Groundwater Suppression and Product Recovery System – Remedial Design Report

ALCO – Maxon Site – Parcel B, BCP Site No. C447043

Maxon ALCO Holdings, LLC

220 Harborside Drive, Suite 300
Schenectady, NY 12305

Prepared For

Maxon ALCO Holdings, LLC

220 Harborside Drive, Suite 300
Schenectady, NY 12305

February 2025
Revision 03

Barton&Loguidice

Maxon ALCO Holdings, LLC.
Parcel B – BCP Site No. C447043
220 Harborside Drive, Suite 300
Schenectady, NY 12305

Groundwater Suppression and Product Recovery System
Remedial Design Report
Parcel B – BCP Site No. C447043

February 2025
Revised 03

Prepared For

Maxon ALCO Holdings, LLC
220 Harborside Drive, Suite 300
Schenectady, New York 12305

Prepared By

Barton & Loguidice, D.P.C.
10 Airline Drive
Albany, New York 12205

Table of Contents

Section			Page
1.0	INTRODUCTION		1
1.1	Project Background		1
1.2	Corrective Measures Investigation Report		2
1.3	Remedial Action Objectives		2
1.3.1	Selected Corrective Measure		3
2.0	PRELIMINARY DESIGN INVESTIGATION		4
2.1	Preliminary Design Investigation Overview		4
2.2	Field Investigation		4
2.2.1	Hydraulic Conductivity Testing and Results		5
2.2.2	Step Pumping Tests and Results		7
2.2.3	Groundwater Gradient		7
2.2.4	Groundwater Monitoring Engineering Control Survey		8
2.2.5	Supplemental Stormwater System Investigation		8
2.3	Remedial System Suitability		9
2.4	Summary of Design Elements		9
2.4.1	Recovery Well		9
2.4.2	Pumping Rate, Well Diameter, and Pump Sizing		10
2.4.3	Groundwater Treatment		12
2.4.4	Material Management		12
2.4.5	Site Restoration		12
2.5	Health and Safety Plan		13
2.5.1	Equipment and Personnel Decontamination Facilities		13
2.5.2	Community Air Monitoring		13
2.5.3	Stormwater Management		13
3.0	PRODUCT RECOVERY SYSTEM DESIGN		15
3.1	System Overview		15
3.2	Recovery Well Design		16
3.3	Drawdown Pump		16
3.4	Passive Skimmer		17
3.5	Effluent Management		17
3.5.1	Flow Metering		17
3.5.2	Effluent Sampling		17
3.6	Utility Installation		18
3.6.1	Electric		18
3.6.2	Effluent Discharge		18
3.7	Petroleum Product Management		19
4.0	SYSTEM OPERATIONS AND MONITORING		20
4.1	System Monitoring		20
4.2	System Operation		20

5.0 PERMITS AND OTHER AUTHORIZATIONS 21

6.0 SCHEDULE 22
6.1 Schedule Milestone 22

7.0 POST CONSTRUCTION PLANS 23
7.1 Site Management Plan Update 23
7.2 Construction Completion Report 23

8.0 REFERENCES 24

Figures

Figure 1 Existing Site Plan
Figure 2 DS-1 Investigation Monitoring Points
Figure 3 Stormwater Network #1 Plan and Profile View
Figure 4 Site Groundwater Contour Map

Appendices

Appendix A Recovery System Design Drawings
Appendix B Hydraulic Conductivity Testing Results Graphs and Table
Appendix C Step Drawdown Test Results Graphs
Appendix D Thiem Calculation
Appendix E Oil/Water Separator Manufacturer's Information
Appendix F Groundwater Drawdown Pump and Controller Manufacturer's Information
Appendix G Passive Skimmer Manufacturer's Information
Appendix H Flow Meter Manufacturer's Information
Appendix I Remedial System Weekly Log

1.0 INTRODUCTION

On behalf of Maxon ALCO Holdings, LLC (Volunteer), Schenectady, NY, Barton & Loguidice, D.P.C (B&L), has prepared the following Groundwater Suppression and Product Recovery System Remedial Design Report to address a known area of petroleum contamination in the vicinity of the Stormwater Diversion Structure 1 (DS-1) associated with the site's stormwater management system. This work plan builds on the results of the Corrective Measures Investigation Report (February 2022) which summarized the work performed in and around the DS-1 structure and the subsequent remedial action decision of a groundwater recovery/treatment system approved by the New York State Department of Environmental Conservation (NYSDEC). This design report also takes into account the pre-design field investigation activities completed by B&L in June and August 2022. The pre-design field investigation activities were outlined in the Corrective Measures Remedial Action Work Plan (March 2022). This report presents the remedial design of the groundwater recovery/treatment system associated with the DS-1 structure and surface water impacts observed at the Mohawk Harbor stemming from Stormwater Outfall #1. The remedial design report was prepared in accordance with the Parcel B Site Management Plan (SMP) and 6 NYCRR Part 375 regulations.

1.1 Project Background

Remedial action programs were implemented during site development at the former ALCO industrial site to remove encountered areas of petroleum. The site remedy included the placement of soil cover systems above site soils harboring residual petroleum compounds. Periodic occurrences of petroleum sheens to the harbor surface from the outfall have been observed during periods of intense rainfall and/or Mohawk River level fluctuations. These sheens are suspected to be associated with residual aged subsurface petroleum mobilized from the soils and entering the Harborside Drive stormwater network (Stormwater Network #1), which conveys flow to Outfall #1 located along the western end of the harbor. The site layout is presented in **Figure 1**.

As a result of these sheens, several investigations have been performed in order to isolate a section of Stormwater Network #1 where petroleum may be infiltrating the stormwater drainage system.

During an investigation of the interior condition of DS-1 on June 25, 2020 by Precision Industrial Maintenance, Inc. (PIM), grout deterioration and cracking at the bottom of the pipe penetration through the upstream wall was noted with seepage of contaminated groundwater into the structure. The structure was cleaned and sealed; however, further investigation of the surrounding conditions was warranted.

In accordance with the approved revised DS-1 Subsurface Investigation letter work plan to the NYSDEC dated July 23, 2020 and the Parcel B SMP, B&L field staff completed a subsurface investigation on August 10 and 11, 2020 around the exterior of DS-1. The purpose of the investigation was to assess the subsurface conditions around the outside of the DS-1 stormwater structure. During the investigation, eight (8) soil borings and three (3) monitoring wells were installed. The locations of the soil borings and monitoring wells are presented on

Figure 2. Soil and groundwater samples were collected and analyzed for the presence of Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs). VOC and SVOC detections were noted in both the soil and groundwater samples. In addition, a thin layer of free-phase petroleum has been noted in monitoring well MW-3. As a result, remedial techniques are warranted to treat the source area that appears to be infiltrating the stormwater system in the vicinity of DS-1.

In an effort to further improve the capturing of free phase oil, B&L installed a Whale Pump Model I submersible pump into monitoring wells MW-1, MW-2, and MW-3 on May 6, 2021. By aggressively pumping each well, it was determined that the product recovery could be temporarily increased using this drawdown method. Although it should be noted that oil accumulation in MW-3 did not occur instantaneously when the pumping test was terminated. It required several days before measureable product was documented at this location.

1.2 Corrective Measures Investigation Report

A Corrective Measures Investigation Report was submitted to the Department (as established in the approved SMP) and subsequently approved on February 15, 2022, to evaluate the residual subsurface petroleum entering the storm system and review remedial treatment options. Based on the Corrective Measures Investigation Report and Department approval, the corrective action determined most suitable to mitigate subsurface petroleum from entering the stormwater system is to install a groundwater recovery system in the immediate vicinity of the DS-1 area that would depress the groundwater table and allow for the capture and conveyance of free phase oil. The groundwater recovery system will be equipped with a product removal mechanism (i.e. passive skimmer). The remedial system will assist in treating the source area, minimizing the infiltration of residual petroleum into the stormwater system and reducing and/or eliminating sheens in the harbor from Outfall #1.

1.3 Remedial Action Objectives

The remedial action objectives of the corrective measure will conform to the Standards, Criteria, and Guidance values (SCGs) defined in the 2014 Decision Document issued by NYSDEC

The performance goals of a groundwater/product recovery system will be to:

- reduce the source area and volume of petroleum infiltration into the stormwater system;
- eliminate petroleum sheen releases to the harbor surface; and
- improve groundwater quality

The effectiveness of the corrective measure will be monitored by weekly tracking of contaminant mass capture through petroleum collection in a passive skimmer and oil/water separator.

1.3.1 Selected Corrective Measure

The installation of a groundwater suppression and product recovery system will promote a more aggressive extraction of residual petroleum product around the DS-1 structure. This method of recovery will create a slight depression of the water table in the vicinity of the DS-1 structure so that free product is directed toward the recovery well and extracted from the ground, thereby preventing seepage into the stormwater system and releases into the harbor.

2.0 PRELIMINARY DESIGN INVESTIGATION

2.1 Preliminary Design Investigation Overview

Based on the results of the Corrective Measures Investigation described in Section 1.2, the source area identified in the vicinity of the DS-1 structure has the potential to infiltrate stormwater network #1 and ultimately release sheen to the harbor surface. To remediate the source area and reduce sheen flow events to the harbor, the Department approved a groundwater suppression and product recovery system as the corrective measure in accordance with the approved SMP for Parcel B.

The recovery system will collect petroleum product in the vicinity of monitoring wells MW-2 and MW-3 located on the north side of the DS-1 structure, where free product has been noted during the DS-1 subsurface investigation (2019) and a subsequent pumping test event (2020). The recovery system is anticipated to slightly depress the water table in the immediate vicinity of the DS-1 structure, inducing a cone of depression and redirecting groundwater flow and free product toward the recovery system. The recovery system will be equipped with a petroleum collection system that will continuously capture free product from the groundwater surface that is drawn towards the system. A detail drawing of the recovery well design is included in **Appendix A**.

Further hydrogeologic evaluations were completed to help determine hydraulic conductivity, groundwater gradient, groundwater flow direction, pumping rates, and radius of influence of a pumping well. Each supplemental investigation is described in greater detail below.

2.2 Field Investigation

The following section provides a description of the field investigations that assisted in the design of a pumping system. The supplemental investigations included the following:

- In-situ Variable Hydraulic Conductivity Testing: Tests were performed at the three (3) DS-1 monitoring wells. For each well, a solid core (slug) was inserted into the water, and a falling head test was performed by recording decreasing head data until the water level had recovered to within 90% of the static water level. A rising head test was then performed following the completion of the falling head test and slug removal. Data was collected using an In-Situ LevelTroll® Data Logger and was evaluated using Aqtesolv® Software Version 4.50 Professional (HydroSOLVE, Inc) for hydraulic conductivity.

- Step-Drawdown Pumping Test: A drawdown test was performed at MW-3 with a Geotech Geosub 2 pump and controller. In-Situ LevelTroll® Data Loggers were inserted into each of the adjacent monitoring wells to record their response to the test. The test consisted of two pumping rates: 0.25 gallons per minute (gpm) and 0.375 gpm. The water level at MW-3 was measured manually using an electronic water level probe.

- Groundwater Monitoring Engineering Control Survey: A control survey was completed to determine the groundwater flow direction and groundwater elevations across the site. Groundwater elevations were compared to the elevations of the upstream stormwater network #1 pipe and were used to assess where groundwater had the potential to intersect and possibly access the stormwater system. Sections of pipe designated as: Structure – (985), Storm MH (1), CB - (15), Structure – (1136), and CB – (14) were determined to be constructed above the water table and these sections were considered to be unlikely areas where groundwater or petroleum product would enter the system. Plan and profile views of the existing stormwater features and observed groundwater elevations is presented as **Figure 3**.
- Groundwater Infiltration Access Point Inventory: The supplemental investigation of the stormwater network #1 focused on the main header pipe and lateral connections to the main header pipe. As presented in Figure 3, the main stormwater header pipe upgradient of the MH-10 structure is above the water table and therefore unlikely to be an entry point of groundwater or petroleum product.
- Analytical sampling of MW-3 Groundwater and the Stormwater System: Analytical sampling was proposed in the work plan to determine if similarities exist in the petroleum product between site monitoring wells and the harbor sheen. Analytical sampling for diesel range organics has not yet been completed due to no occurrences of optimal sampling conditions. Analytical sampling of the groundwater and surface water may still be completed if optimal conditions are met. If samples are collected, analytical sampling results will be provided to NYSDEC.

2.2.1 Hydraulic Conductivity Testing and Results

The measure of hydraulic conductivity describes the ability of rock or soil to transmit water. Given sufficient continuity of the strata and known hydraulic gradients, it is the hydraulic conductivity that will control the migration pathway for groundwater and volumetric rates of groundwater flow. In-situ variable hydraulic conductivity testing was performed within the three (3) DS-1 monitoring wells to assist in the determination of the design pumping rate and pump size for the groundwater recovery well.

To determine the in-place hydraulic conductivity of the unconsolidated material screened by the 2-inch diameter monitoring wells, rising and falling head slug tests were performed at locations MW-1, MW-2, and MW-3 on June 23, 2022. These tests involved raising and lowering the water level in the well and measuring the change in head with respect to time as the well is allowed to recover to static conditions. Testing equipment included an electronic water level probe, a 1-inch by 4-foot long solid PVC core, and an In-Situ LevelTroll® Data Logger (In-Situ, Inc.). The LevelTroll Data Logger is an automated measuring device designed to record small changes in a depressed or elevated head of water within a well. The instrument is connected to a pressure transducer which, when lowered into the water column, converts the pressure exerted by the head of water above it into a linear measurement of the depth of submergence.

The static water level of each well was recorded prior to slug testing and was used as the reference point from which the instrument recorded test data. A falling head test was performed by adding the slug to the water column and record the decreasing head data until the water level has recovered at least to within 90% of the static water level. A rising head test was performed by removing the slug from the water column and recording the increasing head data until the water level has recovered at least to within 90% of the static water level.

Falling/rising head data collected from the In-Situ LevelTroll® was evaluated using Aqtesolv® Software Version 4.50 Professional (HydroSOLVE, Inc) and a graphical representation, along with the hydraulic conductivity value for each well was produced. Only rising head data from MW-1 was used to determine hydraulic conductivity as per the DEC's request. The results of the data evaluation showed that MW-1 and MW-2 produced little to no water level response to the hydraulic conductivity testing. As a result, a second round of falling and rising head tests were completed on the three wells the following day and again little to no water level response were identified in MW-1 and MW-2. The hydraulic conductivity test results table and graphs are presented in **Appendix B**.

The Bouwer-Rice (1976 and 1989) solution for unconfined aquifers was used to determine the hydraulic conductivity of the wells. The solution formulas and variables are illustrated below:

Bouwer-Rice (1976)

$$\ln(H_0) - \ln(h) = \frac{2KLt}{r^2_{rc} \ln(r_e/r_{we})}$$

$$r_{we} = r_w\sqrt{Kz/Kr}$$

Where:

- h is displacement at time *t*
- H_0 is initial displacement
- K_r is radial hydraulic conductivity
- K_z is vertical hydraulic conductivity
- L is screen length
- r_c is nominal casing radius
- r_e is external radius
- r_w is well radius
- r_{we} is equivalent well radius
- t is time

The hydraulic conductivity test analyses included corrections to the nominal casing radius to account for the potential impacts of the downhole equipment. Results for the in-situ variable hydraulic conductivity testing were obtained by averaging the two

rounds of rising head tests that were completed at MW-3. The first round of rising head testing at MW-3 produced a hydraulic conductivity value of 1.913×10^{-4} cm/sec and the second round of testing produced a value of 8.51×10^{-6} cm/sec. The geometric mean of these values is 4.035×10^{-5} cm/sec or 1.34×10^{-6} ft/sec.

2.2.2 Step Pumping Tests and Results

To confirm the estimated maximum pumping rate allowable at this location, a step-drawdown pumping test was performed within MW-3. The test involved inserting a pump into monitoring well MW-3 and then measuring the change in water level with respect to pumping rate using an electronic water level probe. In-Situ LevelTroll® Data Loggers were placed in the adjacent monitoring wells MW-1 and MW-2. Testing equipment included an electronic water level probe, a Geotech Geosub 2 Pump and controller, a Honda Power Equipment EU2000i Inverter Generator, and an In-Situ LevelTroll® Data Logger (In-Situ, Inc.). The LevelTroll Data Loggers were used to record depressed or elevated water head in response to the pumping within MW-3.

The static water level of each well was recorded prior to the step-drawdown pumping test and was used as the reference point from which the data loggers and B&L staff recorded test data. The step-drawdown pump test was performed by setting the pump intake about a foot from the bottom of MW-3. The pump was initially set to 0.25 gallons per minute (GPM) for 90 minutes and then 0.375 GPM for 20 minutes. Data loggers within the adjacent wells were activated prior to pumping, and water levels within MW-3 were taken every five seconds for the first twelve minutes, every ten seconds for the next fifteen minutes, and then every sixty seconds thereafter.

Results for the step-drawdown pump testing showed that MW-3 (2-inch well) could maintain a stable water level when being pumped at 0.25 GPM with an approximate 1.5 feet water level drop. Pumping MW-3 at 0.375 GPM however, would risk dewatering the well or result in a significant drawdown in the well, smearing petroleum product deeper into the aquifer. Monitoring wells MW-1 and MW-2 showed little to no observable change in their water levels in response to pumping MW-3 at pumping rates of 0.25 GPM or 0.375 GPM. The step-drawdown pumping test data are presented in **Appendix C.**

2.2.3 Groundwater Gradient

The Parcel B Site Management Plan (November 2016) defines the horizontal hydraulic gradient from south to north across the Site as approximately 0.006 ft/ft. This value was compared to calculated gradient determined subsequent to the completion of the environmental monitoring point survey. The horizontal hydraulic gradient found under pumping conditions during the step-drawdown pumping test was used to assist in calculating the pumping rate and pump size described in Section 2.4.1. This value was calculated using the distance between MW-1 and MW-3 and their differing water level. The hydraulic gradient was approximately 0.173 ft/ft.

2.2.4 Groundwater Monitoring Engineering Control Survey

The location of each regular quarterly sampling monitoring well, DS-1 area well, harbor groundwater recovery well, and riverbank injection well was recorded by New York State-licensed surveyor Hershberg & Hershberg. Locations were reported in feet as horizontal coordinates referenced to the New York State plane coordinate system (NAD 1983), accurate to the nearest one-tenth (0.1) feet. Elevations were reported in feet referenced to the USGS mean sea level datum; ground levels at wellheads were accurate to at least one-tenth (0.1) feet, and the top rim of the PVC riser and the lid of the protective cover on each monitoring well were accurate to one-hundredth (0.01) feet. Following the survey, groundwater contours/flow direction figures were generated and provided to the Department. Site groundwater contours are presented on **Figure 4**.

2.2.5 Supplemental Stormwater System Investigation

On June 2, 2021, B&L investigated the conditions in DS-1 as well as upstream manhole/catch basin locations in accordance with the Harbor Operation and Maintenance letter submitted to the Department on April 30, 2021, and subsequently approved on May 6, 2021 via email correspondence. The purpose of this investigation was to isolate section(s) upstream of the DS-1 structure, where residual petroleum in the subsurface could potentially be entering the system, as specified in the NYSDEC approved letter. Two of the three stormwater structures downstream of the DS-1 structure (MH-7 and MH-13) were previously investigated by Precision Industrial Maintenance (PIM), and no obvious signs of infiltration into the stormwater system were noted and therefore eliminated from this investigation.

The methodology of this investigation included lowering a photoionization detector (PID) to the bottom of each structure to monitor for the presence of volatile organic compounds, supplemented by an internal swab around each pipe penetration and structure joint/or seal using sorbent pads and a PVC pole. In addition, a video log was captured for any structure that exhibited PID readings. The PID meter was lowered into each structure and hung at the surface of the water for approximately two minutes. The PID meter was set to log data at a one-minute interval.

Based on the stormwater system evaluation there was little to no indication that free product is entering the DS-1 structure via upstream locations; however this investigation omitted any lateral connections or the collection of analytical samples. Based on the results of the stormwater system investigation and as requested by the Department in letter dated January 11, 2022, an additional inspection of stormwater network #1 was required.

2.3 Remedial System Suitability

Monitoring well location MW-3 was the only well of the DS-1 area monitoring wells which showed a response to the hydraulic conductivity testing. It is assumed that wells MW-1 and MW-2 are installed within imported fill material installed around DS-1 and other stormwater structures during construction and do not show signs of free product. As such, MW-3 is the only location with observed product and deemed suitable for the installation of a product recovery system.

2.4 Summary of Design Elements

The supplemental investigations were utilized to identify the location, size, and depth of the recovery well, pumping system, product recovery system, and appropriate containment/disposal.

2.4.1 Recovery Well

The location and construction of a 6-inch monitoring well will be observed by an on-site field hydrogeologist. The recover well will be installed at the location specified on sheet C-100 and E-100 of the attached drawing set.

The borehole will be advance using the most appropriate drilling method for the specific geologic conditions. Based on previous investigations conducted at this site, borehole will be advance using 7.25- to 8.25-inch inner diameter (ID) hollow stem augers. The use of drilling muds or air systems where the potential introduction of drilling lubricants that would contaminate the borehole will not be allowed. Continuous 2-inch split-spoon soil samples will be collected from the ground surface to a depth of approximately 26 feet below grade, which is the estimated completion depth of the borehole. Soil samples will be described by texture, color, density, apparent moisture content, presence or absence of stratification, presence of sedimentary, brittle or secondary structures, and will be classified according to the Unified Soil Classification System. The primary soil descriptions in the field will be completed using the Modified Burmister soil classification system. Soils generated during drilling activities will be screened with a Photoionization Detector (PID) for the presence of volatile organic compounds. Soils found to exceed 15 ppm on the PID will be drummed for characterization and disposal. Soils that are not stained, do not have an odor, or are located above the site demarcation fabric will be reused as fill on-site. Soil handling shall be in accordance with the supplemental site-specific work plan.

The monitoring well will be construction of 6-inch Schedule 40 PVC riser with 10 feet length of 0.010 inch slot PVC well screen. The screen will extend from 16 to 26 feet, intersecting the water table. A clean coarse sand pack of appropriate size will be placed in the annular space between the well screen and the borehole to a minimum height of 2 feet above the top of the screen section. The sand pack shall not limit water flow into the well and should minimize the amount of fines entering the well. Above the sand

pack a 6-inch thick fine sand filter pack (choke sand) will be placed above the coarse sand pack. A 3-foot minimum bentonite seal will be placed above the fine sand filter pack and will be allowed to hydrate prior to adding grout to the borehole. An additional 6-inch fine sand filter pack will be placed above the bentonite seal, followed by the placement of cement-bentonite grout. Grout will be placed using a tremie pipe. The 6-inch PVC well riser pipe will extend into the manhole allowing access to the top of the well and flow meter.

Once the recovery well has been constructed, the well will be developed utilizing a disposable bailer and submersible pump with the goal of achieving sediment free water. Development water will be captured and properly managed in 55 gallon drums.

2.4.2 Pumping Rate, Well Diameter, and Pump Sizing

The hydraulic gradient under pumping conditions, along with the assumed dimensions of the source area, saturated thickness, and hydraulic conductivity calculated during the slug test, were used to estimate the groundwater flow (Q_{gw}) rate through the source area using Darcy's Law.

$$Q_{gw} = W * B * K\frac{\Delta h}{\Delta L}$$

The assumed dimensions of the source area were determined by noting that MW-2 has been observed to occasionally be minimally impacted by residual petroleum odor and sheen during the weekly site inspections. As such, it is assumed that MW-2 represents the outskirts of the source area. The distance between MW-3 and MW-2 is approximately 15 feet, therefore a total plume width of 15 feet was assumed in the calculation. The aquifer's saturated thickness was calculated using the depth from the water table surface to the underlying confining clay/silt layer (approximately 35 ft below ground surface). The depth of the underlying confining layer was determined by reviewing historical boring logs of the site.

Parameter inputs used in Darcy's law to estimate groundwater flow are presented in the table below.

Variable	Parameter	Value
W	Estimated Width of Source Area	15 ft
B	Saturated Thickness of Aquifer (Unconfined)	20 ft
K	Hydraulic Conductivity (Geometric mean)	1.34 x 10^{-6} ft/sec
Δh/ΔL	Hydraulic Gradient (under pumping conditions)	0.173 ft/ft
Q_{gw}	Groundwater Flow	6.9 x 10^{-5} ft^3/second (6.0 ft^3/day)
Q_{gw} + 50% Q_{gw}	Total estimated pumping rate of recovery system including 50% margin of safety	9.0 ft^3/day (67 gal/day)

To account for uncertainty in the site data and to provide a margin of safety should actual groundwater flow rate be higher than the estimated flow rate, the total pumping rate for these calculations was set at 50% higher than the estimated groundwater flow rate (EPA, 1996).

The Thiem equation was then used to estimate the maximum pumping rate (Q_{max}) for a single 6-inch well without interference. The Thiem equation was determined to be the appropriate equation for the area surrounding MW-3 as the aquifer that the recovery system would draw from is unconfined. The Thiem equation calculation is included in **Appendix D**.

$$Q_{max} = \frac{S_{max}(2\pi * B * K)}{\ln\left(\frac{W}{r_w}\right)}$$

Thiem equation inputs are defined in the table below.

Variable	Parameter	Value
r_w	Well Radius	3 in (0.25 ft)
S_{max}	Maximum Allowable Drawdown to Minimize Smearing	3 ft
Q_{max}	Flow for Maximum Allowable Drawdown	1.23 x 10^{-4} ft^3/sec. 10.6 ft^3/day 79 gal/day

The maximum pumping rate (Q_{max}), minimizing smear, is approximately 10.6 cubic feet per day. The total estimated groundwater flow rate, assuming a 50% factor of safety (Q_{gw} + 50% Q_{gw}) was calculated above, with a result of 9.0 cubic feet per day. Since the Q_{max} pumping rate for a 6-inch well is greater than the Q_{gw} + 50% Q_{gw} rate, a single well is appropriate for groundwater drawdown and source removal. If the estimated groundwater flow rate was greater than the maximum pumping rate, then two wells would have been needed.

The step-drawdown pump test suggests that under field conditions pumping at a rate of 0.25 GPM within a 2-inch well would be feasible while also maintaining minimal product smearing. Therefore, it is assumed that a larger 6-inch recovery well would be able to pump at a rate greater than a 2-inch well while also maintaining minimal product smearing.

2.4.3 Groundwater Treatment

The analytical results from groundwater sampled from MW-1, MW-2, and MW-3 during the DS-1 subsurface investigation report were submitted to the City of Schenectady Wastewater Treatment Plant (WWTP) Operator for review. On March 22, 2022 via email correspondence, the City determined the groundwater could not be accepted into the sanitary sewer at current conditions. In order to prevent petroleum product from entering the sanitary sewer system, groundwater will be pumped from the lower portion of the screened interval of the 6-inch recovery well, through an OWS and discharged to the sanitary sewer system. The OWS will be monitored weekly during each product removal monitoring event for free product using an oil/water interface probe. If free product is observed to accumulate in the OWS, it will be removed and consolidated for disposal at a regulated facility. Product removed from the OWS will be quantified and included in the total volume of product removed by the system.

Manufacturer's information on the below-grade OWS tank is included as **Appendix E**. The 350-gallon OWS contains several baffles and material coalescers to prevent any encountered petroleum product from being discharged into the sanitary sewer system. The tank can safely contain approximately 70 gallons of petroleum product without risking discharge to the sanitary sewer.

2.4.4 Material Management

Any soil disturbance, removal, transport, disposal, or import/export of material to/from the site will be conducted in accordance with the NYSDEC approved site specific Excavation Work Plan (EWP) (September 2015), included in the Parcel B Site Management Plan (SMP), supplemental site-specific work plan, and 6 NYCRR Part 375 regulations.

2.4.5 Site Restoration

After the completion of soil removal and any other invasive activities, the cover system will be restored in a manner that complies with the requirements approved of the Remedial Design. For all components of the composite cover system, any constructed demarcation layer will be replaced to provide a visual reference to the top of the existing site soils. If the type of composite cover system changes, with NYSDEC approval, from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the

upper surface of the 'Remaining Contamination'. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in any updates to the SMP.

2.5 Health and Safety Plan

All remedial activities will be performed in accordance with the existing Health and Safety Plan (HASP), December 2013.

2.5.1 Equipment and Personnel Decontamination Facilities

The remedial contractor will be required to install an equipment decontamination pad for the decontamination of equipment and vehicles during the remedial system construction. The decontamination pad will be large enough to contain wash water and debris from the largest-sized vehicles to be utilized, have a curbed perimeter and be underlain by an impervious liner. The remedial contractor will be required to ensure that all heavy equipment is clean prior to crossing areas which do not require remediation or have already been remediated, handling imported fill materials and prior to demobilizing.

The water used to decontaminate the equipment will be containerized and disposed off-site, after waste characterization. Collected sediments will be managed and consolidated on-site with other fill material.

2.5.2 Community Air Monitoring

Prior to the start of work, the Community Air Monitoring Program (CAMP) monitoring protocol will be in place. Work zone air monitoring will be performed in accordance the site established SMP and HASP to monitored dust generation and total VOC levels. This will consist of Dustrak meters placed upwind and downwind of the intrusive activity and monitored regularly to ensure compliance with CAMP regulations. In addition, one PID meter will be placed downwind and monitored regularly. If visible dust is generated or work zone and/or perimeter air monitoring results are above action levels, corrective action measures will be implemented. Corrective action measures may include increasing water coverage, controlling or temporarily ceasing select activities during high wind, reducing speed of equipment that may reduce dust generation, and utilizing different sizes or types of equipment that may cause less dust generation.

If necessary, dust control measures will be implemented to minimize the potential for dust generation during soil excavation and handling, and placement of fill.

2.5.3 Stormwater Management

Stormwater management, soil erosion and sediment control will be performed in accordance with New York State Standards and Specifications for Soil Erosion and Sediment Control and the most recent NYSDEC Stormwater regulations (SPDES General

Permit for Stormwater Discharges for Construction Activities GP-0-20-001). The remedial contractor will be responsible for preventing off-site migration of stormwater during implementation of the corrective measures and compliance with all stormwater soil and erosion control measures. During excavation activities, the ground surface will be below the surrounding environment, preventing runoff from the site.

3.0 PRODUCT RECOVERY SYSTEM DESIGN

3.1 System Overview

The proposed groundwater suppression and product recovery system for the removal of petroleum product will consist of a 6-inch product recovery well in the same location of the existing DS-1 area monitoring well MW-3. The 100% system design drawings are presented as **Appendix A**. The existing monitoring well MW-3 will be abandoned by a licensed driller and in accordance with CP-43: Groundwater Monitoring Well Decommissioning Policy prior to installation of the new 6-inch product recovery well. Extra precaution during the abandonment will be necessary to ensure that the subsurface surrounding MW-3 is not impacted and that hydraulic conductivity of the subsurface is not affected. The selected drilling contractor will attempt to pull the PVC well riser and screen without over drilling to minimize subsurface disturbance. If the well components are able to be retrieved intact and the borehole remains open, the borehole will be backfill with an inert sand filter pack to approximately 10 feet below grade, followed by 3 feet of bentonite chips. The remainder of the borehole will be grouted to 2 feet below grade, followed by the placement of certified clean fill to the surface.

Due to the minimal observed thickness of the petroleum layer (< 0.5") above the groundwater table in area monitoring wells, the groundwater table should be slightly lowered with pumping to increase the hydraulic groundwater gradient towards the product recovery well and increase the volume of recoverable petroleum product. Drawdown tests performed on the existing MW-3 determined that a flow rate of 0.25 Gallons per Minute (GPM) allowed for optimal drawdown in the well without smearing product into the aquifer below. The pumping rate will be adjusted based on actual observed conditions following system startup.

Groundwater effluent from the bottom of the recovery well will be pumped through an in-line flow meter to an OWS located below grade adjacent to the recovery well. Effluent from the OWS will be discharged into the municipal sewer system. Wastewater conveyed by the municipal sewer system is treated by the City of Schenectady Water Pollution Control Plant. B&L and site personnel will monitor the extraction system and use an oil/water interface probe in the OWS to ensure that petroleum product does not accumulate in significant volumes, such that product breakthrough to the sanitary sewer system is encountered. Accumulated product within the OWS will be skimmed utilizing the 4-inch diameter oil pump-out pipe. Product thickness will be evaluated with an interface probe, which will access the tank through the 2-inch diameter interface and level sensor pipe. Product will be removed by Precision Industrial Maintenance, as needed, upon noticeable buildup of product or if the high level alarm sensor is tripped. Product will be removed with the use of a pneumatic drum header or vacuum truck.

Petroleum product will be removed from the recovery well using a passive skimming system. A passive skimmer will be suspended in the well with a floating intake orifice which will adjust vertically as the groundwater table fluctuates. The skimmer will be removed from the well on a weekly basis to extract the accumulated petroleum product. Petroleum product will be consolidated into a 55-gallon drum and secured behind fencing at the site. Petroleum product

accumulating in the OWS will be removed using appropriate methods and consolidated with product removed from the well via the passive skimmer. Petroleum product removed via the passive skimmer and from the OWS will be quantified and recorded. Stored product will be collected by Precision Industrial Maintenance (PIM), located in Schenectady, NY. Once petroleum products are properly profiled, they will be shipped off-site in accordance with all applicable federal, state, and local laws, rules, and regulations and facility specific permits for treatment/disposal.

System controls will be installed adjacent to the existing electrical panel board, located to the east of the proposed system. B&L personnel will record the quantity of effluent discharged to the municipal sewer system measured by the flow meter during weekly inspections. B&L will also record the volume of recovered petroleum product from the passive skimmer during each removal event. Monitoring will be completed at a minimum frequency of weekly following system startup.

3.2 Recovery Well Design

The petroleum product recovery well will be situated in a location to best capture free product, based on the conceptual site model, and modeling of the expected cone of depression and capture zone within the known areas of impact. The well will be installed in the location of existing MW-3, where the majority of free product has been documented during weekly inspections (**Figure 2**). Existing 2-inch monitoring well MW-3 will be abandoned and replaced with a 6-inch recovery well by a New York State-licensed driller. The 6-inch product recovery well will extend to a depth of 26 feet below grade with a screened interval of 16 to 26 feet below the ground surface. The screened interval and total well depth were selected based on observed static water levels (approximately 17 to 18 feet below ground surface) in existing monitoring wells at the site. The water table and the layer of petroleum product will be below the top of the well screen, facilitating product accumulation and removal. The product recovery well will be contained within a pre-cast traffic-rated manhole vault. The well casing will be installed within the manhole vault approximately 1.5 feet below the manhole lid. A detail drawing of the recovery well is included in **Appendix A**.

3.3 Drawdown Pump

A variable speed submersible pump manufactured by QED Environmental Systems will be situated at the bottom of the well to control the groundwater drawdown. Manufacturer's information for the drawdown pump is included as **Appendix F**. Pumping rates will be adjusted to create a cone of depression influencing a flow gradient towards the well to improve product capture. The pump effluent line will exit the recovery well through a pitless adapter. The effluent line will have an in-line flow meter installed to record the flow rate and totalized flow to the OWS.

The pump and the flow meter will connect to an existing power source on site using a buried utility connection. Electrical utility trenching will be performed in accordance with the approved Site Management Plan and the site HASP.

3.4 Passive Skimmer

A 2-inch Passive Select Oil Skimmer manufactured by QED will be suspended with a cable in the recovery well from a specialized well cap. Manual product removal with the passive skimmer offers a low maintenance alternative for product removal. The passive skimmer is equipped with an inner oileophilic hydrophobic screen to repel groundwater and allow for the intake of petroleum product. The passive skimmer's floating intake can adjust within a 12-inch range to accommodate seasonal or pumping-induced fluctuations of the groundwater table. The skimmer has a 20-ounce canister for the collection of petroleum product. Manufacturer's information on the passive skimmer is included as **Appendix G**.

3.5 Effluent Management

3.5.1 Flow Metering

The drawdown pump effluent will pass through an in-line flow meter contained within the recovery well's manhole vault before discharging into the OWS. The in-line flow meter is designed to provide accurate measurements of flow rates below 1 GPM. Flow metering is required by the City of Schenectady in order for the system to discharge to the City's sanitary sewer system. An instrument panel displaying flow rate and totalized flow will be installed on the instrument panel located adjacent to the existing electrical panel. Manufacturer's information for the flow meter is included as **Appendix H**.

3.5.2 Effluent Sampling

System effluent being discharged to the sanitary sewer system which flows to the City of Schenectady Wastewater Treatment Plant will be sampled quarterly, per City requirements. Effluent samples will be collected as grab samples from outlet of the discharge pipe entering the sanitary sewer manhole. Parameters analyzed and reported will include:

- Purgeable Organics by EPA Method 624
- Base/Neutrals and Acids by EPA Method 625
- Total Suspended Solids
- pH
- Hexavalent Chromium
- Total Cyanide
- Oil & Grease
- Metals
- Phenols
- PCBs

Analytical results will be submitted to the City of Schenectady and NYSDEC on a quarterly basis to verify that system effluent can be treated by the wastewater treatment plant. If the wastewater treatment plant operator determines that the effluent to the sanitary sewer system exceeds the treatment capabilities of the plant, the recovery system will be shut off and further effluent pretreatment will be evaluated.

3.6 Utility Installation

Underground utilities will be installed in accordance with the site HASP and the Parcel B SMP, Excavation Work Plan, and site specific work plan. Subsurface utilities to be installed include electric and effluent discharge lines. Utilities will be installed below the 2-foot clean fill layer installed during site development. The clean fill layer as well as any asphalt or concrete will be repaired in kind by the contractor following utility installation. Buried utility installation details are included in **Appendix A**. All existing site utilities will be marked by a private utility locator prior to beginning any utility installations.

3.6.1 Electric

Multiple 120V single phase electrical lines will be installed from the existing electrical panel to power the recovery system components. Transformers and circuit breakers will be installed adjacent to the existing electrical panel board located east of the proposed system. The lines will be installed in buried conduits between the electrical panel and a new buried electrical pull box located north of the system along the walkway to the harbor. The line will be trenched between the pull box and the remedial system at a minimum depth of two feet below grade in a new HDPE conduit. The electrical conduit will be buried a minimum of six inches below a layer of geotextile separation fabric. Electrical connections will be established for the drawdown pump, OWS alarm panel, and the flow meter. Communication lines connecting the flow meter, drawdown pump, and OWS alarms will be installed between the equipment and the instrument panels installed adjacent to the existing site electrical panel.

3.6.2 Effluent Discharge

An effluent discharge line will be installed to allow the OWS effluent to flow by gravity from the OWS to existing sanitary manhole MH-15. The effluent line will consist of a 2-inch PVC pipe placed at a minimum slope of 0.5%. The effluent pipe will be installed approximately six feet below grade to tie into the sanitary manhole slightly above the manhole's downstream invert. An effluent pipe joint will be installed in the manhole in accordance with the Flexible Pipe to Manhole Joint detail in **Appendix A**.

3.7 Petroleum Product Management

During weekly checks, petroleum product collected by the passive skimmer unit will be discharged into a 5 gallon pail with sealable lid. Product will be transferred by hand to a 55 gallon drum. The 55 gallon drum will be staged within the secured fenced area located to the west of the amphitheater walkway. The 55 gallon storage drum will be monitored weekly and PIM will be notified once containers are within 80% of the storage capacity. Once the petroleum products are property profiled, they will be shipped off-site in accordance with all applicable federal, state, and local laws, rules, and regulations and facility-specific permits for treatment/disposal. PIM will be responsible for handling and disposal of accumulated petroleum product at a regulated disposal facility.

4.0 SYSTEM OPERATIONS AND MONITORING

4.1 System Monitoring

Following system startup, the passive skimmer and OWS will be monitored daily for five consecutive days. If the OWS accumulates petroleum product or the passive skimmer collects substantial volumes of groundwater, the system's pumping rate and skimming system configuration will be reevaluated. The length of cable suspending the passive skimmer will be adjusted based on groundwater gauging results until the skimmer intake is determined to be at the stabilized water table elevation.

Once operational, the remedial system will run continuously and operation monitored weekly. The OWS and passive skimmer will be checked weekly for product accumulation. The volume removed with the passive skimmer and from the OWS will be recorded and characterized based on its coloration and groundwater content before being transferred to a 55 gallon storage drum. If petroleum product is determined to consistently be accumulating in volumes exceeding the capacity of the passive skimmer, a larger skimming unit will be evaluated.

Observations during monitoring events will be recorded on the weekly inspection form in use for current site monitoring. The weekly inspection form will be amended to include details regarding the system's operation and product removal. The form which will be added to the weekly inspection form is included as **Appendix I**. The information on the weekly inspection form will continue to be reported on a weekly basis and included with the annual Periodic Review Report.

4.2 System Operation

The remedial system will require minimal operational input once operating. The drawdown pumping rate will be adjusted as necessary to achieve drawdown of less than two feet. Drawdown in excess of two feet will cause petroleum product to smear deeper into the aquifer.

A system control panel will be installed adjacent to the existing electrical panel east of the treatment system. The control panel will include a high level indicator alarm for the OWS tank, pump rate controls, and a flow rate and totalizer panel.

5.0 PERMITS AND OTHER AUTHORIZATIONS

Permits and approvals that may be required for construction include local permits for temporary utility connections, excavation, transportation and disposal, NYSDEC permits for mining of off-site fill sources, a permit for access drive improvements, and general construction permits. B&L will ensure that all necessary permits are procured by the remedial system contractor.

6.0 SCHEDULE

6.1 Schedule Milestone

A preliminary schedule of key milestones for the construction of the treatment system is provided below. Note that the following schedule is generic in nature, given the unknown time period regarding review and approval of the proposed remedial action. A schedule with estimated durations from the date of submittal of the work plan is included in the following table.

Milestone	Estimated time from Work Plan Submittal
Remedial Design Report Submittal to the NYSDEC	April 2023
NYSDEC Remedial Design Report Review	May 2023
Remedial Design Report Response to NYSDEC Comments	June 2023
NYSDEC Second Round of Comment to Remedial Design Report	November 2024
Development of Draft Plans & Specifications	January 2025
Submit Draft Plans & Specifications to the NYSDEC for Review	March 2025
Submit Final Detailed Plans and Specifications	April 2025
Release Contract Documents for Private Bidding	May 2025
Remedial Contractor Selection	May 2025
Contract Award	May 2025
Completion of Remedial Construction	July 2025
Submittal of the Draft Construction Completion Report and Revised Site Management Plan	October 2025
Receive NYSDEC Comments on Draft Construction Completion Report and Revised Site Management Plan	November 2025
Submittal of Certified Construction Completion Report and Final Site Management Plan	January 2026
NYSDEC Approval of Certified Construction Completion Report and Final Site Management Plan	March 2026

7.0 POST CONSTRUCTION PLANS

7.1 Site Management Plan Update

An updated Parcel B Site Management Plan (SMP) will be prepared and submitted concurrent with completion of the remedial construction activities. The purpose of the updated SMP is to assure that proper procedures are in place to provide for long-term protection of human health and the environment after remedial construction is complete.

7.2 Construction Completion Report

A Construction Completion Report (CCR) will be prepared at the conclusion to the remediation to document all remedial actions that have been undertaken in regards to the groundwater recovery/treatment system. The CCR will be prepared in accordance with the DER-10, *Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010).

8.0 REFERENCES

New York State Department of Environmental Conservation, May 2010. DER-10 / Technical Guidance for Site Investigation and Remediation. DEC Program Policy, Office of Remediation and Materials Management.

New York State Department of Environmental Conservation, December 2006. 6 NYCRR PART 375, Environmental Remediation Programs, Subparts 375-1 to 375- 4 & 375-6. Division of Environmental Remediation.

Environmental Protection Agency, September 1996. How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites.

Barton & Loguidice, August 2015. Parcel B – Remedial Design Report (RDR), Former ALCO Site.

Barton & Loguidice, November 2016. Parcel B – Site Management Plan (SMP), Former ALCO Site.

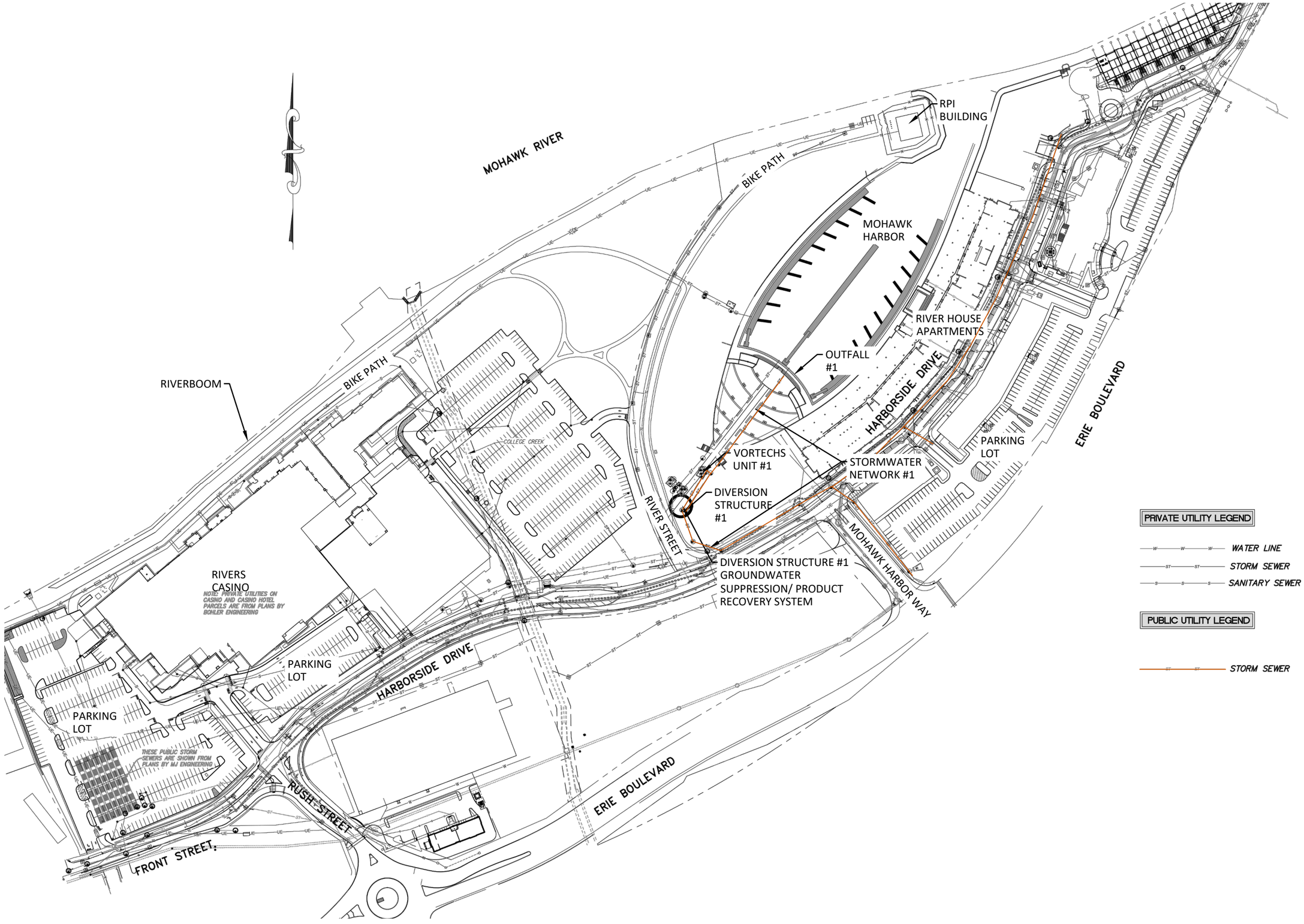
Barton & Loguidice, May 2022. Corrective Measures Remedial Action Work Plan, Groundwater Suppression and Product Recovery System, Former ALCO Site.

Barton & Loguidice, February 2022. Corrective Measures Investigation Report, Stormwater System Evaluation, Former ALCO Site.

Figures

Figure 1

Existing Site Plan



MAXON ALCO HOLDINGS, LLC.

CORRECTIVE MEASURES REMEDIAL ACTION WORK PLAN

SITE PLAN

SCHENECTADY COUNTY, NEW YORK

CITY OF SCHENECTADY

B&L

Barton & Loguidice, D.P.C.

10 Airline Drive
Suite 200
Albany, NY
12205

Date
MARCH 2022

Scale
NOT TO SCALE

Figure Number
1

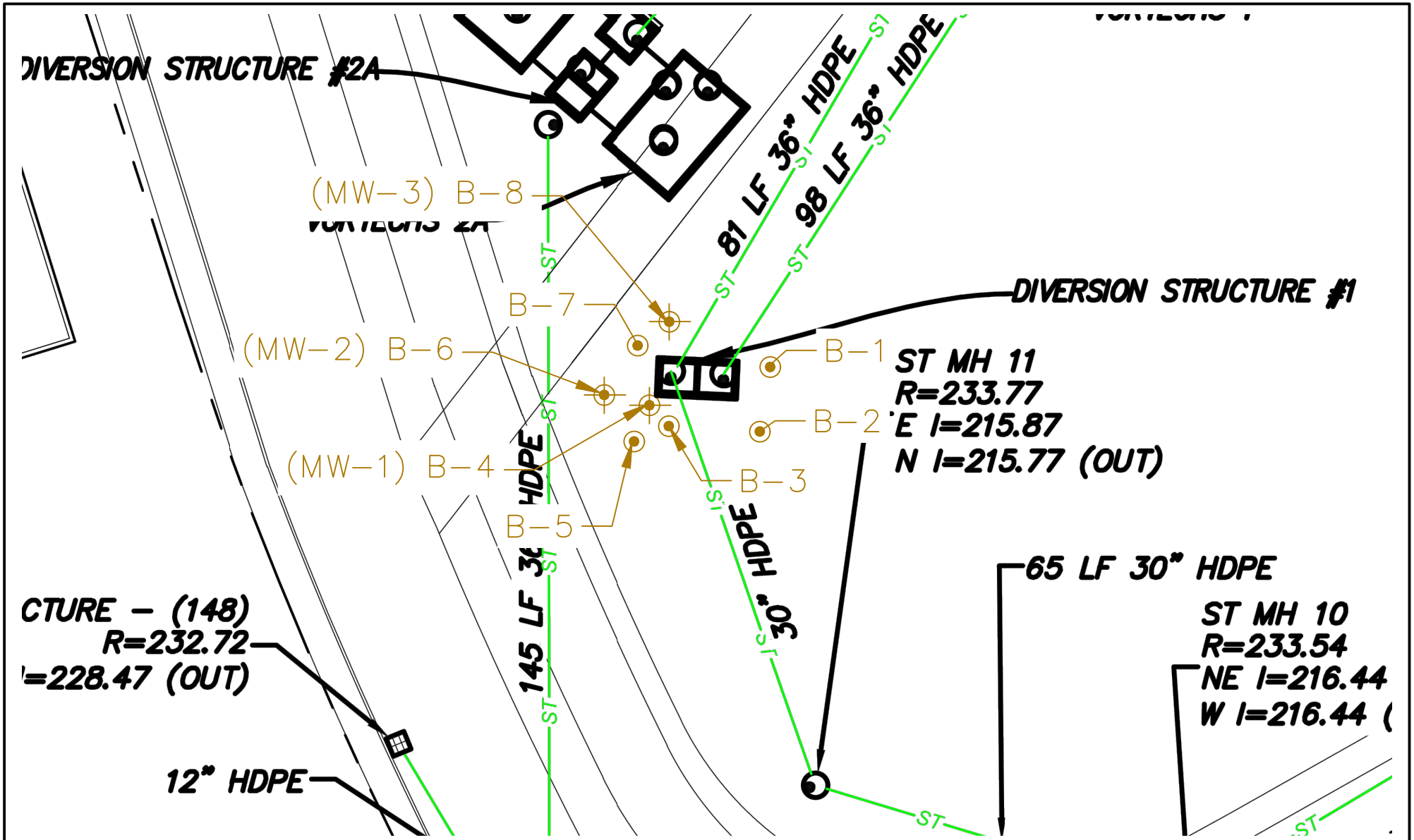
Project Number
1368.001.006

Plotted: Mar 11, 2022 - 2:46PM SYR By: bas
Z:\BL-Vault\D2\18217AD2-1C71-4823-8927-99D5C4054147\0\2550000-2550999\2550124\LL\Figure 1 - Site Plan (ID 2550124).dwg

Figure 2

DS-1 Investigation Monitoring Points

Plotted: Mar 31, 2022 – 11:35AM SYR By: bas
Z:\BL-Vault\ID2\18217AD2-1C71-4823-8927-99D5C4054147\0\2569000-2569999\2569703\L\L\FIGURE 3 – DS-1 SOIL BORING LOCATIONS (ID 2569703).dwg



Barton & Loguidice

Date	Scale
MARCH 2022	NOT TO SCALE

LEGEND

- APPROX. SOIL BORING LOCATION
- APPROX. MONITORING WELL LOCATION

MAXON ALCO HOLDINGS, LLC.
CORRECTIVE MEASURES
REMEDIAL ACTION WORK PLAN

DS-1 SUBSURFACE INVESTIGATION

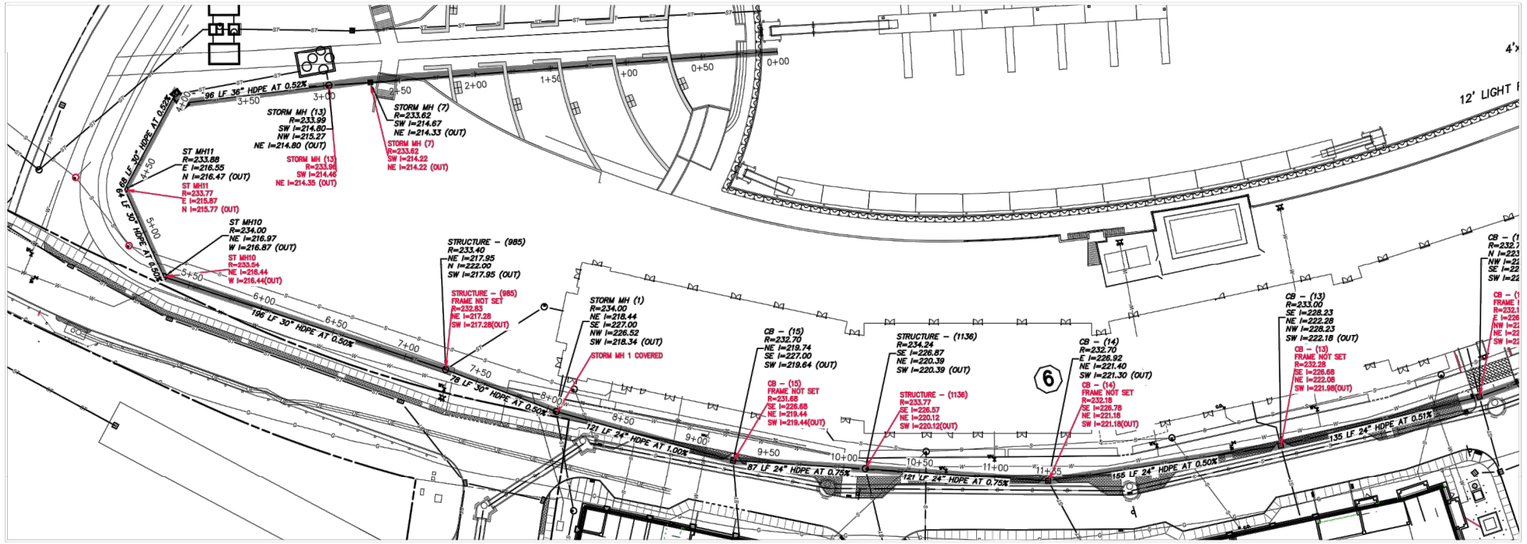
CITY OF SCHENECTADY SCHENECTADY COUNTY, NEW YORK

Figure Number	Project Number
2	1368.001.006

Figure 3

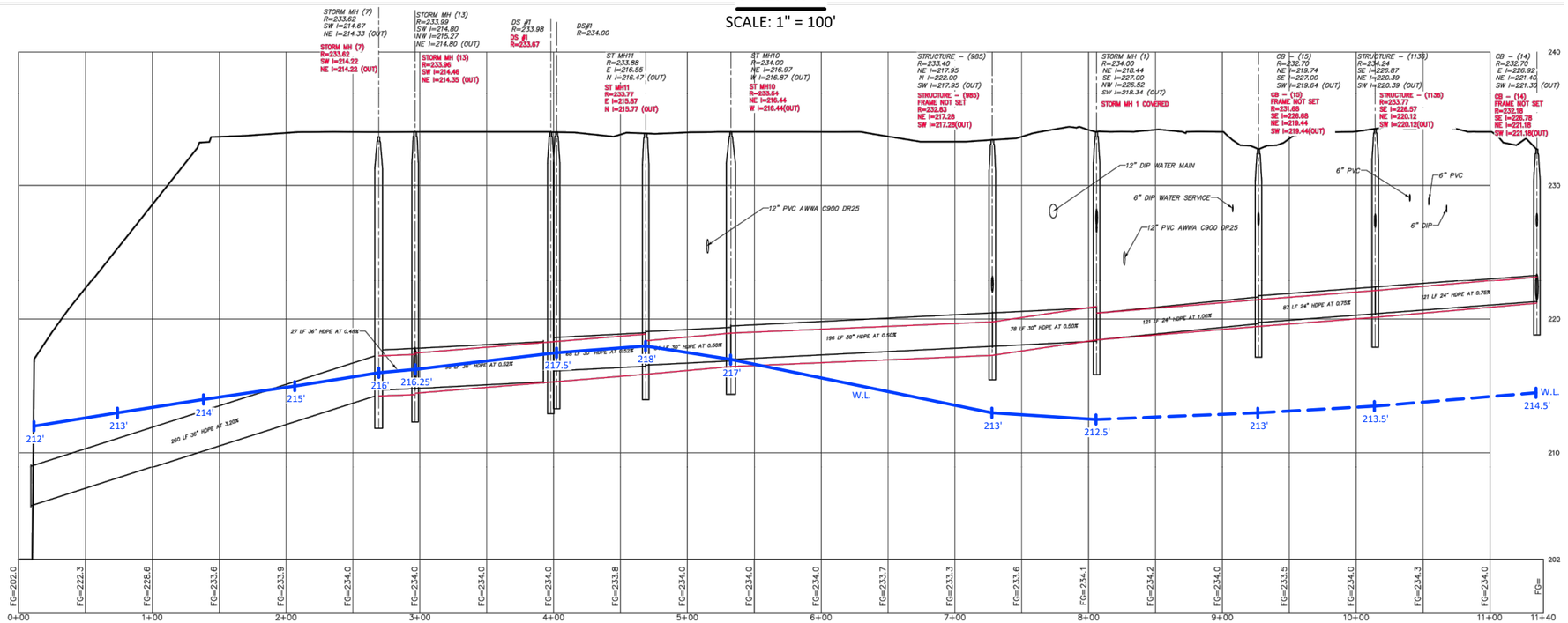
Stormwater Network #1 Plan and Profile View

RED = AS-BUILT



PLAN

SCALE: 1" = 100'



STORM SEWER PROFILE B

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

MAXON ALCO HOLDINGS, LLC, AS AGENT FOR SCHENECTADY METROPLEX DEVELOPMENT AUTHORITY
2021 ALCO A, B, C ENV. SYS.
CITY OF SCHENECTADY
SCHENECTADY COUNTY, NEW YORK

STORM SEWER PLAN AND PROFILE

Barton & Loguidice, D.P.C.
443 Electronics Parkway
Liverpool, NY
13088

Date
JUNE 2022

Scale
AS SHOWN

Figure Number
3

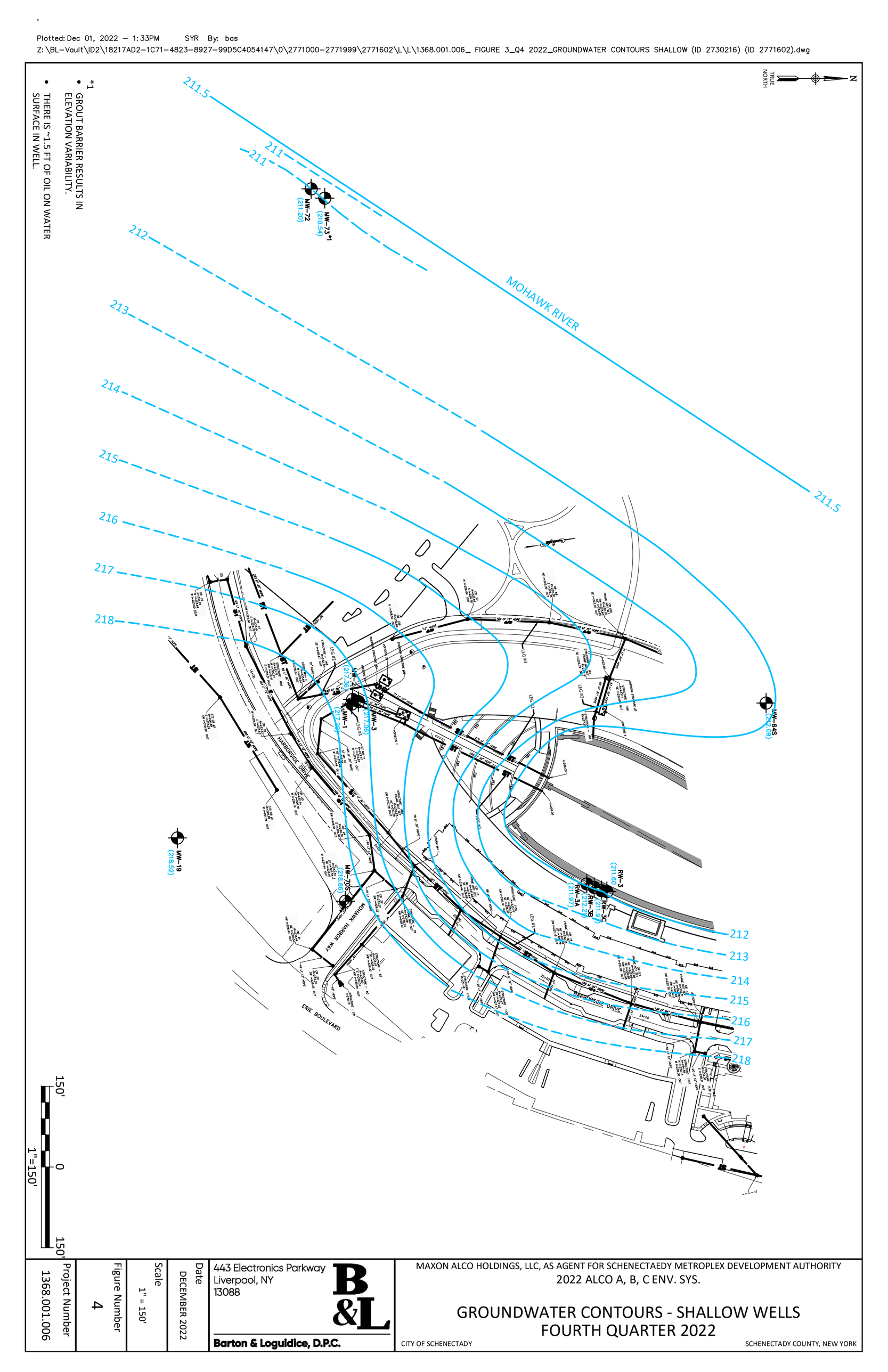
Project Number
1368.001.006

Plotted: Jun 28, 2022 - 3:08PM SYR By: WBG
Z:\BL-Vault\1 - Project Files\1 - Sorted by Project Number {2} Class {2} Folder\1300\1368.001.006\CAD\Groundwater Monitoring\1368.001.006_ Storm Sewer Plan and Profile.dwg

Figure 4

Site Groundwater Contour Map

Plotted: Dec 01, 2022 – 1:33PM SYR By: bas
Z:\BL-Vault\ID2\18217AD2-1C71-4823-8927-99D5C4054147\0\2771000-2771999\2771602\L\L\1368.001.006_ FIGURE 3_Q4 2022_GROUNDWATER CONTOURS SHALLOW (ID 2730216) (ID 2771602).dwg



*1
- GROUT BARRIER RESULTS IN ELEVATION VARIABILITY.
- THERE IS ~1.5 FT OF OIL ON WATER SURFACE IN WELL.

