Operation Manual

350 Ton Shuttle Spider

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TABLE OF CONTENTS

SAFETY

READ THIS MANUAL BEFORE USING EQUIPMENT

Equipment supplied by Texas International Oilfield Tools is intended for installation and use in controlled environments involving hazardous operations and situations.

Only authorized and trained personnel shall install, maintain, operate and/or repair equipment supplied by Texas International Oilfield Tools, LTD. Equipment shall be used only for the purpose for which it is intended.

The User is responsible for ensuring the equipment is in safe working order prior to use. Texas International Oilfield Tools, LTD is not responsible for injuries or equipment damage that arises from equipment neglect or misuse.

The User is responsible for ensuring the safety of all personnel within the vicinity of the equipment. Texas International Oilfield Tools recommends a risk assessment be performed by qualified safety representatives prior to using equipment. All personnel shall possess and use Personal Protective Equipment (PPE) and must be trained at minimum on rig safety, rig procedures, and equipment operation.

Specific detailed instructions and information about shop practices or procedures, operation and service, and safety criteria are not included. Warnings, explanations, and information are provided herein to advise readers to take deliberate action to prevent damage to or failure of equipment and protect personnel from potential injury or lethal conditions. The information provided does not cover all possible hazards or consequences.

Hazard Labels Used in this Manual

DANGER is represented by this hazard symbol and signifies the highest level of risk. Failure to observe and heed this information may result in serious bodily injury or death.

WARNING is represented by this hazard symbol and signifies potential hazards of medium risk. Failure to observe and heed this information may result in significant bodily injury, catastrophic equipment failure, and/or environmental contamination.

CAUTION is represented by this hazard symbol and signifies potential hazards of low risk. Failure to observe and heed this information may result in bodily injury, equipment failure, and/or environmental contamination.

NOTICE symbol denotes items of importance unrelated to personal injury which highlight additional information provided to aid the user during installation, commissioning, operating, and/or maintaining equipment.

Please pay close attention to these advisories.

INTRODUCTION

Texas International Oilfield Tools (TIOT) offers hands-off Shuttles for positioning Spiders over well center. The units are operated from a control console and feature pneumatic slip control, hydraulic door pin removal and insertion, hydraulic door open and close, and hydraulic positioning of the Spider over and away from well center.

When the slip assembly is in the unset (open) position, the tubular and couplings move vertically up or down thru the slips as needed and without interference. The door pin can be pulled, the door can be opened, and the Trolley (and spider) can be moved away from well center from the control console. When the slips are in the set (closed) position, the tubular is held firmly, and a safety locking mechanism prevents the slips from opening. Also, in the set position, the hydraulic system is safely locked so that the pin cannot be pulled, the door will not open, and the Trolley (and spider) cannot move away from well center.

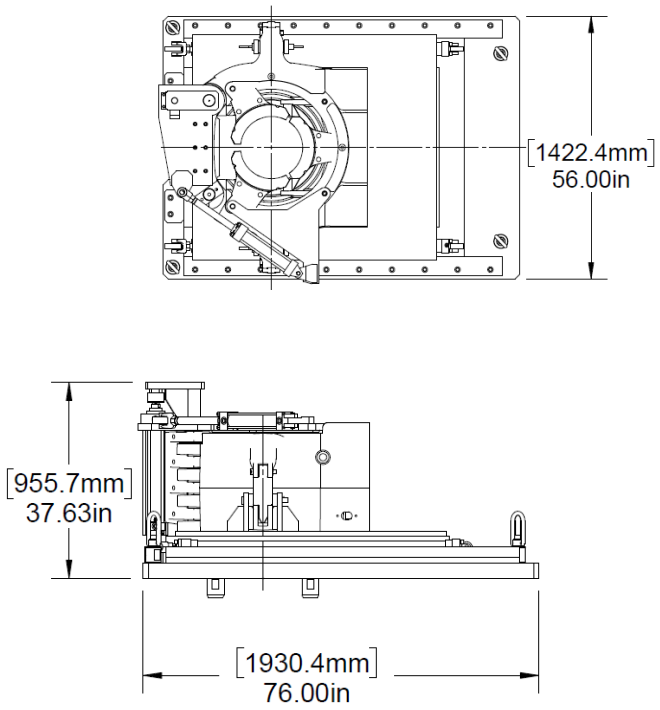
FIGURE 1

SPECIFICATIONS

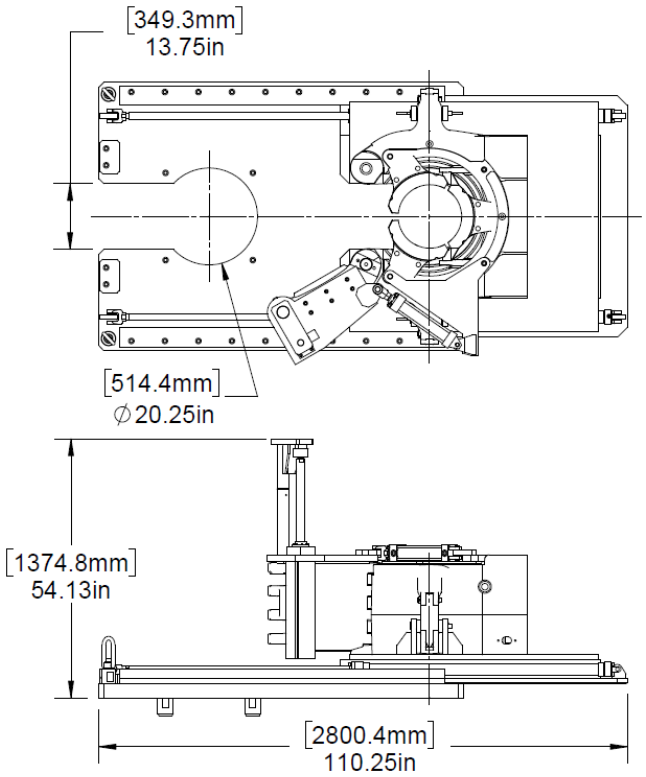
DANGER Do not exceed rated capacities. Equipment damage and serious bodily injury or death could result.

