DGSI
DURHAM GEO SLOPE INDICATOR

Environmental and Geotechnical Products

F.A.P. Plus™ ZW Pump System

The TRUE zero-water, product-only recovery system

Application

For LNAPL recovery in 2-inch and larger-diameter wells and up to 200-ft depths. Recovers light-end hydrocarbons with SSU values of 80 or lower.

Benefits

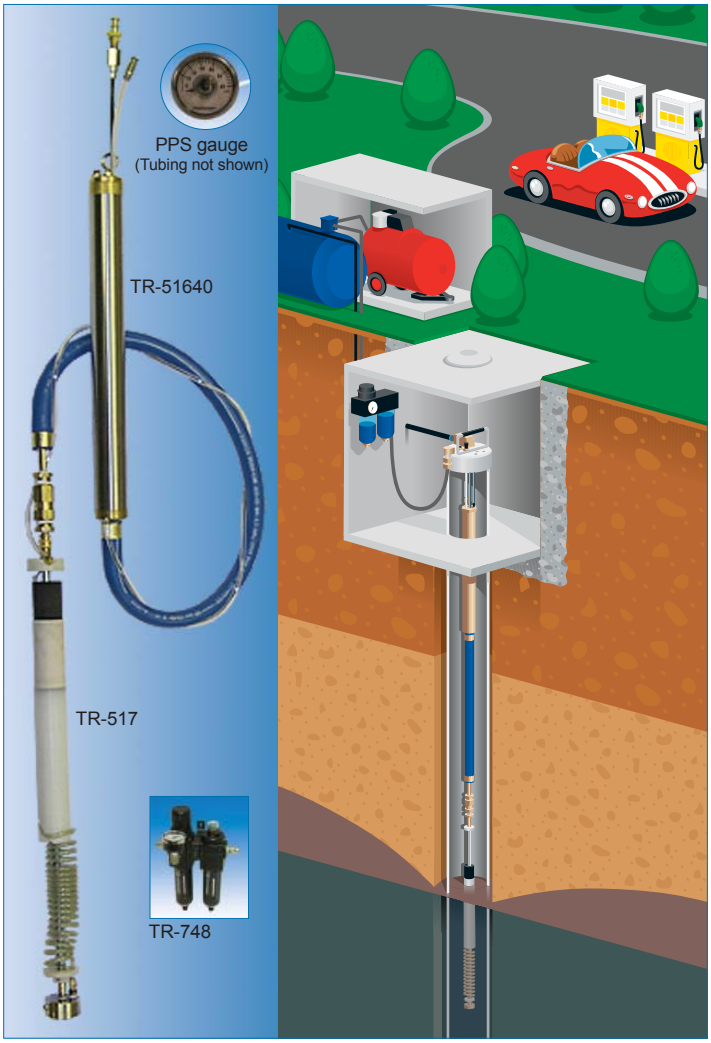
- **Will not recover water**
- **Locates product/water interface**
- **Easy installation**
- **Pump field proven for over 20 years**

Description

The F.A.P. Plus ZW is the first true pneumatic zero-water, product-only recovery system. It is versatile enough to recover a wide range of products, from gasolines, diesel fuels and hydraulic fluids, to more viscous products like # 6 heating oils, all without the worry of ever recovering water. The F.A.P. Plus ZW, an upgraded version of the F.A.P. Plus, incorporates both the ZW (Zero Water) feature and the Precise Positioning System (PPS). The Zero Water pneumatic logic stops and starts the F.A.P Plus ZW automatically, depending on the position of the skimmer inlet. This prevents water from being recovered. Additionally, the Precise Positioning System (PPS) will locate the product/water interface accurately so the pump is installed at the proper level.

Additional system components may include:

- Well Clincher
- Overfill Protection Devices
- Electric Air Compressor
- SolarNAPL Compressor
- Hoses and Tubing



(Left) F.A.P. Plus ZW (TR-51640) with additional Standard Skimmer (TR-517) and Filter/Regulator (TR-748)

Operation

Precise Positioning System (PPS)

The Precise Positioning System includes a surface-mounted pressure gauge to conveniently identify the product/water interface (PWI). When the F.A.P. Plus ZW is lowered into the well, the surface mounted gauge will show a drop in pressure indicating that the PWI has been reached. The system is then raised to accomodate expected water table fluctuations and the pump will begin to cycle product to the surface. If the PPS shows no air pressure, it indicates that the Zero Water function is activated: the water table has risen high enough to turn the pump off. When the water level recedes and the pneumatic Zero Water switch is turned back on, the pump will cycle again and the PPS gauge will show an increase in air pressure.

