

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

RECEIVED

MAY 01 2015

PUBLIC SERVICE
COMMISSION

In the Matter of:

AN INVESTIGATION OF EXISTING AND)
FUTURE SERVICE OF BULLITT UTILITIES,) CASE NO. 2014-00163
INC.)

ANSWERS OF BULLITT UTILITIES, INC.
TO COMMISSION STAFF'S POST-HEARING DATA REQUESTS
AND REQUEST FOR DEVIATION FROM FILING REQUIREMENTS

Comes Bullitt Utilities, Inc., by counsel, and for its Answers to Commission Staff's Post-Hearing Data Requests, states as follows:

Information Request No. 1: Provide a copy of the final plans of the pump station with the professional engineers stamp.

Answer: See Attachment 1.

Information Request No. 2: Provide a more detailed/enlarged location/vicinity map of the force mains.

Answer: See Attachment 1.

Information Request No. 3: Provide the revised/amended/updated report for the Hunters Hollow sanitary sewer evaluation study.

Answer: The amended Hunters Hollow sanitary sewer evaluation study will be provided upon completion.

Information Request No. 4: Provide copies of Bullitt Utilities' bypass reports submitted to DOW during the last 12 months.

Answer: See Attachment 2.

Information Request No. 5: Identification of the BCSD treatment plant that was intended to

receive the 60,000 gallons per day from Bullitt Utilities through the line that was constructed during April/May 2014.

Answer: The Willabrook Wastewater Treatment Plant owned by Bullitt County Sanitation District.

REQUEST FOR DEVIATION: Bullitt Utilities requests leave to deviate from the requirement to file an original and 10 copies of the Answers to the Commission Staff's Post-Hearing Data Requests on the basis of cost and on the basis that if these documents were submitted as exhibits during the hearing held in the above-referenced case, only one copy would have been required to be filed.

Chris Cogan

STATE OF FLORIDA

COUNTY OF _____

The above answers are true and accurate to the best of my knowledge and belief. Subscribed and sworn to before me by Christopher G. Cogan, as Attorney-in-Fact for Carroll F. Cogan, President, Bullitt Utilities, Inc., this ____ day of May, 2015.

My commission expires: _____

Notary Public

Respectfully submitted,



Robert C. Moore
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(502) 227-2271

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing was served by hand delivery on Jeff Derouen, Executive Director, Public Service Commission, 211 Sower Blvd., P.O. Box 615, Frankfort, Kentucky 40602 and by United States Mail on Gregory T. Dutton and Jennifer Black Hans, Assistant Attorney General, 1024 Capital Center Drive, Suite 200, Frankfort, Kentucky 40601-8204, on this the 15 day of May, 2015.


Robert C. Moore

ATTACHMENT 1

2014-0163

CONTAINS

LARGE OR OVERSIZED

MAP(S)

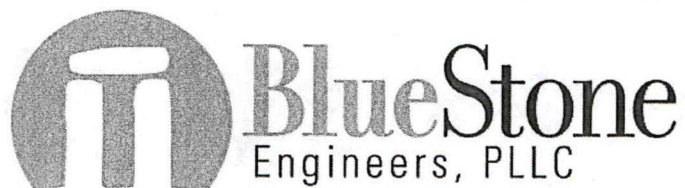
RECEIVED ON:

May 1, 2015

HUNTERS HOLLOW Pump Station and Force Main Design Calculations

Prepared for:
Bullitt Utilities, Inc.
Blue Lick Road
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Prepared by:



3703 Taylorsville Road, Suite 205
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December 28, 2014

BULLITT UTILITIES, INC.

**HUNTERS HOLLOW
PUMP STATION & FORCE MAIN
DESIGN CALCULATIONS**

Background

Based on an Agreed Order for the Hunters Hollow Sanitary Sewer System, a pump station is being provided to divert wastewater flow from the existing treatment plant site located at Blue Lick Road (Bullitt Utilities) to Bullitt County Sanitation District treatment facilities nearby. The pump station will serve the Hunters Hollow Subdivision, Subdivision II, Smith Grove Addition, and areas along Blue Lick Road. This area is bounded by Jefferson County to the north, I-65 to the west, the Union Tool site to the south, and Pioneer Village to the east, located in Bullitt County. Regional planning efforts with the Bullitt County Sanitation District (BCSD) provides for diversion of wastewater flows from the Hunters Hollow system to both the Union Tool Pump Station (pumping to the Willowbrook Wastewater Treatment Facility located off Brooks Road on the west side of I-65), and also to a regional pump station south of John Harper Road (pumping into the Pioneer Village collection system to the Pioneer Village Wastewater Treatment Facility). Since neither facility can handle the full amount of flow from the Hunters Hollow system, the flow will be split between the two treatment facilities with flows ranging from 160,000 gallons to 300,000 gallons depending on which treatment facility is being pumped to.

Wastewater Flow Calculations:

The Hunters Hollow WWTP was originally designed to treat up to 300,000 gallons per day, with wet weather flows sometimes exceeding this amount and with bypasses occurring. This is most likely due to Infiltration and Inflow that exists in the system, with Wet Weather Peak flows exceeding 1 MGD. A temporary high-rate treatment facility installed onsite has supported these totals over the past 6 to 9 months. The typical average daily dry weather flow for the Hunters Hollow system is 160,000 gpd.

Hunters Hollow Average Daily Flow (ADF) = 160,000 gpd = 111 GPM

For peak flow conditions, a Peaking Factor of 3.91 will be utilized.

$$\begin{aligned} PF &= 18 + (P)^{1/2} / 4 + (P)^{1/2} \quad (P = 1.6, \text{ for approximate population of 1600 est}) \\ PF &= 18 + 1.26 / 4 + 1.26 = 3.66 \end{aligned}$$

Peak Daily Flow = 160,000 GPD x 3.66 = 585,600 GPD = 407 GPM

(The pump station will be sized as a temporary facility and thus will not typically pump up to the total Peak Daily Flow to BCSD facilities. Note, that as indicated in the background summary, the maximum flow condition available at the Bullitt County Sanitation District will be limited to 300,000 gallons per day, or 208 GPM at either Wastewater Treatment Facility location. The pump station however, will provide for the ability to pump up to 320 GPM using one pump, and 432 GPM with both pumps in operation pumping to each separate BCSD facility).

Force Main Sizing

Both a 4" and 6" polyethelene force main will be utilized, splitting flow from the proposed Hunters Hollow pump station, with the 4" force main pumping 1050 feet to an influent manhole upstream of the Union Tool Pump Station (BCSD), and the 6" force main pumping 3020 feet to an influent manhole for the BCSD collection system located east of Blue Lick Road at the south end of Lee Villa Court.

Design Criteria:

1. Pipe velocity shall be in the range of 2 - 5 feet per second for wastewater pumps.
2. A Hazen-Williams coefficient, C, of 120 shall be used for Plastic Pipe and 100 for Metal Pipe.
3. Pipe size equals Design Operating Period flow divided by velocity required for design pumping rate.

Force Main Design:

Check minimum/maximum velocity allowable (2 FPS up to 5 FPS) for pipe size for the range of pumping conditions (111 GPM to 208 GPM),

Check 111 GPM MIN AND MAX PREFERRED:

$$A = \frac{0.002228 \text{ CFS/GPM} \times 111 \text{ GPM}}{2.0 \text{ FPS (min Vel}_{\text{allow}})}} = 0.1236 \text{ SF}$$

$$D^2 = \frac{0.1236 \text{ SF} \times 144 \text{ IN}^2/\text{SF} \times 4}{3.14} = 22.67 \text{ IN}^2$$

$$D = \underline{\underline{4.76 \text{ IN DIAMETER}}}$$

$$A = \frac{0.002228 \text{ CFS/GPM} \times 111 \text{ GPM}}{5.0 \text{ FPS (max Vel}_{\text{allow}})}} = 0.0495 \text{ SF}$$

$$D^2 = \frac{0.0495 \text{ SF} \times 144 \text{ IN}^2/\text{SF} \times 4}{3.14} = 9.08 \text{ IN}^2$$

D = 3.01 IN DIAMETER

Check 208 GPM MIN AND MAX PREFERRED:

$$A = \frac{0.002228 \text{ CFS/GPM} \times 208 \text{ GPM}}{2.0 \text{ FPS (min Vel}_{\text{allow}})} = 0.2317 \text{ SF}$$

$$D^2 = \frac{0.2317 \text{ SF} \times 144 \text{ IN}^2/\text{SF} \times 4}{3.14} = 42.50 \text{ IN}^2$$

D = 6.52 IN DIAMETER

$$A = \frac{0.002228 \text{ CFS/GPM} \times 208 \text{ GPM}}{5.0 \text{ FPS (max Vel}_{\text{allow}})} = 0.0927 \text{ SF}$$

$$D^2 = \frac{0.0927 \text{ SF} \times 144 \text{ IN}^2/\text{SF} \times 4}{3.14} = 17.00 \text{ IN}^2$$

D = 4.12 IN DIAMETER

Check velocity for use of a 6-inch force main sewer:

$$\text{Vel} = \frac{Q}{A} = \frac{0.002228 \text{ CFS/GPM} \times 111 \text{ GPM}}{0.196 \text{ SF}}$$

Vel = 1.26 FPS, 6-inch force main will need to maintain higher range of flow than the minimum 111 GPM.

$$\text{Vel} = \frac{Q}{A} = \frac{0.002228 \text{ CFS/GPM} \times 208 \text{ GPM}}{0.196 \text{ SF}}$$

Vel = 2.36 FPS, 6-inch force main will need to maintain flow close to the 208 GPM to keep velocity over 2 fps

For additional flow that may be added using the variable speed pumps the 6-inch force main could pump up to the following and still be below the 5 fps max preferred condition:

$$5 \text{ fps} = \frac{Q}{A} = \frac{0.002228 \text{ CFS/GPM} \times 208 \text{ GPM}}{0.196 \text{ SF}} ; \text{ **Q = 439 GPM**}$$

Check velocity for use of a 4-inch force main sewer:

$$\text{Vel} = \frac{Q/A = 0.002228 \text{ CFS/GPM} \times 111 \text{ GPM}}{0.087 \text{ SF}}$$

Vel = **2.84 FPS, 4-inch force main ok**

$$\text{Vel} = \frac{Q/A = 0.002228 \text{ CFS/GPM} \times 208 \text{ GPM}}{0.087 \text{ SF}}$$

Vel = **5.33 FPS, 4-inch force main slightly over preferred maximum at 208 GPM, will be sufficient from minimum 111 GPM up to almost max 208 GPM.**

Wet Well Design

Optimum wet well volume (including 3-FT drawdown):

$$V = \phi q / 4$$

V = required capacity in gallons

ϕ = minimum time of one pumping cycle in minutes, start-to-start (ideally, 15 minutes for medium size to small size facilities)

q = pump capacity in gallons per minute

For Dry Weather Flows Design (low setting pumping to BCSD):

$$\begin{aligned} V &= (15 \text{ Minutes}) (111 \text{ GPM}) / 4 \\ &= 416.25 \text{ Gallons} \end{aligned}$$

For Dry Weather Flows Design (high setting pumping to BCSD):

$$\begin{aligned} V &= (15 \text{ Minutes}) (208 \text{ GPM}) / 4 \\ &= 780.00 \text{ Gallons} \end{aligned}$$

For Peak Daily Flows Design:

$$\begin{aligned} V &= (15 \text{ Minutes}) (407 \text{ GPM}) / 4 \\ &= 1,527 \text{ Gallons} \end{aligned}$$

Calculate Storage:

Maximum Liquid Level = 503.19 (to prevent overflow/backup). Emergency response storage volume in upstream sewer system is as follows:

Existing:

- Original 6' Diam Wetwell (503.19 - 494.24) * 47.12 SF/FT = 421.73 CF
- “MH WWTP#1” (503.19 – 497.76) * 12.56 SF/FT = 68.20 CF
- Influent Sewer Line (from MH WWTP#1 to Existing Pump Station Wetwell) = 11.5 LF of 12" VCP = 11.5×0.785 SF = 9.03 CF
- Influent Sewer Line (from MH WWTP#1 to upstream MH WWTP#2) = 230 LF of 12" VCP = 230×0.785 = 180.55 CF
- “MH WWTP#2” (503.19 – 499.46) * 12.56 SF/FT = 46.85 CF

Proposed:

- Proposed Sewer Line 1(from MH WWTP#1 to Proposed Manhole WWTP#3) = 14 LF of 12" PVC = 14×0.785 SF = 10.99 CF
- Proposed Sewer Line 2(from Ex. Pump Station Wetwell to Proposed Manhole WWTP#3) = 13.8 LF of 12" PVC = 12×0.785 = 9.42 CF
- Proposed MH WWTP#3 (503.19 – 493.54) * 12.56 SF/FT = 121.20 CF
- Proposed Sewer Line 3 (from MH WWTP#3 to Proposed Wetwell “B”) = 15.6 LF of 12" PVC = 15.6×0.785 = 12.25 CF
- Proposed Sewer Line 4 (3' stub between wetwells) = 3×0.785 = 2.35 CF

Total Line & Manhole Storage = 7.48 gallons/CF x 882.57 CF = 6,602 Gallons

- New 10' Diam. PS Wetwell “A” (503.19 – 488.56) * 78.53 SF/FT = 14.63 * 78.53 SF/FT = 1148.89 CF

Storage in PS Wetwell = 7.48 gallons/CF x 1148.89 CF = 8594 Gallons

- Additional 10' Diam. Wetwell “B” (503.19 – 486.50) * 78.53 SF/FT = 16.69' * 78.53 SF/FT = 1310.66 CF

Storage in Addl Wetwell = 7.48 gallons/CF x 1310.66 CF = 9804 Gallons

Total Emergency Storage in Wetwells = 18,398 Gallons

See table 3 for listings of wet well volumes and depths required. A 10' diameter wetwell/manhole will be constructed to include the storage needed for the design.

TABLE 3
WET WELL VOLUMES

Design Condition	Wet Well Volume for Optimum Operation (gal)	(1) Design Operating Period Peak Flow (gpm)	(2) 120 Min Emergency Response Storage Volume = (1) x 120 (min)	(3) Storage Volume (gal)	(4) Volume Required for Emergency Storage (2) - (3) (gal)	(5) 10' Ø Manhole Vertical Storage Needed (4) ÷ 587.5 (ft)
Avg Flow	416.25	111	13,320	6,602	6,718	11.43
Avg High	780.00	208	24,960*	6,602	18,358	31.25

* In order to provide for additional storage for an hourly peak flow, the peak flow identified at 407 gpm provides 24,420 gallons. The storage provided will additionally meet this requirement.

Float Setting Calculations

Elevation settings for pump station level control switches to be set in the 10' diameter wet well are provided in Table 4.

TABLE 4
LEVEL CONTROL SWITCH SETTINGS

Reference Point	Description	Design Elevations
Wet Well Top	3-feet above finish grade	505.50
Finish Grade	Provide 4" edge above finish grade	505.17
Maximum Liquid Level	Set to avoid overflows/backups	503.19
Influent Sewer	Influent line to Main PS Wetwell	486.50
High Level Alarm	Begin Emergency Storage Depth	488.56
Pump On	12-inches below High Level Alarm	487.56
Pumps Off	12-inches drawdown depth from Pump On	486.56
Minimum Submergence	12-inches below Pump Off	485.56
Wet Well Bottom	24-inches below Minimum Submergence	483.56

Hydraulic Calculations

The 4-inch force main will discharge to an existing 8-inch gravity sewer that runs parallel to Blue Lick Road approximately 1050 feet south to the Union Tool Pump Station. The invert elevation of the force main at the proposed manhole tie-in is 501.00. The high point in the profile, which occurs at station 7+50, is 504.90.

The 6-inch force main will discharge directly to an existing 8-inch gravity sewer that runs southeast of the Union Tool Pump Station on the east side of Blue Lick Road, approximately 3025 feet and directs flow to the Pioneer Village Collection System. The invert elevation of the force main at the proposed manhole tie-in is 486.00. The high point in the profile, which occurs at station 7+50, is 504.90.

Design Static Head (4-inch FM) = I.E. Force Main @ High Point Elevation – "Average of Pump ON/OFF" Elevation

$$H_s = 504.90 - 488.20 = \underline{\underline{16.70 \text{ FT}}}$$

TABLE 5A
EQUIVALENT LENGTH PUMP STATION LOSSES (4-INCH FORCE MAIN):

Type of Head Loss	Quantity	Equivalent Pipe Length for Each Type of Head Loss (ft.)	Total Equivalent Pipe Length (ft.)
Pump Entrance	1	10	10
Check Valve	1	40	40
4" Flow Meter	1	40	40
4" Discharge Pipe	1	10	10
4" Gate Valve	1	4	4
4" – 90 Bend	0	16	0
4" – 45 Bend	5	9	45
4" – 22 ½ Bend	0	5	0
4" – 11 ¼ Bend	1	2	2
Equivalent Pipe Length Subtotal			151
Total Length of Force Main (4-inch)			1,050
Total Equivalent Length (4-Inch FM)			1,201

Tables 6 and 7 calculate TDH (ft) and System Head Data for both the 4-Inch and 6-Inch force mains. Included are pump station losses tabulated in Table 5A and 5B using equivalent pipe lengths determined from force main design plans provided from Derrick Engineering/BCSD. The pumps will be designed to pump to the high point at STA. 7+50, and gravity the rest of the way.

TABLE 5B
EQUIVALENT LENGTH PUMP STATION LOSSES (6-INCH FORCE MAIN):

Type of Head Loss	Quantity	Equivalent Pipe Length for Each Type of Head Loss (ft.)	Total Equivalent Pipe Length (ft.)
Pump Entrance	1	10	10
Check Valve	1	40	40
6" Flow Meter	1	40	40
6" Discharge Pipe	1	10	10
6" Gate Valve	1	4	4
6" - 90 Bend	1	16	16
6" - 45 Bend	8	9	72
6" - 22 ½ Bend	0	5	0
6" - 11 ¼ Bend	3	2	6
Equivalent Pipe Length Subtotal			198
Total Length of Force Main (6-inch)			3,025
Total Equivalent Length (6-Inch FM)			3,223

Pump Selection

Specific pump type and other information for each of the design conditions documented above are provided in Table 7 below. The pumps were selected based on specific needs and comparison to pump curves using Table 6A and 6B as shown on the following pages.

For the design, each pump will be operating between 111 and 208 GPM and between 18' and 32' TDH, with a scouring velocity of 2.04 up to 5.30 FPS. For maximum flow conditions one pump can operate up to 320 GPM at 49' of TDH. Refer to attached pump curves as Appendix 1 of this report.

TABLE 7
PUMP CHARACTERISTICS

Pump Information	4-inch Force Main	6-inch Force Main
Design Flow Rate (GPM)	111	208
Force Main Size (IN)	4.0	6.0
Total Dynamic Head (FT)	18'	32'
Type of Pump	Submersible	Submersible
Model	Essco 493 (or Equal)	Essco 493 (or Equal)
Speed (RPM)	1750	1750
Motor	15 hp VFD	15 hp VFD
Discharge Size (IN)	4	4
Solids Size Passing (IN)	3"	3"
Impeller	9" Vortex 8 Vane	9" Vortex 8 Vane

Table 6A

4-inch Force Main Operating Condition

4" Force Main "A" (Equiv. L = 1,201 FT.)					
PUMP FLOW (GPM)	HEAD LOSS (FT./1,000 FT.) h_f	VELOCITY (FPS)	STATIC HEAD (FT.)	TDH (FT.)	
0	0.00	0.00	16.7	17	
10	0.02	0.26	16.7	17	
20	0.07	0.51	16.7	17	
30	0.16	0.77	16.7	17	
40	0.27	1.02	16.7	17	
50	0.41	1.28	16.7	17	
60	0.57	1.53	16.7	17	
70	0.76	1.79	16.7	17	
80	0.97	2.05	16.7	18	
90	1.21	2.30	16.7	18	
100	1.46	2.56	16.7	18	
110	1.75	2.81	16.7	18	
120	2.05	3.07	16.7	19	
130	2.38	3.33	16.7	19	
140	2.73	3.58	16.7	19	
150	3.10	3.84	16.7	20	
160	3.49	4.09	16.7	20	
170	3.91	4.35	16.7	21	
180	4.34	4.60	16.7	21	
190	4.80	4.86	16.7	22	
200	5.28	5.12	16.7	22	
210	5.78	5.37	16.7	22	
220	6.30	5.63	16.7	23	
230	6.84	5.88	16.7	24	
240	7.40	6.14	16.7	24	
250	7.98	6.40	16.7	25	
260	8.58	6.65	16.7	25	
270	9.20	6.91	16.7	26	
280	9.84	7.16	16.7	27	
290	10.50	7.42	16.7	27	
300	11.18	7.67	16.7	28	
310	11.88	7.93	16.7	29	
320	12.59	8.19	16.7	29	
330	13.33	8.44	16.7	30	
340	14.09	8.70	16.7	31	
350	14.87	8.95	16.7	32	
360	15.66	9.21	16.7	32	
370	16.48	9.47	16.7	33	
380	17.31	9.72	16.7	34	
390	18.16	9.98	16.7	35	
400	19.03	10.23	16.7	36	

Low

High

Table 6B
6-inch Force Main Main Operating Condition

6" Force Main "B" (Equiv. L = 3,223 FT.)					
PUMP FLOW (GPM)	HEAD LOSS (FT./1,000 FT.) h_f	VELOCITY (FPS)	STATIC HEAD (FT.)	TDH (FT.)	
0	0.00	0.00	16.7	17	
10	0.05	0.11	16.7	17	
20	0.19	0.23	16.7	17	
30	0.41	0.34	16.7	17	
40	0.70	0.45	16.7	17	
50	1.05	0.57	16.7	18	
60	1.48	0.68	16.7	18	
70	1.96	0.79	16.7	19	
80	2.51	0.91	16.7	19	
90	3.13	1.02	16.7	20	
100	3.80	1.13	16.7	20	
110	4.53	1.25	16.7	21	
120	5.32	1.36	16.7	22	
130	6.17	1.48	16.7	23	
140	7.08	1.59	16.7	24	
150	8.04	1.70	16.7	25	
160	9.06	1.82	16.7	26	
170	10.14	1.93	16.7	27	
180	11.27	2.04	16.7	28	Low
190	12.45	2.16	16.7	29	
200	13.69	2.27	16.7	30	
210	14.99	2.38	16.7	32	High
220	16.33	2.50	16.7	33	
230	17.73	2.61	16.7	34	
240	19.19	2.72	16.7	36	
250	20.69	2.84	16.7	37	
260	22.25	2.95	16.7	39	
270	23.86	3.06	16.7	41	
280	25.52	3.18	16.7	42	
290	27.23	3.29	16.7	44	
300	28.99	3.40	16.7	46	
310	30.80	3.52	16.7	48	
320	32.67	3.63	16.7	49	
330	34.58	3.74	16.7	51	
340	36.54	3.86	16.7	53	
350	38.56	3.97	16.7	55	
360	40.62	4.08	16.7	57	
370	42.73	4.20	16.7	59	
380	44.89	4.31	16.7	62	
390	47.10	4.43	16.7	64	
400	49.36	4.54	16.7	66	

Buoyancy Calculations (see Figure 3 for dimensions)

Compute buoyancy force:

$$\begin{aligned}\text{Buoyancy Force} &= (\text{displaced volume}) (\text{unit weight of water}) \\ \text{Displaced Volume} &= \text{Volume barrel} + \text{Volume bottom slab} \\ &= (\pi (5.92 \text{ FT})^2 (23.67 \text{ FT})) + (\pi (8.66)^2 (0.67 \text{ FT})) \\ &= 2,606.1 \text{ FT}^3 + 157.9 \text{ FT}^3 \\ &= 2,764 \text{ FT}^3 \\ \text{Buoyancy Force} &= (2,764 \text{ FT}^3) (62.4 \text{ LB/FT}^3) \\ &= 172,473.6 \text{ LBS}\end{aligned}$$

Compute opposing force:

$$\begin{aligned}\text{Opposing Force} &= \text{weight of barrel} + \text{weight of bottom slab} + \text{weight of top slab} + \text{weight of saturated soil over bottom slab extension} \\ \text{Barrel Weight} &= ((\pi r_e^2) - (\pi r_i^2)) (\text{height}) (\text{unit weight concrete}) \\ &= ((\pi (5.92 \text{ FT})^2) - (\pi (5 \text{ FT})^2)) (23.67 \text{ FT}) (150 \text{ LB/FT}^3) \\ &= 112,059.8 \text{ LB} \\ \text{Bottom Slab} &= (\pi r^2) (\text{thickness}) (\text{unit weight concrete}) \\ &= (\pi (8.67 \text{ FT})^2) (0.67 \text{ FT}) (150 \text{ LB/FT}^3) \\ &= 23,753.1 \text{ LB} \\ \text{Top Slab Weight} &= (\text{Volume top slab} - \text{Volume opening}) (\text{unit weight concrete}) \\ &= (\pi (5.92 \text{ FT})^2 - (3 \text{ FT} \times 2 \text{ FT})) (0.67) (150 \text{ LB/FT}^3) \\ &= 10,462.2 \text{ LB} \\ \text{Saturated Soil Weight} &= (\text{Volume soil over slab}) (\text{unit wt. soil} - \text{unit wt. water}) \\ &= [((\pi (8.67 \text{ FT})^2 - \pi (5.92 \text{ FT})^2) (23.51 \text{ FT})) (120 \text{ LB/FT}^3 - 62.4 \text{ LB/FT}^3)] \\ &= 170,691.9 \text{ LB} \\ \text{Opposing Force} &= 112,059.8 \text{ LB} + 23,753.1 \text{ LB} + 10,462.2 \text{ LB} + 170,691.9 \text{ LB} \\ &= 316,967 \text{ LB} \\ \text{Factor of Safety} &= 316,967 / 172,473.6 \\ &= 1.84 (> 1.5) \quad \text{OK}\end{aligned}$$

Force Main Pressure and Water Hammer Calculations

From the UNI-BELL Handbook of Pipe, Design and Construction, 1986, water hammer is an increase in pressure in a pipe caused by a sudden change in velocity. The velocity change usually results from closing of a valve. The maximum surge pressure encountered related to the wave velocity is defined as follows:

$$a = 4660 / (1 + (k/E)(DR-2))^{1/2}$$

Where:

a	=	Wave velocity (FPS)
k	=	Fluid bulk modulus, 300,000 psi for water
DR	=	dimension ratio
	=	(OD (in)/(wall thickness (IN)))
	=	21 for pressure class rating of 200 psi
E	=	Modulus of Elasticity of pipe
	=	400,000 psi for PVC

$$a = 4660 / ((1 + ((300,000 \text{ psi}) / (400,000 \text{ psi}))(21-2))^{1/2}$$

$$a = 808 \text{ FPS}$$

And the maximum pressure surge equals:

$$P = aV / 2.31g$$

Where:

V	=	Maximum change in velocity
g	=	Acceleration due to gravity (32.2 FT/S ²)
P	=	Pressure Surge, (psi)

Determine maximum change in velocity:

The worst case scenario for maximum velocity in the 6" would occur if the pump station shut down while both pumps were running at the minimum static head condition in the 6" pipe:

V	=	q/A
	=	(433 GPM) (0.002228 CFS/GPM) / (0.196 FT ²)
	=	4.92 FPS

By assuming velocity goes to 0 FPS when the station is shut down, ΔV becomes 4.92 FPS, and the maximum pressure surge is as follows:

$$\begin{aligned} P &= (808)(4.92)/(2.31)(32.2) \\ &= 53.4 \text{ psi} \end{aligned}$$

Check total Pressure:

$$\begin{aligned} \text{Total Pressure} &= \text{Surge} + \text{Static} \\ &= 53.4 \text{ psi} + 49 \text{ ft } (62.4 \text{ lb/ft}^3 / 144 \text{ in}^2/\text{ft}^3) @\text{max} \\ &= 53.4 \text{ psi} + 21.1 \text{ psi} \\ &= 74.5 \text{ psi} \end{aligned}$$

Since rated pipe pressure = 150 psi Selection OK

Cyclic Surge (Fatigue) Analysis:

$$C = (5.05 \times 10^{21}) S^{-4.906}$$

Where

$$\begin{aligned} S &= \text{peak hoop stress, psi} \\ C &= \text{average number of cycles to failure} \end{aligned}$$

In estimating the "worst case" conditions:

$$\begin{aligned} C &= (10 \text{ cycles/hr}) \times (24 \text{ hr/day}) \times (365 \text{ day/yr}) \times (80 \text{ yr/lifetime}) \\ C &= 7.01 \times 10^6 \text{ cycles/lifetime} \end{aligned}$$

Calculate peak hoop stress

$$\begin{aligned} S &= (5.05 \times 10^{21} / C)^{0.204} \\ S &= 1,067.7 \text{ psi} \end{aligned}$$

From "water hammer" analysis

$$P_{\max} = 82.7 \text{ psi}$$

From ISO formula;

$$\begin{aligned} \text{DR Required} &= (2S/P) + 1 \\ &= (2 \times 1,067.7 / 82.7) + 1 \\ &= 26.82 \end{aligned}$$

Therefore, a PVC should be selected with DR < 26.82. The proposed force main has a DR of 17. Selection is OK.

