

7 CUBIC FOOT SHIELDED DEMINERALIZER SPECIFICATION

1. Demineralizer, disposable, pre-loaded pressure vessel:

The contractor shall provide a drawing that specifies the specific manufacturing details of the demineralizer assembly including all materials of construction. The contractor shall obtain approval of the drawing from the following shipyard organizations/contacts:

The following is a listing of key design features of the demineralizer. This listing is not all-inclusive.

GENERAL DESIGN FEATURES OF DEMINERALIZERS:

- A. Design Pressure 29" Hg vacuum to 150 PSIG.
- B. Design Temperature 140°F.
- C. Design Flow Rate 25 GPM.
- D. Design maximum differential pressure drop of 5 PSID at 25 GPM.
- E. Outer diameter: 24 + ½ - 0 inches.
- F. Overall height will be 42 inches from bottom of demineralizer to top of uncapped pipe stubs. Overall height will be 42.5 inches from bottom of demineralizer to top of skirt. See attached drawing.
- G. Cleanliness level will be commercial grade. Demineralizer will be free of grease, oil, flux, and loose foreign materials.
- H. Media capacity: minimum 7 cu. ft. total. Media must be capable of removing particulate, cationic, anionic, and colloidal wastes from water, and may only add pure water back to the effluent. Customer will provide media specifications.
- I. Connection ports: inlet, outlet, and vent.
- J. Connections: One inch MNPT threaded pipe for the inlet, outlet, and vent ports. One-inch pipe caps will be installed on the inlet, outlet, and vent connections. The inlet pipe stub will be centered at the top of the demineralizer. The inlet, outlet, and vent pipe stubs will be 2-1/2 inches from the top of the demineralizer to the top of the pipe stubs.
- K. Pressure vessel must meet ASME Boiler and Pressure Vessel Code and bear a "U" stamp.

- L. Demineralizer must be able to be disposed of as radioactive material as a unit, or the products of a volume reduction process must be able to be disposed of as radioactive material.
- M. Demineralizer must have OSHA material safety warnings specified.
- N. Demineralizer must be constructed to support the waste processing media as a fixed bed retained inside the demineralizer. Retention elements must be sized at a mesh of 200 or greater (74 micron or less openings).
- O. The demineralizer inlet distribution header (five inches min. diameter) must have $\frac{1}{4}$ " – $\frac{3}{8}$ " minimum diameter orifices to facilitate the required 25 GPM flow rate. This allows the demineralizer to capture gross sized particles without obstructing the inlet header. Must have a solid bottom distribution plate, and not extend into the demineralizer media when settled in vessel. This distribution header is not intended to retain demineralizer media.
- P. The top of the demineralizer shall be shielded with six (6) inches of steel with a gamma attenuation tenth value thickness of approximately 4 inches, with minimum yield strength of 33,000 PSI.
- Q. The demineralizer shall be dewaterable to less than 0.5 % by water volume as specified in 10CFR61.56. A certified dewatering procedure shall be provided with the demineralizer.
- R. Exposed surfaces of the demineralizer shall have a non-porous surface to provide for easy decontamination of all external exposed surfaces of the demineralizer. Wetted surfaces of carbon steel demineralizer vessels shall be coated with an epoxy like liner to prevent corrosion.
- S. The demineralizer shall have a leakproof top skirt centered on the top of the demineralizer. The skirt shall be welded to the top of the demineralizer, shall be 19.5" inner diameter, shall be 3" high, and shall be 0.25" thick.
- T. A certification shall be provided that all materials used for the construction of the demineralizer assembly meet the Barnwell site criteria and US Ecology site criteria for disposal of radiological material.
- U. The safe working load of the demineralizer shall be established as 2500 pounds and shall be stenciled on the side.
- V. Contractor shall arrange for the transportation company to protect the demineralizer from freezing during shipment.
- W. Install a $\frac{1}{4}$ " thick, 24" diameter carbon steel base plate on bottom of each demineralizer. Overall height from bottom to top of pipe stub is to be maintained 42", and overall height from bottom to top of skirt is to be maintained 42.5".

- X. Stencil on side of shield block in 1" high letters, contrasting color, two places 180 degrees apart: "TOP HEAVY".

