



TORNADO CABLE AND TUBE BLOWING MACHINE

OPERATION & MAINTENANCE



89000 – USA

CABLE BLOWING MACHINE

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QC Final Inspection by: _____

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Unit Serial Number: _____

Build Date: _____

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GMP Limited Warranty can be found at <http://www.gmptools.com/warranty/>

INTRODUCTION



Founded by engineer George M. Pfundt in 1936, GMP started operations in a downtown Philadelphia building as a specialty machine shop doing work for the local Bell Telephone company and for the electric utility company. GMP expanded to a production shop after landing a contract with Western Electric Company and, subsequently, forming

a close relationship with Bell Telephone Laboratories in Murray Hill, N.J., which enabled it to manufacture prototypes of products for experimental use within the Bell System.



Having outgrown the original factory building, the company built a 100,000 square foot plant in Trevoose, PA (a Philadelphia suburb) and moved there in 1957. Today GMP is recognized as a premier worldwide supplier of specialty tools and equipment for the outside plant marketplace. The company's products are known for their robust design and durability to withstand many years of frequent use.



1. SAFETY INSTRUCTIONS

This equipment must only be used by authorized personnel who have been suitably trained and competent to do so.

These instructions are to be made available to operators of this equipment at all times. Failure to observe these safety instructions could result in serious personal injury and or property damage.

WORK AREA AND GENERAL SAFETY

- 1) Read and understand the operation and maintenance manual supplied with this equipment. Keep it in a convenient place for future reference.
- 2) Keep children and untrained personnel away from this equipment while in operation.
- 3) Keep all guards and safety devices in place. Do not operate this equipment with guards removed or damaged.
- 4) Keep hands, feet and loose clothing away from moving parts, especially at cable entry points.
- 5) Always stop the machine and isolate, compressed air, electrical and hydraulic services to carry out lubrication and servicing.
- 6) Check machine before starting for worn or damaged parts. Check that all nuts and bolts are tight.
- 7) If machine is left unattended, ensure that unauthorized use is prevented.
- 8) Never leave the machine unattended while in use.
- 9) Consider the use of safety barriers, especially when used in public places.
- 10) Beware of pinch points involved with rotating components, e.g. screw operated tractor drive lifting mechanisms.
- 11) Beware of hot surfaces, machine uses compressed air and hydraulic services.
- 12) When operating machine always wear eye protection, hard hat, safety shoes and leather gloves, machine operates with compressed air at 175 psi (12 bar) and hydraulic oil at 2000 psi (140 bar).
- 13) Some component and assembly parts are in excess of 55 lbs. (25kg). When lifting care must be taken, ensure sufficient man power/lifting gear is available, to prevent personal injury and damage to the machine.
- 14) Prior to installation ensure the sub-duct route is connected properly.
- 15) Beware of exposed electrical contacts. Do not touch. Or allow metal objects to come into contact.

- 16) Waste hydraulic oils are to be disposed of via an environmentally acceptable method.
- 17) Wear ear protection if noise levels are considered high to prevent ear damage.
- 18) Machine may cause additional fire hazard if involved in an existing fire due to compressed air and hydraulic oils.
- 19) No personnel are to be in manholes or ducts when the Cable Blowing Machine is being operated.
- 20) The machine must be operated on firm ground.
- 21) Stay clear of cables or lines under tension.
- 22) Stay clear of pressurized line and sub-duct.
- 23) Only use the machine for its intended purpose, do not use the tractor drive without the air chamber to push or pull cable.
- 24) Do not place cable drum too close to the Cable Blowing Machine.
- 25) Do not tamper with pressure relief valves or pressure reducing valves.
- 26) The compressed air supply must not be allowed to enter the air chamber or sub-duct before the top tractor drive frame has been closed and the cable inserted into the intake cable guide bracket assembly.
- 27) Do not open the air chamber until all the air has been exhausted and the air pressure gauge reads zero.

FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY, AS THE CABLE COULD BE EJECTED FROM THE CABLE BLOWING MACHINE WITH HIGH FORCE AND VELOCITY.

- 28) Never operate the blowing machine with the electronic control panel immersed in water.
- 29) To prevent damage to the hydraulic hoses and the emergency stop cable never leave them on the ground when not in use.

GENERAL HYDRAULICS SAFETY INSTRUCTIONS

Escaping fluids under pressure can penetrate the skin and cause serious personal injury. Observe the following precautions to avoid hydraulic hazards:

- 1) Ensure all hydraulic connections are securely tightened before operating the machine.
- 2) Check for leaks with a piece of cardboard. **Do not use your hands!**
- 3) Do not exceed working pressure of hydraulic hoses.
- 4) Visually inspect hoses regularly and replace if damaged.

