FORUM

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PERSONNEL TRANSFER BRIDGE

OPERATION / MAINTENANCE MANUAL

SERVICE MANUAL 1031314	
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1 INTRODUCTION

1.1 Name Plate Data

Personnel Transfer Bridge (PTB) s/n – 11-0091 (modified 09-0021)

1.1.1 Specification:

- Extended Length 34m
- Retracted Length 22m
- Stroke 12m (+/- 6m from mid stroke)
- Pedestal Height adjustable via inserts from 3m above bow deck to 9.5m above bow deck
- 100 lb/sqft live loading
- Luff function 2-speed electric brake motor
- Telescope and slew pneumatically controlled
- Spring applied – pneumatically released brakes
- Visual, audible and physical stops to prevent overtravel
- Slew range up to 270 degrees
- Luff range +/- 10 degrees from horizontal
- Walking Width ~1m
- Walking Height ~2m

1.2 Intended Use

The Personnel Transfer Bridge (PTB) is used for the safe transfer of personnel during connected conditions between Tender vessel or FPSO and fixed platform structure or floating unit such as a Tension Leg Platform / Spar. The PTB is suitable for easy connection/ disconnection from the structure and compensating for relative motion whilst providing a safe conduit for personnel to travel between the two structures. Weight and overall envelope size are kept to a minimum. The short tail radius design provides minimum deck space encroachment.

The PTB consists of three (3) major components:

- Pedestal / Pintle Assembly
- A-Frame
- Telescopic Bridge

The Pedestal Mount consists of pedestal complete pintle bearing located at its base and Spiral Staircase to allow access to the Slew Platform. The pintle arrangement consists of two composite, self aligning bearings for radial and vertical loads. The Slew function is powered pneumatically by four (4) drive arrangement utilizing rig air supply. The Slew platform can rotate through 270 degrees allow for the bridge to operate safely in operating mode or stowage mode. Lockable stainless steel control consol for operation of bridge is mounted on slew platform providing slew, luff and telescoping functions, along with visual and audible alarms for over travel of telescoping section, luff and slew.

The A-Frame connects the pedestal to the telescopic bridge and is constructed from rectangular hollow steel sections. Mounted onboard the A-Frame is an electric luff hoist with dual drums and sufficient wire capacity for all turns on a single layer reducing rope wear and tear. Maximum luff provided by hoist is 10 degrees +/- travel from the horizontal position.

The Telescopic Bridge consisting of one fixed and one telescoping section, are manufactured from lattice type steel with integrated walkways. Hinge points located on the fixed section are provided for connection to the A-Frame supports and connection to the luffing system. Horizontal and vertical bogies ensure sufficient support of the telescopic section during operation. Powered by pneumatic drives the telescopic section extends the full length of the bridge to 34 mts. When in “bridge mode” the drives are de clutched to provide 12 mts of travel. In this mode the telescoping section can follow freely the movement of the vessel within the limits of the luffing, slewing range as specified. The telescopic section will be supplied with landing support for landing onto structure. A storm lock device is fitted to allow for the inner and outer booms to be locked together, aiding safe storage at an angle.

1.3 Design Criteria

- IMO Resolution A.649 (16)-1989 “Code for the Construction and Equipment of Mobile Offshore Drilling Units”
- Operating temperature is above Zero degree Celsius.
- The allowable stress safety factor used in the design calculations and analysis are determined according to the following code:

- AISC, American Institute of Steel Construction, Latest Edition
- AWS D1.1, American Welding Society

1.4 Symbol Naming Conventions

WARNING: A Warning Symbol is used when failing to follow the direction can cause injury or death to a person. This symbol will be placed with text describing the type of Warning that must be observed.

CAUTION: A Caution Symbol is used when failing to follow a direction can cause equipment failure. This symbol will be placed with text describing the type of Caution that must be observed.

NOTE: A Note Symbol is used before a step or procedure to describe special instructions about the next step.

