TRI NUCLEAR CORP.
THE INDUSTRY STANDARD IN UNDERWATER FILTRATION
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General Resin Sluicing Procedure

for all Tri Nuclear Underwater Demineralizers

Models:

UD-30A, UD-36A, UD-40A & UD-48A

0.1 Front Matter – Approval and Record of Revision

General Resin Sluicing Procedure
For all Tri Nuclear Underwater Demineralizers

For Models:
UD-30A, UD-36A, UD-40A & UD-48A

NOTE:
This OI-TNC-088 combines and replaces the previous Tri Nuclear Operating Instructions listed below (which are now obsolete).

Previous Document NO.	Revision	Issue Date	Title
OI-36	1.0	11/28/17	General Resin Sluicing Procedure

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)

Approval:	Date
Operations Manager John J. Flynn	15 Jan 2019

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	01/15/2019	Original Issue	----------	

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

0.2 Front Matter – Table of Contents

Attachments:

Number	Description	# of pages
TNC-087-02	AP-65 Brochure Drawing	1
TNC-088-02	General Sluice Brochure Drawing	1
TNC-011-02	UD-30A Brochure Drawing	3
TNC-012-02	UD-36A Brochure Drawing	3
TNC-157-02	UD-40A Brochure Drawing	3
TNC-013-02	UD-48A Brochure Drawing	3

Related Documents:

Number	Title
OI-TNC-011	Operating Instructions and Maintenance Manual Underwater Demineralizer Series

0.3 Front Matter – ISO Safety Symbols - Defined

ISO Symbols	Meaning
WARNING	**WARNING** - Indicates a potentially hazardous situation, which if not avoided **could result in death or serious injury**
CAUTION	**CAUTION** - Indicates a potentially hazardous situation which, if not avoided, **may result in minor or moderate injury**
CAUTION	"**CAUTION"** without the safety alert symbol should be used for safety labels that indicate only equipment damage
NOTICE	**NOTICE** indicates information that relates directly or indirectly to the safety of personnel or protection of property
	Caution: • Normal operation of this equipment will likely result in radioactive contamination. Decontamination must be performed in accordance with approved procedures.

0.4 Front Matter – Precautions and Warnings

Type	Description
WARNING	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.
CAUTION	**For the UD-30A** If the Underwater Demineralizer is filled with **LESS THAN 15** cu ft of resin, there is a remote possibility that the vessel could go buoyant depending how much less resin was filled in the vessel..
	For the UD-36A If the Underwater Demineralizer is filled with **LESS THAN 28** cu ft of resin, there is a remote possibility that the vessel could go buoyant depending how much less resin was filled in the vessel.
	For the UD-40A If the Underwater Demineralizer is filled with **LESS THAN 25** cu ft of resin, there is a remote possibility that the vessel could go buoyant depending how much less resin was filled in the vessel.
	For the UD-48A If the Underwater Demineralizer is filled with **LESS THAN 50** cu ft of resin, there is a remote possibility that the vessel could go buoyant depending how much less resin was filled in the vessel.
	Underwater Demineralizer resin can become extremely "HOT" (>15R/hr is normal and expected at the top of the demineralizer) and proper ALARA controls need to be addressed prior to beginning the sluicing procedure.

0.4 Front Matter – Precautions and Warnings (continued)

Type	Description
CAUTION	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 stop the pump during resin transfer operation since this could cause a hose to plug
	Tri Nuclear Underwater Demineralizer's are NOT designed to have the resin sluiced OUT of the vessel while the vessel is out of the water.
	The initial fill procedure is designed to be used on a NEW / CLEAN Underwater Demineralizer ONLY. Due to ALARA concerns & possible hot spots/rad levels after the Underwater Demineralizer has been operated, it is NOT recommended to perform resin fill via this method on a used / contaminated Underwater Demineralizer vessel.
	For the UD-30A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 15 cu ft of resin. See TNC-011-02 for the resin fill line.
	For the UD-36A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 28 cu ft of resin. See TNC-012-02 for the resin fill line.
	For the UD-40A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 25 cu ft of resin. See TNC-157-02 for the resin fill line.
	For the UD-48A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 50 cu ft of resin. See TNC-013-02 for the resin fill line.

1.0 Introduction

This Operating Instruction is a "generic" procedure designed to provide general guidance for sluicing operations (initial fill, & replacement of resin) of a typical Tri Nuclear Underwater Demineralizer.

All Tri Nuclear Underwater Demineralizers are designed to have the resin sluiced in and out while the vessel is submerged underwater.

Typical resin sluice out operations:

The resin is removed from an Underwater Demineralizer by using the suction of the AP-65 Sandpiper™ pump. As the resin is removed from the vessel, water enters the vessel through its normal water inlets replacing the resin volume as the resin is sluiced out of the vessel.

CAUTION	Tri Nuclear Underwater Demineralizer's are NOT designed to have the resin sluiced OUT of the vessel while the vessel is out of the water.

Typical resin sluice in operations:

New resin is supplied to an underwater demineralizer by from the AP-65 Sandpiper™ pump. As resin is sluiced into the vessel, water exits the vessel through its water inlet connections, with the water volume being replaced by the resin as it is sluiced into the vessel.

⚠WARNING	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.

	Underwater Demineralizer resin can become extremely "HOT" (>15R/hr is normal and expected at the top of the demineralizer) and proper ALARA controls need to be addressed prior to beginning the sluicing procedure.

1.1 Equipment Guide List

The following equipment is recommended for sluicing Tri Nuclear Underwater Demineralizer Systems:

Tri Nuclear Part No.	Description	Qty
AP-65	Resin sluice pump, dolly mounted. Includes 2in AL Sandpiper™ flap valve pump with 1-1/2in SS ball valves, inlet/outlet female camlock couplers, 3/4in water flush valve, & 3/4in drain valve. See Drawing TNC-087-02 for details.	1
FPS-1.5x10	Suction/Discharge hose, 1.5in x 10ft lg with SS male x locking female camlock couplers. 150 PSI rating, hydro tested.	AR
FPS-1.5x25	Suction/Discharge hose, 1.5in x 25ft lg with SS male x locking female camlock couplers. 150 PSI rating, hydro tested.	AR
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
BV-1.5SS-MxF	1-1/2in SS FP Ball Valve with Male by Locking Female camlock couplers. Includes remote grapple lanyard.	2

1.2 Materials of Construction

The following is a list of the materials of construction for sluicing components.

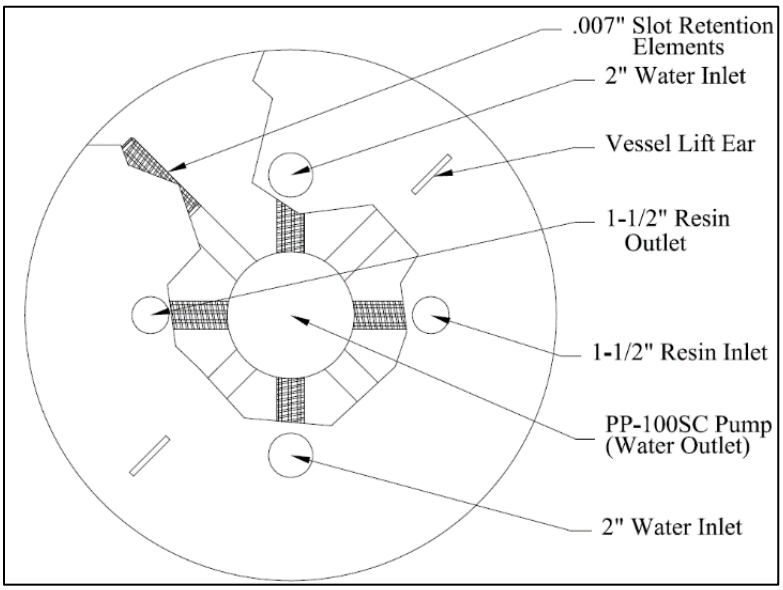
Tri Nuclear Part No.	Description	Materials of Construction
AP-65	Resin sluice pump, dolly mounted. Includes 2in AL Sandpiper™ flap valve pump with 1-1/2in SS ball valves, inlet/outlet female camlock couplers, 3/4in water flush valve, & 3/4in drain valve. See Drawing TNC-087-02 for details.	AL, 304SS, 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
FPS-1.5x50 FPS-1.5x25 FPS-1.5x10	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

2.0 Description of Equipment

2.1 Demineralizer Vessels:

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

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.



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

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.

Capacity of Tri Nuclear Demineralizers			
Model Number	**Typical Resin Capacity**	**Diameter of Demineralizer**	**Height of Demineralizer (to top of pump tube)**
UD-30A	10 cu. ft.	30in	47-1/2in
UD-36A	28 cu. ft.	36in	67-5/8in
UD-40A	25 cu. ft.	40in	61in
UD-48A	50 cu. ft.	48in	76-1/2in

NOTE: Contact Tri Nuclear for capacities of other demineralizers not listed above.

2.2 Resin Sluice Pump (P/N: AP-65)

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, & 3/4in drain valve mounted on a dolly with pneumatic tires and vibration dampeners. The AP-65 also comes equipped with a 3/4in isolation valve to the air regulator as well as a drip pan to contain any possible leakage during the connecting or disconnecting of sluice hoses to the AP-65.

The air regulator is mounted on the back side of the dolly to give the operator a little more distance from the AP-65 when operating / setting the air regulator. See drawing TNC-087-02.

Sluice pump for all Tri Nuclear Underwater Demineralizers.	

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

Each Underwater Demineralizer shipped since October 2011 comes equipped with (2) removable 1-1/2 Male by locking female camlock, 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.

1-1/2in Stainless steel ball valve w/MxF camlock connections	

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

Each Underwater Demineralizer shipped since October 2011 comes equipped with (2) 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.

2.5 Resin Transfer Hoses (P/N: FPS-1.5x25 & FPS-1.5x10)

The resin transfer hoses are 1-1/2in x 25ft long (P/N: FPS-1.5x25) and 1-1/2in x 10ft long (P/N: FPS-1.5x10) and attach to the AP-65 Resin Sluice Pump. They are used for sluicing clean resin from a new resin drum to the demineralizer. This same hose(s) may be used for discharging depleted resin from the demineralizer to a radwaste disposal liner.

3.0 Equipment as Shipped

The AP-65 is shipped on a single pallet. Other items are shipped separately or with the Underwater Demineralizer. Actual shipments may differ depending on customer shipping requirements.

4.0 Initial resin fill of a NEW / CLEAN Underwater Demineralizer. See drawing TNC-088-02, General Sluice Brochure Drawing, for details.

CAUTION	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.
	For the UD-30A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 15 cu ft of resin. See TNC-011-02 for the resin fill line.
	For the UD-36A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 28 cu ft of resin. See TNC-012-02 for the resin fill line.
	For the UD-40A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 25 cu ft of resin. See TNC-157-02 for the resin fill line.
	For the UD-48A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 50 cu ft of resin. See TNC-013-02 for the resin fill line.

CAUTION	The initial fill procedure is designed to be used on a NEW / CLEAN Underwater Demineralizer ONLY. Due to ALARA concerns & possible hot spots/rad levels after the Underwater Demineralizer has been operated, it is NOT recommended to perform resin fill via this method on a used / contaminated Underwater Demineralizer vessel.

4.1 Procure the required / correct amount of resin for the Underwater Demineralizer. Refer to the chart below for the proper resin capacity:

Capacity of Tri Nuclear Demineralizers			
Model Number	**Typical Resin Capacity**	**Diameter of Demineralizer**	**Height of Demineralizer (to top of pump tube)**
UD-30A	15 cu. ft.	30in	47-1/2in
UD-36A	28 cu. ft.	36in	67-5/8in
UD-40A	25 cu. ft.	40in	61in
UD-48A	50 cu. ft.	48in	76-1/2in

NOTE: Contact Tri Nuclear for capacities of other demineralizers not listed above

4.2 Prepare the Underwater Demineralizer for resin filling operations as follows:

4.2.1 Remove the submersible pump if installed and seal the pump tube with tape / plastic etc.

4.2.2 Ensure the camlock cap and valve spool piece (BV-1.5SS-MxF) are installed on the resin outlet male camlock connection.

4.2.3 Remove the inlet Johnson Screen assemblies (or Safety Screen Vent Assemblies (P/N: SSVA-36A)). Seal ONE of the two inlet connections.

4.2.4 Attach a "shop vac" vacuum hose to the other 2in female coupling inlet connection on the top of the Underwater Demineralizer and tape it in place to achieve a good seal.

4.2.5 Attach the FPS-1.5x25 hose to the Resin inlet connection (either the male camlock on the vessel or the male camlock on the valve spool piece (BV-1.5SS-MxF))

4.2.6 Turn on the "shop vac" as this will create a vacuum in the vessel. Open the valve spool piece (BV-1.5SS-MxF) if installed.

4.2.7 Using the end of the FPS-1.5x25 hose, suck the required amount of dry resin into the Underwater Demineralizer vessel.

4.2.8 After the Underwater Demineralizer vessel is filled with resin, remove the tape and replace the components removed in steps 4.2.1 thru 4.2.5.

4.3 Ensure the vessel is full of water prior to submerging in the Spent Fuel Pool or Reactor Cavity.

Before installing the vessel into the pool, fill it with water from an approved water source through the resin inlet hose. The vessel will be full when water starts to overflow the 2in Johnson screens installed in the vessel top water inlet.

