Caulmert Limited

Engineering, Environmental & Planning
Consultancy Services

Bryn Posteg Landfill Site

Sundorne Products (Llanidloes) Ltd

Leachate Management Plan Update

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DISCLAIMER

BRYN POSTEG LANDFILL SITE
LEACHATE MANAGEMENT PLAN

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1.0 INTRODUCTION

1.1 Background

1.1.1 Bryn Posteg Landfill Site in Llanidloes, Powys is operated by Sundorne Products (Llanidloes) Ltd Trading as Potters Waste Management (Potters) under Environmental Permit EPR/BU7766IC. Caulmert Ltd was appointed by Potters to update the current leachate management plan in 2017 (document reference 3033-CAU-XX-XX-RP-V-0300-A0-C4) to incorporate the current treatment process conducted onsite. A further review was commissioned in February 2018 to include an updated water balance calculation to reflect the current status of the site.

1.1.2 Water coming into contact with the non-inert waste deposited at Bryn Posteg Landfill Site due to rainfall infiltration or groundwater ingress, will be impacted by soluble and leachable components of the waste and as such is considered leachate. The Landfill Directive (1999) requires that leachate generation is minimised and the generated leachate is collected and treated efficiently to decrease its impact on the environment.

1.1.3 This leachate management plan was compiled in accordance with guidelines set out in the Environment Agency's technical document LFTGN 02 'Guidance on the monitoring of Landfill leachate, groundwater and surface water' and Sector Guidance Note IPPC S5.03 'Guidance for the treatment of landfill leachate'. The plan describes Potters' proposed set of engineering controls, plant and operational procedures employed for leachate management at the site. The leachate management of the site is reviewed in three separate sections:

- Leachate extraction system;
- Leachate treatment plant; and
- Leachate discharge system.

1.1.4 This leachate management plan is based on information contained in the following documents:

- The current leachate management plan[1] (LMP) for the site (Egniol 2008[1])
- A Leachate Treatment Review compiled in 2012[2], in response to Compliance Assessment Report (CAR) report ID I/120208/BU7766IC dated 08/02/2012, and Improvement Condition IC 4a in the Environmental Permit (EP) BU7766, Variation Notice Number EPR/BU7766IC/V004 for Bryn Posteg Landfill Site; both requesting a review of the leachate treatment at Bryn Posteg and a strategy for its improvement.
- Addendum to this report, providing an update, (July 2014[3]).
- A Leachate treatment system review[4] providing an interim overview of the leachate management and treatment process at Bryn Posteg and outlining planned improvements and upgrades to the treatment system.

[1] Bryn Posteg Landfill Site – Leachate Management Plan, Egniol Consulting Ltd, reference B3246, November 2008.
[2] Leachate Treatment Review Caulmert Ltd, reference 1451.4.POT.KEB.ÅKS.A0, 2012
[3] Leachate Treatment Review Addendum: Caulmert Ltd, reference 1925.10.POT.ÅKS.ÅKS.B0, 2014

2.0 SITE HISTORY AND DEVELOPMENT

2.1 Site setting and development

2.1.1 Bryn Posteg Landfill Site is located at the site of a former lead mine 3 km south east of Llanidloes in Powys and is cantered at National Grid Reference SN 971 822.

2.1.2 The site has been developed over a number of years with the first waste being accepted into Phase 1 in 1982. The site is currently divided into 9 Phases which, in turn, are divided into a number of cells. The current tipping operations are continuing in Phase 9D and 9E.

2.2 Engineering systems

2.2.1 To minimise the potential ingress of groundwater and egress of leachate from the site, prior to placement of the waste a low permeability basal lining system has been constructed. The initial cells of the site were lined with 1 m thick layer of clay with target permeability of $1x10^{-9}$ m/s. Cells developed since 1996 (Phase 6) were lined with GCL and HDPE liner. Cells of Phase 9 include a combination of GCL and geomembrane and 0.5 m mineral liner.

2.2.2 Cells 1 to 8 and 9B are all capped. Cells 1 and 2 are capped with 0.5m mineral liner and 0.5m restoration soils. Cells 3 to (some of Cell) 6 have received a 1mm lap-lay geomembrane liner covered with 0.75m restoration soils. Cell 6 has a welded geomembrane cap (1mm HDPE) covered by 0.75m of restoration soils. Cells 7 and 8 have a GCL cap that currently is covered with around 400mm of subsoil. The final capping of this will have a minimum of 1 metre of soils. Cells 9A to 9C were capped in summer 2017.

2.2.3 To facilitate the drainage and collection of leachate at the site, the base of the landfill has been formed to provide a minimum gradient of 1:50. The drainage layer installed over the basal lining to facilitate transmission of liquid to the collection wells, comprises a layer of tyres. Under phases 7 and 8 this is a layer of loose tyres, which is 2 m thick. Under Phase 9 only bailed tyres up to 600 mm thickness have been used.

2.2.4 Twelve leachate monitoring sumps are identified on Drawing 2601.EMP.01, Sumps 1-6 and Sumps 9A, 9A north, 9a south and 9B-9E. The leachate collection sumps have been erected using concrete rings set on a specifically-designed base in the lowest point of each cell. The leachate sumps site nomenclature are presented below in relation to their designations in the Permit.

[4] Leachate Treatment System: Current Treatment Process, Process Upgrade and Implementation) Caulmert Ltd, reference 2233.1.POT.ÅKS.JDM.A1, 2015

Table 2.0 Leachate Extraction wells identification

Permit Reference (Table S3.1)	Monitoring leachate levels	Monitoring leachate quality
LCP1	Sump 1	Leachate 1
LCP2	Sump 2	Leachate 2
LCP3	Sump 3	Leachate 3
LCP6	(Gas Seal)	(Gas Seal)
LCP7	Sump 4	Leachate 4
LCP8	Sump 5	Leachate 5
RMLP9A	(Gas Seal)	(Gas Seal)
RMLP9B	(Gas Seal)	(Gas Seal)
RMLP9C	Sump 9C	Leachate 6
RMLP9D	Sump 9D	Leachate 7

2.3 Water balance calculation

2.3.1 The water balance calculation for the site was reviewed and updated in March 2014[5] and an update to this has been carried out as part of the HRA Review in February 2018[6]. The February 2018 updated water balance reviews the current potential leachate generation and predicts the potential generation when the site is fully capped and restored. Conservatively this model (updated) version assumes that the absorptive capacity of the waste mass has been fully utilised, representing a conservative assumption. Therefore the assessment of the water balance simplifies the infiltration to the uncapped areas, temporary restored areas and permanently capped areas.

2.3.2 The water balance for the landfill was calculated using an Excel model developed from the calculation guidelines outlined within Waste Management Paper 26B[7]. The amount of leachate generated was calculated based on the interaction between the effective rainfall at the site, the areas of active infill, temporary and permanent restoration, the infilling rate and waste absorptive capacity. The method of calculation reflects that leachate generation is controlled by the area of the site and phasing of capping, but is not directly impacted by the amount of waste accepted at the site. The HRA 2018 update[6] assessed the effects the current landfill form could have on waste permeability and concluded that there is no significant impact that could affect the existing leachate collection and abstraction infrastructure.

2.3.3 It was assumed that leachate is generated by precipitation alone and that the amount of leachate generated by the biodegradation of waste will be negligible. Rainfall data was obtained from the onsite weather station. The water balance considered two potential

[5] Water balance calculation, Caulmert, Document ref 1925.4.POT.SDB.AKS.B0, 2014.
[6] Hydrological Risk Assessment Review, Caulmert Ltd. (February 2018) 3400-CAU-XX-XX-RP-O-3001
[7] Waste Management Paper 26B: Landfill design, construction, and operational practice, Department of the Environment, 1997, Volume 1.

scenarios where effective rainfall (ER) was 60% of the total rainfall (TR) during the summer months and a second options where ER was 40% of TR during the summer months.

2.3.4 The calculation covers the full estimated life time of the site; leachate generation during the first part of recorded landfilling (from 1982), leachate generation during the second (current to closure) part of landfilling, and future generation after closure of the landfill. The March 2014 calculation includes the proposed extension relating to the remediation of Phases 1 and 2. The February 2018 calculation provides a short term, current time frame for 2017, 2018 and 2019 only.

2.3.5 Overall the 2018 updated water balance calculations indicated that the likely leachate generation rates for the current period (2018) are on average between 38.6 m^3 per day (60 % ER) and 35 m^3 per day (40 % ER). Maximum daily generation was calculated as 67.4 m^3 (60 % ER) or higher. The equivalent monthly average figures obtained are 1157 m^3 per month (60 % ER), 1039 m^3 per month (40 % ER) and maximum of 2021 m^3 per month respectively. The predicted annual leachate generation volumes for 2017, 2018 and 2019 are 22884.4 m^3, 13893.7 m^3 and 5802.1 m^3 respectively for 60 % ER and 20538.5 m^3, 12469.5 m^3 and 5207.4 m^3 respectively for 40 % ER.

2.3.6 After closure of the landfill, assuming 5 % infiltration rate through the cap, leachate generation was calculated as an average of 16.1 m^3/day and 483.5 m^3/month (60 % ER) or 14.5 m^3/day and 433.9 m^3/month (40 % ER).

3.0 LEACHATE EXTRACTION SYSTEM

3.1 Summary

3.1.1 The existing extraction system is designed to prevent a build-up of leachate and to reduce the likelihood of outbreaks of leachate or impact on the surrounding hydrogeology. Leachate levels in the landfill are regulated by the Environmental Permit and are permitted at 1 m above the base of the site.

3.1.2 Leachate levels are controlled by extraction of leachate from dedicated leachate sumps and gas extraction wells (as required) around the site. The leachate is pumped to the treatment lagoon, where it undergoes treatment prior to disposal to sewer subject to trade effluent agreement.

3.2 Sumps

3.2.1 Electric pumps are installed within the sumps. The pumps have capacity to pump up to 7 litres of liquid per second.

3.2.2 These pumps have individual control panels, which enable the pump to be controlled by time and by level of leachate within the sump. The leachate levels within the sumps are monitored by automatic switches, which control the operation of the pumps in accordance with leachate level fluctuations. The control panels are fitted with warning lights that are triggered if leachate levels exceed the set level of the float. The pumps are inspected on a monthly basis.

3.2.3 The leachate from each sump is pumped into the balancing lagoon situated in the north-eastern corner of the site (see site layout, drawing 3033-CAU-XX-XX-DR-S-1800.P1). The balancing lagoon allows the treatment lagoon to be fed with liquor that does not vary very much in pollution load. The pumps are operated in a cyclic manner, so that leachate from each part of the site is discharged into the lagoon for a short period of time only; no pump is operated for more than 1 hour at a time. This cyclic pumping is undertaken to avoid step changes to the leachate composition in the treatment plant and thereby protect the activated sludge from shock load and too large variability, as the leachate strength and composition varies across the site.

3.3 Gas wells

3.3.1 In addition, leachate extraction is undertaken within a number of the wells using pneumatic pumps which discharge into shared pipes.

3.3.2 All pumps are subject to routine servicing and repair. Where pumps are installed within gas wells, pump servicing impacts on the gas management of the site. Therefore, in accordance with the gas management plan for the site[8], the pumps will be removed on a rotational basis, from one of the five zones of the gas field (Drawing 1239.GEX.03 in Appendix 1) of the

[8] 2018 Landfill gas management plan, Caulmert Ltd, (February 2018) 3428-CAU-XX-XX-RP-V-0303.

site at a time. The leachate pump schedule (Appendix 4) will be used to track the pump rota. Every time a pump is removed from a gas well, the gas well should be dipped. (The pump schedule is provided in electronic format as a stand-alone file for ease of update and use onsite, and only the title page and schedule layout are included in Appendix 3 for reference.)

3.3.3 To ensure the continuity of leachate levels control, the site holds a number of replacement pumps that can be installed in the event of a breakdown or during periods of pump servicing.

3.3.4 The pump servicing, leachate dips and all other relevant data is recorded on the leachate pump schedule (Appendix 3). The schedule, in the format of an Excel workbook, is updated and kept on the computer on the weighbridge.

3.4 Leachate extraction pipework

3.4.1 The connecting pipework is mostly 75 mm OD pipe. Leachate from the leachate sumps and gas wells on site is pumped to the leachate treatment plant via surface-laid pipework that is butt-welded.

3.4.2 In 2016 the amount of leachate extracted from the site was approximately twice that collected in the previous year. Approximately half of the leachate was tankered offsite, as it exceeded the available capacity of the plant. This indicates that the extraction system infrastructure and operation is efficient at removing leachate from the site, and limits to the amount of leachate managed at the site currently relate to the treatment plant throughput rather than the extraction system.

4.0 BIOLOGICAL LEACHATE TREATMENT

4.1 Principles

4.1.1 The leachate treatment plant at Bryn Posteg was the first full-scale plant to be constructed in the UK. Constructed in 1983, it has been operational continuously since the summer of that year. It was designed and constructed as an open lagoon with aerators, and is set up to operate as a Sequential Batch Reactor (SBR) system to treat leachate from the landfill at rates up to 150 cubic metres (m^3) per day. The treated leachate is discharged via a long pipeline to Llanidloes Sewage Treatment Works (STW), located approximately 3km to the north of the site.

4.1.2 The main component of the leachate treatment plant at Bryn Posteg is a 2000m^3 lined open-air lagoon.

4.1.3 The purpose of the treatment plant is to convert the leachate into an effluent which meets the limits required by the Trade Effluent Consent for discharge to sewer. The two main contaminants requiring treatment are ammoniacal nitrogen and dissolved organic compounds measured as COD and BOD and the well-established optimum process for achieving this is by aerobic biodegradation. This process utilises two types of bacteria:

- Nitrifying bacteria for conversion of ammoniacal nitrogen via nitrite into nitrate. These bacteria are autotrophic i.e. they use inorganic carbon as their food source.
- Heterotrophic bacteria for conversion of dissolved organic compounds to carbon dioxide and water.

4.1.4 Whereas heterotrophic bacteria are relatively robust over a wide ranges of temperature, concentrations, pH levels etc, nitrifying bacteria require closer control over their environment to ensure they will thrive and operate efficiently. Therefore the treatment plant is designed to provide such an environment which includes:

- dissolved oxygen (DO)
- adequate mixing
- food sources including ammoniacal nitrogen, inorganic carbon, potassium, phosphorus and essential trace elements
- pH level between 7 and 9
- temperature between 15°C and 25°C
- uniformity

4.1.5 The general process configuration is summarized in Section 4.2. The infrastructure, procedures and controls employed to ensure optimal conditions are maintained for the efficient operation of the biological agents of the leachate treatment plant are discussed in turn in Section 4.3.

4.2 General Process Configuration

4.2.1 The leachate treatment plant was designed to operate as a stand-alone Sequential Batch Reactor (SBR), typically working on a 20-hour aeration period and a 4-hour settling and discharge period. Over the years there have been numerous upgrades and improvements to the plant to optimize the treatment process and bring it up to the continually-evolving requirements of the principle of Best Available Technique (BAT).

4.2.2 A P&ID and process drawing of the current leachate treatment system is included in Appendix 1, Drawing 2233.02. The process is also described below. This drawing shows the plant process following upgrade and improvements recommended in the 2015 Leachate Treatment Review[4] following a review against the Industrial Emissions Directive article 11 and 14, and following a BAT assessment, using sector guidance note S5.03. The comments in CAR1 form of 14th January 2014 were also considered.

4.2.3 The general principles of the system are as follows:

1. Raw leachate is pumped from the landfill to the leachate balancing lagoon via pipelines across the landfill site (discussed in Section 3 above).
2. Effluent is discharged from the balancing lagoon to the treatment lagoon, where leachate is treated biologically as described in section 4.1.
3. The lagoon is aerated continuously and treated leachate is siphoned off to the clarifier, where sludge settles and is recirculated into the lagoon.
4. The supernatant, the treated leachate, passes through the primary clarifier, then onto be polished and treated in the DAF Filter. Following this it enters the discharge tank where it is monitored prior to discharge (see section 5).

4.2.4 The retention time is currently controlled manually onsite – treated leachate is not discharged until the ammoniacal nitrogen concentration and suspended solids are below the consent limits. The recommended upgrades[4] were made to the leachate treatment system, to stabilise the treatment process during the winter months, when low temperatures previously decreased the nitrification rate to negligible levels.

4.3 Treatment system operation

Lagoon

4.3.1 The leachate lagoon is an oblong with semi-circular ends. The central oblong is 16 x 25 meters and has semi-circular ends, 25 m in diameter. The side slopes have a gradient of 1: 2.5. Maximum depth is 4 m. The typical depth is 3 – 3.5 m. The total volume is 2000 m^3.

4.3.2 The treatment lagoon is now operated as a CSR (continuously stirred reactor). At the bottom of the lagoon are 2 18.5 kW Landia venturi aerators, which provides both aeration and mixing. The venturi aerator is in continuous operation. Dissolved oxygen is provided by this aeration system, which also provides adequate mixing.

4.3.3 The volume of raw leachate pumped into the balancing lagoon is dependent upon conditions within the landfill site. If the lagoon gets close to its maximum water level then the sumps are regulated manually to prevent over topping of the lagoon.

4.3.4 The incoming water is distributed around the perimeter of the lagoon, this helps mixing and, when viewing the lagoon remotely through CCTV, allows the discharge from certain cells and sumps to be observed as the camera can easily focus on that particular location.

4.3.5 The nutrient sources are normally present in sufficient amounts in the leachate and no additional dosing is required. The nitrification process generates acidity and it is necessary to dose alkalinity. This is done automatically (see below).

Aerators

4.3.6 The dissolved oxygen is provided by an aeration system which also provides adequate mixing. The current aeration system is based on two 18.5kW Landia venturi aerators. They push air into the base of the lagoon in a number of locations. The second aerator has been added to increase aeration and mixing efficiency as recommended in the Leachate Treatment Review conducted in 2015[4]. Both aerators will be located in the lagoon so that optimum mixing and aeration is achieved and "dead zones" are eliminated.

Clarifier

4.3.7 A clarifier was introduced to allow the treatment system to move from a batch process to a continuous one. In batch mode the whole treatment was stopped to allow the activated sludge to settle and the supernatant was then discharged to sewer. The clarifier optimizes treatment throughput by allowing constant aeration.

4.3.8 The clarifier operates as follows: mixed liquor is continuously pumped from the treatment lagoon to the clarifier from a submersible pump in the lagoon. In the clarifier, the biomass sludge settles. The supernatant overflows into a small holding tank and is subsequently discharged to sewer. The sludge accumulated in the bottom of the clarifier is returned to the treatment lagoon.

Storage Lagoon

4.3.9 Any potentially-contaminated surface water run-off (e.g. generated at the Materials Recycling Facility (MRF) onsite) is pumped to a storage lagoon, constructed near the leachate treatment plant. The holding lagoon provides separate storage capacity for any contaminated surface water. The segregation of this surface water from the treatment plant lagoon improves the reliability of the biological treatment process[2]. The contaminated surface water bypasses the treatment plant and is pumped to the final holding tank and mixed with the treated leachate before being discharged to sewer.

pH control

4.3.10 The nitrification process generates acidity and it is necessary to dose alkalinity to keep pH within the range for optimal activity of the nitrifying bacterial. An automated caustic soda dosing system has been installed at Bryn Posteg, as recommended in the improvement programme in the 2015 leachate treatment review and to fulfill BAT with regards to process control and safety. A tank holds liquid sodium hydroxide by the lagoon. Liquid NaOH is dosed by an automated dosing pump regulated directly by the pH probe.

Heat retention

4.3.11 The main difficulty in reaching maximum biological treatment in the leachate lagoon at Bryn Posteg all year around is loss of temperature. The location of the lagoon means that the biological treatment is highly exposed to strong winds and low temperatures. During winter the heat loss is so great that biological treatment is inhibited, resulting in exceedances of the discharge consent at the site.

4.3.12 A heat exchange system connected to a 900kW biomass boiler has been installed on site. The Frolin Lambdamat boiler featuring a hydraulic piston stoker is being fuelled with shredded Grade A recycled wood.

4.3.13 This is installed alongside an organic rankine cycle (ORC) generator unit producing 60 kW net of electricity at 35°C reject. The residual heat from the unit, estimated to be 924 kW at 35°C, then passes through an existing plate heat exchanger through which leachate is circulated, heating it to 30°C.

4.3.14 The boiler and generator system operates at temperatures where the use of the equipment does not fall within the scope of the Pressure Equipment Directive, and no further controls or maintenance are required to comply with this. The boiler-generator system is controlled by a supervisory control system integrated with the existing filter control system and benefits from a remote access.

4.3.15 The boiler and generator are set up so that the boiler can directly heat the lagoon with full power if the ORC is offline for any reason.

4.3.16 The heat generated by the ORC unit is transferred to the leachate via a gasketed plate heat exchanger (UK Exchangers, specification is included in Appendix 3). The leachate from the treatment lagoon is pumped through one side of the heat exchanger while the heat transfer medium looping to the ORC unit, flows through the other. Each loop is controlled by a pump and regulated via temperature probes in the loop. The heat exchanger keeps the two fluids separate at all times. This system is designed to keep the lagoon temperature steady, within the 25°C to 30°C temperature range, optimal for denitrification.

4.4 Process control

4.4.1 To gain better process control, and obtain more accurate and real-time monitoring of the treated leachate prior to discharge, monitoring probes have been installed in a small holding tank next to the clarifier where the supernatant is held prior to discharge. The discharge tank has baffles fitted to slow down the flow and let any air bubbles release from the supernatant. This is to improve the accuracy of the monitoring. The monitoring probes currently monitor suspended solids, ammoniacal nitrogen, potassium and temperature. The probes are Hach Lange AMTAX probes, and their output is connected to an SC1000 monitoring and logging platform (see specifications in Appendix 3). The results are logged every 10 minutes. In the treatment lagoon there is a temperature and dissolved oxygen probe, which is connected to the same SC1000 platform. The SC1000 platform can be accessed remotely. The Hach Lange product specification is enclosed in Appendix 3.

4.4.2 The site undertakes manual monitoring on a single sample each day to confirm that the results being received from the probes are consistent with the manual results.

4.4.3 Regular monitoring of MLSS (mixed liquor suspended solids) has been added to the monthly monitoring suite to better control sludge condition and age. It enhances the control of sludge acclimatisation and activity.

4.4.4 The operation of the boiler/CHP and heat exchange unit is considered here in so far as it impacts on the performance of the treatment plant and leachate management, and detailed discussion about process controls to optimise its performance (e.g. electricity production) falls outside of the scope of the leachate management plan

4.5 Leachate Treatment Plant Performance

4.5.1 The leachate quality at Bryn Posteg is monitored in accordance with the requirements of the Environmental Permit (included in Section 5 below) and the monitoring results are reported in the Quarterly Reviews and in the Annual Review each year. It is noticeable that the raw (untreated) leachate strength varies seasonally, and is less strong during the winter month due to the dilution effect with increased rainfall. This change in loading does not appear to be impacting the treatment process significantly.

4.5.2 The quality of the treated leachate also varies seasonally, but with an opposite pattern of concentrations to the raw leachate. Discharge consent limits are achieved easily during the summer, when operational conditions at the treatment lagoon are optimal (temperature >20°C). As the treatment capacity in the summer months achieves high ammoniacal nitrogen conversion rates, it is concluded that the biomass in the activated sludge is well adapted to the leachate at Bryn Posteg and the leachate does not contain any substances which cause inhibitory effects. Moreover, the nutrient status of the raw leachate is sufficient to provide a sufficient treatment as is usually the case in nitrification processes (as opposed to denitrification processes where addition of trace elements and carbon source may be required).

4.5.3 Historically during the winter months, the leachate treatment capacity has been significantly reduced. However it is now anticipated that the installation of the heat exchanger will result in consistent rates of treatment throughout the year.

4.5.4 The leachate is dominated by methanogenic leachate, where the COD: BOD ratio is high (> 2.5:1). Heterotrophic bacteria take precedent over the nitrifying bacteria if readily degradable carbon is present. However, as clearly demonstrated by the high ammoniacal nitrogen conversion rates in the summer, this is not the case at Bryn Posteg.

5.0 LEACHATE DISCHARGE MANAGEMENT

5.1.1 Treated leachate from the site is discharged from the DAF on site to the public sewer situated in Cwmdu, Llanidloes (some 3 km north of the site) by means of a submersible electrical pump and disposed to Llanidloes sewage treatment works (STW) under discharge consent from Severn Trent Water Authority.

5.1.2 The original discharge consent for the site was dated 1st March 1985, and was varied in November 2005. The current discharge consent authorises the discharge of a maximum volume of 200 m^3 of trade effluent to be released to foul sewer in any continuous period of 24 hours and highest rate of discharge cannot exceed 3 l/s.

5.1.3 A set of probes have been installed in the discharge tank and are connected to the SC1000 logging platform. The monitoring probes provide the continuous monitoring of ammonia, lagoon temperature, pH and suspended solids and these are logged every 10 minutes on the SC1000. Since the 2015 leachate treatment review, the ammoniacal nitrogen probe has been upgraded to a more robust model which is more reliable in the leachate environment. If the monitoring results show that the treated leachate is within discharge consent limits, it is discharged to sewer via a flowmeter, as seen on drawing 2233.02. The flowmeter is a Siemens MAG 6000 situated in a U-bend which is always full of water on a descending pipe section just before the pipe rises before discharging into the gravity sewer pipe. The flow meter logs flow measurements every 15 minutes via the SC1000 system.

5.1.4 A dissolved air floatation (DAF) unit has been installed to polish the effluent prior to discharge to sewer and to achieve the 1000 mg/l COD required by the discharge consent.

5.1.5 If the leachate level rises to unacceptable levels and the leachate treatment system cannot store or process a sufficient volume to reduce the levels within an acceptable time period, excess leachate is removed via tankering.

6.0 SYSTEM MAINTENTANCE

6.1.1 All operational and maintenance procedures will be carried out in accordance with this LMP, and manufacturer specifications as appropriate (e.g. pumps, monitoring probes, aerators, caustic soda dousing unit, boiler, CHP and heat exchange unit). A summary of the frequency and type of inspection and maintenance requirements of the different components of the leachate management system onsite is included in Table 6.1.

6.1.2 Regular checks (at least monthly) and appropriate maintenance of the pumps and extraction infrastructure (wells, pipework) and the leachate lagoon, surface water holding lagoon and discharge lagoon will be carried out to avoid potential downtime problems or containment failures. All leachate treatment plant maintenance tasks and responsible personnel are specified in Table 6.2 and contact details are provided in Table 6.3.

6.1.3 Daily inspection of the leachate aeration lagoon will confirm the liquid level and remaining lagoon capacity. Inspections of the lining will include checks for visual evidence of leaks, including inspecting the condition of the HDPE liner where this is visible and particularly at the edges of the lagoon (where UV could cause degradation); check for any evidence of doming of the plastic (which could suggest a catastrophic failure of the plastic and leachate escape underneath the liner; any pools or streams of water, where previously none existed and presence of saturated ground near the side of the lagoon during times of dry weather

6.1.4 Maintenance of borehole headworks, locks, signs, identification labels and dedicated sampling installations will be the responsibility of the monitoring technician and will be performed as required.

6.1.5 Any lost or damaged sampling equipment will be repaired or replaced promptly following detection of the faults. Details of faults should be noted during the routine gas monitoring by the monitoring personnel. Sufficient spares should be carried to allow maintenance to be undertaken during routine monitoring visits. Details of all maintenance shall form part of the information recorded.

6.1.6 At all times installations shall be clearly visible and clearly identified on the ground. Vegetation should be cut as necessary from around both flush and raised headworks. An identified need for maintenance of a particular installation should not reasonably prevent routine sampling and monitoring data being obtained.

6.1.7 Due to the on-going requirement to actively manage leachate generated at the site after its closure, the leachate management plan will continue to be followed after closure of the landfill site. It should be reviewed 12 months prior to closure of the site for the receipt and disposal of waste to ensure it remains valid for the short and long term leachate management in the post closure period.

Table 6.1: Summary of the maintenance requirements for components of the leachate management system at Bryn Posteg

		Daily	Monthly	6-monthly	9-monthly	Annually
Leachate extraction system	**Wells**		Leachate levels, leachate samples for offsite quality analysis. Visual checks of infrastructure			
	Pumps		Inspect pumps, control panel and warning light operation	pump maintenance*		Electric pump PAT testing
	Pipes		Inspect connections to pumps and extraction main integrity			
Treatment plant	**Lagoons**	Continuous level monitor with alarm. Visual lagoon level checks at all lagoons. Inspect lagoon integrity for leaks and signs of deterioration or stress	Visual inspection of lagoon conditions			
	Aerators	According to manufacturer specifications				
	Dosing plant	According to manufacturer specifications				
	Monitoring probes	According to manufacturer specifications				
	Boiler	According to manufacturer specifications				
	CHP unit	Inspect for leakages at the flanges, valves and bolts and inspect oil levels		Inspect unit for mechanical damage, clean the filter, cooling fan, electrical cabinet.	Clean filters, inspect generator lubricant	Refill generator lubricant and inspect cold water side (supplier/ manufacturer). Full service by manufacturer very 2 years
	Heat exchange unit		Look for signs of leakage from plate pack/nozzles	temperature and flows vs commission data		heat exchanger maintenance manufacturer's specification
Discharge		Daily spot sample of effluent quality in relation to probe logger and discharge compliance	Obtain samples for offsite quality analysis			

*(schedule according to gas extraction zones)

Table 6.2 Leachate Treatment Processes and Responsibilities

Process	Personnel	Frequency
NORMAL OPERATING CONDITIONS		
leachate collection	Potters	Continuous
leachate extraction	Potters	Continuous
leachate treatment (for discharge to sewer)	Potters	Continuous
Leachate extraction pipework inspection	Potters	monthly recorded inspections
Leachate well pumps inspection	Potters	monthly recorded inspections
Leachate aeration lagoon/clarifier/ discharge tank pipework inspection	Potters	Weekly recorded inspections
Leachate aeration lagoon level inspection	Potters	Continuous level monitors with alarm system. Daily recorded visual inspections
Leachate aeration lagoon lining inspection	Potters	Daily recorded inspections
storage lagoon lining inspection	Potters	Daily recorded inspections
Leachate Clarifier Inspection	Potters	Weekly recorded inspections
Leachate discharge tank inspection	Potters	Weekly recorded inspections
Leachate lagoon operational parameters monitoring (dissolved oxygen, temperature)	Potters	Continual, 15 minute intervals on telemetry system (daily manual test taken to verify)
treated leachate quality monitoring	Potters	Continual, 15 minute intervals on telemetry system (daily manual test taken to verify)
treated leachate discharge volume monitoring	Potters	Continual, 15 minute intervals on telemetry system (daily manual tests taken to verify)
Ensuring PPC permit & Variation Notice compliance	Potters	Continual
Preparation & submission of monitoring reports to NRW	Potters	As per Schedule in PPC permit
Landfill Leachate Testing	Potters	As per Schedule in PPC permit
Treated Leachate Testing at discharge tank	Potters	As per Schedule in PPC permit
ABNORMAL OPERATING CONDITIONS		
leachate extraction system design	Potters	As required
leachate extraction system installation/alteration	Potters	As required
CQA inspection & validation	Potters	As required during new installation/alteration
new extraction system commissioning	Potters	As required
leachate pipework connection/disconnection	Potters/Gwynt Cymru (Sometimes appointed contractor)	As required
Leachate aeration lagoon/clarifier/ discharge tank pipework inspection	Potters	Daily recorded inspections

Process	Personnel	Frequency
Leachate aeration lagoon level inspection	Potters	Daily recorded inspections
Leachate aeration lagoon lining inspection	Potters	Daily recorded inspections
storage lagoon lining inspection	Potters	Daily recorded inspections
Leachate Clarifier Inspection	Potters	Daily recorded inspections
Leachate discharge tank inspection	Potters	Daily recorded inspections
Notification of permit condition breaches to NRW via Schedule 6 Notification	Potters	Immediately upon becoming aware of breach
EMERGENCY OPERATING CONDITIONS		
Resolving leachate well failures	Potters/Gwynt Cymru	Isolate immediately. Refer to Leachate Treatment System Contingency Plan. Organise and appoint contractor if required.
Resolving leachate treatment lagoon failures	Potters	Isolate immediately. Refer to Leachate Treatment System Contingency Plan. Organise and appoint contractor if required.
Responding to odour complaints	Potters	Immediately upon receipt of complaint
Investigating odour complaints	Potters	Upon receipt of complaint
Notification of permit condition breaches to NRW via Schedule 6 Notification	Potters	Immediately upon becoming aware of breach
Notification of leachate spillage to NRW via Schedule 6 Notification	Potters	Immediately upon becoming aware of spill

Table 6.3 Contacts for leachate treatment plant

Emergency Leachate Treatment Providers to Contact in case of plant failure	
(Current Sewage Provider) Severn Trent Water, Llanidloes WWTP *unit number, street name*	24hr Emergency Telephone: 0800 783 4444
(Current LTP Manager) Potters Environmental Compliance Manager	24hr Emergency Telephone: 01686 412043 David Williams: 07970 190529
Natural Resources Wales *24hr incident line*	Telephone: 0800 807060
Sludge Tanker *(Mayglothing Waste Ltd)*	Telephone: 01544 230364
Tanker for raw leachate for treatment elsewhere *(Mayglothing Waste Ltd)*	Telephone: 01544 230364
Pump & Plant Services	Telephone: 0176 766099
Electrician Karl Lewis	Telephone: 07786 256067

(current DAF provider) WA Cooke & Sons *Ellesmere Works* *Manchester* *M28 3Qn*	Telephone 0204 574721 Mobile (Alistair Fielding) 07710 033925
(current Boiler provider) Isambard Ltd *Richard London*	Telephone 01767 631535 Mobile 07974 740854
(current HDPE Liner provider) Celtic Lining *Mel Jones*	Mobile 07974 374390
(current HDPE Pipework provider) *SGG* *Units 2 & 3 Cleveland St.* *Birkenhead* *CH41 4JN*	Telephone 0151 6471440 Mobile (Steve Gunn Grant) 07976 400483

7.0 LEACHATE MONITORING PLAN

7.1 Monitoring requirements

7.1.1 Leachate at the site is managed according to the EP for the site with the aid of a monitoring programme. The EP for the site details the monitoring schedule. The purpose of this monitoring plan is to outline the monitoring parameters, methodologies, reporting procedures and action plans in relation to leachate at Bryn Posteg Landfill site.

7.1.2 Table 7.1 below summarises the monitored parameter, the frequency of monitoring and how this information is used to manage leachate in compliance with the landfill EP.

Table 7.1: Summary of the monitoring requirements at Bryn Posteg

	Sample points	Frequency	Parameter	Trigger level
Leachate level	LCP1, LCP2, LCP3, LCP6, LCP7, LCP8, RMLP9A, RMLP9B, RMLP9C, RMLP9D	Monthly	leachate level expressed as mAOD and head above cell base	1 m above base
Leachate quality	LCP1, LCP2, LCP3, LCP6, LCP7, LCP8, RMLP9A, RMLP9B, RMLP9C, RMLP9D	Monthly	pH, NH4-N, ferric, ferrous and total iron, total hardness, chloride, total nitrogen, total suspended solids, BOD, COD, TOC	
		Six monthly	Cyanide, chromium (speciated), cadmium, copper, zinc, lead and nickel	
		Annually	VOCs, SVOCs, PCBs, PAHs, base neutral acids and EH	
				Discharge consent
Treated effluent quality	Discharge Tank (between clarifier and DAF)	Monthly*	pH	6 - 10
			NH4-N	150 mg/l
			Suspended Solids	500 mg/l
	Effluent Discharge Point (After DAF)	Monthly*	Sulphate (SO4)	1000 mg/l
			COD	1000 mg/l
			Temperature	43°C
			Visible oils	nil
			Dissolved methane	0.14 mg/l
		Six monthly	Cyanide, chromium (speciated), cadmium, copper, zinc, lead, nickel, VOCs, SVOCs, PCBs, PAHs, base neutral acids and EH	
* performed offsite. The monthly suite includes spot sample parameters				

7.1.3 The monitoring and sampling procedures will be in line with recommendations in section 9.0 of the Environment Agency Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water (2003). The procedures included in Appendix 5 will be agreed with Natural Resources Wales (NRW) and will be taken as the minimum standard.

7.1.4 Sections 7.2, 7.3 and 7.4 contain details of the monitoring methods leachate levels, leachate quality and treated effluent quality respectively, and include controls and contingency plans in the case of exceedance of trigger or consent levels.

7.2 Leachate levels

7.2.1 Leachate level and quality monitoring takes place using the leachate abstraction wells and remote leachate monitoring points. Leachate dip levels should be measured relative to cover level (or other agreed datum). The monitoring should include establishing the dip to base of the wells at least annually. The data will be reported as dip level (m BGL), reduced to Ordinance Datum (mAOD) and as head above the cell base (m). This information is used to detect a rise in the leachate levels different parts of the site.

7.2.2 Leachate levels will be kept below the trigger level in each cell onsite. When leachate levels approach the trigger levels, leachate will be pumped out to reduce levels. The pump control system discussed in Section 3 is designed to automate pump control in relation to this requirement and switch pumps on in relation to the level of leachate in the well.

7.2.3 The leachate will be pumped to the treatment plant onsite. During periods of heavy rainfall, a build-up of leachate may occur despite the leachate treatment plant operating to its full capacity and the volumes discharged being at maximum consent levels. During such periods, the pumping/treatment system shall continue to operate at maximum capacity until levels are reduced back to the trigger levels. Leachate will be tankered offsite if there is no spare capacity at the treatment plant during such events.

7.2.4 In the event that a mechanical or electrical failure of the leachate control system results in unacceptably high or rapidly rising leachate levels, the following steps will be taken by the site manager or site supervisor:

- Arrange for alternative pumping facilities and/or generator where a mechanical or electrical fault is deemed to be the problem.
- Arrange for the necessary repairs to be carried out as soon as practically possible
- Advise NRW if appropriate; and
- Record the details of the events and circumstances in the site diary.

