



**U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION III
CLEAN WATER ACT
COMPLIANCE INSPECTION REPORT**

for

Name of Facility: Hill Mobile Home Park Sewage Treatment Plant

Facility Address: Intersection of Lakewood Road and A.P. Hill Boulevard, Bowling Green, VA 22427

Mailing Address: 5805 Staples Mill Road, Richmond, VA 23228

Report Prepared on: 12/22/2020
Date

By: , PG
Signature

**STACIE
PRATT**

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STACIE PRATT
Date: 2020.12.23
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Report Final as of: 12/23/20
Date

By: _____, EPA
Signature

General Information

Type of Inspection:

Wastewater Treatment Plant CEI

Owner:

Six-O-Five Mobile Home Group, LLC

Operator:

Raynor Environmental Enterprises (REE)

Permittee:

Six-O-Five Mobile Home Group, LLC

NPDES Permit No:

VA0090689

NPDES Permit Effective Date:

July 1, 2016

NPDES Permit Expiration Date:

June 30, 2021

Receiving Water and/or MS4:

Unnamed tributary to Maracossic Creek, to York River

Latitude and Longitude:

38° 03' 51" N, 77° 19' 52" W

On-Facility Inspection Overview

On October 29, 2020, U.S. Environmental Protection Agency (EPA) Region III's contract inspector from PG Environmental, (hereinafter referred to as Inspector) inspected the Hill Mobile Home Park Sewage Treatment Plant (hereinafter, STP or Plant) in Bowling Green, Virginia. Six-O-Five Mobile Home Group, LLC owns the STP and collection system and is the permit holder. REE has been hired to contract operate the Plant. The Inspector was joined by members from EPA, the Virginia Department of Environmental Quality (VDEQ), and Discharger representatives (as listed in the Introduction section of the report).

Approximate Entry Time: 10:00 AM (EDT) **Approximate Exit Time:** 11:20 AM (EDT)



**U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103**

**WASTEWATER TREATMENT FACILITY
COMPLIANCE EVALUATION INSPECTION**

**Hill Mobile Home Park
Sewage Treatment Plant
VPDES Permit No. VA0090689**

INSPECTION REPORT

**Inspection Date:
October 29, 2020**

**Report Date:
December 22, 2020**

EXECUTIVE SUMMARY

Hill Mobile Home Park Sewage Treatment Plant (VPDES Permit No. VA0090689)

On October 29, 2020, U.S. Environmental Protection Agency (EPA) Region III's contract inspector from PG Environmental, (hereinafter referred to as Inspector) inspected the Hill Mobile Home Park Sewage Treatment Plant (hereinafter, STP or Plant) in Bowling Green, Virginia. Six-O-Five Mobile Home Group, LLC (hereinafter, Discharger) owns the STP and collection system and is the permit holder. REE has been hired to contract operate the Plant. The Inspector was joined by members from EPA, the Virginia Department of Environmental Quality (VDEQ), and Discharger representatives (as listed in the Introduction section of the report).

The Plant is a sequence batch reactor (SBR) style package treatment plant designed to provide secondary level treatment of domestic wastewater for a local mobile home park. There are about 15 units at the mobile home park and a population of between 45 to 60 residents. The Plant has a design capacity of 5,000 gallons per day. Flow from the mobile home park is conveyed via gravity to an old septic tank that has been converted into a collection tank for wastewater, prior to it being pumped to the SBR for treatment. Some minimal settling may occur in the collection tank. The SBR process consists of the following phases: fill, interact/react, settle, and decant. Following the decant cycle, flow is sent to a chlorination chamber, holding tank, aeration chamber, and then dechlorinated at Outfall 001 to the unnamed tributary to Maracossic Creek. The Plant typically discharges approximately ten (10) 381-gallon batches per day.

Solids from the SBR process are collected in a waste tank at the east end of SBR unit. Wastes solids are pumped out and hauled off by contractor as needed.

REE took over operations at the Plant in June 2020. At that time, the Discharger had already been issued several Warning Letters and Notices of Violation (NOVs) for effluent limit violations occurring over the preceding year.

The Discharger's activities are regulated under Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0090689 (hereinafter, Permit), which became effective on July 1, 2016 and is set to expire on June 30, 2021.

The primary purpose of the inspection was to review the accuracy and reliability of the Discharger's self-monitoring and reporting program and to obtain information that will assist EPA in assessing the Discharger's compliance with the requirements of the Permit.

The Inspector held discussions with Discharger representatives, conducted a detailed site inspection, and reviewed pertinent documentation regarding the Discharger's compliance with the Permit. Based on the information obtained and reviewed, the Inspector made several observations related to the specific Permit requirements evaluated. These observations are summarized in Table E1.

Table E1. Summary of Permit Requirements and Inspection Observations

Permit Reference	Observations
Permit Status and Effluent Exceedances	
Permit Part I.A.2	1. The Plant experienced 83 effluent limit exceedances from Outfall 001 between July 1, 2016 and September 30, 2020. 2. VDEQ issued numerous warning letters and notices of violation (NOVs) to the Discharger between September 2019 and September 2020, primarily related to effluent limit exceedances. These correspondences, including any Discharger responses and proposed corrective actions, are described in Observation 2.
Permit Part I.A.1	3. The Inspector observed light brown solids directly under Outfall 001 and downstream in the receiving water.
Proper Operation and Maintenance	
Permit Part II.Q	4. The Inspector observed turbidity and cloudiness in the effluent holding tank and post-aeration chamber. 5. Discharger representatives stated that there is no backup or auxiliary power source for the Plant.
Permit Part I.C.3	6. The Plant's operations and maintenance (O&M) manual shows influent coming into the SBR in the anaerobic chamber at the east end of the system; however, the Inspector observed influent being pumped directly into the SAM tank from the wastewater collection tank. 7. The Inspector observed that effluent flow was being estimated by the operator by totaling the number of batches discharged from the SBR; this process is not described in the Plant's O&M manual.
Collection System	
Discharger representatives stated that since they had only been onsite operating for about five months prior to the inspection, and most of that time had involved troubleshooting significant problems with the SBR, they had not yet had a chance to evaluate the collection system.	

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Attachment A: Photograph Log

Attachment B: Exhibit Log

I. INTRODUCTION

On October 29, 2020, U.S. Environmental Protection Agency (EPA) Region III's contract inspector from PG Environmental, (hereinafter referred to as Inspector) inspected the Hill Mobile Home Park Sewage Treatment Plant (hereinafter, STP or Plant) in Bowling Green, Virginia. Six-O-Five Mobile Home Group, LLC owns the STP and collection system and is the permit holder. REE has been hired to contract operate the Plant. The Inspector was accompanied by a representative from EPA Region III as well as a representative from the Virginia Department of Environmental Quality (VDEQ). The primary purpose of the inspection was to review the accuracy and reliability of the Discharger's self-monitoring and reporting program as well as the operation and maintenance of the STP. The weather at the time of the inspection was cool, with periods of heavy precipitation.

The Plant is a sequence batch reactor (SBR) style package treatment plant designed to provide secondary level treatment of domestic wastewater for a local mobile home park. There are about 15 homes and between 45 to 60 residents at the mobile home park. The Plant has a design capacity of 5,000 gallons per day.

Flow from the mobile home park is conveyed via gravity to an old septic tank that has been converted into a centralized collection tank for wastewater, prior to it being pumped to the SBR for treatment. Some minimal settling may occur in the collection tank. The SBR process consists of the following phases:

- **Fill:** Influent fills into an anoxic tank at the head of the SBR unit (referred to as the SAM tank). The fill cycle is flow dependent. The SBR will continue to fill and mix until the system is full. This could take anywhere from 1 to 4 hours depending on time of day and flow conditions.
- **Interact:** Wastewater flows into the aeration chamber where air is cycled on and off to promote denitrification. The SBR will continue to react until the system has enough wastewater for a batch (381 gallons). This could take anywhere from 1 to 4 hours depending on time of day and flow conditions.
- **Settle:** Air delivery is stopped, and solids settle out of the effluent for 40 minutes.
- **Decant:** At the end of the 40-minute decant cycle, and automated solenoid valve is opened at the west side of the SBR unit, and effluent is decanted from the top of the tank for 10 to 11 minutes.

Following the decant cycle, flow is sent to a chlorination chamber, holding tank, aeration chamber, and then dechlorinated at Outfall 001 to the unnamed tributary to Maracossic Creek. The Plant typically discharges approximately ten (10) 381-gallon batches per day.

Solids from the SBR process are collected in a waste tank at the east end of SBR unit. Waste solids are pumped out and hauled off by contractor as needed.

The Plant is covered under Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0090689, which became effective on July 1, 2016 and is set to expire on June 30, 2021 (refer to Attachment B, Exhibit 1). Refer to Attachment B, Exhibit 2 for the Plant operation and maintenance (O&M) manual, which includes diagrams of the facility.

The following personnel were involved in the inspection:

Hiway Mobile Home Community, LLC Representatives:	Matthew Raynor, Owner Representative, Director, Raynor Environmental Enterprises (REE) John Shook, Operator, REE
EPA Inspectors:	Jake Albright, PG Environmental (contractor) Shane McAleer, EPA Region III
VDEQ Representative:	Rebecca Johnson, Senior Water Compliance Inspector

II. INSPECTION PROCESS

The Inspector held discussions with Discharger representatives, conducted a detailed site inspection, and conducted a records review of pertinent documentation regarding the Discharger's compliance with the Permit. This report documents the Inspector's observations.

Facility Site Walk

As part of the process, the Inspector visually observed the treatment train and site conditions in the presence of EPA, VDEQ, and Discharger representatives. The treatment train consists of:

- A wastewater collection tank;
- A three chambered (including waste solids chamber), 5,000-gallon capacity SBR system
- Chlorination chamber;
- Effluent holding tank;
- Post-aeration chamber; and
- Dechlorination.

The Inspector also viewed Outfall 001 and the receiving water.

Records Review

The Inspector conducted a records review to evaluate the Discharger's compliance with the Permit. Most of the records and reports required by the Permit were available for review onsite. The Plants O&M manual and discharge monitoring reports were provided electronically and reviewed offsite after the onsite inspection. The following were reviewed:

- Plant O&M manual (addendum date July 28, 2020);
- Electronic Discharge Monitoring Report (eDMR) data during the period from July 2016 through September 2020;
- pH meter, colorimeter, and dissolved oxygen (DO) meter calibration records (June 1, 2020 to date of inspection) and equipment manuals;
- Operations log (June 1, 2020 to date of inspection);
- Field data collection sheets (Compliance and Process Control; June 1, 2020 to date of inspection);
- Spot check of 2020 contract laboratory chain-of-custodies.

III. SUMMARY OF OBSERVATIONS

The following section summarizes the Inspector's observations relative to the Discharger's Permit requirements, including the status of certain treatment units, operation and maintenance practices, and the Discharger's monitoring and reporting.

A. Permit Status and Effluent Exceedances

Part I.A.2 of the Permit defines effluent limitations and monitoring requirements for Outfall 001 discharges.

Observation 1. According to EPA's Integrated Compliance Information System (ICIS) database, the Plant experienced 83 effluent limit exceedances from Outfall 001 between July 1, 2016 and September 30, 2020 (i.e., since the Permit took effect, refer to Attachment B, Exhibit 3). VDEQ issued a series of Warning Letters and Notices of Violation (NOVs) to the Discharger during that time period for effluent exceedances (refer to Attachment B, Exhibits 4 and 5, respectively). EPA's Enforcement and Compliance History Online (ECHO) Database indicates the Plant was in a state of significant noncompliance (SNC) continuously between July 1, 2019 and June 30, 2020. ECHO indicated that violations had been identified during the quarter encompassing the date of the inspection but did not indicate SNC.

Table 1. Outfall 001 Final Effluent Exceedances (July 1, 2016 through September 30, 2020)

Permit #	Monitoring Period End Date	Parameter Name	DMR Value	Permit Limit	Units	Limit Type
VA0090689	6/30/2019	BOD, carbonaceous [5 day, 20 C]	18	15	mg/L	Monthly Average
VA0090689	7/31/2019	Solids, total suspended	14	10	mg/L	Weekly Average
VA0090689	7/31/2019	Phosphorus, total [as P]	3.91	2.0	mg/L	Monthly Average
VA0090689	8/31/2019	Solids, total suspended	0.26	0.19	kg/d	Monthly Average
VA0090689	8/31/2019	Solids, total suspended	17.3	10	mg/L	Monthly Average
VA0090689	8/31/2019	Solids, total suspended	17.3	15	mg/L	Weekly Average
VA0090689	9/30/2019	Phosphorus, total [as P]	4.48	2.0	mg/L	Monthly Average
VA0090689	10/31/2019	Solids, total suspended	0.386	0.19	kg/d	Monthly Average
VA0090689	10/31/2019	Solids, total suspended	0.386	0.28	kg/d	Weekly Average
VA0090689	10/31/2019	Solids, total suspended	51	10	mg/L	Monthly Average
VA0090689	10/31/2019	Solids, total suspended	51	15	mg/L	Weekly Average
VA0090689	10/31/2019	Nitrogen, Kjeldahl, total [as N]	0.1	0.09	kg/d	Weekly Average
VA0090689	10/31/2019	Nitrogen, Kjeldahl, total [as N]	0.1	0.06	kg/d	Monthly Average
VA0090689	10/31/2019	Nitrogen, Kjeldahl, total [as N]	14.16	3.0	mg/L	Monthly Average
VA0090689	10/31/2019	Nitrogen, Kjeldahl, total [as N]	14.16	4.5	mg/L	Weekly Average

Permit #	Monitoring Period End Date	Parameter Name	DMR Value	Permit Limit	Units	Limit Type
VA0090689	11/30/2019	Solids, total suspended	0.23	0.19	kg/d	Monthly Average
VA0090689	11/30/2019	Solids, total suspended	21	10	mg/L	Monthly Average
VA0090689	11/30/2019	Solids, total suspended	21	15	mg/L	Weekly Average
VA0090689	12/31/2019	Nitrogen, Kjeldahl, total [as N]	0.31	0.09	kg/d	Weekly Average
VA0090689	12/31/2019	Nitrogen, Kjeldahl, total [as N]	0.31	0.06	kg/d	Monthly Average
VA0090689	12/31/2019	Nitrogen, Kjeldahl, total [as N]	21.42	3.0	mg/L	Monthly Average
VA0090689	12/31/2019	Nitrogen, Kjeldahl, total [as N]	21.42	4.5	mg/L	Weekly Average
VA0090689	12/31/2019	Solids, total suspended	24	10	mg/L	Monthly Average
VA0090689	12/31/2019	Solids, total suspended	24	15	mg/L	Weekly Average
VA0090689	1/31/2020	Phosphorus, total [as P]	3.95	2.0	mg/L	Monthly Average
VA0090689	1/31/2020	Solids, total suspended	0.24	0.19	kg/d	Monthly Average
VA0090689	1/31/2020	Solids, total suspended	20.8	10	mg/L	Monthly Average
VA0090689	1/31/2020	Solids, total suspended	20.8	15	mg/L	Weekly Average
VA0090689	1/31/2020	Nitrogen, Kjeldahl, total [as N]	0.18	0.09	kg/d	Weekly Average
VA0090689	1/31/2020	Nitrogen, Kjeldahl, total [as N]	0.18	0.06	kg/d	Monthly Average
VA0090689	1/31/2020	Nitrogen, Kjeldahl, total [as N]	16.58	3.0	mg/L	Monthly Average
VA0090689	1/31/2020	Nitrogen, Kjeldahl, total [as N]	16.58	4.5	mg/L	Weekly Average
VA0090689	1/31/2020	BOD, carbonaceous [5 day, 20 C]	0.22	0.19	kg/d	Monthly Average
VA0090689	1/31/2020	BOD, carbonaceous [5 day, 20 C]	20	15	mg/L	Weekly Average
VA0090689	1/31/2020	BOD, carbonaceous [5 day, 20 C]	20	10	mg/L	Monthly Average
VA0090689	2/29/2020	Solids, total suspended	0.21	0.19	kg/d	Monthly Average
VA0090689	2/29/2020	Solids, total suspended	14	10	mg/L	Monthly Average
VA0090689	3/31/2020	Solids, total suspended	0.43	0.19	kg/d	Monthly Average
VA0090689	3/31/2020	Solids, total suspended	0.43	0.28	kg/d	Weekly Average
VA0090689	3/31/2020	Solids, total suspended	29	10	mg/L	Monthly Average
VA0090689	3/31/2020	Solids, total suspended	29	15	mg/L	Weekly Average
VA0090689	3/31/2020	Nitrogen, Kjeldahl, total [as N]	0.15	0.09	kg/d	Weekly Average

Permit #	Monitoring Period End Date	Parameter Name	DMR Value	Permit Limit	Units	Limit Type
VA0090689	3/31/2020	Nitrogen, Kjeldahl, total [as N]	0.15	0.06	kg/d	Monthly Average
VA0090689	3/31/2020	Nitrogen, Kjeldahl, total [as N]	10.06	3.0	mg/L	Monthly Average
VA0090689	3/31/2020	Nitrogen, Kjeldahl, total [as N]	10.06	4.5	mg/L	Weekly Average
VA0090689	4/30/2020	Nitrogen, Kjeldahl, total [as N]	4.23	3.0	mg/L	Monthly Average
VA0090689	6/30/2020	Nitrogen, Kjeldahl, total [as N]	0.13	0.09	kg/d	Weekly Average
VA0090689	6/30/2020	Nitrogen, Kjeldahl, total [as N]	0.13	0.06	kg/d	Monthly Average
VA0090689	6/30/2020	Nitrogen, Kjeldahl, total [as N]	7.79	4.5	mg/L	Weekly Average
VA0090689	6/30/2020	Nitrogen, Kjeldahl, total [as N]	7.79	3.0	mg/L	Monthly Average
VA0090689	6/30/2020	Solids, total suspended	0.84	0.19	kg/d	Monthly Average
VA0090689	6/30/2020	Solids, total suspended	0.84	0.28	kg/d	Weekly Average
VA0090689	6/30/2020	Solids, total suspended	72	10	mg/L	Monthly Average
VA0090689	6/30/2020	Solids, total suspended	72	15	mg/L	Weekly Average
VA0090689	6/30/2020	BOD, carbonaceous [5 day, 20 C]	0.26	0.19	kg/d	Monthly Average
VA0090689	6/30/2020	BOD, carbonaceous [5 day, 20 C]	22	15	mg/L	Weekly Average
VA0090689	6/30/2020	BOD, carbonaceous [5 day, 20 C]	22	10	mg/L	Monthly Average
VA0090689	7/31/2020	Solids, total suspended	0.72	0.19	kg/d	Monthly Average
VA0090689	7/31/2020	Solids, total suspended	0.9	0.28	kg/d	Weekly Average
VA0090689	7/31/2020	Solids, total suspended	54	10	mg/L	Monthly Average
VA0090689	7/31/2020	Solids, total suspended	68	15	mg/L	Weekly Average
VA0090689	7/31/2020	Nitrogen, Kjeldahl, total [as N]	5.93	4.5	mg/L	Weekly Average
VA0090689	7/31/2020	Nitrogen, Kjeldahl, total [as N]	3.98	3.0	mg/L	Monthly Average
VA0090689	7/31/2020	Phosphorus, total [as P]	3.92	2.0	mg/L	Monthly Average
VA0090689	7/31/2020	BOD, carbonaceous [5 day, 20 C]	11	10	mg/L	Monthly Average
VA0090689	8/31/2020	Nitrogen, Kjeldahl, total [as N]	0.16	0.09	kg/d	Weekly Average
VA0090689	8/31/2020	Nitrogen, Kjeldahl, total [as N]	0.1	0.06	kg/d	Monthly Average
VA0090689	8/31/2020	Nitrogen, Kjeldahl, total [as N]	21.95	4.5	mg/L	Weekly Average

Permit #	Monitoring Period End Date	Parameter Name	DMR Value	Permit Limit	Units	Limit Type
VA0090689	8/31/2020	Nitrogen, Kjeldahl, total [as N]	14.18	3.0	mg/L	Monthly Average
VA0090689	8/31/2020	Solids, total suspended	0.5	0.19	kg/d	Monthly Average
VA0090689	8/31/2020	Solids, total suspended	0.52	0.28	kg/d	Weekly Average
VA0090689	8/31/2020	Solids, total suspended	78.5	10	mg/L	Monthly Average
VA0090689	8/31/2020	Solids, total suspended	85	15	mg/L	Weekly Average
VA0090689	9/30/2020	Nitrogen, Kjeldahl, total [as N]	0.19	0.09	kg/d	Weekly Average
VA0090689	9/30/2020	Nitrogen, Kjeldahl, total [as N]	0.11	0.06	kg/d	Monthly Average
VA0090689	9/30/2020	Nitrogen, Kjeldahl, total [as N]	101.4	4.5	mg/L	Weekly Average
VA0090689	9/30/2020	Nitrogen, Kjeldahl, total [as N]	73	3.0	mg/L	Monthly Average
VA0090689	9/30/2020	Solids, total suspended	0.11	0.19	kg/d	Monthly Average
VA0090689	9/30/2020	Solids, total suspended	0.19	0.28	kg/d	Weekly Average
VA0090689	9/30/2020	Solids, total suspended	14.69	10	mg/L	Monthly Average
VA0090689	9/30/2020	Solids, total suspended	26	15	mg/L	Weekly Average
VA0090689	9/30/2020	BOD, carbonaceous [5 day, 20 C]	25	15	mg/L	Weekly Average
VA0090689	9/30/2020	BOD, carbonaceous [5 day, 20 C]	15	10	mg/L	Monthly Average

In addition to the exceedances listed above, the ICIS data also indicates the Discharger failed to report total nitrogen monitoring for December 2019. October 2020 eDMR data and monitoring results were not available at the time of the inspection.

Observation 2. As stated in Observation 1, VDEQ issued Warning Letters and NOV's in response to the Discharger's noncompliance. See Table 2 for a summary of this correspondence. Operator responses are included in Attachment B, Exhibit 6, where applicable. Responses from both the former Plant operator and the current operator (REE) indicate that continuous adjustments had to be made at the STP, including modifying SBR cycle times and trying to optimize the Plant's biomass; however, exceedances continued to occur.

Table 2. Summary of VDEQ/Discharger Compliance Correspondence

Correspondence Type	Date	Description	Operator Response
Warning Letter	September 30, 2019	Correspondence cites various June 2019 and July 2019 effluent exceedances for TSS, total phosphorus, and CBOD5.	Not provided

Inspection Date: October 29, 2020

Correspondence Type	Date	Description	Operator Response
Warning Letter	October 24, 2019	Correspondence cites various August 2019 effluent exceedances for TSS.	The former Plant operator stated TSS exceedances were believed to be due to a power failure preventing the SBR system from resetting, creating a temporary loss of treatment and disrupting the biomass. The email states the operator reset the system and began adding supplemental bacteria and extending the reaction time/aeration and mixing to aid in recovery.
Warning Letter	November 22, 2019	Correspondence cites a September 2019 exceedance for total phosphorus.	The previous Plant operator stated they pumped out the anoxic tank and going forward would increase alum dosage and extend the settling cycle time in the SBR.
NOV	January 3, 2019	Correspondence cites various October 2019 effluent exceedances for TSS and TKN, as well as observations from an October compliance inspection by VDEQ. Observations included solids in the receiving water, overgrown grass inside the treatment facility fence, inadequate aeration in the SBR treatment unit, and the biomass in the SBR was gray and had a raw influent aroma.	The previous Plant operator responded that they inspected the receiving stream and could not verify any solids loss of the magnitude displayed in described in the report. The operator acknowledged there were some treatment concerns at the time that had were in the process of being addressed, including adding supplemental bacteria to accelerate recovery of the biomass, which the operator believed may have created a toxic shock to the system. He further states that the PLC was checked and they began adding soda ash for pH adjustments as well as supplementing the food source with moderate amounts of sugar to aid in the biomass recovery.
NOV	January 26, 2020	Correspondence cites various November 2019 effluent exceedances for TSS.	Not provided

Correspondence Type	Date	Description	Operator Response
NOV	March 3, 2020	Correspondence cites various December 2019 effluent exceedances for TSS and TKN, as well as a missed sample for total nitrogen.	Not provided
NOV	May 19, 2020	Correspondence cites various March 2020 effluent exceedances for TSS and TKN.	Not provided
NOV	June 15, 2020	Correspondence cites an April 2020 exceedance for TKN.	Not provided
NOV	August 25, 2020	Correspondence cites various June 2020 effluent exceedances for TSS, TKN, and CBOD5.	REE responded that they had made changes to correct operating issues with the programmable logic controller (PLC) that controls the SBR.
NOV	September 22, 2020	Correspondence cites various July 2020 effluent exceedances for TSS, total phosphorus, TKN, and CBOD5.	REE responded stating that July 2020 was full of problems with PLC adjustments, which disrupted the SBR biomass and required reseeded and trying to constantly restart the plant. The email also states the Plant had issues in August due to problems with the influent line, pumps and tanks.

Part I.A.1 of the Permit states, “There shall be no discharge of floating solids or visible foam in other than trace amount.”

Observation 3. The Inspector observed light-colored brown solids in the unnamed tributary to Maracossic Creek, immediately under Outfall 001 and at least 40 to 50 feet downstream (refer to Attachment A, Photographs 12 through 16). The solids appeared different than the natural material in the creek bed. There was no observable odor at the time of the inspection.

The Inspector also observed turbidity in the post-aeration chamber and effluent holding tank (refer to Attachment A, Photographs 9 through 11), which are both located upstream of Outfall 001 and downstream of where effluent is decanted from the SBR system. Solids in the treatment train are further discussed in Observation 4.

A VDEQ inspector made a similar observation during an October 2019 compliance inspection; the operator was not present at the time of the VDEQ inspection. The inspector also noted a “raw influent aroma” was present (refer to Attachment B, Exhibit 7 for a copy of the inspection report). At that time, REE was not operating the plant. The previous operator responded to the VDEQ inspector’s observation via email, stating that the receiving stream was re-inspected and the operator could not

verify any solids loss at the magnitude shown in the report. It does not appear any photographs were provided to support this. The email does acknowledge other potential issues going on at the Plant at the time the email was written (November 15, 2019; refer to Attachment B, Exhibit 6).

As shown in Observation 1, the Plant had TSS exceedances during 12 of the 15 months between July 2019 and September 2020, including in October 2019.

B. Proper Operation and Maintenance

Permit Part II.Q requires the permittee to, “at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the terms of and conditions of this permit. Proper operation and maintenance also includes effective plant performance, adequate funding, adequate licensed operator staffing, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by the permittee only when the operation is necessary to achieve compliance with the conditions of this permit.”

Calibration records, daily log sheets, the Plant operator logbook, and laboratory chain of custodies were reviewed onsite. Examples of documentation are provided in (Attachment B, Exhibit 8).

Observation 4. As stated in Observation 3, turbidity and cloudiness were observed in the effluent holding tank and post-aeration chamber (refer to Attachment A, Photographs 9 through 11), and light-colored solids were observed downstream of Outfall 001 (refer to Attachment A, Photographs 12 through 16). The Discharger representatives stated that they were unsure of exactly what was causing the turbidity downstream of the decant location but guessed that it may be related to the chlorine tablets not dissolving fully.

As shown in Observation 1, the Plant had TSS exceedances during 12 of the 15 months between July 2019 and September 2020.

Observation 5. Discharger representatives stated that there is no backup or auxiliary power source for the Plant. They explained that in the event of a prolonged power outage, wastewater would be held in the wastewater collection tank and collection system and would overflow once capacity is exceeded. As shown in Observation 2, the previous Plant operator attributed August 2019 TSS exceedances to a power failure event that prevented the SBR from resetting, comprising treatment effectiveness.

Permit Part I.C.3 states, “The permittee shall maintain a current Operations and Maintenance (O&M) Manual for the treatment works that is in accordance with Virginia Pollutant Discharge Elimination System Regulations, 9VAC25-31 and (for sewage treatment plants) Sewage Collection and Treatment Regulations, 9VAC25-790...

The O&M manual shall detail the practices and procedures which will be followed to ensure compliance with the requirements of this permit. This manual shall include, but not necessarily be limited to, the following items, as appropriate:

- a. Permitted outfall locations and techniques to be employed in the collection, preservation, and analysis of effluent, storm water and sludge samples;

- b. Procedures for measuring and recording the duration and volume of treated wastewater discharged;
- c. Discussion of Best Management Practices, if applicable;
- d. Procedures for handling, storing, and disposing of all wastes, fluids, and pollutants characterized in Part I B 8 that will prevent these materials from reaching state waters. List type and quantity of wastes, fluids, and pollutants (e.g. chemicals) stored at this facility;
- e. Discussion of treatment works design, treatment works operation, routine preventative maintenance of units within the treatment works, critical spare parts inventory, and record keeping;
- f. Plan for the management and/or disposal of waste solids and residues;
- g. Hours of operation and staffing requirements for the plant to ensure effective operation of the treatment works and maintain permit compliance;
- h. List of facility, local and state emergency contacts; and
- i. Procedures for reporting and responding to any spills/overflows/ treatment works upsets.”

Observation 6. The O&M manual shows influent coming into the SBR in the anaerobic chamber at the east end of the system (refer to Attachment B, Exhibit 2; page 12). The O&M manual also describes the anaerobic chamber as a location where solids can settle during the SBR process.

However, at the time of the inspection, influent was being pumped from the wastewater collection tank over the anaerobic chamber, directly into the SAM tank (refer to Attachment A, Photographs 2 and 3). The O&M manual was reviewed after the inspection, and this finding was not explicitly discussed with the Discharger representatives. While onsite they stated that modifications had been made to the SBR in an effort to achieve better biomass conditions and nitrogen removal, particularly for TKN.

As noted previously, the anaerobic chamber was being used to store wasted solids at the time of the inspection.

Observation 7. The “Sampling, Lab Procedures & Reporting” section of the manual states, “For the facility, flow is reported based on daily readings of the water supply flow meters and reporting the quantity of water used during the intervening period.” While onsite, the Discharger representatives stated that flow was actually calculated by totaling the number of 381-gallon batches discharged from the SBR. For example, four batches would equal a calculated flow of 1,524 gallons/day.

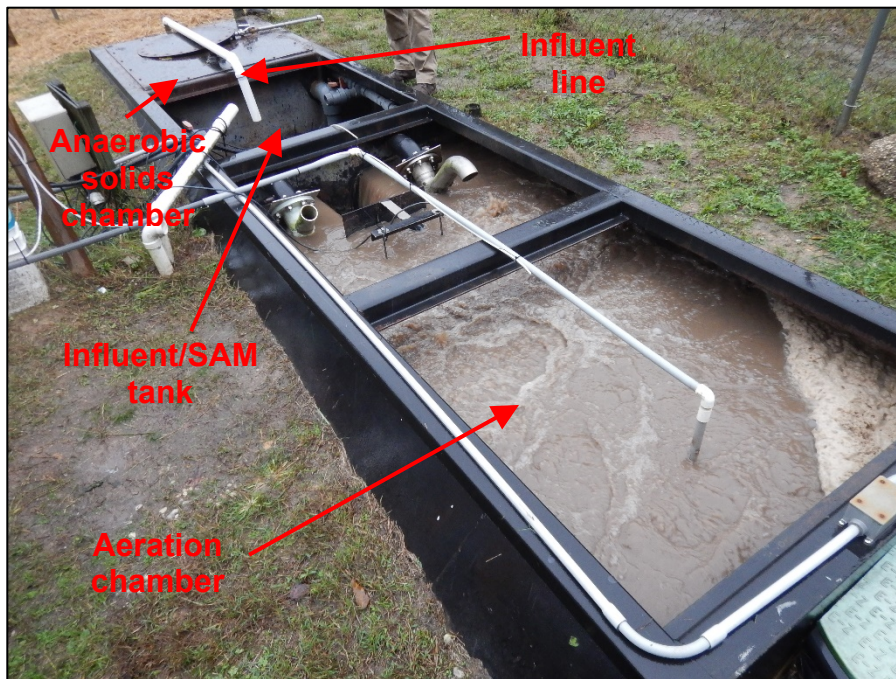
C. Collection System

The collection system was not a focus of the inspection. The Discharger representatives stated that since they had only been onsite operating for about five months prior to the inspection, and most of that time had involved troubleshooting significant problems with the SBR, they had not yet had a chance to evaluate the collection system.

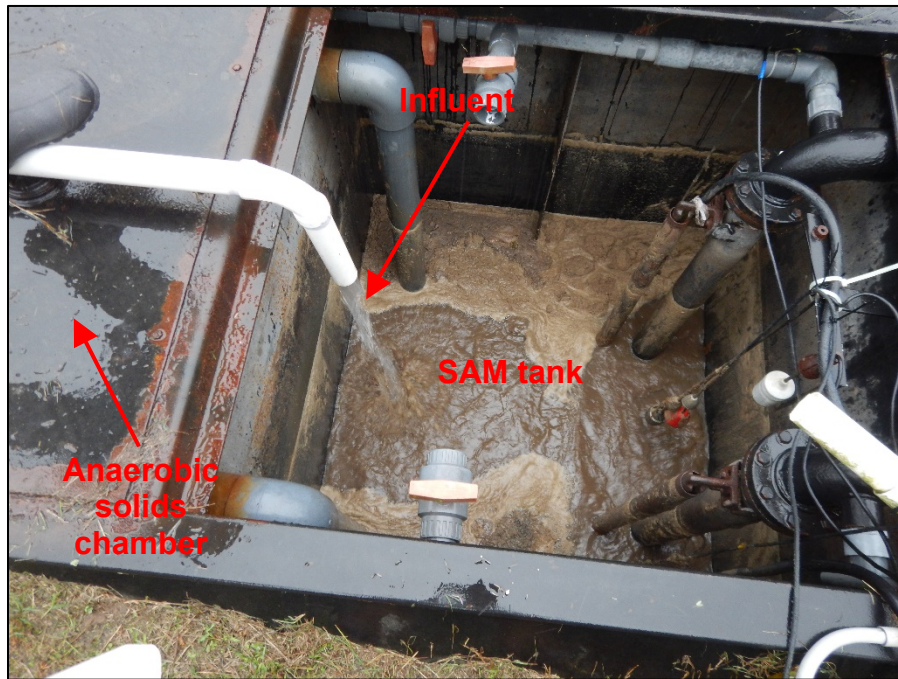
Attachment A
Photograph Log



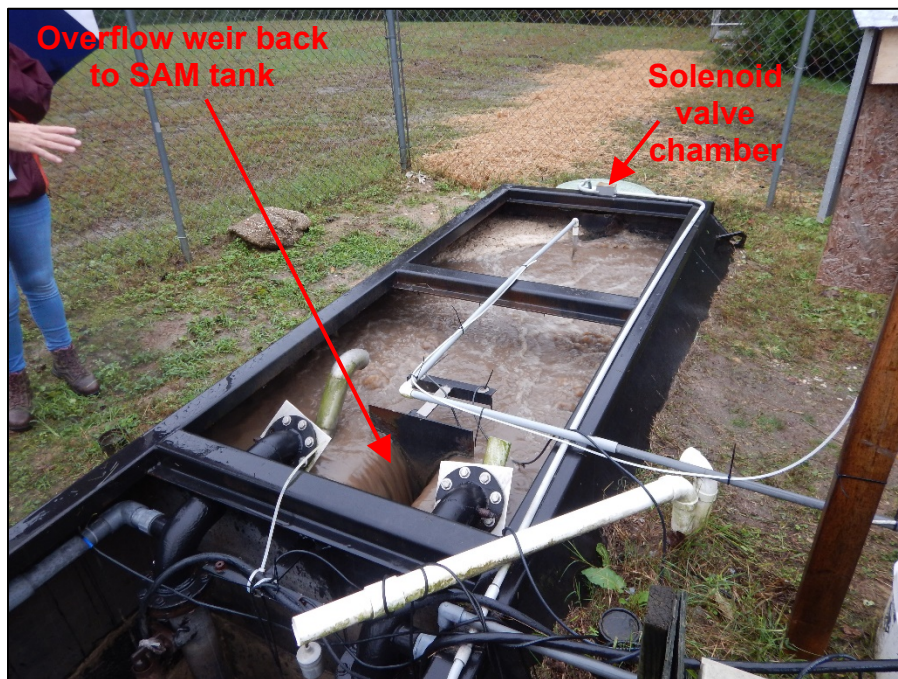
Photograph 1. View of the wastewater collection tank.



Photograph 2. Overview of the SBR unit. Note that the influent line comes over the solids chamber and discharges directly into the SAM tank.



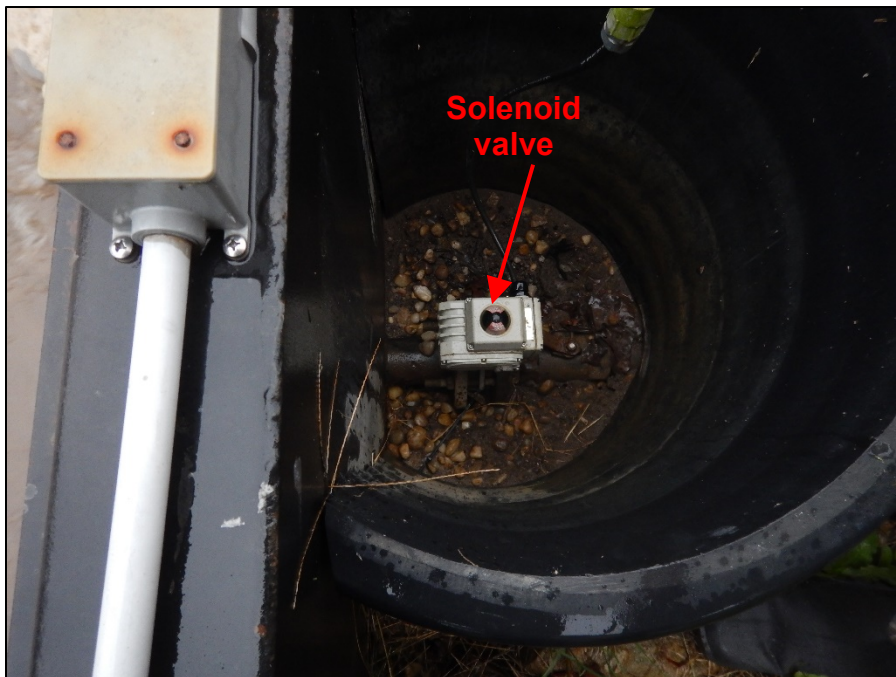
Photograph 3. View of the influent chamber, referred to as the SAM tank. Note the location of the solids chamber.



Photograph 4. View of the aeration chamber.



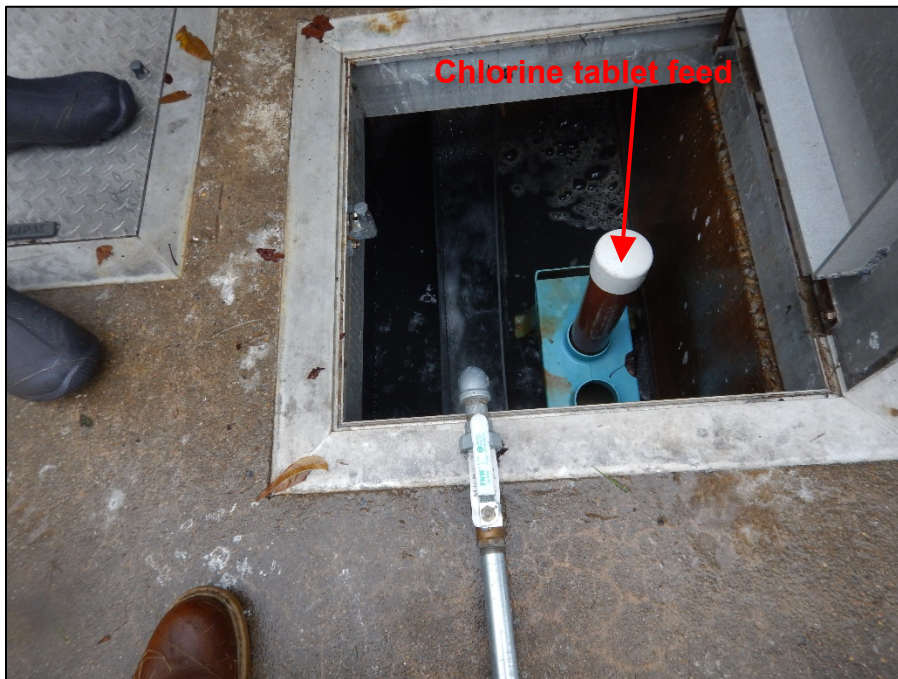
Photograph 5. View of the SBR control panel.



Photograph 6. View inside the solenoid valve chamber.



Photograph 7. Closeup view of the solenoid valve. Note that it was red, indicating it was closed at the time of the inspection.



Photograph 8. View inside the chlorination chamber where sodium hypochlorite tablets are fed to the effluent.



Photograph 9. View of the effluent holding tank. Note the effluent in the chamber was turbid.



Photograph 10. Additional view the effluent in the holding tank. Note the turbidity.



Photograph 11. View inside the post aeration chamber. Note that the effluent appeared cloudy.



Photograph 12. View of dechlorination tablet feed at Outfall 001. Note the presence of light-colored brown solids just under the outfall.



Photograph 13. View downstream of Outfall 001. Note the light-colored solids in the unnamed tributary.



Photograph 14. Additional view downstream of Outfall 001. Note the light-colored solids in the unnamed tributary.



Photograph 15. Additional view downstream of Outfall 001. Note the light-colored solids in the unnamed tributary.



Photograph 16. Close up view of the light-colored solids shown in Photograph 15.

Attachment B
Exhibit Log

Exhibit 1
VPDES Permit No. VA0090689



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHERN REGIONAL OFFICE

13901 Crown Court, Woodbridge, Virginia 22193

(703) 583-3800

www.deq.virginia.gov

Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

Thomas A. Faha
Regional Director

24 June 2016

Via email: JimmyBensonJr@gmail.com

CERTIFY RECEIPT REQUESTED

Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
5805 Staples Mill Road
Richmond, VA 23228

Re: Reissuance of VPDES Permit No. VA0090689
Hill Mobile Home Park Sewage Treatment Plant #2
Caroline County

Dear Mr. Benson:

The Department of Environmental Quality (DEQ) has approved the enclosed effluent limitations and monitoring requirements for the aforementioned permit. Copies of your permit and fact sheet are enclosed.

A Discharge Monitoring Report (DMR) form is no longer included in the reissuance package since you are enrolled in DEQ's electronic DMR (eDMR) program. The first electronic DMR submittal for the month of July 2016 is due by 10 August 2016. Please reference the effluent limits in your permit and report monitoring results in eDMR to the same number of significant digits as are included in the permit limits for the parameter.

The regional contact for eDMR is Rebecca Vice; she can be reached at 703-583-3922 or via email at Rebecca.Vice@deq.virginia.gov.

Please note that compliance with the permit's requirements for use and disposal of sewage sludge does not relieve you of your responsibility to comply with federal requirements set forth in 40 CFR Part 503. Until DEQ seeks and is granted authority to administer the Part 503 regulations by EPA, treatment works treating domestic sewage should continue to work directly with EPA to comply with them. For more information, you may call the EPA Region III office in Philadelphia at 215-814-5735.

As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty days from the date of service (the date you actually received this decision or the date it was mailed to you, whichever occurred first) within which to appeal this decision by filing a notice of appeal in accordance with the Rules of the Supreme Court of Virginia with the Director, Department of Environmental Quality. In the event that this decision is served on you by mail, three days are added to that period.

Alternately, any owner under §§ 62.1-44.16, 62.1-44.17, and 62.1-44.19 of the State Water Control Law aggrieved by any action of the State Water Control Board taken without a formal hearing, or by inaction of the Board, may demand in writing a formal hearing of such owner's grievance, provided a petition requesting such hearing is filed with the Board. Said petition must meet the requirements set forth in §1.23(b) of the Board's Procedural Rule No. 1. In cases involving actions of the Board, such petition must be filed within thirty days after notice of such action is mailed to such owner by certified mail.

VA0090689
Final Permit to Facility
24 June 2016
Page 2 of 2

A Reliability Class II is assigned to this facility and this facility has Class III licensed operator requirements.

Please contact Douglas Frasier at 703-583-3873 or via email at Douglas.Frasier@deq.virginia.gov should you have any questions concerning the permit.

Respectfully,



Bryant Thomas
Regional Water Permits & Planning Manager

Enc.: Permit for VA0090689
Fact Sheet for VA0090689

cc: DEQ-Water, OWPP
EPA-Region III, 3WP12
Department of Health, Culpeper
Water Compliance, NRO
William Stanley, Operator via wps2@outlook.com



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Permit No. **VA0090689**
Effective Date: **July 1, 2016**
Expiration Date: **June 30, 2021**

AUTHORIZATION TO DISCHARGE UNDER THE VIRGINIA POLLUTANT DISCHARGE ELIMINATION SYSTEM AND THE VIRGINIA STATE WATER CONTROL LAW

In compliance with the provisions of the Clean Water Act as amended and pursuant to the State Water Control Law and regulations adopted pursuant thereto, the following owner is authorized to discharge in accordance with the information submitted with the permit application, and with this permit cover page, Part I – Effluent Limitations and Monitoring Requirements, and Part II – Conditions Applicable To All VPDES Permits, as set forth herein.

Owner Name: Six-O-Five Mobile Home Group, LLC
Facility Name: Hill Mobile Home Park STP #2
County: Caroline
Facility Location: Intersection of Lakewood Road and A.P. Hill Boulevard, Bowling Green, VA

The owner is authorized to discharge to the following receiving stream:

Stream Name: Maracossic Creek, UT
River Basin: York River
River Subbasin: None
Section: 3
Class: III
Special Standards: None

A handwritten signature in blue ink, appearing to read "Thomas A. Faha", written over a horizontal line.

Thomas A. Faha
Director, Northern Regional Office
Department of Environmental Quality

June 22, 2016
Date

A. Effluent Limitations and Monitoring Requirements**Outfall 001 – 0.005 MGD Facility**

- 1 There shall be no discharge of floating solids or visible foam in other than trace amounts
- 2 During the period beginning with the permit's effective date and lasting until the expiration, the permittee is authorized to discharge from Outfall Number 001. Such discharges shall be limited and monitored by the permittee as specified below

Parameter	Discharge Limitations				Monitoring Requirements			
	<u>Monthly Average</u> ⁽¹⁾		<u>Weekly Average</u> ⁽¹⁾		<u>Minimum</u>	<u>Maximum</u> ⁽¹⁾	<u>Frequency</u>	<u>Sample Type</u>
Flow ⁽²⁾ (MGD)	NL		NA		NA	NL	1/D	Estimate
pH	NA		NA		6.0 S.U.	9.0 S.U.	1/D	Grab
cBOD ₅ ⁽³⁾	10 mg/L	0.19 kg/day	15 mg/L	0.28 kg/day	NA	NA	1/M	Grab
Total Suspended Solids (TSS) ^{(3) (4)}	10 mg/L	0.19 kg/day	15 mg/L	0.28 kg/day	NA	NA	1/M	Grab
Dissolved Oxygen	NA		NA		5.0 mg/L	NA	1/D	Grab
Total Kjeldahl Nitrogen (TKN)	3.0 mg/L	0.06 kg/day	4.5 mg/L	0.09 kg/day	NA	NA	1/M	Grab
<i>E. coli</i> (Geometric Mean) ^{(5) (6)}	126 n/100 mL		NA		NA	NA	1/W	Grab
Total Residual Chlorine (after contact tank)	NA		NA		1.0 mg/L	NA	1/D	Grab
Total Residual Chlorine (after dechlorination)	0.008 mg/L		0.010 mg/L		NA	NA	1/D	Grab
NO ₂ + NO ₃ as Nitrogen	NL mg/L		NA		NA	NA	1/YR	Grab
Total Nitrogen ⁽⁷⁾	NL mg/L		NA		NA	NA	1/YR	Calculated
Total Phosphorus	2.0 mg/L		NA		NA	NA	1/M	Grab

⁽¹⁾ See Part I B

MGD = Million gallons per day

1/D = Once every day

⁽²⁾ The design flow is 0.005 MGD

NA = Not applicable

1/W = Once every week

⁽³⁾ At least 85% removal for cBOD₅ and TSS shall be attained

NL = No limit, monitor and report

1/M = Once every month

⁽⁴⁾ TSS shall be expressed as two significant figures

S.U. = Standard units

1/YR = Once every calendar year

⁽⁵⁾ Between 10 AM and 4 PM.

⁽⁶⁾ The permittee shall sample and submit *E. coli* results at the frequency of once every week for three (3) months

If all reported results for *E. coli* do not exceed 126 n/100mL, reported as the geometric mean, the permittee may submit a written request to DEQ-NRO for a reduction in the sampling frequency to once per quarter

Upon approval, the permittee shall collect four (4) samples during one month within each quarterly monitoring period as defined below. The results shall be reported as the geometric mean.

The quarterly monitoring periods shall be January through March, April through June, July through September and October through December. The DMR shall be submitted no later than the 10th day of the month following the monitoring period.

Should any of the quarterly monitoring results for *E. coli* exceed 126 n/100mL, reported as the geometric mean, the monitoring frequency shall revert to once per week for the remainder of the permit term.

⁽⁷⁾ Total Nitrogen = Sum of TKN plus Nitrate+Nitrite. Nitrate+Nitrite and TKN samples shall be taken concurrently during the same month.

Estimate = Reported flow is to be based on the technical evaluation of the sources contributing to the discharge.

Grab = An individual sample collected over a period of time not to exceed 15-minutes.

(Remainder of page intentionally left blank)

B. Additional Monitoring Requirements, Quantification Levels and Compliance Reporting**1. Additional Total Residual Chlorine (TRC) Limitations and Monitoring Requirements**

- a. The permittee shall monitor the TRC at the outlet of the chlorine contact tank once per day by grab sample.
- b. No more than three (3) of the total number of monthly samples taken at the outlet of the chlorine contact tank shall be less than 1.0 mg/L for any one calendar month.
- c. No TRC sample collected at the outlet of the chlorine contact tank shall be less than 0.6 mg/L.
- d. If dechlorination facilities exist the samples above shall be collected prior to dechlorination.
- e. If disinfection is by a method other than chlorination, *E. coli* shall be limited and monitored by the permittee as specified below and this requirement, if applicable, shall substitute for the TRC and *E. coli* requirements delineated elsewhere in Part I of this permit.

	<u>Discharge Limitations</u>	<u>Monitoring</u>	<u>Sample Type</u>
	<u>Monthly Average</u>	<u>Frequency Requirements</u>	
<i>E. coli</i>	126 n/100mL Geometric Mean	Once per week (1/W)	Grab Between 10 AM & 4 PM

2. Quantification Levels

- a. The quantification levels (QL) shall be less than or equal to the following concentrations:

<u>Characteristic</u>	<u>Quantification Level</u>
Total Suspended Solids (TSS)	1.0 mg/L
carbonaceous- Biochemical Oxygen Demand-5 day (cBOD ₅)	2 mg/L
Total Residual Chlorine (TRC)	0.10 mg/L
Total Kjeldahl Nitrogen (TKN)	0.50 mg/L

- b. The QL is defined as the lowest concentration used to calibrate a measurement system in accordance with the procedures published for the method. It is the responsibility of the permittee to ensure that proper quality assurance/quality control (QA/QC) protocols are followed during the sampling and analytical procedures. QA/QC information shall be documented to confirm that appropriate analytical procedures have been used and the required QLs have been attained. The permittee shall use any method in accordance with Part II.A of this permit.

3. Compliance Reporting for Parameters in Part I.A.

- a. Monthly Average – Compliance with the monthly average limitations and/or reporting requirements for the parameters listed in Part I.B.2.a. of this permit condition shall be determined as follows: All concentration data below the QL used for the analysis (QL must be less than or equal to the QL listed in Part I.B.2.a. above) shall be treated as zero. All concentration data equal to or above the QL used for the analysis shall be treated as it is reported. An arithmetic average shall be calculated using all reported data for the month, including the defined zeros. This arithmetic average shall be reported on the Discharge Monitoring Report (DMR) as calculated. If all data are below the QL used for the analysis, then the average shall be reported as "< QL". If reporting for quantity is required on the DMR and the reported monthly average concentration is < QL, then report "< QL" for the quantity. Otherwise, use the reported concentration data (including the defined zeros) and flow data for each sample day to determine the daily quantity and report the monthly average of the calculated daily quantities.
- b. Weekly Average – Compliance with the weekly average limitations and/or reporting requirements for the parameters listed in Part I.B.2.a. of this permit condition shall be determined as follows: All concentration data below the QL used for the analysis (QL must be less than or equal to the QL listed in Part I.B.2.a. above) shall be treated as zero. All concentration data equal to or above the QL used for the analysis shall be treated as reported. An arithmetic average shall be calculated using all reported data, including the defined zeros, collected within each complete calendar week and entirely contained within the reporting month.

The maximum value of the weekly averages thus determined shall be reported on the DMR. If all data are below the QL used for the analysis, then the weekly average shall be reported as "< QL". If reporting for quantity is required on the DMR and the reported weekly average concentration is < QL, then report "< QL" for the quantity. Otherwise use the reported concentration data (including the defined zeros) and flow data for each sample day to determine the daily quantity and report the maximum weekly average of the calculated daily quantities.

- c. Single Datum – Any single datum required shall be reported as "< QL" if it is less than the QL used in the analysis (QL must be less than or equal to the QL listed in Part I.B.2.a. above). Otherwise the numerical value shall be reported.
- d. Significant Digits – The permittee shall report at least the same number of significant digits as the permit limit for a given parameter. Regardless of the rounding convention used by the permittee (i.e. 5 always rounding up or to the nearest even number), the permittee shall use the convention consistently and shall ensure that consulting laboratories employed by the permittee use the same convention.
- e. For total phosphorus, all daily concentration data below the quantification level (QL) for the analytical method used should be treated as half the QL. All daily concentration data equal to or above the QL for the analytical method used shall be treated as it is reported.
- f. For total nitrogen (TN), if none of the daily concentration data for the respective species (i.e. TKN, Nitrates/Nitrites) are equal to or above the QL for the respective analytical methods used, the daily TN concentration value reported shall equal one half of the largest QL used for the respective species. If one of the data is equal to or above the QL, the daily TN concentration value shall be treated as that data point is reported. If more than one of the data is above the QL, the daily TN concentration value shall equal the sum of the data points as reported.

C. Other Requirements and Special Conditions

1. 95% Capacity Reopener

A written notice and a plan of action for ensuring continued compliance with the terms of this permit shall be submitted to the DEQ-Northern Regional Office (DEQ-NRO) when the monthly average flow influent to the sewage treatment plant reaches 95% of the design capacity authorized in this permit for each month of any three consecutive month period. The written notice shall be submitted within 30 days and the plan of action shall be received at the DEQ-NRO no later than 90 days from the third consecutive month for which the flow reached 95% of the design capacity. The plan shall include the necessary steps and a prompt schedule of implementation for controlling any current or reasonably anticipated problem resulting from high influent flows. Failure to submit an adequate plan in a timely manner shall be deemed a violation of this permit.

2. Indirect Discharges

The permittee shall provide adequate notice to the Department of the following:

- a. Any new introduction of pollutants into the treatment works from an indirect discharger which would be subject to Section 301 or 306 of Clean Water Act and the State Water Control Law if it were directly discharging those pollutants; and
- b. Any substantial change in the volume or character of pollutants being introduced into the treatment works by a source introducing pollutants into the treatment works at the time of issuance of this permit.

Adequate notice shall include information on (i) the quality and quantity of effluent introduced into the treatment works, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the treatment works.

(Remainder of page intentionally left blank)

3. Operations and Maintenance Manual Requirement

The permittee shall maintain a current Operations and Maintenance (O&M) Manual for the treatment works that is in accordance with Virginia Pollutant Discharge Elimination System Regulations, 9VAC25-31 and Sewage Collection and Treatment Regulations, 9VAC25-790.

The O&M Manual and subsequent revisions shall include the manual effective date and meet Part II.K.2 and Part II.K.4 Signatory Requirements of the permit. Any changes in the practices and procedures followed by the permittee shall be documented in the O&M Manual within 90 days of the effective date of the changes. The permittee shall operate the treatment works in accordance with the O&M Manual and shall make the O&M manual available to Department personnel for review during facility inspections. Within 30 days of a request by DEQ, the current O&M Manual shall be submitted to the DEQ-NRO for review and approval.

The O&M Manual shall detail the practices and procedures which will be followed to ensure compliance with the requirements of this permit. This manual shall include, but not necessarily be limited to, the following items, as appropriate:

- a. Permitted outfall locations and techniques to be employed in the collection, preservation and analysis of effluent, storm water and sludge samples;
- b. Procedures for measuring and recording the duration and volume of treated wastewater discharged;
- c. Discussion of Best Management Practices, if applicable;
- d. Procedures for handling, storing and disposing of all wastes, fluids and pollutants that will prevent these materials from reaching state waters. List type and quantity of wastes, fluids and pollutants (e.g. chemicals) stored at this facility;
- e. Discussion of treatment works design, treatment works operation, routine preventative maintenance of units within the treatment works, critical spare parts inventory and record keeping;
- f. Plan for the management and/or disposal of waste solids and residues;
- g. Hours of operation and staffing requirements for the plant to ensure effective operation of the treatment works and maintain permit compliance;
- h. List of facility, local and state emergency contacts; and
- i. Procedures for reporting and responding to any spills/overflows/ treatment works upsets.

4. Certificate to Construct/Certificate to Operate Requirements

In accordance with *Sewage Collection and Treatment* regulation (9VAC25-790), the permittee shall obtain a Certificate to Construct (CTC) and a Certificate to Operate (CTO) from the Department of Environmental Quality prior to constructing wastewater treatment works and operating the treatment works, respectively. Non-compliance with the CTC or CTO shall be deemed a violation of the permit.

5. Financial Assurance

The permittee shall provide continuous coverage to implement the approved closure plan until released from financial assurance requirements by the State Water Control Board. If a transfer of ownership or operational control of this facility occurs, the permittee shall comply with the requirements of 9VAC25-650 until the new owner or operator has demonstrated compliance with the requirements of 9VAC25-650. Failure to maintain adequate financial assurance in accordance with 9VAC25-650 shall be a basis for termination of this VPDES permit. During the term of this VPDES permit, the permittee shall revise the closure plan implementation cost estimate concurrently with any revision made to the closure plan which increases the closure plan cost. At a minimum, the permittee shall annually adjust the closure plan implementation cost estimate in accordance with 9VAC25-650 within 60 days prior to the anniversary date of the establishment of the approved financial assurance mechanism.

The permittee shall disclose the provisions of this permit to all purchasers of property served by this permitted facility in accordance with Section 55-519 of the Code of Virginia.

6. Licensed Operator Requirement

The permittee shall employ or contract at least one Class III licensed wastewater works operator for this facility. The license shall be issued in accordance with Title 54.1 of the Code of Virginia and Board for Waterworks and Wastewater Works Operators and Onsite Sewage System Professionals Regulations. The permittee shall notify the Department in writing whenever he is not complying, or has grounds for anticipating he will not comply with this requirement. The notification shall include a statement of reasons and a prompt schedule for achieving compliance.

7. Reliability Class

The permitted treatment works shall meet Reliability Class II.

8. Water Quality Criteria Reopener

Should effluent monitoring indicate the need for any water quality-based limitations, this permit may be modified or alternatively revoked and reissued to incorporate appropriate limitations.

9. Sludge Reopener

The Board may promptly modify or revoke and reissue this permit if any applicable standard for sewage sludge use or disposal promulgated under Section 405(d) of the Clean Water Act is more stringent than any requirements for sludge use or disposal in this permit, or controls a pollutant or practice not limited in this permit.

10. Sludge Use and Disposal

The permittee shall conduct all sewage sludge use or disposal activities in accordance with the Sludge Management Plan (SMP) approved with the issuance of this permit. Any proposed changes in the sewage sludge use or disposal practices or procedures followed by the permittee shall be documented and submitted for DEQ-NRO approval 90 days prior to the effective date of the changes. Upon approval, the revised SMP becomes an enforceable part of the permit. The permit may be modified or alternatively revoked and reissued to incorporate limitations or conditions necessitated by substantive changes in sewage sludge use or disposal practices.

11. Treatment Works Closure Plan or Closure Plan

If the permittee plans an expansion or upgrade to replace the existing treatment works, or if facilities are permanently closed, the permittee shall submit to the DEQ-NRO a closure plan for the existing treatment works. The plan shall address the following information as a minimum: Verification of elimination of sources and/or alternate treatment scheme; treatment, removal and final disposition of residual wastewater and solids; removal/demolition/disposal of structures, equipment, piping and appurtenances; site grading, and erosion and sediment control; restoration of site vegetation; access control; fill materials; and proposed land use (post-closure) of the site. The plan should contain proposed dates for beginning and completion of the work. The plan must be approved by the DEQ prior to implementation. Once approved, the plan shall become an enforceable part of this permit and closure shall be implemented in accordance with the approved plan. No later than 14 calendar days following closure completion, the permittee shall submit to the DEQ-NRO written notification of the closure completion date and a certification of closure in accordance with the approved plan.

12. Total Maximum Daily Load (TMDL) Reopener

This permit shall be modified or alternatively revoked and reissued if any approved wasteload allocation procedure, pursuant to Section 303(d) of the Clean Water Act, imposes wasteload allocations, limits or conditions on the facility that are not consistent with the permit requirements.

CONDITIONS APPLICABLE TO ALL VPDES PERMITS

A. Monitoring

1. Samples and measurements required by this permit shall be taken at the permit designated or approved location and be representative of the monitored activity.
 - a. Monitoring shall be conducted according to procedures approved under Title 40 Code of Federal Regulations Part 136 or alternative methods approved by the U.S. Environmental Protection Agency, unless other procedures have been specified in this permit.
 - b. The permittee shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will insure accuracy of measurements.
 - c. Samples taken shall be analyzed in accordance with 1VAC30-45, Certification for Noncommercial Environmental Laboratories, or 1VAC30-46, Accreditation for Commercial Environmental Laboratories.
2. Any pollutant specifically addressed by this permit that is sampled or measured at the permit designated or approved location more frequently than required by this permit shall meet the requirements in A 1 a through c above and the results of this monitoring shall be included in the calculations and reporting required by this permit.
3. Operational or process control samples or measurements shall not be taken at the designated permit sampling or measurement locations. Operational or process control samples or measurements do not need to follow procedures approved under Title 40 Code of Federal Regulations Part 136 or be analyzed in accordance with 1VAC30-45, Certification for Noncommercial Environmental Laboratories, or 1VAC30-46, Accreditation for Commercial Environmental Laboratories.

B. Records

1. Records of monitoring information shall include:
 - a. The date, exact place, and time of sampling or measurements;
 - b. The individual(s) who performed the sampling or measurements;
 - c. The date(s) and time(s) analyses were performed;
 - d. The individual(s) who performed the analyses;
 - e. The analytical techniques or methods used; and
 - f. The results of such analyses.
2. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years, the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the permittee, or as requested by the Board.

C. Reporting Monitoring Results

1. The permittee shall submit the results of the monitoring required by this permit not later than the 10th day of the month after monitoring takes place, unless another reporting schedule is specified elsewhere in this permit.

Monitoring results shall be submitted to:

Department of Environmental Quality – Northern Regional Office (DEQ-NRO)
13901 Crown Court
Woodbridge, VA 22193

2. Monitoring results shall be reported on a Discharge Monitoring Report (DMR) or on forms provided, approved or specified by the Department.
3. Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

D. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Board may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Board may require the permittee to furnish, upon request, such plans, specifications, and other pertinent information as may be necessary to determine the effect of the wastes from this discharge on the quality of state waters, or such other information as may be necessary to accomplish the purposes of the State Water Control Law. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.

E. Compliance Schedule Reports

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. Unauthorized Discharges

Except in compliance with this permit, or another permit issued by the Board, it shall be unlawful for any person to:

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances; or
2. Otherwise alter the physical, chemical or biological properties of such state waters and make them detrimental to the public health, or to animal or aquatic life, or to the use of such waters for domestic or industrial consumption, or for recreation, or for other uses.

G. Reports of Unauthorized Discharges

Any permittee who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance into or upon state waters in violation of Part II.F.; or who discharges or causes or allows a discharge that may reasonably be expected to enter state waters in violation of Part II.F., shall notify the Department of the discharge immediately upon discovery of the discharge, but in no case later than 24 hours after said discovery. A written report of the unauthorized discharge shall be submitted to the Department, within five days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;
2. The cause of the discharge;
3. The date on which the discharge occurred;
4. The length of time that the discharge continued;
5. The volume of the discharge;
6. If the discharge is continuing, how long it is expected to continue;
7. If the discharge is continuing, what the expected total volume of the discharge will be; and

8. Any steps planned or taken to reduce, eliminate and prevent a recurrence of the present discharge or any future discharges not authorized by this permit.

Discharges reportable to the Department under the immediate reporting requirements of other regulations are exempted from this requirement.

H. Reports of Unusual or Extraordinary Discharges

If any unusual or extraordinary discharge including a bypass or upset should occur from a treatment works and the discharge enters or could be expected to enter state waters, the permittee shall promptly notify, in no case later than 24 hours, the Department by telephone after the discovery of the discharge. This notification shall provide all available details of the incident, including any adverse affects on aquatic life and the known number of fish killed. The permittee shall reduce the report to writing and shall submit it to the Department within five days of discovery of the discharge in accordance with Part II.I.2. Unusual and extraordinary discharges include but are not limited to any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;
2. Breakdown of processing or accessory equipment;
3. Failure or taking out of service some or all of the treatment works; and
4. Flooding or other acts of nature.

I. Reports of Noncompliance

The permittee shall report any noncompliance which may adversely affect state waters or may endanger public health.

1. An oral report shall be provided within 24 hours from the time the permittee becomes aware of the circumstances. The following shall be included as information which shall be reported within 24 hours under this paragraph:
 - a. Any unanticipated bypass; and
 - b. Any upset which causes a discharge to surface waters.
2. A written report shall be submitted within 5 days and shall contain:
 - a. A description of the noncompliance and its cause;
 - b. The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and
 - c. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Board may waive the written report on a case-by-case basis for reports of noncompliance under Part II.I. if the oral report has been received within 24 hours and no adverse impact on state waters has been reported.

3. The permittee shall report all instances of noncompliance not reported under Parts II, I.1. or I.2., in writing, at the time the next monitoring reports are submitted. The reports shall contain the information listed in Part II.I.2.

NOTE: The immediate (within 24 hours) reports required in Parts II, G., H. and I. may be made to the Department's Northern Regional Office at (703) 583-3800 or online at

<http://www.deq.virginia.gov/Programs/PollutionResponsePreparedness/MakingaReport.aspx>.

For reports outside normal working hours, leave a message and this shall fulfill the immediate reporting requirement. For emergencies, the Virginia Department of Emergency Services maintains a 24-hour telephone service at 1-800-468-8892.

J. Notice of Planned Changes

1. The permittee shall give notice to the Department as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:
 - a. The permittee plans alteration or addition to any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced:
 - 1) After promulgation of standards of performance under Section 306 of Clean Water Act which are applicable to such source; or
 - 2) After proposal of standards of performance in accordance with Section 306 of Clean Water Act which are applicable to such source, but only if the standards are promulgated in accordance with Section 306 within 120 days of their proposal;
 - b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations nor to notification requirements specified elsewhere in this permit; or
 - c. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.
2. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

K. Signatory Requirements

1. Applications. All permit applications shall be signed as follows:
 - a. For a corporation: by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:
 - 1) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or
 - 2) The manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;
 - b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or
 - c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a public agency includes:
 - 1) The chief executive officer of the agency, or
 - 2) A senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

2. Reports, etc. All reports required by permits, and other information requested by the Board shall be signed by a person described in Part II.K.1., or by a duly authorized representative of that person. A person is a duly authorized representative only if:
 - a. The authorization is made in writing by a person described in Part II.K.1.;
 - b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and
 - c. The written authorization is submitted to the Department.
3. Changes to authorization. If an authorization under Part II.K.2. is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part II.K.2. shall be submitted to the Department prior to or together with any reports, or information to be signed by an authorized representative.
4. Certification. Any person signing a document under Parts II, K.1. or K.2. shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

L. Duty to Comply

The permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the State Water Control Law and the Clean Water Act, except that noncompliance with certain provisions of this permit may constitute a violation of the State Water Control Law but not the Clean Water Act. Permit noncompliance is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if this permit has not yet been modified to incorporate the requirement.

M. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee shall apply for and obtain a new permit. All permittees with a currently effective permit shall submit a new application at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Board. The Board shall not grant permission for applications to be submitted later than the expiration date of the existing permit.

N. Effect of a Permit

This permit does not convey any property rights in either real or personal property or any exclusive privileges, nor does it authorize any injury to private property or invasion of personal rights, or any infringement of federal, state or local law or regulations.

O. State Law

Nothing in this permit shall be construed to preclude the institution of any legal action under, or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any other state law or regulation or under authority preserved by Section 510 of the Clean Water Act. Except as provided in permit conditions on "bypassing" (Part II.U.), and "upset" (Part II.V.) nothing in this permit shall be construed to relieve the permittee from civil and criminal penalties for noncompliance.

P. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Sections 62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law.

Q. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes effective plant performance, adequate funding, adequate staffing, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by the permittee only when the operation is necessary to achieve compliance with the conditions of this permit.

R. Disposal of Solids or Sludges

Solids, sludges or other pollutants removed in the course of treatment or management of pollutants shall be disposed of in a manner so as to prevent any pollutant from such materials from entering state waters.

S. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

T. Need to Halt or Reduce Activity not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

U. Bypass

1. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Parts II, U.2. and U.3.
2. Notice
 - a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, prior notice shall be submitted, if possible at least ten days before the date of the bypass.
 - b. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Part II.I.
3. Prohibition of bypass.
 - a. Bypass is prohibited, and the Board may take enforcement action against a permittee for bypass, unless:
 - 1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

- 2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
 - 3) The permittee submitted notices as required under Part II.U.2.
- b. The Board may approve an anticipated bypass, after considering its adverse effects, if the Board determines that it will meet the three conditions listed above in Part II.U.3.a.

V. Upset

1. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of Part II.V.2. are met. A determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is not a final administrative action subject to judicial review.
2. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
 - a. An upset occurred and that the permittee can identify the cause(s) of the upset;
 - b. The permitted facility was at the time being properly operated;
 - c. The permittee submitted notice of the upset as required in Part II.I.; and
 - d. The permittee complied with any remedial measures required under Part II.S.
3. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

W. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
4. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act and the State Water Control Law, any substances or parameters at any location.

For purposes of this section, the time for inspection shall be deemed reasonable during regular business hours, and whenever the facility is discharging. Nothing contained herein shall make an inspection unreasonable during an emergency.

X. Permit Actions

Permits may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

Y. Transfer of permits

1. Permits are not transferable to any person except after notice to the Department. Except as provided in Part II.Y.2., a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued, or a minor modification made, to identify the new permittee and incorporate such other requirements as may be necessary under the State Water Control Law and the Clean Water Act.
2. As an alternative to transfers under Part II.Y.1., this permit may be automatically transferred to a new permittee if:
 - a. The current permittee notifies the Department at least 30 days in advance of the proposed transfer of the title to the facility or property;
 - b. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and
 - c. The Board does not notify the existing permittee and the proposed new permittee of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in Part II.Y.2.b.

Z. Severability

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

Exhibit 2
Plant O&M Manual

**OPERATION & MAINTENANCE MANUAL
ADENDUM**

PREPARED FOR:

HILL MOBILE HOME PARK STP #2

VA0090689

PREPARED BY:

CULPEPER ENGINEERING, PC

culpeng@gemlink.com

540 423 9706

ADENDUM DATE: 7-28-20

INTRODUCTION

This Operation & Maintenance Manual Addendum is for the Hill Mobile Home Park STP #2 owned by Six-O-Five Mobile Home Group, LLC. The Wastewater Treatment Plant is located in Caroline County, near the intersection of Lakewood Road and A.P. Hill Boulevard in Bowling Green.

This O & M Manual Addendum provides information for the operation and maintenance of the plant to meet the requirements of the issued VPDES Permit, VA0090689. The manual provides information detailing the state discharge requirements, a description of the routine operation of the plant, a description of the installed equipment and the routine maintenance of the equipment, sampling and laboratory requirements and procedures, and plant safety.

The purpose of this manual addendum is to provide guidelines, procedures and objectives to the operator on the operation and maintenance procedures of the wastewater treatment facilities. The operator may use this manual to perform his duties in an efficient and competent manner. The O & M Manual should be kept current (maintain copy of current permit with the Manual); the manual should be considered “operational” and as such, should be updated as appropriate to reflect plant operational procedures employed at the facility.

The Operations and Maintenance requirements portion of this manual provides a minimum schedule of functions that should be performed in order to prevent major problems and insure the highest quality effluent possible for this facility. Copies of the permit, blank forms, equipment literature/reference information are also included. The addendum should be utilized with the existing manual that was provided by the treatment

plant supplier. Detailed information regarding installed equipment is available in the equipment literature.

STATE DISCHARGE REQUIREMENTS

The Virginia Department of Environmental Quality has issued the facility VPDES Permit No. VA0090689. The design flow of the treatment plant is 0.005 MGD. The discharge point (001) is to an unnamed tributary to Maracossic Creek.

TABLE 1 OUTFALL DESCRIPTION				
Number	Discharge Sources	Treatment	Design Flow	Latitude / Longitude
001	Domestic Wastewater	See Section 10	0.005 MGD	38° 03' 51" / 77° 19' 52"

Wastewater Sources and Treatment Description:

Sewage generated in the mobile home park flows via gravity to a septic tank preceding the treatment plant. The sewage is then pumped from the septic tank to the package plant.

The treatment plant is manufactured by Fluidyne and consists of a three cell Sequence Batch Reactor (SBR) using Sequenced Anoxic Mixing (SAM) technology. The following describes each cell and the processes that occur during treatment:

- The sewage flows into the first cell which serves as a surge tank/equalization basin, digester for waste activated sludge (WAS) and also as a grit removal unit. As the first cell fills, it overflows into the second cell.
- The second cell is the anoxic zone where denitrification occurs. There are two centrifugal pumps that once activated, begin filling the third cell.
- Aeration and mixing occur in the third cell, followed by settling and then the supernatant is decanted and discharged.

Disinfection is completed via a tablet chlorinator; dechlorination is also accomplished by a tablet feeder. Effluent passes through a post aeration unit prior to discharge.

The reporting requirements for the facility are specified in the issued permit. A copy of the issued permit has been included as an attachment to this document. A current copy of the VPDES Permit will be maintained with this Manual in the future.

The following requirements have been excerpted from the issued VPDES Permit. These excerpts detail permit requirements associated with reports of unauthorized, unusual, or extraordinary discharges and reports on noncompliance requirements

Unauthorized Discharges

Except in compliance with this permit, or another permit issued by the Board, it shall be unlawful for any person to:

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances; or
2. Otherwise alter the physical, chemical or biological properties of such state waters and make them detrimental to the public health, or to animal or aquatic life, or to the use of such waters for domestic or industrial consumption, or for recreation, or for other uses.

Reports of Unauthorized Discharges

Any permittee who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance into or upon state waters in violation of Part II.F.; or who discharges or causes or allows a discharge that may reasonably be expected to enter state waters in violation of Part II.F., shall notify the Department of the discharge immediately upon discovery of the discharge, but in no case later than 24 hours after said discovery. A written report of the unauthorized discharge shall be submitted to the Department, within five days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;
2. The cause of the discharge;
3. The date on which the discharge occurred;
4. The length of time that the discharge continued;
5. The volume of the discharge;
6. If the discharge is continuing, how long it is expected to continue;
7. If the discharge is continuing, what the expected total volume of the discharge will be; and
8. Any steps planned or taken to reduce, eliminate and prevent a recurrence of the present discharge or any future discharges not authorized by this permit.

Discharges reportable to the Department under the immediate reporting requirements of other regulations are exempted from this requirement.

Reports of Unusual or Extraordinary Discharges

If any unusual or extraordinary discharge including a bypass or upset should occur from a treatment works and the discharge enters or could be expected to enter state waters, the permittee shall promptly notify, in no case later than 24 hours, the Department by telephone after the discovery of the discharge. This notification shall provide all available details of the incident, including any adverse affects on aquatic life and the known number of fish killed. The permittee shall reduce the report to writing and shall submit it to the Department within five days of discovery of the discharge in accordance with Part II.I.2. Unusual and extraordinary discharges include but are not limited to any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;
2. Breakdown of processing or accessory equipment;
3. Failure or taking out of service some or all of the treatment works; and
4. Flooding or other acts of nature.

Reports of Noncompliance

The permittee shall report any noncompliance which may adversely affect state waters or may endanger public health.

1. An oral report shall be provided within 24 hours from the time the permittee becomes aware of the circumstances. The following shall be included as information which shall be reported within 24 hours under this paragraph:
 - a. Any unanticipated bypass; and
 - b. Any upset which causes a discharge to surface waters.
2. A written report shall be submitted within 5 days and shall contain:
 - a. A description of the noncompliance and its cause;
 - b. The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and
 - c. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Board may waive the written report on a case-by-case basis for reports of noncompliance under Part II.I. if the oral report has been received within 24 hours and no adverse impact on state waters has been reported.

3. The permittee shall report all instances of noncompliance not reported under Parts II, I.1. or I.2., in writing, at the time the next monitoring reports are submitted. The reports shall contain the information listed in Part II.I.2.

NOTE: The immediate (within 24 hours) reports required in Parts II, G., H. and I. may be made to the Department's Northern Regional Office at (703) 583-3800 (voice) or online at <http://www.deq.virginia.gov/Programs/PollutionResponsePreparedness/MakingaReport.aspx>.

For reports outside normal working hours, leave a message and this shall fulfill the immediate reporting requirement. For emergencies, the Virginia Department of Emergency Services maintains a 24-hour telephone service at 1-800-468-8892.

The following is a list of terms which may appear in the issued permit. Definitions of the terms have been provided as a reference for facility personnel.

Definition of Terms:

Ammonia N (NH₃-N): A form of nitrogen that is produced largely by deamination of organic nitrogen containing compounds and by hydrolysis of urea.

Carbonaceous Biochemical Oxygen Demand (cBOD₅): The measure of the quantity of oxygen required by bacteria while stabilizing, digesting or treating (biochemical oxidation) the organic matter under aerobic conditions during a five-day period at 20°C under laboratory conditions while in the presence of a chemical inhibitor to block nitrification. Commonly expressed in mg/l.

Total Suspended Solids (TSS): The amount of matter contained in the liquid that will be filtered out by a porous filter with a pore size of 1 micron.

Total Kjeldahl Nitrogen (TKN): Total Kjeldahl nitrogen or [TKN](#) is the **sum of organic nitrogen + ammonia (NH₃)nitrogen and ammonium (NH₄)nitrogen.**

NO₂ (nitrite)+ NO₃ (nitrate) as Nitrogen – Nitrate + Nitrite may be reported as a combined sum. The test procedure allows the sample to be preserved for analysis which extends the holding time.

pH: A term used to describe the acid/base balance in the wastewater. It is defined as the negative logarithm of the hydrogen ion concentration.

Total Residual Chlorine (TRC): The amount of total chlorine contained in the effluent after disinfection. Chlorine residual is measured in two locations. One measurement is taken at the end of the contact chamber to assure adequate disinfection of the wastewater is being achieved. Another measurement is taken after dechlorination to assure that the chlorine is being removed from the effluent stream prior to discharge.

Dissolved Oxygen (DO): Molecular oxygen dissolved in wastewater.

Grab Sample: An individual sample collected over a period of time not to exceed 15 minutes.

Escherichia coli, usually abbreviated to ***E. coli***, is one of the main species of bacteria that live in the lower intestines of mammals.. They are necessary for the proper digestion of food and are part of the intestinal flora. Its presence in groundwater is a common indicator of fecal contamination. It belongs among the [Enterobacteriaceae](#), and is commonly used as a model organism for bacteria in general. *E. coli*. bacteria testing is applicable to monitoring for pollution control.

Quantification Level (QLs): The lowest concentration used to calibrate a measurement system in accordance with procedures published for the approved monitoring method.

DESCRIPTION OF WASTEWATER TREATMENT FACILITY

The facility is a privately owned treatment works which serves a mobile home park. The flow to the treatment facility is domestic wastewater.

Preliminary treatment includes bar screens in manholes where coarse screening occurs prior to flow from the MHP entering a prior septic tank that serves as a pump tank and provides some equalization. Flow is pumped from the tank to the “package plant”.

The package treatment plant is a Fluidyne ISAM Sequencing Bath Reactor. The “Installation Bill of Materials” details the Fluidyne installation.

FLUIDYNE BILL OF MATERIALS		
PROJECT: HILL MOBILE HOME PARK		Date: 03/25/02
Project No.: 02005-SB		Page: 1 of 1
Equipment: ISAM EQUIPMENT		By: INM Rev.:
ITEM	QTY	DESCRIPTION
<u>PVC</u>		
1	1	ISAM PACKAGE TREATMENT TANK (8.5'W X 20'L X 9.5'H)
<u>VALVES</u>		
10	1	3" ELECTRIC EFFLUENT CONTROL BUTTERFLY VALVE (120/1/60)
11	4	2" MANUAL WASTE BALL VALVES (PRE-INSTALLED IN ISAM TANK)
<u>CONTROLS</u>		
20	1	ISAM / MCC CONTROL PANEL
<u>304 STAINLESS STEEL</u>		
31	1	2-FLOAT BRACKET
33	1	3-FLOAT BRACKET
34	1	2' SOLIDS-EXCLUDING DECANTERS
<u>PUMPS</u>		
40	2	3.7HP SUBMERSIBLE ASPIRATOR PUMP (230/1/60)
44	2	20' LONG 3/16" THK LIFT CABLE ASS'Y
<u>HARDWARE & MISCELLANEOUS</u>		
50	7	FLOATS
51	1	VENT VALVE BOX ASSEMBLIES W/3/4" VALVE

Following the SBR, treatment includes tablet chlorine disinfection and dechlorination. There is post aeration provided. The discharge is to an unnamed tributary to Maracossic Creek within the Chesapeake Bay watershed. The permit fact sheet includes information related to the Chesapeake Bay TMDL.

This facility discharges to an unnamed tributary to Maracossic Creek within the Chesapeake Bay watershed. The receiving stream has been identified in the Chesapeake Bay TMDL; approved by the Environmental Protection Agency (EPA) on 29 December 2010. The TMDL addresses dissolved oxygen (D.O.), chlorophyll a and submerged aquatic vegetation (SAV) impairments in the main stem Chesapeake Bay and its tributaries by establishing nonpoint source load allocations (LAs) and point source wasteload allocations (WLAs) for total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) to meet applicable Virginia Water Quality Standards contained in 9VAC25-260-185.

Implementation of the Chesapeake Bay TMDL is currently accomplished in accordance with the Commonwealth of Virginia's Phase I Watershed Implementation Plan (WIP); approved by EPA on 29 December 2010. The approved WIP recognizes the General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Bay Watershed of Virginia (9VAC25-820 et seq.) as controlling the nutrient allocations for nonsignificant Chesapeake Bay dischargers. The approved WIP states that for nonsignificant municipal facilities, nutrient WLAs are to be consistent with Code of Virginia procedures, which set baseline WLAs at 2005 permitted design capacity nutrient load levels.

The TN and TP wasteload allocations for nonsignificant facilities are considered aggregate allocations; however, adherence with current agency guidance, this facility will be required to monitor TN effluent concentration levels during this permit term. Data collected from all nonsignificant facilities will be utilized to verify the estimated facility nutrient loads and the subsequent aggregate wasteload allocations found in the aforementioned WIP.

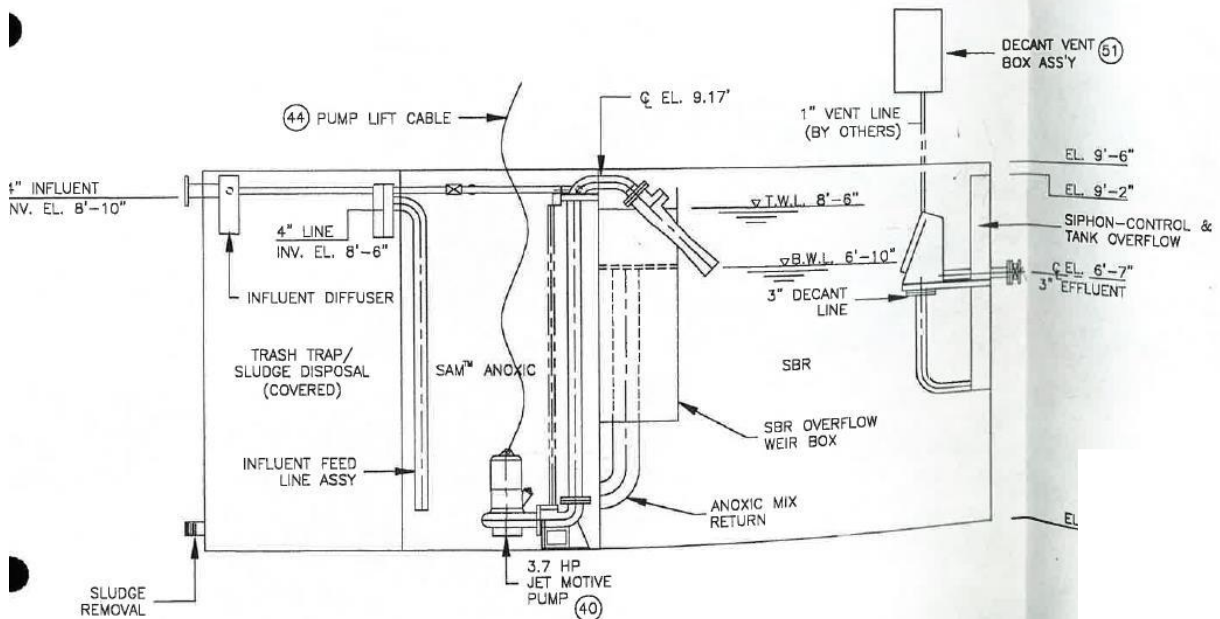
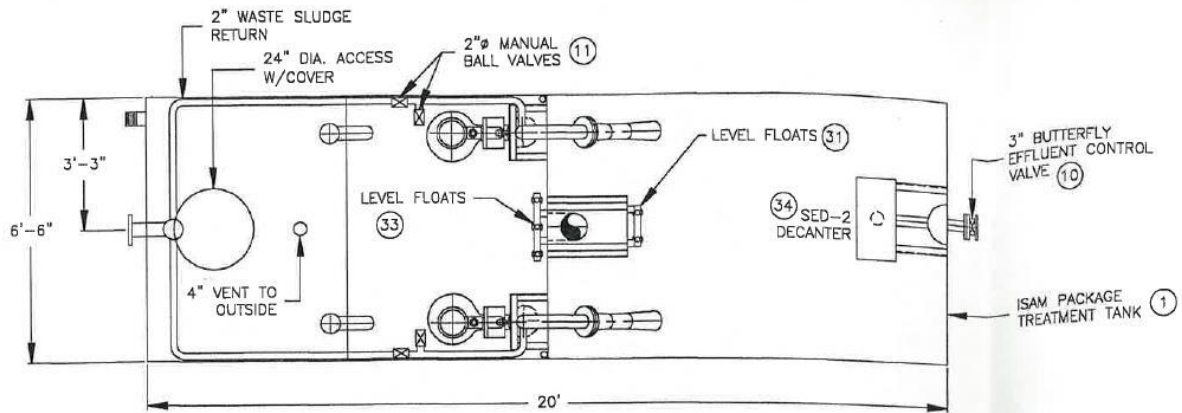
The WIP also considers TSS WLAs for nonsignificant facilities to be aggregate allocations; yet, TSS limits are to be included in individual VPDES permits in conformance with the technology-based requirements found in the Clean Water Act. Furthermore, the WIP recognizes that as long as the aggregated TSS permitted loads for all dischargers is less than the aggregated TSS load in the WIP, the individual permit will be consistent with the TMDL. This individual permit includes TSS limits of 10 mg/L; therefore, this facility is in conformance with technology-based requirements and, in turn, consistent with the Chesapeake Bay TMDL.

Moreover, this individual permit includes limits for total Kjeldahl nitrogen, carbonaceous-biochemical oxygen demand-5 day and D.O., which provide protection of instream D.O. concentrations of at least 5.0 mg/L. As such, the proposed effluent limits for these parameters are consistent with the Chesapeake Bay TMDL and will not cause an impairment or observed violation of the standards for D.O., chlorophyll a or SAV as required by 9VAC25-260-185.

The Permit Fact Sheet also notes the receiving stream is characterized as a swamp/marsh area with no defined flow channel. The following information is included regarding the TKN limitation.

The portion of the receiving stream that this facility discharges to has characteristics of a swamp area; standing, shallow water with no defined channel and little evidence of a distinct flow, allowing plants to grow. For these types of receiving streams, the VPDES Permit Manual recommends a total Kjeldahl nitrogen (TKN) limit of 3.0 mg/L for municipal treatment facilities discharging into swamp and marsh waters. A TKN limit of 3.0 mg/L assumes that the remaining nitrogen is in the form of refractory organic compounds that will not be easily oxidized and that the resulting ammonia concentration is generally less than 1 mg/L. Therefore, this limit ensures that the receiving stream is protected against potential ammonia toxicity as a result of this discharge.

The following is a Fluidyne diagram of the ISAM unit and description of the plant/process.



NOTE:

TANK MATERIAL: 1/4 STEEL PLATE REINFORCED AS REQUIRED FOR HYDRAULIC CONDITIONS.

ALL FLANGES ARE ASA 150# DRILLING, SIZE AS INDICATED.

TANK INCLUDES ALL IN-BASIN EQUIPMENT

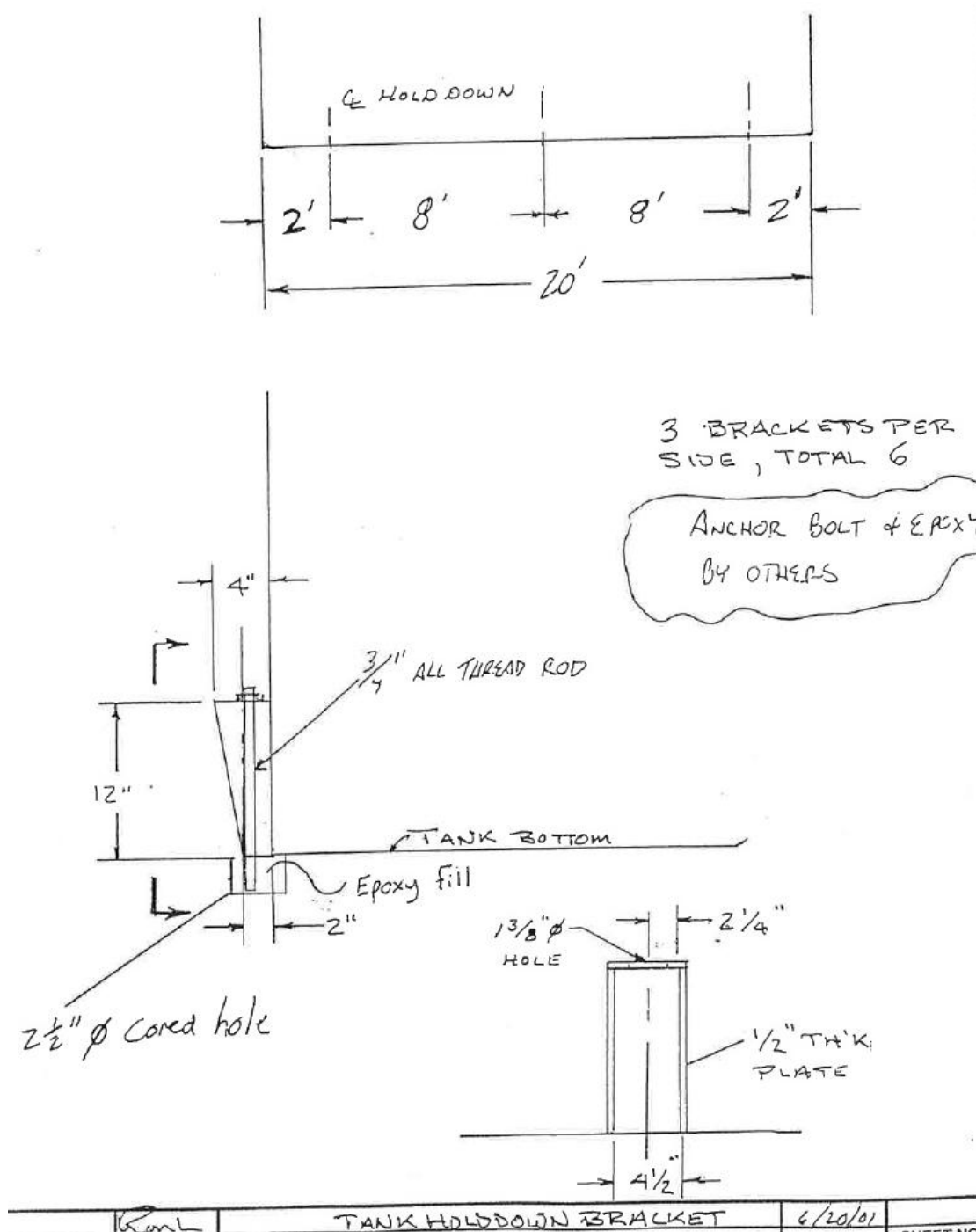
INTERNAL PIPING IS SCHEDULE 40 STEEL OR PVC.

PROTECTIVE COATING: SANDBLAST ENTIRE UNIT TO SPECIFICATIONS SSPC-SP6/SP10 PAINT INSIDE AND OUTSIDE COAL-TAR EPOXY 8-10 MILS.

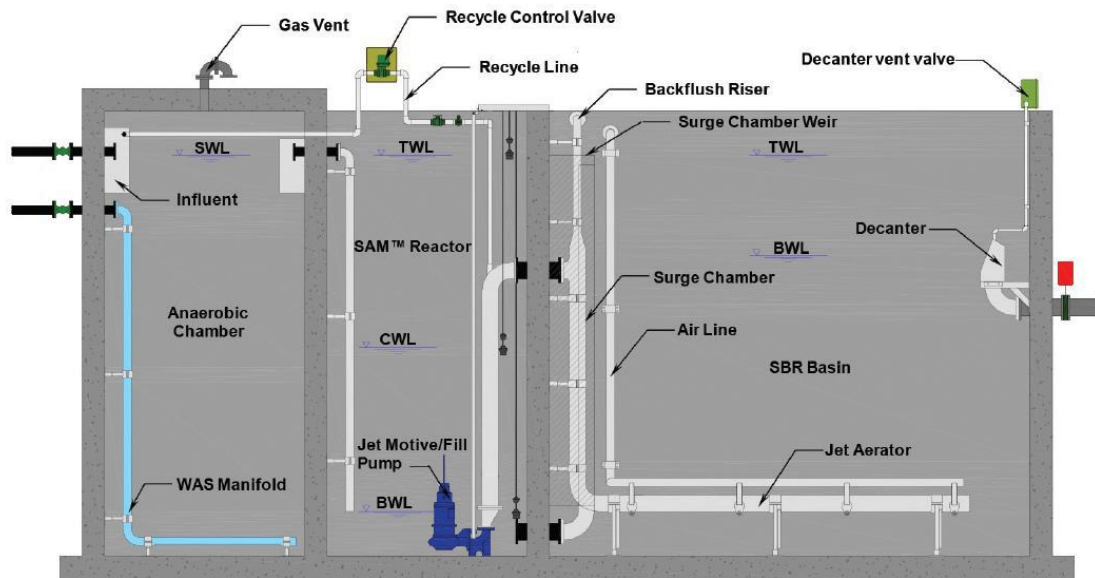
EFFLUENT VALVE AND PIPING MUST BE FREEZE PROTECTED.

This drawing and all appurtenant matter contains information proprietary to Fluidyne Corporation and is loaned subject to return upon demand and must not be reproduced, copied, loaned, reworked, nor used for any other purpose than that for which it is specifically furnished without expressed written consent of Fluidyne Corporation.			
SAM™ PLAN AND ELEVATION HILL MOBILE HOME PARK			
DRAWN	DATE	JOB #	REV
INM	03/21/02		
CHECKED	DATE	SCALE	SHEET OF
		CAD FILE	
		sam/Hill Mobile	

Below is the tie down information specified by Fluidyne:

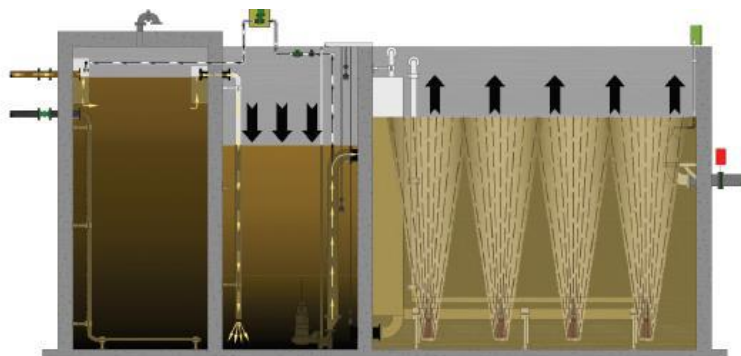


Each cycle (batch) is counted and flow is determined based on the number of batches. A batch discharge volume of ~500 gal./batch may be used (operator may verify).



System Components:

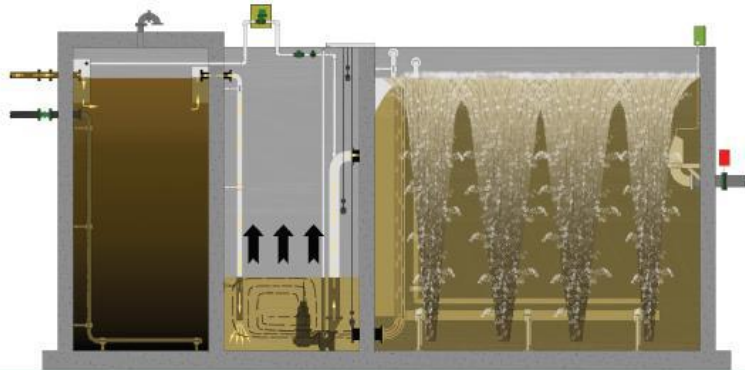
Influent continuously enters the anaerobic chamber where solids settle. Settleable BOD is converted to soluble BOD. BOD is reduced by 30% and solids are reduced by 60%. The influent then flows to the SAM™ reactor. Mixed liquor is maintained in the SAM™ reactor to suppress odors and initiate and accelerate carbon and nitrogen reduction.



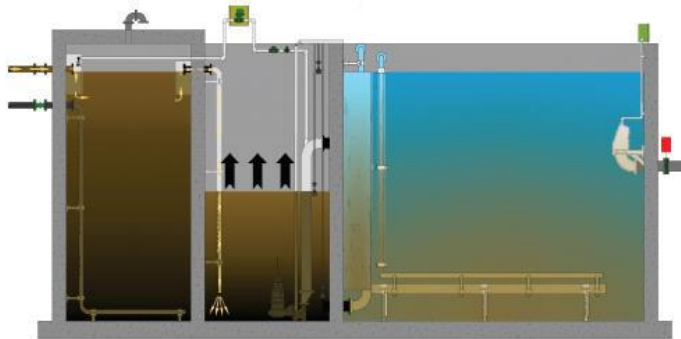
Fill Phase:

When the level in the SAM™ reactor reaches a predetermined "control level" the motive liquid pump is started. The SBR basin is filled and mixed. A percentage of the pumped flow is returned to the anaerobic chamber where biological solids settle. Settled solids in the anaerobic chamber are digested.

Interact Phase:

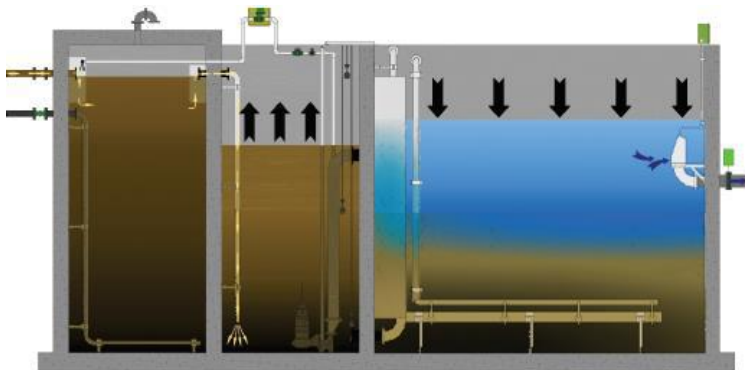


When the level in the SBR reaches TWL, nitrified mixed liquor overflows the surge chamber weir and is returned to the SAM™ chamber to mix and react with the raw influent. Aeration is cycled on and off to provide the required oxygen. Denitrification is reliable and complete. Scum is also removed from the SBR basin.



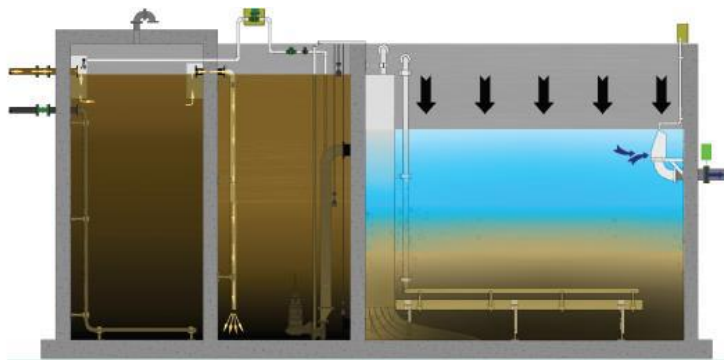
Settle Phase:

When the level in the SAM™ reactor again reaches “control level” aeration is discontinued and the SBR basin settles under perfect quiescent conditions.



Decant Phase:

When the settle timer expires, the decant valve is open and treated effluent is withdrawn from the upper portion of the SBR basin by means of a fixed solids excluding decanter.



Filled Decant Phase:

If, during peak flow events, the SAM™ reactor reaches TWL before the decant phase ends, influent flows in a reverse direction through the surge return line and overflows the surge chamber secondary weir and is diffused into the settled sludge at very low velocity as the decant phase continues.

FLUIDYNE ISAM™

In operation, all influent flow enters the anaerobic basin where influent solids are allowed to settle much like a primary clarifier. Elimination of primary solids in the anaerobic basin allows for much smaller SBR basins at equivalent SRT than conventional SBRs. The anaerobic selector also creates soluble carbon as a food source for biological nutrient removal through anaerobic conversion of settleable BOD to soluble BOD. The influent then flows to the SAM™ surge basin, or influent equalization basin. The surge basin provides flow and nutrient equalization to optimize treatment at the full range of flows and loadings.

100% ON-LINE STANDBY EQUIPMENT

Fluidyne's prepackaged ISAM SBRs are furnished with spare mixing/fill pump and aerator assembly installed for 100% redundancy.

REDUCES WASTE SLUDGE BY 75%

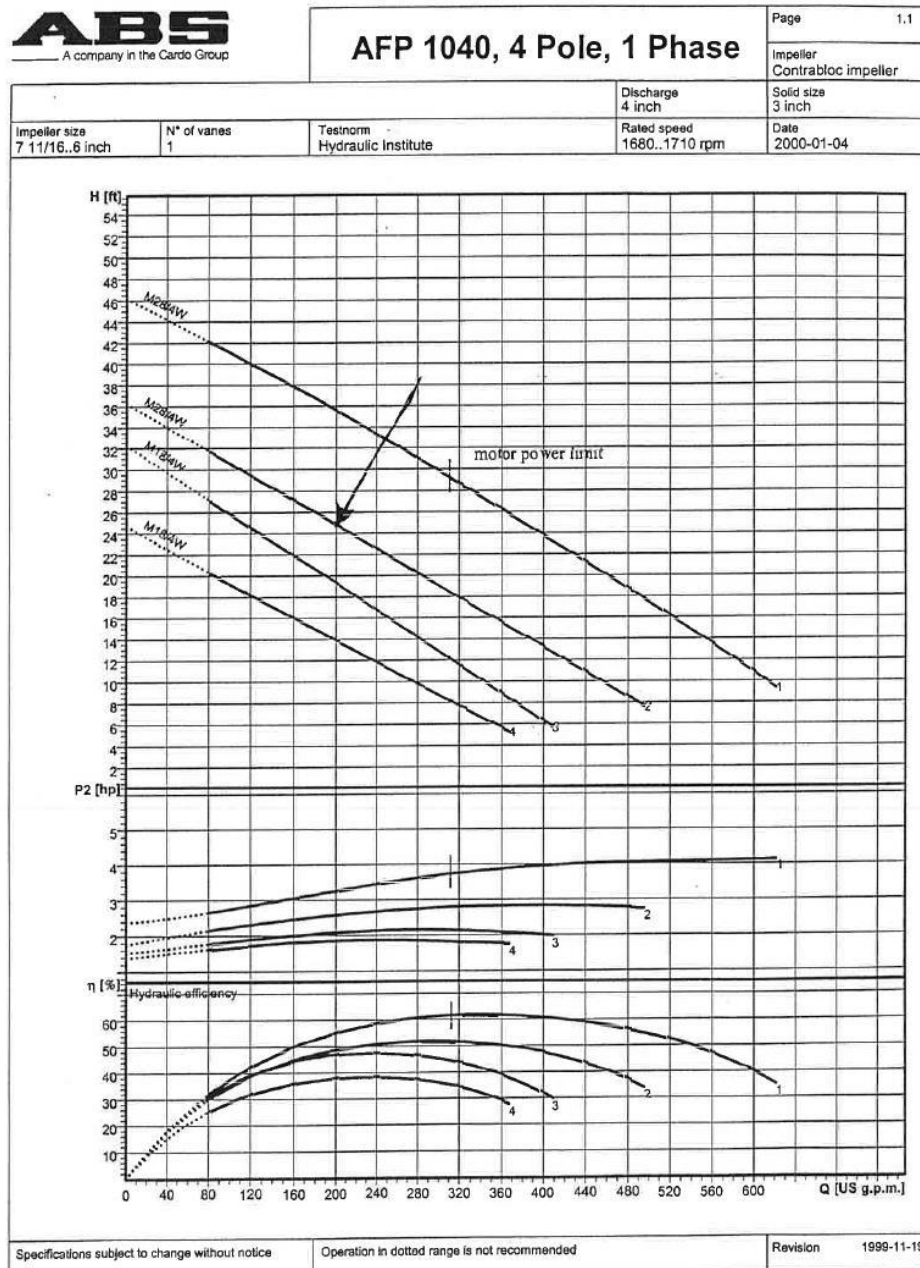
The Fluidyne ISAM™ Sequencing Batch Reactor incorporates an anaerobic selector chamber with the SAM™ SBR. The anaerobic selector not only provides consistent phosphorous removal by subjecting the recirculated biomass

to anaerobic conditions, forcing the release of phosphorous, but also creates soluble carbon as a food source for phosphorous removal through anaerobic conversion of settleable BOD to soluble BOD. Additionally, anaerobic sludge digestion occurs in the anaerobic selector chamber, reducing waste solids production by up to 75% for the entire secondary process.

SEVERAL UNIQUE FEATURES

Several unique features of the Fluidyne ISAM™ SBR include odor control and scum skimming. Mixed liquor is maintained in the SAM™ tank to immediately react with incoming flow from the anaerobic chamber to suppress odors and initiate and accelerate carbon and nitrogen reactions. Mixed liquor is recycled from the top of the SBR tank effectively removing scum by use of proprietary flow and scum control system. In addition, nitrates are recycled to the SAM™ tank for effective and rapid denitrification. Denitrification reactions are accelerated in the presence of the unreacted carbon from the raw sewage entering the SAM™ tank. Aeration and energy requirements are reduced as nitrates are fully reduced to nitrogen gas in the SAM™ tank.