1.5 Naming and Directional Conventions

- To prevent confusion, the names, titles and directions referenced in this document are described as follow:
- **CCW – Counter Clockwise Direction;** defined as the direction of rotation of the pedestal column in a counter clockwise direction when viewed from above.
- **CW – Clockwise Direction;** defined as the direction of rotation of the pedestal column in a clockwise direction when viewed from above.
- **SLEW –** Rotation of the pedestal column in the CW or CCW directions
- **LUFF -** The movement of the boom assembly in a positive or negative angle from the horizontal position
- **TELESCOPE** - The movement of the inner section of the boom in and out relative to the outer boom section
- **FLOAT -** Condition of the PTB that allows for the PTB to absorb the motions of the vessel when the boom tip is landed on the platform, TLP or spar
- **MANEUVER -** Condition of the PTB that allows for operator control of the PTB

1.6 Operator Safety Instructions

 *WARNING – This unit must always be operated by an authorized and trained authorized operator only. Failure to follow these instructions can cause serious injury or death.*

- Know the equipment limitations.
- Know and understand the operation manual.
- Know, understand, and follow the inspection plans.
- Know, understand, and execute routine maintenance procedures.
- Never operate or work on the unit without proper PPE (Personal Protective Equipment). As required by owner/operator regulations
- Do not permit people near the unit controls during inspections or repair unless they are supervised or part of the inspection/repair team.
- Recognize all pinch points on moving components and maintain a safe distance from them.
- Observe all jobsite rules; be in complete control at all times.
- Ample loose clothing, watches or bracelets can in some circumstances be dangerous. Therefore, they are not recommended to be worn on the job.
- Prior to starting the unit and at the beginning of each shift, perform a visual inspection of the unit.
- Unexpected movement during operation could result in a serious injury. Be aware of all surroundings and vessel movement
- Take the necessary steps to prevent oil leakages when connecting or disconnecting the system.

2 UTILITY REQUIREMENTS AND DESCRIPTION

2.1 Electrical

- Motor voltage 3 phase 480 volts 60 Hertz
- Control voltage 1 phase 120 volts 60 Hertz
- Anti condensation heating 86 volts 60 Hertz

The luff hoist is a dual drum winch with sufficient wire capacity for all turns on a single layer. The rope ends are anchored by clamps which are mounted on the flanges of the drums. The rope is endlessly reeved so both drums pull equally. Line pull is two wires each having a design load of 35.6 kN. The drums are mounted on either side of a DEMAG right angle reduction gearbox. The winch is powered by a DEMAG pole changing reversible brake motor. Lowering is power down. The motor brake is a friction holding brake that has been specially treated as has the motor for offshore use. Luff control is via two DEMAG stepped push buttons for raise, lower, slow and fast. The brake is an integral part of the motor and is a light inertia conical design for frequent cycling. The brake is spring applied and is released by the magnetic force axially sliding the motor rotor when the motor is powered. The brake is fail-safe and is rated at least 150% of motor working torque. In order to prolong brake life by phasing the brake, even if flick switching occurs, a DEMAG SGDM-1-110V relay has been installed in the control circuit. This relay phases the pole shifting from high speed to stop such that sufficient dwell time in low speed exists (approx. ½ second) so the motor is slowed magnetically to slow speed prior to the brake applying. The brake can stop the full load fade free should the power fail. The motor starts DOL (slow and fast) and is “WYE” connected. During idle periods the motor is heated via current passing thru two of the windings.

2.2 Pneumatic

- Required Supply 1000CFM at 120-150psi

Telescoping and Slew are air powered and do not require electricity for their operation. Selecting FLOAT mode disables the telescope and slew drives.

Telescoping has twin drives opposite and on top of the outer boom and driving dual racks on the inner boom. Each drive has a vane air motor, a wet disc brake that is spring applied and pneumatically released and a two stage planetary gearbox mounted on a pivoted arm. The output shaft of the planetary gearbox has an internally splined pinion that drives the rack. The pivoted arms are linked to an air cylinder that retracts to pull

the drives towards each other and the pinions out of engagement with the racks de-clutching the telescope drives. The purpose of de-clutching the telescope drives is to reduce unnecessary wear and tear on the drives while in the FLOAT mode. To engage the telescope drive the air cylinder is extended causing the actuating links to spread the drives and the actuating links to go over center locking the drives in the engaged position but still allowing the drives to centralize themselves on the rack teeth. The air cylinder is always pressurized to extend except when de-clutch is selected in the FLOAT mode. Should the pinions not fully engage the rack the cylinder will try to extend until the teeth fully mesh. Once the teeth are fully meshed the cylinder fully extends, the links go over center and the drives lock.