4.4 The vessel is now ready for operation. Refer to the vessel's applicable Operating Instruction for more information regarding the Underwater Demineralizer setup and installation.

5.0 Discharge of depleted resin from a submerged Underwater Demineralizer vessel. See drawing TNC-088-02 for details.

When it is determined that the resin bed is expended, has reached pre-determined rad levels, or prior to movement, the resin in an underwater demineralizer may be sluiced out while the vessel is submerged.

This is the recommended way to sluice out the resin from any Tri Nuclear an underwater demineralizer.

The resin is removed from an underwater demineralizer by using the suction of the AP-65 flap valve Sandpiper™ pump. As the resin is removed from the vessel, water will enter the vessel through its normal water inlets replacing the resin volume as the resin is sluiced out of the vessel.

5.1 Prepare System for Resin Discharge

5.1.1 Ensure the Underwater Demineralizer system is secured per the appropriate Operating Instruction.

5.1.2 If the FPS-1.5x50 hoses and valve spool pieces were removed for normal operations, or were not initially installed, attach them to the vessel as follows: (if the hoses are already installed, skip to step 5.1.3)

5.1.2.1 Raise the underwater demineralizer vessel to the surface of the pool.

5.1.2.2 Remove the cap from the 1-1/2in "resin inlet" camlock connection. Install (1) SLUICE VALVE SPOOL PIECE (BV-1.5SS-MxF) and (1) FPS-1.5x50 hose on this connection. Place the cap on the male 1-1/2in camlock fitting on the end of the hose. Label the hose as "resin inlet".

5.1.2.3 Remove the cap from the 1-1/2in "resin outlet" camlock connection. Install (1) SLUICE VALVE SPOOL PIECE (BV-1.5SS-MxF) and (1) FPS-1.5x50 hose on this connection. Place the cap on the male 1-1/2in camlock fitting on the end of the hose. Label the hose as "resin outlet".

5.1.2.4 Lower the underwater demineralizer vessel back to the pool floor. When the vessel is on the floor, remove the caps from the FPS-1.5x50 hoses and briefly submerge them to fill them with water. Reinstall the caps when they are full of water.

5.1.3 Verify which hose is connected to the "Resin inlet" connection and "Resin outlet" connection on the vessel. The vessel connections have been labeled to identify the resin inlet/outlet connections.

5.2 AP-65 setup for resin discharge
See Tri Nuclear Drawing TNC-087-02 and TNC-088-02 for details.

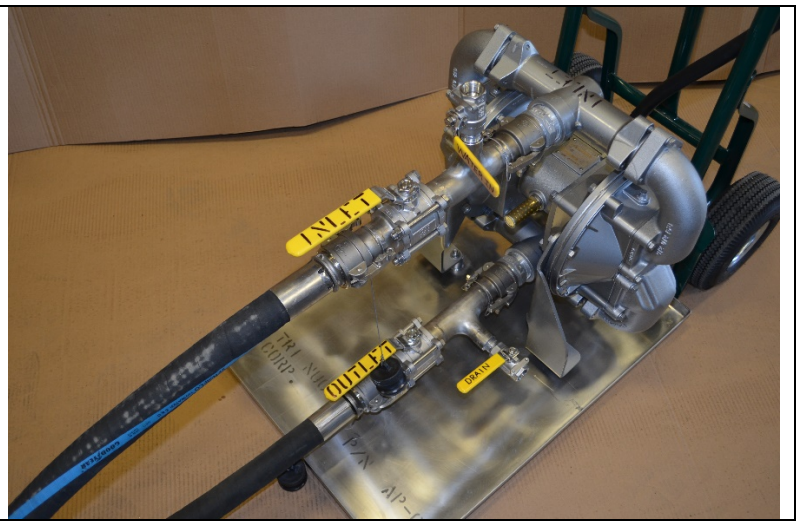
5.2.1 Connect a 100-psi air supply to the 3/4in shutoff valve to the AP-65 air regulator. Ensure the air regulator is backed all the way off. On AP-65's shipped since 2017, the air regulator is mounted on the back side of the dolly.

Air regulator and isolation valve on the AP-65	

5.2.2 Connect a water supply to the 3/4in water inlet valve on the suction side of the AP-65 pump. Verify the water inlet valve is shut.

5.2.3 Remove the cap and attach the FPS-1.5x50 "RESIN OUTLET" hose to the suction of the AP-65 pump. Verify the AP-65 suction valve is shut. Do NOT discard the hose cap as it will be needed after resin sluicing operations are complete.

5.2.4 Attach the FPS-1.5x25 resin transfer hose to the discharge of the of the AP-65 pump. Verify the AP-65 suction valve is shut. Connect the other end of the hose to the waste shipping liner or shielded waste container for final resin disposal.

Hoses attached to the AP-65 with the inlet and outlet valves open	

5.3 Discharge Depleted Resin from Demineralizer

5.3.1 Open the AP-65 suction and discharge valves.

5.3.2 Using a grapple tool, open the "Resin Outlet" valve (if installed) on the Underwater Demineralizer vessel. A lanyard loop has been installed on the valve handle to facilitate opening the valve underwater.

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

5.3.3 Start the AP-65 Sandpiper pump by opening the 3/4in air inlet valve and turning and adjusting the regulator air pressure for a medium flow rate of approximately 15 gpm, which is about 110 strokes per minute on the pump. This will provide a resin slurry velocity flow rate of approximately 4 ft./sec., which is desirable for slurry flow.

CAUTION	Do not stop the pump during resin transfer operation since this could cause a hose to plug

	Underwater Demineralizer resin can become extremely "HOT" (>15R/hr is normal and expected at the top of the demineralizer) and proper ALARA controls need to be addressed prior to beginning the slicing procedure. Due to the nature of the sluice, the hottest resin in the vessel will be the last to be pumped through the sluice hoses.

5.3.4 The resin slurry discharge to the waste container should be monitored continuously in case a resin plug is encountered, and to determine when the resin transfer has been completed. Resin transfer can be typically accomplished in 30 minutes or less.

Dose readings on hoses can also be used to determine when the sluice is complete.

5.3.5 When the resin transfer has been completed and only water is observed discharging into the waste container, stop the AP-65 Sandpiper pump by closing the air inlet valve to the regulator. Shut the AP-65 suction valve.

5.3.6 Flush the AP-65 pump and discharge hose by opening the 3/4in water supply valve. Start the AP-65 pump to flush the pump and FPS-1.5x25 resin transfer hose. When flushing is completed, stop the AP-65 pump and shut the water supply valve.

5.3.7 Remove the water supply to the 3/4in water supply valve.

5.3.8 Start the AP-65 pump and open the 3/4in water inlet valve; --- this will allow air to be forced through the FPS-1.5x25 resin transfer hose and clear out the hose. When the FPS-1.5x25 hose is clear of water, stop the AP-65 pump and shut the 3/4in water inlet valve.

5.3.9 Shut the AP-65 discharge valve and remove the FPS-1.5x25 resin transfer hose.

5.3.10 Shut the “Resin Outlet” valve (if installed) on the Underwater Demineralizer vessel.

5.3.11 Remove the FPS-1.5x50 "RESIN OUTLET" hose from the suction of the AP-65 pump and install the 1-1/2in camlock cap on the male end of the resin outlet hose.

5.4 Recovery from a resin plug in the discharge hose

In case of a resin blockage, the following steps can be taken to recover:

5.4.1 Stop the AP-65 Sandpiper pump & shut the 1-1/2in inlet suction valve.

5.4.2 Open the 3/4in water inlet valve and start the AP-65 pump. Check the discharge flow into waste container and continue pumping until water runs clear, then stop the pump.

5.4.3 Shut the AP-65 pump discharge valve and open the suction valve. This will back-flow pure water and blocked resin back into the demineralizer. This should clear the line. Shut the AP-65 suction valve and 3/4in water supply valve. Proceed with normal resin transfer per 5.3.

6.0 Resin fill of a SUBMERGED Underwater Demineralizer.

6.1 AP-65 setup for resin FILL
See Tri Nuclear Drawing TNC-087-02 and TNC-088-02 for details.

6.1.1 Connect a 100-psi air supply to the 3/4in shutoff valve to the AP-65 air regulator. Ensure the air regulator is backed all the way off. On AP-65's shipped since 2017, the air regulator is mounted on the back side of the dolly.

Air regulator and isolation valve on the AP-65	

6.1.2 Connect a water supply to the 3/4in water inlet valve on the suction side of the AP-65 pump. Verify the water inlet valve is shut.

6.1.3 Remove the cap and attach the FPS-1.5x50 "RESIN INLET" hose to the DISCHARGE of the AP-65 pump. Verify the AP-65 discharge valve is shut. Do NOT discard the hose cap as it will be needed after resin sluicing operations are complete.

6.1.4 Attach the FPS-1.5x25 resin transfer hose to the SUCTION of the of the AP-65 pump. Verify the AP-65 suction valve is shut. Connect the other end of the hose to a new resin drum / container.

Hoses attached to the AP-65 with the inlet and outlet valves open	

6.2 New Resin Drum

CAUTION	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.
	For the UD-30A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 15 cu ft of resin. See TNC-11-02 for the resin fill line.
	For the UD-36A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 28 cu ft of resin. See TNC-12-02 for the resin fill line.
	For the UD-40A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 25 cu ft of resin. See TNC-157-02 for the resin fill line.
	For the UD-48A Do not overfill the Underwater Demineralizer with resin. It is designed to operate with 50 cu ft of resin. See TNC-13-02 for the resin fill line.

6.2.1 Procure the required / correct amount of resin for the Underwater Demineralizer. Refer to the chart below for the proper resin capacity:

Capacity of Tri Nuclear Demineralizers			
Model Number	**Typical Resin Capacity**	**Diameter of Demineralizer**	**Height of Demineralizer (to top of pump tube)**
UD-30A	15 cu. ft.	30in	47-1/2in
UD-36A	28 cu. ft.	36in	67-5/8in
UD-40A	25 cu. ft.	40in	61in
UD-48A	50 cu. ft.	48in	76-1/2in

NOTE: Contact Tri Nuclear for capacities of other demineralizers not listed above

6.2.2 Open a new drum of resin, and with a water hose fill and cover the resin with water.

6.3 Charge the Underwater Demineralizer Vessel with resin

6.3.1 Open the AP-65 suction and discharge valves.

6.3.2 Using a grapple tool, open the “Resin Inlet” valve (if installed) on the Underwater Demineralizer vessel. A lanyard loop has been installed on the valve handle to facilitate opening the valve underwater.

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

6.3.3 Start the AP-65 Sandpiper pump by opening the 3/4in air inlet valve and turning and adjusting the regulator air pressure for a medium flow rate of approximately 15 gpm, which is about 110 strokes per minute on the pump. This will provide a resin slurry velocity flow rate of approximately 4 ft./sec., which is desirable for slurry flow.

6.3.4 Ensure that the new resin in the drum is covered with pure water at all times during resin transfer. While the Sandpiper pump is running, ensure the suction hose remains underwater at all times. The pump is self-priming and can draw air through the hose to the Underwater Demineralizer vessel.

6.3.5 When the first drum is empty of resin, shut off the pump and move the FPS-1.5x25 resin transfer hose to the second drum. Start the pump, and continue the operation until the vessel is fully charged with no more than the resin listed in 6.2.1

6.3.6 After the last drum of resin has been charged into the vessel, flush the FPS-1.5x25 resin transfer hose and FPS-1.5x50 resin inlet hose with water (to ensure all the resin is in the vessel) by pumping 1-2 cu ft. of water through the system from empty resin drum. Secure the air to the AP-65 when complete.

6.3.7 Once resin charging operations are complete, shut the AP-65 suction and discharge valves. Disconnect the FPS-1.5x25 resin transfer hose and store for later use.

6.3.8 Shut the “Resin Outlet” valve (if installed) on the Underwater Demineralizer vessel.

6.3.9 Disconnect the FPS-1.5x50 resin inlet hose from the AP-65 pump and reinstall the hose cap.

7.0 Maintenance

There is no required periodic maintenance required for the AP-65 system.

