TORNADO XP System

Operators Manual

Manufactured by:

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FOREWORD

1. This manual describes the procedures required to operate the Clarus TORNADO XP System. Every effort has been made by Clarus Technologies LLC to assure the accuracy and reliability of the information contained in this document. Clarus Technologies LLC, 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, provincial or municipal regulation with which this publication may conflict.

2. The electrical components of the Clarus TORNADO XP have been designed and assembled by a UL approved facility. This assures that the components were specifically designed for use with low flash point fuels.

   DANGER! The operational techniques used with this equipment are more important than the design of the equipment for the safety of the worker. Therefore, each technician involved in the operation of the Clarus TORNADO XP System must have the proper hazardous materials training and certifications required for working with flammable fuels and oils as defined by the American Petroleum Industry ("API") and other similar organizations.

3. This manual necessarily addresses problems of a general nature. With respect to particular circumstances, local, state, provincial and federal laws and regulations should be reviewed.

4. Clarus is not undertaking to meet the duties of employers to warn and properly train and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations under local, state, provincial 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 ("MSDS").

CLARUS TORNADO XP System
OPERATOR'S MANUAL

I. INTRODUCTION

Congratulations on your purchase of the Clarus TORNADO XP fuel tank cleaning and fuel reclaiming system! The TORNADO XP System 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 TORNADO XP System, please read this manual carefully. If handled and maintained in accordance with manufacturers recommendations it will help you become familiar with the operation of the equipment and contains many helpful hints about TORNADO XP System maintenance.

The TORNADO XP System is designed to process the following fluids only:

Gasoline Diesel Fuel Heating Oil Kerosene JP-8 JP-5

Before attempting to process any fluid other than those specified above, you must contact the manufacturer.

CAUTION! Do not attempt to process any fluid other than those specified above.

The instructions and specifications contained in this manual were in effect as of February 1999. Due to the policy of Clarus Technologies LLC 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 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 TORNADO XP System components, which appear as capitalized terms throughout this manual. ***Read this entire manual before attempting to start and operate the Clarus TORNADO XP System.***

For reference purposes, the use of the term "fuel" will be used interchangeably with the other fuels approved for processing with the TORNADO XP System.

II. SAFETY

To safely operate the Clarus TORNADO XP System, it is essential to know the proper safety procedures and equipment.

A. Safety Warnings.

The definitions for the safety warnings used throughout this manual are as follows:

Danger Means that if the safety information is not followed, personnel, equipment or the environment **will** be seriously harmed, injured or killed.

Caution Means that if the safety information is not followed, personnel, equipment or the environment **could** be harmed, seriously injured or killed.

Warning Means that if the safety information is not followed, personnel, equipment or the environment **may** be seriously harmed, injured or killed.

Material Safety Data Sheets (MSDS)

The MSDS provides technical information regarding use, hazards, precautions and emergency procedures related to specific fluids. The MSDS also contain toll-free phone numbers that may be called to provide further safety and emergency treatment information.

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

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

B. Safety Equipment.

1. Bonding Cables. The **TORNADO XP** must be properly bonded with the cables and clips provided on the Pump and Motor Module. One of the cable/clip assemblies must be attached to the tank being cleaned or the superstructure. The other should be attached to a proper ground. Official documents such as API recommended practice 2003, Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents – sixth edition, September 1998 are available and it is strongly advised that any person operating the **TORNADO XP read and fully comprehend this important information.**

2. Safety Glasses. Operators should wear safety glasses during the setup, operation, and shutting down of the TORNADO XP System. 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.

3. 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.

4. 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 required in all instances.

5. Safety Certification. Owners and operators must be certified in industrial first aid and hazardous waste handling and carry current cards.

6. Wireless Communication. On jobs where the tank is in a location where the other operator can't see one operator, we strongly recommend using a 2-way radio set to permit constant communication during the job.

III. BEFORE THE JOB CHECKLIST

A. Tool Box Meeting.

Prior to each job, the job manager should meet with employees to review MSDS, describe job requirements, and insure that all safety procedures have been followed and confirm that all workers have appropriate personal protective equipment (PPE).

B. PPE.

Prior to each job all workers must have proper Personal Protection Equipment per API standards.

C. Hoses & Fittings.

Check all hoses and fittings for signs of wear or damage and replace as necessary.

D. Condition of Equipment.

Check that all tank-cleaning tools are in good condition.

E. Inventory.

Plan ahead. Have a complete inventory of filters, spill response supplies, fuel testing materials, and oil sorbs.

F. Hand tools.

Make sure all hand tools needed for each job are present.

G. Maintenance.

Wipe down and inspect the TORNADO XP System. Perform any maintenance in between the cleaning jobs and not during an actual job.

