

GREENWOOD PARK
STORMWATER TREATMENT SYSTEM
OPERATION AND MAINTENANCE PLAN

July 23, 2013



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I. Executive Summary

The Greenwood Park stormwater system is designed to collect stormwater as it drains across the site and the first flush of stormwater from an up gradient Tarrant City watershed into two detention ponds. The stormwater is directed into the detention ponds by weirs in conjunction with hydraulically operated flushing gates located near the Tallapoosa Street park entrance. These gates are normally open and will only close during a heavy rainfall event and re-open based on the water level in the ponds or during a power outage thereby allowing the stormwater to flow directly to Village Creek. Stormwater collected in the detention ponds will be absorbed and filtered through layers of grass, soil/sand and gravel before entering a series of perforated underground pipes. The stormwater is then pumped from two well wells through a 4 inch force main into two 20-foot wide bio-swales lined with native wild flowers and grass through which the stormwater will slowly migrate to provide additional filtration before being taken up by the vegetation or entering Village Creek. Together, the detention ponds and bio-swales will work as a "constructed wetland" designed to reduce many of the impurities currently being washed into Village Creek from the upper watershed.

The purpose of this Operations and Maintenance Plan (O&M Plan) is to insure proper functioning of the stormwater system. See **Drawing 1 - Overall Site Grading Plan** located in the Appendix for an overall view of the areas covered by this O&M Plan.

The total five year costs for this plan is \$55,000.00. Costs estimates are listed under each part.

II. Detention Cells and Bioswales

NOTE: Employees must follow the employer's policies related to safety and health including handling chemicals, use of tools/machinery, personal protective equipment use, etc.

a. Detention Cells and Bioswales Operation

There are no direct operations for these areas. The proper flow and filtering of stormwater in the areas depends on the proper operation and maintenance of the Flushing Gates and the Wet Well Submersible Pumps. Also it is critical that the maintenance requirements listed in Sections II *b*, *c*, and *d* are followed.

b. Detention Cells and Bioswales Landscape Maintenance

i. Weekly Landscape Maintenance Checklist

1. Clean up any litter on slopes and bottoms of detention cells and bioswales

ii. Monthly Landscape Maintenance Checklist

January

1. Remove any damaged or dead wildflowers.
2. Take soil samples for nutrient analysis.
3. Spray as required to control fire ant hills.

February

1. Remove any damaged or dead wildflowers.
2. Mow swales as needed to remove woody perennials.

3. Spray as required to control fire ant hills.

March

1. Replace any damaged or dead wildflowers (only required in 2013).
2. Spot spray any existing weeds with Round-Up or Equal.
3. Spray as required to control fire ant hills.

April

1. Remove any damaged or dead wildflowers.
2. Inspect all areas for insect and disease damage and treat as necessary.
3. Fertilize all grassy slopes with 32-3-12 analysis, with 50% slow release nitrogen, or equal to soil sample reports.
4. Fertilize all wildflowers with Nursery Special by Sta-Green or equal 12-6-6 analysis granular fertilizer with slow release nitrogen.
5. Apply lime as per soil sample reports.
6. Spray as required to control fire ant hills.

May

1. Remove any damaged or dead wildflowers.
2. Inspect all areas for insect and disease damage and treat as necessary.

June

1. Remove any damaged or dead wildflowers.
2. Inspect all areas for insect and disease damage and treat as necessary.
3. Spot spray for weeds in all planted areas with Round-Up.
4. Fertilize all areas with 10-10-10 analysis.
5. Spray as required to control fire ant hills.

July

1. Remove any damaged or dead wildflowers.
2. Inspect all areas for insect and disease damage and treat as necessary.
3. Spray as required to control fire ant hills.

August

1. Remove any damaged or dead wildflowers.
2. Inspect all areas for insect and disease damage and treat as necessary.
3. Fertilize all grassy slopes in late August-early September with 8-8-25 analysis (low nitrogen).
4. Spray as required to control fire ant hills.

September

1. Remove any damaged or dead wildflowers.
2. Inspect all areas for insect and disease damage and treat as necessary.
3. Apply pre-emergent herbicides to slopes to prevent weeds.
4. Apply lime if soil tests show pH is low on slopes.
5. Spray as required to control fire ant hills.

October

1. Replace any damaged or dead wildflowers (only required in 2013).
2. Inspect all areas for insect and disease damage and treat as necessary.

3. Spray as required to control fire ant hills.

November - December

1. Remove any damaged or dead wildflowers.
2. Inspect all areas for insect and disease damage and treat as necessary.
3. Spray as required to control fire ant hills.

iii. Estimated Five Year Costs

Detention Cells and Bioswales		
Type Expense	Annual \$	5 Year \$
Mowing	\$2,000.00	\$10,000.00
Fertilizer and Weed Control	\$4,000.00	\$20,000.00
Fire Ant Control	\$1,000.00	\$5,000.00
Wild Flower Replacement (Only Required in 2013)		\$5,000.00
	5 Year Total	\$40,000.00

iv. Equipment Requirements

1. Small Tractor with Sickle Bar Mower and Broadcaster Attachments
2. String Trimmer
3. Standard Landscape Hand Tools

c. Overall Site Planting Plan

See **Drawing 2 – Overall Site Planting Plan** located in the Appendix.

III. Flushing Gates

NOTE: Employees must follow the employer’s policies related to safety and health including handling chemicals, use of tools/machinery, energy control procedures, confined space entry, personal protective equipment use, etc.

The following instructions are based on Grande Water Management Systems’ (GWMS) ACU-GATE CONTROL GATE SYSTEM INSTALLATION, OPERATION & MAINTENANCE MANUAL for Greenwood Park dated August 2012. For further information, please refer to this manual. A copy of the complete manual must be made available for review by employees responsible for operating and maintaining the flushing gates.

Also refer to **Manual 1 – Acu-Gate Control Gate System Installation, Operation & Maintenance (selected pages)** located in the Appendix for selected pages. This contains selected pages from the entire GWMS manual.

See also **Picture 1 – Acu-Gate Control Panel** located in the Appendix for the layout of the control switch, push buttons, indicator lights, and others.

a. Flushing Gates Operation

1. GENERAL

The ACU-GATE flushing gates may be used as control gates since they can be used to store water upstream while in the locked/latched position. For this project the ACU-GATEs are used to control the flow to the overflow treatment areas.

The ACU-GATE flushing gates are constructed of high quality, corrosion resistant stainless steel. These gates are designed to operate under harsh environmental conditions for many years, requiring minimal maintenance.

The ACU-GATE flushing gates are simple to use and require no external water supply.

The gates are operated using a low pressure hydraulic system (10 to 15 bars) that may be operated using either a mechanical hydraulic power pack or a float system. The operation is then controlled using a separate control panel according to the project needs and the design engineer's requirements.

2. SAFETY CONSIDERATIONS

- DO Wear proper protective clothing when working on or around equipment, i.e. hard hats, heavy boots, safety glasses and breathing apparatus (if necessary) and contact your GWMS representative with any questions you may have regarding safety in handling GWMS equipment.
- DO NOT operate equipment before thoroughly reviewing the GWMS Installation, Operation and Maintenance Manual.
- DO NOT operate equipment before a complete start-up is performed by a qualified GWMS representative.
- DO NOT use any mechanical devices to operate equipment other than GWMS supplied devices.
- DO NOT open electrical cabinets before disconnecting power and isolating control circuits.
- DO NOT place any body parts in path of moving parts.
- DO NOT operate equipment if any loose or damaged parts are visible.

3. OPERATION

3.1 GENERAL OPERATING RECOMMENDATIONS

The ACU-GATE control gates are designed to control the flow of low levels of stormwater flow to the dry stormwater detention cells. The system is completely self-contained.

The system consists of a Local Control Panel (LCP) and Hydraulic Power Unit (HPU) connected to two gates. The LCP/HPU is collectively referred to as the "ACU-GATE CONTROL PANEL/HPU". The ACU-GATE CONTROL PANEL/HPU is designed to control the operation of the two flushing gates using the PLC controlled logic, automatically monitoring the water level in the stormwater detention cells. The local HCP may also be used to operate the gates.

See **Drawing 3 – Acu-Gate Control Panel Layout & Picture 1 – Acu-Gate Control Panel** located in the Appendix for the layout of the controls on the LCP.

During dry weather or when control is not required, the gates are normally in the unlocked (unlatched) or open position, allowing water to flow through it. The hydraulic power unit is off and all solenoids are de-energized. The hydraulic pump and the solenoid valves are energized only when the water level upstream attains the "Low Level USWL" (set at 1.5 ft). The gates then transition into the locked (latched) or closed position and remain in that position until the upstream water level attains the "High Level USWL" (set at 2.3 ft). Once the upstream water level exceeds the "High Level USWL" setting, the solenoid valves are de-energized and the gates are unlatched and opened. The operation may also be carried out manually by an operator using the manual pushbuttons to operate the HPU and the manual overrides on the solenoid operated cartridge valves.

When operation is requested, the hydraulic power unit (HPU) is turned on and the corresponding solenoid operated gate valve and dump valve are activated. This results in pressurizing the hydraulic gate cylinder. The hydraulic pressure acts against the latching spring of the gate cylinder, thereby rotating the latching hooks into the latched position thereby latching the control gate. The normal operating pressure is in the order of 200 to 250 psi.

Before operating the control gates for the first time, ensure that all debris and equipment is removed from the area, especially on the downstream side.

Large Debris

Branches, rocks, construction materials (wood, concrete, etc.), or other large debris may lodge in the ACU- GATE control gate when it is operated for the first time. Damage to the seal or sealing surfaces may occur. Remove all large debris before operating the flushing gate.

Installation Debris

Excess concrete or grout from tank construction or control gate installation can damage seals and sealing faces as well as bind on rotating parts and stop the control gate from functioning as designed. Remove all concrete and grout from all flushing gate components before operation.

Mud and Grit

In certain instances, a control gate may become buried in mud and grit. The forces required to operate a buried control gate are excessive and may exceed the design loads. Remove mud and grit before operating the control gate.

Ice Buildup

Under certain conditions, icing may occur. This may result in excessive loading requirements to operate the control gate. Excessive loading may result in damage to control gate components. Remove all ice before operating the control gate.

3.2 OPERATING MODES

The control gates are controlled by the GWMS supplied ACU-GATE CONTROL PANEL/HPU. The ACU-GATE CONTROL PANEL/HPU houses a MicroLogix 1400 PLC and all required expansion modules which controls the operation of the system. The system can be placed in one of three modes, "OFF", "MANUAL" or "AUTO". The system mode is selectable from the three position selector switch located on the outside of the inner enclosure door panel. The system can only function in one mode at a time.

OFF Mode

When the selector switch is put to the "OFF" position, no gate operation may be performed. The gates remain in the unlatched or open position.

The "OFF" mode is selected when personnel are to inspect or maintain the equipment. This ensures that the personnel may carry out their work without risk of control gate operation.

NOTE! The wave produced by a gate in operation may result in serious injury or damage to anyone or anything in its path.

Manual Mode

When the selector switch is put to the "MANUAL" position, the HPU can then only be controlled by the local operator from the enclosure door mounted pushbuttons. The operator can change the control panel mode, start or stop the HPU, open or close a gate using the door mounted push buttons or the manual override on the solenoid operated cartridge valves, and push the emergency stop button.

The operator can "Close" a gate, by using the manual overrides on the solenoid cartridge valves. The gate will only close if there is more than the "Low Level USWL" (1.5 ft) of water upstream.

Auto Mode

When the selector switch is put to the "AUTO" position, the gates will operate in response to the control logic saved on the PLC in the ACU-GATE CONTROL PANEL/HPU.

Alarms indicate that there is a problem with the system and depending on the type of alarm, the system may shut down. The alarms are represented by amber lights on the control panel. No other actions can be performed until the alarm condition is verified and the alarms are reset.

3.3 SYSTEM ALARMS

The system is equipped with four alarms that are specific to this type of an operating system and an Emergency Stop. These alarms are applicable only to the hydraulic power unit which is used to operate the hydraulic cylinder on the Grande ACU-GATE control gate. These alarms are:

- Low oil level;
- Low oil pressure;
- High oil temperature;
- Motor Overload

Low Oil Level Alarm

This alarm is used to monitor the oil level in the HPU reservoir and is always checked. If the oil level in the HPU drops below a certain level (to a level where the hydraulic pump can no longer pump hydraulic fluid effectively), the alarm sensor is activated and a light indicating "Low Oil Level" is illuminated on the control panel enclosure door.

If this alarm occurs when a gate is in operation (its' solenoid operated cartridge valve is energized), the system will turn the alarm on immediately and shut down the HPU to prevent excessive loss of hydraulic fluid. If this alarm occurs, it should be verified by inspecting the level gauge located on the front of the HPU reservoir. If the gauge confirms the condition, then you must determine and repair the cause. If the gauge indicates that the oil level is fine, then the oil level sensor or electronic signal may be faulty and in need of replacement or repair. This alarm will shut the HPU down in "AUTO" mode. This alarm

may be reset, once rectified, by pressing the reset button on the enclosure door. If the system was in operation at the time, the gate will go back to its original un-latched position, even if the water level is between the "Low Level USWL" (1.5 ft) and the "High Level USWL" (2.3 ft).

Low Oil Pressure Alarm

This alarm is used to monitor the hydraulic pressure produced by the HPU and is present when the HPU cannot produce sufficient pressure to operate a flushing gate (Latch/Unlatch). This condition is only checked during the control gate operation, after "Timer 2" expires, in order to allow the system to build pressure. If this alarm condition is present, the alarm sensor is activated and a light indicating "Low Oil Pressure" is illuminated on the control panel enclosure door.

If this alarm occurs the system will turn the alarm on immediately and shut down the HPU to prevent excessive loss of hydraulic fluid. If this alarm occurs, it should be verified by inspecting the pressure gauge located on the HPU manifold. If the gauge confirms the condition, then you must determine and repair the cause. If the gauge indicates that the pressure is fine, then the pressure sensor or electronic signal may be faulty and in need of replacement or repair. This alarm will shut the HPU down in "Auto" mode. This alarm may be reset, once rectified, by pressing the reset button on the enclosure door. If the system was in operation at the time, the gate will go back to its original un-latched position, even if the water level is between the "Low Level USWL" (1.5 ft) and the "High Level USWL" (2.3 ft).

High Oil Temperature Alarm

This alarm is used to monitor the hydraulic fluid temperature to ensure that it remains within acceptable parameters. A light indicating "Low Oil Pressure" is illuminated on the control panel enclosure door when this alarm occurs. This alarm may be confirmed by inspection of the thermometer mounted on the hydraulic reservoir (it is incorporated into the level gauge mounted on the front of the HPU reservoir). If not confirmed by the thermometer, then the sensor may be defective and require replacement.

If this alarm occurs, the operator must verify the hydraulic components to determine what may be causing the overheating. The high temperature alarm will most likely be caused by excessive friction in the gear pump. The normal operating oil temperature will range from ambient to 20°F above ambient temperature. The high temperature alarm is set at 140°F. If the system was in operation at the time, the gate will go back to its original un-latched position, even if the water level is between the "Low Level USWL" (1.5 ft) and the "High Level USWL" (2.3 ft).

Motor Overload Alarm

This alarm is used to monitor the functionality of the HPU motor. If this alarm is present, the motor will not run. Therefore, hydraulic pressure cannot be created to operate the ACU-GATEs.

Emergency Stop

If an operator pushes the "Emergency Stop" button, then all outputs are shut down and the system is inoperable. When the system is shut down using this feature, the button must be reset by twisting and pulling the emergency stop button, at which time the power will be restored and the system will return to its initial state, to its original un-latched position, even if the water level is between the "Low Level USWL" (1.5 ft) and the "High Level USWL" (2.3 ft).

Important Note: If an alarm goes off while a gate is in the closed position, the system will be reset. This means that the operator will only be able to manually operate the gate after the problem is rectified and that the water level upstream is below 8". The gate will not latch if there is more than 8" stored upstream.

The ACU-GATE flushing gates may be operated manually even in the case of a complete PLC failure by using the manual override on the cartridge valves (dump valve & corresponding gate valves) and the start/stop pushbutton located inside the enclosure which controls the operation of the electric pump motor.

3.4 OPERATING A CONTROL GATE

Operation in "AUTO" Mode

When the enclosure door mounted selector switch is in "AUTO" mode, then the system will operate automatically based on the PLC logic. The PLC logic is as follows:

1. The upstream water level readings are taken using the DrexelBrook ultrasonic sensor.

Once the upstream water level attains the "Low Level USWL" (1.5 ft), the HPU is started and will remain operational for the duration of "Timer 1".

2. The oil recirculation timer, "Timer 2", is started. Once it has elapsed, the solenoid operated cartridge valves and dump valve are energized. As a result, pressure is created in the system and the ACU-GATE control gates are latched. The system will only verify the low pressure condition once "Timer 3" has elapsed in order to allow the pressure to build up.

3. The control gates remain latched until the water level attains the "High Level USWL" (2.3 ft).

The HPU is equipped with a hydraulic fluid accumulator and a second pressure sensor. The accumulator and sensor are used to maintain system pressure and to restart the HPU should it be required.

4. The control gates unlatch once the upstream water level exceeds the "High Level USWL" (2.3 ft) and will remain unlatched until the next cycle occurs. The gates will not re-latch if there is water behind them.

Operation in "MANUAL" Mode

When the enclosure door mounted selector switch is in "MANUAL" mode, then the system will operate based on operator commands using the door-mounted push buttons:

1. The upstream water level readings are taken using the DrexelBrook ultrasonic sensor. The operator may latch the gates by pressing the "CLOSE FG-1 FG-2" door-mounted pushbutton.
2. Pressing the "CLOSE FG-1 FG-2" door-mounted pushbutton starts the oil recirculation timer, "Timer 2" and energizes the dump valve and both solenoid operated cartridge valves corresponding to the control gates are activated. As a result, pressure is created in the system and the ACU-GATE control gates are latched.

3. The control gates remain latched until the "OPEN FG-1 FG-2" door-mounted pushbutton is pressed. Once pressed, the solenoid operated cartridge valves and dump valve are de-energized and the gates unlatch (open).

Note: The gates will not latch if there is more than 8" of water behind them.

Manual Operation in Case of PLC Failure

The ACU-GATE control gates may be operated manually even in the case of a complete PLC failure by using the manual override on the cartridge valves (dump valve & corresponding gate valves) and the start/stop pushbutton located inside the control panel which controls the operation of the electric pump motor directly.

The operator must place the HPU selector switch to "MANUAL" mode. The flushing gate solenoid operated cartridge valve corresponding to the flushing gate that is to be operated (FG-X) is placed in the manual override position. Since the flushing gate cartridge valve is a two way valve in the normally opened position, the operator must push/twist the manual override knob into the closed position which will then place the valve in the closed position. In order for the flushing gate to open, the operator must also place the solenoid operated cartridge dump valve, which is a two way normally opened valve, in the manual override position. The operator must push the manual override knob in while twisting so that it stays in the closed position. This will allow the hydraulic fluid to flow to the cylinder and create the required pressure to unlatch the flushing gate. Leaving the system in this position will keep the flushing gate closed for as long as the electric pump motor is left on.

In order to return the system to its normal operating mode and for the gate to un-latch, the electric pump/motor must be turned off and the manual overrides on the cartridge valves must be put back to their original/normal positions.

If the system components are not returned to their normal positions, the system may not operate correctly when controlled in "MANUAL" mode.

Effects of Alarms on System Operation

Should any of the three HPU alarms "Low Oil Level", "Low Oil Pressure" or "High Oil Temperature" alarms occur then the HPU would immediately turn itself off and any flushing gate operation would cease. If a gate was in the process of being latched when the HPU was de-energized, then the spring in the gate cylinder would return the cylinder to its unlatched position. Once the cause of the alarm was determined and rectified, the gate will only be able to re-latch itself when the upstream water level is at 1.5 ft.

In all cases, the alarm needs to be acknowledged by pressing the reset button on the panel door.

Changing the Low Level USWL or High Level USWL SetPoint

Should it become necessary to change either of these set points, follow the instructions in Appendix Manual 1 Acu-Gate Control Gate System Installation, Operation & Maintenance (selected pages) under the USonic-R Series Quick Start section. The complete USonic-R manual is also in the Grande O&M Manual. This is done by going into the configuration menu and finding the set point for Relay 1 (Low Level USWL) or Relay 2 (High Level USWL) and changing the value.

b. Flushing Gates Maintenance

i. Weekly Flushing Gate Maintenance (or after water level has subsided subsequent to a rainfall event)

1. Check to insure that the flushing gates are in the normal closed but unlatched position.
2. Clean trash, debris, limbs, etc. from flushing gate boxes making especially sure to remove any items that might prevent the flushing gates from opening, closing, or latching.
3. Visually inspect the hydraulic power units, hoses, fittings, connections, and cylinders for hydraulic fluid leaks, and take any necessary corrective action.

ii. Monthly Flushing Gate Maintenance

1. Check that the flushing gate latches are operational by energizing and de-energizing the latch hydraulic actuating mechanism from the control panel in accordance with training provided by the manufacturer's technical representative and the GWMS ACU-GATE CONTROL GATE SYSTEM INSTALLATION, OPERATION & MAINTENANCE MANUAL.
2. Visually inspect the hydraulic fluid level in the hydraulic power unit reservoir. If low, fill to the 3/4 mark on the sight glass on the reservoir with Exxon HVI 26 hydraulic fluid.
3. While operating the hydraulic power unit, verify that the differential pressure across the hydraulic fluid filter is within the acceptable range. If the differential pressure is excessive, change the filter. Change the hydraulic fluid after every two filter changes using Exxon HVI 26 hydraulic fluid.*

* Demands on the hydraulic system are so minimal that it is not anticipated that either the hydraulic fluid or filters will have to be changed within the foreseeable future.

IN THE EVENT THAT AN EQUIPMENT PROBLEM OR MALFUNCTION IS ENCOUNTERED, FOLLOW THE TROUBLESHOOTING GUIDE IN GWMS' ACU-GATE CONTROL GATE SYSTEM INSTALLATION, OPERATION & MAINTENANCE MANUAL.

IF THE PROBLEM CANNOT BE RESOLVED, CONTACT THE MANUFACTURER OR MANUFACTURER'S REPRESENTATIVE FOR FURTHER ASSISTANCE.

iii. Estimated Five Year Costs

Flushing Gates		
Type Expense	Annual \$	5 Year \$
Miscellaneous parts replacement	\$2,000.00	\$10,000.00
	5 Year Total	\$10,000.00

iv. Equipment Requirements

1. Standard Hand Tools

IV. Pumping Station Wet Wells

NOTE: *Employees must follow the employer's policies related to safety and health including handling chemicals, use of tools/machinery, energy control procedures, confined space entry, personal protective equipment use, etc.*

The following instructions are based on FLYGT 3068 INSTALLATION, OPERATION, AND MAINTENANCE MANUAL and the STACON AS BUILT SUMP PUMP CONTROL PANEL INFORMATION.

For further information, please refer **Manual 3 - Sump Pump FLYGT 3068 Installation, Operation, and Maintenance** located in the Appendix.

See also **Drawing 4 – Pumping Stations Details** located in the Appendix for the layout of the two wet well pumping stations.

See also **Manual 2 – Stacon Pump Control Panels** located in the Appendix for the bill of materials, electrical, and other information.

See also **Picture 2 – Stacon Automatic Sump Pump Control Panel** located in the Appendix for the layout of the control switch, run time, and indicator lights.

See also **Picture 3 – Stacon Manual Sump Pump Control Panel** located in the Appendix for the layout of the control switch, run time, and indicator lights.

There are two pumping station wet wells with two sump pumps in each station. One station pumps water from A Cell which is west of the pumping stations. The other station pumps water from the B Cell which is east of the pumping stations. One sump pump in each pumping station is operated by a Stacon automatic control panel. The other sump pump in each pumping station is operated manually by a Stacon manual control panel.

a. Automatic Submersible Pump Operation

OFF Mode

When the selector switch is put to the "OFF" position, no pumping will occur.

HAND Mode

When the selector switch is put to the "HAND" position, pumping will occur regardless of the water level in the sump.

AUTO Mode

When the selector switch is put to the "AUTO" position, the pumping will occur in response to float switch being activated by the water level. It will continue to run until the water level drops and the float switch is deactivated.

SYSTEM ALARM

When the water level rises to the high level, the “HIGH LVL ALARM” indicator light will come on until the water level in the sump drops below the high level again.

b. Manual Submersible Pump Operation

OFF Mode

When the selector switch is put to the “OFF” position, no pumping will occur.

HAND Mode

When the selector switch is put to the "HAND" position, pumping will occur regardless of the water level in the sump.

This pump is primarily a backup to ensure the ability to pump water out of the sump to allow safe access in case of repairs or preventative maintenance.

c. Submersible Pump Maintenance

i. Weekly Submersible Pump Maintenance Checklist

1. Check that manual pumps are operational in both A & B Cells. Place the automatic pump switch on each automatic control panel to “OFF” position. Place the manual pump switch on each manual control panel to “ON” position and verifying discharge flow according to the operations section above. Return each manual control panel pump switch to “OFF” after verification is completed.
2. Check that automatic pumps are operational in both A & B Cells. Place the automatic pump switch on each automatic control panel to “HAND” and verifying discharge flow according to the operations section above. Return each control panel pump switch to “AUTO” after verification is completed.
3. Check for any debris in the sump and remove as needed.
4. If a pump fails to pump water and there is still power to the Stacon control panel, turn off both breakers for about 5 minutes and then reset. Repeat step 1 or 2 above as appropriate. If pump still does not pump water, trouble shoot the control panel and the sump pump as needed.

ii. Changing the oil in the pump

1. See **Manual 3 Sump Pump FLYGT 3068 Installation, Operation, and Maintenance** in the appendix pages 35 and 36.

iii. Servicing the pump

1. See **Manual 3 Sump Pump FLYGT 3068 Installation, Operation, and Maintenance** in the appendix pages 36 and 37.

iv. Inspection of the pump

1. See **Manual 3 Sump Pump FLYGT 3068 Installation, Operation, and Maintenance** in the appendix pages 37 and 38.

v. Repairs to Stacon Control Panels

1. See **Manual 2 – Stacon Pump Control Panels** in the appendix for electrical drawings and parts lists.

vi. Estimated Five Year Costs

Pumping Station Wet Wells		
Type Expense	Annual \$	5 Year \$
Miscellaneous parts replacement	\$1,000.00	\$5,000.00
	5 Year Total	\$5,000.00

vii. Equipment Requirements

1. Standard Hand Tools
2. Submersible pumps are mounted on a stainless steel rail/guide for raising and lowering from the ground surface.

Appendix

Summary Estimated Five Year Costs

Drawing 1 Overall Site Grading Plan

Drawing 2 Overall Site Planting Plan

Drawing 3 Acu-Gate Control Panel Layout

Drawing 4 Pumping Stations Detail

Picture 1 Acu-Gate Control Panel

Picture 2 Stacon Automatic Pump Control Panel

Picture 3 Stacon Manual Pump Control Panel

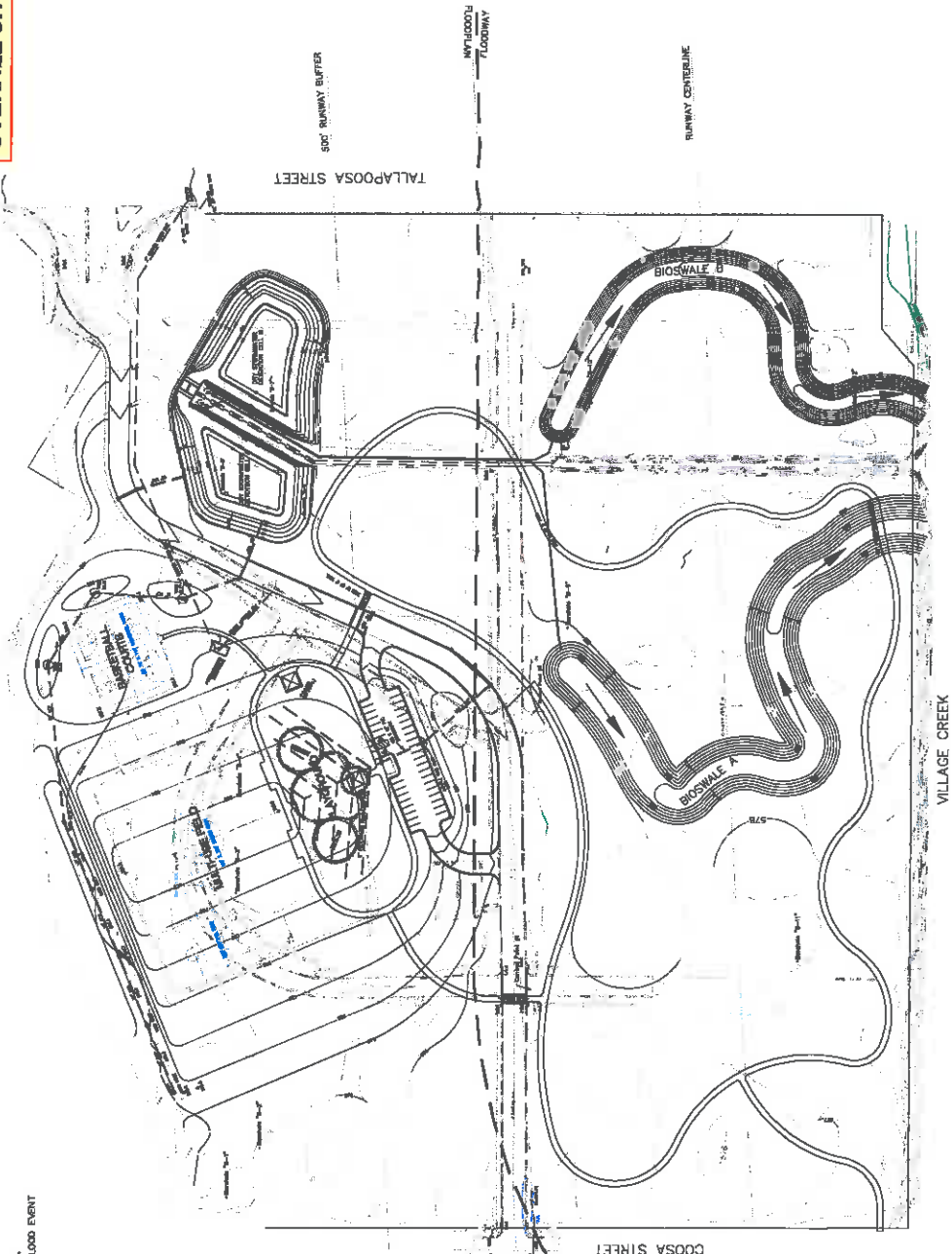
Manual 1 Acu-Gate Control Gate System Installation, Operation & Maintenance (selected pages)


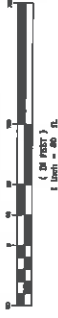
Manual 2 Stacon Pump Control Panels

Manual 3 Sump Pump FLYGT 3068 Installation, Operation, and Maintenance

DRAWING 1
OVERALL SITE GRADING PLAN

TOPOGRAPHY WAS GENERATED BY A PHYSICAL SURVEY PERFORMED BY WALTER SCHEDEL AND ASSOCIATES, INC., SEPTEMBER, 2008. THE ENTIRE SITE IS MARKED DURING THE 100-YEAR FLOOD EVENT FLOODWAY AND FLOODPLAIN DELINEATIONS. FLOODWAY AND FLOODPLAIN DELINEATIONS FOR THE DESIGNATED FLOODWAY AND FLOODPLAIN AREAS, PANELS 316 OF 360 (MAP NUMBER 017303016 E) AND 317 OF 360 (MAP NUMBER 017303017 E).



