



3R VALVE
OPERATIONS AND MAINTANCE MANUAL
MARK ANTHONY BREWERY
RW1



MARK ANTHONY BREWING

July 2023

Introduction:

The following document is for 3R Valve installed December of 2023. 3R Valve supplied a (2) 10" ASR down the hole control valve with a fully automated control system. The downhole control valve is NSF 61 certified and the control system is UL 508 certified.

The downhole control was assembled with an internal spring to close the downhole control valve in case of a hydraulic failure.

The downhole control valve opens and closes to achieve the following (in order of importance);

- 1) Maintain positive well head pressure.
- 2) Meet a flow setpoint.
- 3) Manage the aquifers level.

Two hydraulic hoses (open/close) modulate the downhole control valve from the HPU control system.

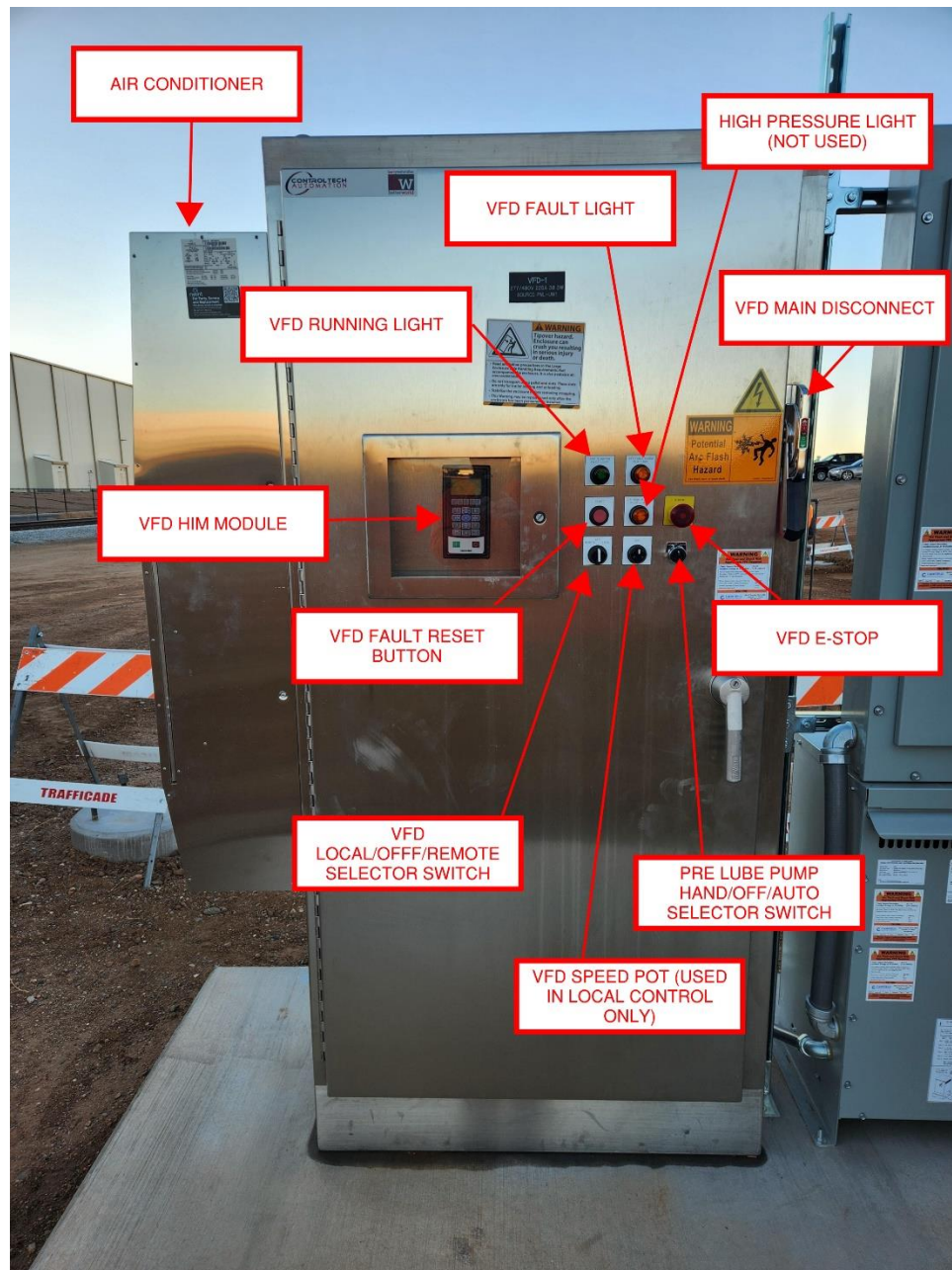
The system is controlled by a PLC that utilized ladder logic. The PLC logic is written in Rockwell Studio 5000 v34.

System overview:

Control System Overview (Typical for RW-1 and RW-2)



Well Pump VFD Enclosure Exterior (Typical for RW-1 and RW-2)



VFD HIM Module: Local display of VFD status.

VFD Running Light: Illuminated **GREEN** when well pump VFD is running.

VFD Fault Light: Illuminated **ORANGE** when well pump VFD is in fault.

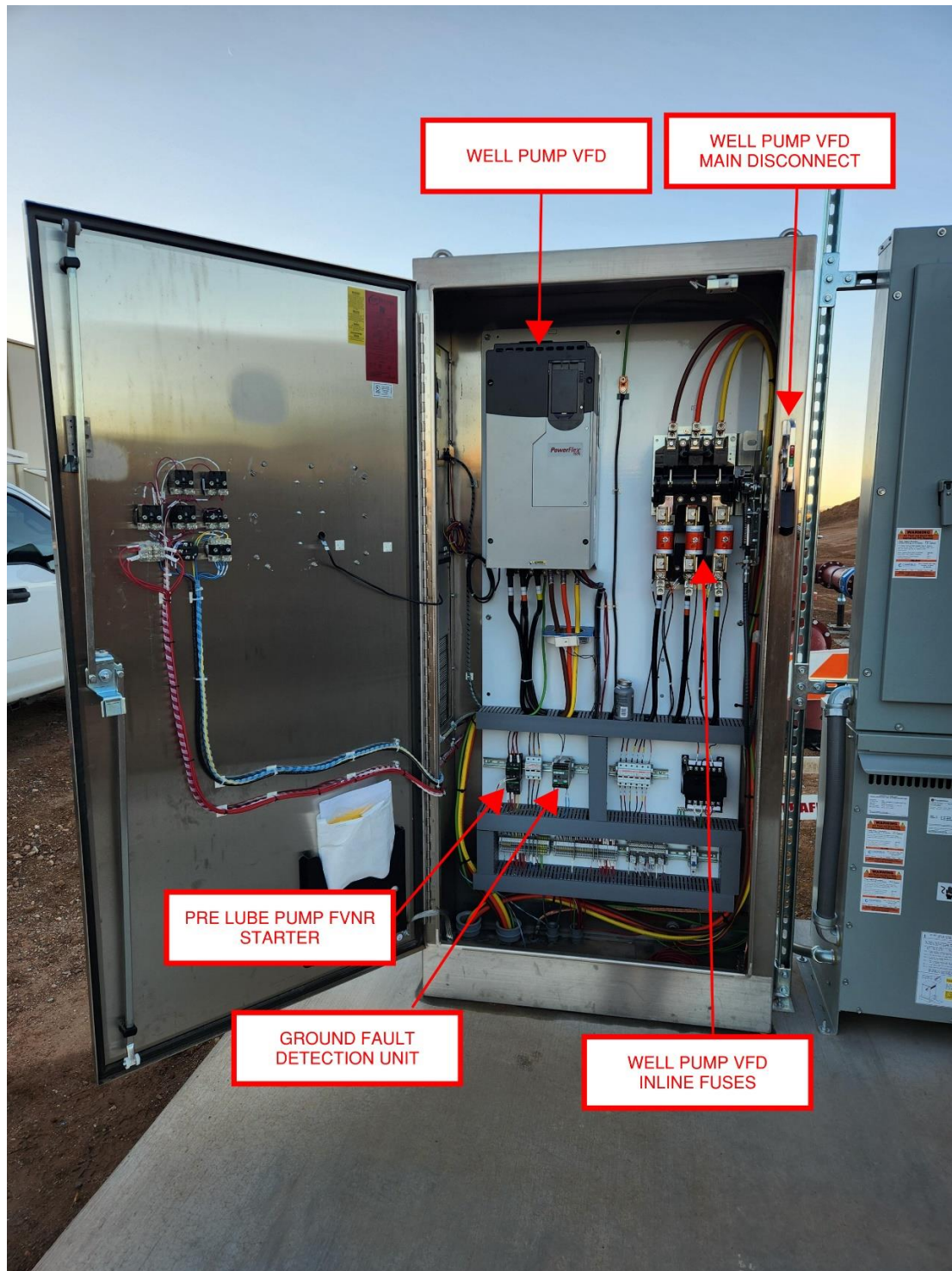
VFD E-Stop: VFD will stop the motor.

Pre-Lube Hand/Off/Auto: If the Pre-Lube H-O-A is not in the Auto position or left in OFF / HAND when the well pump is called for backwash, the well pump will not run.

VFD Local/Off/Remote:

- a. Local Control: Well Pump VFD will start (without pre-lube) and will run based on the VFD speed pot located in the face of the VFD enclosure.
 - a. High Pot:
 - i. Far left or counterclockwise: minimum speed = 45 Hz.
 - ii. Far right or clockwise: maximum speed = 60 Hz.
 - b. NOTE: By starting the VFD in Local Control the operator assumes responsibility for the pre-lube procedure required to starting the well pump. Running the well pump for short periods without pre-lube water or a full column pipe can result in permanent damage to the pump and/or bearings. Prior to running VFD in LOCAL control, it is recommended the Pre-Lube HAND/OFF/AUTO be placed in HAND to allow the pre-lube system to run for 15 minutes minimum.
- b. Remote Control: Well Pump VFD will start and controlled (if pre-lube H-O-A has been in Auto) from the PLC.

