



TRI NUCLEAR CORP.

THE INDUSTRY STANDARD IN UNDERWATER FILTRATION

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Underwater Demineralizer

Series (UD-xxA)

Operating Instructions and Maintenance Manual

For Models:

UD-30A, UD-36A & UD-48A



Operating Instructions and Maintenance Manual Underwater Demineralizer Series	Doc. No.	Rev.	Date	Page 1 of 52
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ORIGINAL DOCUMENT (ENGLISH VERSION ONLY)

Operating Instructions and Maintenance Manual Underwater Demineralizer Series

*For Models:
UD-30A, UD-36A, & UD-48A*

NOTE:

This OI-TNC-011 combines and replaces the previous Tri Nuclear Operating Instructions listed below (which are now obsolete).

Previous Document NO.	Revision	Issue Date	Title
OI-10	4.0	12/10/12	UD-36A Operating Instructions
OI-21	2.0	12/21/12	UD-48A Operating Instructions
OI-24	2.0	12/21/12	UD-30A Operating Instructions
ACN-3	-	03/27/17	Digital Flow Meter Change
<i>For information on legacy/obsolete Tri Nuclear equipment, please see the document: OI-Legacy Rev 0 (Legacy descriptions and information for Tri Nuclear Underwater Systems)</i>			
Approval: Engineering Manager Rick Russell			Date 1/10/20

Tri Nuclear Record of Revision

Revision or Change Number	Effective Date of Revision or Change	Affected Page and / or Paragraph number	Person Entering Revision	Revision or change Cancelled By
Rev. 0	01/15/19	Original Issue	-----	Rev. 1
Rev. 1	01/10/20	0.1, 0.2, 1.0, 1.4, 1.5, 2.1, 2.1.1, 2.1.4, 2.2, 2.3, 2.7, 2.8.1, 2.11.3, 2.11.6, 2.15, 4.1.1.2, 4.1.2, 4.5, 5.0.1, 5.1, 9.0	R. Russell	

If you have any questions concerning changes in this document, please call the main Tri Nuclear office at 518-399-1389 or e-mail at info@trinuclear.com

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TNC-012-02	UD-36A Brochure Drawing	3
TNC-013-02	UD-48A Brochure Drawing	3
TNC-006-02	PP-40SC Brochure Drawing	3
TNC-007-02	PP-100SC Brochure Drawing	1
TNC-008-02	PP-260SC Brochure Drawing	1
TNC-018-12	CB-xxx-FM Control Box Brochure Drawing	1

Related Documents:





Document Number	Title
OI-5	Tri Nuclear Pump Trouble Shooting Guide
OI-TNC-088	General Underwater Demineralizer Sluicing Procedure

ISO Symbols	Meaning
	Yellow warning triangle/black graphical symbol, indicates what the hazard is.
	DANGER - Indicates an imminently hazardous situation, which if not avoided, <u>will result in death or serious injury</u> .
	WARNING - Indicates a potentially hazardous situation, which if not avoided <u>could result in death or serious injury</u>
	CAUTION - Indicates a potentially hazardous situation which, if not avoided, <u>may result in minor or moderate injury</u>
CAUTION	“CAUTION” without the safety alert symbol should be used for safety labels that indicate only equipment damage
	NOTICE indicates information that relates directly or indirectly to the safety of personnel or protection of property
	<u>General Caution:</u> <ul style="list-style-type: none"> Do not use this Equipment for any purpose not described in this Manual.
	<u>Danger:</u> <ul style="list-style-type: none"> High Voltage Do not operate this equipment from any power source that does not match the voltage rating stamped on the equipment. Refer to the Manufacturer’s Identification Label for operational requirements.
	<u>Caution:</u> <ul style="list-style-type: none"> Normal operation of this equipment will likely result in radioactive contamination. Decontamination must be performed in accordance with approved procedures.
	<u>Prohibited:</u> <ul style="list-style-type: none"> Electronics - Must be recycled as required by local environmental law. Do not dispose of by adding to the Municipal waste stream.
	<u>Recycle:</u> <ul style="list-style-type: none"> Metal/Other Parts of the System - Must be recycled as required by local environmental law.

0.3 Front Matter – ISO Safety Symbols – Defined (Continued)


<u>Symbol</u>	<u>Meaning</u>
	Prohibited: <ul style="list-style-type: none"> Do NOT use tools. Hand tighten only.

0.4 Front Matter – Precautions and Warnings

<u>Type</u>	<u>Description</u>
	<p>Do not submerge the control box for any reason.</p> <p>Ensure proper electrical safety precautions are taken if the cover of the control box is open and there is power to the control box.</p>
	<p>Do NOT attempt to perform maintenance on the control box while it is energized.</p> <p>It is expected that trained and qualified personnel will operate the unit. Radiological considerations and requirements are not included in this document and should be specifically addressed by the end user organization.</p>
	<p>Do NOT use the electrical cables or discharge hoses to lift the pump.</p>
	<p>Normal operation of this equipment will likely result in radioactive contamination. Decontamination must be performed in accordance with approved procedures.</p>

0.4 Front Matter – Precautions and Warnings (continued)

<u>Type</u>	<u>Description</u>
	<p>When installing and removing the power cord, do not move the power cable connector with side to side motion in an attempt to install or remove it.</p>

	<p>If difficulty is encountered during installation, ensure that the keyway is lined up and that the male end of the PSC-100P power cord is properly lubricated with a nonconductive electrical lubricant (Dow Corning #4).</p>
	<p>If difficulty is encountered during removal, ensure the power cable has been unthreaded fully and pull in the vertical direction ONLY to remove the power cable from the pump.</p>
	<p>Install the power cord to pump pigtail HAND TIGHT ONLY. Do NOT use any tools (pliers, channel locks etc.) to tighten the connection.</p>
<p>CAUTION</p>	<p>Do not operate the Tri Nuclear Underwater Demineralizer with a stratified media bed (carbon & resin) or a carbon only bed. Resin selection is the responsibility of the customer.</p>
	<p>Do not overfill the Underwater Demineralizer with resin. See Table 2.1 for maximum resin capacities for the UD's.</p>
	<p>Caution should be taken to <u>NOT</u> store any plastic components (eg. filters or hoses) near high radiation fields associated with equipment such as fuel bundles, LPRM's or control blades.</p>
	<p>Breakdown of such components can occur with accumulated exposures of 10E6 Rad. For this reason, precautions should be taken to minimize accumulative dose for the following components: suction hose, power and instrument cable, flow sensor, and electric motor.</p>
	<p>All components are chemically suitable for long term storage in the fuel pool cavity environment.</p>
	<p>Use of any components other than genuine Tri Nuclear replacement parts will void the warranty.</p>
	<p>Fully submerge pump prior to starting the system. Running or "bumping" the pump dry (out of water) will result in damage to the pump.</p>
	<p>Pumps must be installed at least 10 ft. below the water level of the pool to ensure enough NPSH (Net Positive Suction Head) for proper operation of the pump.</p>
	<p>Check for proper phase rotation before running the system. Running the pump in reverse will result in damage over time.</p>

0.4 Front Matter – Precautions and Warnings (continued)

<u>Type</u>	<u>Description</u>
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ORIGINAL INSTRUCTIONS (ENGLISH VERSION ONLY)

CAUTION	<p>When installing the power cord to the pump, ensure the keyway male end on the PSC-100P cable is aligned with the female keyway on the SC connector on the pump.</p> <p>Ensure the PSC-100P plug is sufficiently lubricated with a non-conductive electrical lubricant (Dow Corning #4).</p> <p>Do not use excessive downforce or side-to-side action to try and “make it fit” as you may damage the plug.</p> <p>Install the power cord to pump pigtail HAND TIGHT ONLY. Do NOT use any tools (pliers, channel locks etc.) to tighten the connection.</p>
	<p>When removing the power cord, be sure that the plug is fully unthreaded and pull in a vertical direction only.</p> <p>Do not use side-to-side action to try and “loosen it up” as you may damage the plug.</p>
	<p>Do not start the pump more than once every 2 minutes or 300 starts/day. Damage to the motor winding insulation may occur.</p>
	<p>Slowly lower the vessel in the pool. The addition of water during the lowering of the vessel will help keep the center of gravity of the vessel low and minimize any “wobbling” of the vessel that may occur during lowering.</p>
	<p>Perform a flow meter check:</p> <ul style="list-style-type: none"> • Prior to initial installation • When meter or sensor is replaced • Sensor is suspected to be damaged
NOTICE	<p>Do not install more than 50ft of suction hose to the suction port on the UD system. This will ensure there is adequate flow to the demineralizer.</p>
	<p>The preferred method of storing the submersible pump assembly when not in use is underwater.</p>
	<p>Running the unit without hoses will not produce desired results in pool demineralization or water clarity.</p>
	<p>Very small air bubbles might be observed exiting the pump discharge. This occurs due to the negative pressure in the vessel as air is stripped from the pool water. This observation is normal and should not be of any concern.</p>

1.0 Introduction

The Tri Nuclear's Underwater Demineralizer systems are self-contained, portable Underwater Demineralizer System that is designed to operate in the spent fuel pool or reactor cavity.

The UD's incorporates the following Tri Nuclear design features:

- The Underwater Demineralizer system operates under negative pressure. This design feature eliminates the need for special bolted pressure closures on the pump housing requiring tooling for operation. The pump seals with a simple flat cover plate held in place by negative pressure during operation. One of the many benefits of this design is that it requires no special tooling to install or remove the pump underwater. With the pump installed correctly in the pump tube, the weight of the pump keeps it in place during normal operation.

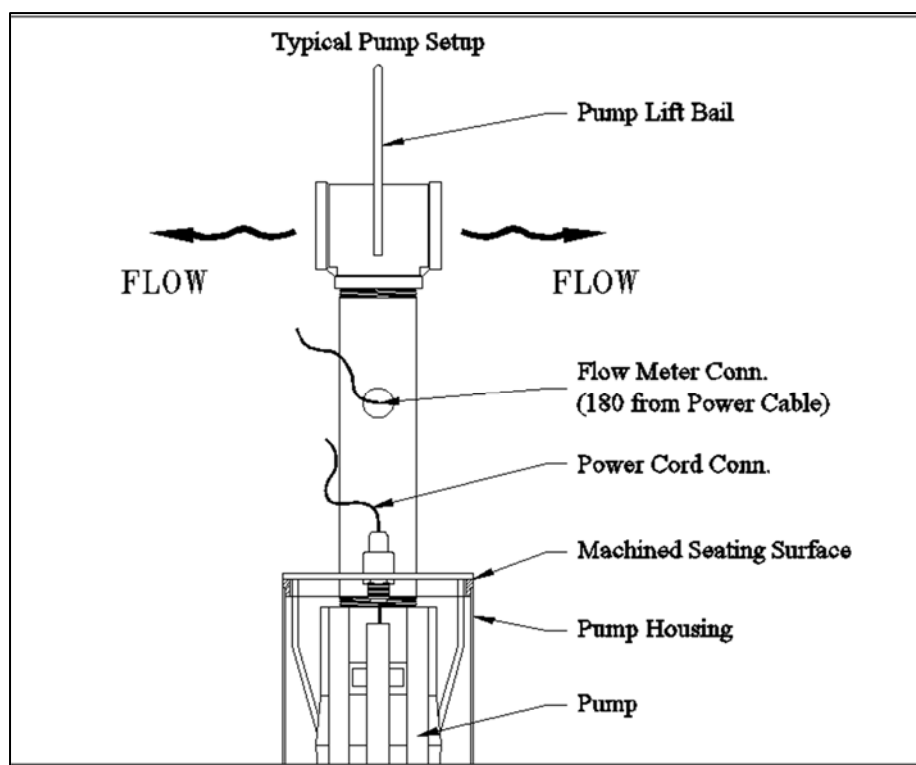


Figure 1.0 – Typical Pump Setup

- Vessel lifting ears meets and exceeds the requirements of NUREG 0612.
- Designed to be sluiced in/out while the vessel is submerged in the pool.
- Initial resin loading can be performed through the inlet connection.
- Vessel designed and fabricated per ASME Boiler and Pressure Code, Section VIII, Div. 1 (but not code stamped)

1.0 Introduction (continued)

Underwater Demineralizer Data			
	UD-30A	UD-36A	UD-48A
System Flow Rate	40 GPM	75 GPM	200 GPM
Resin Capacity	10 Cu Ft	28 Cu Ft	50 Cu Ft
Footprint	30 in. Diameter	36 in. Diameter	48 in. Diameter
System (max) Height	65 in.	89 in.	100 in.
Vessel Height	47-1/2 in.	67-1/2 in.	76-1/2 in.
Pump Used	PP-40SC	PP-100SC	PP-260SC
Reference Drawing	TNC-011-02	TNC-012-02	TNC-013-02

1.1 Typical Operation

Unfiltered water from the pool enters through the water inlet safety screen (.015in slot). This safety screen prevents any resin/media from escaping the vessel through the inlet piping.

The water is then distributed across the media bed via the inlet diverter plate(s). The water travels through the media bed, and into one of the 1-1/2in outlet retention elements (.007in slot) and to a common outlet plenum. There is an additional outlet safety screen (.015in slot) in the pump tube which prevents any resin from escaping in the very unlikely event that a .007in slot retention element fails.

Water then travels through the pump and back to the pool. A sample connection is part of the pump assembly to allow for the collection of an effluent sample of the demineralizer.

1.2 Environmental Conditions

With the exception of the electrical disconnect box, electrical controls, and the flow meter display, the Underwater Demineralizer Systems are designed to be submerged in the spent fuel pool and / or refueling pool water.

- 1.2.1 The Underwater Demineralizer Systems are designed to operate in continuous use in pure and / or borated water from 40F to 140F, PH ranges from 4.0 to 11.0 and up to 100 ft. water depth.
- 1.2.2 The Underwater Demineralizer System components are designed for storage out of water in an ambient temperature range in air from 40F to +140F with 100% humidity.

1.3 Transportation and Storage

The Underwater Demineralizer System components will withstand, or has been protected against, transportation and storage temperatures of 40F to 140F.

The systems have been packaged to prevent damage from the effects of normal humidity, vibration and shock

1.4 Equipment Guide List

TNC Part Number	Description	UD-30A	UD-36A	UD-48A
UD-30A-V	Basic Demineralizer vessel for the UD-30A system, 30in dia, 10 cu.ft. resin capacity, Certified to NUREG-0612	1		
UD-36A-V	Basic Demineralizer vessel for the UD-36A system, 36in dia, 28 cu.ft. resin capacity, Certified to NUREG-0612		1	
UD-48A-V	Basic Demineralizer vessel for the UD-48A system, 40in dia, 50 cu.ft. resin capacity, Certified to NUREG-0612			1
PP-40SC	Grundfos pump, 1-1/2HP/460/3Ph/60Hz, w/cover & SC connector	1		
CB-40-FM	1-1/2 HP/460/3Ph/60 Hz phase reversing control box with twist lock plugs and integral 0-200 GPM digital flow meter.	1		
PP-100SC	Grundfos pump, 2HP/460/3Ph/60Hz, w/cover & SC connector		1	
CB-100-FM	2 HP/460/3Ph/60 Hz phase reversing control box with twist lock plugs and integral 0-200 GPM digital flow meter.		1	
PP-260SC	Grundfos pump, 5HP/460/3Ph/60Hz, w/cover & SC connector			1
CB-260-FM	5 HP/460/3Ph/60 Hz phase reversing control box with twist lock plugs and integral 0-400 GPM digital flow meter.			1
PSC-100P	PSC-100P Power Cable with twist lock plug (100ft 10/4 SO Cable w/ male twistlock plug)	1	1	1
PC-50	PC-50 drop cable with female plug (50ft Cable w/ female connector)	1	1	1
FM-SRD	Flow sensor with reinforced paddlewheel and 100ft cable with Amphenol connector.	1	1	1
PH-2x25	2in x 25ft hose with Polypro MxF camlock couplers	1	1	

1.4 Equipment Guide List (continued)

TNC Part Number	Description	UD-30A	UD-36A	UD-48A
PH-3x25	3in x 25ft hose with Polypro MxF camlock couplers			1
BV-1.5SS-MxF	1-1/2in SS FP Ball Valve with male by locking female camlock couplers. Includes remote grapple lanyard.	2	2	2
FPS-1.5x50	Suction/Discharge hose, 1.5in x 50ft lg with SS male x locking Female camlock couplers. 150 PSI rating, hydro tested.	2	2	2
SH-.5x100	Sample hose, 1/2in x 100ft lg with a 1/2in SS female camlock coupler x 1/2in SS ball valve. 150 PSI rating, hydro tested.	1	1	1
SHCK-UD-30A	Suction Hose Conversion Kit for the UD-30A system. Includes the following: (1) SHCK-SSVA-2x2 Safety Screen Vent Assembly (1) PH-2x50 suction hose (1) SHCK-JS-2x6 Johnson Screen strainer	1		
SHCK-UD-36A	Suction Hose Conversion Kit for the UD-36A system. Includes the following: (2) SHCK-SSVA-2x2 Safety Screen Vent Assemblies (2) PH-2x50 suction hoses (2) SHCK-JS-2x6 Johnson Screen strainers		1	
SHCK-UD-48A	Suction Hose Conversion Kit for the UD-48A system. Includes the following: (2) SHCK-SSVA-3x4 Safety Screen Vent Assemblies (2) PH-3x50 suction hoses (2) SHCK-JS-4x12 Johnson Screen strainer			1
UT-8A	Diffuser Pipe for 2" discharge hose	1	1	
UT-8	Diffuser Pipe for 3in discharge hose			1
UT-10C	Mounting Panel for Phase Reversing Control Box	1	1	1

1.5 Materials of Construction

TNC Part Number	Description	Materials of Construction
UD-30A-V	Basic Demineralizer vessel for the UD-30A system, 30in dia, 10 cu.ft. resin capacity, Certified to NUREG-0612	304LSS, 304SS, 316SS
UD-36A-V	Basic Demineralizer vessel for the UD-36A system, 36in dia, 28 cu.ft. resin capacity, Certified to NUREG-0612	304SS, 316SS
UD-48A-V	Basic Demineralizer vessel for the UD-48A system, 40in dia, 50 cu.ft. resin capacity, Certified to NUREG-0612	304LSS, 304SS, 316SS
PP-40SC PP-100SC PP-260SC	Grundfos pump, w/cover & SC connector	304SS
CB-40-FM CB-100-FM CB-260-FM	PHASE REVERSING control box with twist lock plugs and integral digital flow meter.	Fiberglass Enclosure
PSC-100P	PSC-100P Power Cable with twist lock plug (100ft 10/4 SO Cable w/ male twistlock plug)	10/4 SOOW Cable
PC-50	PC-50 drop cable with female plug (50ft Cable w/ female connector)	10/4 SOOW Cable
FM-SRD	Flow sensor with reinforced paddlewheel and 100ft cable with Amphenol connector.	Polypropylene
PH-2x25 PH-2x50 PH-3x25 PH-3x50	Suction hose with MxF camlock couplers	PVC hose with Polypropylene camlock couplers & 304SS crimped sleeves
FPS-1.5x50	Suction/Discharge hose, 1.5in x 50ft lg with SS male x locking female camlock couplers. 150 PSI rating, hydro tested.	EPDM hose with 316SS camlock couplers & 304SS crimped sleeves
SH-.5x100	Sample hose, 1/2in x 100ft lg with a 1/2in SS female camlock coupler x 1/2in SS ball valve. 150 PSI rating, hydro tested.	PVC reinforced hose with 316SS camlock coupler & 316SS ball valve
SSVA-2x2 SSVA-3x4	Safety Screen Vent Assembly	304SS, 316SS
SHCK-JS-2x6 SHCK-JS-4x12	Johnson Screen strainer	304SS, 316SS
BV-1.5SS-MxF	1-1/2in SS FP Ball Valve with male by locking female camlock couplers. Includes remote grapple lanyard.	304SS, 316SS
UT-8 UT-8A	Diffuser Pipe	304 SS, 316SS female camlock coupler
UT-10C	Mounting Panel for Phase Reversing Control Box	304 SS

2.0 Description of Equipment

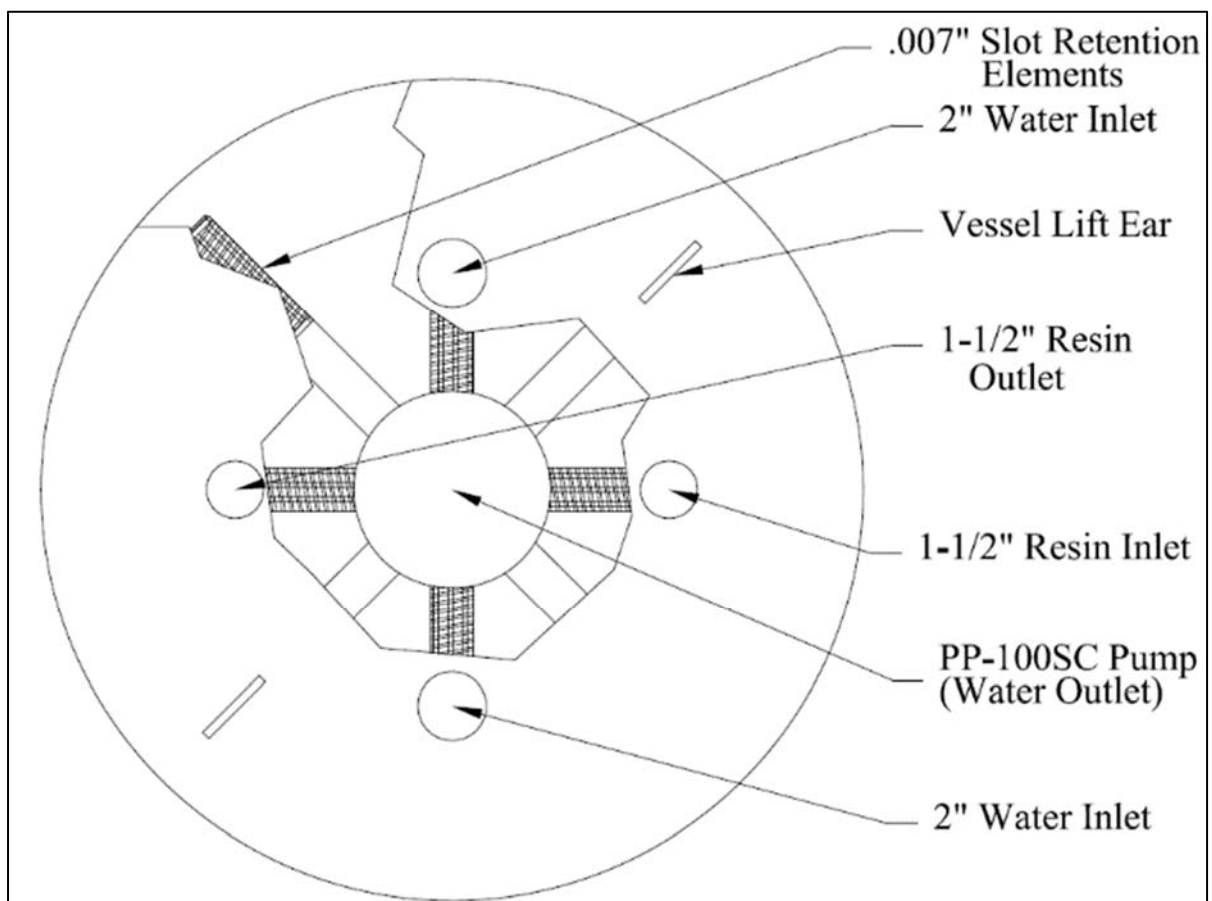
2.1 Demineralizer Vessels:

All Tri Nuclear Underwater Demineralizers are similar in their design and top connections.