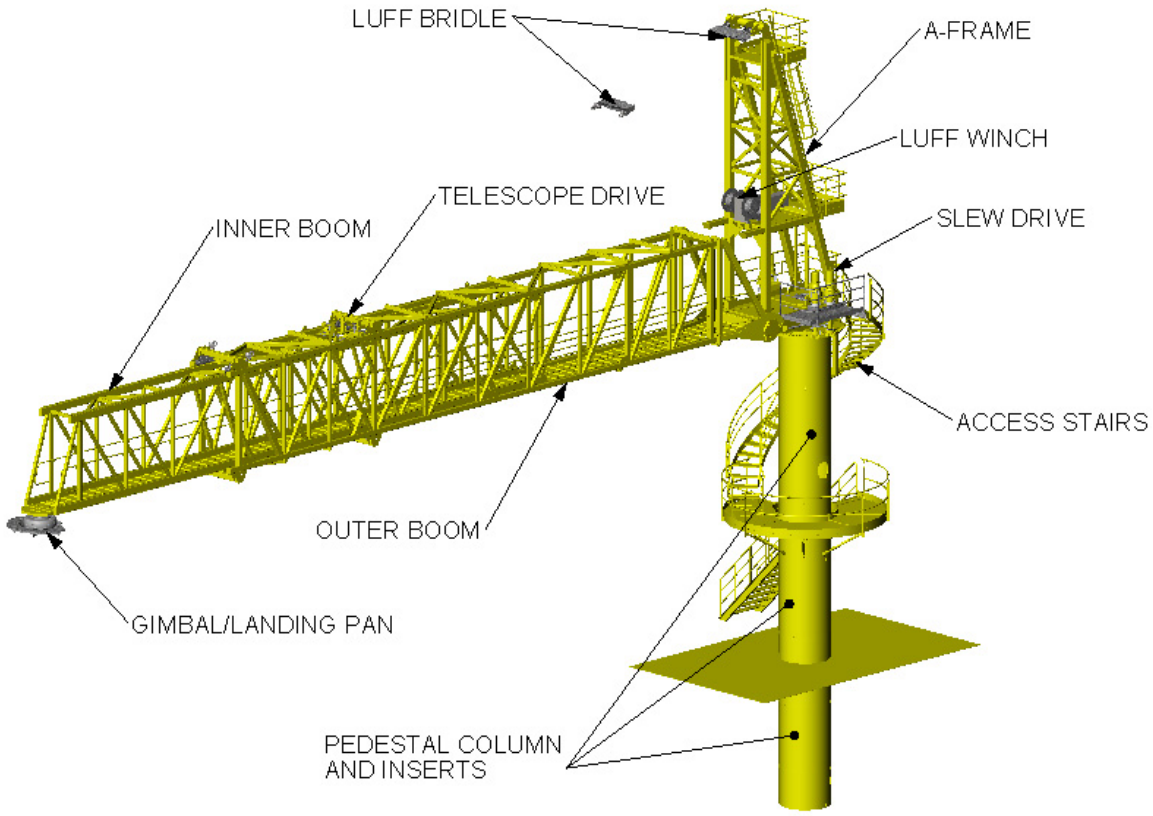
NOTE *For increased control the boom should be in the horizontal position for safe control of the telescoping function*

Slew function of the PTB is controlled through the use of four (4) air driven motors. When in MANEUVER mode the brakes are set via springs and will release once there is movement of the joystick. Movement of the joystick left or right releases the brakes and will cause the bridge to slew CW or CCW. Control is proportional to the movement of the joystick. When in FLOAT mode a positive air supply is applied to the brakes releasing them allowing for the PTB to rotate.