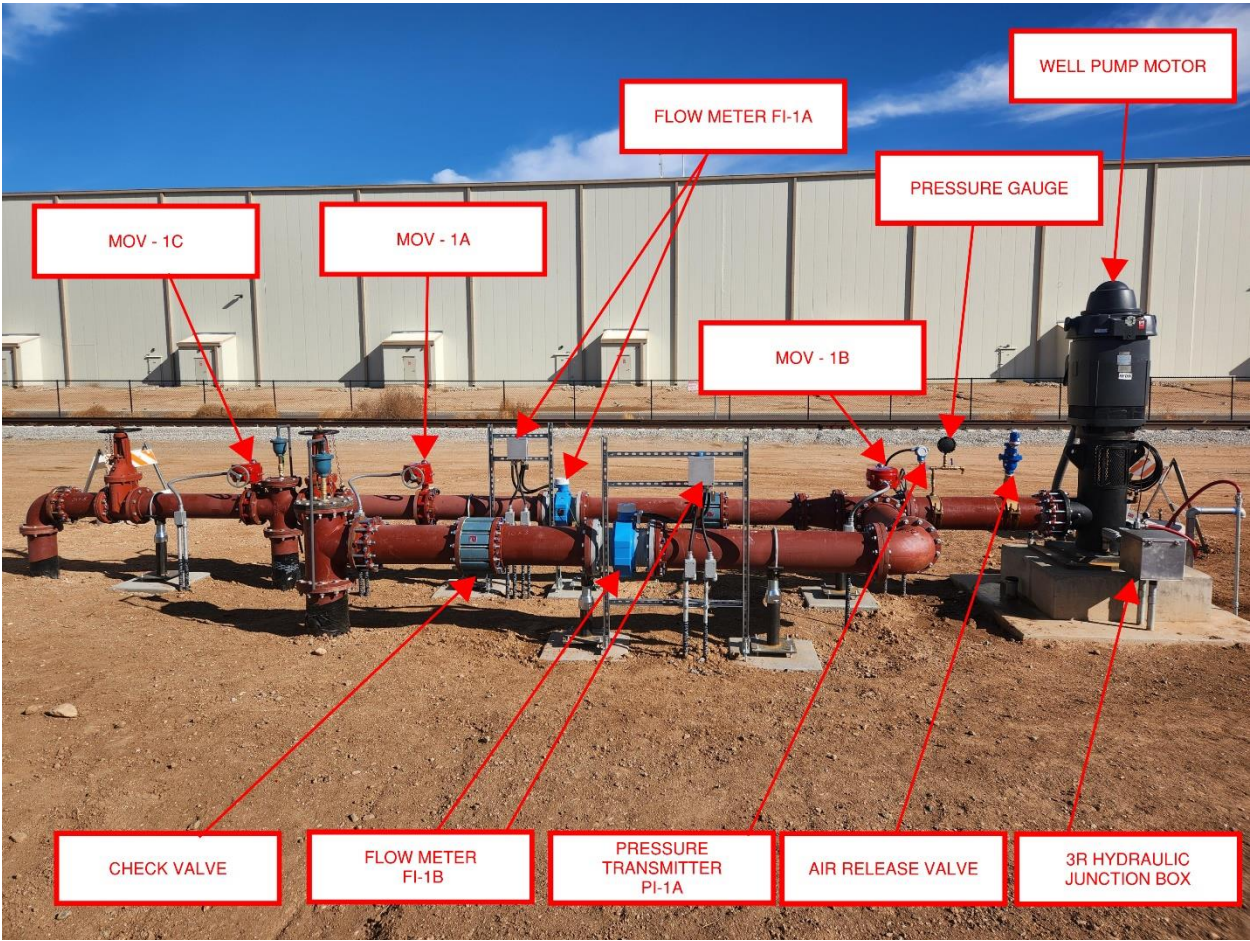
Well Pump VFD Enclosure Interior (Typical for RW-1 and RW-2)



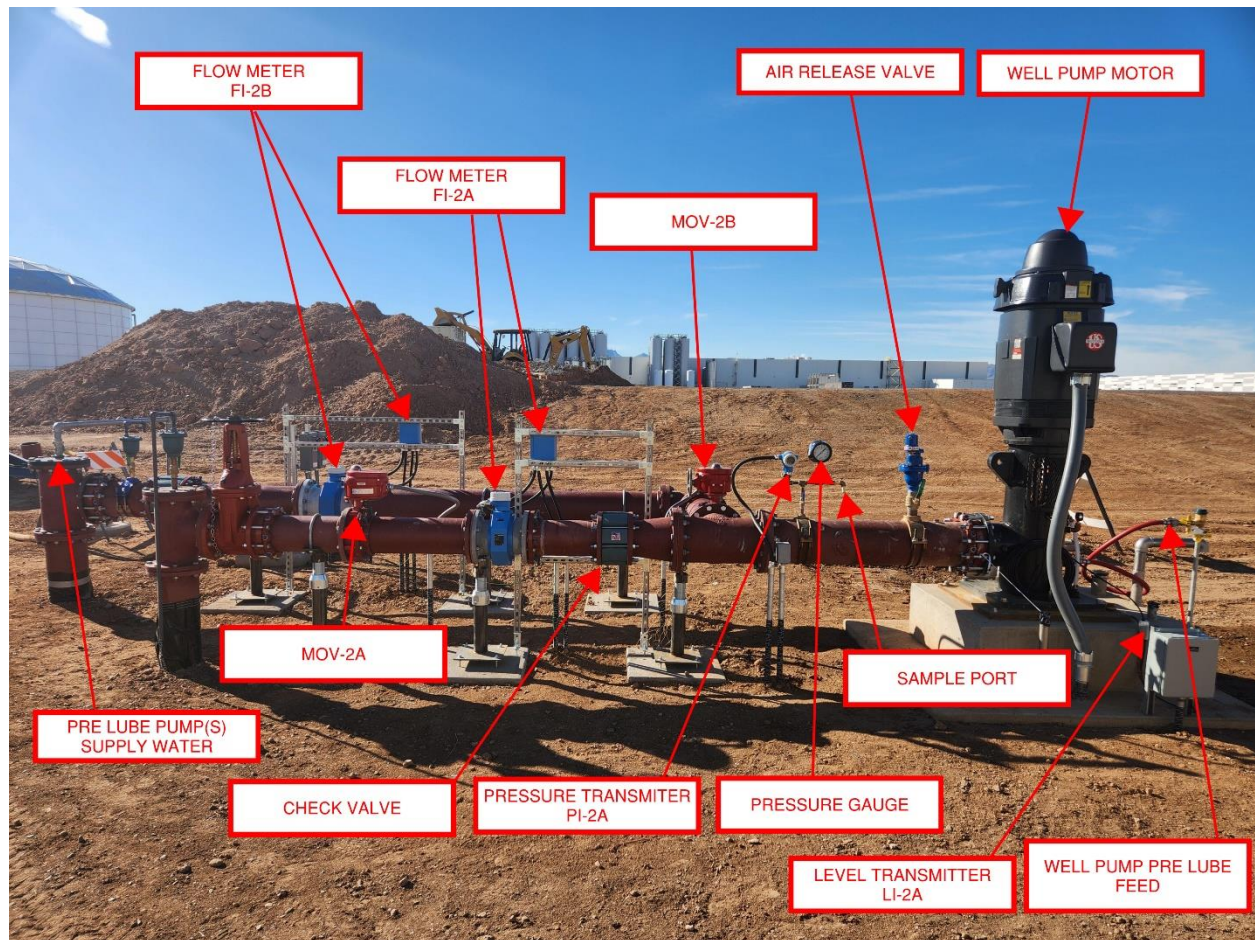
RW-1 Mechanical and Instrument Sideview 1



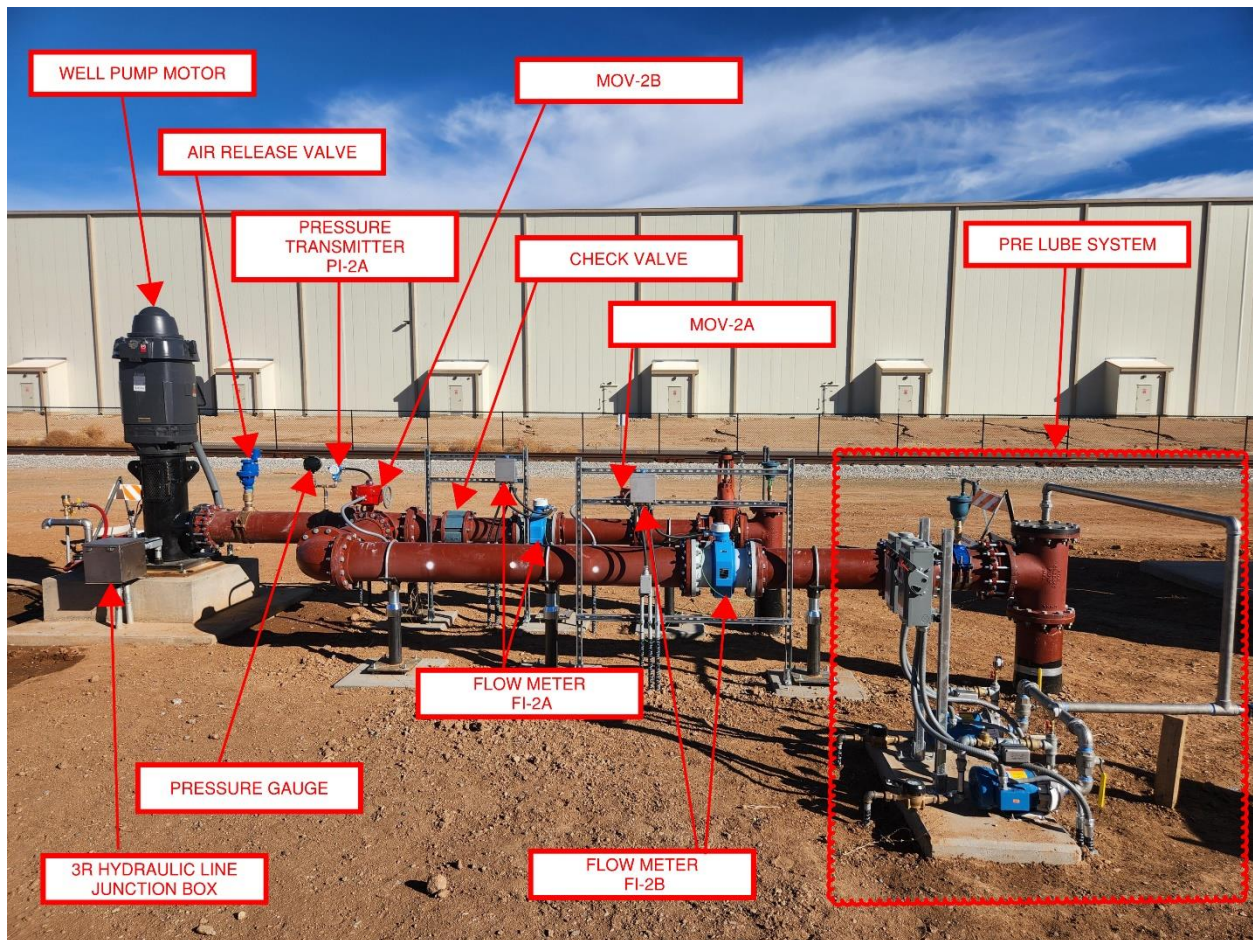
RW-1 Mechanical and Instrument Sideview 2



