

**ADDENDUM NO. 4**

COUNTY OF KAUA'I  
DEPARTMENT OF WATER

INVITATION FOR BIDS  
For

**JOB NO. 16-04, WP2020 #WKK-03**  
**MCC, CHLORINATION FACILITIES – KĪLAUEA WELLS NO. 1 AND NO. 2**  
**KAUA'I, HAWAI'I**

NOTICE TO PROSPECTIVE BIDDERS

This addendum is hereby made a part of the INVITATION FOR BIDS for the subject project, and it shall amend the said contract documents in the following respects:

**Item 1**

Department's Responses to Questions/Comments/Material Substitutions.

**End of Addendum No. 4**

Should you have further questions, please contact the Procurement Officer at (808) 245-5416 or email [mhinazumi@kauaiwater.org](mailto:mhinazumi@kauaiwater.org).



\_\_\_\_\_  
Joseph E. Tait  
Manager and Chief Engineer  
November 19, 2021

**ACKNOWLEDGEMENT OF RECEIPT OF ADDENDUM NO. 4**

Receipt Acknowledged:

\_\_\_\_\_  
Organization

\_\_\_\_\_  
Received by

\_\_\_\_\_  
Date

\_\_\_\_\_  
Title

(Please sign and return this acknowledgement.)



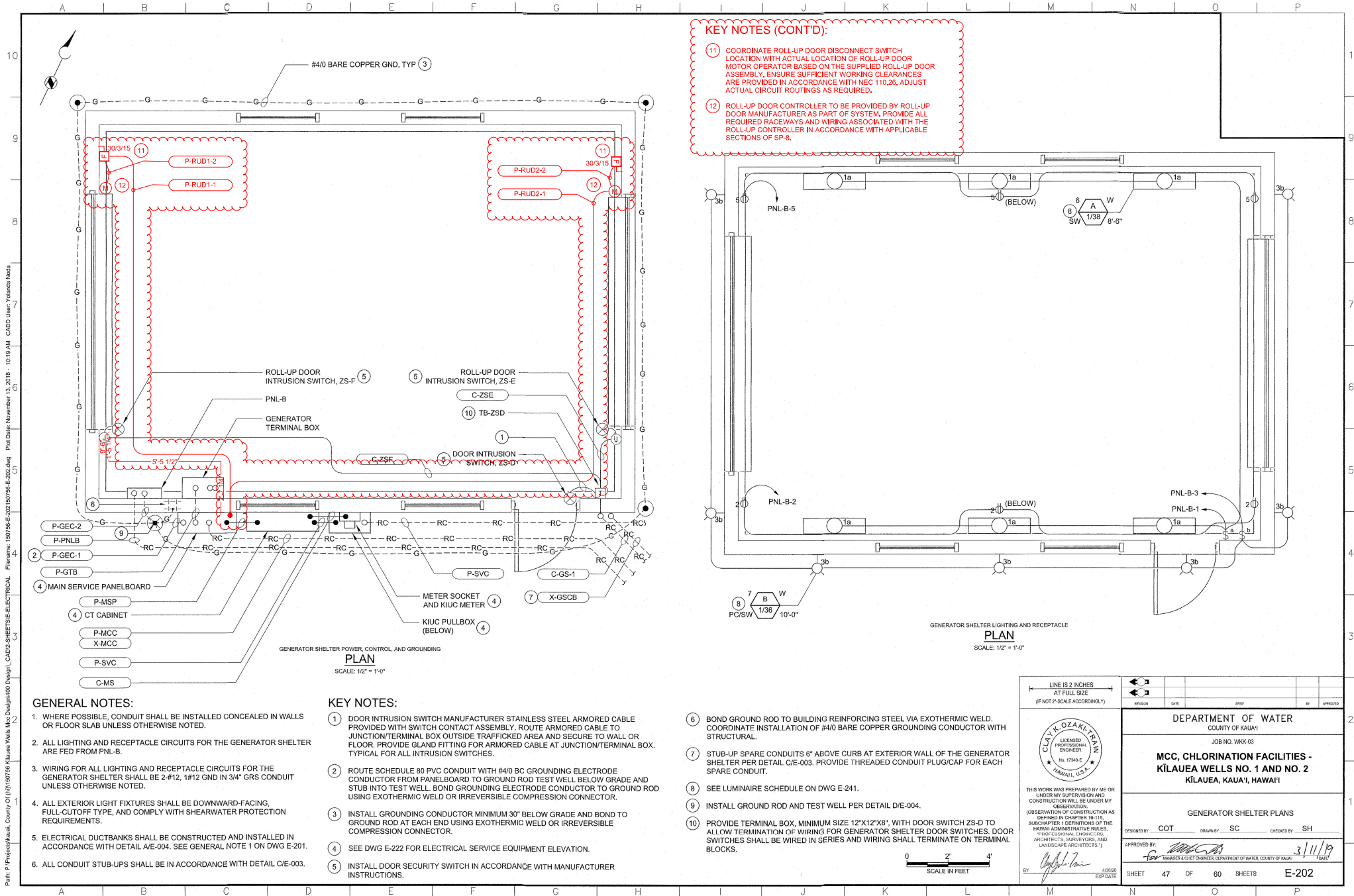
## **Department's Responses to Questions/Comments/Material Substitutions**

**(1) QUESTION:** Para 6.2.08/B. of the specs is asking for electric motor operation with an option for manual operation as back-up. The Door & Window Schedule on Plan A-103 is asking for a roll-up door with a manual operator. Are the roll-up doors to be furnished with an electric operator or a manual operator (chain)?

Plan A-103 Door and Window Schedule - Note is asking that all door and windows/louvers must be rated to withstand hurricane category 5 winds - +/- 130 PSF. Due to this windload rating - the door would be too heavy to manually operate. The lifting weight is approximately 2,570 lbs. We recommend a motor operated door if the coiling doors are to meet the windload on the drawing notes.

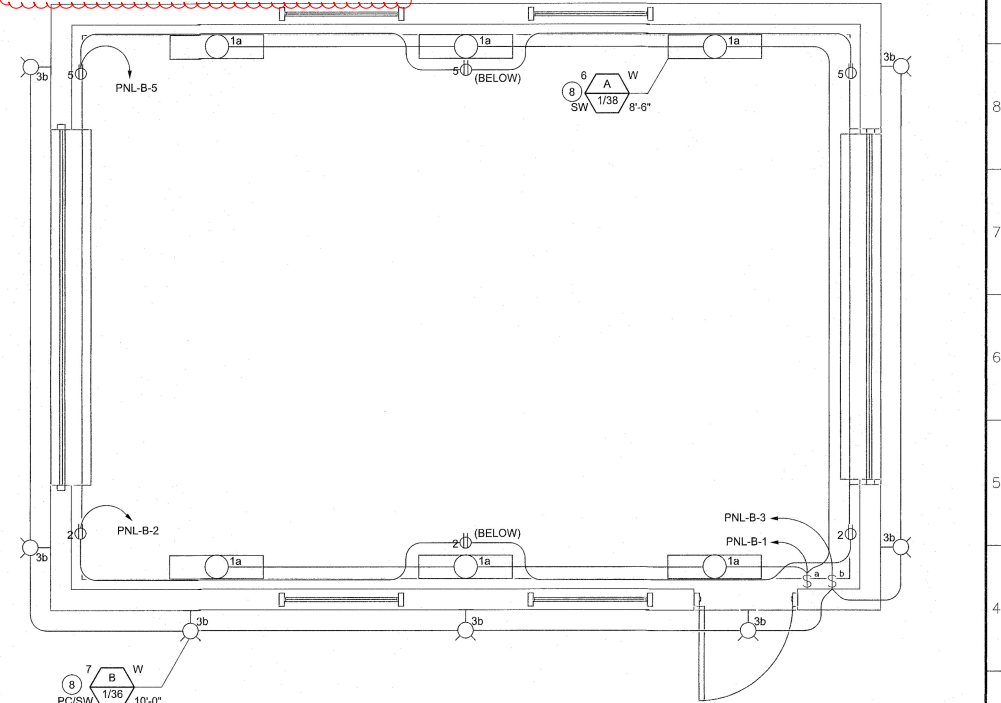
**ANSWER:** Per Paragraph 6.2.08 B, the roll-up door is to be furnished with an electronic operator. Motor size and installation details to be as recommended by the rollup door manufacturer. For the Cookson PSD361 rollup door, the recommended motor size is 1.5 HP/460 V/3 PH. Power to the electric operator shall be provided by and connected to the panelboard at the generator shelter. Markups of the revised electric circuit drawings are also provided (attached). Signed revised electrical circuit drawings will be issued with the construction drawings.

Path: P:\Projects\Kilauea Wells No. 1\DWG\SP-8-ELECTRICAL\CAD\2-SHEETS\SP-8-ELECTRICAL\CAD\2-SHEETS\SP-8-ELECTRICAL.dwg Plot Date: November 13, 2018 - 10:19 AM CADD User: Yousaku Noda  
 File: 1507956-E-20210704-E-202.dwg



**KEY NOTES (CONT'D):**

- 11 COORDINATE ROLL-UP DOOR DISCONNECT SWITCH LOCATION WITH ACTUAL LOCATION OF ROLL-UP DOOR MOTOR OPERATOR BASED ON THE SUPPLIED ROLL-UP DOOR ASSEMBLY. ENSURE SUFFICIENT WORKING CLEARANCES ARE PROVIDED IN ACCORDANCE WITH NEC 110.26, ADJUST ACTUAL CIRCUIT ROUTINGS AS REQUIRED.
- 12 ROLL-UP DOOR CONTROLLER TO BE PROVIDED BY ROLL-UP DOOR MANUFACTURER AS PART OF SYSTEM. PROVIDE ALL REQUIRED RACEWAYS AND WIRING ASSOCIATED WITH THE ROLL-UP CONTROLLER IN ACCORDANCE WITH APPLICABLE SECTIONS OF SP-8.



GENERATOR SHELTER LIGHTING AND RECEPTACLE  
**PLAN**  
 SCALE: 1/2" = 1'-0"

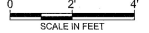
**GENERAL NOTES:**

1. WHERE POSSIBLE, CONDUIT SHALL BE INSTALLED CONCEALED IN WALLS OR FLOOR SLAB UNLESS OTHERWISE NOTED.
2. ALL LIGHTING AND RECEPTACLE CIRCUITS FOR THE GENERATOR SHELTER ARE FED FROM PNL-B.
3. WIRING FOR ALL LIGHTING AND RECEPTACLE CIRCUITS FOR THE GENERATOR SHELTER SHALL BE 2-#12, 1#12 GND IN 3/4" GRS CONDUIT UNLESS OTHERWISE NOTED.
4. ALL EXTERIOR LIGHT FIXTURES SHALL BE DOWNWARD-FACING, FULL-CUTOFF TYPE, AND COMPLY WITH SHEARWATER PROTECTION REQUIREMENTS.
5. ELECTRICAL DUCTBANKS SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH DETAIL A/E-004. SEE GENERAL NOTE 1 ON DWG E-201.
6. ALL CONDUIT STUB-UPS SHALL BE IN ACCORDANCE WITH DETAIL C/E-003.

