SECTIONXXXX

UNI-CENTRAL -DOUBLEFOLD SEAMED- BIO DIGESTER TANKFORBIOGASDIGESTION

PART1–GENERAL

1.1 SUMMARY

A. Section includes: Double fold seamed digester with platforms, complete metalfabrications, Two part beam &stainless steel membrane roof, foundation (engineering only), including mixing and heating perDrawings.

B. Furnish and erect one aboveground double seamed connected anaerobic digester made of"Verinox",includingfoundation,tankstructure,andtankappurtenances as shown on the Contract Drawings and described herein. The digester shall bedesigned to treat and store sludge at mesophilic temperatures (around 100°F). Digester shall include mixing and heating (heating except for winter conditions) and have access ladders and platforms toallow for access totank.

C. The tank assembly process: Double-Seam System

The principle of the LIPP Double-Seam-System is as follows: the edges of steel strips are folded over together twice, connecting them together in such a way that even aggressive liquids inside the tank cannot find any surfaces to attack. The result: corrosion is prevented and maximum leak-tightness is achieved and an increased mechanical strength of the overall structure. Also, it produces a smooth inner tank surface, which allows for enhanced sludge mixing (Figure 2).

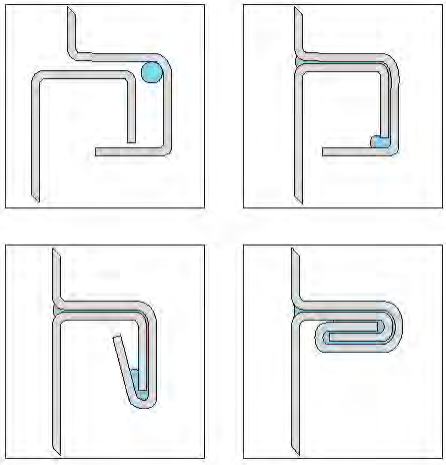


Figure 1: Schematic of Lipp's Double-Seam System. The blue dot represents a sealant placed to further ensure gas and water tightness of the double seam system.

The transportable assembly equipment, enables Verinox coils to be made into tanks in the desired size and with a variable diameter on site, at any location. A tried and tested, optimally automated production method permits fast, flexible and efficient construction and requires minimal installation space.
Steel coils, machines and accessories are transported to the building site where the tank is then constructed on a previously built flat concrete slab. This assembly equipment consists of a profiling and a folding machine installed in series (Figure 3). The mostly automated assembly is done in a top-down approach, starting with the construction of the dome, and finishing with the bottom of the walls (Figure 3, Figure 4).

Figure 2: Verinox coils composition, geometry and assembly

D. VERINOX stainless steel is a patented, award-winning combination material that offers the properties of high-quality stainless steels, 316Ti or 904L and the structural advantages of galvanized steel and has been in use since more than 30 years. It combines a stainless-steel band and a hot-dip galvanized steel band joined with a connecting band (Figure 1). Stainless steel provides an enhanced resistance to corrosion whereas galvanized steel provides mechanical strength to the structure.
By default, 1.4571 (316Ti) stainless steel grades will be used as minimum grade in the digester.

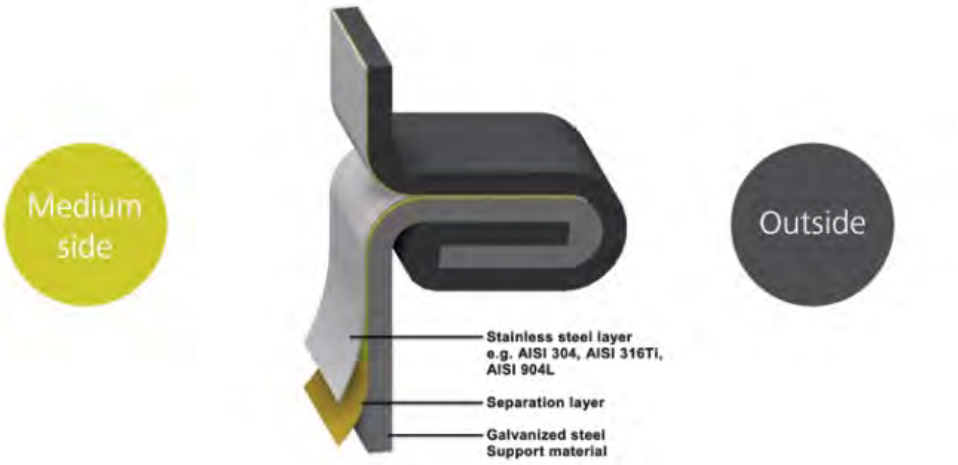


Figure 3: Schematic of the 3 different layers composing the Verinox material. “Medium side” represents the inside of the digester.

E. Allrequiredlabor,materials,andequipmentshallbeincluded.

F. Tank will be insulated and wrapped with painted steel cladding. The exterior tank color shall beselected byPlantStaff frommanufacturer’sstandardcolorpalate.

G. RelatedRequirements:

1. RefertoReportofGeotechnical InvestigationpreparedbyMaterialsTestingConsultants,Inc.,dated_____,andanyaddendumsinAppendix A oftheseSpecifications.

1.2 COORDINATION

A. Coordinate WorkofthisSectionwithlocationandplacementofutilities,piping,andtankfoundation.

1.3 SUBMITTALS

A. SectionXXXXXSubmittalProcedures:Requirementsforsubmittals.

B. ProductData:

1. Submitdataforexpansionjointfittingsandotherpipespecialtyfittings.
2. Submitdataforladderandladdersafetydevices.
3. Submitinformationconcerningmaterialsofconstruction,fabrication,andcoatings.

C. ShopDrawings:

1. Indicate:

a. Completeplan,elevation,andsectionalDrawingsshowingcriticaldimensions.
b. Structural plate foundationand retainingwall concretereinforcement and supportmembersizes andthickness.
c. Weldtypesandsizes.
d. Beam roof assembly &Stainless steel flat membrane pressure cover
e. Supplyandconnectionpipingdetails,includingfittings,expansionjoints,pipesupportmethods,etc.
f. Ladderandladdersafetydevicedetails.
g. Handraildetails.
h. Accesshatchdetails.
i. Roofdetails.
j. Accessoriesdetails,includingladders,cages, and top platforms.