Jet Aspiration is used to aerate the SBR. Liquid from below the surface is pumped through a specially designed nozzle. In passing through the nozzle, the liquid flow increases in velocity. Air is drawn into the low pressure zone in the aspirator and mixes with the liquid in an outer nozzle, forcing oxygen to transfer into solution. The jet plume then discharges through the liquid into the basin and mixes the oxygenated liquid in the plume with the bulk of the basin liquid. There are two aspirator pumps provided: ABS – AFP1040M28/4-12-60 3.7 HP (230/1/60).





AFP 1040 1~ 60 HZ

Hill Mobile Home Park

AFP/M1-M3

Robust, reliable ABS submersible sewage pumps from 1.3 to 23 kW for the dewatering of buildings and sites in private, commercial and communal areas and in industry.

Water pressure-tight encapsulated fully flood-proof motors in standard or explosion-proof versions. Hydraulics with CB (ContraBlock) system or vortex impellers.

Can also be supplied with cooling jacket on request for dry sump applications.

Capacity up to 820 m³/h
Head, max. 92 m

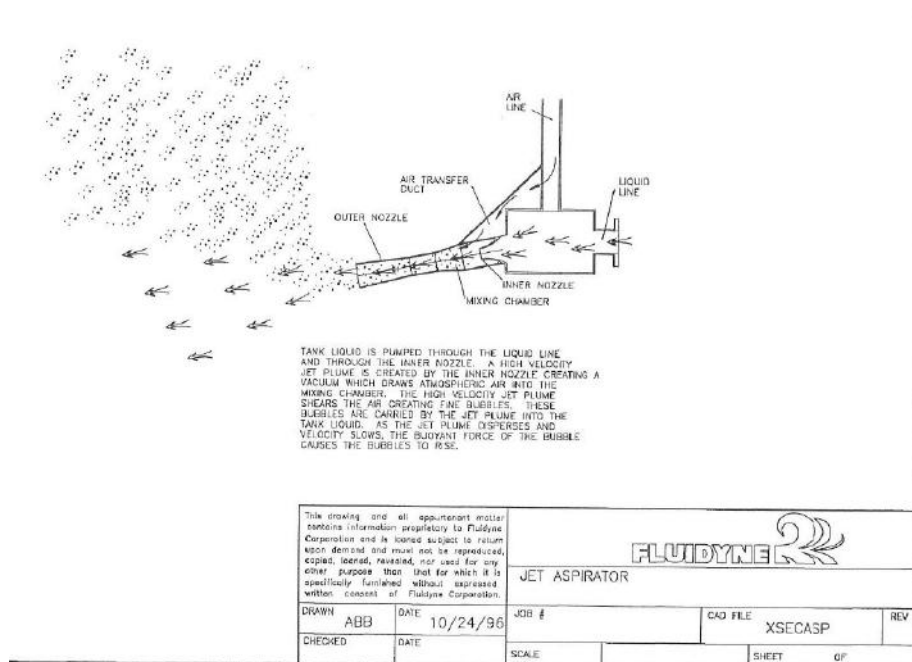
Type: AFP 1040 1~ 60 HZ

Technical data

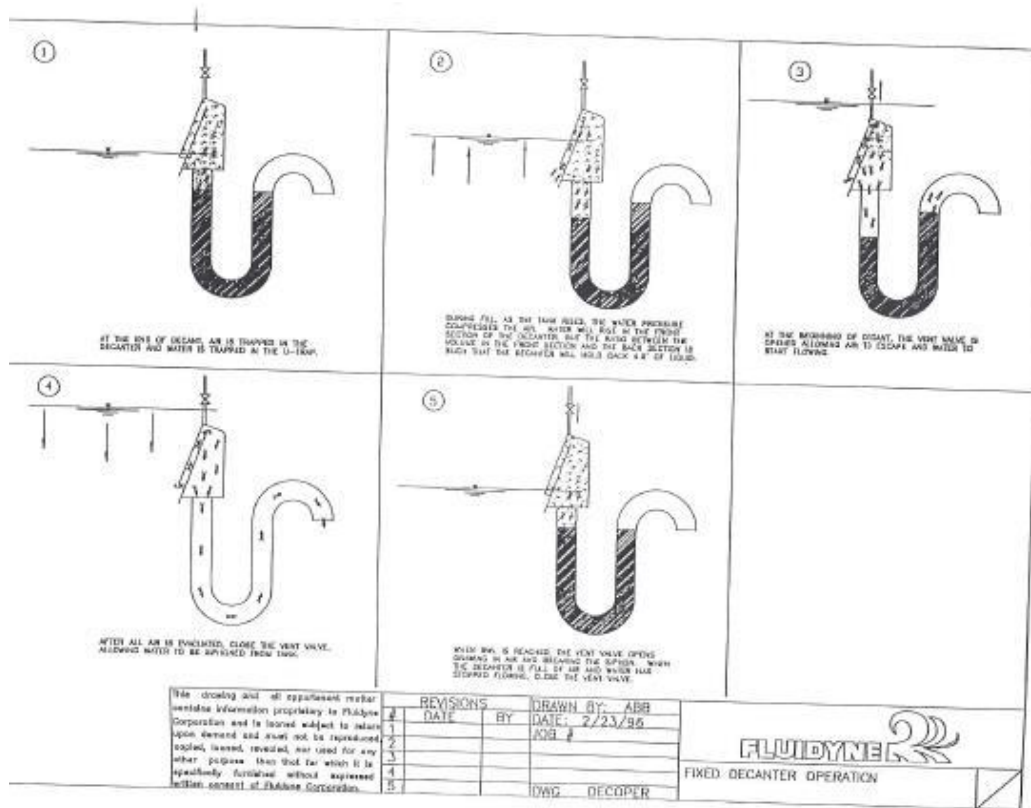
Delivery rate	: 202 US g.p.m.
Delivery head	: 25 ft
Hydr. efficiency	: 48.8 %
Shaft power	: 2.62 hp
Speed	: 1685 rpm
Impeller type	: ContraBlock impeller, 1 vane
Motor output	: 3.75 hp
Voltage	:
Frequency	: 60 Hz
Suction outlet	: DN100
Discharge outlet	: DN100

The ABS Manual is included in the original O & M Manual from the equipment supplier (attached).

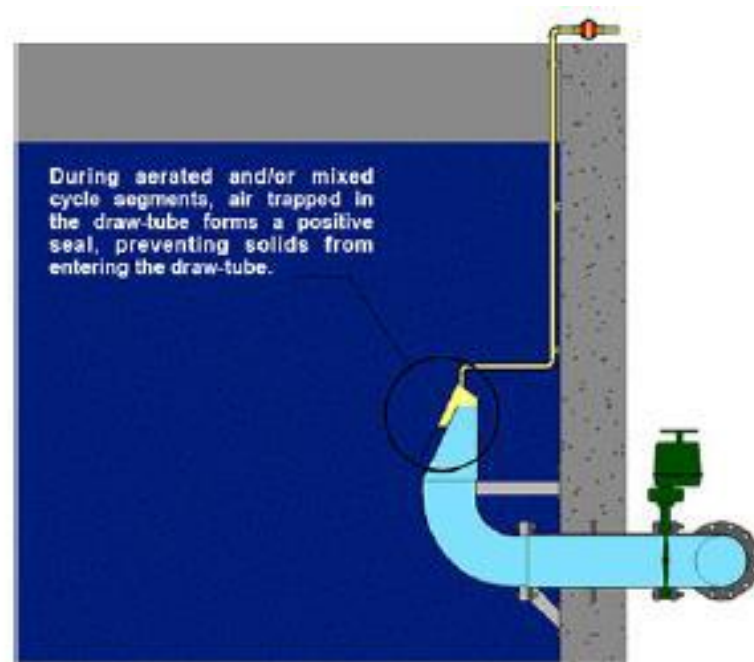
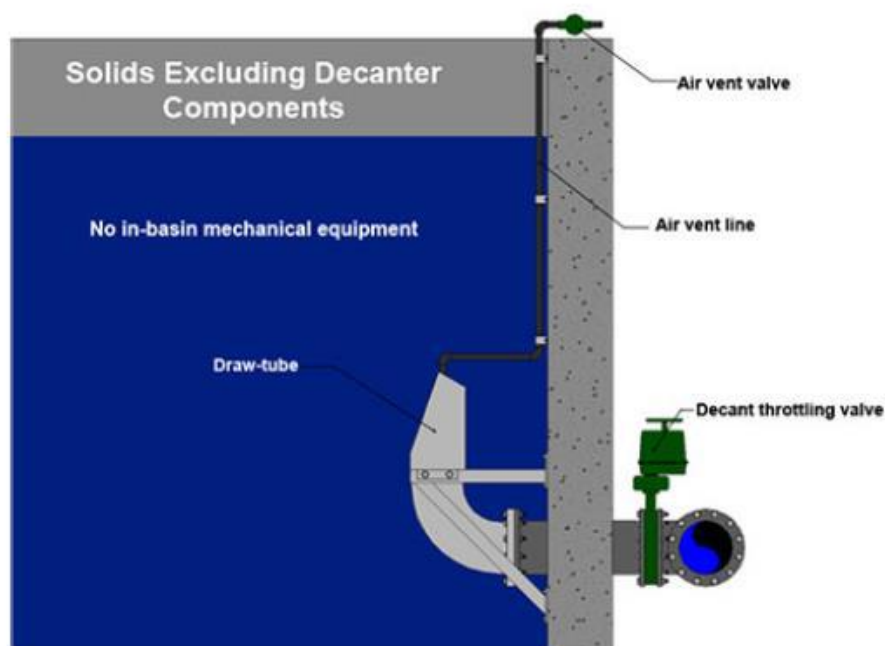
A Fluidyne detail of the jet Aspirator is provided for reference (Detail from O & M Manual).

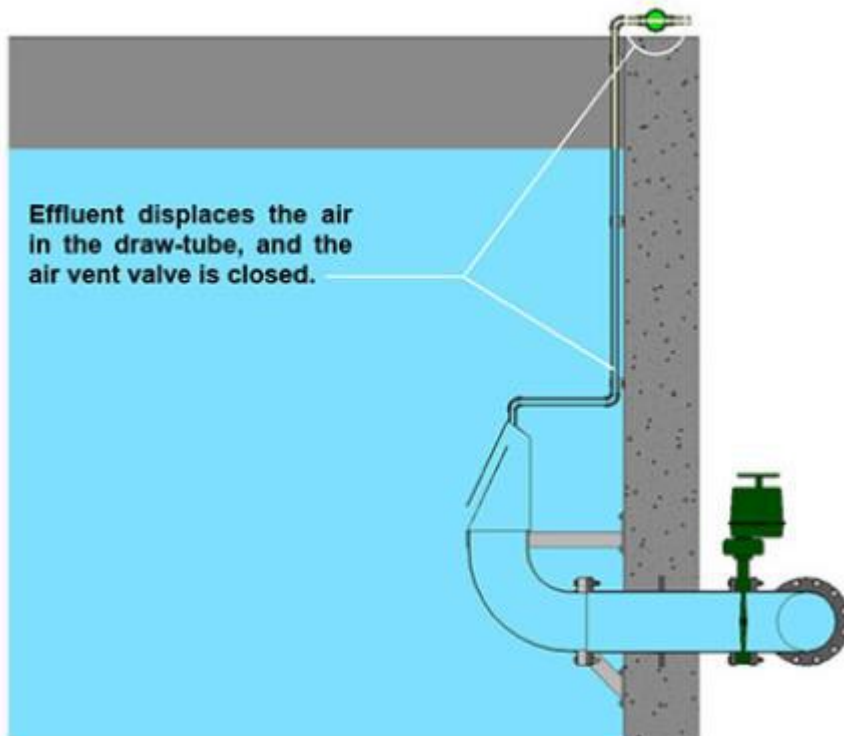
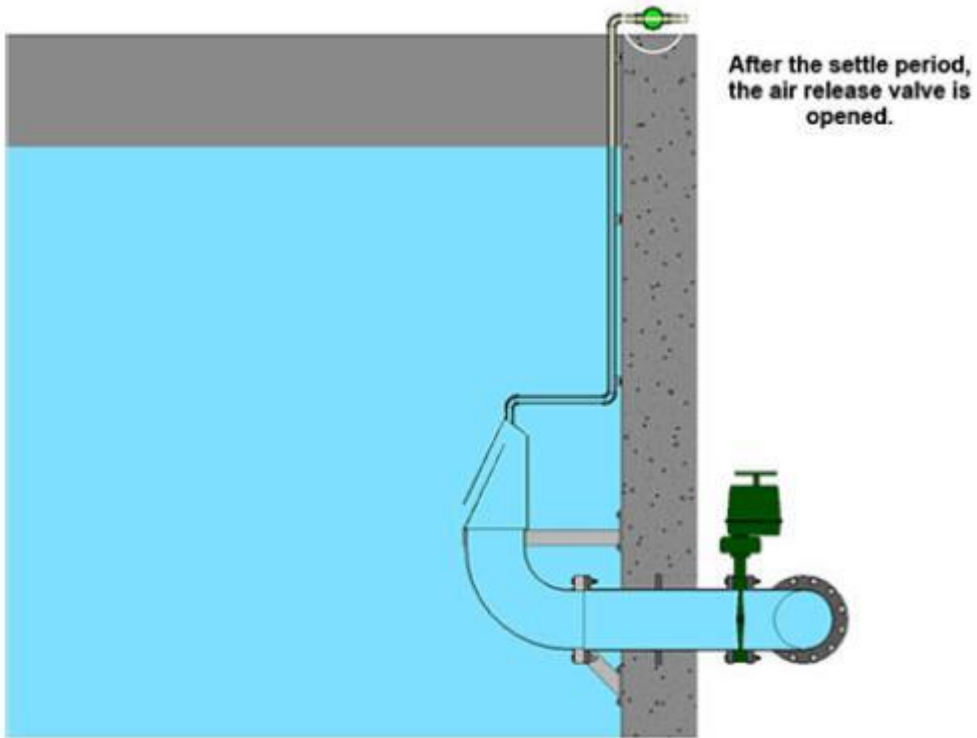


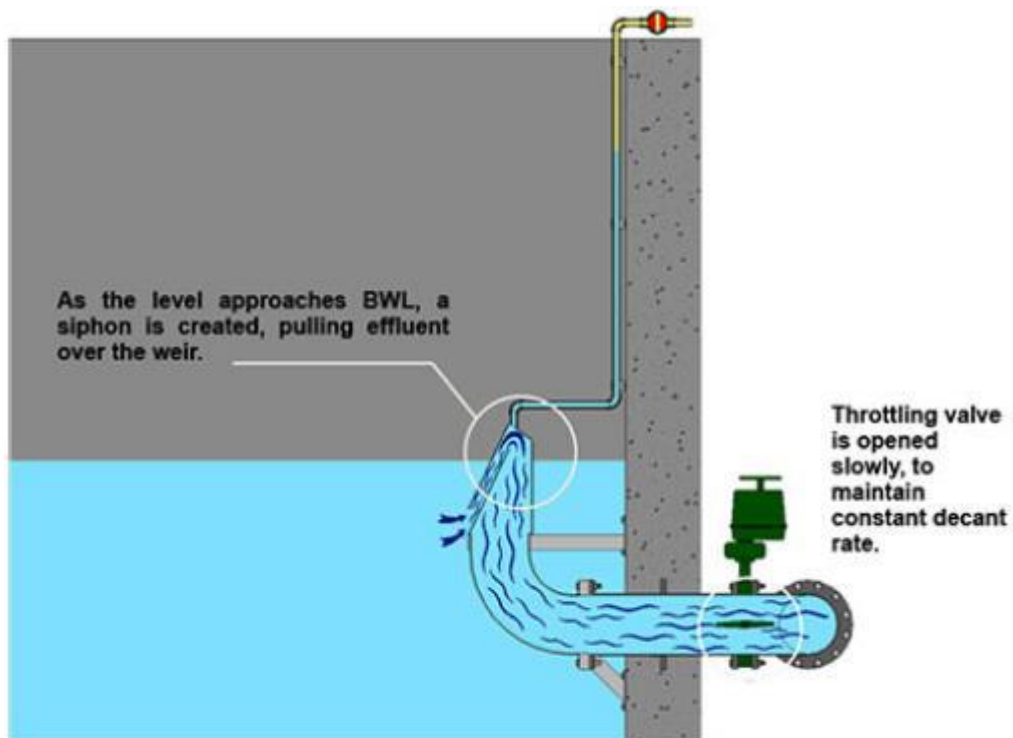
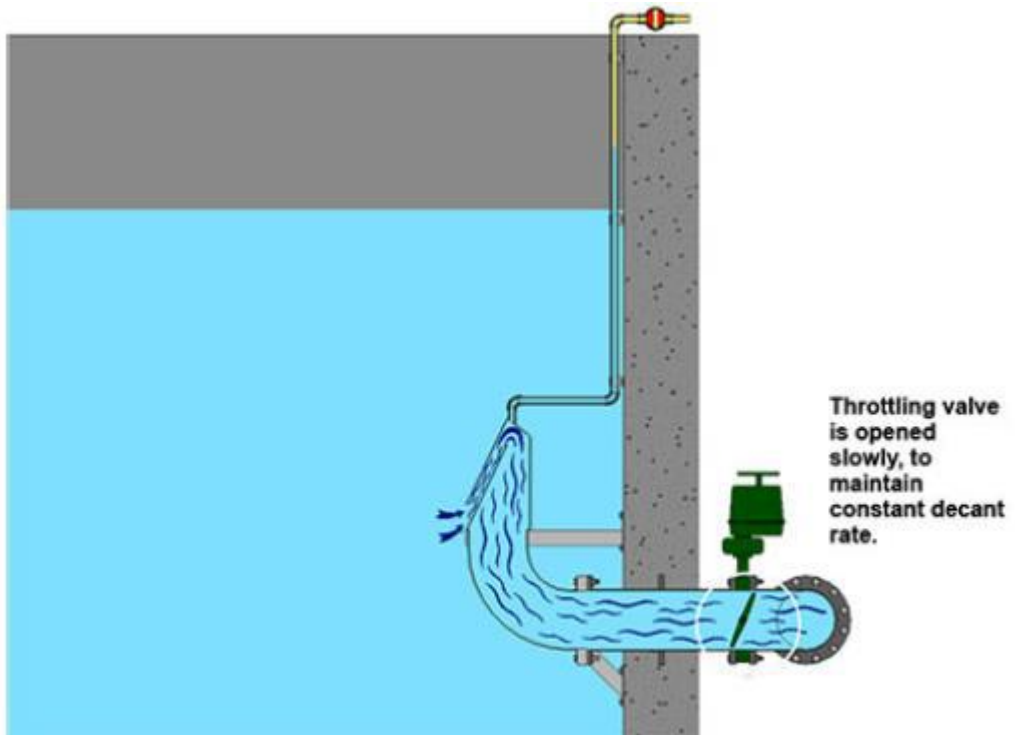
A detail of the Fluidyne fixed decanter is provided for reference (from O & M Manual)
along with Fluidyne literature regarding the decanter.

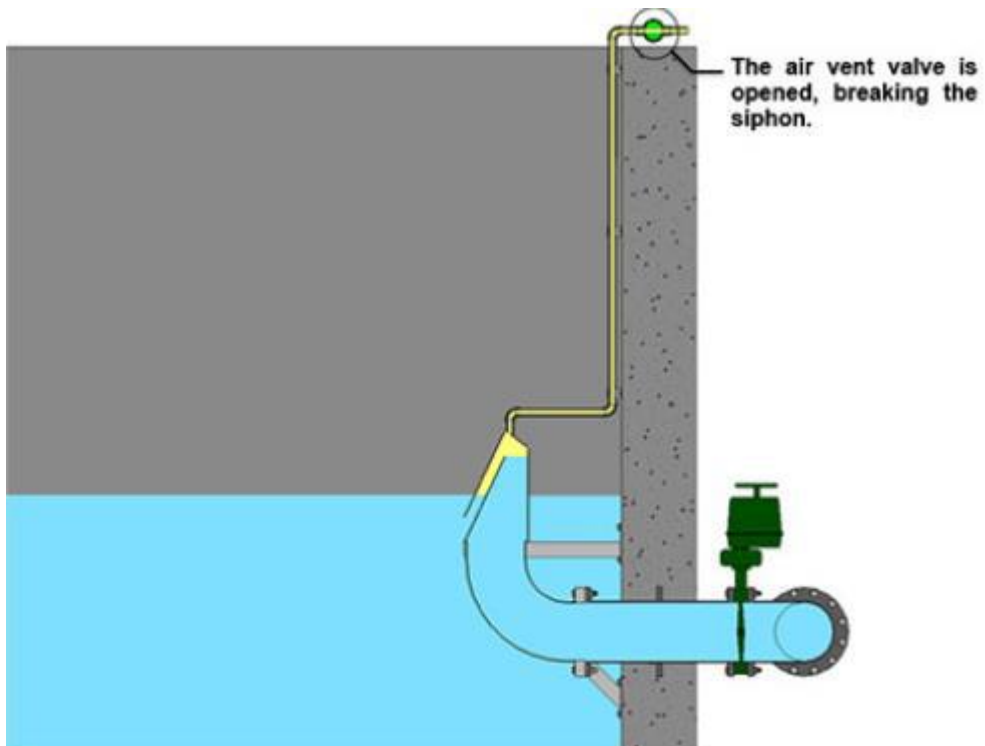
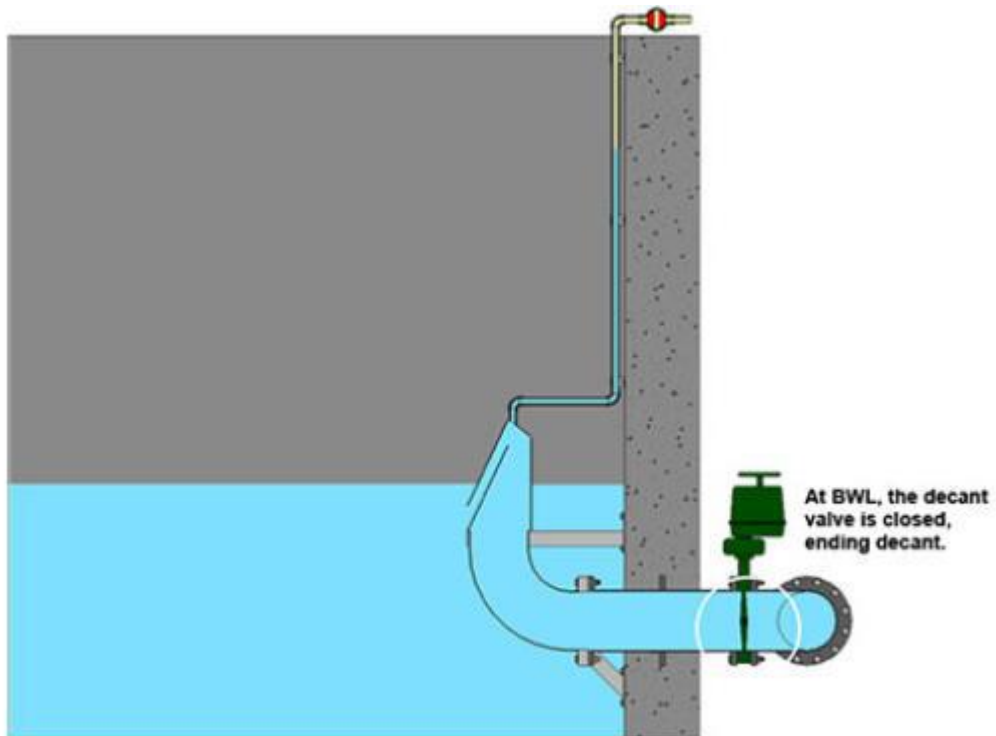


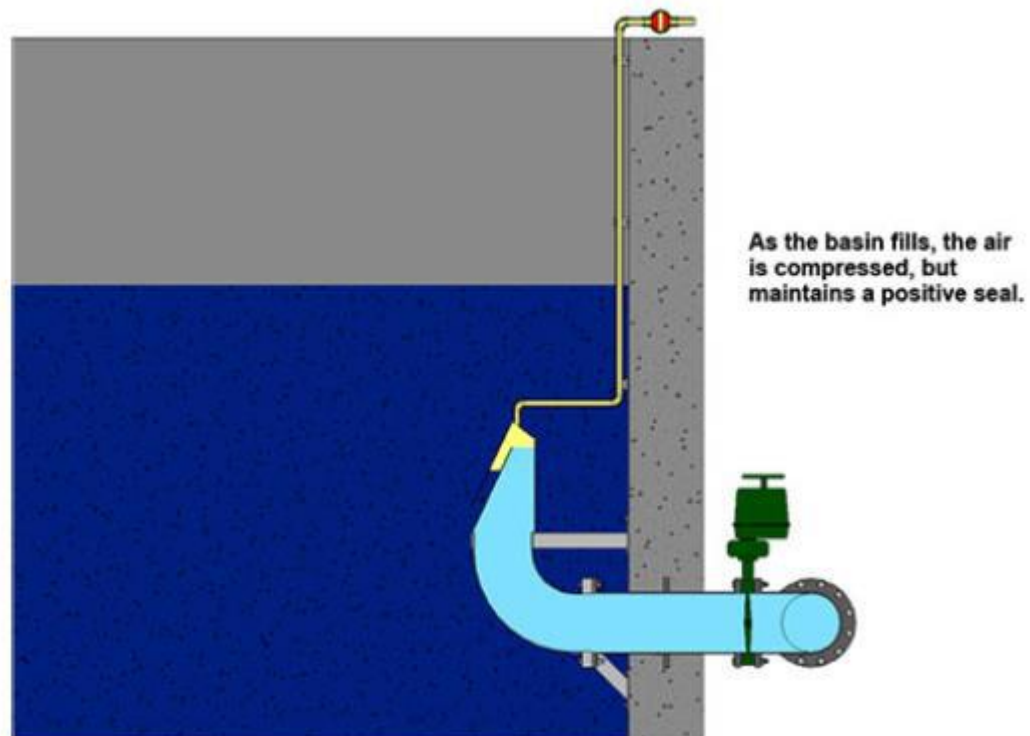
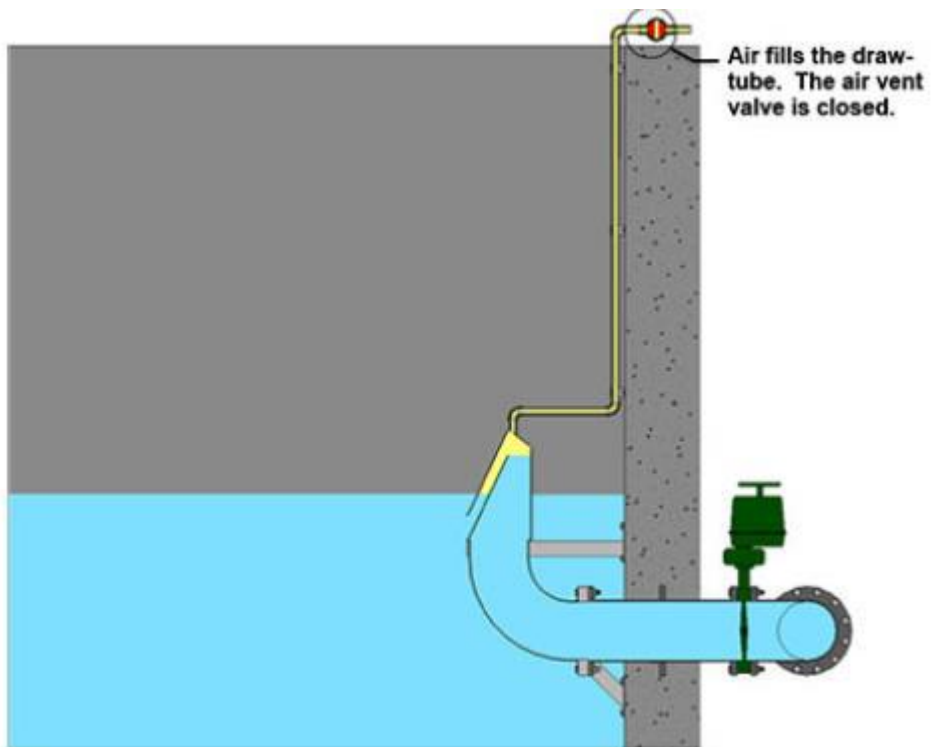
During all times except when decanting, air is trapped in the decanter forming a positive seal. After sludge has settled in the basin, an electric operated ball valve opens releasing air from the decanter. This procedure acts as a siphon and starts effluent withdrawal. The supernatant is withdrawn until bottom water level (BWL) is reached; a few inches above the bottom lip of the decanter. At BWL, the vent valve is opened and air is once again introduced, stopping the decant. By breaking siphon a few inches above BWL, no scum (if any is present) can enter the decanter.











Prior to discharge, the effluent is disinfected by chlorine; post aeration is available (blower to be upgraded to Roots 22) and dechlorination follows prior to discharge.

Final discharge is to an UT of Maracossic Creek.

In summary, the Hill STP is a sewage treatment plant which relies upon the activated sludge treatment process to stabilize the influent domestic wastewater from the mobile home community (MHC). The SBR provides biological treatment (aeration/settling) in a batch operation. Following decanting, the flow is directed to facilities for chlorination, post aeration and dechlorination prior to final discharge.

TREATMENT UNIT OPERATIONS

Screening and Pumping

The influent wastewater from the mobile homes flows through bar screens for removal of coarse solids prior to being delivered to the influent pump tank. The tank provides a location which collects influent from the collection system and allows for the pumped transfer to the SBR treatment plant. The tank may be considered to provide a function similar to a equalization basin. The bar screens and pump tank should be routinely inspected and managed.

Sequencing Batch Reactor (SBR)

The basic treatment is an activated sludge process. The SBR is a fill and draw activated sludge treatment system. In a SBR, wastewater is added to a batch reactor where the flow is treated to remove “undesirable constituents” such that the best treatment possible is achieved. In a SBR time is utilized for operation control with the UNIT serving as the basin for all unit operations including equalization, aeration and clarification. Operations

during treatment will cycle. As noted above aeration will start/stop during treatment prior to the batch entering the settle cycle. Once the settle phase has ended, decant is initiated and the cycle repeats.

HILL MOBILE HOME

DESCRIPTION OF OPERATION

The SBR Control Panel is equipped with an Allan Bradley SLC 500 Programmable Controller with operator interface for operator adjustment of the process timers. Selector switches and indicator lights are provided for manual operation or selecting automatic sequence.

SEQUENCE OF OPERATION

ISAM SYSTEM

A.FLUIDYNE SAM MODE SEQUENCE

- 1) DECANT END TIMER times out, start FILL / INTERACT cycle, start the Aspirator(s), start ASPIRATOR ON TIMER, start MINIMUM INTERACT TIMER.
- 2) ASPIRATOR ON TIMER times out, stop Aspirator (s), start ASPIRATOR OFF TIMER.
- 3)) ASPIRATOR OFF TIMER times out, start Aspirator (s), start ASPIRATOR ON TIMER. Cycling of the Aspirator (s) continues until the tank goes to SETTLE.
- 4) SAM Tank reaches SWL setpoint, SBR is at TWL and MINIMUM INTERACT TIMER done SBR tank goes to SETTLE cycle, stop Aspirator (s), start SETTLE TIMER.
- 5) SETTLE TIMER TIMES out, start DECANT cycle, DECANT BEGIN TIMER starts, decant vent valve opens, start disinfection.
- 6) DECANT BEGIN TIMER times out, decant vent valve closes, open effluent valve.
- 7) BWL is reached, close effluent valve.
- 8) Effluent valve confirmed closed, DECANT END TIMER starts, decant vent valve opens.
- 9) DECANT END TIMER TIMES out, decant vent valve closes, stop disinfection.
- 10) System starts over again.

NOTE:

- 1) The Control System has a batch counter (PANELVIEW SCREEN #8 F4; C5:100 in ladder diagram) that increments a value of 1 after each DECANT cycle. Knowing the decant volume (fixed for each batch), the total flow can be calculated for each day, week or any other time period

ISAM™ AERATION CAPABILITIES (For Programming Reference)

There are three different aeration capabilities during the INTERACT cycle; normal aeration on/off, low flow aeration on/off and high flow aeration, continuous during FILL / INTERACT. Normal aeration and low flow aeration use the following counters in the programming ladder logic:

NORMAL AERATION

C5:1 Aerobic
C5:2 Static

LOW FLOW AERATION

C5:21 Aerobic
C5:22 Static

During high flow aeration Aspirator(s) run continuously.

There is a 24-hour clock allowing for automatic selection of high flow periods and low flow periods. The set points are located at the following N registers in the programming ladder logic.

<u>ADDRESS</u>	<u>DESCRIPTION</u>
N7:1	High Flow On Time
N7:2	High Flow Off Time
N7:3	Daily Low Flow On Time
N7:4	Daily Low Flow Off Time

There is a 7-day clock allowing for automatic selection of weekend flow aeration. Weekend flow aeration uses the same N registers as the low flow aeration. The days are adjustable between 0 – 6 with 0 starting Midnight Saturday and 6 starting Midnight Friday. The set points are located at the following N registers in the programming ladder logic.

<u>ADDRESS</u>	<u>DESCRIPTION</u>
N7:5	Weekend Flow On
N7:6	Weekend Flow Off

The aeration capabilities are enabled or disabled at the following N registers in the programming ladder logic.

<u>ADDRESS</u>	<u>DESCRIPTION</u>
N7:7	High Flow 0=Off, 1=On
N7:8	Daily Low Flow 0=Off, 1=On
N7:9	Weekend Flow 0=Off, 1=On

ISAM™ LIQUID LEVEL SET POINTS

SAM TANK

- LWL LOW WATER LEVEL – Pump shut off,
Set elevation just above pump
- SWL SETTLE WATER LEVEL – Initiate SETTLE cycle
Set elevation 1.5 to 3.0 ft below TWL
- HWL HIGH WATER LEVEL – Initiate alarm denotes liquid level too high
Set elevation 3 in above TWL

SBR TANK

- BWL BOTTOM WATER LEVEL – Stop DECANT cycle, finish batch
Set elevation 1.5 in above intake point of decanter
- TWL TOP WATER LEVEL – Start INTERACT cycle
Set elevation 1 in below over flow weir

NOTE: SWL, TWL and HWL make the condition true on rising liquid level and elevation should be set at top of lead weight

LWL and BWL make the condition true on falling liquid level and elevation should be set when float is approximately at 5 o'clock position

PANELVIEW SCREEN DESCRIPTION (For Operator Control and Monitoring)

- SCREEN 1 Main Menu – F1 SAM Tank, F2 SBR Tank, F3 Set Points, and F4 Alarms
- SCREEN 2 SAM Tank – Indications for LWL, SWL, HWL, Aspirator 1 run, Aspirator 2 run
- SCREEN 3 SBR Tank – Indications for BWL and TWL
- SCREEN 4 TIMER Values 1 – Accumulated run times for Aspirator on/off during Normal Flow and Low Flow
- SCREEN 5 Timer Values 2 – Accumulated run times for Settle, Decant Begin and Decant End

- SCREEN 6 Setpoints 1 – Setpoints for Aspirator on/off during Normal Flow and Low Flow
- SCREEN 7 Setpoints 2 – Setpoints for Settle, Decant Begin and Decant End
- SCREEN 8 Setpoints 3 – Setpoints for clock in Minutes, Hour of Day, Day of Week (0=Sun) and Batch Counter
- SCREEN 9 Setpoints 4 – Setpoints for High Flow On/Off Hour and Low Flow On/Off Hour
- SCREEN 10 Setpoints 5 – Setpoints for Weekend Flow On/Off Day, High Flow Enable, Low Flow Enable and Weekend Flow Enable
- SCREEN 11 Alarms – Alarm indication for Aspirator 1 Fault, Aspirator 2 Fault and SAM Tank High Level
- SCREEN 12 Alarms Clear – To clear alarm F6

NOTE: Each screen will have a multiple function keys (E.g. F1, F2, F3 and so on) that correspond to run times, set points, alarms and other screen displays. Once the screen that the operator wishes to view is displayed, the appropriate function key is then pressed to access a particular value.

For example, to change the set point value for the SETTLE timer the following sequence is necessary:

Starting at MAIN MENU press F3 for Setpoints screen. This will bring up SCREEN 6, which is Setpoints 1. Now press F8 – next function -, which will scroll to the SCREEN 7, or Setpoints 2. Now press F1 to access SETTLE timer then enter the new value.

The unit processes of the SBR and conventional activated sludge systems are the same.

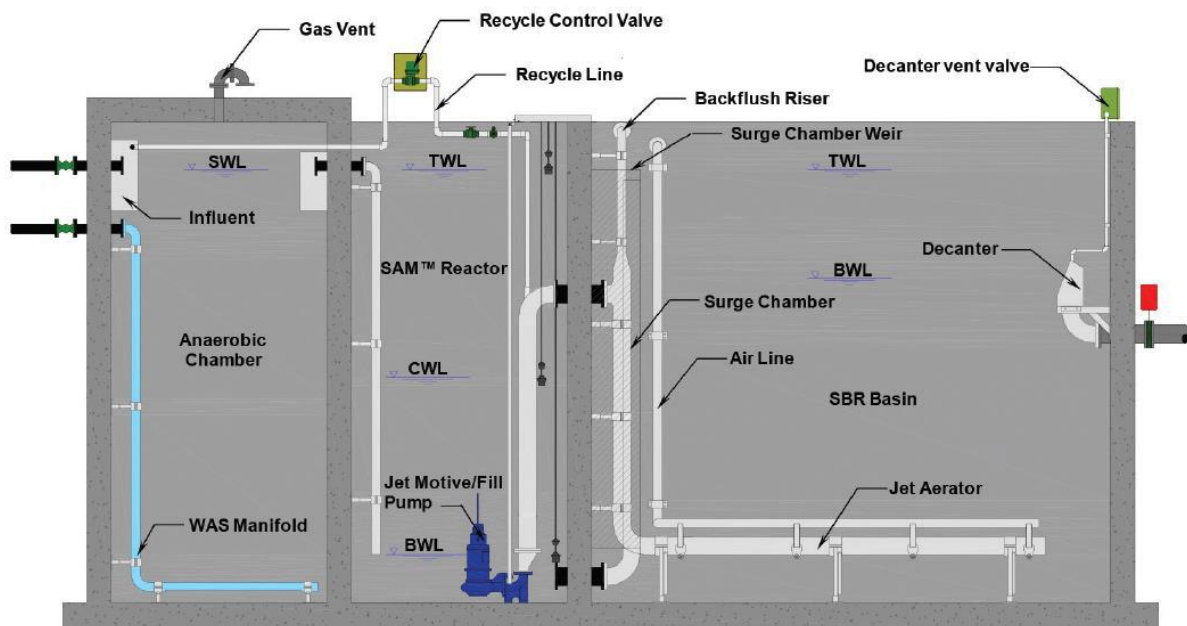
The operator maintains an environment that allows the biomass to treat the wastewater.

As necessary, soda ash may be added to adjust basin pH and the control panel may be adjusted as desired to achieve the desired treatment control (aeration/static timers).

The difference between the SBR and conventional activated sludge is that the SBR system operates in time rather than in space. The basin affords the settling zone for clarification. To assist clarification, the facility may rely on the addition of alum. A chemical feed system is provided for chemical addition. A waste cycle is provided for biomass control. The operator may adjust wasting as necessary to maintain desired MLSS. SBRs afford significant operating flexibility and as with any plant, operator

familiarity with the system is necessary. The controls afford the operator ability to monitor the plant and make desired adjustments to achieve a high degree of treatment.

SBR (time control) treatment eliminates the need for separate primary and secondary clarifiers which should result in reduced operations and maintenance requirements. In addition, RAS pumps are not required. It is also noted that in conventional biological nutrient removal systems, anoxic basins, anoxic zone mixers, and internal MLSS nitrate-nitrogen recirculation pumps may be necessary. With the SBR, processes can be accomplished in one reactor using aeration/mixing equipment, which will minimize operation and maintenance requirements otherwise needed for clarifiers and pumps.



Chlorine Disinfection & Dechlorination

The installed disinfection equipment is tablet chlorination and a contact chamber to provide contact time. To achieve disinfection it is necessary to provide adequate contact time to achieve the required reduction of pathogens. Adequate time to achieve disinfection (CT) is provided in the contact tank. The final effluent from the treatment plant requires the removal of total chlorine in the effluent stream prior to discharge.

Chlorine is removed by tablet (sodium sulfite tablets) dechlorination. A tablet dechlorination unit is provided following the contact tank (on discharge line). The tablet, dechlorination feeder is near the discharge point.

Post Aeration

The wastewater is reaerated prior to discharge. A blower provides the air supply. Small air bubbles are introduced into the flow stream to transfer dissolved oxygen into the effluent prior to final discharge.

PERSONNEL RESPONSIBILITIES

The Hill Mobile Home Park STP is owned by Six-O-Five Mobile Home Group, LLC.

The managing member is James Benson, Jr. Mr. Benson is the responsible entity for the facility. Management has elected to utilize a contract operator for the facility. The contract operator is responsible for the routine, day to day operation of the facility. In addition to the contract operator, the facility relies upon the park maintenance staff for site maintenance (mowing of the plant grounds and routine upkeep). The maintenance staff is available to support the contract operator if necessary.

The contract operator is in daily attendance at the facility (hours may vary based on need) and may be contacted for emergency assistance if necessary.

Operation of the Wastewater Plant

An appropriately certified (minimum Class III) operator is employed/contracted by the owners to provide routine, daily operation of the facilities. The certified operator directs the daily operation of the facility. The operator is in responsible charge of the facility and makes the required, routine operational decisions. The operator is responsible for routine monitoring including daily laboratory testing; sample collection for outsourced laboratory testing; routine record keeping; and submission of the Discharge Monitoring Report to the State. The operator assures there is sufficient inventory on-hand for the operation of the plant including an adequate supply of chemicals and the required laboratory monitoring reagents/equipment. The operator notifies the PM when chemical purchases are required.

Daily tasks performed by the operator may include but are not necessarily limited to the following:

1. Check/clean bar screens and manage removed materials;
2. Check operation of aeration systems;
3. Observe SBR and make any operational modifications deemed appropriate;
4. Hose down the walls of tanks and skim as necessary;
5. Record the plant daily flow in daily log;
6. Check Chlorination & dechlorination systems and perform chlorine residual(contact & final) monitoring;
7. Clean treatment units if necessary;
8. Collect effluent sample for pH and analyze and record in daily log
9. Monitor effluent Dissolved Oxygen and record;
10. Clean as necessary to maintain a neat an orderly condition;
11. Observe discharge point at stream and record observations.

Per the permit (or any DEQ directive) the operator shall routinely collect samples per the type and frequency included in the permit (or DEQ directive):

VA0090689
Part I
Page 1 of 5

A. Effluent Limitations and Monitoring Requirements

Outfall 001 – 0.005 MGD Facility

- 1 There shall be no discharge of floating solids or visible foam in other than trace amounts
- 2 During the period beginning with the permit's effective date and lasting until the expiration, the permittee is authorized to discharge from Outfall Number 001. Such discharges shall be limited and monitored by the permittee as specified below.

Parameter	Discharge Limitations				Monitoring Requirements	
	Monthly Average ⁽¹⁾	Weekly Average ⁽¹⁾	Minimum	Maximum ⁽¹⁾	Frequency	Sample Type
Flow ⁽²⁾ (MGD)	NL	NA	NA	NL	1/D	Estimate
pH	NA	NA	6.0 S.U.	9.0 S.U.	1/D	Grab
cBOD ₅ ⁽³⁾	10 mg/L 0.19 kg/day	15 mg/L 0.28 kg/day	NA	NA	1/M	Grab
Total Suspended Solids (TSS) ^{(3) (4)}	10 mg/L 0.19 kg/day	15 mg/L 0.28 kg/day	NA	NA	1/M	Grab
Dissolved Oxygen	NA	NA	5.0 mg/L	NA	1/D	Grab
Total Kjeldahl Nitrogen (TKN)	3.0 mg/L 0.06 kg/day	4.5 mg/L 0.09 kg/day	NA	NA	1/M	Grab
<i>E. coli</i> (Geometric Mean) ^{(5) (6)}	126 n/100 mL	NA	NA	NA	1/W	Grab
Total Residual Chlorine (after contact tank)	NA	NA	1.0 mg/L	NA	1/D	Grab
Total Residual Chlorine (after dechlorination)	0.008 mg/L	0.010 mg/L	NA	NA	1/D	Grab
NO ₂ + NO ₃ as Nitrogen	NL mg/L	NA	NA	NA	1/YR	Grab
Total Nitrogen ⁽⁷⁾	NL mg/L	NA	NA	NA	1/YR	Calculated
Total Phosphorus	2.0 mg/L	NA	NA	NA	1/M	Grab

⁽¹⁾ See Part I B

⁽²⁾ The design flow is 0.005 MGD

⁽³⁾ At least 85% removal for cBOD₅ and TSS shall be attained

⁽⁴⁾ TSS shall be expressed as two significant figures

⁽⁵⁾ Between 10 AM and 4 PM.

⁽⁶⁾ The permittee shall sample and submit *E. coli* results at the frequency of once every week for three (3) months.

If all reported results for *E. coli* do not exceed 126 n/100mL, reported as the geometric mean, the permittee may submit a written request to DEQ-NRO for a reduction in the sampling frequency to once per quarter.

Upon approval, the permittee shall collect four (4) samples during one month within each quarterly monitoring period as defined below. The results shall be reported as the geometric mean.

The quarterly monitoring periods shall be January through March, April through June, July through September and October through December. The DMR shall be submitted no later than the 10th day of the month following the monitoring period.

Should any of the quarterly monitoring results for *E. coli* exceed 126 n/100mL, reported as the geometric mean, the monitoring frequency shall revert to once per week for the remainder of the permit term.

⁽⁷⁾ Total Nitrogen = Sum of TKN plus Nitrate+Nitrite. Nitrate+Nitrite and TKN samples shall be taken concurrently during the same month.

Estimate = Reported flow is to be based on the technical evaluation of the sources contributing to the discharge.

Grab = An individual sample collected over a period of time not to exceed 15-minutes.

Required Monitoring

As detailed in the permit, monitoring includes onsite monitoring and the collection of samples that are monitored offsite.

All compliance samples shall be collected and preserved as set forth in Guidelines

Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act as published in the Federal Register (40 CFR 136). For samples monitored offsite by a

VELAP Certified contract laboratory, the operator shall prepare an appropriate chain of custody form and deliver the samples to the contract laboratory. In addition, once per week a sample for E. coli shall be collected and transported to the contract laboratory (maximum holding time is 6 hours) for analysis (40 CFR 141.21).

Monthly the operator shall inventory on hand supplies for the facility. Arrange to have any required supplies ordered and verify delivery of requested materials. Necessary materials include sample containers and forms provided by the contract laboratory. It is necessary to maintain transport coolers to assure sample temperature requirements are met.

Plant Operation

Normal day-to-day operations include routine adjustments, routine monitoring and recording of results, and routine plant cleaning. An hour or more per day is required for the routine and necessary “housekeeping” and plant monitoring/observation of the numerous unit operations. Routine reporting (eDMR) and required record keeping are necessary. Record management and reporting may include dedicated operations time offsite, similar to time for sample delivery.

When the plant is running and performing well and is properly adjusted, the overall appearance will be as follows:

1. The screened influent will be free of trash and large solids. Unobstructed flow will be entering the plant (manually cleaned bar screen cleaned daily).
2. The SBR (when under aeration) will be a rich chocolate brown in appearance and will have a musty odor.

3. The SBR (when settling/decanting) will be relatively free of particulate matter and the surface should be relatively free of floatables.
4. The flow leaving the SBR should be clear. The feed crock (in building) should be adequately supplied with alum feed solution (alum is to aid settling) and installed pump should be functional.
5. The effluent should have good clarity
6. The tablet feeders (chlorine and dichlorination) should be stocked.
7. The chlorine contact tank discharge shall have a residual ≥ 1.0 ppm prior to dichlorination.
8. The final discharge should have a ND (non-detect) chlorine residual.
9. Post aeration should be active.
10. The discharge to the receiving stream should have minimal foam and be free of floating solids (trace only). The stream should be free of visible accumulation of sludge.

Operating Routine

The operating staff must check the plant on a daily basis to assess performance and determine if the plant is operating correctly. The operator must be aware of any changes that occur in the nature of the influent flow and respond accordingly. It is important that the operator develop a routine to keep abreast of conditions at the plant. A typical operating routine has been provided below as a guide in development of a personal routine. The operator will develop a familiarity with the plant and the conditions that may impact the plant (including temperature/weather impacts on the facility) and respond

accordingly. The operator has a familiarity with the plant and should be able to adjust his routine accordingly to accommodate any special needs of the plant.

A checksheet is provided as a guide. This checksheet should be used in addition to the Operator's Log Book. The checksheet may be maintained electronically (if the form can be uploaded to a smart phone). It is necessary to assure all daily operations are properly recorded and available thus a paper copy at the facility would be the preferred measure and serve as a valuable reference. A copy of the suggested log is provided.

HILL WASTEWATER PLANT DAILY O & M LOG

Check Equipment/Unit Operation

Checked		Problem	Operating
☐	Bar Screens	☐	☐
☐	Pump Station Pumps/Alarm	☐	☐
☐	SBR	☐	☐
☐	Chemical Addition	☐	☐
☐	Chlorine Feeder	☐	☐
☐	Dechlorination Feeder	☐	☐
☐	Post Air	☐	☐
☐	Discharge	☐	☐

Onsite Monitoring - SBR

Results

Checked				
☐	Settleability	☐	☐	☐
☐	pH	☐	☐	☐
☐	Color	☐	☐	☐
☐	Odor	☐	☐	☐

Note adjustments/additions: _____

Onsite Monitoring - Discharge (or as noted) Results

Checked				
☐	CL2 - Contact	☐	☐	☐
☐	CL2 - Discharge	☐	☐	☐
☐	pH	☐	☐	☐
☐	DO	☐	☐	☐
☐	Temp	☐	☐	☐
☐	Color	☐	☐	☐
☐	Clarity	☐	☐	☐

Comments: _____

Visual Monitoring Outfall Pipe & Stream

Checked		Description/Observation
☐	Outfall Clarity	☐
☐	Outfall Color	☐

Describe Effluent Appearance: _____

☐ Stream Condition: WW Solids Present in stream? Y or N

☐ Stream Appearance: Floating Solids/Foam Y or N

Visual Description of Receiving Stream: _____

Note any Concerns Observed and if DEQ Notification Required
Document any DEQ notification made (Date/Time/Reason)

Maintenance

Routine maintenance of the facility is provided by the contract operator. The staff checks the plant daily to verify operability of installed plant equipment. The contract operator checks all of the functional components of the plant to verify operation while in daily attendance at the plant. If any facility equipment is inoperable or not performing as it should and is in need of maintenance, the operator will attempt to remedy and as necessary notify the Project Manager (PM) if he requires assistance. Should there be a need for offsite maintenance of any plant equipment the PM will make the required contact for repair and arrange for any required assistance to remove a component. The staff will deliver or arrange delivery of equipment to the “shop” for required (offsite) repair. Should a service call to the plant be necessary, the director will make the necessary arrangements for such service. If routine maintenance is being provided at the plant by staff and the attendant requires additional assistance, the PM will be contacted (assistance may be provided from additional staff or by a service representative).

Maintenance Schedule:

Two maintenance file records are maintained for treatment plant equipment. The equipment record is the Bill of Materials provided by Fluidyne based on material delivery 10-23-2002 for the project. Fluidyne may be contacted for support as necessary. They are available for onsite consultation. Upon installation, Fluidyne provided an O & M Manual. Fluidyne has recently provided an electronic copy of the Manual. This Manual has been attached for reference (Original O & M Manual).

A service record should be maintained for mechanical equipment to detail a record of work/service performed, date and name of service provider. These records may be maintained electronically for ease of access.

Routine Maintenance

An abbreviated schedule of routine maintenance performed at the **Hill** STP is presented below:

Daily - Observe all mechanical components and verify operating condition

Weekly:

Empty solid waste containers, including screenings receptacle.

Quarterly:

Blowers – Grease bearings, check oil and as required change oil; check belts (replace as required)

Manual Valves – Verify operation/ service as required

Verify operation of all installed floats

Semi-Annual:

Blowers - check air filters and replace as necessary.

Annual:

Assess Plant for any necessary repairs and to verify integrity

Seasonal:

Remove snow which prohibits access or poses a hazard.

As Required

Repair piping or replace

Check pumps for clogging

Corrective/Emergency Maintenance

Contact project manager (PM) for assistance. Major purchases are processed by the project manager who can authorize or make arrangements for non-routine expenditures.

(SAMPLE)
HILL MOBILE HOME PARK STP

Equipment Identification: _____

Record Year: _____

Item:	Description/Location:	Frequency	Initial and Date			Comments:
Lubrication			Completed:			
Check Oil	Monthly	Completed:				Comments:
Oil Change		Completed:				Comments:
		Completed:				Comments:
Parts Ordered:						
Parts On Hand:						

Maintenance & Repair Contacts – Most components are serviced/repaired by the O & M Contractor staff. Repair components may be purchased and installed by staff. The

Contractor Contact is

Matthew Raynor
Phone: 919 270 4831

Maintenance/ Repair Contacts & Suppliers

Fluidyne:



Motors/Blowers: EEE – Richmond, Virginia
 USA Blue Book (www.usabluebook.com)

Electrical: Dick Sibert
 Office Phone: 804 796-4784
 Shop Phone: 804 796-6564

Pumps or Special Needs: Atlantic Pump & Equipment
 301 Jefferson Davis Hwy.
 Richmond, VA 23224
 804 233 4396

USA Blue Book (www.usabluebook.com)

PLANT TOOLS & SPARE PARTS

Laboratory Equipment is provided by the contract operator. The following equipment is available for use at the **Hill** STP

pH Meter – Oakton/Hach/Thermo Scientific or equal (Plant Pro/Pocket Pro) and buffers (3 buffers available – 4, 7 & 10).

Dissolved Oxygen – YSI Model 550 DO Meter (or equal).

Miscellaneous glassware is available at the plant or the contract operators office (located at Indian Acres of Thornburg site) for use as required.

Miscellaneous Tool Inventory

The following tools should be available at the plant:

Water hose
Skimmers
Long handled brush

The contract operator maintains a maintenance facility nearby (Thornburg). The maintenance staff has a complete shop which is fully equipped with hand and power tools. The following list is a sampling of the tools which are available for use at the Hill STP:

1. Socket Sets
2. Pipe wrenches
3. Crescent Wrenches
4. Pliers
5. Needlenose pliers
6. Channel lock pliers
7. Screwdriver set
8. Hacksaw
9. Hammer
10. Hand truck
11. Portable pump for decanting sludge holding
12. Assorted power tools including a backhoe

Should the maintenance staff require a specific tool not currently available in the shop, for use at the plant, the supervisor purchases the necessary equipment.

Spare Parts Inventory

The following equipment is used for replacement of inoperable plant equipment. The inoperable equipment is repaired or replaced and returned to “stock” for use as needed. Spare parts may be inventoried onsite or at the maintenance shop. The contract operator may also maintain emergency repair equipment for his immediate use.

1. Spare tubing for chemical pump
2. Spare feed pump
3. Kop Kit
4. Belts
5. Grease & Oil
6. Air Filters
7. O Ring Assortment
8. Assorted Pipe
9. Assorted plumbing fittings
10. Replacement float
11. Replacement feeder tubes
12. Utility pump

Process Chemicals

The following chemicals are maintained on-site for routine plant operation:

1. Alum
2. Soda ash
3. Chlorine Tablets
4. Dechlorination Tablets

The alum is used for enhancing clarification and soda ash is available for SBR pH adjustment as necessary. The chemicals are stored dry.

PLANT SAFETY

General

Plant safety is the act of performing routine and emergency operating and maintenance procedures in a safe working manner. Many of the safety rules for operating and maintaining a wastewater treatment plant in a safe manner are common sense, while other procedures have more technical backgrounds. Most accidents occur due to a careless act. To institute plant safety, it is necessary to have each employee thinking safety. When employees are continuously aware that their employer demands safe working procedures, the employees are much more likely to think safety and to carry out their daily tasks in a safe manner.

The safety hazards which may be associated with the operation of the Glenwood STP, are primarily associated with physical injuries and infections or exposure to infectious diseases. Operators must be safety conscious as they enter the plant site; if they are, most injuries and accidents can be avoided.

General Safety Rules

1. All written or verbal safety rules shall be observed and particular job associated hazards recognized.
2. A job shall not be initiated until proper instructions have been received and are understood.
3. Any hazardous conditions, unsafe equipment, or unsafe practice shall be reported to the regional manager.
4. Any and all accidents/injuries shall be reported to the regional manager.
5. Any and all water in the plant/used at the plant is non-potable other than the lab sink and should only be used for plant operation.
6. Walk do not run on the plant grounds.
7. Safety devices/safety guards shall be installed on all equipment with moving parts (ie: blowers).
8. Hand tools and any special equipment shall be kept clean and in good repair.
9. Use the correct tool for a job in the proper manner.
10. Avoid wearing loose clothing which may “catch” on equipment.
11. Practice good housekeeping.
12. Observe personal hygiene rules to avoid infection. Routinely wash hands with soap and water at the lab sink.
13. Practical jokes and “horseplay” are forbidden.
14. Reporting to work under the influence of drugs or alcohol are forbidden.
15. Never sacrifice safety for speed in performing duties.
16. No job is considered finished until the safety of the next person to use the facility or equipment has been maximized.
17. No smoking allowed at plant site.

Safety Evaluation

The most common physical injuries applicable to the operation of this facility are cuts, bruises, strains and sprains. Injuries may be caused by moving machinery, improper lifting techniques, or slippery surfaces. Falls from or into the tanks can be disabling or fatal. Most of these may be avoided by the proper use of ladders, hand tools, and safety equipment and by using common sense. Safety precautions include the following:

1. Bar screen – when manually cleaning screen, be sure to have a clean, firm footing and wear protective gloves when using rake. Return rake to storage location. Never place rake down on the ground with prongs up.
2. Plant tanks – Assure that footing is on a clean, firm surface when hosing units or performing maintenance. Use protective gloves when working around tanks or operating valves in tanks.
3. Chemical Feed Equipment – PPE shall be used when working in the plant vicinity. Additional precaution shall be taken when managing chemical supplies. Chemicals can cause skin and or eye irritation, safe handling procedures shall be employed. As with all lifting, lift with your legs not your back if equipment/supplies are moved.
4. Electric Panel/Control Panel – Only a qualified electrician may service, repair or troubleshoot the electrical system. The electric panel box has 240 Volts – it is hazardous and should not be tampered with by anyone not fully qualified. Call for service.

Infections and Infectious Diseases

Personal hygiene is the best protection against the risk of infections and infectious diseases. Immunizations (tetnus, hepatitis, etc. as recommended by physician) should be kept up to date for all employees working at the plant. Protective gloves should be worn when in contact with wastewater or sludge. Thoroughly wash hands with soap and potable water after working at the plant or after using any of the plant equipment or tools.

Housekeeping

Good housekeeping can prevent many accidents. The following practices shall be employed at the plant:

1. Tools and equipment shall be stored in their proper place when not in use.
2. Clean up all spills of oil, grease, wastewater or sludge.
3. Place all trash in covered trash receptacle and routinely (weekly) empty.
4. Keep work area clear of snow and ice as needed. Provide safe access to plant.

A clean work area will reduce the risk of injury and infections.

Emergency Assistance/Accident Reporting

For emergency help, dial 911. Should an accident occur, notify the project manager as soon as possible (919 270-4831) a written accident report should be prepared.

SAMPLING, LAB PROCEDURES & REPORTING

Monitoring

All of the routine monitoring (other than flow monitoring) required by the issued VPDES

Permit for the Hill MHP STP involves the collection of grab samples. A

“Grab Sample” is an individual sample collected over a period of time not to exceed 15 minutes. The sample thus represents the composition of the wastewater at that time and place. For the facility, flow is reported based on daily readings of the water supply flow meters and reporting the quantity of water used during the intervening period.

The facility is required to collect grab samples for the specified parameters at the indicated frequency:

A. Effluent Limitations and Monitoring Requirements

Outfall 001 – 0.005 MGD Facility

- 1 There shall be no discharge of floating solids or visible foam in other than trace amounts
- 2 During the period beginning with the permit's effective date and lasting until the expiration, the permittee is authorized to discharge from Outfall Number 001. Such discharges shall be limited and monitored by the permittee as specified below.

Parameter	Discharge Limitations				Monitoring Requirements	
	Monthly Average ⁽¹⁾	Weekly Average ⁽¹⁾	Minimum	Maximum ⁽¹⁾	Frequency	Sample Type
Flow ⁽²⁾ (MGD)	NL	NA	NA	NL	1/D	Estimate
pH	NA	NA	6.0 S.U.	9.0 S.U.	1/D	Grab
cBOD ₅ ⁽³⁾	10 mg/L 0.19 kg/day	15 mg/L 0.28 kg/day	NA	NA	1/M	Grab
Total Suspended Solids (TSS) ⁽³⁾⁽⁴⁾	10 mg/L 0.19 kg/day	15 mg/L 0.28 kg/day	NA	NA	1/M	Grab
Dissolved Oxygen	NA	NA	5.0 mg/L	NA	1/D	Grab
Total Kjeldahl Nitrogen (TKN)	3.0 mg/L 0.06 kg/day	4.5 mg/L 0.09 kg/day	NA	NA	1/M	Grab
<i>E. coli</i> (Geometric Mean) ⁽⁵⁾⁽⁶⁾	126 n/100 mL	NA	NA	NA	1/W	Grab
Total Residual Chlorine (after contact tank)	NA	NA	1.0 mg/L	NA	1/D	Grab
Total Residual Chlorine (after dechlorination)	0.008 mg/L	0.010 mg/L	NA	NA	1/D	Grab
NO ₂ + NO ₃ as Nitrogen	NL mg/L	NA	NA	NA	1/YR	Grab
Total Nitrogen ⁽⁷⁾	NL mg/L	NA	NA	NA	1/YR	Calculated
Total Phosphorus	2.0 mg/L	NA	NA	NA	1/M	Grab

⁽¹⁾ See Part I B

⁽²⁾ The design flow is 0.005 MGD

⁽³⁾ At least 85% removal for cBOD₅ and TSS shall be attained

⁽⁴⁾ TSS shall be expressed as two significant figures

⁽⁵⁾ Between 10 AM and 4 PM.

⁽⁶⁾ The permittee shall sample and submit *E. coli* results at the frequency of once every week for three (3) months

If all reported results for *E. coli* do not exceed 126 n/100mL, reported as the geometric mean, the permittee may submit a written request to DEQ-NRO for a reduction in the sampling frequency to once per quarter.

Upon approval, the permittee shall collect four (4) samples during one month within each quarterly monitoring period as defined below. The results shall be reported as the geometric mean.

The quarterly monitoring periods shall be January through March, April through June, July through September and October through December. The DMR shall be submitted no later than the 10th day of the month following the monitoring period.

Should any of the quarterly monitoring results for *E. coli* exceed 126 n/100mL, reported as the geometric mean, the monitoring frequency shall revert to once per week for the remainder of the permit term.

⁽⁷⁾ Total Nitrogen = Sum of TKN plus Nitrate+Nitrite. Nitrate+Nitrite and TKN samples shall be taken concurrently during the same month.

Estimate = Reported flow is to be based on the technical evaluation of the sources contributing to the discharge.

Grab = An individual sample collected over a period of time not to exceed 15-minutes.

The required monitoring points for the given parameters are at the discharge point (effluent) unless otherwise (after contact).

In addition to the required routine monitoring, the licensed operator in charge performs in-plant monitoring of operational parameters, such as settling test, SBR pH and in-plant D.O., to routinely assess plant performance. These tests are discretionary and performed as needed to evaluate plant performance.

The performance tests performed at the facility are the daily tests and compliance monitoring that is performed onsite (pH, DO & chlorine residuals). The operator collects and monitors these parameters onsite. Equipment use and calibrations are performed per the equipment manuals. The equipment manuals are maintained by the contract operator for reference regarding equipment use, maintenance and service. The manuals contain detailed information regarding use; these manuals should be used to perform all required equipment calibration prior to use for monitoring. All laboratory practices (including onsite compliance monitoring) shall be performed in accordance with Title 40 CFR Part 136.

All other testing (offsite analyses) is performed by a contract laboratory (VELAP Certified). Sample containers are provided by the contract laboratory for the specified tests. The operator collects the samples in the provided containers, places the samples in an iced cooler and delivers them directly to the lab. All samples collected and delivered to the laboratory are accompanied by a chain of custody form. A copy of the form is retained in the plant records. All monitoring shall be conducted according to procedures approved under Title 40 Code of Federal Regulations Part 136 or 141.21. As necessary, sample containers are pre-preserved and the laboratory verifies compliance prior to logging samples into processing (Sample Acceptance Procedures).

It is necessary that the facility ensure proper quality assurance/quality control (QA/QC) protocols are followed during sampling and analytical procedures. QA/QC information shall be documented to confirm that appropriate analytical procedures have been used

and the required Quantification Levels (QL's) have been attained. The issued permit includes the following specific QL's:

2. Quantification Levels

- a. The quantification levels (QL) shall be less than or equal to the following concentrations:

<u>Characteristic</u>	<u>Quantification Level</u>
Total Suspended Solids (TSS)	1.0 mg/L
carbonaceous- Biochemical Oxygen Demand-5 day (cBOD ₅)	2 mg/L
Total Residual Chlorine (TRC)	0.10 mg/L
Total Kjeldahl Nitrogen (TKN)	0.50 mg/L

- b. The QL is defined as the lowest concentration used to calibrate a measurement system in accordance with the procedures published for the method. It is the responsibility of the permittee to ensure that proper quality assurance/quality control (QA/QC) protocols are followed during the sampling and analytical procedures. QA/QC information shall be documented to confirm that appropriate analytical procedures have been used and the required QLs have been attained. The permittee shall use any method in accordance with Part II.A of this permit.

Samples and measurements taken as required by the issued VPDES Permit shall be representative of the monitored activity. As noted above, monitoring shall be conducted according to the procedures under Title 40 CFR Part 136 (or alternative procedures approved by the USEPA), unless procedures are specified in the permit (E. coli. - 40 CFR 141.21 with a maximum 6 hour holding time). The permittee shall verify that only VELAP Certified laboratories are used for reporting monitoring results conducted offsite. The facility shall be responsible for performing onsite monitoring and analyses of pH and dissolved oxygen. The facility shall verify appropriate QA/QC practices are routinely performed (including equipment calibration and maintenance procedures) on all monitoring and analytical instrumentation at intervals that assure accuracy of measurements.

Records

Records of monitoring information shall include:

The date, exact place, and time of sampling or measurements;
The individual(s) who performed the sampling or measurements;
The date(s) and time(s) analyses were performed;
The individual(s) who performed the analyses;

The analytical techniques or methods used; and
The results of such analyses.

Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years, the permittee shall retain records of all monitoring information, including all calibration and maintenance records, copies of all reports required by the permit, and records of all data used to complete the application for the permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the permittee, or as requested by the Board.

Reporting Monitoring Results.

The permittee shall submit the results of the monitoring required by the permit not later than the 10th day of the month after monitoring takes place. Monitoring results shall be submitted to:

Department of Environmental Quality - Northern Virginia Regional Office
(DEQ-NVRO)
13901 Crown Court
Woodbridge, VA 22193.

Monitoring results shall be reported on the eDMR online reporting system.

If the permittee monitors any pollutant specifically addressed by this permit more frequently than required by this permit using test procedures approved under Title 40 of the Code of Federal Regulations Part 136 or using other test procedures approved by the U.S. Environmental Protection Agency or using procedures specified in this permit, the

results of this monitoring shall be included in the calculation and reporting of the data submitted in the eDMR. Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

In accordance with the issued VPDES Permit, the following guidance shall be used for Compliance Reporting:

3. Compliance Reporting for Parameters in Part I.A.

- a. Monthly Average – Compliance with the monthly average limitations and/or reporting requirements for the parameters listed in Part I.B.2.a. of this permit condition shall be determined as follows: All concentration data below the QL used for the analysis (QL must be less than or equal to the QL listed in Part I.B.2.a. above) shall be treated as zero. All concentration data equal to or above the QL used for the analysis shall be treated as it is reported. An arithmetic average shall be calculated using all reported data for the month, including the defined zeros. This arithmetic average shall be reported on the Discharge Monitoring Report (DMR) as calculated. If all data are below the QL used for the analysis, then the average shall be reported as "< QL". If reporting for quantity is required on the DMR and the reported monthly average concentration is < QL, then report "< QL" for the quantity. Otherwise, use the reported concentration data (including the defined zeros) and flow data for each sample day to determine the daily quantity and report the monthly average of the calculated daily quantities.
- b. Weekly Average – Compliance with the weekly average limitations and/or reporting requirements for the parameters listed in Part I.B.2.a. of this permit condition shall be determined as follows: All concentration data below the QL used for the analysis (QL must be less than or equal to the QL listed in Part I.B.2.a. above) shall be treated as zero. All concentration data equal to or above the QL used for the analysis shall be treated as reported. An arithmetic average shall be calculated using all reported data, including the defined zeros, collected within each complete calendar week and entirely contained within the reporting month.

The maximum value of the weekly averages thus determined shall be reported on the DMR. If all data are below the QL used for the analysis, then the weekly average shall be reported as "< QL". If reporting for quantity is required on the DMR and the reported weekly average concentration is < QL, then report "< QL" for the quantity. Otherwise use the reported concentration data (including the defined zeros) and flow data for each sample day to determine the daily quantity and report the maximum weekly average of the calculated daily quantities.

- c. Single Datum – Any single datum required shall be reported as "< QL" if it is less than the QL used in the analysis (QL must be less than or equal to the QL listed in Part I.B.2.a. above). Otherwise the numerical value shall be reported.
- d. Significant Digits – The permittee shall report at least the same number of significant digits as the permit limit for a given parameter. Regardless of the rounding convention used by the permittee (i.e. 5 always rounding up or to the nearest even number), the permittee shall use the convention consistently and shall ensure that consulting laboratories employed by the permittee use the same convention.
- e. For total phosphorus, all daily concentration data below the quantification level (QL) for the analytical method used should be treated as half the QL. All daily concentration data equal to or above the QL for the analytical method used shall be treated as it is reported.
- f. For total nitrogen (TN), if none of the daily concentration data for the respective species (i.e. TKN, Nitrates/Nitrites) are equal to or above the QL for the respective analytical methods used, the daily TN concentration value reported shall equal one half of the largest QL used for the respective species. If one of the data is equal to or above the QL, the daily TN concentration value shall be treated as that data point is reported. If more than one of the data is above the QL, the daily TN concentration value shall equal the sum of the data points as reported.

Daily Logs

In addition to the submission of the facility eDMR to the DEQ, the operator shall maintain a daily log of operation. The operator is required to record the day-to-day plant activities and events (sampling, testing, etc.). operation of equipment, maintenance, housekeeping, etc. The operator records daily results of monitoring results on a data sheet, the sheet should indicate the following information:

- The date, exact place, and time of sampling or measurements;
- The individual(s) who performed the sampling or measurements;
- The date(s) and time(s) analyses were performed;
- The individual(s) who performed the analyses;
- The analytical techniques or methods used; and
- The results of such analyses.

In addition, visual observations of the discharge and the receiving stream shall be recorded. A suggested form for recording daily monitoring has been included in this Manual; a copy is provided below.

The monthly data is the basis for the required DMR determinations for monthly average, minimum and maximum results for the daily testing performed at the plant. This data sheet shall be filed in the plant office.

The operator should record his daily operational activities as well as any repair work or maintenance activity performed. Accident listings and any visitors to the facility are also recorded in the daily log. The date and time of each activity are recorded in the log as well as the operator's initials. The maintenance staff should keep a record of any equipment maintenance performed in the separate equipment service record. These records may be maintained electronically for ease of reference. Electronic records should be transmitted routinely to the manager to assure a complete set of electronic records is

maintained. Records may also include maintenance staff time sheets detailing service by staff at the plant

HILL WWTP DAILY MONITORING LOG

Month: _____
 Year: _____

Date	Operator Initials	Flow GPD	SBR pH	SBR DO	SSV	EFF pH	Sample & Test Time	EFF DO	Sample & Test Time	Cl2 Contact	Sample & Test Time	CL2 Disch	Sample & Test Time	EFF DESCRIPTION	STREAM DESCRIPTION
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
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23															
24															
25															
26															
27															
28															
29															
30															
31															

Comments: _____

SOLIDS MANAGEMENT

Solids, sludges or other pollutants removed in the course of treatment or management of pollutants shall be disposed of in a manner so as to prevent any pollutant from such materials entering state waters.

Coarse screenings removed from the treatment plant headworks shall be disposed of in a covered/closed receptacle and the accumulated waste shall be managed as solid waste.

The collected waste shall be routinely managed (place in dumpster for disposal) so as not to create a nuisance condition.

Solids which accumulate in the sludge holding are removed by a septage hauler and treated as septage. The facility will rely on the services of a licensed Septic Service to remove accumulated, waste sludge from the facility. Waste sludge is transported to the Town of Bowling Green WWTF (VA0020737) for additional treatment and final management.

SPILLS & UNUSUAL DISCHARGE PROCEDURES

The Hill MHP STP serves a residential community. The possibility of an unusual discharge associated with noxious waste is remote. In accordance with the issued permit the following information (exerpted from the issued permit) is provided.

F. Unauthorized Discharges

Except in compliance with this permit, or another permit issued by the Board, it shall be unlawful for any person to:

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances; or
2. Otherwise alter the physical, chemical or biological properties of such state waters and make them detrimental to the public health, or to animal or aquatic life, or to the use of such waters for domestic or industrial consumption, or for recreation, or for other uses.

G. Reports of Unauthorized Discharges

Any permittee who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance into or upon state waters in violation of Part II.F.; or who discharges or causes or allows a discharge that may reasonably be expected to enter state waters in violation of Part II.F., shall notify the Department of the discharge immediately upon discovery of the discharge, but in no case later than 24 hours after said discovery. A written report of the unauthorized discharge shall be submitted to the Department, within five days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;
2. The cause of the discharge;
3. The date on which the discharge occurred;
4. The length of time that the discharge continued;
5. The volume of the discharge;
6. If the discharge is continuing, how long it is expected to continue;
7. If the discharge is continuing, what the expected total volume of the discharge will be; and

8. Any steps planned or taken to reduce, eliminate and prevent a recurrence of the present discharge or any future discharges not authorized by this permit.

Discharges reportable to the Department under the immediate reporting requirements of other regulations are exempted from this requirement.

H. Reports of Unusual or Extraordinary Discharges

If any unusual or extraordinary discharge including a bypass or upset should occur from a treatment works and the discharge enters or could be expected to enter state waters, the permittee shall promptly notify, in no case later than 24 hours, the Department by telephone after the discovery of the discharge. This notification shall provide all available details of the incident, including any adverse affects on aquatic life and the known number of fish killed. The permittee shall reduce the report to writing and shall submit it to the Department within five days of discovery of the discharge in accordance with Part II.I.2. Unusual and extraordinary discharges include but are not limited to any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;
2. Breakdown of processing or accessory equipment;
3. Failure or taking out of service some or all of the treatment works; and
4. Flooding or other acts of nature.

I. Reports of Noncompliance

The permittee shall report any noncompliance which may adversely affect state waters or may endanger public health.

1. An oral report shall be provided within 24 hours from the time the permittee becomes aware of the circumstances. The following shall be included as information which shall be reported within 24 hours under this paragraph:
 - a. Any unanticipated bypass; and
 - b. Any upset which causes a discharge to surface waters.
2. A written report shall be submitted within 5 days and shall contain:
 - a. A description of the noncompliance and its cause;
 - b. The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and
 - c. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

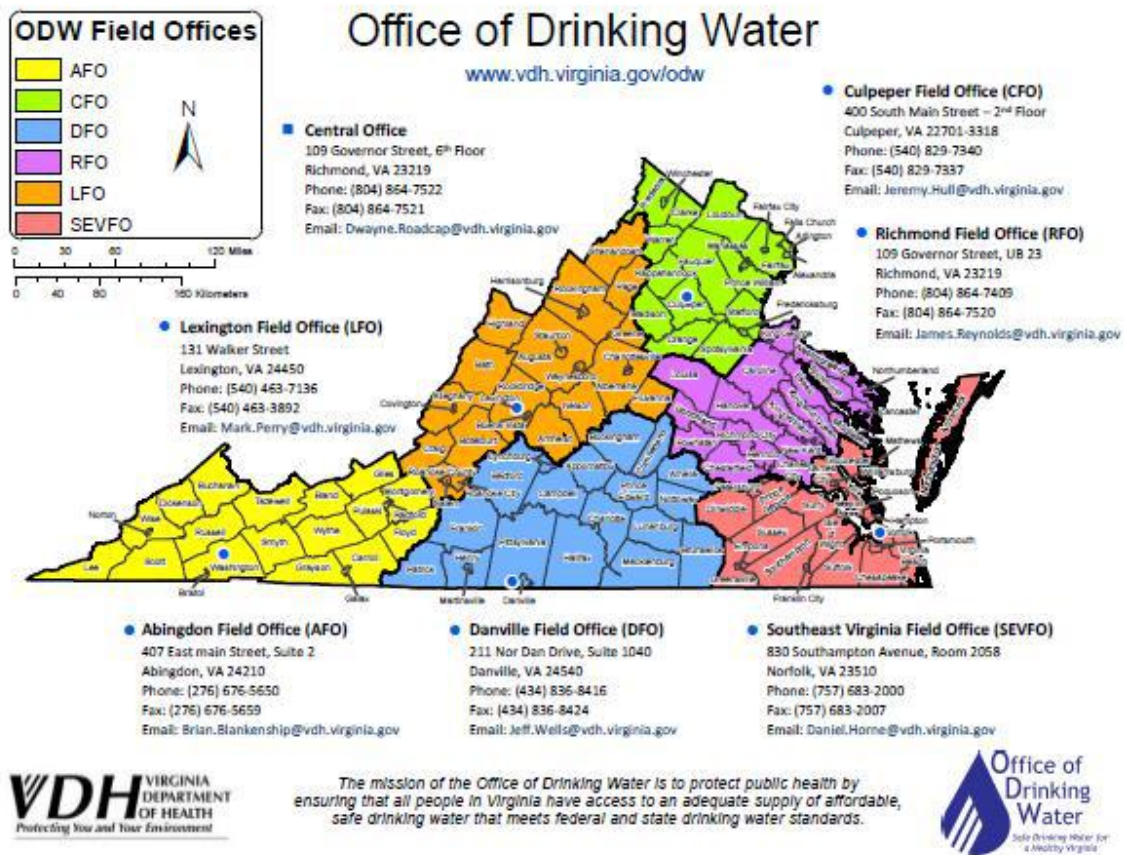
The Board may waive the written report on a case-by-case basis for reports of noncompliance under Part II.I. if the oral report has been received within 24 hours and no adverse impact on state waters has been reported.

3. The permittee shall report all instances of noncompliance not reported under Parts II, I.1 or I.2., in writing, at the time the next monitoring reports are submitted. The reports shall contain the information listed in Part II.I.2.

NOTE: The immediate (within 24 hours) reports required in Parts II, G., H. and I. may be made to the Department's Northern Regional Office at (703) 583-3800 (voice) or online at <http://www.deq.virginia.gov/Programs/PollutionResponsePreparedness/MakingaReport.aspx>.

For reports outside normal working hours, leave a message and this shall fulfill the immediate reporting requirement. For emergencies, the Virginia Department of Emergency Services maintains a 24-hour telephone service at 1-800-468-8892.

In addition to notifying the Department of Environmental Quality, the operator shall also provide notification of unusual discharges to the Virginia Department of Health, Office of Drinking Water. The ODW contact(s) for Caroline County is in **Richmond** Field Office and may be reached at 804 864 7409 or 804 864 7408. This notification allows that Division to act upon any real or potential threat to a drinking water supply.



ATTACHED TO THIS MANUAL ARE THE FOLLOWING DOCUMENTS

FLUIDYNE O & M MANUAL

MANUAL PROVIDED WITH PLANT

EQUIPMENT DETAILS AND LITERATURE FOR

MATERIALS PROVIDED AT TIME OF INSTALLATION

VPDES PERMIT

**OPERATION & MAINTENANCE
INFORMATION**

-FOR-

Fluidyne ISAM™ System

-PROJECT-

Hill Mobile Home Park

-SUBMITTED-

May 21, 2002

-BY-



CORPORATION

**2816 WEST FIRST STREET
CEDAR FALLS, IA 50613**

PHONE: (319) 266-9967

FAX: (319) 277-6034

<http://www.fluidynecorp.com>

fluidyne@cfu.net



Sequencing Batch Reactors
Jet Aeration / Mixing

Hydro-Grit™ - Grit Separators
Surge Anoxic Mix (SAM)™

1905 E University H-243 / Tempe, AZ 85281 / Phone or Fax: (480) 966-1060

Aug 1, 2002

START UP REPORT

JOB:	Hill Mobile ISAM
DATE ON SITE:	July 18, 2002
ENGINEER:	Peter Brooks - office 804-598-6462
	Mobile 804-405-2674
OPERATOR:	Mike Cook 804-994-2088
FLUIDYNE REPRESENTATIVE:	Targie Mandt 480-966-1060
TRIP AND EXPENSES CHARGED TO:	Project
MAN-DAYS ON SITE:	One
TRAVEL DAYS:	Two
TOTAL MAN-DAYS EXPENDED:	Three

I. EQUIPMENT

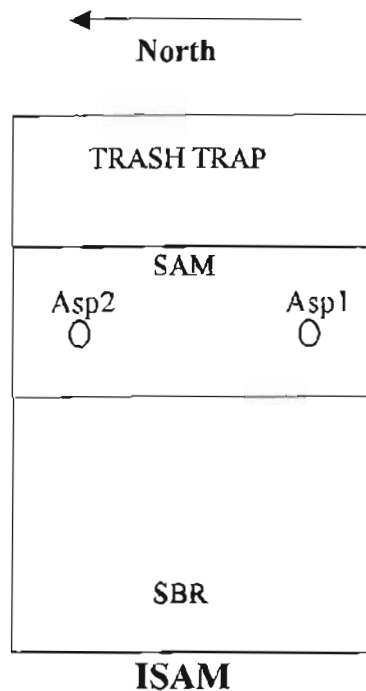
A) BLOWERS

- 1) N/A

B) PUMPS

- 1) Checked rotation
- 2) Measured and recorded current on aspirator pumps:
Nameplate – ABS Model AFP1040M28/4-12-60, 205 GPM @ 25 Ft
TDH, 3.7 HP, 230 V, FLA 17.9 A, Single Phase:
Current @ TWL:
Asp Pump 1 12.5 A
Asp Pump 2 12.5 A
- 3) All current within tolerance

4) Pump orientation in tanks:



C) VALVES

- 1) (1) ¾ in. electric decant vent valve checked limits; both valve and actuator operational in hand and auto
- 2) (1) 3 in. electric operated butterfly valve for decant effluent – reversed open and close output wiring in control panel terminal strip, removed actuator housing and checked field wiring, adjusted limits - valve operational in hand and auto
- 3) (4) 2 in. manual waste ball valves operational

D) IN BASIN EQUIPMENT

- 1) Inspected ISAM tank - hardware, supports, pumps, piping and all other items secure.
- 2) Over flow weir is secure, level, operational and in good condition; weir elevation ~ 8.5 ft
- 3) Stainless steel decanter is secure, level, operational and in good condition; decanter intake elevation ~ 6.83 ft
- 4) Measured decant height from BWL to TWL at 1.75 ft – this height is slightly greater than original design of 1.67 ft (by approximately 1 inch).
- 5) Jet nozzles are secure, at specified elevation, operational and in good condition.
- 6) All other hardware securely fastened

II. PROCESS

A) CONTROLS

- 1) Checked all inputs and outputs
- 2) Tested all mechanical equipment in manual and automatic mode at the control panel
- 3) Tested SBR system in timed automatic mode
- 4) Tested low flow, high flow, weekend flow and normal flow aeration
- 5) Made the following edits in programming logic.
 - Rung 20 added reset for Min React Timer
 - Rung 21 added CTU Min React Timer
 - Rung 27 added I:0/4 TWL and C5:0/DN
 - Rung 43 deleted N.O. C5:10/DN added N.O. I:0/4
 - Rung 53 added CTU C5:15 Alarm Horn Timer
 - Rung 54 added O:0/10 Alarm Horn Output
 - Rung 55 added reset for Alarm Horn Timer
 - Rung 77 Tony added bit for OIT
 - Rung 79 Tony added bit for OIT
- 6) Timers set to the following values for start up:

SBR:

Aerobic normal flow	20 min
Static normal flow	10 min
Aerobic low flow	05 min
Static low flow	22 min
Settle	45 min
Decant begin/end	02 min
Chlorine Extend	02 min

Note: the timer values are based on generic hydraulic and organic loading conditions for start up only. Operator will adjust timers according to actual hydraulic and organic conditions. Waste valves should remain closed until desired solids level is reached

- 7) Adjusted floats to the following elevations:

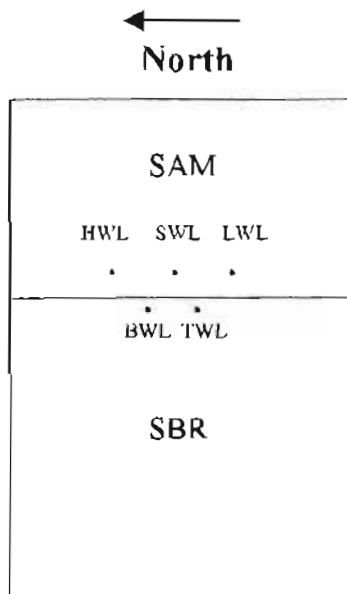
SBR Tank:

BWL ~ 1.5 inches above lip of decanter (intake ~ 6.83 ft)
TWL ~ 1 inch below over flow weir (overflow weir ~ 8.5 ft)

SAM Tank:

LWL ~ 2.0 ft
HWL ~ 3.0 inches above TWL
SWL ~ 2.0 ft below TWL note: surge volume above SWL setpoint must be less than the decant volume; operator should adjust accordingly

Float orientation in tank:



ISAM

- 8) Timed decant cycle at ~ 10 minutes; decant height ~ 1.75 ft.
- 9) Tested all alarm conditions
- 10) Burned EEPROM

B) INSTRUMENTATION

- 1) N/A

C) OBSERVATIONS

- 1) Aeration pattern in SBR tank is excellent
- 2) Mixing in SAM tank is excellent
- 3) Long run of vent piping on exhaust system should be checked periodically for plugging

III. TRAINING

A) SBR CYCLES

- 1) Fill / React / Interact (sub-cycles: aeration on / off)
- 2) Aeration modes: normal, low, weekend and high flow
- 3) Settle
- 4) Decant
- 5) Waste Mixed Liquor
- 6) Cycling times and capacity calculations based on diurnal flows

B) OTHER SYSTEM CYCLES

- 1) N/A

C) MAINTENANCE SCHEDULES OF PUMPS AND MECHANICAL

- 1) Pumps as specified in operations and maintenance manual
- 2) Seal failure indication and troubleshooting
- 2) Adjustment of limit switches on electric operated valves
- 3) Valve failure and troubleshooting
- 4) Float inspection and adjustment
- 7) All others as specified in operations and maintenance manual

D) MECHANICS AND OPERATION OF SYSTEM

- 1) Aspirator aeration principal and operation
- 2) Decanter principal and operation
- 3) Adjustment of SWL based on surge capacity, decant volume, organic loading
- 4) Powering up the control panel and putting system into sequence
- 5) Acknowledging alarms
- 6) Over flow weir principal and operation
- 7) PLC overview including processor, inputs and outputs
- 8) Electrical schematic overview – reading inputs, outputs, terminal numbers and control relays
- 9) Operator interface through Panelview including addressing timers, monitoring alarms, modifying values, setting up clock and accessing batch counter
- 10) Mechanical and sequential troubleshooting of various components within the system

E) PROCESS BIOLOGY

- 1) Process control methods including F/M ratio, MCRT or SRT, and maintaining a constant target MLSS based on organic loading
- 2) Solids calculations and waste pumping rate
- 3) Settle period based on organic and hydraulic conditions
- 4) Aeration on / off values based on DO demand
- 5) Settle testing using settlometer and /or sludge judge and maintaining sludge blanket level
- 6) Process troubleshooting as outlined in operations and maintenance manual
- 7) Laboratory monitoring including influent BOD, MLSS, MLVSS, Ammonia-nitrogen, SVI, D.O., pH and Temperature.

FRANK ELECTRIC CORPORATION
DAILY FIELD SERVICE REPORTFEC S.O. # 11030 CUSTOMER: Fluidyne P.O. # _____PROJECT: Hill Mobile Homes

PHONE # _____ FAX # _____

WEEK OF		MON	TUE	WED	THUR	FRI	SAT	SUN	TOTAL
<u>6/17/02</u>	TRAVEL ON SITE				<u>3.5</u>	<u>3.5</u>			<u>7</u>
						<u>6</u>			<u>6</u>

TIME CHARGES HOURS	STRAIGHT	TIME AND HALF	DOUBLE

START-UP: _____ WARRANTY: _____ TRAINING: _____ OTHER: _____

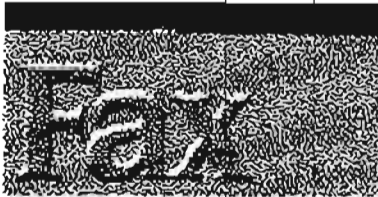
COMMENTS/WORK SUMMARY Arrive on-site, check to ensure programs still in PLC and OIT. Check operation of all field t/o such as float switches, aspirators, decant and effluent valves. Added screens to OIT to show/change accumulated values of timers.

SPECIAL INSTRUCTIONS: Overflow trough weir gasket is leaking. This prevents proper cycling. Per Fluidyne, left effluent valve open and raised SAM SWL float to keep in fill/react.

REPLACEMENT PARTS	MODEL NO.	MANUFACTURER NO.	DESCRIPTION	COST

FEC REP: Tony E. Shellenman REPORTS ATTACHED _____CUSTOMER SIGNATURE: Bruce Brightwell DATE: 6/21/02

CUSTOMER COMMENTS: _____



Date: Tuesday, June 25, 2002

To: FLUIDYNE
RON LICHTNEGER
Phone: 319-266-9967
Fax: 319-277-6034

From: FRANK ELECTRIC CORP.
John Campbell
Phone: 717-764-5959
Fax: 717-764-4662

Pages: 2

Subject: Hill Mobile

Ron:

Attached is Tony's report from Hill Mobile.

Best regards
John

FLUIDYNE BILL OF MATERIALS

PROJECT: HILL MOBILE HOME PARK
Project No.: 02005-SB
Equipment: ISAM EQUIPMENT

Date: 03/25/02
Page: 1 of 1
By: INM Rev.:

ITEM	QTY	DESCRIPTION
1	1	<u>PVC</u> ISAM PACKAGE TREATMENT TANK (8.5'W X 20'L X 9.5'H)
10	1	<u>VALVES</u> 3" ELECTRIC EFFLUENT CONTROL BUTTERFLY VALVE (120/1/60)
11	4	2" MANUAL WASTE BALL VALVES (PRE-INSTALLED IN ISAM TANK)
20	1	<u>CONTROLS</u> ISAM / MCC CONTROL PANEL
31	1	<u>304 STAINLESS STEEL</u> 2-FLOAT BRACKET
33	1	3-FLOAT BRACKET
34	1	2' SOLIDS-EXCLUDING DECANTERS
40	2	<u>PUMPS</u> 3.7HP SUBMERSIBLE ASPIRATOR PUMP (230/1/60)
44	2	20' LONG 3/16" THK LIFT CABLE ASS'Y
50	7	<u>HARDWARE & MISCELANEOUS</u> FLOATS
51	1	VENT VALVE BOX ASSEMBLIES W/3/4" VALVE

**FLUIDYNE CORPORATION
HILL MOBILE HOME PARK
SUBMITTAL INFORMATION**

The following items are required to insure proper operation of the Fluidyne ISAM™:

The tank is designed to be buried except for the top 1'. As a result the 4" influent flange will be above grade. The 4" influent pipe must be freeze protected. We recommend heat tracing the any exposed piping.

The 3" effluent pipe and automated control valve need to be freeze protected and protected from groundwater. We recommend placing the valve in a valve vault and heat tracing.

The effluent line following the decant control valve needs to be sloped and the maximum water level downstream can be no more than 5' 7".

The 1" vent valve pipe needs to be freeze protected. We recommend heat tracing.

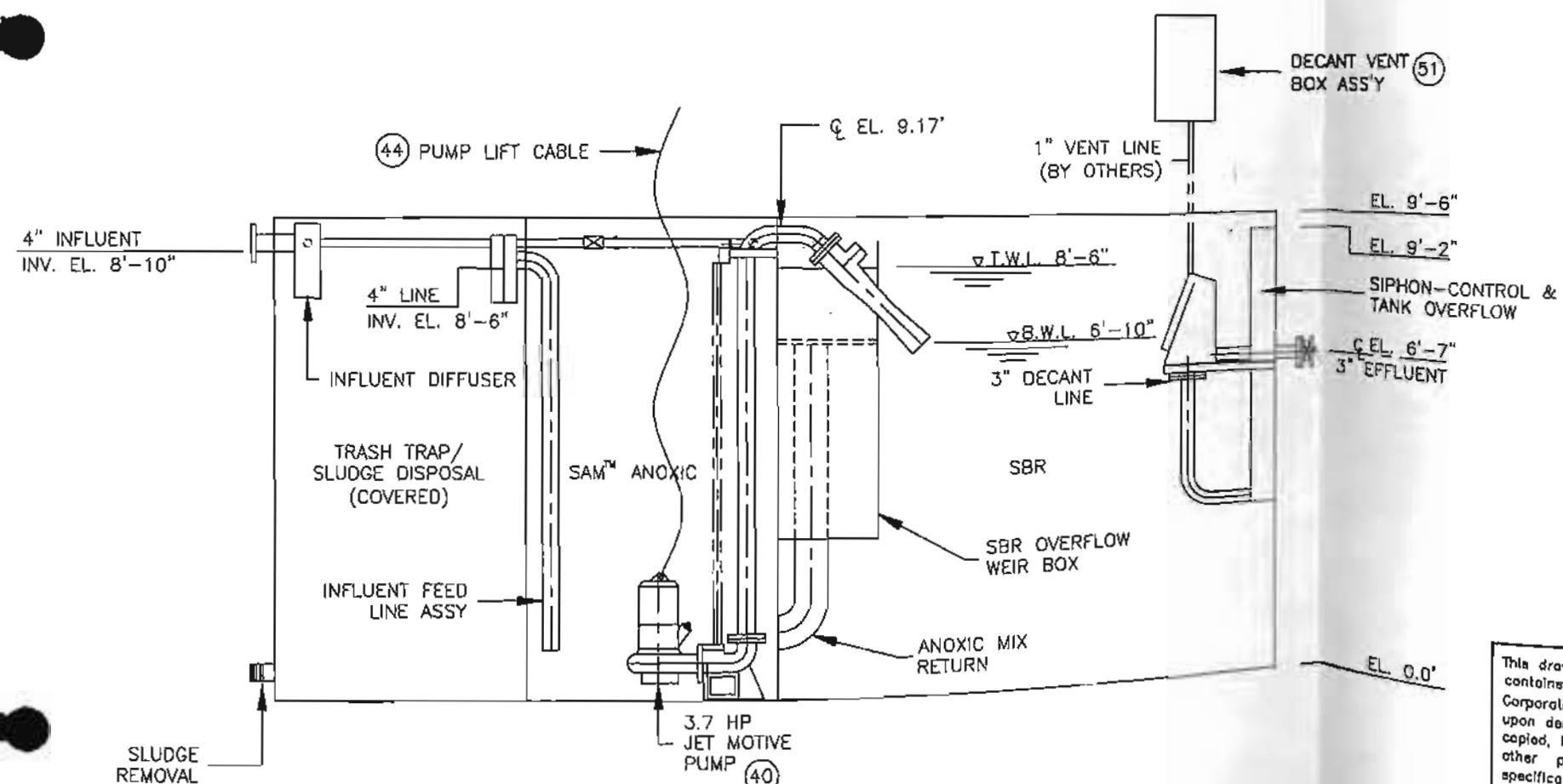
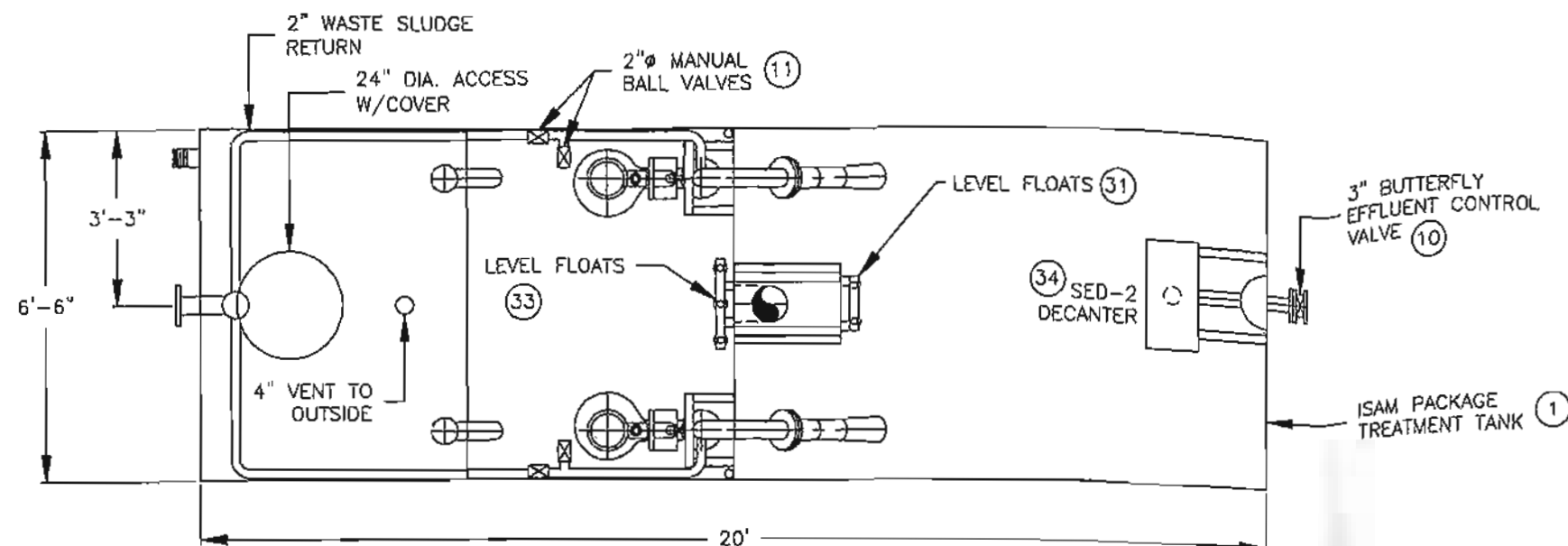
Please see the following additional requirements by the installing contractor.

OTHER SERVICE AND EQUIPMENT:

The installing contractor shall perform the following:

Field unloading and setting of the system on the foundation pad and anchoring in position. Assemble into position, at the location shown on the plant, the ancillary equipment that has been disconnected at the factory for shipping purposes. Other items include:

- 1) Interconnection of piping and wiring which may have been disconnected at the factory for shipping purposes.
- 2) Tie-in of all piping, power and wiring connection to site utilities. The power required at the main power supply is 230 volt, 1 phase, 60 Hz.
- 3) Furnish foundation pad to set the system on
- 4) Place tankage square on pad, Crane capacity of 20,000 pounds minimum
- 5) Touch-up painting of areas damaged during installation
- 6) Filling tank to the proper level to prevent flotation.
- 7) Any remote panels, junction boxes or disconnects required for local codes or to meet job requirements.
- 8) Installing six floats at the proper elevation.
- 9) Providing all conduit and field wiring the six (6) floats, two (2) pumps and one (1) valve to the contractor supplied junction boxes and providing additional wiring back to the control panel.
- 10) Installing the control panel.



NOTE:

TANK MATERIAL: 1/4 STEEL PLATE REINFORCED AS REQUIRED FOR HYDRAULIC CONDITIONS.

ALL FLANGES ARE ASA 150# DRILLING, SIZE AS INDICATED.

TANK INCLUDES ALL IN-BASIN EQUIPMENT

INTERNAL PIPING IS SCHEDULE 40 STEEL OR PVC.

PROTECTIVE COATING: SANDBLAST ENTIRE UNIT TO SPECIFICATIONS SSPC-SP6/SP10 PAINT INSIDE AND OUTSIDE COAL-TAR EPOXY 8-10 MILS.

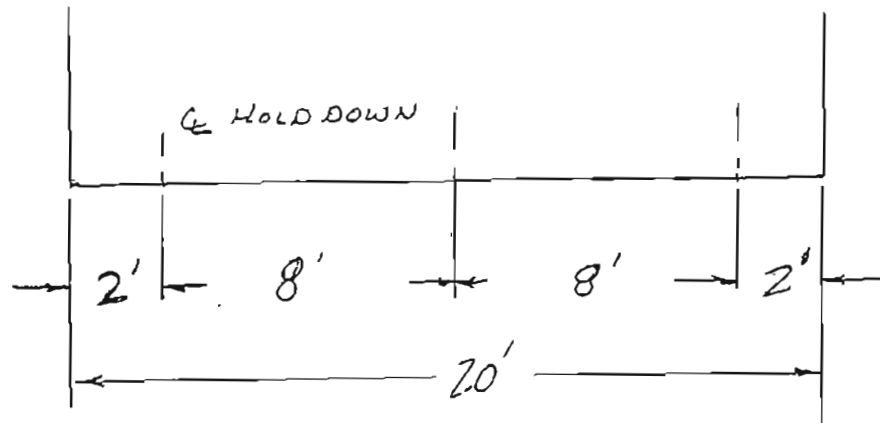
EFFLUENT VALVE AND PIPING MUST BE FREEZE PROTECTED.