**KEY NOTES:**

- 1 DOOR INTRUSION SWITCH MANUFACTURER STAINLESS STEEL ARMORED CABLE PROVIDED WITH SWITCH CONTACT ASSEMBLY. ROUTE ARMORED CABLE TO JUNCTION/TERMINAL BOX OUTSIDE TRAFFICKED AREA AND SECURE TO WALL OR FLOOR. PROVIDE GLAND FITTING FOR ARMORED CABLE AT JUNCTION/TERMINAL BOX. TYPICAL FOR ALL INTRUSION SWITCHES.
- 2 ROUTE SCHEDULE 80 PVC CONDUIT WITH #4/0 BC GROUNDING ELECTRODE CONDUCTOR FROM PANELBOARD TO GROUND ROD TEST WELL BELOW GRADE AND STUB INTO TEST WELL. BOND GROUNDING ELECTRODE CONDUCTOR TO GROUND ROD USING EXOTHERMIC WELD OR IRREVERSIBLE COMPRESSION CONNECTOR.
- 3 INSTALL GROUNDING CONDUCTOR MINIMUM 30" BELOW GRADE AND BOND TO GROUND ROD AT EACH END USING EXOTHERMIC WELD OR IRREVERSIBLE COMPRESSION CONNECTOR.
- 4 SEE DWG E-222 FOR ELECTRICAL SERVICE EQUIPMENT ELEVATION.
- 5 INSTALL DOOR SECURITY SWITCH IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS.

- 6 BOND GROUND ROD TO BUILDING REINFORCING STEEL VIA EXOTHERMIC WELD. COORDINATE INSTALLATION OF #4/0 BARE COPPER GROUNDING CONDUCTOR WITH STRUCTURAL.
- 7 STUB-UP SPARE CONDUITS 6" ABOVE CURB AT EXTERIOR WALL OF THE GENERATOR SHELTER PER DETAIL C/E-003. PROVIDE THREADED CONDUIT PLUG/CAP FOR EACH SPARE CONDUIT.
- 8 SEE LUMINAIRE SCHEDULE ON DWG E-241.
- 9 INSTALL GROUND ROD AND TEST WELL PER DETAIL D/E-004.
- 10 PROVIDE TERMINAL BOX, MINIMUM SIZE 12"X12"X8", WITH DOOR SWITCH ZS-D TO ALLOW TERMINATION OF WIRING FOR GENERATOR SHELTER DOOR SWITCHES. DOOR SWITCHES SHALL BE WIRED IN SERIES AND WIRING SHALL TERMINATE ON TERMINAL BLOCKS.



<p>LINE IS 2 INCHES          AT FULL SIZE          (IF NOT 2" SCALE ACCORDINGLY)</p>	<p>REVISION</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; height: 20px;"> </td> <td style="width: 50%; height: 20px;"> </td> </tr> <tr> <td style="width: 50%; height: 20px;"> </td> <td style="width: 50%; height: 20px;"> </td> </tr> </table>					<p><b>DEPARTMENT OF WATER</b>          COUNTY OF KAUAI</p> <p>JOB NO. WKK-03</p> <p><b>MCC, CHLORINATION FACILITIES -          KILAUEA WELLS NO. 1 AND NO. 2</b>          KILAUEA, KAUAI, HAWAII</p> <p>GENERATOR SHELTER PLANS</p> <p>DESIGNED BY: COT      DRAWN BY: SC      CHECKED BY: SH</p> <p>APPROVED BY: <i>[Signature]</i>      DATE: 3/11/19</p> <p>BY: <i>[Signature]</i>      43928      3/11/19          EXP. DATE</p>
<p>SHEET <b>47</b> OF 60 SHEETS      <b>E-202</b></p>						





**(2) SUBSTITUTION REQUEST:** Specification Section SP-6.2 Coiling Doors, 6.2.07 Manufacturer (Raynor or approval equal).

**ANSWER:** The substitution request to include the CornellCookson LLC door is approved. Product brochures are attached.

ROLLING DOOR

# SERVICE DOOR

Models ESD10 & ESD10W



## THE STANDARD OFFERING THAT'S ANYTHING BUT...

### FLEXIBILITY

Each door is built to meet your exact specifications. We offer many options - from custom graphics to perforated slats - to help you create a product that's uniquely yours.

### PERFORMANCE

Our doors can be configured to withstand the full range of wind load requirements, including Miami-Dade, Texas Department of Insurance, ANSI/DASMA-108 and operational wind load of up to 20 PSF. We can also supply seismic calculations, missile impact ratings and much more.

### RELIABILITY

Rugged, commercial-grade construction requires little to no maintenance for the lifetime of the door.

### SECURITY

Rolling steel doors are significantly more secure than traditional garage or dock doors.

### DURABILITY

Our standard Service Door is constructed to withstand daily use and warranted up to 50,000 cycles (more than twice the amount of many competitive brands).

### MAXIMUM CLEARANCE

Ideal for areas with limited overhead room, Service Door curtains store in an overhead coil fully supported by the side guides.

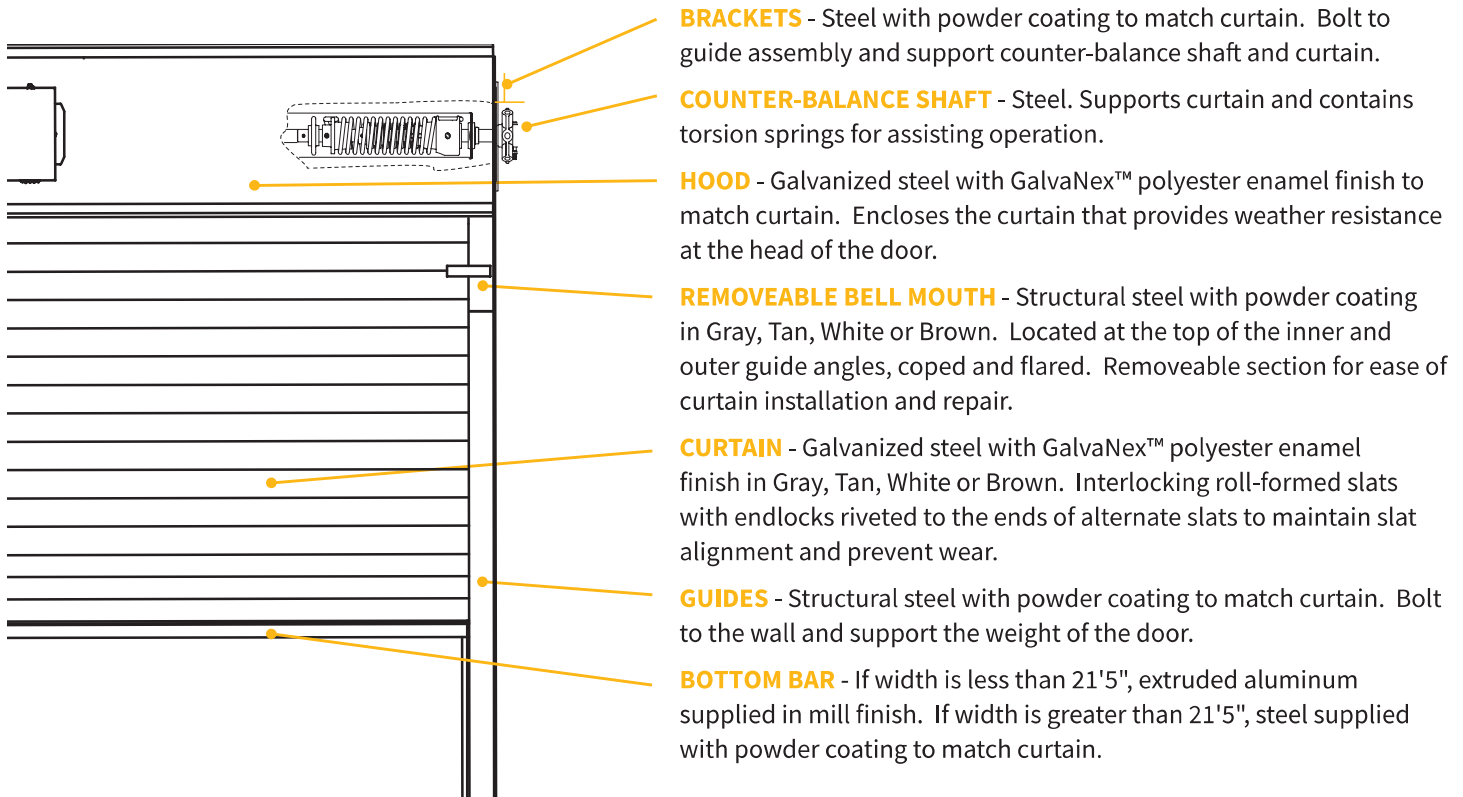
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Preferred door solutions.<sup>®</sup>  
**COOKSON**

## ROLLING DOOR **SERVICE DOOR** Models ESD10 & ESD10W (operational wind-load)

### STANDARD COMPONENT MATERIALS AND FINISHES



### OPERATION AND STRUCTURAL REQUIREMENTS

**Hand-chain, Hand-crank, push-up and a variety of motor options are available.**

This product is supported by a guide assembly attached to the jamb construction. No additional header support is required unless hood supports are mandated by a larger opening width.

### OPTIONAL MATERIALS AND FINISHES

- ▶ Aluminum in mill, clear or color anodized
- ▶ Stainless Steel - 300 series in #4 finish.
- ▶ SpectraShield® Powder Coating in more than 180 colors

**Hand-crank, push-up and motor operation is available.**

- ▶ Hot-dip galvanizing on steel components
- ▶ Zinc-enriched, corrosion-resistant powder coating in Gray



### CUSTOM-DESIGNED SOLUTIONS

Contact our experienced Architectural Design Support Team for help in customizing our products to fit your specific application.

 [www.architectdoorhelp.com](http://www.architectdoorhelp.com)

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**COOKSON** Preferred door solutions.®



# STORMDEFENDER® DOOR

Models PSD361 & PRSD361 (fire-rated)



## SAFE ROOM INNOVATION ENABLES OPEN, AIRY DESIGN

### INVISIBLE PROTECTION = DESIGN FREEDOM

The StormDefender door is big on security and on design. How? By being invisible until called into service. The sleek construction allows for virtually undetectable embedment into precast concrete, creating minimal protrusion into the space. In addition, the coil may be hidden above a finished ceiling or into a soffit.

