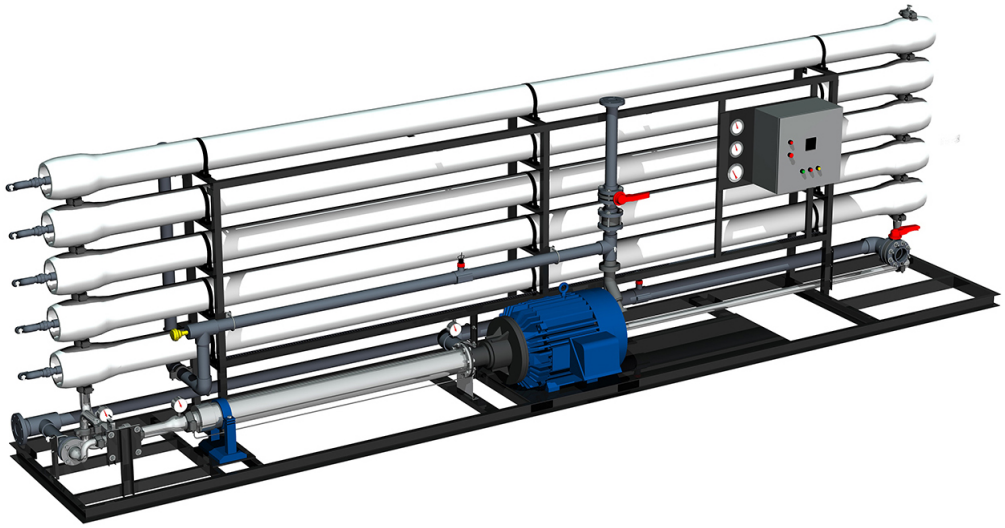
IN STOCK

Seawater Desalination Plant

Technical Proposal



Model 60S

60,000 USGPD (227 m³/d)

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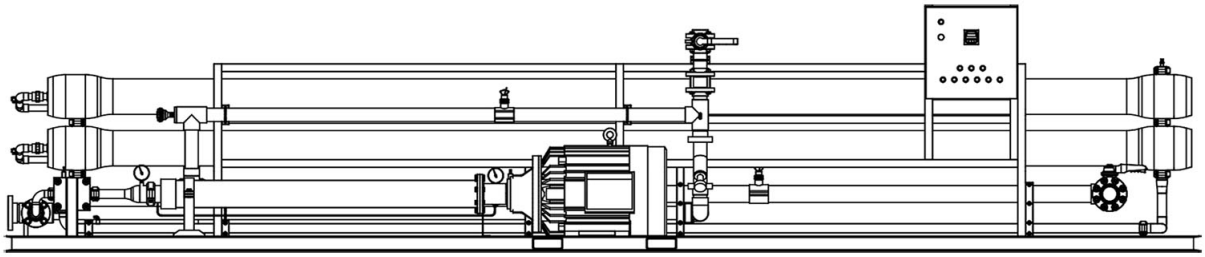
Organization: ISI-Water
Project Name: In Stock 60S RO Plant
Country: United States
Date: 21FEB18

60S - Specification Data Sheet

60,000 US Gallons Per Day - Standard Seawater Reverse Osmosis Skid



The S and H series seawater reverse osmosis skids feature a FEDCO turbine energy recovery device. All ISI Water RO Skids are pre-assembled and ready for installation. Each skid includes all components required to operate and can be customized to include any special requirements. There are many optional upgrades and accessory systems available for use with the RO skids (see www.ISI-Water.com). The product from the RO systems complies with World Health Organization (WHO) standards for potable water (<500 mg/l TDS). Equipment is supplied tested and complete.

Tested.
Prepackaged.
Warrantied.