350 Ton Shuttle Spider						
Capacity	**Weight**	**Tubular Sizes**	**GPM**	**Operating Pressure**		
				Hydraulic		**Pneumatic**
350 Tons	11,000 lbs (4990 kg)	4-1/2” thru 13-3/8”	60 gpm Max	Operating:	1200 psi (82.7 bar)	85 – 125 psi (5.9 – 8.6 bar)
				Max:	1650 psi (113.8 bar)	

Table 1



Over Hole Retracted (Operating) Position
Figure 2



Off Hole Extended Position
Figure 3

INSTALLATION

DANGER

Do not stand on the surface of the Shuttle Spider baseplate. The surface is extremely slippery, and the shuttle trolley can start unexpectedly.

WARNING

The Shuttle Spider assembly must be lifted by the lifting eyes only. Do not lift the assembly by the spider ears.

WARNING

When moving the Shuttle Assembly onto the rig floor and over well center, make sure the trolley is all the way forward on the baseplate, door closed, pin down, and rear lifting lugs are installed.

CAUTION

Lifting the Shuttle Spider Assembly should be performed using four slings, each sling to be minimum 8 feet in length.

NOTICE

The Quick Disconnect supply & return connections at the Trolley and at the Control Console are color coded, reversed male and female, and uniquely sized to prevent incorrect connections. (Figure 4 and Figure 5).

Trolley Supply & Return Connections
Top Row Trolley Connections are in the same order as Bottom Row Control Console Connections
Figure 4

Control Console Supply & Return Connections
Top Row Control Console Connections are in the same order as Bottom Row Trolley Connections
Figure 5

Installation

- ☐ Install the appropriately sized slips for the tubing run into the spider (See Assembly & Disassembly Section).
- ☐ Ensure that the Shuttle Spider and components are fully lubricated per the Lubrication section.
- ☐ Move the Shuttle Spider Assembly to the rig floor using four slings, each sling to be minimum 8 feet in length and connected to the four lifting points (Figure 6 & Figure 7).
- ☐ Move the unit over well center and align the pins underneath the baseplate with the Kelly drive pin holes of the master bushing.
- ☐ Set the unit down and ensure that the baseplate is sitting flat on the rig floor.
- ☐ Remove the two lifting lugs at the back of the baseplate and set aside. (Figure 7).
- ☐ Connect the supply lines to the back of the spider. (Connections are color coded, reversed male and female, and uniquely sized to prevent incorrect connection). (Figure 4)
- ☐ Connect the other ends of the supply lines to the Control Console. (Connections are color coded, reversed male and female, and uniquely sized to prevent incorrect connection). (Figure 5)
- ☐ Connect the Hydraulic Supply and Hydraulic Return lines from the power unit to the Control Console (Figure 8).
- ☐ Connect the Pneumatic Supply to the Control Console (Figure 8).
- ☐ Start the hydraulic power unit and check for air or hydraulic fluid leaks.
- ☐ Operate the unit several times to check functionality of the door pin, door, trolley, and slips. (Refer to the Operation section for instructions).

Safety Check

When checking functionality, the following check is recommended:

With the slips in the set (closed) position, attempt to extend (raise) the door pin by turning the Door Pin lever clockwise to the UP position. ***The pin should not raise. If it does, immediately pull the Shuttle Spider Assembly from service and contact TIOT for assistance.***

DANGER

When moving the Shuttle Assembly off the rig floor and off well center, make sure the trolley is all the way forward on the baseplate, door closed, pin down, and rear lifting lugs are installed.

Figure 6

Figure 7

Hydraulic & Pneumatic Connections on Control Console

Figure 8

OPERATION

DANGER Personnel must stay clear of the Shuttle Spider assembly during operation.

WARNING The Shuttle Spider Trolley will extend beyond the back of the baseplate. Keep the area at the back of the baseplate clear of personnel and obstacles such as tools or other equipment.

WARNING Only trained knowledgeable personnel should operate the equipment.

CAUTION TIOT recommends a safety risk assessment be carried out prior to operation.

Shuttle Spider Operation

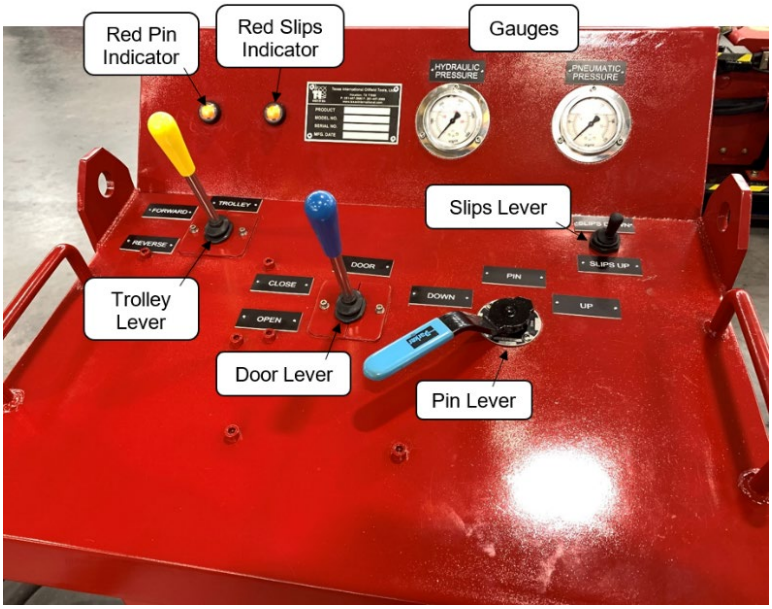
NOTICE The starting and finishing position of the Shuttle Spider Assembly operation sequence is the Shuttle Spider Baseplate in place over well center, slips raised up, door pin raised up, door is open, shuttle trolley is extended to the rear of the baseplate.