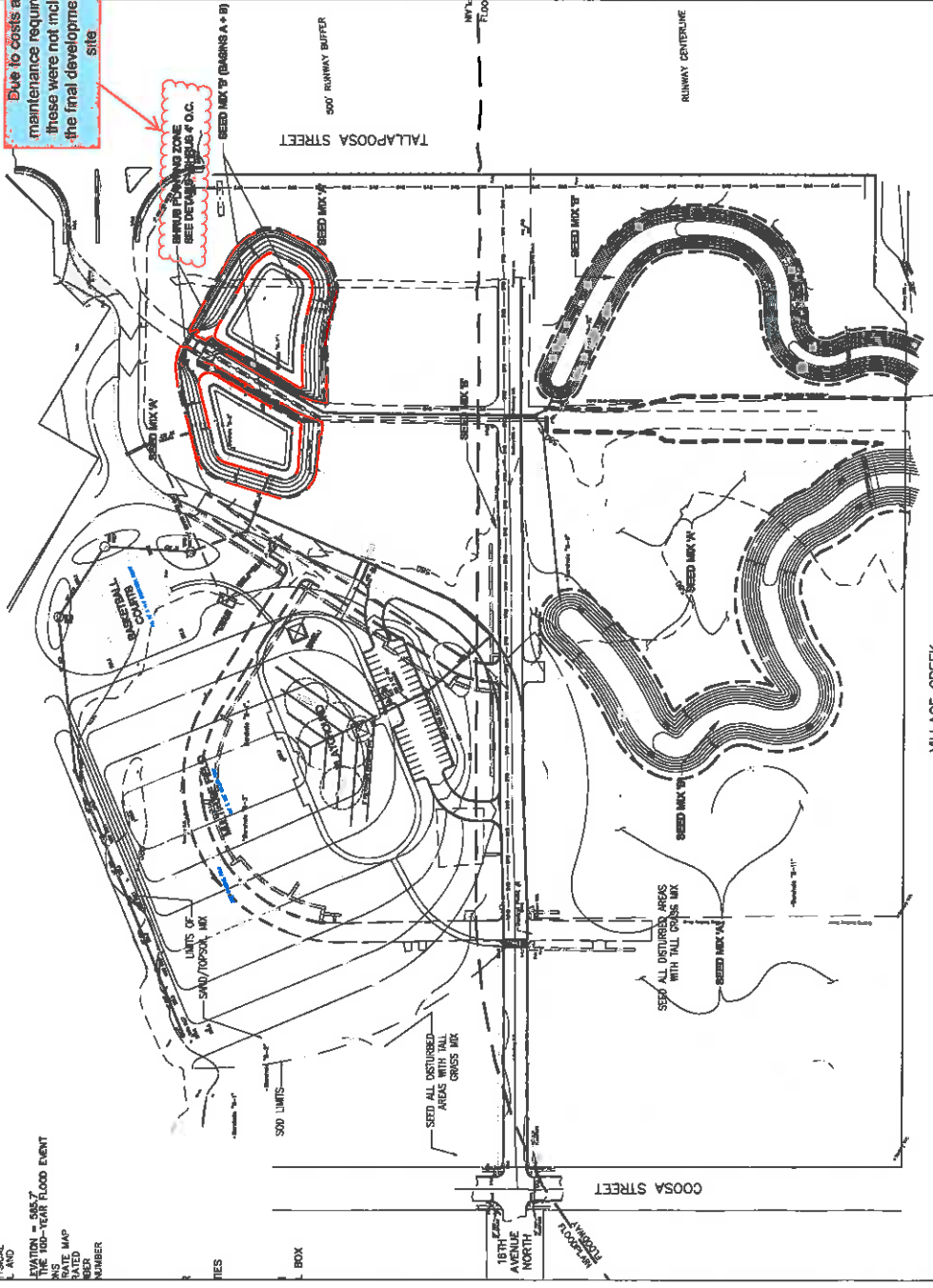
11-03-09	0	ISSUED FOR CONSTRUCTION	TSG:JDM	 <p>ENR 1000 17th Avenue North Birmingham, AL 35203 Phone: 205-988-1100 Fax: 205-988-1101</p>	<p>OVERALL SITE GRADING PLAN GREENWOOD PARK BIRMINGHAM, ALABAMA</p>	 <p>GRAPHIC SCALE (30 FEET) 1 inch = 30 ft.</p>	SHEET OF 26 SHEETS
				PROJECT MANAGER: F.J.MOONEY	DESIGNED BY: T.S.CIBBS		
				CHECKED BY: F.J.MOONEY	DRAWN BY: J.MILLER		
				DATE INO.	REVISION		
				BY			

DRAWING 2 OVERALL SITE PLANTING PLAN

Due to costs and maintenance requirements, these were not included in the final development of the site

Key	Quantity	Item	Planting Schedule	Planting Method	Planting Location	Remarks
AV	1	Aspen (10' x 12')	1/15/18	Plant in place	Central Green	See Item AV Schedule
CA	1	Cherry (10' x 12')	1/15/18	Plant in place	Central Green	See Item CA Schedule
CO	1	Coconut Palm (10' x 12')	1/15/18	Plant in place	Central Green	See Item CO Schedule
DC	1	Deciduous (10' x 12')	1/15/18	Plant in place	Central Green	See Item DC Schedule
DO	1	Deciduous (10' x 12')	1/15/18	Plant in place	Central Green	See Item DO Schedule
VO	1	Variable (10' x 12')	1/15/18	Plant in place	Central Green	See Item VO Schedule
VC	1	Variable (10' x 12')	1/15/18	Plant in place	Central Green	See Item VC Schedule

Planting Schedule	Planting Method	Planting Location	Remarks
1/15/18	Plant in place	Central Green	See Item AV Schedule
1/15/18	Plant in place	Central Green	See Item CA Schedule
1/15/18	Plant in place	Central Green	See Item CO Schedule
1/15/18	Plant in place	Central Green	See Item DC Schedule
1/15/18	Plant in place	Central Green	See Item DO Schedule
1/15/18	Plant in place	Central Green	See Item VO Schedule
1/15/18	Plant in place	Central Green	See Item VC Schedule



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PROJECT MANAGER:	F.D. MOONEY	DESIGNED BY:	T.S. GIBBS						
CHECKED BY:	F.D. MOONEY	DRAWN BY:	J. MILLER						
DATE:	INC.	REVISION	BY						

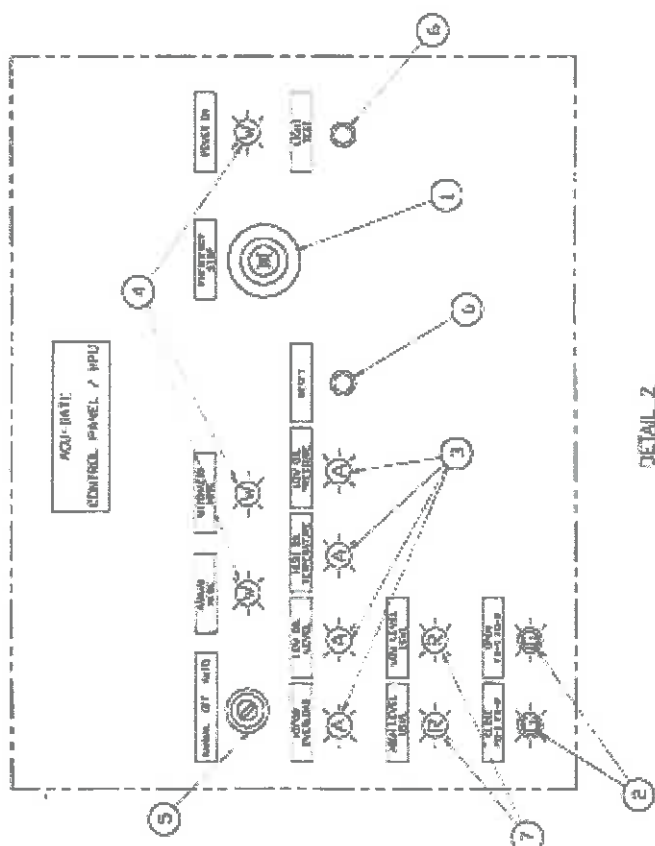
E. M. R. I. X.
 2200 1st Avenue
 Birmingham, AL 35203
 Tel: 205-988-1000
 Fax: 205-988-1001

**OVERALL SITE PLANTING PLAN
GREENWOOD PARK
BIRMINGHAM, ALABAMA**

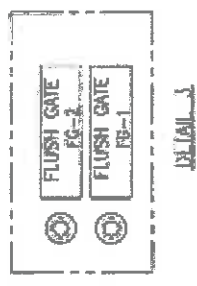
GRAPHIC SCALE
 (1" = 100')
 1" = 100' = 100' = 100'

SHEET
02
OF
26
SHEETS

REF	QTY	MANUF.	PART N	DESCRIPTION
1	1	ALLEN BRADLEY	140P-M1M04	ILLUMINATED RED BP 2 POC, EG
2	2	ALLEN BRADLEY	800P-TR1A3	ILLUMINATED GREEN BUTTONS 22 MM CIRCULAR FG
3	4	ALLEN BRADLEY	800P-TR1A3	MARKER LED 22 MM - ALUMINUM 1/4" DIA 6 VOLT
4	1	ALLEN BRADLEY	800P-TR1A3	MARKER LED 22 MM - ALUMINUM 1/4" DIA 6 VOLT
5	1	ALLEN BRADLEY	800P-TR1A3	MARKER LED 22 MM - ALUMINUM 1/4" DIA 6 VOLT
6	2	ALLEN BRADLEY	800P-TR1A3	MARKER LED 22 MM - ALUMINUM 1/4" DIA 6 VOLT
7	2	ALLEN BRADLEY	800P-TR1A3	MARKER LED 22 MM - ALUMINUM 1/4" DIA 6 VOLT

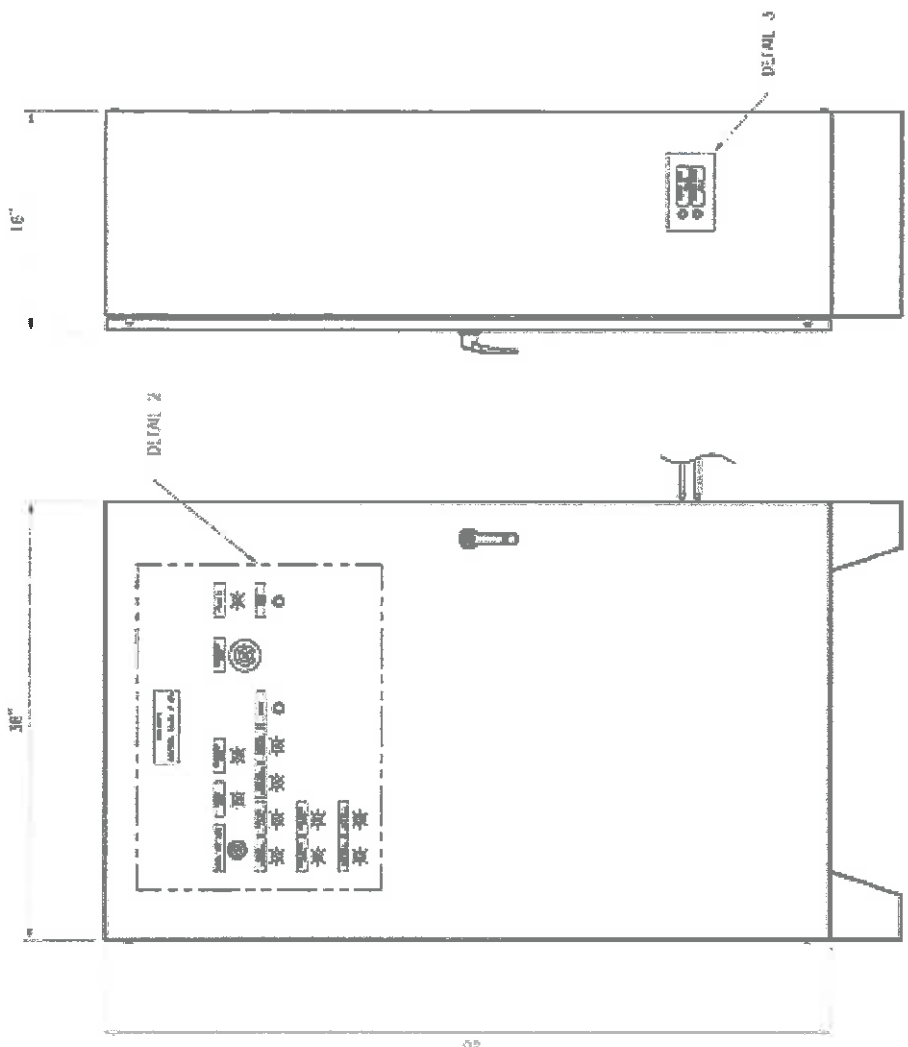


**DRAWING 3
ACU-GATE
CONTROL
PANEL
LAYOUT**



DETAIL 2

DETAIL 3



NOTES:

1- THE LABELS IDENTIFICATIONS ARE WITH WHITE TEXT ON BLACK BACKGROUND

THE EQUIPMENT DETAILS ARE FOR APPROVAL PURPOSES ONLY. ALL INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND THE EXCLUSIVE PROPERTY OF GRANDE WATER MANAGEMENT SYSTEMS.

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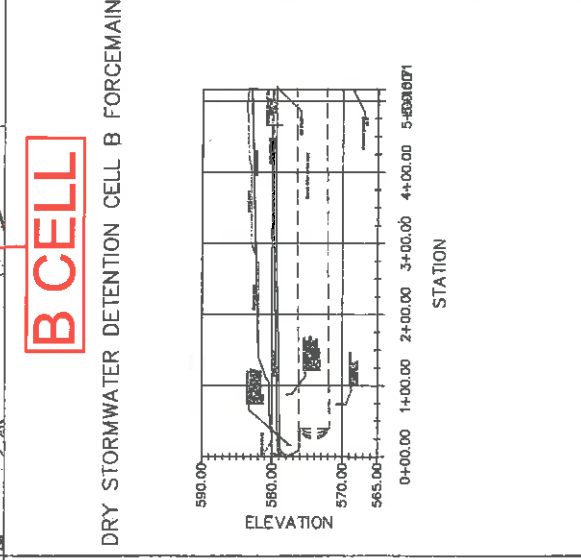
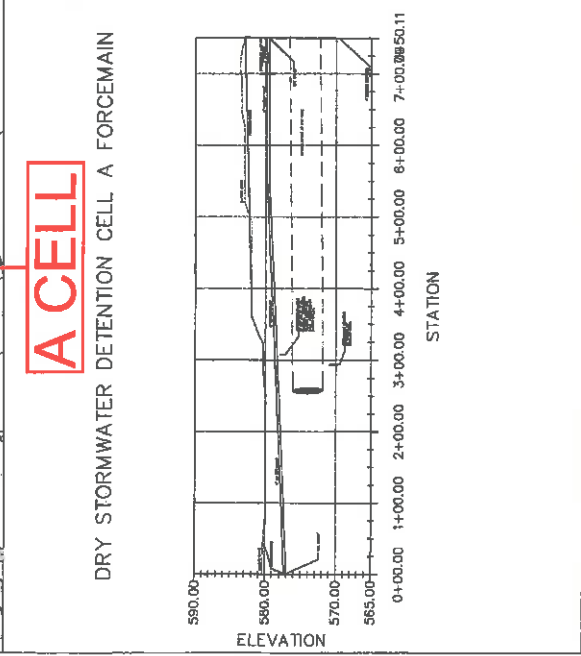
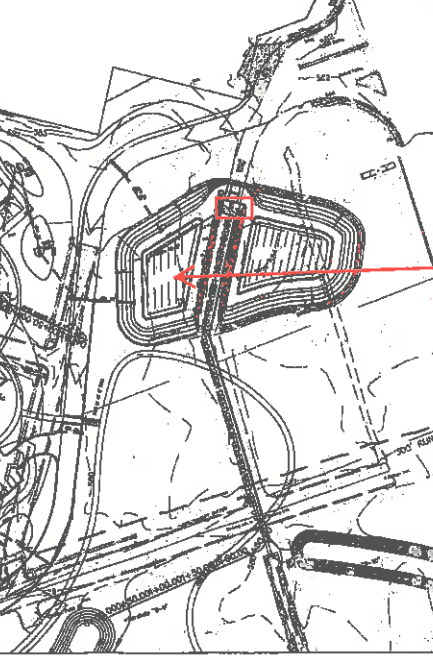
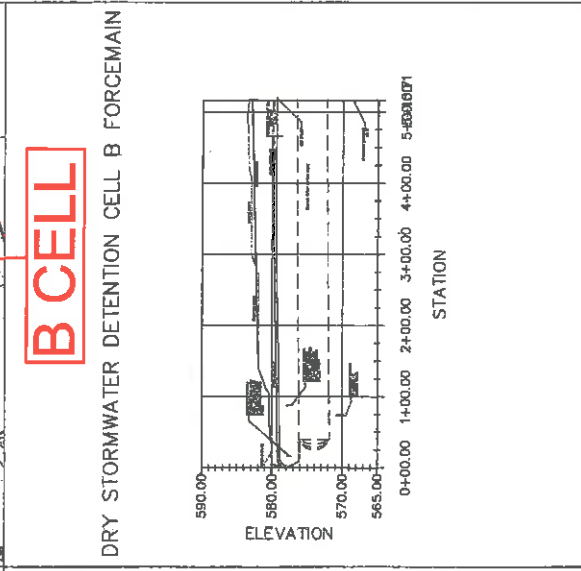
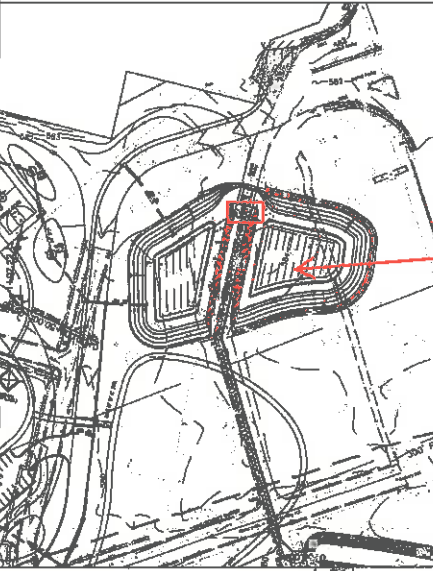
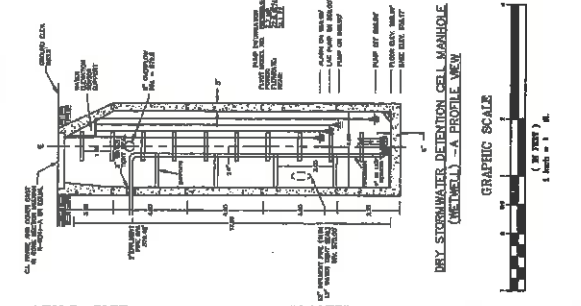
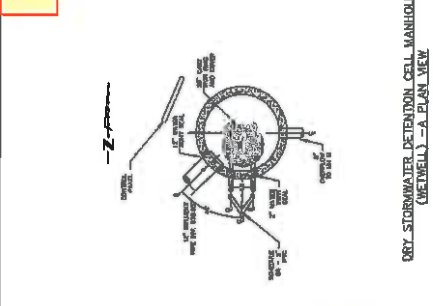
GRANDE ACU-GATE
MODEL CAT--48/45
CONTROL PANEL

GREENWOOD PARK
BIRMINGHAM, ALABAMA
1205--A--05

DATE: 04.15.2011
BY: [Signature]

REV.	DATE	DESCRIPTION
01	04/15/2011	REVISED

**DRAWING 4
PUMPING STATIONS DETAIL**



7-22-08 A 8-29-08 B	ISSUED FOR BIDS RE-ISSUED FOR BIDS	TSG EDM TSG EDM	<p>PUMPING STATION AND FORCEMAIN PLAN AND PROFILES GREENWOOD PARK BIRMINGHAM, ALABAMA</p>		<p>DESIGNED BY: T.S. GIBBS</p> <p>DRAWN BY: J. MILLER</p>	<p>PROJECT MANAGER: F.D. MOONEY</p> <p>CHECKED BY: F.D. MOONEY</p>	<p>DATE</p> <p>NO.</p> <p>BY</p> <p>REVISION</p>
<p>GRAPHIC SCALE (1" = 20')</p>			<p>GRAPHIC SCALE (1" = 20')</p>			<p>SHEET 14 OF 26 SHEETS</p>	



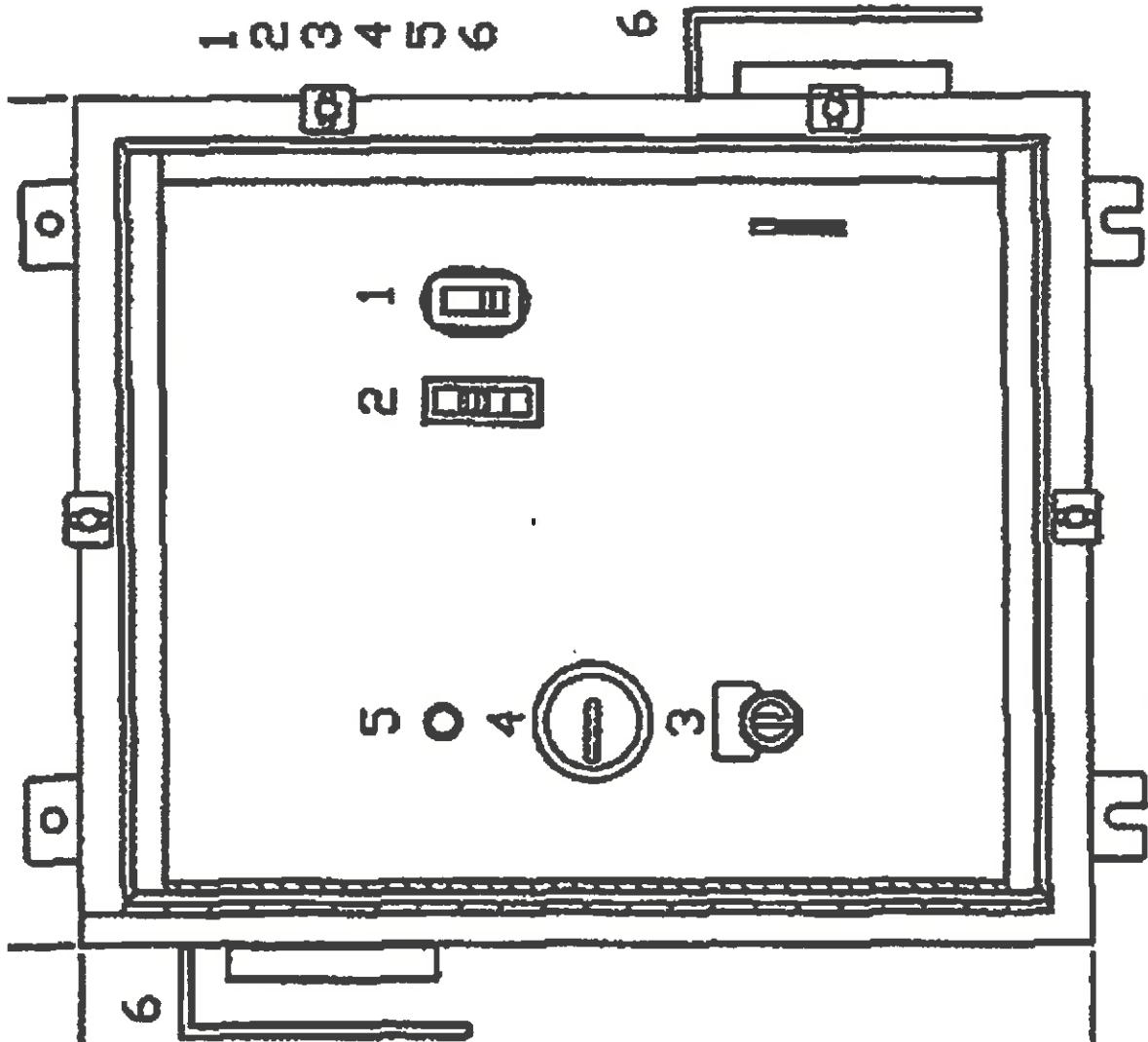
**PICTURE 1
ACU-GATE
CONTROL PANEL**



**PICTURE 2
STACON
AUTOMATIC SUMP
PUMP CONTROL
PANEL**

- 1 - MB1 MOTOR BREAKER
- 2 - CCB CONTROL BREAKER
- 3 - PUMP OFF-ON SELECTOR
- 4 - ETM ELAPSE TIME METER
- 5 - RLI PUMP RUN LIGHT
- 6 - VENTILATION LOUVERS

**PICTURE 3
 STACON MANUAL
 SUMP PUMP
 CONTROL PANEL**

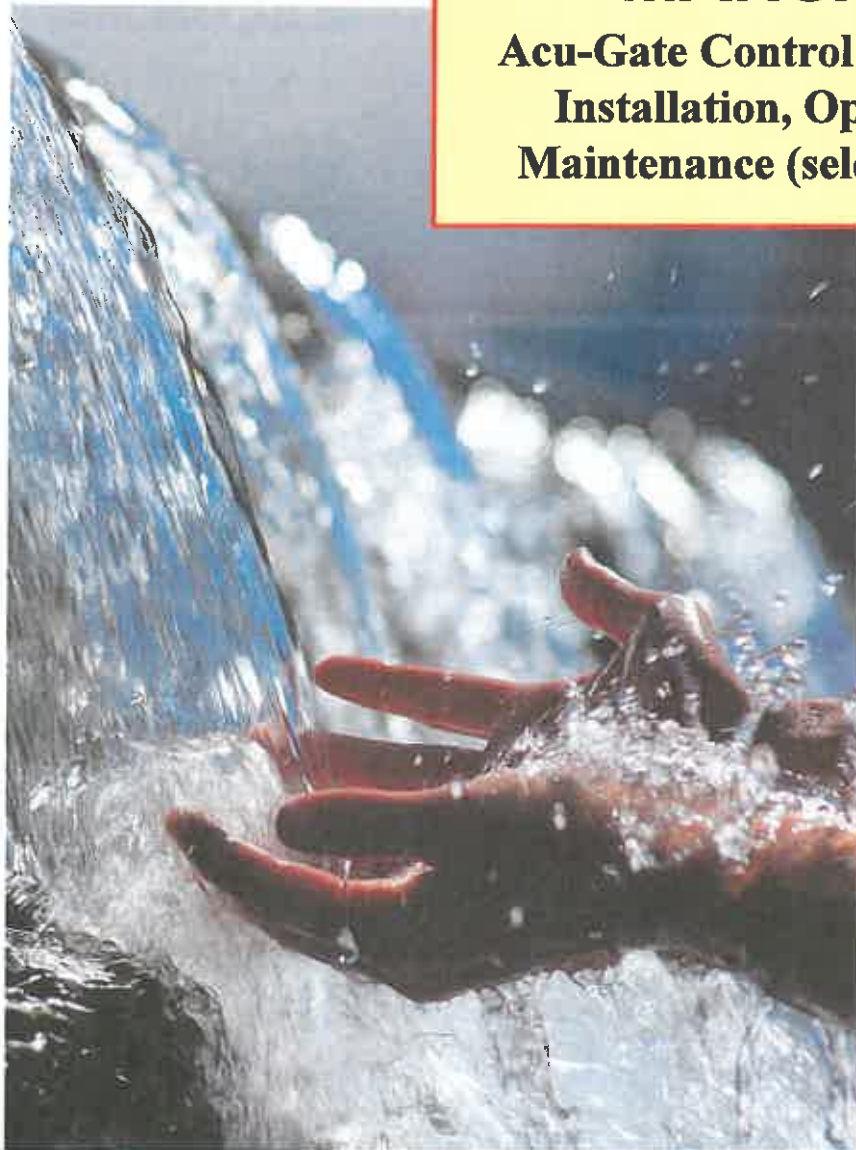


Grande

Water management systems

MANUAL 1

**Acu-Gate Control Gate System
Installation, Operation &
Maintenance (selected pages)**



**The
Clear
Solution**

**GREENWOOD PARK
BIRMINGHAM, ALABAMA**

**ACU-GATE FLUSHING GATES
INSTALLATION, OPERATION & MAINTENANCE MANUAL**

**AUGUST 2012
GWMS #: 1205**



ACU-GATE CONTROL GATE SYSTEM

INSTALLATION, OPERATION & MAINTENANCE

GREENWOOD PARK

BIRMINGHAM, ALABAMA

AUGUST 2012

REFERENCES

PROJECT

GREENWOOD PARK
BIRMINGHAM, ALABAMA

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Our Project Reference #: 1205



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	Installation, Operation & Maintenance Manual for ACU-GATE Control Gate GREENWOOD PARK- Birmingham, Alabama	GWMS Project # : 1205	
		Date : AUGUST 2012	Page : 2 Rev. : 00

1. GENERAL

1.1 GENERAL

ACU-GATE flushing gates are designed to clean settled debris from storage tanks, basins and sewer lines quickly and efficiently. The gates are installed at floor level at the upstream end of a tank or sewer. After the tank or sewer has been used to store water (combined, sewage or storm) and has been drained at the end of an event, the gate is unlatched and the in-situ water stored behind the gate is suddenly released. The resulting wave sweeps any accumulated debris from the floor of the tank or sewer. The ACU-GATE flushing gates may also be used as control gates since they can be used to store water upstream while in the locked/latched position. For this project the ACU-GATEs are used to control the flow to the overflow treatment areas.

The ACU-GATE flushing gates are constructed of high quality, corrosion resistant stainless steel. These gates are designed to operate under harsh environmental conditions for many years, requiring minimal maintenance. These flushing gates may be easily retrofitted in existing equalization or retention/detention storage tanks with little or no modification to the tank structure or mode of operation. In addition they are the only flushing system that can be used for flushing sewer pipes of almost any diameter

The ACU-GATE flushing gates are shipped from the factory, pre-tested, completely assembled and ready to install. Installation consists of installing the anchors (threaded rods) into the concrete wall using a two part chemical adhesive and then mounting the unit using the Grande Water Management Systems supplied mounting brackets. The installation of a gate requires approximately two (2) hours and two (2) workers. No special equipment is needed.

The ACU-GATE flushing gates are simple to use and require no external water supply. The gates store in-situ water behind them so that after the tank is used, this water may be suddenly released, thereby creating a dam-break type wave that surges across the floor of the retention tank to sweep all debris into the end sump.

The gate is operated using a low pressure hydraulic system (10 to 15 bars) that may be operated using either a mechanical hydraulic power pack or a float system. The operation is then controlled using a separate control panel according to the project needs and the design engineer's requirements.

1.2 SAFETY CONSIDERATIONS

In order to ensure worker's safety, we recommend that the personnel responsible for installation, operation and maintenance of the equipment read and study the instructions in this manual before attempting to handle or install the equipment and follow the directions carefully. Also request your mechanical subcontractor to familiarize himself with this manual.

