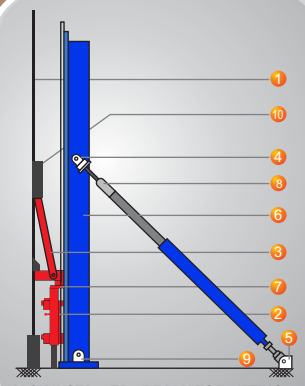
Orione Hydropower

HYDRAULIC TANK JACKING EQUIPMENT

Let's create your
GROWTH STRATEGY
TOGETHER



JACK INSTALLED - READY FOR LIFTING

Description
A tank jacking unit illustrated in the adjacent figure consists of:

1. Shell Plate
2. Hydraulic Jack
3. Lifting Arm with Sliding Chair
4. Upper Lug
5. Lower Lug
6. Vertical Trestle
7. Loading Point
8. Adjustable Stays Pipes
9. Baseplate
10. Slipper / Guide

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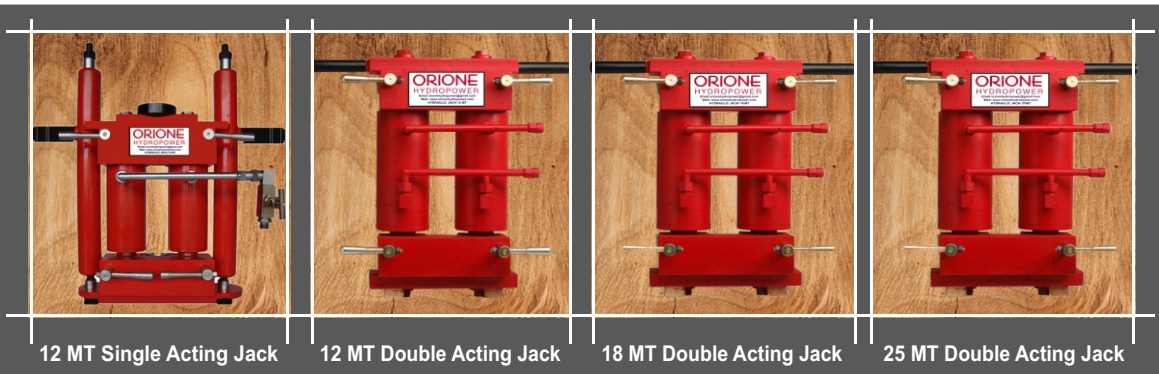


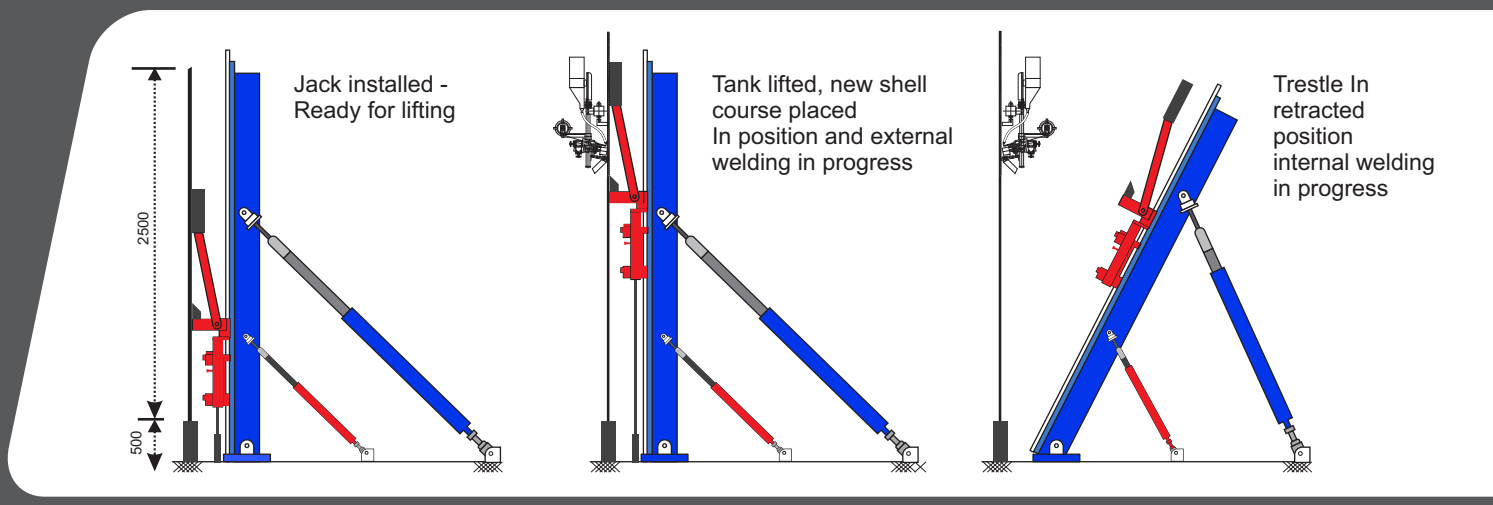
12 MT Single Acting Jack | 12 MT Double Acting Jack | 18 MT Double Acting Jack | 25 MT Double Acting Jack

HYDRAULIC TANK JACKING EQUIPMENT
FOR STORAGE TANKS

POWER PACKS

Description / Models	OTJ-12	OTJ-18	OTJ-25
Working capacity (metric tons)	12	18	25
Testing load (metric tons)	18	27	37.5
Retracting system	Single acting (spring return) / Double acting	Double acting	Double acting
Plate thickness range	range 6-40 mm	range(⩾8mm)	range(⩾8mm)
Arc between jacks/trestles	(1.80 up to 3.5 m)	(1.80 up to 3.5 m)	(1.80 up to 3.5 m)
Shell ring height width minimum	(1,800 mm)	(1,800 mm)	(1,800 mm)