Made in USA

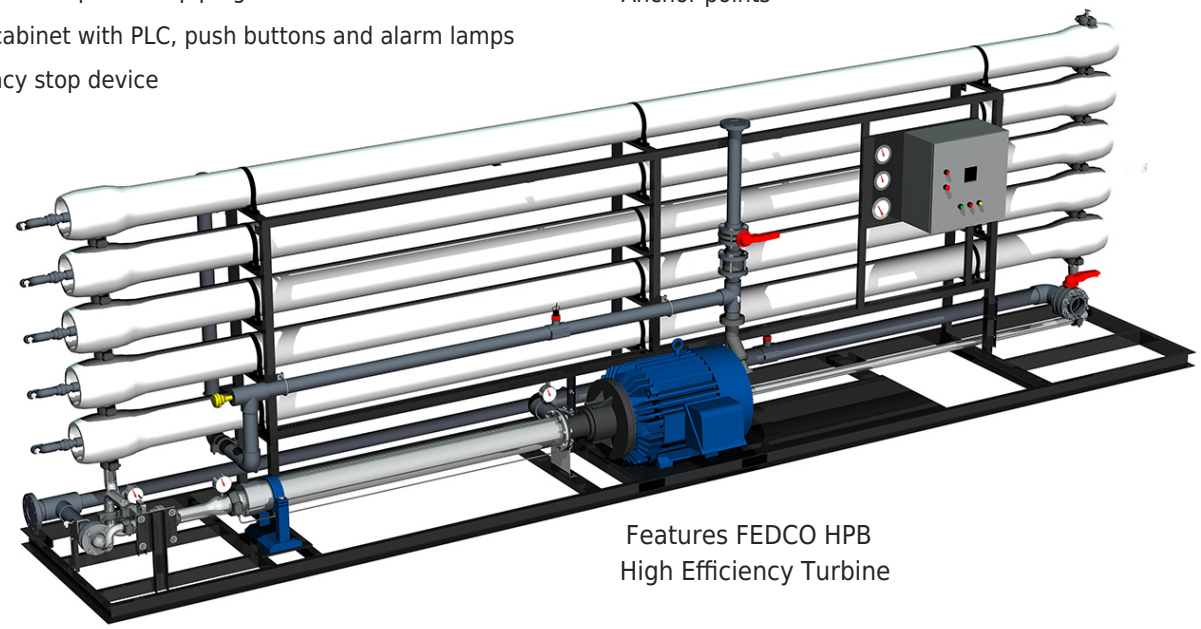
Arrangement	
Maximum Length (in/cm)	315 / 800
Maximum Width (in/cm)	52 / 132
Maximum Height (in/cm)	90 / 229
Dry Weight (lbs/kg)	5,602 / 2,541
Flooded Weight (lbs/kg)	7,475 / 3,390
Feed Connection (in/mm)	3 / DN 80
Brine Connection (in/mm)	2 / DN 50
Product Connection (in/mm)	2 / DN 50
Vessels	2 x 8” x7 El, 1000 psi
Membranes	14 SWRO
High Pressure Pump	FEDCO MSS
Energy Recovery Type	FEDCO HPBe Turbine
Piping Materials	Duplex 2205
Hardware Materials	316SS

Design Parameters	
Nominal Capacity (USgpd / m³/d)	60,000 / 227
Seawater TDS Range (mg/l)	35,000 - 40,000
Inlet SDI Requirement	< 5.0
Design Temperature (C)	25
Recovery (%)	45%
Feed Flow (Usgpm / m³/hr)	93 / 21.0
Brine Flow (Usgpm / m³/hr)	51 / 11.6
Product Flow (Usgpm / m³/hr)	41.7 / 9.5
Nom. Operating Press. (psig /bar)	800 / 55
Min. Feed Pressure (psig/bar)	40 / 2.7
Max Prod./Brine Press. (psig/bar)	10 / 0.7
HPP Motor Power (HP/kW)	50 / 37
Nominal Specific Power (kWh/ kUSgal / kWh/m³)	13.7 / 3.6

SWRO Features and Options

Standard Features

- Epoxy coated structural steel frame
- High efficiency pump and motor
- Energy recovery turbine
- Toray membranes
- Duplex 2205 high pressure piping
- SCH80 PVC low pressure piping
- Control cabinet with PLC, push buttons and alarm lamps
- Emergency stop device
- Corrosion resistant non-metallic process valves
- Local instrument display
- 316SS hardware
- Sample valves
- Air bleed valves
- Anchor points