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FLUIDYNE

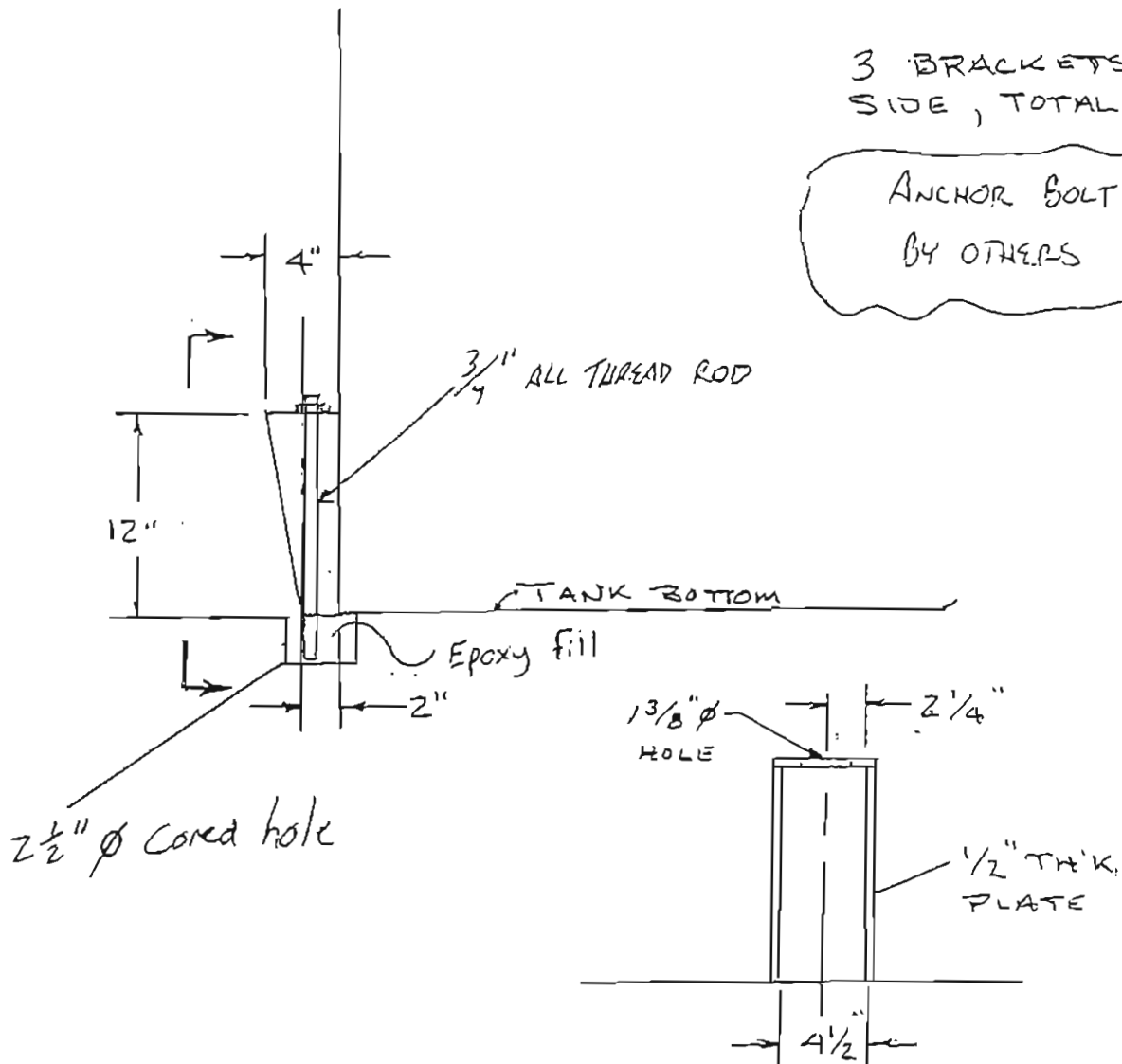
SAM™ PLAN AND ELEVATION
HILL MOBILE HOME PARK

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CHECKED		DATE		SCALE	sam/Hill Mobile	
					SHEET	OF

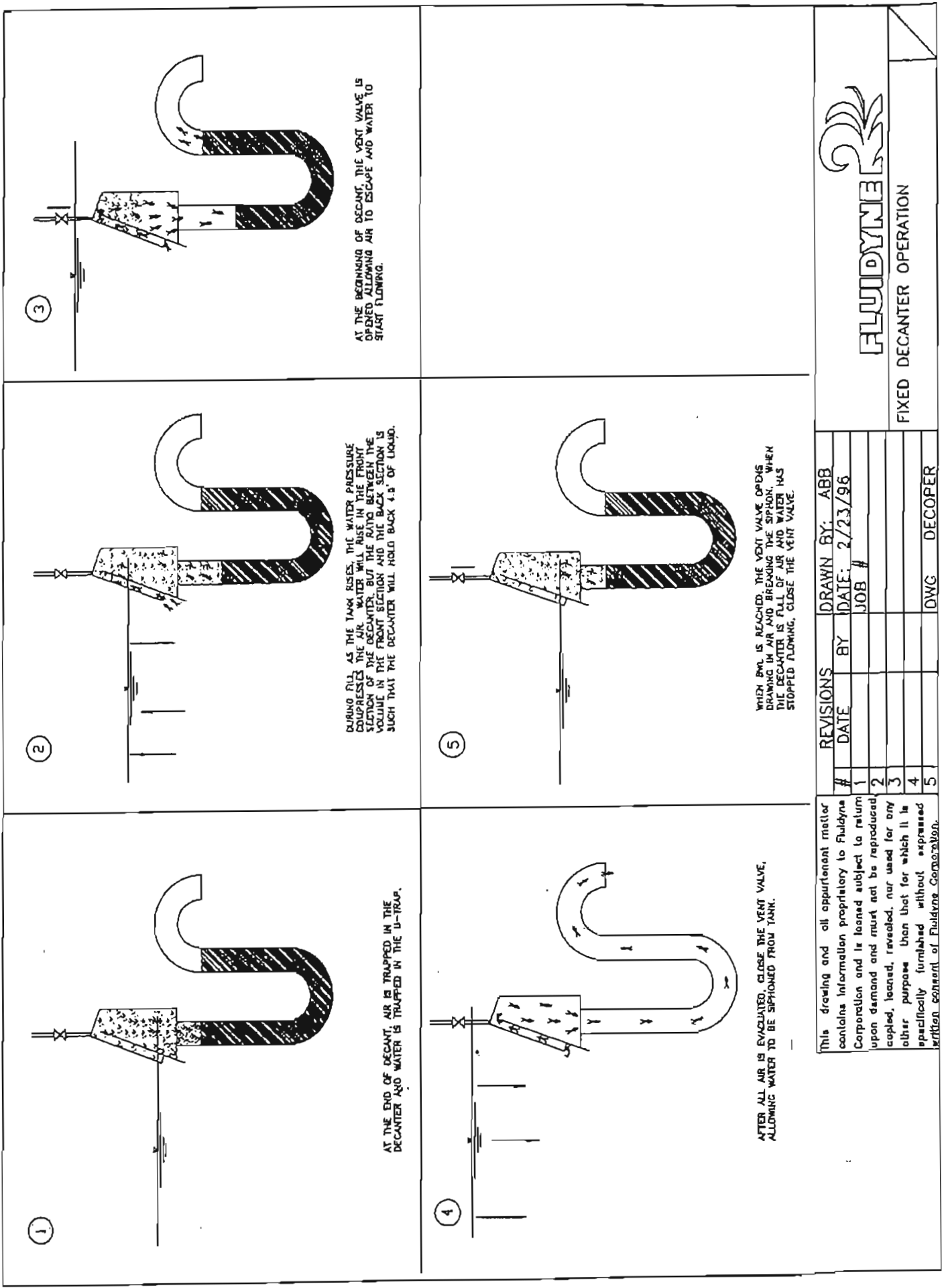


3 BRACKETS PER SIDE, TOTAL 6

ANCHOR BOLT & EPOXY BY OTHERS



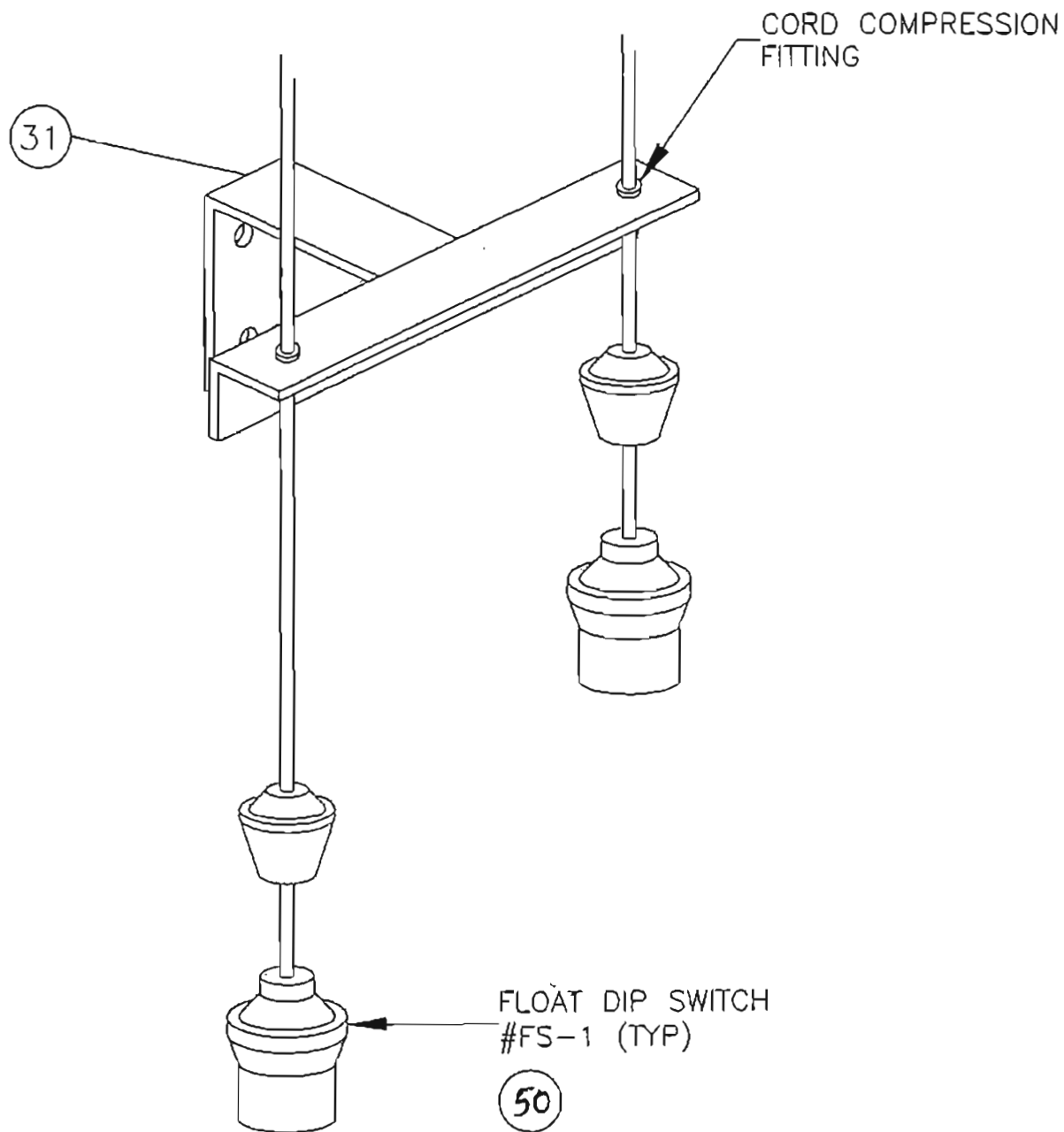
JOB NO.	BY	TANK HOLDDOWN BRACKET	6/20/01	SHEET NO.
		SUBJECT	DATE	



FIXED DECANTER OPERATION

REVISIONS			DRAWN BY: ABB	
#	DATE	BY	DATE:	2/23/96
1			JOB #	
2				
3				
4				
5			DWG	DECOPER

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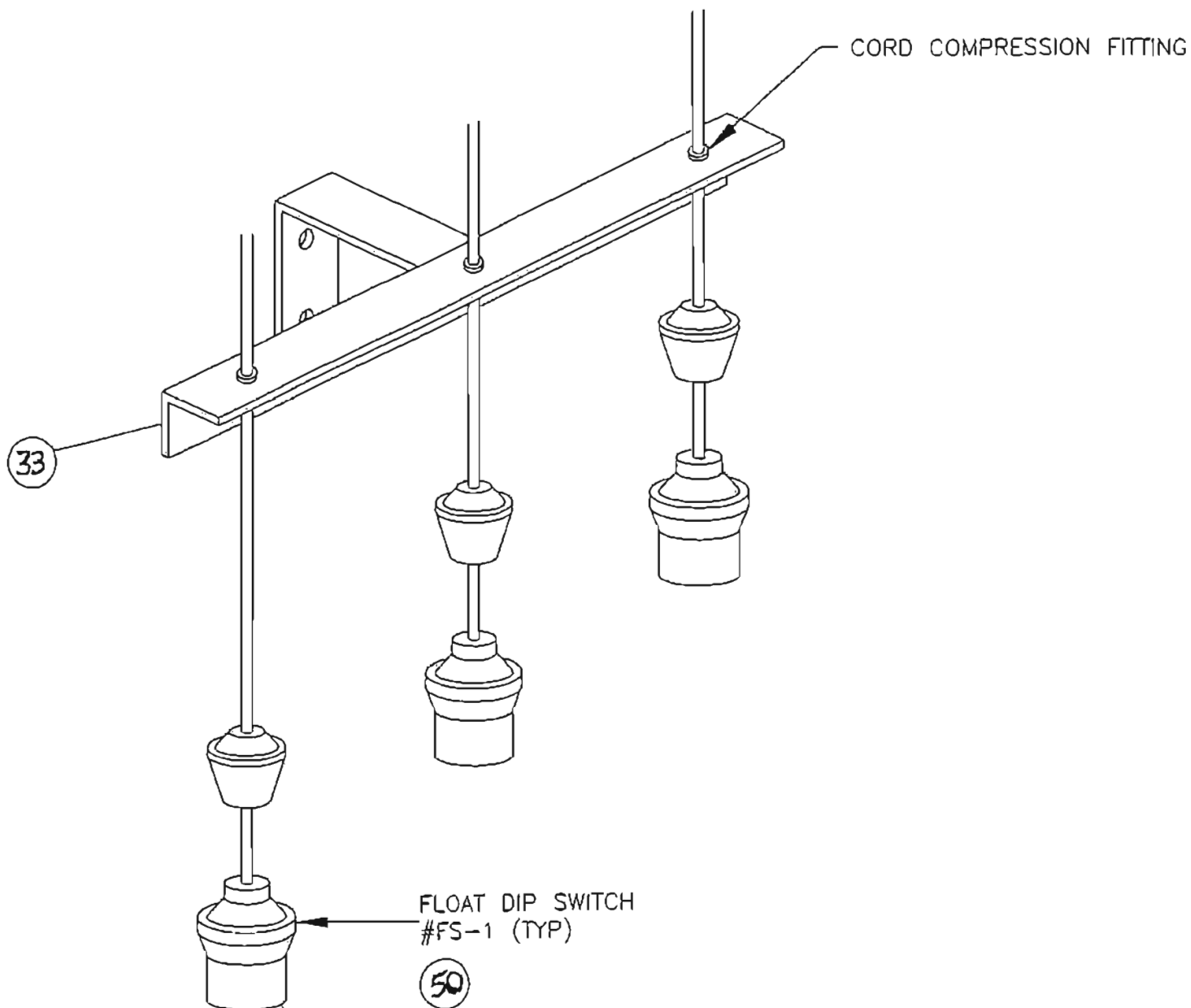


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FLUIDYNE 

2 float bracket

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CHECKED	DATE	SCALE	SHEET	OF	



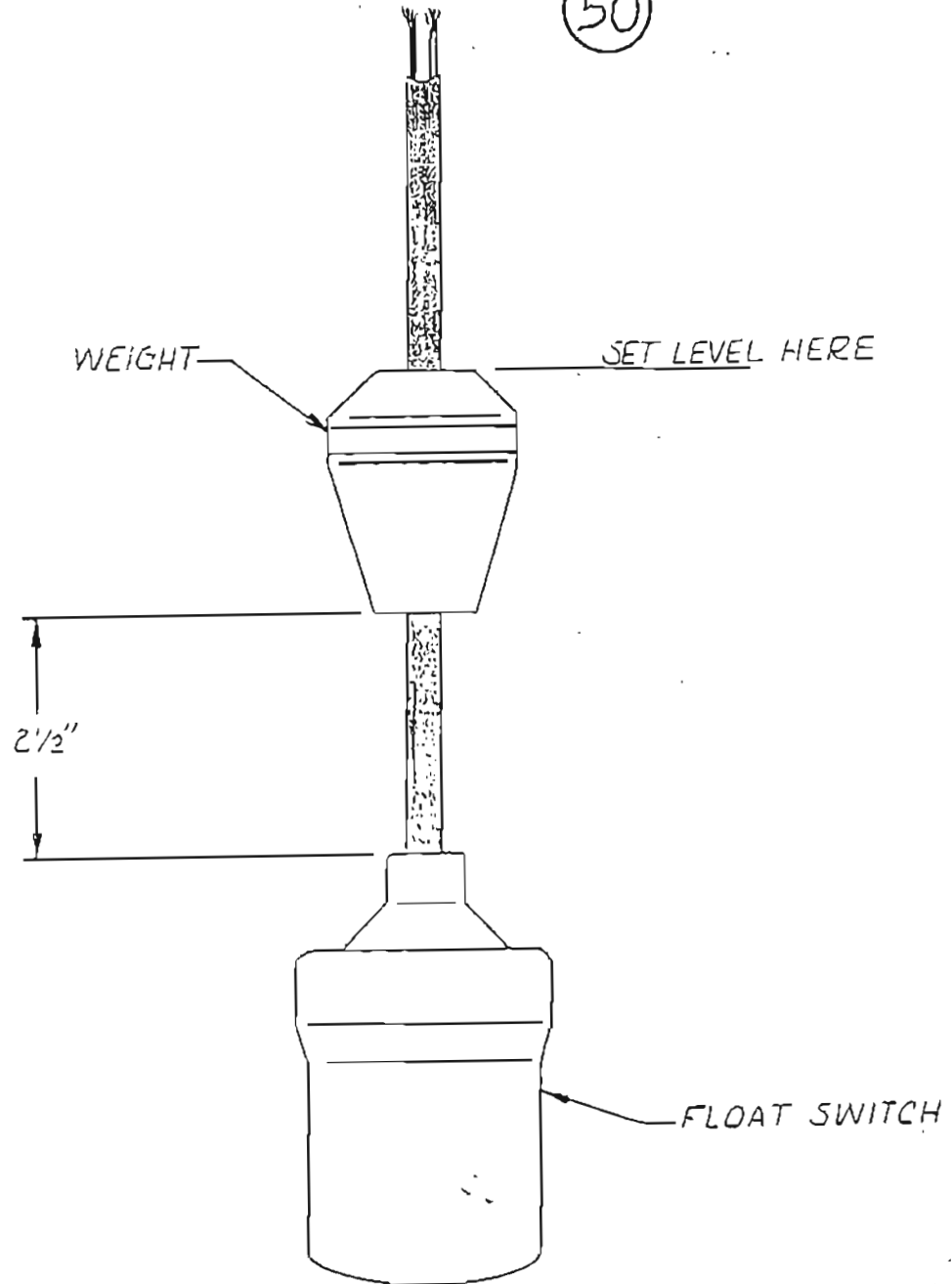
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FLUIDYNE 

3 FLOAT BRACKET

DRAWN INM	DATE 01/09/02	JOB #	CAD FILE 3 float bracket	REV
CHECKED	DATE	SCALE	SHEET	OF

50



ALL DIMENSIONS ARE IN FEET AND/OR INCHES UNLESS NOTED OTHERWISE. DO NOT SCALE THIS DRAWING.

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REVISIONS

NO.	DATE	BY
1		
2		
3		
4		
5		

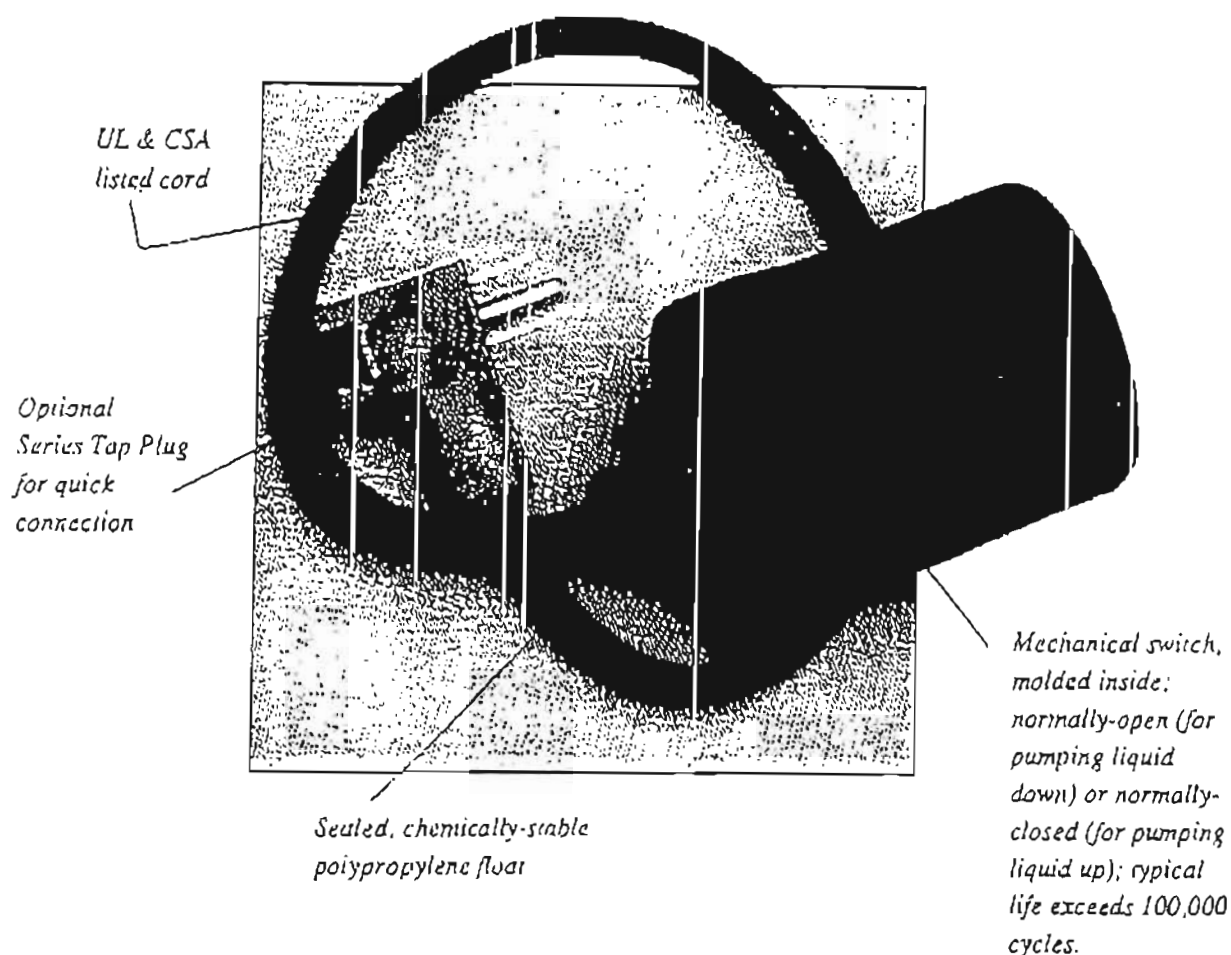
FLUIDYNE 

FLOAT SWITCH

DRAWN BY ABR DATE 10-6-92 NO. 1
CHECKED SCALE N.T.S.



American
Electronic
Components



Liquid Level Control

American Electronic Components, a world leader in high-performance switching, offers a new liquid level control: Mechanical switch floats. Designed for use with sump pumps, liquid level warning alarms, pilot duty control of simplex or duplex systems, or any type of high/low operation, these polypropylene floats are built by a company with over 50 years of experience manufacturing switches and switch assemblies.

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

FOR

FLUIDYNE JET ASPIRATOR UNIT

SECTION ONE: PRELIMINARY INSTALLATION INSTRUCTIONS

1.1 General

This manual contains instructions for installation, operation and maintenance of Fluidyne Corporation aeration systems.

1.2 UNLOADING AND RECEIVING

All equipment should be unloaded with care to avoid damage.

Before signing the release from the carrier, the equipment must be checked for visible damage and checked with the bill of lading. Any damages or shortages should be pointed out to the carrier and noted on the carrier's bill of lading.

Boxes containing smaller items should be checked with the parts list to insure a complete shipment.

On shipments F.O.B. job site, Fluidyne must be notified immediately of any damage or shortages. Fluidyne will not be held responsible for shortages or damages if not notified in writing in seven (7) days.

1.3 STORAGE

Fiberglass Pipe

All fiberglass components and piping should be stored on a flat surface or supported at intervals of 10 feet apart to prevent warping. Also, storage should be in a safe and secure area to prevent damage. Covering of the components is recommended.

Steelwork

All steel components should be stored in a secure area to prevent damage. If items are stacked, use a protective material between stacks to avoid scratching.

SECTION TWO: INSTALLATION

2.1 GENERAL

The Fluidyne aeration equipment is custom designed and manufactured to meet each customer's requirements.

Each installation must be installed in accordance with the plans and specifications and the following installation instructions to insure a complete and properly functioning system.

If any conflict in plans or questions regarding installation arise, contact Fluidyne Corporation before proceeding with installation.

2.2 SUPPORTS

Tighten pipe support clamps to hold FRP pipe in place.

Install nylon locking nuts on pipe support clamps to insure a secure connection.

2.3 INSTALLATION INSPECTION CHECKOFF

1. All connections properly attached.
2. All pipe supports properly adjusted and rubber pads in place. (Do not over tighten on fiberglass pipe).
3. Recheck bolt tightness on all flanged joints.
4. Check all piping for adequate support.

SECTION THREE: START UP

3.1 PUMPS

Before starting, make checks according to manufacturer's O & M Manual.

Check for:

1. Proper lubrication
2. Possible binding of impeller
3. Proper rotation of pump-correct before proceeding further

3.2 OPERATING TIPS

Surface Patterns

With the pump operating, the surface pattern has a rolling effect with a mild boiling some distance away from the aspirator.

SECTION FOUR: MAINTENANCE

General

The aerators supplied by Fluidyne require a relatively low maintenance program. It is recommended that the following items be checked every 2 years.

1. Metal work
 - a. Check for cracks and overall conditions.
 - b. Check bolts for secure fastening.
 - c. Check all fasteners and supports and flanges to insure solid connections.
2. Fiberglass: Check all pipes for cracks and overall condition
3. Nozzles: All nozzles must be checked for debris. If debris is found, it should be pulled out rather than pushed in, if possible. A stiff wire hook works well in pulling debris out.

SECTION FIVE: TROUBLESHOOTING

During system start up or routine operation, There are several problems attributable to aeration system malfunction. The following table lists the most common.

TROUBLESHOOTING GUIDE

<u>PROBLEM</u>	<u>POSSIBLE CAUSE</u>	<u>CORRECTIVE MEASURE</u>
Low oxygen transfer	Debris build-up in nozzle area	Clean nozzles
	Damaged aerator or pipe	Repair
	Pump malfunction	See pump O & M inst.
Large boils of water	Debris build-up in nozzle area	Clean nozzles

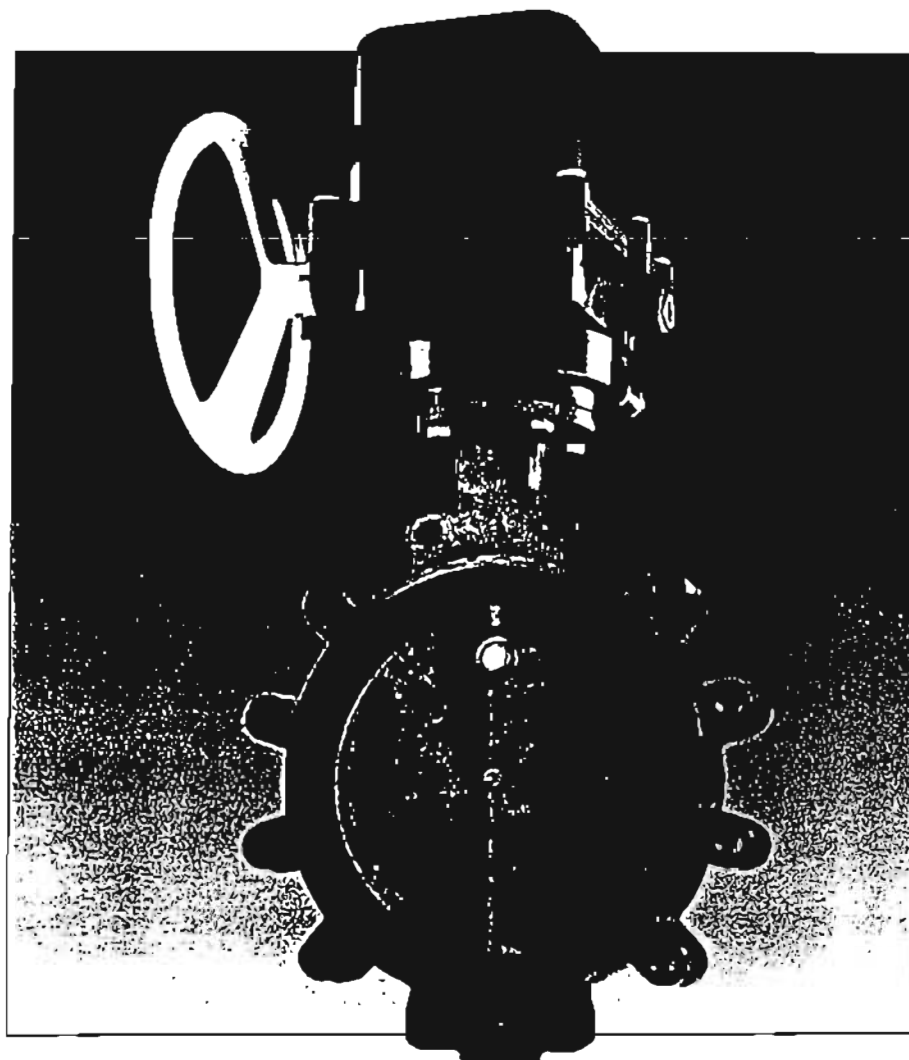
(10) DECANT CONTROL VALVE

KEYSTONE
tyco valves & controls

Resilient Seated Butterfly Valves
Sizes 2–12-inch to 175 psi
Sizes 14–36-inch to 150 psi

Features and Benefits

- Triple function resilient seat provides bi-directional drop-tight shutoff and totally isolates the valve body and stem from the line media.
- Molded-in O-ring seat design serves as flange seals, totally eliminating the need for gaskets between the flanges and the valve.
- Unique dovetail seat retention design allows convenient and economical field replacement.
- Superior one-piece thru-shaft design provides high strength and positive disc control.
- Internal shaft seal prevents external media from entering valve and also adjusts for pressure and shaft rotation.
- Heavy-duty, corrosion resistant top bushing provides upper stem support, absorbs actuator sideloads and extends valve cycle life.
- Polished disc edge ensures optimal performance and maximum seat life.
- Stainless steel torque plug (2–12-inch), disc screws (14–20-inch) and taper pins (24–36-inch) provide positive leak-proof connections while allowing for quick and easy disassembly.
- One-piece body with extended neck allows clearance for flanges and insulation.
- Each valve is factory-tested to 110 percent of manufacturer's pressure rating.



General Applications

Ideally suited for many high performance applications, such as fire protection, water treatment, cooling systems, food and beverage and bulk product handling. Consult factory for appropriate materials for specific services.

Technical Data

Size Range:

Figure AR1 (wafer style) 2–36-inch
Figure AR2 (lugged style) 2–24-inch

Pressure Rating:

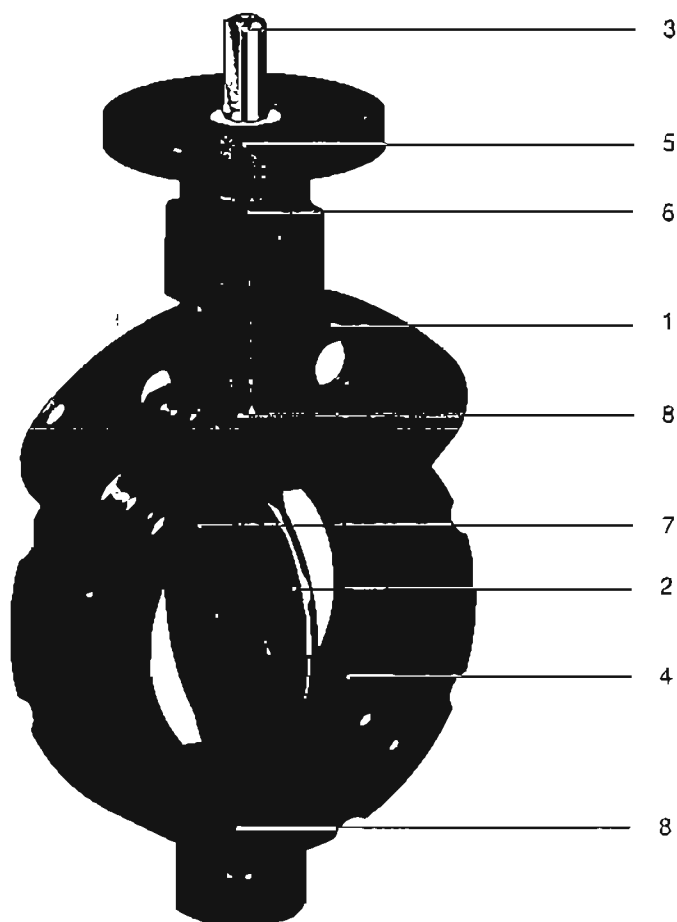
175psi 2–12-inch
150psi 14–36-inch

Dead End Rating:

75psi 2–24-inch
(lugged style body)

A **tyco** INTERNATIONAL LTD. COMPANY

Making Flow Control Easier



Materials

Part	Standard Material	Material Specification	Optional Material
1. Body	Cast iron Ductile iron Carbon steel Stainless steel	ASTM A-126, Class B ASTM A-395 GR 60/40/18 ASTM A-216 WCB (Figure AR2 only) ASTM A-351 CF8M (Figure AR2 8" to 20" only)	
2. Disc	Ductile iron Aluminum bronze 316 Stainless steel	ASTM A-536 GR 65/45/12 ASTM B-148, UNS C95200 Grade A ASTM A-743, CF8M	
3. Stem	316 Stainless steel (2-12-inch) 18-8 Stainless steel (14-20-inch) 17-4 PH Stainless steel (24-36-inch) Phosphate treated steel (2-20-inch)	ASTM A-276 UNS S31600 ASTM A-276 UNS S30400 ASTM A-564 UNS S17400 ASTM A 108 UNS G10450	
4. Seat	NBR food grade (0°F-212°F) EPDM food grade (-40°F-250°F)		Fluoroelastomer (FKM) White NBR
5. Upper stem bushing	Polyester (2-20-inch) Bronze (24-36-inch)		
6. Stem packing	NBR		
7. Torque plug (2-12-inch)	316 Stainless steel	ASTM A-276 UNS S31600 condition A	
7. Disc screws (14-20-inch)	316 Stainless steel	ASTM F-593 Group-2 condition CW1	
7. Taper pins (24-36-inch)	17-4 PH Stainless steel	ASTM A564 UNS S17400 H1075	
8. Upper & Lower, Stem Bearings (2-12-inch)	Sintered metal		

Figure AR1
Water

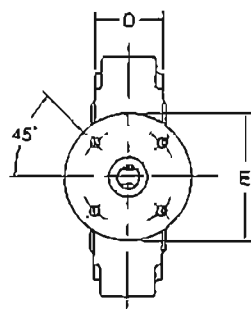
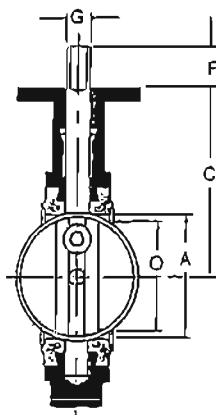
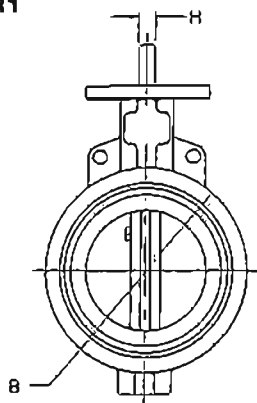


Figure AR2
Lugged

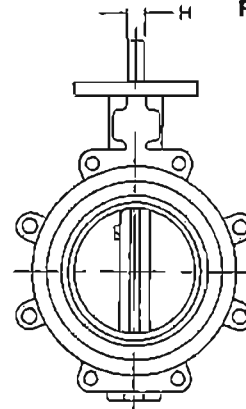


Figure AR1 - Dimensions (inches)

Size	A	B	C	D	E	F	G	H	Q	Key	Top Plate Drilling Bolt Circle	No. Holes	Hole Dia.	Weight (lbs)	Adapt. Code
2	2	4 1/4	5 1/2	1 1/4	4	1 1/4	1/4	1/4	1 1/4	N/A	3 1/4	4	1/4	6.3	BAB
2 1/2	2 1/2	4 1/4	6	1 1/4	4	1 1/4	1/4	1/4	2 1/4	N/A	3 1/4	4	1/4	8.5	BAB
3	3	5 1/4	6 1/4	1 1/4	4	1 1/4	1/4	1/4	2 3/4	N/A	3 1/4	4	1/4	10.0	BAB
4	4	6 1/4	7	2	4	1 1/4	1/4	1/4	3 1/4	N/A	3 1/4	4	1/4	14.0	BAC
5	5	7 1/4	7 1/4	2 1/4	4	1 1/4	1/4	1/4	4 1/4	N/A	3 1/4	4	1/4	18.0	BAD
6	5 1/4	8 1/4	8	2 1/4	4	1 1/4	1/4	1/4	5 1/4	N/A	3 1/4	4	1/4	22.0	BAD
8	7 1/4	10 1/4	9 1/4	2 1/4	6	1 1/4	1/4	1/4	7 1/4	N/A	5	4	1/4	38.0	CAE
10	9 1/4	13	10 1/4	2 1/4	6	2	1 1/4	N/A	9 1/4	1/4 x 1/4	5	4	1/4	51.0	CAF
12	11 1/4	14 1/4	12 1/4	3	6	2	1 1/4	N/A	11 1/4	1/4 x 1/4	5	4	1/4	71.0	CAF
14	13 1/4	16 1/4	12 1/4	3	6	3	1 1/4	N/A	13 1/4	1/4 x 1/4	5	4	1/4	114.0	CAG
16	15 1/4	19 1/4	12 1/4	4	6	3	1 1/4	N/A	15	1/4 x 1/4	5	4	1/4	193.0	CAH
18	17 1/4	21 1/4	14 1/4	4 1/4	8	4 1/4	1 1/4	N/A	16 1/4	1/4 x 1/4	6 1/4	4	1/4	222.0	DAJ
20	19 1/4	23 1/4	15 1/4	5	8	4 1/4	1 1/4	N/A	18 1/4	1/4 x 1/4	6 1/4	4	1/4	315.0	DAJ
24	23 1/4	28 1/4	19 1/4	5 1/4	8	4 1/4	1 1/4	N/A	22 1/4	1/4 x 1/4	6 1/4	4	1/4	506.0	DAJ
30	29 1/4	34 1/4	23	6 1/4	8	4 1/4	2 1/4	N/A	26 1/4	1/4 x 1/4	6 1/4	4	1/4	610.0	DAK
36	35 1/4	41 1/4	27 1/4	7 1/4	8	5 1/4	2 1/4	N/A	34 1/4	1/4 x 1/4	6 1/4	4	1/4	1,185.0	DAV

Figure AR2 - Dimensions (inches)

Size	A	B	C	D	E	F	G	H	Q	Key	Top Plate Drilling			Tapped Lug Data			Weight (lbs)	Adapt. Code
											Bolt Circle	No. Holes	Hole Dia.	Bolt Circle	No. Holes	Tap		
2	2	4 1/4	5 1/2	1 1/4	4	1 1/4	1/4	1/4	1 1/4	N/A	3 1/4	4	1/4	4 1/4	4	1/4-11 UNC	7.0	BAB
2 1/2	2 1/2	4 1/4	6	1 1/4	4	1 1/4	1/4	1/4	2 1/4	N/A	3 1/4	4	1/4	5 1/4	4	1/4-11 UNC	10.0	BAB
3	3	5 1/4	6 1/4	1 1/4	4	1 1/4	1/4	1/4	2 3/4	N/A	3 1/4	4	1/4	6	4	1/4-11 UNC	11.5	BAB
4	4	6 1/4	7	2	4	1 1/4	1/4	1/4	3 1/4	N/A	3 1/4	4	1/4	7 1/4	8	1/4-11 UNC	18.0	BAC
5	5	7 1/4	7 1/4	2 1/4	4	1 1/4	1/4	1/4	4 1/4	N/A	3 1/4	4	1/4	8 1/4	8	1/4-10 UNC	22.5	BAD
6	5 1/4	8 1/4	8	2 1/4	4	1 1/4	1/4	1/4	5 1/4	N/A	3 1/4	4	1/4	9 1/4	8	1/4-10 UNC	28.5	BAD
8	7 1/4	10 1/4	9 1/4	2 1/4	6	1 1/4	1/4	1/4	7 1/4	N/A	5	4	1/4	11 1/4	8	1/4-10 UNC	49.0	CAE
10	9 1/4	13	10 1/4	2 1/4	6	2	1 1/4	N/A	9 1/4	1/4 x 1/4	5	4	1/4	14 1/4	12	1/4-9 UNC	69.0	CAF
12	11 1/4	14 1/4	12 1/4	3	6	2	1 1/4	N/A	11 1/4	1/4 x 1/4	5	4	1/4	17	12	1/4-9 UNC	107.0	CAF
14	13 1/4	16 1/4	12 1/4	3	6	3	1 1/4	N/A	13 1/4	1/4 x 1/4	5	4	1/4	18 1/4	12	1-8 NC	143.0	CAG
16	15 1/4	19 1/4	12 1/4	4	6	3	1 1/4	N/A	15	1/4 x 1/4	5	4	1/4	21 1/4	16	1-8 NC	238.0	CAH
18	17 1/4	21 1/4	14 1/4	4 1/4	8	4 1/4	1 1/4	N/A	16 1/4	1/4 x 1/4	6 1/4	4	1/4	22 1/4	16	1 1/4-7 NC	281.0	DAJ
20	19 1/4	23 1/4	15 1/4	5	8	4 1/4	1 1/4	N/A	18 1/4	1/4 x 1/4	6 1/4	4	1/4	25	20	1 1/4-7 NC	366.0	DAJ
24	23 1/4	28 1/4	19 1/4	5 1/4	8	4 1/4	1 1/4	N/A	22 1/4	1/4 x 1/4	6 1/4	4	1/4	29 1/4	20	1 1/4-7 NC	576.0	DAJ

Notes

1. 'H' Dimension refers to flat on stem.
2. 'Q' dimension is the minimum allowable pipe or flange inside diameter at the centered body face to protect the disc sealing edge against damage when opening the valve.



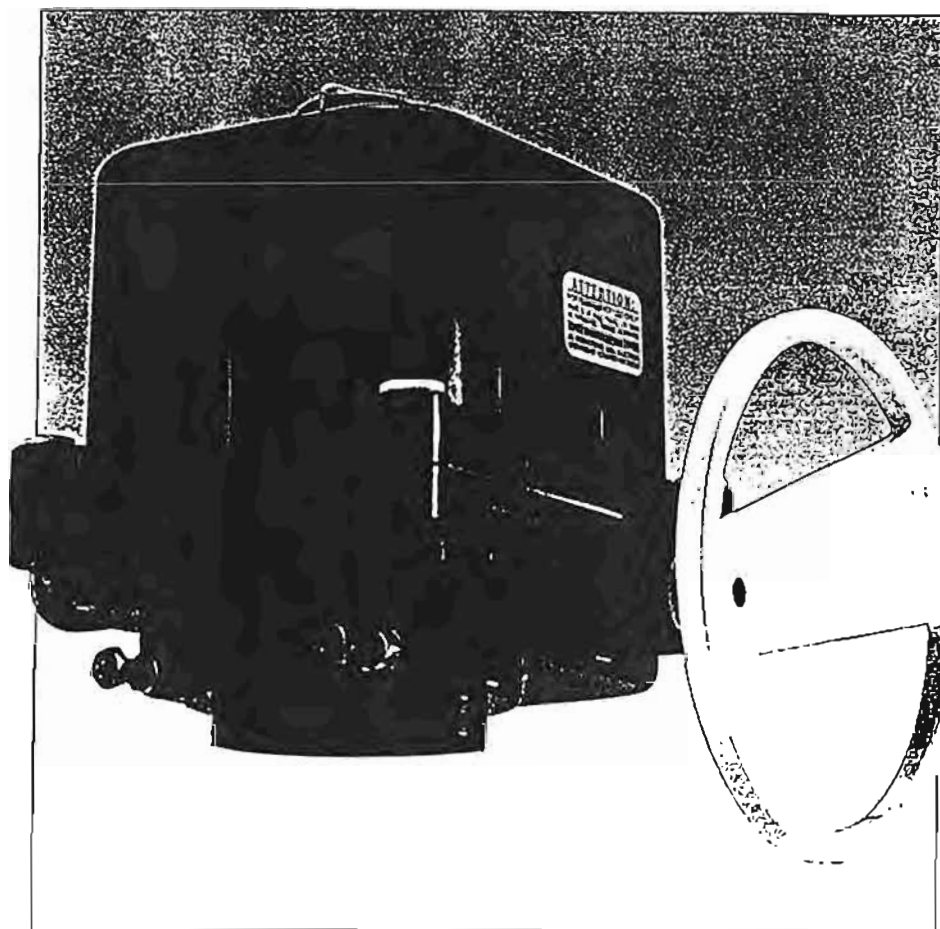
KEYSTONE™

Valves and Controls

Electric Actuator for Quarter-turn Valves For Output Torques to 15,100 lb.in.

Features and Benefits

- Permanently lubricated self-locking gear train eliminates the need for motor brakes.
- Standard manual override does not require use of levers or latches.
- Mechanical travel stops adjustable to 15 degrees in both directions for precise adjustment to valve travel requirements.
- Available in NEMA 4X or NEMA 7 enclosures with Factory Mutual, UL or CSA approvals.
- UL listed motor with thermal overload devices in motor windings protects the motor should overheating occur.
- Dynamometer calibrated torque switches available in units with 600 lb.in. or more output torque eliminate requirement for field calibration.
- Epoxy coated aluminum housings permit service in aggressive environments. Explosion-proof versions utilize zinc-aluminum alloy for maximum enclosure integrity. (Ductile iron housings also available.)
- Visual mechanical position indicator for accurate visual reference of valve position.



- Exclusive K-CAM limit switch cams allow for simple and convenient travel adjustment.
- Direct mounting to Keystone valves or readily adaptable to other quarter-turn valves minimizes costs associated with adaptation.

Optional Temperature: -40°F to 120°F
(-40°C to 49°C)

Output torque: Up to 15,100 lb.in.
(1706 Nm)

Voltage:

- 120 VAC, 1 phase 60/50 hertz (EPI 3 to EPI 151)
- 220 VAC, 1 phase 60/50 hertz (EPI 3 to EPI 151)
- 208 VAC, 3 phase 60 hertz (EPI 6 to EPI 151)
- 230 VAC, 3 phase 60 hertz (EPI 6 to EPI 151)
- 460 VAC, 3 phase 60 hertz (EPI 6 to EPI 151)
- 575 VAC, 3 phase 60 hertz (EPI 6 to EPI 151)
- 12 VDC (EPI 3 to EPI 36)
- 24 VDC (EPI 3 to EPI 36)

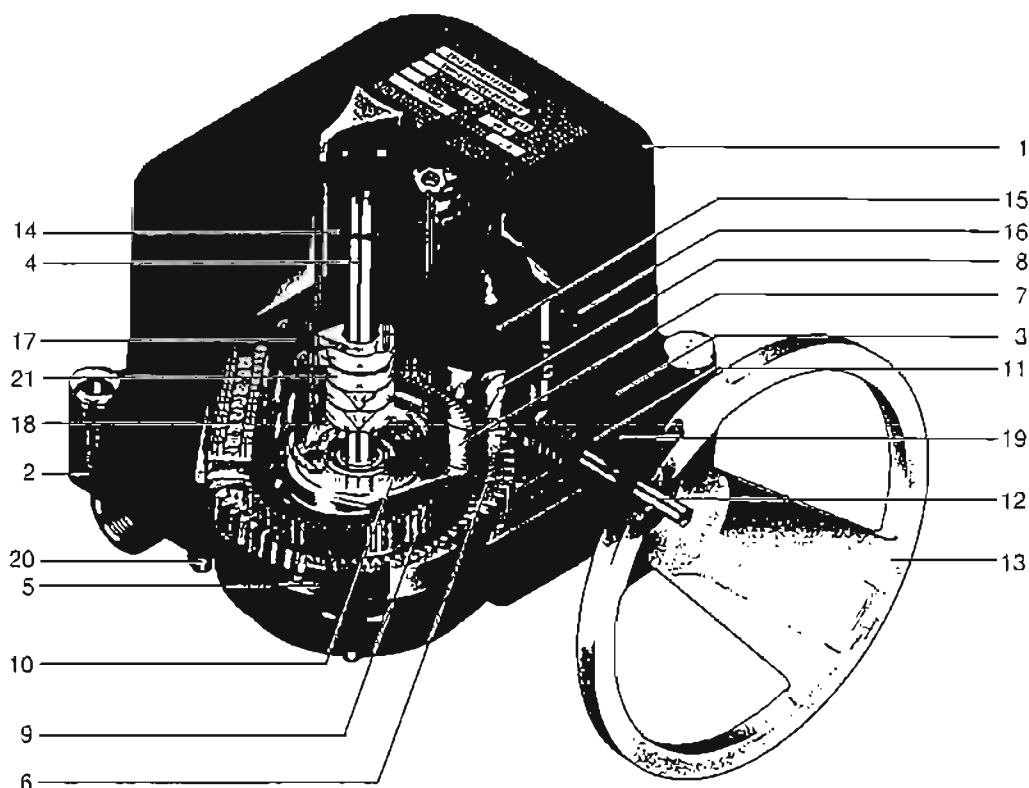
General Applications

For remote control of any quarter-turn application, for example: ball, butterfly, or rotary plug valves, dampers, etc.

Technical Data

Temperature: -20°F to 140°F
(-30°C to 60°C)



**Materials**

Part	Material	Material Standards
1 Cover	Aluminum (1, 2) Aluminum alloy (2) Ductile iron (2, 4)	ASTM A-380 ZA-27 Zinc-aluminum alloy ASTM A-536-80 Grade 65-45-12
2 Base	Aluminum (1, 2) Ductile iron (2, 4)	ASTM A-380 ASTM A-536-80 Grade 65-45-12
3 Switch plate	Aluminum (1, 2) Steel (4)	
4 Indicator shaft	Stainless steel (1, 2, 3, 4)	300/400 grade
5 Output drive	Aluminum (1, 2) Ductile iron	ASTM A-360 ASTM A-536-80 Grade 65-45-12
6 Annulus gear	Aluminum (1, 2) Steel Bronze	ASTM A-360 LP B1-B5 1400
7 Input gear	Glass filled nylon (1, 2) Steel (3, 4)	Minlon® ASTM A-216
8 Worm gear	Steel (1, 2)	
9 Compound gear	Aluminum (1, 2) Steel	ASTM A-360
10 Planetary carrier	Zinc (1, 2, 3) Steel	ASTM B-86
11 Belleville washers	Steel	Commercial grade
12 Handwheel input shaft	Steel Stainless steel	300/400 Grade
13 Handwheel	Aluminum (1, 2, 3) Cast iron (4)	ASTM A-380 ASTM A-536
14 Motor	Commercial MIL-M-17059 (4)	Commercial grade
15 Capacitor	Commercial	Commercial grade
16 Torque switches	SPDT	Commercial grade
7 Travel switches	SPDT (1, 2, 3, 4) 600V, 10/20 A	Commercial grade
18 Terminal strip		Commercial grade
19 Cover O-ring	Nitrile	Commercial grade
20 Travel stops	Steel	Commercial grade
21 Travel adjustment cams	Delrin/Brass	Commercial grade

Notes

- (1) Industrial
NEMA 4/4X
CSA 4/4X/6
- (2) Factory Mutual
FM/CSA explosion proof
- (3) AWWA C-540-variation
NEMA 4/4X
CSA 4/4X/6
- (4) Marine and government variations
MIL-S-901C, MIL-STD-167-1,
API-607, D.O.D.-V-24657 (Type II,
Class I, Service III)

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Principles of Operation

One of the most important features of the Figure 777 is the use of epicyclic gearing. The following explanation and diagram describe, in sequence, how this system is utilized in the Figure 777 actuator.

Electric operation

1. The motor pinion gear drives the input gear.
2. The input gear is directly fixed to the eccentric carrier and, therefore, drives it.
3. The eccentric carrier moves the compound gear around inside of the fixed annulus.
4. Because of a one-tooth difference between the compound gear and output gear, the output gear rotates. This type of gear is inherently self-locking.

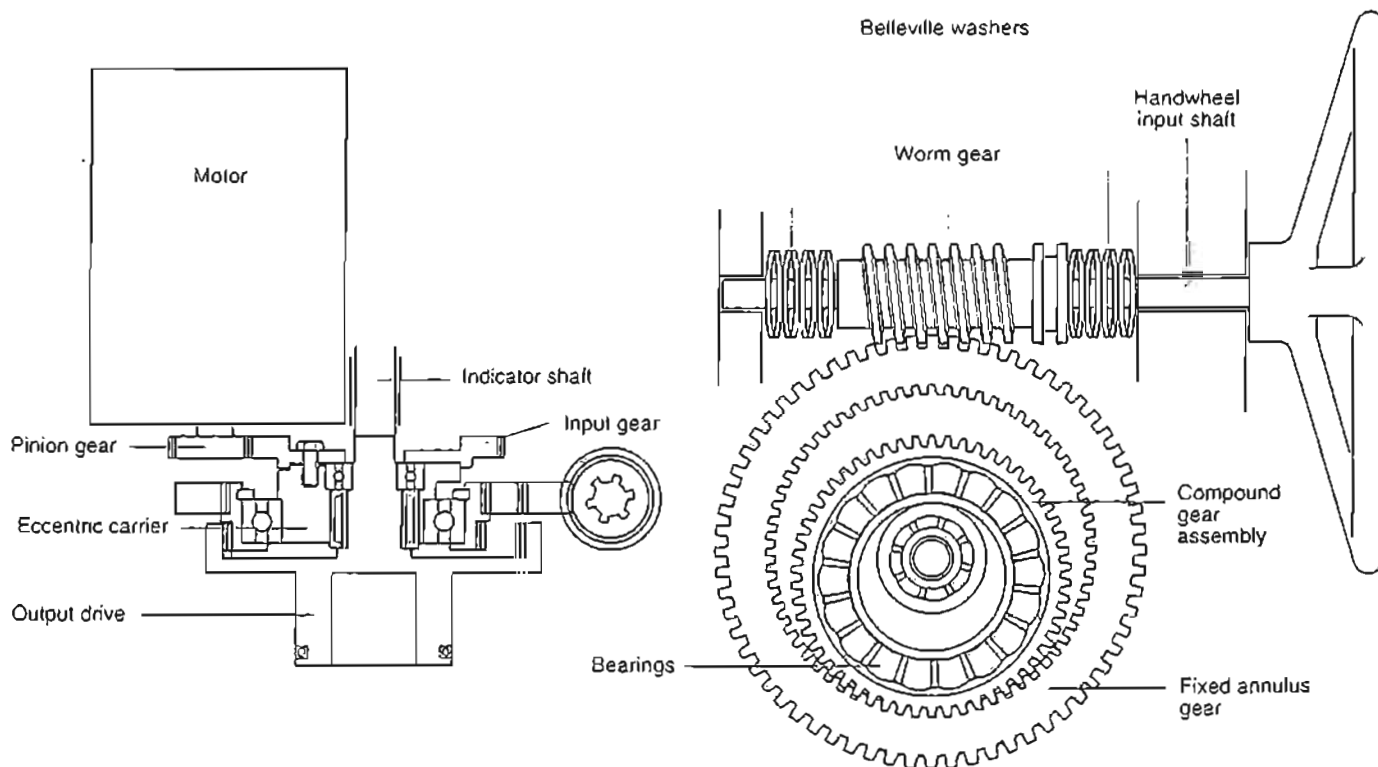
Manual operation

1. Turning the handwheel drives the manual input shaft.
2. The manual input shaft drives the worm gear.
3. The worm gear drives the fixed annulus.

4. Since the fixed annulus is the reference point for the epicyclic gear train, the output gear is also driven.
5. The worm gear can drive the fixed annulus, but the fixed annulus cannot drive the worm gear. Therefore, no de-clutch mechanism is required for manual operation.

Torque limiting

1. Output torque puts a reaction onto the fixed annulus via the compound gear.
2. The reaction force on the fixed annulus tends to move the worm gear against the Belleville washers. This movement is proportional to output torque.
3. The axial movement of the worm gear is converted to a rotation on the torque shaft. This rotation moves the adjustable cams to trip the torque switches.



Keystone Figure 777 Electric Actuator

Models EPI-3 to EPI-151

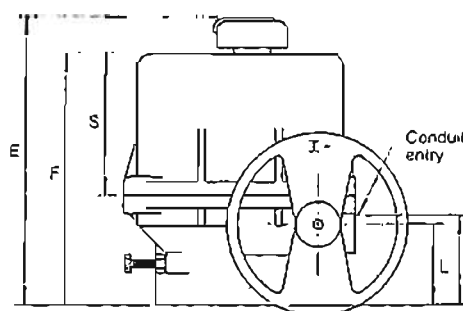
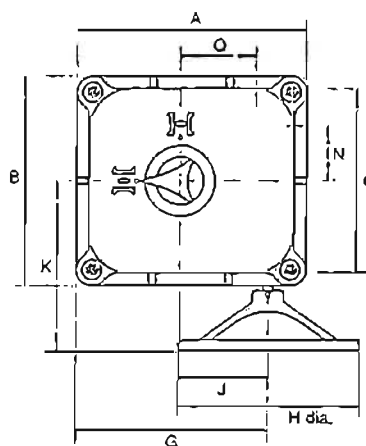
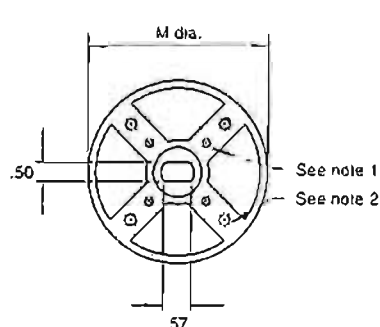
Performance Data—Intermittent Service

Actuator Size	Gear Ratio		Handwheel Rim Pull		Torque Output		Full Load Current Rating (amperes)				Time for 90° Travel (seconds)*		Weight	
	Electric	Manual	Lb	Kg	Lb-In	N-M	120V 1 ph	220V 1 ph	230V 3 ph	460V 3ph	Normal	Speed Control Range	Lb	Kg
EPI-3	1700:1	70:1	15	7	300	34	1.2	0.6	NA	NA	8	NA	8.8	4
EPI-6	1025:1	61:1	16	7.5	600	68	2.1	1.0	0.15	0.1	10	NA	20	9
EPI-13	1025:1	61:1	30	14	1300	147	2.3	1.15	0.20	0.15	10	NA	20	9
EPI-36	1140:1	65:1	65	30	3600	407	2.8	1.9	1.1	0.6	11	NA	53	24
EPI-51	1140:1	65:1	75	34	5100	576	4.1	2.5	1.6	0.8	11	NA	53	24
EPI-91	3420:1	195:1	90	40	9100	1028	3.5	2.3	1.65	0.9	30	NA	110	49.5
EPI-151	3420:1	195:1	90	40	15100	1706	5.0	3.1	2.4	1.2	30	NA	110	49.5

Performance Data—Continuous Service

Actuator Size	Gear Ratio		Handwheel Rim Pull		Torque Output		Full Load Current Rating (amperes)					Time for 90° Travel (seconds)*		Weight	
	Electric	Manual	Lb	Kg	Lb-In	N-M	120V 1 ph	220V 1 ph	260V 3 ph	460V 3ph	575V 3ph	Normal	Speed Control Range	Lb	Kg
EPI-3	3500:1	70:1	15	7	300	34	0.8	0.3	NA	NA	NA	17	18-100	8.8	4
EPI-6	2105:1	61:1	16	7.5	600	68	0.75	0.37	0.07	0.06	.23	21	22-180	20	9
EPI-13	2105:1	61:1	30	14	1300	147	1.1	0.4	0.09	0.07	.26	21	22-180	20	9
EPI-36	2205:1	65:1	65	30	3600	407	1.5	0.8	0.25	0.25	.43	22	23-180	53	24
EPI-51	2205:1	65:1	75	34	5100	576	2.1	1.5	0.35	0.3	.51	22	23-180	53	24
EPI-91	6615:1	195:1	90	40	9100	1028	1.8	1.0	0.45	0.4	.46	60	61-300	110	49.5
EPI-151	6615:1	195:1	90	40	15100	1706	2.5	1.8	0.5	0.45	.55	60	61-300	110	49.5

* These cycle times are approximate under no load conditions. Actual time may vary slightly with load conditions near maximum rating of the actuator and setting of the limit switch cams.

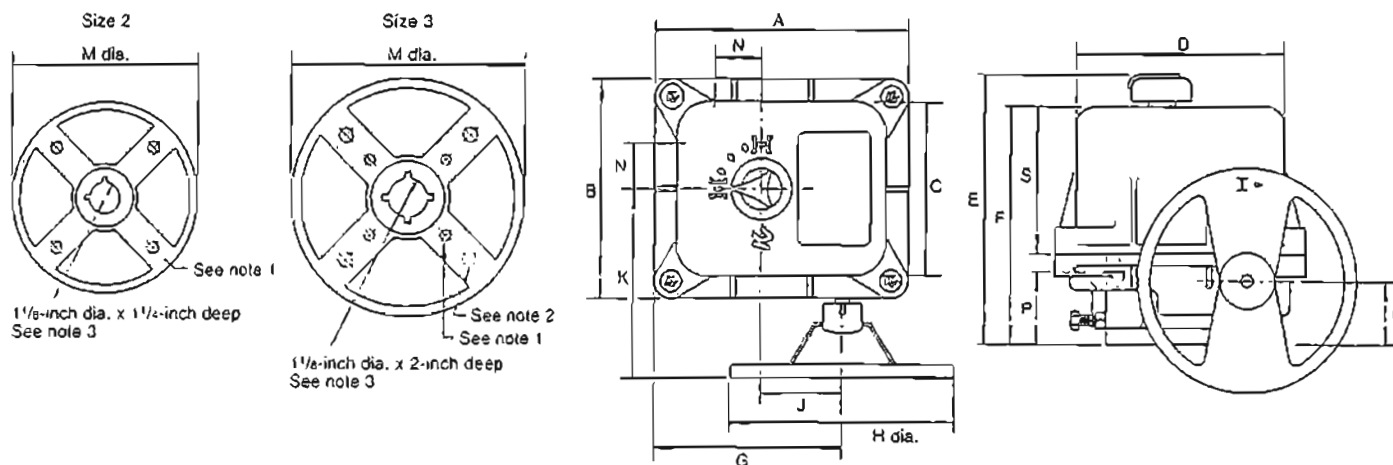


Dimensions (Inches)

Size	EPI Type	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	S
1	EPI 3	6.38	5.75	4.75	5.38	7.72	6.69	5.32	5.00	2.44	4.54	2.09	4.00	1.37	2.12	2.00	4.5

Notes

- Four tapped holes in actuator are 1/8-20UNC on a 1 1/2-inch bolt circle straddling centerline.
- Four tapped holes in actuator are 3/8-16UNC on a 3 1/2-inch bolt circle straddling centerline.
- Two 3/4-inch NPT conduit entries available.
- 'S' dimension is the clearance to remove cover.
- Torque switches are not available in EPI-3.
- Depth of bore is 1.250 inches.

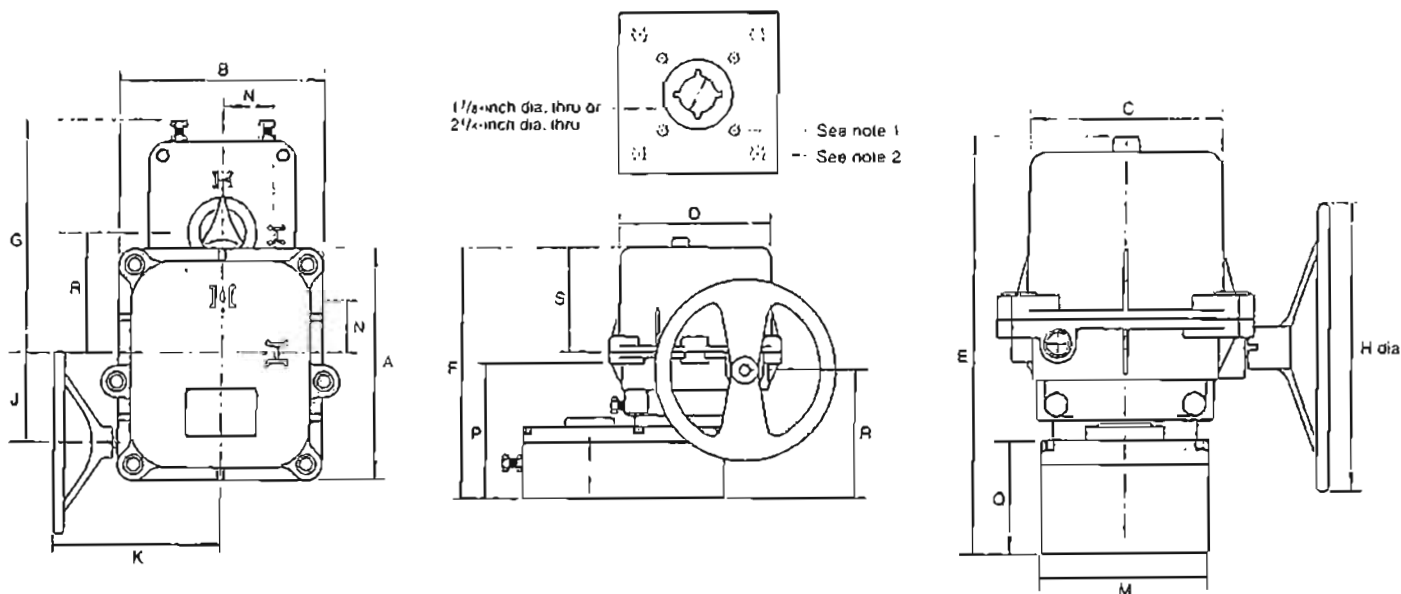


Dimensions (inches)

Size	EPI Type	A	B	C	D	E	F	G	H	J	K	L	M	N	P	S
2	EPI 6, 13	8.94	7.58	6.75	8.11	9.60	8.57	6.90	8.00	3.13	6.50	2.32	4.00	2.06	2.44	8.38
3	EPI 36, 51	11.50	9.50	8.25	10.25	13.00	11.95	9.06	12.00	4.31	8.25	3.81	6.00	2.81	4.00	7.88

Notes

- Four tapped holes in actuator are $\frac{1}{4}$ -16UNC on a 3 $\frac{1}{4}$ -inch bolt circle straddling centerline.
- Four tapped holes in actuator are $\frac{1}{4}$ -13UNC on a 5-inch bolt circle straddling centerline.
- Keyways to accept a $\frac{1}{4}$ -inch square key.
- Two 1-inch NPT conduit entries available.
- 'S' dimension is the clearance required for cover removal.



Dimensions (inches)

Size	EPI Type	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
4	EPI 91, 151	11.50	9.50	8.00	10.00	17.33	16.70	13.06	12.00	4.31	8.25	8.56	7.00	2.81	8.75	4.75	8.00	7.88

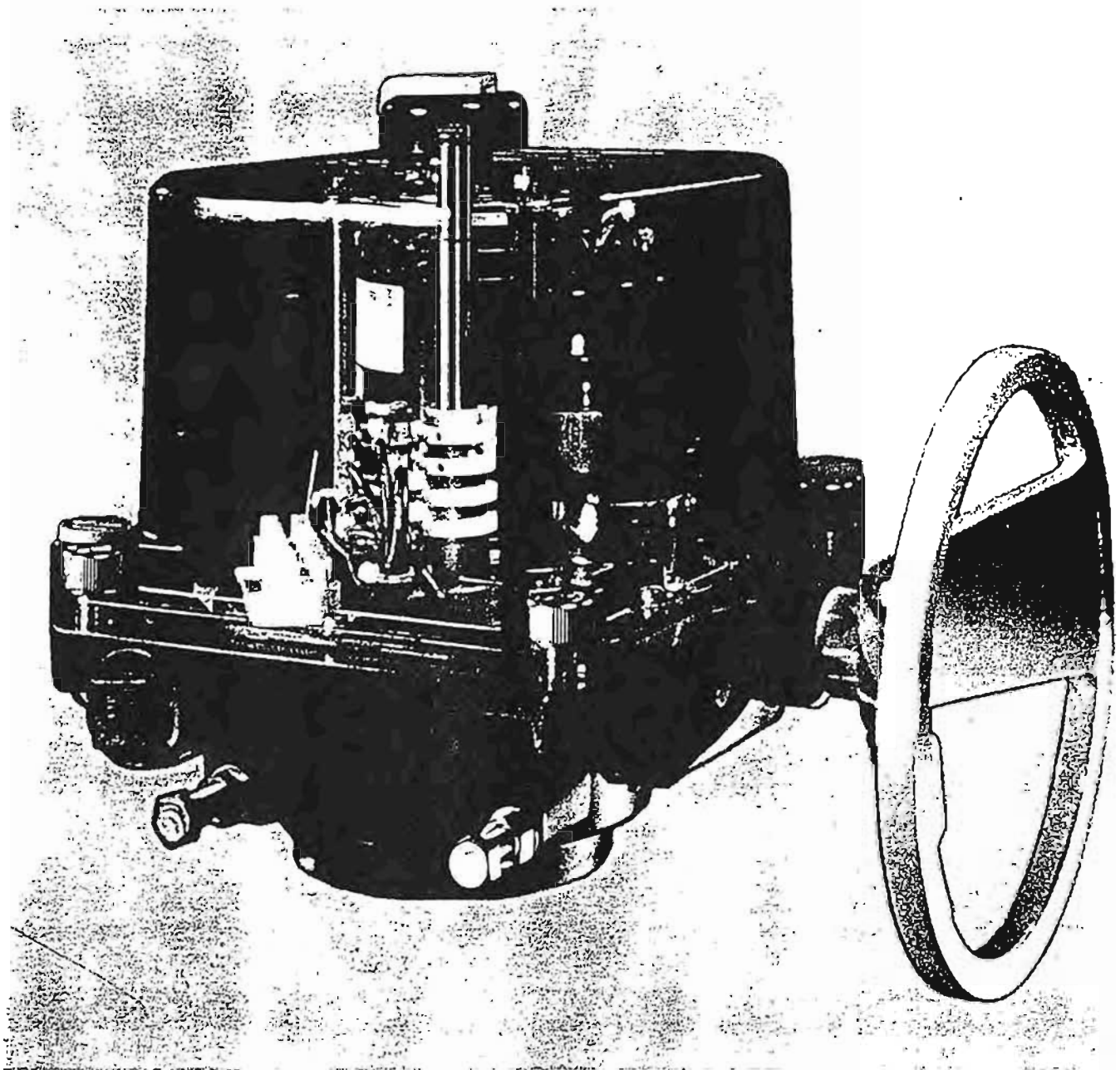
Notes

- Four tapped holes in actuator are $\frac{1}{4}$ -13UNC on a 5-inch bolt circle straddling centerline.
- Four tapped holes in actuator are $\frac{1}{4}$ -10UNC on a 6 $\frac{1}{2}$ -inch bolt circle straddling centerline.
- Keyways to accept $\frac{1}{2}$ x $\frac{1}{2}$ -inch x 4-inch key for 1 $\frac{1}{2}$ -inch or 2 $\frac{1}{2}$ -inch diameter bore.
- Two 1-inch NPT conduit entries available.
- 'S' dimension is the clearance required for cover removal.
- Depth of bore is 4.750 inches.



Figure 777 Electric Actuator

Operation, Maintenance and Instruction Manual



Introduction

The Keystone EPI-TORC Figure 777 hardwired series electric actuator is available in four basic sizes:

Size 1	-	EPI-3
Size 2	-	EPI-6, 13
Size 3	-	EPI-36, 51
Size 4	-	EPI-91, 151

The above models are suitable for direct mounting on Keystone Valve butterfly valves and with proper mounting hardware can be fitted onto other quarter-turn valves or devices.

Actuators for AC single phase, three phase and DC voltage supply systems can be accommodated in both intermittent and continuous duty ratings.

Principle of Operation

One of the most important design features of the F777 is the use of highly efficient epicyclic gearing. The following explanation describes, in sequence, how this system is utilized in the EPI-TORC actuator.

- The electric motor is equipped with a motor pinion gear keyed to the rotor shaft.
- The motor pinion gear drives the input gear which is directly fixed to the eccentric carrier riding on ball bearings.
- The eccentric carrier moves the compound gear, also riding on ball bearings, around the inside of the fixed annulus gear.
- The fixed annulus is locked in place by the worm drive gear of the manual override shaft.
- Because of a one tooth difference between the fixed annulus and the output drive gear, the compound gear causes rotation of the output drive.
- This type of gearing is inherently self-locking and does not require the use of motor brakes and provides for the use of a manual override that does not require a de-clutch mechanism.

Electrical Operation

When electrical power is supplied, as shown on individual wiring diagrams provided inside each unit, the actuator will operate automatically. Individually adjustable end of travel SPDT limit switches will stop the motor in the open and closed positions. Separate individually adjustable SPDT auxiliary open and close limit switches will provide for remote position indication or interlock.

Should the torque of the actuator exceed the factory preset torque limit, then SPDT open and close torque switches will shut off power to the motor until the over-torque situation is corrected. All sizes except the EPI-3 are equipped with torque switches.

All motors are equipped with a thermal overload protector imbedded in the stator windings. The thermal protector will disconnect power to the motor if 120°C is exceeded. Power will be automatically restored when the motor cools below 120°C.

Manual Operation

The manual override handwheel is completely independent of the motor drive and can be safely operated at any time, whether or not the motor is in operation.

- Clockwise rotation of the handwheel will rotate the output drive clockwise.
- Counterclockwise rotation of the handwheel will rotate the output drive counterclockwise.

Manual operation provides rotation in the following manner:

- Rotation of the handwheel drives the manual input shaft.
- The manual input shaft drives the splined worm gear.
- The worm gear drives the fixed annulus gear.
- The compound gear simultaneously engages both the fixed annulus gear and the output drive gear, causing them to rotate together.
- The worm gear is free to drive the fixed annulus, but the fixed annulus will not backdrive the worm gear. Therefore, no de-clutch mechanism is required for manual operation.

Torque Limiting

Except for the EPI-3, all EPI actuators have over-torque protection switches which operate in the following manner:

- Output torque puts a reaction onto the fixed annulus gear via the compound gear.
- The reaction force on the fixed annulus tries to move the splined worm gear against the Belleville washers stacked at either end of the worm gear, (See Figure 9/10). This movement is proportional to output torque.
- The axial movement of the worm gear is converted to a rotation of the torque switch cam shaft. This movement will trip the torque overload switch corresponding to the direction of travel if the preset torque limit is exceeded.

CAUTION!

Torque switches are factory set and sealed. Do not attempt to adjust.

Travel Limiting - Electrical

The SPDT end of travel limit switches are operated by precisely adjustable K-CAMS™ mounted on the indicator shaft which is rigidly connected to the output drive. Each switch is individually adjustable.

Travel Limiting - Mechanical

Externally adjustable travel stops are provided for manual operation limits only. They should not be used to limit travel during electrical operation. (See Figure A).

Pre-installation Storage

All units are shipped with one solid conduit plug and one red plastic shipping plug installed in the conduit openings.

It is preferable that units be stored inside a dry, temperature controlled area prior to installation to prevent formation of condensation inside the unit.

If units must be stored outside, they should be covered and protected against rising water. The red plastic shipping plug must be replaced with a solid conduit plug to prevent entrance of water into the unit.

Installation Procedures

When installing the actuator on a valve, ensure the following:

1. Both valve and actuator are in the same position. The actuator can be handwheel operated to any position to accommodate the valve.
2. The valve can travel freely in both directions.
3. If the valve is equipped with mechanical travel stops, that the stops do not block actuator travel.

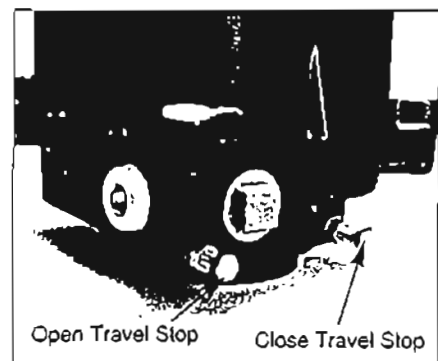


Figure A

Step 1 Mounting

- Install proper adapter, if required, onto valve stem to accommodate actuator bore.
- Install furnished mounting studs into actuator base mounting holes (short threaded length into actuator).
- Position actuator bore over valve stem with mounting studs aligned with valve bonnet or mounting bracket holes.

NOTE: Standard mounting orientation is with the manual override shaft perpendicular to the run of the valve. A second keyway is provided for mounting 90° to standard.

- Lower actuator onto valve stem and secure in place with hex nuts and lock washers furnished.

Step 2 Close Limit Switch and Travel Stop Adjustment

- Manually operate the actuator handwheel clockwise, until the valve is fully closed.
- Check that, at this closed position, the lower two limit switches (wired with blue wires) are actuated by the cam lobes. For adjustment, rotate the cam's brass worm screw until the cam lobe just trips the switch from a clockwise direction. Each cam is individually adjustable.
- With the close limit switches adjusted, loosen the closed travel stop locknut (closed stop located on right when viewed from travel stop side of actuator, see Figure A).
- Rotate closed travel stop clockwise until it just touches the internal stop lug of the output drive.
- Rotate closed travel stop 1/2 turn counterclockwise and lock in position with locknut.

NOTE: Travel stops are located on the base of the EPI-3 thru EPI-51 and on the gear case housing of the EPI-91 and EPI-151.

Step 3 Open Limit Switch and Travel Stop Adjustment

- Manually operate the actuator handwheel counterclockwise, until the valve is fully open.
- Check that, at this open position, the upper two limit switches (wired with red wire) are actuated by the cam lobes.
- For adjustment, rotate the cam's brass worm screw until the cam lobe just trips the switch from a counterclockwise direction. Each cam is individually adjustable.
- With the open limit switches adjusted, loosen the open travel stop locknut (open stop located on left when viewed from travel stop side of actuator, see Figure A).
- Rotate open travel stop clockwise until it just touches the internal stop lug of the output drive.
- Rotate open travel stop 1/2 turn counterclockwise and lock in position with locknut.

Step 4 Wiring

- A wiring diagram is enclosed with each actuator and external wiring should be terminated at the terminal strip in accordance with this diagram.
- Each actuator is provided with two conduit entries threaded for 1" NPT. Due to variable cable gland requirements, glands are not supplied with the actuator.
- Proper sealing of the conduit connections must be done by the user to maintain the weatherproof integrity of the actuator enclosure.

Troubleshooting Checklist

If the actuator does not function properly, examine the items on the following checklist:

1. All customer wiring should be securely in place and in accordance with the proper diagram.
2. The power supply input should be in accordance with that specified on the actuator nameplate.
3. The internal wiring should be securely in place.
4. The travel limit switches should be properly adjusted and should operate before the mechanical travel stops are reached.
5. The gear train should move freely when the handwheel is rotated.
6. All gears should be properly meshed, secured and free from excessive wear.
7. The motor shaft should turn by hand with only a small amount of resistance.
8. Tripping the torque or travel limit switches should stop the motor. Switches connected with red wire prevent the actuator from further counterclockwise rotation. Switches connected with blue wire prevent the actuator from further clockwise rotation.
9. The valve on which the actuator is mounted should not be jammed or require more than the rated torque of the actuator.
10. The capacitor and its associated wiring should be securely connected. A loose or defective capacitor will cause the motor to hum, but not rotate.
11. The torque switches should be factory calibrated and the torque shaft drive pin should fit in the annular groove on the worm gear. Rotation of the handwheel, after contact has been made with the travel stop, should simulate an overtorque situation and cause a rotary motion of the torque shaft to operate the torque switch associated with that direction of travel.
12. The application should not require the actuator to be operated in excess of its duty rating.
13. The ambient temperature should be between -20°F and +140°F.
14. The thermal overload protector should only operate and disconnect motor circuit on fault conditions. If the thermal overload protector does operate, it will not automatically reset until the motor temperature cools down to a safe level.
15. The control circuitry feeding the actuator must not allow power to be supplied to both "open" and "close" motor windings at the same time. For example, when power is applied to the "open" terminal, the "close" terminal must be isolated from the power supply and vice versa. Failure to do so will result in motor overheating.
16. If two or more actuators are to be controlled in parallel with one 3-position switch, that switch must have isolated contacts for each actuator being controlled.

CAUTION:

Do not attempt to connect either the open or close terminal of a F777 actuator directly to the open or close terminal of another F777 actuator. Contact the factory for proper wiring procedures.

Preventative Maintenance

WARNING:

Ensure that electrical supply is shut off prior to performing maintenance.

- Remove cover as per instructions for Figure 2.
- Check visually that:
 - a. All fixing screws are secure.
 - b. All wiring terminal block screws are secure and terminated wiring is in place.
 - c. All wiring quick disconnect terminations on capacitor, torque switches and travel limit switches are secure.
 - d. Torque and travel limit switch operating cams are secure. Check that cam fixing set screws are tight.
 - e. Electrical compartment shows no signs within it of excessive dampness, overheating, dirt or foreign bodies.
 - f. Cover o-ring is in place and not damaged or distorted.
 - g. Indicator shaft o-ring is in place and not worn or damaged.
 - h. Ground terminal is intact and secure.

Disassembly/Assembly Procedures

The photographs are of the Model EPI-13 for illustrations, but the same basic procedure is applicable to all models.

Figure 1 - Handwheel Removal

- Unit is shown with handwheel removed. This would be done by loosening the set screw located in the handwheel hub and pulling off the handwheel.

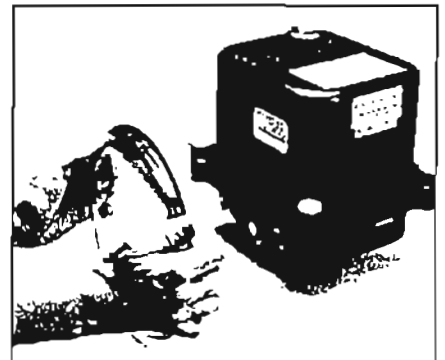


Figure 1

Figure 2 - Cover Removal

- Remove the yellow position indicator by prying off with a screwdriver.
- Remove the socket head capscrew and black indicator cap.
- Remove the yellow dust covers, exposing the cover/base socket head capscrews.
- Disengage the captive capscrews from the base. Screws will remain captive in the cover.
 - EPI-3 has 4 x 5/16"-18 UNC screws (not retained).
 - EPI-6/13 have 4 x 1/2"-13 UNC retained screws.
 - EPI-36/51/91/151 have 6 x 1/2"-13 UNC retained screws.
- Remove cover by pulling up in a vertical action as shown.

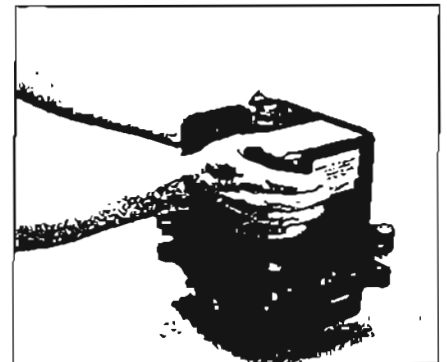


Figure 2

Figure 3 - Customer Wiring Removal

WARNING:

Check that supply voltage is shut off before attempting to remove any wiring.

- Customer wiring should be tagged for later reinstallation. All units are shipped with wiring diagram enclosed inside the housing.
- Remove customer incoming wiring at terminal block.

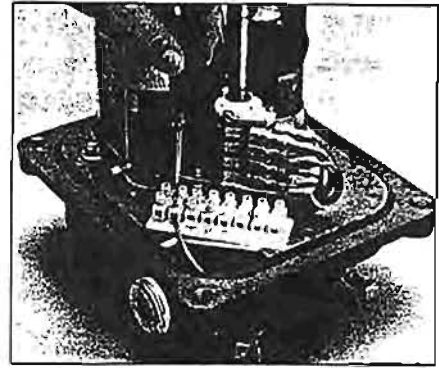


Figure 3

Main Unit Disassembly

- Remove actuator from valve before commencing disassembly.

Figure 4 - Indicator Shaft O-Ring and Snap Ring Removal

- Remove the o-ring from the top of the indicator shaft by squeezing the o-ring and rolling it up out of the o-ring groove.
- Remove the snap ring from the indicator shaft.

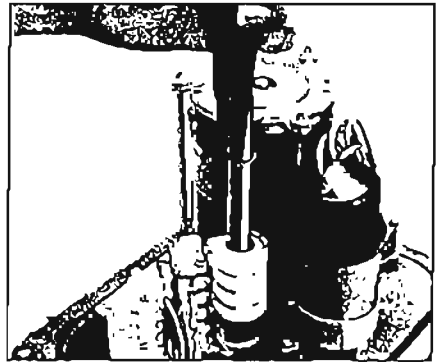


Figure 4

Figure 5 - Cam Removal

- Loosen the two set screws in each cam ring and remove the cams from the indicator shaft.
- For easier access to cam set screws, the capacitor can be removed by loosening the cup bracket clamping screw.



Figure 5

Figure 6/7 - Switchplate Removal

- Remove the socket head capscrews situated on the switchplate.
- Capscrew Sizes:
 - EPI-3 has 3 x #10-32 UNF screws
 - EPI-6 /13 have 4 x #10-32 UNF screws
 - EPI-36 / 51 / 91 /151 have 6 x 5/16" -18 UNC screws
- Remove the complete switchplate sub-assembly by carefully lifting the switchplate up the indicator shaft. Do not force.

NOTE: The motor may be removed from the switchplate by removing the motor mounting bolts and hex nuts after disconnecting the motor wiring from the capacitor and terminal block. The motor may be lifted from the switchplate with the motor pinion gear attached.

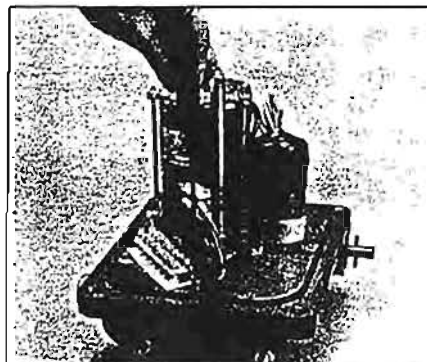


Figure 6

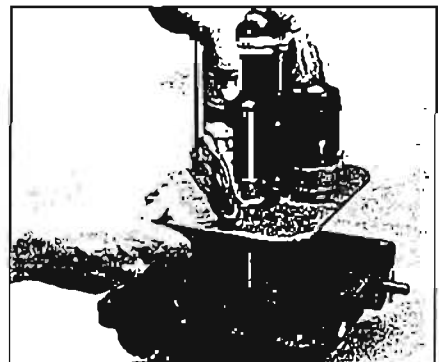


Figure 7

Figure 8 - Gear Train Removal - EPI-6/13

- Grasp the indicator shaft and pull up to release the assembly.
- Take note of top and bottom sides of the fixed annulus so that it may be reassembled properly.
- The two M6 screws securing the input gear may be removed and the input gear separated from the gear set.

NOTE: Removal and reinstallation of the manual override shaft and worm gear will require tools suitable for compressing the Belleville washers. The override shaft bushing must be pressed against the Belleville washers to allow clearance for the removal or installation of the bushing retaining snap ring. Take note of the number and placement of the Belleville washers so that they can be reassembled correctly. (See Fig. 10).

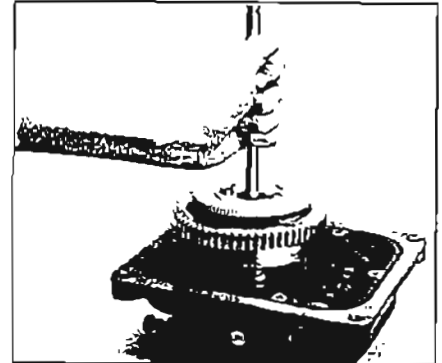


Figure 8

Figure 9 - Gear Train Removal - EPI-36/51/91/151

- Removal of the gear train from the EPI-36 thru EPI-151 models first requires removal of the manual override shaft and worm gear (See note above) to release the fixed annulus.
- Follow Procedures for Figure 8.

Do not attempt further disassembly of gear set.

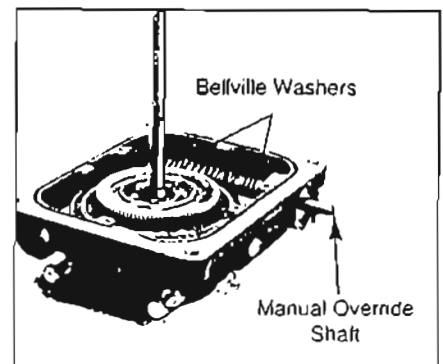


Figure 9

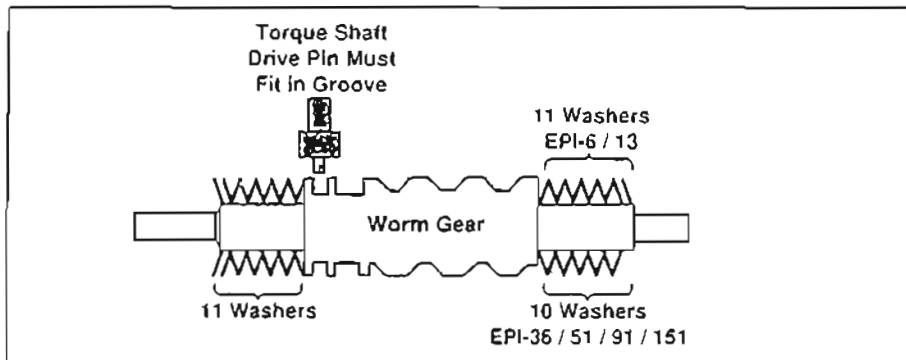


Figure 10

Reassembly Procedures

- Although the gear train is permanently lubricated at the factory, disassembly and reassembly of the actuator may require additional lubrication. A liberal coat of low temperature "Keystone Actuator Lubricant" is recommended for this purpose.
- Worn or damaged o-rings should be replaced prior to reassembly.
- Reinstall the gear train assembly by pressing the output drive firmly into the lower housing bore.
- Reinstall the fixed annulus and if removed, manual override worm gear and shaft.
- Reinstall the input gear.
- Slide the switchplate down over the indicator shaft. Take care that the torque shaft drive pin fits into the annular groove of the manual override worm gear. (See Figure 10).
- The switchplate should fit flush on the lower housing without forcing. Rotation of the motor shaft by hand may be required for proper meshing of the pinion gear and input gear.
- Secure the switchplate with the socket head capscrews removed earlier.
- Slide the limit switch cams onto the indicator shaft with the brass worm gears up. (See Figure 11). Do not lock in place at this time.
- Manually close the actuator by rotating the handwheel clockwise.
- Rotate the two lower cams in a clockwise direction toward the switch trip levers. Ensure that the cam lobes are level with their respective switch levers and tighten the locking set screws in the cam rings. (see Figure 11)
- Manually open the actuator by rotating the handwheel counterclockwise.
- Rotate the top two cams in a counterclockwise direction toward the switch trip levers. Ensure that the cam lobes are level with their respective switch levers and tighten the locking set screws.
- Reinstall the snap ring and o-ring on the indicator shaft.
- Follow the installation procedures for mounting, limit switch adjustment and travel stop adjustment.

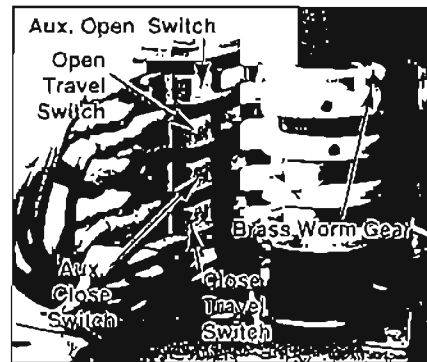


Figure 11

NOTE: Refer to separate publications for installation and/or calibration of specific accessories.

- Reinstall the cover and position indicator.
- Unit should now be ready for power operation.



Adjustment Instructions for Keystone F777

EPI-3/6/13/36/51/91/151 Electric Actuators

Close - Travel Switch

Manually operate the actuator handwheel drive shaft clockwise, until the valve disc is visually in the closed position (0°). At this closed position, check that the lower two limit switches (wired with blue cable) are actuated by the cam lobes. For adjustment, rotate brass worm screw until cam lobe just trips switch from a clockwise direction. Each cam is individually adjustable.

Close - Travel Stop Screw

With the actuator close travel switch set, loosen closed travel stop lock nut and rotate closed travel stop clockwise until it just touches the internal stop lug on the output shaft. Rotate closed travel stop 1/2 turn counterclockwise and lock in position with lock nut.

Open - Travel Switch

Manually operate the actuator handwheel drive shaft counterclockwise until the valve disc is visually in the open position (90°). At this open position, check that the upper two limit switches (wired with red cable) are actuated by the cam lobes. For adjustment, rotate brass worm screw until cam lobe just trips switch from a counterclockwise direction. Each cam is individually adjustable.

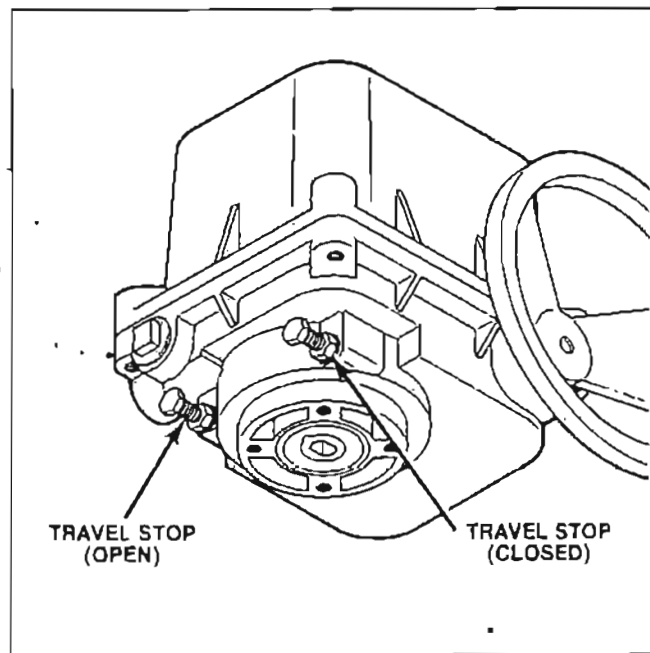
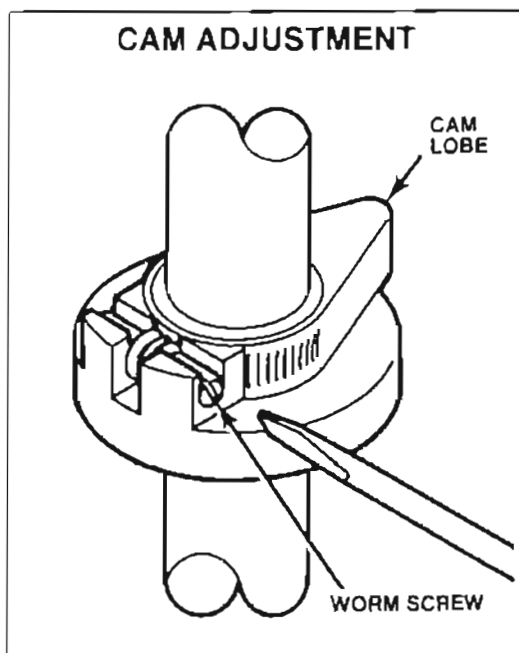
Open - Travel Stop Screw

With the actuator open travel switch set, loosen open travel stop lock nut and rotate open travel stop clockwise until it just touches internal stop lug on the output shaft. Rotate open travel stop 1/2 turn counterclockwise and lock in position with lock nut.

Torque Switches

Torque switches are factory set and sealed. Do not attempt to adjust.

NOTE: Drawing shown of travel stop screw location applies to EPI-3 thru EPI-51 only. Travel stop screws for EPI-91 and 151 located on gear case housing.

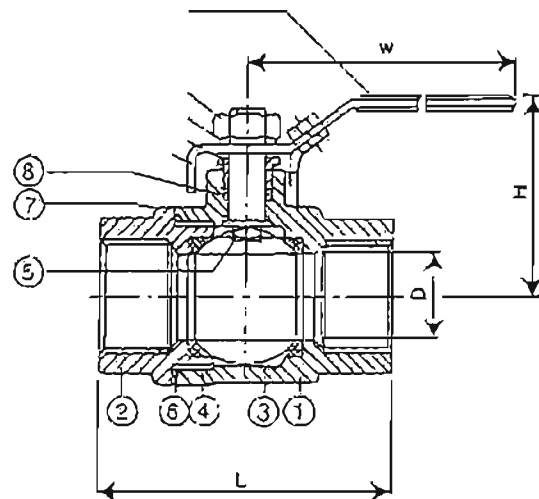
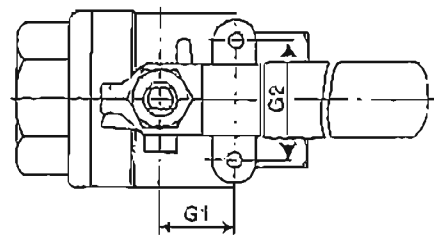
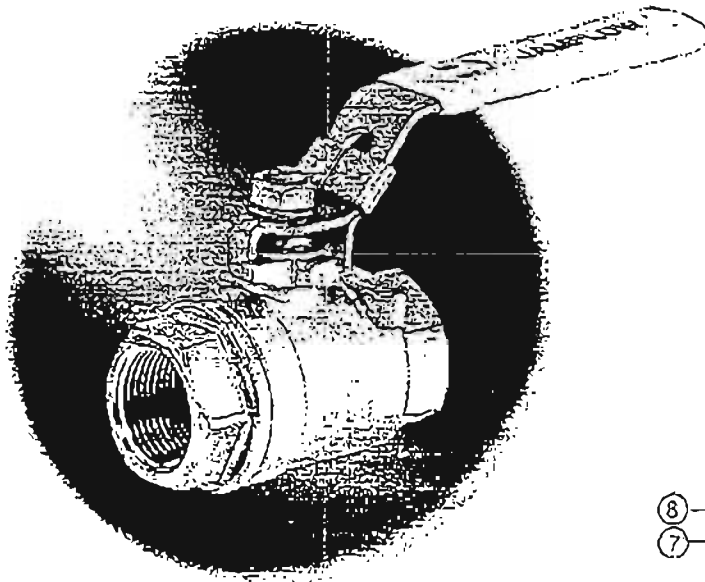


2-PC 1000 WOG STAINLESS STEEL BALL VALVE

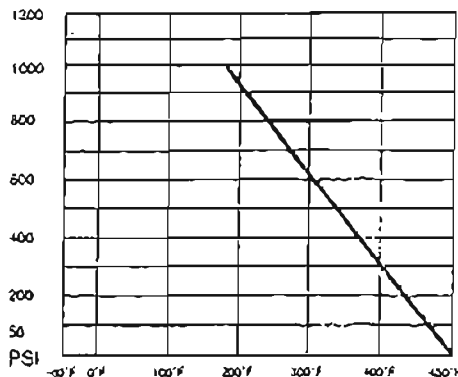
FULL PORT, SCREWED END

MODEL: #321

11 MANUAL WASTE SLUDGE VALVES



PRESSURE / TEMP. RATINGS



STANDARD
DESIGN: ANSI B16.34
TESTING: API 598

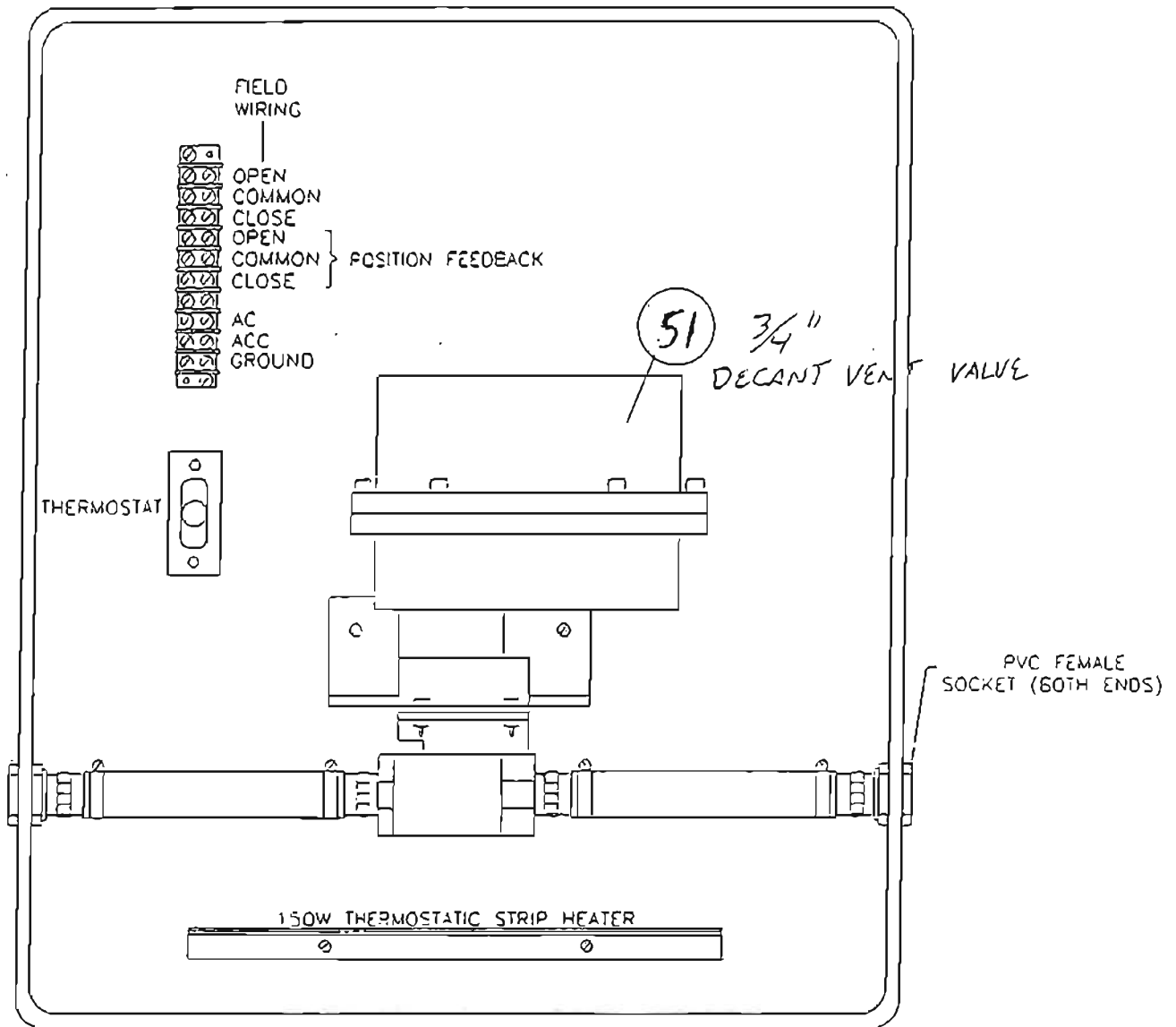
DIMENSIONS

(mm)

SIZE	D	B	L	H	W	G1	G2	CV FACTOR	TORQUE INCH-POUNDS	KGS
1/4"	11.4	27.6	55	53	102.5	12.7	28.5	8	38	0.28
3/8"	12.5	27.8	55	53	102.5	12.7	28.5	7	36	0.27
1/2"	15	33	65	58	130	12.7	28.5	10	43	0.40
3/4"	20	37.3	75	62	130	22.4	35	25	66	0.52
1"	25	43.5	89	73	153	22.4	35	35	101	0.92
1 1/4"	32	51	101	78	153	25.4	38.1	46	158	1.34
1 1/2"	38	55	109	83	182	25.4	38.1	80	187	1.92
2"	50	62	124	91	182	25.4	38.1	110	230	3.12
2 1/2"	65	82.5	160	134	250	N/A	58	310	430	7
3"	80	92.5	172	143	250	N/A	70	360	1380	10.5

MATERIAL LIST

NO.	PART NAME	SPECIFICATION
1	BODY	ASTM A312-304
2	BODY CAP	ASTM A312-304
3	BALL	ASTM A312-304
4	SEAT	PTFE
5	STEM	AISI 316
6	BODY SEAT	PTFE
7	THRUST WASHER	PTFE
8	PACKING	PTFE
9	GLAND NUT	AISI 304
10	STEM NUT	AISI 304
11	STEM WASHER	AISI 304
12	HANDLE	AISI 304
13	COVER	PLASTIC



DECANT VENT VALVE
BOX

51

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2			Job #
3			
4			
5			

FLUIDYNE

DECANT VENT VALVE ASSEMBLY

SPECIFICATIONS

1/4"– 2" CLINCHER® SERIES 2000 SCREWED-END BALL VALVES

Clincher Series 2000 ball valves are rugged high-performance screwed-end ball valves designed to handle an extremely wide variety of liquids, gases, and slurries.

These compact valves have a two-piece body construction and are available with temperature ratings from -60°F to $+500^{\circ}\text{F}$ (-57°C to $+260^{\circ}\text{C}$), depending on materials and pressure combinations.

The standard body style 21 is manufactured in a variety of materials including brass, carbon steel, and 316 stainless steel. The Fire-Tite® Series 23 is available in carbon steel or stainless steel.

Clincher Series 2000 valves are available specially prepared for critical services such as oxygen and high-vacuum. Also available are valves conforming to UL and FM approved configurations. (see Bulletin T110-1).

FEATURES

Unique Flexible-Lip Seat Design

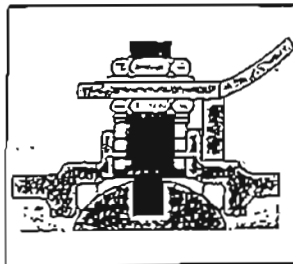
- Exerts continuous pressure against ball for reliable sealing.
- Fluid pressure on the ball increases the effectiveness of the seal on the downstream side.



- Automatically compensates for wear and for changes in temperature and pressure.
- Provides extremely high cycle life.

Excellent Sealing

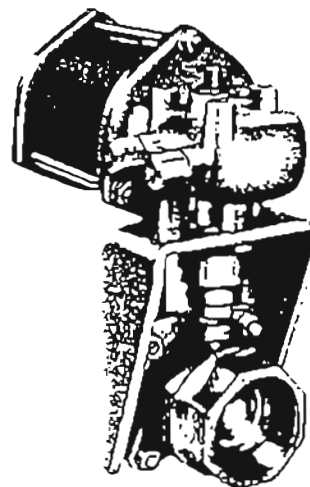
- The compression of low-friction PTFE box rings eliminates stem leakage by avoiding straight-line leakage paths.
- Stem seal adjustment is done simply by tightening the stem nut.



Easy Maintenance

- Seats and seals are easily replaced; no machining is required.

51 DECANT VENT VALVE



- Slotted stem and ball drive make assembly virtually mistake-proof.

High Flow Capacity

- Large port diameters provide highest flow capacity per dollar of valve cost.

Fire-Tite® Version Available

- Secondary metal seal provides effective shutoff in the event of a fire.
- Auxiliary graphite stem seal prevents stem leakage if the primary PTFE seal is destroyed.
- Ideal for services such as furnace fuel lines, LP-gas product lines, and in a variety of petroleum and petrochemical piping systems.

Automatic or Manual Operation

- Quarter-turn operation ensures quick and easy cycling.
- Low torque requirements mean smaller actuators.
- A variety of JAMESBURY actuators and accessories are available mounted and tested on the valves for single-source responsibility.

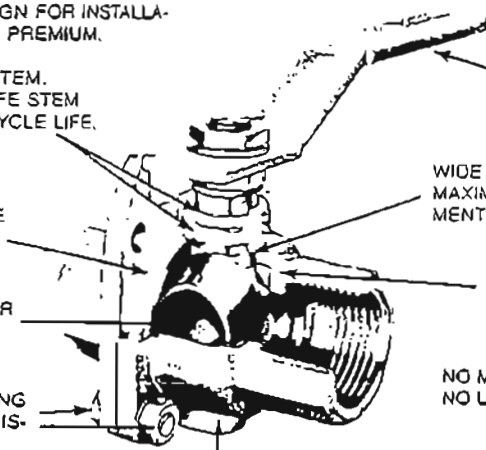
EXTREMELY COMPACT DESIGN FOR INSTALLATION WHERE SPACE IS AT A PREMIUM.

INTERNAL ENTRY STEM.
SELF-ADJUSTING TFE STEM
SEALS FOR HIGH CYCLE LIFE.

LEAKTIGHT TFE BODY SEAL
UNAFFECTED BY TEMPERATURE
FLUCTUATIONS.

LARGE PORT FOR HIGHER
FLOW CAPACITY.

FOUR-BOLT DESIGN WITH LOCKING
FASTENERS FOR VIBRATION RESIS-
TANCE AND JOINT INTEGRITY.



INSULATED HANDLE
ALWAYS SHOWS POSITION
OF BALL.

WIDE BLADE DRIVE FOR
MAXIMUM BALL ENGAGE-
MENT, STRENGTH.

DOUBLE-SEAL[®] SEAT DESIGN
GIVES REPEATABLE, LONG
LIFE SHUTOFF.

NO METAL-TO-METAL MOVING PARTS
NO LUBRICATION EVER REQUIRED.

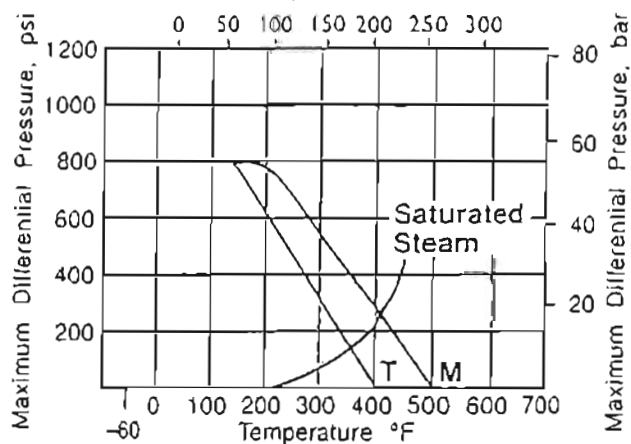
RUGGED-BODY DESIGNED TO RESIST
PIPING STRESSES AND SHOCK.

SPECIFICATIONS

Valve Seat Ratings

These ratings are based on differential pressure with valve ball in the fully closed position and refer to seats only. Refer to valve body ratings to be sure that all components are satisfactory for the application. Valves in brass and carbon steel are suitable for service to -20°F (-29°C), valves in 316 stainless steel (with stainless steel body bolts) to -60°F (-51°C).

Temperature $^{\circ}\text{C}$



These ratings are a conservative guide for general service. Previous experience in a process or new developments may permit applications at ratings above those shown. Please consult with Jamesbury Inc. home office for specific recommendations.

1/4" - 2" Series 2000 valves with filled PTFE (M) seats are rated for saturated steam service to 250 psi when equipped with stainless steel trim. M-seated valves are otherwise steam-rated to 200 psi.

Flow data

The table below provides flow coefficients of valves covered in this bulletin. The C_v values represent the flow of water at $+60^{\circ}\text{F}$ through the valve in U.S. gallons per minute at a pressure drop of 1 psi.

Valve Size inches	C_v	Valve Size inches	C_v
1/4	11	1	49
3/8	16	1-1/4	49
1/2	16	1-1/2	100
3/4	37	2	115

Valve Size DN	C_v	Valve Size DN	C_v
06	11	25	49
10	16	30	49
15	16	40	100
20	37	50	115

Valve Body Ratings

These are maximum working pressure ratings of valve body/body cap assemblies only. The seat ratings above determine the practical pressure limitations according to actual service conditions. Working pressure rating is at -20°F to +100°F (-29°C to +38°C). Recommended test pressure is for hydrostatic test with ball half open.