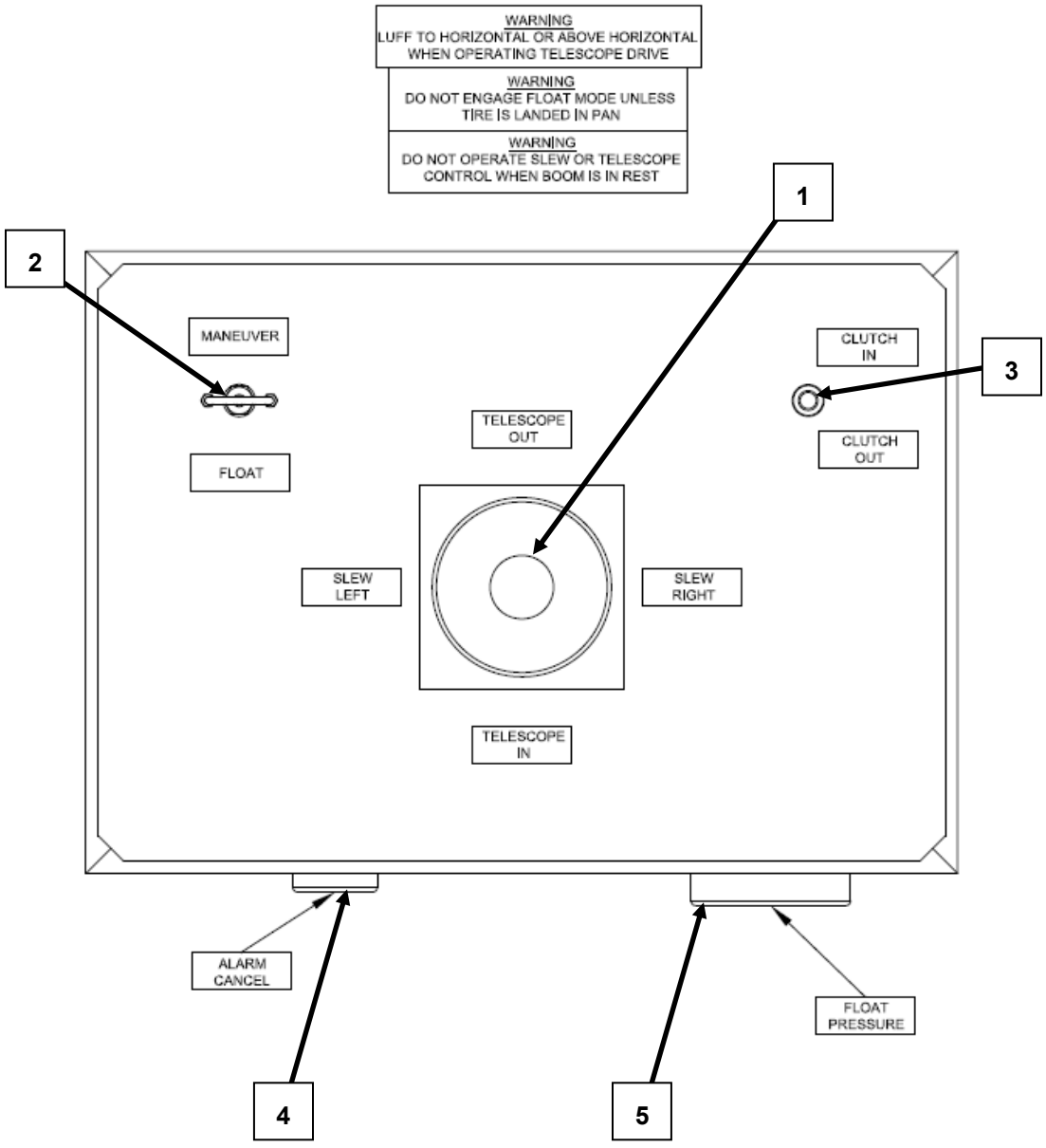
NOTE *For increased control; the boom should be retracted unless positioning for landing on the platform, TLP or spar.*