- END -

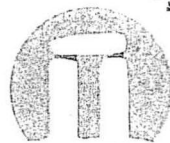
Hunters Hollow Pump Station

Standard & Detailed Technical Specifications

Prepared for:
Bullitt Utilities, Inc.
Blue Lick Road
Hillview, Kentucky 40129

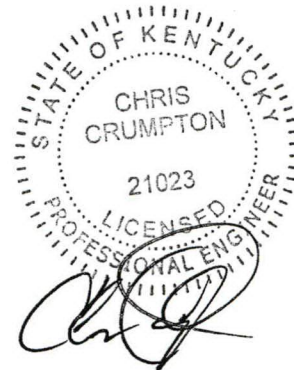
February 2015

Prepared by:



BlueStone
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3703 Taylorsville Road, Suite 205
Louisville, Kentucky 40220



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SPECIFICATIONS
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**STANDARD PUMP
STATION SPECIFICATIONS
SECTION 10**

**SECTION 10
STANDARD SPECIFICATIONS
DUPLEX SEWAGE PUMP STATION
HUNTERS HOLLOW**

10.1 GENERAL

10.1.1. WORK INCLUDED

- A. These specifications cover the work necessary to furnish, install, and complete a duplex submersible non-clog or grinder pump station to the Bullitt County Sanitation District (BCSD) Standards. These specifications additionally utilize standard specifications as set forth by the largest regional service provider Louisville Metropolitan Sewer District (MSD) of which BCSD's Standard Specifications reference in most cases.
- B. The Work to be accomplished under this Section of the Specifications consists of furnishing all labor, materials, equipment, and services necessary for the construction of a duplex pump station and valve vault as shown on the Contract Drawings. The facility components shall include, but not necessarily be limited to, two (2) submersible raw sewage pumps; pump discharge connections; guide rails; bottom, intermediate, and upper guide rail supports; lifting cables; discharge piping, valves, and supports; aluminum access hatches; vents; liquid level sensors; electrical service and controls; flow meters; data quality telephone service; telemetry signals pre-wired in the control panel for future connection by BCSD; and any other items required to make the installation function per its design intent. All components shall be installed in, on, or near a precast concrete wet well basin and valve vault. The structures and dimensions shall be as shown on the Contract Drawings.
- C. The following major Work items are included in the Contract:
 - 1. Site work.
 - 2. Construction of new pump station, valve vault, and appurtenances.
 - 3. Installation of new electrical service and pump control system, including pre-wired telemetry signals.
 - 4. Installation of new data quality telephone service.
 - 5. Installation of Flow Meters

10.1.2. DEFINITION OF ENGINEER

- A. For the purposes of reviewing submittals and interpreting BCSD's standard drawings, specifications, policies, and procedures, the term "Engineer" shall mean the person holding the position of Director of the Engineering Division of BCSD or any person whom BCSD may designate to act in place of said Director.
- B. For matters concerning design, cost, and general professional judgment, the term "Engineer" or "Design Engineer" shall mean the Kentucky Registered Professional Engineer hired by the developer or client to design and supervise the project.

10.1.3. CONTRACTOR REQUIREMENTS

- A. The Contractor shall become familiar with all details of the Work, shall verify all dimensions in the field, and shall advise the Engineer of any discrepancies before initiating the Work.
- B. The Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- C. The Contractor shall use equipment adequate in size, capacity, and numbers to accomplish the Work of this Section in a timely manner.
- D. The Contractor shall comply with the permit and code provisions contained in these specifications.
- E. The Contractor shall submit complete shop drawing packages and operation and maintenance manuals in accordance with Section 1.07 of these specifications.
- F. The Contractor shall be responsible for the factory and field tests required by Sections 3.03, 3.04, and 3.05 of these specifications and shall submit copies of the test reports to document the results.

10.1.4. PERMITS AND APPROVALS

- A. The Owner/Engineer shall obtain any permits and inspections related to or required by the Work in this Contract, including a Kentucky Division of Water Construction Permit.
- B. The Contractor shall furnish electrical inspection by an agency licensed or otherwise qualified to perform electrical inspections in the Commonwealth of Kentucky.
 - 1. All costs incidental to the electrical inspection shall be borne by the Contractor.
 - 2. The Contractor shall provide a Certificate of Compliance with NEC after final approval by the electrical inspector. Final acceptance will be withheld until he has presented the Engineer with the aforementioned Certificate of Compliance.

10.1.5. CODES AND STANDARDS

- A. The Contractor shall comply with applicable codes and regulations of authorities having jurisdiction.
- B. The Contractor shall submit copies of inspection reports, notices, citations, and similar communications to BCSD.

- C. All electrical equipment and details of installations shall comply with the requirements of the latest editions of the National Electrical Code (NFPA-70), the National Electrical Safety Code (ANSI C2), OSHA, KYOSHA, and all applicable codes.

10.1.6. SYSTEM CHARACTERISTICS

- A. Duplex Station.
- B. Submersible Non-clog or Grinder Pump (and must be variable speed compatible)
- C. Pump Motor Rating:
 - 1. 15.0 HP.
 - 2. 460 volts.
 - 3. Three-phase.
 - 4. 22.0 full load amps.
- D. Electrical Service Rating:
 - 1. 480 volts.
 - 2. Three-phase.
 - 3. 100 amps.
 - 4. 3 wire.
- E. Pump Efficiency Ratings:
 - ⇒ Pump efficiencies will be reduced for this operation
- F. Design Operating Point(s):
 - 1. 111 gpm to 208 gpm standard for each pump (up to 320 gpm peak flow)
 - 2. between 18 to 32 TDH (feet) standard (up to 49 peak TDH (feet) at 320 gpm).
 - 3. hydraulic efficiency will be reduced based on operating points.
 - 4. 15 required HP (cannot exceed 90% of motor HP rating).
- G. Shutoff head: 64' TDH (feet)
- H. Third operating point: refer to Supplier Chart
- I. Manufactured by Essco Pumps (or equal)
- J. Model: ESSCO #493, or approved equal.
- K. Maximum operating speed: 1,750 RPM.
- L. Casing size: Maximum Impeller 9-inches C (Vortex 8 Vane Curve Shroud)
- M. Impeller diameter: 9 inches.
- N. Discharge diameter: 4- inches.

- O. Solids passing size: 3-inches.
- P. Cycle time: 15 minutes; Running time: (15.7 minutes to variable)
- Q. Force main pressure rating: 125 psi.
- R. Critical elevation: 503.19 (1' below the existing wetwell and manhole)
- S. Critical Elevation Location: The pump station and sanitary sewer system shall be designed so that under a complete system failure, sanitary flows will discharge as close to the pump station as possible, avoiding discharge into a private residence. This "Critical Elevation" currently occurs at the existing pump station wet well and near-by manhole. This location and elevation shall also be included on the sanitary drawings as well as the O&M Manual

THIS SHALL ONLY OCCUR DURING A COMPLETE SYSTEM FAILURE AND EMERGENCY

10.1.7. SUBMITTALS

A. Shop Drawing Submittals

1. Prior to submitting the manuals described below, the Contractor shall submit seven (7) complete sets of shop drawings to BCSD for review and approval. The shop drawings shall be tailored to the specific project details and shall include, but not necessarily be limited to, the following information:
 - a. Pump manufacturer's literature indicating model numbers, pump and motor characteristics and performance, equipment dimensions, accessory items, hardware, and published pump performance curves showing that the units meet the specified requirements for head, capacity, efficiency, and horsepower for the various conditions specified.
 - b. Installation details for the pump bases, double guide rail assemblies, accessories, and hardware.
 - c. Electrical schematics; electrical components; cut sheets; feeder, branch, and control conductors; disconnect switches; fuses, circuit breakers, and overloads; raceways and fittings; enclosure component layout; and complete motor nameplate data.
 - d. Wet well base, barrel, and top.
 - e. Vent piping.
 - f. Access hatches (wet well and valve vault).
 - g. Piping (force main and pump station), piping supports, watertight through-wall pipe connections, couplings, fittings, and scaled fabrication drawings.
 - h. Valve vault top, base, and barrel.
 - i. Swing check valves, gate valves, ball valve at gauge connection, PVC check valve on drain line between valve vault and wet well, and air release valve.
 - j. Air release and cleanout vaults (top, bottom, base, frame, lid, and watertight through-wall pipe connections).
 - k. Concrete and grout mix designs and mix design support history.
 - l. Flow meters (one for each force main outlet)

2. Additional information may be requested by BCSD at any time for clarification.

B. Operation and Maintenance Manual

1. The operation and maintenance manual (O&M Manual) shall be a thorough and useful reference source for training, educating, and assisting BCSD personnel in the operation and maintenance of the pump station facility. The information contained in the manual shall specifically address the equipment supplied and shall contain no superfluous material. Both the draft and final versions of the O&M Manual shall be bound in suitably labeled, hard cover, 3-ring binders furnished with indexes and tabbed dividers between subject matter.
2. Four (4) copies of the draft version of the O&M Manual shall be delivered to BCSD for review and comments as soon as possible after approval of the shop drawings. The draft manual shall include, but not necessarily be limited to, the following information:
 - a. Approved shop drawings with pump performance curves.
 - b. Complete operating instructions including start-up, shutdown, and emergency procedures.
 - c. Complete parts list (including catalog numbers), parts catalogs, assembly drawings, and pricing information.
 - d. Recommended spare parts list including parts numbers, suppliers, availability, and costs.
 - e. Preventive maintenance schedules.
 - f. Corrective maintenance and alignment instructions.
 - g. Troubleshooting guides.
 - h. A list of complete nameplate data for each piece of equipment supplied.
 - i. The necessary figures, tables, and wording to supplement the material listed above.
 - j. Complete listing of manufacturers' and local suppliers' names; addresses; telephone numbers; fax numbers; and web site addresses for pumps, valves, alternating relays, motor starters, and where applicable, generator and transfer switch.
 - k. Workshop (rebuild) manual.
 - l. Copy of warranty.

Two (2) copies of the marked up draft O&M Manual will be returned to the Contractor so that any corrections, additions, or deletions can be incorporated into the final version.

3. Four (4) copies of the final O&M Manual must be delivered to and approved by BCSD prior to scheduling acceptance testing of the pump station. The final version of the document shall have been revised to satisfactorily address the draft review comments and to incorporate the certified factory pump test reports, pre-commissioning test reports, and final record drawings (as built) of the control panel, pump station, valve vault, and appurtenances.

10.1.8. APPROVAL AND MARKING OF EQUIPMENT

Electrical devices and materials shall be listed and/or labeled by the Underwriters' Laboratories, Inc (UL).

10.1.9. PROTECTION OF ELECTRICAL EQUIPMENT

Electrical equipment shall be protected from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage, and construction. Equipment shall not be stored outdoors even if its enclosure is rated as weatherproof, watertight, etc. Where equipment is installed or stored in moist areas, such as unheated buildings, etc., it shall be provided with an acceptable means of preventing moisture damage such as a uniformly distributed source of heat to prevent condensation.

10.1.10. DEFECTIVE OR DAMAGED EQUIPMENT

- A. Should it be determined by the Contractor, BCSD, or Engineer that any equipment or material has been subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test as directed by the manufacturer and at the expense of the Contractor, or it shall be replaced by the Contractor without change in contract price. Any equipment that fails to meet manufacturer's standards shall be replaced at no additional charge to the Owner.
- B. Any equipment damaged during shipment, while stored, or during construction shall be replaced at the Contractor's expense. Minor scratches on equipment cabinets, etc. may be repaired on site. Any current carrying parts, switch blades, operators, coils, contacts, etc., which are damaged, shall be replaced at no cost to the Owner.

10.1.11. ELECTRICAL SERVICE

- A. The Contractor shall obtain and install a complete electrical service with new service equipment. The new equipment connections and conduit shall be sized for the application, and the service shall meet the requirements of the National Electrical Code (NEC), latest edition, and Louisville Gas and Electric.
- B. The Contractor shall make all necessary arrangements for transfer of power by Louisville Gas and Electric.

10.2. PRODUCTS

10.2.1. GENERAL

- A. Since each pump station has its own set of characteristics based on the pump model selected in the design and since it is prohibitive to prepare design specifications and drawings for each pump model approved by BCSD, these Specifications and Standard Drawings have been prepared based on the constraints given for a particular pump model. This is not intended to prevent the use of other pump models or equipment approved by BCSD but is intended to establish the standard of quality and general configuration of the equipment desired.
- B. Should the Contractor propose to supply a different pump model or type of equipment which has previously been approved by BCSD, the Contractor shall revise the pump

station Drawing(s) and Specification(s) by red lining the revisions to detail them to meet the characteristics of the proposed pump system for BCSD's review and approval. Any changes shall first be approved by the Engineer prior to submittal to BCSD for review.

- C. If approved by BCSD, all revisions shall be shown on the final record drawings and be included in the O&M Manual, which must be furnished prior to final acceptance of the pump station.

10.2.2. STANDARD PRODUCTS

Material and equipment shall be new, shall be the standard products of a manufacturer regularly engaged in the manufacture of the products, and shall essentially duplicate items that have been in satisfactory use at least three (3) years prior to the bid opening.

10.2.3. NAMEPLATES

Two stainless steel nameplates shall be supplied for each pump and motor. These nameplates shall have the manufacturer's name, address, type or style, model or serial number, catalog number, impeller diameter, design flow in gpm, total dynamic head in feet, power in horsepower, voltage, phase, rotational speed in rpm, full load current in amperes, and safety factor stamped on them. One nameplate shall be secured to the item of equipment, and the other shall be mechanically fastened to the inner door of the control panel.

10.2.4. EQUIPMENT GUARDS

Belts, pulleys, chains, gears, projecting set screws, keys, and other rotating parts, so located that any person may come in close proximity thereto, shall be enclosed or guarded per OSHA standards.

10.2.5. PADLOCKS

Upon acceptance of the pump station by BCSD, the Owner will provide and install padlocks to secure the facility.

10.2.6. PIPING

- A. The pipe inside the pump station wet well and valve vault shall be either stainless steel or ductile iron as indicated on the Contract Drawings.

- 1. Stainless steel pipe and fittings shall conform to ASTM A167, Type 304L.

- a. Pipe shall be Schedule 40, and fittings shall be Schedule 80.

- b. Joints for piping 2 inches in diameter and smaller shall be threaded. All other joints shall be flanged.

- 2. Ductile iron pipe and fittings shall be Class 53 conforming to Section 4.2.2.2. of the BCSD Standard Specifications.

- a. Joints shall be flanged.
 - b. Pipe and fittings shall be polyurethane lined.
 - c. Pipe and fittings shall be shop primed and receive two (2) finish coats in the field. The paint system shall be polyamide epoxy based.
- 3. Flanges shall be Class 125; flange bolts shall be stainless steel ASTM A193, Grade B-8, Type 304L; and flange gaskets shall be 1/8-inch ring gaskets.
- B. A detailed and scaled shop drawing of the piping, fittings, valves, etc. shall be submitted for approval.
- C. The installed discharge piping, valve system, and force main shall meet the testing requirements described in Louisville MSD's Standard Specification Section 4.3.5.4. Hydrostatic Tests for Force Mains. The Contractor will be required to perform both pressure and leakage tests to ensure conformance to the testing requirements of the preceding paragraph if the pressure test fails.

10.2.7. VENT PIPE

- A. The vent pipe shall be butt weld Schedule 40 stainless steel pipe and fittings conforming to ASTM A167, Type 304L. A stainless steel insect/bird screen shall be provided on the vent.
- B. The vent pipe shall not be painted.

10.2.8. SEWAGE PUMP GENERAL DESIGN

- A. Non-clog pumps shall be submersible, centrifugal type designed to pump raw, unscreened sewage containing solids and stringy materials.
- B. Grinder pumps shall be submersible, centrifugal type designed to macerate and pump raw, unscreened sewage containing solids and stringy materials.
 - 1. The grinder assembly shall consist of a grinder impeller and a shredding ring and shall be mounted directly below the volute passage. The grinder impeller shall be threaded onto the stainless steel shaft and shall be locked with a screw and washer. The shredding ring shall be pressed onto an iron holding flange for easy removal. The flange shall be provided with tapped backoff holes so that screws can be used to push the shredding ring from the housing. All grinding of solids shall be from the action of the impeller against the shredding ring.
 - 2. Both the grinder impeller and the shredding ring shall be of #440 stainless steel hardened to 58-60 Rockwell C, unless otherwise approved.
 - 3. The grinder unit shall be capable of macerating all materials found in normal domestic and commercial sewage, including reasonable amounts of foreign objects such as wood, plastic, glass, rubber, sanitary napkins, disposable diapers, panty hose, and the like, to a fine slurry that will pass freely through the pump and the discharge piping.
- C. The raw sewage pumps shall be capable of continuous operation under submerged or dry motor conditions without adverse effects due to heat generation. In addition,

the pumps shall be capable of adequate cooling when they are left running with the liquid level lowered to the pump suction inlet to help clean the wet well. Pumping units which require a connection to an external cooling water source to dissipate the heat generated under the conditions specified above will not be acceptable.

- D. Each pump (2 total) shall be supplied with a mating discharge stand which shall be permanently installed in the wet well along with the discharge piping. There shall be no need for personnel to enter the wet well. The pumps shall be automatically connected to their discharge stands when lowered into place and shall be easily removed for inspection and service. No portion of the pump shall bear directly on the floor of the wet well. *(One additional pump shall be provided and stored for backup)*
- E. Connection of the pump to its discharge stand shall be accomplished by a simple linear downward motion of the pump along a rail mounted installation system as specified under Section 2.16 herein.
- F. The pumps shall be certified explosion proof for installation in Class 1, Division 1, Group D environments by Factory Mutual, UL, CSA, or other appropriate governing authorities having jurisdiction.

10.2.9. PUMP CASING

- A. Pump casing shall be constructed of cast iron, ASTM A48, Class 30. The casing shall be of uniform quality and free from blow holes, porosity, hard spots, shrinkage cracks, and other injurious defects. The casing shall be capable of withstanding an operating pressure 50 percent greater than the maximum calculated operating pressure. The volute shall have smooth passages which provide unobstructed flow through the pump.
- B. Watertight mating surfaces shall be machined and fitted with nitrile rubber O-rings such that sealing is accomplished by metal-to-metal contact between the mating surfaces, resulting in proper compression of the O-rings without the requirement of specific torque limits.
- C. Exterior surfaces of the casing in contact with sewage shall be protected by a sewage resistant coating. All exposed nuts and bolts shall be AISI stainless steel, Type 304.

10.2.10. IMPELLER

- A. The pump impellers shall be dynamically balanced.
- B. Grinder pumps shall have recessed impellers designed to handle ground slurry without clogging or binding.
 - 1. Impellers shall be of 85-5-5-5 bronze, or otherwise approved.
 - 2. Impellers shall be threaded onto the pump shafts.
- C. Non-clog pumps shall have channel type impellers designed to handle solids, fibrous materials, sludge, and other items normally found in raw wastewater. Recessed vortex type impellers may be acceptable when specific circumstances warrant;

however, their use in typical installations should be avoided due to the reduced hydraulic efficiency of the equipment.

1. Impellers shall be of Grade 60-45-15 ductile iron, ASTM A395.
2. Impellers shall be slip fit and keyed to the pump shafts whereby they cannot be loosened by torque from either the forward or reverse direction.
3. The pumps shall be capable of passing a minimum 3-inch diameter solid sphere.

10.2.11. PUMP SHAFT

The pump shafts shall be stainless steel of the AISI type recommended by the pump manufacturer. The shafts shall be of adequate size and strength to transmit the full driver horsepower.

10.2.12. SEALS

- A. A tandem mechanical shaft seal system running in an oil bath shall be provided. Upper seals shall be carbon/ceramic with the lower seals being tungsten carbide/tungsten carbide. Each seal interface shall be held in contact by its own spring system. Conventional mechanical seals which require a constant pressure differential to effect sealing will not be allowed.
- B. A sensor shall be provided to detect water leakage into the motor housing. The sensor shall provide a discrete signal for shutting off the pump and activating an alarm pilot light on the control panel.

10.2.13. BEARINGS

Pump bearings shall be ball or roller type designed to handle all thrust loads in either direction. Pumps depending only on hydraulic balance end thrust will not be acceptable. Bearings shall have a minimum B-10 life of 50,000 hours.

10.2.14. MOTOR

- A. The watertight pump motors shall be designed for continuous duty, shall be capable of sustaining a minimum of ten (10) starts per hour, and shall be rated for Class 1, Division 1, Group D service. *Additionally, for the Hunters Hollow Pump Station, pumps and motors must be supplied that provide for variable speed operation and allow for programming of control systems for different pumping conditions for each pump.*
- B. The motors may be either air filled or oil filled, shall have Class F insulation, and shall be NEMA B design in accordance with NEMA MG-1. Temperature sensors shall be embedded in the windings to provide a discrete signal for shutting off the pump and activating an alarm pilot light on the control panel when the winding temperature exceeds the threshold established by the motor manufacturer. The motor shall restart automatically after cooling.
- C. Based on the pump manufacturer's standard design, especially for pump models with larger horsepower drives, water or oil jackets encircling the stator housings may be

utilized for motor cooling purposes. The configuration provided must be a closed loop system in which connections to external coolant sources are not required. Cooling systems circulating wastewater through stator housing jackets are not acceptable.

- D. Motor ratings shall be as shown in Section 1.06 "System Characteristics" of these specifications.
- E. The Contractor shall verify that the existing electrical service is compatible with the specified equipment before ordering the equipment.

10.2.15. POWER CABLE AND CABLE ENTRY

- A. The pump power cable shall comply with NFPA No. 70, Type SO, and shall be of standard construction for submersible pump applications. The cable length shall be such that no splices will be required between the pump and the control panel while providing a two (2) foot vertical sag in the cable between the control panel and cable holder.
- B. The cable entry water seal design shall insure a watertight and submersible seal.

10.2.16. INSTALLATION SYSTEM

- A. The pumps shall be easily lowered into place and removed for inspection and service without the need for personnel to enter the wet well. Connection of the pump to its discharge stand shall be accomplished by a simple linear downward motion of the pump along a rail mounted installation system.
 - 1. For grinder applications, the pump/check valve assembly shall be hydraulically sealed to its discharge case with dual O-rings. A brace, easily removable from the top of the wet well, shall be provided to lock the parts together and to prevent line surges from breaking the seal and allowing leakage.
 - 2. For non-clog applications, sealing shall be accomplished by the weight of the pump pressing tightly against its discharge connection elbow with a machined metal-to-metal contact. Sealing of the discharge interface by means of a diaphragm, O-ring, or other devices will not be acceptable.
- B. A rail mounted installation system incorporating two (2) guide rails; bottom, intermediate, and upper guide rail supports; sliding pump bracket; and lifting cable shall be furnished for each pump.
 - 1. The guide rails shall be non-sparking and of the size standard with the pump manufacturer.
 - 2. The guide rails shall be Schedule 40, Type 304L stainless steel pipe, ASTM A167.
 - 3. All supports and fasteners shall be stainless steel and of a design standard with the pump manufacturer.
 - 4. Intermediate guide rail supports, if required, shall be spaced evenly between the discharge stand and upper guide rail support in order to minimize deflection of the rails. Maximum spacing for the intermediate supports shall be 10 feet.
 - 5. The guide rails shall not support any portion of the weight of the pump.

6. The sliding pump bracket, designed to be non-binding and to ride on the guide rails, shall be an integral part of the pumping unit.
- C. A lifting cable shall be provided to raise and lower the pump through the limits indicated on the Contract Drawings. The aircraft grade cable and all associated hardware shall be stainless steel and shall be capable of supporting the pump with a Safety Factor of two (2).
- D. The Contractor is to demonstrate, in the presence of BCSD's inspector prior to or during the start-up procedure, that pumps have proper hatch clearance, guide rail positioning, and seating. The pumps are to be raised and lowered twice to ensure proper operation. Any necessary alterations or adjustments are to be made by the Contractor, to BCSD's satisfaction, at no additional cost to BCSD.

10.2.17. WET WELL

- A. The wet well shall be constructed of precast reinforced concrete as specified hereinafter and shall be sized as indicated on the Contract Drawings.
- B. Precast Reinforced Concrete

The precast reinforced concrete wet well and top slab shall conform to "Specifications for Reinforced Concrete Manhole Sections," ASTM C478, latest revision. The wet well sections shall contain one or two lines of circular steel reinforcement as required by the ASTM standards. All sewer pipe connections to the precast wet well shall be made with a positive seal gasketing system conforming to ASTM C923 and Louisville MSD's Standard Drawing No. GM-01-01. All wet well joints shall be watertight as described in Louisville MSD's Standard Specification Section 5.2.7., Joint Sealants. The horizontal joints shall be made with a three-way sealing system consisting of a rubber O-ring or single offset rubber gasket, butyl mastic joint sealant, and a 6-inch wide strip of polyolefin covered with butyl mastic around the exterior. To facilitate maintenance, the wet well shall have no more than one through-wall connection for influent sewage. All sewers draining to the wet well shall converge in a single manhole adjacent to the wet well. A single pipe shall connect this manhole and the wet well. The invert of the influent line shall enter the wet well at a higher elevation than the high wet well alarm level.

C. Access Door

1. The access door(s) to the wet well shall be 1/4-inch (minimum thickness) aluminum (6061-T6 Alloy, ASTM B-221) diamond pattern plate, designed to withstand a live load of 300 pounds per square foot. The frame shall be constructed of 1/4-inch thick, one piece extruded aluminum with a continuous 1-inch (minimum) anchor flange around the perimeter. The access door(s), which shall have a 30"x 30" minimum clear opening, shall be adequately sized to allow removal of the pump(s). The actual clear opening of the frame shall allow a minimum of 3-1/2 inches clearance between the pump(s) casing(s) opposite the discharge side of the pump(s) and the inside of the frame, and a minimum of 2-1/2 inches clearance between the sides of the pump(s) casing(s) and the inside of the frame. Factory finish shall be mill finish aluminum. Installation shall be performed in accordance with the manufacturer's instructions. All

aluminum surfaces in contact with concrete shall be coated with a bituminous paint material.

2. The manufacturer shall mark each door leaf, in two locations with a steel stamp using 3/8-inch lettering, with the words "Property of Bullitt Utilities, Inc." When the door(s) are in the open position, one mark shall be located approximately 3 to 4 inches from the edge on the top right corner of the underside of the door(s). The second mark shall be located approximately 3 to 4 inches from the side and above the hinge on the bottom left corner of the underside of the door(s).
3. The door(s) shall be equipped with stainless steel hinges, stainless steel pins, and recessed lift handle flush mounted and not protruding above the cover. Each door leaf, with a maximum of 15 lbs. of manual assistance, shall open to 90 degrees and automatically lock in that position with a stainless steel hold-open arm. The arm shall have a conveniently positioned release handle with a vinyl grip for easy and controlled closing. Door(s) shall be equipped with stainless steel spring operators designed to provide easy operation in opening and to act as a check in retarding downward motion of the door during closing. For safety purposes, should the locking mechanism fail or unauthorized entry occur, the spring operator shall be designed such that the door(s) shall remain in a fully closed position by its own weight. No item may protrude above the access cover except the heads of the carriage bolts and padlock assembly cover.
4. To minimize tampering and improve security, the hinges shall be bolted to the door(s) with stainless steel carriage bolts and nuts. The nuts shall be welded to the bolts on both the door(s) and frame. Door(s) shall be equipped with a recessed padlock and staple assembly which is designed to restrict bolt cutters from severing the padlock. The recess area shall be provided with weepholes to ensure drainage and shall be of adequate size to enclose a standard BCSD padlock which will be furnished and installed by the Owner upon completion of the project. Verification of this requirement shall be noted on the hatch shop drawings. All stainless steel hardware shall be type 304 (minimum) stainless steel. The manufacturer shall guarantee all components of the access doors against defects in material and workmanship for a period of five years.
5. When installing wet wells six feet in diameter and larger, a double leaf access door hatch shall be installed and sized to meet the ultimate pump size access demand and actual clearance as specified between the pump(s) casing(s) and inside of the frame. A large single door shall not be acceptable. The minimum leaf size shall be 30 inches by 30 inches. The maximum leaf size shall be such that the sum of the length and width of the leaf is less than or equal to 84 inches.

10.2.18. VALVE VAULT

- A. The valve vault shall be constructed of precast or cast-in-place reinforced concrete as specified hereinafter and shall be sized as indicated on the Contract Drawings.
- B. Cast-in-Place Concrete

All cast-in-place concrete work shall conform Louisville MSD's Standard Specification Section 5, Structures. Class AA concrete shall be used throughout the structure. All pipe connections to the vault shall be made with a positive seal gasketing system conforming to ASTM C923 and Louisville MSD's Standard Drawing No. GM-01-01.

C. Precast Reinforced Concrete

A precast reinforced concrete valve vault and top slab shall conform to "Precast Concrete Water and Wastewater Structures," ASTM C913, latest revision. All pipe connections to the precast valve vault shall be made with a positive seal gasketing system conforming to ASTM C923 and Louisville MSD's Standard Drawing No. GM-01-01. All valve vault joints shall be watertight as described in Louisville MSD's Standard Specification Section 5.2.7., Joint Sealants.

D. Confined Space Equipment

The valve vault shall be equipped with an aluminum ladder as shown on the Contract Drawings. The ladder shall comply with OSHA requirements. A minimum clear space of 30 inches by 30 inches shall be provided as a landing area at the bottom of the ladder. The ladder shall have retractable side rails or a retractable extension, such as a Bilco Ladder-Up or equal, to facilitate ingress and egress.

E. Access Door

1. The access door(s) to the valve vault shall be 1/4-inch (minimum thickness) aluminum (6061-T6 Alloy, ASTM B-221) diamond pattern plate, designed to withstand a live load of 300 pounds per square foot. The frame shall be constructed of 1/4-inch thick, one piece extruded aluminum with a continuous 1-inch (minimum) anchor flange around the perimeter. The access door(s), which shall have a 30"x 30" minimum clear opening, shall be adequately sized to allow removal of the valves and fittings. Factory finish shall be mill finish aluminum. Installation shall be performed in accordance with the manufacturer's instructions. All aluminum surfaces in contact with concrete shall be coated with a bituminous paint material.
2. The manufacturer shall mark each door leaf, in two locations with a steel stamp using 3/8-inch lettering, with the words "Property of Bullitt Utilities, Inc." When the door(s) are in the open position, one mark shall be located approximately 3 to 4 inches from the edge on the top right corner of the underside of the door(s). The second mark shall be located approximately 3 to 4 inches from the side and above the hinge on the bottom left corner of the underside of the door(s).
3. The door(s) shall be equipped with stainless steel hinges, stainless steel pins, and recessed lift handle flush mounted and not protruding above the cover. Each door leaf, with a maximum of 15 lbs. of manual assistance, shall open to 90 degrees and automatically lock in that position with a stainless steel hold-open arm. The arm shall have a conveniently positioned release handle with a vinyl grip for easy and controlled closing. Door(s) shall be equipped with stainless steel spring operators designed to provide easy operation in opening and to act as a check in retarding downward motion of the door during closing. For safety purposes, should the locking mechanism fail or unauthorized entry occur, the spring operator shall be designed such that the door(s) shall remain in a fully closed position by its own weight. No item may protrude above the access cover except the heads of the carriage bolts and padlock assembly cover.
4. To minimize tampering and improve security, the hinges shall be bolted to the door(s) with stainless steel carriage bolts and nuts. The nuts shall be welded to

the bolts on both the door(s) and frame. Door(s) shall be equipped with a recessed padlock and staple assembly which is designed to restrict bolt cutters from severing the padlock. The recess area shall be provided with weepholes to ensure drainage and shall be of adequate size to enclose a standard BCSD padlock which will be furnished and installed by the Owner, upon completion of the project. Verification of this requirement shall be noted on the hatch shop drawings. All stainless steel hardware shall be type 304 (minimum) stainless steel. The manufacturer shall guarantee all components of the access doors against defects in material and workmanship for a period of five years.