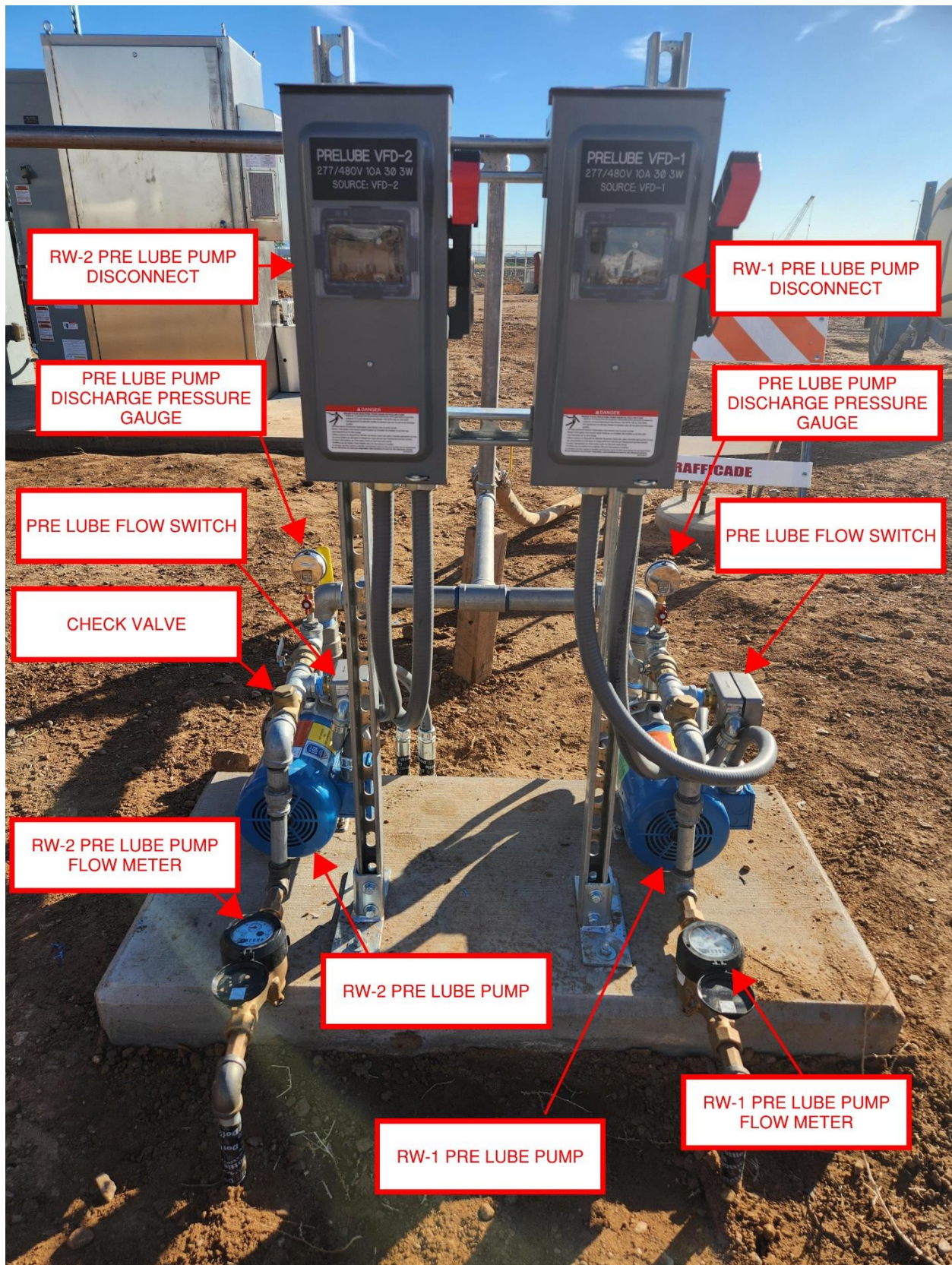
RW-2 Mechanical and Instrument Overview 1



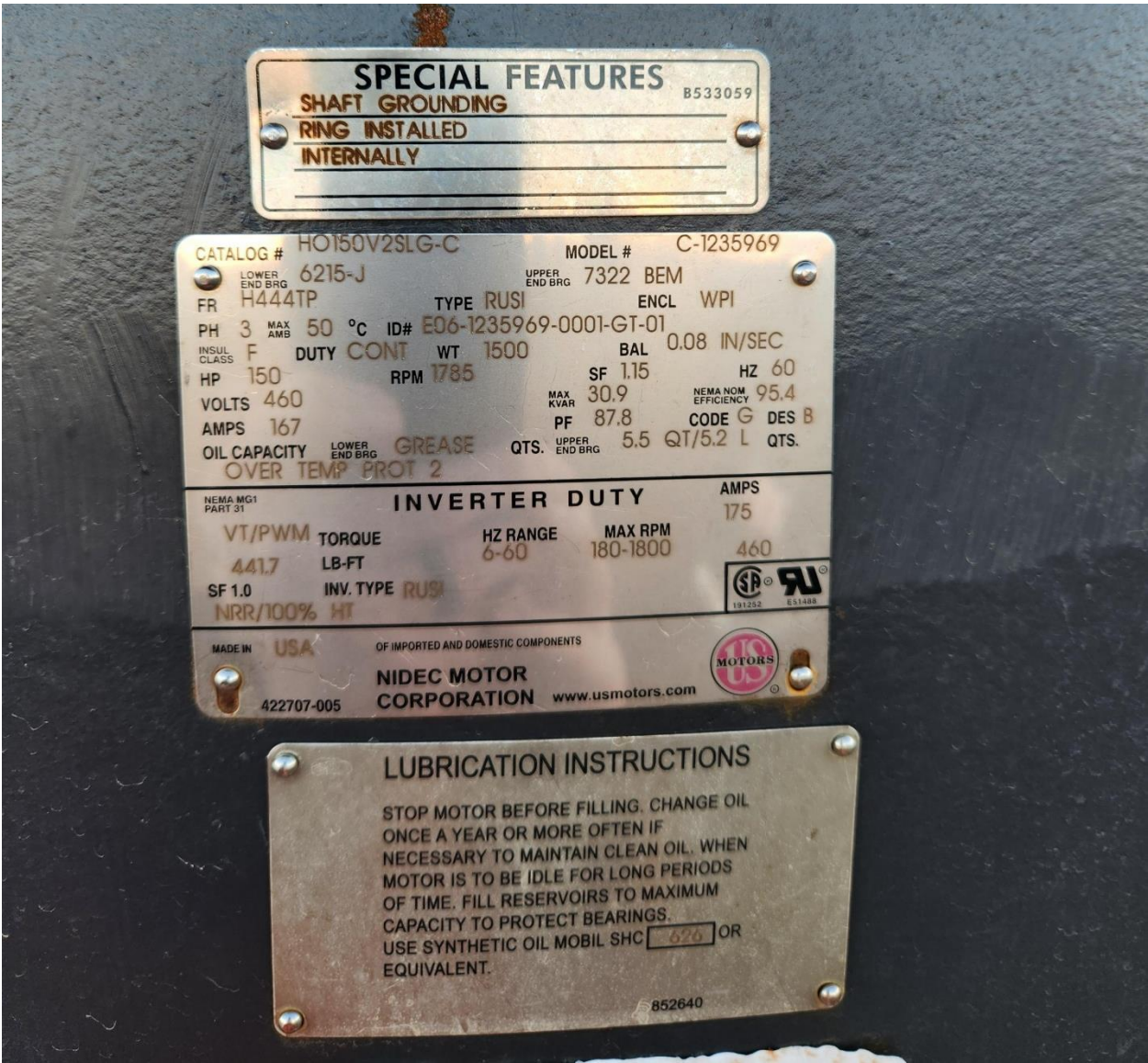
RW-2 Mechanical and Instrument Overview 2



RW-1 & RW-2 Pre Lube System (Located at RW-2)



Motor Nameplate



VFD Nameplate Information

A-B Nameplate 1: Specifications and Custom Catalog Number representing options installed at factory. See Nameplate 2 (Located behind HIM) for equivalent base catalog number and separate options

Cat No: 20F1A N D 186 JN0NNNNN

UL Open Type / IP00 (UL Type 1 with Conduit Plate) Original Firmware: 14.005
UL Type 1 - only with Conduit Plate and Debris Label
Rear = UL Type 4X/IP66 with 4X flange adapter kit

MODEL NUMBER: PowerFlex 753 400V Class **Series: A**
480V Class

Power ND (HD)	110kw (90kW)	150 HP (125 HP)
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Input: 3 Phase 47-63Hz

AC Voltage Range	342-440	432-528
Amps ND (HD)	200.8 (166.5)	174.6 (146.5)

Output: 3 Phase 0-590 Hz

AC Voltage Range	0-400	0-460
Base Frequency (default)	50 Hz	60 Hz
Continuous Amps ND (HD)	205 (170)	186 (156)
60 Sec Ovld Amps ND (HD)	225.5 (255)	204.6 (234)
3 Sec Ovld Amps ND (HD)	307.5 (307.5)	279 (280.8)

PN-411273 2022/09/21
1100
PRODUCT OF USA
Rockwell Automation, 1201 S 2nd St, Milwaukee, WI 53204, USA
Serial Number: 304210264

CE 0035 TUV 13 ATEX 7448 X WHEN OPTION IS INSTALLED
UK CA EAC 25

KCC-REM-RAA-20F-B

Functional Safety IEC 61508-1 IEC 61508-2 0.8%

WHEN OPTION IS INSTALLED

UL US
LISTED
IND. CONT.
EQ. E59272

QR Code

QR Code

480V Class

Well Pump PID Settings:

STARTUP_INTERLOCK

MOV

Source RW1_VFD.FLOW_SETPOINT 350.0

Dest RW1_VFD.PID.SP 350.0

PID

PID

Process Variable

<Backwash

Tieback

Control Variable RW1

PID Master Loop

Inhold Bit

Inhold Value

Setpoint

Process Variable

Output %

PID Setup - RW1_VFD.PID

Tuning

Configuration

Alarms

Scaling

Tag

Setpoint (SP): 350.0

Set Output: 75.0 %

Output Bias: 0.0 %

Tuning Constants

Proportional Gain (Kp): 0.5

Integral Gain (Ki): 0.01 1/s

Derivative Time (Kd): 0.001 s

Reset

Manual Modes

Manual

Software Manual

Setpoint (SP): 350.0

Process Variable: 500.625

Error: -150.625

Output: 75.0 %

Tieback: 0.0 %

Mode: Auto

PV Alarm: High

Deviation Alarm: Low

Output Limiting: Low

Error Within Deadband: No

Setpoint Out of Range: No

PID Initialized: Yes

OK

Cancel

Apply

Help

STARTUP_INTERLOCK

MOV

Source RW1_VFD.FLOW_SETPOINT 350.0

Dest RW1_VFD.PID.SP 350.0

PID

PID

Process

Tieback

Control V

PID Mast

Inhold Bit

Inhold Va

Setpoint

Process

Output %

PID Setup - RW1_VFD.PID

Tuning

Configuration

Alarms

Scaling

Tag

PID Equation: Independent

Control Action: SP - PV

Derivative Of: PV

Loop Update Time: 0.1 secs

CV High Limit: 100.0 %

CV Low Limit: 75.0 %

Deadband Value: 0.0

No Derivative Smoothing

No Bias Calculation

No Zero Crossing for Deadband

PV Tracking

Cascade Loop

Cascade Type: Slave

Setpoint (SP): 350.0

Process Variable: 500.625

Error: -150.625

Output: 75.0 %

Tieback: 0.0 %

Mode: Auto

PV Alarm: High

Deviation Alarm: Low

Output Limiting: Low

Error Within Deadband: No

Setpoint Out of Range: No

PID Initialized: Yes

OK

Cancel

Apply

Help

Well Pump VFD Settings:

0 - PowerFlex 753

All Parameters

Show All

Filter Value

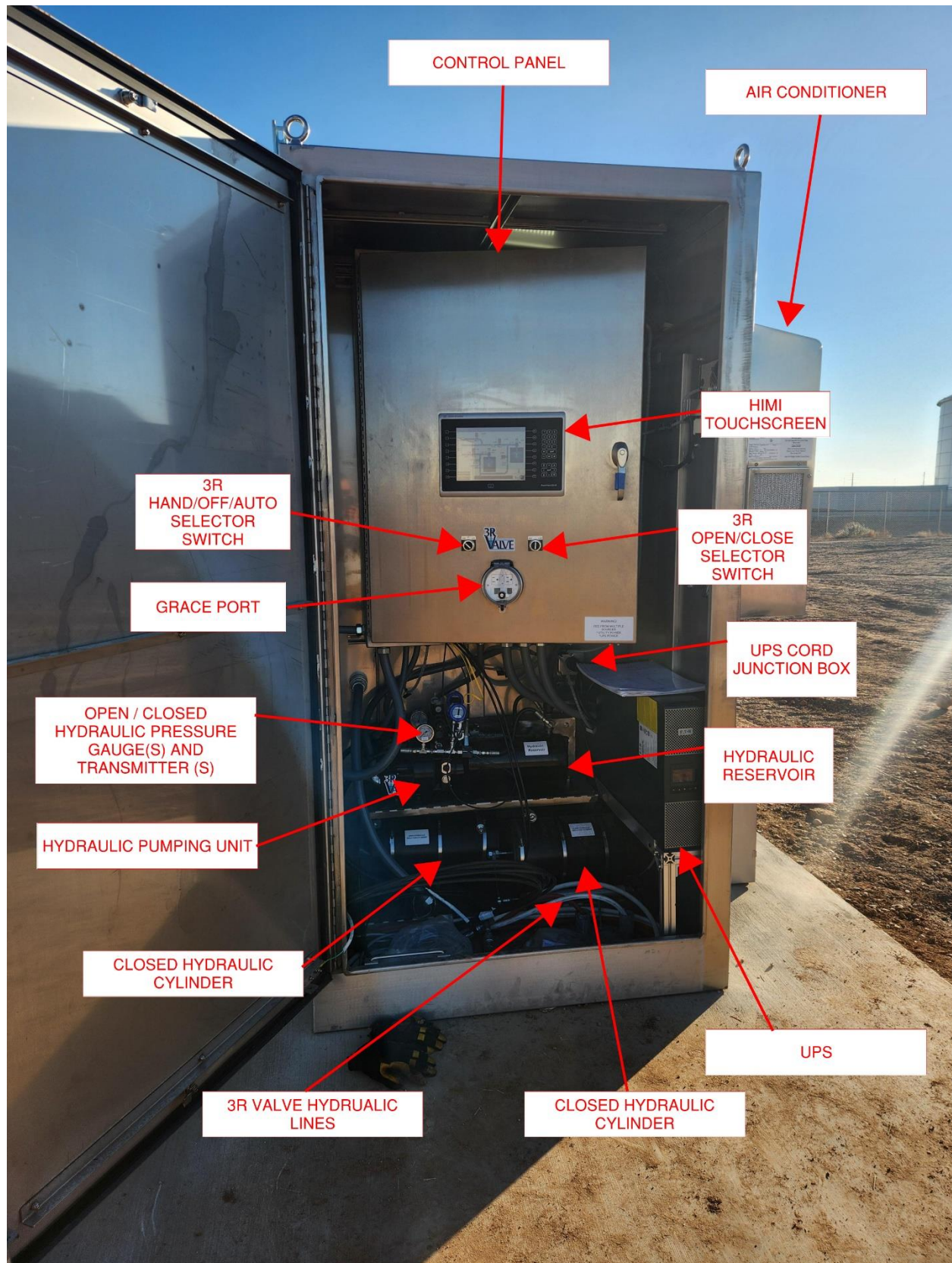
Port	#	Name	Value	Units	Internal Value	Dr
0	26	Motor NP Amps	167.00	Amps	167.00	
0	30	Motor NP Power	150.00		150.00	
0	35	Motor Ctrl Mode	InductionVHz		0	
0	37	Maximum Freq	60.00	Hz	60.00	
0	44	Flux Up Time	0.3473	Secs	0.3473	
0	60	Start Acc Boost	3.10	VAC	3.10	
0	61	Run Boost	3.10	VAC	3.10	
0	74	Ixo Voltage Drop	0.00	VAC	0.00	
0	75	Flux Current Ref	50.10	Amps	50.10	
0	79	EncdrLss VltComp	3.34	VAC	3.34	
0	87	PM IR Voltage	3.34	Volt	3.34	
0	93	PM Dir Test Cur	16.70	Amps	16.70	
0	156	DI Clear Fault	Port 4: Dig In Sts.Input 2		4000102	
0	157	DI Aux Fault	Port 4: Dig In Sts.Input 3		4000103	
0	158	DI Stop	Port 4: Dig In Sts.Input 4		4000104	
0	163	DI Run	Port 4: Dig In Sts.Input 0		4000100	
0	174	DI Speed Sel 1	Port 4: Dig In Sts.Input 1		4000101	
0	230	ROO Sel	Port 0: Drive Status 1.Running		93516	
0	278	Anlg Out0 DataHi	60.000		60.000	
0	522	Min Fwd Speed	45.00		45.00	
0	545	Spd Ref A Sel	Port 4: Anlg In0 Value		40050	
0	550	Spd Ref B Sel	Port 0: Port 5 Reference		875	
0	563	DI ManRef Sel	Port 0: Anlg In0 Value		260	
0	1682	Purge Frequency	5.00		5.00	

Well Pump VFD Settings:

4 - I/O Module 24V		All Parameters	Show All	Filter Value	Reset	
Port	#	Name	Value	Units	Internal Value	Default
4	10	RO0 Sel	Port 0: Drive Status 1.Faulted		93507	
4	51	Anlg In0 Hi	0.000		0.000	
4	52	Anlg In0 Lo	10.000		10.000	
4	78	Anlg Out0 DataHi	60.000		60.000	
4	88	Anlg Out1 DataHi	248.000		248.000	