3 COMPONENT IDENTIFICATION

3.1 System

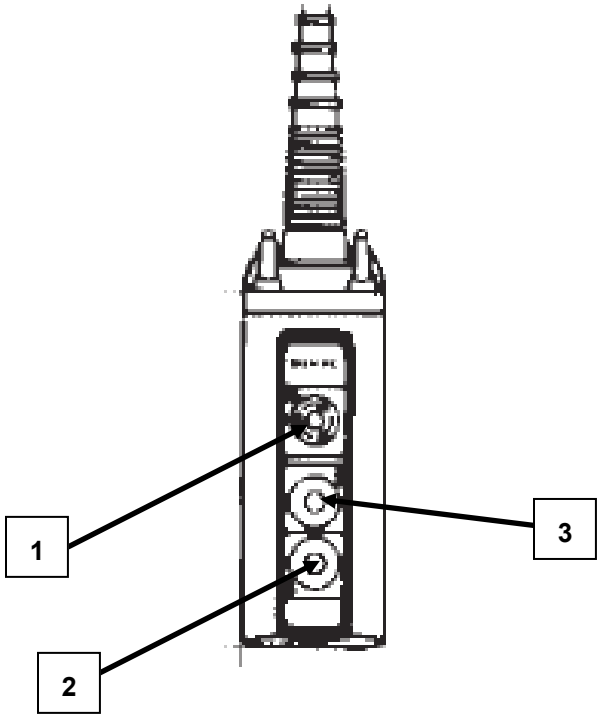


3.2 Operator's Podium (Pneumatic)



Operator Podium (Pneumatic)				
No.	**Description**	**Label**	**Function**	**Type of Control**
1	Joystick		Controls Boom and Slew Movement	Proportional
	FWD Movement	**TELESCOPE OUT**	Extends Boom	
	AFT Movement	**TELESCOPE IN**	Retracts Boom	
	LEFT Movement	**SLEW LEFT**	Rotates Boom CCW	
	RIGHT Movement	**SLEW RIGHT**	Rotates Boom CW	
2	Valve		Controls Manuever/Float Modes	Lever, Manual
	FWD Position	**MANUEVER**	Slew command is enabled	
			Slew brake is applied	
			Telescope command is enabled	
			Telescope brake is applied	
	AFT POSITION	**FLOAT**	Slew command is cancelled	
			Slew brake is released	
			Telescope command is cancelled	
			Telescope brake is released	
3	Valve		Controls Telescope Gear Engagement	Lever, Manual
	FWD Position	**CLUTCH IN**	Moves Telescope Gears Out of Respective Racks	
	AFT Position	**CLUTCH OUT**	Moves Telescope Gears Into Respective Racks	
4	Push Button	**ALARM CANCEL**	Cancels Visual and Audible Alarm Indication	Button
5	Gage	**FLOAT PRESSURE**	Indication of Positive Pressure in "FLOAT" Mode to Release Slew Brakes	

3.3 Luff Control Pendant



LUFF CONTROL PENDANT			
No.	**Description**	**Function**	**Type of Control**
1	Stop Button	Stops Luff Movement	Push to STOP Twist to Reset
2	Up Button	Luff Boom Up	2 Position Low/High Speed
3	Down Button	Luff Boom Down	2 Position Low/High Speed

4 OPERATIONS

4.1 Modes of Operation

Incorrect operation can lead to serious personal injury and loss or damage to property. Follow operating instructions and fully understand them.

Engaging FLOAT mode releases telescoping and slew brake and may disengage telescope drives. Incorrectly engaging FLOAT may cause uncontrolled telescoping and slewing of the PTB.

4.1.1 Float Mode

The FLOAT mode is designed to allow the PTB to FLOAT and absorb the tender's hull motions while the tip remains affixed to the platform, TLP or Spar.

4.1.2 Manuevering Mode

The MANEUVERING mode is intended to allow the PTB to be positioned on the platform, removed from the platform, stored or parked on the tender's bow deck.

4.2 Operational Control

4.2.1 Float Mode

The FLOAT mode is engaged by moving the black control lever on the left side of the control console away from you.

Engaging the FLOAT mode effects the following:

- Slew command is cancelled.
- Slew brake is released.
- Telescope command is cancelled.
- Telescope brake is released.
- The Joystick is disabled in FLOAT mode

If CLUTCH IN is selected (lever pushed away from you) the telescoper drives will both move inwards and disengage their pinions from the dual racks

For FLOAT mode to function correctly there must be at least 80-PSI air pressure. Check FLOAT air pressure (only possible when FLOAT command is enacted) via the FLOAT air pressure gauge on the right hand side of the control console.

The PTB must be in FLOAT mode when the tip of the PTB is landed on the platform, TLP or spar. Failure to engage FLOAT mode can endanger personnel and can cause damage to equipment if the tender pulls away causing the PTB to drop.

4.2.2 Maneuvering Mode

Engaging the MANEUVER mode effects the following:

- The slew command is enabled.
- Slew brake is applied. (Air pressure released)
- Telescope command is enabled.
- Telescope brake is applied. (Air pressure released)
- The Joystick is enabled in MANEUVER mode

If CLUTCH IN is selected (lever pushed away from you) the MANEUVER command cancels CLUTCH OUT and the telescopic drives will move outwards (spread) and engage their pinions with the dual racks

For the MANEUVER command to function and for the PTB to slew and telescope there must be sufficient air pressure (at least 110 PSI). With the MANEUVER command selected, the FLOAT pressure gauge must read zero PSI.

4.2.3 Luff Function

The luff function is electrically powered and does not rely on air pressure for its operation. Selecting FLOAT or MANEUVER mode has no effect on the luff function.

In the FLOAT mode the luff bridle must be lowered sufficiently to ensure the tender cannot heave and lift the PTB disengaging it from the platform by lifting the tip and landing gear

The luff function is operated from a control pendant, which has the following controls;

- Red emergency stop push button.Twist to reset
- Slow-Fast luff up stepped push button. (2 positions/speeds)
- Slow-Fast luff down stepped push button. (2 positions/speeds)

The luff winch is easily seen from the control station making monitoring the drum rotation very easy.

Ensure there are no obstacles or personnel in way of the bridge when luffing.

