



Crack Sealer

ECS-250



Operation



Maintenance



Safety



MO-ECS-21

Etnyre Crack Sealer

ECS-250

Operation, Maintenance and Safety Manual

WARRANTY

E. D. Etnyre & Co. warrants to the original Purchaser, its new product to be free from defects in material and workmanship for a period of twelve (12) months after date of delivery to original Purchaser. The obligation of the Company is limited to repairing or replacing any defective part returned to the Company and will not be responsible for consequential damages or any further loss by reason of such defect.

The company excludes all implied warranties of merchantability and fitness for a particular purpose. There are no warranties, express or implied, which extend beyond the description of the goods contained in this contract.

This warranty does not obligate the Company to bear the cost of machine transportation in connection with the replacement or repair of defective parts, nor does it guarantee repair or replacement of any parts on which unauthorized repairs or alterations have been made or for components not manufactured by the Company except to the extent of the warranty given by the original Manufacturer.

This warranty does not apply to:

- (1) Normal start-up services, normal maintenance services or adjustments usually performed by the selling dealer, factory service representative or customer personnel.
- (2) Any product manufactured by E. D. Etnyre & Co. purchased or subjected to rental use.
- (3) Any product or part thereof which shows improper operation, improper maintenance, abuse, neglect, damage or modification after shipment from factory.
- (4) Any product or part thereof damaged or lost in shipment. Inspection for damage should be made before acceptance or signing any delivery documents releasing responsibility of the delivering carrier.

This warranty and foregoing obligations are in lieu of all other obligations and liabilities including negligence and all warranties of merchantability or otherwise, express or implied in fact or by law.



E. D. ETNYRE & CO., OREGON, ILLINOIS 61061-9778

1333 South Daysville Road Phone: 815-732-2116 Fax: 815-732-7400 www.etnyre.com



WARNING

This equipment uses volatile materials at high temperatures and pressures.

This equipment employs highly combustible or explosive fuels. Potentially life threatening hazards may exist during equipment operation.

Persons must be trained and familiar with Section 2 (Safety Precautions) before operating this equipment.



WARNING

Follow these precautionary instructions exactly. Do not take shortcuts. Do not assume that someone else has acted on your behalf. Failure to follow these instructions may result in death or serious injury. If any rule or precaution is not clear to you, see your supervisor before using the machine.




WARNING

Potentially life-threatening hazards may exist during equipment operation. Only qualified persons should attempt to operate, service, or make adjustments to the equipment.

CALIFORNIA

Proposition 65 WARNING

 **WARNING:** This product can expose you to chemicals including Lead, which is known to the State of California to cause cancer, birth defects or other reproductive harm. For more information, go to: www.P65Warnings.ca.gov

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Please note this warning and remember -

Always start and operate the engine in a well ventilated area;

If in an enclosed area, vent the exhaust to the outside;

Do not modify or tamper with the exhaust system.



WARNING

Fluoroelastomer Handling

Some O-rings and seals used in this vehicle are made from fluoroelastomers. When used under design conditions, fluoroelastomers do not require special handling. However, when fluoroelastomers are heated to temperatures beyond their design temperature (around 600° Fahrenheit), decomposition may occur with the formation of hydrofluoric acid. Hydrofluoric acid can be extremely corrosive to human tissue if not handled properly.

A degraded seal may appear as a charred or black sticky mass. Do not touch either the seal or the surrounding equipment without wearing neoprene or PVC gloves if degradation is suspected. Wash parts and equipment with 10% lime water (calcium hydroxide solution) to neutralize any hydrofluoric acid.

If contact with the skin occurs, wash the affected areas immediately with water. Then rub a 2.5 calcium gluconate gel into the skin until there is no further irritation, while seeking prompt medical attention.

Note to Physicians: For advice or treatment of HF burns, call the DuPont Medical Emergency number, 1-800-441-3637



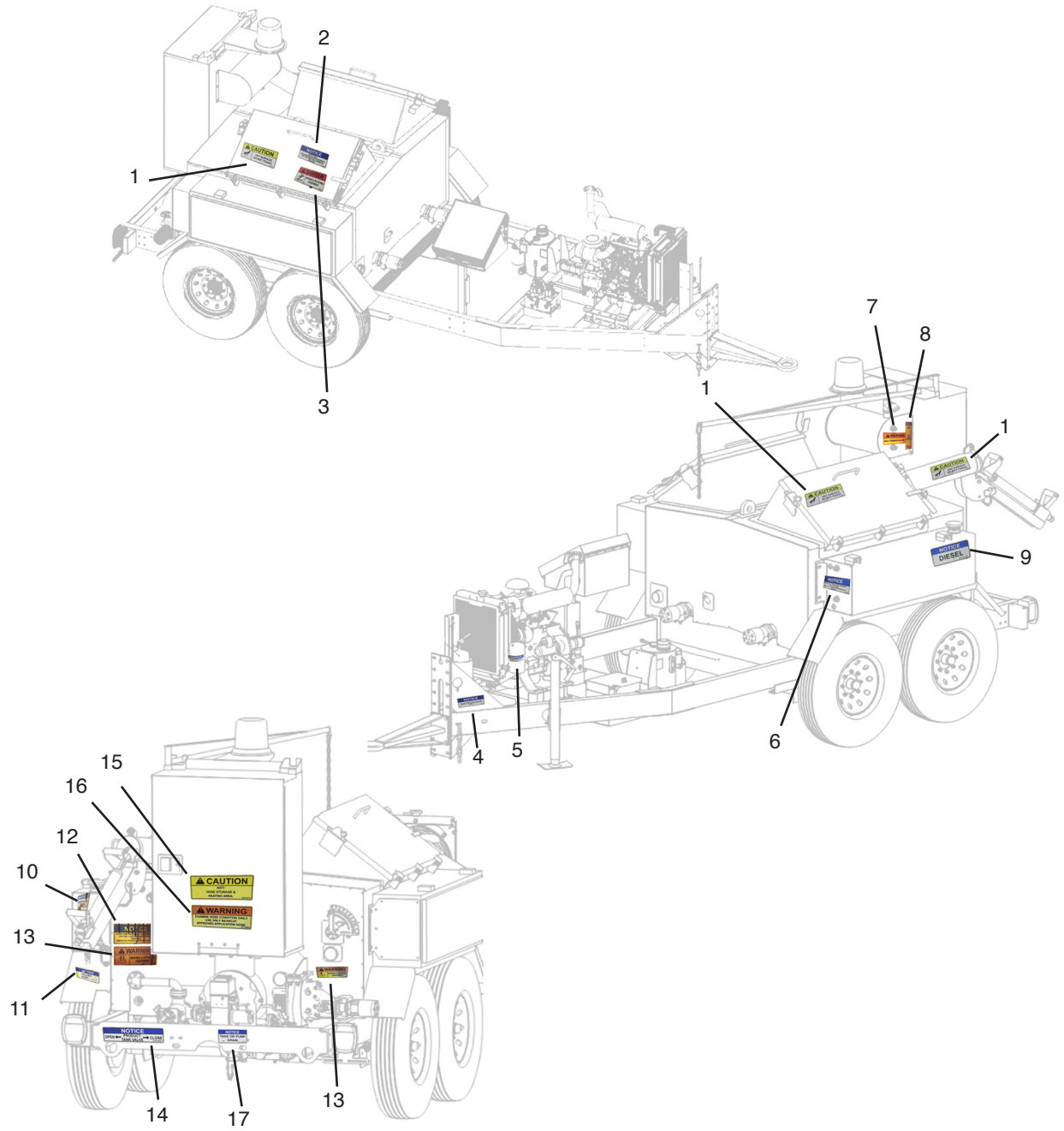
WARNING

The materials used in the Etnyre Crack Sealer are normally heated from 300°F to 450°F during application. Materials used at these temperatures can cause serious or fatal burns and can become explosive under certain conditions. Diesel fuel used in the burner to heat these materials is highly flammable. Extreme care must be exercised at all times to ensure the safety of persons working in proximity to these potentially hazardous conditions.

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Warning And Instruction Plates



REF	PART NO.	QTY	DESCRIPTION	REF	PART NO.	QTY	DESCRIPTION
1	217788	3	Decal-Caution, Hot Surface. Do Not Touch	10	DCL80287	1	Decal-Notice, Burner Fuel Supply
2	DCL80285	1	Decal-Notice, Keep It Full	11	DCL80288	1	Decal-Notice, Flush Fuel
3	217790	1	Decal-Danger, Moving & Rotating Equip	12	DCL80284	1	Decal-Notice, Adjust Pump Packing Daily
4	DCL80080	1	Decal-Notice, Hitch Position Must Be Set	13	217789	2	Decal-Warning, Moving & Rotating Equip
5	DCL80283	1	Decal-Notice, Hydraulic Oil Only	14	MSM80051	1	Decal-Notice, Product Tank Valve
6	DCL80280	1	Decal-Notice, Diesel No.2, Diesel No.1	15	MSM80033	1	Decal-Caution, Hot! Hose Storage
7	DCL80282	1	Decal-Warning, Heat Transfer Oil Only	16	DCL80083	1	Decal-Warning, Examine Hose Condition
8	DCL80286	1	Decal-Notice, Hot - Oil Level - Cold	17	DCL80289	1	Decal-Notice, Tank or Pump Drain
9	DCL81188	1	Decal-Notice, Diesel				

General Safety Instructions

The operation of a bituminous distributor normally requires handling of liquid products at elevated temperatures. Additionally, these liquids may be of a volatile nature. A heating system is supplied to raise or maintain the product temperature, and these systems use highly combustible fuels. As with any type of construction equipment, there are certain hazards associated with improper or careless operation.

Safety warnings have been provided to call attention to any potentially hazardous situation that may cause property damage, personal injury or death to the operator or bystanders. These safety warnings are identified by the following warning symbols.



The **DANGER** symbol alerts you to immediate hazards which **WILL** result in severe personal injury or death.



The **WARNING** symbol alerts you to hazards which **MAY** cause severe personal injury or death.

You will also find **CAUTIONS** and **NOTES** throughout the manual.



CAUTION alerts you to procedures that may result in damage to the equipment if not followed properly.

- A **NOTE** provides general information that the operator should be aware of when performing an operation.

DANGER

To avoid an extreme fire hazard or explosion, **NEVER** use gasoline as fuel in low pressure or generating burners

WARNING

A fully charged dry chemical type fire extinguisher must be within easy reach whenever the burners are operating or there is an open flame near the distributor. The minimum capacity of the fire extinguisher should be 10 pounds.

To prevent an explosion or fire hazard: Position the unit broadside to the wind to prevent volatile fumes from drifting toward the burners.

To prevent an explosion or fire hazard: Do not operate the burners if the tank is damaged or leaking

WARNING

To prevent an explosion or fire hazard: Ensure that the burners are extinguished before removing any material from the tank in any manner. Liquid petroleum (LP) burners can support a flame for several minutes after the fuel supply is turned off.

To prevent an explosion: Do not operate the burners when the vehicle is unattended, when the vehicle is in motion, or with the vehicle in a confined area.

To prevent an explosion or fire hazard: When the burners go out, shut off the fuel supply to both burners and allow the flues to ventilate for at least 3 minutes before re-lighting the burners.

General Safety Instructions



WARNING

To prevent an explosion or fire hazard: Do not heat the material beyond the manufacturer's recommended temperature.

To prevent an explosion or fire hazard: Keep burning cigarettes or other sources of combustion away from manholes and overflow vents.

To prevent an explosion or fire hazard: Check the tank vent to insure that it is free from obstruction before lighting the burners.

To prevent an explosion or fire hazard: Do not operate the burners with the manhole open or open the manhole while the burners are in operation.

To prevent an explosion or fire hazard: Keep area free of all sources of combustion when spraying.

To prevent an explosion or fire hazard: Eliminate sparks from engine exhaust.

To prevent possible fire hazards, burns or falls: Keep the unit clean for safe operation.

To prevent possible hand or facial burns: Always light the inside burner first. Do not reach across a lit burner to light or re-light the inside burner. Shut off the outside burner before lighting the inside burner.

To prevent possible burns: Always use a torch to light the burners. Never attempt to light the burners using a match or pocket lighter.

To prevent possible burns to operators or bystanders, or possible equipment damage, do not start any operation if any control settings are unknown.

To prevent possible burns from leaking material: Be sure all pipe, cap and hose connections are secure before opening valves.

To prevent possible burns from hot asphalt spray: Do not stand, or allow anyone to stand, where accidental opening of a valve may cause contact with hot asphalt.



WARNING

To prevent possible burns from foaming or violent eruption, do not load tank with material temperature over 200°F if water or condensation is present in tank, or if emulsion was used in the previous load. Do not heat material over 200°F if moisture or emulsion is present in tank.

To prevent burns from hot asphalt when handspraying: Hold the handspray gun in proper position and watch for other people.

To prevent burns: Always wear insulated gloves when handling spray bar sections or hoses.

To prevent possible burns from material overflow: Allow sufficient space in the tank for expansion of the material when heating.

To prevent possible burns: Use extreme caution when using a torch to heat the pump. Asphalt accumulated around the pump may ignite when heating the pump with a torch.

To prevent severe injury from becoming entangled in machinery: Stand clear of rotating drives.

To prevent possible injury: Always open the manhole cover slowly. Pressure build up in the tank may cause the cover to burst open.

Before removing the fill line cap, make certain that the asphalt pump is turning and the suction valve is closed.

To prevent possible personal injury: Do not load the vehicle beyond the GVWAR or GVWR. The maximum load volume must be calculated based on material density.