GENERAL PNEUMATIC SAFETY INSTRUCTIONS

The GMP Fiber Optical Cable Blowing Machine is a pneumatic device, using pressurized air to project cable at high velocities. Please observe the following precautions when operating the Cable Blowing Machine:

- 1) Compressed air can cause flying debris. This could cause personal injury. Always wear personal protective equipment.
- 2) Ensure no personnel are in the manhole at the far end of the cable run. Severe personal injury may result.
- 3) Never open the air chamber when pressurized.
- 4) Only authorized, fully trained personnel should operate the air compressor.

GENERAL ELECTRICAL SAFETY INSTRUCTIONS

The electronic control assembly and power supply are electrical devices. Electric shock hazards exist that could result in severe personal injury. Observe the following precautions to avoid electrical hazards:

- 1) Do not operate in or near water. This includes setting the electronic control assembly on a wet surface or exposing them to rain.
- 2) Do not remove cover of electronic control assembly. There are no user serviceable parts inside. Refer servicing to qualified service personnel.
- 3) Check the condition of the emergency stop lead. Replace if worn or damaged.
- 4) Never run the blowing machine without the emergency stop cable being connected to the Blowing Machine and Power Pack.

2. CRITICAL POINTS THAT DRAMATICALLY AFFECT THE OPERATION OF THE CABLE BLOWING MACHINE

- One (1) turn on the cable clamping screw
- Tractor drive to be closed at all times when cable is installed into machine.
- Air Chamber height adjustment correctly set.
- Cable infeed bracket height adjustment correctly set.
- Cord seals in air chamber correctly fitted to provide good sealing.
- Correct cable seals fitted.
- Sub-duct fully connected and pressure tested.
- Sub-duct cable exit retaining device fitted.
- Compressor capacity 175 psi (12 bar) and suitable for size of sub-duct being used.
- Cable drum must be located directly behind and in line with the blowing machine.
- Air chamber, tractor drive belts/chains, housing frames and cable guide intake assembly must be clean and free from debris, sludge, dirt, water and lubricant, each time the blowing machine is used.
- The cable must be hand guided into the blowing machine through a dry clean cloth by the operator wearing work gloves. This will remove any dirt, debris and water on the cable.
- Ensure the compressed air supply is not applied to the cable until approximately 650 feet (200 meters) of cable have been installed or the hydraulic pressure begins to rise.
- The hydraulic pressure should be between 290 - 580 psi (20 - 40 bar) at the start of a blowing installation. If greater do not proceed. Check cable clamping screw setting, sub-duct, cable. Cable seals, cable collet sizes, air chamber/infeed guide height setting. Rectify before recommencing the installation.
- Lubricate the drive chains before use with recommended lubricant.
- Do not repeatedly press the on/off button on the length/speed readout as this may result in irrelevant digits being displayed or may alter the program.
- Always fit the hydraulic hose dust caps when the hose is not in use. Clean and check the quick release couplings before use.

DISCLAIMER

GMP takes care in the design of its products to ensure that the cable is protected during installation. Due to the variety and different methods of cable manufacture the responsibility of checking the cable compatibility with the equipment lies with the operator. Therefore, GMP cannot accept liability for any damage to the cable.

CABLE BLOWING MACHINE

3. GENERAL DESCRIPTION

The cable blowing machine comprising of an air box and cable pusher has been designed to provide an effective and safe method of fiber optic cable installation. The system installs fiber optic cable of 6 - 34mm overall diameter at up to 300 ft/min (90m/min) into pre-installed sub-ducts, employing the viscous drag compressed air principle.

The machine is protected by preset pressure relief valve and preset pressure sensor.

The compressed air is fed into the sub-duct, and the hydraulically powered cable feed system controls the fiber optic cable. The electronic control system provides read out of speed and distance and automatic protection against duct obstruction.

The system comes mounted on sturdy, height adjustable, wheeled tubular steel trolley unit for ease of site maneuverability, and is powered by a hydraulic supply system operating from a recommended supply of 2000 psi x 5 gpm (140 bar x 20 liters/min).

The cable-blowing unit can be detached from the trolley unit and located in a trench or man-hole (depending on the size of the manhole).

The unit is supplied as standard with a Chicago fitting. The air supply hose should be 1 1/4" (32 mm) minimum bore, (not supplied by GMP).