NOTICE The Trolley can extend fully to the rear; however, the Trolley should only be extended to the optimum position where the Silver alignment marks (on the Spider ear and Baseplate) are aligned (Figure 9).

Silver alignment marks on the Spider ear and Baseplate
Figure 9

Setting up the Shuttle Spider for Operation:

☐	With the Shuttle Spider in place over well center per the Installation Section, move the Slips to the up or open position by pulling the Slips lever to the SLIPS UP position. The Slip Indicator will turn Red (Figure 10).
☐	Turn the Pin lever clockwise to the UP position. The pin should raise and stay in the up position and the Pin Indicator will turn Red (Figure 10).
☐	Pull the Door lever to the OPEN position. The Door should open and stay open.
☐	At this point, the Trolley should be centered over the well center hole and ready to accept tubulars. If the Trolley needs to be clear of well center pull the Trolley lever to the REVERSE position. The Trolley should move to the rear of the baseplate.

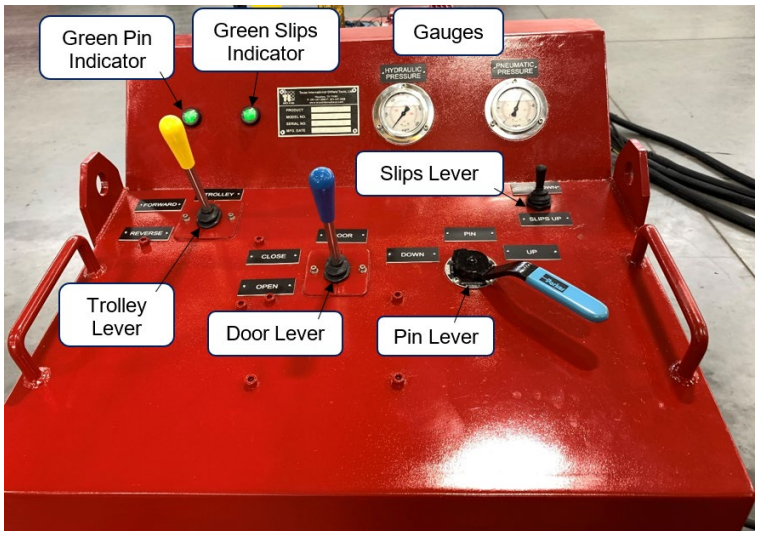


Control Console – Red Indicators

Figure 10

Positioning the Spider over Well Center:

☐	Turn on pneumatic and hydraulic power sources.
☐	Slowly activate the trolley assembly by pushing the Trolley lever to the FORWARD position. The trolley should approach well center. Release the lever when the Trolley reaches the stop blocks.
☐	Close the door by pushing the Door lever to the CLOSE position and release the lever when the door has closed.
☐	Insert the Door Pin by turning the Door Pin lever counterclockwise until the Door Pin is fully seated. The Pin Indicator should be Green (Figure 11).
☐	To grip a tubular in the well center hole, push the Slips lever to the SLIPS DOWN position; the locking mechanism will automatically release, the slips will lower and set (grip) on the tubular. The Slips Indicator should be Green (Figure 11).



Control Console – Green Indicators

Figure 11

The Slip Assembly can be set (closed on the tubular) and unset (open and off the tubular) as needed while running the tubular string. The Door Pin will not release, and the Door cannot open when the Slip Assembly is set.

The tubular running position of the Shuttle Spider Assembly is the Shuttle Spider Baseplate in place over well center, the shuttle trolley in place over well center, door is closed, door pin is seated, and slips will operate up or down for running tubulars.

Pulling the Spider Away from Well Center

☐	When the tubular running operation is complete, pull back the Slips lever to the SLIPS UP position; the locking mechanism will automatically release, and the Slip Assembly will raise and unset (release) the tubular. (The Slips Indicator will turn Red).
☐	Extend the Door Pin by turning the Door Pin lever clockwise to the UP position until the Door Pin is fully raised. (The Pin Indicator will turn Red).
☐	Open the Door by pulling back on the Door lever to the OPEN position.
☐	Slowly move the Trolley assembly away from well center by pulling back on the Trolley lever to the REVERSE position. Release the lever when the Trolley extends beyond the back of the baseplate and the trolley cylinders are fully extended.

ASSEMBLY & DISASSEMBLY

WARNING Only trained knowledgeable personnel shall perform assembly or disassembly of equipment.

CAUTION Use caution when handling and lifting parts.

NOTICE All disassembly and assembly should be performed away from well center in a clean and dry area.

Changing Slips

Slip Assembly: Removal

☐	Raise the Slip Assembly to the open position
☐	With an overhead crane or other suitable device, lift the Slip Assembly just enough to relieve pressure on the slip retainer pins.
☐	Remove the two cotter pins and two slip retainer pins from the yoke.
☐	Lift the Slip Assembly out of the spider body.