Operate the luff controls as follows:

- To stop in an emergency – push red emergency stop push button. To reset twist button allowing it to pop out resetting it.
- To luff up or down using slow speed depress the control button gently until you feel its first step click. This selects low speed or creep speed. The luff brake is automatic and applies whenever the motor is un-powered.
- To increase luff speed, depress the control button fully. This switches the motor from low speed to high speed.
- To decrease the luff speed release the control button slightly until you feel it click. The luff will slow to low speed. Do not release the button completely otherwise, the luff will very abruptly come to a full stop with the brakes on.

4.2.4 Telescope Function

Telescoping and slew are air powered and do not require electricity for their operation.

Selecting FLOAT mode disables the telescope and slew drives. Telescoping has twin drives opposite and are on top of the outer boom and driving dual racks on the inner boom.

Each drive has a vane air motor, a wet disc brake that is spring applied and pneumatically released and a two stage planetary gearbox mounted on a pivoted arm. The output shaft of the planetary gearbox has an internally splined pinion that drives the rack. The pivoted arms are linked to an air cylinder that retracts to pull the drives towards each other and the pinions out of engagement with the racks de-clutching the telescope drives. The purpose of de-clutching the telescope drives is to reduce unnecessary wear and tear on the drives while in the FLOAT mode. To engage the telescope drive the air cylinder is extended causing the actuating links to spread the

drives and the actuating links to go over center locking the drives in the engaged position but still allowing the drives to centralize themselves on the rack teeth. The air cylinder is always pressurized to extend except when de-clutch is selected in the FLOAT mode. Should the pinions not fully engage the rack the cylinder will try to extend until the teeth fully mesh. Once the teeth are fully meshed the cylinder fully extends, the links go over center and the drives lock.

The PTB controls must be in MANEUVER mode to operate telescoping. To extend or retract the PTB simply move the joystick as follows:

- Push away from you to extend
- Pull towards you to retract
- To apply the brakes release the lever

Brakes apply automatically when joystick is released

Telescoping speed is proportional to lever movement.

The PTB's inclination (luff angle) will markedly affect the telescoping speed. It goes downhill faster than uphill. At steep luff angles, the telescopic function may stall going uphill. To prevent stalling luff up or down to make the bridge level. The extend travel has cellular buffers to limit outward extend motion. The retract function has rubber bumpers to limit the retract travel. Do not extend or retract into these limits with speed; creep as you approach them.

Before telescoping ensure no one is on the bridge or positioned such that the PTB will strike them or trap them. Do not inspect or service the telescope mechanism unless the tip (landing gear) of the PTB is resting on the tender's bow deck or the telescoping motion is effectively locked. Severe personal injury can result if telescoping occurs while working in way of the telescope drives.

4.2.5 Slew Function

The PTB must be in MANEUVER mode for the slew function to operate.

To slew left or right:

- Move joystick as follows:
- Left to slew left
- Right to slew right

- To apply brakes release the lever

Slew speed is proportional to lever movement.

Do not slew at speed otherwise, slew may over travel and cause damage or personal injury. Slewing in winds or with excessive tender inclinations can cause loss of slew control. Use extreme care in such circumstances and retract the PTB (telescope fully in) to get increased control. Generally, slew operations are more easily achieved with the bridge retracted.

4.3 Operation

4.3.1 Setting PTB on Platform

The Tender must be positioned such that the telescoping and luffing limits of the PTB are not exceeded. The PTB's range of travel must be sufficient to accommodate the expected excursions of the tender

- Check out controls by Luffing, Slewing and Telescoping within confines of bow deck. Ensure controls answer commands correctly and responsively.
- With landing gear resting on bow deck test FLOAT command (observe pressure gauge and test de-clutch command (causes telescope drives to retreat). Return to MANEUVER mode.
- Ensure spiral access stairs will not strike by objects when PTB slews.
- Luff up bridge to near level or slightly luffed up.
- Slew bridge to align with landing spots on platform. Pan should be in place and securely mounted to the platform by welding or clamping.
- Extend bridge to reach Pan.
- Luff down to set landing gear centred in Pan. Continue luffing down until wires are sufficiently slack to prevent uplift from the expected sea conditions, weather, tides or de ballasting. Engage FLOAT mode while luffing down.
- Activate DE-CLUTCH control by pushing away from you.
- Visually inspect installation of PTB. Ensure landing gear tire is centred in pan. Check that NO part of the PTB, particularly the underside will strike any part of the platform when the tender moves
- If deemed prudent lash the landing gear to the platform to prevent its escape from the Pan