Valve Size	Rating	Maximum Working Pressure with Specified Body Material							
		Brass Body				Carbon Steel, 316 Stainless, Alloy 20, or Monel Body			
		ASTM A449 Body Bolts Code: -0		300 Series SS Body Bolts Code: -3		ASTM A449, A193 Gr. B7 Body Bolts Codes: -0, -1		300 Series SS Body Bolts Code: -3	
		psi	bar	psi	bar	psi	bar	psi	bar
1/4" - 1"	Working pressure	600	41	400	28	800	55	400	28
	Test pressure	900	62	600	41	1200	83	600	41
1-1/4" - 2"	Working pressure	400	28	400	28	800	55	400	28
	Test pressure	600	41	600	41	1200	83	600	41

SPECIAL SERVICES

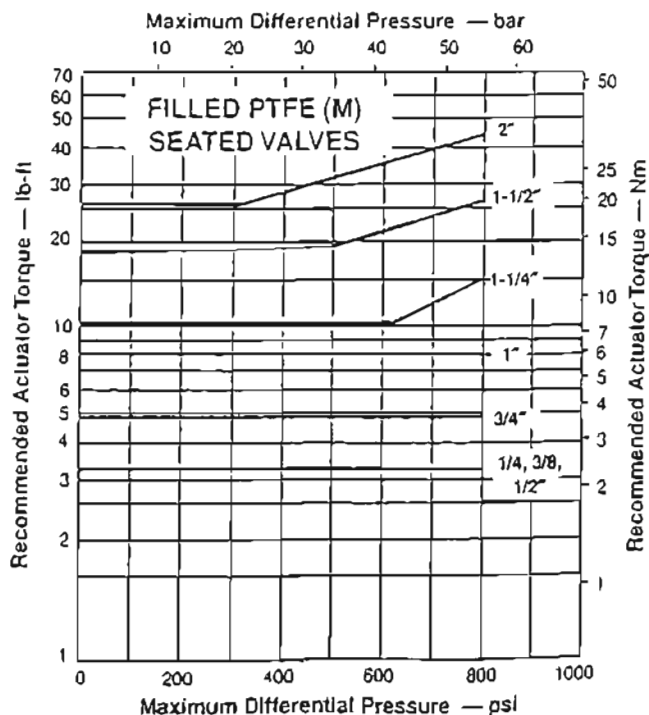
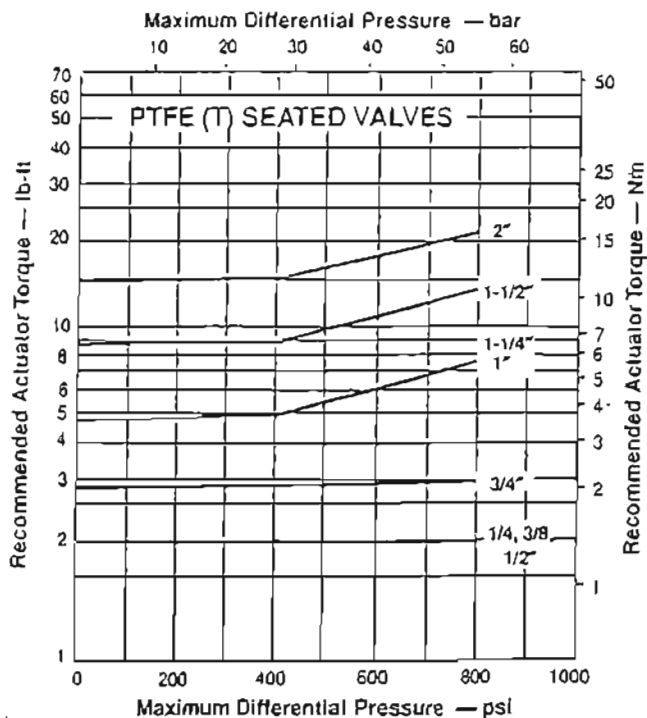
Detailed information about available seat materials, special services, and accessories for *Clincher* Series 2000 valves is contained in the following bulletins (see page 6 for ordering standard accessories):

Steam service	B150-1	Torq-Handle® spring-return handles	B160-1
Oxygen service	B150-3	Limit switches	B160-4
Vacuum service	B150-4	Ball valve seat materials	T140-1
Fire-Tite® valves	B151-2		

TORQUE REQUIREMENTS

Use these torque charts for *Clincher* valves as a guide for actuator selection. Select an actuator that provides the same or greater torque output than that shown in the charts below. Refer to pneumatic and electric actuator bulletins for torque output values and actuator selection tables.

Additional requirements may be imposed by media characteristics, trim, and frequency of valve operation. For clean lubricating fluid service, required torque for PTFE (T) and filled PTFE (M) sealed valves *only* may be reduced 20% when the valve is equipped with 316 stainless steel trim. For difficult service (slurries, semi-solids) increase values by 50%. *If in doubt, select the next larger actuator.*



BILL OF MATERIALS AND PARTS FOR CLINCHER VALVES

Part No.	Part Name	Material				
		Standard			Fire-Tite	
		Style 21-11	Style 21-22	Style 21-36	Style 23-22	Style 23-36
1	Body	Brass ASTM B124 Alloy 377	Carbon steel ASTM A181 Class 70	316 stainless steel Type CF8M	Carbon steel ASTM A181 Class 70	316 stainless steel Type CF8M
2	Body Cap	Brass ASTM B124 Alloy 377	Carbon steel ASTM A181 Class 70	316 stainless steel Type CF8M	Carbon steel ASTM A181 Class 70	316 stainless steel Type CF8M
3	Ball	Brass***, carbon steel (nickel under chrome plated), 316 stainless steel			Carbon or 316 stainless steel	
4	Stem	Brass***, carbon steel, 316 stainless steel			Carbon, 316 stainless steel	
5	Seat	PTFE, or filled PTFE - as specified				
6	Body Seal	PTFE			Spiral wound 316 stainless steel and PTFE	
7	Secondary Stem Seal	Not required			Graphite	
8	Upper Stem Seal	PTFE				
16	Stem Nut	Carbon steel	Carbon steel, stainless steel, or Monel ⁹			Stainless steel
17	Handle	Carbon steel or stainless steel**		Carbon steel or stainless steel**	Carbon steel	
19	Shakeproof Washer	Carbon steel, stainless steel				
21	Compression Ring	Brass	316 stainless steel or Monel ⁹			316 stainless steel
24	Lower Stem Seal	PTFE				
31	Spring Washer	Carbon steel-zinc plated				
52	Body Bolt	ASTM A449 or 300 series stainless	ASTM A449	ASTM A449 or 300 series stainless	ASTM A193 Gr. B7	
53	Hex Nut	Carbon steel or 300 series stainless	Carbon steel ASTM A194 Gr. 2H	Carbon steel ASTM A194 Gr. 2H, or 300 series stainless	ASTM A194 Gr. 2H	
55	Lock Washer	—	Carbon steel††	Carbon steel ††	Carbon steel	
70	Top Ground Spring	Stainless steel	—			

* Furnished only on 1" and larger valves with brass, carbon steel, or 316 stainless steel ball.

** Stainless steel on valves with stainless steel body bolts.

† Valves furnished with actuators are equipped with ASTM A193 Gr. B7 bolts.

†† Not required with ASTM A449 bolts, Stainless steel with 300 series stainless bolts.

*** 1/4" - 3/4" brass valves equipped with actuator must have 316 stainless steel trim.

HOW TO ORDER

Catalog numbers are fully descriptive of a valve. They are made up of size and a ten-digit figure designation with coding as shown below.

1	2	3	4	5	6	7	8
	21		36	00	T	T	0

1	Size
inches	1/4, 3/8, 1/2, 3/4, 1, 1-1/4, 1-1/2, 2
DN	06, 10, 15, 20, 25, 30, 40, 50

2	Body Style
21	Standard screwed end
23	Fire-Tite screwed end

4	Body Material
11	Brass*
22	Carbon steel
36	316 Stainless steel

6	Seat Materials
T	PTFE
M	Filled PTFE

3	Special Service
V	High vacuum
VC	High vacuum certified
	(No entry if standard)

5	Trim Material
00	Same as body material*
22	Carbon steel
36	316 stainless steel

7	Seal Material
T	PTFE

8	Body Fasteners	
	Bolts	Nuts
0	ASTM A449	Carbon Steel
1	ASTM A193 Gr. B7†	ASTM A194 Gr. 2H†
3	300 series stainless steel**	

* 1/4"-3/4" brass valves equipped with actuator must have 316 stainless trim.

** Not suitable for fire-tested applications

† Required for Fire-Tite (23-) valves

Clincher, Double-Seal, and Fire-Tite are trademarks of Jamesbury Inc.

Installation, Maintenance and Operation Instructions

IMO's (Installation, Maintenance and Operating instructions) or AMI's (Assembly, Mounting and Installation Instructions) are shipped with the products. Additional copies of these instructions are available. Call your local Jamesbury Inc. Distributor, or visit our web site.

INTERNATIONAL MANUFACTURING AND SALES LOCATIONS

UNITED STATES: Worcester, Massachusetts • MEXICO: Chihuahua

Our products are available through Neles Controls Sales offices in:

Australia, Austria, Belgium, Brazil, Canada, Chile, China, Denmark, Finland, France, Germany, Indonesia, Italy, Japan, South Korea, Netherlands, Norway, Poland, Portugal, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, United Arab Emirates, United Kingdom, Venezuela, as well as through a world-wide network of representatives.

JAMESBURY

NELES CONTROLS GROUP

Jamesbury Inc. • 640 Lincoln Street • Box 15004

Worcester, Massachusetts 01615-0004 USA

Tel: 508-852-0200 • Fax: 508-852-8172 • Internet: www.jamesbury.com

NELES CONTROLS GROUP • A MEMBER OF RAUMA CORPORATION

SPECIFICATIONS

TYPE EU & ER ELECTRIC ACTUATORS

EU and ER electric actuators offer the simplest, most economical, and reliable automatic control of quarter-turn valves. The only requirement for installation is simple wiring from a convenient switch or centralized control center. The low-cost Type EU uni-directional electric actuators offer distinct price advantages over other available electric actuators. The reversible Type ER actuators provide maximum versatility as well as economy.

These compact actuators offer high-torque output and fast, reliable response. All components are contained in a rugged housing that protects internal components. The EU and ER units are rated for NEMA 4 and 4X.

All actuators have self-lubricating shaft bearings, and the gear box is lubricated and sealed at the factory. No subsequent lubrication is required.

FEATURES

Maximum Allowable Duty Cycle

- Motors used in these actuators have a maximum allowable duty cycle of 25% at an ambient temperature of 80°F (27°C), allowing these actuators to fill practically every service application.

Versatile Actuator Mounting Design

- Actuator mounting provides for rigid vibration-proof attachment of the actuator to the valve.
- The actuator drive shaft is directly aligned with the valve stem, avoiding side thrust.
- Actuator can be mounted in any orientation for maximum installation flexibility.

Rugged Enclosures Protect Drive Train in Severe Services

- Heavy-duty enclosures guard against drive-train misalignment or changes in settings.
- Easy access to internal components is provided if resetting switches or rewiring is ever required.

51

DECANT VENT
VALVE
ACTUATOR



Thermally Protected Motors

- AC motors have a thermal overload device built into the motor winding to prevent motor damage.

Motor Brake

- All ER actuators are equipped with motor brakes as standard. (Not available on EU actuators.)

Weatherproof Enclosures Available for Exposed or Hazardous Locations

- All EU and ER actuators have watertight NEMA 4 and 4X enclosures and are CSA-approved (pending on FM).

Dec clutchable Manual Override

- All ER actuators are equipped with a declutchable manual override. (Not available on EU actuators).

Low Profile Design

- Low profile design is perfect for applications with limited space environments.

SPECIFICATIONS

Temperature: -40°F (-40°C) to $+150^{\circ}\text{F}$ ($+66^{\circ}\text{C}$)
 with heater and thermostat
 Heater recommended below $+40^{\circ}\text{F}$ ($+4^{\circ}\text{C}$)

Conduit Connection: 1/2" NPT

Enclosure: NEMA 4, 4X

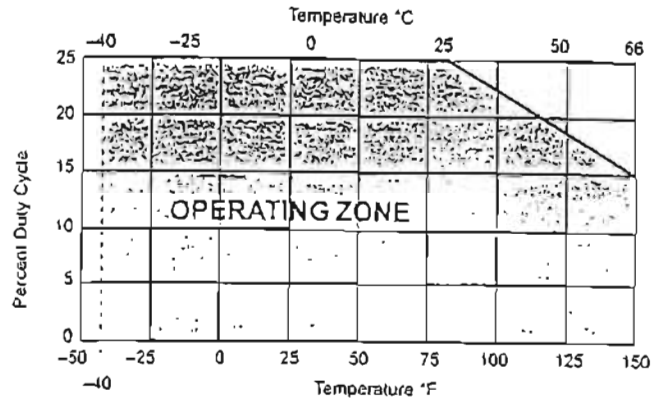
Duty Cycle: AC units: 25%
 DC units: 100%

Approximate Weight: 6 lb (3 kg)

Lubrication: Permanently lubricated gear train & bearings

Options: (Refer to Bulletin A121-2 for Option details)

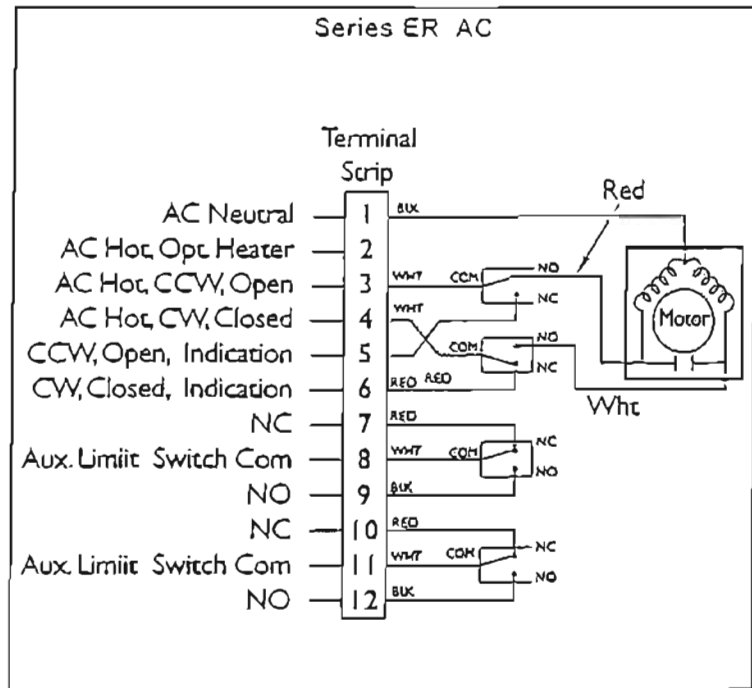
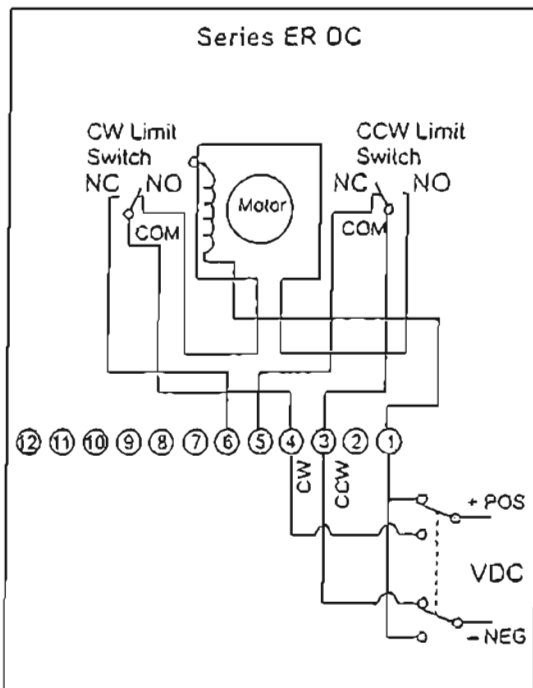
- Extra Single Limit Switch (EU only)
- Two Extra Limit Switches (ER only)
- Heater with Thermostat 115V, 15 watts / 230V, 30 watts*
- Other voltages available — consult factory



* DC heater options require factory installation

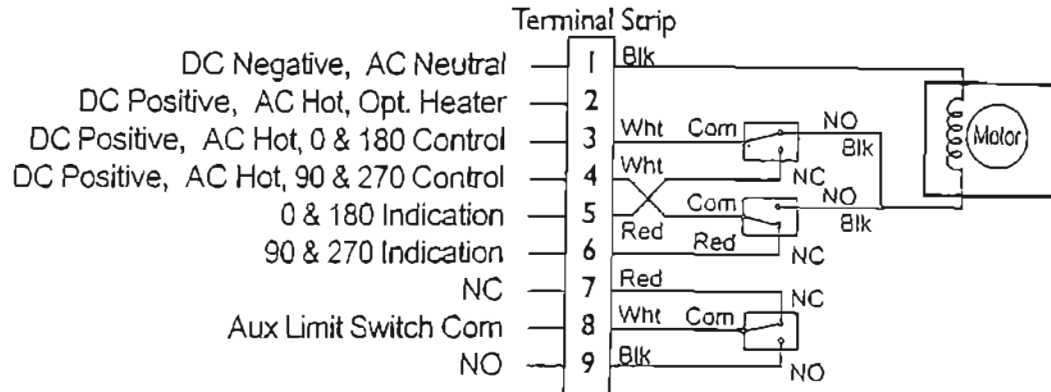
Actuator Model	Torque Output		Speed seconds		Amperes at Stall		Amperes at Maximum Efficiency
	lb-ft	Nm	115/230 VAC	24 VDC	115VAC	230VAC	24 VDC
EU-12	12	16	6	5	1.3	0.6	5.2
EU-25	25	34	8	8	1.8	0.9	7.2
EU-50	50	68	13	13	1.3	0.9	7.2
ER-12	12	16	5	5	0.56	0.28	1.6
ER-25	25	34	8	8	0.56	0.28	2.4
ER-50	50	68	13	13	0.56	0.28	2.0

WIRING DIAGRAMS

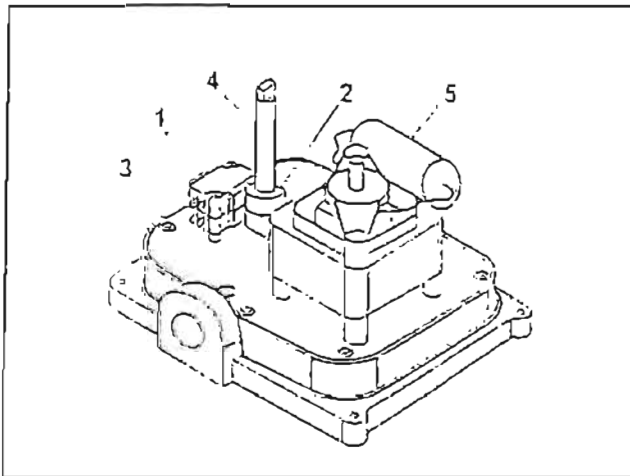


WIRING DIAGRAMS (Continued)

Series EU, AC, DC

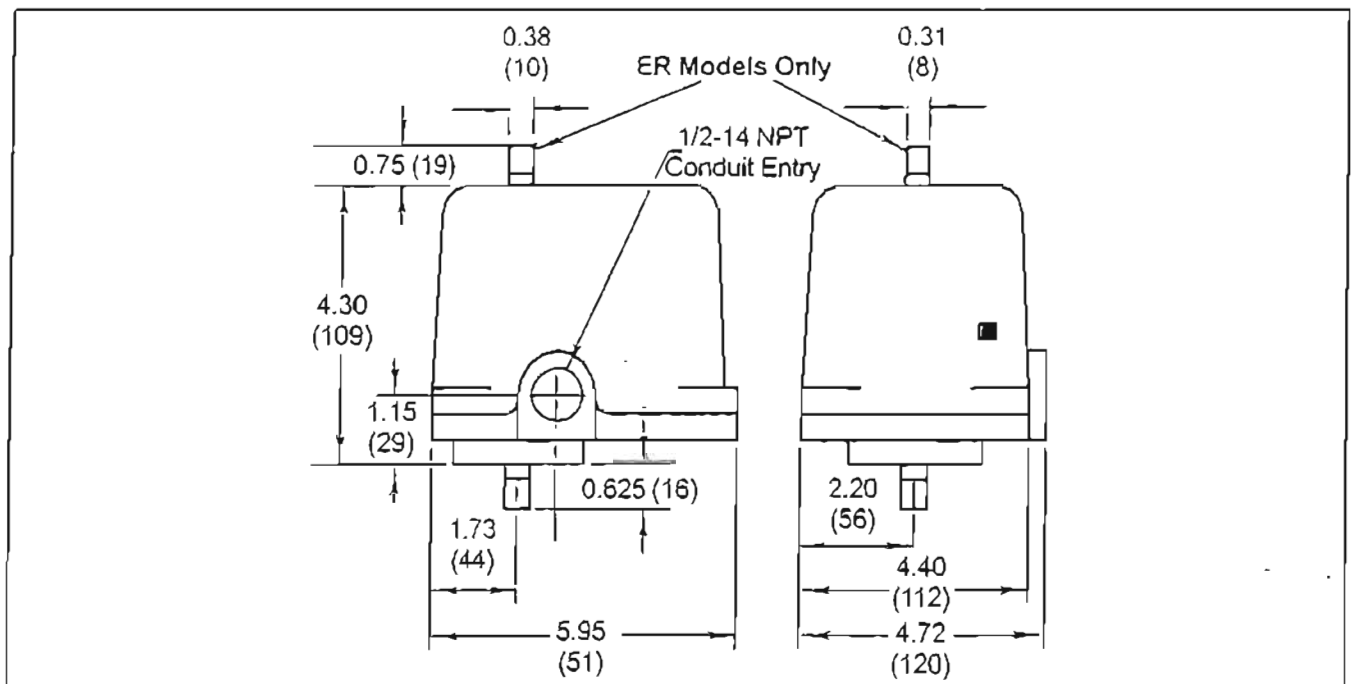


BILL OF MATERIALS AND PARTIAL PARTS LIST



Series ER and EU Parts List	
Item	Part
1	Limit Switch
2	Cam
3	O-Ring
4	Override Shaft (ER only)
5	Capacitor (ER only)

DIMENSIONS



HOW TO ORDER TYPE EU and ER ELECTRIC ACTUATORS

To specify a complete actuator code, simply make a selection from each of the boxes below.

Example: Uni-directional 8 lb-ft actuator for 115 VAC would be coded as an EU8-01M—, as shown below:

1	2	3	4	5
ER	8	01	M	—

1	Actuator Type
EU	Uni-Directional Weatherproof Electric Actuator
ER	Reversible Weatherproof Electric Actuator

2	Actuator Size
12	12 lb-ft Torque Output (All)
25	25 lb-ft Torque Output (All)
50	50 lb-ft Torque Output (All)

3	Voltage
01	115 VAC
02	230 VAC
08	24 VDC

4	Drive Configuration
M	Male Square

5	Options
CT	Cycle Timer ¹
HR	Heater with Thermostat ²
L1	Single Limit Switch (EU only)
L2	Two Limit Switches (ER only) ¹

1. These two options cannot be combined.

2. DC Heater is factory installed only.

HOW TO ORDER ACCESSORY KITS FOR ELECTRIC ACTUATORS

To order an accessory for an ER or EU electric actuator that is to be field-retrofitted, specify the kit numbers shown at right.

Example: To order a separate heater with the actuator specified at the top of the page, simply request an EK5098-01.

Accessory	Kit Number	
	EU	ER
Cycle Timer	EK5095	EK5095
Heater	115 VAC 230 VAC 24VDC	EK5098-01 EK5098-02 EK5098-08
Single Limit Switch	EK5100	N/A
Two Limit Switches	N/A	EK5101

Installation, Maintenance and Operation Instructions

IMO's (Installation, Maintenance and Operating instructions) or AMI's (Assembly, Mounting and Installation Instructions) are shipped with the products. Additional copies of these instructions are available. Call your local Jamesbury Inc. Distributor, or visit our web site.

INTERNATIONAL MANUFACTURING AND SALES LOCATIONS

Worcester, Massachusetts USA • Chihuahua, Mexico

Jamesbury products are available globally through Jamesbury (UK) Ltd. in the UK and Neles Automation sales offices and representatives. Call +1-508-852-0200 or +44-2392-238500 for your local contact.

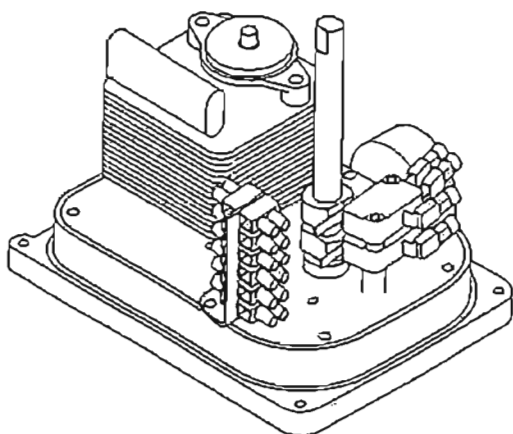
JAMESBURY
A NELES AUTOMATION COMPANY

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IMO - 516 Issue Date 8/97 (7065)

ER SERIES (REVERSING) ELECTRIC ACTUATORS

INSTALLATION, MAINTENANCE AND OPERATING INSTRUCTIONS

GENERAL

This instruction manual contains important information regarding the installation, operation and maintenance of Neles-Jamesbury's ER Electric Actuator. Please read these instructions carefully and save them for future reference.

DESCRIPTION

Neles-Jamesbury's ER Series Electric Actuators are designed to provide reliable and efficient operation of 1/4 turn ball valves. The supported torque range for actuation is between 8 and 50 lb. - ft. The ER Series does not have brakes as standard. They are provided as a factory installed option with butterfly valves or any valves which can impose a significant torque on the actuator when it is not powered. The ER Series is available in AC models with a 25% duty cycle and DC models with a 100% duty cycle.

WARNING

BEFORE REMOVING THE COVER, SHUT OFF ELECTRIC POWER AND DISCONNECT ELECTRIC CONNECTIONS.

CAUTION

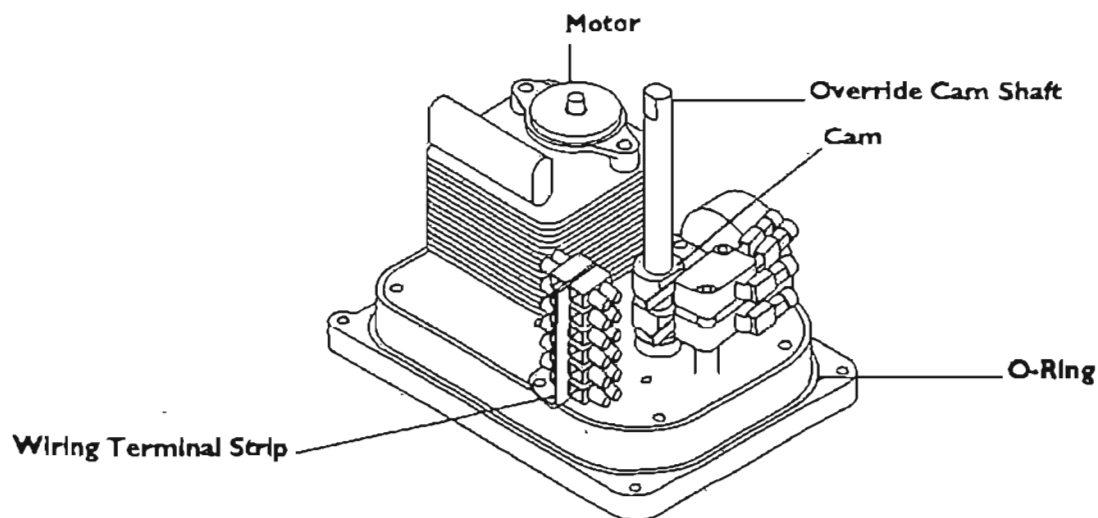
Whenever an actuator is removed from the valve and then re-mounted, the limit switch settings must be checked to make sure the valve is making the proper travel. Reference this IMO for limit switch adjustment instructions.

When servicing a valve/actuator assembly, the best practice is to remove the entire assembly from service.

GENERAL TECHNICAL INFORMATION

ER Series AC voltage actuators use a split phase motor with two limit switches.

It is important to verify that the actuator output torque is appropriate for the torque requirements of the valve and that the actuator duty cycle is appropriate for the intended application.



OPERATION

A 25% duty cycle means that for every operator cycle that the actuator is ON (to open or close the valve), the actuator must be off for a time equal to three operating cycles. For example, if the operating cycle time is 5 seconds, for every operating cycle that the actuator is ON, it must be OFF for 15 seconds. Exceeding the actuators rated duty cycle may cause the thermal overload switch to temporarily shut off power to the motor. Continual overload may burn out the motor.

Operating temperature range is -40 degrees F to 150 degrees F, however, below +40 degrees F the heater option is required.

TOOLS REQUIRED

- Phillips Head Screw Driver
- Regular Screw Driver
- 1/16 Allen Head Wrench

INSTALLATION

Mount these actuators by following actuator mounting instructions contained in the AML in the linkage kit.

To obtain copies of these, contact your nearest Neles-Jamesbury stocking distributor or representative or write: Neles-Jamesbury, Inc., Box 15004, 640 Lincoln Street, Worcester, MA. 01615-0004.

MANUAL OVERRIDE

To operate the actuator manually, push the override shaft down approximately 1/4" and use a wrench on the flats of the shaft to rotate the actuator. The coupling must be designed to accommodate this shaft movement. The override shaft can also be used to provide visual identification of the valve's position.

WIRING

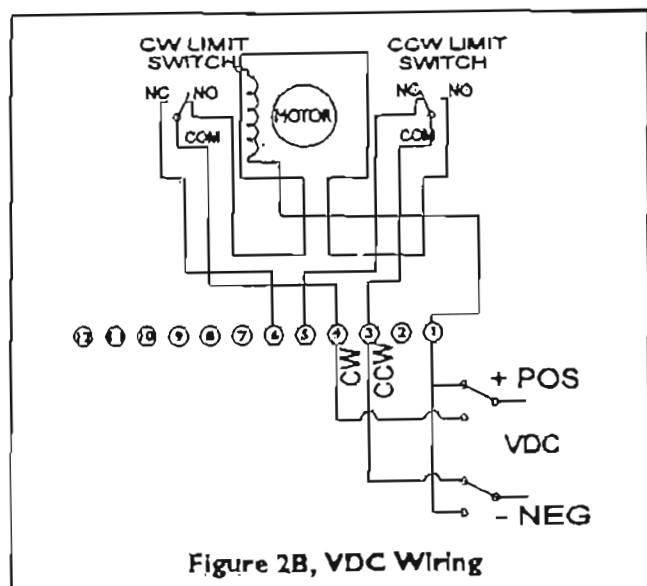
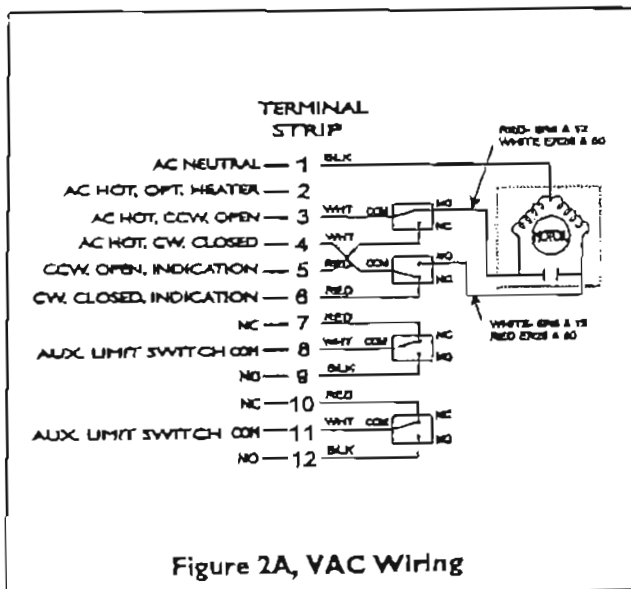
See Figure 2

NOTE: Be sure to follow local wiring codes.

The identification label on each actuator specifies the voltage and current requirements for the actuator. Figure 2 shows the standard power and control wiring connections for AC and DC actuators. To operate the ER Series actuator, the user supplies power to the actuator's motor through two limit switches. The limit switches control the actuator's mechanical travel limits and are factory set at 90° degrees.

VAC - To drive the actuator counterclockwise (CCW), apply power to terminals 1 and 3. To drive the actuator clockwise (CW), apply power to terminals 1 and 4. The actuator can be driven fully open (CCW) or closed (CW) by maintaining power to the motor until the actuator trips the internal limit switches. Power can also be disconnected at any point during the travel to position the actuator.

VDC - DC voltage actuators require a reversing of the power polarity. To drive the actuator CW, apply power so that terminal 1 is negative and terminal 4 is positive. To drive the actuator CCW, apply power so that terminal 1 is positive and terminal 3 is negative.



ADJUSTMENT OF THE LIMIT SWITCHES

See Figure 4

If adjustment of the open or closed position is required, proceed as follows:

A. Adjust the OPEN limit switch cam:

1. Using a hex wrench, loosen the set screw in the OPEN limit switch cam (the second up from the bottom).
2. Apply power to terminals 1 and 3 (See Figure 2) to drive the actuator to the open position (counterclockwise rotation).
3. Remove the power from the actuator.
4. Rotate the cam slowly in the clockwise direction until the limit switch "clicks" closed. Then rotate the cam counterclockwise until it just "clicks" open. Secure the cam by tightening the set screw.
5. Set the vertical cam position so that the bottom of the cam is in contact with the limit switch arm. (See Figure 3) Tighten the cam set screw to secure the cam in position. Do not over-tighten the screws (use less than 8 in.-lbs. of tightening torque). If the cam is not set "high" as described, the cam will become disengaged from the limit switch arm when using the manual override feature.

B. Adjust the CLOSED limit switch cam:

1. Using a hex wrench, loosen the set screw in the CLOSED limit switch cam (the bottom one).
2. Apply power to terminals 1 and 4 (See Figure 2) to drive the actuator to the close position (clockwise rotation).
3. Remove the power from the actuator.
4. Rotate the cam slowly in the counterclockwise direction until the limit switch "clicks" closed. Then rotate the cam clockwise until it just "clicks" open. Secure the cam by tightening the set screw.
5. Set the vertical cam position so that the bottom of the cam is in contact with the limit switch arm. (See Figure 3) Tighten the cam set screw to secure the cam in position. Do not over-tighten the screws (use less than 8 in.-lbs. of tightening torque). If the cam is not set "high" as described, the cam will become disengaged from the limit switch arm when using the manual override feature.

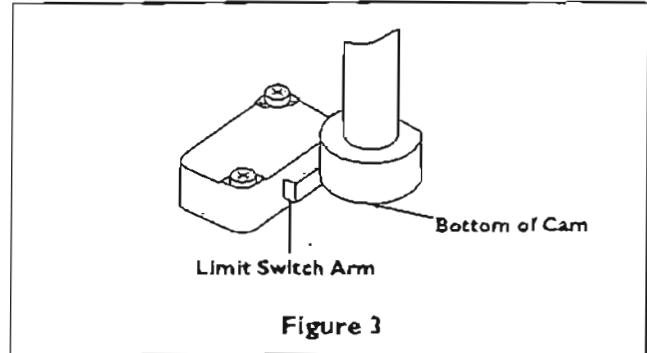
OPTIONAL ACCESSORIES

IMO's for Optional Accessories, please reference the following IMO's:

IMO-S05 for Limit Switch Option

IMO-S07 for Heater Option

IMO-S08 for Timer Option



MAINTENANCE

CAUTION: Use the correct parts. Failure to do so could result in improper operation or personal injury. Contact your Neles-Jamesbury distributor for authentic Neles-Jamesbury replacement parts.

These actuators require no lubrication, and under normal operating conditions only periodic observation is needed to see that they are functioning properly. Maintenance or adjustments other than those described herein, should be referred to Neles-Jamesbury for service.

SPARE PARTS AVAILABLE

- Limit Switch
- Limit Switch Cam
- Cover
- Cover Gasket

TROUBLE SHOOTING

Problem	Try This
1. Motor will not run.	1. Check incoming voltage. 2. Check that all plug-in connectors are tight. 3. Review the Limit Switch Adjustment section to insure that the switches are set correctly. 4. Allow the motor to cool. 5. If these steps fail to correct or identify the problem, contact the Neles-Jamesbury Distributor or Representative in your area.

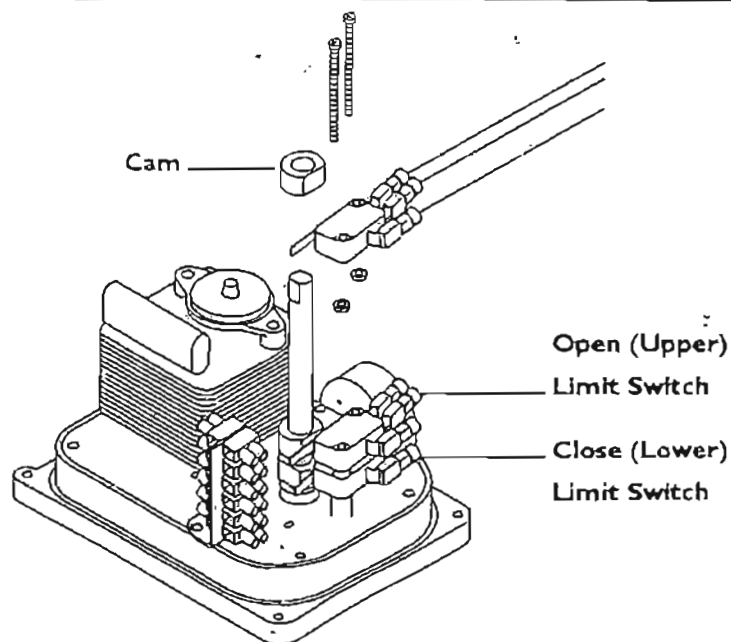


Figure 4

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NELES CONTROLS GROUP

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Worcester, Massachusetts 01615-0004 USA
Tel: 508-852-0200 • Fax: 508-852-8172 • Internet: www.Jamesbury.com
Neles Controls Group • A member of Rauma Corporation

INSTALLATION DIMENSIONS

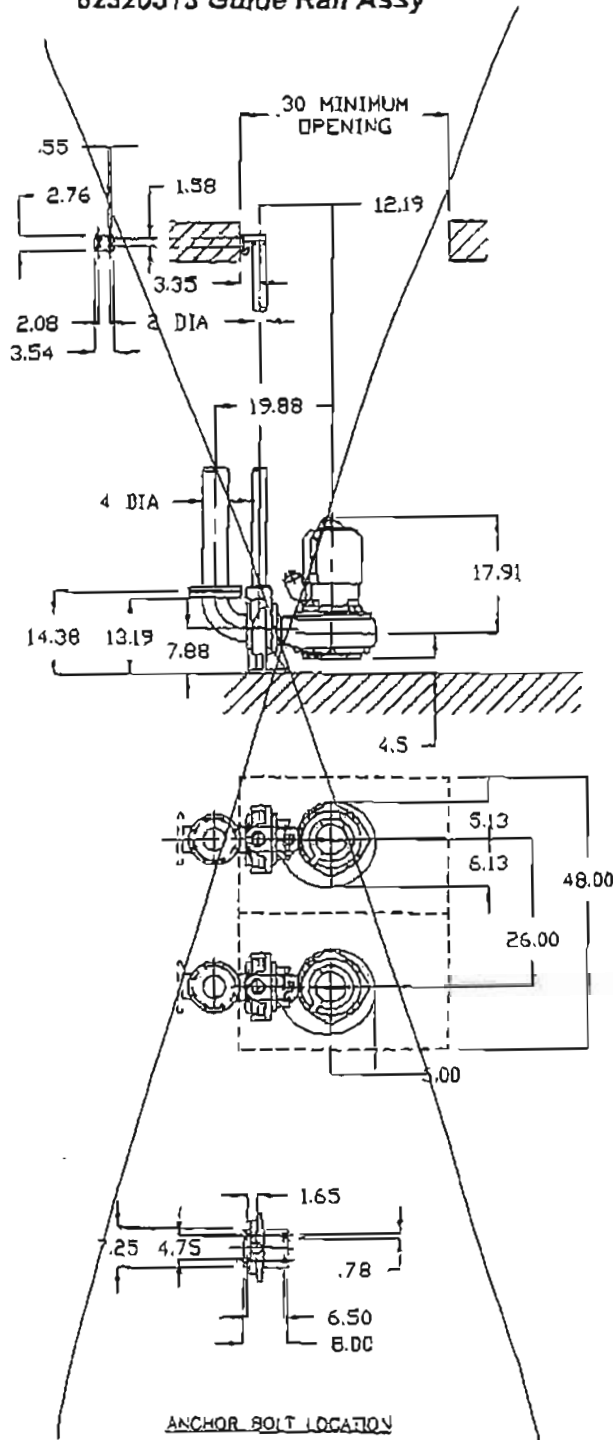
Wet Pit

AFP 1040

Dwg. DS-A01-064 Rev. Date: 04/01

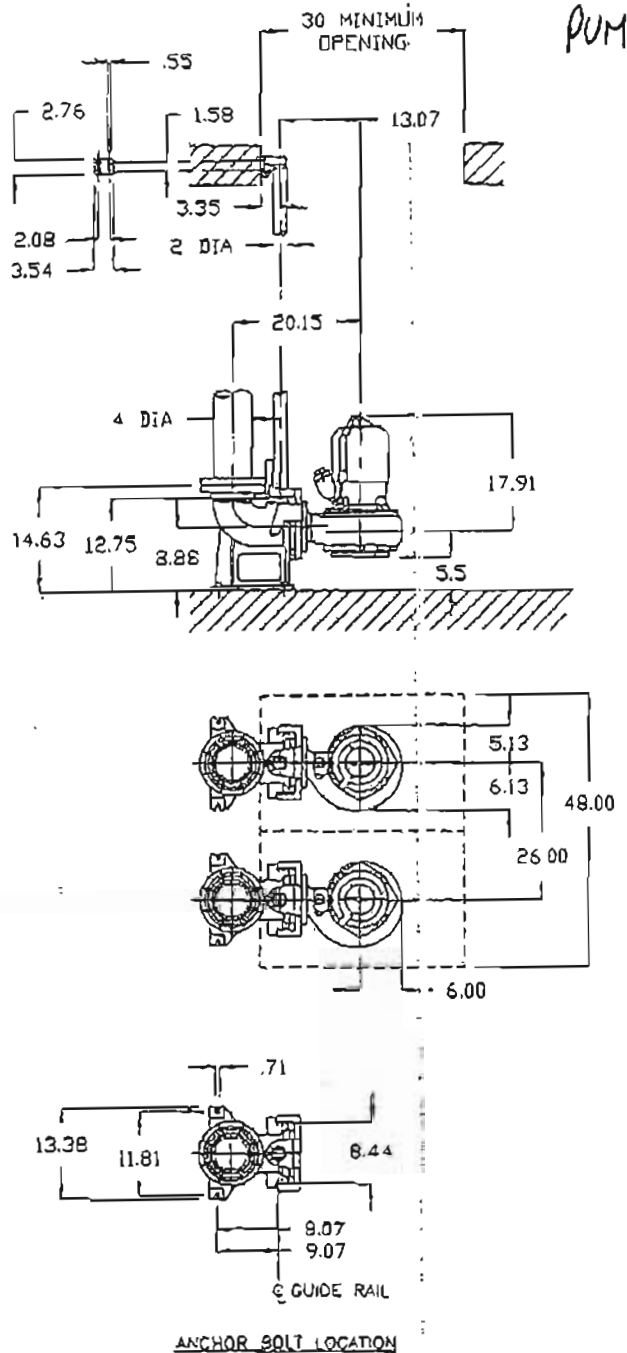
Section AFP Tab 4" Open Cl Page 1.7

62320513 Guide Rail Assy



62320552 Guide Rail Assy

40 JET ASPIRATOR PUMP



TYPICAL DRAWING ONLY, NOT FOR CONSTRUCTION PURPOSES. CONTACT FACTORY FOR CERTIFIED DRAWINGS.

Specifications subject to change without notice

ABS
COST-EFFECTIVE PUMPING

SCOPE

Furnish and install 2 ABS Model AFP 1040 M28/4-1260 submersible non-clog wastewater pump(s). The pump(s) shall be supplied with a mating cast iron 4" inch discharge connection and be capable of delivering 205 U.S. GPM at a total dynamic head of 25 feet. An additional point on the same curve shall be _____ U.S. GPM at a total dynamic head of _____ feet. Shut off head shall be _____ feet (minimum). The motor shall be an integral part of the unit. The motor shall be 3.7 HP connected for operation on a 230 volts, 1 phase, 60 hertz electrical supply service. The pump shall be supplied with a cast iron guide rail base fitted with a 4" inch discharge elbow. Each unit shall be fitted with 20 feet of ~~lifting chain~~ stainless steel cable. The working load of the lifting system shall be a minimum of 50% greater than the pump weight. Each pump motor shall be equipped with 30 feet of power and control cable(s) sized in accordance with NEC standards.

PUMP DESIGN

The pump(s) shall be capable of handling raw unscreened sewage, storm water, and other similar solids-laden fluids without clogging. The discharge base and elbow shall be permanently installed in the wet well and connected to the discharge piping. In order to prevent binding or separation of the pump from the guide rail system, the pump(s) shall connect to the guide rail base automatically and firmly, guided by no more than one guide bar extending from the top of the station to the discharge connection. Dual guide rail systems and/or cable guide systems shall not be considered acceptable. The sliding guide bracket shall be a separate part of the pumping unit, capable of being attached to standard ANSI or DIN pump flanges so that the base is interchangeable with other pumps and not limited to a specific pump. Non standard flange dimensions shall not be considered acceptable. There shall be no need for personnel to enter the wet well to remove or reinstall the pump(s). Positive sealing of the pump to the discharge elbow shall be accomplished by a field replaceable Nitrile rubber profile gasket mechanically held in place between the pump and the sliding guide bracket. Metal to metal contact between the pump and discharge elbow shall not be considered acceptable. No portion of the pump shall bear directly on the floor of the sump. The pump with its appurtenances and cable shall be capable of continuous submergence to a depth of 65 feet.

PUMP CONSTRUCTION

Major pump components shall be of gray cast iron, ASTM A-48, Class 40, with smooth surfaces devoid of porosity or other irregularities. All exposed nuts and bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pumped media (other than the stainless steel components) shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a high solids two part epoxy paint finish on the exterior of the pump.

Sealing design for the pump/motor assembly shall incorporate metal to metal contact between machined surfaces. Critical

mating surfaces where a watertight seal is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without requiring a specific torque limit. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered adequate or equal. No secondary sealing compounds shall be used.

Impeller: The impeller shall be of gray cast iron, ASTM A-48, Class 40 and shall be of the semi-open, non-clogging dynamically balanced single vane design capable of passing a minimum of 3" diameter spherical solids. The impeller shall have a slip fit into the motor shaft and drive key, and shall be fastened to the shaft by a stainless steel bolt which is mechanically prevented from loosening by a positively engaged ratcheting washer assembly.

Self Cleaning Wear Plate: (CB System) The pump shall be equipped with a self cleaning wear plate constructed from gray cast iron, ASTM A-48, Class 40. The wear plate shall be mounted to the volute with four stainless steel/brass adjusting screws to permit close tolerance adjustment between the wear plate and impeller for maximum pump efficiency. The wear plate shall be easily adjustable, without requiring disassembly of the pump. The wear plate shall be designed with a wave shaped inlet and an outward spiral V-shaped groove on the side facing the impeller, to shred and force stringy solids outward from the impeller and through the pump discharge. The use of non-adjustable wear rings shall not be considered equal.

Pump Volute: The pump volute shall be single piece gray cast iron, ASTM A48, Class 40, non-concentric design with centerline discharge. Passages shall be smooth and large enough to pass any solids which may enter the impeller. Minimum discharge size shall be as specified. The discharge flange design shall permit attachment to standard ANSI or DIN flanges/appurtenances.

Rotating Assembly: The rotating assembly (impeller, shaft and rotor) shall be dynamically balanced such that undue vibration or other unsatisfactory characteristics will not result when the pump is in operation.

Shaft: The pump shaft and motor shaft shall be an integral unit. Each shaft shall be of 420 stainless steel material and adequately designed to meet the maximum torque required at any normal start-up condition or operating point in the system. Maximum deflection shall not exceed .002" at the lower seal. Each pump shaft shall have a polished finish and have accurately machined shoulders to accommodate bearings, seals and impeller. Carbon steel or chrome plated shafts shall not be considered adequate or equal.

Mechanical Seals: Each pump shall be equipped with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary industrial duty silicon-carbide seal ring and one rotating industrial duty silicon-carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and motor housing, shall contain one stationary

carbon seal ring and one rotating seal ring made from corrosion resistant Cr-steel. Each seal interface shall be held in contact by its own spring system. The seals shall not require routine maintenance, or adjustment, and shall not be dependent on the direction of rotation for proper sealing. Each pump shall be provided with a lubricant chamber for the shaft sealing system which shall provide superior heat transfer and maximum seal cooling. The lubricant chamber shall be designed to prevent overfilling, and to provide lubricant expansion capacity. The drain and inspection plug shall have a positive anti-leak seal, and shall be easily accessible from the outside of the pump. The seal system shall not rely upon the pumped media for lubrication and shall not be damaged when the pump is run dry.

The following seal types shall not be considered acceptable or equal: Seals of proprietary design, or seals manufactured by other than major independent seal manufacturing companies. Seals requiring set screws, pins, or other mechanical locking devices to hold the seal in place, conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces, cartridge type systems, any system requiring a pressure differential to seat the seal and ensure sealing.

Bearings: Each pump shaft shall rotate on permanently lubricated, greased bearings. The upper bearing shall be a deep grooved ball bearing and the lower bearings shall be heavy duty double row angular contact ball bearing. Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize shaft deflection. B-10 bearing life shall be a minimum of 50,000 hr at BEP.

MOTOR

The motor housing shall be gray cast iron, ASTM A48 Class 40 and the motor shall be of the squirrel-cage induction shell type design, housed in an air filled, water tight chamber (NEMA B type) and shall be capable of continuous submerged operation underwater to a depth of 65 feet. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 155°C (311 °F). The stator shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is unacceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104 °F) and capable of handling up to 12 evenly spaced starts per hour. The service factor (as defined by NEMA) shall be a minimum of 1.10. The motor shall have a voltage tolerance of +/- 10% from nominal. A performance chart shall be provided upon request showing curves for torque, current, power factor, input kW, output HP and efficiency. This chart shall also include data on starting and no-load characteristics.

The rotor bars and short circuit rings shall be made of cast aluminum. The motor shall be designed for continuous duty, completely submerged or unsubmerged. For unsubmerged (dry pit) applications, a cooling jacket shall be fitted to the motor to allow the pumped fluid to be circulated around the motor for cooling with the provisions under the "Cooling System" section of this specification. The explosion proof variant shall be FM

approved for use in NEC Class I, Division I, Groups C & D hazardous locations.

Cooling System: Each unit shall be able to be provided with an adequately designed cooling system. The cooling jacket shall surround the stator housing, thereby providing heat dissipation of the motor. Impeller back vanes shall provide the necessary circulation the pumped media through the cooling jacket. The impeller and back plate interface shall incorporate dimensional tolerances designed to prevent damaging particles from entering the cooling jacket. In addition, the back of the impeller shall incorporate a cutter design which ensures that stringy or fibrous material can not enter the cooling jacket. The cooling jacket shall be a non-clog design by virtue of these features, and clean out ports on the cooling jacket shall not be required. Provisions for external cooling can be provided upon request.

Thermal Protection: Each phase of the motor shall contain a bi-metallic temperature monitor in the upper portion of the stator windings. These thermal switches shall be connected in series and set to open at 140°C +/- 5°C. They shall be connected to the control panel, and used in conjunction with and supplemental to external motor overload protection.

Seal Failure Early Warning System: An electrical probe shall be provided in the oil chamber for detecting the presence of water in the oil chamber. This probe shall be provided for both standard and explosion proof versions. A solid-state device mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe. If water enters the oil chamber, the probe shall signal the solid state relay in the control panel. The relay shall then energize a warning light on the control panel, or cause the pump to be shut down (optional). Float switches, dual probes, or any other monitoring devices located in the stator housing are not considered to be early warning systems, and shall not be considered equal.

Power Cables: The power cables shall be sized according to NEC and CSA standards and shall be of sufficient length to reach the junction box without requiring splices. The outer jacket of the cable shall be oil resistant chloroprene rubber, and shall be capable of continuous submerged operation underwater to a depth of 65 feet.

Cable Entry/Junction Chamber: The cable entry design shall not require specific torque requirements to insure a watertight seal. The cable entry shall consist of a cylindrical elastomer grommet, flanked by stainless steel washers. A cable cap incorporating a strain relief shall mount to the cable entry boss compressing the grommet ID to the cable while the grommet OD seals against the bore of the cable entry. The entry as part of the motor shall be FM approved for use in NEC Class I, Division I, Groups C & D hazardous locations. As an option a removable explosion proof junction chamber shall be available. The junction chamber with terminal board shall fit to the cable entry boss. The junction chamber shall be equipped with a removable cover allowing for cable removal or voltage change without opening the motor. The junction chamber shall be sealed from the motor by means of a sealing gland.

AFP 1040, 4 Pole, 1 Phase

Page 1.1

Impeller
Contrabloc impeller

Impeller size
7 11/16..6 inch

N° of vanes
1

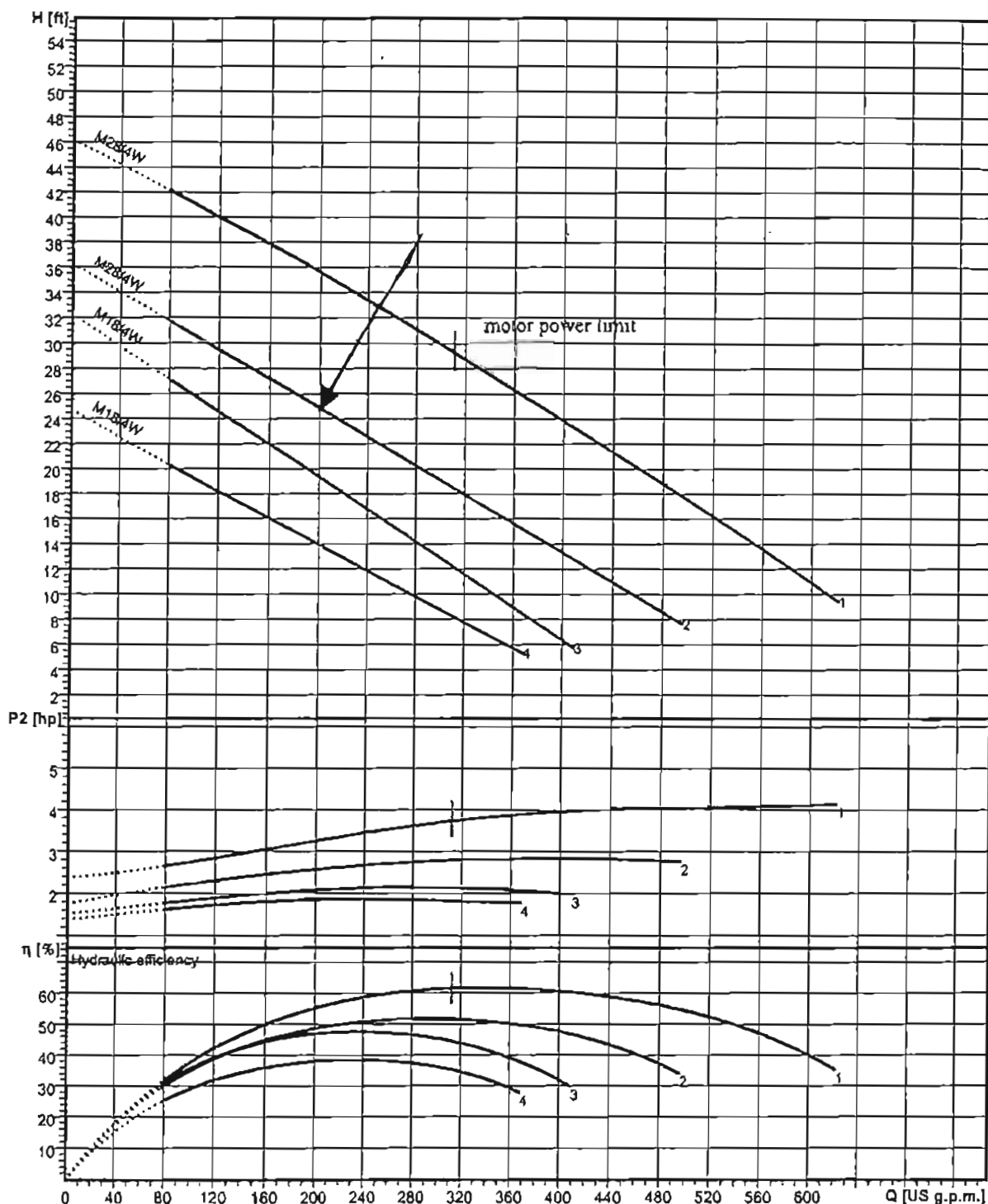
Testnorm
Hydraulic Institute

Discharge
4 inch

Rated speed
1680..1710 rpm

Solid size
3 inch

Date
2000-01-04



Specifications subject to change without notice

Operation in dotted range is not recommended

Revision 1999-11-19

AFP 1040 1~ 60 HZ

HID Mobile Home Park

AFP/M1-M3

Robust, reliable ABS submersible sewage pumps from 1.3 to 23 kW for the dewatering of buildings and sites in private, commercial and communal areas and in industry.

Water pressure-tight encapsulated fully flood-proof motors in standard or explosion-proof versions. Hydraulics with CB (ContraBlock) system or vortex impellers.

Can also be supplied with cooling jacket on request for dry sump applications.

Capacity up to 820 m³/h
Head, max. 92 m

Type: AFP 1040 1~ 60 HZ

Technical data

Delivery rate	: 202 US g.p.m.
Delivery head	: 25 ft
Hydr. efficiency	: 48.8 %
Shaft power	: 2.62 hp
Speed	: 1885 rpm
Impeller type	: ContraBlock Impeller, 1 vane
Motor output	: 3.75 hp
Voltage	:
Frequency	: 60 Hz
Suction outlet	: DN100
Discharge outlet	: DN100

TECHNICAL DATA**4 Pole, 1 Phase****AFP 1040**

Dwg. DS-A01-032 Rev: Date: 01/99

Section AFP Tab 4" Open CB Page 1.2

STANDARD & EXPLOSION PROOF**MOTOR SPECIFICATIONS**

Motor Design	NEMA design B, squirrel cage induction, air filled	
Motor Type	Enclosed submersible	
Insulation Class	Class F, rated at 155°C	
Bimetallic Temp Setting	140°C ± 5°C	
Motor Protection	Thermal	Bimetallic Switches in each Phase
	Leakage	DI Moisture Detection in seal oil chamber
Maximum Submergence	65 feet	
Max. Fluid Temperature	40°C (104°F)	
Voltage Tolerance ±	10%	
RPM	1780	

PUMP & MOTOR DATA

Discharge Size	4"				
Impeller	.4	.3	.2	.1	
Solid Size-Inches	3	3	3	3	
Impeller DIA mm	153	161	177	197	
WK ² LB-FT ² (with water)	.31	.40	.55	.74	
Impeller weight LBS.	7.7	9.6	9.9	10.5	
Minimum Flow GPM	50	60	65	70	
Motor	M18/4W-11	M18/4W-11	M28/4W-12	M28/4W-12	
BHP	2.4	2.4	3.7	3.7	
Phase	1	1	1	1	

MATERIALS of CONSTRUCTION

Motor Housing	Cast Iron ASTM A48 Class 40				
Oil Chamber	Cast Iron ASTM A48 Class 40				
Seal Plate	Cast Iron ASTM A48 Class 40				
Impeller	Cast Iron ASTM A48 Class 40				
Volute	Cast Iron ASTM A48 Class 40				
Bottom Plate CB	Cast Iron ASTM A48 Class 40				
Cable Entry Casting	Cast Iron ASTM A48 Class 40				
Junction Box (optional)	Cast Iron ASTM A48 Class 40				
Water Jacket (optional)	Cast Iron ASTM A48 Class 40				
Pump and Motor Shaft	420 SS				
External Hardware	316 SS				
O-Rings	BUNA "N" (NITRILE)				
Cable Glands	BUNA "N" (NITRILE)				
Upper Bearing	Single Row Ball Permanently Lubricated				
Lower Bearing	Double Row Angular Contact Permanently Lubricated				
Tandem	Lower	Silicon Carbide on Silicon Carbide			
Mechanical Seal	Upper	Tool Steel on Carbon			

WEIGHT OF PUMP AND MOTOR (LBS)

Standard and Explosion proof	176	176	178	180		
Add for water jacket	26	26	26	26		
Add for junction chamber	16	16	16	16		

CABLE SPECIFICATIONS

Power Cable	H07RN-F, Ozoflex, sow				
Control Cable	Included in Power Cable				
Cable OD inches	.75	.75	.75	.75	
Cable, Standard Length	30 feet				

TECHNICAL DATA

4 Pole

Motor Performance

M1-M3Y

Dwg. DS-A01-051 Rev. Date: 01/00

Section

AFP

Tab

Motors M1-M3Y

Page

1.2

STANDARD & EXPLOSION PROOF

Motor Model	BHP Out (P2)	KW In (P1)	RPM	Rated Voltage	Full Load Amps	Locked Rotor Amps	NEMA Code	S.F.	Power Factor at % Load			Motor Efficiency at % Load		
									100%	75%	50%	100%	75%	50%
M1 Frame, Single Phase, 4 Pole														
M13/4W	1.74	1.9	1780	208 230	9.9 9.0	38.8 35.1	E	1.2	.93	.90	.84	77.3	60.0	49.5
M18/4W	2.4	2.6	1780	208 230	13.4 12.1	40.9 35.1	B	1.1	.95	.93	.89	78.2	65.7	58.2
M28/4W	3.75	4.0	1780	208 230	19.8 17.9	52.2 47.2	A	1.1	.97	.96	.92	79.8	69.6	62.1
M1 Frame, Three Phase, 4 Pole														
M15/4	2.0	2.0	1780	208 230 460 575	8.4 7.6 3.8 3.0	48.2 43.6 21.8 17.4	K	1.2	.65	.56	.44	75.3	73.8	67.6
M22/4	3.0	2.9	1780	208 230 460 575	9.8 8.8 4.4 3.5	48.7 44.0 22.0 17.6	G	1.1	.78	.69	.55	80.3	81.9	80.1
M25/4	3.4	3.2	1780	208 230 460 575	10.8 9.8 4.9 3.9	48.7 44.0 22.0 17.6	F	1.1	.81	.73	.59	79.9	81.5	81.1
M35/4	4.7	4.4	1780	208 230 460 575	15.3 13.8 6.9 5.5	66.1 59.8 29.9 23.9	F	1.1	.81	.74	.61	79.1	81.2	81.6
M2 Frame, Single Phase, 4 Pole														
M40/4W	5.4	5.2	1780	208 230	25.3 22.9	75 68	A	1.1	.98	.96	.93	77.2	74.2	65.8
M2 Frame, Three Phase, 4 Pole														
M46/4	6.2	5.8	1780	208 230 460 575	18.8 17.0 8.5 6.8	92 84 42 34	F	1.1	.82	.75	.63	82.4	82.9	80.7
M70/4	9.4	8.3	1780	208 230 460 575	27.2 24.8 12.3 9.8	146 132 66 53	F	1.1	.85	.79	.67	84.8	85.1	84.5
M90/4	12.0	11.2	1780	208 230 460 575	35.4 32 16.0 12.8	148 132 66 53	D	1.0	.87	.84	.75	80.5	84.8	85.2

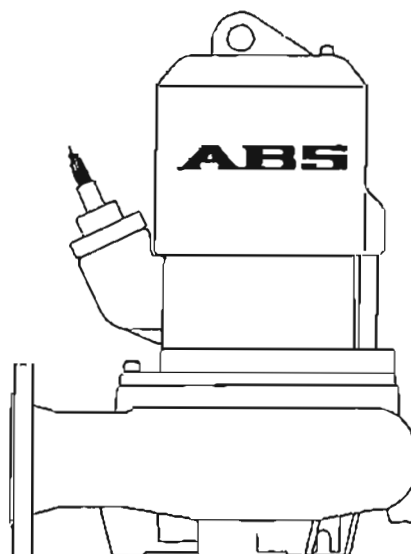
Installation Operation & Maintenance Manual

AFP 0831-2006

&

AFP 1062-1562

Chopper Pump



SUBMERSIBLE WASTEWATER PUMPS

Warranty

FIVE YEAR WARRANTY - STANDARD & EXPLOSION PROOF AFP, AFS & AF SERIES PUMPS

PERMANENT TYPE INSTALLATION

ABS Pumps Inc. warrants its AFP, AFS & AF Series of Submersible Pumps to be free from defects in workmanship and materials for a period of five (5) years after date of shipment to end customer, with approval of installation and start-up of the equipment by the Company's authorized on-site representative and, upon payment of the applicable percentage of the list price of the following parts in effect at time of replacement.

Part Description	Months After Shipment			
	0-18	19-31	32-45	46-60
Rotor & Stator*	0%	25%	50%	75%
Mechanical Seal	0%	25%	50%	75%
Impeller	0%	25%	50%	75%
Cutter Disc	0%	25%	50%	75%
Pump Housing	0%	25%	50%	75%
Ball Bearings	0%	40%	80%	90%

*Stator guarantee effective only if Company's authorized control panels are used.

All other ABS manufactured equipment or other uses of AFP, AFS or AF series pumps will carry a one (1) warranty from date of shipment to end customer, but in no event, longer than eighteen (18) months from date of shipment from the Company.

Start-up reports and electrical system schematics may be required to support Warranty claims and will be required for claims on pumps of 30 horsepower and greater.

The Company's sole obligation under this warranty shall be to make repairs and replace parts when necessary on products that have been returned to it or to an authorized service facility and found to be defective by the Company. Explosion Proof pumps (EX) must be serviced at a facility approved by ABS Pumps Inc. The Company shall not be liable for any special, indirect, or consequential damages of any kind. Major components not manufactured by the Company are covered by the original manufacturer's warranty in lieu of this warranty. The Company will not be held responsible for travel expenses, rented equipment, outside contractors fees, or unauthorized repair shop expenses. The Company neither assumes nor authorizes any person or other company to assume for it, any other obligation in connection with the sale of its equipment. Any enlargement or modification of this Warranty by a Representative or other Sales Agent is their exclusive responsibility. Transportation charges shall be borne by the Buyer. Labor charges for warranty repairs shall not be assumed by the Company for repairs made after one (1) year from date of shipment to end customer. Returns must have prior written authorization from the Company.

This Warranty shall extend only to the original Owner, and shall not apply to any products that have been repaired or altered without the Company's consent or have been subject to misuse, accident or neglect, or have been used for pumping other than raw sewage or similar non-corrosive liquids.

NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WILL APPLY.

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SECTION I**1-1 INTRODUCTION**

This manual was prepared to assist you in the correct installation, operation, maintenance and repair of your ABS pump.

Please read it through carefully and make certain that you are familiar with the contents, and that the recommendations in the chapter on installation and operation are fully understood before running the pump.

ABS pumps have been designed to minimize maintenance. However, regular checks will ensure longer life and greater operating reliability.

WARRANTY: No repair work should be carried out during the warranty period without prior factory approval. To do so may render the warranty void.

PUMP SERIAL NO.: In all correspondence and reports, make certain that the pump serial number is given.

1-2 DESIGN OF PUMP

The ABS AFP type submersible pumps are designed to operate in installations handling raw sewage, industrial waste or other liquids and sludge where suspended solids are found within the medium being pumped.

The motor and pump form a close coupled, fully submersible, watertight unit.

The squirrel cage induction motor is insulated against heat and moisture in accordance with Class "F" (155°C) regulations.

Thermal overload protectors (one per phase) are imbedded in the stator windings. These are connected in series and must be wired to the control panel so they shut down the pump if overheating occurs.

The motor is protected against damage from water entry by an oil chamber and mechanical seal located between the volute and the motor housing. A di-electrode seal probe located in the oil chamber which, when coupled to the ABS Sealminder control, senses for water in the oil chamber and provides a signal which gives a visual or audible warning that an inspection is necessary.

The bearings are pre-lubricated and maintenance free.

Three motor frame sizes are available on AFP series pumps. The table below shows the motor model number and the frame size in which it belongs:

M13/4W, 15/6, 18/4W, 28/4W M15/4, 22/4 25/4, M35/4	M1
M40/4W, 46/4, 70/4, 80/2 M105/4, 90/4, 35/6, 125/2	M2
M130/4, 185/4, 210/4, 200/2, 230/2 M130/6, 160/6	M3

Recessed Design (Vortex) or CB (Contra Block) Non-Clog Impellers are used in the AFP Series pumps.

Recessed impellers are multi-vaned design, positioned within the volute, so that there is a space between the open impeller and casing cover. Due to the action of centrifugal force, water is thrown out into the casing and passes through the unobstructed space between the impeller and casing carrying the solids which are caught up with it into the discharge.

The well-proven CB (Contra Block) system consists of a spiral bottom plate with wave shaped ridges. Rags, fibers, etc., are torn or cut by the shearing edge of the suction inlet and clogging is prevented.

SECTION II**2-1 INSPECTION ON RECEIPT OF PUMP**

The shipping container should be immediately inspected for damage that may have occurred in shipment. Exercise care in opening the shipping container to avoid damage to the pump. Remove any blocking and cushioning from within the container. Check all cushioning for spare parts before discarding. Visually check the pump and any spare parts for damage. Check for damaged inlet and outlet port threads, flanges, and electrical wires, especially where they exit the pump housing. Report any damage or shortage of parts directly to the carrier.

The AFP "Chopper" pumps have been designed for those particularly difficult applications where standard pumps have difficulty coping.

In certain applications the sewage is a problem as all kinds of objects both fibrous and solid get flushed down the toilet.

The AFP hydraulics incorporate an effective cutting and chopping system which can deal effectively with otherwise difficult liquids such as sewage from institutions e.g. prisons and hospitals, sewage from train stations and sewage and run off from a large variety of processing and industrial applications including abattoirs, fish plants, factory fishing boats, wood processing etc. They are also used in agricultural applications involving straw and liquid manure.

2-2 STORAGE BEFORE USE

ABS pumps are shipped from the factory ready for installation and use. They should be held in storage if the pump station is not complete. If storage is necessary, the pump should remain in its shipping container. It should be stored in a warehouse or storage shed that has a clean, dry, temperature-stable area. The pump and its container should be covered to protect it from water, dirt, dust, etc. The ends of the cables must be protected against moisture.

CAUTION!

AT NO TIME SHOULD THE PUMP BE STORED WITHIN AN INCOMPLETE WET PIT. THE PUMP SHOULD NOT BE PLACED INTO THE PIT UNTIL IT CAN BE FULLY INSTALLED AND OPERATED.

AUTOMATIC COUPLING WITH SINGLE GUIDE RAIL

The ABS guide rail with the automatic coupling system ensures rapid and economical installation and allows connection of the pump to the discharge pipe by gravity.

The guide rail base is securely mounted together with the discharge line on the bottom of the wet well.

The submersible pump is lowered by chain down the guide rail; when it reaches the proper operating position, it seals off the discharge outlet automatically by means of its own weight.

The automatic coupling can be repeated as often as necessary. For routine inspection, the pump can be easily lifted by the chain, checked or repaired, and lowered again.

1. Upper guide bracket
2. Anchor bolts
3. Pump bracket
4. Specially shaped gasket
5. Socket head screw
6. Straightening vane
7. Spring washer
8. Socket head screw
9. Flat gasket
10. Flanged discharge elbow
11. Spring washer
12. Hexagon head screw
13. Screw with hex head
14. Washer
15. Guide rail
16. Hex nut
17. Spring washer
18. Washer
19. Guide rail base
20. Hexagon nut
21. Washer
22. Anchor bolts

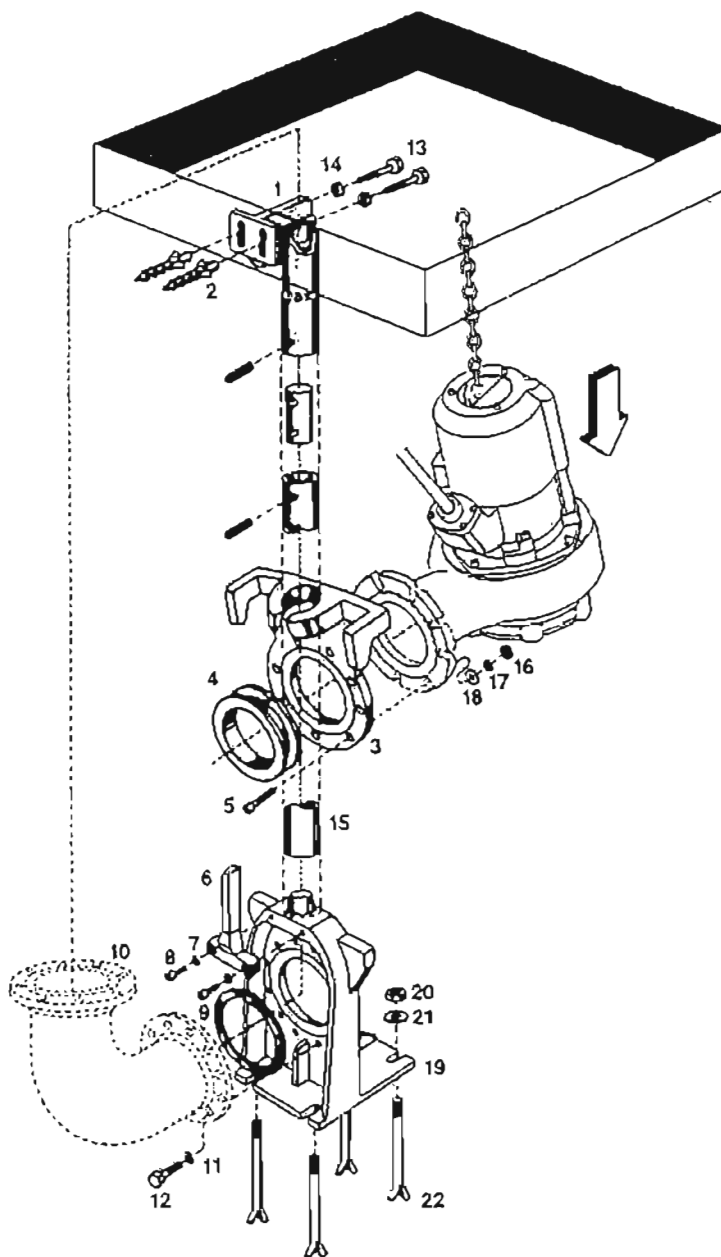


FIGURE 2-1
Automatic Coupling

LONG TERM STORAGE

1. If it is necessary to store a pump for a long period of time, it should be stored in a clean, dry temperature-stable environment. The pump should be covered to protect it from dust, dirt and water. The ends of the cable must be protected against moisture.
2. Do not allow the pump to freeze. Any water trapped inside the pump during testing may expand and cause damage. If the pump must be stored in a sub-freezing environment, consult the factory for specific recommendations and precautions.
3. During storage, the motor should be rotated a few turns once a month. This can be accomplished by turning the impeller by hand. Spinning the motor will lubricate the mechanical seals and prevent their seizing.
4. Prior to installation, the pump motor should be rotated by hand to ensure the mechanical seals are free-spinning.
5. Installed pumps which are idle for long periods of time should be jogged once a month to lubricate the mechanical seals.

2-3 MOUNTING BASE CONSTRUCTION

ABS AFP pumps may be either guide rail mounted or pedestal base mounted. The foundation for both must be rigid enough to absorb any induced vibrations and stress normally generated during pump operation. A pedestal pump will simply sit on this, therefore the foundation must be absolutely level. The guide rail mounted pump will have the guide rail base bolted to the foundation. The mounting bolts will be imbedded in the foundation with size and location defined by the particular job specification and engineering drawings.

CAUTION!

PRIOR TO INSTALLING THE PUMP IN THE WET WELL, REFER TO SECTION 3-1 ENTITLED "INITIAL START-UP". BE SURE THE PUMP IS RUNNING WITH THE CORRECT IMPELLER ROTATION.

2-4 GUIDE RAIL INSTALLATION AND ASSEMBLY OF AUTOMATIC COUPLING SYSTEM

The wet well access cover should be cast either into the concrete roof of the wet well or should be mounted on top of an ABS or contractor supplied steel or fiberglass basin, positioned as shown on the particular job specification engineering drawings and ABS installation drawings. At the same time, the guide rail base anchor bolts should be cast in the bottom of the wet well, again per the job specification engineering drawings and ABS installation drawings.

NOTE

The foundation bolts must be suitably grouted with a good commercial grade grout. The grout should be properly installed to prevent air bubble inclusion and completely encase and seal the area around the bolt.

To assemble the Automatic Coupling System and to install the Guide Rail Assembly, follow these instructions. See Figure 2-1.

1. Mount the straightening vane (6) to the guide rail base (19) with screws (8) and spring washer (7).
2. Install the guide rail base in the bottom of the wet well by means of cast-in anchor bolts (22). Check that the base is level. Add grout beneath base to level. Re-check base after grout dries. Finally, secure in place with hex nuts (20) and washers (21).
3. Position the upper guide bracket to the access cover or to the wall of the opening to determine length of guide rail. The guide rail, which is customer supplied, will be 2" schedule 40 galvanized pipe. After positioning, cut pipe to the required length.
4. Install the guide rail pipe over the tapered plug of the guide rail base.
5. Insert the upper guide bracket tapered plug into the upper end of the guide rail and locate so the guide rail is plumb. Secure upper guide bracket to the access cover or opening wall and Re-check for plumbness. Check that the guide rail base (19), the guide rail (15), and the upper guide bracket (1) are on the same center line with the discharge connection and vertically aligned. This is necessary to assure that the pump will seal itself correctly. Press upper guide bracket (1) into the guide rail pipe (15) so that no play remains and finally secure the upper guide rail bracket by tightening the screws (13).
6. The molded gasket (4) is placed in the pump bracket (3) so that the tapered face points towards the guide rail base and the sealing lips make proper contact all around on both sides. The pump bracket is fastened to the discharge of the pump with socket head screws (5), washer (18), hex nuts (16), and spring washers (17). The hex nuts (16) should be equally tightened in a cross-wise manner to prevent leakage of the seal.
7. The discharge elbow (10), with the flat gasket in place, is attached to the guide rail base with hex head screws (12) and spring washers (11).
8. No welding or building of the guide rail is required.

CAUTION!

NEVER RAISE, LOWER OR MOVE THE PUMP BY LIFTING WITH, OR PULLING ON THE POWER CABLES. THE PUMP IS PROVIDED WITH A LIFTING EYE AND CHAIN. THE CHAIN SHOULD BE USED AT ALL TIMES WHEN MOVING THE PUMP.

Referring to Figure 4-1 and using the pump support chain, follow the procedural steps, (a through d) when lowering the pump down the guide rail until it seats against the guide rail base. The pump should be lowered at an angle to ensure that the top of the discharge connection makes contact first with the base. Continue lowering until pump is completely seated. Slack off the chain, as noted in Step "d" and fasten the upper end of the chain to the hook of the upper guide bracket. Check to make sure that the electrical cables are not supporting any weight.

CAUTION!

ALL DISCHARGE PIPING AND VALVES SHOULD BE SUPPORTED IN SUCH A MANNER THAT NO LOAD IS CARRIED BY THE PUMP DISCHARGE ELBOW.

2-5 PEDESTAL MOUNTING

The pedestal mounted pump is used for portable service. The pump, as supplied by ABS, contains a fully assembled pedestal base and discharge elbow. Either rigidly mounted permanent piping or hoses with quick disconnect couplings may be installed. Refer to the preceding CAUTION note.

2-6 FLOAT SWITCHES & FLOAT SEQUENCES

The fluid levels at which the pumps start or stop are normally controlled by mercury float switches. The float switches are free hanging into the wet well. The cables are held by special brackets mounted to the access cover frame. The clamps are designed to hold the cables without pinching or damaging them.

NOTE

The float switches should never be mounted in direct line of the influent flow.

The float switch consists of a mercury switch within an air-filled housing. The cable is permanently sealed to form a watertight unit (Figure 2-2). A mounting bracket is available with three or four float positions (Figure 2-3A). An alternate mounting method is shown in Figure 2-3B.

Make sure that the float switches do not tangle with each other, catch on pipes, ladders or brackets. This may cause erroneous ON and OFF signals.

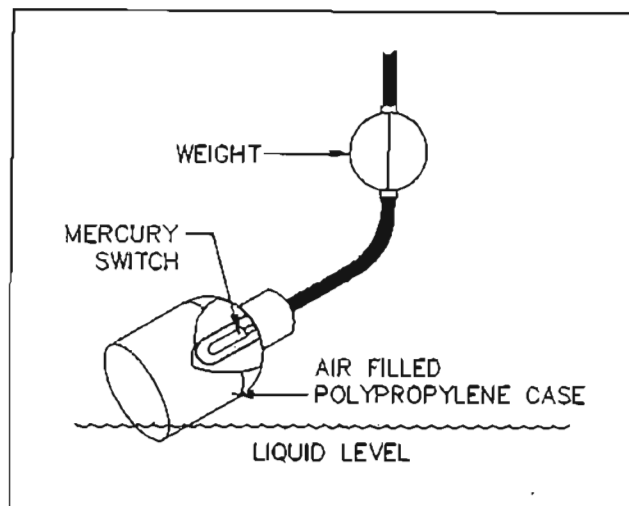


FIGURE 2-2
Mercury Float Switch

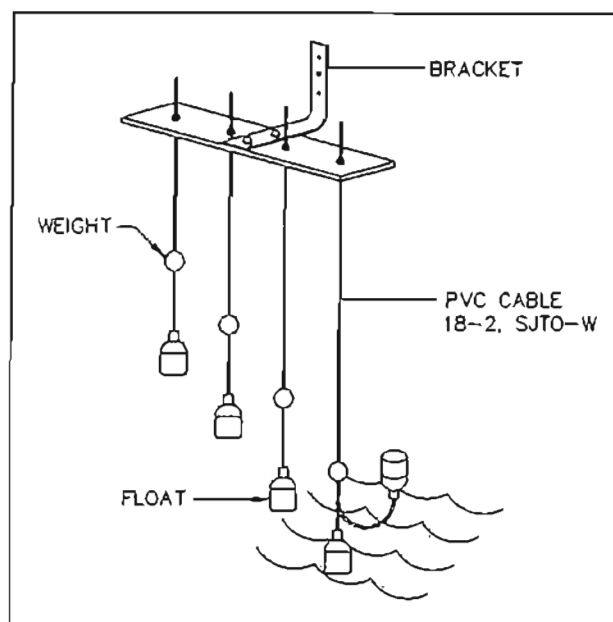


FIGURE 2-3A
Mounting Bracket Float Assembly

2-6-1 FLOAT SEQUENCE, SIMPLEX STATION

As the level of influent rises, and the "PUMP OFF" float is tilted - nothing is activated. As influent continues to rise inside the basin, the "PUMP ON" float is activated. This starts the pump. It will pump until the "PUMP OFF" float deactivates the pump. Should the liquid level continue to rise above the "PUMP ON" float, the "ALARM" float is activated and energizes the high level alarm light on the control panel.

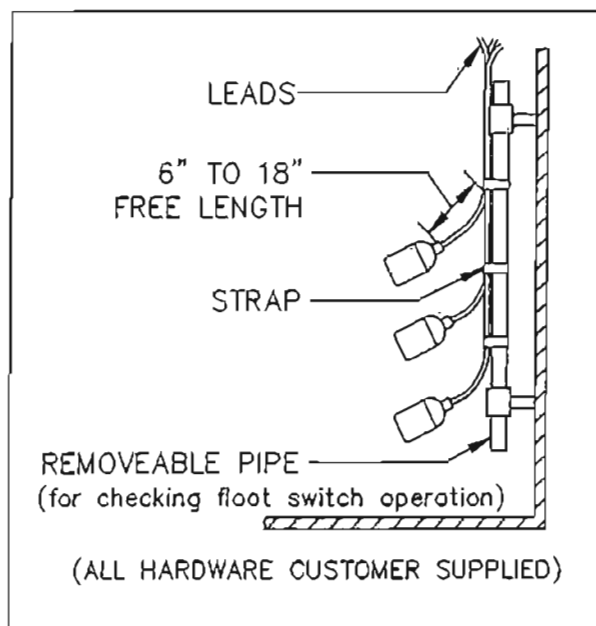


FIGURE 2-3B
Alternate Float Arrangement

2-6-2 FLOAT SEQUENCE, DUPLEX STATION

As level of influent rises, and the "PUMP OFF" float is tilted - nothing is activated. As influent continues to rise inside the basin, the "LEAD PUMP ON" float is activated and starts the lead pump. It will pump until the "PUMP OFF" float deactivates the pump.

On the next start, the opposite pump will be activated by the "LEAD PUMP ON" float. The pumps will then continue to alternate on each start. Should the fluid level continue to rise above the "LEAD PUMP ON" float, the "LAG PUMP ON" float will activate the lag (non-operating) pump and run both pumps until the "PUMP OFF" float deactivates both pumps.

Should the liquid level continue to rise above the "LAG PUMP ON" float, the "ALARM" float is activated and energizes the high level alarm light on the bottom of the control panel.

The engineering drawings will normally specify the levels at which the pump, or pumps, shall turn ON, turn OFF and the point of high level alarm, if required. If the various levels are not specified, the following guidelines should be adhered to in determining float switch locations.

SIMPLEX STATION

"PUMP OFF" - minimum level at top of pump motor housing.

"PUMP ON" - minimum level of 1 1/2 ft above "PUMP OFF" level.

"PUMP HIGH LEVEL ALARM" - minimum level of 1 ft above "PUMP ON", but below influent pipe.

DUPLEX STATION

"PUMP OFF" - minimum level at top of pump motor housing.

"PUMP ON" - minimum level of 1 1/2 ft above pump OFF level.

"LAG PUMP ON" - minimum level of 1 ft above lead pump ON.

"HIGH LEVEL ALARM" - minimum level of 1 ft above lag pump ON, but below influent pipe.

CAUTION!

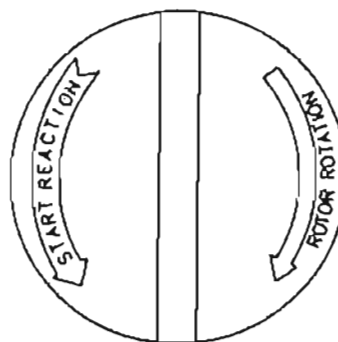
NO PUMP STATION SHOULD BE DESIGNED TO EXCEED 10 STARTS PER HOUR.

SECTION III

3-1 INITIAL START-UP

3-1-1 CHECKING THE IMPELLER ROTATION

After completion of the electrical service power connections to the pump, the direction of rotation should be checked when the pump is first used (also if moved to a new location). Incorrect direction of rotation will result in reduced discharge and can damage the pump.



The top portion of the pump motor housing contains a cast-in arrow and the words "START REACTION" which indicates the direction in which the pump should kick when it is started. This is the starting reaction. The impeller rotates in the opposite direction, indicated by a second arrow "ROTOR ROTATION".

To carry out this test, suspend the pump by the lifting chain and jog the motor. In the case of a fixed installation, this should be done before the pump is fixed in position. The electrical connection of the pump and the rotor rotation (direction of the rotation of the impeller) are correct if the pump (when starting and looking from above) makes a counter-clockwise start reaction (in the direction of the arrow "START REACTION").

CAUTION!

WHEN CHECKING PUMP ROTATION, BE AWARE THAT START REACTIONS (THE SPINNING OF THE ENTIRE PUMP BODY WHEN POWER IS APPLIED) CAN BE VIOLENT AND CAN CAUSE EQUIPMENT DAMAGE AND INJURY. TAKE PRECAUTIONS BEFORE APPLYING POWER. SECURE THE PUMP TO LIMIT THE REACTION, APPLY ONLY A SHORT BURST OF POWER, AND KEEP BYSTANDERS CLEAR.

If the pump should twist in the opposite direction of the arrow, the pump is now running backwards. Remove the main power to the control panel. Interchange the two pump power leads at the terminal strip. In a duplex station, be sure to check both pumps.

CAUTION!

DO NOT SWITCH INCOMING POWER SUPPLY LINE LEADS AS THIS WILL AFFECT ALL PUMPS IN A MULTIPLE INSTALLATION.

NOTE

If a single phase pump should run backwards, consult the ABS Product Service Department immediately. Do not operate the pump.

3-1-2 CURRENT UNBALANCE, THREE PHASE PUMPS ONLY

Upon ascertaining that the pump is rotating in the correct direction, the amount of current unbalance between phases must be calculated. Run the pump under water, checking that all the valves are open in the discharge lines to simulate normal operating load conditions.

CAUTION!

CURRENT UNBALANCE BETWEEN PHASES SHOULD NOT EXCEED 4%. CONSULT THE FACTORY WHEN CURRENT UNBALANCE EXCEEDS 4%. THE PERCENT OF CURRENT UNBALANCE IS DEFINED AND CALCULATED PER THE FOLLOWING EXAMPLE:

$$\% \text{ of current unbalance} = \frac{\text{max. current difference from average} \times 100}{\text{average current}}$$

Example

- Current readings in amps shall be taken on each phase at the control panel terminal strip:

$$T_1 = 10 \text{ amps, } T_2 = 10.5 \text{ amps, } T_3 = 10.5 \text{ amps}$$

$$2. \text{ The average current} = \frac{10 + 10.5 + 10.5}{3} = 10.33$$

$$3. \text{ The maximum current difference from average} = 10.33 - 10.00 = 0.33 \text{ amps.}$$

- The current unbalance for this particular three-phase hookup is 3.2%. If your unbalance between phases should exceed 4%, consult ABS Product Service Department immediately. Do not operate the pump. The results of this current unbalance calculation shall be entered on the "Product Start-Up Report".

3-1-3 INITIAL CURRENT CHECK, SINGLE PHASE PUMPS

CAUTION!

SINGLE PHASE PUMPS REQUIRE THE USE OF A SPECIAL SINGLE PHASE START CIRCUIT IN THE CONTROL PANEL. HOOKING A SINGLE PHASE MOTOR DIRECTLY TO POWER SUPPLY, WITHOUT USING THIS CIRCUIT, WILL DAMAGE THE MOTOR.

Run the pump under water, checking that all valves are open in the discharge lines to simulate normal operating load conditions. Take current readings on the control panel terminal strip on the "common" motor lead. The current draw should never exceed the value given on the nameplate of the pump as "F.L. Amps". If the measured value is higher than the rated "F.L. Amps" value, consult factory immediately.

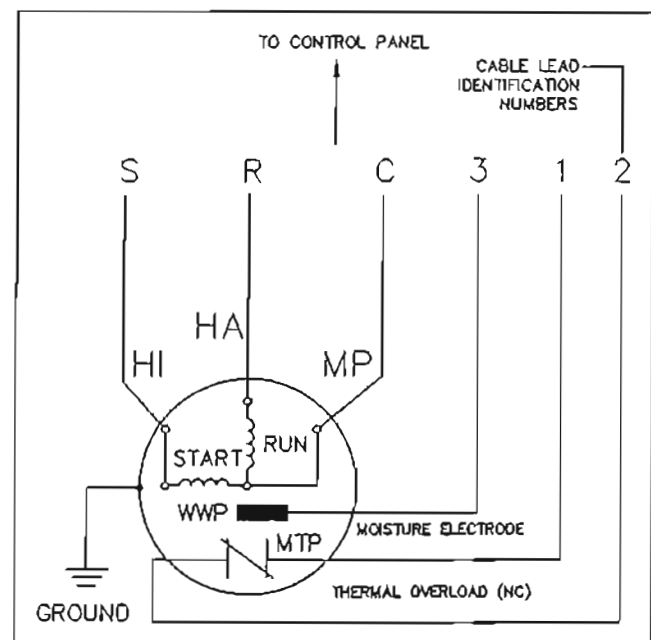


FIGURE 3-1
Pump Wiring Diagram
M18/4W, M28/4W, M40/4W
115/230 60 Hz 1 Phase

AFP SERIES PUMP MOTOR WIRING DIAGRAMS

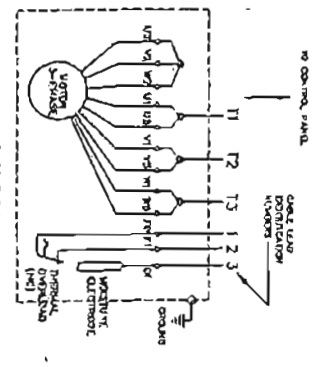


FIGURE 3-8
N1, M2, 2 & 4 Pole
Without Terminal Chamber
230V, 60Hz, 3Phase

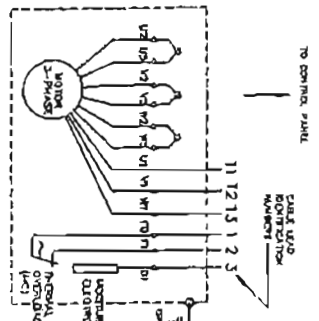


FIGURE 3-9
M1, M2, 2 & 4 Pole
Without Terminal Chamber
460V, 60Hz, 3Phase

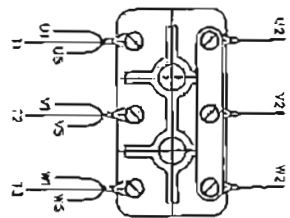


FIGURE 3-2
M1, M2, 2 & 4 Pole
With Terminal Chamber
230V, 60Hz, 3Phase

COLOR CODING
TERMINAL CHAMBER
ONLY

U1 RED
V1 BLUE
W1 WHITE
U2 ORANGE
V2 GREEN
W2 PINK
U3 YELLOW
V3 VIOLET
W3 BLACK
FO BROWN
DI GRAY

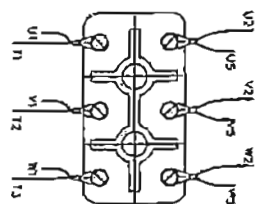


FIGURE 3-3
M1, M2, 2 & 4 Pole
With Terminal Chamber
460V, 60Hz, 3Phase

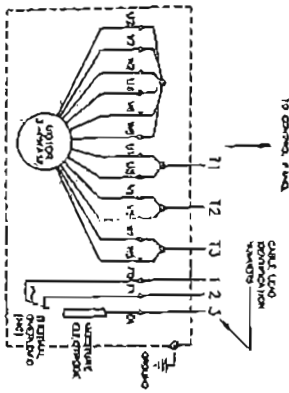


FIGURE 3-10
M1, M2, 6 Pole
Without Terminal Chamber
230V, 60Hz, 3Phase

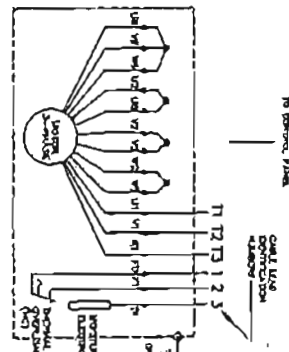


FIGURE 3-11
M1, M2, 6 Pole
Without Terminal Chamber
460V, 60Hz, 3Phase

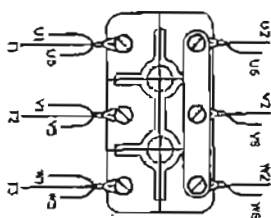


FIGURE 3-4
M1, M2, 6 Pole
With Terminal Chamber
230V, 60Hz, 3Phase

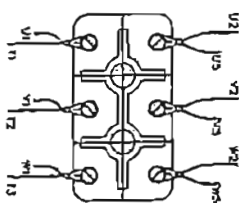


FIGURE 3-5
M1, M2, 6 Pole
With Terminal Chamber
460V, 60Hz, 3Phase

U1, V1 & W1 MUST BE
INTERCONNECTED USING
A WIRE BRIDGE. IT IS
ESSENTIAL THAT THE LEADS ARE CORRECTLY
ISOLATED FROM THE CONNECTION
CHAMBER HOUSING.

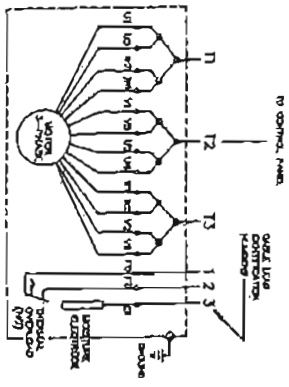


FIGURE 3-12
M1, 4 & 6 Pole
Without Terminal Chamber
230V, 60Hz, 3Phase

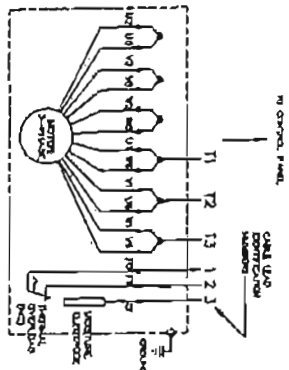


FIGURE 3-13
M1, 4 & 6 Pole
Without Terminal Chamber
460V, 60Hz, 3Phase

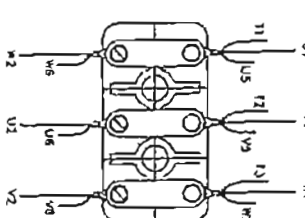


FIGURE 3-6
M1, 4 & 6 Pole
With Terminal Chamber
230V, 60Hz, 3Phase

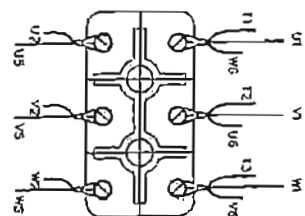


FIGURE 3-7
M1, 4 & 6 Pole
With Terminal Chamber
460V, 60Hz, 3Phase

SECTION IV

CAUTION!

PRIOR TO PLACING THE PUMP INTO OPERATION, A PRODUCT START-UP PROCEDURE SHALL BE ACCOMPLISHED BY AUTHORIZED PERSONNEL. FAILURE TO COMPLETE AND RETURN THE "PRODUCT START-UP REPORT" TO THE FACTORY WILL VOID THE WARRANTY. A COPY OF THIS REPORT IS FURNISHED WITH EACH PUMP.

4-1 GUIDE RAIL INSTALLATION

When the electrical service has been properly connected, the initial Start-Up Procedure completed, all control switches checked and the pump mechanically mounted in position, the operation of the pump is completely automatic. No operational procedures are required except to apply rated power to the pump. There are also no specific shut-down procedures beyond disconnecting the electrical power supply.

- a. ABS submersible pumps are fitted with a bracket which forms an integral part of the pump. A molded gasket is locked into position between the back of the bracket and the discharge face of the pump.
- b. The pump bracket slips over the upper guide rail bracket and the unit is lowered down the two inch guide rail into the wet well.
- c. As the pump is lowered into position an angled slot in the pump bracket hits a straightening vane which squares the pump with the mating flange of the guide rail base. The pump should be lowered at an angle until bracket ears engage as shown.
- d. When the pump is in position, the chain is slacked off. The weight of the pump is suspended by the two pump bracket ears which seat on the pedestal base. The ears also distribute the pump weight for compression of gasket against the mating flange of the guide rail base.

4-2 PORTABLE USAGE

When using the ABS AFP pump for portable service, care must be taken to prevent undue wear or damage. When using the pump on a soft muddy bottom, place a flat plate beneath the pedestal base to prevent the pump from burrowing itself into the mud or sand.

CAUTION!

NEVER RAISE, LOWER OR MOVE THE PUMP BY LIFTING WITH, OR PULLING ON, THE POWER CABLES. THE PUMP IS PROVIDED WITH A LIFTING EYE AND A CHAIN. THE LIFTING EYE SHOULD BE USED AT ALL TIMES WHEN MOVING THE PUMP.

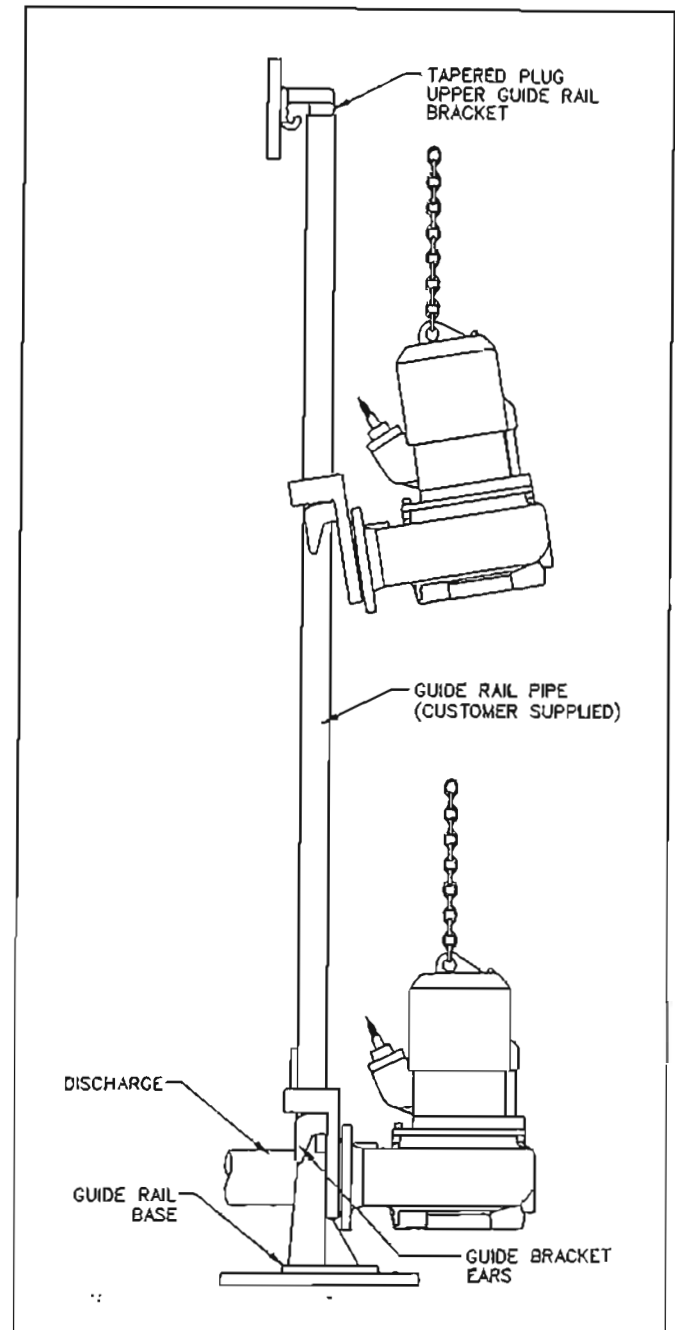


FIGURE 4-1
Guide Rail Installation

SECTION V

ABS pumps are designed for long lasting, efficient and reliable service with a minimum number of preventative maintenance checks. These checks are few but will add years of satisfactory service to the life of the pump. Maintenance checks should be performed at approximately the intervals stated below (the actual time interval will depend on the operating environment).

5-1 MAINTENANCE NOT REQUIRING REMOVAL OF THE PUMP

5-1-1 PUMP WASH-DOWN

The build-up of sludge on the pump body prevents the efficient dissipation of heat from the motor. This internal heat rise can shorten the life of the motor. It is therefore recommended that at six month intervals the pump be washed down with a pressure hose.

5-1-2 FLOAT SWITCH CLEANING

The build-up of fats, grease, and sludge on the float switches may cause them to function improperly. The float switches should be checked for sludge build-up at three month intervals. They may be lifted from the pit and cleaned, or cleaned in place if they are anchored to structural parts of the station. After cleaning, they should be visually inspected and worked in sequence to check pump operation. See Section 2-6.

5-2 MAINTENANCE REQUIRING REMOVAL OF THE PUMP

NOTE

Explosion-proof pumps must be serviced by a factory authorized service center in order to maintain their explosion-proof rating. Parts used in the repair of explosion-proof pumps must be factory supplied, or authorized equivalents.

NOTE

See Section 1-2 for definition of motor frame sizes.

NOTE

Refer to Figures 5-6 and 5-7 for assembly drawings.

CAUTION!

NO REPAIRS SHALL BE MADE TO THE PUMP DURING WARRANTY PERIOD WITHOUT PRIOR FACTORY APPROVAL. TO DO SO MAY VOID THE WARRANTY. ANY REPAIRS SHALL BE MADE BY AN AUTHORIZED SERVICE REPRESENTATIVE.

To remove the pump assembly from the sump basin, first *shut off and lock out the electric power to the pump*. Close the discharge gate valve. Using the lifting chain, raise the pump along the guide rail and lift out of the wet well. If the pump is checked right outside the tank, it is not necessary to disconnect the cable. If the

pump is to be moved away from the wet well, the cable must be disconnected.

CAUTION!

IT IS EXTREMELY IMPORTANT THAT UNDER NO CIRCUMSTANCES THE PUMP BE LIFTED USING THE POWER CABLE.

UNDER NO CIRCUMSTANCES SHOULD TOOLS BE APPLIED TO THE PUMP AND MOTOR WITHOUT THE POWER TO THE CONTROL BOX BEING DISCONNECTED AND LOCKED OUT.

5-2-1 SEAL OIL CHECK

The seal oil in the oil chamber should be checked at yearly intervals or when the seal alarm signal is given.

1. Lay the pump in a horizontal position with the oil fill plug (76) upwards. Clean around the plug.
2. Remove the plug (76) and fiber washer (77). The oil level should be approximately 20mm (3/4 inch) below the counterbore.
3. Drain off a small quantity of oil. If the oil is in a clean condition, no further checks are necessary. Replenish the oil and replace the plug using a new fiber washer (77).
4. If the oil has become discolored or emulsified, i.e., milky looking, drain off all the oil, flush the chamber, and refill with the correct quantity of new oil (108). See Section 5-2-22 for correct type and quantity of oil.
5. A further check must be made after an interval of three weeks. If the oil has again become discolored, the lower mechanical seal and possibly the upper mechanical seal should be replaced. The motor housing should be removed to inspect for water entry. See Section 5-2-3.

5-2-2 COOLING JACKET REMOVAL

It may be beneficial to remove the cooling jacket before any repairs are made to the pump.

1. Place the pump vertically on workbench making sure it is well supported.
2. Unscrew and remove the 3 hex head fixing screws (61) and washers (256).
3. Grasp cooling jacket (59) firmly and remove by hand. Place on workbench next to pump.
4. Remove 2 cooling pipes (208), O-ring (64) and gasket (63).

5-2-3 MOTOR HOUSING REMOVAL AND MOTOR INSPECTION

1. With the pump vertical on workbench remove 4 Allen screws (68) holding the motor housing (55) to the oil chamber (121).
2. Lift the motor vertically about 1 inch above the bench.
3. Tap gently to free the O-Ring (80) compressed between oil chamber (121) and motor housing (55) until the lower half of the pump drops down from the motor housing.
4. Disconnect the seal probe (di-electrode) wire from the seal probe. Slide the motor housing (55) up, and off the rotor (65).