8.0 Troubleshooting

Call Tri Nuclear for troubleshooting sluicing operations

9.0 Replacement Parts

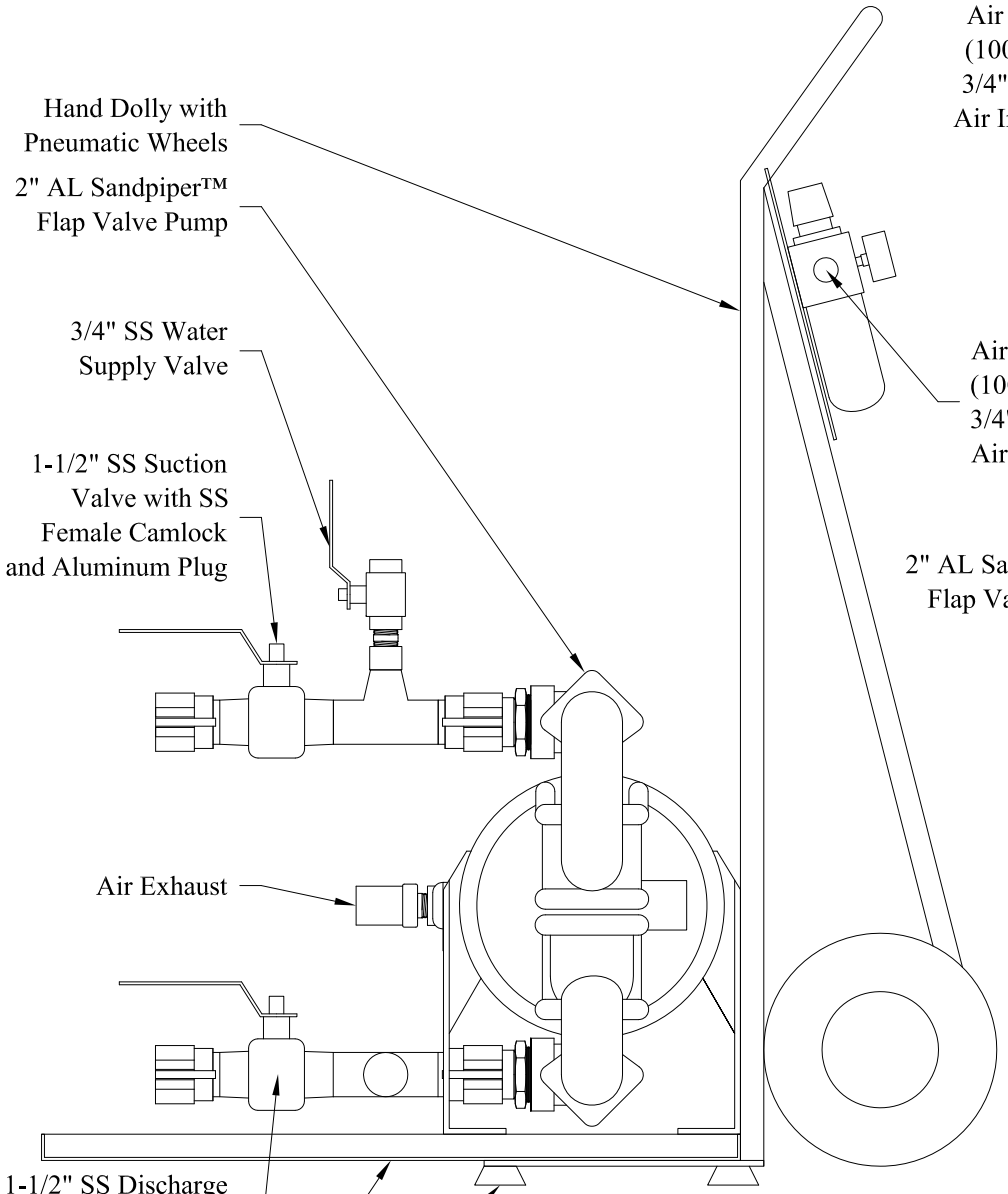
Below is a listing of Recommended Spare Parts for the sluicing Tri Nuclear Underwater demineralizers:

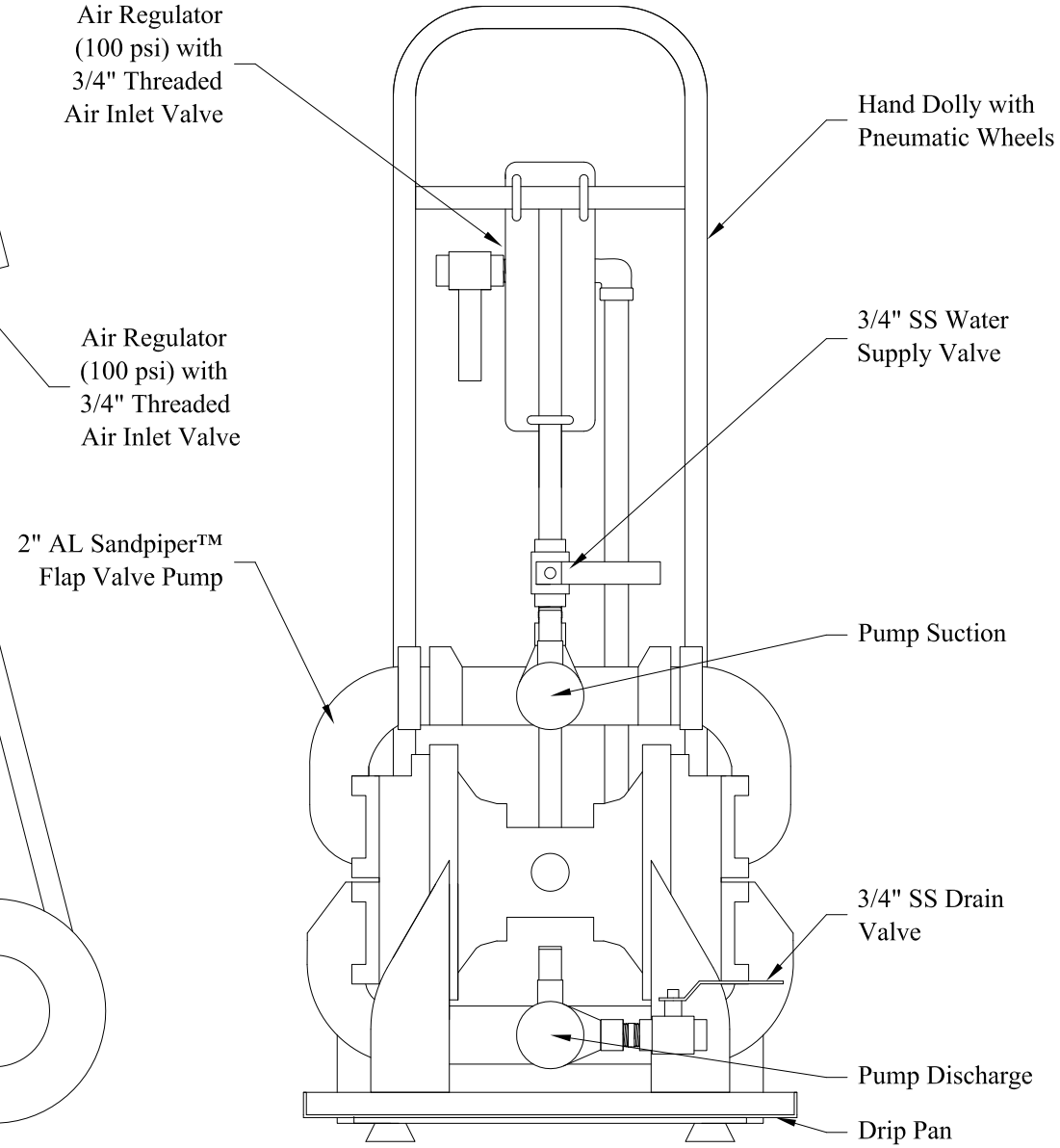
Qty	Part No.	Description
1	AP-65	Resin sluice pump, dolly mounted. Includes 2in AL Sandpiper™ flap valve pump with 1-1/2in SS ball valves, inlet/outlet female camlock couplers, 3/4in water flush valve, & 3/4in drain valve. See Drawing TNC-087-02 for details.
AR	FPS-1.5x10	Suction/Discharge hose, 1.5in x 10ft lg with SS male x locking female camlock couplers. 150 PSI rating, hydro tested.
AR	FPS-1.5x25	Suction/Discharge hose, 1.5in x 25ft lg with SS male x locking female camlock couplers. 150 PSI rating, hydro tested.
AR	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	BV-1.5SS-MxF	1-1/2in SS FP Ball Valve with Male by Locking Female camlock couplers. Includes remote grapple lanyard.

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





General Specifications:

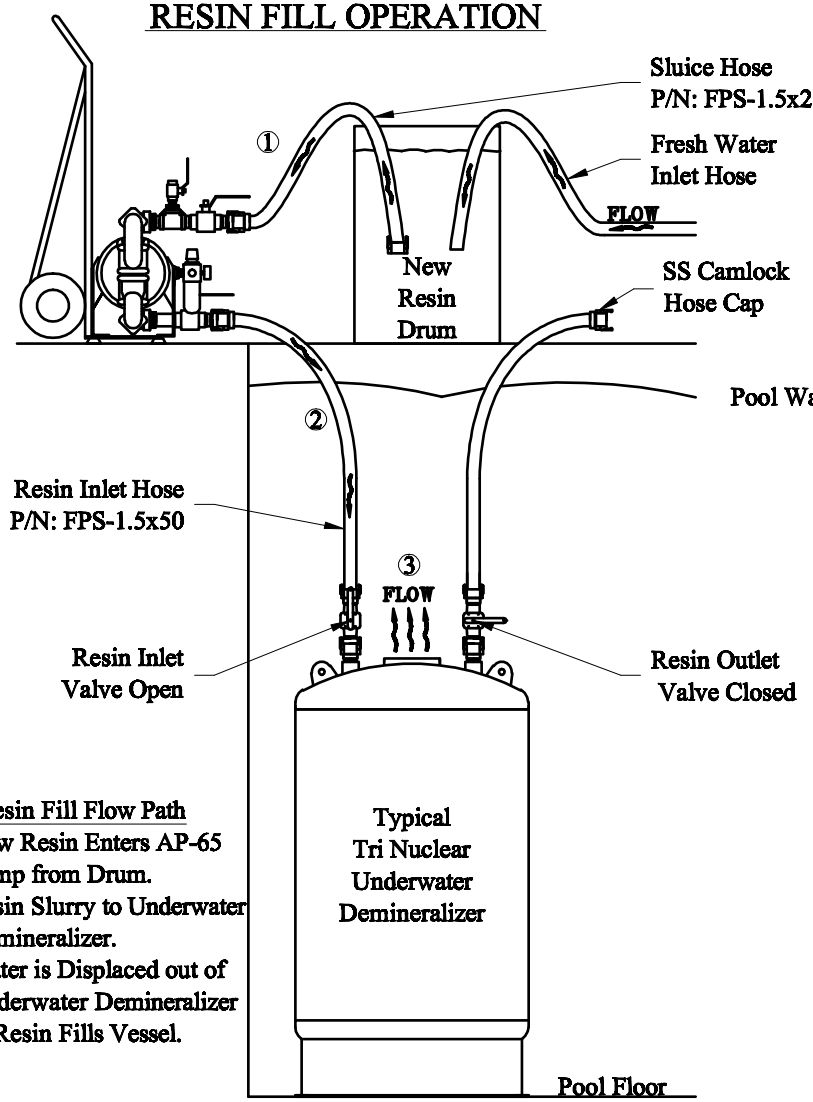
- Maximum Flow Rate: 140 GPM
- Dimensions: 41 in x 22 in x 50 in (LWH)
- Maximum Discharge Pressure: 125 psi
- Hydrostatically Tested to 125 psi
- Equipment Weight: 140 lbs.

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

Resin Sluice Pump for Tri Nuclear Underwater Demineralizers

Model No. AP-65	Rev Rick Russell Date 11/21/17	Brochure	
Dwg. TNC-087-02	Apv'd James L. Warden Date 11/28/17	Rev. B	Page 1 of 1

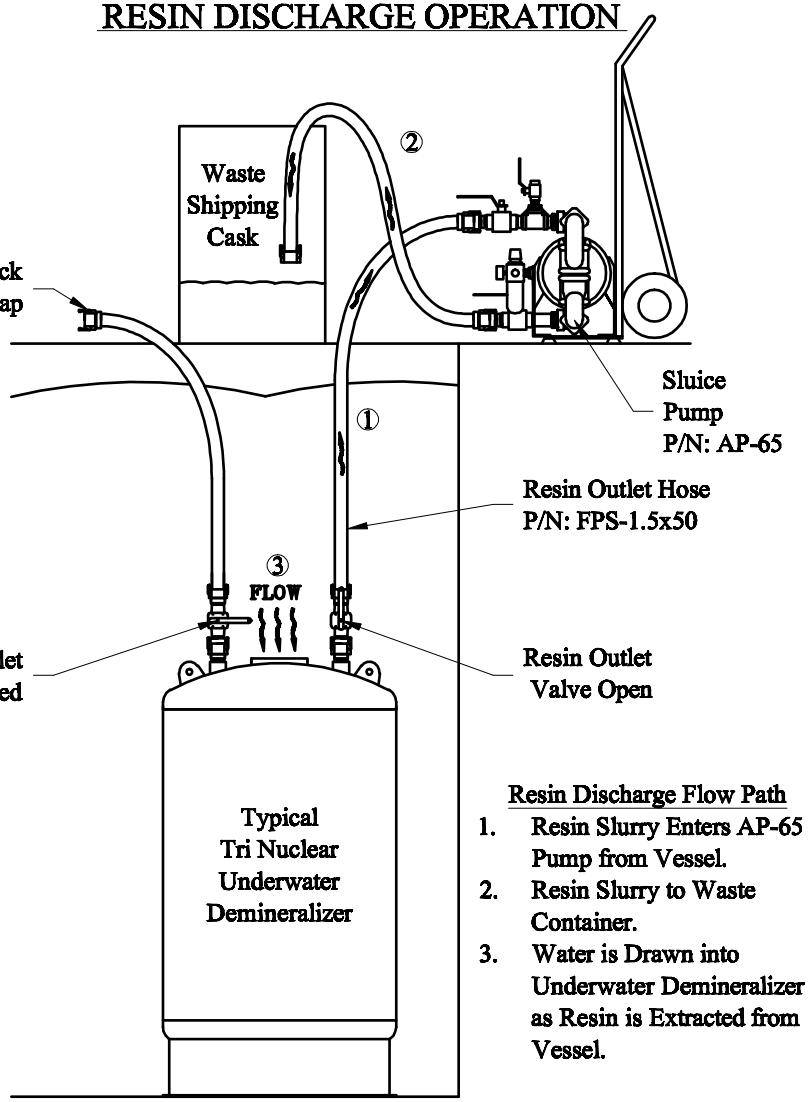
RESIN FILL OPERATION



Resin Fill Flow Path

1. New Resin Enters AP-65 Pump from Drum.
2. Resin Slurry to Underwater Demineralizer.
3. Water is Displaced out of Underwater Demineralizer as Resin Fills Vessel.