Project Number	Figure Number	Scale	Date
1368.001.006	4	1" = 150'	DECEMBER 2022

443 Electronics Parkway
Liverpool, NY
13088
B&L
Barton & Loguidice, D.P.C.

MAXON ALCO HOLDINGS, LLC, AS AGENT FOR SCHENECTAEDY METROPLEX DEVELOPMENT AUTHORITY
2022 ALCO A, B, C ENV. SYS.

GROUNDWATER CONTOURS - SHALLOW WELLS FOURTH QUARTER 2022

CITY OF SCHENECTADY SCHENECTADY COUNTY, NEW YORK

Appendix A

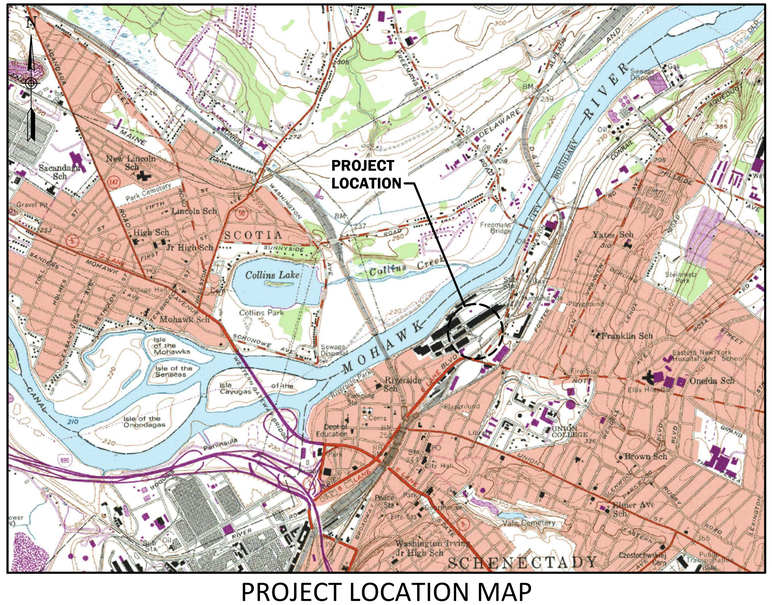
Recovery System Design Drawings

MAXON ALCO HOLDINGS, LLC

GROUNDWATER SUPPRESSION AND PRODUCT RECOVERY SYSTEM

CITY OF SCHENECTADY
SCHENECTADY COUNTY, NEW YORK

Barton & Loguidice



PROJECT LOCATION MAP

NOT TO SCALE

JANUARY 2025

PREPARED AND APPROVED BY

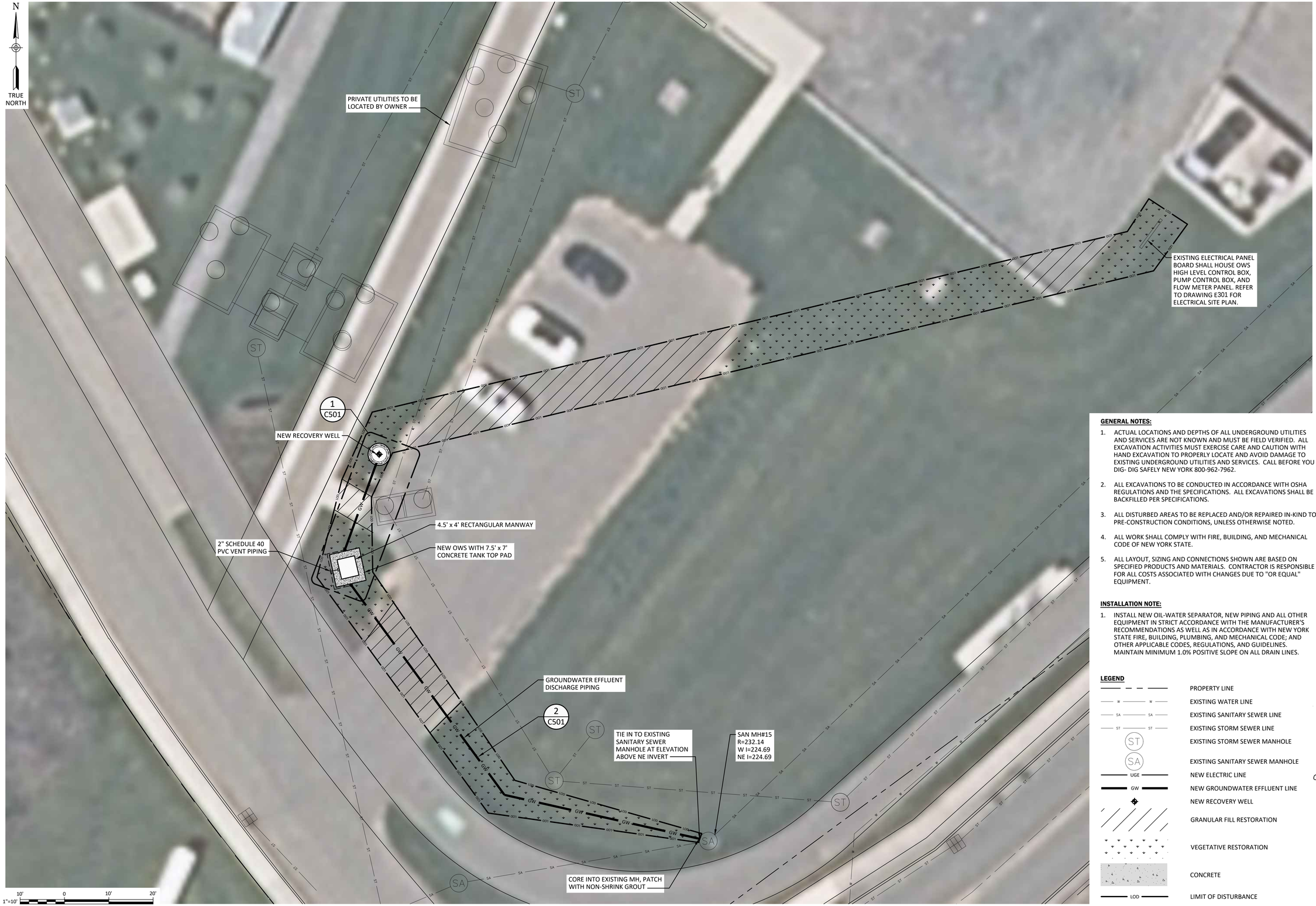
STATE OF NEW YORK
JEFFREY J. REED
083980
LICENSED PROFESSIONAL ENGINEER

JEFFREY J. REED, P.E. — DATE SIGNED
NEW YORK STATE — 01/22/2025
PROFESSIONAL ENGINEERS LICENSE NO. 083980

Sheet Number: G001

Project Number: 1368.001.006

Plotted: Jan 22, 2025 - 1:12PM By: WBG
C:\Users\wbg\AppData\Local\Temp\AcPublish_19024\1368001 G001 Coversheet (ID 2763142).dwg



Plotted: Jan 22, 2025 – 1:12PM By: WBG
Z:\BL-Vault\02\1621AD2-1C71-4823-8927-99D5C4054147\0\2763000-2763999\2763185\L\L\1368001 C100 Site Plan (ID 2763185).dwg

Drawn by: SYR | Designed by: WBG | In charge of: RIC | Checked by: JJR

GENERAL NOTES:

1. ACTUAL LOCATIONS AND DEPTHS OF ALL UNDERGROUND UTILITIES AND SERVICES ARE NOT KNOWN AND MUST BE FIELD VERIFIED. ALL EXCAVATION ACTIVITIES MUST EXERCISE CARE AND CAUTION WITH HAND EXCAVATION TO PROPERLY LOCATE AND AVOID DAMAGE TO EXISTING UNDERGROUND UTILITIES AND SERVICES. CALL BEFORE YOU DIG- DIG SAFELY NEW YORK 800-962-7962.
2. ALL EXCAVATIONS TO BE CONDUCTED IN ACCORDANCE WITH OSHA REGULATIONS AND THE SPECIFICATIONS. ALL EXCAVATIONS SHALL BE BACKFILLED PER SPECIFICATIONS.
3. ALL DISTURBED AREAS TO BE REPLACED AND/OR REPAIRED IN-KIND TO PRE-CONSTRUCTION CONDITIONS, UNLESS OTHERWISE NOTED.
4. ALL WORK SHALL COMPLY WITH FIRE, BUILDING, AND MECHANICAL CODE OF NEW YORK STATE.
5. ALL LAYOUT, SIZING AND CONNECTIONS SHOWN ARE BASED ON SPECIFIED PRODUCTS AND MATERIALS. CONTRACTOR IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH CHANGES DUE TO "OR EQUAL" EQUIPMENT.

INSTALLATION NOTE:

1. INSTALL NEW OIL-WATER SEPARATOR, NEW PIPING AND ALL OTHER EQUIPMENT IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AS WELL AS IN ACCORDANCE WITH NEW YORK STATE FIRE, BUILDING, PLUMBING, AND MECHANICAL CODE; AND OTHER APPLICABLE CODES, REGULATIONS, AND GUIDELINES. MAINTAIN MINIMUM 1.0% POSITIVE SLOPE ON ALL DRAIN LINES.

LEGEND

- PROPERTY LINE
- EXISTING WATER LINE
- EXISTING SANITARY SEWER LINE
- EXISTING STORM SEWER LINE
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY SEWER MANHOLE
- NEW ELECTRIC LINE
- NEW GROUNDWATER EFFLUENT LINE
- NEW RECOVERY WELL
- GRANULAR FILL RESTORATION
- VEGETATIVE RESTORATION
- CONCRETE
- LIMIT OF DISTURBANCE

REVISIONS	

MAXON ALCO HODINGS, LLC.
GROUNDWATER SUPPRESSION AND PRODUCT RECOVERY SYSTEM

SITE PLAN

SCHENECTADY COUNTY, NEW YORK

CITY OF SCHENECTADY

Barton & Loguidice
10 Airline Drive, Suite 200
Albany, NY 12205
NYS CERTIFICATE # 0018246, 020588, 019903, 019905, 020336

STATE OF NEW YORK · JEFFREY J. REED · 083360 · LICENSED PROFESSIONAL ENGINEER

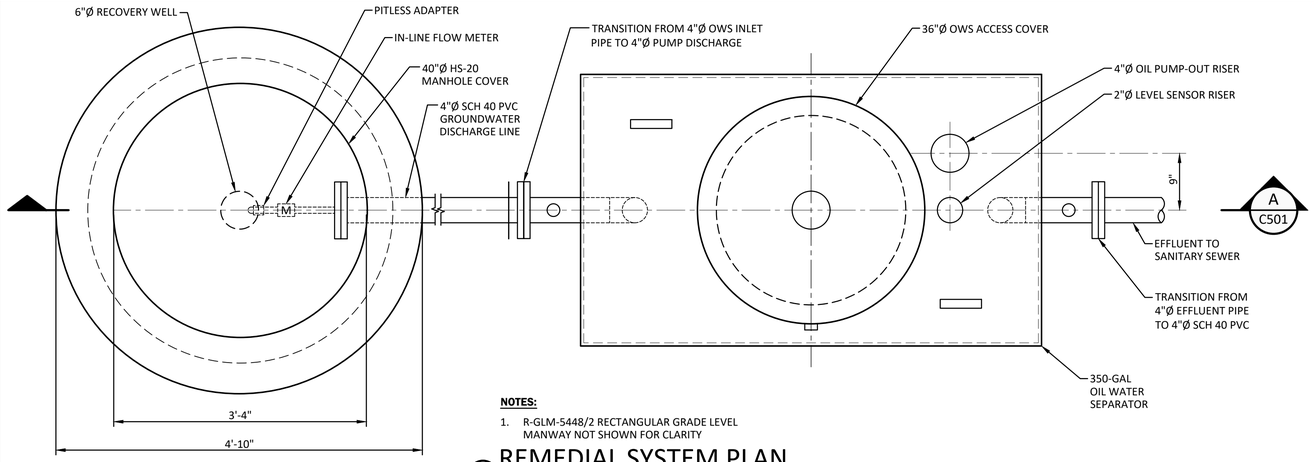
NYS EXP.: 05/31/2027

Date: JANUARY 2025

Scale: 1" = 10'

Sheet Number: C100

Project Number: 1368.001.006

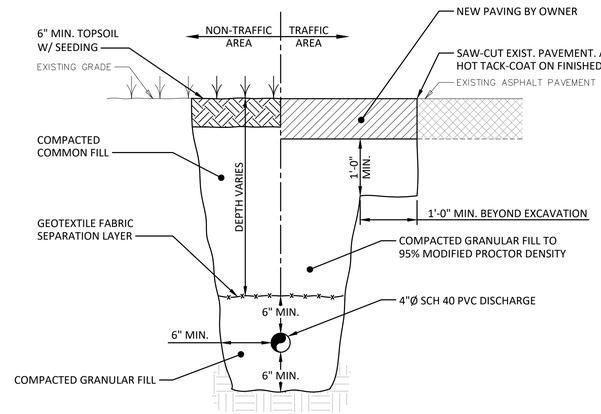


NOTES:

1. R-GLM-5448/2 RECTANGULAR GRADE LEVEL MANWAY NOT SHOWN FOR CLARITY

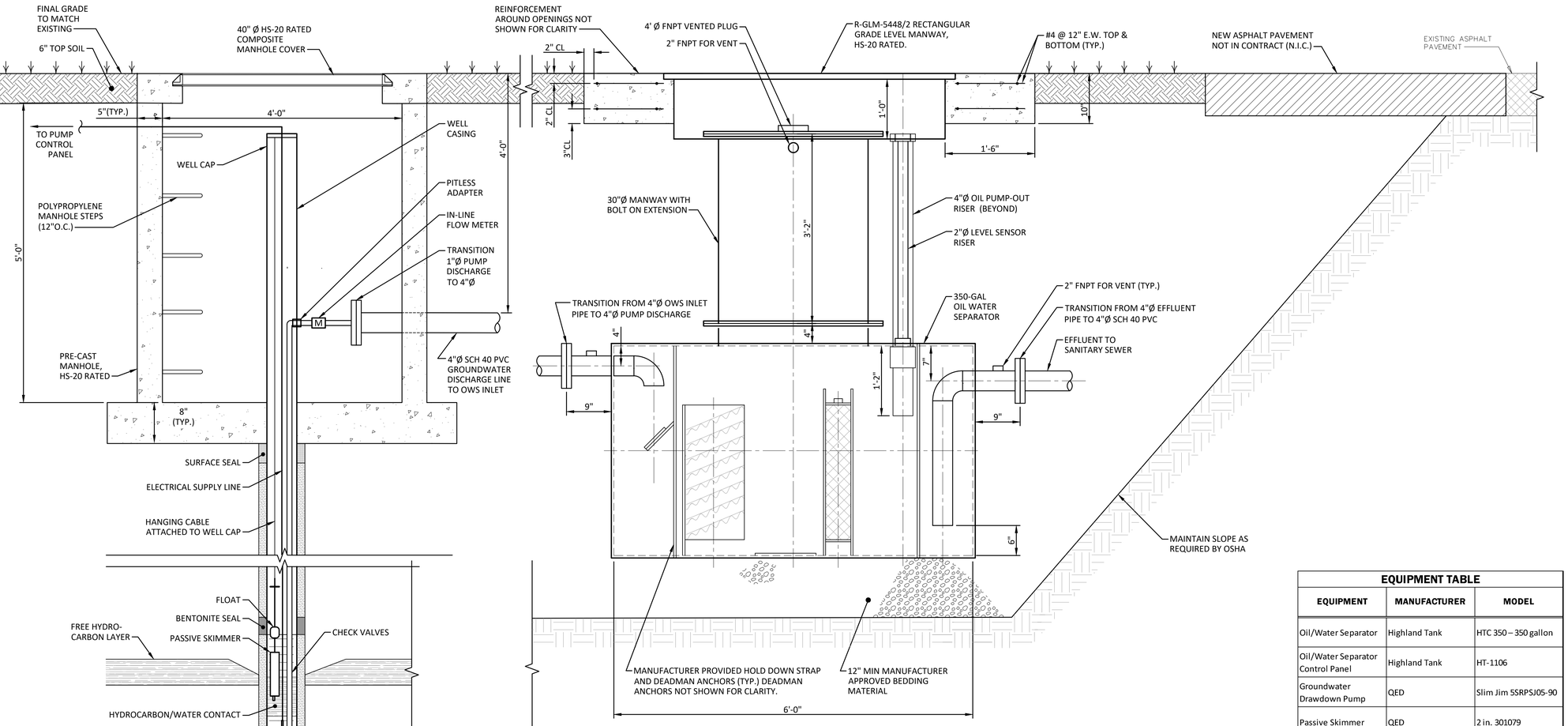
1 REMEDIAL SYSTEM PLAN

SCALE: 1" = 1'-0"



2 TYPICAL TRENCHING DETAIL

SCALE: 3/4" = 1'-0"



NOTES:

1. VENT PIPING NOT SHOWN FOR CLARITY.
2. SEE SHEET C100 FOR UNDERGROUND VENT PIPING SHOWN. TERMINATE TO MANWAY EXTENSION.

A/C501 SECTION

SCALE: 1" = 1'-0"

EQUIPMENT TABLE

EQUIPMENT	MANUFACTURER	MODEL
Oil/Water Separator	Highland Tank	HTC 350 – 350 gallon
Oil/Water Separator Control Panel	Highland Tank	HT-1106
Groundwater Drawdown Pump	QED	Slim Jim 5SRPSJ05-90
Passive Skimmer	QED	2 in. 301079
Flow Meter	Siemens	MAG 5100 W
Pump Controller	Grundfos	CU 300

REVISIONS

MAXON ALCO HODINGS, LLC.
GROUNDWATER SUPPRESSION AND PRODUCT RECOVERY SYSTEM
SCHENECTADY COUNTY, NEW YORK

DETAILS

CITY OF SCHENECTADY

Barton & Loguidice
10 Airline Drive, Suite 200
Albany, NY 12205
NYS CERTIFICATE # 0018246, 020588, 019903, 019905, 020336

STATE OF NEW YORK · JEFFREY J. REED · 083960 · LICENSED PROFESSIONAL ENGINEER

NYS EXP.: 05/31/2027

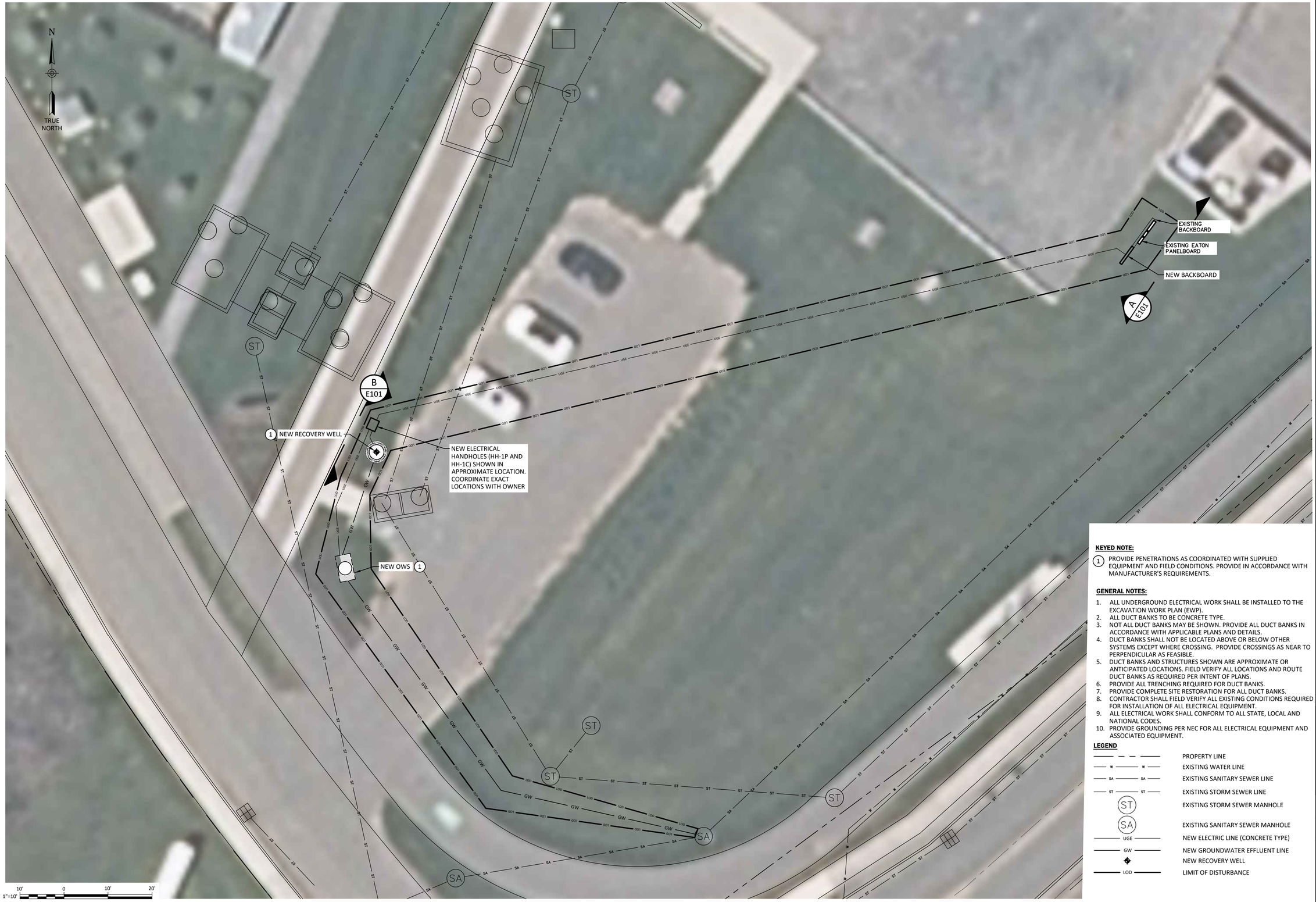
Date: JANUARY 2025

Scale: AS SHOWN

Sheet Number: C501

Project Number: 1368.001.006

Plotted: Feb 03, 2025 – 1:38PM By: WBG
2: \\BL-Vault\V02\18217\A02-1C71-4823-8927-99D5C40541A7\V\2768000-2768999\2768082\\.\\.\368001 C501 Details (ID 2768082).dwg
Checked by JJR Drawn by WBG Designed by RJC In charge of JJR



KEYED NOTE:

(1) PROVIDE PENETRATIONS AS COORDINATED WITH SUPPLIED EQUIPMENT AND FIELD CONDITIONS. PROVIDE IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS.

GENERAL NOTES:

1. ALL UNDERGROUND ELECTRICAL WORK SHALL BE INSTALLED TO THE EXCAVATION WORK PLAN (EWP).
2. ALL DUCT BANKS TO BE CONCRETE TYPE.
3. NOT ALL DUCT BANKS MAY BE SHOWN. PROVIDE ALL DUCT BANKS IN ACCORDANCE WITH APPLICABLE PLANS AND DETAILS.
4. DUCT BANKS SHALL NOT BE LOCATED ABOVE OR BELOW OTHER SYSTEMS EXCEPT WHERE CROSSING. PROVIDE CROSSINGS AS NEAR TO PERPENDICULAR AS FEASIBLE.
5. DUCT BANKS AND STRUCTURES SHOWN ARE APPROXIMATE OR ANTICIPATED LOCATIONS. FIELD VERIFY ALL LOCATIONS AND ROUTE DUCT BANKS AS REQUIRED PER INTENT OF PLANS.
6. PROVIDE ALL TRENCHING REQUIRED FOR DUCT BANKS.
7. PROVIDE COMPLETE SITE RESTORATION FOR ALL DUCT BANKS.
8. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS REQUIRED FOR INSTALLATION OF ALL ELECTRICAL EQUIPMENT.
9. ALL ELECTRICAL WORK SHALL CONFORM TO ALL STATE, LOCAL AND NATIONAL CODES.
10. PROVIDE GROUNDING PER NEC FOR ALL ELECTRICAL EQUIPMENT AND ASSOCIATED EQUIPMENT.

LEGEND

PROPERTY LINE	
W W	EXISTING WATER LINE
SA SA	EXISTING SANITARY SEWER LINE
ST ST	EXISTING STORM SEWER LINE
ST	EXISTING STORM SEWER MANHOLE
SA	EXISTING SANITARY SEWER MANHOLE
UGE	NEW ELECTRIC LINE (CONCRETE TYPE)
GW	NEW GROUNDWATER EFFLUENT LINE
	NEW RECOVERY WELL
LOD	LIMIT OF DISTURBANCE

REVISIONS	

MAXON ALCO HODINGS, LLC.
GROUNDWATER SUPPRESSION AND PRODUCT RECOVERY SYSTEM

ELECTRICAL SITE PLAN

SCHENECTADY COUNTY, NEW YORK
CITY OF SCHENECTADY

Barton & Loguidice
10 Airline Drive, Suite 200
Albany, NY 12205
NYS CERTIFICATE # 0018246, 020588, 019903, 019905, 020336

STATE OF NEW YORK — CARY JESSE WEIS — No. 092449 — LICENSED PROFESSIONAL ENGINEER

NYS EXP.: 05/31/2026

Date: JANUARY 2025

Scale: AS SHOWN

Sheet Number: E101

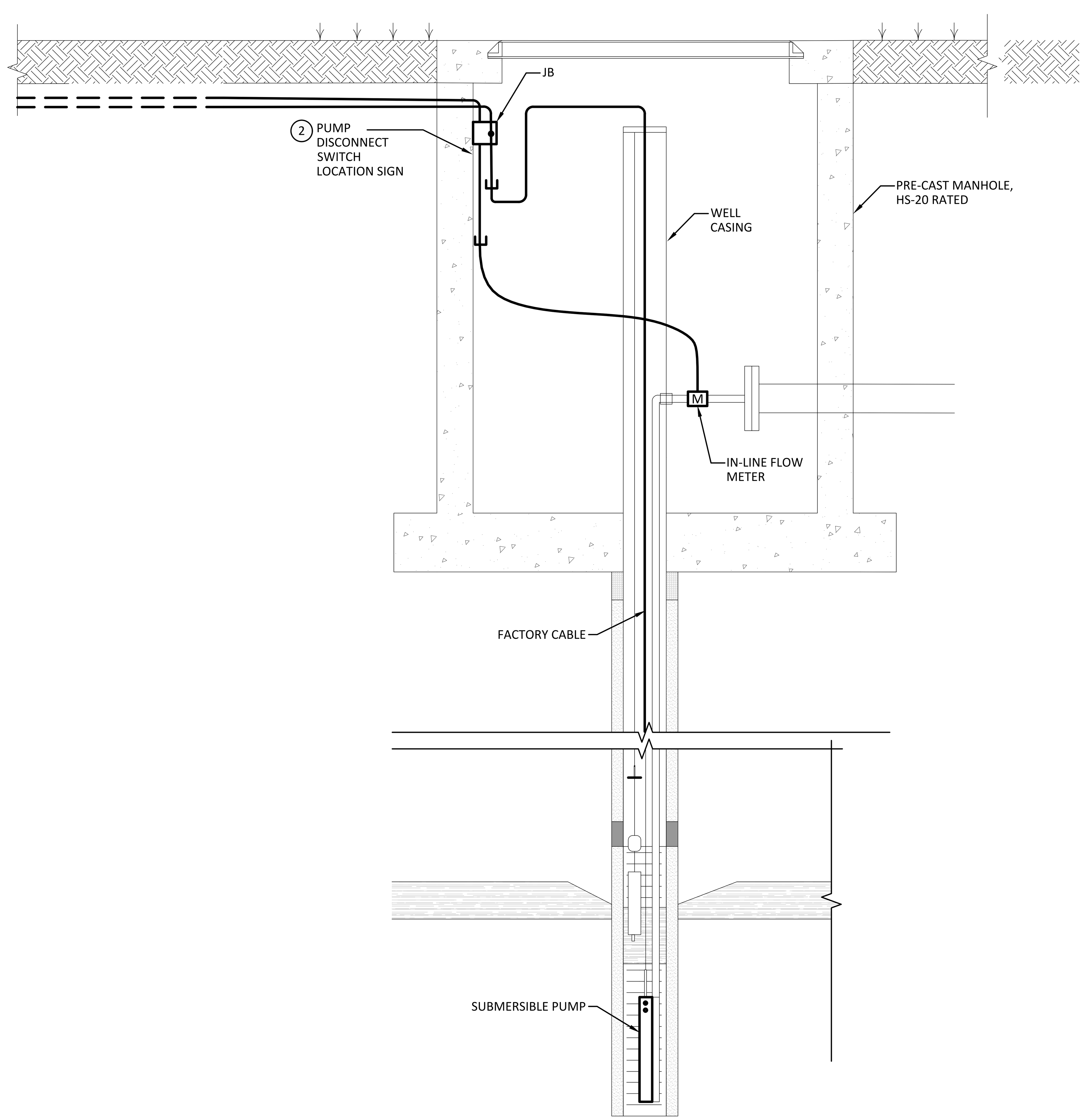
Project Number: 1368.001.006

Plotted: Feb 03, 2025 - 2:09PM By: jwc
Z:\BL-Vault\02\19217A02-1C71-4823-8927-99050405447f\01\2959000-2959999\2959078\1\1368001 E100 Electrical Site Plan (ID 2959078).dwg

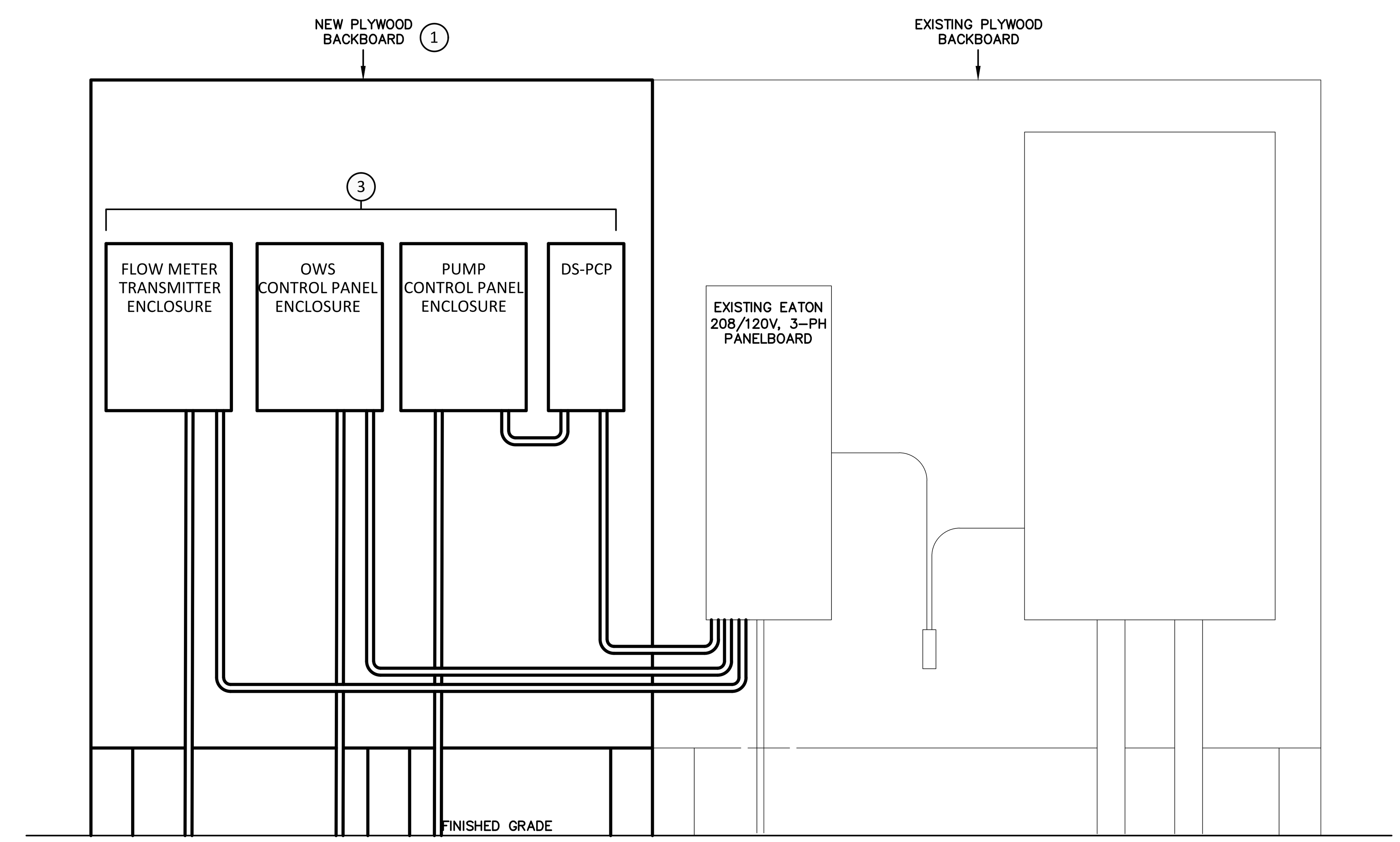
Checked by JC Drawn by CAJ Designed by CAJ In charge of TWB

KEYED NOTES:

1. PROVIDE NEW PLYWOOD AND WOOD SUPPORT POSTS FOR NEW EQUIPMENT. NEW BACKBOARD TO MATCH EXISTING BACKBOARD CONSTRUCTION. ASSUME SUPPORT POSTS ARE 4"X6" AND BACKBOARD IS 3/4" PLYWOOD. ALL MATERIALS TO BE EXTERIOR GRADE.
2. PROVIDE PERMANENT OUTDOOR RATED SIGN. SIGN TO INDICATE LOCATION OF PUMP DISCONNECT SWITCH.
3. CONFIRM LAYOUT WITH APPROVED EQUIPMENT. PROVIDE UNISTRUT SUPPORT ON BACKBOARD. DO NOT INSTALL DIRECTLY ON BACKBOARD.



B/E100 SECTION
SCALE: 1" = 1'-0"



A/E100 SECTION
SCALE: 3/4" = 1'-0"

1"=1'-0" 1' 0 1' 2'

3/4"=1'-0" 2' 1' 0 1' 2'

REVISIONS

MAXON ALCO HODINGS, LLC.
GROUNDWATER SUPPRESSION AND PRODUCT RECOVERY SYSTEM

ELECTRICAL SECTION VIEWS

CITY OF SCHENECTADY
SCHENECTADY COUNTY, NEW YORK

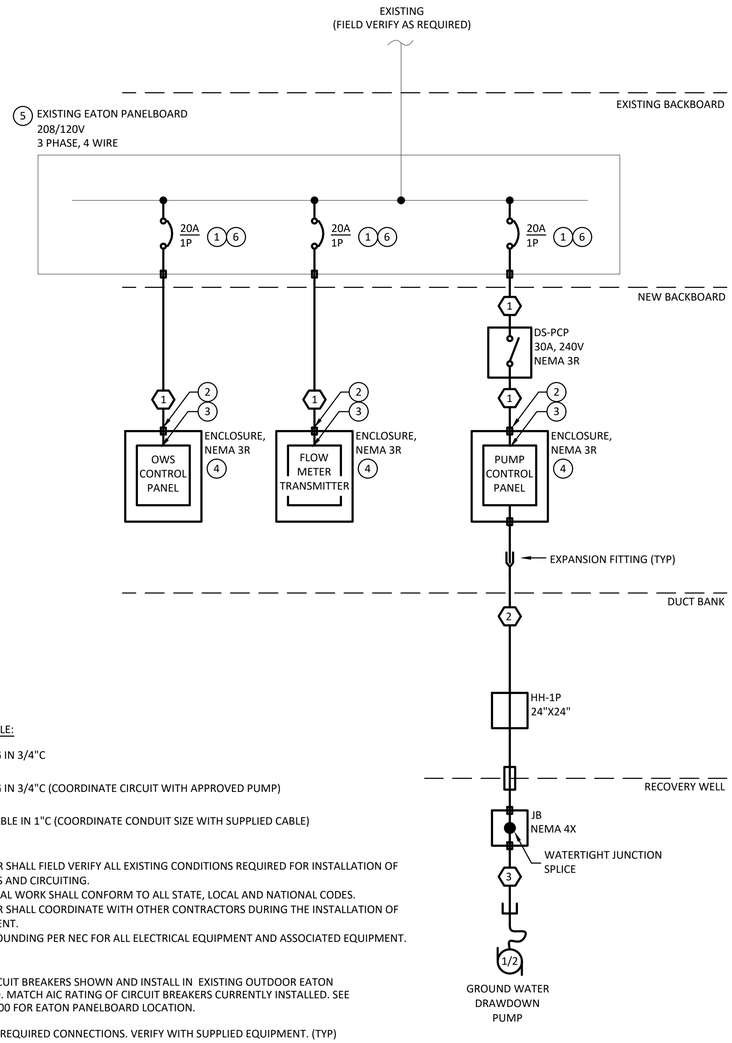
Barton & Loguidice
10 Airline Drive, Suite 200
Albany, NY 12205
NYS CERTIFICATE # 0018246, 020588, 019903, 019905, 020336

STATE OF NEW YORK LICENSED PROFESSIONAL ENGINEER No. 092449
NYS EXP.: 05/31/2026

Date: JANUARY 2025
Scale: AS SHOWN
Sheet Number: E301
Project Number: 1368.001.006

Plotted: Feb 03, 2025 – 2:09PM SYR By: jwc
Z:\BL-Vault\D2\18217AD2-1C71-4823-8927-99D5C4054147\0\3286000-3286999\3286590\L\L1368001 E301 Electrical Section Views (ID 3286590).dwg

Checked by JC | Drawn by CJ | Designed by CJ | In charge of TWB



CIRCUIT SCHEDULE:

1. 2#12, 1#12G IN 3/4"C
2. 2#12, 1#12G IN 3/4"C (COORDINATE CIRCUIT WITH APPROVED PUMP)
3. FACTORY CABLE IN 1"C (COORDINATE CONDUIT SIZE WITH SUPPLIED CABLE)

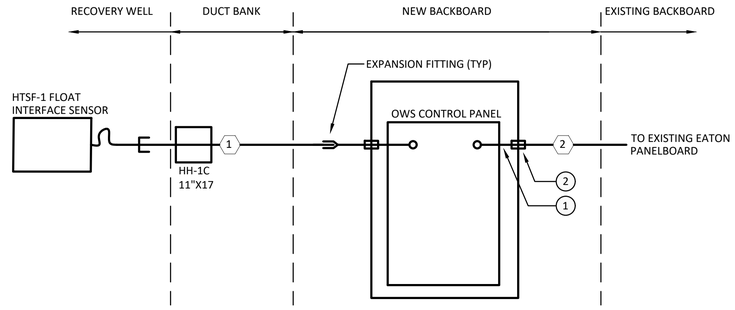
GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS REQUIRED FOR INSTALLATION OF NEW DEVICES AND CIRCUITING.
2. ALL ELECTRICAL WORK SHALL CONFORM TO ALL STATE, LOCAL AND NATIONAL CODES.
3. CONTRACTOR SHALL COORDINATE WITH OTHER CONTRACTORS DURING THE INSTALLATION OF ALL EQUIPMENT.
4. PROVIDE GROUNDING PER NEC FOR ALL ELECTRICAL EQUIPMENT AND ASSOCIATED EQUIPMENT.

KEYED NOTES:

1. PROVIDE CIRCUIT BREAKERS SHOWN AND INSTALL IN EXISTING OUTDOOR EATON PANELBOARD. MATCH AIC RATING OF CIRCUIT BREAKERS CURRENTLY INSTALLED. SEE DRAWING E100 FOR EATON PANELBOARD LOCATION.
2. PROVIDE ALL REQUIRED CONNECTIONS. VERIFY WITH SUPPLIED EQUIPMENT. (TYP)
3. PROVIDE WATERTIGHT PENETRATION WITH MEYERS HUB OR EQUIVALENT. (TYP)
4. PROVIDE NEMA 3R ENCLOSURE WITH HINGED DOOR. COORDINATE REQUIREMENTS WITH SUPPLIED EQUIPMENT.
5. CONFIRM VOLTAGE AND PANEL IS ENERGIZED PRIOR TO BEGINNING WORK.
6. CONFIRM AVAILABLE BREAKER SPACE PRIOR TO BEGINNING WORK.

4 ONE-LINE DIAGRAM
NOT TO SCALE



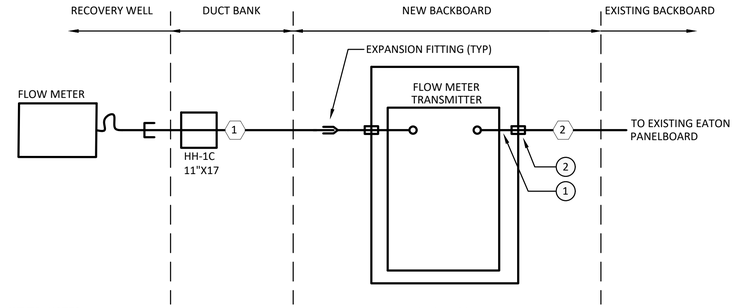
KEYED NOTES:

1. PROVIDE ALL REQUIRED CONNECTIONS. VERIFY WITH SUPPLIED EQUIPMENT. (TYP)
2. PROVIDE WATERTIGHT PENETRATION WITH MEYERS HUB OR EQUIVALENT. (TYP)

CIRCUIT SCHEDULE:

1. VENDOR SUPPLIED CABLE IN 1" CONDUIT (COORDINATE CONDUIT SIZE WITH SUPPLIED CABLE)
2. 2#12 - 1#12GND IN 3/4" CONDUIT

3 OWS DIAGRAM
NOT TO SCALE



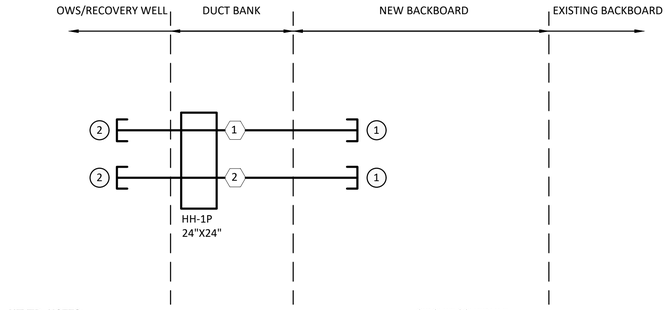
KEYED NOTES:

1. PROVIDE ALL REQUIRED CONNECTIONS. VERIFY WITH SUPPLIED EQUIPMENT. (TYP)
2. PROVIDE WATERTIGHT PENETRATION WITH MEYERS HUB OR EQUIVALENT. (TYP)

CIRCUIT SCHEDULE:

1. 1#20 STP AS BELDEN 8762 (SIGNAL CABLE) AND 1#14 STP AS BELDEN 8720 (COIL DRIVE CABLE) IN 3/4"(COORDINATE CABLE REQUIREMENTS WITH APPROVED EQUIPMENT)
2. 2#12 - 1#12G IN 1"C

2 FLOW METER DIAGRAM
NOT TO SCALE



KEYED NOTES:

1. CAP ABOVE GRADE IN LOCATION COORDINATED WITH OWNER
2. CAP BELOW GRADE IN LOCATION COORDINATED WITH OWNER. PROVIDE AT GRADE, 24"X24"X6" CONCRETE MARKER. INSTALL FLUSH WITH GRADE.

CIRCUIT SCHEDULE:

1. 1"C WITH PULL STRING (FUTURE HEAT TRACE)
2. 1"C WITH PULL STRING (SPARE)

1 SPARE CONDUIT DIAGRAM
NOT TO SCALE

REVISIONS

MAXON ALCO HODINGS, LLC.
GROUNDWATER SUPPRESSION AND
PRODUCT RECOVERY SYSTEM

ELECTRICAL DIAGRAMS

SCHENECTADY COUNTY, NEW YORK

CITY OF SCHENECTADY

Barton & Loguidice
10 Airline Drive, Suite 200
Albany, NY 12205
NYS CERTIFICATE #
0018246, 020588, 019903,
019905, 020336

NYS EXP.: 05/31/2026

Date
JANUARY 2025

Scale
AS SHOWN

Sheet Number
E401

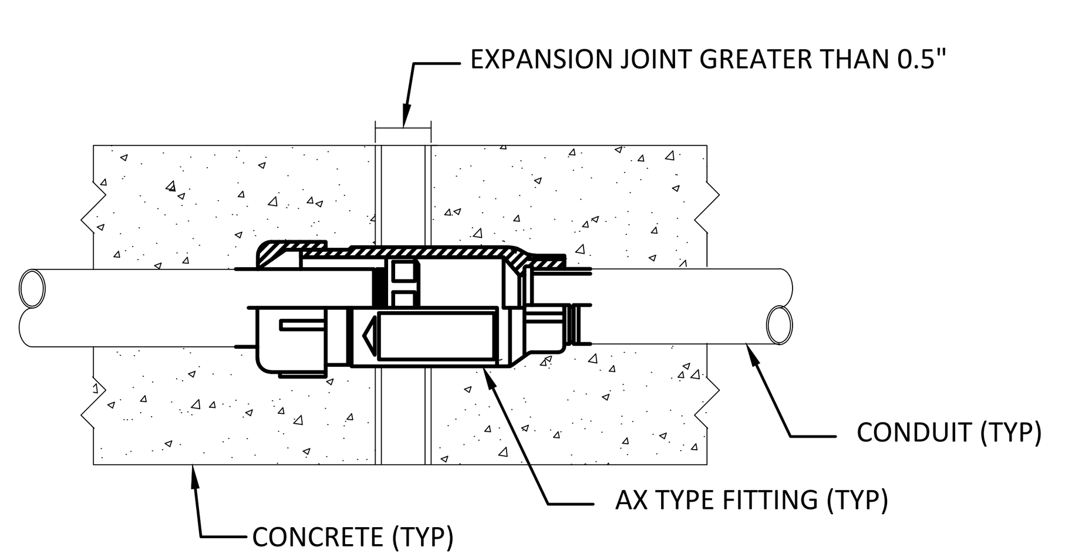
Project Number
1368.001.006

Plotted: Feb 03, 2025 – 2:35PM By: jwc
Z:\BL-Vault\02\16217A02-1C71-4823-8927-99D5C4054147\0\2970000-2970999\2970571\L\L\368001 E501 One-Line Diagram (ID 2970571).dwg
Checked by JC Drawn by CJ Designed by CJ In charge of TWB

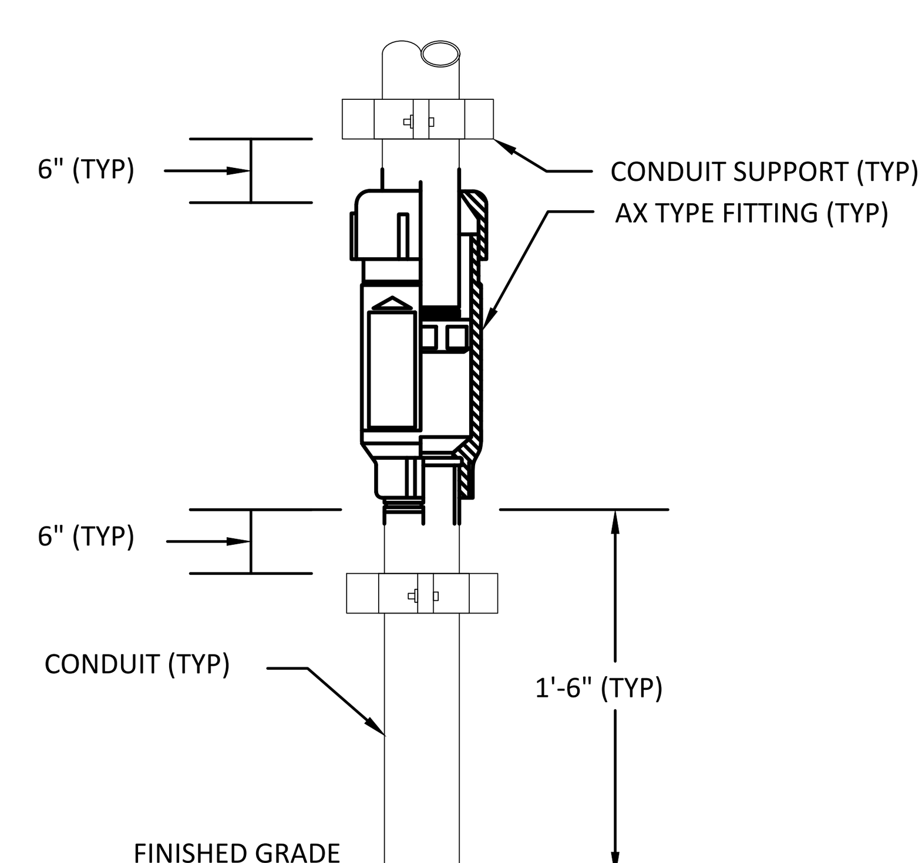
CONDUIT SCHEDULE			
BUILDING OR AREA	AREA DESCRIPTION	CONDUIT TYPE	REMARKS
GENERAL (ALL AREAS)	IN SLAB	SCHEDULE 40 PVC	
	UNDERGROUND 90 DEGREE SWEEPS	RGS	
	RISERS FROM UNDERGROUND	RGS	
UNDERGROUND (HORIZONTAL RUNS)	DUCT BANK	SCHEDULE 40 PVC	

GENERAL NOTE:

1. CONDUIT TYPES ARE UNLESS OTHERWISE INDICATED OR REQUIRED BY EQUIPMENT OR CABLE MANUFACTURER. PROVIDE AS REQUIRED.



EXPANSION JOINT



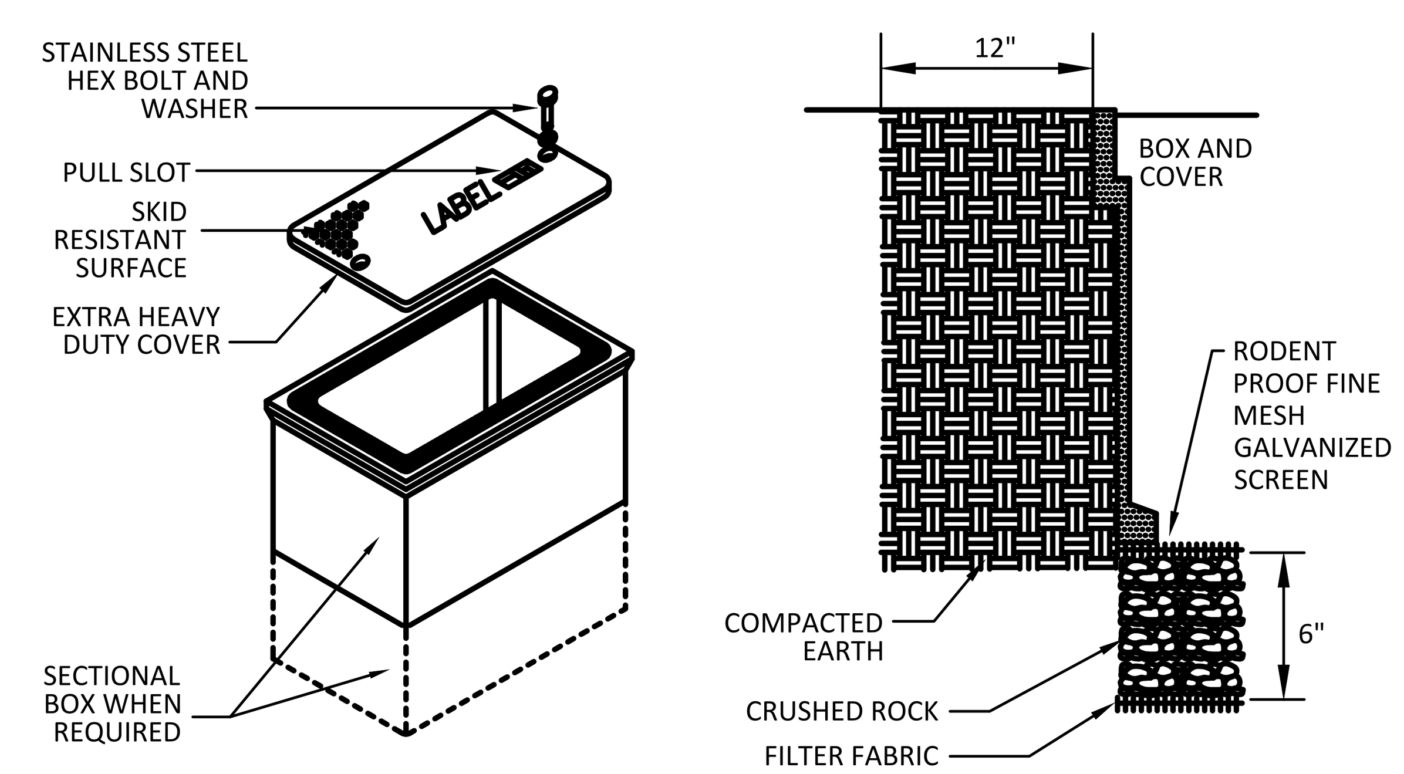
RISER FROM GRADE

GENERAL NOTES:

1. PROVIDE AN EXPANSION FITTING AT ALL EXPANSION JOINTS GREATER THAN 0.5" AND AS OTHERWISE INDICATED.
2. PROVIDE AN EXPANSION AT ALL RISERS FROM GRADE.
3. AX FITTING SHALL BE MODEL AX AS MANUFACTURED BY O-Z GEDNEY OR APPROVED EQUAL.
4. PROVIDE ALL REQUIRED BONDING JUMPERS, BOTH INTERNAL AND EXTERNAL.

3 EXPANSION FITTING DETAIL

NOT TO SCALE

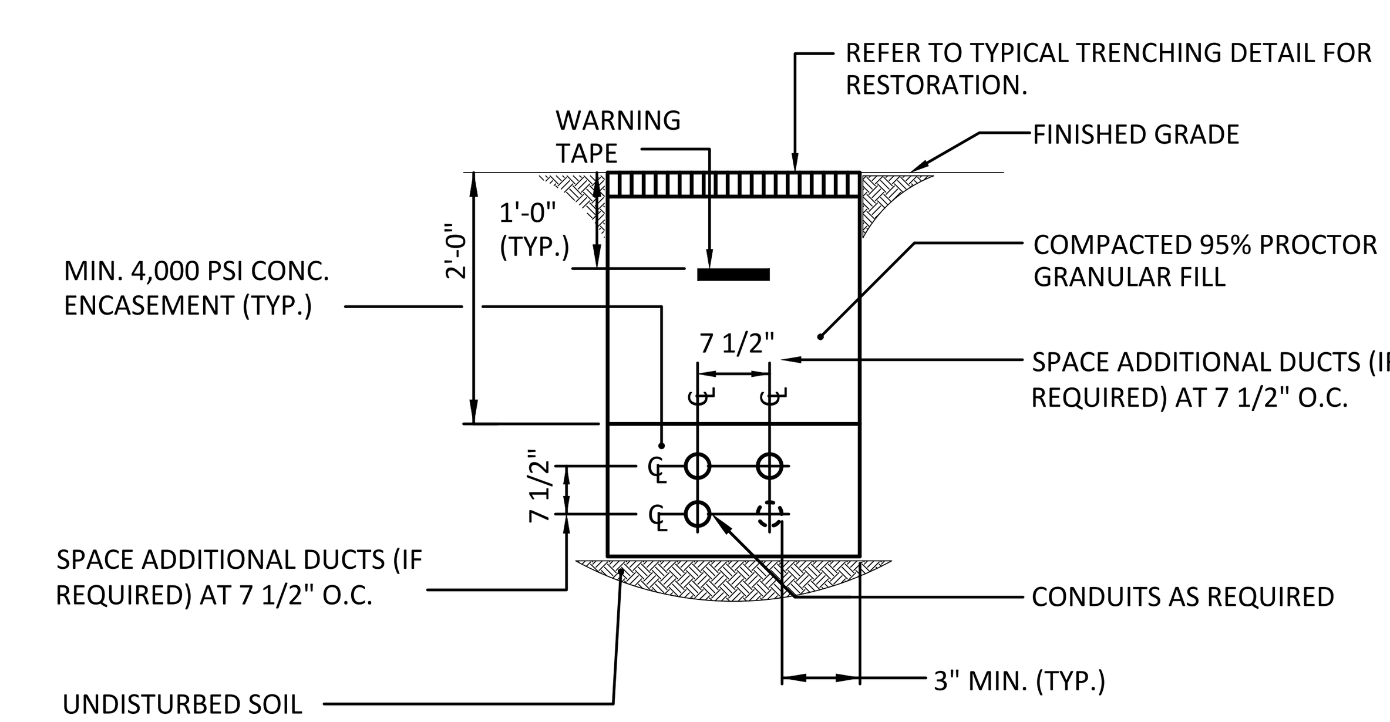


GENERAL NOTES:

1. CONSTRUCTION SHALL BE POLYMER CONCRETE WITH FIBERGLASS REINFORCING.
2. HANDHOLE AND COVER TO BE TIER 22 RATED UNLESS OTHERWISE INDICATED. MINIMUM LOADING REQUIREMENTS TO BE 22,500LB DESIGN LOAD AND 33,750LB TEST LOAD.
2. HANDHOLE TO COMPLY WITH APPLICABLE ANSI AND SCTE STANDARDS.
3. ALL HARDWARE SHALL BE STAINLESS STEEL. PROVIDE SLEEVES FOR ALL PENETRATIONS.
4. BOTTOM SHALL BE OPEN FOR DRAINAGE.
5. PROVIDE SEPARATE POWER AND CONTROL HANDHOLES WHERE BOTH POWER AND CONTROL CIRCUITS ARE PRESENT.
6. ALL FILL AROUND HANDHOLE TO BE COMPACTED IN 8" LAYERS.
7. FILTER FABRIC SHALL BE INSTALLED BENEATH ROCK AND TO 6" ABOVE HANDHOLE BASE ON ALL SIDES.
8. CRUSHED ROCK TO BE 3/4" CRUSHED ANGULAR GRAY STONE.
9. POLYMER CONCRETE HANDHOLES SHALL NOT BE INSTALLED BENEATH ROADWAYS, PARKING LOTS, DRIVEWAYS, OR OTHER PAVED AREAS SUBJECT TO TRAFFIC.