IV. PARTS DESCRIPTON

The following describes the primary components that make up the TORNADO XP along with a description of the hose assemblies needed to operate this equipment.

A. Pump/Controls Module.

This module is the main pumping unit of the TORNADO XP, and consists of the following parts:

1. Sight flow indicator.
2. Duplex Strainer
3. One sliding vane pump.
4. Explosion proof motor.
5. Main Control Panel consisting of all necessary pressure gauges and the start/stop and variable speed controls.

DANGER! The bonding cables must be properly affixed prior to operating the TORNADO XP!

B. Duplex Bag Filter Module.

The first stage of the Tornado XP is a dual chambered, alternate flow bag filter system that is designed to quickly and efficiently remove mid-range size (5 to 50 micron) particulate contamination from fuels.

1. Duplex Bag Filter.
2. Strainer Basket. The strainer basket located inside the bag filter housing and is used to hold the bag filter (Clarus stock #DSP-I).

C. Particulate Filtration Module.

This module contains a filter canisters and cartridge filter which remove fine particulate from the fuel and consists of the following parts:

1. Clarus filter canisters containing a 0.5 micron particulate filter (Clarus Part #KF6018-05).

2. The differential pressure gauge for the particulate filtration module is located on the main control panel. The normal operating range of differential pressure for this filter is 0 to 25 psid. Fluid flow through these filters slows greatly at differential pressures greater than 25 psid above the initial clean differential pressure. These filters should be changed when the gauge reaches approximately 25 psid above the initial clean differential pressure.

3. Filter canister air bleed valves.

D. Coalescer/Separator Canister

This module contains the filter canister which removes free and emulsified water from the fuel and consists of the following parts:

1. Clarus Coalescer/Separator filter canister containing a coalescer (Part #CC-23C) and separator (Part #CS-94C) filter cartridge.

2. Filter canister air bleed valves.

3. Sump water-level sight slass.

4. Water drain valve.

E. Hose Stingers:

There are two hose stingers that attach directly to the TORNADO XP; one 1" is for suction and the other 1" for discharge.

1. The Suction Stinger – this stinger has a female camlock fitting.

2. The Discharge Stinger – this stinger has a female a camlock fitting.

CAUTION - Extension Hoses – If you need extension hoses it is very important that these hoses have a ground wire that bonds both ends of the extension hose.

V. INSTRUCTIONS FOR SETTING UP THE TORNADO XP

A. Basic set-up instructions.

The set-up for the TORNADO XP is simple and straightforward. The following summarizes a typical set-up procedure:

1. Prepare a clean, level working area in which to locate the spill matt.

2. Connect electrical cords at least 50 feet away from the work site.

3. Place cones and caution tape to prevent unauthorized access to work-site.

4. Lock-out/tag-out any electrical circuits or any pump/dispensers or valves on or near the tank system being cleaned.

5. Connect both bond/ground wires to proper points. One of the cable/clip assemblies must be attached to the tank being cleaned or the superstructure.

   The other should be attached to a proper ground. Official documents such as API recommended practice 2003, Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents – sixth edition, September 1998 are available and it is strongly advised that any person operating the **TORNADO XP read and fully comprehend this important information.**

6. Connect the working (tank) hoses or down-tubes onto the system inlet and outlet hoses and place them in the tank.

7. Begin processing fuel - start at a **slow** flow rate and when all air has been purged from the system slowly speed up to the operating flow rate while checking the system for any problems (leaks, excessive pressures, etc.).

VI. OPERATING THE SYSTEM

Once the Tornado XP is in position, the hoses are secured in the tank and the bonding cables are attached, it is time to begin operating.

To begin operating:

1. Turn down the speed control by turning it counter clockwise until it stops.
2. Then press the Green "start" button to activate the motor.
3. As the motor begins to rotate, turn the speed control clockwise 1/3 turn and leave it there until fuel appears in the suction flow indicator and the system becomes fully primed. Once the TORNADO XP is primed, the speed control can be turned up to the appropriate level depending on the work you are doing. For fuel transfers the speed control can be turned up until the pump begins to cavitate. If you are tank cleaning you will need to adjust the pump speed on a job by job basis.

Note on Pump Speed: Pump speeds can be adjusted as high as practical considering hose size and type of fluid being processed. Increasing the pump rpm beyond maximum efficiency, however, will eventually produce tapping or knocking noises in the pump noticeably louder than when the pump was running at a lower rpm. 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.

***CAUTION*! Operating above the cavitation speed for more than a very brief period will cause undue wear and erosion to the pump's internal components**

The TORNADO XP System is configured to clean in two separate processes. One using the Duplex Strainer/Bag Filter module only, and the second, including the Coalescer/Separator and Particulate Filters along with the Duplex Strainer. The following summarizes these two processes.