Allowing the burners to operate for a long period of time without circulating can damage the product and create explosive fumes. If product cannot be circulated after fifteen minutes of heating without circulation, the burners should be extinguished for 20 - 30 minutes before re-lighting the burners.

SAFETY PRECAUTIONS

PERSONAL SAFETY

Persons responsible for the operation and maintenance of Etnyre Crack Sealers should read and understand the following safety precautions and the remainder of this manual before operating the equipment.



WARNING

The materials used in the Etnyre Crack Sealer are normally heated from 300°F to 450°F during application. Materials used at these temperatures can cause serious or fatal burns and can become explosive under certain conditions. Diesel fuel used in the burner to heat these materials is highly flammable. Extreme care must be exercised at all times to ensure the safety of persons working in proximity to these potentially hazardous conditions.



WARNING

Follow these precautionary instructions exactly. Do not take shortcuts. Do not assume that someone else has acted on your behalf. Failure to follow these instructions may result in death or serious injury. If any rule or precaution is not clear to you, see your supervisor before using the machine.

SAFETY RULES

Read each safety rule and make them a part of the daily work routine.

General Protection



WARNING

Exhaust sparks from an engine can ignite volatile gases from the sealant material. Always keep a dry chemical fire extinguisher fully charged and on hand at all times.

Protect yourself:

1. ALWAYS make sure the return and suction line gate valves at the front of the hydraulic reservoir are wired OPEN before starting the engine. A closed valve will cause the hydraulic filter to burst

2. NEVER start the engine until you have read and understand the operating manual
3. ALWAYS wear suitable insulated gloves and protective clothing (long-sleeve shirt, long pants, and coveralls) when touching any part of the equipment
4. ALWAYS wear suitable safety glasses and a face shield
5. ALWAYS keep your body and clothing clear of rotating drive parts

POTENTIAL EXPLOSIVE/FIRE HAZARD CONDITIONS



WARNING

Failure to comply with the following safety rules may result in a fire or explosion that could cause severe burns, injury, or death.

1. NEVER allow lighted cigarettes or any burning material near open loading doors or vents
2. NEVER attempt to light the burner with any type of open flame or igniter other than the burner automatic ignition system
3. NEVER use gasoline in the burner. The burner operates on diesel fuel only
4. NEVER heat the sealant material beyond the maximum temperature recommended by the manufacturer
5. NEVER heat the sealant material in a sealant tank that leaks
6. NEVER use an open flame to heat valves or hoses

BURNER OPERATIONS



WARNING

Potential fire or explosion hazards exist when operating the burner. Failure to follow the burner operation safety procedures could result in severe burns, injury, or death.

1. NEVER operate the burner under the following

conditions:

- a. While the machine is unattended
 - b. While the machine is in motion
 - c. When the machine is parked in a confined area
 - d. If the sealant tank contains water
2. ALWAYS make sure the fire extinguisher is on the machine, fully charged (indicator in the green), and the safety seal is unbroken
 3. ALWAYS make sure the heat jacket and heating coils are covered with sealant material before and during heating
 4. ALWAYS allow sufficient space in the tank for the material to expand when heating.
 5. ALWAYS park the machine broadside to the wind, so any sealant vapors or fumes are carried away from the crew and the engine exhaust

SEALING OPERATIONS



WARNING

Worn or faulty hoses can burst and cause severe burns or death. Check the condition of all hoses before operating the machine.

1. ALWAYS keep the application wand pointed AWAY from all personnel
2. ALWAYS check the condition of the hoses before beginning sealing operations
3. ALWAYS make sure that all pipe and hose connections are secure before opening a valve
4. ALWAYS start the product pump VERY SLOWLY, and make sure that all hoses and valves work properly
5. NEVER pump against a closed valve
6. NEVER remove the application wand from the machine without the shutoff valve in the CLOSE position
7. NEVER look into the sealant tank from the front of the machine. Hot sealant material from the tank circulation pipe and application wand is pumped forward and may splash out
8. NEVER load a block of sealant material into the sealant tank when both loading doors are open

TOWING PROCEDURES

Drive defensively and watch your speed. The machine contains diesel fuel and a large amount of liquid sealant at high temperature. An accident can lead to a major fire.

1. NEVER tow the machine with the burner operating

because you would be:

- a. Breaking the law
 - b. Risking damage to the burner
 - c. Violating the first rule of burner operation (never leave the burner unattended when it is lit)
2. ALWAYS make sure the wheel lug nuts and hitch bolts are tight. Check them daily
 3. ALWAYS use safety chains. Connect them in a crisscross pattern
 4. ALWAYS connect the safety breakaway chain
 5. ALWAYS make sure the machine is level. If not, adjust the hitch height. Towing an out of level machine can result in an accident or spilled sealant
 6. ALWAYS make sure the tires are properly inflated
 7. ALWAYS make sure the electrical connector for the running lights, break lights, turn signals, and electric brakes (if applicable) is connected
 8. ALWAYS make sure the turn signal and break light functions match the tow vehicles inputs

DESCRIPTION

This manual describes the Etnyre Crack Sealer machines.

Etnyre Crack Sealers are designed and manufactured to ensure personal safety when the equipment is operated properly and all safety precautions are strictly followed.

Persons responsible for the operation and field maintenance of the Crack Sealer should read this manual carefully before attempting to operate the equipment or performing any service or adjustment procedures on it.

EQUIPMENT DESCRIPTION

Etnyre Crack Sealers (ECS) use a diesel engine as their power source and an enclosed, high-pressure, diesel fuel burner for heating the asphalt sealing material. No gasoline, propane, or other fuels are used.

The ECS-250 has a 250-gallon sealant tank.

The following description of the equipment should be read to familiarize the operator with the features and capabilities of the ECS-250.



Figure 1. ECS-250

HYDRAULIC SYSTEM

The ECS hydraulic system is powered by a 3-cylinder diesel engine. The hydraulic system gear pump is direct coupled to the diesel engine crankshaft. The hydraulic system is used to drive the two circulating augers, the heat-transfer oil pump, and the product pump.

The augers, oil pump, and product pump are operated on 3 separate hydraulic circuits. This is accomplished by using 3 individual hydraulic gear pumps stacked together as 1 pump assembly. Each pump has a

displacement unique to its own circuit in order to achieve the correct hydraulic motor RPM. For safe and reliable machine operation the engine speed should be set in the range of 1800-2400RPM.

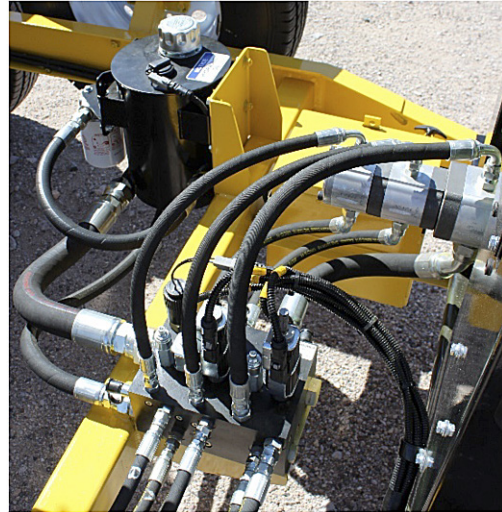


Figure 2. Hydraulic Pump, Reservoir & Valve Manifold

Hydraulic fluid for the system is stored in the hydraulic reservoir. The reservoir is directly connected to the hydraulic valve assembly. Fluid returning from the manifold first passes through a 10-micron filter and then back into the hydraulic reservoir.



Figure 3. Hydraulic Reservoir & Filter

HYDRAULIC VALVE ASSEMBLY

The hydraulic integrated circuit (HIC) consists of 3 main parts: suction manifold, valve bank, and return manifold. The hydraulic fluid is drawn from the reservoir and into the suction manifold inlet. The fluid then exits the manifold through the 3 outlets which each go up to a separate gear pump in the hydraulic pump

stack. The fluid from the pump travels back to the HIC under pressure as 3 separate circuits. The 3 circuits go to their individual valve in the HIC and go out to their corresponding hydraulic motors. The return lines are then routed back to the HIC where the circuits are combined again as in a return manifold, leaving through 1 exit port.

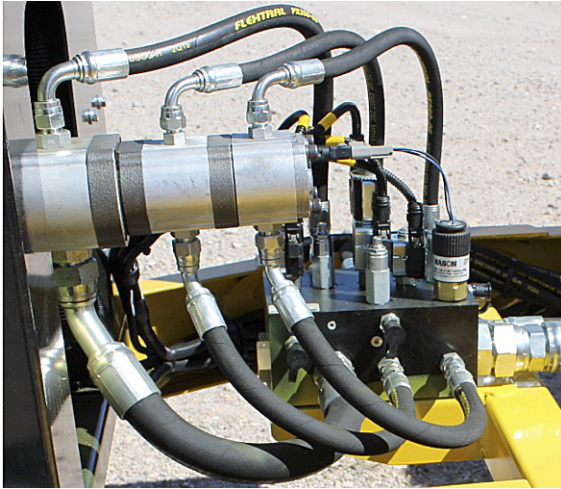


Figure 4 Hydraulic Pump & Valve Assembly

Each working circuit is protected by a hydraulic pressure relief valve. The relief valves are set to achieve the maximum amount of work into the system without causing excessive part wear in the event of a locked-up pump or auger. There is also an incorporated pressure switch on the auger hydraulic circuit. This switch is set to OPEN at a pressure just below the relief valve pressure setting. If the switch opens, a message is displayed to the operator that the augers are “stuck”. If this happens in AUTO mode, the machine will automatically shut off the augers and try again in the opposite direction after a time delay.

The hydraulic cartridge valves are equipped with a manual override. In the event of an electrical failure, each valve can still be manually operated by hand. The HIC is also equipped with diagnostic test port couplings on the pressure side of each circuit for fast diagnostic work in the event of a hydraulic failure.

PRODUCT PUMP

The product pump and hydraulic motor are located at the rear of the ECS-250. The product pump hydraulic circuit runs off the front hydraulic pump in the pump stack. The product pump directional control valve is located at the front of the HIC and directs the flow of hydraulic fluid to the product pump hydraulic motor.

The directional control valve allows either forward or reverse rotation of the product pump. Hydraulic fluid from the product pump hydraulic motor is circulated back to the product pump directional control valve in the hydraulic manifold assembly.

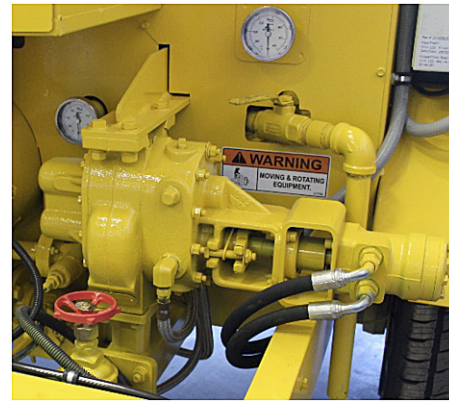


Figure 5 Product Pump

CIRCULATING AUGERS

The dual circulating auger motors hydraulic circuit runs off the middle hydraulic pump in the pump stack and uses the middle valve in the HIC. The hydraulic circuit also uses the pressure switch at the back of the HIC. Hydraulic fluid is sent from the circulating auger directional control valve to the auger motors attached to the front of the product tank.

The auger motors are connected in series and are designed to rotate at the same speed. The circulating augers are also configured to rotate in opposite directions. This enhances sealant material circulation and heating within the product tank and produces a swirl effect in the material. The directional control valve allows either forward or reverse rotation of the circulating augers. Hydraulic fluid is circulated through the auger motors and back to the HIC.



Figure 6 Circulating Augers Inside Heat Coiling

HEAT-TRANSFER OIL PUMP

The heat-transfer (hot-oil) pump and motor are located at the rear of the machine. The rear hydraulic pump in the pump stack drives the hydraulic motor for the heat-transfer oil (hot-oil) pump. The directional control valve controls the hot-oil pump operation in the forward only rotation. Hydraulic fluid from the hot-oil pump hydraulic motor is then returned to the hydraulic manifold assembly.



Figure 7 Heat-Transfer Oil Pump

SEALANT HEATING SYSTEM

The ECS-250 sealant heating system is a closed, controlled, flow heating system which utilizes a high-pressure diesel fuel burner to heat the heat transfer oil (hot-oil). Diesel fuel for the burner is drawn from the ECS-250 fuel tank. The hot-oil is circulated through the heating system by the hot-oil pump. Heat transfer from the hot-oil is used to heat the sealant material to the temperature necessary for application. The system-designed, hot-oil circulation rate eliminates any localized hot spots within the hot-oil system.

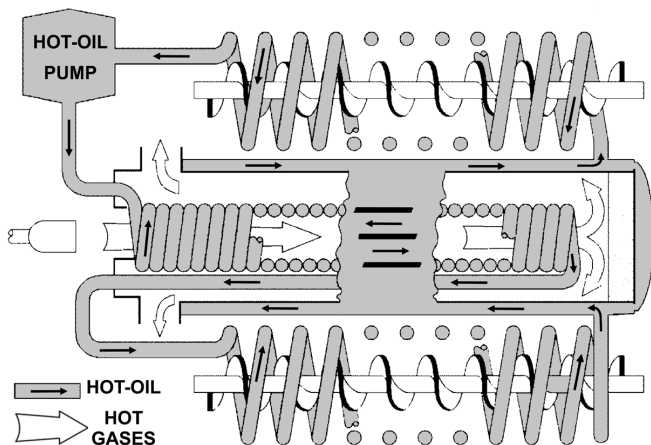


Figure 8 Sealant Heating System

The elimination of hot spots within the heating system reduces hot-oil breakdown and product coking on the heating coils.