This invisibility allows design freedom - a single door can cover multiple openings, or even banks of windows to maximize natural light. With StormDefender Doors, typical safe room spaces - like cafeterias, classroom pods and gymnasiums - can be open and airy instead of dark and claustrophobic. When a storm is imminent, the StormDefender door deploys, automatically turning an open space into an ICC 500/FEMA 361 rated safe room to protect occupants from harsh winds and deadly projectiles. After the event, the door simply disappears back into the structure.

### MEETING THE STANDARDS

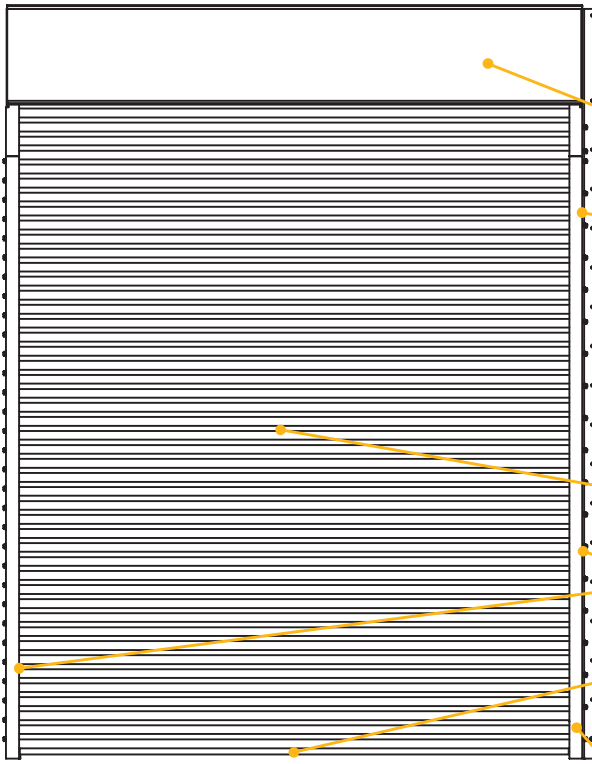
The StormDefender is designed specifically with life safety in mind for safe room protection against tornadoes and hurricanes. Available in fire-rated and non fire-rated models, the door is tested and certified to stringent ICC500-2014 and FEMA P-361, Third Edition code standards.

### BUILT FOR PROTECTION

The StormDefender utilizes our award-winning AlarmGard system with fail-safe operation. It can be connected directly to the building alarm system - deploying the doors upon activation. In the event a storm knocks out power, the door will automatically close to eliminate one more "to-do". The heavy-duty slats are held in place with our patent pending curtain design keeping them in the guides even in the strongest of winds. In addition, sound deadening endlocks reduce noise during operation.

# DEFENDER SERIES **STORMDEFENDER® DOOR** Models PSD361 & PRSD361 (fire-rated)

## STANDARD COMPONENT MATERIALS AND FINISHES



- BRACKETS** - Steel with powder coated finish to match curtain. Bolted to guide assembly and support counter-balance shaft and curtain.
- HOOD** - Galvanized steel color to match curtain.
- HORN AND STROBE LIGHT** - Activates when door is operating.
- PATENT PENDING WINDLOCKS** - Cut into the ends of each slat to engage in the windlock bar. Prevents the curtain from pulling out of the guides during high pressure events.
- MOTOR** - The AlarmGard Operator allows the door to be connected to a notification system or default to the secure/protected position under a power failure. Can be upgraded to the AlarmGard Plus to include a handchain and battery backup.
- CURTAIN** - Steel with SpectraShield® powder coat in gray as standard. 12 gauge, 4" face flat slat with integrated wind locks.
- GUIDES** - Support the weight of the door. Steel with powder coated finish to match curtain.
- BOTTOM BAR** - Steel with powder coating to match curtain. 12 gauge, 4" face bottom bar provides a uniform appearance with the rest of the curtain. A 12 gauge reinforcement channel is inserted into the bottom bar for additional strength. No locking required; once the door is closed it is secure.
- SMOKE GASKET** - Available as standard on Model PRSD361 (fire-rated) door.

## OPERATION AND STRUCTURAL REQUIREMENTS

### Motor operation required.

The AlarmGard Operator allows the door to be connected to a notification system. Upgrade to the AlarmGard Plus to also include a handchain and battery backup. 4000PSI concrete, 1500 PSI grout filled CMU or 36KSI steel jamb construction is required. No additional header support is required unless hood supports are mandated by a larger opening width.

## OPTIONAL FINISHES

- ▶ Stainless Steel
- ▶ SpectraShield® Powder Coating in more than 180 colors
- ▶ AtmoShield™ textured powder coat in 11 colors



## CERTIFICATIONS & LISTINGS

- ▶ ICC 500-2014
- ▶ Miami Dade
- ▶ UL 10B - 3 hour fire rating\*
- ▶ FEMA P-361
- ▶ Texas Department of Insurance (TDI)

\*Model PRSD361 (fire-rated) only



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Preferred door solutions.  
**COOKSON**

**(3) SUBSTITUTION REQUEST:** Specification Section SP-7.2 Pumping Units

**ANSWER:** The substitution request to include the Flowserve pump is approved as noted. Additional information is attached.

Comments:

The pump material and motor shall meet or exceed the requirements of SP-7.2, including but not limited to the following items that were not provided in the substitution request.

- Per Paragraph 7.2.04.B.11, provide the pump bowl material with an enamel interior finish.
- The motor shall meet all of the requirements of Paragraph 7.2.04.C and 7.2.06, including the TEFC enclosure, motor insulation Class F, NEMA Design B, and provided space heaters.
- Per Paragraph 7.2.05 A.2, the impeller material shall meet the requirements of ASTM A744M-00.
- Per Paragraph 7.2.05.C.5, the line shaft bearings shall be water lubricated, thermoplastic bearings that are NSF/ANSI 61 approved. The specified manufacturer is Thordon ThorPlas-White or approved equal.
- Final approval of the requested product to be verified through submittal to DOW.

✓ Accepted

✗ Exception

☐ By others

SECTION SP-7.2 – PUMPING UNITS

7.2.01 DESCRIPTION:

✓ This Section of the specifications covers the furnishing, installing and testing of the new Pump No. 2, which will be used to replace the existing Pump No. 2. The pumping unit shall consist of an outdoor-rated, vertical solid shaft, multi-stage turbine pump with fabricated head configured for aboveground discharge. The pump will have a flanged mounting base.

✓ Design requirements, dimensions, and characteristics of the new pumping unit is based on Gicon Pumps lineshaft turbine pumping units, Model 10RJHC (12 stage). The Contractor shall field verify dimensions on plans and specifications and submit the dimensions with the pumping unit product data, pump curves, and shop drawings for DOW approval prior to ordering the pumping unit. The Contractor shall be responsible for proper fit of the pumping unit installation. The existing piping and equipment that are disturbed during this work and refurbished components that were previously painted shall be painted to match new piping and equipment.

☐ To comply with sanitary survey requirements, Contractor shall seal all openings to the system piping, cap or plug all open pipe nipples or fittings with threaded pipe plugs; or caps and seal all flanged openings through bolted and gaskets covers. Upon reinstallation of the pump, seal the discharge head to the pump base and turn down and screen all vacuum release fittings.

By others.

✓ All new aboveground components of the pumping unit, including factory painted items, shall be painted as specified in Section SP-6.7. The color shall match the existing pump system. Payment for painting work shall be part of the unit price bid or lump sum bid, whichever is specified, for the item of which it is a part.

✓ 7.2.02 EXISTING PUMP AND WELL DATA:

- A. Pump Rated Capacity at 1,760 rpm: 700 gpm at 474 ft head
- B. Existing Pump Bowl Assembly: 12 Stage
- C. Motor Nameplate Rating: 125 hp, 3-phase, 60 Hz, 460 volts, 1,780 rpm
- D. Discharge Column Size: 8 inches
- E. Well Casing Inside Diameter: 12 inches
- F. Top of Pump Bowl Elevation: -20 ft±
- G. Elevation of Bottom of Casing: -120 ft±
- H. Elevation of Bottom of Well: -450 ft±
- I. Elevation of Top of Pump Slab: 390 ft±
- J. Elevation of Estimated Static Water Level: 16 ft±

7.2.03 EXISTING WELL INSPECTION:

The Contractor shall conduct an inspection of the existing well before installing the new pumping unit. The Contractor shall obtain written approval of the proposed inspection procedure from the DOW before the inspection may be conducted. The inspection shall be conducted by a Contractor holding a current C-57 Well Drilling Specialty License from the State of Hawai'i who shall inspect the existing well for silting, caving-in and foreign materials before re-installing the pumping unit. The inspection shall include a visual inspection of the well by video camera lowered into the well. The existing well inside diameter shall be recorded. A written report stating the results of the inspection along with an updated layout drawing showing all dimensions and elevations shall be submitted to the DOW. The DOW reserves the right to reject any inspection that is conducted without written prior approval and require another inspection to be conducted at no additional cost to the DOW. The Contractor shall be liable for any damages resulting from the re-installation of the pumping unit prior to DOW's approval of the inspection procedure.

By others.

7.2.04 NEW VERTICAL LINE SHAFT TURBINE PUMPING UNIT DESCRIPTION:

- ✓ A. NUMBER OF PUMPING UNITS REQUIRED: One (1)
- B. PUMP BOWL ASSEMBLY:
  - ✓ (1) Number required: One (1)
  - ✓ (2) Stages: ~~Twelve (12)~~ Seven (7)
  - ✓ (3) Pump rated capacity and head rated speed: 700 gpm at 474 feet head total dynamic head (TDH), minimum
  - ✓ (4) Minimum pump efficiency: 81.0%
  - ✓ (5) Maximum shut-off head: ~~618 feet~~ 657 feet
  - ✓ (6) Rated pump speed: 1,800 rpm
  - ✓ (7) Impeller Material: Type 316 Stainless Steel, ASTM A774M-00
  - ✓ (8) Impeller Diameter: 9.5 inches, maximum
  - ✓ (9) Bowl Size: 10.76 feet
  - ✓ (10) Pump Bowl Impeller Shaft Material: Type 416 stainless steel, ASTM A582M-95b
  - ✓ (11) Pump Bowl Material: Cast iron CL30 Enamel, ASTM A48-94e1
  - (12) Pump used to specify pump performance characteristics: Gicon Pumps Lineshaft Vertical Turbine Pump, Model 10RJHC (12 stage).
  - ✓ (13) Pump shall conform to SECTION SP-7.2.05.

