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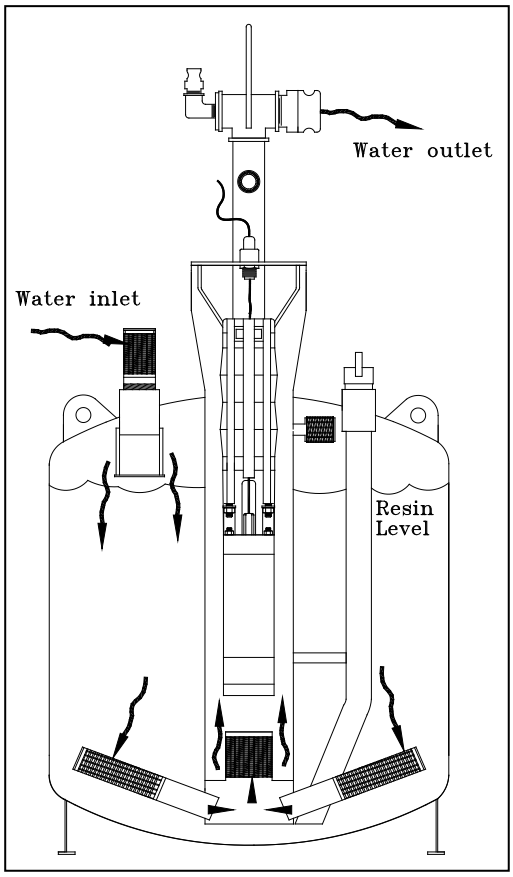
Underwater Demineralizer

Model UD-30A

Operating Instructions



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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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UNDERWATER DEMINERALIZER
(Model UD-30A)

Assembly and Operating Instructions

1.0 INTRODUCTION

The Underwater Demineralizer Model UD-30A is a self-contained, portable Underwater Demineralizer System, 30in dia with at resin capacity of $10ft^3$, and is designed to operate in the spent fuel pool or reactor cavity. The UD-30A's unique design allows for the demineralizer to be operated underwater and under negative pressure. The pump seals with a simple flat cover plate held in place by negative pressure during operation.

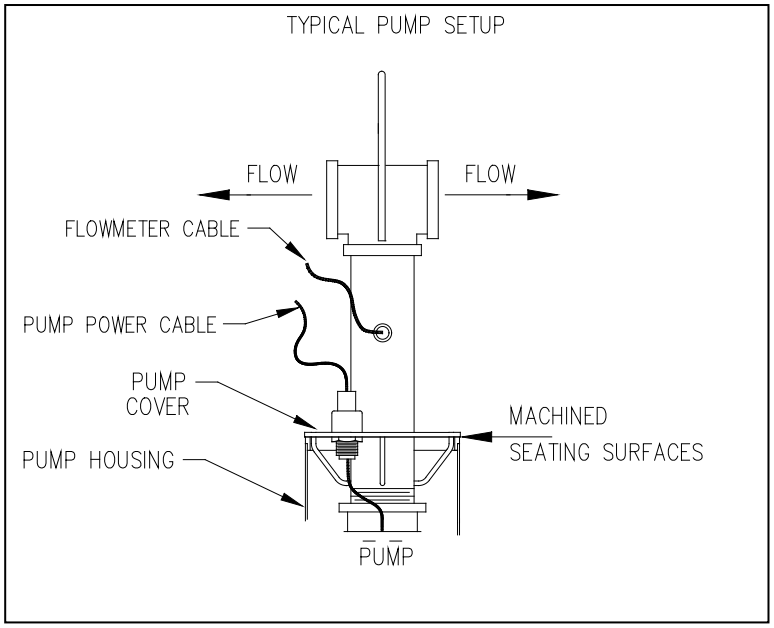

Figure 1.1

One of the many benefits of this design is that it requires no special tooling to install or remove a pump underwater. With the pump installed correctly in the pump tube, the weight of the pump keeps it secure during normal operation.

This procedure covers the initial installation and start-up of the unit and normal underwater operations. A separate procedure, OI-36 - General Underwater Sluicing Procedure, covers the initial loading of resin and subsequent sluicing operations. It is expected that trained and qualified personnel will operate the unit. Radiological considerations and requirements are not included in this document, which may vary between stations, and should be specifically addressed by the end user organization.

1.1 Equipment Guide List

The following is the Equipment Guide List for the Underwater Demineralizer System Model UD-30A:

STANDARD Equipment
Shipped with the UD-30A

TNC Part Number	Description	Qty
UD-30A-V	Basic Demineralizer vessel for the UD-30A system, 30" dia, 10ft^3 resin capacity, Certified to NUREG-0612 & ANSI N14.6	1
PP-100SC	Grundfos pump, 1-1/2 HP/460V/3Ph/60Hz, w/cover, SC connector, CB PR-40-4XP PHASE REVERSING control box with twist lock plugs, PSC-100P Power Cable with twist lock plug and PC-50 drop cable with twist lock plug	1
FM-100	Flow Meter Kit, includes 0-200 GPM analog meter and paddlewheel flow sensor w/100 ft cable	1
PH-2x25	2" x 25' hose with Polypro MxF camlock couplers	1
UT-8A	Diffuser Pipe for 2" discharge hose	1
UT-10A	Mounting Panel for Flow Meter and Control Box	1
SHCK-UD-30A	Suction Hose Conversion Kit for the UD-30A system. Includes the following: (1) Safety Screen Vent Assemblies (P/N: SSVA-2x2) (1) Suction hoses (P/N: PH-2x50) (1) Johnson Screen strainer (P/N: JS-2x6)	1
BV-1.5SS-MxF	1-1/2" SS FP Ball Valve with Male by Locking Female camlock couplers. Includes remote grapple lanyard.	2
FPS-1.5x50	Suction/Discharge hose, 1.5" x 50' lg with SS MxF camlock couplers, 150 PSI	2
SH-.5x100	Sample hose, 1/2" x 100' lg with a 1/2" SS female camlock coupler x 1/2" SS ball valve	1

OPTIONAL Equipment
Recommended for use with the UD-30A

TNC Part Number	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, & 1/4in drain valve.	1
FPS-1.5x25	Suction/Discharge hose, 1.5" x 25' lg with SS MxF camlock couplers, 150 PSI	1

1.2 Materials of Construction

The following is a list of the materials of construction for the Underwater Demineralizer System Model UD-30A:

Tri Nuclear Part No.	Description	Materials of Construction
UD-30A-V	UD-30A Vessel	304SS, 316SS
PP-40SC	1-1/2 HP Grundfos Pump & Motor Assembly	304SS
	CB-PR-40-4XP Phase Reversing Control Box	Fiberglass Enclosure
	PSC-100P Power Cable with twist lock plug (100ft 10/4 SO Cable w/ male twistlock plug)	10/4 SO Cable
	PC-50 drop cable with twist lock plug (50ft 10/4 SO Cable w/ female twistlock connector)	10/4 SO Cable
FM-100	Flow Meter Kit and Paddlewheel Sensor	Polypropylene
PH-2x50 PH-2x25	Suction Hose with MxF camlock couplers	PVC hose with Polypropylene camlock couplers & 304SS crimped sleeves
UT-8A	Diffuser Pipe for 2” discharge hose	304 SS, 316SS female camlock coupler
UT-10A	Mounting Panel for Mounting Panel for Control box and Flow Meter	304 SS
SSVA-2x2	Safety Screen Vent Assembly	304SS, 316SS
JS-2x6	Johnson Screen strainer	304SS, 316SS
BV-1.5SS-MxF	Ball Valve assembly	304SS, 316SS
FPS-1.5x50	Suction/Discharge hose, 1.5” x 50’ lg with SS MxF camlock couplers,	EPDM hose with 316SS camlock couplers & 304SS crimped sleeves
SH-.5x100	Sample hose, 1/2” x 100’ lg with a 1/2" SS female camlock coupler x 1/2" SS ball valve	PVC reinforced hose with 316SS camlock coupler & 316SS ball valve

2.0 EQUIPMENT DESCRIPTION

2.1 UD-30A Vessel

The UD-30A vessel has been designed and built to the ASME Boiler and Pressure Code Section VIII, Div. 1 (but not code stamped). The system outline is shown on brochure drawing TNC-011-02. The vessel has an outside diameter of 30", an overall height of 62" (to the top of the pump lift bail) and an approximate resin capacity of 10 ft^3.

The UD-30A demineralizer top connections include one 2" threaded couplings for installing one safety Johnson screens for water inlet flow (or the suction hose conversion kits), two 1-1/2" male cam-lock couplings (one for resin slurry inlet and one for resin slurry outlet), and a center 8" pipe opening for installing the submersible pump assembly.

The vessel has two lift ears with 1-1/8" dia holes. UD-30A vessels fabricated since June 2012 are load tested and certified to NUREG 0612.

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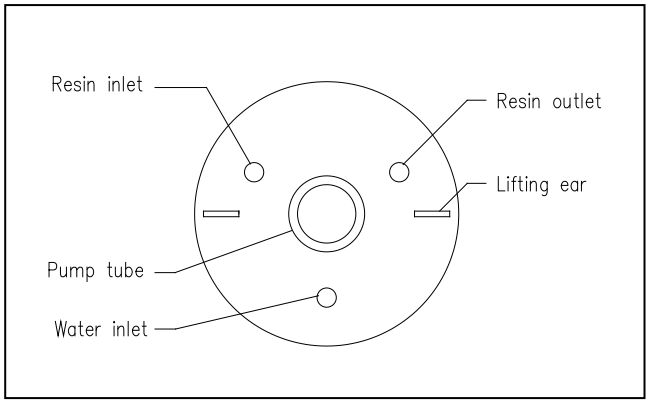


Top view of UD-30A

Standard Operation of the UD-30A (operations *without* suction hose conversion kits installed) See Drawing TNC-011-02:

Unfiltered water from the pool enters thru (1) one water inlet safety screen (.015"). 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. The water travels thru the media bed, and into one of the (4) outlet retention elements (.007") and to a common outlet plenum. There is an additional outlet safety screen (.015") in the pump tube which prevents any resin from escaping in the very unlikely event that a .007" retention element fails.

Water then travels thru the PP-40SC pump and back to the pool thru a 2" x 25ft long hose.

Operation of the UD-30A with suction hoses (operations *with* suction hose conversion kits installed) See Drawing TNC-011-02:

NOTE: This setup is normally used when the plant wants to go after the 'source' of activity in the pool. This typically is the reactor vessel itself.

Unfiltered water from the pool enters thru (1) one water inlet safety screen (.015") attached to the end of (1) one 2" x 50ft hose. Water travels through the suction hoses and into the Safety Screen Vent Assemblies. The Safety Screen Vent Assembly 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. The water travels thru the media bed, and into one of the (4) outlet retention elements (.007") and to a common outlet plenum. There is an additional outlet safety screen (.015") in the pump tube which prevents any resin from escaping in the very unlikely event that a .007" retention element fails.

Water then travels thru the PP-40SC pump and back to the pool through the top of the pump.

Johnson Screen® Retention Elements:
The UD-30A uses Johnson Screens® as the primary and safety screens in the UD-30A. They are spiral wound (Tri Nuclear does not use staked disk or mesh) and are made out of 316L SS "Vee" wire.

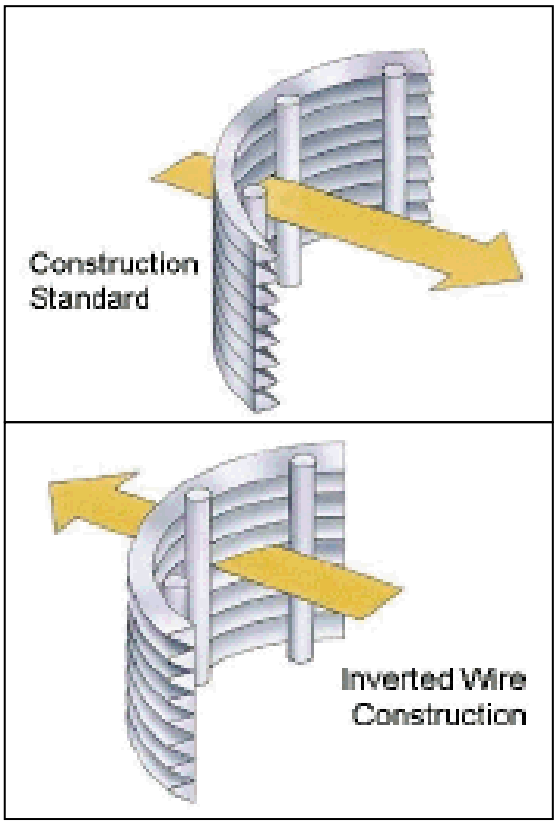
The primary retention element screens are 1-1/2" with .007" slot openings and are of a "standard construction" (see Fig 2.1). They are designed for a uniform distribution flow through the demineralizer bed without any "dead zones" in the bed. These primary retention elements also prevent the escape of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

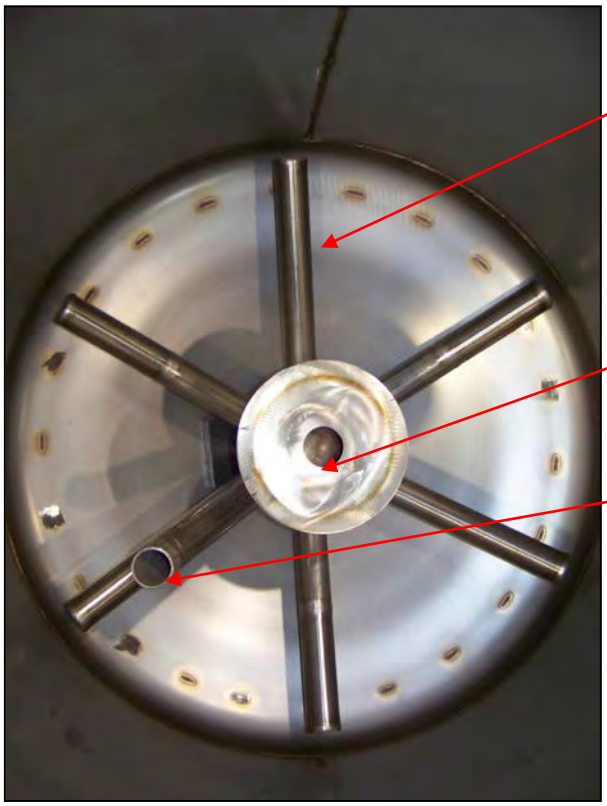
The UD-30A has two different sets of safety screens. The vessel outlet safety screen and the vessel inlet safety screens.