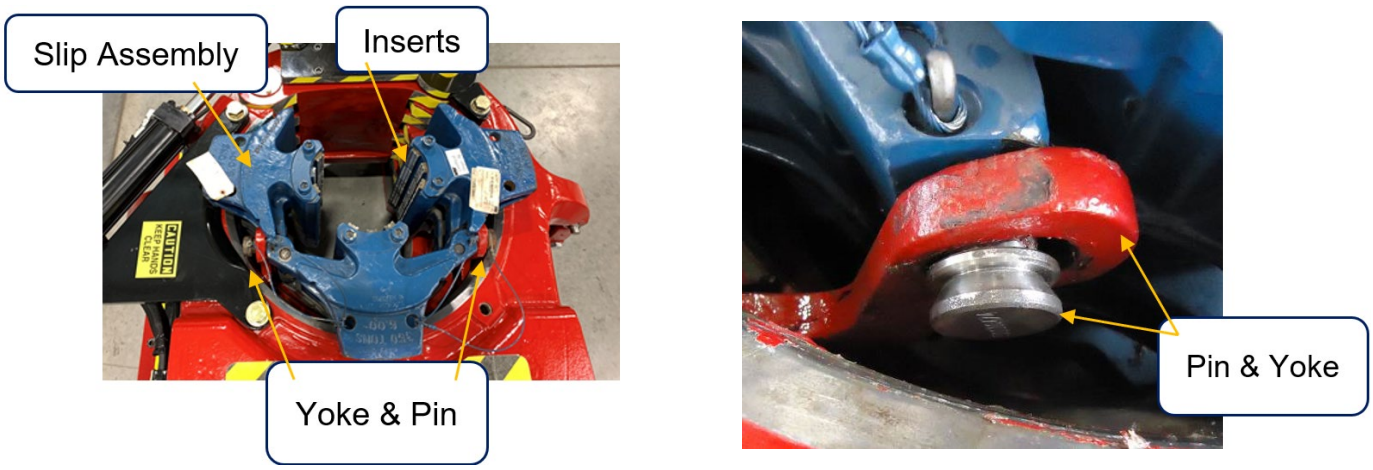


Figure 12

Slip Assembly: Installation

☐	Verify that the inserts in the replacement Slip Assembly are correctly sized and oriented with the teeth up (directional inserts)
☐	Verify that the Slip Assembly is the correct size
☐	Make sure the holes in the yoke are in the up position
☐	With an overhead crane or other suitable device, lift the Slip Assembly and move it into the spider body aligning the holes in the yoke with the mounting holes in the Slip Assembly
☐	Reinstall the two slip retainer pins and two cotter pins

WARNING Do not use grease or pipe dope on inserts or the insert slots as doing so will cause damage and/or failure of the slips.

⚠CAUTION Use only light machine oil on insert slots.

Insert Replacement

☐	With the Slip Assembly removed from the spider, place it on a flat work surface.
☐	Remove the insert retainer cap screws and the insert retainer plate
☐	Pull the inserts out of the slots – if necessary, use a small hammer and pry bar to remove the inserts
☐	Inspect the slots and seat of the slips for damage, galling, or excessive wear. If found, remove the slip from operation for evaluation and replacement/repair
☐	Make sure the slots are clean and free of debris – add a thin layer of light machine oil to the slots
☐	Make sure all new inserts are the same type and size and are clean and free of debris
☐	Install new inserts into the slots with the teeth pointing up (directional inserts)
☐	Reinstall the insert retainer plate and cap screws

INSPECTION

Normal wear during use will eventually reduce the Shuttle Spider's capability. Cracks, wear beyond specified limits, or the appearance of damage indicates impending failure and must be replaced or repaired by an authorized TIOT service facility.

Remove the Shuttle Spider from well center before performing any maintenance.

Disconnect all power sources before performing any inspection or maintenance.

Routine lubrication and inspection are recommended, but criteria and frequency are only suggestion and the User is responsible for establishing and adjusting the schedule according to the actual usage of the tool.

Do not use grease or pipe dope on inserts or the insert slots as doing so will cause damage and/or failure of the slips.

Only trained knowledgeable personnel shall perform inspections.

Lubricate the unit prior to and periodically during use.

When using or storing the Shuttle Spider, lubricate on a regular basis to protect the unit from conditions that can cause damage such as rust and corrosion. (See Storage & Transportation section for more information).

The User is responsible for establishing an Inspection & Maintenance Schedule that provides appropriate measures to keep the tool(s) in safe working order depending upon the tool usage, wear, and environmental conditions. TIOT recommends Daily, Semi-Annual, and Yearly Inspection and Maintenance.

LEVEL 1 Daily inspection while tool is in use.

The equipment must be visually inspected during operation for issues affecting performance. If any sign of damage or wear is discovered, pull the Shuttle Spider Assembly from service, and correct the issue. Visually inspect equipment when not in operation for issues such as wear, corrosion, deterioration, etc. and as follows:

☐	Operate the unit thru a full cycle (raise slips, lift door pin up, open door, move trolley to the rear, move trolley to the front, close door, lower door pin down, set slips) a few times to check functionality.
☐	Visually inspect the equipment for cracks, wear, corrosion, leaks or other signs of wear or overloading.
☐	Visually inspect for loose and missing parts.
☐	Visually inspect for leaks, damaged or worn hoses and fittings.

☐	Visually inspect the slips for wear, damaged or missing inserts.
☐	Visually inspect the insert contact area at the bottom of the slots in the slips for cracks or deformation.

LEVEL 2 Semi-Annual and Yearly inspection while tool is in use.

Includes Level 1 inspection and NDE of critical areas (See Critical Area Maps). Disassembly of equipment is required.

☐	Disassemble the spider to gain access to the door, door pins, and body (May require removing the spider from the Trolley).
☐	Perform a dimensional check of the Wear Areas as identified in the Wear Data Section.
☐	Remove coating (paint) and debris from critical areas.
☐	Perform Magnetic Particle Inspection (MPI) and repair/replace components that fail MPI. Contact TIOT for assistance.