C. PUMP MOTOR: Replacement motor shall be supplied with the following ratings and features.

- ✓ (1) Number required: One (1)
- ✓ (2) Motor Type: Vertical Turbine Enclosed
- ✓ (3) Motor Position: Vertical
- ✓ (4) Motor Enclosure: Totally Enclosed Fan Cooled (TEFC)
- ✓ (5) Motor Insulation: Class F
- (6) Motor Electrical Ratings:
  - ✓ a. Horsepower: 125 HP
  - ✓ b. Controller Type: Reduced Voltage Solid State Starter
  - ✓ c. Maximum Speed: 1,790 rpm
  - ✓ d. Voltage: 460 VAC, 3-phase, 60 Hz
  - e. Full-Load Amps: 147
  - ✓ f. NEMA Design: B
  - ✓ g. Service Factor: 1.15
  - ✓ h. Nominal Efficiency Minimum: 95%
- (7) Motor Accessories:
  - ✓ a. 115 V space heater
  - ✓ b. Winding temperature switches, one per winding/phase
- (8) Motor shall conform to SECTION SP-7.2.06

D. MOTOR DRIVE SHAFT: The existing motor drive shaft shall be replaced with new. The drive shaft shall connect the new head shaft with new motor-pump coupling. The length of the drive shaft shall be cut to fit the new motor.

- ✓ (1) Number Required: One (1)
- ✓ (2) The drive shaft shall be ground and polished Type 416 stainless steel conforming to ASTM A582M-95b. The shaft shall be furnished in a length to fit the new motor. A suitable method shall be provided on the top end of the shaft to allow for impeller adjustment by means of an adjusting nut. The nut shall be provided with a positive locking device.

E. DISCHARGE HEAD ASSEMBLY:

- ✓ (1) Head Baseplate: A new head baseplate shall be provided.
- ✓ (2) Discharge head and mechanical seal: The existing discharge head and mechanical seal shall be replaced with new.
  - ✓ a. Size of discharge flange: 8 inches
  - ✓ b. Class of pipe flange: 250 lb. ANSI B16.1
- ✓ (3) Head shaft and head shaft coupling: The existing head shaft and head shaft coupling shall be replaced with new.
- ✓ (4) The discharge head assembly shall conform to SECTION SP-7.2.05.B.

✓ F. LINE SHAFT AND LINE SHAFT COUPLINGS:

- ✓ (1) Minimum shaft size: 1.19 inch diameter
- ✓ (2) Shaft material: 416 Stainless Steel
- ✓ (3) Coupling Material: 416 Stainless Steel

G. AIR LINE: Air line by others.

- (1) Bottom of air line elevation: -20 ft±
- (2) Air line size: 1/4-inch
- (3) Air line material: Brass or Type 316 stainless steel, AWWA C800. 85% copper and 5% each of tin, lead, and zinc. Conforming to NSF 61.
- (4) Contractor shall field measure new air line during installation and provide the installed length from the top of the pump baseplate to the nearest 0.5 feet.
- (5) Contractor shall connect the existing air line stub out to a new Contractor-provided tap through the new baseplate and/or discharge head in order to connect the air line from the inside of the well to the outside of the well.

✓ H. FACTORY LABORATORY PUMP TEST REQUIREMENTS:

- ✓ (1) Minimum guaranteed efficiency of pump bowl assembly at rated capacity and head: 81.0%
- ✓ (2) Pump test shall conform to SECTION SP-7.2.12.

✓ 7.2.05 PUMPS:

The vertical turbine pump shall be of the multi-stage type as manufactured by Gicon Pumps & Equipment or approved equal.

- ✓ The manufacturer of the pump bowl assembly shall be certified by the International Organization of Standards (ISO) as conforming to the requirements of the ISO 9000 series standards.
- ✓ The pump bowl assembly shall be customized (impeller-trimming), assembled, and tested at the manufacturer's facility certified by the International Organization of Standards (ISO) as conforming to the requirements of the ISO 9000 series standards.
- ✓ Each pumping unit shall consist of a motor, a pump bowl assembly, a discharge column assembly and a discharge head assembly.
- ✓ The pumping unit shall conform to the standards set for by "NSF/ANSI Standard 61: Drinking Water System Components-Health effects", 61-2013 or most recent version.

✓ The pumping unit supplied shall conform to these specifications and the "American National Standard for Deepwell Vertical Turbine Pumps – Line Shaft and Submersible Types", ANSI B58.1 as last revised. These specifications shall serve as a complement to ANSI B58.1 and, where contradictions occur, these specifications shall govern. These specifications indicate minimum material quality and performance required.

✓ All components of the pumping unit shall meet the revised Reduction of Lead in Drinking Water Act. All components shall conform to the NSF 61 Annex G, certifying low lead content in line with the Safe Drinking Water Act.

✓ A. PUMP BOWL ASSEMBLY: The pump bowl assembly shall consist of the pump bowls, impellers, impeller shaft, suction case, discharge case, and strainer.

The pump manufacturer shall provide enough clearance in the pump bowls to allow for any distortion of the pump shaft under any operating condition without the impeller making contact with the bowl.

✓ (1) Pump Bowls: The pump bowls shall be designed for a minimum pressure of 300 psi and shall be made of close-grained cast iron, free from blow holes, sand holes, and other defects. The bowls shall conform to ASTM Designation A48, Class 30 or better, as required, with a minimum tensile strength of 30,000 pounds per square inch. The bowls shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at shutoff head, whichever is greater. Each bowl shall be glass lined and accurately machined and fitted to close dimensions and fitted with bronze sleeve type bearings on each side of the impellers.

✓ (2) Impellers: The impeller shall be of the fully-enclosed type and shall be of Type 316 stainless steel (ASTM A744M-00), or other approved material, of heavy construction and free from blow holes, porosity and other defects. Impellers shall meet the revised Reduction of Lead in Drinking Water Act. The impeller shall be finished all over, accurately fitted and perfectly balanced per ISO 1940 or ANSI 2.19 Grade 2.5. Passages shall be smooth to assure efficient operation and to prevent air or sand locking. The impeller shall be locked securely to the shaft with steel tapered collets. The impellers shall be so designed as to permit axial adjustment to compensate for wear.



- ✓ (3) Impeller Shaft: The impeller shaft shall support the impellers and shall be of ground and polished Type 416 stainless steel, ASTM A582M-95b. The shaft shall be supported by suitable noncorrosive bearings on both sides of each impeller with positive means for water lubricating each bearing. The shaft shall be threaded at the lower end to receive an assembly nut to accurately locate the shaft with respect to the bowls during assembly of the bowl unit. The bottom case bearing shall silicon bronze or other approved material.
- ✓ (4) Suction Case: The suction case shall connect the strainer to the pump bowls and house the bearing which supports the bottom portion of the impeller shaft. The suction case shall be of cast iron construction conforming to ASTM 1003, properly designed to guide water from the well to the first impeller with minimum friction loss.
- ✓ (5) Discharge Case: The discharge case shall be of cast iron, ASTM A48, Class 30, and shall contain a bronze bearing to support the upper end of the pump shaft.
- ✓ (6) Strainer: The strainer shall be of the cone type. The strainer shall be directly attached to the lower end of the suction case or attached to the suction case by means of a short length of suction piping with suitable couplings. The suction piping shall not exceed one foot in length and shall be of identical size and construction as the discharge column coupling.

The strainer shall be Type 316 stainless steel (ASTM A744M-00). The net inlet area of the strainer shall not be less than three times the suction case area. The maximum opening shall not be more than 75 percent of the minimum opening of the water passage through the bowl or impeller.

- ✓ B. DISCHARGE HEAD ASSEMBLY: The discharge head assembly shall consist of a head baseplate, discharge head and head shaft. Replace all existing mounting fasteners with new fasteners of equal quality, grade, etc.

- ✓ (1) Head Baseplate: A new baseplate shall be installed, inclusive of fasteners. The Contractor shall paint the new baseplate to match the existing color. Baseplate shall be sized per the pump manufacturer's recommendations and in accordance with the existing field conditions.
- ✓ (2) Discharge Head and Mechanical Seal: The existing discharge head and mechanical seal shall be replaced with new. The existing discharge head shall be replaced with new and its discharge flange shall be sized as specified. The fasteners for the existing discharge head shall be replaced with new to secure both the new discharge head and new sole plate to the existing concrete pump base. The Contractor shall be responsible to insure that the flange of new discharge head shall align with new aboveground discharge piping. The mechanical seal in the discharge head shall be a John Crane, Durametalllic, or approved equal with a minimum pressure rating of 150 psi.
- ✓ (3) Head Shaft: The existing head shaft shall be replaced with new. The head shaft shall be ground and polished Type 416 stainless steel conforming to ASTM A 582. The head shaft shall not be longer than ten feet and shall be of the size as called for in these specifications. A suitable method shall be provided on the top of the head shaft to allow impeller adjustment by means of an adjusting nut. The nut shall be provided

with a positive locking device. Straightness and machining tolerances shall be as specified under the "Line Shaft" section of these specifications.

- ✓ (4) Head Shaft Coupling: The existing head shaft coupling shall be replaced with new. The line shaft and the head shaft shall be jointed by a stainless steel coupling with a safety factor of 1.5 times the shaft safety factor. Threads shall be left-hand to tighten during pump operation. Sufficient clearance in the discharge head shall be provided to permit easy access to coupling for repair or removal of mechanical seal without disturbing pump motor.
- ✓ C. DISCHARGE COLUMN ASSEMBLY: The discharge column assembly shall consist of the discharge column pipe, combination column couplings, line shaft, line shaft couplings, line shaft bearings, air line, and water-level monitoring tube.
  - ✓ (1) Discharge Column Pipe: The new column pipe shall be, at a minimum, stainless steel pipe to be epoxy coated inside and outside with Tnemec 141 or approved equal. Provide DOW the option for the new column pipe to be Schedule 40 galvanized steel pipe conforming to ASTM A53, Grade B, size and thickness as specified, coated with zinc inside and outside by the hot-dip process. Each section of column shall have straight threads with ends accurately machined to form a butt joint to insure accurately assembled column length and perfect alignment. The pipe shall be furnished in interchangeable sections of not more than ten (10) feet in length. The top end (attached to the discharge head bottom) and the bottom (attached to the top of the pump bowl assembly) of the discharge column pipe shall not exceed five (5) feet in length each.
  - ✓ (2) Combination Column Couplings: New, combination couplings shall be of cast or ductile iron with an alignment spider cast integrally of the same material. Each spider shall have its own water lubricated bearing properly fitted to maintain the alignment of the shafting and to prevent vibration. The design and material of the combination column coupling furnished shall be approved by the DOW before the pumps are installed. If drop-in stainless steel retainers with rubber inserts is proposed to be provided instead of combination column couplings, submit product information for DOW review and approval.
  - ✓ (3) Line Shaft: The new line shaft shall connect the head shaft to the impeller shaft. New replacement line shaft shall be ground and polished Type 416 stainless steel conforming to ASTM A582, of the size as called for in these specifications. The line shaft shall be furnished in interchangeable sections of not more than ten (10) feet in length. To insure accurate alignment of the shafts, they shall be straight within 0.005 inch total indicator reading for a ten (10) feet section; the butting faces shall be machined square to the axis of the shaft; the maximum permissible error in the axial alignment of the thread axis with the axis of the shaft shall be 0.002 in 6 inches.
  - ✓ (4) Line Shaft Coupling: New individual sections of the line shaft shall be connected with ground and polished Type 416 stainless steel sleeve-type couplings conforming to ASTM A582 and sized to receive the specified line shaft. The couplings shall be designed with a safety factor of 1-1/2 times shaft safety factor and shall have a left-handed thread to tighten during pump operation.