D. Manufacturer'sCertificate:

1. Certifythattanksandappurtenancesmeetorexceedspecifiedrequirements.
2. Owner Installation Certificate: Obtain from equipment manufacturer's representative andsubmit, attesting that equipment has been properly installed and is ready for startup andtesting.

E. DelegatedDesignSubmittals:SubmitsignedandsealedShopDrawingswithdesigncalculationsand assumptions fortankstructuralcalculations.

F. TestandEvaluationReports:

1. SubmitInstallationCertificatefromequipmentmanufacturer'srepresentative.

G. ManufacturerInstructions:Submitdetailedinstructionsoninstallationrequirements,includingtankcomponent handlingprocedures,anchoring, andlayout.

H. SourceQuality-ControlSubmittals:Indicateresultsofshoporfactorytestsandinspections.

I. FieldQuality-ControlSubmittals:IndicateresultsofContractor-furnishedtestsandinspections.

J. ManufacturerReports:Certifythattankshavebeeninstalledaccordingtomanufacturerinstructions.

K. QualificationsStatements:

1. Submitqualificationsformanufacturer,erector,andrequiredlicensedprofessionals.
2. Submitmanufacturer'sapprovaloferector.

L. SubmittalDrawingsandSpecifications:

1. The Tank Manufacturing, Construction, and Assembly shall be governed by the TankSupplier's and then the Owner's drawings and specifications showing general dimensionsandconstructiondetails.Afterwrittenapprovalbytheclients Engineeroftheir detailederectiondrawingspreparedbythetankbidder, manufacturing of material can start.Thereshallbenodeviationfromthedrawingsandspecifications,except uponwrittenorderfromtheEngineer.
2. The Bidder is required to furnish, for the approval of the Engineer and at no increase inContractprice,threesetsofcompletespecificationsandconstructiondrawingsforallworknot shown in complete detail on the Bidding Drawings. A complete set of structuralcalculations shall be provided for the tank structure and foundation. All such submissionsshall be stamped by a Licensed Professional Engineer licensed in the state of New York,as well as by a Licensed Professional Engineer or Structural Engineer employed on thetank manufacturer's engineering staff. Where the tank manufacturer's P.E. is licensed inthestateofNew York, onlyonestampis required.
3. The tank manufacturer's and installing contractor's standard published warranty shall beincludedwithsubmittal information.
4. The tank manufacturer shall include a standard Operation and Maintenance Manual at the substantial completion of the tank assembly as well as a set of"As built Drawings".

1.4 QUALIFICATIONSOFTANKSUPPLIER

A. Engineer'sselectionofthedoublefoldseamedVerinoxstoragetankconstructionforthis facility has been predicated upon specific criteria, construction methods, and an optimumcoating for resistance to internal and external tank corrosion. Deviations from the specifieddesign,construction,or coating detailswill not be permitted.

B. The bidder shall offer a new Digester tank structure as supplied from a manufacturer specializing in thedesign, fabrication, and erection of a double fold seam connected galvanized carbon steel / stainless steel plate.This galvanized plate shall be lined with 316Ti Stainless steel plate that is applied in a controlledfactory setting. The completed rolls shall be factory inspected and shipped to the Job Site for tankerection.

C. Strict adherence to the standards of design, fabrication, erection, product quality, and long-termperformanceestablishedinthisSpecification willberequiredbytheOwnerandEngineer.

1.5 QUALIFICATIONSOFTANKBUILDER

A. The tank builder shall be a company in good standing with the local state where tank is to beconstructedandshallcomplywithallapplicableOSHAstatutes.

B. The tank builder shall be experienced in the construction of the specified tank and shall becertified by the tank manufacturer as an authorized and certified builder and shall use the double fold assemblymachine in order to conduct plate seam folding to assemble the tank sidewall as designed.

C. Buildingcrewsshallcomplywiththetankmanufacturer'srequirementsforbuildingpracticesandequip ment used on the job. The crew personnel shall be trained in a factory sponsored programandshallbecertifiedbythetankmanufacturerashavingsatisfactorilycompletedthatprogram.

D. The builder will be required at all times to observe and comply with the provisions of StateStatutes, relating to the regulation of laborers, mechanics, and other workers employed in

anypublic works by the state, county, city, or any political subdivision or by anyone under Contractforpublicworks.

1.6 DELIVERY,STORAGE,ANDHANDLING

A. SectionXXXXXProductRequirements:Requirementsfortransporting,handling,storing,andprotectingproducts.

B. Inspection:AcceptmaterialsonSiteinmanufacturer'soriginalpackagingandinspectfordamage.

C. Storage:

1. Storematerialsinareasprotectedfromweatherandmoistureandaccordingtomanufacturer'sinstructions.
2. Donotstoretank productsdirectlyonground, without a protective material provided.

D. Handling:Handlematerials inamannerastopreventdamagetointeriororexteriorsurfaces.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote fromconstruction operations areas.
2. Provideadditionalprotectionaccordingtomanufacturer'sinstructions.

1.7 EXISTINGCONDITIONS

A. FieldMeasurements:

1. Verifyfieldmeasurementspriortofabrication.
2. IndicatefieldmeasurementsonShopDrawings.

PART2–PRODUCTS

2.1 TANKS

A. Manufacturers:

1. The tanks shown on the Contract Drawings and specified herein is a model _____Uni-Central - LippDigester -asmanufacturedbytheLippAmericaTankSystems,LLC.,inGrand Rapids,Michigan, &Lipp GmbH, Tannhausen, Germany

2.2 DESIGNCRITERIA

A. TankSize:

1. Thedouble-seamVerinoxtankshallhaveanominaldiameterof _____feet, witha nominalsidewallheightofapproximately____ feet.
2. ThebasetankexteriorcolorshallbetheuncoatedGalvanizedsteelplate.Thetankwillbeinsulatedandcladdedasdiscussedin Sections XXXX
3. Thetankdesignshallhaveatwo(2) part roof systems consisting of a Beam supported exterior assembly and a Flat membrane 316Ti Stainless clear span gas tight cover,anchoringtoaccommodatethe required pressure for the digester operation (without beams or supports inside the digester gas zone). No bolted connections allowed, except for openings/inserts and other tank roof installations, of which all connections need

additional epoxy coating sealing certified by tank supplier. Roof itself is clamped outside digester gas-zone.

