controller is powered on by AC power or by the 12VDC battery, function test the Level Switches on the Controller.
7. Connect one end of the Rota Sensor Bar Cable to the Controller.
8. Run the Rota Sensor Bar Cable through the opening at the Powerpack Bulkhead.
9. Connect the other end of the cable to the Rota Sensor Bar on the Lift System.
10. Connect the Antenna Cable to the Antenna
11. Install the Antenna on its 10' Mast
12. Install the Mast on the Powerpack using the swivel clamp on the Powerpack and pipe clamps.
13. Connect the other end of the Antenna Cable to the Controller.

The Powerpack installation is now complete.

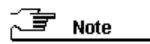
 <b>Note</b>	<p><b>If at an AC Powerpack, bump test the AC motor with a certified electrician to ensure that the motor connections are correct and the motor is spinning in the correct direction.</b></p>
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## N2 Pressure Balancing

The procedure of N2 Pressure Balancing must be performed by a Zedi Field Technician with access to the Controller's Service Tool through their laptop. The Customer is responsible for supplying nitrogen gas bottles onsite. If preferred, the Zedi Field Technicians may bring nitrogen gas bottles to the installation for an additional fee.



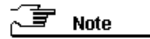
The following procedure is for a seasonally **warm day**. If performing this procedure on a seasonally **cold day**, fill the N2 Vessel to the **Top Level Switch** (instead of Low Level Switch as seen in step 2 below) and **do not** top up the hydraulic tank inside the Powerpack. Doing so may cause the hydraulic tank to overflow with hydraulic oil during its hydraulic oil refresh cycle.



**Before performing the following procedure, the Zedi Field Technician must set “Vessel Charge Type” to “Never” on the Controller’s Service Tool.**

1. Ensure the Level Switches are connected to the Controller and the Controller is powered on.
2. Ensure the N2 Vessel's hydraulic oil level is at the Low Level Switch.
  - a. If the hydraulic oil level is lower than the Low Level Switch (i.e. N2 Low Oil Alarm is activated), then remove the Top Level Switch and through its port fill the N2 Vessel with hydraulic oil so that the Low Level Switch is reached. Return the Top Level Switch onto its port.
  - b. If the hydraulic oil level is higher than the Low Level Switch (i.e. N2 Low Oil Alarm is **not** activated), then bleed the hydraulic oil back to the Powerpack to drop its level to the Low Level Switch. This ensures you know the exact hydraulic oil level in the N2 Vessel.
3. Mark the oil level on the sight glass of the Powerpack's Hydraulic Tank. If there is hydraulic oil in the Lift System's Piston Accumulator, ensure that there is enough room in the Hydraulic Tank to allow for the Accumulator's hydraulic oil to fully drain back to tank during an Accumulator Refresh Cycle without overflowing. If there is a risk of overflowing during refresh cycles, then remove enough hydraulic oil from the Hydraulic Tank to ensure that this does not occur.
4. Using the SJ8000 Sizing Tool, your Zedi Field Technician calculates how much oil is required in the N2 Vessel for normal operation. This volume turns into inches that the hydraulic oil level must drop to in the Hydraulic Tank.
5. Based on the calculation, from the first mark on the sight glass measure downwards the amount of hydraulic oil needed to fill the N2 Vessel and mark the sight glass at this level. For example, if ambient temperature is 65 °F with a 110 gallon N2 Vessel and 625 L Hydraulic Tank, then mark 5.2” down on the Hydraulic Tank from the first mark.
6. Charge the N2 vessel with hydraulic oil from the Hydraulic Tank until you are at the lower mark on the sight glass.
7. Using the SJ8000 Sizing Tool, your Zedi Field Technician calculates how much nitrogen gas is required in the N2 Vessel.
8. Charge the N2 Vessel with nitrogen gas.
9. Close the N2 Vessel isolation valve (hydraulic line) at the powerpack.
10. Start the pump and run until up to speed.

11. Charge or bleed the nitrogen gas from the N2 Vessel until hydraulic horsepower (HHP) imbalance is close to 0 HHP on the Controller. Imbalance Power is seen on Screen 5: Process → View Data → Tab 7: Assisted Lift Data.
12. Open the N2 isolation valve.



Note

**After performing the N2 Pressure Balancing procedure, the Zedi Field Technician must set “Vessel Charge Type” to “Auto Balance” on the Controller through his laptop’s Service Tool. Start up the Powerpack and allow the N2 charging function to automatically balance the system.**



Top up the Powerpack with hydraulic oil if required. With the Low Level Alarm active and the Powerpack shut off, check the hydraulic oil level in the Powerpack’s hydraulic tank. There should be 6 inches to 8 inches of room left in the hydraulic tank for the hydraulic oil in the Lift System’s Accumulator. If there is less room left or the tank is full while the Accumulator is full of hydraulic oil, the hydraulic tank will overflow when the Accumulator attempts to drain its hydraulic oil back to tank.