They are all designed and built to the ASME Boiler and Pressure Code Section VIII, Div. 1 (but not code stamped).

There are one or two water inlet connections (either 2in or 4in couplings) and two 1-1/2in male cam-lock couplings (one for resin slurry inlet and one for resin slurry outlet), and a center 8in pipe opening for installing the submersible pump assembly.

Regardless of the Model of the Underwater Demineralizer, the Resin Inlet & Resin Outlet connections are either stamped or etched on the head near the connection itself.



Top view of a UD-36A Underwater Demineralizer, all others similar


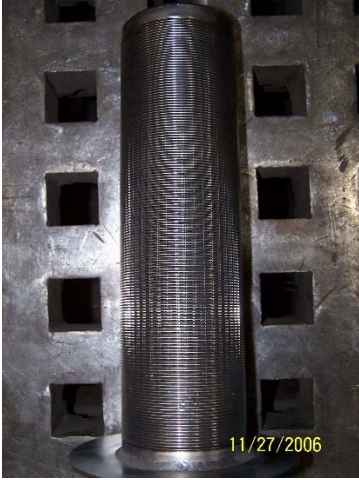
Table 2.1 Underwater Demineralizer Data			
	UD-30A	UD-36A	UD-48A
System Flow Rate	40 GPM	75 GPM	200 GPM
Resin Capacity	10 Cu Ft	28 Cu Ft	50 Cu Ft
Hoses	1 Discharge or 1 Suction	1 Discharge or 2 Suction	1 Discharge or 2 Suction
Footprint	30 in. Diameter	36 in. Diameter	48 in. Diameter
System (max) Height	65 in.	89 in.	100 in.
Vessel Height	47-1/2 in.	67-1/2 in.	76-1/2 in.
Pump Used	PP-40SC	PP-100SC	PP-260SC
Pump Weight	50 lbs.	50 lbs.	85 lbs.
Vessel Empty with Pump Weight	250 lbs.	550 lbs.	1,275 lbs.
Vessel & Pump Filled with Water & Resin Weight	1,100 lbs.	2,550 lbs.	5,750 lbs.
Reference Drawing	TNC-011-02	TNC-012-02	TNC-013-02

Table 2.1.1 Underwater Demineralizer Additional Data			
	UD-30A	UD-36A	UD-48A
NUREG 0612 Certified	Yes, since June 2012	Yes, since January 2011	Yes, since July 2011
Lift ear shackle hole size	1-1/8in dia	1in dia	1-1/8in dia
Inlet connection size	(1) 2in female NPT coupling	(2) 2in female NPT couplings	(2) 4in female NPT couplings

2.1.1 Johnson Screen® Retention Elements

All Tri Nuclear Underwater Demineralizers use Johnson Screens® as the primary and safety screens in the demineralizer. They are spiral wound (Tri Nuclear does not use staked disk or mesh) and are made out of 316L SS “Vee” wire.

The primary retention element screens are 1-1/2in with .007in slot openings and are of a “standard construction” (see Fig 2.1). They are designed for a uniform distribution flow through the demineralizer bed without any “dead zones” in the bed. These primary retention elements also prevent the escape of resin from the demineralizer bed.

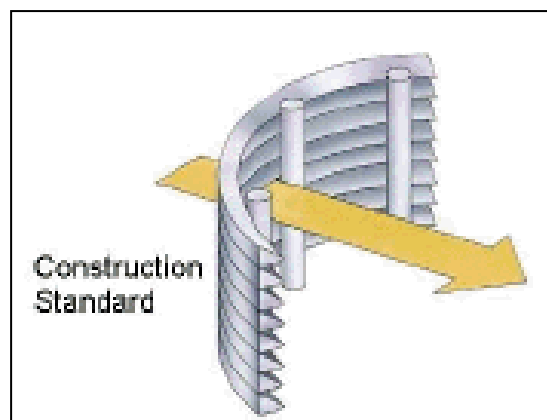
	
<p>Typical Standard .007in Johnson Screen assemblies (welded to the inner head)</p>	<p>Typical Standard .015in Johnson Screen assembly (safety screen for the pump tube)</p>

The safety screens for all UD’s “standard construction” Johnson Screen® with .015in openings and is designed to prevent resin migration from the vessel in the highly unlikely chance that a primary retention element fails. The size of the safety screen depends on the unit they are installed on.

All Tri Nuclear Underwater Demineralizers have safety screens in two different locations: The vessel outlet safety screen and the vessel inlet safety screens.

There is a single vessel outlet safety screen located internally in the water outlet plenum in the pump tube.

The vessel inlet safety screen is either a stand alone screen or part of the suction hose conversion kit. Regardless of the location, all safety screens are “standard construction” Johnson Screen® with .015in openings and are designed to prevent resin migration out of the vessel from the top of the resin bed (a highly unlikely event).



2.1.1 Johnson Screen® Retention Elements (Continued)

While the system is normally operating, the inlet Johnson screen has been sized to allow water to enter through the screen and any residual collected air in the vessel to be vented from the screen.

The vessel inlet screens are designed to be removed remotely from the vessel if required.

2.1.2 UD-30A Vessel (See TNC-011-02 for details)

The UD-30A demineralizer top connections include one 2in female NPT coupling for installing the water inlet Johnson Safety Screen (or Suction Hose Conversion Kit), two 1-1/2in male cam-lock couplings (one for resin slurry inlet and one for resin slurry outlet), and a center 8in pipe opening for installing the submersible pump assembly.



Figure 2.1.2
UD-30A Vessel and pump

2.1.3 UD-36A Vessel (See TNC-012-02 for details)

The UD-36A demineralizer top connections include two 2in female NPT coupling for installing the water inlet Johnson Safety Screen (or Suction Hose Conversion Kit), two 1-1/2in male cam-lock couplings (one for resin slurry inlet and one for resin slurry outlet), and a center 8in pipe opening for installing the submersible pump assembly.



Figure 2.1.3
UD-36A Vessel with pump and sluice valves installed

2.1.4 Deleted.

2.1.5 UD-48A Vessel (See TNC-013-02 for details)

The UD-48A demineralizer top connections include two 4in female NPT coupling for installing the water inlet Johnson Safety Screen (or Suction Hose Conversion Kit), two 1-1/2in male cam-lock couplings (one for resin slurry inlet and one for resin slurry outlet), and a center 8in pipe opening for installing the submersible pump assembly.



Figure 2.1.5
UD-48A Vessel with pump and sluice valves installed

2.2 Submersible Pump Assembly:

Tri Nuclear uses a variety of a submersible pumps and motors to provide flow for the Underwater Demineralizer units. All Tri Nuclear pumps are constructed out of stainless steel and have the following common features:

The assemblies include a pump cover, discharge piping, flow sensor tap, and top lifting bail. The pump has its internal check valve welded in the open position to allow for water to drain out of the pump and pump cover when lifting and removing it from the pool.

There is a stainless steel electrical disconnect mounted on the pump cover for the 100ft PSC-100P power cable. This allows for the removal of the power cable for ease of handling and equipment storage. The electrical disconnect on the pump cover is a “Sea Con” type underwater connector.

There is a seal plug (P/N: SC-P) that should be installed on the pump Sea Con connector whenever the power cord is not installed. The seal plug provides sealing of the connector for underwater storage of the pump (without the power cable) and protects the threads of the Sea Con connector when the power cord is not installed.



	PP-40SC	PP-100SC	PP-260SC
<i>For System</i>	UD-30A	UD-36A	UD-48A
<i>Flow Rate</i>	0-200 gpm	0-200 gpm	0-400 gpm
<i>Pump Weight</i>	45 lb.	45 lb.	90 lb.
<i>Horse Power HP</i>	1-1/2 HP	2 HP	5 HP
<i>Voltage / Freq / phase</i>	460V** / 60 Hz / 3Ph		
<i>Overcurrent Trip Set point</i>	3.7 Amps	4.4 Amps	9.9 Amps
<i>Control Box P/N</i>	CB-40-FM	CB-100-FM	CB-260-FM
<i>Discharge Size</i>	2in Male Camlock	2in Male Camlock	3in Male Camlock
<i>Flow Sensor</i>	FM-SRD		
<i>Power Cords</i>	PSC-100P & PC-50		
Additional Pump/Motor Information			
<i>Reference Drawing</i>	TNC-006-02	TNC-007-02	TNC-008-02
<i>Starting Amps</i>	20.1 Amps	24 Amps	54 Amps
<i>Overcurrent Trip Set point</i>	3.4 Amps	4.4 Amps	9.9 Amps
<i>Service Factor</i>	1.30	1.25	1.15
<i>Circuit Breaker Size</i>	10 AMP	10 Amp	20 Amp
<i>Nominal line to line resistance (ohms)</i>	15.9	12.1	5.0

** voltage listed has an acceptable range of +/- 10% (414V – 506V)

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ORIGINAL INSTRUCTIONS (ENGLISH VERSION ONLY)

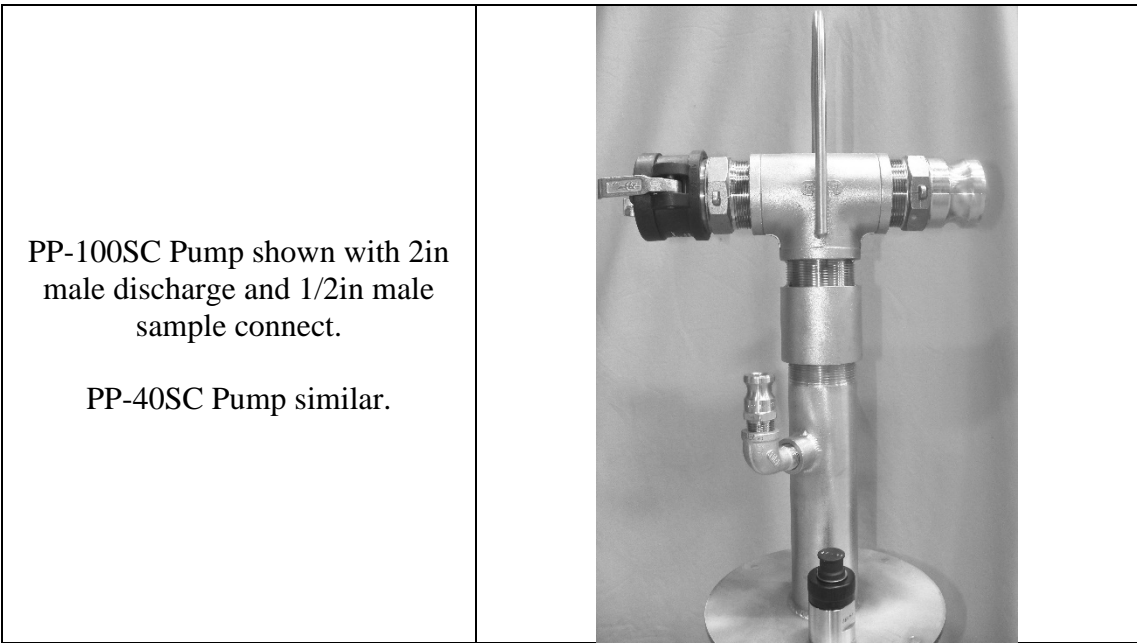


Fig 2.2
PP-100SC Pump - PP-40SC Pump similar.

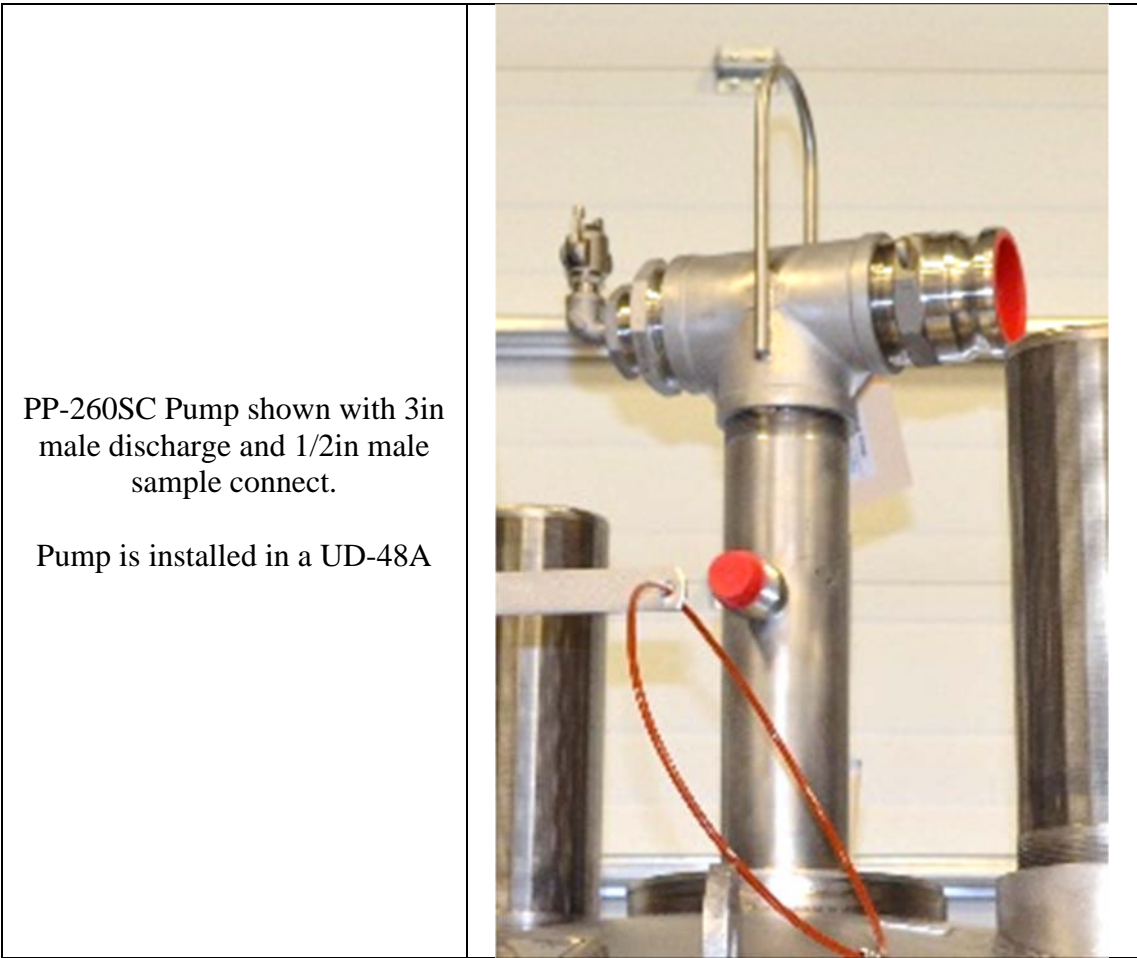


Fig 2.2.1
PP-260SC Pump

2.3 Electrical Control Box (CB-xxx-FM)

All Tri Nuclear CB-xxx-FM control boxes are UL-508 certified.

The CB-xxx-FM is an IP66 / NEMA 4X type fiberglass (14x16) that has two 460V/3Ph/60Hz motor contactors/starters, a manual motor controller with short circuit protection and an adjustable over current trip. The control box has a “phase rotation switch” with safety cover, start/stop pushbuttons and a green “run” indicating light on the front of the panel. The control box includes an integral digital flow meter and Amphenol connection for the flow sensor connection on the front cover.

The phase reversing feature in this control box allows the operator to change the phase rotation of the pump **WITHOUT** having to open the control box and swap two of the three motor leads. This is accomplished by a switch on the front of the control box and two motor contactors/starters inside the control box. These two motor contactors/starters are wired such that when the “phase rotation switch” is in the “A” position the pump motor rotates one direction, and when the “phase rotation switch” is in the “B” position the pump motor rotates in the opposite direction. If the “phase rotation switch” is in the center “O” position, neither motor starter will be energized and the pump will not start.

There is an electrical inlet to connect the “line in” power through the PC-50 drop cable to the control box. There is a twist lock plug to connect the PSC-100P pump power cable to the control box. These connections allow the operator to easily install and remove the cables without the need for special tools.

The primary (460V) side of the transformer is protected by two 1.4 amp fuses and the secondary (120V) side of the transformer is protected by a 1 amp fuse. Fuse details are listed below in the table on the following page.

The digital flow meter is installed to provide a gross indication of system flow. System flow rate is a gauge for determining change in pressure drop through the filters. Under normal operations a filter would be changed out when system flow rate drops to ~50% of clean filter value.

The digital flow meter uses the frequency of the flow sensor signal for indication of system flow.