The 2” inlet screen is of “standard construction” with .015” openings between the wires and is designed for outside to inside flow (see Fig 2.1)

The 3” safety screen uses “inverted wire construction” with .015” openings between the wires and is designed for inside to outside flow (see figure 2.2), and is designed to prevent resin migration from the vessel in the highly unlikely change that a primary retention element fails.

The vessel inlet safety screens (for the standard setup and in the safety screen vent assembly) are a 2in “standard construction” Johnson Screen® with .015” openings and is designed to prevent resin migration out of the vessel from the top of the resin bed (a highly unlikely event).





Typical UD-30A/34A/36A
Internal Johnson Screen lateral arrangement.

2.2 SUBMERSIBLE PUMP ASSEMBLY (P/N: PP-40SC) -See TNC-006-02 for details-

The PP-40SC is a five stage, 1-1/2 HP 460V/3Ph/60Hz pump and motor comes assembled and ready for operation. Nominal rated flow through the PP-40SC pump is 40GPM.

The assembly includes the pump cover, discharge piping, the flow sensor tap, top lifting bail and a capped 1/2" sample port. The pump mounted in the pump tube draws water through the demineralizer and discharges filtered water back to the pool. The pump 2" discharge piping has a flow sensor tap for mounting the flow sensor.

A top 2" tee is mounted to the discharge pipe with one 2" male camlock hose connector with an internal orifice plate installed. The other side of the tee is capped. During normal operations a PH-2x25 hose is installed for horizontally directing filtered water away from the suction of the UD-30A and back to the cavity pool. The pump has one 1" hole drilled through an internal check valve to allow for pump drainage when lifting and removing the pump from the pool.

There is a stainless steel electrical disconnect mounted on the pump cover for the 100 ft 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.

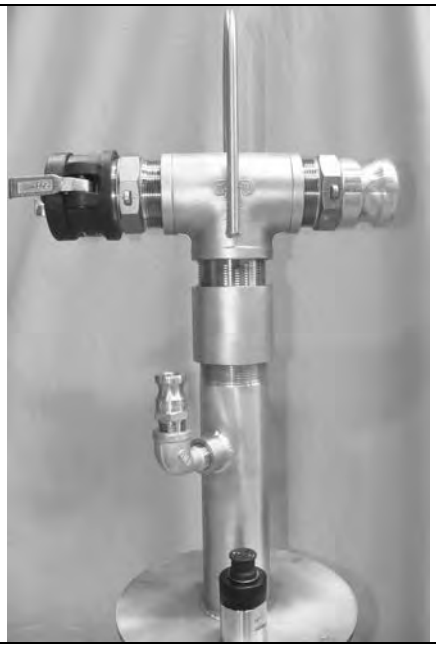
PP-100SC Pump shown with 2in male discharge and 1/2in male sample connect. PP-40SC Pump similar.	

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

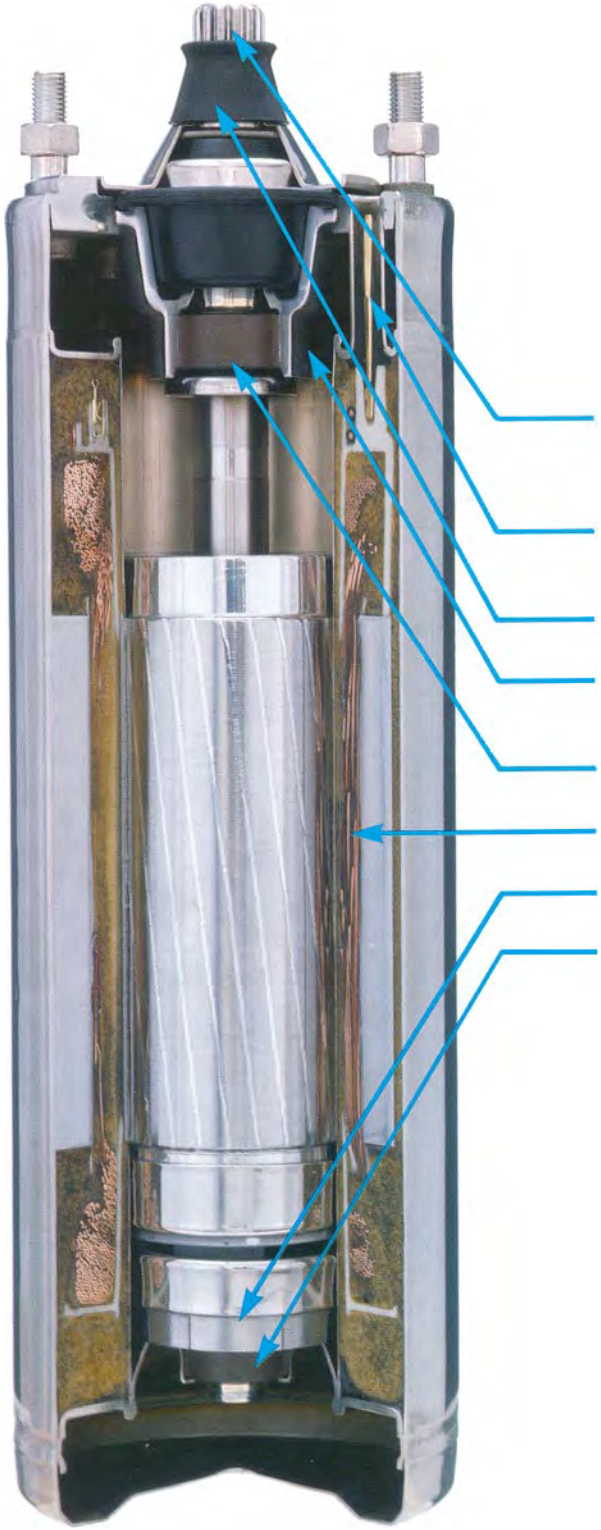
	
Figure 2.2.1 PP-260SC pump cover installed in a UFV-260 Housing UD-36A Similar	Figure 2.2.2 SC-P Seal Plug

2.2.1 Additional Pump/Motor Information:

Additional Information:

Motor Mfgr:	Grundfos
Frame No:	4
Hp:	1-1/2Hp
Voltage:	460 ± 10% VAC (bus voltage: 480 ± 10%)
Phase:	3 Phase
Frequency:	60 ± 5% Hz
Service Factor:	1.30
RPM:	3450
Full Load Amps:	3.7
Starting Amps:	20.1
Efficiency:	Full Load (%) 75
Power Factor:	Full Load (%) 72
Max Thrust:	750lbs
NEMA design:	B
Enclosure:	hermetically sealed (submersible type)
Lubrication:	Water

Figure 2.2.1
PP-40SC
1-1/2HP Grundfos Motor Cut Away View



ONE-PIECE SPLINE SHAFT - Wear resistant, hardened stainless steel ensures maximum resistance to corrosion.

LEADCONNECTOR- 3-wire with ground conforms to National Electrical Code.

SAND SLINGER - Protects against penetration of sand into the motor.

INTERNALCOOLINGCHAMBER- Eliminates the need for a flow inducer sleeve.

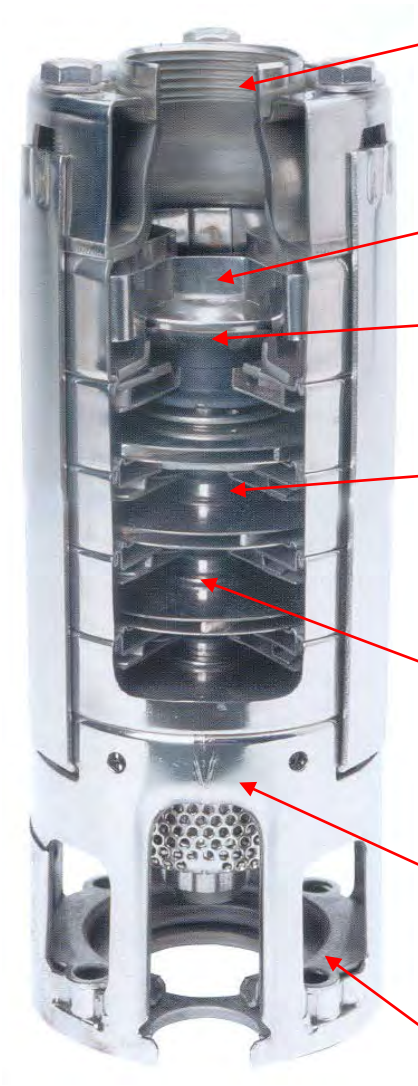
UPPER RADIAL BEARING - Water lubricated ceramic bearing runs against a tungsten carbide shaft journal providing extra long bearing life.

BUILT-IN LIGHTNING PROTECTION - Highly insulated stator is hermetically sealed in stainless steel and encapsulated in polyurethane foam.

THRUST BEARING - Ceramic on carbon design provides longer thrust bearing life.

LOWER RADIAL BEARING - (same as upper radial bearing)

Figure 2.2.2
PP-40SC
Typical Grundfos Pump Cut Away View



2” NPT discharge to pump cover

Check valve w/ 1” hole drilled in it

Upper radial & thrust bearings

Pump stages

NOTE: The PP-40SC pump is a 5 stage pump.

1st stage impellor

Suction screen

Mounting Flange

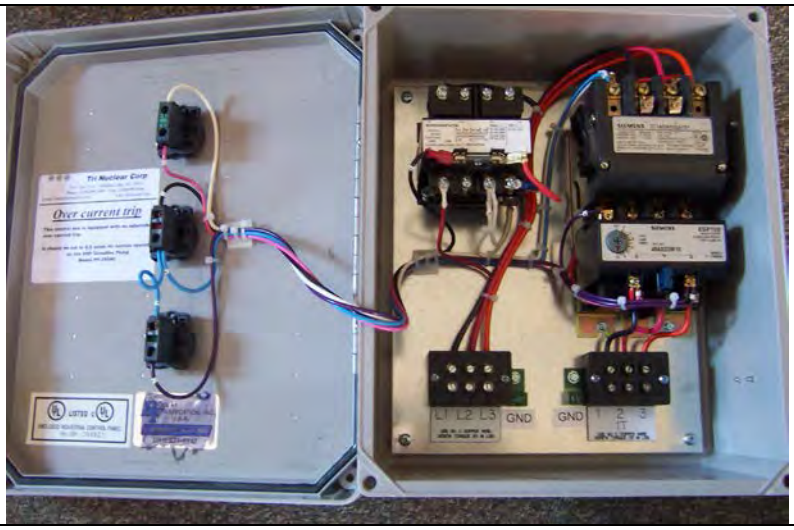
2.3 CONTROL BOX

Tri Nuclear has used three different control boxes for the Underwater Demineralizer pumps over the years. They are the CB-100-4X, the CB-PR-100-4X and the most recent is the CB-PR-100-4XP.

The CB-40-4X (see section 2.3.1) is no longer produced and is referenced here for legacy purposes only. The CB-PR-40-4X (see section 2.3.2) have been replaced by the upgraded CB-PR-40-4XP (see section 2.3.3).

2.3.1 CB-40-4X USED from May 2005 to August 2009 See Drawing TNC-018-01

The CB-40-4X control box is mounted in a NEMA 4X type enclosure and has a 460V/3Ph/60Hz solid state controller with an adjustable over current trip. The control box has start/stop pushbuttons and a green "run" indicating light on the front of the panel. *This item is discontinued and his described here for legacy purposes only.*

Inside view of control box showing solid state starter, transformer, and line in and load terminal blocks.	

