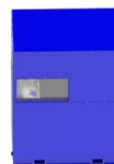
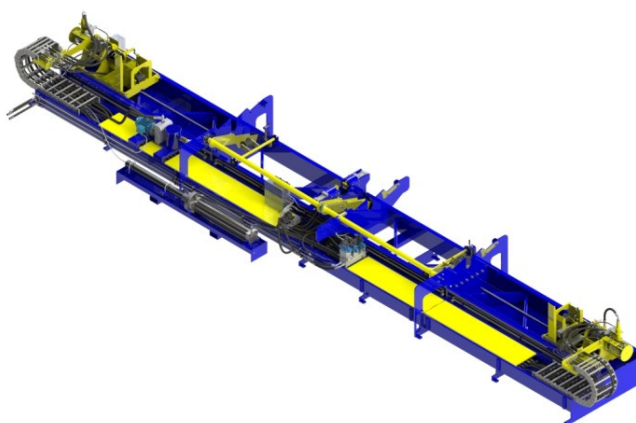


HUB CITY
IRON WORKS

HYDROSTATIC TESTING UNIT

Operation and Maintenance Manual

HTM-2001



Hub City Iron Works
700 E Texas Ave.
Rayne, LA 70578
Phone: (337) 334-6969
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Customer: _____

Location: _____

Job #: _____

Local Rep: _____

Rep Phone # _____

Document # _____

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Service

Call: 337.334.6969

Email: servicerequest@hubcityironworks.com

Spare Parts

Call: 337.334.6969

Visit: www.hubcityironworks.com

Sales

Call: 337.334.6969

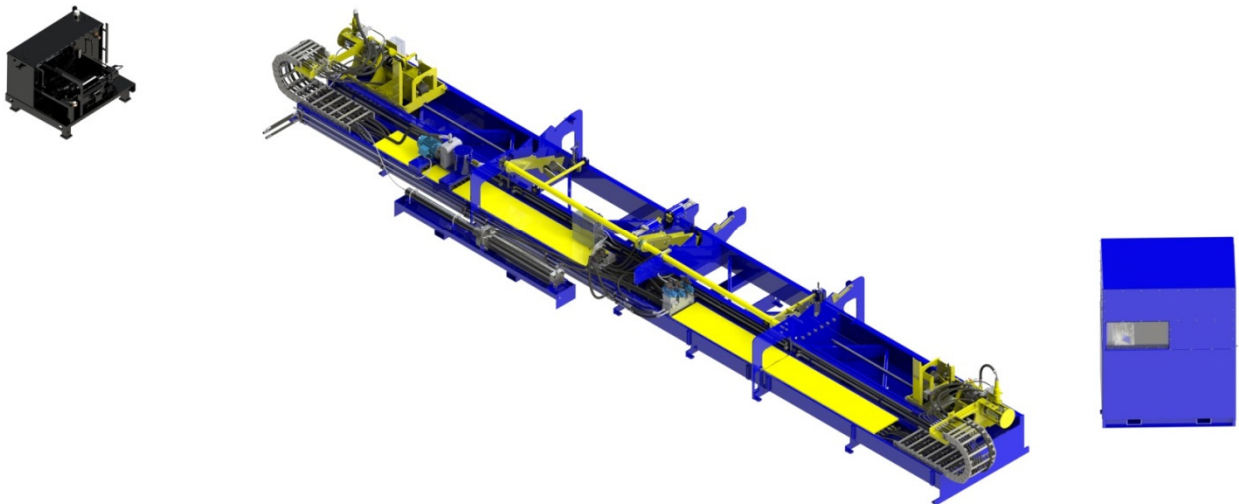
Email: sales@hubcityironworks.com

Introduction

HTM -2001 SEMIAUTOMATIC HYDROTEST MACHINE

Hub City Iron Works' Hydrostatic Testing Unit is a safety oriented product used to pressure test tubing and premium connections up to 20,000 PSI in order to meet API standards. The unit utilizes test plugs with motorized rotation allowing for appropriate torque application, ultimately enabling high quality and consistent test operations. The HTM-2001 is an excellent choice for safely testing tubing and premium connections.

- Pressurizes tubing and premium connections up to 20,000 psi in accordance with API test standards
- Controlled by a single operator within a safety cage featuring a door operated safety switch
- Control station is PLC controlled to minimize human error.
- Test cycle for a joint of tubing can be as quick as two minutes
- Automated loading and off-loading of pipe
- Water is recycled after each test
- Robust construction for demanding oilfield use with moving parts painted "safety yellow"



Safety

Hub City has provided operating procedures and safety information to ensure the wellbeing of both the operator and the equipment.

This operating manual contains important safety information - please read it thoroughly.

Safety Features Include:

- Mechanically active components are painted safety yellow.
- Low oil level indicator protects machinery in the case of a hydraulic line rupture.
- Low voltage operator interface (24vdc).
- Equipment safety labels.
- Operator safety cage with door activated switch



WARNING

**DO NOT ATTEMPT TO DEFEAT ANY OF THE
INSTALLED SAFETY FEATURES ON THIS
MACHINERY**



WARNING

**IMPROPER USE OF THIS MACHINE CAN CAUSE
SEVERE INJURY OR DEATH**



WARNING

**FREEZING WEATHER WILL DAMAGE
MACHINE. DRAIN WATER FROM LINES WITH
SPECIAL CONSIDERATION TO THE LOW
PRESSURE WATER PUMP AND INTENSIFIER**

Machine Specifications

Standard Features

- Operator controlled loading and unloading of pipe.
- Hydraulic power supply
- Range 2 pipe standard
- Safety cage for operator only

Specifications

- Standard capacity (others available at customer request)
 - 2-3/8" 8RD
 - 2-3/8" MS6
 - 2-7/8" 8RD
 - 2-7/8" MS6
 - 3-1/2" 8RD
 - 3-1/2" MS6
 - 4-1/2" MS6
- Test module
 - Length 46' 6"
 - Width 7' 6"
 - Height 42"
 - Ship Weight 18,000lbs
- Hydraulic Power supply
 - Length 6'7"
 - Width 6'6"
 - Height 3'4"
 - Weight 5000lbs
- Operator Cage
 - Length 7'
 - Width 4' 2.5"
 - Height 6'4"
 - Weight 3000lbs

Pipe Plant Requirements

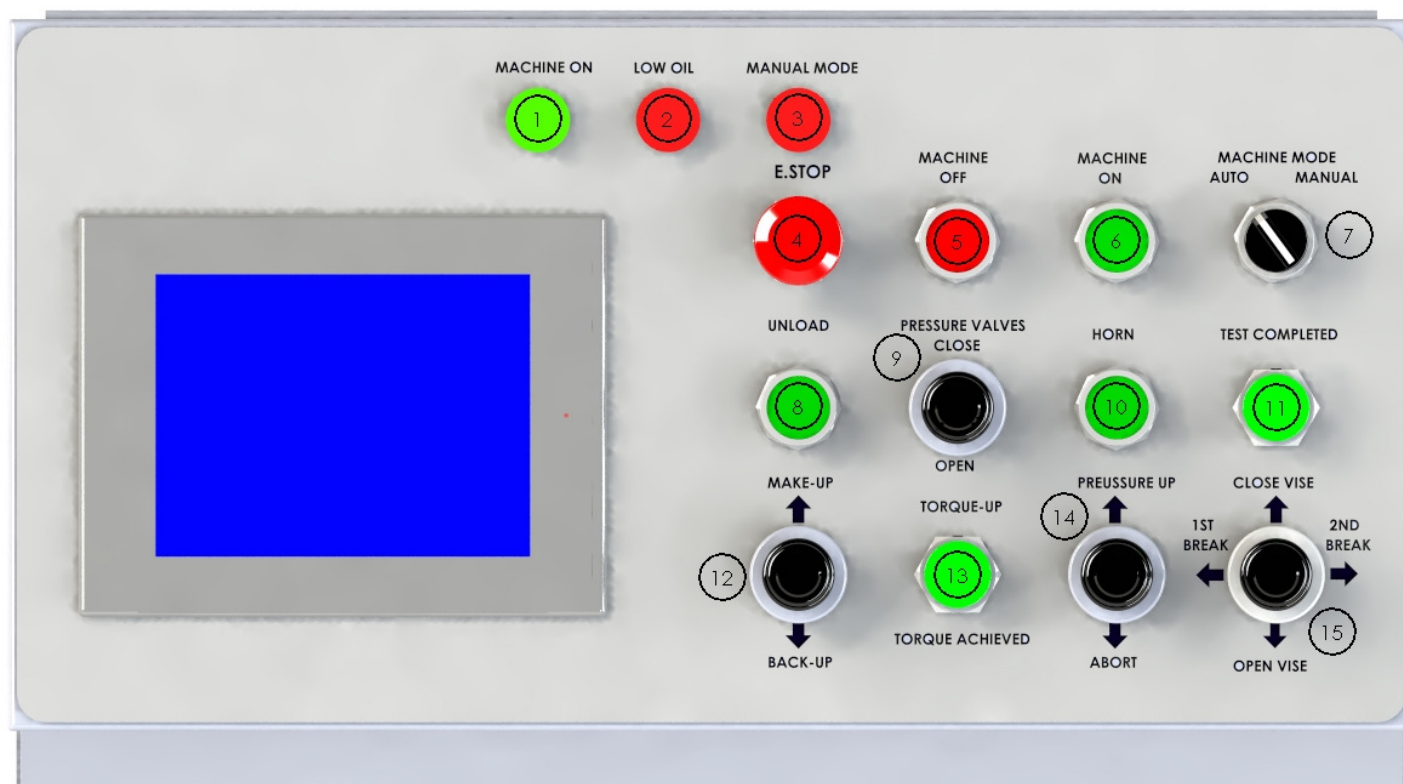
- Electrical 230/480V, 3 Phase, 60 Hz 48 Kilowatts
(Others available upon request)
- Rack height 42"

Machine Setup

1. A site inspection by Hub City personnel is required prior to installation. Failure to do so can lead to prolonged installation times.
2. It is required that a Hub City representative be present during the installation and initial operation of the machine.
3. Machine is to be installed on flat and level concrete. A foundation study by a qualified civil engineer is recommended to protect personnel and equipment. It is recommended that a fresh water source is located nearby. It is also recommended that a cover be built over all equipment to protect the machine and operator from the elements. Machine is to be free from sand and other debris. Loose debris in water or tested pieces can damage seals and high pressure sealing surfaces.
4. Machine is to be leveled on both axes using shims or epoxy grout and also squared off to pipe rack as required. Maximum test module's out of level to be $\frac{1}{2}$ inch per 50-1/2 feet along the length of the machine. Maximum test modules' out of level to be $\frac{1}{8}$ inch per 10 feet along width of the machine. Maximum allowable frame twist or soft foot is $\frac{1}{8}$ inch.
5. Drill and install concrete anchors into slab according to bolt pattern print.
6. Torque down bolts as required.
7. Install power supply according to general layout drawing. Hydraulic power supply is to be leveled and anchored to foundation.
8. Install Operator safety cage according to general layout drawing. Tester module should be in visible range of Operator cage so that an operator can identify any problems with leakage or other defects. Operator cage to be level and anchored to foundation.
9. Hydraulics to be installed and tested by a qualified technician. See manual for hydraulic schematics
10. Electrical to be installed and tested by a qualified technician. See manual for electrical schematics.
11. A Factory acceptance test that is performed or witnessed by a Hub City representative is required during commissioning.

Controls

Standard HTM-2000 Controls



(Standard Control Layout – Specific Control Locations May Change)

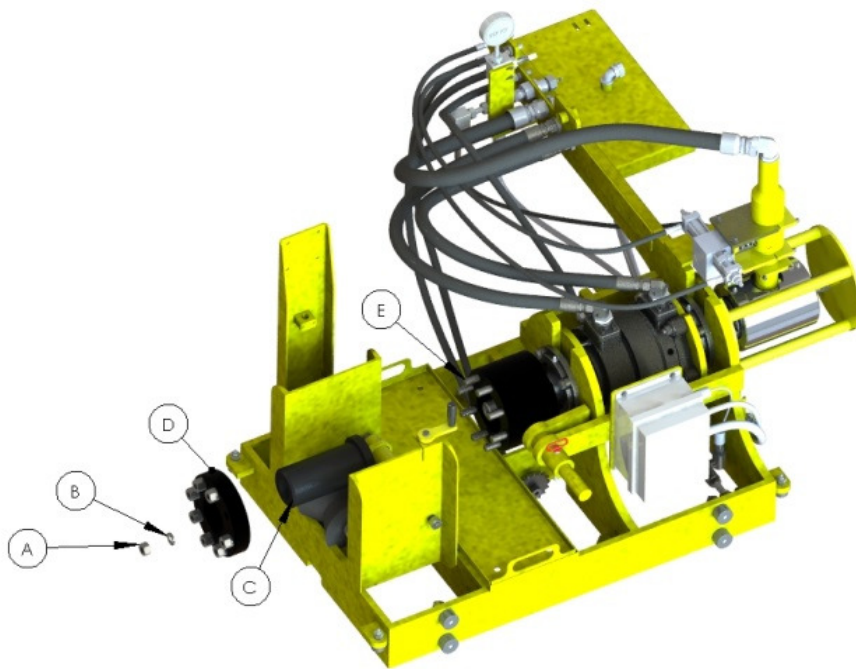
	<u>Function</u>	<u>Description</u>
1	Machine On Light	Indicates machine is powered on
2	Low Oil Light	Indicates a low oil state. Power down machine and refill.
3	Manual Mode Light	Indicates machine is in manual or service mode
4	E. Stop	Emergency stop button
5	Machine Off Button	Turns machine off
6	Machine On Button	Turns machine on
7	Machine Mode Switch	Toggles machine between Auto and Manual mode
8	Load / Unload Button	Loads / Unloads test pieces
9	Pressure Valves Close	Not Available.
10	Horn	Sounds horn
11	Test Complete Light	Indicates test is complete
12	Make-Up / Back-Up	Make-Up: Makes up test piece Back-Up: Breaks out test piece
13	Torque-Up / Torque Achieved	Torque-Up: Torques up work piece Torque Achieved: Indicates torque has been attained
14	Pressure Up / Abort	Brings test piece up to test pressure or aborts test
15	Close/Open Joystick	Close Vise: Closes vice on work piece Open Vise: Opens vice on work piece 1 st Break: Hi torque initial break out, carts don't move 2 nd Break: Hi speed low torque to complete breakout operation

Process Setup

Follow the Process Setup procedure each time a new pipe size or type is to be tested. Failure to do so can damage the test piece, the equipment or cause bodily injury.

Changing Test Plug

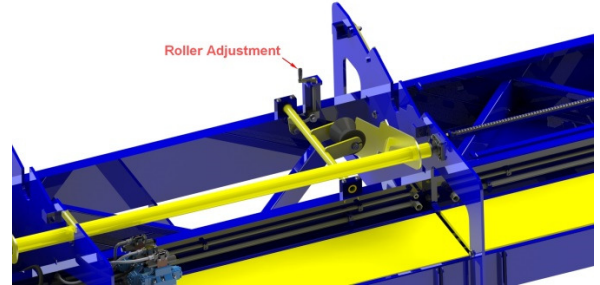
1. When loading the first pipe, or changing pipe sizes or connections, the test plugs(C) need to be changed accordingly.
2. Lock out/Tag out machine to prevent bodily harm.
3. Inspect test plugs to insure that the correct plug is installed or is being installed to test the upcoming connections
4. Inspect test plugs to ensure that there is no unacceptable damage according to API specifications. Damage to the test plugs can damage the pipe connections. It can also cause bodily injury or death
5. Remove the eight hex nuts (A) and washers (B) holding the outer flange (D) of the mandrel.
6. Remove the outer flange.
7. Remove the test plug and store appropriately. Remove O-ring.
8. Replace O-ring.
9. Install new test plug and matching flange.
10. Inspect studs and nuts for damage and wear.
11. Apply anti-seize compound to the studs (E) to prevent thread galling and corrosion.
12. Install selected test plug. Reinstall flange and hex nuts.
13. Torque hex nuts between 320 and 430 foot pounds.