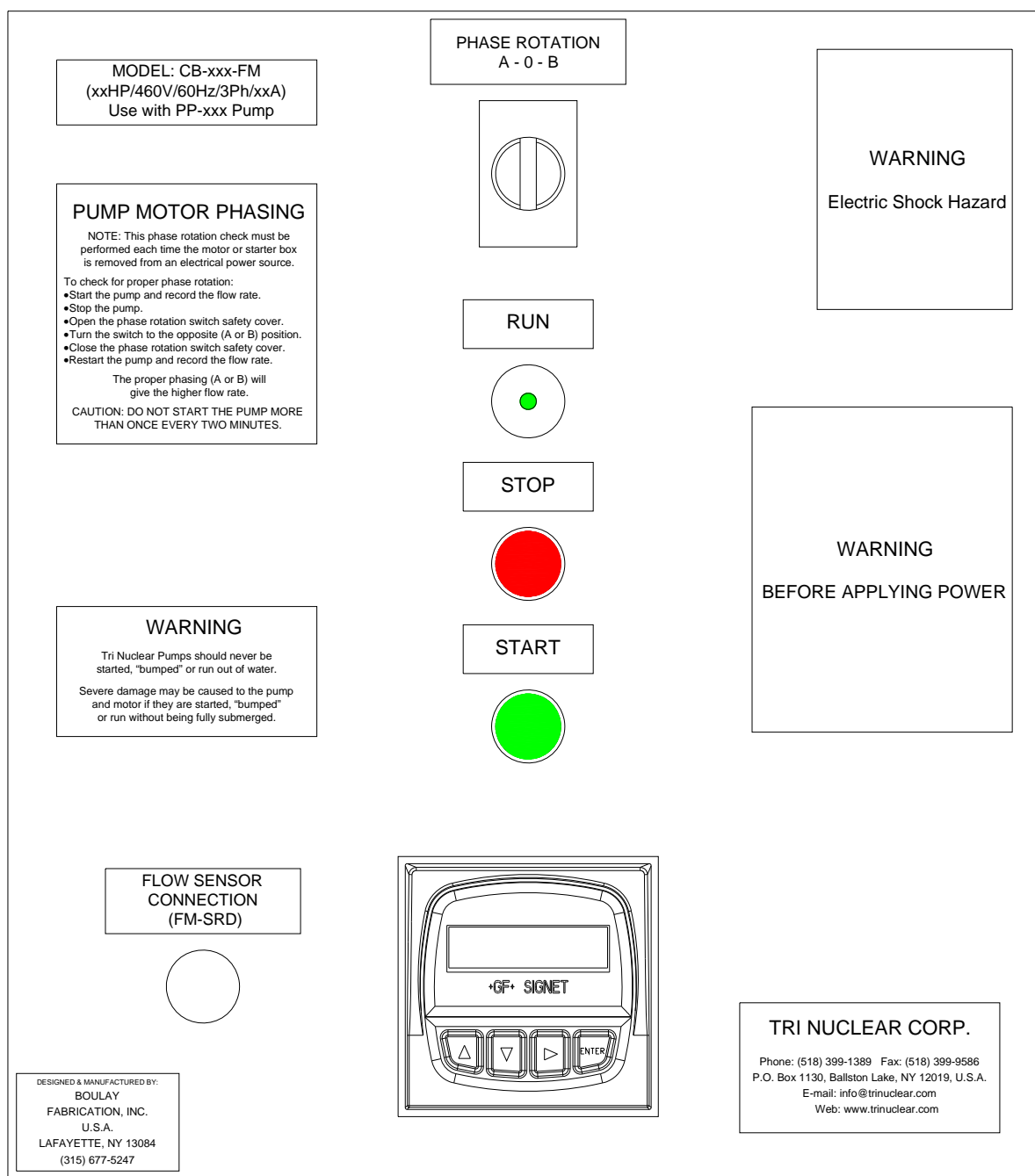
The digital flow meter is powered by a 120V/24DC transformer inside the control box and the flow sensor connects to the meter through an Amphenol connection on the front of the control box.




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Control Box Ratings / Data			
	CB-40-FM	CB-100-FM	CB-260-FM
<i>For System</i>	UD-30A	UD-36A	UD-48A
<i>Horse Power HP</i>	1-1/2 HP	2 HP	5 HP
<i>Overcurrent Trip Set point</i>	3.7 Amps	4.4 Amps	9.9 Amps
<i>Flow Meter Range</i>	0-200 gpm	0-200 gpm	0-400 gpm
<i>Voltage / Freq / phase</i>	460V** / 60 Hz / 3Ph		
<i>Primary Fuse Type / rating / P/N & QTY</i>	Ferraz Shawmut, Amp-trap 2000® ATDR class CC fuse, 1.4 amp Replacement P/N: ATDR1-4/10 QTY: 2ea installed, 1ea spare		
<i>Secondary Fuse Type / rating / P/N & QTY</i>	Littelfuse 3AG Fast-Acting Fuse, 1 Amp Replacement P/N: 312001P QTY: 1ea installed , 1 ea spare		
<i>Flow Sensor</i>	FM-SRD		
<i>Power Cords</i>	PSC-100P & PC-50		
<i>Reference Drawing</i>	TNC-018-12		

** voltage listed has an acceptable range of +/- 10% (414V – 506V)

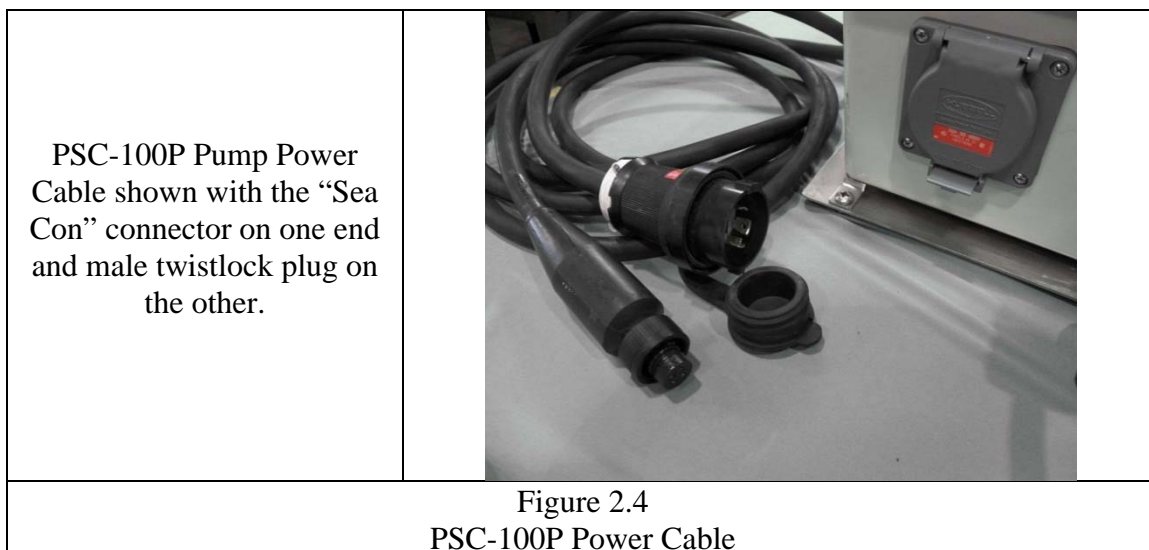
Typical layout of the CB-xxx-FM control box:



<p>CB-260-FM shown Other models similar.</p> <p>The phase rotation switch has a safety cover to prevent inadvertent actuation.</p> <p>FM-SRD installed.</p> <p>Flow meter indicating 272 gpm. Note the digital “dial” and backlight screen for easy viewing.</p>	
<p>Inside view of a typical CB-xxx-FM control box showing the two motor starters, short circuit / over current trip, 460/120V transformer, 120V/24VDC transformer, fuse blocks and the line in/out twist lock plug terminals.</p>	
<p>Twist lock plugs are located on the bottom of the control box.</p> <p>The plug to the right (with the male twist lock connections) is the line in / power in plug.</p> <p>The plug to the left (with the female twist lock connections) is the power out to the pump.</p>	
<p>Figure 2.3 CB-260-FM Control Box, others similar</p>	

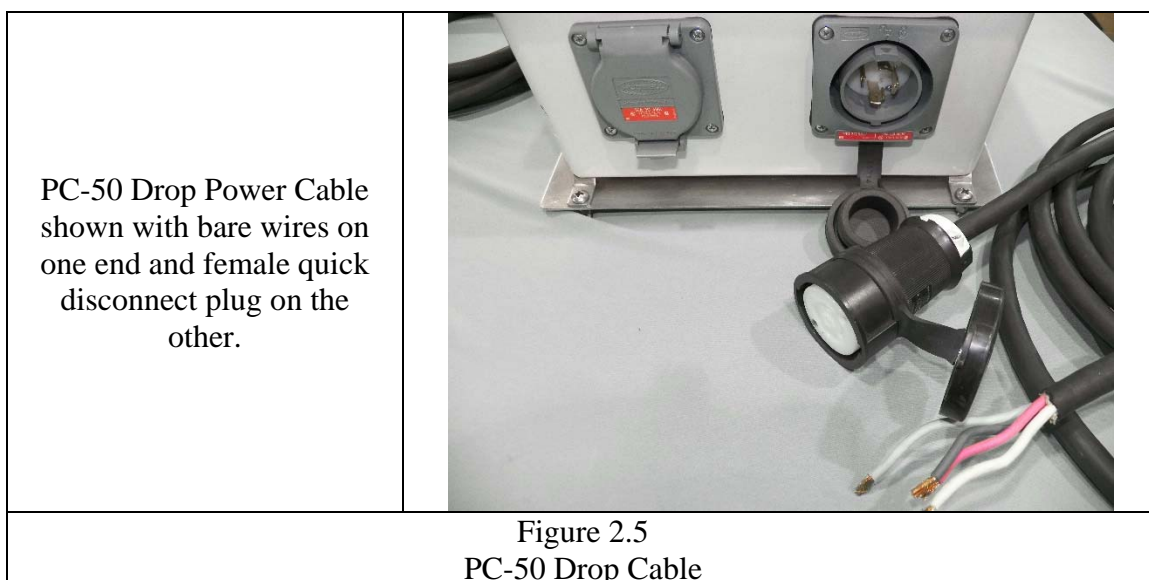
2.4 Pump Power Cable (P/N: PSC-100P):

The PSC-100P Pump Power cable is a 100ft 10/4 SO cable with a male Nema 4x Twist Lock plug x Sea Con Connector. This Pump Power cable is to supply power to the pump from the Phase Reversing Control Box.



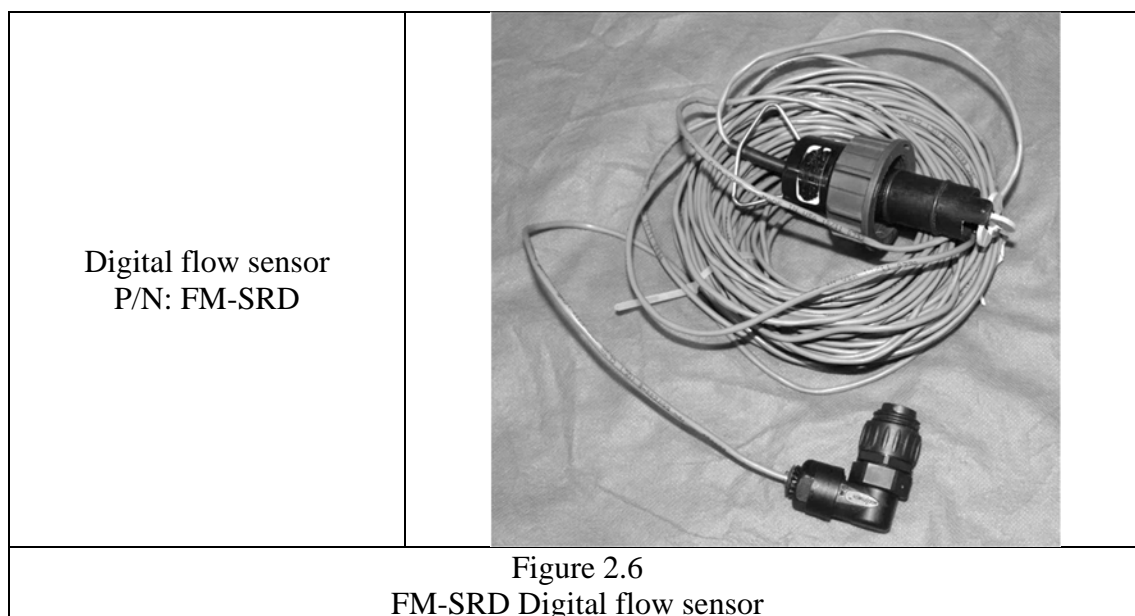
2.5 Drop Cable (P/N: PC-50):

The PC-50 Control Box Drop Cable is a 50ft 10/4 SO cable with a female twist lock plug x bare wire. This drop cable is to supply the control box from the in plant power source / motor control center / welding outlets etc.



2.6 Digital Flow Sensor (P/N: FM-SRD):

The digital flow sensor is a paddlewheel type flow sensor. The paddlewheel has a reinforced sleeve that covers the titanium shaft and is designed to minimize wear of the rotor. When water flows past the paddlewheel and it rotates, the flow sensor produces a sinusoidal waveform with frequency and amplitude directly proportional to the flow rate. The sensor comes equipped with 100ft [30.5m] of instrument cable with a 90 deg. Amphenol connector to connect to the CB-xxx-FM control box front.



2.7 Hoses

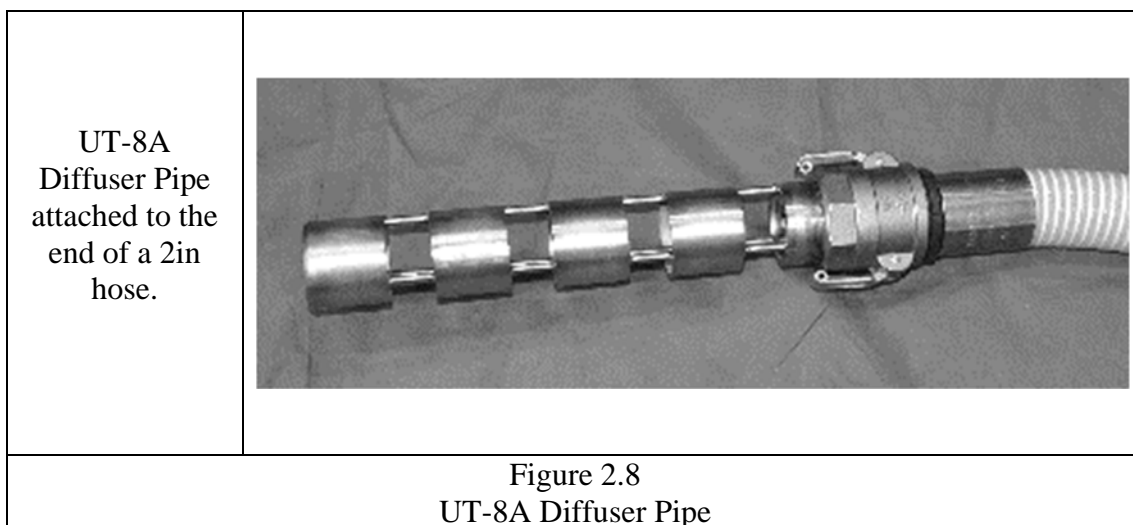
Each Demineralizer comes with two sets of hoses. Which hoses are used depends on the “mode of operation” chosen by the end user for use. Modes of operation are shown on page 3 of the brochure drawings for the UD’s and described in section 5.0 of this OI. The table below shows which hoses are used in which mode of operation.

Pump / vessel version	“Typical” Discharge hose operations	“Optional” Suction hose operations
PP-40SC Pump	(1) PH-2x25 hose w/ UT-8A installed	none
UD-30A Vessel	None	(1) PH-2x50 hose with (1) SHCK-JS-2x6 installed
PP-100SC Pump	(1) PH-2x25 hose w/ UT-8A installed	none
UD-36A Vessel	None	(2) PH-2x50 hoses with (2) SHCK-JS-2x6 installed
PP-260SC Pump	(1) PH-3x25 hose w/ UT-8 installed	none
UD-48A Vessel	None	(2) PH-3x50 hose with (2) SHCK-JS-4x12 installed

2.8 DIFFUSER PIPE (P/N: UT-8A)

This pipe assembly (2-3/8" diameter x 14" lg) has an internal 3/4" orifice and it is connected to the 2" **discharge** hose from the PP-40SC pump on the UD-30A or the PP-100SC pump on the UD-36A.

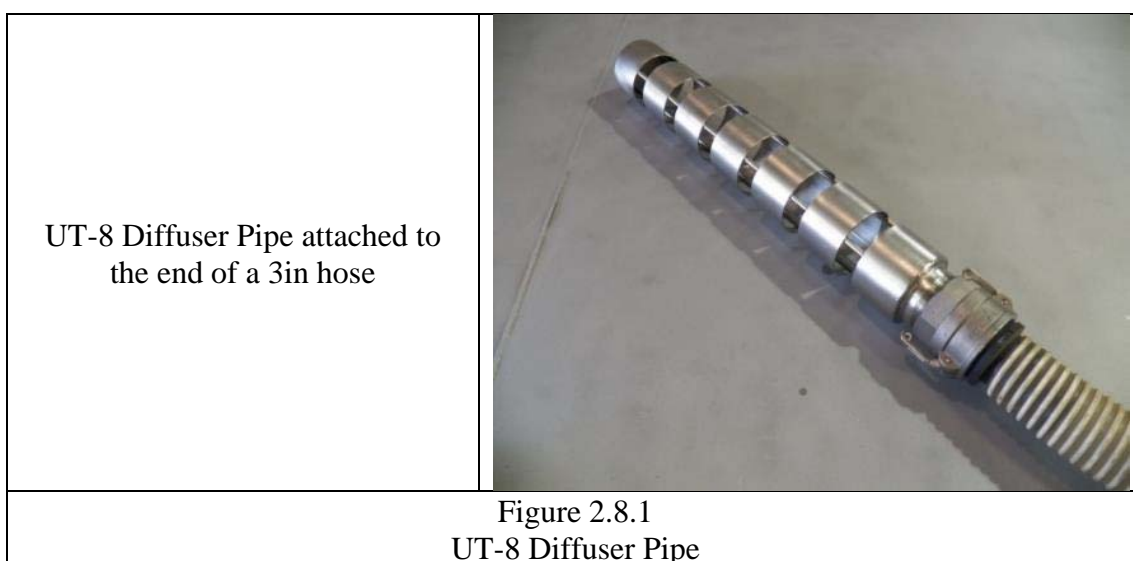
The diffuser is used to minimize the high discharge water velocity preventing hose-end whipping and surface water agitation.



2.8.1 Diffuser Pipe (P/N: UT-8)

The diffuser pipe assembly (4.5in diameter x 32in lg) is connected to the 3in **discharge** hose connected to the PP-260SC pump when it is installed in the UD-48A Underwater Demineralizer.

The diffuser is used to minimize the high discharge water velocity preventing hose-end whipping and surface water agitation.

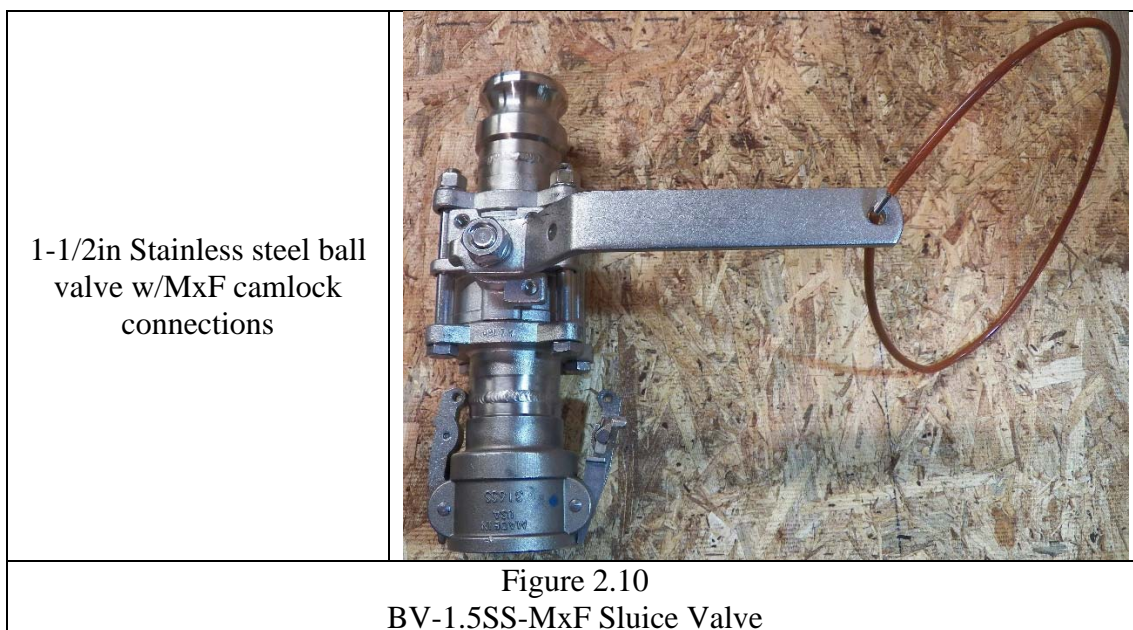


2.9 Sluice Hoses (P/N: FPS-1.5x50)

Each UD comes equipped with two 1-1/2in x 50ft sluice hoses with stainless steel male x female camlock couplers. These hoses are rated for 150 PSI and are hydro tested prior to shipment from the factory.

2.10 Sluice Valves (P/N: BV-1.5SS-MxF)

Each UD comes with (2) removable 1-1/2 Male by locking female camlock, with full port stainless steel ball valves. The handle on the ball valve has a lanyard loop attached for opening the valve with a grapple tool. The purpose of the ball valves is to provide positive isolation to the UD vessel when the sluice hoses are attached. This positive isolation prevents a resin excursion from the vessel in the event a hose is damaged during operations.



2.11 Suction Hose Conversion Kit

Each UD come equipped with a suction hose conversion kit (SHCK). The purpose of the SHCK is to allow the attachment of a 50ft long suction hose to the inlet of the demineralizer. This allows the demineralizer to take a suction away from the demineralizer vessel itself. This is done to capture the source of the activity which is typically near or in the reactor vessel itself.