LUBRICATION

NOTICE

Regular lubrication during usage and storage will prevent corrosion and extend the life of the equipment.

Routine Lubrication

See Figures 13 thru 16 for lubrication locations

☐	Apply EP 4 grease to all grease ports, other areas prone to wear as needed.
☐	The Baseplate surface should be clean, undamaged, free of debris, and frequently lubricated during use with a film of synthetic motor oil applied to the baseplate surface.
☐	Use only light machine oil on inserts and insert slots.

Hinge Pin Grease Fittings

Figure 13

Grease Slip Contact Surfaces in Spider Body

Figure 14

Figure 15

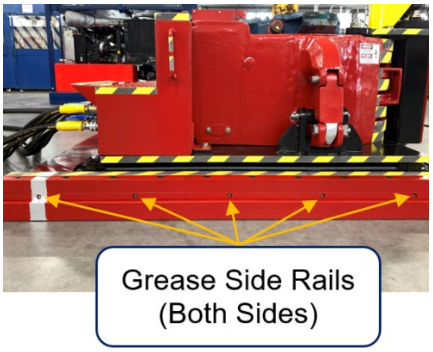


Figure 16

WEAR DATA

Max Wear Data for Elevator/Spiders		
Elevator/Spider Capacity	**350 Tons**	**317.5 Tonnes**
Total Clearance “A”	0.036”	0.9 mm
Hinge Pin Min Diameter New	2.485”	63.1 mm
Max Bore Dia. New	2.512”	63.8 mm
Max Bore Dia. Worn	2.521”	64.0 mm
Ear Thickness “D”	5.50”	139.7 mm
Ear Center to Center “E”	20.50”	520.7 mm
Ear Radius “R”	2.50”	63.5 mm

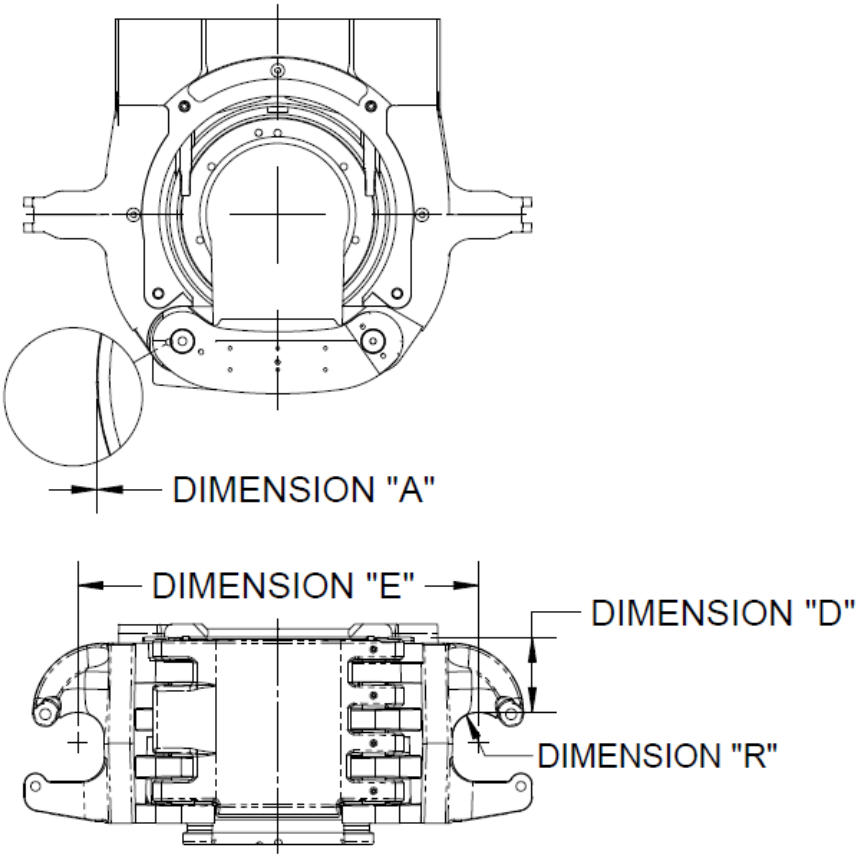
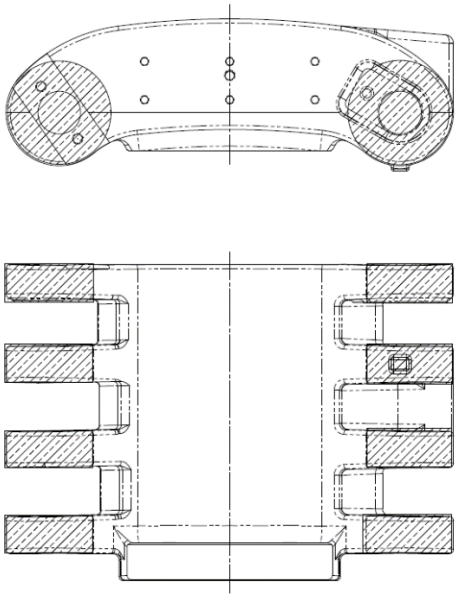