4.3.2 Removing PTB from Platform

- Ensure spiral access stairs will not strike by objects on the Bow deck when PTB slews.
- Engage CLUTCH. Pull DE-CLUTCH lever towards you. Visually check pinions are both engaged with racks.
- Engage MANEUVER mode (Disengage FLOAT mode).
- IMMEDIATELY Luff up to lift landing gear from Pan. Continue luffing up until PTB can be safely slewed.
- Slew PTB to parking position
- Luff bridge to rest location on Bow Deck or boom rest
- Secure using tie downs as required

5 MAINTENANCE

5.1 Periodic Checks

5.1.1 Wheels, Bogies and Side Rollers

- Roller wheel or scuffing
- Signs of binding
- Signs of any damage or cracks
- Security of bolts and shims
- The rollers are fitted with maintenance free bushings, no lubrication is required

5.1.2 Landing Gear (Gimbal)

- Security of bolts
- Ensure no parts of PTB are striking the platform

5.1.3 Hazard Screens

- Ensure screens are secure and in place

5.1.4 Telescoper Drive

- Air lines intact and secure
- Cylinder mounting secure
- No signs of damage or excessive wear in the pinions
- No leaks or other obvious defects in the gearbox/motor assemblies

5.1.5 Slew Drive

- Air lines intact and secure
- Shrink Disc is secure
- No signs of damage or excessive wear in the pinions
- No leaks or other obvious defects in the gearbox/motor assemblies

5.1.6 Pintle and Pedestal Drive

- Pedestal studs are tight, no signs of damage or corrosion
- No signs of damage or cracks
- No signs of excessive wear of pintle bushing or pintle mating surfaces

5.1.7 Luff Winch

- No signs of oil leakage from gearbox
- Wire rope in good condition (ref API RP2D for detailed rope inspection advice)
- Wire rope anchors are tight
- Luff winch anchor bolts tight and secure

5.1.8 Bridles

- No signs of damage to the sheaves or pins

5.2 Lubrication

Using general purpose grease ensure the following locations are sufficiently greased

- Pintle Bearing (Inside pedestal manhole) 2 places
- Pintle Thrust Pads (around circumference of upper pedestal) 10 places
- A-Frame Bridle (top of A-frame) 8 places
- Luff Bridle (access only when luffing equipment is slcked off and can be safely accessed through the boom) 3 places
- Telescope Arms (telescope gearbox mounting) 1 place each side
- Landing Gear Gimbal 1 place

For gearbox and brake levels refer to applicable section of technical drawings and information in the appendix

	LUBE CODE AND DESCRIPTION				
	General Purpose Grease		Motor Grease	Hydraulic Oil	
Ambient Temperature Range	**Above -4°F (-20°C)**	**Below -4°F (-20°C)**	**All Temperatures**	**-10° to 85°C**	**-15° to 75°C**
Castrol	MP Grease	-	-	Hyspin AWS-	Hyspin AWS-32
Chevron	Avi-Motive	Avi-Motive	-	AW Hyd Oil 46	AW Hyd Oil 32
Exxon	Lidok EP2	Lidok EP1	Andox BR	Nuto H46	Nuto H32
Gulf	Gulf Crown	Gulf Crown	-	Harmony	Harmony 32AW
Mobil	Mobilux EP2	Mobilux EP1	-	DTE 25	DTE 24
Shell	Alvania EP2	Alvania EP1	Cyprina RA	Tellus 46	Tellus 32
Statoil	Uniway EP2N	Uniway	-	Hydraway HMA	Hydraway HMA
Texaco	Multifak EP2	Multifak EP1	Regal AFB-2	Rando Oil	Rando Oil
Total	Multis EP2	Multis EP1	-	Azolla ZS 46	Azolla ZS 32
Union	Unoba EP2	Unoba EP1	-	Unax AW46	Unax AW32

Gear Oil									
	ISO VG 150	**ISO VG 220**	**ISO VG 320**	**ISO VG 150**	**ISO VG 220**	**ISO VG**	**ISO VG**	**ISO VG 220**	**ISO VG**
Castrol	Alpha SP 150	Alpha SP 220	Alpha SP 320	Alphasyn	Alphasyn	Alphasyn	Alphasyn	Alphasyn	Alphasyn
Chevron	Ultra Gear	Ultra Gear 150	Ultra Gear	Tegra Syntheti	Tegra Syntheti	Tegra Syntheti	HiPer SYN	HiPerSYN	HiPerSYN
Shell	Omala 150	Omala 150	Omala 320	Omala HD	Omala HD	Omala HD	Tivela S	Tivela S 320	Tivela S 320
Texaco	Meropa 150	Meropa 150	Meropa 320	Pinnacle EP 150	Pinnacle EP 220	Pinnacle EP 320	-	Synlube CLP 220	Synlube CLP

6 ADJUSTMENTS

6.1 Bogies

The PTB telescopes on multi wheel vertical bogies fitted with nylon wheels, which bear on Stainless Steel pins.