7.2.5 If the trigger level is exceeded, the following contingency actions will be carried out:

- Ensure the monitoring equipment is functioning correctly and is within its calibration date and repeat the dip measurement (immediately).
- If the results are confirmed, inform NRW and check the efficiency of the leachate removal system. Submit Schedule 6 notice
- Wherever possible, take corrective measures to remedy the situation (e.g. service or replace malfunctioning pump/increase extraction in nearby locations of the site). Inform NRW of the measures undertaken.
- If corrective measures undertaken are inefficient or the cause of the exceedance cannot be readily identified, investigate the cause of the exceedance and report to NRW on options for further remedial measures (1 month);
- Review impact of the remedial measures and update actions if the leachate head trigger level continues to be exceeded (3 months).

7.3 Leachate quality

7.3.1 Leachate quality monitoring is required to characterise the raw leachate at the site and monitor its evolution through the lifetime of the site.

7.3.2 Whenever possible, the leachate samples should be collected over a single day and on the same day as leachate levels monitoring and groundwater and surface water sampling to allow correlation under the same conditions.

7.3.3 Leachate samples should be taken using a Teflon or stainless steel bailer or stainless steel sample can. Leachate monitoring and sampling should be carried out using dedicated equipment, which should not be used for obtaining 'clean water' samples e.g. groundwater or surface water. Care should be taken to avoid cross-contamination between locations.

7.3.4 Samples of leachate should be submitted for analysis to a laboratory accredited by UKAS or similarly approved. The laboratory should be able to demonstrate an acceptable quality of current results through participation in an independent proficiency check scheme, e.g. Aquacheck.

7.3.5 Water samples should be collected, stored and preserved in accordance with the laboratory requirements, including performing any on-site preservation that may be required (e.g. acidifying samples). Filled sample bottles should be stored upright and placed in cool boxes with ice packs. Samples should be pre-labelled in accordance with the laboratory requirements (but as a minimum should contain the site name, sample location ID, date and initials of technician conducting the sampling) and be submitted to the laboratory within 24 hours of collection.

7.3.6 Water samples submitted for metal analysis that have high silt content may yield anomalously high metal concentrations. Therefore, in order to ensure that only dissolved metals are analysed, it is necessary to instruct the laboratory to filter the sample prior to analysis if this is not their standard procedure.

7.4 Leachate effluent quality

7.4.1 The quality of the treated effluent is monitored to verify the efficiency of the treatment process and confirm compliance with the STW discharge consent for the site.

7.4.2 After upgrade of the leachate treatment plant and processes at the site, compliance with conditions set in the trade effluent consent can be assessed continuously through the combination of in-liquid probes in the discharge tank and logging system. This includes the temperature, pH and ammoniacal nitrogen. In addition, the daily discharge volume should be recorded. The accuracy of the in-liquid probes will be corroborated by obtaining monthly spot samples to be analysed offsite. Any equipment used for such analyses should be maintained according to the manufacturer's recommendations and should be calibrated regularly to ensure its accuracy.

7.4.3 The more-extensive monitoring suite analysed monthly and six monthly by an appropriately accredited offsite laboratory (see paragraph 7.3.4) to review compliance with the discharge consent for the site and monitor the operation of the treatment plant in relation to heavy metals and hazardous substances, as required by the EP for the site. It should be noted that the 2015 leachate treatment review recommended the inclusion of BOD in the monthly effluent sample suite, to enable COD: BOD ratio assessment, which can be used to better understand the dynamics of the microbial community of the treatment plant and therefore optimise its performance.

7.4.4 If a discharge consent limit is exceeded, the following contingency actions will be carried out:

- Stop discharge immediately
- Inform NRW and send Schedule 6 notification
- Assess the time frame required to attain compliance and the volume requiring treatment
- Wherever possible, take corrective measures to remedy the situation
- Review impact of the remedial measures and update actions if the discharge consent continues to be exceeded. Arrange for leachate to be tankered offsite in the short term (3 months).

7.5 Quality Assurance, record keeping and reporting

7.5.1 Appropriate quality assurance and quality control procedures should be implemented to ensure the validity of the collected data. Such measures should include, but not be limited to:

- Separate sampling equipment (e.g. bailers) dedicated for leachate sampling;
- Cleaning sampling equipment between monitoring locations (e.g. rinsing);
- Analysis of field parameters (pH, conductivity, temperature) using appropriately serviced and calibrated instruments;
- Filling of sample bottles to the brim to exclude air where appropriate;
- Transport of the samples to the laboratory in cool boxes within 24 hours of sample collection;
- Chain of custody documentation for the samples;
- Appropriate recording of all field monitoring results and relevant conditions onsite including weather conditions, and observations regarding the monitoring infrastructure and sample matrix (e.g. high suspended solid content);
- Appropriate filing and storing of data and field observations (electronic filing system/monitoring spreadsheet in addition to any hard copy records);
- Review of the field data on the day of monitoring against previous results and repeat the monitoring as soon as possible to confirm the result if any significant deviation is noted.

7.5.2 Records shall be kept of all inspections, maintenance, servicing and calibration of equipment and infrastructure onsite. The pump-servicing schedule proposed as part of the Gas Management Plan for the site is included in Appendix 4 and an electronic copy available

onsite, to be updated with dates and details of pump servicing as specified. An inspection, maintenance and servicing record log for the leachate treatment plant and its components is also included (an electronic copy to be maintained and updated onsite).

7.5.3 All monitoring data will be stored on the site operator's database. All monitoring results will be forwarded to NRW quarterly and should include appropriate comments to clarify any significant variations. Notably, breaches of assessment criteria will be commented on including what contingency action has been implemented.

7.5.4 Leachate monitoring results will be reviewed quarterly and annually in conjunction with other environmental monitoring data at the site as required by the EP. The annual review will also contain conclusions and recommendations regarding the efficiency of the extraction system and treatment plant onsite.

8.0 CONTINGENCY ACTION PLAN

8.1.1 The actions to be taken due to exceedance of trigger levels and discharge consent levels are discussed in sections 7.2 and 7.4 respectively. This section contains a contingency actions to be taken if there is a failure in any part of the leachate extraction and treatment system onsite.

8.1.2 Extraction of leachate from sumps onsite relies on electricity supply to provide power, and could thereby be impacted in the case of a power cut. This is likely to be a short-term event and as such unlikely to cause significant impact on leachate levels. Should mains electricity supply be impacted for more than 24 hours, alternative means of electricity supply should be provided (e.g. generator).

8.1.3 Should any sump or gas well pump fail, the efficiency of leachate extraction would be impacted and there could be an unacceptable build-up of leachate within the site. The pump should be replaced with one of the spare pumps onsite as soon as practically possible.

8.1.4 The leachate extraction pipework is subject to regular inspection (see table 6.1) including checks for cracks in any overground pipework or leaks of leachate from pipework or parts of the site. If any major defects are identified, when a repair could not be carried out immediately, then a temporary fix will be carried out straight away with permanent fix being undertaken as soon as practically possible.

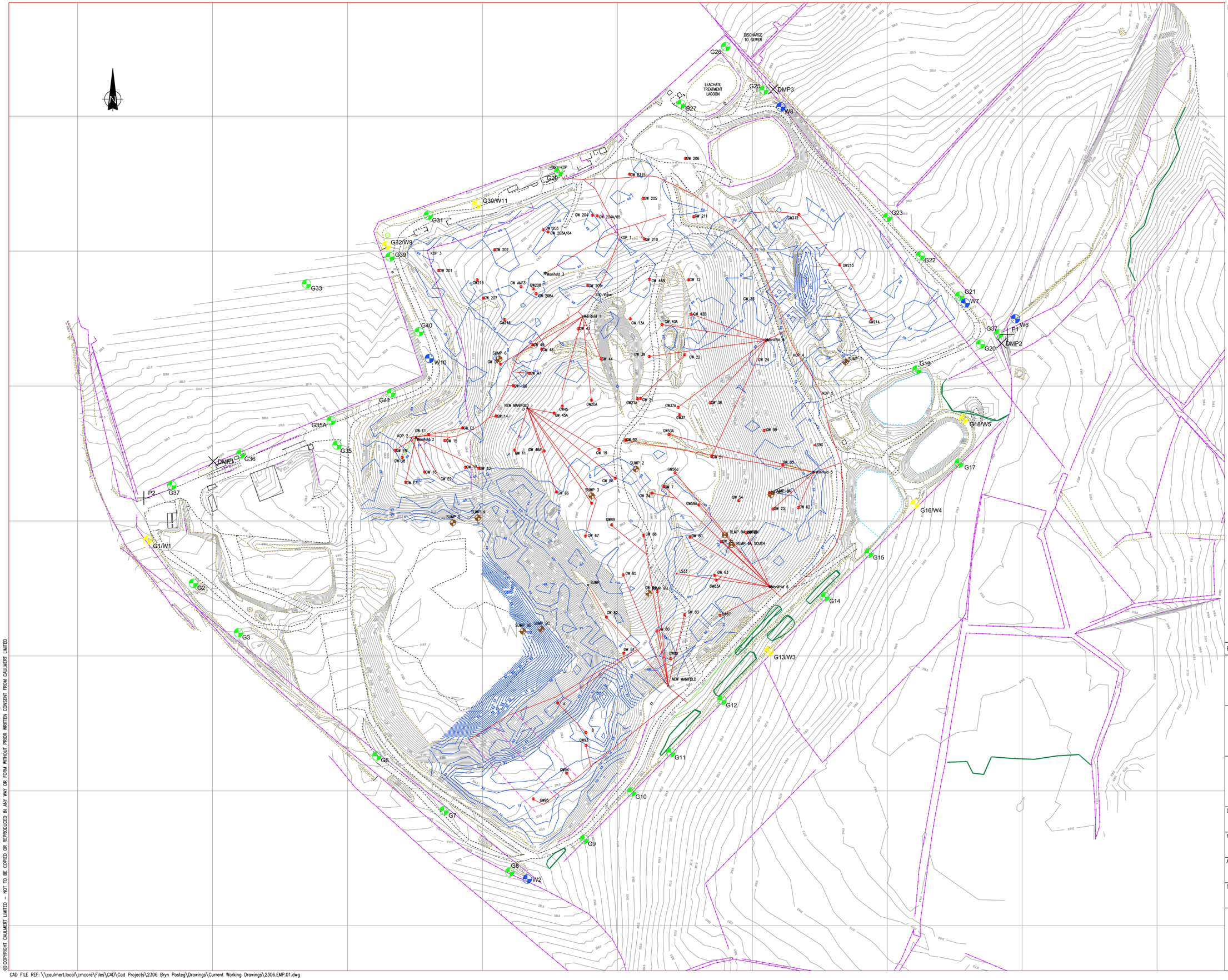
8.1.5 Should the treatment process fail, immediate action will be taken to establish the cause of failure. The leachate treatment process contingency action plan developed as part of the 2015 leachate treatment review has been reviewed and is considered valid for failures that may impact the treatment process onsite. This plan is included in Appendix 6.

8.1.6 Should the treatment process fail for an extended period of time (more than 1 week), and no treatment or discharge is possible, build-up of leachate could occur, potentially breaching the leachate head trigger level. To prevent this, immediate measures should be taken to arrange alternative route of disposal of the extracted leachate, such as tankering offsite.

APPENDIX 1

Drawings

- Drawing 2601.EMP.01 Environmental monitoring plan
- Drawing 3033-CAU-XX-XX-DR-S-1800.C1 Site Layout Plan
- Drawing 2233.02 P&ID upgraded leachate treatment system
- Drawing 1239.GEX.03 Gas extraction system zone maintenance plan



NOTES

1. SURVEY INFORMATION PROVIDED BY POTTERS WASTE MANAGEMENT. SURVEY DATED 12.01.2016
2. ALL LEVELS IN METRES ABOVE ORDNANCE DATUM.
3. DO NOT SCALE FROM THIS DRAWING

LEGEND

- IN WASTE GAS WELL
- GAS MONITORING BOREHOLE
- GROUNDWATER MONITORING BOREHOLE
- GAS MONITORING BOREHOLE WITH GROUNDWATER MONITORING BOREHOLE
- EXISTING LEACHATE COLLECTION POINT
- IN WASTE GAS WELL
- APPROXIMATE POSITION OF SURFACE WATER MONITORING POINT
- APPROXIMATE POSITION OF DUST MONITORING POINT

SURFACE WATER MONITORING POINTS

P1 NANT-Y-BRADNANT

P2 AFON DULAS

DUST MONITORING POINTS

DMP1 VALLEY VIEW

DMP2 RHOSWEN AND PANT

DMP3 PENBRYNDU

REV	MODIFICATIONS	BY	RE	AP	DATE

POTTERS WASTE MANAGEMENT

BRYN POSTEG LANDFILL SITE

ENVIRONMENTAL MONITORING PLAN

DRAWN BY: RWG	DATE: 12.02.2016	
REVIEWED BY: JMC	SCALE @ A1: 1:1250	
AUTHORISED BY: JMC	ISSUE: P	REVISION: P1
DRAWING NUMBER: 2601.EMP.01		

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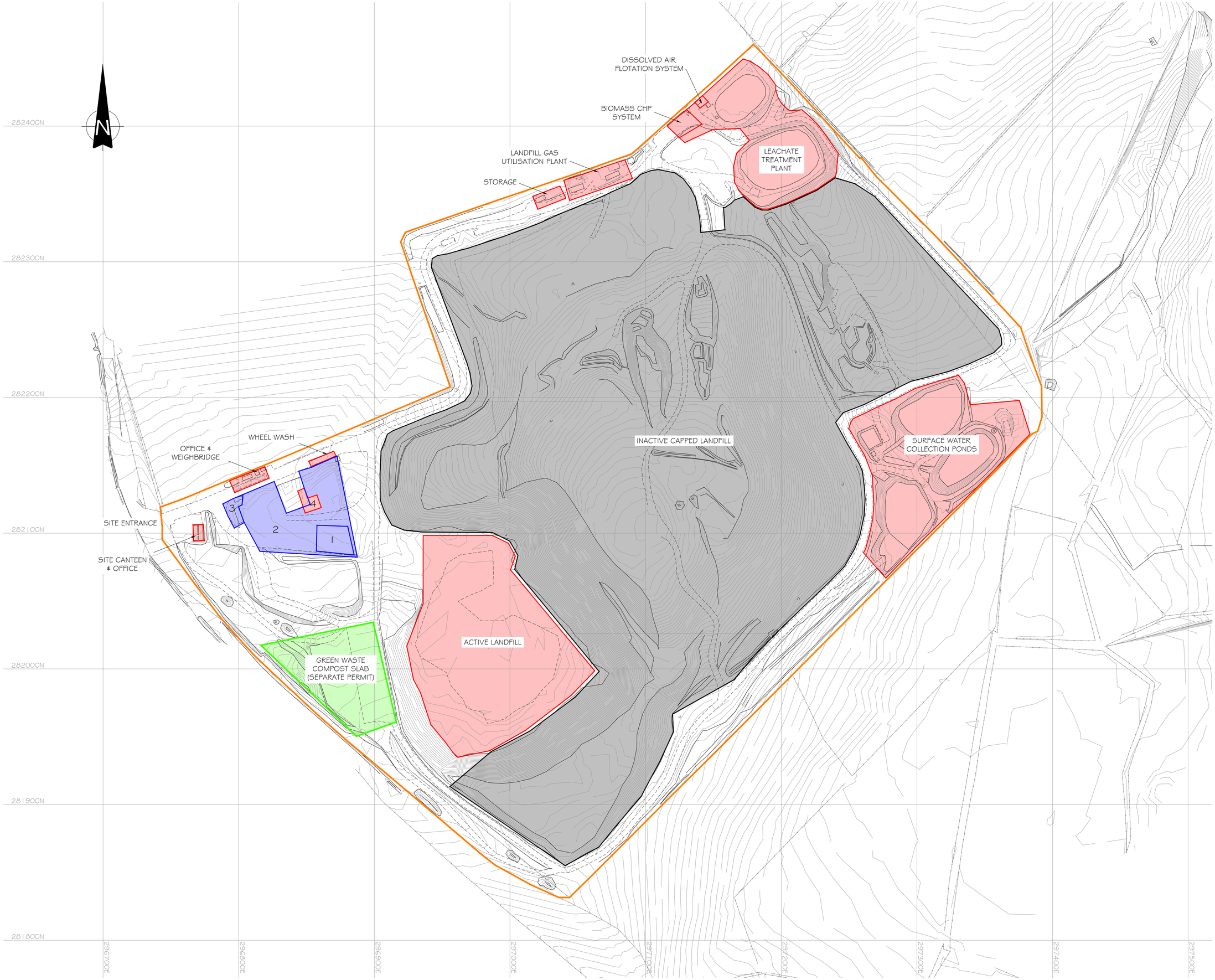
CAD FILE REF: \\caulmert.local\cmcore\Files\CAD\Cad Projects\2306 Bryn Posteg\Drawings\Current Working Drawings\2306.EMP.01.dwg

Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG Company Registered No: 06716319



NOTE

1. DO NOT SCALE FROM THIS DRAWING, WORK FROM FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM U.N.O.

2. NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING WILL BE ALLOWED WITHOUT THE PRIOR PERMISSION IN WRITING.

3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.

- SITE BOUNDARY
- MRF PERMIT ACTIVITY
- LANDFILL PERMIT / GENERAL SITE ACTIVITY
- GREEN WASTE COMPOSTING PERMIT ACTIVITY
- CAPPED LANDFILL

1. MBT COMPOST (MRF PERMIT)
2. WASTE RECPETION (MRF PERMIT)
3. TYRE STORAGE & BAILING (MRF PERMIT)
4. TROMMEL (LANDFILL PERMIT)

REV	MODIFICATIONS	BY	RE	AP	DATE
C1	APPROVED AND ISSUED	EJD	SB	SB	19/12/17
P1	ISSUED FOR COMMENT	EJD	SB	SB	20/11/17

POTTERS WASTE MANAGEMENT

PROJECT:
BRYN POSTEG LANDFILL SITE

TITLE:
ENVIRONMENTAL MONITORING PLAN

DRAWN BY	DATE	
EJD	20/11/2017	
REVIEWED BY	SCALE @ A1	JOB REF:
SB	1:1250	3033
AUTHORISED BY	ISSUE	REVISION
SB	A0	C1

DRAWING NUMBER
3033-CAU-XX-XX-DR-S-1800

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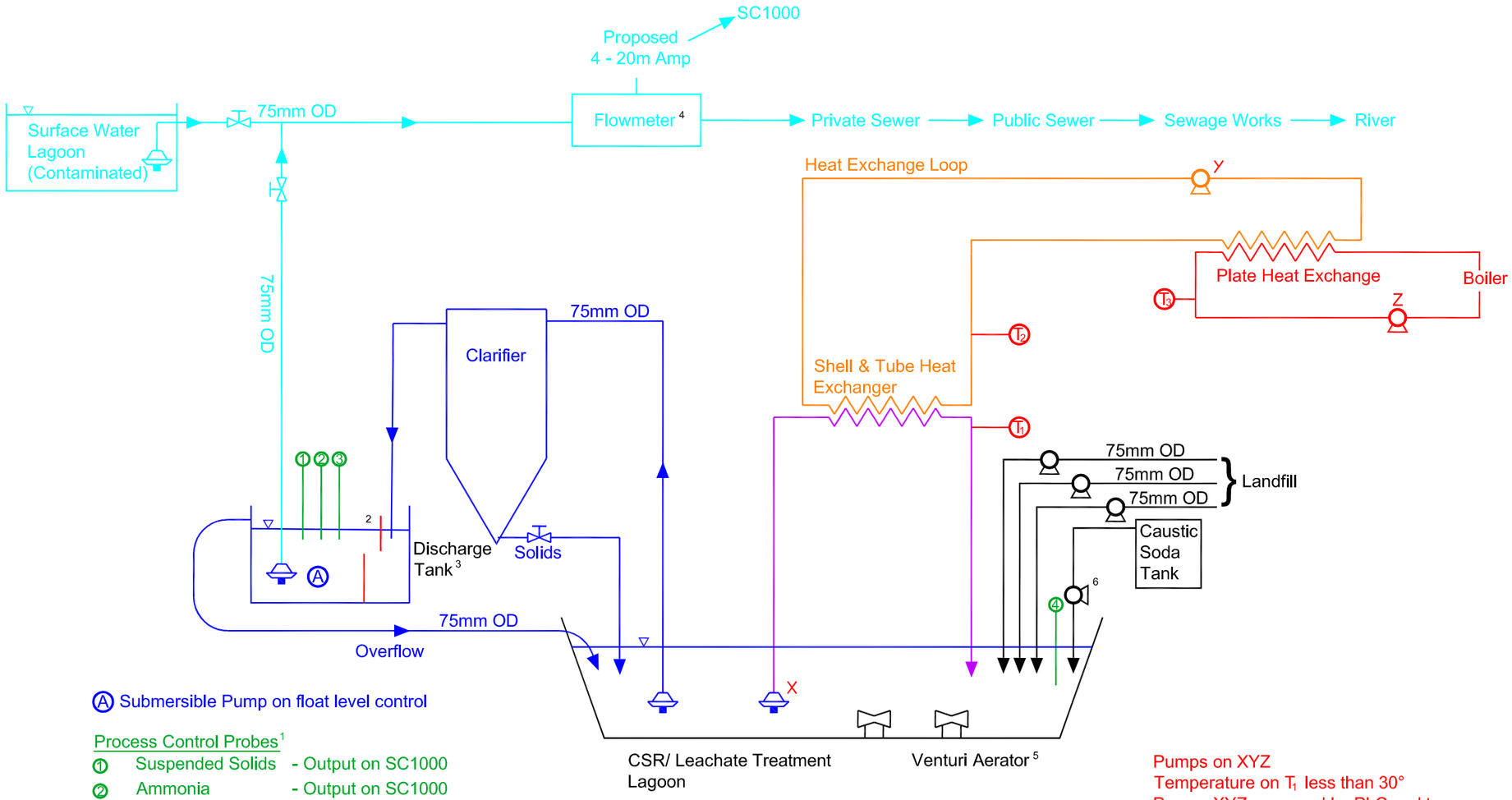

Ⓐ Submersible Pump on float level control

Process Control Probes[1]

① Suspended Solids - Output on SC1000

② Ammonia - Output on SC1000

③ pH - Output on SC1000

④ Dissolved oxygen + water temperature probe -Output on SC1000

Pumps on XYZ
Temperature on T_1 less than 30°
Pumps XYZ managed by PLC and temp on T_1 T_2 T_3
Also actual valve on 3way bypass to assist temp control

NOTES

1. MAKE AND MODEL OF MONITORING PROBES INCLUDED IN APPENDIX 1.
2. BAFFLED TANK TO CREATE LAMINAR FLOW FOR BETTER PROCESS MONITORING ACCURACY.
3. DISCHARGE TANK
4. SPECIFICATION INCLUDED IN APPENDIX 1
5. 18.5kw LANDIA VENTURI AERATOR
6. AUTOMATED DOSING PUMP REGULATED BY pH PROBE

LEGEND

T — TEMPERATURE PROBE

SUBMERSIBLE PUMP

PUMP

REV	MODIFICATIONS	BY	CH	AP	DATE

POTTERS WASTE MANAGEMENT

BRYN POSTEG LANDFILL SITE

P & ID UPGRADED PROCESS

DRAWN BY: EW	DATE: 27.03.2015	
CHECKED BY: LS	SCALE @ A3: N.T.S.	
APPROVED BY: LS	ISSUE: Fn	REVISION: -

DRAWING NUMBER: 2233.02

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CAD FILE REF: M:\Cad Projects\2233 Bryn Posteg\Final Drawings\2233.01_02_Fn.dwg

NOTES

1. SURVEY INFORMATION PROVIDED NRG. SURVEY DATED 18.08.2011.
2. DO NOT SCALE FROM THIS DRAWING.
3. ALL LEVELS IN METRES ABOVE ORDNANCE DATUM.

LEGEND

- EXISTING PIPELINE
- NEW 90mm DIA. SDR 17.6 PIPEWORK
- NEW 160mm DIA. SDR 17.6 PIPEWORK
- GAS WELLS INSTALLED IN AUGUST 2011
- EXISTING GAS WELLS

ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5

REV	MODIFICATIONS	BY	CH	AP	DATE

POTTERS WASTE MANAGEMENT

BRYN POSTEG LANDFILL SITE

GAS EXTRACTION SYSTEM ZONE MAINTENANCE PLAN

DRAWN BY: ILO	DATE: 01.12.2011	
CHECKED BY: AKS	SCALE @ A1: 1:1000	
APPROVED BY: AKS	ISSUE: Fn	REVISION: -

DRAWING NUMBER: 1239.GEX.03

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Registered Office: Unit F13, Inf'ec, Parc Menai, Bangor, Gwynedd, LL57 4FG Company Registered No: 06716319

CAD FILE REF: M:\Cad Projects\1239 Bryn Posteg Env Management\Working Drawings\Preliminary Drawings\1239.GEX.03.dwg

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APPENDIX 2

Water balance calculation

Bryn Posteg: Massbalance leachate generation

Waste Density	1	Mg/m3	
Abs Capacity	0.03	m3 per m3	
Effective Rainfall (Winter)	100%	of TR(monthly values)	
Effective Rainfall (Summer)	60%	of TR(monthly values)	
infiltration rate temporarily restored	50%	(monthly values)	
Infiltration rate fully restored	**5% of ER**	(monthly values)	

Year	Month	Active Phase	Temp restored phase	restored phase	Effective Rainfall	Active Catchment Area	Active Infiltration	Temp restored phase	Temp rest area	Temp rest infiltration	Restored Phase	Restored Area	Restored Infiltration	Waste Input	Total Water	Cumulative Water	Absorptive Capacity	Cumulative Absorptive Capacity	Cumulative Generation	Monthly Generation	Daily Generation	Seasonal total	Cumulative yearly total
			Up to and Incl	Up to and Incl	mm	m^2	m^3		m^2	m3		m^2	m3	tons/month	m3	m3	m3	m3	m3	m3	m3		
2017	Jan	Cell 9D		Cells 1-9C	103.4	22415	2317.6			0.0	Cells 1-9C	122241	632.0		2949.6	2949.6		0.0	2949.6	2949.6	98.3		
	Feb	Cell 9D		Cells 1-9C	83.7	22415	1876.2			0.0	Cells 1-9C	122241	511.6		2387.9	5337.5		0.0	5337.5	2387.9	79.6		
	Mar	Cell 9D		Cells 1-9C	37.1	22415	831.5			0.0	Cells 1-9C	122241	226.7		1058.2	6395.7		0.0	6395.7	1058.2	35.3	6395.7	
	Apr	Cell 9D		Cells 1-9C	31.4	22415	703.5			0.0	Cells 1-9C	122241	191.8		895.3	7291.0		0.0	7291.0	895.3	29.8		
	May	Cell 9D		Cells 1-9C	42.4	22415	951.3			0.0	Cells 1-9C	122241	259.4		1210.7	8501.7		0.0	8501.7	1210.7	40.4		
	Jun	Cell 9D		Cells 1-9C	50.9	22415	1141.8			0.0	Cells 1-9C	122241	311.3		1453.2	9954.9		0.0	9954.9	1453.2	48.4		
	Jul	Cell 9D		Cells 1-9C	69.2	22415	1551.2			0.0	Cells 1-9C	122241	423.0		1974.2	11929.1		0.0	11929.1	1974.2	65.8		
	Aug	Cell 9D		Cells 1-9C	37.4	22415	838.5			0.0	Cells 1-9C	122241	228.6		1067.2	12996.2		0.0	12996.2	1067.2	35.6		1980.7
	Sep	Cell 9D		Cells 1-9C	38.8	22415	870.3			0.0	Cells 1-9C	122241	237.3		1107.6	14103.8		0.0	14103.8	1107.6	36.9	7708.1	
	Oct	Cell 9D		Cells 1-9C	81.6	22415	1828.2			0.0	Cells 1-9C	122241	498.5		2326.7	16430.5		0.0	16430.5	2326.7	77.6		
	Nov	Cell 9D		Cells 1-9C	133.4	22415	2991.2			0.0	Cells 1-9C	122241	815.6		3806.8	20237.3		0.0	20237.3	3806.8	126.9		
	Dec	Cell 9D		Cells 1-9C	123.8	22415	2774.1			0.0	Cells 1-9C	122241	756.4		3530.6	23767.9		0.0	23767.9	3530.6	117.7	23767.9	
2018	Jan		Cell 9D	Cells 1-9C	103.4		0.0	Cell 9D	22415	1158.8	Cells 1-9C	122241	632.0		1790.8	25558.7		0.0	25558.7	1790.8	59.7		
	Feb		Cell 9D	Cells 1-9C	83.7		0.0	Cell 9D	22415	938.1	Cells 1-9C	122241	511.6		1449.7	27008.4		0.0	27008.4	1449.7	48.3		
	Mar		Cell 9D	Cells 1-9C	37.1		0.0	Cell 9D	22415	415.8	Cells 1-9C	122241	226.7		642.5	27650.9		0.0	27650.9	642.5	21.4	13547.1	
	Apr		Cell 9D	Cells 1-9C	31.4		0.0	Cell 9D	22415	351.7	Cells 1-9C	122241	191.8		543.6	28194.4		0.0	28194.4	543.6	18.1		
	May		Cell 9D	Cells 1-9C	42.4		0.0	Cell 9D	22415	475.7	Cells 1-9C	122241	259.4		735.1	28929.5		0.0	28929.5	735.1	24.5		
	Jun		Cell 9D	Cells 1-9C	50.9		0.0	Cell 9D	22415	570.9	Cells 1-9C	122241	311.3		882.3	29811.8		0.0	29811.8	882.3	29.4		
	Jul		Cell 9D	Cells 1-9C	69.2		0.0	Cell 9D	22415	775.6	Cells 1-9C	122241	423.0		1198.6	31010.3		0.0	31010.3	1198.6	40.0		
	Aug		Cell 9D	Cells 1-9C	37.4		0.0	Cell 9D	22415	419.3	Cells 1-9C	122241	228.6		647.9	31658.2		0.0	31658.2	647.9	21.6		
	Sep		Cell 9D	Cells 1-9C	38.8		0.0	Cell 9D	22415	435.1	Cells 1-9C	122241	237.3		672.4	32330.7		0.0	32330.7	672.4	22.4	4679.8	
	Oct		Cell 9D	Cells 1-9C	81.6		0.0	Cell 9D	22415	914.1	Cells 1-9C	122241	498.5		1412.6	33743.3		0.0	33743.3	1412.6	47.1		
	Nov		Cell 9D	Cells 1-9C	133.4		0.0	Cell 9D	22415	1495.6	Cells 1-9C	122241	815.6		2311.2	36054.5		0.0	36054.5	2311.2	77.0		
	Dec		Cell 9D	Cells 1-9C	123.8		0.0	Cell 9D	22415	1387.1	Cells 1-9C	122241	756.4		2143.5	38198.0		0.0	38198.0	2143.5	71.5	14430.1	
2019	Jan			All Cells	103.4		0.0			0.0	All Cells	144656	747.8		747.8	38945.8	0.0	0.0	38945.8	747.8	24.9		
	Feb			All Cells	83.7		0.0			0.0	All Cells	144656	605.4		605.4	39551.3	0.0	0.0	39551.3	605.4	20.2		
	Mar			All Cells	37.1		0.0			0.0	All Cells	144656	268.3		268.3	39819.6	0.0	0.0	39819.6	268.3	8.9	7488.9	
	Apr			All Cells	31.4		0.0			0.0	All Cells	144656	227.0		227.0	40046.6	0.0	0.0	40046.6	227.0	7.6		
	May			All Cells	42.4		0.0			0.0	All Cells	144656	307.0		307.0	40353.5	0.0	0.0	40353.5	307.0	10.2		
	Jun			All Cells	50.9		0.0			0.0	All Cells	144656	368.4		368.4	40722.0	0.0	0.0	40722.0	368.4	12.3		
	Jul			All Cells	69.2		0.0			0.0	All Cells	144656	500.5		500.5	41222.5	0.0	0.0	41222.5	500.5	16.7		
	Aug			All Cells	37.4		0.0			0.0	All Cells	144656	270.6		270.6	41493.1	0.0	0.0	41493.1	270.6	9.0		
	Sep			All Cells	38.8		0.0			0.0	All Cells	144656	280.8		280.8	41773.9	0.0	0.0	41773.9	280.8	9.4	1954.3	
	Oct			All Cells	81.6		0.0			0.0	All Cells	144656	589.9		589.9	42363.8	0.0	0.0	42363.8	589.9	19.7		
	Nov			All Cells	133.4		0.0			0.0	All Cells	144656	965.2		965.2	43329.0	0.0	0.0	43329.0	965.2	32.2		
	Dec			All Cells	123.8		0.0			0.0	All Cells	144656	895.1		895.1	44224.1	0.0	0.0	44224.1	895.1	29.8	6026.1	
																			max	3806.8	126.9		
																			ave	1228.4	40.9		

Bryn Posteg: Massbalance leachate generation

Waste Density		1	Mg/m3
Abs Capacity		0.03	m3 per m3
Effective Rainfall (Winter)		100%	of TR(monthly values)
Effective Rainfall (Summer)		40%	of TR(monthly values)
infiltration rate temporarily restored		50%	(monthly values)
Infiltration rate fully restored		**5% of ER**	(monthly values)

Year	Month	Active Phase	Temp restored phase	restored phase	Effective Rainfall	Active Catchment Area	Active Infiltration	Temp restored phase	Temp rest area	Temp rest infiltration	Restored Phase	Restored Area	Restored Infiltration	Waste Input	Total Water	Cumulative Water	Absorptive Capacity	Cumulative Absorptive Capacity	Cumulative Generation	Monthly Generation	Daily Generation	Seasonal to yearly total
			Up to and Incl	Up to and Incl	mm	m^2	m^3		m^2	m3		m^2	m3	tons/month	m3	m3	m3	m3	m3	m3	m3	
2017	Jan	Cell 9D		Cells 1-9C	106.9	22415	2397.1			0.0	Cells 1-9C	122241	653.6		3050.7	3050.7		0.0	3050.7	3050.7	101.7	
	Feb	Cell 9D		Cells 1-9C	93.5	22415	2095.3			0.0	Cells 1-9C	122241	571.3		2666.6	5717.3		0.0	5717.3	2666.6	88.9	
	Mar	Cell 9D		Cells 1-9C	53.1	22415	1191.1			0.0	Cells 1-9C	122241	324.8		1515.9	7233.2		0.0	7233.2	1515.9	50.5	7233.2
	Apr	Cell 9D		Cells 1-9C	18.9	22415	423.7			0.0	Cells 1-9C	122241	115.5		539.3	7772.5		0.0	7772.5	539.3	18.0	
	May	Cell 9D		Cells 1-9C	30.3	22415	678.2			0.0	Cells 1-9C	122241	184.9		863.1	8635.6		0.0	8635.6	863.1	28.8	
	Jun	Cell 9D		Cells 1-9C	30.2	22415	676.6			0.0	Cells 1-9C	122241	184.5		861.0	9496.6		0.0	9496.6	861.0	28.7	
	Jul	Cell 9D		Cells 1-9C	34.6	22415	776.0			0.0	Cells 1-9C	122241	211.6		987.6	10484.2		0.0	10484.2	987.6	32.9	
	Aug	Cell 9D		Cells 1-9C	27.6	22415	618.9			0.0	Cells 1-9C	122241	168.8		787.7	11271.9		0.0	11271.9	787.7	26.3	
	Sep	Cell 9D		Cells 1-9C	22.9	22415	513.2			0.0	Cells 1-9C	122241	139.9		653.1	11925.0		0.0	11925.0	653.1	21.8	4691.8
	Oct	Cell 9D		Cells 1-9C	71.8	22415	1609.7			0.0	Cells 1-9C	122241	438.9		2048.6	13973.6		0.0	13973.6	2048.6	68.3	
	Nov	Cell 9D		Cells 1-9C	113.4	22415	2542.4			0.0	Cells 1-9C	122241	693.3		3235.7	17209.3		0.0	17209.3	3235.7	107.9	
	Dec	Cell 9D		Cells 1-9C	116.7	22415	2615.9			0.0	Cells 1-9C	122241	713.3		3329.2	20538.5		0.0	20538.5	3329.2	111.0	20538.5
2018	Jan		Cell 9D	Cells 1-9C	106.9		0.0	Cell 9D	22415	1198.6	Cells 1-9C	122241	653.6		1852.2	22390.7		0.0	22390.7	1852.2	61.7	
	Feb		Cell 9D	Cells 1-9C	93.5		0.0	Cell 9D	22415	1047.6	Cells 1-9C	122241	571.3		1619.0	24009.6		0.0	24009.6	1619.0	54.0	
	Mar		Cell 9D	Cells 1-9C	53.1		0.0	Cell 9D	22415	595.5	Cells 1-9C	122241	324.8		920.3	24930.0		0.0	24930.0	920.3	30.7	13005.0
	Apr		Cell 9D	Cells 1-9C	18.9		0.0	Cell 9D	22415	211.9	Cells 1-9C	122241	115.5		327.4	25257.4		0.0	25257.4	327.4	10.9	
	May		Cell 9D	Cells 1-9C	30.3		0.0	Cell 9D	22415	339.1	Cells 1-9C	122241	184.9		524.0	25781.4		0.0	25781.4	524.0	17.5	
	Jun		Cell 9D	Cells 1-9C	30.2		0.0	Cell 9D	22415	338.3	Cells 1-9C	122241	184.5		522.8	26304.2		0.0	26304.2	522.8	17.4	
	Jul		Cell 9D	Cells 1-9C	34.6		0.0	Cell 9D	22415	388.0	Cells 1-9C	122241	211.6		599.6	26903.7		0.0	26903.7	599.6	20.0	
	Aug		Cell 9D	Cells 1-9C	27.6		0.0	Cell 9D	22415	309.5	Cells 1-9C	122241	168.8		478.2	27382.0		0.0	27382.0	478.2	15.9	
	Sep		Cell 9D	Cells 1-9C	22.9		0.0	Cell 9D	22415	256.6	Cells 1-9C	122241	139.9		396.5	27778.5		0.0	27778.5	396.5	13.2	2848.5
	Oct		Cell 9D	Cells 1-9C	71.8		0.0	Cell 9D	22415	804.8	Cells 1-9C	122241	438.9		1243.8	29022.2		0.0	29022.2	1243.8	41.5	
	Nov		Cell 9D	Cells 1-9C	113.4		0.0	Cell 9D	22415	1271.2	Cells 1-9C	122241	693.3		1964.5	30986.7		0.0	30986.7	1964.5	65.5	
	Dec		Cell 9D	Cells 1-9C	116.7		0.0	Cell 9D	22415	1307.9	Cells 1-9C	122241	713.3		2021.2	33008.0		0.0	33008.0	2021.2	67.4	12469.5
2019	Jan			All Cells	106.9		0.0			0.0	All Cells	144656	773.5		773.5	33781.5	0.0	0.0	33781.5	773.5	25.8	
	Feb			All Cells	93.5		0.0			0.0	All Cells	144656	676.1		676.1	34457.5	0.0	0.0	34457.5	676.1	22.5	
	Mar			All Cells	53.1		0.0			0.0	All Cells	144656	384.3		384.3	34841.9	0.0	0.0	34841.9	384.3	12.8	7063.4
	Apr			All Cells	18.9		0.0			0.0	All Cells	144656	136.7		136.7	34978.6	0.0	0.0	34978.6	136.7	4.6	
	May			All Cells	30.3		0.0			0.0	All Cells	144656	218.8		218.8	35197.5	0.0	0.0	35197.5	218.8	7.3	
	Jun			All Cells	30.2		0.0			0.0	All Cells	144656	218.3		218.3	35415.8	0.0	0.0	35415.8	218.3	7.3	
	Jul			All Cells	34.6		0.0			0.0	All Cells	144656	250.4		250.4	35666.2	0.0	0.0	35666.2	250.4	8.3	
	Aug			All Cells	27.6		0.0			0.0	All Cells	144656	199.7		199.7	35865.9	0.0	0.0	35865.9	199.7	6.7	
	Sep			All Cells	22.9		0.0			0.0	All Cells	144656	165.6		165.6	36031.5	0.0	0.0	36031.5	165.6	5.5	1189.6
	Oct			All Cells	71.8		0.0			0.0	All Cells	144656	519.4		519.4	36550.9	0.0	0.0	36550.9	519.4	17.3	
	Nov			All Cells	113.4		0.0			0.0	All Cells	144656	820.4		820.4	37371.2	0.0	0.0	37371.2	820.4	27.3	
	Dec			All Cells	116.7		0.0			0.0	All Cells	144656	844.1		844.1	38215.3	0.0	0.0	38215.3	844.1	28.1	5207.4

APPENDIX 3

Technical specifications and operation manuals

- Landia Aerators
- Landia Chopper Pumps
- Siemens MAG 6000 flow meter
- Hach Lange Analytical Probes and SC1000 instrument platform
- Froling Lambdamat Kommunal woodchip boiler
- E-Rational ORC-1000 CHP unit
- UK Exchangers Ltd Gasket plate heat exchanger

Data sheet

DOC053.52.03068

Dez01

>>FILTRAX

Sampling and sample preparation

Application

Automatic sampling and sample preparation system for the supply of up to three process measuring instruments (AMTAX, PHOSPHAX, NITRATAX *bypass*) with solid-free sample from the activated-sludge basin, the Bio-P-basin, the de-nitrification, the after-clarification or from surface waters.

