



EF-2 Tornado

Operators' Manual

Manufactured by:

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FOREWORD

1. This manual describes the procedures required to operate the Clarus EF-2 Tornado. Every effort has been made by Clarus to assure the accuracy and reliability of the information contained in this document. Clarus, however, makes no representation, warranty, or guarantee in connection with this manual and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any federal, state, or municipal regulation with which this publication may conflict.
2. We highly recommend that all personnel involved with the operation of this equipment have the proper hazardous materials training and certifications required for working with flammable fuels and oils.
3. This manual necessarily addresses problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed
4. Clarus does not undertake the duties of employers to warn, properly train, equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertake their obligations under local, state, or federal laws.
5. Information concerning safety and health risks and proper precautions with respect to particular materials and conditions should be obtained from the employer, the manufacturer or supplier of that material, or the material safety data sheet.

CLARUS EF-2 TORNADO OPERATOR'S MANUAL

I. INTRODUCTION

Congratulations on your purchase of the Clarus EF-2 Tornado tank cleaning and fuel reclaiming equipment! The EF-2 Tornado is a product of Clarus engineering and manufacturing. It is made of the finest materials, under a rigid quality control system. It will give you long and satisfactory service.

To obtain the best use of your EF-2 Tornado, please read this manual carefully. It will help you become familiar with the operation of the equipment and contains many helpful hints about EF-2 Tornado maintenance.

The EF-2 Tornado is designed to process these following fluids only:

Diesel Fuel Heating Oil Kerosene JP-8

Before attempting to process any fluid other than those specified above, you must contact the manufacturer. ***Do not attempt to process any fluid other than those specified above and discussed further in the Manual.***

The instructions and specifications contained in this manual were in effect as of July 2015. Due to the policy of Clarus to continually improve its products, however, modifications in these specifications may be made at any time.

This Operators Manual was compiled for your benefit. By reading and following the simple safety, setup, operation, and trouble-shooting instructions described in the manual, you should receive many years of trouble-free operation. Familiarize yourself with the names of the EF-2 Tornado components, which appear as capitalized terms throughout this manual. ***Read this entire manual before attempting to start and operate the Clarus EF-2 Tornado.***

For reference purposes, the use of the term “fuel” will be used interchangeably with the other fuels approved for processing with the EF-2 Tornado.

II. SAFETY

To safely operate the Clarus EF-2 Tornado, it is essential to know the proper safety procedures and equipment.

A. Safety Warnings.

Material Safety Data Sheets (MSDS or SDS)

The MSDS or SDS provides technical information regarding use, hazards, precautions and emergency procedures related to specific fluids, such as what to do if someone swallows a hazardous fluid or gets the fluid in the eyes. The MSDS or SDS also contains toll-free phone numbers that may be called to provide further safety and emergency treatment information.

Operators of the Clarus EF-2 Tornado must have on hand an MSDS or SDS for each type of fluid, e.g., diesel fuel, kerosene, etc. that they will be processing. The MSDS or SDS are available through local oil companies. In some localities it is required by law that appropriate MSDS or SDS are on hand whenever hazardous or flammable material is being processed.

NOTE! It is the responsibility of the operator that appropriate MSDS or SDS are on hand at the site of operations.