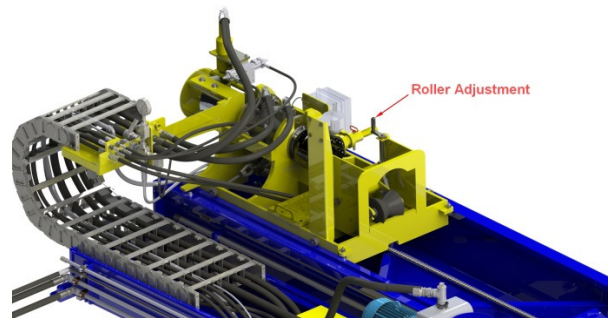
V Roller adjustment

The V roller pipe supports are designed to support the test piece at an elevation that allows the test plugs to mate with the box or pin without damaging the connections.

1. Clear rollers of test pipe. Raise center V rollers so that pipe rests above centerline.
2. Load first test piece into machine. Bring in cars so that cars are off the home sensors.
3. Adjust center V rollers so that pipe is centered in the vise.
4. Actuate the "Close Vise" Joystick. Check that Pipe is centered, adjust as necessary. Open vise
5. Bring in cars so that pipe is resting on both of the cars v rollers. Note where pipe is with reference to the test plug. Bring cars out and adjust V rollers.
6. Repeat Step 5 until test piece is centered between mandrels.



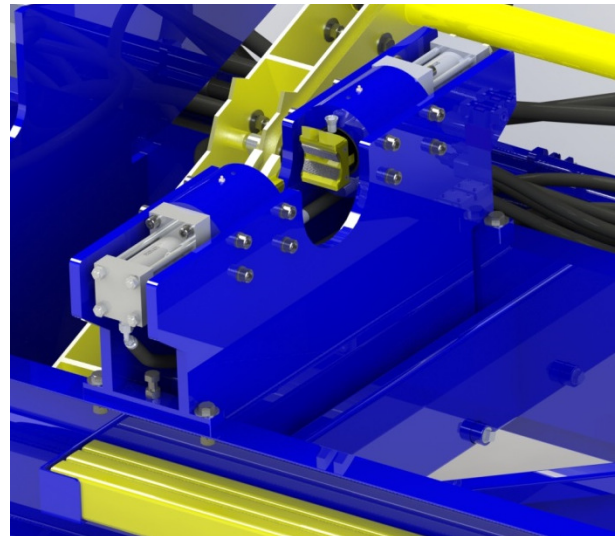
Center V roller adjustment



Car V roller adjustment

Pipe Vise adjustment

1. Clear all pipe from load racks.
2. **Vise is factory set and should require little to no adjustment throughout its use.**
3. The HTM-2001 is equippable with dies that handles tubulars from 2-3/8" to 4-1/2".
4. Die holders can be removed by pressing the button on the top of the stainless half inch pin and pulling up simultaneously.
5. After removing die assembly, remove the 2 screws holding the end plate.
6. Replace die.
7. Reinstall by assembling parts in the reverse order that they were removed.



Rack adjustment

1. Pipe diameter tab may need adjustment for pipes of different diameter. Loosen bolts on load plates. Move plates as required so that load arms grab only one pipe at a time. Tighten bolts as required. Test pipe should come into contact with all three load plates

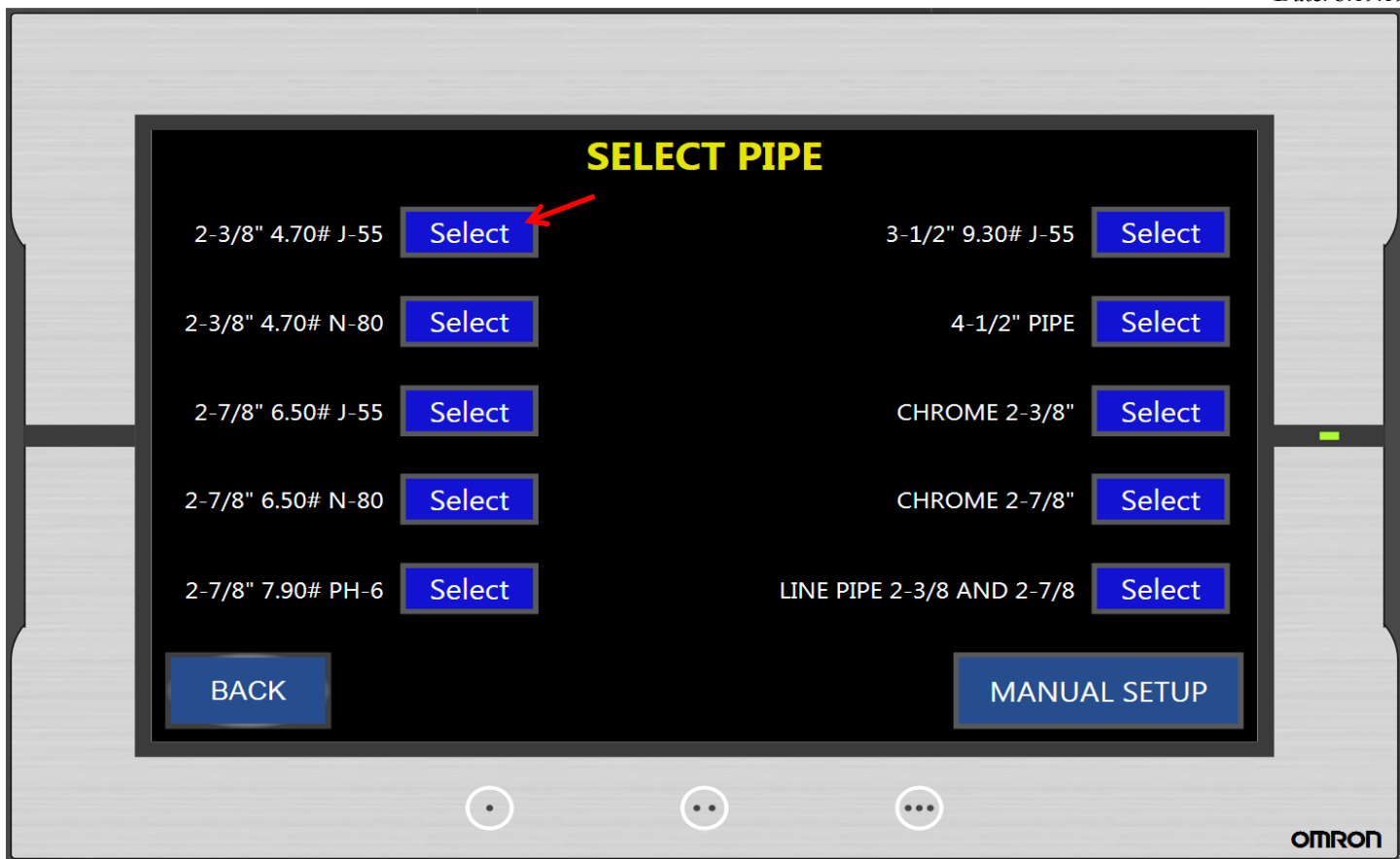
Startup

1. Before starting, ensure that all daily maintenance is completed.
2. Load pipe onto pipe rack.
3. Remove thread protectors. Visually inspect threads for damage.
4. **Blow compressed air through each test piece to remove any debris in test piece. Failure to do so will cause damage to the machine's seals and prevent it from holding pressure.**
5. Apply pipe dope to threads.
6. Enter test cage and close door.
7. Follow the menu options to select pipe size, grade, connection type, torque, pressure, test time, and pressure buffer. (See below for detailed menu instructions)

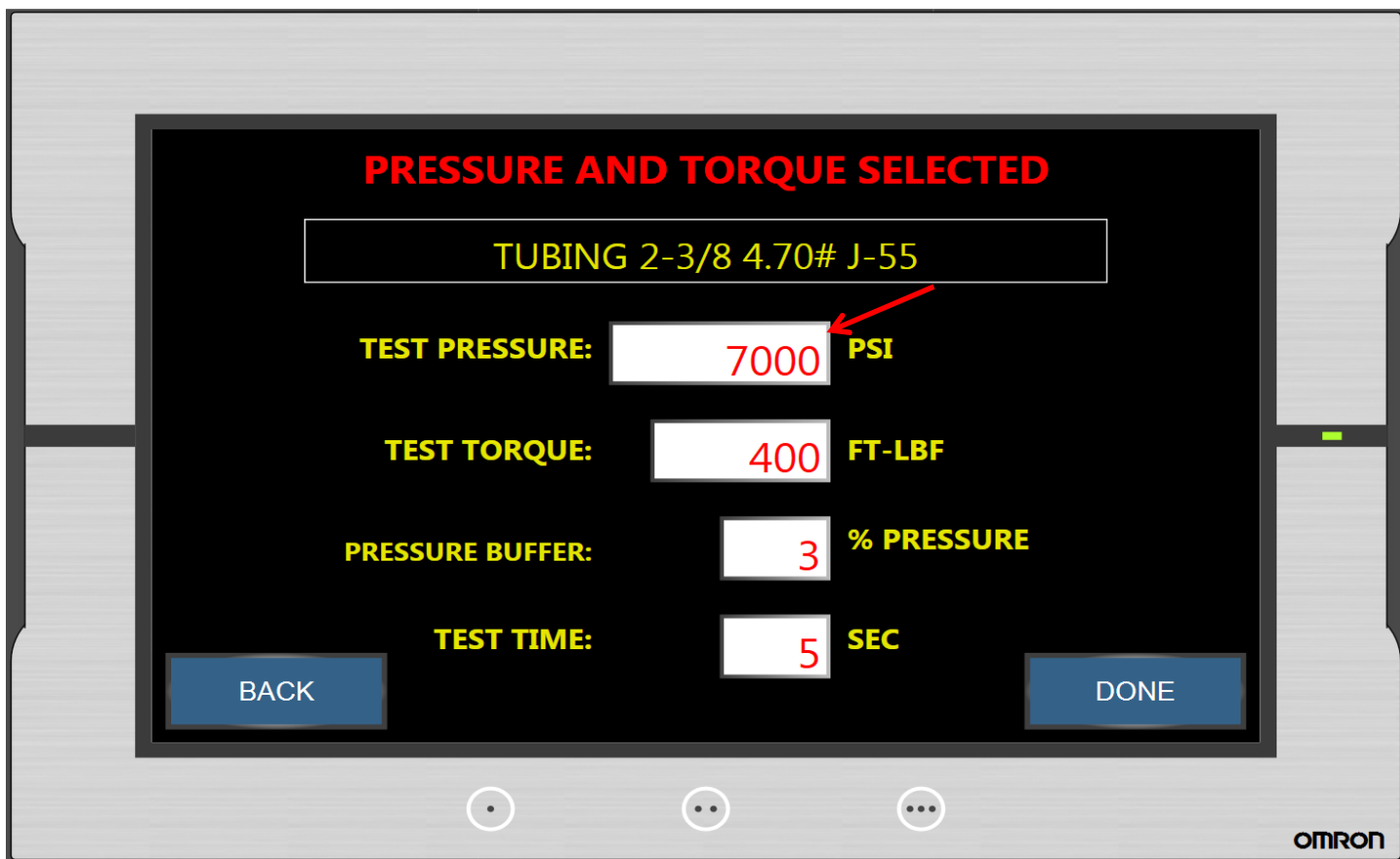
To select pipe, press the “PIPE SELECT” key.



Press “PIPE SELECT”.



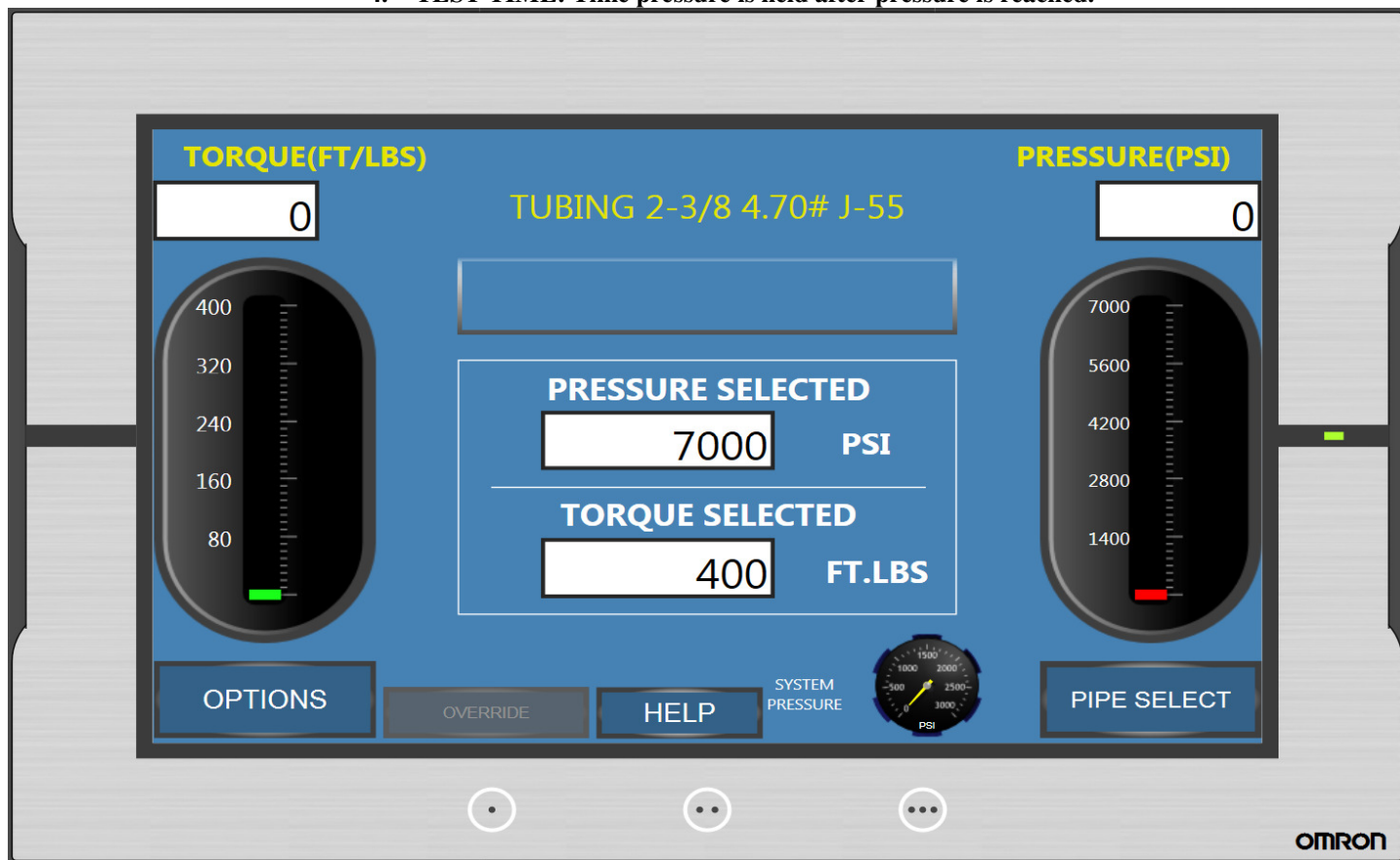
SELECT DESIRED PIPE TO BE TESTED



MODIFY VALUES AS REQUIRED AND THEN SELECT "DONE"

1. TEST PRESSURE: Minimum pressure required for a completed test.

2. **TEST TORQUE:** Torque required to perform a satisfactory seal
3. **PRESSURE BUFFER:** Rapid pressurization of the test piece often causes a pressure differential to occur especially in larger diameter pipe. This value, expressed as a percentage over test pressure, helps counteracts the equalization of the pressure differential between the fill line and the actual test piece.
4. **TEST TIME:** Time pressure is held after pressure is reached.



REVIEW SETTINGS AS REQUIRED.

Process

1. Press “Machine On” (**Control #6**). This will turn on the hydraulic system.
2. Ensure that the machine is in Auto mode and that the correct mandrels are installed on the machine.