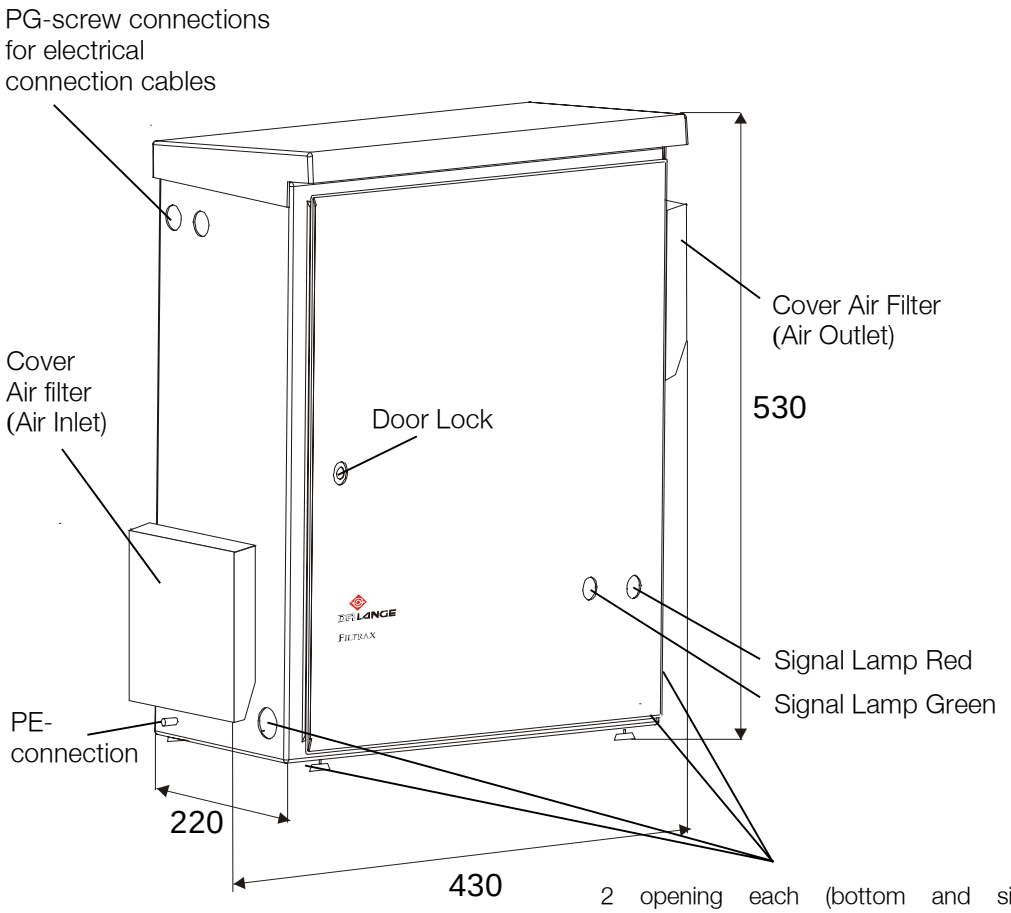
Components:

Control unit in stainless steel housing with aeration and heating for outside installation, micro-processor contol with integrated self-monitoring and flow measurement, menu operation, 5 m long heated suction tube, sample tube (2 m unheated, 10 m heated, 20 m heated, 30 m heated), 2 special filter modules in the filter module carrier from stainless steel, low maintenance through automatic air cleaning system.

LANGE
FOR WATER QUALITY

Control unit

Control unit

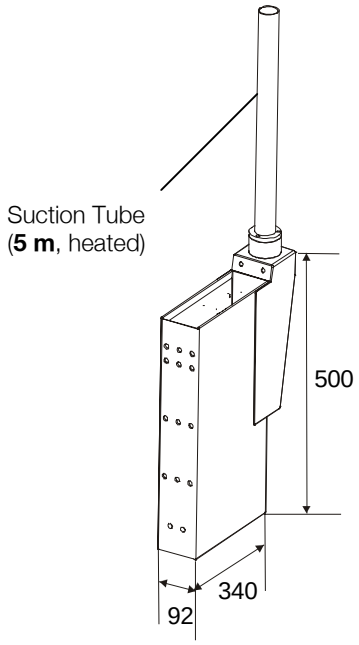


2 opening each (bottom and side) for connecting the suction tube (from the left) and the sample tube (from the right) - included in the delivery scope are two filler plugs and sealing rings for unclosed openings -

Module carrier

The module carrier and the 5 m long suction tube form a unit. Inside the module carrier there are two filter modules that are covered with a filter membrane. Through this filter membrane the sewage water sample gets into a special duct system and from there into the suction tube which will be connected to the control unit. The module carrier will be mounted at the sampling position with the basin edge attachment and immersed.

Module Carrier with Suction Tube

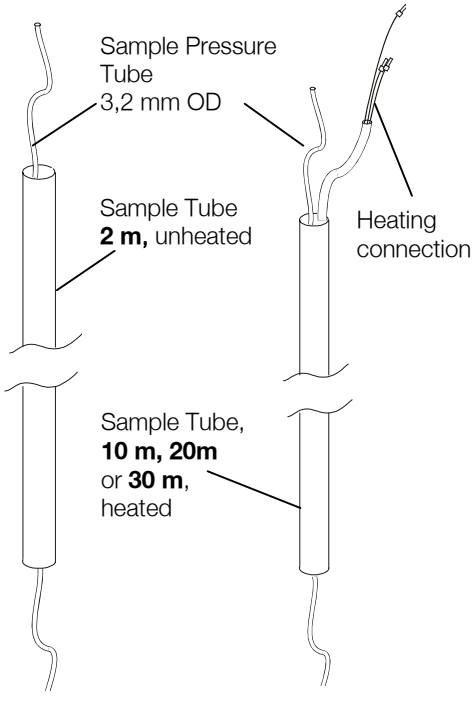


Sample tubes

From the control unit the sample gets to the process measuring instrument through a sample tube. Sample tubes of 4 different lengths permit an adjustment to the manifold installation conditions:

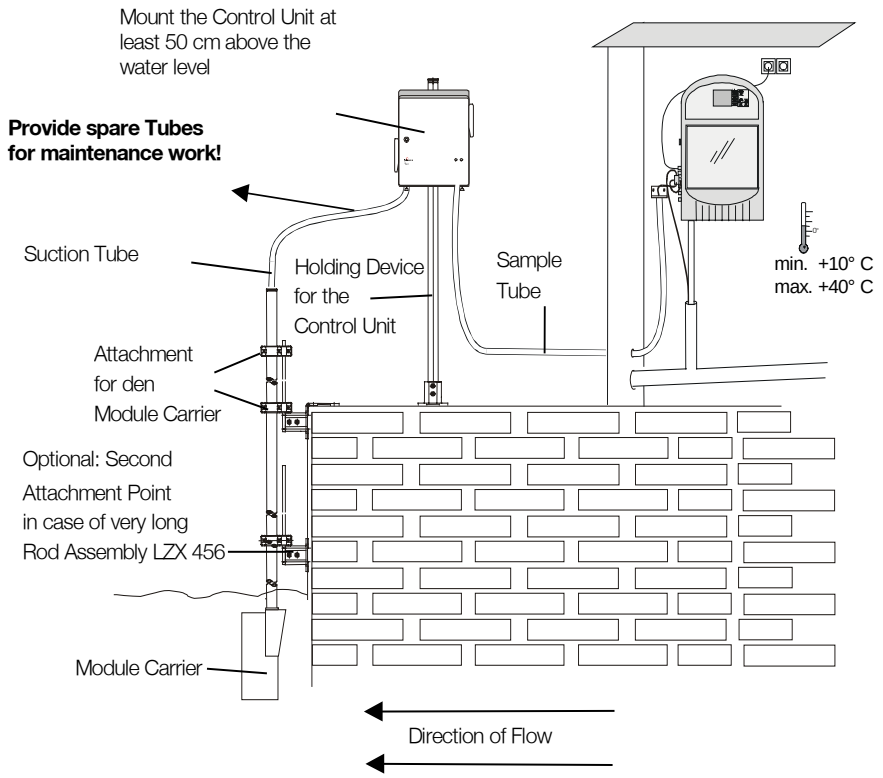
- the 2 m long unheated sample tube is suited for frost-free areas of application
- the three 10 m, 20 m and 30 m long sample tubes possess a powerful pipe accompanying heating for an installation in the open.

Sample Tubes

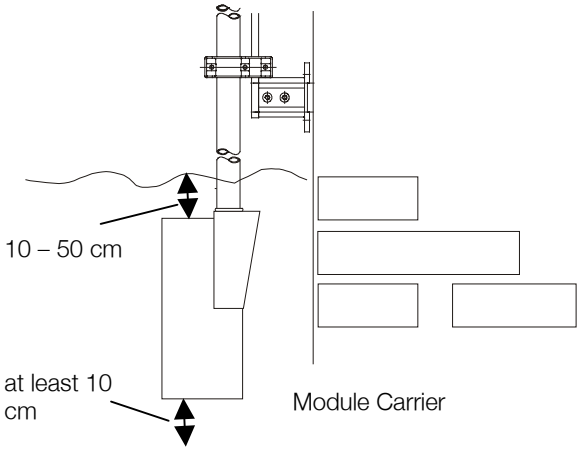


Assembly with basin edge attachment

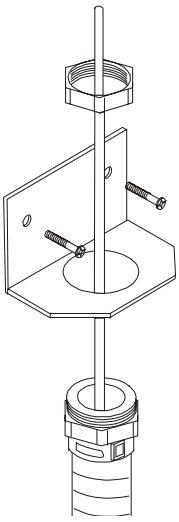
Basin edge attachment



Immersion depth

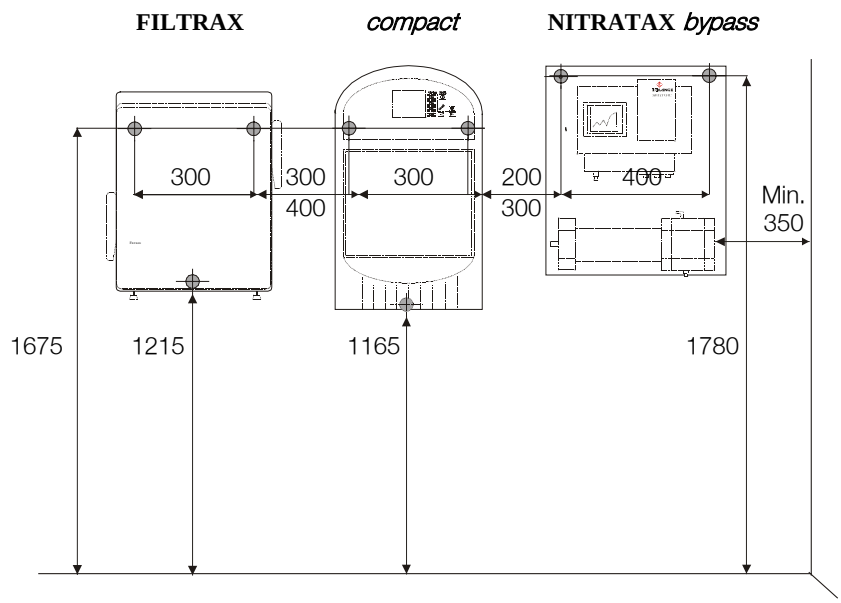


Assembly Angle Sample Tube

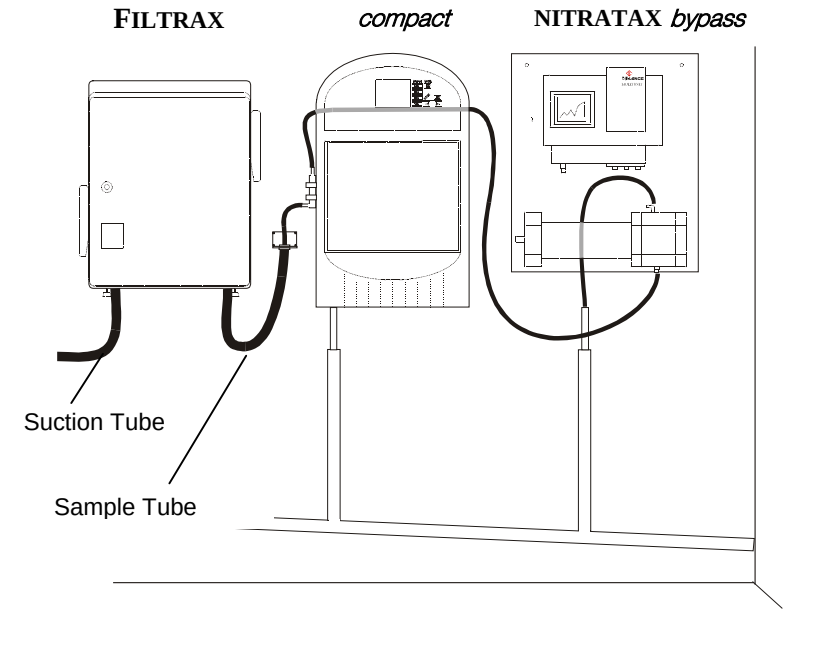


Installation inside buildings

Information for drilling (in mm)



Tube connection

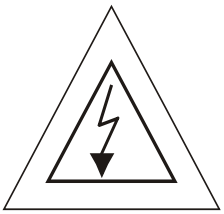


Note: Every process instrument must have a separate discharge tube! The individual instrument discharges must only be brought together in a larger discharge pipe with regular water throughput.

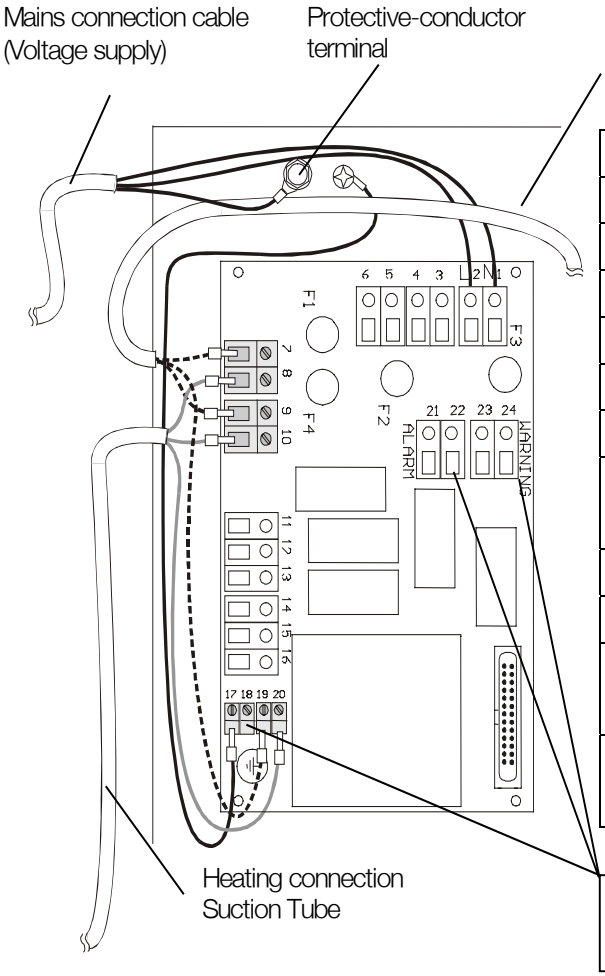
Electrical connections

If the mains plug of the supply connection cable is removed, a suited two-pole off-switch with clear labelling has to be installed in direct vicinity of the control unit for voltage supply!

Terminal assignment



Achtung, Attention!
Vor dem Öffnen des Gerätes Netzstecker ziehen
Disconnect mainsplug before servicing
Tirer fiche de prise de courant avant d'ouvrir l'appareil



Terminals	Connection
1	N (System 230 V 50-60 Hz / Option: 115 V)
2	L (System 230 V 50-60 Hz / Option: 115 V)
7	N (Heating Sample Tube)
8	N (Heating Suction Tube)
9	L (Heating Sample Tube)
10	L (Heating Suction Tube)
18	Protective-conductor screening signal lines (terminals 21-24)
19	Protective conductor heating Suction Tube
20	Protective conductor heating Sample Tube
21 / 22	Alarm contact Make contact potentailfree
23 / 24	Warning contact Make contact potentialfree

Only screened signal lines may be connected!
The screen is put onto terminal 18.

Order number system

FILTRAX	
LXV294.00.01000	FILTRAX with 2 m unheated sample hose
LXV294.00.02000	FILTRAX with 10 m heated sample hose
LXV294.00.03000	FILTRAX with 20 m heated sample hose
LXV294.00.04000	FILTRAX with 30 m heated sample hose

Wear parts and spares

FILTRAX	
EZH 051	Baysilone Paste
LZX 675	Sample Tube 2 m unheated
LZX 672	Sample Tube 10 m heated 230 V
LZX 671	Sample Tube 10 m heated 115 V
LZX 674	Sample Tube 20 m heated 230 V
LZX 673	Sample Tube 20 m heated 115 V
LZX 765	Sample Tube 30 m heated 230 V
LZX 026	Flow Meter complete
LZX 017	Filter Mat Set (8 only) for Control Unit
LZX 677	Filter Module complete packed
EYV 017	Film Bag for the storage of the Filter Module
LZX 667	Tube Set for one year
LZX 018	Wear Parts Set for one year
LZX 024	Compressor 230 V
LZX 025	Compressor 115 V
XQF 025	LED lamp green
XQF 024	LED lamp red
HPP 497	Air Guide Plate
LZX 027	Fan complete
LZX 670	Module Carrier complete with 5 m Suction Tube 230 V
LZX 669	Module Carrier complete with 5 m Suction Tube 115 V
HLS 191	Sample Connection Tube (external), 6 m, 2/4 mm black
LZP 777	Pump Cartridge
LZX 019	Pump Rollers 2-duct (5 only)
LZV 205	Valve (2/2-ways)

Technical data

FILTRAX				
Supply	230 V (Option 115 V) ±10 % alternating voltage, 50-60 Hz			
Power input	Line	Heating off	Max. (-20° C)	Cont. (-20° C)
	2 m	150 VA	450 VA	< 200 VA
	10 m	150 VA	950 VA	< 300 VA
	20 m	150 VA	1500 VA	< 400 VA
	30 m	150 VA	2100 VA	< 500 VA
Sample quantity	approx. 900 ml/h for up to 3 process measuring instruments			
Delivery head	Module Carrier Control Unit: 3 m Control Unit - process measuring instrument: 7 m			
Outputs	Alarm contact: potential-free contact (230 V, 3 A) Warning contact: potential-free contact (230 V, 3 A) Service interface: RS 232			
Line length	Suction Tube: 5 m Sample Tube (unheated): 2 m Sample Tube (heated): 10 m, 20, 30 m			
Maintenance required	approx. 1 h / month			
Medium temperature	+ 5° C to +40° C			
Ambient temperature	-20° C to +40° C			
Type of protection	IP 55			
Dimensions	Control Unit (W x H x D): 430 x 530 x 220 mm Module Carrier (W x H x S): 92 x 500 x 340 mm			
Mass	Control Unit: approx. 22 kg Modul carrier with 5 m Suction Tube: approx. 9 kg Sample Tube 10 m: approx. 5 kg Sample Tube 20 m: approx. 10 kg Sample Tube 30 m: approx. 15 kg Assembly pipe 2 m: approx. 5 kg			

LANGE FOR WATER QUALITY

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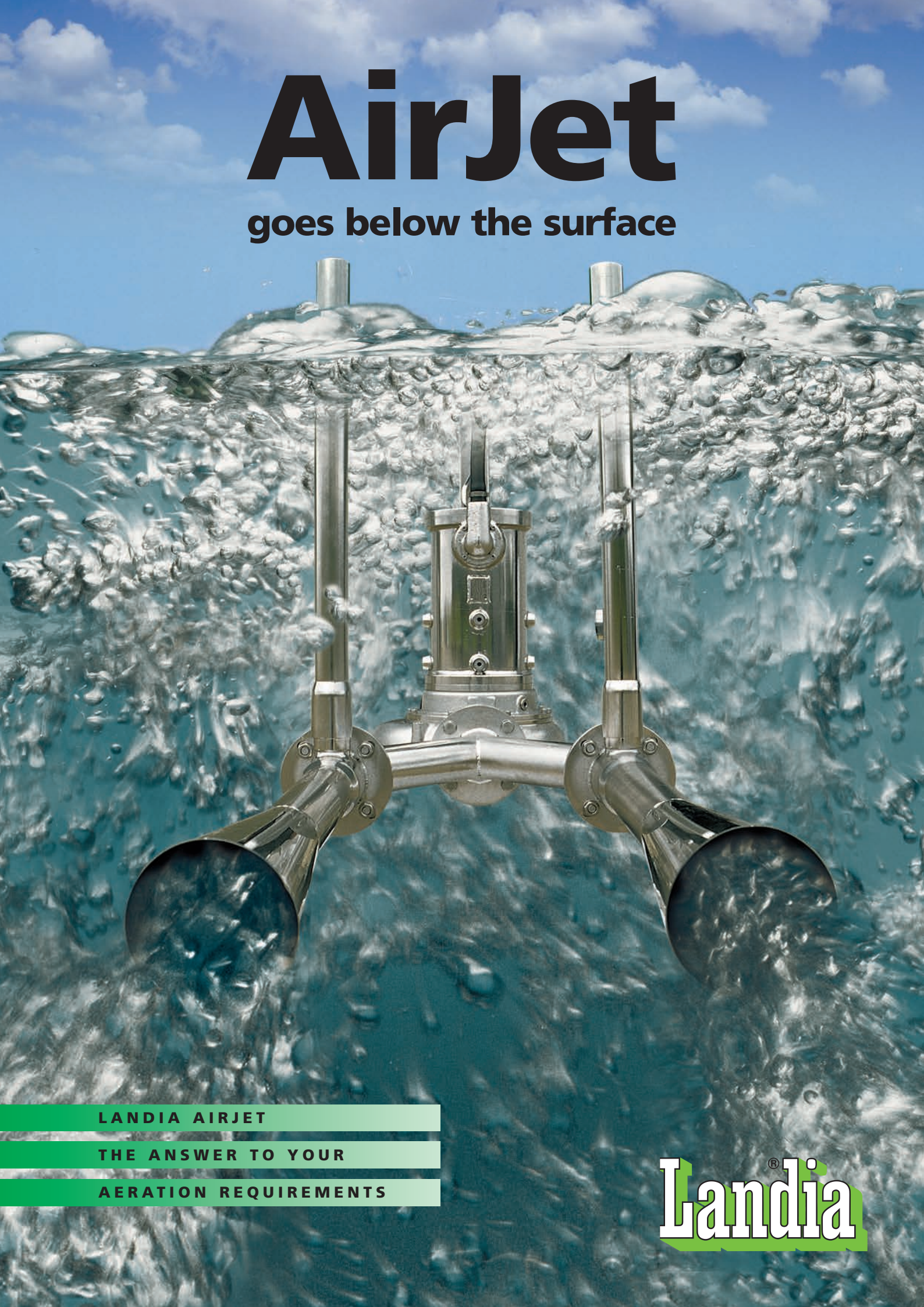
GB – Basingstoke
Hampshire. RG 22 4AP
Tel. +44 (0) 1256 333 403
Fax +44 (0) 1256 330 724
info@drlange.co.uk
www.drlange.com

AirJet

goes below the surface



LANDIA AIRJET

THE ANSWER TO YOUR

AERATION REQUIREMENTS

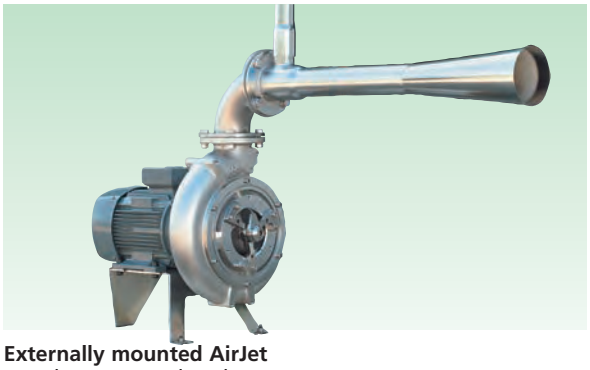
Landia®

AirJet - systems to aerate and mix difficult mediums when treating sewage, storm water, industrial effluents and agricultural waste

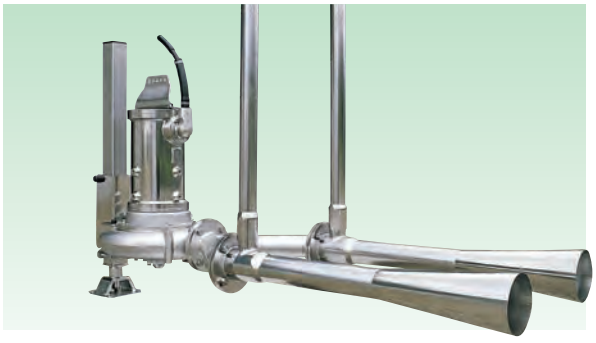
Unique benefits

The benefits of the Landia AirJet aeration and mixing systems are created by the unique concept of combining a highly efficient air ejector with chopper pumps, and may also be used in conjunction with supplementary mixing systems, for optimum oxygen transfer rate.

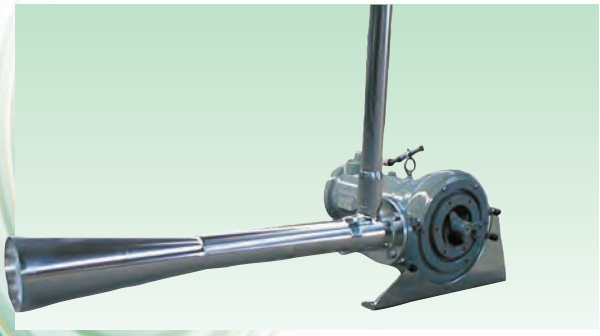
As a world leader, Landia offers below surface aeration and mixing technology combined with chopper pumps. Combining chopper pump aeration systems with Landia submersible mixers provides the most beneficial approach to energy efficient and customized solutions even when treating the most difficult mediums.



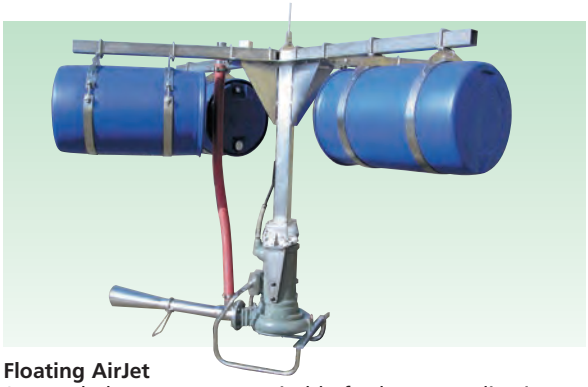
Externally mounted AirJet
For above-ground tanks



Submersible AirJet
Guide rail mounted, horizontally and vertically adjustable



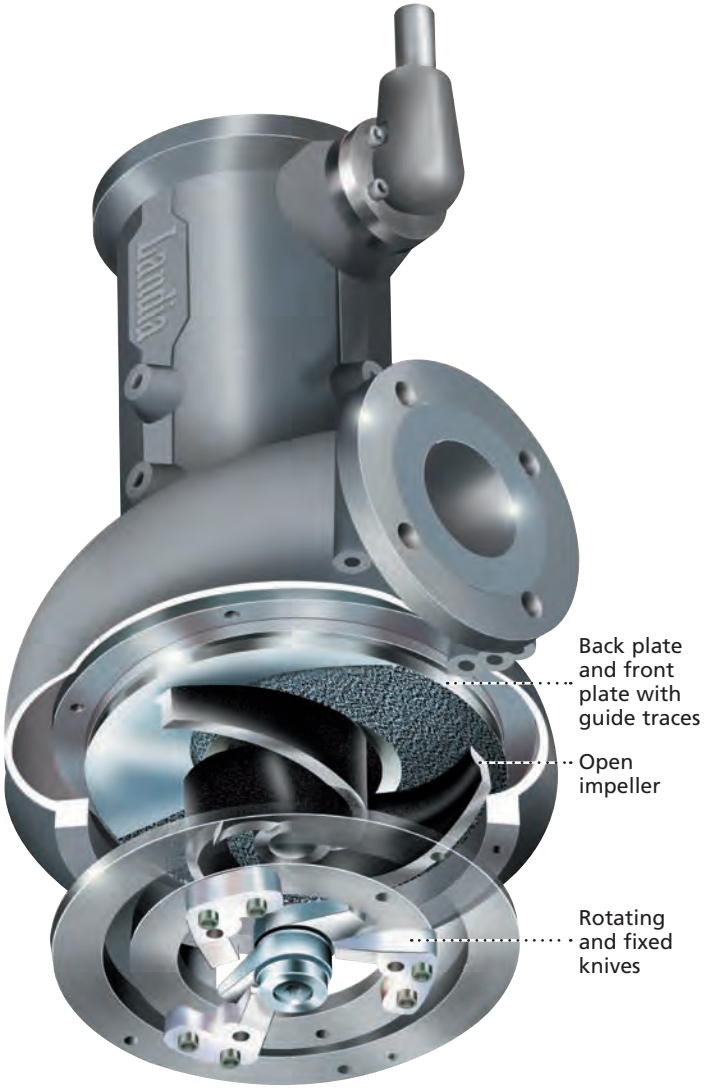
Submersible AirJet
Free standing on bottom of tank or lagoon



Floating AirJet
Suspended on pontoons, suitable for lagoons adjusting to liquid levels

Our customers choose Landia AirJet systems due to their numerous benefits

- Easy to install, even in flooded tanks
- Ideal for operation where liquid levels vary
- Self-aspirating, no need for compressed air supply
- Low investment stand-by aeration capacity during peak periods of oxygen demand
- Vigorous mixing capabilities improving oxygen transfer and preventing sedimentation
- Non-clogging aeration system capable of handling liquids with high dry matter content or coarse, unscreened dry matter particles
- Chopper pumps and equipment available in solid stainless steel for aggressive liquids
- Low noise level compared to other systems
- Odour reduction by preventing septicity



The advantages of combining chopper pumps with venturi ejectors

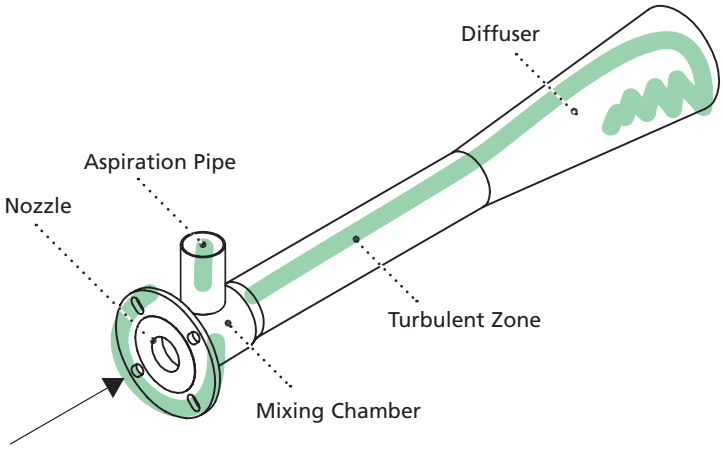
Rotating and fixed knives
in front of the pump inlet ensure dry matter particles are chopped before they enter the pump and the diffuser of the aerator. This prevents clogging of the pump inlet and outlet, as well as the ejector.

Open impeller
prevents dry matter particles from being "caught" in the pump.

Back plate and front plate with guide traces
enhance transport of dry matter particles to the pump outlet and prevent build up of dry matter around the sealing system.

Organic dry matter is chopped into smaller particles, thus improving aerobic digestion and the process of reducing odours and BOD levels.

The function of the ejector



The liquid is pumped through the nozzle into the mixing chamber. Passing through the nozzle, liquid velocity is increased remarkably. This creates a stable negative pressure resulting in the air being drawn through the aspiration pipe.

In the mixing chamber air and liquid are mixed thoroughly. This mixing is enhanced in the ejector's high turbulent zone after which the liquid/air mix is flushed out through the diffuser by means of the high pressure created by the pump.

AirJet product range and performances

Pumps: A comprehensive range of AirJet with chopper pumps from 3.5 kW to 30.0 kW rated motor power is available.

According to process and application requirements AirJets can be delivered with one or two ejectors.

Materials: All ejectors are in stainless steel. Chopper pumps can be delivered in solid stainless steel, cast iron, or combined versions.

Installation: Submersible AirJets can be mounted on a stainless steel guide rail system for adjustment of horizontal and vertical position of pump and to allow easy pump removal for inspection and maintenance.

Performance: Oxygen transfer rates according to SOTR (ANSI/ASCE 2-91) are up to 1.2 kg O2/kWh.

Complete technical data and performance documentation are available on request. Contact us for sizing and process optimized solutions to your application.

Landia's AirJet systems – recommended by satisfied customers

Hundreds of AirJet systems operate in numerous countries worldwide.
They aerate and mix multiple liquids and sludges and efficiently match our customers' requirements in a great variety of situations.
Landia has an extensive track record of widely different applications.

Here are just a few:

Dry-installed AirJets in jam factory effluent aeration tank

Dry-installed AirJet in tannery effluent aeration tank

Dry-installed AirJet in tannery effluent aeration tank

Submersible AirJets in leachate tank

Submersible AirJets in leachate tank

Landia's AirJet systems – recommended by satisfied customers

Submersible AirJets in paper industry effluent aeration tank

Floating AirJets in lagoon

Submersible AirJet for odour alleviation in abattoir wastewater

Combined system of submersible AirJet and submersible mixer in equalization tanks from vegetable processing industry

Submersible AirJet for agricultural waste

Submersible AirJet for agricultural waste

Landia's AirJet systems – recommended by satisfied customers

Storm water tank cleaning

Storm water tank cleaning

A complete range of submersible mixers and mixer/aerators

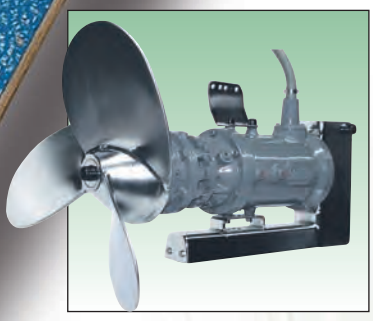
Landia's extensive range of submersible mixers and mixer/aerators add supplementary possibilities to optimize aeration efficiency and oxygen transfer. Sufficient mixing is achieved, solids remain suspended and thoroughly mixed with oxygen enriched effluent, thus enhancing aerobic digestion and improving process efficiency and final effluent quality.