5. When installing valve vaults six feet in diameter and larger, a double leaf access door hatch shall be installed and sized to facilitate access to valves and fittings. A large single door shall not be acceptable. The minimum leaf size shall be 30 inches by 30 inches. The maximum leaf size shall be such that the sum of the length and width of the leaf is less than or equal to 84 inches.

10.2.19. CHECK VALVES

Check valves shall be lever and weight swing type with bronze-to-bronze seating. The valve design shall allow for operation when negative heads are encountered. The valves shall be designed to operate at all pressures in the sewer system. A check valve shall be installed in the discharge line of each pump as shown on the Contract Drawings. Check valves shall be installed such that the lever arm may be totally disassembled, including the removal of hinge pins, without removing the valve from the line.

10.2.20. GATE VALVES

Gate valves shall be AWWA C509, resilient wedge, rising stem suitable for use in sewage applications. Each valve shall be provided with a handwheel opening counterclockwise. The valves shall have flanged ends with 125 lb. drilling. A gate valve shall be installed in the discharge line of each pump and in the emergency pump connection line as shown on the Contract Drawings.

10.2.21. EMERGENCY PUMP CONNECTION

As shown on the Contract Drawings, a 6-inch line shall be installed in the valve vault to enable a portable pump to be connected to the force main. The end of the pipe shall protrude through the top slab of the valve vault and shall be equipped with a 6-inch stainless steel adapter designed to accommodate a positive cam-locking coupler for quick, secure connection of the portable pump discharge hose. The adapter, McMaster-Carr Part No. 53015K58 or approved equal, shall be threaded onto the pipe and shall be protected with a stainless steel locking dust cap, McMaster-Carr Part No. 53015K125 or approved equal. BCSD will provide the required padlock.

10.2.22. BALL VALVES/GAUGE TAPS

Ball valves shall be threaded and have a stainless steel body, stainless steel ball and stem, teflon seats and seals, and a regular port. The gauge tap assemblies shall be stainless steel and installed as shown on the Contract Drawings.

10.2.23. SEWAGE COMBINATION AIR VALVE

- A. The sewage combination air valve (SCAV), when required, shall be specifically designed for use in sewage applications. Its design shall prevent contact between the sewage and the sealing mechanism and shall ensure drip tight sealing. A spring-loaded joint between the sealing mechanism and the float/rod assembly shall perform without jamming under vibrations related to the surges from pump starts and stops.
- B. The SCAV shall automatically release air and gas from a filling system, shall admit air into an emptying system, and shall continuously release accumulated air and gas in a pressurized flowing system.
- C. The SCAV shall be an A.R.I. Model D-020 with attachments as manufactured by A.R.I. Flow Control Accessories, Inc. (Phone: 310-286-2220, Fax: 310-286-2221). Specific size requirements shall be determined by the Engineer.
 - 1. The carbon steel valve body shall be conical in shape and shall have a factory applied, fusion bonded epoxy coating (4 mils DFT) for hydrogen sulfide/sulfuric acid resistance.
 - 2. All springs, washers, stems, and floats shall be constructed of 303 stainless steel.
 - 3. All O-rings and seals shall be made of Buna with pressure ratings equivalent to the overall working pressure required for the SCAV.
 - 4. The air release mechanism and seal shall be constructed of polypropylene (formed for the seal).
- D. The SCAV shall be fitted with an inlet stainless steel ball valve to isolate it from the force main for maintenance or replacement.

10.2.24. MECHANICAL COUPLINGS

Mechanical couplings shall be installed as shown on the Contract Drawings. Mechanical couplings shall be epoxy coated ductile iron with stainless steel nuts and bolts. Couplings shall be Dresser Style 38 or 138, Ford Style FC1 or FC2, or approved equal.

10.2.25. ELECTRICAL

A. General

- 1. All materials and equipment installed shall be new and unused and shall be of the latest design of manufacturers regularly engaged in the manufacture of such products that conform with the requirements of the Contract Drawings and Specifications.
- 2. These Specifications, the associated Drawings, and other Contract Documents have been prepared with the intention of their yielding, through construction, electrical installations that are fully operable, safe, complete, and in full

compliance with the latest editions of the National Electrical Code, local codes and ordinances, and any other authority having jurisdiction over the Work.

B. Conduit

1. All exposed conduit shall be rigid aluminum. All couplings, bushings, and connectors shall be of the same materials and intended for use in a rigid aluminum conduit system. Threads, whether manufactured or made on the job site, shall meet the provisions of the NEC.
2. Below-grade plastic conduit shall be Schedule 40 PVC or Schedule 80 PVC, rated for use with 90-degree celsius conductors and for use in direct sunlight, with chemical weld joints. This Contractor shall provide all fittings, adapters, etc. required for a complete installation as required by the Drawings. Reference Section 3.07.B.

C. Wire and Cable

1. All conductors shall be of stranded softdrawn copper construction with thermoplastic type THHN/THWN 600 V insulation. Conductors shall be sized as shown on the Drawings. Power and lighting conductor sizes smaller than No. 12 AWG shall not be permitted.
2. Control Conductors: Conductors utilized within enclosures utilized for motor control, alarm, and signaling circuitry shall be type MTW, size #14 AWG stranded copper. Control conductors external to enclosures (not including pump and float cables) shall be type THHN/THWN, size #14 AWG stranded copper. Conductors within enclosures shall be neatly routed utilizing plastic Panduit-type wireway. Conductors shall be identified with slide-on plastic sleeves as manufactured by Grafoplast. Conductor identification numbers shall indicate the terminal number on which the conductor shall terminate.

D. Control Panel Enclosures

1. Main Control Panel

- a. The control system, as listed, shall be housed in a single stainless steel or aluminum, NEMA 3R enclosure suitable for outdoor installations with a stainless steel, three-point vault door closing handle and drip shield. It shall be manufactured from 14 gauge, Type 304 stainless steel. All hardware, including the hinges, latches, and provisions for a 5/8-inch diameter hasp opening for a padlock, shall be stainless steel. BCSD will provide the padlock upon completion of the project.
- b. The enclosure shall have a 12 gauge steel, formed, removable subpanel. The panel shall be degreased, cleaned, and treated with a phosphatizing process, then primed and painted with white industrial-grade baking enamel.
- c. The enclosure shall have a hinged inner door (dead front) fabricated from 5052-H32, 0.080-inch thick (minimum) marine alloy aluminum. The inner door shall be hinged on one side and held closed by two (2) hand operated, 1/4-turn fasteners or thumb screw fasteners on the other side. Operator devices are to be mounted on, or protrude through, the inner door. The hinge and inner door assembly shall be of sufficient strength to

prevent sagging, buckling or warping of the inner door after inner door devices are installed. A mechanical catch shall be provided that will hold the door open while working inside the panel. Duplicate nameplates for the motor and pump shall be mechanically fastened to the inner door.

- d. Double stainless steel (ASTM A167, Type 304) control panel pedestals, one for pump cables and one for intrinsically safe circuits, shall be furnished, each provided with a screened, louvered vent. The pedestal shall be sized for the application (venting, wiring, and support) and anchored to the top slab with a minimum of four (4) half-inch (1/2") stainless steel anchors (AISI Type 316). Electrical cables shall be sealed with aluminum cord grips, Remke Industries type RSR or equal sized for the application, which provide a gastight seal between the pedestal and the panel. A 1/2-inch (minimum) aluminum mounting plate between the pedestal and the control panel may be required depending on the size and structural rigidity of the panel.
- e. Boxes used for mounting equipment or devices outside the control cabinet shall be stainless steel or aluminum, NEMA 4X construction.

2. Other Enclosures

Other enclosures shall be stainless steel or aluminum, NEMA 4X with provisions for pad locking. Enclosures larger than 12"x12" shall have a hinged door.

E. Control Panel Components

1. Phase Monitor

- a. Loss of voltage on any phase, undervoltage, and loss of rotational sequence shall be detected by a phase monitor suitable for the electrical service provided. The monitor shall reset automatically when measured parameters return to the normal range of operation. The phase monitor shall include a means for adjusting drop out voltage, an LED indicating normal conditions, and shall plug into an 8-pin tubular base.
- b. The phase monitor shall be Diversified Electronic Type SUA or SLA or equal.

2. Motor Controller, Overload, and Short Circuit Protection

- a. Motor starters shall be 600VAC, full voltage, NEMA rated, non-reversing, horsepower rated starters with solid state overload relays.
- b. Contactor shall meet the following requirements:
 - i. Silver alloy power contacts, silver auxiliary contacts.
 - ii. Saddle type, pressure type or wire clamp power terminations rated at 75 degrees Celsius.
 - iii. Operating temperature range of -13 to +131 degrees Fahrenheit.
 - iv. Corrosion resistant treatment on all metal parts.
 - v. Coil voltage operating range of 85%-110% of nominal.
 - vi. DPDT auxiliary contacts rated NEMA A600 with 7200VA make/720VA break/10 amp continuous rating.
Provide Allen-Bradley Bulletin 509 or equal.

- c. Overload relay shall meet the following requirements:
 - i. Phase loss protection
 - ii. Selectable class 10, 20, 30 time current trip characteristics.
 - iii. Directly mountable on contactor.
 - iv. 120VAC remote reset solenoid.
 - v. Isolated normally open and normally closed fine silver, 360VA rated contacts.

Provide Allen Bradley Bulletin 592 SMP-1 solid state overload relay with model number 193-ER1D remote reset solenoid or equal.
- d. Short circuit protection shall be a molded case circuit breaker meeting the following requirements:
 - i. 125 amp frame size
 - ii. Fixed magnetic, adjustable thermal trip settings
 - iii. 600VAC, 6 amp SPDT auxiliary contacts to indicate breaker position.
 - iv. 600VAC, 6 amp SPDT alarm contacts to indicate breaker trip.
 - v. AIC rating of 25,000A minimum @480VAC.

Provide Cutler Hammer E125 frame molded case circuit breaker with catalog no. AUXALRMEPK auxiliary/alarm contact kit or equal.

3. Indicator Lights

- a. Indicator lights shall be watertight/oiltight, NEMA 4/13, "push-to-test", full voltage type, with lens color and legend plate as indicated on the drawings.
- b. The indicator lights shall be Allen-Bradley Bulletin 800T or equal.

4. Push Buttons

- a. Push buttons shall be watertight/oiltight NEMA 4/13, black, flush-mounted, full voltage with legend plate as indicated on the drawings.
- b. The push buttons shall be Allen-Bradley Bulletin 800T, type QT10 or equal.

5. Alternator

- a. Alternator shall alternate the lead pump on successive pumping cycles and provide for energization of the lag pump. Four (4) normally-open float switches (high level alarm, lead, lag, and off) shall be wired directly to intrinsically-safe inputs contained within the alternator. The alternator shall contain logic for the detection of malfunctioning float switches and shall adjust the mode of operation so that both pumps may continue to be duplexed. Operation of the duplexor shall revert to normal operation automatically upon detection of proper float switch function. A built-in time delay shall prevent the simultaneous energization of both pumps. An alarm contact shall close in the event of high wet well level is detected only. Contacts shall be SPDT rated 10 A resistive, 345 VA inductive at 120 VAC.
- b. Hand-Off-Auto switches (one for each pump) and a lead selector switch for control of the pump sequence shall be included on the alternator. A

Test/Clear momentary pushbutton shall be provided that energizes the lead pump while the pushbutton is actuated. Release of this pushbutton shall de-energize the load and simultaneously alternate to the other load for testing. During fault conditions, this pushbutton shall reset the fault detection algorithm. LEDs shall indicate the status of the float switch inputs, load outputs and high wet well level/faulty alarm. The alternating relay shall be mounted within the control panel such that these operator interface devices are accessible with the inner door closed while precluding contact with the wiring terminals. The cutout in the inner door shall be framed around the accessible portion of the alternator so that sharp edges are not accessible.

- c. The alternator shall be Diversified Electronics model no. ARM-120-AFE or equal.

6. Heaters

- a. The enclosure shall have a combination of three (3) brass sheath, screw-base-type spaceheaters of 100 watts each. The screw bases shall be porcelain. An electric heat thermostat for controlling the spaceheaters shall be installed behind the inner door. The thermostat is not required to be accessible through the inner door.
- b. The heaters shall be Chromalox Type SCB or equal.
- c. The thermostat shall be Dayton Model No. 2E173B or equal.

7. Legend Plates

All equipment, disconnect switches, circuit breakers, motor starters, pushbutton stations, relays, and similar devices shall be clearly labeled or function otherwise identified. Identification labels shall be engraved lamacoid plates having black background with white letters. Attach each plate with aluminum or stainless steel screws.

8. Rotary Instrument Switches

- a. Instrument switches shall be multi-pole rotary switch with Cam-operated contacts. Ammeter switch operation shall ensure that current transformer current paths are maintained regardless of switch position. The switch contacts shall operated by rotation of the shaft. The switch rating shall be 600 volts, 210 (minimum) amperes continuous. The contacts shall be marked for identification following a standard system. The switch design shall be panel mounted with a molded cover. The escutcheon shall be appropriate for the type of electrical service supplied. The switch handle shall be knurled. The cam and contacts shall be silver with double break design.
- b. The voltmeter and ammeter switches shall be Klockner Moeller Type TO or equal.

9. Voltmeter and Ammeters

- a. Voltmeters and ammeters shall be analog, flush-mounted, switchboard type instruments with rectangular palters. The meter nameplates shall

- indicate voltage or current rating, frequency rating, full scale value and the value of any internal or external compensating resistor required.
 - b. The voltmeter shall be complete with cam switch for selecting phase-to-phase voltage.
 - c. A current transformer shall be provided for each phase. The current transformers shall be Instrument Transformers Model 2 or equal.
 - d. The meters shall be General Electric Type AB or equal.
- 10. Control Power Transformer
 - a. Where utility-supplied, 120VAC electrical service is not available, 120VAC control voltage shall be supplied from the incoming power via a single phase 240 x 480 V primary transformer sized to provide a minimum of 3KVA, 120VAC, 60HZ power. The transformer shall be mounted outside the Main Control Panel Enclosure. The transformer shall be of a type listed for outdoor use and housed in a stainless steel enclosure.
 - b. The transformer shall be Square D Class 7400 or equal.
- 11. Circuit Breakers
 - a. Circuit breakers for supplying ancillary systems shall be operable from front of the control panel. The breakers shall be black, rated for the fault current available and shall have the number of poles as indicated on the drawings.
 - b. Circuit breakers shall be General Electric Q Line type or equal.
- 12. Elapsed Time Meter
 - a. Elapsed time meter shall utilize 120VAC, 60 Hz, permanent magnet motor that is accurate within plus or minus 50 milli-seconds per start or stop and operate at 100 percent when running at normal frequency. The counter wheels shall be gear and pinion type, 1-inch in diameter and have easy-to-read numbers. The elapsed time meter shall be non-resettable, capable of registering elapsed time up to 99,999.9 hours.
 - b. Meter to be Cramer Model 635K or equal.
- 13. Control Relays
 - a. Control relays shall be NEMA 300, plug-in type, with blade-type terminations, a temperature operating range of -30 degrees C to 55 degrees C, integral, mechanical on/off indicator, 10A contacts and voltage rating as required.
 - b. Control relays shall be Allen Bradley Bulletin 700, Type HB or equal.
- 14. Duplex Receptacle
 - a. The receptacle shall be 125 volt, 20 amp NEMA 5-20R GFI receptacle with "Test" and "Reset" buttons.
 - b. Provide metal cover plate.
 - c. The receptacle shall be Leviton 6899-I or equal.

15. Power Distribution Blocks

- a. Power distribution blocks shall be aluminum, tin plated and must be compatible with copper conductors. Each block shall be sized appropriately for the size and number of wires being terminated and shall be based on NEC ampacity tables using 75⁰ Celsius wire.
- b. Blocks to be as manufactured by Marathon or equal.

16. Fuse Holders

- a. Fuse holders shall be 600V, 30 amp high impact thermoplastic with copper alloy, tin plated clips.
- b. Holders to be as manufactured by Marathon or equal.

F. Grounding

1. The resistance value of the main grounding conductor measured between the main disconnect and a good earth ground shall not exceed five (5) ohms.
2. Ground Rods: Ground Rods shall be the copper clad steel type and shall be a minimum of 10 feet in length, 3/4-inch in diameter. Ground rods shall be equal to those as manufactured by Copperweld Steel Company.
3. Grounding electrode conductors shall be bare copper. Equipment grounding conductor shall be copper, THHN/THWN insulated, green (or green with yellow tracer) in color, and rated at 600 volts.

G. Float Switches

1. Liquid level detention shall be by sealed, mercury float switches mounted in unbreakable steel shells and encased in solid polyurethane. The float switches shall be weighted, suspended by cables which shall contain the wiring for the switches and shall be covered with a material which is highly resistant to sewage components. Floats requiring fasteners to maintain their depth in the wet well are unacceptable. The tilt bulb hanger and hardware shall be stainless steel (ASTM A167, Type 304).
2. The float cables shall be supplied of sufficient length to be installed without splicing.
3. Floats to be Consolidated Electric Bulletin B100, Model LS or equal.
4. Mounting Bracket to be Ohio Electric Control Model 100-6 or equal.

H. Fuses

1. Unless otherwise noted, the fuses shall be dual-element, current-limiting, type RK5 rated for 200,000 amps, voltage as required by drawings. Mini fuses are not acceptable.
2. The fuses shall be manufactured by Bussman, Littelfuse or approved equal.

I. Disconnect Switches

1. Disconnect switches shall be general duty, NEMA 4X, stainless steel, fusible, front operated, with provisions for padlocking in open or closed position; voltage; ampere rating and number of poles as noted on the drawings, fused unless noted, and rated for use as service entrance equipment. The disconnect shall utilize a quick-make, quick-break mechanism. A class R fuse kit and, where applicable, grounding kits shall be provided.
2. The disconnect switch shall be General Electric, Square D, Westinghouse or equal.

J. Service Pole

For overhead service, the Contractor shall provide a 25-foot long, Class 4, wood pole (treated lumber) for up to 200 amp service or as required by LG&E. This wood pole shall be installed as a part of the Overhead Service Switch Rack detailed on the Drawings. For services over 200 amp, Contractor shall contact LG&E at 627-3265 for pole classification and requirements. Underground service shall utilize the same switch rack detail as overhead service except that a 12-foot aluminum I-beam shall be substituted for the wood pole.

K. Cord Grips

1. Provide standard duty, single eye, single weave, stainless steel support grips of sufficient strength for both power and control cords.
2. Cord grips shall be as manufactured by Hubbell or equal.

L. Auxiliary Alarm System

1. General

The station shall be provided with an auxiliary alarm system housed in a NEMA 4X, aluminum or stainless steel, padlockable enclosure. The system shall be powered by battery on constant charge from battery charger.

2. Battery

- a. The battery, when fully charged, shall power the alarm light and horn for a minimum of five hours. The battery shall be a rechargeable, sealed, maintenance-free, lead-calcium, 12 V, 25 ampere-hour (minimum).
- b. The battery shall be Eagle Picher Carefree Magnum or equal.

3. Battery Charger

- a. The battery charger, at a minimum, shall be sized to supply power for the maximum battery charging current plus the remaining demand of the alarm devices.
- b. The battery charger shall be Power Sonic SLA-type, 12 V, dual-rate charger Model No. PSC-124000A or equal.

4. Alarm Light

- a. The alarm light fixture shall be a weatherproof, wall-mounted incandescent, 60 W fixture with a red, polycarbonate globe. The incandescent lamp shall be 12 VDC, 15 W. The alarm light shall be energized through a 12 VDC, 100 W flasher capable of generating 60 flashes per minute.
- b. The globe shall be as manufactured by Major, Model BXVP-10PCR or equal.
- c. The flasher shall be a Wagner Model No. 552 or equal.

5. Alarm Horn

- a. The alarm horn shall be 12 VDC, rated for outdoor, weatherproof service and shall be capable of producing 100 dB as measured 10 feet from the horn. The horn silence pushbutton shall be housed in a NEMA 4X, stainless steel enclosure. The horn silence pushbutton shall be accessible to the general public.
- b. The alarm horn shall be Edwards Weatherproof AdaptaHorn Model 877-E1 or equal.

M. Surge Arrester

1. A surge arrester shall be provided to protect equipment against energy surges due to lightning strikes. Surge arrester shall utilize a metal oxide element inside an enclosure suitable for outdoor mounting. Arrester shall be capable of passing 900 joules of energy per pole and shall be rated for the service voltage.
2. Surge arrester shall be GE TRANQUELL secondary surge arrester

N. Flow Meters

1. Two six-inch ULTRAMAG flow meters shall be installed in an additional meter vault on the downstream side of the proposed valve vault and shall include signal converter, flow totalizer and associated wiring and piping.
2. One additional standard flow meter shall be installed on the bypass outflow line in the existing pump house with separate totalizer.

O. Variable Frequency Drives

1. Low Harmonic Adjustable Speed Drives shall be provided in conjunction with the pump supplier
2. Detailed Specifications are provided in the next Section "Low Harmonic Adjustable Speed Drive Specification"

P. Phone Dialer

1. A phone dialer shall be provided and installed capable of dialing up to 16 numbers to notify of pump and power failure, and high level alarms.
2. Dialer shall be a RACO dialer as listed in Detailed Technical Specifications section below for "RACO Dialer".

10.3. EXECUTION

10.3.1. GENERAL

The Contractor shall furnish and install as detailed, at the elevations given and where shown on the Drawings, a complete duplex submersible pump station capable of handling raw, unscreened domestic sewage. The station shall include submersible grinder or non-clog sewage pumps, pump discharge connections, guide rails, guide rail supports, lifting cables, discharge piping and valves, access hatches, vents, liquid level sensors, electrical service and controls, data quality telephone service, telemetry signals pre-wired in the control panel for future connection, and a precast concrete wet well and valve vault.

10.3.2. BACKFILL AND FINISH GRADING

- A. Class I (No. 9 crushed stone aggregate) backfill material shall be placed around the pump station to within 18 inches of the surface of the surrounding ground, with sufficient allowance for settlement. The remaining fill shall be earth material free of rocks in the areas of piping and excavated material in all other areas. Rock and/or shale excavation may be placed in the top 18 inches of fill but shall not be above piping or any closer than 12 inches from finished grade.
- B. All fill shall be placed so as to load structures symmetrically. Rough grading shall be held below finish grade and then topsoil which has been stockpiled shall be evenly spread over the surface.
- C. Grading shall be brought to the levels shown on the Drawings or to elevations established by the Engineer. Final dressing shall be accomplished by hand work, machine work, or a combination of these methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade.

10.3.3. FACTORY PUMP TESTS

- A. Factory performance and vibration tests shall be conducted on each pump, including the unit to be furnished as a spare.
 - 1. During each performance test, the pump shall be run at each head condition for a sufficient time to permit accurate determination of discharge, head, and power input.
 - 2. Vibration tests to determine horizontal, vertical, and axial spectrum and wave form shall be performed at each bearing location.
- B. All tests shall be run in accordance with the Standards of the Hydraulic Institute.
- C. Certified copies of the factory test reports shall be furnished to the Engineer for review and shall be included in the final O&M Manual.

10.3.4. PRE-COMMISSIONING TEST

- A. When the facility is substantially complete, the pump manufacturer's representative shall visit the job site to inspect, operate, and test the pumping equipment to ensure

that it satisfies the manufacturer's installation standards, meets the prescribed performance criteria, and complies with the requirements specified herein.

- B. All adjustments necessary to place the equipment in satisfactory working order shall be made at the time of the pre-commissioning test.
- C. The Contractor shall provide all labor, equipment, materials, water, and other utilities required for testing.
- D. Copies of the pre-commissioning test report shall be furnished to the Engineer for review and shall be included in the final O&M Manual.

10.3.5. ACCEPTANCE TEST

- A. After construction is complete, the pre-commissioning test has been performed, and the final O&M Manual has been submitted and approved, each pump shall be given a running test in the presence of the Engineer and other authorized BCSD representatives to determine its ability to operate without vibration or overheating and to deliver its rated capacity under the specified conditions.
 - 1. During the test, observations shall be made in regard to head, capacity, and motor input.
 - 2. The limits of vibration as set forth in the 13th Edition of the Standards of the Hydraulic Institute shall govern.
- B. All defects or defective equipment revealed by or noted during the test shall be corrected or replaced promptly at the expense of the Contractor, and if necessary, the acceptance test shall be repeated until results acceptable to the Engineer are obtained.
- C. The Contractor shall provide all labor, equipment, materials, water, and other utilities required for testing.
- D. In the event that the Contractor is unable to demonstrate to the satisfaction of the Engineer and BCSD representatives that the units will satisfactorily perform the service required and that they will operate free from vibration and overheating, the pumping units may be rejected. The Contractor shall then remove and replace the equipment at his own expense, and the acceptance test shall be repeated.
- E. Copies of the acceptance test report, including all vibration readings made, shall be furnished to the Engineer for review.

10.3.6. PUMP WARRANTY

- A. For submersible pumps, the pump manufacturer's standard warranty against defects in workmanship and material shall be provided to Bullitt Utilities, Inc. for the units being supplied. At a minimum, the warranty shall cover 100% parts and labor for five (5) years from the date of acceptance. The pump manufacturer shall repair or replace defective equipment, parts, or components within ten (10) working days of receipt of defective items shipped prepaid by Bullitt Utilities, Inc. to the manufacturer's authorized repair facility.

For grinder pumps, at a minimum the manufacturer's warranty shall cover 100% parts and labor for one (1) year from the date of acceptance. The pump manufacturer shall repair or replace defective equipment, parts, or components within ten (10) working days of receipt of defective items shipped prepaid by Bullitt Utilities, Inc. to the manufacturer's authorized repair facility.

- B. Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the manufacturer will not be accepted. The manufacturer shall assume prime responsibility for the guarantee of the station and all components.
- C. Those items normally consumed in service, such as oil, grease, etc., shall be the responsibility of BCSD and/or Bullitt Utilities, Inc.

10.3.7. ELECTRICAL INSTALLATION

A. Excavation, Backfilling and Grading:

1. The Contractor shall perform all earth and rock excavation, backfilling and grading required for this part of the work. Rock excavation shall be made to a depth of 4 inches below pipe and filled to subgrade with dense graded aggregate limestone.
2. Trenches shall be maintained free of water until backfilling is completed.
3. Backfilling material in earth excavation shall be clean earth to a line at least 12 inches above the top of the conduit. From this line upward, rock not more than 6 inches in diameter may be used provided it is spaced at least 12 inches apart. Filling between rock shall be of clean earth, thoroughly tamped in 6-inch layers to the finished grade.
4. Depth of bury for all conduit shall be a minimum of 24 inches below finished grade.

B. Conduit:

1. PVC shall be concrete encased where it passes under roadways. PVC shall not be used where exposed on the exterior nor where exposed to direct sunlight. This Contractor shall plan his work so that runs of conduit miss equipment by other trades. Conduit bushings shall have insulating material which has been permanently fastened to the fittings. Bushings for conduit 1-1/2 inches trade size and larger shall be complete with grounding lug and shall be bonded to the box by means of bare copper wire. All field bends shall be made with standard tools and bending equipment manufactured especially for this purpose. Bends in metallic conduit shall be made while cold and in no case shall the conduits be heated. Conduits shall not be bent through more than 90 degrees. Size of conduits shall not be less than that required by the National Electrical Code.
2. All conduit installed on concrete surfaces shall be anchored with spacer type conduit clamps preventing contact between the conduit and the concrete surface. Conduits penetrating walls shall be grouted in place to form a seal. Conduits penetrating floors shall be sleeved.
3. Provide an anti-oxidation compound on threads of all metallic conduit.

4. All conduit shall be run continuous between devices with a minimum number of bends. Back-to-back 90 degree bends (180 degree change of direction) will not be acceptable. During construction, all new conduits shall be kept dry and free of moisture and debris.
5. No conduit smaller than 3/4-inch trade size shall be used.
6. Conduit Schedule:

Location	Sched. 40 PVC	Sched.80 PVC	Aluminum
Underground/Encased	X	X	
Direct Buried		X	
Exposed			X
Emergence from UG			X

C. Wire and Cable:

1. Direct Burial Cable: No cable buried directly in the earth (not in raceway) will be allowed on this project.
2. Wire shall not be installed until all work of any nature that may cause injury to the wire is completed. Mechanical means shall not be used in pulling in wires No. 8 or smaller. Approved wire pulling lubricant shall be used as required to prevent insulation damage and overstressing of the wire while pulling through conduit. In no case shall conductors be greased or coated with any substance injurious to the conductor insulation or sheath.
3. All wires connected to terminal boards, terminal blocks, or to other similar terminals shall terminate by means of pressure terminals. Where terminal boards, terminal blocks, etc. are designed and manufactured to accept bare wire and have a pressure plate on each side of the wire, no pressure terminals on the wire will be required. Where the wire would have to encircle the holding screw to make a proper connection, the wire terminals are required.
3. Where the wire is shown larger than that required for the load, it is done so for voltage drop or other purposes and must be installed as shown. Conductors connected to the main service disconnect and to the individual pump starters shall be sized to accommodate the full capacity of the service disconnect and starters. Where the wire is stranded, the removal of strands in order to install the wire into a lug provided on any equipment will not be permitted. A larger lug shall be installed which will accept the wire size indicated.
4. Float switches and associated mounting hardware shall be installed such that they may remain in place during pump removal.

D. Grounding:

1. Ground rods shall be driven vertically into the earth so that the top of the rod is at least 1 foot below finished grade. Where rock is encountered at a depth of less than 4 feet, rods shall be buried in a trench at not less than 2 feet below finished grade.
2. Connections to ground rods and all other ground connections below grade shall have a minimum mechanical contact surface area between the conductor and the ground rod of not less than three square inches. All connections made below finished grade shall be exothermic. Installation of grounding conductors shall be such that they are not exposed to physical damage. All connections shall be firm and tight.