PRIOR TO LOADING OR OFF LOADING PIPE, ENSURE THAT THERE ARE NO PERSONNEL OR EQUIPMENT IN THE PIPES PATH

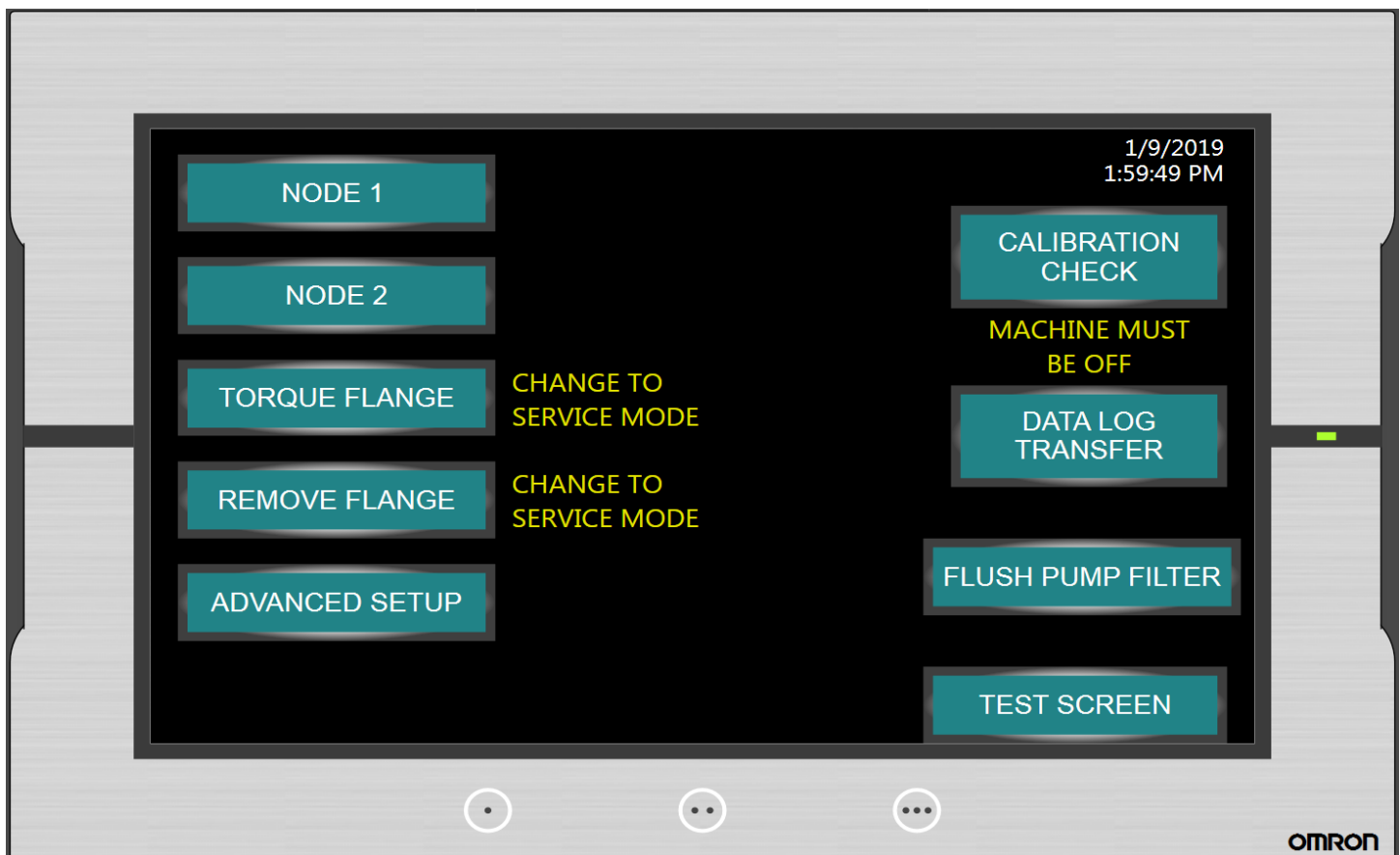
3. Assuming that the machine is free and clear and with the pipe on the rack, actuate the Load / Unload button (**Control #8**). This will load the pipe onto the machine and simultaneously unload the test piece currently on the machine.
4. Activate the Make-Up joystick (**▲ Control #12**) until both motors stop. You may be required to close the vise and use the Back-Up joystick (**▼ Control #12**) if threads do not engage properly. See “v-roller adjustment” section on how to avoid this
5. Press and hold the Torque-Up button (**Control #13**). It will tighten the connections according to the size and connection type selected previously on the interface screen.
6. After torque is reached, the machine will automatically begin filling the test piece with water. All air must be allowed to escape. As all of the air exits, the water exiting the tube will become less turbulent and air will

stop coming out. The pressure gauge on the control console needs to be at least 70 psi before continuing to the next step. Larger diameter pipe will typically take longer. Not allowing the air to escape will result in a failed test.

7. Actuate the Pressure-Up joystick (▲ **Control #14**). Keep the actuator engaged until peak pressure is reached. It is normal for a slight pause or even a loss of pressure to show on the screen once pressure reaches 90% of test pressure due to equalization. The tester will automatically stop at set pressure and a message on the interface screen will say “Pressure Reached”. Release the joystick. **
The Test Complete Light (**Item #11**) will illuminate when test is completed. Tester will automatically depressurize and vise will automatically close.
8. Once vise is closed and pressure is released, Push 1st Break joystick (◀ **Control #15**). High torque will be applied to remove the test plugs. Activate until both test mandrels break loose and are spinning.
9. Push 2nd Break joystick (▶ **Control #15**). The carts will finish unthreading and cars will move back to the home station. Vise will open automatically once cars are in the home station.
10. Ensure that vise is released
11. Actuate the Load/Unload Button (**Control #8**) again to repeat the process.

** If an issue occurs during the pressurization process, actuate the abort joystick to depressurize the test piece. Inspect the pipe and all connections for leaks. Break connections as below and fix any issues and attempt the test again.

Advanced processes and settings.



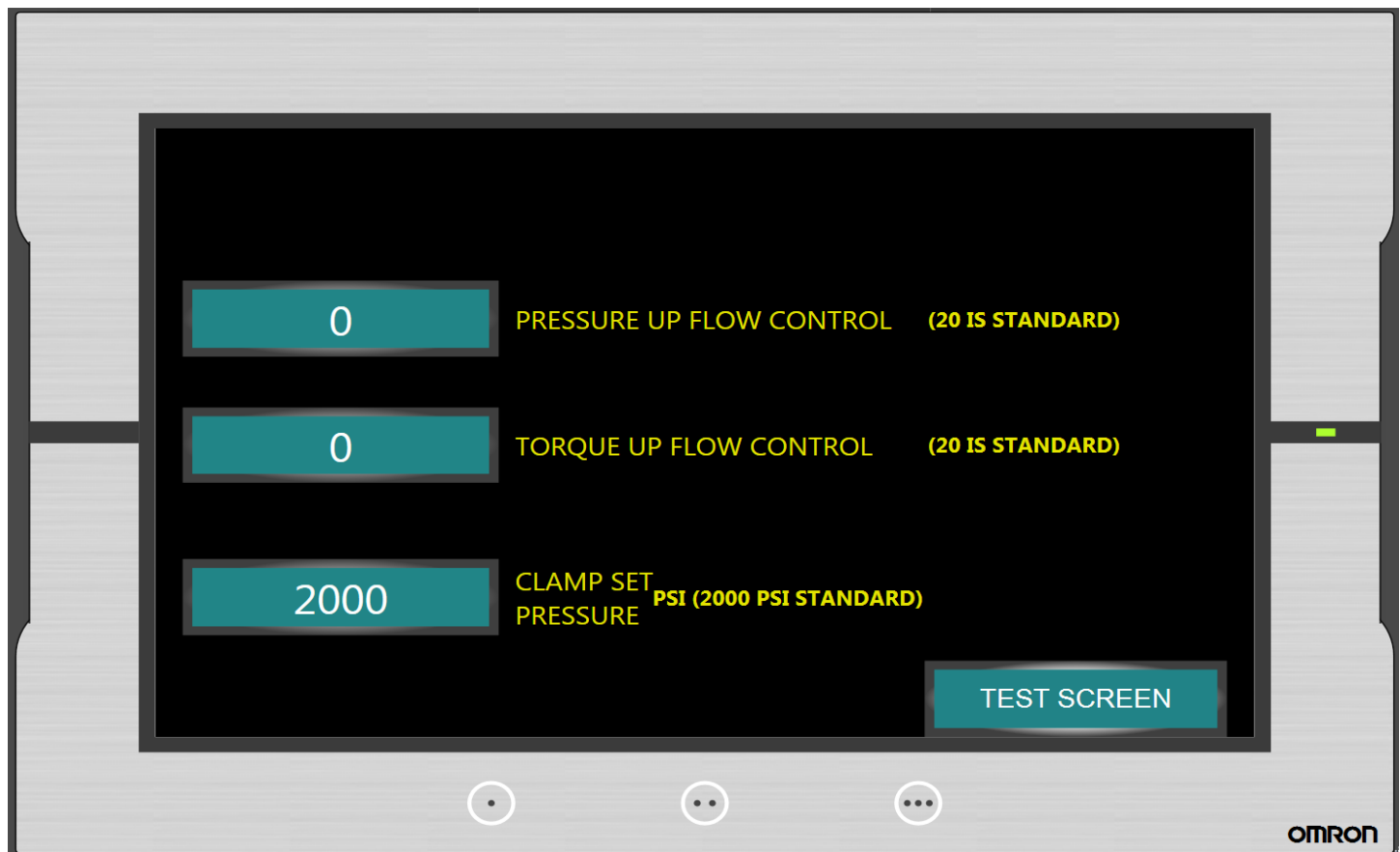
NODE 1: List of inputs and outputs for node 1 which is located in the control panel located in the center of the testing machine. Used for troubleshooting electrical issues.

NODE 2: List of inputs and outputs for node 2 which is located in the operator's panel Used for troubleshooting electrical issues.

TORQUE FLANGE: Used to torque the flanges after replacing an o-ring. It is required that the mandrel, mandrel flange, mandrel studs, and drive flanges be removed before activating. Once removed push the torque pin into the flange on **ONE CAR ONLY**. Actuate the makeup switch until satisfactorily torqued. Mandrels studs and flanges can all be reinstalled.

REMOVE FLANGE: Used to remove the flanges to replace an o-ring. It is required that the mandrel, mandrel flange, mandrel studs, and drive flanges be removed before activating. Once removed push the torque pin into the flange on **ONE CAR ONLY**. Actuate the 2nd break switch until satisfactorily torqued. Mandrels studs and flanges can all be reinstalled.

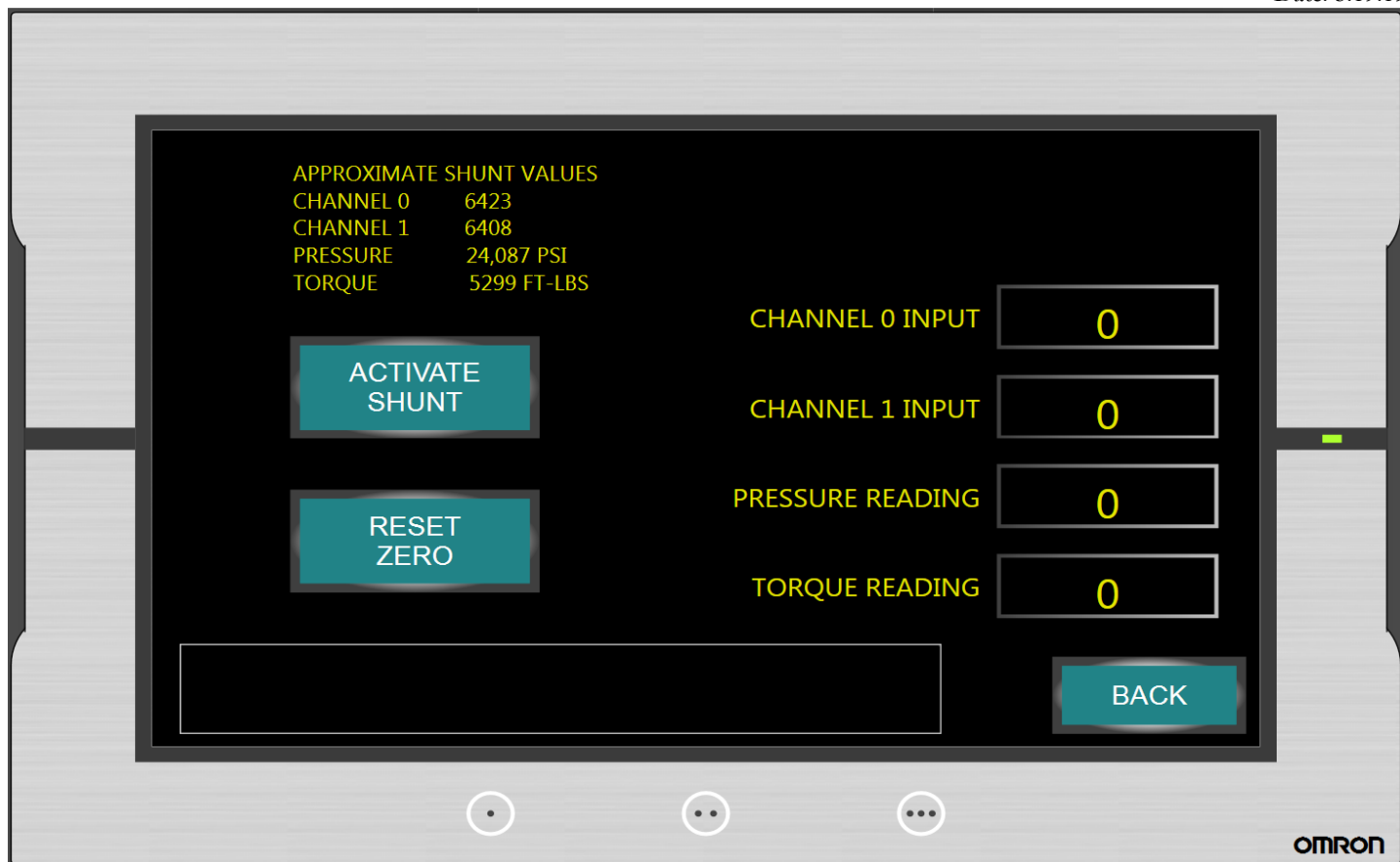
ADVANCED SETUP: Contains more options for better control of the machine.



PRESSURE UP FLOW CONTROL: This determines the flow reduction percentage once pressure reaches 90% of test pressure.

TORQUE UP FLOW CONTROL:

CALIBRATION CHECK: Advanced options to check calibration of sensors. Advanced users only




Approximate shunt values: Approximate values displayed on the right side of the machine when the “ACTIVATE SHUNT” button is on.

RESET ZERO: resets zero of both sensors. Machine must be off and free of pipe, “activate shunt” must also be off.

DATA LOG TRANSFER: Creates multiple spreadsheet files on a USB drive located on the backside of the control console.

FLUSH PUMP FILTER: Turns on low pressure water pump for flushing, testing or, for purging air.

Preventative Maintenance Procedure

	<h1 style="margin: 0;">Hydrotester Daily Preventative Maintenance</h1>							
<p>Company: _____</p> <p>Location: _____</p> <p>Machine No.: _____</p> <p>Week of: _____</p>								
<p>Instructions:</p> <p>Inspect each item at the start of each shift - initial next to block after task is complete</p> <p>For more detailed information consult operators manual.</p>								
Day	Inspect control console (1) touch screen for loose wires and proper function (2) switches and joysticks for loose and/or broken wires	Inspect j-boxes (1) loose wires	Inspect load/unload arms (1) cracks, bent parts, and excessive wear (2) broken bearings or loose grease fittings (3) hydraulic cylinder and hoses for leaks	Inspect vise (1) cracks, bent parts, and excessive wear (2) pipe jaws for wear and missing parts (3) hydraulic cylinder and hoses for leaks	Inspect low car (1) frame for cracks or bent parts (2) pipe adjustment roller and bearing for wear and grease them (3) hoses and fittings for leaks (4) drive chain and sprockets for wear (5) rotary coupling for leaks (6) all other bearings for wear and grease them (7) Clean excess pipe dope off trays	Inspect high car (1) frame for cracks or bent parts (2) pipe adjustment roller and bearing for wear and grease them (3) hoses and fittings for leaks (4) drive chain and sprockets for wear (6) all other bearings for wear and grease them (7) Clean excess pipe dope off trays	Inspect power supply (1) all fittings and hoses for leaks (2) electrical panel for loose wires (3) low oil switch functions properly (4) Check oil levels in hydraulic reservoir (5) Check return filter pressure gauge while make-up motors & loaders are operating	Inspect Water System (1) all piping for leaks/cracks (2) Trough for debris. Clean at first sign of contamination (Critical to performance)
1								
2								
3								
4								
5								
6								
7								
<p>Comments:</p> <div style="border: 1px solid black; height: 100px; margin-top: 5px;"></div>								



Hydrotester Yearly Preventative Maintenance

Company: _____
Location: _____
Machine No.: _____
Week of: _____

Instructions:

Inspect each item at the start of each shift - initial next to block after task is complete

For more detailed information consult operators manual.