Features FEDCO HPB
High Efficiency Turbine

Optional Upgrades

- Local power distribution equipment (see power distribution equipment section for more details)
- Options for pump control (soft start, VFD)
- Touchscreen operator interface
- Customized automation programming and system integration
- Remote monitoring (over internet)
- Dow Filmtec or Hydranautics membranes
- Containerization
- Other customizations by request

SWRO Features and Options - Continued

Optional Upgrades - Included

Valve Summary	
Valve	Standard
Feed isolation valve	Manual BFV
Product delivery/divert valve	PVC Automated 3-Way BV
Product check valve	PVC 150# spring loaded cone check valve up to 4”, 316SS wafer check valve for 6”
Brine check valve	PVC 150# spring loaded cone check valve up to 4”, 316SS wafer check valve for 6”-8”
All sample valves	Manual ball valve, plastic (1/4”/DN8)
Air bleed valves	Manual ball valve, 316SS (1/4"/DN8)

Notes: BFV = Butterfly Valve, CV = Check Valve, BV = Ball valve. Valves by Asahi, GF Signet, Hayward, Swagelok, Parker and Davis typical. Other valve types or manufacturers available by request.

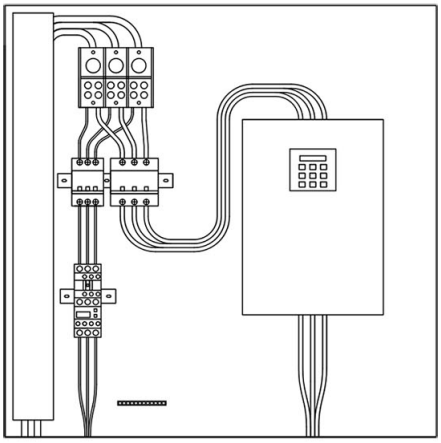
Instrumentation Summary	
Instrument	Standard
Suction pressure gauge	×
HP pump discharge pressure gauge	×
Membrane pressure gauge	×
Membrane differential pressure gauge	×
Suction pressure transmitter	×
Membrane pressure transmitter	×
Feed flow meter with transmitter and display	×
Product flow meter with transmitter and display	×
Product conductivity sensor with transmitter and display	×

Notes: Pressure gauges and transmitters by NoShok. Flow, conductivity and pH instruments by GF Signet. Differential pressure gauges by Orange Research, transmitters by Foxboro or equivalent. Other instruments available by request.

3 Phase Power Distribution Equipment

All Turbine (S/H) Applications

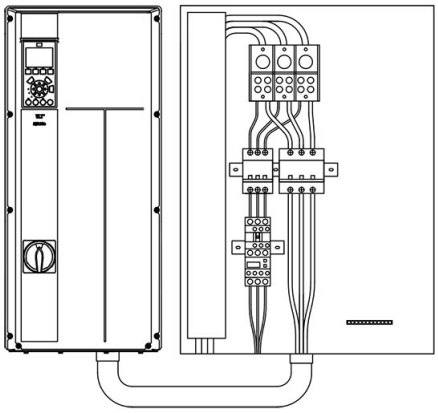
The RO systems can be provided with a power distribution cabinet for controlling the pump motors. The standard cabinets include controlls for the feed pump and high pressure pump. The standard option includes a soft start for the high pressure pump. Variable frequency drives (VFDs) are available in the premium system and can be used on other pumps by request. Other loads can be accomodated (see following pages for custom applications).



Standard System Equipment

- Nema 4 Enclosure
- Power distribution blocks
- Feed pump motor circuit protector
- Feed pump FVNR starter
- Feed pump overload relay
- High pressure pump motor circuit protector
- High pressure pump soft starter
- Grounding buss
- Labels
- Prewired within cabinet and to HP Pump

Notes: Power cabinet dimensions may vary. Cabinet is typically supplied mounted on the RO skid but can be provided loose for installation seperately on site if preferred. Various options for starters and other power equipment available upon request.