Wear proper protective clothing when working on or around equipment, i.e. hard hats, heavy boots, safety glasses and breathing apparatus (if necessary) and contact your GWMS representative with any questions you may have regarding safety in handling GWMS equipment.

	Installation, Operation & Maintenance Manual for ACU-GATE Control Gate GREENWOOD PARK- Birmingham, Alabama	GWMS Project # : 1205	
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1.3 RECEIVING, HANDLING & STORAGE

This manual describes the recommended procedure for installation, operation and maintenance of GWMS equipment when used in conjunction with the attached approved documents that have been supplied by GWMS. Proper care and precautions must be taken in handling and storing the equipment at the delivery site. For any information not contained in this document or for additional information, contact GWMS.

Carefully inspect the equipment and accessories when received, prior to unloading trucks, and report all shortages or suspected damage by marking the Bill of Lading at this time and notify GWMS immediately.

Use proper equipment and adequate support and bracing when lifting or unloading the items and store equipment in original shipping containers until installation. The units are not weatherproof until fully installed and functioning.

Store equipment evenly on planks or timbers on a flat and horizontal surface. Uneven storage may cause the equipment to become permanently warped.

Do not stack equipment higher than the height it has been shipped to your site.

Do not stack other goods or equipment on GWMS equipment.

Please note that small system components are always shipped in closed crates or boxes. We recommend storing this equipment in its' original packaging in a safe and locked area.

Inside dry storage is always best for all equipment. However, if this is not possible, covering equipment stored outside with tarpaulins is recommended to minimize potential damage by climate.

Electronic components, control panels, etc. must always be stored in a dry and heated storage area.

Off-site storage must follow the same requirements as on-site storage.

NO PREVENTIVE MAINTENANCE IS REQUIRED DURING STORAGE.



2. LIST OF EQUIPMENT SUPPLIED BY GWMS

2.1 GWMS SUPPLIED EQUIPMENT

For this project, GWMS has supplied the following equipment:

- Two (2) ACU-GATE flushing gates, model GAG-48/45 in SS 304;
- One (1) Local control panel in a NEMA 4X enclosure;
- One (1) Hydraulic power unit
- One (1) Ultrasonic level sensor and transducer

2.2 LIST OF SPARE EQUIPMENT

- One (1) hydraulic cylinder
- One (1) 3-way solenoid valve
- One (1) 2-way solenoid valve
- One (1) filter cartridge

2.3 WEIGHT OF EQUIPMENT

- ACU-GATE model GAG-48/45 625 lbs each
- HPU/LCP Enclosure 700 lbs

3. INSTALLATION INSTRUCTIONS

3.1 GENERAL INSTALLATION RECOMMENDATIONS

Precise and accurate installation is critical to proper operation of GWMS equipment. GWMS assumes no liability, expressed or implied, for interpretation of the contents of this manual. If you have any questions concerning the interpretation of the contents of this manual or the procedures described herein you should contact GWMS. GWMS expressly disclaims all liability, expressed or implied, for faulty installation of any ACU-GATE flushing gate or associated equipment and for any direct, consequential, or incidental damages that may result.

Read and follow the Installation, Operation and Maintenance Manual thoroughly before attempting to install the equipment.

Accurately locate and brace embedded items during placement of concrete and ensure that all embedded items have been properly installed and that they are within the tolerances shown on the approved drawings before proceeding with the installation of equipment.

Adequately support and brace heavy items during the placement of the equipment and tighten all nuts and/or anchor bolts uniformly using the anchor bolt manufacturer recommended maximum torque.

Do not disassemble the equipment for installation unless specifically instructed to by GWMS.

Ensure that all excess concrete and grout is removed from installation site before proceeding with installation.

Nuts for studs or anchors must be tightened evenly. Pulling the equipment frame or tightening against an uneven surface will, in most cases, result in WARPING THE FRAME which will cause excessive leakage or improper operation of the equipment.

3.2 INSTALLATION INSTRUCTIONS

The installation of the ACU-GATE flushing system is simple and consists of the following four basic steps:

- Installing the Chemical Anchors
- Installing the ACU-GATE Control Gate
- Installing the Local Control Panel / Hydraulic Power Pack
- Installing and Purging the Hydraulic Lines

3.2.1 Installing the Chemical Anchors

The embedded anchors are installed in the concrete wall, which forms the wall of the flush water storage area (FWSA). The chemical anchors consist of the threaded rods and the two part chemical adhesive. The threaded rods must be accurately placed in the concrete wall at the exact location shown on the approval drawings and allowed to set prior to the installation of the flushing gates.

- Care must be taken to accurately mark the location of each anchor.
- The hole is then drilled to the proper depth.
- The hole is blown clean.
- The two part adhesive is inserted into the hole.
- The treaded rod is inserted into the hole (while turning) and allowed to set for twenty-four hours.

These instructions are intended as a guide for most typical installations.

3.2.2 Installing the ACU-GATE Control Gate

The ACU-GATE gate is shipped completely pre-assembled and ready to install.

Simply attach it to the wall using the embedded threaded rods, the supplied brackets, washer, lock washer and nut. The exact position of the gate opening, the gate and the attachment brackets are shown on the drawings in Section 8. Please follow the following instructions for proper installation.

- The concrete wall and anchoring system (between the concrete opening and the embedded threaded rods) must be checked to ensure that it is completely flat within a tolerance of + 0" and - 1/8" and that the frame can be attached to it without causing the frame to bend. If the concrete wall face between the concrete opening and the threaded rods does not conform to this tolerance then corrective steps must be taken, such as grinding or filling of the concrete face prior to installation of the gates.
- Both the concrete wall and the back of the stainless steel gate frame gasket (which is to be sealed against the concrete wall) must be clean and dry. Any debris that may have accumulated during construction of the wall or transportation and manipulation of the gates must be removed by washing the surfaces, wiping them dry and allowing them to air dry before proceeding with the next step.
- Place the gate in its installed position against the concrete wall. Ensure that the gate is aligned with the opening, ensuring that the bottom of the gate is perfectly horizontal and that the lowest point on the concrete opening invert is at the same elevation as the gate opening invert. Two wooden spacers are measured and prepared, so that the gate may be placed in this position and held in place for proper gate attachment.
- Using the brackets supplied by GWMS attach the gate frame to the threaded anchor rod as shown on approval drawing (see Section 8). The nuts are then tightened (torque to a maximum of 25 ft-lbs) so that the gasket is compressed evenly between the concrete wall and the back of the gate frame.

3.2.3 Installing the Local Control Panel / Hydraulic Power Pack

The hydraulic power pack and control panel are shipped completely pre-assembled and tested in an explosion proof enclosure and ready to install. The enclosure supports are simply anchored to the concrete floor using eight expansion anchors. Please refer to approval drawings (see Section 8) for LCP / HPU arrangement. The main power connections and all field connections between the local control panel, the remote PLC and field devices are made by a qualified electrician.

3.2.4 Installing the Hydraulic Lines

Installing the hydraulic lines consists of several steps and the use of several components, including the continuous rigid stainless steel, the SWAGELOK tube fittings (union connectors), the SWAGELOK support system and the HILTI 1/4" Kwik-Bolt anchors.

Each ACU-GATE flushing gate is equipped with a hydraulic cylinder, which is used to operate the gate. The cylinder is equipped with one SWAGELOK female connector which is shipped covered, in order to ensure that no debris enters the cylinder during transportation and installation. The covering on the fitting is removed.

- The hydraulic tube end is inserted into the SWAGELOCK fitting at the cylinder (ensure that the tube end is inserted fully into the fitting) and the compression nut is finger-tightened. While holding the SWAGELOK fitting with a wrench, tighten the nut with a second wrench 1 1/4 turn. The other end of the hydraulic tube is then fitted with a SWAGELOCK Union fitting (part number SS-600-6) (should the tube length not be sufficient) and the compression nut is finger tightened. While holding the fitting with a wrench, tighten the nut with a second wrench 1 1/4 turn. Following this, insert the next hydraulic line and repeat the process until the line reaches the hydraulic power pack.
- Insert one tube end into the SWAGELOK fitting located on the HPU manifold (ensure that the tube end is inserted fully into the fitting) and finger tighten the compression nut. Next, while holding the SWAGELOK fitting with a wrench, tighten the nut with a second wrench 1 1/4 turn.
- The stainless steel 3/8" o.d., hydraulic tubing (shipped to site in one continuous roll) must be run continuously between the cylinder and the LCP/HPU. The exact routing will depend on site constraints. The hydraulic line must be attached to the concrete structure at intervals of five (5') feet.
- A mounting rail is anchored to the concrete using two 1/4" HILTI "Kwik-Bolt" as shown on drawing (see Section 8). Then each line is attached to the mounting rail using the stainless steel 316 clamp supplied, as shown on the drawing.
- Once the lines are installed from the HPU to the gate cylinder, the hydraulic line is left unconnected at the hydraulic cylinder. The reservoir is filled with oil and the end of the hydraulic line (at the hydraulic cylinder) is placed into a clean and empty container. With an operator at both the hydraulic power unit and at the hydraulic cylinder, the motor is started and hydraulic fluid is allowed to fill the hydraulic line. The hydraulic motor is left on until at least one (1) quart of hydraulic fluid is collected at the cylinder to ensure that the hydraulic line is purged of air. At this time the hydraulic line is connected to the fitting on the cylinder and is tightened in place.



4. OPERATION

4.1 GENERAL OPERATING RECOMMENDATIONS

The ACU-GATE control gates are designed to control the flow of low levels of stormwater flow to the dry stormwater detention cells. The system is completely self-contained.

GWMS has supplied a Local Control Panel (LCP) and Hydraulic Power Unit (HPU) for this project. The LCP/HPU is collectively referred to as the "ACU-GATE CONTROL PANEL/HPU". The ACU-GATE CONTROL PANEL/HPU is designed to control the operation of the flushing gates using the PLC controlled logic, automatically monitoring the use of the storage tank. The local HCP may also be used to operate the gates.

Tank No./Name	Number of gates	Gates	Control Panel
1	2	FG-1, FG-2	ACU-GATE CONTROL PANEL/HPU

During dry weather or when control is not required, the gates are normally in the unlocked (unlatched) or open position, allowing water to flow through it. The hydraulic power unit is off and all solenoids are not energized. The hydraulic pump and the solenoid valves are energized only when the water level upstream attains the "Low Level USWL" (8"). The gates then transition into the locked (latched) or closed position and remain in that position until the upstream water level attains the "High Level USWL" (18"). Once the upstream water level exceeds the "High Level USWL" (18"), the solenoid valves are de-energized and the gates are unlatched and opened. The operation may also be carried out manually by an operator using the manual pushbuttons to operate the HPU and the manual overrides on the solenoid operated cartridge valves.

When operation is requested, the hydraulic power unit (HPU) is turned on and the corresponding solenoid operated gate valve and dump valve are activated. This results in pressurizing the hydraulic gate cylinder. The hydraulic pressure acts against the latching spring of the gate cylinder, thereby rotating the latching hooks into the latched position thereby latching the control gate. The normal operating pressure is in the order of 200 to 250 psi.

Before operating the control gates for the first time, ensure that all debris and equipment is removed from the area, especially on the downstream side.

Large Debris

Branches, rocks, construction materials (wood, concrete, etc), or other large debris may lodge in the ACU-GATE control gate when it is operated for the first time. Damage to the seal or sealing surfaces may occur. **Remove all large debris before operating the flushing gate.**



Installation Debris

Excess concrete or grout from tank construction or control gate installation can damage seals and sealing faces as well as bind on rotating parts and stop the control gate from functioning as designed. **Remove all concrete and grout from all flushing gate components before operation.**

Mud and Grit

In certain instances, a control gate may become buried in mud and grit. The forces required to operate a buried control gate are excessive and may exceed the design loads. Remove mud and grit before operating the control gate.

Ice Buildup

Under certain conditions, icing may occur. This may result in excessive loading requirements to operate the control gate. Excessive loading may result in damage to controlgate components. **Remove all ice before operating the control gate.**

DO NOT operate equipment before thoroughly reviewing this Installation, Operation and Maintenance Manual.

DO NOT operate equipment before a complete start-up is performed by a qualified GWMS representative.

DO NOT use any mechanical devices to operate equipment other than GWMS supplied devices.

DO NOT open electrical cabinets before disconnecting power and isolating control circuits.

DO NOT place any body parts in path of moving parts.

DO NOT operate equipment if any loose or damaged parts are visible.

	<i>Installation, Operation & Maintenance Manual for ACU-GATE Control Gate GREENWOOD PARK- Birmingham, Alabama</i>	GWMS Project # : 1205	
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4.2 OPERATING MODES

The control gates are controlled by the Grande Water Management Systems (GWMS) supplied ACU-GATE CONTROL PANEL/HPU. The ACU-GATE CONTROL PANEL/HPU houses a MicroLogix 1400 PLC and all required expansion modules which controls the operation of the system. The system can be placed in one of three modes, "Manual", "Off" or "Auto". The system mode is selectable from the three position selector switch located on the outside of the inner enclosure door panel. The system can only function in one mode at a time.

When the selector switch is put to the "Off" position, no gate operation may be performed. The gates remain in the unlatched or open position.

The "Off" mode is selected when personnel are to inspect or maintain the equipment. This ensures that the personnel may carry out their work without risk of control gate operation. **NOTE: The wave produced by a gate in operation may result in serious injury or damage to anyone or anything in its path.**

4.2.1 Manual Mode

When the selector switch is put to the "Manual" position, the HPU can then only be controlled by the local operator from the enclosure door mounted pushbuttons. The operator can change the control panel mode, start or stop the HPU, open or close a gate using the door mounted push buttons or the manual override on the solenoid operated cartridge valves, and push the emergency stop button.

The operator can "Close" a gate, by using the manual overrides on the solenoid cartridge valves. The gate will only close if there is less than the "Low Level USWL" (8") of water upstream.

4.2.2 Auto Mode

When the selector switch is put to the "Auto" position, the gates will operate in response to the control logic saved on the PLC in the ACU-GATE CONTROL PANEL/HPU.

Alarms indicate that there is a problem with the system and depending on the type of alarm, the system may shut down. The alarms are represented by amber lights on the control panel. No other actions can be performed until the alarm condition is verified and the alarms are reset.

4.3 ALARMS

The system is equipped with four alarms that are specific to this type of an operating system and an Emergency Stop. These alarms are applicable only to the hydraulic power unit which is used to operate the hydraulic cylinder on the Grande ACU-GATE control gate. These alarms are:

- Low oil level ;
- Low oil pressure ;
- High oil temperature;
- Motor Overload

4.3.1 Low Oil Level Alarm

This alarm is used to monitor the oil level in the HPU reservoir and is always checked. If the oil level in the HPU drops below a certain level (to a level where the hydraulic pump can no longer pump hydraulic fluid effectively) the alarm sensor is activated and a light indicating "Low Oil Level" is illuminated on the control panel enclosure door.

If this alarm occurs when a gate is in operation (its' solenoid operated cartridge valve is energized), the system will turn the alarm on immediately and shut down the HPU to prevent excessive loss of hydraulic fluid. If this alarm occurs, it should be verified by inspecting the level gauge located on the front of the HPU reservoir. If the gauge confirms the condition, then you must determine and repair the cause. If the gauge indicates that the oil level is fine, then the oil level sensor or electronic signal may be faulty and in need of replacement or repair. This alarm will shut the HPU down in "Auto" mode. This alarm may be reset, once rectified, by pressing the reset button on the enclosure door. If the system was in operation at the time, the gate will go back to its original un-latched position, even if the water level is between the "Low Level USWL" (8") and the "High Level USWL" (18").

4.3.2 Low Oil Pressure Alarm

This alarm is used to monitor the hydraulic pressure produced by the HPU and is present when the HPU cannot produce sufficient pressure to operate a flushing gate (Latch/Unlatch). This condition is only checked during the control gate operation, after "Timer 2" expires, in order to allow the system to build pressure. If this alarm condition is present, the alarm sensor is activated and a light indicating "Low Oil Pressure" is illuminated on the control panel enclosure door.

If this alarm occurs the system will turn the alarm on immediately and shut down the HPU to prevent excessive loss of hydraulic fluid. If this alarm occurs, it should be verified by inspecting the pressure gauge located on the HPU manifold. If the gauge confirms the condition, then you must determine and repair the cause. If the gauge indicates that the pressure is fine, then the pressure sensor or electronic signal may be faulty and in need of replacement or repair. This alarm will shut the HPU down in "Auto" mode. This alarm may be reset, once rectified, by pressing the reset button on the enclosure door. If the system was in operation at the time, the gate will go back to its original un-latched position, even if the water level is between the "Low Level USWL" (8") and the "High Level USWL" (18").



4.3.3 High Oil Temperature Alarm

This alarm is used to monitor the hydraulic fluid temperature to ensure that it remains within acceptable parameters. A light indicating "Low Oil Pressure" is illuminated on the control panel enclosure door when this alarm occurs. This alarm may be confirmed by inspection of the thermometer mounted on the hydraulic reservoir (it is incorporated into the level gauge mounted on the front of the HPU reservoir). If not confirmed by the thermometer, then the sensor may be defective and require replacement.

If this alarm occurs, the operator must verify the hydraulic components to determine what may be causing the overheating. The high temperature alarm will most likely be caused by excessive friction in the gear pump. The normal operating oil temperature will range from ambient to 20°F above ambient temperature. The high temperature alarm is set at 140°F. If the system was in operation at the time, the gate will go back to its original un-latched position, even if the water level is between the "Low Level USWL" (8") and the "High Level USWL" (18").

4.3.4 Motor Overload

This alarm is used to monitor the functionality of the HPU motor. If this alarm is present, the motor will not run. Therefore, hydraulic pressure cannot be created to operate the ACU-GATES.

4.3.5 Emergency Stop

If an operator pushes the "Emergency Stop" button, then all outputs are shut down and the system is inoperable. When the system is shut down using this feature, the button must be reset by twisting and pulling the emergency stop button, at which time the power will be restored and the system will return to its initial state, to its original un-latched position, even if the water level is between the "Low Level USWL" (8") and the "High Level USWL" (18").

Important Note: If an alarm goes off while a gate is in the closed position, the system will be reset. This means that the operator will only be able to manually operate the gate after the problem is rectified and that the water level upstream is below 8". The gate will not latch if there is more than 8" stored upstream.

The ACU-GATE flushing gates may be operated manually even in the case of a complete PLC failure by using the manual override on the cartridge valves (dump valve & corresponding gate valves) and the start/stop pushbutton located inside the enclosure which controls the operation of the electric pump motor.

4.4 OPERATING A CONTROL GATE

4.4.1 Operation of the ACU-GATE CONTROL PANEL/HPU in "Auto" Mode

When the enclosure door mounted selector switch is in "Auto" mode, then the system will operate automatically based on the PLC logic. The PLC logic is as follows:

1. The upstream water level readings are taken using the DrexelBrook ultrasonic sensor. Once the upstream water level attains the "Low Level USWL" (8"), the HPU is started and will remain operational for the duration of "Timer 1".
2. The oil recirculation timer, "Timer 2", is started. Once it has elapsed, the solenoid operated cartridge valves and dump valve are energized. As a result, pressure is created in the system and the ACU-GATE control gates are latched. The system will only verify the low pressure condition once "Timer 3" has elapsed in order to allow the pressure to build up.
3. The control gates remain latched until the water level attains the "High Level USWL" (18"). The HPU is equipped with a hydraulic fluid accumulator and a second pressure sensor. The accumulator and sensor are used to maintain system pressure and to restart the HPU should it be required.
4. The control gates unlatch once the upstream water level exceeds the "High Level USWL" (18") and will remain unlatched until the next cycle occurs. The gates will not relatch if there is water behind them.

INITIAL TIMER SETTINGS

TIMER	INITIAL SETPOINT	Description
1	60 seconds	Hydraulic power unit idle time
2	5 seconds	Oil recirculation timer
3	5 seconds	Low Pressure Alarm time delay

These settings may be modified using a notebook computer (not supplied by GWMS), programming software (not supplied by GWMS) and an adaptor cable (not supplied by GWMS).

4.4.1.1 **Modification of the PLC Timers and System Information**

Should any of the PLC timers require modification or in the event that the system information requires to be accessed, the following steps should be performed directly on the PLC:

1. Enter the Monitoring menu by pressing the arrows and the OK button.
2. With the up/down arrows, select the N7 file number and press the OK button.
3. The N7 values that can be viewed or modified are as follows:
 - a. N7:5 = Value of the counter of how many times the HPU maintains the pressure when the automatic cycle is selected, during 1 system operation cycle.
 - b. N7:11 = Recirculating time before cylinders get activated (5 seconds)
 - c. N7:12 = Low Pressure Alarm delay timer in Automatic mode (5 seconds)
 - d. N7:14 = Timer off delay of HPU during Automatic mode (60 seconds)
4. Press the OK button to be able to modify the value of those registers with the up/down keys.
5. Press the OK button to validate the change.

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4.4.2 Operation of the ACU-GATE CONTROL PANEL/HPU in "Manual" Mode

When the enclosure door mounted selector switch is in "Manual" mode, then the system will operate based on operator commands using the door-mounted push buttons:

1. The upstream water level readings are taken using the DrexelBrook ultrasonic sensor. The operator may latch the gates by pressing the "CLOSE FG-1 FG-2" door-mounted pushbutton.
2. Pressing the "CLOSE FG-1 FG-2" door-mounted pushbutton starts the oil recirculation timer, "Timer 2" and energizes the dump valve and both solenoid operated cartridge valves corresponding to the control gates are activated. As a result, pressure is created in the system and the ACU-GATE control gates are latched.
3. The control gates remain latched until the "OPEN FG-1 FG-2" door-mounted pushbutton is pressed. Once pressed, the solenoid operated cartridge valves and dump valve are de-energized and the gates unlatch (open).

Note: The gates will not latch if there is more than 8" of water behind them.

4.4.3 Effects of Alarms on System Operation

Should any of the three HPU alarms "Low Oil Level", "Low Oil Pressure" or "High Oil Temperature" alarms occur then the HPU would immediately turn itself off and any flushing gate operation would cease. If a gate was in the process of being latched when the HPU was de-energized, then the spring in the gate cylinder would return the cylinder to its unlatched position. Once the cause of the alarm was determined and rectified, the gate will only be able to re-latch itself when the upstream water level is at 8".

In all cases, the alarm needs to be acknowledged by pressing the reset button on the panel door.

4.4.4 Manual Operation in Case of PLC Failure

The ACU-GATE control gates may be operated manually even in the case of a complete PLC failure by using the manual override on the cartridge valves (dump valve & corresponding gate valves) and the start/stop pushbutton located inside the control panel which controls the operation of the electric pump motor directly.

The operator must place the HPU selector switch to "Manual" mode. The flushing gate solenoid operated cartridge valve corresponding to the flushing gate that is to be operated (FG-X) is placed in the manual override position. Since the flushing gate cartridge valve is a two way valve in the normally opened position, the operator must push/twist the manual override knob into the closed position which will then place the valve in the closed position. In order for the flushing gate to open, the operator must also place the solenoid operated cartridge dump valve, which is a two way normally opened valve, in the manual override position. The operator must push the manual override knob in while twisting so that it stays in the closed position. This will allow the hydraulic fluid to flow to the cylinder and create the required pressure to unlatch the flushing gate. Leaving the system in this position will keep the flushing gate closed for as long as the electric pump motor is left on.

In order to return the system to its normal operating mode and for the gate to un-latch, the electric pump/motor must be turned off and the manual overrides on the cartridge valves must be put back to their original/normal positions.

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If the system components are not returned to their normal positions, the system may not operate correctly when controlled in "Auto" mode.

4.5 PLC PROGRAM LISTING

5. MAINTENANCE

5.1 GENERAL

The ACU-GATE control gates are factory tested and adjusted, shipped pre-assembled to site and readjusted (should they require it) once they are installed at site by authorized GWMS personnel. No further adjustments are necessary. Should adjustments be made on the ACU-GATE control gates without approval and/or consultation with GWMS in advance and in writing, then the warranty will be void.

5.2 PREVENTATIVE MAINTENANCE

Visual inspection on a regular basis is all the maintenance required. The following procedures are recommended:

- The area behind the control gates should be inspected to ensure that no large debris, such as wood, branches or rocks are present. Should debris be found, it should be removed.
- The gates should be visually inspected to ensure that they are normally in the unlatched position. Should this not be so, lift the gate up and determine the cause of the problem. Clean the seal and the surface of the frame on which it sits, remove any obstacle and then re-latch the gate by operating it manually (from the LCP/HPU enclosure).
- Visually inspect the hydraulic tubing and the connections for any leaks and take corrective action.
- Because of the small oil displacement when a gate is operated (12 cubic inches) very little air is displaced through the breather cap, as a result it requires no maintenance.
- The system is equipped with an intake strainer and a pressure filter. The pressure filter is equipped with an indicator, therefore the filter need only be changed if required. The hydraulic fluid should only be changed every two filter changes.
- Visually inspect the hydraulic fluid level in the hydraulic power pack reservoir. If low, fill to the 3/4 mark on the sight glass on the reservoir.
- Note: Use only UNIVIS HVI 26 to top off hydraulic fluid. Using other types of hydraulic fluid will void warranty. The oil should be replaced after two oil filter changes.
- The visual inspection should be carried out according to the following schedule:
 - After the first two events.
 - At regular three month intervals thereafter, preferably after an event.

6. TROUBLESHOOTING

6.1 GENERAL

Because of the simplicity of the equipment and the lack of complicated mechanical components, there should not be any problems with its proper operation. No modifications should be made to the equipment after start-up by the system operator without contacting GWMS and receiving GWMS approval in writing prior to implementing any changes.

The ACU-GATE control gates are constructed entirely of stainless steel, are permanently sealed, and require no lubrication. This will ensure long trouble-free years of service. However if operating problems are experienced, please refer to this section of the manual for help in rectifying the problem. Should you need additional assistance, please contact GWMS.

6.2 HYDRAULIC CONTROL PANEL (HCP) NOT FUNCTIONING

The HCP for this project consists of an explosion proof enclosure, equipped with explosion proof switches, lights, push buttons and an emergency stop pushbutton on the door of the enclosure. Because of the simplicity of the HCP, the system should operate reliably and without problems. If the system does not operate properly, then the cause is most likely a defective component. Should a component be found to be defective, simply replace it. Do not substitute components with "or Equal" parts, use only manufacturer supplied replacement parts. A list of the components is contained in this manual. If the problem persists, please contact GWMS for assistance.

6.3 GATE FAILS TO LATCH DURING OPERATION

This may be caused by several conditions. The first is that the system was energized when the water level exceeded the "Low Level USWL" (8"). The latches closed, but the gate was still in the open position. Simply de-energize the gates in question from the HCP. This will cause the latches to open, which will allow the upstream water to flow through the gate. The latches can only re-latch the gate when the water level attains the "Low Level USWL" (8").

If a gate does not latch during the control cycle, this is probably caused by debris impeding the proper closing and latching of the gate. In this case, the system must be de-energized. The gates will be unlocked as a result of the shut down. The gate must then be lifted up manually and any debris obstructing its operation must be removed. The silicon seal and the frame lip on which the seal rests should be wiped clean. The gate will remain in the unlatched position until the next operation sequence occurs.

6.4 GATE FAILS TO OPERATE BECAUSE OF LOW OIL PRESSURE

If a low oil pressure alarm occurs, the hydraulic power unit (HPU) will immediately stop operating to ensure that no oil is spilled into the environment, should the alarm be caused by an oil leak. If this occurs, then the gate will need to be unlatched (as described above) once the problem which caused the low oil pressure alarm to sound is corrected.

The low pressure alarm may be caused by a leak in the hydraulic system, which comprises the manifold, the flexible and/or rigid hydraulic lines, a hydraulic line connection or the operating cylinder. The cause of the low pressure alarm should be determined and the defective part should be replaced. If a replacement part is not available, please contact GWMS to obtain it. After the part is replaced, hydraulic fluid (UNIVIS HVI 26) may need to be added to the HPU reservoir and the hydraulic line may need to be purged of air. Please verify that the sensor is operating properly by verifying the operating pressure on the pressure gauge.

The low oil pressure alarm may also be caused by a defective dump valve or a defective dump valve solenoid. The dump valve is normally open. This means that a failure would result in the pumped oil returning directly to the reservoir and therefore no pressure would be built up. If either the dump valve solenoid or the valve cartridge itself is found to be the cause, it should be replaced.

6.5 GATE FAILS TO OPERATE BECAUSE OF LOW OIL LEVEL ALARM

If this condition occurs, please verify the cause, rectify the problem and then refill the reservoir with hydraulic fluid. A low oil level alarm will normally be caused by a leak in the hydraulic system. The cause of the leak must be determined and repaired. The reservoir is then topped off with hydraulic fluid and tested. Please verify that the electronic level sensor is working properly by verifying the oil level gauge mounted on the HPU reservoir.

Please note that air trapped in the hydraulic lines may also cause a low level alarm when the air in the pipe is replaced with hydraulic fluid from the reservoir.

6.6 GATE FAILS TO OPERATE BECAUSE OF HIGH TEMPERATURE ALARM

If this condition occurs, the cause should be determined. If it is caused by an increase in temperature then allow the ambient temperature to return to normal before operating the unit. Verify that the temperature sensor is working properly by checking the oil temperature gauge mounted on the HPU reservoir. If this condition is caused by mechanical failure of the hydraulic power pack, please refer to section 6.7.

6.7 TROUBLESHOOTING THE HYDRAULIC POWER PACK

The hydraulic components may require servicing from time to time. In order to facilitate troubleshooting of the mechanical components, we have compiled a failure analysis list which will help to reduce down time spent in troubleshooting.

The following is a general guide used for hydraulic drive systems:

- Understanding the System
 - Defects can only be detected when there is a perfect understanding of the system.
 - Initially it is necessary to establish the capacities of the system components. Each has a maximum pressure, maximum flow or torque. If these values are exceeded, there is the possibility of a failure.
 - Generally, the pressure in the system must be monitored regularly in order to verify that the maximum pressure is not exceeded for each individual component.
- System Procedure
 - First the system should be analyzed to learn the logical sequence of operation for each component. Then, by using the hydraulic schematic to locate the origin of the failure, down time of the machine can be reduced.
- Some indications to system failure are:
 - Excessive Heat
This may be caused by a misaligned coupling, overloading the bearings and transfer of heat into the system through the pump. Return lines warmer than normal indicates that the system is operating at higher pressure than the relief valve setting.
 - Excessive Noise Level
This may be caused by misalignment, cavitations or lack of fluid. Contaminated oil can cause a valve spool to seize, producing excessive noise.

The preceding problems are postly attributed to a clogged filter, dirty lines, high oil viscosity or low oil level.

Some possible corrective procedures to follow are:

- Change dirty oil filters.
- Clean air breather.
- Eliminate restriction in suction lines.
- Verify oil and change oil if necessary.
- Verify the RPM and rotation direction of electric motor.
- Excessive load in system. Verify setting of pump relief valve.
- Tighten all connections.
- Verify all pump suction lines and eliminate any entrance of air.
- Suction line not immersed in oil. Re-plumb the line and immerse well below the minimum reservoir oil level.
- Verify the oil level and top up. (All drain and return lines should be well under oil level.)