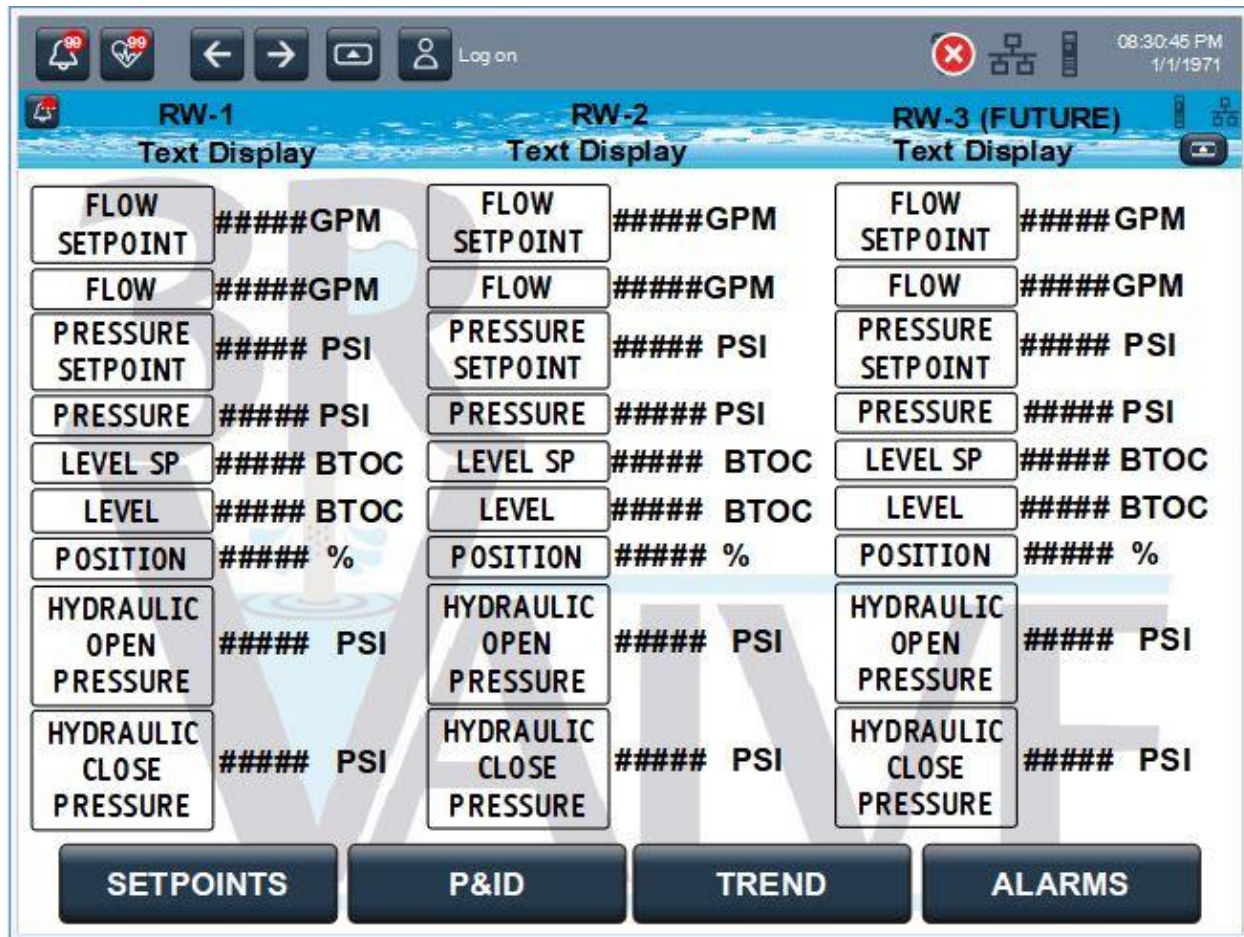
5 - EtherNet/IP		Show All	Filter Value	Reset		
Port	#	Name	Value	Units	Internal Value	Default
5	5	Net Addr Sel	Parameters		1	
5	7	IP Addr Cfg 1	10		10	
5	8	IP Addr Cfg 2	70		70	
5	9	IP Addr Cfg 3	162		162	
5	10	IP Addr Cfg 4	106		106	
5	11	Subnet Cfg 1	255		255	
5	12	Subnet Cfg 2	255		255	
5	13	Subnet Cfg 3	255		255	
5	14	Subnet Cfg 4	128		128	
5	17	DL To Net 01	Port 0: Output Current		7	

3R Valve and Well Pump Control Panel System



HMI Touchscreens:

Main Screen:



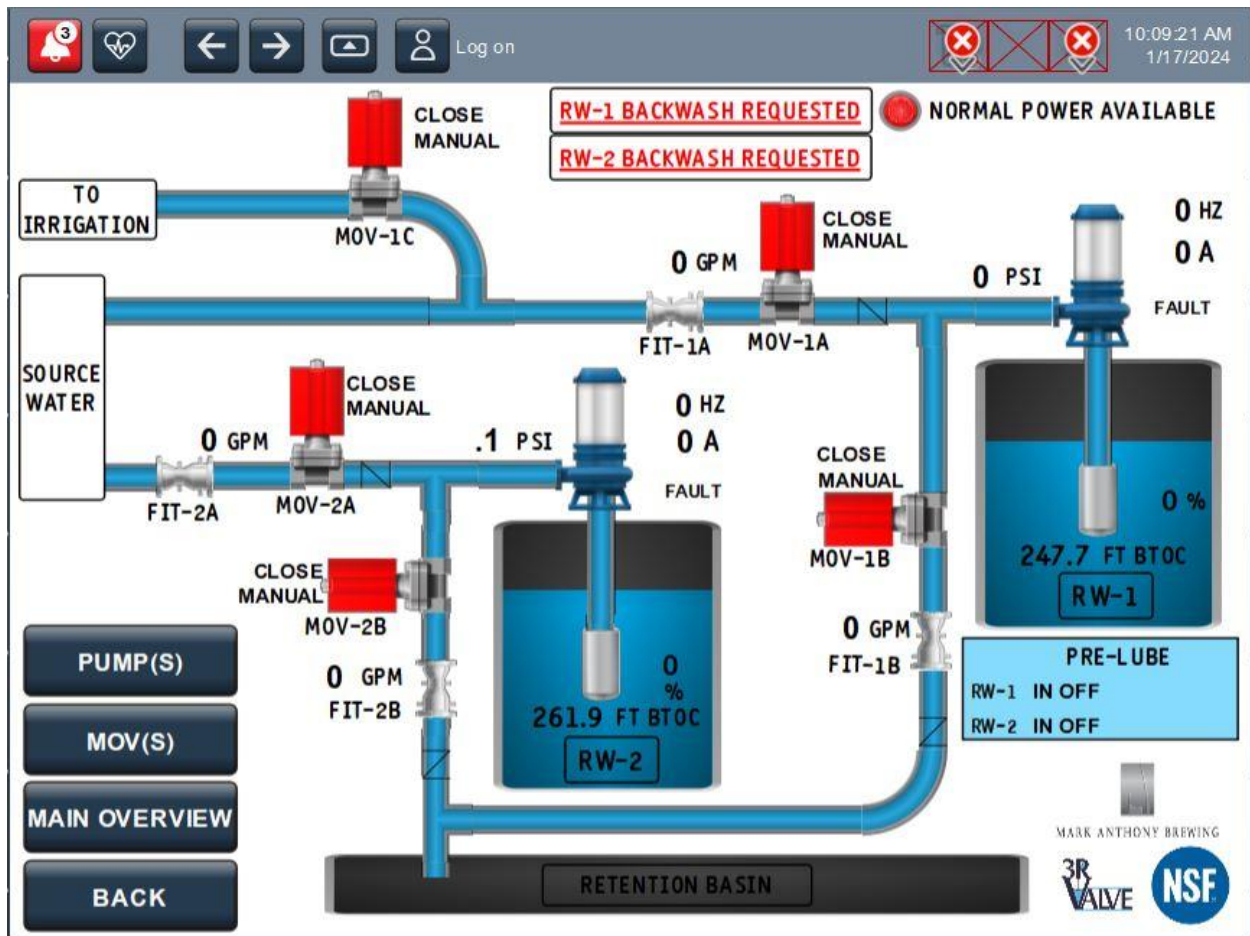
The Main screen gives an overall system setpoints for all process instrumentation associated with RW1, RW2 and RW3 (future).

The **MAIN** Screen Displays the system status and setpoints.

Setpoints Button: Press this to go to the **SETPOINTS NAVIGATION** Screen.

P&ID Button: Press this to go to the **P&ID** Screen.

P&ID Screen:



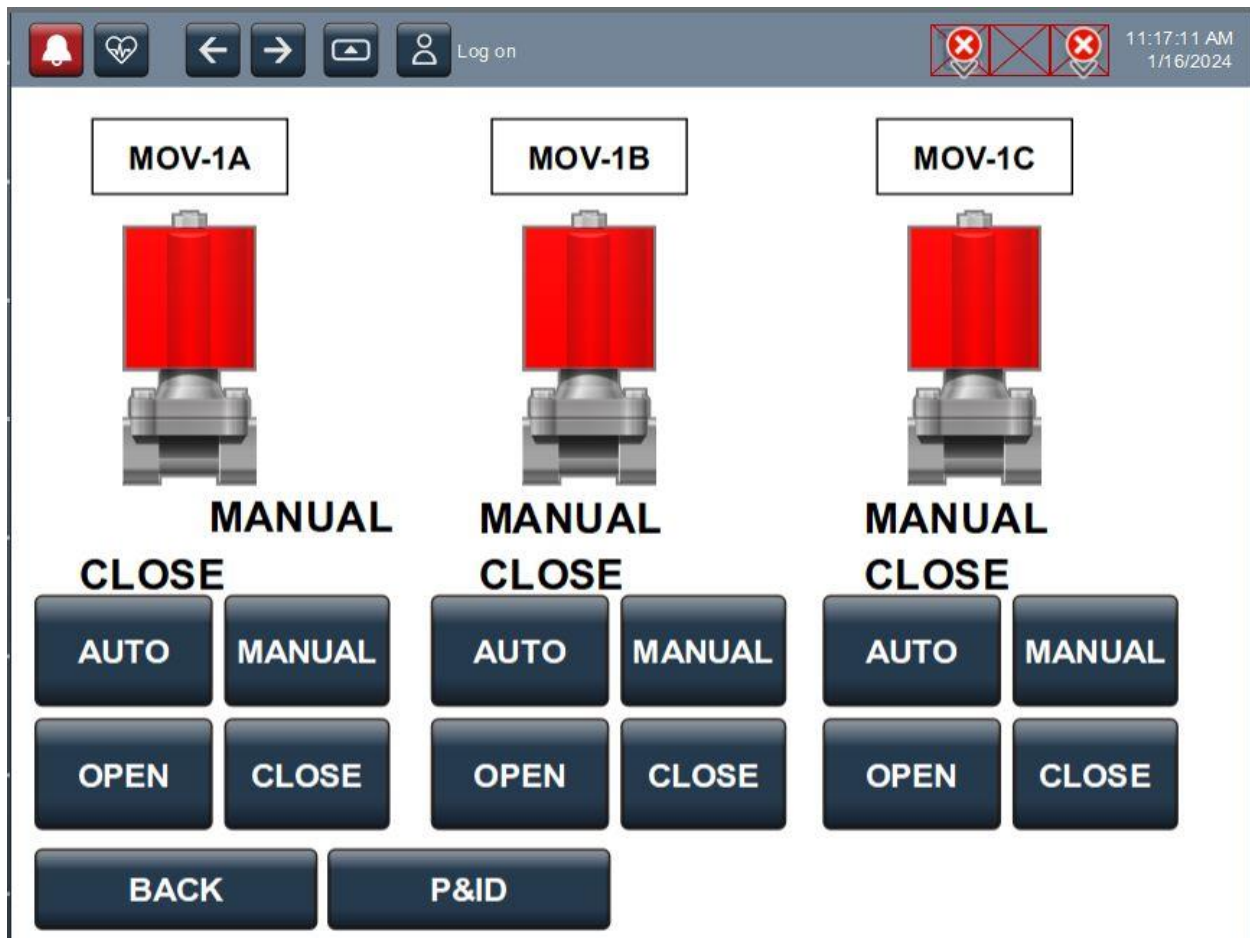
The P&ID screen gives an overall system status for all process instrumentation associated with RW1 and RW2.