Premium System Equipment

- Nema 4 Enclosure
- Power distribution blocks
- Feed pump motor circuit protector
- Feed pump FVNR starter
- Feed pump overload relay
- High pressure pump motor circuit protector
- High pressure pump VFD by Danfoss
- Grounding buss
- Labels
- Prewired within cabinet, VFD, and HP Pump

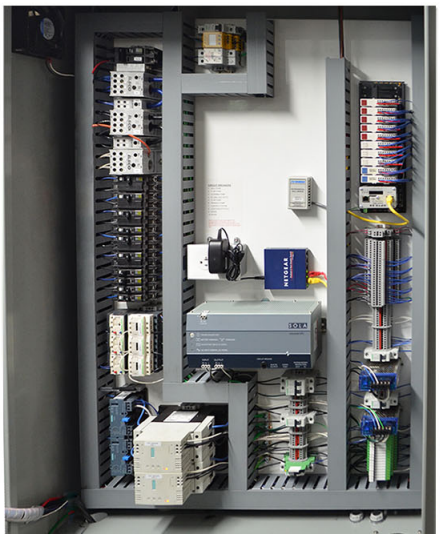
Notes: Power cabinet dimensions may vary. Cabinet and VFD are supplied mounted on the RO skid. Various options for starters, VFDs and other power equipment available upon request. The Danfoss VFD are Nema 4 / IP66.

3 Phase Power Distribution Equipment

Non-Standard Power Distribution Systems

The power distribution system can be built to client specifications. Some applications may require spare pumps, different motor sizes or other features. Additional control may be added by replacing starters with variable frequency drives, and other features can be added such as transient voltage surge suppression, power monitor, line reactors, and others.

Example premium power cabinet with Danfoss VFD mounted on RO Skid
Shown with touchscreen interface and main disconnect options



Example custom power and control cabinet
(Power on the left, control on the right)

Example Fully Integrated Motor Control Center

Multimedia Filtration System

Optional Pretreatment - Included

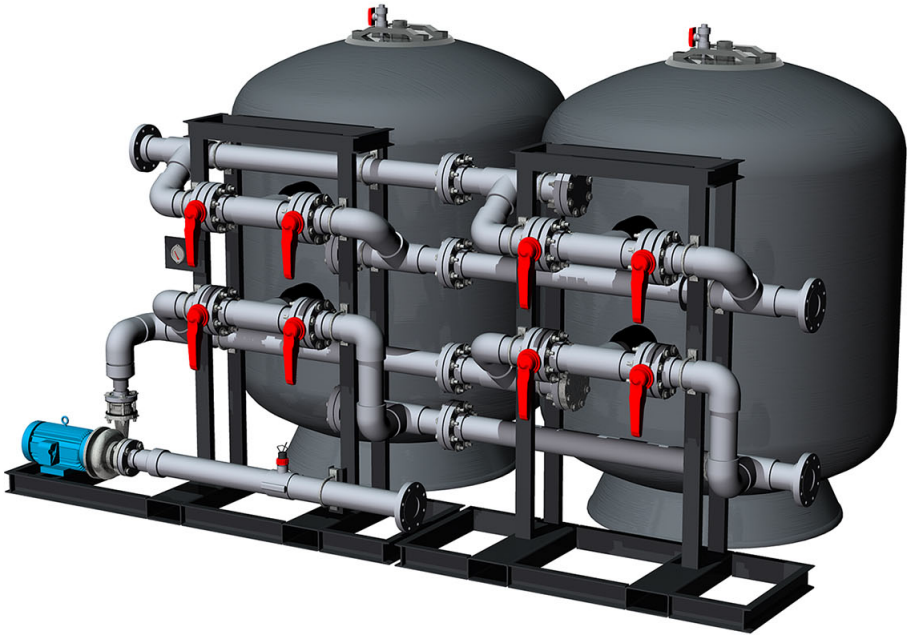
Depending upon the inlet water conditions, it is often necessary to install a pretreatment system to reduce the turbidity and total suspended solids (TSS) of the water in order to make it suitable for RO membranes. ISI-Water offers multimedia filtration systems for use with our reverse osmosis plants. The systems can accommodate plants of any size and are available in multiple arrangements. The typical media filtration system consists of a vertical pressure vessel(s) including media (gravel, sand and anthracite) and a backwash system. Depending on the flow required, two or more tanks may be required. Other media are available such as carbon, greensand and zeolite.