RESIN DISCHARGE OPERATION



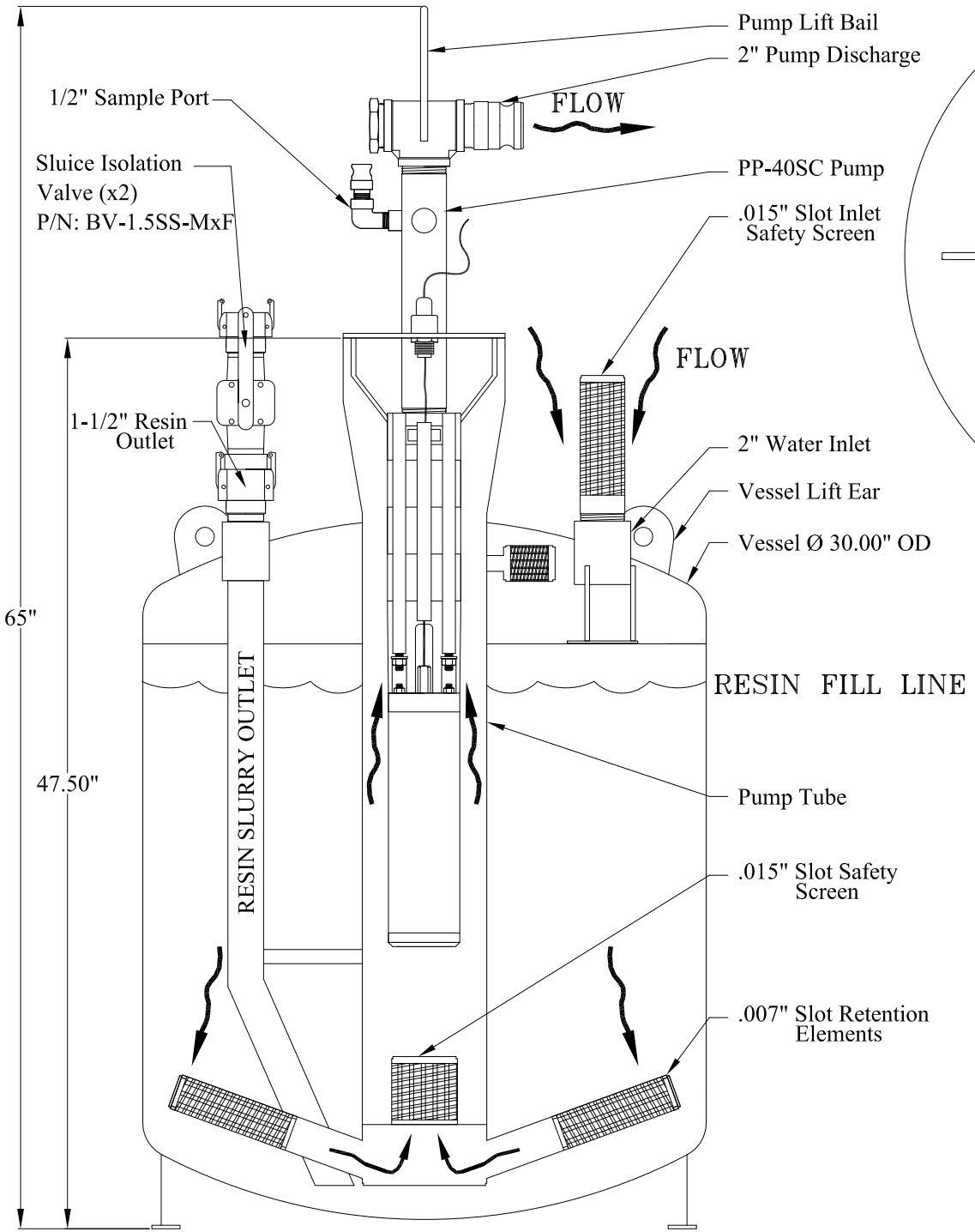
Resin Discharge Flow Path

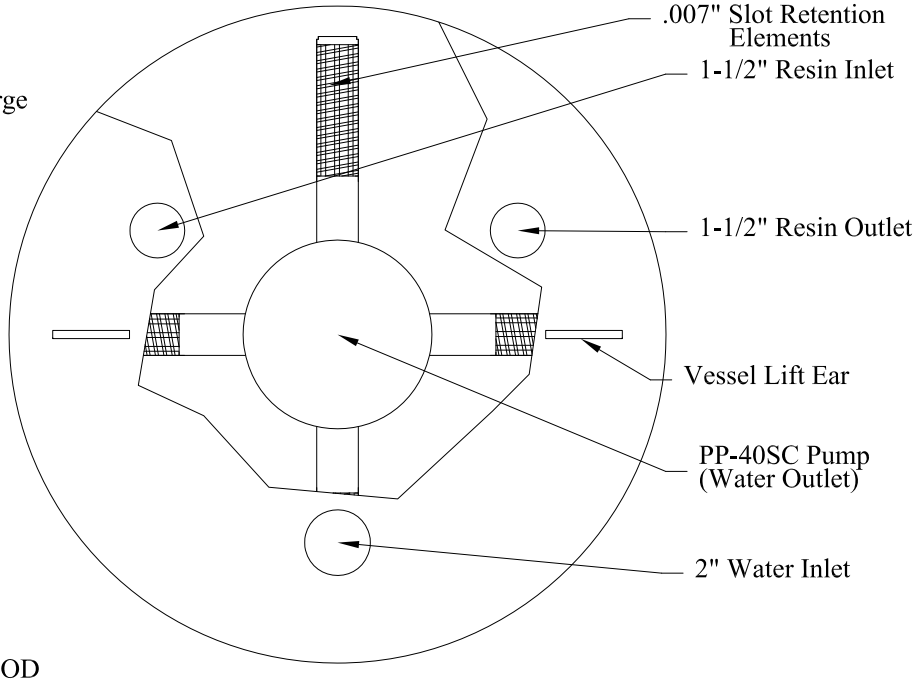
1. Resin Slurry Enters AP-65 Pump from Vessel.
2. Resin Slurry to Waste Container.
3. Water is Drawn into Underwater Demineralizer as Resin is Extracted from Vessel.

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

Typical Underwater Demineralizer Sluice Operation Schematic

Model No. -	Drawn Rick Russell Date 11/07/11	Brochure
Dwg. TNC-088-02	Apv'd James L. Warden Date 11/22/11	Rev. - Page 1 of 1





General Specifications:

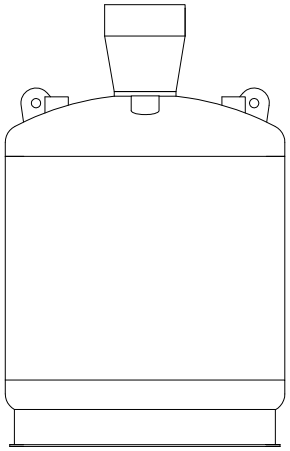
- Vessel Design per A.S.M.E. Boiler & Pressure Vessel Code, Section VIII, Div I. (Not Code Stamped)
- Lifting Certified per NUREG-0612 / ANSI N14.6
- Designed to be Sluiced In/Out while Submerged in Pool.
- All Material: 304L Stainless Steel
- Resin Capacity: 10 Cu. Ft.
- Power Requirements: 1-1/2HP, 460V, 3 PH, 60 Hz, 3.7A
- Design Flow Rate: 40 GPM
- Design Pressure: 50 PSIG
- Vessel Empty/Dry with Pump: 250 lbs.
- Vessel Full of Resin/Water with Pump: 1,100 lbs.

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

Underwater Demineralizer
30" OD, 40 GPM, 10 CU. FT. Capacity

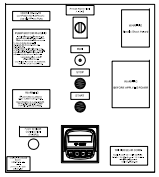
Model No. UD-30A	Rev Rick Russell Date 08/25/17	Brochure	
Dwg. TNC-011-02	Apv'd James L. Warden Date 08/30/17	Rev. D	Page 1 of 3

UD-30A-Inlet Inlet Screen

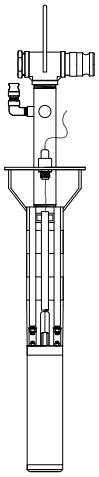


UD-30A-V Vessel

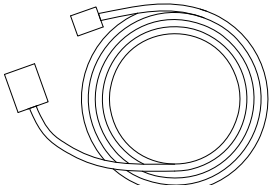
UD-30A-V Vessel



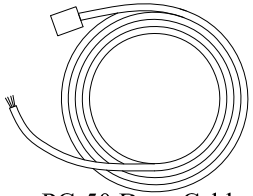
CB-40-FM
Phase Reversing Control Box
with Integral Flow Meter



PP-40SC Pump

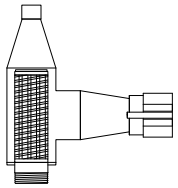


PSC-100P Power Cord
with Twistlock Plug

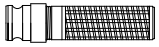


PC-50 Drop Cable
with Twistlock Plug

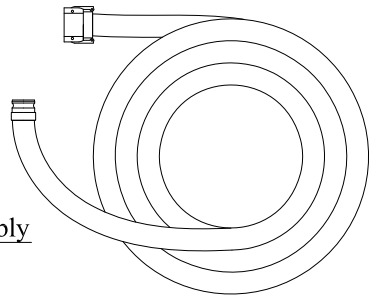
PP-100SC Pump



SHCK-SSVA-2x2
Safety Screen Vent Assembly



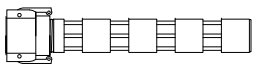
SHCK-JS-2x6
Johnson Screen Strainer



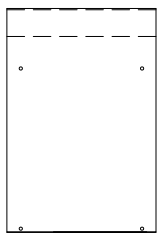
PH-2x50 Suction Hose

SHCK-UD-30A Suction Hose Conversion Kit

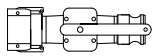
FM-SRD Flow Sensor



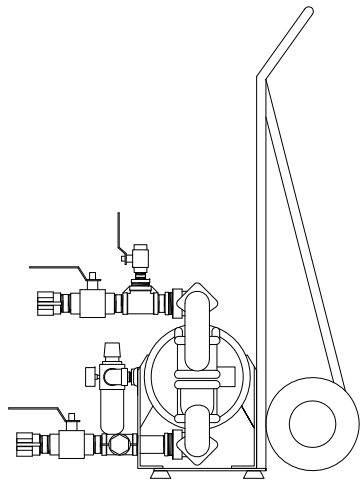
UT-8A 2" Diffuser Pipe



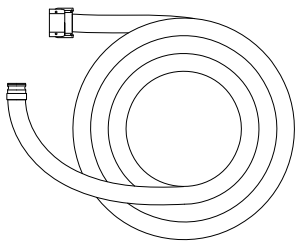
UT-10C Mounting Panel



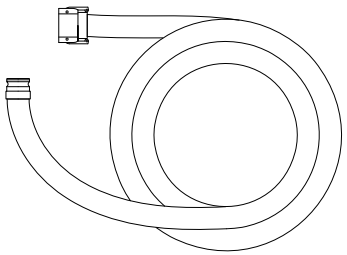
BV-1.5SS-MxF
Sluice Isolation Valve
Qty: 2



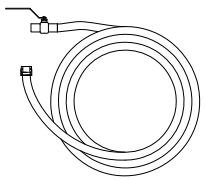
AP-65 Sluice Pump
NOTE: Not supplied with system.



FPS-1.5x50 Sluice Hose
Qty: 2



PH-2x25 Discharge Hose



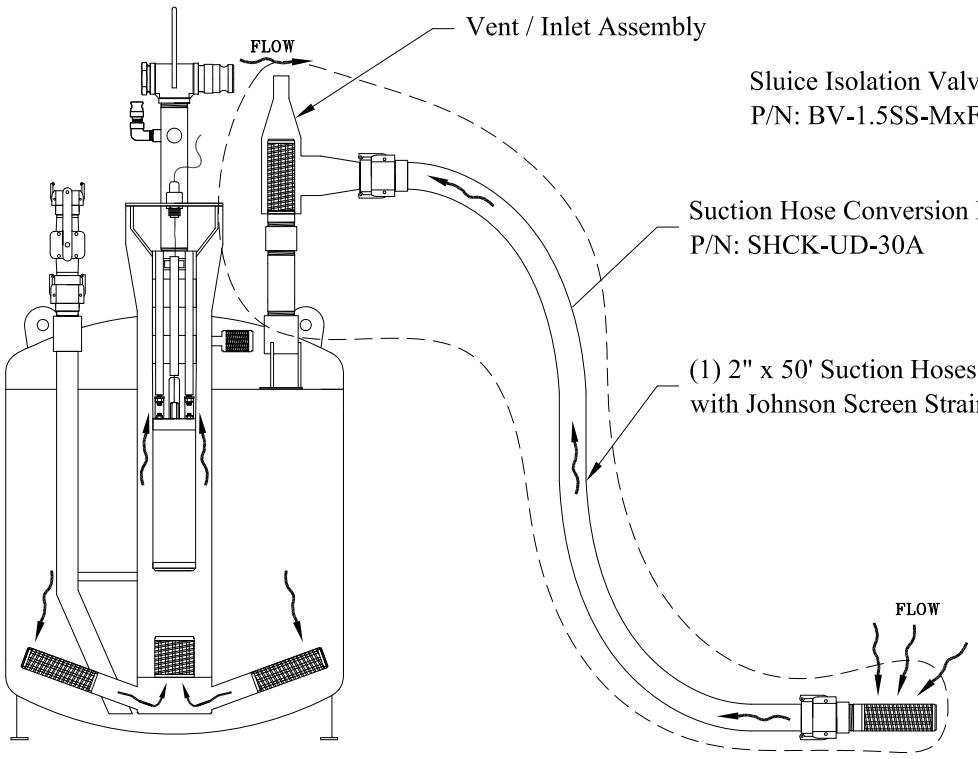
SH-.5x100 Sample Hose

NOTE:
All Items Shown come with the UD-30A in listed quantity except as noted.