5-2-4 LOWER MECHANICAL SEAL REMOVAL

1. Drain off the oil (108)-see Section 5-2-1.
2. Remove the volute (149) by removing 4 socket head screws (150) securing it to the oil chamber. If the volute does not release easily, lift the pump a short distance off the bench and tap the volute all around until it releases. Lay the pump on its side.
3. Remove the impeller bolt (144) (right hand thread), lock washers (145), and impeller washer (143). The impeller (146) can now be pulled from the shaft. It may be necessary to pry gently between the impeller and the housing to dislodge the impeller. Use caution when prying so as not to damage the impeller, shaft, or housing.
4. Remove the impeller key (66).
5. Remove the circlip (140) retaining the mechanical seal (138). Apply oil to the shaft to aid in sliding the mechanical seal off the shaft.
6. The sealing faces of the mechanical seal are very hard and brittle. Use care to avoid damaging the faces. Using fingers or two small screw drivers, carefully pry the rotating portion of the mechanical seal off the shaft. Refer to Figure 5-1.
7. The stationary portion may be removed from the housing by gently prying with two small screw drivers. The stationary portion may also be removed at a later time if it will not come out easily by prying. Refer to Figure 5-1.

5-2-5 OIL CHAMBER REMOVAL

1. Once the oil is drained, and the lower mechanical seal is removed, the oil chamber (121) may be removed.
2. Stand the motor vertically on the bench with the oil chamber resting on two boards thick enough to prevent the shaft from touching the bench top.

3. Remove four socket head screws (68) securing the oil chamber to the motor housing (55).
4. Tip the motor on its side, supporting the motor housing with blocks of wood. Tap the oil chamber away from the motor housing with a dead blow hammer to unseat the O-rings. Slide the oil chamber off the shaft (65).

5-2-6 ROTOR REMOVAL

1. With the motor on its side, thread an impact puller (dent puller) into the tapped hole in the end of the shaft. A suitable impact puller may be fabricated using a piece of threaded rod whose thread matches that of the tapped hole, and a weight with a clearance hole bored through.
2. Using the puller, tap the rotor (65) and bearing lid (67) assembly loose from the motor housing (55). Once the bearing lid is unseated from the bore in the motor housing, draw the assembly out of the motor housing approximately 2 inches to gain access to the seal probe wire. Unplug this wire from the connector by pulling straight out.
3. Slide the rotor assembly the rest of the way out of the motor housing being careful not to damage the stator winding (254).

5-2-7 REMOVAL OF UPPER MECHANICAL SEAL AND TRANSITION PIECE

1. Remove circlip (107).
2. Remove the rotating metal seal ring, together with its O-Ring. A piece of shim stock slid under the O-Ring of the seal, and wrapped around the shaft will aid in sliding the O-Ring over the circlip grooves in the shaft.
3. On large frame motors (M2-M3), remove the transition piece (102) by removing the 4 Allen screws (103). Remove the transition piece O-Ring (105).
4. Press the stationary seal out of the transition piece.
5. On small frame motors (M1), pry the stationary portion of the seal out of the bearing lid (67).

Alternate Arrangement

In certain assemblies an alternate arrangement is used to separate the oil chamber from the motor housing. In lieu of an upper mechanical seal an upper lip seal is used. To disassemble the lip seal, the following instructions should be used.

1. On large frame motors (M2-M3), remove the transition piece (102) by removing the 4 Allen screws (103). Remove the transition piece O-Ring (105).

2. Pry the upper lip seal (274) out of the transition piece.
3. On small frame motors (M1), pry the lip seal out of the bearing lid (67).

5-2-8 BEARING LID AND LOWER BEARING REMOVAL

1. Remove the shaft circlip (273). Be careful not to scratch the shaft.
3. Support the bearing lid (67), and press the rotor shaft assembly out of the bearing.
4. Press the double row ball bearing (96) out of the bearing lid (67). Apply pressure to only the outer race of the bearing.
5. On large frame motors (M2), remove the bearing support washer (272).

5-2-9 CABLE REPLACEMENT (STANDARD & EXPLOSION-PROOF)

CAUTION!

REPAIR OR REPLACEMENT OF EXPLOSION PROOF STATORS AND CABLES MUST BE PERFORMED BY A FACTORY AUTHORIZED SERVICE REPRESENTATIVE.

Do NOT attempt to make repairs to the assembly as safety regulations could be violated and the installation could become hazardous. Replacement MUST be performed by a factory authorized service representative.

Removal

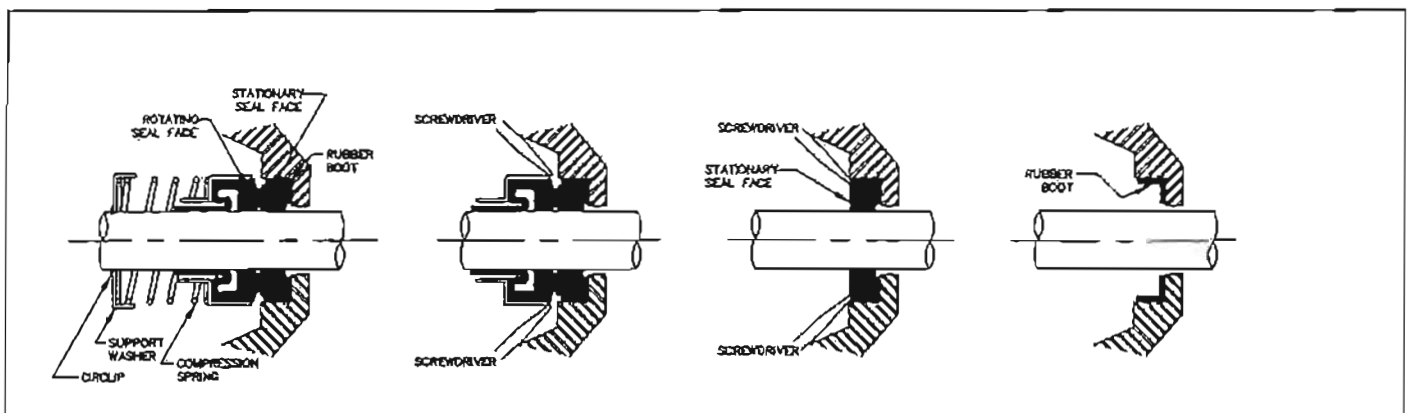
1. Remove motor housing per Section 5-2-3.
2. Disconnect ground wire from housing body. Clip stator leads close to crimp connectors.
3. Remove 4 Allen screws (313). Pull out cable cap (23) along with cable (26) and sealing grommet (315) and support washer (316).

Installation

1. To replace cable, thoroughly clean cable cap and cable entry bore. Install cable cap (23) on cable along with cable seal (315) and support washer (316). Reconnect cable leads per wiring diagram and push assembly into motor housing (55). Secure with 4 Allen screws (313) and reconnect ground wire to motor housing.

5-2-10 STATOR REPLACEMENT

1. Stators are pressed into the motor housing and cannot be removed by heating. If the stator winding is damaged and requires replacement, contact the ABS Product Service Department. ABS stocks replacement stators in housings for all AFP motors.
2. When reconnecting a replacement stator, tuck/tie all leads in neatly to avoid having leads contact any rotating parts inside the motor.



1. Remove the circlip (273) underneath the support washer.
2. Remove the support washer and compression spring. Clean the shaft thoroughly and coat with seal oil.
3. Using two screwdrivers 180° apart, pry the rotating seal face away from the stationary seal face.
4. With a continuous twisting motion, pull the seal face along the shaft.
5. Using two screwdrivers 180° apart, pry the stationary seal face out from the rubber boot.
6. Remove the rubber boot from the housing.

FIGURE 5-1
Lower Mechanical Seal Dismantling Sequence

5-2-11 CABLE INSTALLATION

1. Cable installation is a direct reversal of the removal sequence. There should be about 15mm (9/16") of the outer jacket projecting inside the housing after tightening the cap securing screws (313). Always use a new cable seal (315).
2. If a connection chamber is not fitted, the leads are crimped in the correct order with insulated connectors, checking each crimp for security.
3. The ground is attached to the tapped hole provided on the housing side using special washers and a slotted screw (8).
4. The di-electrode wire is left loose for the present time.
5. If a connection chamber is fitted, connect wires to terminal board (50) according to wiring diagram.

5-2-12 CONNECTION CHAMBER REPLACEMENT

Refer to Connection Chamber Cross Section on page 33.

Removal

1. Remove 4 Allen screws (338) and spring washers (339). Remove chamber lid (336).
2. Disconnect wires from terminal board (50) by removing hex nuts.
3. Remove 2 Allen screws (230) and washers (231). Remove terminal board.
4. Remove 4 Allen screws (334) and spring washers (335).
5. Remove connection chamber (333).
6. Slice around silicone seal (if present) with a sharp knife and remove grommet (343).
7. Thoroughly clean surfaces of connection chamber (333).

Installation

1. Feed wires through grommet (343). Position grommet in motor housing (55).
2. Install 4 Allen screws (334) and spring washers (335), secure connection chamber (333) to motor housing (55).
3. Install terminal board (50) using 2 Allen screws (230) and washers (231).
4. Connect wires to hex terminal board according to wiring diagram with nuts and jumpers. Connect ground wire to housing with hexagon head screw (52) and spring washer.

5. Inspect O-Ring (337), replace if damaged. Brush O-Ring with oil and install chamber lid (336) with 4 Allen screws (338) and spring washers (339).

5-2-13 BEARING LID INSTALLATION

1. Thoroughly clean the bearing lid (67).
2. For M2 motors, insert washer (272) into bore of bearing lid (67).
3. Apply grease to bearing (96). Pack the grease from both sides of the bearing.

Recommended greases:

Chevron SRI	Amoco Rykon Premium #2
Exxon Unirex N2	Texaco Premium RB
Lubriko AC#2	Lubriko LM206

NOTE

To avoid damaging the bearing apply pressure to only the outer race of the bearing.

4. Using a suitable pressing tool, press bearing into lid.
5. For M1 motors, insert washer (272) and install circlip (100).
6. Place bearing lid face up in press with inner race of bearing supported by a suitable piece of pipe.
7. Press rotor shaft (65) into bearing lid (67) until seated. Install circlip (273) onto shaft.

5-2-14 INSTALLATION OF UPPER MECHANICAL SEAL AND TRANSITION PIECE

1. Clean the transition piece (102) thoroughly.
2. Using soapy water, lubricate the outside of the rubber boot of the stationary seal assembly (106). Do not touch the tool steel/carbon seal face. Insert seal into the transition piece (102).
3. Install new transition piece O-Ring (105), and place the transition piece into the bearing lid (102). M2 only: Secure with the 4 Allen screws (103) and spring washer (104); apply pressure evenly.
4. Apply water/soap solution on the seal rubber skirt and install the new rotating seal ring on the shaft so that the polished face mates with the tool steel/carbon face of the stationary seal. Take care not to cut the rubber skirt or O-Ring on the circlip groove.
5. Install circlip (107). Compress the mechanical seal assembly in order to properly seat the circlip.

Alternate Arrangement**Installation of Upper Lip Seal and Transition Piece.**

1. Using soapy water, lubricate the outside of the rubber outer housing of the lip seal (274). Position the lip seal with the flat side towards the motor and insert it into the transition piece (102). Press it in until it seats in the bottom of the housing.
2. Install a new transition piece O-Ring (105), and place the transition piece into the bearing lid (67). M2-M3 only: Secure with the 4 Allen screws (103) and spring washers (104) apply pressure evenly.

5-2-15 OIL CHAMBER INSTALLATION

1. Thoroughly clean the oil chamber (121) shaft and transition piece (102) bores and rotor shaft (65).

NOTE : A new O-Ring (126) must be used.

2. Place the oil chamber (121) on the press table. Brush oil around the inside diameter to facilitate fitting the lid.
3. **Installation with cooling jacket**
Position bearing lid (67) with location boss (M2-M3 motor)/location recess (M1 motor) in line with centerline of bolt hole located next to cooling pipe return port (port on mounting foot without "V" mark). See Figure 5-2.

Installation without cooling jacket

Position bearing lid (67) with location boss (M2-M3 motor)/location recess (M1 motor) in line with centerline of bolt hole located next to oil fill plug. Refer to Figure 5-3.

5-2-16 MOTOR HOUSING INSTALLATION

1. Position oil chamber/shaft assembly with oil fill plug facing you.
2. Loop a new O-Ring (80) over the oil chamber diameter. Brush with oil.
3. Suspend the motor housing/stator assembly over the oil chamber/shaft assembly.
4. **Installation with cooling jacket**
Position motor housing mounting foot with "V" mark in line with "V" mark cast on the oil chamber mounting foot with cooling pipe fill port. Refer to Figure 5-2.

Installation without cooling jacket

Position motor housing mounting foot with "V" mark in line with "V" mark cast on the oil chamber mounting foot with cooling pipe fill port. Refer to Figure 5-3.

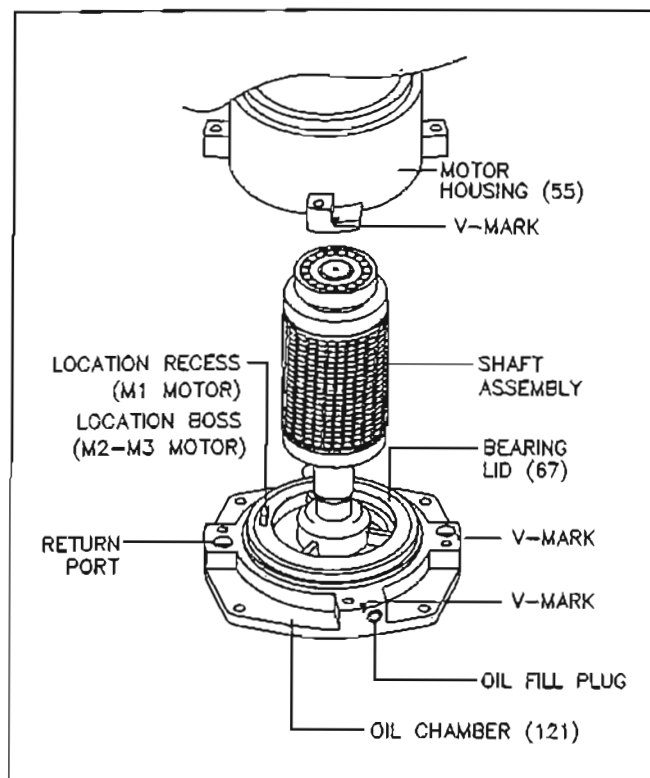


FIGURE 5-2
Motor Housing Arrangement - Cooling Jacket

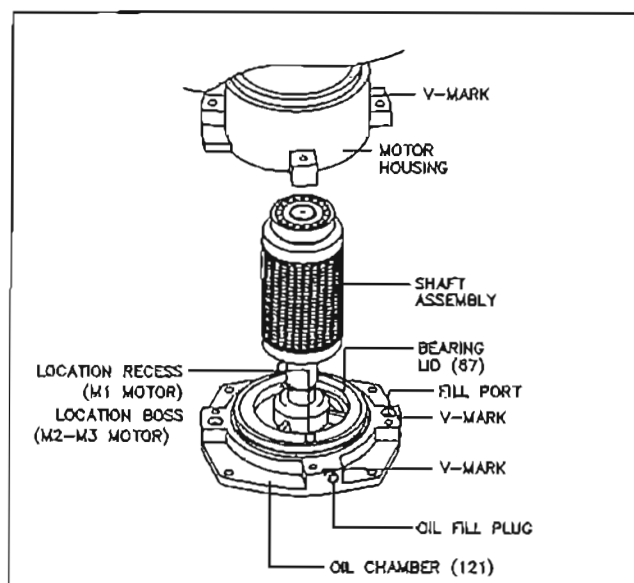


FIGURE 5-3
Motor Housing Arrangement - No Cooling Jacket

NOTE

It is critical that the location boss/recess on the bearing lid (67) be properly aligned with location boss on motor housing (55). This keeps bearing lid (67) from rotating counterclockwise, which prevents the seal probe wire from wrapping around the rotor assembly (65).

5. Lower motor housing assembly to within about 3 inches of the oil chamber (121).
6. Connect two ends of seal probe wire.
7. Lower motor housing (55) to oil chamber (121), ensuring that:
 - a. The "V" marks are lined up properly
 - b. The O-Ring is not pinched
 - c. Seal probe wire is not pinched
8. Insert and tighten 4 Allen screws (68) and washers (69).

5-2-17 COOLING JACKET INSTALLATION

1. Lubricate both ends of cooling pipes (208) with soapy water and position in holes located on oil chamber (121).
2. Place O-ring (64) over motor housing and position on middle rib. Apply grease to O-ring.
3. Place flat gasket seal (63) on top of motor housing with screw holes in line.

NOTE

In order for cooling jacket to function properly, the risers must be positioned as shown in Figure 5-4. The return riser must be positioned adjacent to the cable entry.

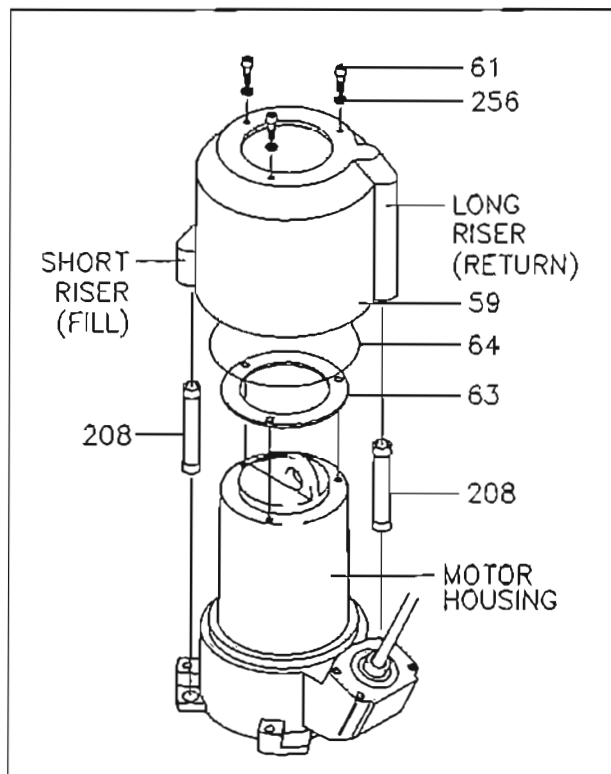


FIGURE 5-4
Cooling Jacket Alignment

4. Referring to Figure 5-4, position cooling jacket (59) over motor housing (55) making sure cooling pipes (208) are in line with fill and return holes.

Lower jacket until cooling pipes (208) are fully seated in place.

5. Secure cooling jacket (59) to motor housing (55) with 3 hex head fixing screws (61) and washers (256).

5-2-18 LOWER MECHANICAL SEAL INSTALLATION

1. Coat both faces of the mechanical seal with 10W oil.
2. Coat the rubber boot of the stationary part of the mechanical seal (138) with soapy water.
3. Press into position using a clean, lint free rag and both thumbs. Do not use hard or sharp tools on a mechanical seal.
4. Coat the rubber boot of the rotating half of the mechanical seal with soapy water.
5. Slide the rotating part of the seal into position using finger pressure only.
6. When the complete seal assembly is in place, slide the backup washer up against the seal, compress the seal spring, and install lock circlip (140).

5-2-19 IMPELLER REPLACEMENT

1. Place the impeller key (66) in keyway on shaft (65).
2. Coat the impeller bore and shaft with anti-seize compound. Tap the impeller (146) into position.
3. Apply thread locking compound to impeller bolt threads.
4. Insert impeller securing washer(s) (143) and the Allen screw (144) and tighten.

5-2-20 VOLUTE REPLACEMENT

Vortex Models

Oil and loop a new O-Ring (133) over the oil chamber end. Push the volute (149) onto the oil chamber with the discharge in line with cable entry. Install Hex screw (150) and spring washer (151) to secure volute.

CB Models

Push the volute onto the oil chamber with the discharge in line with cable entry. Install Allen screws (150) and lock washers (151). Install the bottom plate (163) into volute per the following section, 5-2-21.

5-2-21 BOTTOM PLATE ADJUSTMENT

1. *Push bottom plate (163) into position on the volute (149).
2. Hold bottom plate (163) in position with one hand, check the gap between the impeller blade and bottom plate with a feeler gauge. The correct gap is 0.4-1.0mm (.010-.025 in).

*For dry pit models, loop a new O-Ring (164) onto the bottom plate.

3. The gap is adjusted by turning the brass adjusting screws (265) one half turn at a time until the gap is even all around.
4. Insert and tighten the 4 Allen screws (266) through the brass screws (265). Re-check the gap and adjust if necessary.

5-2-22 OIL REPLACEMENT

1. Once the pump is assembled the oil chamber may be filled.

NOTE

Use Only 10W High Detergent Oil.
Consult factory if non-toxic oil is required.
Do not put oil in motor housing.

Oil Chamber Capacity:

M1	M13/4W, 15/6, 18/4W, 28/4W M15/4, 22/4 25/4, M35/4	See parts legend
M2	M40/4W, 46/4, 70/4, 80/2 M105/4, 90/4, 35/6, 125/2	See parts legend
M3	M130/4, 185/4, 210/4, 200/2, 230/2 M130/6, 160/6	See parts legend

5-3 COOLING JACKET RETROFIT

An existing AFP1 Pump without a cooling jacket can be retrofitted to accommodate one. This is easily accomplished by repositioning the motor housing (55) and bearing lid (67).

1. Position pump upright on workbench with discharge and cable entry facing towards you.
2. Remove 3 set screws from top of motor housing (55) and set aside. With a cooling jacket installed, these are no longer needed for the assembly of the pump.
3. Remove all 4 Allen screws (68) that hold motor housing (55) to oil chamber (121).
4. Lift motor housing (55) up approximately 3" to clear location recess/boss on perimeter of bearing lid (67).
5. Rotate the motor housing (55) 90° clockwise so that the "V" cast on the motor housing (55) lines up with the "V" cast on the oil chamber (121). Refer to Figure 5-5.
6. **Small Frame Motor (M1)**
Rotate bearing lid (67) 90° clockwise in the same direction as the motor housing (55). This is to allow the location boss on the motor housing (55) to properly align with the location recess on the bearing lid (67). See Figure 5-5.

NOTE

It is critical that the location boss be seated in the location recess. This keeps bearing lid (67) from rotating counterclockwise, which prevents the seal probe wire from wrapping around the rotor assembly (65).

Large Frame Motor (M2-M3)

Rotate bearing lid (67) 90° clockwise in the same direction as the motor housing (55). This is to allow the location boss on the motor housing (55) to properly align with the location boss on the bearing lid (67). See Figure 5-5 for correct alignment.

NOTE

It is critical that the location boss on the bearing lid (67) be properly aligned with location boss on motor housing (55). This keeps bearing lid (67) from rotating counterclockwise, which prevents the seal probe wire from wrapping around the rotor assembly (65).

NOTE

If there is any difficulty moving the bearing lid it is advisable to remove the motor housing (55) and drain the oil from the oil chamber (See Section 5-2-1) and to remove the lower mechanical seal (See Section 5-2-3). This will help to loosen the bearing lid. To replace mechanical seal and oil consult Section 5-2-18 and 5-2-22.

7. Lower motor housing (55) to oil chamber (121), ensuring that:

- a. The "V" marks are lined up properly
- b. The O-Ring is not pinched
- c. Seal probe wire is not pinched

Insert and tighten 4 Allen screws (68) and spring washers (69).

8. Remove the rubber plugs (210) from newly revealed holes in oil chamber (121) and put aside. These are no longer required in the assembly of the pump.
9. Remove 4 hex head screws (150) and washers (151) from oil chamber (121).
10. Suspend motor assembly (motor housing & oil chamber) about 2" above volute (149).
11. Rotate motor assembly so discharge and cable entry are in line. Lower motor assembly into the volute (149).
12. Insert and tighten 4 Allen screws (150) and washers (151).
13. Refer to Section 5-2-17 for cooling jacket installation.

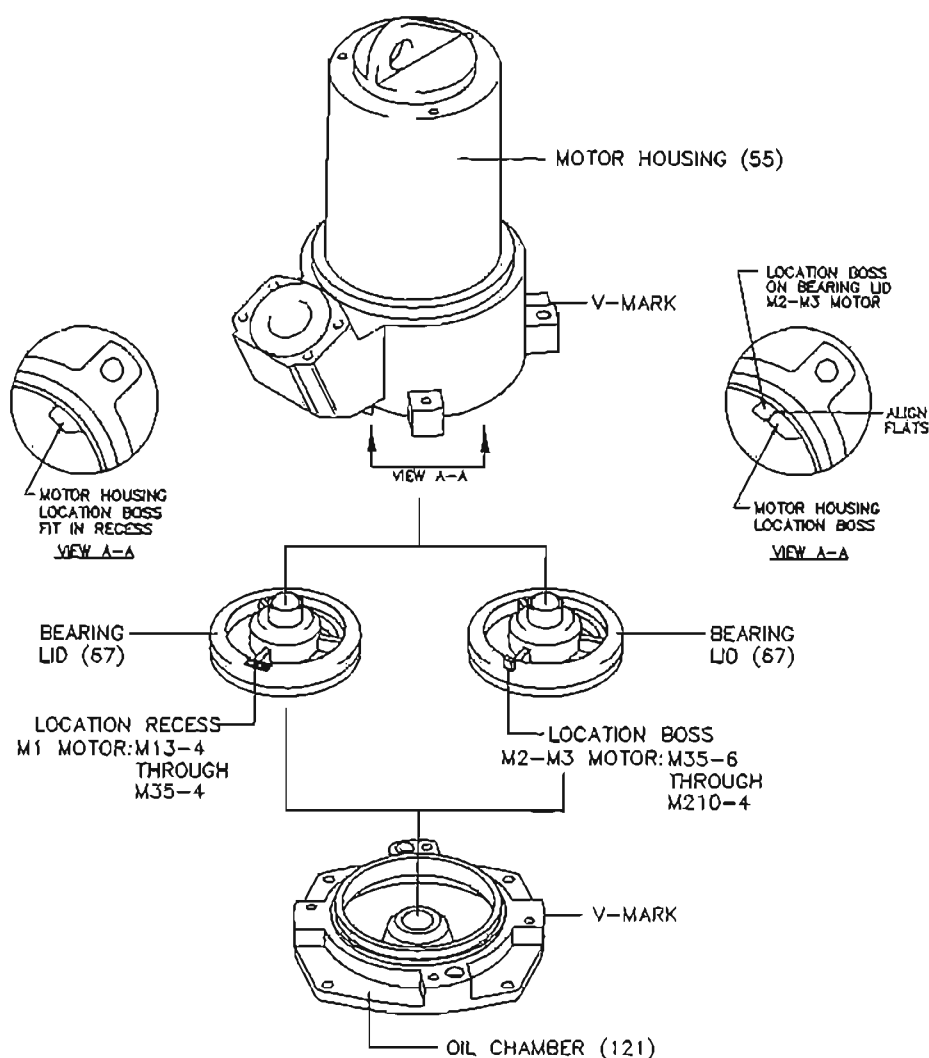


FIGURE 5-5
Cooling Jacket Retrofit

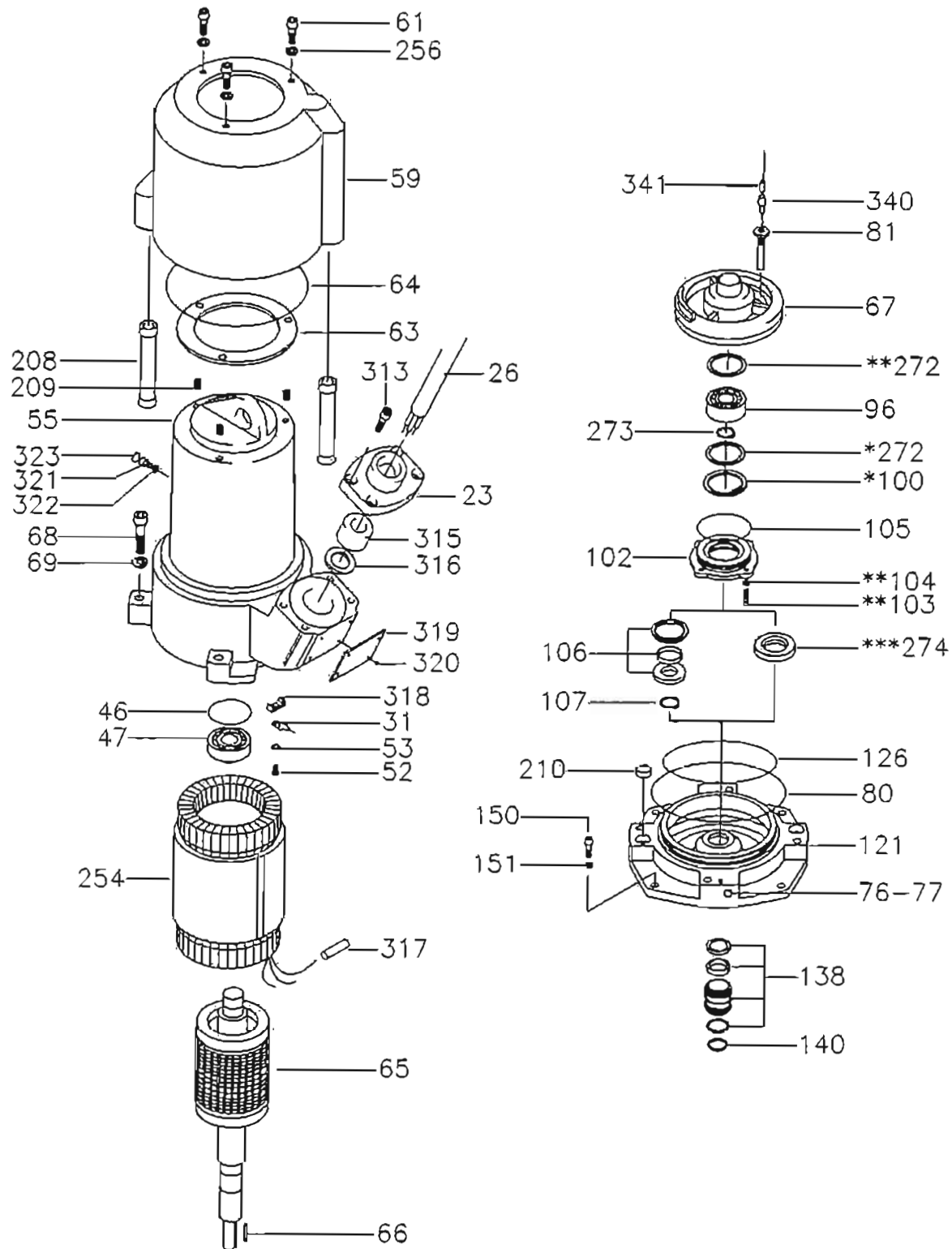
5-4 HELPFUL HINTS FOR ON-SITE INSPECTION AND SERVICING OF PUMPS

There are many checks which can be carried out on-site without the necessity of transporting the pump to a workshop. These are listed below to aid the service technician.

1. Check direction of rotation - see Section 3-4-1.
2. When pump is fully submerged and running under normal conditions, check the current draw. Compare with nameplate or technical data and check setting of overload in control panel.
3. Check the function of the seal probe (di-electrode). Is the warning signal on? Is the probe functioning? This can be checked by placing a jumper lead between the #3 control lead from the pump and ground. This simulates water in the oil chamber.
4. Check float switches and cables for accumulations of dirt, grease, etc. Carefully wash off floats. Check operation as indicated in Section 2-6.
5. Check cables for damage
6. Sump/well cleaning: When cleaning the pump, the opportunity to remove any build-up of sediment/sludge in the sump bottom should be taken. Loosen the sediment with a spade, and shovel it towards the pump. Add water and pump the loose sediments away, repeating until well is clean.

7. Check control panel for functioning. Note any faults and also check for moisture or corrosion.
8. Check the function of check valves.
9. Stator check: The stator windings can be checked for continuity via the cable ends.
10. Meg-Ohm resistance test: This is done between pump body or ground connection and power leads. The resistance should be in the 50-100 meg-ohm range.
11. After raising and cleaning the pump, it is recommended that the impeller be inspected and the gap measured. See Section 5-2-21 for adjustment method.
12. Seal oil check: See Section 5-2-1. If the oil is good, simply replenish the amount (within 20mm or 3/4" of the plug screw). Use a new fiber washer when replacing plug. (Do not overfill with oil - an air pocket is needed to compensate for heat expansion).
13. Head and flow check: In certain cases pressure gauges are installed which measure pressure in the pump discharge line. These are mainly used to indicate fall-off in head pressure. Direct comparison to the pump performance curve is difficult as:
 - a. The head will vary as the water level falls.
 - b. The discharge may vary depending on valve settings. However, regular recording of the head will indicate that impeller/bottom plate adjustment may be needed or that a check valve is allowing back flow in a duplex station.

Regular recording of the pressure readings will help in determining the condition of the pump unit and piping system.



* M1 ONLY

** M2-M3 ONLY

*** OPTIONAL, MAY BE USED IN PLACE OF MECHANICAL SEAL (106)

FIGURE 5-6
Motor Assembly

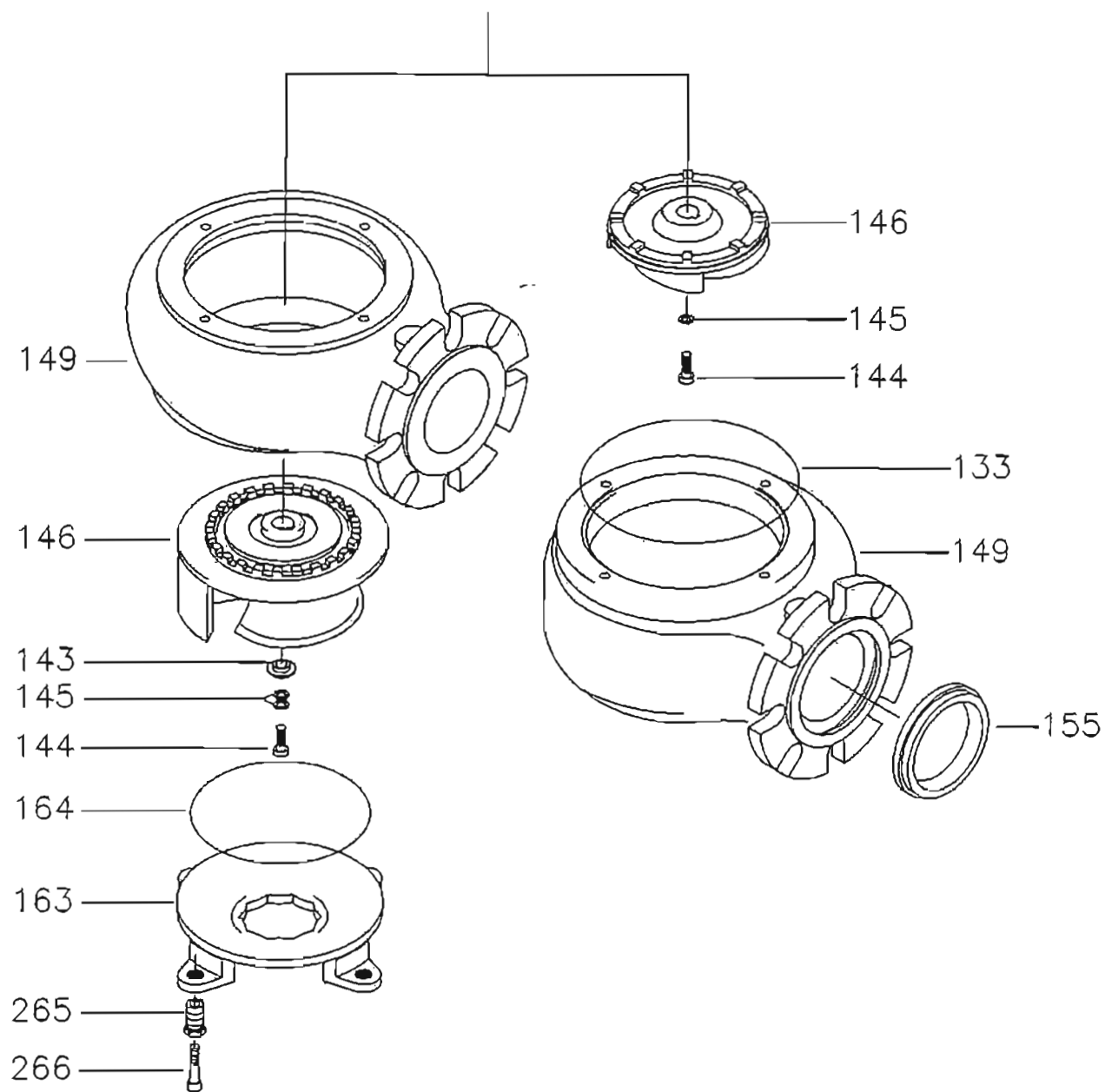


FIGURE 5-7
HYDRAULIC ASSEMBLY

SYMPTOM	POSSIBLE CAUSE	ACTION
1. PUMP WILL NOT START	A. Power supply failure B. Burned-out fuse or tripped circuit breaker C. Damaged power cable D. Level switch failure E. Jammed impeller F. Water inside motor G. Foreign matter build-up	A. Check Power Supply Check electrical system for loose connections Check operating voltage between the three power lines-three phase Check operating voltage between terminals L1 and L2-single phase. B. Check circuit protectors, reset circuit breakers C. Check external cable for damage - repair D. Check level switches E. Inspect and remove jamming object F. Refer to symptom 8 and 9 G. Clean floats carefully
2. REPEATED TRIPPING	A. Circuit protection underrated B. Phase current unbalance C. Pump connected to incorrect voltage D. Wet or Damaged wiring E. Obstruction in pump F. Incorrect rotation G. Shorted motor	A. Check rating and replace with proper size B. Check amp draw C. Verify connections. See wiring diagram D. Inspect external cable, replace if worn or damaged. E. Remove obstruction F. Check rotation per Section 3-1-1 G. Check motor for shorts using a meggar
IF SYMPTOMS CONTINUE, CONSULT ABS PRODUCT SERVICE DEPARTMENT		
3. PUMP RUNS IN "HAND" BUT NOT IN AUTOMATIC MODE	A. Bad "OFF" float switch B. Bad "ON" float switch	A. Install wire jumper between "OFF" switch terminals. If pump starts to run replace the "OFF" float switch. B. Install wire jumper between "ON" float terminals. If pump starts to run replace the "ON" float switch.
4. PUMPS RUN SEPARATELY BUT NOT TOGETHER (DUPLEX OPERATION)	A. Faulty lead pump float switch B. Faulty lag pump float switch C. Foreign matter build up on float	A. With power off, invert each float switch. Check leads for continuity. Replace failed switch. B. Same as Action A C. Clean floats
5. PUMP WILL NOT SHUT OFF	A. Float switch failure B. Control panel failure	A. With power off, check float switches for continuity. B. Check control panel schematic drawing
6. HIGH LEVEL ALARM DOES NOT COME ON	A. Faulty high level alarm switch	A. Install wire jumper between alarm terminals. Replace high level alarm float switch.
7. LOW FLOW	A. Incorrect pump rotation B. Liquid level in pit too low, air bound C. Obstruction in pump or piping D. Partially closed valve(s) E. Bottom plate gap too large	A. Check rotation per Section 3-1-1 B. Check liquid level and location of level switches. C. Remove obstruction. D. Check and adjust valve E. Adjust bottom plate gap per Section 5-2-21
8. WATER IN OIL CHAMBER	A. Loose or damaged oil plug B. Mechanical Seal Failure	A. Check plug - replace B. Replace mechanical seal per Section 5-2-4
9. WATER INSIDE MOTOR CASING	A. Damaged upper lip seal or mechanical seal B. Damaged O-ring between oil chamber and motor casing. C. Cut in jacket of power cable D. Water wicking down power cable from wet well junction box	A. Replace seal per Section 5-2-7 & 5-2-14 B. Replace O-ring C. Inspect and replace as necessary D. Dry and reseal junction box. Replace power cable

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Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
23	31320129		1	Cable cap	Kabeleinführung	Entree de cable	GG20	AFP M15/6-M35/4 Std.	
23	21325001		1	Cable cap	Kabeleinführung	Entree de cable	1 4408	AFP M15/6-M35/4 SX	
26	12100093		1	Cable	Kabel	Cable	7x1.5mm	10m, 20m, 30m	
26	12100044		1	Cable	Kabel	Cable	10x1.5mm	10m, 20m, 30m	
31	12180014		1	Cable shoe	Kabelschuh	Chaussure de cable			
46	11120469	AB	1	O-ring	O-ring	Joint torique	Ø52 x 3 DIN 3771		
47	11010052		1	Ball bearing	Rillenkugellager	Roult gorg prof	6304 ZR		
52	11260104		1	Lens head screw	Flachkopfschraube	Vis à tête plate	M5 x 10 DIN 85		
53	11500003		1	Locking washer	Sicherungsscheibe	Tête-frein			
55	31000255		1	Motorhousing	Motorgehäuse	Carcasse moteur		AFP M15/6-M35/4 Std.	
55	31005015		1	Motorhousing	Motorgehäuse	Carcasse moteur		AFP M15/6-M35/4 SX	
59	31010076		1	Cooling jacket	Kühlmantel	Chemise froid		Not available with SX	
61	11210243		3	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M8 x 25 DIN 912		
63	43070356	A	1	Gasket	Flachdichtung	Joint plat	152 5x108x3 NBR		
63	43070357	B	1	Gasket	Flachdichtung	Joint plat	152 5X 108X3	Viton	
64	11120808	A	1	O-ring	O-ring	Joint torique	170x10 NBR50		
64	11120464	B	1	O-ring	O-ring	Joint torique	170X8	Viton	
65	65015000		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M15/6	1 4021	
65	65015059		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M15/6	1 4401	
65	65010287		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M18/4	1 4021	
65	65015021		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M18/4	1 4401	
65	65015116		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M22/4&M25/4	1 4021	
65	65015118		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M22/4&M25/4	1 4401	
65	65015117		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M35/4	1 4021	
65	65015119		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M35/4	1 4401	
65	65010286		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M28/4	1 4021	
65	65015007		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M28/4	1 4401	
68	11830003		1	Impeller key	Paßfeder	Clevisse	8x8x25 DIN 6885		
67	31155010		1	Bearing lid	Lager deckel	Couvercle palier			
68	11210246		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10 x 45 DIN 912		
69	11530018		4	Spring washer	Federring	Rondelle	M10 x DIN 7980		
76	11210279		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12 x 20 DIN 912		
77	11130077	AB	1	Copperwasher	Kupferdichtung	Joint cuivre	Ø12x15 5 DIN 7803		
80	11121005	A	1	O-ring	O-ring	Joint torique	Ø172 x 4 DIN 3770		
80	11120307	B	1	O-ring	O-ring	Joint torique	Ø170 x 4	Viton	
81	12120241		1	DI-probe	DI-electrode	Sonde DI			
96	11020015		1	Ball bearing	Rillenkugellager	Roult gorg.prof.	3305 C3		
100	11080012		1	Circlip	Sicherungsring	Circlip	Ø62 x 2 DIN 472		
102	31403104		1	Transition piece	Zwischenstück	Douille-entretorse			
105	11120129	AB	1	O-ring	O-ring	Joint torique	Ø57 x 2 5 DIN 3770		
106	11100028		1	Mechanical seal	Gleitringsdichtung	Garniture Mecanique			
107	11070007		1	Circlip	Sicherungsring	Circlip	Ø25 x 1.2 DIN 471		
108	11030048		1.2	Oil	Öl	Huile			

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Pos. No.	Part No.	Kit	Qty	Description	Benennung	Désignation	Dimensions /Din	Comments	Price
121	31040142	AB	1	Oil chamber	Ölkammer	Boîte à huile	Ø155 x 4 DIN 3770	AFP M15/6-M35/4 Std.	
121	31045013		1	Oil chamber	Ölkammer	Boîte à huile		AFP M15/6-M35/4 SX	
126	11120082		1	O-ring	O-ring	Joint torqué			
138	11110095		1	Mechanical seal	Gleitringdichtung	Garniture Mécanique			
138	11110105		1	Mechanical seal	Gleitringdichtung	Garniture Mécanique		SX (Viton)	
140	1107C007		1	Circlip	Sicherungsring	Circlip		Ø25 x 1.2 DIN 471	
208	51380051		2	Cooling pipe	Kühlungsrohr	Tuyau froid			
208	51385002		2	Cooling pipe	Kühlungsrohr	Tuyau froid		Viton	
209*	11380018		3	Grub screw	Gewindestift	Goujon		M8 x 16 DIN 913	
210*	43070395		2	Seal	Dichtung	Joint			
254	65005212		1	Stator	Wicklung	Stator	AFP M15/6 SX/Std.	208/3/60Hz	
254	65005516		1	Stator	Wicklung	Stator	AFP M15/6 SX/Std.	220/380/3/60Hz	
254	65005065		1	Stator	Wicklung	Stator	AFP M15/6 SX/Std.	230/460/3/60Hz	
254	65005397		1	Stator	Wicklung	Stator	AFP M15/6 SX/Std.	380/3/60Hz	
254	85005220		1	Stator	Wicklung	Stator	AFP M15/6 SX/Std.	575/3/60Hz	
254	65005122		1	Stator	Wicklung	Stator	AFP M18/4 Std.	208/1/60Hz	
254	65005072		1	Stator	Wicklung	Stator	AFP M18/4 Std.	230/1/60Hz	
254	65005502		1	Stator	Wicklung	Stator	M22/4&25/4 SX/Std.	208/3/60Hz	
254	65005503		1	Stator	Wicklung	Stator	M22/4&25/4 SX/Std.	220/380/3/60Hz	
254	65005504		1	Stator	Wicklung	Stator	M22/4&25/4 SX/Std.	230/460/3/60Hz	
254	65005505		1	Stator	Wicklung	Stator	M22/4&25/4 SX/Std.	380/3/60Hz	
254	65005501		1	Stator	Wicklung	Stator	M22/4&25/4 SX/Std.	575/3/60Hz	
254	85005395		1	Stator	Wicklung	Stator	AFP M28/4 Std.	208/1/60Hz	
254	65005073		1	Stator	Wicklung	Stator	AFP M28/4 Std.	230/1/60Hz	
254	65005510		1	Stator	Wicklung	Stator	AFP M35/4 SX/Std.	208/3/60Hz	
254	65005511		1	Stator	Wicklung	Stator	AFP M35/4 SX/Std.	220/380/3/60Hz	
254	65005512		1	Stator	Wicklung	Stator	AFP M35/4 SX/Std.	230/460/3/60Hz	
254	65005513		1	Stator	Wicklung	Stator	AFP M35/4 SX/Std.	380/3/60Hz	
254	65005509		1	Stator	Wicklung	Stator	AFP M35/4 SX/Std.	575/3/60Hz	
258	11470016		3	Washer	Scheibe	Rondelle	Ø8.4 DIN 125		
272	11060011		1	Support washer	Stützscheibe	Rondelle	Ø62x50x3 DIN 988		
273	11080055		1	Circlip	Sicherungsring	Circlip	Ø25 x 1.2 DIN 983		
313	11210238		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M8 x 30 DIN 912		
315	43075038	A	1	Seal	Dichtung	Joint	Ø15.1	Cable 7x1.5	
315	43075039	B	1	Seal	Dichtung	Joint	Ø15.1 Viton	Cable 7x1.5	
315	43070353	A	1	Seal	Dichtung	Joint	Ø18.5	Cable 10x1.5	
315	43070573	B	1	Seal	Dichtung	Joint	Ø18.5 Viton	Cable 10x1.5	
316	42015000		1	Washer	Scheibe	Rondelle	40x15.5x3	Cable 7x1.5	
316	4201C077		1	Washer	Scheibe	Rondelle	40x20.5x3	Cable 10x1.5	
317	12180044		6	Butt connector	St.verbinder	Connecteur			
319	42245001		1	Nameplate	Typenschild	Plaque signalétique			
320	11550024		4	Rivet	Halbrundkerbnagel	Rivet	3 x 4 DIN 1476		

SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP M15/6-M35/4 EX FM 60HZ

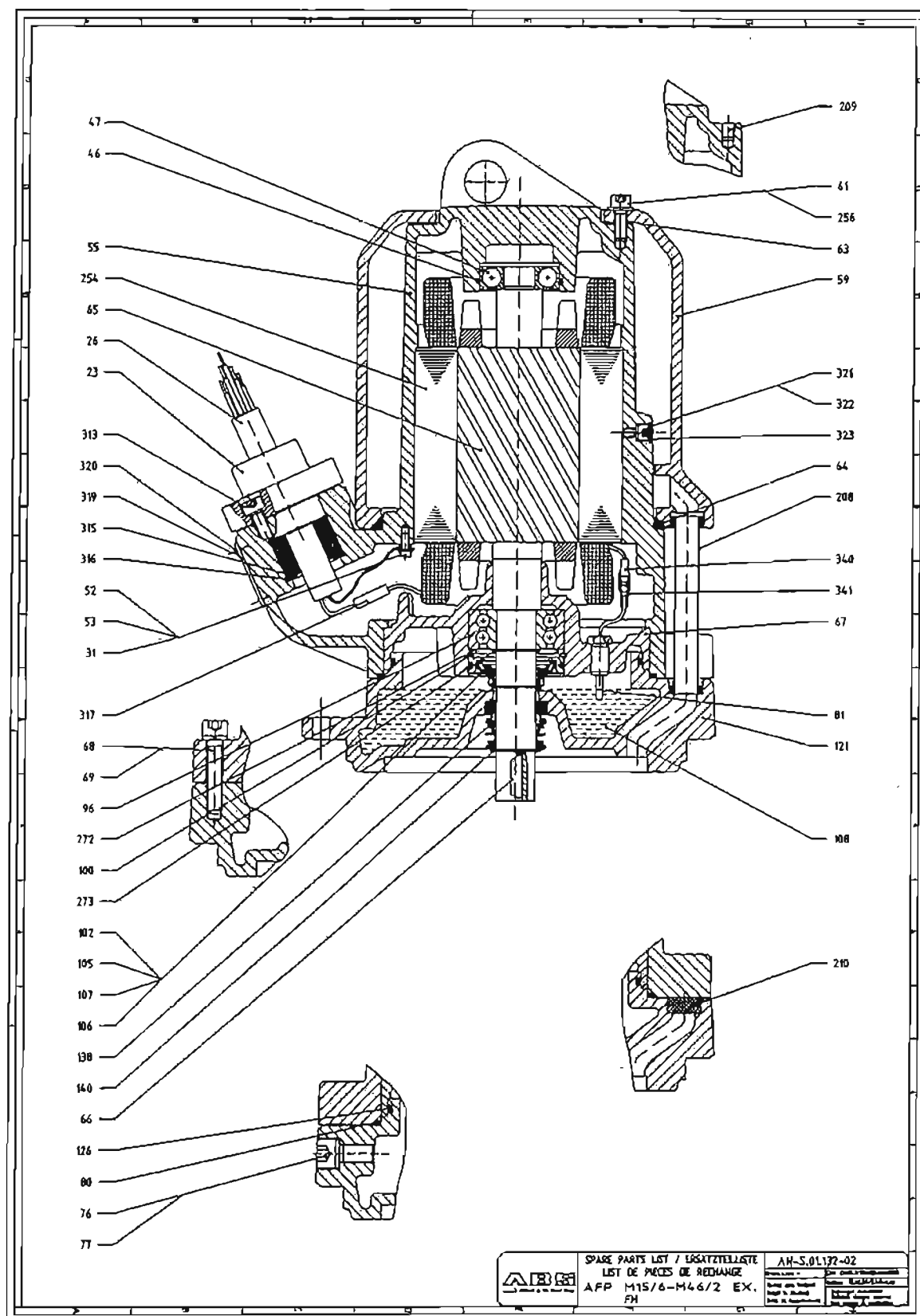
With & without Cooling jkt/Mit & ohne Kühlmantel/Avec & sans chemise refroid

AFP M15/6-M35/4 SX EX FM 60HZ

Without Cooling jkt/Ohne Kühlmantel/Sans chemise refroid

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 Drawing ref. Nr. : AN-S.01.132-02

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
321	11210281		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M6 x 8 DIN 912		
322	11130003	AB	1	Seal ring	Dichtring	Rondelle	10x6 DIN 7603		
323	11490020	AB	1	Seal washer	Verschlußscheibe	Rondelle joint	DIN 470		
340	12180006		1	Round plug	Rundslecker	Fiche rond			
341	12180008		1	Coupling	Kupplung	Accouplement			
	81195053	A	1	Seal kit	Dichtungssatz	Jeu de joint complet		With cooling jacket	
	61195057	B	1	Seal kit	Dichtungssatz	Jeu de joint complet	Viton (Not SX)	With cooling jacket	
				Without cooling jacket	Ohne Kühlmantel	Sans chemise refroid			



Consult Factory for non-toxic oil (108). Optional, lip seal (274) may be used in place of Mechanical Seal (106).
Consult Factory for cable seal (315) compatibility with specific cables (26), Cooling Jacket Kit - 62665005 (M1)

SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP M35/6-M125/2 EX FM 60 HZ

With & without cooling jkt/Mit & ohne Kühlmantel/Avec & sans chemise refroid

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 Supersedes Issue : 14/07/00
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 Drawing ref. Nr. : AN-S.01.133-03

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
23	31320129		1	Cable cap	Kabelanführung	Entree de cable	GG20	Cable 10x1.5	
23	31325000		1	Cable cap	Kabelanführung	Entree de cable	GG20	Cable 10x2.5	
26	12100044		1	Cable	Kabel	Cable	AO7RN-F 10x1.5	10m,20m,30m	
26	12100011		1	Cable	Kabel	Cable	AO7RN-F 10x2.5	10m,20m,30m	
31	12180014		1	Cable shoe	Kabelschuh	Chaussure de cable			
46	11120228	AB	1	O-ring	O-ring	Joint torique	Ø62 x 3 DIN 3771		
47	11010049		1	Ball bearing	Rillenkugellager	Roull.gorg.prof.	6304 2R		
52	11260104		1	Lens head screw	Flachkopfschraube	Vis à tête plate	M5 x 10 DIN 85		
53	11500003		1	Locking washer	Sicherungsscheibe	Tête-frein			
55	31000262		1	Motorhousing	Motorgehäuse	Carcasse moteur	GG20	M35/6-M90/4	
55	31005025		1	Motorhousing	Motorgehäuse	Carcasse moteur	GG20	M70/6,M105/4,M125/2	
59	31010077		1	Cooling jacket	Kühlmantel	Chemise froid		M35/6-M90/4	
59	31015082		1	Cooling jacket	Kühlmantel	Chemise froid		M70/6,M105/4,M125/2	
61	11210243		3	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M8 x 25 DIN 912		
63	43070358		1	Gasket	Flachdichtung	Joint plat	190x132x3		
63	43070578		1	Gasket	Flachdichtung	Joint plat	190x132x3	Viton	
64	11120809		1	O-ring	O-ring	Joint torique	200X10 DIN3771		
64	11120836		1	O-ring	O-ring	Joint torique	200X8 DIN3771	Viton	
65	65010469		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M35/6	1 4021	
65	65015031		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M35/6	1 4401	
65	65010543		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M40/4 W	1 4021	
65	65015006		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M40/4 W	1 4401	
65	65010531		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M46/4	1 4021	
65	65015029		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M46/4	1 4401	
65	65010468		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	M80/2	1 4021	
65	65015051		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	M80/2	1 4401	
65	65010543		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	M70/4,75/4,M90/4	1 4021	
65	65015006		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	M70/4,75/4,M90/4	1 4401	
65	65015142		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M70/6	1 4021	
65	65015143		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M70/6	1 4401	
65	65015129		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M105/4	1 4021	
65	65015140		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M105/4	1 4401	
65	65015138		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M125/2	1 4021	
65	65015139		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M125/2	1 4401	
66	11630011		1	Impeller key	Paßfeder	Clavette	8x7x32 DIN 6885		
67	31155011		1	Bearing lid	Lager deckel	Couvercle palier			
68	11210258		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12 x 50 DIN 912		
69	11530019		4	Spring washer	Federling	Rondelle	M12 x DIN 7980		
76	11210279		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12 x 20 DIN 912		
77	11130077	AB	1	Copper washer	Kupferdichtung	Joint cuivre	12 x 15.5 DIN 7603		
80	11120168	A	1	O-ring	O-ring	Joint torique	Ø205 x 4 DIN 3770		
80	11120835	B	1	O-ring	O-ring	Joint torique	Ø205 x 4 DIN 3771	Viton	
81	12120241		1	DI-probe	DI-electrode	Sonde DI			
96	11020017		1	Ball bearing	Rillenkugellager	Roult.gorg.prof.	3307		

SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP M35/6-M125/2 EX FM 60 HZ

With & without cooling jk/Mit & ohne Kühlmantel/Avec & sans chemise refroid

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Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
102	31400556		1	Transition piece	Zwischen stück	Douille-entretoise		Lip seal	
102	31400557		1	Transition piece	Zwischen stück	Douille-entretoise	Mech. Seal	AFP M35/6-M90/4	
102	31405003		1	Transition piece	Zwischen stück	Douille-entretoise	Mech. Seal	M70/6,M105/4,M125/2	
103	11210240		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M6 x 20 DIN 912		
104	11530004		4	Spring washer	Federling	Rondelle	M6 x DIN 7960		
105	11120027	AB	1	O-ring	O-ring	Joint torique	Ø70 x 3,5 DIN 3770		
106	11100029		1	Mechanical seal	Gleitringdichtung	Garniture Mecanique		AFP M35/6-M90/4	
106	11110188		1	Mechanical seal	Gleitringdichtung	Garniture Mecanique		M70/6,M105/4,M125/2	
107	11070008	AB	1	Circlip	Sicherungsring	Circlip	Ø30 x 1,5 DIN 471	AFP M35/6-M90/4	
107	11060058	AB	1	Circlip	Sicherungsring	Circlip	Ø35 x 1,5 DIN 983	AFP M105/4-M125/2	
108	11030046		2	Oil	Öl	Huile			
121	31040148		1	Oil chamber	Ölkammer	Boîte à huile	GG 20	M70/6,M105/4,M125/2	
121	31045015		1	Oil chamber	Ölkammer	Boîte à huile	GG 20	AFP M80/2 (Vitr 0844)	
121	31045015		1	Oil chamber	Ölkammer	Boîte à huile	GG 20	AFP M125/2 Std	
126	11121027	AB	1	O-ring	O-ring	Joint torique	Ø190 x 4 DIN 3770		
138	11110096		1	Mechanical seal	Gleitringdichtung	Garniture Mecanique	30mm		
138	11110107		1	Mechanical seal	Gleitringdichtung	Garniture Mecanique	30mm	Viton	
138	11110163		1	Mechanical seal	Gleitringdichtung	Garniture Mecanique	30mm	With shield	
138	11110165		1	Mechanical seal	Gleitringdichtung	Garniture Mecanique	30mm (viton)	With shield	
140	11070073	AB	1	Circlip	Sicherungsring	Circlip	Ø30 x 1,5 DIN 471		
208	31380094		2	Cooling pipe	Kühlungsrohr	Tuyau froid			
209	11360018		3	Grub screw	Gewindestift	Goujon	M8 x 16 DIN 913		
210	43070395		2	Seal	Dichtung	Joint			
254	65005216		1	Stator	Wicklung	Stator	AFP M35/6	208/3/60Hz	
254	65005087		1	Stator	Wicklung	Stator	AFP M35/6	230/460/3/60Hz	
254	65005398		1	Stator	Wicklung	Stator	AFP M35/6	380/3/60Hz	
254	65005278		1	Stator	Wicklung	Stator	AFP M35/6	575/3/60Hz	
254	65005399		1	Stator	Wicklung	Stator	AFP M40/4	208/1/60Hz	
254	65005074		1	Stator	Wicklung	Stator	AFP M40/4	230/1/60Hz	
254	65005400		1	Stator	Wicklung	Stator	AFP M46/4	208/3/60Hz	
254	65005460		1	Stator	Wicklung	Stator	AFP M46/4	220/380/3/60Hz	
254	65005068		1	Stator	Wicklung	Stator	AFP M46/4	230/460/3/60Hz	
254	65005369		1	Stator	Wicklung	Stator	AFP M46/4	380/650/3/60Hz	
254	65005401		1	Stator	Wicklung	Stator	AFP M46/4	575/3/60Hz	
254	65005376		1	Stator	Wicklung	Stator	M80/2	208/3/60Hz	
254	65005418		1	Stator	Wicklung	Stator	M80/2	220/380/3/60Hz	
254	65005370		1	Stator	Wicklung	Stator	M80/2	230/460/3/60Hz	
254	65005377		1	Stator	Wicklung	Stator	M60/2	380/660/3/60Hz	
254	65005378		1	Stator	Wicklung	Stator	M80/2	575/3/60Hz	
254	65005218		1	Stator	Wicklung	Stator	M70/4,75/4,M90/4	208/3/60Hz	
254	65005110		1	Stator	Wicklung	Stator	M70/4,75/4,M90/4	220/380/3/60Hz	
254	65005069		1	Stator	Wicklung	Stator	M70/4,75/4,M90/4	230/460/3/60Hz	
254	65005283		1	Stator	Wicklung	Stator	M70/4,75/4,M90/4	380/660/3/60Hz	
254	65005279		1	Stator	Wicklung	Stator	M70/4,75/4,M90/4	575/3/60Hz	

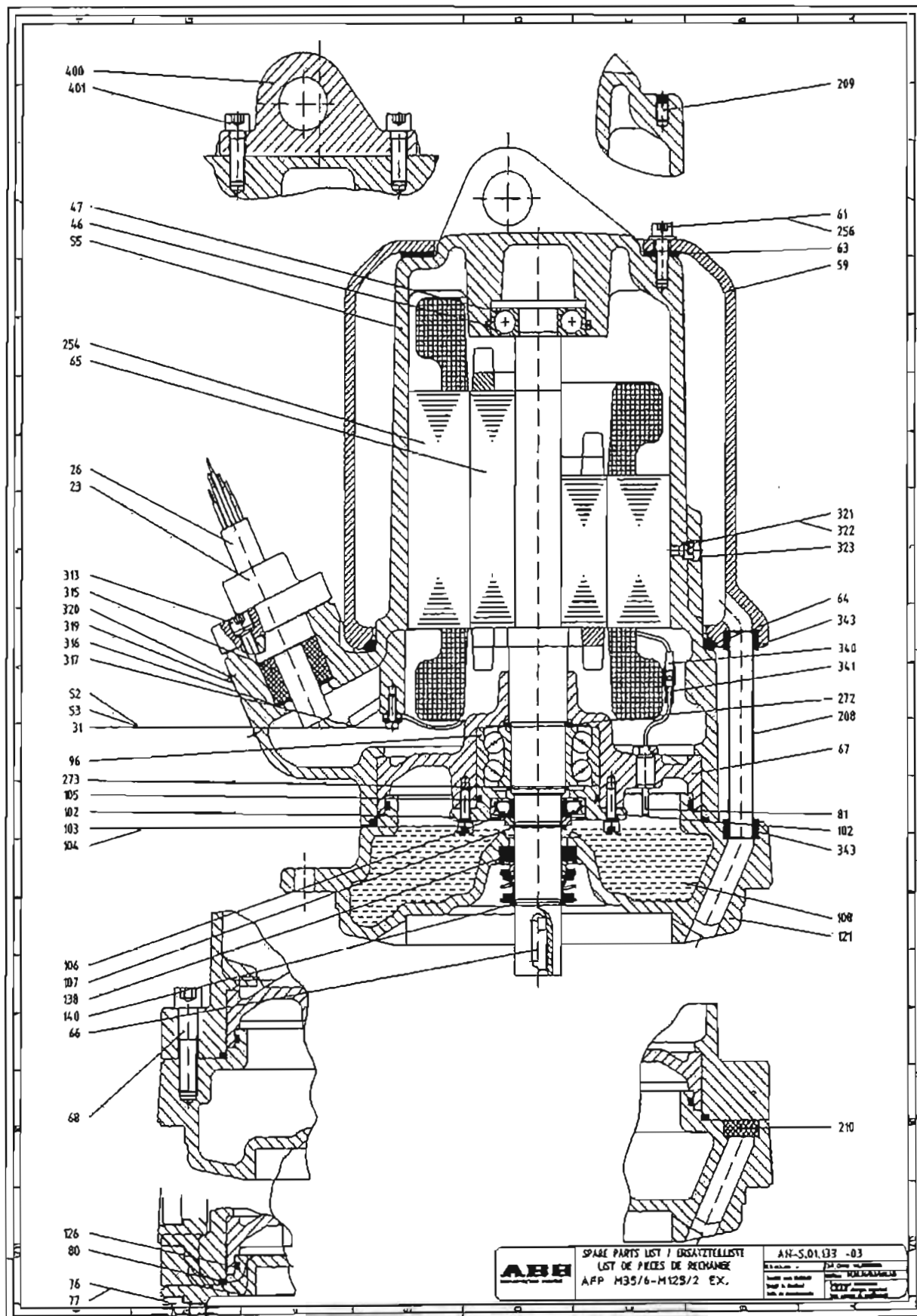
SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÉCES DE RECHANGE

AFP M35/6-M125/2 EX FM 60 HZ

With & without cooling jack/Mit & ohne Kühlmantel/Avec & sans chemise refroid

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Pos. No.	Part No.	Kit	Qty	Description	Benennung	Désignation	Dimensions /Din	Comments	Price
254	65005545		1	Stator	Wicklung	Stator	AFP M70/6	208/380Hz	
254	65005546		1	Stator	Wicklung	Stator	AFP M70/6	220/380/3/60Hz	
254	65005547		1	Stator	Wicklung	Stator	AFP M70/6	230/460/3/60Hz	
254	65005548		1	Stator	Wicklung	Stator	AFP M70/6	380/660/3/60Hz	
254	65005549		1	Stator	Wicklung	Stator	AFP M70/6	575/3/60Hz	
254	65005402		1	Stator	Wicklung	Stator	AFP M105/4	208/3/60Hz	
254	65005515		1	Stator	Wicklung	Stator	AFP M105/4	220/380/3/60Hz	
254	65005403		1	Stator	Wicklung	Stator	AFP M105/5	230/460/3/60Hz	
254	65005404		1	Stator	Wicklung	Stator	AFP M105/4	380/660/3/60Hz	
254	65005405		1	Stator	Wicklung	Stator	AFP M105/4	575/3/60Hz	
254	65005406		1	Stator	Wicklung	Stator	AFP M125/2	208/3/60Hz	
254	65005333		1	Stator	Wicklung	Stator	AFP M125/2	230/460/3/60Hz	
254	65005407		1	Stator	Wicklung	Stator	AFP M125/2	380/660/3/60Hz	
254	65005408		1	Stator	Wicklung	Stator	AFP M125/2	575/3/60Hz	
256	11470072		3	Washer	Scheibe	Rondelle	Ø 8 4 DIN 9021		
272	42010044		1	Washer	Scheibe	Rondelle	Ø 35 x 44 x 3		
273	11080058	AB	1	Circlip	Sicherungsring	Circlips	Ø 35 x 1 5 DIN 983		
274	11090017	AB	1	Lip seal	Wellendichtring	Joint à lèvres	30 x 62 x 10	AFP M35/6-M90/4	
274	11090053	AB	1	Lip seal	Wellendichtring	Joint à lèvres	35x62x7 DIN 3760	M70/6, M105/4, M125/2	
313	11210238		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M 8 x 30 DIN 912		
315	43070353	A	1	Seal	Dichtung	Joint	Ø 18.5	Cable 10x1.5	
315	43070573	B	1	Seal	Dichtung	Joint	Ø 18.5 (viton)	Cable 10x1.5	
315	43070352	A	1	Seal	Dichtung	Joint	Ø 22.0	Cable 10x2.5	
315	43070575	B	1	Seal	Dichtung	Joint	Ø 22.0 (viton)	Cable 10x2.5	
316	42010077		1	Washer	Scheibe	Rondelle	Ø 40 x 20.5 x 3	Cable 10x1.5	
316	42010087		1	Washer	Scheibe	Rondelle	Ø 40 x 23 x 3	Cable 10x2.5	
317	12180044		8	Butt connector	St.verbinder	Connecteur			
319	42245001		1	Nameplate	Typenschild	Plaque signalétique			
320	11550024		4	Rivet	Halbrundkerbnägel	Rivet	3 x 4 DIN 1476		
321	11210281		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M 6 x 8 DIN 912		
322	11130003	AB	1	Seal ring	Dichtring	Rondelle	10x6 DIN 7803		
323	11490020	AB	1	Seal washer	Verschlusscheibe	Rondelle joint	DIN 470		
340	12180006		1	Round plug	Rundstecker	Fiche rond			
341	12180008		1	Coupling	Kupplung	Accouplement			
343	43075078		4	Seal	Dichtung	Joint			
343	43075084		4	Seal	Dichtung	Joint		Viton	
400	21425002		1	Lifting device	Hebevorrichtung	Mecanisme de levage		M70/6, M105/4, M125/2	
401	11210245		2	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M 10 x 30 DIN 912	M70/6, M105/4, M125/2	
402	11530018		2	Spring washer	Federung	Rondelle	10 DIN 7980	M70/6, M105/4, M125/2	
				W/out cooling jacket	Ohne Kühlmantel	Sans chemise refroid			
	61195055	A	1	Seal kit	Dichtungssatz	Jeu de joint complet			
	61195059	B	1	Seal kit	Dichtungssatz	Jeu de joint complet	Viton		



Consult Factory for non-toxic oil (108). Optional, lip seal (274) may be used in place of Mechanical Seal (106).
Consult Factory for cable seal (315) compatibility with specific cables (26). Cooling Jacket Kit - 62665008 (M2)

SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP M130/4-M210/4,M130/6-M160/6 EX FM 60HZ
AFP M185/2-M230/2 EX FM 60HZ

With & without cooling jk/MR & ohne Kühlmantel/Avec & sans chemise refroid

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Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
8	12170027		1	Earth plug	Erdungsanschluß	Prise de terre			
23	31320129		1	Cable cap	Kabeleinführung	Entree de cable	GG20	Cable 10x1 5	
23	31325000		1	Cable cap	Kabeleinführung	Entree de cable	GG20	Cable 10x2 5	
23	31320140		1	Cable cap	Kabeleinführung	Entree de cable	GG20	Cable 4x4+2x0 75	
26	12105002		1	Cable	Kabel	Câble	10x1,5	L=10m,20m,30m	
26	12105003		1	Cable	Kabel	Câble	10x2,5	L=10m,20m,30m	
26	12100034		1	Cable	Kabel	Câble	4x4+2x0.75	L=10m,20m,30m	
31	12180014		1	Cable shoe	Kabelschuh	Chaussure de cable			
46	11120293	AB	1	O-ring	O-ring	Joint torique	Ø90 x 4 Viton		
47	11010031		1	Ball bearing	Rillenkugellager	Roult.gorg.prof.	6308 DIN 625		
52	11260104		1	Lens head screw	Flachkopfschraube	Vis à tête plate	M5 x 10 DIN 85		
53	11500003		1	Locking washer	Sicherungsscheibe	Tête-frein			
55	31005043		1	Motorhousing	Motorgehäuse	Carcasse moteur	Ø40 single cable	AFP M130/4	
55	31005044		1	Motorhousing	Motorgehäuse	Carcasse moteur	Ø34x2 double cable	AFP M130/4	
55	31005039		1	Motorhousing	Motorgehäuse	Carcasse moteur	Ø40 single cable	M185/4-230/2 & M160/6	
55	31005040		1	Motorhousing	Motorgehäuse	Carcasse moteur	Ø34x2 double cable	M185/4-230/2 & M160/6	
56	41385004		1	Vent pipe	Entlüftungrohr	Tube d'aspiration			
59	31015096		1	Cooling jacket	Kühlmantel	Chemise froid	GG20		
61	11210245		3	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10 x 30 DIN 912		
63	43075050	A	1	Gasket	Flachdichtung	Joint plat			
63	43075053	B	1	Gasket	Flachdichtung	Joint plat	Viton		
64	11120820	A	1	O-ring	O-ring	Joint torique	280X10		
64	43075065	B	1	O-ring	O-ring	Joint torique	280X10 (Viton)		
65	65015102		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M130/4	1.4021	
65	65015113		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M130/4	1.4401	
65	65015096		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M185/4 M210/4	1.4021	
65	65015112		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M185/4 M210/4	1.4021	
65	65015108		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M90/6 M130/6	1.4021	
65	65015107		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFP M160/6	1.4021	
65	65015114		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFPM185/2,200/2,230/2	1.4021	
65	65015126		1	Rotor with shaft	Rotor mit Welle	Rotor avec arbre	AFPM185/2,200/2,230/2	1.4401	
66	11630011		1	Impeller key	Paßfeder	Clavette	8x7x32 DIN 6885		
67	31155031		1	Bearing lid	Lager deckel	Couvercle palier	GG20		
68	11210145		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M18 x 45 DIN 912		
69	11530021		4	Spring washer	Federling	Rondelle	Ø16 x DIN 7980		
76	11210279		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12 x 20 DIN 912		
77	11130077	AB	1	Copper washer	Kupferdichtung	Joint cuivre	12 x 15.5 DIN 7603		
80	11120819	A	1	O-ring	O-ring	Joint torique	Ø297 x 4 DIN 3771		
80	11120865	B	1	O-ring	O-ring	Joint torique	Ø297 x 4 DIN 3771	Viton	
81	12120225		1	DI-probe	DI-electrode	Sonde DI	M12		
96	11020020		1	Ball bearing	Rillenkugellager	Roult.gorg.prof.	3310 B DIN 628		
102	31405001		1	Transition piece	Zwischenstück	Douille-entretoise	GG20		
103	11210240		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M8 x 20 DIN 912		

SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP M130/4-M210/4,M130/6-M160/6 EX FM 60HZ
AFP M185/2-M230/2 EX FM 60HZ

With & without cooling jkt/Mit & ohne Kühlmantel/Avec & sans chemise refroid

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Pos. No.	Part No.	Kit	Qty	Description	Benennung	Désignation	Dimensions /Din	Comments	Price
104	11530004	AB	4	Spring washer	Federring	Rondelle	M6 x DIN 7980		
105	11120041		1	O-ring	O-ring	Joint torique	Ø104 5 x3 DIN 3771		
106	11100083		1	Mechanical seal	Gleitringdichtung	Garniture Mecanique	Ø50MM		
107	11070012		1	Circlip	Sicherungsring	Circlip	Ø50 x 2 DIN 471		
108	11030046		5,7	Oil	Öl	Huile		2006	
108	11030046		5	Oil	Öl	Huile		1034-1540	
121	31045018		1	Oil chamber	Ölkammer	Boîte à huile	GG20	2006	
121	31045019		1	Oil chamber	Ölkammer	Boîte à huile	GG20	1034-1540	
126	11120818	AB	1	O-ring	O-ring	Joint torique	Ø275 x 4 DIN 3770		
127	11120011	A	4	O-ring	O-ring	Joint torique	Ø24x4 DIN 3771		
127	11120864	B	4	O-ring	O-ring	Joint torique	Ø24x4 DIN 3771	Viton	
138	11110093		1	Mechanical seal	Gleitringdichtung	Garniture Mecanique	Ø45mm		
138	11110109		1	Mechanical seal	Gleitringdichtung	Garniture Mecanique	Ø45MM (Viton)		
140	11070077		1	Circlip	Sicherungsring	Circlip	Ø45x42 5x1 75		
206	31385003		2	Cooling pipe	Kühlungsrohr	Tuyau froid			
209	11360029		3	Grub screw	Gewindestift	Goujon	M10x12 DIN 913		
210	43075051		2	Seal	Dichtung	Joint	Ø32x12		
254	65005423		1	Stator	Wicklung	Stator	AFP M130/4	208/3/60	
254	65005424		1	Stator	Wicklung	Stator	AFP M130/4	220/380/3/60	
254	65005332		1	Stator	Wicklung	Stator	AFP M130/4	230/460/3/60	
254	65005425		1	Stator	Wicklung	Stator	AFP M130/4	360/660/3/60	
254	65005426		1	Stator	Wicklung	Stator	AFP M130/4	575/3/60	
254	65005427		1	Stator	Wicklung	Stator	AFP M185/4 & 210/4	208/3/60	
254	65005428		1	Stator	Wicklung	Stator	AFP M185/4 & 210/4	220/380/3/60	
254	65005330		1	Stator	Wicklung	Stator	AFP M185/4 & 210/4	230/460/3/60	
254	65005429		1	Stator	Wicklung	Stator	AFP M185/4 & 210/4	380/660/3/60	
254	65005430		1	Stator	Wicklung	Stator	AFP M185/4 & 210/4	575/3/60	
254	65005431		1	Stator	Wicklung	Stator	AFP M90/6 M130/6	208/3/60	
254	65005432		1	Stator	Wicklung	Stator	AFP M90/6 M130/6	220/380/3/60	
254	65005411		1	Stator	Wicklung	Stator	AFP M90/6 M130/6	230/460/3/60	
254	65005433		1	Stator	Wicklung	Stator	AFP M90/6 M130/6	380/660/3/60	
254	65005434		1	Stator	Wicklung	Stator	AFP M90/6 M130/6	575/3/60	
254	65005435		1	Stator	Wicklung	Stator	AFP M160/6	208/3/60	
254	65005436		1	Stator	Wicklung	Stator	AFP M160/6	220/380/3/60	
254	65005410		1	Stator	Wicklung	Stator	AFP M160/6	230/460/3/60	
254	65005437		1	Stator	Wicklung	Stator	AFP M160/6	380/660/3/60	
254	65005438		1	Stator	Wicklung	Stator	AFP M160/6	575/3/60	
254	65005528		1	Stator	Wicklung	Stator	AFPM185/2,200/2,230/2	208/3/60	
254	65005529		1	Stator	Wicklung	Stator	AFPM185/2,200/2,230/2	220/380/3/60	
254	65005538		1	Stator	Wicklung	Stator	AFPM185/2,200/2,230/2	230/460/3/60	
254	65005530		1	Stator	Wicklung	Stator	AFPM185/2,200/2,230/2	380/660/3/60	
254	65005531		1	Stator	Wicklung	Stator	AFPM185/2,200/2,230/2	575/3/60	

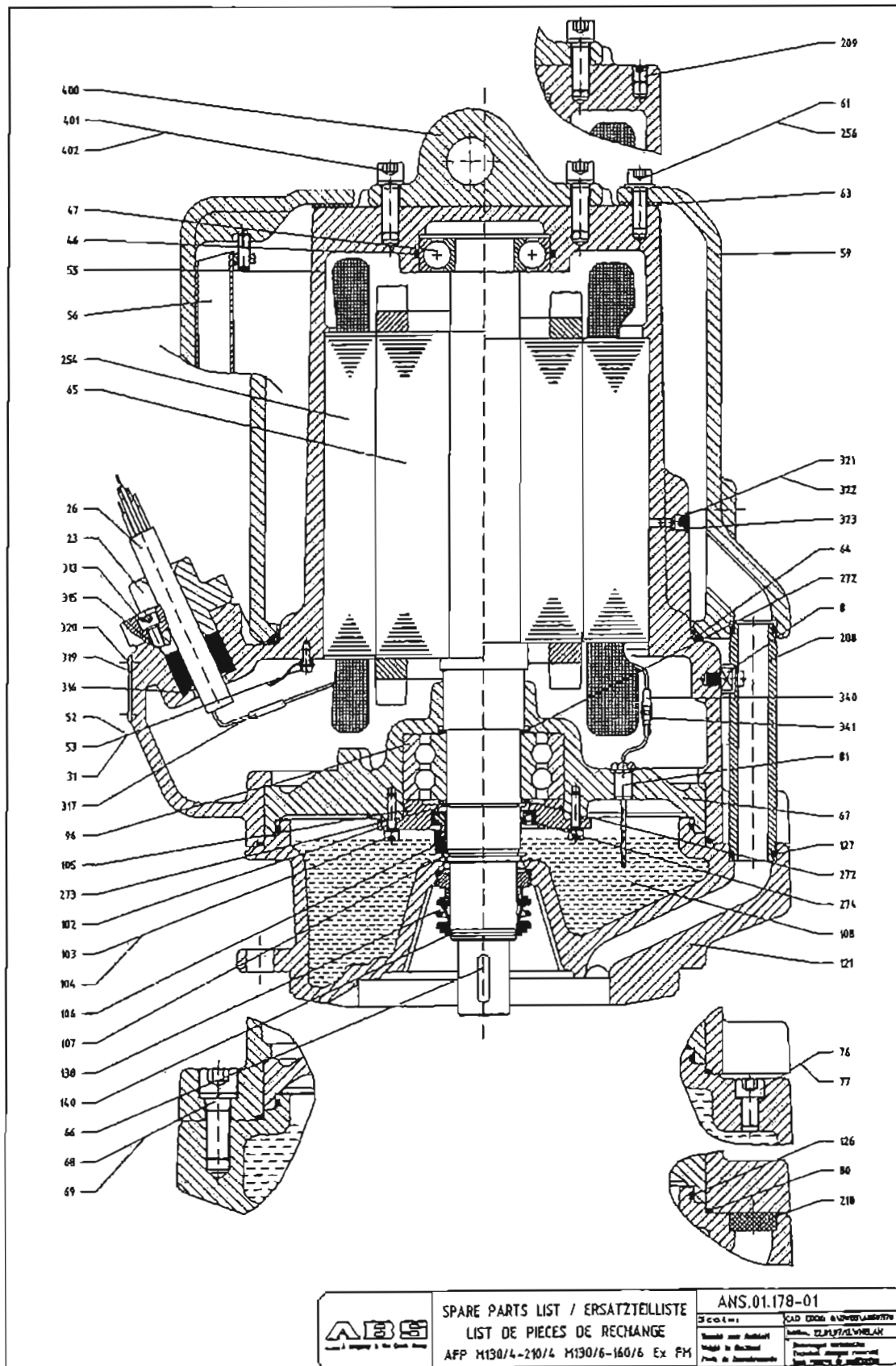
SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP M130/4-M210/4,M130/6-M160/6 EX FM 60HZ
AFP M185/2-M230/2 EX FM 60HZ

With & without cooling jkt/Mit & ohne Kühlmantel/Avec & sans chemise refroid

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Issue of : 18/02/00
Supersedes Issue : 04/07/97
Issue No. : 2
Drawing ref. Nr. : AN-S.01.178-01

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
256	11470064		3	Washer	Scheibe	Rondelle	A10 5 DIN 9021		
272	11080011		1	Washer	Scheibe	Rondelle	Ø50x62x3 DIN988		
272	11080011		1	Washer	Scheibe	Rondelle	Ø50x62x3 DIN988		
273	11070012		1	Circlip	Sicherungsring	Circlip	Ø50 x 2 DIN 471		
274	11090082	AB	1	Lip seal	Wellendichtung	Joint à lèvres	50X72X10		
313	11210238		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M8 x 30 DIN 912		
315	43075064	A	1	Seal	Dichtung	Joint	Ø18.8	Cable 10x1.5	
315	43075067	B	1	Seal	Dichtung	Joint	Ø18.8 (Viton)	Cable 10x1.5	
315	43070352	A	1	Seal	Dichtung	Joint	Ø22	Cable 10x2.5	
315	43070575	B	1	Seal	Dichtung	Joint	Ø22 (Viton)	Cable 10x2.5	
315	43075052	A	1	Seal	Dichtung	Joint	Ø19	Cable 4x4+2x0.75	
315	43075059	B	1	Seal	Dichtung	Joint	Ø19 (Viton)	Cable 4x4+2x0.75	
316	42010077		1	Washer	Scheibe	Rondelle	Ø40 x 20.5 x 3	Cable 10x1.5	
316	42010087		1	Washer	Scheibe	Rondelle	Ø40 x 23 x 3	Cable 10x2.5	
318	42015010		1	Washer	Scheibe	Rondelle	Ø34 x 21 x 1.5	Cable 4x4+2x0.75	
317	12180044		8	Bolt connector	St verbinder	Connecteur			
319	42245001		1	Nameplate	Typenschild	Plaque signalétique		USA	
320	11550024		4	Rivet	Halbrundkerbnagel	Rivet	3 x 4 DIN 1475		
321	11210253		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M8 x 10 DIN 912		
322	11130003	AB	1	Seal ring	Dichtungsscheibe	Rondelle joint	6 x 10 DIN 7503		
323	11490020	AB	1	Seal washer	Verschlußscheibe	Rondelle joint	DIN 470		
340	12180006		1	Round plug	Rundstecker	Fiche rond	4mm		
341	12180008		1	Coupling	Kupplung	Accouplement	4mm		
400	21425004		1	Lifting device	Hebevorrichtung	Mecanisme de levage	GG20		
401	11210228		2	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12 x 35 DIN 912		
402	11530019		2	Spring washer	Federling	Rondelle	Ø12 DIN 7980		
				W/out cooling jacket	Ohne Kühlmantel	Sans chemise refroid			
	61195070	A	1	Seal kit	Dichtungssatz	Jeu de joint complet			
	61195071	B	1	Seal kit	Dichtungssatz	Jeu de joint complet	Viton		



SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP M15/6-M105/4 60 HZ
CB HYDRAULICS

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Drawing ref. Nr. : AN-S.01.116-02

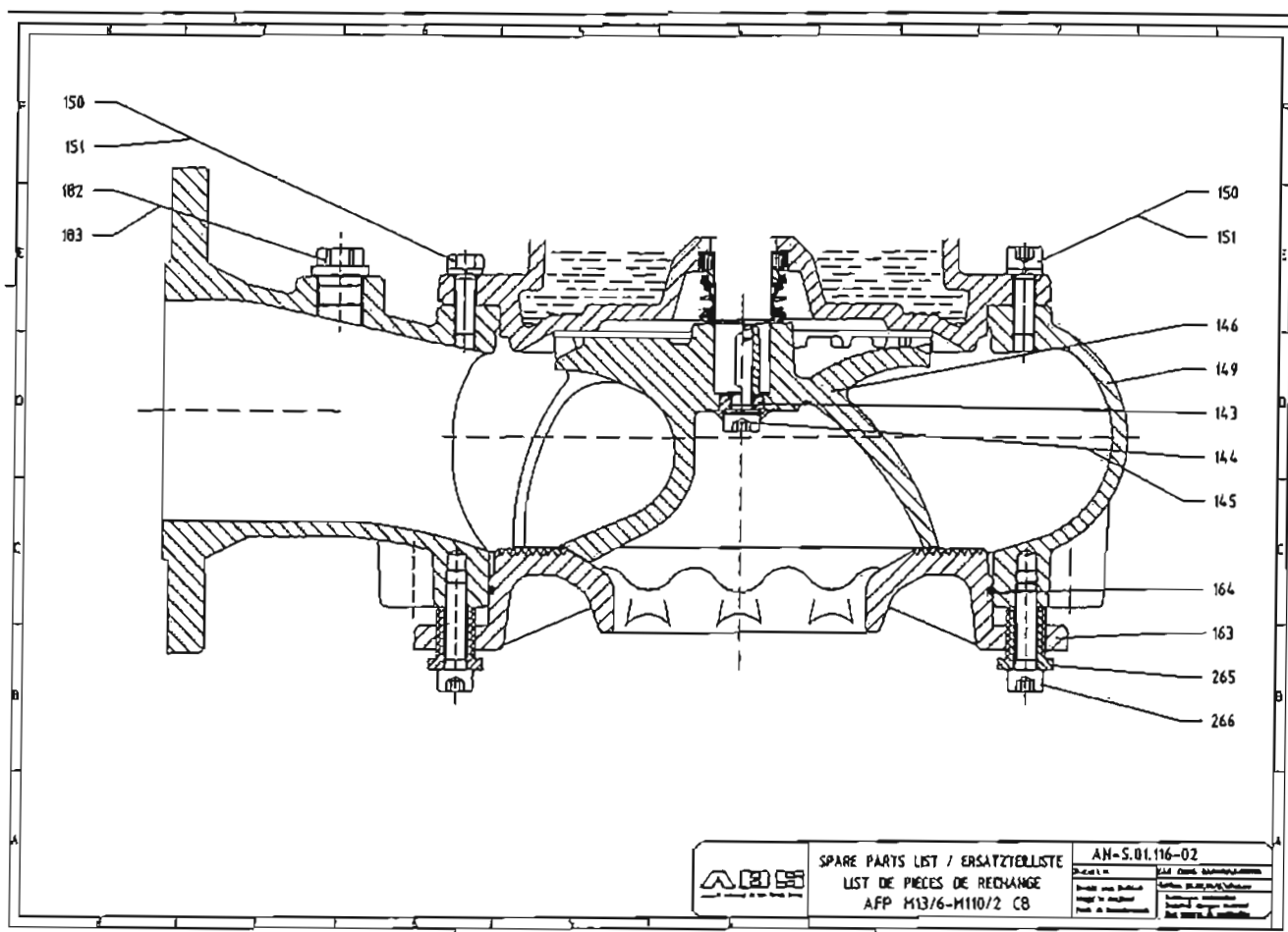
Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
143	42010055		1	Washer	Scheibe	Rondelle		AFP M15/6-M40/2	
143	42010049		1	Washer	Scheibe	Rondelle		AFP M35/6-M105/4	
144	11210239		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x35 DIN 912	AFP M15/6-M40/2	
144	11210228		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN 912	AFP M35/6-M105/4	
145	11490027		2	Locking washer	Klemmscheibe	Rondelle-frein	DIN 25201	AFP M15/6-M40/2	
145	11490028		2	Locking washer	Klemmscheibe	Rondelle-frein	DIN 25201	AFP M35/6-M105/4	
146	31070860		1	Impeller	Laufrad	Roue		0841.1 & 1040.1	
146	31070863		1	Impeller	Laufrad	Roue		0841.2 & 1040.2	
146	31070864		1	Impeller	Laufrad	Roue		0841.3 & 1040.3	
146	31070865		1	Impeller	Laufrad	Roue		0841.4 & 1040.4	
146	31070853		1	Impeller	Laufrad	Roue		1041.1	
146	31070854		1	Impeller	Laufrad	Roue		1041.2	
146	31070870		1	Impeller	Laufrad	Roue		1041.3	
146	31070871		1	Impeller	Laufrad	Roue		1041.4	
146	31070857		1	Impeller	Laufrad	Roue		1541.1 & 1042.1	
146	31070858		1	Impeller	Laufrad	Roue		1541.2 & 1042.2	
146	31070859		1	Impeller	Laufrad	Roue		1042.3	
146	31070874		1	Impeller	Laufrad	Roue		1042.4 & 1541.4	
146	31070875		1	Impeller	Laufrad	Roue		1042.5 & 1541.5	
146	31070876		1	Impeller	Laufrad	Roue		1042.6 & 1541.6	
146	35075110		1	Impeller	Laufrad	Roue		1046 A	
146	31070847		1	Impeller	Laufrad	Roue		1046.1	
146	31070818		1	Impeller	Laufrad	Roue		1046.2	
146	31070819		1	Impeller	Laufrad	Roue		1046.3	
149	31050556	*	1	Volute	Kreiseltammer	Corps de pompe		0841	
149	31055000	*	1	Volute	Kreiseltammer	Corps de pompe		1040	
149	31050563	*	1	Volute	Kreiseltammer	Corps de pompe		1041	
149	31050594	*	1	Volute	Kreiseltammer	Corps de pompe		1042 & 1046A	
149	31050565	*	1	Volute	Kreiseltammer	Corps de pompe		1541	
149	31050574	**	1	Volute	Kreiseltammer	Corps de pompe		0841 V + H	
149	31055002	**	1	Volute	Kreiseltammer	Corps de pompe		1040 V + H	
149	31050576	**	1	Volute	Kreiseltammer	Corps de pompe		1041 V + H	
149	31050604	**	1	Volute	Kreiseltammer	Corps de pompe		1042 & 1046 V+H	
149	31050578	**	1	Volute	Kreiseltammer	Corps de pompe		1541 V + H	
150	11200187		1	Hexagonal screw	Sechskantschraube	Vis hexagonal	M10x35 DIN 933	AFP M15/6-M35/4	
150	11210239		3	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x35 DIN 912	AFP M15/6-M35/4	
150	11210228		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN 912	AFP M35/6-M105/4	
151	11530018		1	Spring washer	Federring	Rondelle	Ø10 DIN 7980	AFP M15/6-M35/4	
151	11530018		3	Spring washer	Federring	Rondelle	Ø10 DIN 7980	AFP M15/6-M35/4	
151	11530019		4	Spring washer	Federring	Rondelle	Ø12 DIN 7980	AFP M35/6-M105/4	
163	31080552		1	Bottom plate	Bodenplatte	Plaque de base		0841	
163	31080552		1	Bottom plate	Bodenplatte	Plaque de base		1040	
163	31080588		1	Bottom plate	Bodenplatte	Plaque de base		1041	

SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP M15/6-M105/4 60 HZ
CB HYDRAULICS

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Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
163	31060589		1	Bottom plate	Bodenplatte	Plaque de base		1042	
163	31060140		1	Bottom plate	Bodenplatte	Plaque de base		1046	
163	31060137		1	Bottom plate	Bodenplatte	Plaque de base		1541	
163	31060131		1	Bottom plate	Bodenplatte	Plaque de base		0841 V + H	
163	31060131		1	Bottom plate	Bodenplatte	Plaque de base		1040 V + H	
163	31060143		1	Bottom plate	Bodenplatte	Plaque de base		1041 V + H	
163	31060145		1	Bottom plate	Bodenplatte	Plaque de base		1042&1541 V + H	
163	31065000		1	Bottom plate	Bodenplatte	Plaque de base		1046 V + H	
164	11120140		1	O-ring	O-ring	Joint torique		0841 V + H	
164	11120140		1	O-ring	O-ring	Joint torique		1040 V + H	
164	11120063		1	O-ring	O-ring	Joint torique		1041 V + H	
164	11120071		1	O-ring	O-ring	Joint torique		1042&1541 V + H	
164	11120094		1	O-ring	O-ring	Joint torique		1046 V + H	
182	11560018		1	Plug	Stopfen	Bouchon	R 1/2 DIN 910		
183	11130013		2	Fibre washer	Fiberdichtung	Joint fibre	Ø21x26x1		
265	42030500		4	Adjusting screw	Stellschraube	Vis de réglage	M16x30	0841	
265	42030501		4	Adjusting screw	Stellschraube	Vis de réglage	M18x35	1040 - 1541 V + H	
266	11210246		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x45 DIN 912		
		*		Without venting	Ohne Entlüftung	Sans purge d'air			
		**		With venting	Mit Entlüftung	Avec purge d'air			



SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP M15/6-M125/2 60 HZ
VORTEX HYDRAULICS

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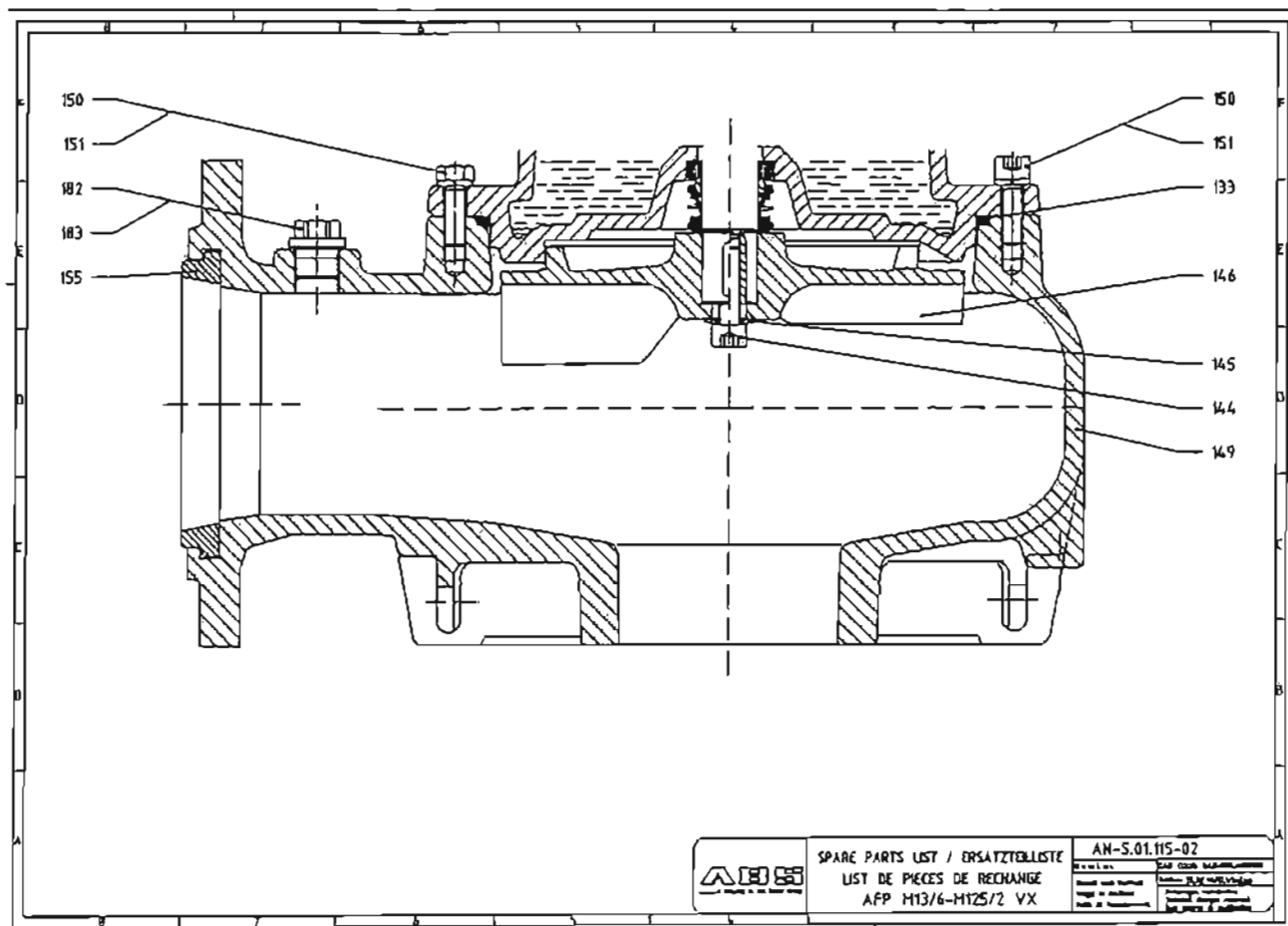
Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
133	11120112		1	O-ring	O-ring	Joint tonque	Ø220x6	AFP M15/6-M35/4	
133	11120073		1	O-ring	O-ring	Joint tonque	Ø260x7 DIN 3771	AFP M35/6-M125/2	
144	11210245		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x30 DIN 912	AFP M15/6-M35/4	
144	11210228		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN 912	AFP M35/6-M125/2	
145	11470064		1	Washer	Scheibe	Rondelle	Ø10.5 DIN 9021	AFP M15/6-M35/4	
145	11470038		1	Washer	Scheibe	Rondelle	Ø12 DIN 6796	AFP M35/6-M125/2	
146	35075002		1	Impeller	Laufrad	Roue		0831 1	
146	35075032		1	Impeller	Laufrad	Roue		0831 2	
148	35075001		1	Impeller	Laufrad	Roue		0831 3	
148	35075085		1	Impeller	Laufrad	Roue		0831 4	
146	35075086		1	Impeller	Laufrad	Roue		0831 5	
146	35075076		1	Impeller	Laufrad	Roue		0834 5	
146	35075077		1	Impeller	Laufrad	Roue		0834 6	
146	35075078		1	Impeller	Laufrad	Roue		0834 7	
146	35075002		1	Impeller	Laufrad	Roue		1031 1	
146	35075001		1	Impeller	Laufrad	Roue		1031 2	
146	35075000		1	Impeller	Laufrad	Roue		1031 3	
146	35075085		1	Impeller	Laufrad	Roue		1031 4	
146	35075088		1	Impeller	Laufrad	Roue		1031 5	
148	35075087		1	Impeller	Laufrad	Roue		1031 6	
146	35075061		1	Impeller	Laufrad	Roue		1031 1 SX	
146	35075098		1	Impeller	Laufrad	Roue		1031 2 SX	
146	35075095		1	Impeller	Laufrad	Roue		1031 3 SX	
146	35075092		1	Impeller	Laufrad	Roue		1031 4 SX	
146	35075111		1	Impeller	Laufrad	Roue		1031 5 SX	
146	35075112		1	Impeller	Laufrad	Roue		1031 6 SX	
148	35075062		1	Impeller	Laufrad	Roue		1032 1 SX	
148	35075099		1	Impeller	Laufrad	Roue		1032 2 SX	
146	35075093		1	Impeller	Laufrad	Roue		1032 3 SX	
146	35075113		1	Impeller	Laufrad	Roue		1032 4 SX	
146	35075004		1	Impeller	Laufrad	Roue		1032.1	
146	35075003		1	Impeller	Laufrad	Roue		1032.2	
148	35075029		1	Impeller	Laufrad	Roue		1032.3	
146	35075088		1	Impeller	Laufrad	Roue		1032.4	
149	31050451	*	1	Volute	Kreisellammer	Corps de pompe		0831	
149	31050452	**	1	Volute	Kreisellammer	Corps de pompe		0831 V+H	
149	31050572	*	1	Volute	Kreisellammer	Corps de pompe		1031	
149	31050590	**	1	Volute	Kreisellammer	Corps de pompe		1031 V+H	
149	31055012	*	1	Volute	Kreisellammer	Corps de pompe		1031 SX	
149	31055009	*	1	Volute	Kreisellammer	Corps de pompe		1032 SX	
149	31050573	*	1	Volute	Kreisellammer	Corps de pompe		1032	
149	31050591	**	1	Volute	Kreisellammer	Corps de pompe		1032 V+H	
150	11200187		1	Hexagonal screw	Sechskantschraube	Vis hexagonal	M10x35 DIN 933	AFP M15/6-M35/4	

SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÉCES DE RECHANGE

AFP M15/6-M125/2 60 HZ
VORTEX HYDRAULICS

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Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
150	11210239		3	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x35 DIN 912	AFP M15/6-M35/4	
150	11210228		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN 912	AFP M35/6-M125/2	
151	11530018		1	Spring washer	Federring	Rondelle	Ø10 DIN 7980	AFP M15/6-M35/4	
151	11530018		3	Spring washer	Federring	Rondelle	Ø10 DIN 7980	AFP M15/6-M35/4	
151	11530019		4	Spring washer	Federring	Rondelle	Ø12 DIN 7980	AFP M35/6-M125/2	
155	43070021		1	Seal	Dichtung	Joint		1031 + 1032	
182	11560018		1	Plug	Stopfen	Bouchon	R $\frac{1}{2}$ DIN 910		
183	11130013		2	Fibre washer	Fiberoichtung	Joint fibre	Ø21x26x1		
		*		Without venting	Ohne Entlüftung	Sans purge d'air			
		**		With venting	Mit Entlüftung	Avec purge d'air			

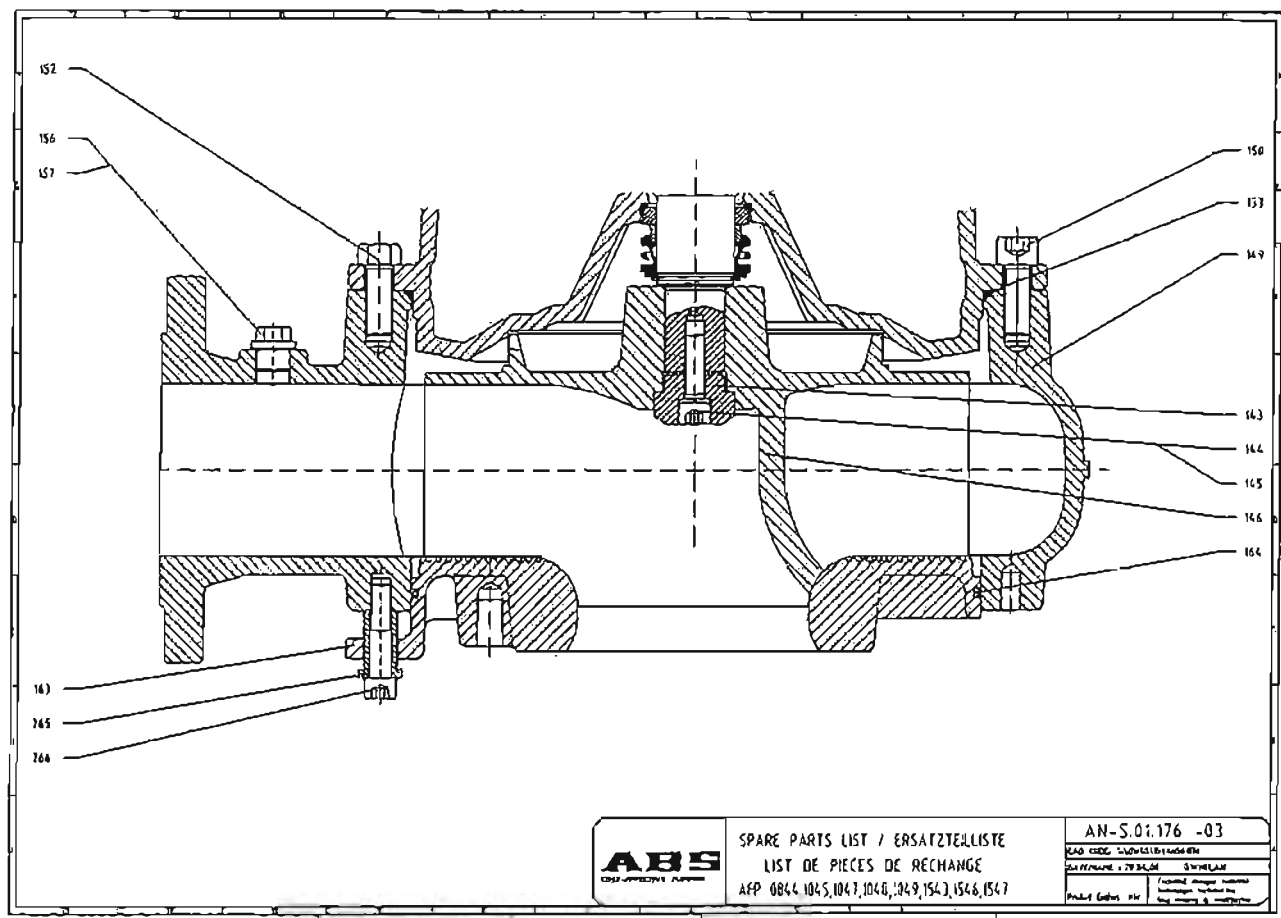


SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP 0844 60 HZ
HYDRAULICS

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Supersedes Issue :
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Drawing ref. Nr. : AN-S.01.176-03

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
133	11120520		1	O-ring	O-ring	Joint torique	Ø215.49x3.53		
143	42010049		1	Washer	Scheibe	Rondelle			
144	11210228		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN 912		
145	11490028		2	Locking washer	Klemmscheibe	Rondelle-frein	M12 DIN 25201		
146	35075268		1	Impeller	LaufRad	Roue	Ø170 GG20	0844 3	
146	35075256		1	Impeller	LaufRad	Roue	Ø180 GG20	0844 4	
149	31055083		1	Volute	Kreisellammer	Corps de pompe	1045 GG20		
150	11210239		3	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x35 DIN 912		
152	11200187		1	Hex nut	Sechskantmutter	Ecrou hexagonal	M10x35 DIN 933		
156	11560018		1	Screwed plug	Verschlußschraube	Bouchon fileté	R1/2" DIN910		
157	11130013		1	Fibre washer	Fiberdichtung	Joint fibre	21X28X1		
163	31065028		1	Bottom plate	Bodenplatte	Plaque de base			
164	11120063		1	O-ring	O-ring	Joint torique	Ø205x5 DIN 3771		
265	42030501		4	Adjusting screw	Stellschraube	Vis de réglage	M18x35 Brass		
286	11210251		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x50 DIN 912		