Standard Features

- Vertical filament wound fiberglass tank
- Structural steel frame, epoxy coated
- Manual butterfly valves (4 valve arrangement)
- Differential pressure indicator
- Centrifugal backwash pump
- SCH80 PVC pipe and fittings
- 316SS hardware

Standard Media

- Gravel base - covers laterals
- Sand (.4-.55 mm) - 24”
- Anthracite (85 mm - 95 mm) - 6”



Example two tank arrangement
*In stock unit has single tank

Multimedia Filtration System

Optional Pretreatment - Model Summary

The design summary of each multimedia system is listed below. Key design parameters include:
Maximum design filtration flux: 9 gpm/ft², 0.2 m3/h/m²
Backwash flux: 13 gpm/ft², 2.8 3/h/m²

The standard systems are designed for full flow to the RO system with all media tanks online. The RO system will need to be shut down during the media backwash cycle. Additional tanks may be added to allow RO system to continue operation while one multimedia filter is backwashing. The standard systems are designed for full flow to the RO system with all media tanks online. The RO system will need to be shut down during the media backwash cycle. Additional tanks may be added to allow RO system to continue operation while one multimedia filter is backwashing. Automation is available for all MMF systems.

Media Tank Summary								
SWRO Model Number	Filter Quality	MMF Filter Model	Media Filter Outer Diameter (in/mm)	Total Filter Area ft² (m²)	Max Flow Rate gpm (m³/h)	Backwash Flow Rate gpm (m³/h)	Ship Weight Lbs (Kg)	Recommended Backwash Tank Volume USgal (m³)
60S/SE/H/HE	1	SMD1200	48.3 (1229)	11.9 (1.13)	109 (24.9)	158 (35.9)	450 (205)	2500 (9.5)
80S/SE/H/HE	1	SMD1400	56.7 (1442)	16.2 (1.54)	149 (33.9)	215 (48.8)	500 (227)	3500 (13.2)
100S/SE/H/HE 120S/SE	1	SMD1600	64.7 (1644)	21.1 (2.01)	194 (44.2)	281 (63.9)	550 (250)	4500 (17.0)
120H/HE 140S/SE/H/HE 160S/SE	1	SMD1800	72.4 (1839)	26.8 (2.54)	247 (56.0)	356 (80.9)	550 (250)	6000 (22.7)
160H/HE 180S/SE	1	SMD2000	80.4 (2042)	33.0 (3.14)	304 (69.1)	439 (99.8)	550 (250)	7000 (26.5)
180H/HE 200S/SE/H/HE 225S/SE	1	SMD2200	88.3 (2245)	40.0 (3.80)	368 (83.6)	532 (120.9)	590 (268)	8000 (30.3)
225H/HE 250S/SE/H/HE 300S/SE	2	SMD1800	72.4 (1839)	53.5 (5.09)	492 (112)	356 (80.9)	590 (268)	6000 (22.7)
300H/HE 350S/SE/H/HE	2	SMD2000	80.4 (2042)	66.0 (6.28)	608 (138)	439 (99.8)	950 (432)	7000 (26.5)
400S/SE/H/HE 450S/SE	2	SMD2200	88.3 (2245)	80.0 (7.60)	736 (167)	532 (120.9)	950 (432)	8000 (30.3)

Note:
Actual arrangement shall be determined at time of order. Available space, train configuration and layout, containerized systems, design flux, and media selection may require changes to the above table details.

Cartridge Filtration System

Optional Pretreatment - Included

As a final pretreatment step before RO, a 5 micron cartridge filter is recommended. Pumps and energy recovery devices can easily be damaged by debris in the feed stream. Membranes can also be damaged by sand and grit, causing reduced product quality. A cartridge filter ensures that any remaining solids do not enter the RO system.

The filter housings are offered in both non-metallic and alloy. Standard housings use 2.5” x 40” filter cartridges and are mounted in the upright position. Housings can be customized by request to accommodate various sizes and positions of nozzles and filter cartridge lengths.