B. Safety Equipment.

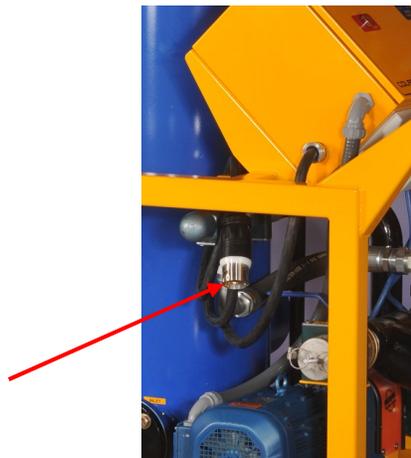
1. Safety Glasses. Operators should wear safety glasses during the setup, operation, and shutting down of the EF-2 Tornado. The major hazard is the possibility of splashing petroleum-based fluids into the eye. If petroleum-based fluid is splashed into the eye, severe damage may occur. First Aid treatment should be initiated immediately. Refer to MSDS or SDS.
2. Protective Gloves. Appropriate protective gloves should be worn whenever there is a possibility that the fluids being processed may come into contact with the hands. Different types of gloves may be required for differently types of fluids. The local safety supply source can recommend the appropriate protective gloves.
3. Respirators. Whenever operating the equipment within a confined area or without adequate ventilation, proper breathing apparatus should be employed. Always avoid breathing fumes and/or vapors. Obtaining certification for working in confined spaces is highly recommended and required in certain instances. It is your responsibility to know when.
4. Safety Certification. Owners and operators should be certified in industrial first aid, hazardous waste handling, and carry current cards.
5. Wheel Chocks. Wheel chocks must be used whenever the EF-2 Tornado is being operated or is located on floating platforms that may tilt due to wave action or other factors. The equipment is designed to roll easily, which it will do without wheel chocks. **Do not rely on the wheel brakes alone if so equipped.**

III. SET-UP AND OPERATING INSTRUCTIONS

First, the entire lengths of all hoses should be visually inspected for cracks or wear that might cause leakage to occur during operations. Spills may be punishable by fines or loss of privileges on waterways and can cause serious damage to your professional reputation. **A Spill Mat should be placed under the EF-2 Tornado whenever it is on a job.** For proper operation, all hoses, and fittings must be correctly connected, all valves should be closed tight, and all points of potential leakage must be inspected to assure that they are properly secured.

A. Setting Up the Equipment.

1. Electrical Connections. The electrical power requirements for the EF-2 Tornado are 230 volts AC and a minimum 50-amp circuit breaker. **Do not attempt to run the System on 460 volts: the electrical components of the System will be seriously damaged.** Operating the System on circuits with less than 50 ampere capability may result in tripping a breaker. ***NOTE! When plugging in the EF-2 Tornado, an inrush current to charge the capacitors on the motor drive can trip weak or loaded 50 AMP breakers. If this happens, simply turn the breaker back on and since the capacitors are now charged, the breaker should not trip again.*** Make sure that all circuits and cords or adapters in use are properly grounded and away from flammable vapor. Use extension cords with the correct gauge: 0-100 feet should be 6 gauge and 100+ feet should be 4 gauge.



IV. FILTERS

When changing filters, make sure to have something underneath the used filter as you move it, such as a bucket or oilsorb, to capture any incidental drips.

A. Particulate Filter.



The Particulate Filter is located in the Particulate Filter Canister. **It is important to use only Clarus-approved particulate cartridges in the particulate stage of the System.** Unapproved filters that have not been tested may not be capable of producing the results, which provide the reason for using the System. **Unapproved filters are not covered under the System's warranty.** It is not always necessary to replace the Particulate Filter after (or during) each job. These filters are expensive and need replacing only when the gauge shows the differential pressure across the filter has reached approximately 35 psid above the initial clean differential pressure, indicating that the filter is becoming plugged and should be changed.

Before changing the Particulate Filter, lift the Suction Hose into the air and run the machine at a slow speed to evacuate the Particulate Canister of fluid. After most of the fluid has been removed, stop the pump and vent the Particulate Filter by opening the valve on the "Clean Bleed." **Do not open the lid prior to venting the canister!** Then remove the lid of the Canister, taking care not to damage the O-ring. Remove the plugged up filter and replace it with a new Particulate Filter. When placing filters in the Canister, make sure to center them around the threaded shaft. Also make sure that the filter is seated flat on the base.