Year	Power Supply (1) Drain hydraulic reservoir & clean w/ suitable solvent. (2) Remove suction strainer & clean w/ solvent	Machine Alignment (1) Verify machine is aligned properly. Correct if necessary	Winterizing (1) Remove plug on water pump & strainer & drain water at night to prevent freezing (2) Antifreeze may be added to lower freezing point							

Comments:

Trouble shooting guide

Problem	Corrective Action
Tester fails to hold pressure	<p>Attempt test on different pipe Check test plug for damage Check and replace rotary coupling seals(part # 13993, 13994) Inspect check valve O-ring on high side (part # 14076) Check rotary coupling shaft O-ring (part #13993) Check rotary coupling shaft for wear (part #13914) Inspect check valve O-rings on low side (part # 14076) Inspect intensifier seals(part #37230, 37421) Check and replace test plug/mandrel O-ring(part# 37249) <u><i>(Debris in system water is a major contributing factor to pressure loss and care should be taken to keep system water clean)</i></u></p>
Mandrels fail to make up	Check thread profile, if necessary recut threads
Machine fails to reach specified torque	<p>Check system pressure Call service representative</p>
Jaws fail to grip pipe	<p>Check dies for wear, replace if necessary. Check pump pressure when dies are closing. If dies are dirty, clean and reattempt</p>
Clamp is denting pipe	<p>Check wall thickness of pipe Check system pressure when closing vise.</p>

Parts List

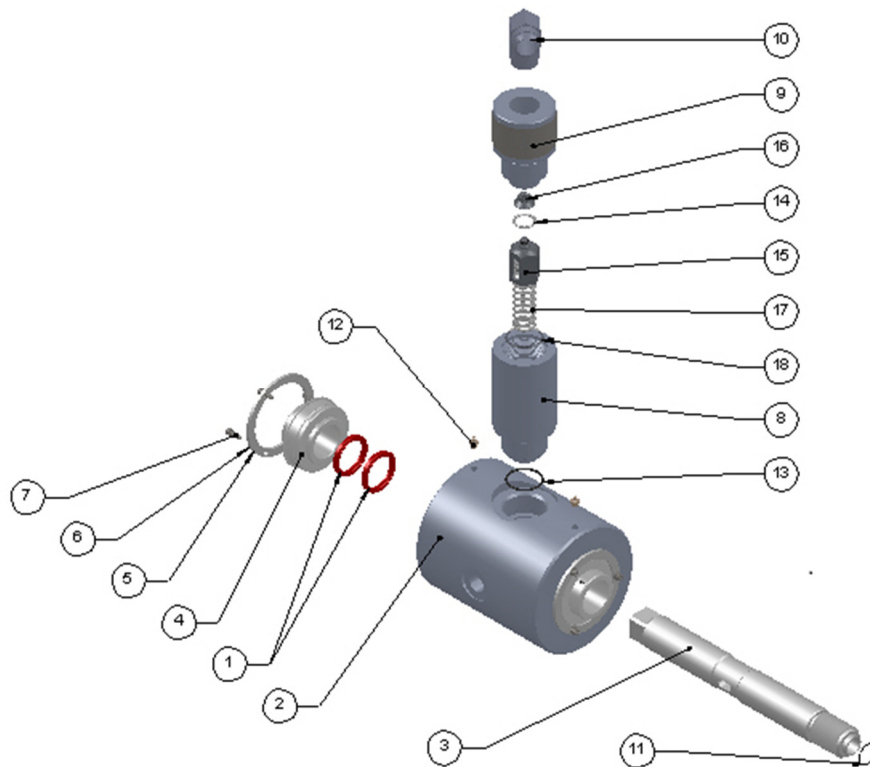
Recommended Spare Parts

LEVEL A		
Stocked on Location & KMI		
NAME	QTY	SAP#
Limit Switch Arms, LSZ52D	2	14113
Fuse, MDL-2 2A	10	17480
SEAL, POLY PACK	10	13993
RING, BACKUP	10	13994
ROCKET BODY/SEAT ORING	10	14075
ROCKET SEAL ORING	10	14076
RINEER / ROTARY SHAFT ORING	10	21380
CHECK VALVE SEAT	1	24139
ROCKET CAP	1	21147
ROCKET BODY	1	24137
FILL SIDE SPRING	1	24144
FLANGE/FLANGE ORING	30	29046
FLANGE /PLUG ORING.	30	37249
9.5 OD SML PLUG FLANGE	1	37268
9.5 OD LG OD PLUG FLANGE	1	24205
FLANGE ALL THREAD ROD	4	29133
RINEER MAIN BEARING	2	14598
CART LARGE CAM FOLLOWER	2	27201
CART SMALL CAM FOLLOWER	2	14601
INTENSIFIER BUSHING	2	29275
INTENSIFIER BACKUP RING	12	37230
INTENSIFIER SEAL	12	37241
DUMP SIDE CHECK BODY	1	21306
DUMP SIDE CHECK SEAT	1	24133
DUMP SIDE SWIVEL	1	22342
WISE DIES	*	
PIPE ROLLER RUBBER WHEEL	1	13630
RUBBER ROLLER BEARING	2	14599
TEST MANDRELS	*	
Level B		
0-3 days delivery		
NAME	QTY	SAP#
Pressure Transducer,GT1850 Series 4-20mA	1	24691
Load Cell,RDE900-3MTNTL-166 Output 4-20mA	1	24692
PLC, 40I/O CP1H	1	16823
PLC Expansion I/O Unit	1	16375
8 port Ethernet Switch(MOXA)	1	16479
Ethernet Device, CP1W-CIF41	1	15285
Amplifier,DRC1-A06 DinRail	1	24763

Power Supply, 480v/24vdc Power Supply 20A	1	24184
Contact, 24vdc coil ;25HP,50A	1	14974
Thermal Overload relay (22-26A)	1	17014
Thermal Overload relay(26-32A)	1	17022
Contact, 24vdc coil ; 15hp,32A	1	16444
Thermal Overload Relay(5-8A)	1	17024
Joystick, Two ways Joystick	1	17309
Joystick, 4 ways Joystick	1	17311
Relay, 8 pins 2 Pole 24vdcCoil	1	17001
Relay, 11 pins 3 Pole 24vdc Coil Relay	1	17002
Limit switch, adjust Lever, 5A 230vAC	1	17397
Limit switch, Plunger Actuated	1	17403
Relay ,24vdc 1PDT Phoenix	2	43849
8" Touchscreen Omron	1	17132
Breaker, 5A 1 Pole Breaker	1	14656
ROTARY COUPLING SHAFT	1	13914
ROTARY COUPLING SHAFT BEARING	2	15492
ROTARY COUPLING BODY	1	27508
ROTARY COUPLING END CAP	2	24211
RINEER MOTOR SHAFT	1	20862
INTENSIFIER FLANGE	1	24213
INTENSIFIER TUBE	1	24212
DUMP SIDE CHECK CYLINDER	1	15114
CART PIPE ROLLER	2	13630
LOAD CYLINDER	1	24125
LARGE VISE CYLINDER	1	24124
SMALL VISE CYLINDER	1	15113
V ROLLER RUBBER WHEEL SHAFT	2	42404
V ROLLER SHAFT LG	2	42403
GO3 VALVE	1	17604
G06 VALVE OPEN CENTER	1	28595
G06 VALVE P-T CENTER	1	28593
MODIFIED TAP BLOCK FOR G06 P-T VALVE	1	28602
Level C		
0-120 Day Delivery		
NAME	QTY	SAP#
RINEER MOTOR	1	16441
WATER PUMP ASSEMBLY	1	24734
INTENSIFIER CYLINDER	1	24126
HIGH VOLUME HYDRAULIC PUMP	1	22532
HIGH VOLUME HYDRAULIC MOTOR	1	16412
HIGH PRESSURE HYDRAULIC PUMP	1	22534
HIGH PRESSURE HYDRAULIC MOTOR	1	16414

Rotary Coupling w/ Rocket valve

Revision: A

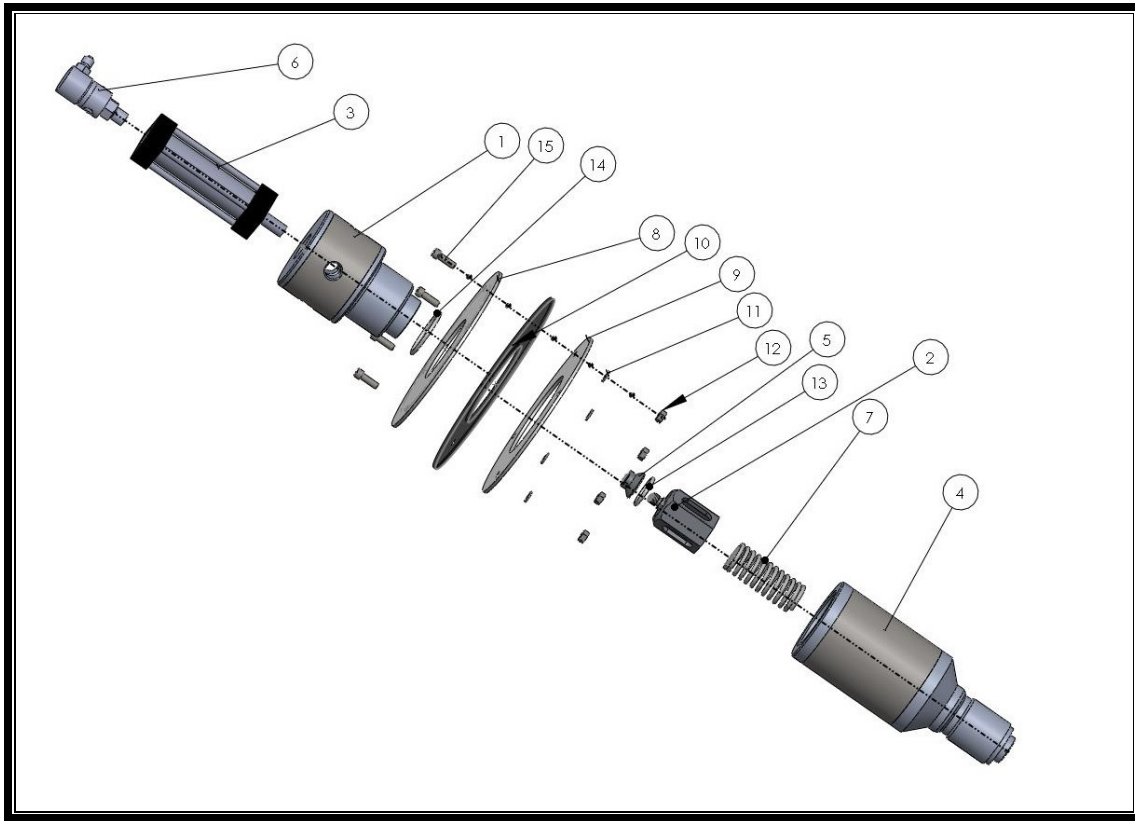


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	38136	ROTARY CPLG SEAL	4
2	110-400-068-013	ROTARY COUPLING BODY RCKT STYLE SEAT	1
3	110-400-007-020	ROTARY COUPLING SHAFT (2.0" X 17")	1
4	15492	ROTARY COUPLING BEARING,	2
5	110-200-069-018	RETAINING RING FOR BEARING	2
6	14138	WASHER, LOCK,	6
7	28240	BOLT, SHCS	6
8	110-400-001-024	HYDRO T UNIT CHECK VALVE BODY	1
9	110-400-010-024	CHECK VALVE SEAT - FILL SIDE	1
10	22192	ELBOW, HYDRAULIC	1
11	21380	ROTARY SHAFT ORING	1
12	16086	GREASE ZERK,	2
13	14075	ROTARY/CHECK BODY ORING	1
14	14076	ROCKET ORING	1
15	110-400-008-027	HYDRO T UNIT CHECK VALVE ROCKET BODY	1
16	110-400-009-027	HYDRO T UNIT CHECK VALVE ROCKET CAP	1
17	24144	FILL SIDE ROCKET SPRING	1
18	14075	CHECK VALVE BODY ORING	1

Discharge Valve

Revision: B

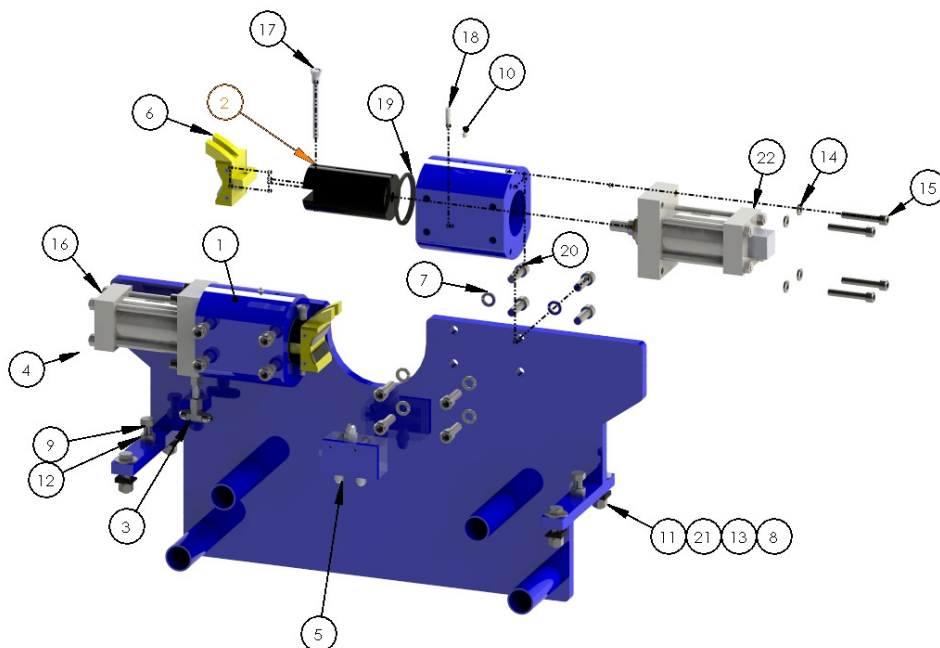
Discharge Check Valve



Item #	Part #	Description	Quantity
1	24133	CHECK VALVE SEAT	1
2	13889	HYDRO T UNIT CHECK VALVE BODY	1
3	15114	HYDRAULIC CYLINDER	1
4	21306	CHECK VALVE BODY, DUMP SIDE	1
5	21147	HYDRO T UNIT CHECK VALVE ROCKET CAP	1
6	22342	HYDRAULIC SWIVEL	1
7	24145	SPRING DUMP SIDE	1
8	110-200-043-018	OILER POT INSERT-P3	1
9	110-200-177-018	OILER POT INSERT-P5	1
10	110-200-045-XXX	OILER POT INSERT RUBBER DISK	1
11	28272	LOCK WASHER	4
12	28229	HEX NUT	4
13	14076	O RING	1
14	42227	ORING	1
15	28240	BOLT	4
16	21380	ROTARY SHAFT ORING	1