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

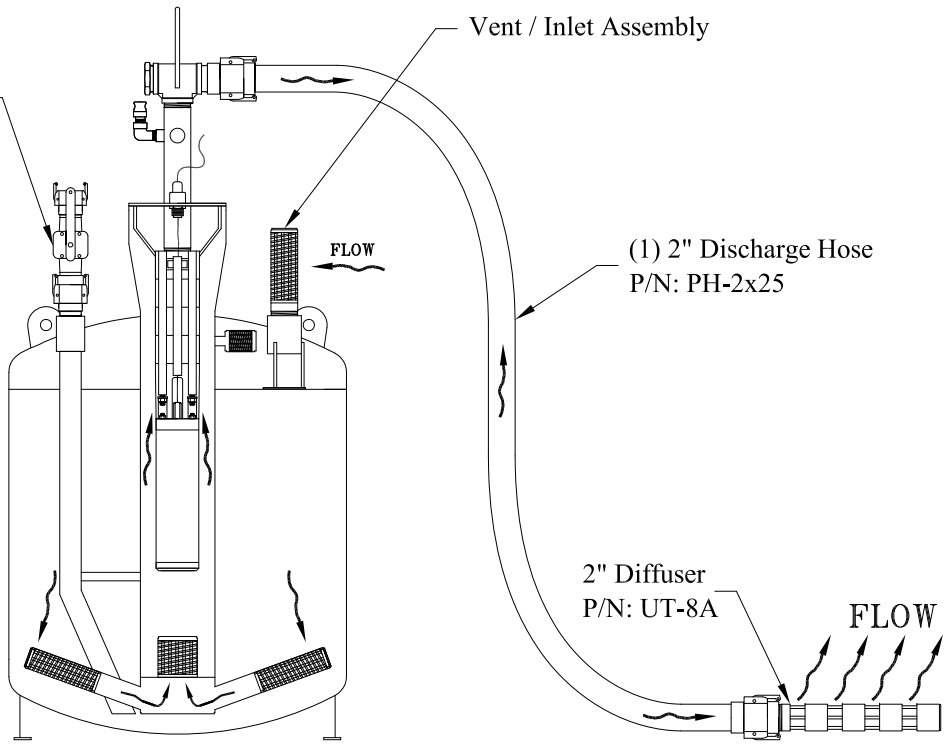
UD-30A System
Modes of Operation

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



"OPTIONAL"
SUCTION HOSE OPERATIONS

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



"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.

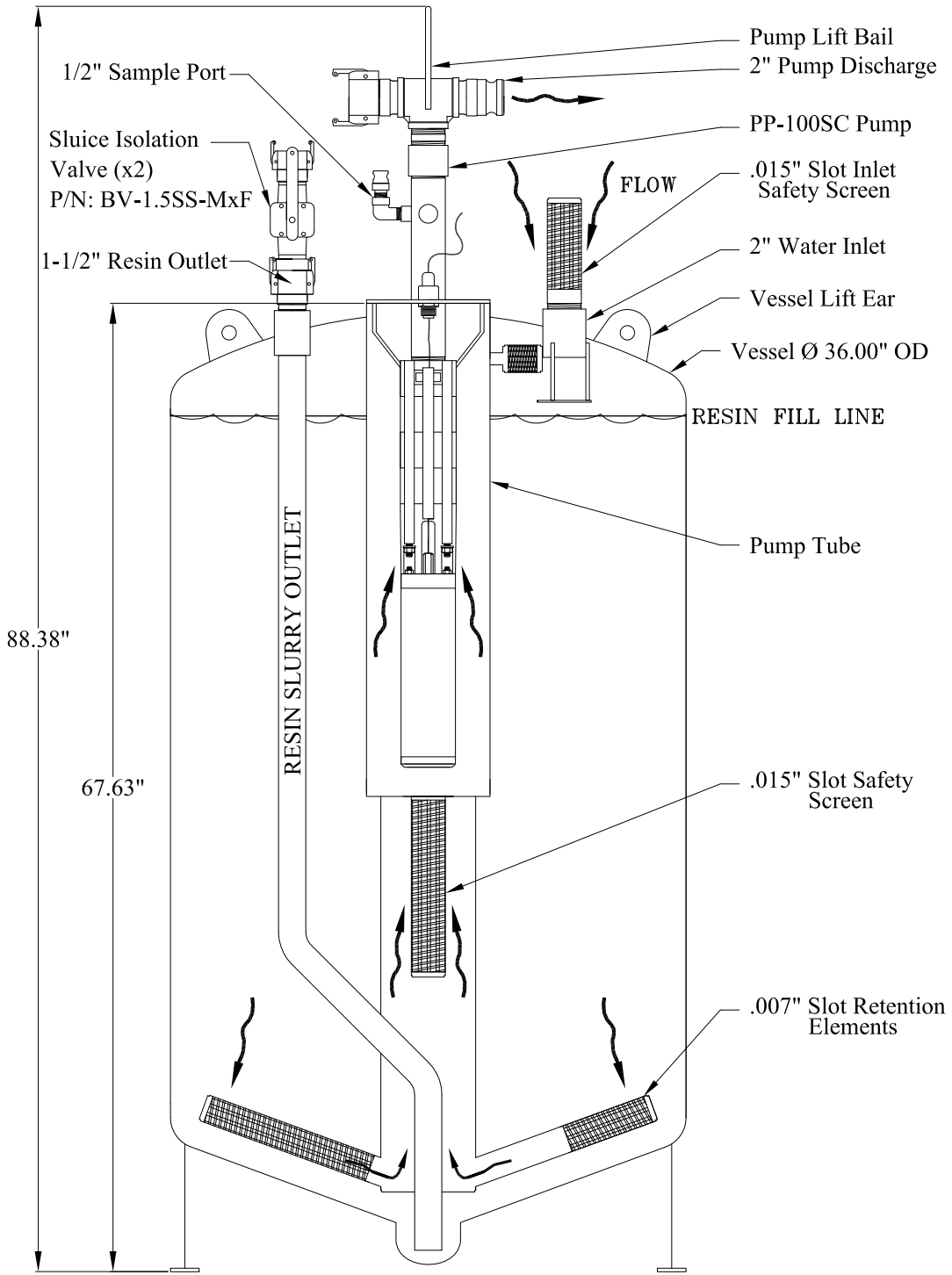
*SHCK-UD-30A Includes:

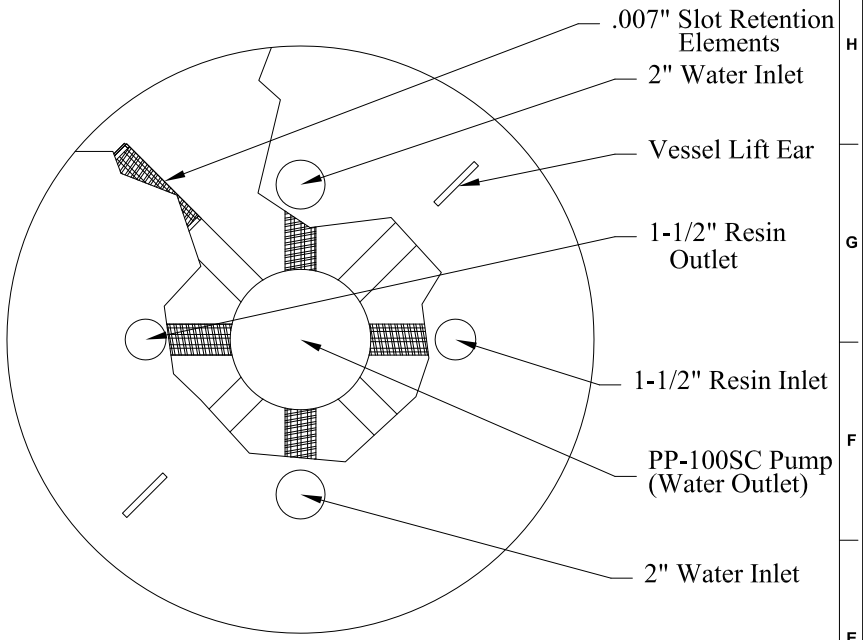
- (1) Safety Screen Vent Assembly, P/N: SHCK-SSVA-2x2
- (1) Suction Hose, P/N: PH-2x50
- (1) Johnson Screen Strainer, P/N: SHCK-JS-2x6

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

UD-30A System
Modes of Operation

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





General Specifications:

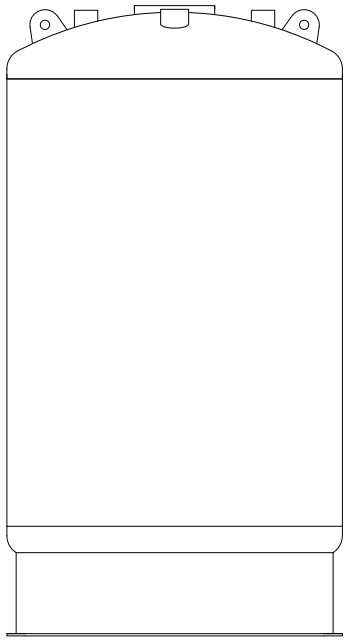
- Vessel Design per A.S.M.E. Boiler & Pressure Vessel Code, Section VIII, Div I. (Not Code Stamped)
- Lifting Certified per NUREG-0612
- Designed to be Sluiced In/Out while Submerged in Pool.
- All Material: 304 Stainless Steel
- Resin Capacity: 28 Cu. Ft.
- Power Requirements: 2HP, 460V, 3 PH, 60 Hz, 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

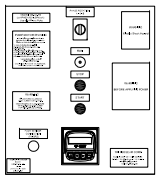
Model No. UD-36A	Rev. Rick Russell Date 08/25/17	Brochure	
Dwg. TNC-012-02	Apv'd James L. Warden Date 08/30/17	Rev. E	Page 1 of 3

UD-36A-Inlet Inlet Screen
Qty: 2

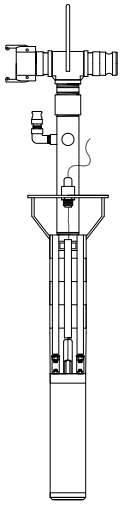


UD-36A-V Vessel

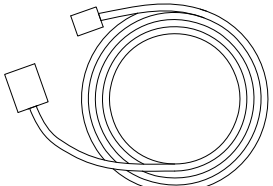
UD-36A-V Vessel



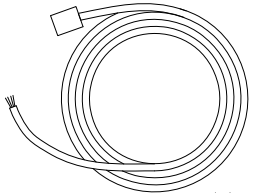
CB-100-FM
Phase Reversing Control Box
with Integral Flow Meter



PP-100SC Pump

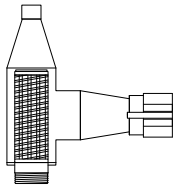


PSC-100P Power Cord
with Twistlock Plug

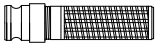


PC-50 Drop Cable
with Twistlock Plug

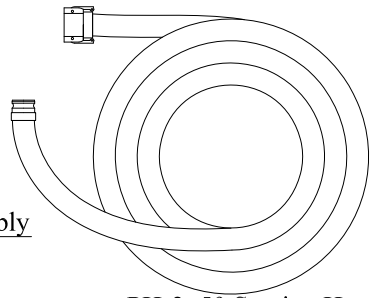
PP-100SC Pump



SHCK-SSVA-2x2
Safety Screen Vent Assembly
Qty: 2



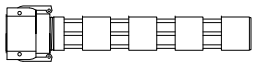
SHCK-JS-2x6
Johnson Screen Strainer
Qty: 2



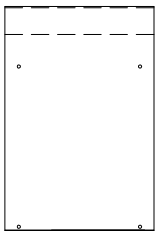
PH-2x50 Suction Hose
Qty: 2

SHCK-UD-36A Suction Hose Conversion Kit

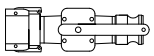
FM-SRD Flow Sensor



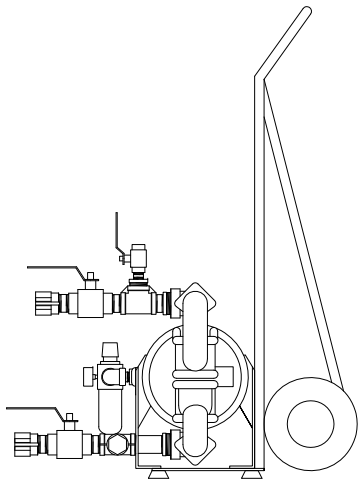
UT-8A 2" Diffuser Pipe



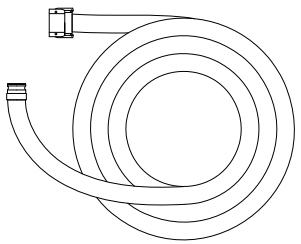
UT-10C Mounting Panel



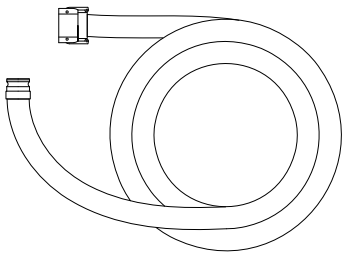
BV-1.5SS-MxF
Sluice Isolation Valve
Qty: 2



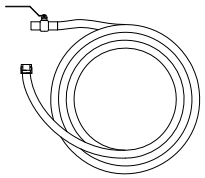
AP-65 Sluice Pump
NOTE: Not supplied with system.