The sealant heating system completely isolates the sealant tank from any direct contact with the hot gases produced by the burner. The primary heating coil is surrounded by a heating chamber. The heating chamber is enclosed by a hot-oil filled outer jacket (heat jacket). All heat-related contact with the sealant material is accomplished through the ECS-250 sealant heating system.

The hot-oil from the sealant heating system is also circulated through a heat trace system used to heat the product pump and product related plumbing.

The diesel fuel burner is a sealed, self-contained unit. The burner contains an integral high-pressure diesel fuel pump, a solid-state igniter, and a cage type blower. The diesel fuel is pressurized to approximately 150 PSI and injected into the burner head through an atomizing nozzle. The atomized fuel is ignited and the hot gases are forced out of the burner by the blower.

The diesel fuel burner blows the hot gases through the inside of the hot-oil filled primary heating coil. The direct heat from the burner provides the initial heat transfer to the hot-oil system. The primary heating coil is surrounded by the heating chamber, which contains the hot gases after they exit the heating coil. When the hot gases exit the end of the heating coil they are deflected back over the outside of the heating coil by a refractory material bulkhead, which closes the end of the heating chamber. Circulating the hot gases over the outside of the heating coil provides additional heat transfer to the hot-oil.

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Figure 9 Diesel Fuel Burner

The heating chamber is constructed with a hot-oil filled outer heat jacket. The hot-oil is circulated through the heat jacket to provide additional heat transfer to the hot-oil and indirect heating to the sealant material. By containing the hot gases in this manner, near maximum theoretical heat transfer from the burner to the hot-oil is accomplished. The hot gases circulate through the heating chamber and exit through two exhaust stacks at the rear of the ECS-250.

The hot-oil is pumped through the primary heating coil into the right-hand circulating auger heating coil to heat the sealant material. The circulating auger heating coil turns are spaced to allow melted sealant material to flow through them. However, large pieces of un-melted sealant material cannot pass between the coils and jam the rotating auger blades.

CIRCULATING AUGER HEATING COIL

The hot-oil is circulated through the circulating auger heating coil and back into the heat jacket. The hot-oil is circulated through the heat jacket for additional heat transfer to the hot-oil. The hot-oil exits from the left side of the heat jacket and is circulated through the left-hand circulating auger heating coil to provide sealant material heating in the left side of the sealant tank.

The ECS-250 has an additional heat transfer coil in the forward portion of the sealant tank. The added sealant material heating capability ensures fast and efficient heating operation with the larger capacity sealant tank.


The hot-oil is circulated from the left-hand auger heating coil and into the hot-oil manifold assembly. The hot-oil pump draws the hot-oil from the manifold assembly and begins the heat transfer and circulation cycle again.

The sealant heating system uses a hot-oil expansion tank located on top of the sealant tank to contain the hot-oil as it is heated. The hot-oil expansion tank has a capacity equal to half the volume of the total filled system. The tank contains a sight glass for both hot and cold oil level checks. The tank uses an integral cold seal to minimize oxidation of the hot-oil during system cooling cycles. The hot-oil expansion tank is connected to the upper portion of the manifold assembly and is the final component in the closed-loop sealant heating system. A fill connection for servicing the sealant heating system and a vent is located at the top of the tank.



Figure 10 Hot-Oil Expansion Tank

SEALANT TANK AND CIRCULATING AUGERS

 WARNING	
Do not load sealant material into the sealant tank with both loading doors open. Hot sealant will splash out of the open door. Hot sealant can cause serious or fatal burns.	

The Etnyre Crack Sealer (ECS) has two sealant loading doors on the top of the sealant tank. The sealant loading doors are accessible from the sides of the machine. Each sealant loading door has a loading shelf attached to the inside of the door. The loading shelf keeps the block of sealant material from falling into the sealant tank until the door is closed. This design prevents hot sealant from splashing out of the tank during material loading. The sealant loading doors are equipped with DOT-approved safety latches for transportation of elevated temperature materials. The safety latches may also be locked for added safety or security reasons.



Figure 11 Sealant Loading Door

The sealant tank contains two hydraulically driven circulating augers. The circulating augers rotate inside the circulating auger heating coils. The design assures splash free horizontal circulation of the sealant material within the tank. The heating coils prevent blocks of un-

melted sealant material from jamming the circulating augers. The circulating auger shaft is equipped with a leak-proof, high-temperature packing gland. The special packing gland reduces the need for periodic repacking and prevents sealant leakage during operation.

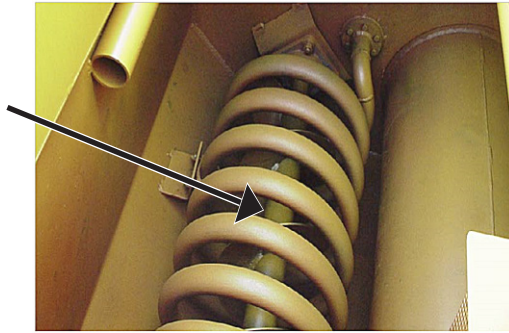


Figure 12 Circulating Auger

SEALANT PLUMBING

The product pump is a positive-displacement pump, which is driven by the product pump hydraulic motor. The product pump directional control valve is used to set pump direction (forward/reverse). Hot-oil from the sealant heating system is circulated through the product pump heating jacket. The hot-oil is also used to heat the product tank valve, the tank and pump drain valve, and related plumbing. Any frozen sealant material within the pump and plumbing is liquefied by the hot-oil heat trace system. The product pump is mounted in an inverted position, which allows the pump to be drained of any residual material for maintenance purposes.

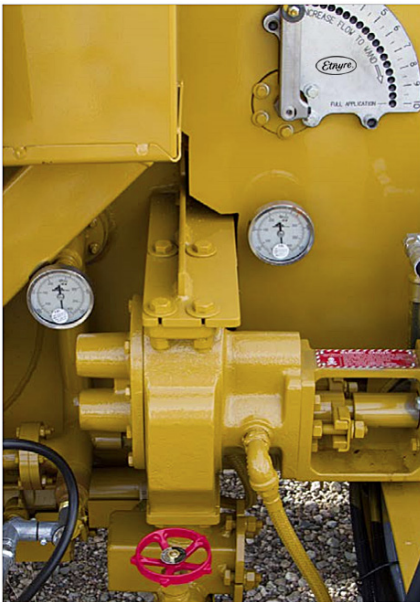


Figure 13 Product Pump

The product tank valve is located at the rear of the product tank, next to the product pump. The product tank valve controls the sealant material flow from the product tank to the sealant plumbing. The valve is operated by an electric linear actuator connected to an extension shaft at the rear of the ECS-250. The actuator has 2 end-of-stroke internal limit switches; this tells the computer the position of the tank valve. This can also be seen on the machines display. The actuator is also equipped with overload protection which stops the actuator if the tank valve is stuck or takes too long to open. The tank valve will not reset, and the machine operation will need to be restarted. This is to ensure long component life and operator safety. A warning message will be displayed if the tank valve fails to open.

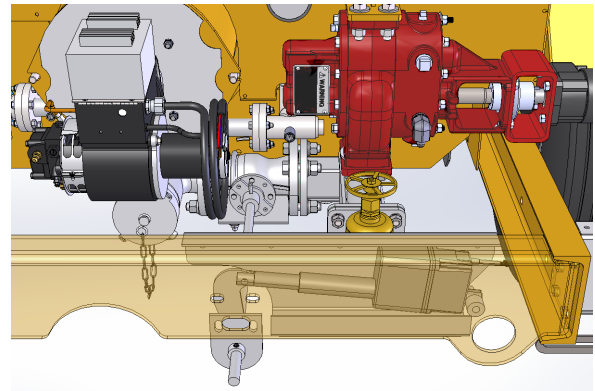


Figure 14 Product Tank Valve

Once the sealant material is melted enough to allow circulation, the tank valve is opened, and the product pump directional control valve is positioned to start the product pump. The product pump circulates the sealant material through the sealant plumbing. The sealant material flow through the sealant plumbing is controlled by the application/ recirculation valve. The application/ recirculation valve is a 3-way valve with a detent selector used to adjust sealant circulation through the plumbing. The application/recirculation valve can be set from the "0" position (full tank circulation) to the "10" position (full flow to the application wand). The application/ recirculation valve allows constant sealant material flow through the sealant plumbing system to eliminate any frozen sealant-related blockages. Continuous sealant material circulation also maintains sealant material consistency.

With the application/recirculation valve in the “0” position, all sealant material is circulated back into the sealant tank. With the application/ recirculation valve moved to approximately the “10” position, maximum sealant material flow is directed to the application wand.



Figure 15 Application / Recirculation Valve

SEALANT APPLICATION WAND

The sealant material is pumped through a 20-foot long, high-temperature hose to the application wand. The hose has a high-temperature outer cover to protect it from the heat trace lines located inside the hose trough. The aluminum application wand is connected to the hose with a swivel joint to prevent binding and permit tangle-free operation. The application wand has two insulated handles and an insulated section between the handles.

The rear handle of the application wand is also the application wand shutoff valve. The shutoff valve is a 1/4-turn, ball-type valve, which allows precise control of the sealant material during application.

The Etnyre Crack Sealer is equipped with an application wand return tube. The return tube allows continuous circulation of the sealant material through the application wand and back into the sealant tank. Circulating hot sealant material through the application wand and hose eliminates any frozen sealant material blockage problems during sealing operations. Place the application wand in the return tube and open the shutoff valve when the sealant wand is not in use. The application wand retaining bracket, located below the return tube, secures the application wand during wand-to-sealant tank circulation. As an aid to safe operation, the application wand cannot be installed or removed from the retaining bracket unless the shutoff valve is in the CLOSE position.



Figure 16 Sealant Application Hose

OPERATING CONTROLS

The operating console is located on the right-hand side of the machine, in front of the sealant tank. The console is mounted on a pedestal with a lockable cover which doubles as a sunshade. The operating control panel contains the following controls and indicators:

1. Master Power ON/OFF switch
2. Auto/Manual control switches
3. Engine control & display
4. Temperature control & display
5. Beacon switch
6. Generator switch (option)
7. Work lights switch (option)



Figure 17 Control Panel

The MASTER POWER ON/OFF switch provides power to the operating panel, and the AUTO/MANUAL control switch determines which group of switches will control the machine operation. If Auto control is selected, then only the switches in the Auto control group will control the machine. If Manual control is selected, then only the switches in the Manual control group will control the machine.

The engine controller is located directly above the MASTER POWER switch and has 3 main buttons: OFF, AUTO, and RUN. When the controller is powered up it defaults to AUTO, and the engine can start by pressing RUN. After selecting RUN, the controller pre-heats, starts, and allows the engine to warm up. While running, the screen will display engine operating parameters, and the up and down arrows can be used. Selecting OFF will shut down the engine after an idle cool down, selecting OFF a second time will force engine shutdown. An engine warning light is also incorporated on the controller for quick reference of engine status.

For Auto machine control there are two switches that control machine operation: START/STOP and CLEANOUT. Toggling START will start or resume machine operation. Toggling STOP will stop or pause machine operation. CLEANOUT will reverse the product pump; once cleanout is terminated, the machine operation will stop, and engine will return to idle. Holding down the CLEANOUT switch for 3 seconds will initiate the cleanout command, and once the time runs out or the switch is actuated a second time; the cleanout command will terminate. Cleanout will only work if the tank valve is open and the product pump is on (machine circulating material).

When operating in Auto mode, there are user defined variables that can be changed on the settings page of the display. These variables are Pump Temp, Auger Temp, and Cleanout Time. Pump Temp is the temperature required inside of the sealant tank for the tank valve to open and the product pump to turn on in the forward direction. Auger Temp is the temperature required inside of the tank for the augers to turn on. Cleanout Time is the time in minutes that the machine will perform the cleanout function before terminating. It is recommended that this time is kept longer than the anticipated time to thoroughly clean the wand, hose and plumbing, since cleanout can be terminated at the end by actuating the CLEANOUT switch a second time.

As part of the ECS-250 safety system, the sealant heating system requires five separate inputs before the diesel fuel burner can operate. If the burner is operating and any of the required inputs are removed, the burner shuts down. When the temperature control system cycles to the burner OFF condition, the burner fuel pump is immediately shut off. This ensures raw fuel is never pumped into the burner chamber. The burner inputs are as listed:

1. Master power switch
2. Burner ON/OFF switch or AUTO control START switch
3. Hot-oil pressure switch
4. Hot-oil temperature probe
5. PID temperature control

Only the master power switch, burner ON/OFF switch, and PID sealant temperature control are operable by the user. In AUTO control, the START switch commands the burner ignition sequence, and the burner ON/OFF switch is neglected. Based on the selected control mode, actuating either switch will allow the rest of the system to energize, provided the necessary input conditions are met. The burner ignition system has a built-in, one-minute delay, which allows the electrically heated injection nozzle to preheat the diesel fuel prior to ignition. The preheat sequence eliminates burner backfires.

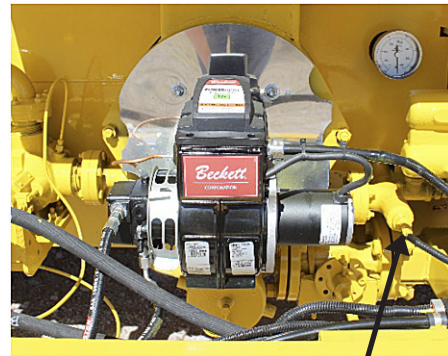



Figure 18 Hot Oil Temperature Probe

The hot-oil pressure switch requires a minimum pressure of 4-PSI within the hot-oil system to close. Loss of pressure shuts down the burner.

