



Final Technical Memorandum

To: Glaré Sanchez, CSSA

From: Parsons Staff

CC: Chris Beal, Julie Burdey, Scott Pearson, file (746546.07000)

Date: September 14, 2010

Re: CSSA B-3 Extraction Well Construction Summary

This Technical Memorandum summarizes construction information for a new groundwater extraction well located within the Solid Waste Management Unit (SWMU) B-3 Bioreactor site in Camp Stanley Storage Activity (CSSA), Boerne, Texas.

INTRODUCTION

Parsons received a proposal to construct a groundwater extraction well for CSSA under U.S. Army Corps of Engineers - Fort Worth District, Contract W91278-06-D-0028, Task Order D011, Task 7 as part of the CSSA SWMU B-3 Bioreactor Treatability Study. Services were performed in accordance with TCEQ Rules and Regulations, and American Water Well Association standards.

PROJECT BACKGROUND AND OBJECTIVES

Between March and April 2009, Parsons constructed a water well within the SWMU B-3 site at CSSA (Figure 1) under scoped DO11 project tasks. The well was drilled by a licensed well service contractor, GeoProjects International (GPI) of Austin, Texas. Parsons installed the groundwater well at the SWMU B-3 treatability study for purposes of monitoring selected groundwater parameters and water levels, and to provide groundwater to the SWMU B-3 Bioreactor treatability study system. The well produces groundwater from the Middle Trinity Aquifer. Under normal conditions, this well can supplement and enhance current water demands of the treatment system. Well construction and surface completion meet or exceed local and state regulatory requirements.

WELL CONSTRUCTION

The SWMU B-3 groundwater extraction well (B3-EXW01) was constructed in the south end of SWMU B-3 on the east side of Trench 5. The drilling subcontractor mobilized to the site on March 18, 2009. B3-EXW01 was drilled directly at 10-inch diameter to 345 feet deep below ground surface (bgs), penetrating approximately 22 feet of basal Upper Glen Rose (UGR) Limestone and

advancing to the Lower Glen Rose (LGR) Limestone-Bexar Shale formational contact. Total depth was achieved on April 7, 2009. The next day the borehole was cleaned by surging and air-lifting. At this time, GPI estimated well yield at 20 gallons per minute (gpm).

Upon completion the borehole was surveyed by geophysical and camera logging (Attachment 1). No extraordinary geologic features (e.g., large fractures or faults) were observed. Significant water was seen entering the borehole at 21.8 feet bgs. This infiltration appeared to be several gpm and was believed to originate from the bioreactor trenches. Selection of casing depth was determined based on these geological logs. Drilling fluids were discharged into SWMU B-3 Trench 5 after passing over a small settling pit to remove majority of solids.

In order to maximize yield and promote closed-loop circulation between the bioreactor and the aquifer, 6-inch diameter PVC surface casing was installed to 199 feet. A series of shale traps were affixed to the terminus of the surface casing and assisted the grouting of the casing. Beginning with 120-gallon lifts, a Volclay grout mixture was slowly pumped into the annular space using a side-discharge tremie pipe. The grout was allowed to cure for more than 48 hours before any well development occurred. Surface casing closed off several shallow perched, water-bearing zones and infiltrating bioreactor water, consequently reducing estimated, sustainable well yield (under present drought conditions) to about 10 gpm. The well yield is expected to increase under more favorable hydrologic conditions. The well completion is diagrammed in Figure 2.

All investigation-derived media, including soil cuttings, drilling fluids, and purged groundwater was managed within the confines of SWMU B-3.

The extraction well was completed with a surface completion consisting of a 12'x12'x6" square concrete pad (Figure 3). The pad was constructed by Sanchez Contracting, Inc. of San Antonio, Texas, as a subcontractor to USA Environmental LP (USA) of New Braunfels, Texas. Subgrade conduit was constructed beneath the pad to accommodate well pump motor leads and control wiring (Figure 3). The wellhead is equipped with sample taps, pressure and flow gauges, a 2-inch by-pass connection, and flow control/isolation valves installed by GPI. No water quality samples were collected at this time, and the well was not chlorinated.

On May 11, 2009, GPI set a new 4-inch, 5-hp submersible pump (Grundfos model 40S50-15) on 2-inch galvanized steel column pipe at 338 feet bgs in the newly constructed well. Manufacturer information and specifications are included in Attachment 2. The pump operates using a single phase, 230-volt Franklin Electric electrical motor. The pump size was determined by analyzing water level data, aquifer characteristics derived from pumping tests conducted in previous years, and the potential dynamic head calculated for the system. The system has been designed to provide between 5 and 40 gpm to the B-3 water supply tank. Two check valves were inserted, one above the pump, and one between the eighth and ninth pipe joint at approximately 162 feet bgs.

USA installed 2-inch HDPE pipe from the wellhead system to the holding tank located on the north side of the bioreactor (Figure 1). The pipe runs above-grade to the tank. At the tank, USA converted the conveyance to 2-inch rigid PVC and constructed a manifold to introduce groundwater from the MW16-LGR/CC wells and the new extraction well.

Electrical Installation

The electrical distribution system was also extended to the well location. The supply well electrical controls and metering is protected by a metal housing structure recycled from the former SWMU B-3 SVE blower system. The structure encloses the electrical controls and power supply, SCADA equipment, and flow meters. It is bolted at the corners to the concrete pad. The Subcontractor provided 120/240V, single phase power to the extraction well in conformance with NFPA 70. Figure 1 shows the location of the existing overhead electrical utility, and the new extension to the new groundwater well and controls structure.

Two utility poles were installed to extend the electrical distribution to the new groundwater well. The wire originates at an existing utility pole with existing 4,160 Primary/ 240 Volt secondary transformers and runs to a new offset pole, then spans 225 feet of remediation test cells to the well site. There was limited opportunity for placing a pole within the treatment unit; therefore, only a single span across the area was extended. The new utility poles are equipped with hardware, guy wires, 8000-lb downguy anchor assemblies, supporting materials, grounding conductors and plate. The end utility pole at the supply well is 51 feet from the wellhead.

One run of two #4 ACSR aerial conductors was installed. The secondary cables are aluminum/copper, triplex, with cross-linked polyethylene insulation on the phase conductors. One 50-KVA pole-type transformer complete with one 100 amp fused-open-cutout, one 3KV lightning arrester, jumpers, and hardware on the new pole at well site.

The utility pole located closest to the wellhead is equipped with a riser and weatherhead. The service entrance conductors are routed 2 feet underground from the utility pole to the equipment housing structure in 2-inch diameter Schedule 80 PVC conduit.

The existing housing structure was also already equipped with a 200-amp, 4-wire service panel. The subcontractor wired the service panel to the external safety switch to provide 120/240-volt single phase power, and included a double-pole breaker for operating a 60-amp/240-volt motor and single-pole breakers for the 20-amp/120-volt Remote Telemetry Unit (RTU) panel (to be installed later under separate contract), and existing 15-amp/120-volt utility outlet and light fixture.

Equipment Installation

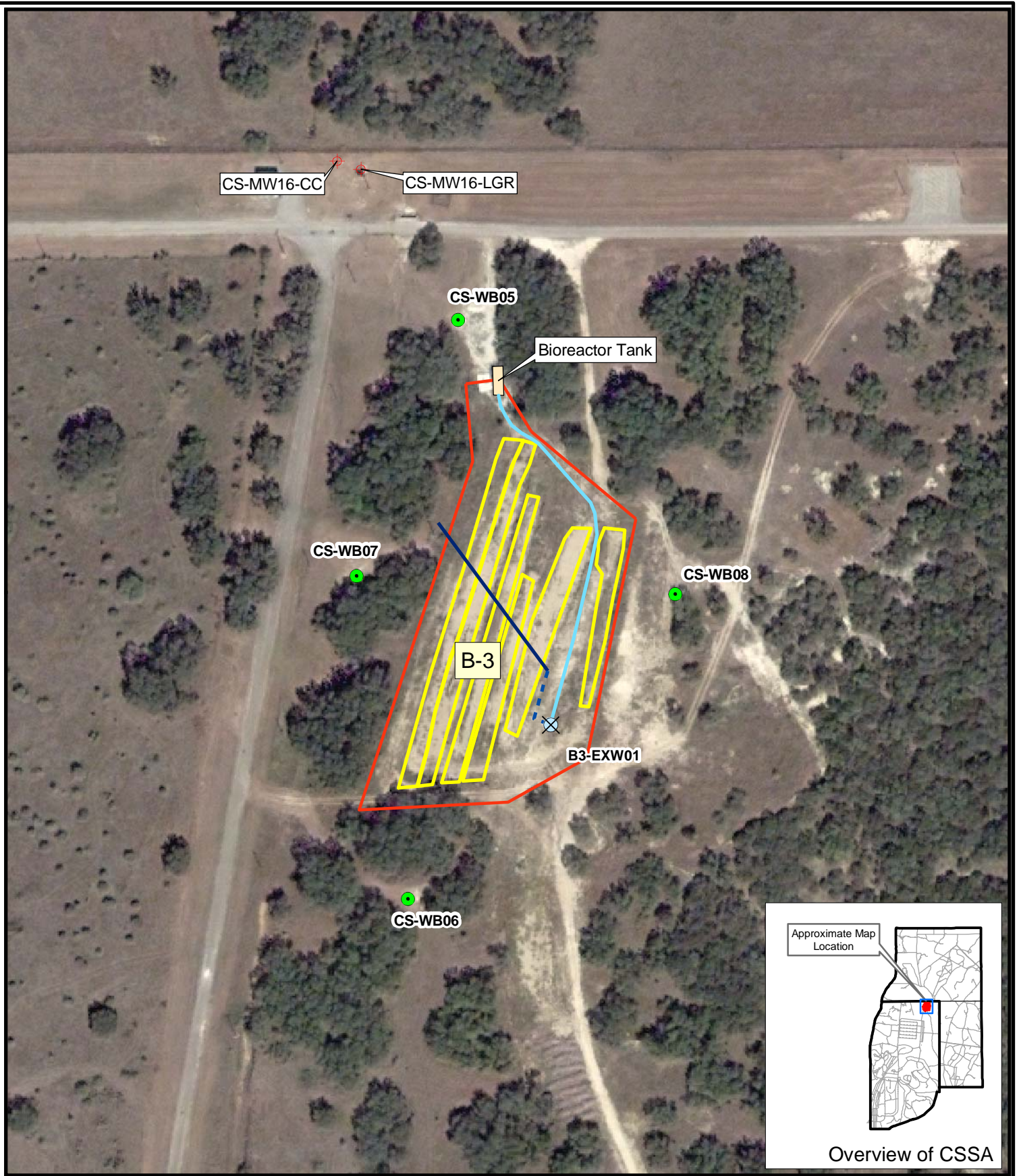
To assist in the operation of the well, a SymCom Model 235P PumpSaver Plus[®] was installed by GPI in July 2009. The PumpSaver module is installed with the