CB-260-4X shown mounted on the UT-10 control panel with associated flow meter CB-40-4X similar		

Figure 2.3.2 CB-260-4X Nema 4X Contorl Box shown, CB-40-4X similar

NOTE: This control box is *ONLY* rated for 460V/3Ph/60Hz.
A 380V/50Hz control box version of this was also supplied. See Drawing TNC-018-04 for details.

2.3.2 CB-PR-40-4X (Phase Reversing Control Box)
USED from August 2009 to November 2012 See Drawing TNC-018-02

In August of 2009 Tri Nuclear introduced an upgraded version of our standard control box that 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 starters inside the control box. These two motor 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 position, neither motor starter will be energized and the pump will not start.

The CB-PR-40-4X is a NEMA 4X type enclosure (14x16) and has two 460V/3Ph/60Hz solid state controllers with an single 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.

CB-PR-260-4X shown CB-PR-40-4X similar The Phase Rotation Switch has a safety cover to prevent inadvertent actuation.	
Inside view of a CB-PR-260-4X control box showing the two solid state motor starters, over current trip, transformer, and line in and load terminal blocks CB-PR-40-4XP similar	

Figure 2.3.3 CB-PR-260-4X PHASE REVERSING Contorl Box shown,
CB-PR-400-4X similar

NOTE: This control box is *ONLY* rated for 460V/3Ph/60Hz.
A 380V/50Hz control box can be supplied upon request. See Drawing TNC-018-05 for details.

2.3.4 CB-PR-40-4XP PHASE REVERSING CONTROL BOX WITH TWISTLOCK PLUGS

The CB-PR-40-4XP is a NEMA 4X type fiberglass (14x16) that has two 460V/3Ph/60Hz solid state controllers with an single 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 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 starters inside the control box. These two motor 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 position, neither motor starter will be energized and the pump will not start.

The 460V / 3ph / AC 30amp Nema 4X Twist Lock plugs allow the operator to quickly and easily install the PC-50 drop cable and PSC-100P pump power cable to the control box without drilling and connecting bare cables to internal terminal blocks in the control box.

See Drawing TNC-018-07 for Phase Reversing Control Box details.

CB-PR-260-4XP shown

CB-PR-40-4XP similar

The Phase Rotation Switch has a safety cover to prevent inadvertent actuation.

Figure 2.3.4 CB-PR-260-4XP Contorl Box outside view
CB-PR-40-4XP similar

2.3.4 CB-PR-40-4XP (Cont.)

Inside view of a typical CB-PR-40-4XP control box showing the two solid state motor starters, over current trip, transformer, and the Twist Lock plug terminals

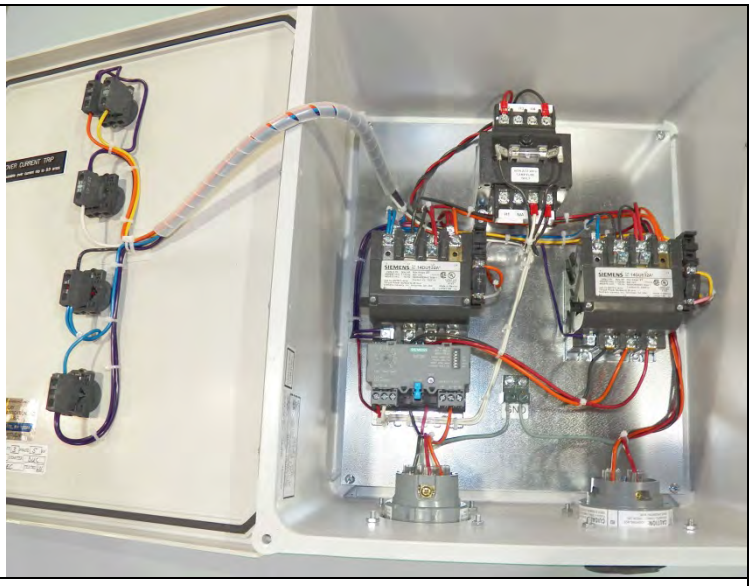


Figure 2.3.4.1 CB-PR-40-4X Inside View of Control Box

Twist Lock plugs are located on the bottom of the control box.
The plug to the right (with the male Twist Lock connections) is the line in / power in plug.

The plug to the left (with the female Twist Lock connections) is the power out to the pump.

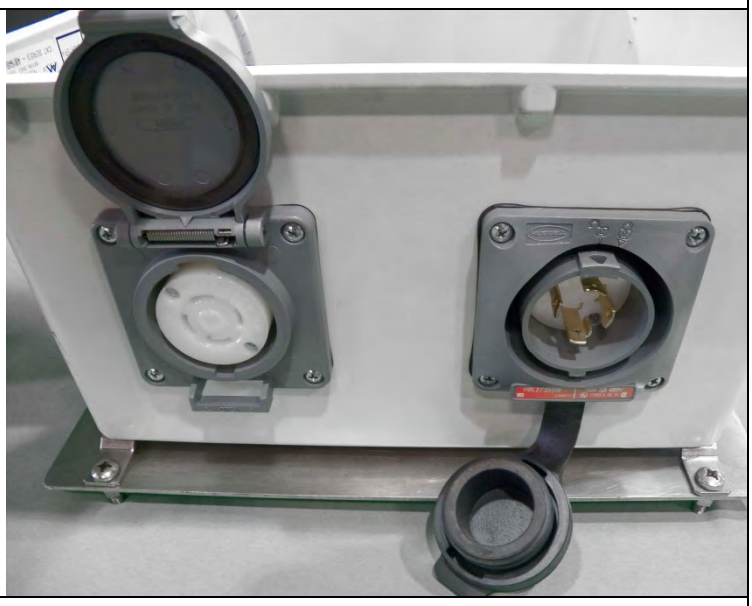


Figure 2.3.4.2 CB-PR-40-4XP Twist Lock Plugs

2.4 PUMP POWER CABLE

2.4.1 POWER CABLE WITH TWISTLOCK PLUGS (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.

PSC-100P Pump Power Cable shown with the "Sea Con" connector on one end (to the left). The plug to the right (with the male Twist Lock connections) is to connect to the female line out on the CB-PR-xxx-4XP control box.	

Figure 2.4.1
PSC-100P Power Cable

2.4.2 POWER CABLE (P/N:PSC-100):

The PSC-100 Pump Power cable is a 100ft 10/4 SO cable with a Sea Con Connector x bare wire end. This Pump Power cable is to supply power to the pump from any Control Box without the twistlock plug connections.

PSC-100 Pump Power Cable shown with the "Sea Con" connector on one end *This item is described here for legacy purposes only.*	

Figure 2.4.2
PSC-100 Power Cable

2.5 DROP CABLE (P/N: PC-50):

The PC-50 Control Box Drop Cable is a 50’ 10/4 SO cable with a female Nema 4X 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.

PC-50 Pump Power Cable shown with bare wires on one end (to connect to the in plant power connection/supply (to the right). The plug to the left (with the female Twist Lock connections) is to connect to the male line in on the CB-PR-xxx-4XP control box.	

2.6 FLOW METER AND SENSOR (P/N: FM-100):

The UD-30A 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 ion exchange bed.

The flow meter used for the UD-30A is a self-powered analog meter that provides flow indication from 0-200 GPM. The flow meter uses the amplitude of the flow sensor signal to drive the 100-microamp meter movement.

The flow sensor for the UD-30A is a paddlewheel type flow sensor. The paddlewheel has a re-enforced 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 of instrument cable.

Flow Sensor Specifications:

Output frequency:	5-6 Hz/fps nominal
Flow Range:	1-50 fps
Linearity:	± 1% full range

Flow Meter Specifications:

Input signal amplitude:	0.4 V peak to peak minimum
Input Frequency range:	0-200 Hz
Meter Range:	100 micro amps ± 2% at full deflection

FM-260 Analog Flow Meter shown FM-100 Flow Meter similar	
FM-100 Paddlewheel Flow Sensor	

Figure 2.6
FM-100 Flow Meter

2.7 DISCHARGE HOSE (P/N: PH-2x25)

The UD-30A comes equipped with one 2" x 25' hose with male x female cam lock couplers that is connected to the discharge of the PP-40SC pump in order to move water away from the unit for better water circulation.

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.

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

UT-8A attached to the end of a 2in hose.	

Figure 2.8.1
UT-8A Diffuser Pipe

2.9 SLUICE HOSES P/N: (FPS-1.5x50)

The UD-30A comes equipped with two 1-1/2" x 50' 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-30A comes 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-30A 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	

Figure 2.10
BV-1.5SS-MxF - Sluice Valve

2.11 SUCTION HOSE CONVERSION KIT (SHCK-UD-30A) See Drawing TNC-011-02

Each UD-30A come equipped with a suction hose conversion kit. The purpose of the SHCK-UD-30A is to allow the attachment of (1) 2in x 50ft long suction hoses to the inlet of the demineralizer. This allows the demineralizer to take a suction away from the vessel itself. This is typically done for source reduction purposes. The UD-30A vessel is placed near the Rx vessel flange and the suction hoses are lowered into the vessel itself to go after the source of the activity.

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

(1ea) Safety Screen Vent Assembly, P/N: SSVA-30A
(1ea) Johnson Screen Strainer Assembly, P/N: SSVA-2x2
(1ea) Suction Hose, P/N: PH-2x50

2.11.1 SAFETY SCREEN VENT ASSEMBLY (P/N: SSVA-30A)

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

The SSVA-30A has an integral 2in .015" Johnson Screen safety screen to prevent resin migration to the pool/cavity from the top of the resin bed.

Cut away view of the Safety Screen Vent Assembly	

Figure 2.11.1
Safety Screen Vent Assembly

2.11.2 JOHNSON SCREEN STRAINER ASSEMBLY (P/N: 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.

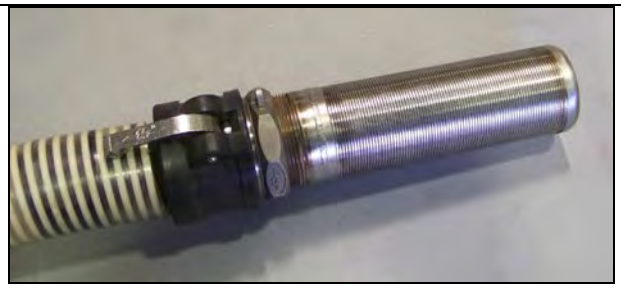
Johnson Screen Strainer Assembly installed on a PH-2x50 hose	

Figure 2.11.2
Johnson Screen Strainer Assembly

2.11.3 SUCTION HOSE (PH-2x50)

The SHCK comes equipped with a 2" x 50' suction hose with male x female cam lock couplers. The male end of the hose attaches to the Safety Screen Vent Assembly and the female end of the hose is attached to the Safety Screen Strainer Assembly.

UD-36A with SHCK installed (above) on right vessel inlet. Left vessel inlet has the standard inlet safety screen installed.	

Figure 2.11.3
Suction Hose Conversion Kit installed on a UD-36A
UD-30A Similar

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 PP-100SC pump. When it is desired to take an effluent sample, the valve is opened and a sample can be drawn.

Sample hose for the UD-30A pump	

Figure 2.12
Suction Hose Conversion Kit installed on a UD-30A

OPTIONAL SLUICING EQUIPMENT FOR THE UD-36A
(these items are optional and must be purchased separately)

2.13 RESIN SLUICE PUMP (P/N: AP-65) - (OPTIONAL)

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-36, General Resin Sluicing Procedure for information on its use.

Sluice pump for all Tri Nuclear underwater demineralizers.	

Figure 2.13
AP-65 Resin Sluice Pump

2.12 RESIN TRANSFER HOSE (P/N: FPS-1.5x25) (OPTIONAL)

The resin transfer hose is a 1-1/2" x 25' hose attached to the AP-65 Resin Sluice Pump discharge and is used for sluicing clean resin from a new resin drum to the demineralizer. This same hose may be used for discharging depleted resin from the demineralizer to a radwaste disposal liner.

3.0 EQUIPMENT AS SHIPPED

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

3.1 MAIN UNIT ON FIRST PALLET - The UD-30A demineralizer is banded to a standard sized wooden pallet.

3.2 The pump assembly is installed and shipped in a wooden crate with the power cable, control box. The following additional items are shipped in the pump crate:

- FM-100
- UT-8A
- SSVA-30A (part of the Suction Hose Conversion Kit)
- JS-2x6 (part of the Suction Hose Conversion Kit)
- BV-1.5SS-MxF
- SH-.5x100
- UT-10A

3.3 The PH-2x25 discharge hose, the PH-2x50 suction hose, the (2) FPS-1.5x50 sluice hoses, mounting panel, flow meter and diffuser are all strapped down and shrunk wrapped to the same pallet as the UD-30A.

3.4 ACCESSORY EQUIPMENT ON SECOND PALLET - The second wooden pallet contains the following optional items (if ordered) for the UD-36A:

- AP-65
- FPS-1.5x25
- Any additional hoses

3.5 RECEIPT INSPECTION – Using the EGL in this procedure carefully inspect and ensure all items are accounted for. Any missing or damaged items must be reported to Tri Nuclear ASAP.