- Bleed air from system.
- Change the pump seals.
- Realign pump and electric motor.
- Replace damaged coupling.
- Verify condition of seals and bearings.
- Verify axes alignment of pump and motor shafts.
- Install a pressure gauge and adjust to correct pressure.
- Repair or replace.



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Manual for ACU-GATE Control Gate
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7. WARRANTY

The ACU-GATE Control Gate as supplied by Grande Water Management Systems, Inc. including the anchoring system, frame, gate, locking and sealing mechanism, hydraulic cylinder, hydraulic tubing, hydraulic pump, reservoir, valves and mechanical connections shall be guaranteed against any manufacturing and design defects for a period of five (5) years from the date of installation. The electronic control panel, PLC, expansion modules, solenoids, motor, relays, timers, sensors and all other electronic components supplied by Grande Water Management Systems, Inc. shall be guaranteed against manufacturing and design defects for a period of one (1) year from the date of installation. The warranty covers the cost of all component parts as well as the labour of a qualified technician required to repair or replace the parts.

The guarantee and the remedies provided for defective parts set forth above shall be in accordance with Section 15101 of the project specifications and are in lieu of and shall supersede any and all guarantees or warranties, express or implied, or remedies provided by law or otherwise (including those set forth in purchase order forms or other sales documents).

Any damages resulting from improper use or abuse, unauthorized modification, correction or repair done to GWMS equipment or components without receiving prior written consent of GWMS will result in voiding the warranty.

To contact GWMS, please address your correspondence to:

Grande Water Management Systems
100 Alexis Nihon Blvd, suite 547
Montreal, Quebec
CANADA
H4M 2P1

or phone: Tel (514) 904-6580 or Toll-free: 1-866-904-6580
Fax (514) 904-6573 or e-mail: info@grandeinc.com

	<i>Submittal for Approval ACU-GATE Flushing Gates Greenwood Park</i>	GWMS Project # : 1205	
		Date : July 2011	Page : 1 Rev. : 00

8. APPROVAL DOCUMENTS

8.1 AS-BUILT DOCUMENTS AND DRAWINGS

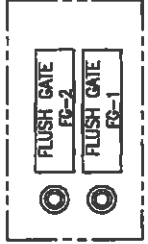
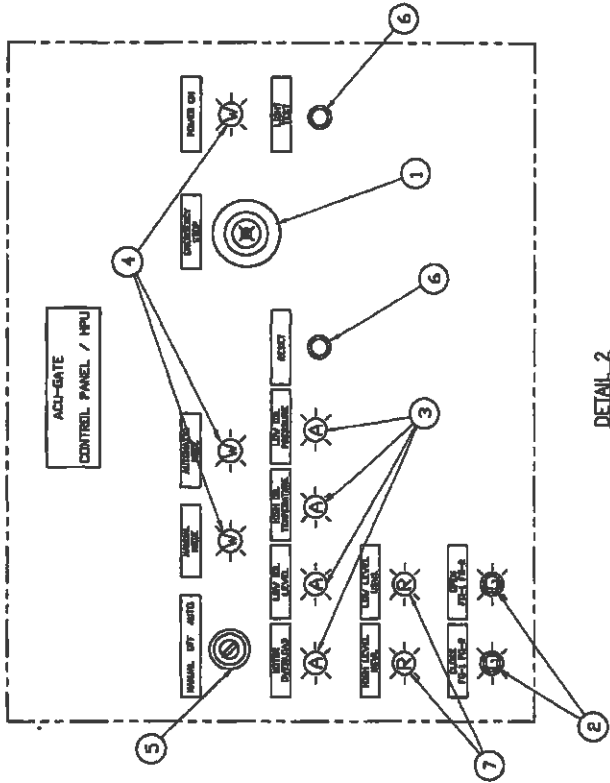
8.1.1 As-Built Drawings

THE EQUIPMENT DETAILS ARE FOR APPROVAL PURPOSES ONLY.
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 EXCLUSIVE PROPERTY OF GRANDE WATER MANAGEMENT SYSTEMS.

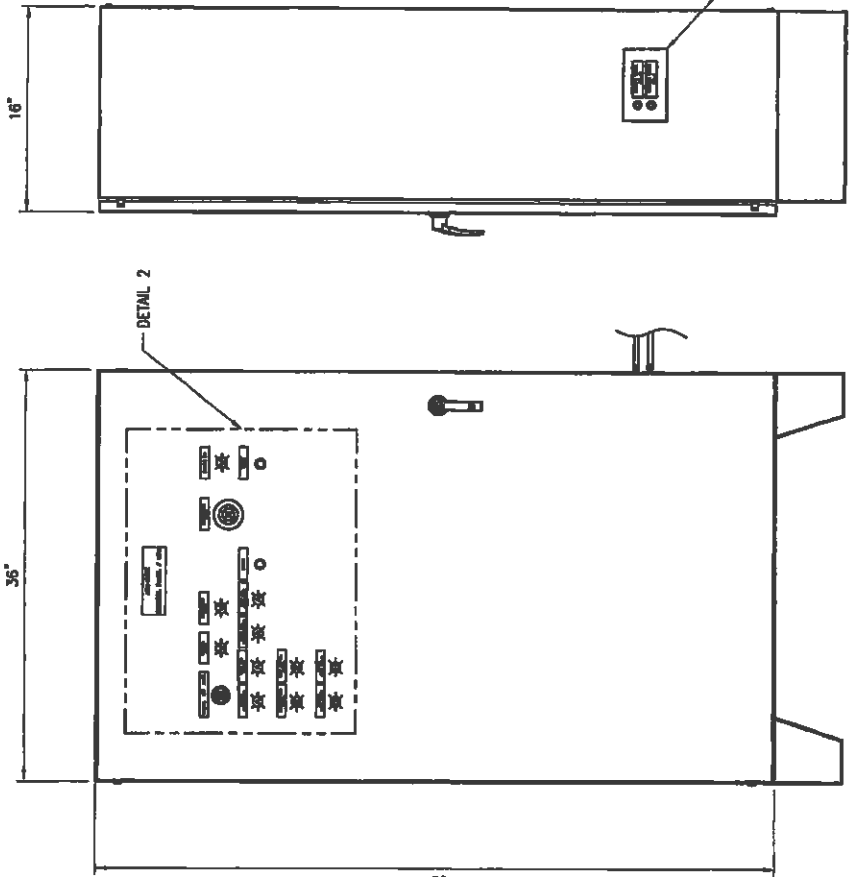
NOTES:

1- THE LAMICOIDES IDENTIFICATIONS ARE WITH WHITE TEXT ON BLACK BACKGROUND

REF	CITY / MANUF.	PART N.	DESCRIPTION
1	ALLEN BRADLEY	800PH410	ILLUMINATED RED SP 7 POS : BK
2	ALLEN BRADLEY	800PH410	ILLUMINATED GREEN BUTTONS 22 ENCLOSURE
3	ALLEN BRADLEY	800PH410	AMBER LED 22 MM AL ALUM. LENS. BUTTON
4	ALLEN BRADLEY	800PH410	WHITE LED 22 MM : COG. REEL. POWER ON
5	ALLEN BRADLEY	800PH410	GREEN LED 22 MM : TEST
6	ALLEN BRADLEY	800PH410	FLUSH BUTTON 22 MM (BLACK) : TEST
7	ALLEN BRADLEY	800PH410	RED LED 22 MM WATER LEVELS



DETAIL 3



Grande
 Water management systems
 100 Maple Haven Blvd. Tel.: (514) 904-8880
 Suite 217 Quebec Fax: (514) 904-8873
 H9A 2H1 www.grandele.com

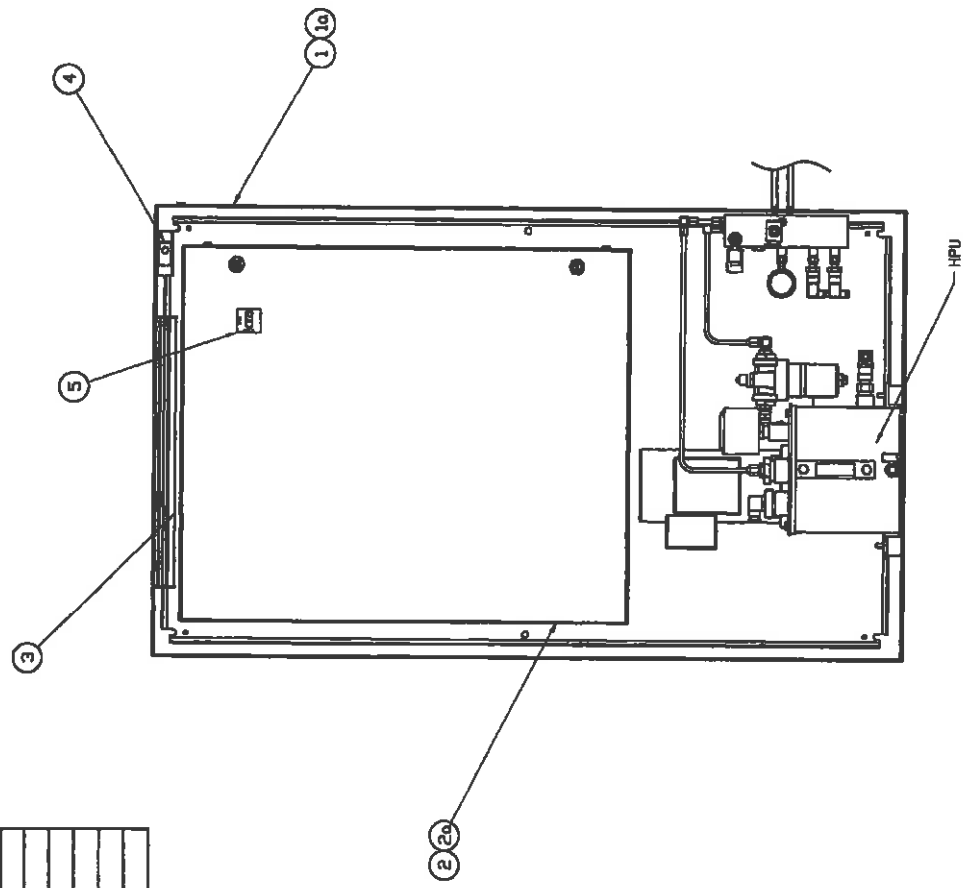
GRANDE ACU-GATE
 MODEL GAT-48/45
 OUTER PANEL
 GREENWOOD PARK
 BRIMINGHAM, ALABAMA


Scale: N.T.S. Date: JUN. 15, 2011 Rev: 01

REV.	DATE	DESCRIPTION
01	6/22/10	AS-BUILT

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REF	QTY	MANUF.	PART. N.	DESCRIPTION
1	1	EUROBEX	5412ES6803616	STAINLESS STEEL ENCLOSURE NEMA 4X 60X36X16
1a	1	EUROBEX	8818P0036	PANEL 60X36
2	1	EUROBEX	5412ES303608	ENCLOSURE NEMA 12: 30X36X8
2a	1	EUROBEX	681-SP3036	PANEL : 30X36
3	1	HOFFMAN	LF120V18	FLUORESCENT LIGHT
4	1	HOFFMAN	ALF5WD	DOOR SWITCH
5	1	ABB	CHBS3AH	PAOLOCKABLE HANDLE
5a	1	ABB	CHS8A250	SHAFT 250 MM





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H9L 2P1 www.grandetec.com

GRANDE ACU-GATE
MODEL GAT-48/45
INNER PANEL

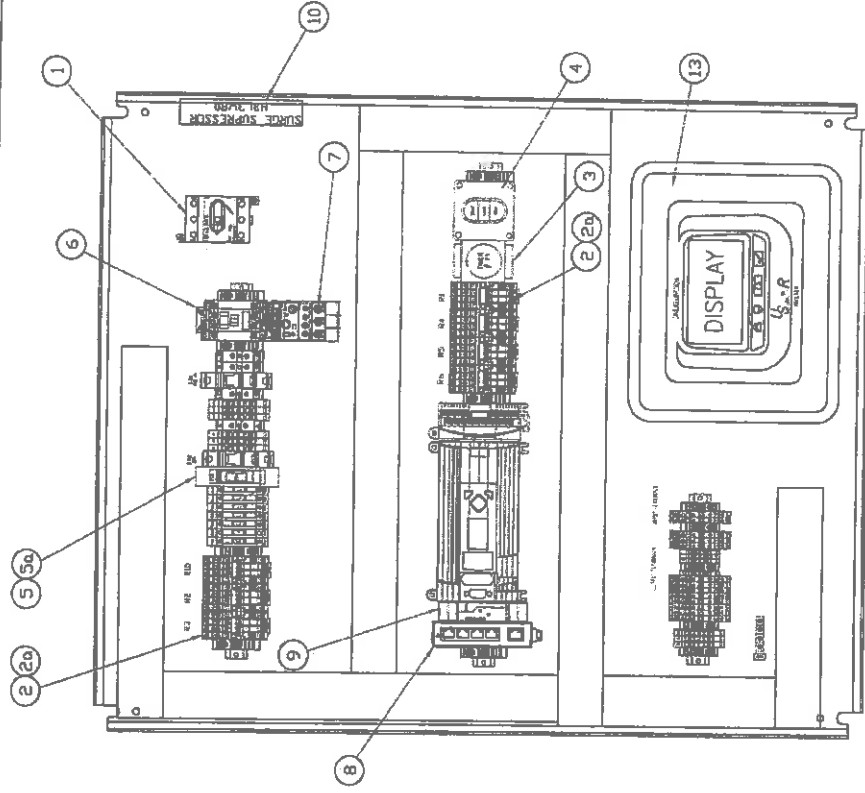
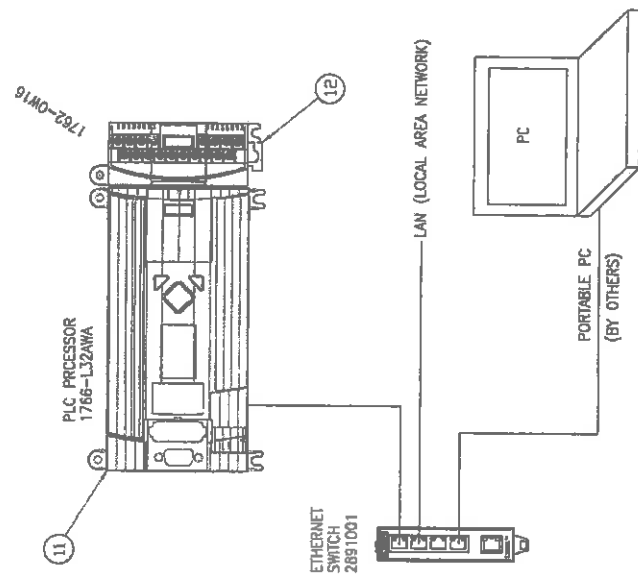
GREENWOOD PARK
BIRMINGHAM, ALABAMA

Date: N.T.S. Rev: 1205-A-06 Date: JUN. 15, 2011 01

REV.	DATE	DESCRIPTION
01	4/7/11	AS-BUILT

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REF	QTY	MANUF.	PART. N	DESCRIPTION
1	1	ABB	OT83F3	POWER DISCONNECT SWITCH 83 A
2	7	ALLEN BRADLEY	700HC141-3-4	RELAY/PSD 120 VAC
2b	7	ALLEN BRADLEY	700HNT03	RELAY BASE 14 BLADE HC
3	1	ALLEN BRADLEY	700HRS2T17	TIMER RELAY 2P2D
3b	1	ALLEN BRADLEY	700HR101	RELAY BASE 11 PIN
4	1	ALLEN BRADLEY	800PP-L12E9FE	START/STOP BUTTONS
5	1	FERRAZ	ATD92D	TD RUBE 2 20 A
5a	1	FERRAZ	USC511	FUSE HOLDER 1 POLE WITH INDIC.
6	1	ALLEN BRADLEY	10022D10	CONTACTOR 23 A 120V
7	1	ALLEN BRADLEY	193EEEB	OVERLOAD RELAY 3P2T A
8	1	PHOENIX	2891001	ETHERNET SWITCH 3 PORTS RJ 45
9	1	PHOENIX	283840	POWER SUPPLY 24 V 1 A
10	1	HUBBLE	HBL3080	16 POINT VAC/DC RELAY OUTPUT MODULE
11	1	ALLEN BRADLEY	1786-L32AWA	16 POINT VAC/DC RELAY OUTPUT MODULE
12	1	ALLEN BRADLEY	1786-CW16	ETHERNET SWITCH 2891001
13	1	DEBREDT/BROOK	USR-111100250000	USONIC R MODULE WITH TRANSDUCER



Grande Water management systems

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Suite 517 Miramichi, Quebec (514) 264-6515
www.grandewater.com

Scale: N.T.S. Proj. No.: 1205-A-07 Date: JUN. 15, 2011 Rev. 01

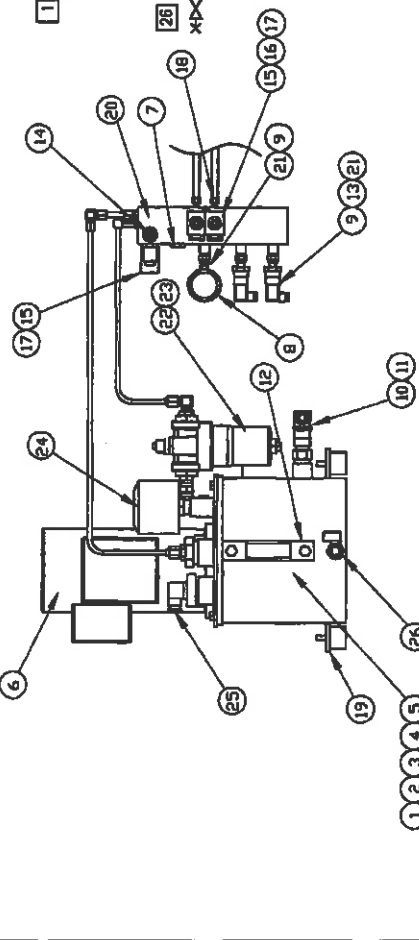
Model: GRANDE ACU-GATE
MODEL CAT-48/45
INNER PANEL

Project: GREENWOOD PARK
BIRMINGHAM, ALABAMA

REV.	DATE	DESCRIPTION	REV.	DATE	DESCRIPTION
01	4/27/14	AS-BUILT			

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REF	QTY	MANUF.	PART #	DESCRIPTION
1	1	WANBEE	RES-26-S63M4	2 GALLON GAGE WITH LEVEL & TEMPERATURE INDICATOR
2	1	PARKER	9ET6182110	INTAKE STRAINER
3	1	PARKER	D77A2A	HYDRAULIC GEAR PUMP
4	1	VEBICO	6027 * 26689	PUMP/ADAPTOR & GASKET
5	1	VEBICO	L075-6637602018-1675-12-1/8	PUMP/MOTOR COUPLING
6	1	BALDOR	VFD3507M	ELECTRIC MOTOR 3/4 HP /120VAC /1PH /1760RPM / 60HZ /56C /SAS2LC /TEFC /F
7	1	PARKER	CV4H103P	POPNET ONE-WAY CHECK VALVE
8	1	STAUFF	SPG-01-05005	PRESSURE INDICATOR 0-500 PSI
9	3	STAUFF	SMPO-7/8-1/8-VE	TEST POINT CONNECTOR
10	1	MP FLTR	827AF-1/8R-SM-B-HC	HIGH OIL TEMPERATURE ALARM (140°F)
11	1	WATERS	826-1	TEMPERATURE SENSOR WELL
12	1	PARKER	FL80221	LEVEL & TEMPERATURE GAUGE
13	2	MP FLTR	SMA-2-1/4-HC	LOW OIL PRESSURE ALARM (170 PSI)
14	1	PARKER	RAH101-510	OIL PRESSURE SENSOR (200 PSI)
15	3	PARKER	D9L101HR-1	ADJUSTABLE PRESSURE RELIEF VALVE (250 PSI)
16	1	PARKER	ACPS6A032E1KTC	SOLENOID OPERATED VALVE 2"X1/2"X1/2"X1/2"
17	2	PARKER	31BLD120	SHRIMPPOINT 20UMC.O. 1/2"X 3/8" SAE
18	2	PARKER	9M1629-316	PARKER ACCUMULATOR 50MM 95% 2EL. FOR ITEM 16
19	4	SPENAUER	315-222	SOLENOID (120VAC)
20	1	WANBEE	LB11119	PARKER ADAPTOR
21	3	STAUFF	SMO20-1/8PT-V	ANTI-VIBRATION BUPPORT
22	1	PARKER	15QN-1-100BNDMS16-4	ALUMINUM MANIFOLD
23	1	PARKER	963700Q	ADAPTOR FITTING
24	1	SCHROEDER	ABF 210	FILTER CARTRIDGE
25	1	MP FLTR	RLG1-1/8S1-A-600	BREATHER CAP
26	1	PARKER	IM608-B	LOW OIL LEVEL ALARM



Grande
Water management systems

100 South Wilson Blvd., 1st. (514) 901-6580
Suite 547 (514) 901-8573
Montreal, Quebec H4M 2P1 www.grandebc.com

GRANDE ACU-GATE
MODEL GAG-48/45
HYDRAULIC POWER UNIT

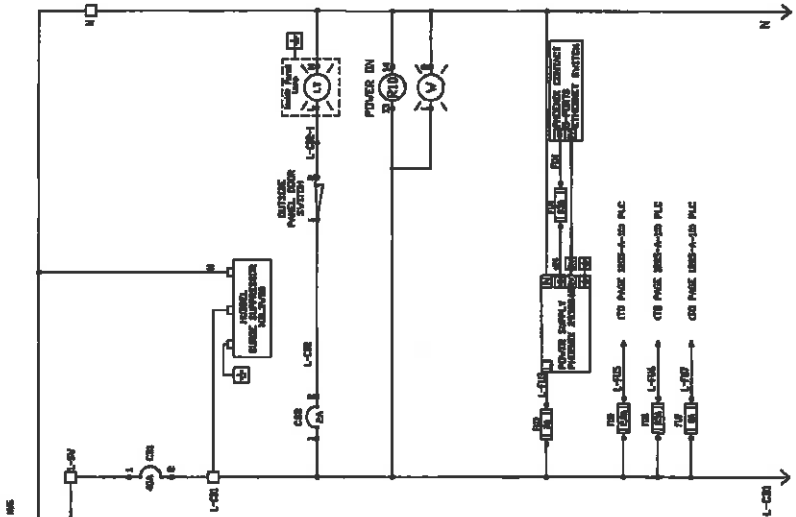
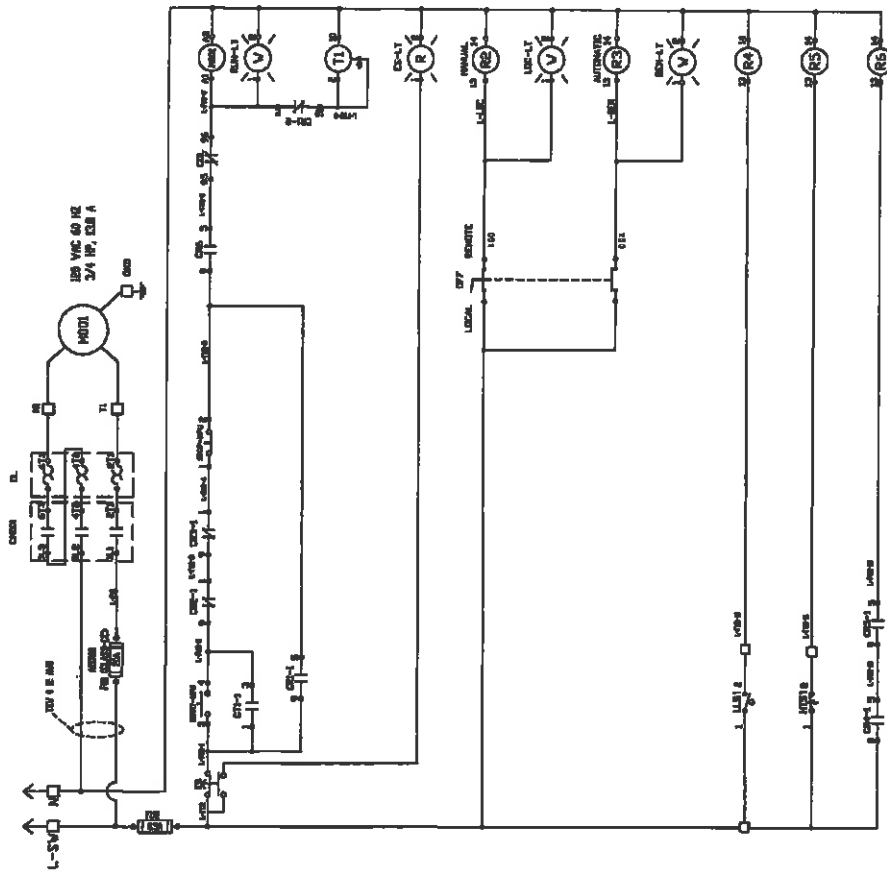
GREENWOOD PARK
BIRMINGHAM, ALABAMA

Rev: N.T.S. Date: JUN. 15, 2011 01

HYDRAULIC POWER UNIT

REV.	DATE	DESCRIPTION
01	6/27/12	AS-BUILT

THE EQUIPMENT DETAILS ARE FOR APPROVAL PURPOSES ONLY. ALL INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND THE EXCLUSIVE PROPERTY OF GRANDE WATER MANAGEMENT SYSTEMS.



WIRING COLORS:

- LINE AND LOAD CONDUCTORS = BLACK
- AC POWER = BLUE
- DC POWER = RED
- CONTROL WIRING = WHITE
- CONTROL WIRING = RED
- CONTROL WIRING EXT. = YELLOW

WIRING SIZE AND TYPE:

- ANALOG SIGNAL = 18 AWG SHELDED TWISTED PAIR
- POWER WIRING = 12 AWG SHELDED TWISTED PAIR
- OTHER WIRING = 14 AWG TWI WIRE OR LARGER

Grande
Water management systems

100 Maple Ridge Blvd. E.L. (514) 884-8880
Montreal, Quebec P.Q. (514) 884-8810
www.grandetr.com

GRANDE ACU-GATE
MODEL GAT-48/45
POWER WIRING

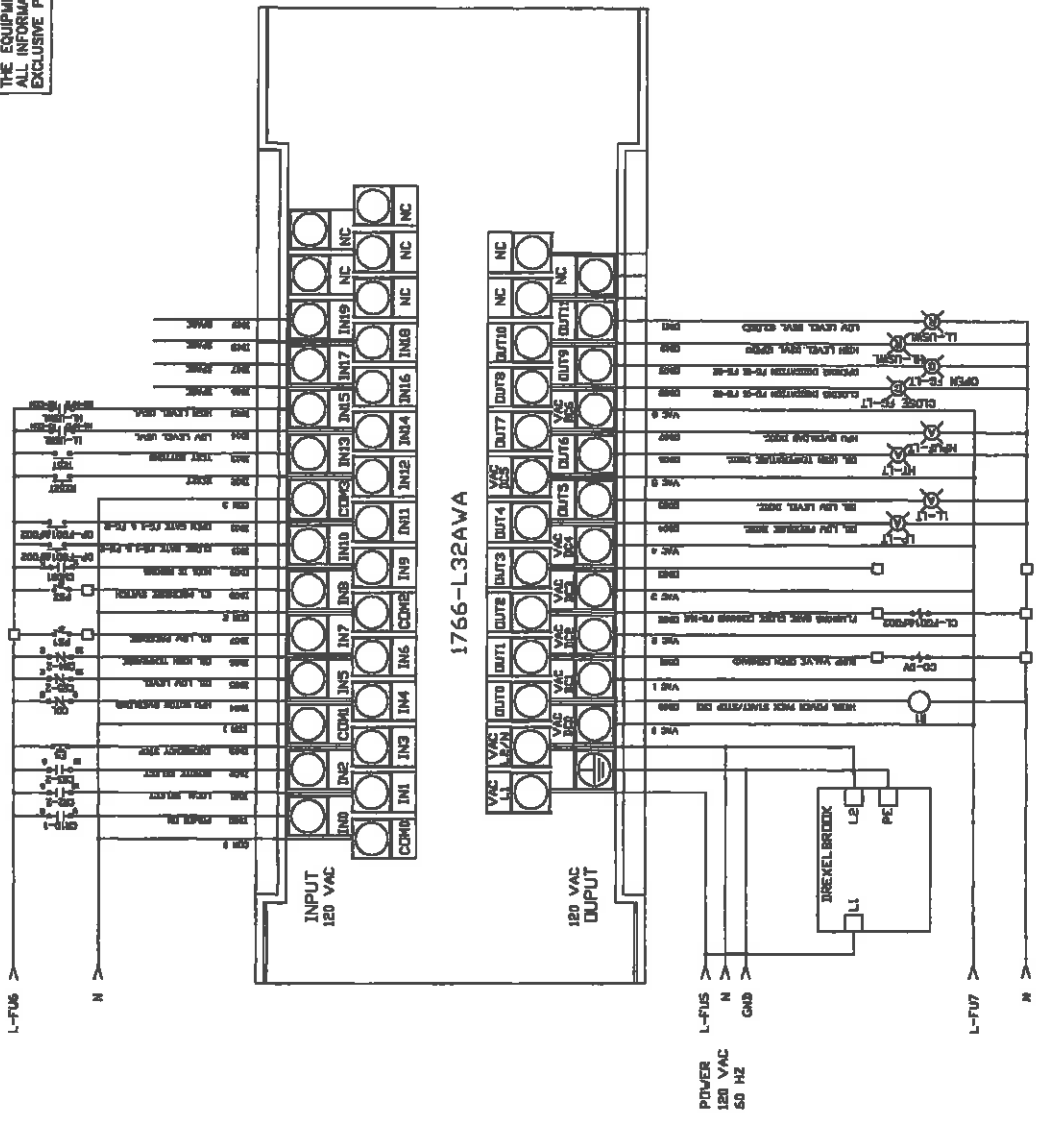
GREENWOOD PARK
BIRMINGHAM, ALABAMA

Date: N.T.S. Draw No: 1205-A-09 Date: JUN. 15, 2011 01

REV.	DATE	DESCRIPTION
01	4/27/13	AS-BUILT

REV.	DATE	DESCRIPTION

THE EQUIPMENT DETAILS ARE FOR APPROVAL PURPOSES ONLY. ALL INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND THE EXCLUSIVE PROPERTY OF GRANDE WATER MANAGEMENT SYSTEMS.