Clamp Assembly

Revision: C



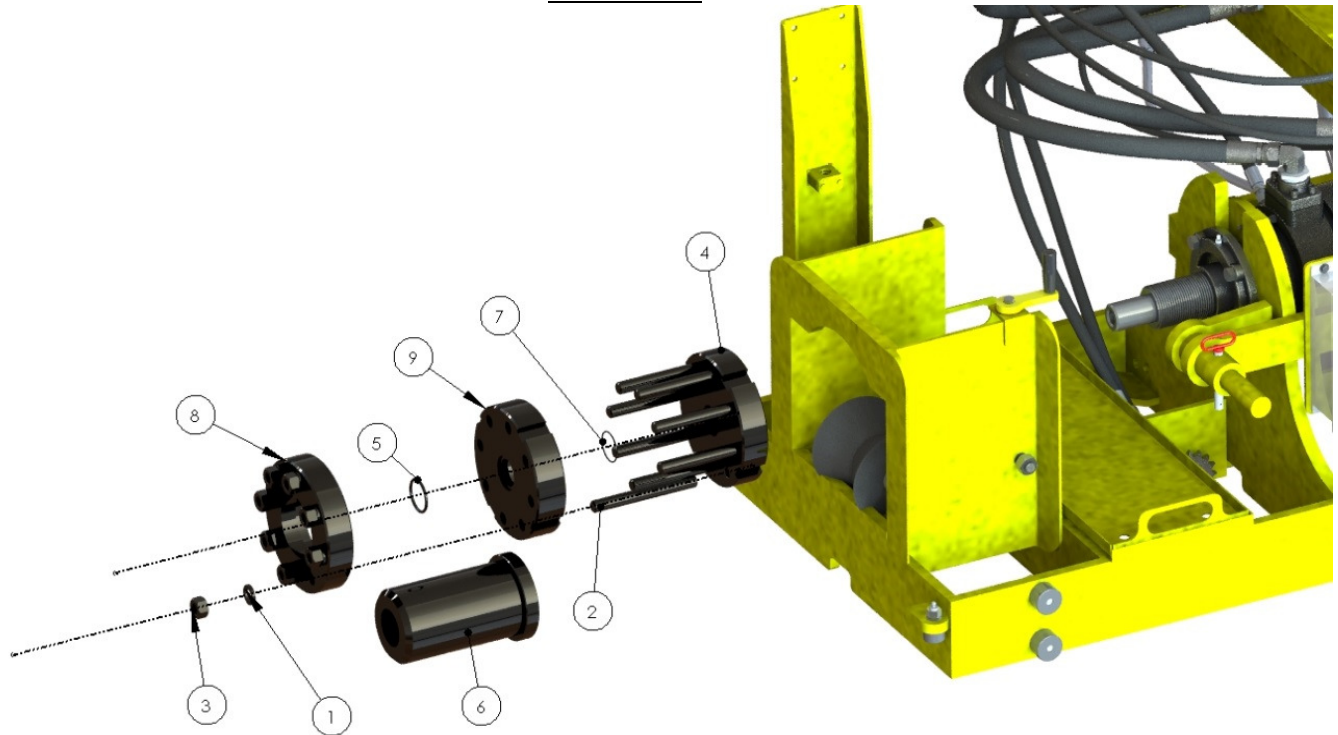
Note: Panel hidden for visibility

Item #	Part #	Description	Quantity
1	37708	CLAMP BORE HOLDER	2
2	37709	CLAMP INNER PUSH ROD	2
3	110-601-067-00	EXTENDED TEE	1
4	110-700-214-00	CLAMP (VISE) FAB ASSEM	1
5	110-701-021-00	FLOW DIVIDER ASSEMBLY	1
6	110-701-727-00	DIE HOLDER ASSEMBLY 2-3/8	2
	110-701-726-00	DIE HOLDER ASSEMBLY 2-7/8	2
	110-701-728-00	DIE HOLDER ASSEMBLY 1-1/2	2
	110-701-725-00	DIE HOLDER ASSEMBLY 3 1/2	2
	110-701-729-00	DIE HOLDER ASSEMBLY 4 1/2	2
7	14133	WASHER, LOCK, .75"	20
8	14319	BOLT, HHCS, .75" X 3" NC GR5	4
9	14404	BOLT, HHCS, .75" X 3" NF GR5	2
10	16086	GREASE ZERK, 1/8 NPT	2
11	16485	NUT, HEX, .75" NC	4
12	16496	NUT, HEX, .75" NF	2
13	17653	WASHER, FLAT,	4
14	17674	WASHER, LOCK,	8
15	28382	BOLT, SHCS, . " NC GR8	8
16	37892	CYLINDER,	1
17	38195	QUICK RELEASE PIN	2
18	38197	DOG SET SCREW, CUTOM	2
19	38344	4IN ID WIPER SEAL	2

20	38410	BOLT, SHCS, .75"-10 X 2.250" NC GR8	16
21	42012	SHIM, IRON LEVELING GAL. .75 SCREW	4
22	42357	CYL, 3.25, W/SWITCH POS 9	1

Mandrel Assembly

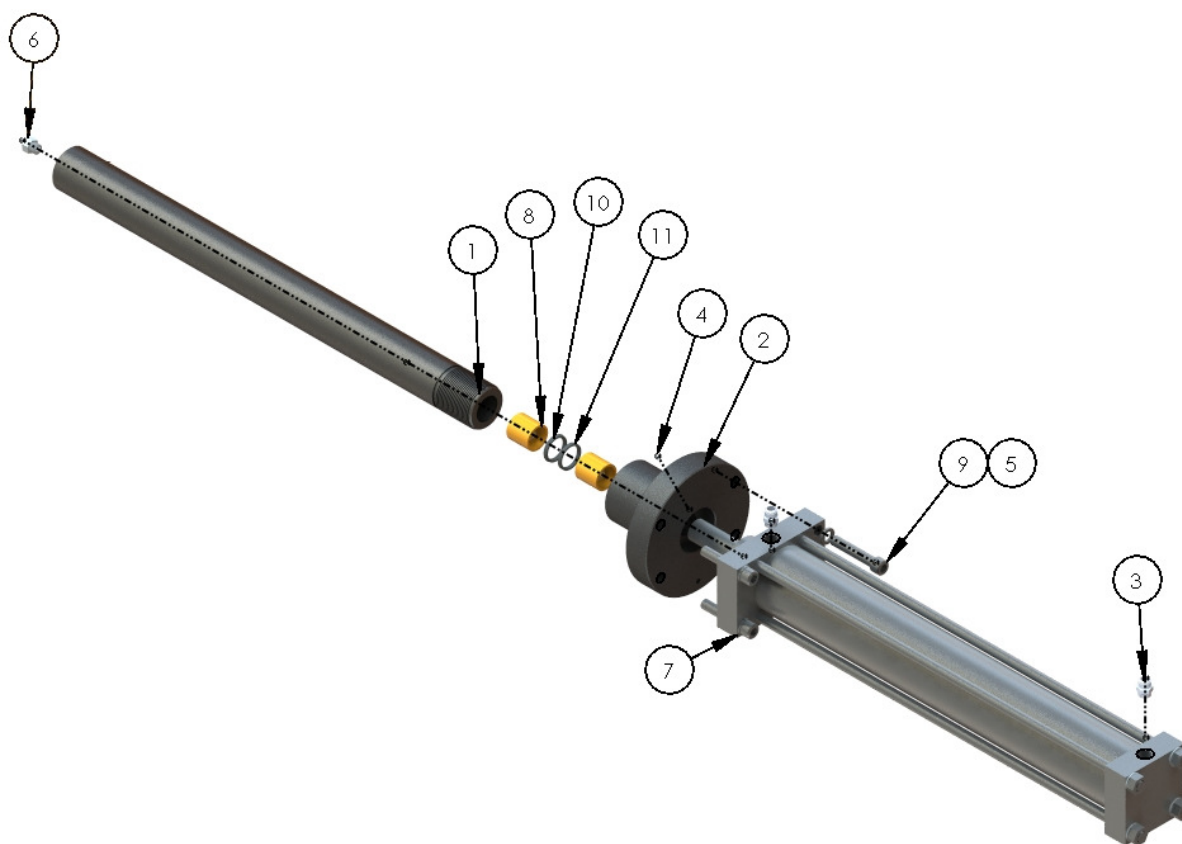
Revision: A



Item #	Part #	Description	Quantity
1	17677	WASHER, LOCK,	8
2	29133	ATR	8
3	16518	NUT, HEX,	8
4	24954	LOCKING FLANGE	1
5	37249	MANDREL/TEST PLUG O-RING	1
6	24522	HYDRO TEST PLUG, 2-3/8" 8RD PIN 4.70#	
	24523	HYDRO TEST PLUG, 2-3/8" 8RD BOX 4.70#	
	24524	HYDRO TEST PLUG, 2-7/8" 8RD PIN 6.50#	
	24525	HYDRO TEST PLUG, 2-7/8" 8RD BOX 6.50#	
	24526	HYDRO TEST PLUG, 3-1/2" 8RD PIN 9.30#	
	24527	HYDRO TEST PLUG, 3-1/2" 8RD BOX 9.30#	
	24528	HYDRO TEST PLUG, 2-3/8" MS6 PIN 5.95#	
	24530	HYDRO TEST PLUG, 2-3/8" MS6 BOX 5.95#	
	24531	HYDRO TEST PLUG, 2-7/8" MS6 PIN 7.90#	
	24532	HYDRO TEST PLUG, 2-7/8" MS6 BOX 7.90#	
	24533	HYDRO TESTPLUG,3-1/2" MS6 PIN 12.95#	
	24534	HYDRO TESTPLUG,3-1/2" MS6 BOX 12.95#	
	24535	HYDRO TEST PLUG, 4-1/2" MS6 PIN 15.50#	
	24536	HYDRO TEST PLUG, 4-1/2" MS6 BOX 15.50#	
7	29046	MID MANDREL O-RING	1
8	24205	SMALL CLAMP FLANGE	1
	37268	LARGE CLAMP FLANGE	1
9	24204	DRIVE FLANGE	1

Intensifier Assembly

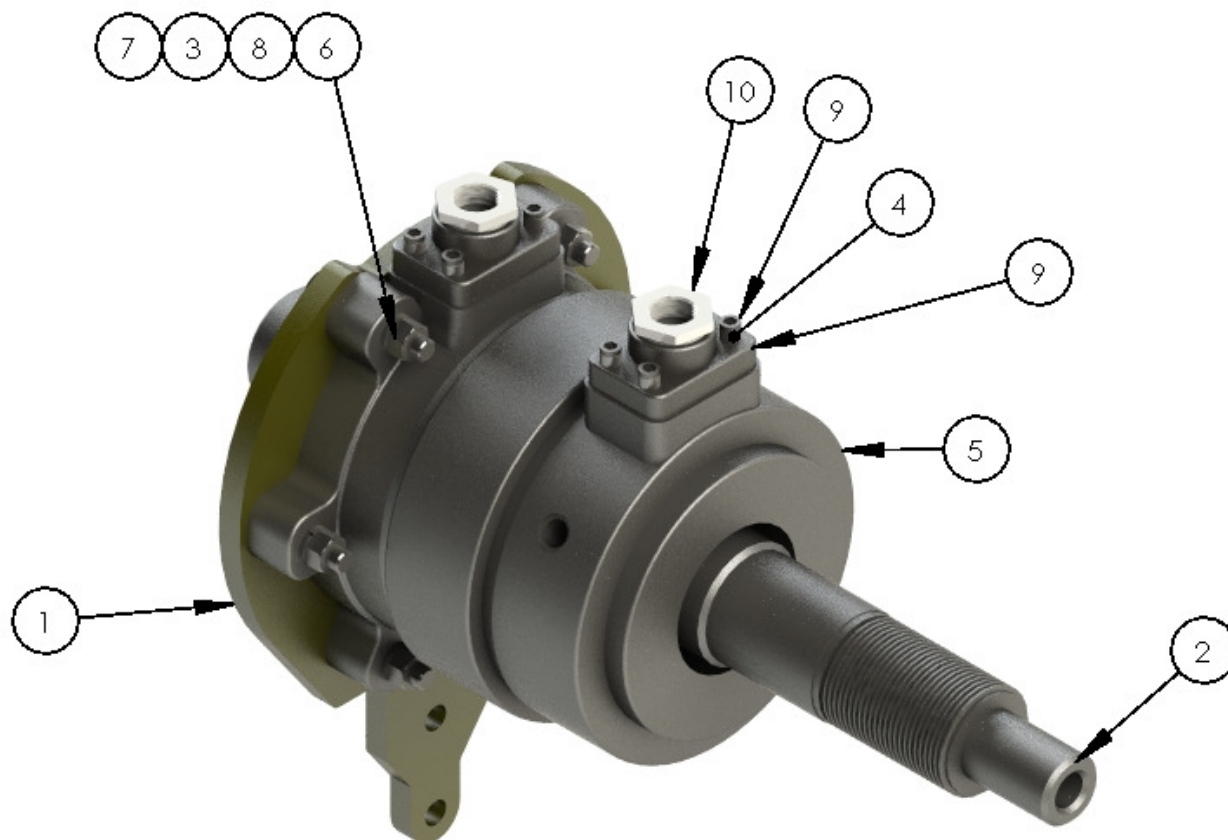
Revision: A



Item #	Part #	Description	Quantity
1	24212	INTENSIFIER CYLINDER w/AUTOCLAVE	1
2	24213	ADAPTER FLANGE 15 in. O.D. INTENSIFIER	1
3	15756	#16 MSAE O-RING X #16 MJIC ADAPTER	2
4	16087	GREASE ZERK, 3/8 UNF	2
5	17675	WASHER, LOCK, 1.125"	4
6	21978	ADAPTER, 9/16x1/4 MA9H4H 60K PSI	1
7	24126	7" HYD. CYL.	1
7a	46522	CYLINDER REPLACEMENT ROD	1
7b	46523	CYLINDER SEAL KIT	1
8	29275	BUSHING	2
9	29309	BOLT, SHCS, 1.125" X 6" NF GR8	4
10	37230	SEAL	1
11	37241	RING, BACKUP	1

Rineer Motor

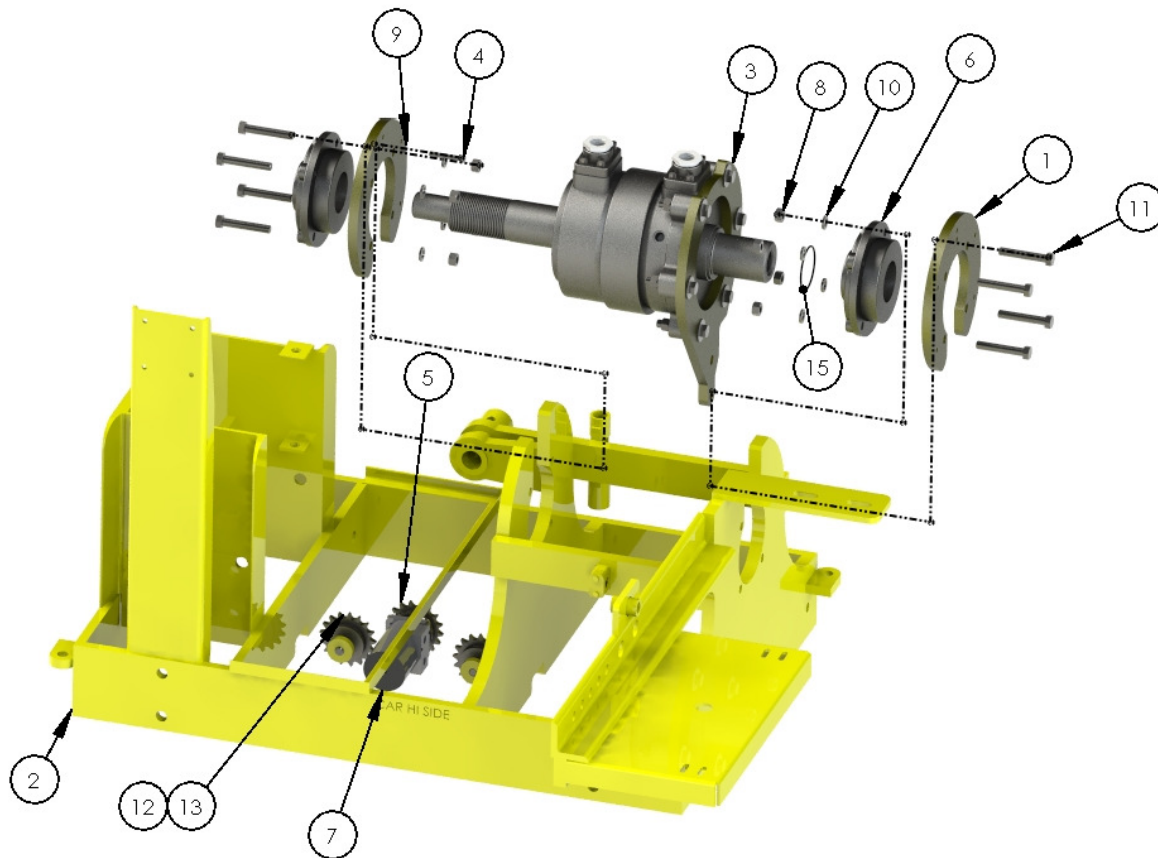
Revision: A



Item #	Part #	Description	Quantity
1	42582	CAR MOTOR TORQUE PLATE	1
2	20862	RINEER MOTOR SHAFT	1
3	14318	BOLT, HHCS	6
4	14473	BOLT, SHCS	8
5	16441	RINEER MOTOR HYDRO-TEST-UNIT	1
6	16484	NUT, HEX,	6
7	17651	WASHER, FLAT	6
8	17674	WASHER, LOCK,	6
9	21204	HARDWARE, MOUNTING	2
10	37066	THRD BUSHING	2