- ✓ (5) Line Shaft Bearings: The new line shaft bearings shall be water lubricated bearings. The line shaft thermoplastic bearings shall be NSF/ANSI 61 approved and installed on the line shaft section located above the static water level. The thermoplastic bearings shall be Thordon ThorPlas-White or approved equal. The line shaft rubber bearings shall be installed on the line shaft section located at or below the static water level. The rubber bearings shall be Cutlass or approved equal. The new bearings shall be compatible with the new spiders and line shafts. The retainer rings, if used, shall be stainless steel. The maximum spacing between bearings shall be 10 feet.
- (6) Air Line: The new air line in the well is 1/4-inch, Type 316 stainless steel (PVC coated) pipe and shall be terminated at the elevation specified. The air line shall be strapped to the pump column with stainless steel straps no more than ten (10) feet apart.

By others.

7.2.06 PUMP MOTOR:

- ✓ The electric motor shall be vertical hollow shaft with non-reverse ratchet, P-base, squirrel cage induction design, NEMA premium efficiency. Enclosure shall meet NEMA totally enclosed design. Motor shall have Class F insulation with temperature rise as specified by NEMA standards for class of insulation used and shall have a 1.15 service factor. The motor shall be designed for “soft” starting, and capable of continuous operation under the head specified.
- ✓ The motor shall have a horsepower rating of not less than specified and shall not be loaded in excess of 95% of its nameplate rating at the rated head and capacity of the pump. Additionally, the motor shall not be loaded in excess of 100% of its nameplate rating at any condition from zero flow to the maximum capacity of the pump. The motor shall be capable of operating for a few minutes under shutoff head conditions.
- ✓ Motor windings shall be encapsulated or sealed with epoxy according to NEMA standards by an insulation system such as Custom Polyseal or approved equal.
- ✓ Thrust bearings shall be provided as an integral part of the motor and shall be of ample capacity to handle the continuous down thrust as specified by the pump manufacturer. The bearing shall be of such a size that the average life rating based on continuous operation is no less than five (5) years. The bearings shall also have the capacity to allow the pump to operate for at least ten (10) minutes with the discharge valve closed. The motor shall be designed to prevent reverse rotation when the unit is shut down.
- ✓ Contractor shall be responsible for all modifications to ensure proper fit and match for new motor on new pump discharge head. All electrical connections (splicing and associated work) shall be completed by a certified electrical contractor.
- ✓ The motor shall be U.S. Motors or approved equal.
- ✓ The motor shall be manufactured within the previous two (2) years of the date of this contract and the manufacturer’s certificate of compliance shall be provided for DOW approval.
- ✓ A. SPACE HEATERS: Motor shall be equipped with space heaters to prevent condensation inside the motor enclosure after motor shutdown and maintain the temperature of the winding at not less than 9-degree F (5-degree C) above outside ambient temperature.

Heaters shall be flexible wraparound type rated 115V, single phase, 60 Hz. The space heater rating in watts and volts shall be noted on the motor nameplate or on a second nameplate. Space heater leads H1 and H2 shall be brought to a separate terminal block or pigtailed in the motor box or separate box with a threaded conduit opening.

- ✓ B. TEMPERATURE SENSING AND PROTECTION: Motor shall be equipped with over temperature protection. Protection shall be NEMA Type 2 bi-metallic thermal switch (Klixon) type.
- ✓ C. TERMINAL BOXES: Provided with threaded hubs. Provide neoprene gaskets at the base of the box and between the halves of the box. Provide a grounding lug located within the box for the cable or raceway ground connection. Boxes shall be designed to rotate in order to permit installation in any of four positions 90 degrees apart. Provide oversized boxes one size larger than standard as a minimum.
- ✓ D. NAMEPLATES: Motor nameplates shall be engraved or stamped stainless steel. Information shall include those items enumerated in NEMA Standard MG 1, as applicable. Nameplates shall be permanently fastened to the motor frame and shall be visibly positioned for inspection. Additionally, provide the following information on nameplates or additional nameplates for:
  - ✓ (1) NEMA guaranteed minimum efficiency.
  - ✓ (2) Explosion-Proof motors: Indicate UL frame temperature limit code.
  - ✓ (3) Space heater information.
  - ✓ (4) NEMA MG 1 Over Temperature Protection Type Number.
  - ✓ (5) Temperature device rating and alarm and shutdown set point information.
- E. CONSTRUCTION: All motors provided under this specification shall have the following features of construction:
  - ✓ (1) Cast iron frames. Aluminum frame motors are not permitted.
  - ✓ (2) Aluminum rotor material and copper stator windings with F-insulation without exceeding the B-temperature rise of 144-degree F (80-degree C) at rated load and with Design-B torque/current characteristics rated for continuous operation duty.
  - ✓ (3) Stamped steel or cast metal fan shrouds with non-sparking fan blades.
  - ✓ (4) Non-hygroscopic motor leads.
  - ✓ (5) NEMA Design-B as standard design.
  - ✓ (6) Service factor of 1.15.
  - ✓ (7) Grounding terminal in conduit box.

✓ (8) Stainless steel nameplate.

✓ F. PROTECTIVE COATING: Before shipment, coat the shaft extension and any other external bare exposed metal parts of each motor with an easily removable rust preventive.

✓ G. PACKAGING: All loose motors shall be packed in Styrofoam or securely fastened to a hardwood skid or pallet for fork-truck handling and shall be covered for protection against dirt and moisture during transit and for short-time outdoor storage.

✓ H. FACTORY TESTS: The manufacturer's factory motor Prototype Tests per IEEE Standard 112 Appendix-A on motors through 250 horsepower shall be submitted as Product Data for the motor. Actual factory tests for these motors are not required. The standard routine factory tests shall be conducted, that may include:

(1) Winding resistance in ohms and converted to 77 degree F (25 degree C).

(2) Resistive Unbalance and Quarter Voltage Impedance, as applicable.

(3) Locked-Rotor current (Single phase).

(4) High Potential.

(5) No-Load Excitation (volts, amperes, RPM).

(6) Bearing vibration check.

(7) Efficiency, Power Factor, Current at 115%, 100%, 75%, 50%, and no load.

✓ 7.2.07 PRE-LUBRICATION WATER: The pre-lubrication line and its components shall be reconnected to the new pump. The pump installer shall verify that existing flow and pressure conditions for the pre-lube line are acceptable and provide proper lubrication for the pumping unit line shaft. The Contractor shall be responsible for providing any additional valves, piping, parts, associated hardware, or modifications to the discharge head or discharge head connection that are not specified or shown in the drawings, necessary to provide acceptable flow, direction, and pressure conditions onto the line shaft at no additional cost to DOW.

✓ 7.2.08 SPARE PARTS: Each bidder shall include in his bid the cost of supplying and delivering the following list of spare part to the DOW:

A. One (1) extra set of packing rings, one (1) set per pump.

B. One (1) extra set of bearings for one (1) motor, one (1) set per motor.

7.2.09 REFURBISHMENT OF EXISTING INCIDENTAL ITEMS: Unless directed otherwise, the Contractor shall replace all existing piping flange fasteners and gaskets removed to facilitate the pump replacement with new materials. New fasteners shall be galvanized, of the same type, grade, size and material as the original, and suitable for the intended service. New flange gaskets shall be non-asbestos containing material and otherwise match the existing. The Contractor shall also replace any miscellaneous piping appurtenances disassembled during the course of the pump repair work and found to be unusable and are necessary for a complete and operating installation.

By others.

✓ 7.2.10 SUBSTITUTION OF SPECIFIED PUMP: If a specified pump model has been used to dimension plans and specify pump performance characteristics, a substitute pump can be used only if the following conditions have been met:

- A. All changes in dimensions resulting from the substitution of the specified pump shall be the responsibility of the Contractor. The substitution must be approved by the DOW.
- B. The substitute pump shall have performance characteristics equal to or better than the specified pump. Performance characteristics that shall be compared are the required horsepower, efficiency and head-capacity curve.
- C. The DOW shall approve the substitution before the substitute pump is ordered.

✓ 7.2.11 PRELIMINARY SUBMITTALS: The Contractor shall obtain written approval from the DOW prior to ordering the pumping unit. The DOW reserves the right to reject any non-approved pumping unit that is ordered and require the Contractor to supply a different pumping unit that meets with DOW's approval at no additional cost. To obtain approval to order the proposed pumping unit the Contractor shall submit one (1) hard copy and one (1) electronic set of the following to the DOW following the requirements of SP-1.6, SP-1.17, and the Water Construction Notes:

- A. PRELIMINARY PUMP CHARACTERSTIC CURVES: The preliminary pump characteristic curves shall show the proposed head, efficiency and brake horsepower vs. capacity of the pump to be furnished.
- B. PUMPING UNIT SPECIFICATIONS: The Contractor shall submit complete specifications for the pump he proposes to furnish. All pumping unit material shall be specified. Provide written verification that all materials meet the revised Reduction of Lead in Drinking Water Act.
- C. THRUST LOAD CURVES: The Contractor shall supply with his proposal a curve showing the thrust load from shutoff head to the lowest head specified. The rating of the thrust bearing being furnished with the motor shall be shown as part of the data on the curve.
- D. CERTIFICATION OF COMPLIANCE WITH ISO 9000 SERIES STANDARDS: The Contractor shall submit certification that the pump and motor manufacturer are registered/certified by the ISO as conforming to the requirements of ISO 9000 series standards.
- E. NSF/ANSI 61 CERTIFICATION: The Contractor shall submit proof of certification that the pump and motor are registered as conforming to the requirements of NSF/ANSI Standard 61.

Provide written verification that all other materials are NSF/ANSI 61 compliant.