4.0 ASSEMBLY AND INSTALLATION IN POOL

4.1 Pre Start Up

4.1.1 Flow Meter & Sensor Installation

CAUTION:

The flow meter dial read-out gauge is a delicate instrument (milliammeter) and should be protected from rough handling. It could be broken if dropped on the floor. Mount it to the UT-10A control panel and hung on a suitable railing for protection.

Remove the FM-100 flow meter from its box. Verify the analog flow meter has a 0-200 GPM scale and mount the flow meter to the control panel UT-10A using the two bracket mounting screws located in the FM-100 flow meter's box.

Figure 4.1.1
FM-100 Meter mounted on UT-10A Control Panel

4.1.2 Remove the paddlewheel flow sensor from its box. Connect the flow sensor cable to the back of the FM-100 meter's green electrical plug using figure 4.1.2 as a guide.

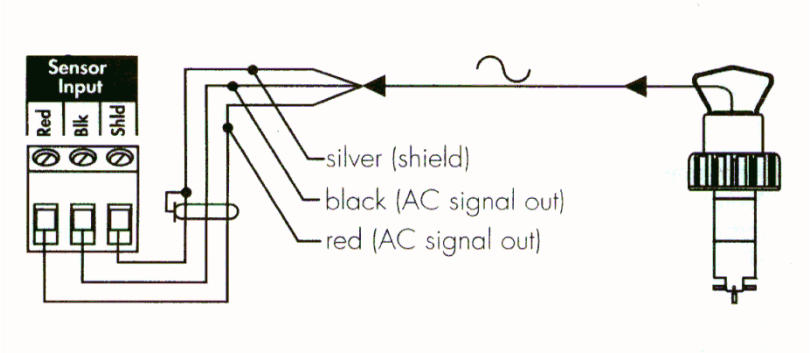


Figure 4.1.2
FM-100 Flow Sensor to Flow Meter wiring diagram

4.1.3 Mount the CB-PR-40-4XP Control Box to the UT-10A Control Panel

4.1.3.1 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 panel.

Figure 4.1.3.1
Mounting feet installed on the back of the CB-PR-40-4XP Control Box

4.1.3.2 Using a #3 Phillips Screwdriver and a 1/2in open or box end wrench, mount the CB-PR-40-4XP control box using the four (4) mounting screws, lock washers & nuts located on the UT-10A control panel) assembly on the UT-10A Control Panel.

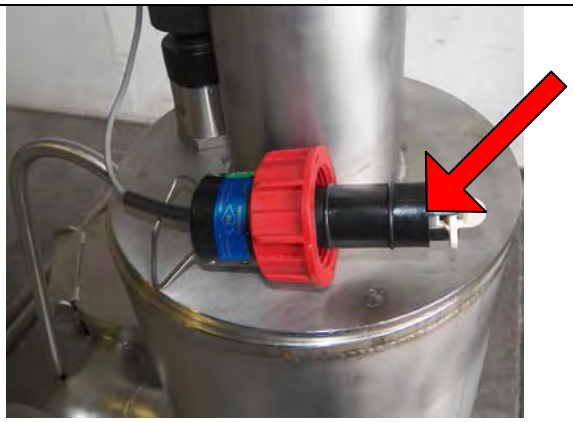
CB-PR-40-4XP control box shown mounted on the UT-10A Counting Panel.

Figure 4.1.3.2
CB-PR-40-4XP mounted to a UT-10A Control Panel

4.1.3 Flow Sensor

Before installing the flow sensor to the flow tap mounted on the pump discharge pipe, flip the paddle wheel with a finger to check for dial read-out response.

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.



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

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.

4.1.4 Pump Power Cable

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 The plug provides a waterproof seal; therefore, the pump assembly can be stored underwater with the seal plug installed.	
Remove the PSC-100P power cable from the pump box. 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 the 100' cable. The mating SeaCon female connector is mounted to the pump cover. Place a thin coat of lubricant on the inside of the connector	

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.

Install the power cord to pump pigtail HAND TIGHT ONLY. ***DO NOT*** use any tools (pliers, channel locks etc.) to tighten the connection.

PP-260SC pump shown PP-40SC Pump similar	 

Eliminate the possibility of a bending force on the connector by using the cable ties provided to fasten the pump power cable to the vertical discharge pipe of the pump. (see photograph below)

Connect the other end of the power cable to the pump control box.

Large cable tie holding the PSC-100P power cable in place PP-260SC shown, PP-40SC pump similar.	

4.1.5 Sample Hose

The PP-40SC pump has a vertical 1/2in male camlock connection as its sample port. The pump is shipped with this port capped with a 1/2in SS camlock cap. If sampling of the demineralizer effluent is desired, remove this cap and install the sample hose PRIOR to the pump being installed in the pool.

Remove the cap from the 1/2in male camlock on the PP-40SC pump and couple the female camlock on the sample hose to it.

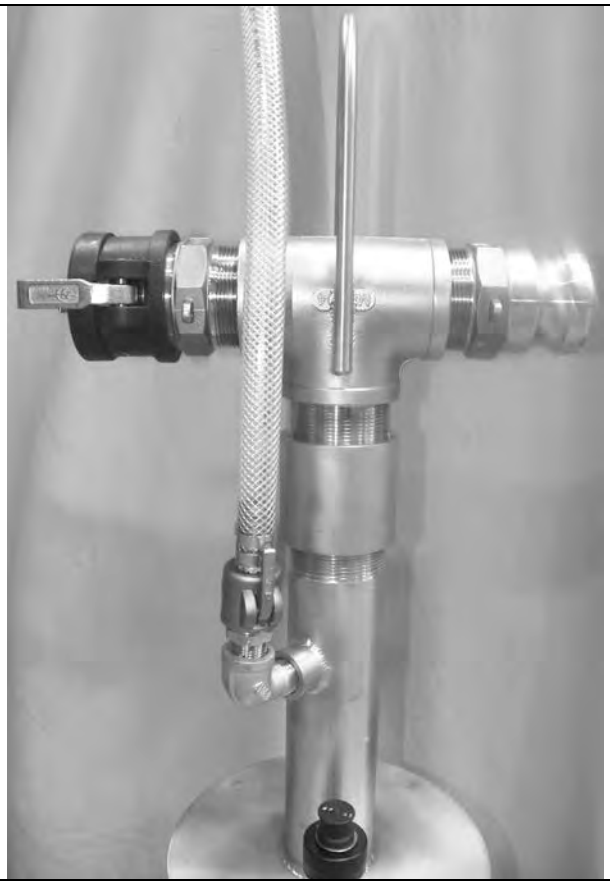


Figure 4.1.5
SH-.5x100 Sample Hose attached to the PP-100SC pump.
PP-40SC pump similar.

4.1.6 Zip-Tie Cables Together

Lay-out the 100 ft. of pump power cable, flow meter cable and sample hose in a straight line. Tie the three 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.

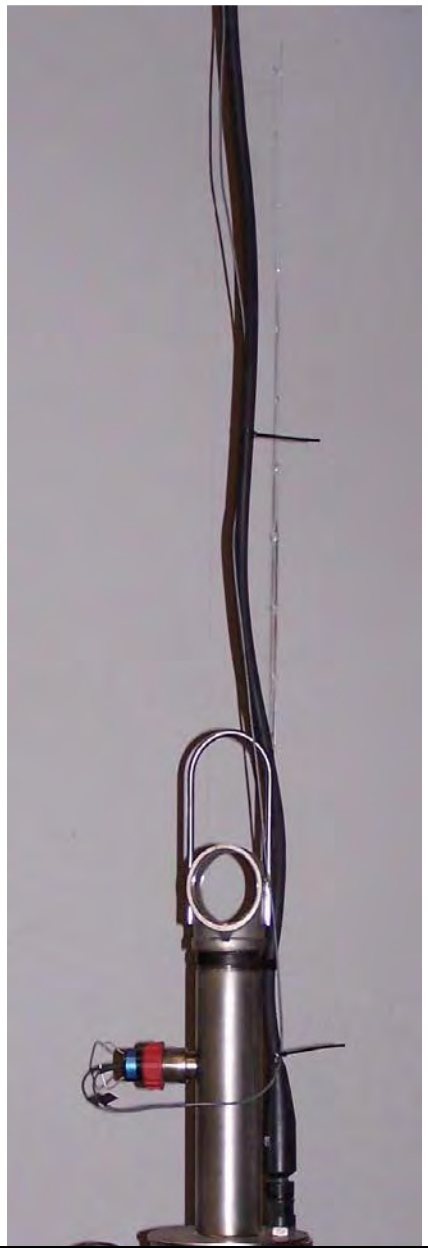


Figure 4.1.6
PSC-100P Power Cable zip tied to the FM-100 flow sensor cable
PP-260SC shown, PP-40SC pump similar.

4.1.7 Install Cables to the Control Box

After the CB-PR-40-4XP control box has been mounted to the UT-10A Mounting Panel, attach the PSC-100P power cord and PC-50 Drop Cable as shown below:

CB-PR-40-4XP control box shown mounted on the UT-10A Mounting Panel.	
Install the PC-50 line in Twist Lock Plug to the CB-PR-40-4XP control box (shown on right) Connect the bare end of the PC-50 drop cable to an in plant power supply. Install the PSC-100P Pump Power Cable Twist Lock Plug to the CB-PR-40-4XP control box (shown on left)	

4.2 UD-30A VESSEL

Prior to proceeding any further, ensure the vessel has been filled with resin per OI-36, General Resin Sluicing Procedure for Tri Nuclear Underwater Demineralizers. The rest of this procedure assumes the vessel is already filled with resin.

Tri Nuclear dwg. TNC-011-12 shows a schematic view of the UD-30A system, 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 2" x 50ft suction hoses).

Regardless of the mode of operation, the sluice valves and sluice hoses are installed. This allows the operators to sluice resin out of the vessel without having to raise the vessel to the surface to install hoses.

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

4.2.1 TYPICAL operations:

Verify that the Johnson screen assembly on the 2" water inlet connections is installed. This assembly acts as a safety screen preventing resin from migrating from the vessel during resin fill operations.

4.2.2 OPTIONAL operations:

If installed, remove the standard inlet Johnson Screen assemblies and thread in the SSVA-30A.

Install the PH-2x50 suction hose to the female camlock coupler on the SSVA-30A and the Johnson Screen Strainer Assembly (JS-2x6) to the male end of the hose.

UD-36A with SHCK installed (above) on right vessel inlet. Left vessel inlet has the standard inlet safety screen installed. UD-30A similar.

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.

The vessel connections are etched (Resin Outlet shown) to aid the operator in connecting hoses.

4.2.4 DISCHARGE HOSE

If the UD-30A is being set up for "TYPICAL" Operations, couple the female camlock of the 2in x 25 ft. long discharge hose (P/N: PH 2x25) to the 2in male camlock connection on the PP-40SC pump tee.

Connect the diffuser pipe (P/N: UT-8A) to the male camlock on the end of the discharge hose. A handling line (NOT SUPPLIED) may be tied to the UT-8A diffuser for moving the hose underwater to a desired locations.

The diffuser pipes are used to dampen a hose "whip" reaction which occurs at the end of a discharge hose.

NOTE:

Running the UD-30A without suction or discharge hoses will not produce desired results in pool demineralization due to "short circuiting" the water flow (the pump will discharge directly above the vessel inlet connections).

It is also not required or desired to install BOTH suction and Discharge hoses to the UD-30A

4.3 Install Pump in Vessel

Lower the PP-40SC pump into theUD-30A vessel.

PP-260SC pump being installed in a UFV-260 housing
Installation of a PP-40SC pump into the UD-30A housing similar

The PP-40SC pump will 'self-center' as it is lowered into the UD-30A housing.

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

4.4 SUBMERGE VESSEL IN 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 the 2in Johnson screens installed in the vessel top water inlet.

4.4.2 Lift the vessel with a crane, using caution to guide the vessel hoses to prevent them from fouling the rigging equipment or be trapped underneath the vessel. If the PP-40SC 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.

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 with CB-PR-40-4XP Phase Reversing Control Box

IMPORTANT - READ THIS STEP CAREFULLY!

!!!WARNING!!!

Do not run the pump until a proper phase rotation check is made! Running the pump in reverse for any long duration WILL damage the pump!

!!!WARNING!!!

DO NOT RUN/BUMP THE PUMP DRY OR OUT OF THE WATER!
SEVERE DAMAGE TO THE PUMP MAY OCCUR!

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.

!!!WARNING!!!

DO NOT START THE PUMP MORE THAN ONCE EVERY TWO MINUTES

This phase rotation check must be performed each time the motor or starter box is disconnected from the electrical power source.

5.0 OPERATIONS

5.1 NORMAL OPERATIONS

Note:
During normal operations, the two FPS-1.5x50 hoses (resin inlet & outlet) may be removed from the vessel. The 1-1/2in camlock caps installed on the hoses must be installed on the 1-1/2in male camlock fittings on the valve spool pieces (resin inlet & outlet) on the UD-30A vessel. These connections must be capped during operation.