ZW (Zero Water) feature

The intelligent logic incorporated in the F.A.P. Plus ZW will start or stop the pump based on the skimmer inlet position. When the water table rise exceeds the standard travel allotted by the skimmer, the float will activate a pneumatic switch, shutting the air supply off and stopping pump operation. When the water table recedes and the skimmer inlet is at the proper product/water interface, the pneumatic switch is released, allowing the pump to re-start automatically. This feature ensures that only product is recovered. The F.A.P. Plus ZW pump will then lift recovered product to the surface and discharge the pumped product to a storage tank that can be fitted with an optional Tank-Full Shut-Off unit.

F.A.P. Plus™ ZW Pump (TR-51640) - consists of a flexible, special inner bladder and a flexible Buna-N® hose which forms the outer pump body. The pump operates by alternately inflating and deflating the annular space between the inner bladder and the outer hose. When compressed air is applied, the inner bladder collapses, propelling the fluid to the surface. When the air is exhausted, the inner bladder rebounds to its original shape, thereby causing a suction which pulls fluid into the pump. The pump is capable of producing a suction of 17 inches of mercury, enough to recover viscous product and operate in deep wells up to 200 feet.

SPECIFICATIONS	
TR-51640 F.A.P. Plus ZW™ Pump Includes F.A.P. Plus ZW pump (TR-51640) and Coalescing Filter/Regulator (TR-748). (Requires skimmer - Order separately, see p.3)	
Size and Weight	1.75 in-OD by 59 in long. 6 lb
Air Requirements	0.5 cfm at 100 psig (2.8 dm³ at 690 kPa)
Operating Pressure	60 to 100 psig
Pump Capacity	15 - 20 gal/hr at 10 ft DTH 10 - 15 gal/hr at 100 ft *TDH* *Based on gasoline through 3/8-in ID hose.*
Max. Viscosity	Contact factory
Suction	17 in Hg
Materials	Flexible Buna-N® (outer bladder) Tygon® special (inner bladder)
Connections	Brass, stainless steel
Air Supply to Pump	1/4 in-OD push-to-connect fitting
Fluid Discharge	3/8 in-ID hose-barb fitting
PPS Sensor*	1/8 in-OD polyethylene tubing (100 ft supplied with each pump)
Sensor Fitting*	Female quick-connect
TR-516 F.A.P. Plus™ Pump (Does not include ZW feature) Includes F.A.P. Plus pump (TR-516) and Coalescing Filter/Regulator (TR-748). (Requires skimmer - Order separately, see p.3)	
Specifications	Same as above (without ZW option)

* Available only on F.A.P. Plus ZW

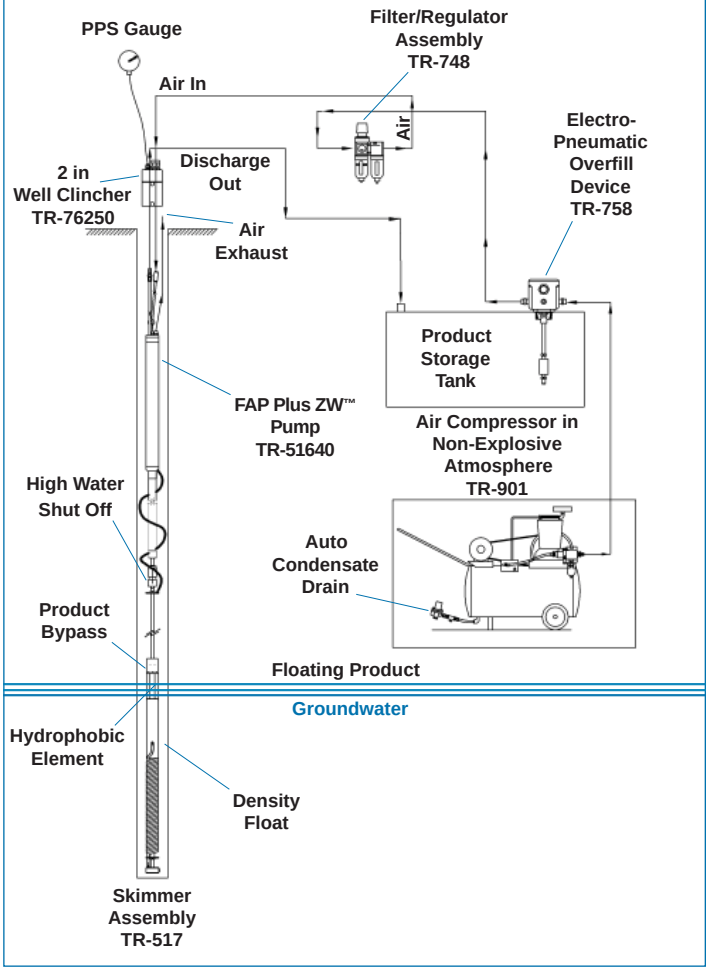
Maintenance: *Biofouling may occur because the hydrophobic element is positioned at the air/product interface. If fouling occurs, the element can be cleaned using a soft brush or replaced by unthreading the bypass element and installing a new hydrophobic element.*

Coalescing Filter/Regulator (TR-748) - Is included with purchase of the F.A.P. Plus ZW and should be installed at the well head to supply the proper air pressure to a F.A.P. Plus ZW pump.