GRANDE
Water management systems
180 South Main Blvd. Tel: (513) 884-8588
Suite 547 Fax: (513) 884-8833
Madison, Quebec
H3M 2P1
www.grandine.com

GRANDE ACU-GATE
MODEL GAT-48/45
DIGITAL INPUT & OUTPUT - PLC WIRING DIAGRAM

Project: GREENWOOD PARK
BIRMINGHAM, ALABAMA

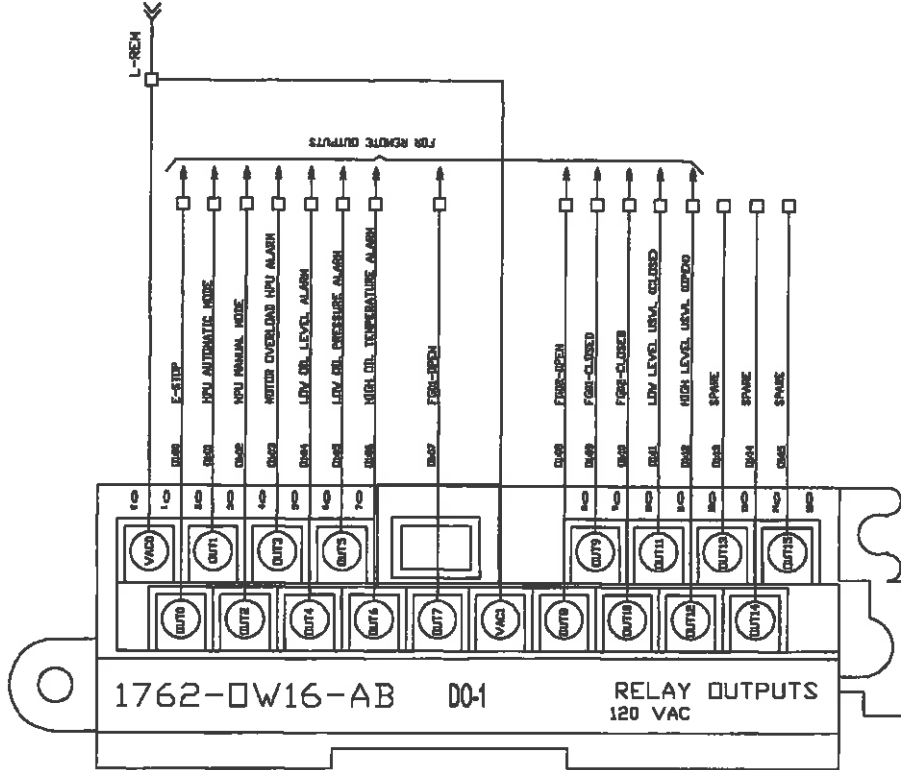
Date: JUN. 15, 2011
Rev: 01

REV.	DATE	DESCRIPTION
01	6/27/11	AS-BUILT

THE EQUIPMENT DETAILS ARE FOR APPROVAL PURPOSES ONLY. ALL INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND IS THE EXCLUSIVE PROPERTY OF GRANDE WATER MANAGEMENT SYSTEMS.

NOTES:

1- OUTPUTS FOR REMOTE SYSTEM ARE IN YELLOW COLOR (EXTERNAL 120 VAC)



GRANDE ACU-GATE
 MODEL GAT-48/45
 DIGITAL OUTPUT D01 - WIRING DIAGRAM

GREENWOOD PARK
 BIRMINGHAM, ALABAMA

N.T.S. 1205-A-11 JUN. 15, 2011 01

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 Water management systems

100 Apollo Rd. S.W. Tel: (516) 694-0500
 Merrick, NY 11566 Fax: (516) 594-0573
 11441 291 www.grandewater.com

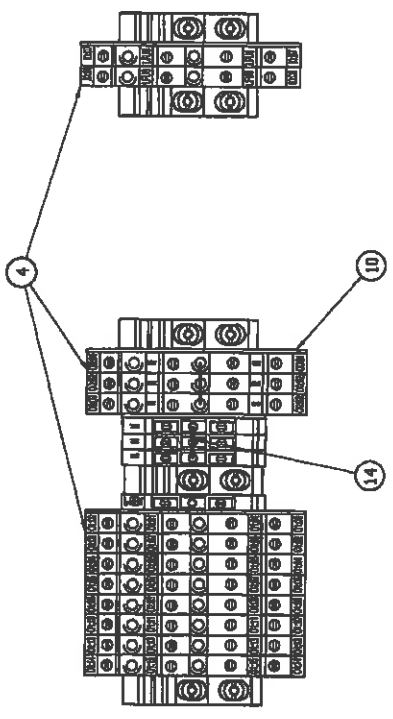
REV.	DATE	DESCRIPTION
01	6/27/11	AS-BUILT

THE EQUIPMENT DETAILS ARE FOR APPROVAL PURPOSES ONLY. ALL INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND THE EXCLUSIVE PROPERTY OF GRANDE WATER MANAGEMENT SYSTEMS.

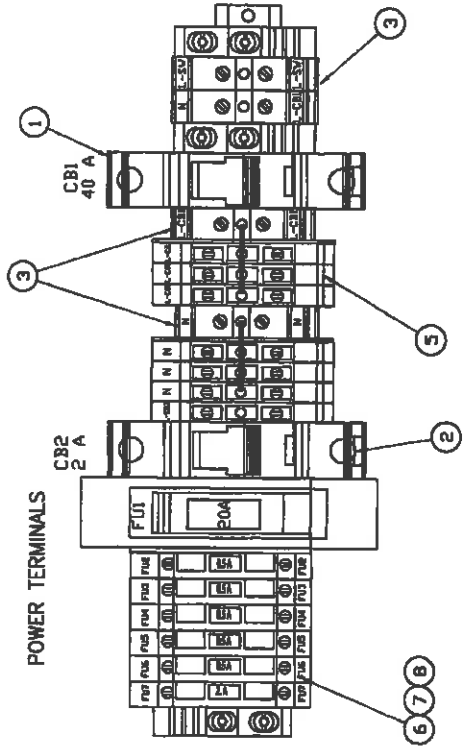
REF	QTY	PART #	MANUF.	DESCRIPTION
1	1	5201-440	ABB	CIRCUIT BREAKER 40 A
2	1	5201-142	ABB	CIRCUIT BREAKER 2 A
3	4	UK-4N	PHOENIX CONTACT	TERMINAL BLOCK 18x2, GREY
4	13	UK-3N	PHOENIX CONTACT	TERMINAL BLOCK DOUBLE GREY
5	10	UK-3N	PHOENIX CONTACT	TERMINAL BLOCK GREY
6	6	UK-5-HEBIL 260	PHOENIX CONTACT	TERMINAL'S BLOCK WITH FUSIE, LAMP'S INDIC.
7	6	GGN1/2	PHOENIX CONTACT	FUSE 0.6 A
8	1	GGN2	PHOENIX CONTACT	FUSE 2 A
9	4	D-UKK 3/6	PHOENIX CONTACT	END SECTION
10	6	D-UK 3/6	PHOENIX CONTACT	STOPPER
12	10	CLIPPER 38-5	PHOENIX CONTACT	STOPPER
13	1	UKK-PE	PHOENIX CONTACT	GND
14	1	FB-10-5	PHOENIX CONTACT	JUMPER BAR

INPUT TERMINALS

OUTPUT TERMINALS



POWER TERMINALS



NOTES:

- 1- GREY TERMINALS ARE FOR SAFE AREA & 24 VDC WIRING.
- 2- BLUE TERMINAL BLOCKS ARE FOR HAZARDOUS AREA.

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Water management systems

100 Alachua Blvd. Tallahassee, FL 32310
 540 S.W. 10th Ave. Fort Lauderdale, FL 33315
 1401 S.W. 11th St. Fort Lauderdale, FL 33315

Tel: (904) 595-4500
 Fax: (904) 595-4573
 www.grandeh2o.com

GRANDE ACU-GATE
MODEL GAT-48/45
TERMINAL BLOCKS

GREENWOOD PARK
BIRMINGHAM, ALABAMA

DATE: JUN. 15, 2011
 REV: 01
 N.T.S.
 SCALE: 1:205-A-12

REV.	DATE	DESCRIPTION
01	4/27/12	AS-BUILT

	<i>Submittal for Approval ACU-GATE Flushing Gates Greenwood Park</i>	GWMS Project # : 1206	
		Date : July 2011	Page : 2 Rev. : 00

8.1.2 Drexelbrook Ultrasonic Level Indicator Operating Instructions



A Leader in
Level Measurement

For Assistance Call 1-800-527-6297
Outside North America + 215-674-1234

Installation and Operating Instructions

USonic-R™ Series

2-Channel, Continuous, Remote
Ultrasonic, Level Measurement
System using:
USR-XXXX Series Electronics
and
USS-XX Remote Sensing
Elements

U.S. and Canada: 1-800-553-9092
24-Hour Service: 1-800-527-6297
International: +1 215-674-1234
Fax: +1 215-674-2731
E-mail: drexelbrook.service@ametek.com
Website: www.drexelbrook.com

Quick Start Menu

Menu Navigation:

1. Hold ENTER Button 5 seconds to access configuration menu.
2. Use UP & DOWN buttons to select menu items
3. Press ENTER button to change selected items
4. Hold ENTER button to go to previous menu or continue to hold to return to operate mode.
5. Press UP & DOWN buttons simultaneously to force target acquisition.



Function	Item	Menu Selection Choices (default)
Fct. 1.00.00	Channel 1	
Fct. 1.01.00	Channel Enable	Yes / No
Fct. 1.02.00	Application Type	
Fct. 1.02.01	APP Type	Level / Flow
Fct. 1.03.00	Level	
Fct. 1.03.01	Units	IN / FT / MM / CM / M
Fct. 1.03.02	Tank Height	User defined (360")
Fct. 1.03.03	Offset	User defined (0")
Fct. 1.04.00	Volume	
Fct. 1.04.01	Vessel Type	VERTICAL HOR CYL FLAT HOR CYL DISHED HOR CYL HEMI SPHERE CUSTOM
Fct. 1.04.02	Copy to Strapping Table	VERTICAL HOR CYL FLAT HOR CYL DISHED HOR CYL HEMI SPHERE
Fct. 1.04.03	Vessel Units	GALLONS / M3 / LITERS / BARRELS/ INPERIAL GALLONS

Quick Start Menu

Function	Item	Menu Selection Choices (default)
Fct. 1.04.04	Max Capacity	User defined (1000GAL)
Fct. 1.05.00	Flow	FLOW Menu shown only when Flow is selected in 1.02.01
Fct. 1.05.01	Flow Type	PARSHALL SUB FLOW PARSHALL PALMER BOWLUS/ TRAPEZ FLUME/ RECT WEIR W/WO END / V-NOTCH WEIR / CUSTOM
Fct. 1.05.02	Flume Size	CODE FROM TABLE OR NUMERIC VALUE – See Section 4.8
Fct. 1.05.03	Flow Units	GPM / MGD / M3/HR / LPS / LPM
Fct. 1.05.04	Head Units	IN / FT / MM / CM / M
Fct. 1.05.05	Zero distance	User defined
Fct. 1.05.06	Delay	User defined
Fct. 1.05.07	Totalizer Scale	X1, X10, X100, X1K, X10K, X100K, X1M
Fct. 1.05.08	Reset Totalizer	NO / YES
Fct. 1.06.00	Range Config.	
Fct. 1.06.01	Range Assign	LEVEL / VOLUME / FLOW / DISTANCE
Fct. 1.06.02	LRV	User defined (0")
Fct. 1.06.03	URV	User defined (348")
Fct. 1.07.00	Strapping	
Fct. 1.07.01	Max Points	2...21
Fct. 1.07.02	IN PT 1	User defined
Fct. 1.07.03	OUT PT 1	User defined
Fct. 1.07.04 through 1.07.43	IN / OUT Points 2 – 21	User defined
Fct. 1.08.00	Sensor	

Quick Start Menu

Function	Item	Menu Selection Choices (default)
Fct. 1.08.01	Gain type	SG / SG High / 100% / 84% / 67% / 50% / 32% / 17% / 8% – Consult Factory
Fct. 1.08.02	SG Adjust	User defined – Consult Factory * Any change in this function will change 1.08.01 to “SG”
Fct. 1.08.03	Ping Rate	300 / 700 / 1100 / 1500 milliseconds
Fct. 1.08.04	Near Zone Fault NZ Out	HIGH / LOW (22 mA / 3.7 mA)
Fct. 1.08.05	Lost Echo Fault LE Out	HIGH / LOW / Last Known Value (22 mA / 3.7 mA / Hold)
Fct. 1.08.06	Temp Units	F / C
Fct. 1.08.07	Sensor Software Revision	Read Only
Fct. 1.08.08	Echo Count	
Fct. 1.08.09	Pipe Length “Pipe Len”	0 (Edit length in units) – for open air (no pipe) use “0”
Fct. 1.08.10	Pipe Diameter “Pipe Diam”	2”, 3”, 4”, 6”, 8” 10” 12” (Pipe diameters greater than 12” are treated as open-air installations).
Fct. 1.08.11	Low Offset “Low Offset”	User numerical entry (-1, 0, +1). Consult Factory before use
Fct. 1.08.12	High Offset “Hi Offset”	User numerical entry (-1, 0, +1). Consult Factory before use
Fct. 1.09.00	Calibration	
Fct. 1.09.01	Point	Consult Manual (Factory Calibrated) See Section 8.2
Fct. 2.00.00	Channel 2	Same as channel #1
Fct. 3.00.00	Relays	
Fct. 3.01.01	Enable	YES / NO

Quick Start Menu

Function	Item	Menu Selection Choices (default)
Fct. 3.01.02	Relay Type	ALARM CONTROL SAMPLE PUMP 1, 2, 3, 4, 5, 6 MANUAL ALARM MANUAL NORMAL
Fct. 3.01.03	Channel Assignment	CHANNEL 1 / CHANNEL 2
Fct. 3.01.04	Variable Assignment	LEVEL / VOLUME / FLOW / RANGE / FLOW SUM / FLOW DIFF / SUBMG / TRAV SCREEN / L.E. / N.Z. / DIST
Fct. 3.01.05	Set point	User defined
Fct. 3.01.06	Dead Band	User defined
Fct. 3.01.07	Sample value	User defined
Fct. 3.01.08	Sample Duration	WIDTH OF SAMPLE PULSE 50 – 1000 mS
Fct. 3.01.09	Time Delay	User defined 0 – 99 seconds
Fct. 3.01.10	Time Delay Mode	FORWARD / REVERSE
Fct. 3.01.11	Fail Safe	HLFS / LLFS
Fct. 3.01.12	Fault Condition "Fault Cond"	Alarm / Normal
Fct. 3.02 - 3.06	Relays 2 – 6	Same as above
Fct. 3.07	Display "Display"	
Fct. 3.07.01	Indicator "Indicator"	Fill Alarm / Fill Normal
Fct. 4.00.00	Analog Output	
Fct. 4.01.00	Analog Output #1	
Fct. 4.01.01	Channel Assignment	CHANNEL 1 / CHANNEL 2
Fct. 4.01.02	Variable Assignment	LEVEL / VOLUME / FLOW / RANGE / FLOW SUM / FLOW DIFF / SUBMG / TRAV SCREEN / L.E. / N.Z. / DIST
Fct. 4.01.03	4 mA Point	User defined (0%)
Fct. 4.01.04	20 mA Point	User defined (100%)

Quick Start Menu

Function	Item	Menu Selection Choices (default)
Fct. 4.01.05	Damping	User defined 0 – 99 seconds
Fct. 4.01.06	Lock mA	User defined
Fct. 4.01.07	Trim 4 mA	CONSULT MANUAL
Fct. 4.01.08	Trim 20 mA	CONSULT MANUAL
Fct. 4.02.00	AO #2	Same as above
Fct. 5.00.00	System	
Fct. 5.01.01	Password Enable	NO / YES
Fct. 5.01.02	Change Password	ENTER NEW KEY SEQUENCE
Fct. 5.02.00	Miscellaneous	
Fct. 5.02.01	Set Clock	User defined (Factory set)
Fct. 5.02.02	Reset Factory Defaults?	NO / YES
Fct. 5.02.03	System Software Revision	Read Only
Fct. 5.02.04	Reset Counter	Read Only
Fct. 5.03.00	Data Logger	
Fct. 5.03.01	Enable	NO / YES
Fct. 5.03.02	Interval	5 SECONDS – 12 HOURS / INTERVAL OFF
Fct. 5.03.03	Duration	Read Only duration of data logging – dependant on interval
Fct. 5.03.04	CH1 Trigger Assignment	DISTANCE / LEVEL / VOLUME / FLOW / OFF
Fct. 5.03.05	CH1 Trigger High Point	User defined
Fct. 5.03.06	CH1 Trigger Low Point	User defined
Fct. 5.03.07	CH2 Trigger Assignment	DISTANCE / LEVEL / VOLUME / FLOW / OFF
Fct. 5.03.08	CH2 Trigger High Point	User defined

Quick Start Menu

Function	Item	Menu Selection Choices (default)
Fct. 5.03.09	CH2 Trigger Low Point	User defined
Fct. 5.03.10	Overwrite	NO / YES
Fct. 5.03.11	Reset Data logger memory	NO / YES
Fct. 5.04.00 Communications		
Fct. 5.04.01	Baud Rate	9600 / 19200 (19200)
Fct. 5.04.02	Communications Type	RS232 / RS485 (RS232)
Fct. 5.04.03	Device ID	1 – 32 (1)
Fct. 6.00.00 Display		
Fct. 6.01.00 Configure		
Fct. 6.01.01	AutoScroll	ENABLE / DISABLE
Fct. 6.01.02	Scroll Rate	User defined
Fct. 6.01.03	Hide ALL	YES / NO
Fct. 6.01.04	Show ALL	YES / NO
Fct. 6.02.00 CHANNEL 1		
Fct. 6.02.01	Range	Show / Hide
Fct. 6.02.02	Level	Show / Hide
Fct. 6.02.03	Distance	Show / Hide
Fct. 6.02.04	Volume	Show / Hide
Fct. 6.02.05	Flow	Show / Hide
Fct. 6.02.06	Totalizer	Show / Hide
Fct. 6.02.07	Resettable Totalizer	Show / Hide
Fct. 6.02.08	Temperature	Show / Hide
Fct. 6.03.00 CHANNEL 2		
Fct. 6.03.01	Range	Show / Hide
Fct. 6.03.02	Level	Show / Hide
Fct. 6.03.03	Distance	Show / Hide
Fct. 6.03.04	Volume	Show / Hide

Quick Start Menu

Function	Item	Menu Selection Choices (default)
Fct. 6.03.05	Flow	Show / Hide
Fct. 6.03.06	Totalizer	Show / Hide
Fct. 6.03.07	Resettable Totalizer	Show / Hide
Fct. 6.03.08	Temperature	Show / Hide
Fct. 6.04.00	Differential	
Fct. 6.04.01	Flow Sum	Show / Hide
Fct. 6.04.02	Flow Difference	Show / Hide
Fct. 6.04.03	Submergence	Show / Hide
Fct. 6.04.04	Traveling Screen	Show / Hide
Fct. 6.05.00	Analog Output 1	
Fct. 6.05.01	Show AO 1	Show / Hide
Fct. 6.06.00	Analog Output 2	
Fct. 6.06.01	Show AO 2	Show / Hide
Fct. 6.07.00	Clock	
Fct. 6.07.01	Show Clock	Show / Hide



STACON AS BUILT

AUTOMATIC PUMP CONTROLS

BILL OF MATERIAL				BY: B.A.S.	
QUOTE NO.		72963AA (EAAABA)		Date: 6/27/2012	Rev:
JOB NAME		GREENWOOD PUMP STATIONS		R12-0075 & 0078	
CUSTOMER		JIM HOUSE		Po#14632-2	
QTY	LEGEND	DESCRIPTION	MFG.	PART #	Check Off
1		ENCLOSURE (TYPE 4X SS)	HOFFMAN	A-30H2410SSLP	/
1		SUB PANEL	HOFFMAN	A-30P24	/
1	N	ISOLATED NEUTRAL BLOCK 175 A. (1-4) Line [2/0 to 14] – Load [4 to 14]	BUSSMANN	16220-1	/
2	G	GROUND BUSS (#8-1)	SQD	PK7GTA	/
1	MB1	MOTOR BREAKER	SQD	HDL26015	/
1	PC1	PHASE CONTROLLER (3 HP)	SQD	ATV12HU22M2	/
1	CCB	CONTROL CIRCUIT BREAKER	SQD	QOU115	/
1	CCT	CONTROL TRANSFORMER	SQD	9070-T75D23S12	/
1		FUSE HOLDER (1 POLE)	BUSSMANN	BCA6031PQ	/
2	F1-2	FUSE	BUSSMANN	KTK-R-5/600V	/
1	FL	FLASHER (UR)	MPE	025-120-105	/
1	AL	ALARM LIGHT	INGRAM	LX-25 (RED)	/
14	TS	TERMINAL STRIP	SQD	9080-GK6	/
1	HOA	HAND-OFF-AUTO SELECTOR	SQD	9001SKS43B	/
1		(NO, NC) CONTACT	SQD	9001-KA1	/
1	RL1	RUN LIGHT (120VAC - GREEN)	SQD	9001-OG120	/
2	PL1-2	PILOT LIGHT (24VAC/DC - AMBER)	SQD	9001-OY24	/
1	PL3	PILOT LIGHT (24VAC/DC - RED)	SQD	9001-OR24	/
1	* ETM	ELAPSED TIME METER	REDINGTON	710-0016	/
2	R1-2	CONTROL RELAY (24VAC, 11 PIN)	SQD	8501KP13P14V14	/
1	R3	CONTROL RELAY (120VAC, 11 PIN)	SQD	8501KP13P14V20	/
3		11 PIN SOCKET	IDEC	SR3P-05	/
1	TH1	THERMOSTAT	BILBEE	B-200	/
1	HT	HEATER	HEATRON	HEATFLEX	/
1	SPD	SURGE PROTECTION DEVICE 230V (1PH, 3W)	SQD	SDSA1175	/
2		LOUVERS (SS)	HOFFMAN	AVK66SS6	/
2		COVERS OVER LOUVERS	STA-CON	8 X 8	/

NOTES: * OR EQUAL

MANUAL 2
 Stacon
 Sump Pump
 Control Panels

PACKING LIST

Quote#: 72963AA	Date: 6/27/2012	Rev:
-----------------	-----------------	------

SPARE PARTS					
QTY	LEGEND	DESCRIPTION	MFG	PART #	
2	* F1-2	FUSE	BUSSMANN	KTK-R-5/600V	N
1		LIGHT BULB (24VAC/DC)	CANDELA CORP	24PSB	N
1		LIGHT BULB (120VAC/DC)	CANDELA CORP	120PSB	N
FLOAT SWITCHES PER CONTROL					
3	FS	FLOAT SWITCH	SJ ELECTRODE	SJ40SGMWENO	N

AS BUILT

SHOP CHECK SHEET AS BUILT

Quote#: 72963AA Date: 6/27/2012 Rev:

P.O.#	14632-2			Ship Date	6/27/2012		
H.P.'s	2.4	# PUMPS	1	VOLTAGE	230V	PHASE	1 to 3
		DRIPSHIELD	N/A	SERIAL #	R12-0075 & 0078		
DEADFRONT	ALUM.	ENCLOSURE TYPE	4X	MATL.	304 STAINLESS STEEL		

SPECIAL INSTRUCTIONS Check OFF

Wire size from MB to PC [wire size - 10 AWG.	N
RED WARNING LABEL	[X]
*WARNING - BEFORE APPLYING POWER: ELECTRICAL CONNECTIONS CAN BECOME LOOSE DURING SHIPPING. TIGHTEN ALL SCREWS, AND INSPECT FOR DAMAGE TO WIRES AND COMPONENTS.	

Wire Numbers - Type	N
Legends and Legend Sheet	N
Ground Lugs	N
Overload Heater Chart (N/A)	N
Pump Data Sheet	N
Drawings on Door	N
Picture of Panel	N

UL Serial No. CD-716844, CD-716845 N

Spare Parts

[X] In Panel See Packing List []

[X] In Separate Box See Packing List []

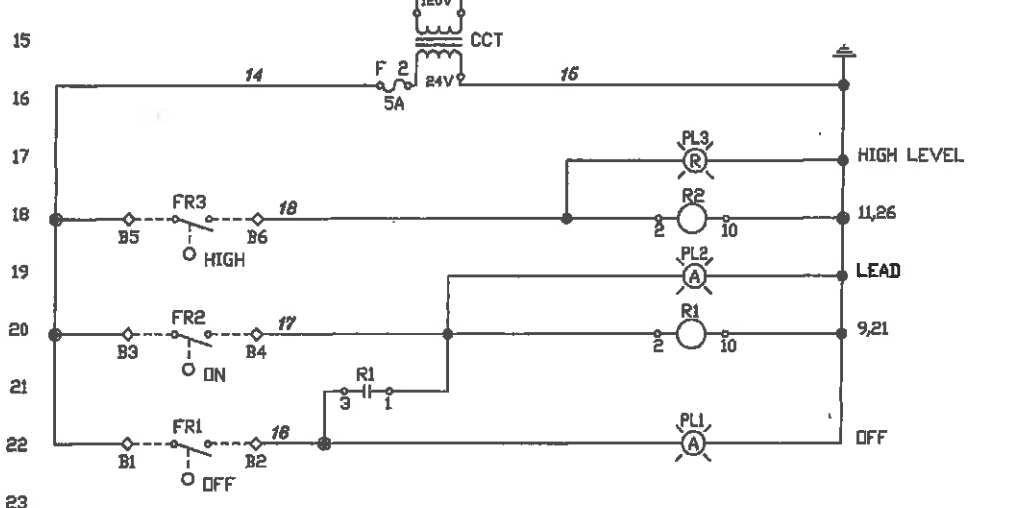
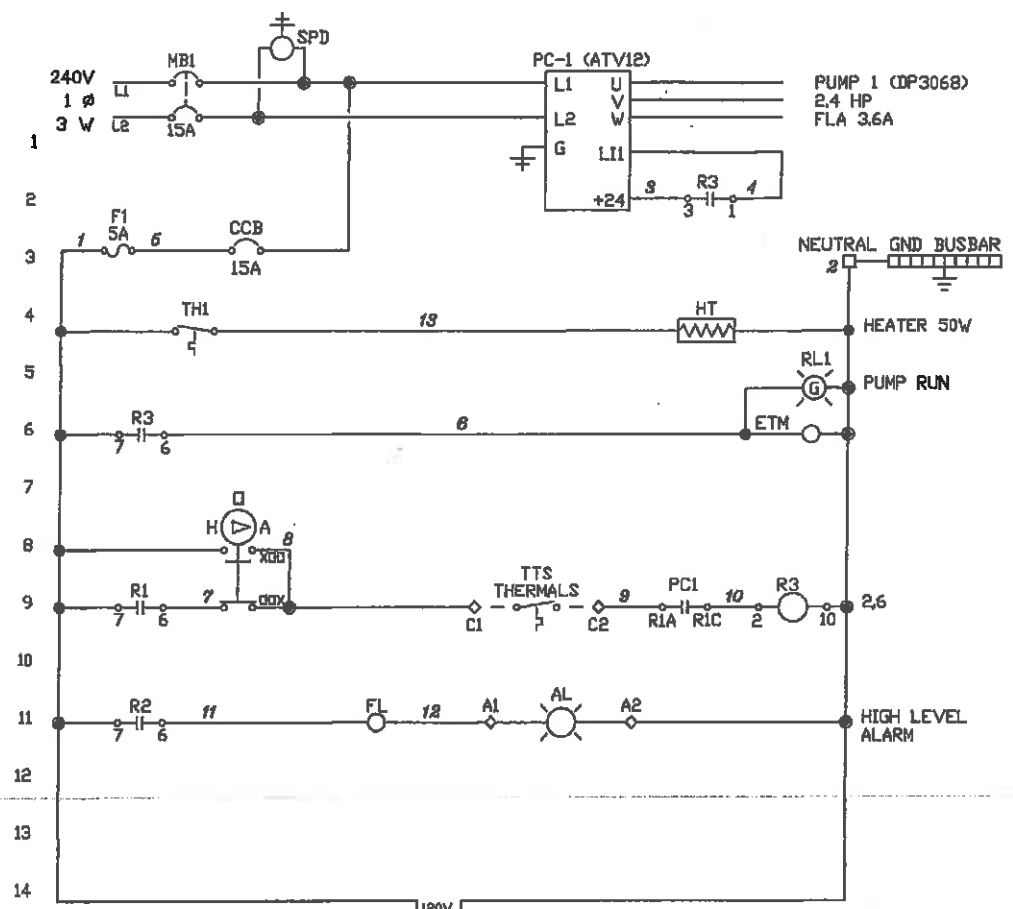
Wired by: subpanel _____ R.R.P. _____ door/deadfront _____ V.M. _____ /R.R.P. _____

Tester _____ T.W. Tauw

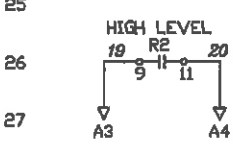
Inspector _____ R.R.P. RRP Jack Ramsey

Comments (3) FLOATS PER CONTROL (6) TOTAL SHIPPED IN SEPARATE BOXES.

PC SERIAL #'S **8B1138331087, 8B1203873014**



LAST WIRE #20



CUSTOMER	JIM HOUSE
JOB NAME	GREENWOOD PUMP STATIONS
ENCLOSURE	UL TYPE RATING: UL TYPE 1
VOLTAGE	240V PHASE 1 HZ 60
HP.	#1 2.4 #2 X #3 X #4 X
F.L.A.	3.6A X X X
TOTAL F.L.A.	11.2A
SERIAL #	R12-0075 & 0076 DATE: 6/27/2012
SCCR:	1 KA SYMMETRICAL RMS, 240 V. MAX.
MANUFACTURED BY:	STA CON INC 2525 S. DBT APOPKA FL 32703

GREENWOOD PUMP STATIONS
 QUOTE NO. DATE DRAWN BY REVISION
 72963AA 6/15/2012 B.A.S.

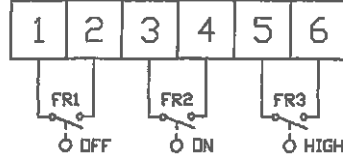
EAAABA
 STA-CON 2525 S.O.B.T.
 INCORPORATED APOPKA, FL 32703

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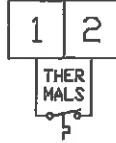
AS BUILT

Nonintrinsically safe wiring terminals

TERMINAL STRIP B (TS-B)



TERMINAL STRIP C (TS-C)



DEVICES ON THE BOTTOM OF THE TERMINAL STRIP ARE REMOTE COMING INTO CONTROL PANEL.
DEVICES ON THE TOP OF THE TERMINAL STRIP ARE CONTACTS LEAVING THE CONTROL PANEL.