3. All metal electrical equipment cabinets shall be securely bonded to a grounding conductor running through any conduit terminating at the cabinet or enclosure by use of a grounding lug bushing and jumper wire to the enclosure wall. Control cabinets shall be provided with an equipment ground bus (including lugs or screw terminals) securely bonded to the enclosure. Junction boxes and other enclosures shall utilize an equipment ground bus or lug as required to securely bond the equipment grounding conductor to the enclosure. The grounding conductor shall be connected with pressure connectors at the main disconnect to the main grounding system. Where screw terminals or set screw lugs are used, sufficient lugs shall be provided such that not more than one conductor is installed into each lug or terminal.
4. No flexible conduit shall serve as a grounding conductor.
5. Where lightning arresters are furnished and installed either separately or with equipment and the grounding connections are not inherently provided, a suitable, separate grounding conductor shall connect the lightning arrester with a separate ground rod. This rod shall be bonded with any adjacent grounding system.

10.3.8. UTILITIES

A. Electricity

The Contractor shall coordinate the installation of a complete electrical service with the Louisville Gas & Electric Company (LG&E). When applying for service, the Contractor shall inform LG&E that the service is for a wastewater pumping facility. Developer's Engineer shall furnish all electrical data requested by LG&E. Raceway, conductors, and other installation details shall be in accordance with the requirements of LG&E. The Contractor shall be responsible for securing all permits, inspections, and approvals necessary for the transfer of a functional electrical service and the associated LG&E account to Bullitt Utilities, Inc., upon acceptance of the facility.

END OF SECTION

**STANDARD
SPECIFICATIONS
VARIABLE
FREQUENCY DRIVES**

Low Harmonic Adjustable Speed Drive Specification

Part 1 – GENERAL

1.01 DESCRIPTION

- A. This specification describes a complete Adjustable Speed AC Drive (ASD) used to control the speed of NEMA design B induction motors used in areas where low harmonic content is desired or mandated.
- B. The drive manufacturer shall supply the Drive and all necessary controls as herein specified.
- C. The ASD shall be manufactured by a company with at least ten (10) years experience in the production of this type of equipment.

1.02 QUALITY ASSURANCE

- A. The Drive manufacturing facility shall be ISO 9001 and ISO 14001 certified.
- B. All printed circuit boards shall be completely tested before being assembled into the complete Drive. The Drive shall be subjected to a functional test and load test. The load test shall be at full rated load, or cycled load.
- C. The drive manufacturer shall have an analysis laboratory to evaluate the failure of any component.

1.03 QUALIFICATIONS

- A. The ASD shall meet the following specifications
 - 1) UL 508A and 508C – Underwriter's Laboratory. The ASD shall be UL listed and carry the UL mark.
 - 2) CAN/CSA-C22 No. 14-M91 – Canadian Standards Association. The ASD shall be C-UL or CSA listed and carry the appropriate mark.
 - 3) Institute of Electrical and Electronic Engineers (IEEE). Standard 519-1992, IEEE Guide for Harmonic Content and Control.
- B. The ASD shall comply with the following European Union's CE directives. The ASD shall carry CE mark.

- 1) EMC Low Voltage Directive 73/23 EEC
- 2) EMC Directive 89/336 EEC
- 3) Machinery Directive 98/37 EC

1.04 SUBMITTALS

A. The Submittals shall include the following information:

- 1) Outline Dimensions and Weight.
- 2) Customer connection and power wiring diagrams.
- 3) Complete technical product description including a complete list of options provided.
- 4) Compliance to IEEE 519 – Harmonic analysis for particular jobsite including total voltage harmonic distortion and total current distortion. In case an alternative low harmonics solution is offered, the drive manufacturer shall provide calculations, specific to this installation, showing total harmonic current distortion (TDD), at the Point of Common Coupling (PCC), is less than required.

Part 2 – DESIGN

2.01 DESCRIPTION

- A. The ASD shall be solid state AC to AC inverter controlled device utilizing the latest isolated gate bipolar transistor (IGBT) technology.
- B. The drive shall be an Ultra Low Harmonic Adjustable Speed AC Drive that is designed to comply with standard IEEE 519-1992 when installed into system that already is in compliance with the standard.

2.02 HARMONICS

- A. The Ultra Low Harmonic construction of the ASD shall not contribute any significant harmonics at the input terminals of the ASD, and shall maintain harmonics levels at the ASD's input terminals to levels at or below those listed in "Harmonic Control in Electrical Power Systems, IEEE Std. 519-1992." in the system that already is in compliance with the said standard.
- B. All harmonic management devices must be internal to the ASD enclosure and supplied as a complete solution.
- C. The ASD shall have an active line supply unit which controls the waveform of the input current and reduces the low order harmonic current drawn

from the power line. Line currents and voltages shall be nearly sinusoidal. IGBTs shall be used in the rectified and inverter circuits.

- D. Each input phase of the ASD shall incorporate a symmetrical LCL filter arranged in a T- configuration. The inductors are to be series power components that carry the full current of the ASD.
- E. The input current to the ASD shall have a total harmonic content less than 5% of full rated capability at the input terminals of the ASD on power system sized according to IEEE 519-1992 at line voltage unbalance up to 3% and under all motor load conditions.
- F. The ASD shall operate at fundamental power factor 1.0 on the supply side under all motor load conditions.
- G. The input power factor shall be programmable from 0.8 lagging to 0.8 leading, allowing the ASD to be used as a compensating device for installations that are excessively inductive or excessively capacitive in reactive power. The reactive power required by other loads connected to the same distribution system may be compensated for by the providing that ASD has sufficient capacity for reactive and active loads.
- H. The ASD's design shall not compensate for existing harmonic content in the distribution system

2.03 RATINGS

- A. The ASD shall be rated to operate from 3-phase power at 208 VAC to 240 VAC +10/-10% / 380 VAC to 500 VAC +10/-10% / 525 to 690 VAC (600 VAC, UL and CSA) +10/-10%. The overvoltage trip level shall be a minimum of 30% over nominal, and the undervoltage trip level shall be a minimum 35% under the nominal voltage.
- B. The ASD shall be rated to operate at the following environmental operating conditions: ambient temperature 0 to 40°C continuous. ASDs that can operate at 40° C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level without derating, less than 95% humidity, non-condensing.
- C. The ASD shall be offered from 10 HP to 2,800 HP in similar construction and operation, using the same technology.
- D. The ASD shall be rated to operate from input power from 48 Hz to 63 Hz.
- E. Output voltage and current ratings shall match the adjustable frequency operating requirements of standard NEMA design A or NEMA design B motors.

- F. The normal duty overload current capacity shall be 110% of rated current for one (1) minute out of five (5) minutes.
- G. The ASD efficiency shall be 97% or better of the full rated capability of the ASD at full speed and load. In case an alternative low harmonics solution is offered, the overall efficiency of the ASD and the harmonic mitigation components shall meet the efficiency requirement.

2.04 CONSTRUCTION

- A. All models shall provide a complete, ready-to-install solution.
- B. The latest, most efficient IGBT power technology shall be used. This technology shall be used for all power and voltage ranges offered by the manufacturer.
- C. The ASD shall offer microprocessor based control logic that is isolated from power circuitry.
- D. The ASD shall use the same main control board for all ratings.
- E. Control connections shall remain consistent for all power ratings.
- F. The ASD shall employ an active AC to DC rectifier (commonly referred to as an active supply unit).
- G. The ASD shall be offered in UL Type 1 and NEMA Type 12.
- H. ASDs at and above 150 HP power rating shall be of free-standing construction and shall include the following standard features:
 - I. Include disconnect switch and fuses for sizes 150hp and above.
- J. The power modules in the cabinet shall be of a modular construction for quick removal and replacement.
- K. To ensure fast and easy handling of the modules in high power range at or above 250 hp, modular power modules and heavy power components such as line filters and power transformers shall be constructed on a wheeled frame and roll directly into and out of the ASD with bus stab connections.
- L. Desired optional features shall be furnished and mounted by the ASD manufacturer and shall also be available as field installable kits as an alternative. All optional features shall carry all of the necessary certifications as described in Section 1.03. Field installed kits shall not affect the ASD's certification.

2.05 OPERATOR INTERFACE

- A. The ASD shall be equipped with a front mounted operator control panel consisting of a four- (4-) line by 20-character back-lit alphanumeric LCD display and a keypad with keys for Run/Stop, Local/Remote, Increase/Decrease, Reset, Menu navigation and Parameter select/edit.
- B. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple ASDs.
- C. The display of the control unit shall have the following features:
 - 1) The LCD display shall have contrast adjustment provisions to optimize viewing at angle.
 - 2) All parameter names, fault messages, warnings and other information shall be displayed in complete words or standard abbreviations to allow the user to understand what is being displayed without the use of a manual or cross-reference table.
 - 3) Additional languages including British English, French, Spanish, Portuguese, German, Italian, Dutch, Danish, Swedish, Finnish, Czech and Polish shall be selectable.
 - 4) During normal operation, one (1) line of the control panel shall display the speed reference, and run/stop forward/reverse and local/remote status. The remaining three (3) lines of the display shall be programmable to display the values of any three (3) operating parameters. The selection shall include at least the following values:
 - i. Flow Economy in GPM / kW or m³/h / kW
 - ii. SMARTFLOW in GPM or m³/h
 - iii. Speed/torque in percent (%), RPM or user-scaled units
 - iv. Output frequency, voltage, current and torque
 - v. Input voltage, power and kilowatt hours
 - vi. Energy Savings in \$ or Euro
 - vii. Heatsink temperature and DC bus voltage
 - viii. Status of discrete inputs and outputs
 - ix. Values of analog input and output signals

- x. Values of PID controller reference, feedback and error signals
- D. The keypad shall be used for local control, for setting all parameters, and for stepping through the displays and menus.
- E. A copy function to upload and store parameter settings from an ASD and download stored parameter settings to the same ASD or to another ASD shall exist.
- F. An auto-tune function shall identify the optimal motor tuning parameters for typical applications.
- G. An auto-tune function shall also be available to tune the PID speed regulator loop. Manual adjustments shall also be allowed.
- H. Selection shall be offered for 2-wire, 3-wire, and Fieldbus Start/Stop control.

2.06 PROTECTIVE FEATURES

- A. For each programmed warning and fault protection function, the ASD shall display a message in complete words or abbreviations. The five (5) most recent fault messages and times shall be stored in the ASD's fault history.
- B. The ASD shall include internal MOV's for phase to phase and phase to ground line voltage transient protection.
- C. Output short circuit and ground fault protection rated for 100,000 amps without relying on line fuses shall be provided per UL508C.
- D. Motor phase loss protection shall be provided.
- E. The ASD shall provide electronic motor overload protection qualified per UL508C.
- F. Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated voltage or undervoltage at 65% of min. rated voltage.
- G. The ASD shall protect itself against input phase loss.
- H. A power loss ride through feature shall allow the ASD to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.
- I. Stall protection shall be programmable to provide a warning or stop the ASD after the motor has operated above a programmed torque level for a programmed time limit.

- J. Underload protection shall be programmable to provide a warning or stop the ASD after the motor has operated below a selected underload curve for a programmed time limit.
- K. Over-temperature protection shall provide a warning if the power module temperature is less than 5°C below the over-temperature trip level.
- L. Input terminals shall be provided for connecting a motor thermistor (PTC type) to the ASD's protective monitoring circuitry. An input shall also be programmable to monitor an external relay or switch contact.

2.07 CONTROL INPUTS AND OUTPUTS

A. Discrete Inputs

- 1) A minimum of six (6) discrete inputs shall be provided.
- 2) A minimum of six (6) of the inputs shall be programmable with function selections (run/stop, hand-off-auto, etc.).
- 3) Inputs shall be designed for use with either the ASD's internal 24 VDC supply or a customer supplied external 24 VDC supply.

B. Discrete outputs

- 1) Minimum of three (3) form C relay contact outputs shall be provided.
- 2) All outputs shall be independently programmable to activate with at least 20 function selections including;
 - i. Operating conditions such as drive ready, drive running, drive fault, process transmitter error, etc.
 - ii. General and Pump specific warning and fault conditions (Pump Clogged, Pump Protect, Sleep Mode, Etc.)
 - iii. Relay contacts shall be rated to switch 2 Amps at 24 VDC or 115/230 VAC.

C. Analog Inputs

D. Minimum of two (2) analog inputs shall be provided:

- 1) At least one (1) must support bi-polar voltage input.
- 2) Resolution of analog inputs must be at least 11 bit total resolution.
- 3) All inputs shall be independently programmable with input function selections.

- 4) A differential input isolation amplifier shall be provided for each input.
 - 5) Analog input signal processing functions shall include scaling adjustments, adjustable filtering and signal inversion.
- E. If the input reference is lost, the ASD shall give the user the option of the following. The ASD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus.
- 1) Stopping and displaying a fault
 - 2) Hold the ASD speed based on the last good reference received
 - 3) Cause a warning to be issued, as selected by the user.
- F. Analog Outputs
- 1) Minimum of two (2) 0 / 4–20 mA analog outputs shall be provided.
 - 2) Outputs shall be independently programmable to provide signals proportional to output function selections including output speed, frequency, voltage, current and power as well as Pumping process values such as Smartflow, Actual pressure, Flow Economy, etc.

2.08 SERIAL COMMUNICATIONS

- A. The ASD shall be capable of communicating with other ASDs or controllers via a serial communications link. A variety of communications interface modules for the typical overriding control systems shall be available.
- B. Interface modules shall be available for a wide selection of protocols including but not limited to:
- 1) Modbus RTU
 - 2) Ethernet IP / TCP
 - 3) ControlNet
 - 4) DeviceNet
 - 5) Profibus
- C. Interface modules shall mount directly to the ASD control board or be connected via fiber optic cables to minimize interference and provide maximum throughput.

- D. I/O shall be accessible through the serial communications adapter. Serial communication capabilities shall include, but not be limited to:
 - 1) Run-Stop control
 - 2) Hand-Off-Auto Control
 - 3) Speed Adjustment
 - 4) PID (proportional/integral/derivative) control adjustments
 - 5) Current Limit
 - 6) Accel/Decel time adjustments
- E. The ASD shall have the capability of allowing the overriding controller to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, and diagnostic warning and fault information.
- F. A connection shall also be provided for personal computer interface. Software shall be available for ASD setup, diagnostic analysis, monitoring and control. The software shall provide real time graphical displays of ASD performance.

2.09 CONTROL FUNCTIONS AND ADJUSTMENTS

- A. Output frequency shall be adjustable between 0 Hz and 300 Hz. Operation above motor nameplate shall require programming changes to prevent inadvertent high-speed operation.
- B. Stop mode selections shall include coast to stop and ramp to stop.
- C. The ASD shall be capable of controlling deceleration of a load without generating an overvoltage fault caused by excessive regenerated energy. Overvoltage control on deceleration shall extend the ramp time beyond the programmed value to keep the amount of regenerated energy below the point that causes overvoltage trip.
- D. The ASD shall be capable of starting into a rotating load (flying start) regardless of motor direction. It should then accelerate or decelerate to the active reference without tripping on fault or causing component damage. The ASD shall also be capable of flux braking at start to stop a reverse spinning motor prior to ramp.
- E. The ASD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective

trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.

- F. Functions shall include flux optimization to limit the audible noise produced by the motor and to maximize efficiency by providing the optimum magnetic flux for any given speed operating point.
- G. The ASD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The ASD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for ASD acceleration from zero speed without signaling a false underload condition.
- H. Two (2) programmable critical frequency lockout ranges shall be provided to prevent the ASD from operating the load continuously at an unstable speed.

Part 3 – Controls and Programming

3.01 Application Program

- A. All logic set forth in this specification must reside internal to the drives internal microprocessor. If an external controller is required it must be clearly stated and included in the base bid.
- B. Drive shall be preprogrammed with a pump specific application macro.
- C. The program must be designed for ease of use and come standard with a user friendly programming manual specific for centrifugal pumps.
- D. The Control Panel (keypad) should have the ability to display pump nomenclature (PSIG, GPM, IP/s, mm/s, etc.) to allow the operator to have a better understanding of the current pump and system status.
- E. Drive shall have an internal PID to control a process variable such as pressure, flow, level, etc. The PID controller should be able to regulate speed or torque to accurately control the process variable.
- F. The drive shall recognize system low demand and have the option to automatically shut down in a suspended sleep mode until the process demand requires the pump to turn back on.
- G. The drive system shall have the ability to perform process control (PID) using either motor speed, or motor torque, as the manipulated variable.

- H. The drive shall have the ability to follow a speed reference through the drives keypad, an analog input or serial bus command.

3.02 Multipump Program

- A. The drive program shall have a Multipump Macro that would allow a maximum of 4 drives to communicate and control up to a 4 pumps. One drive will operate one pump.
- B. Drive to drive communication shall be over a fiber optic network for maximum RFI/EMI noise suppression.
- C. The drives shall control to a single process variable and automatically stage and de-stage pumps on and off depending on the process demand. The settings at which the pumps are staged and de-staged shall be field adjustable through the drives standard keypad.
- D. In the event of a drive, motor or pump fault the others drives will recognize this failure and shall compensate with the next available pump.
- E. When multipump pumps are running the drives shall synchronize in speed to ensure the pumps share the load evenly.
- F. In the event a pump is demonstrating wear and is not able to share the load equally a synchronous torque option will be available. This option will synchronize the torques of all the running pumps to help evenly distribute the load over all the running pumps. The motors shall be identical on all the pumps running in synchronous torque mode.
- G. The drives shall alternate the operation of the pumps based on operating hours of the pumps. After a programmable time widow the lead status will transfer to the next available drive.
- H. The drives shall have a pressure boost function to compensate for additional system friction losses at higher flow rates. This function shall automatically increase the pressure setpoint when additional pumps are staged on. Alternatively the pressure setpoint will decrease as pumps are de-staged off.

3.03 Flow Estimation

- A. Flow Estimation – The drive shall have the ability to estimate the pump flow to an accuracy of $\leq \pm 5\%$ of the total rated pump flow through a variable speed range of 50%–100% of the motor synchronous speed and without external process transmitters.

- B. The flow calculation algorithm shall be operational using commonly available pump performance curves. Factory performance tests shall not be required to attain the flow accuracy.
- C. The flow calculation algorithm shall have the ability to be field calibrated without requiring field instrumentation.
- D. () When checked; the flow calculation logic shall be capable of correcting for a changing specific gravity via a 4–20 mA signal, serial bus communication, or corrected via temperature transmitter input.
- E. () When checked; The flow calculation logic shall be capable of calculating pump flow on a magnetic drive pump with a metal containment shell.

3.04 Pump Protection

- A. Pump Protection – The drive shall have the ability to warn and/or protect the pump against process upset conditions of dry-running (severe cavitation), operation below recommended minimum flow, and operation past recommended maximum flow throughout the anticipated variable speed range and without the need for external process transmitters.
 - 1) The pump protection feature shall be easily set-up using values of flow (GPM or M3/hr).
 - 2) The pump protection feature shall have the ability to offer control reactions specific to the condition:
 - i. Dry-Run: Warn only, Warn & Stop
 - ii. Min-Flow: Warn only, Warn & Control to Min Speed
 - iii. Max-Flow: Warn only
 - 3) The protection logic shall account for changing load profiles due to changes in speed, including mechanical and hydraulic losses
 - 4) The protection logic shall not false trip when the drive is reducing speed in normal control modes.
 - 5) () When checked; The protection logic shall be capable of calculating pump flow on a magnetic drive pump with a metal containment shell.

3.05 Flow Economy

- A. Flow Economy – The drive shall have the ability to calculate the Flow Economy ratio of pump flow divided by electrical input power.

- 1) The pump flow shall be calculated using a sensorless flow function integral to the drive.
- 2) The electrical power input shall be the true electrical power consumption which includes all drive and motor losses.
- 3) The Flow Economy Ratio shall be a selectable parameter on the drives keypad and shall be available through a 4–20mA output or through a serial bus register.

3.06 Condition Monitoring

- A. Drive shall have the capability to monitor up to two(2) channels of information. These channels shall be either an external 4–20mA / 0–10VDC analog inputs or a minimum of 13 internal drive and pump signals.
 - 1) The keypad display should clearly indicate the units of the condition monitored such as Amps, Hz, IP/s or mm/s etc.
 - 2) The drive will have two programmable levels for a high condition and two programmable levels for low levels to signal a warning and alarm.
 - 3) In the event the event the alarm level is reached drive shall have the option to signal an alarm, go to a safe predetermined minimum speed, fault the pump or go into a suspended sleep mode until the level is restored above normal.

3.07 Cavitation Control

- A. The drive shall have the ability to monitor the suction conditions of a pump and react to prevent the onset of pump cavitation.
- B. The drive shall have the ability to monitor an external analog signal from either a suction pressure or level transmitter.
 - 1) When the suction conditions of the pump reach a critical low level the drive will slow down to reduce the NPSH requirement of the pump. The
 - i. The intensity at which the drive reduces the pump speed shall be configurable to the specific application.
 - 2) The drive shall resume normal operation above the low level limit threshold.

3.08 Pump Cleaning Sequence

- A. The drive shall have the ability to detect a blockage in the pump using sensorless speed and torque measurements.
- B. On detection of this blockage the pump shall enter into a Pump Cleaning Sequence. This sequence includes running the pump in a programmed designed to clear blockages. This program includes running the pump in forward and reverse directions until the blockage is cleared.
- C. If the blockage can not be cleared the drive shall fault the pump and clearly identify the pump has faulted due to blockage.
- D. The drive supplier shall verify with the pump manufacturer the pump is suitable to run in reverse rotation.

Part 4 EXECUTION

4.01 INSTALLATION

- A. The drive manufacturer shall provide adequate drawings and instruction material to facilitate installation of the Drive by qualified electrical and mechanical personnel employed by others.

4.02 START-UP

- A. Certified factory start-up shall be provided for each ASD by a factory authorized service center. A certified start-up form shall be filled out for each ASD with a copy provided to the owner, and a copy kept on file at the manufacturer.
- B. The factory will extend the normal warranty for the ASD with a certified factory start-up.

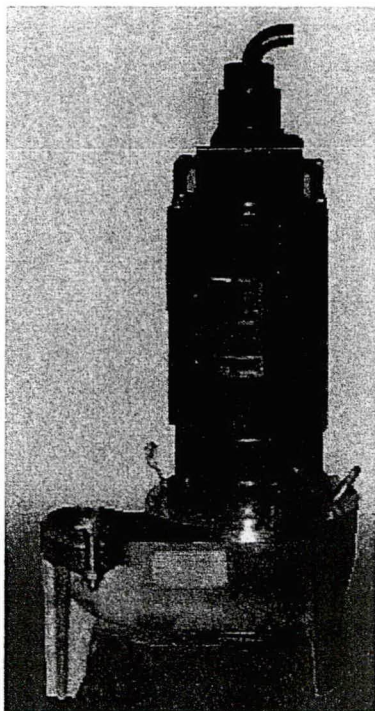
4.03 WARRANTY

- A. Standard Warranty shall be 12 months from the date of start-up, not to exceed 18 months from the date of shipment. The warranty shall include all parts.
- B. With a certified start-up, warranty shall be 24 months from the date of start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time, and expenses.

**DETAILED
TECHNICAL
SPECIFICATIONS**

ESSCO

EXPLOSION-PROOF SUBMERSIBLE PUMP Model 493



The **ESSCO** Model 493 submersible pump is of the 100% recessed impeller design. Unit is capable of handling long stringy material, large size solids and slurries, with maximum solids handling efficiency. The **ESSCO** pump incorporates the vortex pumping action along with unique pump design, allowing the greatest flexibility in the submersible pump field.

VOLUTE: Each volute is engineered for maximum life in normal applications. **ESSCO** utilizes a single piece volute design

with extra material in high wear areas. Units have 3" suction and discharge openings and are capable of passing pipe size diameter solids of long length.

DISCHARGE: Each **ESSCO** Model 493 pump is available with quick disconnect discharge flange, either 3" or 4" connection. All pumps are equipped with stainless steel hardware.

IMPELLER: **ESSCO** pumps are available with various impeller designs to allow for high capacity low head or low capacity high head applications. **ESSCO** utilizes investment cast impellers for higher casting density and thicker vanes and back shrouds which allow for maximum life. By use of the **JLIttec®** manufacturing techniques **ESSCO** offers trimmed impellers in extremely hard and difficult to handle alloys. By use of this production technique, impellers can be machined to act as a shredder (for solids coming in contact with the eye of the impeller) or machined to handle solids more delicate in nature.

WEAR PLATE: The **ESSCO MODEL 493** is available with a wear plate located behind the impeller. The wear plate is designed to protect the motor bracket and mechanical seal from particle erosion. The wear plate can also act as a barrier for a seal flushing fluid when a simple wear plate is not sufficient protection against wear created by the pumped media. Again **ESSCO** utilizes the **JLIttec®** production method for manufacturing this pump

ESSCO Pumps & Controls

4935 Telegraph Rd.
Los Angeles, Ca 90022
(323) 261-2181
Fax (323) 261-1523
www.esscopumps.com
Email sales@esscopumps.com

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DXP
The Industrial
Distribution Experts

EXPLOSION-PROOF SUBMERSIBLE PUMP Model 493

component to ensure the best possible casting quality and material density.

COOL AGIVENT: Each **ESSCO** submersible pump includes the Cool Agivent® apparatus which is for venting the pump case and cooling the external surface of the motor. This patented device will allow a more shallow wet well design, as well as keeping the motor cool when not submerged. All **ESSCO** submersible pump motors are capable of running dry continuously. (consult factory for specific applications).

MOTOR: **ESSCO** offers U.L. listed explosion-proof motors for Class 1, Division 1, group D hazardous locations. The motor is manufactured by Reliance Electric Co. and includes moisture detection and thermal protection as standard features. Heavy duty bearings and dual mechanical seals are standard for both motor designs and on special request high temperature and energy efficient designs are available. (Not all motor options are available on U.L. listed motors.)

In addition to the above listed standard items **ESSCO** offers the following options:

~~316 S.S. motor shaft~~
Nitronic 50 shaft acid resistant stainless steel
Tungsten carbide lower mechanical seal with stainless steel metal components and Buna-N elastomer

Silicon carbide lower mechanical seal with stainless steel metal components and Viton elastomers

Mechanical seal flush
316 S.S. motor mounting bracket
2-part epoxy coating
Steel motor jacket
316 S.S. motor jacket
Motor jacket flush connection (for cooling in hot liquid applications)
Viton motor "O" rings
Teflon coated Viton "O" rings

OPTIONAL LIQUID END MATERIALS:

~~Ni Hard 550 Brn
Ni Hard 650+ Brn
HCl 550 Brn
HCl 650+ Brn
CD4MCu
316 S.S.
304 S.S.
Hastalloy
Alloy 20
Navy Bronze
Other~~

ADDITIONAL OPTIONS:

Certified Performance Test*
Certified Hydrostatic Test*
Certified Motor Test
Explosion-proof Slide Rail Assembly
U.L. Listed Control Panels

*All tests are conducted as per Hydraulic Institute Standards.

