

Mud-Mixing System

Solids Control Systems & Products



Regardless of rig size or project complexity, M-I SWACO will use our operational and engineering experience to design a system that meets the customers and market expectations. We will then engineer, fabricate and commission the mud-mixing system required to perform efficiently and safely. Whether it's a single HIRIDE* eductor, or a fully automated, touch-screen-controlled, multifunction system, it will deliver the best performance available.

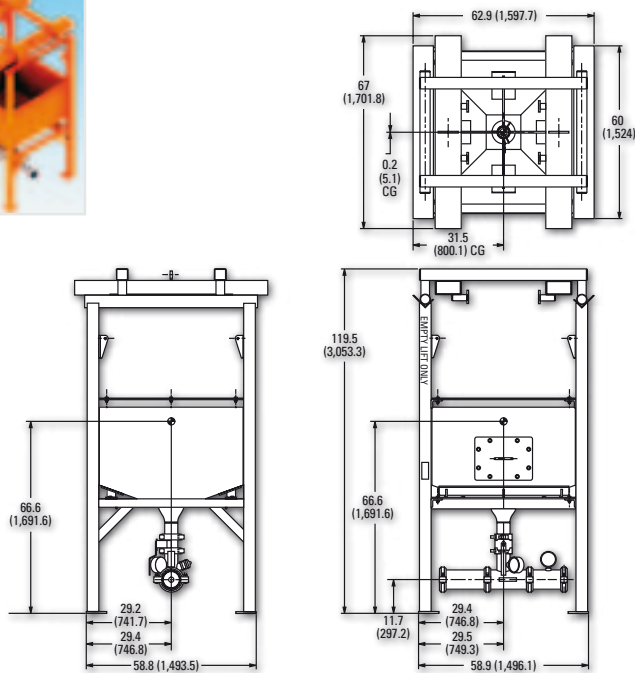
If one quality best describes the system, it is "versatility." Originally conceived for mixing drilling fluids, an M-I SWACO system can be designed for completion fluids as well. Rugged construction, using low-temperature carbon steel and stainless steel, ensures long life in hostile environments. All components feature a minimized footprint and the flexibility to be positioned as rig space dictates.

System components

Each of the components supplied by M-I SWACO can be put in one of three categories: Solids induction, liquid injection and control.

Arrangement drawing: Bulk-bag-additive unit

All dimensions are expressed in inches (millimeters).



Solids induction

Bulk-bag-additive unit

The big bag unit coupled with the HIRIDE eductor ensures optimum feeding performance, product management and safety.

- Adjustable for bulk bag heights 48 to 72 in. (1,219 to 1,829 mm)
- Super sacks up to 4,000 lb (1,814 kg)
- Integrated sack cutter
- Improved materials handling
- Improved mixing rates - bentonite 33,000 lb/hr (14,969 kg/hr)
- Reduces hazardous dust, material storage requirements, waste generation and product loss
- Feeds directly into the HIRIDE eductor which reduces dust and entrains the solid additives

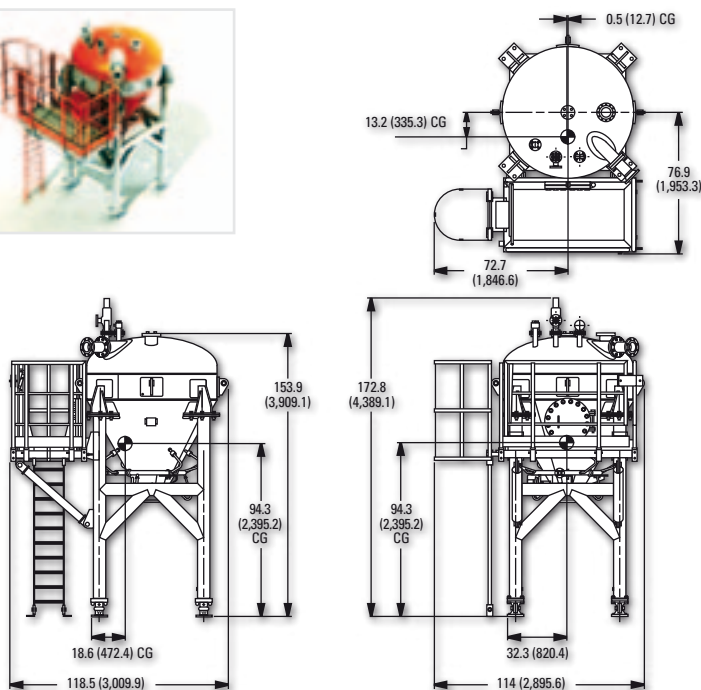
Surge tank

The pressure vessel integrates the storage and feed of bulk materials. An integral load cell and indicator accurately presents the amount of material added by weight.

- Maintains a continuous flow of solids; accurate level and flow control
- Optimal mixing efficiency and effectiveness
- With HIRIDE eductor creates a dust-free environment for improved health and safety conditions
- Standard capacity is 70.6 ft³ (2 m³). Manufactured in other sizes.
- Conforms to ASME Section VIII Div 1 and hazardous-area operation ATEX and the European Pressure Equipment Directive PED 97/23/EC
- Automated management of storage volume
- Fitted with load cells and high- and low-level indicators, pressure gauge, and pressure-relief valve
- Can operate in low temperatures -4°F (-20°C)
- Maximum process temperature of 200°F (93°C)

Arrangement drawing: Surge tank

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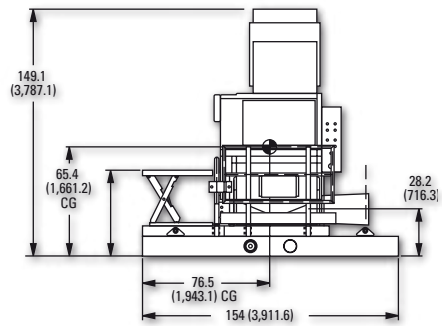
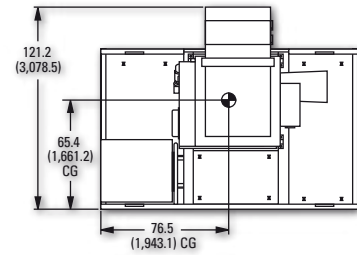
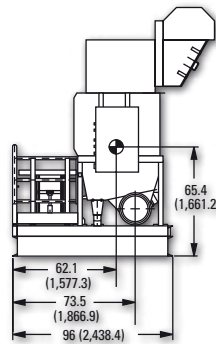
Automatic sack slitter and pallet lifter

An operator feeds sacked chemicals into the automatic sack slitter where the chemical is separated from the sack in a dust-controlled environment. The chemicals are then passed through the HIRIDE eductor, or dosing screw/valve to the HIRIDE eductor, to facilitate mixing. The sack is discarded into a disposal bag to minimize operator handling and dusting. A pallet lifter is used in conjunction with the sack slitter to ergonomically enhance the operator's activities by eliminating the need for bending and picking up heavy sacks.

- Ergonomic design
- Automatic sack compactor
- Self-cleaning, dust-extraction system
- Can process up to 120 sacks/hr
- Rated for hazardous environment Zone 1 gas
- Minimized lifting with pallet lifter
- Dust-free attachments create a healthier environment
- Minimized product loss
- Lower maintenance

Arrangement drawing: Automatic sack slitter

All dimensions are expressed in inches (millimeters).



HiRIDE Eductor

The HiRIDE eductor integrates a proprietary MINIMUM PRESSURE DROP (MPD) 175 nozzle and unique TRIMIX DIFFUSER (TMD) into an easily installed, rugged, stainless steel frame which has been designed to an optimal height for improved ergonomics. The unit is available in three configurations: FE, SE and EA.

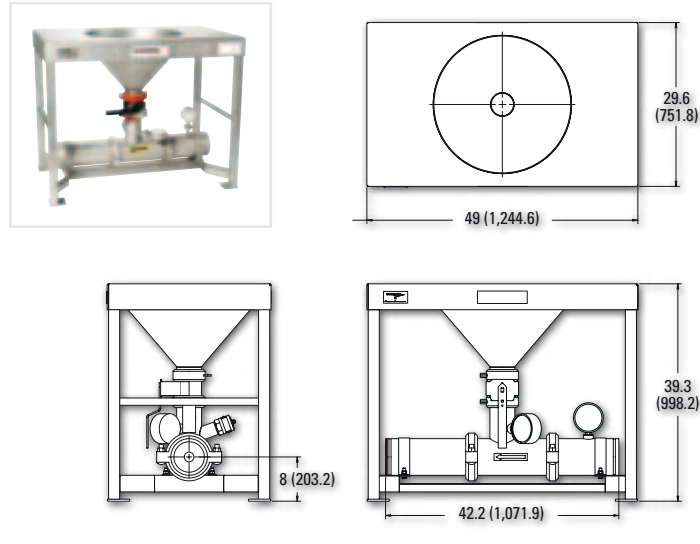
- Rapid, complete mixing of dry or liquid additives into the fluid system
- Lowest comparable pressure loss
- Creates high shear rates in a circulating loop
- Compact design with small footprint
- Dust-free, dry-product mixing
- Minimizes “fish eyes” in hard-to-mix products
- Requires less energy
- Flexible design eliminates extra equipment
- Ideal for rigs where space is at a premium
- A greater degree of worker safety

HiSIDE Blender (rental equipment)

The HiSIDE® blender is an example of scientific theory and practical engineering meeting to create the next evolution of mix-on-the-fly technology. In offshore drilling, precise fluid density and rheological control are much too important to be left to a mix-on-the-fly unit that may not be doing its job. M-I SWACO personnel, using advanced Computational Fluid Dynamics (CFD) modeling, have proven that this is often the case. With the aid of CFD, M-I SWACO has designed and engineered the HiSIDE blender as the answer to the question of accuracy and speed in mix-on-the-fly operations. Capitalizing on a unique combination of baffle geometry, exhaustive design and patented¹, Westfall[^] static mixers; the HiSIDE blender delivers efficient cut-

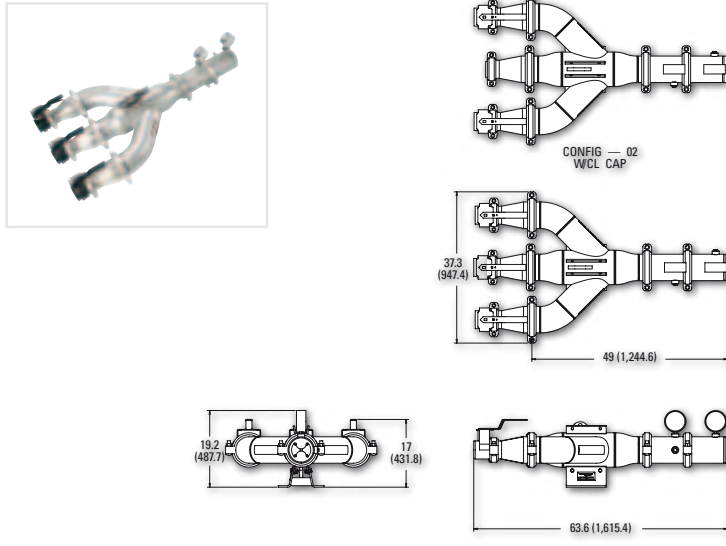
Arrangement drawing: HiRIDE Eductor

All dimensions are expressed in inches (millimeters).



Arrangement drawing: HiSIDE Blender

All dimensions are expressed in inches (millimeters).



back of WBM and effective shearing of OBM, ensuring downhole stability, emulsion quality and rapid supply-boat turnaround.

- Accurate, high-volume and thorough mixing on the fly
- All-steel construction and no moving parts
- Minimal pressure drop across the unit
- In-line baffle premixing and in-line static mixers
- Same unit for OBM and SBM
- Fewer downhole problems
- Faster turnaround for supply vessels
- Easy-to-use, trouble-free operation
- Energy-efficient design

¹Patent number 5,839,828

[^]Westfall is a mark of Westfall Manufacturing Company.

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Liquids injection

Caustic soda mix tank

This unit provides an enclosed area for adding sacks of caustic soda to the fluid system.

- Compact footprint similar to HIRIDE eductor
- Ergonomic height
- Dust-free enclosure
- Wetted parts are stainless steel
- Minimal lifting required
- Reduced product loss and healthier environment
- Minimized corrosion

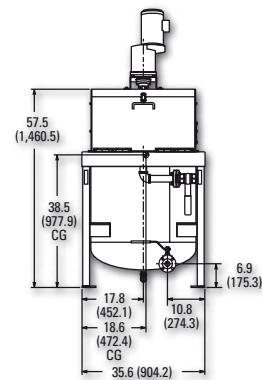
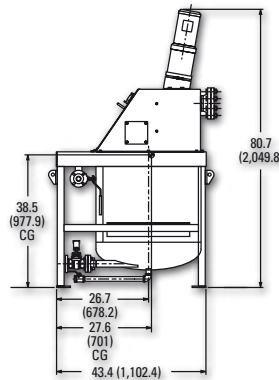
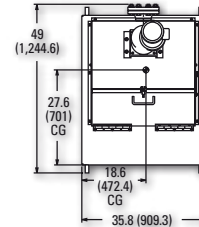
Chemical-additive unit

The chemical-additive unit is the new standard for introducing liquid chemicals into the fluids-mixing process.

- Precise control of injection rates
- Quick installation; easy to operate
- Compact footprint: 5 x 8 x 4 ft high (1.5 x 2.4 x 1.2 m high)
- ATEX Zone 1 gas motors and meters
- Wetted parts are stainless steel
- Gear pumps for high-viscosity fluids and greater control over the chemical-injection process. Each revolution of the gears delivers a finite volume of chemical
- Optimal liquid dosing
- Low-maintenance operation
- Pumps a wide variety of chemical additives

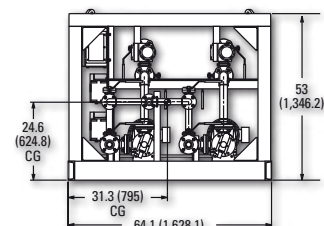
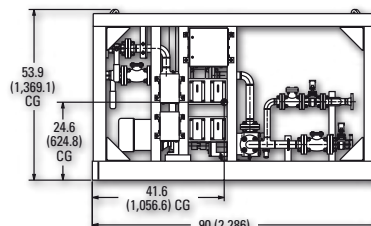
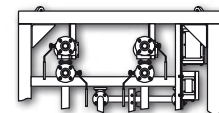
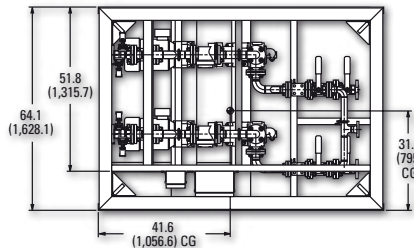
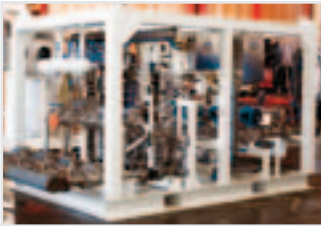
Arrangement drawing: caustic soda mix tank

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Arrangement drawing: chemical-additive unit

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System control

Human-Machine Interface (HMI) systems are becoming increasingly common features in modern drilling installations. They are designed to operate in standalone mode, or can be integrated into other control systems. Outputs from these systems, including alarms, can be available to a multitude of control displays including the driller, operator, logger and M-I SWACO personnel.

HMI systems allow operators to set upper and lower performance parameters and preset some timed operations for equipment that once required manual operation and monitoring. advantages include:

- Improved working environment
- Reduced dust and potential hazards
- Reduced personnel requirements
- Improved equipment performance

The overall control system for the fluids-mixing package consists of a Programmable Logic Controller (PLC) control cabinet networked via Ethernet to a server panel holding two redundant server PCs, a logger PC and viewer monitors.

In addition to the main acquisition network, a maintenance and diagnostic Profibus MPI network is provided for diagnostic and maintenance tasks.



The Mud-Mixing system runs on Cimplicity Plant Edition[^] which is run on the Windows XP[^] operating system as the main SCADA package. A Microsoft SQL server is configured as the logging PC to afford reliable historic data logging and retrieval.

User interface and system control is achieved via a trackball/mouse and keyboard. All communications between the application PLCs and the workstations are controlled via the M-I SWACO dual redundant servers.

Workstation displays show various information pages which are selectable via the trackball/mouse. The operator can control and monitor the performance of equipment using the operator-interface unit. To allow the operator to configure and control the package, a layered paged system is available for ease of use.



[^]Cimplicity Plant Edition is a mark of GE Fanuc Automation.
[^]Windows XP is a mark of Microsoft Corporation.