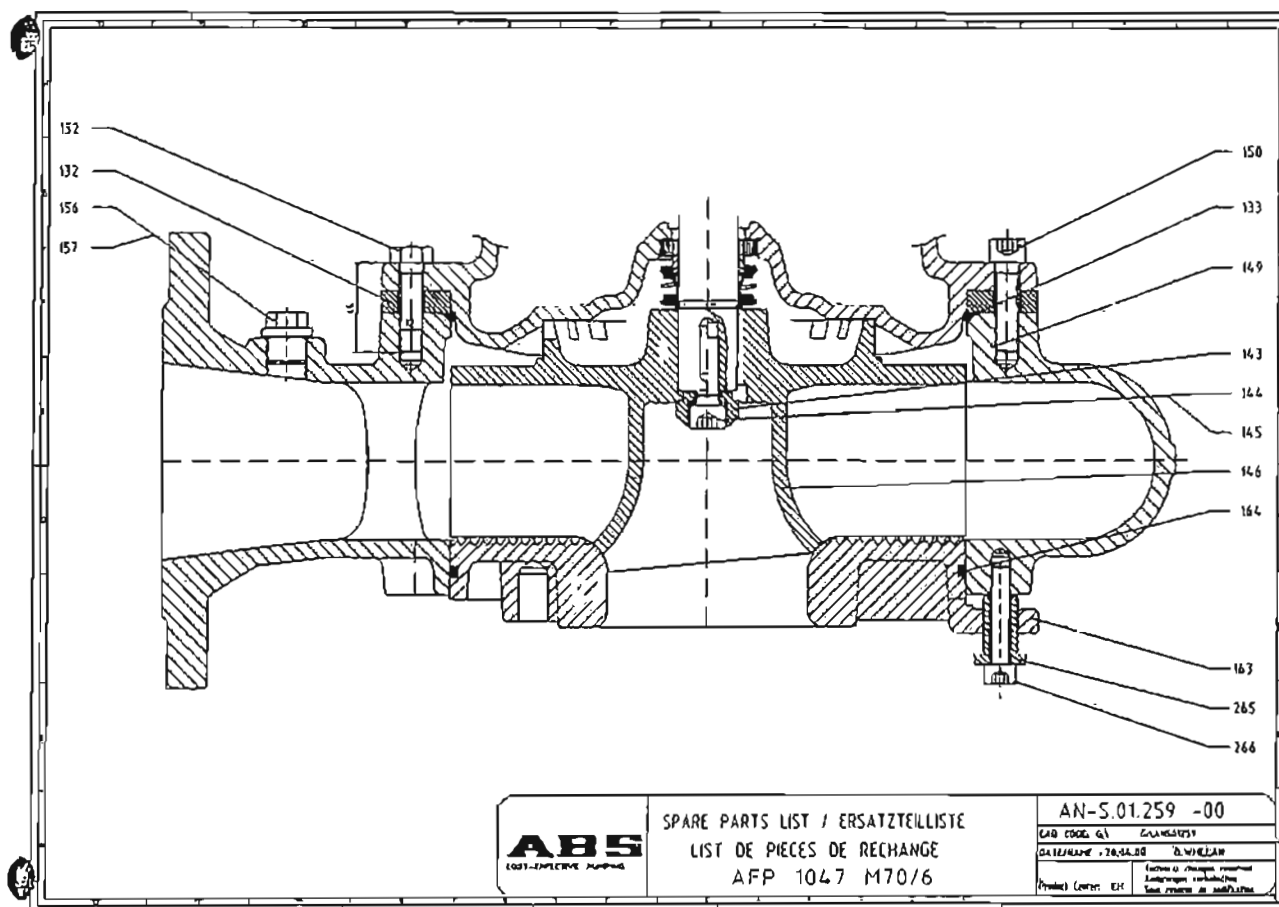


SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP 1047 M70/6 HZ
HYDRAULICS

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 Drawing ref. Nr. : AN-S.01.259-00

Pos. No.	Part No.	Klt	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
132	21565004		1	Spacer ring	Zwischenring	Bague intermédiaire			
133	11120521		1	O-ring	O-ring	Joint torique	Ø253.49x3 53		
143	42010049		1	Washer	Scheibe	Rondelle			
144	11210235		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x40 DIN 912		
145	11490028		2	Locking washer	Klemmscheibe	Rondelle-frein	M12 DIN 25201		
146	35075258		1	Impeller	Laufrad	Roue	Ø264 GG20	1047.1	
146	35075259		1	Impeller	Laufrad	Roue	Ø250 GG20	1047.2	
146	35075260		1	Impeller	Laufrad	Roue	Ø233 GG20	1047.3	
149	31055028		1	Volute	Kreiselkammer	Corps de pompe	ANSI 1047 GG20		
150	11210222		3	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x45 DIN933		
151	11470019		4	Spring washer	Federring	Rondelle	A13 DIN125		
152	11200212		1	Hexagonal screw	Sechskantschraube	Vis hexagonal	M12x45 DIN933		
156	11560018		1	Plug	Stopfen	Bouchon	R 1/2 DIN 910		
157	11130013		2	Fibrewasher	Fiberdichtung	Joint fibre	Ø21x26x1		
163	31085027		1	Bottom plate	Bodenplatte	Plaque de base			
164	11120071		1	O-ring	O-ring	Joint torique	Ø248x5 DIN 3771		
265	42030501		4	Adjusting screw	Stellschraube	Vis de réglage	M18x35 Brass		
266	11210251		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x50 DIN 912		

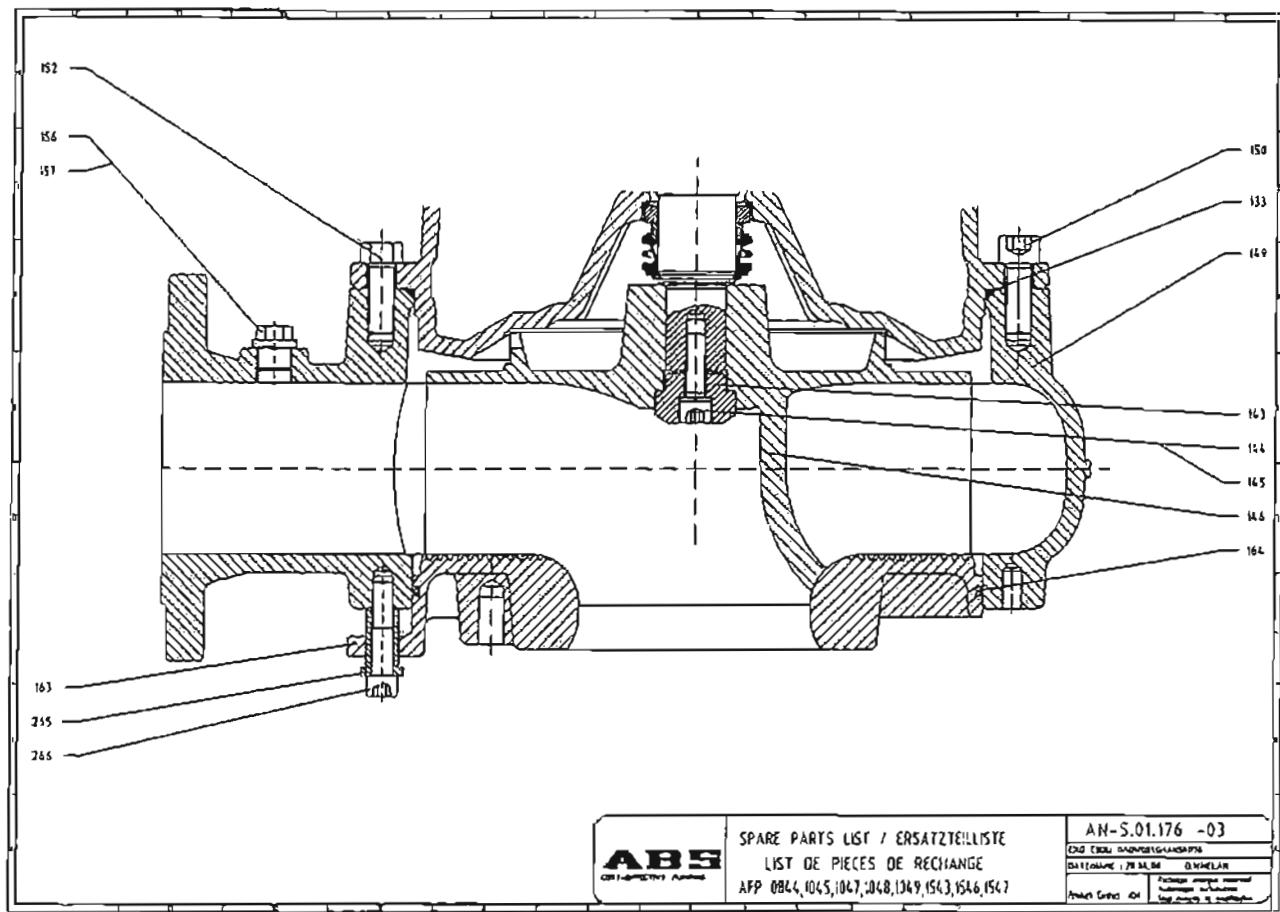


SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP 1547 M70/6 HZ
HYDRAULICS

Page : 1 of 1
 Issue of : 24/11/00
 Supersedes Issue :
 Issue No. : 1
 Drawing ref. Nr. : AN-S.01.176-03

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
133	11120521		1	O-ring	O-ring	Joint torique	Ø253,49x3 53		
143	42010049		1	Washer	Scheibe	Rondelle			
144	11210235		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x40 DIN 912		
145	11490028		2	Locking washer	Klemmscheibe	Rondelle-frein	M12 DIN 25201		
146	35075261		1	Impeller	LaufRad	Roue	Ø264 GG20	1547.1	
146	35075262		1	Impeller	LaufRad	Roue	Ø250 GG20	1547.2	
146	35075263		1	Impeller	LaufRad	Roue	Ø233 GG20	1547.3	
149	31050578		1	Volute	Kreisellammer	Corps de pompe	ANSI 1547 GG20		
150	11210228		3	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN912		
151	11470019		4	Spring washer	Federling	Rondelle	A13 DIN125		
152	11200171		1	Hexagonal screw	Sechskantschraube	Vis hexagonal	M12x35 DIN933		
156	11560018		1	Plug	Stopfen	Bouchon	R 1/2 DIN 910		
157	11130013		2	Fibre washer	Fiberdichtung	Joint fibre	Ø21x26x1		
163	31065017		1	Bottom plate	Bodenplatte	Plaque de base			
164	11120071		1	O-ring	O-ring	Joint torique	Ø246x5 DIN 3771		
265	42030501		4	Adjusting screw	Stellschraube	Vis de réglage	M18x35 Brass		
266	11210251		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x50 DIN 912		

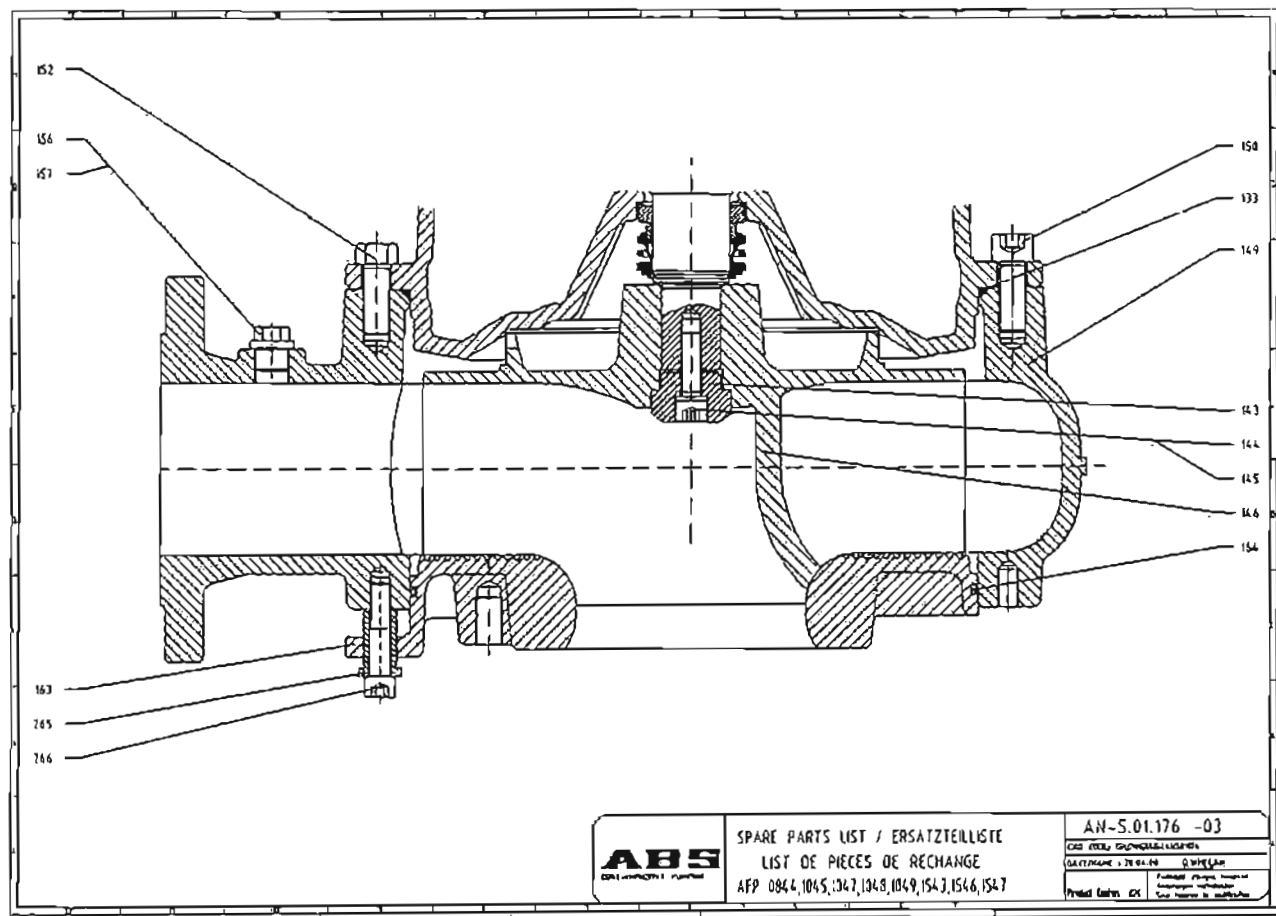


SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP 1049 & 1546 60 HZ
HYDRAULICS

Page : 1 of 1
 Issue of : 14/07/00
 Supersedes Issue :
 Issue No. : 1
 Drawing ref. Nr. : AN-S.01.176-03

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
133	11120521		1	O-ring	O-ring	Joint torique	Ø253 49x3.53		
143	42010049		1	Washer	Scheibe	Rondelle			
144	11210228		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN 912		
145	11490028		2	Locking washer	Klemmscheibe	Rondelle-frein	M12 DIN 25201		
146	35075272		1	Impeller	Laufrad	Roue	Ø253 GG20	1049.1	
146	35075273		1	Impeller	Laufrad	Roue	Ø246 GG20	1049.2	
146	35075274		1	Impeller	Laufrad	Roue	Ø236 GG20	1049.3	
146	35075275		1	Impeller	Laufrad	Roue	Ø228 GG20	1049.4	
146	35075276		1	Impeller	Laufrad	Roue	Ø224 GG20	1049.5	
146	35075277		1	Impeller	Laufrad	Roue	Ø245 GG20	1546.1	
146	35075278		1	Impeller	Laufrad	Roue	Ø236 GG20	1546.2	
146	35075279		1	Impeller	Laufrad	Roue	Ø231 GG20	1546.3	
146	35075280		1	Impeller	Laufrad	Roue	Ø221 GG20	1546.4	
146	35075281		1	Impeller	Laufrad	Roue	Ø210 GG20	1546.5	
146	35075282		1	Impeller	Laufrad	Roue	Ø203 GG20	1546.6	
149	31055067		1	Volute	Kreiselkammer	Corps de pompe	GG20	1049	
149	31050585		1	Volute	Kreiselkammer	Corps de pompe	GG20	1546	
150	11210228		3	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN 912		
152	11200171		1	Hex nut	Sechskantmutter	Ecrou hexagonal	M12x35 DIN 933		
156	11560018		1	Screwed plug	Verschlußschraube	Bouchon fileté	R 1/2" DIN910		
157	11130013		1	Fibre washer	Fiberdichtung	Joint fibre	21X26X1		
163	31065027		1	Bottom plate	Bodenplatte	Plaque de base		1049	
163	31065033		1	Bottom plate	Bodenplatte	Plaque de base		1546	
164	11120071		1	O-ring	O-ring	Joint torique	Ø248x5 DIN 3771		
265	42030501		4	Adjusting screw	Stellschraube	Vis de réglage	M18x35 Brass		
266	11210251		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x50 DIN 912		



SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP 1062 60 HZ
HYDRAULICS

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 Issue of : 18/02/00
 Supersedes Issue :
 Issue No. : 1 & 2
 Drawing ref. Nr. : AN-S.01.216-01

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
133	11120521		1	O-ring	O-ring	Joint torique	Ø253.49x3.53		
144	11210514		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x180 DIN 912		
145	11490028		2	Locking washer	Klemmscheibe	Rondelle-frein	DIN 25201		
148	35075195		1	Impeller	Laufrad	Roue	Ø215	1062.2	
146	35075237		1	Impeller	Laufrad	Roue	Ø200	1062.3	
146	35075234		1	Impeller	Laufrad	Roue	Ø180	1062.4	
149	31055026		1	Volute	Kreisellammer	Corps de pompe	GG20		
150	11210228		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN 912		
151	11530018		4	Spring washer	Federung	Rondelle	Ø10 DIN 7980		
156	11560018		1	Plug	Stopfen	Bouchon	R $\frac{1}{2}$ DIN 910		
157	11130013		1	Fibrewasher	Fiberdichtung	Joint fibre	Ø21x26x1		
163	31085024		1	Bottom plate	Bodenplatte	Plaque de base	GG30		
265	42030529		4	Adjusting screw	Stellschraube	Vis de réglage	M20x40		
266	11210187		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x60 DIN 912		



SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP 1034 60 HZ
HYDRAULICS

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Issue of : 18/02/00
Supersedes Issue : 18/06/98
Issue No. : 2
Drawing ref. Nr. : AN-S.01.239-01

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Désignation	Dimensions /Din	Comments	Price
133	11120073		1	O-ring	O-ring	Joint torique	Ø260x7 DIN 3771		
144	11210258		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x50 DIN 912		
145	42015008		1	Locking washer	Klemmscheibe	Rondelle-frein			
146	35075222		1	Impeller	Laufrad	Roue	Ø211 GG25	1034 5	
146	35075223		1	Impeller	Laufrad	Roue	Ø201 GG25	1034 8	
146	35075224		1	Impeller	Laufrad	Roue	Ø191 GG25	1034 7	
146	35075225		1	Impeller	Laufrad	Roue	Ø181 GG25	1034 8	
146	35075226		1	Impeller	Laufrad	Roue	Ø171 GG25	1034 9	
149	31055056		1	Volute	Kreiselkammer	Corps de pompe			
150	11210228		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x35 DIN 912		
151	11530019		4	Spring washer	Federling	Rondelle	Ø12 DIN 7980		
156	11560018		1	Screwed plug	Verschlußschraube	Bouchon fileté	R 1/2" DIN 910		
157	11130013		1	Fibre washer	Fiberdichtung	Joint fibre	21X26X1		



AN-S.01.239-01

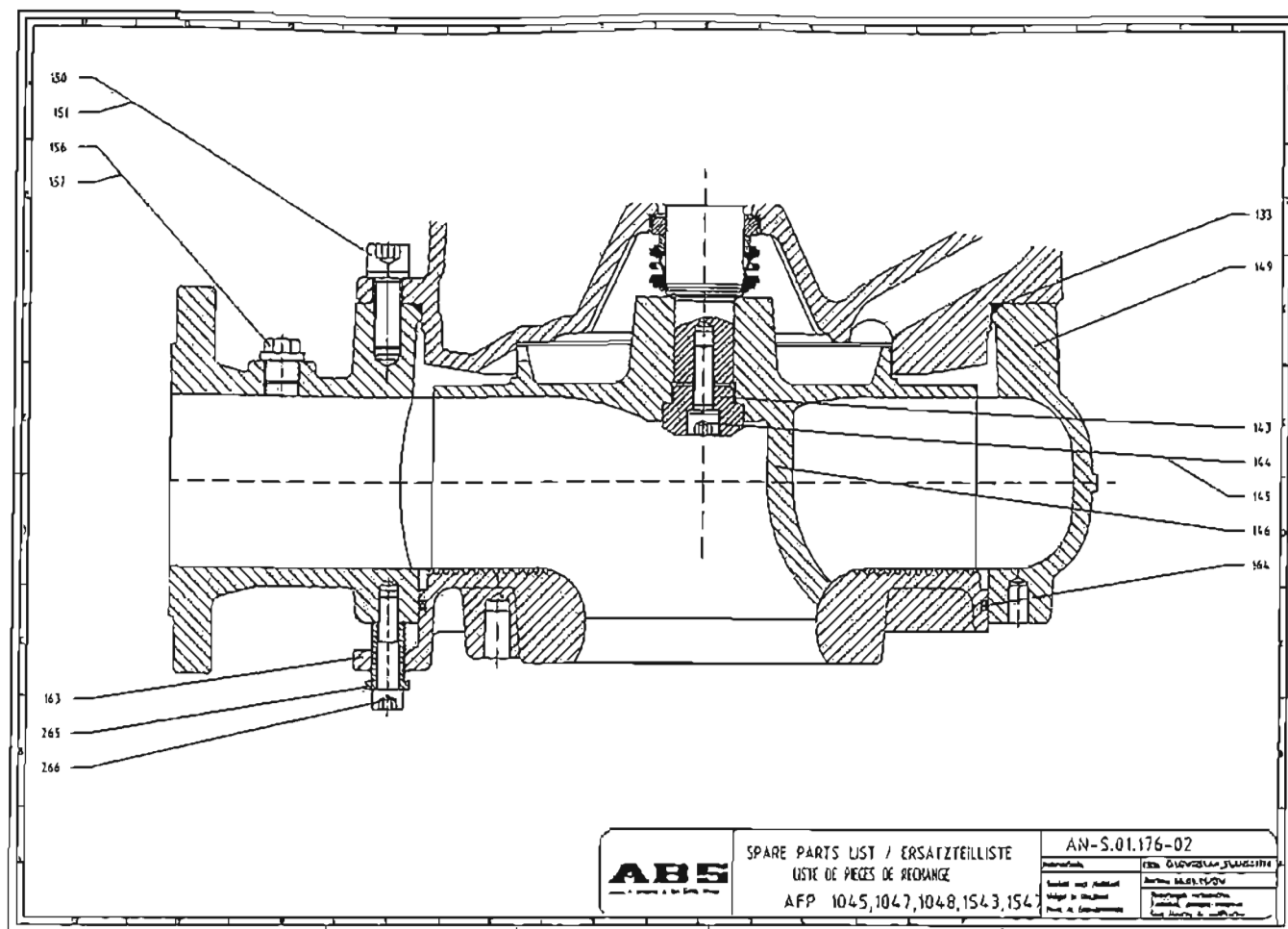
Signature/Name	(Sgt. GRANT WOOD)
Location where incident occurred or observed	Dallas TX 06/19/87
Date & Time/Agency	Continued regarding the financial charges received from company of subject's/bs

SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP 1047, 1048 & 1547 60 HZ
HYDRAULICS

Page : 1 of 1
Issue of : 18/02/00
Supersedes Issue : 02/03/99
Issue No. : 3
Drawing ref. Nr. : AN-S.01.176-02

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
133	11120521		1	O-ring	O-ring	Joint torique	Ø253.49x3 53		
143	42015008		1	Washer	Scheibe	Rondelle			
144	11210235		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x40 DIN 912		
145	11490028		2	Locking washer	Klemmscheibe	Rondelle-frein	M12 DIN 25201		
146	35075145		1	Impeller	Laufrad	Roue	Ø264 GG20	1047.1	
146	35075146		1	Impeller	Laufrad	Roue	Ø250 GG20	1047.2	
146	35075147		1	Impeller	Laufrad	Roue	Ø233 GG20	1047.3	
146	35075240		1	Impeller	Laufrad	Roue	Ø205 GG20	1048.3	
148	35075246		1	Impeller	Laufrad	Roue	Ø197 GG20	1048.4	
148	35075247		1	Impeller	Laufrad	Roue	Ø190 GG20	1048.5	
146	35075094		1	Impeller	Laufrad	Roue	Ø264 GG20	1547.1	
148	35075138		1	Impeller	Laufrad	Roue	Ø250 GG20	1547.2	
146	35075139		1	Impeller	Laufrad	Roue	Ø233 GG20	1547.3	
149	31055026		1	Volute	Kreiseltammer	Corps de pompe	ANSI 1047 GG20		
149	31055037		1	Volute	Kreiseltammer	Corps de pompe	1048 GG20		
149	31050578		1	Volute	Kreiseltammer	Corps de pompe	ANSI 1547 GG20		
150	11200188		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x40 DIN 933		
151	11470019		4	Spring washer	Federring	Rondelle	A13 DIN125		
156	11560018		1	Plug	Stopfen	Bouchon	R 1/2 DIN 910		
157	11130013		2	Fibre washer	Fiberdichtung	Joint fibre	Ø21x26x1		
163	31065027		1	Bottom plate	Bodenplatte	Plaque de base		1047	
163	31065028		1	Bottom plate	Bodenplatte	Plaque de base		1048	
163	31085017		1	Bottom plate	Bodenplatte	Plaque de base		1547	
164	11120071		1	O-ring	O-ring	Joint torique	Ø248x5 DIN 3771	1047 & 1547	
164	11120063		1	O-ring	O-ring	Joint torique	Ø205x5 DIN 3771	1048	
265	42030501		4	Adjusting screw	Stellschraube	Vis de réglage	M18x35 Brass		
265	11210251		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M10x50 DIN 912		

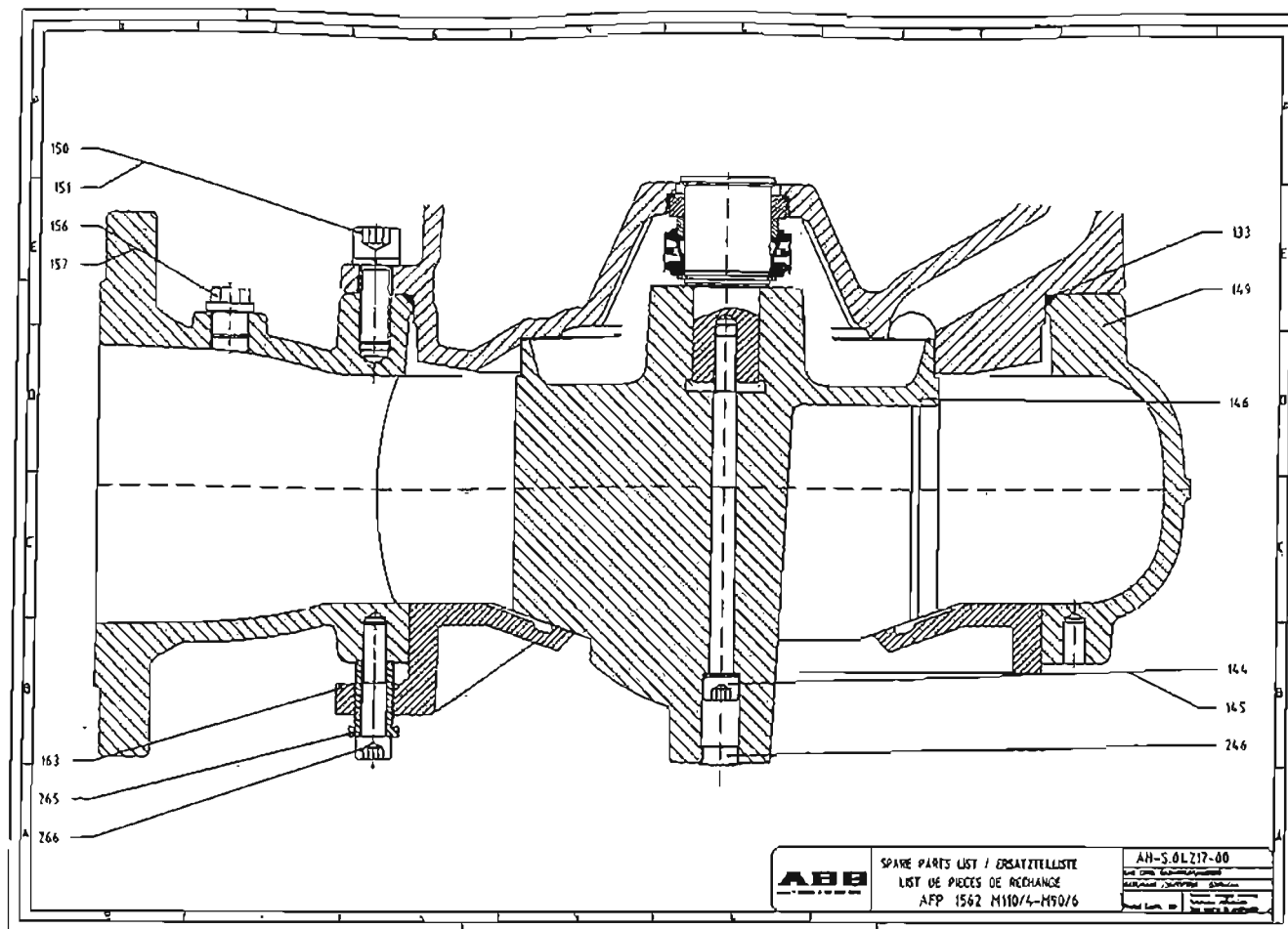


SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP 1562 60Hz HZ
HYDRAULICS

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 Issue of : 26/05/00
 Supersedes Issue :
 Issue No. : 1&2
 Drawing ref. Nr. : AN-S.01.217-00

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
133	11120126		1	O-ring	O-ring	Joint torique	Ø320x5 DIN 3770		
144	11210514		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x180 DIN 912		
145	1149C028		2	Locking washer	Klemmscheibe	Rondelle-frein	DIN 25201		
146	35075188		1	Impeller	Laufrad	Roue	Ø225 GGG 60		
149	31055024		1	Volute	Kreisellammer	Corps de pompe	GG20		
150	11210145		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M16x45 DIN 912		
151	11530021		1	Spring washer	Federring	Rondelle	Ø16 DIN 7980		
156	11580018		1	Plug	Stopfen	Bouchon	R 1/2 DIN 910		
157	11130013		2	Fibre washer	Fiberdichtung	Joint fibre	Ø21x26x1		
163	31065025		1	Bottom plate	Bodenplatte	Plaque de base	GG30		
246	13780070		1	Plug	Stopfen	Bouchon			
265	42030530		4	Adjusting screw	Stellschraube	Vis de réglage	M20x45		
286	11210187		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x60 DIN 912		

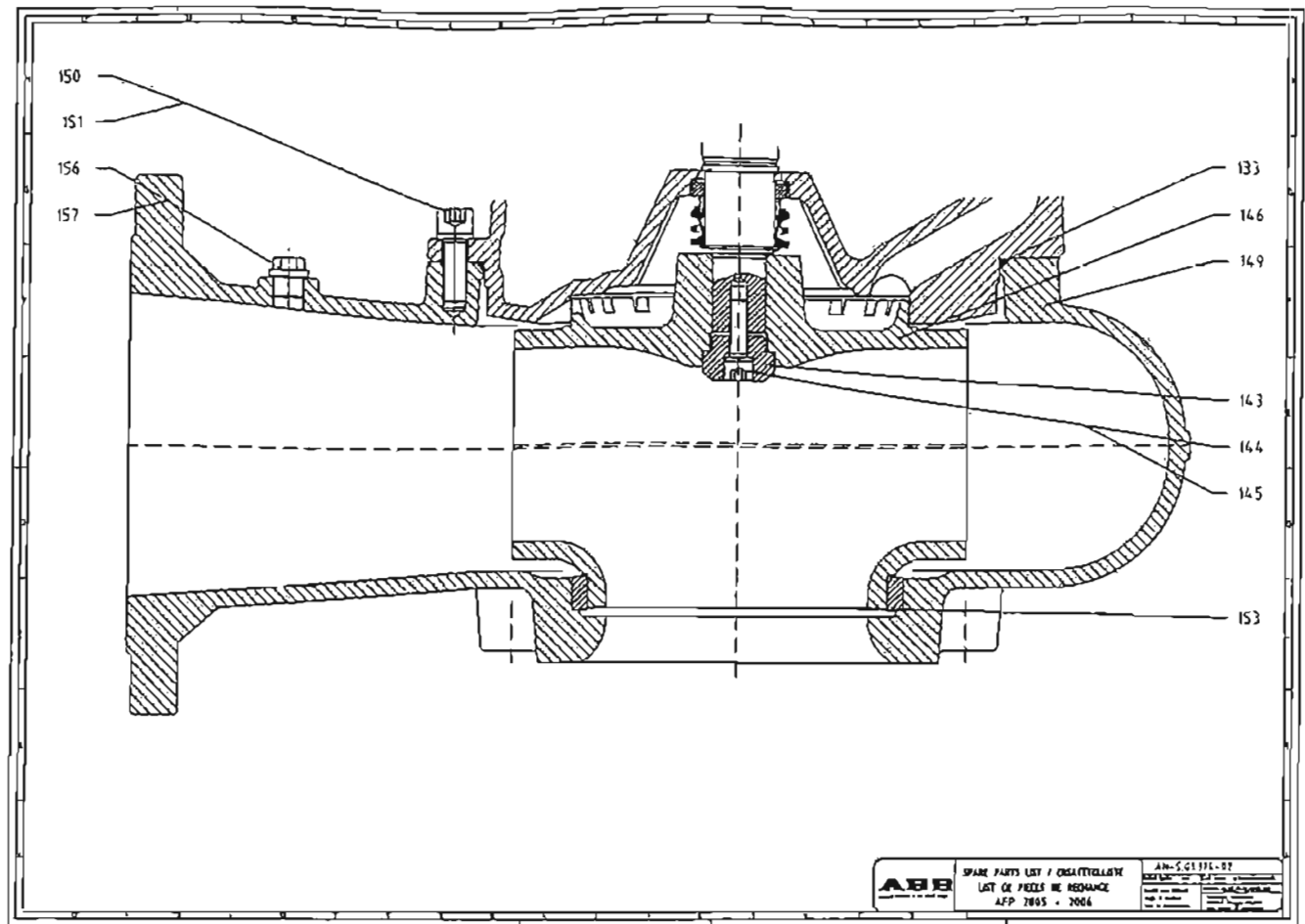


SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP 2006 60 HZ
HYDRAULICS

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Issue of : 18/02/00
Supersedes Issue : 31/07/98
Issue No. : 3
Drawing ref. Nr. : AN-S.01.174-02

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
133	11120126		1	O-ring	O-ring	Joint torique	Ø320x5		
143	42015C08		1	Washer	Scheibe	Rondelle			
144	11210235		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M12x40 DIN 912		
145	11490028		2	Locking washer	Klemmscheibe	Rondelle-trein	M12 DIN 25201		
146	35075167		1	Impeller	Laufrad	Roue	Ø295 GG20	2006 1	
146	35075168		1	Impeller	Laufrad	Roue	Ø285 GG20	2006 2	
149	31055025		1	Volute	Kreisellammer	Corps de pompe	DN200 GG20		
150	11210145		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M16X45 DIN 912		
151	1153C021		4	Spring washer	Federring	Rondelle	Ø16 DIN 7980		
153	31345C00		1	Wear ring	Schleissring	Bague d'usure			
156	11560018		1	Screwed plug	Verschlußschraube	Bouchon fileté	R 1/2" DIN910		
157	11130013		1	Fibre washer	Fiberdichtung	Joint fibre	21X26X1		



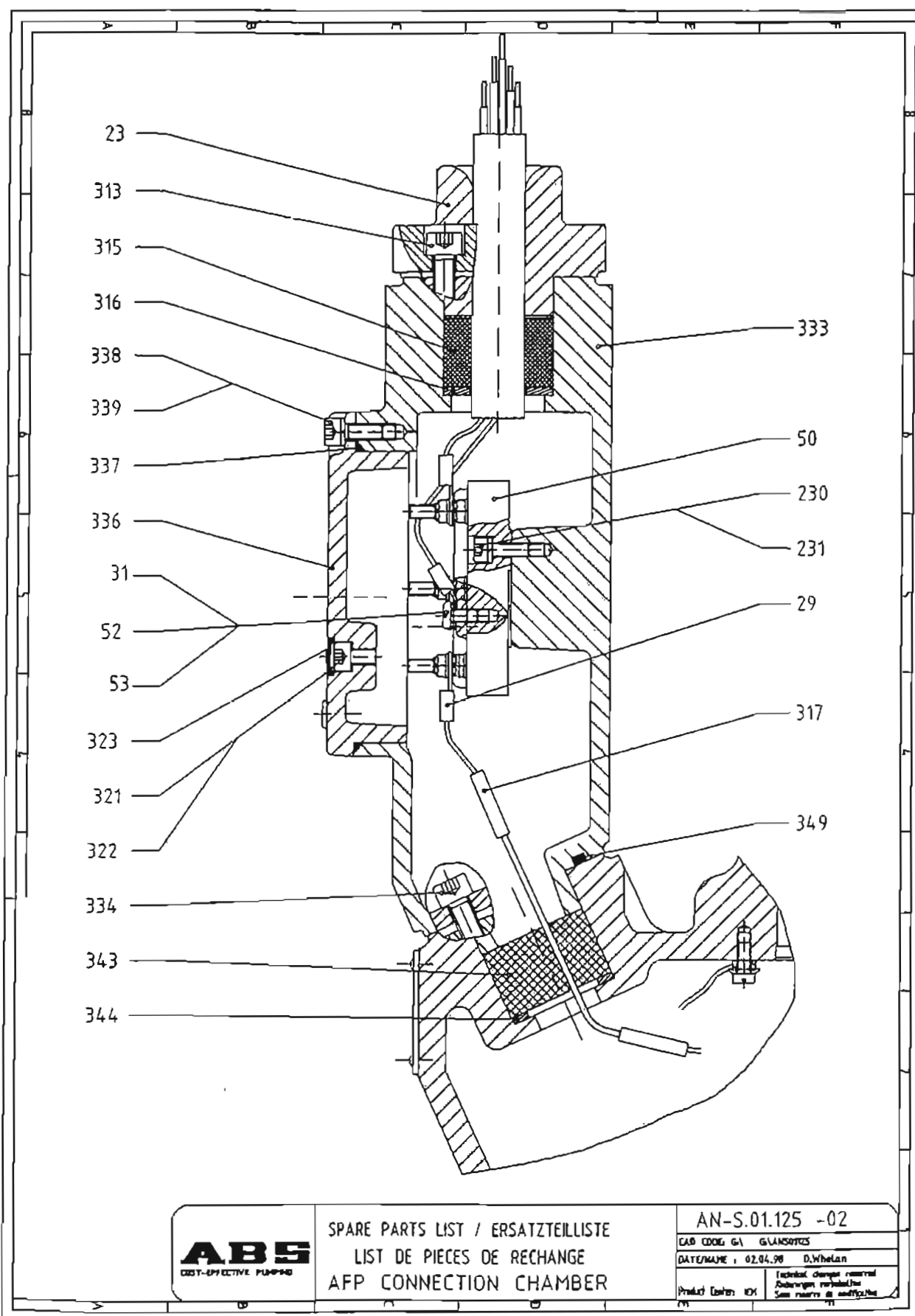
SPARE PARTS LIST/ERSATZTEILLISTE/LISTE DE PIÈCES DE RECHANGE

AFP EX CONNECTION CHAMBER - USA

AFP M130/4-M230/2 EX FM 60HZ

Page : 1 OF 1
 Issue of : 15/11/00
 Supersedes Issue : 04/07/1997
 Issue No. : 2
 Drawing ref. Nr. : AN-S.01.125-02

Pos. No.	Part No.	Kit	Qty	Description	Benennung	Designation	Dimensions /Din	Comments	Price
23	31325006		1	Cable cap	Kabelinführung	Entrée de câble			
29	12180031		12	Cable shoe	Flachsteckhülse	Cosse-câble	Ø0.5-1.5 M6		
31	12180014		1	Cable shoe	Flachsteckhülse	Cosse-câble			
50	12200020		1	Terminal block	Klemmenleiste	Plaque à bornes			
52	11260104		1	Hexagonal screw	Sechskantschraube	Vis hexagonal	M5x10 DIN 85		
53	11500003		1	Locking washer	Sicherungsscheibe	Tôle-frein			
230	11210014		2	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M5x15 DIN 912		
231	11530003		2	Spring washer	Federring	Rondelle	Ø5 DIN 7980		
313	11210238		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M8x30 DIN 912		
315	43075060		1	Seal	Dichtung	Joint	OD50 ID20		
315	43075061		1	Seal	Dichtung	Joint	OD50 ID24		
315	43075062		1	Seal	Dichtung	Joint	OD50 ID32		
316	42015018		1	Washer	Scheibe	Rondelle	Ø30x21x3		
316	42015018		1	Washer	Scheibe	Rondelle	Ø50x25 5x3		
316	42015017		1	Washer	Scheibe	Rondelle	Ø50x33 5x3		
317	12180049		12	Bolt connection	St. verbind.	Connecteur	Ø2 5-6 5mm		
317	12180044		5	Bolt connection	St. verbind.	Connecteur	Ø1 0-2.5mm		
321	11210281		1	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M6x8 DIN 912		
322	11130003		1	Seal ring	Dichtung	Rondelle joint	Ø6x10 DIN 7603		
323	11490020		1	Seal washer	Verschlusscheibe	Rondelle joint	DIN 470		
333	31395002		1	Housing	Gehäuse	Corps			
334	11210238		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M8x30 DIN 912		
336	31395001		1	Cover	Deckel	Couvercle			
337	11120038		1	O-ring	O-ring	Joint torique	Ø101x3 DIN 3771		
338	11210226		4	Cylinder screw	Zylinderschraube	Vis à tête cylindrique	M6x16 DIN 912		
339	11530016		4	Spring washer	Federring	Rondelle	Ø6 DIN 7980		
343	43070570		1	Seal	Dichtung	Joint			
344	42015002		1	Washer	Scheibe	Rondelle	Ø40x28x2.5		
349	11120318		1	O-ring	O-ring	Joint torique	Ø48 0x4 0		



FOR SERVICE:

**ABS PUMPS INC.
140 POND VIEW DRIVE
MERIDEN, CT USA 06450
TELEPHONE: (203) 238-2700
FAX: (203) 235-1080**

FOR PARTS:

FAX: (203) 639-1850

HILL MOBILE HOME

DESCRIPTION OF OPERATION

The SBR Control Panel is equipped with an Allan Bradley SLC 500 Programmable Controller with operator interface for operator adjustment of the process timers. Selector switches and indicator lights are provided for manual operation or selecting automatic sequence.

SEQUENCE OF OPERATION

ISAM SYSTEM

A.FLUIDYNE SAM MODE SEQUENCE

- 1) DECANT END TIMER times out, start FILL / INTERACT cycle, start the Aspirator(s), start ASPIRATOR ON TIMER, start MINIMUM INTERACT TIMER.
- 2) ASPIRATOR ON TIMER times out, stop Aspirator (s), start ASPIRATOR OFF TIMER.
- 3)) ASPIRATOR OFF TIMER times out, start Aspirator (s), start ASPIRATOR ON TIMER. Cycling of the Aspirator (s) continues until the tank goes to SETTLE.
- 4) SAM Tank reaches SWL setpoint, SBR is at TWL and MINIMUM INTERACT TIMER done SBR tank goes to SETTLE cycle, stop Aspirator (s), start SETTLE TIMER.
- 5) SETTLE TIMER TIMES out, start DECANT cycle, DECANT BEGIN TIMER starts, decant vent valve opens, start disinfection.
- 6) DECANT BEGIN TIMER times out, decant vent valve closes, open effluent valve.
- 7) BWL is reached, close effluent valve.
- 8) Effluent valve confirmed closed, DECANT END TIMER starts, decant vent valve opens.
- 9) DECANT END TIMER TIMES out, decant vent valve closes, stop disinfection.
- 10) System starts over again.

NOTE:

- 1) The Control System has a batch counter (PANELVIEW SCREEN #8 F4; C5:100 in ladder diagram) that increments a value of 1 after each DECANT cycle. Knowing the decant volume (fixed for each batch), the total flow can be calculated for each day, week or any other time period

ISAMTM AERATION CAPABILITIES **(For Programming Reference)**

There are three different aeration capabilities during the INTERACT cycle; normal aeration on/off, low flow aeration on/off and high flow aeration, continuous during FILL / INTERACT. Normal aeration and low flow aeration use the following counters in the programming ladder logic:

NORMAL AERATION

C5:1	Aerobic
C5:2	Static

LOW FLOW AERATION

C5:21	Aerobic
C5:22	Static

During high flow aeration Aspirator(s) run continuously.

There is a 24-hour clock allowing for automatic selection of high flow periods and low flow periods. The set points are located at the following N registers in the programming ladder logic.

ADDRESS**DESCRIPTION**

N7:1	High Flow On Time
N7:2	High Flow Off Time
N7:3	Daily Low Flow On Time
N7:4	Daily Low Flow Off Time

There is a 7-day clock allowing for automatic selection of weekend flow aeration. Weekend flow aeration uses the same N registers as the low flow aeration. The days are adjustable between 0 – 6 with 0 starting Midnight Saturday and 6 starting Midnight Friday. The set points are located at the following N registers in the programming ladder logic.

ADDRESS**DESCRIPTION**

N7:5	Weekend Flow On
N7:6	Weekend Flow Off

The aeration capabilities are enabled or disabled at the following N registers in the programming ladder logic.

<u>ADDRESS</u>	<u>DESCRIPTION</u>
N7:7	High Flow 0=Off, 1=On
N7:8	Daily Low Flow 0=Off, 1=On
N7:9	Weekend Flow 0=Off, 1=On

ISAM™ LIQUID LEVEL SET POINTS

SAM TANK

- LWL LOW WATER LEVEL – Pump shut off,
Set elevation just above pump
- SWL SETTLE WATER LEVEL – Initiate SETTLE cycle
Set elevation 1.5 to 3.0 ft below TWL
- HWL HIGH WATER LEVEL – Initiate alarm denotes liquid level too high
Set elevation 3 in above TWL

SBR TANK

- BWL BOTTOM WATER LEVEL – Stop DECANT cycle, finish batch
Set elevation 1.5 in above intake point of decanter
- TWL TOP WATER LEVEL – Start INTERACT cycle
Set elevation 1 in below over flow weir

NOTE: SWL, TWL and HWL make the condition true on rising liquid level and elevation should be set at top of lead weight

LWL and BWL make the condition true on falling liquid level and elevation should be set when float is approximately at 5 o'clock position

PANELVIEW SCREEN DESCRIPTION (For Operator Control and Monitoring)

- SCREEN 1 Main Menu – F1 SAM Tank, F2 SBR Tank, F3 Set Points, and F4 Alarms
- SCREEN 2 SAM Tank – Indications for LWL, SWL, HWL, Aspirator 1 run, Aspirator 2 run
- SCREEN 3 SBR Tank – Indications for BWL and TWL
- SCREEN 4 TIMER Values 1 – Accumulated run times for Aspirator on/off during Normal Flow and Low Flow
- SCREEN 5 Timer Values 2 – Accumulated run times for Settle, Decant Begin and Decant End

- SCREEN 6 Setpoints 1 – Setpoints for Aspirator on/off during Normal Flow and Low Flow
- SCREEN 7 Setpoints 2 – Setpoints for Settle, Decant Begin and Decant End
- SCREEN 8 Setpoints 3 – Setpoints for clock in Minutes, Hour of Day, Day of Week (0=Sun) and Batch Counter
- SCREEN 9 Setpoints 4 – Setpoints for High Flow On/Off Hour and Low Flow On/Off Hour
- SCREEN 10 Setpoints 5 – Setpoints for Weekend Flow On/Off Day, High Flow Enable, Low Flow Enable and Weekend Flow Enable
- SCREEN 11 Alarms – Alarm indication for Aspirator 1 Fault, Aspirator 2 Fault and SAM Tank High Level
- SCREEN 12 Alarms Clear – To clear alarm F6

NOTE: Each screen will have a multiple function keys (E.g. F1, F2, F3 and so on) that correspond to run times, set points, alarms and other screen displays. Once the screen that the operator wishes to view is displayed, the appropriate function key is then pressed to access a particular value.

For example, to change the set point value for the SETTLE timer the following sequence is necessary:

Starting at MAIN MENU press F3 for Setpoints screen. This will bring up SCREEN 6, which is Setpoints 1. Now press F8 – next function –, which will scroll to the SCREEN 7, or Setpoints 2. Now press F1 to access SETTLE timer then enter the new value.

MAIN MENU

F1 - SAM Tank
F2 - SBR Tank
F3 - Setpoints
F4 - Alarms

SAM Tank

Aspirators

HNL		
SNL		
LWL	Running	Running

F2 - SBR Tank

F3 - Setpoints

F4 - Alarms

F5 - Main Menu

SBR Tank

THL

BNL

F1 - SAM Tank

F3 - Setpoints

F4 - Alarms

F5 - Main Menu

Timer Values

F5 - Main Menu F8 - Next

Times in minutes unless noted.

Aspirator On	F1	HHH
Aspirator Off	F2	HHH
Aspirator On Low Flow	F3	HHH
Aspirator Off Low Flow	F4	HHH

Timer Values

F5 - Main Menu

F7 - Previous F8 - Next

Settle	F1	HHH
Settle High Flow	F2	HHH
Decant Begin	F3	HHH
Decant End	F4	HHH

Setpoints

F5 - Main Menu F8 - Next

Times in minutes unless noted.

Aspirator On	F1	HHH
Aspirator Off	F2	HHH
Aspirator On Low Flow	F3	HHH
Aspirator Off Low Flow	F4	HHH

Setpoints

F5 - Main Menu

F7 - Previous F8 - Next

Settle	F1	HHH
Settle High Flow	F2	HHH
Decant Begin	F3	HHH
Decant End	F4	HHH

Setpoints

F5 - Main Menu

F7 - Previous

F8 - Next

Minuter	F1	HH
Hour of the day	F2	HH
Day of the week 0=Sun	F3	H
Batch Counter	F4	HHHHH

Setpoints

F5 - Main Menu

F7 - Previous

F8 - Next

High Flow On Hour

F1

HH

High Flow Off Hour

F2

HH

Low Flow On Hour

F3

HH

Low Flow Off Hour

F4

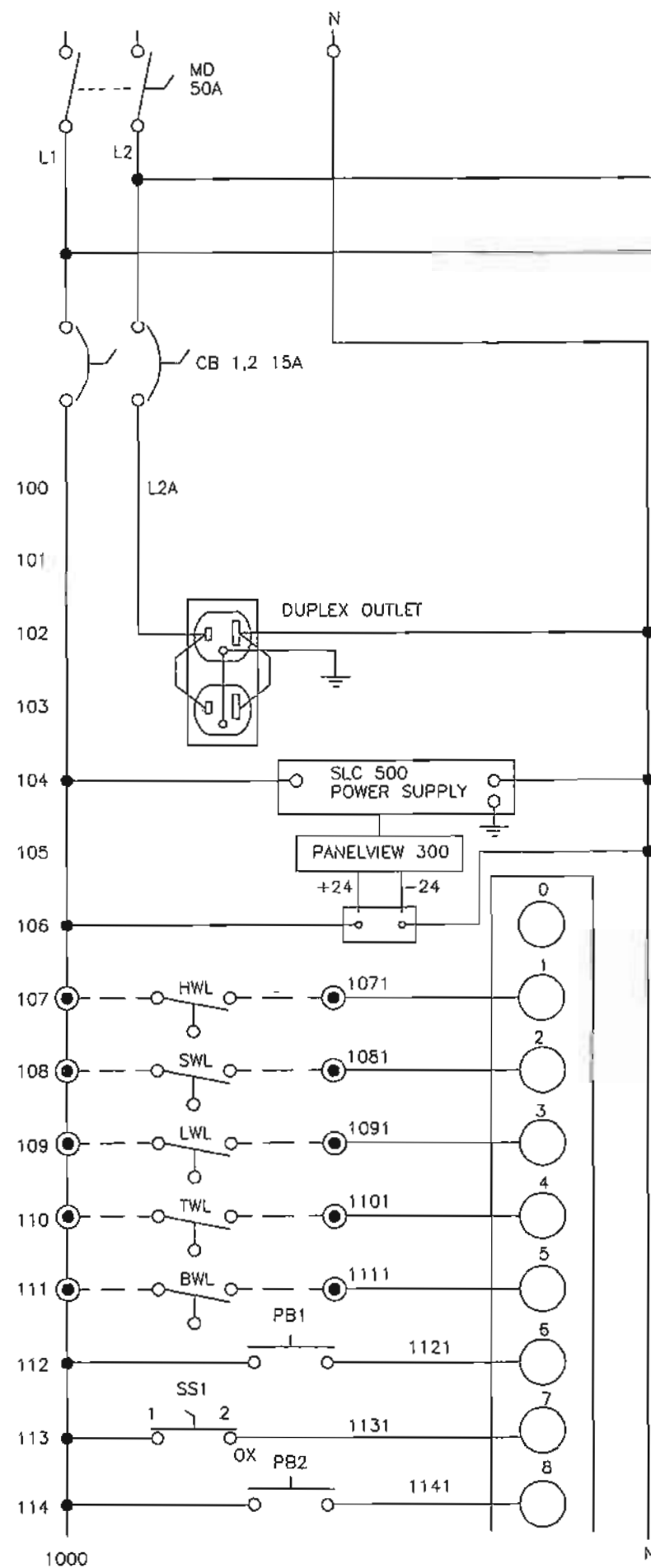
HH

Setpoints

F7 - Previous F8 - Main Menu

WE Low Flow On Day	F1	H			
WE High Flow Off Day	F2	H			
Hi/Lo Flow enable (0=En, 1=Dis)					
Hi F3	H	Lo F4	H	WE Lo F5	H

230V, 1PH, 60hz



SPARE

HWL SAM TANK

SWL SAM TANK

LWL SAM TANK

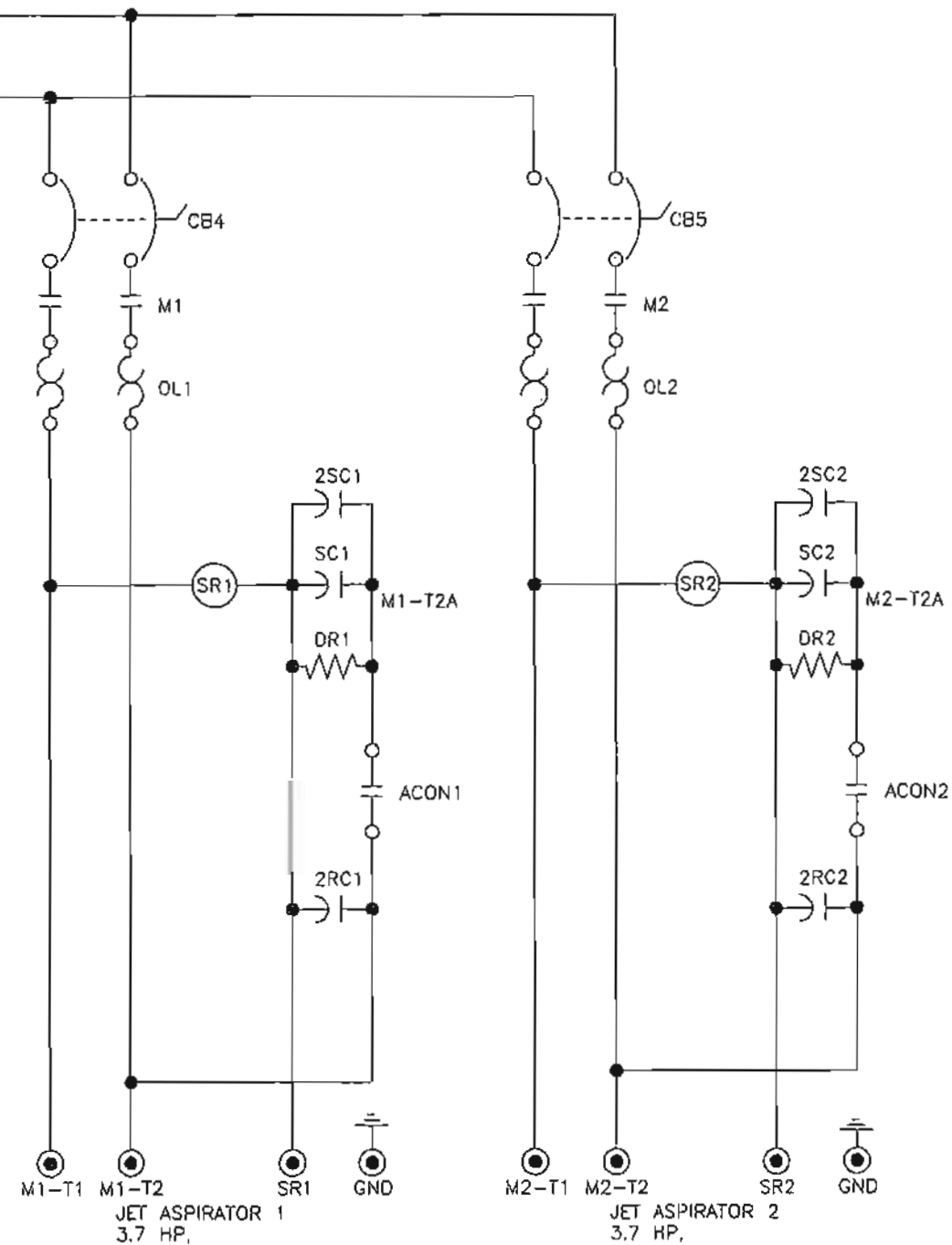
TWL SAM TANK

BWL SAM TANK

RESET

ASPIRATORS

ACKNOWLEDGE



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FLUIDYNE

WIRING SCHEMATICS
HILL MOBILE PARK

DRAWN INM DATE 03/21/02

CHECKED DATE

JOB #

SCALE

CAD FILE

Hill Mobile Pilot A

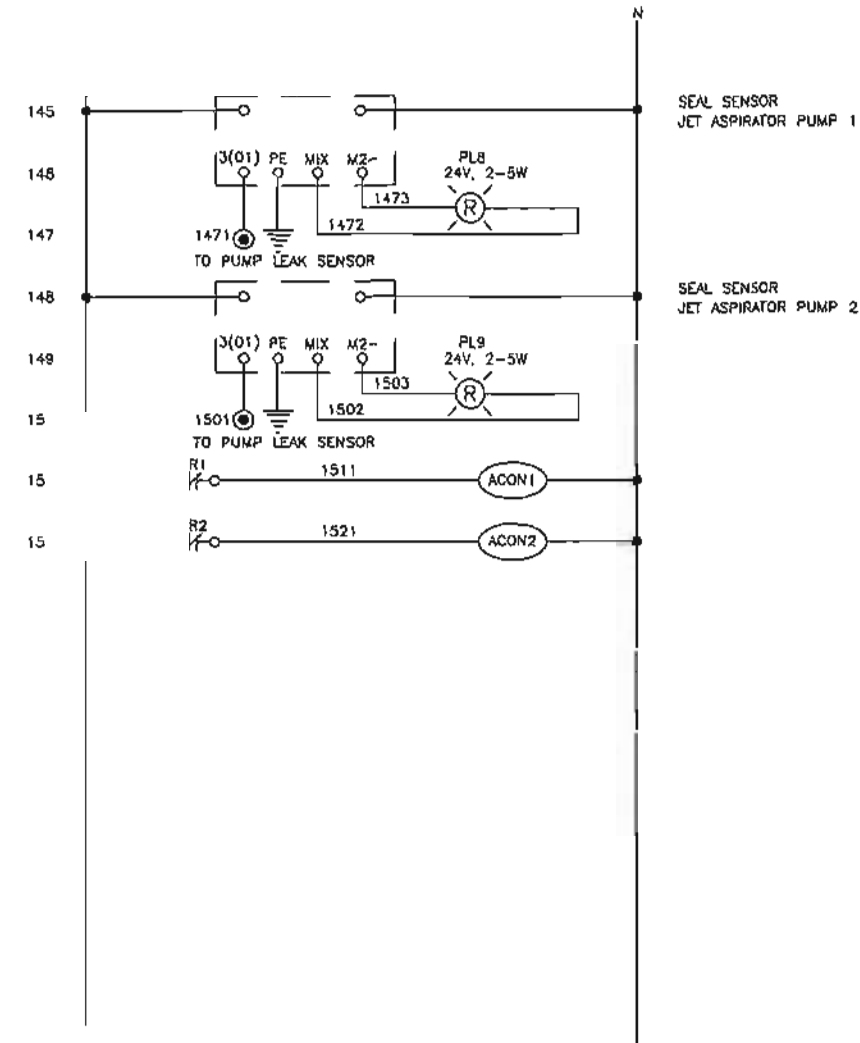
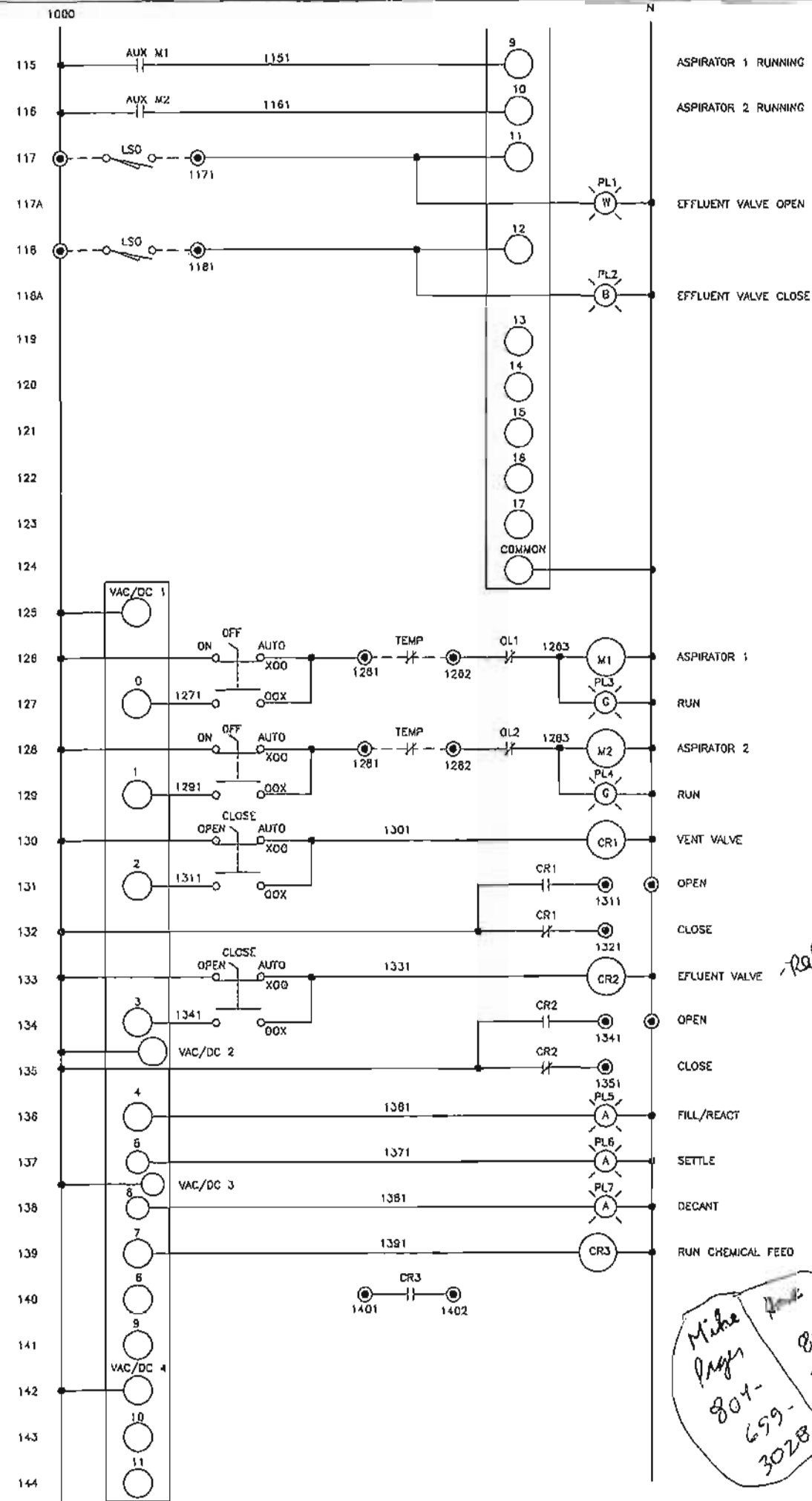
REV

B

SHEET 1 OF 2

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	ADDED P.S. & ACON1 + 2	04/02/02	
B	AS BUILT	05/20/02	



FLUIDDYNE 2

WIRING SCHEMATICS
HILL MOBILE PARK

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DRAWN INM
CHECKED

DATE 04/02/02
DATE

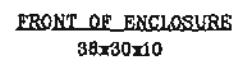
JOB #
SCALE

CAD FILE
Hill Mobile Pilot 2 A

REV
B

SHEET 2 OF 2

Mike
Lynn
804-
699-
3028
804-
994-
2088



MOUNTING PLATE

ITEM	IDENT.	QTY	DESCRIPTION	MANUFR.	CATALOG NO.	REMARKS
1		1	ENCLOSURE NEMA 4X S.S.	HOFFMAN	A-36H3010SSLP	
2		1	PANEL	HOFFMAN	A-36P30	
3	MAIN	1	DISC. SWITCH	ABB	OF45ES	
4		1	PISTOL HANDLE	ABB	0HB45J6	
5		1	SHAFT	ABB	0XP5X265	
6	CB4,5	2	BREAKER 40A 2 POLE	ABB	S3N040TW-2	
7		4	(PACK) BREAKER LUGS	ABB	K3TA-2	
8	M1,M2	2	CONTACTOR	ABB	A-26-30-10-84	
9		2	OVERLOAD RELAY	ABB	TA25DU32	
10	CB1,2,3	3	BREAKER 16A	SQ. D	QCUI15	
11		1	PLC	A.B.	1747-L30A	
12		1	EEPROM	A.B.	1747-M1	
13		1	PANELVIEW	A.B.	2711-K3A2L1	
14	CR1,CR2	2	RELAY	OMRON	MY2P-S-AC120	360116
15		2	SOCKET	CUST CONN	OTC8-PC	360042
16	CR3	1	RELAY "CR3"	SQ. D	8501-KC12V20	
17	SS1	1	SELECTOR SWITCH 2 POS	ABB	CBK-2AMK	
18	SS2-5	4	SELECTOR SWITCH 3 POS	ABB	CBK-3MKL	
19	PB1,PB2	2	PUSHBUTTON	ABB	CBK-KPB	
20		11	CONTACT BLOCK N.O.	ABB	CBK-CB10	
21	CR3	1	SOCKET, 11 PIN	C.H.	D5PA1	
22	PL3,PL4	2	PILOT LIGHT GREEN	ABB	CBK-KL1G	
23	PL5,6,7	3	PILOT LIGHT AMBER	ABB	CBK-KL1Y	
24	PL1	1	PILOT LIGHT WHITE	ABB	CBK-KL1W	
25	PL2	1	PILOT LIGHT BLUE	ABB	CBK-KL1L	
26	PL8,PL8	2	PILOT LIGHT RED 24VAC	ABB	CBK-KL1BR	
27		1	UTILITY BOX	STEEL CITY	68371 1/2	250218
28		1	COVER	STEEL CITY	58-C-7	250208
29		1	RECEPT	P&S	5282	250087
30		40	TERMINAL BLOCK TYPE UK5N	PHOENIX	30 04 38 2	400250
31		1	END BARRIER	PHOENIX	30 03 02 0	400000
32		1	END CLAMP	PHOENIX	08 00 88 8	
33		4	(STRIP) TERMINAL MARKER	PHOENIX	10 51 00 3	400203
34		8	(FT) 1 1/2 X 3 WIRE DUCT	PANDUIT		170006
35		8	(FT) 1 1/2" COVER	PANDUIT		170017
36		1	GND BAR	SQ. D	1130-PK8GTA	410277
37		2	TERMINAL BLOCK 6 POINT	CINCH	363-11-06-00	400236
38	SC1,SC2	4	START CAPACITOR	CUST PROP.	3268218	
39		2	DISCHARGE RESISTOR "DR"	CUST PROP.	3268471	
40	2RC1,2RC2	2	RUN CAPACITOR	CUST PROP.	3287080	
41	SR1,SR2	2	START RELAY	CUST PROP.	3271821	
42	ACON1,2	2	AUX START RELAY	CUST PROP.	C25DND230A	
43	JP1-JP2	2	SEAL FAIL RELAY	CUST PROP.		
44		1	CABLE	A.B.	1747-C10	
45	PS	1	POWER SUPPLY 24VDC	IDEC	PS6R-B24	
46		20	LEGEND PLATE	SQ. D TELE	TA2-B233101	

N
N
1000
1000
1000
1000
1000
1000
1000
1000
1000
SPARE
SPARE
1071
1081
1081
1101
1111
1171
1181
1281
1282
1282
1311
1321
1341
1351
1471
1501
SPARE
SPARE
SPARE
M1-T1
M1-T2
SR1
GND
M2-T1
M2-T2
SR2
GND

- FEC** FRANK
ELECTRIC
CORPORATION

DATE: 4-5-72

					CUSTOMER:	FLUIDDYNE	
					ORDER NO.:	2977	
					PROJECT:	HILL MOBILE PARK	
					DESTINATION:		
					FEC JOB No.	10861A01	DWG SIZE:
REV		DESCRIPTION	DATE	BY	(CHK)	FEC SO No. 10881	SHEET No. 1 OF

SCALE FACTOR = 8

Cross Reference Report

O:0.0/0 - RUN ASP 1
4,12,71
O:0.0/1 - RUN ASP 2
5,13,72
O:0.0/2 - OPEN VENT VALVE
34
O:0.0/3 - OPEN EFF. VLV
36
O:0.0/4 - FILL/REACT
20
O:0.0/5 - SETTLE IND
31
O:0.0/6 - Decant Indicato
44
O:0.0/7 - RUN CHLORINE
44
O:0.0/9 - System Alarm
50
I:0.0/1 - SAM HWL
/4,5,21,25,/31,33,3
I:0.0/2 - SAM SWL
25,38
I:0.0/3 - SAM Tank LWL
4,5
I:0.0/5 - SBR BWL
/38
I:0.0/6 - RESET
16,19,22
I:0.0/7 - Dual Aspirator Opera
4,4,5,5
I:0.0/8 - Acknowledge
51
I:0.0/9 - Aspirator 1 Run Aux
/71
I:0.0/10 - Aspirator 2 Run Aux
/72
I:0.0/12 - Effluent Valve close
34
- /15 - First Pass
/23,/26,/47,/53
S:5/0 - Overflow Trap
57,73
B3/1 - CALL ASP1
3,4
B3/2 - CALL ASP 2
3,5
B3/3 - LEAD ALT 1
4,10,/11,12
B3/4 - LEAD ALT ASP 2
5,/10,11,13
B3/6 - LAG ASP 1
4,12
B3/7 - LAG ASP 2
5,13
B3/8 - ONE SHOT ALT
6,9
B3/9 - O/S LOCKOUT
/6,7
B3/10 - LATCH FILL/ASP
2,3,/6,/7,14,17,20,21
B3/15 - EFF. VLV LATCH
35,36,37
B3/20 - CONDITION SETTL
25,26,27
B3/21 - SETTLE PULSE
26,28
B3/22 - LOCKOUT ONE SHOT
/26,27
B3/23 - SETTLE LATCH
21,28,29,30,31,32
B3/40 - SBR BWL LATCH
/33,34,/34,35,37,39,40,41,/52
L-,50 - DECANT LATCH
42,43,44

SLC Processor Overview

General

The SLC processors offer a wide range of choices in memory, I/O capacity, instruction set, and communication ports to allow you to tailor a control system to your exact application requirements. These products have a strong reliability history covering hundreds of thousands of installations in a broad range of applications.

SLC 500 processors offer 20, 30, or 40 fixed digital I/O. By adding an expansion chassis, you can add 2 I/O modules for a maximum of 64 additional I/O.

SLC 5/01 processors let you configure modular controllers of up to 960 I/O and a 1K- or 4K-instruction memory capacity.

SLC 5/02 processors let you configure modular controllers of up to 4096 inputs plus 4096 outputs nominally and a 4K-instruction memory. By installing an optional scanner module into one of the 30 I/O module slots, you can add ControlNet I/O, DeviceNet I/O, or Universal Remote I/O to the system. They offer 19 additional instructions, including a message instruction for initiating peer-to-peer communication.

SLC 5/03 processors let you configure modular controllers of up to 4096 inputs plus 4096 outputs and a memory of 8K or 16K words. In addition to the features of the SLC 5/02, they have a second built-in communication port — an RS-232-C port that can be configured for ASCII or DF1 protocol, and can be configured for connection to a 1761-NET-AIC converter to provide access to a DH-485 network. SLC 5/03 processors provide bit-instruction execution times of 0.44µs and an overall system throughput of up to 10 times faster than competitive processors. Additional capabilities include: floating-point math, online programming and run-time editing, flash memory upgrades, built-in key-switch, and a built-in real-time clock and calendar.

SLC 5/04 and 5/05 processors let you configure modular controllers of up to 4096 inputs plus 4096 outputs and a memory of either 16K, 32K, or 64K words. They have all the features of the SLC 5/03 processors, plus a faster communication port and shorter execution times (bit-instruction execution times of 0.37µs). Instead of a DH-485 port, the SLC 5/04 has a built-in DH+ port for communication with other SLC 5/04 and PLC processors, operator interfaces, and programming terminals. Communication via the DH+ network is three times faster than DH-485 communication. SLC 5/05 processors provide a 10BASE-T 10M-bit/s Ethernet port.

Features

- Simple and affordable processors with broad capabilities to address applications such as material handling, HVAC control, assembly operations, small process control, and SCADA applications
- Advanced instruction set based on PLC-5 mid-size processors
- Broad line of digital and analog I/O modules, including intelligent I/O modules and including I/O modules available from third-party (Encompass™ program) vendors
- Each SLC 500 or SLC 5/01 processor has a DH-485 port for programming and processor-to-processor communication initiated from the other node

- SLC 5/02, SLC 5/03, SLC 5/04 and SLC 5/05 processors have communication ports (Ethernet, DH+, DH-485, or RS-232-C) that can initiate communication
- Add ControlNet I/O (1771-, 1746-, 1793-, 1794-, 1797-I/O modules) with a 1747-SCNR15 scanner module
- Add DeviceNet I/O (1791D-, 1793-, and 1794-I/O module and 1792-I/O blocks) with a 1747-SDN scanner module
- Add Universal Remote I/O (1746-, 1771-, 1793-, and 1794-I/O modules and 1791-I/O blocks) with a 1747-SN scanner module
- Add BASIC programming capability and DH-485 and RS-232 communication ports with a 1747-BAS module

Specifications

Battery	SLC 5/01, 5/02, 5/03, 5/04, 5/05: 1747-BA
Module Compatibility	• SLC 500 and 5/01 processors are not compatible with 1746-BLM, 1746-BTM, 1746-MPM, 1746-HS, 1746-HSCE, 1746-QV, 1747-SN, 1747-SDN, and 1747-SCNR15 modules • SLC 5/02 processors are not compatible with 1746-BLM and 1746-MPM modules
Shock	• Operating: 30 g (modular hardware)
Vibration	• Displacement: 0.015 inches peak-to-peak @ 5-57Hz • Acceleration: 2.5 g @ 57-2000 Hz • Duration: 1 hr per axis (x, y, z) (fixed hardware)
Environmental conditions	• Operational temperature: 0 to 60° C (32 to 140° F) • Storage temperature: -40 to 85° C (-40 to 185° F) • Relative Humidity: 5-95% (without condensation)
Programming devices	• 1747-PT1 Hand-Held Terminal¹ • 1747-PTA1 E Memory Pak¹ • IBM PC-AT compatible computers See page 5-11 for memory device information

¹ Works with SLC 500, 5/01, and 5/02 processors only

For more information, see: the SLC 500 Family System Overview, pub. 1747-2.30; the SLC 500 Chassis-Based Processors Product Data, pub. 1747-2.39.

Selecting the Processor Category

Max I/O	I/O Communication	Max User Memory	General Communication Ports	Processor Category
84 thru 104	• Processor-resident local I/O	• 1K instructions	• DH-485 (cannot initiate messages)	SLC 500 Processor
960	• Processor-resident local I/O	• 1K or 4K instructions	• DH-485 (cannot initiate messages)	SLC 5/01 Processor
4096 in + 4096 out	• Processor-resident local I/O • I/O at remote locations ¹	• 4K instructions	• DH-485	SLC 5/02 Processor
4096 in + 4096 out	• Processor-resident local I/O • I/O at remote locations ¹	• 8K or 16K words total	• DH-485 • RS-232 ²	SLC 5/03 Processor
4096 in + 4096 out	• Processor-resident local I/O • I/O at remote locations ¹	• 16K, 32K, or 64K words total	• DH+ • RS-232 ²	SLC 5/04 Processor
4096 in + 4096 out	• Processor-resident local I/O • I/O at remote locations ¹	• 16K, 32K, or 64K words total	• Ethernet • RS-232 ²	SLC 5/05 Processor

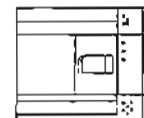
¹ This type of I/O in this type of controller system requires a separate I/O scanner installed in an I/O module slot to provide a ControlNet, DeviceNet, or Universal Remote I/O port (see page 5-26).

² Configurable for communication thru a 1761-NET-AIC in a DH-485 network or thru a 1761-NET-DNI in a DeviceNet network.

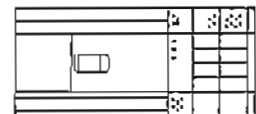
SLC 500 Catalog Numbers — Fixed Hardware Style

I/O Configuration ¹	Inputs	Outputs	Line Power	Catalog Number
12 inputs and 8 outputs	120V ac	Contact	120/240V ac	1747-L20A
	120V ac	Triac	120/240V ac	1747-L20B
	24V dc Sink (Source Load)	Contact	120/240V ac	1747-L20C
	24V dc Sink (Source Load)	Triac	120/240V ac	1747-L20D
	24V dc Sink (Source Load)	24V dc Transistor Source	120/240V ac	1747-L20E
	24V dc Sink (Source Load)	Contact	24V dc	1747-L20F
	24V dc Sink (Source Load)	24V dc Transistor Source	24V dc	1747-L20G
	24V dc Source (Sink Load)	24V dc Transistor Sink	120/240V ac	1747-L20L
	24V dc Source (Sink Load)	24V dc Transistor Sink	24V dc	1747-L20N
	240V ac	Contact	120/240V ac	1747-L20R
	240V ac	Triac	120/240V ac	1747-L20P
	120V ac	Contact	120/240V ac	1747-L30A
18 inputs and 12 outputs	120V ac	Triac	120/240V ac	1747-L30B
	24V dc Sink (Source Load)	Contact	120/240V ac	1747-L30C
	24V dc Sink (Source Load)	Triac	120/240V ac	1747-L30D
	24V dc Source (Sink Load)	24V dc Transistor Sink	120/240V ac	1747-L30L
	240V ac	Triac	120/240V ac	1747-L30P
	120V ac	Contact	120/240V ac	1747-L40A
24 inputs and 16 outputs	120V ac	Triac	120/240V ac	1747-L40B
	24V dc Sink (Source Load)	Contact	120/240V ac	1747-L40C
	24V dc Sink (Source Load)	24V dc Transistor Source	120/240V ac	1747-L40E
	24V dc Sink (Source Load)	Contact	24V dc	1747-L40F
	24V dc Source (Sink Load)	24V dc Transistor Sink	120/240V ac	1747-L40L
	240V ac	Triac	120/240V ac	1747-L40P

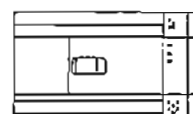
SLC 500
fixed 20-I/O
controller



SLC 500
fixed 30-I/O
controller with
expansion chassis



SLC 500
fixed 40-I/O
controller



2-Slot Expansion Chassis

1746-A2

¹ With the addition of a 2-slot expansion chassis to the Fixed-Hardware-Style Controller, a maximum of 32 additional I/O of any type (ac/dc/contact) can be installed. However, the following modules are incompatible with these controllers: 1746sc-INI4I, 1746sc-INI4VI, 1746-HS, 1746-HSCE, 1746-OV, 1747-SN, 1747-SDN. Also, some combinations of modules are incompatible because of backplane current loading. See publication 1747-2.30 for details of module compatibility.

SLC / 1746 System

Selecting SLC Processors

SLC Processors

Processor/ Cat. No.	Maximum User Memory	Number of I/O	Local Analog I/O Max	Data Table Max Words	Timers/Counters Maximum	Program Scan Time/Kword	I/O Scan Time
SLC 500 (1747-L20)	1K instructions	84 total (local)	4	User configured	Restricted only by memory	8ms (typ)	2.6ms (typ)
SLC 500 (1747-L30)	1K instructions	94 total (local)	4			8ms (typ)	2.6ms (typ)
SLC 500 (1747-L40)	1K instructions	104 total (local)	4			8ms (typ)	2.6ms (typ)
SLC 5/01 (1747-L511)	1K instructions	960 absolute maximum (local) ²	96			8ms (typ)	2.6ms (typ)
SLC 5/01 (1747-L514)	4K instructions	960 absolute maximum (local) ²	96			8ms (typ)	2.6ms (typ)
SLC 5/02 (1747-L524)	4K instructions	4096 in + 4096 out absolute maximum ²	96			4.8ms (typ)	1.6ms (typ)
SLC 5/03 ¹ (1747-L531)	8K words total (4K words for data or prog.) (4K words for data only)	4096 in + 4096 out absolute maximum ²	96			1ms (typ)	0.225ms (typ)
SLC 5/03 ¹ (1747-L532)	16K words total (12K words for data or prog.) (4K words for data only)	4096 in + 4096 out absolute maximum ^{2, 3}	96			1ms (typ)	0.225ms (typ)
SLC 5/04 (1747-L541)	16K words total (12K words for data or prog.) (4K words for data only)	4096 in + 4096 out absolute maximum ^{2, 3}	96			0.9 ms (typ)	0.225ms (typ)
SLC 5/04 (1747-L542)	32K words total (28K words for data or prog.) (4K words for data only)	4096 in + 4096 out absolute maximum ^{2, 3}	96			0.9 ms (typ)	0.225ms (typ)
SLC 5/04 (1747-L543)	64K words total (60K words for data or prog.) (4K words for data only)	4096 in + 4096 out maximum ²	96			0.9 ms (typ)	0.225ms (typ)
SLC 5/05 (1747-L551)	16K words total (12K words for data or prog.) (4K words for data only)	4096 in + 4096 out absolute maximum ^{2, 3}	96			0.9 ms (typ)	0.225ms (typ)
SLC 5/05 (1747-L552)	32K words total (28K words for data or prog.) (4K words for data only)	4096 in + 4096 out absolute maximum ^{2, 3}	96			0.9 ms (typ)	0.225ms (typ)
SLC 5/05 (1747-L553)	64K words total (60K words for data or prog.) (4K words for data only)	4096 in + 4096 out maximum ³	96			0.9 ms (typ)	0.225ms (typ)

¹ Modbus slave protocol is embedded in the RTU-5/03 processors available from an Encompass partner. The Modbus slave protocol is supported on the RS-232 port (channel0). For information on the Encompass program, see page 15-9.

² The absolute maximum number of I/O for these processors only reflects the I/O addressing capability. It does not take into account the amount of memory that may be required for a ladder-logic program to monitor and control the I/O. The practical ratio of memory per I/O is totally dependant upon your specific application.

³ You cannot configure this number of I/O for these processors with local I/O only. To configure this number of I/O for these processors, you must add a 1747-SN Remote I/O Scanner module to configure I/O on a Universal Remote I/O link, add a 1747-SDN DeviceNet Scanner module to configure I/O on a DeviceNet network and/or add a 1747-SCNR ControlNet Scanner module to configure I/O on a ControlNet network.

SLC 500 Processors (continued)

Max Number of Local I/O Chassis ¹	Max Number of I/O Module Slots in the Local I/O Chassis	Communication Ports	Backup Memory	Battery-backed RAM	Backplane Current Load	Processor/ Cat. No.
1	2	DH-485 ³	EEPROM or UVPR0M	Option	not applicable (fixed style)	SLC 500 (1747-L20)
1	2	DH-485 ³	EEPROM or UVPR0M	Option	not applicable (fixed style)	SLC 500 (1747-L30)
1	2	DH-485 ³	EEPROM or UVPR0M	Option	not applicable (fixed style)	SLC 500 (1747-L40)
3	30	DH-485 ³	EEPROM or UVPR0M	Option	350mA @ 5V dc 105mA @ 24V dc	SLC 5/01 (1747-L511)
3	30	DH-485 ³	EEPROM or UVPR0M	Option	350mA @ 5V dc 105mA @ 24V dc	SLC 5/01 (1747-L514)
3 ²	30	DH-485	EEPROM or UVPR0M	Standard	350mA @ 5V dc 105mA @ 24V dc	SLC 5/02 (1747-L524)
3 ²	30	DH-485 RS-232 ⁴	Flash	Standard	500mA @ 5V dc 175mA @ 24V dc	SLC 5/03 (1747-L531)
3 ²	30	DH-485 RS-232 ⁴	Flash	Standard	500mA @ 5V dc 175mA @ 24V dc	SLC 5/03 (1747-L532)
3 ²	30	DH+ RS-232 ⁵	Flash	Standard	1.0A @ 5V dc 200mA @ 24V dc	SLC 5/04 (1747-L541)
3 ²	30	DH+ RS-232 ⁵	Flash	Standard	1.0A @ 5V dc 200mA @ 24V dc	SLC 5/04 (1747-L542)
3 ²	30	DH+ RS-232 ⁵	Flash	Standard	1.0A @ 5V dc 200mA @ 24V dc	SLC 5/04 (1747-L543)
3 ²	30	Ethernet RS-232 ⁵	Flash	Standard	1.0A @ 5V dc 200mA @ 24V dc	SLC 5/05 (1747-L551)
3 ²	30	Ethernet RS-232 ⁵	Flash	Standard	1.0A @ 5V dc 200mA @ 24V dc	SLC 5/05 (1747-L552)
3 ²	30	Ethernet RS-232 ⁵	Flash	Standard	1.0A @ 5V dc 200mA @ 24V dc	SLC 5/05 (1747-L553)

¹ I/O chassis — a physical assembly that houses I/O.

² With this processor, you can also install a 1747-SN Remote I/O Scanner module to configure I/O on a Universal Remote I/O link and/or add a 1747-SDN DeviceNet Scanner module to configure I/O on a DeviceNet network. You can configure 32 I/O chassis per Universal Remote I/O scanner using complementary I/O. If you don't use complementary I/O, you can configure 16 I/O chassis per Universal Remote I/O scanner. With the DeviceNet scanner, you can address a maximum of 63 DeviceNet devices over the DeviceNet network.

³ An SLC 500 or SLC 5/01 processor can only receive messages and send reply messages to command messages sent from other nodes on the DH-485 network; it cannot initiate communication.

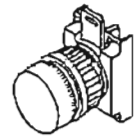
⁴ The SLC 5/03 has an RS-232 port, which can also be configured for a DH-485 network, enabling the SLC-5/03 to connect to two DH-485 networks simultaneously.

⁵ The SLC 5/04 and SLC 5/05 have an RS-232 port, which can also be configured for a DH-485 network.

Memory Devices

Catalog Number/Product	For this Product	Function	Memory Size
1747-M1 EEPROM	SLC 500 Processors	Program and data table storage	8K bytes, 1K instructions
1747-M2 EEPROM	SLC 500 Processors	Program and data table storage	32K bytes, 4K instructions
1747-M3 UVPR0M	SLC 500 Processors	Program and data table storage	8K bytes, 1K instructions
1747-M4 UVPR0M	SLC 500 Processors	Program and data table storage	32K bytes, 4K instructions
1747-M11 Flash Memory	SLC 5/03 and 5/04 Processors (cat. no. 1747-L541 or -L542)	Program and data table storage	28K instructions (4K-word data table)
1747-M12 Flash Memory	SLC 5/03 OS302 Processor or higher or SLC 5/04 OS401 Processor or higher (cat. no. 1747-L543)	Program and data table storage	60K instructions (4K-word data table)

Standard pilot lights



Pilot lights

Item	Voltage	Catalog number	List price
	Operator only	CBK-KLF★①	\$ 8.50
	Full voltage type		
	6V	CBK-KLF6★	
	12V	CBK-KLF7★	
	24V	CBK-KLF8★	30.00
	48V	CBK-KLF9★	
	120V	CBK-KLF1★	
	Resistor type		
	120V/60V	CBK-KLR1★	34.00
	240V/120V	CBK-KLR2★	
	Transformer type		
	120V/6V	CBK-KLT1★	
	240V/6V	CBK-KLT2★	
	380V/6V	CBK-KLT3★	85.00
	480V/5V	CBK-KLT4★	

★ Select the lens color from the Illuminated Buttons & Lenses selection chart and substitute the suffix code for the ★. The lens and bulb are included in the price.

★ Illuminated buttons and lenses

	Color	Suffix code
	Red	R
	Green	G
	Yellow	Y
	Blue	L
	Clear ①	C
	White	W

NOTE: White LEDs come with clear lenses.

Pilot lights — LED bulb②

Item	Voltage	Catalog number	List price
	Full voltage type		
	24V	CBK-KLFL8★	\$ 38.00
	120V	CBK-KLFL1★	39.00
	230V	CBK-KLFL2★	45.00
	Transformer type		
	380V/24V	CBK-KLTL3★	
	480V/24V	CBK-KLTL4★	74.00

★ Select the lens color from the Illuminated Buttons & Lenses selection chart and substitute the suffix code for the ★. The lens and bulb are included in the price.

Lamp bulbs

Item	Voltage	Catalog number	List price
Filament type  Neon type 	Filament		
	8 VAC/DC	CBK-LB6	
	12 VAC/DC	CBK-LB12	
	24 VAC/DC	CBK-LB24	
	30 VAC/DC	CBK-LB30	
	48 VAC/DC	CBK-LB48	\$ 8.00
	60 VAC/DC	CBK-LB60	
	130 VAC/DC	CBK-LB1	
	Neon③		
	110 VAC/DC	CBK-LBN1	
	220 VAC	CBK-LBN2	
	220 VDC	CBK-LBND2	
LED Bulbs 	Color		
	Standard		
	Red 24 VAC/DC	CBK-LBD8R	16.00
	120 VAC	CBK-LBD1R	15.00
	230 VAC	CBK-LBD2R	21.00
	Green 24 VAC/DC	CBK-LBD8G	15.00
	120 VAC	CBK-LBD1G	15.00
	230 VAC	CBK-LBD2G	21.00
	Yellow 24 VAC/DC	CBK-LBD8Y	15.00
	120 VAC	CBK-LBD1Y	16.00
	230 VAC	CBK-LBD2Y	21.00
	Blue 24 VAC/DC	CBK-LBD8L	18.00
	120 VAC	CBK-LBD1L	18.00
	230 VAC	CBK-LBD2L	24.00
	White 24 VAC/DC	CBK-LBD8W	18.00
	120 VAC	CBK-LBD1W	18.00
	230 VAC	CBK-LBD2W	24.00
	Flashing		
	Red 24 VDC	CBK-LBDRF	
	Green 24 VDC	CBK-LBDGF	20.00
	Yellow 24 VDC	CBK-LBDYF	

22 mm

① Lamp module and bulb must be ordered separately; see pages 1.26 - 1.29.

② For blue or white LED add \$ 3.00 to list price.

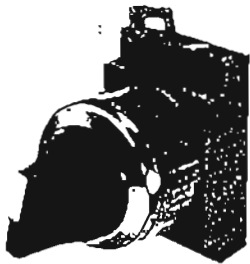
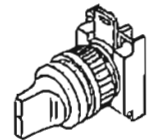
③ Use with red, yellow, and clear lenses only.

④ To order a lens insert, refer to the lens insert selection chart on pages 1.30 - 1.31 and place the appropriate suffix code at the end of the catalog number (but before the contact block suffix code, if there is one) and add \$.90 to the list price.

Selector switches

Non-illuminated

2 position



CBK-M2BMK



CBK-2BMKE



CBK-CB10



5 contact block holder

Knob operator— 2 position

	Type	Color	Black plastic ring	Chrome plastic ring		Chrome metal ring	
			Catalog number	Catalog number	List price	Catalog number	List price
	Maintained	Black	CBK-2BMK	CBK-C2BMK	\$ 13.00	CBK-M2BMK	\$ 15.50
		Red	CBK-2BMKR	CBK-C2MKR		CBK-M2BMKR	
		Grey	CBK-2BMKE	CBK-C2BMKE		CBK-M2BMKE	
	Momentary	Black	CBK-2BSK	CBK-C2BSK	18.00	CBK-M2BSK	18.50
		Red	CBK-2BSKR	CBK-C2BSKR		CBK-M2BSKR	
		Grey	CBK-2BSKE	CBK-C2BSKE		CBK-M2BSKE	
	Maintained	Black	CBK-2AMK	CBK-C2AMK	13.00	CBK-M2AMK	15.50
		Red	CBK-2AMKR	CBK-C2AMKR		CBK-M2AMKR	
		Grey	CBK-2AMKE	CBK-C2AMKE		CBK-M2AMKE	

Lever operator — 2 position

	Type	Color	Black plastic ring	Chrome plastic ring		Chrome metal ring	
			Catalog number	Catalog number	List price	Catalog number	List price
	Maintained	Black	CBK-2BML	CBK-C2BML	\$ 13.00	CBK-M2BML	\$ 15.50
		Red	CBK-2BMLR	CBK-C2BMLR		CBK-M2BMLR	
		Grey	CBK-2BMLE	CBK-C2BMLE		CBK-M2BMLE	
	Momentary	Black	CBK-2BSL	CBK-C2BSL	18.00	CBK-M2BSL	18.50
		Red	CBK-2BSLR	CBK-C2BSLR		CBK-M2BSLR	
		Grey	CBK-2BSLE	CBK-C2BSLE		CBK-M2BSLE	
	Maintained	Black	CBK-2AML	CBK-C2AML	13.00	CBK-M2AML	15.50
		Red	CBK-2AMLR	CBK-C2AMLR		CBK-M2AMLR	
		Grey	CBK-2AMLE	CBK-C2AMLE		CBK-M2AMLE	

22 mm

Selector switch contacts

2 Position

As viewed from the front, the contacts are in the normal position with the switch handle in either the 'A' or 'B' position. In the 'C' position, the contact(s) change state.

Contact blocks (Maximum 4 per operator)

Item	Separate contact blocks catalog number	Included with operator suffix code	List price adder
1 N.O. 1 N.C.	CBK-CB10 CBK-CB01	10 01	\$ 8.00
1 N.O. & 1 N.C. 2 N.O. 2 N.C.	CBK-CB10 + CBK-CB01 CBK-CB10 + CBK-CB10 CBK-CB01 + CBK-CB01	11 20 02	18.00

Selector switches are complete except for contact blocks.

- To order a selector switch operator complete with contact block, add the appropriate suffix code to the end of the catalog number and add the list price adder to the operator list price. EX: CBK-2BMK, \$ 21.00
- To order just the contact block, refer to 'Separate contact blocks' column and indicate catalog number and quantity. EX: CBK-CB10, qty 1, \$ 8.00

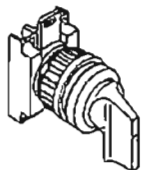
5 Contact block holders (Maximum 4 contact blocks)

To order an assembled unit with a 5 contact block holder, add the digit '5' to the end of the catalog number and add \$ 4.00 to the list price.

EX: CBK-2BMK5, \$ 17.00

Example of individual component ordering

$$\begin{array}{rcl} \text{CBK-2BMK} & + & \text{CBK-CB10} \\ \$ 13.00 & + & \$ 8.00 \\ \hline & = & \$ 21.00 \end{array}$$



Selector switches

Non-illuminated

3 position



Knob operator — 3 position

	Type	Color	Black plastic ring	Chrome plastic ring		Chrome metal ring	
			Catalog number	Catalog number	List price	Catalog number	List price
	Maintained	Black	CBK-3MK	CBK-C3MK	\$ 13.00	CBK-M3MK	\$ 15.50
		Red	CBK-3MKR	CBK-C3MKR		CBK-M3MKR	
		Gray	CBK-3MKE	CBK-C3MKE		CBK-M3MKE	
	Momentary return from A & C position	Black	CBK-3SK	CBK-C3SK	16.00	CBK-M3SK	18.50
		Red	CBK-3SKR	CBK-C3SKR		CBK-M3SKR	
		Gray	CBK-3SKE	CBK-C3SKE		CBK-M3SKE	
	Momentary return from C position	Black	CBK-3SRK	CBK-C3SRK	16.00	CBK-M3SRK	18.50
		Red	CBK-3SRKR	CBK-C3SRKR		CBK-M3SRKR	
		Gray	CBK-3SRKE	CBK-C3SRKE		CBK-M3SRKE	
	Momentary return from A position	Black	CBK-3SLK	CBK-C3SLK	16.00	CBK-M3SLK	18.50
		Red	CBK-3SLKR	CBK-C3SLKR		CBK-M3SLKR	
		Gray	CBK-3SLKE	CBK-C3SLKE		CBK-M3SLKE	

Lever operator — 3 position

	Type	Color	Black plastic ring	Chrome plastic ring		Chrome metal ring	
			Catalog number	Catalog number	List price	Catalog number	List price
	Maintained	Black	CBK-3ML	CBK-C3ML	13.00	CBK-M3ML	15.50
		Red	CBK-3MLR	CBK-C3MLR		CBK-M3MLR	
		Gray	CBK-3MLE	CBK-C3MLE		CBK-M3MLE	
	Momentary return from A & C position	Black	CBK-3SL	CBK-C3SL	18.00	CBK-M3SL	18.50
		Red	CBK-3SLR	CBK-C3SLR		CBK-M3SLR	
		Gray	CBK-3SLE	CBK-C3SLE		CBK-M3SLE	
	Momentary return from C position	Black	CBK-3SRL	CBK-C3SRL	18.00	CBK-M3SRL	18.50
		Red	CBK-3SRLR	CBK-C3SRLR		CBK-M3SRLR	
		Gray	CBK-3SRAE	CBK-C3SRAE		CBK-M3SRAE	
	Momentary return from A position	Black	CBK-3SLL	CBK-C3SLL	18.00	CBK-M3SLL	18.50
		Red	CBK-3SLLR	CBK-C3SLLR		CBK-M3SLLR	
		Gray	CBK-3SLE	CBK-C3SLE		CBK-M3SLE	

Contact blocks (Maximum 4 per operator)

Item	Separate contact blocks catalog number	Assembled to operator suffix code	List price
1 N.O.	CBK-CB10	10	\$ 8.00
1 N.C.	CBK-CB01	01	
1 N.O. & 1 N.C.	CBK-CB10 + CBK-CB01	11	18.00
2 N.O.	CBK-CB10 + CBK-CB10	20	
2 N.C.	CBK-CB01 + CBK-CB01	02	

Selector switches are complete except for contact blocks.

- To order a selector switch operator complete with contact block, add the appropriate suffix code to the end of the catalog number and add the list price adder to the operator list price.

EX: CBK-3MK10, \$ 21.00

- To order just the contact block, refer to "Separate contact blocks" column and indicate catalog number and quantity.

EX: CBK-CB10, qty 1, \$ 8.00

5 Contact block holders

To order an assembled unit with a 5 contact block holder, add the digit '5' to the end of the catalog number and add \$ 4.00 to the list price.

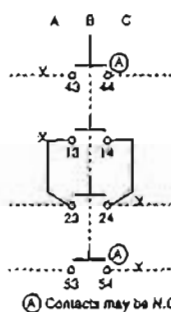
EX: CBK-3MK5, \$ 17.00

Selector switch contacts

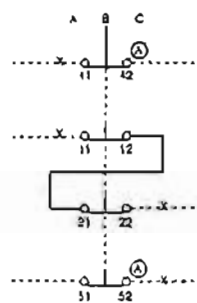
3 Position

As viewed from the front, the contact(s) are in the normal position with the switch handle in the 'B' position. In the 'A' position, the left contact(s) change state. In the 'C' position, the right contact(s) change state.

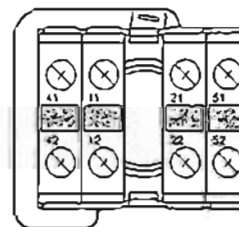
Fig. 1 — Center position connection detail



For B position, normally open function



For B position, normally closed function

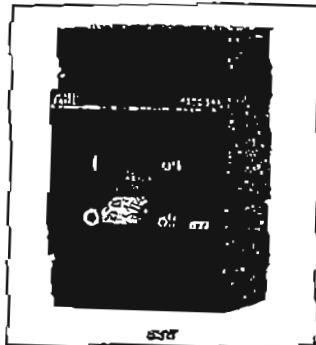


S3

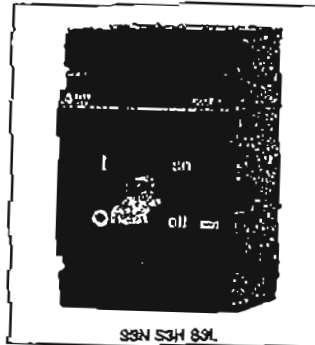
150/225A

Standard thermal-magnetic

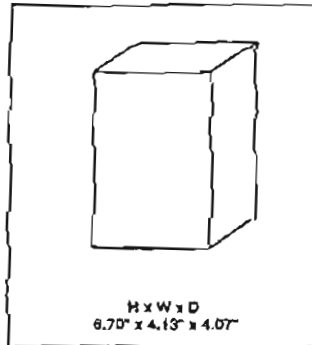
83



S3



S3N S3H S3L



H x W x D
6.70" x 4.13" x 4.07"

Standard S3 package includes complete circuit breaker and mounting hardware. Order cable lugs as a separate item, copper/aluminum (Cu/Al) lugs are no charge when ordered with breaker.

General

The S3 breaker family ranges from 15 through 225 amperes. The S3 trip mechanisms are non-interchangeable and use sensitive electromechanical relays for overcurrent trip protection. Heat sensitive bimetal are used for thermal, overcurrent protection. Short circuit current protection begins at 10 times the thermal rating of the breaker and uses a magnetic coil principle.

Versions

To meet all application needs, the S3 is available in various versions:

- T = Thermal-magnetic
- Q = 100% UL rated
- D = Molded case switch
- M = Magnetic only (MCP)

Performance level

Each version is also available in different maximum fault interrupting levels

- B = 240VAC
- N = Normal
- H = High
- L = Extra high

Number of poles

In UL/CSA form, the S3 is available in two pole or three pole versions, both with the same dimensions. A four pole version is also available in IEC form. For price estimate, add 35% to list price of selected version three pole breaker, contact ABB Control for details.

Accessory mounting

Internal accessories are UL/CSA approved for both factory or field installation. Accessories require control cable connectors. Shunt trips or UVR's mount in the left cavity. Auxiliary or bell alarm switches mount in the right cavity.

Reverse feeding

All versions of the S3 family are suitable for reverse feed applications.

Molded case switches

UL1087 switches include no overcurrent protection except for a high instantaneous trip mechanism for self protection. IEC type molded case switches with no trip protection are also available.

UL/CSA interrupting capacity (kA RMS)

UL489 / CSA C22.2

Voltage	N	H	L
240VAC	85	100	150
480VAC	25	50	86 ^①
600VAC	14	14	25
500VDC	35	50	85
600VDC	20	35	50

IEC-947 interrupting capacity (kA RMS)

Voltage	N	H	L
230VAC	85	100	170
380/400/415VAC	35	65	85
440VAC	30	50	65
500VAC	25	40	60
690VAC	14	16	20
500VDC	35	50	65
750VDC	20	35	50

Isomax

S3
150/225A
Standard thermal-magnetic

Breaker	IC at 240VAC	Rating	Magnetic trip	2 pole, 240VAC catalog number	List price	3 pole, 240VAC catalog number	List price
S3B	160kA	175A 200A 225A	1750A 2000A 2250A	S3B175TW-2 S3B200TW-2 S3B225TW-2	\$ 460 \$ 472	S3B175TW S3B200TW S3B225TW	\$ 590 \$ 602

Breaker	IC at 480VAC	Rating	Magnetic trip	2 pole, 480VAC/500VDC catalog number	List price	3 pole, 600VAC/DC catalog number	List price
S3N	25kA	15A	500A	S3N015TW-2	\$ 318	S3N015TW	\$ 413
		20A	500A	S3N020TW-2		S3N020TW	
		25A	500A	S3N025TW-2		S3N025TW	
		30A	500A	S3N030TW-2		S3N030TW	
		35A	500A	S3N035TW-2		S3N035TW	
		40A	500A	S3N040TW-2		S3N040TW	
		50A	500A	S3N050TW-2	\$ 407	S3N050TW	\$ 504
		60A	600A	S3N060TW-2		S3N060TW	
		70A	700A	S3N070TW-2		S3N070TW	
		80A	800A	S3N080TW-2		S3N080TW	
		90A	900A	S3N090TW-2		S3N090TW	
		100A	1000A	S3N100TW-2		S3N100TW	
		125A	1250A	S3N125TW-2	\$ 573	S3N125TW	\$ 717
		150A	1500A	S3N150TW-2		S3N150TW	
		175A ⁽¹⁾	1750A	S3N175TW-2		S3N175TW	
		200A ⁽¹⁾	2000A	S3N200TW-2		S3N200TW	
		225A ⁽¹⁾	2250A	S3N225TW-2		S3N225TW	

Breaker	IC at 480VAC	Rating	Magnetic trip	2 pole, 480VAC/500VAC catalog number	List price	3 pole, 600VAC/DC catalog number	List price
S3H	50kA	15A	500A	S3H015TW-2	\$ 527	S3H015TW	\$ 619
		20A	500A	S3H020TW-2		S3H020TW	
		25A	500A	S3H025TW-2		S3H025TW	
		30A	600A	S3H030TW-2		S3H030TW	
		35A	600A	S3H035TW-2		S3H035TW	
		40A	500A	S3H040TW-2		S3H040TW	
		50A	500A	S3H050TW-2	\$ 617	S3H050TW	\$ 702
		60A	600A	S3H060TW-2		S3H060TW	
		70A	700A	S3H070TW-2		S3H070TW	
		80A	800A	S3H080TW-2		S3H080TW	
		90A	900A	S3H090TW-2		S3H090TW	
		100A	1000A	S3H100TW-2		S3H100TW	
		125A	1250A	S3H125TW-2	\$ 1376	S3H125TW	\$ 1588
		150A	1500A	S3H150TW-2		S3H150TW	
		175A ⁽¹⁾	1750A	S3H175TW-2		S3H175TW	
		200A ⁽¹⁾	2000A	S3H200TW-2		S3H200TW	
		225A ⁽¹⁾	2250A	S3H225TW-2		S3H225TW	

Breaker	IC at 480VAC	Rating	Magnetic trip	2 pole, 480VAC/500VAC catalog number	List price	3 pole, 600VAC/DC catalog number	List price
S3L	65kA	15A	500A	S3L015TW-2	\$ 624	S3L015TW	\$ 824
		20A	500A	S3L020TW-2		S3L020TW	
		25A	600A	S3L025TW-2		S3L025TW	
		30A	600A	S3L030TW-2		S3L030TW	
	65kA	35A	500A	S3L035TW-2	\$ 694	S3L035TW	\$ 894
		40A	500A	S3L040TW-2		S3L040TW	
		50A	500A	S3L050TW-2		S3L050TW	
		60A	600A	S3L060TW-2		S3L060TW	
		70A	700A	S3L070TW-2	\$ 818	S3L070TW	\$ 1010
		80A	800A	S3L080TW-2		S3L080TW	
		90A	900A	S3L090TW-2		S3L090TW	
		100A	1000A	S3L100TW-2		S3L100TW	
		125A	1250A	S3L125TW-2	\$ 1818	S3L125TW	\$ 2260
		150A	1500A	S3L150TW-2		S3L150TW	
		175A ⁽¹⁾	1750A	S3L175TW-2		S3L175TW	
		200A ⁽¹⁾	2000A	S3L200TW-2		S3L200TW	
		225A ⁽¹⁾	2250A	S3L225TW-2		S3L225TW	

maximum



Description for A & AE contactors

Application

A Line contactors are mainly used for controlling 3-phase motors and for controlling power circuits corresponding to their operating characteristics up to 690 and even 1000 VAC and 440 VDC.