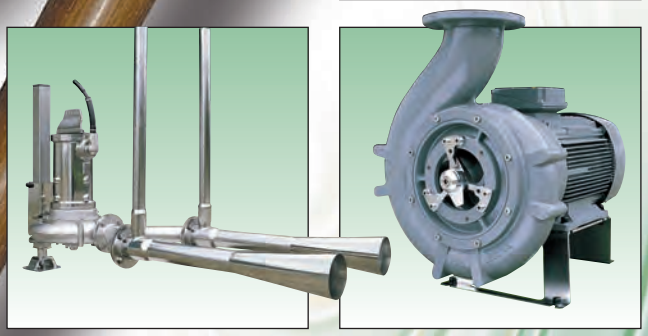
Mixer/Aerator PODB-I

More than 80 years of experience,

offering solutions and systems for the treatment of difficult mediums

Landia tackles the tasks which demand a specialist's expertise, and solves problems with e.g. pumping, mixing and aeration in domestic and industrial wastewater treatments, as well as numerous industrial processes.





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INFORMATION
PROCESS ANALYSIS
ON-SITE ANALYSERS
AMTAX SC + PHOSPHAX SC

Short paths—optimal results

On-site analysers for Ammonium and Phosphate

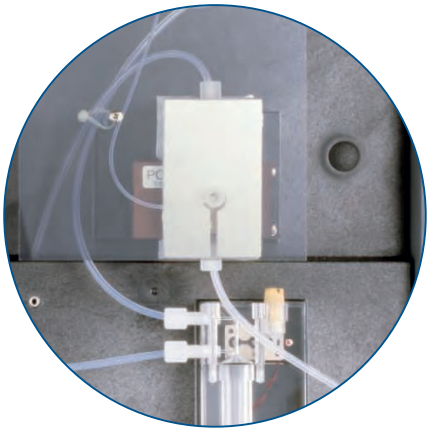
HACH LANGE

UNITED FOR WATER QUALITY

At the right place in the process: AMTAX sc and PHOSPHAX sc

”On-site” means measuring Ammonium and Phosphate in the tank. The main advantage is that short sample paths give quick, undistorted results. This is the idea behind the new digital analyser generation from HACH LANGE—AMTAX sc and PHOSPHAX sc.
The concept is a practical, logical extension of the proven AMTAX and PHOSPHAX series. It combines all the advantages: the high precision of an analyser and the simplicity of a probe.

The design of the analysis and reagent systems is the same in the AMTAX sc and PHOSPHAX sc, and provides permanent accessibility and complete transparency: The AMTAX sc measures the NH_4-N concentration with a gas-sensitive electrode (GSE)



The difference in the PHOSPHAX sc: a two-beam photometer with LEDs determines the PO_4-P concentration

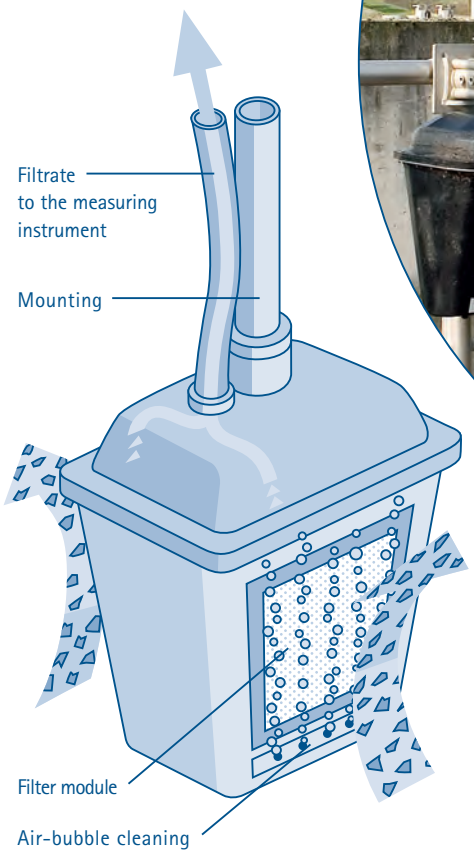
Combined advantages: analyser and probe in one

The exact, accurate measurement of an analyser, installed at the side of the tank like a probe! These advantages are combined in the SC analysers for the determination of NH_4-N and PO_4-P. AMTAX sc and PHOSPHAX sc are designed to be installed at the measuring location. They carry out measurements exactly at the right point in the process, and their high-precision analysis is unaffected by external interferences. Moreover, they are simple to assemble and operate. With their SC technology, they are ready for use in the network of the SC controller.

Save investment costs: NH_4 and PO_4 analysers on site

The AMTAX sc and PHOSPHAX sc need no separate analysis location. Climate-dependant wet-chemical analysis used to require cost-intensive and time-consuming additional construction measures. But HACH LANGE now protects the core of the proven AMTAX and PHOSPHAX series with a weather-proof, lockable housing. Moreover, the operation of the electronic and analysis systems is safeguarded both passively (insulation) and actively (temperature control). The sample and the measured value are therefore not influenced by external factors.

Filter probe in service position:
the complete system is installed tank-side and requires very little space



Immersed in the water:
While the low-maintenance filter probe continuously samples the water, air bubbles prevent the formation of any coatings

On-site tank-side installation in a weatherproof housing
➔ **Undistorted sample with minimum effort— no additional construction measures**

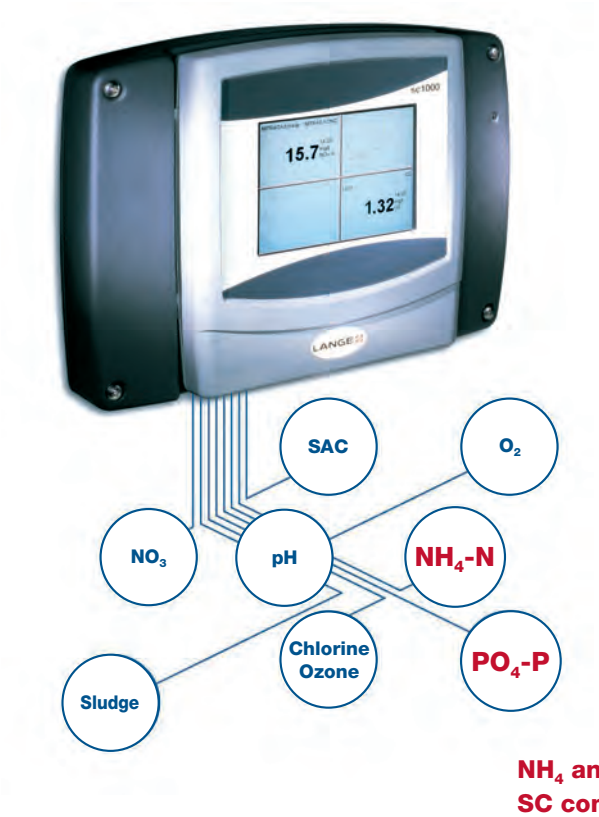
Simple and direct like a probe
➔ **Uncomplicated handling during measurement and installation**

Exact and accurate like an analyser
➔ **Transparent, high quality measurement technology brings reliable values with the shortest of response times**

Flexible installation
➔ **Easy to integrate into existing and new plants**

Measurement of Ammonium and Phosphate on the SC platform

The SC platform is leading-edge technology from HACH LANGE with the universal controller concept for all probes and analysers. This future-safe technology has now been extended to cover Ammonium and Phosphate—two key parameters in water and wastewater analysis.
AMTAX sc and PHOSPHAX sc are the first members of a new analyser generation for process measurement technology. It offers all the advantages of SC technology, as the instruments are freely combinable with all the sensors in the network or can be used as a stand alone solution. NH_4 and PO_4 measurement is therefore flexible in practice and cuts costs.



Flexible in the SC system: AMTAX sc and PHOSPHAX sc can be combined with all sensors via the SC controller

Up to eight sensors on one SC controller per measuring location
➔ **Cuts costs**

Plug and play with SC controller
➔ **Simple to install and operate and therefore quickly ready for operation**

Process control through measurement of NH_4 and PO_4
➔ **Process optimisation**

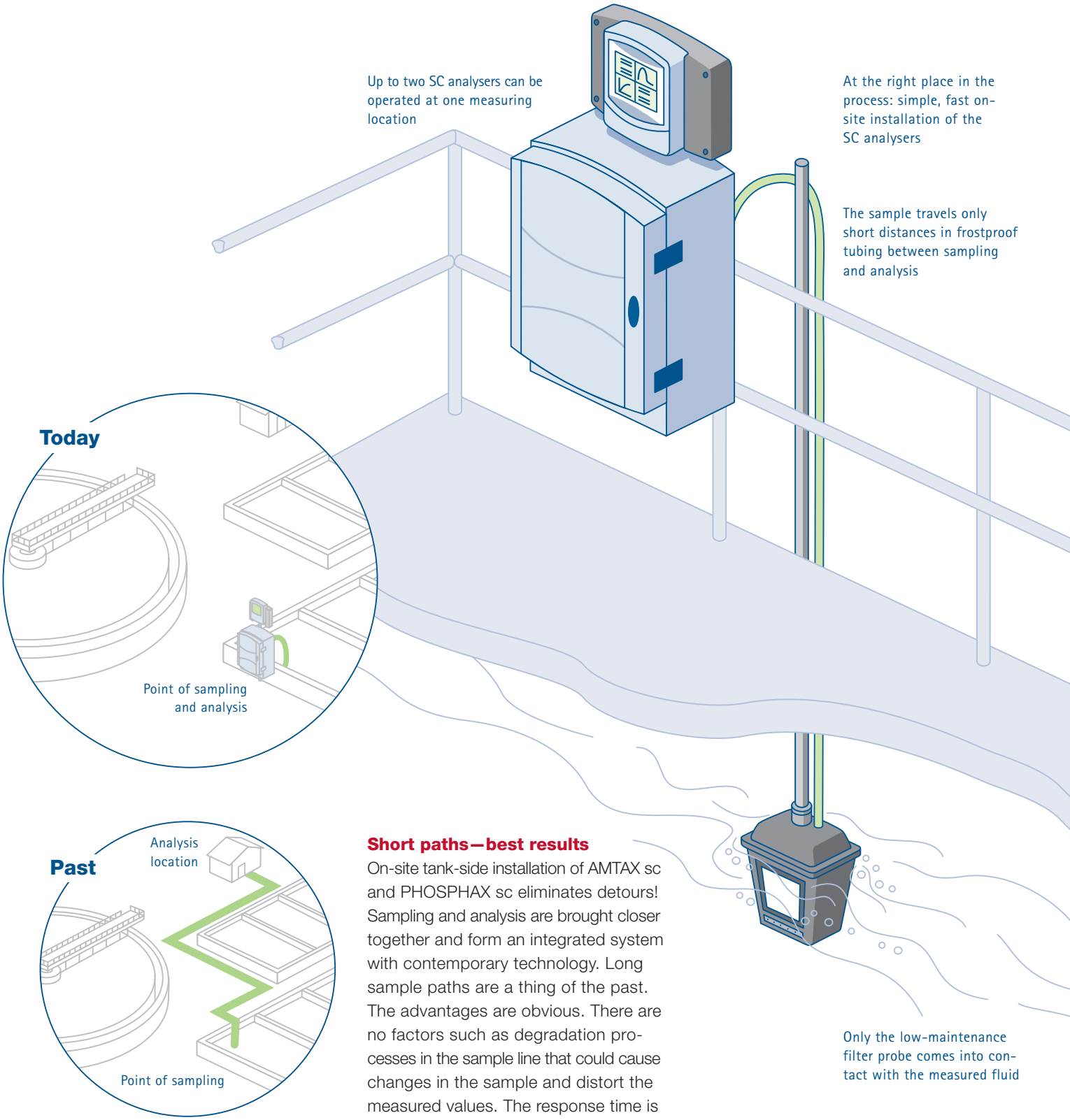
NH_4 and PO_4 measurement SC compatible

AMTAX sc and PHOSPHAX sc speak the language of the SC technology. This means that they can share a SC controller with up to eight sensors. The SC analysers profit from the convenient handling of the SC controller and the uniform user interface: an intuitively operated colour touchscreen, where measured values and time course curves are displayed.

Wide measuring range for all applications

Thanks to their wide measuring range (0.05 to 1,000 mg/l NH_4-N and 0.05 to 50 mg/l PO_4-P), the new analysers are extremely versatile. They can also be used for exact determinations at the limits of water and wastewater analysis.
This means that, for example, NH_4, O_2 and PO_4 can be monitored in parallel in standard processes in the activated sludge stage of municipal and industrial sewage treatment plants. The sensors operate either in a network or as a stand alone solution.

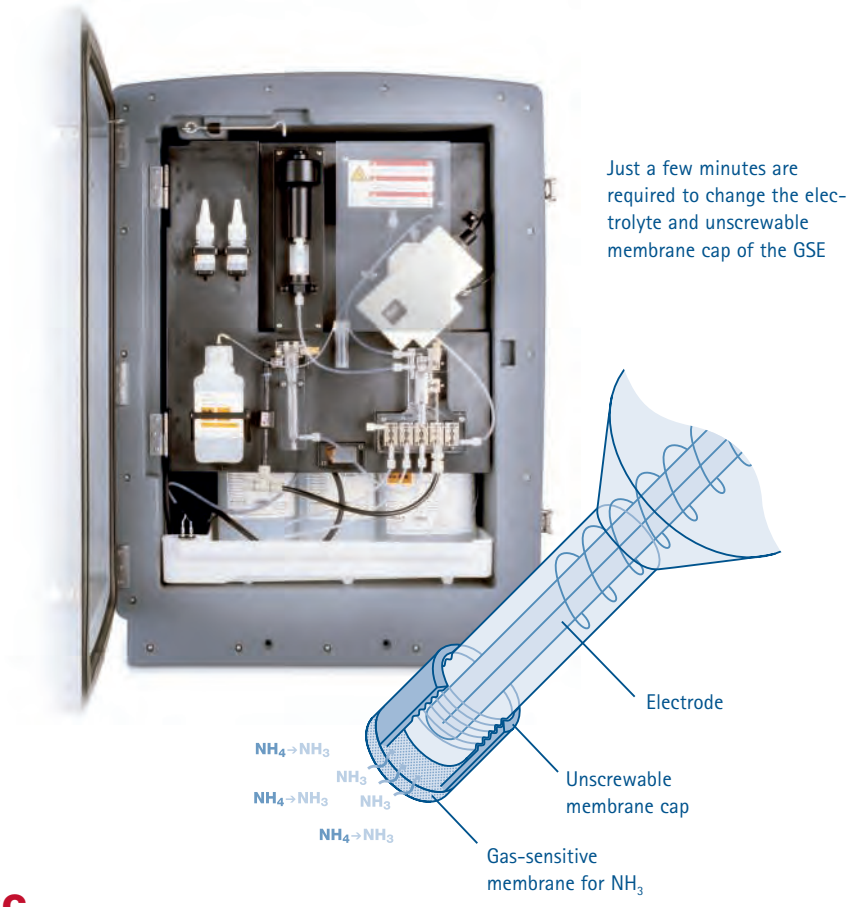
On site—no detours



Short paths—best results

On-site tank-side installation of AMTAX sc and PHOSPHAX sc eliminates detours! Sampling and analysis are brought closer together and form an integrated system with contemporary technology. Long sample paths are a thing of the past. The advantages are obvious. There are no factors such as degradation processes in the sample line that could cause changes in the sample and distort the measured values. The response time is also faster: only 5 minutes from sampling to measured value!

AMTAX sc



Just a few minutes are required to change the electrolyte and unscrewable membrane cap of the GSE

Wide measuring range and maximum precision

The AMTAX sc measures the Ammonium concentration with a gas-sensitive electrode (GSE). The Ammonium in the sample is first converted to gaseous Ammonia. Only the NH_3 gas passes through the gas-permeable membrane of the electrode and is detected. This method guarantees a wide measuring range and is less susceptible to cross-sensitivity methods that make use of an ion-selective electrode (ISE).

Technical data: AMTAX sc

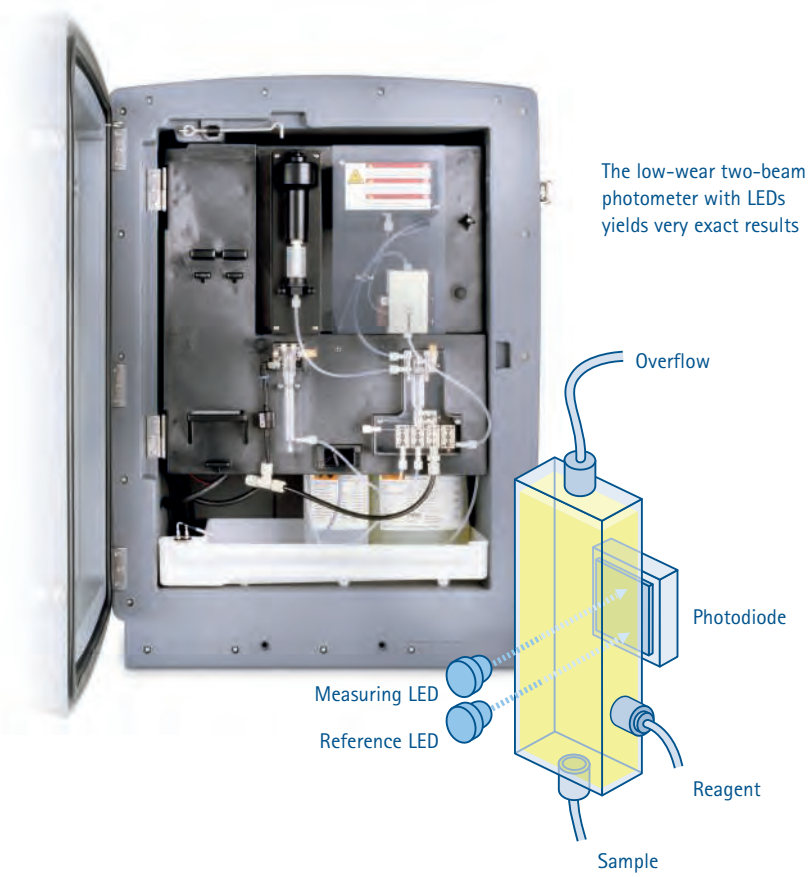
Measurement method	GSE (gas sensitive electrode) with unscrewable membrane cap		
Measuring range	0.05 – 20.0 mg/l NH_4-N	1.0 – 100 mg/l NH_4-N	10 – 1,000 mg/l NH_4-N
Lower limit of detection	0.05 mg/l NH_4-N	1.0 mg/l NH_4-N	10 mg/l NH_4-N
Accuracy	3 % +0.05 mg/l	3 % +1.0 mg/l	4.5 % +10 mg/l
Response time (T90)	5 min. including sample preparation		
Measurement interval	5 – 120 min.		
Special features	Automatic cleaning and calibration, extensive self-diagnosis, optional 2-channel version for continuous sample preparation		
Installation	Wall mountable, rail mountable and mountable on a stand indoors or outdoors (IP 55)		
Dimensions	(W x H x D) 540 x 720 x 390 mm		
Power supply	230 V AC/50 Hz (optional 115 V AC, 50 – 60 Hz), connection on SC 1000 Controller		
Weight	31 kg including reagents		
Ambient temperature	-20 °C to +45 °C		
Sample temperature	+4 °C to +40 °C		
Sample preparation	Filter probe (see below) and continuous sample preparation with FILTRAX, ultrafiltration, etc.		
Operation/Outputs	Through SC controller; outputs: mA, relay, bus		

Technical data: Filter probe for AMTAX sc or PHOSPHAX sc

Functional principle	In-situ membrane filtration; filter modules are exchangeable
Special features	Continuous self-cleaning with air bubbles
Maintenance time	Typically about 0.5 h/month
Installation	Mount in the tank or channel (IP 68)
Dimensions	(W x H x D) 315 x 250 x 120 mm
Weight	Approx. 8 kg

Subject to change without notice

PHOSPHAX sc



The low-wear two-beam photometer with LEDs yields very exact results

More than 50% less chemicals with proven yellow method

The PHOSPHAX sc determines the Phosphate content by the vanado-molybdate yellow method. A low-maintenance two-beam photometer with LEDs measures the PO_4-specific yellow colour. Before each measurement, it automatically determines the intrinsic colour of the wastewater. This value is taken into account in each determination. Distorted measurement results are therefore excluded. The yellow method requires very little reagent and therefore reduces operating costs considerably.

Technical data: PHOSPHAX sc

Measurement method	Two-beam photometer with LEDs (yellow method)	
Measurement ranges	0.05 – 15.0 mg/l PO_4-P	1.00 – 50.0 mg/l PO_4-P
Lower limit of detection	0.05 mg/l PO_4-P	1.00 mg/l PO_4-P
Accuracy	2 % +0.05 mg/l	2 % +1.0 mg/l
Response time (T90)	5 min. including sample preparation	
Measurement interval	5 – 120 min.	
Special features	Automatic cleaning and calibration, extensive self-diagnosis, optional 2-channel version for continuous sample preparation	
Installation	Wall mountable, rail mountable and mountable on a stand indoors or outdoors (IP 55)	
Dimensions	(W x H x D) 540 x 720 x 390 mm	
Power supply	230 V AC/50 Hz (optional 115 V AC, 50 – 60 Hz), connection on SC 1000 Controller	
Weight	31 kg including reagents	
Ambient temperature	-20 °C to +45 °C	
Sample temperature	+4 °C to +40 °C	
Sample preparation	Filter probe (see left) and continuous sample preparation with FILTRAX, ultrafiltration, etc.	
Operation/Outputs	Through SC controller; outputs: mA, relay, bus	

Subject to change without notice

When the system automatically recognises that the filter performance is deteriorating, ...

... the filter surfaces can simply be cleaned of deposits

After just a few minutes the filter probe is ready for operation again

Order Information

DESCRIPTION	ART. NO.
AMTAX sc*	
- 0.05 – 20.0 mg/l NH_4-N, with 5m filter probe (230 V AC)	LXV421.99.11001
- 1.0 – 100 mg/l NH_4-N, with 5m filter probe (230 V AC)	LXV421.99.21001
- 10.0 – 1,000 mg/l NH_4-N, with 5m filter probe (230 V AC)	LXV421.99.31001
- 0.05 – 20.0 mg/l NH_4-N, 1-channel version continuous sample	LXV421.99.13001
- 1.0 – 100 mg/l NH_4-N, 1-channel version continuous sample	LXV421.99.23001
- 10.0 – 1,000 mg/l NH_4-N, 1-channel version continuous sample	LXV421.99.33001
- 2-channel versions and 115 V AC power supply	On request
PHOSPHAX sc*	
- 0.05 – 15.0 mg/l PO_4-P, with 5m filter probe (230 V AC)	LXV422.99.11001
- 1.0 – 50.0 mg/l PO_4-P, with 5m filter probe (230 V AC)	LXV422.99.21001
- 0.05 – 15.0 mg/l PO_4-P, 1-channel version continuous sample	LXV422.99.13001
- 1.0 – 50.0 mg/l PO_4-P, 1-channel version continuous sample	LXV422.99.23001
- 2-channel versions and 115 V AC power supply	On request
ACCESSORIES	
AMTAX sc reagent kit 0.05 – 20.0 mg/l NH_4-N	LCW865
AMTAX sc reagent kit 1.0 – 100 mg/l NH_4-N	LCW871
AMTAX sc reagent kit 10.0 – 1,000 mg/l NH_4-N	LCW866
AMTAX sc cleaning solution	LCW867
NH_4-N electrodes	LZY069
Set of electrolyte (3pcs.)/membrane caps (3pcs.)	LCW868
PHOSPHAX sc reagent	LCW869
PHOSPHAX sc cleaning solution	LCW870
Filter probe 230 V AC/50 Hz, 5 m heated tube	LXV429.99.01000
Filter probe 230 V AC/50 Hz, 10 m heated tube	LXV429.99.02000
Filter probe 115 V AC/50 – 60 Hz, 5 m heated tube	LXV429.99.01100
Filter probe 115 V AC/50 – 60 Hz, 10 m heated tube	LXV429.99.02100
Filter module	LZY140
SC 1000 Controller	LXV400 + LXV402
Tank rim mounting for filter probe	LZX414.00.50000
Rail mounting for SC analyser	LZY285

Subject to change without notice. *Other models on request.

HACH LANGE Services

Contact us to place an order, request information or receive technical support.

On-site support by our technical field staff.

Assurance of legal compliance, together with environmental protection through collection of used reagents.

Extended warranty with inspection contract.

www.hach-lange.com
up to date and secure, with downloads, information and shop.

Cost-saving process optimisation with the HACH LANGE trailer.

HACH LANGE—the specialists for water analysis

Everything from a single supplier

Whether field or laboratory analysis, samplers or process measurement technology, HACH LANGE stands for the total spectrum of water analysis —from visual methods to comprehensive systems of reagents, mesurement technology and accessories.

For every application

Solutions from HACH LANGE are tailor-made for wastewater, drinking water or process water—for reliable control of operational processes and monitoring of legally prescribed limit values.

Parameters from A to Z

From ammonium to zinc—consistently user friendly and proven in daily practice. Regulatory bodies and industry know they can rely on HACH LANGE solutions for everything from sample preparation to quality control.

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HACH LANGE

UNITED FOR WATER QUALITY

Transmitter MAG 5000/6000 compact version (left) and 19“ insert version (right)

The MAG 5000 and 6000 are transmitters engineered for high performance, easy installation, commissioning and maintenance. The transmitters evaluate the signals from the SITRANS F M sensors type MAG 1100, MAG 1100 F, MAG 3100, MAG 3100 P and MAG 5100 W.

Transmitter types:

- MAG 5000: Max. measuring error ± 0.4 % ± 1 mm/s (incl. sensor)
- MAG 6000: Max. measuring error ± 0.2 % ± 1 mm/s (incl. sensor, see also sensor specifications) and with additional features such as: "plug & play" add-on bus modules; integrated batch functions.

Benefits

- Superior signal resolution for optimum turn down ratio
- Digital signal processing with many possibilities
- Automatic reading of SENSORPROM data for easy commissioning
- User configurable operation menu with password protection.
- 3 lines, 20 characters display in 11 languages.
- Flow rate in various units
- Totalizer for forward, reverse and net flow as well as additional information available
- Multiple functional outputs for process control, minimum configuration with analogue, pulse/frequency and relay output (status, flow direction, limits)
- Comprehensive self-diagnostic for error indication and error logging (see under SITRANS F M diagnostics)
- Batch control (MAG 6000 only)
- Custody transfer approval: PTB, OIML R 117, OIML R 49, MI-001, PTB K 7.2 and OE12/C 040 for chilled water
- MAG 6000 with add-on bus modules for HART, FOUNDATION Fieldbus H1, DeviceNet, Modbus RTU/RS 485, PROFIBUS PA and DP

Application

The SITRANS F M flowmeters are suitable for measuring the flow of almost all electrically conductive liquids, pastes and slurries. The main applications can be found in:

- Water and waste water
- Chemical and pharmaceutical industries
- Food and beverage industries
- Power generation and utility

Design

The transmitter is designed as either IP67 NEMA 4X/6 enclosure for compact or wall mounting or 19" version as a 19” insert as a base to be used in:

- 19" rack systems
- Panel mounting IP20/NEMA 1 (prepared for IP65/NEMA 2 display side)
- Back of panel mounting IP20/NEMA 1
- Wall mounting IP66/NEMA 4X

Several options on 19” versions are available such as:

- Transmitters mounted in safe area for Ex ATEX approved flow sensors (incl. barriers)
- Transmitters with electrode cleaning unit on request

Function

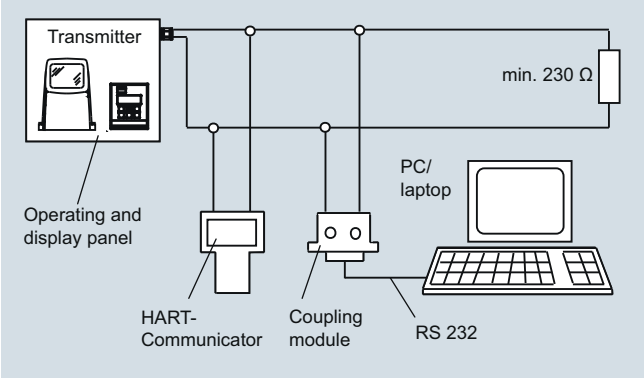
The MAG 5000/6000 are transmitters with a build-in alphanumeric display in several languages. The transmitters evaluate the signals from the associated electromagnetic sensors and also fulfil the task of a power supply unit which provides the magnet coils with a constant current.

Further information on connection, mode of operation and installation can be found in the data sheets for the sensors.

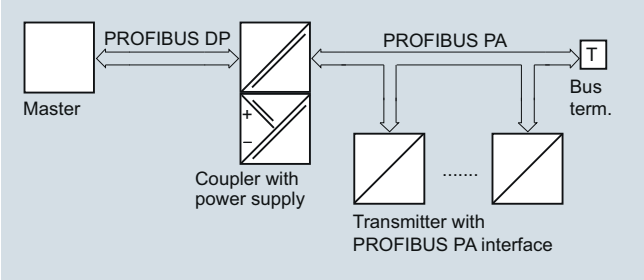
Displays and controls

Operation of the transmitter can be carried out using:

- Control and display unit
- HART communicator
- PC/laptop and SIMATIC PDM software via HART communication
- PC/laptop and SIMATIC PDM software using PROFIBUS or Modbus communication



HART communication



PROFIBUS PA communication

Transmitter MAG 5000/6000

Technical specifications

Mode of operation and design	
Measuring principle	Electromagnetic with pulsed constant field
Empty pipe	Detection of empty pipe (special cable required in remote mounted installation)
Excitation frequency	Depend on sensor size
Electrode input impedance	> 1 x 10^{14} Ω
Input	
Digital input	11 ... 30 V DC, R_i = 4.4 KΩ
• Activation time	50 ms
• Current	$I_{11\ V\ DC}$ = 2.5 mA, $I_{30\ V\ DC}$ = 7 mA
Output	
Current output	
• Signal range	0 ... 20 mA or 4 ... 20 mA
• Load	< 800 Ω
• Time constant	0.1 … 30 s, adjustable
Digital output	
• Frequency	0 ... 10 kHz, 50 % duty cycle (uni/bidirectional)
• Pulse (active)	24 V DC, 30 mA, 1 KΩ ≤ R_i ≤ 10 KΩ, short-circuit-protected (power supplied from flowmeter)
• Pulse (passive)	3 … 30 V DC, max. 110 mA, 200 Ω ≤ R_i ≤ 10 KΩ (powered from connected equipment)
• Time constant	0.1 … 30 s, adjustable
Relay output	
• Time constant	Changeover relay, same as current output
• Load	42 V AC/2 A, 24 V DC/1 A
Low flow cut off	0 ... 9.9 % of maximum flow
Galvanic isolation	All inputs and outputs are galvanically isolated.
Max. measuring error (incl. sensor and zero point)	
• MAG 5000	0.4 % ±1 mm/s
• MAG 6000	0.2 % ±1 mm/s
Rated operation conditions	
Ambient temperature	
• Operation	• Display version: -20 ... +60 °C (-4 ... +140 °F) • Blind version: -20 ... +60 °C (-4 ... +140 °F) • MI-001 version -25 ... +55 °C (-13 ... +131 °F) • Custody Transfer (CT) version -20 ... +50 °C (-4 ... +122 °F)
• Storage	-40 ... +70 °C (-40 ... +158 °F)
Mechanical load (vibration)	
Compact version	18 ... 1000 Hz, 3.17 g rms, sinusoidal in all directions to IEC 68-2-36
19" insert	1 ... 800 Hz, 1 g, sinusoidal in all directions to IEC 68-2-36
Degree of protection	
Compact version	IP67/NEMA 4X/6 to IEC 529 and DIN 40050 (1 mH_2O 30 min.)
19" insert	IP20/NEMA 1 to IEC 529 and DIN 40050
EMC performance	IEC/EN 61326-1 (all environments) IEC/EN 61326-2-5

Display and keypad	
Totalizer	Two eight-digit counters for forward, net or reverse flow
Display	Background illumination with alphanumeric text, 3 x 20 characters to indicate flow rate, totalized values, settings and faults; Reverse flow indicated by negative sign
Time constant	Time constant as current output time constant
Design	
Enclosure material	
• Compact version	Fiber glass reinforced polyamide; stainless steel AISI 316/1.4436 (IP65)
• 19" insert	Standard 19" insert of aluminum/steel (DIN 41494), width: 21 TE, height: 3 HE
• Back of panel	IP20/NEMA 1; Aluminum
• Panel mounting	IP20/NEMA 1 (prepared for IP65/NEMA 2 display side); ABS plastic
• Wall mounting	IP66/NEMA 4X; ABS plastic
Dimensions	
Compact version	See dimensional drawings
19" insert	See dimensional drawings
Weight	
Compact version	0.75 kg (2 lb)
19" insert	See dimensional drawings
Power supply	• 115 ... 230 V AC +10 % -15 %, 50 ... 60 Hz • 11 ... 30 V DC or 11 ... 24 V AC
Power consumption	• 230 V AC: 17 VA • 24 V AC: 9 VA, I_N = 380 mA, I_{ST} = 8 A (30 ms) • 12 V DC: 11 W, I_N = 920 mA, I_{ST} = 4 A (250 ms) • 24 V DC: 8.4 VA, I_N = 350 mA, I_{ST} = 4 A (10 ms) I_{ST}= 4 A (250 ms): For solar panel please secure stable current supply
Certificates and approvals	CE, C-UL general purpose, C-tick; FM Class I, Div 2, CSA Class I, Div 2
Custody transfer approval (MAG 5000/6000 CT)	• Cold water: MI-001, PTB/OIML R 49 (pattern approval DE/DK) • Hot water: PTB and DANAK (MAG 6000 CT) • Chilled water: PTB K 7.2; OE12/C 040 • Other media than water (milk, beer etc.): PTB and DANAK OIML R 117 (pattern approval DE/DK) (MAG 6000 CT)
Communication	
Standard	
• MAG 5000	Without serial communication or HART as option
• MAG 6000	Prepared for client-mounted add-on modules
Optional (MAG 6000 only)	HART, Modbus RTU/RS 485, FOUNDATION Fieldbus H1, DeviceNet, PROFIBUS PA, PROFIBUS DP as add-on modules
• MAG 5000/6000 CT	No communication moduls approved

Safety barrier (e/ia)

Application	**For use with MAG 5000/6000 19" and MAG 1100 Ex ATEX/MAG 3100 Ex ATEX**		
Ex approval	MAG 1100 Ex [EEx e ia] IIB ATEX		
	MAG 3100 Ex [EEx e ia] IIC ATEX		
Cable parameter	Group	Capacity in µF	Inductance in mH
Electrode	IIC	≤ 4.1	≤ 80
	IIB	≤ 45	≤ 87
	IIA	≤ 45	≤ 87
Ambient temperature			
• During operation	-20 ... +50 °C (-4 ... +122 °F)		
• During storage	-20 ... +70 °C (-4 ... +158 °F)		
Enclosure			
• Material	Standard 19" insert in aluminum/steel (DIN 41494)		
• Width	21 TE (4.75")		
• Height	3 HE (5.25")		
• Rating	IP20 / NEMA 1 to EN 60529		
• Mechanical load	1 g, 1 … 800 Hz sinusoidal in all directions to EN 60068-2-36		

Selection and Ordering data

Transmitter MAG 5000

Description	Article No.	
Transmitter MAG 5000 Blind for compact and wall mounting; IP67/NEMA 4X/6, fibre glass reinforced polyamide		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6910-1AA30-0AA0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6910-1AA10-0AA0**	
Transmitter MAG 5000 Display for compact and wall mounting; IP67/NEMA 4X/6, fibre glass reinforced polyamide		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6910-1AA30-1AA0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6910-1AA10-1AA0**	
• 115 ... 230 V AC, 50/60 Hz, with HART	**7ME6910-1AA10-1BA0**	
Transmitter MAG 5000 CT for compact and wall mounting, approved for custody transfer (only with approval marks, no verification – only a complete flowmeter can be verified, i.e. sensor together with the transmitter); IP67/NEMA 4X/6, fibre glass reinforced polyamide		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6910-1AA30-1AB0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6910-1AA10-1AB0**	
Transmitter MAG 5000 for 19" rack and wall mounting		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6910-2CA30-1AA0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6910-2CA10-1AA0**	

⬟ We can offer shorter delivery times for configurations designated with the Quick Ship Symbol ⬟. For details see page 9/5 in the appendix.