The temperature probe for the hot-oil system is located at the rear of the Kracker, below the hot-oil temperature gauge. The hot-oil temperature probe is a Resistance Temperature Detector (RTD) sensor. This is the same type of temperature sensor that is used inside the sealant tank. RTD sensors require sensor specific calibration values which can be found on the settings page of the display. The only time this value should ever be changed is when calibrating a new sensor.

 **WARNING**

Changing the temperature calibration value can cause the burner to stay on longer and the hot-oil to reach unsafe temperatures. Maximum recommended safe heating temperature is 525°F. Always refer to analog Hot-Oil gauge for hot-oil temperature.

When the hot-oil temperature reaches 525° F the burner shuts down. When the hot-oil temperature drops below the 525° F setpoint and the material is under set temperature, the 60 second burner delay starts.

The PID temperature control is manually set by the operator. The correct temperature setting (set point) is determined by the sealant manufacturer's recommendation. The PID sealant temperature control receives temperature input from an RTD sensor located in the sealant tank. When the sealant material within the sealant tank reaches the set point, the PID sealant temperature control switch opens, and the burner is shut down. When the sealant material temperature drops approximately 5° F, the PID sealant temperature control switch closes and allows the burner to ignite.

The sealant material retains heat much longer than the hot-oil. During normal operation, the hot-oil temperature may drop as much as 100° F before the sealant material temperature drops enough to allow the burner to ignite. These temperature differences cause the burner to cycle on and off at different intervals.

PREPARING EQUIPMENT FOR USE



WARNING

The Etnyre Crack Sealer uses volatile materials at high temperatures and pressures. This equipment employs highly combustible or explosive fuels. Potentially life-threatening hazards may exist during equipment operation. Only qualified persons should attempt to operate, service, or make adjustments to the Etnyre equipment.



WARNING

To avoid potential severe burns, injury, or death, persons must read the SAFETY PRECAUTIONS section before operating this crack sealing equipment.



WARNING

Operators must read and understand this material before attempting to use the machine.



WARNING

Always wear safety gear and protective clothing to include insulated gloves, safety glasses and face shield, long sleeve shirt, long pants, boots and coveralls when operating the Etnyre Crack Sealer. Failure to do so may result in severe burns, injury, or death.

This section contains information with which the operator must become familiar in order to prepare the Etnyre Crack Sealer for crack sealing operations. Four essential areas are covered:

1. Operating Controls, Gauges, and Indicators

The operating functions of all Kracker controls are given. The operator must be familiar with these controls before attempting to use the equipment.

2. Initial Checkout of Machine

Preliminary inspection and control settings are given for the machine.

3. Loading Sealant Material

Initial loading and safety procedures are provided for the machine.

4. **Heating/Circulating Sealant** (located in the OPERATING INSTRUCTIONS chapter of this manual)

Procedures are given, and warning and cautionary notes are emphasized for heating and circulating sealant material to the required temperature.

Familiarity with these areas of activity will prepare the operator for safe, efficient operation of the equipment.

OPERATING CONTROLS, GAUGES & INDICATORS

Operating Control Panel

Refer to page 14, **OPERATING CONTROLS** section for detailed list of contents (*See Figure 17*).

The operating control panel is mounted on a pedestal located in front of the sealant tank on the right-hand side of the machine. The operating control panel contains the following controls and indicators:

1. Master power ON/OFF switch
2. Auto/Manual control switches
3. Engine control & display
4. Temperature control & display
5. Beacon switch
6. Generator switch (option)
7. Work lights switch (option)

The engine controller contains readouts and indicators for engine glow plug preheat, water temperature, charging system, oil pressure, and other engine vitals. An engine warning light is also incorporated on the controller for quick reference of engine status.

The MASTER POWER switch must be in the ON position with the engine running to energize the burner circuitry.

The beacon switch controls the amber safety beacon on top of the machine.

The PID temperature control is used to set sealant material temperature. The upper “set temp” value on the control is set to the desired sealant material pour temperature (set point) by selecting edit and increasing the value with the buttons on the face of the control. The pour temperature is usually determined by the sealant manufacturer’s specification. The lower indicator shows

actual sealant material temperature within the sealant tank (pot temperature).

The hour meter records actual engine run time in hours. The hour meter enables accurate tracking of run time for scheduled maintenance such as engine oil changes.

Control Switches

The MANUAL CONTROL switches provide bi-directional control of the auger and product pump motors, and single directional control of the hot-oil motor. Moving the switch in either the indicated FORWARD or REVERSE direction provides control of the hydraulic motor(s).

The AUTO CONTROL machine function takes this work away from the operator and the machine will operate the valves automatically based on hot-oil and product temperature.



Figure 19 HIC Manifold

Temperature Gauges

The ECS-250 has two temperature gauges located at the rear of the machine. The left-hand gauge measures the hot-oil temperature and the right-hand gauge measures the sealant temperature in the system plumbing at the application/recirculation valve.

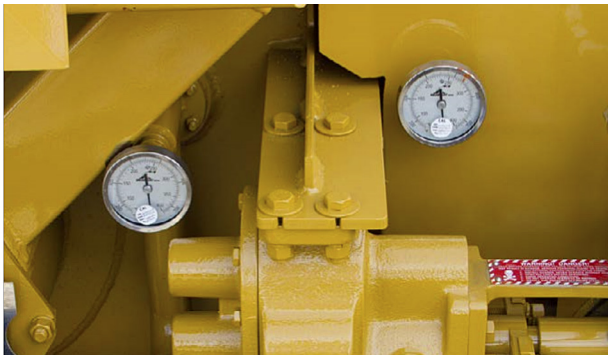


Figure 20 Analog Temperature Gauges

INITIAL CHECKOUT OF MACHINE

CAUTION

The initial checkout procedures given below are minimum requirements. Failure to perform these steps can result in damage to the equipment and unsafe operation conditions.

Each day before loading the machine with sealant material, perform the following steps:

1. Visually inspect the fire extinguisher, tires, lug nuts, hitch bolts, hoses, fittings, and engine belts
2. Make sure the battery is clean, secure, and has sufficient water in the cells
3. Make sure the fuel feed valve for the burner is OPEN and the flush fuel valve is CLOSED

NOTE: No. 2 Grade diesel fuel will start to gel at temperatures around 17.5°F. If the ECS is operated at temperatures below 18°F, use No. 1 grade diesel fuel. If No. 1 diesel fuel is not available, mix an additive to combat gelling. A great additive is Clean Boost® Sno-Cat™. This is available in most places such as Walmart, Amazon and Truck Stops

4. Make sure all fluid levels are adequate; add fluid when necessary:
 - a. Engine oil – dipstick located on the left side of the engine
 - b. Radiator coolant – check the coolant in the radiator overflow tank
 - c. Diesel fuel – check the fuel level in the fuel tank

CAUTION

Use either Type 32 or Type 46 hydraulic fluids in the hydraulic reservoir. Do not mix fluid types.

- d. Hydraulic fluid – sight glass located on the forward end of the hydraulic reservoir
- e. Heat-transfer oil (hot-oil) – hot and cold level sight glasses located on the left side of the hot oil expansion tank

CAUTION

The suction and return line gate valves for the hydraulic reservoir must be open and wired in the open position. Do not start the engine with either valve closed. Failure to do so will cause the hydraulic filter to burst.

- f. Position the IGNITION switch on the engine control panel to OFF
- g. Position the BURNER switch on the temperature control panel to OFF



CAUTION

The valves listed in the flowing step cannot be moved when the sealant material is frozen. Make sure the valves are in this position when the machine is shut down.

- h. Verify the following valves are positioned as indicated:
 - i. Product tank valve – CLOSED
 - ii. Application/recirculation valve – “0” (full tank circulate)
- i. Make sure the circulating auger and product pump directional control valves manual overrides are in the NEUTRAL position
- j. Make sure the tank and pump drain valve is CLOSED and the external pipe plug is installed

LOADING SEALANT MATERIAL



WARNING

Do not load sealant material into sealant tank with both loading doors open. Hot sealant material will splash out of the open door. Hot sealant material can cause serious or fatal burns.

Load the sealant material into the ECS-250 sealant tank as follows:

1. Open either sealant loading door until the door is fully open
2. Place a block of sealant material on the sealant loading door and position it so the block rests against the loading shelf



WARNING

Do not hold the sealant loading door handle. Let the door fall closed to keep hot sealant from splashing out of the tank

3. Push the sealant loading door up and allow it to close. The block of sealant material drops into the sealant tank when the door is almost closed
4. During initial sealant tank loading, place as many blocks of sealant material as possible

into the sealant tank

5. Once the sealant material melts, add additional blocks of sealant to the sealant tank until the sealant level is 4 to 5 inches above the circulating auger heating coils

Always keep the sealant tank full of sealant material. The material tank is full when the sealant material is just below the edge of the loading shelf. The melted sealant material should not wet the loading shelf.

A full sealant tank retains heat much longer than a partially loaded tank. Due to heat retention by the sealant material, a full sealant tank reheats to operating temperature the next day faster than an empty tank.

OPERATING INSTRUCTIONS

NOTE: The Etnyre Crack Sealer uses volatile materials at high temperatures and pressures. This equipment employs highly combustible or explosive fuels. Potentially life-threatening hazards may exist during equipment operation. Only qualified persons should attempt to operate, service, or make adjustments to this machine.



WARNING

To avoid potential severe burns, injury, or death, persons must read the SAFETY PRECAUTIONS section before operating Etnyre equipment.

Ensure the necessary procedures in the PREPARING EQUIPMENT FOR USE Chapter are accomplished before performing any of the operations described in this section.



CAUTION

Do not start the engine until the "INITIAL CHECKOUT OF MACHINE" in the **PREPARING EQUIPMENT FOR USE** chapter are performed.

DIESEL ENGINE STARTUP

1. Pull out MASTER POWER switch to power up the engine controller.
2. Press the run button on the engine controller. Wait for the engine to pre-heat and start.
3. Allow the engine to warm up for one minute.

NOTE: It may be necessary to first select "AUTO" on the controller for the "RUN" button to work.

AUTOMATIC CONTROL

1. The following conditions **MUST** be met for the AUTO machine function to safely and successfully run:
 - a. Application/recirculation valve must be set to "0"



WARNING

Extreme care must be used during circulation and sealing operations to make sure that system components operate at their rated pressures. Failure to check the condition of all hoses and connections when pumping could result in severe burns, injury, or death from pumping errors made with faulty equipment



WARNING

Always wear safety gear and protective clothing to include insulated gloves, safety glasses and face shield, long sleeve shirt, long pants, boots and coveralls when operating this machine. Failure to do so may result in severe burns, injury, or death.

- b. Tank valve and drain valve must be closed
 - c. Ensure control toggle switch is set to "AUTO"
2. Toggle up on the "START/STOP" switch to start the AUTO machine function

NOTE: Machine will heat until required temperature for tank valve to open and pump to start circulating.

3. Position the BEACON switch on the temperature control panel to ON
4. Go to HEATING/CIRCULATING SEALANT step 4

HOT-OIL CIRCULATION (MANUAL CONTROL)

The hot-oil pressure switch requires a minimum of 4-PSI system pressure to close. The burner will not ignite until the sealant heating system is pressurized by the hot-oil pump:

1. With the engine running, turn on the hot oil pump by the switch on the control panel.
2. Make sure the hot-oil pump hydraulic motor starts to rotate. Note: hot oil light should turn green.
3. Set ENGINE SPEED to HIGH

BURNER OPERATION (MANUAL CONTROL)

CAUTION

Before starting the burner, position the machine broadside to the wind to allow the wind to carry emitted vapors away from the hot exhaust stack of the engine. Failure to do so creates an explosion hazard.

The diesel fuel burner is used to heat the hot-oil, which is circulated in the sealant heating system. The burner requires the following five inputs before it can light:

1. Engine (ON)
2. Burner ON/OFF switch (ON)
3. Hot-oil pressure switch (CLOSED)
4. Hot-oil temperature sensor (CLOSED)
5. PID sealant temperature control (CLOSED)

With the ignition ON and the engine running, the hot-oil bypass valve must be closed enough for the heating system to build the minimum hot-oil system pressure. Once the hot-oil system reaches 4-PSI, the pressure switch closes:

1. Make sure the burner fuel feed valve is OPEN
2. On the temperature control pane, set the PID temperature control to the desired pour temperature (set point). This temperature is normally specified by the sealant material manufacturer
3. Position the BURNER switch on the temperature control panel to ON. The burner has a one-minute preheat delay before it ignites. Wait one FULL minute for burner ignition
4. The burner runs until the hot-oil temperature reaches 525°F, or the sealant tank temperature reaches the set temperature
5. Position the BEACON switch on the temperature control panel to ON
6. During the initial heating cycle the burner runs continuously for approximately 25 minutes. Once the hot-oil reaches operating temperature the burner cycles on and off about every 1 1/2 to 2 1/2 minutes, depending on the hot-oil and sealant temperature differences. Each time the burner ignition sequence is initiated, the one minute

burner preheat delay is started before the burner can ignite

HEATING/CIRCULATING SEALANT

WARNING

Potential fire or explosion hazards exist when operating the burner. Failure to follow the burner operation safety procedures could result in severe burns, injury, or death.

WARNING

Do not heat material beyond the maximum temperature recommended by the supplier. Excessively heated material could create an explosion hazard, resulting in severe burns, injury, or death.

WARNING

Do not load sealant material into sealant tank with both loading doors open. Hot sealant material will splash out of the open door, which can cause serious or fatal burns.

WARNING

Extreme care must be used during circulation and sealing operations to make sure system components operate at their rated pressures. Failure to check the condition of all hoses and connections when pumping could result in severe burns, injury, or death from pumping errors made with faulty components.