Your N2 pressure is now balanced for regular operation.

## Configuration

Once all SJ8000 equipment has been installed, your Zedi Field Technician will update the Controller’s firmware, configure the firmware to your well’s specifications and commission the Controller so that it’s accessible on Zedi Access.

Before startup, your Zedi Field Technician will conduct the following.

- Check all bolts are tight and torqued to specifications.
- Ensure the Support Structure and Concrete Pad is level on the Gravel Pad.
- Ensure the Lift System is aligned to the polished rod so that the Lift System pulls up the rod string as straight as possible.
- Fine tuning of Lift System position may be required after start up.



Before leaving the site, run the SJ8000 for a few minutes to ensure proper installation, alignment and Carrier Bar clamping. During stroking the Carrier Bar assembly must not hit the wellhead at the bottom of the stroke or the sheaves at the top of the stroke, which severely damages the equipment.

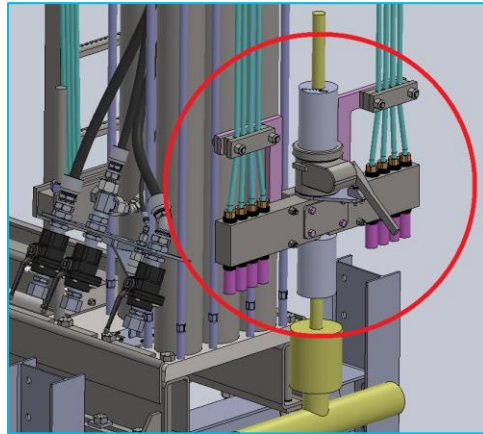
## Removal of Lift System for Workovers and Maintenance

For a well workover and for select maintenance services, the Lift System must be unclamped from the rod string, moved away from the wellhead and returned to its proper position after servicing as per the following instructions. It is best practice to use the Retraction Screw and Handle to crank the Lift System towards the rear of the Support Structure in order to clear the area around the wellhead.



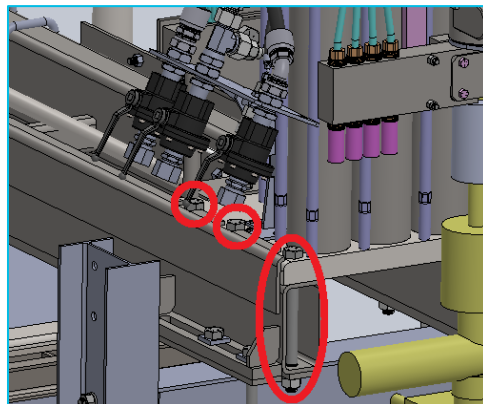
Failure to follow these instructions for the removal of the Lift System may damage equipment and void warranty. Do not remove the Lift System completely off the Support Structure. Doing so may compromise the alignment of the Lift System to the wellhead, which may damage equipment and void the warranty. If you need to completely remove the Lift System and/or Support Structure from the vicinity of the wellhead, contact your Zedi Field Technician.

1. Remove the rod clamps, rod rotator, rod rotator plate and carrier bar from the polished rod at the wellhead.



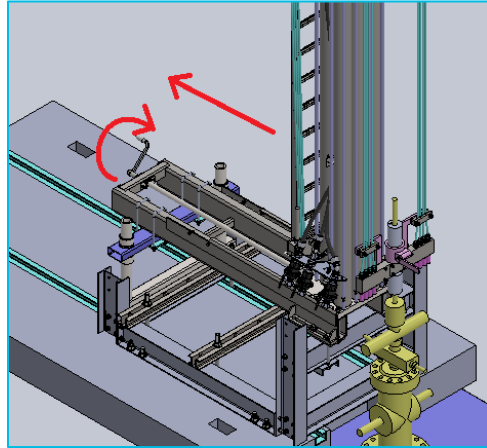
Remove Carrier Bar assembly from polished rod

2. Remove the 6 bolts at the Lift System Bottom Manifold. There are 3 bolts on each side of the Bottom Manifold. Lubricate the surface of the slide rail with grease or other lubricant (path that the cylinder will be moving along) to lower friction during the retraction.



Remove bottom manifold nuts and bolts

3. Crank the Retraction Handle to move the Lift System away from the wellhead.



Crank back the Lift System

4. Move the Lift System to the middle of the Support Structure and not to the very rear, thus ensuring the Bottom Manifold is secured under the Support Structure lip.



Lift System secured at middle of support structure during workover

Once the workover or maintenance service has been completed, reinstall the Lift System onto the wellhead exactly to the dimensions stated in this manual's [Lift System Installation](#) section. Failure to reinstall the Lift System correctly to specifications may damage equipment and void warranty.



Before leaving the site, run the SJ8000 for a few minutes to ensure proper installation, alignment and Carrier Bar clamping. During stroking the Carrier Bar assembly must not hit the wellhead at the bottom of the stroke or the sheaves at the top of the stroke, which severely damages the equipment.