Transmitter MAG 6000

Description	Article No.	
Transmitter MAG 6000 Blind for compact and wall mounting; IP67/NEMA 4X/6, fibre glass reinforced polyamide		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6920-1AA30-0AA0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6920-1AA10-0AA0**	
Transmitter MAG 6000 for compact and wall mounting; IP67/NEMA 4X/6, fibre glass reinforced polyamide		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6920-1AA30-1AA0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6920-1AA10-1AA0**	
Transmitter MAG 6000 for compact and wall mounting; IP65/NEMA 4, stainless steel AISI 316/1.4436 (only for sensor with SS terminal box) (for remote installation order SS terminal box separately)		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6920-1QA30-1AA0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6920-1QA10-1AA0**	
Transmitter MAG 6000 CT for compact and wall mounting, approved for custody transfer (no communication modules possible; only with approval marks, no verification – only a complete flowmeter can be verified, i.e. sensor together with the transmitter); IP67/NEMA 4X/6, fibre glass reinforced polyamide		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6920-1AA30-1AB0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6920-1AA10-1AB0**	
Transmitter MAG 6000 SV for compact and wall mounting; special excitation 44 Hz settings for Batch application DN ≤ 25/1" IP67/NEMA 4X/6, fibre glass reinforced polyamide		
11 ... 30 V DC/ 11 ... 24 V AC	**7ME6920-1AB30-1AA0**	
115 ... 230 V AC, 50/60 Hz	**7ME6920-1AB10-1AA0**	
Transmitter MAG 6000 for 19" rack and wall mounting		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6920-2CA30-1AA0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6920-2CA10-1AA0**	

Description	Article No.	
Transmitter MAG 6000 SV for 19“ rack and wall mounting; special excitation 44 Hz settings for Batch application DN ≤ 25/1“		
• 11 ... 30 V DC/ 11 ... 24 V AC	**7ME6920-2CB30-1AA0**	
• 115 ... 230 V AC, 50/60 Hz	**7ME6920-2CB10-1AA0**	
MAG 6000 with IP66/NEMA 4X enclosure; 115 ... 230 V AC, 50/60 Hz; cable gland PG13.5	**7ME6920-2EA10-1AA0**	
MAG 6000 with safety barrier for Ex-approved sensors, complete mounted with IP66/NEMA 4X wall mounting enclosure, ATEX, 115 ... 230 V AC, 50/60 Hz; cable gland PG13.5		
• For ATEX 2G D sensors	**7ME6920-2MA11-1AA0**	
MAG 6000 SV, 19” insert, in IP66/NEMA 4X , ABS plastic enclosure, excitation frequency 44 Hz for Batch application DN ≤ 25/1“; cable gland PG13.5		
• 11 … 30 V DC, 11 … 24 V AC, 50/60 Hz	**7ME6920-2EB30-1AA0**	
• 115 … 230 V AC, 50/60 Hz	**7ME6920-2EB10-1AA0**	

⬟ We can offer shorter delivery times for configurations designated with the Quick Ship Symbol ⬟. For details see page 9/5 in the appendix.

Operating instructions for SITRANS F M MAG 5000/6000

Description	Article No.
For SITRANS F M MAG 5000/6000 IP67	
• English	**A5E02338368**
• German	**A5E02944982**
• Spanish	**A5E02944995**
• French	**A5E02944990**
For SITRANS F M MAG 5000/6000 19"	
• English	**A5E02082880**

This device is shipped with a Quick Start guide and a CD containing further SITRANS F literature.

All literature is also available for free at:
http://www.siemens.com/flowdocumentation

Communication modules for MAG 6000

Description	Article No.	
HART (not for MAG 6000 I) ⬟	**FDK:085U0226**	
Modbus RTU/RS 485 ⬟	**FDK:085U0234**	
PROFIBUS PA Profile 3 ⬟	**FDK:085U0236**	
PROFIBUS DP Profile 3 ⬟	**FDK:085U0237**	
DeviceNet ⬟	**FDK:085U0229**	
FOUNDATION Fieldbus H1	**A5E02054250**	

Operating instructions for SITRANS F add-on modules

Description	Article No.
HART	
• English	**A5E03089708**
PROFIBUS PA/DP	
• English	**A5E00726137**
• German	**A5E01026429**
MODBUS	
• English	**A5E00753974**
• German	**A5E03089262**
• Spanish	**A5E03089278**
• French	**A5E03089265**
FOUNDATION Fieldbus	
• English	**A5E02318728**
• German	**A5E02488856**
• Spanish	**A5E02512177**
• French	**A5E02512169**
DeviceNet	
• English	**A5E03089720**

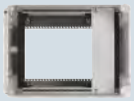
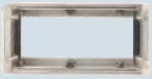
This device is shipped with a Quick Start guide and a CD containing further SITRANS F literature.

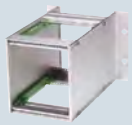
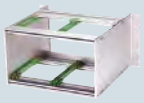
Accessories for MAG 5000 and MAG 6000

Description	Article No.	
Wall mounting unit for IP67/ NEMA 4X/6 version, wall bracket, terminal box in polyamide		
• 4 x M20 cable glands ⬟	**FDK:085U1018**	
• 4 x ½“ NPT cable glands ⬟	**FDK:085U1053**	
Sun lid for MAG 5000/6000 transmitter (Frame and lid)	**A5E02328485**	
Cable for standard electrode or coil, 3 x 1.5 mm² / 18 gage with shield PVC; Temperature range: -30 ... +70 °C (-22 ... +158 °F)		
• 10 m (33 ft) ⬟	**FDK:083F0121**	
• 20 m (65 ft) ⬟	**FDK:083F0210**	
• 40 m (130 ft) ⬟	**FDK:083F0211**	
• 60 m (200 ft) ⬟	**FDK:083F0212**	
• 100 m (330 ft)	**FDK:083F0213**	
• 150 m (500 ft)	**FDK:083F3052**	
• 200 m (650 ft)	**FDK:083F3053**	
• 500 m (1650 ft)	**FDK:083F3054**	

⬟ We can offer shorter delivery times for configurations designated with the Quick Ship Symbol ⬟. For details see page 9/5 in the appendix.

Transmitter MAG 5000/6000

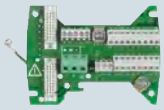
Description	Article No.	
Electrode cable for empty pipe or low conductivity[1], double shielded, 3 x 0.25 mm². Temperature range : -30 ... +70 °C (-22 ... +158 °F)		
• 10 m (33 ft)	FDK:083F3020	
• 20 m (65 ft)	FDK:083F3095	
• 40 m (130 ft)	FDK:083F3094	
• 60 m (200 ft)	FDK:083F3093	
• 100 m (330 ft)	FDK:083F3092	
• 150 m (500 ft)	FDK:083F3056	
• 200 m (650 ft)	FDK:083F3057	
• 500 m (1650 ft)	FDK:083F3058	
Low-noise electrode coax cable for low conductivity and high vibration levels of cables, 3 x 0.13 mm²		
• 2 m (6.6 ft)	A5E02272692	
• 5 m (16.5 ft)	A5E02272723	
• 10 m (33 ft)	A5E02272730	
Cable kit with standard coil cable[1], 3 x 1.5 mm²/18 gage with shield PVC and electrode cable double shielded, 3 x 0.25 mm² Temperature range: -30 ... +70 °C (-22 ... +158 °F)		 
• 5 m (16.5 ft)	A5E02296329	
• 10 m (33 ft)	A5E01181647	
• 15 m (49 ft)	A5E02296464	
• 20 m (65 ft)	A5E01181656	
• 25 m (82 ft)	A5E02296490	
• 30 m (98 ft)	A5E02296494	
• 40 m (130 ft)	A5E01181686	
• 50 m (164 ft)	A5E02296498	
• 60 m (200 ft)	A5E01181689	
• 100 m (330 ft)	A5E01181691	
• 150 m (500 ft)	A5E01181699	
• 200 m (650 ft)	A5E01181703	
• 500 m (1650 ft)	A5E01181705	
Potting kit for terminal box of flow sensors for IP68/NEMA 6P (not for Ex sensors)	FDK:085U0220	
19" safety barrier (21 TE) [EEx e ia] IIC for MAG 1100 Ex sensors and MAG 3100 Ex sensors, incl. back plate	FDK:083F5034	
Panel mounting enclosure for 19" insert (21 TE); IP65/NEMA 2 enclosure in ABS plastic for front panel mounting	FDK:083F5030	
Panel mounting enclosure for 19" insert (42 TE); IP65/NEMA 2 enclosure in ABS plastic for front panel mounting	FDK:083F5031	

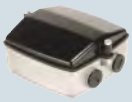
Description	Article No.	
Back of panel mounting enclosure for 19" insert (21 TE); IP20/NEMA 1 enclosure in aluminum	FDK:083F5032	
Back of panel mounting enclosure for 19" insert (42 TE); IP20/NEMA 1 enclosure in aluminum	FDK:083F5033	
IP66/NEMA 4X, wall mounting enclosure for 19" inserts (without back plates). Use with PCB A5E02559813 or A5E02559814		
• 21 TE	FDK:083F5037	
• 42 TE	FDK:083F5038	
Front cover (7TE) for panel mounting enclosure	FDK:083F4525	
Sun shield for remote MAG 5000/6000 transmitters	A5E01209496	
Sun Shield for compact MAG 5000/6000 transmitters on MAG 3100 (DN 15 ... 2000 (½" ... 78") or MAG 5100 W (DN 150 ... 1200 (6" ... 48")	A5E01209500	

We can offer shorter delivery times for configurations designated with the Quick Ship Symbol . For details see page 9/5 in the appendix.

[1] Not for MAG 6000 with safety barrier

Spare parts

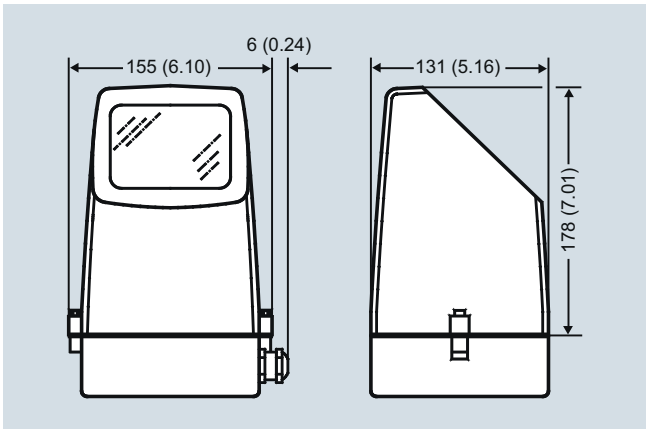
Description	Article No.	
Connection board (for polyamide terminalbox)		
• 12 ... 24 V	**A5E02559817**	
• 115 ... 230 V	**A5E02559816**	
Connection board (for stainless steel terminal-box)		
• 12 ... 24 V	**A5E02604280**	
• 115 ... 230 V	**A5E02604272**	
19" enclosure, 12 ... 24 V, 115 ... 230 V		
• Connection board for standard 19" transmitter	**A5E02559809**	
• Connection board for transmitter ia and safety barrier	**A5E02559810**	
• Connection board for transmitter ia/ib and safety barrier (only for sensors produced before October 2007)	**A5E02559811**	
• Connection board for transmitter and cleaning unit	**FDK:083F4123**	
SENSORPROM memory unit (Sensor code and serial numbers must be specified on order)		
• 2 kB (for MAG 5000/6000/ MAG 6000 I)		
- 1 pc.	**FDK:085U1005**	
- 10 pcs.	**FDK:083F5052**	
• 250 B (for MAG 2500/3000)	**FDK:085U1008**	
Display unit for MAG 5000/6000		
• Black neutral front	**FDK:085U1038**	
• Siemens front	**FDK:085U1039**	
Display unit for 19" versions	**FDK:085U3349**	

Description	Article No.	
Cable glands, for above cable, 4 pcs.		 ½" NPT M20
• M20	**A5E00822490**	
• ½" NPT	**A5E00822501**	
• PG 13.5, 2 pcs.	**FDK:083G0228**	
Sealing screws for sensor/ transmitter, 2 pcs	**FDK:085U0221**	
Terminal box, in polyamide, inclusive lid		
• M20	**FDK:085U1050**	
• ½" NPT	**FDK:085U1052**	
Terminal box lid, in polyamide	**FDK:085U1003**	
Terminal box, in stainless steel, inclusive lid for MAG 6000 in stainless steel and for all Ex sensors		
• M20	**A5E00836867**	
• ½" NPT	**A5E00836868**	
Terminal box (3A) for MAG 1100 F in polyamide, inclusive lid		
• M20	**A5E00822478**	
• ½" NPT	**A5E00822479**	
Wall unit enclosure IP66, 12 ... 24 V, 115 ... 230 V		
• PCB for standard transmitter	**A5E02559813**	
• PCB for transmitter ia/e and safety barrier	**A5E02559814**	
• PCB for transmitter ia/ib and safety barrier (7ME6130, 7ME6150 and 7ME6330)	**A5E02559812**	
• PCB for transmitter and cleaning unit	**A5E02559815**	

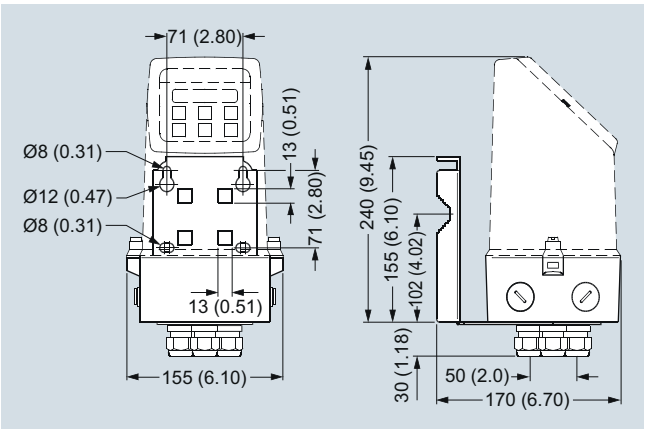
⬟ We can offer shorter delivery times for configurations designated with the Quick Ship Symbol ⬟. For details see page 9/5 in the appendix.

Dimensional drawings

Transmitter IP67/NEMA 4X/6 compact polyamide

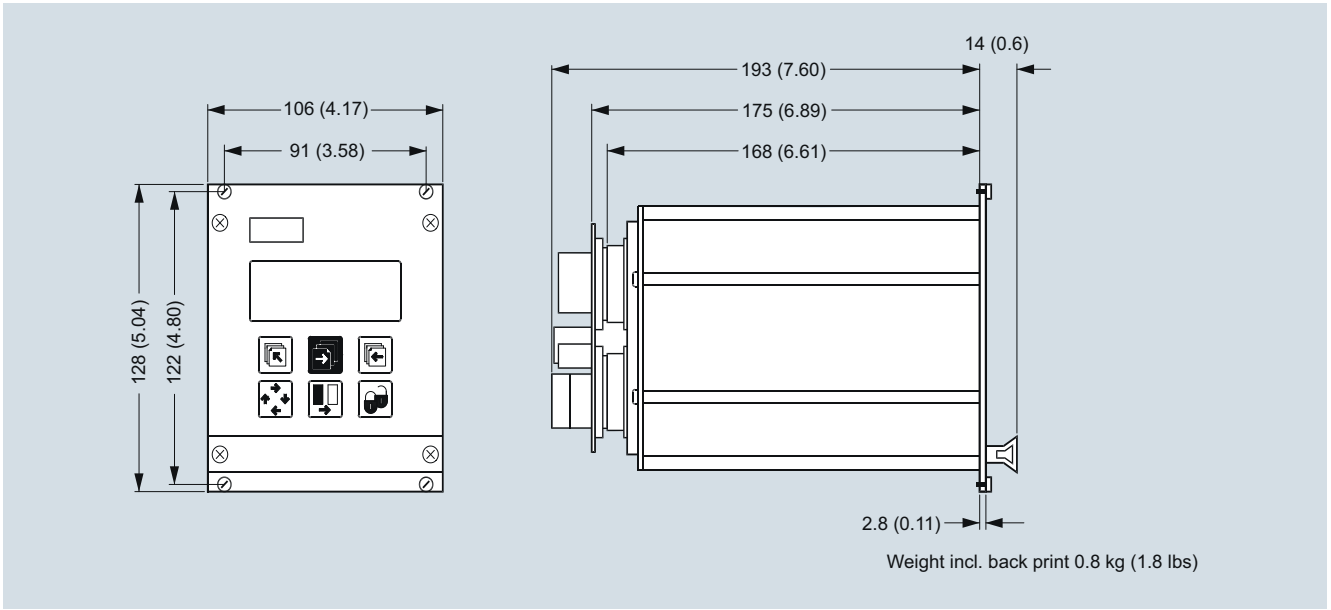


Transmitter compact mounted, dimensions in mm (inch)



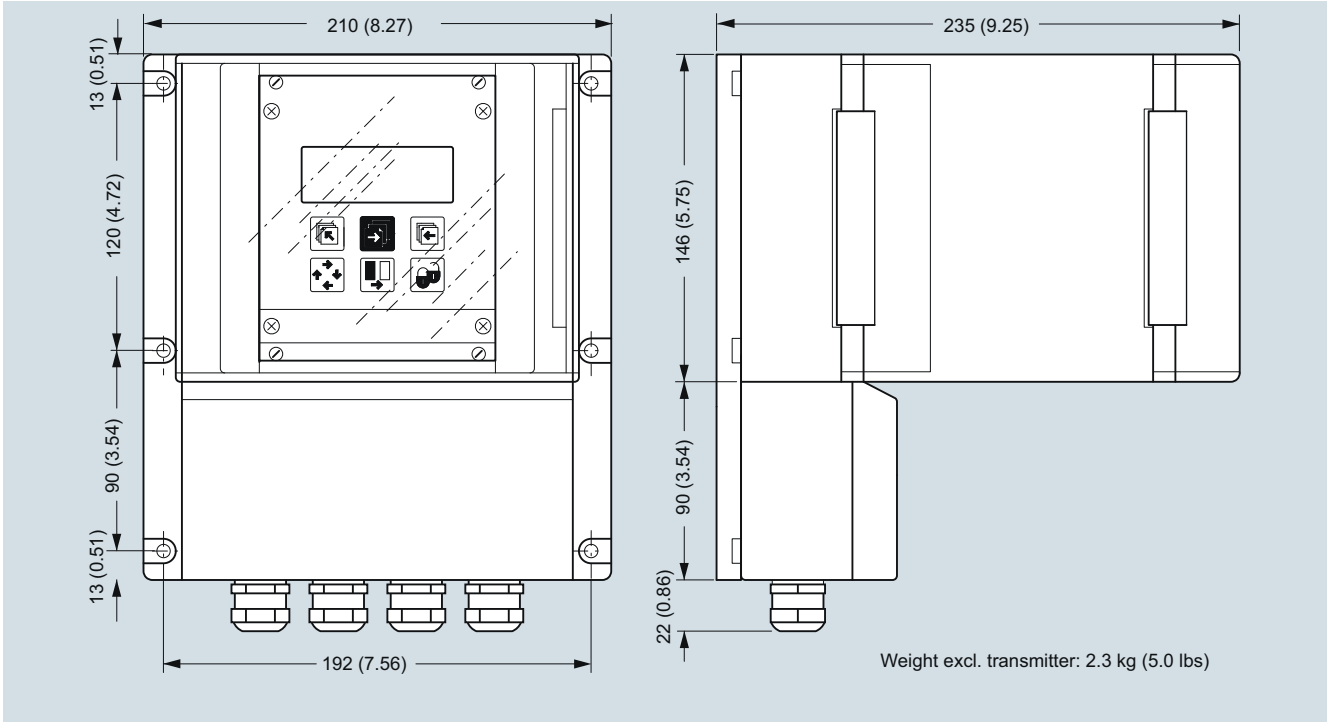
Transmitter wall mounted, dimensions in mm (inch)

Transmitter, 19" IP20/NEMA 1 standard unit



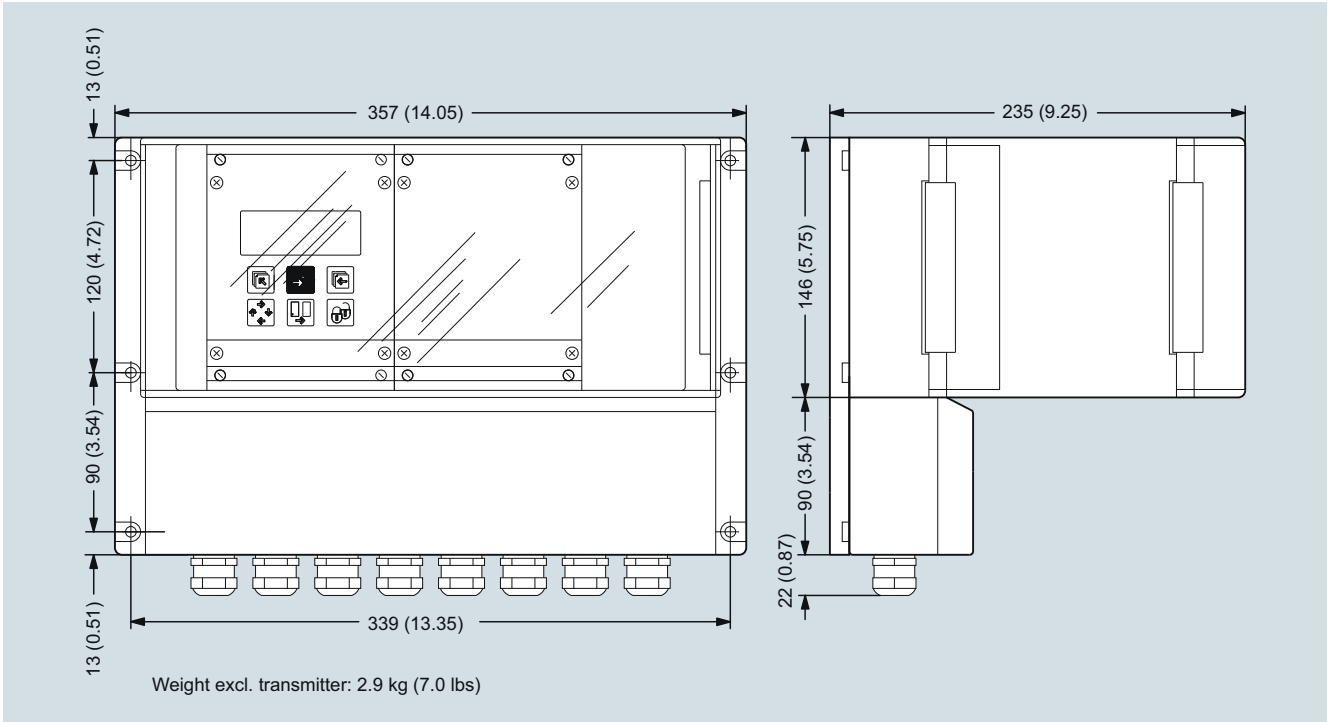
Dimensions in mm (inch)

Transmitter, wall mounting IP66/NEMA 4X, 21 TE



Dimensions in mm (inch)

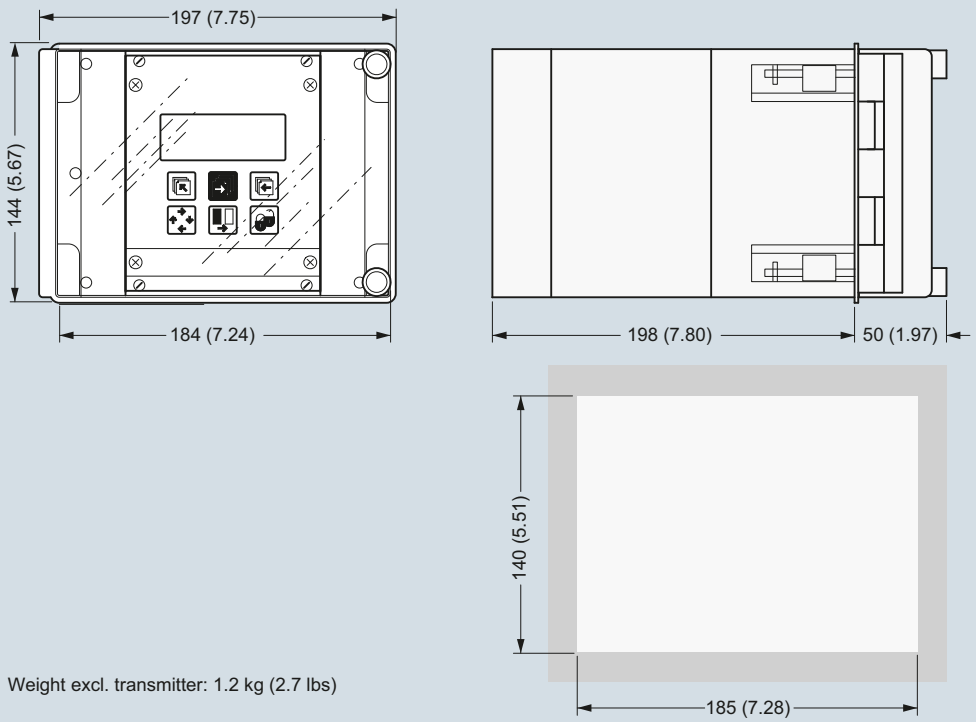
Transmitter, wall mounting IP66/NEMA 4X, 42 TE



Dimensions in mm (inch)

Transmitter MAG 5000/6000

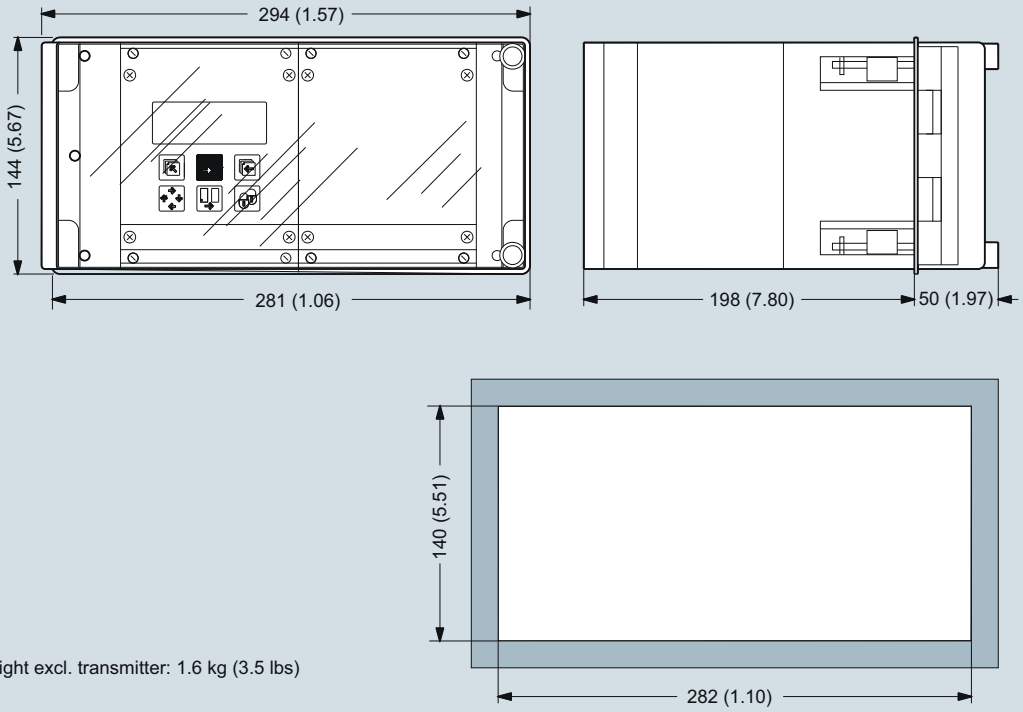
Transmitter, panel front IP20/NEMA 1, 21 TE



Weight excl. transmitter: 1.2 kg (2.7 lbs)

Dimensions in mm (inch)

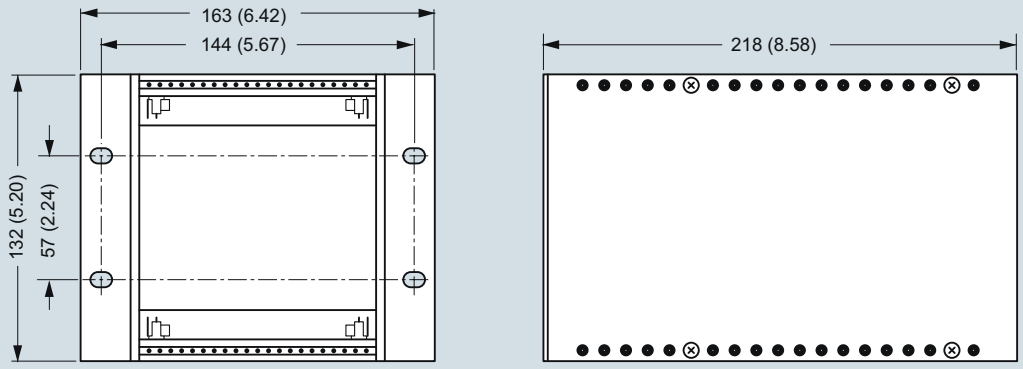
Transmitter, panel front IP20/NEMA 1, 42 TE



Weight excl. transmitter: 1.6 kg (3.5 lbs)

Dimensions in mm (inch)

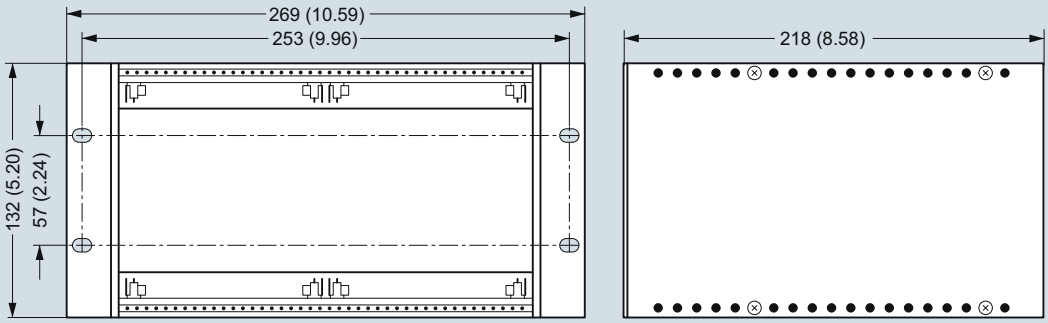
Transmitter, back of panel IP20/NEMA 1, 21 TE



Weight: 0.7 kg (1.6 lbs)

Dimensions in mm (inch)

Transmitter, back of panel IP20/NEMA 1, 42 TE



Weight: 0.9 kg (2.0 lbs)

Dimensions in mm (inch)

Schematics

Electrical connection

Grounding

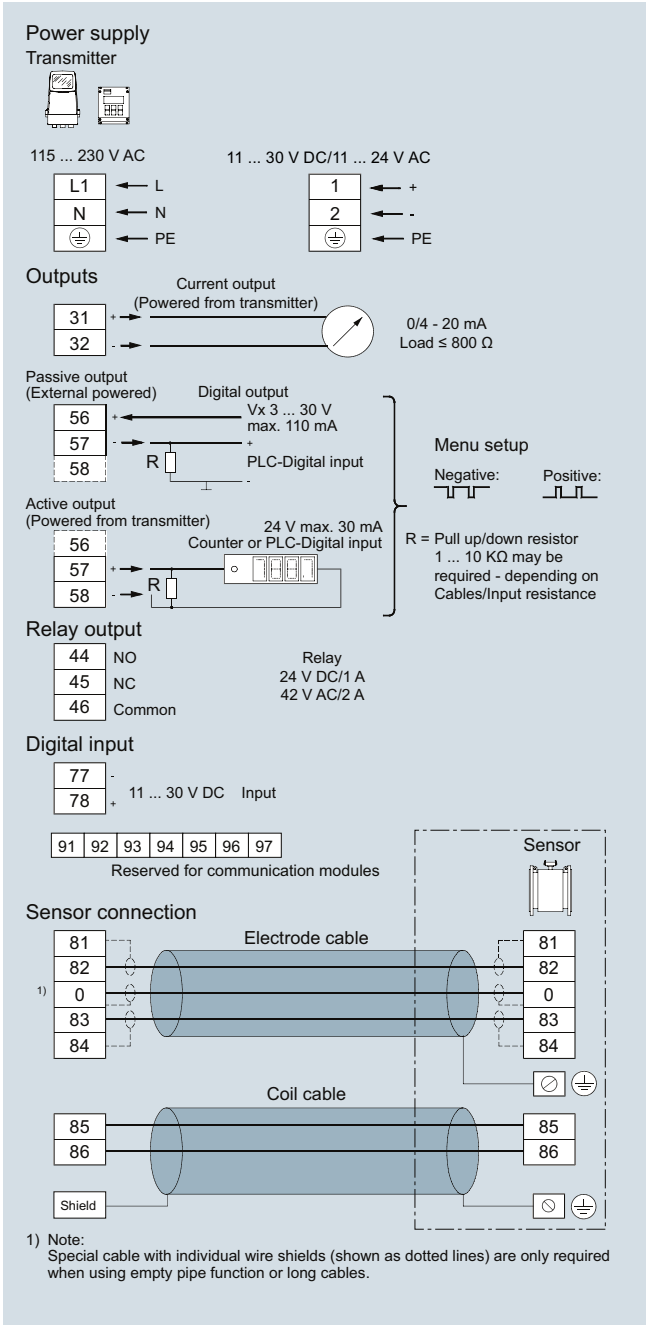
PE must be connected due to safety class 1 power supply.

Mechanical counters

When mounting a mechanical counter to terminals 57 and 58 (active output), a 1000 µF capacitor must be connected to the terminals 56 and 58. Capacitor + is connected to terminal 56 and capacitor - to terminal 58.

Output cables

If the output cable length is long in noisy environment, we recommend to use shielded cable.



1) Note:
Special cable with individual wire shields (shown as dotted lines) are only required when using empty pipe function or long cables.

Operating Instructions

Lambdamat Kommunal S/H

Translation of the original German operating instructions for the operator

Read and follow the instructions and safety information!

Technical changes, typographical errors and omissions reserved!

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CE

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Contents

1 General

Thank you for choosing a quality product from Froling. The product features a state-of-the-art design and conforms to all currently applicable standards and testing guidelines.

Please read and observe the documentation provided and always keep it close to the system for reference. It contains important safety information and all the operation and maintenance specifications needed to operate the system safely, properly and cost-effectively.

The constant further development of our products means that there may be minor differences from the pictures and content. If you discover any errors, please let us know.

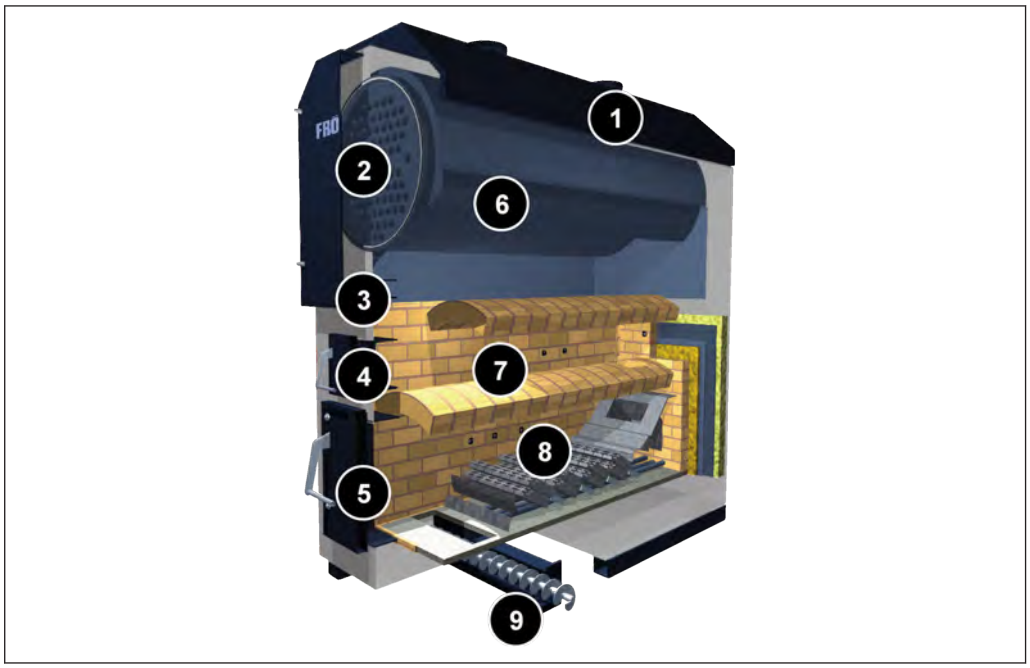
Subject to technical change.

Guarantee conditions

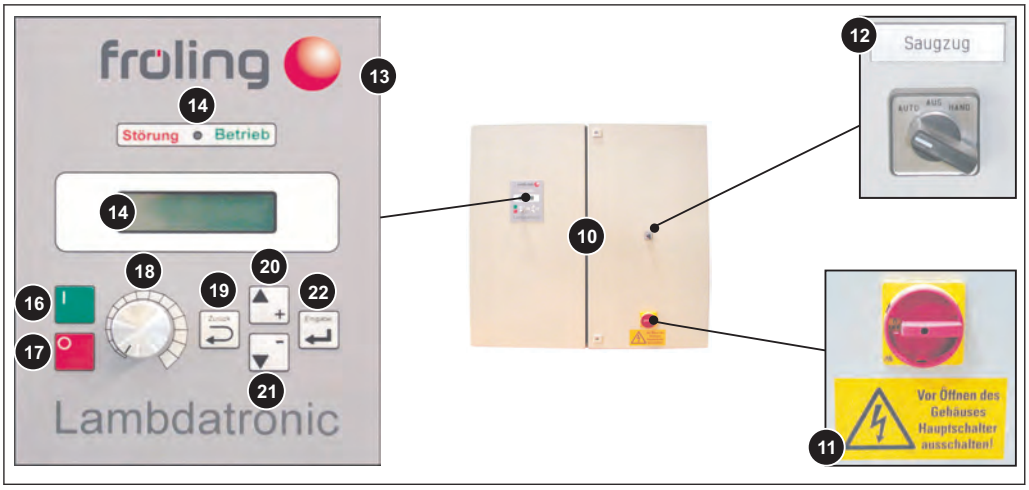
Our sale and delivery conditions generally apply. These conditions have been made available to customers, and customers have been made aware of them at the time of order completion.

You can also find the guarantee conditions on the enclosed guarantee certificate.

