ENG Designs - Hydra Product Family

Engineered mixing, aeration, and chemical distribution | Wicked Mixing. Purpose-built process equipment.

Product Family Overview

ENG Designs develops low-pressure, air-powered systems for basin circulation, solids suspension, oxygen-transfer support, and chemical distribution. Each Hydra system is configured around basin geometry, operating depth, process duty, solids characteristics, available utilities, and the required control strategy.

System	Primary duty	Core process arrangement	Typical applications
Hydra-Bubble™	Hydraulic mixing and solids suspension	Periodic large-bubble release creates full-depth circulation with no submerged moving parts.	EQ, anoxic zones, sludge storage, lagoons, industrial process tanks
Hydra-Fusion™	Integrated mixing and aeration	Hydra-Bubble hydraulic circulation operates with a fine-bubble aeration system; duties may be operated independently or together.	Activated sludge, SBR, aerobic digesters, oxidation ditches, municipal and industrial wastewater
Hydra-Dose™	Chemical mixing and distribution	Controlled air-release mixing distributes treatment chemicals through the basin; dosing hardware and controls are selected for the chemical and process objective.	pH adjustment, nutrient addition, coagulant or polymer service, odor control, industrial process treatment

Selection Logic

- Choose Hydra-Bubble when mixing is required independently of oxygen transfer.
- Choose Hydra-Fusion when aeration and basin circulation must be optimized as separate process duties within one engineered system.
- Choose Hydra-Dose when rapid, uniform chemical dispersion is the primary process objective and the dosing design must be coordinated with basin circulation.

Common Engineering Deliverables

Design phase	Available deliverables
Application review	Process objective, basin geometry, operating levels, liquid properties, solids loading, utilities, materials, and control philosophy
System design	Equipment layout, air-flow and pressure basis, piping and valve concept, materials, instrumentation, and equipment schedule
Submittal	Plan and section drawings, details, bill of materials, component data, control narrative, and installation requirements
Project support	Startup and commissioning support, operating setpoint review, and project-specific documentation

Important: Final equipment count, airflow, pressure, diffuser quantity, chemical feed rate, materials, and controls are project-specific and require an ENG Designs application review.

HYDRA-BUBBLE™

LOW-PRESSURE LARGE-BUBBLE MIXING SYSTEM

Full-depth circulation. Solids suspension. No submerged moving parts.

Product Overview

Hydra-Bubble is a low-pressure, large-bubble mixing system. A submerged accumulator periodically releases a large air slug that rises through the water column and drives vertical lift, surface spread, wall downflow, and floor return. The system is intended to provide basin-scale circulation and solids suspension without relying on a submerged motor or impeller.

Key Features

- No submerged moving parts in the mixer assembly.
- Steady low-pressure air supply with periodic large-bubble releases.
- Mixer count, spacing, release rate, and airflow are selected for the basin geometry and process duty.
- Applicable as a standalone mixing system or as the hydraulic mixing element within Hydra-Fusion or Hydra-Dose.

Attached-Sheet Performance Data (Project-Specific)

Parameter	Published value / design note
Nominal air-slug volume per release	0.5 to 1.5 ft3 at accumulator pressure; air expands during ascent
Bubble rise velocity	> 4.0 ft/s
Typical release interval	10 to 30 seconds; determined by airflow and accumulator size
Typical airflow per mixer	0 to 20 SCFM
Typical operating pressure	Approximately 3 to 16 psig; driven primarily by submergence and system losses
Performance objective	Uniform solids suspension, full-depth circulation, and floor return flow

Construction and Interfaces

Item	Typical / available configuration
Accumulator body	Corrosion-resistant body; Type 304 stainless steel typical; material and size options available
Internal components	ABS and stainless steel, model dependent
Air connection	3/4 in NPT at mixer
Air distribution piping	Type 304 stainless steel minimum or Schedule 80 CPVC, per project specification
Supports and clamps	Type 304 stainless steel minimum, per project design
Anchors	Type 316 stainless steel adhesive anchors, per project design
Warranty	Five-year warranty on ENG Designs materials and workmanship, subject to applicable written terms and approved service conditions

Hydra-Bubble™ - Engineering Performance and Model Data

Mixing Intensity - 1.5 ft3 Model

Depth (ft)	Pressure (psig)	Accumulated volume (SCF)	2 BPM SCFM	3 BPM SCFM	4 BPM SCFM	5 BPM SCFM	6 BPM SCFM
10	4.3	1.94	3.9	5.8	7.8	9.7	11.6
15	6.5	2.17	4.3	6.5	8.7	10.9	13.0
20	8.7	2.39	4.8	7.2	9.6	12.0	14.3
25	10.9	2.62	5.2	7.9	10.5	13.1	15.7
30	13.1	2.85	5.7	8.6	11.4	14.3	17.1
35	15.3	3.07	6.1	9.2	12.3	15.4	18.4

BPM = bubbles per minute. Other mixer sizes have proportional flow and volume values.

Models and Dimensions

Model	Footprint (L x W)	Height	Unit weight	Air connection	Materials
HB-0.50	12.25 x 14.25 in	18.50 in	31.3 lb (SS version)	3/4 in NPT	ABS / 304-316 SS
HB-0.75	17.00 x 23.75 in	19.75 in	36.0 lb (SS version)	3/4 in NPT	ABS / 304-316 SS
HB-1.50	17.30 x 22.00 in	21.75 in	50.0 lb (SS version)	3/4 in NPT	ABS / 304-316 SS

Typical Applications

Application	Process objective
Equalization basins	Full-volume homogenization, solids suspension, and reduced settling risk
Anoxic zones	Circulation where mixing is required independently of oxygen demand
Sludge holding / process tanks	Reduce stratification and maintain bulk circulation
MBBR / IFAS	Media movement and basin circulation; project-specific evaluation required
Industrial wastewater	Homogenization and solids suspension across variable process conditions

Hydra-Bubble Application Data Required

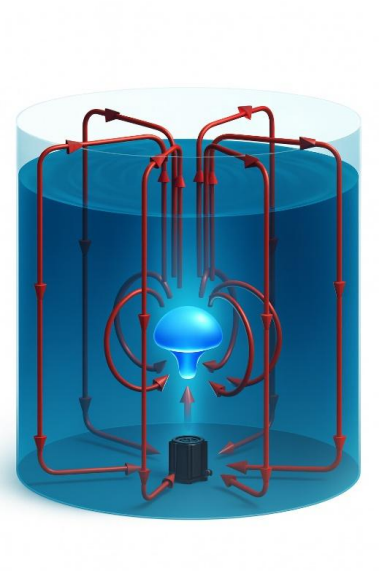
- Basin shape and dimensions; floor slope and obstructions; minimum, normal, and maximum operating levels.
- Process duty; TSS/MLSS; viscosity; temperature; density; solids settling behavior; required operating schedule.
- Available air source, pressure, flow, turndown, air quality, and allowable blower location.
- Materials, electrical area classification, access, lifting, anchorage, and maintenance constraints.

HYDRA-BUBBLE™

INSTALLATION AND SYSTEM INTEGRATION

Basin-specific layout and documentation.

Hydraulic Circulation and Mixer Installation



Conceptual circulation pattern



Representative mixer and pipe mounting

System Configuration

- A zone or grid is supplied from an air header with branches routed to the mixer locations shown on the project drawings.
- Airflow balance and release frequency are established during design and confirmed during startup.
- Mixer spacing is coordinated with tank geometry, inlet and outlet locations, internal equipment, floor features, and access constraints.
- Blower and piping design must provide required pressure at the hydraulically remote mixer at design flow.

Inspection and Commissioning

Stage	Minimum verification
Pre-startup	Verify installation against approved drawings; confirm anchors, supports, pipe routing, valves, and unobstructed mixer openings.
Air system startup	Verify blower rotation and protection; leak-test accessible air piping; confirm valve positions and header pressure.
Wet commissioning	Observe release timing and distribution; balance branches; confirm full-basin circulation and absence of persistent dead zones.
Operating verification	Review solids profile, settling or deposition observations, process response, and final operating setpoints.

Hydra-Fusion™ - Integrated Mixing and Fine-Bubble Aeration

Micro meets macro. Two process duties, independently optimized.

Product Overview

Hydra-Fusion combines Hydra-Bubble hydraulic mixing with a fine-bubble aeration system. The mixing and aeration duties may operate independently or together, allowing oxygen-transfer demand and hydraulic-circulation demand to be addressed separately within one engineered process system.

Functional Architecture

Function	Primary equipment	Control objective
Hydraulic mixing	Hydra-Bubble mixers, air distribution piping, valves, and blower capacity allocated to mixing duty	Maintain circulation, solids suspension, and basin uniformity
Oxygen transfer	Fine-bubble diffusers, aeration grid, valves, and blower capacity allocated to aeration duty	Meet project oxygen demand and dissolved-oxygen control targets
Integrated operation	Instrumentation, controls, and shared or separate blower arrangement as designed	Match airflow and energy use to actual process requirements

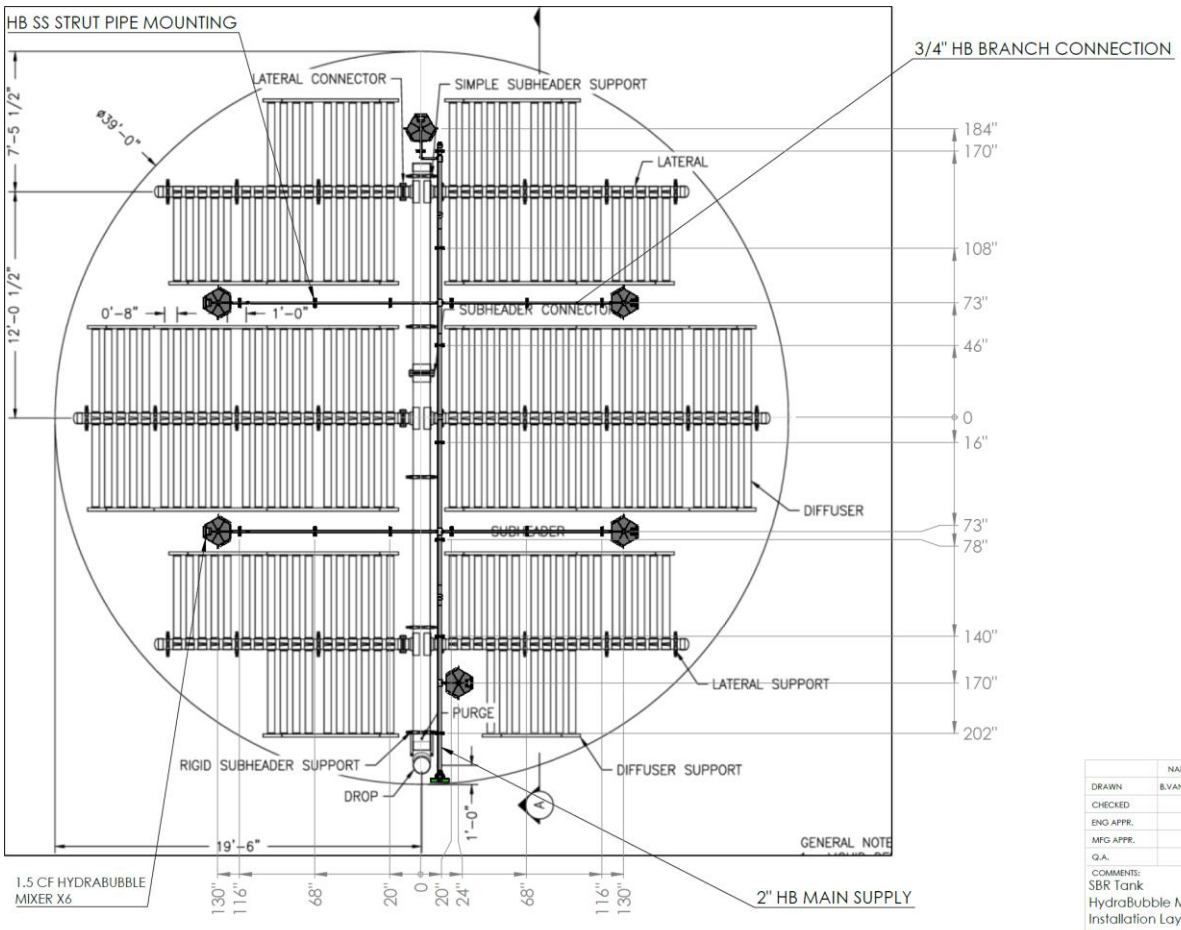
ENG-Published Performance Observations

Published statement	Qualification
20-30% improvement in oxygen-transfer efficiency in field applications	ENG-published field observation; performance is project-specific and must not be treated as a guaranteed value without an approved performance basis and test protocol.
Improved dissolved-oxygen distribution and reduced dead zones	Expected process objective of combined circulation and fine-bubble aeration; verify by project-specific commissioning or testing.
Lower blower energy when mixing airflow is not forced to follow oxygen demand	Potential operating benefit depends on blower selection, turndown, controls, basin duty cycle, and required mixing/aeration setpoints.

Typical Applications

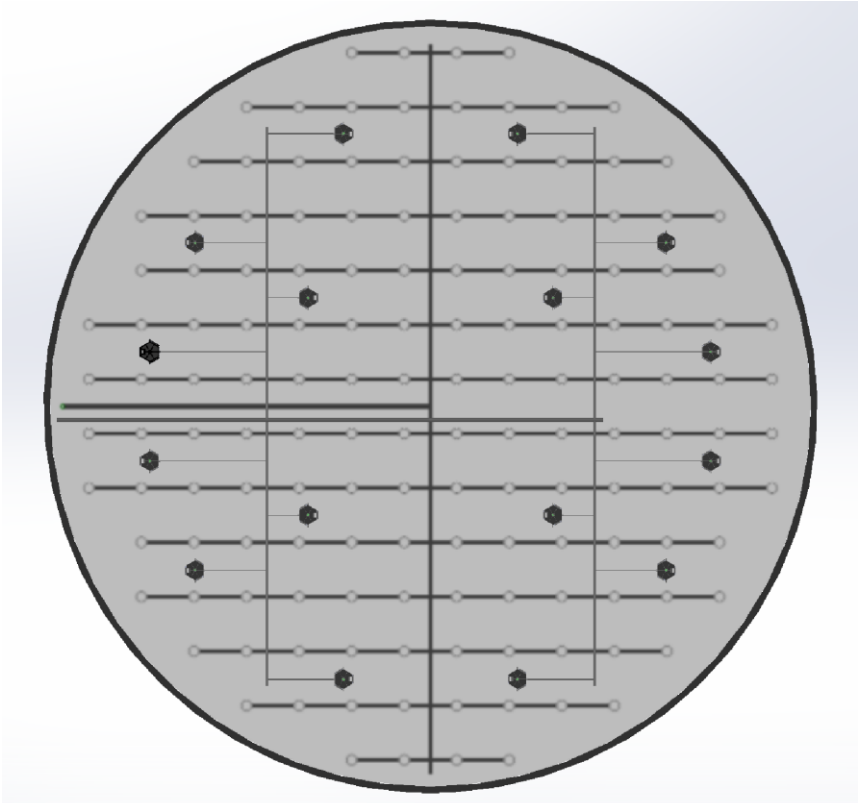
- Activated sludge basins and aerobic process zones.
- Sequencing batch reactors (SBRs).
- Aerobic digesters, lagoons, and oxidation ditches.
- Equalization basins requiring controlled aeration and independent mixing capability.
- Municipal and industrial wastewater, including food and beverage process treatment.

No universal oxygen-transfer, mixing-energy, or treatment-performance guarantee is stated. Final design criteria and acceptance testing must be established in the project specifications.



	NAME	DATE
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ENG APPR.		
MFG APPR.		
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COMMENTS:
SBR Tank
HydraBubble Mixer
Installation Layout
DWG



Hydra-Fusion™ - Engineering Data and Project Requirements

Process, hydraulic, mechanical, electrical, and controls coordination.

Design Inputs Required

Category	Required project information
Basin and operation	Tank geometry; water levels; operating modes; cycle times; inlet/outlet locations; internal equipment; redundancy requirements
Wastewater characteristics	Flow; temperature; elevation; TDS/salinity where applicable; MLSS/TSS; viscosity/density when non-waterlike; fouling constituents
Oxygen demand	AOR by operating case; process safety factors; alpha, beta, theta and fouling factors; target DO; diffuser submergence; required turndown
Mixing duty	Solids suspension objective; allowable settling; operating modes requiring mixing without aeration; required mixing schedule
Utilities and site	Electrical service; available air equipment; ambient limits; area classification; noise/enclosure requirements; SCADA protocol
Materials	Wastewater and chemical exposure; stainless-steel grade; thermoplastic requirements; coatings; gasket and elastomer compatibility

Available System Scope

Subsystem	Potential ENG Designs scope
Aeration	Fine-bubble diffusers, aeration piping, header network, valves, and installation details
Mixing	Hydra-Bubble mixers, distribution piping, supports, anchors, valves, and layout
Air supply	Blower selection and package coordination; shared or separate blower configuration; air filtration and accessories
Instrumentation	DO, pressure, flow, temperature, level, and other process instrumentation as specified
Controls	Local panel, VFD coordination, PLC/HMI logic, operating modes, alarms, and SCADA integration
Services	Design support, submittals, startup, commissioning support, and operator training as contracted

Minimum Control Functions

- Independent enable/disable and airflow control for mixing and aeration duties, as applicable to the selected architecture.
- Blower permissives, protection, pressure limits, fault handling, and lead/lag or standby logic where multiple blowers are provided.
- DO-based aeration control where specified; timed, continuous, or process-interlocked mixing modes as required.
- Manual override, local/remote selection, operating indication, alarms, and trend points coordinated with the plant control standard.

Verification Basis

The project submittal should state the oxygen-demand basis, diffuser design point, airflow range, blower duty points, mixing airflow, pressure losses, operating modes, materials, and acceptance criteria. Any guaranteed performance must be tied to an agreed test method and defined influent, wastewater, basin, and operating conditions.

HYDRA-DOSE™

CHEMICAL MIXING AND DISTRIBUTION SYSTEM

Controlled dosing coordinated with basin-scale circulation.

Product Overview

Hydra-Dose is an engineered chemical mixing and distribution approach that uses controlled air-release cycles to disperse treatment chemicals through a basin or process tank. The dosing point, mixing layout, materials, feed equipment, and control sequence are selected around the chemical, process objective, reaction time, tank geometry, and operating conditions.

System Objectives

- Distribute the applied chemical rapidly and uniformly through the intended process volume.
- Coordinate chemical feed with active basin circulation and the required contact or reaction time.
- Reduce localized overfeed or underfeed risk through appropriate injection-point and mixing-layout design.
- Provide a control sequence that interlocks chemical feed with verified system operating status.

Functional Elements - Project-Specific

Element	Design responsibility / requirement
Mixing system	Hydra-Bubble mixer quantity, location, air flow, pressure, release frequency, piping, valves, and supports
Chemical feed interface	Chemical source, metering or transfer equipment, injection point, backflow prevention, isolation, flushing, and containment as required
Controls and instrumentation	Dose command, flow pacing or process feedback, permissives, alarms, trend points, manual control, and SCADA interface
Materials compatibility	Wetted metals, plastics, elastomers, adhesives, tubing, valves, seals, and coatings selected for the named chemical and concentration
Safety and compliance	Owner/engineer requirements for storage, ventilation, containment, labeling, emergency response, and applicable codes

Potential Application Categories

Process objective	Project data needed before selection
pH or alkalinity adjustment	Chemical identity/concentration; target range; influent variability; alkalinity/acidity; response time; measurement locations
Nutrient addition	Chemical identity; required mass rate; process flow/load basis; target residual; biological operating mode
Coagulation / conditioning	Chemical and polymer type; jar or bench test data; feed range; shear sensitivity; contact sequence and separation process
Odor / sulfide control	Chemical identity; sulfide/odor data; contact time; process conditions; monitoring and control objective
Industrial process treatment	Complete stream composition; reaction objective; compatibility data; temperature; solids; viscosity; hazardous classifications

The categories above are application-screening examples, not confirmation that a specific chemical or duty is suitable. Chemical compatibility, reaction performance, dose rate, and regulatory requirements must be verified for each project.

Hydra-Dose™ - Application Data and Control Requirements

Complete inputs are required before equipment selection.

Chemical and Process Data Required

Input	Required information
Chemical identification	Product name; manufacturer; SDS and technical data sheet; active ingredient; supplied concentration; dilution; temperature; specific gravity; viscosity; pH
Compatibility	Manufacturer compatibility recommendations for metals, plastics, elastomers, adhesives, coatings, tubing, valves, and seals
Dose basis	Minimum, normal, and maximum feed rate with units; calculation basis; turndown; daily usage; batch or continuous operation
Process objective	Target concentration/residual/pH; required response; upstream and downstream sampling points; contact time; reaction or mixing constraints
Tank and hydraulics	Geometry; levels; volume by operating case; inflow/outflow; residence time; internal equipment; floor slope; short-circuiting concerns
Liquid properties	Flow; temperature; TSS; density; viscosity; salinity/TDS; oil/grease; fouling or scaling constituents

Controls and Safeguards to Define

Function	Project decision required
Dose command	Fixed rate, flow-paced, batch quantity, ratio control, or feedback control from a verified process measurement
Permissives	Mixing air proven, tank level within limits, chemical available, isolation valves aligned, no active leak/containment alarm
Shutdowns	Loss of mixing air, low/high tank level, pump fault, high pressure, leak detection, analyzer fault, emergency stop
Monitoring	Chemical flow or pump status, tank level, air pressure/flow, process measurement, accumulated dose, alarms, and trends
Operating modes	Automatic, manual, local, remote, maintenance/flush, startup, shutdown, and fault recovery

Submittal and Acceptance Requirements

- Process and instrumentation diagram or functional schematic showing chemical and air interfaces.
- Equipment schedule, wetted-material list, compatibility documentation, and manufacturer data for supplied components.
- Control narrative, I/O list, setpoint schedule, alarm matrix, and cause-and-effect logic as required by project scope.
- Installation drawings identifying injection points, mixer locations, supports, anchors, access, containment, and flushing provisions.
- Commissioning plan defining pre-start checks, water test where appropriate, calibration, operating verification, sampling locations, and acceptance criteria.