Standard Features

- Non-metallic - SCH80 PVC
- Manual suction and discharge isolation valves
- Differential pressure indicator
- Air bleed valve
- Drain valve
- 316SS mounting hardware

Optional Features

- Automated valves (pneumatic or motorized)
- Differential pressure transmitter (dPET)
- Choice of filter cartridges (1, 5, 10, or 20 micron)
- Duplex 2205, Super Duplex 2507 Housings available upon request
- Mounting on RO skid (depends on application)

Example cartridge filter housing

RO Cleaning System

Optional Subsystem - Included

RO membranes require routine chemical cleaning. The frequency of cleaning will vary based on feed water conditions, but this is typically completed every 2 to 6 months. ISI-Water cleaning systems are sized to accommodate RO skids ranging in size from 30,000 USgpd (114 m^3/d) through 500,000 USgpd (1,892 m^3/d) and can be custom-built to suit customer specifications. One cleaning system can serve multiple RO trains, but it should be sized for the largest train in the plant. The cleaning system contains all the necessary equipment required to perform and monitor RO membrane cleaning.

Standard Features

- Cleaning Pump
- Structural steel frame with fork pockets and epoxy coating
- Polyethylene cleaning tank
- SCH80 PVC piping
- 316SS hardware
- Pressure gauge
- Process flow sensor and display
- Pump discharge check valve
- Manual recirculation valve
- Manual cleaning delivery valve
- Manual drain valve
- Differential pressure gauge

Example cleaning system

Shown with optional bag filter and differential pressure gauge

ISI standard cleaning systems are summarized in the following table.

Cleaning System Summary				
For use with RO Skid Model Number	Motor Power (HP / KW)	Discharge Size (in / mm)	Cleaning Flow Rate (gpm / m³/hr)	Design Pressure (psi/bar)
30S/SE 60S/SE	7.5/5.6	2/DN 50	80/18.2	40/2.76
60H/HE 80S/SE 100S/SE	7.5/5.6	3/DN 80	120/27.3	40/2.76
80H/HE 100H/HE 120S/SE 140S/SE	7.5/5.6	3/DN 80	160/36.3	40/2.76
120H/HE 140H/HE 160S/SE	10/7.5	4/DN 100	200/45.4	40/2.76
160H/HE 180S/SE	10/7.5	4/DN 100	240/54.5	40/2.76
180H/HE 200S/SE 225S/SE	10/7.5	4/DN 100	280/63.6	40/2.76
250S/SE 225H/HE	15/11.2	6/DN 150	320/72.7	40/2.76
250H/HE 300S/SE	15/11.2	6/DN 150	360/81.8	40/2.76
350S/SE	15/11.2	6/DN 150	400/90.8	40/2.76
300H/HE	15/11.2	6/DN 150	440/99.9	40/2.76
350H/HE 400S/SE	30/22.4	6/DN 150	480/109	40/2.76
450S/SE 500S/HE	30/22.4	6/DN 150	520/118	40/2.76
400H/HE	30/22.4	6/DN 150	560/127	40/2.76

Chemical Dosing System

Optional Pretreatment - Included

Chemical dosing systems are often required for operation of an RO plant. Typical chemical requirements for RO include antiscalants for the feed water to ensure scaling potential, for pH adjustement of the permeate water, and chlorine dosing. Anti-corrosion chemicals can also be included. Custom chemical dosing systems can be supplied per customer request and specification.

Standard Features (per dosing point)

- 15 Gallon day tank
- Peristaltic dosing pump with manual stroke adjustment
- Suction and discharge tubing
- Priming and anti-siphon valve
- 1/2” MNPT Injector
- Chemical Injector
- Suction screen

Example Customized Dosing Skid

Surface Mount Low Pressure Feed Pump

Optional Subsysten - Included

The high pressure pump on an RO system needs a specific flowrate and pressure at its suction to perform properly. This system comes with a low pressure feed pump skid that is designed to supply these flows and pressures accordingly. This skid will be placed on the surface next to a water source. It is designed to pull seawater out of the source and push it to the plant.

Features

- Duplex 2205 pump construction material
- 5 Horsepower motor
- Danfoss VFD
- Suction Isolation Valve
- Discharge Pressure Indicator
- Discharge Check valve
- Structural Steel Skid