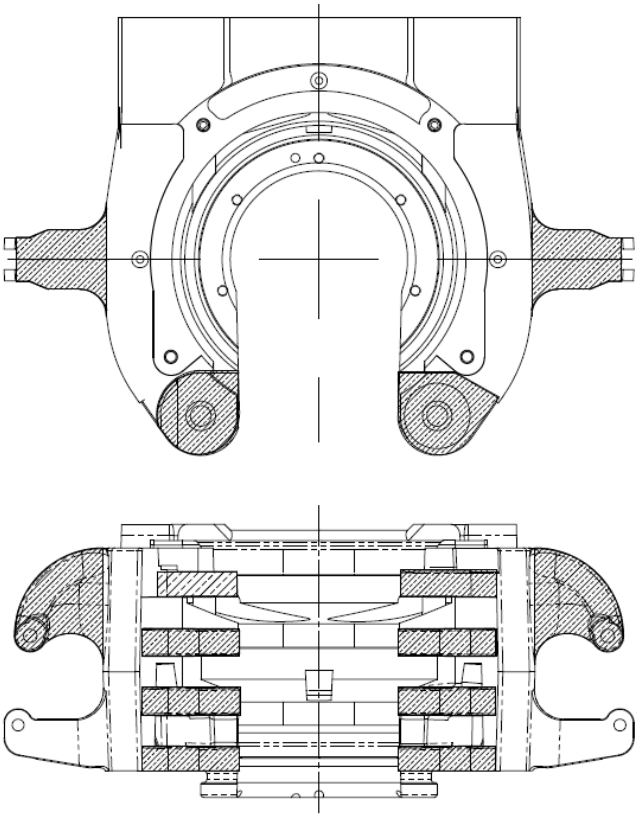
Figure 17

CRITICAL AREA MAPS

Hatched Areas Are Load Bearing and Critical



Door Critical Areas
Figure 18



Body Critical Areas
Figure 19

TROUBLESHOOTING

NOTICE Carry out the following suggested solutions for troubleshooting problematic equipment. If issues cannot be solved, please contact TIOT for assistance.

Affected Item	Issue	Possible Failure Mode	Suggested Solution
Slips	Tubular slides through the slips when in the set position or tubular surface is damaged or distorted	Incorrect slip or insert combination. Slip assembly is not the correct size for the tubular used	Pull slips and make changes to match the tubular
		Inserts broken, teeth missing, full of debris.	Replace or clean inserts as required
	Slips sticking in the body/will not raise or lower	Insufficient lubrication	Lubricate according to the Lubrication Section
		Low air pressure	Verify adequate air pressure from source
			Verify adequate air pressure at and from Control Console
		Air leaks	Ensure that connections are secure and undamaged.
			Check for and replace damaged hoses.
		Control Valve leaking or damaged	Replace Control Valve
		Cylinder Seals leaking	Replace Cylinder Seals or Cylinder
		Locking mechanism stuck	Ensure that locking mechanism is properly lubricated according to the Lubrication Section
			Look for signs of binding, damage, or wear to the locking mechanism components
			Using a pry bar, lift the bottom of the lock rod to release the locking mechanism and/or remove the locking mechanism for repair
	Slips do not swing open when raised/unset	Hinge pin and/or hinge springs damaged or missing	Replace or install hinge pin/hinge springs as needed

	Slips are uneven when setting on a tubular	Damaged slip	Remove and replace slips
		Inserts broken, teeth missing, full of debris	Replace or clean inserts as required
		Yoke bent	Remove and straighten or replace yoke
		Slip retainer pin missing from yoke	Install retainer pin and cotter pin
Trolley	The door pin will not raise	The door pin will not raise if the slips are set	A safety mechanism keeps the door pin from raising until the slips are released and raised from the tubular
		Low or no hydraulic pressure	Verify adequate hydraulic pressure from source
			Verify adequate hydraulic pressure at and from Control Console
			Ensure that connections are correct, secure and undamaged.
			Check for and replace damaged hoses.
		Guide rod isn't contacting valve	Remove front cover and check the guide rod pad and ensure that it will fully compress the air valves; adjust if needed
		Guide Rod on door pin assembly is bent or binding	Remove front cover and check guide rod for damage; replace or repair as needed
		Check door pin for binding or damage	Some disassembly may be required to access and inspect the door pin. Check wear according to the Wear Data section. Replace pin if needed
	Door will not open or close	The door will not open until the pin is fully raised	A safety mechanism keeps the door from opening until the pin is fully raised
		Low or no hydraulic pressure	Verify adequate hydraulic pressure from source
			Verify adequate hydraulic pressure at

			and from Control Console
			Ensure that connections are correct, secure, and undamaged.
			Check for and replace damaged hoses.
		Check door pin for binding or damage	Some disassembly may be required to access and inspect the door pin. Check wear according to the Wear Data section. Replace pin if needed
	Trolley will not move	The trolley cannot move until the door pin is up and the door is open	A safety mechanism keeps the trolley from moving until the door is open and the pin is fully raised
		Inadequate lubrication	Lubricate the trolley baseplate and the side rails according to the Lubrication Section
		Obstacles or debris on the trolley baseplate	Remove obstacles and or debris and recoat the sliding surfaces with grease according to the Lubrication Section
		Low or no hydraulic pressure	Verify adequate hydraulic pressure from source
			Verify adequate hydraulic pressure at and from Control Console
			Ensure that connections are correct, secure, and undamaged.
			Check for and replace damaged hoses.

STORAGE AND TRANSPORTATION

Do not transport the Shuttle Spider Assembly sitting only on the Kelly pins.

- Transport the unit in a suitable container or by other safe means designed specifically for handling this type of equipment.
- Unpainted surfaces should be coated with a rust preventing agent.
- Prevent exposure to water and moisture.
- Clean the tool after each use - steam clean as needed; remove mud, debris, and any other substances.