TR-748

TR-748 Filter/Regulator (Coalescing)	2 lb
Dimensions	10.3 in by 2.48 in
Range	0 - 125 psi (Max 150 psi)
Fittings	1/4-in output push-lock fitting, 3/8-in inlet barbed fitting
Capacity	Less than 1 psi pressure drop while passing 20 scfm at 100 psig
Replacement Filter	TR-600217 Particulate filter TR-601157 Coalescing filter

Typical F.A.P. Plus ZW™ System Installation



F.A.P. Plus ZW (TR-51640). The F.A.P. Plus (TR-516) is similar to the above, but does not come with the ZW option and PPS gauge (items marked with *).

Skimmers (Choose One)

The skimmer is attached to the bottom of the F.A.P. Plus ZW™ pump and is used to separate the product from the water in the well. The skimmer is a necessary part of the F.A.P. Plus and F.A.P. Plus ZW pumps and must be ordered separately. Three types of skimmers are available: standard, high-viscosity, and density.

Note: Density skimmers are not compatible with the F.A.P. Plus ZW. To use a density skimmer, you can either purchase a conversion kit (TR-51699) or you can purchase the F.A.P. Plus pump (TR-516).

How do I select the most appropriate skimming system?

Important elements in choosing a F.A.P. Plus ZW™ system are:

- Water table fluctuations
- Product viscosity
- Type of product
- Well diameter
- Amount of product present
- Depth from bottom of well to product/water interface

Visit www.durhamgeo.com to download our design data sheet for defining all your site conditions.

Standard Skimmer (TR-517 / TR-51711 / TR-51718) - Is used to recover gasoline, jet fuel and most diesel fuels. It combines a density float, hydrophobic element, product bypass screen, hollow guide rod and coiled hose. The center guide rod allows the skimmer to travel freely in response to the water table changes. The skimmer is designed to float with the inlet positioned at the water/product interface, providing 24 or 36 inches of skimmer travel.

The hydrophobic element is made of a special porous plastic with a pore size that will allow only product to pass. The bypass screen on top of the hydrophobic element allows the product to enter the skimmer directly when the product layer is greater than 2 inches.

TR-517 / 51711 F.A.P. Plus ZW™ Standard Skimmer	5 lb
Dimensions	1 ¾ in-OD x 67-in long. Fits 2-in and larger wells
Materials	UHMW polyethylene, stainless steel, PVC urethane tubing, hydrophobic material, brass fittings and Nylon
Float	UHMW polyethylene, S.G. 0.95
TR-517 Travel	36 in (Min. depth of 24 in required)*
TR-51711 Travel	24 in (Min. depth of 18 in required)*
903801	Hydrophobic element replacement

* from bottom of well to product/water interface.

***Tech Tip:** The F.A.P. Plus ZW™ requires a minimum of 60 psi for optimal performance*

High Viscosity Skimmer (TR-70410) - Is used when the product has a viscosity higher than 80 SSU, such as oils. The 4-in high viscosity skimmer uses the same design as the TR-517, less the hydrophobic and bypass screen. The skimmer has 30-in of travel and a specific gravity of 0.95, allowing it to float at the water/product interface. The product collects on top of the skimmer inlet and from there it is pumped to the surface. In normal applications, the skimmer will remove product down to a product layer of ¼ in to ½ in. The skimmer can be adjusted in the field to remove the product even further and attain a thinner layer.

TR-70410 F.A.P. Plus ZW™ High Viscosity Skimmer	8 lb
Dimensions	1 ¾ in-OD x 67 in long
Materials	UHMW polyethylene, stainless steel, urethane tubing, brass fittings and PVC
Float	UHMW polyethylene, S.G. 0.95
Travel	30 in

Density Skimmers (TR-702 / 704 / 706 / 712) - Are used when there is less than 18 inches of fluid from the bottom of the well to the water/product interface. These skimmers have a specific gravity of 0.95 and float in the water with the top inlet just above the product/water interface. The 2-in, 4-in and 6-in sizes are for use in well casings with these nominal inside diameters. The 11.5-in model is self-supporting and may be used in large diameter wells, open excavations and open water applications.