SQD Ground Busbar PK12CTA, PK12CTA, PK16CTA	
Wire Range AWG CU-AL	Torque lb-in.
14-10 CU, 12-10 AL	20
8	25
6-4	35
Two 14 or 12 CU, Two 12 or 10 AL	25

SQD Terminal Block GR6 + GR6	
Wire Range AWG CU	Torque lb-in.
(Type GR6) 22-10	11-12
(Type GR6) 22-8	18-20

Panduit Ground Lug One-Barrel	
Wire Range AWG CU	Torque lb-in.
(LAMA2-14-QY) 12-14	15
6-10	40
2-4	50
(LAMA1/0-14-QY) 10-14	35
8	40
4-6	45
2/0-3	50
(LANA250-56-QY) 2-6	275
250-1	375
(LANA350-38-QY) 2-6	275
350-1	375
(LANA600-38-6Y) 600-4	500
Two-Barrel	
(LAM2A1/0-14-6Y) 10-14	35
8	40
4-6	45

AS BUILT

EAAABA

GREENWOOD PUMP STATIONS

sta-con 2625 S.O.B.T.
INCORPORATED APOPEKA, FL 32703

QUOTE NO. DATE DRAWN BY REVISION
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TYPICAL FOR 2 PANELS
MANUAL PUMP CONTROLS

BILL OF MATERIAL					BY: MED
QUOTE NO.		73696AA		Date: 7.10.13	Rev:
JOB NAME		GREENWOOD PARK		R	
CUSTOMER		JIM HOUSE		Po#	
QTY	LEGEND	DESCRIPTION	MFG.	PART #	Check Off
1		ENCLOSURE (TYPE 4X 6S)	HOFFMAN	A-24H2010SSLP	[]
1		SUB PANEL	HOFFMAN	A-24P20	[]
1	N	ISOLATED NEUTRAL BLOCK 175 A. (1-4) Line [2/0 to 14] - Load [4 to 14]	BUSSMANN	16220-1	[]
2	G	GROUND BUSS (#8-1)	SQD	PK7GTA	[]
1	MB1	MOTOR BREAKER	SQD	HDL26015	[]
1	PC1	PHASE CONTROLLER (3 HP)	SQD	ATV12HU22M2	[]
1	CCB	CONTROL CIRCUIT BREAKER	SQD	QOU115	[]
1		FUSE HOLDER (1 POLE)	BUSSMANN	BCA6031PQ	[]
1	F1	FUSE	BUSSMANN	KTK-R-5/600V	[]
2	TS	TERMINAL STRIP	SQD	9080-GK6	[]
1	SW	OFF-ON SELECTOR	SQD	9001SKS11B	[]
1		(NO) CONTACT	SQD	9001-KA3	[]
1	RL1	RUN LIGHT (120VAC - GREEN)	SQD	9001-OG120	[]
1	ETM	ELAPSED TIME METER	REDINGTON	710-0016	[]
1	R1	CONTROL RELAY (120VAC, 11 PIN)	SQD	8501KP13P14V20	[]
1		11 PIN SOCKET	IDEC	SR3P-05	[]
1	TH1	THERMOSTAT	BILBEE	B-200	[]
1	HT	HEATER	HEATRON	HEATFLEX	[]
1	SPD	SURGE PROTECTION DEVICE 230V (1PH, 3W)	SQD	SDSA1175	[]
2		LOUVERS (SS)	HOFFMAN	AVK66SS6	[]
2		COVERS OVER LOUVERS	STA-CON	8 X 8	[]

NOTES: * OR EQUAL

PACKING LIST

Quote#: 73696AA		Date: 7.10.13		Rev:
SPARE PARTS				
QTY	LEGEND	DESCRIPTION	MFG	PART #
1	F1	FUSE	BUSSMANN	KTK-R-5/600V
1		LIGHT BULB (120VAC/DC)	CANDELA CORP	120PSB

73696AA - GREENWOOD PARK

SHOP CHECK SHEET

Quote#: 73696AA	Date: 7.10.13	Rev:
-----------------	---------------	------

P.O.#		# PUMPS	1	Ship Date	
H.P.'s	2.4	DRIPSHIELD	N/A	VOLTAGE	230V PHASE 1 to 3
DEADFRONT	ALUM.	ENCLOSURE TYPE	4X	SERIAL #	
				MATL.	304 STAINLESS STEEL

SPECIAL INSTRUCTIONS	Check OFF
----------------------	-----------

Wire size from MB to PC [wire size - AWG.	[]
RED WARNING LABEL	[X]
*WARNING - BEFORE APPLYING POWER: ELECTRICAL CONNECTIONS CAN BECOME LOOSE DURING SHIPPING. TIGHTEN ALL SCREWS, AND INSPECT FOR DAMAGE TO WIRES AND COMPONENTS.	

Wire Numbers - Type	[]
Legends and Legend Sheet	[]
Ground Lugs	[]
Overload Heater Chart (N/A)	[]
Pump Data Sheet	[]
Drawings on Door	[]
Picture of Panel	[]

UL Serial No.	[]
---------------	-----

Spare Parts

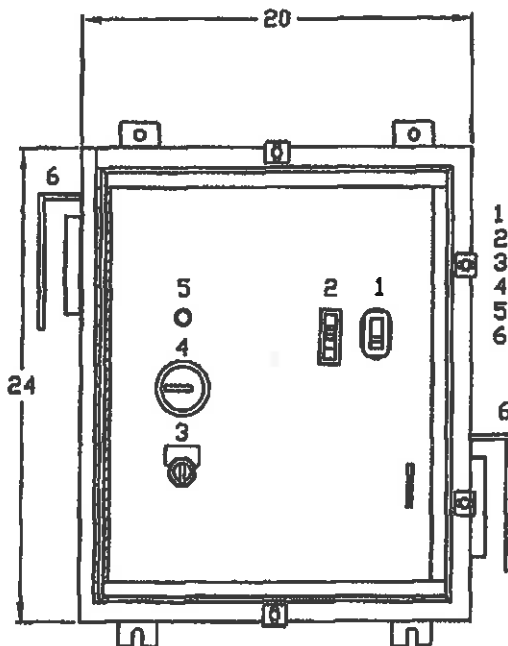
- [X] In Panel See Packing List []
- [X] In Separate Box See Packing List []

Wired by: subpanel _____ door/deadfront _____

Tester _____

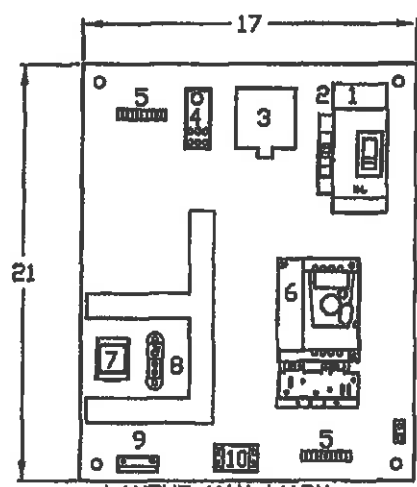
Inspector _____

Comments _____



- 1 - MBI MOTOR BREAKER
- 2 - CCB CONTROL BREAKER
- 3 - PUMP OFF-ON SELECTOR
- 4 - ETM ELAPSE TIME METER
- 5 - RLI PUMP RUN LIGHT
- 6 - VENTILATION LOUVERS

OUTER DOOR HAS BEEN REMOVED FOR CLARITY



- 1 - MBI MOTOR BREAKER 1
- 2 - CCB CONTROL CIRCUIT BREAKER
- 3 - SPD SURGE PROTECTIVE DEVICE
- 4 - N NEUTRAL BLOCK
- 5 - GRD GROUND BAR
- 6 - PC PHASE CONVERTER
- 7 - R1 RELAY
- 8 - TH THERMSTAT
- 9 - HT HEATER
- 10 - TS TERMINAL STRIP

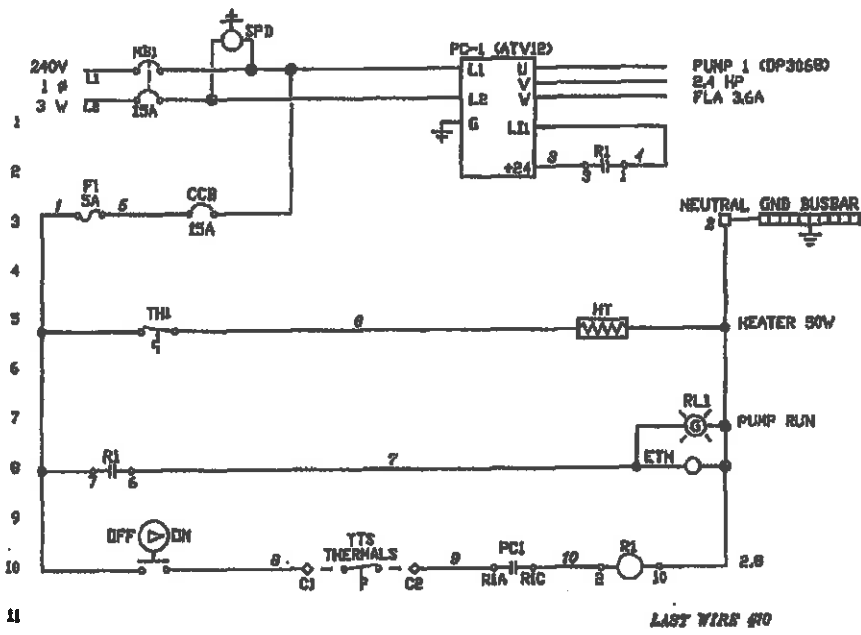
LAYOUT MAY VARY

GREENWOOD PARK	
QUOTE NO.	DATE
73696AA	7.10.13
DRAWN BY REVISION M.E.D.	

2825 SOUTH DEPT
APPROVA, FLORIDA
32705



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GREENWOOD PARK
 QUOTE NO. DATE DRAWN BY REVISION
 73696AA 7.10.13 MED

ESSS SOUTH DPT
 APUKA, FLORIDA
 32708

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TERMINAL STRIP C (TS-C)



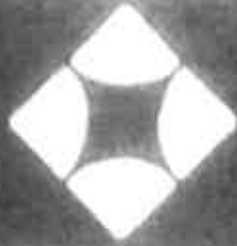
DEVICES ON THE BOTTOM OF THE TERMINAL STRIP
 ARE REMOTE COMING INTO CONTROL PANEL.
 DEVICES ON THE TOP OF THE TERMINAL STRIP
 ARE CONTACTS LEAVING THE CONTROL PANEL.

SQD Ground Busbar PIYOTA, PIYOTA, PIYOTA		
Wire Range	Avg CU	Torque
14-10 CU, 12-10 AL	20	18-18
8	20	18-18
6-4	20	18-18
Two 14 or 12 CU, Two 12 or 10 AL	25	

Fanduit Ground Lug One-Barrel		
Wire Range	Avg CU	Torque
(LANA8-14-DY) 12-14	15	18
6-10	20	18
2-4	20	18
(LANA10-14-DY) 10-14	25	18
4-6	20	18
2/0-3	20	18
(LANA20-26-DY) 2-6	27.5	18
20-1	27.5	18
(LANA30-38-DY) 2-5	27.5	18
20-1	27.5	18
(LANA40-38-DY) 20-1	27.5	18
Two-Barrel		
(LANA10-14-DY) 10-14	35	18
8	40	18
4-6	45	18

SQD Terminal Block GSS + GRS		
Wire Range	Avg CU	Torque
(Type GSS) 20-10	11-12	
(Type GRS) 20-8	18-20	

CUSTOMER: JIM HOUSE
 JOB NAME: GREENWOOD PARK
 ENCLOSURE UL TYPE RATING: UL TYPE 1
 VOLTAGE: 240V PHASE 1 HZ 60
 HP: 01 2.1 22 X 23 X 24 X
 F.L.A.: 3.6A X X X
 TOTAL F.L.A.: 11.2A
 SERIAL #: DATE:
 SCCR: 1 KA SYMMETRICAL RMS, 240 V, MAX.
 MANUFACTURED BY:
 57A CON INC 8888 S. DUT APUKA FL 32708



STACON

LIMITED WARRANTY

Sta-Con, Incorporated warrants all parts to be free from defects in materials and workmanship under normal use and service. The obligation of Sta-Con under this warranty is limited to making good by repair or replacement as Sta-Con deems most appropriate. The warranty does not cover reimbursement for labor, transportation, removal, installation or other expenses which may be incurred in connection with repair or replacement.

This warranty applies with respect to commercial classes of equipment such as control systems, etc. We warrant this equipment for a period of 1 year from the date of shipment. This warranty does not apply if the Sta-Con product has been subjected to misuse, negligence, unauthorized alteration, improper installation, maintenance or storage, accidental damage, faulty repair efforts or acts of God. This warranty covers only such failures as result from defective material or workmanship in Sta-Con products and shall in no event cover any resultant systems failure, any special, indirect, incidental or consequential damages whatsoever. Similarly, this warranty does not apply to products or parts in instances where adjustments thereof will correct the alleged defect.

Control panels containing controllers, drives and other computerized equipment need TVSS protection in order to satisfy the requirements for the one year warranty. The protection equipment must be kept in working condition during the one year period.

Any components to the control that are supplied by the purchaser are not covered by the warranty.

Sta-Con, Incorporated neither assumes nor authorizes any person to assume on its behalf any other warranties in connection with Sta-Con, Inc.

The forgoing warranties are exclusive and in lieu of all other express and implied warranties except warranty of title, including but not limited to implied warranties of merchantability and fitness for a particular purpose.



ITT

Water & Wastewater

Installation, Operation, and Maintenance Manual

Flygt 3068

MANUAL 3

**Sump Pump FLYGT 3068
Installation, Operation, and
Maintenance**



Engineered for life

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Introduction and Safety

Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

Inspect the delivery

Inspect the package

1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.
If the product has been picked up at a distributor, make a claim directly to the distributor.

Inspect the unit

1. Remove packing materials from the product.
Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
For your personal safety, be careful when you handle nails and straps.
4. Contact your sales representative if anything is out of order.

Product warranty

Coverage

ITT undertakes to remedy faults in products from ITT under these conditions:

- The faults are due to defects in design, materials, or workmanship.
- The faults are reported to an ITT representative within the warranty period.
- The product is used only under the conditions described in this manual.
- The monitoring equipment incorporated in the product is correctly connected and in use.
- All service and repair work is done by ITT-authorized personnel.
- Genuine ITT parts are used.
- Only Ex-approved spare parts and accessories authorized by ITT are used in Ex-approved products.

Limitations

The warranty does not cover faults caused by these situations:

- Deficient maintenance
- Improper installation
- Modifications or changes to the product and installation made without consulting ITT

- Incorrectly executed repair work
- Normal wear and tear

ITT assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses

Warranty claim

ITT products are high-quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, then contact your ITT representative.

Spare parts

ITT guarantees that spare parts will be available for 15 years after the manufacture of this product has been discontinued.

Safety



WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
- Any pressure-containing device can explode, rupture, or discharge its contents if it is over-pressurized. Take all necessary measures to avoid over-pressurization.
- Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by ITT. If there is a question regarding the intended use of the equipment, please contact an ITT representative before proceeding.
- Installation, Operation, and Maintenance manuals clearly identify accepted methods for disassembling units. These methods must be adhered to. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to impellers, propellers, or their retaining devices to aid in their removal.
- Do not change the service application without the approval of an authorized ITT representative.



CAUTION:

You must observe the instructions for installation, operation, and maintenance contained in this manual. Failure to do so could result in physical injury, damage, or delays.


Safety message levels




About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product
- Product malfunction

Definitions

Safety message level	Indication
 <p>DANGER:</p>	A hazardous situation which, if not avoided, will result in death or serious injury

Safety message level	Indication
 WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
 CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
 Electrical Hazard:	The possibility of electrical risks if instructions are not followed in a proper manner
NOTICE:	<ul style="list-style-type: none"> • A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

User safety

General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Helmet
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

Hazardous liquids

The product is designed for use in liquids that can be hazardous to your health. Observe these rules when you work with the product:

- Make sure that all personnel who work with sewage systems are vaccinated against diseases to which they may be exposed.
- Observe strict personal cleanliness.

Wash the skin and eyes

Do the following if chemicals or hazardous fluids have come into contact with your eyes or your skin:

If you need to wash your...	Then...
Eyes	<ol style="list-style-type: none"> 1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Skin	<ol style="list-style-type: none"> 1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least one minute. 3. Seek medical attention, if required.

Ex-approved products

Follow these special handling instructions if you have an Ex-approved unit.

Personnel requirements

These are the personnel requirements for Ex-approved products in potentially explosive atmospheres:

- All work on the product must be carried out by certified electricians and ITT-authorized mechanics. Special rules apply to installations in explosive atmospheres.
- All users must know about the risks of electric current and the chemical and physical characteristics of the gas, the vapor, or both present in hazardous areas.
- Any maintenance for Ex-approved products must conform to international and national standards (including IEC/EN 60079-17).

ITT disclaims all responsibility for work done by untrained and unauthorized personnel.

Product and product handling requirements

These are the product and product handling requirements for Ex-approved products in potentially explosive atmospheres:

- Only use the product in accordance with the approved motor data.
- The Ex-approved product must never run dry during normal operation. Dry running during service and inspection is only permitted outside the classified area.
- Before you start work on the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.
- Make sure that thermal contacts are connected to a protection circuit according to the approval classification of the product, and that they are in use.
- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.
- The yield stress of fasteners must be in accordance with the approval drawing and the product specification.
- Do not modify the equipment without approval from an authorized ITT representative.
- Only use parts that are provided by an authorized ITT representative.

ATEX guidelines

ATEX compliance is fulfilled only when you operate the unit within its intended use. Do not change the conditions of the service without the approval of an ITT representative. When you install or maintain ATEX-compliant equipment, always comply with the directive and applicable standards in IEC/EN 60079-14.

Permitted liquid level for ATEX

See the dimensional drawings of the product for the minimum permitted liquid level according to the ATEX approval. If the information is missing on the dimensional drawing, the product must be fully submerged. Level-sensing equipment must be installed if the product can be operated at less than the minimum submersion depth.

Monitoring equipment

For additional safety, use condition-monitoring devices. Condition-monitoring devices include but are not limited to the following:

- Level indicators
- Temperature detectors

Environmental safety

The work area

Always keep the station clean to avoid and/or discover emissions.

Recycling guidelines

Always recycle according to these guidelines:

1. Follow local laws and regulations regarding recycling if the unit or parts are accepted by an authorized recycling company.
2. If the first guideline is not applicable, then return the unit or parts to your IIT representative.

Waste and emissions regulations

Observe these safety regulations regarding waste and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

Transportation and Storage

Transportation guidelines

Precautions



WARNING:

- Stay clear of suspended loads.
 - Observe accident prevention regulations in force.
-

Position and fastening

The pump can be transported either horizontally or vertically. Make sure that the product is securely fastened during transportation, and cannot roll or fall over.

Lifting



WARNING:

- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
 - Lift and handle the product carefully, using suitable lifting equipment.
 - The product must be securely harnessed for lifting and handling. Use eyebolts or lifting lugs if available.
 - Always lift the unit by its lifting handle. Never lift the unit by the motor cable or by the hose.
 - Do not attach sling ropes to shaft ends.
-

Lifting equipment

Lifting equipment is always required when handling the pump. It must fulfill the following requirements:

- The minimum height (contact ITT for information) between the lifting hook and the floor must be sufficient to lift the pump.
 - The lifting equipment must be able to hoist the pump straight up and down, preferably without the need for resetting the lifting hook.
 - The lifting equipment must be securely anchored and in good condition.
 - The lifting equipment must support weight of the entire assembly and must only be used by authorized personnel.
 - Two sets of lifting equipment must be used to lift the pump for repair work.
 - The lifting equipment must be dimensioned to lift the pump with any remaining pumped media in it.
 - The lifting equipment must not be oversized.
-

NOTICE:

Oversized lifting equipment could cause damage if the unit should stick when being lifted.

Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:

- Protect the product against humidity, heat sources, and mechanical damage.
- Do not place heavy weights on the packed product.

Freezing precautions

The pump is frost-proof while operating or immersed in liquid, but the impeller/propeller and the shaft seal may freeze if the pump is raised in a temperature below freezing.

Follow these guidelines to avoid freezing damage:

When	Guideline
Before storage	<ul style="list-style-type: none"> • The pump must be allowed to run for a short time after raising it to discharge remaining pumped liquid. • The discharge opening must be covered in a suitable way, or placed facing down so that any still remaining pumped liquid runs out. • If present, the cooling jacket must be drained manually by opening the air vent screws at the top of the cooling jacket.
After storage	<p>If the impeller/propeller is frozen, it must be thawed by immersing the pump in liquid before operating the pump.</p> <p>NOTICE: Never use a naked flame to thaw the unit.</p>

Long-term storage

If the pump is stored more than 6 months, the following apply:

- Before operating the pump after storage, it must be inspected with special attention to the seals and the cable entry.
- The impeller/propeller must be rotated every other month to prevent the seals from sticking together.

Product Description

Pump design

The pump is submersible, and driven by an electric motor.

Intended use



WARNING:

Only use Ex- or MSHA-approved pumps in an explosive or flammable environment.

NOTICE:

Do NOT use the pump in highly corrosive liquids.

For information about pH, see *Application limits* (page 44).

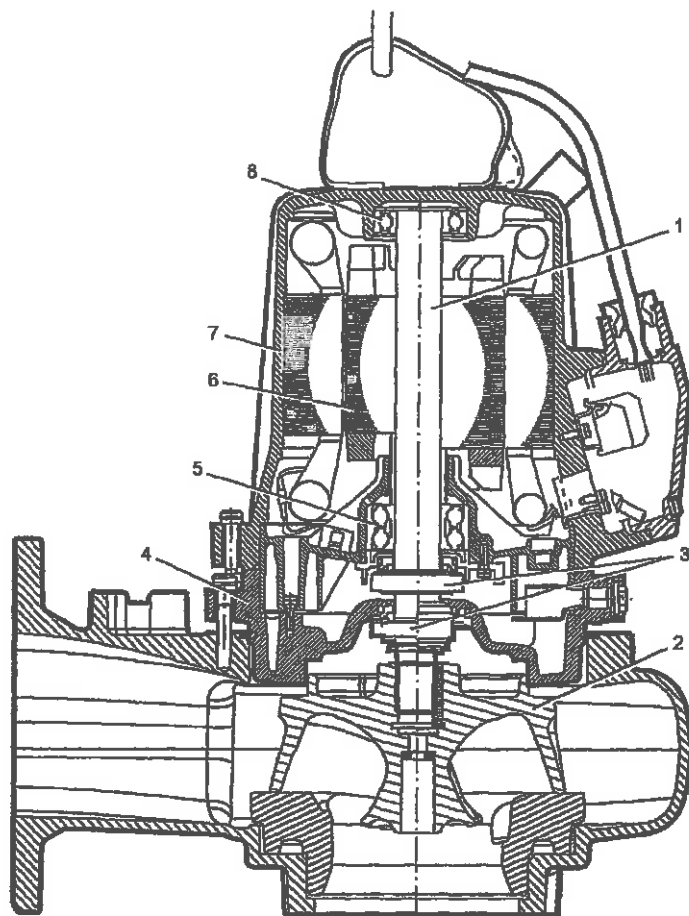
Spare parts

- Modifications to the unit or installation should only be carried out after consulting with ITT.
- Original spare parts and accessories authorized by ITT are essential for compliance. The use of other parts can invalidate any claims for warranty or compensation. For more information contact your ITT representative.

Pressure class

LT	Low head
MT	Medium head
HT	High head

Parts



Position	Part	Description
1	Shaft	The shaft is made of stainless steel, with an integrated rotor.
2	Impeller	There are multiple types of impellers. For information about the pumps impellers, see Parts List.
3	Mechanical seals	One inner and one outer seal in a combination of materials: <ul style="list-style-type: none"> • Aluminium oxide Al_2O_3 • Carbon CSb • Silicon carbide RSiC • Corrosion-resistant cemented carbide WCCR For information about the pumps mechanical seals, see Parts List.
4	Oil housing	The oil housing includes a coolant that lubricates and cools the seals; the housing acts as a buffer between the pumped liquid and the drive unit.
5	Main bearings	3068.090, 3068.180, 3068.250, 3068.590, 3068.890: The bearing consisting of a two-row angular contact ball bearing. 3068.170, 3068.890: The bearing consisting of a single-row ball bearing.
6	Motor	For information about the motor, see <i>Motor data</i> (page 44).
7	Stator housing	The pump is cooled by the ambient liquid/air.
8	Support bearing	The bearing consisting of a single-row ball bearing.

Monitoring equipment

The following applies to the monitoring equipment of the pump:

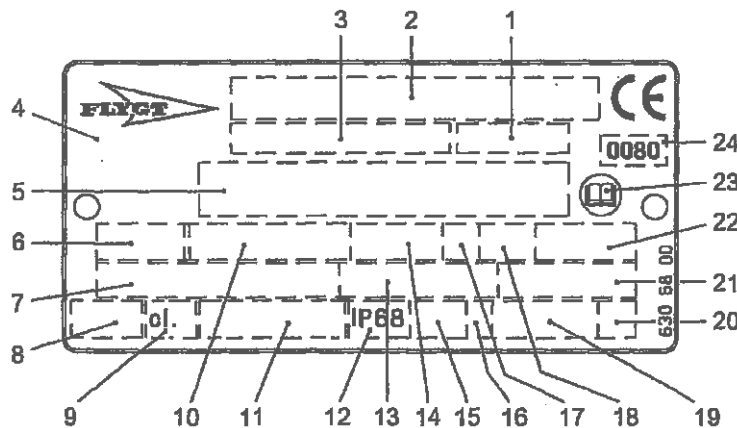
- The stator incorporates three thermal contacts connected in series that activate the alarm and stops the pump at overtemperature
- The thermal contacts open at 125°C (257°F).
- Only 3068.090, 3068.180: The pump is equipped with thermal contacts that open at 125°C (257°F) or 140°C (285°F).
- Ex-approved pumps must have thermal contacts connected to the control panel.
- The sensors must be connected to either the MiniCAS II monitoring equipment or an equivalent equipment.
- The monitoring equipment must be of a design that makes automatic restart impossible.
- The label in the junction box shows if the pump is equipped with optional sensors.

Optional sensors

FLS FLS is a miniature float switch for detection of liquid in the stator housing. Due to its design it is best suited for pumps in a vertical position. The FLS sensor is installed in the bottom of the stator housing.

The data plate

The data plate is a metal label located on the main body of the pump. The data plate lists key product specifications. Explosion-proof products also have an approval plate. Both are described below.



1. Curve code/Propeller code
2. Serial number, see *Product denomination* (page 14)
3. Product number
4. Country of origin
5. Additional information
6. Phase; type of current; frequency
7. Rated voltage
8. Thermal protection
9. Thermal class
10. Rated shaft power
11. International standard
12. Degree of protection
13. Rated current
14. Rated speed
15. Maximum submergence
16. Direction of rotation: L=left, R=right
17. Duty class
18. Duty factor
19. Product weight
20. Locked rotor code letter

21. Power factor
22. Maximum ambient temperature
23. Read installation manual
24. Notified body/only for EN-approved Ex-products

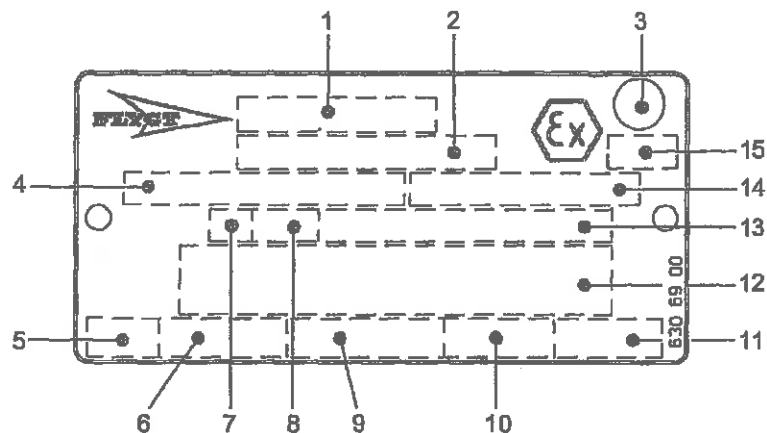
Figure 1: The data plate

Approvals

This section describes the EN and FM approvals that explosion-proof products have. For more information, please contact your ITT representative. In addition to the data plate, explosion-proof products also have either an EN or a FM approval plate.

EN

- European Norm
- ATEX Directive
- EN 50014, EN 50018, EN 1127-1
- Ex II 2 G EEx d IIB T4
- Ex I M2 EEx d I (only 3068.090)



1. Approval
2. Approval authority + approval number
3. Approval for Class I
4. Approved drive unit
5. Stall time
6. Starting current/Rated current
7. Duty class
8. Duty factor
9. Input power
10. Rated speed
11. Controller
12. Additional information
13. Maximum ambient temperature
14. Serial number
15. ATEX marking

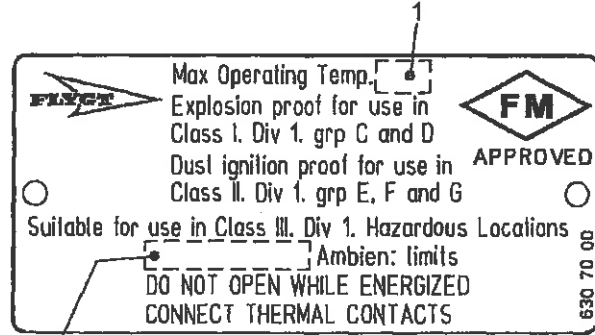
Figure 2: EN approval plate

EN approval for cable entry:

- Certificate number: INERIS 02ATEX9008 U
- Ex II 2 G or IM2 EEx d IIC or EEx dI

FM

This illustration describes the approval plate for Factory Mutual (FM) and the information contained in its



- fields.
1. Temperature class
 2. Maximum ambient temperature

Figure 3: FM approval plate

Product denomination

Sales denomination

The sales denomination consists of the four-digit sales code and two letters that indicate the hydraulic end and type of installation.

This is an example of a sales denomination, and an explanation of its parts.

NP 3085

/ \ |

1 2 3

1. Hydraulic part
2. Installation type
3. Sales code

Product code

The product code consists of nine characters divided into two parts.

This is an example of a product code, and an explanation of its parts.

NP 3085.183

| |

1 2

1. Sales denomination
2. Version

Serial number

The serial number is used for identification of an individual product, and is divided into four parts.

This is an example of a serial number, and an explanation of its parts.

NP 3085.183 - 951 0163

| | | |

1 2 3 4

1. Product code
2. Production year
3. Production cycle
4. Running number

Installation

Install the pump

**WARNING:**

- Before installing the pump, check that the cable and cable entry have not been damaged during transportation.
- Note that special rules apply to installation in explosive atmospheres.
- Make sure that the pump cannot roll or fall over and injure people or damage property.
- Do not install CSA-approved products in locations that are classified as hazardous in the national electric code, ANSI/NFPA 70-2005.

NOTICE:

- Do not run the pump dry.
- Never force piping to make a connection with a pump.

These requirements apply:

- Use the pump dimensional drawing in order to ensure proper installation.
- Provide a suitable barrier around the work area, for example, a guard rail.
- Check the explosion risk before you weld or use electric hand tools.
- Remove all debris from the inlet piping system before you install the pump.

Authority regulation

Vent the tank of a sewage machine station in accordance with local plumbing codes.

Fasteners

**WARNING:**

- Only use fasteners of the proper size and material.
- Replace all corroded fasteners.
- Make sure that all fasteners are properly tightened and that there are no missing fasteners.

Install with P-installation

In the P-installation, the pump is installed on a stationary discharge connection, and operates either completely or partially submerged in the pumped liquid. These requirements and instructions only apply when the installation is made according to the dimensional drawing.

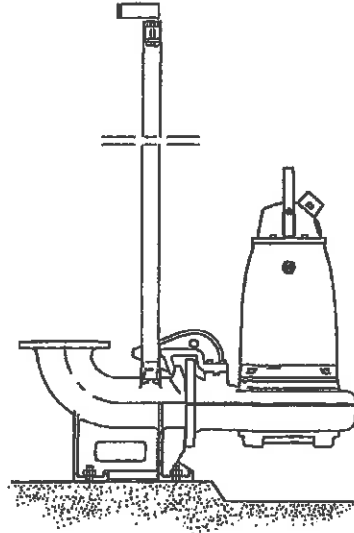


Figure 4: P-installation

These items are required:

- Guide bars
- Guide bar bracket for attaching the guide equipment to the access frame or to the upper part of the sump
- Cable holder for holding the cable
- Access frame (with covers) to which the upper guide bar bracket and cable holder can be attached
- Discharge connection for connecting the pump to the discharge line

The discharge connection has a flange which fits the pump casing flange and a bracket for attaching the guide equipment.