Control Console

Figure 20

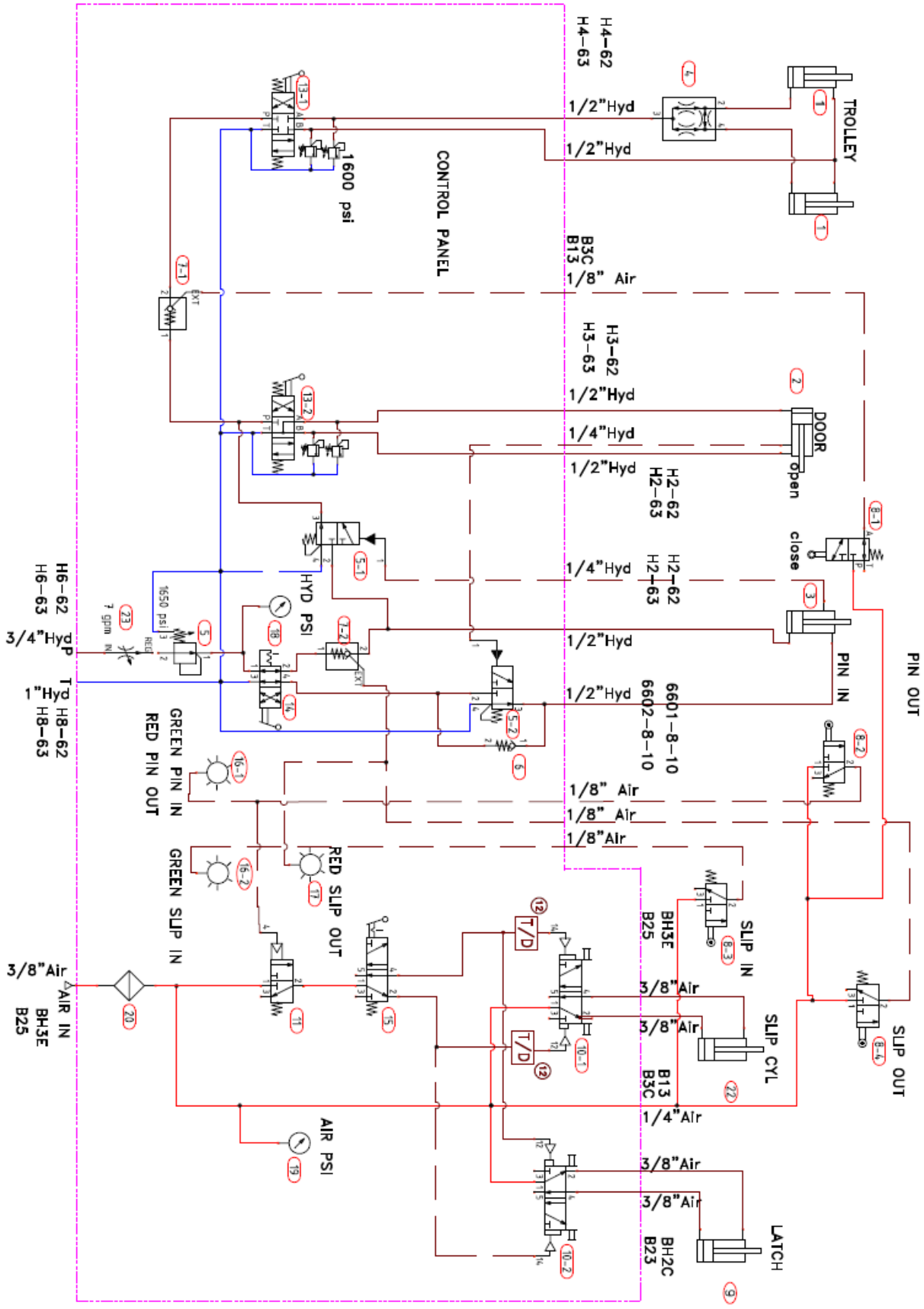


Figure 21 (Components Listed in Table 2)

Item	Qty	Part Number	Description
1	2	060208	CYLINDER, HYDRAULIC
2	1	060209	CYLINDER, HYDRAULIC
3	1	060210	CYLINDER, HYDRAULIC
4	1	060214	FLOW DIVIDER
5	2	060215	DIRECTION CONTROL VALVE
6	1	060216	CHECK VALVE
7	2	060217	PILOT OPERATED CHECK VALVE
8	1	060218	DIRECTION CONTROL VALVE
9	1	060211	CYLINDER, PNEUMATIC
10	2	060219	DIRECTION CONTROL VALVE
11	1	060220	DIRECTION CONTROL VALVE
13	1	060222	DIRECTION CONTROL VALVE
14	1	060223	DIRECTION CONTROL VALVE
15	1	060224	DIRECTION CONTROL VALVE
16	2	060225	GREEN-ON/RED-OFF INDICATOR
17	1	060226	RED-ON INDICATOR
18	1	060227	GAUGE, PRESSURE
19	1	060228	GAUGE, PRESSURE
20	1	060229	AIR FILTER
22	2	060049	CYLINDER, PNEUMATIC
23	1	060230	FLOW CONTROL