1.1 Product overview



1	Wood chip boiler – Froling Lambdamat Kommunal
2	Reversing chamber door
3	Cleaning port door
4	Vault door
5	Combustion chamber door
6	Multipoint heat exchanger
7	Multi-layer high-temperature firebrick-lined combustion chamber
8	Hydraulic conveyor grate with primary air inflow
9	Fully automatic ash removal to an ash container



10	Switch cabinet with integrated Lambdatronic H 3000 controller
11	Main switch: Switches the power supply on and off for the entire system
12	Selector switch for induced draught fan: AUTO: The induced draught fan is switched on and off by the Lambdatronic H 3000 OFF: The induced draught fan is switched off MANUAL: The induced draught fan is switched on and is not controlled by the Lambdatronic
13	Control panel of the Lambdatronic H 3000 controller
14	Status LED (operating status): - slow green flashing light: boiler active - fast green flashing light: boiler deactivated - red flashing light: fault
15	Two-line display showing operating mode, operating status, parameters, etc.
16	Start button: Switches the boiler on
17	Stop button: Switches the boiler off
18	Temperature selector: Sets the boiler temperature setpoint (setting range: 70 – 90°C)
19	Back button: Returns you from submenus, undoes inputs
20	Up arrow button: Moves up through the menu, increases or activates parameters
21	Down arrow button: Moves down through the menu, decreases or deactivates parameters
22	Enter button: Takes you to submenus, calls or confirms inputs

2 Safety

2.1 Hazard levels of warnings

This documentation uses warnings with the following hazard levels to indicate direct hazards and important safety instructions:

⚠ DANGER

The dangerous situation is imminent and if measures are not observed it will lead to serious injury or death. You must follow the instructions!

⚠ WARNING

The dangerous situation may occur and if measures are not observed it will lead to serious injury or death. Work with extreme care.

⚠ CAUTION

The dangerous situation may occur and if measures are not observed it will lead to minor injuries or damage to property.

2.2 Pictograms used

The following symbols are used in the documentation and/or on the boiler to show what is required and forbidden and to give warnings.

In accordance with machine guidelines, signs fitted directly in the hazard area indicate immediate hazards or safety procedures. These stickers must not be removed or covered.

	Refer to the operating instructions		Wear safety shoes
	Wear protective gloves		Wear hearing protection
	Keep the doors closed		Turn off the main switch
	Unauthorised access prohibited		
	Hot surface warning		Hazardous electrical voltage warning
	Hazardous or irritant materials warning		Automatic boiler startup warning
	Hand injury warning		Warning of injury to fingers or hands, automatic fan
	Cutting injury warning		Warning of injury to fingers or hands, automatic screw

2.3 General safety information

⚠ DANGER

If the device is used incorrectly:

Incorrect use of the system can cause severe injury and damage.

When operating the system:

- ❒ Observe the instructions and information in the manuals
- ❒ Observe the details on procedures for operation, maintenance and cleaning, as well as troubleshooting in the individual manuals.
- ❒ Any work above and beyond this should be carried out by authorised heating engineers or by Froling customer services.

⚠ WARNING

External influences:

Negative external influences, such as insufficient combustion air or non-standard fuel can cause serious faults in combustion (e.g. spontaneous combustion of carbonisation gases or flash fires) which can in turn cause serious accidents!

When operating the boiler, please note the following:

- ❒ Instructions and information regarding versions and minimum values, as well as standards and guidelines for heating components in the instructions must be observed.

⚠ WARNING

Severe injuries and damage can be caused by an inadequate flue gas system.

Problems with the flue gas system, such as poor cleaning of the flue pipe or insufficient chimney draught can cause serious faults in combustion (such as spontaneous combustion of carbonisation gases or flash fires).

Take the following precautions:

- ❒ Optimum boiler performance can only be guaranteed if the flue gas system is functioning correctly.

2.4 Permitted uses

The Froling Lambdamat Communal is designed exclusively for heating domestic water. Only use fuels specified in the "Permitted fuels" section.

⇨ See "Permitted fuels" [page 10]

The boiler should only be operated when it is in full working order. It should be operated in accordance with the instructions, observing safety precautions, and you should ensure you are aware of the potential hazards. The inspection and cleaning intervals in these operating instructions should be observed. Ensure that any malfunctions which might impact safety are traced and removed immediately. The manufacturer and supplier are not liable for any damage resulting from non-permitted uses.

2.4.1 Permitted fuels

Wood chips

Criterion	ÖNORM M 7133	CEN/TS 14961	Description as per ÖNORM M 7133
Water content	**W20**	**M20**	Air dried
	W30	**M30**	Suitable for storage
	W35	**-**	Limited suitability for storage
	W40	**M40**	High-moisture wood chips
	W50	**-**	Freshly harvested wood chips
Size	**G30**	**P16**	Fine wood chips
	G50	**P45**	Medium wood chips
	G100	**P63/100**	Coarse wood chips (for hydraulic feeders only)

Note on standard

Austria:	ÖNORM M 7133 or EN 14961
Germany:	Wood chips as per §3 (1) point 4 of the First Federal Emissions Protection Ordinance (BImSchV) - applicable version Specifications as per DIN CEN/TS 14961 and/or ÖNORM M 7133

Wood shavings

Wood shavings generally cause problems with combustion. Therefore their use is permitted only with authorisation from Froling. The following additional points also apply:

- Sawdust and carpentry waste should only be used with systems with a rotary valve.
- The store should be fitted with a pressure release device in accordance with regional regulations.
- The same limits apply for the permitted water content of sawdust as for wood chips.

2.4.2 Non-permitted fuels

The use of fuels not defined in the "Permitted fuels" section, and particularly the burning of refuse, is not permitted.

⚠ CAUTION

In case of use of non-permitted fuels:

Burning non-permitted fuels increases the cleaning requirements and leads to a build-up of aggressive sedimentation and condensation, which can lead to damage to the boiler and also invalidates the guarantee. Using non-standard fuels can also lead to severe faults with combustion.

For that reason, when operating the boiler:

❒ Only use permitted fuels

2.4.3 Qualification of operating staff

⚠ CAUTION

If unauthorised persons enter the Boiler room:

Risk of personal injury and damage to property

❒ The operator is responsible for keeping unauthorised persons, in particular children, away from the system.

Only trained operators are permitted to operate the unit. The operator must also have read and understood the instructions in the documentation.

2.4.4 Protective equipment for operating staff

You must ensure that staff have the protective equipment specified by accident prevention regulations.

- For inspection and cleaning:
  - suitable workwear
  - protective gloves
  - sturdy shoes

- Additional for operating:
  - Hearing protection (sound level > 70 dB)
  - Protective goggles

2.5 Design information

2.5.1 Installation and approval for the heating system

The boiler should be operated in a closed heating system. The following standards govern the installation:

Note on standards

ÖNORM / DIN EN 12828 Heating Systems in Buildings

NOTICE! Each heating system must be officially approved.

The appropriate supervisory authority (inspection agency) must always be informed when installing or modifying a heating system, and authorisation must be obtained from the building authorities:

Austria: Inform the civic/municipal building authorities.

Germany: Notify an approved chimney sweep and the building authorities.

2.5.2 General information for installation room (boiler room)

Boiler room characteristics

- There must not be a potentially explosive atmosphere in the boiler room as the boiler is not suitable for use in potentially explosive environments.
- The boiler room must be frost-free.
- The boiler does not provide any light, so the customer must provide sufficient lighting in the boiler room in accordance with national workplace design regulations.
- When using the boiler above 2000 metres above sea level you should consult the manufacturer.
- Danger of fire due to flammable materials.
  No flammable materials should be stored near the boiler. Flammable objects (e.g. clothing) must not be put on the boiler to dry.
- Damage due to impurities in combustion air.
  Do not use any solvents or cleaning agents containing chlorine in the room where the boiler is installed.
- Keep the air suction opening of the boiler free of dust.

Ventilation of the boiler room

Ventilation air for the boiler room should be taken from and expelled directly outside, and the openings and air ducts should be designed to prevent weather conditions (foliage, snowdrifts, ...) from obstructing the air flow.

Unless otherwise specified in the applicable building regulations for the boiler room, the following standards apply for the design and dimensions of the air ducts:

Note on standards

ÖNORM H 5170 - Construction and fire protection requirements
TRVB H118 - Technical directives on fire protection/prevention

2.5.3 Requirements for central heating water

The following standards and guidelines apply:

Note on standards

Austria:	ÖNORM H 5195-1
Germany:	VDI 2035
Switzerland:	SWKI 97-1
Italy:	D.P.R. no. 412

NOTICE! Note on filling with make-up water: Always bleed the filling hose before connecting, in order to prevent air from entering the system.

Return lift

If the hot water return is below the minimum return temperature, some of the hot water outfeed will be mixed in.

⚠ CAUTION

Risk of dropping below dew point/condensation formation if operated without return lift.

Condensation water forms an aggressive condensate when combined with combustion residue, leading to damage to the boiler.

Take the following precautions:

❒ Regulations stipulate the use of a return lift.

➥ The minimum return temperature is 65 °C. We recommend fitting some kind of control device (e.g. thermometer).

2.5.4 Use with storage tank

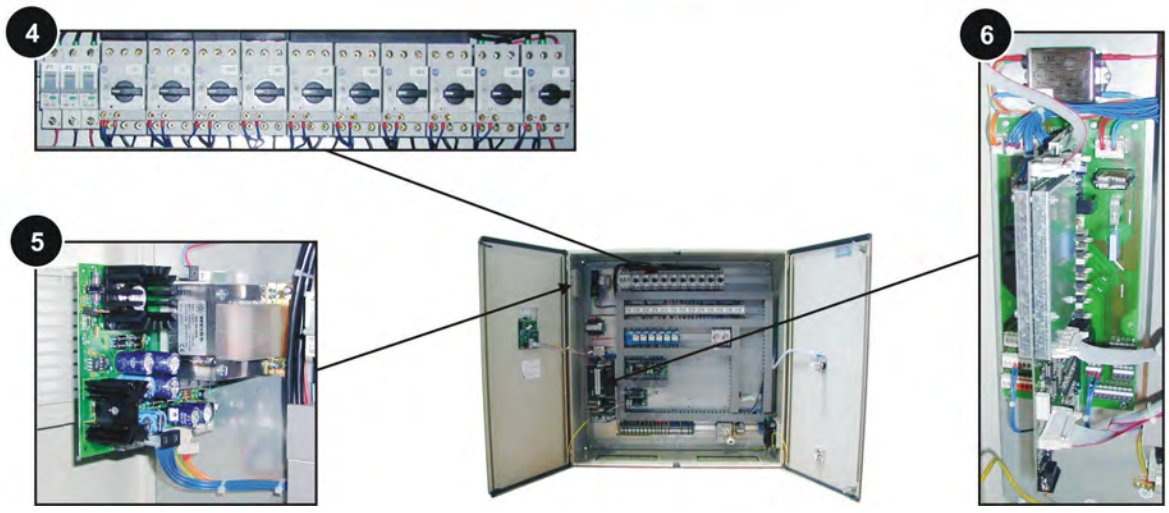
NOTICE

In principle it is not necessary to use a storage tank for the system to run smoothly. However we recommend that you use the system with a storage tank, as this ensures a continuous supply of fuel in the ideal output range of the boiler.

For the correct dimensions of the storage tank and the line insulation (in accordance with ÖNORM M 7510 or guideline UZ37) please consult your installer or Froling.

⇨ See "Addresses" [page 47]

2.6 Safety devices



Item	Description	Description
1	Main switch	Before starting any maintenance work: Switch off the entire system ❒ The power to all components is switched off.
2	Stop button	If the system overheats: Switch off the boiler ❒ The pumps continue to run ➥ **CAUTION! Always turn off the heating using the STOP button. Never use the main switch.**
3	Door switch	Switches the induced draught fan to full speed if the door is opened while the boiler is running
4	Safety overload switches, motor overload switch	Switch off the related component in the event of fault currents or overloads
5	Power supply fuses	Properly fuse the control system and any electronic components F1 Primary transformer 800 mAT F2 Power supply 5 VDC 1.6 AT F3 Power supply +15 VDC 200 mAT F4 Power supply -15 VDC 200 mAT F5 Power supply 24 VDC 2.0 AT F6 Power supply 12 VDC 3.15 AT ❒ When changing fuses, fit fuses with the rated current specified.
6	Motherboard fuse	Motherboard fuse 5 AT ❒ When changing the fuse, fit a fuse with the rated current specified.
5 Devices for preventing the boiler from overheating		
A	Boiler controller	Switches the boiler and feed off if the boiler temperature reaches a predefined value (default 5°C) above the boiler temperature setpoint.
B	Thermal discharge safety device	At a temperature of around 100°C a valve opens and sends cold water to the safety heat-exchanger (safety battery) to reduce the temperature.
C	Safety temperature limiter (STL)	Switches off the blower fan at a maximum boiler temperature of 105°C. The pumps continue to run. Once the temperature falls to below approx. 75°C, the STL can be reset mechanically: ❒ Unscrew the cap on the safety temperature limiter ❒ Reset the safety temperature limiter by turning with a screwdriver
D	Safety valve (not illustrated, provided by the customer)	When the boiler pressure is too high, the safety valve opens and vents off the hot water as steam. ❒ Before you start up the system again, top up the system to replace any water which has been lost through venting.

2.6.1 External safety devices

Safety cut-out switch for sliding floor hydraulic chamber

Before starting any maintenance work in the hydraulic chamber of the sliding floor:

- ❒ Turn the safety cut-out switch to the "0" position
  - ➥ The boiler follows the shutdown procedure and the discharge system is deactivated
- ❒ Turning the selector switch past the "0" position engages the locking lever
  - ➥ The switch can be locked with a padlock to prevent it from being switched on again

On completion of the maintenance work:

- ❒ Remove the padlock
- ❒ Turn the selector switch past the "0" position to automatically release the locking switch. The selector switch can now be turned back to the "1" position.
- ❒ Acknowledge the fault and press the Start button to activate the boiler

2.7 Residual risks

⚠ WARNING

When touching hot surfaces:

Severe burns are possible on hot surfaces and the flue gas pipe!

When work is carried out on the boiler:

- ❒ Shut down the boiler in a controlled way (operating status "Switched off Off") and allow it to cool down
- ❒ Protective gloves must generally be worn for work on the boiler, and it should only be operated using the handles provided
- ❒ Insulate the flue pipes or simply avoid touching them during operation.

⚠ WARNING

If the combustion chamber, cleaning port, reversing chamber or middle vault door is opened during operation:

Opening a door may result in injury or damage or flue gas generation!

Take the following precautions:

- ❒ Do not open the doors while the boiler is operating!

⚠ WARNING

If non-permitted fuel types are used:

Non-standard fuels can cause serious faults in combustion (e.g. spontaneous combustion of carbonisation gases / flash fires) which can lead to serious accidents!

Take the following precautions:

- ❒ Only use fuels specified in the "Permitted fuels" section of these operating instructions.

2.8 Emergency procedure

2.8.1 Overheating of the system

If the system overheats and the safety devices fail to operate, proceed as follows:

NOTICE! Do not under any circumstances switch off the main switch or disconnect the power supply.

- ❒ Keep all the doors on the boiler closed
- ❒ Open all mixer taps, switch on all pumps.
  - ➥ The Froling heating circuit control takes on this function in automatic operation.
- ❒ If a third-party controller is used, carry out the appropriate measures to activate the mixer taps and pumps manually.
- ❒ Leave the boiler room and close the door
- ❒ Increase heat consumption by turning on all radiators and other appliances
- ❒ Open any available radiator thermostat valves

If the temperature does not drop:

- ❒ Contact the installer or Froling customer services
  ⇨ See "Addresses" [page 47]

2.8.2 Smell of flue gas

DANGER

If you smell flue gas in the boiler room:

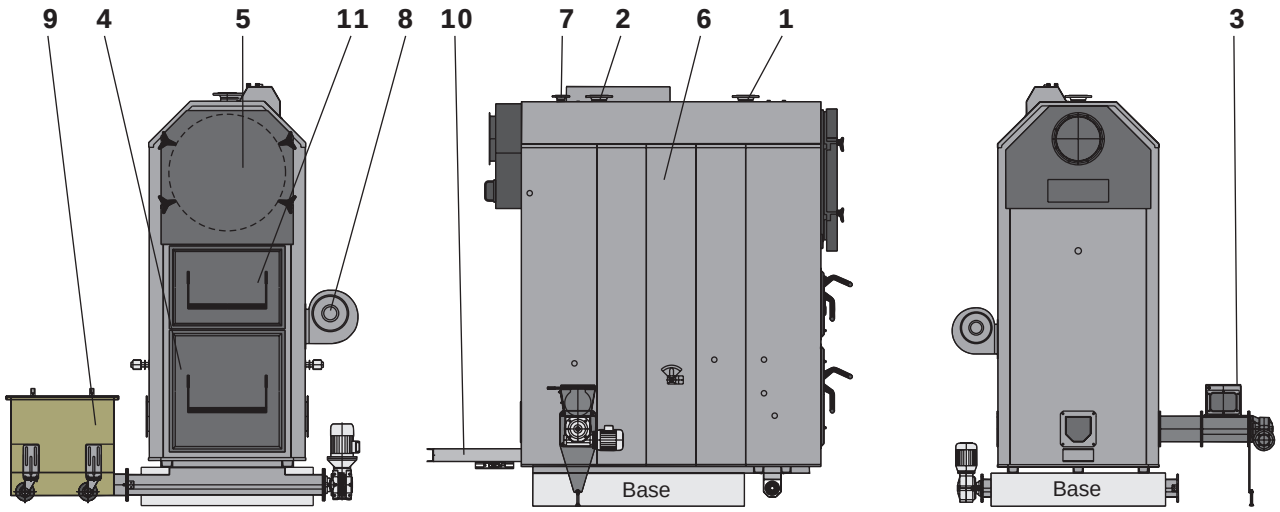
Inhaling toxic flue gas can potentially be fatal!

If you smell flue gas in the room where the boiler is installed:

- ❒ Keep all the doors on the boiler closed
- ❒ Shut down the boiler according to procedure
- ❒ Ventilate the room where the boiler is installed
- ❒ Close the fire door and doors to living areas

3 Technology

3.1 Technical specifications for the Lambdamat Kommunal

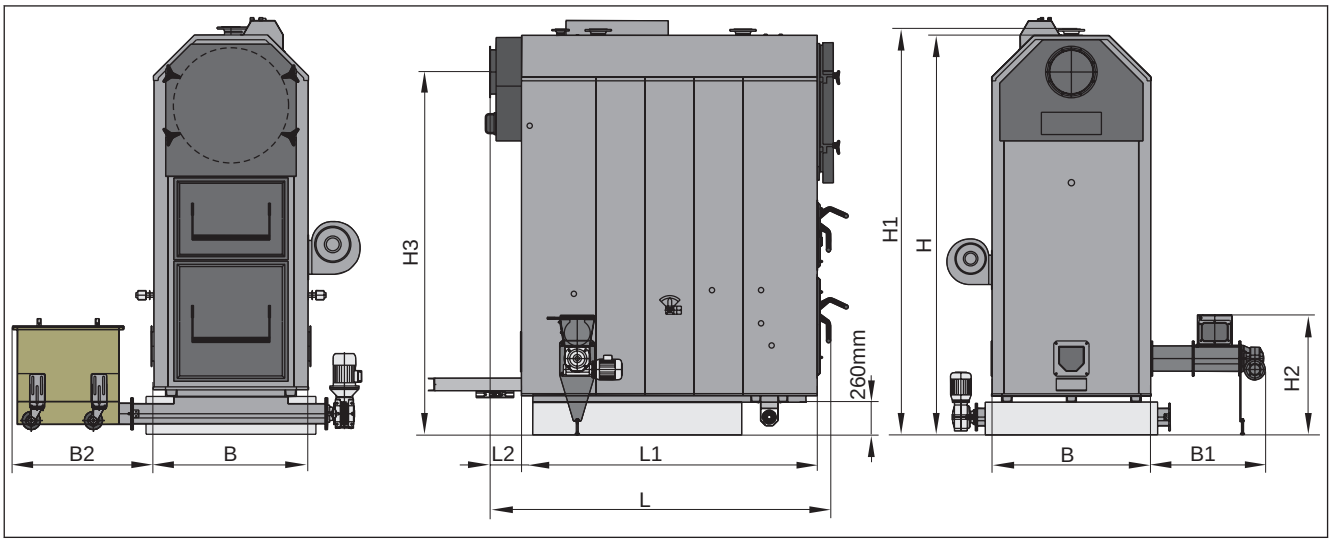


1 ... Boiler and tank outfeed
2 ... Boiler and tank return feed
3 ... Stoker screw
4 ... Combustion chamber door
5 ... Cleaning port door
6 ... Heat exchanger
7 ... Safety valve connection
8 ... Combustion air fan
9 ... Ash trolley for chamber
10 ... Hydraulic grate drive
11 ... Tunnel door

Lambdamat KOM wood chip boiler		320	500	750	1000
Nominal output range	kW	90 – 300	150 – 5800	225 – 750	300 – 999
Permitted operating pressure	bar	4	4	4	4
Max. permitted operating temperature	°C	95	95	95	95
Max. permitted temperature	°C	110	110	110	110
Boiler capacity (water)	Liter	790	1100	1840	2390
Total boiler weight	kg	5780	7350	11440	13950
Chamber / firebrick	kg	2000 / 2500	2700 / 2600	3620 / 4320	3900 / 5750
Heat exchanger	kg	1280	2010	3500	4300
Water-side resistance (ΔT = 20 K)	mbar	18	15	15	27
Flow rate (ΔT = 20 K)	m³/h	13,78	21,53	32,30	43,06

Chimney design data:					
Flue gas temperature without compressed air cleaning	°C	220	220	220	220
Flue gas temperature with compressed air cleaning	°C	180	180	180	180
Flue gas mass flow at G50 W30, O_2 = 11%	m³/h	1561	2602	3903	5100
Draught requirement at ID fan outlet	Pa	2	2	2	2
Flue gas pipe diameter	mm	300	350	400	450

3.2 Dimensions of Lambdamat Kommunal



Lambdamat KOM wood chip boiler		320	500	750	1000
L Boiler length[1)]	mm	2715	2715	3070	3740
B Boiler width	mm	1070	1270	1630	1630
H Boiler height[2)]	mm	2745	3174	3597	3849
H1 Outfeed/return feed height[2)]	mm	2802	3224	3656	3910
H2 Flue gas pipe height[2)]	mm	2210	2880	3150	3300
H3 Stoker height (incl. BBF)[2)]	mm	950	950	1270	1040
Outfeed / return feed connection	DN/PN6	100	100	100	125
Safety heat exchanger connection	DN/PN6	50	50	65	65
L1 Boiler length	mm	2350	2350	2710	3350
L2 Flue gas header box length	mm	257	257	257	257
B1 Stoker length (incl. gearing)	mm	912	900	1260	1011
B2 Ash container width	mm	975 (180 l)	1295	1295	1275

1) … Length without optional compressed air cleaning

2) … Height including plinth to be constructed on-site (H = 260 mm), excluding safety heat exchanger

4 Operating the system

4.1 Assembly and initial startup

Assembly, installation and initial startup of the boiler must only be carried out by qualified staff, and these procedures are described in the accompanying assembly instructions.

See assembly instructions for the Lambdamat Communal

NOTICE

Optimum efficiency and efficient, low-emission operation can only be guaranteed if the system is set up by trained professionals and the standard factory settings are observed.

Take the following precautions:

❒ Initial startup should be carried out with an authorised installer or with Froling customer services

4.2 Filling/refilling the store with fuel

When filling the store you should always ensure that you are using the right fuel:

See "Permitted fuels"

For blowing in fuel the following precautions also apply:

While the store is being filled the boiler must be set to "Switched off Off" or "Switched off Case cooling on". The vacuum generated by blowing in the fuel could bring smoke back into the store.

⚠ CAUTION

Risk of injury and damage to property from blowing fuel into the store with the boiler switched on!

Take the following precautions:

❒ Switch off the boiler by pressing the Stop button

❒ Set the boiler to "Switched off Off" or "Switched off Case cooling on" and leave to cool for **at least two hours**.

Before filling the store, always make sure that there are no foreign bodies in the store. Close all openings to the store to seal out dust.

4.2.1 Sliding floor discharge unit

- ❒ The maximum dumping height (depending on the fuel density) as specified in the operating instructions for the sliding floor must not be exceeded.
- ❒ Driving over the fuel in the store can cause the material to be compacted.
  - ➥ This may stop the slide rods from running smoothly.

Filling the store by driving over the slide rods

Slide rods can be driven over, provided the following precautions are taken:

- ❒ The slide rods must be covered by a residual fuel layer approx. 30 cm deep so that the truck does not drive directly over the sliding floor keyways.
- ❒ On no account may the truck drive over the longitudinal support for the slide rods. (Provide guidance systems for driving the truck into the store, or position gates appropriately)
- ❒ While the truck is on the sliding floor, the hydraulic unit must be switched off
- ❒ While it is on the sliding floor the truck should be manoeuvred as little as possible

Filling the store by tipping fuel onto or next to the slide rods

- ❒ If the fuel can be tipped out without driving over the slide rods, the store can be filled while the boiler is running

4.2.2 Horizontal screw feed system

- ❒ When the boiler system is running, fuel can be tipped into the store at any time.
  - ➥ CAUTION: Fuel may only be blown in if the pressure conditions in the store are suitable and the water content of the fuel does not exceed a maximum of W30.

4.2.3 Inclined screw feed system

The inclined screw must always be moved into an upright position in order to fill the store.

This can be done as follows:

- ❒ If the store is filled while the boiler system is running, the screw moves automatically into an upright position.
  - ➥ If the store is empty, the screw must be moved by hand into an upright position and wedged with fuel.
- ❒ If the feed system is not running when the store is filled, the screw can be held upright using string.
  - ➥ TIP: The string should be thin enough for it to break as the store is filled.

4.2.4 Articulated arm / spring blade feed system

Blowing in fuel with the stirrer head still covered

- ❒ If the head of the stirrer is still covered with fuel and the arms are drawn in against the stirrer plate, fuel can be blown in at any time provided the boiler is **switched off**

Blowing in fuel with the stirrer arms free and residual fuel present

- ❒ Before filling the store, shovel any residual fuel over the middle of the stirrer
- ❒ Switch on the stirrer for 4 minutes using the "Man. fuelling in com. chamb." parameter to draw the arms in.
- ❒ When the arms are drawn in against the stirrer plate, the store can be filled by blowing in fuel.
- ❒ Any fuel that was introduced into the combustion chamber when the stirrer was switched on must be removed manually.

Blowing in fuel to an empty bunker

If the store is empty, stop blowing in fuel after about 5 minutes and take a look in the store. If the middle of the stirrer is covered with fuel and the arms are no longer visible:

- ❒ Activate the stirrer for 4 minutes using the "Man. fuelling in com. chamb." parameter
- ❒ Once the arms are drawn in, filling can continue.
  - ➥ If the layer of fuel on top of the stirrer is not deep enough after the first 5 minutes to allow the spring blades or articulated arms to be drawn in, repeat the process until there is enough fuel present.
- ❒ Any fuel that was introduced into the combustion chamber when the stirrer was switched on must be removed manually.

4.2.5 Pellet discharge screw

- ❒ Provided all the conditions in 3.3 are met, filling can be started at any time.

4.3 Heating the boiler

4.3.1 Switching on the system

❒ Turn the main switch on the switch cabinet to the "ON" position
➥ After the system check by the controller, the system is ready for operation
➥ "Switched off Off" appears on the display

4.3.2 Switching on the boiler

Heating up with automatic ignition (LM 500 Kom only)

❒ Press the Start button
➥ Fuel is fed into the combustion chamber and heated by the ignition blower fan.
➥ The heating system is controlled via the controller according to the selected mode.

Heating up without automatic ignition

Prepare the material:
❒ paper and cardboard
❒ coarse wood chips
❒ dry firewood

With the boiler switched off:

❒ Set the "ID fan" selector switch to "OFF"
❒ The ID fan is deactivated and does not start up automatically when the combustion chamber door is opened

❒ Place some scrunched-up paper and cardboard inside
❒ Place some coarse wood chips on top and finally some firewood
❒ Light the paper

❒ Set the "ID fan" selector switch to "MANUAL"
➥ The ID fan starts up
➥ This helps to ignite the material more quickly and prevents smoke from developing inside the boiler room
➥ Leave the combustion chamber door open!

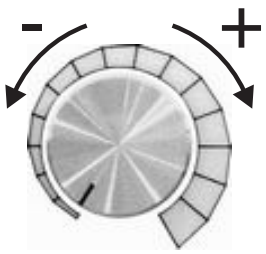
Once the firewood is alight:

❒ Use the cleaning tool to push fuel to the back of the combustion chamber

Start the boiler:

❒ Close the combustion chamber door
❒ Set the "ID fan" selector switch to "AUTO"
❒ Acknowledge the combustion chamber door error message
❒ Press the Start button
  ➥ The boiler is switched on and begins to heat up

4.3.3 Setting the boiler temperature



To increase the boiler temperature:

❒ Turn the temperature selector to the right
  ➥ The boiler temperature is increased
  The right-hand stop corresponds to the preset boiler temperature setpoint (max. 90°C)

To reduce the boiler temperature:

❒ Turn the temperature selector to the left
  ➥ The boiler temperature is reduced
  The left-hand stop corresponds to 70°C

4.3.4 Controlling the boiler

NOTICE! See the operating instructions for the Lambdatronic H 3000

4.3.5 Switching off the boiler

❒ Press the Stop button
  ➥ The boiler follows the shutdown program and switches to "Switched off Off" status
  ➥ The Lambdatronic controls the connected heating components.

NOTICE! Always use the Stop button to shut down the boiler according to procedure. The pumps must continue to run for a minimum of 6 hours!

4.3.6 Switching off the system

⚠ WARNING

When switching off the main switch in automatic mode:

Serious combustion faults leading to serious accidents are possible!

Before switching off the main switch:

❒ Press Stop key

➥ The boiler follows the shutdown procedure and switches to the cleaning cycle in "Switched off Off "status

CAUTION! Only when the boiler has cooled down and is in "Switched off Off**" status**

❒ Switch off the main switch on the controller

➥ The controller is switched off

➥ The components powered via the switch cabinet are powered down

5 Servicing

5.1 General information on servicing

Regular cleaning of the boiler extends its life and is a basic requirement for smooth operation.
You should therefore clean the boiler regularly.

⚠ DANGER

When working on electrical components:

Risk of electrocution!

When work is carried out on electrical components:

- ❒ Only have work carried out by a qualified electrician
- ❒ Observe the applicable standards and regulations
  - ➥ Work must not be carried out on electrical components by unauthorised people

⚠ WARNING

When inspecting and cleaning the boiler with the main switch on:

Serious injuries possible due to automatic boiler startup!

Before inspection and cleaning work in/on the boiler:

- ❒ Press the Stop button
  - ➥ The boiler follows the shutdown procedure and switches to "Switched off Off" status
  - ➥ Allow the boiler to cool down for at least 2 hours.
  - ➥ Switch off the main switch and take precautions to prevent accidental switching on.

⚠ WARNING

Incorrect inspection and cleaning:

Incorrect or insufficient inspection and cleaning of the boiler can cause serious faults in combustion (e.g. spontaneous combustion of carbonisation gases / flash fires) and this can lead to serious accidents and damage!

Take the following precautions:

- ❒ Clean the boiler following the instructions in the instruction manual. Follow the boiler operating instructions.

⚠ WARNING

Inspection and cleaning of the combustion chamber with the combustion chamber temperature sensor in position

Risk of damage to the thermocouple!

Before inspection and cleaning work in the combustion chamber:

❒ Mark the position of the thermocouple.

❒ Loosen the clamp and pull out the thermocouple.

➥ After maintenance:

❒ Carefully clean any tar or soot deposits from the thermocouple.

❒ Re-insert the thermocouple to the marked position and fix in place with the clamp.

NOTICE

We recommend that you keep a maintenance book in accordance with ÖNORM M7510 of the Technical Directive for Fire Prevention (TRVB)

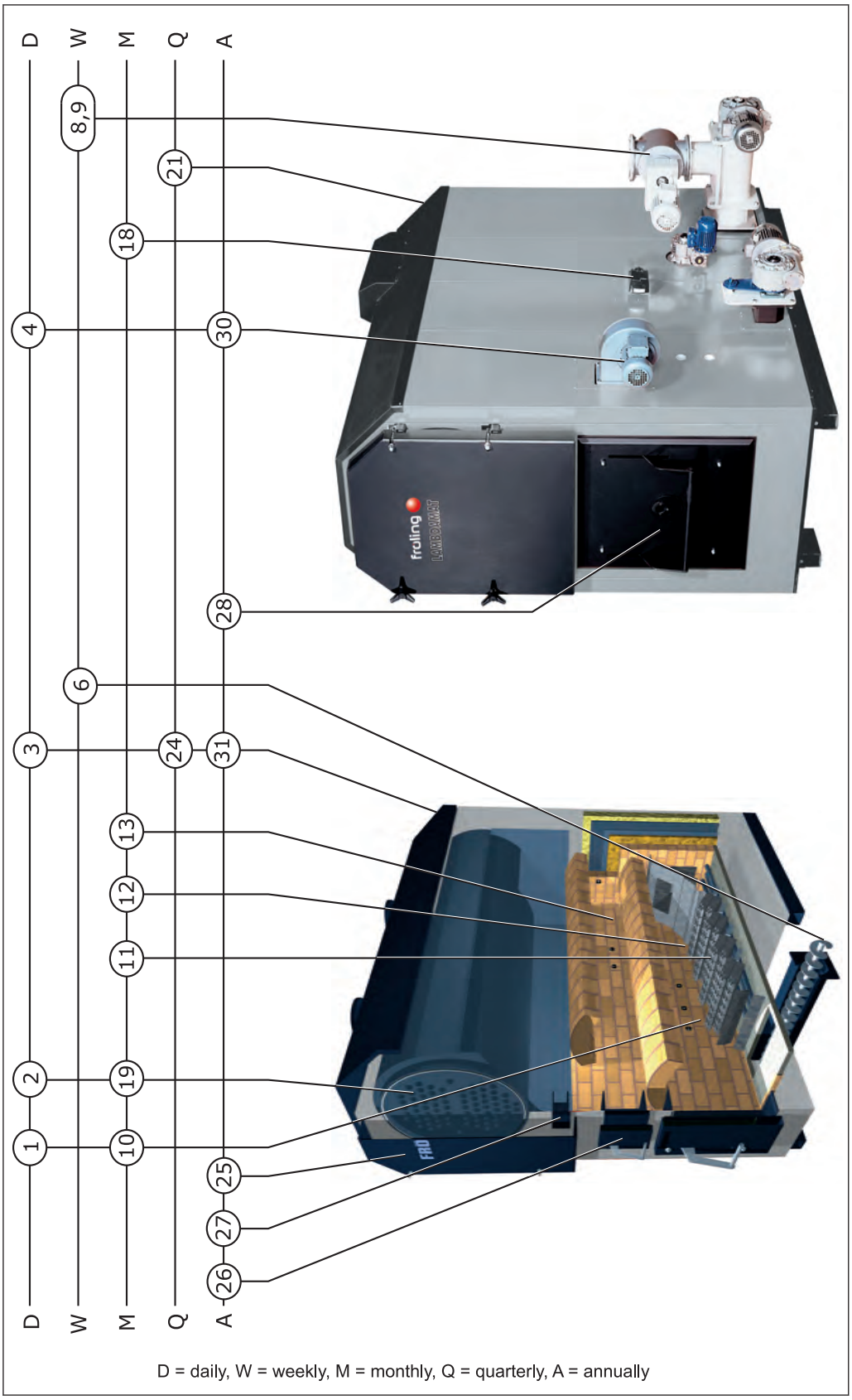
5.2 Inspection and cleaning

For inspection and cleaning use the cleaning kit provided. The cleaning kit consists of:

- Chamber plate (triangular plate)
- Flat scraper
- Large brush (Ø 81 mm)
- Small brush (Ø 53 mm)

❒ We recommend that you also use an industrial vacuum cleaner.

5.3 Maintenance schedule



5.3.1 Required jobs and checks

❒ The following maintenance schedule is based on **max. 3000** service hours per year.
➥ Reduce the intervals if this number is exceeded.

Daily

1 Combustion chamber

❒ General visual inspection
❒ Clean components if necessary

2 Heat exchanger

❒ General visual inspection
❒ Clean if necessary

3 Induced draught fan

❒ General visual inspection
❒ Clean if necessary
➥ Replace immediately if faulty

4 Combustion air blower fan

❒ General visual inspection
❒ Clean if necessary
➥ Replace immediately if faulty

Weekly

5 Geared motors

❒ Visually check all geared motors for oil leaks

6 Ash removal

❒ Check the ash level
❒ Empty ash container if necessary

⇨ See "Emptying the ash container" [page 40]

7 Infra-red light barrier (where fitted)

❒ Clean the photo cell and check the switching point

8 Burn back flap

❒ Clean dust collector, check function of spring return actuator

9 Rotary valve

❒ Check for noise and heat development

Monthly

10 Combustion chamber

❒ Using a flat scraper and working from the tunnel door, carefully pull the ash on the upper side of middle vault towards you

❒ Using a flat scraper and working from the tunnel door, carefully push the ash on the upper side of the lower vault towards the rear

↳ CAUTION! Be careful not to damage the firebricks with the flat scraper.

❒ Using a flat scraper, pull the ash on the combustion chamber grate towards the ash shaft

↳ Before starting cleaning, mark the position of the combustion chamber thermocouple and remove it carefully to prevent it from being damaged by the cleaning equipment

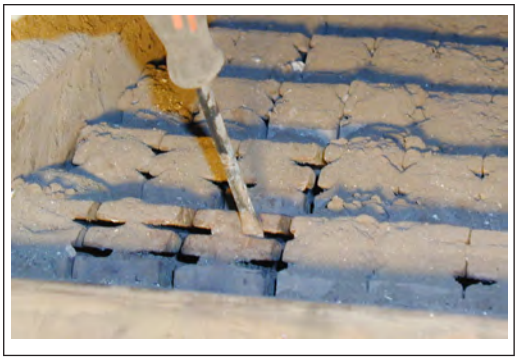
↳ After cleaning, push the combustion chamber thermocouple back in as far as the mark

❒ On the "Test Mode" menu, switch on the ash removal screws to remove the ash which has fallen into the ash container. If your system is not fitted with automatic ash removal, shovel the ash out of the chamber by hand

↳ The ash removal screws of the heat exchanger ash removal system will also operate at the same time.