- Fasteners for the discharge connection
 - Anchor bolts
1. Install the access frame:
 - a) Place the access frame in position and align it horizontally.
 - b) Grout the frame in place.
 2. Grout the anchor bolts in place.

Be careful when you align and position the discharge connection in relation to the access frame.
 3. Place the discharge connection in position, and tighten the nuts.
 4. Install the guide bars:
 - a) Secure the guide bars in the bracket.
 - b) Check that the guide bars are placed vertically. Use a level or a plumb line.
 5. Connect the discharge pipe to the discharge connection.
 6. Lower the pump along the guide bars.

When it reaches the bottom position, the pump automatically connects to the discharge connection.
 7. Secure the motor cable:
 - a) Fasten the permanent lifting device to the pump and to the access frame. For example, you can use a stainless-steel lifting chain with shackles.
 - b) Fasten the cable to the cable holder.

Make sure that the cable cannot be sucked into the pump inlet or that it is neither sharply bent, or pinched. Support straps are required for deep installations.

- c) Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* (page 26).

- Clean all debris from the sump before starting the pump.

Install with S-installation

In the S-installation, the pump is transportable and intended to operate either completely or partially submerged in the pumped liquid. The pump is equipped with a connection for hose or pipe and stands on a base stand.

These requirements and instructions only apply when the installation is made according to the dimensional drawing. For information about the different installation types, see Parts List.

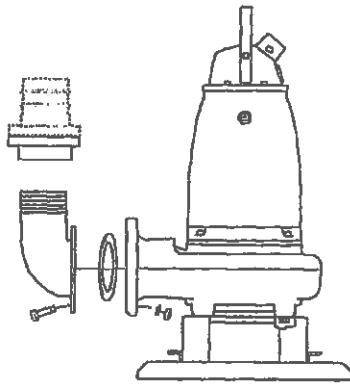


Figure 5: S-installation

1. Run the cable so that it has no sharp bends, is not pinched, and cannot be sucked into the pump inlet.
2. Connect the discharge line.
3. Lower the pump into the sump.
4. Place the pump on the base and make sure it cannot fall over or sink.

Alternatively, the pump can be suspended with a lifting chain just above the sump bottom. Make sure that the pump cannot rotate at startup or during operation.

5. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* (page 26).

Install with F-installation

In the F-installation, the pump is free standing and installed primarily in a small sump on a firm surface. The pump is intended to operate completely or partially submerged in the pumped liquid. The pump is equipped with a connection for hose or pipe and with supporting legs and/or a strainer. These requirements and instructions are for F-installations that comply to the dimensional drawing.

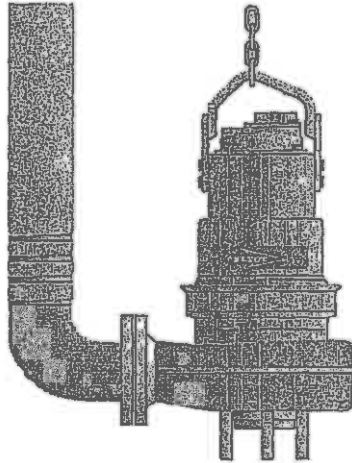


Figure 6: F-installation

These items are required:

- Nipple pipe/Flange/Coupling
 - Pipe or hose
1. Run the cable so that it has no sharp bends, is not pinched, and cannot be sucked into the pump inlet.
 2. Fit the nipple pipe/flange/coupling.
 3. Lower the pump into the sump.
 4. Place the pump on the sump bottom and make sure it cannot fall over.
 5. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* (page 26).

Make the electrical connections

General precautions



Electrical Hazard:

- A certified electrician must supervise all electrical work. Comply with all local codes and regulations.
- Before starting work on the pump, make sure that the pump and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.
- Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the end of the motor cable above the liquid level.
- Make sure that all unused conductors are insulated.
- There is a risk of electrical shock or explosion if the electrical connections are not correctly carried out or if there is fault or damage on the product.



CAUTION:

If the pump is equipped with automatic level control and/or internal contactor, there is a risk of sudden restart.

Requirements

These general requirements apply for electrical installation:

- The supply authority must be notified before installing the pump if it will be connected to the public mains. When the pump is connected to the public power supply, it may cause flickering of incandescent lamps when started.
- The mains voltage and frequency must agree with the specifications on the data plate. If the pump can be connected to different voltages, the connected voltage is specified by a yellow sticker close to the cable entry.
- The fuses, short-circuit, and circuit breakers must have the proper rating, and the pump overload protection (motor protection breaker) must be connected and set to the rated power according to the data plate. The starting current in direct-on-line starting can be up to six times higher than the rated current.
- The fuse rating and the cables must be in accordance with the local rules and regulations.
- If intermittent operation is prescribed, the pump must be provided with monitoring equipment supporting such operation.
- The motor is convertible between different voltages, as stated on the data plate. This conversion is done in the stator housing.

Cables

These are the requirements to follow when you install cables:

- The cables must be in good condition, not have any sharp bends, and not be pinched.
- The sheathing must not be damaged and must not have indentations or be embossed (with markings, etc.) at the cable entry.
- The cable entry seal sleeve and washers must conform to the outside diameter of the cable.
- The minimum bending radius must not be below the accepted value.
- If using a cable which has been used before, a short piece must be peeled off when refitting it so that the cable entry seal sleeve does not close around the cable at the same point again. If the outer sheath of the cable is damaged, then replace the cable. Contact an ITT service shop.
- The voltage drop in long cables must be taken into account. The drive unit's rated voltage is the voltage measured at the terminal board in the upper part of the pump.

NOTICE:

Do NOT use Variable Frequency Drive (VFD) with this pump.

Earthing (Grounding)



Electrical Hazard:

- You must earth (ground) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the earth (ground) lead to verify that it is connected correctly.
- If the motor cable is jerked loose by mistake, the earth (ground) conductor should be the last conductor to come loose from its terminal. Make sure that the earth (ground) conductor is longer than the phase conductors. This applies to both ends of the motor cable.
- Risk of electrical shock or burn. You must connect an additional earth- (ground-) fault protection device to the earthed (grounded) connectors if persons are likely to come into physical contact with the pump or pumped liquids.

Connect the motor cable to the pump



CAUTION:

Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the end of the motor cable above the liquid level.

For information about the cable entry, see the Parts list.

1. Remove the entry gland screw from the stator housing.
2. Remove the stator housing.
This provides access to the terminal board/closed end splices.
3. Remove the terminal board.
4. Check the data plate to see which connections are required for the power supply:
 - Y
 - D
 - Y serial
 - Y parallel
 - Y/D
5. Arrange the connections on the terminal board/closed end splices in accordance with the required power supply.
6. Connect the motor conductors (U1, V1, W1, and earth (ground)) according to applicable cable chart. The earth (ground) conductor must be 50 mm (2.0 in.) longer than the phase conductors in the junction box of the unit.
7. Make sure that the pump is correctly connected to earth (ground).
8. Make sure that any thermal contacts incorporated in the pump are properly connected to the terminal block/closed end splices.
9. Install the stator housing.
10. Install the entry gland screw.

Connect the motor cable to the starter and monitoring equipment



WARNING:

Do not install the starter equipment in an explosive zone or in the sump.

NOTICE:

- Thermal contacts are incorporated in the pump.
 - Thermal contacts must never be exposed to voltages higher than 250 V, breaking current maximum 4 A. It is recommended that they are connected to 24 V over separate fuses to protect other automatic equipment.
-

The single phase pumps must be equipped with a starter which has start and run capacitors.

A specially Flygt designed starter is required for the operation of single phase pumps. The connection of the motor cable to the starter is shown in the wiring diagram.

1. If thermal contacts are included in the pump installation, connect the T1 and T2 control conductors to the monitoring equipment.

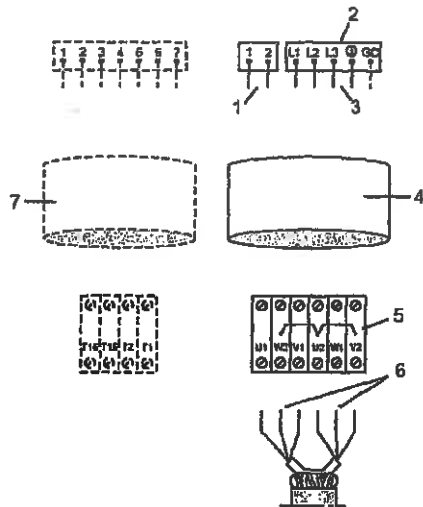
Do not connect the T1 and T2 leads to thermal contacts if the temperature of the pumped liquid is above 40°C (104°F).

NOTICE:

Ex-approved products must always have the thermal contacts connected irrespective of the ambient temperature.

2. Connect the mains leads (L1, L2, L3, and earth [ground]) to the starter equipment.
For information about the phase sequence and the color codes of the leads, see *Cable charts* (page 21).
3. Check the functionality of the monitoring equipment:
 - a) Check that the signals and the tripping function work properly.
 - b) Check that the relays, lamps, fuses, and connections are intact.
 Replace any defective equipment.

Cable charts



1. Control leads
2. Starter equipment
3. Mains leads
4. Motor cable
5. Terminal blocks on pump
6. Stator leads
7. Control cable

Figure 7: Connection locations

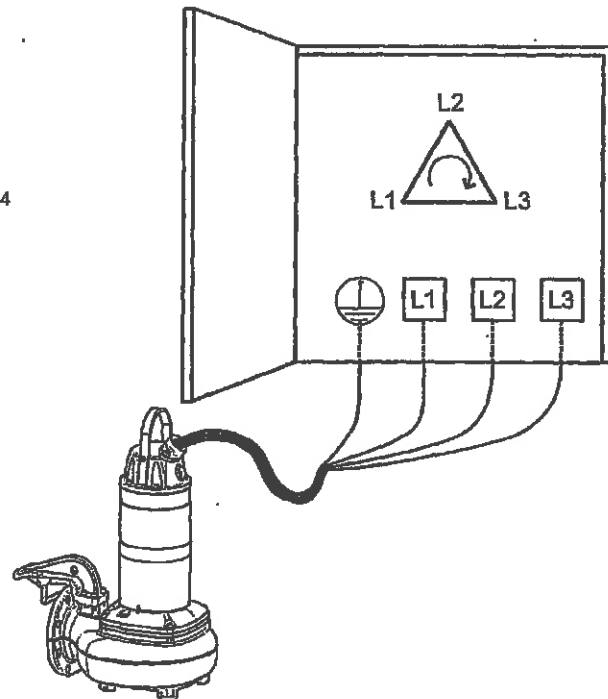


Figure 8: Phase sequence

Colors and marking of the mains leads

Mains	SUBCAB 7GX	SUBCAB 4GX	SUBCAB AWG	SUBCAB Screened	SI-SL-BIHFSIH-J
L1	Black 1	Brown	Red	Brown	Brown
L2	Black 2	Black	Black	Black	Black
L3	Black 3	Grey	White	Grey	Grey
L1	Black 4	-	-	-	-
L2	Black 5	-	-	-	-
L3	Black 6	-	-	-	-
	Yellow/Green	Yellow/Green	Yellow/Green	Screen from leads	Yellow/Green
Groundcheck (GC)	-	-	Yellow	-	-

Installation (Continued)

Color and marking of the control leads

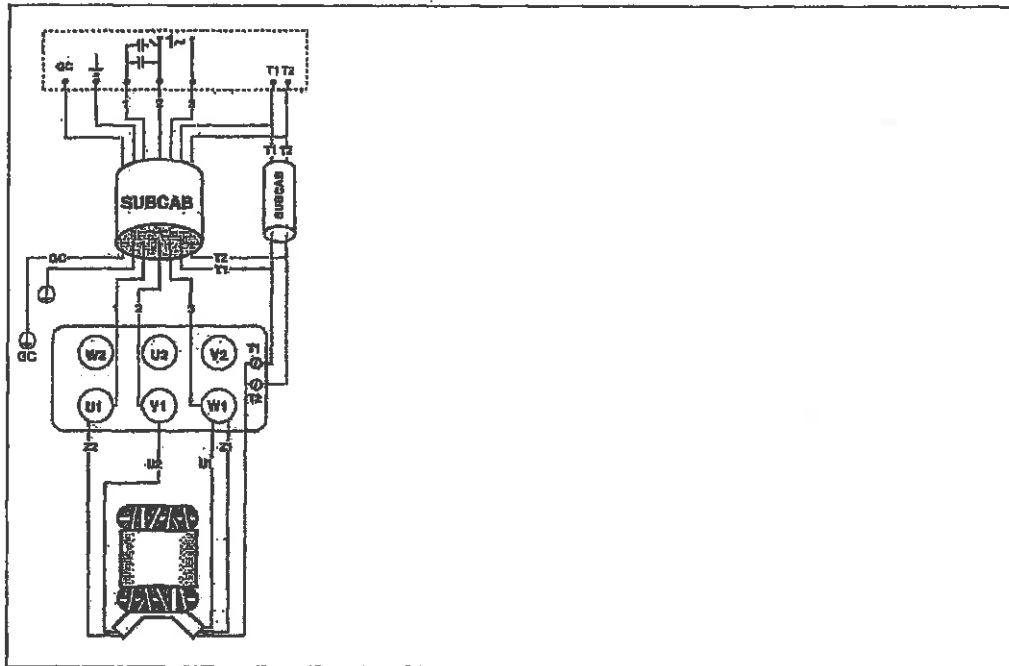
Control	SUBCAB 7GX and SUBCAB 4GX	SUBCAB AWG	SUBCAB screened
T1	White T1	Orange	White T1
T2	White T2	Blue	White T2
T3	-	-	White T3
T4	-	-	White T4

Colors of the stator leads

Stator connection	Lead color
U1	Red
U2	Green (Brown if 1 phase stator 4 leads is used)
U5	Red
V1	Brown
V2	Blue
V5	Brown
W1	Yellow
W2	Black
W5	Yellow

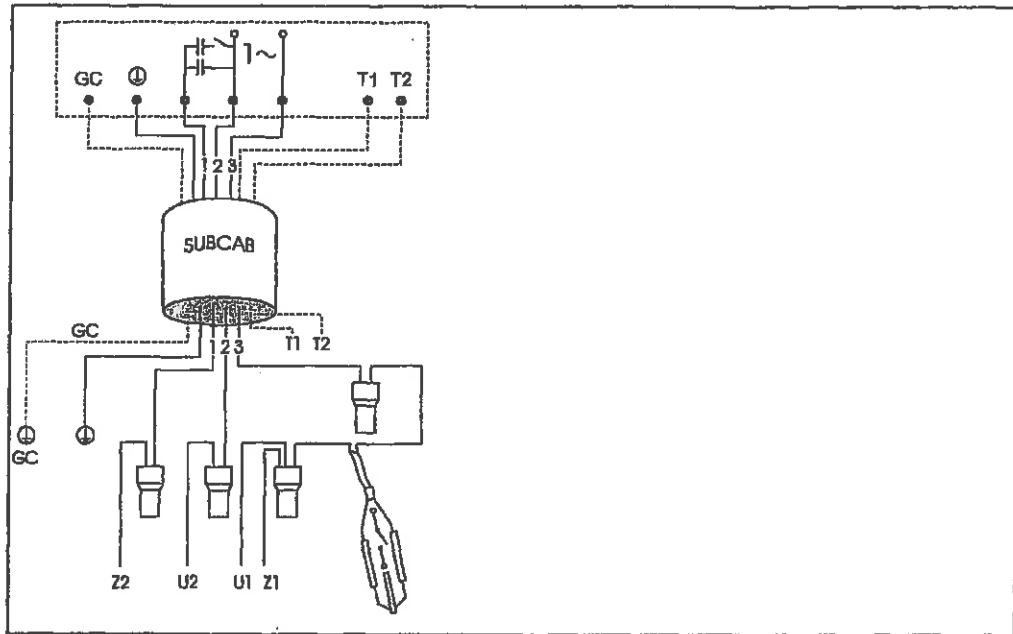
SUBCAB 4GX/SUBCAB AWG/SI-SL-BIHF, 4 stator leads, 1 phase

This table shows the connection diagrams for example the SUBCAB 4GX.



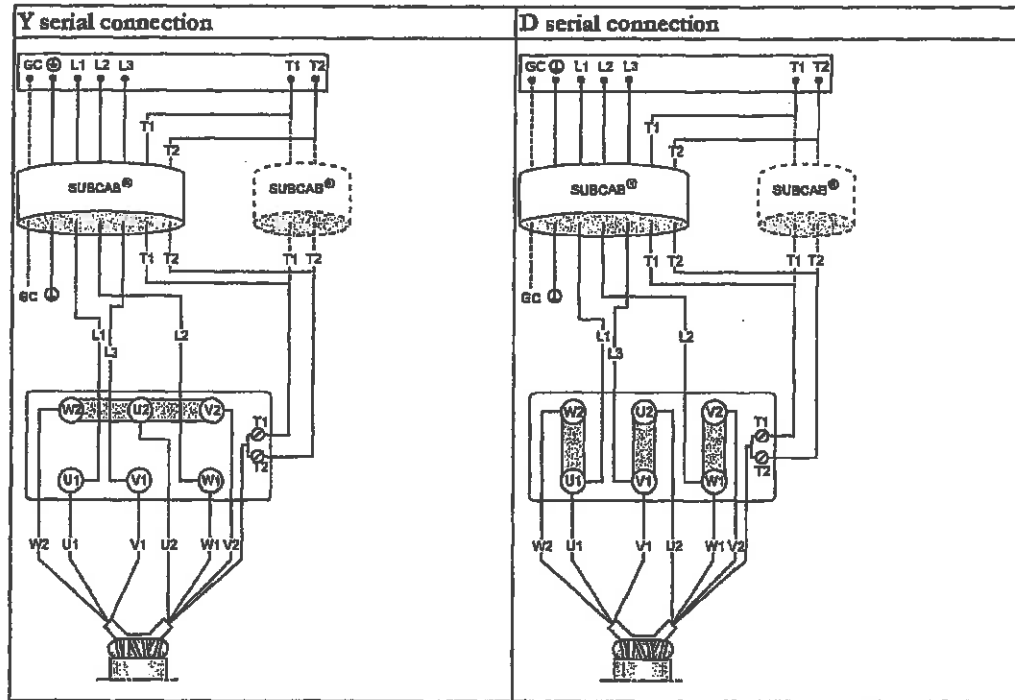
SUBCAB 4GX/SUBCAB AWG, 4 stator leads, 1 phase

This table shows the connection diagrams for example the SUBCAB 4GX with level regulator.



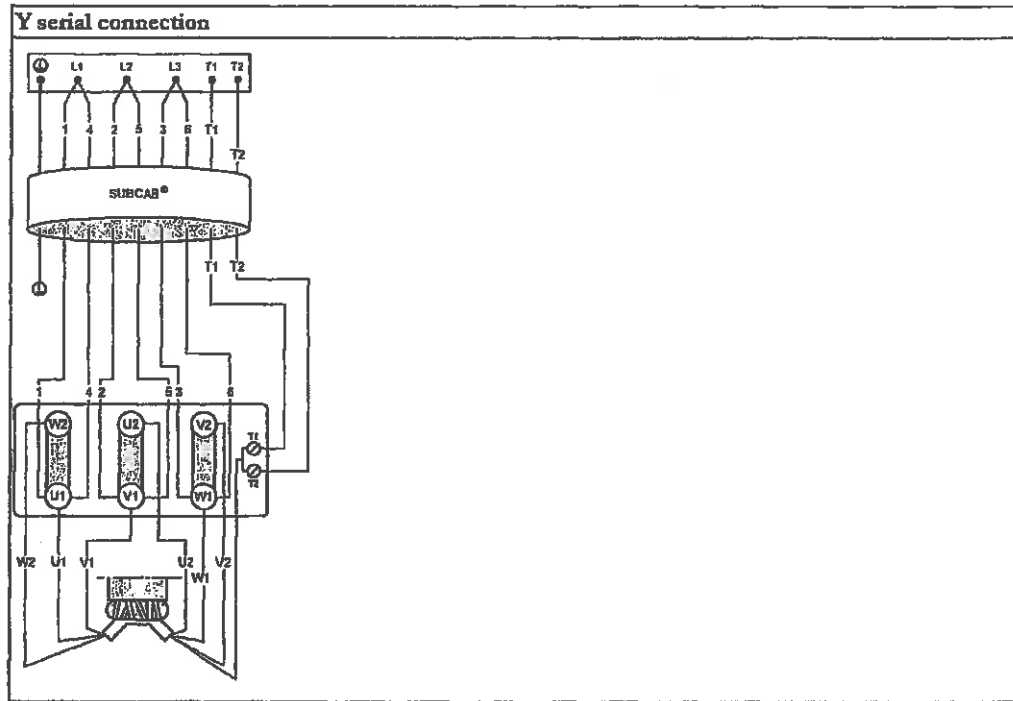
SUBCAB 4GX/SUBCAB AWG, 6 stator leads, Y and D connection

This table shows the connection diagrams for example the SUBCAB 4GX (3-phase power cable), with Y and D connection.



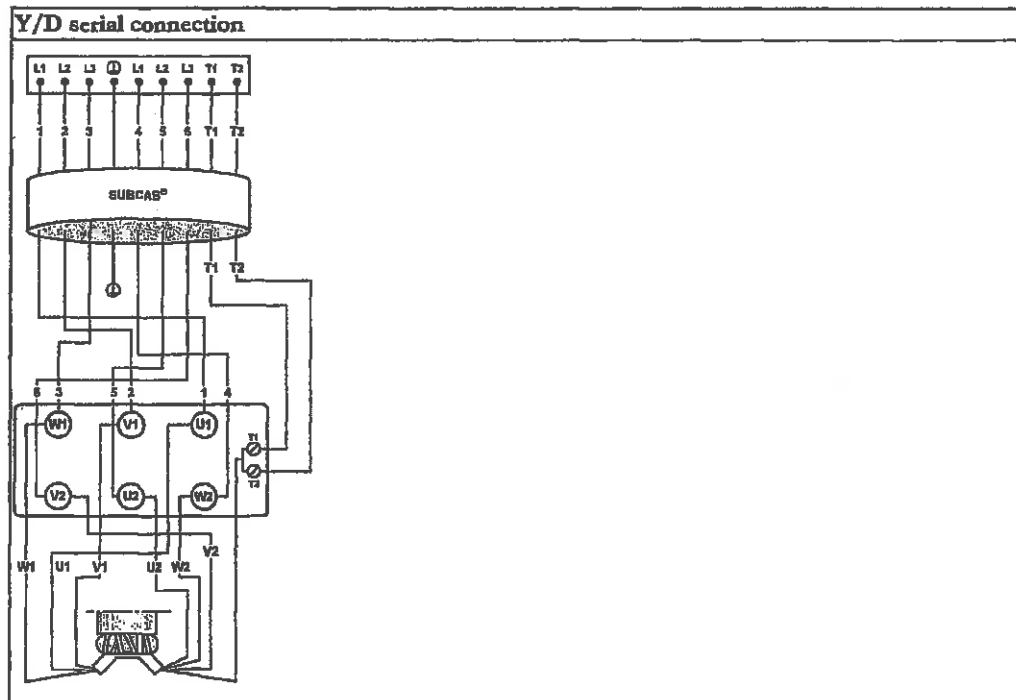
SUBCAB 7GX, 2 motor cables, 6 stator leads, D connection

This table shows the connection diagrams for the SUBCAB 7GX (3-phase power cables), with D serial connection.



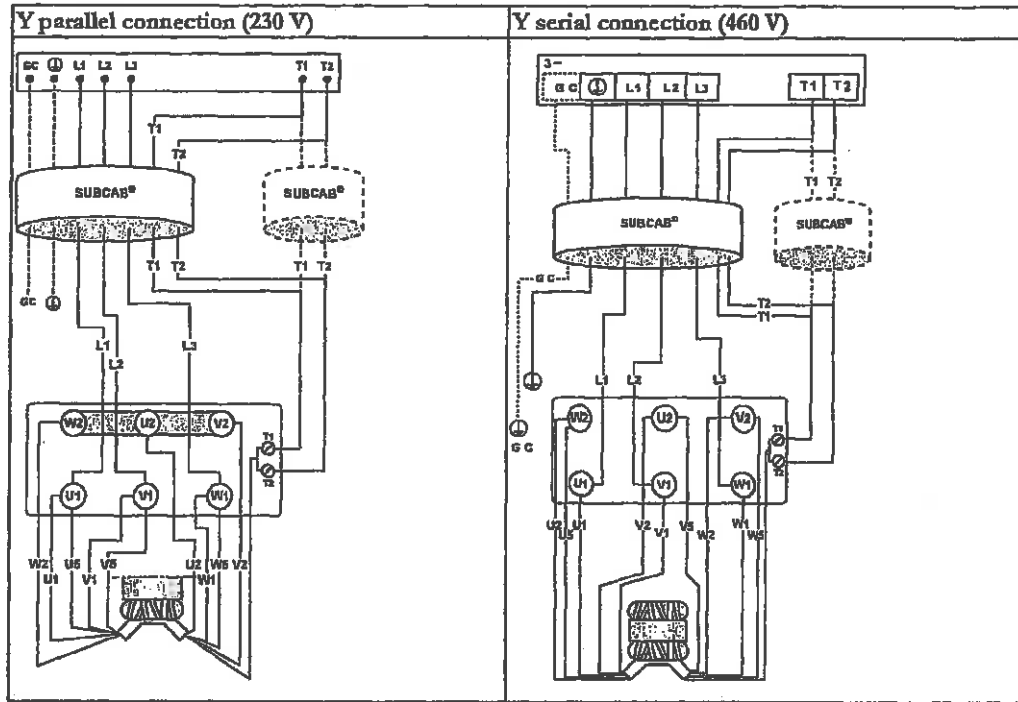
SUBCAB 7GX, 6 stator leads, Y/D connection

This table shows the connection diagrams for the SUBCAB 7GX (3-phase power cable), with Y/D serial connection.



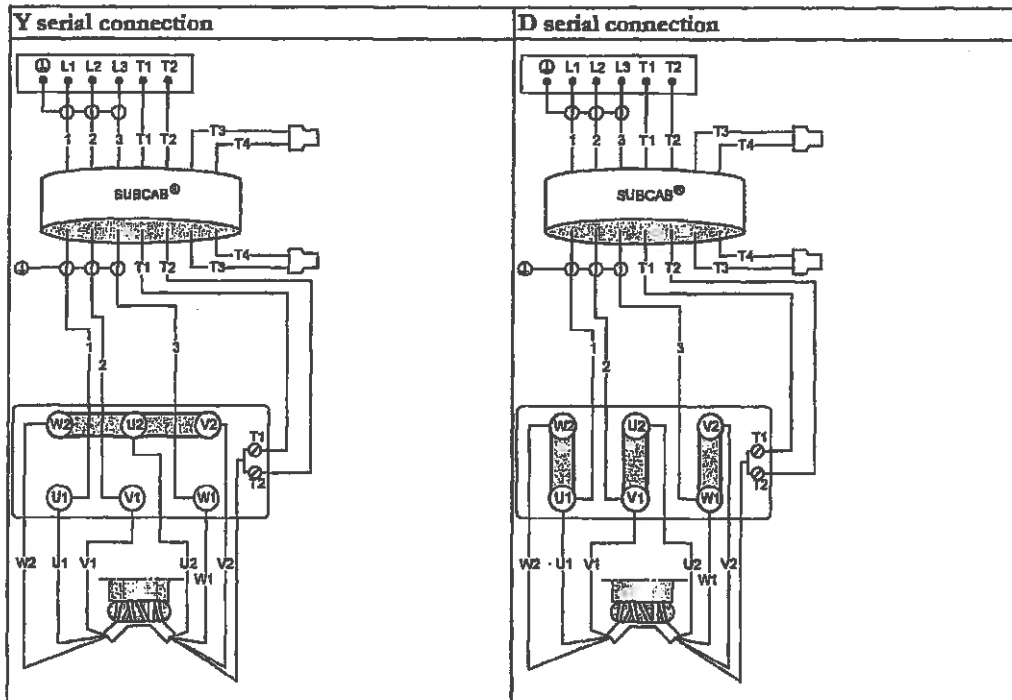
SUBCAB 4GX/SUBCAB AWG, 9-leads, 230/460 V, Y connection

This table shows the connection diagrams for example the SUBCAB 4GX (3-phase power cables), with Y parallel/serial connection (60 Hz only).



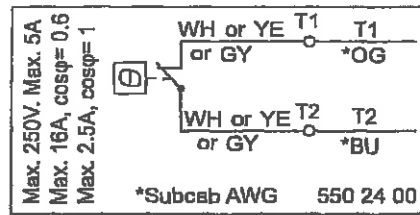
SUBCAB Screened S3X2.5+3X2.5/3+4X1.5, 6 stator leads, Y and D connection

This table shows the connection diagrams for the SUBCAB Screened (3-phase power cable), with Y parallel/serial connection (60 Hz only).

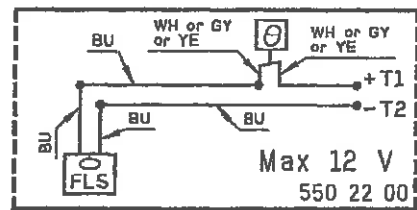


Sensor-connection

Thermal contact



FLS and Thermal contact



Value

0 mA	Overtemperature
7.8 mA	OK
36 mA	Leakage

The values have a 10 % tolerance

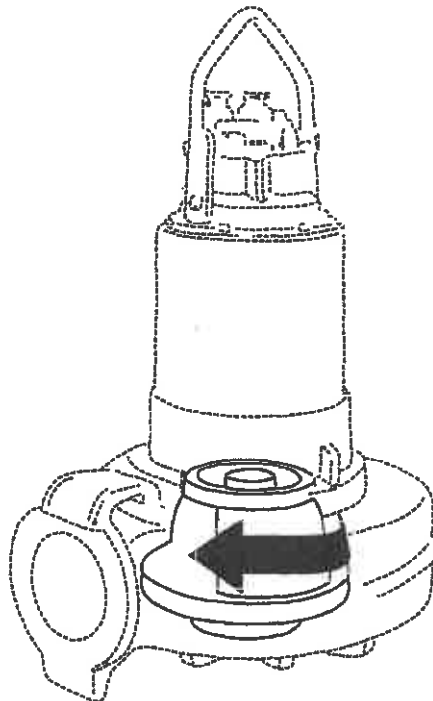
Check the impeller rotation



WARNING:

The starting jerk can be powerful.

1. Start the motor.
2. Stop the motor.
3. Check that the impeller rotates according to this illustration.



The correct direction of impeller rotation is clockwise when you look at the pump from above.

4. If the impeller rotates in the wrong direction, do one of these steps:
 - If the motor has a 1-phase connection, contact the local ITT shop.
 - If the motor has a 3-phase connection, transpose two phase leads and do this procedure again.