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Member of the Hydraulic Institute

Form: 493 Brochure



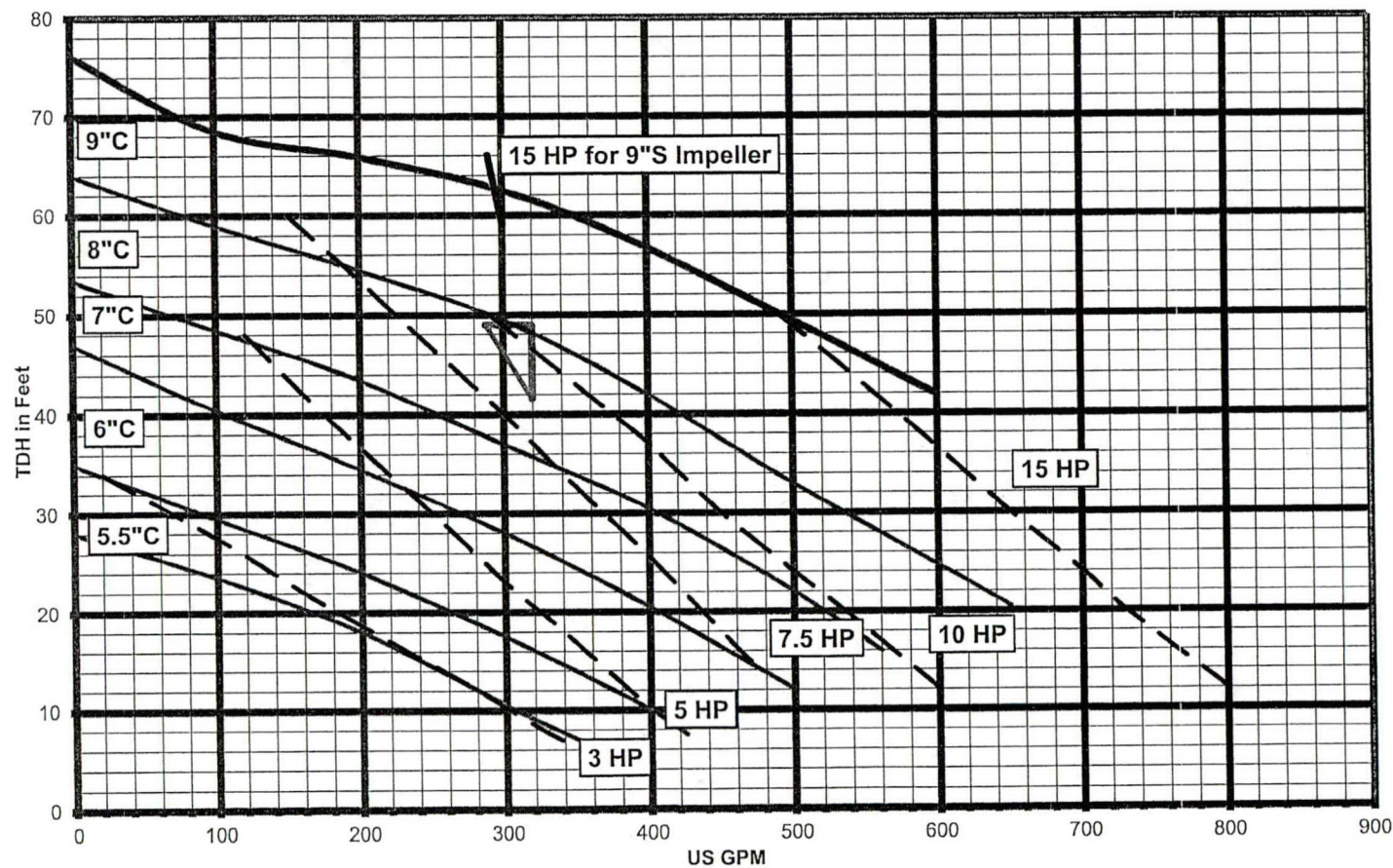


Pumps

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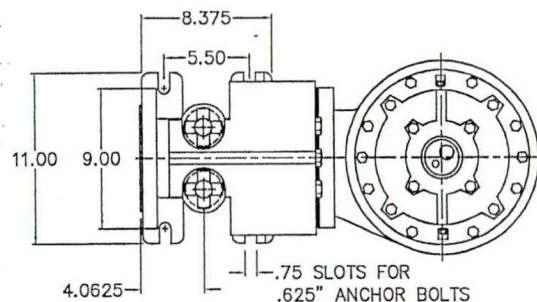


Pump Model:	493	Impeller No.:	1007
RPM:	1750	Sphere Size:	3"
Type:	Submersible		
Impeller Type:	Vortex 8 Vane	Revised Date Nov-98	
Impeller Dia:	Various		
Condition Point:	320 GPM	49 TDH	
Condition Point:	0 GPM	0 TDH	
Condition Point:	0 GPM	0 TDH	

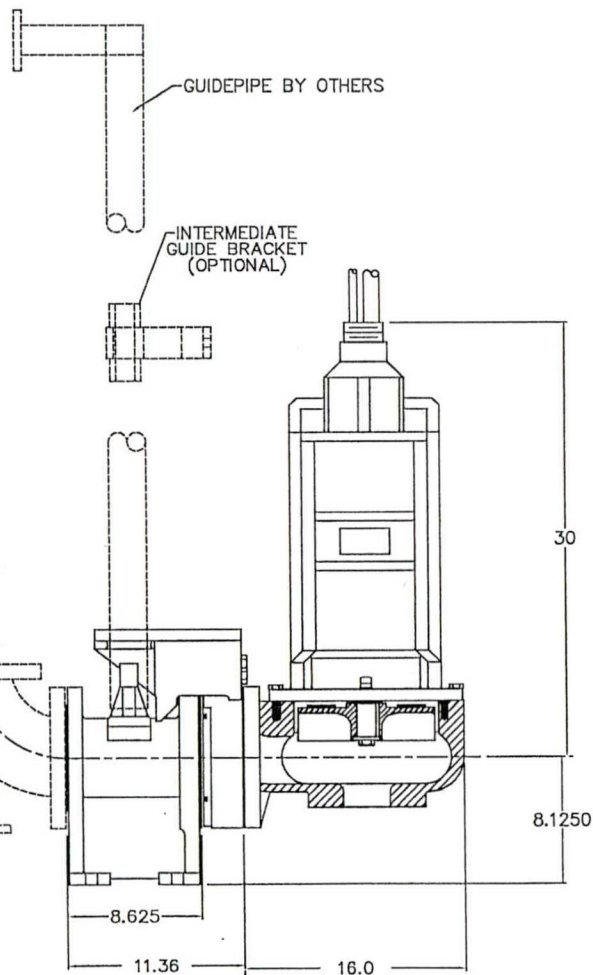
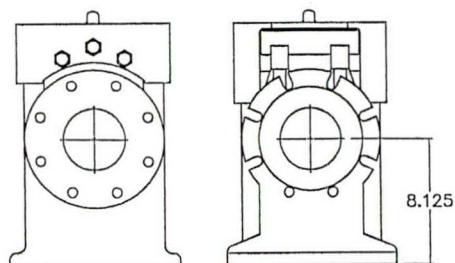


JOB #:

PATTERN NO.	MATERIAL
	304 S.S.
	316 S.S.
	STEEL
	BRONZE
	MAGANESE BRONZE
	DUCTILE IRON
	CAST IRON
	OTHER



ELBOW BY OTHERS



* AS CAST DIMENSIONS
ALL DIMENSIONS ARE IN INCHES

DATE:
3/3/92
FILE NAME:
3009
DRAWN BY:
ED FRATZKE
CHECKED BY:
J.I.
REV. DATE:

ESSCO PUMPS

493 ON A
4" SLIDE RAIL
ASSEMBLY

RELIANCE ELECTRIC MOTOR DATA
COMPILED FROM THE SUBMERSIBLE
MOTOR ACTION GUIDE

THREE PHASE 1750 RPM (4 POLE) MOTORS

Pg ED-3

HP (1)	RPM	NEMA DESIGN CODE	LOCKED ROTOR CODE	WT	FRAME	FULL LOAD AMPS		FULL LOAD		COIL RESISTANCE		CABLE SIZE	
						230V	480V	PF	EFF	230V	480V	230V	480V
.5	1750	A	R	200	140TY Mount	4.0	2.0	53.5	47.0	4.67	18.8	14	14
.75		A	P			4.2	2.1	63.4	54.9	4.67	18.8		
1		B	M			3.4	1.7	86.4	63.5	3.25	13.0		
1.5	1750	B	L	200	140TY Mount	4.6	2.3	86.2	70.5	2.27	9.10	14	14
2			K			5.8	2.9	86.4	73.5	2.08	8.32		
3			J			8.8	4.4	81.7	78.1	1.17	4.68		
5	1750	B	H	200	180TY	14.8	7.4	81.3	76.0	.95	3.80	12	14
7.5				200	180TY	21.0	10.5	80.6	83.8	.55	2.18	10	14
10				335	210TY	27.0	13.5	80.5	86.2	.37	1.47	8	12
15	1750	B	G	335	210TY	42.0	21.0	77.8	86.0	.21	.85	8	10
20				335	210TY	56.0	28.0	80.3	84.4	.18	.71	6	8
25				445	250TY	66.0	33.0	84.1	84.8	.14	.56	4	8
30	1750	B	G	445	250TY	78.0	39.0	85.4	84.1	.11	.45	2	8
40			F	445	250TY	104.0	52.0	84.6	86.7	.08	.34	2	6
50			G	1150	320TY	-	64.6	79.8	91.1	-	.149	1/0	4
60	1750	B	F	1150	320TY	-	79.4	81.4	92.0	-	.124	2/0	2
75			F	1150	320TY	NA	91.3	83.0	92.6	NA	.0971	NA	2
100			G	1500	360TY	NA	116.0	86.1	93.7	NA	.088	NA	1
125			F	1500	360TY	NA	149.0	84.7	93.0	NA	.0532	NA	2/0

(1) MOTOR RATINGS ABOVE 60 HP ARE NOT AVAILABLE IN VOLTAGES BELOW 460 VOLTS.

- MULTIPLY 230 VOLT AMPERAGE IN TABLE ABOVE BY 1.15 TO GET FULL LOAD AMPERAGE AT 208 VOLTS.
- CONTROL CABLE FOR ALL MOTOR IS .485+/- .025 INCH DIAMETER, CONDUCTOR IS 18/5
- WHEN MOTORS ARE ORDERED AT 460 VOLT CONNECTION ONLY, MOTORS ARE NOT RECONNECTABLE TO 230 VOLT.
- CONSULT FACTORY FOR CABLE LENGTHS GREATER THAN 95 FEET

SUBMERSIBLE MOTORS

1/4 HP-200 HP Frames 140TY to L360TY

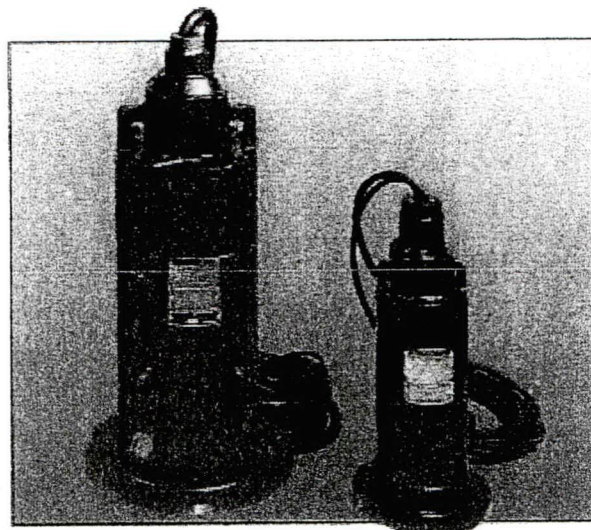
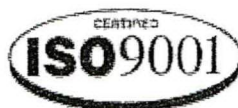
With 70 years of motor experience, Reliance® submersible motors stand out among all others due to our attention to detail. The components of each motor work together as a system to deliver long life and guaranteed efficiencies which maximize up-time production capability. The Reliance submersible motor is designed for the toughest jobs. When conditions are extreme and performance is critical, these motors deliver the quality and durability needed.

STANDARD FEATURES

- **Certifications** - U.L.® and CSA listed for Class I Groups C&D hazardous locations
- **Frame** - Rugged cast iron ASTM type A-48, Class 30 or better
- **Hardware** - 316 stainless steel is standard
- **Stator Insulation** - Specially treated Class "F" and "H" non-hygroscopic insulation with multiple dips and bakes. Phase insulation included for inverter duty
- **Rotor** - Die cast aluminum, dynamically balanced. Exceeds NEMA limits per MG1 - 12.06
- **Shaft** - High strength, 416 stainless steel
- **Bearings** - Specially adapted for vertical assembly. Both upper and lower bearings are prepacked and sealed for life with special high temperature grease
- **Cable Entry System** - Epoxy sealed butt spliced connect for nonwicking cable entry design
- **Moisture System** - Two wire/two probe monitoring system constantly monitors oil chamber and stator housing for moisture
- **Seals** - Tandem (dual) shaftseal system working independent of each other. Designed to withstand 200 PSI at all seal locations

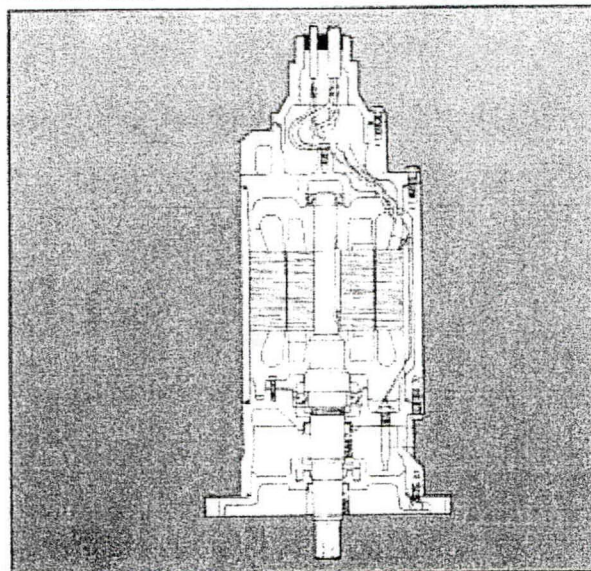
COMMITMENT TO QUALITY

Reliance submersible motors are manufactured at our Ashtabula, Ohio plant which is ISO 9001 certified.



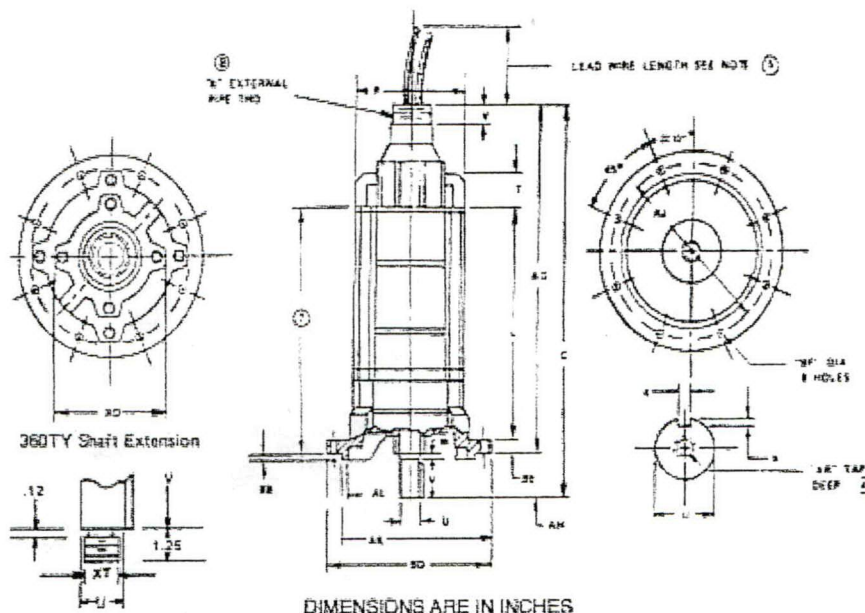
SPECIFICATIONS

Horsepower	1/4 to 200
Speed	3600, 1800, 1200, 900, 720, 600 RPM
Enclosure	TENV-Submersible
Frame	140TY-L360TY
NEMA Design	B
Power Supply	Single-phase, 60 Hz, 115/230 or Three-phase, 60 Hz, 208, 230, 460, 575 (A wide range of other frequencies and voltages are also available.)
Insulation	Class F
Duty	Continuous
Ambient	40°C
Service Factor	Three-Phase 1.15



**RELIANCE
ELECTRIC**

SUBMERSIBLE MOTORS



DIMENSIONS

Frame	C	L	P	T	U(3)	V	W	AG	AH	AJ	AK(5)	AL(2)
140TY	25.44	15.38	8.00	2.25	.6750	1.25	.31	23.88	1.56	10.00	(9)	9.125
180TY	26.66	16.50	9.62	2.25	1.2500	2.00	.26	24.38	2.28	11.50	(9)	10.625
210TY	31.89	21.12	11.50	2.25	1.4380	2.00	.25	30.12	1.56	14.12	13.125	12.00
250TY	38.53	24.12	12.75	3.50	1.750	3.31	.25	35.50	3.03	16.00	15.000	14.00
320TY	43.12	24.69	15.75	4.25	2.500	3.19	2.12	37.81	5.31	17.25	16.000	15.25
360TY	49.81	31.25	19.38	4.25	2.4997	3.19	2.12	43.25	6.56	18.75	17.500	15.15
L360TY	51.81	33.25	20.38	4.25	2.4997	3.19	2.12	45.25	6.56	18.75	17.500	15.25

Frame	BD(1)	BE	BF	XR(4)	XT	Lead Connection			Keyway			Weight
						X(8)	Y	XD	BB	a	b	
140TY	11.062	.75	.44	3/8-16	(9)	2-1/2-8	1.25	5.50	.12	.187	.09	160
180TY	12.375	.75	.56	1/2-13	(9)	2-1/2-8	1.25	6.50	.12	.250	.12	200
210TY	15.250	.75	.56	5/8-11	(9)	2-1/2-8	1.25	7.75	.25	.375	.19	315
250TY	17.000	1.00	.69	5/8-11	(9)	2-1/2-8	1.25	7.75	.25	.375	.19	750
320TY	18.750	.83	.89	3/4-16	(9)	3/8	1.25	10.69	.25	.50	.25	1150
360TY	20.25	1.12	.89	(9)	1-1/2-12	3/8	1.25	10.69	.25	.50	3.00	1500
L360TY	20.25	1.12	.89		1-1/2-12	3/8	1.25	10.69	.25	.50	3.00	1550

- (1) "BD" varies ± .010
 (2) "AL" varies ± .005, -.000
 (3) "U" varies up to 1.6250 dia. + .000, -.005
 (4) "XR" tap depth on 140TY is .63, on 180TY thru 250TY is 1.38
 (5) Standard lead wire length is 25 feet - other lengths available if specified on sales order

- (6) "AK" varies ± .000, -.002
 (7) Minimum submerged depth
 (8) Protective conduit furnished by customer if required.
 (9) Dimension not applicable to this frame.

Reliance® is a trademark of Reliance Electric Industrial Company or its subsidiaries.
 U.L.® is a registered trademark of Underwriter's Laboratories, Inc.
 CSA® is a registered trademark of the Canadian Standards Association.

THIS MATERIAL IS NOT INTENDED TO PROVIDE OPERATIONAL INSTRUCTIONS. APPROPRIATE RELIANCE ELECTRIC INDUSTRIAL COMPANY INSTRUCTION MANUALS AND PRECAUTIONS SHOULD BE STUDIED PRIOR TO INSTALLATION, OPERATION OR MAINTENANCE OF EQUIPMENT.

Reliance Electric / 24701 Euclid Avenue / Cleveland, Ohio 44117 / 216-266-7000

**RELIANCE
ELECTRIC**

Service Bulletin

B-8073-9

RELIANCE ELECTRIC SUBMERSIBLE MOTOR Five Year Warranty

1. Reliance® Duty Master® Tandem Seal Submersible Motor is warranted for a period of five years from date of shipment to the Original Buyer, to be free from defects in material and workmanship and to conform to any applicable drawings and specifications approved by Reliance Electric.
2. The five year warranty is prorated as shown below:

Parts will be replaced within the time period noted and Buyer will be invoiced at the percentage rate noted with price in effect at time of shipment. *

NOTE: Seals and bearings are considered maintenance items and are only warranted for 1 year in service or 18 months from date of shipment to the Original Buyer.

Months from date of shipment to Original Buyer

0-18	19-31	32-45	46-60
0%	25%	50%	75%

3. If within this period Reliance Electric receives from the Original Buyer written notice of any alleged defect in any such apparatus and, if the apparatus is found not to be in conformity with this warranty (the Buyer having provided Reliance a reasonable opportunity to perform any appropriate test thereon) Reliance will, at its option and expense, either repair the same or supply a replacement therefore.
4. Reliance Electric, under either option, shall have the right to require the Original Buyer to deliver the apparatus for this purpose to a designated service center and the Original Buyer shall pay all charges for inbound and outbound transportation, removal and reinstallation of pump if required. Reliance shall pay only the direct and actual cost of apparatus repair or replacement as provided above.
5. * Labor charges for in-warranty repairs performed by Reliance Electric or its designated Service Center shall be assumed by Reliance if the Repair is completed within 18 months from date of shipment to Original Buyer.
6. On repaired motors, the warranty period shall be the residual of the Original motor supplied.

 **Rockwell Automation**
Reliance Electric

7. The Duty Master Tandem Seal Submersible Motor has a double seal with a moisture detection system. The warranty, 1 year in service or 18 months from date of shipment to the Original Buyer, shall cover the cost of replacement of the outer seal. In the event of failure of the inner seal and the moisture detection system is connected, Reliance shall be responsible for the cost of the replacement of the outer seal only. All other labor and material cost shall be borne by the user.

In The Event The Moisture Detection System Is Not Connected, The Warranty Is Void.

Applications in which the outer seal runs dry require "Hydro-Pad" design seals. Standard design seals will not be covered by warranty if motor runs in a dry condition.

8. The Duty Master Tandem Seal Submersible Motor has motor winding thermostats. The thermostats must be connected per local, state, and/or the National Electric Code.

In The Event The Motor Winding Thermostats Are Not Connected, The Warranty Is Void.

9. Motors destined for long term storage shall be stored in accordance to Reliance Electric suggested Service Bulletins. Any damage to the motor due to improper storage shall void this warranty.
10. This warranty is in lieu of and excludes all other expressed or implied warranties, including without limitations, any implied warranty or merchantability or fitness for a particular purpose. In no event shall the Company be liable for special or consequential damages, or for any other loss, damage or expense of any kind, including loss of profits, arising in connection with this agreement or with the use of or inability to use the services furnished under this agreement.

Reliance Electric / 24701 Euclid Avenue / Cleveland, Ohio 44117 / 216-266-7000

 **Rockwell** Automation
Reliance Electric



5 Year Warranty

ESSCO STANDARD FIVE YEAR WARRANTY

Effective Date Upon Shipment

Pump S/N _____

Applies To:			
Pump Material		Pump Type	
<input type="checkbox"/>	Cast Iron	<input type="checkbox"/>	Submersible
<input type="checkbox"/>	Stainless Steel	<input type="checkbox"/>	Horizontal (HDP)
<input type="checkbox"/>		<input type="checkbox"/>	Vertical (VDP)
<input type="checkbox"/>		<input type="checkbox"/>	Column (VSCP)

1. The ESSCO VORTEX impeller pump liquid end is warranted for a period of five years from date of shipment to original buyer, to be free from defects in material and workmanship and to conform to any applicable drawings and specifications approved by ESSCO.

2. The five year warranty is prorated as shown below. (Parts will be replaced within the time period noted and buyer will be invoiced at the percentage rate noted with prices in effect at time of shipment of replacement parts.)

Months From Effective Date to Original Buyer in %			
0-18	19-31	32-45	46-60
0 %	25 %	50 %	75 %

3. If within this period ESSCO receives from original buyer written notice of any alleged defect in any such apparatus

and if the apparatus is found not to be in conformity with this warranty (the buyer having provided ESSCO a reasonable opportunity to perform any appropriate test thereon), ESSCO will, at its option and expense, either repair the same or supply a replacement thereof.

4. ESSCO, under either option, shall have the right to require the original buyer to deliver the apparatus for this purpose to a designated service center and the original buyer shall pay only the direct and actual cost of apparatus repair or replacement as provided above.
5. Labor charges for in-warranty repairs performed by ESSCO or its designated service center shall be assumed by ESSCO if the repair is completed within 6 months from date of shipment to original buyer.
6. On a repaired pump, the warranty period shall be the residual of the original pump supplied.

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Form 5YearStandardWarranty





5 Year Warranty

7. Pumps destined for long term storage shall be stored in accordance with ESSCO suggested service bulletins. Any damage to the pump and motor due to improper storage shall void this warranty.
8. ESSCO'S LIABILITY UNDER THIS WARRANTY OR ANY OTHER WARRANTY WHETHER EXPRESSED OR IMPLIED IN LAW OR FACT SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE MATERIAL AND WORKMANSHIP AND AND IN NO EVENT SHALL ESSCO BE LIABLE FOR CONSEQUENTIAL OR INDIRECT DAMAGES OR COSTS ASSOCIATED WITH REMOVAL OR RE-INSTALLATION OF THE PUMPING EQUIPMENT.
9. ESSCO reserves the right to reject any claim due to mis-application, abuse, neglect or non-maintenance of equipment. All rotating parts are subject to the above replacement schedule. Cast iron, ductile iron, stainless steel pumps put into grit service, without prior written factory approval, shall void all warranties whether expressed or implied.
10. ESSCO extends the warranty on ESSCO manufactured parts and pumps only. All "buy-out" items carry their standard manufacturer's warranty. ESSCO'S warranty does not cover mechanical seals. Pump units subjected to chemical attack will void this warranty.

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Form 5YearStandardWarranty



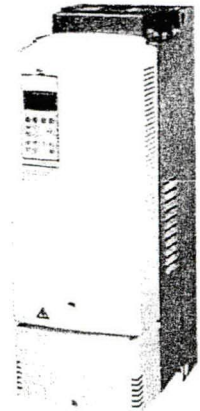


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PUMPSMART® PS200 Variable Speed Drive

Description

ITT Monitoring and Control is pleased to present the award winning ITT PumpSmart PS200 variable speed drive. The PS200 is the powerful combination of a standard variable speed drive and over 150 years of pump hydraulic design and pump process knowledge. By leveraging commonly available information through the variable speed drive such as speed, power and torque PumpSmart provides key pump performance indicators which maximizes control and reduces energy consumption over a standard variable speed drive. Key Features included with PumpSmart are:



SmartFlow* – Using speed and torque data from the motor and by modeling the pump performance curve PumpSmart is able to calculate the flow of the pump with out any external instrumentation.

Pump Protection – Because PumpSmart knows where the pump is operating on the pump performance curve at any speed, PumpSmart can alert an operator or fault the pump in the event of a process upset condition such as dry-run, dead-head, minimum-flow or run-out.

Multi-Pump Operation – A properly controlled variable speed multi-pump system is one of the most efficient and flexible means to meet highly variable systems. However coordinating the control of the system is highly variable and considerations such as optimally staging and de-staging pumps, balancing flow between pumps, distributing pump wear, and providing fault back-up detection must be factored into the control scheme. PumpSmart takes all these factors into account and provides the most efficient multi-pump control logic, all with out and external PLC.

Cavitation Protection – By monitoring a suction pressure transmitter PumpSmart provides an active condition monitoring function to protect the pump from the onset of cavitation. This unique feature is not just a general alarm. PumpSmart

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will intelligently reduce the speed on the pump which in turns reduces the NPSH requirements of the pump. This allows the pump to operate with in the acceptable suction pressure conditions and still produce the maximum flow the pump system will allow. Once suction pressure conditions are restored to safe levels the pump will resume normal operating conditions.

VFD Platform

The PS200 Ultra Low Harmonic (ULH) drive series is a microprocessor based Direct Torque Controlled (DTC) adjustable speed AC drive based on the ABB ACS800 drive platform. The PS200 ULH drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for a wide range of applications.

In the PS200 ULH drive the solution for harmonics mitigation is incorporated into the drive. The drive is equipped with an active, controlled supply unit and low harmonic line filter instead of conventional diode bridge supply. The result is exceptionally low line harmonic content meeting IEEE 519 at the drive's input terminals. The PS200 ULH drive meets IEEE 519 at terminals with even 3% line imbalance. Consequently, the PS200 ULH drive does not require 18-pulse transformer or additional external input filter for harmonic mitigation, and is thus simple, compact solution for the drive installations where low harmonic content is required.

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APPLICABLE SPECIFICATIONS

Any specifications not explicitly included as part of this proposal are excluded from this offering.

The following specifications apply:

- Electrical Details-1, C5
- Electrical Details-2, C6
- Pump Station Details, C3
- Section 10 Standard Specifications Duplex Sewage Pump Station Hunters Hollow

SPECIFIC TECHNICAL COMMENTS/EXCEPTIONS

ITT takes exception to all the stated specification above and is providing a variable frequency drive package believed to meet the intent of these specifications. A complete detail as to what is being offered follows.

Panel Description –

Fabricated and tested NEMA 3R stainless steel dead front Duplex panel, PS200 460Vac drive with v5.05 firmware (x2), mains distribution block, through door lockable fused disconnect with fast acting fuses (x2), door mounted NEMA rated keypad (x2), door mounted Hand-Off-Auto selector switch (x2), Reset & E-Stop pushbuttons (x2), fused 120Vac control transformer, NEMA 3R fan cooling, manual bypass with Bypass/Off/VFD selector switch & electronic overloads (x2), safety relay†, indicator lights for VFD Mode/VFD Run/VFD Fault/Bypass Selected/Bypass Running, float switch controller (in bypass mode), elapsed time meter (x2), alarm horn & beacon. Panel dimension: 60"H x 48"W x 18"D.

Note: Specific exceptions to specifications:

- Dead front is made of painted steel
- Fused 1000VA control transformer
- 200W cabinet heaters w/thermostat

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CLARIFICATIONS AND EXCEPTIONS TO SPECIFICATIONS

GENERAL

IEEE519 - 1992 is a guideline for electrical systems as a whole; and not individual devices such as VFDs. ITT cannot confirm compliance without a harmonic analysis to ensure system guidelines are met. System electrical information including transformer (PCC) size, transformer impedance, transformer short circuit rating, and a one-line drawing with all linear and non-linear loads is required to perform these calculations.

We propose to supply the PumpSmart PS200 drive design on the ABB ACS800 platform with features indicated in this proposal.

ITT is acting as an equipment supplier only, not as a contractor, or sub-contractor. The listed specifications, (see **Applicable Specifications**, page 1) are applicable only to the extent of the ITT "Equipment Provider" scope of supply as described.

Specifically not included in this proposal is: Special crating, offloading at job-site, storage, installation and testing equipment, foundations, anchor bolts, templates, external wiring, field testing, independent analysis, seismic calculations and video taping of seminars.

NOTE: these items are the sole responsibility of the purchaser.



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SCOPE OF SUPPLY

Qty.	Tag / Equipment ID	Product ID
2	No Tag Provided	A08745A01

Item Description
Input Voltage: 460 VAC Rated Output Current: 29 AMPS 110% 1 min – Normal Duty Construction: Wall Mount (ITTU31 – Ultra Low Harmonic) Enclosure: NEMA 1 Nominal Horsepower: 15HP Frame Size: R5 Input Disconnecting Means: Input Disconnect w/ Fusing (included via enclosure) Bypass: None Input Impedance: 10% LCL High frequency filter Communication Protocols: None Other Options: 2 nd Environment EMC Filter, Common Mode Filter, Conformal Coated Boards

Drive Input Fuse Ratings	
Amps (600 V)	Bussmann Type
40A	JJS-40

Dimensions and Weights				
Height in / mm	Width in / mm	Depth in / mm	Weight lbs / kg	Dimension Drawing
32 / 816	10.4 / 265	15.4 / 390	143 / 65	Upon Request

Heat Dissipation & Airflow Requirements			
Power Losses		Airflow	
Watts	BTU/Hr	CFM	CM/Hr
657	2,240	206	350

Note: Table details are not for construction and are subject to change.