2.11.1 UD-30A Suction Hose Conversion Kit (P/N: SHCK-UD-30A) See Drawing TNC-011-02

The SHCK-UD-30A comes with the following components:

- (1ea) SHCK-SSVA-2x2 Safety Screen Vent Assembly
- (1ea) PH-2x50 suction hose
- (1ea) SHCK-JS-2x6 Johnson Screen strainer

2.11.2 UD-36A Suction Hose Conversion Kit (P/N: SHCK-UD-36A) See Drawing TNC-012-02

The SHCK-UD-36A comes with the following components:

(2ea) SHCK-SSVA-2x2 Safety Screen Vent Assembly

(2ea) PH-2x50 suction hose

(2ea) SHCK-JS-2x6 Johnson Screen strainer

2.11.3 Deleted.

2.11.4 UD-48A Suction Hose Conversion Kit (P/N: SHCK-UD-48A) See Drawing TNC-013-02

The SHCK-UD-48A comes with the following components:

(2ea) SHCK-SSVA-3x4 Safety Screen Vent Assembly

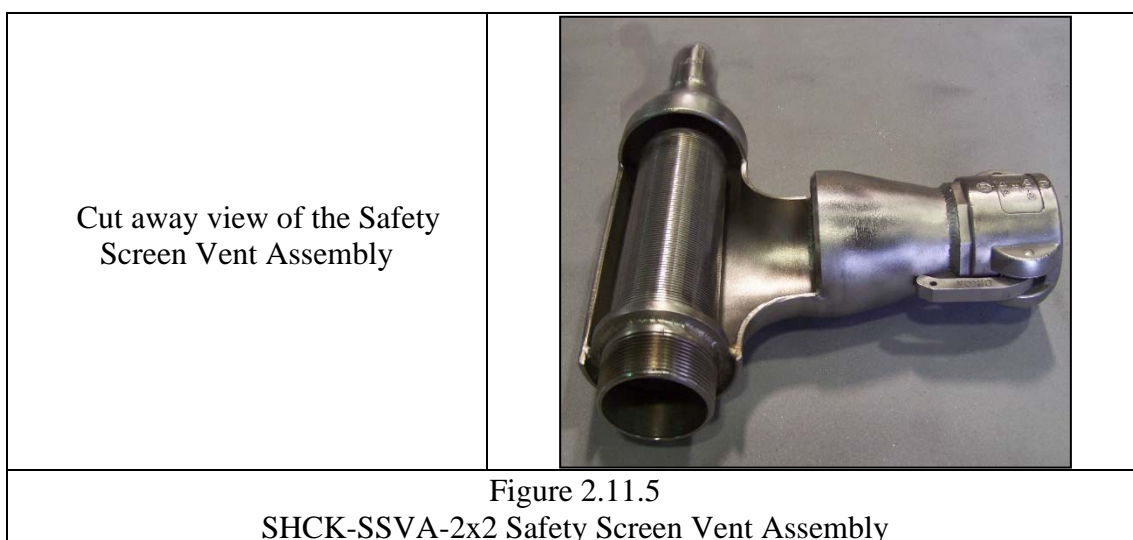
(2ea) PH-3x50 suction hose

(2ea) SHCK-JS-4x12 Johnson Screen strainer

2.11.5 Safety Screen Vent Assembly (P/N: SHCK-SSVA-2x2)

The Safety Screen Vent Assembly (P/N: SHCK-SSVA-2x2) threads into the inlet coupling on the top of the UD-30A or UD-36A in place of the standard inlet safety screen. The SHCK-SSVA-2x2 has a 2in female camlock hose connection and a vent that will allow any gases that come out of solution in the UD vessel to be vented to the pool.

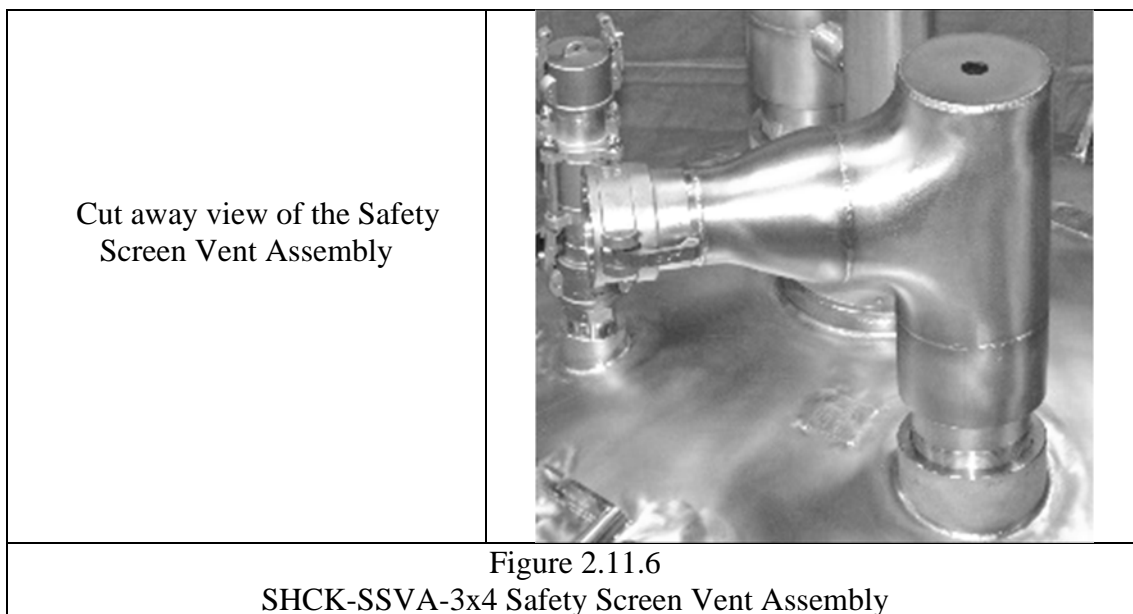
The SHCK-SSVA-2x2 has an integral 2in .015" Johnson Screen safety screen to prevent resin migration to the pool/cavity from the top of the resin bed.



2.11.6 Safety Screen Vent Assembly (P/N: SHCK-SSVA-3x4)

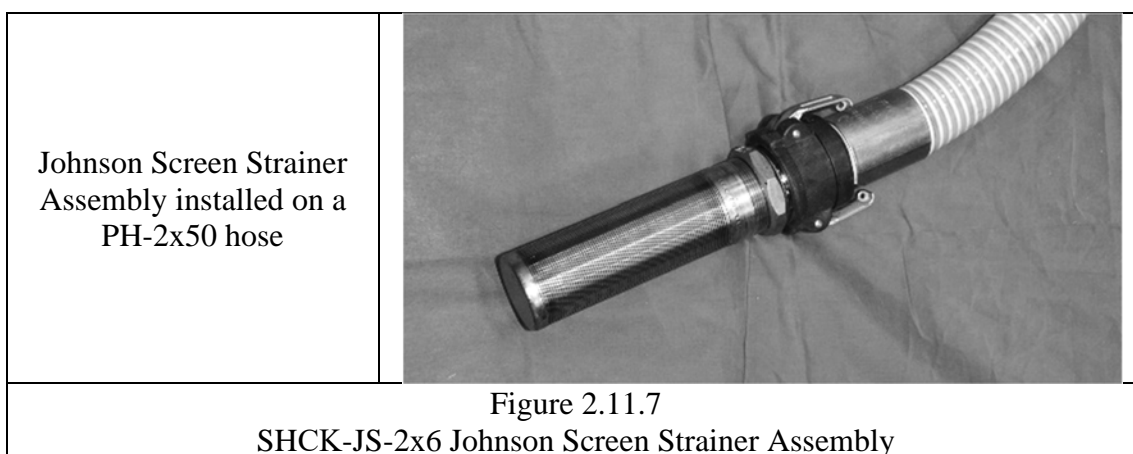
The Safety Screen Vent Assembly (P/N: SHCK-SSVA-3x4) threads into the inlet coupling on the top of the or UD-48A in place of the standard inlet safety screen. The SHCK-SSVA-3x4 has a 3in female camlock hose connection and a vent that will allow any gases that come out of solution in the UD vessel to be vented to the pool.

The SHCK-SSVA-3x4 has an integral 4in .015" Johnson Screen safety screen to prevent resin migration to the pool/cavity from the top of the resin bed.



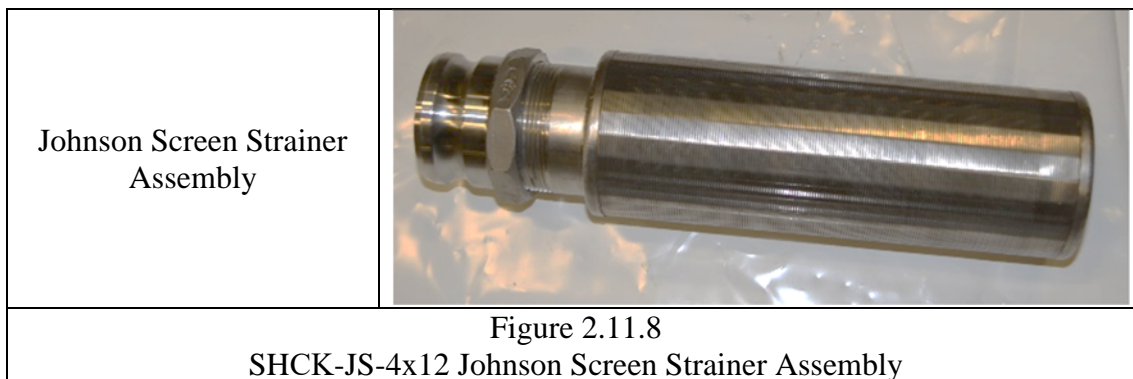
2.11.7 Johnson Screen Strainer Assembly (P/N: SHCK-JS-2x6)

The Johnson Screen Strainer Assembly is a 2in .015" Johnson with a male camlock connection. It is designed for two purposes. The first is to prevent the suction hose from dead heading on the pool/cavity floor or wall. The second is to prevent any large particles (>.015") items from entering the hose and fouling the Safety Screen Vent Assembly.



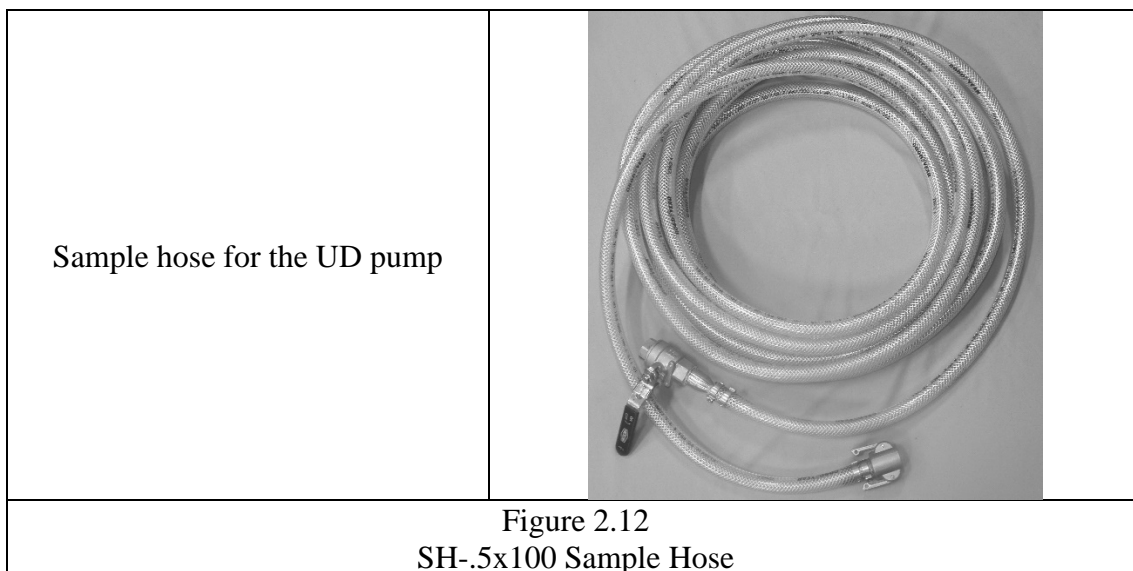
2.11.8 Johnson Screen Strainer Assembly (P/N: SHCK-JS-4x12)

The Johnson Screen Strainer Assembly is a 4in .015in Johnson with a 3in male camlock connection and connects to a 3in suction hose. It is designed for two purposes. The first is to prevent the suction hose from dead heading on the pool/cavity floor or wall. The second is to prevent any large particles (>.015in) items from entering the hose and fouling the Safety Screen Vent Assembly.



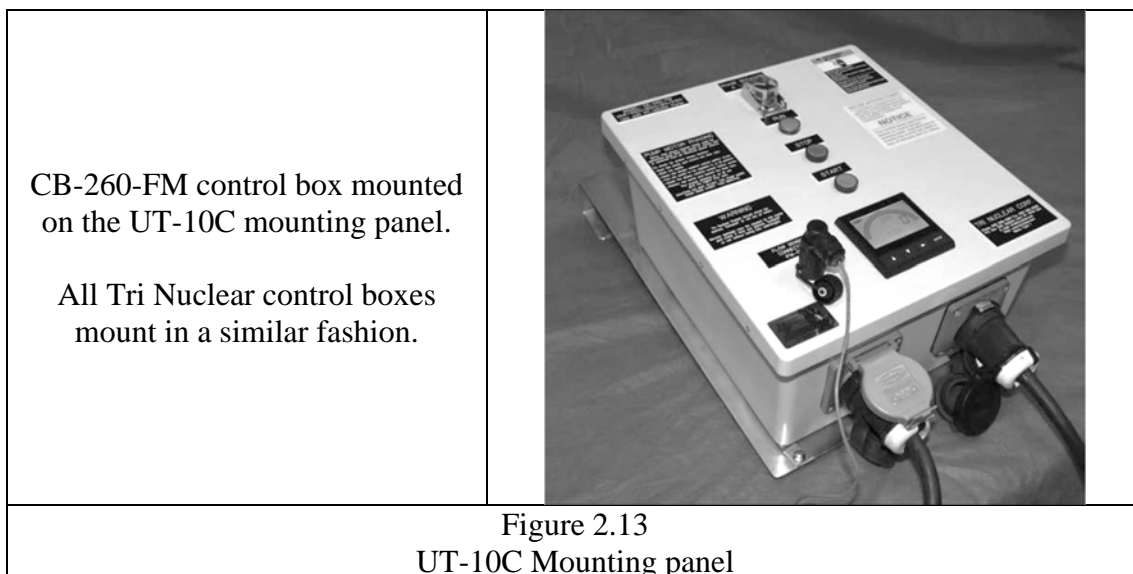
2.12 Sample Hose (P/N: SH-.5x100)

The sample hose is a 1/2in x 100ft long hose (P/N: SH-.5x100) with a stainless steel female camlock coupler and a 1/2in SS ball valve. The hose is connected to the male camlock sample port on the pump. When it is desired to take an effluent sample from the operating vessel, the valve is opened and a sample can be drawn.



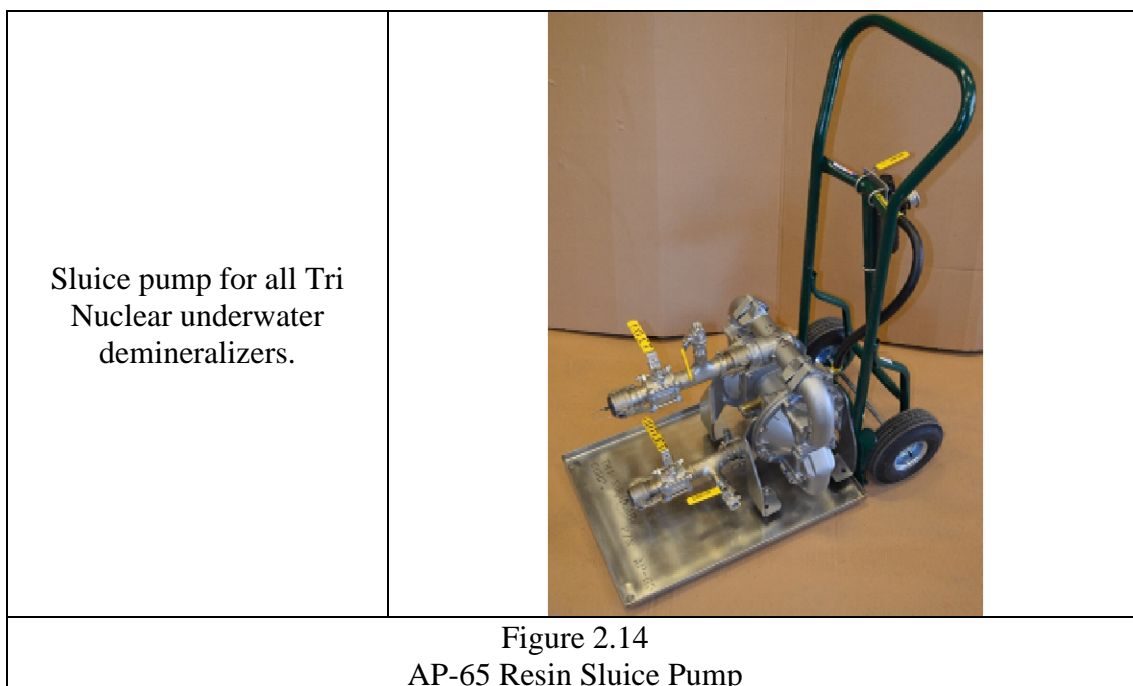
2.13 Mounting Panel (P/N: UT-10C)

The UT-10C mounting panel allows the control box to be mounted securely to a panel that is designed to hang from a typical hand rail.



2.14 Resin Sluice Pump (P/N: AP-65) - OPTIONAL EQUIPMENT

The Resin sluice pump is a 2in AL Sandpiper™ flap valve pump with 1-1/2in SS ball valves, inlet/outlet female camlock couplers & 3/4in water flush valve mounted on a dolly with pneumatic tires. (P/N: AP-65). See drawing TNC-087-02 and OI-TNC-088, General Resin Sluicing Procedure for information on its use.



3.0 Equipment as Shipped

This is a general description of how the equipment is typically shipped. Actual shipments may differ depending on customer shipping requirements.

Vessel - shipped on a pallet.

Pump, control box, flow sensor, and power cables – shipped in a pump crate.

Hoses and other items – shipped on a pallet.

RECEIPT INSPECTION - Carefully inspect the main unit and pump for any shipping damage. Using the Packing List or EGL (Equipment Guide List), verify all material ordered has been received.

4.0 Assembly and Installation in Pool

4.1 Pre Start Up

4.1.1 Mount the CB-xxx-FM control box to the UT-10C mounting panel

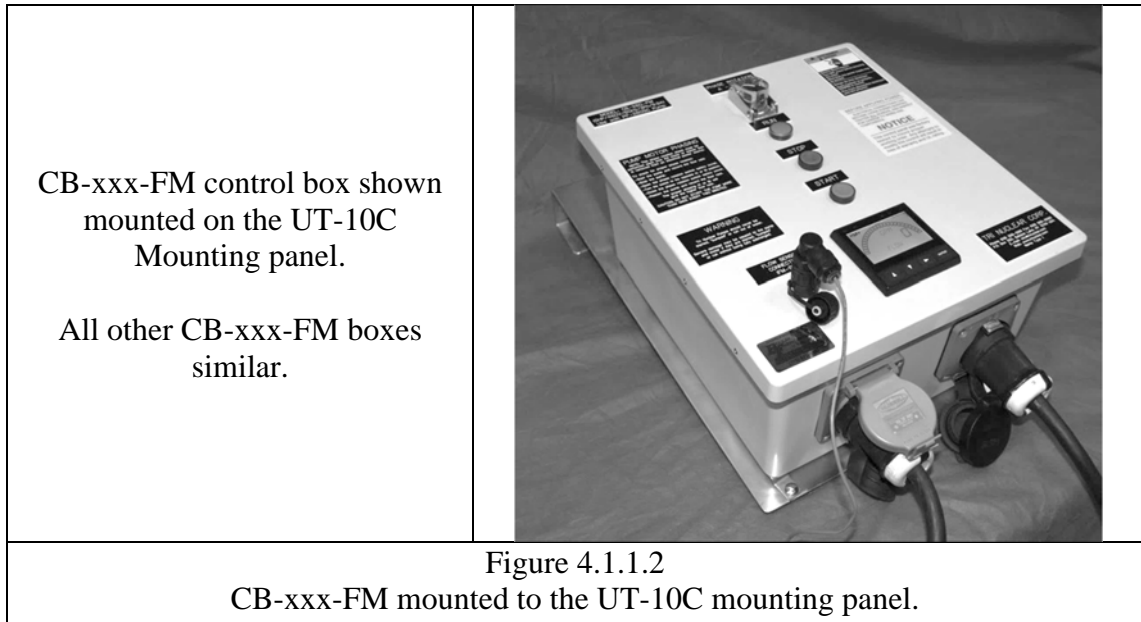
4.1.1.1 Remove the control box from its cardboard box. Locate the mounting feet in a bag inside the control box. The bag is taped to the bottom and/or side of the control box with a tag marked “Do Not Discard”.