For serviceability, all bogies and side rollers can be slid out of position and serviced in a workshop. All rollers are identical and utilize maintenance free bushings.

Side rollers take lateral loads only and are therefore carry very small loads. For interchangeability reasons they have been made oversized to keep them identical to the vertical wheeled bogies.

All wheel sets are adjustable via shims and can be removed as assembled units.

6.1.1 Bogie Shimming

When the Inner Boom is telescoped and is resting on the platform (Bridge Mode) the 4 wheel bogies are loaded (sagging loads) whilst the 2 wheel bogies are unloaded. This loading circumstance also occurs with the bridge level, supported by the luff ropes or the Inner Boom fully retracted into The Outer Boom. The Inner Boom is"tail heavy". For shimming or wheel clearance purposes this position allows you to shim the 2 wheel bogies.

When the Inner Boom is fully telescoped and not resting on the platform (supported by the luff ropes) the 2 wheel bogies are loaded (hogging loads) and the 4 wheel bogies are unloaded. This position allows you to shim or check clearances of the 4 wheel bogies.

Check the bogie wheel clearances when they are unloaded. Do this by prying between an end wheel and the track with a broad bladed pry bar.

⚠ *Caution: The wheels are nylon. Do not use anything sharp that could cut or otherwise injure the wheels.*

Prying under one wheel determines the total clearance amongst all the wheels because of the equalization arrangement. Add shims as required when there is more than 5-8 mm gap (total clearance) on one wheel of 4 wheel bogies or 3-5 mm gap on one wheel of two wheel bogies.

After adjusting the shims check the bridge by telescoping fully and ensuring no binding occurs. Also observe the following locations for correct operating clearances:

- Ensure telescoper pinions are engaging the full rack face. If not the arms on the telescopers can be raised or lowered with washers on their pivot pins.
- Buffer stops (bolt on) mounted on Inner Boom rear Aft upper cross member. These must clear the cross members on the Outer Boom
- Inner Boom foot path lower edge at its aft lower face must not rub on OuterBoom foot path.

6.1.2 Servicing bogies:

Ensure bridge is safely parked and all brakes applied in MANEUVER mode.
Disconnect grease lines (fittings allow black nylon tubes to be pulled out by pushing ferrule holding tubing inwards and then withdrawing tube).

Position Inner Boom to unload either the 2 wheel bogies or the 4 wheel bogies. To check if bogie is unloaded try turning the wheels by hand. Unloaded wheels turn easily by hand.

Remove the 4 M16 Cap screws holding the bogie assemblies. These bolts pass through the shims.

Slide the entire bogie assembly out of position. NOTE bogies trucks only bear on support pivots and will drop freely if turned or pulled away from rail.

Inspect bogies for wear, bearing condition, tread condition, pin rotation, bore elongation and condition.

Re assemble in reverse order and shim to get prescribed wheel gap.

Extend bridge and observe unloaded bogies to ensure a gap exists over the entire travel. Note with the bridge level and suspended on the luff wires, the load on the bogies will shift from 2 wheels to the 4 wheel bogies as the bridge is retracted. Approx. mid way Inner Boom will be balanced (neither nose heavy or tail heavy and only the lower bogies will be loaded

Side rollers are bolted in place and being single wheels have no bogies or equalization. These are simply adjusted in sets of four grouped as follows: Forward, Mid or Aft. Shims are used under each wheel and are stacked to give 3-5mm clearance.

6.2 Clutch Cylinder

Ensure cylinder links connecting to drives go over-centre when air cylinder is fully extended. This mechanically locks drives in the "Clutched" position.

Check when pinions are meshed with the racks.

NOTE *NOTE: If pinions do not mesh when cylinder is initially extended the air pressure in the air circuit will continue to try to extend the cylinder into the locked position and full pinion-rack mesh. Full meshing is automatic while the cylinder is pressurized.*

6.3 Telescope Drive Height

Ensure pinion faces are centered on the rack teeth. Raise or lower the telescoper drives by adding or removing washers at their pivot pins. Shimming Bogies should not require adjustment to telescoper drive heights.