BACK Button : Press this button to return to the previous screen.

MAIN OVERVIEW Button : Press this button to go to the MAIN OVERVIEW page.

MOV(S) Button : Press this button to go to the MOV page for the respective location of RW-1 or RW-2.

RW-1 MOV SCREEN:



AUTO Button: Press this button to place the MOV in AUTO for PLC automation control.

MANUAL Button: Press this button to place the MOV in MANUAL for manual control via the local HMI.

OPEN Button: This button will appear when in MANUAL mode. Press this button to manually open the MOV.

Close Button: This button will appear when in MANUAL mode. Press this button to manually close the MOV.

Note. If MOV-1A and MOV-1B are not in AUTO or left in MANUAL, the pre-lube, well pump and injection system will not run automatically.

Note. MOV-1C is currently only programmed to open/close in manual mode. No programming has been done for MOV-1C automation.

RW-1 WELL PUMP SCREEN

 Log on

09:43:04 AM
1/17/2024

Runtime Hours	0	Min Speed Setpoint	45 HZ	FAULT   Pump Interlock Status (MOV) MOV-1A Open MOV-1B Close
Runtime Minutes	0	Pump Startup Pressure Setpoint		
Starts	0	2 PSI	0 HZ 0 AMPS	
		Pump Pre Lube Time Setpoint (Minutes)	15 MIN	

START BACKWASH

STOP BACKWASH

BACK

P&ID

BACKWASH SETTING SCREEN

 Log on09:43:49 AM
1/17/2024

BACKWASH SETTINGS

BACKWASH TIME SETPOINT (HRS)	BACKWASH GALLONS SETPOINT (KGAL)	BACKWASH FLOW SETPOINT (GPM)
.75	10000	350
TIME TOTAL MODE	FLOW TOTAL MODE	TIME MODE

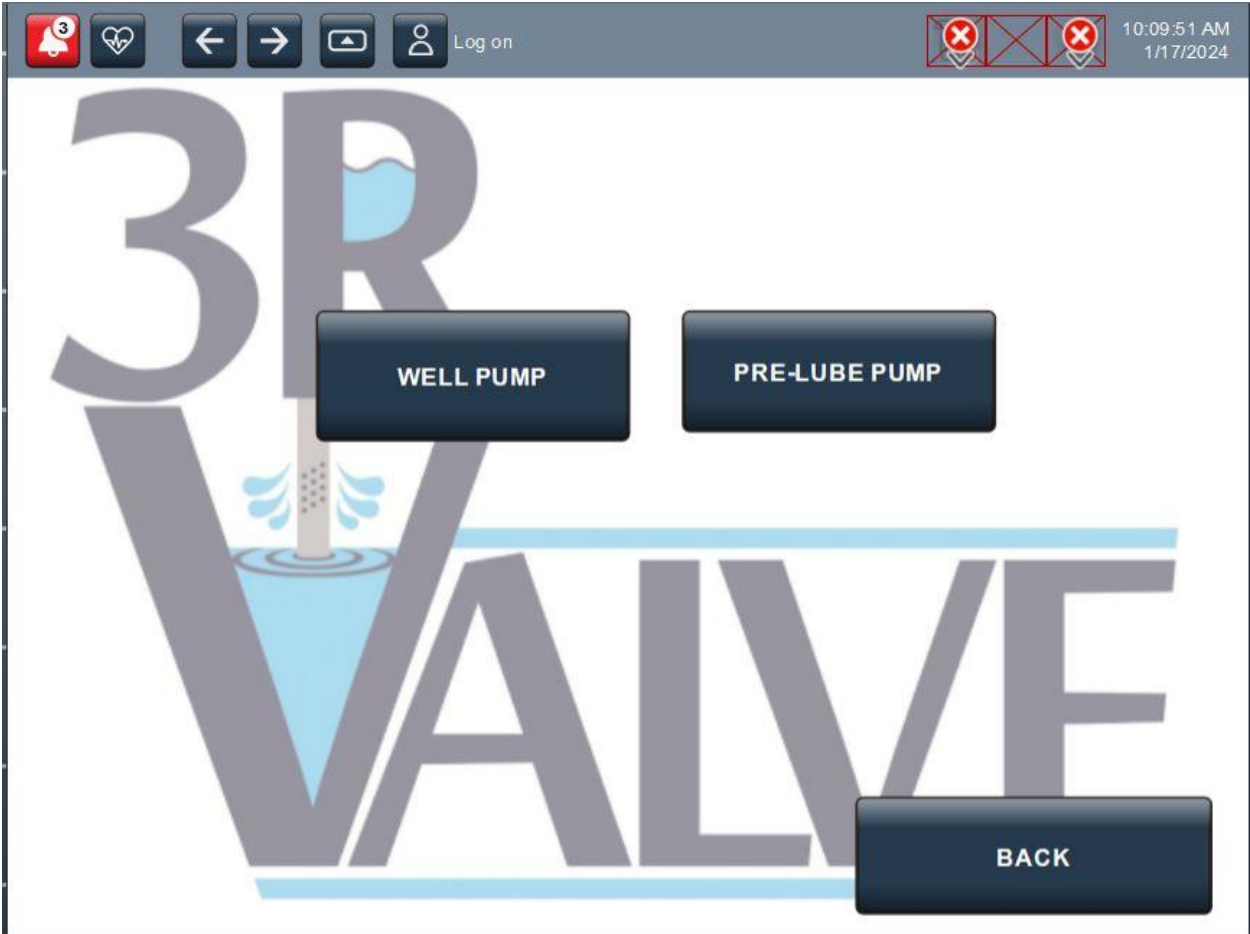
BACKWASH TRIGGER

LEVEL	PERIODIC
300 FEET BTOC	7 DAY
MANUAL	INJECTED
LEVEL MODE	10000 KGAL

FAULT
0 HZ
0 AMPS


BACK **P&ID**

RW-1 AND RW-2 PUMP NAVIGATION Screen



RW-1 AND RW-2 BACKWASH PUMP PRE-LUBE PUMP Screen

 Log on

10:10:58 AM
1/17/2024

Runtime Hours

0

Runtime Minutes

0

Starts

1

IN OFF



BACK

P&ID

RW-1 AND RW-2 TREND NAVIGATION Screen



RW1 SETTINGS Screen

Valve Calibration Button: Press this to navigate to the **WELL NO. 1 VALVE CALIBRATION MAIN** screen.

Troubleshooting Button: Press this to navigate to PLC Inputs and Outputs Troubleshooting.

Back Button: Press this to navigate to the previous screen.

Pressure Setpoint: Enter the desired system pressure (PSI) setpoint for 3R Valve to use as a control setting. This pressure is the well head pressure.

Pressure Deadband: Enter the desired deadband that 3R Valve will use as a control (open/close) setpoint by adding or subtracting from the desired Pressure Setpoint.

Flow Setpoint: Enter the desired system flow (GPM) setpoint for 3R Valve to use as a control setting.

Flow Deadband: Enter the desired deadband that 3R Valve will use as a control (open/close) setpoint by adding or subtracting from the desired Flow Setpoint.

Level Setpoint: Enter the desired (neg) level (BTOC) setpoint for 3R Valve to use as a control setting. This level setpoint is used as a fail safe and the value chosen should be larger than the expected aquifer level during injection.

Open Pressure Cut In Pressure Setpoint: Enter the desired pressure (PSI) the PLC (Programmable Logic Controller) will use to unlatch the Valve Fully Open Bit in the PLC program. Default pressure: 1100 PSI.

Open Pressure Cut Out Pressure Setpoint: Enter the desired pressure (PSI) the PLC (Programmable Logic Controller) will use to latch the Valve Fully Open Bit in the PLC program. Default pressure: 1675 PSI.

Close Pressure Cut In Pressure Setpoint: Enter the desired pressure (PSI) the PLC (Programmable Logic Controller) will use to unlatch the Valve Fully Closed Bit in the PLC program. Default pressure: 1100 PSI.

Close Pressure Cut Out Pressure Setpoint: Enter the desired pressure (PSI) the PLC (Programmable Logic Controller) will use to latch the Valve Fully Closed Bit in the PLC program. Default pressure: 1675 PSI.