The unit is supplied with 2 x hydraulic hoses x 23 feet (7 meters) and an emergency stop lead x 26 foot (8 meters) long for connecting between the cable blowing machine and hydraulic power pack (or hydraulic power source).

The unit is CE approved.



FEATURES

Fully labeled control panel containing:

- Power ON/OFF button (silver)
- Emergency Stop Button (red)
- Blowing speed read out in either ft/min or m/min through a separate calibration
- Length counter recording in feet or meters through a separate calibration
- Hydraulic pressure read out dial
- Air pressure read out dial
- Air pressure control lever
- Hydraulic on/off control valve
- Emergency stop connection socket
- Adjustable speed control for drive belts
- Battery Charging Connection

Control panels may be removed independently for repair work.

CHASSIS

- Front mounted wheels for ease of maneuverability
- Light painted tubular steel frame
- Adjustable frame allowing unit to be tilted at 20° to manhole
- Adjustable rear legs for uneven terrain
- Blowing unit is detachable from the trolley for trench / manhole location

AIR BOX

- Manufactured from aluminum
- Range taking of cables from 6 - 32mm by means of interchangeable collets with double split cable sealing arrangements.
- Sub-duct sealing at mouth of box
- Sub-duct gripping facility with non-duct crush and distortion design.
- All seals are one size cord seals (except cable seals)
- Upper section of air box is retained
- Air box alignment is adjustable for varying cable diameters
- Tools are not required to split box for insertion of cable and sub-duct.
- On/off air control valve

CABLE FEEDER

- Manufactured from cast aluminum
- Hydraulically powered
- Unit lifts and splits to allow insertion of cable between drive belts
- Drive belts are polyurethane and molded to unit ensuring long life between replacement.
- Lifting facility, to allow unit level lift.
- Belt tension can be set by means of adjustable chain drive tensioner fitted to side of unit
- System relief valve fitted as standard to operate at 1600 psi (110 bar).

4. SPECIFICATION

OPERATING CAPACITIES

Pushing Force:	0 - 220 lbs (0-100kg)
Pushing Speed:	0 - 300 ft/min (0-90m/min)
Cable Size:	.24 - 1.34 inch (6 - 34mm) OD
Sub – Duct Size:	1/2 - 2 1/2 inch (12 - 63mm) OD

HYDRAULIC DRIVE SYSTEM

Operating Pressure:	1670 psi (115 bar) max
Flow:	4 gpm (15 liters/min) recommended
Pressure Switch Setting:	1450 psi (100 bar) .47-1.34 inch (12-34mm) OD cable 870 psi (60 bar) .24-.47 inch (6-12mm) OD cables
Relief Valve Setting:	1600 psi (110 bar) .47-1.34 inch (12-34mm) OD cable 1015 psi (70 bar) .24-.47 inch (6-12mm) OD cables
Initial starting pressure:	290 - 580 psi (20-40 bar) (if greater, the set-up needs checking)

PNEUMATIC SYSTEM

Air Hose Bore (min):	1¼ (32mm)
Operating Pressure:	175 psi (12 bar)
Flow:	The air supply should be filtered, cooled and dehumidified

For Ducts with an Inner Diameter of: Minimum Flow Acceptable

0 up to 1 inch (0 up to 25mm) :	150CFM	4m³/min
1 up to 1 1/8 inch (26 up to 30mm) :	185CFM	5 m³/min
1 1/8 up to 1 3/8 inch (31 up to 35mm) :	250CFM	7 m³/min
1 3/8 up to 1 5/8 inch (36 up to 40mm) :	375CFM	10 m³/min
1 5/8 up to 1 3/4 inch (41 up to 44mm) :	450CFM	12 m³/min
1 3/4 up to 2 inch (44 up to 44mm):	700 CFM	19 m³/min

ELECTRONIC CONTROL SYSTEM

Power Requirements: 12 Volts DC (gel cell battery supplied)
Fuse Rating: 3.15 amp (slow-blow)

DIMENSION AND WEIGHTS

Height: 48 1/2" (1230mm)
Length: 42" (1060mm)
Width: 27 1/2" (700mm)
Weight: 155 lbs. (70kg)
Tire Size: 3.00 - 4 / 260 x 85
Tire Pressure: 25 psi (1.72 bar)
Drive Chain Lubrication: Metaflux 70 - 88 Chain Spray

INSTALLATION PRINCIPLE

Basic standard: Viscous Drag Method
Optional: Missile System

Charging the 12 volt battery before use:

Plug in the supplied battery charger in the charging jack found on the right of the control panel. Initially charge the battery for 8 hours before use (to approximately 13 volts). Continuous charging of the battery with your charger will reduce the life of the battery. Remove the charger when charging is complete. When voltage dips to 12 volts, recharge the battery. Optimize battery life by turning off the display when not in use.