B. Coalescer/Separator Filter.



The Coalescer/Separator Filters are located in the Coalescer/Separator Canister. This canister holds five combination filters. The purpose of the C/S Filters is to remove gross amounts of emulsified or free water from the fuel being processed. Under normal conditions, the C/S filters do not require frequent change, possibly no more than two or three times a year. The efficiency of these Cartridges diminishes after approximately four (4) months of continuous use.

To change the C/S Filter, purge the System using the same procedure as used for changing the Particulate Filter. Remove the filter housing lid hardware and tighten the nut located on the swing arm to raise the lid. Next, remove the nuts holding the inner plate in place. Remove the old Coalescer/Separator Filter and insert the new filter in its correct place. When placing filters in the canister, make sure to center them around the threaded shaft. Also make sure that the filter is seated flat on the base. Reassemble the filter housing in reverse order.

C. Duplex Strainer.



To change the Duplex Strainer, purge the System using the same procedure as used for changing the Particulate Filter. Have a 5 or 10-gallon bucket placed next to the plugged canister, resting on the spill mat. Open the valve on the top of the canister to release any pressure, then open the canister lid, reach into the canister and pull out the bag filter. ALWAYS WEAR GLOVES AND EYE PROTECTION WHEN HANDLING FUEL, OR FILTERS. The bag and strainer will be full of oil and should be lifted partially out and allowed to drain to make filter removal easier. When drained, pull the filter out of the strainer, placing the strainer back in the canister and place the bag filter in the bucket. Install a new bag filter in the canister, close the lid, and engage the lid lock.

V. CONTROLS AND FUNCTIONS

1. Control Panel. The Control Panel contains the Stop and Start buttons and the speed Control for the motor. Differential Pressure Gauges for the Pump and Particulate Filter and an Inlet Vacuum Gauge are covered below. Close attention to the gauges and Speed control is essential for proper operation of the equipment. The Duplex Strainer assembly has a differential pressure gauge for monitoring bag filter status.



2. Start/Stop Buttons. The Stop and Start Buttons are colored red and green, respectively. Their sole purpose is to supply power to the electric motor that drives the pump. In case of an emergency, the Stop button should be activated immediately.
3. Speed Control. The Speed Control permits the operator to continuously vary the pump speed from approximately 140 rpm to its maximum rated speed of approximately 1600 rpm. When starting the EF-2 Tornado, we recommend that the pump be kept at a low speed and then slowly brought up to operating speed over the course of a few seconds.
4. Operating Speed. Pump speeds should be adjusted to the maximum possible considering the hose sizes and type of fluid being processed. ***CAUTION! The Return Hose can recoil when under pressure and slide out of the tank, and spill fuel. Make sure you keep a good grip on the hose or use a spring clamp or other device to prevent the hoses or tubes from coming out of the tank.*** It is a good idea to make marks every foot for the first 4 feet on all the suction and return hoses or tubes being used so you will know at all times how close you are to having the hose or tube come out of the tank. This will also help you know how much hose you have extended into the tank.
5. Wireless Communication Headsets. (Owner supplied) In jobs where there are two operators and the tank is in a location where one operator can't be seen by the other operator, we strongly recommend using a wireless head set to permit communication during the job.

VI. GAUGE PANEL

Layout of gauges represent the unit's flow path



6. Pump Pressure Gauge. This gauge measures the output of the pump. The normal operating range is 10 psi to 100 psi, a by-pass valve on the pump will activate at pressures over 100 psi.
7. Inlet Vacuum Gauge. The Inlet Vacuum Gauge measures the suction developed by the Pump. The range is zero to 30 inches of mercury. The normal operating vacuum ranges from 10 to 20 inches of mercury. Generally, the maximum operating vacuum will be less than 25 inches of mercury.
8. Particulate Filter Differential Gauge. The normal operating range of differential pressure for this filter is 0 to 35 psid. Fluid flow through this filter slows greatly at differential pressures greater than 35 psid above the initial clean differential pressure. The filter should be changed when the gauge reaches 35 psid above the initial clean differential pressure.