Install the four (4) mounting feet to the back of the control box with a flat head screwdriver.



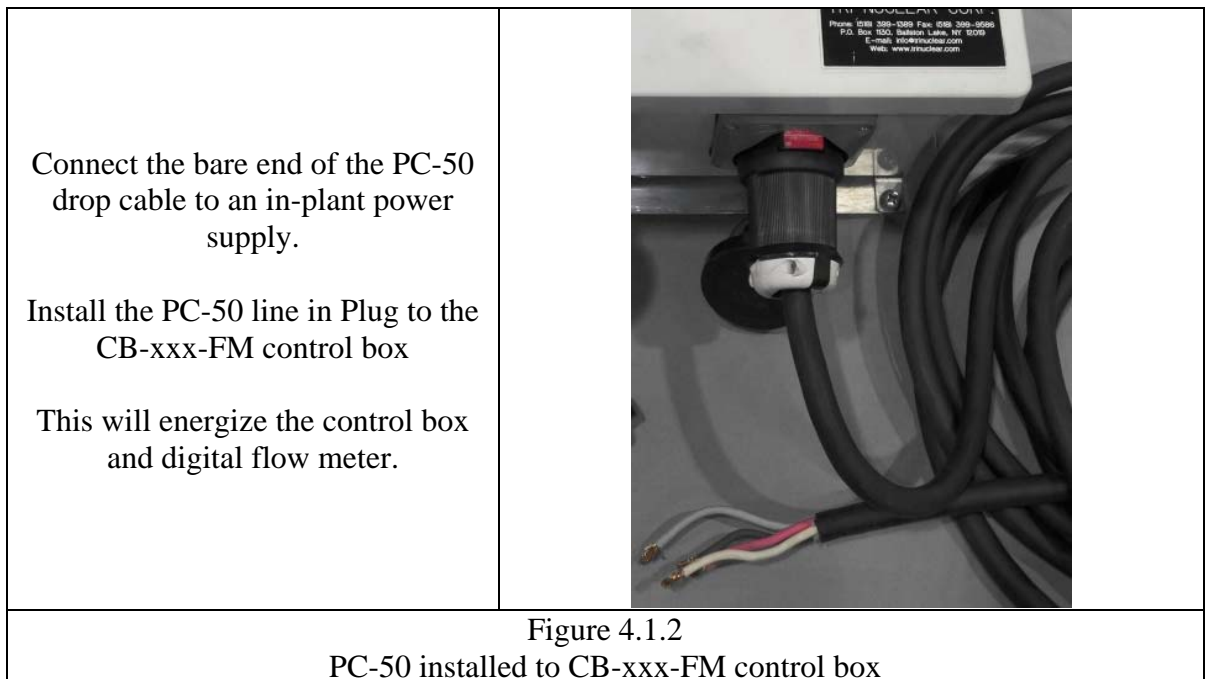
Figure 4.1.1.1
Mounting feet installed on the back of the CB-600-FM control box
All other CB-xxx-FM control boxes similar.

4.1.1.2 Using a #3 Phillips Screwdriver and a 1/2in open or box end wrench, mount the CB-xxx-FM control box using the four (4) mounting screws, lock washers & nuts (located on the UT-10C mounting panel) assembly on the UT-10C Mounting panel.



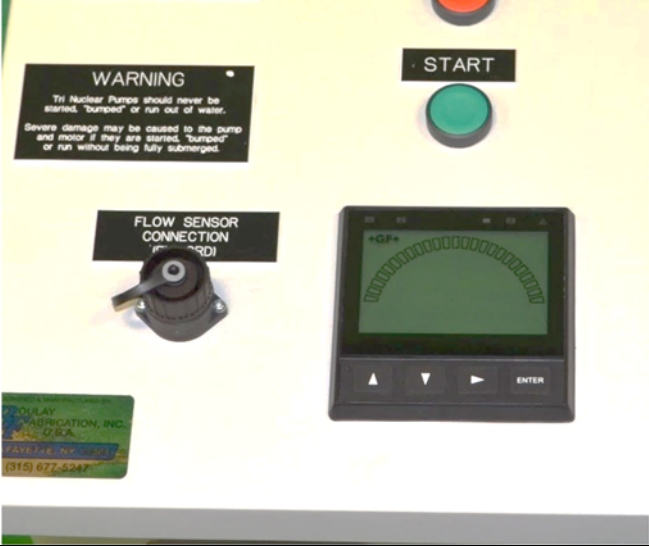

4.1.2 Install line in power to the Control Box

After the CB-xxx-FM control box has been mounted to the UT-10C Mounting Panel, attach the PC-50 Drop Cable as shown below:



4.1.3 Install the Digital Flow Sensor cable to the control box

After the CB-xxx-FM control box has been mounted to the UT-10C mounting panel, attach the FM-SRD cable to the control box:

<p>Remove the dust cover for the FM-SRD connection on the front of the CB-xxx-FM control box.</p>	
<p>Install the FM-SRD to the connection on the front of the CB-xxx-FM control box.</p>	
<p>Figure 4.1.3 FM-SRD installed in CB-xxx-FM Control Box</p>	

4.1.4 Energize the control box

4.1.4.1 Energize the control box by supplying power to the PC-50 power cable.

4.1.5 Digital Flow Sensor installation in the pump.

NOTICE	Perform a flow meter check: <ul style="list-style-type: none">- Prior to initial installation- When sensor is replaced- Sensor is suspected to be damaged
---------------	--

4.1.5.1 Prior to installing the flow sensor in the pump, perform a flow meter check by flipping the paddle wheel with a finger to check for dial read-out response. You should be able to achieve 1/2 to full scale deflection by spinning the paddlewheel in either direction.

This is to ensure the flow sensor and digital meter work prior to installing the pump in the water.




4.1.5.2 Verify the two O-rings are installed on shaft of the Flow Sensor. The flow sensor may not operate properly without the O-rings installed.

4.1.5.3 Prior to installing the flow sensor in the pump, lubricate the O-rings with DI water or other approved lubricant

4.1.5.4 Install the probe into the flow sensor tap making sure the slots in the fitting mate properly with the flow meter sensor orientation pins. The paddle wheel will then be perpendicular to the direction of flow.




4.1.6 Pump Power Cable

<p style="text-align: center;">CAUTION</p> 	<ul style="list-style-type: none"> • When installing the power cord to the pump, ensure the keyway male end on the PSC-100P cable is aligned with the female keyway on the SC connector on the pump. • Ensure the PSC-100P plug is sufficiently lubricated with a non-conductive electrical lubricant (Dow Corning #4). • Do no excessive downforce or side-to-side action to try and “make it fit” as you may damage the plug. • Install the power cord to pump pigtail HAND TIGHT ONLY. Do NOT use any tools (pliers, channel locks etc.) to tighten the connection. <hr/> <ul style="list-style-type: none"> • When removing the power cord, be sure that the plug is fully unthreaded and pull in a vertical direction only. • Do not use side-to-side action to try and “loosen it up” as you may damage the plug.
---	--

When installing and removing the power cord, do not move the power cable connector with side to side motion in an attempt to install or remove it.

- If difficulty is encountered during installation ensure the keyway is oriented properly and that the male end of the PSC-100P power cord is properly lubricated with a non-conductive electrical lubricant (Dow Corning #4).
- If difficulty is encountered during removal ensure the power cable has been unthreaded fully and pull in the vertical direction **ONLY** to remove the power cable from the pump.

<p>Remove the Sea Con seal plug (P/N: SC-P) from the pump power connector. This plug should be installed whenever the power cable is removed for proper protection</p> <p>The plug provides a waterproof seal; therefore, the pump assembly can be stored underwater with the seal plug installed.</p>	
<p style="text-align: center;">Figure 4.1.6 Sea Con seal plug removal from PP-xxx-SC pump</p>	

Place a thin coat of non-conductive lubricant (Dow Corning #4) on the outside surface of the female SeaCon connector found at one end of PSC-100P cable.



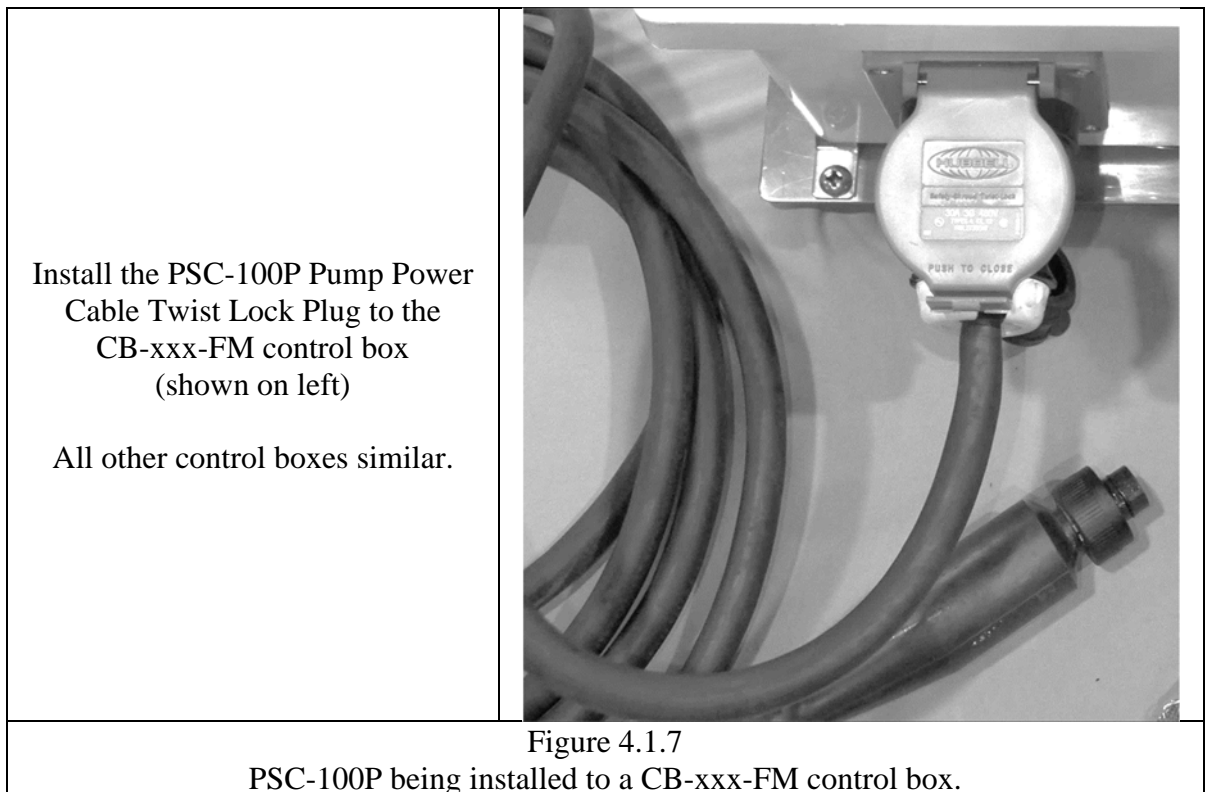
PSC-100P shown being installed on a PP-260SC pump. All other pump similar



Figure 4.1.6.1
PSC-100P being installed on a PP-xxx-SC pump

4.1.7 Install Pump Power Cables to the Control Box

Attach the PSC-100P power cord to the CB-xxx-FM control box as shown below:



4.1.8 Zip-Tie Cables Together





Lay-out the 100 ft. of pump power cable and flow meter cable in a straight line. Tie the two cables together with "zip-ties" every 2 feet starting at the pump end. Approx. 50 zip-ties are in a small plastic bag in the flow meter box. These "zip-ties" are black in color and are made out of polypropylene. They will float if accidentally dropped in the water.



4.2 Installing the demineralizer in the water.

Using customer supplied resin, fill the vessel with the proper amount of resin listed in table 2.1 per OI-TNC-088, General Resin Sluicing Procedure for Tri Nuclear Underwater Demineralizers.

The rest of this procedure assumes the vessel is already filled with resin.

	Do not submerge the control box for any reason.
	Do NOT use the electrical cables to lift the pump out of the water.
	Do not operate the Tri Nuclear Underwater Demineralizer with a stratified media bed (carbon & resin) or a carbon only bed. Resin selection is the responsibility of the customer.
	Do not overfill the Underwater Demineralizer with resin. See Table 2.1 for maximum resin capacities for the UD's.
	Do not install more than 50ft of suction hose to the suction port on the UD system. This will ensure there is adequate flow to the demineralizer.
	Running the unit without hoses will not produce desired results in pool demineralization or water clarity.

Determine which “MODE” of operation will be used: “TYPICAL” or “OPTIONAL”.

The brochure drawings for the UD's show a schematic view of the different UD systems, including the difference between “TYPICAL” operations (suction via the inlet screens on the top of the vessel) and the “OPTIONAL” setup using suction hoses (suction via the 2in or 3in suction hoses).

Determine which “MODE” of operation will be used, “TYPICAL” or “OPTIONAL”

Regardless of the mode of operation, the sluice valves and sluice hoses are installed on the vessel. This allows the operators to sluice resin out of the vessel without having to raise the vessel to the surface to install hoses after the UD has been used. Installing the sluice valves and hoses after the UD has been used increases dose to the workers installing them.

4.2.1 TYPICAL operations:

Verify that the two Johnson screen assemblies on the water inlet connections are installed. These assemblies act as safety screens preventing resin from migrating from the vessel during resin fill operations.

Install the discharge hose to the discharge of the pump.



Figure 4.2.1
UD-36A Vessel setup for typical operations

UT-8 Diffuser Pipe attached to
the end of a 3in hose

UT-8A similar



Figure 4.2.1.1
UT-8 Diffuser Pipe

4.2.2 OPTIONAL operations:

Remove the Johnson screen assemblies (if installed) from the water inlet connection.

Install the SHCK-SSVA-3x4 (or -2x2) Safety Screen Vent Assembly on the water inlet connection.

Install a suction hose to the SHCK-SSVA-3x4 (or -2x2) Safety Screen Vent Assembly.

Install the SHCK-JS-2x6 to the end of the PH-2x50 hose or the SHCK-JS-4x12 to the end of the PH-3x50 hose as applicable.



Figure 4.2.2
UD-48A Vessel setup for optional operations
(note the PH-3x50 suction hose is NOT installed in this photograph)

SHCK-JS-2x6 Johnson Screen
Strainer Assembly installed on
a PH-2x50 hose

SHCK-JS-4x12 similar



Figure 4.2.2.1
SHCK-JS-2x6 Johnson Screen Strainer Assembly

4.2.3 Sluice valves

Remove the stainless steel camlock caps from the 1-1/2in resin inlet & outlet male camlock connections and install the 1-1/2in SS ball valve assembly (BV-1.5SS-MxF) to each connection.

Verify the valves are shut. Install the Resin Sluice hose (FPS-1.5x50) to the valve and place the SS camlock cap on the end of the hose.

It is highly recommended that the end of the hoses are labeled "Resin in" / "Resin out" for future sluicing operations.

BV-1.5SS-MxF installed on a UD-48A.

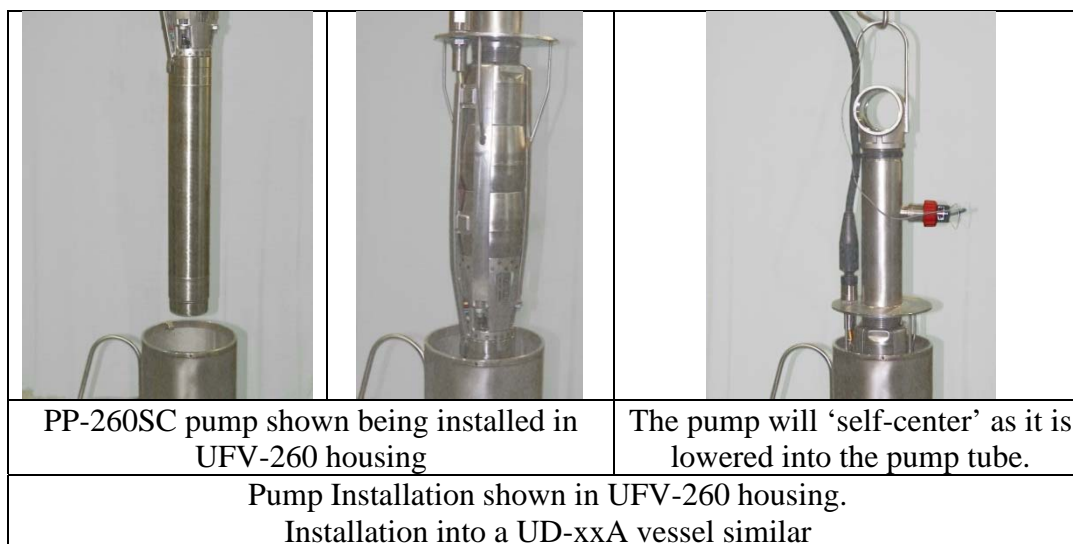
All other UD's similar



Figure 4.2.3
BV-1.5SS-MxF Sluice Valve

4.3 Install the pump in the UD-xxA vessel

Lower the PP-xxxSC pump into the pump tube of the UD-xxA vessel.



Note: The pump may be installed in the housing AFTER the demineralizer vessel has been lowered into the pool

4.4 Submerge vessel in the pool

- 4.4.1 Before installing the vessel into the pool, fill it from an approved water source through the resin inlet hose. The vessel will be full when water starts to overflow out of the top of the pump tube or through the inlet SHCK-SSVA-2x2 or -3x4 safety screen vent assembly.
- 4.4.2 Using customer supplied rigging, lift the vessel using caution to guide the vessel hoses to prevent them from fouling the rigging equipment or be trapped underneath the vessel. If the pump is installed and lowered with the vessel, ensure the power cable, flow sensor cable and pump discharge hose do not foul the rigging lines or become trapped underneath the vessel.
- 4.4.3 After the vessel is in place remove caps from the FPS-1.5x50 hoses and submerge the open end momentarily to fill them with water and reinstall the caps.

4.5 Phase Rotation Check.

A Phase Rotation Check is necessary because a 3 phase AC motor can run both backwards & forwards, but the centrifugal pump end is designed to pump efficiently in one direction only.

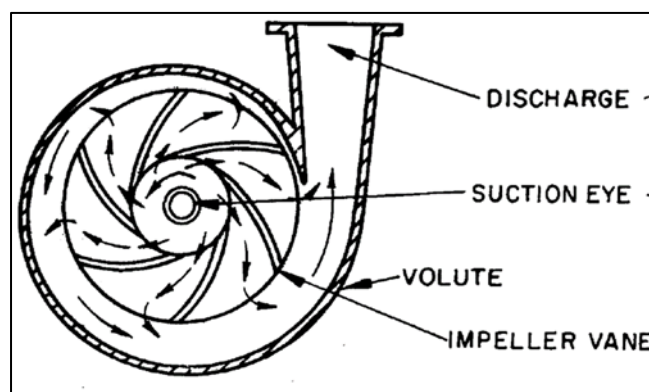
Perform a Phase Rotation Check whenever a pump is disconnected from its electrical power source!

System	Typical flow Rate phased CORRECTLY	Typical flow Rate phased BACKWARDS
UD-30A	40 GPM	16 GPM
UD-36A	75 GPM	30 GPM
UD-48A	200 GPM	60 GPM

Note: All Tri Nuclear Pumps are centrifugal pumps.

If they are phased backwards the impeller is rotating opposite of what it should.

***IT DOES NOT MEAN THE PUMP
WILL PUMP WATER
BACKWARDS!***



Typical centrifugal pump

CAUTION	Do not start the pump more than once every 2 minutes or 300 starts/day. Damage to the motor winding insulation may occur.
	Fully submerge pump prior to starting the system. Running or “bumping” the pump dry (out of water) will result in damage to the pump.
	Pumps must be installed at least 10 ft. below the water level of the pool to ensure enough NPSH (Net Positive Suction Head) for proper operation of the pump.

- 4.5.1 To check for proper phase rotation of the pump motor, turn on the unit and record the flow rate. Switch the phase of the pump using the phase rotation switch, start the pump and again record the flow rate. The proper phasing will give the higher flow rate.

To change the phase of the pump, stop the pump (if running), open the safety cover, Turn the switch to the Phase A or B position, Close the safety cover, and restart the pump.

- 4.6 When all the steps of section 4.0 are completed, the unit is ready for operation in the spent fuel pool or reactor cavity.

5.0 Operations

Once the steps of section 4.0 have been completed and the pump has been phased properly, the UD is ready for operation.

- 5.1 Start the PP-xxxSC pump. Observe and record the flow on the flow meter for future reference.