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PS200 ULH Specifications

Input Connection

Input Voltage (U ₁).....	380/400/415/440/460/480/500Vac 3-phase +/-10%
Frequency:	48 - 63 Hz
Line Limitations:	Max +/-3% of nominal phase to phase input voltage
Fundamental Power Factor (cos ϕ):	1.0
Connection:	U ₁ , V ₁ , W ₁
Output (Motor) Connection	
Output Voltage:	0 to U ₁ , 3-phase symmetrical, UN at the field weakening
Output Frequency:	-300 to +300 Hz, in DTC mode (0-3.2((U ₁ input voltage/UN motor)*fN motor))with dU/dT choke limited 120Hz
Frequency Resolution:	0.01 Hz
Continuous Output Current:.....	1.0 * I _{2N} (normal use)
.....	1.0* I _{2hd} (heavy-duty use)
Short Term Overload Capacity.....	I _{Nmax} = 1.1 * I _{2N} (1 min / 5 minutes @ 40°C), typical I _{hdmax} = 1.5 * I _{2hd} (at least 1 min / 5 min @ 40°C)
Peak Overload Capacity.....	I _{max} (400 Vac and 500 Vac) (at least 10 seconds at start)
Field Weakening Point.....	8 to 300 Hz
Switching Frequency	3 kHz (average), DTC dynamically varies from 1 to 12kHz
Acceleration & Deceleration Time.....	0.00 to 1800 Sec
Efficiency	97% at nominal power level
Short circuit withstand rating	65,000 AIC (UL) R2-R8;
Connection	U ₂ , V ₂ , W ₂
Enclosure	
Style:	UL (NEMA) Type 1
Agency Approval	
Listing and Compliance:.....	UL, cUL, CE

Ambient Conditions, Operation

Air Temperature.....	0° to 40°C (104°F), above 40°C the maximum output current is Current is de-rated 1% for every additional 1°C (up to 50°C) (122°F) maximum limit)
Relative Humidity.....	5 to 95%, no condensation allowed, maximum relative humidity is 60% in the presence of corrosive gasses
Contamination Levels	
IEC	60721-3-1, 60721-3-2 and 60721-3-3
Chemical Gasses	3C1 (w/o coating), 3C2 (with coating)

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Solid Particles	352
Installation Site Altitude	0 to 1000m (3300ft) above sea level. At sites over 1000m (3300ft) above sea level, the maximum power is de-rated 1% for every additional 100m (330ft). If the installation site is higher than 2000m (6600ft) above sea level, please contact your local ITT distributor or representative for further information.
Vibration Max	1mm (0.04") 5 to 13.2 Hz, Max 7 m/s ² (23 ft/s ²) 13.2 to 100 Hz sinusoidal

Ambient Conditions, Storage and Transportation (in Protective Shipping Package)

Air Temperature.....	-20° to 70°C (-4° to 158°F)
Relative Humidity.....	Less than 95%, no condensation allowed
Atmospheric Pressure	70 to 106 kPa (10.2 to 15.4 PSI)
Vibration Max	1mm (0.04") 5 to 13.2 Hz, Max 7 m/s ² (23 ft/s ²) 13.2 to 100 Hz
Shock (IEC 60068-2-29).....	Max 100 m/s ² (330 ft/s ²) 11 ms
Free Fall	250mm for weight less than 100Kg / 100mm for weight greater than 100Kg

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PS200 ULH Specifications (continued)

Analog Inputs

Three (3) Programmable Differential Inputs

Two (2) Current Signals.....	0 (4) to 20 mA, Input Resistance $R_I = 100$ ohms
One (1) Voltage Signal.....	-10Vdc / 0(2) to +10Vdc, Input Resistance $R_I = 200$ k-ohms
Common Mode Voltage.....	+/-15 Vdc, max.
Common Mode Rejection Ratio	> 60 dB at 50 Hz
Resolution	0.025% (12 bit)
Accuracy	+/- 0.5%
Input Updating Time	6 ms (Standard Application Software)
Optional Isolation	Available through optional external module

Reference Power Supply

Voltage	+10Vdc, 0, -10Vdc +/- 0.5% at 25°C (77°F)
Maximum Load	10 mA
Applicable Potentiometer	1 k-ohm to 10 k-ohm

Analog Outputs

Two (2) Programmable Current Outputs

Signal Level.....	0 (4) to 20 mA
Resolution	0.025% (12 bit)
Accuracy	+/-1% Full Scale Range at 25°C (77°F)
Maximum Load Impedance	700 ohms
Output Updating Time	24 ms (Standard Application Software)

Digital Inputs

Six (6) Programmable Digital Inputs (Common Ground), plus One (1) Start Interlock

Isolation.....	Isolated, can be divided in two isolated groups
Isolation Test Voltage	500 VAC, 1 minute
Signal Level.....	24Vdc, -15% to +20%
Logical switch thresholds.....	< 8Vdc at "0", >12Vdc at "1"
Input Current	10 mA, Digital Input 1 to Digital Input 5, 5 mA Digital Input 6

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Filtering Time Constant..... 1 ms
Input Updating Time..... 6 ms (Standard Application Software)
Internal 24 Vdc Supply for Digital Inputs
Voltage 24Vdc
Maximum Current..... 100 mA
Connector..... X22:7
Protection Short Circuit Proof
An external 24 Vdc supply may be used instead of the internal supply

Relay Outputs

Three Programmable Relay Outputs

Switching Capacity..... 8 A at 24Vdc or 250Vac, 0.4 A at 120Vdc
Maximum Continuous Current..... IC = 2 Amps RMS
Contact Material..... Silver Cadmium Oxide (AgCdO)
Isolation Test Voltage 4 kVac, 1 minute
Output Updating Time 100 ms (Standard Application Software)

Protections

Single Phase..... Protected (input & output)
Over Voltage Trip Limit..... $1.3 * U_{1max}$
Under Voltage Trip Limit..... $0.65 * U_{1min}$
Over Temperature..... Protected
Auxiliary Voltage..... Short Circuit Protected
Ground Fault..... Protected
Microprocessor Fault..... Protected
Motor Stall Protection Protected
Motor Over Temperature..... Protected (I2t)

Specifications are subject to change without notice. Please consult the factory when specifications are critical.

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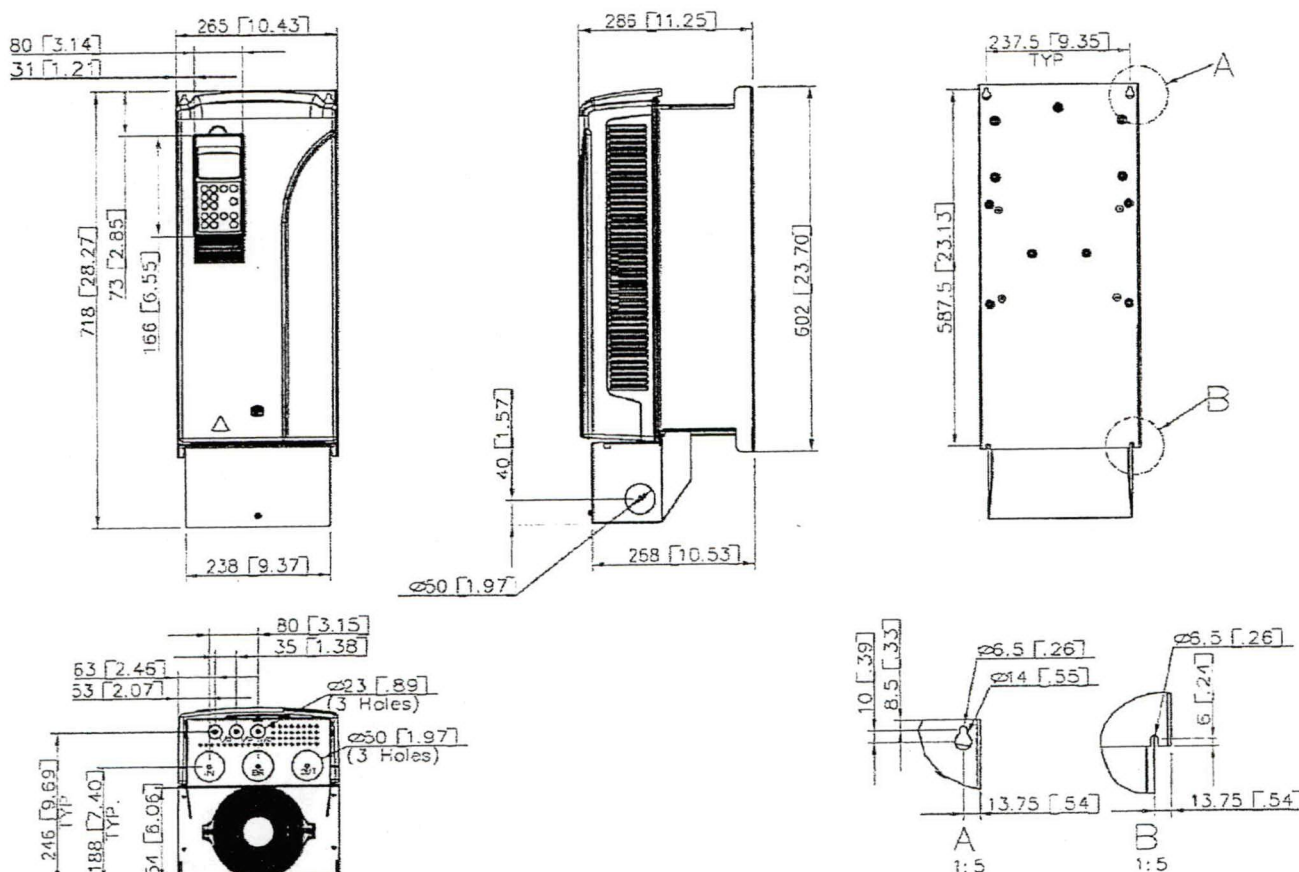


PumpSmart PS200 Drive Dimensions and Ratings Frame R5-NEMA1/IP21

PUMPSMART

PumpSmart PS200 Pump and Motor Control System

The PumpSmart PS200 is a pump and motor control system that provides integral starting, right-sizing, pump protection and process control for all pumping applications. The PumpSmart PS200 is based upon the ABB ACS800 variable frequency drive platform. PumpSmart Control Solutions has worked with ABB to incorporate proprietary pump protection, process control and configuration algorithms into the drive to make it more suitable for pumping applications



Drive Dimensions

Frame	Height mm [inches]	Width mm [inches]	Depth mm [inches]	Weight kg [lbm]
R5	718 [28.27]	265 [10.43]	286 [11.26]	34 [75]

*Dimensions not for construction



PumpSmart PS200 Drive Dimensions and Ratings Frame R5-NEMA1/IP21

PUMPSMART

Drive Ratings

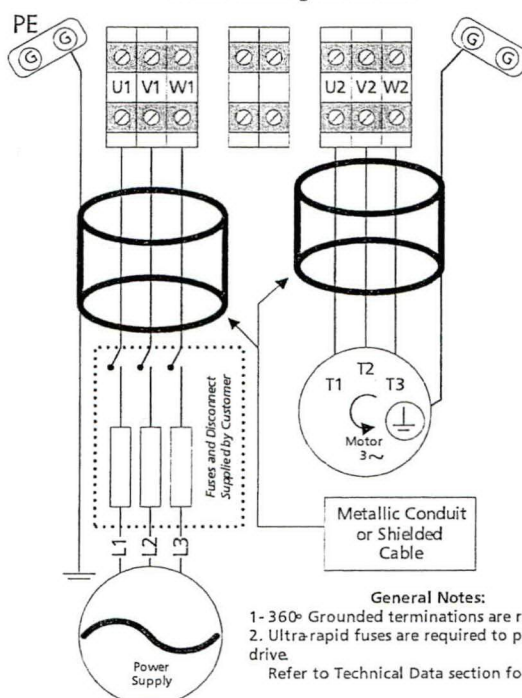
ITT P/N	Input Voltage VAC	Power P _N ¹		Nominal Current I _{2N} ² Amps IEC/NEMA	Heat Dissipation		Air Flow		Frame	Enclosure Rating	Recommended Main Fuses		
		KW	HP		Watts	BTU/hr	M ³ /hr	CFM			IEC269gG (A)	UL class T (A)	Bussmann Type
A08098A08	230	18.5	25	69/69	525	1790	250	147	R5	NEMA 1 IP21	80	90	JJS -90
A08098A09	230	22	30	80/80	613	2090					100	100	JJS -100
A08098A10	230	22	40	94/104	812	2770					125	125	JJS -125
A08100A10	380*/460	30	50	61/65	988	3370					80	80	JJS -80
A08100A11	380*/460	37	60	75/79	1187	4050					100	100	JJS -100
A08100A12	380*/460	45	75	88/96	1439	4910					125	125	JJS -125
A08186A07	575	30	40	46/46	850	2900					63	70	JJS -70
A08186A08	575	37	50	52/52	1011	3450					63	80	JJS -80

¹ P_N - Nominal Power Rating at listed voltage rating for variable torque loads

² I_{2N} - Continuous base current with 10% overload for 1 min / 5 minutes

* KW rating applies to drives with 380VAC input voltage

Power Cabling Schematic



Frame Size	U1/V1/W1 - U2/V2/W2 R+, R- Terminals				Earthing PE Terminal			
	Max. Wire Size		Torque		Max. Wire Size		Torque	
	mm ²	AWG	Nm	Lb-ft	mm ²	AWG	Nm	Lb-ft
R5	6..70	10-2/0	15	11.1	6..70	10-2/0	15	11.1



PumpSmart PS200

Drive Dimensions and Ratings

Frame R5-NEMA1/IP21

PUMPSMART

PumpSmart® PS200

Drive Hardware: ABB ACS800 -6 Pulse PWM

CERTIFICATIONS

600 VAC and Below
UL Listed
Canadian UL Listed

CSA Certified
CE Marked

INPUT POWER

Voltage..... 208...690 VAC 3 Phase $\pm 10\%$
Overload..... 110% for 1 min/5 min,
140-150% for 10 sec at startup
Frequency..... 48...63Hz

Fundamental Power..... $\cos\phi_1 = 0.98$ (fundamental)
Factor ($\cos\phi_1$)..... $\cos\phi_1 = 0.93...95$ (total)
Efficiency..... 98% (at nominal power)

MOTOR CONNECTION

Voltage..... $0...V_{1in}/V_{3in}$
Frequency..... 0...300 Hz
0...120 Hz with dV/dT Filters
Motor Control..... ABB Direct Torque Control Software
Static Accuracy: 10% of Motor Slip
Dynamic Accuracy: 0.3-0.4% second
Speed Control..... with 100% Torque Step

ENVIRONMENTAL LIMITS

Enclosures..... NEMA 1/IP21
NEMA 12/IP54
Temperature..... 5...104° F (-15 to 40°C) Standard
104...122° F (40-50 C) with
de-rating (1%/1 C)
Humidity..... 5...95% Relative Humidity
Altitude..... 0...3300 Ft (0...1000M) Standard
3300...13,123Ft (1000...4000M) with
de-rating (1%/100M)
Vibration..... Max. 1 mm (0.04 in.) 5-13.2 HZ
Max. 7 m/s^2 (23 ft/s^2) 13.2 - 100
HZ, Sinusoidal
Shock, Free Fall Not Allowed

STANDARD INPUT/OUTPUT

2 Current Analog Inputs..... 4...20mA
100 Ω Input Resistance
11 bit resolution
1 Voltage Analog Input..... 2-10 VDC
200 Ω Input Resistance
11 bit resolution
Galvanically isolated as a group

2 Current Analog Output..... 4...20mA
700 Ω Max load impedance
10 bit resolution
Galvanically isolated as a group

Digital Inputs (7)..... 2 Wire Start/Stop
Hand-off Auto (HOA)
3-Wire Start/Stop
Setpoint 1-2
Speed Override
Specific Gravity
Secondary Protect A/B
Digital Reset
E Stop/Permissive
Motor Thermistor
24 VDC Input Voltage
1 mS filtering time

Relay Outputs (3)
Configurable..... Form-C Switchover Contact
24 VDC or 250 VAC
2A max continuous current

Reference Voltage..... 10 VDC $\pm 0.5\%$
Output 10mA max current

Auxiliary Voltage Output... 24 VDC $\pm 10\%$
250 mA max current output

DRIVE PROTECTION

Keypad Failure
Earth Fault
Over Voltage
Over Temperature (VFD)
Phase Loss
Over Current
Under Voltage
Over Temperature (Motor)
Over Torque
Motor Stall

PUMP PROTECTION

Loss of Suction/Dry Run
Low Flow
Run-out Flow
Shut-off/Dead Head
Critical Speed Lockout
General Condition
Sleep Function
Sensor Failure
Safe Speed Operation

FEATURES:

Smartflow
Smartcontrol (PID Torque)
Cavitation Control
Automatic Fault Reset
Multipump (Synchronous Control)
Multipump (Backup)
System Curve Compensation
Pump Cleaning Sequence

FIELDBUS

Communication Modules..... Modbus, Profibus DP
Ethernet, DeviceNet
ControlNet

Certified for Construction Purposes only when signed

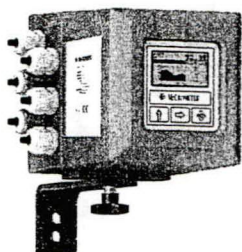
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Customer Name.....

Goulds S/N.....

Customer P.O #.....

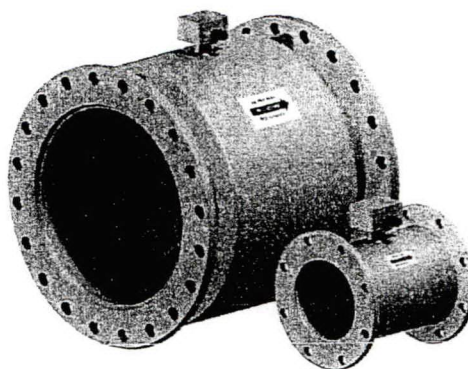
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SIGNAL CONVERTER



MODEL UM06 AND UM08
ULTRA MAG® ELECTROMAGNETIC FLOW METER
 150 PSI FLANGED TUBE METER, SIZES 2" thru 48"
 300 PSI FLANGED TUBE METER, SIZES 2" thru 48"



DESCRIPTION

MODELS UM06 AND UM08 FLANGED TUBE ULTRA MAG®

meters are manufactured to the highest standard available for magmeters. They incorporate microprocessor technology to offer very low flows and broad rangeability. The flanged end tube design permits use in a wide range of applications with up to 300 PSI working pressure. Flanged ends are Class "D" flat face flanges (150 PSI) or Class "F" raised face flanges (300 PSI). The fabricated tube is stainless steel with steel or stainless steel flanges and is lined with UltraLiner™, an NSF approved, fusion bonded epoxy material.

INSTALLATION is made similar to placing a short length of flanged end pipe in the line. The meter can be installed vertically, horizontally, or inclined on suction or discharge lines. The meter must have a full pipe of liquid for proper operation. Fluid must be grounded to the downstream flange of the sensor either via internal grounding electrodes (4-12") or using McCrometer 316 SS Grounding Rings. Any 90 or 45 degree elbows, valves, partially opened valves, etc. should not be placed closer than five pipe diameters upstream and two pipe diameters downstream. All blending and chemical injection should be done early enough so the flow media is thoroughly mixed prior to entering the measurement area.

SIGNAL CONVERTER: The L-Series signal converter is the reporting, input and output control device for the sensor. The converter allows the measurements, functional programming, control of the sensor and data recording to be communicated through the display and hard wired inputs/outputs. The L-Series microprocessor-based signal converter has a self-diagnostic test mode, a six-point curve-fitting algorithm to improve accuracy, a 4-20mA (1000 ohm) analog output, an RS485 port, an 8 line graphical display with 3-key touch programming, and a rugged enclosure that meets IP67. The converter will output rate of flow and total volume. The converter also comes standard with password protection and many more features right at your fingertips.

OPTIONAL:

Separate 4-20mA output for reverse flow signal output
 DC powered converter (10-35 VDC, 20 W)
 Meter mounted converter
 Five-year warranty
 Hastelloy® electrodes
 ANSI or DIN flanges
 Stainless Steel junction box for harsh water submersion
 Special lay lengths, including ISO standard lay lengths
 Converter sun shield

SPECIFICATIONS

WARRANTY	2 Years.
ACCURACY TESTS	3-point wet flow calibration of every complete flow tube with its signal converter. If desired, the tests can be witnessed by the customer. The McCrometer test facilities are traceable to the National Institute of Standards & Technology. Uncertainty relative to flow is $\pm 0.15\%$.
ACCURACY	Plus or minus 0.5% of actual flow.
REPEATABILITY	$\pm 0.05\%$ or $\pm 0.0008\text{ft/s}$ ($\pm 0.25\text{mm/s}$), whichever is greater.
HEAD LOSS	None. No obstruction in line and no moving parts.
PRESSURE RANGE	150 PSI maximum working pressure (UM06) 300 PSI maximum working pressure (UM08)
TEMPERATURE RANGE	Operating: -10 to 77°C (14 to 170°F) Storage: -15 to 77°C (5 to 170°F)
VELOCITY RANGE	.2 to 49 FPS.
BI-DIRECTIONAL FLOW	Forward and reverse flow indication and forward, reverse, net totalization are standard with all meters.
CONDUCTIVITY	5 $\mu\text{S/cm}$.
LINER	UltraLiner NSF approved, fusion bonded epoxy.
ELECTRODES	Type 316 stainless steel, others optional.
POWER SUPPLY	1AC: 90-265VAC/44-66 Hz (20W/25VA) or DC: 10-35VDC (20W). AC or DC must be specified at time of ordering.
4-20mA OUTPUT	Opto-isolated and fully programmable for zero and full scale (0-24mA). (Optional second 4-20mA is available for reverse flow output.)
FREQUENCY OUTPUT	Frequency/pulse transistor output for flow rate or for external totalizer. Capable of sinking $<250\text{mA}$ @ $<35\text{V}$ usable for pulse/frequency, flow outputs, or as alarm outputs for fault conditions including empty-pipe, forward/reverse, polarity (normal open/close), 4-20mA over-range, pulse over-range.
EMPTY PIPE SENSING	Zero return when electrodes are uncovered.
ALARMS	Programmable alarm outputs.
DIGITAL TOTALIZER	L-Series restrictive based on pipe size. Cubic Meter, Cubic Centimeter, Milliliter, Liter, Cubic Decimeter, Decaliter, Hecaliter, Megaliter, Cubic Inches, American Gallons, Imperial Gallons, Cubic Feet, Standard Barrel, Oil Barrel, Cubic Yard, American Kilogallon, Imperial Kilogallon, Acre Feet, Megagallon, Imperial Megagallon
RATINGS	Metering Tube: NEMA 6P/IP68 with remote converter and potted junction box. Electronics enclosure: IP67 and CE Certified.



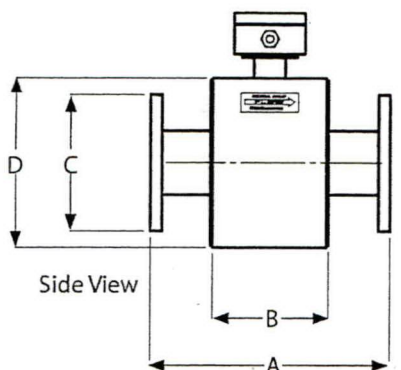
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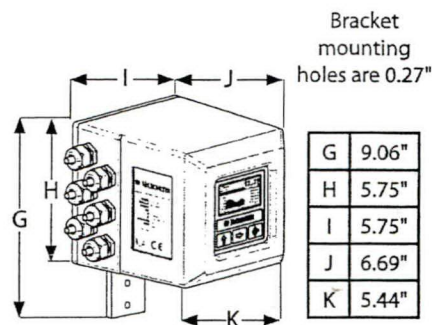
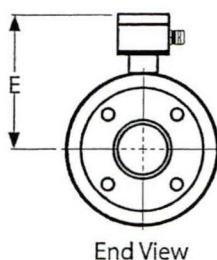
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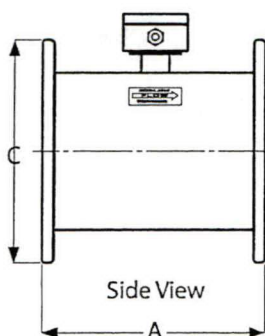
MODEL UM06 AND UM08 ELECTROMAGNETIC FLOW METER



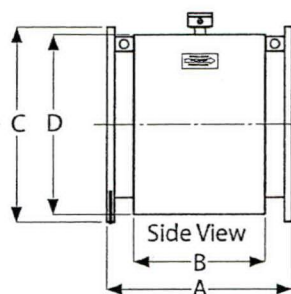
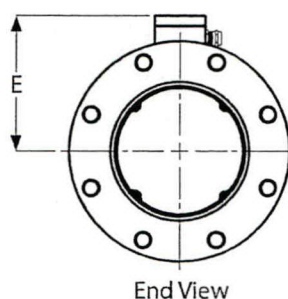
2" and 3" Models Body Style



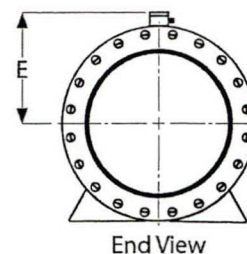
Converter Dimensions



4" to 12" Models Body Style



14+\" Models Body Style



**Grounding Rings are 0.125" thick.

Pipe Size (Nominal)	Meter Pipe ID	Flow Ranges GPM Standard .2 to 49 FPS Min - Max	DIMENSIONS (Lay Lengths)										Estimated Shipping Weight (lbs.)	
			A*		B	C		D	E	F		UM06	UM08	
			UM06	UM08		UM06	UM08			UM06	UM08			
2"	2.156	2 - 480	11.00	11.00	6.70	6.00	6.50	7.90	7.95	10.95	11.45	93	107	
3"	3.250	5 - 1,080	13.40	13.40	6.70	7.50	8.25	9.40	8.70	12.45	12.83	97	111	
4"	3.750	8 - 1,920	13.40	13.40	n/a	9.00	10.00	n/a	6.75	11.25	11.75	78	108	
6"	5.750	19 - 4,320	14.60	14.60	n/a	11.00	12.50	n/a	7.75	13.25	14.00	82	138	
8"	7.375	33 - 7,680	16.10	17.25	n/a	13.50	15.00	n/a	8.75	15.50	16.25	115	195	
10"	9.750	52 - 12,000	18.50	18.50	n/a	16.00	17.50	n/a	9.15	17.15	17.90	144	247	
12"	11.750	74 - 17,300	19.70	19.70	n/a	19.00	20.50	n/a	11.00	20.50	21.25	193	342	
14"	13.625	90 - 23,500	21.70	22.75	12.00	21.00	23.00	20.30	14.15	24.65	25.65	321	476	
16"	15.625	118 - 30,700	23.60	25.25	14.20	23.50	25.50	21.10	14.90	26.65	27.65	390	645	
18"	17.625	150 - 39,000	23.60	25.25	14.20	25.00	28.00	21.10	15.90	28.40	29.90	446	750	
20"	19.563	185 - 48,000	25.60	28.25	16.20	27.50	30.50	24.80	16.95	30.70	32.20	588	874	
24"	23.500	270 - 69,000	30.70	35.75	21.70	32.00	36.00	29.60	18.80	34.80	36.80	769	1,568	
30"	29.250	420 - 108,000	35.80	41.75	26.50	38.75	43.00	35.90	21.95	41.33	43.45	1,261	2,317	
36"	35.250	610 - 156,000	46.10	46.10	28.20	46.00	50.00	42.70	25.35	48.35	50.35	1,696	2,915	
42"	41.250	830 - 212,000	48.05	**	32.10	52.75	**	48.35	28.68	55.05	**	**	**	
48"	47.250	1,080 - 277,000	50.00	**	36.00	59.50	**	54.00	32.00	61.75	**	**	**	

* Laying lengths for meters with ANSI Class 150 Flanges are equal to UM08 laying lengths

** Consult factory



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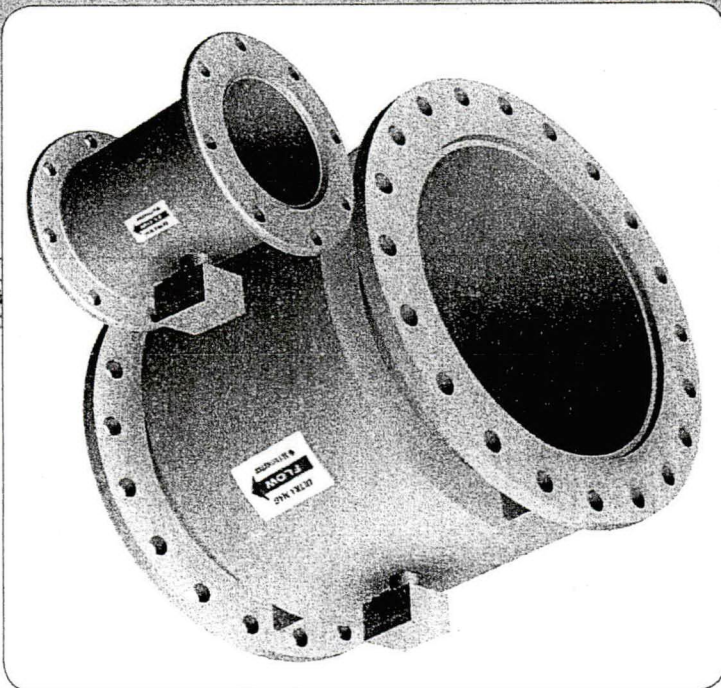
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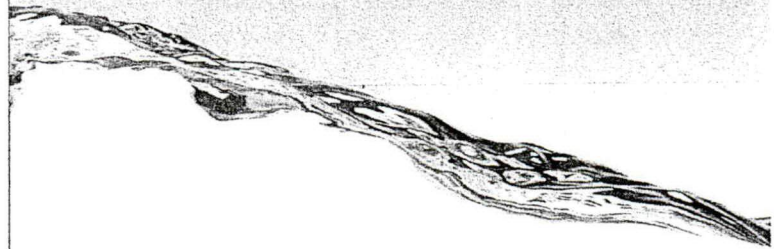
Ultra Mag®

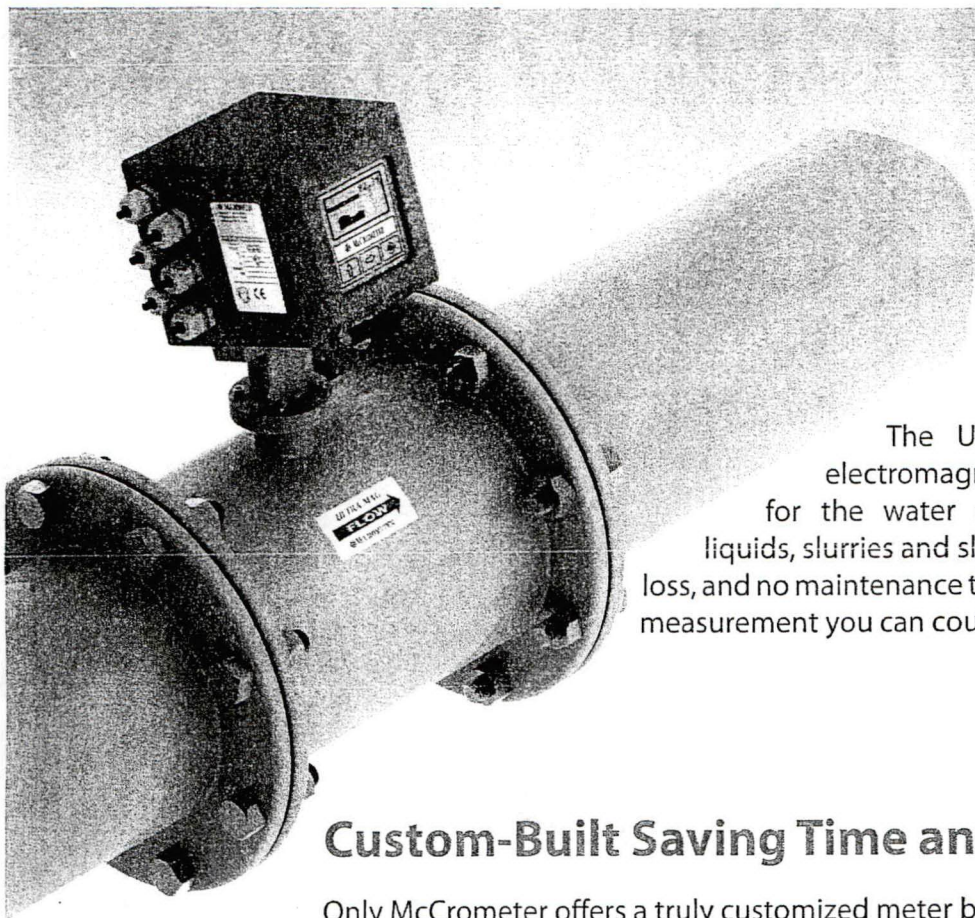
Electromagnetic Flowmeter



**Flow Measurement Solution for
Water and Wastewater**

ULTRA MAG® 





The Ultra Mag® from McCrometer is an electromagnetic flowmeter designed specifically for the water and wastewater industry measuring liquids, slurries and sludge. With a wide flow range, no head loss, and no maintenance the Ultra Mag® delivers a highly accurate measurement you can count on.