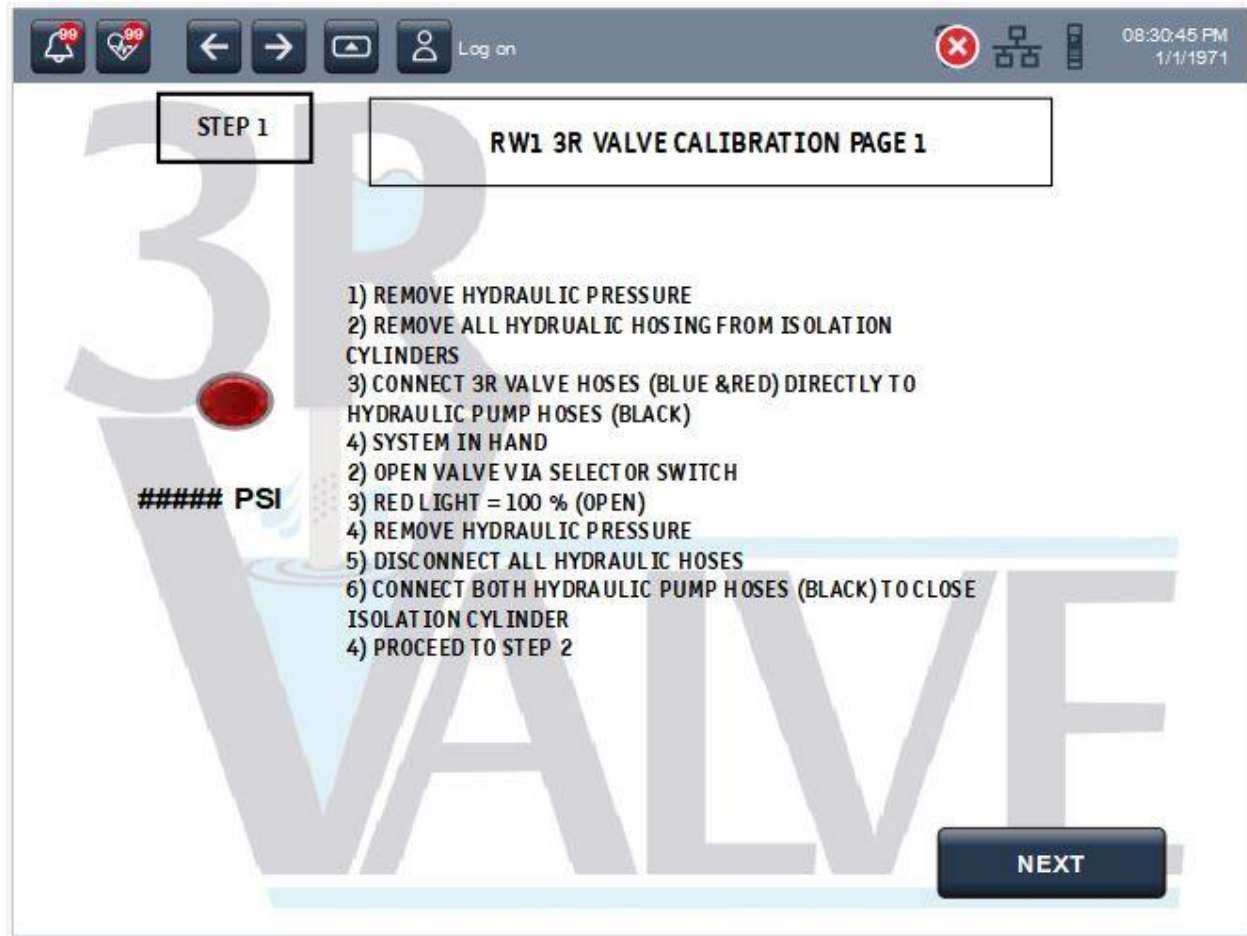
Open Interval: Enter the desired time (seconds) for 3R Valve automatic control will wait to change valve position. Default time: 5 seconds.

Open Duration: Enter the desired time (milliseconds) for 3R Valve automatic control will engage the open solenoid. Default time: 1000 milliseconds or 1.0 seconds.

Close Interval: Enter the desired time (seconds) for 3R Valve automatic control to wait to change valve position. Default time: 5 seconds.

Close Duration: Enter the desired time (milliseconds) for 3R Valve automatic control will engage the close solenoid. Default time: 1000 milliseconds or 1.0 seconds.

RW1 VALVE CALIBRATION MAIN Screen



This screen displays the valves current position.

Main Button: Press this to navigate to the **MAIN** screen.

Back Button: Press this to navigate to the previous screen.

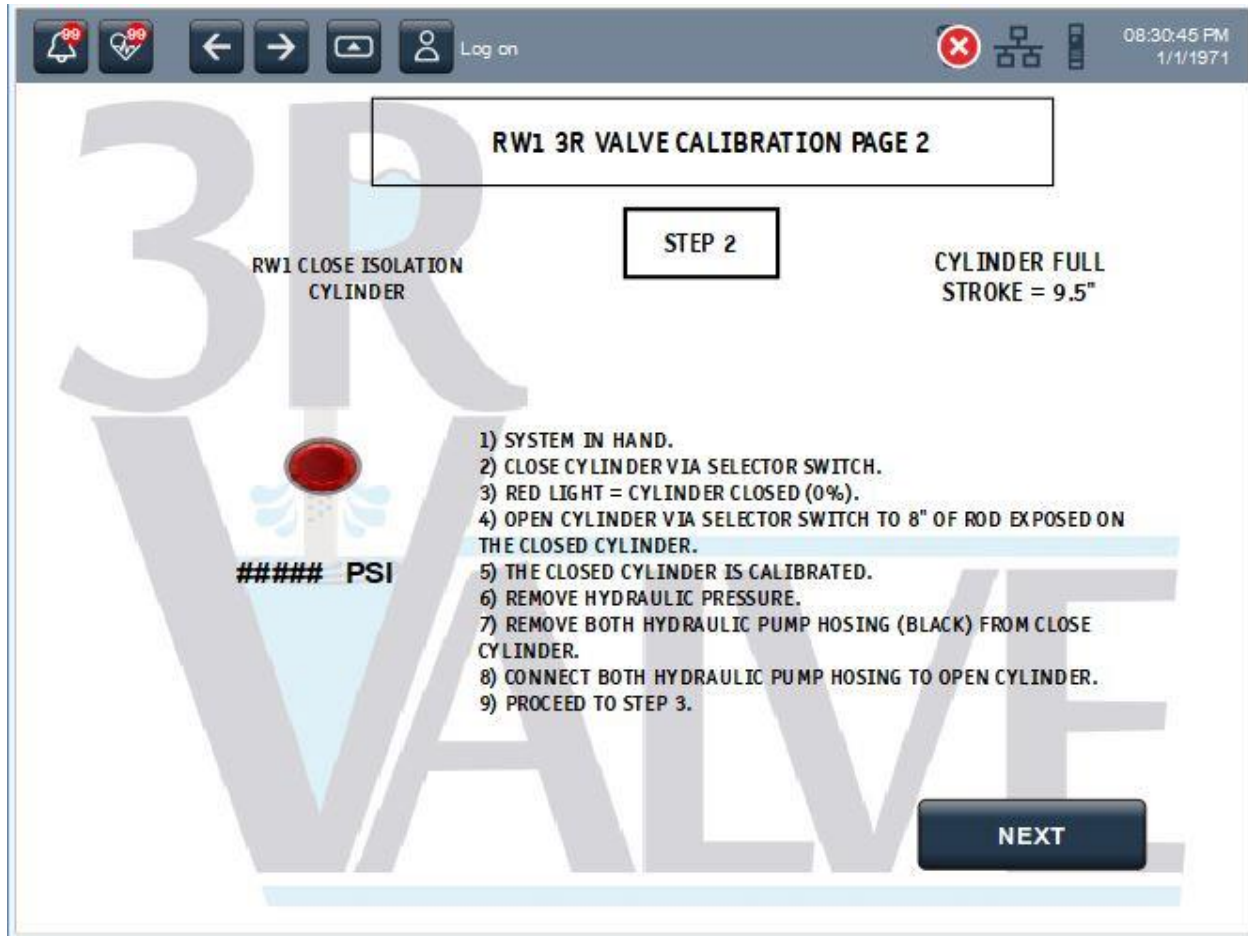
Step No. 1 Button: Press this button to go to the **WELL NO. 1 VALVE CALIBRATION STEP 1** Screen to start the process of calibrating 3R Valve located in the well and the (2) isolation cylinders located on the 3R Valve skid for Well No. 1.

Step No. 2 Button: Press this button to go to the **WELL NO. 1 VALVE CALIBRATION STEP 2** Screen. It is not recommended to skip step no. 1.

Step No. 3 Button: Press this button to go to the **WELL NO. 1 VALVE CALIBRATION STEP 3** Screen. It is not recommended to skip step no. 1 or 2.

Step No. 4 Button: Press this button to go to the **WELL NO. 1 VALVE CALIBRATION STEP 4** Screen. It is not recommended to skip step no. 1, 2 or 3.

RW1 VALVE CALIBRATION STEP NO. 1 Screen



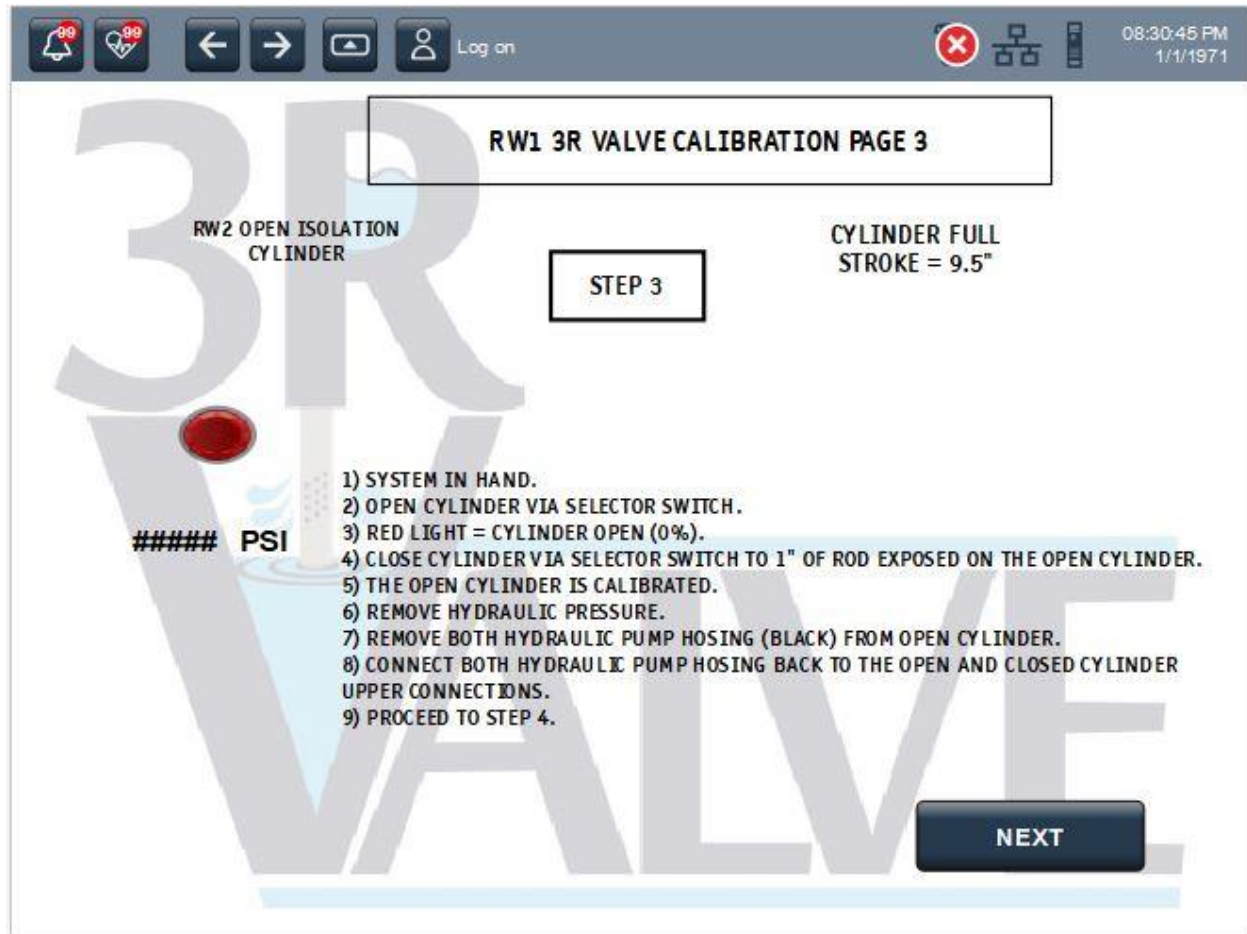
Follow the onscreen instructions to start the 3R Valve ASR Valve calibration process.