The sealant material in the ECS-250 sealant tank must be heated to a partially liquid state before the sealant material can start to circulate in the sealant tank.

1. Allow the heating system to operate for approximately 30 minutes and attempt to OPEN the product tank valve. The product tank valve should move with little resistance. If necessary, wait several minutes for the sealant to melt and try to open the valve again



CAUTION

Do not force the product tank valve open. Wait until the sealant material in the valve melts. Forcing the valve open may damage the equipment and create an unsafe condition.

2. Position the product tank valve to the OPEN position
3. Move the product pump directional control toggle switch to the FORWARD position. If necessary, let the sealant continue to heat for several minutes and try to move the product pump directional toggle switch to the FORWARD position again
4. Allow the machine to heat and circulate the sealant material

NOTE: The circulation temperature gauge indicates approximately 300°F due to the heating system heat trace in the plumbing. Actual product circulation does not begin until the gauge indicates an increase in temperature above 300°F

5. When the sealant material reaches the pour temperature (determined by the sealant manufacturer) as indicated on the circulation temperature gauge, OPEN the right-hand sealant loading door



WARNING

Never look into the sealant tank from the front of the machine. Sealant circulating from the circulation pipe or the application wand is pumped forward. Hot sealant may splash forward, resulting in severe burns or injury.

6. Looking from the rear of the sealant tank, verify there is adequate sealant flow from the circulation pipe into the sealant tank
7. Close the right-hand sealant loading door

NOTE: It is not necessary for the entire sealant tank to be liquefied to begin work. Crack sealing operations may begin as soon as there is adequate flow through the application wand. The sealant material is normally ready for application in about one hour.

8. With the application wand positioned in the application wand return tube and retaining

bracket assembly, ensure that the application wand shutoff valve is OPEN

9. Gradually move the application/recirculation valve from the “0” position to the “8” position
10. OPEN the left-hand sealant loading door



WARNING

Never look into the sealant tank from the front of the machine. Sealant circulation from the circulation pipe or the application wand is pumped forward. Hot sealant may splash forward, resulting in severe burns or injury.

11. Looking from the rear of the sealant tank, verify there is adequate sealant flow from the application wand nozzle into the sealant tank. If necessary, wait until the sealant flow from the application wand increases

NOTE: If material does not flow from the wand then there is a plug in the hose or wand. Residual material left in hose or wand can be pushed or sucked out by the product pump. To reverse the pump in AUTO mode: Hold the cleanout switch down for 3 seconds to initiate cleanout, once in cleanout the pump is reversed, resume forward pump before cleanout time expires by selecting stop then immediately selecting start.

It may be required to place hose back in hose box and/or heat application wand.

12. CLOSE the left-hand sealant loading door
13. Stretch out the application wand hose and attach the hose to the hose boom
14. Allow the sealant material to circulate through the application wand
15. Crack sealing operations can begin. Continue to add blocks of sealant material to the sealant tank. Always keep the sealant tank full. As work continues, the remainder of the sealant material will liquefy
16. In AUTO CONTROL: augers will turn on automatically when ready



CAUTION

If the circulating augers make a squealing sound when the directional control valve switch is moved, immediately stop the augers. Allow additional time for the sealant to heat and attempt to restart the circulation augers. Failure to do so may damage the hydraulic system.

17. When the sealant material temperature reaches the pour temperature as indicated on the PID temperature control, gradually move the circulating auger directional control switch to the FORWARD or REVERSE position
18. Operate the circulating augers for the remainder of the crack sealing operation

SEALANT APPLICATION

Crack sealing operations may begin as soon as there is adequate flow through the application wand as described in **PREPARING EQUIPMENT FOR USE** chapter.



Figure 21 Sealant Application Wand



WARNING

Always keep the application wand pointed away from all personnel. Failure to do so could result in severe burns, injury, or death.

1. CLOSE the application wand shutoff valve
2. Remove the application wand from the application wand return tube
3. Place the application wand tip in the selected crack and OPEN the application wand shutoff valve. Move the application wand along the crack
4. CLOSE the application wand shutoff valve at the end of the crack. Keep the application wand shutoff valve in the CLOSE position when moving from one crack to the next
5. Use the application/recirculation valve to adjust the flow rate of the sealant material through the application wand (normally the “7” or “8” position)
6. Place the application wand in the application wand return tube and OPEN the shutoff valve when the application wand is not in use

7. Keep sealant material tank full during crack sealing operations. Add sealant material in accordance with the procedures given in **PREPARING EQUIPMENT FOR USE** Chapter, Loading Sealant Material.

SHUT DOWN

At the end of crack sealing operations, make sure the sealant tank is full. If necessary, add sealant material in accordance with the procedures given under **PREPARING EQUIPMENT FOR USE**, Loading Sealant Material, prior to shut down.

The Etnyre Crack Sealer is designed with a Flush-Free™ system to eliminate solvent flushing at the end of the work shift.



CAUTION

Do not short cut the following procedures. Failure to follow these procedures exactly will result in blocked plumbing and extended heating times.

The shutdown procedures given below assume the machine is at normal operating temperature, the product pump is in FORWARD, and sealant material is circulating through the application wand and hose:

1. Place the application wand in the application wand return tube and retaining bracket assembly, and OPEN the application wand shutoff valve
2. Loosen the throttle lock on the engine and increase the engine speed to FULL throttle. Tighten the throttle lock
3. Move the application/recirculation valve to the “9” position. Slight squealing may be heard from the product pump hydraulic motor
4. Allow the machine to circulate sealant through the application wand and hose for approximately three minutes
5. Position the product pump directional control valve to full REVERSE
6. Move the application/recirculation valve from the “9” position to the “0” position for 30 seconds
7. Move the application/recirculation valve from the “0” position to the “10” position
8. CLOSE the application wand shutoff valve and remove the application wand from the application wand return tube and retaining bracket assembly
9. Remove the application wand hose from the hose boom and lay the hose out straight on the ground



WARNING

Always keep the application wand pointed away from all personnel. Failure to do so could result in severe burns, injury, or death.

10. Raise the application wand overhead. With the nozzle pointing up, cycle the shutoff valve OPEN and CLOSED 10 to 12 times. An audible sucking sound should be heard from the nozzle when the hose starts to clear
11. With the shutoff valve OPEN and the wand raised, have a helper raise the hose and slowly walk the hose toward the machine to let the hose drain sealant down into the machine
12. CLOSE the application wand shutoff valve and place the application wand in the application wand return tube and retaining bracket assembly
13. OPEN the left-hand sealant loading door
14. Remove the application wand from the application wand return tube and place the application wand in the hose trough
15. CLOSE the left-hand sealant loading door
16. Install the external cap on the application wand return tube
17. Place the application wand hose into the hose trough. Close the hose trough door and make sure the flexible hose trough cover is pulled over the top of the hose
18. Position the BURNER switch on the temperature control panel to OFF
19. Position the circulating auger directional control valve to the NEUTRAL (CENTER) position
20. Position the hot-oil bypass valve to the STOP (OPEN) position



CAUTION

The valves listed in steps 21 and 22 cannot be moved when the sealant material is frozen. Make sure the valves are in this position when the machine is shut down.

21. Position the application/recirculation valve to the "0" position
22. Position the product tank valve to the CLOSE position
23. Position the product pump directional control valve to the NEUTRAL (CENTER) position
24. Loosen the throttle lock on the engine and reduce the engine speed to a smooth idle. Allow the

engine to run at idle speed for a one-minute cool down prior to shut down.

25. Position the BEACON switch on the temperature control panel to OFF
26. Position the IGNITION switch on the engine control panel to OFF

PREPARATION FOR OVERNIGHT SHUT DOWN

Before the present work shift ends, add sealant material to the sealant tank until the tank is full (4 to 5 inches above the heating coils). Close and latch the sealant loading doors, and make sure the external cap is installed on the application wand return tube.

A full load of sealant retains heat longer than a partial load. Startup time at the beginning of the next work shift is minimized when the sealant tank is kept full.

PREPARATION FOLLOWING EXTENDED SHUT DOWN

If the ECS-250 is shut down for two or more days, the following preparation will allow normal startup for the next work shift.

On the day before the normal work shift, start the hot-oil pump and the burner in accordance with the procedures given in **PREPARING EQUIPMENT FOR USE** Chapter. DO NOT run the circulating augers or the product pump.

After one hour, shut off the burner and the hot-oil pump; machine, as well. The heat will diffuse through the sealant material overnight and normal startup procedures may be used the next day.

APPENDIX A

QUICK REFERENCE OPERATING GUIDE

The following illustrated operating guide is provided as an aid to ECS-250 operation. The illustrated guide is meant to supplement the setup and operating instructions provided in this manual, not replace them. The operator must be trained and familiar with all safety and operating information given in this manual prior to performing any crack sealing operations.



WEAR SAFETY GLASSES
& FACE SHIELD



HOT

WEAR INSULATED GLOVES

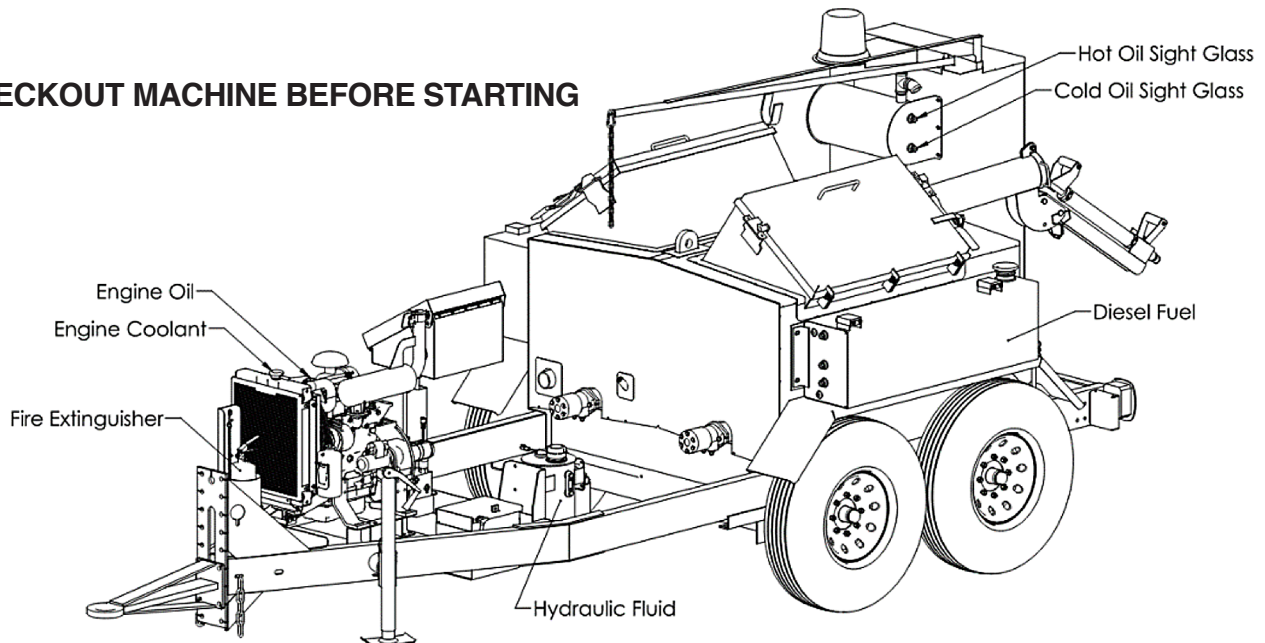


WEAR PROTECTIVE
CLOTHING (LONG
SLEEVE SHIRT, PANTS,
BOOTS AND COVERALLS



AVOID FIRE OR FLAME NEAR MACHINE

CHECKOUT MACHINE BEFORE STARTING



BEFORE STARTING ENGINE CHECK VALVES

CHECK HOSE AND LOAD MATERIAL



WARNING

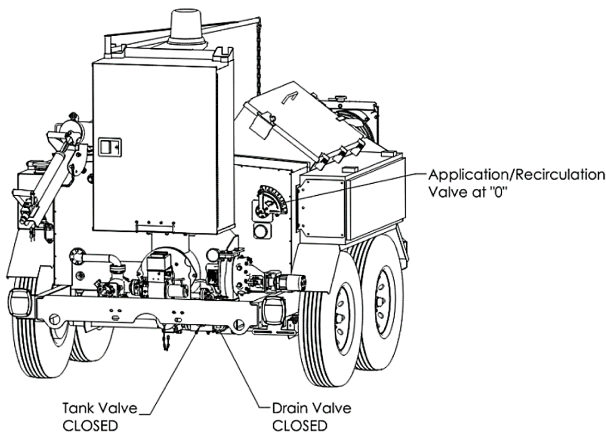
Check hose daily for signs of wear or damage.

Do not load sealant material into sealant tank with both loading doors open. Hot sealant material will splash out of the open door, which can cause serious or fatal burns.

1. For best results ALWAYS place application hose in application hose box whenever stored or transported



Figure 22 Application Hose in Hose Box



2. Place blocks of material on lid, then close the lid, allowing blocks to drop into tank
3. DO NOT set blocks of material directly on ground; rocks and dirt will stick
4. For maximum production, always keep tank full



Figure 23 Sealant Door

STARTING MACHINE



WARNING

Potential fire or explosion hazards exist when operating the burner. Do not operate the burner when the machine is towed or is unattended. Failure to follow the burner operation safety procedures could result in severe burns, injury, or death.