Custom-Built Saving Time and Money

Only McCrometer offers a truly customized meter built to fit your application reducing labor during installation and ultimately saving you money.

We offer the following:

- Special lay lengths
- Flanged end connections
(ANSI, AWWA, DIN, JIS, smooth, and grooved ends)
- Meter or remote mounted converter
- Custom cable lengths

Applications

Industrial

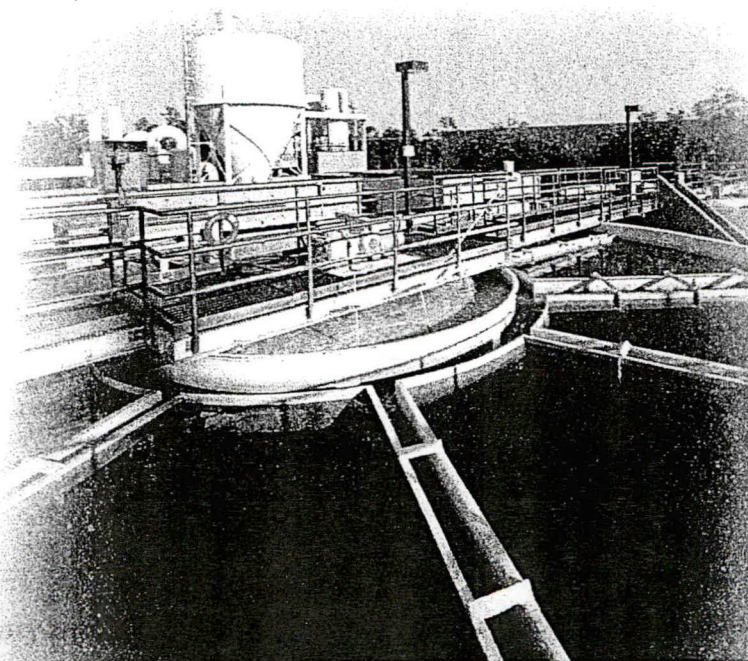
Raw Water
Chilled Water
Cooling Water
Process Control
Effluent wastewater

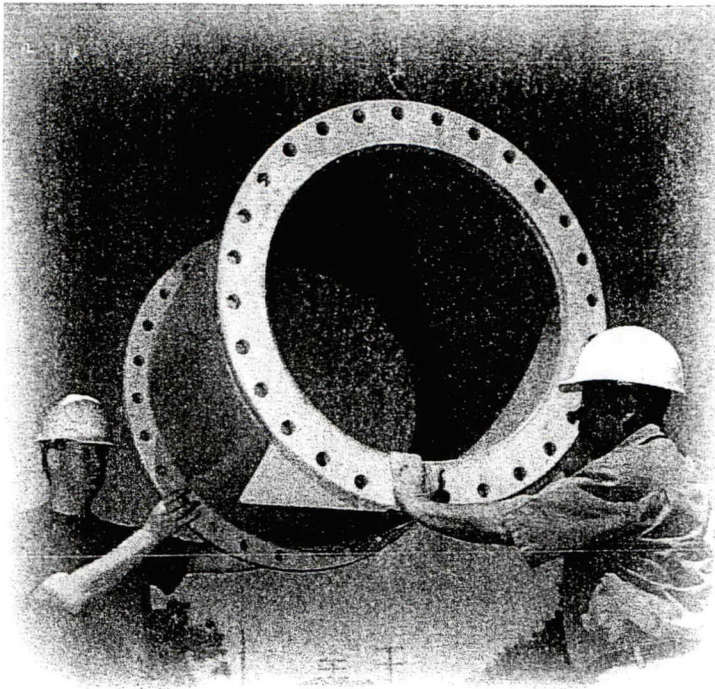
Clean Water

Well Water
Potable Water
Pump Stations
Rate-of-Flow Control
Raw Water Transmission

Wastewater

Influent
Effluent
Reclaimed
Lift Stations
Waste Activated Sludge
Return Activated Sludge





Superior Durability with Fusion-Bonded Ultraliner™

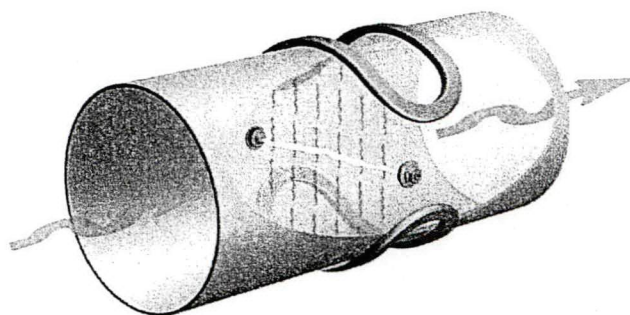
The fusion-bonded epoxy Ultraliner™ has been tested and certified by NSF. This unique liner is applied by using a fluidized bed method resulting in superior resistance against abrasion and corrosion for water and wastewater utilization. The liner provides a highly protective coating with non-conductive properties for outstanding electrical insulation.

Unlike other liners, the Ultraliner creates a seamless continuous barrier over the meter that will not delaminate, separate or collapse.

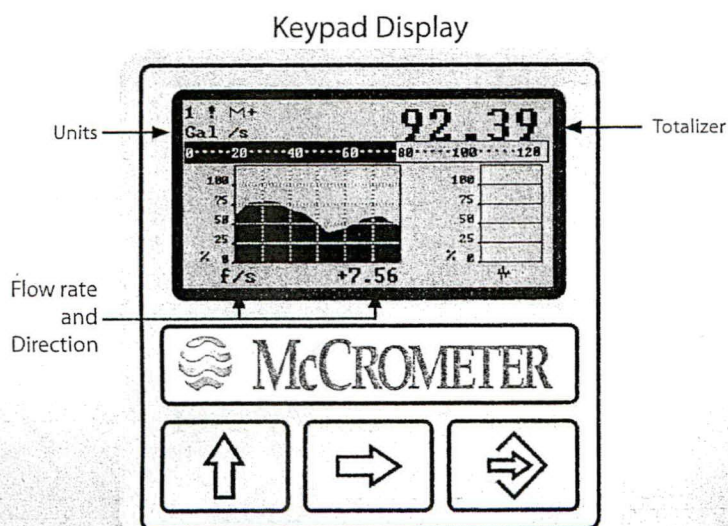
Performance Advantages

- No obstruction to the flow
- No moving parts to wear or break
- Maintenance free
- Worry-free accurate measurement
- Debris or solids will not clog the meter
- No head loss
- Bi-directional flow
- Empty pipe detection
- Unaffected by changes in density and viscosity
- No risk of liner delamination or separation
- Wide Flow Range

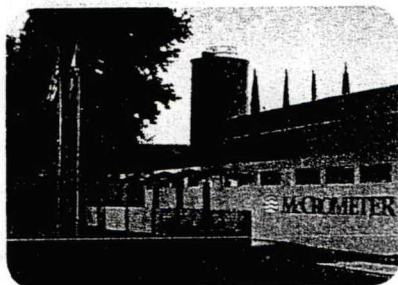
Principles of Operation



The Ultra Mag is a non-invasive flow measurement device. It uses two compact, high density magnetic coils to generate an electromagnetic field inside the pipe section. As conductive liquid flows through the pipe, a voltage is created, which is measured by electrodes inserted through the flowmeter lining into the flow. The voltage is converted to a flow rate reading by the Ultra Mag's signal converter and shown on the digital display.



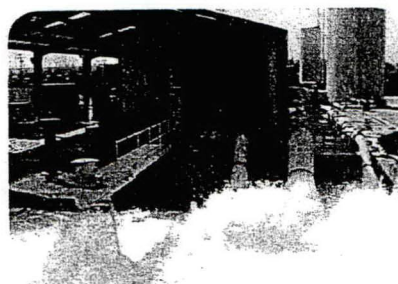
COMMITMENT TO INTEGRITY



For over 55 years, McCrometer has demonstrated an unyielding commitment to integrity which is reflected in our stringent flowmeter calibration processes. Each flowmeter is individually wet calibrated in one of our two world-class NIST traceable calibration facilities and delivered with a Certificate of Calibration.



Our Hemet, California factory boasts a robust Calibration Test Lab that enables production of the most accurate and precise flow instrumentation. The test facility utilizes three gravimetric systems and two volumetric systems providing accuracy and calibration tests of flowmeters from 1/2 to 20-inch diameter, with flow rates up to 4,000 gpm.



Our large volume test facility is located in Porterville, California. This facility is one of the world's largest volumetric test facilities owned by a meter manufacturer, and it offers accuracy and calibration tests of flowmeters from 3 to 72-inch diameter, with flow rates up to 60,000 gpm.

For specifications visit: www.mccrometer.com/umspecs

Represented by:



MCCROMETER



Verbatim[™] Responder

Responder
for use with Verbatim
Automatic Dialing
Remote Monitoring System

The RACO Verbatim® Responder is designed to operate in conjunction with the RACO Verbatim Voice Alarm Autodialer. The Verbatim autodialer places command calls to the remotely located Responder, and causes control output relays on the Responder to be activated.

Thus the Verbatim Autodialer is able to automatically control equipment at a separate location using ordinary, economical dial-up phone service as the connecting medium. This is in addition to the Verbatim autodialer's usual role in placing voice alarm calls to personnel in the event of non-routine alarm conditions.

A TYPICAL WATER LEVEL CONTROL APPLICATION

A commonly encountered situation is a water tank with float switches or other sensors which monitor the water level, and which generate routine "request to pump" and "request to stop" commands that need to be relayed to a remotely located well pump site. The problem is how to get that command information to the remote pump site.

This problem can be solved with a Verbatim autodialer at the tank site, with the respective float switch contacts connected to the corresponding alarm inputs on the autodialer. In operation, when a given float switch activates, the autodialer places an alarm phone call to the Responder and causes the appropriate corresponding output relay on the Responder to be activated. The pump equipment connected to the Responder is thus automatically controlled, causing the water level at the tank to cycle between suitable low and high limits.

PERSONNEL ALARM CALLS IN THE EVENT OF RESPONDER FAILURE

Part of the Responder's function is to issue a series of DTMF "9" tones upon receipt of a valid command. This

acknowledges the alarm (request to activate a relay) at the autodialer, suspending further dialing activity.

However, if the Responder should fail to receive or act on a command call, no acknowledgement will occur, and the autodialer will go on to place voice alarm calls to personnel, warning of a failure.

A water level control system should also typically include separate "emergency low level" and "emergency high level" detection switches, which would be connected into separate additional inputs on the autodialer, and which would result in immediate emergency notification calls to personnel in the event of out-of-limit water level conditions.

SECOND-LEVEL CONTROL

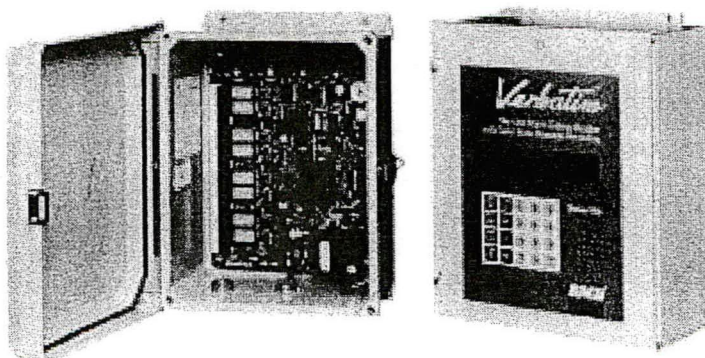
Some systems will include a separate, non-emergency "low low" detection which calls for a second pump to be turned on to increase flow. This can generally be accommodated by using additional control relay outputs on the Responder.

OPTIONAL "CONDITIONAL ACKNOWLEDGEMENT" CONFIGURATION

For additional security, the Responder can be optionally field-configured so that the acknowledgement tones (DTMF 9's) are issued only if an auxiliary input on the Responder is closed to ground by an external set of contacts.

If the contacts are open, a command call placed by the Verbatim autodialer will not be acknowledged, resulting in followup voice alarm calls being placed to personnel by the Verbatim autodialer.

If it is desired to use this feature, it is up to the system engineer to arrange for the appropriate operation of these external contacts, so that the acknowledgement of alarm calls is allowed, or prevented, in the desired fashion.



MODEL RSP RESPONDER SPECIFICATIONS

Call answer duration	Adjustable, 30 to 90 sec.
Output relays	2 standard, 8 optional
Relay contacts	SPDT (normally open/ normally closed), 5 amps, 120 VAC
Basic unit dimensions	9"H x 7"W x 2-1/2"D
Basic unit mounting centers	8-1/4"H x 6-1/4"W (via screws up to 6-32)
Optional enclosure	Fiberglass NEMA 4X
Optional enclosure dimensions	11-1/4"H x 9-1/4"W x 5-1/2"D
Optional enclosure mounting centers	10-3/4"H x 6"W (via screws up to 5/16")
Power	120 VAC, 10 VA nominal; 12 VDC available on special order.

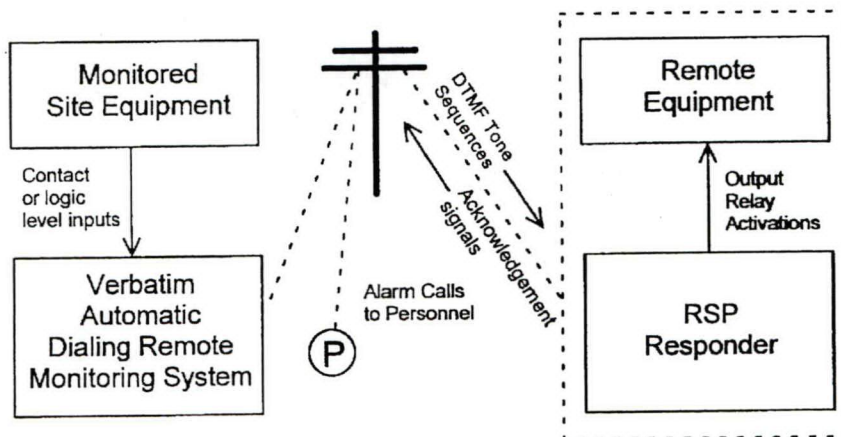
The Responder has no voice or dialout or battery backup provisions. It has no programming that could be lost during powerdown.

Phone line interface is FCC approved.

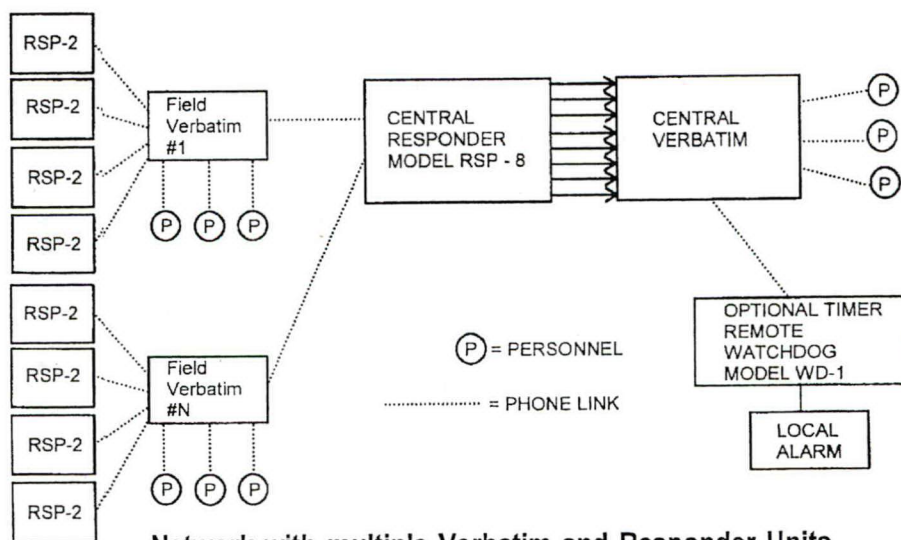
All specifications are subject to change without notice.

RESPONDER ORDER NUMBERS

NUMBER OF OUTPUTS	BASIC UNIT	WITH NEMA 4X
TWO	RSP-2-NB	RSP-2
EIGHT	RSP-8-NB	RSP-8



Typical Responder and Verbatim Network



Network with multiple Verbatim and Responder Units

DIRECT RESPONDER OPERATION

Although the Responder normally is commanded by a Verbatim autodialer, it is also possible for personnel to call a Responder and issue the proper series of DTMF touch tones to achieve the same relay operations as when the Verbatim provides the commands.

A single auxiliary dry contact input on the Responder can be connected so that if, and only if, that input is closed to ground, the caller will hear an initial 400 Hz signal tone as an indirect indication of current conditions.

BUILT-IN TIMER

The Responder incorporates a built-in timer which activates a built-in audio alarm and a selected output relay if a valid command call is not received within the preset time period. The timeout period can be set to 6 minutes, 24 minutes, 3 hours or 24 hours. The timer can be disabled if necessary. An additional relay is supplied on two-relay models for this auxiliary use.

COMMAND ACTIVATION CODES

The separate commands that control specific output relays on the Responder, are implemented as extended command dialout phone numbers programmed into the autodialer. Alarm Call Grouping is invoked at the autodialer so that each input results in the dialing of its own distinct command phone number as the first number dialed.

Each command phone number begins with the initial digits (usually seven for a local call) required to reach the Responder's phone number. These digits are followed by a programmable delay period of several seconds to allow time for the Responder to answer the call, before the final command digits are issued.

A plug-in PROM chip determines which followup command tone digits are required to activate a given output relay. This chip is normally furnished for four command digits, but on special order up to ten digits can be implemented for increased security.

PERSONNEL PHONE NUMBERS

In addition to the command phone numbers programmed into the autodialer, personnel phone numbers are also programmed. Alarm Call Grouping programming includes these personnel phone numbers in common for all command inputs. Personnel will only be called if an initial call to the Responder is not acknowledged.

There is an overall limit of sixteen phone numbers programmable at the Verbatim autodialer. Each personnel phone number can be shared by all command inputs. For example, one Verbatim autodialer could be set up to command two outputs on each of six separate Responders, and still allow followup or emergency personnel calls to four personnel phone numbers.

It is possible to program second, duplicate command phone numbers for a given command input, still ahead

of the personnel phone numbers, to provide a second chance for the command call to get through before personnel would be called. This uses up additional phone number allocations out of the total of sixteen.

RELAY OUTPUTS

The Responder is available with two relay outputs standard, or eight outputs optional. Normal relay operation is momentary, one second nominal duration. However the unit may be field-configured so that the first two relays together implement a single latched output. On eight output versions, the first four relays can be field-configured to implement two such latched outputs.

MOUNTING OPTIONS

The Responder is available in either a basic unit (circuit board configuration suitable for mounting on a flat panel surface), or optionally with a NEMA 4X enclosure.

ADDITIONAL SYSTEM ENGINEERING CONSIDERATIONS

Each respective command input to the autodialer must be returned to its normal state before a different command input is invoked, in order to prevent "collisions" of command calls, redundant command calls, and unintended premature acknowledgement of the calls.

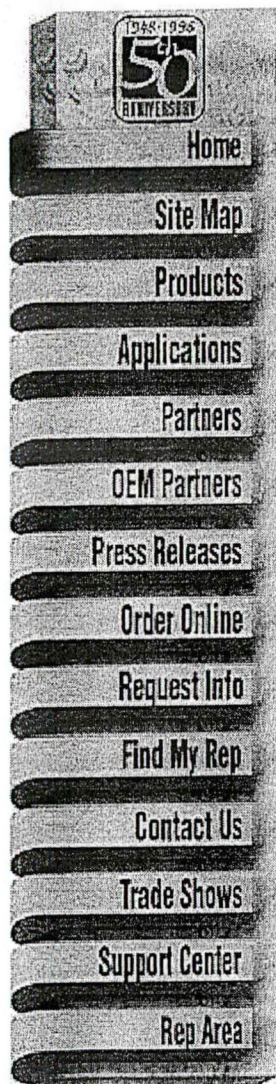
The Verbatim autodialer serves only to relay commands to remote Responders. In general, it must receive appropriate contact or logic-level inputs from an intelligent controller, although in simple systems, float switches might suffice.

In special cases it is possible to have the responder linked to the Verbatim autodialer via a direct wire pair instead of dial-up telephone lines. Contact factory for details.

More than one Responder, and/or more than one Verbatim autodialer, may be combined in one overall control system or network.

Note that while the Verbatim autodialer includes a built-in power failure detection with dialout alarm, it must be disabled when using Alarm Call Grouping. If a dialout alarm is required in the event of power failure, one of the alarm inputs on the autodialer must be connected to external relay contacts which indicate the presence or absence of power.

It is the responsibility of the system engineer or customer to verify that the risk of possible sustained failure of dial-up phone lines, or of the Verbatim autodialer, or of the control system commanding it, is acceptable as considered against risks of alternative approaches. Failure of the Responder itself, including that caused by local power failure, would presumably result in notification calls to personnel either directly if it did not respond with an acknowledgement, or else subsequently, as a result of emergency limits being exceeded.



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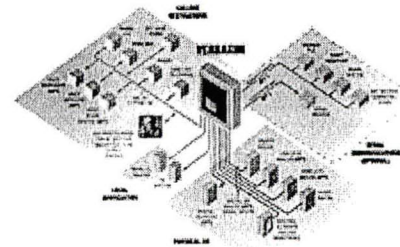
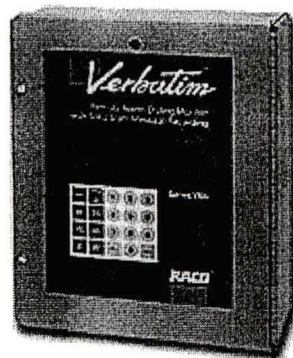
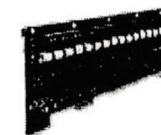
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Model Number 301VSS-8C, Verbatim® VSS-8C Autodialer

List Price \$2,350.00

Verbatim® model VSS-8C monitors 8 dry contact inputs plus 120 VAC power source.

[larger image](#)INPUT / OUTPUT /
INTERFACE OPTIONS[Digital Signal Inputs](#)

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7:30 A.M. TO 4:00 P.M. PST

RACO LIVE SUPPORT

SORRY, LIVE SUPPORT IS CURRENTLY AWAY.

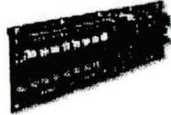
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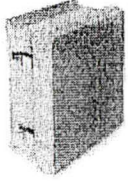
Specifications

# of Digital Alarm Inputs	8
# of Optional Digital Alarm Inputs	16
	24
	32
# of Optional Analog Alarm Inputs	1
	4
	8
	16
# of Optional Digital Outputs	4
	8
# of Optional PLC Addresses	32
	64
	96
PLC Protocols	DF1 & Modbus connection via RS-232 [optional]
Verbatim SCADA Compatibility	Compatible with RACO SCADA software
# of Phone Numbers Dialed	16
Voice Recording Time	26 sec



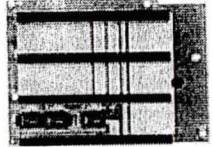
[Analog Signal Inputs](#)
[more available ..](#)

OPTIONAL ENCLOSURES



[Optional Enclosures](#)

SYSTEM UPGRADES



[Expansion Bus Option](#)

ARRA Compliance



[ARRA Details](#)

FCC Registered	Part 68, "Ringer Equivalence": 0.3A
Alarm Call Grouping	Alarm calls to up to 16 phone number groups
Alarm Criteria	Alarm on Closed Circuit Alarm on Open Circuit Run Time Meter Status only Totalizer
Alarm Reset	ON/OFF
Alarm Reset Time	0.1 to 99.9 hours
Alarm System Enable/Disable	Local and Remote Enable or Disable
Alarm Trip Delay	0.1 to 999.9 sec
Autocall Test	ON/OFF
Autocall Time Interval	0.1 to 99.9 hours
Call Back/Call Forward	Separate unique phone number
Dialing Format	TouchTone or Rotary Pulse
# of Message Repetitions	1 to 20 repetitions
Phone Numbers	16 phone numbers up to 60 digits each
Ring Delay	1 to 20 rings
Security Code	6 digits
Station ID & Message Recording Time	User variable
Time Between Alarm Calls	0.1 to 99.9 min
Current Draw	Standby 300 mA Operational 460 mA
Accommodates	Field-installed upgrades
Indoor Enclosure	Rugged Metal
Trade Name	Verbatim®
Typical Monitoring	Boilers Chemical Plants Computer Rooms Facility Security Fish Hatcheries Frozen Food Storage HVAC Systems

Applications	Hydroelectric Power Stations Pipeline & Compressor Stations Remote Pump Stations Storage Tanks Telephone Switchgear Unattended SCADA Systems Water & Wastewater Treatment Plants
Typical Sensors	Flow Leak Level Motion pH Power Pressure Temperature Vacuum
Communication Method	Landline Wireless - Cellularm
Notification Methods	PA System Pager Voice Call
Read/Write Data Registers	Any discrete or integer data register [optional]
PLC I/O Point Sensing	Two RS232/RS232 ports [optional]

Electrical

Power Requirement	105-135 VAC, 50/60 Hz, 15 watts maximum or 8-14 VDC at 500 mA maximum.
Battery Charging	Precision voltage controlled, including automatic rapid recharge after drain.
Battery Backup Time	20 hours
Input Sensing	Eight unpowered contact inputs standard. Open contacts see 5 volts DC; closed contacts see 10 ma DC.
Printer Port	Standard Centronics Parallel

Physical

Surge Protection	Integral gas tube and solid-state protectors on all phone, power, and signal lines.
Weight	8 lbs

Height	11 7/8 in.
Width	9 3/4 in.
Depth	5 in.
Mounting Centers	11 3/8" vertical x 6" horizontal

Environmental

Temperature Range	20 to 130 °F
Humidity	0 to 95%, Non-condensing

Speech Messages

Speech Messages	Users record their own messages. Also includes resident vocabulary for programming guidance and for default "alarm/normal" speech if no user messages are recorded.
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UL Standard

UL Standard	Verbatim® complies with UL Standards: 1459, 1950
-------------	--

Warranty

Warranty	5 years
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Features

- Monitors 8 channels plus internal AC power
- Solid-state message recording
- Expandable modular design
- Superior surge protection on all inputs
- Alarm call grouping
- Low cost
- Remote programming
- Nonvolatile memory
- 20 hour battery backup
- 5 year warranty

Telephone

- Rotary pulse or tone dialing, keyboard selectable.
- Dials up to 16 different numbers, each up to 60 digits long.
- Allows programming of PBX delays in 1 second increments.

- FCC Registered Part 68, "Ringer Equivalence": 0.3A.
- Alarm Acknowledgement is by TouchTone key or by calling back.
- Built-in speaker phone allows two-way conversation.
- Compatible with most cellular telephone systems.

Modular Options

- **Channels.** Upgradeable to 16, 24 or 32 contact channels.
- **Analog.** Custom scaled in the units of measurement required for your job. Analog alarms on a high and a low alarm setpoint. Upgradeable to 1, 4, 8 or 16 analog channels.
- **Remote Supervisory Control.** The operator can turn equipment on or off via any telephone. Upgradeable to 4 or 8 outputs.
- **Modbus Interface.** In addition to physical inputs, the unit is upgradeable to 32, 64 or 96 additional alarms of any type via RS232 and Modbus RTU master protocol.
- **Cellular Telephone.** Our Cellularm™ System provides temporary or permanent alarm autodialing over the cellular telephone network when conventional telephone lines are disabled or unavailable. Furnished in a rugged, weather-resistant housing that's easy to transport and set up.

Factory Options

- **Enclosure.** System available in NEMA 4X enclosure, which is corrosion proof and sealed against 12 feet of water.
- **Environmental.** Thermostatically controlled heater available, suggested for operation below 20°F or where condensation may occur.
- **Local Alarm Relay Output.** Relay activates during unacknowledged alarm conditions.
- **Secure Front Panel.** Verbatim® System furnished without front panel programming controls and indicators. Restricts access to unsupervised or remotely located units, as well as reducing the initial purchase price.
- **Solar Electric Generator Systems.** Ideal for remote location applications where conventional power and telephone services are not available or too costly. Provides steady, clean power and has sufficient storage capacity for overcast and inclement weather conditions.