TR-704

TR-706

Note: Density skimmers are not Zero Water (ZW) compatible, therefore it is essential that either the F.A.P. Plus ZW conversion kit (TR-51699) or F.A.P. Plus pump (TR-516) be purchased.

TR-702 / 704 / 706 / 712 F.A.P. Plus Density Skimmer	3 lb
TR-702 Dimensions	1.65-in dia.
TR-704 Dimensions	3.5-in dia.
TR-706 Dimensions	5.5-in dia.
TR-712 Dimensions	11.5-in dia.
Float	UHMW polyethylene, S.G. 0.95
Inlet Screen	Stainless steel mesh
Coil	Polyurethane tubing
Effective Travel	Up to 24 in
TR-51699 F.A.P. Plus ZW Conversion Kit	10-32 plug, 1/8 in-OD plug

View animated graphics on the web. Visit www.DGSI.info/FAP to see how the pumps function.

Accessories

Well Clincher (TR-762 / 764 / 766 / 768) - Serves as a well seal and pump support. It simplifies hose connection. A retractable handle provides for easy installation or removal of the pump system.

TR-764
(Shown mounted to well.)

Well Clincher	Diameter	Weight
TR-762*	2 in	1 lb
TR-764	4 in	1 lb
TR-766	6 in	1 lb
TR-768	8 in	1 lb

*Handle not supplied.

Tank-Full Shut-Off (TR-75713) - Is installed on the recovery tank or drum to prevent overfilling of the product storage vessel. The main air is supplied to the inlet side of the overfill device and the outlet air supply to the F.A.P. Plus ZW pump. The overfill device is triggered by increased fluid levels in the recovery tank and mechanically shuts-off the air supply to the F.A.P. Plus ZW pump. The standard overfill device can be used with up to five pumps and installs into a standard 2-in bung. (Contact DGSI if more than 5 pumps must be conected).

TR-75713

TR-75713 Tank-Full Shut-Off	4 lb
Dimensions	6 x 6 x 21 in
Enclosure	PVC and aluminum
Operating Presure	0 - 100 psi

Electro-Pneumatic Overfill Protection Device (TR-758) - Uses an intrinsically safe float sensor to shut off the air supply to the F.A.P. Plus ZW pump. Includes a programmable 24-hour timer to allow on/off time settings in 15 minute increments. Features a NEMA 4 rated enclosure with Solid State GEM Pak® circuitry and an 8-ft power cord. **Note:** Must be located in non-hazardous environment.

TR-758

Electro-Pneumatic Overfill Protection Device	Dimensions	Air capacity	Voltage (ac)	Weight
TR-758	8 x 6 x 4 in	23scfm@100 psi	110 V	10 lb

Suspension Cable Kits (918701) - Kits come with fittings and 50 ft of cable for typical installations. Longer cable lengths are available **(918702)** and sold per ft.

Hoses and Tubing (TR-732 / 734 / 735) - For the F.A.P. Plus ZW are available in various sizes and sold per foot.

PN	Size	Composite	Use
TR-732	1/2 in ID	Buna-N	Optional above-ground air supply
TR-734	3/8 in ID	Buna-N	Above-ground fluid discharge or air supply, or downwell fluid discharge
TR-735	1/4 in OD	Polyethylene	Downwell supply to pump

Membrane Dryer (TR-749) - Is installed in the air supply line to the F.A.P. Plus ZW pump. The dryer reduces dew point to -4°F to eliminate moisture from the air supply. Recommended for extreme weather conditions.

TR-749

TR-749 Membrane Dryer	9 lb
Maximum flow	3 cfm

Related Accessories

Air Compressor (TR-901) - Electric, non-explosion-proof 2.5-hp, indoor-use air compressor producing 4.2 scfm. This compressor can be used with up to three F.A.P. Plus ZW systems. A 5-hp compressor is available for use with more than three systems. If other air sources are used, they should include a 5-micron coalescing air filter. In freezing or high humidity conditions, an air dryer is required to avoid system damage.

Air Compressor	hp	Tank size	cfm @ 100 psi	Voltage (ac)	Weight
TR-901	2.5	20	5.5	115 V (60 Hz)	150 lb
TR-905	5	80	17.1	230 V (50 Hz)	600 lb

SolarNAPL (TR-51600) - Is a solar-powered air compressor which can be configured to run the F.A.P. Plus ZW skimming system. It uses the sun's energy — a renewable resource — as the only power source necessary to operate recovery pumps and is an excellent option for remote locations.

TR-51600

TR-51600 SolarNAPL	210 lb

F.A.P., F.A.P. Plus and F.A.P. Plus ZW are trademarks of Durham Geo Slope Indicator.

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