9. Duplex Differential Pressure Gauge. The differential pressure gauge will inform the operator when the strainer/bag filter is plugging up and requires replacement. Change outs should normally occur when the differential pressure reaches 10-15 psid. The gauge measures the differential pressure of the canister that is in use.
10. ComboCan Quick Open Lid. The ratcheting lever-action quick open lid facilitates easy filter change outs.
11. Duplex Strainer Basket. The strainer basket is designed to hold a trade size #2 bag filter (25 micron typical).

VII. STARTING THE SYSTEM

ALWAYS USE THE SPILL MAT WHEN OPERATING THE EF-2 Tornado

With the hoses properly secured in the tank, press the Green “start” button and turn the speed control clockwise, 1/2 turn until fuel draws into the suction hose. This is recommended pump speed for priming the System.

Initially, the pump will be sucking air from the Suction Hose and slowly drawing fluid out of tank and into the system. Approximately 15 gallons are required to completely prime the System.

The EF-2 Tornado is configured to clean in two separate processes.

The first process involves turning the valve handle that controls the flow to the canisters (on the lower left side of the cart below the control panel) to the upright position. In this position the EF-2 Tornado will pre-filter out all the gross contaminants in the tank utilizing the Duplex Strainer alone for quick and inexpensive filter change outs. After the tank has been cleaned using the Duplex Strainer, (you’ll know you are done when the psid gauge on the Duplex Strainer no longer shows an increase in value) it is then time to move the valve handle to the horizontal position, which turns on all the filters. After turning the machine on you’ll need to bleed (the air) out of the Coalescer/Separator and Particulate canisters using the Clean Bleed System, as follows:

1. When filling the system with fluid, first open the clean bleed valve on the Particulate and Duplex Filters. Leave the valve open while watching the air escape through the discharge hose. When the majority of air has passed out of the particulate filter, close the valve and proceed to the Coalescer/Separator filter. When the C/S filter has been filled, close the valve, and repeat the procedure until no more air is seen leaving the discharge hose.

2. During normal operation of the EF-2 Tornado, it's a good idea to periodically vent out the particulate filter, as it will collect the residual air that enters the system. This will make sure the filter canister is always full of fluid and being used to its fullest capacity.
3. When changing out filters, use the Clean Bleed System to vent the filter canister of pressure before opening the canister lid.

After bleeding out the canisters, process the tank and fuel until no more contaminants can be found, and you've processed at least four (4) times the volume of the tank. This process will remove all the water and microorganisms.

A. Tank Cleaning/Fluid Filtration.

Once the system has been primed, gradually increase the pump speed.

As the pump speed reaches maximum efficiency, increasing rpm's will eventually produce tapping or knocking noises in the pump noticeably louder than when the pump was running at lower rpm's. These louder tapping or knocking noises indicate that the pump is cavitating.¹ For maximum efficiency, the pump should be operated at the pump speed just below where cavitation begins. **Operating above the cavitation speed for more than a very brief period will cause undue wear and erosion of the pump's internal components.**

After the appropriate operating speed for the pump has been achieved, move the end of the Discharge Hose and Suction Hose around inside the tank to stir up the sludge and debris and suction it from the tank bottom. The contaminants will be agitated in the fluid and then pumped through the system and taken out by the various filters.

During a fuel tank cleaning operation, the Suction hose should be watched continually. Continue to run the machine for a few more minutes and move the hoses around the tank to assure that all solid material has been filtered out. You will develop a better understanding of when the tank is cleaned as your experience operating the System increases.

B. Emptying the System

To drain the filters and hoses, reduce the pump rpm to a slow speed and lift the suction hose out of the fluid until the hose is sucking air. The pump will push air through the filters, displacing the fluid. Open all System valves. System is emptied at the end of every job and when changing filters.

¹ Cavitation is the sudden production and collapse of bubbles behind a fast-rotating propeller or pump vane. The violent collapse of the bubbles erodes the surface of the propeller or vane. Cavitation is accompanied by noise that ranges from a low rumble to loud tapping or knocking. The possibility of cavitation is reduced as the velocity of the pump is decreased.