Shell ring height maximum	(2.5 or 3.0 m)	(2.5 or 3.0 m)	(2.5 or 3.0 m)
Jack unitary climbs (mm/stroke)	100 mm	100 mm	100 mm
Time per stroke	(2 to 5 minutes)	(2 to 5 minutes)	(2 to 5 minutes)
Jack weight approx.(kgs)	35	45	55
Trestle complete weight approx.(kgs)	315	400	500
Jack with Trestle set weight approx.(kgs)	350	415	475
Power Pack	**Kgs**	**Liters**	**PSI/ BAR**
10 HP, Max 34 jacks OTJ-12 300 kgs 150 liters 1706 psi	300 Kgs	150 Liter	1706 PSI/ 118 BAR
15 HP, Max 45 jacks OTJ-12 300 kgs 150 liters 1706 psi	325 Kgs	200 Liter	1706 PSI/ 118 BAR
20 HP, Max 65 jacks HLJ-12 350 kgs 300 liters 1706 psi	350 kGS	350 Liter	1706 PSI/ 118 BAR
Retractable Jack	**OTJR-12**	**OTJR-18**	**OTJR-25**



TANK JACKING EQUIPMENT'S OPERATION PROCEDURE

OTJ Assembly Set Up

The following parts are supplied per one OTJ assembly.

OTJ Assembly Part List

Item No.	Qty.	Part Name
1.	1.	Trestle Base Plate
2.	1	Trestle Box
3.	1.	Loading Point
4.	1.	Sliding Chair
5.	1.	Lifting Arm
6.	2	Stay Pipe
7.	2	Upper Lugs
8.	2	Lower Lugs
9.	1	Stud Bolt
10.	1	6 inch Bolt
11.	4	3 inch Bolt
12.	5	Nuts
13.	1	Hydraulic Jack
14.	2	Female 1/2" BSP of 5.0 m Hydraulic Hoses
15.	2	Male to Female 1/2" BSP Elbow
16.	2	Male 1/2" BSP Tee
17.	2	Female 1/2" BSP Needle Valve
18.	2	Male 1/2" BSP Connector

It is recommended the OTJ is first assembled outside the shell ring being erected and then brought inside through the use of a crane/forklift.

The number of jacks required is determined by the size and weight of the tank

Selection Criteria:

1. Jacks **must not exceed** working capacity at any time
2. Ratio **Tank Diameter (Ø)** VS **Tank Height (H)**Max applicable tank height using lifting jacks is 25 m For Ø ≥ H. Use jacking system with appropriate number of jacks For H ≤ Ø ≤ 2 H. Lifting Jacks can be used **ONLY** with written authorization from M/s Orione Hydropower.

Tech Support:

For H >2 Ø. **Unsafe. Never lift** a tank

3. Number of jacks/trestles calculation

a. A = W x WLF / Ω

W: Tank lifting weight in metric tons not considering bottom ring and annular plate

WLF: Wind load factor use 1.20 for max speed of 57.6 km/hr. Ω: Jack rated working capacity (eg. use 12 for OTJ 12)

b. B = π x Ø / 3.50 Ø: Tank diameter in meters Max arc spacing: 3.50 m

c. C = Select the greatest value between A and B

d. D (Jacks Spacing) = π x Ø / C

e. If D ≥ 1.80 then C is the number of jacks required

f. If D < 1.80 redo the calculation using a higher rated jack

Note: Tanks with permanent column roof support need two additional jacks/trestle per column

4. Arc distance between jacks **MUST NOT** exceed 3.50 m
5. Wind speed when lifting **MUST NOT** exceed 57.6 km/hr (16 m/s)
6. Max shell ring height depends of selected trestle: 2.5 m or 3.0 m
7. Min shell ring height: 1.80 m. If first shell ring sits on annular plate
8. Min shell ring height: 1.00 m. If shell ring sits on beam spacers of0.80 m
9. Plate thickness less than 6.00 mm: Use special reinforcement
10. Jacking system **CANNOT** be removed during tank erection. Remove **ONLY** after the tank is fully lifted and bottoring has been welded to the annular plate

Working Principle:

a. The tank foundation is ready made. Base plates are laid out and welded.

b. The periphery of the tank is marked out on the base plates. Guide members for shell plates are erected.

c. The top shell plates are erected and welded vertically. The roof trusses are assembled and joined to the top shell plate.

d. Lifting trestles with hydraulic jacks are fitted internally (or externally for base repair) along the periphery of the tank. The number of jacks required Is determined by the size and weight of the tank. Stability Calculations are carried out while determining the number Of jacks to be deployed.

e. Lifting lugs and guide lugs (fend-off lugs) are welded to the shell plates

f. The hydraulic jacks are connected in a series by means of high pressure hoses and are connected to a high pressure pump from which all jacks are jointly served. A slipper with a lifting arm transfers the fitting power over a lifting lug welded to the shell plate.

g. The top shell plate and roof construction are lifted one plate high along with the center column if the roof is supported by it.

h. The slipper engages a guide lug and thus keeps the shell ring in the correct position during the hoisting operation.

i. The roof plates are fitted and welded in place. At the same time, the next shell plats are fitted and welded.