1. Pull out “MASTER POWER” switch and select “AUTO” control
2. Press “RUN” on engine controller, wait for pre-heat and engine to start. Allow engine to warm up for 1 minute.
3. Set desired material temperature
4. Select “START”



Figure 24 Starting Machine Diagram

RECIRCULATING MATERIAL INTO TANK



WARNING

Never look into the sealant tank from the front of the machine. Sealant circulating from the circulation pipe or the application wand is pumped forward. Hot sealant may splash forward, resulting in severe burning or injury.

1. Make sure application/recirculation valve is set at "0" for full circulation
2. Wait for machine to start circulating into tank
3. Carefully open the right-hand sealant loading door. Verify material flow from the circulation pipe. Close sealant loading door
4. Wait for desired material application temperature

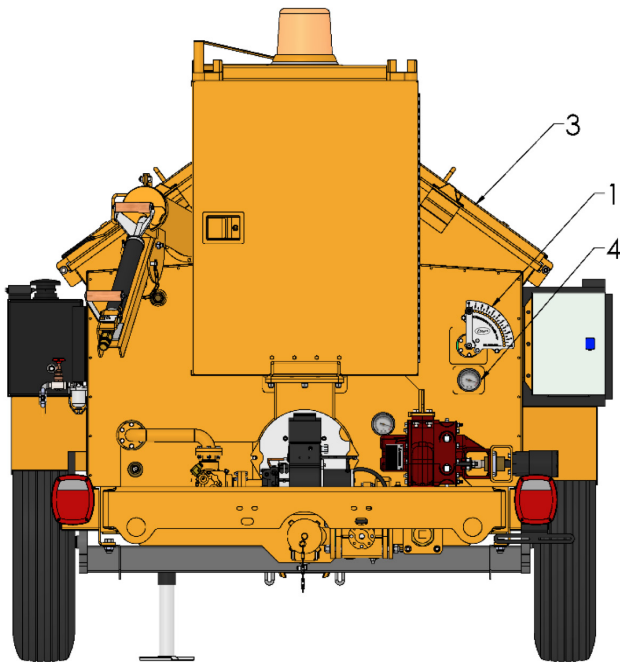


Figure 25 Recirculating Material into Tank Illustration



WARNING

The materials used in the Etnyre Crack Sealer are normally heated from 300°F to 450°F during application. Materials used at these temperatures can cause serious or fatal burns and can become explosive under certain conditions.

RECIRCULATING MATERIAL THRU HOSE AND WAND



WARNING

Always reverse the product pump before removing or connecting the hose. Never look into the sealant tank from the front of the machine. Sealant circulating from the circulation pipe or the application wand is pumped forward. Hot sealant may splash forward, resulting in severe burning or injury.

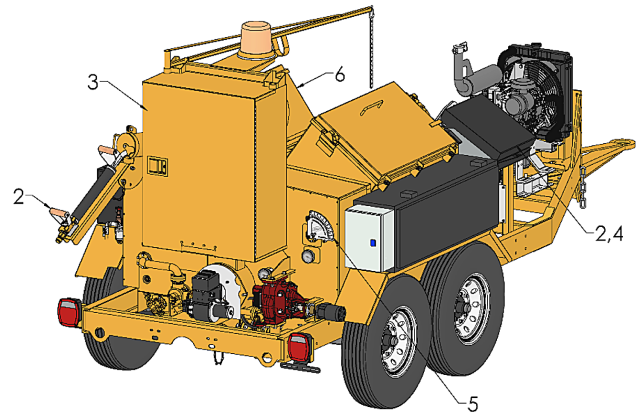


Figure 26 Recirculating Material Thru Hose and Wand Illustration

1. Make sure application wand is in return tube, and application wand is in the OPEN position
2. REVERSE the product pump (activate CLEANOUT)
3. Remove hose end from hose box and attach hose to wand
4. Put the product pump in FORWARD (press STOP then START)
5. Move application/recirculation valve to "8" to start, then set "5"
6. Carefully open the left-handed sealant loading door. Verify material flow from application wand. Close sealant loading door. After clear flow is reached through hose, move application/recirculation valve to desired application setting

REMOVING THE HOSE FROM THE HOSE BOX



WARNING

Always keep the application wand pointed away from all personnel. Failure to do so could result in severe burns, injury, or death.

1. Secure the remaining hose in the hose box, to the hose jib. Ensure hose jib is facing the rear
2. CLOSE application wand valve before removing from the ECS-250
3. When the product temperature (on PID gauge) reaches the auger set temperature, the augers will start

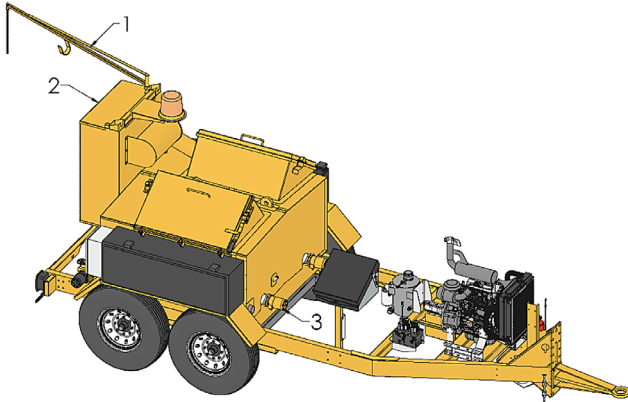


Figure 27 Removing Hose From Hose Box Illustration

SEALING CRACKS



CAUTION

Hose and wand assembly must circulate to tank when not filling cracks. Failure to circulate application wand assembly will cause clogs in hose and wand.

1. OPEN application wand valve to apply sealant material into cracks
2. CLOSE application wand valve at the end of each crack
3. For maximum heat recovery, keep the sealant tank FULL

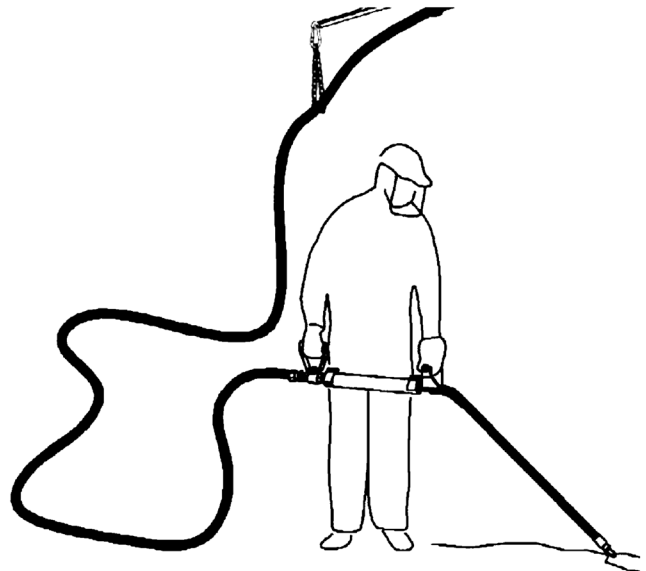


Figure 28 Personnel Sealing Cracks

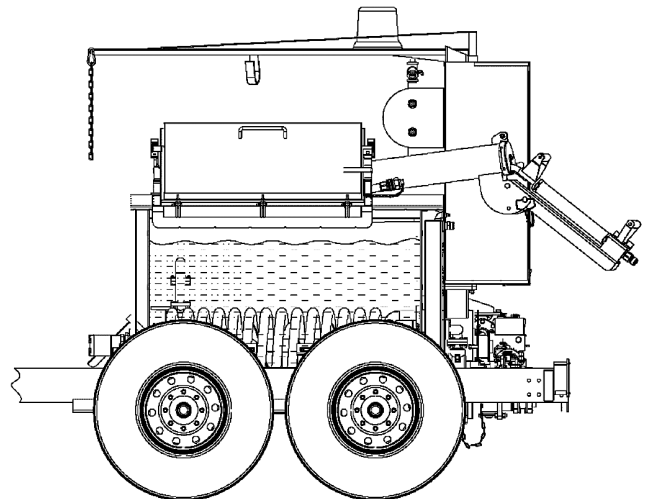


Figure 29 Sealant Tank Full

AFTER SEALING CRACKS



WARNING

Always reverse the product pump before removing or connecting the hose.

1. Place application wand assembly in the return tube and secure with valve OPEN
2. Allow the wand assembly to circulate
3. Move application/recirculation valve to "8". Allow material to circulate at full flow for 1-2 minutes
4. Hold CLEANOUT switch down for 3 seconds to activate CLEANOUT
5. Move application/recirculation valve to "10"
6. Lay hose connected to wand on the ground

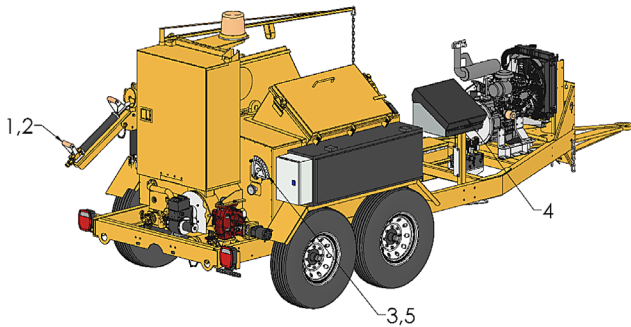
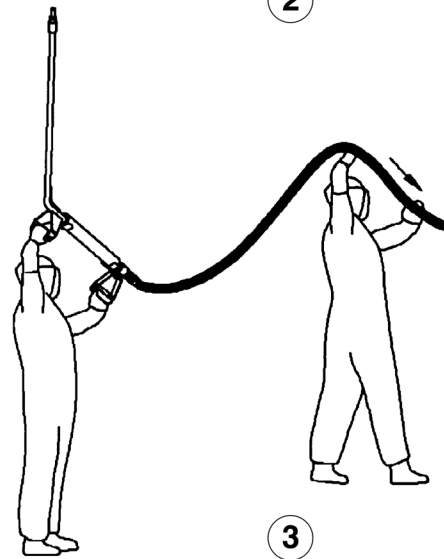
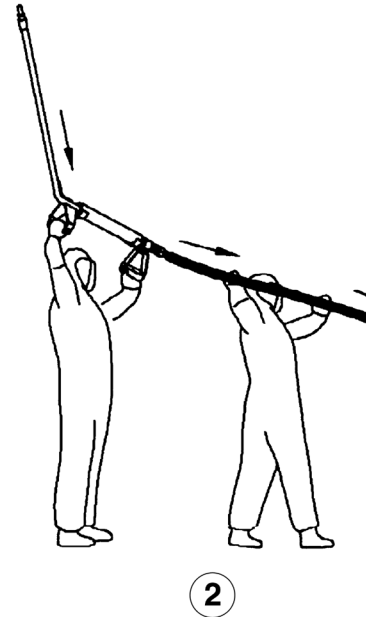
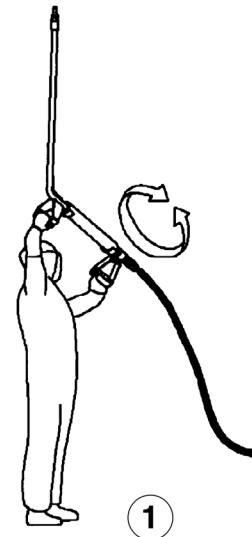


Figure 30 After Sealing Cracks Illustration



CLEAN OUT PROCEDURE

1. Raise application wand assembly overhead
2. OPEN and CLOSE application wand valve 15 – 20 times. **DO NOT SHORT CUT THIS STEP**
3. Meanwhile, have a helper lift hose and slowly walk back to the machine to drain hose

Figure 31 Wand & Hose Clean-Up With Helper Illustration

CLEAN OUT PROCEDURE (CONT.)

1. CLOSE application wand valve and return the hand wand to the return tube. Secure to return tube with wand valve OPEN
2. Store hose in hose box
3. Move application/recirculation valve to “0” (wait one minute before proceeding)
4. Wait or toggle CLEANOUT again

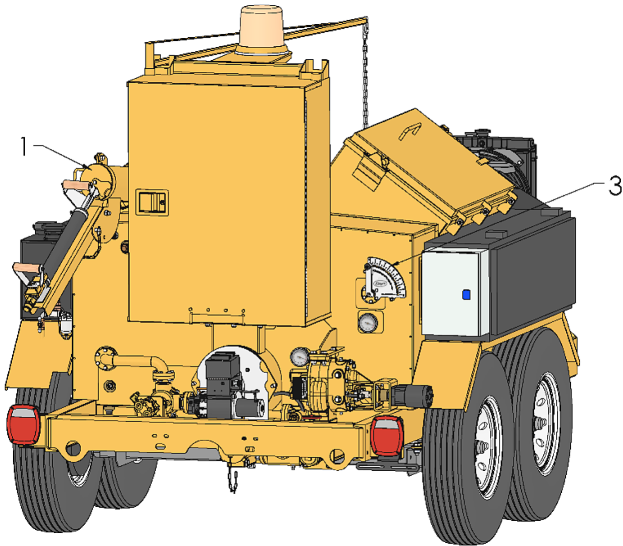


Figure 32 Clean Out Procedure Illustration I



WARNING

Always reverse the product pump before removing or connecting the hose.

5. Let engine IDLE for one minute to allow engine to cool
6. Select OFF on engine controller to turn off engine
7. Push in MASTER POWER switch
8. Store wand in return tube. Leave wand valve in the OPEN position to lock wand

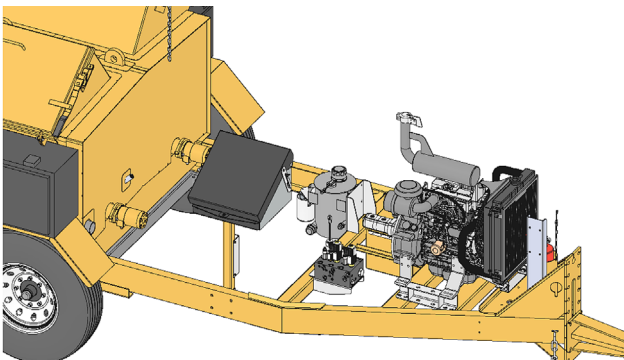


Figure 33 Clean Out Procedure Illustration II

APPENDIX B

FIELD MAINTENANCE

The recommended field maintenance procedures and scheduled intervals for the care of the Etnyre Crack Sealing machine is listed in this section. Overall productivity of the ECS-250 is increased and equipment downtime is minimized by carefully following the procedures given in this section. In addition, the individual component manufacturers' literature included in the back of this manual should be followed.