motor control panel and protects the submersible pump from adverse electrical conditions such as under/over voltage and/or current, as well as running the pump dry. At its current settings, the PumpSaver module de-energizes the pump when the water level is within 15 feet of the pump, and re-starts the well after a 50-minute recovery period. In this configuration, the well EXW-01 can pump automatically to the Bioreactor storage tank for distribution to the trenches without the aid of the SCADA system.

However, the well was fully incorporated into SWMU B-3 automation system in January 2010. The well was equipped with an Endress+Hauser (E+H) FMX167 WaterPilot transducer to report the water level in the well to the SCADA system. A spare (E+H) Prowirl 72F flowmeter was also installed on the discharge piping to measure the flowrate and total discharge from the well (Figure 3). Both instruments have 4-20 milliamp (mA) output to provide the SCADA system operation with accurate water level and discharge measurements. These instruments are connected to a Remote Telemetry Unit (RTU) that wireless transmits this information and receives operational pumping commands from the GAC Shack RTU, where the Bioreactor automation is centralized. The operators also manually monitor the amount of groundwater produced from the well as part of their routine Bioreactor Operation and Maintenance (O&M).

The actuation of the well is based upon the demand of the 5000-gallon storage tank at the north end of the Bioreactor. As the tank empties water into the Bioreactor trenches, it wirelessly calls upon all the extraction wells to convey water until the tank is filled. More information regarding the operation of the extraction wells can be found in the ***"B-3 Bioreactor Operations & Maintenance Manual"*** in ***Treatment Technologies and Treatability Studies (Volume 4) of the CSSA Environmental Encyclopedia.***

Attachment 2 includes manufacturer information on the installed equipment.



Aerial Photo Date: 2008



150 75 0 150 Feet

- EXW-01
- Westbay Wells
- Water Well Locations
- Trenches
- SWMU Boundary
- Overhead Power (~215')
- Underground 240 Volt Power (~50')
- 2" HDPE Discharge Line