Operation

Precautions

- Never operate the pump without safety devices installed.
- Never operate the pump with the discharge valve closed.
- Make sure that all safety guards are in place and secure.
- Make sure you have a clear path of retreat.
- Never work alone.
- Beware of the risk of a sudden start if the product is used with an automatic level control.

Distance to wet areas



Electrical Hazard:

Risk of electrical shock when pumping or mixing near a lake, jetties, beaches, ponds, fountains, or similar. There must be a safety distance of at least 20 m (65 ft.) between the person and the product if the person is in contact with the pumped or mixed liquid.



Electrical Hazard:

Risk of electrical shock. This pump has not been investigated for use in swimming pools. If used in connection with swimming pools special safety regulations apply.

Noise level

NOTICE:

The noise level of the product is lower than 70 dB. However, the noise level of 70 dB may be exceeded in some installations and at certain operating points on the performance curve. Make sure that you understand the noise level requirements in the environment where the pump is installed. Failure to do so may result in hearing loss or violation of local laws.

Start the pump



WARNING:

- If you need to work on the pump, make sure that it is isolated from the power supply and cannot be energized.
 - Make sure that the pump cannot roll or fall over and injure people or damage property.
 - In some installations, the pump and the surrounding liquid may be hot. Bear in mind the risk of burn injuries.
 - Make sure nobody is close to the pump when it is started. The pump will jerk in the opposite direction of the impeller rotation.
-

NOTICE:

Make sure that the rotation of the impeller is correct. For more information, see Check the impeller rotation.

1. Check the oil level in the oil housing.
 2. Remove the fuses or open the circuit breaker, and check that the impeller can be rotated freely.
 3. Conduct insulation test phase to ground. To pass, the value must exceed 5 megohms.
-

4. Check that the monitoring equipment works.
5. Start the pump.

Maintenance

Precautions



WARNING:

- Always follow safety guidelines when working on the pump. See *Introduction and Safety* (page 3).
- Disconnect and lock out electrical power before installing or servicing the pump.
- Make sure that the pump cannot roll or fall over and injure people or damage property.
- Rinse the pump thoroughly with clean water before working on the pump.
- Rinse the components in water after dismantling.

Make sure that you follow these requirements:

- Check the explosion risk before you weld or use electrical hand tools.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product and its components have been thoroughly cleaned.
- Do not open any vent or drain valves or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.

Maintenance guidelines

During maintenance and before reassembly, always remember to perform these tasks:

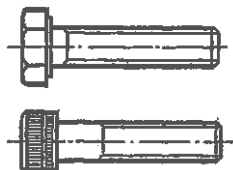
- Clean all parts thoroughly, particularly O-ring grooves.
- Change all O-rings, gaskets, and seal washers.
- Lubricate all springs, screws, and O-rings with grease.

During reassembly, always make sure that existing index markings are in line.

The reassembled drive unit must always be insulation-tested and the reassembled pump must always be test-run before normal operation.

Torque values

Screw and nuts

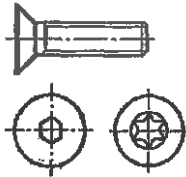


Stainless steel, A2 and A4											
	Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
Torque, Nm (ft-lbs)	70 +80 ¹	2.7 (2)	5.4 (4)	9.3 (6.9)	22 (16)	44 (32)	76 (56)	187 (138)	364 (268)	629 (464)	1240 (915)
Carbon steel and alloyed steel											

¹ Property class 70 is torque tightened as class 80.

Torque, Nm (ft- lbs)	8.8	2.9 (2.1)	5.7 (4.2)	9.8 (7.2)	24 (18)	47 (35)	81(60)	194 (143)	385 (285)	665 (490)	1310 (966)
	10.9	4.0 (2.9)	8.1 (6)	14 (10.3)	33 (24.3)	65 (48)	114 (84)	277 (204)	541 (399)	935 (689)	1840 (1357)
	12.9	4.9 (3.6)	9.7 (7.2)	17 (12.5)	40 (30)	79 (58)	136 (100)	333 (245)	649 (480)	1120 (825)	2210 (1630)

Screws with countersunk heads



Stainless steel, A2 and A4

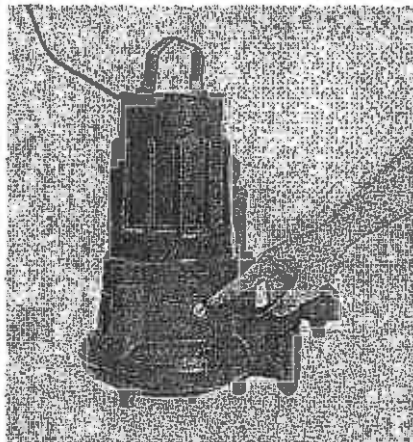
	Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24
Torque, Nm (ft-lbs)	70 +80 ¹	1.2 (0.9)	2.7 (2)	5.4 (4)	9.3 (6.9)	22 (16)	44 (32)	76 (56)	120 (88)	187 (138)

Carbon steel and alloyed steel

Torque, Nm (ft-lbs)	8.8	2.3 (1.7)	4.6 (3.4)	7.8 (5.8)	19 (14)	38 (28)	65 (48)	158 (116)	308 (228)	532 (392)
	10.9	3.2 (2.4)	6.5 (4.8)	11(8)	26 (19)	52 (38)	91 (67)	222 (164)	433 (320)	748 (552)
	12.9	3.9 (2.9)	7.8 (5.8)	14 (10.3)	32 (23.6)	63 (46)	109 (80)	266 (196)	519 (383)	896 (661)

Change the oil

This image shows the plugs that are used to change the oil.

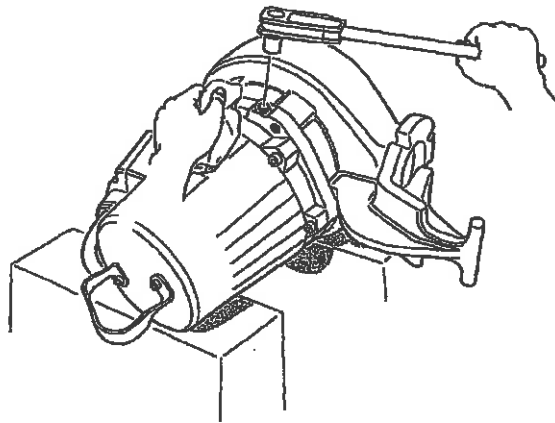


Empty the oil

**WARNING:**

The oil housing may be pressurized. Hold a rag over the oil plug to prevent oil from spraying out.

1. Place the pump in a horizontal position and unscrew the oil plug.



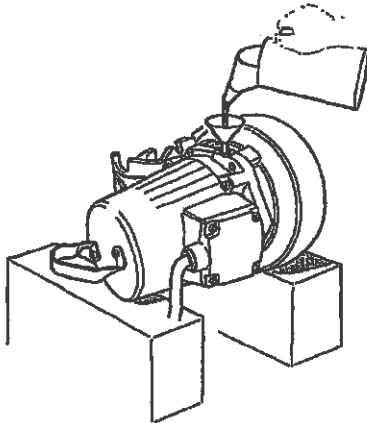
2. Place a container under the pump and turn the pump.

Fill with oil

The oil should be a paraffin oil with viscosity close to ISO VG32.

1. Replace the O-ring of the oil plug.
2. Fill with oil.

Quantity: approximately 0.6 liters (0.63 quarts)



3. Refit the oil plug and tighten.
Tightening torque: 10-40 Nm (7.5-29.5 ft-lbs)

Replace the impeller

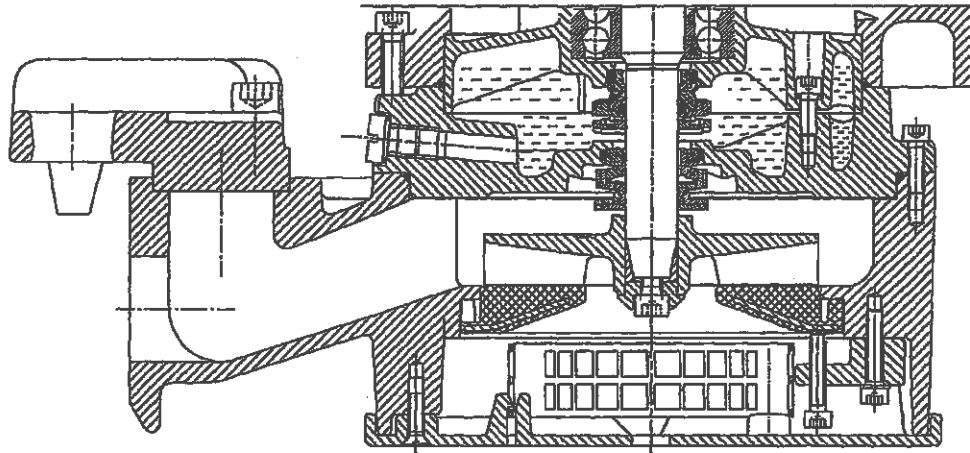


Figure 9: B-impeller

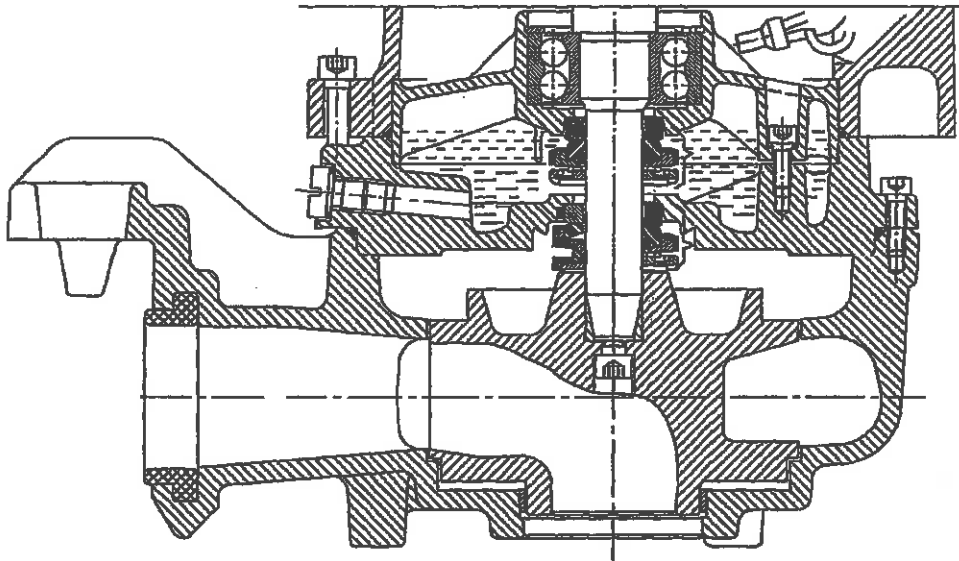


Figure 10: C-impeller

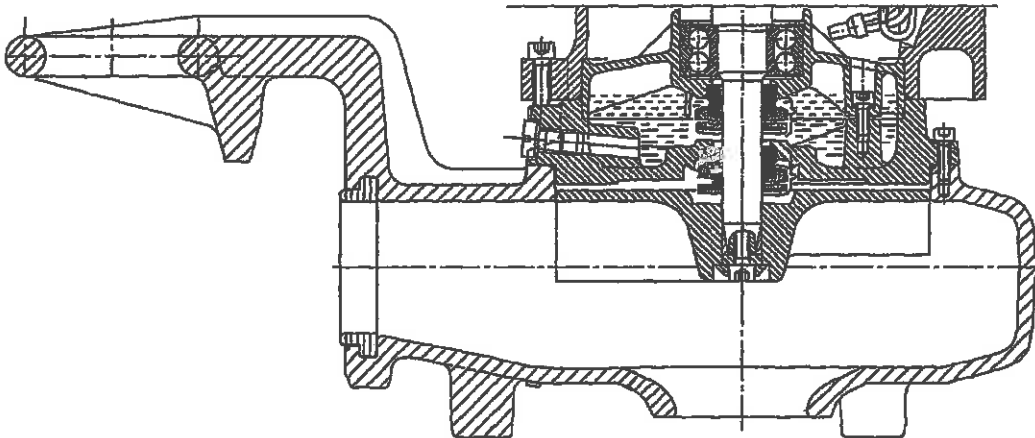


Figure 11: D-impeller

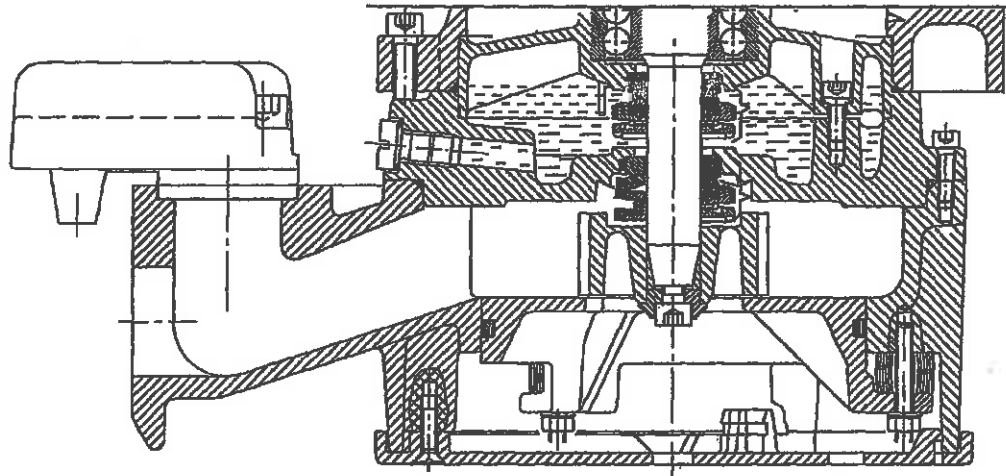


Figure 12: F-Impeller

Required tools:

- 6 mm hexagon-bit adaptor with an extension of at least 125 mm (4.92 in.) or an extended hexagon bit with the same measurement
 - Impeller puller
- If applicable, contact your local ITT representative for correct type and size.
- A wooden or copper rod for locking the impeller in place, if applicable.
 - Two crowbars, if applicable



WARNING:

- A worn impeller and/or pump housing can have very sharp edges. Wear protective gloves.
- When laying the pump on its side, do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.
- If you fail with the impeller installation, you must redo the installation procedure from the beginning.

Remove the impeller



CAUTION:

A worn impeller and/or pump housing can have very sharp edges. Wear protective gloves.

1. Lay the pump on its side.
2. For the S-installation, remove the strainer bottom.
3. Remove these items, based on your pump version:
 - For the C and D impellers in pressure classes MT and HT, remove the pump housing.
 - For the B, F, and D impellers in pressure class LT, remove the suction cover.
4. Remove the impeller screw.
If applicable, use the rod.
5. Remove the impeller.
Use the impeller puller or the crowbars.
6. Remove the conical sleeve.

Install the impeller

1. Make sure that the end of the shaft is clean and free from burrs.

- Polish off any flaws with a fine emery cloth.
2. Mount the impeller:
 - a) Fit the conical sleeve onto the shaft.
 - b) Press the impeller onto the shaft with the lubricated impeller screw.
 - c) Tighten the impeller screw.
For tightening torque, see *Torque values* (page 30).
If applicable, use the rod.
Check that the impeller can rotate freely.
 3. For B-, F-impeller, D-impeller pressure class LT:
 - a) Fit the suction cover.
 - b) Fit and tighten the lubricated screws.
For tightening torque, see *Torque values* (page 30).
 4. For C-, D-impeller pressure class MT and HT:
 - a) Fit the pump housing.
 - b) Fit and tighten the lubricated screws.
For tightening torque, see *Torque values* (page 30).
 5. For S-installation, mount the strainer bottom.
 - a) Fit the strainer bottom to the pump housing.
 - b) Fit and tighten the lubricated screws.
For tightening torque, see *Torque values* (page 30).

Replace the M-impeller

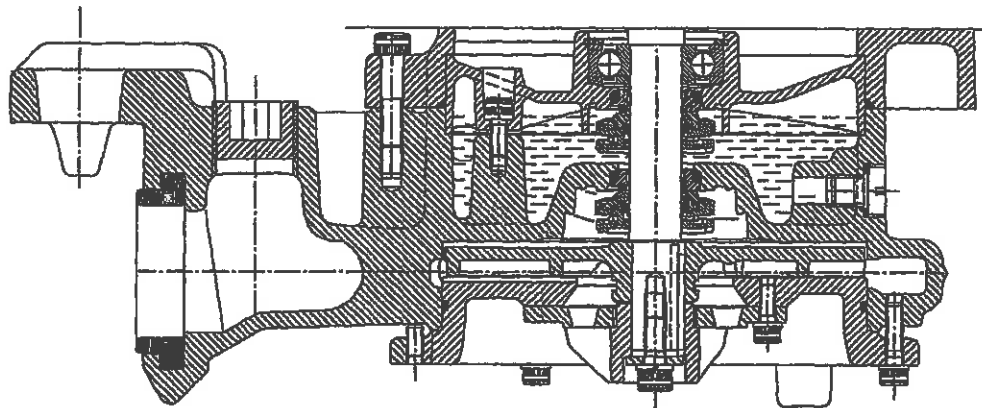


Figure 13: M-impeller

Remove the M-impeller



CAUTION:

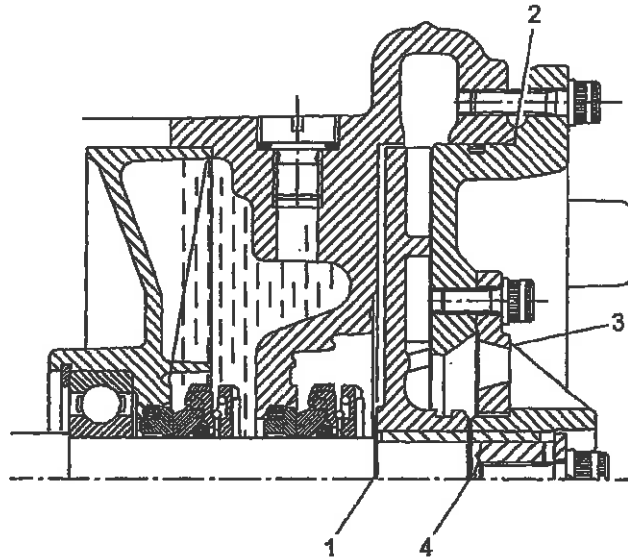
A worn impeller and/or pump housing can have very sharp edges. Wear protective gloves.

1. Lay the pump on its side.
2. Remove the impeller screw.
If applicable, use the rod.
3. Remove the washers.
4. Remove the suction cover unit and cutter wheel:
 - a) Remove the suction cover screws and washers.
 - b) Remove the suction cover.

- c) Remove the cutter ring.
- d) Remove the cutter wheel.
5. Remove the impeller.
Use the impeller puller or the crowbars.
6. Remove the washers.

Install and adjust the M-impeller

This figure shows correct position of washers or positions of where to measure distances by fitting washers.



WARNING:

Rotating cutting wheel. Disconnect power before lifting the pump.



1. Prepare the shaft:
 - a) Make sure that the end of the shaft is clean and free from burrs.
Polish off any flaws with a fine emery cloth.
 - b) Make sure that the parallel key is seated in the keyway on the shaft.
 - c) Fit four adjusting washers onto the shaft.
Use washers with a thickness of 0.1 mm (0.004 in.) or 0.3 mm (0.12 in.).
Position 1
2. Prepare the suction cover unit:
 - a) Make sure that the cutter ring is mounted on the suction cover.
 - b) Remove the O-ring from the outside of the suction cover.
3. Adjust the impeller:
 - a) Mount the impeller, the suction cover, cutter ring, and the cutter wheel.

- b) Hand-tighten the impeller screw and the suction cover screws.
- c) Measure the distance between the suction cover and the pump housing by fitting as many adjusting washers in the gap as possible.
Use washers with a thickness of 0.1 mm (0.004 in.) or 0.3 mm (0.12 in.).
Note the numbers of washers equals X.
- Position 2
- d) Remove the impeller screw, the suction cover, the cutter ring, and the impeller.
- e) Add/remove the adjustment washers to achieve correct distance.
- f) Keep Y number of washers on the shaft.
Use the formula $Y = X - 1$.
- g) Mount the impeller.
4. Adjust the cutting device:
- a) Fit four adjusting washers onto the shaft.
Use washers with a thickness of 0.1 mm (0.004 in.) or 0.3 mm (0.12 in.).
Position 4
- b) Fit the suction cover unit and the cutter wheel.
- c) Fit and hand-tighten the impeller screw and the suction cover screws.
- d) Measure the distance between the cutter wheel and the cutter ring.
The distance should be between 0.05 - 0.15 mm (0.002 - 0.006 in.).
Position 3
- e) Remove the impeller screw, the cutter wheel, and the suction cover unit from the shaft.
- f) Remove or add adjusting washers at position 4 in order to get the requested distance.
Use washers with a thickness of 0.1 mm (0.004 in.) or 0.3 mm (0.12 in.).
5. Mount the suction cover unit:
- a) Fit a new greased O-ring on the outside of the suction cover.
- b) Fit the suction cover unit onto the shaft.
- c) Fit and tighten the lubricated screws.
For tightening torque, see *Torque values* (page 30).
6. Mount the cutter wheel:
- a) Fit the cutter wheel.
- b) Fit the washer on the lubricated impeller screw.
- c) Tighten the impeller screw.
For tightening torque, see *Torque values* (page 30).
Check that the impeller and cutter wheel can rotate freely.

Service the pump

Regular inspection and service of the pump ensures more reliable operation, severe operating conditions will require more frequent inspections.

If the seals have been replaced an inspection of the oil is recommended after one week of operation.

Type of service	Inspection interval
Intermediate service	<ul style="list-style-type: none"> • Every year (standard applications) • For hot water applications ($\leq 70^{\circ}\text{C}$ [160°F]) with the following mode of operation: <ul style="list-style-type: none"> • Intermittent: twice a year • Continuous: every 1000 hours • Every 5 year: For application with M-impeller with usage < 10 min/day and approximately 10 starts/day.

Maintenance (Continued)

Type of service	Inspection interval
Major service in an authorized service shop	<ul style="list-style-type: none"> • Type of installation: • Permanent: 3 years • Portable: once a year • For hot water applications ($\leq 70^{\circ}\text{C}$ [160°F]) with these mode of operation: • Intermittent: once a year • Continuous: every 4000 hours • Every 20,000 hours: For application with M-impeller with usage < 10 min/day and approximately 10 starts/day.

Intermediate service

Service of the...	Action
Cable	<ol style="list-style-type: none"> 1. If the outer jacket is damaged, replace the cable. 2. Check that the cables do not have any sharp bends and are not pinched.
Connection to power	Check that the connections are properly tightened.
Electrical cabinets	Check that they are clean and dry.
Impeller	<ol style="list-style-type: none"> 1. Check the impeller clearance. 2. Adjust the impeller, if necessary.
Stator housing	<ol style="list-style-type: none"> 1. Drain all liquid, if any. 2. Check the resistance of the leakage sensor. Normal value approx. 1500 ohms, alarm approx. 430 ohms.
Insulation	<ol style="list-style-type: none"> 1. Check that the resistance between the earth (ground) and phase lead is more than 5 megohms. 2. Conduct a phase-to-phase resistance check.
Junction box	Check that it is clean and dry.
Lifting device	Check that local safety regulations are followed.
Lifting handle	<ol style="list-style-type: none"> 1. Check the screws. 2. Check the condition of the lifting handle. 3. Replace if necessary.
O-rings	<ol style="list-style-type: none"> 1. Replace the oil plug O-rings 2. Replace the O-rings at the entrance or junction cover. 3. Grease the new O-rings.
Overload protection and other protections	Check the correct settings.
Personnel safety devices	Check the guard rails, covers, and other protections.
Rotation direction	Check the impeller rotation.
Oil housing	Fill with new oil, if necessary.
Terminal block/closed end splice	Check that the connections are properly tightened.
Thermal contacts	Check the resistance of the leakage sensor. Normally closed circuit; interval 0-1 ohm.
Voltage and amperage	Check the running values.

Major service

For a major service, take this action, in addition to the tasks listed under intermediate service.

Service of the...	Action
Support and main bearing	Replace the bearings with new bearings.
Mechanical seal	Replace with new seal units.

Service in case of alarm

For information about indication values for sensors, see *Sensor connection*.

Alarm source	Action
FLS	<ol style="list-style-type: none"> 1. Check for liquid in the stator housing. 2. Drain all liquid, if any. 3. Check the mechanical seal unit, the O-rings, and the cable entry, if liquid was found.
Thermal contact	Check the start and stop levels.
The overload protection	Check that the impeller can rotate freely.

Troubleshooting

Introduction

Follow these guidelines when troubleshooting the pump:

- Disconnect and lock out the power supply except when conducting checks that require voltage.
- Make sure that no one is near the pump when the power supply is reconnected.
- When troubleshooting electrical equipment, use the following:
 - Universal instrument multimeter
 - Test lamp (continuity tester)
 - Wiring diagram

The pump does not start



WARNING:

Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
An alarm signal has been triggered on the control panel.	<p>Check that:</p> <ul style="list-style-type: none"> • The impeller rotates freely. • The sensor indicators do not indicate an alarm. • The overload protection is not tripped. <p>If the problem still persists: Contact the local ITT service shop.</p>
The pump does not start automatically, but can be started manually.	<p>Check that:</p> <ul style="list-style-type: none"> • The start level regulator is functioning. Clean or replace if necessary. • All connections are intact. • The relay and contactor coils are intact. • The control switch (Man/Auto) makes contact in both positions. <p>Check the control circuit and functions.</p>
The installation is not receiving voltage.	<p>Check that:</p> <ul style="list-style-type: none"> • The main power switch is on. • There is control voltage to the start equipment. • The fuses are intact. • There is voltage in all phases of the supply line. • All fuses have power and that they are securely fastened to the fuse holders. • The overload protection is not tripped. • The motor cable is not damaged.
The impeller is stuck.	<p>Clean:</p> <ul style="list-style-type: none"> • The impeller • The sump in order to prevent the impeller from clogging again.

If the problem persists, refer to the Flygt Service Guide on the web or contact the local ITT service shop. Always state the serial number of your pump when you contact ITT, see *Product Description* (page 10).

The pump does not stop when a level sensor is used



WARNING:

Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

Cause	Remedy
The pump is unable to empty the sump to the stop level.	<p>Check that:</p> <ul style="list-style-type: none"> • There are no leaks from the piping and/or discharge connection. • The impeller is not clogged. • The non-return valve(s) are functioning properly. • The pump has adequate capacity. For information: Contact the local ITT service shop.
There is a malfunction in the level-sensing equipment.	<ul style="list-style-type: none"> • Clean the level regulators. • Check the functioning of the level regulators. • Check the contactor and the control circuit. • Replace all defective items.
The stop level is set too low.	Raise the stop level.

If the problem persists, refer to the Flygt Service Guide on the web or contact the local ITT service shop. Always state the serial number of your pump when you contact ITT, see *Product Description* (page 10).

The pump starts-stops-starts in rapid sequence

Cause	Remedy
The pump starts due to back-flow which fills the sump to the start level again.	<p>Check that:</p> <ul style="list-style-type: none"> • The distance between the start and stop levels is not too small. • The non-return valve(s) work(s) properly. • The riser is not too long without a non-return valve.
The self-holding function of the contactor malfunctions.	<p>Check:</p> <ul style="list-style-type: none"> • The contactor connections. • The voltage in the control circuit in relation to the rated voltages on the coil. • The functioning of the stop-level regulator. • Whether the voltage drop in the line at the starting surge causes the contactor's self-holding malfunction.

If the problem persists, refer to the Flygt Service Guide on the web or contact the local ITT service shop. Always state the serial number of your pump when you contact ITT, see *Product Description* (page 10).

The pump runs but the motor protection trips



WARNING:

Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Troubleshooting (Continued)

Cause	Remedy
The motor protection is set too low.	Set the motor protection according to the data plate.
The impeller is difficult to rotate by hand.	<ul style="list-style-type: none"> • Clean the impeller. • Clean out the sump. • Check that the impeller is properly trimmed.
The drive unit is not receiving full voltage on all three phases.	<ul style="list-style-type: none"> • Check the fuses. Replace fuses that have tripped. • If the fuses are intact, notify a certified electrician.
The phase currents vary, or they are too high.	Contact the local ITT service shop.
The insulation between the phases and ground in the stator is defective.	<ol style="list-style-type: none"> 1. Use an insulation tester. With a 1000 V DC megger, check that the insulation between the phases and between any phase and ground is > 5 megohms. 2. If the insulation is less: Contact the local ITT service shop.
The density of the pumped fluid is too high.	<p>Make sure that the maximum density is 1100 kg/m³ (9.2 lb/US gal)</p> <ul style="list-style-type: none"> • Change the impeller or to a more suitable pump. • Contact the local ITT service shop.
There is a malfunction in the overload protection.	Replace the overload protection.

If the problem persists, refer to the Flygt Service Guide on the web or contact the local ITT service shop. Always state the serial number of your pump when you contact ITT, see *Product Description* (page 10).

The pump delivers too little or no water



WARNING:

Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
The impeller rotates in the wrong direction.	<ul style="list-style-type: none"> • If it is a 3-phase pump, transpose two leads. • If it is a 1-phase pump: Contact the local ITT service shop.
One or more of the valves are set in the wrong positions.	<ul style="list-style-type: none"> • Reset the valves that are set in the wrong position. • Replace the valves, if necessary. • Check that all valves are correctly installed according to media flow. • Check that all valves open correctly.
The impeller is difficult to rotate by hand.	<ul style="list-style-type: none"> • Clean the impeller. • Clean out the sump. • Check that the impeller is properly trimmed.
The pipes are obstructed.	Clean out the pipes to ensure a free flow.
The pipes and joints leak.	Find the leaks and seal them.
There are signs of wear on the impeller, pump, and casing.	Replace the worn parts.
The liquid level is too low.	<ul style="list-style-type: none"> • Check that the level sensor is set correctly. • Depending on the installation type, add a means for priming the pump, such as a foot valve.

If the problem persists, refer to the *Flygt Service Guide* on the web or contact the local ITT service shop. Always state the serial number of your pump when you contact ITT, see *Product Description* (page 10).

Technical Reference

Motor data

Feature	Description
Motor type	Squirrel-cage induction motor
Frequency	50 or 60 Hz
Supply	1-phase or 3-phase
Starting method	<ul style="list-style-type: none"> ▪ Direct on-line ▪ Star-delta
Maximum starts per hour	30 evenly spaced starts per hour
Code compliance	IEC 60034-1
Rated output variation	±5%
Voltage variation without overheating	±10%, provided that it does not run continuously at full load
Voltage imbalance tolerance	2%
Stator insulation class	F (155°C [310°F])

Application limits

Data	Description
Liquid temperature	<p>40°C (104°F) maximum</p> <p>The pump can be operated at full load only if at least half the stator housing is submerged.</p> <p>Ex-approved pumps: 40°C (104°F) maximum</p>
Liquid density	1100 kg/m ³ (9.2 lb per US gal) maximum
pH of the pumped media (liquid)	5.5–14 for cast iron pumps
Depth of immersion	20 m (65 ft) maximum
Other	For the specific weight, current, voltage, power ratings, and speed of the pump, see the data plate of the pump.



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