⇨ See "Emptying the ash container" [page 40]

11 Conveyor grate



❒ Check the conveyor grate for dirt and obstructions (nails, stones, slag,...). Clean where necessary

➥ The primary air slots must be free and unobstructed

❒ Check the grate, grate shafts and grate bearings for wear and deformation

➥ Change any worn or deformed components

❒ Check the grate drive for dirt and deposits

12 Air-cooled grate side plates (where fitted)

❒ Check the grate side plates for dirt and slag and clean the openings with a slotted screwdriver if necessary

13 Firebrick vault combustion chamber

❒ Remove ash that has collected above the upper vault using the cleaning device

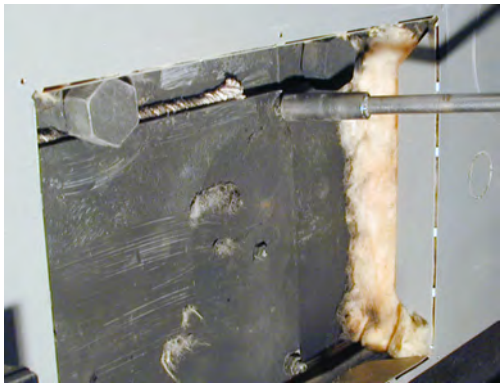
↪ Before starting cleaning, mark the position of the combustion chamber thermocouple and remove it carefully to prevent it from being damaged by the cleaning equipment

↪ After cleaning, push the combustion chamber thermocouple back in as far as the mark

14 Area under conveyor grate

❒ Remove the cover from the cleaning hatch

❒ Remove the cleaning cover



❒ Check the grate area and ash rakes for dirt and deposits. Clean where necessary

↪ Check the seal when replacing the cleaning cover

15 Dust separator

❒ Check the ash level and empty the container if necessary

16 FGP (option)

❒ Remove the pipe insulation from the inspection cover
❒ Unfasten the nuts on the inspection cover and remove the cover
➥ **Check the pipe for dirt and deposits. Clean where necessary**

17 Ash transfer chamber

❒ Check the ash level and clean if necessary

18 Combustion chamber thermocouple

❒ Check function and wear

19 Cleaning the multipoint heat exchanger

❒ Thoroughly clean the heat exchanger, either manually with a brush or automatically using compressed air

Quarterly

20 Actuators, drives

❒ Visually check the function of the drives of the feed and ash removal screws and the grate

Check the efficiency of the air flap actuators:

❒ Press the reset button on the servo motor to release the air flap

➥ Hold down the reset button

❒ Turn the air flap to the opposite stop

❒ Release the reset button

➥ The air flap must return automatically to its original position

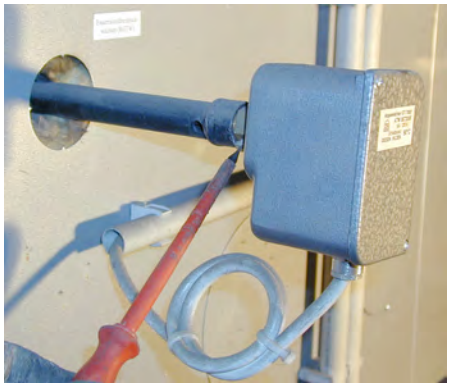
21 Flue gas sensor

- ❒ Loosen the retaining screw and pull out the flue gas sensor
- ❒ Wipe off the flue gas sensor with a clean cloth
- ❒ Insert the flue gas sensor back into the flue gas pipe and finger-tighten the retaining screw

22 Underpressure controller

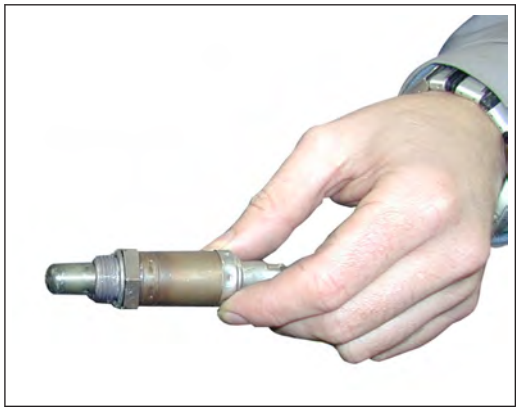
- ❒ Disconnect the silicone tube from the differential pressure transducer
- ❒ Using compressed air, blow out the line in the direction of the combustion chamber to remove any deposits
- ❒ Reconnect the silicone tube to the "minus" nipple

23 Combustion chamber overpressure sensor



❒ Loosen the retaining screw
❒ Pull the combustion chamber overpressure sensor out of the spacer tube
❒ Clean any deposits from the sensor with a soft cloth
❒ Check that the spacer tube is clear

24 Lambda probe



❒ Unscrew and remove the lambda probe and clean with a clean cloth
  ➥ **CAUTION! Lambda probe may be hot!**
❒ Refit and finger-tighten the lambda probe
  ➥ **Check the seal after tightening**

Yearly

25 Reversing chamber door

❒ Check fibre-glass seal for perfect alignment on the door frame
  ➥ Imprint on the fibre-glass seal or ceramic packing

If the imprint of the seal is broken:

❒ The seal is no longer guaranteed
❒ Tighten the door latches or replace the fibre-glass seal or ceramic packing

26 Vault door

❒ Same procedure as described above

27 Cleaning port door

❒ Same procedure as described above

28 Combustion chamber door

❒ Same procedure as described above
  ➥ When adjusting the combustion chamber door, also check the efficiency of the door contact switch
  Reset if necessary

29 Stoker screw

❒ Check coil of the screw for wear

30 Combustion air blower fan

❒ Clean any dust and deposits from the protective grating
❒ Dismantle the protective grating and clean the fan with a soft brush where necessary

31 Induced draught fan + FGP blower

❒ Mark the position of the flange
❒ Loosen the blower flange screws

❒ Remove the blower and, depending on the design, clean the blower wheel with a brush
➥ Refer to the marked position when refitting the unit

32 Bearings

❒ Grease all bearings of the screws and the drives

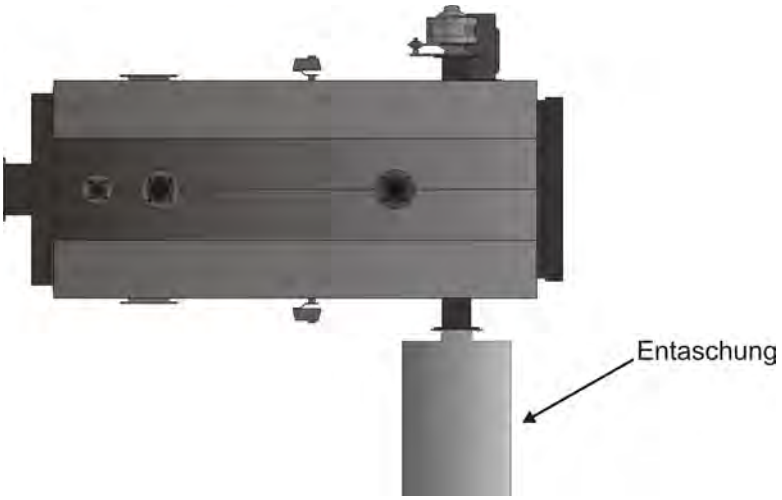
33 Slide-in unit

❒ Check the function of the loading system sprinklers as per the manufacturer's instructions

34 Flue gas pipe

❒ Check the flue gas pipe and chimney for deposits and clean with the flue brush where necessary
➥ Always use stainless steel brushes to clean stainless steel flue pipes, chimney pipes and connections

Emptying the ash container



Ash removal:

❒ Unscrew the wing nuts on the ash container flange
❒ Separate the ash container from the flange and take the ash container to the ash disposal point

5.3.2 Maintenance schedule for safety devices

No.	Component / Maintenance Operation		Int.
1	**System pressure** ❒ Check the system pressure on the pressure gauge ➥ The value must be 20% over the pre-stressed pressure of the expansion tank **NOTICE! See the expansion tank operating instructions** If the system pressure is less: ❒ Top up the water ☞ If this occurs frequently it indicates that the heating system is not sealed correctly. Call the installer. ❒ If large pressure fluctuations are observed: ➥ Have the expansion tank checked.		D
2	**Burn back flap** ❒ Check the seal and efficiency of the burn back flap		W
3	**Safety valve (provided by the customer)** ❒ Check the safety valve as per the manufacturer's instructions **NOTICE! See the safety valve operating instructions**		M
4	**Safety battery valve** ❒ Pull the safety valve sensor out of its immersion sleeve ❒ Hold the sensor in a heated water tank fitted with a temperature display ❒ Heat the water until the temperature reaches the setpoint value for the valve ➥ At this temperature the valve must open and allow cold water to flow into the safety battery ❒ After the test, push the valve sensor back into its immersion sleeve ❒ Check for water flowing out of the safety battery drain pipe ➥ Clean or change the valve if it leaks ☞ Risk of scaling in the safety heat exchanger ❒ If the heat exchanger is badly scaled, the flow rate will be very low. In this case the heat exchanger must be descaled by a specialist company.		Q
5	**Safety temperature limiter (STL)** ❒ Pull the STL capillary sensor out of its immersion sleeve ❒ Hold the sensor in a heated water tank fitted with a temperature display ❒ Heat the water until the temperature reaches the setpoint value (approx. 100°C) for the STL ➥ The system will shut down and a fault message will be displayed ☞ If the system does not shut down, change the STL immediately ❒ Reset the STL by hand: ❒ Allow the sensor to cool down and then unscrew the cap from the STL ❒ Reset the safety temperature limiter by turning with a screwdriver		Y
6	**Heating EMERGENCY STOP switch** ❒ Check that the heating emergency stop switch is working properly		

5.3.3 Maintenance instructions for hydraulic system

⚠ WARNING

Do not use unskilled personnel for hydraulic system maintenance

Risk of injury and damage to property!

Take the following precautions:

❒ Only allow trained professionals to carry out servicing and maintenance work on the hydraulic system. Follow the manufacturer's operating instructions.

NOTICE! Do not allow the oil temperature to exceed +50°C or fall below -30°C.

The interval at which oil should be changed depends on a variety of factors including the age of the oil and the amount of dirt contained in it. As a general rule, the oil should be changed at the following intervals:

Interval (service hours)	Component / Maintenance Operation
50 - 100	First maintenance after installation. (This does not apply to subsequent maintenance): ❒ Change the oil and the filter
50	❒ Check the oil level ➥ The oil must show no visible signs of foaming ❒ Check the tightness of screw connectors
200	❒ Check the return filter for dirt (pressure gauge on filter) ❒ Change the filter cartridge if necessary
5000 (or yearly)	❒ Change the oil ❒ Change the return filter and the vent filter sets

To change the oil, proceed as follows:

❒ Move all hydraulic cylinders to the end stop
➥ This will expel all the oil
❒ Drain off or pump off the oil from the hydraulic unit
❒ Remove the unit cover or open the inspection cover
❒ Thoroughly clean the oil tank (make sure you remove all oil sludge)
❒ Change the return filter and the vent filter sets
❒ Refit the unit cover or close the inspection cover
❒ Fill the tank with hydraulic oil to the level mark shown on the inspection glass
☞ Use the hydraulic oil grade specified by the manufacturer
❒ At the other end of the cylinder plunger (relative to its current position), disconnect the hydraulic cylinder hose on the fixed piping side. Place a container under the disconnected hose.
❒ Using the hydraulic unit move the cylinders to the other end position
➥ The remaining old oil will be pushed out of the hose and into the container.
❒ Refit the hydraulic hoses and check the seal
❒ Bleed the hydraulic system and check the oil level

5.4 Preparing to test emissions

- ❒ According to the stipulations of Austrian standard ÖNORM M 5861-1, the flue gas piping must have a built-in DN100 test flange.
- ❒ The entire system must be thoroughly cleaned 2 to 3 days before emission tests are performed. (The entire system in this case means: ash containers, combustion chamber, vault, heat exchanger, smoke flue pipe connection between boiler and cyclone, container under cyclone, flue gas piping and chimney).
- ❒ System performance must be measured at full load and at partial load.
- ❒ In the last two days before the test, system output must be increased to approximately the rated output of the boiler. This is to prevent the release during testing of any old deposits (e.g. tar) in the flue gas piping.
- ❒ Wood chip as per ÖNORM M 7133 with a maximum water content of 30% must be provided by the operator.

  Wood chip size:
  - for screw feed loading: max. G 50
  - for hydraulic loading: max. G 100
- ❒ One or two days before the test, the efficiency and settings of the system should be checked by our service technician.The system must be set up for the fuel to be used during the emission tests (test measurements by our service technician).
- ❒ Our service technician will be present at the tests. Emission tests should be carried out by an accredited test institute or, in Germany, a chimney sweep.

5.5 Maintenance agreement / Customer service

NOTICE! We recommend a yearly inspection by Froling customer services or an authorised partner (third party maintenance).

Regular maintenance and servicing by a heating specialist will ensure a long, trouble-free service life for your heating system. It will ensure that your system stays environmentally-friendly and operates efficiently and cost-effectively.
In the course of this maintenance the entire system is inspected and optimised, particularly regulation and control of the boiler. The emission measurement carried out can also be used to draw conclusions about the combustion performance of the boiler.
For this reason, FROLING offers a service agreement, which optimises operating safety. Please see the details in the accompanying guarantee certificate.

Your Froling customer service office will also be happy to advise you.

NOTICE

All national and regional regulations relating to regular testing of the system must be observed. Please be advised that, in Austria, commercial systems with a rated heat output of 50 kW or more must be regularly tested at yearly intervals in accordance with the Heating Plant Regulations (Feuerungsanlagen-Verordnung).

5.6 Replacement parts

With Froling original replacement parts in your boiler, you are using parts that match perfectly. As the parts fit together so well, installation times are shortened and a long service life is maintained.

NOTICE

Installing non-original parts will invalidate the guarantee.

❒ Only replace components or parts with original replacement parts

5.7 Disposal information

5.7.1 Disposal of the ash

❒ The ash should be disposed of in accordance with waste management regulations.

5.7.2 Disposal of system components

❒ Ensure that they are disposed of in an environmentally friendly way in accordance with waste management regulations.
❒ You can separate and clean recyclable materials and send them to a recycling centre.
❒ The combustion chamber must be disposed of as builders' waste.

6 Troubleshooting

6.1 General faults in the power supply

Error characteristics	Cause of error	Elimination of error
Nothing is shown on the display No power to the controller	General power failure Main switch is turned off FI circuit breaker or line protection is switched off Faulty fuse in the controller	 Turn on the main switch Switch on the FI circuit breaker or line protection Replace the fuse – note the amperage (10AT)

6.1.1 Behaviour of system after a power failure

When the power supply has been restored the boiler returns to the previous mode and is controlled according to the specified program.

- ❒ **After a power failure, check whether the STL has tripped.**
- ❒ **Keep the doors of the boiler closed during and after the power failure.**

6.2 Excessive temperature

The safety temperature limiter (STL) shuts down the boiler when it reaches a temperature of approx. 100°C. Once the temperature falls to below approx. 75°C, the STL can be reset mechanically:

- ❒ Unscrew the cap on the safety temperature limiter
- ❒ Reset the safety temperature limiter by turning with a screwdriver
- ❒ Replace the cap

6.3 Faults with fault message

If a fault has occurred and has not yet been cleared:

- ❒ Status LED flashes red
- ❒ A fault message is shown on the display

The term "fault" is a collective term for warnings, errors and alarms. The boiler reacts differently to the three types of message:

WARNING	In case of warnings the boiler initially continues controlled operation, giving the option of resolving the error quickly to prevent a shutdown.
ERROR	The boiler follows the shutdown procedure and remains in "Switched off Off" status until the problem is resolved.
ALARM	An alarm triggers a system emergency stop. The boiler shuts down immediately, the heating circuit controller and pumps remain active.

6.3.1 Procedure for fault messages

- ❒ Find and eliminate the fault

NOTICE! For a list of messages refer to the Lambdatronic H 3000 operating instructions

- ❒ Acknowledge fault by pressing the Enter button
- ❒ Start the boiler by pressing the Start button

7 Appendix

7.1 Addresses

7.1.1 Address of manufacturer

FRÖLING
Heizkessel- und Behälterbau GesmbH

Industriestaße 12
A-4710 Grieskirchen
AUSTRIA

TEL 0043 (0)7248 606 0
FAX 0043 (0) 7248 606 600
INTERNET www.froeling com

7.1.2 Address of the installer

Stamp

E-RATIONAL ORC-1000

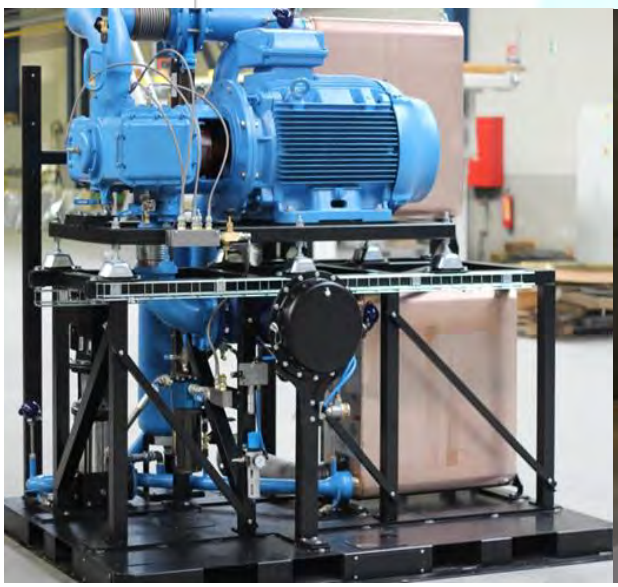
BEP Europe (Burke E. Porter, www.bepco.com) - through its Energy & Infrastructure Division – "E-Rational" (www.e-rational.net) is delivering a cost-effective solution to convert low temperature heat into clean energy power without emissions. Our state-of-the-art **Organic Rankine Cycle (ORC)** technology combined with the usage of industrial grade components makes E-Rational's ORCs user-friendly, robust and economically viable.

E-Rational's ORC machine has been designed for a maximized combined uptime and efficiency with a minimized operational and maintenance cost. This resulted in a skid-mounted modular machine, CE-compliant, with plug-and-play connections for easy installation.

The ORC-1000 machine absorbs up to 1,000 kW (3.4 MMBTU/h) thermal heat in a temperature range between 80°C and 150°C (176 °F – 302 °F). The ORC units are heat powered by hot water, thermal oil or low pressure steam coming from:

- ✓ Waste heat flows from industrial processes, e.g. cooling cycles from chemical plants, glass-, steel- & food- industry, power plants, etc.
- ✓ Unused heat in District Heating networks
- ✓ Biomass furnaces and CHP/COGEN or biogas installations
- ✓ Geothermal wells

Depending on the operating conditions, E-Rational's ORC-1000 series are offered with different types of expander-generator sets with typical outputs ranging from 55 kWe to 132 kWe.



E-RATIONAL
VALUE FOR HEAT

PRODUCT DATA SHEET

UPDATE JAN/2015

ORC-1000	Skid mounted modular Organic Rankine Cycle machine
Generator type	Asynchronous, 2 pole, 3 phase, 400V, 50-60 Hz
Generator Power Range	55kWe - 75kWe - 90kWe - 110kWe - 132kWe
Expander	E-Rational (single screw, radial inflow)
Heat Exchangers	Plate heat exchangers
Applied EG-Norms:	
✓ Machine directive	2006/42/EG
✓ EMC Directive	2004/108 EG
✓ Low voltage directive	2006/95/EG
✓ Pressure Equipment Directive	97/23/EG
Electrical Enclosures	IP55
Control system	PLC, Web Based Remote Monitoring

Dimensions (L x W x H)	*2,933 mm x 1,856 mm x 2,530 mm*	*9'6" x 6'1" x 7'5"*
Operating Mass (kg)	*±3,800 kg*	*±8,378 Lbs*
Operating Conditions (ambient temperature)	*-20°C to +50°C*	*-4 °F to 122 °F*
Temperature Heat input	*80°C – 150°C*	*176 °F – 302 °F*
Maximum heat input	*1,000 kWth*	*3.4 MMBTU/h*

Heat source	✓ Hot water ✓ Thermal oil ✓ Low Pressure steam
ORC working Fluid (depending on conditions)	✓ Honeywell r245fa® ✓ Solkatherm SES36®
Hydraulic connection heat source	2 Flanges DN150 PN16
Hydraulic connection cooling	2 Flanges DN150 PN16
Cooling system	✓ Cold water ✓ Cooling tower ✓ Air cooler
Housing	Suited for indoor installation
Noise level	<70 dB at 10 m
Emissions	✓ No Emission ✓ No fuel consumption

TYPICAL PERFORMANCES

HEAT SOURCE: Hot water 1,000 kWth - 43m³/h (3.4 MMBTU/h - 189 GPM)
COOLING: Cold water

Temperature heat source		Gross power production	
		Cold water out 20°C (68 °F)	Cold water out 30°C (86 °F)
90°C	*194 °F*	*72 kWe*	*65 kWe*
100°C	*212 °F*	*84 kWe*	*74 kWe*
110°C	*230 °F*	*91 kWe*	*81 kWe*
120°C	*248 °F*	*101 kWe*	*91 kWe*
130°C	*266 °F*	*111 kWe*	*101 kWe*
140°C	*284 °F*	*121 kWe*	*112 kWe*

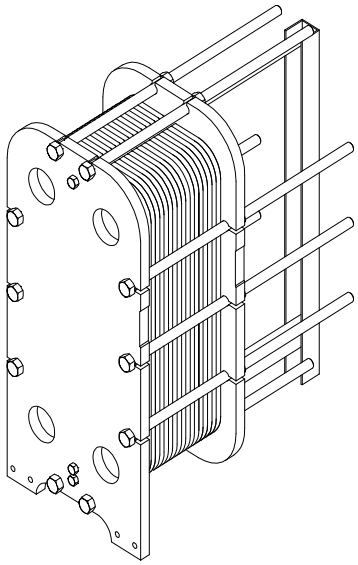
HEAT SOURCE: Low Pressure Steam 1,000 kWth - 1.53 Tons/h - 0.43 kg/s (3.4 MMBTU/h - 3,373 Lbs/h)
COOLING: Cold water out 20°C (68°F)

Steam Pressure		Saturated Steam Temperature		Gross power production
1.5 bara	*21.76 psi*	*111°C*	*232 °F*	*99 kWe*
2.0 bara	*29.01 psi*	*120°C*	*248 °F*	*109 kWe*
2.8 bara	*40.61 psi*	*131°C*	*268 °F*	*117 kWe*
4.0 bara	*58.02 psi*	*143°C*	*289 °F*	*124 kWe*

UK EXCHANGERS LTD

the heat transfer specialists

Plate Heat Exchanger Operating & Instruction Manual



This manual contains essential information with regards to the safe handling, installation, operation and maintenance of the heat exchanger equipment. It is important that the relevant personnel are made aware of this document, and have fully read and understood its contents before becoming involved with heat exchangers of this type. Failure to read the manual may result in misuse, thus resulting in potential injury to personnel and damage to the equipment.

Unit 55, Stilebrook Road
Olney
Buckinghamshire
MK46 5EA
Tel: 01234-244320
Fax: 01234-714978

E-Mail: sales@ukeltd.com Web Page: www.uk-exchangers.com

Index

1. Long Term Storage Prior to Use :-

a) Less than 6 months from Delivery

- Seal up connections
- Store in an environment away from moisture in temperatures that are between 15 and 20 C (avoid temperatures lower than 15 C)
- Cover the plate pack with black plastic to exclude any sun light, whilst still allowing air to circulate
- Suitable storage conditions are as follows:

    1. Cool (temperature around 15 C)
    2. Dry (humidity kept low)
    3. Free from dust
    4. Moderately ventilated
    5. Relatively dark and away from sunlight

b) Greater than 6 months from Delivery

- Apply a rust preventive agent to the tie bolts along the threads between the follower frame plate and the back support leg, the frame bars and any other un-painted surface. Do not allow oil or any other substance to touch the gaskets, .
- Seal up connections
- Loosen tie bolts until the plate pack is relaxed – this is achieved when pack opened by 10% more than initial tightening dimension. The tie bolts should not be removed or loosened to such an extent that dirt is allowed to enter in-between the plates.
- Attach warning label to advise personnel not to use exchanger in this partially opened condition and to act as a reminder to re-tighten to correct assembly measure prior to use
- Cover the plate pack with black plastic to exclude any sun light whilst still allowing air to circulate..
- Store in temperatures that are between 15 and 20 C (avoid temperatures lower than 15 C) away from any moisture/damp, sources of ozone (sunlight, welding, or salt atmospheres), and away from any other corrosive agents

2. Installation - General Points :-

Exercise extreme caution at all times when lifting

- Lift from underneath if on a base (pallet).
- Lift from lifting lugs when fitted – these are in the head frame plate – lift off the base, being careful to support the rear leg when the angle approaches 45 degrees as it shall fall backwards after this point. Block between the follower plate and the frame bars to prevent the follower plate from moving up or downwards.
- Lift from the top frame bar (close to the head / fixed frame plate, and support leg).
- Lift from the tie bolts (in-between the frame plates, close to head frame plate)

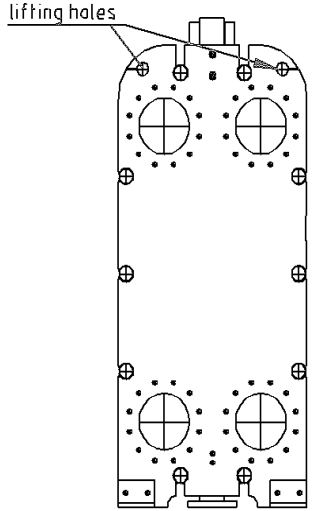
Avoid Lifting from the following:

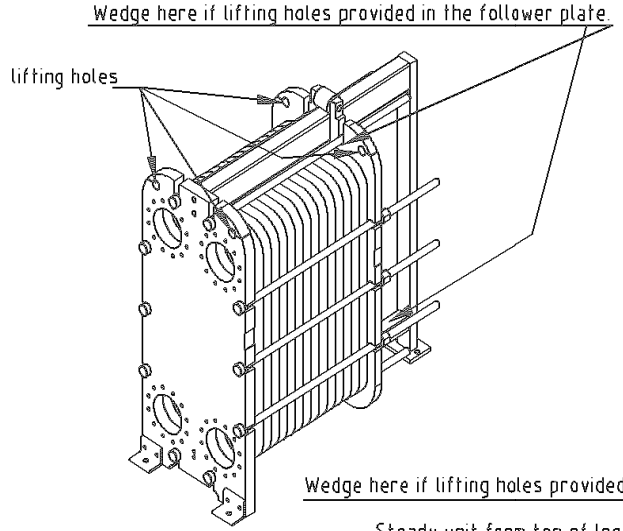
- From the follower / mobile frame plate unless wedges are blocked between the frame plate and the frame bars to prevent the plate from moving upwards.
- Lifting from the intermediate frame plates / connection grids (if fitted)
- Lifting from the tie bolts near to, and after, the follower / mobile frame plate.

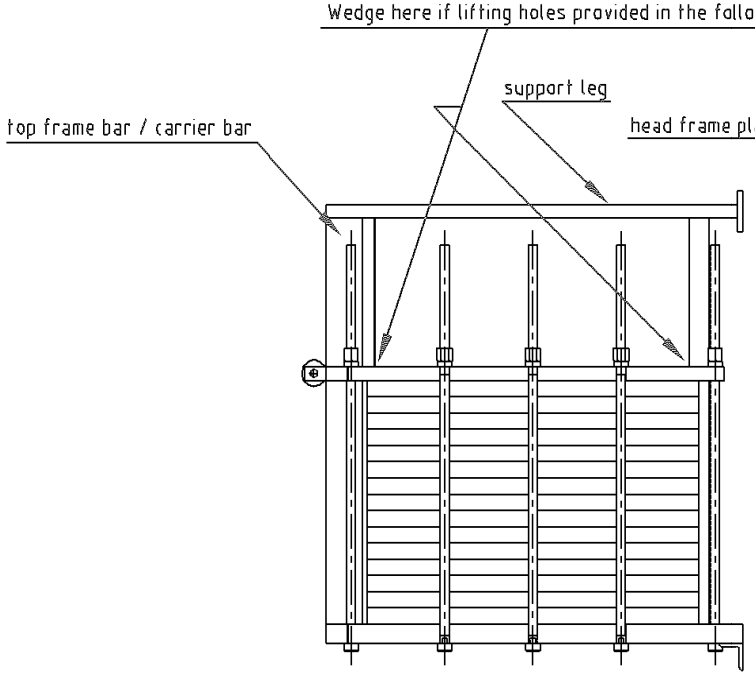
Removal from pallet base – large exchangers :

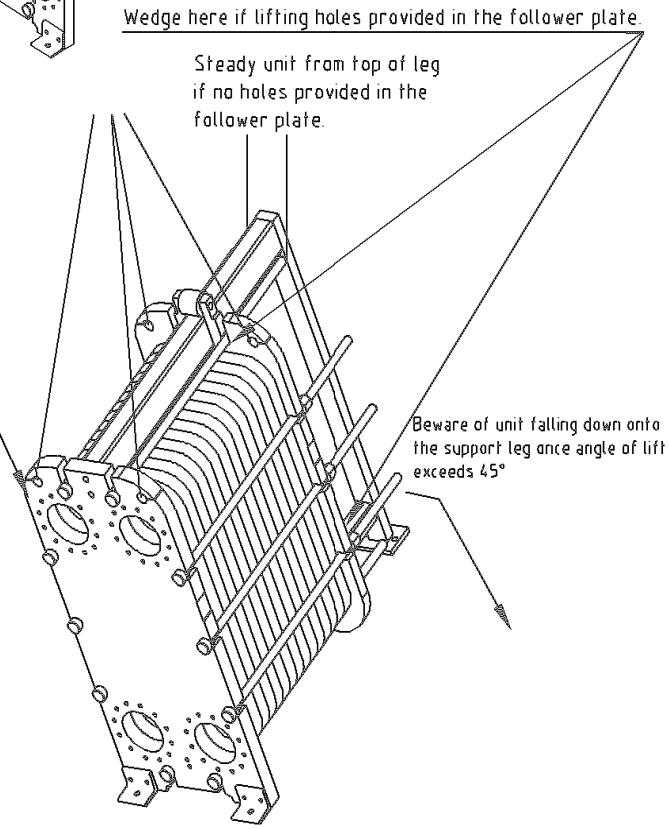
Two cranes are required for large units.

- Attach suitable lifting equipment to the lifting holes provided in the head frame plate. Commence lifting.
- When unit approx. 30 degrees angle stop lifting and check security of lifting equipment attachment points and tackle. Block under frame end that has been elevated.
- Attach tailing crane lifting equipment to top frame bar next to the support leg and lift to take up slack in the lifting equipment.
- Continue lifting using both cranes – the main weight should be taken by the device fitted to the head frame plate. The tailing crane should only be used to “steady” the unit and to prevent the heat exchanger from falling back down onto the leg foot.
- Once the angle of the exchanger has reached beyond 45 degrees, the tailing crane can then be lowered slowly in order to stand the exchanger up right into the correct position.
- Great care must be taken to ensure the safety of all personnel near to the exchanger whilst the unit is being lifted. It is essential to take all precautions necessary to prevent the exchanger from “crashing” down onto the support leg foot when the angle of lift exceeds 45 degrees.
- Once the exchanger is up right then it can be moved by attaching lifting equipment to the lifting holes in the head frame plate, and through the lifting holes in the follower frame plate. Before lifting, ensure that a wooden wedge is inserted in between the underneath of the top carrier bar and the follower frame plate. Alternatively, attach a strap around the top carrier bar to support the leg end of the exchanger whilst it is being moved.


lifting holes


Wedge here if lifting holes provided in the follower plate.
lifting holes


Wedge here if lifting holes provided in the follower plate.
support leg
top frame bar / carrier bar
head frame plate


Wedge here if lifting holes provided in the follower plate.
Steady unit from top of leg
if no holes provided in the
follower plate.
Beware of unit falling down onto
the support leg once angle of lift
exceeds 45°

General Instructions Continued:

Space :- Leave a minimum of double the width of the exchanger, either side of the unit, to allow for access to the bolts and for the easy removal of the heat transfer plates.

Thawing out :- Rubber gaskets that have been subjected to a low temperature during freight or storage can stiffen from the cold and should be "thawed" at approx. 20 C for at least 24 hours prior to use..

Leakage :- Gasketed plate heat exchangers have the potential to leak. Therefore to avoid damage to plant room floor, electrical conduits, etc., we recommend that a drip tray be placed underneath the plate pack.

Pipe work :- We recommend the following .....

1) that the pipe work is fully supported to avoid weight/forces acting upon the unit.
2) the fitting of flexible couplings if the pipe work is subject to vibration.
3) the fitting of flexible couplings if operating over 80 Deg. C. (to absorb expansion).
4) that the pipe work is completely flushed before attaching to exchanger.
5) the fitting of isolation valves to all pipe work to allow the PHE to be serviced without the need to drain down long lengths of pipe work..
6) the fitting of de-mountable elbow bends onto connections located on follower frame plate - this allows the follower plate to be pushed back fully along the frame bars – also, it allows the plate pack to be tightened further if necessary/possible without straining the connections.

Welding :- If pipe work is to be welded near to the exchanger, then do not use the unit as a grounding mechanism. Electric arcs can occur between the plates, which will damage both the plate material and the gaskets. Isolate the exchanger before any welding is carried out.

Filtration :- Mesh size recommended = no greater than 0.5 mm.

Connections:- **All connections on pipes must not be allowed to rotate -** Use two wrenches when attaching unions to threaded stub connections. One to tighten the union, & the other to prevent the stub end from rotating (avoids damage to gasket inside the unit which seals against the back on the stub connection).
Use a none hardening thread sealant for best results when attaching screwed unions, etc.

Flanged connections - If the connection nozzle hole is rubber lined, the liner will act as the flange gasket. Bolt the connecting flange directly to the endplate using the drilled & tapped holes provided. Tighten bolts evenly - do not over-tighten as this could strip the threads cut into the frame plate.

Bolt length – before bolting flanged connections directly to the head plate – CHECK to ensure bolts are not too long to avoid damaging the heat transfer plates in the pack. Bolts that are too long can cut through the back of the frame plate and piece the first number of heat transfer plates in the pack – this shall cause the unit to leak around the connection areas at start up.

If stand-off, or loose backing flanges are fitted to the exchanger, a suitable gasket is required to seal the flange.

Unless otherwise stated, the liquid circuits should be connected to flow in reverse directions through the exchanger (counter-current). Refer to Contract drawing, or quotation details, if the connections are not marked. See Fig. 1 for nozzle designation.

Vents & Drains- Not supplied with the PHE – these need to be installed to allow adequate venting and draining of the exchanger – locate vents and drains into the connecting pipe work as close to the exchanger as possible.

Safety :- If the unit is to operate above 60 Deg. C., or if it contains corrosive media, then consideration needs to be given to protecting nearby personnel. We recommend the fitting of protective screens / shields over the plate pack. Insulate hot surfaces as necessary.
Pressure relief valves – these should be fitted into both circuits

Steam units – it is good practice to fit vacuum gauges into the steam pipe work – consult a steam specialist for advise on selection and fitting of these devices.

3, Commissioning & Starting :-

Safety : Before starting

- Ensure that all safety checks have been made and that all protective screens and safety devices are in place and fitted correctly.
- Check that the maximum working pressure and temperature of the system do not exceed the values stated on the exchanger name plate or the design specification.
- Check that the liquids that are intended to be passed through the exchanger are all as per the design specification, and that they are suitable for the all wetted parts of the exchanger.
- Plate pack tightening – if the unit has been standing for some time before use, check the pack tightening dimensions. When the PHE leaves the factory, the pack is not always set at the minimum assembly measure. It is recommended that the pack is tightened down to its minimum setting (see sequence or data sheet for these dimensions) before use.

Shock :- It is essential that the exchanger is not subjected to thermal or mechanical shock Both water hammer & thermal shock can be avoided by not using fast acting control valves, therefore, sufficient consideration should be given to protecting the heat exchanger when designing the associated control systems.

Start up : Once the system has been completely filled, fully vent system & then close vent valves.

- Close isolation valves between pump & exchanger.
- Fully open valve fitted into return line from the exchanger.
- Start the circulation pump.
- ***Gradually*** open closed valve fitted to inlet line of exchanger.
- Vent circuit again if necessary.
- Repeat for other circuit(s).

Checks :- Check system pressure and temperatures do not exceed exchanger design specification
Check for leaks, pressure pulses, and ensure that all pump and air vents are closed.

Steam :- Use only slow acting control valves and mechanisms.

Before start up :-
a) ensure that the steam control valve is fully closed.
b) ensure that the exchanger is fully drained of condense.

- Start cold circuit first, then the steam side.
- Open steam control valve slowly - this prevents water hammer of any condensate in the steam line, and reduces the pressure / thermal shock to the exchanger.
- Ensure that the steam trap is correctly sized to allow full condensate discharge - this prevents water clogging inside the exchanger.

4. Shutting down the Exchanger :-

Warning Water hammer & thermal shock can damage the exchanger resulting in loss of fluid from one, or more, of the liquid circuits.

Shut down :

- SLOWLY close the control valve on the "hot" circuit whilst maintaining the full flow on the "cold" circuit.
- Switch off hot circuit pump.
- SLOWLY close the control valve on the cold circuit.
- Switch off the cold circuit pump.
- Close all isolating valves.

5. Opening the Heat Exchanger :-

Tools :- Good quality friction / ratchet spanners and ring or open ended spanners, plus light machine oil.