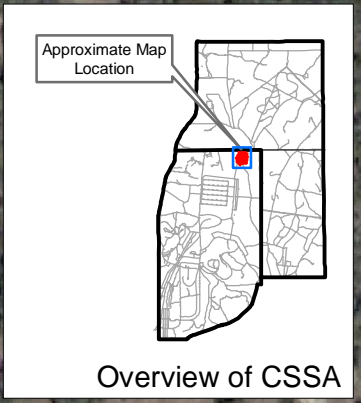


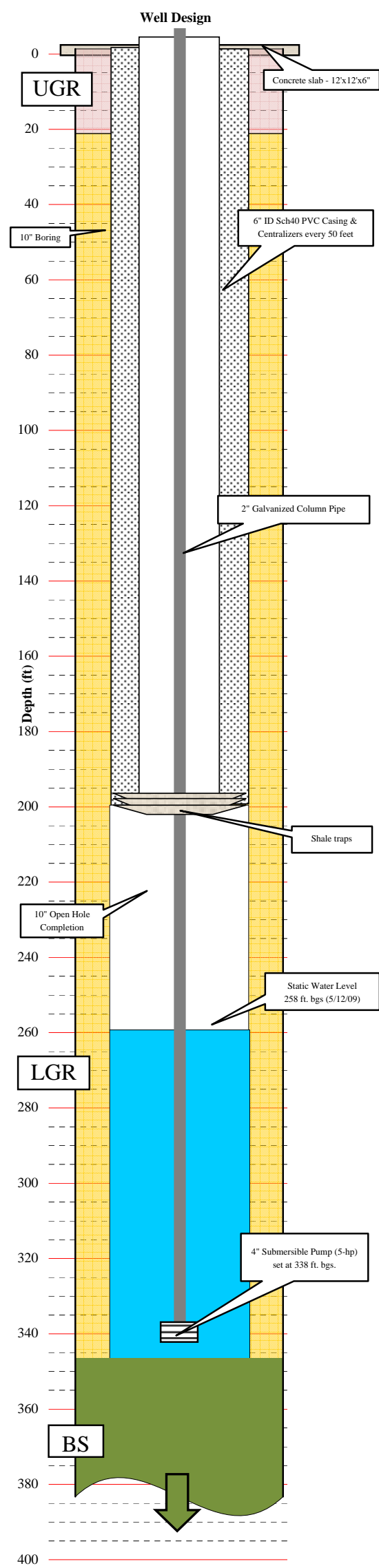
Figure 1

**EXW-01 Extraction Well
Electrical Service and Water Distribution
Camp Stanley Storage Activity**

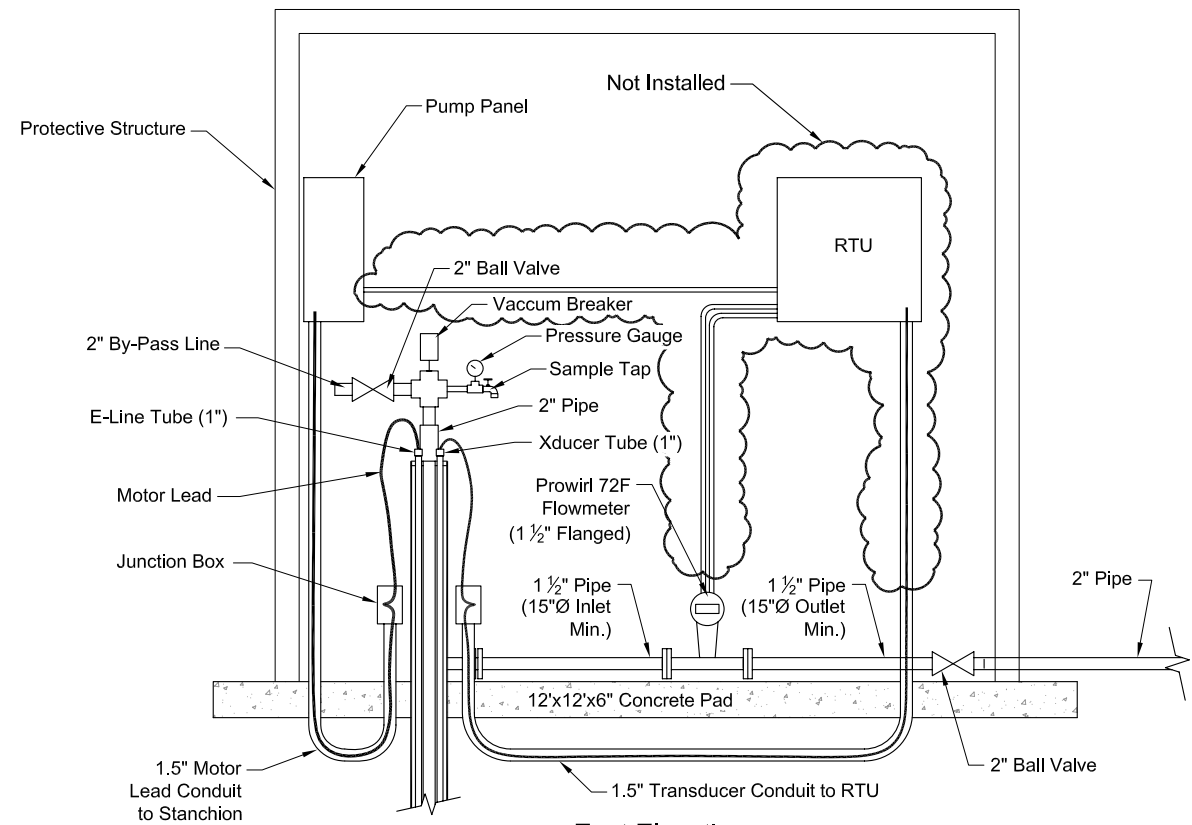
PARSONS

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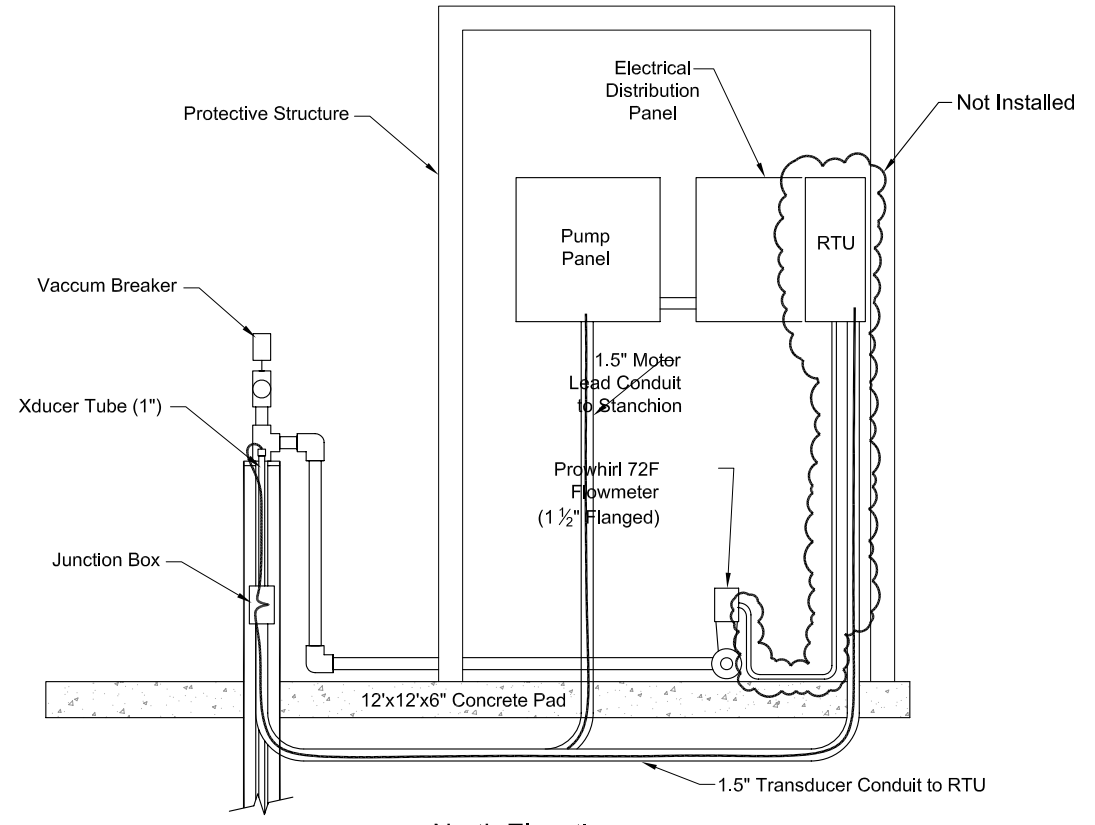
Figure 2
SWMU B-3 Groundwater Extraction Well B3-EXW01
General Construction Design
Camp Stanley Storage Activity - Boerne, TX



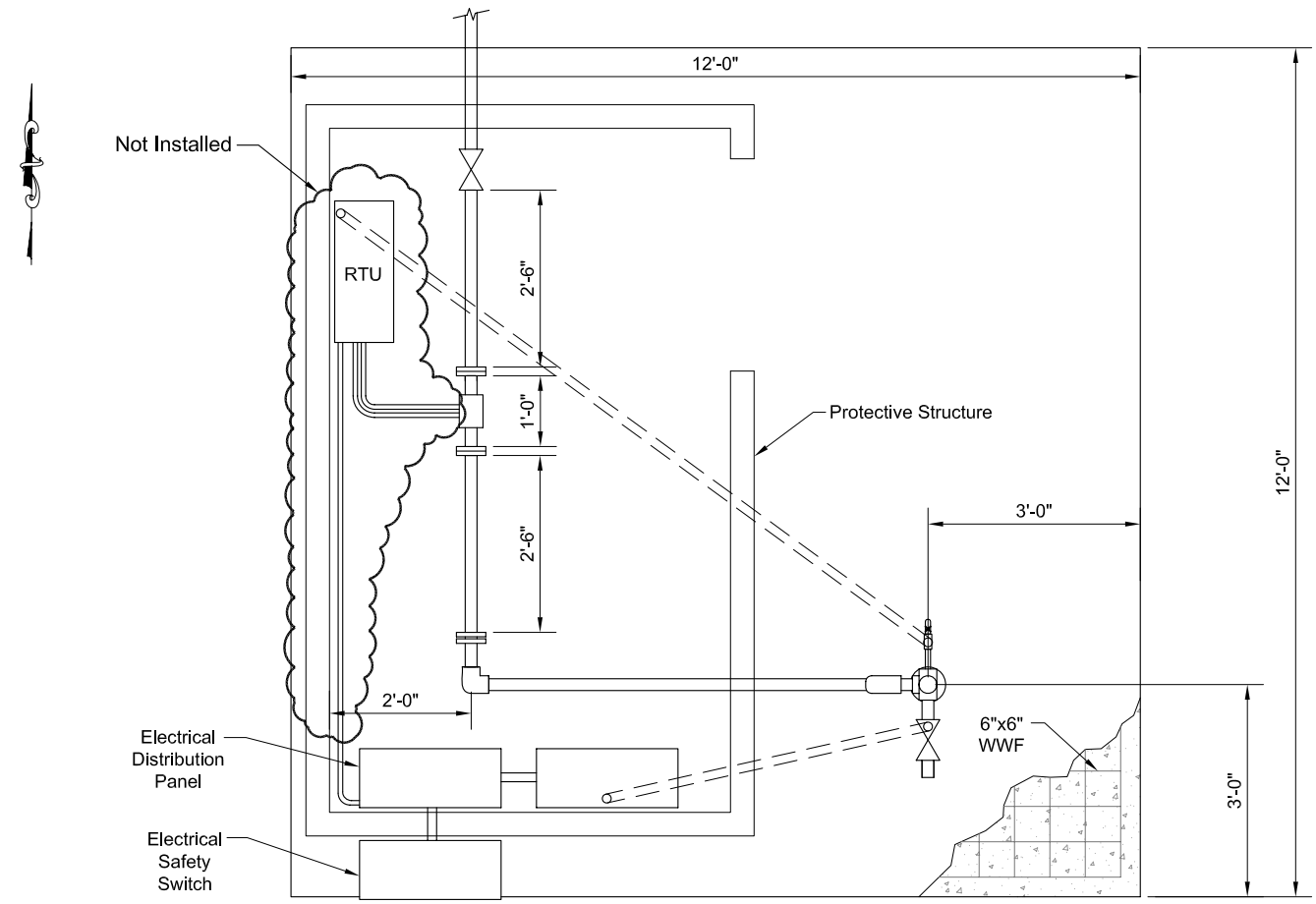
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East Elevation
Scale: 3/8"=1'-0"



North Elevation
Scale: 3/8"=1'-0"



Plan
Scale: 3/8"=1'-0"

Figure 3
B-3 Extraction Well EXW-01
Surface Completion Design
Camp Stanley Storage Activity

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ATTACHMENT 1

State of Texas Well Report Geophysical Log Borehole Video (DVD)

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Water Well Logging & Video Recording Services

Geo Cam, Inc. 126 Palo Duro, San Antonio, TX 210-495-9121

Borehole: B-3

Logs: GAMMA, RESISTIVITY, CALIPER, SP, SPR

Project: CAMP STANLEY B-3 SUPPLY WELL

Date: 04-20-09

Client: GEO PROJECTS

County: BEXAR

Location: N 29° 42' 33.6" W98° 36' 49.8"

State: TX

Drilling Contractor: GEO PROJECTS

Driller T.D. (ft) : 340

Elevation: 1232' GPS

Logger T.D. (ft) : 340

Depth Ref: G.L.

Date Drilled: APRIL 2009

BOREHOLE DATA

BIT RECORD			CASING RECORD			
RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	10"	0	340	NONE		
2						
3						

Drill Method: AIR ROTARY

Weight:

Fluid Level (ft) : 221

Hole Medium:

Mud Type:

Time Since Circ:

Viscosity:

Rm:

at:

Deg C

Logged by: Kelly Tuten

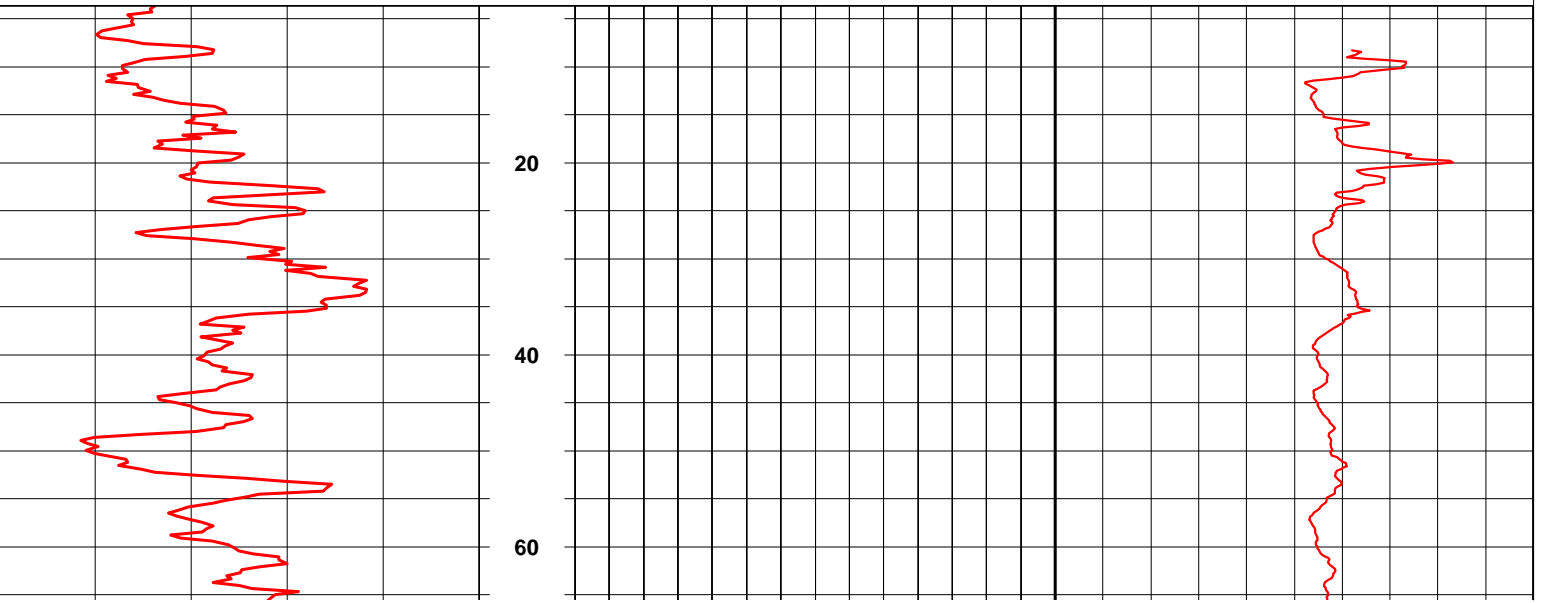
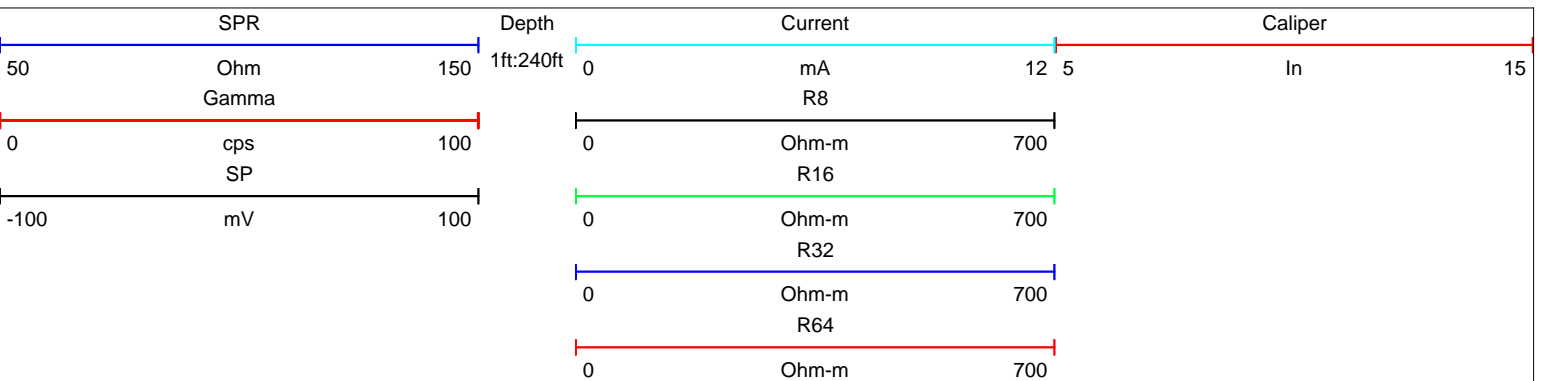
Unit/Truck: 05

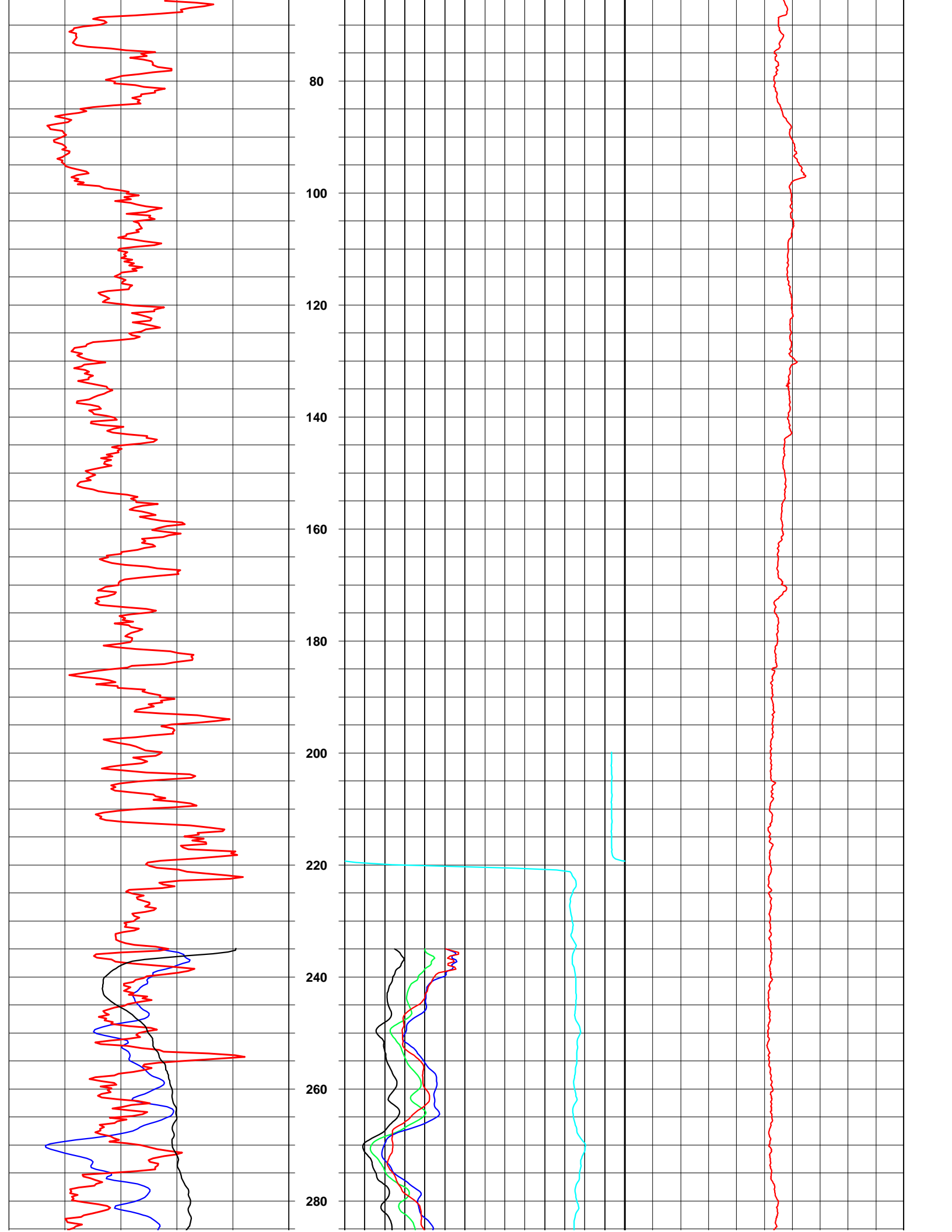
Witness: Michael Miller

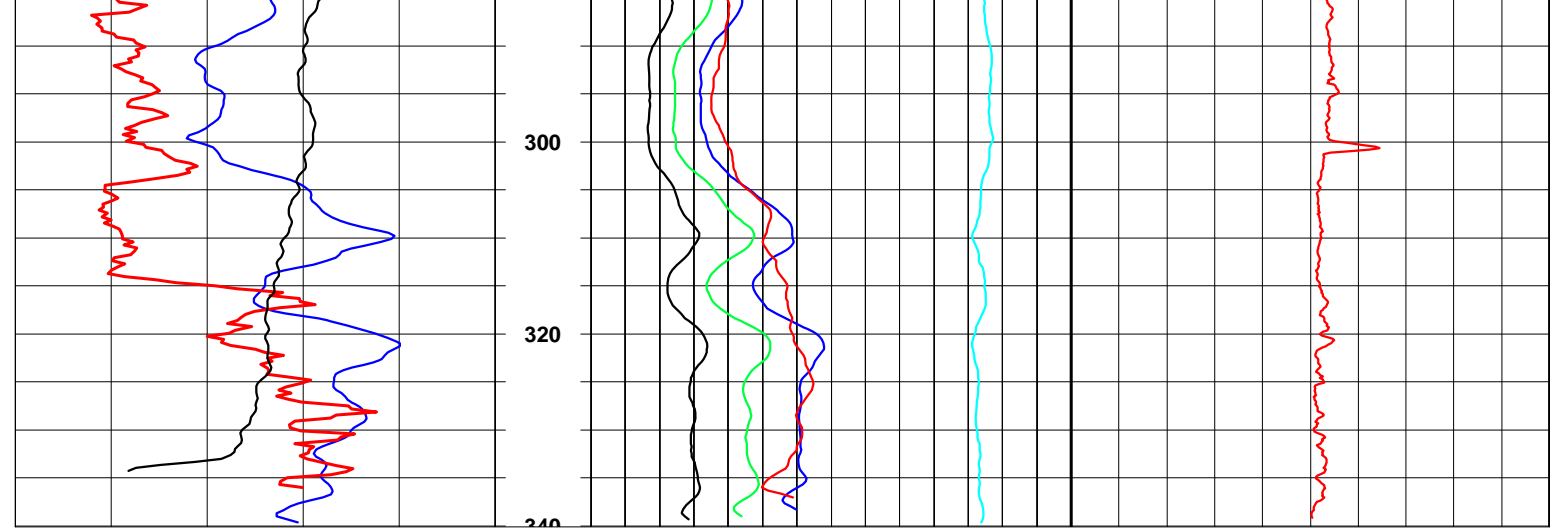
LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./IN.
GAMMA	2	20	336	4	20
RESISTIVITY, SP, SPR	2	20	338	235	20
CALIPER	1	20	339	8	20

Comments:

GENERAL DATA







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STATE OF TEXAS WELL REPORT for Tracking #178924