2 HANDHOLE DETAIL

NOT TO SCALE



1 CONCRETE DUCT BANK DETAIL

NOT TO SCALE

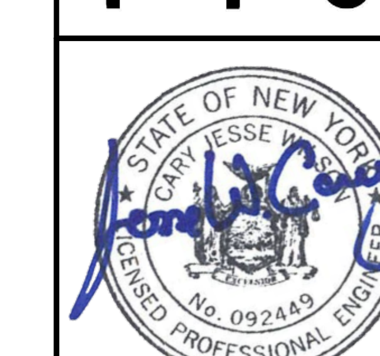
REVISIONS

MAXON ALCO HODINGS, LLC.
GROUNDWATER SUPPRESSION AND PRODUCT RECOVERY SYSTEM

ELECTRICAL DETAILS AND SCHEDULE

CITY OF SCHENECTADY
SCHENECTADY COUNTY, NEW YORK

Barton & Loguidice
10 Airline Drive, Suite 200
Albany, NY 12205
NYS CERTIFICATE #
0018246, 020588, 019903, 019905, 020336



NYS EXP.: 05/31/2026

Date: JANUARY 2025

Scale: AS SHOWN

Sheet Number: E501

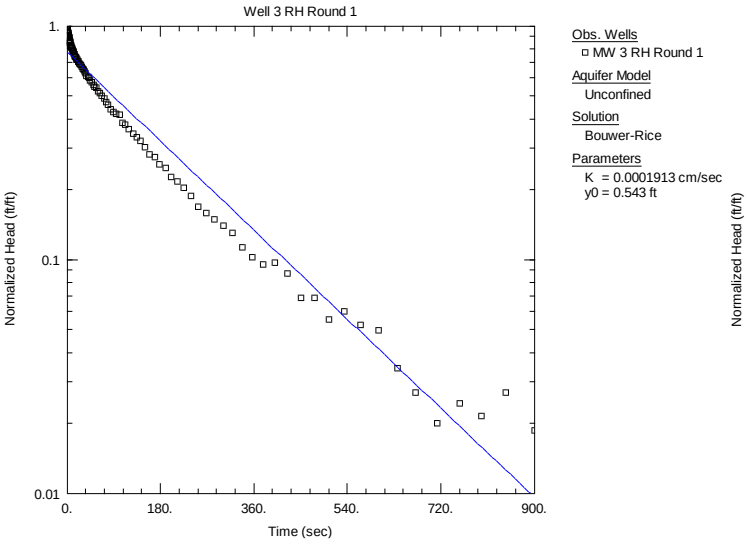
Project Number: 1368.001.006

Plotted: Feb 03, 2025 – 2:19PM SYR By: jwc
Z:\BL-Vault\02\18217AD2-1C71-4823-8927-99D5C4054147\0\2970000-2970999\2970571\L\L\1368001 E501 One-Line Diagram (ID 2970571).dwg
Checked by JC Drawn by CJ Designed by CJ In charge of TWB

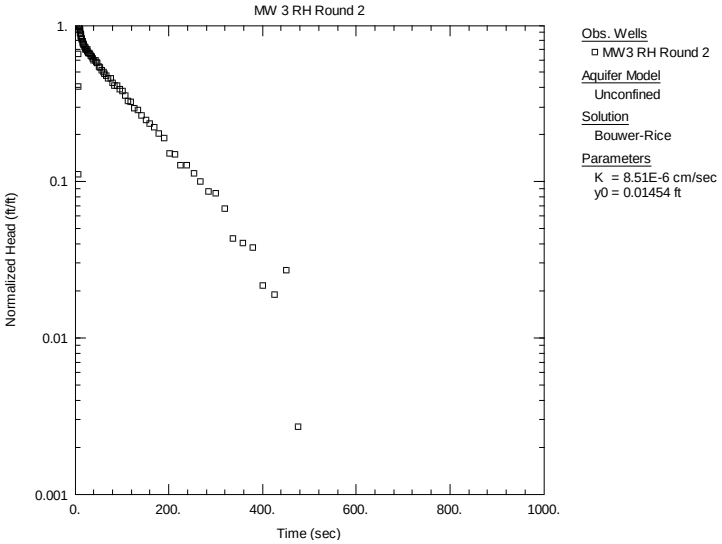
Appendix B

Hydraulic Conductivity Testing Results Graphs and Table

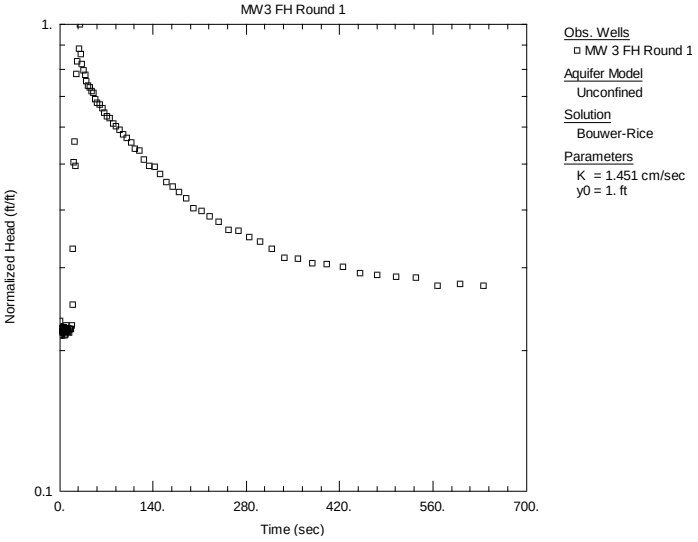
Hydraulic Conductivity Testing Results for MW-3



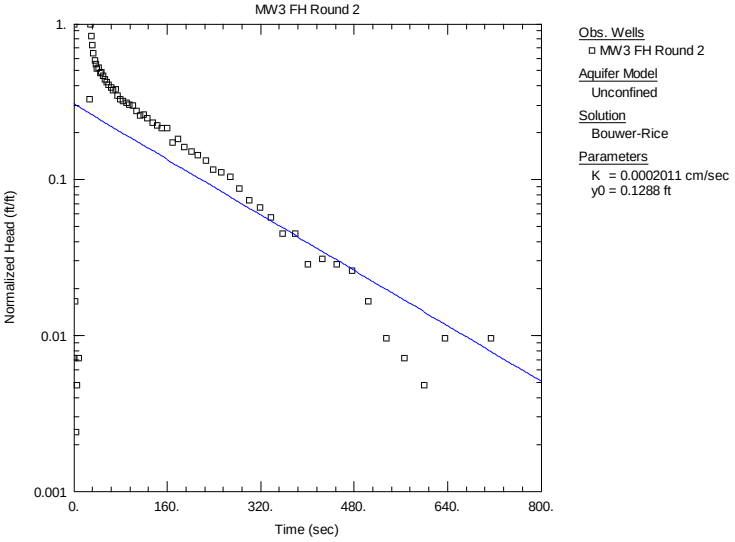
Linear-Log Axis, Normalized head



Linear-Log Axis, Normalized head



Log-Linear Axis, Normalized head



Linear-Log Axis, Normalized head

Unit	Well ID	Total Well Depth (ft)	Radius of Well (ft)	Screened Interval (ft)	Run	Static Water Level (ft)	Test	Displacement (ft)	Bouwer-Rice Hydraulic Conductivity (cm/sec)	Comments
Overburden	MW-1	26	0.08333	16-26	1	17.01	FH	0.22692	1.451	Not valid, no response
							RH	0.02449	0.00007452	
					2	16.86	FH	0.015	0.00001361	
							RH	0.007	1.451	Not valid, no response
	MW-2	26	0.08333	16-26	1	16.96	FH	0.154	1.451	Not valid, no response
							RH	0.0099	1.451	Not valid, no response
					2	16.85	FH	0.011	1.451	Not valid, no response
							RH	0.013	0.00001511	
	MW-3	26	0.08333	16-26	1	17.47	FH	0.88329	1.451	Not valid
							RH	0.69802	0.0001913	
					2	17.2	FH	0.42	0.0002011	
							RH	0.37	0.00000851	

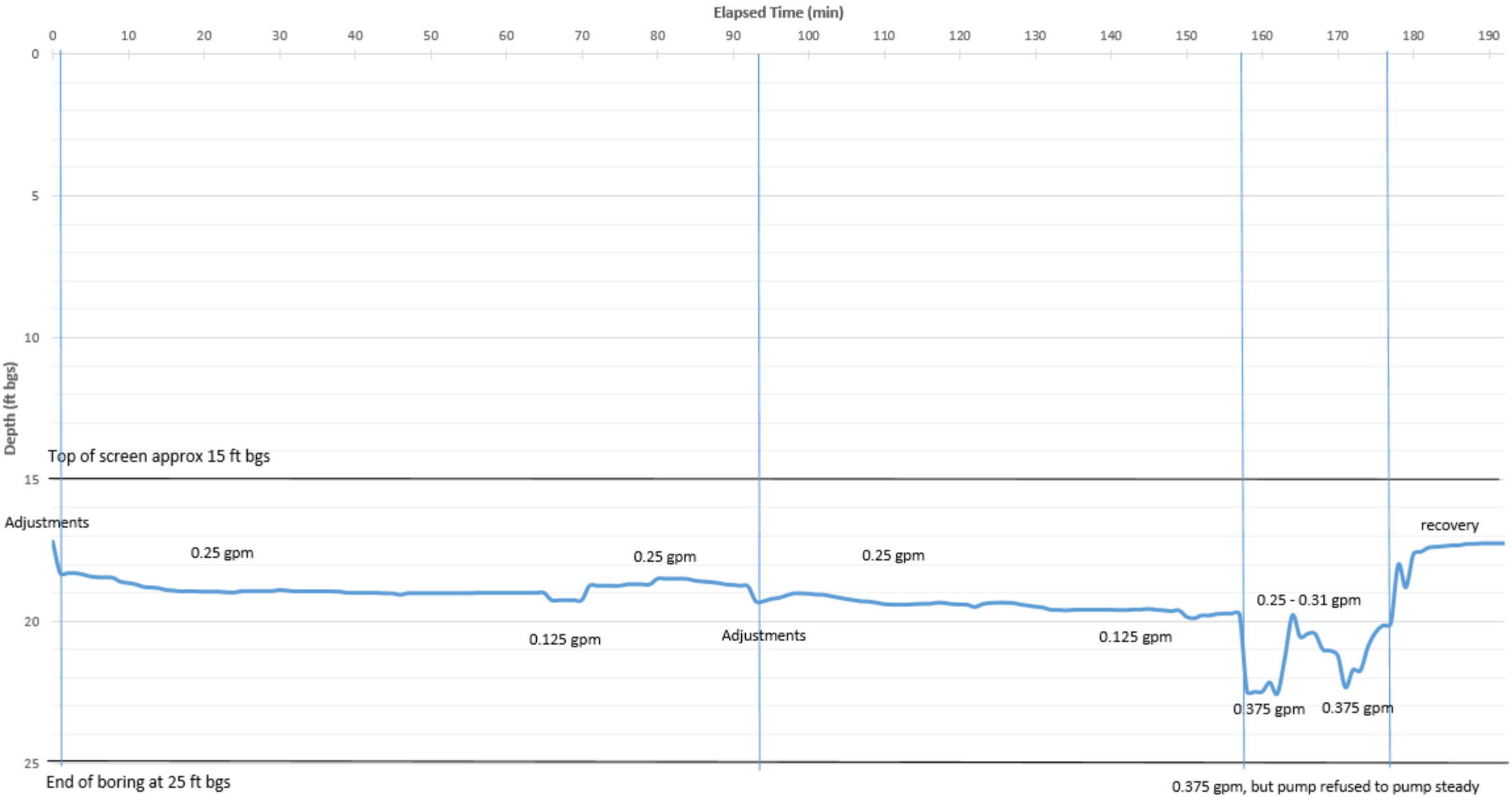
Geometric mean of MW-3 RH 0.000040348 cm/sec

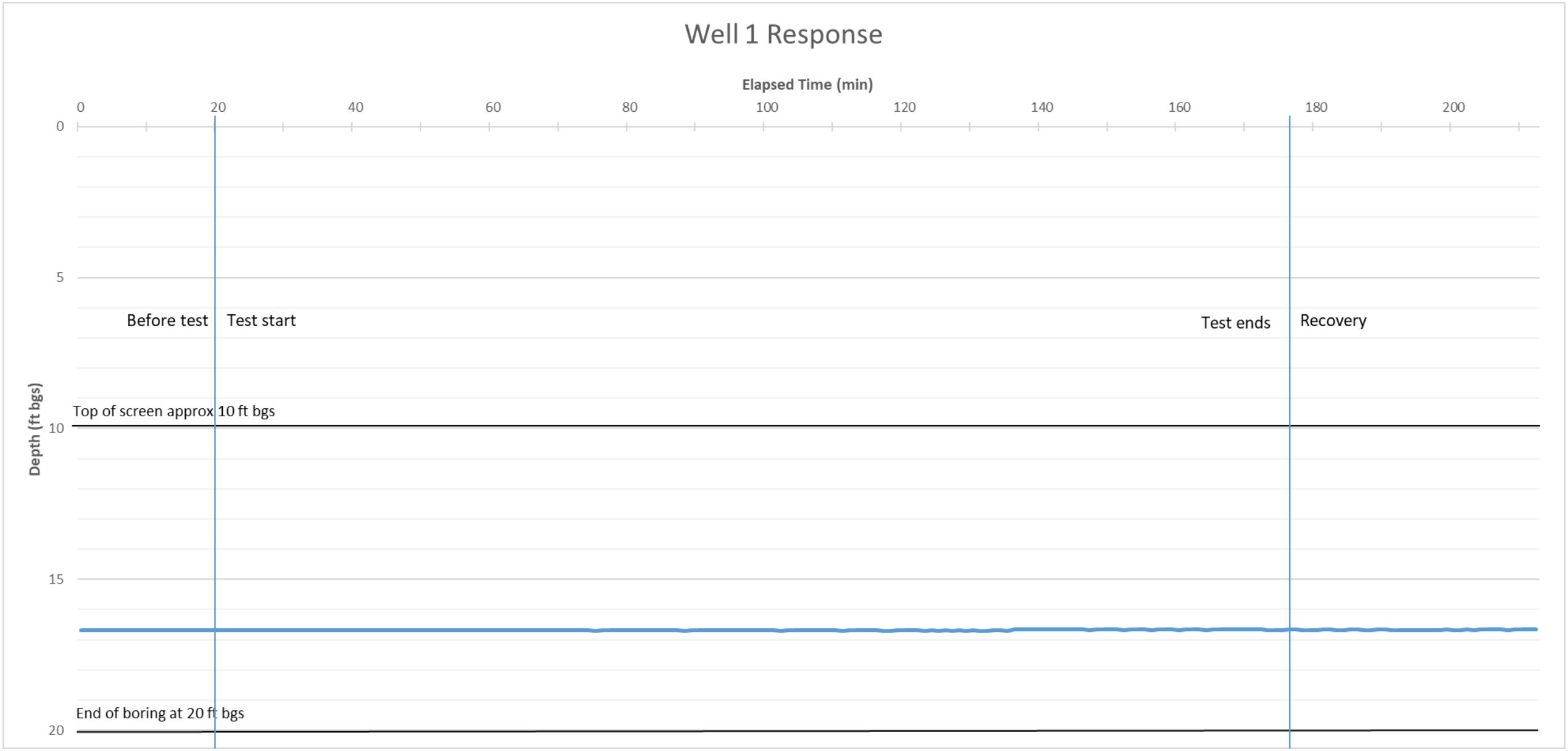
Average of MW-3 RH 0.000099905 cm/sec

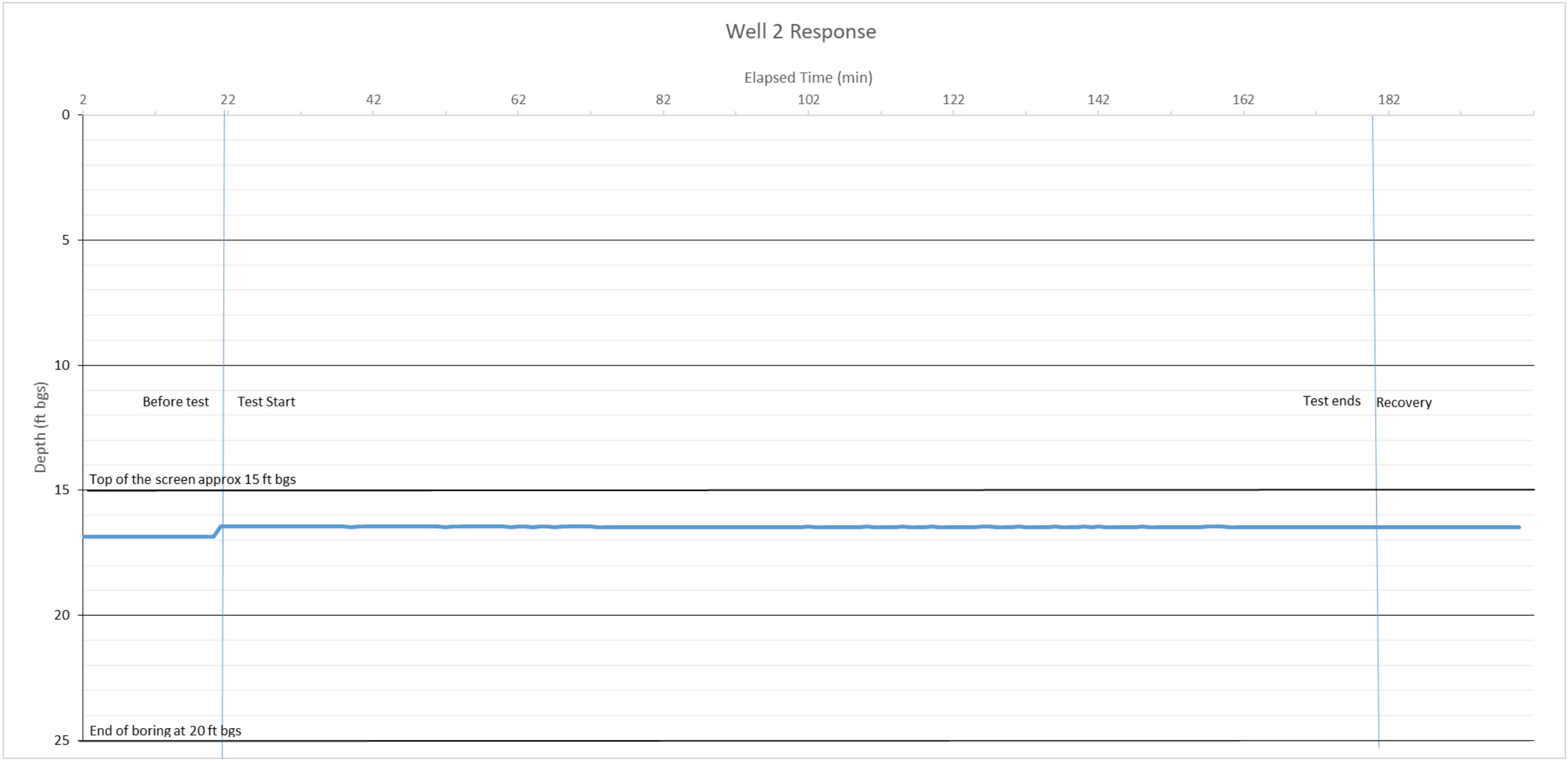
Appendix C

Step Drawdown Test Results Graphs

Step Test Linear for Well 3




Well 1 Response
Elapsed Time (min)
0
20
40
60
80
100
120
140
160
180
200
Depth (ft bgs)
0
5
10
15
20
Before test
Test start
Test ends
Recovery
Top of screen approx 10 ft bgs
End of boring at 20 ft bgs


Well 2 Response
Elapsed Time (min)
2
22
42
62
82
102
122
142
162
182
0
5
10
15
20
25
Depth (ft bgs)
Before test
Test Start
Test ends
Recovery
Top of the screen approx 15 ft bgs
End of boring at 20 ft bgs

Appendix D

Thiem Calculation

Barton & Loguidice

JOB	1368.001.006		
SHEET NO.	1	OF	1
CALCULATED BY	BAG	DATE	6/6/2023
CHECKED BY	BDD	DATE	6/14/2023

Thiem Calculation

Eqn. 1 $$Q_{max} = \frac{S_{max}(2\pi * B * K)}{\ln\left(\frac{W}{r_w}\right)}$$

(Thiem Equation)

Where:	S_{max} = Maximum Allowable Water Table Drawdown =	3	ft
	r_w = Well Radius =	0.25	ft
	W = Estimated Width of Source Area =	15	ft
	B = Saturated Thickness of Unconfined Aquifer =	20	ft
	K = Hydraulic Conductivity =	1.34E-06	ft/sec
	Q_{max} = Flow Rate for Maximum Allowable Drawdown		

$$Q_{max} = \frac{3\ ft \times (2\pi \times 20 \times 0.00000134)}{\ln(15 / 0.25)} = 1.23E\text{-}04\ ft^3/sec$$

1.23E-04	ft^3/sec	x	60	sec/min	x	7.48	gal/ft^3	=	5.54E-02 gal/min

Appendix E

Oil/Water Separator Manufacturer's Information

Highland Tank | count on our products. trust in our people.

oil/water separation

cylindrical underground

HT-2040

PRODUCT DETAILS

Highland Tank cylindrical underground oil/water separators are typically installed in industrial areas and receive oil waste-water generated during processes such as bulk petroleum storage and handling, aircraft and vehicle fueling, maintenance, washing and environmental remediation of petroleum contaminated sites.

The effluent from oil/water separators is typically discharged to either a storm or sanitary sewer system.

Our high-efficiency oil/water separators are recommended for a wide range of industrial applications, such as:

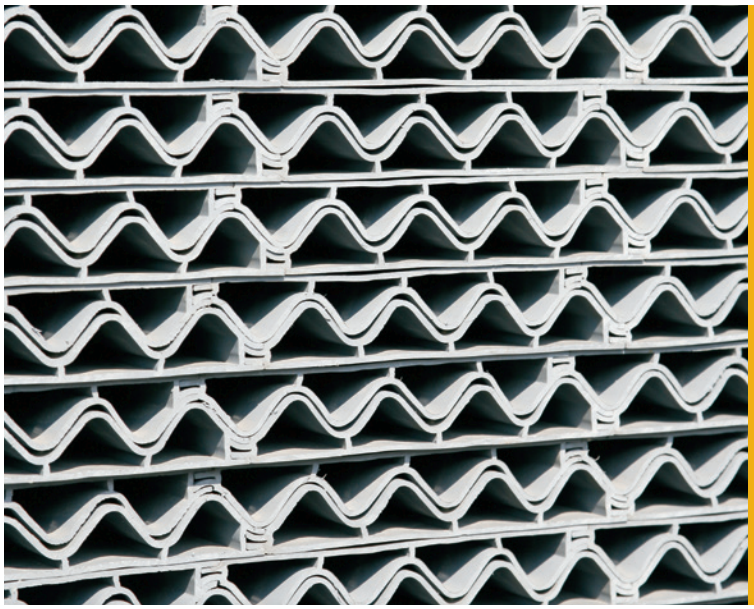
- Airports & Aircraft Services
- Electric Utilities & Power Plants
- Environmental Remediation
- Industrial Facilities
- Military & Government Facilities
- Municipalities
- Petroleum Production & Marketing Facilities
- Railroad Yards
- Transportation Companies

They are also located in vehicle service areas associated with each of these facilities:

- Fueling Facilities
- Repair & Maintenance Shops
- Wash Areas

Highland oil/water separators set the standard for reliability. Our separators are highly efficient - treating wastewater under a wide range of conditions.

Unlike other oil/water separators, they are easy to install, operate and maintain.



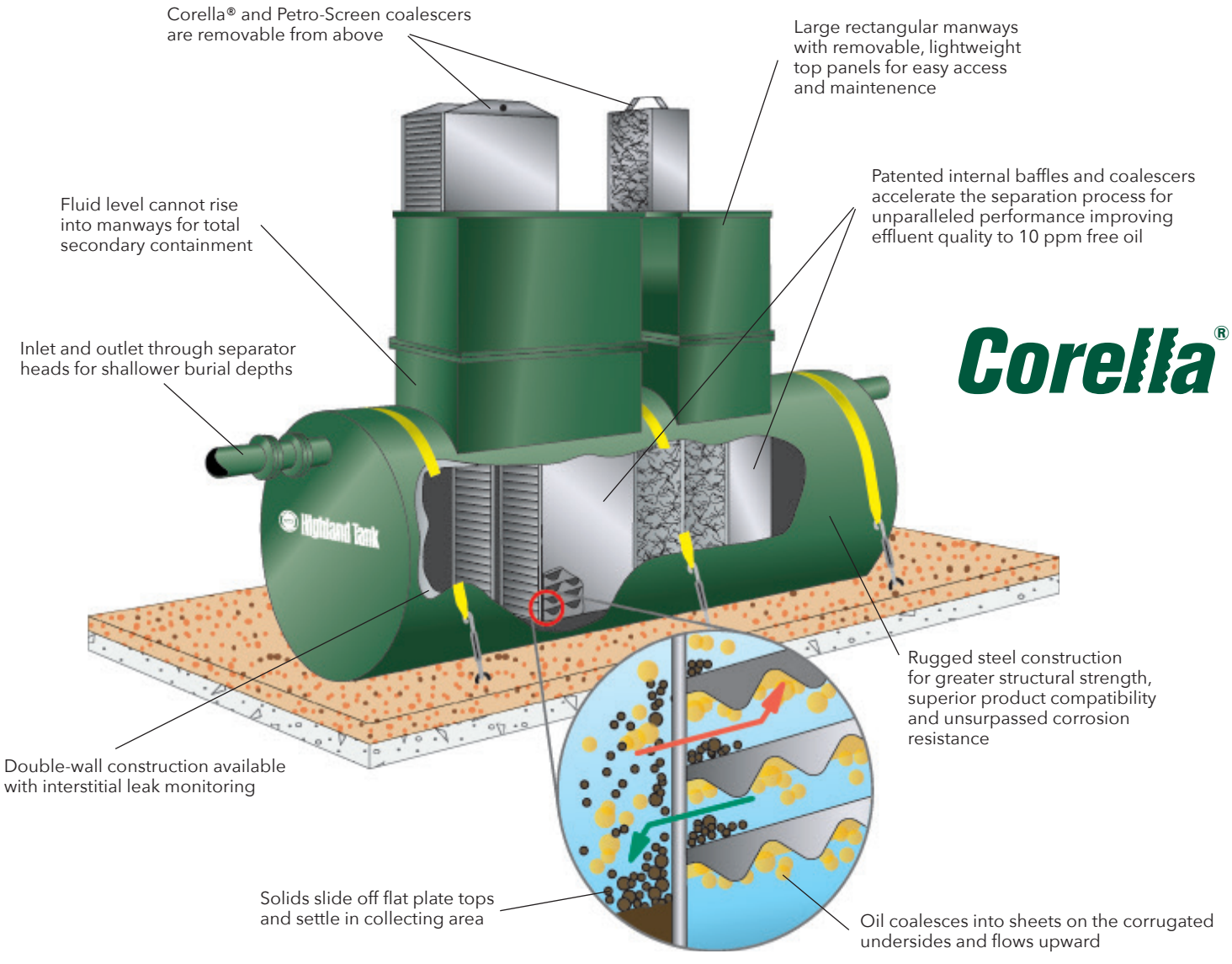
Corella® The Newest Advancement in Oil/Water Separation Technology

The Corella® Coalescer is a removable, inclined parallel, flat/corrugated plate coalescer that enhances separation of both oil and solids from all strata of the wastewater stream. It is individually engineered to specific application and job-site requirements to maximize utility.

◀ Patented **Corella® technology**

Corella® | cleaner. safer. smarter.

UL-2215 LISTED



Highland Tank Oil/Water Separators are listed and approved under one or more of the following patents and approvals:

Underwriters' Laboratories, Inc. UL-SU2215

U.S. Patents - 4,722,800; 5,520,825 & 6,605,224

Canadian Patents - 1,325,179; 1,296,263 & 2,389,065

City of New York, Board of Standards and Appeals under Calendar Number 1215-88-SA

Massachusetts Board of State Examiners of Plumber and Gas Fitters

Approval Code P1-0594-25

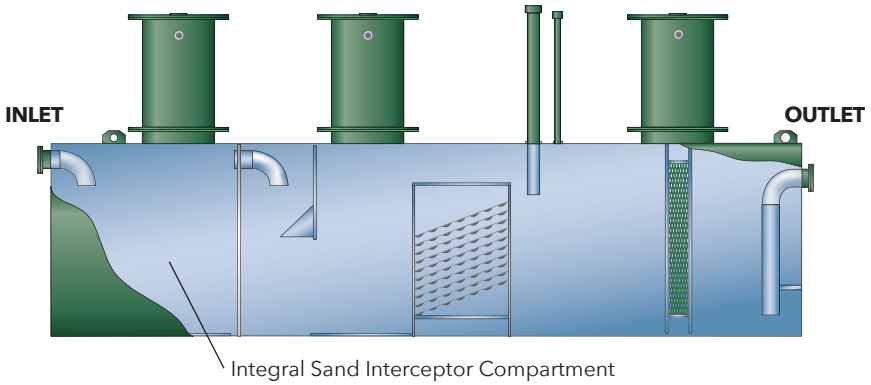
Evaluated to DIN Parts 4 & 5, DIN 38-409 Part 18

pre-engineered design options

G

Series - G Oil/Water Separators

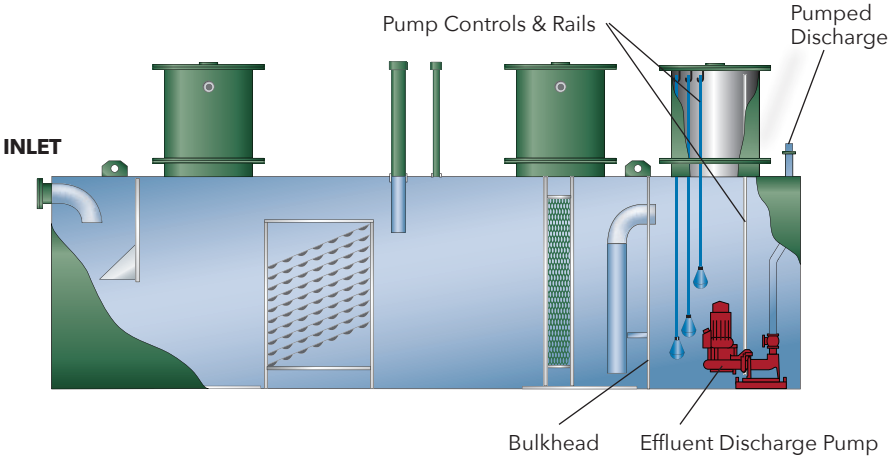
Feature an integral sand interceptor compartment to permit sand and gravel to settle out before the wastewater enters the separation chamber.



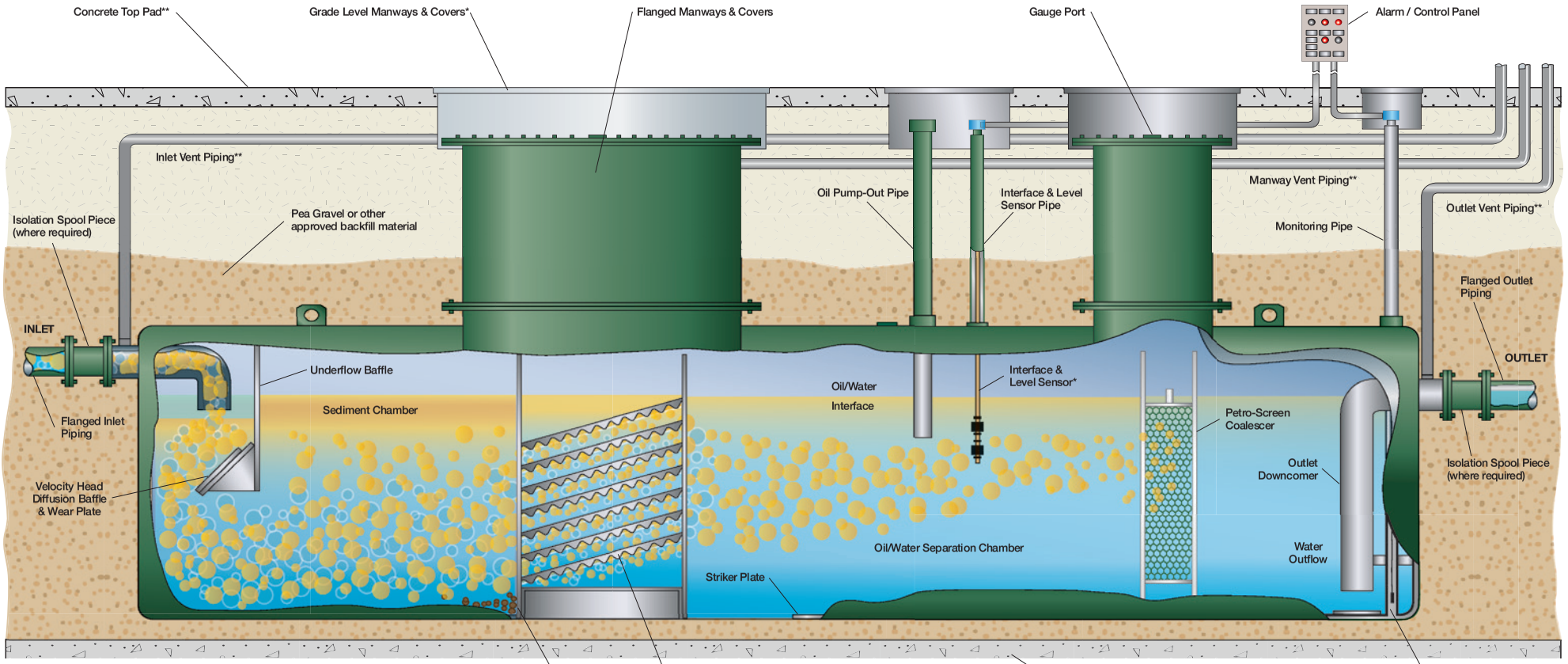
J

Series - J Oil/Water Separators

Feature an integral effluent pump-out compartment with level controls to operate a pump at prescribed levels. The pumped effluent can then be routed through Highland's Advanced Hydrocarbon Filtration System to further improve performance.



cylindrical oil/water separator



How It Works

Highland Tank's patented oil/water separators are stationary wastewater treatment tanks filled with water.

They contain specially designed internal baffles and coalescers to accelerate the separation process.

The tank is designed to allow convenient access for inspection and maintenance from above. Inlet flow is directed against the velocity head diffusion baffle to reduce flow turbulence and to distribute the flow evenly over the separator's cross-sectional area.

In the sediment chamber, heavy solids settle out and concentrated oil rises to the surface. The oily water then passes through the Corella® Coalescer, an inclined arrangement of stacked, parallel, flat and corrugated plates.

The corrugated underside of the Corella® plates causes the oil to coalesce into sheets. The oil globules then rise to the surface of the separation chamber, where the separated oil accumulates.

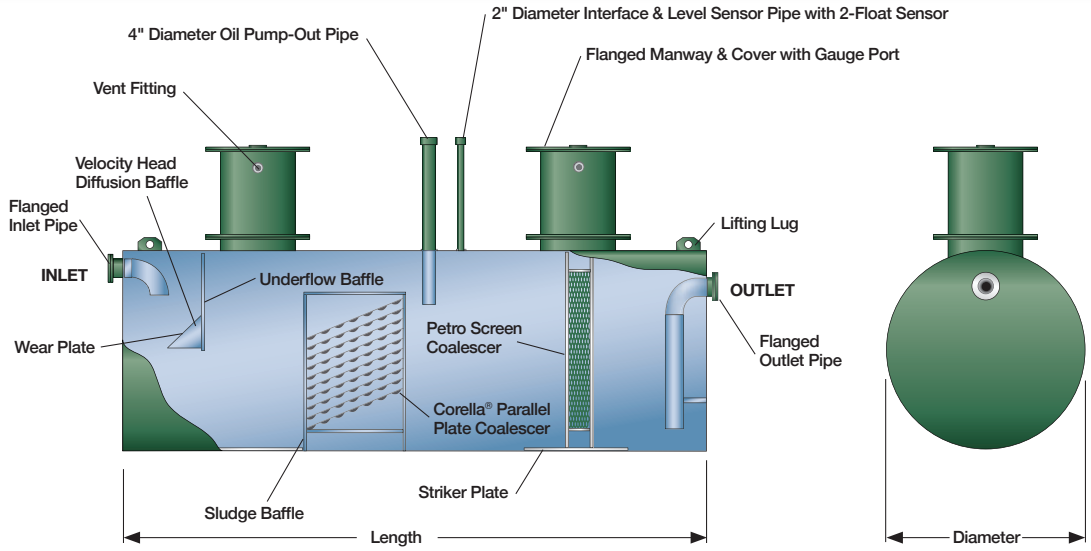
Any remaining solids sink to the top of the plates and slide off the plates to the solids collection area.

The effluent flows down and toward the outlet and is discharged by gravity displacement. A Petro-Screen polypropylene impingement coalescer (an encased bundle of layered oil-attracting fibers) is used to intercept droplets of oil that are too minute to be removed by the Corella® Coalescer.

Electronic oil level controls sound an alarm at high oil levels so that waste oil can be removed from the separator. Double-wall separators are monitored with electronic leak detection systems for the interstitial space.

cylindrical separator sizing guide

HT-2040



Model HT or HTC	Flow Rate Gal/Min	Total Volume Gallons	Recommended Oil Pump-Out Gallons	Dimensions Diameter	Dimensions Length	Inlet & Outlet Diameter
350	35	350	70	3'-6"	6'-0"	4"
550	55	550	110	3'-6"	7'-9"	4"
1,000	100	1,000	200	4'-0"	10'-9"	6"
2,000	200	2,000	400	5'-4"	12'-0"	6"
3,000	300	3,000	600	5'-4"	18'-0"	8"
4,000	400	4,000	800	5'-4"	24'-0"	8"
5,000	500	5,000	1,000	6'-0"	23'-10"	8"
6,000	600	6,000	1,200	6'-0"	28'-8"	10"
7,000	700	7,000	1,400	7'-0"	24'-4"	10"
8,000	800	8,000	1,600	7'-0"	28'-0"	10"
9,000	900	9,000	1,800	8'-0"	24'-0"	12"
10,000	1,000	10,000	2,000	8'-0"	26'-8"	12"
12,000	1,200	12,000	,400	8'-0"	32'-0"	12"
15,000	1,500	15,000	3,000	10'-0"	25'-6"	14"
20,000	2,000	20,000	4,000	10'-6"	31'-0"	16"
25,000	2,500	25,000	5,000	10'-6"	38'-9"	18"
30,000	3,000	30,000	6,000	10'-6"	46'-6"	20"
40,000	4,000	40,000	8,000	12'-0"	47'-3"	24"
50,000	5,000	50,000	10,000	12'-0"	59'-6"	24"
60,000	6,000	60,000	12,000	13'-0"	60'-6"	24"

Plate spacing and orientation may vary depending on site conditions. Custom sizing is available. Consult Highland Tank for Series G & J sizing information.

Highland Tank

Stoystown, PA
One Highland Road
Stoystown, PA 15563-0338
814.893.5701

Manheim, PA
4535 Elizabethtown Road
Manheim, PA 17545-9410
717.664.0600

Watervliet, NY
958 19th Street
Watervliet, NY 12189-1752
518.273.0801

Greensboro, NC
2700 Patterson Street
Greensboro, NC 27407-2317
336.218.0801

Lebanon, PA
2225 Chestnut Street
Lebanon, PA 17042-2504
717.664.0602

Friedens, PA
1510 Stoystown Road
Friedens, PA 15541-7402
814.443.6800

Clarkston, MI
4701 White Lake Road
Clarkston, MI 48346-2554
248.625.8700

Mancelona, MI
9517 Lake Street
Mancelona, MI 49659-7968
248.625.8700

PROUDLY MADE IN AMERICA

Appendix F

Groundwater Drawdown Pump and Controller Manufacturer's Information

ELECTRIC PUMPS FOR LANDFILLS AND REMEDIATION SITES

SlimJim™ Pump Systems

TORPEDO™ PUMPS & Control Panels
QED

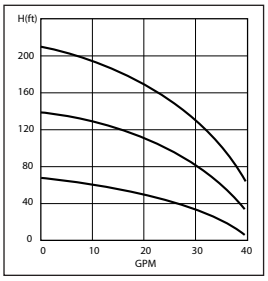
Small diameter pump (4.5” OD) provides flows up to 30 gpm in smaller risers without the need of a control panel.

The Slim Jim is our small diameter, light weight and cost-effective Torpedo pump. No control panel is needed for this pump, with its built-in auto on/off start and run-dry protection. It offers plug-in operation at 115V or 230V single phase power. The rounded bullet end, heavy duty Torpedo™ shroud outperforms and outlasts stainless steel housings. There are no shroud wheels to break or hamper pump removal. The stainless steel motor and pump casing and HDPE protective shroud resist corrosion. There is also a chemical-resistant Teflon version.

The SlimJim pump is a great utility pump for general pit-vault dewatering, and excels in cleanouts, collapsed pipes or bent risers. The optional three phase operation with control panels adds several benefits: variable speed to program the pump with an iPhone (view and change pump data and parameters).

Specifications (See back for more details)

4.5” Environmental Pumps : 10, 22 gpm
4.5” Standard Pumps : 5,10,15, 22, 30 gpm



Flows up to 30 gpm
Delivers head capability to 330’. Consult website for flow curves of each model.

Lightweight
Compact, easy-to-handle 4.5” OD pump weighs only 22 pounds.

Cost Effective
Lowers capital costs and eases maintenance at over 500 landfills.

Plug-in Operation
Pump immediately using any 115V or 230V single phase power source.

QED®
Innovative Environmental Products

(800) 624-2026 • www.qedenv.com
P.O. Box 3726 Ann Arbor, MI 48106-3726 USA • (734) 995-2547 • Fax (734) 995-1170 • info@qedenv.com

SlimJim™ Pump Systems

SlimJim Environmental Pumps (Teflon and Viton seals)

		Flow (gpm)	Dia. (inches)	Length (lb)	Wt. HP	Volts	Phase	
50898	10SRPSJE05-100	10	4.5	34.4	22	½	115	Single
50899	10SRPSJE05-100	10	4.5	34.4	22	½	230	Single
50900	10SRPSJE05-140	10	4.5	34.4	22	½	115	Single
50901	10SRPSJE05-140	10	4.5	34.4	22	½	230	Single
50902	10SRPSJE07-180	10	4.5	35.5	23	¾	230	Single
50903	10SRPSJE07-220	10	4.5	37.6	23	¾	230	Single
50904	10SRPSJE10-260	10	4.5	39.0	26	1	230	Single
50905	10SRPSJE10-300	10	4.5	40.1	26	1	230	Single
50906	10SRPSJE10-340	10	4.5	42.2	26	1	230	Single
50907	22SRPSJE05-40	22	4.5	34.4	22	½	115	Single
50908	22SRPSJE05-40	22	4.5	34.4	22	½	230	Single
50909	22SRPSJE05-80	22	4.5	34.4	22	½	115	Single
50910	22SRPSJE05-80	22	4.5	34.4	22	½	230	Single
50911	22SRPSJE07-110	22	4.5	35.5	23	¾	230	Single
50912	22SRPSJE05-140	22	4.5	37.6	23	½	230	Single
50913	22SRPSJE10-180	22	4.5	42.2	26	1	230	Single
50914	22SRPSJE10-210	22	4.5	42.2	26	1	230	Single

SlimJim Standard Pumps (Buna Seals)

50915	5SRPSJ05-90	5	4.5	34.4	22	½	115	Single
50916	5SRPSJ05-90	5	4.5	34.4	22	½	230	Single
50917	5SRPSJ05-140	5	4.5	34.4	22	½	115	Single
50918	5SRPSJ05-140	5	4.5	34.4	22	½	230	Single
50919	5SRPSJ05-180	5	4.5	35.5	22	½	115	Single
50920	5SRPSJ05-180	5	4.5	35.5	22	½	230	Single
50921	5SRPSJ07-230	5	4.5	37.6	23	¾	230	Single
50922	5SRPSJ07-270	5	4.5	37.6	23	¾	230	Single
50923	5SRPSJ07-320	5	4.5	38.6	23	¾	230	Single
50924	5SRPSJ10-360	5	4.5	42.2	26	1	230	Single
50925	5SRPSJ10-410	5	4.5	42.2	26	1	230	Single
50926	5SRPSJ15-450	5	4.5	43.3	26	1½	230	Single
50927	10SRPSJ05-110	10	4.5	34.4	22	½	115	Single
50928	10SRPSJ05-110	10	4.5	34.4	22	½	230	Single
50929	10SRPSJ05-160	10	4.5	34.4	22	½	230	Single
50930	10SRPSJ07-200	10	4.5	35.5	23	¾	230	Single
50931	10SRPSJ07-260	10	4.5	37.6	23	¾	230	Single
50932	10SRPSJ10-290	10	4.5	39.0	26	1	230	Single
50933	10SRPSJ15-330	10	4.5	40.2	26	1½	230	Single
50934	15SRPSJ05-70	15	4.5	34.4	22	½	115	Single
50935	15SRPSJ05-70	15	4.5	34.4	22	½	230	Single
50936	15SRPSJ05-110	15	4.5	34.4	22	½	115	Single
50937	15SRPSJ05-110	15	4.5	34.4	22	½	230	Single
50938	15SRPSJ07-150	15	4.5	35.5	23	¾	230	Single
50939	15SRPSJ07-180	15	4.5	37.6	23	¾	230	Single
50940	15SRPSJ10-220	15	4.5	39.0	26	1	230	Single
50941	15SRPSJ10-250	15	4.5	40.1	26	1	230	Single
50942	15SRPSJ15-290	15	4.5	42.2	26	1½	230	Single
50943	22SRPSJ05-40	22	4.5	34.4	22	½	115	Single
50944	22SRPSJ05-40	22	4.5	34.4	22	½	230	Single
50945	22SRPSJ05-80	22	4.5	34.4	22	½	115	Single
50946	22SRPSJ05-80	22	4.5	34.4	23	½	230	Single
50947	22SRPSJ07-120	22	4.5	35.5	23	¾	230	Single
50948	22SRPSJ10-160	22	4.5	37.6	23	1	230	Single
50949	22SRPSJ10-190	22	4.5	42.2	26	1	230	Single
50950	22SRPSJ15-220	22	4.5	42.2	26	1½	230	Single
50951	30SRPSJ05-40	30	4.5	34.4	22	½	115	Single
50952	30SRPSJ05-40	30	4.5	34.4	22	½	230	Single
50953	30SRPSJ07-90	30	4.5	34.4	23	¾	230	Single
50954	30SRPSJ10-130	30	4.5	39.0	23	1	230	Single

Accessories

Commander™ Control Panels
Touch Screen Standard

- Touch screen displays
- Adjust alarm, transducer flow meter setup
- Breakers, not fuses.
- Isolation barriers.
- "Finger-safe" safety standards.
- 304 Stainless Steel Enclosure.

Level Transducers

- High static accuracy and repeatability
- Ranges from 3-1000 PSI gauge
- Easy field maintenance

Flow Meters

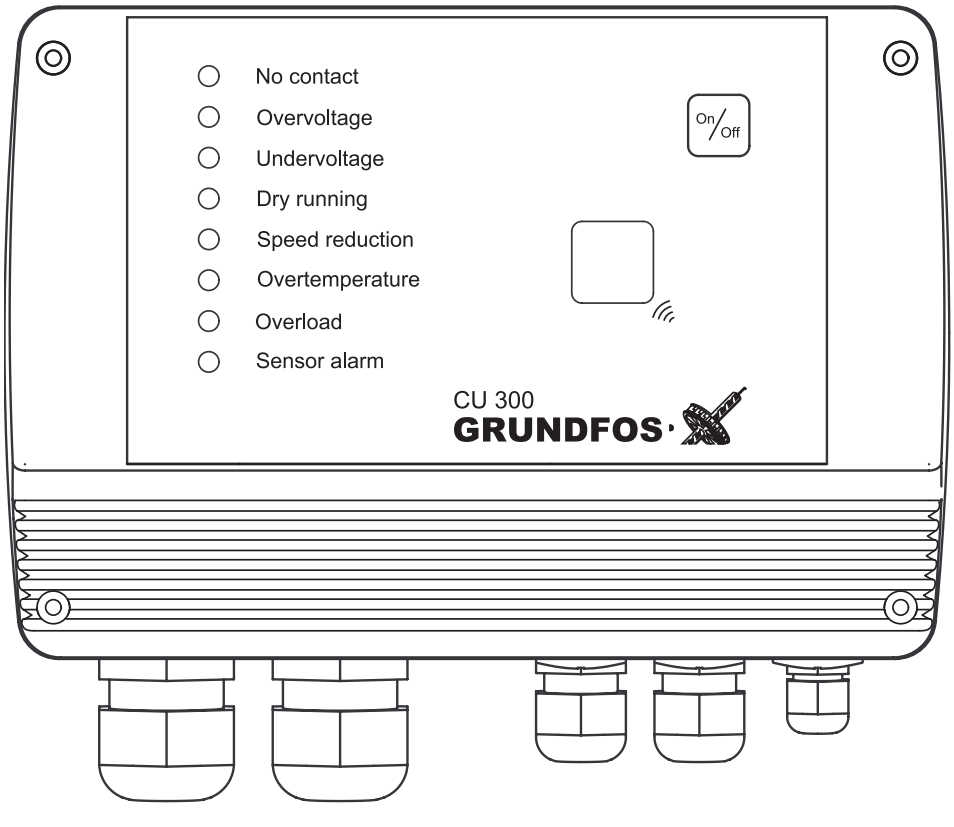
- Traditional insertion & magnetic meters
- Low-voltage solar powered option

For complete details on all products visit:
www.qedenv.com

QED®
Innovative Environmental Products

CU 300

GB Installation and operating instructions



TM01 2753 4198

GRUNDFOS®

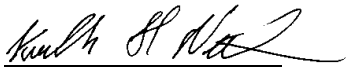
Declaration of Conformity

We **GRUNDFOS** declare under our sole responsibility that the product **CU 300**, to which this declaration relates, is in conformity with the Council Directives on the approximation of the laws of the EEC Member States relating to

— Electromagnetic compatibility (89/336/EEC).
Standards used: EN 55 014 and EN 55 014-2.

— Electrical equipment designed for use within certain voltage limits (73/23/EEC).
Standard used: EN 60 335-1.

Bjerringbro, 1st August 2000



Kenth Hvid Nielsen
Technical Manager

CONTENTS

		Page
1.	**General**	**5**
1.1	Expansion possibilities	5
1.2	On/Off button	5
2.	**CU 300 as an alarm unit**	**6**
2.1	Description	6
2.2	Installation	6
2.3	Location	6
2.4	Mounting the CU 300	6
2.5	Electrical connection	7
2.5.1	Mains supply	7
2.5.2	Pump supply	7
2.5.3	Alarm signal relay	7
2.5.4	Digital input	7
2.6	Description of dry-running protection	8
2.6.1	Function	8
2.7	Settings	8
2.7.1	Required R100 settings	8
2.8	Description of the dewatering function	8
2.8.1	Applications	8
2.8.2	Function	9
2.9	Settings	9
2.9.1	Required R100 settings	9
2.9.2	Run/stop times	9
3.	**CU 300 with constant pressure control - 0 to 6 bar**	**10**
3.1	Description	10
3.2	Function	10
3.3	Positioning the pressure sensor	11
3.4	System sizing	12
3.5	Installation	12
3.6	Location	12
3.7	Mounting the CU 300	12
3.8	Electrical connection	13
3.8.1	Mains supply	13
3.8.2	Pump supply	14
3.8.3	Alarm signal relay	14
3.9	Settings	14
3.9.1	Required R100 settings	14
3.10	Start-up	14
4.	**CU 300 with constant pressure control - 0 to 10 bar**	**15**
4.1	Description	15
4.2	Function	15
4.3	Positioning the pressure sensor	15
4.4	System sizing	16
4.5	Installation	16
4.6	Location	16
4.7	Mounting the CU 300	16
4.8	Electrical connection	17
4.8.1	Mains supply	17
4.8.2	Pump supply	18
4.8.3	Alarm signal relay	18
4.9	Settings	18
4.9.1	Required R100 settings	18
4.10	Start-up	18
5.	**CU 300 with constant pressure control - two-pump operation**	**19**
5.1	Description	19
5.2	Function	19
5.3	Positioning the pressure sensor	20
5.4	System sizing	20
5.5	Installation	20
5.6	Location	20
5.7	Mounting the CU 300	20
5.8	Electrical connection	21
5.8.1	Auxiliary relay	21
5.8.2	Mains supply	21
5.8.3	Pump supply	22
5.8.4	Alarm signal relay	22
5.8.5	Flow switch and pressure sensor	22
5.9	Settings	22
5.9.1	Required R100 settings	22
5.10	Start-up	22
6.	**CU 300 with sensors**	**23**
6.1	General	23
6.2	Sensor functioning	23
6.2.1	Alarm limits	23
6.2.2	Warning limits	23
6.2.3	Start/stop limits	23
6.3	Installation	24
6.4	Location	24
6.5	Mounting the CU 300	24
6.6	Electrical connection	25
6.6.1	Mains supply	25
6.6.2	Pump supply	26
6.6.3	Alarm signal relay	26
6.6.4	Sensors	26
6.7	Settings	26
6.7.1	Required R100 settings	26
7.	**CU 300 connected to potentiometer**	**27**
7.1	Description	27
7.2	Installation	27
7.3	Location	27
7.4	Mounting the CU 300	27
7.5	Electrical connection	28
7.5.1	Mains supply	28
7.5.2	Pump supply	29
7.5.3	Alarm signal relay	29
7.5.4	Potentiometer SPP 1	29
7.6	Settings	29
7.6.1	Required R100 settings	29

8. CU 300 connected to water meter 30
8.1 Description 30
8.2 Installation 30
8.3 Location 30
8.4 Mounting the CU 300 30
8.5 Electrical connection 31
8.5.1 Mains supply 31
8.5.2 Pump supply 31
8.5.3 Alarm signal relay 31
8.5.4 Water meter (pulse flow meter) 32
8.6 Settings 32
8.6.1 Required R100 settings 32

9. Constant water level 33
9.1 Description 33
9.2 Function 33
9.3 Installation 33
9.4 Location 33
9.5 Mounting the CU 300 33
9.6 Electrical connection 34
9.6.1 Mains supply 34
9.6.2 Pump supply 35
9.6.3 Alarm signal relay 35
9.6.4 Level sensor 35
9.7 Settings 35
9.7.1 Required R100 settings 35

10. CU 300 connected to RS-232, RS-485 36
10.1 Description 36
10.2 CU 300 connected to a PC directly 36
10.3 Installation 37
10.4 Location 37
10.5 Mounting the CU 300 37
10.6 Electrical connection 38
10.6.1 Mains supply 38
10.6.2 Pump supply 38
10.6.3 Alarm signal relay 39
10.6.4 RS-485 input 39
10.6.5 RS-232 input 39
10.6.6 Modem 39
10.6.7 PC Tool CU 300 39

11. Alarm functions 40
11.1 No contact 40
11.2 Overvoltage 40
11.3 Undervoltage 40
11.4 Dry running 41
11.5 Speed reduction 41
11.6 Overtemperature 41
11.7 Overload 42
11.8 Sensor alarm 42

12. CU 300 with R100 43
12.1 Menu OPERATION 47
12.1.1 Setpoint 47
12.1.2 Operating mode 47
12.1.3 Alarm 47
12.2 Menu STATUS 48
12.2.1 Operating mode 48
12.2.2 Actual setpoint and external setpoint 48
12.2.3 Temperature 49
12.2.4 Speed 49
12.2.5 Power input and power consumption 49
12.2.6 Operating hours and number of starts 49
12.2.7 Sensor 1 and sensor 2 49
12.2.8 Digital input 49
12.2.9 Accumulated flow and energy per m^3 50
12.3 Menu LIMITS 50
12.3.1 Sensor 1 50
12.3.2 Stop, sensor 1 50
12.3.3 Warning, sensor 1 50
12.3.4 Alarm, sensor 1 50
12.3.5 Sensor 2 51
12.3.6 Stop, sensor 2 51
12.3.7 Warning, sensor 2 51
12.3.8 Alarm, sensor 2 51
12.3.9 Stop type 51
12.3.10 Digital input 52
12.3.11 Accumulated flow 52
12.3.12 Warning, temperature 52
12.4 Menu INSTALLATION 52
12.4.1 Controller 52
12.4.2 External setpoint 53
12.4.3 Automatic restart 53
12.4.4 Start delay 54
12.4.5 Run/Stop 54
12.4.6 Dry-running stop 54
12.4.7 Dry-running protection 54
12.4.8 Maximum speed 54
12.4.9 Button on CU 300 55
12.4.10 Number 55

13. Technical data 56

14. Disposal 57

Before beginning installation procedures, these installation and operating instructions should be studied carefully. The installation and operation should also be in accordance with local regulations and accepted codes of good practice.

1. General

The control unit CU 300 is developed for the SQE submersible pumps.

The CU 300 covers the voltage range:

1 x 100-240 V, +6%/–10%, 50/60 Hz, PE.

The CU 300 enables:

- control of the pump on the basis of sensor signals,
- setting of operating parameters, and
- monitoring of operation and alarm indication, if any.

The CU 300 indicates the following alarms:

- No contact,
- Overvoltage,
- Undervoltage,
- Dry running,
- Speed reduction,
- Overtemperature,
- Overload,
- Sensor alarm.

The individual alarms are described in detail in section *11. Alarm functions*.

The CU 300 receives alarm signals from the motor for the following parameters:

- Dry running.
- Incipient pump/motor defect.
- Too high temperature in motor electronics.
- Supply failure.

As standard, the CU 300 incorporates an alarm signal relay.

1.1 Expansion possibilities

The CU 300 enables the use of:

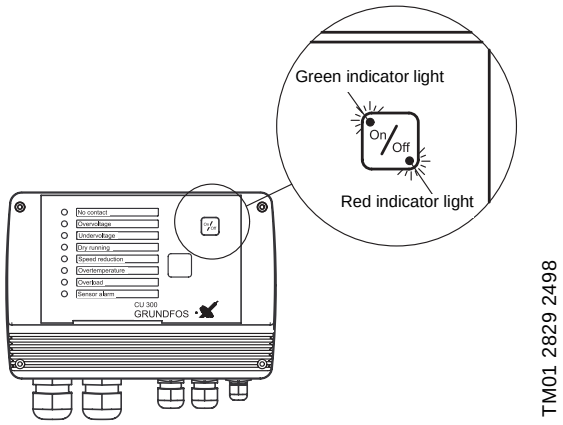
- **Remote control R100:**
  Wireless infra-red remote control by means of the R100 enables change of factory settings and monitoring of the installation by calling up actual operating data, e.g. speed, operating hours and power consumption.
- **External sensors:**
  Reception of data from external sensors and control according to the data received, e.g. flow rate, pressure, water level and conductivity.
- **External potentiometer SPP 1:**
  Manual speed control.

1.2 On/Off button

By means of the On/Off button on the CU 300, it is possible to

- start/stop the pump and
- reset possible alarms.

Fig. 1



TM01 2829 2498

The green and red indicator lights in the On/Off button indicate pump operating condition as follows:

Indication	Description
Green indicator light permanently on.	Pump is operating.
Green indicator light flashing.	Pump has been stopped by either: • a sensor, • an external on/off switch or • a stop command from the R100.
Red indicator light permanently on.	Pump has been stopped by means of the On/Off button.*
Red indicator light flashing.	The CU 300 is communicating with the R100.

* If the On/Off button has been used to stop the pump, this button must also be used for restarting.

If the On/Off button is pressed for minimum 5 seconds, the pump is started, irrespective of any active fault/alarm indications. When the On/Off button is released, the pump will stop.

2. CU 300 as an alarm unit

2.1 Description

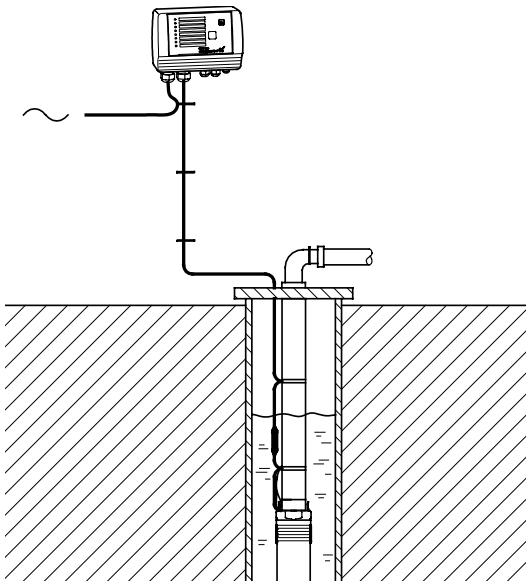
When the CU 300 is connected to an SQE pump, any alarm will be indicated by one of the eight red indicator lights on the CU 300.

The indications are based on signals from the motor and from sensors, if installed. The individual alarms are described in detail in section *11. Alarm functions*.

It is possible to connect an external alarm signal transmitter and an external on/off switch, see section *2.5 Electrical connection* concerning connection, etc.

Fig. 2 shows an example of an installation with the CU 300 as an alarm unit.

Fig. 2



TM01 3150 3498

The CU 300 functions as an alarm unit for the pump. Furthermore, it is possible to communicate with the pump via the remote control R100, see also section *12. CU 300 with R100*.

2.2 Installation

Before starting any work on the CU 300, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

2.3 Location

The CU 300 can be placed both indoors and outdoors. It must not be exposed to direct sunlight.