Safety :- Wear gloves – the edges of the plates are sharp. Other protective gear may be necessary depending upon the types of fluids in the exchanger (such as face and gas masks for ammonia exchangers)

Procedure :-

- Allow unit to cool, and clean off tops of plates (use brush or air line).
- Release all pressure from inside of exchanger by venting and draining in a safe manner according to the fluids that are contained within the exchanger.
- If fitted, remove the pipe work connected to follower frame plate, & the intermediate frame plates.
- Lightly oil tie bolt threads, and along top of frame carrier bar (upper most frame bar).
- Undo the clamping bolts uniformly - keep the frame plates as parallel as possible during this operation.
- Push / pull back the mobile frame plate away from plates pack & secure if necessary.
- Separate heat transfer plates carefully, avoiding damage to gaskets.

WARNING – on some frame models the heat transfer plates are supported by the lower frame bar as opposed to being "hung" from the top frame bar(DN65-2.5" & DN100 – 4" connection frames in particular). The plates can fall back when the follower frame plate is moved – take extreme caution when pulling back the follower plate on these models.
(This warning does not apply to any other frame types, especially those where the plates hang from the top frame bar).

Suggested bolt loosening sequence :- See Fig. 2 on next page

FIG. 1 : NOZZLE DESIGNATION

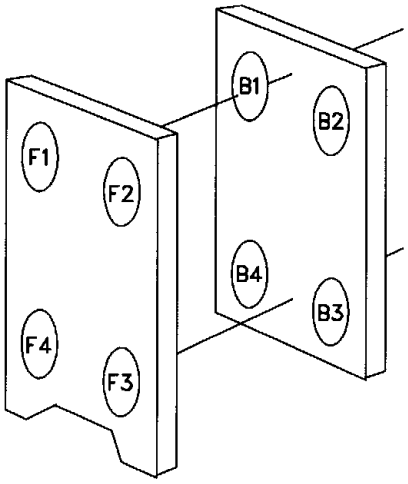


FIG. 2 : BOLT LOOSENING SEQUENCE

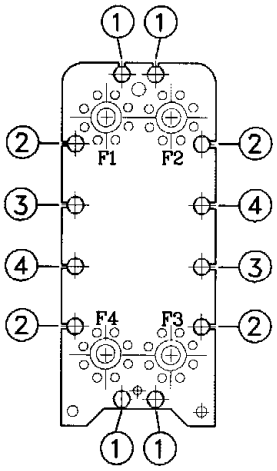
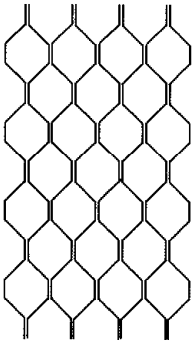
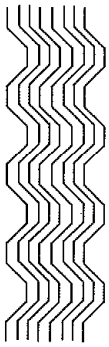


FIG. 5 :-
EXAMPLE OF THE PLATE HONEYCOMBE PATTERN.



CORRECT



WRONG !

FIG. 6 : TIGHTENING DIMENSION

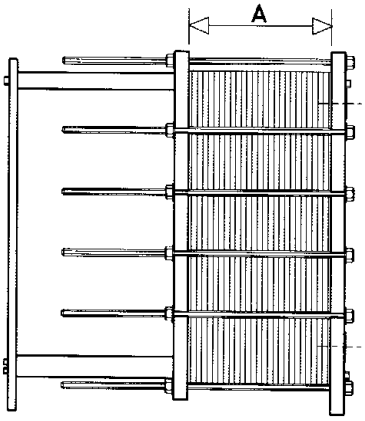


FIG. 7 : TIGHTENING SEQUENCE

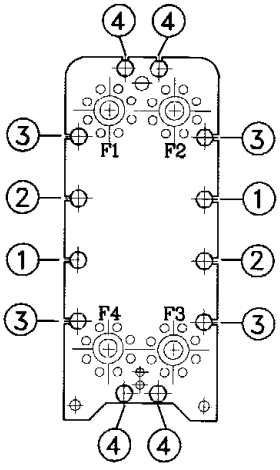
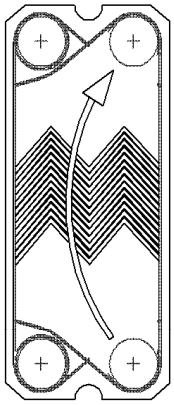
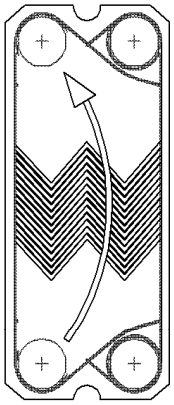


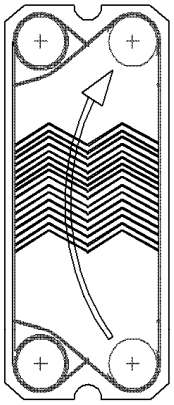
FIG 3: PLATES



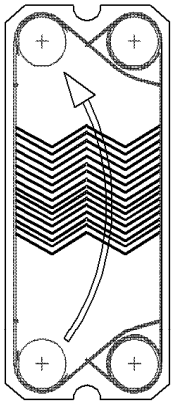
Code R1234 plate - Low
(right hand flow)



Code L1234 plate - Low
(left hand flow)



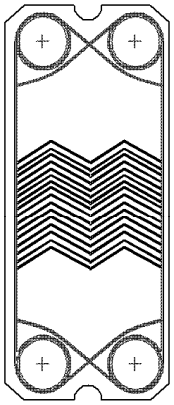
Code R1234 plate - High
(right hand flow)



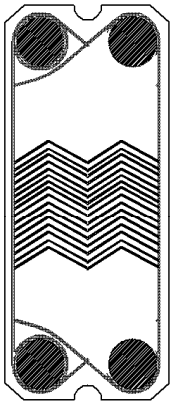
Code L1234 plate - High
(left hand flow)

Type Low Theta / Thermal short = long herringbone arrows

Type High Theta / Thermal long = short herringbone arrows



Start plate



End plate code 0000
(All ports blanked off)

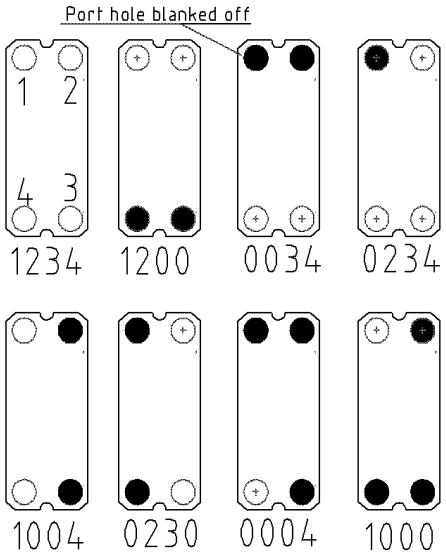


FIG 4: GASKETS

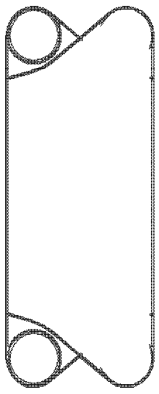
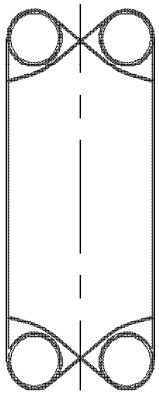
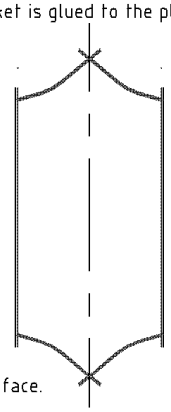


Plate gasket



Start plate gasket
(made up of 2 x half of plate gasket)
(this gasket is glued to the plate)



Alternative Start plate gasket
The O-ring sections have been cut off - this only applies when rubber lined connections are fitted, and the liners have an integral / moulded O-ring back face that fits into the gasket groove of the plate.
The start plate gasket O-rings are not removed if the rubber connection liner has a flat back face.

6. Cleaning of the plates :-

Safety :- Wear gloves & eye goggles when using cleaning detergents.

Brushing :- Use nylon or other types of "soft" scrubbing brushes with detergent. ***Never*** use a metal brush, steel wool, or sand/glass paper.

Gasket glue :- Removal – use Acetone. Alternatively, use an LP gas flame, heating the reverse side of the plate. Do not use any other type of gas which may produce a "harder" flame. A tank of boiling water can be used to soften the glue.

Detergents :- Consult a cleaning specialist for a suitable choice of detergent. Ensure that all detergents used are compatible with the plate and gasket material before use.

- **Oxide or chalk** deposits - use 2 to 5% nitric acid solution.
- **Organic, protein containing** deposits - use 2% solution of sodium hydroxide at temperature of 50 deg. C.
- **Grease** deposits - use neat kerosene, or an emulsifying agent (Jizer or Gunk).
- **Lime** deposits - 10% nitric acid soak at room temperature for 10 minutes, followed by a caustic soda wash.

C.I.P. :- If the solution requires recirculation, select a flow that is as high as possible, and certainly no less than the service or product flows.

Follow the instructions as given by the detergent supplier / cleaning specialist. We suggest that for recirculated cleaning detergent methods, the fluid should be pumped through the exchanger for no less than 30 minutes.

- **Milk** deposits - circulate 1.5% nitric acid at 65 deg. C. (2.4 litres of 62% HNO in 100 litres of water)
- **Organic or grease** deposits - circulate 1.5% sodium hydroxide (NaOH) at 85 deg. C. (5 litres of 30% NAOH in 100 litres of water)

Rinsing :- **After using any type of cleaning agent, always rinse thoroughly with fresh water. If cleaning in place, then circulate fresh water for at least 10 mins.**

"Rouging" This is a red, or if high temperatures are involved, a black, some times hard and shiny, coloured coating on the plate surfaces. This can only be removed by citric acid dipping as mechanical cleaning is not effective unless a polishing type machine is used. The coating is formed if high chlorides are present in the fluid being passed through the exchanger, and is actually part corrosion of the stainless steel plates. It is most likely that the plate surface shall become pitted, and passivation of plates is a necessity if the chloride levels cannot be reduced. However, continued use of the stainless steel plates in this environment shall lead to complete failure of the plates, and a plate pack replacement shall be necessary.

7. Plate types :-

Each plate is identified by the gasket arrangement, the number of port holes open, and the angle of the pressing.

Example plate code:- L1234 High

L	=	Left hand flow (No gasket O-rings around port holes on the left hand side of the plate).
1234	=	All port holes open
High	=	Thermal length / theta type of the plate (angle of the pressing).

See the Fig 3. for further examples of plate types.

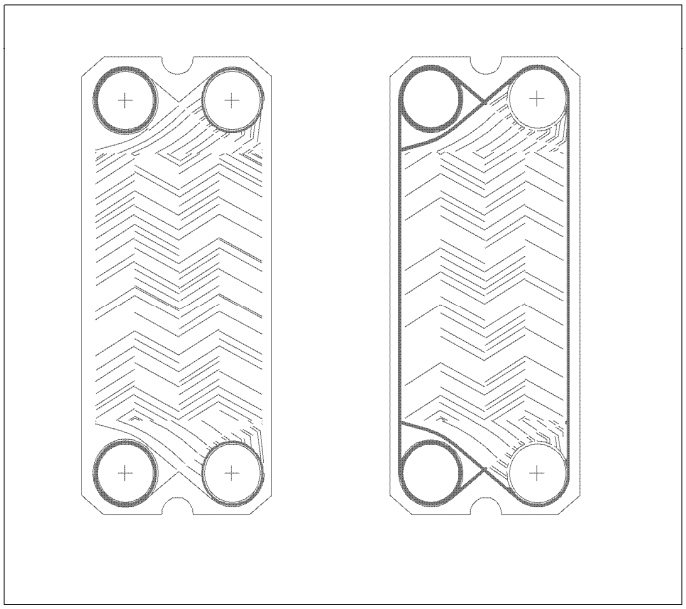
A left handed plate and a right handed plate are effectively the same, except, one is rotated 180 degrees to the other.

The plates are always arranged in the pack so that they alternate between left & right handed plates.

If any of the plates become damaged, these can be removed, however, in order to respect the alternate handed plate rule, if a damaged plate is to be removed and not replaced, then the next plate in the pack must also be taken out (this shall be opposite handed to the damaged plate).

Double Wall Plate Types

Double wall plates have the same appearance as the “standard” single wall plate types



Left hand plate view: “Back” plate with 4 x O-rings fitted
Right hand plate view: “Front” plate with flow gasket fitted

The back plate locks in behind the front plate.
The 4 x O-rings provide the seal between the front & back plate around the port holes.

Other types have 2 x rings – the two plates lock into each other and the thicker O-rings act as the ring sections of the gasket as shown in the right hand view (the ring section from the main gasket having been removed first so that the thicker/separate rings can replace this removed section)

Some types are not fitted with O-rings, instead the plates are laser welded together around he O-ring seal would have been placed. These have standard plate gaskets fitted.

8. Gaskets :-

See Fig. 4 for gasket types.

O-rings :- Where these are fitted, the flat side of the gasket is fitted into the circular gasket groove. If the O-ring is not flat on one side, then the thinnest part / side of the ring should be located into the gasket groove. It may be necessary to apply a small amount of gasket glue, or "Locktite" to hold the O-ring in place whilst the plate pack is being assembled.

For double walled plates fitted with O-rings located between each pair of plates - the O-rings are around each port hole and prevent liquid from entering into the gap between the plates. These rings are glued into position. Use adhesive sparingly when attaching these rings to the plates and ensure that they are located central inside the circular gasket groove in the plate around each port hole. Adhesive only needs to be applied to one plate (usually the "back" one as opposed to the "front" one) out of the pair of double walled plates. The adhesive is only applied to hold the ring in place during assembly. There are four O-rings per pair of plates.

Plate gaskets :- If the gaskets are to be replaced, ensure that the same plate port holes remain "open" as with the old gasket. If a number of gaskets are to be replaced, and the plates have been cleaned so the outline of the old gasket has been removed, then before attaching the gaskets, stack the plates with all of the pressing / herringbone patterns face in the same direction - the "arrow heads" facing towards you. Fix all gaskets to the plates so that the two port holes on the right hand side of the plate are surrounded by the gasket O-rings.

Adhesive :- Chlorine free glues only, such as Pliobond 20 or 30, Bostic 1782, 3M EC 1099, Scotchgrip 847, and Bond Spray 77.
Use adhesive in a well ventilated area and wear gloves to prevent skin contact with the glue.

If no instructions are provided by the adhesive manufacturer, then we suggest that a thin layer of glue is spread into the plate gasket groove, using either a narrow paint brush or a syringe. Contact adhesives also require a thin layer of adhesive to be applied to the flat faced side of the gasket. Check that, once stuck, the gasket will be correctly positioned, then fix the gasket to the plates, ensuring that all parts are seated into the gasket grooves, with no parts of the gasket stretched or "bunched".
Stack the plates, and leave to set. Warm oven curing accelerates the drying process.

Snap in types :- These require no adhesive - they are located by pushing the gasket fully down into the gasket groove, or by pushing the gasket lugs through holes in the plate (depending on type)- some of the lugs may need to be pulled through by using thin nose pliers to ensure correct seating.

Snap in types :- These are fitted with "clips" made up of two or three prongs. These locate around the outside edge of each plate.

Rubber liners :- If the rubber frame plate nozzle liners have an O-ring moulded into the liner itself, then this moulded O-ring fits into the gasket groove in the first heat transfer plate. Therefore, if new gaskets have been fitted, the O-ring portion of the plate gasket around the plate port holes shall have to be cut off and removed prior to assembly back into the frame. The start plate gasket then shall look like the lowest diagram in **FIG. 4**
NOTE – if there is no moulded ring in the back of the liner (the liner in this case would be thin and flat) then the start plate gasket would remain in tact as per the middle sketch in **FIG. 4**

Start plate :- These are usually made up of 2 flow plate gaskets cut lengthways in half (See FIG 4). They are usually glued into place – even if the other plates are adhesive free. Ensure that when preparing the start plate gasket, all lugs and webbing are cut off to allow the start plate to sit flat against the back of the frame plate. Units with rubber lined ports require the O-ring portion to be removed from the start plate gasket – see note above.
Start plate gaskets for gasket systems that are either snap in or the clip on type are usually supplied with the start plate gaskets glued into place.

9. Plate Pack Assembly :-

Safety :- Wear gloves – the edges of the plates are sharp.

Plates :- These must be clean, dry, and free from oil or grease. If there are any oil deposits on the gaskets, or on the gasket seating area, then there is a strong likelihood that the plates shall slip out of place when the unit is being tightened.
If the gaskets are contaminated with dirt, or grit, then these can cause leakage.

WARNING – on some frame models the heat transfer plates are supported by the lower frame bar as opposed to being "hung" from the top frame bar(DN100 – 4" connection frames in particular). The plates can fall back when they are loaded into the frame – therefore an assistant may be required to hold the plates in the frame until the follower plate can be pushed forward.

Assembly :-

- Refer to the Plate Sequence Sheet to determine the order of the plates, & the type required.
- Fit the start plate (see Plate Type Diagram), ensuring the plate pattern is pointing in the correct direction. If rubber liners fitted into the head frame plate then check to see that the O-ring portion of the plate gasket around the port holes which locate against the liner have been removed.
- Fit plates according to the Plate Sequence Sheet on some frames (not IS or FS type), it is sometimes necessary to ensure that the plates do not fall backwards during pack assembly operation.
- Ensure all gaskets face towards the fixed / head frame plate (unless stated other wise in the Plate Sequence Diagram), and ensure all gaskets are seated correctly and that all location tabs are correctly attached.
- Alternate between left & right handed plates - if the plate edges form a regular honeycomb pattern, then the left / right hand sequence is correct (see Fig. 5).
- Check that all plates are hanging correctly – knock down on the top of the plates gently if some are out of line.

10. Tightening of the plate pack :-

Procedure :-

- Lightly oil tie bolt threads. Do not allow oil or grease onto the gaskets or the gasket seating faces on the back of the plates. Wet or oil contaminated plates can become misaligned during tightening. In the event, dismantle, clean, and dry all areas in contact with the gaskets.
- Evenly tighten all bolts. We recommend the use of ratchet spanners.
- Ensure clamping is as uniform as possible, thus keeping the frames plates parallel throughout the operation. Avoid skewing the frame plates by more than 10 m.m.
- Check to ensure that no plates have lifted out of line.
- Tightening is complete when the distance between the inside faces of the two frame plates equals the "A" dimension as shown on the contract drawing.
- Finally check that all bolts are in tension, and clean any spilt oil off the frame plates.
- On completion, the unit can be pressure tested (at the **working** pressure only).

See Fig. 6 for "A" dimension example.
See Fig. 7 for suggested bolt tightening sequence.

Warning: - Do not tighten the plate pack less than the minimum tightening dimension as given on the contract drawing/ sequence sheet. Over compression will damage both plates & gaskets. Always check that the number of plates actually fitted is correct because the tightening dimension is calculated by use of the following equation :-

Tightening dimension = No. of plates x (plate thickness + coefficient)

The coefficients vary depending on the model type. Contact the Sales Offices for the correct coefficient to use if the Contract Sequence Sheet is not available.

EPDM gaskets:- This material is harder than nitrile, therefore, has to be compressed for the first time gradually – otherwise, the plates can distort around the region surrounding the port holes. This only applies to plates with port holes of 100 mm and above, and a thickness of less than 0.6 mm.

Compression 1: minimum tightening dimension + 15% - leave for 2 hours
Compression 2: minimum tightening dimension + 7.5% - leave for 12 hours
Compression 3: tighten down to either maximum tightening dimension or alternatively the minimum.

Minimum tightening measure:- If not set at this measure in the first instance, then it is recommended that the pack is tightened down to this setting after approx. one month in operation, or after opening the pack without changing the gaskets.

11. Trouble Shooting :-

Assembly /Dismantling :-

1)	Nuts tight to turn on assembly	:- insufficient oil on threads
	Nuts tight to turn when dismantling	:- pressure still inside unit – isolate, drain & vent
2)	Plates move out of alignment	:- remove plates & degrease, then dry.
		:- inspect plate hanging system for damage.
3)	Plates riding up during tightening	:- loosen pack, knock down, re-tighten with top of frame plate slightly in further than bottom. Even out when close to assembly measure.

Excessive pressure drops :-

1)	Liquid flows higher than design	:- check & adjust
2)	Plate channels blocked	:- back flush, C.I.P., or dismantle to clean.
3)	Inaccurate measurement	:- check pressure gauge for accuracy
		:- ensure measurement does not include any bend, valve / fitting, & pipe run losses.
4)	Liquid temp. below design.	:- viscous media generate higher resistance to flow at lower temperatures.
5)	Media used not as per design	:- the addition of glycol or other additives can increase the pressure drop.

Leakage :-

1)	leakage near connection	:- check condition of nozzle liner (if fitted).
		:- check condition of O-ring gaskets on first plate (O-ring can be damaged or pulled out of seat if connection has been rotated).
		:- check the flange gasket (if fitted).
		:- check the stub connection backing flange for splits
		:- For flanged units – check length of bolts used to bolt flanges directly to the head plate – bolts that are too long can cut through head plate and pierce the first heat transfer plates in the pack. Isolate, drain down, remove flange bolts that are too long and replace for shorter ones, replace pierced plates, and re-assemble.
2)	cross contamination	:- check all plates for cracks and / or holes.

3)	leakage from plate pack	:- check tightening dimension – tighten to minimum. :- check condition of the gaskets. :- check that all gaskets are seated correctly. :- Double wall plates – check plate O-rings or weld
4)	Leakage between plates	:- Double wall plates - O-ring failed – replace ring, or replace plate pair if welded type. :- Double wall plates - crack or hole in plate

For nearly all leakage problems, it shall be necessary to dismantle the unit before any attempts to rectify the fault can be made. Mark the area(s) from where the leaks are occurring before taking apart the exchanger.

"Cold leakage":- Caused by a sudden change in temperature. The sealing properties of certain elastomers are temporarily reduced when the temperature changes suddenly. No action is required as the gaskets should re-seal after the temperature has stabilised.

Gasket failures are generally a result of :-

1) old age
2) excessive exposure to ozone
3) high operating temperature - above the temp. limit of the material.
4) exposure to pressure surges.
5) chemical attack
6) physical damage - resulting from poor assembly practise, or damage resulting from a misaligned plate (check the hanging system at the top of the plate for distortion).

Decrease in the performance :-

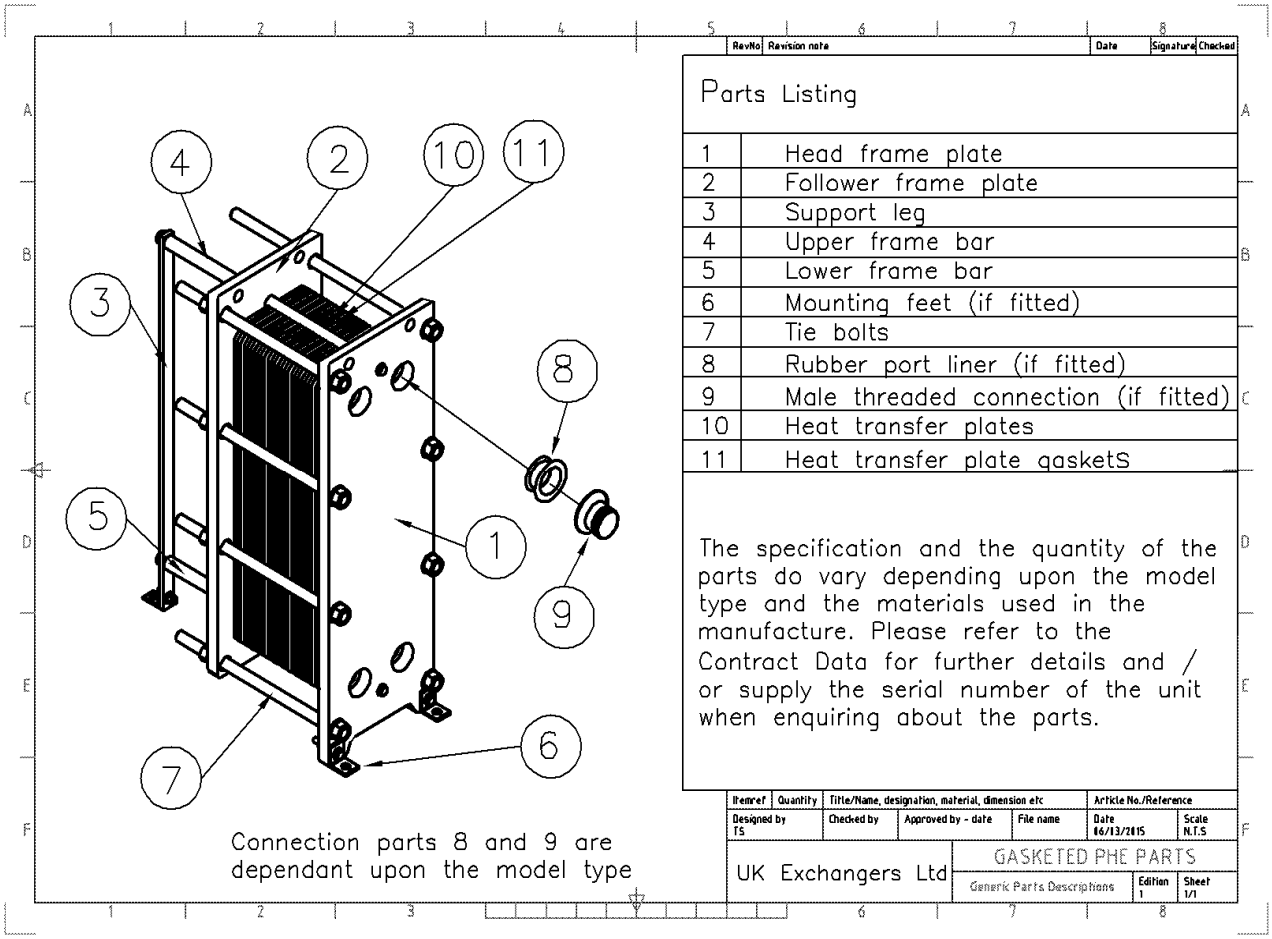
1) plate surfaces require cleaning or de-scaling.
2) pumps or associated controls have failed.
3) plate channels blocked.
4) liquid flows not as per the design specification.
5) associated chiller / cooling tower / boiler under sized.
6) cooling water flow temperature to the exchanger is higher than design.
7) heating media temperature lower than design figures.
8) steam flow not sufficient - control valve malfunction.
9) steam trap broken or jammed - this can cause the unit to become filled with condensate.
9) plate pack has been assembly incorrectly.
10) unit running in co-current flow, instead of counter current - check with contract drawing and alter pipe work if necessary., and check direction of pump flows.
11) air lock has developed in the plate pack.

12. Maintenance :-

Time interval :-	Once a year as a minimum.
Performance :-	check temperatures and flows against commissioning data.
Plate pack :-	check the tightening dimension, and look for any signs of leakage. Tighten down to the minimum assembly measure if not already at this measure.
Nozzles :-	check general condition, and for any signs of leakage.
Frame :-	wipe clean all painted parts, and check surfaces for signs of damage - "touch up" if necessary.
Bolts & bars :-	check for rust, and clean. Lightly coat threaded parts with molybdenum grease, or a corrosion inhibitor (ensure that no grease, etc. falls onto the plate gaskets).
Rollers :-	if fitted to the follower frame plate, lubricate bearings with light machine oil.

13. Spare Parts :-

To help identify the unit, it shall be necessary to quote the serial number as given on the nameplate.
Replacement parts and other information can be obtained from :- **spares@ukeltd.com**



UK Exchangers Ltd, Unit 55, Stilebrook Road,Olney, Buckinghamshire, MK46 5EA
Tel: 01234-244320 Fax: 01234-714976 E-Mail: spares@ukeltd.com

APPENDIX 4

Pump servicing schedule

Sump 3

Description
Well Depth
Well Dia
Well Head
Manifold
Gas Pipe Dia

Throttle Valve
Monitoring Point
Pump Type
Pump Depth
Pump Counter
Air

Date	Well Depth	Pump Depth	Dip 1 after taken pump out	Time Taken Out	Dip 2 before pump back in	Time Put In	Pump Depth	Pump Type, Top / bottom loader	Pump Serial Number	Fitter /Repairer

GW66

Description	**Throttle Valve**
Well Depth	**Monitoring Point**
Well Dia	**Pump Type**
Well Head	**Pump Depth**
Manifold	**Pump Counter**
Gas Pipe Dia	**Air**

Date	Well Depth	Pump Depth	Dip 1 after taken pump out	Time Taken Out	Dip 2 before pump back in	Time Put In	Pump Depth	Pump Type, Top / bottom loader	Pump Serial Number	Fitter /Repairer

APPENDIX 5

Monitoring protocol

APPENDIX 5 – LEACHATE SAMPLING PROTOCOL

Equipment and maintenance

Any equipment used in the monitoring of water or leachate will be serviced and maintained in accordance with the manufacturer's recommendations. It shall be inspected prior to each monitoring round and replaced periodically as required to prevent issues relating to equipment deterioration.

A log of maintenance will be kept by the site operator

Leachate sampling protocol

Before leaving the office:

(i) Check the requirements of the monitoring visit – number and type of samples to be taken, type of measurements and records to be made and recorded
(ii) verify the sampling bottle requirements and label with site name, date, sample location and technician initials.
(iii) Ensure any required equipment is clean and in good working order
(iv) Obtain any keys or tools required to gain access to the sampling points and ensure clean water is available for flushing sampling equipment between samples
(v) Ensure you have the correct Personal Protective Equipment as per site risk assessments, including as standard: safety glasses, protective gloves, high visibility clothing and protective footwear.

On site:

(i) Record in the site diary date, locations monitored, sampling equipment and method used, name of technician and on-site weather conditions;
(ii) During the course of the monitoring visit a visual inspection of the site and its surroundings should be made making a note of any vegetation dieback or leachate outbreaks.

At the sump:

(i) Record any damage to manhole/headworks
(ii) Dip the leachate from cover level and record the depth to the top of the leachate and the base of the manhole.
(iii) Samples shoud be taken using a Teflon bailer or stainless steel sample cup used only for sampling of leachate. The bailer should be marked LEACHATE ONLY.
(iv) The bailer/sampling can will be flushed out in between sample locations
(v) Take any field readings required
(vi) Transfer the sample from the bailer into the bottle provided and clearly labelled with the location code, date, site name and technician initials. Fill the bottle to the brim to exclude air unless otherwise specified
(vii) Samples should be placed in an appropriate container (e.g. cool box) and transported to the laboratory within 24 hours.

At the effluent discharge point:

(i) As above, samples should be taken using a stainless steel sample cup used only for sampling of the treated effluent. The dedicated equipment should be marked TREATED EFFLUENT ONLY.
(ii) The sampling can will be flushed out between samples to prevent cross-contamination
(iii) Transfer the samples from the can into the bottle provided and clearly labelled the site name, location name, date and technician initials.
(iv) Samples should be placed in an appropriate container (e.g. cool box) and transported to the laboratory within 24 hours.
(v) All daily field samples (temperature, ammoniacal nitrogen, pH and daily volume) should be carried out at approximately the same time on each calendar day. The results will be recorded and kept safe within the site's electronic file system.

Reporting the results:

(i) Any problems noted as part of the visual inspection during the sampling procedure will be recorded in the site diary and the Site Manager will be informed.
(ii) Once the laboratory analysis reports are received, import data into the site operator's database, check for any breaches in trigger levels and inform the Site Manager if any are noted. A report should be printed and distributed to NRW within one month of receipt of the laboratory test results and a copy kept on the site file

APPENDIX 6

Contingency Plans

Caulmert Limited

Engineering, Environmental & Planning
Consultancy Services

Bryn Posteg Landfill Site

Potters Waste Management

Leachate Treatment System

Contingency Plan

Prepared by:

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Document Reference: 2233.1.POT.ÅKS.JDM.A1

May 2015

BRYN POSTEG LANDFILL SITE
LEACHATE TREATMENT SYSTEM:
CONTINGENCY PLAN

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

1.1.1 The leachate treatment plant at Bryn Posteg operates as a CSR activated sludge biological treatment plant. It is undergoing an improvement programme during 2015 to ensure its continuous operation, in particular during the winter months.

1.1.2 This plan outlines the actions to be taken, should the process deviate outside of its normal operating parameters.

1.1.3 This Action Plan will be subject to review and update, with points added and expanded upon as the leachate plant is upgraded. A full review of the Action plan will be undertaken in 12 months' time.

1.0 ACTION PLAN

1.1 General

1.1.1 The leachate treatment plant at Bryn Posteg treats leachate from the landfill site and discharges the treated leachate to the wastewater treatment works at Llanidloes under a Discharge Consent to Severn Trent Water. (006247V)

1.1.2 Should the leachate treatment plant fail in its operation, there is a risk for adverse environmental impact and/or a breach of discharge consent conditions. The table on the next pages lists potential failures and actions to be taken to rectify and return to normal operating conditions. Table 2 below contains necessary contact details.

Table 1 Action Plan

Item No	Nature of Failure	Indicating Parameter	Risk	Immediate Action	Once failure is rectified
1	Pumping of raw leachate to treatment plant fails	Leachate does not enter LTP – observed by site personnel near the LTP and/or via CCTV	Pipe failure – risk for environmental pollution	Fault finding: Stop pumps. Walk the pipes, look for leaks. If pipe leak is found, do immediate leak impact assessment: Contain leak. If impact beyond the site boundary, contact Environmental Compliance Manager. Contact NRW. Send Schedule 6 notification if required.	If leak has had an impact beyond the landfill, establish a remediation and monitoring program on affected water (surface/groundwater)
			Sump pump failure – no adverse impact	Replace faulty pump	Resume operation
2	Leachate Lagoon Aerator(s) stop working	Leachate lagoon not "bubbling". Visible by site personnel nearby and on CCTV	Activated Sludge will become inactive. Biological treatment ceases.	Stop pumping raw leachate. Stop Discharge to sewer Fault find: Electrical fault – ring electrician	Resume aeration. Monitor ammoniacal nitrogen concentration. Start discharging to sewer when treatment efficiency is re-established, and discharge consent parameters are met
			If long period before restart,	Once repaired – restart aeration.	If plant is reseeded, enter

Item	Nature of Failure	Indicating Parameter	Risk	Immediate Action	Once failure is rectified
			the activated sludge may die.	Monitor ammoniacal nitrogen concentration. If biological treatment does not resume within 48 hours, organize reseeding of the plant. Organise tankering of leachate off-site and/or use holding lagoon if required during re-start of plant.	start-up phase (slow increase of feed and discharge volumes, increase monitoring and surveillance)
3	Heat exchanger stops heating. Temperature has an adverse impact on the treatment capacity	Temperature readings, increase in ammoniacal nitrogen concentration	Breach of discharge consent.	Stop pumping raw leachate. Stop discharge to sewer Repair heating Organise tankering of leachate off-site and/or use holding lagoon if required. Inform NRW. Send Schedule 6 notification if required.	Continue aeration. Once heating is restored, and ammonia concentrations are within discharge consent levels, resume normal operation and discharge.
4	Failing probes in discharge tank	Erroneous reading (out of normal operating limits)	Disruption of leachate treatment	Re-calibrate/repair probes. Use field kit to analyse parameters until probes are functioning. Only discharge to sewer if other analyses confirm that discharge consent parameters are achieved.	Once operating parameters are within normal range, resume normal operation and discharge.

Item	Nature of Failure	Indicating Parameter	Risk	Immediate Action	Once failure is rectified
				Organise tankering of leachate off-site and/or use holding lagoon if required.	
5	Accidental discharge of untreated/not sufficiently treated leachate	Elevated ammoniacal nitrogen, SS	Breach of discharge consent.	Stop discharge to sewer immediately. Contact STW. Investigate reason. Inform NRW. Send Schedule 6 notification.	Once operating parameters are within normal range, resume normal operation and discharge to sewer.
6	Overfeeding of leachate treatment lagoon	Increase in ammoniacal nitrogen concentration, increased demand of alkalinity, foaming at lagoon	Stress of active sludge, potentially inhibit/killing off sludge.	Stop pumping raw leachate. Stop discharge to sewer. Continuous aeration. If biological treatment does not resume within 48 hours, organize reseeding of the plant. Organise tankering of leachate off-site and/or use holding lagoon if required.	Once operating parameters are within normal range, resume normal operation and discharge to sewer. If plant is reseeded, enter start-up phase (slow increase of feed and discharge volumes, increase monitoring and surveillance)
7	Overtopping of lagoon	Float level alarm. Leachate overtopping out onto the landfill. Visible by site personnel nearby and on CCTV	Environmental contamination	Stop pumping raw leachate immediately. Contain spill and prevent further contamination. Use holding lagoon as additional storage if required.	Once pumping failure has been rectified, resume normal operation and discharge to sewer. If leak has had an impact

Item	Nature of Failure	Indicating Parameter	Risk	Immediate Action	Once failure is rectified
				Organise tankering of leachate off-site, if required. Inform NRW. Send Schedule 6 notification.	beyond the landfill, establish a remediation and monitoring program on affected water (surface/groundwater)

1.2 Contact Details

1.2.1 Table 2 contains contact details for relevant persons and organisations, that may need to be contacted should the leachate treatment plant fail or fall outside of normal operating parameters

Table 2: Contact Numbers

List of Contacts	
Potters Environmental Compliance Manager	01686 4120430- 24hr site contact 07970 190529 – David Williams
Severn Trent Water, Llanidloes WWTP	24hr Emergency Number 0800 783 4444
Natural Resources Wales	24hr incident line 0800 807060
Emergency Services	999
Sludge Tanker (Severn Waste Serivces)	01686 835046 / 625577
Tanker for raw leachate for treatment elsewhere (Severn Waste Serivces)	01686 835046 / 625577
Pump & Plant Services	0176 766099
Electrician Carl Lewis	07786 256067

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