C. Removing Excess Water.

1. Removing Large Amounts of Water from Fuel Tanks Prior to Full Operation. Prior to cleaning a tank, it is useful to know if it contains a large quantity of water. If the customer doesn't know, and you suspect that there may be a large quantity of water in the tank, it will be best to first strip off the water before beginning to filter the fuel. Because water is heavier than fuel, the water will be in a layer below the fuel. Place the suction hose on the tank bottom and the Discharge Hose into a waste tank/drum and run the system at a moderate speed until water is gone being careful not to overflow the waste tank/drum.
2. Removal of Normal Amounts of Water. During the initial part of normal operations, carefully watch the sight glass on the lower right side of the Coalescer/Separator Canister. It indicates the level of water that has accumulated in the sump from the fuel in the tank being cleaned. When the water level in the Coalescer/Separator reaches a preset level the auto drain valve will activate. To ensure proper operation make certain the ¼ turn ball valve on the auto drain is in the open position and the hose is in an appropriate container.

IMPORTANT! If attempting to manually drain, do not open valve quickly! Crack open the valve slowly to drain. Close the valve slowly to prevent a pressure spike that could implode the Coalescer/Separator cartridge.

VIII. DISPOSAL OF WASTE OIL AND BY-PRODUCTS

A. Waste Fuel and Water.

Through normal operation, small quantities of waste fuel and water will be collected by the EF-2 Tornado operator. These small quantities of waste fuel and water should be stored in waste tank/drums and must be disposed of properly.

The disposal of waste fuel and water can most easily be done by contacting a waste oil hauling company in your area.

It is the responsibility of EF-2 Tornado owner to contact all local, county, state and federal agencies to inquire about guidelines for proper disposal of waste fuel and water and other fluids processed by the EF-2 Tornado. Obtain these guidelines in writing and keep them in your files. It is most important, however, to follow the guidelines and stay tuned to any changes in the laws that might affect your practices.

Disposal of all waste fuel and water must be tracked and documentation of proper disposal(s) kept on file.

B. By-Products.

There are several by-products that need to be disposed of properly when operating the EF-2 Tornado: used filters and oil sorbs, and sludge.

The owner of the EF-2 Tornado is responsible for contacting all local, county, state and federal agencies regarding handling and disposal of used filters and oilsorbs. Obtain these rules in writing and keep them on hand for reference.

To document compliance, owners must follow these guidelines and track all disposal times and charges with receipts.

Sludge, filters and sorbs should be drained of fuel and can often be taken in containers to the local incinerator and burned in a “special burn.” You will be issued a receipt for the product you bring in and you should keep it in your files to prove you are complying with the law.

IX. COMPLETING THE OPERATION/FINISHING THE JOB

When the tank is considered to be clean, the EF-2 Tornado must be cleared of the fuel it has been processing. Remove the Suction Hose from the fluid until it sucks air. There is no danger to the pump when it sucks air for a short time at low rpms.

Being careful not to allow fluid to drip from the open end of the Suction Hose, raise the hose above the level of the pump to assist in draining the hose. Slowly “walk” the raised portion of the hose toward the pump. Leave the Discharge Hose in the tank.

NOTE! WHEN FINISHING A JOB, ALWAYS MAKE SURE THAT YOU REPLACE THE APPROPRIATE PLUGS OR CAPS ON THE HOSE ENDS!

Let the machine run while it empties out. Remember, the System itself holds about 75 gallons. When very little fluid is visibly passing out through the discharge hose, the System is adequately empty.

When the System is empty, turn it off and empty all residual fluid from the hoses into the tank. Turn the valves off and cap the hose ends. Disconnect and store the power cord.