FPS-1.5x50 Sluice Hose
Qty: 2



PH-2x25 Discharge Hose



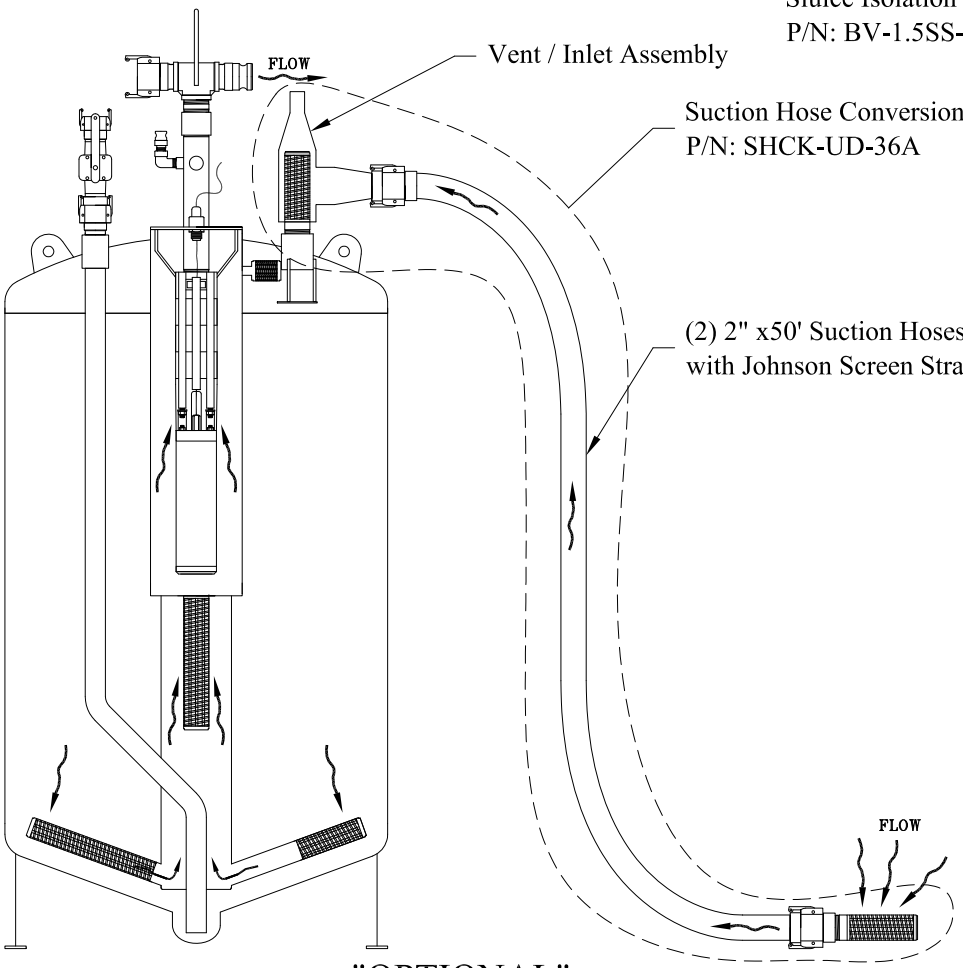
SH-.5x100 Sample Hose

NOTE:
All Items Shown come with the UD-36A in listed quantity except as noted.

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

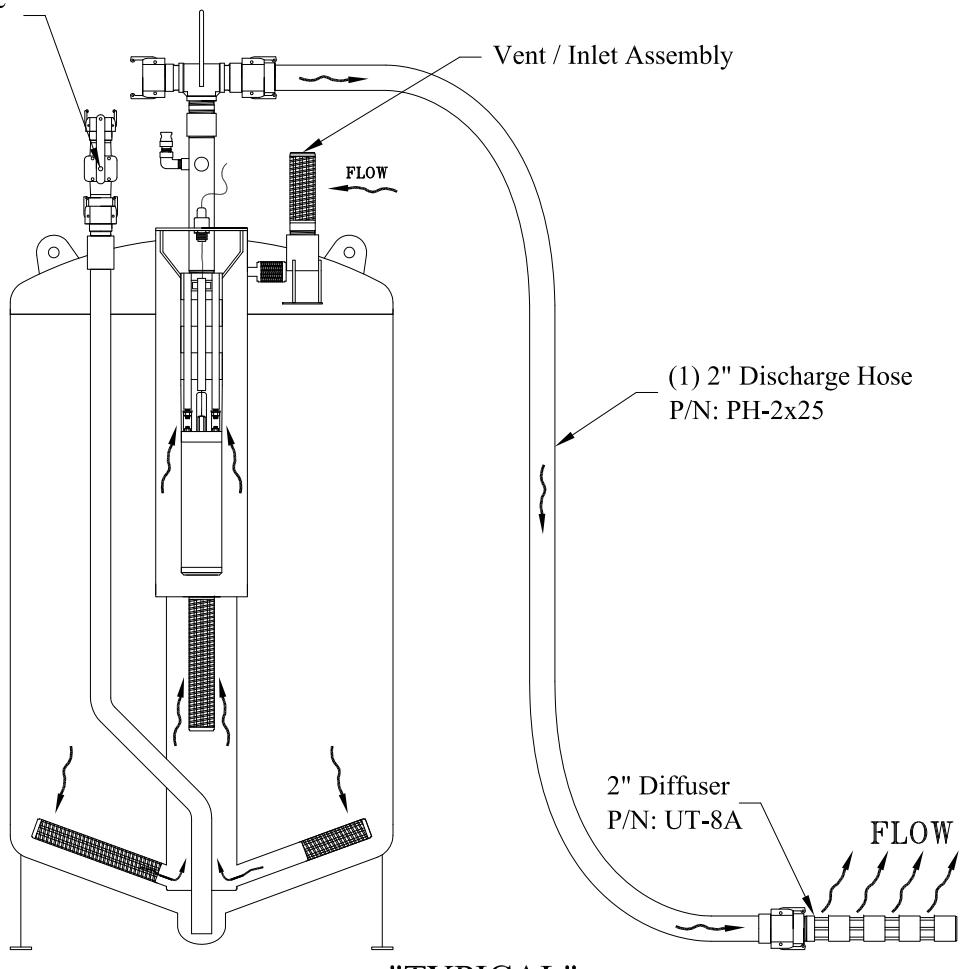
UD-36A System
Part Identification

Model No.	Dwg.	Rev.	Page
UD-36A	TNC-012-02	E	2 of 3



"OPTIONAL"
SUCTION HOSE OPERATIONS

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



"TYPICAL"
DISCHARGE HOSE OPERATIONS

NOTE: UD-36A 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.

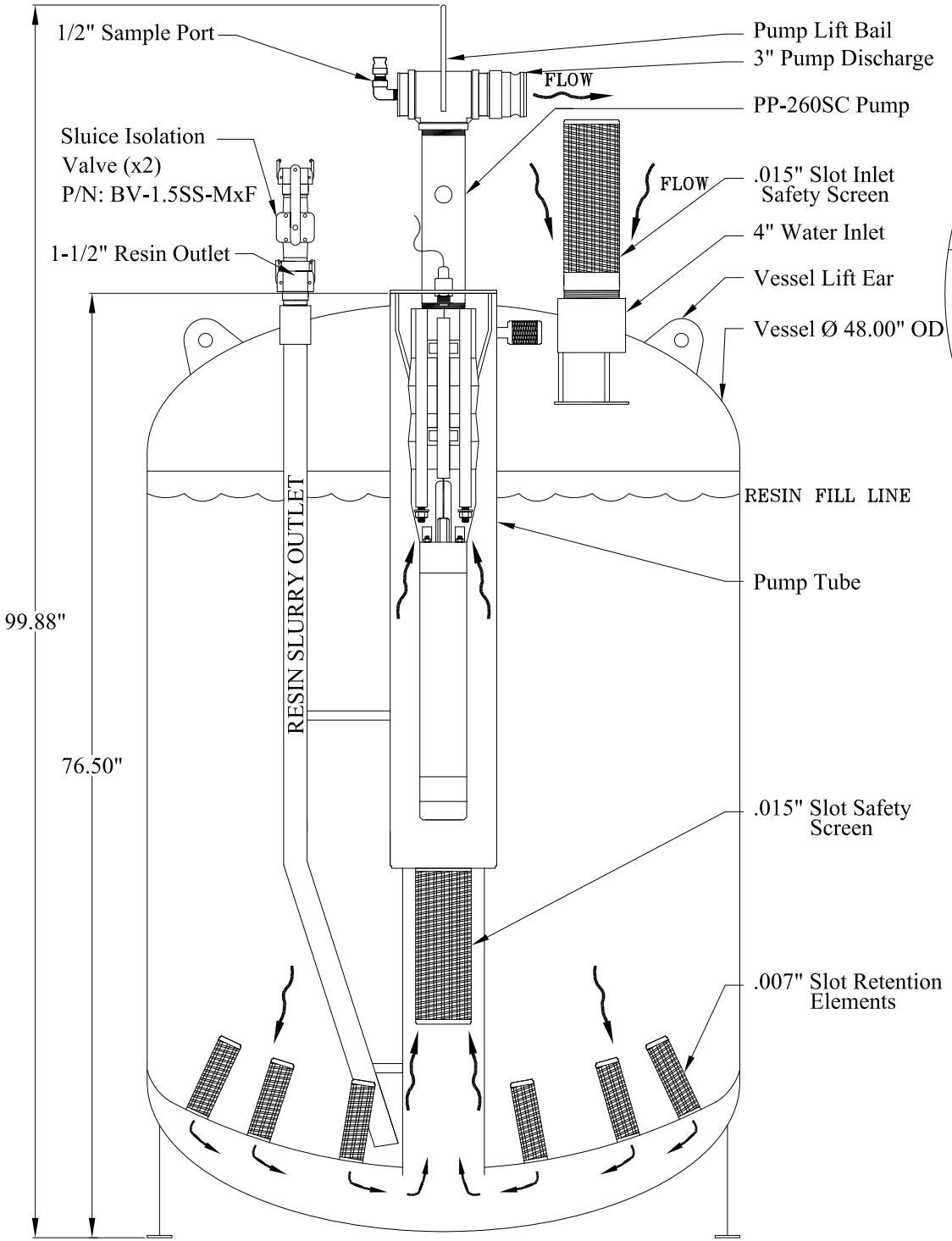
*SHCK-UD-36A Includes:

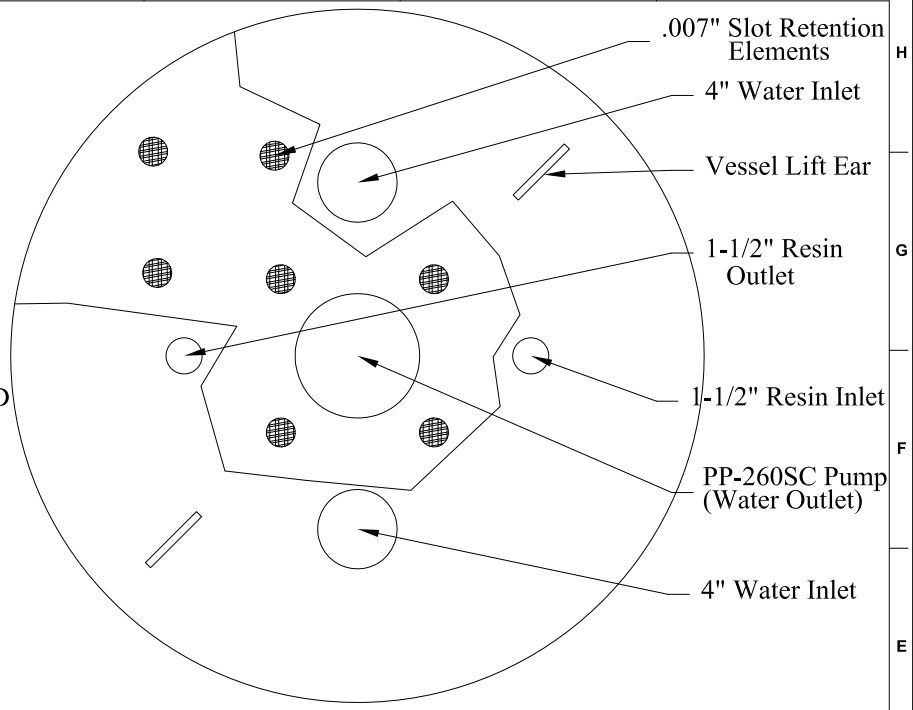
- (2) Safety Screen Vent Assembly, P/N: SHCK-SSVA-2x2
- (2) Suction Hose, P/N: PH-2x50
- (2) Johnson Screen Strainer, P/N: SHCK-JS-2x6