Owner:	U. S. Government	Owner Well #:	B3-XW01
Address:	25800 Ralph Fair Rd. Boerne , TX 78015	Grid #:	68-20-1
Well Location:	Camp Stanley Storage Facility Boerne , TX 78015	Latitude:	29° 42' 33" N
Well County:	Bexar	Longitude:	098° 36' 49" W
Elevation:	No Data	GPS Brand Used:	Garmin
<hr/>			
Type of Work:	New Well	Proposed Use:	Monitor

Drilling Date: Started: **3/19/2009**
Completed: **5/5/2009**

Diameter of Hole: Diameter: **10 in From Surface To 345 ft**

Drilling Method: **Air Rotary**

Borehole Completion: **Open Hole**

Annular Seal Data: 1st Interval: **From 0 ft to 3 ft with 3 portland (#sacks and material)**
2nd Interval: **From 3 ft to 130 ft with 33 bent/volclay (#sacks and material)**
3rd Interval: **From 130 ft to 197 ft with 20 bentonite (#sacks and material)**
Method Used: **Tremie and surface pour**
Cemented By: **Geoprojects International, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: Static level: **258.5 ft. below land surface on 5/5/2009**
Artesian flow: **No Data**

Packers: **Combined 5 Rubber shale Traps From 197' to 199.5'**

Plugging Info: Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality: Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information: **Geoprojects International, Inc.**
8834 Circle Drive
Austin , TX 78736

Driller License Number: **2525**

Licensed Well Driller Signature: **Lee Gebbert**

Registered Driller Apprentice Signature: **No Data**

Apprentice Registration Number: **No Data**

Comments: **Annular Seal additional info.**
0 to 3' 3 sacks portland
3' to 13' 13 sacks 3/8 bentonite chips
13' to 14' 10 sacks portland
14' to 130' 20 sacks Volclay
130' to 197' 23 sacks 3/8 bentonite chips.

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking number (Tracking #178924) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	23'	Upper Glen Rose, yellow weathered limestone
23'	343'	Lower Glen Rose, Brown to grey limestone
343'	345'	Baxer shale

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
New 6"	Certa-loc	SCH 40 PVC Casing	from + 4' to 199.5'

ATTACHMENT 2

EQUIPMENT INFORMATION

Grundfos Model 40S50-15 Submersible Pump

SymCom Model 235P PumpSaver Plus

Endress+Hauser ProWhirl 72F

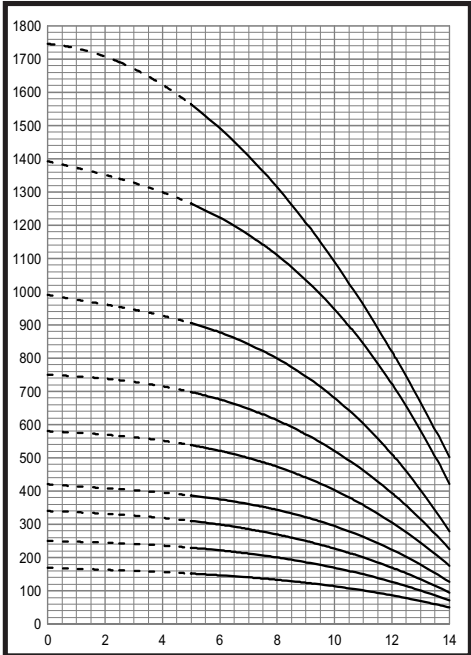
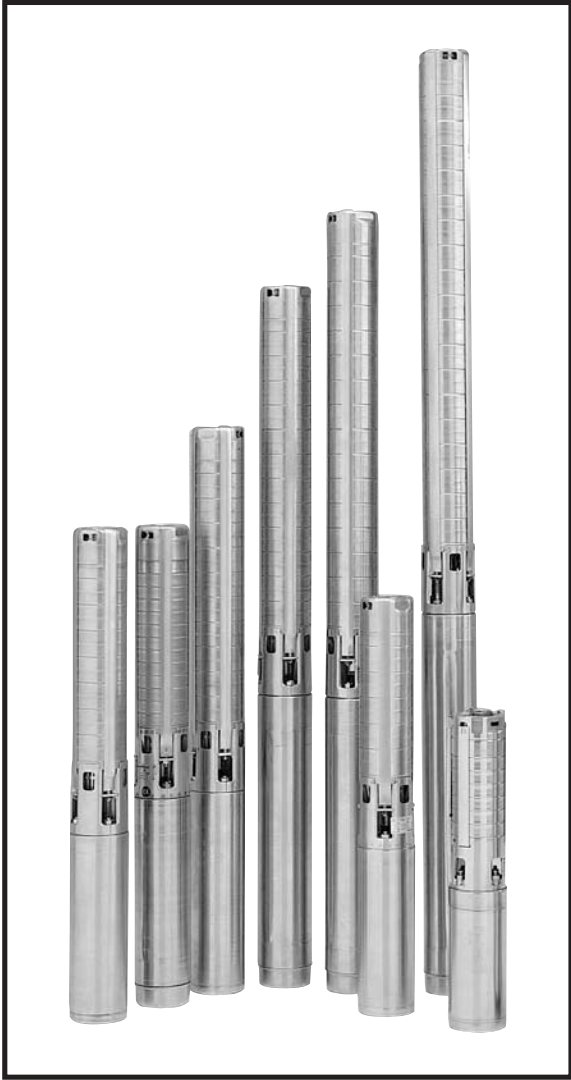
Endress+Hauser WaterPilot FMX167

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Easy Selection Chart

Performance Curves and Technical Data

4-Inch Submersible Pumps



Performance Curves



Materials of Construction

Grundfos Stainless Steel Submersible Pumps

4" Submersible Easy Selection Charts.

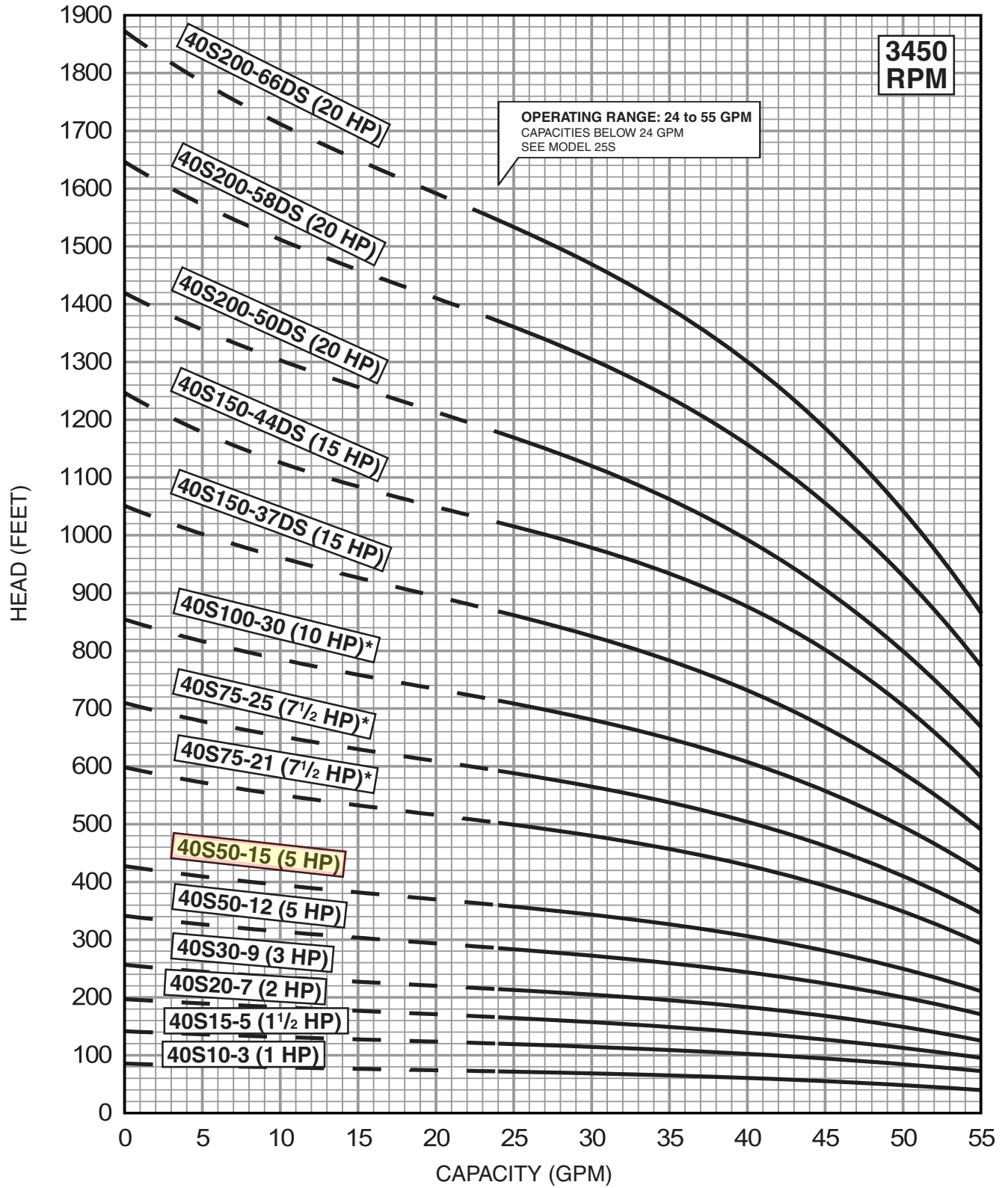


See 10S performance curves for higher head models.
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

FLOW RANGE: 24 - 55 GPM

OUTLET SIZE: 2 " NPT

NOMINAL DIA. 4"



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

4" MOTOR STANDARD, 1-10 HP/3450 RPM.
6" MOTOR STANDARD, 15-20 HP/3450 RPM.