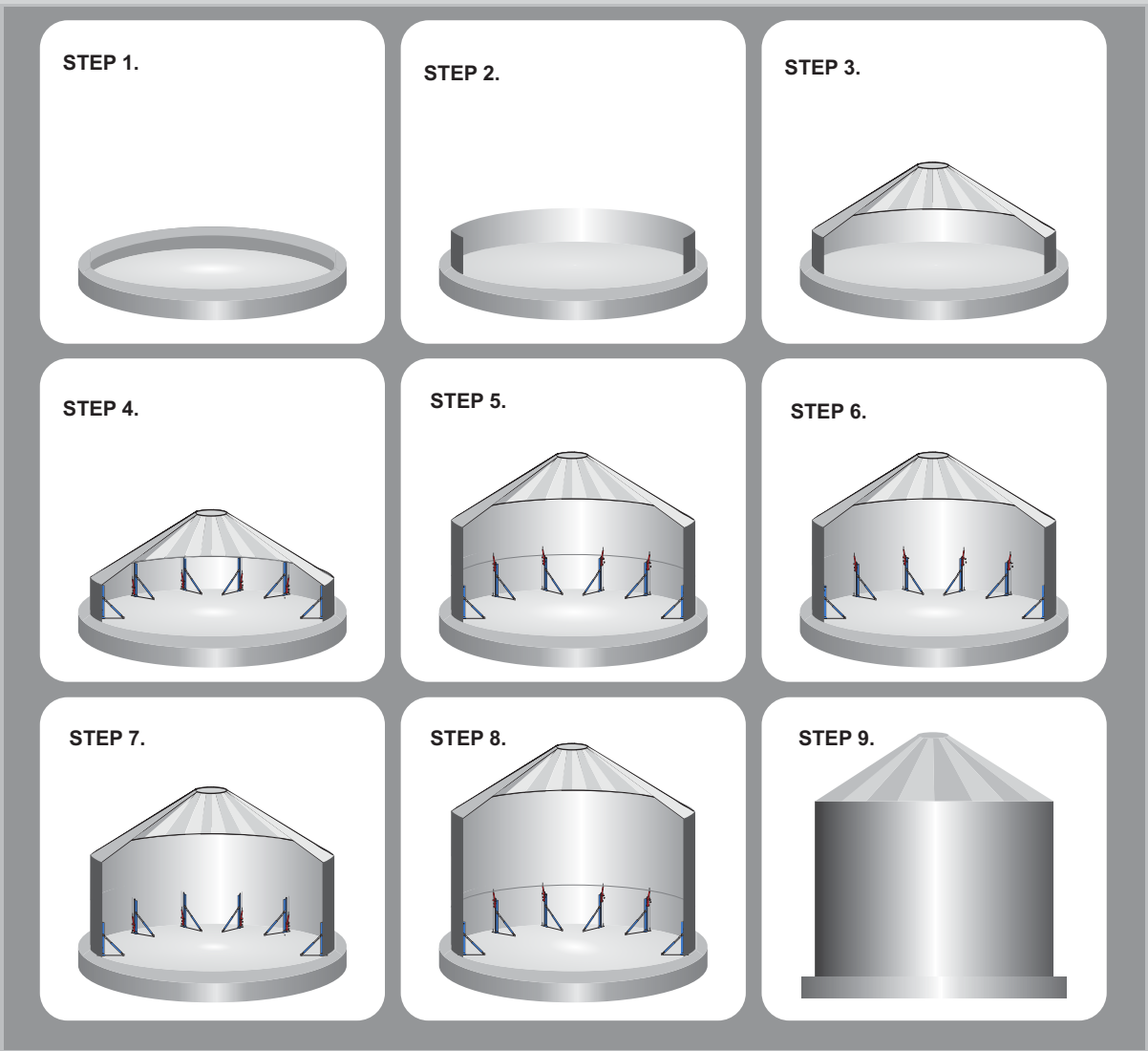
j. The lifting lugs and guide lugs are removed from the top shell plate and are welded to the next shell plate. The hydraulic jacks are lowered to the original lifting position.

k. The tank is lifted again to allow the continued erection of shell plates until the full height of the tank has been reached.

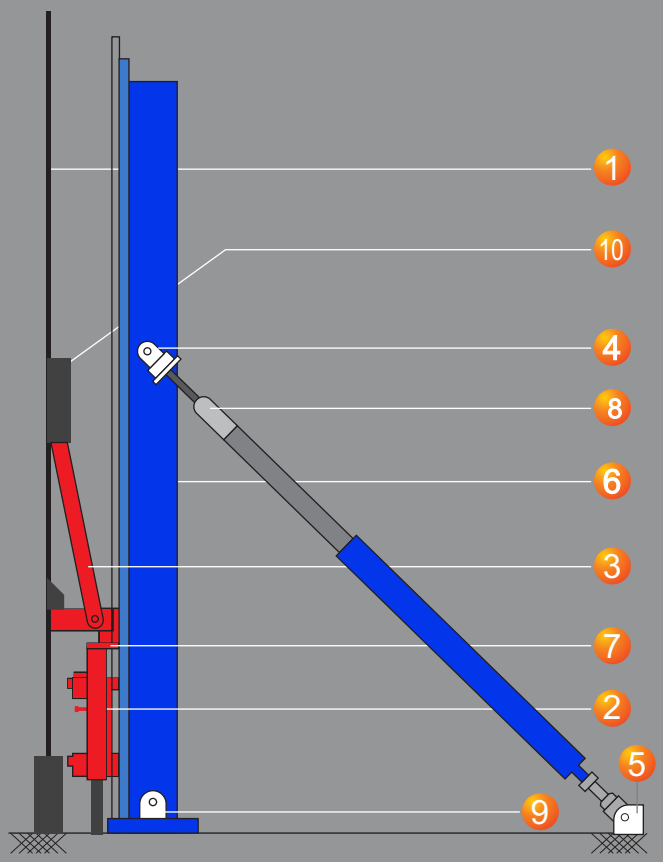
l. When the last shell plate is fitted and welded in place, the finished tank is lifted slightly so that the guide members can be dismantled.

m. The tank is lowered; the shell plates and the base plate are welded together.

n. The jacking equipment is dismantled.