Note: To 'REMOVE HYDRUAULIC PRESSURE', perform the following steps:

- Turn well selector switch from HAND to OFF position.
- Rotate hydraulic pressure relieve valve(s) to the open position to remove hydraulic pressure from the CLOSE and OPEN hydraulic system. Verify pressure is 0 PSI.
- Rotate hydraulic pressure relieve valve(s) to the close position.
- Once hydraulic pressure is removed, proceed to (2) on the HMI touchscreen.

Press Next to go to Step No. 2.

RW1 VALVE CALIBRATION STEP NO. 2 Screen



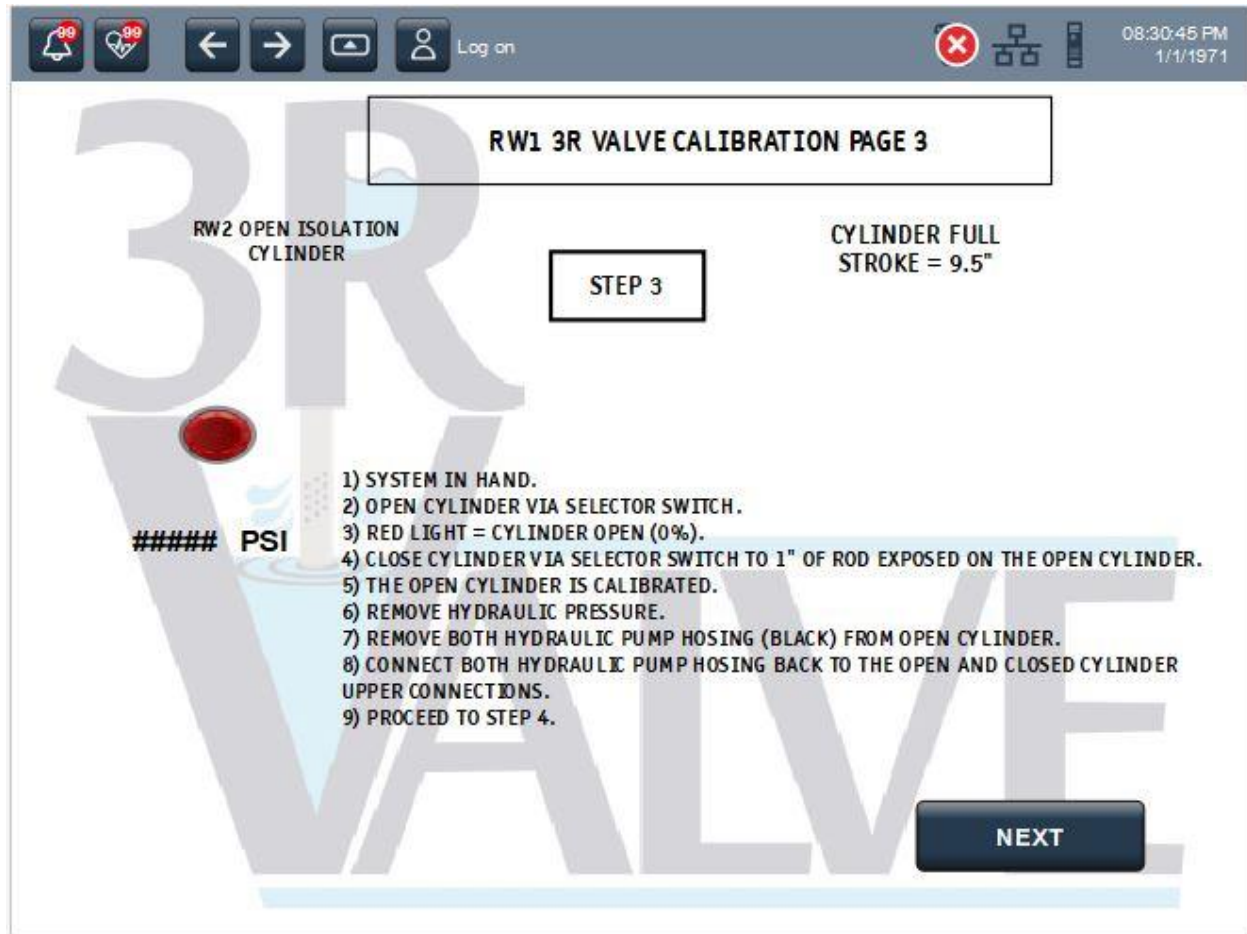
Follow the onscreen instructions to start the CLOSED ISOLATION CYLINDER calibration process.

Note: To 'REMOVE HYDRAULIC PRESSURE', perform the following steps:

- Turn well selector switch from HAND to OFF position.
- Rotate hydraulic pressure relieve valve to the open position to remove hydraulic pressure from the CLOSE hydraulic system. Verify pressure is 0 PSI.
- Rotate hydraulic pressure relieve valve to the close position.
- Once hydraulic pressure is removed, proceed to (3) on the HMI touchscreen.

Press Next to go to Step No. 3.

RW1 VALVE CALIBRATION STEP NO. 3 Screen



Follow the onscreen instructions to start the OPEN ISOLATION CYLINDER calibration process.

Note: To 'REMOVE HYDRAULIC PRESSURE', perform the following steps:

- Turn well selector switch from HAND to OFF position.
- Rotate hydraulic pressure relieve valve to the open position to remove hydraulic pressure from the OPEN hydraulic system. Verify pressure is 0 PSI.
- Rotate hydraulic pressure relieve valve to the close position.
- Once hydraulic pressure is removed, proceed to (4) on the HMI touchscreen.

Press Next to go to Step No. 4.

RW1 VALVE CALIBRATION STEP NO. 4 Screen

PSI

VALVE OPEN

1) SYSTEM IN HAND
2) OPEN VALVE
3) GREEN LIGHT = PRESS VALVE OPEN
4) CLOSE VALVE
5) GREEN LIGHT = PRESS VALVE CLOSED
6) VERIFY THE CLOSED CYLINDER HAS THE FOLLOWING EXPOSED ROD

1" +/- 1/4"

7) VERIFY THE OPEN CYLINDER HAS THE FOLLOWING EXPOSED ROD

8" +/- 1/4"

VALVE CLOSED

%

PSI

BACK **NEXT**

RW1 VALVE

Follow the onscreen instructions to start the valve calibration process.

Press Back to return to the **WELL NO. 1 VALVE CALIBRATION MAIN** Screen.

Verify the hydraulic hoses are in the correct configuration and fittings are tight.

CLOSE the valve via the HOA and OPEN/CLOSE selector switch until the CLOSE HYDRAULIC PRESSURE reaches 1400 PSI or greater. Press the FULLY CLOSED BUTTON.

OPEN the valve via the HOA and OPEN/CLOSE selector switch fully until the OPEN HYDRAULIC PRESSURE reaches 1400 PSI or greater. Press the FULLY OPEN BUTTON.

Again, CLOSE the valve via the HOA and OPEN/CLOSE selector switch until the CLOSE HYDRAULIC PRESSURE reaches 1400 PSI or greater. Verify the feedback reads 0%. If not, press the FULLY CLOSED BUTTON again.

Place the HOA back into AUTO and resume normal operations.

RW1 TROUBLESHOOTING Screen

Log on

09:44:45 AM
1/17/2024

ANALOG INPUT SLOT 1

INPUT	RAW	RAW MIN	RAW MAX	SCALED MIN	SCALED MAX	SCALED OUT
0	4002	4000	20000	0	5000	.63
1	5064	4000	20000	0	5000	332.5
2	2132	651	20000	0	100	7.65
3	3999	4000	20000	0	100	-.01
4	4003	4000	20000	0	3000	0
5	10110	4000	20000	0	693	264.64
6	20807	4000	20000	0	3000	0
7	0	0	0	0	0	0

ANALOG INPUT SLOT 2

INPUT	RAW	RAW MIN	RAW MAX	SCALED MIN	SCALED MAX	SCALED OUT
0	3200	0	0	0	0	0
1	3200	0	0	0	0	0
2	3200	0	0	0	0	0
3	3200	0	0	0	0	0
4	3200	0	0	0	0	0
5	3200	0	0	0	0	0
6	3200	0	0	0	0	0
7	3200	0	0	0	0	0

ANALOG OUTPUT SLOT 3

OUTPUT	RAW	RAW MIN	RAW MAX	SCALED MIN	SCALED MAX	SCALED OUT
0	20000	0	0	45	20000	20000
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0

**DISCRETE INPUT
SLOT 4**

IN 0

IN 1

IN 2

IN 3

IN 4

IN 5

IN 6

IN 7

IN 8

IN 9

IN 10

IN 11

IN 12

IN 13

IN 14

IN 15

**DISCRETE INPUT
SLOT 5**

IN 0

IN 1

IN 2

IN 3

IN 4

IN 5

IN 6

IN 7

IN 8

IN 9

IN 10

IN 11

IN 12

IN 13

IN 14

IN 15

**DISCRETE OUTPUT
SLOT 6**

OUT 0

OUT 1

OUT 2

OUT 3

OUT 4

OUT 5

OUT 6

OUT 7

OUT 8

OUT 9

OUT 10

OUT 11

OUT 12

OUT 13

OUT 14

OUT 15

BACK

Analog Inputs:

- For each analog channel the following is displayed:
 - RAW engineering units into PLC from field device.
 - RAW minimum.
 - RAW maximum.
 - SCALED minimum.
 - SCALED maximum.
 - SCALED output.
- Discrete Inputs. Each channel input the PLC is identified as On or Off.
 - Refer to panel drawings for control wiring details.
- Discrete Outputs. Each channel output from the PLC is identified as On or Off.
 - Refer to panel drawings for control wiring details.