B. TankCapacity:

1. TankNetCapacityshallbe_____gallons(nominal, U.S.gallons),eachtank.
2. TankCapacity:TheNetCapacityshall includetherequiredfreeboard of5'0"fromthetop water level tothebiogas piping.
3. Maximum LiquidFillRate:XXXGPM.
4. Maximum LiquidDrawdownRate:XXXGPM.
5. TotalSolidsContentofstoredliquid:5%TS.
6. Maximum Chloride: Cl- at 500ppm
7. Maximum operational temperature: 120°F

C. FloorElevation:

1. FinishedfloorelevationshallbesetatElev.XXXX.00feet.
2. TankFloor:Inordertoaccommodatethedoubleseamequipment,thefoundationshallrunflat(will notbesloped)foradistanceof3feetasmeasuredinbothdirections(in/out)fromtheperimeterofth etankwall.Insidetheflatarea,thefinishedfloorshallbeconcretegroutandslopedatXpercenttoth eXXinchsuctionpipe.Thefoundationshallbeprovidedwitha10-inch D.I. influent pipe, 8-inch diameter D.I. outlet pipe, and two 6-inch D.I. recirculationpipesprovidedbytheSupplier.Thepipesshallextendpasttheedgeofthefoundation slab5feetasshowninDrawings andshall be encasedinconcrete.

D. TankDesignStandards:

1. Thematerials,design,fabrication,anderectionofthedoublefoldseamconnectionsystemshall conform to the General Technical Approvals No. Z-14. 3-15 and to the scope of thestandard DINEN1993–4-1:2010-12
2. The conditions described in DIN EN 1993 – 4- 1:2010-12, shall be applied to tanks usedforLiquidstorageofNon-hazardousmaterials.Thegeneralapprovalhereindealsexclusivelywiththe DoubleSeamasam echanicalconnectionofthecircularwrappedsteelsheeting.Thestructuraldesignofthe DoubleS eamconnectiontanksystemshallconformtothegeneralprinciplesofAWWAStandard Latestrevision.

E. DesignLoads:

1. SpecificGravityoftankliquid1. 01
2. WindVelocity:100mph
3. AllowableSoilBearingLoading:1,650psf(seeMaterialsTestingConsultants,Inc.Geotechnical ReportdatedAugust2019)
4. RoofSnowLoad35psf
5. EarthquakeSeismicDesign

    a. Pseudo-DynamicSiteAmplificationFactor,S1.5
    b. UseFactor,I,1.25

2.3 MATERIALSSPECIFICATIONS

A. PlatesandSheets:

1. Platesandsheetsusedintheconstructionofthedoubleseamtankshellshallcomplywiththemini mumstandards of AISC andASTM,latestedition.
2. Design requirements for steel sheet shall be ASTM Type A Grade 50 with a maximumallowable tensilestress of 40,000 psi.

3. Designrequirementsforallgalvanizedsteelsheetingshallbeforsteelsheet,Zinc-Coated(Galvanized)orZinc-IronAlloy-Coated(Galvannealed)bytheHot-DipProcessasrequiredbystandardASTMA653.

B. Sealants:

1. The double seam folded plate systems shall have a joint sealant applied, and shall be aonecomponent,moisturecured,polyurethanecompound.Thesealantshallbesuitableforcontact with the liquid contents of the tank and shall be certified to meet the ANSI/NSFStandard61forindirectadditives.ThesealantshallbeaSika1Asealantmaterialorequal.Thesealantshallbeusedtosealbetweenthedoubleseamfoldedplateconnections.Thesealant shall cure to a rubber-like consistency, have excellent adhesion to the steel plate,lowshrinkage,andbesuitablefor interiorandexterioruse.
2. Sealantcuringrateat73°Fand50%RH:

   a. Tack-freetime:6to8hours.
   b. Finalcuretime:10to12days.

3. Neoprenegasketsandtapetypesealershallnotbeused.

2.4 TANKINTERIORLININGPLATE

A. StainlessSteelInteriorLining“Verinox”shallbecompletedinafactorymachiningprocessasfollows:

1. All steel sheets shall be provided in a rolled coil and run through a special adhesivecompressiveprocessinwhichthestainlesssteelinteriorlinerlayerisadheredtothebasecarbonsteelplatebywayoftheuseofarollingmachineinwhichanisolationlayerofPVCisrolledandcompressedandbondedtotheinteriorlayerandthusformsaprotectivelineragainstcorrosion.
2. Once all coils are lined with the stainless steel, then all finished coils of steel shall bewrappedinprotective packagingforshipmenttothesite.
3. Prior to lining, inspection of all rolled coil steel sheets shall be made for traces of foreignmatterorrust.Ifforeignmaterial,damage,orrustisfound,thenallsheetsshallberejectedand willnotbeallowedto belinedwiththestainlesssteel innerlayer.

B. FactoryInspection:

1. Themanufacturer’squalitysystemshallbeISO9001certified.
2. Allsteelcoilsshallbeinspectedformilthicknessandgalvanizedquality.

C. Packaging:

1. AllsheetsthatpassFactoryInspectionandQualityControlchecksshallbeprotectedfromdamageprior topackingfor shipment.
2. Heavyplasticsheetingshallbeplacedaroundallcoilstoeliminateanyabrasionordamageduringshipment.

2.5 TANKASSEMBLY

A. Foundation:

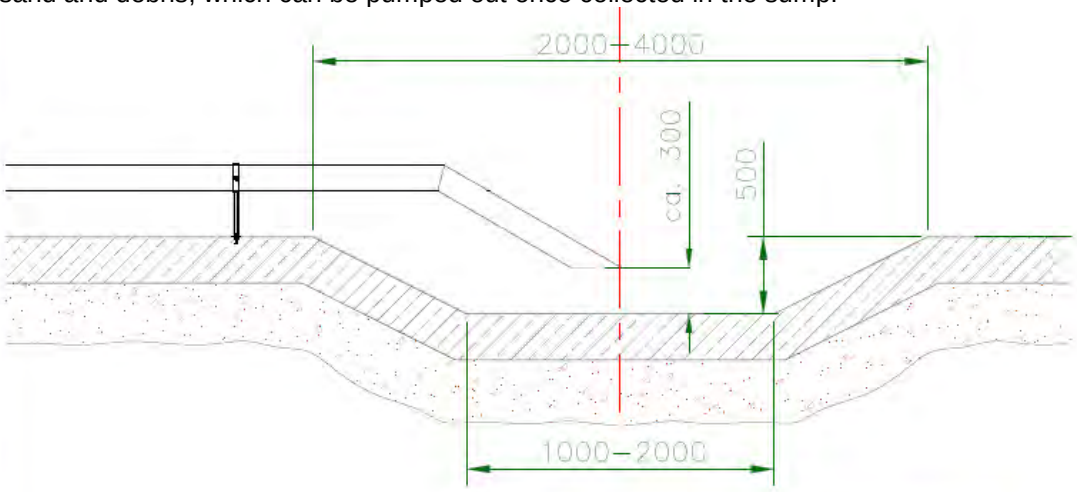
1. Thetankfoundationshallbeapartofthedesigncontractandshallbeinstalledbythetankbidder, unless otherwise noted, and mutually accepted by the Tank Supplier, Engineer,andOwner.
2. The tank foundation shall be designed by the tank manufacturer to safely sustain thestructureanditsliveloads.
3. TankfootingdesignshallbebasedonthesoilbearingcapacitygiveninParagraph2.2Eofthis Specification Section, as previously determined by geotechnical analysis

performedbyalicensedsoilsengineer.Thecostofthisinvestigationandanalysisisnottobeinclud edinthebidprice.Copiesofthesoilreportshallbeprovidedtothebiddingtankmanufacturersprior to bid date by the Owner or Engineer, and are included as an attachment to theseconstruction documents.

4. Footing designs for soil bearing strengths less than that specified, and from designsdeviating from tank manufacturer's standard shall be the responsibility of the Owner andhisEngineerbasedontankliveanddeadloadingdataprovidedbythetankmanufacturer.

B. ConcreteFloors:

1. Thefloordesignistobeofreinforcedconcretewithaformedtrough,allowingforthesteelsidewalls heettobeembeddedintothetroughsettingonlevelplatesequallyplacedinthetrough as per the "double seam" tank manufacturer's required design. The steel sidewallof the double seam tank shall be welded to each level plate around the circumference oftheentiretankbasering area.
2. The placement and leveling of the attachment plates shall be required, and the maximumdifferential elevation within the trough shall not exceed 1/16 inch within any 10 feet oflength.
3. Once the Sidewall Ring is lowered into the trough and welded in place, then each weldshallbe inspected asto itconsistencyandpenetration for strength.
4. The Embedment Trough shall be filled with a quick cure concrete grout material, so as toprovideacomplete watertightsealbetweenthesteelsheetingandconcretefloor.
5. Toprovideacompletewatersealantaroundtheinsideandoutsideedgeoftheslotmountembedm ent,aPVCsealantistobeplacedaminimumof4inchesupthetankwalland4inches outontheconcretefloor.
6. Provide pump sump design and dimensions do not vary with the size of the digester. The sump is a truncated cone with a diameter of 3 and 6 ft respectively and a height of 1,64 ft and is in the center of the flat foundation. To remove sediments, a pipe is located 300 mm above the sump. This places it below the raft base plate surface to maximize grit removal and high enough to prevent clogging the pipe. It serves as a collection point for sand and debris, which can be pumped out once collected in the sump.



7. For the floor heating a thermal insulation (compliant with EN 13167) is necessary:
   The product characteristics have to have a heat conductivity of: λD ≤ 0.050 W/(m·K) and a thermal insulation of: ≥ 2.5 (m2K)/W.
   Mechanical resistance requirements are to be chosen by the civil contractor best suited for location. Typically these insulating material can be used (within the Civil Engineering scope):
   1) FOAMGLAS® cellular glass insulation (or equivalent)
   2) Standard SF insulation boards made of extruded polystyrene foam (XPS)

8. Equipotential bonding & tank grounding
   Tank grounded might be necessary depending on the local legislation. Equipotential bonding - commonly referred to as bonding - is a very important measure in reducing the risk of equipment damage and personal injury. Clamps (provided by Lipp) are connected to the digester.
9. Provide design for a 10” concrete dike - necessary on the lower part outside the tank with the purpose of a mechanical protection of the digester lower part and slab interface connection, hold the cladding in place and prevent the insulation from being in contact with rainwater and snow (to be provided by civil contractor).

C. SidewallStructure:

1. Field assembly of the double seam folded steel tank shall be in strict accordance with theproceduresoutlinedinthemanufacturer’sassemblymanual andperformedbyanauthorized“double-seam”tanksupervisorusingthespecialtyerectionassemblymachinesregularly required for all assembly of the double seam tanks, also all assistance on siteshallbefactorytrainedand certifiederectors.
2. Specializederectionmachinesandbuildingframesandequipmentdevelopedandmanufacture dbythetankmanufacturershallbe used toerectthetanks.
3. Particular care shall be taken in handling of the tank coils, and assembly crew shall avoidabrasionordamageofthesteelcoil.Priortoaliquidtest,allsurfaceareasshallbevisuallyins pectedbytheEngineer.
4. The placement of sealant into the double fold systems may be inspected as the erectionprocessiscompleted.However,theEngineer’sinspectionshallnotrelievethebidderfro mhisresponsibilityfor liquidtightness.
5. No backfill shall be placed against the tank sidewall without prior written approval anddesign review of the tank manufacturer. Any backfill shall be placed according to the strictinstructionsofthetank manufacturer.

D. TANKROOFSYSTEM –

1. External Beam supported Roof
   The roof shall be an EBSR, or Externally Supported Roof, and shall be full self-supporting with no interior column supports,The EBSR shall be designed to support the pressure inside the digester, eliminating the need of bolted beam supports in the roof structure in contact with the gas.
2. Roof shall be comprised on a center compression ring and exterior radial members connecting to an exterior angle at the eve of the reactor vessel. Decking shall comprise of painted galvanized steel sectional panels including insulation.

3. All structural sheet steel shall be Galvanized coated and painted materials

4. Rolled Structural Shapes: Conform to minimum standards of ASTM A 36 or AISI 1010.

5. Flat Stainless Steel Membrane Self-supporting Cover

a. Tanks with diameters of up to 80 ft. may be provided with a stainless steel diaphragm self-supported roof system
b. The roof plate system shall consist minimum 316Tigraded Stainless steel material with a thickness of 1.0 mm (3/64) based on local design load requirements
c. All Plates shall be factory cut and factory welded so as to match the tank diameter using a flash welding procedure under stringent factory standards
d. Once all cutting, welding and membrane assembly is completed and inspected, the roof materials shall be protectively packaged and shipped to the tank site for installation
e. The roof membrane shall be attached to the tank sidewall by the connection of a Lower C-Channel and an Upper C-Channel. These Structural Profile channels shall be bolted to the tank sidewall

f. The membrane stainless steel roof materials shall be rolled out over the tank sidewall and then attached to the lower and upper channels in accordance with the manufacturers requirements so as to provide a gas tight seal and self- supporting cover
g. Once the self-supporting membrane is secured in place then any access opening shall be cut into the roof membrane
h. This cover system shall accept flanges and manways as designed. All flange openings shall be installed with outer and inner backing plates for additional support to insure the gas tightness of the cover
i. The Membrane cover shall then be pressurized to verify the roof is in fact gas tight

D. HydraulicOver-PressureSafetySystem

1. HydraulicOver-PressureSafetyValve:

a. XXX

2.6 LATERAL MIXING OF DIGESTER

Two 18.5 kW retractable agitators are fitted into the digester and oriented in such way to provide a horizontal mixing pattern. Depending on the size of the digester, up to two lateral agitators can be installed per tank with two possible implementations: shaft or freewheeling versions. The mixing system has to achieve the following:

1. Operate on an intermittent basis for app. 1/3 of the time and allow for mixing during maintenance of mixing equipment.
2. All mixing equipment needs to be able to be retracted and maintained (including front wheels and bearings) without process interruption and the need to empty the digester for this operation.
3. Mixer to operate inside digester walls to allow for efficient mixing.
4. The equipment supplier has to provide the optimum configuration to move the heat of the wall and floor heating system of the digester to an equal temperature in the complete volume of the digester. Especially the wall heating system requires aconfiguration to transfer the wall heat towards the center of the digester.

B. Shaft agitator

To ensure destratification of the sludge bed, at least one of the mixers is fitted at the bottom of a vertical draft tube (shaft agitator) mounted on the tank wall. This induces a top-down pumping motion in addition to the horizontal mixing pattern and prevents the formation of foam at the surface of the sludge bed. Fresh sludge needs to be fed into this draft tube, which provides efficient blending with the rest of the digester content. The top end of the draft tube is installed at a defined measurement of the equipment supplier below the lowest sludge level, which allows the digested sludge to drop into the shaft at an optimum level for homogenization. The pumping flowrate provided by the shaft agitator in the draft tube needs to be capable of pumping 660,000 gal/h.With the combination of horizontal and vertical motion, grit settling, and foam accumulation are optimized.

C. Freewheeling agitator

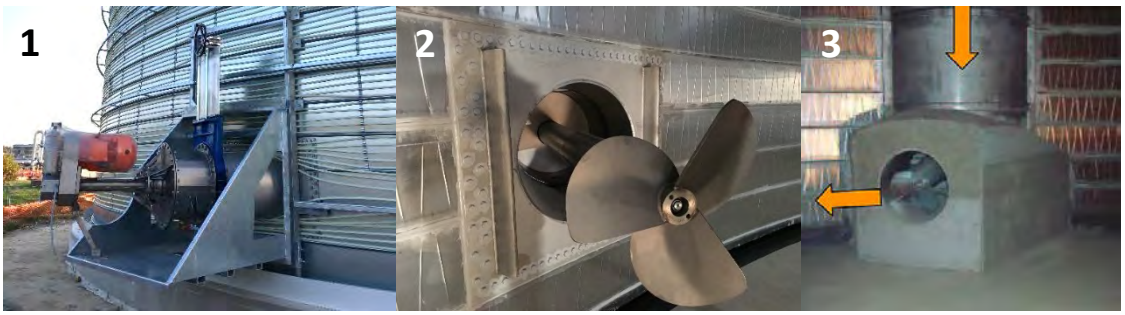
In addition to the shaft agitator, a freewheeling agitator is installed. The unit is the same as the one inserted in a draft tube. It contributes to an overall homogeneity of the digester in combination with the draft tube mixer and the pumping system. It should allow for a pumping flowrate of up to 845,000 gal/h.

D. Mixer specification

Both shaft and freewheeling agitator are used to maintain the overall homogeneity of the digester. These agitators are retractable, removable and installed at the bottom of the digester's wall, outside of ATEX zoning during normal operation. They are provided with a app. 3 x 23" diameter blades propeller and a vibration-resistant frame. The provided mounting frame needs to be tilt in the correct angle to allow a good mixing result for the full liquid volume and mix in an anticlockwise direction. The extractable agitators are supported with a metal console that is mounted on the digester wall to prevent damages in the shaft due to settlement of the foundation. All agitators' components in contact with the fluid, as well as all parts located in the tank, are made of stainless steel. The agitator needs to be operated with a Variable Frequency Drive (Not supplied by LIPP).

Parameters	
Power /Motor type	*18.5 kW /4 poli*
Rated power	*18.5 kW*
Rated voltage	*400 V*
Frequency	*50 Hz*
Révolutions per minute (motor)	*1450 rpm*
Revolutions per minute (propeller)	*Up to 450 rpm*
Electric motor noise level	*70dB*
Rated voltage	*400 V*
Power factor, cos(phi)	*0.86*

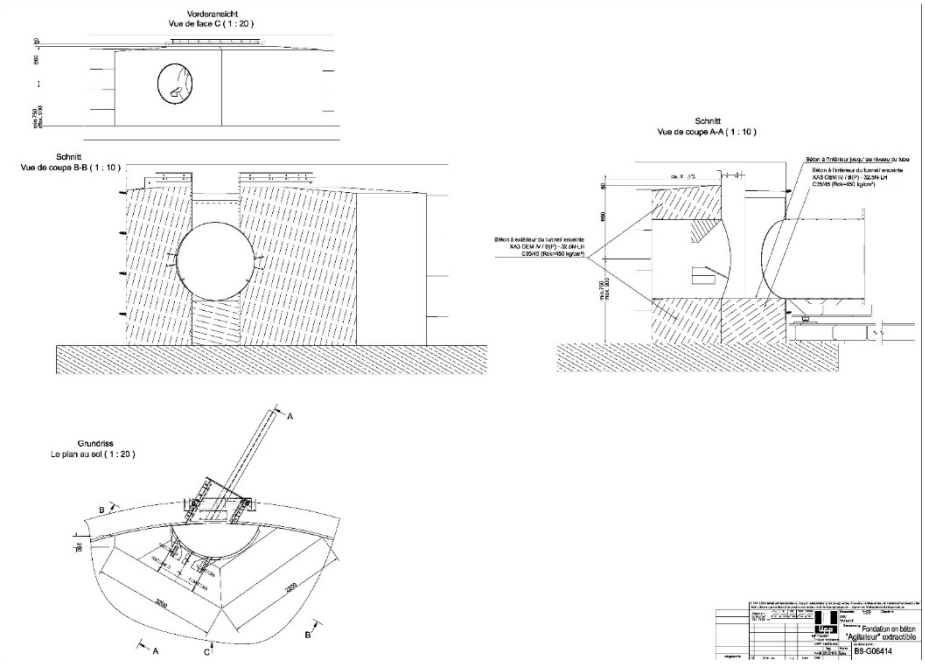
E. LIPP Lateral mixing systemshaft foundation



To minimize the vibrations due to the agitator motion, a concrete base is built at the bottom of the shaft (not part of LIPP). The concrete base of the agitator is constructed by the civil engineer partner using a temporary formwork. The latter can be done using boards or erect a outer wall and then fill the inner part with concrete. The formwork must be fixed on the inner wall of the digester. The formwork is then filled with concrete in a 2-step sequence to allow the concrete to consolidate properly.

Construction of this base can happen only once the digester is assembled and anchored.

Attention: When floor heating is installed, is it prohibited to use stays to support the framework as it can damage the heating network.



2.7 RECIRCULATION PUMP

The digester must be equipped with at least one recirculation pump (chopper pump) that is used to transfer the sludge from the bottom of the digester to above the liquid level. This system allows to mechanically break down the foam layer and, when starting up the digestion process, allows for homogenising the medium with a bottom-up motion. Recommended pump sizing between 2,500 and 4,500 gallons/min.

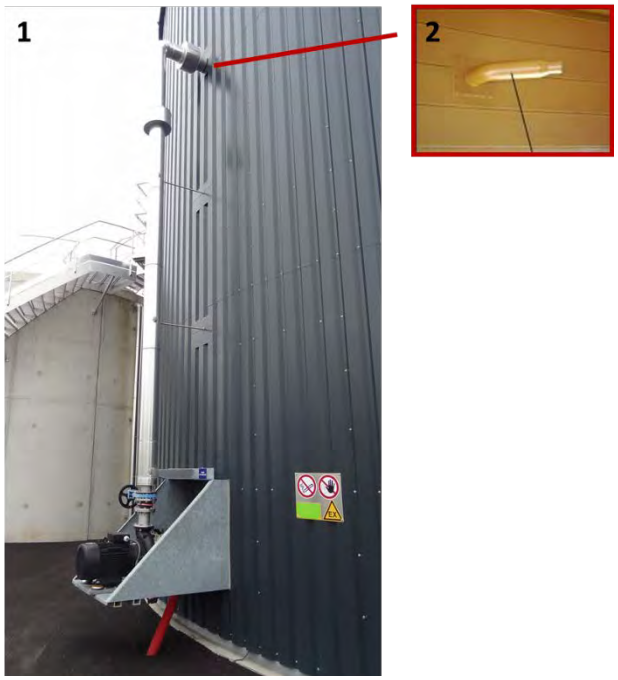
A. Foam sensor

As per standard, the Lipp digester should be equipped with a foam sensor. This sensor allows for automatic start-up of the recirculation pump and the shaft agitator in the event of a foam layer creation.

B. Foam abatement

A recirculation pump interlocked with the foam sensor allows to prevent foam accumulation on the sludge surface. The foam abetment pump sucks the digested sludge from the lower part of the tank and sprays it on a predefined angle of the supplier onto the top of the sludge bed via the spray nozzle. Any floating or foam layer that has formed is broken down by the jet sprayed onto it. The pumping system configuration is interlocked with the mixing system to work in conjunction against foam creation.Real pumping capacity can be in the range from 500to 1,500gpm.The pump must also allow for digester mixing during digester start-up phase while the other mixing system is not yet operational due to liquid level or in the event of maintenance of the mixers.

Special care must be taken to ensure that the pump discharge pipe does not freeze. Should this be a risk, the pipe should be thermally insulated. Tracing is not required.



2.8 DIGESTER WALL AND FLOOR HEATING SYSTEM

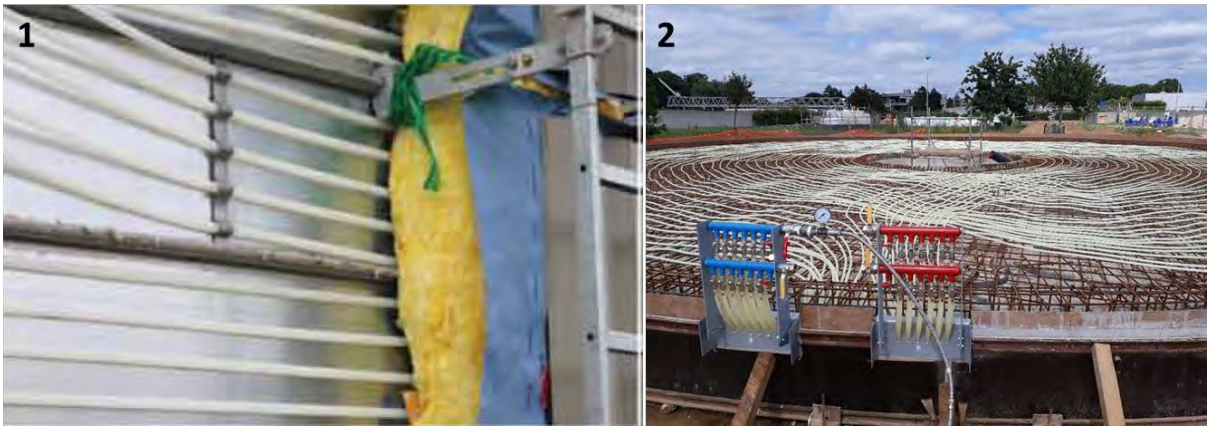
Sludge heating using the certified LIPP heating unit wrapped OUTSIDE on tank shell and imbedded in concrete foundation. Heating is realized through a wall and floor heating, integrated to the outer tank wall and within concrete slab.

The elements described in this section are provided and installed (digester's wall only) by LIPP and installation of heating tubing in foundation by supplier of foundation (calculation and supply of heating tubes by LIPP). Heating is delivered by a heating hose manifold, which is installed between the digester's outside wall and the mineral wool-based insulation. The heating manifold must be able to maintain and service from the outside of the digester. Should the amount of heat transferred from the wall heating system be insufficient to maintain the digester at the required temperature, additional heating can be provided by heat-exchangers during e.g. winter conditions to preheat fresh sludge.

Heating pipe specification:

Parameters	PE-HDXc SD4+ pipe
Measurements	
Inner Diameter	0,787"
Wall thickness	0,0787"
Operating conditions (EN ISO 15875-1)	
Class	5
Tmax	175 °F (The pipe allows a water temperature of up to 192 °F)
Pressure	< 6 bar
Oxygentightness	100 °F ≤0.32 mg/(m²• d) DIN 4726 175 °F ≤3.6 mg/(m²• d) DIN 4726

The required hot water is supplied with a respective hot water distribution system which is not part of this delivery package. The sludge temperature can be measured with temperature sensors and can be controlled automatically by adjusting the hot water inlet.



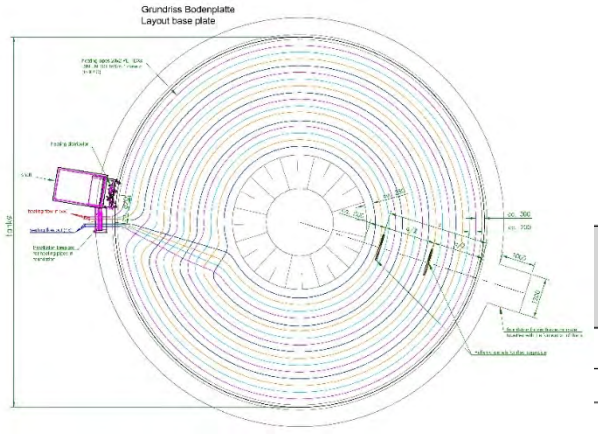
1: Wall heating system – Outside tank wall for maintenance; 2 Floor heating system in foundation

1. Wall heating system

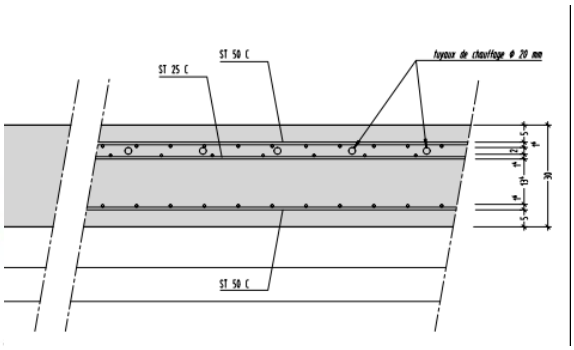
   A heating hose manifold is installed on the outside of the digester. Its purpose is the distribution of the heating hoses for the feed-in and return flow of the wall heating system. Equipment supplier to finishes on the connection point of the inlet and outlet of the heating hose manifold outside the foundation. An easy access to the heating hose manifold must be insured for inspections and air purge operations. A lifting device will be required according to local health and safety requirements.

2. Floor heating (civil engineering scope)

   The floor heating system is located within the raft and organized according the manufacturers design. The system consists of several heating circuits with dedicated inlets and outlets. Inlets are spaced according equipment supplier specification. The pipes are located below the top surface of the raft, or the minimal distance authorized by legislation & civil engineering studies. No floor heating to be provided at the center sump. The heating pipes need to be installed by a heating specialist before concrete is casted. The design of the concrete slab must take into account the heating pipes temperature (up to 176°F).



Sample of possible floor heating distribution



Positioning of floor heating pipes

3. Cladding and insulation for wall heating system

(0) Digester's wall, (1) Wall heating, (2) Aluminium lining, (3) Mineral wool, (4) Permeable membrane, (5) Corrugated sheet cladding	Heating Manifold with possibility of maintenance from the outside

2.9 APPURTENANCES(PER AWWAD103,SECTION5)

A. PipeConnections:

1. Wherepipeconnectionsareshowntopassthroughtankpanels,theyshallbefieldlocated(elevation andazimuth),sawcut,(acetylenetorchcuttingorweldingis<u>not</u>permitted),andshall utilize an interior and exterior flange assembly that ensures the tank shell reinforcingshall comply with AWWA Dl03 latest edition. Sika 1A sealant or equal shall be applied onanycutpaneledgesorboltedpanelconnections.

   a. Nozzleandmanway sizesandlocationsshallbeshownand/orscheduledonPlanDrawings.

B. AccessPlatform:

1. An access Top Platform complete with required handrail and kick guard located at the bottom of the handrail. The purpose is to provide safe working access for preventative maintenance to and inspection of the Flat membrane roof, its anchoring system, and any accessories mounted on the tank wall, at or above the access deck height.

C. AccessOpening(s):

1. OnebottomaccessopeningsshallbeprovidedasshownontheContractDrawingsinaccordance withAWWAD100and D103.
2. Themanholeopeningshallbeaminimumof31inchesindiameter.Theaccessdoor(shellmanhole) and the tank shell reinforcing shall comply with AWWA D103 latest edition,

andAWWAD100.

D. Insulation:

1. Theentiretankshallhaveinsulationonallexposedsidewallarea.
2. Insulationshallbethermallyefficient,formaldehyde-free,fireresistant,andnon-combustiblefiberglassblanketwithasmoothlaminatedvaporbarrier.

a. Minimum installedblanketthicknessshallbe7inches.
b. MinimumR-value25.
c. Blanketmaterialshallbedurablenon-organicglassthatwillnotrot,isnotsusceptible to mildew or deterioration, and is non-corrosive to pipes, wiring, metalstuds,andsteelsheeting.

E. SteelSheeting:

1. Theexteriorsidewallsshallbesheetedwithfinishedsteelcladding.

a. 29gaugestructuralqualityfull-hardcorrugatedgalvanizedsteelsheeting.*PanelProfileTBDbyplantstafffrommanufacturer'sstandardselections.*
b. 36-inchpanelwidthwith3/4-inchribheight.
c. UL790ClassAFireResistanceRating.
d. UL2218Class4HailImpactResistance.
e. UL580Class90UpliftTestRating.
f. EqualtoFabralGRANDRIB3; Metal sales Pro panel II - orotherPanelProfilechosenbyPlantStaff.
g. Coloroptiontobeselected byOwner.

F. IdentificationPlate:

1. A manufacturer's nameplate shall list the tank serial number, tank diameter and height,andmaximumdesigncapacity.Thenameplateshallbeaffixedtothetankexteriorsidewall at a location approximately 5 feet from grade elevation in a position of unobstructed view,exteriortoinsulationandcladding.

PART 3–EXECUTION

3.1 EXAMINATION

A. Verifylayoutandorientationoftankaccessoriesandpipingconnections.

3.2 INSTALLATION

A. AccordingtoAWWAD100/103,asindicatedonDrawings,andaccordingtoman ufacturer'sinstructions.
B. Preparesiteandtankfoundation.

C. Connectallpipingtounderandthroughtank foundation.

D. Installtank &roofFlat membrane then assemble the Beam supportsystem.

E. Constructremainingtanksidewall.

F. Installtanksidewallpenetrationfittingsasrequiredatgradeasthatportion(elevationandazimuth)ofside wallis rolledintoplace.

G. Anchorsidewalltofoundation.

H. Tocompleteinstallation,installtankaccessories,gasstorage,accessplatformsanddecking,ladders,insulation,cladding,etc.

I. Touchupand complete interior coatings.

3.3 FIELDTESTING

A. Hydrostatic:

1. Following completion of erection and cleaning of the tank (prior to the installation of anyinsulation or tank cladding), the structure shall be tested for liquid tightness by filling tanktoitsoverflowelevation.Contractormayusepolishing pondwatertofillthetank.
2. Any leaks disclosed by this test shall be corrected by the erector in accordance with themanufacturer'srecommendations.
3. Water required for testing shall be furnished by the Owner at the time of tank erectioncompletion, and at no charge to the tank erector. Disposal of test water shall be theresponsibilityoftheOwner.
4. Laborandequipmentnecessaryfortank testingistobeincludedinthepriceofthetank.

B. GasStorage:

1. Testexterior,particularlyaroundanchoringsystem,andcomponentconnectionsforbiogasleaks.
2. Testairspacebetweeninnermembraneandoutermembraneforbiogasleaksusingsystem'sintegralsamplinghose.
3. Testheadspacebetweentankliquidandbottommembraneforbiogasleaks.
4. Testbiogasstoragevolumemeasurementsystem.

3.4 MANUFACTURER'SSERVICES

A. Furnishfieldrepresentativeexperiencedininstallationoftanktosuperviseinstallation.

3.5 GASSTORAGESYSTEMFIELDSERVICE

A. Provide personnel from the gas storage system manufacturer for assembly supervision, finalinstallationcheckandapproval, andcommissioningof the gasstoragesystem.

B. Provide gas storage system manufacturer personnel for one trip, two days on site, for trainingOwner'spersonnelinproperoperationandmaintenanceofgasstoragesystemanditscomponents.

3.6 MANUFACTURER'SWARRANTY

A. The tank manufacturer shall include a warranty for the tank materials and any required repair ofthe interior linings. The tank manufacturer shall warrant the liquid storage tank shall be free fromanydefectinmaterialorworkmanshipundernormalandproperuse,maintenance,andoperationduringtheperiodexpiringontheearlierof(1)oneyearafterprocessliquidisfirstintroducedintothe tank, or (2) 18 months after a substantial portion of the tank sheets is delivered to the sitewherethetankis erected.

B. The tank manufacturer shall warrant the interior stainless-steel layer of the tank will not corrodeunder normal and proper use, maintenance, and operation during the period expiring on theearlier of (1) five years after process liquid is first introduced into the tank, or (2) 62 months afterasubstantialportionofthetanksheetsisdeliveredtothesitewherethetankiserected.

LIPP Mixer System Maintenance

Changing of the Mixer during operation

LIPP GmbH
Anlagenbau + Umwelttechnik
D-73497 Tannhausen
Tel.: 0049 7964/ 9003-0
Fax: 0049 7964/ 9003-27
www.lipp-system.de
UNIQUE.WORLDWIDE

Sequence:

1. Disconnect electrical connections without current (in the cabinet disconnect) and then also in the terminal box (6)
2. Remove (disassemble) small flange (2)
3. Move agitator blade (7) in the chamber (3) to stop behind large slide valve retire (agitator shaft still fluid sealing via two mechanical seals)
4. Close large valve (1)
5. Remove substrate in chamber (3) by opening a ball valve (4 not shown) at the bottom with mobile pump
6. Remove (disassemble) large flange (5)
7. Agitator can now be completely removed and repaired if necessary