OTJ ASSEMBLY SET UP



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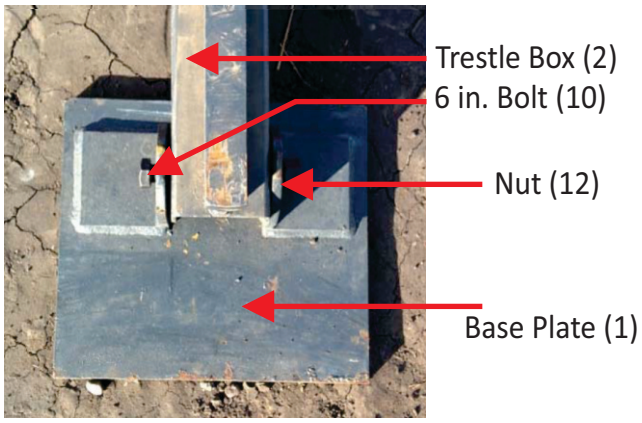
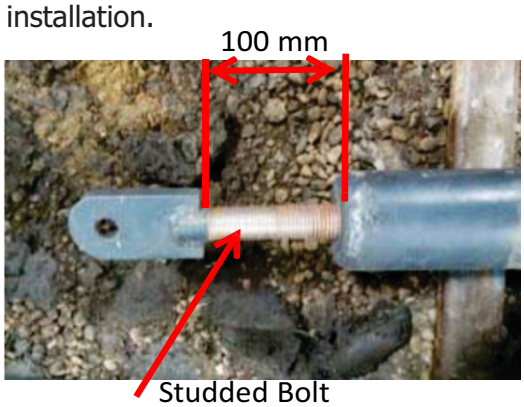
6. Vertical Trestle
7. Loading Point
8. Adjustable Stays Pipes
9. Baseplate
10. Slipper / Guide

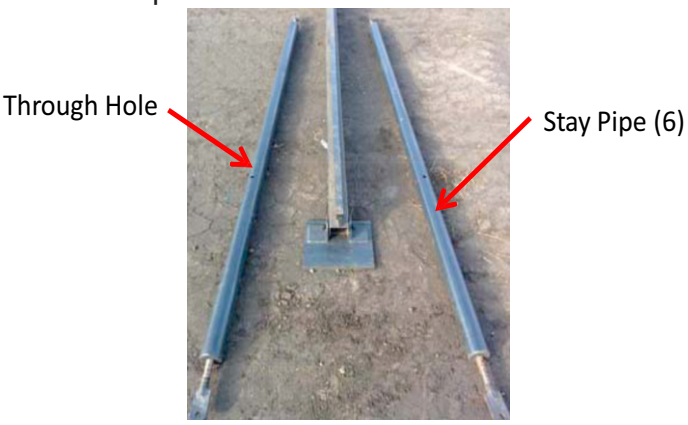
1. The base plate is laid on the ground facing upright. The trestle box is position and fixed to the base plate with the adequate bolt and nut as shown below. Ensure the bolt and nut fasten properly.



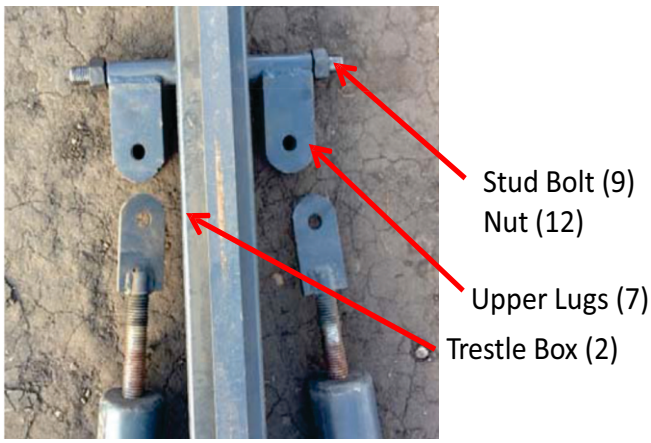
2. The stay pipe studded bolt needs to be screwed out to a distance of 100 mm as shown below. This needs to be done to both ends of the stay pipes. This allows proper adjustment later in the installation.



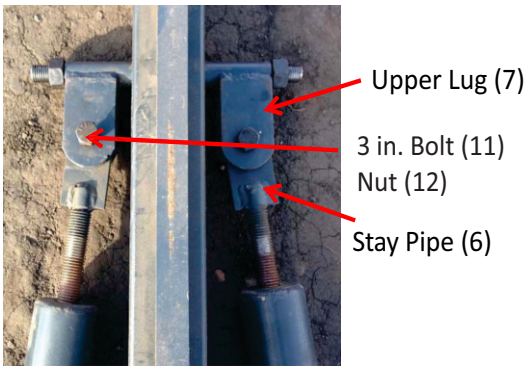
3. The stay pipes are then laid in the adequate position as shown below. The location of the through hole in the stay pipe need to be closets to the base plate.



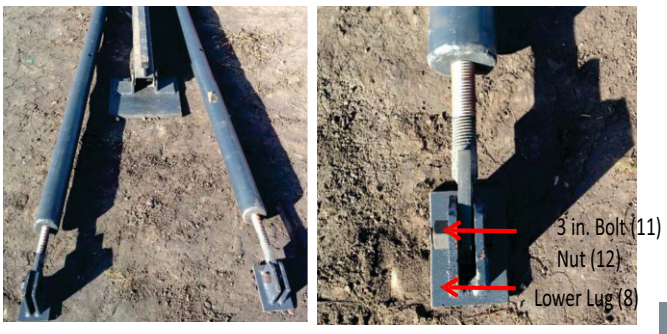
4. The stud bolt is then inserted in the hole located about halfway through the trestle box. The upper lugs are fixed to the stud bolts with the adequate nuts as shown below. Ensure the stud bolt and nuts are fasten properly.



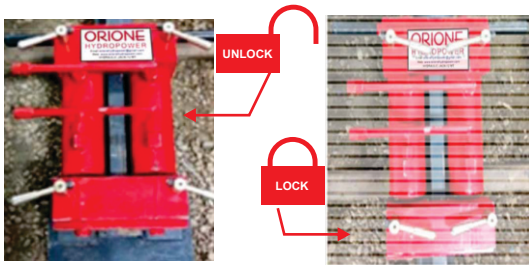
5. The stay pipes are then positioned and fixed to the upper lugs with the adequate bolts and nuts as shown below. Ensure the bolts and nuts are fasten properly.