A. Operating with the Duplex Strainer/Bag Filter Module Only

The TORNADO XP System will filter out a majority of the gross contaminates stirred up in the tank utilizing the Duplex Strainer/ Bag Filter alone. This process saves time and the cost associated with using the particulate filters during the initial stage of tank cleaning. To use this process, simply turn the 3-way fluid outlet flow valve so that the fluid is flowing from the bag filters directly to the system outlet.

B. Final Stage - Cleaning the Fuel (all filter modules)

To clean fuel for use, it is required that the fuel pass through **all** the filtration Modules. To use the All the filtration modules, simply turn the 3-way fluid outlet flow valve so that the fluid is flowing from the Coalescer/Separator module directly to the system outlet.

C. Bleeding the air from the TORNADO XP

1. To bleed a filter, fill the system with fluid by first turning it on as outlined above, then begin to bleed the system through the bleed valves on each canister starting with the bag filters. Note: Filter canisters should be bled in the order of the fluid flow (example: First the bag filters then the particulate filters and finally ending with the coalescer/separators). To bleed a canister, simply open the bleed valve while watching the air escape through the discharge hose. When the majority of air has passed out of the filter, turn the valve off.
2. During normal operation of the TORNADO XP System, it's a good idea to periodically bleed the filters, as they will collect residual air that enters the system. This will make sure the filter canisters are always full of fluid and being used to their fullest capacity.

[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

3. When changing out filters, use the bleed system to relieve pressure from the filter canisters before opening the canister's lid.

4. Note: Backpressure from fuel in an elevated discharge line will cause fuel to spill out of the canisters when the lids are removed. When in a backpressure situation, close the suction and discharge valves.

Note on Tank Cleaning: The tank cleaning process will be more effective and shorter in duration if the fuel level in the tank is below ¼ full. The tank can be cleaned when it is full of fuel, however, it will go quicker with less fuel.

1. To set up for tank cleaning, attach the 1" Suction Hose and the tank cleaning down-tube to the end of the Discharge Hose. The suction tube must always be the largest diameter possible to supply the pump an unrestricted flow of fuel. The discharge tube is smaller to create pressure and velocity for washing down the interior of the tank.
2. To begin cleaning a tank, use the Suction Tube to thoroughly vacuum the bottom of the tank while discharging fuel at the top of the fuel level.
3. When the tank bottom has been vacuumed, park the Suction Tube at the lowest end of the tank and then begin washing down all lower surfaces of the tank with the discharge tube, washing all particulate toward the Suction Tube.
4. During a fuel tank cleaning operation, the Suction Stinger should be watched continually. When no solid material is visible through the Suction Stinger for an extended period of time, and the fluid appears clear despite the continued manipulation of the Discharge and Suction Hoses, the tank is considered clean. 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 clean as your experience operating the System increases.

E. Removing Large Amounts of Water from Fuel Tanks Prior to Full Operation.

Prior to cleaning a tank, it is important to determine if it contains a large quantity of water. If you suspect that there may a large quantity of water in the tank use water sensing paste to determine the amount of accumulated water. Use the suction hose on a slow speed to 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 tube on the tank bottom and the Discharge Hose into a waste tank/drum and run the system at a slow speed until water is gone. At all times have a technician monitor the discharge hose as it fills the waste tank/drum to prevent a spill.

F. Removal of Normal Amounts of Water.

During the initial stages of normal operations, it is important to frequently watch the sight glass on the lower side of the Coalescer/Separator Canister in order to monitor the level of water in the sump. If the Coalescer/Separator sumps overfill, water will be discharged back into the cleaned fuel. A small plastic ball, visible in the sight glass,

floats on water and sinks in fuel. This ball indicates the level of water in the sump that has been stripped from the fuel being cleaned. As the ball rises it indicates that more water is accumulating in the canister.

When the ball gets ¾ of the way to the top of the sight glass there will be approximately one gallon of water in the sump of the Coalescer/Separator Canister. Empty the sump by opening the valve. Watch the ball in the sight glass and when it hits the bottom, very slowly turn the valve off.

CAUTION! Do not open or close the Coalescer/Separator drain valve quickly! Opening or Closing the valve slowly will prevent a pressure spike that could implode the Coalescer/Separator cartridge.

VII. CHANGING FILTERS

A. Changing-out the Duplex Strainer Bag Filters.

1. To change-out bag filters have a 5 or 10 gallon bucket placed next to the plugged canister. Open the valve on the side of the canister to release the suction, then open the canister lid, reach into the canister and pull out the bag filter. The bag and strainer will be full of fluid and should be lifted partially out and allowed to drain. Once 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 tighten the lid bolts.

   ALWAYS WEAR GLOVES AND EYE PROTECTION WHEN HANDLING FUEL OR FILTERS.