2.4 Mounting the CU 300

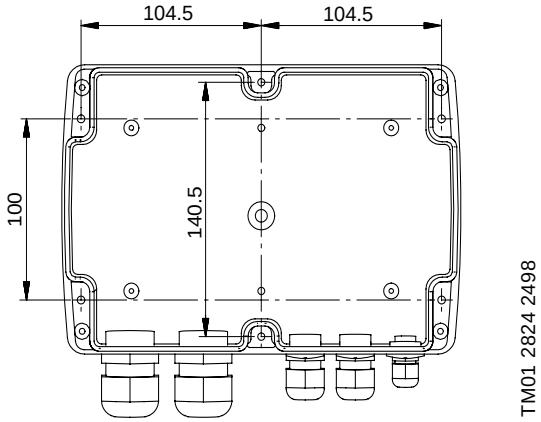
The CU 300 is designed for wall mounting.

The box has six mounting holes (ø4), see fig. 3 (dimensions stated in mm).

The CU 300 must be mounted:

- horizontally (see fig. 3) to allow condensed water, if any, to escape.
- on a plane surface to avoid deformation of the box.

Fig. 3



TM01 2824 2498

The CU 300 is supplied with a set of gaskets for the Pg screwed connections.

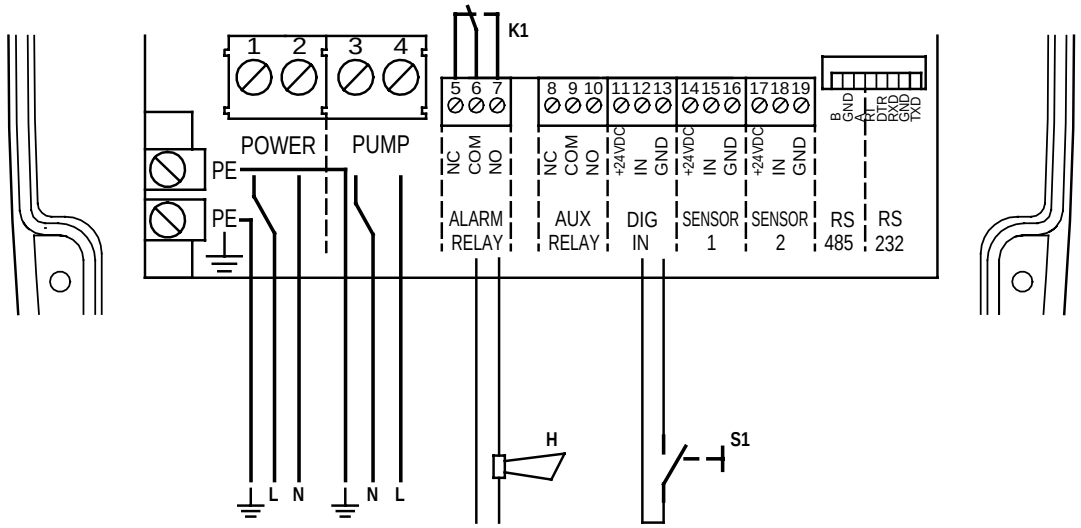
The gaskets are to be used for the connection of cables/wires to ensure tight connections (IP 55) and cable relief.

2.5 Electrical connection

Never make any connections in the CU 300 unit unless the electricity supply has been switched off. The CU 300 must be connected in accordance with the rules and standards in force for the application in question.

The supply voltage and frequency are marked on the nameplate. Make sure that the CU 300 is suitable for the electricity supply on which it will be used.

Fig. 4



TM01 3067 3398

Legend:

Pos.	Description
S1	On/off switch for start/stop of pump.
H	Alarm signal transmitter (optional).
K1	Internal alarm signal relay. Relay data: 250 VAC, 8 A, AC1.

2.5.1 Mains supply

POWER, terminals 1, 2 and PE:

Connect terminals 1 and 2 to the phase and neutral leads of the mains supply. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

Back-up fuse: Maximum 16 A.

Note: The leads of the mains supply must not be connected to terminals 3 and 4 (PUMP).

2.5.2 Pump supply

PUMP, terminals 3, 4 and PE:

Connect terminals 3 and 4 to the phase and neutral leads of the pump. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

2.5.3 Alarm signal relay

ALARM RELAY, terminals 5, 6 and 7:

Connect terminals 5, 6 and 7 to the internal alarm signal relay as follows:

- Terminal 5 NC (normally closed).
- Terminal 6 COM (common).
- Terminal 7 NO (normally open).

The relay is activated when the alarm and warning limits are exceeded.

Manual or automatic restarting can be selected in the R100 display *12.4.3 Automatic restart*.

Manual restarting is carried out by means of the On/Off button on the CU 300.

2.5.4 Digital input

DIG IN, terminals 11, 12 and 13:

In fig. 4, the digital input is used to start and stop the pump.

The function of the digital input can be selected by means of the R100 in display *12.3.10 Digital input*.

2.6 Description of dry-running protection

When the pump sucks air, the pump power input decreases.

If the pump power input falls below the dry-running power limit set in the R100 display *12.4.6 Dry-running stop*, the pump will stop and the CU 300 will indicate the dry-running alarm.

2.6.1 Function

The dry-running protection applies only if the motor speed lies within the “maximum speed” range (i.e. maximum speed less 1,000 min^{-1}), see fig. 5.

Normally, “maximum speed” is 10,700 min^{-1}. However, it can be reduced in the R100 display *12.4.8 Maximum speed*. The dry-running power limit set in display *12.4.6 Dry-running stop* must match the speed.

Changing the setpoint:

If the setpoint is changed by means of the R100 display *12.1.1 Setpoint* or *12.4.2 External setpoint*, the pump can be forced to run at a reduced speed in relation to the “maximum speed”. The dry-running protection will not protect the pump if the reduced speed lies outside the “maximum speed” range (i.e. maximum speed less 1,000 min^{-1}), see fig. 5.

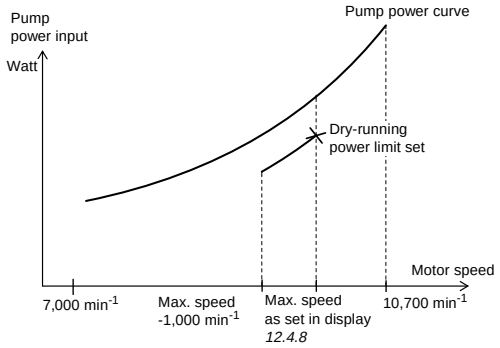
Constant pressure control:

In constant pressure control mode, the dry-running protection is active, as the motor will operate at “maximum speed” in connection with dry running.

Pump power input curve:

The curve shows the pump power input in relation to the pump speed.

Fig. 5



TM01 2689 2598

2.7 Settings

In the following section, the relevant R100 displays and settings are shown and described.

For a detailed description of the R100 displays, see section *12. CU 300 with R100*. Each individual display has a number which refers to the section in which it is described in detail.

2.7.1 Required R100 settings

If the maximum speed of the pump has been reduced by more than 1,000 min^{-1}, the dry-running stop value must be changed. In order to change the dry-running protection function, the following R100 settings must be made:

Display	R100 setting
12.4.7 Dry-running protection 	Set “Dry-running protection” to “Active”. **Note:** In certain installations, it may be necessary to disable the dry-running protection. This is done in this display. The disabling applies to the dry-running power limit set in display *12.4.6 Dry-running stop*. See fig. 5.
12.4.6 Dry-running stop 	Set the dry-running power limit, i.e. dry-running stop. See “Setting of dry-running power limit (dry-running stop)” below and section *13. Technical data*.

Setting of dry-running power limit (dry-running stop):

1. Start the pump against a closed discharge pipe.
2. Read the input power (P_1) in the R100 display *12.2.5 Power input and power consumption*.
3. Calculate the dry-running power limit, P_1 x 0.9 [W].
4. Set this value in the R100 display *12.4.6 Dry-running stop*.

Note: If the pump is worn, a new setting of the dry-running power limit may be required.

2.8 Description of the dewatering function

When the pump sucks air, the pump power input decreases.

If the pump power input falls below the dry-running power limit set in the R100 display *12.4.6 Dry-running stop*, the pump will stop.

During dewatering, the green indicator light in the On/Off button on the CU 300 is flashing to indicate that the pump has stopped.

2.8.1 Applications

The dewatering function can be used in applications where the pump often runs dry, e.g.:

- in boreholes with a low yield.
- in boreholes and building sites where the water table should be lowered.

2.8.2 Function

The dewatering function works as follows:

1. The pump is operating.
2. The pump sucks air due to a drop in the water level.
3. The load decreases, and consequently the pump power input does as well.
4. The pump stops when the power input falls to the dry-running power limit set in the R100 display *12.4.6 Dry-running stop* in the INSTALLATION menu.
   Note: The length of the stop time depends on the length of the run time according to a setting made in the R100 display *12.4.5 Run/Stop* in the INSTALLATION menu.

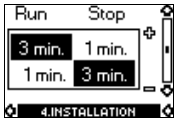
2.9 Settings

In the following section, the relevant R100 displays and settings are shown and described.

For a detailed description of the R100 displays, see section *12. CU 300 with R100*. Each individual display has a number which refers to the section in which it is described in detail.

2.9.1 Required R100 settings

In order to activate the dewatering function, the following R100 settings must be made:

Display	R100 setting
12.4.7 Dry-running protection 	Set “Dry-running protection” to “Active”.
12.4.6 Dry-running stop 	Set the dry-running power limit, i.e. dry-running stop. See “Setting of dry-running power limit (dry-running stop)” below.
12.4.5 Run/Stop 	Set the relation between run and stop times. **Indication of operation:** The dry-running alarm indication on the CU 300 is automatically disabled, when the setting is made in display *12.4.5 Run/Stop*. To disable the dewatering function and return to dry-running protection, simply set the Run/Stop fields to “–” (not active).

Setting of dry-running power limit (dry-running stop):

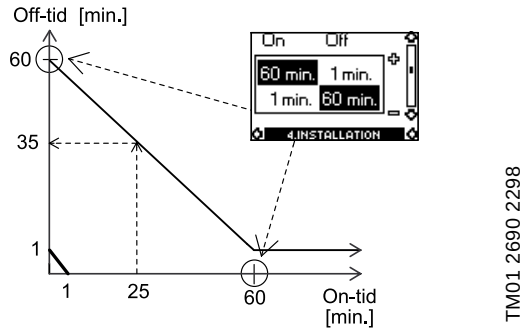
1. Start the pump against a closed discharge pipe.
2. Read the input power (P_1) in the R100 display *12.2.5 Power input and power consumption*.
3. Calculate the dry-running power limit, P_1 x 0.9 [W].
4. Set this value in the R100 display *12.4.6 Dry-running stop*.

2.9.2 Run/stop times

The dewatering function means that there is a dependence between the period of time during which the pump is running, the run time, and the period of time during which the pump is stopped, the stop time.

Fig. 6 shows an example of run/stop times set in the R100 display *12.4.5 Run/Stop*.

Fig. 6



Explanation:

The run and stop times were set to 60 min. each. The pump has been running for 25 min. when dry running occurs. The pump will be stopped for 35 min. If the pump had been running for e.g. 2 hours (120 min.), the stop time would be 1 min.

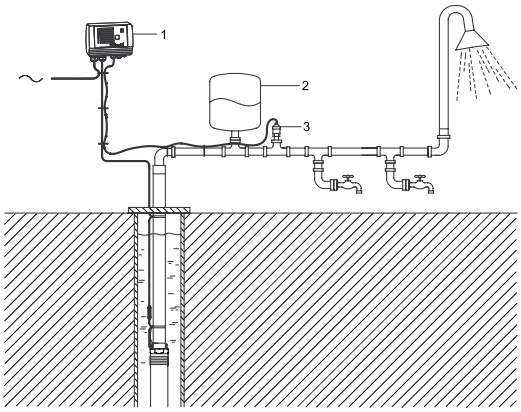
3. CU 300 with constant pressure control - 0 to 6 bar

3.1 Description

Using constant pressure control enables automatic adjustment of the pump performance according to consumption. The system maintains a constant pressure within the maximum pump performance in spite of a varying water consumption.

Fig. 7 shows an example of an installation with constant pressure control within the range from 0 to 6 bar.

Fig. 7



TM01 9649 2400

Pos.	Description
1	CU 300.
2	Diaphragm tank. Absorbs pressure variations.
3	Pressure sensor. The required pressure is set using the R100.

3.2 Function

The pressure is registered by means of the pressure sensor, which transmits a signal to the CU 300. The CU 300 adjusts the pump performance accordingly by changing the pump speed.

Mains borne signalling:

The communication between the CU 300 and the pump is effected via the power supply cable.

This communication principle is called mains borne signalling (or power line communication). Using this principle means that no additional cables to the pump are required.

The communication of data is effected by means of a high-frequency signal transmitted to the power supply cable and led into the electronics unit by means of signal coils incorporated in the motor and the CU 300 respectively.

When does the pump start?

The pump starts as a consequence of...

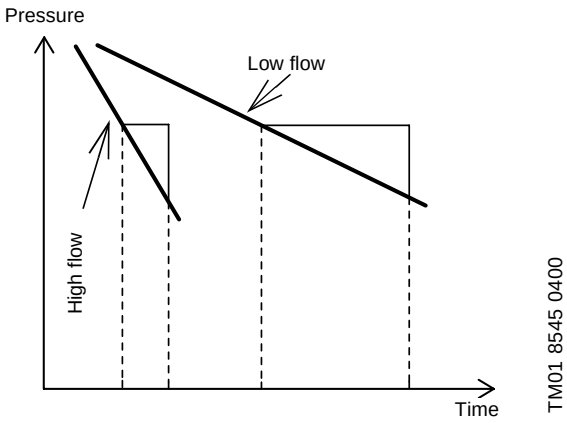
- a high flow or
- a low pressure or
- a combination of both.

To ensure that the pump is started when water is consumed, a flow detection is required. The flow is detected via pressure changes in the system. When water is consumed, the pressure will drop accordingly depending on the size of the diaphragm tank and the water flow:

- at a low flow, the pressure will drop slowly.
- at a high flow, the pressure will drop quickly.

See fig. 8.

Fig. 8



TM01 8545 0400

Note: When the pressure is dropping 0.1 bar/s or faster, the pump will start immediately.

If a diaphragm tank of 8 litres is used, the pump will start at a flow rate of approx. 0.18 m³/h.

Note: If a larger tank is used, the flow must be higher before the pump starts.

Consumption up to 0.18 m³/h:

The pump will start when the pressure has dropped to 0.5 bar below the pressure setting.

The pump will run until the pressure is 0.5 bar above the pressure set.

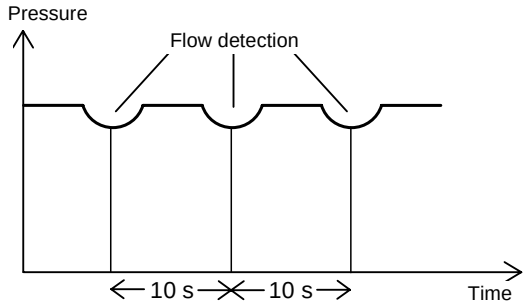
Flow detection:

During pump operation, i.e. when water is consumed, the CU 300 will adjust the pump speed to maintain a constant pressure. In order to stop the pump when no water is consumed, the CU 300 performs flow detection every 10 seconds.

The pump speed is reduced until a small pressure drop is registered. This pressure drop indicates that water is consumed and the pump speed is resumed, see fig. 9.

If the pump speed can be reduced without any pressure drop being registered, this indicates that no water is consumed. The diaphragm tank will be filled with water and the pump will be stopped.

Fig. 9



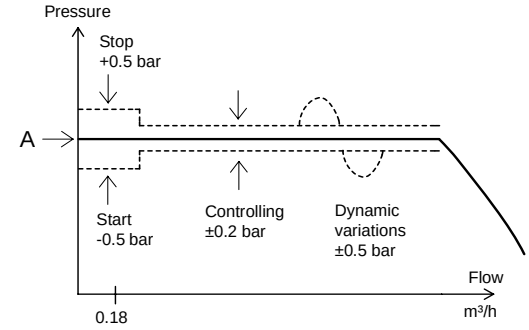
System limits:

Even though the CU 300 is controlling the pressure within ±0.2 bar, bigger pressure variations may occur in the system.

If the consumption is suddenly changed, e.g. if a tap is opened, the water must start flowing before the pressure can be made constant again. Such dynamic variations depend on the pipework, but, typically, they will lie between 0.5 and 1 bar.

If the desired consumption is higher than the quantity the pump is able to deliver at the desired pressure, the pressure follows the pump curve as illustrated in fig. 10.

Fig. 10

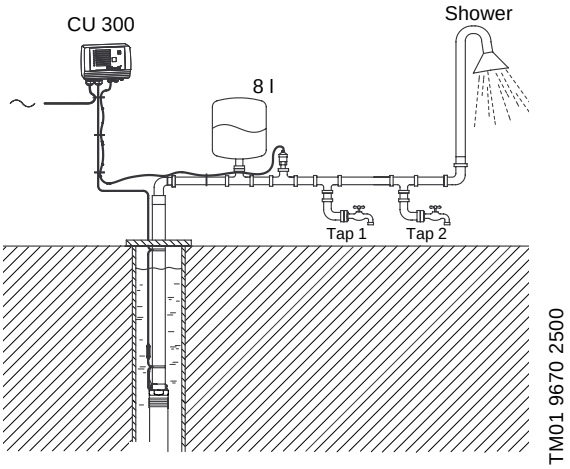


A = Pressure set

3.3 Positioning the pressure sensor

Pressure loss often causes inconvenience to the user. The CU 300 keeps the pressure constant in the place where the pressure sensor is positioned, see fig. 11.

Fig. 11



In fig. 11, tap 1 is placed close to the pressure sensor. Therefore, the pressure will be kept nearly constant at tap 1, as the friction loss is small. At the shower and tap 2, the friction loss is bigger. This, of course, depends on the piping. However, old and furred-up piping may cause inconvenience due to friction loss.

Therefore, it is recommended that the pressure sensor be positioned as close to the places of consumption as possible.

3.4 System sizing

The installation must be designed for the maximum pump pressure.

In normal installations with the CU 300 and an SQE pump set to constant pressure control, the required tank size is 8 litres. Bigger tanks can be used without causing any problems.

3.5 Installation

Before starting any work on the CU 300, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

3.6 Location

The CU 300 can be placed both indoors and outdoors. It must not be exposed to direct sunlight.

3.7 Mounting the CU 300

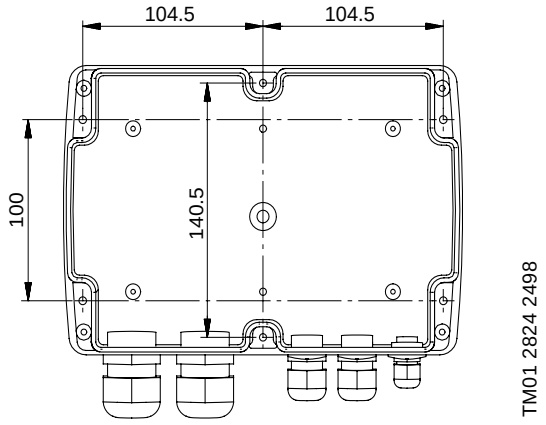
The CU 300 is designed for wall mounting.

The box has six mounting holes (ø4), see fig. 12 (dimensions stated in mm).

The CU 300 must be mounted:

- horizontally (see fig. 12) to allow condensed water, if any, to escape.
- on a plane surface to avoid deformation of the box.

Fig. 12



The CU 300 is supplied with a set of gaskets for the Pg screwed connections.

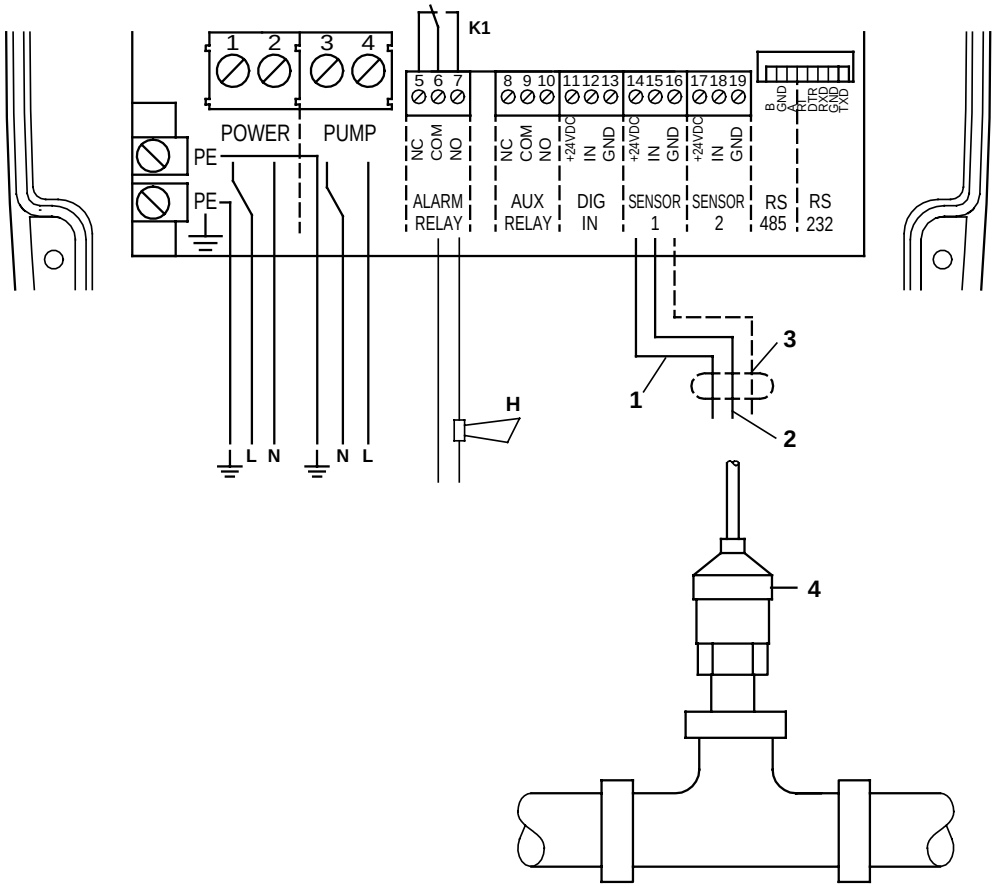
The gaskets are to be used for the connection of cables/wires to ensure tight connections (IP 55) and cable relief.

3.8 Electrical connection

Never make any connections in the CU 300 unit unless the electricity supply has been switched off. The CU 300 must be connected in accordance with the rules and standards in force for the application in question.

The supply voltage and frequency are marked on the nameplate. Make sure that the CU 300 is suitable for the electricity supply on which it will be used.

Fig. 13



TM01 9650 2400

Legend:

Pos.	Description
1	Pressure sensor, brown lead, terminal 14.
2	Pressure sensor, black lead, terminal 15.
3	Pressure sensor, screen, terminal GND.
4	Pressure sensor. Must be connected to sensor input 1.
H	Alarm signal transmitter (optional).
K1	Internal alarm signal relay. Relay data: 250 VAC, 8 A, AC1.

3.8.1 Mains supply

POWER, terminals 1, 2 and PE:

Connect terminals 1 and 2 to the phase and neutral leads of the mains supply. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

Back-up fuse: Maximum 16 A.

Note: The leads of the mains supply must not be connected to terminals 3 and 4 (PUMP).

3.8.2 Pump supply

PUMP, terminals 3, 4 and PE:

Connect terminals 3 and 4 to the phase and neutral leads of the pump. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

3.8.3 Alarm signal relay

ALARM RELAY, terminals 5, 6 and 7:

Connect terminals 5, 6 and 7 to the internal alarm signal relay as follows:

- Terminal 5 NC (normally closed).
- Terminal 6 COM (common).
- Terminal 7 NO (normally open).

The relay operates when the alarm and warning limits are exceeded.

Manual or automatic restarting can be selected in the R100 display *12.4.3 Automatic restart*.

Manual restarting is carried out by means of the On/Off button on the CU 300.

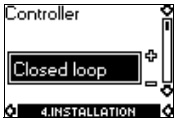
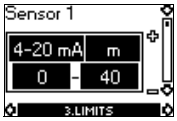
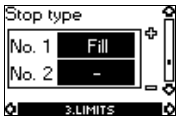
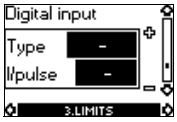
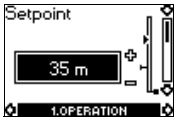
3.9 Settings

In the following section, the relevant R100 displays and settings are shown and described.

For a detailed description of the R100 displays, see section *12. CU 300 with R100*. Each individual display has a number which refers to the section in which it is described in detail.

3.9.1 Required R100 settings

The following R100 settings must be made:

Display	R100 setting
12.4.1 Controller 	Select “Closed loop”.
12.3.1 Sensor 1 	Set the sensor type. **Example:** • Sensor output signal (4-20 mA), • setting range unit (m), • setting range - head (0-40 m).
12.3.9 Stop type 	Set the stop type. • Sensor 1: “Fill”. • Sensor 2: “–” (not active).
12.3.10 Digital input 	Set • Type to “–” (not active) and • l/pulse to “–” (not active).
12.1.1 Setpoint 	Set the desired head (m). **Example:** 35 m. **Rule:** The maximum setting of the setpoint corresponds to the maximum value set in display *12.3.1 Sensor 1* less 5 m. In this case, 40 less 5 = 35 m.

3.10 Start-up

Prior to start-up, the precharge pressure of the diaphragm tank must be set to 70% of the setpoint set in the R100 display *12.1.1 Setpoint*.

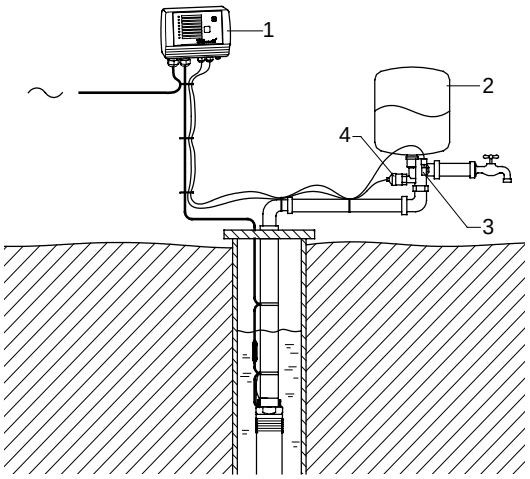
4. CU 300 with constant pressure control - 0 to 10 bar

4.1 Description

Using constant pressure control enables automatic adjustment of the pump performance according to consumption. The system maintains a constant pressure within the maximum pump performance in spite of a varying water consumption.

Fig. 14 shows an example of an installation with constant pressure control within the range from 0 to 10 bar.

Fig. 14



TM01 2653 2198

Pos.	Description
1	CU 300.
2	Diaphragm tank. Absorbs pressure variations.
3	Flow switch. The pump starts at once when water is consumed at the taps.
4	Pressure sensor. The required pressure is set using the R100.

4.2 Function

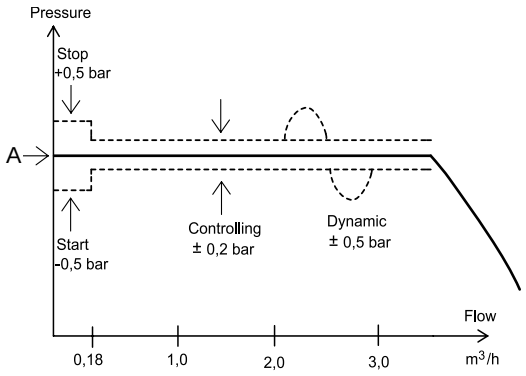
The pressure is registered by means of the pressure sensor and transmitted to the CU 300. The CU 300 adjusts the pump performance accordingly. To ensure that the pump is started when water is consumed, a flow switch must be included in the system.

The required pressure (setpoint) is set in the R100 display *12.1.1 Setpoint*.

- **Consumption up to 0.18 m³/h.**
  The flow switch contact is open.
  The pump starts when the pressure is equal to the setpoint less 0.5 bar. The pump will fill the tank and stop when the pressure is equal to the setpoint plus 0.5 bar. Consequently, the pump runs on/off operation.
- **Consumption above 0.18 m³/h.**
  The flow switch contact is closed.
  The pump starts when the flow switch contact closes and the speed control ensures that the pressure is kept constant. If the flow is below 0.18 m³/h and the flow switch contact is opened, the tank is filled to a pressure equal to the setpoint plus 0.5 bar. When this pressure is reached, the pump stops. Stopping is a combination of the flow switch contact opening and the pressure being equal to the setpoint plus 0.5 bar.

If the flow is larger than the quantity the pump is able to deliver at the desired pressure, the pressure follows the pump curve as illustrated in fig. 15.

Fig. 15



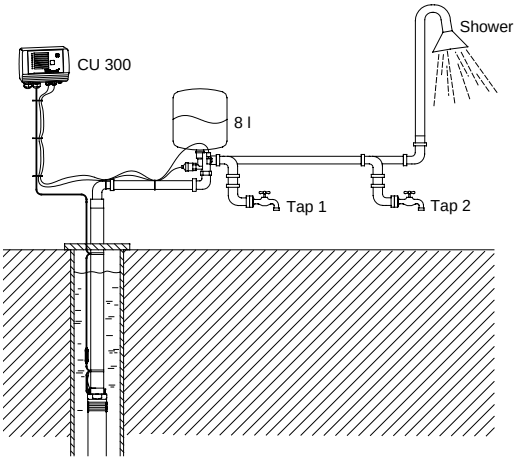
TM01 2833 2598

A = Required pressure

4.3 Positioning the pressure sensor

Pressure loss often causes inconvenience to the user. The CU 300 keeps the pressure constant in the place where the pressure sensor is positioned, see fig. 16.

Fig. 16



TM01 2834 2598

In fig. 16, tap 1 is placed close to the pressure sensor. Therefore, the pressure will be kept nearly constant at tap 1, as the friction loss is small. At the shower and tap 2, the friction loss is bigger. This, of course, depends on the piping. However, old and furred-up piping may cause inconvenience due to friction loss.

Therefore, it is recommended that the pressure sensor be positioned as close to the places of consumption as possible.

4.4 System sizing

The installation must be designed for the maximum pump pressure.

In normal installations with the CU 300 and an SQE pump set to constant pressure control, the required tank size is 8 litres. Bigger tanks can be used without causing any problems.

4.5 Installation

Before starting any work on the CU 300, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

4.6 Location

The CU 300 can be placed both indoors and outdoors. It must not be exposed to direct sunlight.

4.7 Mounting the CU 300

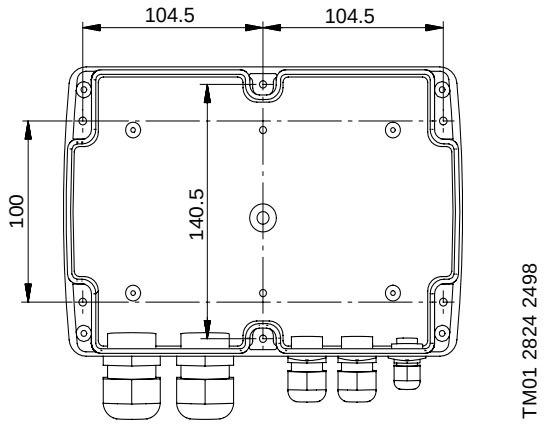
The CU 300 is designed for wall mounting.

The box has six mounting holes (ø4), see fig. 17 (dimensions stated in mm).

The CU 300 must be mounted:

- horizontally (see fig. 17) to allow condensed water, if any, to escape.
- on a plane surface to avoid deformation of the box.

Fig. 17



The CU 300 is supplied with a set of gaskets for the Pg screwed connections.

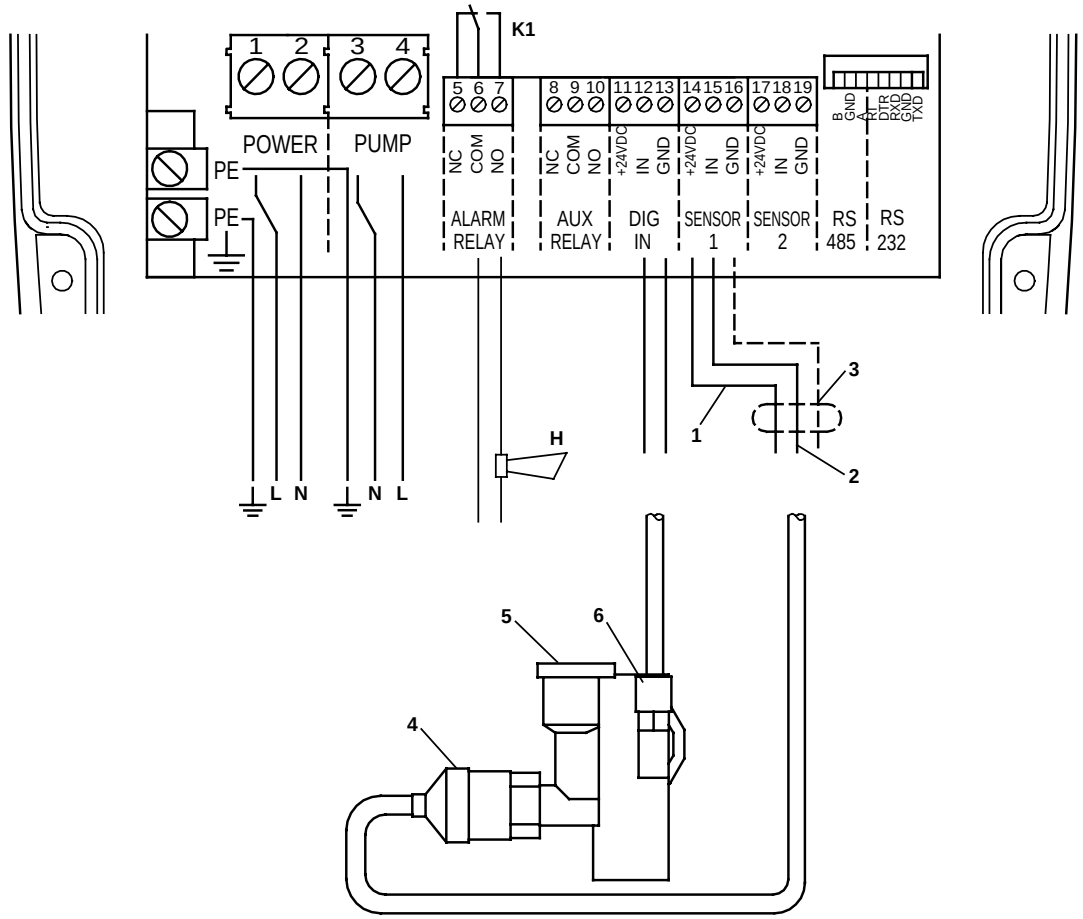
The gaskets are to be used for the connection of cables/wires to ensure tight connections (IP 55) and cable relief.

4.8 Electrical connection

Never make any connections in the CU 300 unit unless the electricity supply has been switched off. The CU 300 must be connected in accordance with the rules and standards in force for the application in question.

The supply voltage and frequency are marked on the nameplate. Make sure that the CU 300 is suitable for the electricity supply on which it will be used.

Fig. 18



TM01 3089 3398

Legend:

Pos.	Description
1	Pressure sensor, brown lead, terminal 14.
2	Pressure sensor, black lead, terminal 15.
3	Pressure sensor, screen, terminal GND.
4	Pressure sensor. Must be connected to sensor input 1.
5	Diaphragm tank connection.
6	Flow switch. Must be connected to the digital input, terminals 12 and 13. Cannot be connected wrongly.
H	Alarm signal transmitter (optional).
K1	Internal alarm signal relay. Relay data: 250 VAC, 8 A, AC1.

4.8.1 Mains supply

POWER, terminals 1, 2 and PE:

Connect terminals 1 and 2 to the phase and neutral leads of the mains supply. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

Back-up fuse: Maximum 16 A.

Note: The leads of the mains supply must not be connected to terminals 3 and 4 (PUMP).

4.8.2 Pump supply

PUMP, terminals 3, 4 and PE:

Connect terminals 3 and 4 to the phase and neutral leads of the pump. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

4.8.3 Alarm signal relay

ALARM RELAY, terminals 5, 6 and 7:

Connect terminals 5, 6 and 7 to the internal alarm signal relay as follows:

- Terminal 5 NC (normally closed).
- Terminal 6 COM (common).
- Terminal 7 NO (normally open).

The relay operates when the alarm and warning limits are exceeded.

Manual or automatic restarting can be selected in the R100 display *12.4.3 Automatic restart*.

Manual restarting is carried out by means of the On/Off button on the CU 300.

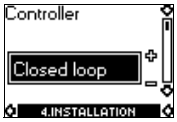
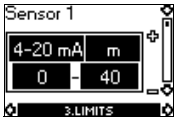
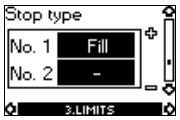
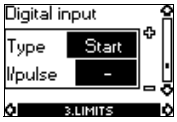
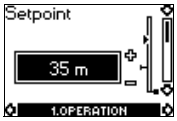
4.9 Settings

In the following section, the relevant R100 displays and settings are shown and described.

For a detailed description of the R100 displays, see section *12. CU 300 with R100*. Each individual display has a number which refers to the section in which it is described in detail.

4.9.1 Required R100 settings

The following R100 settings must be made:

Display	R100 setting
12.4.1 Controller 	Select “Closed loop”.
12.3.1 Sensor 1 	Set the sensor type. **Example:** • Sensor output signal (4-20 mA), • setting range unit (m), • setting range - head (0-40 m).
12.3.9 Stop type 	Set the stop type. • Sensor 1: “Fill”. • Sensor 2: “–” (not active).
12.3.10 Digital input 	Set • Type to “Start” and • I/pulse to “–” (not active).
12.1.1 Setpoint 	Set the desired head (m). **Example:** 35 m. **Rule:** The maximum setting of the setpoint corresponds to the maximum value set in display *12.3.1 Sensor 1* less 5 m. In this case, 40 less 5 = 35 m.

4.10 Start-up

Prior to start-up, the precharge pressure of the diaphragm tank must be set to 70% of the setpoint set in the R100 display *12.1.1 Setpoint*.

5. CU 300 with constant pressure control - two-pump operation

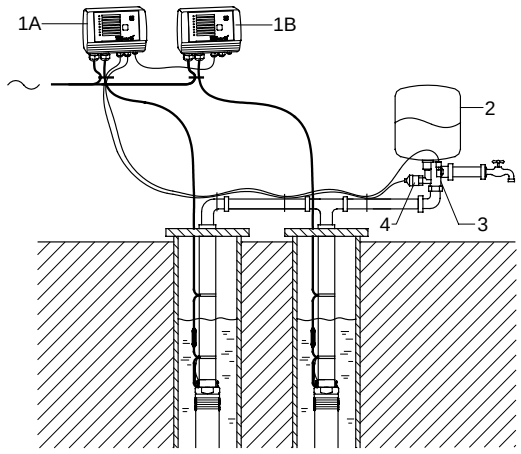
5.1 Description

Using constant pressure control in connection with two-pump operation enables automatic adjustment of the pump performance according to the consumption in systems where a high flow is required. The system maintains a constant pressure within the maximum pump performance in spite of a varying water consumption.

Note: During two-pump operation, the two pumps **must** have the same nominal flow, e.g. two SQE 2.

Fig. 19 shows an example of a two-pump installation with constant pressure control.

Fig. 19



Pos.	Description
1A, 1B	1A = CU 300 (master), 1B = CU 300 (slave).
2	Diaphragm tank, minimum 24 litres. Absorbs pressure variations.
3	Flow switch. The pump starts at once when water is consumed at the taps.
4	Pressure sensor. The required pressure is set using the R100.

5.2 Function

The pressure is registered by means of the pressure sensor and transmitted to the CU 300 (master). The CU 300 adjusts the pump speed to ensure that the pressure is kept constant. To ensure that the pump connected to the CU 300 (master) is started when water is consumed, a flow switch must be included in the system.

Set the CU 300 (master) to the desired pressure (setpoint) in the R100 display *12.1.1 Setpoint*.

- **Consumption up to 0.18 m³/h.**
  The flow switch contact is open.
  The pump connected to the CU 300 (master) starts when the pressure is equal to the setpoint less 0.5 bar. The pump will fill the tank and stop when the pressure is equal to the setpoint plus 0.5 bar. Consequently, the pump runs on/off operation.
- **Consumption above 0.18 m³/h.**
  The flow switch contact is closed.
  The pump connected to the CU 300 (master) starts when the flow switch contact closes and the speed control ensures that the pressure is kept constant.
  If the flow is lower than 0.18 m³/h and the flow switch contact is opened, the tank is filled to a pressure equal to the setpoint plus 0.5 bar. When this pressure is reached, the pump stops. Stopping is a combination of the flow switch contact opening and the pressure being equal to the setpoint plus 0.5 bar.
  If the consumption exceeds the quantity the pump connected to the CU 300 (master) is able to deliver, the pressure in the diaphragm tank will fall.

The pump connected to the CU 300 (slave) will be started in the two following situations:

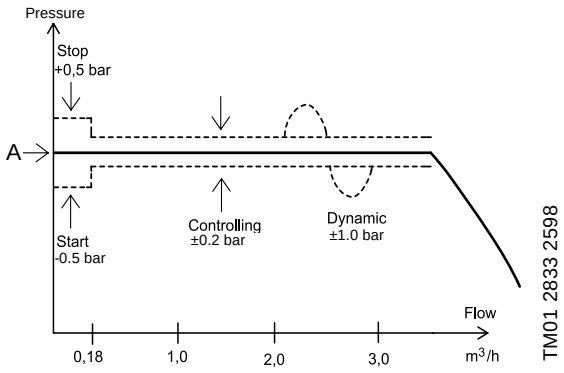
1. If the pressure in the diaphragm tank falls to 1 bar below the setpoint or
2. if the pump connected to the CU 300 (master) has been operating at maximum performance for more than 5 seconds and the water requirement has increased.

The pump connected to the CU 300 (slave) will be stopped in the three following situations:

1. If the system pressure is 1 bar higher than the setpoint or
2. if the pump connected to the CU 300 (master) has been operating at minimum performance for more than 5 seconds and the water requirement has fallen or
3. if the flow switch indicates “no flow" and the system pressure is 0.5 bar higher than the setpoint.

If the flow is larger than the quantity the pumps are able to deliver at the desired pressure, the pressure follows the pump curve as illustrated in fig. 20.

Fig. 20



A = Required pressure

5.3 Positioning the pressure sensor

See section *4.3 Positioning the pressure sensor*.

5.4 System sizing

The installation must be designed for the maximum pump pressure.

In two-pump installations set to constant pressure control, the required tank size is 24 litres. Bigger tanks can be used without causing any problems.

5.5 Installation

Before starting any work on the CU 300, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

5.6 Location

The CU 300 can be placed both indoors and outdoors. It must not be exposed to direct sunlight.

5.7 Mounting the CU 300

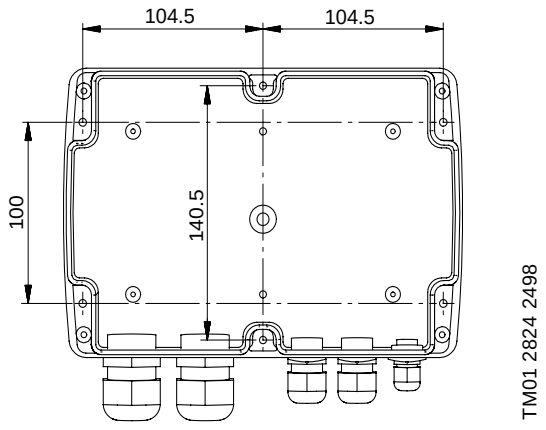
The CU 300 is designed for wall mounting.

The box has six mounting holes (ø4), see fig. 21 (dimensions stated in mm).

The CU 300 must be mounted:

- horizontally (see fig. 21) to allow condensed water, if any, to escape.
- on a plane surface to avoid deformation of the box.

Fig. 21



The CU 300 is supplied with a set of gaskets for the Pg screwed connections.

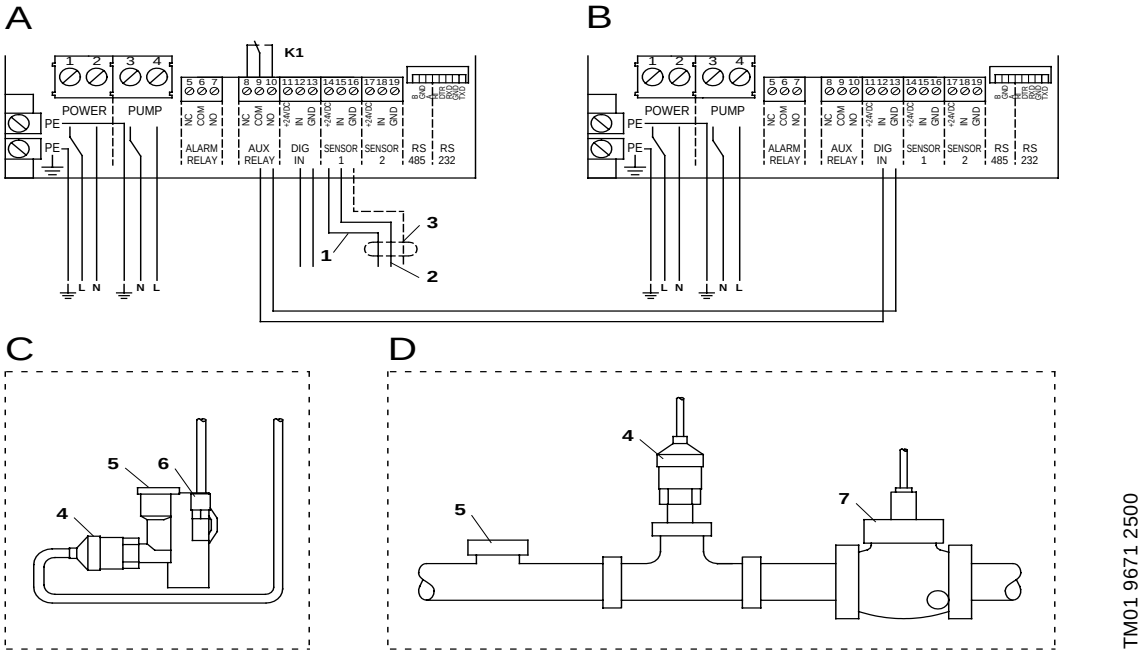
The gaskets are to be used for the connection of cables/wires to ensure tight connections (IP 55) and cable relief.

5.8 Electrical connection

Never make any connections in the CU 300 unit unless the electricity supply has been switched off. The CU 300 must be connected in accordance with the rules and standards in force for the application in question.

The supply voltage and frequency are marked on the nameplate. Make sure that the CU 300 is suitable for the electricity supply on which it will be used.

Fig. 22



Legend:

Pos.	Description
A	CU 300 (master).
B	CU 300 (slave).
C	Installation for Q < 7 m³/h.
D	Installation for Q > 7 m³/h.
1	Pressure sensor, brown lead, terminal 14.
2	Pressure sensor, black lead, terminal 15.
3	Pressure sensor, screen, terminal GND.
4	Pressure sensor. Must be connected to sensor input 1.
5	Diaphragm tank connection.
6	Flow switch (Q < 7 m³/h). Must be connected to the digital input, terminals 12 and 13. Cannot be connected wrongly.
7	Flow switch (Q > 7 m³/h). Must be connected to the digital input, terminals 12 and 13. Cannot be connected wrongly.
K1	Internal alarm signal relay. Relay data: 250 VAC, 8 A, AC1.

5.8.1 Auxiliary relay

Connect the CU 300 (master) to the CU 300 (slave) as follows:

Connections	
CU 300 (master)	**CU 300 (slave)**
Terminal 9 (COM)	Terminal 12 (IN)
Terminal 10 (NO)	Terminal 13 (GND)

See fig. 22.

5.8.2 Mains supply

POWER, terminals 1, 2 and PE:

Connect terminals 1 and 2 to the phase and neutral leads of the mains supply, see fig. 18. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

Back-up fuse: Maximum 16 A.

Note: The leads of the mains supply must not be connected to terminals 3 and 4 (PUMP).

5.8.3 Pump supply

PUMP, terminals 3, 4 and PE:

Connect terminals 3 and 4 to the phase and neutral leads of the pump, see fig. 18. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

5.8.4 Alarm signal relay

ALARM RELAY, terminals 5, 6 and 7:

Connect terminals 5, 6 and 7 to the internal alarm signal relay as follows:

- Terminal 5 NC (normally closed).
- Terminal 6 COM (common).
- Terminal 7 NO (normally open).

The relay operates when the alarm and warning limits are exceeded.

Manual or automatic restarting can be selected in the R100 display *12.4.3 Automatic restart*.

Manual restarting is carried out by means of the On/Off button on the CU 300.

5.8.5 Flow switch and pressure sensor

Connect the flow switch and the pressure sensor to the CU 300 (A = master) as illustrated in fig. 22.

Flow switch	
Pump type	**Product number**
SQE 1	96 03 73 32
SQE 2, SQE 3, SQE 5, SQE 7	96 03 75 59

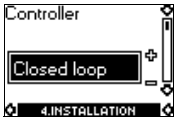
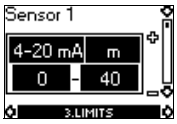
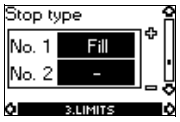
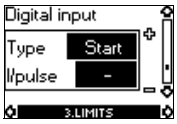
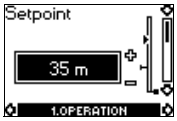
5.9 Settings

In the following section, the relevant R100 displays and settings are shown and described.

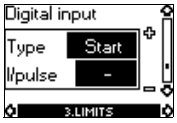
For a detailed description of the R100 displays, see section *12. CU 300 with R100*. Each individual display has a number which refers to the section in which it is described in detail.

5.9.1 Required R100 settings

The following R100 settings must be made on the CU 300 (master):

Display	R100 setting
12.4.1 Controller 	Select “Closed loop”.
12.3.1 Sensor 1 	Set the sensor type. **Example:** • Sensor output signal (4-20 mA), • setting range unit (m), • setting range - head (0-40 m).
12.3.9 Stop type 	Set the stop type. • Sensor 1: “Fill”. • Sensor 2: “–” (not active).
12.3.10 Digital input 	Set • Type to “Start” and • l/pulse to “–” (not active).
12.1.1 Setpoint 	Set the desired head (m). **Example:** 35 m. **Rule:** The maximum setting of the setpoint corresponds to the maximum value set in display *12.3.1 Sensor 1* less 5 m. In this case, 40 less 5 = 35 m.

The following R100 setting must be made on the CU 300 (slave):

Display	R100 setting
12.3.10 Digital input 	Set • Type to “Start” and • l/pulse to “–” (not active).

5.10 Start-up

Prior to start-up, the precharge pressure of the diaphragm tank must be set to 70% of the setpoint set in the R100 display *12.1.1 Setpoint*.

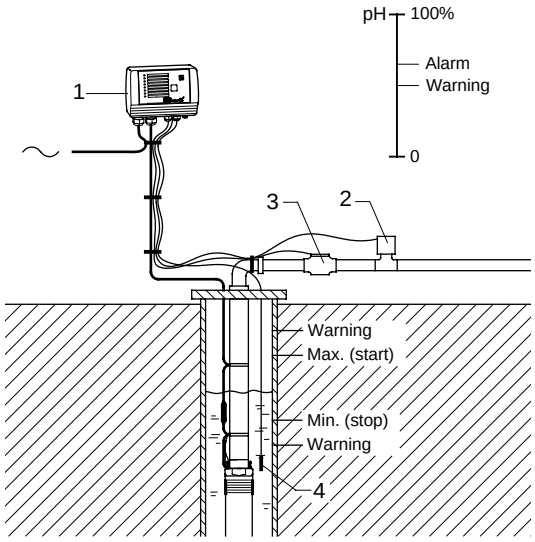
6. CU 300 with sensors

6.1 General

The CU 300 can be used in systems with 1 to 3 sensors connected.

Fig. 23 shows an example of an installation incorporating sensors.

Fig. 23

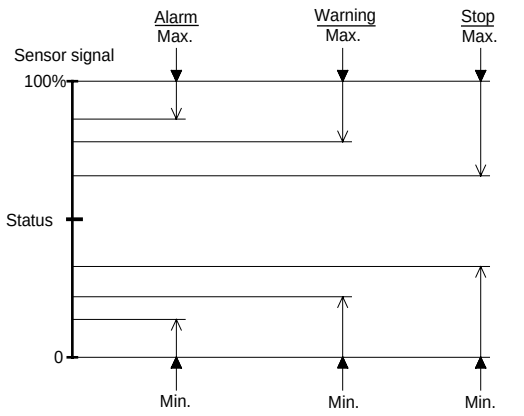


Pos.	Description
1	CU 300.
2	pH sensor. Detects the water quality.
3	Pulse flow meter. Detects the water quantity.
4	Level sensor.

The alarm, warning and stop limits can be set individually for all sensors connected. The limit settings do not influence each other, and each setting offers its own functioning.

Fig. 24 shows a schematic presentation of the setting of maximum and minimum limits for alarm, warning and stop respectively.

Fig. 24



It is necessary to set only the limits applying to the sensor selected. Where "–" is selected, the setting is automatically "not active".
These settings are made in the R100 displays *12.3.1* to *12.3.9*.

6.2 Sensor functioning

6.2.1 Alarm limits

When an alarm limit is exceeded, the following takes place:

1. The pump is stopped.
2. The alarm signal relay operates.
3. The "Sensor alarm" indicator light on the CU 300 is on.
4. The alarm appears in the R100 display *12.1.3 Alarm*.

If the pump has stopped already or if the alarm signal relay has operated, this condition is maintained.

6.2.2 Warning limits

When a warning limit is exceeded, the following takes place:

1. The alarm signal relay operates.
2. Pump operation is continued. No "Sensor alarm" indication.
3. The warning appears in the R100 display *12.1.3 Alarm*.

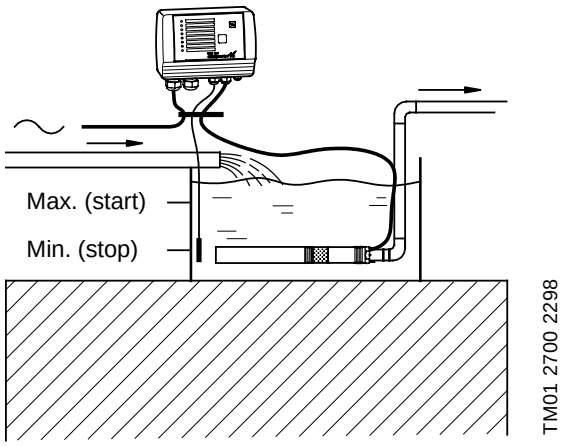
6.2.3 Start/stop limits

Start/stop limits should be used in connection with the emptying/filling of e.g. water tanks.

The start/stop function depends on the application, i.e. emptying or filling.

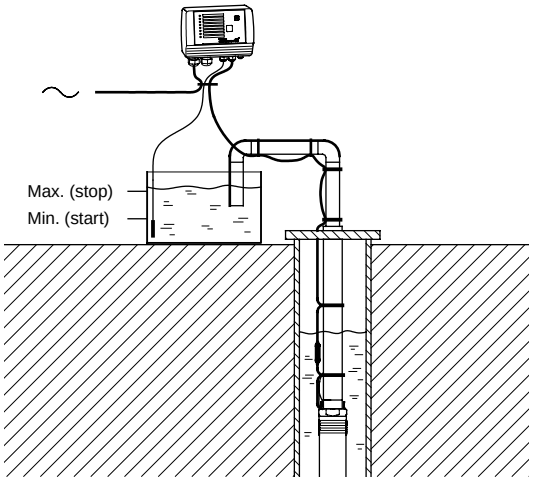
- Emptying means that the pump must start at a given maximum water level and stop at a given minimum water level, see fig. 25.

Fig. 25



- Filling means that the pump must start at a given minimum water level and stop at a given maximum water level, see fig. 26.

Fig. 26



TM01 2699 2298

6.3 Installation

Before starting any work on the CU 300, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

6.4 Location

The CU 300 can be placed both indoors and outdoors. It must not be exposed to direct sunlight.

6.5 Mounting the CU 300

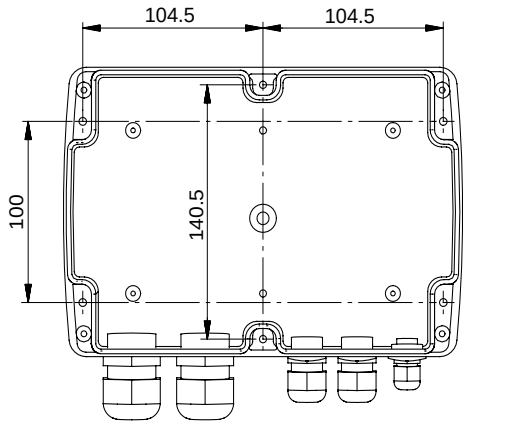
The CU 300 is designed for wall mounting.

The box has six mounting holes (ø4), see fig. 27 (dimensions stated in mm).

The CU 300 must be mounted:

- horizontally (see fig. 27) to allow condensed water, if any, to escape.
- on a plane surface to avoid deformation of the box.

Fig. 27



TM01 2824 2498

The CU 300 is supplied with a set of gaskets for the Pg screwed connections.

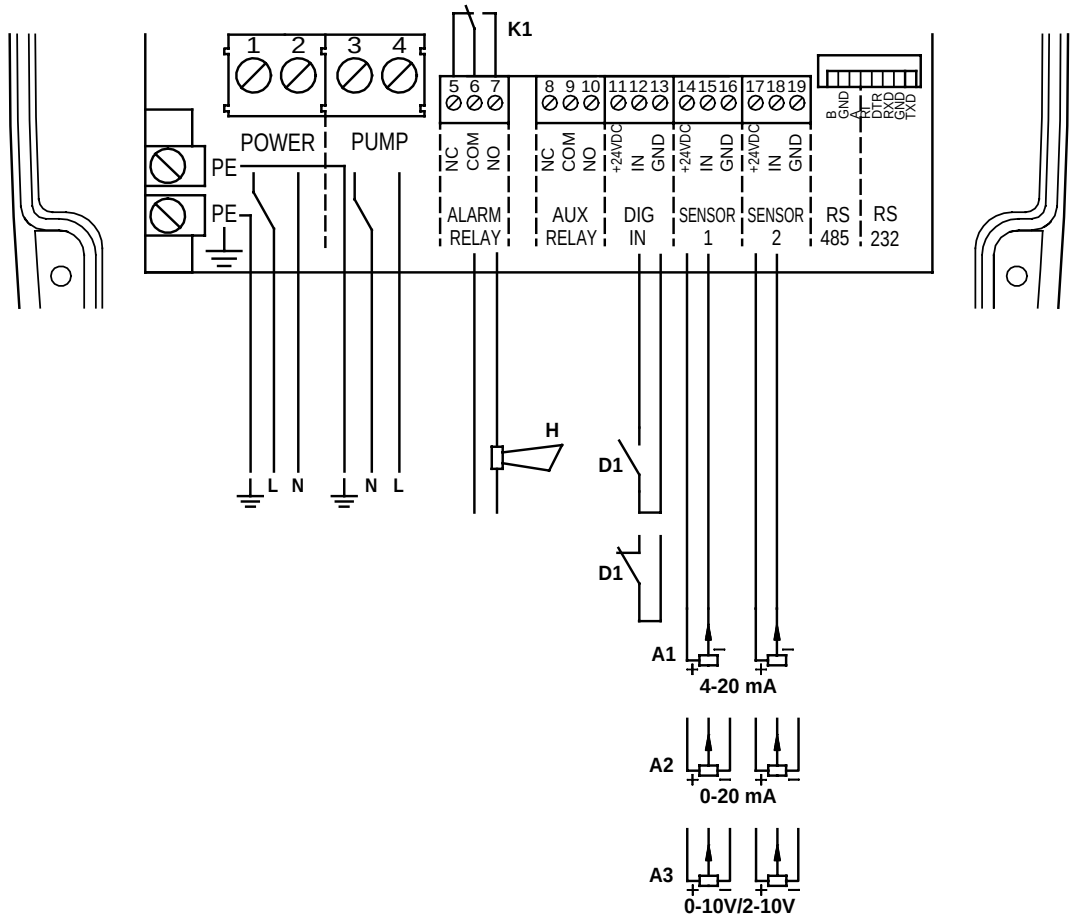
The gaskets are to be used for the connection of cables/wires to ensure tight connections (IP 55) and cable relief.

6.6 Electrical connection

Never make any connections in the CU 300 unit unless the electricity supply has been switched off. The CU 300 must be connected in accordance with the rules and standards in force for the application in question.

The supply voltage and frequency are marked on the nameplate. Make sure that the CU 300 is suitable for the electricity supply on which it will be used.

Fig. 28



TM01 3088 2500

Legend:

Pos.	Description
A1	Analog sensor, output signal 4-20 mA.
A2	Analog sensor, output signal 0-20 mA.
A3	Analog sensor, output signal 0-10/2-10 V.
D1	Digital sensor, NO (normally open).
D2	Digital sensor, NC (normally closed).
H	Alarm signal transmitter (optional).
K1	Internal alarm signal relay. Relay data: 250 VAC, 8 A, AC1.

6.6.1 Mains supply

POWER, terminals 1, 2 and PE:

Connect terminals 1 and 2 to the phase and neutral leads of the mains supply. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

Back-up fuse: Maximum 16 A.

Note: The leads of the mains supply must not be connected to terminals 3 and 4 (PUMP).