Table 2

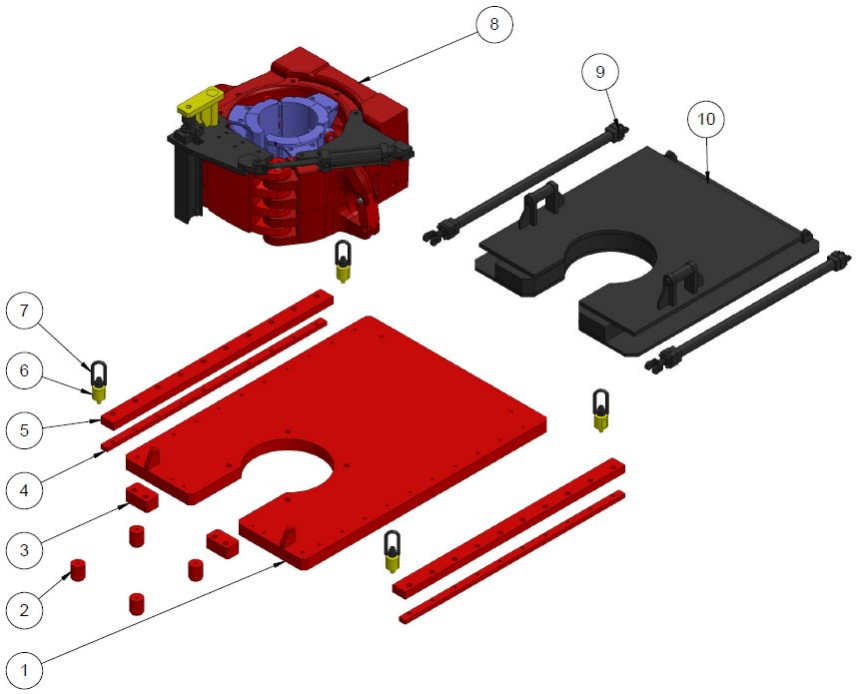
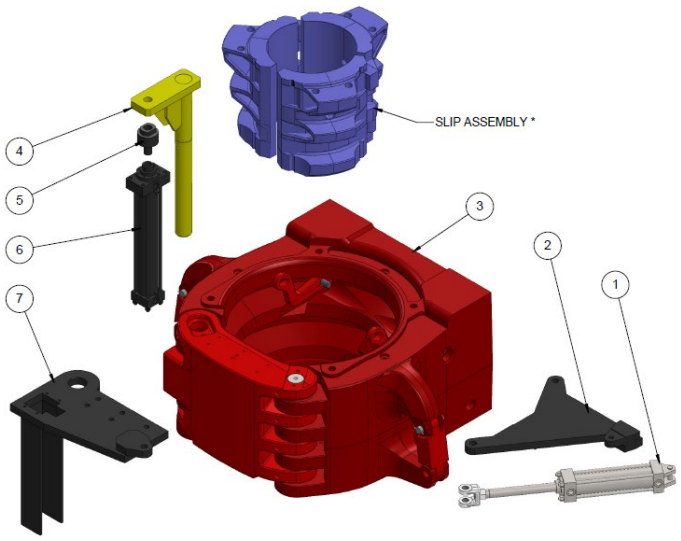


Figure 22 (Components Listed in Table 3)

Item	Qty	Part Number	Description
1	1	T76513A	SHUTTLE SPIDER BASEPLATE
2	4	T76513A-01-03	KELLY PIN
3	2	T76513A-02	STOP BLOCK
4	2	T76513A-04	SIDE RAIL WEB
5	2	T76513A-03	SIDE RAIL FLANGE
6	4	T76513D	ADAPTER LUG
7	4	2994T450	HOIST RING
8	1	T33492	350 TON SPIDER ASSEMBLY
9	2	060208	TROLLEY CYLINDERS
10	1	T76513B	SHUTTLE TROLLEY

Table 3

350 Ton Shuttle Spider Components (T33492)



* See Table 7

Figure 23 (Components Listed in Table 4)

Item	Qty	Part Number	Description
1	1	060209	CYLINDER, HYDRAULIC
2	1	T76513C-01	DOOR CYLINDER BRACKET
3	1	T28501-1-KIT	350 TON SPIDER BODY
	1	T28502-KIT	350 TON SPIDER DOOR
4	1	T76513C-03	OVERHUNG PIN
5	1	P1347570125	LINEAR COUPLER
6	1	060210	CYLINDER, HYDRAULIC
7	1	T76513C-02	PIN CYLINDER BRACKET

Table 4

350 Ton Shuttle Spider Body Sub-Components (T28501-1-KIT)

Item	Qty	Part Number	Description
N/S	1	T28501-1	350 TON ELEV/SPIDER BODY
N/S	1	T33494	YOKE, 350 TON
N/S	2	T11541	UPPER LINK BLOCK PIN
N/S	2	T26257	LINK RETAINER
N/S	2	T28509	YOKE PIVOT PIN
N/S	2	080019	YOKE PIN COVERS
N/S	3	940325-5	SLIP CONE OILERS
N/S	1	T28510	LOCKING MECHANISM
N/S	1	040242	SCREW

N/S – Not Shown

Table 5

350 Ton Shuttle Spider Door Sub-Components (T28502-KIT)

Item	Qty	Part Number	Description
N/S	1	T28502	350 TON ELEV/SPIDER DOOR
N/S	1	T28504	STATIONARY HINGE PIN

N/S – Not Shown

Table 6

350 Ton Shuttle Spider Slips

Slip Size	Pipe Size	Slip Assy	Body Guide	Insert - Qty	Insert Retainer
5 1/2" x 4 1/2"	4 1/2"	T28556Y8	T28579	24785 - 36	T26792-1
5 1/2"	5 1/2"	T28556		16407 -36	T26791
7"	5 3/4"	T28551Y10	T28578	29254 - 48	T27036-1
	6 5/8"	T28551Y3	T28577	24784 - 48	T26790
	7"	T28551		16407 - 48	T26324
7 5/8"	7 5/8"	T28546	T28576	16407 - 60	T27492
8 5/8"	8 5/8"	T28541	T28575	15660 -60	T26320
9 5/8"	9 5/8"	T28536	T28574	15660 - 72	T26321
10 3/4"	10 3/4"	T28531Y	T28573		T26320-1
11 3/4"	11 3/4"	T28526	T28572		T28597
13 3/8"	13 3/8"	T28521	T28571	15660 - 84	T28581

Table 7

Every Company has to have a Toolbox.

At Texas International Oilfield Tools,

We provide the tools to fuel the World!