5. OPERATING PROCEDURE

SUB-DUCT INTEGRITY AND LUBRICATION

Sub-duct integrity and lubrication is entirely the responsibility of the operator.

1. Ensure that the sub-duct is fully prepared for use i.e.:

- Fully connected
- Pressure tested
- Cable exit retaining device fitted
- lubricated (if required)

VERIFYING AIR FLOW AND LUBRICATION (IF REQUIRED)



2. Clean the air chamber with a dry cloth, fit the correct size cable seal collet, sub-duct seal collets and sub-duct clamp collets refer to sections 8 & 9 and appendices 7 & 8 for further details. The collet with the horizontal "O" Ring grooves is fitted into the base of the air chamber and secured with a cap screw. Refit the radial seal cords.



3. Open the sub-duct clamp and place the sub-duct into the sub-duct seal collet and sub-duct clamp collet. Ensure the sub-duct is fully engaged into the sub-duct seal collet.



4. Clamp the sub-duct and tighten the two retaining nuts just enough to secure the duct. (Over tightening could strip the threads on the clamps)



5. Fit the cable seal plug and two cable seals (coated with silicon grease) into the lower half cable seal collet. Ensure that the split of the innermost seal is in the lower half of the air chamber slightly rotated from the vertical. The split of the outer most seal is also in the lower half of the air chamber slightly rotated from the vertical in the other direction to the innermost seal. Both grooves face away from the tractor drive.



6. Fit the upper cable guide collet ensure both seals are correctly located.



7. Re-fit the air chamber lid ensuring correct location on the dowels and tighten down the 4 retaining knobs.

8. Check the air valve is in the “closed” position and connect the air supply from the compressor



9. Notify installation team that preparations are completed and that checking the air flow through the sub-duct is about to commence.
10. **Note: Only authorized fully trained operators should be allowed to operate the air compressor.**

With the air compressor ready to provide air, turn the air valve to the “open” position.



11. Confirm that air is being expelled from the far end of the sub-duct under pressure. If not this indicates the run is too long, there is leak, an obstruction or the sub-duct is crushed or otherwise damaged or disconnected. This must be remedied before any cable blowing is undertaken, when confirmation is received, turn the air valve to the “closed” position and shut down the compressor.



12. Ensure all air has exhausted from the air chamber and sub-duct. Open the air chamber and sub-duct clamp and withdraw the sub-duct. Add blowing lubricant to the sub-duct at the rate of 8 oz. (237ml) of lubricant per 2000 ft (600 m) of sub-duct assuming a 1 1/4 bore. Adjust quantity for different bore sizes. **Note: Never open the air chamber until the air pressure gauge reads zero.**



13. Insert a suitable foam plug into the sub-duct and re-fit the sub-duct into the air chamber and secure with the sub-duct clamp as already described. The foam plug should be sized so as to be a snug fit in the sub-duct. By blowing this plug down the sub-duct the lubricant will be evenly distributed along the length of the sub-duct. Before blowing the plug through the sub-duct, ensure the sub-duct cable exit retaining device is fitted at the end of the run, to prevent the plug flying out of the open end of the sub-duct causing injury.

14. Re-fit the air chamber lid ensuring correct location on the dowels and tighten down the 4 retaining screws.



15. NOTIFY INSTALLATION TEAM

Notify installation team that preparations for lubricating the sub-duct are complete and ready to commence.

16. With the compressor ready to provide air, turn the air valve to the open position.



17. When the foam plug has been expelled from the end or the sub-duct, turn the air valve to the “closed” position and shut down the compressor. **Allow the air chamber and sub-duct to exhaust all the compressed air. Note: Never open the air chamber until the air pressure gauge reads zero.**

18. Open the air chamber and remove the cable seal collet plug.

6. OPERATING PROCEDURE

CABLE BLOWING

It is imperative that all persons using, operating or maintaining this cable blowing machine be fully trained and competent and authorized to do so and have read the entire operation manual.

General Machine Products and CBS Products Ltd, CANNOT BE HELD RESPONSIBLE FOR MISUSE OF THIS EQUIPMENT.