6.6.2 Pump supply

PUMP, terminals 3, 4 and PE:

Connect terminals 3 and 4 to the phase and neutral leads of the pump. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

6.6.3 Alarm signal relay

ALARM RELAY, terminals 5, 6 and 7:

Connect terminals 5, 6 and 7 to the internal alarm signal relay as follows:

- Terminal 5 NC (normally closed).
- Terminal 6 COM (common).
- Terminal 7 NO (normally open).

The relay operates when the alarm and warning limits are exceeded.

Manual or automatic restarting can be selected in the R100 display *12.4.3 Automatic restart*.

Manual restarting is carried out by means of the On/Off button on the CU 300.

6.6.4 Sensors

SENSOR 1 and SENSOR 2, terminals 14, 15, 16, 17, 18 and 19:

Terminals 14, 15 and 16 (SENSOR 1) and terminals 17, 18 and 19 (SENSOR 2) are used for external sensors, e.g. a pressure gauge, a flow meter or another type of sensor.

Limits for the signal from an external sensor are set by means of the R100 in the LIMITS menu.

The signal can be used

- to start and stop the motor and
- to operate the alarm signal relay, without stopping the motor.

The sensors must give signals within the ranges 0-20 or 4-20 mA, 0-10 or 2-10 VDC. Changeover between current and voltage signals is carried out by means of the R100.

The total load of terminals 11, 14 and 17 (+24 VDC) must not exceed 100 mA.

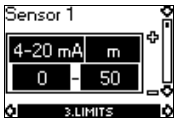
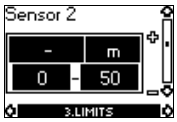
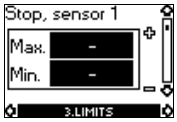
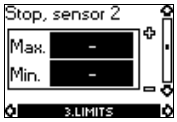
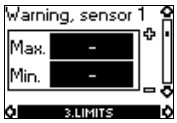
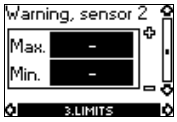
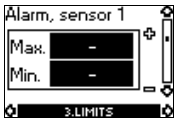
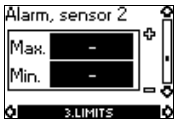
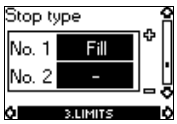
6.7 Settings

In the following section, the relevant R100 displays and settings are shown and described.

For a detailed description of the R100 displays, see section *12. CU 300 with R100*. Each individual display has a number which refers to the section in which it is described in detail.

6.7.1 Required R100 settings

The following R100 settings must be made:

Display	R100 setting
12.3.1 Sensor 1  *12.3.5 Sensor 2* 	Set the • sensor output signal (4-20 mA), • setting range unit (m), and • setting range (0-50) for sensor 1 and sensor 2 respectively. Sensor 2 is set to “not active”.
12.3.2 Stop, sensor 1  *12.3.6 Stop, sensor 2* 	Set the • maximum stop limit and • minimum stop limit for sensor 1 and sensor 2 respectively.
12.3.3 Warning, sensor 1  *12.3.7 Warning, sensor 2* 	Set the • maximum warning limit and • minimum warning limit for sensor 1 and sensor 2 respectively.
12.3.4 Alarm, sensor 1  *12.3.8 Alarm, sensor 2* 	Set the • maximum alarm limit and • minimum alarm limit for sensor 1 and sensor 2 respectively.
12.3.9 Stop type 	Set the desired stop type. **Example:** • Sensor 1: Fill. • Sensor 2: “–” (not active).

It is necessary to set only the limits applying to the sensor selected. Where “–” is selected, the setting is automatically “not active”.

7. CU 300 connected to potentiometer

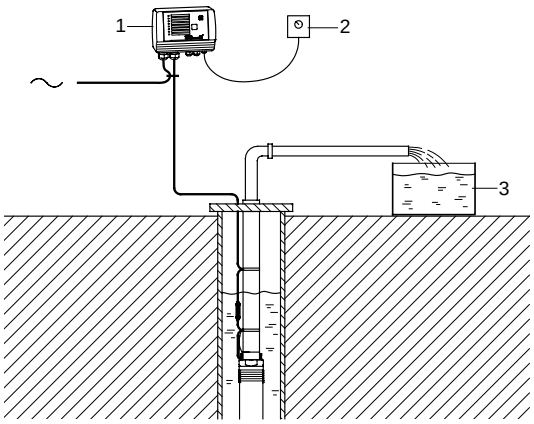
7.1 Description

Using an external potentiometer enables:

- manual control of the motor speed, and thereby of pump performance.
- manual starting/stopping of the pump.
  Note: To stop the pump, turn the potentiometer (SPP 1) to “STOP”.

Fig. 29 shows an example of an installation incorporating a potentiometer.

Fig. 29



Pos.	Description
1	CU 300.
2	External GRUNDFOS potentiometer, SPP 1. The required flow is obtained by changing the motor speed manually using the external potentiometer.
3	Water tank.

7.2 Installation

Before starting any work on the CU 300, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

7.3 Location

The CU 300 can be placed both indoors and outdoors. It must not be exposed to direct sunlight.

7.4 Mounting the CU 300

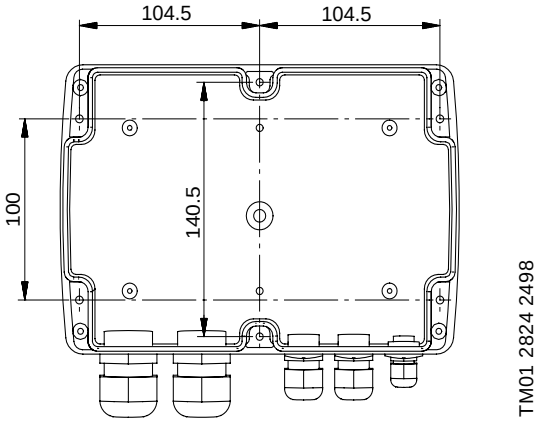
The CU 300 is designed for wall mounting.

The box has six mounting holes (ø4), see fig. 30 (dimensions stated in mm).

The CU 300 must be mounted:

- horizontally (see fig. 30) to allow condensed water, if any, to escape.
- on a plane surface to avoid deformation of the box.

Fig. 30



The CU 300 is supplied with a set of gaskets for the Pg screwed connections.

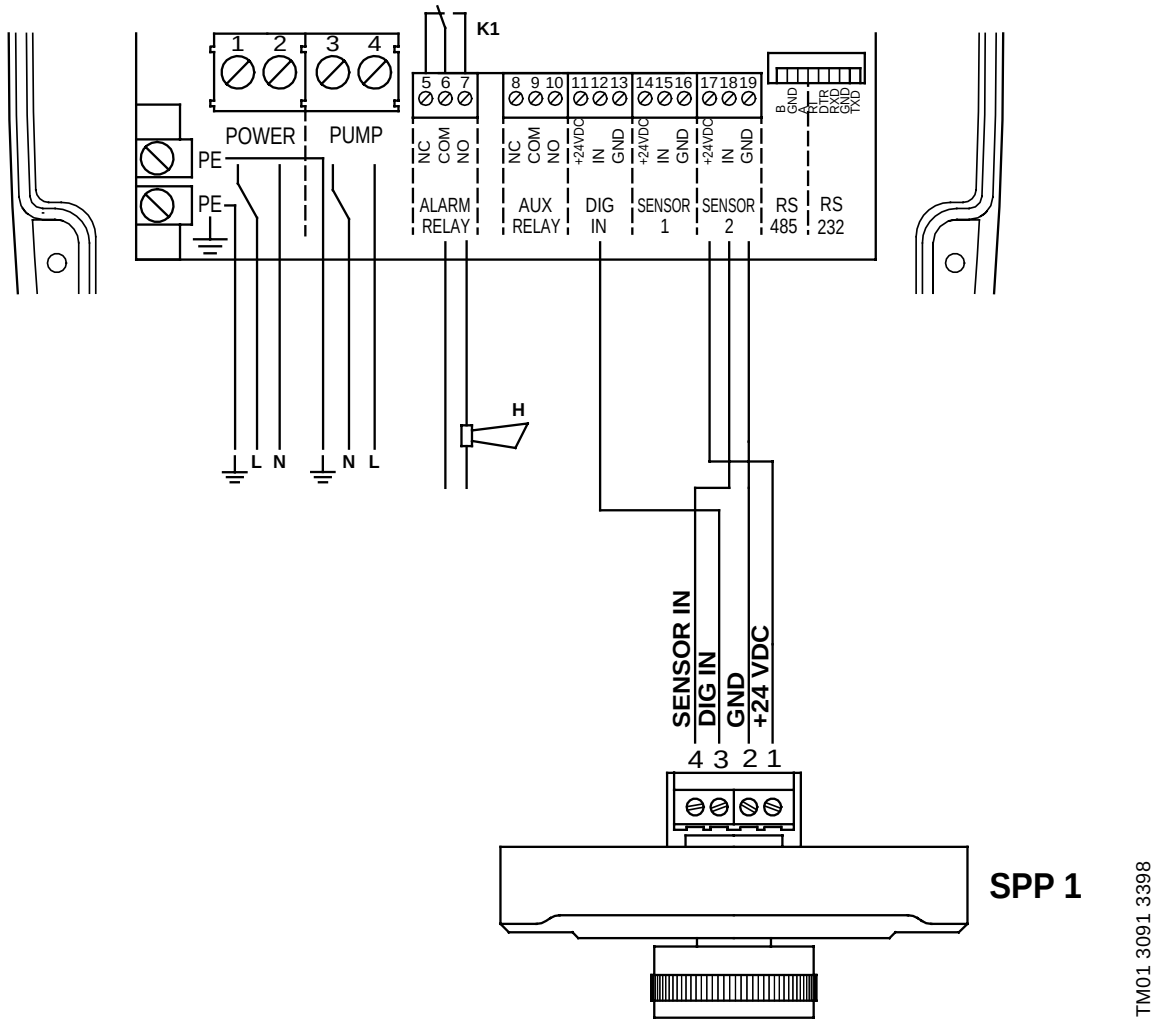
The gaskets are to be used for the connection of cables/wires to ensure tight connections (IP 55) and cable relief.

7.5 Electrical connection

Never make any connections in the CU 300 unit unless the electricity supply has been switched off. The CU 300 must be connected in accordance with the rules and standards in force for the application in question.

The supply voltage and frequency are marked on the nameplate. Make sure that the CU 300 is suitable for the electricity supply on which it will be used.

Fig. 31



Legend:

Pos.	Description
K1	Internal alarm signal relay. Relay data: 250 VAC, 8 A, AC1.
H	Alarm signal transmitter (optional).
SPP 1	External GRUNDFOS potentiometer, SPP 1.

7.5.1 Mains supply

POWER, terminals 1, 2 and PE:

Connect terminals 1 and 2 to the phase and neutral leads of the mains supply. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

Back-up fuse: Maximum 16 A.

Note: The leads of the mains supply must not be connected to terminals 3 and 4 (PUMP).

7.5.2 Pump supply

PUMP, terminals 3, 4 and PE:

Connect terminals 3 and 4 to the phase and neutral leads of the pump. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

7.5.3 Alarm signal relay

ALARM RELAY, terminals 5, 6 and 7:

Connect terminals 5, 6 and 7 to the internal alarm signal relay as follows:

- Terminal 5 NC (normally closed).
- Terminal 6 COM (common).
- Terminal 7 NO (normally open).

The relay operates when the alarm and warning limits are exceeded.

Manual or automatic restarting can be selected in the R100 display *12.4.3 Automatic restart*.

Manual restarting is carried out by means of the On/Off button on the CU 300.

7.5.4 Potentiometer SPP 1

Connections between the SPP 1 and the CU 300:

Terminals	
SPP 1	**CU 300**
1	17 (SENSOR 2 +24 VDC).
2	19 (SENSOR 2 GND).
3	12 (DIG IN).
4	18 (SENSOR 2 IN).

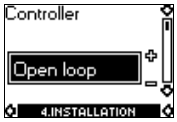
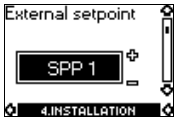
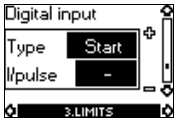
7.6 Settings

In the following section, the relevant R100 displays and settings are shown and described.

For a detailed description of the R100 displays, see section *12. CU 300 with R100*. Each individual display has a number which refers to the section in which it is described in detail.

7.6.1 Required R100 settings

The following R100 settings must be made:

Display	R100 setting
12.4.1 Controller 	Select “Open loop”. Enabling of speed control.
12.4.2 External setpoint 	Set the external setpoint to “SPP 1”. Enabling of speed control using the SPP 1. Sensor input 2 is calibrated to the signal from the SPP 1. The internal 24 VDC of the CU 300 is used.
12.3.10 Digital input 	Set • Type to “Start” and • I/pulse to “–” (not active).

8. CU 300 connected to water meter

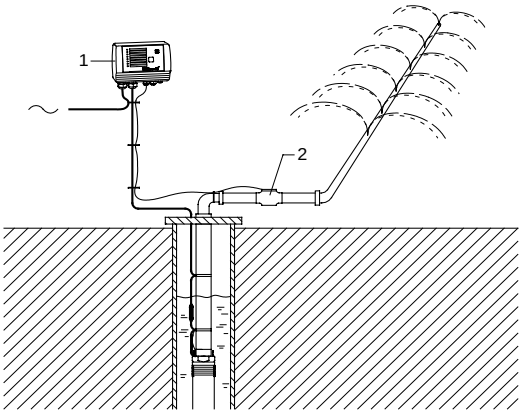
8.1 Description

Using a water meter (pulse flow meter) enables:

- monitoring of the flow,
- stop of pump after a given quantity of water has been pumped and
- indication of accumulated flow and the energy consumption required to pump 1 m³.

Fig. 32 shows an example of an irrigation system incorporating a water meter.

Fig. 32



TM01 2659 1999

Pos.	Description
1	CU 300.
2	Water meter (pulse flow meter).

8.2 Installation

Before starting any work on the CU 300, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

8.3 Location

The CU 300 can be placed both indoors and outdoors. It must not be exposed to direct sunlight.

8.4 Mounting the CU 300

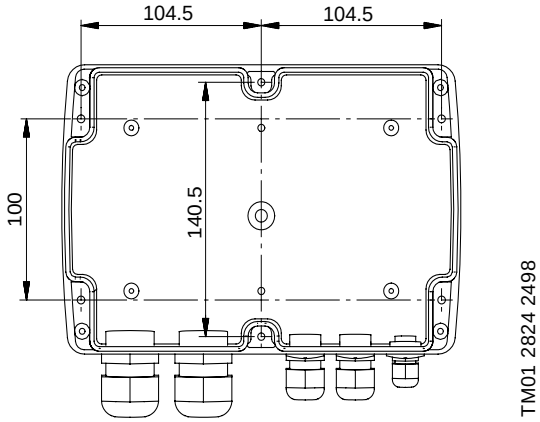
The CU 300 is designed for wall mounting.

The box has six mounting holes (ø4), see fig. 33 (dimensions stated in mm).

The CU 300 must be mounted:

- horizontally (see fig. 33) to allow condensed water, if any, to escape.
- on a plane surface to avoid deformation of the box.

Fig. 33



TM01 2824 2498

The CU 300 is supplied with a set of gaskets for the Pg screwed connections.

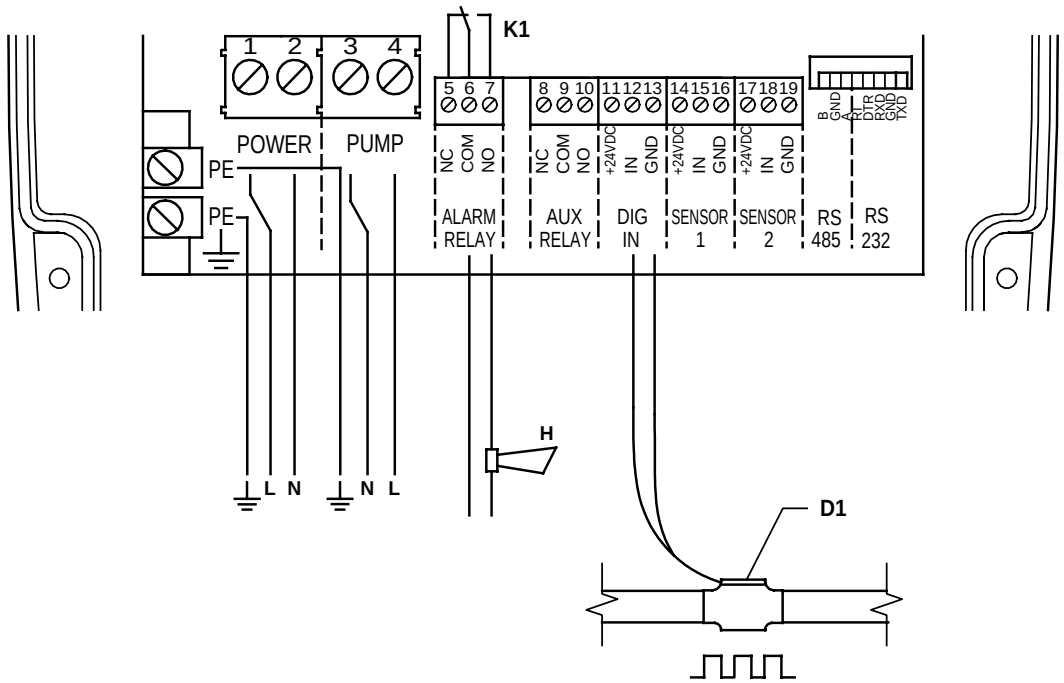
The gaskets are to be used for the connection of cables/wires to ensure tight connections (IP 55) and cable relief.

8.5 Electrical connection

Never make any connections in the CU 300 unit unless the electricity supply has been switched off. The CU 300 must be connected in accordance with the rules and standards in force for the application in question.

The supply voltage and frequency are marked on the nameplate. Make sure that the CU 300 is suitable for the electricity supply on which it will be used.

Fig. 34



TM01 6223 1899

Legend:

Pos.	Description
D1	Water meter (pulse flow meter).
H	Alarm signal transmitter (optional).
K1	Internal alarm signal relay. Relay data: 250 VAC, 8 A, AC1.

8.5.1 Mains supply

POWER, terminals 1, 2 and PE:

Connect terminals 1 and 2 to the phase and neutral leads of the mains supply. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

Back-up fuse: Maximum 16 A.

Note: The leads of the mains supply must not be connected to terminals 3 and 4 (PUMP).

8.5.2 Pump supply

PUMP, terminals 3, 4 and PE:

Connect terminals 3 and 4 to the phase and neutral leads of the pump. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

8.5.3 Alarm signal relay

ALARM RELAY, terminals 5, 6 and 7:

Connect terminals 5, 6 and 7 to the internal alarm signal relay as follows:

- Terminal 5 NC (normally closed).
- Terminal 6 COM (common).
- Terminal 7 NO (normally open).

The relay operates when the alarm and warning limits are exceeded.

Manual or automatic restarting can be selected in the R100 display *12.4.3 Automatic restart*.

Manual restarting is carried out by means of the On/Off button on the CU 300.

8.5.4 Water meter (pulse flow meter)

DIG IN, terminals 12 and 13:

Connect terminals 12 and 13 to the water meter:

- Terminal 12 IN (signal input).
- Terminal 13 GND (earth).

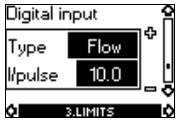
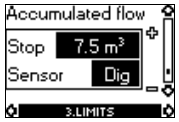
8.6 Settings

In the following section, the relevant R100 displays and settings are shown and described.

For a detailed description of the R100 displays, see section *12. CU 300 with R100*. Each individual display has a number which refers to the section in which it is described in detail.

8.6.1 Required R100 settings

The following R100 settings must be made:

Display	R100 setting
12.3.10 Digital input 	Set • Type to “Flow” and • l/pulse to **Example:** “10 l/pulse”. When a value has been set in this display, the actual flow will appear in display *12.2.8 Digital input*.
12.3.11 Accumulated flow 	A value should only be set in this display if the following is required: • stop of pump after a given quantity of water has been pumped. Set • Stop to the desired flow. **Example:** • Stop: “7.5 m³”. • Sensor: “Dig”. When a value has been set in this display, the “Accumulated flow” and “Energy per m³” will appear in display *12.2.9 Accumulated flow and energy per m³*.

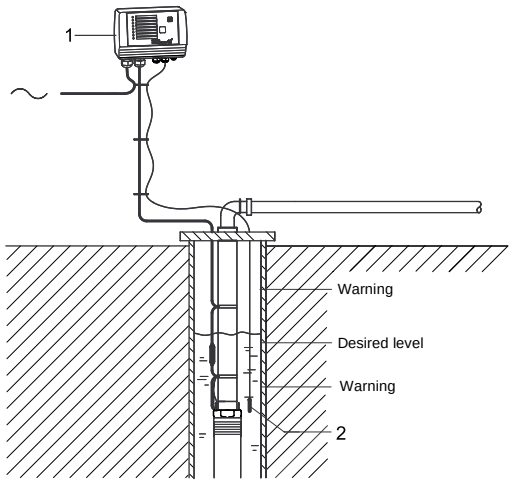
9. Constant water level

9.1 Description

The water level can be kept constant by connecting an analog level sensor.

Fig. 35 shows an example of an installation designed for maintaining a constant water level in the borehole.

Fig. 35



Pos.	Description
1	CU 300.
2	Water meter (analog flow meter).
3	Level sensor.

9.2 Function

The CU 300 controls the pump speed and consequently adjusts the pump performance to the borehole yield.

1. When the water level is much higher than the desired level (setpoint), the pump is running at maximum performance.
2. When the level is coming closer to the desired level, the pump performance will be reduced.
3. When the desired level is reached, the pump speed will be so low that the pump performance is zero. After further 60 seconds, the pump will stop.

9.3 Installation

Before starting any work on the CU 300, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

9.4 Location

The CU 300 can be placed both indoors and outdoors. It must not be exposed to direct sunlight.

9.5 Mounting the CU 300

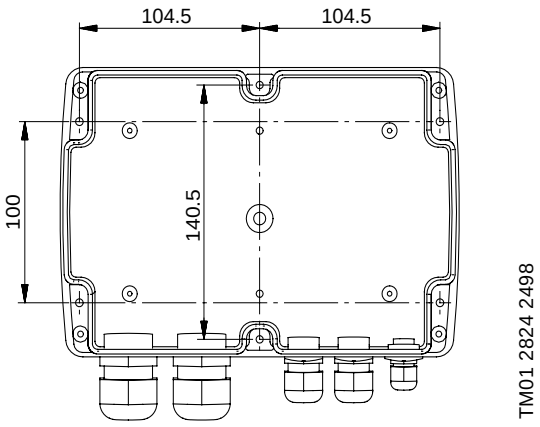
The CU 300 is designed for wall mounting.

The box has six mounting holes (ø4), see fig. 36 (dimensions stated in mm).

The CU 300 must be mounted:

- horizontally (see fig. 36) to allow condensed water, if any, to escape.
- on a plane surface to avoid deformation of the box.

Fig. 36



The CU 300 is supplied with a set of gaskets for the Pg screwed connections.

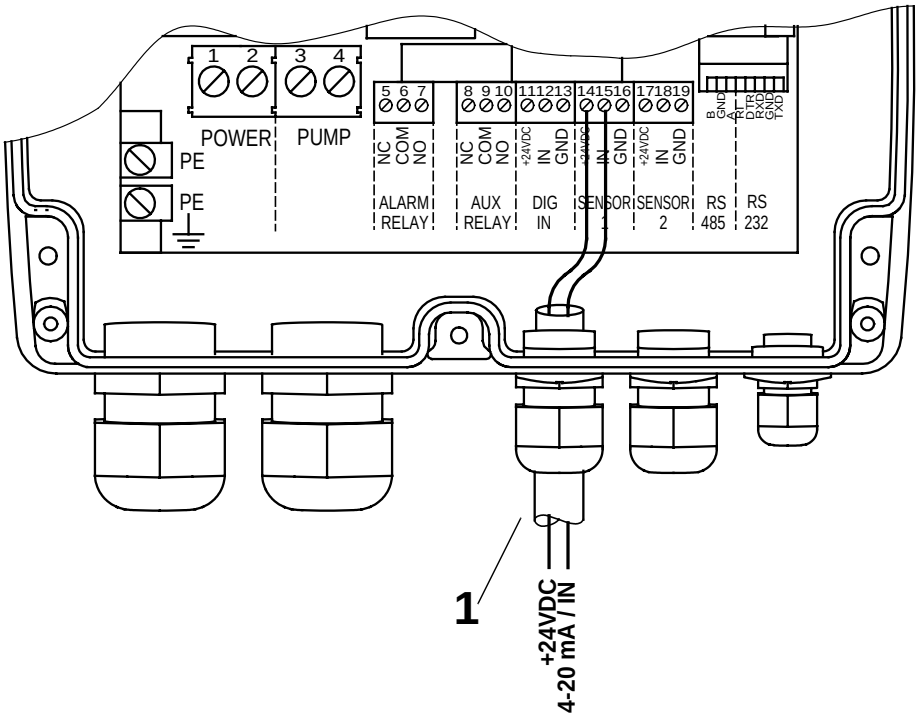
The gaskets are to be used for the connection of cables/wires to ensure tight connections (IP 55) and cable relief.

9.6 Electrical connection

Never make any connections in the CU 300 unit unless the electricity supply has been switched off. The CU 300 must be connected in accordance with the rules and standards in force for the application in question.

The supply voltage and frequency are marked on the nameplate. Make sure that the CU 300 is suitable for the electricity supply on which it will be used.

Fig. 37



TM01 6213 2400

Legend:

Pos.	Description
1	Connection of level sensor: • Terminal 14, 24 VDC supply. • Terminal 15, signal input.

9.6.1 Mains supply

POWER, terminals 1, 2 and PE:

Connect terminals 1 and 2 to the phase and neutral leads of the mains supply. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

Back-up fuse: Maximum 16 A.

Note: The leads of the mains supply must not be connected to terminals 3 and 4 (PUMP).

9.6.2 Pump supply

PUMP, terminals 3, 4 and PE:

Connect terminals 3 and 4 to the phase and neutral leads of the pump. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

9.6.3 Alarm signal relay

ALARM RELAY, terminals 5, 6 and 7:

Connect terminals 5, 6 and 7 to the internal alarm signal relay as follows:

- Terminal 5 NC (normally closed).
- Terminal 6 COM (common).
- Terminal 7 NO (normally open).

The relay operates when the alarm and warning limits are exceeded.

Manual or automatic restarting can be selected in the R100 display *12.4.3 Automatic restart*.

Manual restarting is carried out by means of the On/Off button on the CU 300.

9.6.4 Level sensor

Connect terminals 14 and 15 to the level sensor:

- Terminal 14, 24 VDC (voltage supply).
- Terminal 15, IN (signal input).

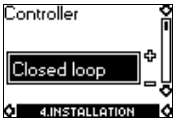
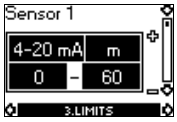
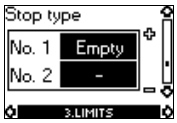
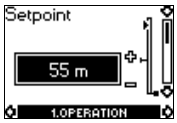
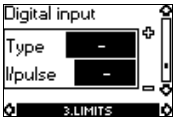
9.7 Settings

In the following section, the relevant R100 displays and settings are shown and described.

For a detailed description of the R100 displays, see section *12. CU 300 with R100*. Each individual display has a number which refers to the section in which it is described in detail.

9.7.1 Required R100 settings

The following R100 settings must be made:

Display	R100 setting
12.4.1 Controller 	Select “Closed loop”.
12.3.1 Sensor 1 	Set the sensor type. **Example:** • Sensor output signal (4-20 mA), • setting range unit (m), • setting range (0-60 m).
12.3.9 Stop type 	Set the stop type. • Sensor 1: “Empty”. • Sensor 2: “–” (not active).
12.1.1 Setpoint 	Set the desired water level (m). **Example:** 55 m. **Rule:** The maximum setting of the setpoint corresponds to the maximum value set in display *12.3.1 Sensor 1* less 5 m. In this case, 60 less 5 = 55 m. The water level can be kept within a tolerance of ±1% of the setting range.
12.3.10 Digital input 	Set • Type to “–” (not active) and • l/pulse to “–” (not active).

10. CU 300 connected to RS-232, RS-485

10.1 Description

Using the RS-232 input enables:

- communication over long distances via modem,
- direct connection of a PC.

Using the RS-485 input enables:

- communication via GRUNDFOS field bus GENIbus,
- connection to the GRUNDFOS G100 gateway for communication over long distances, e.g. via radio.

10.2 CU 300 connected to a PC directly

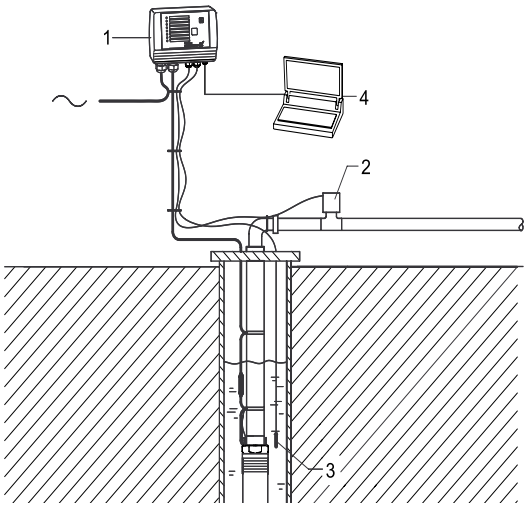
Fig. 38 shows an example of an installation which is connected to a PC directly via the RS-232 input.

The installation shown in the example, fig. 38, enables:

- configuration,
- fault finding,
- servicing

of the installation by means of a PC with PC Tool CU 300 software.

Fig. 38



Pos.	Description
1	CU 300.
2	E.g. a pH sensor for monitoring of water quality.
3	Level sensor.
4	PC.

CU 300 with modem connection to PC:

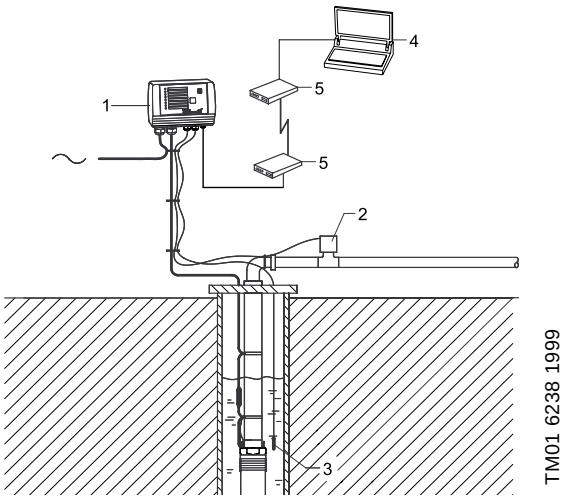
Fig. 39 shows an example of an installation connected to a modem with telephone connection to modem/PC via the RS-232 input.

The installation shown in the example, fig. 39, enables:

- configuration,
- fault finding,
- servicing

of the installation over long distances.

Fig. 39



Pos.	Description
1	CU 300.
2	E.g. a pH sensor for monitoring of water quality.
3	Level sensor.
4	PC.
5	Modem.

CU 300 connected to GENIbus network:

Fig. 40 shows an example of an installation connected to a GENIbus network with two CU 300 installations via the RS-485 input. The GENIbus network is connected to a G100 gateway with radio connection to a PC.

The installation shown in the example, fig. 40, enables:

- configuration,
- fault finding,
- servicing,
- data logging

of the connected installations over long distances.

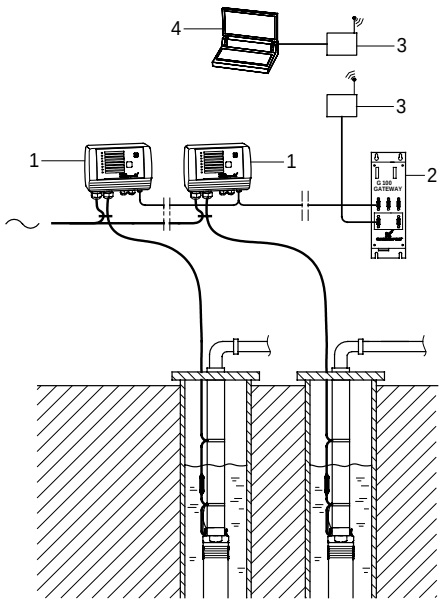
It is possible to connect and communicate with up to 32 GENIbus units on one network.

The units can be

- CU 300 units only or
- CU 300 units in combination with other GRUNDFOS products with GENIbus connection to for instance a CU 3.

Contact GRUNDFOS for further details.

Fig. 40



Pos.	Description
1	CU 300.
2	G100 gateway.
3	Radio.
4	PC.

10.3 Installation

Before starting any work on the CU 300, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

10.4 Location

The CU 300 can be placed both indoors and outdoors. It must not be exposed to direct sunlight.

10.5 Mounting the CU 300

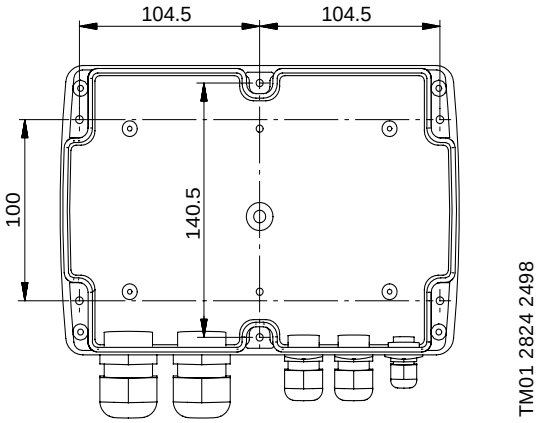
The CU 300 is designed for wall mounting.

The box has six mounting holes (ø4), see fig. 41 (dimensions stated in mm).

The CU 300 must be mounted:

- horizontally (see fig. 41) to allow condensed water, if any, to escape.
- on a plane surface to avoid deformation of the box.

Fig. 41



The CU 300 is supplied with a set of gaskets for the Pg screwed connections.

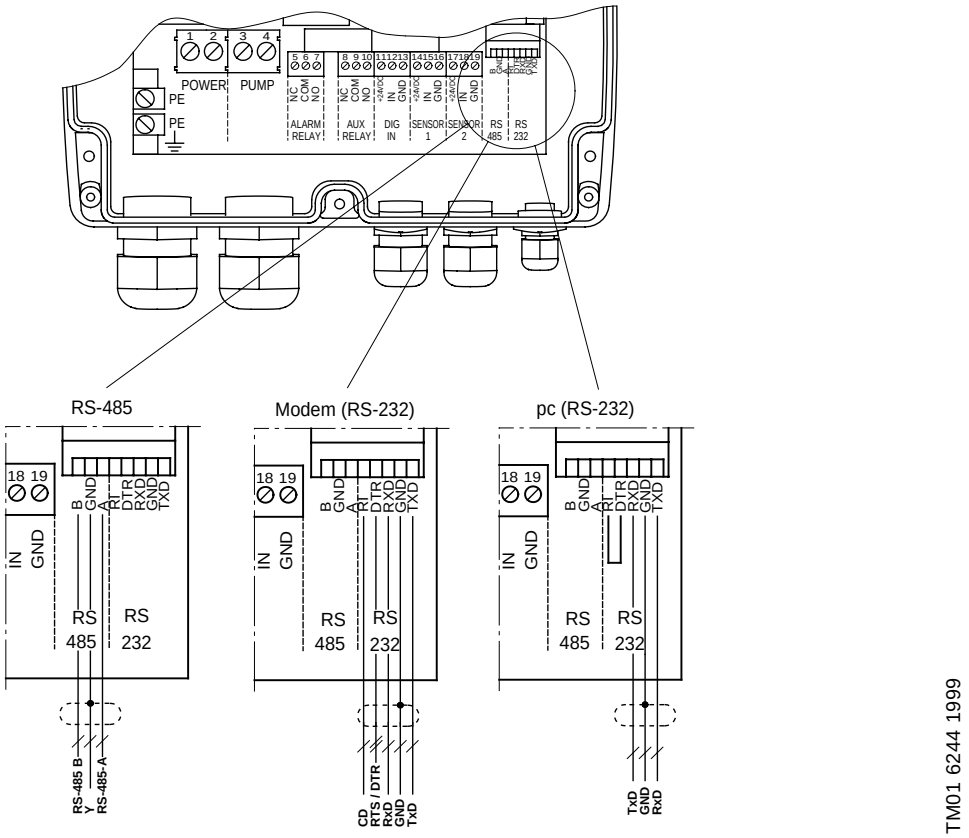
The gaskets are to be used for the connection of cables/wires to ensure tight connections (IP 55) and cable relief.

10.6 Electrical connection

Never make any connections in the CU 300 unit unless the electricity supply has been switched off. The CU 300 must be connected in accordance with the rules and standards in force for the application in question.

The supply voltage and frequency are marked on the nameplate. Make sure that the CU 300 is suitable for the electricity supply on which it will be used.

Fig. 42



TM01 6244 1999

Legend:

Pos.	Description
RS-485	Connection of RS-485, GENIbus.
Modem (RS-232)	Connection of modem to RS-232.
PC (RS-232)	Connection of PC to RS-232.

10.6.1 Mains supply

POWER, terminals 1, 2 and PE:

Connect terminals 1 and 2 to the phase and neutral leads of the mains supply. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

Back-up fuse: Maximum 16 A.

Note: The leads of the mains supply must not be connected to terminals 3 and 4 (PUMP).

10.6.2 Pump supply

PUMP, terminals 3, 4 and PE:

Connect terminals 3 and 4 to the phase and neutral leads of the pump. Each terminal can be connected to any of the two leads.
Connect the PE terminal to the green/yellow earth lead. Each PE terminal must be connected to an earth lead of its own.

Maximum cross-section of the leads to be connected is 6 mm².

10.6.3 Alarm signal relay

ALARM RELAY, terminals 5, 6 and 7:

Connect terminals 5, 6 and 7 to the internal alarm signal relay as follows:

- Terminal 5 NC (normally closed).
- Terminal 6 COM (common).
- Terminal 7 NO (normally open).

The relay operates when the alarm and warning limits are exceeded.

Manual or automatic restarting can be selected in the R100 display *12.4.3 Automatic restart*.

Manual restarting is carried out by means of the On/Off button on the CU 300.

10.6.4 RS-485 input

The RS-485 input, terminals A, Y (GND) and B, is for external BUS communication.

The communication is effected according to the GRUNDFOS BUS protocol, GENIbus, and is two-way communication.

The CU 300 can communicate with a PC with the PC Tool CU 300 installed.
An RS-232/RS-485 adaptor is supplied with the PC Tool CU 300. Connect the adaptor to the CU 300, terminals A, Y (GND) and B, for direct communication with a PC on a GENIbus network.
The PC Tool CU 300 enables configuration, monitoring and fault finding of the actual installation.

The RS-485 input is a low-voltage circuit. Therefore, all connections to terminals A, Y (GND) and B must be separated from network circuits by means of double or reinforced insulation.

A screened, twisted-pair cable is required.
The maximum cable length is 1200 m.

10.6.5 RS-232 input

The RS-232 input, terminals RI, DTR, RXD, GND and TXD, is a communication input.

The communication is effected according to the GRUNDFOS BUS protocol, GENIbus, and is two-way communication.

The CU 300 can communicate with a PC with the PC Tool CU 300 installed.
The PC Tool CU 300 enables configuration, monitoring and fault finding of the actual installation.

The RS-232 input is a low-voltage circuit. Therefore, all connections to terminals RI, DTR, RXD, GND and TXD must be separated from network circuits by means of double or reinforced insulation.

A screened, twisted-pair cable is required.
The maximum cable length is 20 m.

10.6.6 Modem

Connect the modem to the RS-232 input as follows:

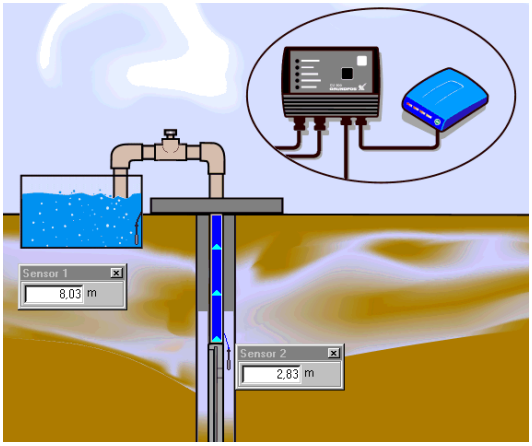
CU 300 terminals	Modem connection
RI	CD
DTR	DTR and RTS
RXD	RXD
GND	GND
TXD	TXD

When connected to a modem, the CU 300 enables communication over long distances. In a service situation, the service engineer will be able to diagnose faults and, if required, correct them at a distance.

10.6.7 PC Tool CU 300

The PC Tool CU 300 is Windows95/NT-based software, see the PC Tool CU 300 opening display in fig. 43.

Fig. 43



TM01 6374 2199

The PC Tool CU 300 is user-oriented with a graphic user interface with pop-ups.

The PC Tool CU 300 is an all-round PC tool which enables any kind of communication with the CU 300 and the SQE:

Subject	Description
Installation	Programming of the CU 300 and the SQE pump.
Operation	Monitoring and operation of CU 300-based SQE pumping systems.
Service	Fault finding and fault correction in CU 300-based SQE pumping systems.

The PC Tool CU 300 can be used in connection with communication via:

- RS-232 with modem connection.
- RS-232 without modem connection.
- GENIbus (RS-485) directly.
- GENIbus (RS-485) with G100 to network.

11. Alarm functions

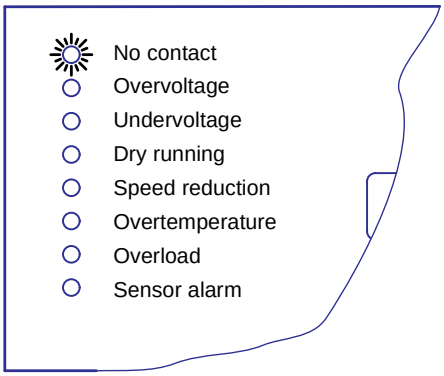
The alarm functions indicated by the eight red indicator lights on the CU 300 are described in the following sections.

11.1 No contact

The connection and/or communication between the CU 300 and the motor is not established.

No contact is permanently on, see fig. 44.

Fig. 44



Possible cause	Remedy
Motor is not an MSE 3 motor.	Install an MSE 3 motor.
Motor is not connected.	Check connections.
Cable breakage.	Check cable.
Poor/no connection.	Check connections.
The cable length exceeds 200 m.	Reduce the cable length.
The CU 300 is defective.	Replace the CU 300.
Motor is defective.	Replace motor.

Important:

The alarm indication “No contact” will also appear if the pump and the CU 300 do not have the same number (allocated by the R100). The problem may occur e.g. in connection with replacing a motor or a CU 300.

Solution: The pump and the CU 300 must be allocated the same number via the R100 display *12.4.10 Number*.

The alarm “No contact” makes the On/Off button on the CU 300 inactive, and actual operating parameters cannot be called up. However, installation parameters can be called up.

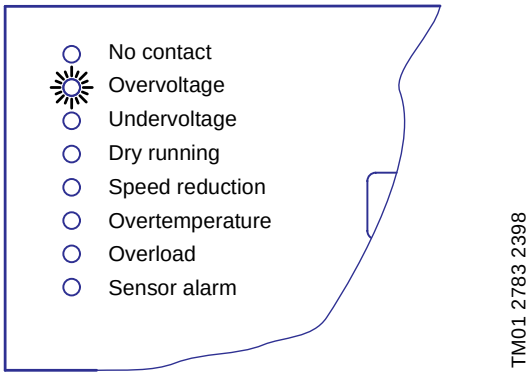
“No contact” does not cause a pump stop.

11.2 Overvoltage

The supply voltage to the motor exceeds the maximum value allowed.
Factory setting, see section *13. Technical data*.

The motor is stopped and **Overvoltage** is permanently on, see fig. 45.

Fig. 45



Possible cause	Remedy
Unstable electricity supply.	Contact the electricity supply authorities.
Too high supply voltage.	Contact the electricity supply authorities. Check installation.
Supply voltage outside voltage range of motor.	Check installation.

Restarting:

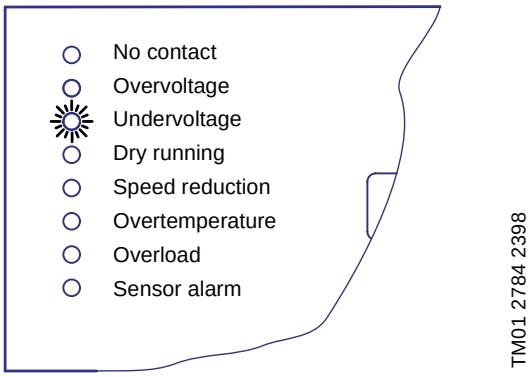
When the supply voltage lies within the voltage range of the motor, the motor will restart automatically.

11.3 Undervoltage

The supply voltage to the motor is lower than the minimum value allowed.
Factory setting, see section *13. Technical data*.

The motor is stopped and **Undervoltage** is permanently on, see fig. 46.

Fig. 46



Possible cause	Remedy
Unstable electricity supply.	Contact the electricity supply authorities.
Supply voltage outside voltage range of motor.	Check installation.
Voltage drop in mains is too big.	Increase wire cross-section.

Restarting:

When the supply voltage lies within the voltage range of the motor, the motor will restart automatically.

11.4 Dry running

The purpose of the dry-running protection is to protect the pump in case of insufficient water flow.

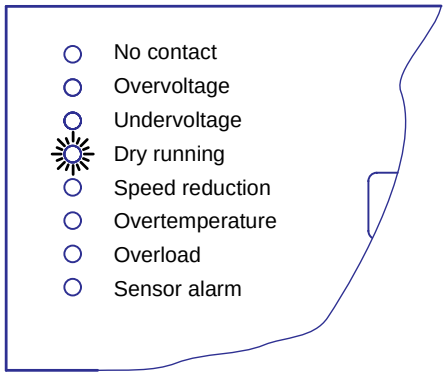
The dry-running protection makes the conventional dry-running protection unnecessary.

No additional cables to the motor are required.

The dry-running alarm is activated when the load has been below the dry-running power limit for an accumulated time of 5 seconds.

The motor is stopped and **Dry running** is permanently on, see fig. 47.

Fig. 47



Possible cause	Remedy
The pump performance is too high compared to the borehole yield.	Replace the pump with a smaller one.
	Reduce pump performance using the R100 display *12.4.8 Maximum speed*.
Borehole filter is blocked.	Borehole service is required.

Restarting:

After 5 minutes (factory setting), or the period set by means of the R100 display *12.4.3 Automatic restart*, the motor will restart automatically.

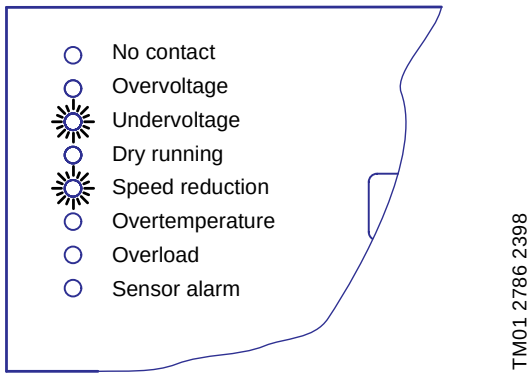
11.5 Speed reduction

At a moderate undervoltage or overload of the motor, the speed is reduced, but the motor is not stopped. The speed reduction indicator light is on, and at the same time the undervoltage or overload light is on.

Speed reduction and **Undervoltage** or **Overload** are permanently on.

In fig. 48, the “Speed reduction” alarm was caused by undervoltage.

Fig. 48



Possible cause	Remedy
Pump is worn, causing overload.	Pump must be serviced.
Wrong combination of pump and motor, causing overload.	Replace pump or motor.
Unstable electricity supply, causing undervoltage.	Contact the electricity supply authorities.
Too big voltage drop over the cable, causing undervoltage.	Size cable to avoid too big voltage drop.

Speed resuming:

When the supply voltage lies within the voltage range of the motor again and the cause of the overload has disappeared, the motor resumes normal speed.

11.6 Overtemperature

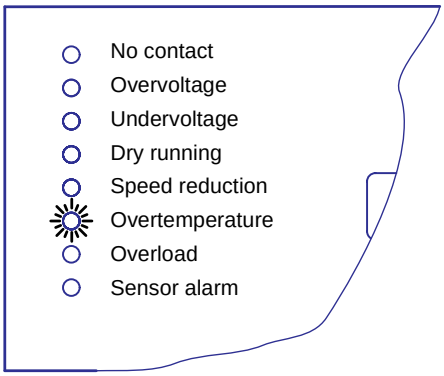
The motor temperature is monitored continuously during operation.

The motor is factory-set to a maximum value, see section *13. Technical data*.

The motor temperature has exceeded the maximum temperature limit. If the temperature is too high, there is a risk that the motor electronics will be damaged.

The motor is stopped and **Overtemperature** is permanently on, see fig. 49.

Fig. 49



A too high operating temperature may indicate that the installation needs service.

Possible cause	Remedy
Insufficient cooling/flow velocity along motor.	Take out pump and install flow sleeve.
Insufficient cooling due to incrustation of the motor.	Clean motor. Install flow sleeve.

Restarting:

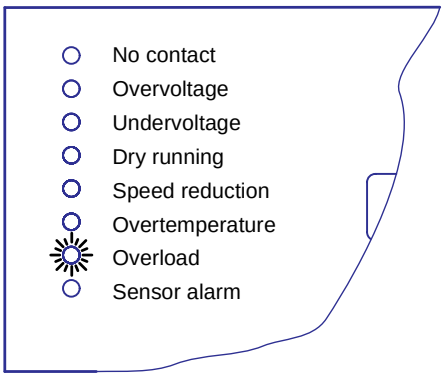
When the motor electronics has cooled sufficiently, the motor will restart automatically, see section *13. Technical data*.

11.7 Overload

The motor is overloaded, i.e. the current consumption of the motor exceeds the limit value.
Factory setting, see section *13. Technical data*.

The motor is stopped and **Overload** is permanently on, see fig. 50.

Fig. 50



Possible cause	Remedy
Pump is defective.	Pump must be serviced.
Sand or gravel in pump.	Pump must be serviced.
Wrong combination of pump and motor.	Replace pump or motor.

Restarting:

After 5 minutes (factory setting), or the period set by means of the R100 display *12.4.3 Automatic restart*, the motor will restart automatically.

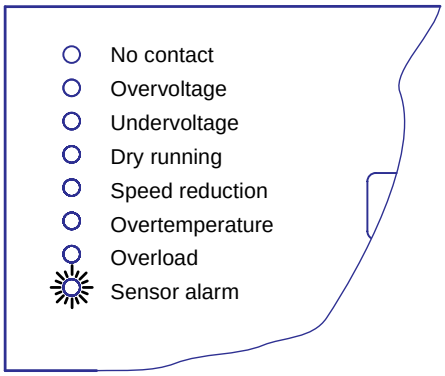
11.8 Sensor alarm

This alarm means that:

- a connected sensor has detected that an alarm limit has been exceeded or
- the sensor signal has fallen outside the measuring range set.

The motor is stopped and **Sensor alarm** is permanently on, see fig. 51.

Fig. 51



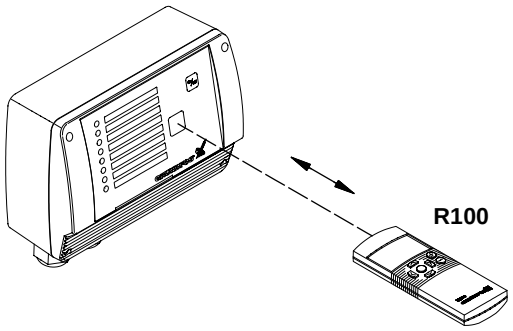
Restarting:

After 5 minutes (factory setting), or the period set by means of the R100 display *12.4.3 Automatic restart*, the motor will restart automatically.

12. CU 300 with R100

The remote control R100 is used for wireless communication with the CU 300. The R100 communicates via infra-red light. During communication, there must be visual contact between the CU 300 and the R100, see fig. 52.

Fig. 52



The R100 offers possibilities of setting and status displays for the CU 300.

When the communication between the R100 and CU 300 has been established, the red indicator light in the On/Off button will flash.

For general use of the R100, see the operating instructions for this unit.

The menu structure for the R100 and CU 300 is divided into five parallel menus, each including a number of displays.

0. GENERAL, see operating instructions for the R100.

1. OPERATION

2. STATUS

3. LIMITS

4. INSTALLATION

Overview of menus, see fig. 53, page 44.

Note: The number stated at each individual display in fig. 53 refers to the section in which the display is described.

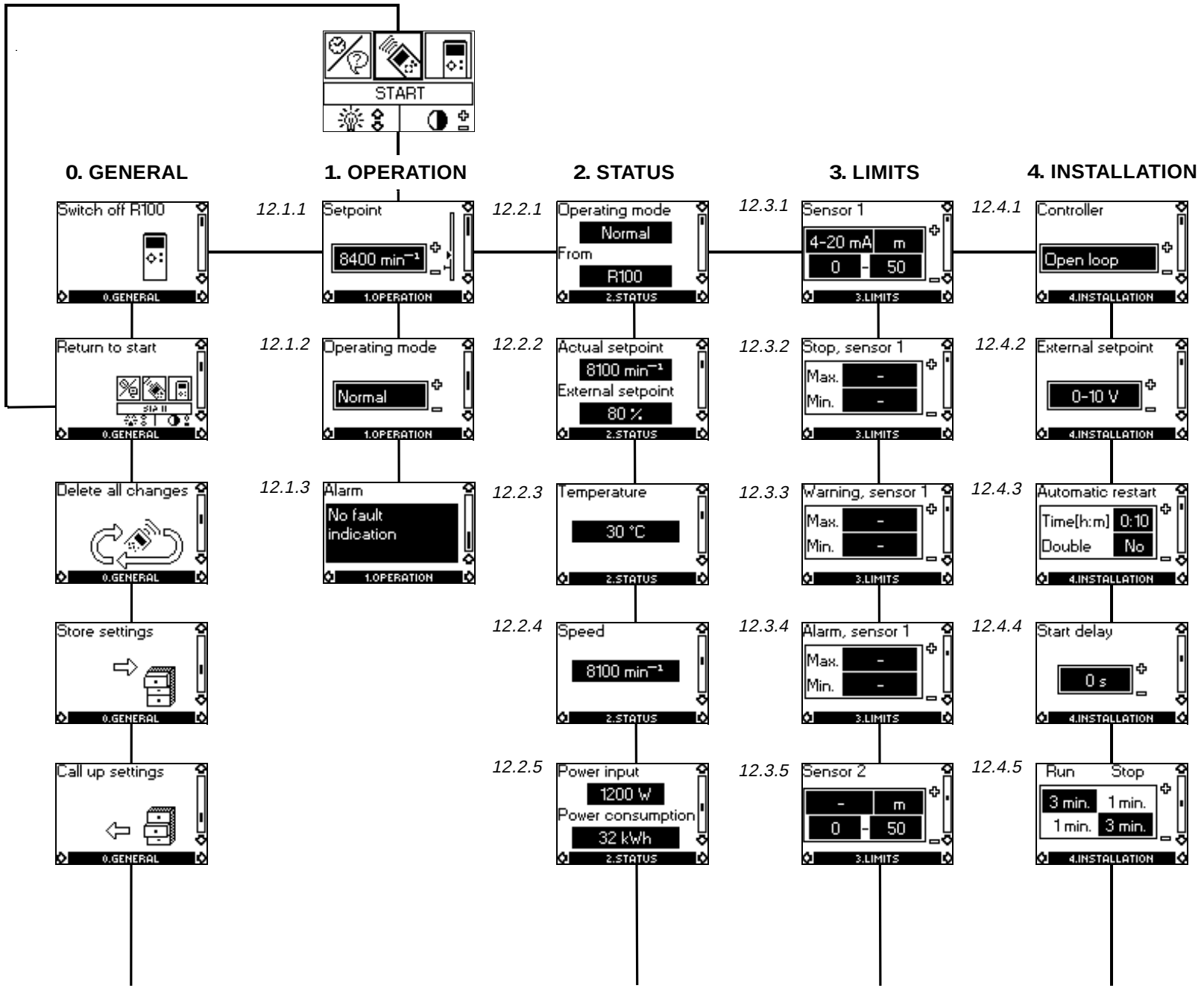
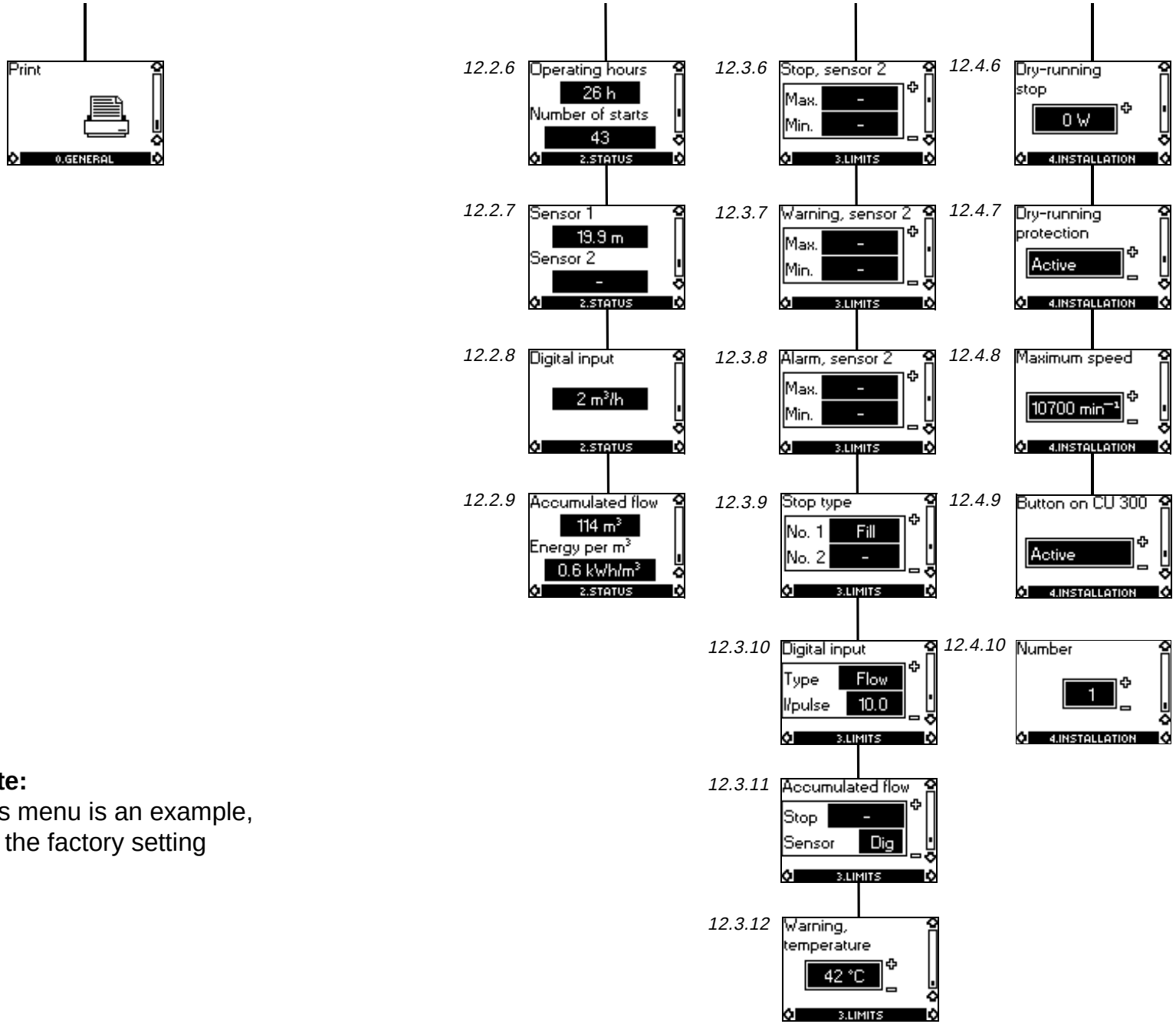

START
0. GENERAL
1. OPERATION
2. STATUS
3. LIMITS
4. INSTALLATION
Switch off R100
Return to start
Delete all changes
Store settings
Call up settings
12.1.1 Setpoint
8400 min⁻¹
12.1.2 Operating mode
Normal
12.1.3 Alarm
No fault indication
12.2.1 Operating mode
Normal
From
R100
12.2.2 Actual setpoint
8100 min⁻¹
External setpoint
80 %
12.2.3 Temperature
30 °C
12.2.4 Speed
8100 min⁻¹
12.2.5 Power input
1200 W
Power consumption
32 kWh
12.3.1 Sensor 1
4-20 mA m
0 - 50
12.3.2 Stop, sensor 1
Max. -
Min. -
12.3.3 Warning, sensor 1
Max. -
Min. -
12.3.4 Alarm, sensor 1
Max. -
Min. -
12.3.5 Sensor 2
- m
0 - 50
12.4.1 Controller
Open loop
12.4.2 External setpoint
0-10 V
12.4.3 Automatic restart
Time[h:m] 0:10
Double No
12.4.4 Start delay
0 s
12.4.5 Run Stop
3 min. 1 min.
1 min. 3 min.