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

UD-36A System
Modes of Operation

Model No.	Dwg.	Rev.	Page
UD-36A	TNC-012-02	E	3 of 3





General Specifications:

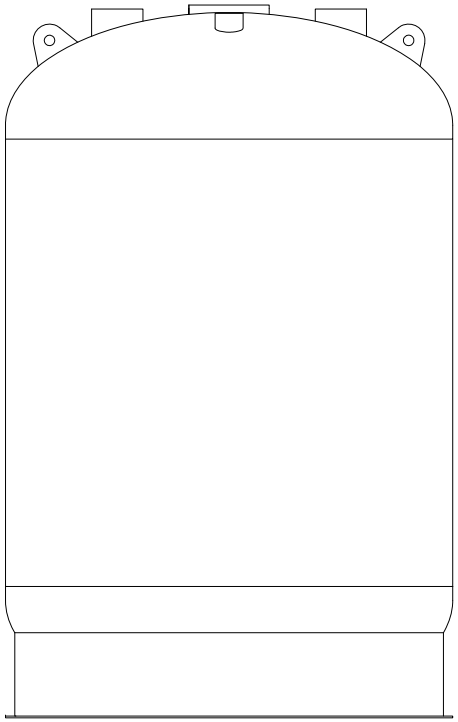
- Vessel Design per A.S.M.E. Boiler & Pressure Vessel Code, Section VIII, Div I. (Not Code Stamped)
- Lifting Certified per NUREG-0612
- Designed to be Sluiced In/Out while Submerged in Pool.
- All Material: 304L Stainless Steel
- Resin Capacity: 50 Cu. Ft.
- Power Requirements: 5HP, 460V, 3 PH, 60 Hz, 9.9A
- Design Flow Rate: 200 GPM
- Design Pressure: 50 PSIG
- Vessel Empty/Dry with Pump: 1,275 lbs.
- Vessel Full of Resin/Water with Pump: 5,750 lbs.

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

Underwater Demineralizer
48" OD, 200 GPM, 50 CU. FT. Capacity

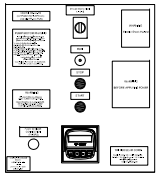
Model No. UD-48A	Rev. Rick Russell Date 08/25/17	Brochure	
Dwg. TNC-013-02	Apv'd James L. Warden Date 08/30/17	Rev. C	Page 1 of 3

UD-48A-Inlet Inlet Screen
Qty: 2

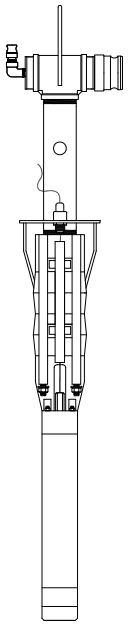


UD-48A-V Vessel

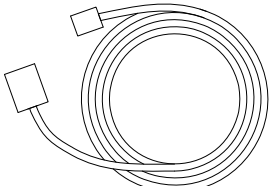
UD-48A-V Vessel



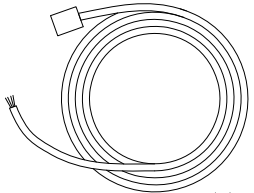
CB-260-FM
Phase Reversing Control Box
with Integral Flow Meter



PP-260SC Pump

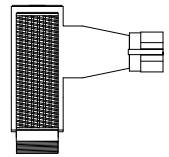


PSC-100P Power Cord
with Twistlock Plug



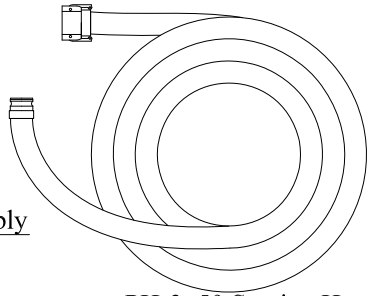
PC-50 Drop Cable
with Twistlock Plug

PP-260SC Pump



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

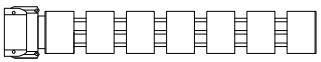
SHCK-JS-4x12
Johnson Screen Strainer
Qty: 2



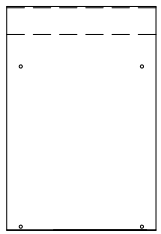
PH-3x50 Suction Hose
Qty: 2

SHCK-UD-48A Suction Hose Conversion Kit

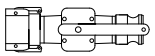
FM-SRD Flow Sensor



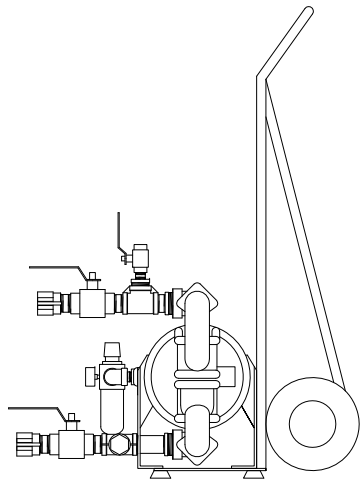
UT-8 3" Diffuser Pipe



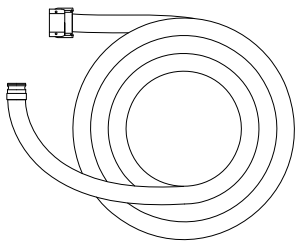
UT-10C Mounting Panel



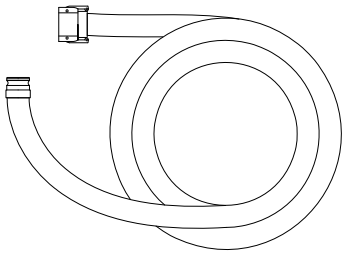
BV-1.5SS-MxF
Sluice Isolation Valve
Qty: 2



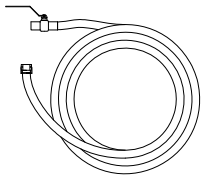
AP-65 Sluice Pump
NOTE: Not supplied with system.



FPS-1.5x50 Sluice Hose
Qty: 2



PH-3x25 Discharge Hose



SH-.5x100 Sample Hose

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

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

UD-48A System Part Identification

Model No.	Dwg.	Rev.	Page
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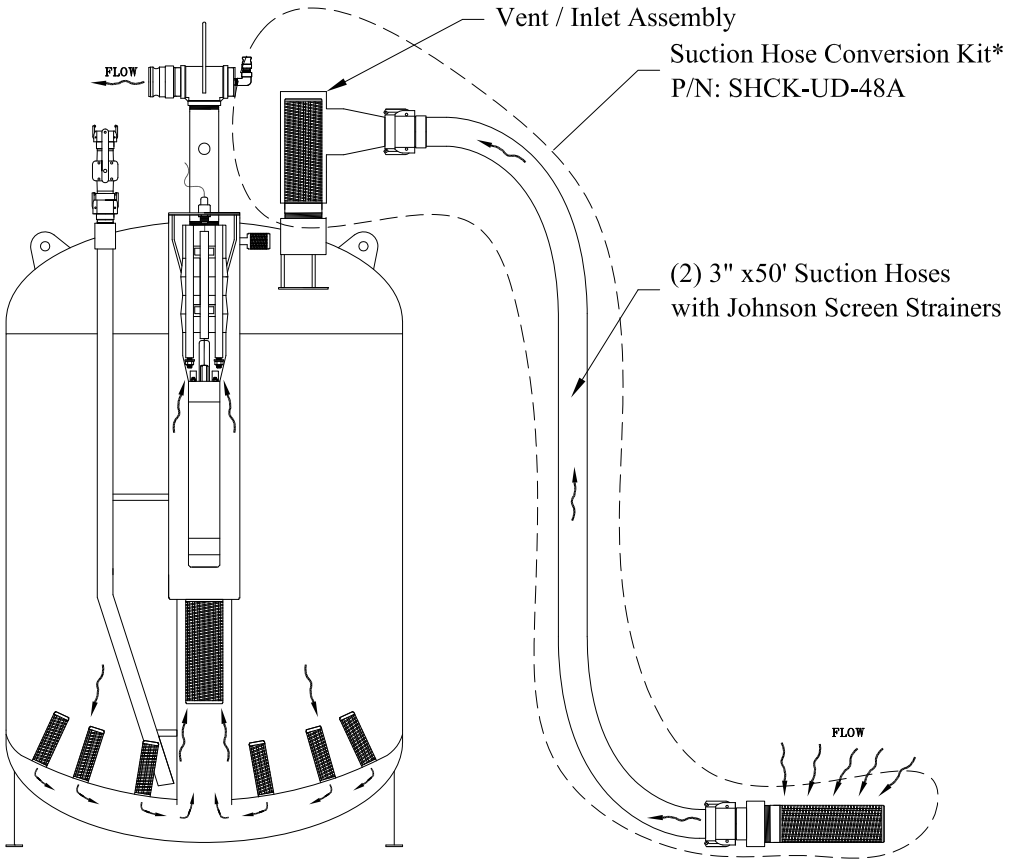
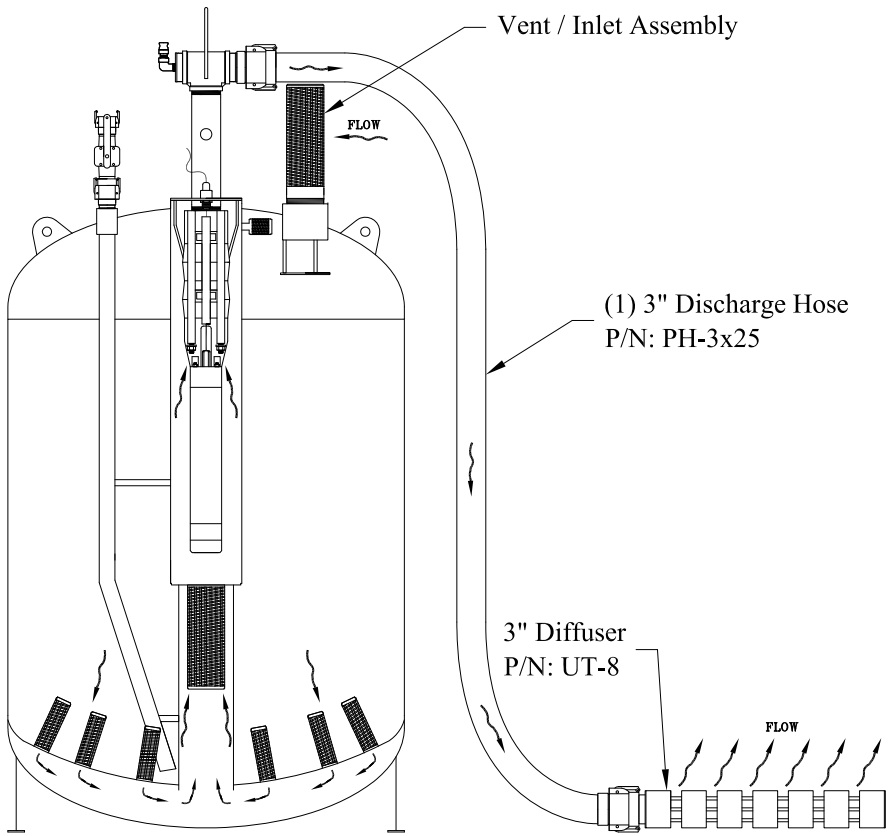


"OPTIONAL"
SUCTION HOSE OPERATIONS

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



"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.