Description of 3 pole and 4 pole contactors: A9 – A110

All A and AE contactors can be assembled side by side. The add-on or built-in auxiliary contacts are suitable for low level currents.

When mounted with a 4-pole CA5 auxiliary contact block, A9 – A18 contactors ensure positive safety between their auxiliary contacts.

Control circuit types

- A & UA types: AC operated with laminated magnetic circuit.
- AE types: with laminated magnetic circuit and double-winding coil fed from DC supply via a CDLS insertion contact mounted on the device. The CDLS has an N.C. lagging contact for insertion of the second winding.

Quick mounting on DIN rail: EN 50022 and EN 50023 standards:

- 25 x 7.5 mm for A9 – A40,
- 35 x 15 mm for A9 – A75,
- 75 mm for A45 – A110.

Location of side mounted accessories: on right or left hand side. Factory mounted on:

- left hand side for CDLS on A90 – A110-30-11,
- right hand side for CDLS/CCLS on AE45 – AE110.

Holes for screw mounting (screws not supplied). Distance between holes according to EN 50003.

Terminals delivered in open position with captive screws (screws of unused terminals must be tightened).

Screwdriver guidance for all terminals makes it possible to use motorized screwdrivers.

All terminals provide protection against accidental direct contact with live parts according to VDE0108 – Part 100.

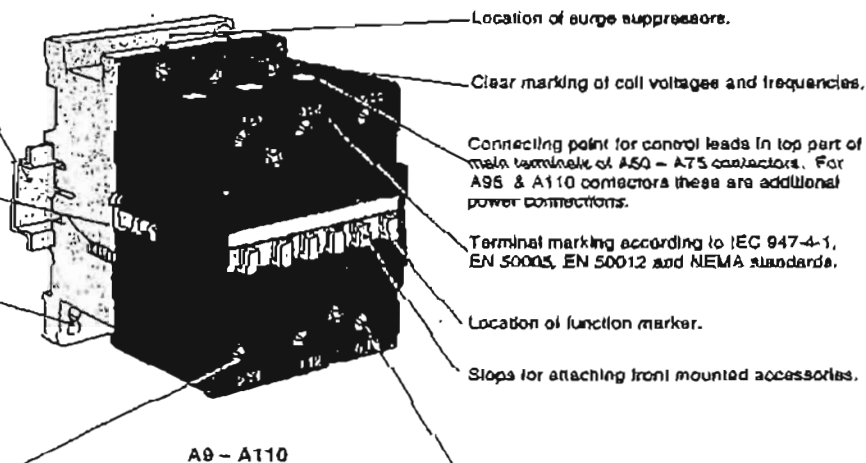
All A9 – A40 contactor terminals as well as A45 – A110 contactor auxiliary contact and coil terminals ensure IP20 degree of protection according to IEC 947-1.

Contact types

- 3 pole contactors with N.O. or N.C. built in auxiliary contact for A9 – A40 contactors — with or without side mounted, factory assembled auxiliary contacts for A50 – A110 contactors
- 4 pole contactors: 4 N.O. or 2 N.O. & 2 N.C. without any auxiliary contacts.

Contactors for specific applications

- UA type for 3 phase capacitor switching.



A9 – A110

Terminal screws:

- Poeldrive (+/-) N° 2 for all A9 – A40 terminals and for A60 – A110 coil terminals.
- M8 screws with 8.5 mm slot for A50 – A75 main terminals.
- M8 hex threaded socket screw for A95 & A110 main terminals.

Catalog number explanation

A9-30-10-84

Frame size

Power pole

- 30 = 3 N.O.
- 40 = 4 N.O.
- 22 = 2 N.O. & 2 N.C.

Coil voltage

(see coil voltage selection chart)

Auxiliary contacts

- 10 = 1 N.O. & 0 N.C.
- 01 = 0 N.O. & 1 N.C.
- 11 = 1 N.O. & 1 N.C.
- 00 = No auxiliary provided

Coil voltage selection chart

Hz	Ctrl	Volts															
	Type	TE	24	48	115	220	230	240	277	380	415	440	480	500	575	600	690
60	A		81	83	84	84		34	75	80	42	48	88	88	51	53	53
50	A		91	89	84			60				65	88			55	
DC	BC	07	01	18	04		27	08	29								
DC	AE	80	81	83	86		87		88	89							

For other voltages, see page 1.13

CONTACTORS: Description: 1.1 – 1.3 Selection: 1.4 – 1.8 Accessories: 1.9 – 1.10 Technical data: 1.20 – 1.30 Motor data: 1.31 Dimensions: 1.32 – 1.42



Non-reversing contactors 3 pole, AC & DC operated



A9-30-10



A28-30-10



A63-30-84



AE50-30-04

Contactors

General purpose current			Motor switching current	Maximum motor horsepower ratings (A) (B)				Standard Aux. contacts		AC operated		DC operated	
AC oper.	DC oper.	208V		240V	480V	575/600V	N.O.	N.C.	Catalog number	List price	Catalog number	List price	
AC1	AC1	AC3	UL rated										
21	—	9	2	2	5	7.5	1 0	0 1	A9-30-10-84 A9-30-01-84	\$ 78	BC9-30-10-04 BC9-30-01-04	\$ 123	
25	—	11	3	3	7.5	10	1 0	0 1	A12-30-10-84 A12-30-01-84	84	— —	— —	
30	21	17	5	5	10	15	1 0	0 1	A18-30-10-84 A18-30-01-84	102	BC18-30-10-04 BC18-30-01-04	147	
40	33	28	7.5	10	20	25	1 0	0 1	A28-30-10-84 A28-30-01-84	183	BC28-30-10-04 BC28-30-01-04	228	
50	46	32	10	10	25	30	1 0 0 2	0 1 0 2	A30-30-10-84 A30-30-01-84 — —	252 — — —	— BC30-30-00-04 BC30-30-22-04	— 287 287	
60	—	41	10	15	30	40	1 0	0 1	A40-30-10-84 A40-30-01-84	300	— —	— —	
80	—	54	15	20	40	50	0 1	0 1	A60-30-00-84 A60-30-11-84	400 330	AE50-30-00-04 AE60-30-11-04	345 376	
90	—	65	20	25	50	60	0 1	0 1	A83-30-00-84 A83-30-11-84	350 372	AE83-30-00-04 AE83-30-11-04	447 477	
106	—	80	25	30	60	75	0 1	0 1	A75-30-00-84 A75-30-11-84	383 413	AE75-30-00-04 AE75-30-11-04	488 518	
125	—	96	30	30	60	76	0 1	0 1	A86-30-00-84 A86-30-11-84	420 460	AE86-30-00-04 AE86-30-11-04	628 558	
140	—	110	30	40	75	100	0 1	0 1	A110-30-00-84 A110-30-11-84	480 480	AE110-30-00-04 AE110-30-11-04	660 660	
NEMA rated													
NEMA size	Continuous current												
00	9		1.5	1.5	2	2	1	0	A8N00-30-10-84	\$ 78	BC8N00-30-10-04	\$ 123	
0	18		3	3	5	5	1	0	A16N0-30-10-84	102	BC16N0-30-10-04	147	
1	27		7.5	7.5	10	10	1	0	A28N1-30-10-84	183	BC28N1-30-10-04	228	
2	45		10	15	25	25	1	1	A50N2-30-11-84	330	AE50N2-30-11-04	375	
3	80		25	30	50	50	1	1	A75N3-30-11-84	413	AE75N3-30-11-04	518	

Coil voltage selection

All AC operated catalog numbers include a 120VAC coil. All DC operated catalog numbers include a 110VDC coil. To select other coil voltages, substitute the code from the Coil Voltage Selection Chart for the two digits after the last dash in the catalog number.

Ex.: A 240V coil is required for an A75 contactor. A75-30-00-80

Auxiliary contact blocks

For additional auxiliary contact blocks, see catalog number explanation on page 1.2. Add \$ 20 to list prices for each additional auxiliary, and see page 1.18 for available combinations.

Coil voltage selection chart

Vol	Coil type	12	24	48	110	120	125	200	220	240	277	380	415	440	480	500	600
60	A	91	92	93	94	95	—	34	75	87	42	43	85	86	51	53	56
50	A	—	81	83	84	—	—	—	80	—	—	—	—	—	—	—	—
DC	BC	07	01	16	04	—	27	—	05	33	—	—	—	—	—	—	—
DC	AE	80	81	83	86	—	87	—	82	80	—	—	—	—	—	—	—

For other voltages, see page 1.13



Type TA, Class 10 for Contactors A9 - A110



TA25DU



TA42DU



TA75DU



TA80DU



TA110DU

For contactor	Setting range A	Catalog number
A9 - A40 BC9 - BC300	0.1 - 0.18	TA25DU018
	0.18 - 0.25	TA25DU025
	0.25 - 0.4	TA25DU04
	0.4 - 0.63	TA25DU063
	0.63 - 1.0	TA25DU10
	1.0 - 1.4	TA25DU14
	1.4 - 1.8	TA25DU18
	1.7 - 2.4	TA25DU24
	2.2 - 3.1	TA25DU31
	2.8 - 4.0	TA25DU40
	3.5 - 5.0	TA25DU50
	4.5 - 6.5	TA25DU65
	6.0 - 8.5	TA25DU85
	7.5 - 11	TA25DU11
	10 - 14	TA25DU14
	13 - 19	TA25DU19
A30 - A40	18 - 25	TA42DU25
	22 - 32	TA42DU32
	29 - 42	TA42DU42
A(E)50 - A(E)78	18 - 25	TA75DU25
	22 - 32	TA75DU32
	29 - 42	TA75DU42
	36 - 52	TA75DU52
	45 - 60	TA75DU60
A(E)95 - A(E)110	45 - 60	TA80DU60
	52 - 80	TA80DU80
	60 - 80	TA80DU80
	85 - 90	TA110DU90
	80 - 110	TA110DU110

① To select an overload relay for BC9 - BC30 contactors, delete the "X" from the catalog number. For BC9-30-01-04 contactors with setting range of 1.3 - 1.8: OLR catalog number will be T25DU1.8

OVERLOAD RELAYS: Summary table 3.1 - 3.3 Selection: 3.3 - 3.4 Accessories: 3.6 - 3.8 Technical data: 3.7 - 3.10 Dimensions: 3.11 - 3.12



Description for Overload relays



TA25DU

Application

TA thermal O/L relays are used with A Line contactors for the protection of motors having a nominal voltage of up to 600VAC max per UL/CSA (890VAC and 800VDC per IEC).

Product range

• Standard relays:

Types: TA25DU, TA42DU, TA75DU, TA80DU, TA110DU

– TA25 to TA110 are directly connected in the motor circuit.

Construction and function

Thermal O/L relays and their accessories meet UL, CSA and most other important international standards (IEC), European standards (EN) and the most important national standards (DIN-VDE, NFC-UTE, BS, etc.). They meet the certification and approval directives required throughout the world.

Thermal O/L relays are 3 pole.

The motor current flows through their bimetals (1 per phase) which are indirectly heated. Under the effect of the heating, the bimetals bend, cause the relay to trip and the position of the auxiliary contacts to change.

The relay setting range is graduated in amps. In compliance with international and national standards, the setting current is the motor nominal current and not the tripping current (no tripping at $1.05 \times$ setting current, tripping at 1.2 times setting current).

The tripping curves (cold or warm starting, 3 phases and 2 phases) are shown on page 3.10

The relays are built to be self protecting in the event of an overload until the short circuit protection device is actuated.

Function of TA25DU – TA110DU thermal O/L relays

	Resetting	Relay tripped		Relay not tripped
	Contacts	Manual	Automatic	
Effect of blue button indexed on R	Resetting	Yes	No	No
	95-98	Closed when the button is pressed	No effect	No effect
	97-98	Open when the button is pressed	No effect	No effect
Effect of blue button indexed on R/O	Resetting	Yes	No	No
	95-98	Closed when the button is released	No effect	Open when the button is pressed Closed when the button is released
	97-98	Open when the button is pressed	No effect	No effect



Allen-Bradley

PanelView Standard Operator Terminals

**PV300 Micro, PV300, PV550,
PV600, PV900, PV1000, PV1400**

User Manual

**Rockwell
Automation**

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGT-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION



Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss

Attention statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

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Terminal Overview

Chapter Objectives

This chapter gives an overview of the PanelView Operator Terminals.

- intended uses
- terminal types and features
- applications
- configuration mode
- terminal messages
- printing
- accessories and replacement parts

Intended Uses

You can use the PanelView operator terminals for a wide variety of machine control and monitoring applications.

ATTENTION

Do not use a PanelView terminal for emergency stops or other controls critical to the safety of personnel or equipment. Use separate hardwired operator interface devices that do not depend on solid state electronics. See the inside front cover of this manual for guidelines.

Terminal Types

PanelView terminals are available in a variety of options.

- display size and type (monochrome, grayscale, color)
- operator input (touch screen or keypad)
- communication port (DH-485, RS-232, Remote I/O, DH+, ControlNet, DeviceNet, Ethernet, DF1)
- RS-232 printer port support

In addition, some terminals are available with:

- AC or DC power (LI at the end of a catalog number indicates a DC terminal, for example, 2711-B5A1LI, or -T9C1LI).
- Stainless steel bezel available on PanelView 550 keypad or keypad & touch terminals.

Contact your Allen-Bradley representative for availability.

Color and Grayscale Terminals

Color terminals support a fixed palette of 16 standard EGA colors. Electroluminescent (grayscale) terminals support a fixed palette of 4 colors (shades of yellow). All color in an application is defined when the application is created. Colors are not selectable at the terminal.



PanelView 300 Monochrome Terminals

The PanelView 300 terminal is only available with 24V dc input power.

Operator Input	Communication Port				Printer Port RS-232	Catalog Number
	DH-485	RS-232 (DH-485)	DeviceNet	RS-232 (DF1)		
Keypad	x					2711-K3A2L1
		x				2711-K3A5L1
			x		x	2711-K3A10L1
				x		2711-K3A17L1

PanelView 300 Micro Monochrome Terminals

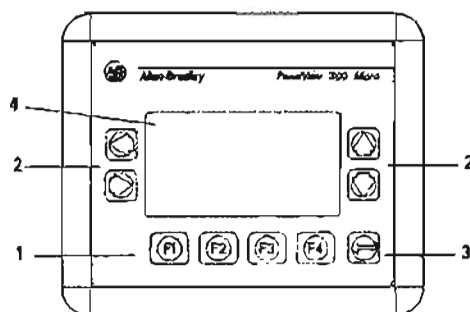
The PanelView 300 Micro is available only with 24V dc input power and does not have a printer port. The PV300 Micro contains a single RS-232 communication port which supports either DF1 or DH485 communication protocols as specified in the table below.

Operator Input	Communication Port		Catalog Number
	DH-485	DF1	
Keypad	x		2711-M3A19L1
		x	2711-M3A18L1

PanelView 300 Micro Features

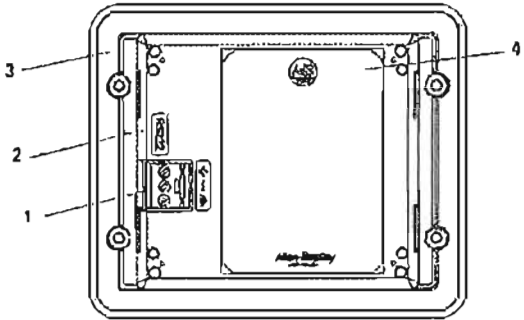
This section defines features of the PanelView 300 Micro keypad terminal.

PanelView 300 Micro Features (Front)



#	Feature	Description
1	Function Keys (F1 - F4)	Use the function keys to initiate functions on the terminal display.
2	Cursor Keys	Use the cursor keys (left, right, up, down) as programmed function keys in addition to the F1 - F4 function keys or to move the cursor in displayed lists, to select a numeric entry object, to enter configuration mode, or to enter/modify numeric and ascii data.
3		Stores an entered value.
4	Keypad Terminal Display	Liquid crystal display with integral backlight. Displays application text, controls, graphics.

PanelView 300 Micro Features (Back)

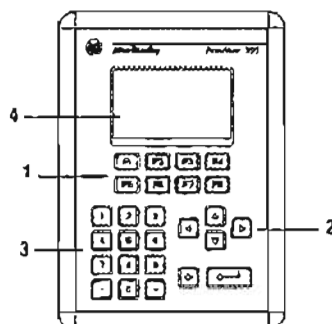


#	Feature	Description
1	Power Connection Terminals	Connects to a 24V dc (11-30 V dc) external power source
2	DF1 or DH-485 (RS232) Communication Port	Connects to an SLC, PLC, or MicroLogix controller using an RS-232 connection. Also used for downloading applications directly from a computer.
3	Sealing Gasket	Seals the front of the terminal to an enclosure or panel.
4	Nameplate Label	Provides product information.

PanelView 300 Features

This section defines features of the PanelView 300 keypad terminal.

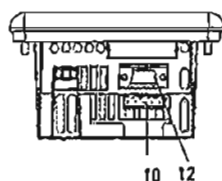
PanelView 300 Features (Front)



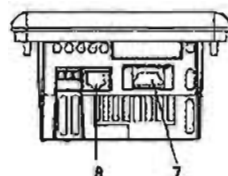
#	Feature	Description
1	Function Keys (F1 - F8)	Use the function keys to initiate functions on the terminal display. These keys may have custom legends.
2	Cursor Keys	Use the up or down cursor keys to move the cursor up or down in a list or to increment/decrement values. Use the left or right cursor keys to select an object with an indicator bar, or to enter configuration mode.
3	Numeric Entry Keys	0-9 Enters numeric values . Enters a decimal point - Enters a negative value ← Clears entered digits or cancels the scratchpad ↵ Stores an entered value.
4	Keypad Terminal Display	Initiate the function of a displayed object, such as an ON or OFF push button, by pressing the corresponding function key (F1 - F8).

PanelView 300 Features (Back)

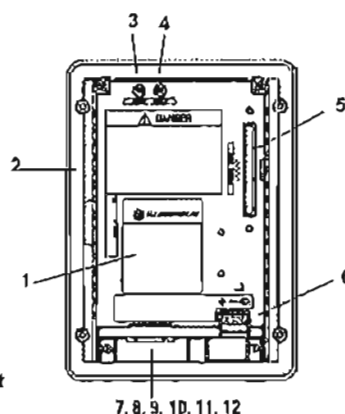
DeviceNet with additional RS-232 Port



DH-485 without RS-232 Port



RS-232 (DH-485 or DF1) without additional RS-232 Port

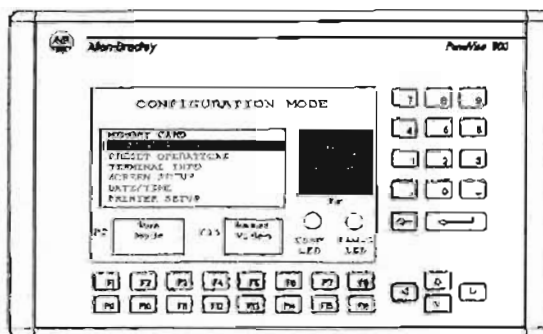


#	Feature	Description
1	Nameplate Label	Provides product information
2	Sealing Gasket	Seals the front of the terminal to an enclosure or panel
3	COMM LED (Green)	Indicates when communications is occurring
4	FAULT LED (Red)	Indicates firmware or hardware faults.
5	Memory Card Slot	Accepts a memory card which stores applications.
6	Power Connection Terminals	Connects to an external 24V dc power source (18-32V dc).
7	DH-485 Communication Port	Connects to an SLC or MicroLogix controller, DH-485 network, or Wallmount Power Supply (Cat. No. 1747-NP1).
8	DH-485 Programming Connector	Connects to a Personal Computer Interface Converter (Cat. No. 1747-PIC) for transferring applications. Also connects to an SLC programmer, such as the Hand-Held Terminal (Cat. No. 1747-PF1)
9	RS-232 (DH-485) Communication Port	Connects to the Channel 0 port of an SLC 5/03, 5/04 or 5/05 controller for point-to-point DH-485 communications. Connects to a MicroLogix controller through an AIC+ Link Coupler. Also connects to the RS-232 serial port of a computer for transferring applications.
10	DeviceNet Connector	Connects to a DeviceNet network.
11	RS-232 (DF1) Communication Port	Connects to a PLC, SLC or MicroLogix controller with a DF1 port. This port also connects to the RS-232 port of a computer.
12	RS-232 Printer/ File Transfer Port	Connects to a printer (K3A10L1 version only) On a DeviceNet terminal, this port also connects to the RS-232 port of a computer for transferring applications.

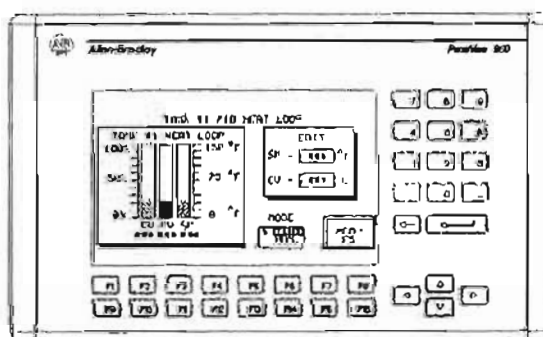
Applications

PanelView terminals operate with custom designed applications. The first time you power on the terminal, (no application file loaded), the terminal displays the Configuration Mode menu. Chapter 3 describes the terminal functions you can configure from this menu.

Note: Remote I/O terminals provide an out-of-box application for setting Remote I/O communication parameters.



If an application is loaded, the terminal displays the application's start-up screen.

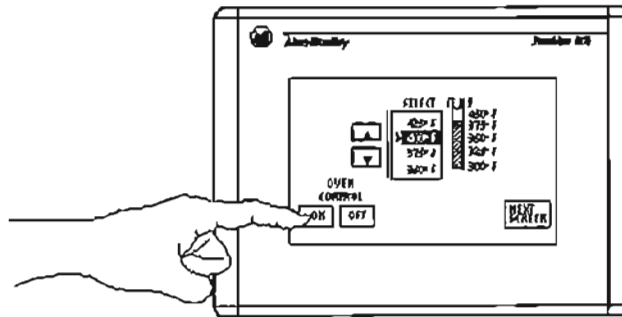


Note: The application designer is responsible for documenting the operation of the application and selecting a startup screen.

How the terminal operates depends on the application and the type of terminal (touch screen or keypad).

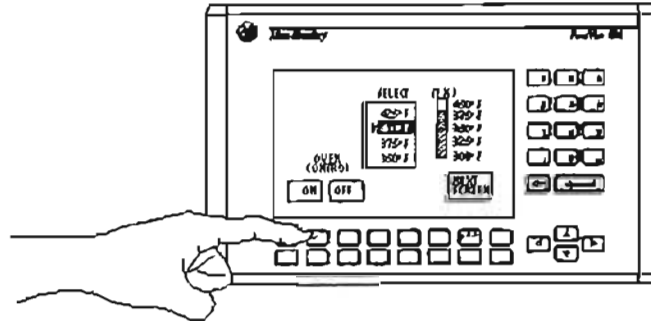
Touch Screen Operation

Applications for touch screen terminals are controlled by touching screen objects.



Keypad Operation

Applications for keypad terminals are controlled by pressing function keys that correspond to screen objects. Data is entered manually using the numeric entry keys.



A function key legend kit is available for each terminal (except the 300 Micro) to create custom labels for the function keys. See the accessories at the end of this chapter.

ATTENTION



Do not press multiple touch screen objects or multiple function keys at the same time. This may result in unintended operation.

Configuration Mode Menu

You can configure terminal functions from the Configuration Mode menu including:

- select a language
- upload/download applications with a memory card
- set or display serial communication parameters
- select preset values
- obtain terminal and application information
- adjust screen parameters
- set time and date
- set printer parameters (for terminals with an RS-232 printer port)
- return to run mode

Chapter 3 describes how to enter configuration mode and operations you can perform using the Configuration Mode menu.

Terminal Messages

Terminal messages display:

- status of an operation
- minor faults, errors, or numeric entry mistakes
- operator prompts

Appendix B describes terminal messages and provides a list of recommended actions.

Printing

PanelView terminals equipped with an RS-232 printer port can print:

- triggered messages in a message display
- triggered states of a multistate indicator
- alarm messages
- alarm list

Print attributes for objects are defined in the application.

Any printer that supports the IBM enhanced character set can be connected to the RS-232 printer port of a PanelView terminal.

Alarm List

PanelView terminals support an Alarm List queue to store information on triggered alarms. The Alarm List stores a maximum of 100 alarms or as many as the terminal can hold in nonvolatile RAM. The number of alarms stored in the list is configured using the PanelBuilder32 software.

The Alarm List stores the following data for each alarm:

- acknowledge indicator
- alarm date and time
- acknowledge date and time
- alarm trigger value
- alarm text including variables

The Alarm List is cleared:

- when an application is downloaded to the terminal
- when the terminal is reset or power is cycled

The Alarm List object may appear on the Alarm Banner or other application screens. The data that displays in the Alarm List is configured using the PanelBuilder32 Software.

Accessories

Software

Catalog No.	300M	300	550	600	900	1000	1400	Description
2711-ND3	x	x	x	x	x	x	x	Windows software required for creating PanelView applications on a personal computer.

Function Key Legend Kits

Catalog No.	300	550	600	900	1000	1400	Description
2711-NF1		x					5 legend inserts with key labels F1-F10 on one side. Use blank side to create custom labels.
2711-NF2A				x			1 legend insert for PV900 keypad (monochrome) terminal with key labels F1-F16 on one side. Use blank side to create custom labels.
2711-NF2C				x			1 legend insert for PV900 keypad (color) terminal with key labels F1-F16 on one side. Use blank side to create custom labels.
2711-NF4			x				1 legend insert with key labels F1-F10 on one side. Use blank side to create custom labels.
2711-NF5						x	2 legend inserts. One has key labels F1-F16; the other has key labels F17-F21. Use blank sides to create custom labels.
2711-NF6					x		1 legend insert with key labels F1-F16. Use blank side to create custom labels.
2711-NF7	x						2 legend inserts with key labels F1-F4 and F5-F8. Use blank side to create custom labels.

Memory Cards and Retainer

Catalog No.	300	550	600	900	1000	1400	Description
2711-NM11 ¹	x	x	x	x	x	x	256K memory card for storing applications.
2711-NM12 ¹	x	x		x	x	x	1M flash memory card for storing applications.
2711-NM13	x	x	x	x	x	x	2M flash memory card for storing applications.
2711-NM14	x	x	x	x	x	x	4M flash memory card for storing applications.
2711-NM15	x	x	x	x	x	x	10M flash memory card for storing applications.
2711-NM24 ²	x	x	x	x	x	x	4M flash ATA card for storing applications and font files.
2711-NM28	x	x	x	x	x	x	8M flash ATA card for storing applications and font files.
2711-NM216 ¹	x	x	x	x	x	x	16M flash ATA card for storing applications and font files.
2711-NMCC		x	x	x	x		Secures memory card in the PanelView 500/600 keypad or the PanelView 900/1000 keypad and touch screen. Prevents electrostatic discharge.
2711-NMCD		x					Secures memory card in 550 touch screen terminal and prevents electrostatic discharge.
2711-NMCE	x		x				Secures memory card in PanelView 300 keypad and 600 touch screen terminals and prevents electrostatic discharge.

¹ Contact Allen-Bradley for availability.

² Not available for purchase.

Antiglare Overlay

Self-adhesive filters minimize the reflection of terminal displays.

Catalog No.	300M	300	550	600	900	1000	1400
2711-NV4 (Keypad)			x				
2711-NV4T (Touch Screen Terminals)			x	x			
2711-NV3K (Keypad)					x		
2711-NV3T (Touch Screen Terminals)					x		
2711-NV5 (Keypad)				x			
2711-NV7K (Keypad Terminals)							x
2711-NV7T (Touch Screen Terminals)							x
2711-NV6K (Keypad Terminals)						x	
2711-NV6T (Touch Screen Terminals)						x	
2711-NV8 (Keypad Terminals)		x					

DH-485 Operating and Programming Cables

Catalog No.	Description
1747-PIC	Personal Computer Interface Converter converts RS-232 signals to/from RS-485 signals. Use to transfer applications between a DH-485 terminal and a computer.
1747-C10	1.83 meter (6 foot) cable connects a DH-485 terminal to an SLC or DH-485 network.
1747-C11	0.30 meter (1 foot) cable connects a DH-485 terminal to an SLC or DH-485 network.
1747-C20	6.1 meter (20 foot) cable connects a DH-485 terminal to an SLC or DH-485 network.
1747-CP3	45 cm (17.7 inch) cable connects an RS-232 terminal to an AIC+ (Port1) through a null modem adapter.
1761-CBL-AP00	45 cm (17.7 inch) cable connects an RS-232 terminal to an AIC+ (Port2) through a null modem adapter.
1761-CBL-AC00	3 meter (9.8 foot) cable connects an RS-232 terminal to an AIC+ (Port1) through a null modem adapter.
1761-CBL-AS03	3 meter (9.8 foot) cable connects a DH-485 terminal to an AIC+ (Port3).
1761-CBL-AS09	9.9 meter (29.5 foot) cable connects a DH-485 terminal to an AIC+ (Port3).
1761-CBL-AM00	45 cm (17.7 inch) cable with 2 mini DIN, right angle connectors.
1761-CBL-HM02	2 meter (6.5 foot) cable with 2 mini DIN, right angle connectors.
2711-CBL-HM05	5 meter runtime cable with 2 mini DIN, right angle connectors.
2711-CBL-HM10	10 meter runtime cable with 2 mini DIN, right angle connectors.
1761-CBL-PM00	45 cm (17.7 inch) cable connects an RS-232 terminal to an AIC+ (Port2) through a null modem adapter.
1761-CBL-PM02	2 meter (6.5 foot) cable connects an RS-232 terminal to an AIC+ (Port2) through a null modem adapter.
2711-CBL-PM05	5 meter programming cable with a D-shell and mini DIN connector.
2711-CBL-PM10	10 meter programming cable with a D-shell and mini DIN connector.

PanelView File Transfer Utility

Catalog No.	Description
2711-ND7	Transfers .PVA files between a PanelView terminal and a computer running Windows.

Power Supply and Link Couplers

The following items are available for all PanelView terminals.

Catalog No.	Description
1747-NP1	Wallmount Power supply provides power for DH-485 communications when an SLC or network is not connected.
1747-AIC	AIC Link Coupler links devices on a DH-485 network.
1761-NET-AIC	AIC+ Advanced Interface Converter links devices on a DH-485 network including MicroLogix.
1761-NET-DNI	DeviceNet Interface links DF1 PanelViews on a DeviceNet network.
1761-NET-ENI	Ethernet Interface links DF1 or Ethernet devices on an EtherNet/IP network.

RS-232 Cables

Catalog No.	Description
2711-NC13	5 meter (15 foot) connects an RS-232 terminal to the Channel D port of an SLC 5/03 controller or the RS-232 port of a computer or printer.
2711-NC14	10 meter (32 foot) cable connects an RS-232 terminal to the Channel D port of an SLC 5/03 controller or the RS-232 port of a computer or printer.
2711-NC21	5 meter (15 foot) connects an RS-232 terminal to a MicroLogix controller (except PV300 Micro).
2711-NC22	15 meter (49 foot) cable connects an RS-232 terminal to a MicroLogix controller (except PV300 Micro).
2706-NC13	3 meter (10 ft) cable connects an RS-232 terminal to an SLC 5/03 controller or the RS-232 port of a computer or printer.
1761-CBL-AP00	0.5 meter (1.5 ft) cable connects a PanelView 300 Micro RS-232 terminal to an SLC or PLC.
1761-CBL-PM02	2 meter (6.5 ft) cable connects a PanelView 300 Micro RS-232 terminal to an SLC or PLC.
2711-CBL-PM05	5 meter (15 ft) cable connects a PanelView 300 Micro RS-232 terminal to a ControlLogix, AIC+, SLC controller, or computer RS-232 port.
2711-CBL-PM10	10 meter (30 ft) cable connects a PanelView 300 Micro RS-232 terminal to a ControlLogix, AIC+, SLC controller, or computer RS-232 port.
1761-CBL-AM00	0.5 meter (1.5 ft) cable connects a PanelView 300 Micro RS-232 terminal to a MicroLogix.
1761-CBL-HM02	2 meter (6.5 ft) cable connects a PanelView 300 Micro RS-232 terminal to a MicroLogix.
2711-CBL-HM05	5 meter (15 ft) cable connects a PanelView 300 Micro RS-232 terminal to a MicroLogix 1000/1200/1500, DeviceNet DNI, or AIC+ module.
2711-CBL-HM10	10 meter (30 ft) cable connects a PanelView 300 Micro RS-232 terminal to a MicroLogix 1000/1200/1500, DeviceNet DNI, or AIC+ module.

Remote I/O or DH+ Cable

Catalog No.	Description
1770-CD	Shielded, 3-conductor cable (Belden 9463) for connecting a Remote I/O terminal to a Remote I/O network.

Replacement Parts

Backlight Lamps

Catalog No.	550	600	900	1000	Description
2711-NL1	x				Halogen backlight lamp for all PV550 terminals. Provides backlighting for LCD display.
2711-NL2			x		Backlight for PV900 color terminal.
2711-NL3		x			Backlight for PV600 color terminal.
2711-NL4				x	Backlight for PV1000 color terminal

Real Time Clock Modules

Catalog No.	300	550	600	900	1000	1400	Description
2711-NB2		x					Real time clock module for PV550 (Series D or earlier). Does not apply to the PV550 touch screen terminals. Contains lithium battery.
2711-NB3		x	x	x	x	x	Real time clock module for PV600, PV900, PV1000, PV1400 or PV550 (Series E or later). Does not apply to PV550/PV600 touch screen terminals. Contains lithium battery
2711-NB4	x	x	x				Real time clock module for PV300 keypad, PV550/PV600 touch screen only terminals. Contains lithium battery.

Panel Mount Clips and Studs

Catalog No.	600	900	1000	1400	Description
2711-NP1				x	10 panel mount clips for PV1400 terminal.
2711-NP2	x	x	x		6 panel mount clips for PV600, PV900 or PV1000 terminals.
2711-NP3				x	Optional panel mount studs (18) for PV1400 terminals.

Remote I/O Connector

Catalog No.	550	600	900	1000	1400	Description
22112-046-03	x	x	x	x	x	Terminal block connector plugs into Remote I/O port of Remote I/O terminals.

Power Input Connector

Catalog No.	300M	Description
2711-TB0C	x	Removable DC power input connectors for PanelView 300 Micro (qty of 10)

Troubleshooting and Maintenance

Chapter Objectives

This chapter tells how to isolate and correct common operating problems and perform routine maintenance tasks.

- equipment required
- using troubleshooting chart
- LED indicators
- cleaning display window
- replacing clock module
- replacing backlight

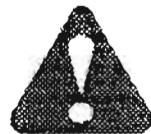
Note: The PanelView 300 Micro has no internal components that are user accessible. The rear cover is not removable, do not attempt to remove the cover. The real-time clock battery and LCD display backlight are not replaceable.

Equipment Required

Other than verifying that the correct power source is connected to the terminal (use a voltmeter), no electronic diagnostic equipment is required for troubleshooting.

Using the Troubleshooting Chart

The following pages provide a troubleshooting chart for the terminal. This chart lists the most common operating problems, causes, and steps to correct them.

ATTENTION

The PanelView terminals contain hazardous voltages. Do not insert objects or let objects fall into the terminal through ventilation slots. Always disconnect power when checking wiring connections. Failure to take adequate precautions may result in electrical shock.

Troubleshooting Chart

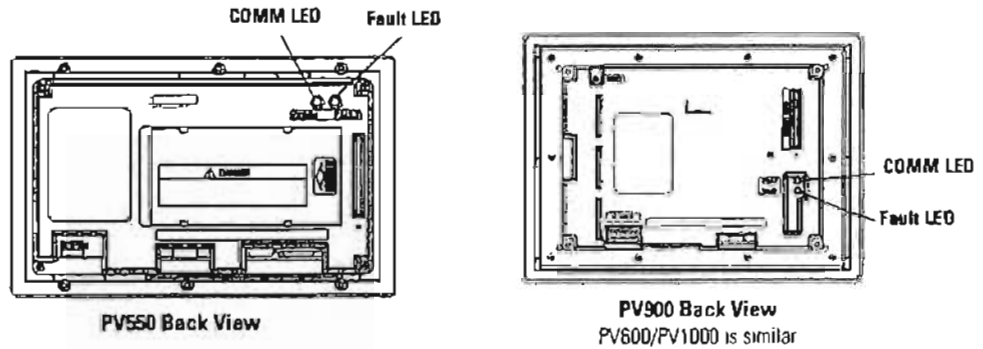
Problem	Probable Cause(s)	Corrective Action(s)
Terminal does not power up.	1. Improper connection to power source. 2. Incorrect input voltage level. 3. DC power wires reversed (DC terminals only). 4. Power terminal block not fully seated (PV300 terminals only).	1. Verify wiring and connections to power source. 2. Verify correct voltage is present at power terminals. 3. Make sure DC power positive and negative are connected to the proper terminals. 4. Verify power terminal block is snapped onto base of PV300 Micro.
Application file will not download (first download).	1. Communication cable disconnected. 2. Incorrect baud rate or communication settings. 3. Incorrect computer COM port selection.	1. Check communication cable type and connections. 2. Verify computer and terminal are set to same communication settings. 3. Verify correct COM port number in WinPFI or PanelBuilder32 software.
Application file will not download (subsequent downloads).	1. Incorrect communication or baud rate settings.	1. Verify computer and terminal have same communication settings. Change settings in Communication Setup screen of the terminal.
No communications with MicroLogix, ControlLogix, SLC or PLC controller.	1. Communications (COMM) fault. 2. Baud rates not set properly. 3. Controller is not in run mode. 4. Terminal node and maximum node numbers are not set correctly.	1. Check status of COMM LED. Verify cable connections using cable diagrams in Chapters 12. 2. Verify that terminal and controller are set at the same baud rate. 3. Place controller in run mode. 4. Verify node address settings.
No communications with PLC but COMM LED is active.	1. PanelView is trying to communicate with a controller at a different address. 2. The inhibit bit is set as the default on the Channel Status Screen in the PLC.	1. Verify address of the controller. 2. Change setting of the inhibit bit.
No communications with computer.	1. Communications (COMM) fault. 2. No SLC, network, or power supply connection at terminal's DH-485 port. 3. Baud rates not set correctly. 4. Terminal node and maximum node numbers are not set correctly. 5. Computer fault. 6. Communication driver not properly loaded. 7. Printer port is enabled.	1. Check status of COMM LED. Verify cable connections using cable diagrams in Chapter 10. 2. Personal Computer Interface Converter (PIC) receives power from DH-485 connection. Verify that the terminal is connected to an SLC, network, or wallmount power supply as shown in Chapter 12. 3. Verify that terminal and computer are set at the correct baud rate. 4. Verify node number settings. 5. Refer to user manual for computer. 6. Refer to RSLogix online help or manual. 7. Disable printing on the Printer Setup screen of the Configuration Mode menu.
Clock Module Battery Low message is displayed.	1. Internal parameters corrupt. a. Clock module battery failure.	1. Reload application and cycle power to the terminal. 2. Replace clock module as described in instructions provided with clock module kit. For PanelView 300 Micro, clock module cannot be replaced.
Cannot transfer application from memory card.	1. Memory card is not properly installed. 2. Application is too large for terminal memory. 3. Data checksum is incorrect. 4. Invalid file format.	1. Verify correct installation. 2. Reduce size of application file. 3. Check that memory card is properly seated. Application may be corrupt. 4. Verify file format (.PVA) being transferred.

Problem	Probable Cause(s)	Corrective Action(s)
Cannot transfer application to memory card.	1. Memory card is not properly installed 2. Memory card is write protected.¹ 3. File currently exists on memory card¹ 4. Application file is too large, not enough space on memory card 5. Invalid memory card format.¹ 6. Data checksum is incorrect. 7. Application does not exist.¹	1. Verify correct installation. 2. Change memory card protection switch 3. Erase and reformat card. 4. Reduce size of application file or erase/format memory card. 5. Replace or reformat memory card. If problem continues, try another card. 6. Check that card is installed correctly. If problem continues, try another card. 7. Check the Terminal Info screen to verify that an application exists
Screen objects do not function. ¹	1. Terminal not communicating with controller. 2. Terminal in screen saver mode.	1. Check status of COMM LED. See problem 'No communications with SLC or PLC controller' for more information. 2. Access Screen Setup from the terminal Configuration Mode to check if terminal is in Screen Saver Mode.
Application file name appears as "*****" on Terminal Info screen.	1. Application is invalid. 2. Application is unusable because of error	1. Download application and try again. 2. Download new application
Area on color screen appears dark	1. One of the backlight tubes has burnt out.	1. Replace color backlight.
Screen objects are not visible.	1. Correct power is not applied 2. Contrast or intensity is not set correctly 3. Terminal is in screen saver mode. 4. PV550 backlight lamp is not on 5. Terminal's backlight is burnt out	1. Verify power connections. 2. Access Screen Setup on the Configuration Mode menu and adjust the contrast. On keypad terminal's, press the left and right arrow keys simultaneously, then press [F9] or [F15]. 3. Access Screen Setup on the Configuration Mode menu to see if terminal is set for screen saver mode. 4. Access Screen Setup on the Configuration Mode menu and turn on backlight 5. Replace backlight.
Values do not update on display but appear as asterisks "****"	1. Terminal is not communicating with controller. 2. Value is invalid or exceeds the field width defined for the object	1. Check status of COMM LED. Refer to problem 'No communication with SLC or PLC controller' for more details. 2. Change the field width for the object.
Can't enter Configuration Mode when pressing Left and Right arrow keys simultaneously.	1. Left and right arrow keys are assigned to screen objects in the terminal application.	1. Contact Allen-Bradley technical support for assistance

¹ Terminal displays a warning message with instructions if these errors occur

Indicators

On PanelView terminals (except PanelView 300 Micro), use the COMM and Fault LED indicators to isolate operating problems. The illustration below shows the location of these indicators on some terminals. See chapter 1 for LED locations on other terminals.



On PanelView 300 Micro terminals, view the Comm and Fault indicators in the terminal configuration mode (Communication Setup selected).

DF1, DH-485, DH+ LED Indications

LED	This Pattern:	Indicates:
Comm ¹	Solid Fill	Normal operating state (no communication faults)
	No Fill	Fault detected • Make sure controller is run mode • Verify baud settings of terminal and controller • Verify proper terminal to controller connections
	Flashing	When power is first applied (momentarily)
	Blinking	No communications established. For DF1 terminals, the Comm indicator flashes until an application is loaded.
Fault	No Fill	Normal operating state
	Solid	Fault detected. Cycle power to the terminal. If the fault still exists, the terminal requires servicing.
	Blinking	Hardware is functioning but no application is loaded or the current application is corrupt. Reload the application into the terminal.

¹ Comm LED stays on until powerup self-tests are complete.

Remote I/O LED Indications

LED	This pattern:	Indicates:
Comm ¹	Solid Fill	Normal operating state (no communication faults)
	No Fill	Communications not functioning • Verify that baud rate and rack settings match the PLC settings • Verify proper terminal to controller connections • Verify that the PLC enables Remote I/O communications
	Blinking	No communications established. PLC is in program mode.
	Flashing	When power is first applied (momentarily)
Fault	No Fill	Normal operating state
	Solid Fill	Fault detected. Cycle power to the terminal. If the fault still exists, the terminal requires servicing.
	Blinking	Hardware is functioning but no application is loaded or the current application is corrupt.

¹ Comm LED stays on until powerup self-test are complete

DeviceNet, ControlNet, EtherNet/IP

LED	This Pattern:	Indicates:
Comm	Solid Fill	Normal operating state (no communication faults).
	No Fill	Hardware failed.
	Flashing	When power is first applied (momentarily).
	Blinking	No communications established.
Fault	Solid Fill	Normal operating state (no communication faults).
	No Fill	Hardware failed.
	Blinking	Hardware is functioning but no application is loaded or the current application is corrupt.

Cleaning the Display Window

To clean the display window:

ATTENTION

Use of abrasive cleansers or solvents may damage the window. Do not scrub or use brushes.

1. Disconnect power from the terminal at the power source.
2. Use a clean sponge or a soft cloth to clean the display with a mild soap or detergent.
3. Dry the display with a chamois or moist cellulose sponge to avoid water spots.

Removing Paint and Grease

Remove fresh paint splashes and grease before drying by rubbing lightly with isopropyl alcohol (70% concentration). Afterward, provide a final wash using a mild soap or detergent solution. Rinse with clean water.

Equipment Hose Downs

Be aware that screen objects on touch cell terminals may activate during equipment hose downs.

ATTENTION

Because touch terminals have sensitive touch cell regions, it is possible for screen objects to activate during equipment hose downs.

Replacing the Clock Module

The Real-Time Clock (RTC) module contains a lithium battery used only by the real-time clock. The battery is not used for application backup or input retention. The clock module has a typical life expectancy of 7 years.

Note: The real-time clock on the PanelView 300 Micro terminal is not replaceable.

The clock module replacement kits for the PanelView terminals are listed in Chapter 1 under *Replacement Parts*. Replacement instructions are provided with the kits.

ATTENTION

The clock module contains lithium. Do not attempt to dispose of the module in a fire or incinerator. Doing so may cause the clock module to explode. Follow disposal regulations in your area for lithium battery disposal.

Replacing the Backlight

Replacement backlights are available for the PanelView terminals. See *Replacement Parts* in Chapter 1 for the catalog numbers. Replacement instructions are provided with the kits.

Note: The backlight on the PanelView 300 and 300 Micro terminal is not replaceable.

Specifications

PanelView 300 Micro

Electrical	
DC Power Supply Voltage Limits Power Consumption	11 to 30V dc (24V nominal) 2.5W maximum (0.105A @24Vdc)
Mechanical	
Enclosure	NEMA Type 12/13, 4X (Indoor use only), IP54, IP65
Weight	284 grams (10 oz.)
Dimensions	mm Inches 133 (H) x 112 (W) x 48 (D) 5.23 (H) x 4.38 (W) x 1.87 (D)
Installed Depth	35mm (1.39 inches)
Display	
Type	Liquid Crystal Display (LCD) with integral LED backlight (100,000 hour life)
Size	73 mm (w) x 42 mm (h) 2.87 in (w) x 1.67 in (h)
Pixels	128 x 64
Terminal Memory	
Total Application Flash Memory	240K bytes (application screens)
Environment	
Operating Temperature	0 to 55° C (32 to 131° F)
Storage Temperature	-20 to 85° C (-4 to 188° F)
Relative Humidity (non-condensing)	5 to 95% at 0 to 55° C (32 to 131° F)
Heat Dissipation	2.5 Watts (8.5 BTU/Hour)
Impulse Shock	30G operating, 50G nonoperating
Vibration (operating)	2G up to 2,000 Hz

Character Sizes (Pixel size = 0.48 x 0.48 mm)

Size in Pixels width x height)	Characters/Row	Maximum Rows	Dimensions in mm Width x Height
4 x 6	31	10	1.9 x 2.9
6 x 8	20	7	2.9 x 3.8
6 x 16	20	3	2.9 x 7.7
6 x 24	20	2	2.9 x 11.5
12 x 8	10	7	5.8 x 3.8
12 x 16	10	3	5.8 x 7.7
12 x 24	10	2	5.8 x 11.5
18 x 8	6	7	8.6 x 3.8
18 x 16	6	3	8.6 x 7.7
18 x 24	6	2	8.6 x 11.5

PanelView 300

Electrical	
DC Power Supply Voltage Limits Power Consumption	18 to 32V dc (24V dc nominal) 10 Watts, max. (0.42A @ 24V dc)
Mechanical	
Enclosure	NEMA Type 12/13, 4X (Indoor use only), IP54, IP65
LED Indicators COMM Fault	Green Red
Weight	673 grams (1.48 lbs)
Dimensions	mm Inches 197 (H) x 140 (W) x 82 (D) 7.76 (H) x 5.53 (W) x 3.21 (D)
Installed Depth	69mm (2.73 inches) 122.4 mm (4.82 inches) with memory card retainer 216 mm (8.5 inches) with memory card retainer and clearance to insert and remove memory card
Display	
Type	Liquid Crystal Display (LCD) with integral LED backlight (100,000 hour life)
Size	73 mm (w) x 42 mm (h) 2.87 in. (w) x 1.67 in. (h)
Pixels	128 x 64

Terminal Memory

Total Application Flash Memory	240K bytes (application screens)
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Environment

Operating Temperature	0 to 55° C (32 to 131° F)
Storage Temperature	-25 to 85° C (-4 to 188° F)
Relative Humidity (non-condensing)	5 to 95% at 0 to 55° C (32 to 131° F)
Heat Dissipation	18 Watts (69 BTU/HR)
Impulse Shock (operating/non-operating)	15G/30G
Vibration (operating)	2G up to 2,000 Hz

Character Sizes (Pixel size = 0.48 x 0.48 mm)

Size in Pixels width x height)	Characters/Row	Maximum Rows	Dimensions in mm Width x Height
4 x 6	31	10	1.9 x 2.9
6 x 8	20	7	2.9 x 3.8
6 x 16	20	3	2.9 x 7.7
6 x 24	20	2	2.9 x 11.5
12 x 8	10	7	5.8 x 3.8
12 x 16	10	3	5.8 x 7.7
12 x 24	10	2	5.8 x 11.5
18 x 8	6	7	8.6 x 3.8
18 x 16	6	3	8.6 x 7.7
18 x 24	6	2	8.6 x 11.5

Messages, Codes and Self-Test Numbers

This appendix lists:

- terminal messages and codes that may appear during terminal operation
- description of self-test numbers

Types of Terminal Messages

Status Messages

Indicate the terminal is performing an operation that may limit access to the terminal, such as an application download or a communication problem. The message disappears when the terminal completes the operation or when the condition is satisfied.

Reminder Messages

Indicate a minor fault or mistake. Reminder messages appear when an invalid operation is attempted, such as entering an out-of-range value. Pressing any key removes the message.

Warning Messages

Indicate the operation may produce undesirable results. You must respond to warning messages as indicated in the message.

Fault Messages

Indicate the terminal has detected a condition which prevents further operation. The current application will halt. The terminal must be reset (power cycled) to recover from this type of error.

General Terminal Messages

Error Number	Terminal Messages	Type	Meaning	Recommended Action
200-206, 300, 318-321, 328, 329, 331, 346, 347, 355, 356, 358, 367, 404, 411, 416, 417, 421-425, 447-449, 457, 459, 700, 1105, 1111, 1113, 1115, 1207-1211, 2002-2009, 2016, 2018, 2021, 2028 and 2029	A fault has occurred. Error = X	Minor Fault or Terminal Fault	A minor fault was detected that could impact terminal operation or a terminal fault was detected.	Press any key to recover from a minor fault. For terminal faults, contact technical support with the error code.
208	Write to logic controller failed	Comm Status	Controller does not accept data from the terminal. Controller is not connected.	Check connections (on Remote I/O units). Verify that controller is in run mode and not busy. Verify that controller data files are not in use by other applications.
303	Aborted.	Reminder/File Transfer Status	The terminal received an abort command during a file transfer.	Try again.
304	File read access error	Reminder	Error reading the source file from a source device.	Try again. If problem continues, contact technical support.
305	File write access error	Reminder	Error writing source file.	Try again. If problem continues, contact technical support.
307	File not supported	Reminder/File Transfer Status	File is incompatible with the terminal's firmware.	Contact technical support to verify compatibility. File must be a .PVA file.
308	Timeout	Reminder / File Transfer Status	The terminal was waiting for the partner device in a file transfer, but the terminal timed out before the data or expected reply was received.	Check cable connections or data corruption with noise on cable. Verify that the computer was not reset. Try again.
309-311	Data corrupted. Verify file and retry.	Reminder/File Transfer Status	The data checksum failed in a file transfer.	Check electrical and cable connections. Try the file transfer again.
312	Unknown device	Reminder / File Transfer Status	Verify the file type entered. Try again.	Destination or source device is invalid for a read or write application transfer.
313	File too large	Reminder / File Transfer Status	Reduce application size. See Appendix A for terminal requirements. If copying to a card, check card space.	File too large to be transferred to the terminal. In a memory card transfer, the card does not have enough space.
314	No Card Inserted	Reminder	Install a memory card and try again.	You tried to transfer data to/from a memory card but there is no card in the card slot.
315	Unformatted card	Reminder	Memory card is unformatted, contains an unrecognizable format or is corrupt.	Reformat the card or replace it with a new card if corrupt. Try again.
316	Write Protected Card	Reminder / File Transfer Status	A write command to the card failed because the card switch is in the protected mode.	Select write mode by changing the switch on the top edge of the card. Try again.
317	File exists. Cannot overwrite	Reminder/File Transfer Status	See message 342. This message only occurs when the file cannot be renamed.	Change the file name or save to a new memory card.
323	No application on PV terminal	Reminder/File Transfer Status	You tried to load an application on a memory card but there is no application in the terminal.	View the Terminal Info screen to see if an application is loaded in the terminal.
324	Check card status	Reminder/File Transfer Status	Problem formatting the memory card.	Try a new memory card.

Error Number	Terminal Messages	Type	Meaning	Recommended Action
325	Unformatted card	Reminder	Memory card is unformatted, contains an unrecognizable format or is corrupt.	Reformat the card or replace it with a new card. Try again.
326	No Card Inserted	Reminder	You tried to transfer data to/from a memory card but there is no card in the card slot.	Install a memory card and try again.
327	No files	Reminder	You tried to transfer a file from the memory card but there are no files on the card.	Use memory card containing application (PVA) files.
330	Write Protected Card	Reminder / File Transfer Status	A write command to the card failed because the card switch is in protected mode.	Select write mode by changing the switch on the top edge of the card. Try again.
332	No application on PV terminal	Reminder/File Transfer Status	You tried to load an application on a memory card but there is no application in the terminal.	View the Terminal Info screen to see if an application is loaded in the terminal.
333	File in use - Request denied	Reminder	Attempt to format memory card containing a file used by the application. This usually occurs when an application requires a font file on the memory card.	Format the memory card on a computer or a PanelView terminal that does not have an application loaded.
334	Unexpected card removal. Please disconnect card before removal.	Reminder / File Transfer Status	You removed the memory card during normal operation and did not press the Disconnect button on the Memory Card configuration screen.	Press the Disconnect Card button to close the files on the card. When prompted, remove the card from the slot and then re-insert the card. Enter Configuration Mode and press the Run Mode button.
340	Format erases entire card: 0 or F1 - Abort 1 or F2 - Continue	Warning	Operator pressed (F4) Erase / Format Card on the Memory Card configuration screen.	Enter appropriate response: 0 or F1 to abort 1 or F2 to continue
341	Proceed with download? 0 or F1 -Abort 1 or F2 - Continue	Warning	You pressed (F2), Restore From Card on the Memory Card configuration screen.	Enter appropriate response: 0 or F1 to abort 1 or F2 to continue
342	The PVA File exists. 0 or F1 -Abort 1 or F2 - Upload with new PVA filename	Reminder / File Transfer Status	You pressed (F3), Save To Card on the Memory Card configuration screen when the file exists on the card.	Enter appropriate response: 0 or F1 to abort 1 or F2 to upload new PVA file.
361	Value not in range	Reminder	Entered value is outside of valid range.	Enter a value within the valid range.
364	Closing Files . . .	Status	Terminal is preparing for removal of memory card.	Wait for files to close before removing memory card.
365	Remove card . . .	Reminder	You must remove the memory card for the terminal to continue operation.	Remove the memory card.
366	Card disconnection will require card removal to continue operation.	Warning	Attempt to disconnect the memory card.	After memory card is disconnected it must be removed from card slot before the terminal will operate.
392	File not supported	Reminder/File Transfer Status	File is incompatible with the terminal type.	In PanelBuilder32, select the Setup tab on the Application Settings dialog and select the correct terminal type.
393	File not supported	Reminder/File Transfer Status	File is incompatible with the communication protocol of the terminal.	In PanelBuilder32, select the Setup tab on the Application Settings dialog and make sure the protocol matches your terminal.

Error Number	Terminal Messages	Type	Meaning	Recommended Action
394	File not supported	Reminder/File Transfer Status	File is incompatible with the terminal's firmware.	In PanelBuilder32, click the Catalog & Revisions button on the Setup tab on the Application Settings dialog. Select a firmware version that matches your terminal.
395	File not supported	Reminder/File Transfer Status	File is incompatible with the operator input type (keypad, touch or keypad and touch) of terminal.	In PanelBuilder32, select the Setup tab on the Application Settings dialog. Select the type of operator input that matches your terminal.
396	File not supported	Reminder/File Transfer Status	File is incompatible with the terminal.	Download the file to the terminal again. If problem reoccurs, contact technical support.
415	Retained memory lost. Presets were loaded.	Reminder	The battery backed memory was invalid during startup. The system defaulted to preset values instead of the last states.	No action necessary. Terminal reverts to defaults.
436	Logic Controller has screen control	Reminder	You tried to change the application screen but it is configured for controller only access.	No action required, controller will change screens as programmed.
634	Read Fail or Write Fail	Status	ControlLogix Tag or address does not exist or is the wrong data type. Designated slot does not contain a ControlLogix Processor.	Check tag address. Check for data type mismatch. Verify ControlLogix slot location.
1109	Font file unavailable, Font error = ****	Minor Fault or Terminal Fault	You downloaded an application to the PanelView without the appropriate memory card (containing the font file) inserted in the card slot of the terminal.	From the Memory Card screen, press the Disconnect button to close the files on the card. Remove the card from the card slot. Locate the card containing the font file or copy the correct font file to a card. Insert the correct memory card in the card slot and enter Run mode.
1110	No valid application	Reminder	You tried to run an application that has not been downloaded to the terminal.	Download application to terminal.
1118	Access denied.	Status	Wrong password entered.	Enter a valid password.
1119	Access denied.	Status	Password not recognized	Enter a valid password.
1120	Security tampering.	Status	PVA file was corrupted - attempt to bypass security was detected	New application file must be downloaded to the terminal.
1121	No operator selected.	Status	There is no currently selected operator, but a password change has been requested	Select the operator requiring the new password.
1122	Password change is not allowed.	Reminder	Password is unchangeable	Password cannot be changed at the current level of security.
1123	Password change is not allowed.	Reminder	Operator cannot change password	Current operator does not have access for password changes.
1124	New password must be entered before it can be verified.	Reminder	New pass words must be entered twice.	Enter the new password again to verify that it was entered correctly.
1125	New and verify passwords differ.	Status	The same password was not entered for verification.	Enter the same password for New and Verify.
1126	Please verify new password.	Reminder	New pass words must be entered twice.	Enter the new password again.
1127	Password changed	Reminder	Password change is effective.	You must use new password for security access.

Error Number	Terminal Messages	Type	Meaning	Recommended Action
2005	Application file: Insufficient RAM	Terminal Fault	Application file may be too large.	Try again. If possible, reduce the size of the application.
2007 - 2010	Application file contains errors	Terminal Fault	Application contains incompatible data.	Check application and try again.
2011	Retained memory lost. Presets were loaded.	Reminder	The battery backed memory was invalid during startup. The system defaulted to preset values instead of the last states.	No action necessary. Terminal reverts to defaults.
2012	Application file: Too many retained memory devices	Terminal Fault	The battery-backed RAM is too full to hold all devices requiring presets.	Reduce the number of control objects. Use global objects.
2014	Hardware configuration is corrupted	Terminal Fault	The terminal hardware configuration is corrupt.	Contact technical support.
2030, 2031	Hardware and firmware do not match	Terminal Fault	A mismatch exists between the terminal firmware and the terminal hardware.	Verify that the series and revision markings on the back of the terminal are compatible with the firmware.

DH-485 Terminal Messages

Error Number	Terminal Messages	Type	Meaning	Recommended Action
612	No active node(s) found on network	Comm Status	Tag or address does not exist or is the wrong data type.	Check tag address. Check for data type mismatch.
613	Required network node(s) not found	Comm Status	Tag or address does not exist or is the wrong data type.	Check tag address. Check for data type mismatch.
615	Duplicate node address	Comm Status	More than one node was assigned the same address.	Verify all device nodes.
616	Data errors on the link	Comm Status	Corrupt data packets were detected on DH-485 network.	Verify controller addressing and baud rate settings. Check for loose or reversed wiring.

ControlNet Terminal Messages

See Terminal Codes for messages below				
Error Number	Terminal Messages	Type	Meaning	Recommended Action
634	PanelView offline	Comm Warning	PanelView is offline.	Check connections
634	Write fail.	Comm Warning	PanelView is communicating with the controller. The data table address does not exist.	Check / define data table address in the controller.
634	Write timeout.	Comm Warning	PanelView is not communicating with the logic controller.	Check connections and node configuration in the application.
634	Read fail.	Comm Warning	PanelView is communicating with the controller. The data table address does not exist.	Check/define data table address in the controller.
634	Read timeout.	Comm Warning	PanelView is not communicating with the controller.	Check/define data table address in the controller.
636	Initial write failed.	Reminder	Write to Logic Controller on Startup was configured and on powerup, the PanelView could not write initial values to a node's data table address. or Write to Logic Controller on Startup was not configured and the PanelView was unable to write a controller. Note: The error is only displayed on the first write attempt.	Check/define data table address in the controller. Check communication connections and node configuration in the application.

Remote I/O Terminal Messages

Error Number	Terminal Messages	Type	Meaning	Recommended Action
661	Timeout - No Block Transfer Writes	Comm Status	The PLC is communicating with the terminal, but the PanelView is not receiving BTW requests required by the application.	Check ladder logic for missing BTW instructions (instructions are not enabled) or addressing errors. Check for logic controller errors.
662	Timeout - No Block Transfer Reads	Comm Status	The PLC is communicating with the terminal, but the PanelView is not receiving BTR requests required by the application.	Check ladder logic for missing BTR instructions (instructions are not enabled) or addressing errors. Check for logic controller errors.
663	Timeout - No Block Transfer Requests	Comm Status	The PLC is communicating with the terminal, but the PanelView is not receiving BTR or BTW requests required by the application.	Check ladder logic for missing BTR or BTW instructions (instructions are not enabled) or addressing errors. Check for logic controller errors.
664	PLC in program mode	Comm Status	The PLC is offline (in Program Mode). The COMM LED on the Configuration Mode menu is off.	Place the PLC in run mode to resume communication.
665	No PLC communications	Comm Status	The PLC is not communicating. Possible causes are disconnected cable, no power to PLC, incorrect baud rate or rack settings for PLC configuration. COMM LED is off.	Check for pulled cables and PLC power. Check baud rate settings and rack configurations. Check wiring of connector. Communication resumes when problem is corrected.
666	Invalid Rack Configuration	Comm Status	No communications can occur because of an invalid rack configuration.	Correct the RIO rack configuration.
667	Remote I/O Hardware Failed	Comm Status	During startup, the terminal detected a missing, corrupt or nonfunctional Remote I/O card. The terminal will run but not communicate.	Contact technical support and provide specific message.

EtherNet/IP Messages

For a description of EtherNet/IP terminal codes, see page B-13.

DH+ Terminal Messages

Error Number	Terminal Messages	Type	Meaning	Recommended Action
675 or 684	Required network node(s) not found	Comm Status	The network is active, but the logic controller(s) are not located at the expected nodes.	Verify that the logic controller(s) required by the application are at the expected node addresses and that the communication parameters are set properly.
676 or 685	File access error	Comm Status	1. The terminal is trying to access one or more controller data files that are unavailable. 2. If the message is flashing, the terminal is trying to read or write data files that are unavailable.	1. The data files do not exist on the controller. Create the data files. 2. The data file is smaller than what is required. For example, the PanelView uses N7:10 but only N7:0 is defined in the controller.
677 or 686	Unstable DH+ network	Comm Status	Corrupt data packets or intermittent system configuration was detected on DH+ network.	Verify all controller addressing and baud rate settings. Check for loose or reversed wiring.
678 or 687	Duplicate node detected	Comm Status	More than one node was assigned the same address.	Verify all device nodes.
679 or 688	No active Node(s) found on network	Comm Status	No other DH+ devices can be located on the network.	Verify that PanelView terminal and logic controller(s) are correctly connected to the system. Check cable and wiring. If error continues, verify that baud rates on the terminal and controller are the same. Communication resumes when the problem is corrected.
681 or 690	DH+ hardware failed	Comm Status	During startup, the terminal detected a missing, corrupt, or nonfunctional DH+ card. The terminal will run but not communicate.	Contact technical support and provide the specific terminal message.

DF1 Terminal Messages

Error Number	Terminal Messages	Type	Meaning	Recommended Action
675 or 682	Required network node(s) not found	Comm Status	The network is active, but the logic controller(s) are not located at the expected nodes.	Verify that the logic controller(s) required by the application are at the expected node addresses and that the communication parameters are set properly.
676 or 683	File access error	Comm Status	The terminal is trying to access one or more controller data files that are unavailable. If the message is flashing, the terminal is trying to read or write data files that are unavailable.	The data files do not exist on the controller. Create the data files.
679 or 686	Panelview offline	Comm Warning	PanelView is offline.	Check connections
681 or 688	DF1 hardware failed	Comm Status	During startup the terminal detected a missing, corrupt, or nonfunctional DF1+ card. The terminal will run but not communicate.	Contact technical support and provide terminal message.

Terminal Codes

Terminal Codes are displayed on the PanelView terminal during operation or terminal configuration.

DeviceNet Codes

Comm Status codes appear as a banner at the top of an application screen or as an LED status on the terminal's Configuration screen. Error 634 appears in upper left of banner. Codes less than 12 are minor faults and clear automatically when corrected. Codes above 12 require a terminal reset to clear.

DeviceNet Comm Status Code	Indicates:	Recommended Action
1	No connections established. Occurs on power-up until a device connection is established on the network.	Establish a connection over DeviceNet to the PanelView.
2	A connection is in the timed out state. Occurs when I/O polling stops after an I/O poll connection is running.	Check that the network wiring and that the master device (scanner) is operational.
3	An peer tag cannot be obtained. Occurs if the device associated with a peer tag is not responding or the peer tag does not exist at the specified class, instance, and attribute number.	Ensure the data location is correct and that the end device is attached and operational. For write tags, ensure that the appropriate attribute is targeted. If the targeted device is UCMM capable, ensure it has enough explicit message connections to allow the PanelView to take one. If the targeted device is not UCMM capable, ensure that it is owned by a Master device (scanner).
4	A zero length I/O message was received placing the I/O application in idle mode. Occurs when scanner is in program mode.	Error clears when switched back to run. Correct the problem of the Master sending the I/O idle condition.
5	Message Overrun. Message traffic from the PanelView is being generated quicker than it is possible to send the data. Occurs with large I/O sizes when Change-Of-State is being used and state changes are occurring very quickly or if polling too fast.	Slow down I/O polling or the state changes generating Change-of-State I/O messages. Use Cyclic I/O at a fast heartbeat rate rather than Change-of-State. Use the production inhibit capability on the master.
6	Offline Connection Set Identify Received. An Offline Connection Set Point-to-Point Identify Message has been received. Occurs if a Client device on the network capable of executing the Offline Connection Set sends a Point-to-Point Identify message to the terminal while it is in the Offline State. (It failed Duplicate MAC ID Detection on startup).	No action required. The error clears within 500 ms of the last Identify message sent.
7	A Listen Only connection has timed out. It has not received a message in at least four times the expected packet rate value. This occurs if the message associated with the Listen Only tag is not occurring or was not identified correctly.	Check that the Listen Only tags are properly configured. Verify that the associated message is occurring at the expected packet rate. DeviceNet traffic monitor may be helpful.
10	Autobaud in Progress. Occurs on startup while the Autobaud process is executing.	No action required. The error clears within 10 seconds, the maximum time allowed to detect a baud rate.
11	No network power detected. Occurs if network 24V is not present.	Check the wiring. This message will clear automatically when 24V power is restored.
12	Dup MAC Failure. Occurs if the PanelView powers up with the same Node Address present on the network.	Change the node address to an unused address and reset the terminal.
13	Bus-off Interrupt occurred. CAN Chip is held in reset. Caused by noise on network signal lines or an attempt to connect to the network at the wrong baud rate.	Check baud rate and network wiring, including termination resistors. Reset the terminal.

Alert codes appear as a box in the middle of the screen. Error 636 appears in the upper left corner. Operation of the terminal continues. Alert messages can be cleared.

DeviceNet Alert Codes	Indicates:	Recommended Action
2	Unsupported DeviceNet Message received. The Network Access Object received a message that is not supported.	Should not occur in normal operation. Clear the message. If problem re-occurs, contact technical support.
3	Initial Writes Failure. The Motherboard failed to send all input data to the daughter card prior to network startup.	Should not occur during normal operation. Clear the message. If problem reoccurs, contact technical support.
4	Invalid Peer Address. Occurs at runtime if the node address of a peer tag is the same as the PanelView.	Clear the message and determine which tag in the application is pointing to the PanelView's node address. Correct the application.
7	Change-Of-State Input Overrun. Occurs if PanelView state changes on I/O input data occurs faster than the PanelView can send them to the I/O scanner.	Clear the message. Excessive network traffic could cause this problem if inputs are changing rapidly.
8	An external network process has caused the reset of the network access process. Connections are temporarily lost. Occurs if an external device sends an Identify Object Reset Service to the terminal or if an external device changes the terminal's node address (directly or using the Offline Connection Set).	No action required. Any server connections will need to be re-established.
10	Unsupported DeviceNet message received	Should not occur during normal operation. Clear the message. If problem reoccurs, contact technical support.
12	Invalid ASA Number (0x00000000 or 0xFFFFFFFF). Occurs if the flash memory is corrupt or an invalid ASA number was programmed.	Clear the message. The message occurs each time the terminal is reset. The terminal operates normally but you should correct the problem. Contact technical support.
14	Get Next Scan Item Failed in peer mode.	Should not occur in normal operation. Clear the message. If problem reoccurs, contact technical support.
15	Peer Input Data not received. Will occur if an input (push button) changes a second time before its previous state was sent on the network. Only for Peer tags.	Clear the message. Excessive network traffic could cause this problem if inputs are changing rapidly. Handle high speed input data over I/O connections if possible.
16	I/O Connection Size does not match size of I/O data in Assembly Instances 1 & 2. Programmed connection sizes for I/O do not match the amount of data represented by the I/O type tags.	Clear the message and if the problem reoccurs, consult technical support.
19	Get Next Contact Request Failure. In Peer Mode scanning, the request to obtain the next tag in current context failed.	Should not occur in normal operation. Clear the message. If problem reoccurs, contact technical support.
20	Autobaud Failure. The autobaud process failed to detect a valid baud rate within 10 seconds. Occurs if network traffic is nonexistent or intermittent.	Start the terminal when network traffic exists or use a fixed baud rate.
23	Nonvolatile Objects have been reset. Nonvolatile storage of some objects required a full reset on powerup. Certain nonvolatile values will be reset to defaults.	Can occur when the daughtercard firmware in the terminal is upgraded. Clear the message and continue. If problem reoccurs, contact technical support.
38	An external client device on the network has performed a Set Attribute request on the Baud Rate setting. The baud may be different on next terminal reset.	Confirm the Active Baud on the Communication Setup screen of the terminal.

Fault codes appear as a full screen box with Error 635 appears in the upper left corner. Reset the terminal to clear the condition. If the problem reoccurs, note the 2-digit code and contact technical support.

DeviceNet Fault Codes	Indicates:	Recommended Action
5	PCCC Message Transaction error during the transfer	Should not occur in normal operation. Clear the message. If problem re-occurs, contact technical support.
6	Stack overflow fault	Should not occur during normal operation. Clear the message. If problem reoccurs, contact technical support.
13	Invalid Screen Context Priority Received	Should not occur during normal operation. Clear the message. If problem reoccurs, contact technical support.
17	Client Object Failed	Should not occur during normal operation. Clear the message. If problem reoccurs, contact technical support.
18	CAN Chip Failed to initialize	Should not occur during normal operation. Clear the message. If problem reoccurs, contact technical support.
33	I/O Assembly Remap Error	Revalidate the application and download. If problem re-occurs, contact technical support.
37	The size of a particular channel exceeds the size limitation set by the daughtercard.	Should not occur during normal operation. Clear the message. If problem reoccurs, contact technical support.
39	The application contains more Listen Only channels that the daughtercard supports.	Reset the terminal. If problem re-occurs, contact technical support.
20xx	Critical Internal DeviceNet firmware fault	Should not occur during normal operation. Clear the message. If problem reoccurs, contact technical support.
9-11, 21, 22, 24-36	Internal faults associated with motherboard/daughtercard communications	Should not occur during normal operation. Clear the message. If problem reoccurs, contact technical support.

General Codes

General Terminal Alert Code	Alert Type	Indicates:	Recommended Action
603	Critical fault	File download error	Reset the terminal. If problem occurs again, contact technical support.
9020	Critical fault	An internal fault occurred.	Reset the terminal. If problem occurs again, contact technical support.

ControlNet Codes

These errors appear at the top of the application screen or on the terminal's configuration screen. If you should get an alert number that is not listed, contact technical support.

ControlNet Error Codes	Error Type	Indicates:	Recommended Action
1803	Informational	The communications device has completed the request to force the device into the listen-only state.	The PanelView was detected as having a duplicate node address and is in the listen-only mode. Check the node address (MAC ID) of the devices on the network to verify that addresses are not duplicated.
1824	Warning	The PanelView was forced to a listen-only state.	Contact technical support.
1826	Warning	A fixed tag packet was received but there is no place to route the packet. The data packet is discarded and the error message is displayed.	Contact technical support.
1828	Warning	An attempt was made to open an unsupported transport class.	Contact technical support.
1829	Warning	An attempt was made to open a Class 1 transport with application triggering or a Class 3 transport with cyclic triggering.	Contact technical support.
3333	Warning	A connection has timed out.	A file transfer was unexpectedly interrupted. Try to transfer again.

These messages appear on the terminal screen as DC Error=xx. If you get an alert number that is not listed here, contact technical support.

ControlNet Alert Codes	Alert Type	Indicates:	Recommended Action
9000	Critical fault	Interface startup failed.	Contact technical support.
9003	Critical fault	CIP S/N is not valid.	Contact technical support.
9004	Critical fault	Out of buffers.	Contact technical support.
9010	Critical fault	Invalid target node, target node is the same as the PanelView, or larger than the UMAX.	Check node address of all devices on the network including the PanelView terminal.
9012	Communications Warning	ControlNet object received a reset request.	Contact technical support.
9014	Critical fault	A fatal CPU fault occurred.	Contact technical support.
9015	Critical fault	A ControlNet hardware fault occurred.	Contact technical support.
9016	Critical fault	RAM verification failed at startup.	Contact technical support.
9017	Critical fault	CRC verification failed at startup.	Contact technical support.
9018	Critical fault	A critical internal error occurred.	Contact technical support.
9019	Critical fault	An internal fault occurred.	Reset terminal, if problem occurs again, contact technical support.
9020	Critical fault	An internal fault occurred.	Reset terminal. If problem occurs again, reload application. If problem persists, contact technical support.

EtherNet/IP Codes

These messages appear on the terminal screen as DC Error=xx. If you get an alert number that is not listed here, contact technical support.

Error Number	Terminal Messages	Type	Meaning	Recommended Action
xx,xx,xx Number depends on hardware fault detected.	Communication Interface Fault	Critical Fault	A hardware problem was detected during power-up. If you ignore message and display the EtherNet/IP Communications Screen, the Comm Status displays "Comms hardware fault:" without an error number. The FW revision, serial number and EtherNet/IP address fields are displayed.	Contact technical support to have unit repaired.
770	Buffer overflow	Comm Status	Internal error occurred.	Contact technical support.
771	Buffer underflow	Comm Status	Internal error occurred.	Contact technical support.
1799	Heap partition empty	Comm Status	Internal error occurred.	Contact technical support.
16387	Comms not started yet . . .	Comm Status	The PanelView has not connected to the network.	Check IP configuration (on the Communication Setup screen) and wait for PanelView to connect to the network.
16388	CIP S/N is not valid	Critical fault.	DC incorrectly configured.	Contact technical support.
16389	Out of buffers	Critical fault.	No buffers are available for read or write operations.	Contact technical support.
16390	An initial write failed	Comm Warning	Write to Logic Controller on Startup was configured and on powerup, the PanelView could not write initial values to a node's data table address. or Write to Logic Controller on Startup was not configured and the PanelView was unable to write a controller. Note: The error is only displayed on the first write attempt.	Check/define data table address in the controller. Check communication connections and node configuration in the application.
16391	PV write failed	Comm Warning	PanelView is communicating with the controller. The data table address does not exist.	Check/define data table address in the controller.
16392	PV write timeout	Comm Warning	PanelView is not communicating with the logic controller.	Check connections and node configuration in the application.
16393	PV read fail	Comm Warning	PanelView is communicating with the controller. The data table address does not exist.	Check/define data table address in the controller.
16394	PV read timeout	Comm Warning	PanelView is not communicating with the controller.	Check/define data table address in the controller.
16397	CN object received a reset request	Comm Warning	An Ethernet object received a reset request from a device on the network.	The PanelView does not support network resets.
16398	The Connection Originator is indicating it is in Program Mode	Comm Warning	The logic controller is offline (in Program Mode). The COMM LED on the Configuration Mode menu is off.	Place the logic controller in run mode to resume communication.
16399	A fatal CPU fault occurred	Critical Fault	A fatal CPU fault occurred.	Contact technical support.
16401	The RAM check failed	Critical Fault	RAM verification failed at startup.	Contact technical support.

Error Number	Terminal Messages	Type	Meaning	Recommended Action
16402	The CRC check of the firmware failed	Critical Fault	CRC verification failed at startup.	Contact technical support.
16403	OS startup failed	Critical Fault	Operating system failed to start.	Contact technical support.
16404	PV Client Task Fault	Critical Fault	Internal error has occurred.	Contact technical support.
16405	Invalid preset information received from motherboard.	Critical Fault	Internal error has occurred.	Contact technical support.
16406, 16407	Connection with Addr or scan rate invalid or no connection being attempted.	Critical Fault	Internal error has occurred.	Contact technical support.
16408	No buffers available for read operation	Critical Fault	Internal error has occurred.	Contact technical support.
16409	DC couldn't send out the write request in time.	Critical Fault	Too many write operations are occurring.	Contact technical support.
16410	Too many clients attempted to connect to server	Critical Fault	Internal error has occurred.	Contact technical support.
16411	XS-WD creation error	Critical Fault	Internal error has occurred.	Contact technical support.
16412	XS-WD start error	Critical Fault	Internal error has occurred.	Contact technical support.
16413	ENet addr is not valid	Communication Warning	The EtherNet address for a device on the EtherNet/IP network is invalid.	Contact technical support.
16414	Duplicate IP address detected	Critical Fault	The PanelView has the same IP address as another device on the EtherNet/IP network.	Change the IP address of the PanelView (on the Communication Setup screen) so that is unique on the network.
16415	Unknown error detected	Communication Warning	An operating system message has occurred.	Contact technical support.
16416	No network link	Critical Fault	Communications has not been established with network.	Check Ethernet cable.
16417	DHCP/BootP Enable failed	Communication Warning	The DHCP/BootP Enable server failed to allocate an IP address, subnet mask and gateway address to the PanelView terminal	Check DHCP/BootP Enable server on your network.
16418	Invalid IP Address or Subnet Mask	Communication Warning	The IP address or the subnet mask of the PanelView terminal is not valid. Important: The Gateway Address cannot be entered at the terminal; you must configure this address in the Communication Setup dialog of PanelBuilder32.	Enter a valid IP address and/or the subnet mask of the PanelView terminal on the Communication Setup screen. This error occurs if the downloaded application has DHCP/BootP enabled and it is then disabled at the terminal. On a restart, the terminal will not have the necessary information (IP Address, Subnet Mask, Gateway Address) to connect to the network.
16420	Invalid Gateway Address	Communication Warning	The Gateway Address is not valid.	Change the Gateway Address in the PanelBuilder32 software.

Remote I/O Communication Loss

When communication fails on a Remote I/O network:

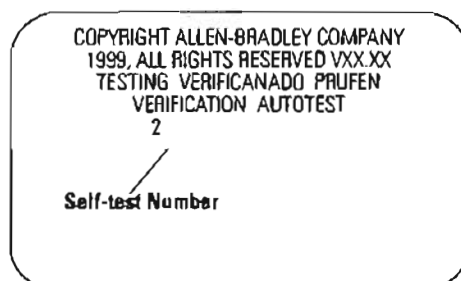
- Object states are maintained and the message "No PLC Communication" is displayed on the screen.
- If Block Transfers are defined for the application, but no BTR or BTW instructions are received, another message appears when the Block Transfer Timeout occurs.

These messages continue to display until communications is established. If a write operation is attempted to the logic program controlling the PanelView objects, the terminal will display the message "Error: Write to Logic Controller failed".

If a PanelView object is activated during a communication loss, the object retains its new state and sends this state value to the controller when communications is established.

Self-test Numbers

The self-test numbers appear on the screen during powerup.



Test Number	Indicates
1	STATIC RAM test
2	Terminal searching for a file to download.
10	Erase boot flash area.
11	Copy boot code
12	Boot code copy successful
13	Boot code copy failed. Check for error after boot code is copied to the onboard flash EPROM.
20	Erase firmware from flash EPROM
21	Copy firmware to firmware flash memory
22	Firmware copy successful
23	Firmware copy failed
24	Performed CRC base firmware check
25	Firmware not compatible with boot code
26	Firmware not compatible with hardware

Test Number	Indicates
30	Watchdog test
31	Stuck key test
32	Real time clock test
33	LCD RAM failed
34	Performed CRC extended firmware check

Note: You may not see all of these test numbers during a powerup.

If a test fails, the terminal displays:

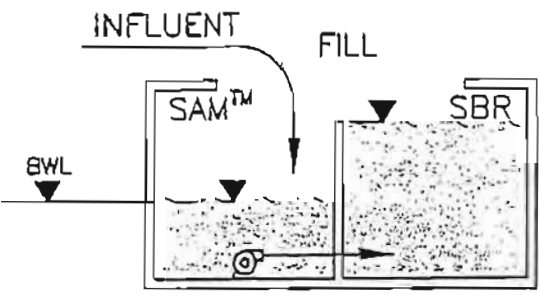
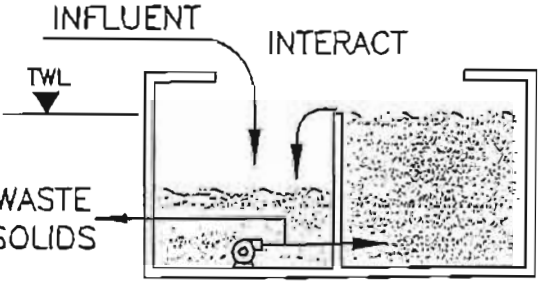
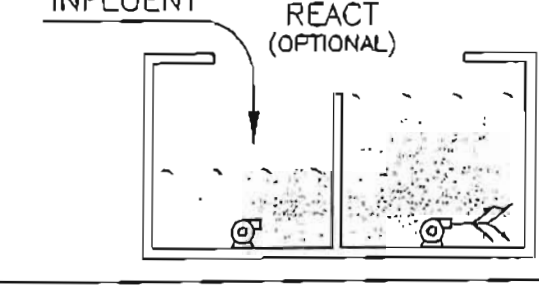
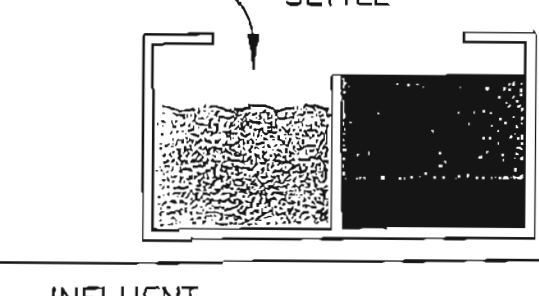
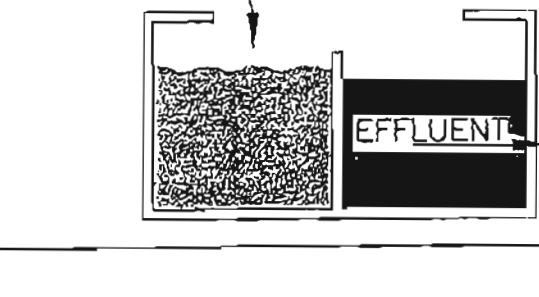
ERROR! FEHLER! ERREUR! ERRORE!

The following test numbers appear only if a problem occurs.

Test Number	Indicates
40	No executable code to run after boot
50	Wrong memory card format
60	CPU could not execute code

The table below shows fault conditions that may occur during powerup.

Fault Indicator	Indicates
Solid Red	Static RAM Test failed. Contact technical support.
Blinking Red (6 times per second)	Checksum test on boot code failed. Contact technical support.
Blinking Red (5 seconds on/5 seconds off)	Boot code is incorrect for terminal type (touch screen or keypad). Contact technical support.

% OF MAX VOLUME	% OF CYCLE TIME	SAM™ ACTION	PURPOSE FUNCTION	OPERATIONS	
				PUMP	AIR
SAM™ 0-50	SAM™ 100		<u>FILL PHASE</u> Add Waste Water	On	On/Off (Opt'l)
SBR 10-40	SBR 10-30		Mix		
			Aerate		
SAM™ 0-50	SAM™ 100		<u>INTERACT PHASE</u> Add Waste Water	On/Off Cycle	On/Off Cycle
SBR 0	SBR 25-75		Intermix		
			Aerate		
			Waste Sludge		
SAM™ 0-25	SAM™ 100		<u>REACT PHASE (OPTIONAL)</u> Hold	On/Off Cycle	On/Off Cycle
SBR 0	SBR 0-50		Mix/Aerate		
SAM™ 10-40	SAM™ 100		<u>CLARIFY PHASE</u> Settle	Off	Off
SBR 0	SBR 10-30				
SAM™ 10-40	SAM™ 100		<u>REMOVE EFFLUENT PHASE</u> Draw Effluent	Off	Off
SBR 10-40	SBR 5-25				

FILL PHASE:

During this phase, the reactor is filled with raw wastewater or the influent. All the liquid in the reactor is mixed but not always aerated. During this phase, the influent is mixed with the existing liquid and solids in the reactor and the result is mixed liquor.

REACT PHASE:

After filling the tank or reactor, the reactions (biochemical and biological – all natural) are normally completed by holding and aerating. The operator who programs the microprocessor controlling the SBR chooses the proper time for the aerobic and anoxic mixing based upon the influent anticipated for the SBR. As the effluent is tested by the plant operator, the programming can be changed on-site to accommodate changes in the influent and achieve the design results in the effluent. Alternately, dissolved oxygen probes can continuously send dissolved oxygen (DO) and adjust aerobic and anoxic periods accordingly.

Testing must take place on a regular basis even after the plant is certified as fully operational by the factory and the local health authority. In the event the effluent requirements are changed at a later date by the EPA or local health authority, a simple programming change may accommodate the new requirements.

SETTLE PHASE:

Once the mixing (both aerobic and anoxic) is completed, the mixed liquor is allowed to settle. In a standard SBR system, there is a second reactor or holding tank and during the Settle Phase, the other reactor is accepting the influent and beginning the Fill Phase.

DECANT PHASE:

Once the microprocessor shows that the Settle Phase is completed, the Decant Phase begins. The clarified water (in the upper portion of the reactor) or effluent is drawn off through a decanter. Conservative design dictates shallow decants of 3 to 4 feet of water to minimize disruption of settled sludge (the solids which have settled to the bottom of the reactor).

WASTE SLUDGE PHASE:

This is a short period either during REACT PHASE or at the end of the decant period in which mixed liquor settled sludge is withdrawn from the basin. This is done to maintain a proper MLSS and MCRT level in the basin.

IDLE PHASE:

This is a time period in the SBR cycle when microorganisms are further stabilized as they “digest” organics and other nutrients and wait for further influent. The bacteria have a chance to build up their appetite. It is very important that the solids stay in the SBR because the bacteria in the solids will become active again as more influent is introduced.

PROCESS KINETICS

The primary goal for any biological treatment system, including sequencing batch reactors (SBRs), is the removal of dissolved organics and organic solids with the concomitant reduction of oxygen demand. These organics may be settleable, colloidal or dissolved. We rely on a physical process, which is sedimentation to remove settleable solids. Colloidal and dissolved organic solids are removed through the use of biochemical processes. The secondary goal of treatment in SBRs is often the conversion of ammonia to nitrate for reduction of ultimate oxygen demand and/or removal of nitrogen for nutrient control.

Microbiology

In order to understand the biokinetics of sequencing batch reactors, it is necessary to look at the organisms of importance in biological systems. The microorganisms in biological waste treatment systems belong to the kingdom of Protista. Protists are unicellular or multicellular organisms with no tissue differentiation. Protists may, for the purpose of the environmental engineer, be classified conveniently by their carbon and energy sources, or by their ability to utilize molecular oxygen.

Classification of Microorganisms

Organisms that utilize organic compounds for their carbon and energy sources are heterotrophic. Heterotrophic organisms are responsible for the conversion of organic matter to carbon dioxide as well as denitrification in biological treatment systems. Autotrophic organisms are those whose carbon source is inorganic, usually bicarbonate ions or carbon dioxide. Autotrophs may be further classified into photosynthetic organisms whose energy source is light, and chemosynthetic organisms whose energy is derived from the oxidation-reduction of inorganic compounds. Chemosynthetic autotrophs that use ammonia as their energy source are responsible for nitrification in sequencing batch reactors.

Organisms may also be classified by their ability to utilize molecular oxygen. Strict (obligate) aerobes require molecular (dissolved) oxygen. Strict (obligate) anaerobes utilize chemically bound oxygen, such as may be found in sulfates. Molecular oxygen is toxic to obligate anaerobes. Facultative organisms can utilize either free or chemically bound oxygen.

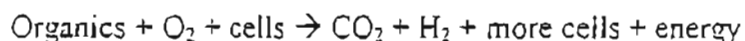
The majority of treatment in sequencing batch reactors is accomplished by bacteria. Bacteria are single-celled Protists that utilize soluble food, require moisture and reproduce by binary fission. The range in size is about 0.5 to 15 μm . Bacterial cells are 80 to 90% water and the dry portion is approximately 90% organic. The organic fraction may be approximated to be $\text{C}_5\text{H}_7\text{O}_2\text{N}$. The inorganic fraction consists of P_2O_5 (50%), SO_3 , Na_2O , and CaO , plus trace nutrients such as iron and copper.

Fungi, which are normally defined by the environmental engineer as multicellular, heterotrophic protists, are also of importance in biological treatment. Fungi are obligate aerobes that prefer low pH (optimum of approximately 5.6) and have a low nitrogen requirement. In suspended growth reactors such as sequencing batch reactors, fungi often cause problems in solids separation. They form filamentous growths, which are settled poorly. Fungi are a particular problem in the treatment of low-pH or nitrogen-deficient wastes since they compete favorably with bacteria under these conditions.

Also of importance in biological treatment systems are unicellular protists such as protozoans, and multicellular organisms such as rotifers. These organisms perform an effluent "polishing" role by consuming small, colloidal organic particles and individual bacterial cells. Thus, these organisms serve to reduce turbidity in biological system effluents.

Energy Reactions

The overall reaction involved in heterotrophic metabolism may be described by:



The organic material is utilized for both energy and cell synthesis. The oxidation-reduction reactions involve the transfer of electrons from a reduced substance (the electron donor) to an oxidizing substance (the electron acceptor). We normally think of the electron donor as food. Heterotrophic metabolism utilizes organic electron donors; autotrophic metabolism uses inorganic electron donors. In aerobic systems, oxygen is the terminal electron acceptor. In anoxic systems, the terminal electron acceptor is nitrite/nitrate, while CO_2 and SO_4 serve as the terminal electron acceptor in anaerobic systems. The terminal electron acceptor determines the amount of energy which is available from the food.

Process Discussion

SBR technology permits organic removal, including nutrient removal or conversion, all within the confines of a single reactor.

In an SBR's cycle of operation, the oxygen uptake rate, and F/M ratio are constantly changing; when aeration is initiated, after the "Anoxic Fill" period, the F/M ratio can range from 0.6 to 1.0, or higher, and the oxygen uptake rate can exceed 125 mg/l-hr.; at the end of the aeration period, the F/M ratio, and uptake rate should be near zero. It is this non steady state operation that is the key to the SBR process. The wide swings in the F/M ratio place selective pressures on the biomass. The period when the F/M ratio and uptake rate are high is called a "feast" period; food and air are plentiful, and the D. O. level stays near zero because the oxygen demand exceeds the aeration system's maximum capacity. This "feast" period inhibits the growth of slow growing filaments, and encourages the growth of floc forming zoogloeal organisms. The period when the F/M ratio and uptake rates are low is a "famine" period; all available food has been

utilized. The "famine" period inhibits the growth of fast growing filaments, and again, encourages the growth of desirable organisms.

A true SBR is a "complete mix" process; the composition of the biomass should be the same at all points in the reactor. High substrate tension during part of the Fill cycle favors floc-forming organisms over filamentous organisms. Floc forming organisms are better able to store substrate during Anoxic periods than filamentous organisms. Anoxic fill followed by aeration clearly favors floc-forming organisms.

In an SBR, dissolved oxygen level is zero or near zero during Anoxic fill. During this period, active biomass is storing organic substrate in a readily available form for oxidation once oxygen is again introduced into the system. During the initial aeration phase, the capacity of the organisms to utilize oxygen will generally exceed the transfer capabilities of the aeration system. Thus, mass transfer takes place at near zero D. O. conditions, and in the possible presence of reaction enhancement. At the end of the cycle, the organic substrate has been oxidized more fully and dissolved oxygen rises in the reactor.

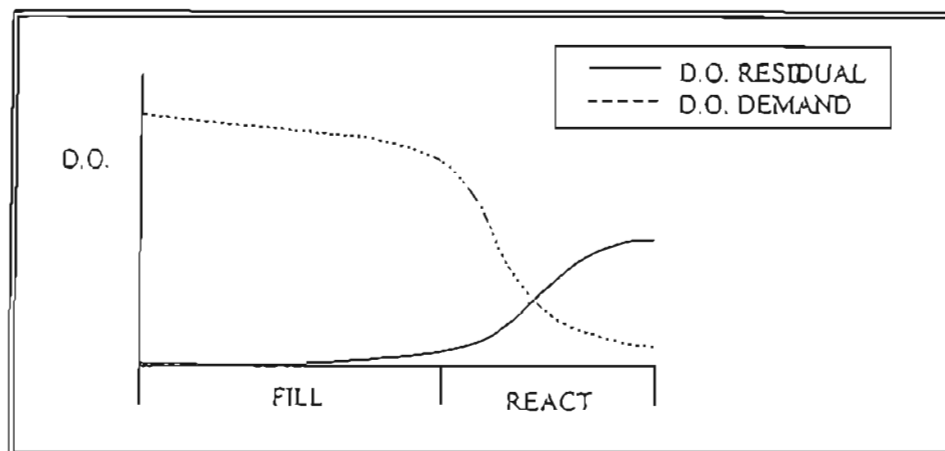


Figure 2. Dissolved Oxygen level in Fill and React Phase.

BOD Reduction

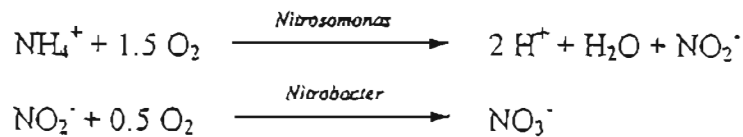
The removal of organics, usually measured as BOD, occurs throughout the SBR process. Most of the bacteria in the reactor are facultative in nature. They will remove BOD anaerobically when oxygen is absent (Fill phase) and aerobically when oxygen is present (React phase). Oxygen requirements are calculated assuming only aerobic removal of BOD. Because only part of the cycle is devoted to aeration, oxygen demand must be satisfied within this interval. The required cycle time for BOD removal only is less than that for operation to control nutrients.

Nutrient Removal

Nitrogen

There are different forms of nitrogen in wastewater. These are: Ammonia and Ammonium, Organic Nitrogen, Nitrate and Nitrite, and nitrogenous gases. When the amount of nitrogen exceeds the standards, it must be removed because it can be toxic, it exerts oxygen demand and would stimulate the growth of algae and aquatic plants.

The oxidation of ammonia to nitrates (nitrification) involves two steps; conversion of ammonia first to nitrite by autotrophic bacteria, *Nitrosomonas*, and then to nitrate by *Nitrobacter*, which are also autotrophic. The oxygen requirement is approximately 4.6 lbs. Of O₂ per lb. Of ammonia nitrogen applied. The oxidation reactions may be represented by:



When maximum nitrogen removal is required, nitrates (and nitrites) can also be reduced through biological action.

In the absence of dissolved oxygen, a number of facultative bacteria commonly present in wastewater treatment systems are able to utilize nitrates as a terminal electron acceptor with the resultant formation of nitrogen gas (denitrification). The electron donor (carbonaceous energy source) is usually present as a natural carbon source in the wastewater in an SBR basin.

The necessary conditions must be present to achieve nitrification and/or denitrification. The conditions for nitrification are sufficient D. O. and alkalinity and ammonia. Denitrification requires sufficient carbon source and nitrates. In addition, the conditions in the reactor must be appropriate for maintaining the nitrifying and denitrifying bacteria.

To ensure the growth of nitrifying organisms, it is necessary to provide sufficient solids residence time and a suitable aerated basin volume at a dissolved oxygen level adequate for nitrification to occur. An anoxic period in the SBR cycle is required for nitrate reduction. Excessive aeration times and high D.O. levels promote nitrification at the expense of the carbon source available for denitrification. Alternatively, the anoxic conditions necessary for denitrification provide an environment in which the nitrifying organisms cannot grow. Also, as conditions are changed to allow for more and more unmetabolized carbon sources to be present to accelerate the denitrification rate, there will be a corresponding increase in the concentration of ammonia, which must first be oxidized to nitrates prior to its availability for reduction. These facts require that the cycle increments be carefully controlled.

In Nitrogen deficient wastes such as many high organic containing industrial wastes, nitrogen may have to be added to allow unimpeded removal of organics. Normally, about 5 mg/L of ammonia-nitrogen is required for every 100 mg/L of BOD₅. This nitrogen is required for cell synthesis and ultimately ends up as cell biomass.

Phosphorus

Forms of Phosphorus include: Orthophosphorus, which is reactive phosphorus (PO_4^{3-} , HPO_4^{2-} , H_2PO_4^-); Polyphosphates, which is the macromolecular form P_2O_7 ; and organic phosphorus. Like nitrogen, phosphorus promotes algal bloom and accelerates eutrophication.

Phosphorus removal can be accomplished by chemical treatment such as addition of a suitable coagulant, like ferric chloride, which precipitates the phosphorus out for removal with the sludge. However, this method of phosphorus removal will produce substantially greater volumes of sludge and will have an adverse effect on the overall operation of the system. Therefore, chemical addition should generally be used as a back up to biological phosphorus removal.

With the SBR process, biological removal of phosphorus can be achieved without chemical addition if the carbon to phosphorus ratio is adequate.

The biological removal of phosphorus first requires an anaerobic period (i.e. the absence of dissolved oxygen and oxidized nitrogen) and the presence of exogenous electron donors (i.e. the substrate) during the anaerobic period. This period should be followed by an aerobic period (i.e. presence of dissolved oxygen), which promotes luxury uptake of phosphorus by the biomass. A suitable quantity of the sludge mass is removed from the reactor in the waste sludge phase before the next anaerobic period. The control strategy eliminates oxidized nitrogen and dissolved oxygen during part of the Fill phase (anaerobic period) and provides aeration during the React phase.

It is possible to attain biological phosphorus reduction of 90 percent. However, a realistic design is to plan biological reduction down to 2-3 ppm. If the requirement is less than 2-3 ppm, chemicals, such as alum, can be added to the reactor effluent, followed by filtration to obtain further reduction. The amount of chemical needed for this additional reduction is small. The solids generated are backwashed to the sludge holding tank or digester. Since the SBR process provides for biological phosphorus removal, chemical and sludge handling costs are greatly reduced.

In phosphorus deficient wastes such as many high organic containing industrial wastes, phosphorus should be added to allow unimpeded removal of organics. Normally, about 1 mg/L of phosphorus is required for every 100 mg/L BOD₅.

Process Control

There are several methods available for process control. These methods include constant F/M ratio, constant mixed liquor suspended solids (MLSS) and constant mean cell residence time (MCRT) or sludge age.

F/M Ratio

F/M is the food to microorganisms ratio, which can be expressed as:

$$F/M = \text{lb. BOD added per day} / \text{lbs. MLVSS}^* \text{ under aeration}$$

*Mixed liquor volatile suspended solids

The constant F/M ratio method is, in theory, a good method for process control. However, there are several practical difficulties which make control by this method a problem. First of all, the influent BOD is constantly changing, requiring careful sampling and frequent BOD testing. Also, it takes five days to get the results of the BOD test and by then, things have changed. Although the F/M ratio in an SBR system continually changes due to the variances during Fill and React phases, the average values are comparable to those in activated sludge systems. Currently, most proposed SBRs are planned around a low load design, typically with an F/M ratio of 0.05 to 0.1. This is comparable to an extended aeration type process.

Conventionally loaded activated sludge plants operate in the range of 0.15 – 0.4 F/M ratio. Sequencing batch reactors can also be designed to operate in this range. When nutrient control is required, a lower F/M is recommended.

Solids

The constant MLSS method is a good simple method for operating if the influent BOD does not vary greatly from day to day. It is used by many experienced operators because it requires minimal testing and can produce a good quality effluent if the influent loading and flow do not vary greatly. The constant MLSS method basically requires maintaining a constant solids level in the basins. The operator must determine the best MLSS level for treating the wastewater in the summer and in the winter. The target MLSS for the winter will be higher than the summer, because the biomass is not as active, so more microorganisms are required to do the same job. The constant MLSS method does not take into account changes in F/M as the influent BOD rises and falls or changes in the growth rate of the biomass due to changing influent and temperature. Therefore, when there is a problem, the operator may have trouble adjusting the system due to lack of process control data.

Mean Cell Residence Time

The mean cell residence time is expressed as:

$$\text{MCRT} = \frac{\text{lbs. MLSS under aeration}}{(\text{lbs. SS in effluent} + \text{lbs. SS wasted})}$$

MCRT is the average time a single microorganism is in the system before it is wasted. For example, suppose there were 25,000 pounds of solids in both SBR tanks. If 1000 pounds of solids were wasted everyday, it would take 25 days to waste all of the solids. The MCRT would therefore be 25 days. Of course, some of the biomass would remain in the basins much longer than 25 days, and some would be wasted very soon after they are created, but the average would be 25 days. To use this method of process control, the operator determines the target MCRT and then divides the total amount of solids in the basins to determine the amount to waste each day. For example, to maintain a 30-day MCRT, one thirtieth of the solids would be wasted everyday.

The constant MCRT method is the best method of process control because it takes into account the changes that occur in the influent and allows the operator to control the type of microorganisms in the system. It also determines exactly how much sludge to waste each day, but it is more complicated than the constant MLSS method. The operator, with the help of the engineer, should determine the optimum MLSS to maintain in the tank by charting the MLSS and the effluent characteristics in order to determine what MLSS gives the best results. The optimum MLSS will change with the seasons and may be considerably different in summer and winter. In order to operate the system by this method, the operator should measure the MLSS everyday. Due to the long cycle times during low flows, it may be that the operator will only be able to sample one basin each day. The five-day average MLSS should be charted on graph paper. If a trend of falling mixed liquor is noted, the waste sludge time should be shortened. If the mixed liquor concentration is rising over a period of time, the wasted sludge time should be increased. During the spring and fall, the wasting time will have to be adjusted to make the transition between the summer and winter MLSS target concentrations.

Each week, the operator should calculate the F/M ratio and the MCRT. As the SBR process may range from extended aeration to conventional or even high rate process, the F/M ratio should be appropriate for the process selected. The MCRT will be a minimum of 15 days, if ammonia oxidation is required.

Laboratory Monitoring

In order to successfully operate the SBR system, certain laboratory tests must be conducted on a regular basis. The results of the laboratory test will allow the operator to make informed decisions about the process control and will provide a record of the conditions that produced the best effluent. The operator should pay very close attention to recording the results of lab tests.

✓ **Influent BOD**

BOD test should be run at least three times a week on the raw wastewater.

✓ **MLSS**

The mixed liquor suspended solids should be measured once a day. It is done by filtering a mixed liquor sample then dried at 105°C until constant weight. When running the MLSS test, the liquid level in the basins must be taken into account, since the higher the liquid level, the more dilute the MLSS will be. For ease of process control, all results should be converted to the bottom water level results.

A record of the five-day moving average MLSS should be kept and plotted on graph paper so that rising and falling trends in MLSS can be noted and corrected. To calculate the five-day moving average, average the first five days of data. When the sixth day data is available, drop day one and add day six, so that days two through six are averaged together. On the seventh day, average the data for days three to seven. Therefore, the average is taken of the last five days of data.

✓ **MLVSS**

The mixed liquor volatile suspended solids should be measured at least once a month. It is done by incinerating the dried sample at 500°C , the loss in weight indicates the MLVSS or the volatile suspended solids. The MLVSS indicates the true amount of biomass, since inert solids are not volatile. The result of MLSS, MLVSS and influent BOD will allow the calculation of the F/M ratio and MCRT.

✓ **Ammonia-nitrogen**

Careful measurement of the effluent ammonia-nitrogen may be required. The effluent ammonia-nitrogen should be measured every day during the first few months of operation and at least three times per week thereafter. The real goal of process control is to remove ammonia-nitrogen, since this goal will automatically result in good BOD removal.

✓ **Sludge Volume Index (SVI)**

A sludge settling test should be performed on each basin everyday, the SVI should be calculated.

✓ Dissolved Oxygen (D.O.)

If online dissolved oxygen measurement is not available, the dissolved oxygen should be measured daily in each basin during the aeration cycle.

✓ pH and Temperature

pH and temperature should be measured daily.