Fig. 53



Note:
This menu is an example,
not the factory setting

Factory setting of R100 values

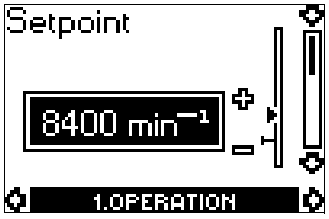
Menu OPERATION		
Display	**Factory setting**	**Value stored in**
12.1.1 Setpoint	10,700 min^{-1}	CU 300
12.1.2 Operating mode	Stop	CU 300
Menu LIMITS		
Display	**Factory setting**	**Value stored in**
12.3.1 Sensor 1	Sensor output signal: – Unit: m Min.: 0 Max.: 1	CU 300
12.3.2 Stop, sensor 1	Max.: – Min.: –	CU 300
12.3.3 Warning, sensor 1	Max.: – Min.: –	CU 300
12.3.4 Alarm, sensor 1	Max.: – Min.: –	CU 300
12.3.5 Sensor 2	Sensor output signal: – Unit: m Min.: 0 Max.: 1	CU 300
12.3.6 Stop, sensor 2	Max.: – Min.: –	CU 300
12.3.7 Warning, sensor 2	Max.: – Min.: –	CU 300
12.3.8 Alarm, sensor 2	Max.: – Min.: –	CU 300
12.3.9 Stop type	No. 1: – No. 2: –	CU 300
12.3.10 Digital input	Type: – l/pulse: –	CU 300
12.3.11 Accumulated flow	Stop: – Sensor: –	CU 300
12.3.12 Warning, temperature	–	CU 300
Menu INSTALLATION		
Display	**Factory setting**	**Value stored in**
12.4.1 Controller	Open loop	CU 300
12.4.2 External setpoint	–	CU 300
12.4.3 Automatic restart	Time: 0:05 Double: No	Motor
12.4.4 Start delay	0 s	CU 300
12.4.5 Run/Stop	Run: – Stop:–	Motor
12.4.6 Dry-running stop	• Motor type 0.1 to 0.63 kW, dry-running stop = 300 W. • Motor type 0.7 to 1.05 kW, dry-running stop = 680 W. • Motor type 1.1 to 1.73 kW, dry-running stop = 800 W.	Motor
12.4.7 Dry-running protection	Active	Motor
12.4.8 Maximum speed	10,700 min^{-1}	Motor
12.4.9 Button on CU 300	Active	CU 300
12.4.10 Number	–	CU 300 and motor

12.1 Menu OPERATION

The OPERATION menu for the CU 300 offers the possibility of setting and reading operating parameters.

Factory settings are marked in **bold**-faced type under each individual display. See also table on page 46.

12.1.1 Setpoint



TM Sq1_01 GB

Set the required setpoint.

- Setpoint set.
- Actual setpoint.

Setting range: *7,000-**10,700 min**$^{-1}$* (100 min^{-1} intervals).

Dry-running protection:

If “Setpoint” is used to reduce the speed, the dry-running protection will apply only in the “maximum speed” range (i.e. maximum speed less 1,000 min^{-1}). See section *2.6.1 Function*.

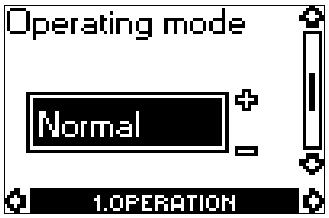
Relation to other displays:

The setting in display *12.1.1 Setpoint* is overridden by the “Max.” and “Min.” settings in display *12.1.2 Operating mode*.

If “Closed loop” is selected in display *12.4.1 Controller*, the setpoint is set within the setting range of the installed sensor.

Example: If the sensor input no. 1 is connected to a pressure sensor using the unit metre (m) and the measuring range (0-60), the setpoint can be set between 0 and 55 m in display *12.1.1 Setpoint*.

12.1.2 Operating mode



TM Sq1_02 GB

Select one of the following operating modes:

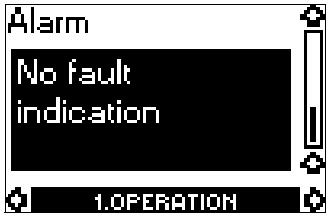
- *Max*.
  Pump operation is set to maximum speed, irrespective of setpoint. The maximum speed is set in display *12.4.8 Maximum speed* (default: 10,700 min^{-1}).
- *Normal.*
  Normal operating mode, i.e. pump operation is based on the setpoint set in display *12.1.1 Setpoint*.
  Examples: Speed set in display *12.1.1 Setpoint* or sensor control.
- *Min.*
  Pump operation is set to minimum speed, 7,000 min^{-1}, irrespective of setpoint.
- ***Stop***.
  The pump is stopped.

If the On/Off button has been used to stop the pump, this button must also be used for restarting.

Relation to other displays:

The “Max.” and “Min.” settings override the setpoint setting in display *12.1.1 Setpoint*.

12.1.3 Alarm



TM Sq1_03 GB

This display shows the types of alarm that may occur.

Possible alarms are described in the following table:

Alarm indication	Description
No fault indication	No alarms are registered by the CU 300.
No contact to pump	No communication between the CU 300 and the pump.
Overvoltage	The supply voltage exceeds the limit value.
Undervoltage	The supply voltage is below the limit value.
Dry running	The dry-running protection of the pump has been activated.
Overtemperature	The motor temperature exceeds the limit value.
Overload	The current consumption of the motor exceeds the limit value.
Alarm, sensor 1	The sensor 1 signal has fallen outside the measuring range set. **Note:** The sensor number refers to the terminal connection input number.
Alarm, sensor 2	The sensor 2 signal has fallen outside the measuring range set. **Note:** The sensor number refers to the terminal connection input number.
Sensor 1 defective	The sensor signal of a 4-20 mA or 2-10 V sensor is below 2 mA or 1 V respectively.
Sensor 2 defective	The sensor signal of a 4-20 mA or 2-10 V sensor is below 2 mA or 1 V respectively.
Warning, sensor 1	The sensor 1 warning limit has been exceeded.
Warning, sensor 2	The sensor 2 warning limit has been exceeded.
Warning, temperature	The temperature warning limit has been exceeded.
Digital alarm: low flow	The installation has been set up for “constant water level” by means of a flow switch. The flow is lower than 0.18 m³/h.

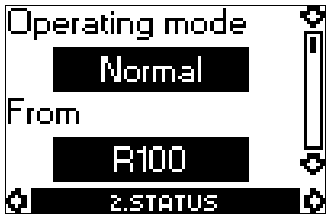
12.2 Menu STATUS

The STATUS menu for the CU 300 provides operating data about pump/motor and sensors. It is not possible to change or set values in this menu.

When [OK] is pressed continuously in this display, the displayed value is being updated.

The measuring accuracy is stated in section *13. Technical data*.

12.2.1 Operating mode



TM Sq2_01 GB

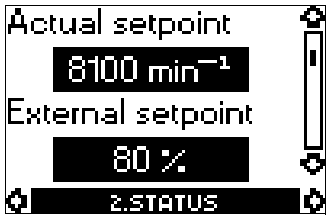
Possible operating modes:

- *Max*.
  Pump operation has been set to maximum speed, e.g. 10,700 min^{-1}.
- *Normal*.
  Normal operating mode, i.e. pump operation is based on the setpoint setting made in display *12.1.1 Setpoint*.
- *Min.*
  Pump operation has been set to minimum speed, 7,000 min^{-1}.
- *Stop.*
  The pump has stopped.

The operating mode was selected from one of the following:

- *CU 300* (On/Off button on the CU 300).
- *R100*.
- *Dig* (signals received via digital input).
- *Sensor 1* (signals received via sensor 1 input).
- *Sensor 2* (signals received via sensor 2 input).

12.2.2 Actual setpoint and external setpoint



TM Sq2_02 GB

This display shows the actual setpoint and the external setpoint in % of the range from minimum value to the setpoint set.

Readings to be used in the following two situations:

- in installations including a potentiometer or
- in large SCADA systems
  (SCADA = Supervisory Control and Data Acquisition).

Relation to other displays:

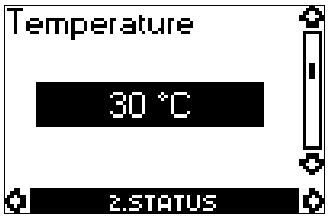
The readings of this display are based on the settings made in display *12.4.2 External setpoint* and *12.1.1 Setpoint*.

External setpoint:

Possible readings: 0-100%.

Tolerance: ±5%.

12.2.3 Temperature



TM Sq2_03 GB

The actual temperature of the motor electronics stated in "°C" or "F".

Tolerance: ±5%.

Relation to other displays:

To select "F", choose the language "US English".

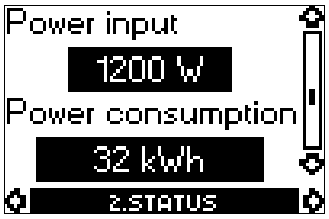
12.2.4 Speed

TM Sq2_04 GB

The actual speed stated in min^{-1} (rpm).

Tolerance: ±1%.

12.2.5 Power input and power consumption



TM Sq2_05 GB

Power input:

The actual motor power from the electricity supply. The power input is displayed in W (watt).

Note: This value is used for the calculation of dry-running power limit (dry-running stop).

Power consumption:

The accumulated motor power consumption in kWh.

The value of power consumption is accumulated from the pump's birth and it cannot be reset.

The value

- is stored in the motor electronics, and it is kept even if the CU 300 is replaced.
- is updated in the software every 2 minutes of continuous operation. The displayed value is updated every two hours.

Tolerance: ±5%.

12.2.6 Operating hours and number of starts

TM Sq2_06 GB

Operating hours:

The value of operating hours is accumulated from the pump's birth and it cannot be reset.

The value

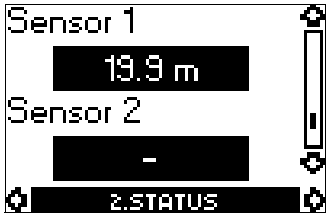
- is stored in the motor electronics, and it is kept even if the CU 300 is replaced.
- is updated in the software every 2 minutes of continuous operation. The displayed value is updated every two hours.

Number of starts:

The value of number of starts is accumulated from the pump's birth and it cannot be reset.

The value is stored in the motor electronics, and it is kept even if the CU 300 is replaced.

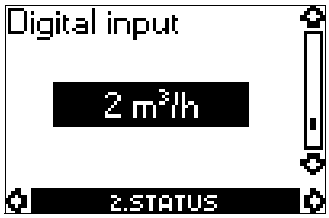
12.2.7 Sensor 1 and sensor 2



TM Sq2_07 GB

The actual values of sensor 1 and sensor 2 respectively.

12.2.8 Digital input



TM Sq2_08 GB

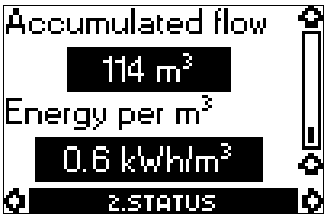
The actual value (flow) registered by the digital sensor based on an l/pulse detection.

Minimum value displayed: 0.1 m³/h.

Relation to other displays:

This display is available only if "Type" is set to "Flow" in display *12.3.10 Digital input*.

12.2.9 Accumulated flow and energy per m³



TM Sq2_09 GB

In this display, the following can be read:

- The water quantity (m³) pumped.
- Energy per m³.
  The energy used to pump 1 m³ (instantaneous value).

Relation to other displays:

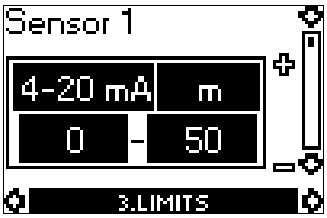
This display is available only if a sensor is selected in display *12.3.11 Accumulated flow*. The accumulated flow is registered by this sensor.

12.3 Menu LIMITS

The LIMITS menu for the CU 300 offers the possibility of setting limit values for pump/motor and sensor operation. It is possible to set both stop, warning and alarm limits in this menu.

Factory settings are marked in **bold**-faced type under each individual display. See also table on page 46.

12.3.1 Sensor 1



TM Sq3_01 GB

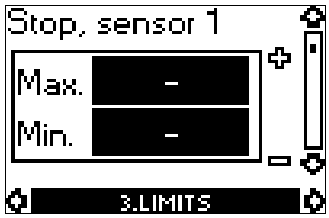
Make the following settings according to sensor type:

- Sensor output signal: **"–"** (not active), *0-20 mA, 4-20 mA, 0-10 V, 2-10 V.*
- Setting range unit: *m³/h,* ***m***, *%, GPM, ft.*

Setting range:

- Minimum value: ***0****-249* (0, 1, 2, ...249).
- Maximum value: ***1****-250* (1, 2, ...250).

12.3.2 Stop, sensor 1



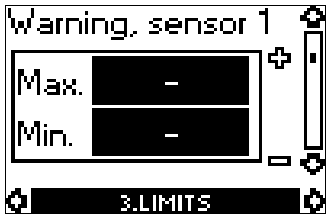
TM Sq3_02 GB

Set the maximum and minimum stop limits of sensor 1.

Setting range/unit:

- Maximum value: **"–"** (not active), possible settings according to the setting in display *12.3.1 Sensor 1*.
- Minimum value: **"–"** (not active), possible settings according to the setting in display *12.3.1 Sensor 1*.

12.3.3 Warning, sensor 1



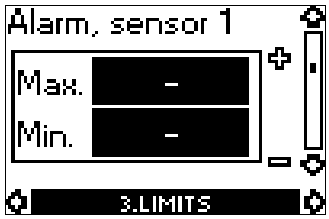
TM Sq3_03 GB

Set the maximum and minimum warning limits of sensor 1.

Setting range/unit:

- Maximum value: **"–"** (not active), possible settings according to the setting in display *12.3.1 Sensor 1*.
- Minimum value: **"–"** (not active), possible settings according to the setting in display *12.3.1 Sensor 1*.

12.3.4 Alarm, sensor 1



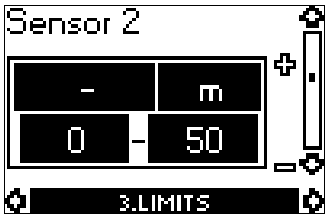
TM Sq3_04 GB

Set the maximum and minimum alarm limits of sensor 1.

Setting range/unit:

- Maximum value: **"–"** (not active), possible settings according to the setting in display *12.3.1 Sensor 1*.
- Minimum value: **"–"** (not active), possible settings according to the setting in display *12.3.1 Sensor 1*.

12.3.5 Sensor 2



TM Sq3_05 GB

Make the following settings according to sensor type:

- Sensor output signal: **"–"** (not active), *0-20 mA, 4-20 mA, 0-10 V, 2-10 V.*
- Setting range unit: *m³/h,* ***m****, %, GPM, ft.*

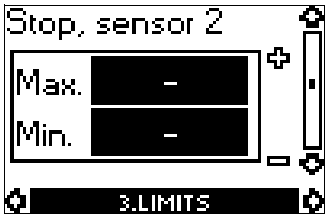
Setting range:

- Minimum value: ***0****-249* (0, 1, 2, ...249).
- Maximum value: ***1****-250* (1, 2, ...250).

Relation to other displays:

If a selection is made in display *12.4.2 External set-point*, display *12.3.5 Sensor 2* is not available - and vice versa.

12.3.6 Stop, sensor 2



TM Sq3_06 GB

Set the maximum and minimum stop limits of sensor 2.

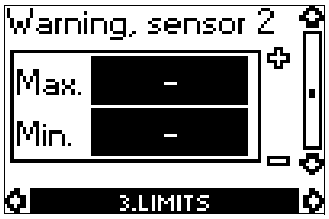
Setting range/unit:

- Maximum value: **"–"** (not active), possible settings according to the setting in display *12.3.5 Sensor 2*.
- Minimum value: **"–"** (not active), possible settings according to the setting in display *12.3.5 Sensor 2*.

Relation to other displays:

If a selection is made in display *12.4.2 External set-point*, display *12.3.6 Stop, sensor 2* is not available.

12.3.7 Warning, sensor 2



TM Sq3_07 GB

Set the maximum and minimum warning limits of sensor 2.

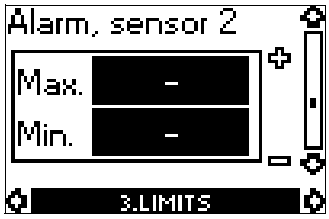
Setting range/unit:

- Maximum value: **"–"** (not active), possible settings according to the setting in display *12.3.5 Sensor 2*.
- Minimum value: **"–"** (not active), possible settings according to the setting in display *12.3.5 Sensor 2*.

Relation to other displays:

If a selection is made in display *12.4.2 External set-point*, display *12.3.7 Warning, sensor 2* is not available.

12.3.8 Alarm, sensor 2



TM Sq3_08 GB

Set the maximum and minimum alarm limits of sensor 2.

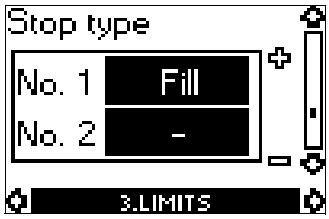
Setting range/unit:

- Maximum value: **"–"** (not active), possible settings according to the setting in display *12.3.5 Sensor 2*.
- Minimum value: **"–"** (not active), possible settings according to the setting in display *12.3.5 Sensor 2*.

Relation to other displays:

If a selection is made in display *12.4.2 External set-point*, display *12.3.8 Alarm, sensor 2* is not available.

12.3.9 Stop type



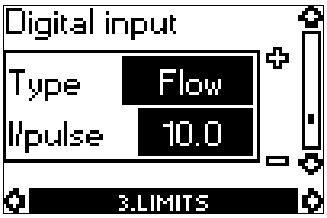
TM Sq3_09 GB

Select the stop function of the sensors connected.

The following functions are available:

- *Fill.*
  The pump must start at a given minimum water level and stop at a given maximum level.
- *Empty.*
  The pump must start at a given maximum water level and stop at a given minimum level.

12.3.10 Digital input



TM Sq3_10 GB

Select the function of either

- the digital sensor connected to the digital input (flow measuring) or
- the external on/off switch for the pump.

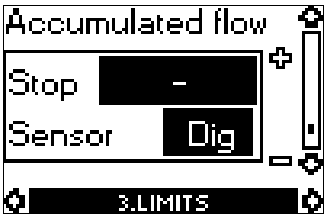
The following functions are available:

- **"–"** (not active).
- *Stop*.
  The pump is stopped when a switch connected to terminals 12 and 13 is closed. No l/pulse to be set. See section *2.5.4 Digital input*.
- *Start*.
  The pump is started when a switch connected to terminals 12 and 13 is closed. No l/pulse to be set. See section *2.5.4 Digital input*.
- *Flow*.
  If "Flow" is selected, the l/pulse value must also be set.
  Setting range: **"–"** (not active), *0.1, 0.2, 0.3, ...20, 21, 22, ...100* l/pulse.

Relation to other displays:

The selection of "Flow" in this display makes display *12.2.8 Digital input* available, i.e. status of digital input.

12.3.11 Accumulated flow



TM Sq3_11 GB

Stop:

Set the pump stop when a given water quantity has been pumped.

Setting range: **"–"** (not active), *0.1, 0.2, 0.3, ...20, 21, 22, ...100 m³*.

The pump stops when the set quantity is reached. By pressing the On/Off button twice, the accumulated quantity is reset and the pump is restarted.

Sensor:

Set the sensor to detect the water quantity.

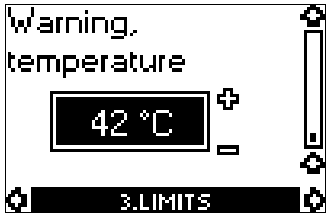
The following settings are available:

- **"–"** (not active).
- *1.*
  Analog sensor input 1.
- *2.*
  Analog sensor input 2.
- *Dig.*
  Digital sensor input.

Relation to other displays:

If a sensor is selected in this display, display *12.2.9 Accumulated flow and energy per m³* is made available.

12.3.12 Warning, temperature



TM Sq3_12 GB

Set the temperature warning limit of the motor.

Setting range: **"–"** (not active), *2, 4, 6, ...85°C*.

Note: The maximum temperature depends on the motor type.

Set the temperature warning limit between normal operating temperature and maximum temperature.

Relation to other displays:

The actual operating temperature is seen in display *12.2.3 Temperature*.

If the temperature warning limit is exceeded, the alarm signal relay operates.

Advantage: Instead of a sudden stop without a warning, you get:

- information that the motor temperature is rising and
- the possibility of planning service of the installation.

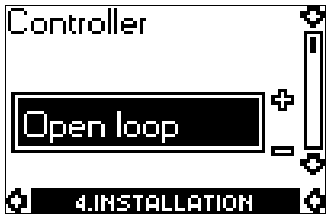
Usage: This function can be used e.g. if the pumped liquid contains a relatively high level of ochre.

12.4 Menu INSTALLATION

The INSTALLATION menu for the CU 300 offers the possibility of configuring the CU 300, pump/motor and sensors.

Factory settings are marked in **bold**-faced type under each individual display. See also table on page 46.

12.4.1 Controller



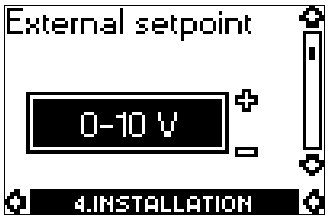
TM Sq4_01 GB

Select the controller type.

The following settings are available:

- ***Open loop.***
  The speed is:
  set to normal operation based on the setpoint set in display *12.1.1 Setpoint* (e.g. 10,700 min^{-1}) or controlled by means of a signal connected to sensor input 2.
  See section *7. CU 300 connected to potentiometer*.
- *Closed loop.*
  Controlling according to sensor 1 (type and unit).
  Example: Constant pressure control.
  See section *4. CU 300 with constant pressure control - 0 to 10 bar*.
  Relation to other displays:
  The unit (min^{-1}) of display *12.1.1 Setpoint* is changed according to the unit of the sensor installed.

12.4.2 External setpoint



TM Sq4_02 GB

Set the pump performance control by means of external signal.

To be used in the following two situations:

- for installations including a potentiometer or
- in large SCADA systems.
  In SCADA systems, this function makes it possible to control pump performance via remote controlling (e.g. via a PC).

The following settings are available:

- *SPP 1*.
  GRUNDFOS potentiometer.
  See section *1.1 Expansion possibilities*.
- *4-20 mA*.
- *0-20 mA*.
- *2-10 V*.
- *0-10 V*.
- **"–"** (not active).
  No external setpoint setting made.

Description:

By connecting a current or voltage signal to sensor input 2, it is possible to control the motor speed between the setpoint set in display *12.1.1 Setpoint* and the lowest speed of 7,000 min^{-1}.

If the setpoint is set to 10,700 min^{-1} in display *12.1.1 Setpoint*, the motor speed can be changed between 7,000 and 10,700 min^{-1}.

The actual setpoint is calculated by the CU 300 and shown in display *12.2.2 Actual setpoint and external setpoint*.

If an SPP 1 potentiometer is connected, the internal voltage supply of the CU 300 is used to generate the signal.

See section *7. CU 300 connected to potentiometer*.

Relation to other displays:

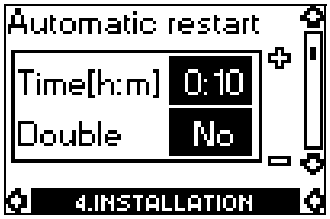
If display *12.4.1 Controller* is set to "Closed loop" instead of "Open loop" (factory setting), the controlling is based on signals from sensor 1. Therefore the unit in display *12.1.1 Setpoint* is changed from min^{-1} to the unit of sensor 1 (m^3/h, m, %, GPM, ft).

If a setting is made in display *12.4.2 External setpoint*, the displays:

- *12.3.5 Sensor 2*,
- *12.3.6 Stop, sensor 2*,
- *12.3.7 Warning, sensor 2*, and
- *12.3.8 Alarm, sensor 2*

are no longer available.

12.4.3 Automatic restart



TM Sq4_03 GB

Set the automatic restart time from stop to restart attempt.

The following settings are available:

Time:

- ***0:05***.
- "–" (not active).
- *1, 2, ...30* m (1 min. intervals),
  30, 45, 1 h, ...*2* h (15 min. intervals),
  2 h *30* m, *3* h, ...*4* h (30 min. intervals).

Double:

- *Yes*,
- ***No***.

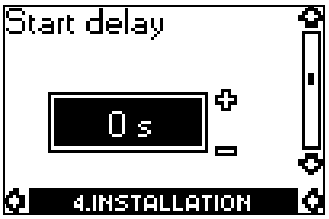
When "Yes" is selected, the restart time set will be doubled automatically for every 10 motor stops caused by an alarm. The time is doubled up to a stop time of 4 hours. After 10 hours of operation without an alarm, the restart time is automatically set to:

- the time set in the "Time" field or
- ***5*** min. (default) if no setting was made in the "Time" field.

Relation to other displays:

If "Double" is selected, the dewatering function is disabled.

12.4.4 Start delay



TM Sq4_04 GB

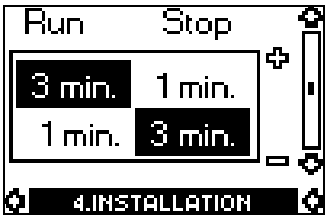
Set a start delay.

This function is used in installations having several pumps connected to the same pipeline and where it is required that the pumps do not start up at the same time.

The SQE pumps have a built-in soft starter. Therefore, the starting current is no problem.

Setting range: ***0**-60 s* (2 sec. intervals).

12.4.5 Run/Stop



TM Sq4_05 GB

Set the Run and Stop times for the dewatering function.

See section *2.8 Description of the dewatering function*.

Operating indication:

The dry-running alarm indication on the CU 300 is automatically disabled, when this display setting is made.

When the setting "–" is selected, the dewatering function is disabled, and the dry-running alarm indication can be activated again.

Run:

Run time, i.e. the period of time in which the pump is to run.

Setting range: **"–"** (not active), *1, 2, ...60 min.*

Stop:

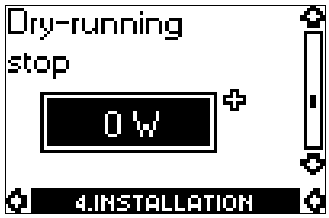
Stop time, i.e. the period of time in which the pump is stopped.

Setting range: **"–"** (not active), *1, 2, ...60 min.*

Relation to other displays:

If "Double" is selected in display *12.4.3 Automatic restart*, the dewatering function is disabled.

12.4.6 Dry-running stop



TM Sq4_06 GB

The dry-running stop value is factory-set.

The value depends on the actual motor.

The factory setting depends on the power rating of the motor, see section *13. Technical data*.

When the dry-running protection or the dewatering function is to be active, the minimum value of the pump power input must be set in this display.

See section *2.8 Description of the dewatering function*.

Setting range: ***0**-2500 W* (10 W intervals).

Relation to other displays:

12.4.7 Dry-running protection must be set to "Active".

If "Double" is selected in display *12.4.3 Automatic restart*, the dewatering function is disabled.

The actual pump power input can be read in display *12.2.5 Power input and power consumption*.

12.4.7 Dry-running protection

TM Sq4_07 GB

The following settings are available:

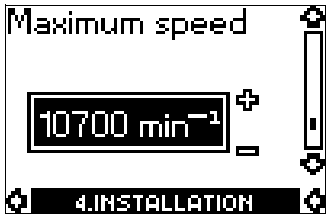
- ***Active***,
- *Not active*.

The setting in this display applies to both the dewatering function and the dry-running protection.

In certain installations, it may be necessary to disable the dry-running protection.

See section *2.6 Description of dry-running protection*.

12.4.8 Maximum speed



TM Sq4_08 GB

Set the maximum speed.

Setting range: *7,000-**10,700 min^{-1}*** (100 min^{-1} intervals).

12.4.9 Button on CU 300

TM Sq4_09 GB

The On/Off button on the CU 300 can be set to:

- ***Active***,
- *Not active*.

12.4.10 Number

TM Sq4_10 GB

Allocate a number to the CU 300 and the pump connected. The CU 300 and the pump must have the same number.

Setting range: **"–"** (not active), *1, 2, ...64*.

Once a number setting has been made, the factory setting (not active) is no longer available.

In connection with BUS communication, a number **must** be allocated to the CU 300 and the pump.

If the CU 300 and the pump do not have the same number, the alarm "No contact" will be indicated.

13. Technical data

Supply voltage

1 x 100-240 V +6%/–10%, 50/60 Hz, PE.

Power consumption

5 W.

Back-up fuse

Maximum 16 A.

Current consumption

Maximum 130 mA.

Mains borne signalling

Frequency shift keying (FSK).
(132.45 kHz, ±0.6 kHz).

Enclosure class

IP 55.

Maximum length between CU 300 and pump

200 metres.

Ambient temperature

- During operation: –30 to +50°C
  (must not be exposed to direct sunlight).
- During storage: –30 to +60°C.

Weight

2.0 kg.

Relative air humidity

Maximum 95%.

Materials

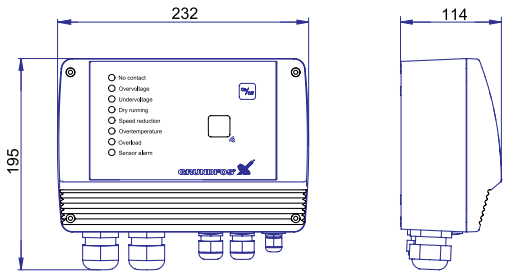
The CU 300 box is made of black PPO.

EMC (Electromagnetic compatibility)

According to EN 55 014 and EN 55 014-2.

Dimensional sketch

Fig. 54



TM01 2781 2298

Inputs/output

Alarm relay	Potential-free changeover contact. Maximum contact load: 250 VAC. Maximum current: 1 A. Minimum contact load: 5 VDC, 10 mA. Specifications: 250 VAC/8A/AC1.
Auxiliary relay	Potential-free changeover contact. Maximum contact load: Safety extra-low voltage to be used only. Maximum current: 1 A. Minimum contact load: 5 VDC, 10 mA. Specifications: 250 VAC/8A/AC1.
Digital input	External potential-free contact. Logic “0”: U_{in} > 3.2 V. Logic “1”: U_{in} < 0.9 V.
Sensor 1	Voltage signal: 0-10 VDC/2-10 VDC, R_i = 11 kΩ. Tolerance: ±3% at maximum voltage signal. Screened cable is recommended. Maximum cable length: 500 m. Current signal: DC 0-20 mA/4-20 mA, R_i = 500 Ω. Tolerance: ±3% at maximum current signal. Screened cable is recommended. Maximum cable length: 500 m.
Sensor 2	Potentiometer SPP 1: 0-24 VDC, 10 kΩ (via internal voltage supply). Screened cable is recommended. Maximum cable length: 100 m. Voltage signal: 0-10 VDC/2-10 VDC, R_i = 11 kΩ. Tolerance: ±3% at maximum voltage signal. Screened cable is recommended. Maximum cable length: 500 m. Current signal: DC 0-20 mA/4-20 mA, R_i = 500 Ω. Tolerance: ±3% at maximum current signal. Screened cable is recommended. Maximum cable length: 500 m.
RS-485	GRUNDFOS field bus, GENIbus. 0.25 - 1 mm² screened 2-core cable. Maximum cable length: 1200 m.
RS-232	Is not electrically separated. RI: Ring Indicator input from modem. DTR: Data Terminal Ready output to modem. RX 232: Input data. TX 232: Output data. GND: Ground.

Factory settings

Alarm	Connected motor (P2)		
	0.1 - 0.63 kW	**0.7 - 1.05 kW**	**1.1 - 1.73 kW**
Overvoltage *)	320 VAC	320 VAC	320 VAC
Undervoltage	Speed reduction: 190 V	Speed reduction: 190 V	Speed reduction: 210 V
	Stop limit: 150 V	Stop limit: 150 V	Stop limit: 150 V
Dry-running stop	300 W	680 W	800 W
Dry running	"Active" (R100 setting, display *12.4.7 Dry-running protection*)		
Speed reduction	In connection with undervoltage or overload		
Overtemperature	Stop limit: 65°C	Stop limit: 65°C	Stop limit: 85°C
	Restart: 55°C	Restart: 55°C	Restart: 75°C
Overload	4 A	8 A	11 A
Sensor alarm	No sensor used (R100 setting, see section *12.3 Menu LIMITS*)		

*) Operation is guaranteed up to 280 VAC. In order to avoid unnecessary stops, the overvoltage stop limit is as stated.

Accuracy of R100 readings

Operation

Display	Accuracy
12.2.2 External setpoint	±5%
12.2.3 Temperature	±5%
12.2.4 Speed	±1%
12.2.5 Power input	±5%
12.2.5 Power consumption	±5%
12.2.9 Energy per m^3	±5%

Sensors

The sensor signal accuracy depends on the sensor type. See the sensor specifications in question.

14. Disposal

Disposal of this product or parts of it must be carried out according to the following guidelines:

1. Use the local public or private waste collection service.
2. In case such waste collection service does not exist or cannot handle the materials used in the product, please deliver the product or any hazardous materials from it to your nearest GRUNDFOS company or service workshop.

Denmark
GRUNDFOS DK A/S
Poul Due Jensens Vej 7A
DK-8850 Bjerringbro
Tlf.: +45-87 50 50 50
Telefax: +45-87 50 51 51

Argentina
Bombas GRUNDFOS de Argentina S.A.
Mexico 1404
(1640) Martinex
Buenos Aires
Phone: +54-11-4717 0090
Telefax: +54-11-4717 1091

Australia
GRUNDFOS Pumps Pty. Ltd.
P.O. Box 2040
Regency Park
South Australia 5942
Phone: +61-8-8461-4611
Telefax: +61-8-8346 2313

Austria
GRUNDFOS Pumpen Vertrieb Ges.m.b.H.
Grundfosstraße 2
A-5082 Grödig/Salzburg
Tel.: +43-6246-883-0
Telefax: +43-6246-883-30

Belgium
N.V. GRUNDFOS Bellux S.A.
Boomsesteenweg 81-83
B-2630 Aartselaar
Tél.: +32-3-870 7300
Télécopie: +32-3-870 7301

Brazil
GRUNDFOS do Brasil Ltda.
Rua Tomazina 106
CEP 83325 - 040
Pinhais - PR
Phone: +55-41 668 3555
Telefax: +55-41 668 3554

Canada
GRUNDFOS Canada Inc.
2941 Brighton Road
Oakville, Ontario
L6H 6C9
Phone: +1-905 829 9533
Telefax: +1-905 829 9512

China
GRUNDFOS Pumps (Shanghai) Co. Ltd.
22 Floor, Xin Hua Lian Building
755-775 Huai Hai Rd, (M)
Shanghai 200020
PRC
Phone: +86-21-64 67 28 09
Telefax: +86-21-64 67 28 08

Czech Republic
GRUNDFOS s.r.o.
Cajkovského
779 00 Olomouc
Phone: +420-68-5716 111
Telefax: +420-68-543 8908

Finland
OY GRUNDFOS Pumput AB
Mestarintie 11
Piispankylä
FIN-01730 Vantaa (Helsinki)
Phone: +358-9 878 9150
Telefax: +358-9 878 91550

France
Pompes GRUNDFOS Distribution S.A.
Parc d'Activités de Chesnes
57, rue de Malacombe
F-38290 St. Quentin Fallavier (Lyon)
Tél.: +33-4 74 82 15 15
Télécopie: +33-4 74 94 10 51

Germany
GRUNDFOS GMBH
Willy Pelz Straße 1-5
D-23812 Wahlstedt/Holstein
Tel.: +49-4554-98-0
Telefax: +49-4554-98 7399/7355

Greece
GRUNDFOS Hellas A.E.B.E.
20th km. Athinon-Markopoulou Av.
P.O. Box 71
GR-19002 Peania
Phone: +30-1-66 83 400
Telefax: +30-1-6646273

Hong Kong
GRUNDFOS Pumps (Hong Kong) Ltd.
Unit 1, Ground floor
Siu Wai Industrial Centre
29-33 Wing Hong Street &
68 King Lam Street, Cheung Sha Wan
Kowloon
Phone: +852-27861706/27861741
Telefax: +852-27858664

Hungary
GRUNDFOS Hungária Kft.
Lakatos u. 65
H-1184 Budapest
Phone: +36-1296 0620
Telefax: +36-1290 5534

India
GRUNDFOS Pumps India Private Limited
Flat A, Ground Floor
61/62 Chamiers Aptmt
Chamiers Road
Chennai 600 028
Phone: +91-44 432 3487
Telefax: +91-44 432 3489

Indonesia
PT GRUNDFOS Pompa
Jl. Rawa Sumur III, Blok III / CC-1
Kawasan Industri, Pulogadung
Jakarta 13930
Phone: +62-21-460 6909
Telefax: +62-21-460 6910/460 6901

Ireland
GRUNDFOS (Ireland) Ltd.
Unit 34, Stillorgan Industrial Park
Blackrock
County Dublin
Phone: +353-1-2954926
Telefax: +353-1-2954739

Italy
GRUNDFOS Pompe Italia S.r.l.
Via Gran Sasso 4
I-20060 Truccazzano (Milano)
Tel.: +39-02-95838112/95838212
Telefax: +39-02-95309290/ 95838461

Japan
GRUNDFOS Pumps K.K.
1-2-3, Shin Miyakoda
Hamamatsu City
Shizuoka pref. 431-21
Phone: +81-53-428 4760
Telefax: +81-53-484 1014

Korea
GRUNDFOS Pumps Korea Ltd.
2nd Fl., Dong Shin Building
994-3 Daechi-dong, Kangnam-Ku
Seoul 135-280
Phone: +82-2-5317 600
Telefax: +82-2-5633 725

Malaysia
GRUNDFOS Pumps Sdn. Bhd.
7 Jalan Peguam U1/25
Glenmarie Industrial Park
40150 Shah Alam
Selangor
Phone: +60-3-519 29 22
Telefax: +60-3-519 28 66

Mexico
Bombas GRUNDFOS de Mexico S.A. de C.V.
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
Apodaca, N.L. 66600
Mexico
Phone: +52-8-144 4000
Telefax: +52-8-144 4010

Netherlands
GRUNDFOS Nederland B.V.
Pampuslaan 190
NL-1382 JS Weesp
Tel.: +31-294-492 211
Telefax: +31-294-492244/492299

New Zealand
GRUNDFOS Pumps NZ Ltd.
17 Beatrice Tinsley Crescent
North Harbour Industrial Estate
Albany, Auckland
Phone: +64-9-415 3240
Telefax: +64-9-415 3250

Norway
GRUNDFOS Pumper A/S
Strømsveien 344
Postboks 235, Leirdal
N-1011 Oslo
Tlf.: +47-22 90 47 00
Telefax: +47-22 32 21 50

Poland
GRUNDFOS Pompy Sp. z o.o.
ul. Klonowa 23
Baranowo k. Poznania
PL-62-081 Przezmierowo
Phone: +48-61-650 13 00
Telefax: +48-61-650 13 50

Portugal
Bombas GRUNDFOS (Portugal) Lda.
Rua Calvet de Magalhães, 241
Apartado 1079
P-2780 Paço de Arcos
Tel.: +351-21-440 76 00
Telefax: +351-21-440 76 90

Russia
OOO GRUNDFOS- Service Center
Shkolnaya, ul., 39
RUS-109544 Moskow
Phone: +7-095 271 00 00
Telefax: +7-095 271 09 39

Singapore
GRUNDFOS (Singapore) Pte. Ltd.
24 Tuas West Road
Jurong Town
Singapore 638381
Phone: +65-861 5381
Telefax: +65-861 8402

Spain
Bombas GRUNDFOS España S.A.
Camino de la Fuentecilla, s/n
E-28110 Algete (Madrid)
Tel.: +34-91-848 8800
Telefax: +34-91-628 0465

Sweden
GRUNDFOS AB
Box 63, Angeredsvinkeln 9
S-424 22 Angered
Tel.: +46-31-332 23 00
Telefax: +46-31 331 94 60

Switzerland
GRUNDFOS Pumpen AG
Bruggacherstrasse 10
CH-8117 Fällanden/ZH
Tel.: +41-1-806 8111
Telefax: +41-1-806 8115

Taiwan
GRUNDFOS Pumps (Taiwan) Ltd.
14, Min-Yu Road
Tunglo Industrial Park
Tunglo, Miaoli County
Taiwan 366, R.O.C.
Phone: +886-37-98 05 57
Telefax: +886-37-98 05 70

Thailand
GRUNDFOS (Thailand) Ltd.
947/168 Moo 12, Bangna-Trad Rd., K.M. 3,
Bangna, Phrakanong
Bangkok 10260
Phone: +66-2-744 1785 ... 91
Telefax: +66-2-744 1775 ... 6

Turkey
GRUNDFOS POMPA SAN. ve TIC. LTD. STI
Bulgurlu Caddesi no. 32
TR-81190 Üsküdar Istanbul
Phone: +90 - 216-4280 306
Telefax: +90 - 216-3279 988

United Arab Emirates
GRUNDFOS Gulf Distribution
P.O. Box 16768
Jebel Ali Free Zone
Dubai
Phone: +971-4- 8815 166
Telefax: +971-4-8815 136

United Kingdom
GRUNDFOS Pumps Ltd.
Grovebury Road
Leighton Buzzard/Beds. LU7 8TL
Phone: +44-1525-850000
Telefax: +44-1525-850011

U.S.A.
GRUNDFOS Pumps Corporation
3131 North Business Park Avenue
Fresno, CA 93727
Phone: +1-559-292-8000
Telefax: +1-559-291-1357

Addresses revised 31.07.2000

96 42 79 72

V7 14 46 90 08 00	GB
Repl. V7 14 46 90 10 99	

GRUNDFOS®

Appendix G

Passive Skimmer Manufacturer's Information

SOS® Passive Skimmers

For Low Recovery Wells

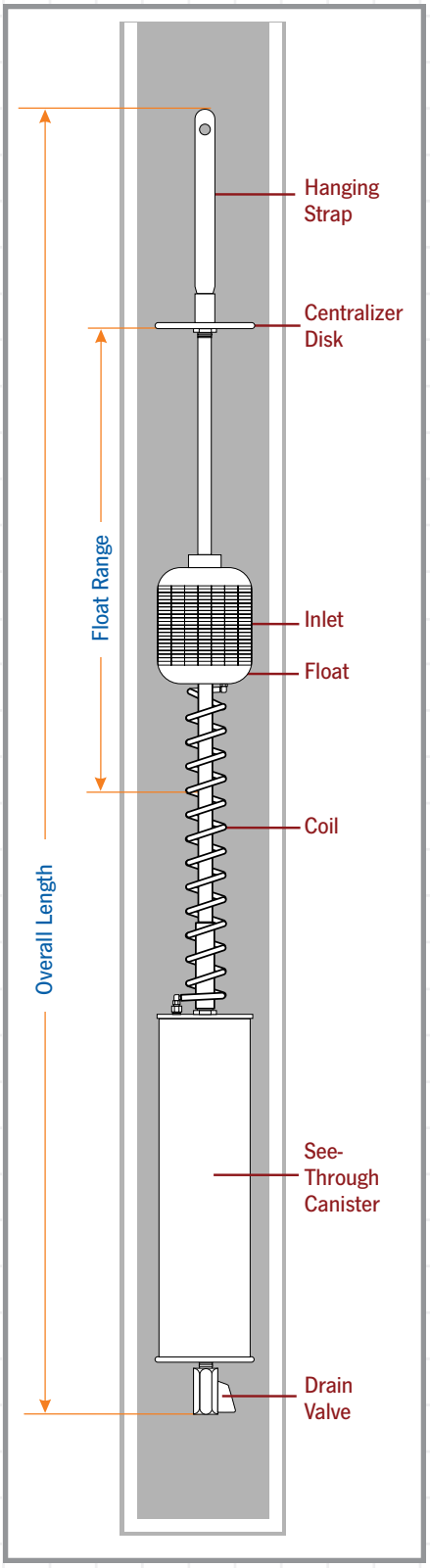
The QED family of Passive Skimmers has been designed for free product recovery applications in sites where active pumping systems are not applicable due to existing conditions or extreme low permeability formations. The floating intake head follows the groundwater fluctuations in the recovery well, allowing only the free-floating phase (LNAPL) to be captured, without taking water, and stored in the built-in reservoir for further manual transfer to a tank.

Passive Skimmers are available for 2" (50 mm) and 4" (100 mm) extraction wells, with different reservoir capacities.

Advantages

1. **Simple systems for extreme low recovery applications.**
2. **Inexpensive option if active system is not practical.**

SOS® Passive Skimmers



Specifications

Model No.	2 in. SOS 301079	2 in. SOS 301080	4 in. SOS 301032	4 in. SOS 301033
Canister Volume	20 oz. (600 cc)	30 oz. (900 cc)	101 oz. (3,000 cc)	203 oz. (6,000 cc)
Well Diameter	2 in. (5 cm)	2 in. (5 cm)	4 in. (10 cm)	4 in. (10 cm)
Float Travel Range	12 in. (30 cm)	12 in. (30 cm)	18 in. (46 cm)	18 in. (46 cm)
Overall Length	65 in. (165 cm)	76.5 in. (194 cm)	69.5 in. (177 cm)	85.5 in. (217 cm)

LNAPL Fluid Density	< 1.0 SG
Kinematic Viscosity @ 50 ˚F (10 ˚C)	200 centistokes
Recommended Initial LNAPL Layer	> .25 in. (> .64 cm)
Residual LNAPL Layer	Sheen
Suitable Types of LNAPL	Gasoline, jet fuel
Materials	Stainless steel, Viton®, PVC, brass, closed cell foam.

Viton is registered trademark of DuPont Dow Elastomers.

Characterize Your Specific Site

The QED Test Kit enables you to measure the density and viscosity of your actual floating hydrocarbon layer. This FREE, do-it-yourself kit comes complete with simple, illustrated instructions. Once you have recorded the results of your hydrocarbon test, QED application specialists will be able to provide expert technical assistance in system design and specification.

P.O. Box 3726 Ann Arbor, MI 48106 USA **800-624-2026** **F 734-995-1170** info@qedenv.com www.qedenv.com

Appendix H

Flow Meter Manufacturer's Information

SIEMENS

Calculations on MAG5100W DN 25 / 1" sensor

Low flow range

Flowrate [Gal(US)/min]	Flow velocity [m/s]	Max. error *) [% of Flowrate]
0.78	0.10	± 1.20
0.97	0.12	± 1.00
2.59	0.33	± 0.50

Selected flow range

Flowrate [Gal(US)/min]	Flow velocity [m/s]	Max. error *) [% of Flowrate]
0.25	0.03	
1.04	0.13	± 0.95
1.83	0.24	± 0.62
2.62	0.34	± 0.50
3.42	0.44	± 0.43
4.21	0.54	± 0.38
5.00	0.64	± 0.36

Maximum flow rate

Flowrate [Gal(US)/min]	Flow velocity [m/s]	Max. error *) [% of Flowrate]
77.81	10.00	± 0.21

The following data are used for the calculation:

Transmitter choice:	MAG6000	Minimum flow rate:	0.25 Gal(US)/min
Sensor choice:	MAG5100W	Maximum flow rate:	5 Gal(US)/min

Accuracy: 0.2% ± 1.0 mm/s

Version: 3.2.410 (2012-07-24)

SIEMENS

SITRANS F

Electromagnetic flowmeters SITRANS FM MAG 5100 W

Operating Instructions

Introduction 1

Safety notes 2

Description 3

Installing/Mounting 4

Connecting 5

Service and maintenance 6

Diagnostics and Troubleshooting 7

Technical specifications 8

Product documentation and support A

Appendix B

7ME652
7ME658

04/2022
A5E03063678-AF

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Digital Industries
Postfach 48 48
90026 NÜRNBERG
GERMANY

Document order number: A5E03063678
Ⓟ 05/2022 Subject to change

Table of contents

1 Introduction 5

1.1 Purpose of this documentation 5

1.2 Document history 5

1.3 Designated use 5

1.4 Checking the consignment 6

1.5 Items supplied 6

1.6 Industrial use note 6

1.7 Security information 6

1.8 Transportation and storage 7

1.9 Notes on warranty 7

2 Safety notes 9

2.1 Laws and directives 9

2.2 Conformity with European directives 10

2.3 Conformity with PED directive 10

2.4 Installation in hazardous area 13

2.5 Improper device modifications 14

2.6 Custody transfer 14

2.6.1 MI-001 14

2.6.2 PTB K7.2 15

3 Description 17

3.1 System components 17

3.2 Design 18

3.3 Theory of operation 18

4 Installing/Mounting 21

4.1 Installation safety precautions 21

4.2 Determining a location 22

4.3 Orienting the sensor 25

4.4 Mounting 26

4.5 Potential equalization 31

5 Connecting 33

5.1 Remote installation 34

5.2 Installation check 37

5.3 Potting ... 38
5.4 Direct burial ... 39
6 Service and maintenance ... 41
6.1 Maintenance ... 41
6.2 Verification ... 41
6.3 Recalibration ... 43
6.4 Technical support ... 43
6.5 Transportation and storage ... 44
6.6 Return procedure ... 44
6.7 Disposal ... 45
7 Diagnostics and Troubleshooting ... 47
7.1 Sensor check ... 47
7.2 Fluctuating process values ... 48
8 Technical specifications ... 49
8.1 MAG 5100 W ... 49
8.2 Cable data ... 53
8.3 Effect of temperature on working pressure ... 54
8.4 Process fluid conductivity ... 55
8.5 Liner selection ... 56
8.6 Electrode selection ... 56
8.7 Sizing tables ... 57
8.8 Dimensions and weight ... 59
A Product documentation and support ... 65
A.1 Product documentation ... 65
A.2 Technical support ... 66
B Appendix ... 67
B.1 Measuring ranges ... 67
B.2 Measuring range according to EN1434 (2007) ... 69
B.3 Flange mating dimensions (metric) ... 70
B.4 Factory settings ... 76
B.5 Coil resistance ... 78
Glossary ... 81
Index ... 83

Introduction

1

1.1 Purpose of this documentation

These instructions contain all information required to commission and use the device. Read the instructions carefully prior to installation and commissioning. In order to use the device correctly, first review its principle of operation.

The instructions are aimed at persons mechanically installing the device, connecting it electronically, configuring the parameters and commissioning it, as well as service and maintenance engineers.

1.2 Document history

The contents of these instructions are regularly reviewed and corrections are included in subsequent editions. We welcome all suggestions for improvement.

The following table shows the most important changes in the documentation compared to each previous edition.

Edition	Remarks
04/2022	Electrical connection correction
10/2021	Updated torque values
09/2021	Updated Installation instructions
01/2020	Integration of JIS 10K in 7ME652
09/2018	Updated custody transfer
05/2016	• General update • Updated safety notes • Updated torque values • Updated remote installation • Updated technical data
11/2010	Minor updates
07/2010	First edition Replaces MAG 5100 W part of SITRANS FM Handbook (A5E02435647) and MAG 5100 W instruction (A5E00718677)

1.3 Designated use

Use the device in accordance with the information on the nameplate and in the Technical specifications (Page 49).

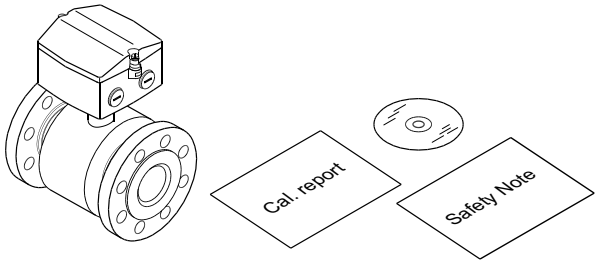
1.4 Checking the consignment

1. Check the packaging and the delivered items for visible damages.
2. Report any claims for damages immediately to the shipping company.
3. Retain damaged parts for clarification.
4. Check the scope of delivery by comparing your order to the shipping documents for correctness and completeness.

⚠ **WARNING**
Using a damaged or incomplete device Risk of explosion in hazardous areas. • Do not use damaged or incomplete devices.

1.5 Items supplied

- SITRANS FM MAG 5100 W
- Calibration report
- DVD with documentation and cerificates
- Safety Note



1.6 Industrial use note

NOTICE
Use in a domestic environment This Class A Group 1 equipment is intended for use in industrial areas. In a domestic environment this device may cause radio interference.

1.7 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
https://www.siemens.com/industrialsecurity.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
https://www.siemens.com/cert.

1.8 Transportation and storage

To guarantee sufficient protection during transport and storage, observe the following:

- Keep the original packaging for subsequent transportation.
- Devices/replacement parts should be returned in their original packaging.
- If the original packaging is no longer available, ensure that all shipments are properly packaged to provide sufficient protection during transport. Siemens cannot assume liability for any costs associated with transportation damages.

NOTICE
Insufficient protection during storage The packaging only provides limited protection against moisture and infiltration. • Provide additional packaging as necessary.

Special conditions for storage and transportation of the device are listed in Technical specifications (Page 49).

1.9 Notes on warranty

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. The sales contract contains all obligations on the part of Siemens as well as the complete and solely applicable warranty conditions. Any statements regarding device versions described in the manual do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of publishing. Siemens reserves the right to make technical changes in the course of further development.

Safety notes

2

This device left the factory in good working condition. In order to maintain this status and to ensure safe operation of the device, observe these instructions and all the specifications relevant to safety.

Observe the information and symbols on the device. Do not remove any information or symbols from the device. Always keep the information and symbols in a completely legible state.

⚠ CAUTION

Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Only qualified personnel should install or operate this instrument.

Note

Alterations to the product, including opening or improper modifications of the product are not permitted.

If this requirement is not observed, the CE mark and the manufacturer's warranty will expire.

2.1 Laws and directives

Observe the safety rules, provisions and laws applicable in your country during connection, assembly and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC Part I) (Canada)

Further provisions for hazardous area applications are for example:

- IEC 60079-14 (international)
- EN 60079-14 (EU and UK)

2.2 Conformity with European directives

The CE marking on the device symbolizes the conformity with the following European directives:

Electromagnetic compatibility EMC 2014/30/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to electromagnetic compatibility
Low voltage directive LVD 2014/35/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
Pressure equipment directive PED 2014/68/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment

The applicable directives can be found in the EU declaration of conformity of the specific device.

CE marked equipment

All meters carry either a CE mark or a CE mark followed by eg.200

- CE200: This indicates that the product conforms to:
  - PED 2014/68/EU
  - LVD 2014/35/EU
  - EMC 2014/68/EU
- CE: This indicates that the product conforms to:
  - LVD 2014/35/EU
  - EMC 2014/68/EU

2.3 Conformity with PED directive

Instrument safety standards

The device has been tested at the factory, based on the safety requirements. In order to maintain this condition over the expected life of the device the requirements described in these Operating Instructions must be observed.

NOTICE
Material compatibility Siemens Flow Instruments can provide assistance with the selection of wetted sensor parts. However, the full responsibility for the selection rests with the customer and Siemens Flow Instruments can take no responsibility for any failure due to material incompatibility.

Conformity with PED directive

"Pressure Equipment Directive" (PED) is mandatory for all pressure equipment sold within the EU and EFTA.

Note

Liquids danger group

The device is designed for liquids of danger group "Liquids fluid group 1"

Siemens Flow Instruments products confirm to PED by following the tables below.

Table 2-1 MAG 5100 W (7ME6520)

Flange size		EN 1092-1			AS 4087	ANSI B16,5	AWWA C-207	JIS B 2220:2004
mm	inch	PN 10	PN 16	PN 40	PN 16	150 lb	300 lb	K 10
15	½"	N/A	N/A	SEP	N/A	SEP	N/A	SEP
25	1"	N/A	N/A	SEP	N/A	SEP	N/A	SEP
40	1½"	N/A	N/A	SEP	N/A	SEP	N/A	SEP
50	2"	N/A	SEP	N/A	SEP	SEP	N/A	SEP
65	2½"	N/A	SEP	N/A	SEP	SEP	N/A	SEP
80	3"	N/A	SEP	N/A	SEP	SEP	N/A	SEP
100	4"	N/A	SEP	N/A	SEP	SEP	N/A	SEP
125	5"	N/A	SEP	N/A	N/A	Cat II	N/A	SEP
150	6"	N/A	Cat II	N/A	Cat II	Cat II	N/A	Cat II
200	8"	SEP	Cat II	N/A	Cat II	Cat II	N/A	Cat II
250	10"	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
300	12"	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
350	14"	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
400	16"	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
450	18"	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
500	20"	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
600	24"	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
700	28"	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A
750	30"	N/A	N/A	N/A	N/A	N/A	Cat I	N/A
800	32"	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A
900	36"	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A
1000	40"	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A
1050	42"	N/A	N/A	N/A	N/A	N/A	Cat I	N/A
1100	44"	N/A	N/A	N/A	N/A	N/A	Cat I	N/A
1200	48"	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A

Table 2-2 MAG 5100 W (7ME6580)

Flange size		**EN 1092-1**				**AS 4087**	**ANSI B16,5**	**AWWA C-207**	**JIS B 2220:2004**
mm	**inch**	**PN 6**	**PN 10**	**PN 16**	**PN 40**	**PN 16**	**150 lb**	**300 lb**	**K 10**
15	½"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	1"	N/A	N/A	N/A	SEP	N/A	SEP	N/A	SEP
40	1½"	N/A	N/A	N/A	SEP	N/A	SEP	N/A	SEP
50	2"	N/A	N/A	N/A	SEP	SEP	SEP	N/A	SEP
65	2½"	N/A	N/A	SEP	N/A	SEP	SEP	N/A	SEP
80	3"	N/A	N/A	SEP	N/A	SEP	SEP	N/A	SEP
100	4"	N/A	N/A	SEP	N/A	SEP	SEP	N/A	SEP
125	5"	N/A	N/A	SEP	N/A	N/A	Cat II	N/A	SEP
150	6"	N/A	N/A	Cat II	N/A	Cat II	Cat II	N/A	Cat II
200	8"	N/A	SEP	Cat II	N/A	Cat II	Cat II	N/A	Cat II
250	10"	N/A	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
300	12"	N/A	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
350	14"	N/A	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
400	16"	N/A	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
450	18"	N/A	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
500	20"	N/A	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
600	24"	N/A	Cat I	Cat II	N/A	Cat II	Cat II	N/A	Cat II
700	28"	N/A	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A
750	30"	N/A	N/A	N/A	N/A	N/A	N/A	Cat I	N/A
800	32"	N/A	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A
900	36"	N/A	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A
1000	40"	N/A	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A
1050	42"	N/A	N/A	N/A	N/A	N/A	N/A	Cat I	N/A
1100	44"	N/A	N/A	N/A	N/A	N/A	N/A	Cat I	N/A
1200	48"	N/A	Cat I	Cat II*	N/A	Cat II	N/A	Cat I	N/A
1400	54"	Cat I	Cat I	Cat II*	N/A	N/A	N/A	Cat I	N/A
1500	60"	Cat I	Cat I	Cat II*	N/A	N/A	N/A	Cat I	N/A
1600	66"	Cat I	Cat I	Cat II*	N/A	N/A	N/A	Cat I	N/A
1800	72"	Cat I	Cat I	Cat II*	N/A	N/A	N/A	Cat I	N/A
2000	78"	Cat I	Cat I	Cat II*	N/A	N/A	N/A	Cat I	N/A

The key to the tables is as follows:

Table 2-3 Table key

Cat I	Product covered by PED Cat I and only available as fully PED conforming
Cat II	Product covered by PED Cat II and only available as fully PED conforming
Cat II*	Product covered by PED Cat II but available as non-conforming to PED
SEP	Excluded from PED under Sound Engineering Practice

2.4 Installation in hazardous area

WARNING

Equipment used in hazardous locations

Equipment used in hazardous locations must be Ex-approved for the region of installation and marked accordingly. It is required that the special conditions for safe use provided in the manual and in the Ex certificate are followed!

Hazardous area approvals

The device is approved for use in hazardous area and has the following approvals:

- MAG 5100 W DN 15 to 1200: FM / CSA Class I, Div. 2

WARNING

Suitable hazardous area approval

Make sure the hazardous area approval is suitable for the environment in which the device will be installed.

WARNING

All approvals are based on non-flammable processes only!

WARNING

Potential equalization

In operation, the output is earthed through the conductive medium being measured and therefore potential equalisation is necessary throughout the hazardous area.

The apparatus housing shall be connected to the potential equalising conductor in the hazardous area.

WARNING

Laying of cables

Cables for use in hazardous area must satisfy the requirements for having a proof voltage < AC 500 V applied between the conductor/ground, conductor/shield and shield/ground.

Connect the devices that are operated in hazardous areas as per the stipulations applicable in the country of operation.

2.5 Improper device modifications

WARNING

Improper device modifications

Risk to personnel, system and environment can result from modifications to the device, particularly in hazardous areas.

- Only carry out modifications that are described in the instructions for the device. Failure to observe this requirement cancels the manufacturer's warranty and the product approvals.

2.6 Custody transfer

MAG 5100W (7ME652) is approved for custody transfer.

2.6.1 MI-001

The MAG 5100 W MI-001 verified and labeled products are a Class II approval according to Directive 2014/32/EU of the European Parliament and Council of 26 February, 2014 on measuring instruments, Annex VI Thermal Energy Meters (MI-004) in the sizes from DN 50 to DN 1200 (Article No. 7ME6520). The MID certification is obtained as a modul B + D module approval according to the above mentioned directive. Module B : Type approval according to OIML R 49 Module D : Quality insurance approval of production.