6. The lower lugs are then positioned and fixed to the opposite side of the stay pipes with the adequate bolts and nuts as shown below. Ensure the bolts and nuts are fasten properly.



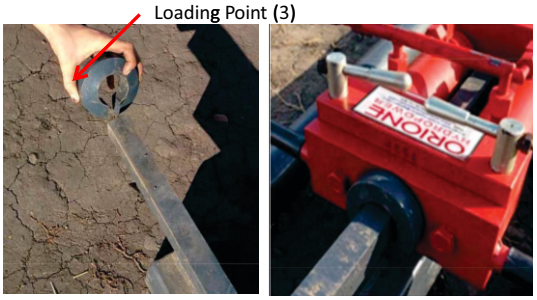
7. They hydraulic jacks can be locked and unlocked through the use of its four levers. The levers position shown below activates the locking and unlocking mechanism. Always ensure that top and bottom levers are in their correct position when switching from locking to unlocking and vice versa.



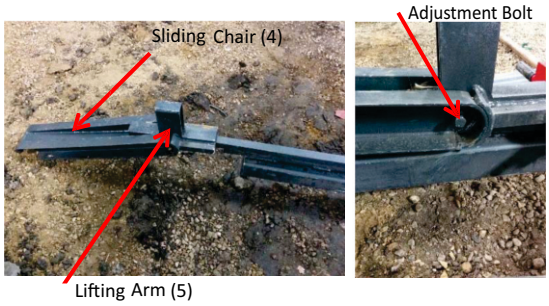
8. The hydraulic jack is then mounted into the trestle

box rail as shown below. Ensure that before mounting into the rail the levers in the hydraulic jack are in their **unlock** position. Once the hydraulic jack is mounted make sure the levers in the hydraulic jack are in their **locked** position.


9. The loading point is then inserted from the top end of trestle box rail with the concave side of the loading point entering first as shown below.

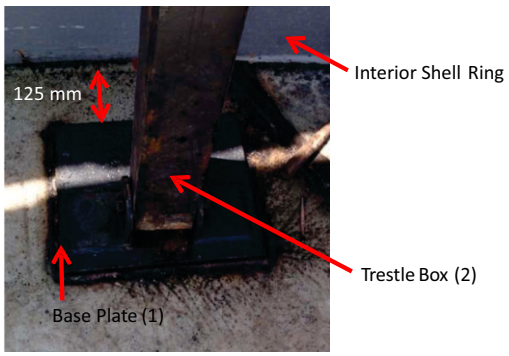


10. The sub-assembly compose of the sliding chair and lifting arm is then inserted from the top end of the trestle box rail and is slid along and rested on top loading point as shown below. If the sub-assembly is not sliding smoothly unbolt the bolt connecting the trestle box and sliding chair just enough so the assembly slides smoothly up and down the trestle box rail.

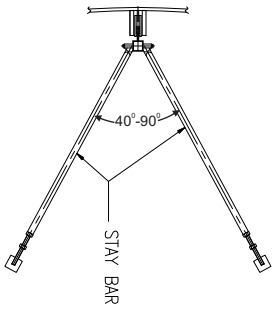


11. The OTJ is then brought inside the first shell ring through the roof openings left open. The OTJ is rigged as seen below.

12. The base plate is position at a distance of 125 mm away from the tank shell ring as shown below. The base plate is welded all around to the tank annular plate with a fillet weld size of 6 mm.



13. The stay pipes are then spread open and placed so an angle of 40-90 degrees is produce between the two stay pipes as shown below. The lower lugs are then welded to the tank annular plate all around with a fillet weld size of 6 mm.



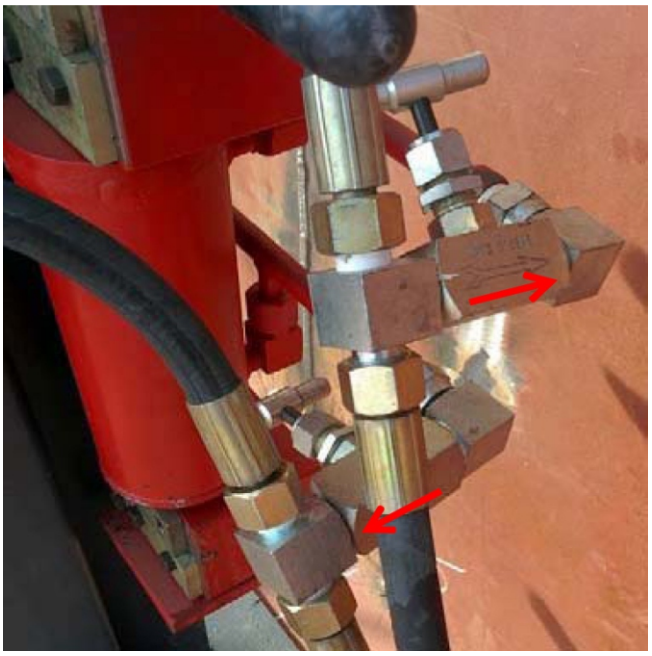
14. The trestle box is then leveled and ensured that it sits perpendicular to the annular plate on its four faces This is done by faces. checking the trestle box faces with a bubble level and turning the stay pipes through the use of the studded bolts.

15. The arc distance between each OTJ assembly being placed inside the periphery of the tank needs to be between 1800 mm (min) – 3500 mm (max). The arc distance should be symmetrical with equal spacing between all the OTJ. It is common for the stay pipes of a OTJ assembly to cross with those of another OTJ assembly as the arc length distance get closer to the min.