If the FPS-1.5x50 hoses were removed, they must be reinstalled prior to resin sluice out operations when the vessel is full of potentially 'hot' resin. Plant HP and operators need to discuss the issue of these sluice hoses before they are removed for normal operations.

5.1.1 Start the PP-40SC pump, and observe and record the flow on the flow meter for future reference. The normal flow rate for the UD-30A should be between 40-50 GPM. Higher flow rates (between 50-60 gpm) are also acceptable for recirc demineralizers. If flow is observed to be >60 GPM it is out of spec high. If this occurs please contact Tri Nuclear with the details of the operations leading up to this high flow rate so we can help troubleshoot the problem.

5.1.2 Occasionally (once every12-24 hrs), shut-off the pump and observe if much air vents from the top water inlet Johnson screen. 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 to be vented from the screen. 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.

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

When 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

If the pump is to be replaced perform the applicable pre-start up checks of section 4 prior to installing the new pump.

  PP-260SC pump being installed in a UFV-260 housing Installation of a PP-40SC pump into the UD-30A housing similar	  The PP-40SC pump will 'self-center' as it is lowered into the UD-30A housing.

5.4 TROUBLESHOOTING

See OI-5, Tri Nuclear Pump Trouble Shooting Guide, for trouble shooting guidelines with the UD-36A.

5.5 SLUICING OPERATIONS

See OI-36, General Resin Sluicing Procedure for Tri Nuclear Underwater Demineralizers, for the procedure for sluing resin into and out of Tri Nuclear Underwater Demineralizers.

6.0 STORAGE REQUIREMENTS

6.1 Caution should be taken to ***NOT*** store any plastic components (eg. filters or hoses) near high radiation fields associated with equipment such as fuel bundles, LPRM's or control blades. Breakdown of such components can occur with accumulated exposures of 10^6R. For this reason, precautions should be taken to minimize accumulative dose for the following components: suction hose, filter cartridges, power and instrument cable, flow sensor, and electric motor. All components are chemically suitable for long term storage in the fuel pool cavity environment.

6.2 The preferred method of storing the submersible pump assembly when not in use is underwater. Periodically, running the pump (at least once a month) is also desirable to prevent seals from remaining in a stagnant condition.

7.0 Precautions and Warnings

WARNING:
Do not run/bump the pump dry or out of the water! Severe damage to the pump may occur!

WARNING:
Install the power cord to pump pigtail HAND TIGHT ONLY. Do NOT use any tools (pliers, channel locks etc.) to tighten the connection.

CAUTION:
Do not start the pump more than once every 2 minutes or 300 starts/day. Damage to the motor winding insulation may occur.

CAUTION:
Do not run the pump until a proper phase rotation check is made! Running the pump in reverse for any long duration will damage the pump!

CAUTION:
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 that the keyway is lined up 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.

CAUTION:
The CB-PR-40-4XP is rated for 460V/3ph/60Hz ONLY. Any other voltage/frequency supplied to this control box will prevent them from operating properly.

CAUTION:
The flow meter dial read-out gauge is a delicate instrument (milliammeter) and should be protected from rough handling. It could be broken if dropped on the floor. Mount it to the UT-10A control panel and hung on a suitable railing for protection.

NOTE:
Perform the flow meter check before installing the Underwater Filter units into the pool for the first time, whenever the flow meter or sensor is replaced, or anytime the flow sensor is suspected of being damaged.

NOTE:
It is not recommend to operate the UD-30A with a stratified media bed (resin & carbon media).

8.0 Troubleshooting

See OI-5, Tri Nuclear Pump Trouble Shooting Guide, for trouble shooting guidelines with the UD-30A.

9.0 Replacement Parts

Below is a listing of **Recommended Spare Parts:**

Qty	Part No.	Description
1	PP-40SC	Grundfos pump, 1-1/2 HP 460V/3Ph/60Hz, w/cover, SC connector, CB PR-40-4XP PHASE REVERSING control box with twist lock plugs, PSC-100P Power Cable with twist lock plug and PC-50 drop cable with twist lock plug
1	FM-100	Flow Meter Kit, includes 0-200 GPM analog meter and paddlewheel flow sensor w/100 ft cable
1	CB-PR-40-4XP	1-1/2 HP 460V/3Ph/60Hz PHASE REVERSING control box, NEMA 4X, 14x16 enclosure, solid state starter/overload block, Start/Stop push buttons, run light and phase reversing switch w/ safety cover. Includes NEMA 4X twist lock plugs for line in/line out, PC-50 drop cable (w/twist lock plug) and associated twist lock plug to wire to an existing PSC-100 power cable
1	PSC-100P	Pump Power Cable, 100ft 10/4 SO with SC connector & twist lock plug (Note: For use with the CB-PR-xxx-4XP control box)
1	PC-50	Control Box Drop Cable, 50ft 10/4 SO cable w/ twist lock plug x bare wire (Note: For use with the CB-PR-xxx-4XP control box)
1	SC-P	Seal Plug for electrical connector on Tri Nuclear pumps
1	PH-2x25	2” x 25’ hose with Polypro MxF camlock couplers
1	UT-8A	Diffuser Pipe for 2in discharge hose.
1	SHCK-UD-30A	Suction Hose Conversion Kit for the UD-30A system. Includes the following: (1) Safety Screen Vent Assemblies (P/N: SSVA-2x2) (1) Suction hoses (P/N: PH-2x50) (1) Johnson Screen strainer (P/N: JS-2x6)
2	FPS-1.5x50	Suction/Discharge hose, 1.5” x 50’ lg with SS MxF couplers, 150 PSI
2	BV-1.5SS-MxF	1-1/2” SS FP Ball Valve with Male by Locking Female camlock couplers. Includes remote grapple lanyard.
1	SH-.5x100	Sample hose, 1/2” x 100’ lg with SS F camlock coupler x SS ball valve
Optional Sluicing Equipment		
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, & 1/4in drain valve.
1	FPS-1.5x25	Suction/Discharge hose, 1.5” x 25’ lg with SS MxF camlock couplers, 150 PSI

10.0 ADDITIONAL INFORMATION

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

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or

James L. Warden
President
Tri Nuclear Corp.
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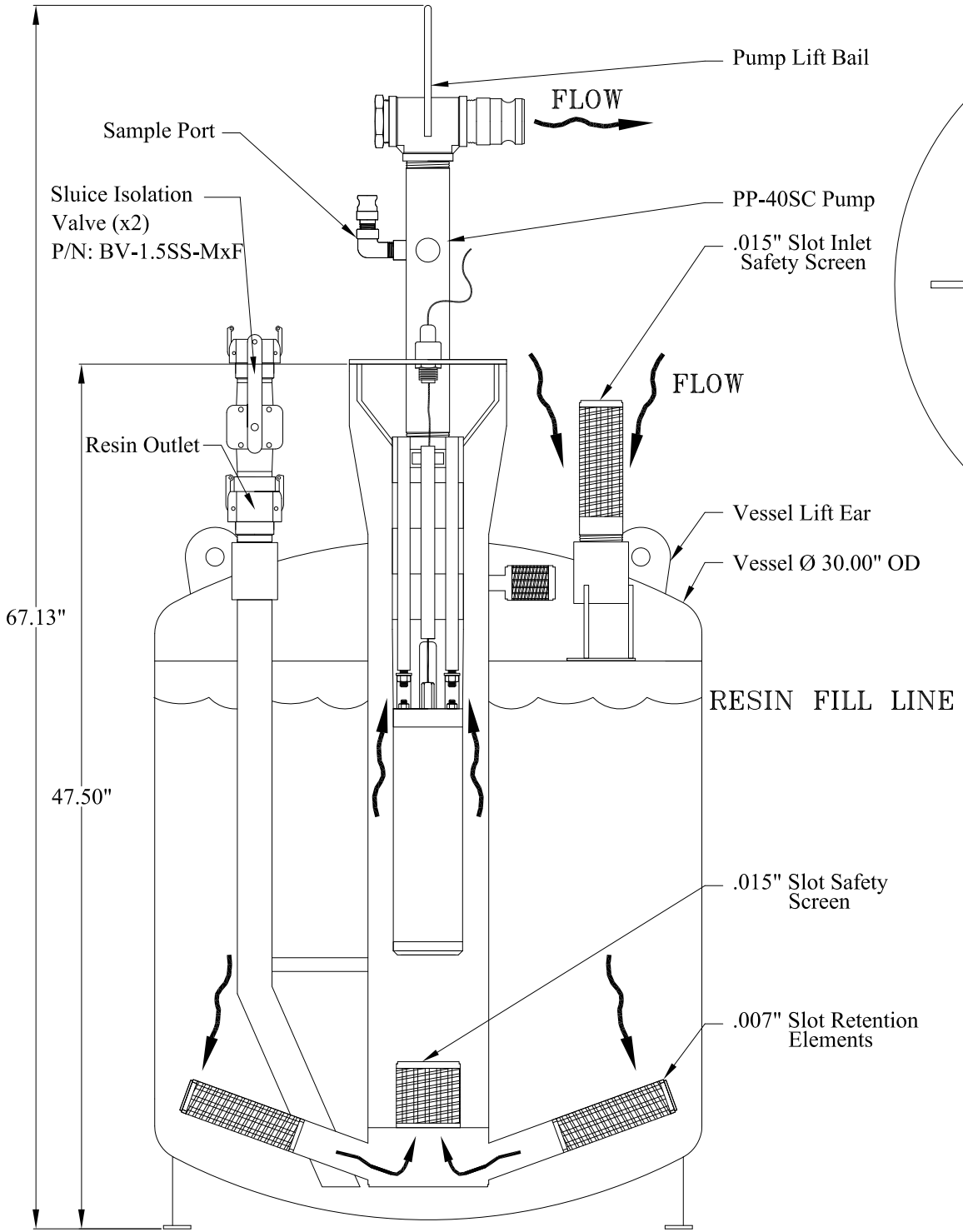
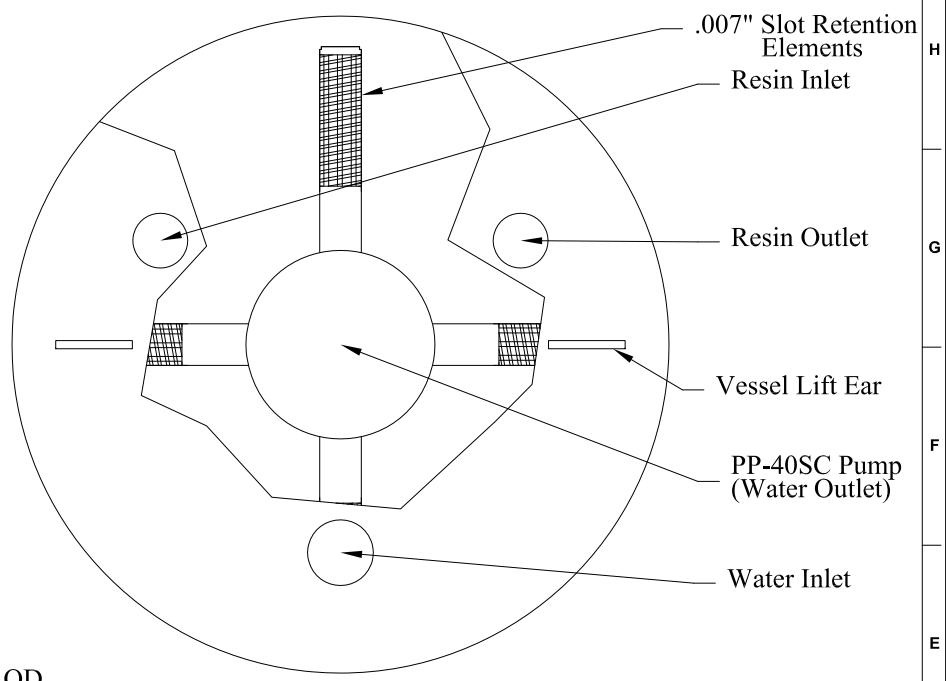
www.trinuclear.com
e-mail: jwarden@trinuclear.com

We also have a CD-Rom that contains all the operating procedures/drawings/brochures for this system and all other Tri Nuclear equipment. Please call, fax, or e-mail us to request your copy.