* Also available with 6" motor.

Performance conforms to ISO 9906: 1999 (E) Annex A
Minimum submergence is 5 feet.

DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
40S10-3	A	1	4"	2" NPT	24.6	11.8	12.8	3.8	3.9	32
40S15-5	A	1 1/2	4"	2" NPT	29.7	13.6	16.1	3.8	3.9	37
40S20-7	A	2	4"	2" NPT	34.5	15.1	19.4	3.8	3.9	41
40S30-9	A	3	4"	2" NPT	43.3	20.6	22.7	3.8	3.9	65
40S50-12	A	5	4"	2" NPT	51.3	23.6	27.7	3.8	3.9	78
40S50-15	A	5	4"	2" NPT	56.2	23.6	32.6	3.8	3.9	84
40S75-21*	A	7 1/2	4"	2" NPT	74.6	29.6	45.0	3.8	3.9	120
40S75-25*	A	7 1/2	4"	2" NPT	81.2	29.6	51.6	3.8	3.9	124
40S100-30*	A	10	4"	2" NPT	103.7	43.9	59.8	3.8	3.9	181
40S150-37DS	A	15	6"	2" NPT	99.5	28.0	71.5	5.4	5.4	244
40S150-44DS	A	15	6"	2" NPT	111.0	28.0	83.0	5.4	5.4	340
40S200-50DS**	B	20	6"	2" MPT	136.0	30.6	105.4	5.4	5.5	319
40S200-58DS**	B	20	6"	2" MPT	149.2	30.6	118.6	5.4	5.5	334
40S200-66DS**	B	20	6"	2" MPT	162.4	30.6	131.8	5.4	5.5	394

NOTES: All models suitable for use in 4" wells, unless otherwise noted.
 Weights include pump end with motor in lbs.
 * Also available with 6" motor.
 ** Built into sleeve 2" MPT discharge, 6" min. well dia.

MATERIALS OF CONSTRUCTION

COMPONENT	CYLINDRICAL SHAFT (3-44 Stgs.)	DEEP SET (50-66 Stgs.)
Check Valve Housing	304 Stainless Steel	304 Stainless Steel
Check Valve	304 Stainless Steel	304 Stainless Steel
Diffuser Chamber	304 Stainless Steel	304 Stainless Steel
Impeller	304 Stainless Steel	304 Stainless Steel
Suction Interconnector	304 Stainless Steel	304 Stainless Steel
Inlet Screen	304 Stainless Steel	304 Stainless Steel
Pump Shaft	431 Stainless Steel	431 Stainless Steel
Straps	304 Stainless Steel	304 Stainless Steel
Cable Guard	304 Stainless Steel	304 Stainless Steel
Priming Inducer	304 Stainless Steel	304 Stainless Steel
Coupling	316/431 Stainless Steel **	329/ 416 Stainless Steel
Check Valve Seat	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Top Bearing	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Impeller Seal Ring	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Intermediate Bearings	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Shaft Washer	LCP (Vectra®)	LCP (Vectra®)
Split Cone	304 Stainless Steel	304 Stainless Steel
Split Cone Nut	304 Stainless Steel	304 Stainless Steel
Sleeve	Not Required	316 Stainless Steel
Sleeve Flange	Not Required	304 Stainless Steel

NOTES: Specifications are subject to change without notice.
 Vectra® is a registered trademark of Hoechst Calanese Corporation.
 *Stainless Steel option available.

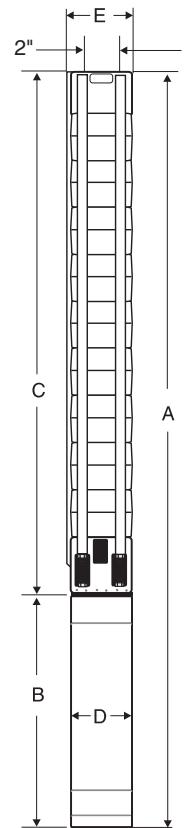


Fig. A

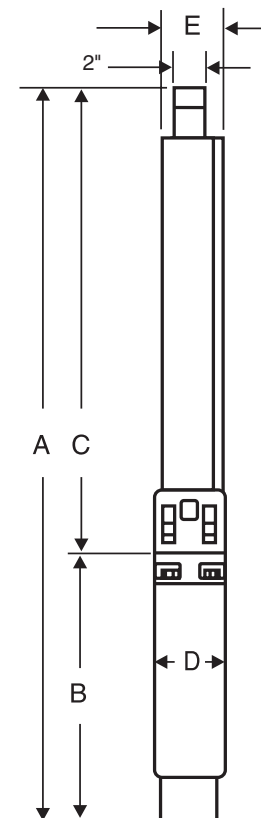


Fig. B

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SINGLE-PHASE PUMPSAVER CATALOG



Having issues with your SymCom product?
Call our **Technical Support Team** with
your questions.

800-843-8848
technicalsupport@symcom.com

To Our Customers:

Many times, issues with a product are the result of an incorrect setting. By calling us, SymCom's Technical Support Team, the issue can be eliminated. With our experienced staff, we can go over the settings with you to ensure that everything is set correctly. We are well versed in all products and applications for SymCom products. Chances are, we have run into your issue before.

The best way to fix an issue is to have you at the unit when you call, that way, we can make sure that all issues are fixed the first time. In the event that we determine your unit is not functioning properly, we will issue you a return material authorization (RMA) number to send the unit in for evaluation. If the unit is determined to be faulty and covered under warranty, we will replace the unit at no charge to you. No need to contact your distributor for a replacement. A new unit will be sent to you directly if it is covered under warranty.

So call our friendly support staff today for any and all of your questions regarding your SymCom products.

Best Regards,

SymCom Technical Support Team

Note: The use of flow restrictors, unusually high head pressures, or low water conditions at the time of calibration may interfere with the detection of dead-head and dry-well conditions.

5 - 15hp, 230VAC - Model 235P



SymCom's Model 235P PumpSaver®Plus is designed to protect 5-15 hp, 230V, single-phase pumps from dry-well, dead-head, jammed impeller and overvoltage and undervoltage conditions.

A calibration adjustment allows the Model 235P to be calibrated to your specific pumping applications, thereby reducing the possibility of false or nuisance tripping. A unique microcontroller-based voltage and current-sensing circuit constantly monitors the incoming power for fluctuations causing overcurrent and undercurrent. When an abnormality, such as loss of suction is detected, the PumpSaver®Plus deactivates its output relay and directly disconnects the pump motor.

The PumpSaver®Plus communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults. An IR Kit-12 (12" fiber optic kit) allows the Informer to access these parameters even when the PumpSaver®Plus is enclosed in a control box. This is valuable for troubleshooting the pump while it is running.

An external current transformer is required for operation (sold separately).

Size	Current	CT*
5 - 7½ HP	27.5 - 42.1	50:5
10 HP	51	75:5
15 HP	75	100:5

NOTE: The PumpSaver®Plus models have a sensitivity adjustment for the dry-well trip point. After calibration is done, you can adjust the sensitivity for the dry-well/dead-head trip point from 70-90% of the full load. This makes the unit even more adaptable to varying pumping applications. If you have a very low producing well, you increase the sensitivity closer to the 90% mark, or if you have a very heavy producing well, you would decrease the sensitivity around the 70% mark.

Specifications

Functional Specifications	
Adjustments/Settings	
Overcurrent	125% of calibration point
Underload (dry-well)	Adjustable (70 to 90% of calibrated run power)
Overvoltage	265VAC
Undervoltage	190VAC
Number of restarts allowed in a 60-sec. period (rapid-cycling)	4
Trip Delay Times	
Overcurrent	5 seconds
Dry-well	4 seconds
Restart Delay Times	
Over/undervoltage	2 seconds
All other faults	Manual, 2-225 Minutes
Input Characteristics	
Supply Voltage	230VAC
Load Range	5 - 15 hp
Frequency	50/60Hz (Note: 50Hz will increase all delay timers by 20%)
Output Characteristics	
Output Contact Rating-SPST	A300, 720VA@240VAC (10 amps max.)
General Characteristics	
Operating Temperature	-40° to 55° C (-40° to 131° F)
Maximum Input Power	5 W
Wire Gauge	Solid or Stranded 10 - 22AWG
Terminal Torque	13 in.-lbs.
Standards Passed	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 2, 4kV contact, 6kV air
Surge Immunity	IEC 61000-4-5, Level 4, 4kV line-to-line and line-to-ground
Safety Marks	
cUL Listed	UL508, C22.2 No. 14
Dimensions	5.26" W x 2.93" H x 2.90" D
Weight	14 oz.
Mounting Methods	#8 screws

For a typical wiring diagram see page 35.

For installation instructions see page 36.

For product dimensions see page 54.