Troubleshooting Guide for SBR System

Observation	Probable Cause	Solution
FOAMING		
White sudsy foam on surface of SBR tank. May be very thick and billowing, may be blown off the tank onto walkways, etc. if very thick.	SBR process overloaded with BOD to process start-up.	Do not be alarmed. This is normal during start-up. Do not waste sludge until MLSS reaches desired level.
	Excessive sludge wasting causing low MLSS.	Reduce wasting rate until MLSS returns to desired level.
	Toxic sludge in plant influent causing low MLSS in SBR tank.	Test influent and industries for toxic discharge. Seed affected tank, if possible, with mixed liquor from other tank. Do not waste sludge until MLSS returns to level desired.
Shiny dark tan foam on SBR tank surface.	High mass due to insufficient wasting.	Increase wasting time by no more than 10 percent until MLSS approaches desired concentration.
Very dark brown, almost black foam on surface of SBR tank, mixed liquor is very dark brown to almost black, septic or sour odors may be detected.	Anaerobic conditions in SBR tank.	Check aeration troubleshooting guide.
CLOUDY SECONDARY EFFLUENT		
Secondary effluent is cloudy and may contain visible suspended matter.	Low MLSS due to process start-up.	This is normal during process start-up. Do not waste until MLSS reaches desired concentration.
	Increase in organic loading.	Reduce sludge wasting rate to increase MLSS. Check oxygen in basin and adjust aeration if required.
	Toxic sludge load.	Check MLVSS, if low, do not waste sludge until MLVSS approaches normal. Sample industrial users for toxicity.
	Over aeration causing mixed liquor floc to shear.	Decrease aeration and monitor D.O. level.
	Incorrect dissolved oxygen level in tank.	Adjust aeration as needed.
ASHING AND PINPOINT OR STRAGGLER FLOC		
Fine dispersed floc (about the size of a pinhead) extending throughout the tank at the end of the settling period. Small islands of sludge accumulate on the surface of the basin and may be drawn into the decanter.	SBR tank underloaded (high MLSS) due to old sludge in tank.	Increase sludge wasting time by no more than 10 percent per day until MLSS approaches desired concentration. Check foaming troubleshooting guide.

Observation	Probable Cause	Solution
SOLIDS WASHOUT		
Sludge pulled into decant mechanism, effluent suspended solids increase	Sludge blanket too high, should be at least 5 feet below decanter at the end of settling period.	Check sludge pump to be sure it is operational. Increase sludge wasting time if necessary.
	Poor settling due to process start-up.	This is normal during process start-up. The settleability will improve as the MCRT increases.
Sludge rising in clouds to the surface of the SBR tank.	Low dissolved oxygen in tank, especially during settling.	Increase aeration time.
	Insufficient nutrients in influent, ratios should be 100 parts total nitrogen to 1 part phosphorus to 0.5 parts iron.	If nutrients are insufficient, add nitrogen in the form of Anhydrous Ammonia, iron in the form of Ferric Chloride, and/or phosphorus in the form of Trisodium Phosphate.
	pH in SBR basin less than 6.5.	Raise pH by adding lime or caustic soda. Check industrial areas for low pH.
Sludge clumps from the size of a golf ball to as large as a basketball rising to the surface of the SBR basin and dispersing. Bubbles noted in the floating sludge.	Denitrification occurring in SBR basin.	Increase sludge wasting rate no more than 10 percent per day. Check oxygen level in basin and adjust if needed.
	Septic conditions in SBR basin. This is most likely to occur during settling.	Increase aeration time.
HIGH EFFLUENT AMMONIA-NITROGEN		
Effluent ammonia-nitrogen levels rising or exceed effluent limits.	Low MCRT due to system start-up.	High Effluent $\text{NH}_3\text{-N}$ during start-up is normal. The system will require several weeks to build up nitrogen bacteria before meeting effluent $\text{NH}_3\text{-N}$ limits.
	Inadequate air supply for nitrification.	Increase aeration time.
	Insufficient alkalinity in plant influent to allow nitrification. Nitrification uses up to 7.2 pounds of alkalinity for every pound of ammonia-nitrogen removed.	Add alkalinity, usually in the form of soda ash.

Observation	Probable Cause	Solution
DECANT PROBLEMS		
Decant occurs during aeration, allowing large amounts of solids to escape from SBR basin.	Decant vent valve not seating well during closure or decanter air piping leaking, allowing air to escape from the decant mechanism. Decant vent valve or air piping frozen during cold weather. Stop decant vent timer set too low, preventing siphon break. Decant air piping and/or vent valve too small; time required for siphon break too long.	Clean decant vent valve, check decant air piping for leaks. Check heat tape and insulation on piping. Check strip heater in solenoid cabinet. Replace as necessary. Extend time to allow siphon break. Replace decanter air piping and if needed, vent valve.
Decant does not occur when called for by the SBR controller.	Decant vent valve failure. Start decant timer set too short, not allowing full evacuation of all air	Replace vent valve. Extend time to allow all air to be exhausted from the decanter.

Exhibit 3
ICIS Database DMR Data
(July 2016 – September 2020)

NPDES ID	Mon. Period End Date	Parameter	Worst % excd.	Quantity 1	Quantity 2	Quantity Units	Concentration 1	Concentration 2	Concentration 3	Concentration Units
VA0090689	09/30/2020	Oxygen, dissolved [DO]					6			mg/L
VA0090689	09/30/2020	pH					6.7		8.6	SU
VA0090689	09/30/2020	Solids, total suspended	630	56	73	kg/d		73	101.4	mg/L
VA0090689	09/30/2020	Nitrogen, Kjeldahl, total [as N]	478	11	19	kg/d		14.69	26	mg/L
VA0090689	09/30/2020	Phosphorus, total [as P]						1.31		mg/L
VA0090689	09/30/2020	Flow, in conduit or thru treatment plan		.0018	.0027	MGD				
VA0090689	09/30/2020	Chlorine, total residua					1.02	NODI B	NODI B	mg/L
VA0090689	09/30/2020	Chlorine, total residua						15		mg/L
VA0090689	09/30/2020	E. coli						15	25	#/100mL
VA0090689	09/30/2020	BOD, carbonaceous [5 day, 20 C]	67	11	18	kg/d				mg/L
VA0090689	08/31/2020	Oxygen, dissolved [DO]					5.2			mg/L
VA0090689	08/31/2020	pH					7.1		8.2	SU
VA0090689	08/31/2020	Solids, total suspended	685	5	52	kg/d		78.5	85	mg/L
VA0090689	08/31/2020	Nitrogen, Kjeldahl, total [as N]	388	1	16	kg/d		14.18	21.95	mg/L
VA0090689	08/31/2020	Phosphorus, total [as P]						1.9		mg/L
VA0090689	08/31/2020	Flow, in conduit or thru treatment plan		.0025	.0035	MGD				
VA0090689	08/31/2020	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	08/31/2020	Chlorine, total residua					1.06			mg/L
VA0090689	08/31/2020	E. coli						11		#/100mL
VA0090689	08/31/2020	BOD, carbonaceous [5 day, 20 C]		.05	.06	kg/d		8	8	mg/L
VA0090689	07/31/2020	Oxygen, dissolved [DO]					5.5			mg/L
VA0090689	07/31/2020	pH					6.8		8.1	SU
VA0090689	07/31/2020	Solids, total suspended	440	72	9	kg/d		54	68	mg/L
VA0090689	07/31/2020	Nitrogen, Kjeldahl, total [as N]	33	.05	.08	kg/d		3.98	5.93	mg/L
VA0090689	07/31/2020	Phosphorus, total [as P]	96					3.92		mg/L
VA0090689	07/31/2020	Flow, in conduit or thru treatment plan		.0035	.0035	MGD				
VA0090689	07/31/2020	Chlorine, total residua					1.05	NODI B	NODI B	mg/L
VA0090689	07/31/2020	Chlorine, total residua								mg/L
VA0090689	07/31/2020	E. coli						51		#/100mL
VA0090689	07/31/2020	BOD, carbonaceous [5 day, 20 C]	10	14	.2	kg/d		11	15	mg/L
VA0090689	06/30/2020	Oxygen, dissolved [DO]					6			mg/L
VA0090689	06/30/2020	pH					7.3		8.4	SU
VA0090689	06/30/2020	Solids, total suspended	620	84	84	kg/d		72	72	mg/L
VA0090689	06/30/2020	Nitrogen, Kjeldahl, total [as N]	160	13	13	kg/d		7.79	7.79	mg/L
VA0090689	06/30/2020	Phosphorus, total [as P]						1.54		mg/L
VA0090689	06/30/2020	Flow, in conduit or thru treatment plan		.0056	.0216	MGD				
VA0090689	06/30/2020	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	06/30/2020	Chlorine, total residua					1.03			mg/L
VA0090689	06/30/2020	E. coli						71		#/100mL
VA0090689	06/30/2020	BOD, carbonaceous [5 day, 20 C]						22	22	mg/L
VA0090689	05/31/2020	Oxygen, dissolved [DO]	120	26	.26	kg/d		6.65		mg/L
VA0090689	05/31/2020	pH					7.5		8	SU
VA0090689	05/31/2020	Solids, total suspended		.09	.09	kg/d		6	6	mg/L
VA0090689	05/31/2020	Nitrogen, Kjeldahl, total [as N]		.06	.06	kg/d		2	2	mg/L
VA0090689	05/31/2020	Phosphorus, total [as P]						.38		mg/L
VA0090689	05/31/2020	Flow, in conduit or thru treatment plan		.004	.006	MGD				
VA0090689	05/31/2020	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	05/31/2020	Chlorine, total residua					1.2			mg/L
VA0090689	05/31/2020	E. coli						6		#/100mL
VA0090689	05/31/2020	BOD, carbonaceous [5 day, 20 C]		.13	.13	kg/d		9	9	mg/L
VA0090689	04/30/2020	Oxygen, dissolved [DO]					8.3			mg/L
VA0090689	04/30/2020	pH					8		8	SU
VA0090689	04/30/2020	Solids, total suspended		14	14	kg/d		9	9	mg/L
VA0090689	04/30/2020	Nitrogen, Kjeldahl, total [as N]	41	.006	.006	kg/d		4.23	4.23	mg/L
VA0090689	04/30/2020	Phosphorus, total [as P]						.2		mg/L
VA0090689	04/30/2020	Flow, in conduit or thru treatment plan		.004	.004	MGD				
VA0090689	04/30/2020	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	04/30/2020	Chlorine, total residua					1.6			mg/L
VA0090689	04/30/2020	E. coli						1		#/100mL
VA0090689	04/30/2020	BOD, carbonaceous [5 day, 20 C]		.13	.13	kg/d		5	5	mg/L
VA0090689	03/31/2020	Oxygen, dissolved [DO]					8.1			mg/L
VA0090689	03/31/2020	pH					7.5		8	SU
VA0090689	03/31/2020	Solids, total suspended	190	43	43	kg/d		29	29	mg/L
VA0090689	03/31/2020	Nitrogen, Kjeldahl, total [as N]	235	15	15	kg/d		10.06	10.06	mg/L
VA0090689	03/31/2020	Phosphorus, total [as P]						1.61		mg/L
VA0090689	03/31/2020	Flow, in conduit or thru treatment plan		.004	.004	MGD				
VA0090689	03/31/2020	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	03/31/2020	Chlorine, total residua					1			mg/L
VA0090689	03/31/2020	E. coli						43		#/100mL
VA0090689	03/31/2020	BOD, carbonaceous [5 day, 20 C]		.12	.12	kg/d		8	8	mg/L
VA0090689	02/29/2020	Oxygen, dissolved [DO]					8.9			mg/L
VA0090689	02/29/2020	pH					7		8	SU
VA0090689	02/29/2020	Solids, total suspended	40	21	21	kg/d		14	14	mg/L
VA0090689	02/29/2020	Nitrogen, Kjeldahl, total [as N]		.04	.04	kg/d		2.4	2.4	mg/L
VA0090689	02/29/2020	Phosphorus, total [as P]						2		mg/L
VA0090689	02/29/2020	Flow, in conduit or thru treatment plan		.004	.004	MGD				
VA0090689	02/29/2020	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	02/29/2020	Chlorine, total residua					1			mg/L
VA0090689	02/29/2020	E. coli						16		#/100mL
VA0090689	02/29/2020	BOD, carbonaceous [5 day, 20 C]		.06	.06	kg/d		.4	4	mg/L
VA0090689	01/31/2020	Oxygen, dissolved [DO]					8.2			mg/L
VA0090689	01/31/2020	pH					7.5		8	SU
VA0090689	01/31/2020	Solids, total suspended	108	24	24	kg/d		20.8	20.8	mg/L
VA0090689	01/31/2020	Nitrogen, Kjeldahl, total [as N]	453	18	18	kg/d		16.58	16.58	mg/L
VA0090689	01/31/2020	Phosphorus, total [as P]	98					3.95		mg/L
VA0090689	01/31/2020	Flow, in conduit or thru treatment plan		.003	.003	MGD				
VA0090689	01/31/2020	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	01/31/2020	Chlorine, total residua					1.2			mg/L
VA0090689	01/31/2020	E. coli						5		#/100mL
VA0090689	01/31/2020	BOD, carbonaceous [5 day, 20 C]		.22	.22	kg/d		20	20	mg/L
VA0090689	12/31/2019	Nitrogen, total [as N]	100					NODI **X**		mg/L
VA0090689	12/31/2019	Nitrite + Nitrate total [as N]						NODI B		mg/L
VA0090689	12/31/2019	Oxygen, dissolved [DO]					7.8			mg/L
VA0090689	12/31/2019	pH					7.5		8	SU
VA0090689	12/31/2019	Solids, total suspended		.036	.036	kg/d		24	24	mg/L
VA0090689	12/31/2019	Nitrogen, Kjeldahl, total [as N]	614	31	31	kg/d		21.42	21.42	mg/L
VA0090689	12/31/2019	Phosphorus, total [as P]						.68		mg/L
VA0090689	12/31/2019	Flow, in conduit or thru treatment plan		.004	.004	MGD				
VA0090689	12/31/2019	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	12/31/2019	Chlorine, total residua					1			mg/L
VA0090689	12/31/2019	E. coli						2		#/100mL
VA0090689	12/31/2019	BOD, carbonaceous [5 day, 20 C]		.13	.13	kg/d		9	9	mg/L
VA0090689	11/30/2019	Oxygen, dissolved [DO]					7.1			mg/L
VA0090689	11/30/2019	pH					7		8	SU
VA0090689	11/30/2019	Solids, total suspended	110	23	23	kg/d		21	21	mg/L
VA0090689	11/30/2019	Nitrogen, Kjeldahl, total [as N]		.027	.027	kg/d		2.45	2.45	mg/L
VA0090689	11/30/2019	Phosphorus, total [as P]						1		mg/L
VA0090689	11/30/2019	Flow, in conduit or thru treatment plan		.003	.003	MGD				
VA0090689	11/30/2019	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	11/30/2019	Chlorine, total residua					1.2			mg/L
VA0090689	11/30/2019	E. coli						9		#/100mL
VA0090689	11/30/2019	BOD, carbonaceous [5 day, 20 C]		.022	.022	kg/d		2	2	mg/L
VA0090689	10/31/2019	Oxygen, dissolved [DO]					6.6			mg/L
VA0090689	10/31/2019	pH					6.5		8	SU
VA0090689	10/31/2019	Solids, total suspended	410	386	386	kg/d		51	51	mg/L
VA0090689	10/31/2019	Nitrogen, Kjeldahl, total [as N]	372	1	1	kg/d		14.16	14.16	mg/L
VA0090689	10/31/2019	Phosphorus, total [as P]						.97		mg/L
VA0090689	10/31/2019	Flow, in conduit or thru treatment plan		.002	.002	MGD				
VA0090689	10/31/2019	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	10/31/2019	Chlorine, total residua					1			mg/L
VA0090689	10/31/2019	E. coli						18		#/100mL
VA0090689	10/31/2019	BOD, carbonaceous [5 day, 20 C]		.05	.05	kg/d		7	7	mg/L
VA0090689	09/30/2019	Oxygen, dissolved [DO]					5.2			mg/L
VA0090689	09/30/2019	pH					7		8	SU
VA0090689	09/30/2019	Solids, total suspended		.049	.049	kg/d		4.4	4.4	mg/L
VA0090689	09/30/2019	Nitrogen, Kjeldahl, total [as N]		.005	.005	kg/d		.49	.49	mg/L
VA0090689	09/30/2019	Phosphorus, total [as P]	124					4.48		mg/L
VA0090689	09/30/2019	Flow, in conduit or thru treatment plan		.003	.003	MGD				
VA0090689	09/30/2019	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	09/30/2019	Chlorine, total residua					1.5			mg/L
VA0090689	09/30/2019	E. coli						2		#/100mL
VA0090689	09/30/2019	BOD, carbonaceous [5 day, 20 C]		NODI B	NODI B	kg/d		NODI B	NODI B	mg/L
VA0090689	08/31/2019	Oxygen, dissolved [DO]					6.1			mg/L

VA0090689	08/31/2019	pH				7.5		8.5	SU
VA0090689	08/31/2019	Solids, total suspended	73	.26	.26	kg/d	17.3	17.3	mg/L
VA0090689	08/31/2019	Nitrogen, Kjeldahl, total [as N]		.02	.02	kg/d	1.53	1.53	mg/L
VA0090689	08/31/2019	Phosphorus, total [as P]					.41		mg/L
VA0090689	08/31/2019	Flow, in conduit or thru treatment plan		.004	.004	MGD			
VA0090689	08/31/2019	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	08/31/2019	Chlorine, total residua				1.2			mg/L
VA0090689	08/31/2019	E. coli					1		#/100mL
VA0090689	08/31/2019	BOD, carbonaceous [5 day, 20 C]					NODI B	NODI B	mg/L
VA0090689	07/31/2019	Oxygen, dissolved [DO]				5.8			mg/L
VA0090689	07/31/2019	pH				7		8	SU
VA0090689	07/31/2019	Solids, total suspended	7795	.15	.14	kg/d	14	14	mg/L
VA0090689	07/31/2019	Nitrogen, Kjeldahl, total [as N]		.02	.02	kg/d	1.91	1.91	mg/L
VA0090689	07/31/2019	Phosphorus, total [as P]					3.91		mg/L
VA0090689	07/31/2019	Flow, in conduit or thru treatment plan		.003	.003	MGD			
VA0090689	07/31/2019	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	07/31/2019	Chlorine, total residua				1.6			mg/L
VA0090689	07/31/2019	E. coli					2		#/100mL
VA0090689	07/31/2019	BOD, carbonaceous [5 day, 20 C]					NODI B	NODI B	mg/L
VA0090689	06/30/2019	Oxygen, dissolved [DO]				6			mg/L
VA0090689	06/30/2019	pH				6.7		7.9	SU
VA0090689	06/30/2019	Solids, total suspended		.0795	.0795	kg/d	7	7	mg/L
VA0090689	06/30/2019	Nitrogen, Kjeldahl, total [as N]		.0082	.0082	kg/d	.72	.72	mg/L
VA0090689	06/30/2019	Phosphorus, total [as P]					.28		mg/L
VA0090689	06/30/2019	Flow, in conduit or thru treatment plan		.003	.0045	MGD			
VA0090689	06/30/2019	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	06/30/2019	Chlorine, total residua				1.08			mg/L
VA0090689	06/30/2019	E. coli					1		#/100mL
VA0090689	06/30/2019	BOD, carbonaceous [5 day, 20 C]	20	.0833	.2044	kg/d	7	18	mg/L
VA0090689	05/31/2019	Oxygen, dissolved [DO]				7			mg/L
VA0090689	05/31/2019	pH				7		7.6	SU
VA0090689	05/31/2019	Solids, total suspended		.0121	.0121	kg/d	1	1	mg/L
VA0090689	05/31/2019	Nitrogen, Kjeldahl, total [as N]		.0038	.0038	kg/d	.31	.31	mg/L
VA0090689	05/31/2019	Phosphorus, total [as P]					.03		mg/L
VA0090689	05/31/2019	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	05/31/2019	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	05/31/2019	Chlorine, total residua				1.07			mg/L
VA0090689	05/31/2019	E. coli					1		#/100mL
VA0090689	05/31/2019	BOD, carbonaceous [5 day, 20 C]		.0246	.0246	kg/d	2	2	mg/L
VA0090689	04/30/2019	Oxygen, dissolved [DO]				7			mg/L
VA0090689	04/30/2019	pH				7.1		7.6	SU
VA0090689	04/30/2019	Solids, total suspended		.0121	.0121	kg/d	1	1	mg/L
VA0090689	04/30/2019	Nitrogen, Kjeldahl, total [as N]		.0076	.0076	kg/d	.63	.63	mg/L
VA0090689	04/30/2019	Phosphorus, total [as P]					1.22		mg/L
VA0090689	04/30/2019	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	04/30/2019	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	04/30/2019	Chlorine, total residua				1.22			mg/L
VA0090689	04/30/2019	E. coli					2		#/100mL
VA0090689	04/30/2019	BOD, carbonaceous [5 day, 20 C]		.0242	.0242	kg/d	2	2	mg/L
VA0090689	03/31/2019	Oxygen, dissolved [DO]				7			mg/L
VA0090689	03/31/2019	pH				7.4		7.6	SU
VA0090689	03/31/2019	Solids, total suspended		.0363	.0363	kg/d	3	3	mg/L
VA0090689	03/31/2019	Nitrogen, Kjeldahl, total [as N]		.0044	.0044	kg/d	.36	.36	mg/L
VA0090689	03/31/2019	Phosphorus, total [as P]					.02		mg/L
VA0090689	03/31/2019	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	03/31/2019	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	03/31/2019	Chlorine, total residua				1.2			mg/L
VA0090689	03/31/2019	E. coli					1		#/100mL
VA0090689	03/31/2019	BOD, carbonaceous [5 day, 20 C]		.0242	.0242	kg/d	2	2	mg/L
VA0090689	02/28/2019	Oxygen, dissolved [DO]				7			mg/L
VA0090689	02/28/2019	pH				7.2		7.7	SU
VA0090689	02/28/2019	Solids, total suspended		.0121	.0121	kg/d	1	1	mg/L
VA0090689	02/28/2019	Nitrogen, Kjeldahl, total [as N]		.0046	.0046	kg/d	.38	.38	mg/L
VA0090689	02/28/2019	Phosphorus, total [as P]					1.83		mg/L
VA0090689	02/28/2019	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	02/28/2019	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	02/28/2019	Chlorine, total residua				1.2			mg/L
VA0090689	02/28/2019	E. coli					1		#/100mL
VA0090689	02/28/2019	BOD, carbonaceous [5 day, 20 C]		.0242	.0242	kg/d	2	2	mg/L
VA0090689	01/31/2019	Oxygen, dissolved [DO]				7			mg/L
VA0090689	01/31/2019	pH				7		7.7	SU
VA0090689	01/31/2019	Solids, total suspended		.0121	.0121	kg/d	1	1	mg/L
VA0090689	01/31/2019	Nitrogen, Kjeldahl, total [as N]		.0046	.0046	kg/d	.38	.38	mg/L
VA0090689	01/31/2019	Phosphorus, total [as P]					.06		mg/L
VA0090689	01/31/2019	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	01/31/2019	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	01/31/2019	Chlorine, total residua				1.22			mg/L
VA0090689	01/31/2019	E. coli					1		#/100mL
VA0090689	01/31/2019	BOD, carbonaceous [5 day, 20 C]		.0242	.0242	kg/d	2	2	mg/L
VA0090689	12/31/2018	Nitrogen, total [as N]					.34		mg/L
VA0090689	12/31/2018	Nitrite + Nitrate total [as N]					.18		mg/L
VA0090689	12/31/2018	Oxygen, dissolved [DO]				7			mg/L
VA0090689	12/31/2018	pH				7.1		7.6	SU
VA0090689	12/31/2018	Solids, total suspended		.0121	.0121	kg/d	1	1	mg/L
VA0090689	12/31/2018	Nitrogen, Kjeldahl, total [as N]		.0021	.0021	kg/d	.18	.18	mg/L
VA0090689	12/31/2018	Phosphorus, total [as P]					.06		mg/L
VA0090689	12/31/2018	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	12/31/2018	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	12/31/2018	Chlorine, total residua				1.2			mg/L
VA0090689	12/31/2018	E. coli					1		#/100mL
VA0090689	12/31/2018	BOD, carbonaceous [5 day, 20 C]		.0242	.0242	kg/d	2	2	mg/L
VA0090689	11/30/2018	Oxygen, dissolved [DO]				7			mg/L
VA0090689	11/30/2018	pH				7.2		7.6	SU
VA0090689	11/30/2018	Solids, total suspended		.0121	.0121	kg/d	1	1	mg/L
VA0090689	11/30/2018	Nitrogen, Kjeldahl, total [as N]		.0024	.0024	kg/d	.2	.2	mg/L
VA0090689	11/30/2018	Phosphorus, total [as P]					.06		mg/L
VA0090689	11/30/2018	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	11/30/2018	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	11/30/2018	Chlorine, total residua				1.07			mg/L
VA0090689	11/30/2018	E. coli					1		#/100mL
VA0090689	11/30/2018	BOD, carbonaceous [5 day, 20 C]		.0242	.0242	kg/d	2	2	mg/L
VA0090689	10/31/2018	Oxygen, dissolved [DO]				7			mg/L
VA0090689	10/31/2018	pH				7.2		7.7	SU
VA0090689	10/31/2018	Solids, total suspended		.0121	.121	kg/d	1	1	mg/L
VA0090689	10/31/2018	Nitrogen, Kjeldahl, total [as N]		.0029	.0029	kg/d	.24	.24	mg/L
VA0090689	10/31/2018	Phosphorus, total [as P]					.2		mg/L
VA0090689	10/31/2018	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	10/31/2018	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	10/31/2018	Chlorine, total residua				1.2			mg/L
VA0090689	10/31/2018	E. coli					1		#/100mL
VA0090689	10/31/2018	BOD, carbonaceous [5 day, 20 C]		.0242	.0242	kg/d	2	2	mg/L
VA0090689	09/30/2018	Oxygen, dissolved [DO]				7			mg/L
VA0090689	09/30/2018	pH				7.2		7.6	SU
VA0090689	09/30/2018	Solids, total suspended		.0121	.0121	kg/d	1	1	mg/L
VA0090689	09/30/2018	Nitrogen, Kjeldahl, total [as N]		.0172	.0172	kg/d	1.42	1.42	mg/L
VA0090689	09/30/2018	Phosphorus, total [as P]					.06		mg/L
VA0090689	09/30/2018	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	09/30/2018	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	09/30/2018	Chlorine, total residua				1.09			mg/L
VA0090689	09/30/2018	E. coli					1		#/100mL
VA0090689	09/30/2018	BOD, carbonaceous [5 day, 20 C]		.0242	.0242	kg/d	2	2	mg/L
VA0090689	08/31/2018	Oxygen, dissolved [DO]				7			mg/L
VA0090689	08/31/2018	pH				7.1		7.7	SU
VA0090689	08/31/2018	Solids, total suspended		.0121	.0121	kg/d	1	1	mg/L
VA0090689	08/31/2018	Nitrogen, Kjeldahl, total [as N]		.0036	.0036	kg/d	.31	.31	mg/L
VA0090689	08/31/2018	Phosphorus, total [as P]					.07		mg/L
VA0090689	08/31/2018	Flow, in conduit or thru treatment plan		.0032	.0032	MGD			
VA0090689	08/31/2018	Chlorine, total residua					NODI B	NODI B	mg/L
VA0090689	08/31/2018	Chlorine, total residua				1.12			mg/L
VA0090689	08/31/2018	E. coli					5		#/100mL
VA0090689	08/31/2018	BOD, carbonaceous [5 day, 20 C]		.0848	.1453	kg/d	7	12	mg/L
VA0090689	07/31/2018	Oxygen, dissolved [DO]				6.8			mg/L
VA0090689	07/31/2018	pH				7.1		7.6	SU
VA0090689	07/31/2018	Solids, total suspended		.0121	.0121	kg/d	1	1	mg/L
VA0090689	07/31/2018	Nitrogen, Kjeldahl, total [as N]		.0016	.0016	kg/d	.13	.13	mg/L

VA0090689	07/31/2018	Phosphorus, total [as P]						.06		mg/L
VA0090689	07/31/2018	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	07/31/2018	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	07/31/2018	Chlorine, total residua				1.04				mg/L
VA0090689	07/31/2018	E. coli						1		#/100mL
VA0090689	07/31/2018	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	06/30/2018	Oxygen, dissolved [DO]								mg/L
VA0090689	06/30/2018	pH				7			7.7	SU
VA0090689	06/30/2018	Solids, total suspended	.0121	.0121	ka/d			1	1	mg/L
VA0090689	06/30/2018	Nitrogen, Kieldahl, total [as N]	.0079	.0079	ka/d			.21	.21	mg/L
VA0090689	06/30/2018	Phosphorus, total [as P]						.11		mg/L
VA0090689	06/30/2018	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	06/30/2018	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	06/30/2018	Chlorine, total residua				1.01				mg/L
VA0090689	06/30/2018	E. coli						1		#/100mL
VA0090689	06/30/2018	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	05/31/2018	Oxygen, dissolved [DO]				7				mg/L
VA0090689	05/31/2018	pH				7			7.6	SU
VA0090689	05/31/2018	Solids, total suspended	.0121	.0121	ka/d			1	1	mg/L
VA0090689	05/31/2018	Nitrogen, Kieldahl, total [as N]	.0024	.0024	ka/d			.2	.2	mg/L
VA0090689	05/31/2018	Phosphorus, total [as P]						.05		mg/L
VA0090689	05/31/2018	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	05/31/2018	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	05/31/2018	Chlorine, total residua				1.06				mg/L
VA0090689	05/31/2018	E. coli						1		#/100mL
VA0090689	05/31/2018	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	04/30/2018	Oxygen, dissolved [DO]				7				mg/L
VA0090689	04/30/2018	pH				7			8	SU
VA0090689	04/30/2018	Solids, total suspended	.0121	.0121	ka/d			1	1	mg/L
VA0090689	04/30/2018	Nitrogen, Kieldahl, total [as N]	.0042	.0042	ka/d			.35	.35	mg/L
VA0090689	04/30/2018	Phosphorus, total [as P]						.05		mg/L
VA0090689	04/30/2018	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	04/30/2018	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	04/30/2018	Chlorine, total residua				1.07				mg/L
VA0090689	04/30/2018	E. coli						1		#/100mL
VA0090689	04/30/2018	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	03/31/2018	Oxygen, dissolved [DO]				7				mg/L
VA0090689	03/31/2018	pH				7.6			7.6	SU
VA0090689	03/31/2018	Solids, total suspended	.0121	.0121	ka/d			1	1	mg/L
VA0090689	03/31/2018	Nitrogen, Kieldahl, total [as N]	0	0	ka/d			0	0	mg/L
VA0090689	03/31/2018	Phosphorus, total [as P]						.17		mg/L
VA0090689	03/31/2018	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	03/31/2018	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	03/31/2018	Chlorine, total residua				1.07				mg/L
VA0090689	03/31/2018	E. coli						1		#/100mL
VA0090689	03/31/2018	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	02/28/2018	Oxygen, dissolved [DO]				7				mg/L
VA0090689	02/28/2018	pH				7.4			7.6	SU
VA0090689	02/28/2018	Solids, total suspended	.0121	.0121	ka/d			1	1	mg/L
VA0090689	02/28/2018	Nitrogen, Kieldahl, total [as N]	.0028	.0028	ka/d			.23	.23	mg/L
VA0090689	02/28/2018	Phosphorus, total [as P]						.18		mg/L
VA0090689	02/28/2018	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	02/28/2018	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	02/28/2018	Chlorine, total residua				1.18				mg/L
VA0090689	02/28/2018	E. coli						1		#/100mL
VA0090689	02/28/2018	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	01/31/2018	Oxygen, dissolved [DO]				7				mg/L
VA0090689	01/31/2018	pH				7.4			7.6	SU
VA0090689	01/31/2018	Solids, total suspended	.0121	.0121	ka/d			1	1	mg/L
VA0090689	01/31/2018	Nitrogen, Kieldahl, total [as N]	.009	.009	ka/d			.74	.74	mg/L
VA0090689	01/31/2018	Phosphorus, total [as P]						.05		mg/L
VA0090689	01/31/2018	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	01/31/2018	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	01/31/2018	Chlorine, total residua				1.14				mg/L
VA0090689	01/31/2018	E. coli						1		#/100mL
VA0090689	01/31/2018	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	12/31/2017	Nitrogen, total [as N]						.81		mg/L
VA0090689	12/31/2017	Nitrite + Nitrate total [as N]				7		.39		mg/L
VA0090689	12/31/2017	Oxygen, dissolved [DO]				7.6			7.6	SU
VA0090689	12/31/2017	pH	.0121	.0121	ka/d			1	1	mg/L
VA0090689	12/31/2017	Solids, total suspended	.0015	.0015	ka/d			.12	.12	mg/L
VA0090689	12/31/2017	Nitrogen, Kieldahl, total [as N]						.12		mg/L
VA0090689	12/31/2017	Phosphorus, total [as P]						NODI B		mg/L
VA0090689	12/31/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	12/31/2017	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	12/31/2017	Chlorine, total residua				1.23				mg/L
VA0090689	12/31/2017	E. coli						1		#/100mL
VA0090689	12/31/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	11/30/2017	Oxygen, dissolved [DO]				7				mg/L
VA0090689	11/30/2017	pH	.0121	.0121	ka/d			7.6	7.9	SU
VA0090689	11/30/2017	Solids, total suspended	.0012	.0012	ka/d			1	1	mg/L
VA0090689	11/30/2017	Nitrogen, Kieldahl, total [as N]						.1	.1	mg/L
VA0090689	11/30/2017	Phosphorus, total [as P]						.14		mg/L
VA0090689	11/30/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	11/30/2017	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	11/30/2017	Chlorine, total residua				1.17				mg/L
VA0090689	11/30/2017	E. coli						1		#/100mL
VA0090689	11/30/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	10/31/2017	Oxygen, dissolved [DO]				7				mg/L
VA0090689	10/31/2017	pH				7.6			7.6	SU
VA0090689	10/31/2017	Solids, total suspended	.0484	.0484	ka/d			4	4	mg/L
VA0090689	10/31/2017	Nitrogen, Kieldahl, total [as N]	0	0	ka/d			0	0	mg/L
VA0090689	10/31/2017	Phosphorus, total [as P]						.18		mg/L
VA0090689	10/31/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	10/31/2017	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	10/31/2017	Chlorine, total residua				1.29				mg/L
VA0090689	10/31/2017	E. coli						1		#/100mL
VA0090689	10/31/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	09/30/2017	Oxygen, dissolved [DO]				7				mg/L
VA0090689	09/30/2017	pH				7.6			7.6	SU
VA0090689	09/30/2017	Solids, total suspended	.0363	.0363	ka/d			3	3	mg/L
VA0090689	09/30/2017	Nitrogen, Kieldahl, total [as N]	.0014	.0014	ka/d			.12	.12	mg/L
VA0090689	09/30/2017	Phosphorus, total [as P]						.11		mg/L
VA0090689	09/30/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	09/30/2017	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	09/30/2017	Chlorine, total residua				1.24				mg/L
VA0090689	09/30/2017	E. coli						1		#/100mL
VA0090689	09/30/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	08/31/2017	Oxygen, dissolved [DO]				7				mg/L
VA0090689	08/31/2017	pH				7.1			7.6	SU
VA0090689	08/31/2017	Solids, total suspended	.0121	.0121	ka/d			1	1	mg/L
VA0090689	08/31/2017	Nitrogen, Kieldahl, total [as N]	.0028	.0028	ka/d			.23	.23	mg/L
VA0090689	08/31/2017	Phosphorus, total [as P]						.15		mg/L
VA0090689	08/31/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	08/31/2017	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	08/31/2017	Chlorine, total residua				1.07				mg/L
VA0090689	08/31/2017	E. coli						1		#/100mL
VA0090689	08/31/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	07/31/2017	Oxygen, dissolved [DO]				7				mg/L
VA0090689	07/31/2017	pH				7.1			7.6	SU
VA0090689	07/31/2017	Solids, total suspended	.0121	.0121	ka/d			1	1	mg/L
VA0090689	07/31/2017	Nitrogen, Kieldahl, total [as N]	.0017	.0017	ka/d			.14	.14	mg/L
VA0090689	07/31/2017	Phosphorus, total [as P]						.17		mg/L
VA0090689	07/31/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	07/31/2017	Chlorine, total residua						NODI B	NODI B	mg/L
VA0090689	07/31/2017	Chlorine, total residua				1.1				mg/L
VA0090689	07/31/2017	E. coli						1		#/100mL
VA0090689	07/31/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	ka/d			2	2	mg/L
VA0090689	06/30/2017	Oxygen, dissolved [DO]				7				mg/L
VA0090689	06/30/2017	pH	.0121	.0121	ka/d			7.6	7.6	SU
VA0090689	06/30/2017	Solids, total suspended	.0164	.0164	ka/d			1	1.35	mg/L
VA0090689	06/30/2017	Nitrogen, Kieldahl, total [as N]						.23		mg/L
VA0090689	06/30/2017	Phosphorus, total [as P]								
VA0090689	06/30/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD					
VA0090689	06/30/2017	Chlorine, total residua						0	0	mg/L

VA0090689	06/30/2017	Chlorine, total residua				1.26			mg/L
VA0090689	06/30/2017	E. coli					1		#/100mL
VA0090689	06/30/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	05/31/2017	Oxygen, dissolved [DO]				7			mg/L
VA0090689	05/31/2017	pH				7		7.6	SU
VA0090689	05/31/2017	Solids, total suspended	.0121	.0121	kg/d		1	1	mg/L
VA0090689	05/31/2017	Nitrogen, Kjeldahl, total [as N]	.0039	.0039	kg/d		.32	.32	mg/L
VA0090689	05/31/2017	Phosphorus, total [as P]					.41		mg/L
VA0090689	05/31/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD		0	0	mg/L
VA0090689	05/31/2017	Chlorine, total residua				1.06			mg/L
VA0090689	05/31/2017	Chlorine, total residua					0		mg/L
VA0090689	05/31/2017	E. coli					1		#/100mL
VA0090689	05/31/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	04/30/2017	Oxygen, dissolved [DO]				7			mg/L
VA0090689	04/30/2017	pH				7		7.7	SU
VA0090689	04/30/2017	Solids, total suspended	.0121	.0121	kg/d		1	1	mg/L
VA0090689	04/30/2017	Nitrogen, Kjeldahl, total [as N]	.0013	.0013	kg/d		.11	.11	mg/L
VA0090689	04/30/2017	Phosphorus, total [as P]					.41		mg/L
VA0090689	04/30/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD		0	0	mg/L
VA0090689	04/30/2017	Chlorine, total residua					0		mg/L
VA0090689	04/30/2017	Chlorine, total residua				1.2			mg/L
VA0090689	04/30/2017	E. coli					1		#/100mL
VA0090689	04/30/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	03/31/2017	Oxygen, dissolved [DO]				7.3			mg/L
VA0090689	03/31/2017	pH				7.6		7.7	SU
VA0090689	03/31/2017	Solids, total suspended	.0121	.0121	kg/d		1	1	mg/L
VA0090689	03/31/2017	Nitrogen, Kjeldahl, total [as N]	0	0	kg/d		0	0	mg/L
VA0090689	03/31/2017	Phosphorus, total [as P]					.08		mg/L
VA0090689	03/31/2017	Flow, in conduit or thru treatment plan	.0032	.0032	MGD		0	0	mg/L
VA0090689	03/31/2017	Chlorine, total residua					0		mg/L
VA0090689	03/31/2017	Chlorine, total residua				1.09			mg/L
VA0090689	03/31/2017	E. coli					1		#/100mL
VA0090689	03/31/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	02/28/2017	Oxygen, dissolved [DO]				7			mg/L
VA0090689	02/28/2017	pH				7.6		7.7	SU
VA0090689	02/28/2017	Solids, total suspended	.0121	.0121	kg/d		1	1	mg/L
VA0090689	02/28/2017	Nitrogen, Kjeldahl, total [as N]	0	0	kg/d		0	0	mg/L
VA0090689	02/28/2017	Phosphorus, total [as P]					.42		mg/L
VA0090689	02/28/2017	Flow, in conduit or thru treatment plan	.0036	.0045	MGD		0	0	mg/L
VA0090689	02/28/2017	Chlorine, total residua					0		mg/L
VA0090689	02/28/2017	Chlorine, total residua				1.24			mg/L
VA0090689	02/28/2017	E. coli					1		#/100mL
VA0090689	02/28/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	01/31/2017	Oxygen, dissolved [DO]				6.9			mg/L
VA0090689	01/31/2017	pH				7.6		7.8	SU
VA0090689	01/31/2017	Solids, total suspended	.0121	.0121	kg/d		1	1	mg/L
VA0090689	01/31/2017	Nitrogen, Kjeldahl, total [as N]	.0016	.0016	kg/d		.13	.13	mg/L
VA0090689	01/31/2017	Phosphorus, total [as P]					.41		mg/L
VA0090689	01/31/2017	Flow, in conduit or thru treatment plan	.0033	.004	MGD		0	0	mg/L
VA0090689	01/31/2017	Chlorine, total residua					0		mg/L
VA0090689	01/31/2017	Chlorine, total residua				1.17			mg/L
VA0090689	01/31/2017	E. coli					1		#/100mL
VA0090689	01/31/2017	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	12/31/2016	Oxygen, dissolved [DO]				7			mg/L
VA0090689	12/31/2016	pH				7.6		7.8	SU
VA0090689	12/31/2016	Solids, total suspended	.0121	.0121	kg/d		1	1	mg/L
VA0090689	12/31/2016	Nitrogen, Kjeldahl, total [as N]	.0024	.0024	kg/d		.2	.2	mg/L
VA0090689	12/31/2016	Phosphorus, total [as P]					.25		mg/L
VA0090689	12/31/2016	Flow, in conduit or thru treatment plan	.0032	.0032	MGD		0	0	mg/L
VA0090689	12/31/2016	Chlorine, total residua					0		mg/L
VA0090689	12/31/2016	Chlorine, total residua				1.1			mg/L
VA0090689	12/31/2016	E. coli					1		#/100mL
VA0090689	12/31/2016	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	11/30/2016	Oxygen, dissolved [DO]				7			mg/L
VA0090689	11/30/2016	pH				7.5		7.6	SU
VA0090689	11/30/2016	Solids, total suspended	.0145	.0145	kg/d		1	1	mg/L
VA0090689	11/30/2016	Nitrogen, Kjeldahl, total [as N]	0	0	kg/d		0	0	mg/L
VA0090689	11/30/2016	Phosphorus, total [as P]					.39		mg/L
VA0090689	11/30/2016	Flow, in conduit or thru treatment plan	.0032	.0032	MGD		0	0	mg/L
VA0090689	11/30/2016	Chlorine, total residua					0		mg/L
VA0090689	11/30/2016	Chlorine, total residua				1.2			mg/L
VA0090689	11/30/2016	E. coli					1		#/100mL
VA0090689	11/30/2016	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	10/31/2016	Oxygen, dissolved [DO]				7			mg/L
VA0090689	10/31/2016	pH				7.4		7.7	SU
VA0090689	10/31/2016	Solids, total suspended	.0121	.0121	kg/d		1	1	mg/L
VA0090689	10/31/2016	Nitrogen, Kjeldahl, total [as N]	0	0	kg/d		0	0	mg/L
VA0090689	10/31/2016	Phosphorus, total [as P]					.42		mg/L
VA0090689	10/31/2016	Flow, in conduit or thru treatment plan	.0032	.0041	MGD		0	0	mg/L
VA0090689	10/31/2016	Chlorine, total residua					0		mg/L
VA0090689	10/31/2016	Chlorine, total residua				1.48			mg/L
VA0090689	10/31/2016	E. coli					1		#/100mL
VA0090689	10/31/2016	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	09/30/2016	Oxygen, dissolved [DO]				7			mg/L
VA0090689	09/30/2016	pH				7.5		7.7	SU
VA0090689	09/30/2016	Solids, total suspended	.0121	.0121	kg/d		1	1	mg/L
VA0090689	09/30/2016	Nitrogen, Kjeldahl, total [as N]	.0016	.0016	kg/d		.13	.13	mg/L
VA0090689	09/30/2016	Phosphorus, total [as P]					.09		mg/L
VA0090689	09/30/2016	Flow, in conduit or thru treatment plan	.0036	.0045	MGD		0	0	mg/L
VA0090689	09/30/2016	Chlorine, total residua					0		mg/L
VA0090689	09/30/2016	Chlorine, total residua				1.11			mg/L
VA0090689	09/30/2016	E. coli					1		#/100mL
VA0090689	09/30/2016	BOD, carbonaceous [5 day, 20 C]	.0242	.0242	kg/d		2	2	mg/L
VA0090689	08/31/2016	Oxygen, dissolved [DO]				6.9			mg/L
VA0090689	08/31/2016	pH				7.4		7.6	SU
VA0090689	08/31/2016	Solids, total suspended	.0136	.0136	kg/d		1	1	mg/L
VA0090689	08/31/2016	Nitrogen, Kjeldahl, total [as N]	0	0	kg/d		0	0	mg/L
VA0090689	08/31/2016	Phosphorus, total [as P]					.08		mg/L
VA0090689	08/31/2016	Flow, in conduit or thru treatment plan	.0036	.0054	MGD		0	0	mg/L
VA0090689	08/31/2016	Chlorine, total residua					0		mg/L
VA0090689	08/31/2016	Chlorine, total residua				1.17			mg/L
VA0090689	08/31/2016	E. coli					1		#/100mL
VA0090689	08/31/2016	BOD, carbonaceous [5 day, 20 C]	.0273	.0273	kg/d		2	2	mg/L
VA0090689	07/31/2016	Oxygen, dissolved [DO]				7			mg/L
VA0090689	07/31/2016	pH				7.5		7.7	SU
VA0090689	07/31/2016	Solids, total suspended	.0102	.0102	kg/d		1	1	mg/L
VA0090689	07/31/2016	Nitrogen, Kjeldahl, total [as N]	.0015	.0015	kg/d		.15	.15	mg/L
VA0090689	07/31/2016	Phosphorus, total [as P]					.4		mg/L
VA0090689	07/31/2016	Flow, in conduit or thru treatment plan	.0034	.0045	MGD		0	0	mg/L
VA0090689	07/31/2016	Chlorine, total residua					0		mg/L
VA0090689	07/31/2016	Chlorine, total residua				1.19			mg/L
VA0090689	07/31/2016	E. coli					1		#/100mL
VA0090689	07/31/2016	BOD, carbonaceous [5 day, 20 C]	.0204	.0204	kg/d		2	2	mg/L

Exhibit 4
VDEQ Warning Letters
(September 2019 – November 2019)



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHERN REGIONAL OFFICE

13901 Crown Court, Woodbridge, Virginia 22193

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Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas Faha
Regional Director

September 30, 2019

WARNING LETTER

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC.
5805 Staples Mill Road
Richmond, VA 23228

RE: WL No. W2019-09-N-1013

Hill Mobile Home Park 2 - STP

VA0090689

Caroline County

VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson;

The Department of Environmental Quality (DEQ), Northern Regional Office (NRO), has reason to believe that the Six O Five Mobile Home Group, LLC. may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

This letter addresses conditions at the facility named above, and also cites compliance requirements of the State Water Control Law and Regulations. Pursuant to Va. Code § 62.1-44.15 (8a), this letter is not a case decision under the Virginia Administrative Process Act, Va. Code § 2.2-4000 *et seq*. The Department requests that you respond **within 20 days of the date of this letter**.

OBSERVATIONS AND LEGAL REQUIREMENTS

Facility staff are required to submit discharge monitoring reports (DMRs) and documents to DEQ NRO, including the following *relevant* data results. The following describe DEQ NRO staff factual observations and identify the applicable legal requirements.

1. *Observations:*

Parameter	Observation – DMR Monitoring Period and Relevant Reported Monitoring Results	Legal Requirement (Permit, Part I.A.1.b.)
<i>July 2019</i>		
Total Suspended Solids (TSS), Qty. Ave. (KG/D)	15	0.19
TSS, Qty. Max. (KG/D)	14.0	0.28
TSS, Conc. Ave. (mg/L)	14	10
Total Phosphorus, Conc. Ave. (mg/L)	3.91	2.0
<i>June 2019</i>		
CBOD ₅ , Conc. Max. (mg/L)	18	15

***This facility had 2.0 points in the Compliance Auditing System at the end of July 2019.**

ENFORCEMENT AUTHORITY

Va. Code § 62.1-44.23 of the State Water Control Law provides for an injunction for any violation of the State Water Control Law, any State Water Control Board rule or regulation, an order, permit condition, standard, or any certificate requirement or provision. Va. Code §§ 62.1-44.15 and 62.1-44.32 provide for a civil penalty up to \$32,500 per day of each violation of the same. In addition, Va. Code § 62.1-44.15 authorizes the State Water Control Board to issue orders to any person to comply with the State Water Control Law and regulations, including the imposition of a civil penalty for violations of up to \$100,000. Also, Va. Code § 10.1-1186 authorizes the Director of DEQ to issue special orders to any person to comply with the State Water Control Law and regulations, and to impose a civil penalty. Va. Code §§ 62.1-44.32 (b) and 62.1-44.32 (c) provide for other additional penalties.

FUTURE ACTIONS

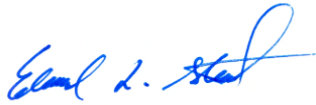
After reviewing this letter, please respond in writing to DEQ **within 20 days of the date of this letter** detailing actions you have taken or will be taking to ensure compliance with state law and regulations. If corrective action will take longer than 90 days to complete, you may be asked to sign a Letter of Agreement or enter into a Consent Order with the Department to formalize the plan and schedule. *It is DEQ policy that appropriate, timely, corrective actions undertaken in response to a Warning Letter will avoid adversarial enforcement proceedings and the assessment of civil charges or penalties.*

Please advise us if you dispute any of the observations recited herein or if there is other information of which DEQ should be aware. In the event that discussions with staff do not lead to a satisfactory conclusion concerning the contents of this letter, you may elect to participate in DEQ's Process for Early Dispute Resolution. Also, if informal discussions do not lead to a satisfactory conclusion, you may request in writing

that DEQ take all necessary steps to issue a final decision or fact finding under the APA on whether or not a violation has occurred. For further information on the Process for Early Dispute Resolution, please see Agency Policy Statement No. 8-2005 posted on the Department's website under "Programs," "Enforcement," and "Laws, Regulations, & Guidance" (<http://www.deq.virginia.gov/Programs/Enforcement/Laws,Regulations,Guidance.aspx>) or ask the DEQ contact below.

Please direct written materials regarding this matter to Rebecca Johnson. Written materials may be sent either via the US Postal Service or electronically, via E-mail. DEQ recommends sending electronic responses as an Acrobat PDF or in a Word-compatible, write-protected format. If you have questions or wish to arrange a meeting, please contact Rebecca Johnson at (703) 583-3854 or by e-mail at Rebecca.Johnson@deq.virginia.gov

Sincerely,



Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy: ECM, Compliance Auditor; Compliance Manager – DEQ



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHERN REGIONAL OFFICE

13901 Crown Court, Woodbridge, Virginia 22193

(703) 583-3800

www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas Faha
Regional Director

October 24, 2019

WARNING LETTER

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC.
5805 Staples Mill Road
Richmond, VA 23228

RE: WL No. W2019-10-N-1041

Hill Mobile Home Park 2 - STP

VA0090689

Caroline County

VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson;

The Department of Environmental Quality (DEQ), Northern Regional Office (NRO), has reason to believe that the Six O Five Mobile Home Group, LLC. may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

This letter addresses conditions at the facility named above, and also cites compliance requirements of the State Water Control Law and Regulations. Pursuant to Va. Code § 62.1-44.15 (8a), this letter is not a case decision under the Virginia Administrative Process Act, Va. Code § 2.2-4000 *et seq*. The Department requests that you respond **within 20 days of the date of this letter**.

OBSERVATIONS AND LEGAL REQUIREMENTS

Facility staff are required to submit discharge monitoring reports (DMRs) and documents to DEQ NRO, including the following *relevant* data results. The following describe DEQ NRO staff factual observations and identify the applicable legal requirements.

1. *Observations:*

Parameter	Observation – DMR Monitoring Period and Relevant Reported Monitoring Results	Legal Requirement (Permit, Part I.A.2.)
August 2019		
Total Suspended Solids (TSS), Qty. Ave. (KG/D)	0.26	0.19
TSS, Conc. Ave. (mg/L)	17.3	10
TSS, Conc. Weekly Max. (mg/L)	17.3	15

***This facility had 2.2 points in the Compliance Auditing System at the end of August 2019.**

ENFORCEMENT AUTHORITY

Va. Code § 62.1-44.23 of the State Water Control Law provides for an injunction for any violation of the State Water Control Law, any State Water Control Board rule or regulation, an order, permit condition, standard, or any certificate requirement or provision. Va. Code §§ 62.1-44.15 and 62.1-44.32 provide for a civil penalty up to \$32,500 per day of each violation of the same. In addition, Va. Code § 62.1-44.15 authorizes the State Water Control Board to issue orders to any person to comply with the State Water Control Law and regulations, including the imposition of a civil penalty for violations of up to \$100,000. Also, Va. Code § 10.1-1186 authorizes the Director of DEQ to issue special orders to any person to comply with the State Water Control Law and regulations, and to impose a civil penalty. Va. Code §§ 62.1-44.32 (b) and 62.1-44.32 (c) provide for other additional penalties.

FUTURE ACTIONS

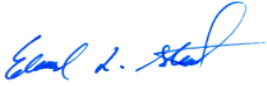
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Please advise us if you dispute any of the observations recited herein or if there is other information of which DEQ should be aware. In the event that discussions with staff do not lead to a satisfactory conclusion concerning the contents of this letter, you may elect to participate in DEQ's Process for Early Dispute Resolution. Also, if informal discussions do not lead to a satisfactory conclusion, you may request in writing that DEQ take all necessary steps to issue a final decision or fact finding under the APA on whether or not a violation has occurred. For further information on the Process for Early Dispute Resolution, please see Agency Policy Statement No. 8-2005 posted on the Department's website under "Programs," "Enforcement," and "Laws, Regulations, & Guidance"

(<http://www.deq.virginia.gov/Programs/Enforcement/Laws,Regulations,Guidance.aspx>) or ask the DEQ contact below.

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Sincerely,



Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy: ECM; Compliance Auditor; and Compliance Manager – DEQ



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY NORTHERN REGIONAL OFFICE

13901 Crown Court, Woodbridge, Virginia 22193
(703) 583-3800

www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas Faha
Regional Director

November 22, 2019

WARNING LETTER

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC.
5805 Staples Mill Road
Richmond, VA 23228

RE: WL No. W2019-11-N-1015
Hill Mobile Home Park 2 - STP
VA0090689
Caroline County

VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson;

The Department of Environmental Quality (DEQ), Northern Regional Office (NRO), has reason to believe that the Six O Five Mobile Home Group, LLC. may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

This letter addresses conditions at the facility named above, and also cites compliance requirements of the State Water Control Law and Regulations. Pursuant to Va. Code § 62.1-44.15 (8a), this letter is not a case decision under the Virginia Administrative Process Act, Va. Code § 2.2-4000 *et seq*. The Department requests that you respond **within 20 days of the date of this letter**.

OBSERVATIONS AND LEGAL REQUIREMENTS

Facility staff are required to submit discharge monitoring reports (DMRs) and documents to DEQ NRO, including the following *relevant* data results. The following describe DEQ NRO staff factual observations and identify the applicable legal requirements.

1. *Observations:*

Parameter	Observation – DMR Monitoring Period and Relevant Reported Monitoring Results	Legal Requirement (Permit, Part I.A.2.)
September 2019		
Total Phosphorous, Conc. Ave. (mg/L)	4.48	2.0

***This facility had 3.2 points in the Compliance Auditing System at the end of September 2019.**

ENFORCEMENT AUTHORITY

Va. Code § 62.1-44.23 of the State Water Control Law provides for an injunction for any violation of the State Water Control Law, any State Water Control Board rule or regulation, an order, permit condition, standard, or any certificate requirement or provision. Va. Code §§ 62.1-44.15 and 62.1-44.32 provide for a civil penalty up to \$32,500 per day of each violation of the same. In addition, Va. Code § 62.1-44.15 authorizes the State Water Control Board to issue orders to any person to comply with the State Water Control Law and regulations, including the imposition of a civil penalty for violations of up to \$100,000. Also, Va. Code § 10.1-1186 authorizes the Director of DEQ to issue special orders to any person to comply with the State Water Control Law and regulations, and to impose a civil penalty. Va. Code §§ 62.1-44.32 (b) and 62.1-44.32 (c) provide for other additional penalties.

FUTURE ACTIONS

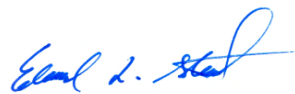
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Please advise us if you dispute any of the observations recited herein or if there is other information of which DEQ should be aware. In the event that discussions with staff do not lead to a satisfactory conclusion concerning the contents of this letter, you may elect to participate in DEQ's Process for Early Dispute Resolution. Also, if informal discussions do not lead to a satisfactory conclusion, you may request in writing that DEQ take all necessary steps to issue a final decision or fact finding under the APA on whether or not a violation has occurred. For further information on the Process for Early Dispute Resolution, please see Agency Policy Statement No. 8-2005 posted on the Department's website under "Programs," "Enforcement," and "Laws, Regulations, & Guidance"

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Sincerely,

A handwritten signature in blue ink, appearing to read "Edward L. Stuart". The signature is fluid and cursive, with a large initial "E" and a stylized "S" at the end.

Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy: ECM; Compliance Auditor; and Compliance Manager – DEQ

Exhibit 5
VDEQ NOVs
(January 2020 through September 2020)



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHERN REGIONAL OFFICE

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(703) 583-3800

www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas Faha
Regional Director

January 3, 2019

NOTICE OF VIOLATION

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC.
5805 Staples Mill Road
Richmond, VA 23228

RE: Referral NOV No. W2019-12-N-0005
Hill Mobile Home Park 2 - STP
VA0090689
Caroline County
VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson:

This letter notifies you of information upon which the Department of Environmental Quality ("Department" or "DEQ") may rely in order to institute an administrative or judicial enforcement action. Based on this information, the DEQ Northern Regional Office (NRO), has reason to believe that the Six O Five Mobile Home Group, LLC. may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq.* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

This letter addresses conditions at the facility named above, and also cites compliance requirements of the State Water Control Law and Regulations. Pursuant to Va. Code § 62.1-44.15 (8a), this letter is not a case decision under the Virginia Administrative Process Act, Va. Code § 2.2-4000 *et seq.* The Department requests that you respond **within 10 days of the date of this letter to arrange a prompt meeting.**

OBSERVATIONS AND LEGAL REQUIREMENTS

Facility staff are required to submit discharge monitoring reports (DMRs) and documents to DEQ NRO, including the following *relevant* data results. The following describe DEQ NRO staff factual observations and identify the applicable legal requirements.

1. *Observations:*

Parameter	Observation – DMR Monitoring Period and Relevant Reported Monitoring Results	Legal Requirement (Permit, Part I.A.2.)
<i>October 2019</i>		
Total Suspended Solids (TSS), Qty. Ave. (KG/D)	0.386	0.19
TSS, Qty. Max. (KG/D)	0.386	0.28
TSS, Conc. Ave. (mg/L)	51	10
TSS, Conc. Max. (mg/L)	51	15
Total Kjeldahl Nitrogen (TKN), Qty. Ave. (KG/D)	0.10	0.06
TKN, Qty. Max. (KG/D)	0.10	0.09
TKN, Conc. Ave. (mg/L)	14.16	3.0
TKN, Conc. Max. (mg/L)	14.16	4.5

2. *Observation:* During the technical inspection conducted on October 9, 2019, DEQ staff observed solids in the receiving stream. DEQ staff did not receive 24-hour notification of the unauthorized discharge from the permittee.

Legal Requirement: Permit Condition, Part II. F. and G. “Unauthorized Discharges. Except in compliance with this permit, or another permit issued by the Board, it shall be unlawful for any person to: 1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances; or 2. Otherwise alter the physical, chemical or biological properties of such state waters and make them detrimental to the public healthy, or to animal or aquatic life, or to the use of such waters for domestic of industrial consumption, or for recreation or for other uses.”...and “Reports of Unauthorized Discharges. Any permittee who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance into or upon state waters in violation of Part II.F.; or who discharges or causes or allows a discharge that may reasonably be expected to enter state waters in violation of Part II.F., shall notify the Department of the discharge immediately upon discovery of the discharge, but in no case later than 24 hours after said discovery.”

3. *Observations:* On October 9, 2019, DEQ staff conducted a compliance site inspection and observed the following:

- The grass inside the treatment facility fence was overgrown;
- There was inadequate aeration in the SBR treatment unit; and
- The biomass in the SBR was gray and had a raw influent aroma.

Legal Requirement: Permit Condition Part II. Q. “Proper Operation and Maintenance The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes effective plant performance,

adequate funding, adequate staffing, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by the permittee only when the operation is necessary to achieve compliance with the conditions of this permit.” Provide photo documentation of the items noted above that have been addressed and/or an explanation of how the facility plans to address the items noted above to DEQ-NRO within thirty days of the date of this inspection report.”

***This facility had 7.2 points in the Compliance Auditing System at the end of October 2019.**

ENFORCEMENT AUTHORITY

Va. Code § 62.1-44.23 of the State Water Control Law provides for an injunction for any violation of the State Water Control Law, any State Water Control Board rule or regulation, an order, permit condition, standard, or any certificate requirement or provision. Va. Code §§ 62.1-44.15 and 62.1-44.32 provide for a civil penalty up to \$32,500 per day of each violation of the same. In addition, Va. Code § 62.1-44.15 authorizes the State Water Control Board to issue orders to any person to comply with the State Water Control Law and regulations, including the imposition of a civil penalty for violations of up to \$100,000. Also, Va. Code § 10.1-1186 authorizes the Director of DEQ to issue special orders to any person to comply with the State Water Control Law and regulations, and to impose a civil penalty. Va. Code §§ 62.1-44.32 (b) and 62.1-44.32 (c) provide for other additional penalties.

FUTURE ACTIONS

DEQ staff wishes to discuss all aspects of their observations with you, including any actions needed to ensure compliance with state law and regulations, any relevant or related measures you plan to take or have taken, and a schedule, as needed, for further activities. In addition, please advise us if you dispute any of the observations recited herein or if there is other information of which DEQ should be aware. In order to avoid adversarial enforcement proceedings, the Six O Five Mobile Home Group, LLC. may be asked to enter into a Consent Order with the Department to formalize a plan and schedule of corrective actions and to settle any outstanding issues regarding this matter, including the assessment of civil charges.

In the event that discussions with staff do not lead to a satisfactory conclusion concerning the contents of this letter, you may elect to participate in DEQ’s Process for Early Dispute Resolution. Also, if informal discussions do not lead to a satisfactory conclusion, you may request in writing that DEQ take all necessary steps to issue a final decision or fact finding under the APA on whether or not a violation has occurred. For further information on the Process for Early Dispute Resolution, please see Agency Policy Statement No. 8-2005 posted on the Department’s website under “Programs,” “Enforcement,” and “Laws, Regulations, & Guidance”

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Please direct written materials regarding this matter to James Datko. Written materials may be sent either via the US Postal Service or electronically, via E-mail. DEQ recommends sending electronic responses as an Acrobat PDF or in a Word-compatible, write-protected format. Please contact her at (703) 583-3870 or by e-mail at James.Datko@deq.virginia.gov **within 10 days of the date of this letter** to discuss this matter and arrange a prompt meeting.

Sincerely,



Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy: ECM; Compliance Auditor; and Compliance Manager – DEQ
Vincent Lofton, Operator - vincentsevensons@aol.com



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY NORTHERN REGIONAL OFFICE

Matthew J. Strickler
Secretary of Natural Resources

13901 Crown Court, Woodbridge, Virginia 22193
(703) 583-3800
www.deq.virginia.gov

David K. Paylor
Director

Thomas Faha
Regional Director

January 26, 2020

NOTICE OF VIOLATION

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC.
5805 Staples Mill Road
Richmond, VA 23228

RE: NOV No. W2020-01-N-0005
Hill Mobile Home Park 2 - STP
VA0090689

Caroline County

VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson:

This letter notifies you of information upon which the Department of Environmental Quality ("Department" or "DEQ") may rely in order to institute an administrative or judicial enforcement action. Based on this information, the DEQ Northern Regional Office (NRO), has reason to believe that the Six O Five Mobile Home Group, LLC. may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq.* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

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OBSERVATIONS AND LEGAL REQUIREMENTS

Facility staff are required to submit discharge monitoring reports (DMRs) and documents to DEQ NRO, including the following *relevant* data results. The following describe DEQ NRO staff factual observations and identify the applicable legal requirements.

1. *Observations:*

Parameter	Observation – DMR Monitoring Period and Relevant Reported Monitoring Results	Legal Requirement (Permit, Part I.A.2.)
November 2019		
Total Suspended Solids (TSS), Qty. Ave. (KG/D)	0.23	0.19
TSS, Conc. Ave. (mg/L)	21	10
TSS, Conc. Max. (mg/L)	21	15

***This facility had 8.2 points in the Compliance Auditing System at the end of November 2019.**

ENFORCEMENT AUTHORITY

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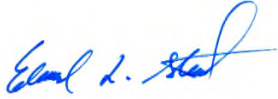
FUTURE ACTIONS

DEQ staff wishes to discuss all aspects of their observations with you, including any actions needed to ensure compliance with state law and regulations, any relevant or related measures you plan to take or have taken, and a schedule, as needed, for further activities. In addition, please advise us if you dispute any of the observations recited herein or if there is other information of which DEQ should be aware. In order to avoid adversarial enforcement proceedings, the Six O Five Mobile Home Group, LLC. may be asked to enter into a Consent Order with the Department to formalize a plan and schedule of corrective actions and to settle any outstanding issues regarding this matter, including the assessment of civil charges.

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Sincerely,



Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy: ECM; Compliance Auditor; and Compliance Manager – DEQ
Vincent Lofton, Operator - vincentsevensons@aol.com



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHERN REGIONAL OFFICE

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Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas Faha
Regional Director

March 3, 2020

NOTICE OF VIOLATION

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC
5805 Staples Mill Road
Richmond, VA 23228

RE: NOV No. W2020-02-N-0015

Hill Mobile Home Park 2 - STP

VA0090689

Caroline County

VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson:

This letter notifies you of information upon which the Department of Environmental Quality ("Department" or "DEQ") may rely in order to institute an administrative or judicial enforcement action. Based on this information, the DEQ Northern Regional Office (NRO), has reason to believe that the Six O Five Mobile Home Group, LLC may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq.* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

This letter addresses conditions at the facility named above, and also cites compliance requirements of the State Water Control Law and Regulations. Pursuant to Va. Code § 62.1-44.15 (8a), this letter is not a case decision under the Virginia Administrative Process Act, Va. Code § 2.2-4000 *et seq.* (APA)

OBSERVATIONS AND LEGAL REQUIREMENTS

Facility staff are required to submit discharge monitoring reports (DMRs) and documents to DEQ NRO, including the following *relevant* data results. The following describe DEQ NRO staff factual observations and identify the applicable legal requirements.

1. *Observations:*

Parameter	Observation – DMR Monitoring Period and Relevant Reported Monitoring Results	Legal Requirement (Permit, Part I.A.2.)
<i>December 2019</i>		
TSS, Concentration (Conc.) Average (Ave.) (mg/L)	24	10
TSS, Conc. Maximum (mg/L)	24	15
Total Nitrogen, As N, Conc. Ave. (mg/L)	X	NL
Total Kjeldahl Nitrogen (TKN) Quantity Avg., (kg/D)	0.31	0.06
TKN, Qty. Max. (kg/D)	0.31	0.09
TKN, Conc. Avg. (mg/L)	21.42	3.0
TKN, Conc. Max. (mg/L)	21.42	4.5

2. *Observation:* The 2019 Annual DMR was due to DEQ-NRO by January 10, 2020 and was received on January 22, 2020.

Legal Requirement: Part 2. Section C. No. 1 states: “The permittee shall submit the results of the monitoring required by this permit not later than the 10th of the month after monitoring takes place unless another reporting schedule is specified elsewhere in this permit. Monitoring results shall be submitted to the department’s regional office.”

***This facility had 9.0 points in the Compliance Auditing System at the end of December 2019.**

ENFORCEMENT AUTHORITY

Va. Code § 62.1-44.23 of the State Water Control Law provides for an injunction for any violation of the State Water Control Law, any State Water Control Board rule or regulation, an order, permit condition, standard, or any certificate requirement or provision. Va. Code §§ 62.1-44.15 and 62.1-44.32 provide for a civil penalty up to \$32,500 per day of each violation of the same. In addition, Va. Code § 62.1-44.15 authorizes the State Water Control Board to issue orders to any person to comply with the State Water Control Law and regulations, including the imposition of a civil penalty for violations of up to \$100,000. Also, Va. Code § 10.1-1186 authorizes the Director of DEQ to issue special orders to any person to comply with the State Water Control Law and regulations, and to impose a civil penalty. Va. Code §§ 62.1-44.32 (b) and 62.1-44.32 (c) provide for other additional penalties.

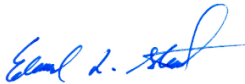
FUTURE ACTIONS

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Please direct written materials regarding this matter to James Datko. Written materials may be sent either via the US Postal Service or electronically, via E-mail. DEQ recommends sending electronic responses as an Acrobat PDF or in a Word-compatible, write-protected format. Please contact him at (703) 583-3870 or by e-mail at James.Datko@deq.virginia.gov **within 10 days of the date of this letter** to discuss this matter and arrange a prompt meeting.

Sincerely,



Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy:

ECM; Compliance Auditor; Compliance Manager; and Enforcement – DEQ
Vincent Lofton, Operator - vincentsevensons@aol.com



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHERN REGIONAL OFFICE

13901 Crown Court, Woodbridge, Virginia 22193

(703) 583-3800

www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas Faha
Regional Director

May 19, 2020

NOTICE OF VIOLATION

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC
5805 Staples Mill Road
Richmond, VA 23228

RE: NOV No. W2020-05-N-0007

Hill Mobile Home Park 2 - STP

VA0090689

Caroline County

VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson:

This letter notifies you of information upon which the Department of Environmental Quality ("Department" or "DEQ") may rely in order to institute an administrative or judicial enforcement action. Based on this information, the DEQ Northern Regional Office (NRO), has reason to believe that the Six-O-Five Mobile Home Group, Limited Liability Corporation (LLC) may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq.* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

This letter addresses conditions at the facility named above, and also cites compliance requirements of the State Water Control Law and Regulations. Pursuant to Va. Code § 62.1-44.15 (8a), this letter is not a case decision under the Virginia Administrative Process Act, Va. Code § 2.2-4000 *et seq.* (APA)

OBSERVATIONS AND LEGAL REQUIREMENTS

Facility staff are required to submit discharge monitoring reports (DMRs) and documents to DEQ NRO, including the following *relevant* data results. The following describe DEQ NRO staff factual observations and identify the applicable legal requirements.

1. *Observations:*

Parameter	Observation – DMR Monitoring Period and Relevant Reported Monitoring Results	Legal Requirement (Permit, Part I.A.2.)
<i>March 2020</i>		
TSS, Quantity (Qty.) Average (Avg.) (kg/D)	0.43	0.19
TSS, Qty. Maximum (Max.) (kg/D)	0.43	0.28
TSS, Concentration (Conc.) Avg. (mg/L)	29	10
TSS, Conc. Max. (mg/L)	29	15
TKN (N-KJEL), Qty. Avg. (kg/D)	0.15	0.06
TKN (N-KJEL), Qty. Max. (kg/D)	0.15	0.09
TKN (N-KJEL), Conc. Avg. (mg/L)	10.06	3.0
TKN (N-KJEL), Conc. Max. (mg/L)	10.06	4.5

***This facility had 9.0 points in the Compliance Auditing System at the end of March 2020.**

ENFORCEMENT AUTHORITY

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FUTURE ACTIONS

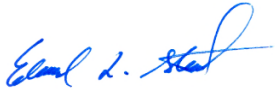
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fact finding under the APA on whether or not a violation has occurred. For further information on the Process for Early Dispute Resolution, please see Agency Policy Statement No. 8-2005 posted on the Department's website under "Programs," "Enforcement," and "Laws, Regulations, & Guidance" (<http://www.deq.virginia.gov/Programs/Enforcement/Laws,Regulations,Guidance.aspx>) or ask the DEQ contact listed below.

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Sincerely,

A handwritten signature in blue ink, appearing to read "Edward L. Stuart".

Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy:

ECM; Compliance Auditor; Compliance Manager; and Enforcement – DEQ
Vincent Lofton, Operator - vincentsevensons@aol.com



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY NORTHERN REGIONAL OFFICE

Matthew J. Strickler
Secretary of Natural Resources

13901 Crown Court, Woodbridge, Virginia 22193
(703) 583-3800
www.deq.virginia.gov

David K. Paylor
Director

Thomas Faha
Regional Director

June 15, 2020

NOTICE OF VIOLATION

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC
5805 Staples Mill Road
Richmond, VA 23228

RE: NOV No. W2020-06-N-0005
Hill Mobile Home Park 2 - STP
VA0090689

Caroline County

VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson:

This letter notifies you of information upon which the Department of Environmental Quality ("Department" or "DEQ") may rely in order to institute an administrative or judicial enforcement action. Based on this information, the DEQ Northern Regional Office (NRO), has reason to believe that the Six-O-Five Mobile Home Group, Limited Liability Corporation (LLC) may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq.* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

This letter addresses conditions at the facility named above, and also cites compliance requirements of the State Water Control Law and Regulations. Pursuant to Va. Code § 62.1-44.15 (8a), this letter is not a case decision under the Virginia Administrative Process Act, Va. Code § 2.2-4000 *et seq.* (APA)

OBSERVATIONS AND LEGAL REQUIREMENTS

Facility staff are required to submit discharge monitoring reports (DMRs) and documents to DEQ NRO, including the following *relevant* data results. The following describe DEQ NRO staff factual observations and identify the applicable legal requirements.

1. *Observation:*

Parameter	Observation – DMR Monitoring Period and Relevant Reported Monitoring Results	Legal Requirement (Permit, Part I.A.2.)
April 2020		
TKN (N-KJEL), Conc. Avg. (mg/L)	4.23	3.0

***This facility had 6.0 points in the Compliance Auditing System at the end of April 2020.**

ENFORCEMENT AUTHORITY

Va. Code § 62.1-44.23 of the State Water Control Law provides for an injunction for any violation of the State Water Control Law, any State Water Control Board rule or regulation, an order, permit condition, standard, or any certificate requirement or provision. Va. Code §§ 62.1-44.15 and 62.1-44.32 provide for a civil penalty up to \$32,500 per day of each violation of the same. In addition, Va. Code § 62.1-44.15 authorizes the State Water Control Board to issue orders to any person to comply with the State Water Control Law and regulations, including the imposition of a civil penalty for violations of up to \$100,000. Also, Va. Code § 10.1-1186 authorizes the Director of DEQ to issue special orders to any person to comply with the State Water Control Law and regulations, and to impose a civil penalty. Va. Code §§ 62.1-44.32 (b) and 62.1-44.32 (c) provide for other additional penalties.

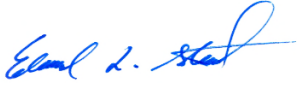
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Sincerely,

A handwritten signature in blue ink, appearing to read "Edward L. Stuart".

Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy:

ECM; Compliance Auditor; Compliance Manager; and Enforcement – DEQ
Matthew Raynor, Environmental Consultant – tarmatt@aol.com



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHERN REGIONAL OFFICE

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(703) 583-3800

www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas Faha
Regional Director

August 25, 2020

NOTICE OF VIOLATION

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC
5805 Staples Mill Road
Richmond, VA 23228

RE: NOV No. W2020-08-N-0009

Hill Mobile Home Park 2 - STP

VA0090689

Caroline County

VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson:

This letter notifies you of information upon which the Department of Environmental Quality ("Department" or "DEQ") may rely in order to institute an administrative or judicial enforcement action. Based on this information, the DEQ Northern Regional Office (NRO), has reason to believe that the Six-O-Five Mobile Home Group, Limited Liability Corporation (LLC) may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq.* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

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1. *Observations:*

Parameter	Observation – DMR Monitoring Period and Relevant Reported Monitoring Results	Legal Requirement (Permit, Part I.A.2.)
<i>June 2020</i>		
TSS, Quantity (Qty.) Average (Avg.) (kg/D)	0.84	0.19
TSS, Qty. Maximum (Max.) (kg/D)	0.84	0.28
TSS , Concentration (Conc.) Avg. (mg/L)	72.0	10
TSS Conc. Max. (mg/L)	72.0	15
TKN (N-KJEL), Qty. Avg. (mg/L)	0.13	0.06
TKN (N-KJEL), Qty. Max. (kg/D)	0.13	0.09
TKN (N-KJEL), Conc. Avg. (mg/L)	7.79	3.0
TKN (N-KJEL), Conc. Max. (mg/L)	7.79	4.5
CBOD5, Qty. Avg. (mg/L)	0.26	0.19
CBOD5, Conc. Avg. (mg/L)	22	10
CBOD5, Conc. Max. (mg/L)	22	15

***This facility had 6.0 points in the Compliance Auditing System at the end of June 2020.**

ENFORCEMENT AUTHORITY

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Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy:

ECM; Compliance Auditor; Compliance Manager; and Enforcement – DEQ

Matthew Raynor, Environmental Consultant – tarmatt@aol.com



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHERN REGIONAL OFFICE

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(703) 583-3800

www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas Faha
Regional Director

September 22, 2020

NOTICE OF VIOLATION

Mr. Jimmy Benson
Manager Member
Six-O-Five Mobile Home Group, LLC
dba SMG, LLC
5805 Staples Mill Road
Richmond, VA 23228

RE: NOV No. W2020-09-N-0009

Hill Mobile Home Park 2 - STP

VA0090689

Caroline County

VIA E-MAIL: Jimmy@JimmyBenson.com

Dear Mr. Benson:

This letter notifies you of information upon which the Department of Environmental Quality ("Department" or "DEQ") may rely in order to institute an administrative or judicial enforcement action. Based on this information, the DEQ Northern Regional Office (NRO), has reason to believe that the Six-O-Five Mobile Home Group, Limited Liability Corporation (LLC) may be in violation of State Water Control Law § 62.1-44 and the Virginia Pollutant Discharge Elimination System (VPDES) Permit regulation 9 VAC 25-31-50.A *et seq.* at the Hill Mobile Home Park 2 – Sewage Treatment Plant (STP) facility.

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1. *Observations:*

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<i>July 2020</i>		
TSS, Quantity (Qty.) Average (Avg.) (kg/D)	0.72	0.19
TSS, Qty. Maximum (Max.) (kg/D)	0.90	0.28
TSS , Concentration (Conc.) Avg. (mg/L)	54.0	10
TSS Conc. Max. (mg/L)	68.0	15
Total Phosphorous, Conc. Avg. (mg/L)	3.92	2.0
TKN (N-KJEL), Conc. Avg. (mg/L)	3.98	3.0
TKN (N-KJEL), Conc. Max. (mg/L)	5.93	4.5
CBOD5, Conc. Avg. (mg/L)	11	10

***This facility had 7.0 points in the Compliance Auditing System at the end of July 2020.**

ENFORCEMENT AUTHORITY

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Sincerely,

A handwritten signature in blue ink, appearing to read "Edward L. Stuart".

Edward L. Stuart
Regional Water Compliance Manager

cc via electronic copy:

ECM; Compliance Auditor; Compliance Manager; and Enforcement – DEQ
Matthew Raynor, Environmental Consultant – tarmatt@aol.com

Exhibit 6
Discharger Compliance Response Emails and Letters

>

October 9, 2019

Rebecca Johnson
Inspector
DEQ
13901 Crown Court
Woodbridge VA, 22193

Dear Mrs. Johnson:

This communication is about a warning letter for Hills Mobile Park permit number VA0090689 TSS exceedance. During this reporting period, we found that there was a power failure at the facility and the system had to be manually reset as a result of the system being off for a majority of the day coupled with the elevated temperature I think there was some biological die off that resulted in the elevated results for this reporting period. Since then we have had the anoxic tank pumped out and have adjusted the aspirator run times. We also continue to add alum to help precipitate out some of the colloids we also use polymer to aid in floc formation and settling. In conclusion, we are making every attempt to meet permit requirements and appreciate any assistance you can render.

Thanks

Vincent Lofton

Enclosure

From: vincentsevensons@aol.com
To: rebecca.johnson@deq.virginia.gov
Subject: Letter Of Non Compliance Hill Mobile Home Park
Date: Friday, October 11, 2019 4:31:27 AM

Good morning Ms.Johnson

I am Writing in reference to Hill Mobile Park VA0090689 letter of non compliance for the eDMR submitted for august 2019

The Parks WWTP exceeded the TSS parameters for the monthly reporting period ,I believe that due to a power failure and the SBR system

not resetting created a temporary loss of treatment that effected the biomass .We reset the system and began adding supplemental bacteria to aid in recovery. we continue to make adjustments to the system we extended the reaction time/aeration and mixing to aid in recovery .

If you have any questions please call 804-909-1993

Thanks
Vincent Lofton

From: vincentsevensons@aol.com
To: rebecca.johnson@deq.virginia.gov
Subject: Hill Mobile Park September 2019
Date: Tuesday, October 15, 2019 1:44:03 PM

Good afternoon Ms. Johnson

I am writing you in reference to Hill mobile park VA0090689 letter of non compliance on total phosphorus limits the test results

indicated 4.48 mg/l and the limits are 2.0 mg/l . We recently pumped out the anoxic tank on the system which is the only thing I can think of to

attribute the elevated results .Going forward we have increased our alum dose and extended the settling time cycle in the SBR PLC setting

I am hopeful that this will correct the elevated readings please let me know if you have any questions.

Thanks
Vincent Lofton
804-909-1993

From: vincentsevensons@aol.com
To: rebecca.johnson@deq.virginia.gov
Subject: Hill MHP -VA0090689
Date: Friday, November 15, 2019 4:47:19 PM

Good afternoon Mrs. Johnson

I am following up on the compliance R-con inspection performed on 11/8/19 as requested we reported per your observations that there was a potential loss of solids that may have entered the receiving stream /Maracossic creek on the DEQ web site after receiving your report as a matter of protocol . We inspected the receiving stream and could not verify any solids loss of the magnitude displayed in the photo and mentioned in the report .But we do acknowledge there are some treatment concerns that have and are being addressed we have started adding supplemental bacteria to accelerate the recovery of the biomass which I believe was a toxic shock to the system ,We have checked the aeration settings on the PLC they are at 3 minutes and the residual of dissolved oxygen is well within parameters Averaging 4.0 PPM we have are adding soda ash for ph. adjustments .And have began supplementing the food source with moderate amounts of sugar to aid in the biomass recovery .As always I appreciate any suggestions or help you can render.

Thanks
Vincent Lofton

Vincent Lofton

> [Job Title]

> [Job Title]

[Address 1]

[Address 2]

[City, ST ZIP Code]

[Telephone]

[Email]

[Website]

December 12, 2019

Rebecca Johnson
Water Compliance Inspector
Department of Environmental Quality
13901 Crown Court
Woodbridge VA.22193

Dear Mrs. Johnson

This communication is in response to a warning letter dated 11/22/19 VA0090689WL referencing a reported exceedance for Hill Mobile Home Park for total phosphorus for 9/2019 DMR reporting period. During the time frame we are referencing we had recently had the anaerobic tank pumped out and experienced a minor reduction in treatment our adjustment where to increase alum use to help precipitate out phosphorus and increasing the reaction cycle on the SBR PLC.

WE continue to make adjustments to the system, including the addition of cold weather bacteria after meeting with Maryland Biochemical to assist in improving the overall performance of the facility .We have seen encouraging results. Please let me know if you have any questions.

Sincerely,
Vincent Lofton

From: [Matthew Raynor](#)
To: ["Rebecca Johnson"; "Jimmy Benson"](#)
Cc: ["Datko, Jim"](#)
Subject: RE: VA0090689 Notice of Violation
Date: Tuesday, August 25, 2020 10:05:18 AM

Ms. Johnson,

In response to your attached NOV for Hill MHC WWTP; We have made numerous changes to correct operating issues with the PLC that controls the SBR. These and other changes are putting the facility on a path to compliance. We had continuing issues in July as well but so far in August we are on track. You have been sent continual reports weekly from the operators.

Please contact me or John if you need anything.

Matthew Raynor,
REE Va. Inc

Matthew E. Raynor
524 Meadow Ave. Loop
Banner Elk, NC 28604
B (828) 733-5028
C (919) 270-4831

From: Rebecca Johnson <rebecca.johnson@deq.virginia.gov>
Sent: Tuesday, August 25, 2020 9:27 AM
To: Jimmy Benson <jimmy@jimmybenson.com>
Cc: Matthew Raynor <tarmatt@aol.com>; Datko, Jim <james.datko@deq.virginia.gov>
Subject: VA0090689 Notice of Violation

Good morning,

Attached is a copy of the above referenced document. Should you have any questions please feel free to contact me.

V/r,
Rebecca Johnson

Department of Environmental Quality
Northern Regional Office
Water Compliance Inspector Senior II
13901 Crown Court
Woodbridge, VA 22193
Office: (703) 583-3854

Please report all pollution incidents, including SSO's and suspected violations of state environmental law, via the DEQ website: <https://www.deq.virginia.gov/Programs/PollutionResponsePreparedness/MakingaReport.aspx>

From: [Matthew Raynor](mailto:Matthew_Raynor@deq.virginia.gov)
To: rebecca.johnson@deq.virginia.gov; jimmy@jimmybenson.com
Cc: james.datko@deq.virginia.gov
Subject: Re: VA0090689 Notice of Violation
Date: Tuesday, September 22, 2020 10:34:04 AM

Ms. Johnson,

We have overcome many challenges at the Hill's WWTP. We rectify one issue just to discover another. We hope we are at the bottom of the "issues" barrel. July was full of problems with PLC adjustments, which were wreaking havoc on the bio-mass. Reseeding bio-mass and trying to constantly restart the plant. The only thing I can say is we never allowed any solids to discharge and spent a load of time make sure we had the plant in operation but we ironed out those issues to only discover new ones. We bombed in August due to problems with the influent line, pumps and tanks. These had to be replaced which took a lot of time to troubleshoot, then come up with solutions. We think we have most of those settled. We remain in high hopes for September. We feel a little like "Sisyphus" but we keep push the rock!

Matt

-----Original Message-----

From: Rebecca Johnson <rebecca.johnson@deq.virginia.gov>
To: Jimmy Benson <jimmy@jimmybenson.com>
Cc: Matthew Raynor <tarmatt@aol.com>; Datko, Jim <james.datko@deq.virginia.gov>
Sent: Tue, Sep 22, 2020 9:58 am
Subject: VA0090689 Notice of Violation

Good morning Jimmy,

Attached is a copy of the above referenced document. Should you have any questions please feel free to contact me.

V/r,
Rebecca Johnson

Department of Environmental Quality
Northern Regional Office
Water Compliance Inspector Senior II
13901 Crown Court
Woodbridge, VA 22193
Office: (703) 583-3854

Please report all pollution incidents, including SSO's and suspected violations of state environmental law, via the DEQ website: <https://www.deq.virginia.gov/Programs/PollutionResponsePreparedness/MakingaReport.aspx>

Exhibit 7
VDEQ October 2019 Compliance Inspection Report



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHERN REGIONAL OFFICE

13901 Crown Court, Woodbridge, Virginia 22193

(703) 583-3800

www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas A. Faha
Regional Director

November 8, 2019

Mr. James Benson
Six-O-Five Mobile Home Group, LLC
P.O. Box 70367
Richmond, VA 23255-0367

Re: **Hill MHP- STP - Permit # VA0090689**

Dear Mr. Benson:

Attached is a copy of the Inspection Report generated while conducting a Facility Recon Inspection at Hill Mobile Home Park (MHP) Sewage Treatment Plant (STP), on October 9, 2019. This letter is not intended as a case decision under the Virginia Administrative Process Act, Va. Code § 2.2-4000 et seq. (APA).

Please review the "Request for Corrective Action" section and submit in writing, a narrative outlining how the facility plans to address these items, to the Department of Environmental Quality – Northern Regional Office (DEQ-NRO) within thirty dates from the date of this inspection report. If you have any questions or comments concerning this report, please feel free to contact me at (703) 583-3854 or email at Rebecca.Johnson@deq.virginia.gov

Sincerely,

A handwritten signature in purple ink that reads "Rebecca L. Johnson".

Rebecca Johnson
Environmental Specialist II

cc via electronic copy:

ECM; Compliance Manager; Compliance Auditor; and Compliance Inspector - DEQ

James Benson; Jimmy@JimmyBenson.com

Vincent Lofton, Operator; Vincentsevensons@aol.com

Virginia Department of Environmental Quality

COMPLIANCE INSPECTION REPORT

FACILITY NAME: Hill MHP - STP		INSPECTION DATE: <u>October 9, 2019</u>	
		INSPECTOR <u>Rebecca Johnson</u>	
PERMIT No.: <u>VA0073504</u>		REPORT DATE: <u>November 8, 2019</u>	
TYPE OF FACILITY: ☒ Municipal ☐ Major ☐ Industrial ☒ Minor ☐ Federal ☐ Small Minor		TIME OF INSPECTION:	
		1430	1510
		TOTAL TIME SPENT (including prep & travel) <u>8 Hours</u>	
PHOTOGRAPHS: ☒ Yes ☐ No		UNANNOUNCED INSPECTION? ☒ Yes ☐ No	
REVIEWED BY / Date: <u><i>Elena L. Stash</i></u> <u>11/8/19</u>			
PRESENT DURING INSPECTION: Amy Hagerdon, DEQ			

<u>WL # W2019-10-N-1041:</u> <u>Paraphrase Noncompliance issues</u>	<u>Reported Cause of Noncompliance:</u>	<u>Corrective Action Taken:</u>
1. TSS, Qty. Ave. Exceedance 2. TSS, Conc. Ave. Exceedance 3. TSS, Conc. Weekly Max. Exceedance	Power failure to SBR effected biomass	Reset system and is feeding bacteria to aid in the recovery

INSPECTION OVERVIEW AND CONDITION OF TREATMENT UNITS

DEQ staff arrived onsite for an unannounced site inspection and Mr. Lofton, Operator, was not onsite. The purpose of this site visit was to observe the treatment system, outfall and receiving stream.

Facility Tour

Sequencing Batch Reactor

The grass inside the fence was overgrown. The unit was not aerating upon arrival. The activated sludge in this unit was gray and had a raw influent aroma, **Photos 1 & 2**. The blowers started and aerated the SBR for two minutes and then shut off, **Photo 3**. There was inadequate aeration in the SBR treatment unit.

See Request for Corrective Action.

Chlorine Contact Chamber and Tank (CCC and CCT)

There were chlorine tablets readily available to disinfect the SBR effluent prior to final effluent discharge, **Photo 4**. The water in the CCT was green, **Photo 5**.

Outfall 001

The treatment system was not discharging while DEQ staff was onsite. There was a raw influent aroma at the outfall pipe and there were solids in the receiving stream, **Photos 6 – 9**.

See Request for Corrective Action.

Operations staff did not report the solids in the receiving stream to DEQ within 24-hours.

See Request for Corrective Action.

DEQ staff departed at 1510.

VA DEQ Recon Inspection Report

Permit #	VA0090689
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EFFLUENT FIELD DATA: N/A

Flow	MGD	Dissolved Oxygen	mg/L	TRC (Contact Tank)	N/A
pH	S.U.	Temperature	°C	TRC (Final Effluent)	N/A
Was a Sampling Inspection conducted? ☐ Yes (See Sampling Inspection) ☒ No					

CONDITION OF OUTFALL AND EFFLUENT CHARACTERISTICS:

1. Type of outfall: ☒ Shore Based ☐ Submerged	Diffuser? ☐ Yes ☒ No
2. Are the outfall and supporting structures in good condition?	☒ Yes ☐ No
3. Final Effluent (evidence of following problems): ☒ Sludge Bar ☐ Grease	
☐ Turbid effluent ☐ Visible foam ☐ Unusual color ☐ Oil sheen	
4. Is there a visible effluent plume in the receiving stream?	☐ Yes ☒ No
5. Receiving stream: ☐ No observed problems ☒ Indication of problems (explain below)	
<u>Comments:</u> Solids were observed in the receiving stream.	

VA DEQ Recon Inspection Report

REQUEST for CORRECTIVE ACTION:

1. *Observation(s)*: During the October 9, 2019 inspection, sludge solids were observed in the receiving stream.

Legal Requirement: Permit Condition Part II, Section F, Unauthorized Discharges, states, "Except in compliance with this permit, or another permit issued by the Board, it shall be unlawful for any person to

- 1) discharge into state waters sewage, industrial waste, other wastes, or any noxious or deleterious substances; or
- 2) Otherwise alter the physical, chemical or biological properties of such state waters and make them detrimental to the public health, or to animal or aquatic life, or to the use of such waters for domestic industrial consumption, or for recreation or for other uses.

G. Reports of Unauthorized Discharges. Any permittee who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance into or upon state waters in violation of Part II.F; or who discharges or causes or allows a discharge that may reasonably be expected to enter state waters in violation of Part II.F, shall notify the Department of the discharge immediately upon discovery of the discharge, but in no case later than 24 hours after said discovery. A written report of the unauthorized discharge shall be submitted to the Department within five days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;
2. The cause of the discharge;
3. The date on which the discharge occurred;
4. The length of time that the discharge continued;
5. The volume of the discharge;
6. If the discharge is continuing, how long it is expected to continue;
7. If the discharge is continuing, what the expected total volume of the discharge will be; and
8. Any steps planned or taken to reduce, eliminate and prevent a recurrence of the present discharge or any future discharges not authorized by this permit.

Discharges reportable to the Department under the immediate reporting requirements of other regulations are exempted from this requirement.

H. Reports of Unusual or Extraordinary Discharges. If any unusual or extraordinary discharge including a bypass or upset should occur from a treatment works and the discharge enters or could be expected to enter state waters, the permittee shall promptly notify, in no case later than 24 hours, the Department by telephone after the discovery of the discharge. This notification shall provide all available details of the incident, including any adverse affects on aquatic life and the known number of fish killed. The permittee shall reduce the report to writing and shall submit it to the Department within five days of discovery of the discharge in accordance with Part II.I.2. Unusual and extraordinary discharges include but are not limited to any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;
2. Breakdown of processing or accessory equipment;
3. Failure or taking out of service some or all of the treatment works; and
4. Flooding or other acts of nature

DEQ staff would like to remind the permittee that when solids are observed in the stream, this must be reported to DEQ-NRO within 24 hours of discovery.

VA DEQ Recon Inspection Report

2. *Observations:* On October 9, 2019, DEQ staff conducted a compliance site inspection and observed the following:
- The grass inside the treatment facility fence was overgrown;
 - There was inadequate aeration in the SBR treatment unit; and
 - The biomass in the SBR was gray and had a raw influent aroma.

Legal Requirement: Permit Condition Part II. Q. “Proper Operation and Maintenance The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes effective plant performance, adequate funding, adequate staffing, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by the permittee only when the operation is necessary to achieve compliance with the conditions of this permit.” Provide photo documentation of the items noted above that have been addressed and/or an explanation of how the facility plans to address the items noted above to DEQ-NRO within thirty days of the date of this inspection report.

Provide an explanation as to how the permittee plans to address the items noted above to DEQ-NRO within thirty days of the date of this inspection report.

NOTES and COMMENTS:

None.



SBR



1) SBR – Overgrown Grass – Poor housekeeping

2) Thin and Gray biomass in SBR



3) SBR Aerating and Overgrown Grass – Poor housekeeping

4) Chlorination Unit – Overgrown Grass - Poor housekeeping



5) Basin Prior to Post Aeration Tank – Green water



6) Outfall 001 Pipe



7) Solids in the receiving stream



8) Solids in the receiving stream



9) Solids in the receiving stream

Exhibit 8
Examples of Plant Documentation and Recordkeeping
(Operational Data and Calibration Logs)

MONTH OCT		YEAR 2020		HILL WWTP MONTHLY MONITORING											
DATE	TOTALIZER	FLOW	TIME	DO	SAMPLE TIME	TIME	PH	TIME	SL2	TIME	THC	EST	TIME	OPEN	
1	1905 GALLONS		9:26AM	7.64	9:31	9:36	7.40	9:41	2.20	9:46	0	22.7	9:51	SAF	
2	1143 GALLONS		9:30AM	7.72	9:35	9:40	8.00	9:45	2.20	9:50	0	22.9	9:55	SAF	
3	1905 GALLONS		9:30	7.72	9:35	9:40	8.00	9:45	2.20	9:50	0	22.9	9:55	SAF	
4	1524 GALLONS		10:00	7.61	10:05	10:10	7.75	10:15	2.25	10:20	0	22.9	10:25	SAF	
5	1143 GALLONS		10:00	8.13	10:05	10:10	8.17	10:15	2.37	10:20	0	21.0	10:25	SAF	
6	1524 GALLONS		8:40AM	8.30	8:45AM	8:50AM	8.31	8:55AM	1.66	9:00AM	0	20.5	9:05AM	SAF	
7	3048 GALLONS		8:35AM	8.02	8:40AM	8:45AM	7.98	8:50AM	1.60	8:55AM	0	20.4	9:00AM	SAF	
8	0 GALLONS		9:00AM												
9	3048 GALLONS		8:15AM	7.93	8:20AM	8:25AM	7.90	8:30AM	2.44	8:35AM	0	20.3	8:40AM	SAF	
10	4454-5334 GALS		12:20	7.90	12:25	12:30	7.91	12:35	2.40	12:40	0	20.4	12:45	SAF	
11	3810 GALS		10:30	7.62	10:35	10:40	7.40	10:45	2.20	10:50	0	20.7	10:55	SAF	
12	6364-478-5334 GALS		9:43 AM	7.60	9:48	9:53	7.52	9:58	2.20	10:03	0	21.8	10:08	SAF	
13	4470 GALS		10:47 AM	7.94	10:52	10:57	8.24	11:02	2.20	11:07	0	21.8	11:12	SAF	
14	4502 GALS		12:15	7.95	12:20	12:25	7.77	12:30	2.35	12:35	0	21.5	12:40	SAF	
15	4572 GALS		10:05 AM	8.13	10:10	10:15	7.92	10:18	2.20	10:23	0	21.9	10:28	SAF	
16	4572 GALLONS		11:02 AM	7.96	11:07	11:12	7.92	11:17	2.20	11:22	0	21.9	11:27	SAF	
17	4572 GALLONS		1:30 PM	7.66	1:35 PM	1:40 PM	7.72	1:45 PM	2.66	1:50 PM	0	21.6	1:55 PM	SAF	
18	4546 GALLONS		12:30	7.74	12:35	12:40	7.80	12:45	2.41	12:50	0	21.7	12:55	SAF	
19	3429 GALS		9:32	8.40	9:37	9:42	7.75	9:47	2.31	9:52	0	20.5	9:57	SAF	
20	4191 GALS		9:42 AM	8.33	9:47	9:52	8.18	9:57	2.20	10:02	0	20.5	10:07	SAF	
21	3810 GALS		10:50	8.51	10:55	11:00	7.98	11:05	2.20	11:10	0	21.8	11:15	SAF	
22	3810 GALS		10:15	8.22	10:20	10:25	8.01	10:30	2.27	10:35	0	21.6	10:40	SAF	
23	5213 GALS		9:130	8.15	9:135	9:140	7.97	9:145	2.22	9:150	0	21.9	9:155	SAF	
24	6096 GALS		1:20	8.24	1:25	1:30	7.77	1:35	2.20	1:40	0	21.8	1:45	SAF	
25	4191 Gal		9:145	8.70	9:150	9:155	7.94	9:160	2.35	9:165	0	21.8	9:170	SAF	
26	5715 GALS		10:05	8.31	10:10	10:15	8.04	10:20	2.88	10:25	0	20.8	10:30	SAF	
27	4953 GALS		9:25AM	8.70	9:30AM	9:35AM	7.93	9:40AM	2.66	9:45AM	0	20.5	9:50AM	SAF	
28	6096 GALS		9:40AM	8.75	9:45AM	9:50AM	8.01	9:55AM	3.29	10:00AM	0	21.5	10:05AM	SAF	
29	3429 GALS		7:05AM	8.16	7:10AM	7:15AM	7.63	7:20AM		7:25AM	0		7:30AM		
30															
31															

EXAM 10AL/45 SEC

OCT 9 2020 EECU

OCT 15 2020 E.101

BOB TOS Ten Ten Pumping ECU1

SAMPLE DATE

EXAM 1 GAL/45 SEC

SAMPLE DATE

OCT 9, 2020 ECOLI
 OCT 15, 2020 E. coli
 OCT 22, 2020 CBOO TSS, THY Total Phosphate, ECOLI
 OCT 28, 2020 CBOO TSS, THY Total Phosphate, ECOLI

Oct 22, 2020 NCH 10:11am Settle-260
 AB EFF
 DO-9.49 Temp-22.6 | DO-8.82 Temp-21.4
 PH-7.40 PH-8.01
 CL²-2.27 CL²EFF-0 Batch-4586
 CL²pills-3 D-Chlor pills-0
 Added all samples

Oct 23, 2020 NCH 9:30 Settle
 AB EFF
 DO-4.27 Temp-22.8 | DO-8.15 Temp-21.5
 PH-7.56 PH-7.87
 CL²-2.24 CL²EFF-0 Batch-4596
 CL²pills-0 D-Chlor pills-0

Oct 29, 2020 NCH 1:20 Settle-300
 AB EFF
 DO-6.55 Temp-21.4 | DO-8.24 Temp-22.4
 PH-7.57 PH-7.73
 CL²-2.20 CL²EFF-0 Batch-4612
 CL²pills-4 D-Chlor pills-4

Oct 25, 2020 NCH 9:45am Settle-300
 AB EFF
 DO-7.40 Temp-21.2 | DO-8.70 Temp-21.0
 PH-7.41 PH-7.94
 CL²-2.35 CL²EFF-0 Batch-4623
 CL²pills-0 D-Chlor pills-6

Oct 26, 2020 NCH 10:05am Settle-300
 AB EFF
 DO-5.90 Temp-21.2 | DO-8.31 Temp-19.8
 PH-7.47 PH-8.04
 CL²-2.17 CL²pills-1 CL²EFF-0
 D-Chlor pills-0 Batch-4638

Oct 27, 2020 JPS 9:25am Settle-250 Batch-4651

AERATION BASIN		EFFLUENT	
DO-7.76	Temp-21.3	DO-8.70	Temp-20.0
PH-7.56	Temp-21.3	PH-7.95	Temp-20.0
CL ² -2.88	CL ² EFFLUENT-	CL ² pills-5	D-Chlor pills-7

 Dewatered Digester Tank, 4,953 Gallons

Oct 2020

PH METER CALIBRATION

DATE	TIME	BUFFER #7	BUFFER #4	BUFFER #10	READING #7	TEMP.	COMMENTS
1	7:30	7.0	4.1	10.0	7.0	17.3	MC
2		7.0	4.1	10.1	7.1	17.9	NCH
3	7:05	7.1	4.0	10.0	7.0	18.2	MC
4	7:20	7.0	4.1	10.0	7.0	19.7	MC
5	7:25	7.1	4.0	10.0	7.0	19.1	MC
10-6	6:30	7.0	4.0	10.0	7.0	19.3	JAD
10-7	8:30	7.0	4.0	10.0	7.0	19.5	JAD
10-8	9:00	7.0	4.0	10.0	7.0	18.9	JAD
10-9	7:45	7.1	4.1	10.1	7.0	17.9	MC
10-10	6:50	7.0	4.1	10.0	7.0	18.1	KSM
10-11	6:30	7.0	4.0	10.1	7.0	18.9	KSM
10-12	7:55	7.1	4.1	10.0	7.0	20.9	MC
10-13	7:30	7.1	4.1	10.1	7.0	18.0	MC
10-14	6:00	7.0	4.0	10.0	7.0	18.1	JAD
10-15	6:00	7.1	4.0	10.0	7.0	18.3	JAD
10-16	6:00	7.0	4.1	10.1	7.0	17.1	JSP
10-17	7:15	7.1	4.0	10.1	7.0	17.2	JSP
10-18	7:30	7.1	4.1	10.0	7.0	17.1	JAD
10-19	7:30	7.0	4.1	10.1	7.0	16.2	MC
10-20	7:05	7.0	4.1	10.1	7.0	17.3	MC
10-21	7:00	7.1	4.1	10.1	7.0	19.4	JAD
10-22	7:35	7.1	4.1	10.0	7.0	19.3	MC
10-23	7:40	7.0	4.0	10.1	7.0	19.9	WLC
10-24	9:00	7.1	4.1	10.1	7.0	18.5	NCH
10-25	6:00	7.0	4.0	10.0	7.0	18.8	NCH
10-26	7:35	7.1	4.0	10.1	7.0	18.9	MC
10-27	7:30	7.0	4.1	10.1	7.0	17.3	NLC
10-28	7:00 AM	7.0	4.0	10.0	7.0	18.4	JPS
10-29	6:20 AM	7.00	4.01	10.01	7.03	19.7	JPS

CL2 METER CALIBRATION

Oct 20 2020

DATE	TIME	ZERO	0.21 +/- 0.09	0.92 +/- 0.10	1.63 +/- 0.14	
1	7:35	0	.21	.92	1.62	WCH
2	7:45	0	.21	.92	1.62	WCH
3	7:05	0	.21	.93	1.62	WCH
4	7:20	0	.22	.93	1.62	WCH
5	7:30	0	.21	.94	1.62	WCH
10-6	6:30	0	.21	.93	1.62	WCH
10-7	8:30	0	.22	.93	1.62	JAD
10-8	8:00	0	.21	.93	1.62	JAD
10-9	7:45	0	.21	.92	1.60	WCH
10-10	6:50	0	.20	.92	1.61	WCH
10-11	6:30	0	.22	.93	1.61	WCH
10-12	7:55	0	.23	.91	1.60	WCH
10-13	7:30	0	.21	.92	1.62	WCH
10-14	6:00	0	.22	.91	1.62	JAD
10-15	6:00	0	.21	.91	1.60	JAD
10-16	6:00	0	.22	.92	1.61	JAD
10-17	7:15	0	.21	.93	1.63	JAD
10-18	7:30	0	.23	.92	1.62	JAD
10-19	7:30	0	.23	.93	1.63	WCH
10-20	7:05	0	.21	.93	1.60	WCH
10-21	7:00	0	.21	.92	1.63	JAD
10-22	7:35	0	.21	.93	1.62	WCH
10-23	7:40	0	.22	.93	1.62	WCH
10-24	9:00	0	.23	.91	1.60	WCH
10-25	6:00	0	.22	.92	1.63	WCH
10-26	7:35	0	.21	.93	1.63	WCH
10-27	7:30	0	.23	.92	1.63	WCH
10-28	7:00 AM	0	.19	.96	1.64	JPS
10-29	6:20 AM	0	.20	.98	1.63	JPS

PH, CL₂

Oct 2020

DO METER CALIBRATION

DATE	TIME	MILB	CALIBRATION	TEMP	NOTE
1	7:35		100%	16.2	NH
2	7:15		100%	16.8	NH
3	7:05		100%	16.9	NH
4	7:20		100%	17.5	NH
5	7:30		100%	18.7	NH
10-6	6:30		100%	18.5	JAD
10-7	8:30		100%	18.7	JAD
10-8	8:00		100%	18.9	JAD
10-9	7:45		100%	18.0	NH
10-10	6:50		100%	18.3	KSM
10-11	6:30		100%	18.9	KSM
10-12	7:55		100%	19.1	NH
10-13	7:30		100%	16.0	NH
10-14	6:00		100%	17.1	JAD
10-15	6:00		100%	17.5	JAD
10-16	6:00		100%	17.1	JPS
10-17	7:15		100%	17.2	JPS
10-18	7:30		100%	17.1	JAD
10-19	7:30		100%	17.1	NH
10-20	7:05		100%	17.9	NH
10-21	7:00		100%	18.4	JAD
10-22	7:35		100%	18.4	NH
10-23	7:40		100%	19.1	NH
10-24	9:00		100%	19.9	NCH
10-25	6:00		100%	18.5	NCH
10-26	7:30		100%	17.2	NH
10-27	7:30		100%	19.6	NH
10-28	7:00AM		100%	18.7	JPS
10-29	6:20AM		100%	20.1	JPS