X. JOB COMPLETION CHECKLIST

1. After finishing the job, prepare for the next job by cleaning tools and equipment as you put them away.

2. Stow all used oil sorb and filters on the truck and clean up their storage containers.
3. Place any waste fuel and water in the storage drum for disposal.
4. Rags and coveralls placed in laundry.
5. Prepare list of things needed to do as follow up.
6. Bookkeeping and reports.

XI. TROUBLE-SHOOTING

A. Motor doesn't run or runs erratically.

If the motor doesn't run at all or runs erratically, first make sure you have power by testing the power source with a multimeter. If there is power, then check your fuses. The two main fuses are located on the inside of the control panel. Make sure you disconnect the power to the EF-2 Tornado before checking any possible electrical problems.

If you have power and fuses are OK, next check the voltage. Use a multimeter to check how many volts are present at the end of the power source. For the EF-2 Tornado to work properly you must have a steady 220-230 volts AC. If the power is fluctuating, find another circuit to plug into and test it.

If the power is adequate, the last thing to check is the motor brushes. The brushes are located on each side of the motor. With a large slotted screwdriver, remove the cap covering the brush. Remove the brush and inspect the spring for shorts against the copper wire or for breaks. Next, check the end of the brush for wear.

B. System won't prime.

If the EF-2 Tornado won't prime, chances are there is an air leak on the vacuum side of the pump in one of the hoses or fittings. Make sure that there is nothing plugging the hoses. Do this by turning off the EF-2 Tornado and put your hand over the hose and feel for the suction. If suction is present, plug the working hose back in and go to the next connection and repeat the process until you find lack of suction. At this point you will inspect that section of hose for cracks, bad camlock gaskets, or something plugging it. Also check for plugged Bag Filters in the Duplex.

C. Vacuum is running high (above 25 in Hg).

Check the suction hoses for debris plugging them. Check the Pump suction strainer by removing the strainer cap and removing the mesh strainer to see if it is plugged. Clean if

necessary. If the strainer is clean, you may be simply operating the pump at rpm's too fast for the size of suction hose you're using. **Running the pump too fast for the existing conditions can cause cavitation.** Reducing pump rpm should lower the vacuum.

D. High pump pressure.

Most likely the Particulate or Duplex filter are plugged. Check differential pressure gauge to see if the filter needs to be changed and change if necessary.

Note: Periodically, especially if cleaning extremely dirty tanks, the instrument lines to the gauges may become plugged. Simply remove one at a time and make sure it is clear. On the back of the gauges are two fittings that also should be removed and the screens inside the gauge part removed and cleaned. Please make sure to support the gauge body with a large wrench before taking off and replacing the hose fitting.

XII. CARE AND MAINTENANCE

The pump has two grease fittings that should be greased every 600 hours of operation with Mobil® - Mobilgrease XHP222, Exxon® - RONNEX MP Grease, or equivalent Lithium grease compatible with the pump elastometers. Apply the grease with a handgun until the grease begins to escape from the grease-relief fitting port. Excessive greasing can cause grease to be pushed between the mechanical seal faces, which may result in seal failure. It is normal for some grease to escape from the telltale hole under the bearing for a short period of time after lubrication. If this condition persists, it may be an indication that an excessive amount of grease was used or that the seal is leaking.

Wheel bearings should be lubricated with grease every 90 days.

The carts and external portions of the equipment may be cleaned with a mixture of a light detergent and water.

Never use strong degreasers or strong chemicals on the equipment: they may dull the finish and remove the lettering on the control panel.

NEVER USE SPRAY CLEANERS, PRESSURE WASHERS OR USE A GARDEN HOSE ON THE CONTROL BOX. THE FAN INTAKE & EXHAUST SHROUDS CAN ALLOW WATER INSIDE THE BOX, WHICH WILL SHORT OUT THE MOTOR CONTROL.

THE CONTROL BOX CAN HANDLE NORMAL RAIN
CONDITIONS.

XIII. REPLACEMENT PARTS

Please call 360-671-1514 or e-mail info@claruscfi.com to order replacement parts.