   WARNING! 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.

B. Changing-out the Particulate Filters.

   1. The Particulate Filters, (Clarus Technologies LLC Part#KF-05), are located in the Particulate Filter Canister. **It is important to use only Clarus-approved particulate cartridges in the particulate stage of the System.** Unproven filters that have not been tested may not be capable of producing the results that provide the reason for using the System. Unproved 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 need replacing only when the particulate gauge shows a differential pressure of approximately 25 pounds per square inch differential ("psid") above the initial clean differential pressure. A psid of 25 or greater indicates that the filter is plugged up and should be changed. Both filters must be changed at the same time.

 ***CAUTION! Do not open the lid prior to venting the canister!***

3. Opening a canister lid prior to venting will result in a fuel spill. Once a canister has been completely vented, remove the lid of the Canister, taking care not to damage the O-ring. Remove the plugged filter and replace it with a new Particulate Filter. When placing filters in the Canister, make sure to center them on the threaded shaft. Also make sure that the filter is seated flat on the base.

C. Changing-out the Coalescer/Separator Filter.

1. The Coalescer/Separator Filters, (Clarus Technologies Part #23-C, and 94-C), are located in the Coalescer/Separator Canister. This canister holds two filters. The purpose of the Coalescer/Separator Filter is to remove gross amounts of emulsified and free water from the fuel being processed. Under normal conditions, the Coalescer/Separator filter does 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. Both filter sets must be changed at the same time.

2. To change the Coalescer/Separator Filter, purge the System using the same procedure as used for changing the Particulate Filter. Remove the old Coalescer Filter and Separator Filter and insert the new filters in their correct place. When placing filters in the canister, take extra time to insure that each filter is centered on the threaded shaft and seated flat on the base.

VIII. COMPLETING THE OPERATION/FINISHING THE JOB

A. Once the tank and it's fuel appear clean, the job is complete and the TORNADO XP System can be cleared of fuel and properly disassembled.

1. 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 and displace the fluid. Put the Duplex Strainer handle in the center position to drain out both canisters. The System must be emptied at the end of every job and when changing filters.

2. Being careful not to allow fluid to drip from the open end of the Suction Hose, raise the hose above the level of the system to assist in draining the hose. Slowly "walk" the raised portion of the hose toward the pump. Secure the Discharge Hose in the tank and leave it open to drain the fuel.

3. Let the machine run while it de-fuels. When very little fluid is visibly passing out through the stinger, the system is adequately empty.

4. 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. Then dismantle the system for transport.

 **WARNING! WHEN FINISHING A JOB, YOU MUST REPLACE THE APPROPRIATE PLUGS OR CAPS ON THE HOSE ENDS!**

IX. JOB COMPLETION CHECKLIST

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

B. Stow all used oil sorb and filters in containers for disposal.

C. Place any waste fuel and water in the storage drum for disposal.

D. Prepare list of things needed to do as follow-up or repair/replacement items for the System.

E. Complete reports.

X. DISPOSAL OF WASTE OIL AND BY-PRODUCTS

A. Fuel and Water.

Through normal operation, small quantities of waste fuel and water will be collected by the TORNADO XP System operator. These small quantities of waste fuel and water should be stored in waste tank/drums and must by 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 TORNADO XP System owner to contact all local, county, state provincial and federal agencies to inquire about guidelines for proper disposal of waste fuel and water and other fluids processed by the TORNADO XP System. Obtain these guidelines in writing and keep them in your files. It is critical to follow these 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 kept on file.

B. By-Products.

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

The owner of the TORNADO XP System is responsible for contacting all local, county, state, provincial 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.

XI. TROUBLE-SHOOTING

A. System won't prime.

If the TORNADO XP System won't prime, chances are there is an air leak on the vacuum side of the pump or a plug in one of the hoses or fittings. Make sure that there is nothing plugging the hoses. Do this by turning on the Tornado XP System while placing your hand over the stinger and feeling 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 Strainer.

NOTE: Over time the instrument lines to the gauges may become plugged. To clean 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. 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 Standard Oil Company Amolith All-Weather Grease, or an equivalent 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.

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 will dull the finish.

XII. REPLACEMENT PARTS

Please call 800-671-1514 to order replacement parts.

Part Number	Description
CC23C	Coalescer
CS94C	Separator
DSP-1	Micron Bag Filters (100/case)
KF6018-05	Tornado 0.5 micron filters (case)
TOR-0012	Tornado Hose, 1" Replacement - 12 ft length
TOR-0006	Tornado Spill Mat
TOR-0008	Tornado Motor
TOR-0010	Tornado Pump Maintenance Kit
TOR-0009	Tornado Pump Rebuild Kit
TOR-0007	Tornado Pump