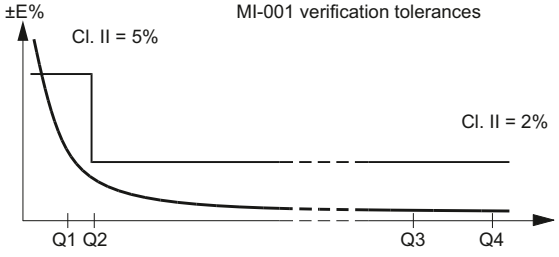


Figure 2-1 MI-001 verification tolerances

MI-001 approval is valid for:

- DN 50 to 1200 mm (2" to 48")
- Horizontal and vertical installation
- Compact or remote with max. 500 m cable
- Power supply 115 to 230 V AC, 12 to 24 V AC/DC

Other restrictions may apply (see certificate).

Special label is required for MI-001 approved meters. An example of the product label is shown below:

Figure 2-2 Nameplate MAG 6000, 5100 W

MAG 5100 W (7ME6520) MI-001 is verified and labeled at a given Q3 and Q3/Q4 = 1.25 and Q2/Q1 = 1.6 measuring ranges see appendix Measuring ranges (Page 67)

2.6.2 PTB K7.2

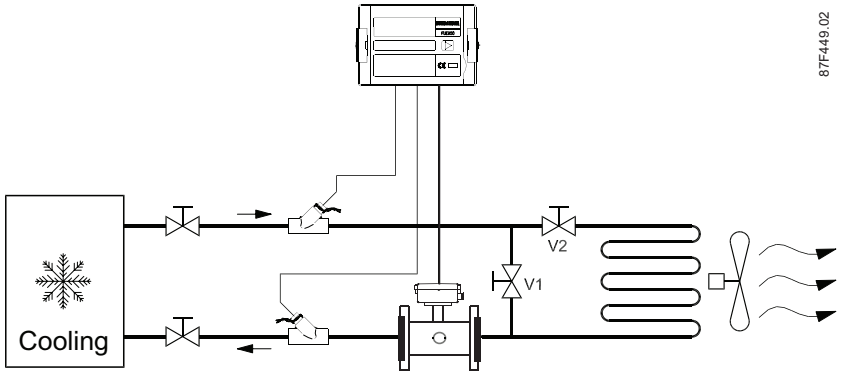
MAG 5000/6000 CT together with MAG 5100W (7ME652) are approved for PTB K7.2 under the following installation conditions:

- DN 50 to 300 mm (2" to 12")
- Horizontal installation
- Compact or remote with max. 10 m (33 ft.) cable

Other restrictions may apply (see certificate 22.76/10.02)

Measuring range according to EN1434 (2007), see appendix Measuring range according to EN1434 (2007) (Page 69)

Installation conditions



Description

3

The main applications of the SITRANS F M electromagnetic flow sensors can be found in the following fields:

- Process industry
- Chemical industry
- Steel industry
- Mining
- Utility
- Power generation & distribution
- Oil & gas / HPI
- Water & waste water
- Pulp & paper

3.1 System components

The SITRANS FM flowmeter system includes:

- Transmitter (types: SITRANS FM MAG 5000/6000 or MAG 6000 I)
- Sensor (types: SITRANS FM MAG 1100/1100 F, MAG 3100/3100 P or MAG 5100 W)
- Communication module (optional) (types: HART, PROFIBUS PA/DP, MODBUS RTU RS 485, Foundation Fieldbus H1, Devicenet)
- SENSORPROM memory unit

Communication solutions

The SITRANS FM range of add-on modules, presently including HART, Foundation Fieldbus. MODBUS RTU RS 485, PROFIBUS PA / DP and Devicenet, are all applicable with the SITRANS FM MAG 6000 transmitter.

3.2 Design

The SITRANS FM MAG 5100 W is an electromagnetic flow sensor designed to meet the requirements in ground water, drinking water, waste water, sewage or sludge applications. With its coned design, increased low-flow accuracy is achieved making it especially useful for leak detection. It is suitable for direct burial and constant flooding. MAG 5100 W complies with drinking water and custody transfer approvals.

MAG 5100W DN15 to 40

MAG 5100W DN50 to 300 (7ME6520)

MAG 5100W DN350 to 1200 (7ME6520)

MAG 5100W DN25 to 2000 (7ME6580)

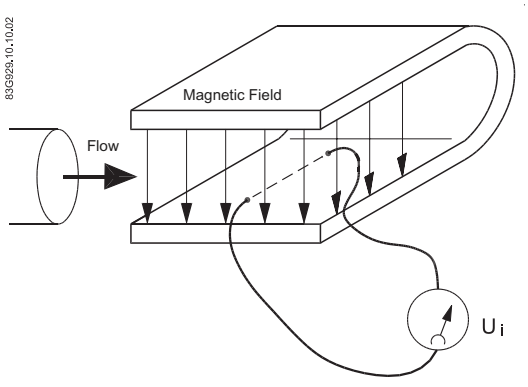
MAG 5100W compact installation with MAG 5000/6000 IP67

MAG 5100W compact installation with MAG 6000 I

The sensors carry a wide range of approvals, see Technical data (Page 49).

3.3 Theory of operation

The flow measuring principle is based on Faraday's law of electromagnetic induction.



U_i = When an electrical conductor of length L is moved at velocity v, perpendicular to the lines of flux through a magnetic field of strength B, the voltage U_i is induced at the ends of the conductor

U_i = L x B x v

- U_i = Induced voltage
- L = Conductor length = Inner pipe diameter = k_1
- B = Magnetic field strength = k_2
- v = Velocity of conductor (media)
- k = k_1 x k_2

U_i = k x v, the electrode signal is directly proportional to the fluid velocity

Operating principle

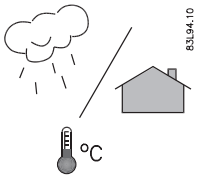
The coil current module generates a pulsating magnetizing current that drives the coils in the sensor. The current is permanently monitored and corrected. Errors or cable faults are registered by the self-monitoring circuit.

The input circuit amplifies the flow-proportional induced voltage signal from the electrodes. The input impedance is extremely high: $>10^{14}$ Ω which allows flow measurements on fluids with conductivities as low as 5 µS/cm. Measuring errors due to cable capacitance are eliminated due to active cable screening.

The digital signal processor converts the analog flow signal to a digital signal and suppresses electrode noise through a digital filter. Inaccuracies in the transmitter as a result of long-term drift and temperature drift are monitored and continuously compensated for via the self-monitoring circuit. The analog to digital conversion takes place in an ultra low noise ASIC with 23 bit signal resolution. This has eliminated the need for range switching. The dynamic range of the transmitter is therefore unsurpassed with a turn down ratio of minimum 3000:1.

Installing/Mounting

4



SITRANS F flowmeters with minimum IP65/NEMA 4X enclosure rating are suitable for indoor and outdoor installations.

- Make sure that pressure and temperature specifications indicated on the device nameplate / label will not be exceeded.

WARNING

Installation in hazardous location

Special requirements apply to the location and interconnection of sensor and transmitter.
See Installation in hazardous area (Page 13)

4.1 Installation safety precautions

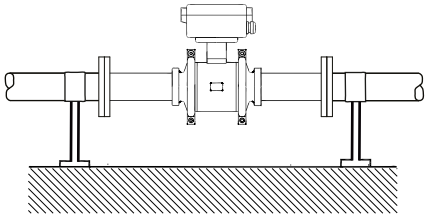
WARNING

High pressure hazard

In applications with working pressures/media that can be dangerous to people, surroundings, equipment or others in case of pipe fracture, we recommend that special precautions such as special placement, shielding or installation of a pressure guard or a safety valve are taken when the flowmeter is mounted.

Note

Install the sensor in well-supported pipelines in order to support the weight of the flowmeter.



Vibrations

Avoid strong vibrations.

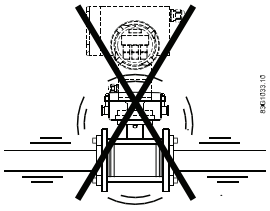


Figure 4-1 Avoid vibrations

CAUTION

In applications with strong vibrations, Siemens recommends remote mounting of the transmitter!

4.2 Determining a location

Note

The sensor must always be completely filled with liquid.

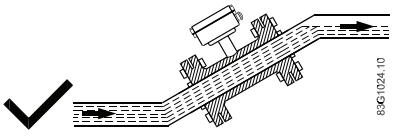


Figure 4-2 Correct installation with filled pipes

- Avoid the following installations
  - Installation at the highest point in the pipe system
  - Installation in vertical pipes with free outlet

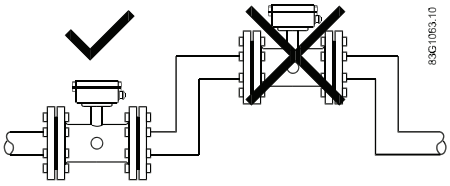


Figure 4-3 Wrong installation at high point

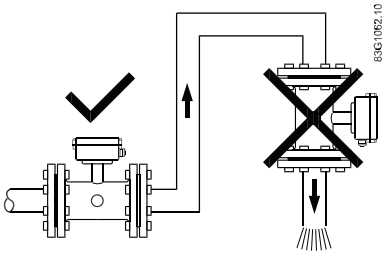


Figure 4-4 Correct installation at low point before outlet

Inlet and outlet conditions

To achieve accurate flow measurement it is essential to have straight lengths of inlet and outlet pipes and a certain distance to pumps and valves.

It is also important to centre the flowmeter in relation to pipe flanges and gaskets.

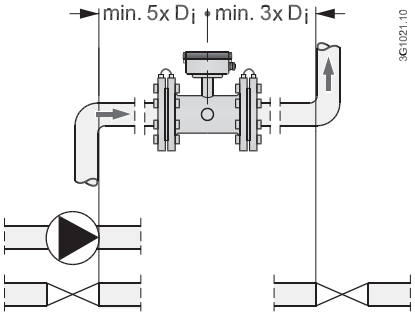


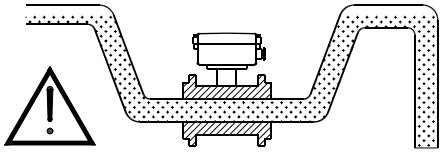
Figure 4-5 Inlet and outlet conditions

Note

MI-001 approved with OD inlet and 0D outlet conditions

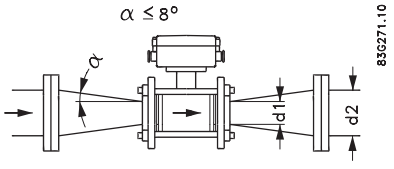
Installation in partially filled pipes

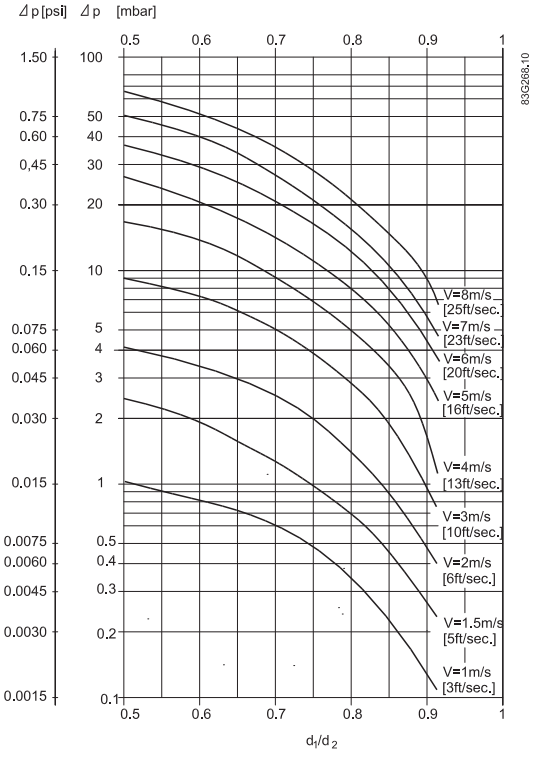
For partially filled pipes or pipes with downward flow and free outlet the flowmeter should be located in a U-tube.



Installation in large pipes

The flowmeter can be installed between two reducers (for example DIN 28545). At α ≤ 8° the following pressure drop curves apply. The curves are applicable to water.





Example:

A flow of 3 m/s (v) in a sensor with a diameter reduction from DN 100 to DN 80 ($d_1/d_2 = 0.8$) gives a pressure drop of 2.9 mbar.

4.3 Orienting the sensor

The sensor operates in all orientations, but Siemens has the following recommendations:

- Vertical installation with an upwards flow

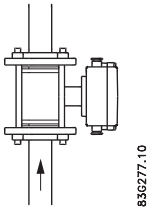


Figure 4-6 Vertical orientation, upwards flow

NOTICE
Abrasive liquids / liquids containing solid particles
A vertical installation minimizes wear and deposits in the sensor

Note

Gas/air bubbles in the liquid

A vertical installation minimizes any negative effect of gas/air bubbles in the liquid

- Horizontal installation, terminal box upwards or downwards

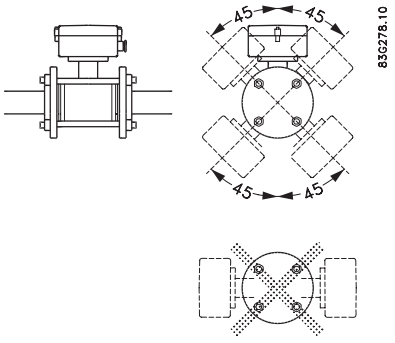


Figure 4-7 Horizontal installation, various terminal box positions

NOTICE
Do NOT mount the sensor with the terminal box sideways
This will position the electrodes at the top where there is possibility for air bubbles and at the bottom where there is possibility for mud, sludge, sand etc.

Note

Empty pipe detection

For applications with empty pipe detection, the sensor can be tilted 45°, as shown above.

Transporting

WARNING

Lifting the sensor

Do **NOT** lift the sensor by the terminal box. Do **NOT** use a forklift. If available lift the sensor by the lifting eyes fitted to the device. Otherwise lift the sensor by the process connections.

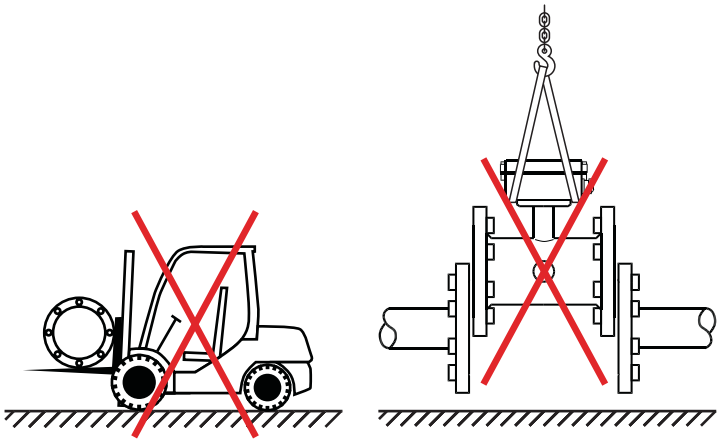


Figure 4-8 Incorrect transportation

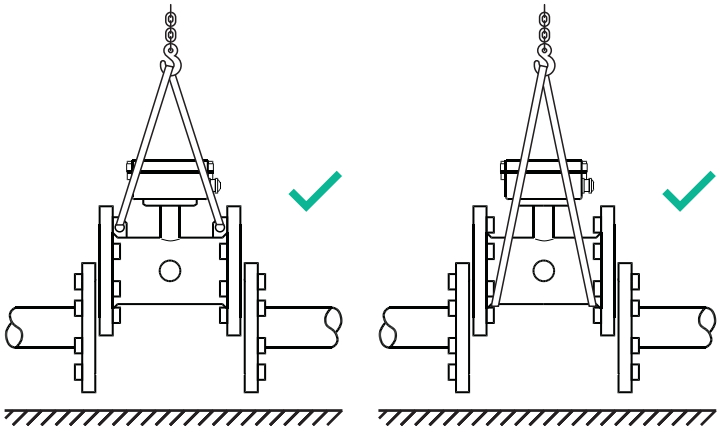
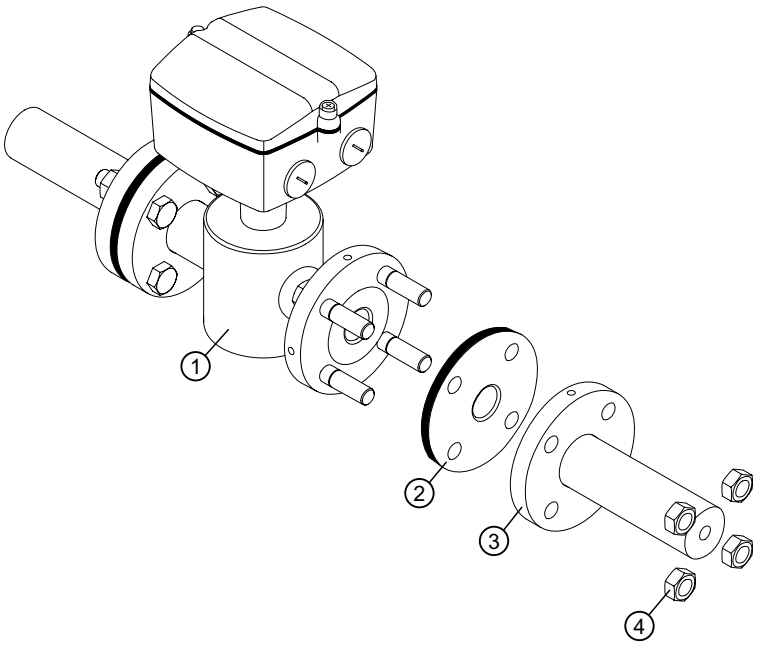


Figure 4-9 Correct transportation

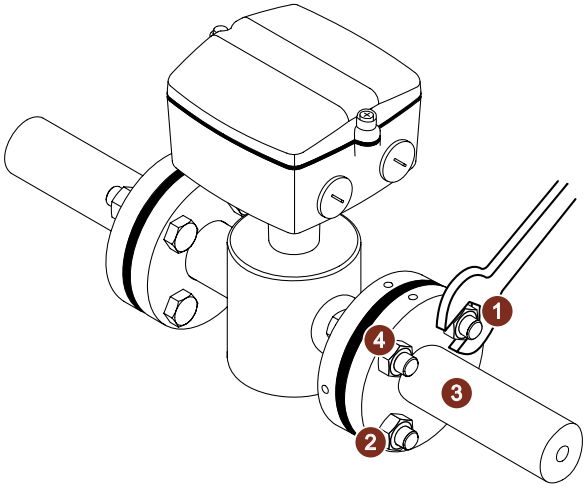
4.4 Mounting

- Install the sensor in rigid pipelines in order to support the weight of the meter.
- Center the connecting pipelines axially in order to avoid turbulent flow profiles.
- Use proper gaskets according to liner type (not included).



① Sensor
② Gasket
③ Process connection
④ Nuts

Tightening



1. Cross-tighten the bolts in the shown sequence.
2. Fasten bolts according to the torques values below.

Note

Conversion to F/Lbs

To convert the torque values from Nm to F/Lbs multiply by 0.74.

Note

Torque values are calculated on the basis of use of gaskets.

Table 4-1 Minimum and maximum torques for 7ME652, EN 1092-1 and ANSI B16.5 in Nm

Nominal size		EN 1092-1						ANSI B16.5	
		PN 10		PN 16		PN 40		Class 150	
Liner		EPDM, NBR		EPDM, NBR		EPDM, NBR		EPDM, NBR	
mm	inch	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
15	½	-	-	-	-	3.2	4	3.6	4
25	1	-	-	-	-	6.9	7	7.8	8
40	1½	-	-	-	-	15.0	16	12.9	14
50	2	-	-	9.2	10	-	-	11.9	13
65	2½	-	-	6.7	7	-	-	17.2	18
80	3	-	-	8.2	9	-	-	21.2	22
100	4	-	-	11.6	12	-	-	15.0	16
125	5	-	-	16.4	17	-	-	25.0	26
150	6	-	-	26.8	28	-	-	32.8	34
200	8	26.1	27	27.9	29	-	-	51.1	54
250	10	25.5	27	48.8	51	-	-	56.0	59
300	12	34.0	36	65.1	68	-	-	74.7	78
350	14	33.7	35	67.0	70	-	-	103.7	109
400	16	50.7	53	94.3	99	-	-	100.8	106
450	18	49.4	52	95.1	100	-	-	145.9	153
500	20	59.8	63	130.6	137	-	-	140.1	147
600	24	92.3	97	200.6	211	-	-	216.4	227
700	28	104.9	110	201.0	211	-	-	-	-
750	30	-	-	-	-	-	-	-	-
800	32	149.8	157	282.3	296	-	-	-	-
900	36	158.4	166	298.8	314	-	-	-	-
1000	40	210.1	221	400.6	421	-	-	-	-
1050	42	-	-	-	-	-	-	-	-
1100	44	-	-	-	-	-	-	-	-
1200	48	289.1	304	575.4	604	-	-	-	-

Table 4-2 Minimum and maximum torques for 7ME652, AWWA C-207, AS 4087 and JIS B2220 in Nm

Nominal size		**AWWA C-207**		**AS 4087**		**JIS B2220**	
		Class D		**PN 16**		**10K**	
Liner		**EPDM, NBR**		**EPDM, NBR**		**EPDM, NBR**	
mm	**inch**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**
15	½	-	-	-	-	3.2	4
25	1	-	-	-	-	9.1	10
40	1½	-	-	-	-	15.0	16
50	2	-	-	7.5	8	8.1	9
65	2½	-	-	13.3	14	11.7	12
80	3	-	-	16.4	17	7.2	8
100	4	-	-	23.2	24	10.1	11
125	5	-	-	-	-	17.9	19
150	6	-	-	21.6	23	23.5	25
200	8	-	-	33.6	35	24.4	26
250	10	-	-	61.2	64	39.3	41
300	12	-	-	54.4	57	39.3	41
350	14	-	-	89.3	94	47.9	50
400	16	-	-	111.4	117	69.0	72
450	18	-	-	141.9	149	68.7	72
500	20	-	-	129.6	136	83.7	88
600	24	-	-	203.9	214	121.9	128
700	28	116.9	123	206.0	216	-	-
750	30	131.7	138	-	-	-	-
800	32	178.3	187	338.8	356	-	-
900	36	194.1	204	350.8	368	-	-
1000	40	212.3	223	408.5	429	-	-
1050	42	233.7	245	-	-	-	-
1100	44	230.7	242	-	-	-	-
1200	48	246.8	259	446.7	469	-	-

Table 4-3 Minimum and maximum torques for 7ME658, EN 1092-1 in Nm

Nominal size		**EN 1092-1**							
		PN6		**PN10**		**PN16**		**PN40**	
Liner		**Ebonite**		**Ebonite**		**Ebonite**		**Ebonite**	
mm	**Inch**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**
25	1	-	-	-	-	-	-	10.7	11
40	1 ½	-	-	-	-	-	-	22.9	24
50	2	-	-	-	-	-	-	30.3	32
65	2 ½	-	-	-	-	8.5	9	-	-
80	3	-	-	-	-	10.8	11	-	-
100	4	-	-	-	-	13.8	14	-	-

Nominal size		EN 1092-1							
		PN6		PN10		PN16		PN40	
Liner		Ebonite		Ebonite		Ebonite		Ebonite	
mm	Inch	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
125	5	-	-	-	-	19.2	20	-	-
150	6	-	-	-	-	29.8	31	-	-
200	8	-	-	29.3	31	31.2	33	-	-
250	10	-	-	27.4	29	52.4	55	-	-
300	12	-	-	36.2	38	72.6	76	-	-
350	14	-	-	36.9	39	73.5	77	-	-
400	16	-	-	55.0	58	102.6	108	-	-
450	18	-	-	53.2	56	102.9	108	-	-
500	20	-	-	64.0	67	140.7	148	-	-
600	24	-	-	97.8	103	214.7	225	-	-
700	28	-	-	111.3	117	213.5	224	-	-
750	30	-	-	-	-	-	-	-	-
800	32	-	-	158.0	166	298.1	313	-	-
900	36	-	-	166.3	175	313.7	329	-	-
1000	40	-	-	219.8	231	419.6	441	-	-
1050	42	-	-	-	-	-	-	-	-
1100	44	-	-	-	-	-	-	-	-
1200	48	-	-	301.0	316	599.7	630	-	-
1400	54	187.5	197	382.8	402	702.1	737	-	-
1500	60	212.1	223	437.8	460	-	-	-	-
1600	66	215.7	226	521.6	548	951.2	999	-	-
1800	72	270.2	284	586.3	616	1069.0	1122	-	-
2000	78	326.6	343	657.5	690	1284.4	1349	-	-

Table 4-4 Minimum and maximum torques for 7ME658, ANSI B16.5, AWWA C-207, AS 4087 and JIS B2220 in Nm

Nominal size		ANSI B16.5		AWWA C-207		AS 4087		JIS B2220	
		Class 150		Class D		PN 16		10K	
Liner		Ebonite		Ebonite		Ebonite		Ebonite	
mm	Inch	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
25	1	3.1	4	-	-	-	-	4.7	5
40	1 ½	6.6	7	-	-	-	-	6.8	7
50	2	12.7	13	-	-	9.4	10	9.4	10
65	2 ½	16.0	17	-	-	12.0	13	13.4	14
80	3	23.5	25	-	-	16.7	17	7.8	8
100	4	17.6	19	-	-	26.1	27	11.0	12
125	5	28.5	30	-	-	-	-	19.5	20
150	6	38.0	40	-	-	23.7	25	26.1	27
200	8	58.1	61	-	-	37.7	40	26.0	27

Nominal size		ANSI B16.5		AWWA C-207		AS 4087		JIS B2220	
		Class 150		Class D		PN 16		10K	
Liner		Ebonite		Ebonite		Ebonite		Ebonite	
mm	Inch	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
250	10	61.7	65	-	-	69.3	73	43.3	45
300	12	84.8	89	-	-	60.7	64	41.2	43
350	14	112.6	118	-	-	98.0	103	52.0	55
400	16	108.8	114	-	-	121.0	127	74.6	78
450	18	157.1	165	-	-	153.7	161	73.9	78
500	20	149.9	157	-	-	139.7	147	89.6	94
600	24	229.9	241	-	-	218.0	229	129.4	136
700	28	-	-	124.1	130	217.9	229	-	-
750	30	-	-	139.4	146	-	-	-	-
800	32	-	-	188.4	198	358.2	376	-	-
900	36	-	-	204.2	214	369.4	388	-	-
1000	40	-	-	222.8	234	427.2	449	-	-
1050	42	-	-	246.8	259	-	-	-	-
1100	44	-	-	241.4	254	-	-	-	-
1200	48	-	-	257.7	271	465.9	489	-	-
1400	54	-	-	373.4	392	-	-	-	-
1500	60	-	-	388.6	408	-	-	-	-
1600	66	-	-	471.5	495	-	-	-	-
1800	72	-	-	480.8	505	-	-	-	-
2000	78	-	-	592.6	622	-	-	-	-

Torque calculations

All values are theoretical and are calculated making the following assumptions:

1. All bolts are new and material selection is according to EN 1515-1 table 2.
2. Gasket material not exceeding 75 shore A durometer is used between the flowmeter and mating flanges.
3. All bolts are galvanized and adequately lubricated.
4. The values are calculated for use with carbon steel flanges.
5. Flowmeter and mating flanges are correctly aligned.

4.5 Potential equalization

To obtain optimum results from the measuring system, the sensor must have the same electrical potential as the liquid being measured.

This is achieved by means of built-in grounding electrodes.

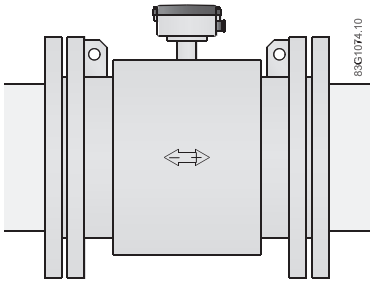


Figure 4-10 Potential equalization with earthing electrodes

Cathodic protected piping

Special attention must be paid to systems with cathodic protection.

⚠ WARNING

Use in hazardous area!

Cathodic pipe protection is not allowed in hazardous areas

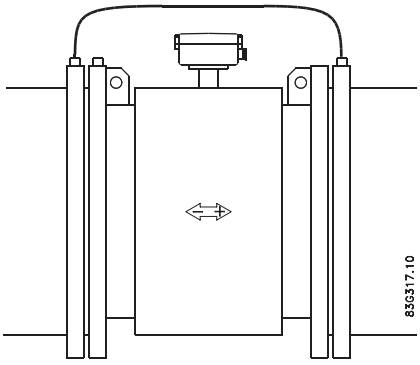


Figure 4-11 Cathodic protection

- Isolate the sensor from cathodic protected pipes using insulated bolts.
- Use bypass cable between the mating flanges

Note

Remote mounted sensor versions

If the above is not acceptable, remote mounted sensors can alternatively be connected as follows:

- Connect coil current cable shield at sensor end via a 1.5 µF condensator
- Make sure that electrode cable shield is not connected at both ends

Connecting

5

The following contains a short description of how to connect a remote mounted sensor to a transmitter type SITRANS FM MAG 5000 / 6000 or MAG 6000 I. For more information, e.g. about wiring of power supply and outputs, refer to the Operating Instructions for the respective transmitters.

Before connecting

- Check that serial numbers on sensor and SENSORPROM® unit are identical.

⚠ WARNING

The pertinent regulations must be observed for electrical installation.

- Never install the device with the mains voltage switched on!
- Danger of electric shock!
- The electrodes and magnetic current line may only be connected when the device is not connected to the power supply.
- If the housing is under voltage (power supply), the cover may be unscrewed by qualified personnel only.

⚠ WARNING

Mains supply from building installation Class II

A switch or circuit breaker (max. 15 A) must be installed in close proximity to the equipment and within easy reach of the operator. It must be marked as the disconnecting device for the equipment.

Cable specifications

- Only use cables with at least the same degree of protection as the sensor to install the sensor.
- The line length from the cable gland to the terminals must be kept as short as possible. Line loops in the terminal box must be avoided.
- To guarantee the IP67 degree of protection, use cables with the required specifications.

⚠ WARNING

Protective conductor terminal

The required cable is min. AGW16 or 1.5 mm^2 Cu.

⚠ WARNING

Wire insulation

For field wiring installation: Ensure that the national requirements of the country in which the flowmeters are installed is met.

See also

Cable data (Page 53)

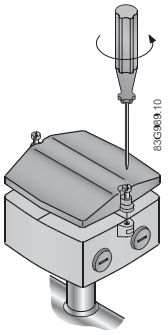
5.1 Remote installation

Note

Remote installation only

The following applies to remote installation of MAG 5000 / 6000 or MAG 6000 I.

1. Unscrew and remove terminal box lid.



2. Mount the two terminal blocks as shown and insert electrode cable plug ① (terminals 82, 0 and 83) and coil cable plug ② (terminals 85 and 86).
   Terminals electrode cable: 82, 0 and 83
   Terminals special electrode cable: 84, 83, 0, 82 and 81
   Terminals coil cable: 85; 86

Note

Special electrode cable

Special electrode cable must be connected to terminals 84, 83, 0, 82 and 81.

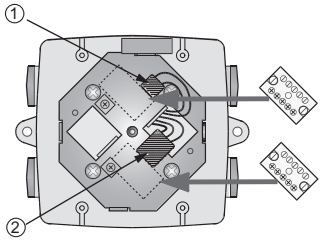
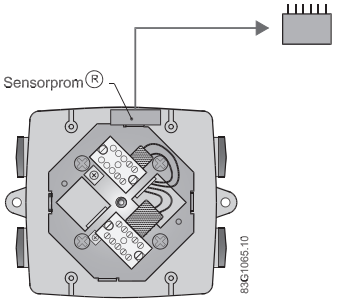


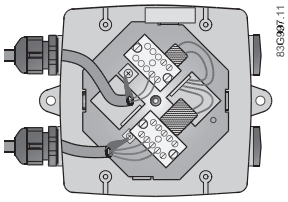
Figure 5-1 Terminal box without blocks

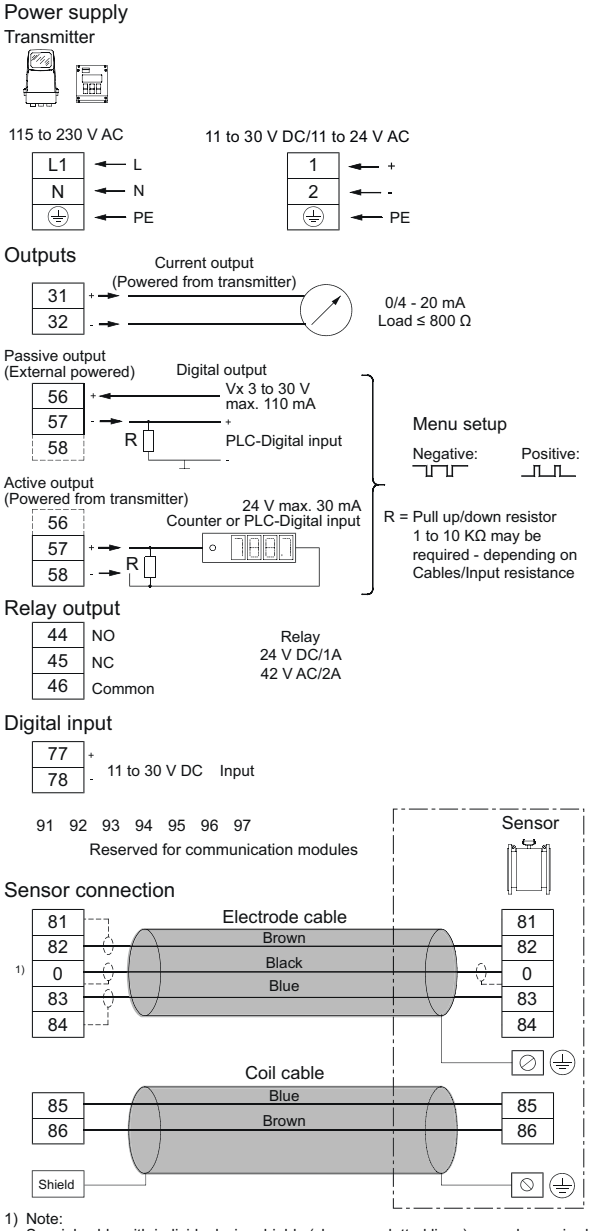
3. Remove SENSORPROM® unit from sensor and mount it on connection plate in transmitter, see relevant transmitter operating instructions.



4. Fit the ½" NPT or M20 cable glands for supply and output cables.

5. Fit and connect electrode and coil cables as shown below.





1) Note:
Special cable with individual wire shields (shown as dotted lines) are only required when using empty pipe function or long cables.

CAUTION

Unscreened cable ends

Keep unscreened cable ends as short as possible.

CAUTION

Prevent interference

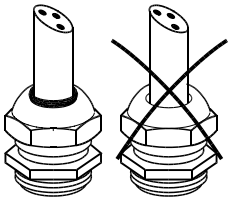
Separate electrode and coil cables to prevent interference.

WARNING

Use in hazardous area

Connect mains protective earth to the PE terminal in accordance with the above diagram in order to obtain potential equalization.

6. Tighten cable glands well to obtain optimum sealing. The cable entry gasket must obtain firm contact with the cable.

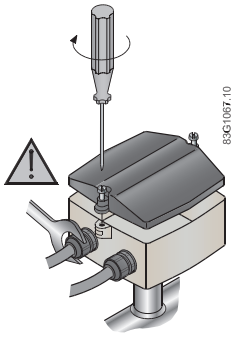


7. Remount terminal box lid.

Note

Tightening torque

Tighten the bolts with 0.5 Nm.



5.2 Installation check

The meter is now ready to go into normal operation - for commissioning and setting of parameters refer to the relevant transmitter manual.

Before commissioning it must be checked that:

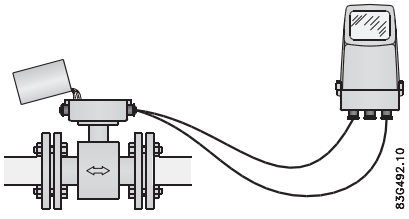
- The device has been installed and connected in accordance with the guidelines provided previous in this chapter and in Installing/Mounting (Page 21).

5.3 Potting

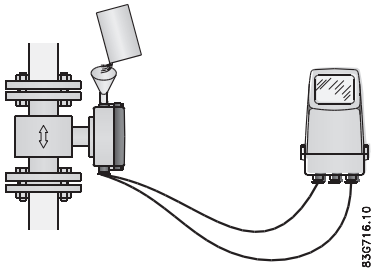
If sensor is buried or permanently submerged, terminal box must be encapsulated with silicon dielectric gel (non-toxic, transparent and self-healing gel).

NOTICE
Electrical connections Do **not** pot meter before electrical connections have been made.

- Mix the two components of the potting kit well and pour into terminal box.
- Let cure for approximately 24 hours at approximately 25°C (77°F). Curing time increases by 100% per -10°C (-18°F).



Horizontal orientation



Vertical orientation

Note

Gel can be penetrated with test instruments or be removed in case of cable replacement.

5.4 Direct burial

Recommendations for direct burial of remote sensor:

- Check for visible damages in paint finish !
- Use protection conduit !
- Protect sensor with pea gravel at least 300 mm around sensor. This provides some drainage and also avoids caking sensor with earth. It also helps to locate sensor in case excavation takes place.

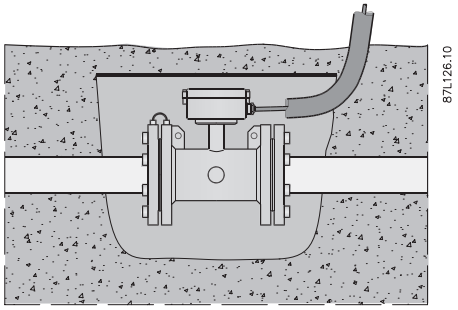


Figure 5-2 Direct burial of sensor

⚠ CAUTION

Sensor should not be subject to heavy vehicles applying excessive weight above sensor or pipeline

NOTICE

SENSORPROM memory unit

Remove the SENSORPROM from terminal box on sensor and relocate in remote transmitter prior to burying sensor.

All sensor data plate information and serial number should be recorded for each sensor prior to burying. This will ensure correct matching with SENSORPROM unit.

⚠ WARNING

Electrical cable identification

Use suitable coil and electrode cables

Lay electrical cable identification tape above pea gravel before it is covered with earth.

Service and maintenance

6

6.1 Maintenance

The device is maintenance-free. However, a periodic inspection according to pertinent directives and regulations must be carried out.

An inspection can include check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover screws
- Reliability of power supply, lightning protection, and grounds

NOTICE
Repair and service must be carried out by Siemens authorized personnel only.

Note

Siemens defines flow sensors as non-repairable products.

6.2 Verification

With the SITRANS FM Verificator It is possible to validate the product, installation and application without interrupting the process. The verification consists of the following test routines:

- Insulation test of the entire flowmeter system and cables
- Test of sensor magnetic properties
- Transmitter gain, linearity and start of scale value test
- Digital output test
- Analog output test

The Verificator can be used for SITRANS FM flowmeters with sensor types MAG 1100, MAG 1100 F, MAG 3100, MAG 3100 P and MAG 5100 W connected to transmitters MAG 5000 or MAG 6000.

When connected to a PC, you can print a full verification report containing all test results.

SIEMENS **MAGFLO Verification Certificate**

Customer:

Name
Address
Phone
Email

MAGFLO Identification:

TAG No./Name	0
Sensor Code No.	7ME65202YC122A
Sensor Serial No.	101902H441
Transmitter Code No.	7ME692
Transmitter Serial No.	062830N231
Location	

Results:

Verification file name or No.		File #1
Transmitter		Passed
Sensor	Insulation	Passed
	Magnetic Circuit	Passed

Velocity	Current Output			Frequency Output		
Theoretical	Theoretical	Actual	Deviation	Theoretical	Actual	Deviation
0,5m/s	4,800mA	4,800mA	-0,05%	0,500kHz	0,498kHz	-0,32%
1,0m/s	5,600mA	5,596mA	-0,26%	1,000kHz	0,996kHz	-0,37%
3,0m/s	8,800mA	8,794mA	-0,12%	3,000kHz	2,997kHz	-0,09%
	Current Output 4-20mA			Frequency Output 0-10kHz		

Transmitter Settings:

Basic	Qmax.	20,0000 m³ /h
	Flow Direction	Positive
	Low flow Cut-off	1,50%
	Empty Pipe	ON
Output	Current Output	ON (4-20mA)
	Time Constant	5,0 Sec.
	Relay Output	Error Level
	Digital Output	Pulse
	Frequency Range	N/A
	Time Constant	N/A
	Volume/pulse	10,0 l/p
	Pulse width	0,066 sec.
	Pulse polarity	Positiv
Totalizer 1 value before test		114,69851 l
Totalizer 1 value after test		130,3003 l
Totalizer 2 value before test		5,98203 l
Totalizer 2 value after test		8,95478 l
Operating time in days		245

Sensor Details:

Size	DN 50 2 IN
Cal. Factor	1,79904997
Correction Factor	1,0
Excitation Freq.	3,125Hz

Verificator Details (083F5060)

Serial No.	010116N258
Device No.	83948
Software Version	1.40
PC-Software Version	5.01
Cal. date	2017.04.20
ReCal. date	2018.04.20

Comments

These tests verify that the flowmeter is functioning within 2% deviation of the original test parameters.
Verification is traceable to National and International Standards.

Date and signature

2017.05.24 B. Andersen

Figure 6-1 Example of a verification certificate

6.3 Recalibration

Siemens Process Instrumentation offers to recalibrate the sensor. The following calibration types are offered as standard:

- Standard matched pair calibration
- Customer-specified calibration
- Accredited Siemens ISO/IEC 17025 calibration

Note

For recalibration the SENSORPROM unit must always be returned with the sensor.

6.4 Technical support

If you have any technical questions about the device described in these Operating Instructions and do not find the right answers, you can contact Customer Support:

- Via the Internet using the **Support Request:**
  Support request (http://www.siemens.com/automation/support-request)
- Via Phone:
  - Europe: +49 (0)911 895 7222
  - America: +1 423 262 5710
  - Asia-Pacific: +86 10 6475 7575

Further information about our technical support is available on the Internet at
Technical support (http://support.automation.siemens.com/WW/view/en/16604318)

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base online on the Internet at:

Service and support (http://www.siemens.com/automation/service&support)

There you will find:

- The latest product information, FAQs, downloads, tips and tricks.
- Our newsletter, providing you with the latest information about your products.
- Our bulletin board, where users and specialists share their knowledge worldwide.
- You can find your local contact partner for Industry Automation and Drives Technologies in our partner database.
- Information about field service, repairs, spare parts and lots more under **Services**.

Additional Support

If you have additional questions about the device, please contact your local Siemens representative and offices at:

Local contact person (http://www.automation.siemens.com/partner)

6.5 Transportation and storage

To guarantee sufficient protection during transport and storage, observe the following:

- Keep the original packaging for subsequent transportation.
- Devices/replacement parts should be returned in their original packaging.
- If the original packaging is no longer available, ensure that all shipments are properly packaged to provide sufficient protection during transport. Siemens cannot assume liability for any costs associated with transportation damages.

NOTICE
Insufficient protection during storage The packaging only provides limited protection against moisture and infiltration. • Provide additional packaging as necessary.

Special conditions for storage and transportation of the device are listed in Technical specifications (Page 49).

Handling

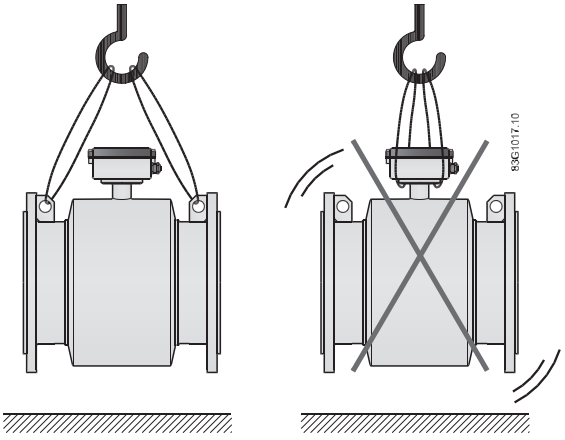


Figure 6-2 Handling of sensor

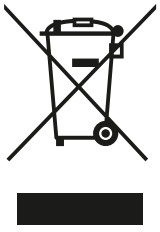
6.6 Return procedure

To return a product to Siemens, see Returns to Siemens (www.siemens.com/returns-to-siemens).

Contact your Siemens representative to clarify if a product is repairable, and how to return it. They can also help with quick repair processing, a repair cost estimate, or a repair report/cause of failure report.

NOTICE
Decontamination The product may have to be decontaminated before it is returned. Your Siemens contact person will let you know for which products this is required.

6.7 Disposal



Devices described in this manual should be recycled. They may not be disposed of in the municipal waste disposal services according to the Directive 2012/19/EC on waste electronic and electrical equipment (WEEE).

Devices can be returned to the supplier within the EC and UK, or to a locally approved disposal service for eco-friendly recycling. Observe the specific regulations valid in your country.

Further information about devices containing batteries can be found at: Information about battery / product return (WEEE) (https://support.industry.siemens.com/cs/document/109479891/)

Diagnostics and Troubleshooting 7

7.1 Sensor check

Requirement

To check the SITRANS FM sensors the following test instruments will be required:

- Digital Meter/Multimeter
- Megger
- (Moving Coil Meter)

Sensor check

Remove the transmitter from the sensor or remote position before making the following checks.

Coil resistance check

- Measure the coil resistance between connection numbers 85 and 86 using a digital meter. Resistance should be within range stated in Coil resistance table.

A low reading may indicate moisture within the coil housing or shorted coil tums.

A high reading would indicate an open circuit coil.

Note

In case of deviation from nominal coil values, the sensor is damaged and must be replaced

Coil insulation check

⚠ WARNING

Potential hazard!

Only carry our a coil insulation check in non-hazardous area!

- Megger between connection number 85 and the sensor body.
  The resistance should be above 20 MΩ.

A low megger reading would indicate the coil insulation is breaking down. This is normally due to fluid ingress into the coil housing.

Sensors with an insulation resistance down to 1 MΩ may still work satisfactorily but this is not guaranteed.

Electrode resistance check

- Measure the electrode resistance between connections 82 and 0 with a moving coil meter. With a sensor full of fluid the resistance should be between 5 KΩ and 50 KΩ. If the sensor is empty the resistance will be infinite.
- Repeat the resistance measurements between connections 83 and 0. The results should be the same.

If the resistance is low there may be a short on the electrodes or wiring (in the case of a remote mounted transmitter). Alternatively there may be water ingress or moisture in the terminal box.

If the resistance is high and the pipe is completely full of fluid check the following:

1. Fluid is electrically conductive.
2. Electrodes are not coated with grease or any deposit.
3. Electrode circuit is not open.
4. Remote mounted transmitter has a 3 core cable with an overall shield continuously from sensor to transmitter, including junction boxes and terminal rails inside panels.
5. Shield is connected to 0 or to earth terminal (PE) on sensor.

Note

Sensors removed from line

For sensors removed from line with dry bore, use megger between terminal 82 and compression plate, and 83 and compression plate to show any water ingress behind electrodes or within enclosure.

7.2 Fluctuating process values

Question

Why do the displayed process values fluctuate when the electrode cable is moved?

Answer

There can be several causes for fluctuating process values:

- Deposits on electrodes
  - Clean the electrodes.
- Defect electrode cable
  - Replace the cable
- Incorrect cable connection
  - Connect the electrode cable (82, 83, 0 and shield) according to the instructions in Remote installation (Page 34)

Technical specifications

8

8.1 MAG 5100 W

Table 8-1 Technical data

Version	MAG 5100W (7ME6520)	MAG 5100W (7ME6580)
Product characteristic	Mainly for the European market EPDM or NBR lining	Mainly for the non-European market Ebonite lining
Design and nominal size	*Coned sensor:* • DN 15 to 300 (½" to 12") *Full bore sensor:* • DN 350 to 1200 (14" to 48")	*Full bore sensor:* • DN 25 to 2000 (1" to 78")
Measuring principle	Electromagnetic induction	
Excitation frequency (Mains supply: 50 Hz/60 Hz)	*DN 15 to 65 (½" to 2½"):* • 12.5 Hz / 15 Hz *DN 80 to 150 (3" to 6"):* • 6.25 Hz / 7.5 Hz *DN 200 to 300 (8" to 12"):* • 3.125 Hz / 3.75 Hz *DN 350 to 1200 (14" to 48"):* • 1.5625 Hz / 1.875 Hz	*DN 25 to 65 (1" to 2½"):* • 12.5 Hz / 15 Hz *DN 80 to 150 (3" to 6"):* • 6.25 Hz / 7.5 Hz *DN 200 to 300 (8" to 12"):* • 3.125 Hz / 3.75 Hz *DN 350 to 2000 (14" to 78"):* • 1.5625 Hz / 1.875 Hz

Table 8-2 Process connections

Version	MAG 5100W (7ME6520)	MAG 5100W (7ME6580)
EN 1092-1	*PN 10 (145 psi):* • DN 200 to 300 (8" to 12") Flat face flanges *PN 10 (145 psi):* • DN 350 to 1200 (14" to 48") Raised face flanges *PN 16 (232 psi):* • DN 50 to 300 (2" to 12") Flat face flanges *PN 16 (232 psi):* • DN 350 to 1200 (14" to 48") Raised face flanges *PN 40 (580 psi):* • DN 15 to 40 (½" to 1½") Flat face flanges	Raised face (EN 1092-1, DIN 3501 and BS4504 have the same mating dimensions) PN 16 (87 psi): • DN 1400 to 2000 (54" to 78") PN 10 (145 psi): • DN 200 to 2000 (8" to 78") PN16 (232 psi): • DN 65 to 600 (2½" to 24") PN 40 (580 psi): • DN 25 to 50 (1" to 2")
ANSI B16.5	Class 150 lb: ½" to 24"	Class 150 lb: 1" to 24"
AWWA C-207	Class D: • 28" to 48", Flat face flanges	Class D: • 28" to 78", Flat face flanges
AS4087	*PN 16 (230 psi):* • DN 50 to 1200 (2" to 48")	*PN 16 (230 psi):* • DN 50 to 1200 (2" to 48")
JIS B 2220:2004	K10 (1" to 24")	K10 (1" to 24")

Table 8-3 Rated operating conditions

Version	MAG 5100W (7ME6520)	MAG 5100W (7ME6580)
Ambient temperature • Sensor	-40 to +70 °C (-40 to +158 °F)	-40 to +70 °C (-40 to +158 °F)
• With compact transmitter		
MAG 5000/6000 [2)]	-20 to +60 °C (-4 to +140 °F)	-20 to +60 °C (-4 to +140 °F)
MAG 6000 I	-20 to +60 °C (-4 to +140 °F)	-20 to +60 °C (-4 to +140 °F)
Operating pressure [abs. bar][1]	DN 15 to 40 (½" to 1½") 0.01 to 40 bar (0.15 to 580 psi) DN 50 to 300 (2" to 12")[3)] 0.03 to 20 bar (0.44 to 290 psi) DN 350 to 1200 (14" to 48") 0.01 to 16 bar (0.15 to 232 psi)	DN 25 to 50 (1" to 2") 0.01 to 40 bar (0.15 to 580 psi) DN 65 to 1200 (2½" to 48") 0.01 to 16 bar (0.15 to 232 psi) DN 1400 to 2000 (54" to 78") 0.01 to 10 bar (0.15 to 145 psi)
Enclosure rating		
Standard	IP67 to EN 60529 / NEMA 4X/6 (1 mH_2O for 30 minutes)	IP67 to EN 60529 / NEMA 4X/6 (1 mH_2O for 30 minutes)
Option	IP68 to EN 60529 / NEMA 6P (10 mH_2O continuously)	IP68 to EN 60529 / NEMA 6P (10 mH_2O continuously)
Corrosive category	C4 according to ISO 12944-2	C4 according to ISO 12944-2

Version	MAG 5100W (7ME6520)	MAG 5100W (7ME6580)
Pressure drop	DN 15 and 25 (½" and 1"): • Max. 20 mbar (0.29 psi) at 1 m/s (3 ft/s) DN 40 to 300 (1½" to 12"): • Max. 25 mbar (0.36 psi) at 3 m/s (10ft/s) DN 350 to 1200 (14" to 48"): • Insginificant	Insignificant
Test pressure	1.5 x PN (where applicable)	1.5 x PN (where applicable)
Mechanical load (vibration)	18 to 1000 Hz random in x,y, z directions for 2 hours according to EN 60068-2-36 Sensor: 3.17 grms Sensor with compact MAG 5000/6000 transmittter mounted: 3.17 grms Sensor with compact MAG 6000 I transmitter mounted: 1.14 grms	18 to 1000 Hz random in x,y, z directions for 2 hours according to EN 60068-2-36 Sensor: 3.17 grms Sensor with compact MAG 5000/6000 transmittter mounted: 3.17 grms Sensor with compact MAG 6000 I transmitter mounted: 1.14 grms
Process fluid temperature		
NBR	-10 to +70 °C (14 to 158 °F)	-
EPDM	-10 to +70 °C (14 to 158 °F)	-
EPDM (MI-001)	+0.1 to +30 °C (32 to 76 °F)	-
EPDM (PTB K 7.2)	+0.1 to +50 °C (32 to 122 °F)	-
Ebonite	-	-10 to +70 °C (14 to 158 °F)
EMC	EMC 2004/108/EC	EMC 2004/108/EC

1) Maximum operating pressure decreases with increasing operating temperature

2) MAG 5000/6000 CT -20 to +50 °C (-4 to +122 °F)

3) For PTB K7.2 DN50 to 150: 0.03 to 16 bar DN200 to 300: 0.03 to 10 bar or 0.03 to 16 bar

Table 8-4 Design

Version	MAG 5100W (7ME6520)	MAG 5100W (7ME6580)
Housing and flange material	Carbon steel, with corrosion-resistant two-component epoxy coating (min. 150 µm) Corrosive category C4, according to ISO 12944-2	Carbon steel ASTM A 105, with corrosion-resistant two-component epoxy coating (min. 150 µm)
Measuring pipe	AISI 304 (1.4301)	AISI 304 (1.4301)
Electrodes	Hastelloy	Hastelloy
Grounding electrodes (standard	Hastelloy	Hastelloy
Terminal box	Fibre glass reinforced polyamide	Fibre glass reinforced polyamide

Table 8-5 Certificates and approvals

Version	MAG 5100W (7ME6520)	MAG 5100W (7ME6580)
Calibration Standard production calibration, calibration report shipped with sensor	Zero-point, 2 x 25 % and 2 x 90 %	Zero-point, 2 x 25 % and 2 x 90 %
Custody transfer (only with MAG 5000/6000 CT)	*OIML R 49 pattern approval cold water (Denmark and Germany):* • DN 50 to 1200 (2" to 48") *MI 001 cold water (EU):* • DN 50 to 300 (2" to 12") *MPTB K7.2 Energy metering:* • DN 50 to 300 (2" to 12")	-
Drinking water approvals	*EPDM liner:* • ANSI/NSF 61 Standard (Cold water, US) • WRAS (WRc, BS6920 cold water, GB) • ACS (F) • DVGW W270 (D) • Belgaqua (NBR) *NBR liner:* • ANSI/NSF 61 Standard (Cold water, US), only ANSI and AWWA flanges)	• NSF/ANSI Standard 61 (Cold water, US) • WRAS (WRc, BS6920 cold water, GB)
Other approvals	• MCERTS • PED - 97/23 EC[1)] • CRN • VdS: Extinguishing systems DN 50 to 300 • FM Fire Service Meter (Class Number 1044) DN 50, DN 80, DN 100, DN 150, DN 200, DN 250, DN 300 (2", 3", 4", 6", 8", 10", 12") • CSA Class 1, Div 2	• PED - 97/23 EC[1)] (only < DN 600 (< 24")) • FM Class 1, Div 2 • CSA Class 1, Div 2

[1)] : For sizes larger than 600 mm (24") in PN 16, PED conformity is available as cost-added option. The basic unit will carry the LVD (Low Voltage Directive) and EMC approval.

8.2 Cable data

Description

Cable for standard electrode or coil	
Electrode cable, double shielded	
Cable kit with standard coil cable and electrode cable double shielded (also available as low noise cable for MAG 1100 sensor)	

Standard applications

Table 8-6 Technical data, standard application cables

		Coil cable	Standard electrode cable
Basic data	No. of conductors	2	3
	Min. sqr. area	0.5 mm^2	0.2 mm^2
	Shield	Yes	Yes
	Max. capacitance	N/A	350 pF/m
Max. cable loop resistance	Media temperature:		
	< 100 °C (212 °F)	40 Ω	N/A
	> 200 °C (392 °F)	6 Ω	N/A
Cable glands on sensor and transmitter	M20x1.5 gland - Cable ø 5 to 13 mm (0.20 to 0.51 inches)		
	½ NPT gland - cable ø 5 to 9 mm (0.20 to 0.35 inches)		

Special applications, for example low conductivity or electrical noise

Table 8-7 Technical data, special application cables

		Coil cable	Special electrode cable
Basic data	No. of conductors	3	3
	Sqr. area	1.5 mm^2	0.25 mm^2
	Shield	Yes	Double
	Color code	Brown, blue, black	Brown, blue, black
	Outside color	Grey	Grey
	Ext. diameter	7.8 mm	8.1 mm
	Conductor	Flexible CU	Flexible CU
	Isolation material	PVC	PVC
Ambient temperature	Flexible installation	-5 to +70°C (23 to 158°F)	-5 to +70°C (23 to 158°F)
	Non-flexible installtaion	-30 to +70°C (-22 to 158°F)	-30 to +70°C (-22 to 158°F)

		Coil cable	Special electrode cable
Cable parameter	Capacity	161.50 pF/m	N/A
	Inductance	0.583 µH/m	N/A
	L/R	43.83 þH/Ω	N/A

8.3 Effect of temperature on working pressure

Effect of temperature on working pressure.

Table 8-8 Metric measures (pressure in bar)

Flange specifications	Flange rating	Temperature (°C)			
		-5	10	50	90
Sizes DN25 to 2000					
EN 1092-1	PN 10	10.0	10.0	9.7	9.4
	PN 16	16.0	16.0	15.5	15.1
	PN 40	40.0	40.0	38.7	37.7
ANSI B16.5	150 lb	19.7	19.7	19.3	18.0
AWWA C-207	Class D	10.3	10.3	10.3	10.3
AS		16.0	16.0	15.5	15.1
JIS	10K	14.0	14.0	14.0	14.0
Sizes DN 15 to 300 (order no. 7ME6520 only)					
EN 1092-1	PN 10	10.0	10.0	10.0	8.2
	PN 16	10.0	16.0	16.0	13.2
	PN 40	40.0	40.0	38.7	37.7
ANSI B16.5	150 lb	10.0	19.7	19.7	16.2
AS		16.0	16.0	16.0	13.2
JIS		14.0	14.0	14.0	

Table 8-9 Imperial measures (pressure in psi)

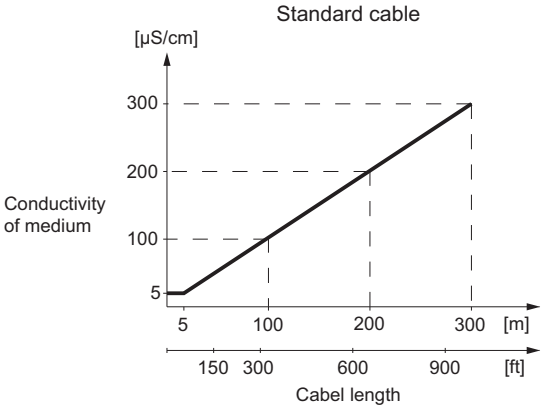
Flange specifications	Flange rating	Temperature (°F)			
		23	50	120	200
Sizes 1" to 78"					
EN 1092-1	PN 10	145	145	141	136
	PN 16	232	232	225	219
	PN 40	580	580	561	547
ANSI B16.5	150 lb	286	286	280	261
AWWA C-207	Class D	150	150	150	150
Sizes ½" to 12" (order no. 7ME6520 only)					
EN 1092-1	PN 10	145	145	145	119
	PN 16	145	232	232	191
ANSI B16.5	150 lb	145	286	286	235

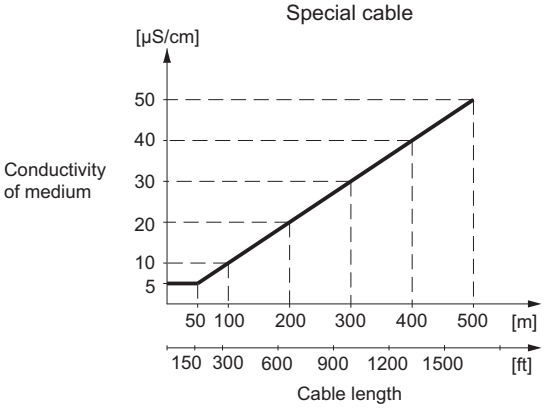
8.4 Process fluid conductivity

Compact installation

Liquids with an electrical conductivity ≥ 5 µS/cm.

Remote installation





Note

Empty sensor detection requirement

For detection of empty sensor the min. conductivity must always be >50 µS/cm and the max. length of the electrode cable when remote mounted is 50 meters (164 ft). Special cable must be used!