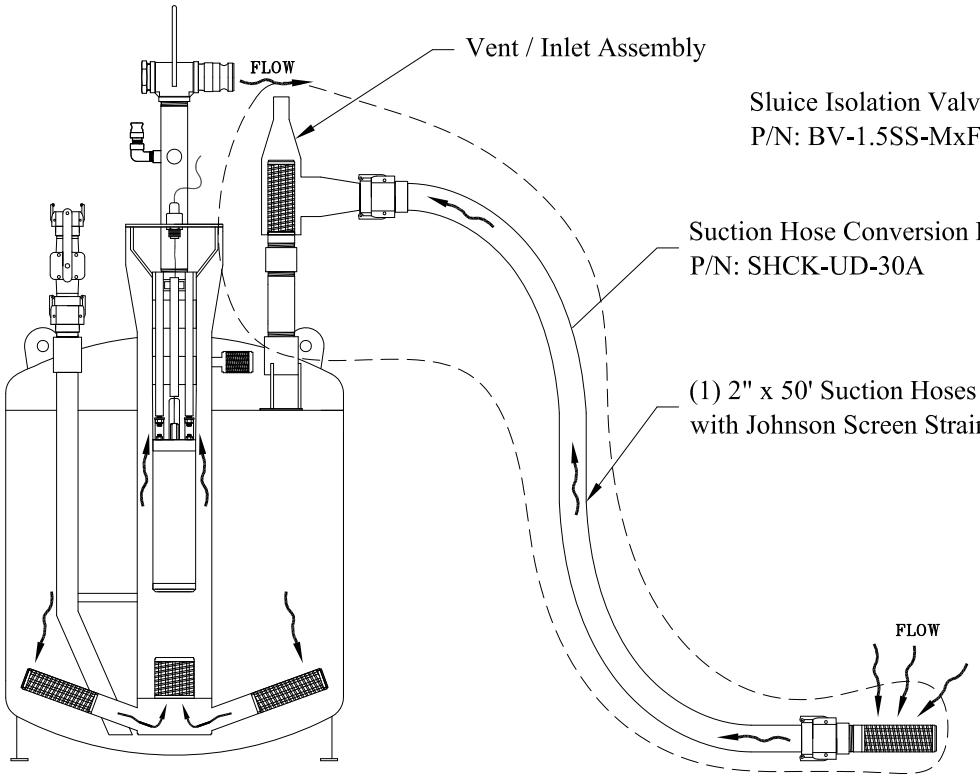
General Specifications:

- 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

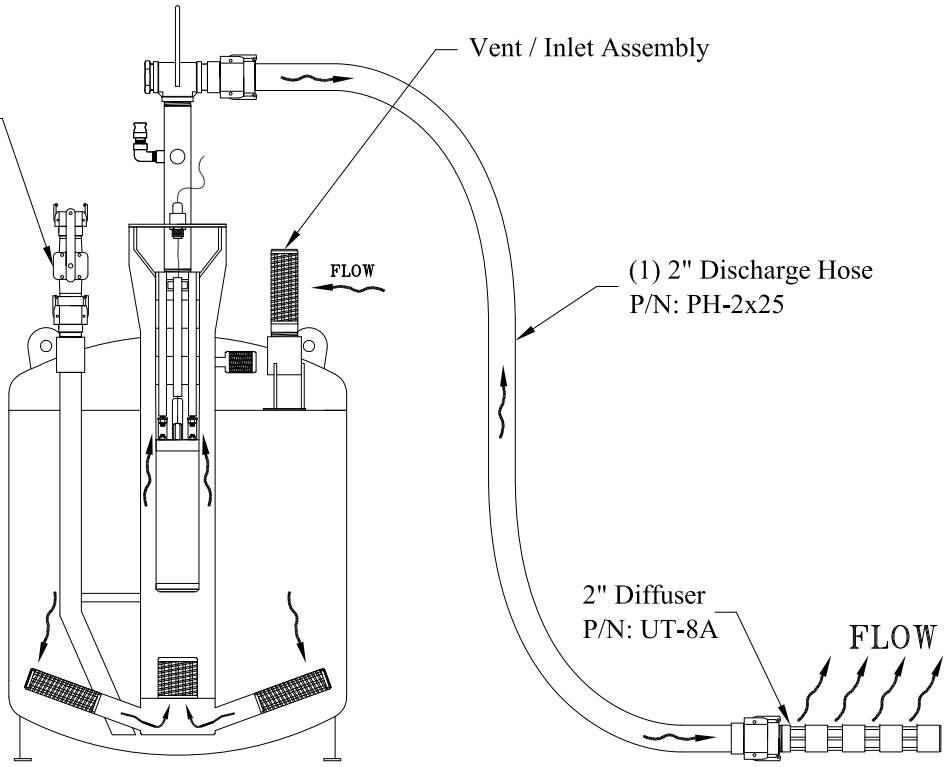
Underwater Demineralizer
30" OD, 40 GPM, 10 CU. FT. Capacity

Model No. UD-30A	Rev Rick Russell Date 06/05/12	Brochure	
Dwg. TNC-011-02	Apv'd James L. Warden Date 06/06/12	Rev. B	Page 1 of 2



"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

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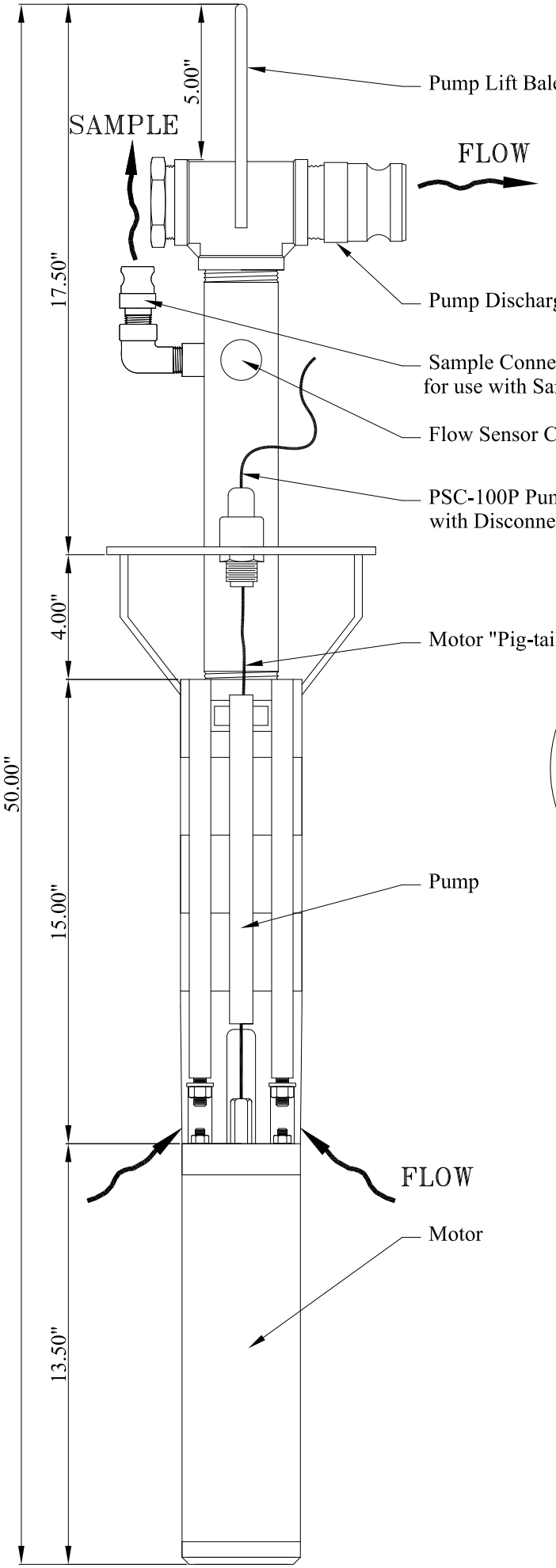
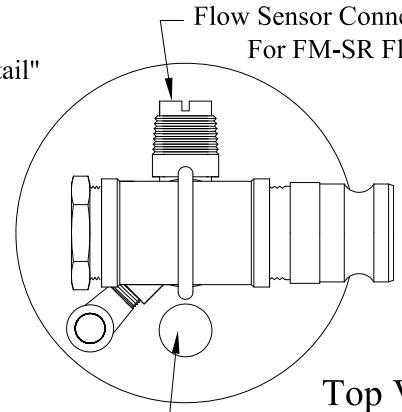
UD-30A System
Modes of Operation

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





Specifications:

- P/N: PP-40SC
- Power Requirements: 1-1/2HP, 460V, 3 PH, 60 Hz, 3.7A
- Power Requirements: 1-1/2HP, 380V, 3 PH, 50 Hz, 3.4A
- Flow: 40 GPM (33 GPM @ 50 Hz)
- Material: All Stainless Steel
- Dimensions: 8-5/8" x ~10-1/2" x 50" (LWH)
- Weight: 45#
- See Dwg. TNC-018 for Control Box Electrical Schematic

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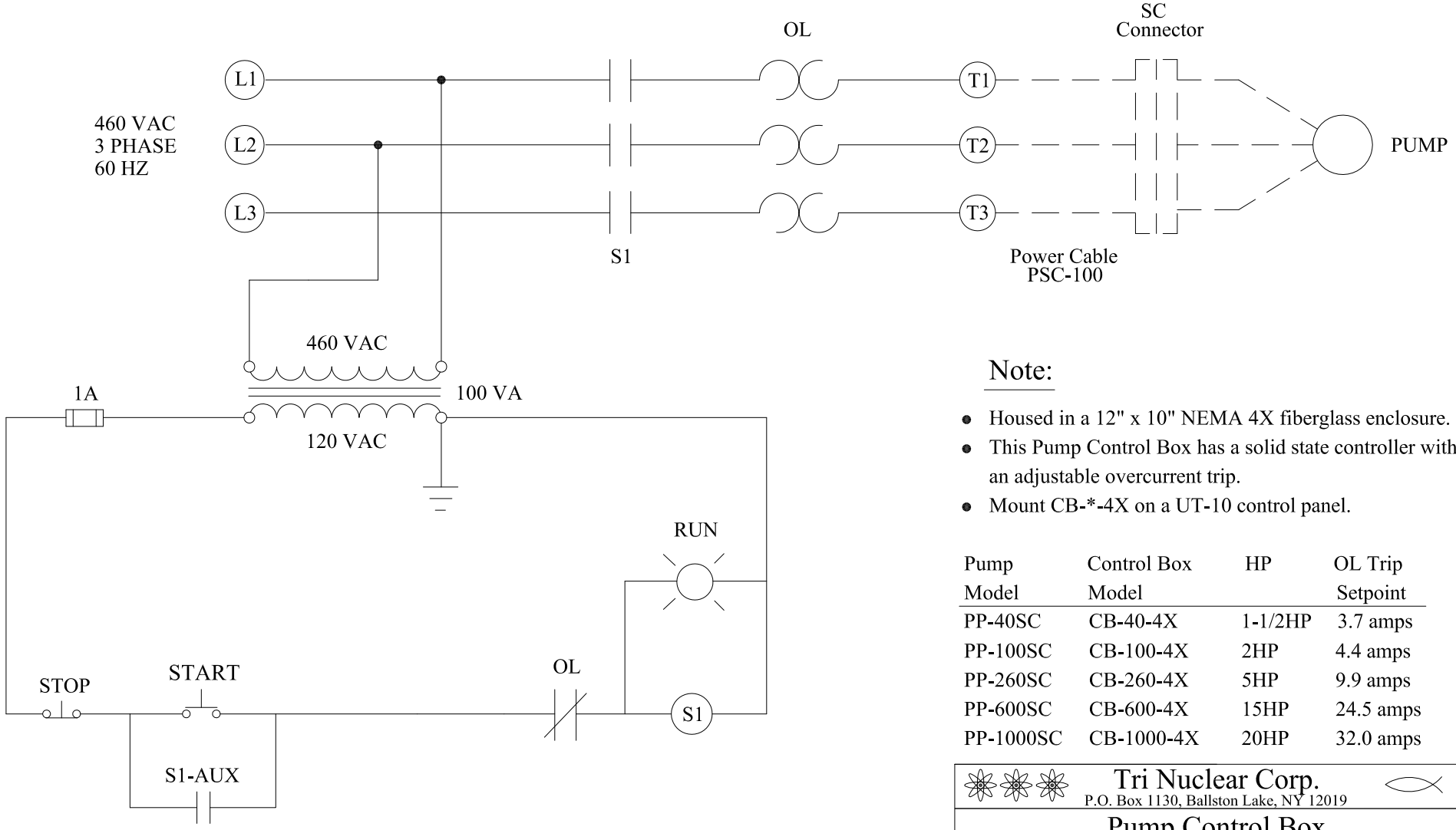
UD-30A Pump Assembly
PP-40SC

Model No. PP-40SC	Rev. Rick Russell Date 12/06/12	Brochure	
Dwg. TNC-006-02	Apv'd James L. Warden Date 12/10/12	Rev. B	Page 1 of 1

A fused disconnect or circuit breaker
must be provided by installer.
Provide disconnect sizing per
NEC-430-53 (c)



Note:

- Housed in a 12" x 10" NEMA 4X fiberglass enclosure.
- This Pump Control Box has a solid state controller with an adjustable overcurrent trip.
- Mount CB-*-4X on a UT-10 control panel.