Alarm Autodialing

The system is designed to continuously monitor preset alarm points. If an alarm condition is sensed at a monitored point, the Verbatim System will automatically dial a list of 16 pre-programmed emergency telephone numbers, calling until it gets an answer. When the call is answered and acknowledged, the system reports the alarm location and status via pre-recorded voice messages.

Communicating over standard land-line or wireless telephone networks, the Verbatim® delivers alarm messages to standard phones, cell phones, numeric or voice pagers, and voice mail systems, and talks

just as easily with computers.

User-Recorded Messages

The voice messages are digitally pre-recorded by the user. Anything that can be spoken is accurately stored in memory from names and numbers to technical terms and detailed instructions. Messages are delivered with maximum clarity, lessening the chance for misunderstanding or error. And, you can easily enter or change your messages over the phone or at the front panel.

A Fully Interactive System

With Verbatim®, you're never out of touch with your monitoring system. With any standard touch-tone phone, you can call in for a status report, review and change programming, or control a remote device. With the touch of a key, you can listen to local sounds or talk to personnel using the unit's built-in speaker phone.

When calling for status report you hear a comprehensive summary of all conditions monitored by the system, including internal power. Hard copies of event data alarms, acknowledgements, inquiries, and programming changes can be printed out at any time using the system's data logging capabilities.

Controls and indicators are provided on the Verbatim® front panels for on-site programming and review of system operation, alarm status, and battery condition.

Supervisory Control System

A Verbatim® System can be equipped with up to 8 digital control outputs to remotely actuate HVAC systems, pumps, compressors, and other electrical devices from a standard phone, the Verbatim® front panel, or a PC.

SCADA System

RACO MMI/SCADA Systems provide monitoring and control of up to 200 RACO Verbatim® Remote Terminal Units (RTUs) over the standard dial-up telephone network. Each RTU has full alarm monitoring, reporting, and autodialing capabilities, and because Verbatim® systems report by exception, they do not need to be polled. When an alarm is sensed, the RTU reports to the central computer. If the computer operator does not acknowledge the alarm, the RTU will commence autodialing.

PLC Network Interface

Offering alarm and monitoring for as many as 96 remote channels, the Verbatim® can use RS232 communications to work with any PLC or other device using Modicon's Modbus protocol.

Take Control of Remote Equipment

A Verbatim® System can be used with a RACO Responder or another Verbatim® to actuate pumps, compressors, gates, or other electrically operated equipment over the dial-up telephone network. Upon receipt of an alarm signal low water level, for example the Verbatim® issues a command to activate an output relay in the Responder or other Verbatim® unit, which initiates an action such as turning on a pump motor.

Memory Retained During Power Failure

Verbatim® systems incorporate a non-volatile memory. Recorded alarm messages and user-entered programming is retained indefinitely in the event of a power loss.

Battery Backup for Safety

A rechargeable gel cell battery provides up to 20 hours of continuous operation in the event of power loss. And because the system uses a precision regulated charger instead of the traditional "trickle" charger, the time required for charging is minimized and battery life is significantly extended.

Built for Long Term Survival in The Toughest Environments

Verbatim® is designed and built for superior performance year after year. The system's rugged durability is evident in its heavy-duty metal enclosure, carefully selected and proven solid state components, and sealed membrane keyboard. Heavy-duty solid-state and gas tube surge protection is provided on all power, phone, and signal lines.

View PDF Options

Options

[Verbatim Responder](#)
[Modbus Interface Option](#)
[Data Communications Option](#)
[Remote Supervisory Control Option](#)
[Analog Signal Input Monitoring Option](#)
[Digital Input Monitoring Option](#)

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Specifications

[Dialer Specifications - Verbatim Model DSP](#)

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Application Bulletin

[National Energy Group Application Presentation](#)
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RACO Manufacturing and Engineering Co., 1400 62nd St., Emeryville, CA 94608 (510) 658-6713 800-722-6999 FAX (510) 658-3153

DIALER SPECIFICATION - VERBATIM® MODULAR SERIES VSS

Description and Phone Number Dialing:

1. The dialer shall be a solid state component capable of dialing up to 16 telephone numbers, each up to 60 digits in length. Phone numbers and Standard pulse dialing or Touch Tone DTMF dialing are user programmable via the system's keyboard or remotely via Touch Tone telephone. In addition, the dialer shall:

- ** Group Alarm Calls - On alarm, system shall selectively call the correct phone number according to the specific alarm(s).
- ** Detect Telephone Line Fault and indicate condition with Front Panel LED.
- ** Automatically select Tone versus Pulse Dialing.
- ** Monitor Call Progress - Detect Busy and Ringing Signals, Abandon Call if Busy, Wait until phone is answered to Annunciate Voice Reports.
- ** Provide Numeric Pager Support
- ** Provide PBX Support

Solid State Voice Message Recording & Playback:

2. The unit shall have two different categories of speech message capability, all implemented with permanent non-volatile solid state circuitry with no mechanical mechanisms. The unit shall allow for message recording from a remote telephone as well as from the front panel.

- ** User Field Recorded Messages: The user may record and re-record his own voice messages for each input channel and for the Station ID.
 - a. There shall be no limit on the length of any particular message within the overall available message recording time, which shall vary from 26 to 635 seconds, depending upon the number of input channels selected, and the recording rate used.
 - b. The unit shall allow selective recording of both Normal and Alarm advisory messages for each input channel.
 - c. The unit shall provide for automatic setting of the optimum speech recording rate for the total set of messages recorder, in order to achieve optimum recording sound quality.
 - d. Circuit board switches or jumper straps shall not be an acceptable means of manipulating message length or recording rates.
- ** Permanent Resident Non-Recorded Messages: Permanent built-in messages shall be included to support user programming operations, to provide supplemental warning messages such as advising that the alarms have been disabled, and to allow the unit to be fully functional even when the installer has not recorded any messages of his own.

Input Monitoring Function:

3. The basic unit shall continuously monitor the presence of AC power and the status of four (4) contact closure inputs. AC power failure, or violation of the alarm criteria at any input shall cause the unit to go into alarm status and begin dial-outs. The unit shall, upon a single program entry, automatically accept all input states as the normal non-alarm state, eliminating possible confusion about Normal Open versus Normally Closed inputs. Further, as a diagnostic aid, unit shall have the capability of directly announcing the state of any given input as currently "Closed Circuit" or "Open Circuit" without disturbing any message programming. Each input channel shall also be independently programmable, without the need to manipulate circuit board switches or jumpers, to any of the following:

- ** Normally Open, Normally Closed, or for No Alarm (Status Only).
- ** Run Time Meter - to accumulate and report the number of hours a particular input circuit has been closed. Any channel so configured will never cause an alarm call, rather, on inquiry will recite it's message according to the status of the input and then report the closed circuit time to the tenth of an hour. The input will accumulate and report in tenths of hours up to a total accumulated running time of 99,999.9 hours. The initial value of the Run Time Meter shall be programmable in order to agree with existing electromechanical Run Time Meters. Up to a total of 8 Run Time Meters may be programmed.
- ** Pulse Totalizer - to count the accumulated number of pulses (momentary contact closures) occurring at the input so programmed. Any input channel may be programmed for a Totalizer Function, up to a maximum of 8. Maximum Input pulse rate is 100 Hz, with a 50% Duty Cycle. The spoken scaled value will not "roll-over" to zero until a value of 4,294,967,294. has been exceeded.

Input/Output Expansion Capability:

4. The standard unit shall be modular in design, permitting it, therefore, to accept "plug-in" expansion circuit boards to incorporate any of the following:

- ** Contact Closure Expansion Capability to a total of 8, 16, 24, or 32 total dry contact inputs.
- ** Analog Input Capability to a total of 1, 4, 8, or 16 total analog inputs.
- ** Remote Supervisory Control Outputs to manipulate 4 or 8 output relays.

Modbus Communications:

5. The unit shall accept an expansion card which enables it to communicate directly with devices utilizing Modbus RTU Protocol. A unit so configured shall be capable of "reading" and "writing" to 32, 64, or 96 data registers via Touch Tone Telephone. No modem or host computer shall be required. Interface shall consist of a single RS-232 Serial Cable.

Printer/Computer Communications:

6. The unit shall be equipped with a centronics parallel printer port, enabling the user to print alarm reports, download programming data, and generate scheduled status reports as required. Alternatively, the unit shall be able to accept an optional modular, plug-in asynchronous communications card to permit any of the following:

- ** Local Data Logging - Permits a single dialer to communicate with a local Serial printer to log routine status reports, alarm reports, and programming data.
- ** Central Data Logging - Permits one or more dialers to communicate with a single centrally located Serial printer equipped with a suitable modem to log routine status reports, alarm reports, and programming data.
- ** Data Acquisition and Control - Permits one or more dialers to communicate with a centrally located Computer/Printer System equipped with a SCADA software package, thereby functioning as a stand alone SCADA system.

Alarm and Inquiry Messages:

7. Upon initiating an alarm call, the system is to "speak" only those channels which are currently in "alarm status". Inquiry phone calls can be made directly to the unit at any time, for a complete status report.

Acknowledgement:

8. Alarms are acknowledged either by pressing a Touch Tone "9" as the call is being received, or by calling the unit back after having received an alarm call.

Nonvolatile Program Memory Retention:

9. User-entered programming and voice messages shall be kept intact, even during power failures or when all power has been removed, for up to ten (10) years. This shall be accomplished through inclusion in the system of a lithium battery separate from the unit's backup rechargeable gel cell battery.

Local and Remote Programming Capabilities:

10. The user may optionally elect to alter the following parameters from their standard normal default values via keyboard entry or remotely from any Touch Tone telephone.

- ** Alarm Response Delay: 0.1 to 999.9 seconds, with different delays being assignable to different alarms.
- ** Delay Between Alarm Call outs: 0.1 to 99.9 minutes.
- ** Alarm Reset Time: 0.1 to 99 hours, or "No Reset".
- ** Incoming Ring Response (Answer) Delay: 1 to 20 Rings.
- ** Number Of Message Repetitions: 1 to 20 Repetitions.
- ** Autocall Test: When enabled, the unit shall place a single round of test calls, both at the time this function is enabled, and also at regular subsequent intervals until this function is disabled.
- ** Remote System Microphone Activation.
- ** Remote Arming and Disarming of System.

Phone Line:

11. The dialer is to use a standard "dial-up" telephone line (direct leased line is not required), and is to be F.C.C. approved. Connection to the telephone is through a 4-pin modular jack (RJ 11).

Speakerphone:

12. The unit shall be capable of dialing any phone number on command and functioning as a speakerphone.

Real Time Clock:

13. The unit shall be equipped with a real time clock thereby making it possible to:

- ** Alarm Ready Schedule - The dialer shall be user programmable to follow a specific schedule of operations. This shall include the flexibility to set a weekday, weekend, and holiday schedule. With this feature the dialer shall arm and disarm itself according to the schedule programmed.
- ** In the event any of the printer configurations outlined in Section 6, are utilized, all alarm reports will be time and date stamped. Routine scheduled status reports can also be programmed.

Power/Battery Backup:

14. Normal power shall be 105-135 VAC, 15 watts nominal. The product is to contain its own gel cell rechargeable battery which is automatically kept charged when AC power is present. The system shall operate on battery power for a minimum of 20 continuous hours in the event of AC power failure. A shorter backup time shall not be acceptable. The built-in charger shall be precision voltage controlled, not a "trickle charger", in order to minimize recharge time and to maximize battery life available.

Integral Surge Protection:

15. All power, phone line, dry contact, and analog signal inputs shall be protected at the circuit board to IEEE Standard 587, category B(6,000 volts open circuit/3,000 amps closed circuit). Gas tubes followed by solid state protectors shall be integral to the circuit board for each line.

Technical/Customer Support:

16. All users shall be provided and/or shall have access to the following support resources.

- ** Each autodialer shall be shipped with a VHS Format Video Tape which details all features of the product and provides an in-depth step-by-step programming guide. A superficial marketing overview will not be acceptable.
- ** A Fax-on-Demand System which allows any user to call the manufacturer and retrieve copies of all technical information available directly into his own fax system. This service shall be available on a 24 hour basis.
- ** A toll free 800 number shall be available during manufacturer's normal working day to permit users to talk directly with technical service personnel and resolve problems not solved by either the Video Instruction Tape or the information provided via Fax-on-Demand.

Warranty:

17. The dialer shall be covered by a **FIVE (5) YEAR warranty covering parts and labor performed at the Factory.**

Additional Features: Sealed Switches, LED Indicators, Alarm Disable Warning, Talkthrough:

18. All keyboard and front panel switches shall be sealed to prevent contamination. Front panel LED's shall indicate: Normal Operation, Program Mode, Call in Progress, Status for each Channel, AC Power present, AC Power failure, and Low, Discharging, or Recharging Battery. On any inquiry telephone call, or On-Site status check, the voice shall provide specific warning if no dialout phone numbers are entered, or if the unit is in "alarm disabled" mode, or if AC power is off or has been off since last reset. A built-in microphone shall allow anyone at a remote site to listen to Local sounds and to have a two-way conversation with personnel at the dialer.

Miscellaneous Special Order Items:

19. The following options shall be available on specific order:

- ** Radio Communications Interface
- ** Various NEMA 4X (sealed) Enclosures
- ** Thermostatically Controlled Heater
- ** UL Approved Power Supply
- ** Cellulam Communications Systems

ATTACHMENT 2



Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#42914-03

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 4/28/14 @ 1:30 P.M.

Date and Time bypass/overflow ended: 4/29/14 @ 8:00 A.M.

Responsible/Affected facility: Hunters Hollow Lift Station #2

Location: Big Wood Ct. - Bullitt County

Cause of bypass/overflow: Due to very heavy rain and one of the station pumps burning up, it was necessary to start up a portable pump to keep the level down in the wet well and out of residential basements. The pump has been pulled and taken to Quality Electric for repair.

Estimated gallons of loss: 153,000

Environmental impact (what streams are impacted?): Pumping to a drainage ditch.

Method of cleanup: Operator raked up

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#42914-04**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 4/28/14 @ 1:35 P.M.

Date and Time bypass/overflow ended: 4/29/14 @ 3:15 P.M.

Responsible/Affected facility: Hunters Hollow Lift Station #1

Location: Blue Lick Road at Hillview Blvd.. – Bullitt County

Cause of bypass/overflow: Due to very heavy rain and the increased flow into this station it was necessary to start up the bypass pump to keep water out of residential basements.

Estimated gallons of loss: 216,000

Environmental impact (what streams are impacted?): Pumping to a drainage ditch.

Method of cleanup: None necessary

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#51114-01**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 5/10/14 @ 9:00 A.M.

Date and Time bypass/overflow ended: 5/11/14 @ 9:50 A.M.

Responsible/Affected facility: Hunters Hollow Lift Station #1 (Ziniz)

Location: Blue Lick Road at Hillview Blvd. – Bullitt County

Cause of bypass/overflow: Due to heavy rain and increased flow, it was necessary to start the bypass pump to keep water out of basements.

Estimated gallons of loss: 216,000

Environmental impact (what streams are impacted?): Drainage Ditch

Method of cleanup: None necessary

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#72814-02**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 7/27/14 @ 8:00 P.M. (Was found at this time)

Date and Time bypass/overflow ended: 7/28/14 @ 2:00 P.M.

Responsible/Affected facility: Hunters Hollow WWTP

Location: Blue Lick Road at Triangle - Bullitt County

Cause of bypass/overflow: Due to strong storms with very heavy rain the three plant pumps were not able to keep up with the incoming flow. It was necessary to start up a gasoline engine driven portable pump to assist the three pumps in getting caught up with the incoming flow into the plant wet well. This was absolutely necessary to keep water out of basements.

Estimated gallons of loss: 270,000

Environmental impact (what streams are impacted?): Trib. to Brooks Run

Method of cleanup: Yet to be determined. Will follow up with additional information.

Comments: The stream does need some cleaning and that is scheduled for Monday August 4th, 2014.

Notification received by:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#81814-01**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 8/17/14 @ 11:00 A.M.

Date and Time bypass/overflow ended: 8/17/14 @ 10:00 P.M.

Responsible/Affected facility: Hunters Hollow WWTP

Location: Blue lick Road at Triangle

Cause of bypass/overflow: Due to heavy rain the self priming pumps and the submersible pump could not keep up with the flow. So our serviceman had to start up a portable bypass pump to help keep water out of subdivision basements.

Note: On 8/18/14 servicemen hard piped the portable pump to the Veolia Actiflo plant.

Estimated gallons of loss: 132,000

Environmental impact (what streams are impacted?): Trib. to Brooks Run

Method of cleanup: Spread lime on effected area.

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#82914-01**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 8/29/14 @ 8:30 A.M.

Date and Time bypass/overflow ended: 8/29/14 @ 1:15 P.M.

Responsible/Affected facility: Hunters Hollow WWTP

Location: Blue Lick Road at Triangle

Cause of bypass/overflow: The Covered Bridge serviceman found that the wet well at the treatment plant lift station was full to overflowing. He worked on the pumps and worked with Veolia personnel to get the Actiflo plant to take more flow.

Note: Veolia personnel had to reprogram the computer for the Actiflo so that it would take more GPM.

Estimated gallons of loss: 75,000

Environmental impact (what streams are impacted?): Trib. to Brooks Run

Method of cleanup: Lime has been spread on the spill area.

Comments:

Notification received by:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#91114-01**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 9/11/14 @ 7:30 A.M.

Date and Time bypass/overflow ended: 9/11/14 @ 10:00 P.M.

Responsible/Affected facility: Hunters Hollow WWTP

Location: Blue Lick Road at Triangle – Bullitt County

Cause of bypass/overflow: Due to the very heavy rain the Veolia Actiflo plant could not keep up with the flow for a period of time until their personnel made adjustments to the system and computer so that it would keep up. The portable pump had to be disconnected from pumping to the Actiflo. --- Adjustments were made to the computer, to the necessary valves and the chemical fee so the Actiflo could handle more flow.

Estimated gallons of loss: 180,000

Environmental impact (what streams are impacted?): Trib. to Brooks Run Note: The creek was out of its banks early in the morning of the 11th.

Method of cleanup: Servicemen raked up solid material and disposed of same. Spread lime on effected area.

Comments:

Notification received by:

Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#92914-01

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 9/29/14 @ 1:00 A.M. (As observed by the temporary plant operator for Veolia Water)

Date and Time bypass/overflow ended: 9/29/14 @ 9:45 A.M.

Responsible/Affected facility: Hunters Hollow WWTP Lift Station

Location: Blue Lick Road at W. Triangle -- Bullitt County

Cause of bypass/overflow: The was a very heavy flow coming into the lift station and as reported by the Veolia operator the water was mudding looking and it came with such force that it overflowed the wet well. I was notified of the occurrence by Tim Schaeffer with Veolia at 9:32 A.M. I had my serviceman, Shawn Ford, there by 9:45 A.M. and he reported to me that there was not a bypass at that time and the wet well was pumped down to the normal level. He road around the subdivision to try an locate a possible source. He looked at both remote lift stations and it looked to him that whatever the substance was came through the #2 lift station because it still had a muddy look to it but he could not find where it came from. There were no contractors working in the area.

Estimated gallons of loss: 2,500

Environmental impact (what streams are impacted?): Trib. to Brooks Run (If anything reached the creek would have been minimal.)

Method of cleanup: Lime will be spread on the ground.

Comments:



Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#12414-01

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 12/4/14 @ 10:30 A.M.

Date and Time bypass/overflow ended: 12/7/14 @ 1:00 P.M.

Responsible/Affected facility: Hunters Hollow WWTP

Location: Blue Lick Road at Triangle

Cause of bypass/overflow: We were notified by Veolia that the Actiflo temporary plant was going to be out of service for a period of time so they could clean it out. It has gotten clogged up and will not let the effluent discharge.

Estimated gallons of loss: 784,000

Environmental impact (what streams are impacted?): Trib. to Brooks Run

Method of cleanup: The solid material was raked up and disposed of. Lime was spread on the effected area. Bullitt Septic Tank Service is cleaning the creek starting today, December 11, 2014.

Comments: Also note that on December 10, 2014 a structure was installed at the plant lift station, using bales of straw, to help prevent solids and floatables from entering the creek, should we experience any future bypasses.

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#122814-01**

TEMPO Incident ID#:

Revised 1/15/15

Notified by: Larry Smither

Date and Time bypass/overflow started: 12/28/14 @ 8:45 A.M.

Date and Time bypass/overflow ended: 12/28/14 @ 4:30 P.M.

Responsible/Affected facility: Hunters Hollow lift station #2

Location: Big Oaks – Bullitt County – Hunters Hollow Subdivision

Cause of bypass/overflow: Responded to an alarm call. Found that both lift pumps were stopped up and not pumping. Had to start up the bypass pump to keep water out of basements. Brought in the necessary equipment, pulled both pumps, cleaned, reinstalled and placed back in service.

Estimated gallons of loss: 54,000

Environmental impact (what streams are impacted?): Drainage ditch

Method of cleanup: As much as possible, the debris was raked up and disposed of. Lime was also spread on the effected area. We did have a vacuum truck on site on 2 different occasions to vacuum up the remaining solids but due to the extreme cold, most of it was frozen and the truck could not get it all. When it thaws, the truck will try again.

1/23/15 – Additional information – The frozen area did thaw and the solid material on the ground dried up. So instead of having the tank truck return, two of our servicemen on 1/22/15, using rakes, raked up the effected area completely and properly disposed of all the raked up material. They then spread additional lime on the overflow area. They also picked up all the trash around the site. Job is now complete for this event.

Comments:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#11515-02**

TEMPO Incident ID#:

Notified by: Called in by Shawn Ford at 2:00 P.M. on 12/30/14

Date and Time bypass/overflow started: 12/30/14 @ 12:30 P.M.

Date and Time bypass/overflow ended: 12/30/14 @ 7:30 P.M.

Responsible/Affected facility: Hunters Hollow Subdivision WWTP

Location: Blue Lick at Triangle – Bullitt County

Cause of bypass/overflow: We were notified by the operator of the Veolia – Actiflo plant that their filters were stopped up and couldn't take the flow being pumped to it. So the discharge hose from the portable pump and to be taken loose and placed in a bypass position. Note: This was being filtered thru a straw bale baracade. As soon as the Veolia operator had the filters clean the flow started going thru the temporary plants right away.

Estimated gallons of loss: 52,500

Environmental impact (what streams are impacted?): Tributary to Brooks Run

Method of cleanup: As much as possible, the debris was raked up and disposed of. Lime was also spread on the effected area. We did have a vacuum truck on site on 2 different occasions to vacuum up the remaining solids but due to the extreme cold, most of it was frozen and the truck could not get it all. When it thaws, the truck will try again.

1/23/15 – Additional information – The frozen area did thaw and the solid material on the ground dried up. So instead of having the tank truck return, two of our service people on 1/22/15, using rakes, raked up the effected area completely and properly disposed of all the raked up material. They then spread additional lime on the overflow area. Job is now complete for this event.

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#11515-03**

TEMPO Incident ID#:

Notified by: Called in by Shawn Ford at 5:55 P.M. on 1/3/15

Date and Time bypass/overflow started: 1/3/15 @ 5:15 P.M.

Date and Time bypass/overflow ended: 1/3/15 @ 10:20 P.M.

Responsible/Affected facility: Hunters Hollow Subdivision WWTP

Location: Blue Lick at Triangle – Bullitt County

Cause of bypass/overflow: Due to the rainy conditions, heavy flow and the portable pump not working properly. Some of the flow was being bypassed. Serviceman worked on the portable pump, got it working like it should and after a time the pumps were able to catch up with the flow.

Estimated gallons of loss: 18,750

Environmental impact (what streams are impacted?): Tributary to Brooks Run

Method of cleanup: As much as possible, the debris was raked up and disposed of. Lime was also spread on the effected area. We did have a vacuum truck on site on 2 different occasions to vacuum up the remaining solids but due to the extreme cold, most of it was frozen and the truck could not get it all. When it thaws, the truck will try again.

1/23/15 – Additional information – The frozen area did thaw and the solid material on the ground dried up. On 1/22/15 – two of our servicemen, using rakes, raked up the effected area completely and properly disposed of all the raked up material. They then spread additional lime on the overflow area. Job is now complete for the event.

Comments:

Larry PH. 693-8634
Smith

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification**

TEMPO Incident ID#:

Notified by (caller): Lawrence W Smither

Date and Time bypass/overflow started: 2/09/15 @ 5:00 am

Date and Time bypass/overflow ended: 2/09/15 @ 1:30 pm

Responsible/Affected facility: Hunters Hollow STP

Location: Bullitt County, Kentucky
Blue Lick Rd at Triangle Lane

Cause of bypass/overflow: Self priming pump stopped working; serviceman had to disassemble pump, make repairs, and place it back in service.

Estimated gallons of loss: 153,000

Environmental impact: Tributary of Brooks Run

Method of cleanup: Raked up and spread lime.

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#22415-01**

TEMPO Incident ID#:

Notified by: Larry Smither (Shawn Ford, serviceman, tried to call the bypass in on Saturday and Sunday, the 21st and 22nd, but could get no answer.)

Date and Time bypass/overflow started: 2/21/15 @ 2:30 P.M.

Date and Time bypass/overflow ended: 2/26/15 @ 9:00 A.M.

Responsible/Affected facility: Hunters Hollow WWTP

Location: Blue Lick Road @ W. Triangle – Bullitt County

Cause of bypass/overflow: Due to sleet, freezing rain, rain and melting snow the temporary plant could not keep up with the flow.

Estimated gallons of loss: 1,710,000

Environmental impact (what streams are impacted?): Trib. to Brooks Run

Method of cleanup: Raked up the solid material and trash on the ground and properly disposed of same. Spread lime on effected area.

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#30415-01**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 3/4/15 @ 10:00 A.M.

Date and Time bypass/overflow ended: 3/9/15 @ 10:30 A.M.

Responsible/Affected facility: Hunters Hollow WWTP Lift Station

Location: Blue Lick Road @ W. Triangle – Bullitt County

Cause of bypass/overflow: Very heavy rain. The pumps could not keep up with the flow, so a portable was used to keep the wet well down at a safe level to keep water out of basements.

Estimated gallons of loss: 1,800,000

Environmental impact (what streams are impacted?): Trib. to Brooks Run

Method of cleanup: Raked up as much of the trash as possible and disposed of same. Also spread lime on effected area.

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#30415-02**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 3/4/15 @ 10:15 A.M.

Date and Time bypass/overflow ended: 3/5/15 @ 4:00 P.M.

Responsible/Affected facility: Hunters Hollow Lift Station #2

Location: Bog Wood Way – Bullitt County

Cause of bypass/overflow: Very heavy rain. The lift station pump could not keep up with the flow, so a portable was set up to keep the wet well down at a safe level to keep water out of basements.

Estimated gallons of loss: 336,000

Environmental impact (what streams are impacted?): Drainage Ditch

Method of cleanup: None necessary

Comments:

Notification received by:

Notification date and time:

Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#30415-03

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 3/4/15 @ 12:45 P.M.

Date and Time bypass/overflow ended: 3/5/15 @ 3:00 P.M.

Responsible/Affected facility: Hunters Hollow Lift Station #1

Location: Blue Lick Road @ Hillview Blvd. – Bullitt County

Cause of bypass/overflow: Very heavy rain. The lift station pumps could not keep up with the flow, so the emergency bypass pump was started up to keep the wet well down at a safe level to keep water out of basements.

Estimated gallons of loss: 360,000

Environmental impact (what streams are impacted?): Drainage Ditch

Method of cleanup: None necessary

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#30915-01**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 3/7/15 @ 7:00 P.M.

Date and Time bypass/overflow ended: 3/11/15 @ 9:00 A.M.

Responsible/Affected facility: Hunters Hollow Lift Station #2

Location: Big Wood Way – Bullitt County

Cause of bypass/overflow: Due to heavy rain last week and now the melting snow, the lift station pump could not keep up with the flow, so a portable was set up to keep the wet well down at a safe level to keep water out of basements.

Estimated gallons of loss: Drainage Ditch

Environmental impact (what streams are impacted?): Drainage Ditch

Method of cleanup: None necessary

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#31315-01**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 3/13/15 @ 6:00 P.M.

Date and Time bypass/overflow ended: 3/15/15 @ 8:45 P.M.

Responsible/Affected facility: Hunters Hollow Lift Station #2

Location: Big Wood Way – Bullitt County

Cause of bypass/overflow: Due to heavy rain the lift station pump could not keep up with the flow, so a portable was set up to keep the wet well down at a safe level to keep water out of basements.

Estimated gallons of loss: 576,000

Environmental impact (what streams are impacted?): Drainage Ditch

Method of cleanup: Had a tank truck vacuum up what they could get. Then serviceman raked up and disposed of solid material and spread lime on the effected area.

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#31415-01**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 3/13/15 @ 7:45 P.M.

Date and Time bypass/overflow ended: 3/15/15 @ 8:30 A.M.

Responsible/Affected facility: Hunters Hollow Lift Station #1

Location: Blue Lick Road @ Hillview Blvd. – Bullitt County

Cause of bypass/overflow: Very heavy rain. The lift station pumps could not keep up with the flow, so the emergency bypass pump was started up to keep the wet well down at a safe level to keep water out of basements.

Estimated gallons of loss: 720,000

Environmental impact (what streams are impacted?): Drainage Ditch

Method of cleanup: Raked up the solid material and disposed of same. Also spread lime on the effected area.

Comments:

Notification received by:

Notification date and time:

**Environmental & Public Protection Cabinet
Department for Environmental Protection
Division of Water
Bypass/Overflow Notification
BPR#31515-01**

TEMPO Incident ID#:

Notified by: Larry Smither

Date and Time bypass/overflow started: 3/14/15 @ 5:30 A.M.

Date and Time bypass/overflow ended: 3/14/15 @ 4:00P.M.

Responsible/Affected facility: Hunters Hollow WWTP Lift Station

Location: Blue Lick Road @ W. Triangle – Bullitt County

Cause of bypass/overflow: Very heavy rain. The pumps could not keep up with the flow, so a portable was used to keep the wet well down at a safe level to keep water out of basements.

Estimated gallons of loss: 165,000

Environmental impact (what streams are impacted?): Drainage Ditch

Method of cleanup: Clean up information to follow

Comments:

Notification received by:

Notification date and time: