

Completion Fluids Filtration

Filtration: Filtration Equipment

A complete service for optimizing your production with solids-free completion fluids

There is hardly any element of drilling a well today that isn't considered "critical" at some point in the well-construction process. This is definitely true of the

completion process and all the elements that comprise it, especially the purity of the completion brines.

Operators have come to rely on the filtration equipment and services from M-I SWACO to deliver solids-free brines in a safe, reliable and cost-efficient manner.

QHSE features

In addition to being newer than most of our competitors' equipment, our filtration units and other components have been outfitted for worker health and safety as well as environmental protection.

- Pollution pans and curtains
- Certified slings and shackles
- Drilled pad eyes that are certified annually
- Anti-fall devices
- Spill-containment berms
- Can handle zero-discharge fluids such as $ZnBr_2$
- Stainless steel connections with safety pins
- Hoses tested to maximum working pressure



Bulk DE delivery system

Since 1998, M-I SWACO has provided the industry's first bulk DE delivery system for extra convenience, safety and health protection. The totally enclosed unit features precise controls and provides a considerable list of advantages.

- Significantly reduces dust inhalation
- No lifting required, eliminates back injuries
- No sack or pallet waste
- Waterproof DE filtering media
- Simple operation and hookup; equipped with air-operated vibrators
- First in the industry
- Fine, medium, coarse DE grades available



Bulk tank



The high-efficiency filtration solutions from M-I SWACO minimize downtime and formation damage while reducing waste and environmental costs

DE filtration system equipment

The DE units from M-I SWACO utilize a proven design that is recognized not only for its effective filtration but also for reliability, low maintenance and significant environmental safeguards.

- O-ring-gasketed plates
- Blow-down valves maximize fluid recovery
- Curtains minimize spill potential
- Hose construction
 - Open/close ball valves
 - Stainless steel fittings
 - Designed to eliminate spillage of trapped fluids
 - Pressure tested and certified
- Backup hydraulic systems



Backup hydraulic power-pack unit

Oil and grease remediation services

M-I SWACO can use existing technology to effectively remove organic components that cause failure of static sheen test. This will reduce completion fluid oil and grease values to levels acceptable for discharge.

- Various grades of DE filter media
- Media additives tailored for oil and grease removal
- Specially designed, oil-adsorbing cartridges; one replaces ten 2.5 in. (64 mm) standard cartridges of similar length
- Plant-reclaimed fluids pass oil and grease specification
 - This process has been used successfully on offshore and land locations. M-I SWACO utilizes it to reclaim oil-contaminated fluid returned to its completion fluid plants

Onshore reclamation services

After onshore reclamation, M-I SWACO certifies that the levels of oil and grease will meet NPDES permit (or similar) requirements and that reclaimed fluids will meet new-fluids specifications. For fluids with densities greater than 11.6 lb/gal (1.4 kg/L), M-I SWACO

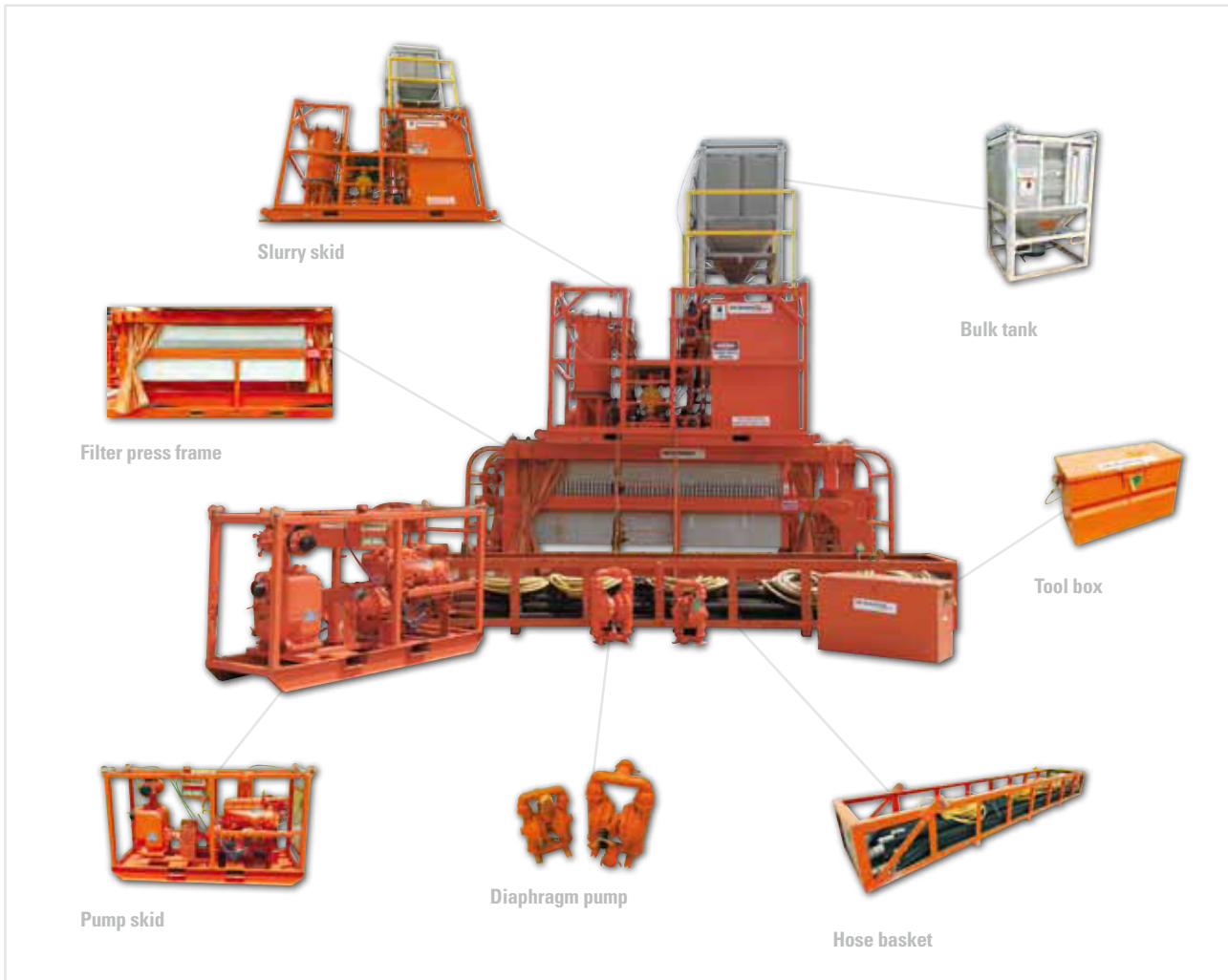
guarantees immediate credit after completion of the wellbore, based upon agreed-to volume and density losses. All charges associated with the disposal of oil, sludge, spent DE and other waste materials resulting from the reclamation are absorbed by the operator.

Typical service parameters

Type of Fluid	Expected Solids Loading	Filtration Package
Fresh seawater	Low	2 or 10 micron filters
Light brine: NaCl/KCl	Low	2 or 10 micron filters
Medium-weight brine: CaCl ₂ , NaHCO ₂	Low	2 or 10 micron filters
Medium-weight brine: CaCl ₂ , CaBr ₂	High	DE and 2 or 10 micron filters
Heavy-weight brine: NaBr, CaBr ₂ , KHCO ₂	Low/high	DE and 2 or 10 micron filters
Very heavy-weight brine: ZnBr ₂ , CsF, NaHCO ₂	High	DE and 2 or 10 micron filters



Dual pod unit



Features and advantages

- New, well-maintained equipment
- Customizable DE filtration
- Specially designed cartridge filtration
- Flexible equipment configurations
- Well-trained technicians
- Oil and grease remediation
- Filtration solutions for all brines
- Bulk DE delivery system
- Greater filtration efficiency
- Less waste
- Environmental compliance
- Healthier working environment
- Two chemical-injection diaphragm pumps
- Platinum-grade cartridges – 33% more efficient than standard stick-type
- Thiocyanate removal
- DE filtration press and slurry skids are stackable for tight spaces
- Backup hydraulic pump

DE Filtration Units plate and frame skid

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Safety and operational considerations

- M-I SWACO provides ladders with each unit
- Retractable lanyard fall-protection devices
- Slurry skids equipped with handrails
- Diatomaceous Earth (DE) bulk tanks reduce back injuries associated with handling sacks
- Safe working and operating conditions require 3 ft (0.9 m) clearance around equipment
- All DE filtration presses and slurry skids stackable
- Maximum filtration rates 12 to 14 bbl/min (1.9 to 2.2 m³/min) (clean fluid with little or no solids). Accounting for solids and density, the average filtration rate is 10 bbl/min (1.6 m³/min). Factors that affect filtration rates are density, viscosity and solids loading. Mechanically, filtration rates are decreased as the length of the pump suction increases
- Average DE filtration capacity (lb/bbl) depends upon viscosity, density and solids loading
- Average number of filtration cycles depends upon viscosity, density and solids loading

Operating specifications

- Cake thickness, in. (mm): 1¼ (32)
- Plate size, in. (mm): 47 x 47 (1,200 x 1,200)
- Filter cloths/polypropylene with sewn-in, high-density cord for caulked-in-place installation
- Recessed, center-feed, alternating four-corner discharge
- Material of construction: polypropylene
- Gasket sealing area with EPDM elastomer O-ring-type gaskets
- Fully ported
- Maximum operating pressure 100 psi (7 bar) @ 120°F (49°C) operating temperature

Filter press frame

- Oil-rig-style
- Design pressure: 100 psi (7 bar)
- Full-width, 304 stainless steel sidebar caps
- 304 stainless steel sluice pan, welded in place: 36 in. (914 mm) deep with 12 in. (305 mm) slope end to end
- Lifting eyes certified tested
- Mounting pad for sluice pump
- Forklift slots in base



Hydraulic closing system

- Double-acting hydraulic cylinder
- Stainless steel cylinder rod
- Dual Haskel[^] hydraulic pumps

Paint system

- White sandblast to SSPC-SP10 material preparation
- Special, three-coat Carboline[^] paint system

Feed and discharge manifold

- Material of construction: schedule 20, 304 stainless steel
- PVC butterfly valves
- 4 in. (102 mm) inlet and outlet connections
- Manual valve actuation



Slurry skid

- Size, L x W x H, ft (m): 14 x 8 x 7.5 (4 x 2 x 2.29)
- Weight, lb (kg): 8,000 (3,629)
- Equipped with a dual-pod cartridge unit containing a total of 10 uniquely designed, 6½ in. (165 mm) OD, platinum-grade cartridges or 30 standard, 2½ in. (64 mm) OD cartridges. (Platinum-grade cartridges are 33% more efficient than standard stick-type)
- Each cartridge is 40 in. (1,016 mm) long
- It takes approximately 10 min to change a set of 10 cartridges; easy disposal
- The slurry skid may be stacked on top of the filter press
- Ladder and retractable lanyard device for fall protection included



Pump skid

- Size, L x W x H, ft (m): 10.42 x 3 x 6.42 (3.18 x 0.9 x 1.96)
- Weight, lb (kg): 3,500 (1,587)
- Engine manufacturer: Deutz[^]
 - Displacement, in.³ (cc): 353/371 (5,785/6,080)
 - Output, hp: 85
- Pump manufacturer: Gorman-Rupp[^] UBB60-B
 - Size, in. (mm): 4 x 4 (102 x 102)
 - Self-Priming Centrifugal
 - Output: 14½ bbl/min @ 75 psi (5 bar)
- The 1600, 1500, 1200 and 800 DE filtration presses and slurry skids are stackable
- Maximum filtration rates are 12 to 14 bbl/min (1.9 to 2.2 m³/min) for clean fluid with little or no solids-loading; lower with increased solids-loading

[^]Haskel is a mark of Haskel International, Inc.

[^]Carboline is a mark of Carboline Company.

[^]Deutz is a mark of Deutz AG Corporation.

[^]Gorman-Rupp is a mark of Gorman-Rupp Company.



Miscellaneous and safety equipment

DE Bulk Tanks

- Size, L x W x H, ft (m): 4 x 5 x 7.42 (1 x 2 x 2.26)
- DE bulk tanks hold 1,800 lb (816 kg) of DE
- DE bulk tanks weigh 850 lb (386 kg) empty

DE Sack Material

- DE available in 25 and 50 lb (11 and 23 kg) sacks



Chemical Injection Diaphragm Pump

- Type: Air
- Size, in. (mm): 2 (51) and 3 (76)
- Manufacturer: Versa-Matic[^]



Hose Basket

- Size, L x W x H, ft (m): 22 x 4 x 3 (7 x 1 x 0.9)
- Weight, lb (kg): 4,500 (2,041)
- Hose lengths and sizes:
 - Most hoses are available in 20 ft (6.1 m) sections rented by the foot
 - 4 in. (102 mm) suction and discharge hose with stainless steel safety lock camlock connections
 - 3 in. (76 mm) suction and discharge hose with stainless steel safety lock camlock connections
 - 2 in. (51 mm) suction and discharge hose with stainless steel safety lock camlock connections
- All hoses are pressure-tested, certified and have stainless steel connections
- 1 in. (25 mm) air hose with brass safety crow connection is available in 25 and 50 ft (8 and 15 m) sections

[^]Versa-Matic is a mark of Versa-Matic Tool, Inc.

Specifications				
Filtration unit	1,600 ft² DE Filtration Unit (149 m²) plate and frame skid	1,500 ft² DE Filtration Unit (139 m²) plate and frame skid	1,200 ft² DE Filtration Unit (111 m²) plate and frame skid	800 ft² DE Filtration Unit (74 m²) plate and frame skid
Unit size, ft ² (m ²)	1,600 (149)	1,500 (139)	1,200 (111)	800 (74)
Plates	64	60	45	33
Manufacturer	JWI [^] (Siemens [^])	JWI (Siemens)	JWI (Siemens)	JWI (Siemens)
Size, L x W x H, ft (m)	23.25 x 9 x 7.75 (709 x 3 x 2.36)	23.25 x 9 x 7.75 (709 x 3 x 2.36)	22 x 4 x 7.17 (7 x 1 x 2.19)	16.75 x 4.76 x 7.17 (5.11 x 1.5 x 2.19)
Weight, lb (kg)	24,000 (10,886)	24,000 (10,886)	22,000 (9,979)	20,000 (9,072)
Filtration surface area, ft ² (m ²)	1,600 (149)	1,500 (139)	1,200 (111)	800 (74)
Design operating pressure, psi (bar)	100 (7)	100 (7)	100 (7)	100 (7)

[^]JWI is a mark of Siemens Water Technologies Holding Corp.

[^]Siemens is a mark of Siemens Aktiengesellschaft Corporation.

Equipment

Filtration: Filtration Equipment



Centrifugal pump

- 4 x 4 ft (1 x 1 m) NPT female connections
- Open-type, 6-vane impeller 40-50-18 ductile iron
- No. 20 gray-iron casing (max. operating 130 psi [9 bar])
- Handles 1½ in. (29 mm) spherical solids
- Oil sight glass
- Brass pressure-relief valve
- Oil-lubricated silicon carbide vs. tungsten carbide mechanical seal
- Maximum temperature of liquid pumped: 160°F (71°C)
- Buna N O-ring
- Double discharge fitting of stainless steel material
- Dodge[^] Para-Flex[^] coupling



M-I SWACO blending tank

- Size, L x W x H, ft (m): 9.42 x 8 x 9.5 (2.87 x 2 x 2.9)
- Weight, lb (kg): 6,000 (2,722)
- Capacity, bbl (m³): 65 (10.3)
- Jetted chemical hopper

Cargo boxes

- Unit size L x W x H, ft (m): 6 x 6 x 9.33 (2 x 2 x 2.84)
- Weight, lb (kg) empty: 8,000 (3,629)



Dual pod unit

- Skid size L x W x H, ft (m): 7 x 3 x 6.5 (2 x 1 x 1.98)
- Weight, lb (kg): 2,000 (907)
- Number of cartridges: 10
- Hoses (25 ft [7.6 m] sections): 25 ft (7.6 m) of suction and 25 ft (7.6 m) of discharge

Hydraulic power pack

- Size, L x W x H, ft (m): 7.5 x 3.42 x 5 (2.29 x 1.04 x 1.52)
- Weight, lb (kg): 4,000 (1,814)
- Engine manufacturer: Deutz
 - Displacement, in.³ (cc): 353/371 (5,785/6,080)
 - Output, hp: 72
 - Panel with oil-pressure and temperature gauges equipped with safety shutdown
 - Cast-iron manifold
 - Spark-arrestor muffler
 - Manual Chalmatic air intake shutdown
 - Oil-bath air cleaner
 - V-belt shutdown
 - Hand throttle, rigid mounts
 - PTO clutch
- Hoses (hydraulic hoses), ft (m): 80 (24)

[^]Dodge and Para-Flex are marks of Baldor Electric Company.

Filter Press Package (Unit)

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The Filter Press Unit is used as part of a filter package and is typically the first point of filtration for completion brines.

Applications

Inexpensive Diatomaceous Earth (DE) filter media is used in the Filter Press Unit from M-I SWACO to remove heavy solids contamination from high volumes of brines.

How it works

The Filter Press Unit is always used with a guard filter placed downstream to catch any possible DE bleed-off. When a twin-vessel cartridge unit is used downstream from the Filter Press Unit, it provides a polish filter.

Features

- Gasketed polypropylene filter plates and cloths for zero fluid loss
- Hydraulic-ram closure with pneumatically powered hydraulic pump and manual standby pump in case of air-supply failure
- Compact, rugged carbon steel construction with transport/lifting frame and slings
- Integral slurry pan for wash-down of filter cake
- Inlet/outlet manifold in 316 stainless steel complete with blowdown system for fluid recovery

Advantages

- Removal of heavy solids contamination from high volumes of fluid



FILTER FLOC

Filtration: Filtration/Reclamation Chemistry

FILTER FLOC* polymer is a suspension designed to flocculate residual displacement solids in a manner that facilitates removal from a brine-base completion fluid. By flocculating the residual displacement solids, the contaminant can be easily transported

to the surface and removed through the brine filtration process.

For completion fluid applications, FILTER FLOC polymer is applied as a spacer in the displacement train. FILTER FLOC additive is intended for use in freshwater, seawater, monovalent,

and calcium brine fluids. FILTER FLOC additive can also be utilized in the reclamation of completion fluid brines. For reclamation applications, optimum FILTER FLOC polymer additions are determined through pilot testing.