System	Normal flow rates
UD-30A	40 - 50 GPM
UD-36A	75 - 100 GPM
UD-48A	200 - 260GPM

If flow is observed to be significantly higher than the upper range, please contact Tri Nuclear with the details of the operations leading up to this high flow rate so we can help troubleshoot the problem.

NOTICE	Very small air bubbles might be observed exiting the pump discharge. This occurs due to the negative pressure in the vessel as air is stripped from the pool water. This observation is normal and should not be of any concern.
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5.2 Effluent Sample

If desired, an effluent sample may be obtained from the sample hose SH-.5x100.

With the pump running, open the sample valve on the end of the 100ft sample hose to flush the hose. After the hose has been flushed, a sample may be obtained.

5.3 Pump Change Out

If it becomes necessary to remove the pump perform the following:

- Turn off the pump.
- Using a pump lift hook lift and remove the pump.
- Install the pump per section 4.1 & 4.3

5.4 Resin Sluice out

When it becomes necessary to sluice the resin out of the vessel, perform the following:

- Turn off the pump.
- Sluice out per OI-TNC-088, General Underwater Demineralizer Sluicing Procedure

6.0 Storage Requirements

CAUTION	<p>Caution should be taken to <u>NOT</u> store any plastic components (eg. filters or hoses) near high radiation fields associated with equipment such as fuel bundles, LPRM's or control blades.</p> <p>Breakdown of such components can occur with accumulated exposures of 10E6 Rad. For this reason, precautions should be taken to minimize accumulative dose for the following components: suction hose, power and instrument cable, flow sensor, and electric motor.</p> <p>All components are chemically suitable for long term storage in the fuel pool cavity environment.</p>
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- 6.1 The preferred method of storing the submersible pump assembly when not in use is underwater. The flow sensor can be removed for storage. The PSC-100P power cable can also be removed for storage, however, the SC-P plug must be installed on the pump cover to protect the electrical connection on the pump.



7.0 Maintenance

There is no required periodic maintenance required for Tri Nuclear UD systems.

8.0 Troubleshooting

Effective troubleshooting requires that problem locations be systematically eliminated until the problem is found.

See OI-5, General Troubleshooting Procedure for all Tri Nuclear Underwater Systems, for trouble shooting guidelines with the UD's.

9.0 Replacement Parts

Below is a listing of **Recommended Spare Parts** for each system:

TNC Part Number	Description	UD-30A	UD-36A	UD-48A
PP-40SC	Grundfos pump, 1-1/2 HP/460V/3Ph/60 Hz, w/cover, SC connector. Includes CB-100-FM phase reversing control box with twist lock plugs and integral 0-200 gpm digital flow meter, FM-SRD digital flow sensor, PSC-100P power cable with twist lock plug and PC-50 drop cable with twist lock plug.	1		
CB-40-FM	1-1/2 HP/460V/3Ph/60 Hz phase reversing control box with twist lock plugs and integral 0-200 gpm digital flow meter. Includes FM-SRD digital flow sensor.	1		
PP-100SC	Grundfos pump, 2 HP/460V/3Ph/60 Hz, w/cover, SC connector. Includes CB-100-FM phase reversing control box with twist lock plugs and integral 0-200 gpm digital flow meter, FM-SRD digital flow sensor, PSC-100P power cable with twist lock plug and PC-50 drop cable with twist lock plug.		1	
CB-100-FM	2 HP/460V/3Ph/60 Hz phase reversing control box with twist lock plugs and integral 0-200 gpm digital flow meter. Includes FM-SRD digital flow sensor.		1	
PP-260SC	Grundfos pump, 5 HP/460V/3Ph/60 Hz, w/cover, SC connector. Includes CB-260-FM phase reversing control box with twist lock plugs and integral 0-400 gpm digital flow meter, FM-SRD digital flow sensor, PSC-100P power cable with twist lock plug and PC-50 drop cable with twist lock plug.			1
CB-260-FM	5 HP/460V/3Ph/60 Hz phase reversing control box with twist lock plugs and integral 0-400 gpm digital flow meter. Includes FM-SRD digital flow sensor.			1

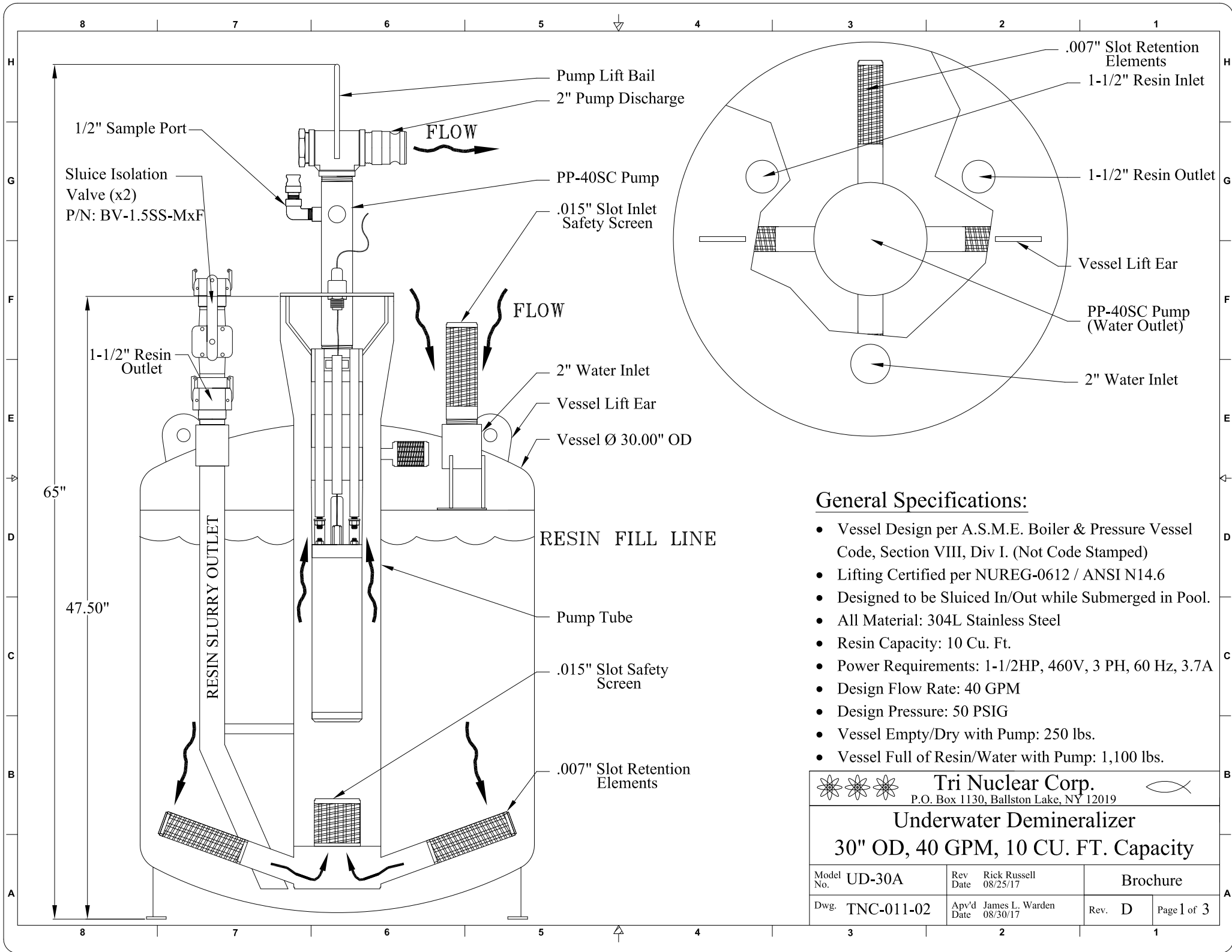
9.0 Replacement Parts (continued)

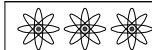
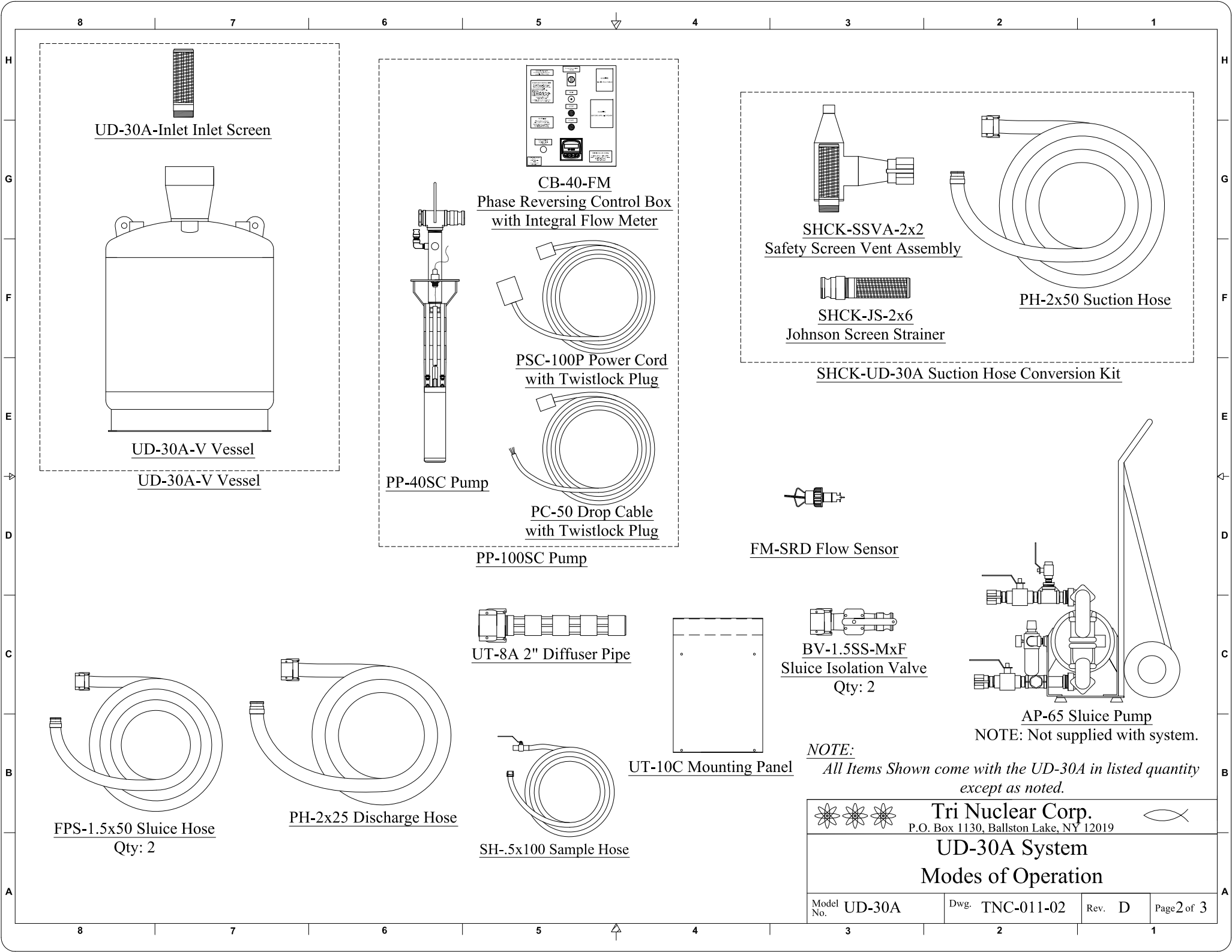
TNC Part Number	Description	UD-30A	UD-36A	UD-48A
PSC-100P	PSC-100P Power Cable with twist lock plug (100ft 10/4 SO Cable w/ male twistlock plug)	1	1	1
PC-50	PC-50 drop cable with female plug (50ft Cable w/ female connector)	1	1	1
FM-SRD	Flow sensor with reinforced paddlewheel and 100ft cable with Amphenol connector.	1	1	1
PH-2x25	2in x 25ft hose with Polypro MxF camlock couplers	1	1	
PH-2x50	2in x 50ft hose with Polypro MxF camlock couplers	2	2	
PH-3x25	3in x 25ft hose with Polypro MxF camlock couplers			1
PH-3x50	3in x 50ft hose with Polypro MxF camlock couplers			2
FPS-1.5x50	Suction/Discharge hose, 1.5in x 50ft lg with SS male x locking Female camlock couplers. 150 PSI rating, hydro tested.	2	2	2
SH-.5x100	Sample hose, 1/2in x 100ft lg with a 1/2in SS female camlock coupler x 1/2in SS ball valve. 150 PSI rating, hydro tested.	1	1	1
SC-P	Seal Plug for electrical connector on Tri Nuclear pumps	1	1	1

10.0 ADDITIONAL INFORMATION

For additional information, or if special problems develop, please contact:

Rick Russell
 Engineering Manager
 Tri Nuclear Corp.
 Ph. 518-399-1389
 Fx. 518-399-9586
 Cell. 518-728-3635
www.trinuclear.com
 e-mail: rick@trinuclear.com



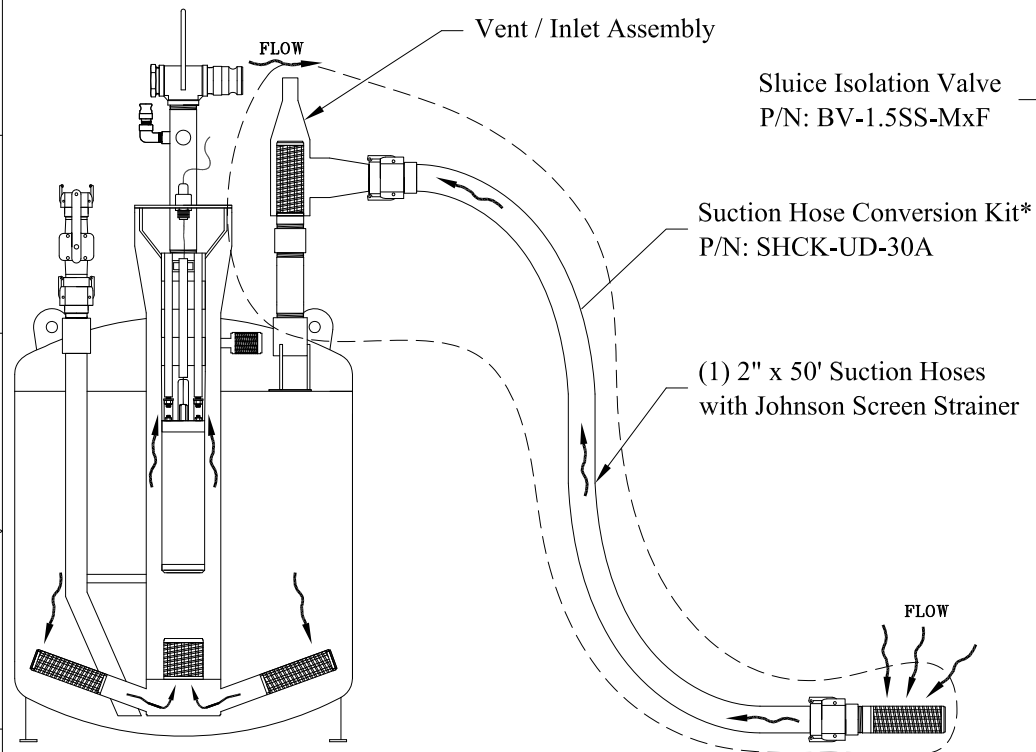


Tri Nuclear Corp.
P.O. Box 1130, Ballston Lake, NY 12019



UD-30A System Modes of Operation

Model No.	UD-30A	Dwg.	TNC-011-02	Rev.	D	Page 2 of 3
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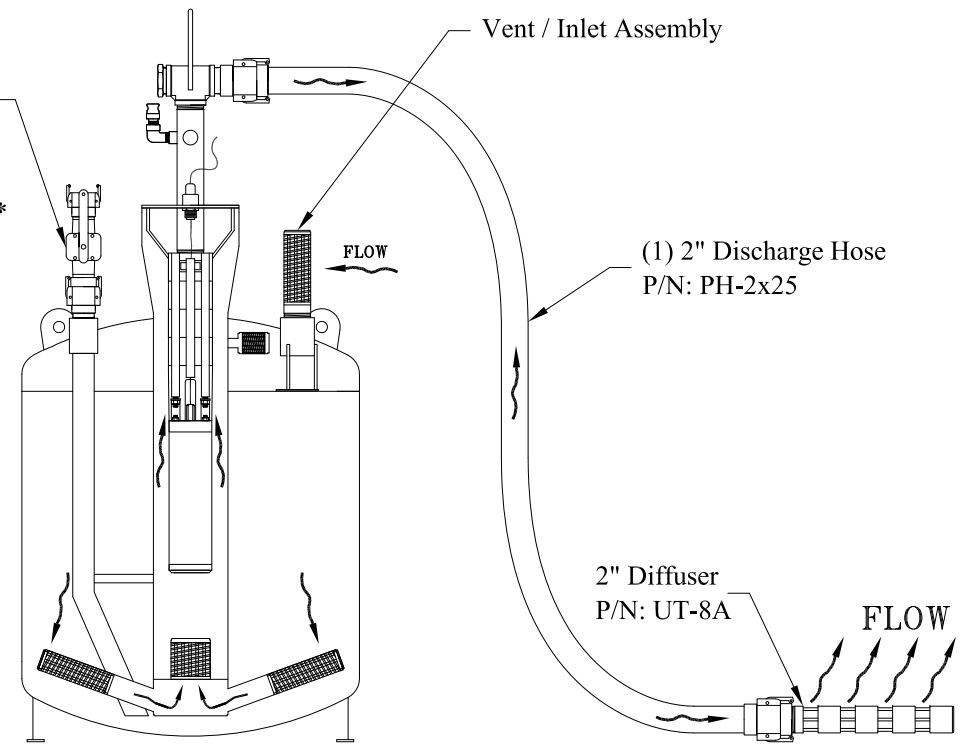


"OPTIONAL" SUCTION HOSE OPERATIONS

Single Suction Hose attached to
Vessel Inlet. No Hose attached to
discharge of pump.

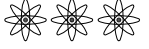

*SHCK-UD-30A Includes:

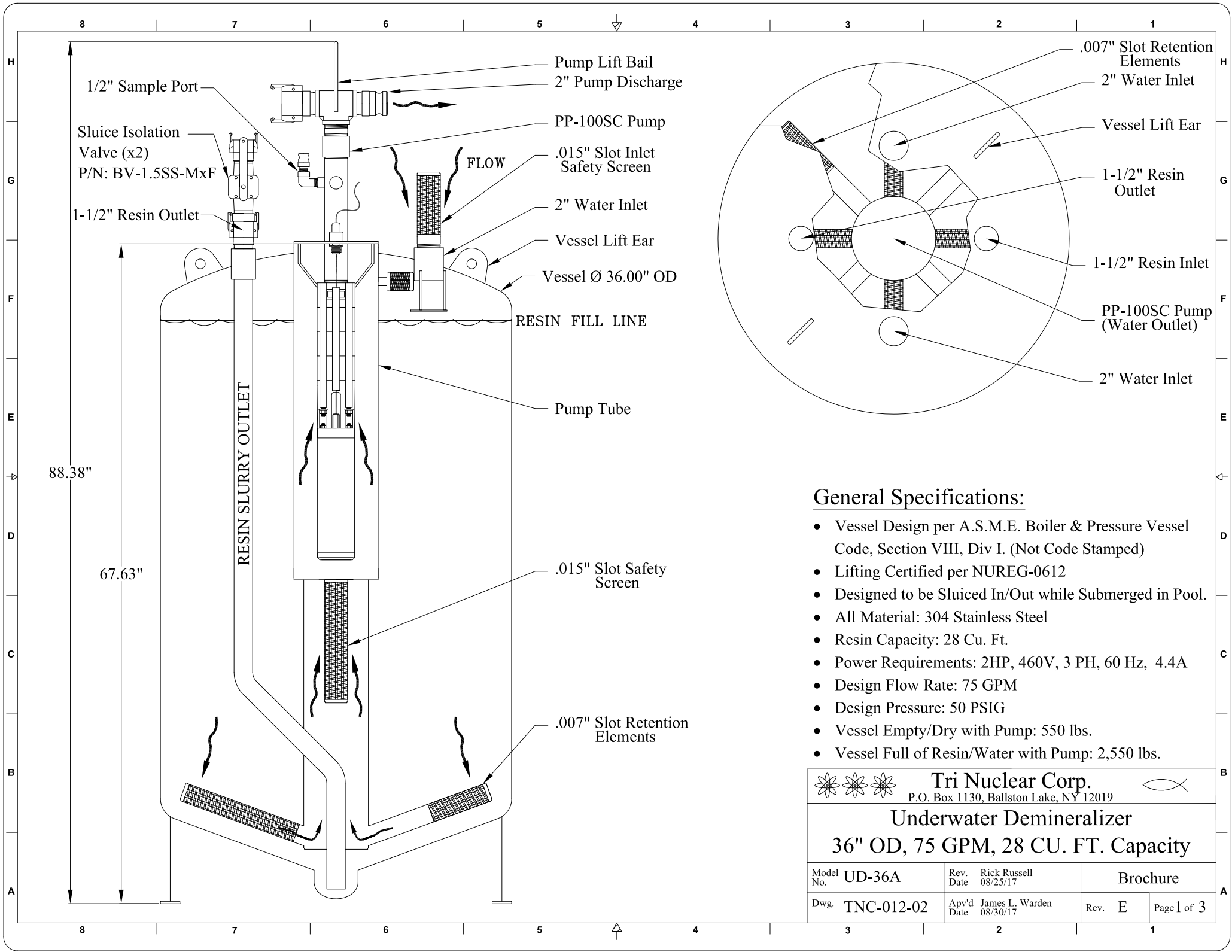
- (1) Safety Screen Vent Assembly, P/N: SHCK-SSVA-2x2
- (1) Suction Hose, P/N: PH-2x50
- (1) Johnson Screen Strainer, P/N: SHCK-JS-2x6



"TYPICAL" DISCHARGE HOSE OPERATIONS



NOTE: UD-30A to be run with either Suction or Discharge
Hoses attached for efficient cross-circulation. This system is
not required to run with both Suction & Discharge Hoses.