Hi Car w/ Motors

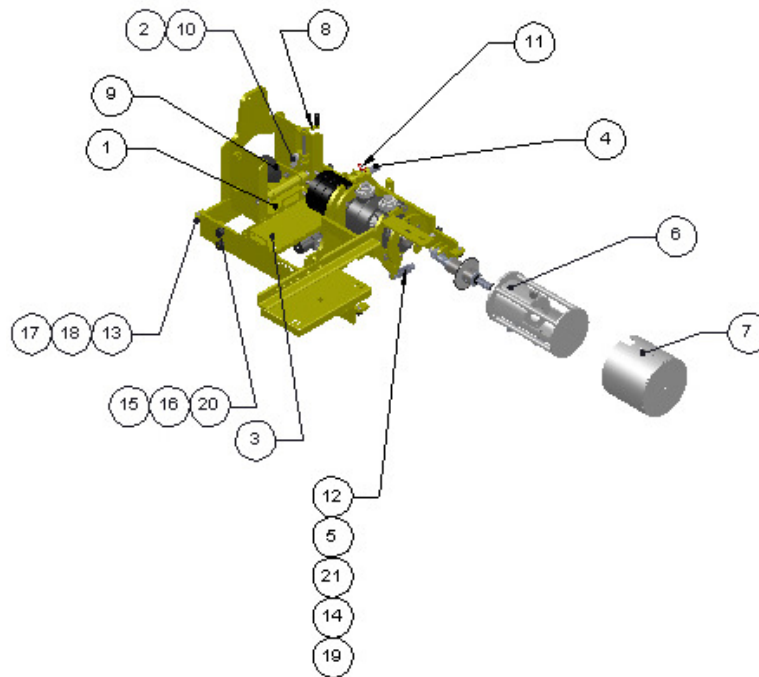
Revision: A



Item #	Part #	Description	Quantity
1	42618	CAR OILER & BEARING SUPPORT PLATE	2
2	110-700-130-00	DRIVE CAR HI SIDE FAB ASSEM.	1
3	110-701-659-00	RINEER MOTOR SUB ASSEMBLY	1
4	14330	BOLT, HHCS	1
5	14514	SPROCKET,	1
6	14598	BEARING, MOUNT BALL, FLANGED	2
7	16392	CHARLYNN HYD MOTOR P/N HS	1
8	16484	NUT, HEX,	8
9	16487	NUT, HEX, .	1
10	17674	WASHER, LOCK, .	8
11	21817	BOLT, HHCS	8
12	27155	BOLT SHOULDER	2
13	29114	SPROCKET IDLER,	2
14	36357	BOLT, FHSCS, .	4
15	36488	ORING, 70 DURO BUNA-N	1

Hi Car Main Assembly

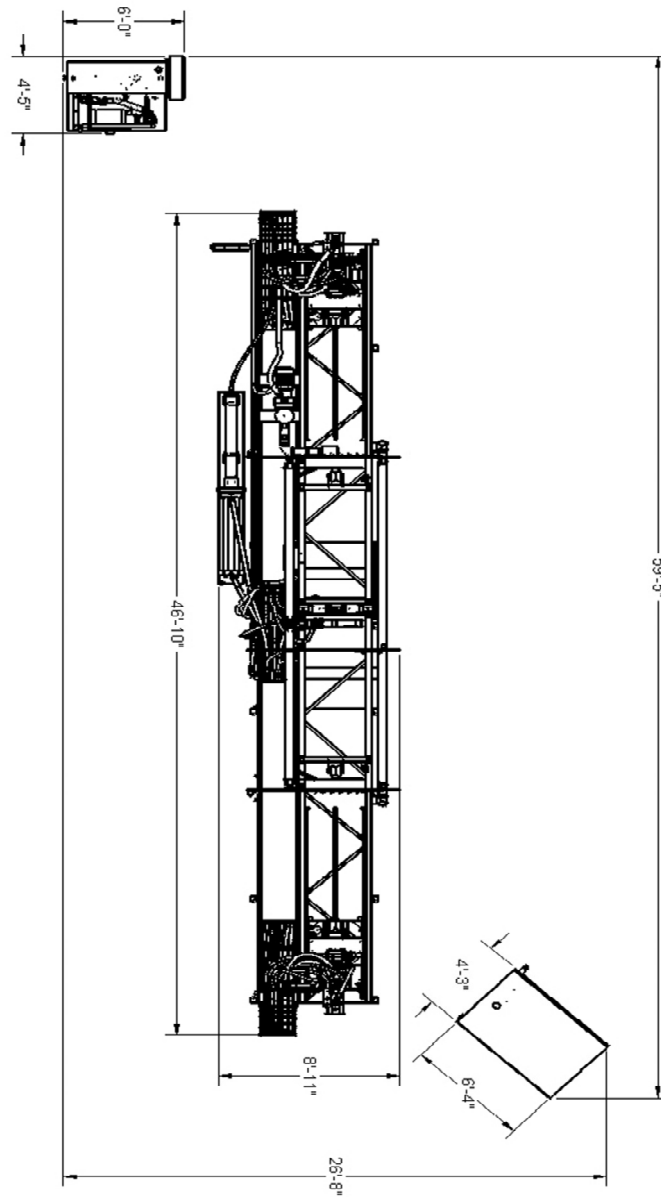
Revision: A



Note: Some items hidden for visibility

Item #	Part #	Description	Quantity
1	110-200-101-018	TRAY BASE PLATE -SMALL	1
2	42507	CAR ROLLER TIE ROD GUIDE	1
3	110-200-115-018	TRAY BASE PLATE -LARGE	1
4	42367	TORQUE PIN FOR COUPLING MAKEUP	1
5	26864	ATR	1
6	110-700-106-00	DUMP SIDE POT	1
7	110-700-326-00	SPLASH BLOCK	1
8	110-701-101-00	TVL CAR PIPE ROLLER JACK ASSMBLY	1
9	110-701-102-00	V-ROLLER ASSEM HI & LO CARS	1
10	110-701-302-00	CAR ROLLER JACK TIE ROD ASSM.	1
11	16199	PIN HITCH, w/LANYARD	1
12	38215	THREADED CLEVIS	1
13	27368	NUT, HEX	4
14	14010	CLEVIS PIN ,	1
15	16505	NUT, HEX	
16	17677	WASHER, LOCK, .	4
17	14601	CAM FOLLOWER WHEEL	4
18	27368	WASHER, LOCK	1
19	16485	NUT, HEX, .	2
20	27201	CAM FOLLOWER WHEEL	8
21	17350	ROD EYE	1

HTM-2001 Equipment Layout Calibration



CALIBRATION RECORD

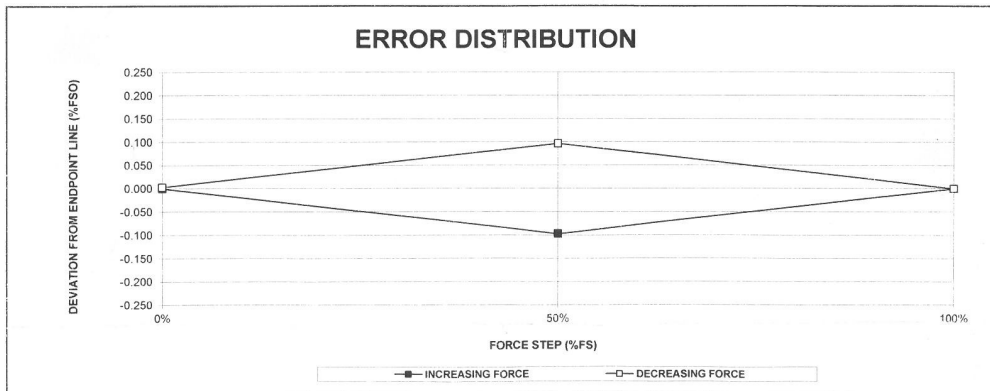
STELLAR TECHNOLOGY INCORPORATED	237 Commerce Drive Amherst, New York 14228 USA Tel: 716.250.1900 • Fax: 716.250.1909
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CALIBRATION RECORD							
CUSTOMER Knight Oil Tools			SERIES/PART NUMBER RDE900-3MTNTL-191		LOAD RANGE 0-3 TN Tension		S/N 1311691
COMP. TEMP. RANGE (°F) 0 TO 185			GAGE RESISTANCE 5000		MAX. OVERLOAD 4.5 TN		
OPER. TEMP. RANGE (°F) -65 TO 250			MAX/CAL VOLTAGE 36/12 VOLTS		JOB NUMBER 14-2539		

ALL DATA IN mA				TEST TEMPERATURE: AMBIENT			
STEP	OUTPUT	INCREASING		OUTPUT	DECREASING		HYSTERESIS
		IDEAL	DIFFERENCE		IDEAL	DIFFERENCE	
0%	4.059	4.059	0.000	4.060	4.059	0.001	0.001
50%	12.039	12.055	-0.016	12.055	12.055	0.000	0.016
100%	20.050	20.050	0.000	20.050	20.050	0.000	0.000
FSO	15.991						

REPEATABILITY @ AMBIENT

STEP	OUTPUT 1	OUTPUT 2
0%	4.058	4.059
100%	20.047	20.051
FSO	15.989	15.992



SUMMARY			CONNECTIONS		MISC
ZERO BALANCE	4.059		PIN	DESCRIPTION	CONNECTOR
FULL SCALE OUTPUT	15.991		RED	EXC+	1/2 NPTM
HYSTERESIS (%FSO)	0.097		BLK	EXC-	CAL. REC. NO.
END POINT LINEARITY (%FSO)	0.097		GRN	SHUNT+	42075.63869
REPEATABILITY (%FSO)	0.019		WHT	SHUNT-	QA STAMP
SHUNT OUTPUT (DELTA VALUE)	12.814		N/C	SHIELD	
Shunt 6404 channel input values 75299 ft-lb					 3/12/2015

DCN: 6368

234961-10

LORD STI STELLAR TECHNOLOGY

237 Commerce Drive
Amherst, New York 14228 USA
Tel: 716.250.1900 • Fax: 716.250.1909

CALIBRATION RECORD

CUSTOMER			SERIES/PART NUMBER		SERIAL NUMBER		SALES ORDER	
N/A			GT1850-30000G-387		1709686		2510486	
CUSTOMER PO			CUSTOMER PART NUMBER		PRESSURE RANGE			
N/A			N/A		0-30000 PSIG			
COMP. TEMP. RANGE (°F)			GAGE RESISTANCE		PROOF / BURST PRESSURE			
30 TO 130			5000		45000/60000			PSI
OPER. TEMP. RANGE (°F)			MAX/CAL VOLTAGE		CONDITION			
-40 TO 185			36/12 VOLTS		NEW			
					LAB ID			

ALL DATA IN mA

TEST TEMPERATURE: AMBIENT

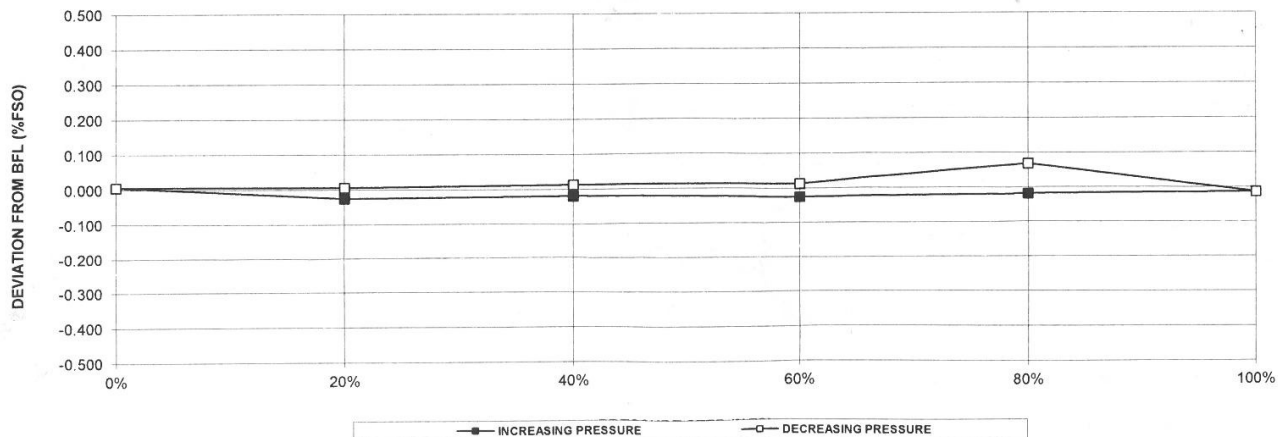
STEP	INCREASING			DECREASING			HYSTERESIS
	OUTPUT	BEST	DIFFERENCE	OUTPUT	BEST	DIFFERENCE	
0%	3.918	3.917	0.001	3.918	3.917	0.001	0.000
20%	7.099	7.103	-0.004	7.104	7.103	0.001	0.005
40%	10.287	10.290	-0.003	10.292	10.290	0.002	0.005
60%	13.472	13.476	-0.004	13.478	13.476	0.002	0.006
80%	16.659	16.662	-0.003	16.673	16.662	0.011	0.014
100%	19.847	19.849	-0.002	19.847	19.849	-0.002	0.000
FSO	15.929					SHUNT	12.789