How to order:

235P* (5 - 15hp, 230VAC)

* current transformer sold separately



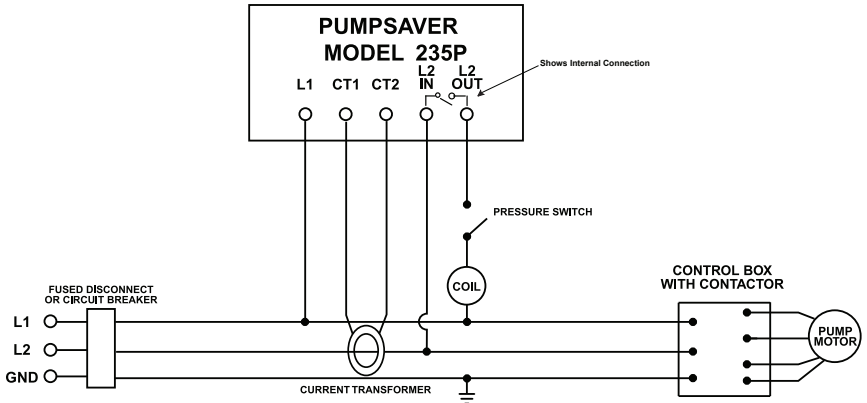
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...your electronic control & protection specialists

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5 - 15hp, 230VAC - Model 235P
 TYPICAL WIRING DIAGRAM



Model 235P

Size	Current	CT*
5 - 7½ HP	27.5 - 42.1	50:5
10 HP	51	75:5
15 HP	75	100:5

* external current transformers sold separately

PUMPSAVER®PLUS

INSTALLATION INSTRUCTIONS

The PumpSaver®Plus INSIDERS fit inside 1/3 – 3hp, 230V Franklin™, Pentek®, Grundfos® or CentriPro™ control boxes. PumpSavers are designed to protect single-phase pumps from dry-well, dead-head, rapid-cycling, jammed impeller, and over/undervoltage conditions. Typical applications include residential waterwells, commercial waterwells, irrigation wells, and golf course and other sprinkler systems.

CONNECTIONS

(INSIDERS)

Refer to specific connection instructions depending on the particular control box being used:

Grundfos® control box	- page 28
Pentek® control box	- page 31
Franklin™ control box	- page 32
CentriPro™ control box	- page 33

(111P / 233P / 235P)

NOTE: Use in conjunction with UL listed or recognized thermal or solid-state overload relays only.

1. Mount the PumpSaver®Plus Model 111P / 233P / 235P in a convenient location in or near the pump control box. If the location is wet or dusty, a NEMA 3R, 4 or 12 enclosure should be used.
2. Refer to Typical Wiring Diagram for 111P / 233P / 235P on pages 34 and 35.

NOTE: For Model 235P, one line from the fused disconnect must pass through the current transformer.

The Model 235P will NOT function without an external CT (sold separately).

NOTE: If the Model 235P immediately trips out upon completion of the calibration process, the current transformer may be installed incorrectly. Switch the CT1 and CT2 connections at the unit, then repeat the calibration process.

CALIBRATION / RESTART DELAY

(INSIDERS)

1. Turn RESTART DELAY/CALIBRATION to the CAL position and close the box cover.
2. Apply power to the system. The pump should run for approximately 10 seconds and then shut off – this indicates the INSIDER has calibrated.
3. Remove power from the system. Open the control box and set the appropriate dry-well recovery time with the RESTART DELAY / CALIBRATION knob.
4. Shut the control box and re-apply power to the system.

(111P / 233P / 235P)

NOTE: The Model 111P / 233P / 235P should be calibrated during normal pumping conditions.

1. Turn the RESTART DELAY/CALIBRATION knob fully counter-clockwise to the CAL. position.
2. Apply power- the pump will run for approximately 10 seconds then shut off.
3. Set the RESTART DELAY/CALIBRATION knob to the desired restart delay (dry-well recovery time) - the pump will turn on.

CALIBRATING WHILE PUMPING

The Model 111P / 233P / 235P can also be calibrated while the pump is running. Turn the RESTART DELAY/CALIBRATION knob to CAL. while pumping. Wait for the pump to turn off (approx-



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PUMPSAVER®PLUS INSTALLATION INSTRUCTIONS

mately 10 seconds), then adjust the RESTART DELAY/CALIBRATION knob to the desired setting.

MANUAL RESET MODE (111P / 233P / 235P only)

Set the RESTART DELAY/CALIBRATION knob to RESET for manual reset mode. If the 111P / 233P / 235P trips off due to a voltage or load problem, the RESTART DELAY/CALIBRATION knob must be rotated out of the RESET position to restart the pump, and then can be placed back in the RESET position for subsequent manual reset mode.

NOTE: Any restart delay can be bypassed by rotating the RESTART DELAY/CALIBRATION knob to the RESET position and back to the desired restart delay setting.

NOTE: The restart delay can be changed at any time. The next trip will follow the new restart delay setting.

OPERATION

The PumpSaver®Plus units monitor pump loads in amps and kilowatts. When the current (amps) exceeds approximately 125% of calibrated current, or power (kW) drops below the adjustable underload trip point, the PumpSaver®Plus units –after the trip delay– will turn off the pump. The PumpSaver®Plus units will automatically restart the pump after the selected restart delay time (unless in the manual reset mode).

The calibration is stored in permanent memory. The PumpSaver®Plus does not need to be recalibrated if power is lost.

SENSITIVITY

The PumpSaver®Plus units have an adjustment knob to set the underload trip sensitivity. Setting SENSITIVITY to the middle position (straight up) is equivalent to SymCom's standard underload trip level. Adjust the SENSITIVITY knob to increase/decrease underload sensitivity up to approximately $\pm 10\%$ of the standard trip. It may be necessary to increase the sensitivity if the PumpSaver®Plus does not trip on dry-run or dead-head or it is known that the water level in the well is very low relative to the pumps capabilities.

WARNING: Decreasing the SENSITIVITY may compromise the PumpSaver's ability to detect dry-run and/or dead-head conditions.

RUN HOURS

The PumpSaver®Plus units record pump run hours. Run hours can be displayed by a PumpSaver®Plus Informer. Run hours can be reset on the PumpSaver®Plus units. –please read the instruction fully before performing the procedure.

NOTE: Turn the SENSITIVITY knob completely to the left (counter-clockwise) or completely to the right (clockwise) when directed.

WARNING: ENSURE POWER IS APPLIED TO THE INSIDERS IN A SAFE MANNER WHEN PERFORMING THE FOLLOWING PROCEDURE.



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PUMPSAVER®PLUS

INSTALLATION INSTRUCTIONS

To Reset Run Hours:

1. Remove power to the PumpSaver®Plus.
2. Set the RESTART DELAY/CALIBRATION knob to RESET and the SENSITIVITY knob to the middle (12:00) position.
3. Apply power to the PumpSaver®Plus – the CAL. LIGHT will turn on.
4. Turn the SENSITIVITY knob to the right – the CAL. LIGHT will turn off and the RUN LIGHT will turn on.
5. Turn the SENSITIVITY knob to the left – both lights will turn on.
6. Turn the SENSITIVITY knob to the right.
7. After 10 seconds, the CAL. and RUN LIGHTS will blink twice indicating the run hours have successfully been reset.

RAPID CYCLING

Rapid cycling is defined as more than 4 restarts in a 60-second period. The PumpSaver®Plus is capable of detecting a rapid-cycle condition whether a control device, such as a pressure switch, is installed before* or after it. Upon detecting either form of rapid cycling, the PumpSaver®Plus will lock-out, preventing damage to the pump. To reset the PumpSaver®Plus, remove and re-apply power.

RAPID CYCLING (Line Side / Upstream)

Rapid cycling of the line side of the PumpSaver®Plus may be caused by several naturally occurring conditions which are indistinguishable from true rapid cycling. For this reason, once tripped, Symcom's protection will wait 30 minutes and restart. If any restart is successful (pump runs for more than 1 minute), the rapid cycle counter will reset to zero. If the PumpSaver®Plus encounters rapid cycle 4 times without a successful restart, the PumpSaver®Plus will lock-out and require a manual reset. To reset the PumpSaver®Plus, remove and re-apply power.

*Protection against rapid cycling of a control device installed before the PumpSaver®Plus is disabled by default. Read the following instructions fully before performing the procedure to enable this feature.

NOTE: Turn the SENSITIVITY knob completely to the left (counter-clockwise) or completely to the right (clockwise) when directed.

To Enable Rapid-Cycle Protection when a Control Device is Installed BEFORE the PumpSaver®Plus: (to disable, follow the same procedure)

1. Remove power to the PumpSaver®Plus.
2. Set the RESTART DELAY/ CALIBRATION knob to RESET and the SENSITIVITY knob to the middle (12:00) position.
3. Apply power to the PumpSaver®Plus – the CAL. LIGHT will turn on.
4. Turn the SENSITIVITY knob to the right – the CAL. LIGHT will turn off, RUN LIGHT will turn on.
5. Turn the SENSITIVITY knob to the left – both lights will turn on.
6. Turn the SENSITIVITY knob right – left – right – left – right.
7. After 2 seconds, the CAL. and RUN LIGHTS will blink once indicating line side rapid-cycle protection has been enabled.



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PUMPSAVER®PLUS INSTALLATION INSTRUCTIONS

RAPID CYCLING (Load Side / Downstream)

Load side rapid cycling of the pump will immediately result in a manual lock-out. The pump will not restart automatically. To reset the PumpSaver®Plus, remove and re-apply power.

Note: Protection against rapid cycling of a control device installed after the PumpSaver®Plus is always enabled. Disabling line side detection will not disable load side detection.

USING AN INFORMER

The PumpSaver®Plus units are equipped with an infrared LED that will communicate to a SymCom Informer – a hand-held, battery operated, diagnostic tool. An Informer IR Kit is required for the PumpSaver®Plus Insider units to communicate to the Informer. The Informer will display the model number; run time; pump starts; restart delay setting; restart delay timer; real-time voltage, current and power; dry-well and overload trip points; calibration voltage; last 20 faults; voltage, current, power and run time for the last 20 faults; highest/lowest voltage and current since calibration; and the CT size if applicable. The Informer can be used on any single-phase PumpSaver®Plus equipped with an infrared LED transmitter – Models 111-Insider-P; 231-Insider-P; 232-Insider; 111P; 233P; 234-P; 235P and 236-P.