✓ 7.2.12 MANUFACTURER LABORATORY PUMP TEST: The Contractor shall obtain written approval from the DOW of all curves and data sheets for each bowl assembly to be used before the pumps may be installed. The DOW reserves the right to reject any pump that is installed for

which the Contractor has not obtained approval for and require the Contractor to remove and replace the non-approved pump at no additional cost to the DOW.

To obtain the DOW approval the Contractor shall submit a minimum of one (1) manufacturer-certified hard copy and one (1) electronic set of performance curves and test data sheets of the manufacturer's laboratory running test conducted for each bowl assembly furnished. The running test shall be conducted in accordance with the latest edition of the "American National Standard for Deepwell Vertical Turbine Pumps – Line Shaft and Submersible Types" ANSI B 58.1 to show that the specified conditions can be met by the bowl assemblies furnished. The performance curves shall show the head-capacity, efficiency-capacity, overall efficiency-capacity and required brake horsepower capacity curves for each bowl assembly.

✓ 7.2.13 LAYOUT DRAWINGS: The Contractor shall obtain written approval of the pump and piping layout drawings before any construction may begin. The DOW reserves the right to reject any layout drawings that have not been approved and require the Contractor to revise the layout drawings at no additional cost to the DOW. The Contractor, at no additional cost to the DOW, shall redo construction work that is done prior to the DOW's approval of the layout drawings or that is not in accordance with the approved layout drawings. To obtain approval the Contractor shall submit a minimum of one (1) hard copy and one (1) electronic set of pump and piping layout drawings. All dimensions of pump, valves, piping, fittings and appurtenances shall be shown.

7.2.14 INSTALLATION OF PUMPING UNIT: Installation of the pumping units shall be made for the Contractor by a subcontractor holding a C-57A Pump Installation Specialty License for the State of Hawai'i, under the direction of the supplier of the pumping units. The units shall be installed only in the presence of the DOW's Construction Inspector.

By contractor.

The pump installer shall have a minimum of five (5) years experience in the installation, testing, maintenance, and repair of vertical turbine deepwell pumping units of similar capacity, head, setting and horsepower as the pumping unit specified. The pump installer shall also have nearby plant facilities and equipment to immediately repair the pumping units should any emergency arise.

✓ 7.2.15 INSTALLATION INSTRUCTIONS AND MAINTENANCE MANUAL: The pump manufacturer shall also provide two (2) hard copies and one (1) electronic copy of instructions for the installation of the pumping units and proper maintenance of the same.

✓ 7.2.16 TEST OF PUMPING UNITS: After installation of all machinery and other equipment in the sump, a complete operating test of the pumping unit and other equipment shall be made over a period of seven (7) days.

The Contractor shall make his own arrangements and pay for power and other costs as required.

By others.

✓ Throughout the operating test, the pumping unit shall run smoothly without vibration, leaks or heating of the bearings. If during or as a result of this test, any structural or mechanical defect or weakness develops, or if the equipment fails to deliver its required discharge at the respective head under required conditions, the DOW reserves the right to reject any part or all of the equipment and demand reconstruction or replacement to meet the requirements of these specifications.

- ✓ During the period between the first test and the final acceptance of the pumping unit by the DOW, the unit shall be left in place and in good working condition for use by the DOW in order to provide service, if required, and at no additional cost to the DOW.
- ✓ After the operating test has been completed to the satisfaction of the DOW, overall efficiency test shall be made in accordance with the Rotodynamic Pumps for Hydraulic Performance Acceptance Tests (ANSI/HI 14.6), 2016 Edition, Hydraulic Institute.
- ✓ The capacity of each pumping unit will be tested under the head-capacity conditions specified. The overall efficiency of each pumping unit will be the ratio of the water horsepower delivered by the pump to the total electrical power consumed.
- ✓ The quantity of water delivered is to be based on differential pressure readings of the flow tube. No special calibration shall be made. Tests shall be made with the electric current normally furnished by the KIUC. No correction for variation in the electric power will be allowed.
- Should the tests for efficiency for either pumping unit result in an overall efficiency of less than that specified at the guaranteed capacity and head point, the Contractor shall make the changes and replacements, and of any additional tests required shall be paid by the Contractor.
- ✓ If each pumping unit is capable of pumping the rated capacity under normal operating conditions, the efficiency test may be waived at the option of DOW.
- ✓ 7.2.17 MEASUREMENT AND PAYMENT: Payment for the furnishing and installing of material, equipment, incidentals and all work included in this Section shall be made at the unit price item or the lump sum item indicated in the Proposal, whichever is specified, and shall be full compensation for all work in connection therewith, complete and finished in accordance with the drawings and specifications.

\*\*\*END OF SECTION\*\*\*



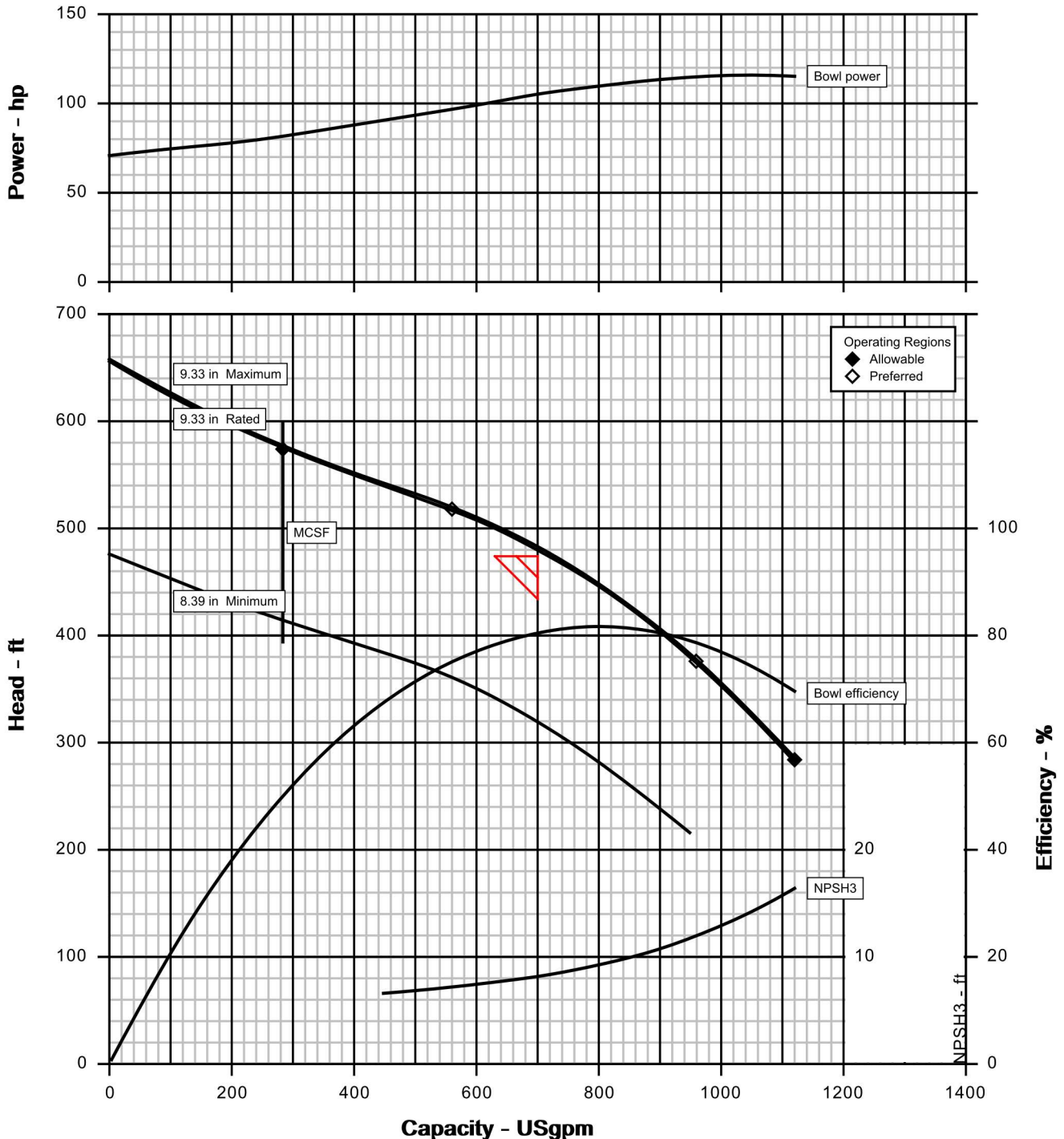


Pump size & type / Stages : 12EML / 7  
 Based on curve no. : EC-2631  
 Impeller diameter : 9.33 in

Customer : -  
 Item number : Vertical Line Shaft Turbine  
 Service : -  
 Flowserve reference : 3764677851  
 Date : November 9, 2021

Capacity : 700.0 USgpm  
 Head : 474.00 ft  
 Density / Specific gravity : - / 1.000  
 Pump speed : 1,770 rpm  
 Ns / Nss : 1,466 / 9,410 (US units)  
 Test tolerance : ANSI/HI 14.6 Grade 1U

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.  
 Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 480.91 ft corresponds with 474 ft head at discharge flange adjusted for elevation and friction losses.