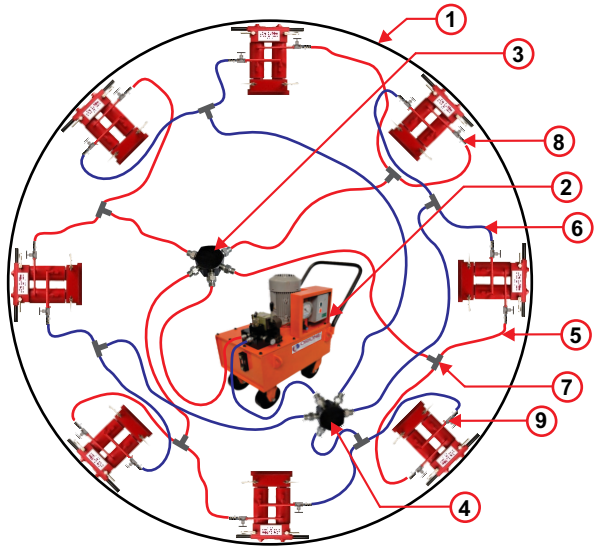
Hydraulic Hoses and Fittings Set Up

16. The valves and associated fittings are then connected in each hydraulic jack as seen below. The needle valve has an arrow showing the direction of flow; ensure it is properly placed as seen below.

Thread seal tape must be applied to each of the fittings being connected.



17. The hydraulic hoses are then connected as seen in the below diagram. The 5 way blocks areused in order to evenly distribute the hydraulic oil throughout the system. This will ensure the shell ring being erected is lifted evenly. The hydraulic hoses connected into the power pack need to be in the sequence as seen below. The red hoses indicate outgoing hydraulic oil and the green hoses indicated incoming hydraulic oil. There must also be a needle valve connected prior to connecting the outgoing hydraulic oil hoses to thepower pack as seen above and below.



1. Shell Plate Ring
2. Power Pack
3. 5 Way Block- "A"
4. 5 Way Block- "B"
5. Female 1/2" BSP, 5m Hydraulic Hoses- "A"
6. Female 1/2" BSP, 5m Hydraulic Hoses "B"
7. Male 1/2" BSP Tee
8. Quick connect coupler
9. Needle Valve

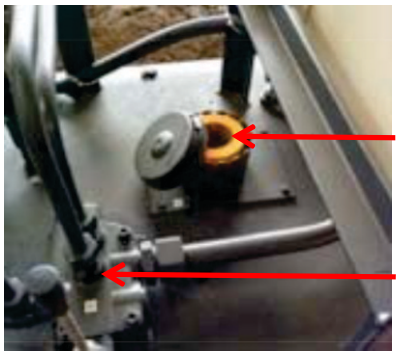
Hydraulic Power Pack Set Up

18. Ensure that all hoses connections in the system are tightly seal and thread seal tape at each hose joint to avoid any leakage during operation.

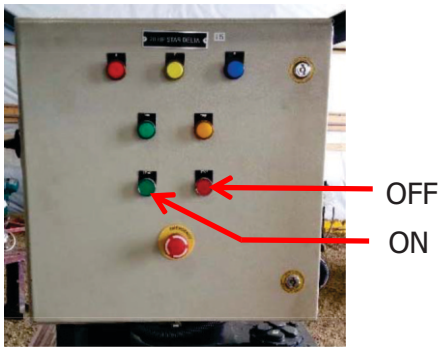
19. Fill the power pack with the adequate oil based on the environment working temperature. The hydraulic fluid inlet cap is removed and the power pack is filled as shown below.

Temperature	Oil Specs
Below 0°C (32°F) Mobil Oil 10W	Mobil Oil 10W
0°C to 25°C (32° F to 80°F)	Mobil Oil 20W-20
Above 25°C (80°F)	Mobil Oil 30 or any oil with viscosity of 68

Power Pack Model	Weight Empty (kg)	Oil Tank Capacity (Liters)
10	300	150
15	325	200
20	350	350



20. Connect the main control box to the power source as per the principal electrical diagram in Section 10. Press the ON button and hold for two seconds. Ensure the direction of the motor fan is rotating in the clockwise direction.



21. The following steps are carefully followed in order to properly fill the system with hydraulic oil (hoses and hydraulic jacks) prior to any shell ring erection. This steps will also ensure that no air goes into the system.

a. The hydraulic jack levers top and bottom need to be in their lock position.
b. All the needle valves in the system need to be open to half (four full turns).
c. Power pack should be completely filled with hydraulic oil. Check oil level indicator.
d. Turnthe Power Pack ON.
e. The operation level is then pulled and hold.

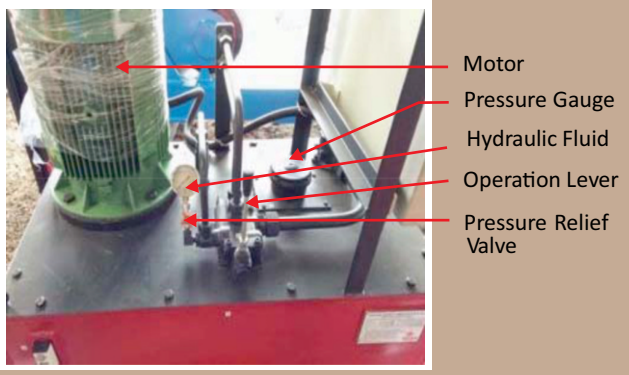
Hydraulic oil should begin to travel across the hoses and into the hydraulic jacks. The hydraulic jack should slowly begin to extract its piston 100 mm. It will be indicated that all the pistons have been extracted completely by a drastic increase in pressure.

f. The operation leaver is then pushed and hold. The hydraulic jack should slowly begin to retract its piston 100 mm. It will be indicated that all the pistons have been retracted completely by a drastic increase in pressure.

g. The oil level indicator is then checked It is expected to be low since the system is being checked. filled. The power pack is then refilled with hydraulic oil until the oil level indicator reads half.

h. In steps e-f the hydraulic jacks have completed a full cycle and unitary climb of 100 mm. This same process is repeated two times.

I The system is now ready to erect the first shell ring. The hydraulic jacks are lowered manually by hand. This is done by unlocking the top and bottom hydraulic jack levers and slowly sliding the hydraulic jacks until they touch the ground level. The top and bottom levers are then put in their lock position.