INFORMER TROUBLESHOOTING GUIDE

The Informer does not activate when the ON button is pressed.	Battery Polarity Reversed - Verify the + and - terminals on the battery match the markings inside the battery compartment.
	Low Battery - Replace the battery.
The COMM STATUS light is off and all display values remain at zero.	Weak Signal - Ensure the Informer is aimed directly at the PumpSaver's infrared LED and is within the operating distance.
	PumpSaver®Plus not transmitting - Verify the PumpSaver®Plus is energized and the green RUN light is illuminated.
The COMM STATUS light is blinking.	Sunlight - Verify the sun is not shining directly onto the Informer's infrared receiver.
	Weak Signal - Ensure the Informer is aimed directly at the PumpSaver's infrared LED and is within the operating distance. OR If using an older Informer (version 1.xx or earlier) with a PumpSaver®Plus, this is a normal condition.
The displayed values fluctuate radically.	Weak Signal - Ensure the Informer is aimed directly at the PumpSaver's infrared LED and is within the operating distance.
The Informer displays values even after communication is lost.	This Is Normal - The Informer holds the last values it received before communication was lost. (until the auto shut off)

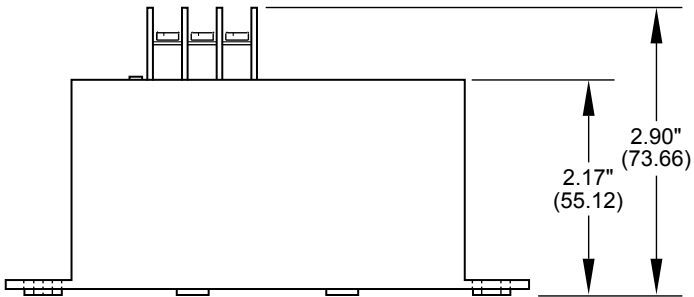
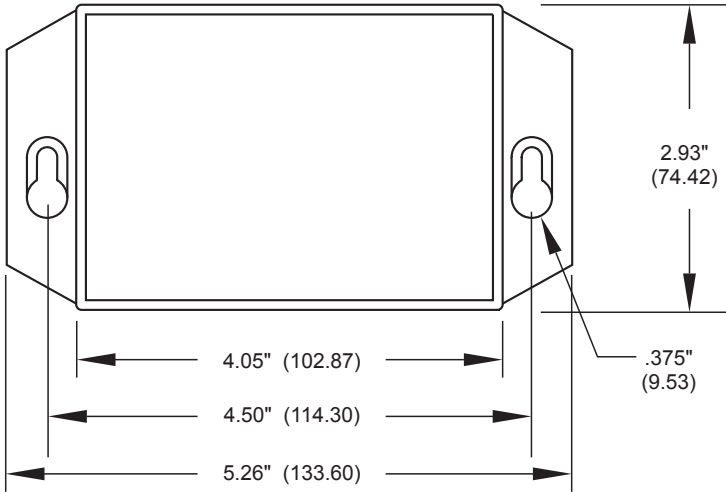


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111P / 233P / 235P - DIMENSIONS



Voltage/Current/Power Monitors - Overload Relays

SymCom's 777 family of products are UL listed as Electronic Overload Relays. The KW/HP units are also power monitors that can calculate a Power reading for use with many software solutions.

Communication & I/O Modules

Units that are used for converting the information coming from a 777 family or 601 family product to Modbus, Devicenet, 4-20mA or Profibus signal to be sent over a network.

Remote Monitors

SymCom's remote monitors are used in conjunction with the 777 and 601 families to display real-time voltages and currents. Fault codes are listed on an easy to read display. Using a remote monitor will also help by making it safer for employees to gather real-time information without having to open the electrical panel.

Solutions Software

Used to monitor, log information, control and change configurations and setpoints on the 777 and 601 family of products.

Voltage Monitors, single-phase & 3-phase

Used to monitor incoming line voltages for High or Low voltage, Reverse-phase, Unbalanced voltage and Single-Phased voltages.

Current Monitors, single-phase & 3-phase

Used to monitor current levels in a motor for High or Low current, Unbalanced current and Single-Phased currents.

Alternating Relays

Unit will alternate between two pumps so they will have equal running time, thus not wearing one pump out prematurely.

Intrinsically-Safe Relays

Units designed to be used in hazardous applications where explosive materials are present.

Pump Controllers

Used to control from 2 to 4 pumps in multiple pump applications. Has the ability to be used in pump-up or pump-down configurations. Different models have multiple uses. SymCom also provides Intrinsically-Safe pump controllers.

Load Sensors

Can be used as proof relays to detect tool wear, feed rates and loss of prime on pumps by detecting current levels. Many different configurations can be used for differing uses.

Auxiliary Products

TIMERS - On-delay timer that starts its timer when power is applied. Output contact is energized when the timing is complete, anywhere from 6 seconds to 10 minutes or 0.5 to 12 seconds.

CURRENT TRANSFORMERS - Donut or foot mounted CT used for transmitting current signal from the main conductors to the SymCom units where required.



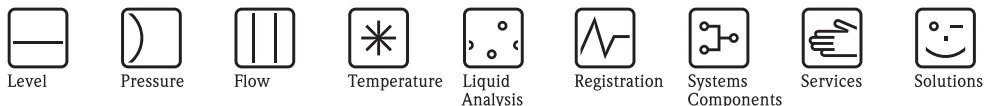
For warranty information,
please see **Terms and Conditions** at
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Technical Information

Proline Prowirl 72F, 72W, 73F, 73W

Vortex flow measuring system

Reliable flow measurement of gas, steam and liquids



Application

For the universal measurement of the volume flow of gases, steam and liquids.

The mass flow of steam, water (as per IAPWS-IF97 ASME), natural gas (as per AGA NX-19/AGA8-DC92 detailed method/AGA8 Gross Method 1/SGERG-88), compressed air, other gases and liquids can also be measured with the aid of integrated temperature measurement and by reading in external pressure values (optional).

Maximum range of applications thanks to:

- Fluid temperature range from -200 to $+400$ °C (-328 to $+752$ °F)
- Pressure ratings up to PN 250/Class 1500
- Sensor with integrated (optional) diameter reduction by one line size (R Style) or two line sizes (S Style)
- Dualsens version (optional) for redundant measurements with two sensors and electronics

Approvals for:

- ATEX, FM, CSA, TIIS, NEPSI, IEC
- HART, PROFIBUS PA, FOUNDATION Fieldbus
- Pressure Equipment Directive, SIL 2

Your benefits

The robust **Prowirl sensor**, tried and tested in over 100 000 applications, offers:

- High resistance to vibrations, temperature shocks, contaminated fluids and water hammer
- No maintenance, no moving parts, no zero-point drift ("lifetime" calibration)
- Software initial settings save time and costs

Additional possibilities:

- Complete saturated steam or liquid-mass measuring point in one single device
- Calculation of the mass flow from the measured variables volume flow and temperature in the integrated flow computer
- External pressure value read-in for superheated steam and gas applications (optional)
- External temperature value read-in for delta heat measurement (optional)

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Endress+Hauser 

People for Process Automation



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



Solutions

Technical Information

Waterpilot FMX167

Hydrostatic level measurement

Reliable and robust level probe with ceramic measuring cell

Compact device for level measurement in fresh water, wastewater and saltwater



Application

The Waterpilot FMX167 is a pressure sensor for hydrostatic level measurement.

Three versions of FMX167 are available at Endress+Hauser:

- FMX167 with a stainless steel housing, outer diameter of 22 mm (0.87 in): Standard version suitable for drinking water applications and for use in bore holes and wells with small diameters
- FMX167 with a stainless steel housing, outer diameter of 42 mm (1.66 in): Heavy duty version, easy clean flush-mounted process diaphragm. Ideally suited to wastewater and sewage treatment plants
- FMX167 with a coated housing, outer diameter of 29 mm (1.15 in): Corrosion resistant version generally for use in saltwater, particularly for ship ballast water tanks.

Your benefits

- High mechanical resistance to overload and aggressive media
- High-precision, robust ceramic measuring cell with long-term stability
- Climate proofed sensor thanks to completely potted electronics and 2-filter pressure compensation system
- 4 to 20 mA output signal with integrated overvoltage protection
- Simultaneous measurement of level and temperature with optionally integrated Pt100 temperature sensor
- Usage in drinking water: KTW, NSF
- Approvals: ATEX, FM and CSA
- Marine certificate: GL, ABS
- Extensive range of accessories provides complete measuring point solutions

Additional documentation

Field of activities	<ul style="list-style-type: none">■ Pressure measurement: FA004P/00/EN■ Recording technology: FA014R/09/EN■ System components: FA016K/09/EN
Technical Information	<ul style="list-style-type: none">■ Technical Information Waterpilot FMX21 with 4 to 20 mA with HART output signal: TI431P/00/EN■ Technical Information Deltapilot M: TI437P/00/EN■ Temperature Head Transmitter iTEMP PCP TMT181: TI070R/09/EN
Operating Instructions	<ul style="list-style-type: none">■ Waterpilot FMX167: BA231P/00/EN■ Cable shortening kit: SD552P/00/A6
Safety instructions	<ul style="list-style-type: none">■ ATEX II 2 G Ex ia IIC T6: XA131P/00/A3■ ATEX II 3 G Ex nA II T6: XA132P/00/A3
Installation/Control Drawings	<ul style="list-style-type: none">■ FM IS Class I, Div. 1, Groups A – D: ZD063P/00/EN■ CSA IS Class I, Div. 1, Groups A – D: ZD064P/00/EN
Drinking water approval	<ul style="list-style-type: none">■ SD126P/00/A3

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