Pump Model	Control Box Model	HP	OL Trip Setpoint
PP-40SC	CB-40-4X	1-1/2HP	3.7 amps
PP-100SC	CB-100-4X	2HP	4.4 amps
PP-260SC	CB-260-4X	5HP	9.9 amps
PP-600SC	CB-600-4X	15HP	24.5 amps
PP-1000SC	CB-1000-4X	20HP	32.0 amps

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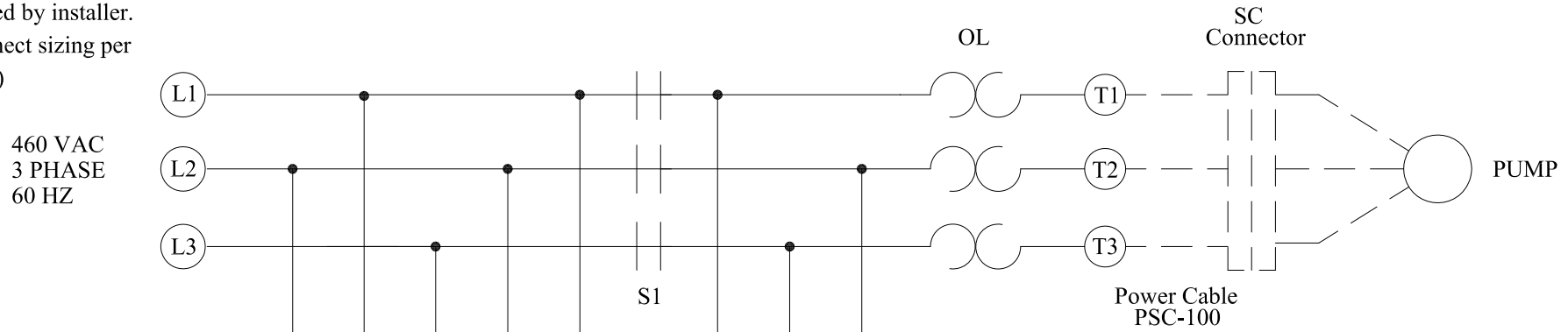
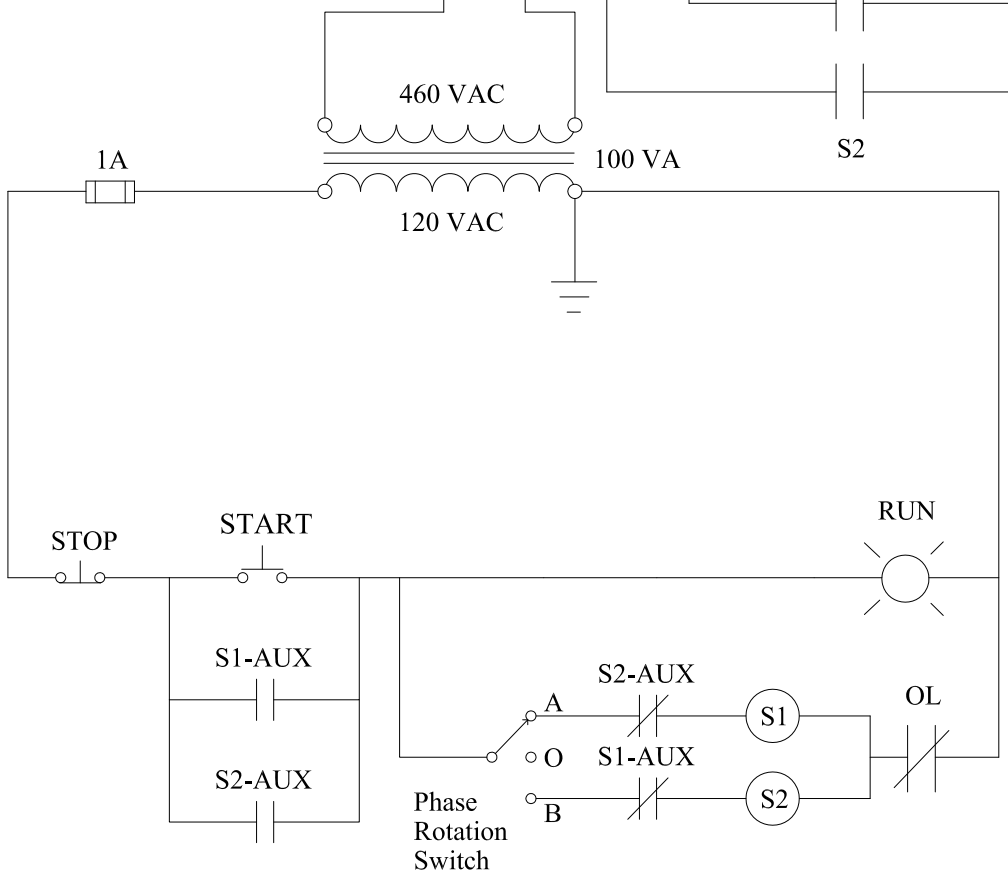
Pump Control Box
Electrical Schematic

Model No. CB-*-4X	Rev. Rick Russell Date 05/10/12	Brochure	
Dwg. TNC-018-01	Apv'd James L. Warden Date 05/10/12	Rev. A	Page 1 of 1

A fused disconnect or circuit breaker must be provided by installer. Provide disconnect sizing per NEC-430-53 (c)





Note:

- Housed in a 16" x 14" NEMA 4X fiberglass enclosure.
- This Pump Control Box has a phase reversing switch which eliminates the need to swap leads to perform a phase rotation check.
- This Pump Control Box has a solid state controller with an adjustable overcurrent trip.
- Mount CB-PR-*-4X on a UT-10A control panel.

Pump Model	Control Box Model	HP	OL Trip Setpoint
PP-40SC	CB-PR-40-4X	1-1/2HP	3.7 amps
PP-100P	CB-PR-100P-4X	2-1/2HP	3.9 amps
PP-100SC	CB-PR-100-4X	2HP	4.4 amps
PP-260SC	CB-PR-260-4X	5HP	9.9 amps
PP-600SC	CB-PR-600-4X	15HP	24.5 amps
PP-1000SC	CB-PR-1000-4X	20HP	32.0 amps

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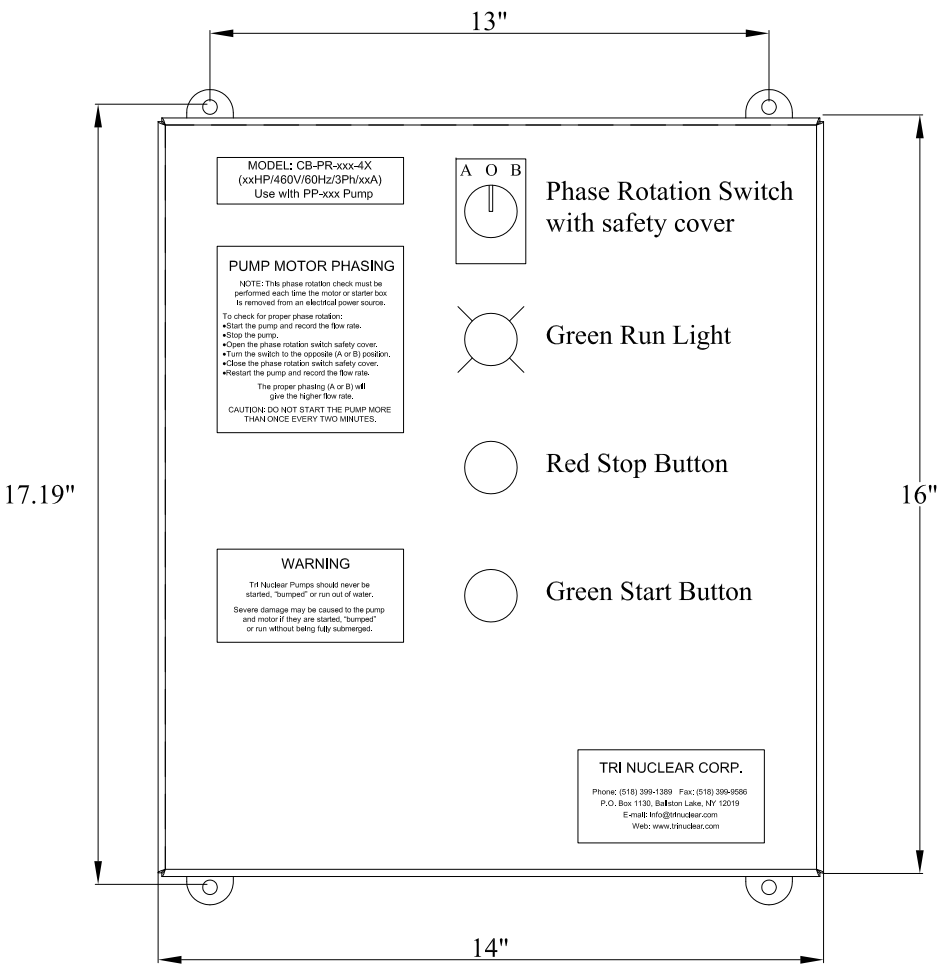
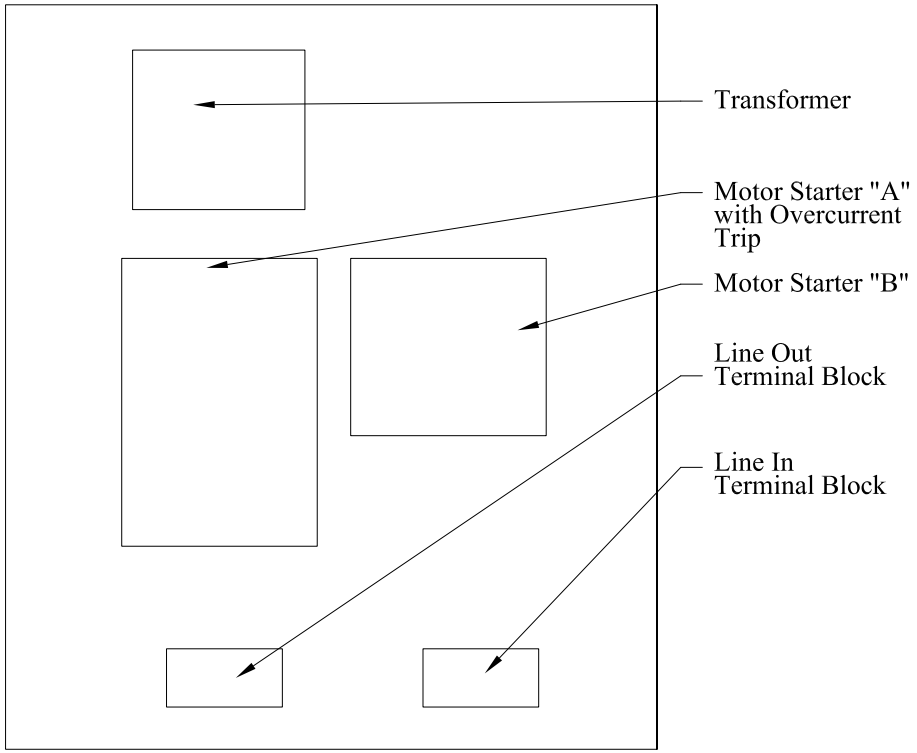
Phase Reversing Pump Control Box Electrical Schematic

Model No. CB-PR-*-4X	Rev. Rick Russell Date 05/10/12	Brochure	
Dwg. TNC-018-02	Apv'd James L. Warden Date 05/10/12	Rev. B	Page 1 of 2

CONTROL BOX FRONT



CONTROL BOX INSIDE



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, rotate the switch to the Phase A or B position, close the safety cover, and restart the pump.

This phase rotation check must be performed each time the motor or starter box is disconnected from the electrical power source.