Lifting and Fend Off Lugs Set Up

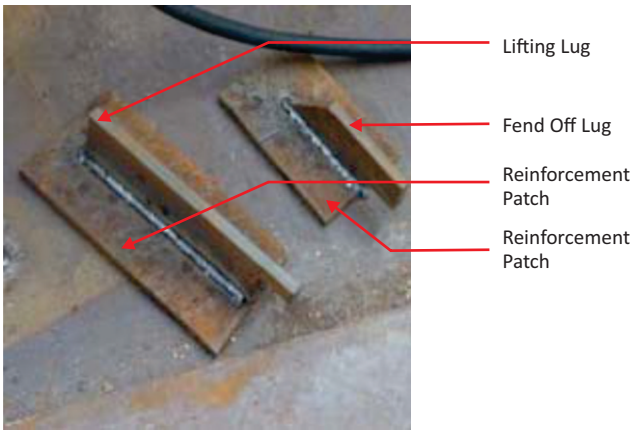
22. The lifting and fend off lugs are **not** supplied by Orione Hydro power and must be manufacture by the user using the same material as the tank being erected. The lifting lug is used as the load point when erecting the tank. The fend off lugs is used as a safety measured and no direct load should be applied when erecting the tank. The lifting and fend off lugs must be manufacture according to the following two cases.

Case 1: When the shell ring being erected has a thickness larger than 6 mm. In this case thelifting and fend off lugs are manufacture with accordance to drawings CC-2 to CC-6.

Case 2: When the shell ring being erected has a thickness of 6 mm or less. In this case the lifting and fend off lugs are manufacture using the same drawing as case 1 but a special precaution is taken. A reinforcement patch plate is welded directly to the lifting and fend off lugs all around with a fillet weld of 6 mm.

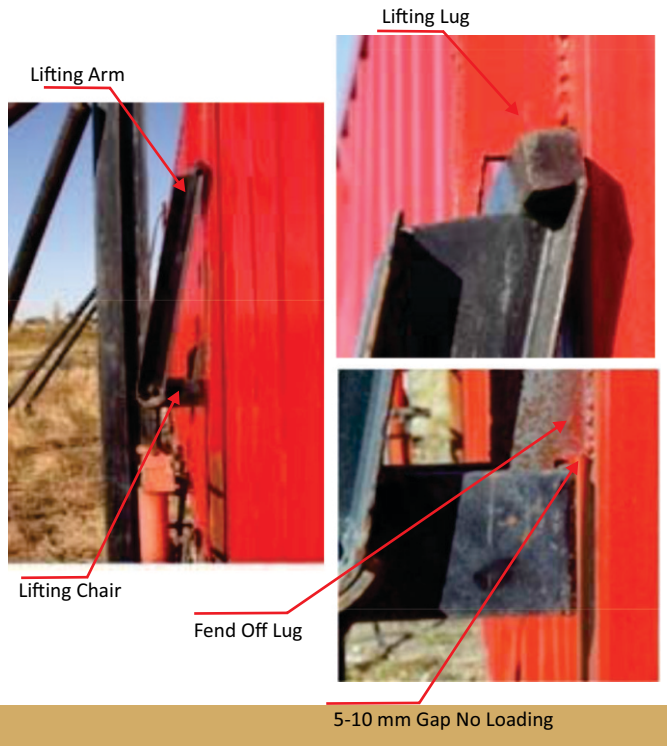
Dimensions of reinforcement patch:

Lifting Lug: 150 mm x 300 mm x 12 mm (same material as shell ring being erected) Fend Off Lug: 150 mm x 200 mm x 12 mm (same material as shell ring being erected)



In case buckling is observed an addition a curved ring with the same radius as the tank shell fabricated of mild steel angle (75x75x75 angle) or plate 12 mm thick sections of 1 meter in length can be used and placed on top of the lifting lug and stich welded to the tank shell plate.

23. The lifting lugs are then welded to the shell ring being erected one for each OTJ with a fillet weldof 6 to 8 mm all around. Ensure that all the lifting lugs are welded at the same level slightly abovethe point where the lifting arm touches the shell ring. The fend off lugs are welded to the shellring being erected in such a manner that there is a minimum gap of 5 mm between the bottomedge of the fend off lug and the upper edge of the sliding chair. It is important to note the fend off lugs should not be taking any direct load when erecting the shell ring at any time.



24. The following safety precautions need to be carefully followed and completed before erecting the shell ring.

a. Bolts have been properly fasten in all the OTJ assembly.

b. Hoses and fittings have been properly connected with thread seal tape.

c. All the necessary welds have been properly done; as per previous instructions.

d. The system must be properly filled with hydraulic oil (refer step 22)

e. The hydraulic jack levers top and bottom need to be in their **lock position**.

f. All the needle valves in the system should be halfway open (four full turns).
The following instructions need to be follow in order to erect the first shell ring and lowered to sit on top of the second shell ring.

g. The erected first shell ring needs to be lifted to the following height:
Height of second shell ring + Desirable Gap – 30 mm

h. Slowly pull the operation lever until the hydraulic jack's piston have extracted 100 mm. It will be indicated that all the pistons have been extracted completely by a drastic increase in pressure.

i Slowly push the operation lever until the hydraulic jack's piston have retracted 100 mm. It will be indicated that the pistons have been retracted completely by a drastic increase in pressure.