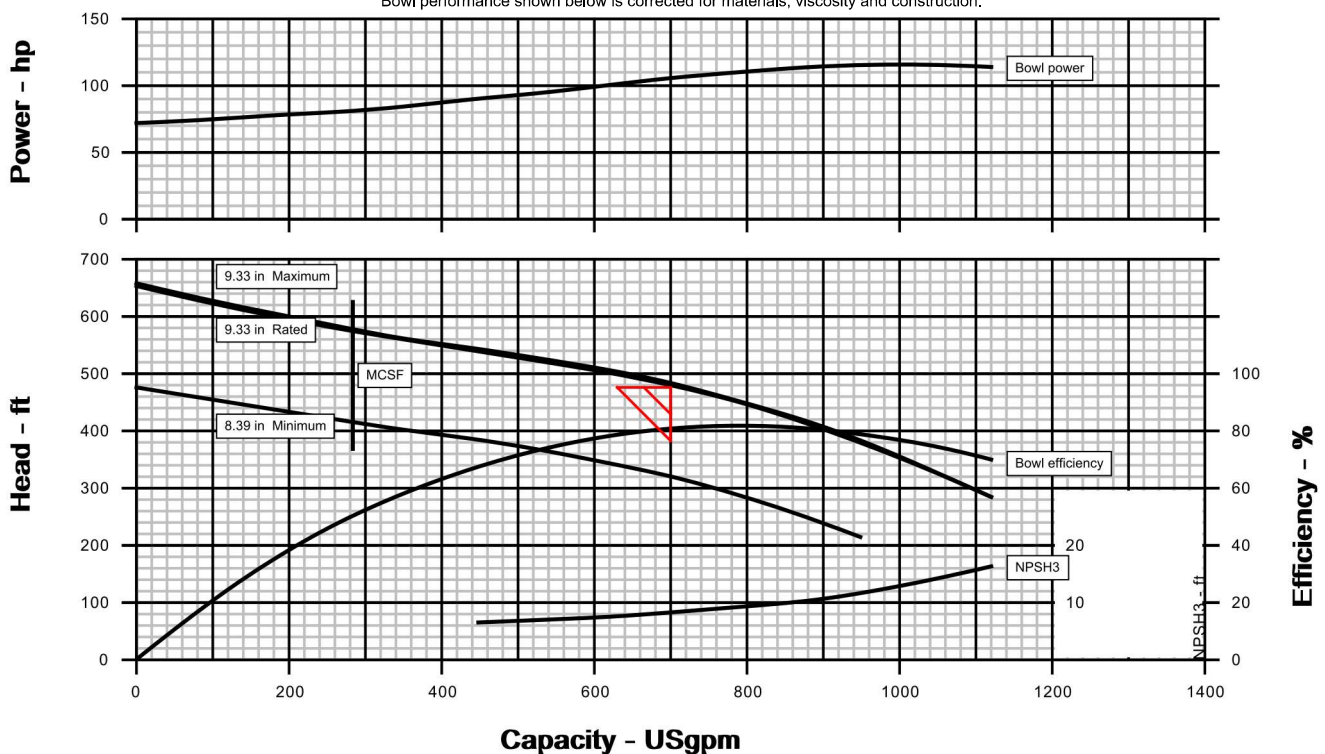
Customer	: -	Pump / Stages	: 12EML / 7
Customer reference	: -	Based on curve no.	: EC-2631
Item number	: Vertical Line Shaft Turbine	Flowserve reference	: 3764677851
Service	: -	Date	: November 9, 2021

Operating Conditions		Materials / Specification	
Capacity	: 700.0 USgpm	Material column code	: C30
Water capacity (CQ=1.00)	: -	<b>Other Requirements</b> Hydraulic selection : No specification Construction : NSF 61 Test tolerance : ANSI/HI 14.6 Grade 1U Continuously Rising Head Curve Required Driver Sizing : Max Power (SO to EOC) not using SF Seal configuration : Single Mechanical Seal	
Normal capacity	: -		
Rated head @ Discharge flange	: 474.00 ft		
Water head (CH=1.00)	: -		
NPSH available (NPSHa) @ Low liquid level	: 34.0 ft		
NPSHa less NPSH margin @ Impeller eye	: -		
Maximum suction pressure	: Not applicable		
Rated suction pressure	: Not applicable		
Liquid			
Liquid type	: Other		
Liquid description	: -		
Temperature / Specific gravity	: 60 °F / 1.000		
Viscosity / Vapor pressure	: 1.00 cSt / -		

Performance			
Pump speed	: 1,770 rpm	Impeller diameter	: Rated / Maximum / Minimum
NPSH required (NPSH3) @ Impeller eye	: 8.2 ft		: 9.33 in / 9.33 in / 8.39 in
Minimum submergence	: 24.00 in	Impeller diameter ratio (rated/max)	: 100.0 %
Hydraulic power	: 85.0 hp	Maximum head at rated diameter	: 655.46 ft
Efficiency (Pump overall / Bowl) (CE=1.00)	: 80.8 % / 80.9 %	Head rise to shut off	: 36.3 %
Power (rated/max)	: 105 hp / 116 hp	Total head ratio (rated / max) / (max / rated)	: 99.5 % / 100.6 %
Driver power rating	: 125 hp / 93.2 kW	Flow at BEP	: 798.3 USgpm
Bowl pressure	: 283.8 psig	Flow as % of BEP	: 87.7 %
(based on shut off @ cut dia/rated SG)		Minimum continuous flow	: 285.2 USgpm
Maximum allowable	: 424.0 psig	Rated thrust (at Rated flow)	: 2,940.9 lbf
Bowl & column hydrotest	: 354.7 psig	Maximum thrust (at Shut off flow)	: 3,919.3 lbf
Dischg Head Dischg Region MAWP	: 300.0 psig	Min thrust - Runout flow / Max Suction	: 1,913.3 lbf
Ns / Nss	: 1,466 / 9,410 (US units)	(A negative thrust value indicates an upthrust condition)	

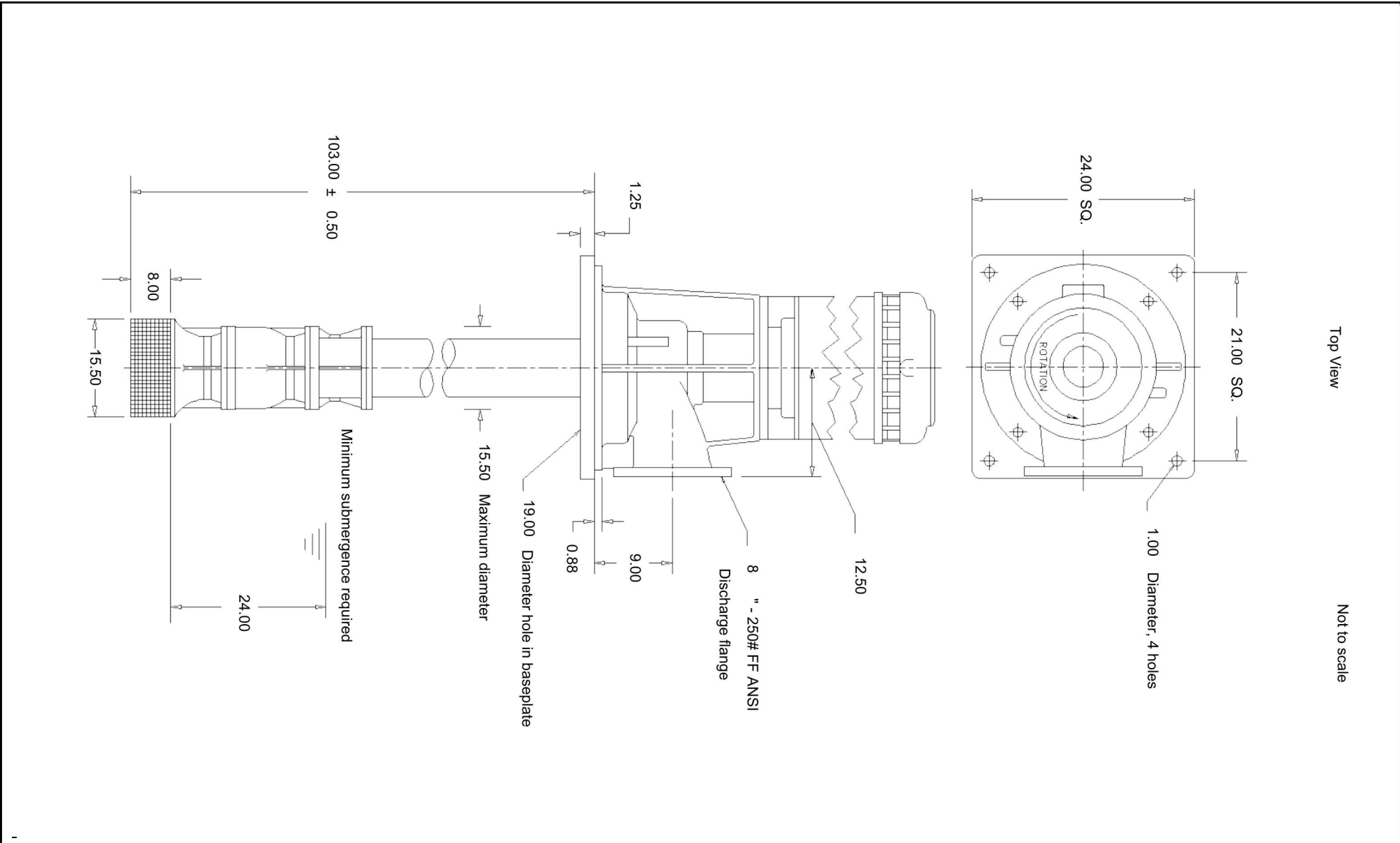
CURVES ARE APPROXIMATE. PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 480.91 ft corresponds with 474 ft head at discharge flange adjusted for elevation and friction losses.

Customer	: -	Pump / Stages	: 12EML / 7
Customer reference	: -	Based on curve no.	: EC-2631
Item number	: Vertical Line Shaft Turbine	Flowserve reference	: 3764677851
Service	: -	Date	: November 9, 2021
<b>Construction</b>		<b>Driver Information</b>	
Bowl construction / lined	: Flanged - Std Wall / Lined bowls	Manufacturer	: Flowserve Choice
Impeller type	: Enclosed	Power / SF (Req' / Act')	: 125 hp / 93.2 kW / 1.15 / 1...
Impeller fastening	: Colleted	Vertical shaft type	: Solid
Suction strainer	: Basket strainer	Hollow shaft coupling	
Column construction	: Flanged	Driver type	: NEMA Electric Motor
Column flange spec'n	: Taneytown Specification	Frame size / Base dia	: 405
Column dia (nominal)	: 8.00 in	Enclosure	: WP1
Column pipe length	: 0.75 ft	Duty type	
Column section length	: 120.00 in	Efficiency type	
Lineshaft brg spacing	: 120.00 in	Hazardous area class	: -
Lineshaft diameter	: 1.69 in	Explosion 'T' rating	: -
Lineshaft coupling type	: Threaded coupling	Volts / Phase / Hz	: 460 / 3 / 60 Hz
Lineshaft bearings, qty	: 1	Amps-full load/locked rotor	: - / -
Lineshaft construction	: Open	Motor starting	: Direct on line (DOL)
Lineshaft lubrication	: Pumpage	Insulation	: -
Enclosing tube diameter	: -	Temperature rise	: -
Disch size/rating/face	: 8 in / 250 lb ANSI / FF	Bearings / Lubrication	: - / -
Pump/driver coupling	: Spacer coupling	Motor mounted by	: Customer
"W" - Cast / Above Grade Discharge		Motor Thrust rating down/up	: 6,700.0 lbf / 2,010.0 lbf
<b>Materials</b>		<b>Seal Information</b>	
Bowl	: Cast Iron A48 CL30	Arrangement	: Single Mechanical Seal
Impeller	: 316LSS A743 GR CF-3M	Size	: -
Bowl bearing	: Carbon	Manufacturer / Type	: Flowserve / ISC2-PX
Bowl shaft	: 416SS A582 Gr 416	Material code (Man'f/API)	: 5Z4T / -
Bowl wear ring	: None supplied	Gland material	: 300SS
Impeller wear ring	: None supplied	Auxiliary seal device	: -
Suction strainer	: 316SS	Seal flush plan	: Plan 13
Column	: Steel A53 Type E GrB	Seal flush construction	: Tube
Lineshaft	: 416 stainless steel	<b>Paint and Package</b>	
Lineshaft bearing	: Rubber Buna-N	Pump paint	: -
Lineshaft sleeve		Support plate paint	: -
Discharge head	: Cast Iron A48 CL30	Shipment type	: -
Support plate	: Steel A36	<b>Additional information</b>	
<b>Weights (Approx.)</b>		Pit / sump depth	: 8.75 ft
Complete pump	: -	Pump length	: 8.58 ft
Mounting plate	: -	mounting surface to bell/strainer bottom	
Driver (net)	: 1,200.0 lb	Available well diameter	: 100.00 in
<b>Testing</b>		Max dia below mtg surface	: 15.50 in
Hydrostatic test	: Non witnessed		
Performance test	: Non witnessed		
NPSH test	: None		
<b>Notes</b>			
-			
Discharge flange is designed only to bolt up to an ANSI/ASME 250 lb flange but is not fully ANSI/ASME compliant.			
-			
-			