Perform all diesel engine checks, oil and filter changes, and other maintenance procedures as recommended by the engine manufacturer.

Replace the hydraulic system filter element every 500 hours of machine operation as indicated by the hour meter on the engine control panel.



Figure 34 Hydraulic Reservoir and Filter

SCHEDULED MAINTENANCE

Table 1-1 lists ECS-250 maintenance and inspection items and the necessary intervals when they are to be performed.

TABLE 1-1: SCHEDULED MAINTENANCE

PERIOD	MAINTENANCE AND INSPECTION ITEM
Daily	1. Check trailer lights and connectors
	2. Check for leaks at hose connections, valves, tank fittings
	3. Check tire pressure
	4. Make sure hitch bolts and lug nuts are secure
	5. Make sure safety chains are secure
	6. Make sure the safety break-away chain is attached
	7. Check hydraulic fluid level (Note 1)
	8. Check hot-oil fluid level (Note 2)

TABLE 1-1: SCHEDULED MAINTENANCE (con't)

Weekly	1. Inspect product pump bearings for leaks
	2. Check brake fluid level in hitch master cylinder (if appl.)
	3. Check battery water level and connections.
6 Months	1. Pack product pump bearings
	2. Pack wheel bearings
	3. Inspect brake linings
	4. Replace fuel filter or service sediment bowl
12 Months	1. Sample hot-oil and test, or drain and replace
	2. Replace hydraulic system filter
	3. Replace hydraulic system fluid
500 Hours	1. Replace hydraulic system filter
	2. Replace fuel filter or service sediment bowl
1000 Hours	1. Sample hot-oil and test, or drain and replace
	2. Replace hydraulic system fluid

1. Check the hydraulic fluid level with the sight glass located on the front of the hydraulic reservoir. Fluid should be visible when the system is cold.
2. Check the hot-oil level with the sight glass located on the left side of the hot-oil expansion tank. Oil should be visible on the lower sight glass when the system is cold.

TABLE 1-2: ENGINE MAINTENANCE SCHEDULE

DESCRIPTION OF CHECK	DAILY	300 HRS.	600 HRS.	1200 HRS.	REMARKS
COOLING SYSTEM					
Coolant level and fouling	X				10 mm upper position from the radiator core
Coolant leak	X				

TABLE 1-2: ENGINE MAINTENANCE SCHEDULE (con't)

DESCRIPTION OF CHECK	DAILY	300 HRS.	600 HRS.	1200 HRS.	REMARKS
COOLING SYSTEM					
Radiator filler cap fitting condition	X				To be securely tightened
Fan belt tension (replace if necessary)	X				Deflection of 8 - 12 mm (approximately 10 kg. force)
Coolant temperature	X				75 - 90° C
Coolant replacement					Every 6 months
Radiator external face cleaning			X		
Cooling system circuit cleaning				X	
Radiator filler cap* function		X			According to engine manufacturer's spec.
AIR INTAKE SYSTEM					
Replace air cleaner* element		X			
ELECTRICAL SYSTEM					
Electrolyte level		X			Replenish with distilled water
Battery cleaning		X			

TABLE 1-2: ENGINE MAINTENANCE SCHEDULE (con't)

DESCRIPTION OF CHECK	DAILY	300 HRS.	600 HRS.	1200 HRS.	REMARKS
ELECTRICAL SYSTEM					
Ammeter registration	X				Immediately after engine start, gauge goes to (+) side
Charge warning lamp	X				Light off (during operation)
Electrolyte gravity			X		
Wiring and connection				X	
Preheating condition	X				About 25 seconds
ENGINE					
Starting and noise conditions	X				
Exhaust smoke condition	X				exhaust smoke color
Valve clearance check*				X	According to engine manufacturer's spec.

1. The service intervals after 1200 hours of operation should be made every 100 hours of operation in accordance with Table 2-1
2. When service on the asterisked (*) items is necessary, consult the engine manufacturer's requirements

HEAT-TRANSFER OIL (HOT-OIL) REPLACEMENT

Table 1-3 lists the tools and equipment necessary to replace the hot-oil in the sealant heating system.

TABLE 1-3: TOOLS AND EQUIPMENT

TYPE	DESCRIPTION
Air Compressor	100 CFM capacity or larger
Air Hose	Minimum 1/2-in. I.D. with Female Quick Coupler
Pipe Bushing	1/4-in. X 1/4-in. NPT Bushing
Air Coupling	1/4-in. Male Quick Coupler Fitting
Bucket or Drain Pan	11-gallon or larger



WARNING

Allow the hot-oil to cool for a minimum of 24 hours after burner operation before draining the sealant heating system. Failure to do so could result in severe burns, injury, or death.

Perform the following procedures to replace the hot-oil in the sealant heating system:

1. Replace the drain pan (11-gallon minimum) below the drain valve and product pump
2. Loosen the bottom fitting of the flex line, which connects the heat trace system to the drain valve heat jacket



CAUTION

The hot-oil drains from the flex line fitting and the heat jacket fitting.

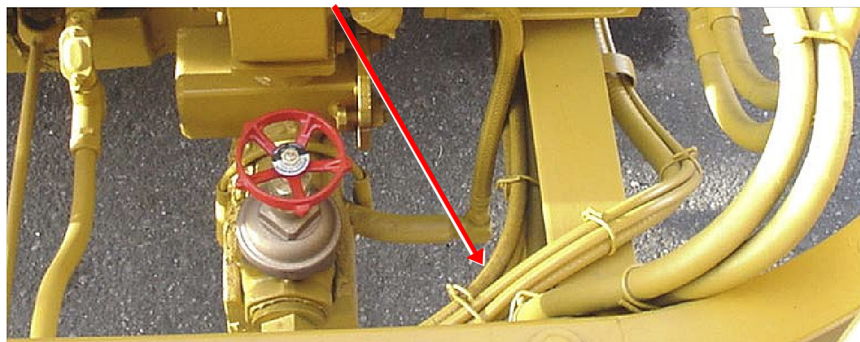


Figure 35 Flex Line & Heat Jacket Fitting

3. Remove the flex line from the heat jacket fitting and allow the hot-oil to drain from the sealant heating system into the drain pan
4. Start the hot-oil pump in accordance with the procedures given in **PREPARING EQUIPMENT FOR USE** Chapter. **DO NOT START THE BURNER**
5. Let the hot-oil pump run until the hot-oil stops flowing from the flex line fitting
6. Shutdown the hot-oil pump and diesel engine in accordance with the procedures given in **OPERATING INSTRUCTIONS** Chapter
7. Remove the overflow line and straight fitting from the hot-oil expansion tank 90 degree elbow
8. Install the pipe bushing and male quick coupling in the 90-degree elbow



Figure 36 Male Quick Coupling

9. Attach an air hose to the quick coupling and allow air pressure to purge any remaining hot-oil from the sealant heating system
10. Remove the air hose from the quick coupling

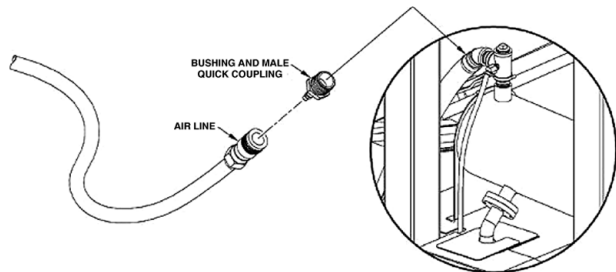
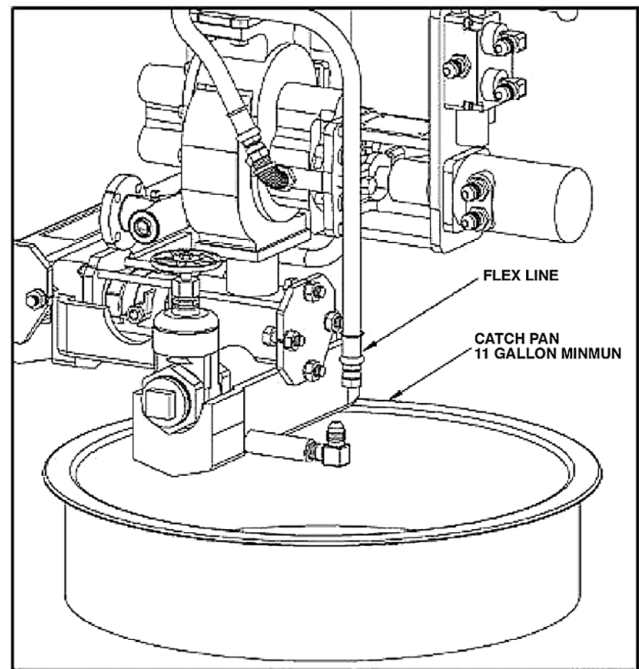


Figure 37 Oil Removal Illustration

A diagram of the hot-oil replacement setup from the ECS-250 is displayed above. This portion of the procedure will effectively drain the hot-oil from the sealant heating system. To refill the system with new oil perform the following steps:

1. Remove the pipe bushing and male quick coupling from the 90-degree elbow on the hot-oil expansion tank
2. Install the overflow line and straight fitting in the hot-oil expansion tank 90-degree elbow
3. Install the flex line fitting on the drain valve heat jacket fitting
4. Remove the filler cap located on the top of the hot-oil expansion tank
5. Start the hot-oil pump. **DO NOT START THE BURNER**
6. Add hot-oil until the expansion tank is full. Allow the hot-oil pump to run for 15 minutes and check the expansion tank cold

level sight glass

CAUTION

The hot-oil expansion tank should contain approximately a 4-inch depth of hot-oil (cold system). Do not overfill.

7. Add hot-oil as necessary to maintain a visible level in the lower sight glass of the hot-oil expansion tank
8. Shut down the hot-oil pump and diesel engine. Replace the hot-oil expansion tank filler cap
9. Check the flex line to drain valve heat jacket fitting for leaks

NOTE: When the burner is operated for the first time after the hot-oil replacement procedure, some hot-oil may spill from the hot-oil expansion tank overflow line.

10. Place a bucket or drain pan under the hot oil expansion overflow line to catch any hot-oil overflow the first time the burner is operated

PRODUCT PUMP PACKING GLAND REPLACEMENT

Perform the following procedures to replace the product pump packing gland:

1. Loosen the two bolts that hold the split retainer on the product pump shaft
2. Remove the two bolts, and move the split retainer as far to the right as possible to allow access to the shaft packing

CAUTION

Do not scratch the pump shaft when removing the old shaft packing. A damaged shaft causes excessive packing wear and leakage.

3. Use an awl or scribe to remove the packing from the pump shaft. Make sure all the old packing is removed from the packing recess

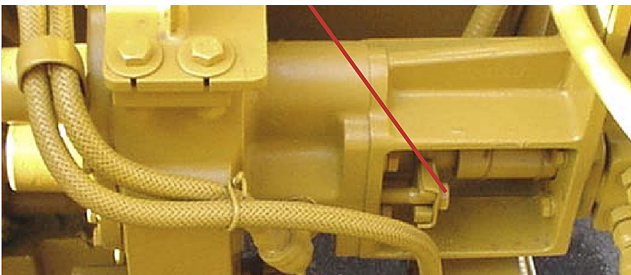


Figure 38 Product Pump

4. Repack the pump shaft with clean, new packing material. Use only Etnyre Part No. RNG-80054
5. Position the split retainer over the new packing and install the two retainer bolts finger-tight
6. Perform sealant heating and circulation operations in accordance with the procedures given in **PREPARING EQUIPMENT FOR USE** Chapter.

CAUTION

Do not over-tighten the split retainer bolts. Only snug-tighten the bolts. Over-tightened bolts will cause the packing to score the pump shaft.

7. With the machine at normal operating temperature and the product pump rotating, carefully snug-tighten the split retainer bolts

CAUTION

Adjust the pump packing daily. The packing must leak one (1) drop per minute for shaft lubrication.

8. Periodically snug-tighten the split retainer bolts as excess seepage appears at the product pump shaft during operation

HOT-OIL PUMP PACKING GLAND REPLACEMENT

Perform the following procedures to replace the hot-oil pump packing gland:

1. Loosen the two bolts that hold the retainer on the hot-oil pump shaft
2. Remove the two bolts and lift the retainer up to allow access to the hot-oil pump shaft packing

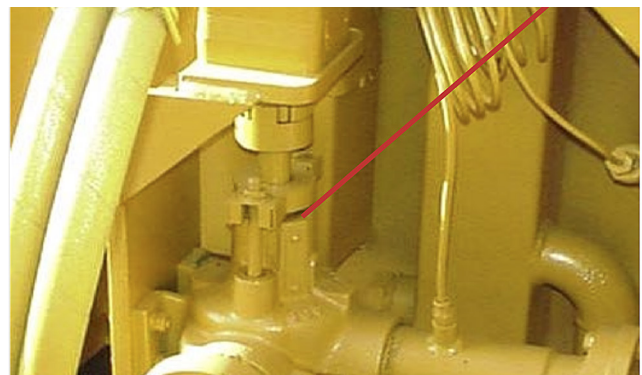


Figure 39 Hot Oil Pump

**CAUTION**

Do not scratch the pump shaft when removing the old shaft packing. A damaged shaft causes excessive packing wear and leakage.