4029
Shunt valves 24087 psi
423.2 closed

REPEATABILITY @ AMBIENT

STEP	OUTPUT 1	OUTPUT 2
0%	3.917	3.918
100%	19.846	19.846
FSO	15.929	15.928

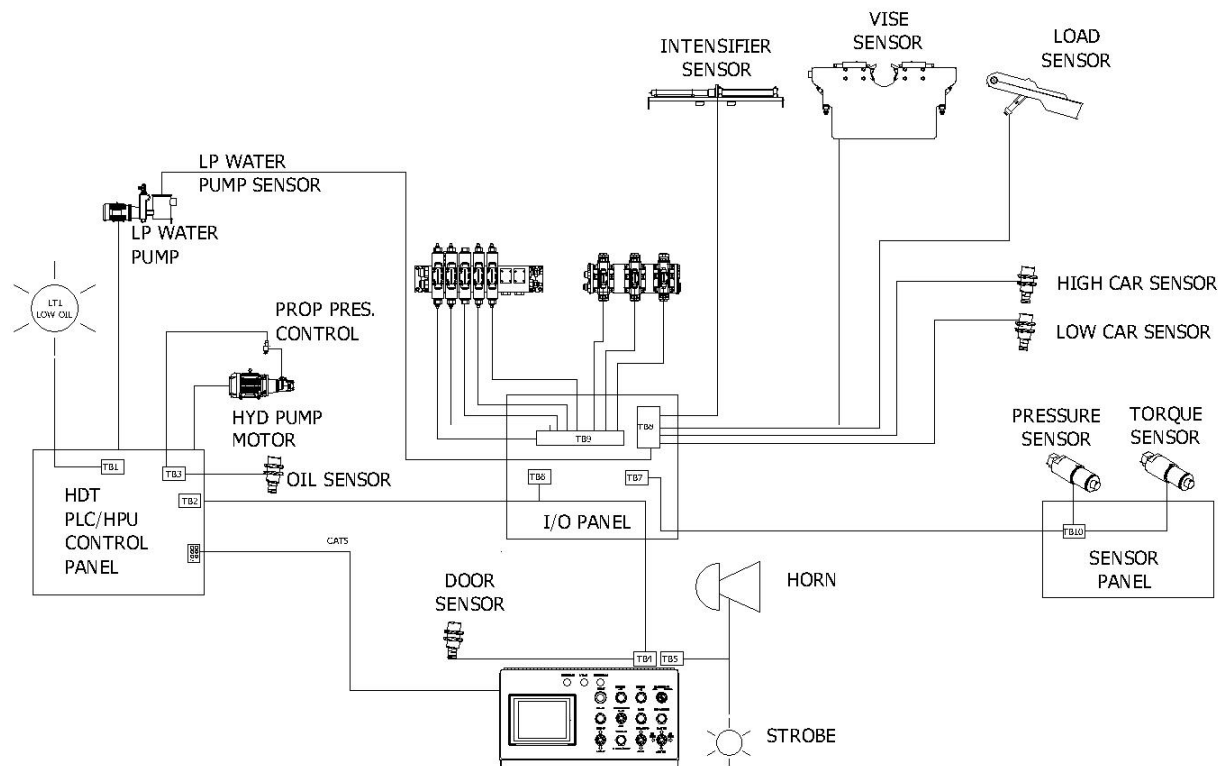
ERROR DISTRIBUTION



SUMMARY		CONNECTIONS		MISC
ZERO BALANCE	3.918	PIN	DESCRIPTION	CONNECTOR
FULL SCALE OUTPUT	15.929	RED	EXC+	1/2 NPTM
STATIC ACCURACY (%FSO)	0.069	BLK	EXC-	CAL. REC. NO.
		GRN	SHUNT+	42908.62899
		WHT	SHUNT-	QA STAMP
		SHIELD	N/C	STI 48 QA
				6/22/201

DCN 9987

Electrical Schematics



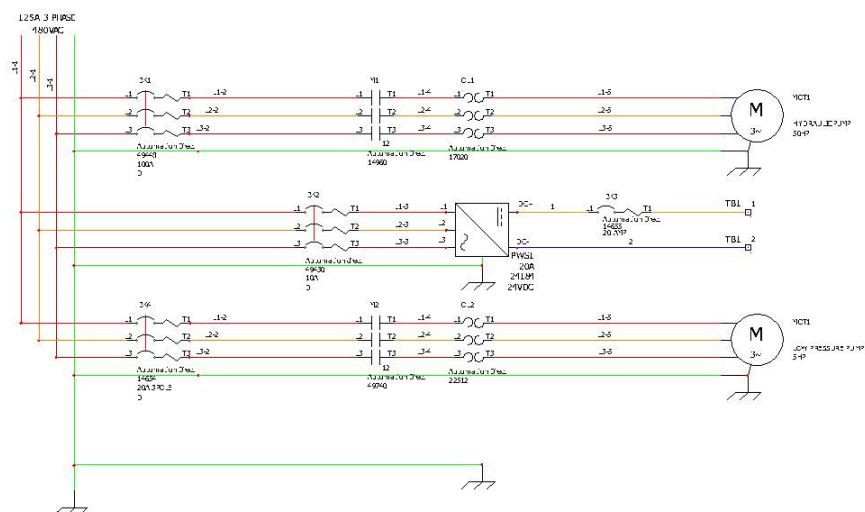
OUTLINE

CONTRACT: 110-800-007-00

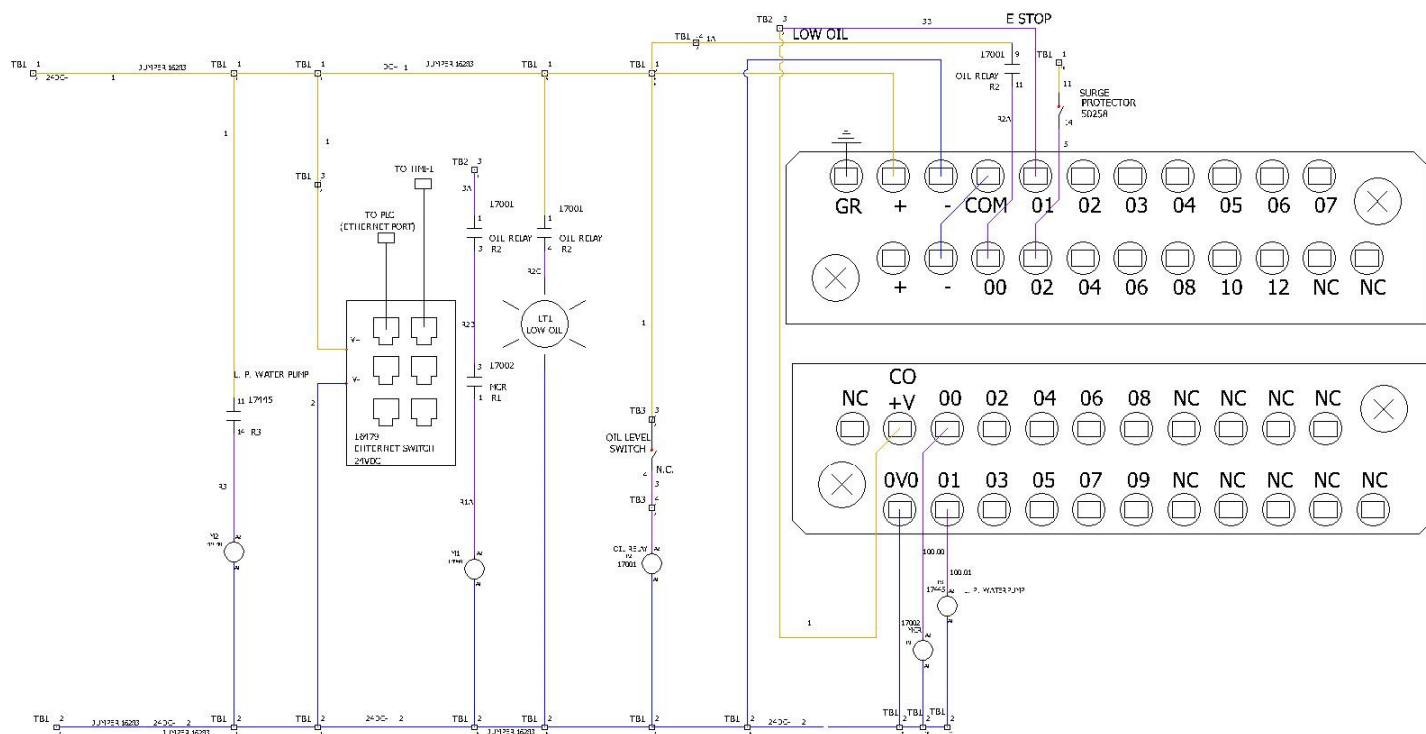
LOCATION:

OVERVIEW

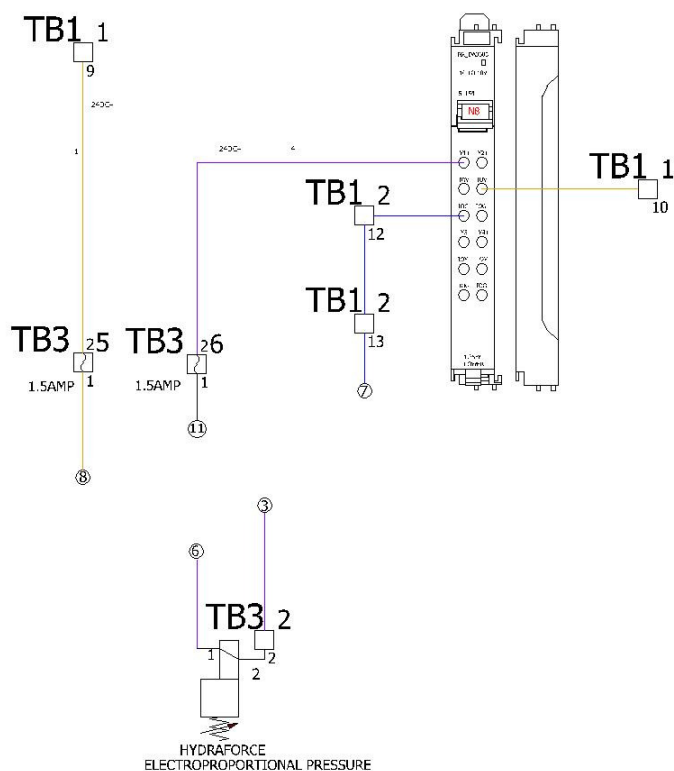
				REVISION
A	8/10/18	RWL		A
REV.	DATE	NAME	CHANGES	SCHEME
				01



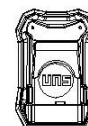
CONTRACT: 110-800-007-00	LOCATION: HPU PANEL	HDT PLC/HPU PANEL				REV. 1		REVISION
		480V 3PH				A		A
		REV.	DATE	NAME	CHANGES		SCH. 02	



HDT PLC/HPU PANEL 24VDC						REVISION
		B	1/8/19	RWL	CHANGED SOURCE FOR OUTPUTS	A
		A	8/10/18	RWL		
		REV.	DATE	NAME	CHANGES	SCHEME
CONTRACT: 110-800-007-00	LOCATION: HPU PANEL					03



TERMINAL	FUNCTION	USED?
①	CAN LO	NO
②	CAN HI	NO
③	GROUND(COIL)	YES
④	NO CONNECTION	NO
⑤	GROUND(COIL2)	NO
⑥	PWM OUTPUT COIL	YES
⑦	SUPPLY GROUND	YES
⑧	SUPPLY POWER	YES
⑨	ENABLE	NO
⑩	+5V REFERENCE	NO
⑪	UNIVERSAL INPUT	YES
⑫	NO CONNECTION	NO



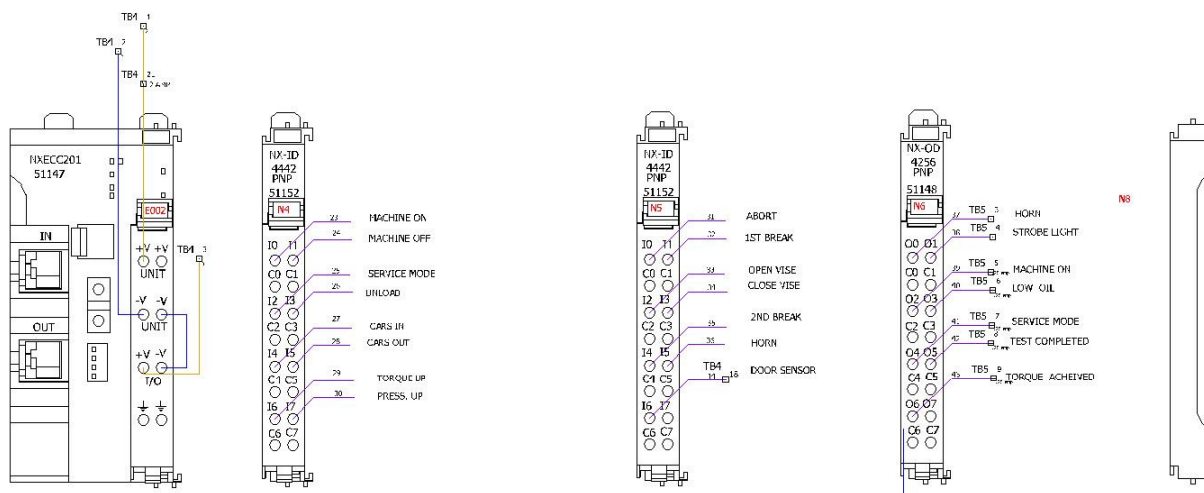
HDT PLC/HPU PANEL 24VDC				REVISION
B	1/8/19	RWL	ADDED XMD01	A
A	8/10/18	RWL		
REV.	DATE	NAME	CHANGES	SCHEME
				04

CONTRACT: 110-800-007-00

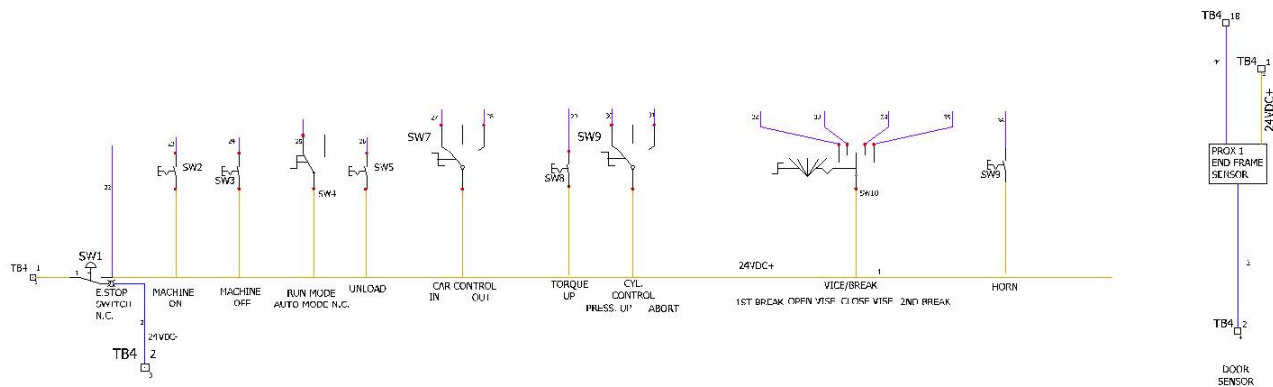
LOCATION:

HPU PANEL

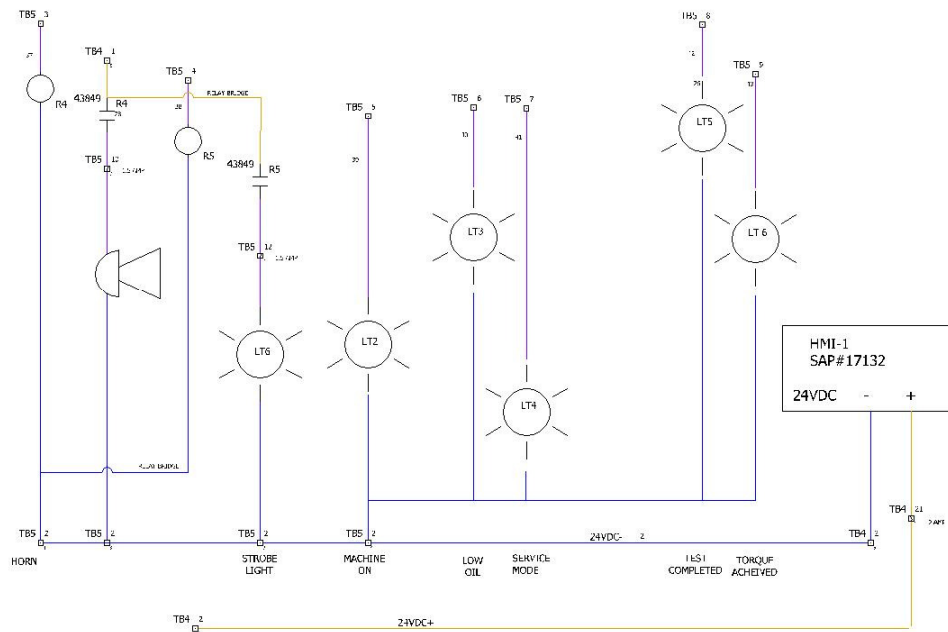
MODE 1



CONTRACT: 110-800-007-00	LOCATION: CONTROL STATION	CONTROL CONSOLE INPUTS 24VDC				REVISION A
		A	8/10/18	RVL		
		REV.	DATE	NAME	CHANGES	
						SCHEME 05