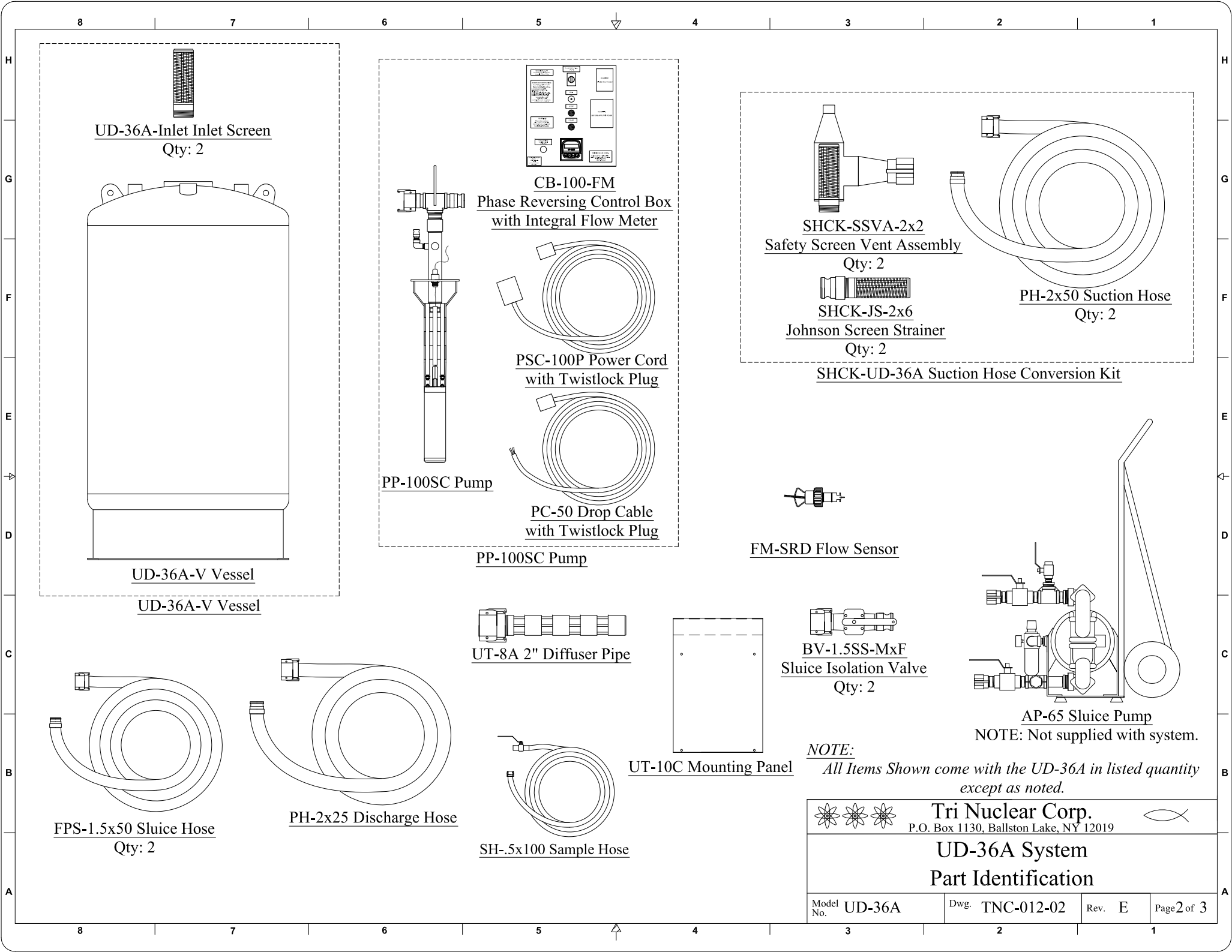
 Tri Nuclear Corp. P.O. Box 1130, Ballston Lake, NY 12019					
UD-30A System Modes of Operation					
Model No.	UD-30A	Dwg.	TNC-011-02	Rev.	D
				Page 3 of 3	

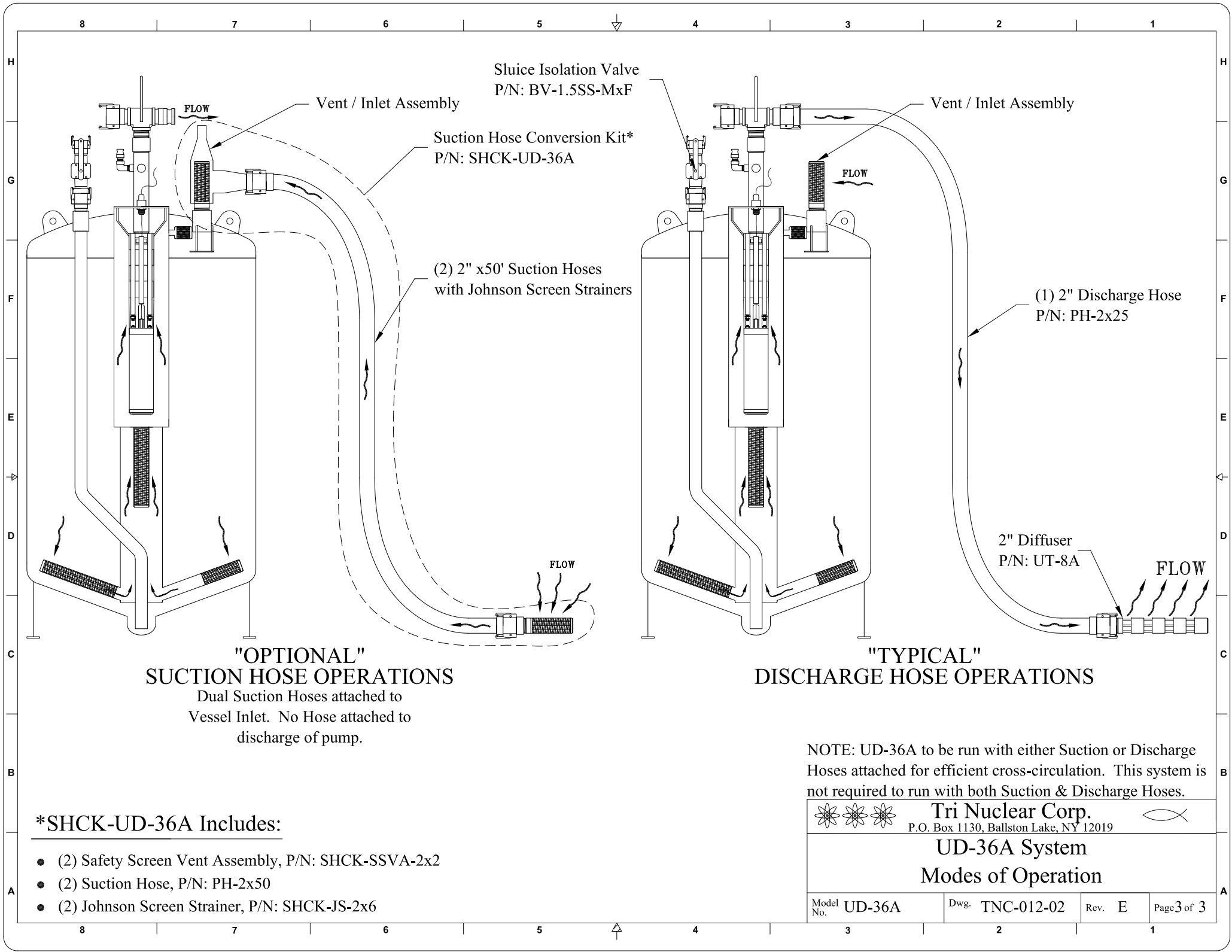


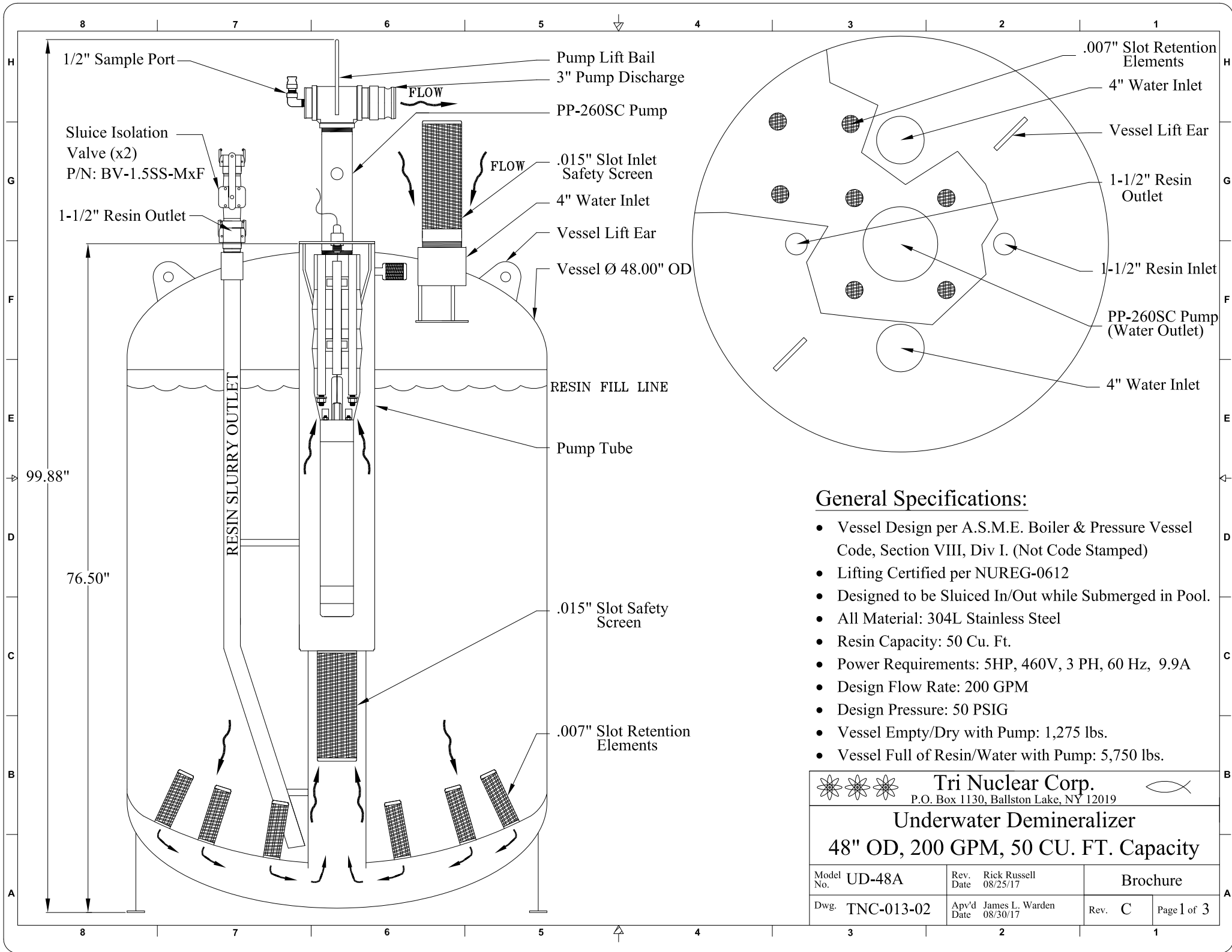
General Specifications:

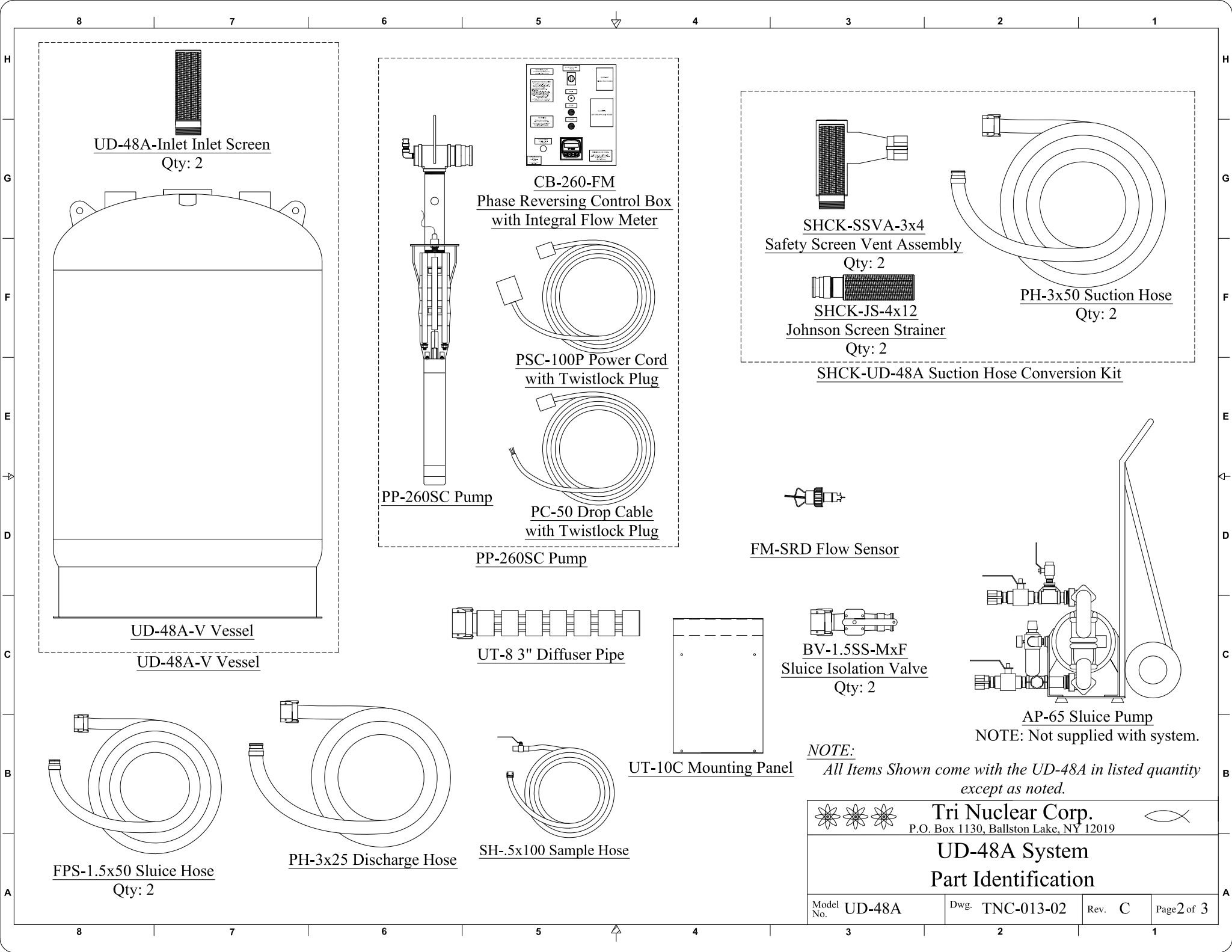
- Vessel Design per A.S.M.E. Boiler & Pressure Vessel Code, Section VIII, Div I. (Not Code Stamped)
- Lifting Certified per NUREG-0612
- Designed to be Sluiced In/Out while Submerged in Pool.
- All Material: 304 Stainless Steel
- Resin Capacity: 28 Cu. Ft.
- Power Requirements: 2HP, 460V, 3 PH, 60 Hz, 4.4A
- Design Flow Rate: 75 GPM
- Design Pressure: 50 PSIG
- Vessel Empty/Dry with Pump: 550 lbs.
- Vessel Full of Resin/Water with Pump: 2,550 lbs.

		Tri Nuclear Corp. P.O. Box 1130, Ballston Lake, NY 12019			
Underwater Demineralizer					
36" OD, 75 GPM, 28 CU. FT. Capacity					
Model No. UD-36A		Rev. Date Rick Russell 08/25/17		Brochure	
Dwg. TNC-012-02		App'd Date James L. Warden 08/30/17		Rev. E	Page 1 of 3









UD-48A-Inlet Inlet Screen
Qty: 2

CB-260-FM
Phase Reversing Control Box
with Integral Flow Meter

SHCK-SSVA-3x4
Safety Screen Vent Assembly
Qty: 2

SHCK-JS-4x12
Johnson Screen Strainer
Qty: 2

PH-3x50 Suction Hose
Qty: 2

SHCK-UD-48A Suction Hose Conversion Kit

PSC-100P Power Cord
with Twistlock Plug

PC-50 Drop Cable
with Twistlock Plug

PP-260SC Pump

PP-260SC Pump

FM-SRD Flow Sensor

UD-48A-V Vessel

UD-48A-V Vessel

UT-8 3" Diffuser Pipe

BV-1.5SS-MxF
Sluce Isolation Valve
Qty: 2

AP-65 Sluce Pump
NOTE: Not supplied with system.



UT-10C Mounting Panel

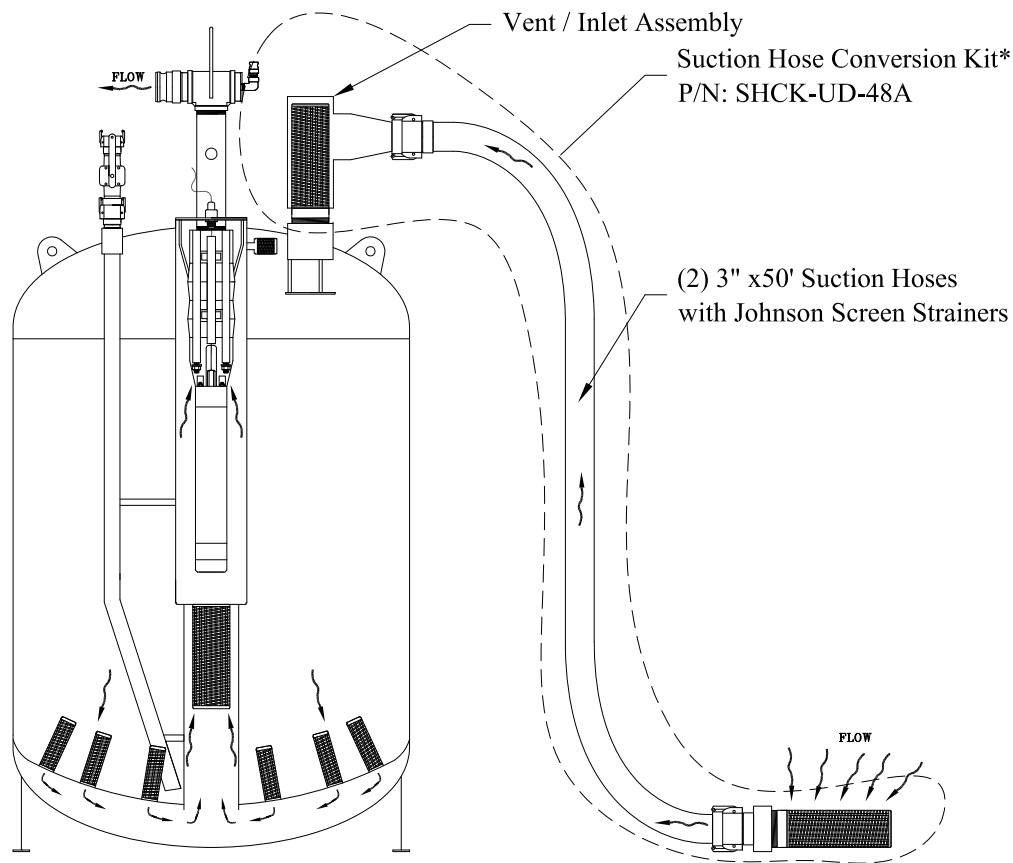
NOTE:
All Items Shown come with the UD-48A in listed quantity
except as noted.