Tri Nuclear Corp.
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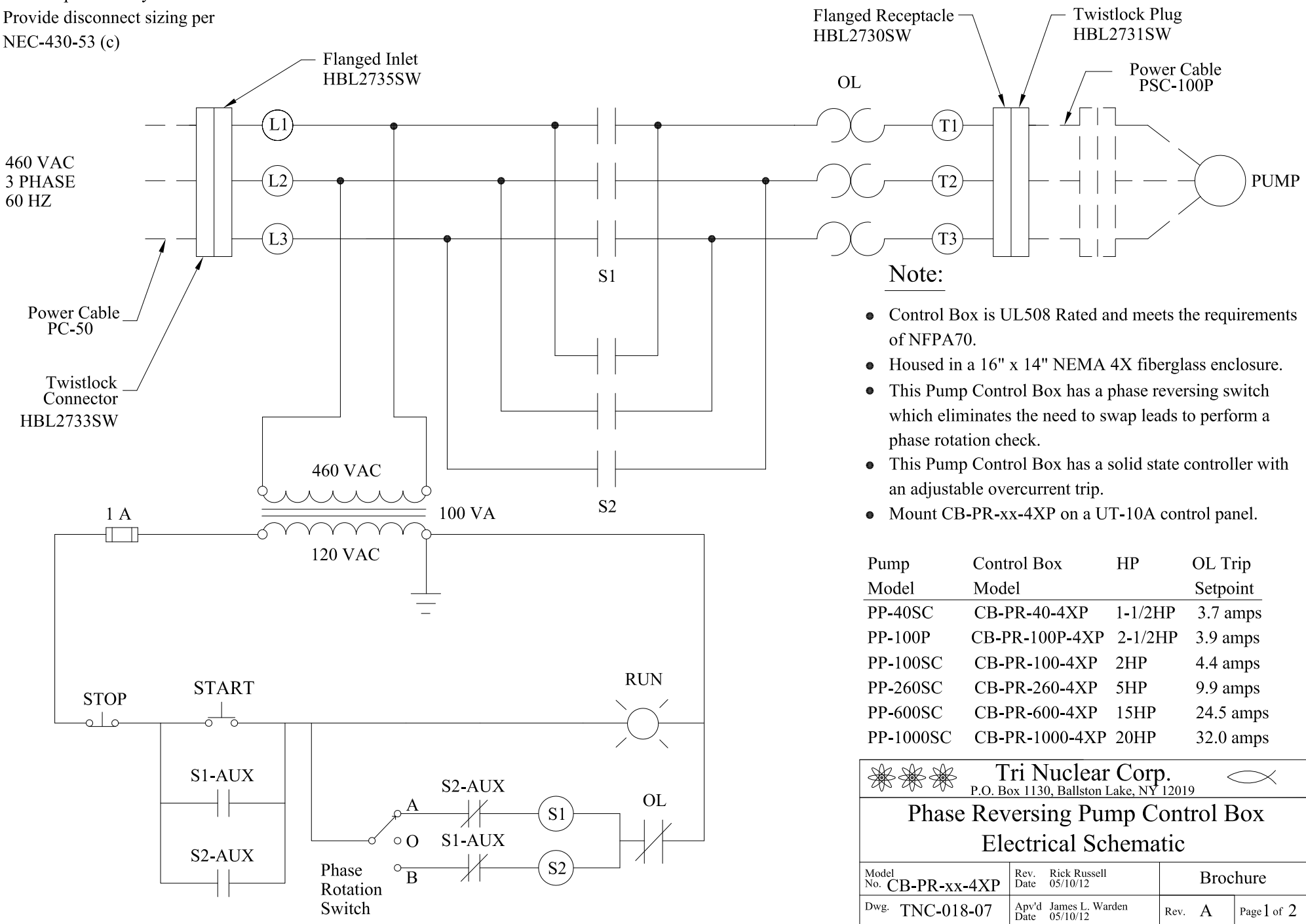
Phase Reversing Pump Control Box
Electrical Schematic

Model No.	Dwg.	Rev.	Page
CB-PR-xx-4X	TNC-018-02	B	2 of 2

A fused disconnect or circuit breaker must be provided by installer. Provide disconnect sizing per NEC-430-53 (c)



Note:

- Control Box is UL508 Rated and meets the requirements of NFPA70.
- Housed in a 16" x 14" NEMA 4X fiberglass enclosure.
- This Pump Control Box has a phase reversing switch which eliminates the need to swap leads to perform a phase rotation check.
- This Pump Control Box has a solid state controller with an adjustable overcurrent trip.
- Mount CB-PR-xx-4XP on a UT-10A control panel.

Pump Model	Control Box Model	HP	OL Trip Setpoint
PP-40SC	CB-PR-40-4XP	1-1/2HP	3.7 amps
PP-100P	CB-PR-100P-4XP	2-1/2HP	3.9 amps
PP-100SC	CB-PR-100-4XP	2HP	4.4 amps
PP-260SC	CB-PR-260-4XP	5HP	9.9 amps
PP-600SC	CB-PR-600-4XP	15HP	24.5 amps
PP-1000SC	CB-PR-1000-4XP	20HP	32.0 amps

Tri Nuclear Corp.
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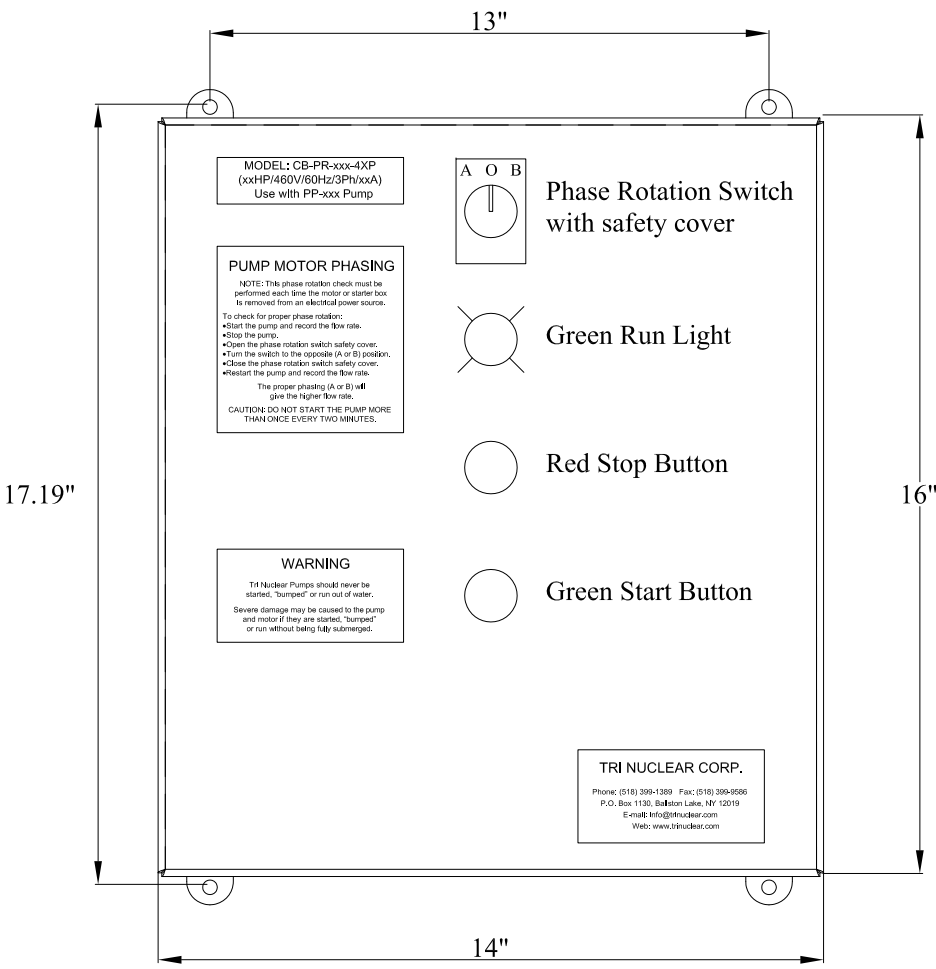
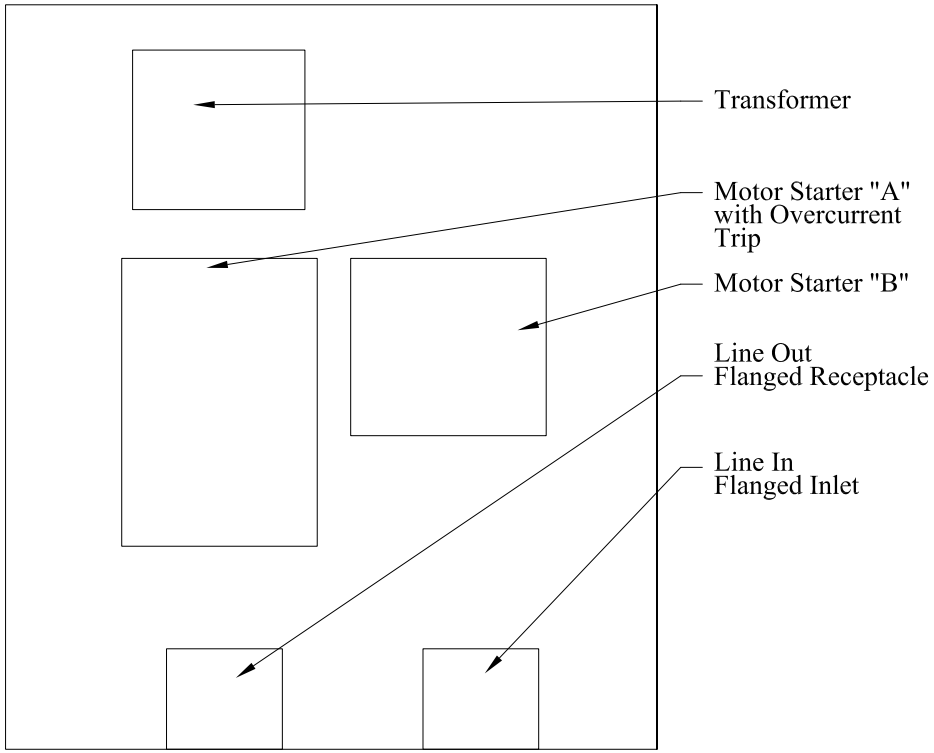
Phase Reversing Pump Control Box Electrical Schematic

Model No. CB-PR-xx-4XP	Rev. Rick Russell Date 05/10/12	Brochure	
Dwg. TNC-018-07	Apv'd James L. Warden Date 05/10/12	Rev. A	Page 1 of 2

CONTROL BOX FRONT



CONTROL BOX INSIDE



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, rotate the switch to the Phase A or B position, close the safety cover, and restart the pump.

This phase rotation check must be performed each time the motor or starter box is disconnected from the electrical power source.

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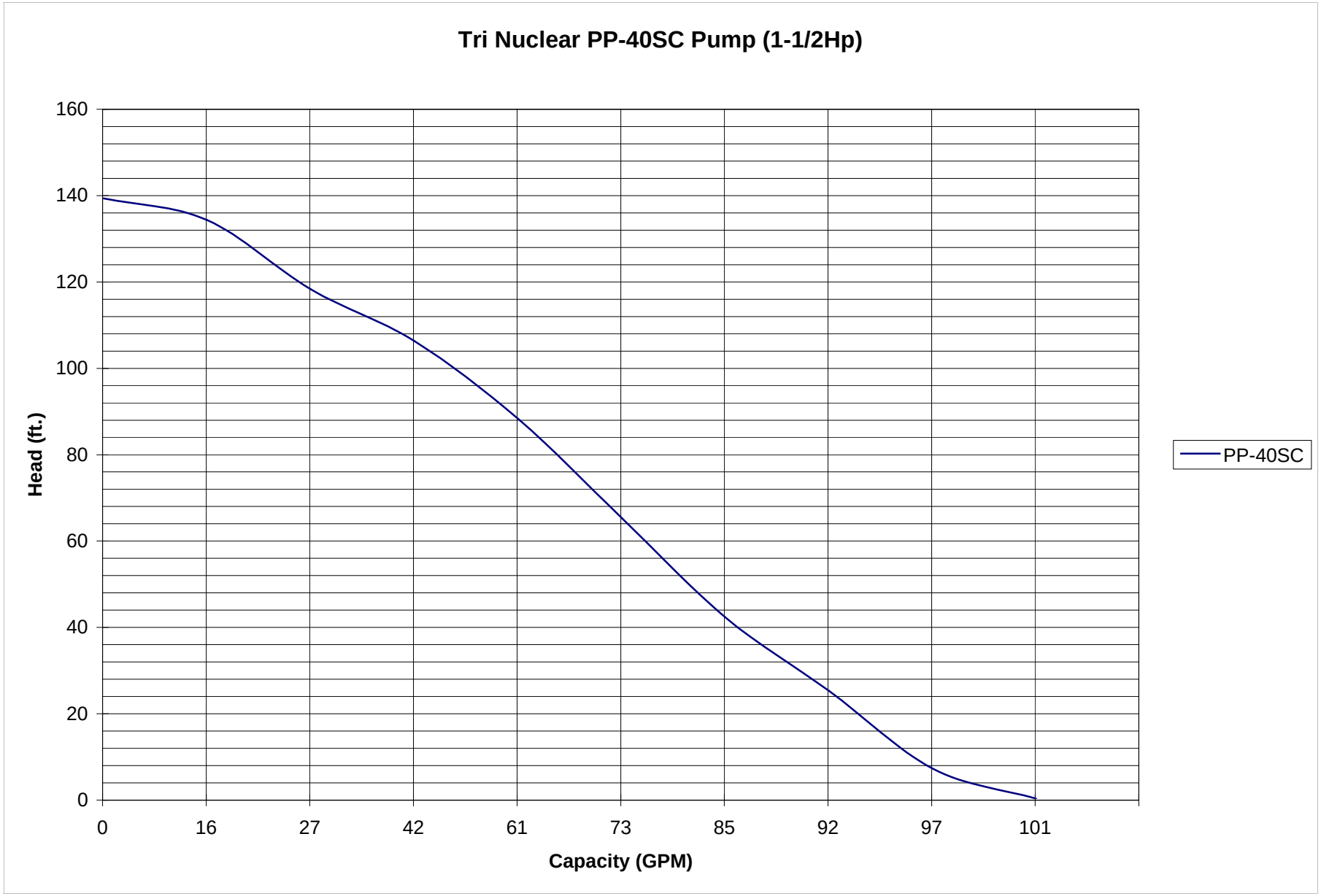
Phase Reversing Pump Control Box
Electrical Schematic

Model No.	Dwg.	Rev.	Page
CB-PR-xx-4XP	TNC-018-07	A	2 of 2


Tri Nuclear PP-40SC Pump (1-1/2Hp)
Head (ft.)
160
140
120
100
80
60
40
20
0
0
16
27
42
61
73
85
92
97
101
Capacity (GPM)
PP-40SC