*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

Tri Nuclear Corp.
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UD-48A System
Modes of Operation

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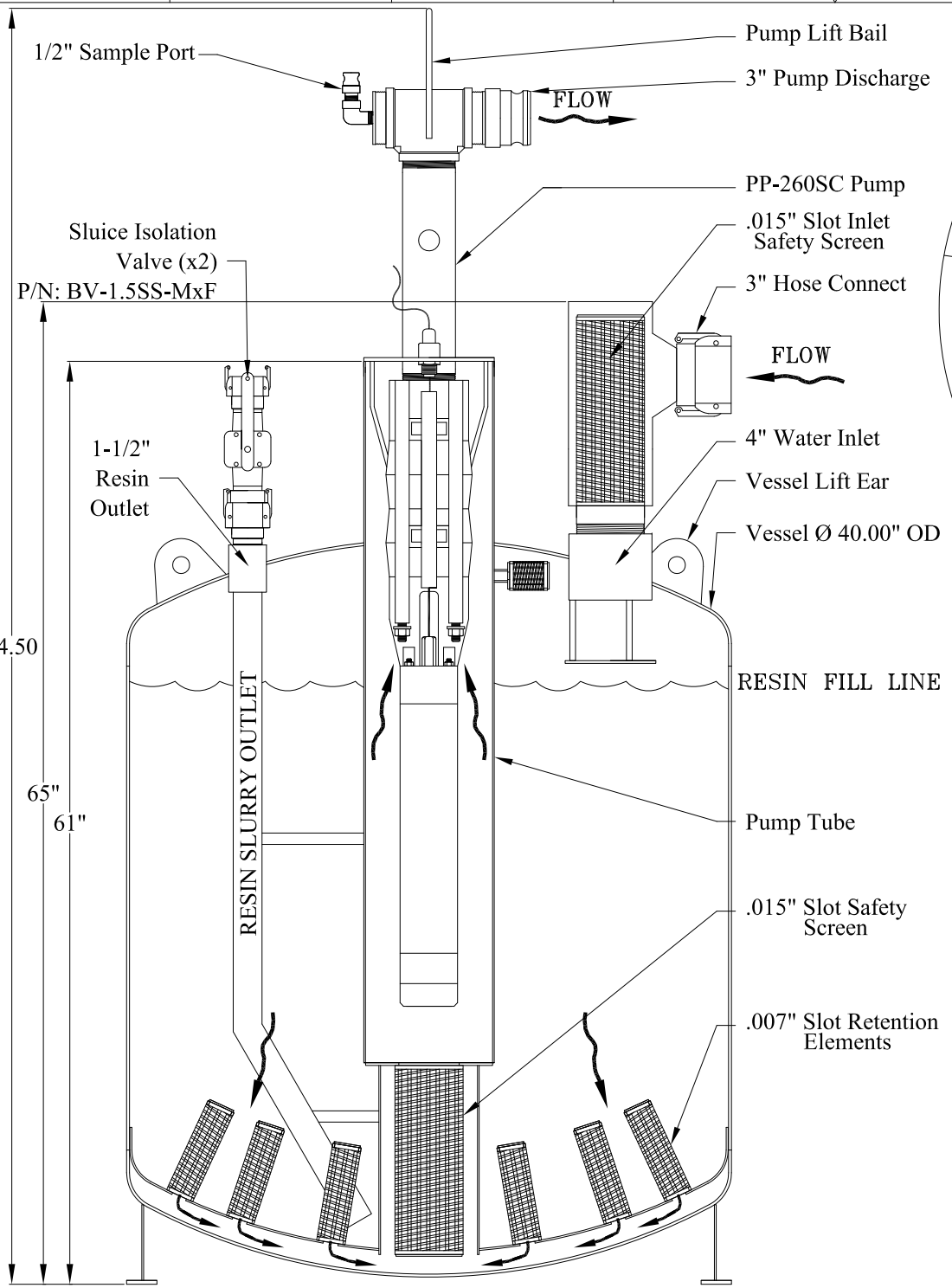
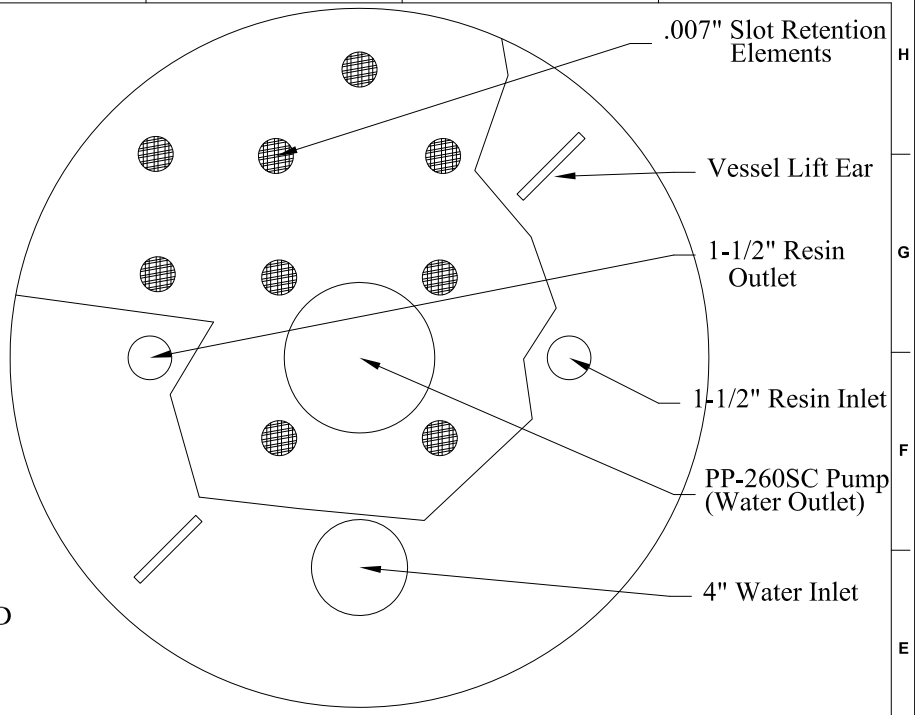




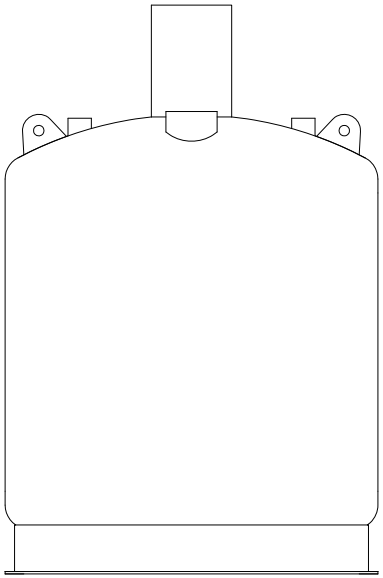
General Specifications:

- 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: 304L Stainless Steel
- Resin Capacity: 25 Cu. Ft.
- Power Requirements: 5HP, 460V, 3 PH, 60 Hz, 9.9A
- Design Flow Rate: 200 GPM
- Design Pressure: 50 PSIG
- Vessel Empty/Dry with Pump: 800 lbs.
- Vessel Full of Resin/Water with Pump: 2,800 lbs.

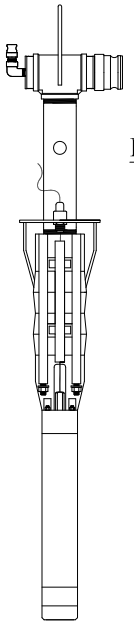
Tri Nuclear Corp.
P.O. Box 1130, Ballston Lake, NY 12019

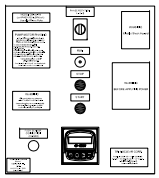
Underwater Demineralizer
40" OD, 200 GPM, 25 CU. FT. Capacity

Model No. UD-40A	Drawn Rick Russell Date 09/22/17	Brochure	
Dwg. TNC-157-02	Apv'd James L. Warden Date 09/26/17	Rev. -	Page 1 of 3

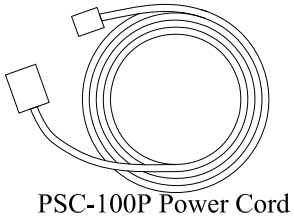


UD-40A-V Vessel

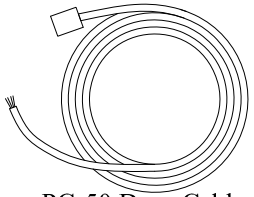




CB-260-FM
Phase Reversing Control Box
with Integral Flow Meter



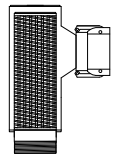
PSC-100P Power Cord
with Twistlock Plug



PP-260SC Pump

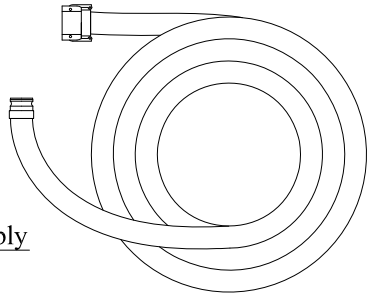
PC-50 Drop Cable
with Twistlock Plug

PP-260SC Pump



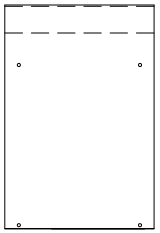
SHCK-SSVA-3x4
Safety Screen Vent Assembly

SHCK-JS-4x12
Johnson Screen Strainer



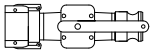
PH-3x50 Suction Hose

SHCK-UD-40A Suction Hose Conversion Kit

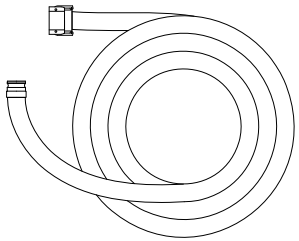


UT-10C Mounting Panel

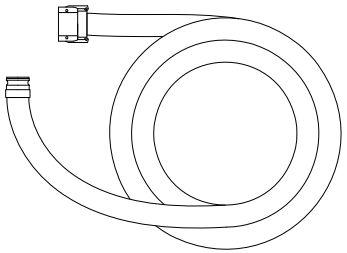
FM-SRD Flow Sensor



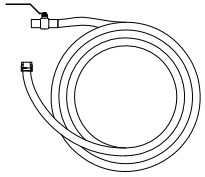
BV-1.5SS-MxF
Sluice Isolation Valve
Qty: 2



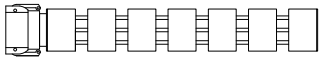
FPS-1.5x50 Sluice Hose
Qty: 2



PH-3x25 Discharge Hose



SH-.5x100 Sample Hose



UT-8 3" Diffuser Pipe

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

UD-40A System
Part Identification

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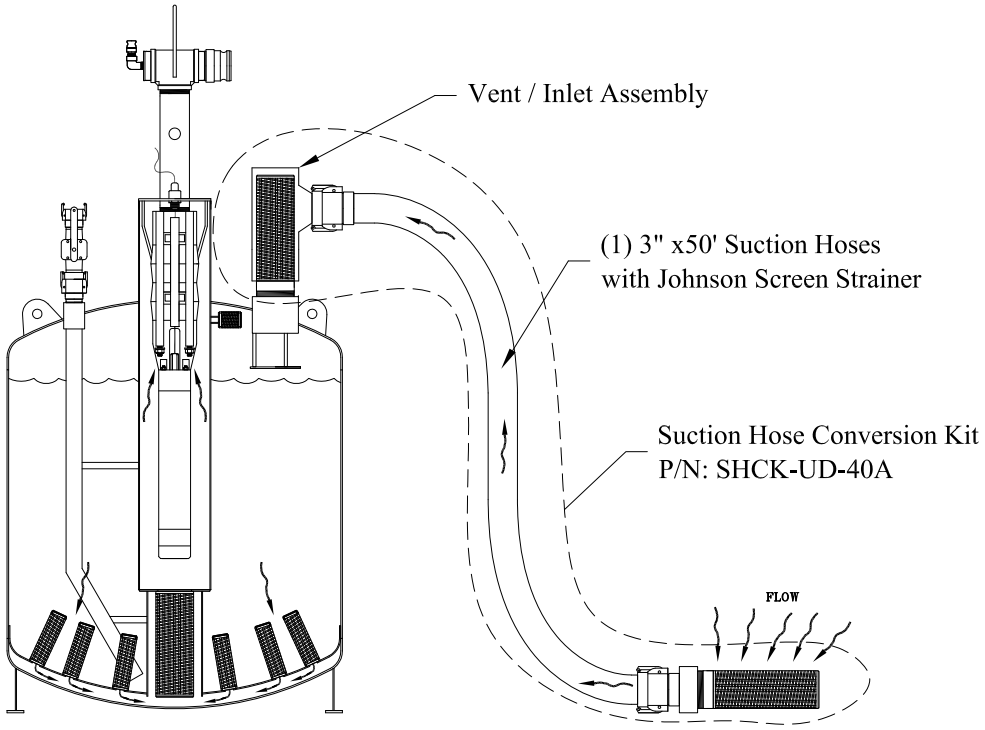
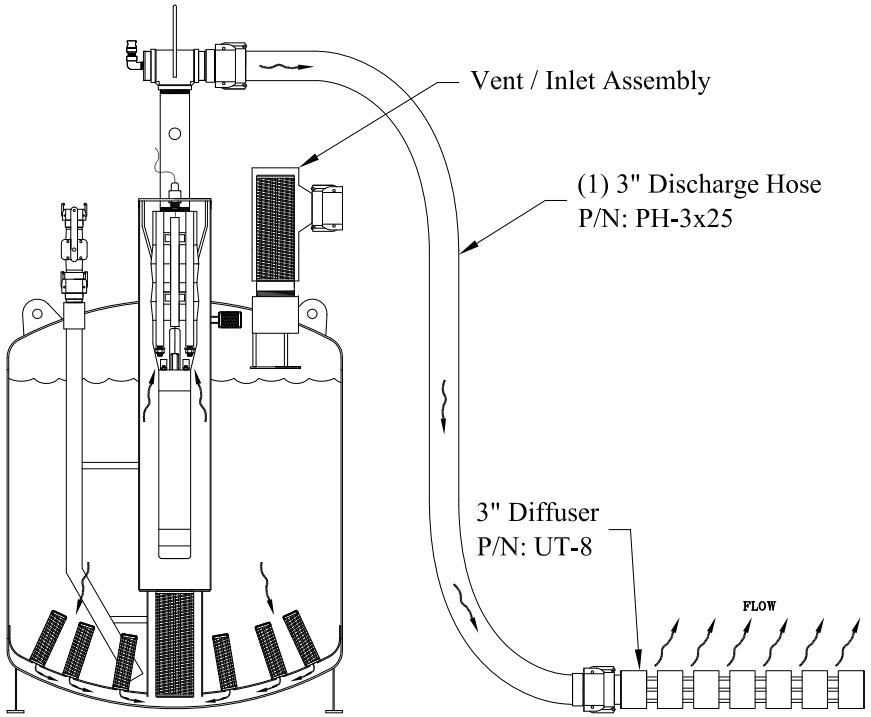


EDM COLLECTION OPERATIONS
(Suction Hose Attached)



SFP OPERATIONS
(Discharge Hose Attached)

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UD-40A System
Modes of Operation

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