FPS-1.5x50 Sluce Hose
Qty: 2

PH-3x25 Discharge Hose

SH-.5x100 Sample Hose

 Tri Nuclear Corp. P.O. Box 1130, Ballston Lake, NY 12019						
UD-48A System Part Identification						
Model No.	UD-48A	Dwg.	TNC-013-02	Rev.	C	Page 2 of 3

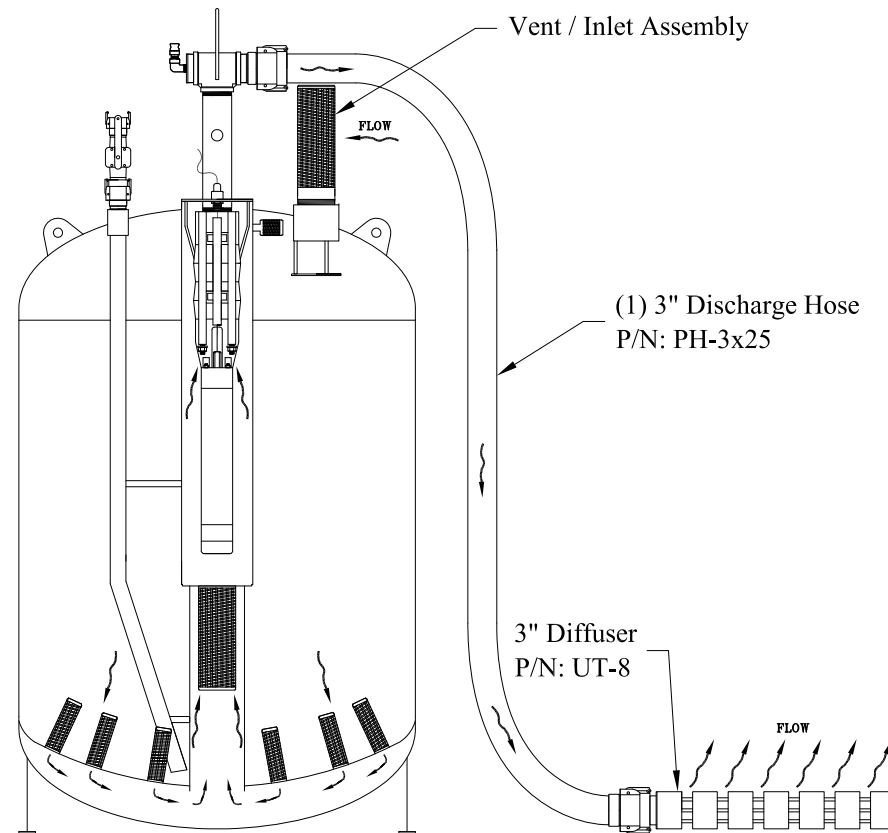


"OPTIONAL" SUCTION HOSE OPERATIONS

Dual Suction Hoses attached to
Vessel Inlet. No Hose attached to
discharge of pump.

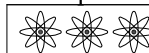
*SHCK-UD-48A Includes:

- (2) Safety Screen Vent Assembly, P/N: SHCK-SSVA-3x4
- (2) Suction Hose, P/N: PH-3x50
- (2) Johnson Screen Strainer, P/N: SHCK-JS-4x12



"TYPICAL" DISCHARGE HOSE OPERATIONS

NOTE: UD-48A to be run with either Suction or Discharge
Hoses attached for efficient cross-circulation. This system is
not required to run with both Suction & Discharge Hoses.

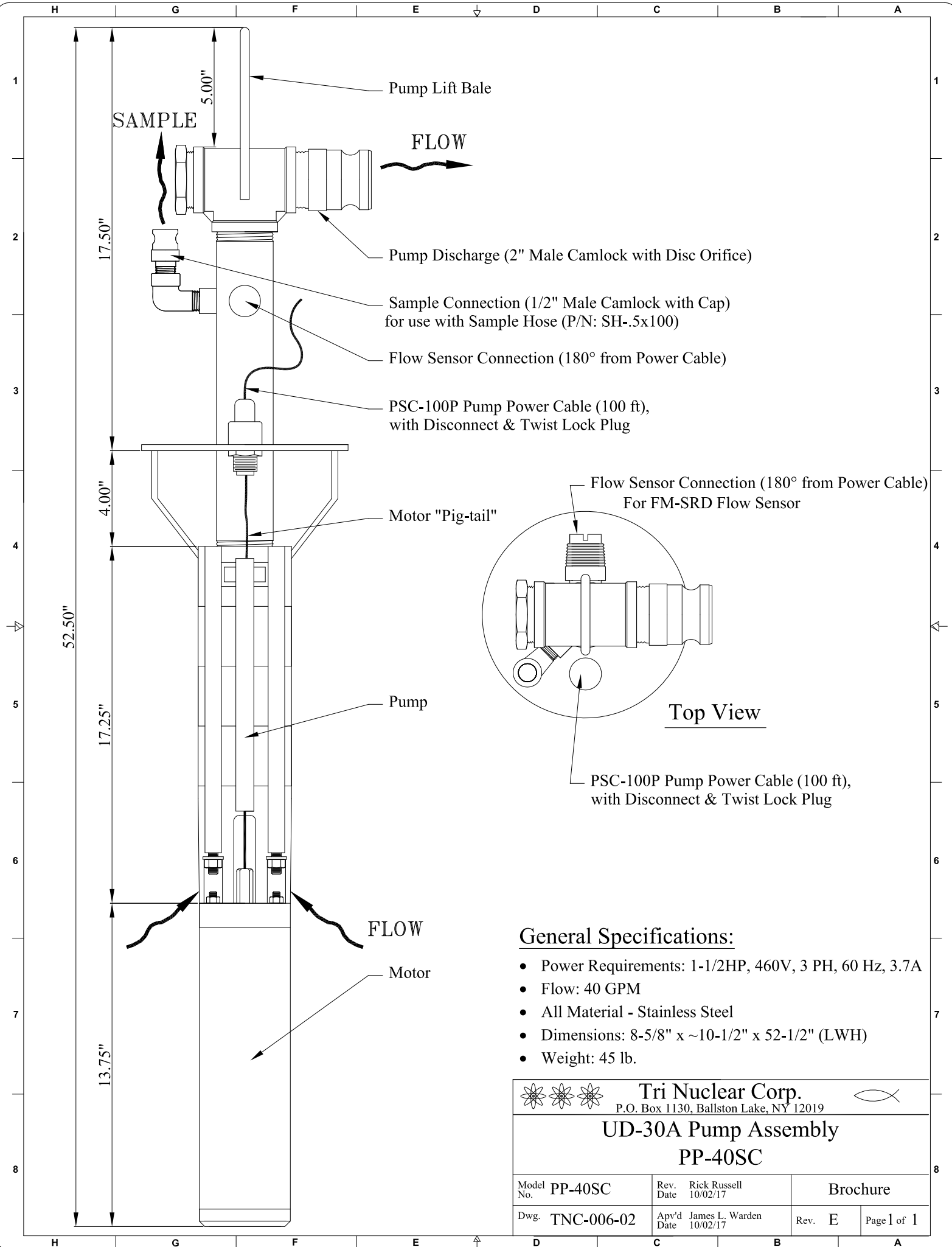


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UD-48A System Modes of Operation

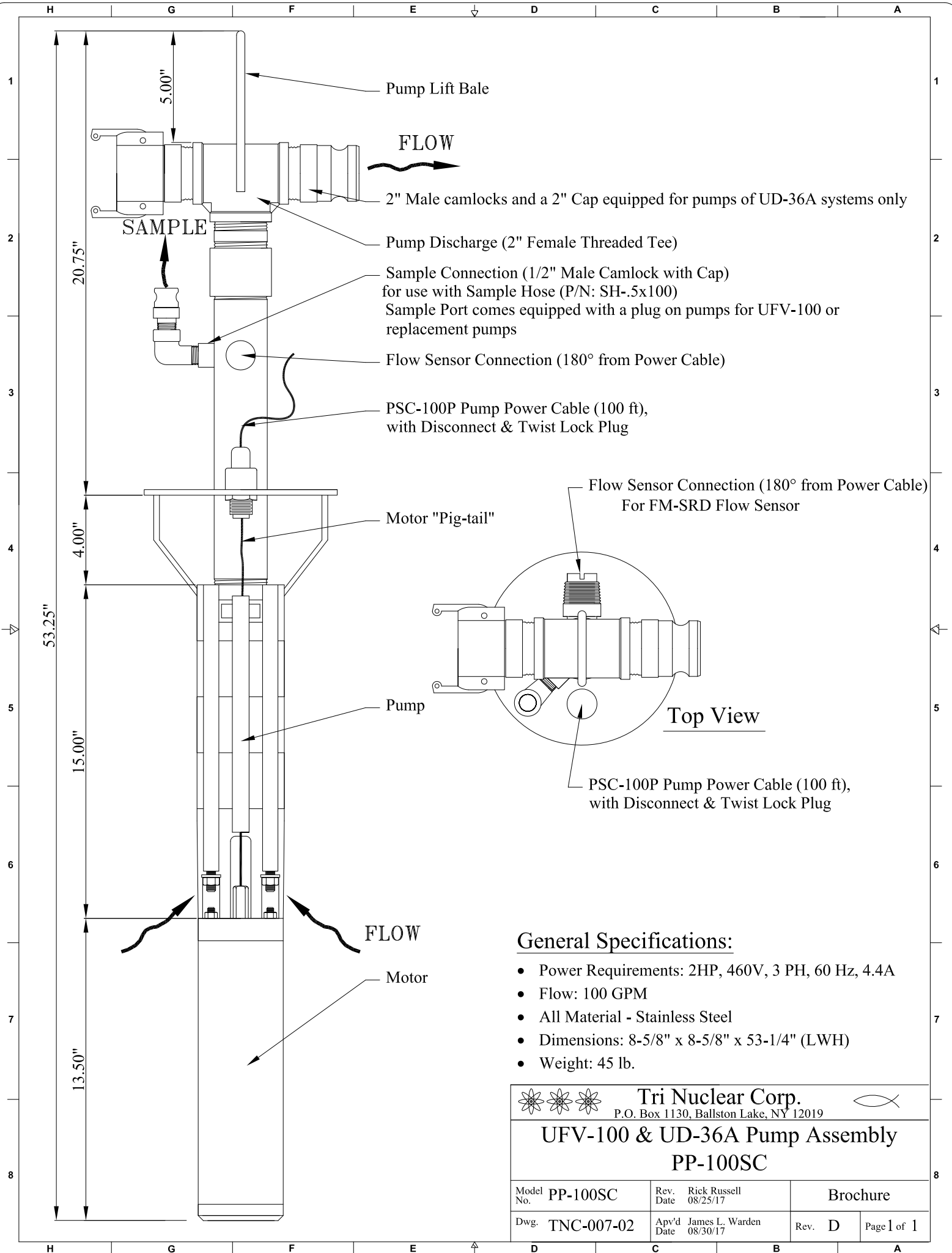
Model No.	UD-48A	Dwg.	TNC-013-02	Rev.	C	Page 3 of 3
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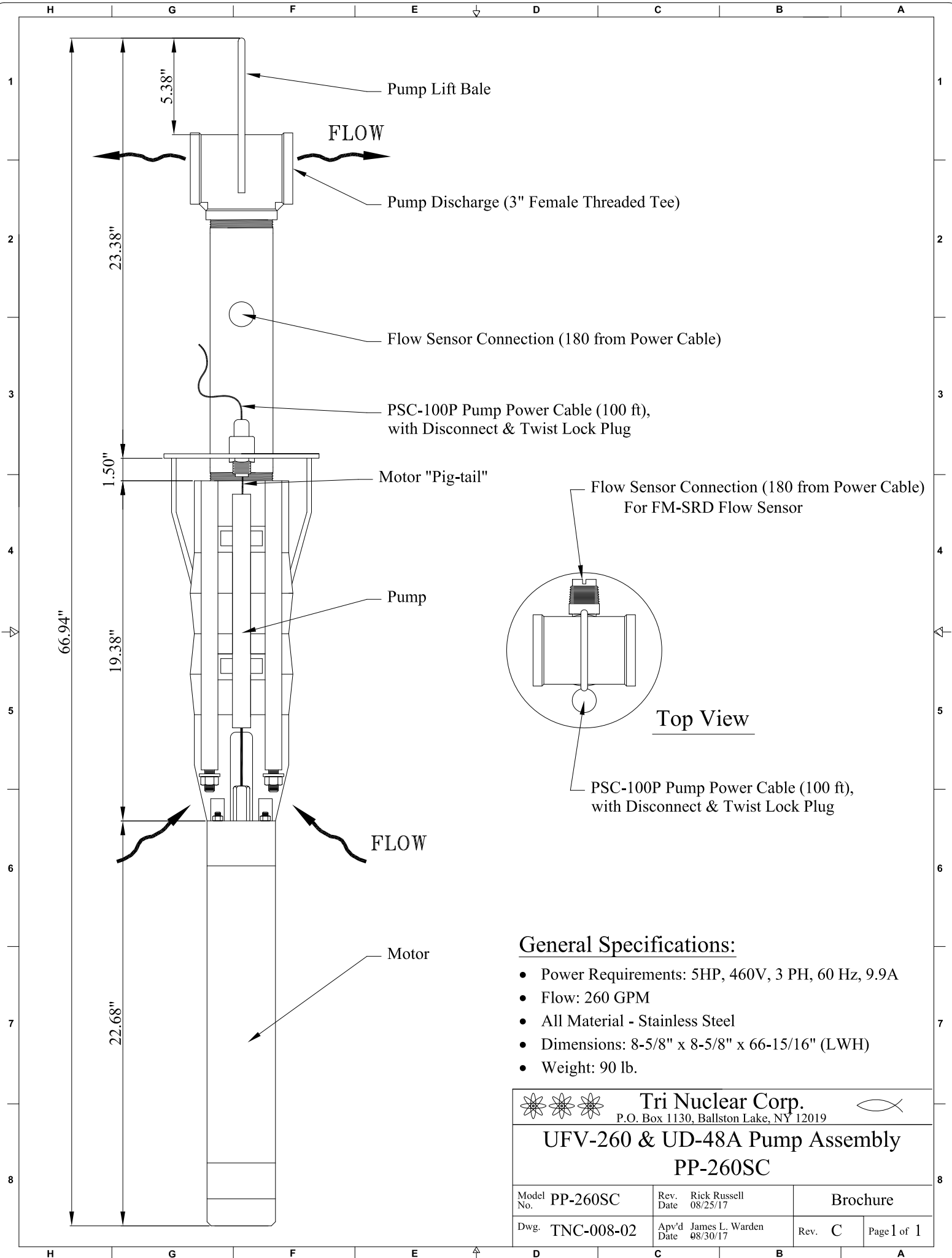


General Specifications:

- Power Requirements: 1-1/2HP, 460V, 3 PH, 60 Hz, 3.7A
- Flow: 40 GPM
- All Material - Stainless Steel
- Dimensions: 8-5/8" x ~10-1/2" x 52-1/2" (LWH)
- Weight: 45 lb.



			Tri Nuclear Corp. P.O. Box 1130, Ballston Lake, NY 12019			
UD-30A Pump Assembly PP-40SC						
Model No. PP-40SC		Rev. Date Rick Russell 10/02/17		Brochure		
Dwg. TNC-006-02		App'd Date James L. Warden 10/02/17		Rev. E		Page 1 of 1

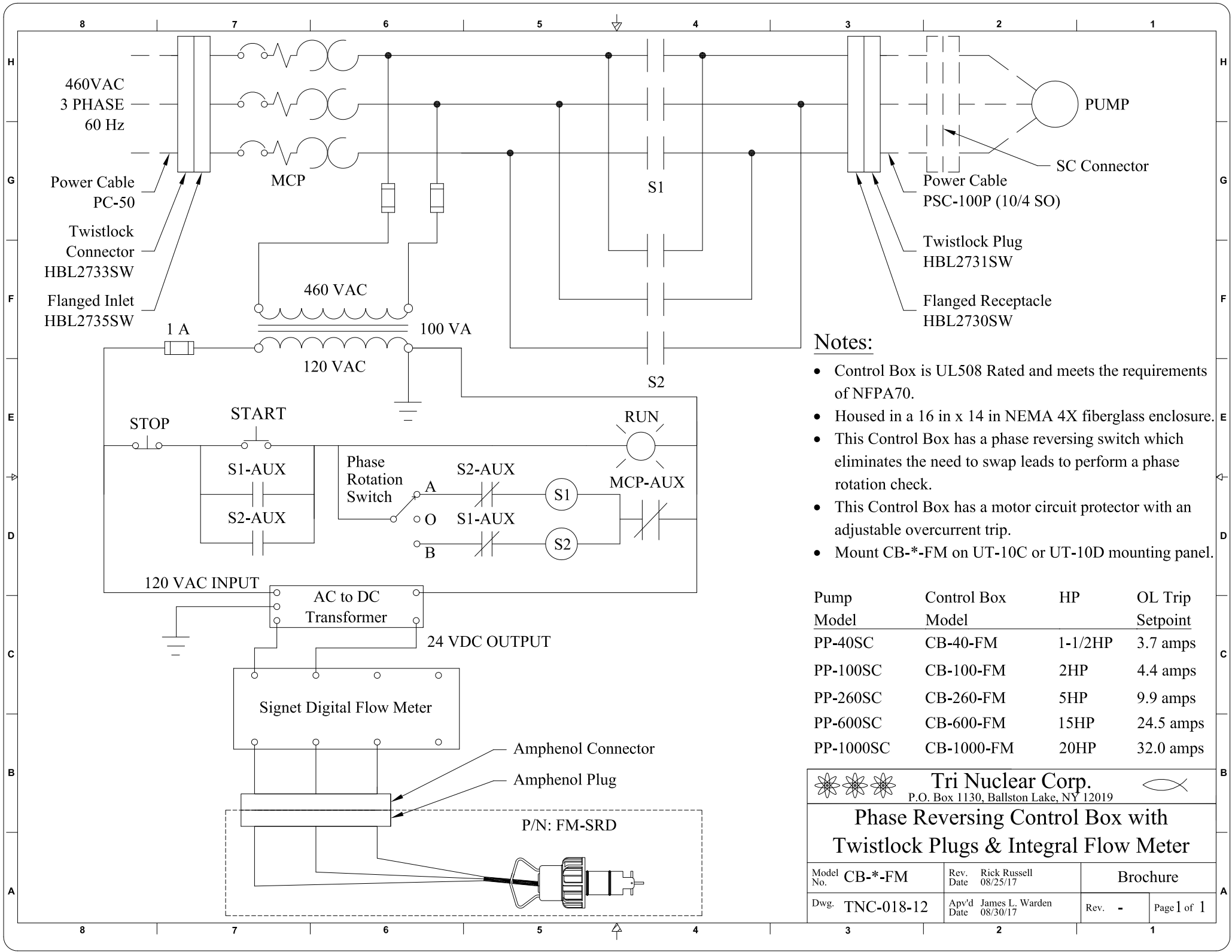




General Specifications:

- Power Requirements: 5HP, 460V, 3 PH, 60 Hz, 9.9A
- Flow: 260 GPM
- All Material - Stainless Steel
- Dimensions: 8-5/8" x 8-5/8" x 66-15/16" (LWH)
- Weight: 90 lb.


		Tri Nuclear Corp. P.O. Box 1130, Ballston Lake, NY 12019			
UFV-260 & UD-48A Pump Assembly PP-260SC					
Model No. PP-260SC		Rev. Rick Russell Date 08/25/17		Brochure	
Dwg. TNC-008-02		App'd James L. Warden Date 08/30/17		Rev. C	Page 1 of 1




Notes:

- Control Box is UL508 Rated and meets the requirements of NFPA70.
- Housed in a 16 in x 14 in NEMA 4X fiberglass enclosure.
- This Control Box has a phase reversing switch which eliminates the need to swap leads to perform a phase rotation check.
- This Control Box has a motor circuit protector with an adjustable overcurrent trip.
- Mount CB-*-FM on UT-10C or UT-10D mounting panel.

Pump Model	Control Box Model	HP	OL Trip Setpoint
PP-40SC	CB-40-FM	1-1/2HP	3.7 amps
PP-100SC	CB-100-FM	2HP	4.4 amps
PP-260SC	CB-260-FM	5HP	9.9 amps
PP-600SC	CB-600-FM	15HP	24.5 amps
PP-1000SC	CB-1000-FM	20HP	32.0 amps



Tri Nuclear Corp.
P.O. Box 1130, Ballston Lake, NY 12019



**Phase Reversing Control Box with
Twistlock Plugs & Integral Flow Meter**

Model No. CB-*-FM	Rev. Date Rick Russell 08/25/17	Brochure	
Dwg. TNC-018-12	Apv'd Date James L. Warden 08/30/17	Rev. -	Page 1 of 1