2. Media Requirements:

The demineralizer shall be furnished complete with the following media:

- A. 3.5 cubic feet of HOH resin (Class 3) that conforms to O-I-1279, FEDERAL SPECIFICATION ION EXCHANGE RESINS or HOH resin that conforms to MIL-R-24119 Class 6 Grade I Type A. The resin shall be loaded first.
- B. 3.5 cubic feet of newly manufactured, coconut shell based, granular, activated carbon:
US SIEVE SERIES 20 X 50 MESH,
0.6 mm AVERAGE EFFECTIVE MEAN PARTICLE DIAMETER,
APPARENT DENSITY (ASTM D 2854) 30 lbs/ft³ AVERAGE,
TOTAL ASH CONTENT (ASTM D 2866) 2% MAXIMUM,
CARBON TETRACHLORIDE ACTIVITY (ASTM D 3467) 62% MINIMUM,
BALL PAN HARDNESS (ASTM D 3802) 97 MINIMUM,
pH (ASTM D 3838) 3.0 - 10.0,
IODINE NUMBER (ASTM D 4607) 1050 MINIMUM,
SURFACE AREA (B.E.T. EQUATION) 1100 -1250 m²/g.
PICACHEM W6 20 x 50 Coconut Shell Base Activated Carbon is a product that meets the preceding activated carbon specifications. The carbon shall be loaded last so that it is above the resin bed.

3. Hydrostatic Test Certification:

- A. The contractor shall provide a certification that the completed demineralizer assembly has been hydrostatically tested to a minimum of 225 psig for 30 minutes.
- B. The demineralizer shall be blown down of free standing liquid after hydrostatic test and prior to shipment.
- C. A copy of hydrostatic test certification papers shall be provided for the demineralizer with the hydrostatic test pressure; documented proof of duration of test, and date the hydro was performed. Absence of the documents listed above shall be cause for rejection.

4. Lifting Eye Hole Requirements:

- A. Two ½"-13UNC-2B lifting eyeholes must be drilled and tapped into the six-inch top plate material. The holes must be tapped to a usable depth of 7/8" (minimum) must be drilled 180 degrees apart on a 15" DBC.

- B. An area one inch in all directions from the center of each lifting eye hole must be flat to allow 360 degree contact of the safety hoist ring bushing. An area two inches in all directions from the center of each lifting eyehole must be clear of obstructions that would restrict free movement of the safety hoist ring.
- C. A load test shall be performed on the lifting eye holes for the safety hoist rings. The test load shall be held for a minimum of 10 minutes and applied in the same direction the demineralizer is lifted, not to exceed 8.6° from vertical. The test load shall be 150 % +5%, -0% of the safe working load of each lifting eye hole. The combined safe working load of all lifting eye holes shall be 2500 pounds. This safe working load may exceed the actual or calculated gross weight of a demineralizer (filled with water) offered by a company.
- D. After load test, the lifting eye holes shall be visually inspected to the maximum extent practicable for cracks, crushed threads, gouges and other deficiencies that would affect load bearing capability.
- E. Proof of the lifting eye hole certification must be submitted to the Shipyard for each demineralizer. A copy of all load test certification papers, results of visual inspections and safety factor calculations shall be sent to the Shipyard with delivery. Calculations proving that lifting eye holes possess a minimum safety factor of 10:1 based on material yield strength shall be based on the established safe working load of 2500 pounds. Each set of load test and visual inspection papers must list the corresponding demineralizer serial number. Absence of these documents shall be cause for rejection. Protect threaded lifting eyeholes with appropriate thread protector.
- F. The tapped lifting holes shall meet the requirements of ANSI N14.6-1993. This requires a drop weight test per ASTM E 208 or a Charpy impact test per ASTM A 370 of the base material as specified in paragraph 4.2.6 of ANSI N14.6-1993. The anticipated minimum service temperature for lifting the demineralizer vessel is 20 deg. F; therefore, the nil ductility transition temperature shall be at least 40 deg. F below the anticipated minimum service temperature.

Attachment (A) – Document No. 2356ZN01
DEMINERALIZER SKETCH