Top View

Not to scale

Customer	: -	Pump size & type	: 12EML	Drawing number	: -
Item number	: Vertical Line Shaft Turbine	Pump speed / Stages	: 1,770 rpm / 7	Date	: November 9, 2021
Service	: -	Flow / Head	: 700.0 USgpm / 474.00 ft	Certified by / Date	: -
Customer PO #	: -	Driver power / Frame	: 125 hp / 93.2 kW / 405	Seal type	: ISC2-PX
Flowserve reference	: 3764677851	Volts / Phase / Hz	: 460 / 3 / 60 Hz	Seal flush plan	: Plan 13

Customer	: -	Pump / Stages	: 12EML / 7
Customer reference	: -	Based on curve no.	: EC-2631
Item number	: Vertical Line Shaft Turbine	Flowserve reference	: 3764677851
Service	: -	Date	: November 9, 2021
<b>Duty Conditions</b>		<b>Performance</b>	
Quantity of pumps	: 1	Hydraulic power	: 85.0 hp
Liquid description	: -	Pump overall efficiency	: 80.8 %
Liquid type	: Other	NPSH3 @ Impeller eye	: 8.2 ft
Frequency	: 60 Hz	Rated brake power	: 105 hp
Flammable	: No	Maximum brake power	: 116 hp
Toxic	: No	Motor rating	: 125 hp / 93.2 kW
H2S	: No	Ns / Nss	: 1,466 / 9,410 (US units)
Rated flow	: 700.0 USgpm	MCSF	: 285.2 USgpm
Rated head	: 474.00 ft @ Discharge flange	Rated impeller diameter	: 9.33 in
NPSHa	: 34.0 ft @ Low liquid level	Maximum impeller diameter	: 9.33 in
Viscosity	: 1.00 cSt	Minimum impeller diameter	: 8.39 in
Specific gravity	: 1.000	Maximum head	: 655.46 ft
Maximum suction pressure	: 0.0 psig @ -	Flow at BEP	: 798.3 USgpm
Rated suction pressure	: 0.0 psig	Flow as % of BEP	: 87.7 %
Maximum liquid temperature	: 60 °F	Rated/max diameter	: 100.0 %
Vapor pressure	: -	Head rise to shut off	: 36.3 %
Altitude	: -	Rated/max head	: 99.5 %
Static head	: -	Visc. capacity correction factor (CQ)	: 1.00
Pump length strategy used	: As required for NPSH and submerg...	Visc. head correction factor (CH)	: 1.00
		Visc. efficiency correction factor (CE)	: 1.00
<b>Selection status</b>			
Product line	: VTP Wet Pit	Business unit	: Taneytown
Pump speed	: 1,770 rpm	Selection status	: Acceptable
<b>Working Pressure Limits</b>		<b>Flow Velocities and Nozzle Sizing</b>	
Bowl assembly MRWP	: 283.8 psig	Nozzle sizing strategy based on	: Flanged - Std Wall
Column assembly MRWP	: 283.8 psig	Discharge nozzle design flow	: 700.0 USgpm
Discharge region of discharge head MRWP	: 280.9 psig	Actual calculated discharge velocity	: 4.38 ft/s
Bowl assembly MAWP	: 424.0 psig	Actual discharge inside diameter	: 8.08 in
Column assembly MAWP	: 286.0 psig	Actual calculated column velocity	: 4.59 ft/s
Discharge region of discharge head MAWP	: 300.0 psig		
<b>Hydrostatic Test Pressures (when purchased)</b>		<b>Additional Performance</b>	
Bowl / Column Assemblies HTP	: 354.7 psig / 354.7 psig	Torque rating (max power)	: 6.55 hp/100 rpm
Discharge region of discharge head HTP	: 351.1 psig	Torque rating (rated power)	: 5.94 hp/100 rpm
		Overall torque limit of pump shafts	: 8.33 hp/100 rpm
		Pump WR <sup>2</sup> at 1,770 rpm	: 8.94 lb-ft <sup>2</sup>
<b>Materials</b>		<b>Sump &amp; Submergence</b>	
Requested pump material	: C30	User defined well / sump opening	: 100.00 in
Selected pump material	: C30	Required minimum well / sump opening	: 17.00 in
Bowl material	: Cast Iron A48 CL30	User defined pit depth	: 8.75 ft
First stage impeller material	: 316LSS A743 GR CF-3M	Min req. pit depth for pump length	: 8.75 ft
Upper stage impeller material	: 316LSS A743 GR CF-3M	Combined bowl & column assembly length	: 8.58 ft
Bowl wear ring material	: None	Clearance from strainer/bearing hub to sump bottom	: 10.00 in
Impeller wear ring material	: None supplied	Available submergence above bell lip	: 24.00 in
Bowl shaft material	: 416 stainless steel	Req. min. submergence above bell lip	: 24.00 in
Bowl bearing material	: Carbon	User defined NPSHa	: 34.0 ft
Column material	: Carbon steel	User defined mounting surf. to LLL	: 5.92 ft
Lineshaft material	: 416 stainless steel	Max allowed LLL for pump length	: 5.92 ft
Open lineshaft bearing material	: Rubber Lineshaft Bearings	NPSHa at eye of impeller	: 35.3 ft
Discharge head material	: Cast Iron	NPSH3 @ Impeller eye	: 8.2 ft

Customer	: -	Pump / Stages	: 12EML	/ 7
Customer reference	: -	Based on curve no.	: EC-2631	
Item number	: Vertical Line Shaft Turbine	Flowserve reference	: 3764677851	
Service	: -	Date	: November 9, 2021	

**Performance Corrections**

Head Corrections		Efficiency Corrections	
Pump rated head at discharge flange	: 474.00 ft	Bowl efficiency after correction	: 80.9 %
Discharge pressure at discharge flange	: 205.2 psig	Pump overall efficiency	: 80.8 %
C/L discharge flange to mounting surface	: 9.00 in		
Mounting surface to low liquid level	: 5.92 ft		
Pump rated head at low liquid level	: 480.67 ft		
Discharge head friction loss	: 0.24 ft		
Column friction loss	: 0.01 ft		
Bowl head	: 480.91 ft		

**Construction and Dimensions**

Bowl Assembly Construction		Bowl Assembly Dimensions	
Bowl construction	: Flanged - Std Wall	Bowl shaft diameter	: 1.69 in
Bowl lining	: Lined bowls	Bowl O.D.	: 11.50 in
Impeller design	: Enclosed	Bell O.D.	: 14.00 in
Impeller fastening	: Colleted	Strainer O.D.	: 15.50 in
Strainer type	: Basket strainer	Bowl assembly length to bell lip	: 86.00 in
Qty of unbalanced, std design impellers	: 7	Suction bearing hub length below bell lip	: 8.00 in
Qty of balanced, std design impellers	: -	Impeller eye to bell lip	: 8.00 in
Qty of unbalanced, alt first stage impellers	: -	Upper stages impeller rated diameter	: 9.33 in
Qty of balanced, alt first stage impellers	: -	First stage impeller rated diameter	: 9.33 in

Column Assembly Construction		Column Assembly Dimensions	
Column construction	: Flanged	Column nominal diameter	: 8.00 in
Column wall description	: Factory Default Wall Thickness	Column wall thickness	: 0.2770 in
Lineshaft lubrication	: Open Lineshaft (Product Lube)	Column length	: 0.75 ft
Column flange rating	: FLS "Regular"	Max column segment length	: 120.00 in
Shaft split	: One piece shaft	Lineshaft diameter	: 1.69 in
Lineshaft coupling type	: Threaded coupling	Bearing span	: 120.00 in
Actual calculated column velocity	: 4.59 ft/s		

Discharge Head Assembly Construction		Discharge Head Assembly Dimensions	
Discharge head design	: "W" - Cast / Above Grade Discharge	Discharge position	: Above mounting surface
Discharge head size	: 8.00 in	C/L shaft to discharge flange face	: 12.50 in
Discharge head flange spec./rating	: 250 lb ANSI/ASME B16.1 "Bolt-up" ...	C/L head discharge to mounting surface	: 9.00 in
Discharge flange size	: 8 in	Shaft diameter through stuffing box	: 1.69 in
Head shaft sealing method	: Single Mechanical Seal		
Driver shaft type	: Solid shaft driver		
Solid shaft coupling type	: Spacer coupling		
Solid shaft coupling size	: 1WS/PS_S		

**Thrust Data**

Thrust bearing location	: Thrust bearing supplied in the driver	Thrust with rated head/rated suction	: 2,940.9 lbf
Thrust stand selection method	: Use rated head & max suction	Thrust with shutoff head/rated suction	: 3,919.3 lbf
Thrust stand size	: None supplied	Thrust with runout head/rated suction	: 1,913.3 lbf
Thrust used for stand sizing	: 2,940.9 lbf	Thrust with rated head/max suction	: 2,940.9 lbf
Max thrust limit for this design	: 12,000.0 lbf	Thrust with shutoff head/max suction	: 3,919.3 lbf
Min thrust limit for this design	: -	Thrust with runout head/max suction	: 1,913.3 lbf

**Additional Notes**

	<p>User messages:</p> <p><u>Single Piece Shaft Material</u></p> <p>The single piece shaft selection requires the line shaft material and the bowl shaft material to be equal. The line shaft material has been automatically set accordingly. If you really need the selected line shaft material, either change the bowl shaft material to match or select a split bowl/line shaft.</p> <p><u>Single Piece Shaft...</u></p>
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