Hydraulic Jack Pistons Extracted

Hydraulic Jack Pistons Retracted

j. Steps h-i the hydraulic jacks have completed a full cycle and unitary climb of 100 mm.

k. Ensure that when lifting the pressure stays between 80-120 bars. Start lifting with pressure of 80 bars; gradually increase the pressure as needed. This can be done by closing the pressure relief valve.

l. Repeat steps h-k until the desirable height determined in step g is reached. It is important to note that not all hydraulic jacks will reach the desirable height at the same time. As soon as a hydraulic jack reaches the desirable height close the needle valves for that hydraulic jack and redo this process for all the hydraulic jacks.

m. Once the desirable height has been reached ensure that the hydraulic jack pistons have been completed retracted.

n. Close all the needle valves on all the hydraulic jacks.

o. Open the needle valves on the first hydraulic jack being lowered.

p. Unlock the lower levers on the first hydraulic jack being lowered. Note: the lower levers should unlock smoothly do not force the handle to the point of bending/breaking.

q. Pull or push the operation lever until the hydraulic jack pistons have extracted 70 mm close the needle valve and set the lower levers to the lock position.

r. Repeat steps o-q for the rest of the hydraulic jacks.

s. Open all the needle valves on all the hydraulic jacks.

t. Pull the operation lever all the way this will cause an additional lift of 30 mm The mm. hydraulic jacks must be in a complete piston extraction position (that is 100 mm). While pulling and holding the operation lever close the needle valve coming out of the power pack (outgoing hydraulic oil). This will ensure the load is transmitted to the lower lever locks.

u. Unlock all the upper levers in all the hydraulic jacks. Note: the upper levers should unlock smoothly do not force the handle to the point of bending/breaking. The first shell ring being lifted should now sit at:

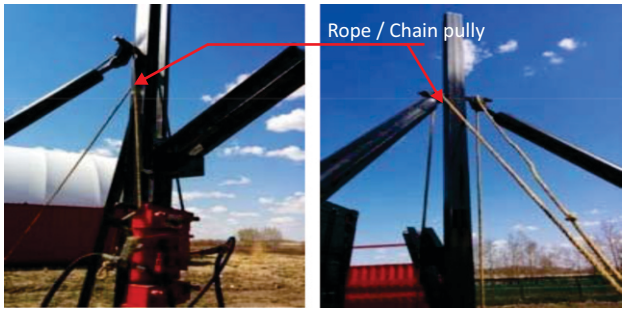
v. Height of the second shell ring + Gap (3 or 5 mm)

w. The second shell ring is then built. The first shell ring is then lowered by opening the needle valve coming out of the power pack (outgoing hydraulic oil) slowly. The hydraulic jack pistons should retract slowly due to the weight of the first shell ring erected. After the needle valve is open it will take a few minutes before the first shell ring completely sits on top of the second shell ring. The hydraulic jacks are then manually lowered to the required height were the second shell ring will be erected from.

x. The hydraulic jacks are lowered through the use of a rope system as seen below Ensure that as one person holds the rope the other sets the upper below. and lower levers in the unlock position.

y. The lifting and fend off lugs are then removed from the first shell ring and welded to thesecond shell ring.

z. Step g-y is the repeated for the rest shell rings being erected.



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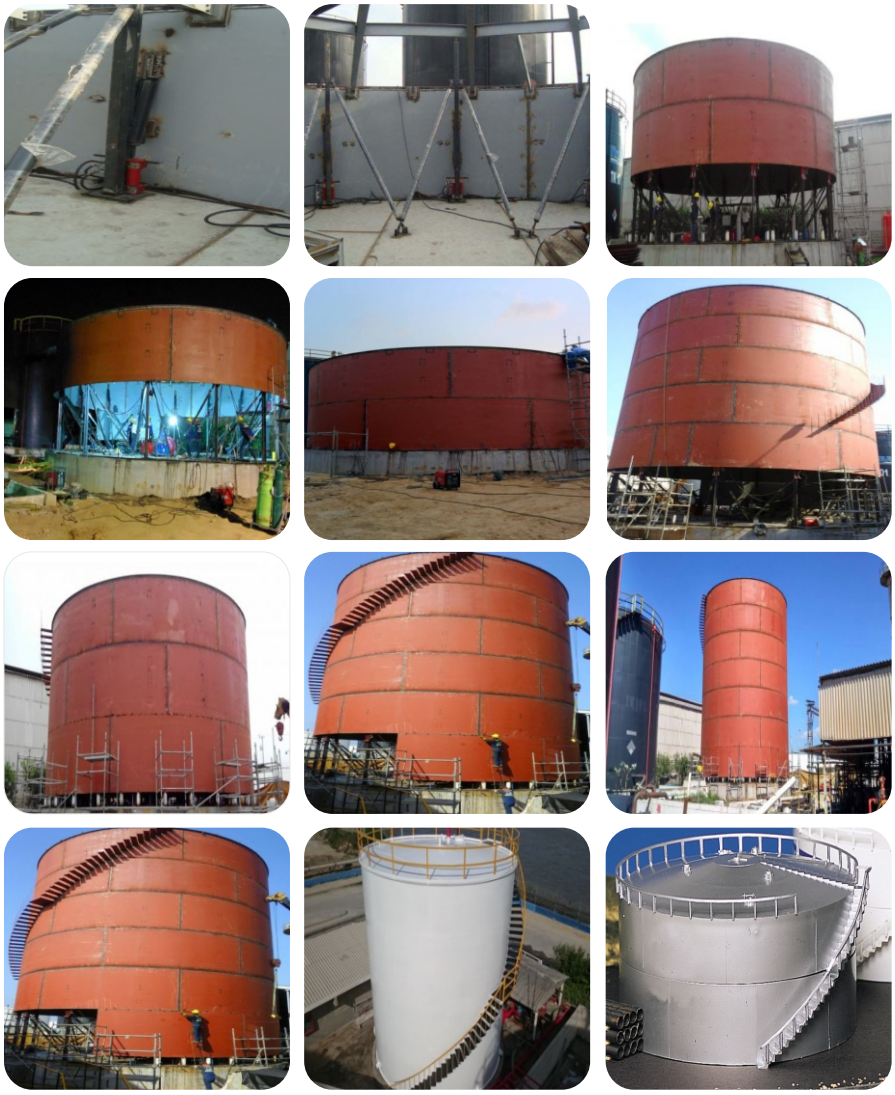

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