3. Use an awl or scribe to remove the packing from the pump shaft. Make sure all the old packing is removed from the packing recess
4. Repack the pump shaft with clean, new packing material. Use only Etnyre Part No. RNG-80297
5. Position the retainer over the new packing and install the two retainer bolts finger tight
6. Perform hot-oil heating and circulation operations in accordance with the procedures given in the **PREPARING EQUIPMENT FOR USE** Chapter.

**CAUTION**

Do not over-tighten the retainer bolts Only snug-tighten the bolts. Over-tightened bolts will cause the packing to score the pump shaft.

7. With the hot-oil at normal operating temperature and the hot-oil pump rotating, carefully snug-tighten the retainer bolts

**CAUTION**

Adjust the pump packing daily. The packing must leak one (1) drop per minute for shaft lubrication.

8. Periodically snug-tighten the retainer bolts as excess seepage appears at the hot-oil pump shaft during operation

RECOMMENDED FLUIDS

The heat-transfer oils (hot-oil) listed in Table 3-4 are suitable for use in ECS-250 series crack sealing machines. Oils other than those listed may be acceptable provided they meet the general specifications.

The heat-transfer oil used in ECS-250 series crack sealing machines must be solvent-extracted, thoroughly dewaxed, clay-filtered, paraffin based oil recommended for operating temperatures up to 600° F (316° C) in a closed, forced circulation system.

TABLE 1-4: SUITABLE HEAT-TRANSFER OILS

MANUFACTURER	PRODUCT NAME	PRODUCT NO.
Chevron USA	Heat Transfer Oil	1
CONOCO, Inc.	Heat Transfer Oil	-
Gulf Oil Corp.	Gulftherm	68
Mobil Oil Corp.	Mobiltherm	603
Shell Oil Corp.	Thermia Oils	C
Diamond Shamrock	Heat Transfer Oil	-
Sun Oil Co.	Heat Transfer Oil	25
Texaco, Inc.	Texatherm	46
Union Oil Co.	Redline Series	225

HEAT-TRANSFER OIL SPECIFICATION

Table 3-5 lists the general specification for heat-transfer oil suitable for use in ECS-250 series crack sealing machines.

TABLE 1-5: HEAT-TRANSFER OIL SPECIFICATION

CATEGORY	SPEC.
Gravity, API	30
Carbon Residue, WT%	0.10
Flash Point	440° F
Pour Point	5° F
Viscosity @ 100° F (38° C)	110
Distillation Rate, 50%	780° F
Viscosity @ 210° F (99° C)	40
Specific Gravity @ 500° F (260° C)	0.67
Viscosity Index	95
Specific Heat @ 500° F (260° C)	0.70

NOTE: Aromatic or high temperature flash point lubricating oils must not be mixed with paraffin base heat-transfer oils.

HYDRAULIC FLUID

Premium quality hydraulic oil such as Union AW or equivalent is recommended. For minimum ambient temperature below 32° F (0° C), use SAE 10W (150-215 SUS grade). Above 32° F (0° C), use SAE 20-20W (315 SUS grade).

TABLE 1-6: DEPTH CHART

ECS-250 (Measured from Top of Tank, Curbside)	
DEPTH (INCHES)	U.S. GALLONS
0	270
1	259
2	248
3	237
4	226
5	215
6	204
7	194
8	185
9	176
10	167
11	158
12	149
13	140
14	131
15	122
16	113
17	104
18 (Top of Flue)	95

APPENDIX C

TROUBLESHOOTING

Table 2.1 is provided as a guide to assist the user in the maintenance and troubleshooting of the ECS-250 crack sealer.

TABLE 2-1: TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	SOLUTION
Heat transfer oil (hot-oil) slow to heat	1. Insufficient hot-oil in system	1. Check hot-oil level; add if necessary
	2. Hot-oil is contaminated or aged	2. Remove sample for testing or drain system and install new oil. Refer to procedures and specifications in this section
	3. Temperature gauge out of calibration	3. Replace or recalibrate temperature gauge
Burner does not light	Insufficient pressure in sealant heating system due to:	
	1. Hot-oil pump inoperative	1. Check hot-oil pump; repair or replace
	2. Low hot-oil level	2. Check hot-oil level; add if necessary
	3. Faulty hot-oil pressure switch	3. Replace hot-oil pressure switch
Burner does not shut off	Component malfunction or maladjustment	Shut off burner manually with burner switch on control panel. Consult factory for corrective action

TABLE 2-1: TROUBLESHOOTING (CON'T)

SYMPTOM	POSSIBLE CAUSE	SOLUTION
Circulating augers do not rotate	1. Auger directional control not working	1. Use manual override on valve
	2. Cold sealant	2. Allow sealant to heat
	3. Lack of hydraulic pressure due to:	
	a. Insufficient hydraulic fluid	a. Check fluid level; add if necessary
	b. Hydraulic valve closed	b. Open hydraulic valve
	c. Malfunction in hydraulic pump, motor or directional control valve	c. Check components; repair as necessary. Consult factory technical support
When hot-oil temperature exceeds 525° F	Temperature probe calibration is wrong	Adjust rear T-Cal value up
When diesel engine stops		
Diesel engine stalls or runs poorly	Malfunction or maladjustment in engine	Refer to engine manufacturer's literature
Product pump does not rotate	1. Cold sealant	1. Allow sealant to heat
	2. Lack of hydraulic pressure due to:	
	a. Insufficient hydraulic fluid	a. Check fluid level; add if necessary
	b. Hydraulic valve closed	b. Open hydraulic valve
	c. Malfunction in hydraulic pump, motor or directional control valve	c. Check components; repair as necessary. Consult factory technical support
	3. Malfunction in product pump	Check product pump and repair or replace. Refer to manufacturer's literature

TABLE 2-1: TROUBLESHOOTING (CON'T)

SYMPTOM	POSSIBLE CAUSE	SOLUTION
Sealant material does not flow	1. Cold sealant	1. Allow sealant to heat
	2. Application/Recirculation valve setting incorrect	2. Refer to Preparing Equipment For Use: Heating/Circulating Sealant
	3. Clog in application wand	3. Allow wand and hose assembly to heat in hose trough until wand circulates
	4. Damaged or worn valves	4. Repair or replace as necessary. Consult factory technical support
	5. Worn product pump	5. Replace product pump
Hot-oil pump does not rotate	1. Malfunction in pump or hydraulic motor	1. Repair or replace as necessary. Consult factory technical support

APPENDIX D

SPECIFICATIONS

FRAME	6-in. channel iron side rails, square tubular cross members, all-welded construction
AXLE	Dual, 7,000-lb rated load axle with rubber torsion suspension
BRAKES	
STANDARD	Electric, includes cab servo
TIRES & WHEELS	LT235/85R (E) highway tread tires, 6.75 x 16.5, 8 x 6.5 BC wheels
TONGUE JACK	5,000-lb, side-mounted, top-wind, swivel jack with base plate
HITCH TONGUE	Pintle or ball, height adjustable from 16" to 32"
SAFETY CHAINS	3/8" x 48" high-test chain with a combined working load limit of 10,800 lbs. with chain shackles
SEALANT TANK	
TANK - ECS-250	250-gallon capacity, 3/16" & 1/4" steel plate, all-welded construction
TANK - ECS-400	400-gallon capacity, 3/16" & 1/4" steel plate, all-welded construction
SEALANT LOADING DOORS	21" x 36" insulated doors on each side of the tank, positioned at a 30° angle for ease of opening splash-proof hinged lids with integral loading shelf; loading height: 54" Meets all DOT requirements for 49 CFR part 172 and 173.
INSULATION	2-in. thick mineral wool panel insulation (equal to 3-1/2-in. of fiberglass at 400° F), moisture absorption rate less than 1% Wrapped with 16-gauge hot roll steel
CIRCULATING AUGERS	Two hydraulically driven, right-hand spiral, circulating augers, one on each side of sealant tank
PACKING GLANDS	High-temperature, leak-proof, packing gland on each end of the auger shafts

SPECIFICATIONS (CON'T)

PRODUCT PUMP	2-in. positive-displacement pump with hydraulic bi-directional control
CIRCULATING PLUMBING	3-way valve allows variable circulation of sealant material to tank or through the application wand
MATERIAL SCREEN	Located below pump intake, prevents any foreign objects from entering pump mechanism Accessible for daily clean out
APPLICATION WAND AND HOSE	Insulated hose enclosure heated by heat trace portion of hot-oil system Capable of heating and clearing a clogged hose
HOSE STORAGE BOX	Insulated hose enclosure heated by the hot-oil system burner exhaust Capable of heating a clogged hose
WAND RETURN TUBE	Located at rear of unit, allows continuous circulation of sealant through application wand into tank when sealant is not being applied
WAND LOCKOUT	Secures application wand in return tube or hose trough Prevents wand removal with application valve open
HOSE BOOM	6-ft removable boom swivels around the unit to support the hose
FLUSH-FREE SYSTEM	
HEAT TRACING	Product pump, inlet plumbing, tank valve, and hose trough are heat traced with hot-oil
FLUSHING REQUIREMENT	No solvent flushing is required with heat trace system

SPECIFICATIONS (CON'T)

HOT-OIL HEAT EXCHANGER

HEAT EXCHANGER	<p>Primary heating coil and heating chamber</p> <p>Entire heating system is located below 100-gallon level of sealant tank</p>
FLAME CONTACT	<p>Flame contact heats primary heating coil and inner surface of oil-jacketed heating chamber</p> <p>Total contact area: 7,000 sq.-in.</p>
HEAT TRANSFER AREA	<p>Heat transfer area consists of two circulating auger heating coils, outer portion of oil-jacketed heating chamber, and heat trace plumbing</p> <p>Minimum heat transfer area: 7,700 sq.-in.</p> <p>The ECS-400 contains an additional heating coil in the forward position of the sealant tank</p>
HOT-OIL PUMP and PLUMBING	<p>Positive-displacement pump provides forced circulation of hot-oil through heating system</p> <p>Forced circulation prevents premature hot-oil break down, which reduces heating efficiency</p>
HOT-OIL	<p>Standard, approved, paraffin-base, heat-transfer oil with a maximum operating temperature of 600° F in a closed, forced circulation system</p> <p>System capacity: ECS-250 - 14 gallons ECS-400 - 17 gallons</p>
EXPANSION TANK	<p>Equipped with fill connection, vent, and overflow line</p> <p>Cold seal system prevents oxidation of hot-oil</p> <p>Capacity: 1/2 of total system capacity (7 or 8-1/2 gallons)</p>

SPECIFICATIONS (CON'T)

BURNER AND CONTROLS

BURNER	Forced -air diesel-fired burner, 315,000 BTU/hr output Uses an electrically heated injection nozzle that pre-heats the fuel prior to ignition to prevent burner back fire
HEAT SHIELD	Protects the coil and motor from burner chamber heat convection
BURNER FUEL	Draws diesel fuel from ECS-250 fuel tank through a separate sediment filter and shutoff valve
ENGINE	ISUZU: 23.9-hp, 0.9L, 3-cylinder diesel engine Electric start, hour meter, rainproof muffler, 12 V DC battery and 40 Amp alternator KUBOTA: 24.8-hp, 1.1L, 3-cylinder diesel engine Electric start, hour meter, rainproof muffler, 12 V DC battery and 40 Amp alternator
DIESEL	Capacity: ECS-250 - 24 gallons ECS-400 - 35 gallons

HYDRAULIC SYSTEM

HYDRAULIC PUMP	Gear hydraulic pump stacked with 0.69 cu-in., 0.25 cu-in. and 0.16 cu-in. displacement sections
CIRCULATING AUGER MOTOR	Two bi-directional, variable speed, 6.1 cu-in. displacement hydraulic motors with relief valve
PRODUCT PUMP MOTOR	Bi-directional, variable speed, 6.1 cu-in. displacement hydraulic motor with relief valve
HOT-OIL PUMP MOTOR	Variable speed, 0.47 cu-in. displacement hydraulic motor with relief valve
HYDRAULIC RESERVOIR	Configured with a fill, vent, drain connection, and return line filter Capacity: ECS-250 - 2 gallons / ECS-400 - 2 gallons

SPECIFICATIONS (CON'T)

TRAILER LIGHTS AND WIRING

LIGHTS	Equipped with federal motor carrier safety regulation compliant stoplight, taillight, and turn signals
WARNING BEACON	Located on top of unit ON/OFF switch located on Control Panel
ELECTRICAL WIRING	All wiring is protected by conduit, wire loom, or other covering

OVERALL DIMENSIONS

LENGTH (MAXIMUM)	197-in. (varying depending on hitch type)
WIDTH	80 inches
HEIGHT	82.5 inches (without beacon)
LOADING HEIGHT	48 inches
HITCH HEIGHT	16 inch to 32 inch (adjustable)

MISCELLANEOUS

TOOLBOX	Storage for safety equipment, tools, spare nozzle tips, and parts
FIRE EXTINGUISHER	10-lb. ABC, mounted on front of unit
THERMOMETERS	Hot-oil gauge: 150° F to 750° F Sealant tank gauge: 100°F to 450°F (PID Temperature control) Sealant plumbing gauge: 150° F to 750° F
PAINT	Waterborne BearCat Gold

OPTIONS

HITCH TYPES	Available for a variety of ball or pintle hitches
PAINT	Standard waterborne enamel colors

APPENDIX E

OVERALL DIMENSIONS