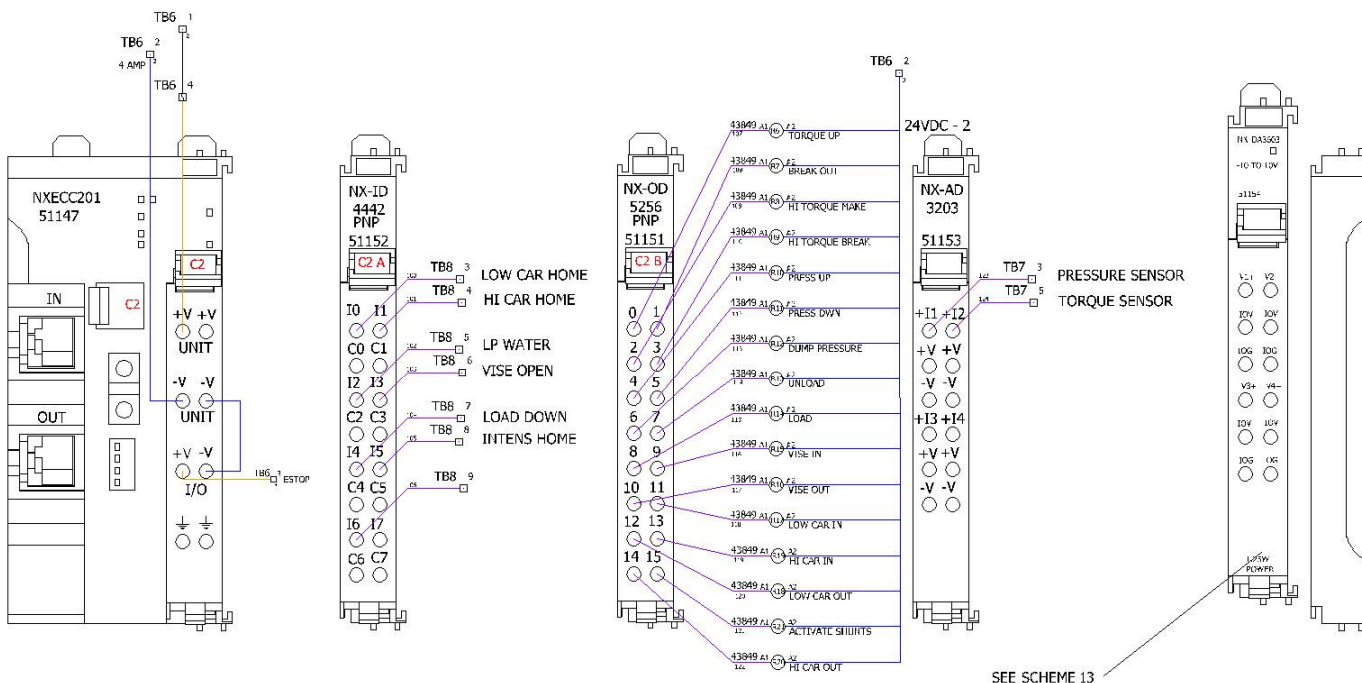


CONTRACT: 110-800-007-00	LOCATION: CONTROL STATION	CONTROL CONSOLE INPUTS 24VDC				REVISION
						A
		A	8/10/18	RWL		
		REV.	DATE	NAME	CHANGES	SCHEME
					06	

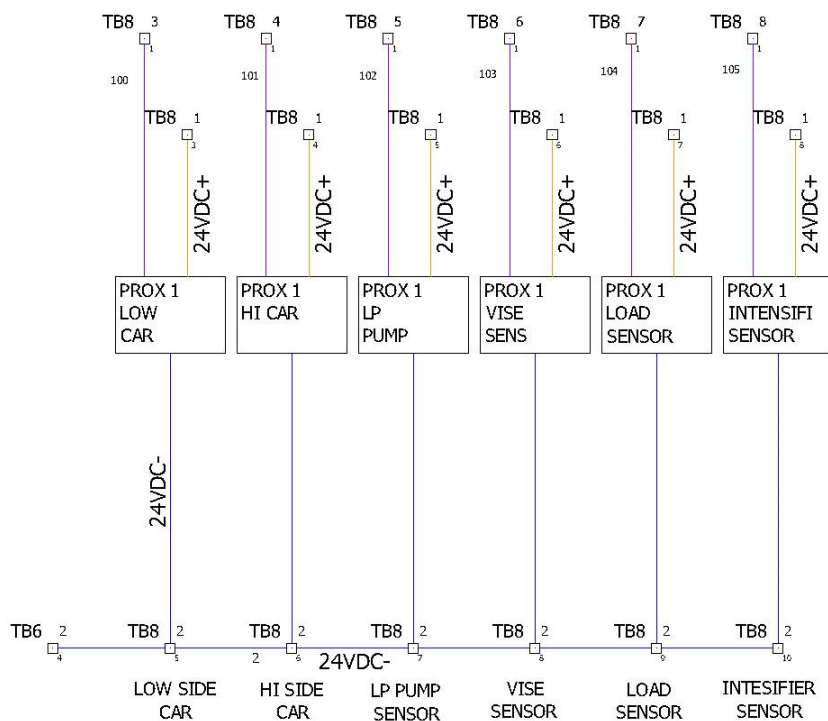


CONTRACT: 110-800-007-00		LOCATION: CONTROL STATION		REVISION	
				A	
				SCHEME	
				07	

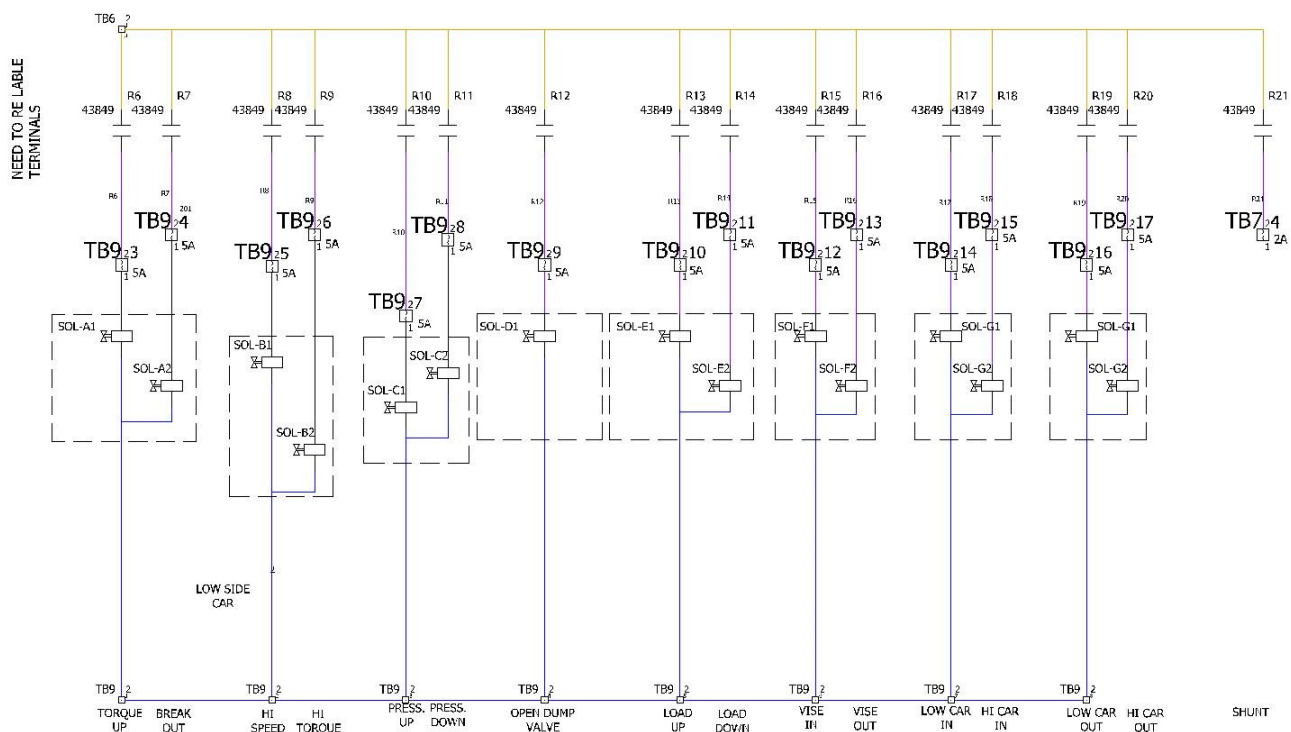
NODE 2



CONTRACT: 110-800-007-00		LOCATION:		I/O PANEL		REVISION	
						A	
						SCHEME	
						08	



CONTRACT: 110-800-007-00	LOCATION: I/O PANEL	MAIN I/O DIGITAL INPUT				REVISION
						A
		A	8/10/18	RWL		
		REV.	DATE	NAME	CHANGES	SCHEME
						09



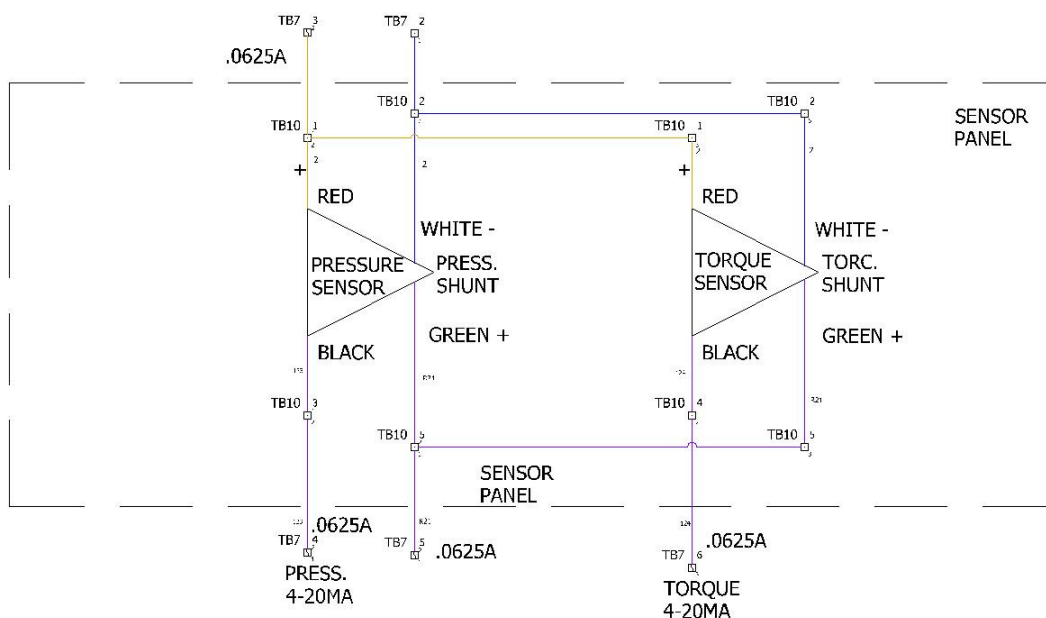
MAIN I/O DIGITAL OUTPUT

CONTRACT: 110-800-007-00

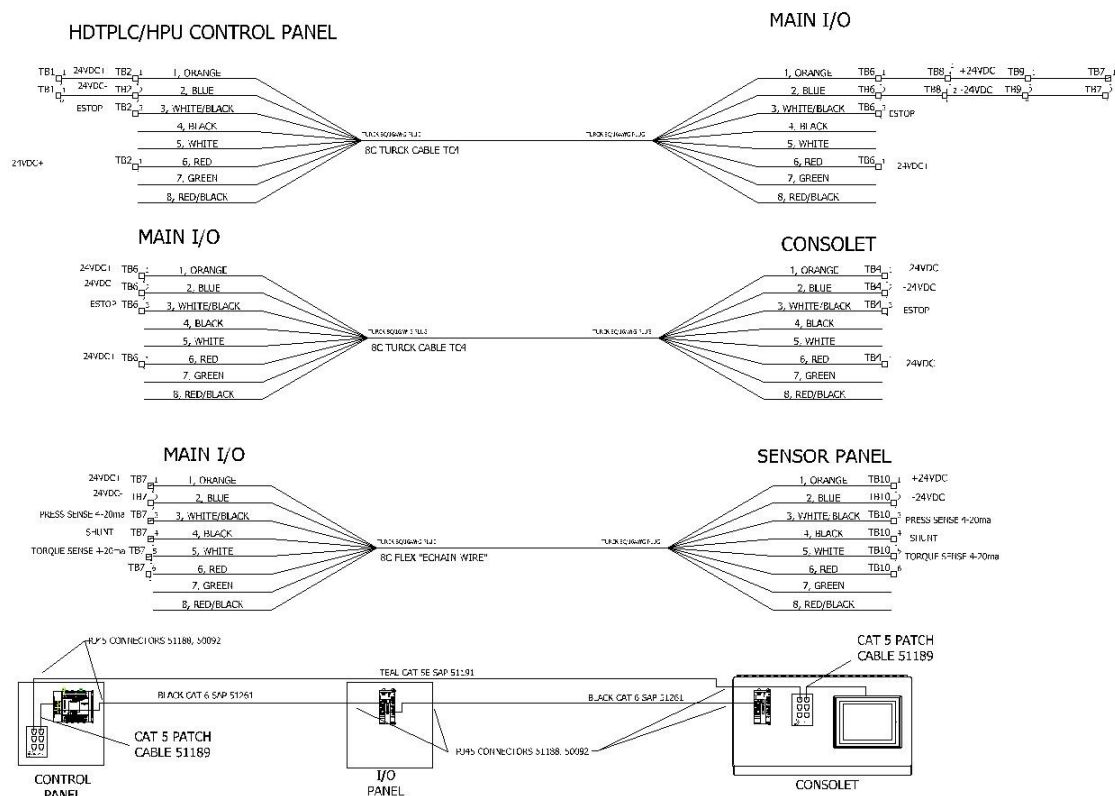
LOCATION:

I/O PANEL

REV.	DATE	NAME	CHANGES	REVISION
A	8/10/18	RWL		A
				SCHEME
				10

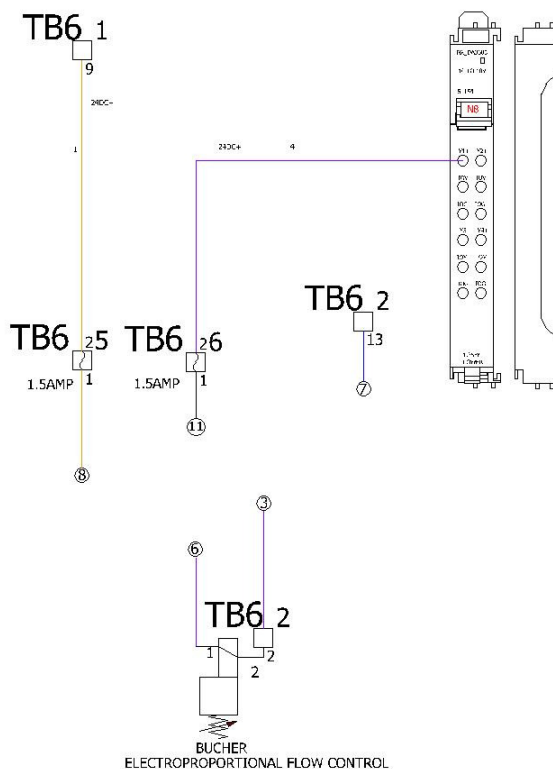


CONTRACT: 110-800-007-00		LOCATION:		I/O PANEL		REVISION	
						B	
						11	
						CORRECTED WIRING	
						CHANGES	
						SCHEME	
						11	

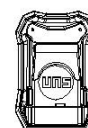


CONTRACT: 110-800-007-00		LOCATION: N/A		WIRE JUNCTION SCHEME				REVISION	
								A	
				A 8/10/18		RWL			
				REV. DATE		NAME		CHANGES	
								SCHEME 12	

MOUNTED ON NODE 1



TERMINAL	FUNCTION	USED?
①	CAN LO	NO
②	CAN HI	NO
③	GROUND(COIL)	YES
④	NO CONNECTION	NO
⑤	GROUND(COIL2)	NO
⑥	PWM OUTPUT COIL	YES
⑦	SUPPLY GROUND	YES
⑧	SUPPLY POWER	YES
⑨	ENABLE	NO
⑩	+5V REFERENCE	NO
⑪	UNIVERSAL INPUT	YES
⑫	NO CONNECTION	NO



CONTRACT: 110-800-007-00		LOCATION: HPU PANEL		MAIN I/O PANNEL 24VDC				REVISION	
								A	
				A 1/8/19 RWL					
				REV. DATE		NAME		CHANGES	
								SCHEME	
								13	