8.5 Liner selection

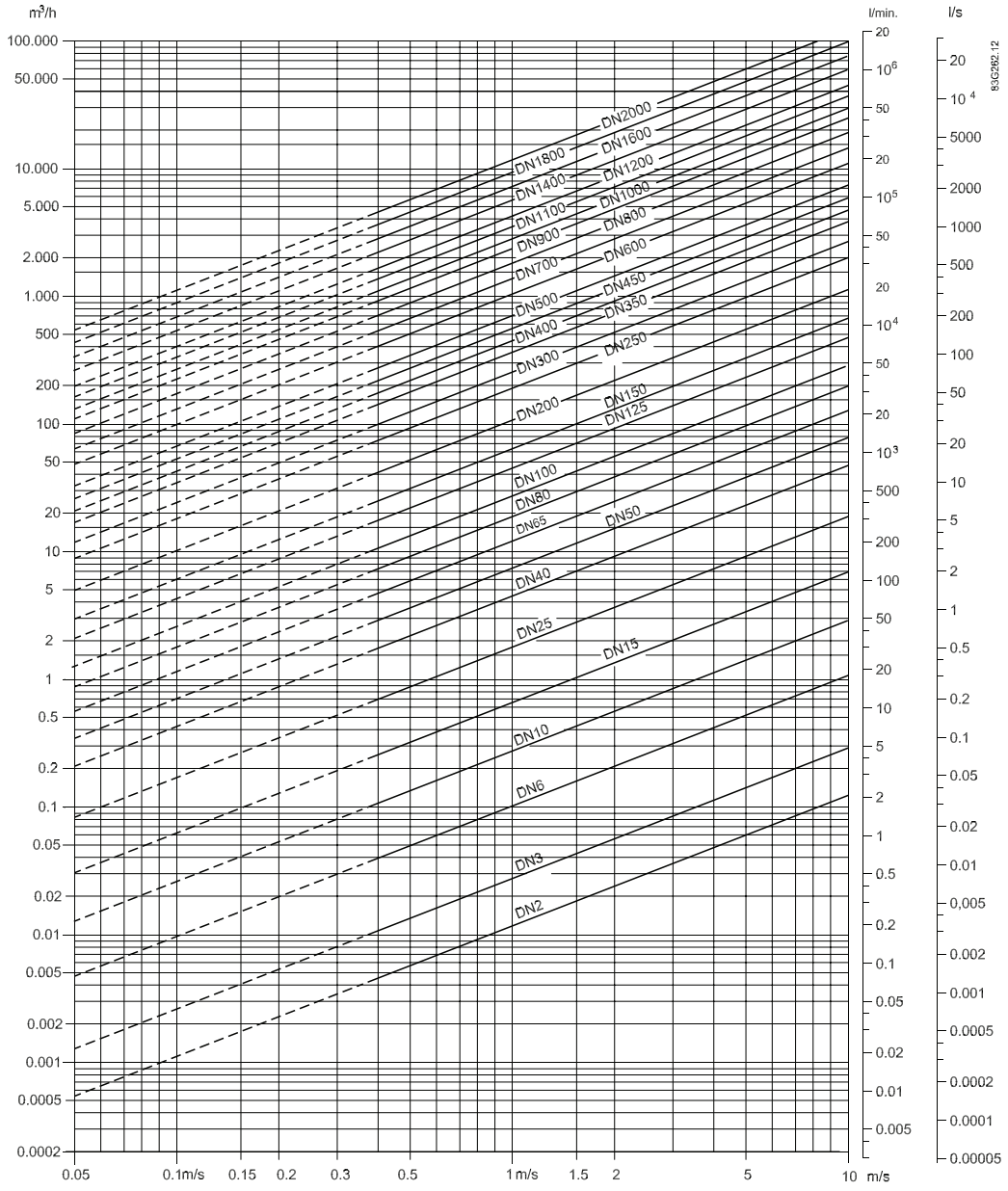
Liner	Applications
EPDM	Drinking water applications (not hydrocarbons)
Ebonite	Drinking water applications wastewater applications and certain chemicals applications
NBR	General purpose. Drinking water, sea waters

8.6 Electrode selection

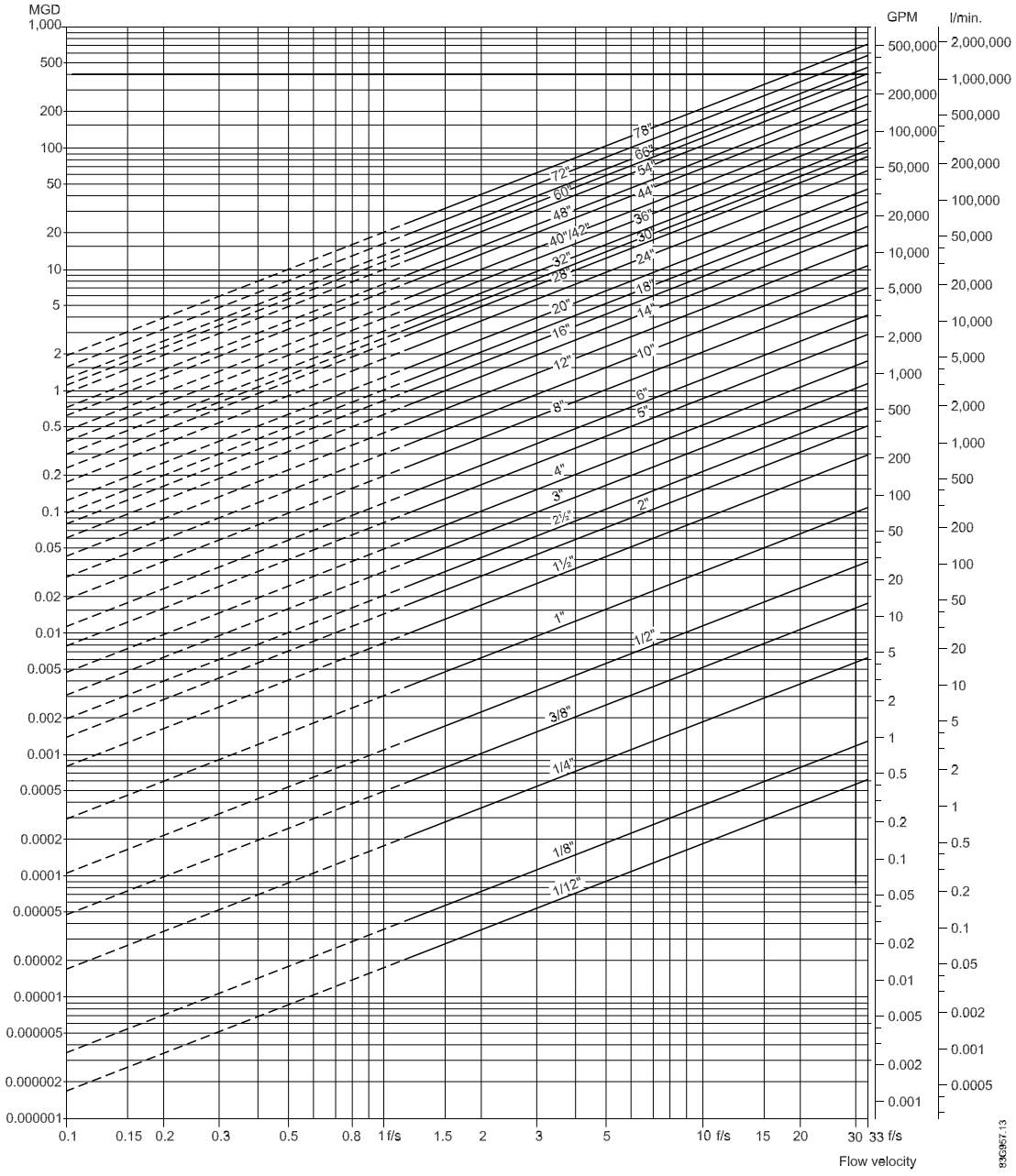
Electrodes	
Hastelloy C	The preferred choice for water and wastewater, chemicals, food and beverage, and pharmaceutical industries

8.7 Sizing tables

Sizing table (DN 2 to DN 2000)



Sizing table (DN $^{1}/_{12}$" to DN 78")



The tables show the relationship between flow velocity v, flow quantity Q and sensor dimension DN.

Guidelines for selection of sensor

Min. measuring range: 0 to 0.25 m/s (0 to 0.8 ft/s)

Max. measuring range: 0 to 10 m/s (0 to ft/s)

Normally the sensor size is selected so that the nominal flow velocity v lies within the measuring range 1 to 3 m/s (1 to 15 ft/s).

Flow velocity calculation formula:

(metric measures)

$$V = \frac{1273.24 \times Q\ [l/s]}{DN^2\ [mm]}\ [m/s] \text{ or } V = \frac{353.68 \times Q\ [m^3/h]}{DN^2\ [mm]}\ [m/s]$$

(imperial measures)

$$V = \frac{0.408 \times Q\ [GPM]}{(\text{Pipe ID})^2\ [inch]}\ [ft/s] \text{ or } V = \frac{283.67 \times Q\ [MGD]}{(\text{Pipe ID})^2\ [inch]}\ [ft/s]$$

8.8 Dimensions and weight

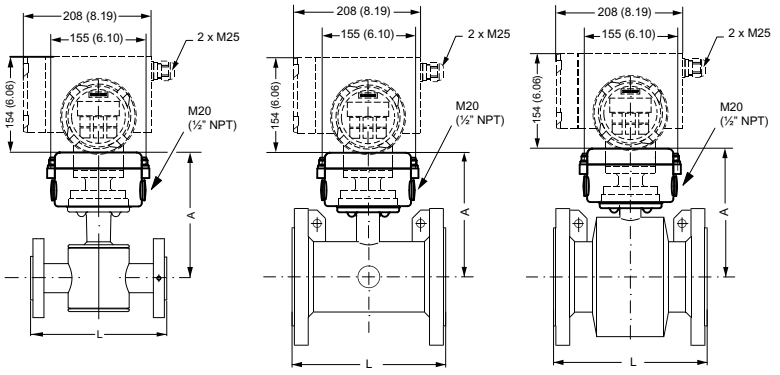


Figure 8-1 MAG 5100 W with MAG 6000 I / MAG 6000 I Ex d

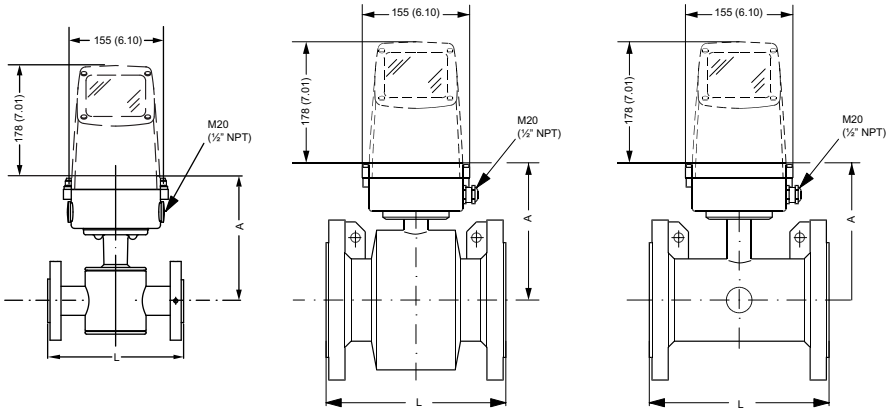


Figure 8-2 MAG 5100 W with MAG 5000 / 6000

Dimensions

Table 8-10 Nominal size A

Nominal size		**A**			
		Order no. 7ME6520 NBR or EPDM liner		**Order no. 7ME6580 Ebonite liner**	
mm	**inch**	**mm**	**inch**	**mm**	**inch**
15	½	177	7	-	-
25	1	187	7.4	187	7.4
40	1½	202	8	197	7.8
50	2	188	7.4	205	8.1
65	2½	194	7.6	212	8.3
80	3	200	7.9	222	8.7
100	4	207	8.1	242	9.5
125	5	217	8.5	255	10.0
150	6	232	9.1	276	10.9
200	8	257	10.1	304	12.0
250	10	284	11.2	332	13.1
300	12	310	12.2	357	14.1
350	14	382	15.0	362	14.3
400	16	407	16.0	387	15.2
450	18	438	17.2	418	16.5
500	20	463	18.2	443	17.4
600	24	514	20.2	494	19.4
700	28	564	22.2	544	21.4
750	30	591	23.3	571	22.5
800	32	616	24.3	606	23.9
900	36	663	26.1	653	25.7
1000	40	714	28.1	704	27.7
1050	42	714	28.1	704	27.7
1100	44	765	30.1	755	29.7
1200	48	820	32.3	810	31.9
1400	54	**N/A**	**N/A**	925	36.4
1500	60	**N/A**	**N/A**	972	38.2
1600	66	**N/A**	**N/A**	1025	40.4
1800	72	**N/A**	**N/A**	1123	44.2
2000	78	**N/A**	**N/A**	1223	48.1

Table 8-11 Nominal size L for 7ME6520

Nominal size		L													
		PN 10		PN 16[1)]		PN 40		Class 150		AWWA C-207		AS 16		JIS10K	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
15	½	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A	N/A	N/A	200	7.9
25	1	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A	N/A	N/A	200	7.9
40	1½	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A	N/A	N/A	200	7.9
50	2	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A	200	7.9	200	7.9
65	2½	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A	200	7.9	200	7.9
80	3	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A	200	7.9	200	7.9
100	4	N/A	N/A	250	9.8	N/A	N/A	250	9.8	N/A	N/A	250	9.8	250	9.8
125	5	N/A	N/A	250	9.8	N/A	N/A	250	9.8	N/A	N/A	N/A	N/A	250	9.8
150	6	N/A	N/A	300	11.8	N/A	N/A	300	11.8	N/A	N/A	300	11.8	300	11.8
200	8	350	13.8	350	13.8	N/A	N/A	350	13.8	N/A	N/A	350	13.8	350	13.8
250	10	450	17.7	450	17.7	N/A	N/A	450	17.7	N/A	N/A	450	17.7	450	17.7
300	12	500	19.7	500	19.7	N/A	N/A	500	19.7	N/A	N/A	500	19.7	500	19.7
350	14	550	21.7	550	21.7	N/A	N/A	550	21.7	N/A	N/A	550	21.7	550	21.7
400	16	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A	600	23.6	600	23.6
450	18	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A	600	23.6	600	23.6
500	20	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A	600	23.6	600	23.6
600	24	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A	600	23.6	600	23.6
700	28	700	27.6	700	27.6	N/A	N/A	N/A	N/A	700	27.6	700	27.6	N/A	N/A
750	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	750	29.5	N/A	N/A	N/A	N/A
800	32	800	31.5	800	31.5	N/A	N/A	N/A	N/A	800	31.5	800	31.5	N/A	N/A
900	36	900	35.4	900	35.4	N/A	N/A	N/A	N/A	900	35.4	900	35.4	N/A	N/A
1000	40	1000	39.4	1000	39.4	N/A	N/A	N/A	N/A	1000	39.4	1000	39.4	N/A	N/A
1050	42	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1000	39.4	N/A	N/A	N/A	N/A
1100	44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1100	43.3	N/A	N/A	N/A	N/A
1200	48	1200	47.2	1200	47.2	N/A	N/A	N/A	N/A	1200	47.2	1200	47.2	N/A	N/A

[1)] > DN 700 are non-PED versions

Table 8-12 Nominal size L for 7ME6580

Nominal size		L															
		PN 6		PN 10		PN 16[1)]		PN 40		Class 150		AWWA C-207		AS 16		JIS10K	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
15	½	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	1	N/A	N/A	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A	N/A	N/A	200	7.9
40	1½	N/A	N/A	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A	N/A	N/A	200	7.9
50	2	N/A	N/A	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A	200	7.9	200	7.9
65	2½	N/A	N/A	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A	200	7.9	200	7.9
80	3	N/A	N/A	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A	200	7.9	200	7.9

Nominal size		L															
		PN 6		PN 10		PN 16[1)]		PN 40		Class 150		AWWA C-207		AS 16		JIS10K	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
100	4	N/A	N/A	N/A	N/A	250	9.8	N/A	N/A	250	9.8	N/A	N/A	250	9.8	250	9.8
125	5	N/A	N/A	N/A	N/A	250	9.8	N/A	N/A	250	9.8	N/A	N/A	N/A	N/A	250	9.8
150	6	N/A	N/A	N/A	N/A	300	11.8	N/A	N/A	300	11.8	N/A	N/A	300	11.8	300	11.8
200	8	N/A	N/A	350	13.8	350	13.8	N/A	N/A	350	13.8	N/A	N/A	350	13.8	350	13.8
250	10	N/A	N/A	450	17.7	450	17.7	N/A	N/A	450	17.7	N/A	N/A	450	17.7	450	17.7
300	12	N/A	N/A	500	19.7	500	19.7	N/A	N/A	500	19.7	N/A	N/A	500	19.7	500	19.7
350	14	N/A	N/A	550	21.7	550	21.7	N/A	N/A	550	21.7	N/A	N/A	550	21.7	550	21.7
400	16	N/A	N/A	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A	600	23.6	600	23.6
450	18	N/A	N/A	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A	600	23.6	600	23.6
500	20	N/A	N/A	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A	600	23.6	600	23.6
600	24	N/A	N/A	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A	600	23.6	600	23.6
700	28	N/A	N/A	700	27.6	700	27.6	N/A	N/A	N/A	N/A	700	27.6	700	27.6	N/A	N/A
750	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	750	29.5	N/A	N/A	N/A	N/A
800	32	N/A	N/A	800	31.5	800	31.5	N/A	N/A	N/A	N/A	800	31.5	800	31.5	N/A	N/A
900	36	N/A	N/A	900	35.4	900	35.4	N/A	N/A	N/A	N/A	900	35.4	900	35.4	N/A	N/A
1000	40	N/A	N/A	1000	39.4	1000	39.4	N/A	N/A	N/A	N/A	1000	39.4	1000	39.4	N/A	N/A
1050	42	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1000	39.4	N/A	N/A	N/A	N/A
1100	44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1100	43.3	N/A	N/A	N/A	N/A
1200	48	N/A	N/A	1200	47.2	1200	47.2	N/A	N/A	N/A	N/A	1200	47.2	1200	47.2	N/A	N/A
1400	54	1400	55.1	1400	55.1	1400	55.1	N/A	N/A	N/A	N/A	1400	55.1	N/A	N/A	N/A	N/A
1500	60	1500	59.1	1500	59.1	1500	59.1	N/A	N/A	N/A	N/A	1500	59.1	N/A	N/A	N/A	N/A
1600	66	1600	63	1600	63	1600	63	N/A	N/A	N/A	N/A	1600	63	N/A	N/A	N/A	N/A
1800	72	1800	70.9	1800	70.9	1800	70.9	N/A	N/A	N/A	N/A	1800	70.9	N/A	N/A	N/A	N/A
2000	78	2000	78.7	2000	78.7	2000	78.7	N/A	N/A	N/A	N/A	2000	78.7	N/A	N/A	N/A	N/A

[1)] > DN 700 are non-PED versions

Weight

Table 8-13 Weight for 7ME6520

Nominal size		PN 10		PN 16[1)]		PN 40		Class 150		AWWA C-207		AS 16		JIS10K	
mm	inch	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs
15	½	**N/A**	**N/A**	**N/A**	**N/A**	5	11	5	11	**N/A**	**N/A**	**N/A**	**N/A**	5	11
25	1	**N/A**	**N/A**	**N/A**	**N/A**	6	13	6	13	**N/A**	**N/A**	**N/A**	**N/A**	6	13
40	1½	**N/A**	**N/A**	**N/A**	**N/A**	9	20	9	20	**N/A**	**N/A**	**N/A**	**N/A**	9	20
50	2	**N/A**	**N/A**	10	22	**N/A**	**N/A**	10	22	**N/A**	**N/A**	10	22	10	22
65	2½	**N/A**	**N/A**	12	26	**N/A**	**N/A**	12	26	**N/A**	**N/A**	12	26	12	26
80	3	**N/A**	**N/A**	13	29	**N/A**	**N/A**	13	29	**N/A**	**N/A**	13	29	13	29
100	4	**N/A**	**N/A**	17	37	**N/A**	**N/A**	18	40	**N/A**	**N/A**	17	37	17	37
125	5	**N/A**	**N/A**	20	44	**N/A**	**N/A**	21	46	**N/A**	**N/A**	**N/A**	**N/A**	20	44
150	6	**N/A**	**N/A**	27	60	**N/A**	**N/A**	30	66	**N/A**	**N/A**	21	46	26	57
200	8	38	84	39	86	**N/A**	**N/A**	47	104	**N/A**	**N/A**	34	75	35	77
250	10	52	115	56	123	**N/A**	**N/A**	64	141	**N/A**	**N/A**	48	106	51	112
300	12	62	137	72	159	**N/A**	**N/A**	92	203	**N/A**	**N/A**	61	134	59	130
350	14	99	218	115	254	**N/A**	**N/A**	131	289	**N/A**	**N/A**	106	234	88	194
400	16	121	267	143	315	**N/A**	**N/A**	161	355	**N/A**	**N/A**	124	273	113	249
450	18	144	317	177	390	**N/A**	**N/A**	182	401	**N/A**	**N/A**	145	320	135	298
500	20	165	364	222	489	**N/A**	**N/A**	217	478	**N/A**	**N/A**	175	386	151	333
600	24	225	496	321	708	**N/A**	**N/A**	305	672	**N/A**	**N/A**	285	628	179	395
700	28	272	600	331	730	**N/A**	**N/A**	**N/A**	**N/A**	284	626	350	772	**N/A**	**N/A**
750	30	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	331	730	**N/A**	**N/A**	**N/A**	**N/A**
800	32	300	661	386	851	**N/A**	**N/A**	**N/A**	**N/A**	394	869	485	1069	**N/A**	**N/A**
900	36	372	820	482	1063	**N/A**	**N/A**	**N/A**	**N/A**	487	1074	645	1422	**N/A**	**N/A**
1000	40	454	1001	672	1482	**N/A**	**N/A**	**N/A**	**N/A**	589	1299	696	1534	**N/A**	**N/A**
1050	42	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	693	1528	**N/A**	**N/A**	**N/A**	**N/A**
1100	44	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	774	1706	**N/A**	**N/A**	**N/A**	**N/A**
1200	48	728	1605	1116	2460	**N/A**	**N/A**	**N/A**	**N/A**	916	2019	1116	2460	**N/A**	**N/A**

[1)] > DN 700 are non-PED versions

Table 8-14 Weight for 7ME6580

Nominal size		PN 6		PN 10		PN 16[1)]		PN 40		Class 150		AWWA C-207		AS 16		JIS10K	
mm	inch	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs
15	½	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
25	1	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	6	13	5,5	12	**N/A**	**N/A**	**N/A**	**N/A**	5	11
40	1½	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	9	20	7,5	17	**N/A**	**N/A**	**N/A**	**N/A**	8	18
50	2	**N/A**	**N/A**	**N/A**	**N/A**	9	20	10	22	9	20	**N/A**	**N/A**	9	20	9	20
65	2½	**N/A**	**N/A**	**N/A**	**N/A**	12	26	**N/A**	**N/A**	10	22	**N/A**	**N/A**	12	26	12	26

Nominal size		PN 6		PN 10		PN 16[1)]		PN 40		Class 150		AWWA C-207		AS 16		JIS10K	
mm	inch	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs
80	3	N/A	N/A	N/A	N/A	13	29	N/A	N/A	15	33	N/A	N/A	13	29	13	29
100	4	N/A	N/A	N/A	N/A	16.5	36	N/A	N/A	20	44	N/A	N/A	16.5	36	16	35
125	5	N/A	N/A	N/A	N/A	22	48	N/A	N/A	24	53	N/A	N/A	N/A	N/A	20	44
150	6	N/A	N/A	N/A	N/A	27	59	N/A	N/A	28	62	N/A	N/A	29	64	27	59
200	8	N/A	N/A	42	92	42	92	N/A	N/A	49	108	N/A	N/A	42	92	41	90
250	10	N/A	N/A	58	128	66	145	N/A	N/A	75	165	N/A	N/A	66	145	58	128
300	12	N/A	N/A	72	159	81	178	N/A	N/A	98	216	N/A	N/A	81	178	72	158
350	14	N/A	N/A	99	218	115	254	N/A	N/A	131	289	N/A	N/A	106	234	88	194
400	16	N/A	N/A	121	267	143	315	N/A	N/A	161	355	N/A	N/A	124	273	113	249
450	18	N/A	N/A	144	317	177	390	N/A	N/A	182	401	N/A	N/A	145	320	135	298
500	20	N/A	N/A	165	364	222	489	N/A	N/A	217	478	N/A	N/A	175	386	151	333
600	24	N/A	N/A	225	496	321	708	N/A	N/A	305	672	N/A	N/A	285	628	179	395
700	28	N/A	N/A	272	600	314	692	N/A	N/A	N/A	N/A	284	626	350	772	N/A	N/A
750	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	331	730	N/A	N/A	N/A	N/A
800	32	N/A	N/A	300	661	396	873	N/A	N/A	N/A	N/A	394	869	485	1069	N/A	N/A
900	36	N/A	N/A	372	820	474	1043	N/A	N/A	N/A	N/A	487	1074	645	1422	N/A	N/A
1000	40	N/A	N/A	454	1001	600	1321	N/A	N/A	N/A	N/A	589	1299	696	1534	N/A	N/A
1050	42	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	693	1528	N/A	N/A	N/A	N/A
1100	44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	774	1706	N/A	N/A	N/A	N/A
1200	48	N/A	N/A	728	1605	885	1948	N/A	N/A	N/A	N/A	916	2019	1116	2460	N/A	N/A
1400	54	1338	2944	1592	3502	1890	4158	N/A	N/A	N/A	N/A	1592	3502	N/A	N/A	N/A	N/A
1500	60	1520	3344	1850	4070	2238	4924	N/A	N/A	N/A	N/A	1950	4290	N/A	N/A	N/A	N/A
1600	66	1696	3731	2110	4642	2525	5555	N/A	N/A	N/A	N/A	2110	4642	N/A	N/A	N/A	N/A
1800	72	2110	4642	2560	5632	3460	7612	N/A	N/A	N/A	N/A	2560	5632	N/A	N/A	N/A	N/A
2000	78	2564	5641	3640	8008	4205	9251	N/A	N/A	N/A	N/A	3640	8008	N/A	N/A	N/A	N/A

[1)] > DN 700 are non-PED versions

Product documentation and support

A

A.1 Product documentation

Process instrumentation product documentation is available in the following formats:

- Certificates (http://www.siemens.com/processinstrumentation/certificates)
- Downloads (firmware, EDDs, software) (http://www.siemens.com/processinstrumentation/downloads)
- Catalog and catalog sheets (http://www.siemens.com/processinstrumentation/catalogs)
- Manuals (http://www.siemens.com/processinstrumentation/documentation)
  You have the option to show, open, save, or configure the manual.
  - "Display": Open the manual in HTML5 format
  - "Configure": Register and configure the documentation specific to your plant
  - "Download": Open or save the manual in PDF format
  - "Download as html5, only PC": Open or save the manual in the HTML5 view on your PC

You can also find manuals with the Mobile app at Industry Online Support (https://support.industry.siemens.com/cs/ww/en/sc/2067). Download the app to your mobile device and scan the device QR code.

Product documentation by serial number

Using the PIA Life Cycle Portal, you can access the serial number-specific product information including technical specifications, spare parts, calibration data, or factory certificates.

Entering a serial number

1. Open the PIA Life Cycle Portal (https://www.pia-portal.automation.siemens.com).
2. Select the desired language.
3. Enter the serial number of your device. The product documentation relevant for your device is displayed and can be downloaded.

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

Scanning a QR code

1. Scan the QR code on your device with a mobile device.
2. Click "PIA Portal".

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

A.2 Technical support

Technical support

If this documentation does not completely answer your technical questions, you can enter a Support Request (http://www.siemens.com/automation/support-request).

For help creating a support request, view this video here.

Additional information on our technical support can be found at Technical Support (http://www.siemens.com/automation/csi/service).

Service & support on the Internet

In addition to our technical support, Siemens offers comprehensive online services at Service & Support (http://www.siemens.com/automation/service&support).

Contact

If you have further questions about the device, contact your local Siemens representative at Personal Contact (http://www.automation.siemens.com/partner).

To find the contact for your product, go to "all products and branches" and select "Products & Services > Industrial automation > Process instrumentation".

Contact address for business unit:
Siemens AG
Digital Industries
Process Automation
Östliche Rheinbrückenstr. 50
76187 Karlsruhe, Germany

Appendix

B

B.1 Measuring ranges

MAG 5100 W (7ME6520) MI-001 is verified and labeled at a given Q3 and Q3/Q4 = 1.25 and Q2/Q1 = 1.6 measuring ranges:

Order code: P11	**50 (2")**	**65 (2½")**	**80 (3")**	**100 (4")**	**125 (5")**	**150 (6")**	**200 (8")**	**250 (10")**	**300 (12")**
"R" Q3/Q1	40	40	40	40	40	40	40	40	40
Q4 [m³/h]	20	31.25	50	78.75	125	200	312.5	500	787.5
Q3 [m³/h]	**16**	**25**	**40**	**63**	**100**	**160**	**250**	**400**	**630**
Q2 [m³/h]	0.64	1.0	1.6	2.52	4.0	6.4	10.0	16.0	25.2
Q1 [m³/h]	0.4	0.63	1.0	1.58	2.5	4.0	6.25	10.0	15.75

Order code: P12	**50 (2")**	**65 (2½")**	**80 (3")**	**100 (4")**	**125 (5")**	**150 (6")**	**200 (8")**	**250 (10")**	**300 (12")**
"R" Q³/Q1	63	63	63	63	63	63	63	63	63
Q4 [m³/h]	20	31.25	50	78.75	125	200	312.5	500	787.5
Q3 [m³/h]	**16**	**25**	**40**	**63**	**100**	**160**	**250**	**400**	**630**
Q2 [m³/h]	0.41	0.63	1.02	1.6	2.54	4.06	6.35	10.2	16.0
Q1 [m³/h]	0.25	0.40	0.63	1.00	1.59	2.54	3.97	6.35	10.0

Order code: P13	**50 (2")**	**65 (2½")**	**80 (3")**	**100 (4")**	**125 (5")**	**150 (6")**	**200 (8")**	**250 (10")**	**300 (12")**
"R" Q³/Q1	80	80	80	80	80	80	80	80	80
Q4 [m³/h]	20	31.25	50	78.75	125	200	312.5	500	787.5
Q3 [m³/h]	**16**	**25**	**40**	**63**	**100**	**160**	**250**	**400**	**630**
Q2 [m³/h]	0.32	0.5	0.8	1.26	2.0	3.2	5.0	8.0	12.6
Q1 [m³/h]	0.20	0.31	0.50	0.79	1.25	2.00	3.13	5.00	7.9

Order code: P16	**50 (2")**	**65 (2½")**	**80 (3")**	**100 (4")**	**125 (5")**	**150 (6")**	**200 (8")**	**250 (10")**	**300 (12")**
"R" Q³/Q1	160	160	160	160	160	160	160	160	160
Q4 [m³/h]	50	78.75	125	200	312.5	500	787.5	1250	2000
Q3 [m³/h]	**40**	**63**	**100**	**160**	**250**	**400**	**630**	**1000**	**1600**
Q2 [m³/h]	0.4	0.63	1.0	1.6	2.5	4.0	6.3	10.0	16.0
Q1 [m³/h]	0.25	0.39	0.63	1.0	1.56	2.5	3.94	6.3	10.0

Order code: P17	**50 (2")**	**65 (2½")**	**80 (3")**	**100 (4")**	**125 (5")**	**150 (6")**	**200 (8")**	**250 (10")**	**300 (12")**
"R" Q³/Q1	200	200	200	200	200	200	200	200	200
Q4 [m³/h]	50	78.75	125	200	312.5	500	787.5	1250	2000
Q3 [m³/h]	**40**	**63**	**100**	**160**	**250**	**400**	**630**	**1000**	**1600**

Order code: P17	**50 (2")**	**65 (2½")**	**80 (3")**	**100 (4")**	**125 (5")**	**150 (6")**	**200 (8")**	**250 (10")**	**300 (12")**
Q2 [m³/h]	0.32	0.50	0.80	1.28	2.0	3.2	5.0	8.0	12.8
Q1 [m³/h]	0.2	0.32	0.5	0.8	1.25	2.0	3.15	5.0	8.0

Order code: P18	**50 (2")**	**65 (2½")**	**80 (3")**	**100 (4")**	**125 (5")**	**150 (6")**	**200 (8")**	**250 (10")**	**300 (12")**
"R" Q³/Q1	250	250	250	250	250	250	250	250	250
Q4 [m³/h]	50	78.75	125	200	312.5	500	787.5	1250	2000
Q3 [m³/h]	**40**	**63**	**100**	**160**	**250**	**400**	**630**	**1000**	**1600**
Q2 [m³/h]	0.26	0.4	0.64	1.02	1.6	2.56	4.0	6.4	10.24
Q1 [m³/h]	0.16	0.25	0.4	0.64	1.0	1.6	2.52	4.0	6.4

Order code: P24	**350 (14")**	**400 (16")**	**450 (18")**	**500 (20")**	**600 (24")**
"R" Q³/Q1	40	40	40	40	40
Q4 [m³/h]	1250	1250	2000	2000	3125
Q3 [m³/h]	**1000**	**1000**	**1600**	**1600**	**2500**
Q2 [m³/h]	40.0	40.0	64.0	64.0	100.0
Q1 [m³/h]	25.0	25.0	40.0	40.0	62.5

Order code: P25	**350 (14")**	**400 (16")**	**450 (18")**	**500 (20")**	**600 (24")**
"R" Q³/Q1	63	63	63	63	63
Q4 [m³/h]	1250	2000	3125	3125	5000
Q3 [m³/h]	**1000**	**1600**	**2500**	**2500**	**4000**
Q2 [m³/h]	25.4	40.63	63.49	63.49	101.6
Q1 [m³/h]	15.9	25.4	39.7	39.7	63.49

Order code: P26	**350 (14")**	**400 (16")**	**450 (18")**	**500 (20")**	**600 (24")**
"R" Q³/Q1	80	80	80	80	80
Q4 [m³/h]	2000	3125	5000	5000	7875
Q3 [m³/h]	**1600**	**2500**	**4000**	**4000**	**6300**
Q2 [m³/h]	32.0	50.0	80.0	80.0	126.0
Q1 [m³/h]	20	31.25	50.0	50.0	78.75

Order code: P27	**350 (14")**	**400 (16")**	**450 (18")**	**500 (20")**	**600 (24")**
"R" Q³/Q1	100	100	100	100	100
Q4 [m³/h]	3125	3125	5000	5000	7875
Q3 [m³/h]	**2500**	**2500**	**4000**	**4000**	**6300**
Q2 [m³/h]	40.0	40.0	64.0	64.0	100.8
Q1 [m³/h]	25.0	25.0	40.0	40.0	63.0

Order code: P29	**700 (28")**	**750 (30")**	**800 (32")**	**900 (36")**	**1000 (40")**	**1200 (48")**
"R" Q^3/Q1	40	40	40	40	40	40
Q4 [m^3/h]	5000	5000	5000	7875	7875	7875
Q3 [m^3/h]	**4000**	**4000**	**4000**	**6300**	**6300**	**6300**
Q2 [m^3/h]	160.0	160.0	160.0	252.0	252.0	252.0
Q1 [m^3/h]	100.0	100.0	100.0	157.5	157.5	157.5

Order code: P30	**700 (28")**	**750 (30")**	**800 (32")**	**900 (36")**	**1000 (40")**	**1200 (48")**
"R" Q^3/Q1	63	63	63	63	63	-
Q4 [m^3/h]	5000	5000	5000	7875	7875	-
Q3 [m^3/h]	**4000**	**4000**	**4000**	**6300**	**6300**	-
Q2 [m^3/h]	101.6	101.6	101.6	160.0	160.0	-
Q1 [m^3/h]	63.5	63.5	63.5	100.0	100.0	-

Order code: P30	**700 (28")**	**750 (30")**	**800 (32")**	**900 (36")**	**1000 (40")**	**1200 (48")**
"R" Q^3/Q1	80	80	80	80	80	-
Q4 [m^3/h]	5000	5000	5000	7875	7875	-
Q3 [m^3/h]	**4000**	**4000**	**4000**	**6300**	**6300**	-
Q2 [m^3/h]	80.0	80.0	80.0	126.0	126.0	-
Q1 [m^3/h]	50.0	50.0	50.0	78.75	78.75	-

B.2 Measuring range according to EN1434 (2007)

DN	**15**	**25**	**40**	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**	**300**
Q_p/Q1	25	25	25	25	25	25	25	25	25	25	25	25
Q_S (1.25* Q_p)	1.9	4.4	12.5	20	31.25	50	78.75	125	200	312.5	500	787.5
Q_p	1.5	3.5	10.0	16	25	40	63	100	160	250	400	630
Q1	0.06	0.14	0.4	0.64	1	1.6	2.52	4	6.4	10	16	25.2

DN	**15**	**25**	**40**	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**	**300**
Q_p/Q1	50	50	50	50	50	50	50	50	50	50	50	50
Q_S (1.25* Q_p)	1.9	4.4	12.5	20	31.25	50	78.75	125	200	312.5	500	787.5
Q_p	1.5	3.5	10.0	16	25	40	63	100	160	250	400	630
Q1	0.03	0.07	0.2	0.32	0.5	0.8	1.26	2	3.2	5	8	12.6

DN	**15**	**25**	**40**	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**	**300**
Q_p/Q1	100	100	100	100	100	100	100	100	100	100	100	100
Q_S (1.25* Q_p)	1.9	4.4	12.5	20	31.25	50	78.75	125	200	312.5	500	787.5

DN	15	25	40	50	65	80	100	125	150	200	250	300
Q_p	1.5	3.5	10.0	16	25	40	63	100	160	250	400	630
Q1	0.02	0.04	0.1	0.16	0.25	0.4	1.63	1	1.6	2.5	4	6.3

DN	15	25	40	50	65	80	100	125	150	200	250	300
Q_p/Q1	100	100	100	100	100	100	100	100	100	100	100	100
Q_S (1.25* Q_p)	5	11	31	50	78.75	125	200	312.5	500	787.5	1250	2000
Q_p	4	9	25	40	63	100	160	250	400	650	1000	1600
Q1	0.04	0.09	0.3	0.64	0.63	1	1.6	2.5	4	6.3	10	16

B.3 Flange mating dimensions (metric)

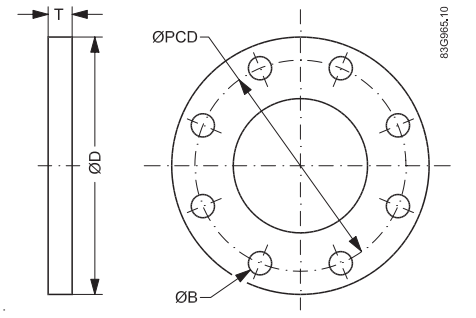


Figure B-1 Flange mating dimensions

Table B-1 Flange mating dimensions (metric) for 7ME6520

DN	Dimensions (mm)				Bolting	
mm	D	PCD	T	B	Holes	Bolts
PN10						
200	340	295	24	22	8	M20
250	395	350	26	22	12	M20
300	445	400	26	22	12	M20
350	505	460	30	22	16	M20
400	565	515	32	26	16	M24
450	615	565	36	26	20	M24
500	670	620	38	26	20	M24
600	780	725	42	30	20	M27
700	895	840	35	30	24	M27
800	1015	950	38	33	24	M30
900	1115	1050	38	33	28	M30
1000	1230	1160	44	36	28	M33
1200	1455	1380	55	39	32	M36
PN16						
50	165	125	20	18	4	M16

DN	Dimensions (mm)				Bolting	
mm	D	PCD	T	B	Holes	Bolts
65	185	145	20	18	8	M16
80	200	160	20	18	8	M16
100	220	180	22	18	8	M16
125	250	210	22	18	8	M16
150	285	240	24	22	8	M20
200	340	295	26	22	12	M20
250	405	355	30	26	12	M24
300	460	410	36	26	12	M24
350	520	470	37	26	16	M24
400	580	525	41	30	16	M27
450	640	585	46	30	20	M27
500	715	650	50	33	20	M30
600	840	770	56	36	20	M33
700	910	840	40	36	24	M33
800	1025	950	41	39	24	M36
900	1125	1050	48	39	28	M36
1000	1255	1170	59	42	28	M39
1200	1485	1390	78	48	32	M45
PN40						
15	95	65	14	14	4	M12
25	115	85	16	14	4	M16
40	150	110	18	18	4	M16
150 lb						
15	89	60	12	16	4	M12
25	108	79	16	16	4	M12
40	127	98	19	16	4	M12
50	150	121	21	19	4	M16
65	180	140	24	19	4	M16
80	190	152	26	19	4	M16
100	230	191	27	19	8	M16
125	255	216	28	22	8	M20
150	279	241	31	22	8	M20
200	343	298	34	22	8	M20
250	406	362	38	25	12	M24
300	483	432	42	25	12	M24
350	535	476	35	29	12	M27
400	595	540	37	29	16	M27
450	635	578	40	32	16	M30
500	700	635	43	32	20	M30
600	815	749	48	35	20	M33
AWWA						
700	927	864	33	35	28	M33

DN	Dimensions (mm)				Bolting	
mm	**D**	**PCD**	**T**	**B**	**Holes**	**Bolts**
750	984	914	35	35	28	M33
800	1060	978	38	41	28	M39
900	1168	1086	41	41	32	M39
1000	1289	1200	41	41	36	M39
1050	1346	1257	45	41	36	M39
1100	1403	1315	45	41	40	M39
1200	1511	1422	48	41	44	M39
AS 4087 PN16						
50	150	114	20	18	4	M16
65	165	127	20	18	4	M16
80	185	146	20	18	4	M16
100	215	178	20	18	4	M16
150	280	235	23	18	8	M16
200	335	292	24	18	8	M16
250	405	356	30	22	8	M20
300	455	406	33	22	12	M20
350	525	470	30	26	12	M24
400	580	521	30	26	12	M24
450	640	584	30	26	12	M24
500	705	641	38	26	16	M24
600	825	756	48	30	16	M27
700	910	845	56	30	20	M27
800	1060	984	56	36	20	M33
900	1175	1092	66	36	24	M33
1000	1255	1175	66	36	24	M33
1200	1490	1410	76	36	32	M33
K10						
15	95	70	12	15	4	M12
25	125	90	16	19	4	M16
40	140	105	18	19	4	M16
50	155	120	20	19	4	M16
65	175	140	20	19	4	M16
80	185	150	20	19	8	M16
100	210	175	20	19	8	M16
125	250	210	22	23	8	M20
150	280	240	22	23	8	M20
200	330	290	22	23	12	M20
250	400	355	24	25	12	M22
300	445	400	24	25	16	M22
350	490	445	26	25	16	M22
400	560	510	28	27	16	M24
450	620	565	30	27	20	M24

DN	Dimensions (mm)				Bolting	
mm	D	PCD	T	B	Holes	Bolts
500	675	620	30	27	20	M24
600	795	730	32	33	24	M30

Table B-2 Flange mating dimensions (metric) for 7ME6580

DN	Dimensions (mm)				Bolting	
mm	D	PCD	T	B	Holes	Bolts
PN6						
1400	1630	1560	56	36	36	M33
1500	1730	1660	80	36	36	M33
1600	1830	1760	63	36	40	M33
1800	2045	1970	69	39	44	M36
2000	2265	2180	74	42	48	M39
PN10						
200	340	295	24	22	8	M20
250	395	350	26	22	12	M20
300	445	400	26	22	12	M20
350	505	460	30	22	16	M20
400	565	515	32	26	16	M24
450	615	565	36	26	20	M24
500	670	620	38	26	20	M24
600	780	725	42	30	20	M27
700	895	840	35	30	24	M27
800	1015	950	38	33	24	M30
900	1115	1050	38	33	28	M30
1000	1230	1160	44	36	28	M33
1200	1455	1380	55	39	32	M36
1400	1675	1590	65	42	36	M39
1500	1785	1700	105	42	36	M39
1600	1915	1820	75	48	40	M45
1800	2115	2020	85	48	44	M45
2000	2325	2230	90	48	48	M45
PN16						
65	185	145	20	18	8	M16
80	200	160	20	18	8	M16
100	220	180	22	18	8	M16
125	250	210	22	18	8	M16
150	285	240	24	22	8	M20
200	340	295	26	22	12	M20
250	405	355	29	26	12	M24

DN	Dimensions (mm)				Bolting	
mm	**D**	**PCD**	**T**	**B**	**Holes**	**Bolts**
300	460	410	32	26	12	M24
350	520	470	37	26	16	M24
400	580	525	41	30	16	M27
450	640	585	46	30	20	M27
500	715	650	50	33	20	M30
600	840	770	56	36	20	M33
700 (WN)	910	840	40	36	24	M33
800	1025	950	41	39	24	M36
900	1125	1050	48	39	28	M36
1000	1255	1170	59	42	28	M39
1200	1485	1390	78	48	32	M45
1400	1685	1590	84	48	36	M45
1500	1820	1710	130	56	36	M52
1600	1930	1820	102	56	40	M52
1800	2130	2020	110	56	44	M52
2000	2345	2230	124	62	48	M56
PN40						
25	115	85	16	14	4	M12
40	150	110	18	18	4	M16
50	165	125	20	18	4	M16
150 lb						
25	110	79	16	16	4	M12
40	125	98	20	16	4	M12
50	150	121	21	19	4	M16
65	180	140	24	19	4	M16
80	190	152	26	19	4	M16
100	230	191	26	19	8	M16
125	255	216	26	22	8	M20
150	280	241	27	22	8	M20
200	345	299	31	22	8	M20
250	405	362	32	25	12	M24
300	485	432	34	25	12	M24
350	535	476	37	29	12	M27
400	595	540	37	29	16	M27
450	635	578	42	32	16	M30
500	700	635	45	32	20	M30
600	815	749	50	35	20	M33
AWWA						
700	927	864	33	35	28	M33
750	984	914	35	35	28	M33
800	1061	978	38	41	28	M39
900	1168	1086	41	41	32	M39

DN	Dimensions (mm)				Bolting	
mm	D	PCD	T	B	Holes	Bolts
1000	1289	1200	41	41	36	M39
1050	1346	1257	45	41	36	M39
1100	1403	1316	45	41	40	M39
1200	1511	1422	48	41	44	M39
1400	1683	1594	54	48	44	M45
1500	1854	1759	57	48	52	M45
1600	2032	1930	64	48	52	M45
1800	2197	2096	67	48	60	M45
2000	2362	2261	70	54	64	M52
AS 4087 PN16						
50	150	114	11	18	4	M16
65	165	127	11	18	4	M16
80	185	146	11	18	4	M16
100	215	178	13	18	4	M16
150	280	235	13	18	8	M16
200	335	292	19	18	8	M16
250	405	356	19	22	8	M20
300	455	406	23	22	12	M20
350	525	470	30	26	12	M24
400	580	521	30	26	12	M24
450	640	584	30	26	12	M24
500	705	641	38	26	16	M24
600	825	756	48	30	16	M27
700	910	845	56	30	20	M27
800	1060	984	56	36	20	M33
900	1175	1092	66	36	24	M33
1000	1255	1175	66	36	24	M33
1200	1490	1410	76	36	32	M33
K10						
25	125	90	14	19	4	M16
40	140	105	16	19	4	M16
50	155	120	16	19	4	M16
65	175	140	18	19	4	M16
80	185	150	18	19	8	M16
100	210	175	18	19	8	M16
125	250	210	20	23	8	M20
150	280	240	22	23	8	M20
200	330	290	22	23	12	M20
250	400	355	24	25	12,	M22
300	445	400	24	25	16	M22
350	490	445	26	25	16	M22
400	560	510	28	27	16	M24

DN	Dimensions (mm)				Bolting	
mm	**D**	**PCD**	**T**	**B**	**Holes**	**Bolts**
450	620	565	30	27	20	M24
500	675	620	30	27	20	M24
600	795	730	32	33	24	M30

B.4 Factory settings

Dimension-dependent factory settings

Table B-3 50 Hz version

DN			Qmax				Unit	Volume/ pulse	Pulse unit	Totalizer unit
			Order no. 7ME6520		Order no. 7ME6580					
mm	Inch	**Fac settings**	Min.	Max.	Min.	Max.				
15	½	**2000**	159	6361	-	-	l/h	1	l	l
25	1	**5000**	441	17671	441	17671	l/h	10	l	l
40	1½	**12**	1.1	45	1.1	45	m^3/h	10	l	l
50	2	**20**	1.7	63	1.7	70	m^3/h	10	l	l
65	2½	**30**	2.9	100	2.9	119	m^3/h	100	l	l
80	3	**50**	4.0	160	4.5	180	m^3/h	100	l	l
100	4	**120**	6.2	250	7	282	m^3/h	100	l	l
125	5	**180**	10.0	400	11	441	m^3/h	100	l	m^3
150	6	**250**	15.7	629	15.9	636	m^3/h	100	l	m^3
200	8	**400**	24.9	997	28.2	1130	m^3/h	1	m^3	m^3
250	10	**700**	40.0	1600	44.1	1767	m^3/h	1	m^3	m^3
300	12	**1000**	62.5	2500	63.6	2544	m^3/h	1	m^3	m^3
350	14	**1200**	86.5	3463	86.5	3463	m^3/h	1	m^3	m^3
400	16	**1800**	113	4523	113	4523	m^3/h	1	m^3	m^3
450	18	**2000**	143.1	5725	143.1	5725	m^3/h	1	m^3	m^3
500	20	**3000**	176.7	7068	176.7	7068	m^3/h	1	m^3	m^3
600	24	**4000**	254.4	10178	254.4	10178	m^3/h	10	m^3	m^3
700	28	**5000**	346.3	13854	346.3	13854	m^3/h	10	m^3	m^3
750	30	**6000**	397.6	15904	397.6	15904	m^3/h	10	m^3	m^3
800	32	**7000**	452.3	18095	452.3	18095	m^3/h	10	m^3	m^3
900	36	**9000**	572.5	22902	572.5	22902	m^3/h	10	m^3	m^3
1000	40	**12000**	706.8	28274	706.8	28274	m^3/h	10	m^3	m^3
1050	42	**12000**	706.8	28274	706.8	28274	m^3/h	10	m^3	m^3
1100	44	**14000**	855.2	34211	855.2	34211	m^3/h	10	m^3	m^3
1200	48	**15000**	1017.8	40715	1017.8	40715	m^3/h	10	m^3	m^3

DN			Qmax				Unit	Volume/ pulse	Pulse unit	Totalizer unit
			Order no. 7ME6520		Order no. 7ME6580					
1400	54	**25000**	-	-	1385.4	55417	m^3/h	10	m^3	m^3
1500	60	**30000**	-	-	1590.4	63617	m^3/h	10	m^3	m^3
1600	66	**35000**	-	-	1809.5	72382	m^3/h	10	m^3	m^3
1800	72	**40000**	-	-	2290.2	91608	m^3/h	10	m^3	m^3
2000	78	**45000**	-	-	2827.4	113097	m^3/h	10	m^3	m^3

Table B-4 60 Hz version

DN			Qmax				Unit	Volume/ pulse	Pulse unit	Totalizer unit
			Order no. 7ME6520		Order no. 7ME6580					
mm	Inch	**Fac. settings**	Min.	Max.	Min.	Max.				
15	½	9	0.7	28	-	-	US GPM	1	US G	US G
25	1	**22**	1.9	77.8	1.9	77.8	US GPM	1	US G	US G
40	1½	**52**	4.9	199.1	4.9	199.1	US GPM	1	US G	US G
50	2	**88**	6.9	277.2	7.7	311.2	US GPM	1	US G	US G
65	2½	**132**	11.0	440.2	13.1	525.9	US GPM	1	US G	US G
80	3	**220**	17.6	705.1	19.9	796.7	US GPM	1	US G	US MG
100	4	**528**	27.5	1101	31.1	1244.8	US GPM	1	US G	US MG
125	5	**793**	44.0	1762.2	48.6	1945.1	US GPM	1	US G	US MG
150	6	**1101**	69.3	2772.9	70	2800.9	US GPM	1	US G	US MG
200	8	**1761**	109.7	4391.9	124.4	4979.5	US GPM	1	US G	US MG
250	10	**3082**	176.1	7045.2	194.5	7780.5	US GPM	1	US G	US MG
300	12	**4402**	275.1	11007.8	280	11203.9	US GPM	1	US G	US MG
350	14	**5283**	381.2	15249.7	381.2	15249.7	US GPM	1	US G	US MG
400	16	**7925**	497.9	19918.1	497.9	19918.1	US GPM	1	US G	US MG
450	18	**8806**	630.2	25208.8	630.2	25208.8	US GPM	1	US G	US MG
500	20	**13209**	778	31122	778	31122	US GPM	1	US G	US MG
600	24	**17611**	1120.3	44815.7	1120.3	44815.7	US GPM	10	US G	US MG
700	28	**19812**	1524.9	60999.1	1524.9	60999.1	US GPM	10	US G	US MG
750	30	**22014**	1750.6	70024.5	1750.6	70024.5	US GPM	10	US G	US MG
800	32	**30820**	1991.8	79672.4	1991.8	79672.4	US GPM	10	US G	US MG
900	36	**39626**	2522.8	100835.3	2522.8	100835.3	US GPM	10	US G	US MG
1000	40	**52834**	3112.2	124488.1	3112.2	124488.1	US GPM	10	US G	US MG
1050	42	**52834**	3431.2	137248.1	3431.2	137248.1	US GPM	10	US G	US MG
1100	44	**61640**	3765.7	150630.6	3765.7	150630.6	US GPM	10	US G	US MG
1200	48	**66043**	4481	179262.9	4481	179262.9	US GPM	10	US G	US MG
1400	54	**110072**	-	-	6099.9	243993.7	US GPM	1000	US G	US MG
1500	60	**132086**	-	-	7002.4	280098.3	US GPM	1000	US G	US MG
1600	66	**154100**	-	-	7967.2	318689.6	US GPM	1000	US G	US MG

DN			Qmax				Unit	Volume/ pulse	Pulse unit	Totaliz- er unit
			Order no. 7ME6520		Order no. 7ME6580					
1800	72	**176115**	-	-	10083.5	403341.5	US GPM	1000	US G	US MG
2000	78	**198129**	-	-	12448.8	497952.5	US GPM	1000	US G	US MG

B.5 Coil resistance

Table B-5 Coil resistance [Ω]

		MAG 1100, MAG 1100 F		MAG 3100, MAG 3100 P, MAG 5100 W (Order no. 7ME6580)		MAG 5100 W (Order no. 7ME6520)	
DN	Inch	Resistance	Tolerance	Resistance	Tolerance	Resistance	Tolerance
2	1/12	104	+/– 5	104			
3	1/8	104	+/– 5	104			
6	1/4	99	+/– 17	104			
10	3/8	99	+/– 17	104			
15[1)]	1/2	91	+/– 9	104			
25	1	91	+/– 17	104	+/– 2	104	+/– 10
40	11/2	91	+/– 9	92	+/– 2	92	+/– 10
50	2	91	+/– 9	92	+/– 2	119.4	+/– 10
65	21/2	99	+/– 17	100	+/– 2	127	+/– 10
80	3	91	+/– 17	94	+/– 2	126	+/– 10
100	4	91	+/– 9	92	+/– 2	125	+/– 10
125	5	92	+/– 2	126	+/– 10		
150	6	94	+/– 2	116	+/– 10		
200	8	90	+/– 2	109	+/– 10		
250	10	92	+/– 2	104	+/– 10		
300	12	100	+/– 2	108	+/– 10		
350	14	112	+/– 2	100	+/– 6		
400	16	100	+/– 4	100	+/– 6		
450	18	108	+/– 4	100	+/– 6		
500	20	122	+/– 4	100	+/– 6		
600	24	115	+/– 4	98	+/– 6		
700	28	128	+/– 4	98	+/– 6		
750	30	133					
800	32	128	+/– 4	98	+/– 6		
900	36	131	+/– 4	98	+/– 6		
1000	40	131	+/– 4	88	+/– 6		
1100	44	126					
1200	48	130	+/– 4	88	+/– 6		
1400	54	130					
1500	60	124					

		MAG 1100, MAG 1100 F		MAG 3100, MAG 3100 P, MAG 5100 W (Order no. 7ME6580)		MAG 5100 W (Order no. 7ME6520)	
1600	66	133					
1800	72	133					
2000	78	147					

[1] On MAG 1100 DN 15 produced as of May 1999 the coil resistance must be 86 ohm, +8/–4 ohm.

Note

Reference values

- All resistance values are at 20 °C
- The resistance changes proportionally 0.4% / °C

Spare parts

Description	
Cable glands, 2 pcs. M20 ½" NPT	
Sealing screws for sensor/transmitter, 2 pcs.	
Terminal box, in polyamide, inclusive of lid M20 ½" NPT	
Terminal box lid, in polyamide	

Description	
Terminal box, in stainless steel, inclusive of lid M20 ½" NPT	
Potting kit for terminal box of MAG sensors for I P68/NEMA 6P (not for EX)	 

Glossary

ASIC

Application-Specific Integrated Circuit is an integrated circuit (IC) customized for a particular use, rather than intended for general-purpose use.

Elex V

EMC

Electromagnetic compatibility (EMC) is the branch of electrical sciences which studies the unintentional generation, propagation and reception of electromagnetic energy with reference to the unwanted effects (Electromagnetic Interference, or EMI) that such energy may induce. The goal of EMC is the correct operation, in the same electromagnetic environment, of different equipment which use electromagnetic phenomena, and the avoidance of any interference effects.

IP

An IP (Ingress Protection) number is used to specify the environmental protection of enclosures around electronic equipment. These ratings are determined by specific tests. The IP number is composed of two numbers, the first referring to the protection against solid objects and the second against liquids. The higher the number, the better the protection. For example, in IP67 the first Number (6) means that the device is totally protected against dust, and the second (7) that it is protected against the effect of immersion between 15cm and 1m

PED

The Pressure Equipment Directive (97/23/EC) is the legislative framework on European level for equipment subject to a pressure hazard. It was adopted by the European Parliament and the European Council in May 1997 and has been obligatory throughout the European Union since May 2002.

SENSORPROM

All sensor related settings/data saved on an EPROM. SENSORPROM technology automatically configures the transmitter at start up providing calibration data, pipe size, sensor type, and output settings. The SENSORPROM automatically stores values or settings changed by users, and automatically re-programs any new transmitter without loss of accuracy.

USM

USM II is a Communication Platform. The Siemens USM II concept enables fitting of add-on bus modules without loss of functionality:

1. All modules can be fitted as true "plug & play"
2. Module and transmitter are automatically configured through the SENSORPROM

Index

A

Abrasive liquids, 25
Add-on modules, (See Communication module)
Applications, 17

C

Cable specifications, 34, 53
Catalog
  catalog sheets, 65
Cathodic protection, 32
Certificates, 9, 65
Coil insulation check, 47
Coil resistance check, 47
Communication modules, 17
Customer Support, (Refer to Technical support)
Customer Support Hotline, 43

D

Dimensions, 60
Direct burial, 39
Disposal, 45
Document history, 5
Downloads, 65

E

Electrical connection
  Cable specifications, 34
  Remote installations, 34
  Safety instructions, 33
Electrode resistance check, 48
Empty pipe detection, 25

F

FAQ
  Fluctuating process values, 48
Flange mating dimensions, 70

G

Gas / Air bubbles, 25

H

Hazardous area
  Approvals, 13
  Laws and directives, 9
Horizontal Pipes, 25
Hotline, 43, (Refer to Support request)

I

Inlet / outlet conditions, 23
Installation
  Horizontal Pipes, 25
  in U-tube, 22
  Indoor/outdoor, 21
  Large pipes, 24
  Location in system, 22
  Mounting of sensor, 26
  Partially filled pipes, 24
  Pipes with free outlet, 23
  Remote, 34
  Safety instructions, 21
  Vertical pipes, 25
Internet
  Contact person, 44
  Support, 43
Items supplied, 6

L

Laws and directives
  Disassembly, 9
  Personel, 9

M

Mains supply, 33
Maintenance, 41
Manuals, 65
Material compatibility, 10
Measurement principle, 18
Modifications
  correct usage, 14
  improper, 14
Mounting, (See Installation)

P

Potential equalization, 32
Potting, 38
Pressure
    Safety instructions, 21
Pressure Equipment Directive, 11
Process fluid
    Conductivity, 55
Protective conductor terminal, 34
Protective earth, 34

R

Recalibration, 43
Repair, 41
Return procedure, 45

S

Safety, 9
    Instrument safety standards, 10
    Sensor installation, 21
Safety instructions
    Electrical connection, 33
Scope of delivery, 6
Sensor check, 47
Sensor orientation, 25
Service, 41, 43, 66
Service and support
    Internet, 66
Support, 43, 66
Support request, 66
System components, 17

T

Technical support, 66
    partner, 66
    personal contact, 66
Test certificates, 9
Theory of operation, 18
Torques values, 27

V

Vertical Pipes, 25
Vibrations, 22

W

Warranty, 7
Weight, 63
Wire insulation, 34
Wiring, (See Electrical connection)

Appendix I

Remedial System Weekly Log

27	28	29	30	31	32
ALCO Parcel B					
DS-1 Remedial System					
Petroleum product removed from skimmer?	Volume of petroleum product removed from skimmer:	Depth of petroleum product in OWS:	Volume of petroleum product removed from OWS:	Petroleum product observations:	Groundwater pumping rate and adjustments made:

The experience to
listen
The power to
solve℠

Barton
&Loguidice

www.bartonandloguidice.com