1. Position the Cable Blowing Machine in line with the proposed sub-duct.
2. Adjust the mounting frame to the desired height and angle by means of the front frame supports. Withdraw the front "R" clip and retaining pin while supporting the weight of the cable-blowing unit. Raise or lower the blowing unit and locate onto the support bar for the desired position. Refit the retaining pin and "R" clip. Alternatively the blowing unit may be detached from the trolley frame by withdrawing both "R" clips and retaining pins, while supporting the weight of the blowing unit. The blowing unit can then be located in a trench, manhole (depending on size) or at ground level. Ensure the blowing unit is stable and the electronic panel is not immersed in water.
3. If trolley mounted, stabilize the frame on uneven ground by adjusting the height on the pivoting feet at the rear of the unit and locking in position.

Note: Care should be taken when wheeling the trolley around not to catch the adjustable feet pads on curbs or boulders, this may damage the pivoting foot.

4. Position the cable drum some 20 to 25 ft. (6 to 8 meters) directly behind and in line with the cable blowing machine. (Cable carrying device to be suitably leveled and restrained).
5. Ensure the battery is fully charged before commencement of installation. The battery is charged with the supplied charger thru the jack located on the right of the control panel.
6. Open tractor drive and unscrew retaining knobs on the air chamber.
7. Open the air chamber lid on the pivot bolts.



Clean any debris, sludge, dirt, water, lubricant, etc. from the air chamber, frame housing and cable intake guide bracket assembly each time before use.
Lubricate both chains before use.
Clean both tractor drive belts before use.
Ensure cord seals are intact and not damaged

8. Unscrew the sub-duct clamp retaining bolts.

Refer to the Section 4 “**SPECIFICATION**” for the correct pressure settings for the relief valve and pressure switch and to Section 6 “**MAINTENANCE**” for the setting procedures.

NOTE: The cable blowing machine is supplied as standard with the pressure relief valve set at 1600 psi (110 bar) and the pressure switch set at 1450 psi (100 bar), these settings are suitable for cables in the range 12 - 32mm O.D.

For cables 6 - 12mm O.D. these settings need to be changed, refer to the section 4 “**SPECIFICATION**” for the correct pressure settings for the relief valve and pressure switch and to section 6 “**MAINTENANCE**” for the pressure setting procedures.

9. Open the sub-duct clamp on the pivot bolts, select and fit the correct size cable seal, sub duct seal and sub duct clamp collets for the cable and sub duct being used. (Refer to Tornado configuration guide on page 58). **Always check and verify the correct size collets are fitted before operating the blowing machine.**



10. Place the sub-duct into the sub-duct seal collet and sub-duct clamp collet. Ensure the sub-duct is fully engaged into the sub-duct seal collet.



11. Clamp the sub-duct and tighten the two retaining nuts. Remove the upper cable collet.

12. Release the adjusting screw locking ring, turn the adjusting knob until the mark on the air chamber support bracket aligns with the size of the cable to be installed on the increment gauge. Tighten the locking ring to prevent any movement during installation. (Refer to section 11 for details).



13. Ensure that the sub-duct is fully prepared for use, i.e.

- Fully connected
- Pressure tested
- Cable exit retaining device fitted
- Lubricated

For further details on sub-duct lubrication refer to Section 5

14. Open the collet retaining bracket on the pivot bolt.



15. Select the correct size cable infeed collet to suit the size of the cable to be installed and secure with the cap screw into each housing. Note: Sealing cord is not required on this collet.

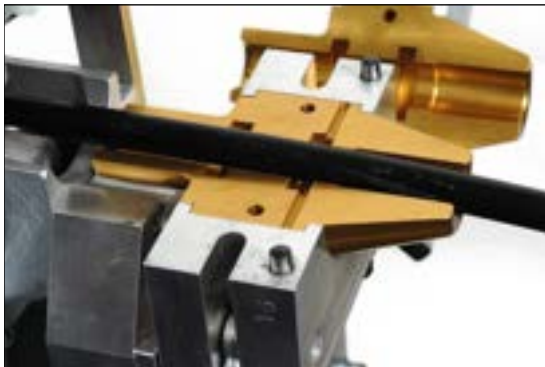


Always check and verify the correct size collets are fitted before operating the blowing machine.

16. Adjust the height of the intake cable guide bracket to suit the size of the collet and the size of the cable to be installed. To adjust the height, unscrew the locking ring back to the adjusting knob, rotate the adjusting knob on the underside of the bracket, align the cable collet size arrow indicator for the range of cable collet being used, to the outside diameter (O.D.) cable size to be installed in the same color band for each marker plate i.e. silver to i.e. silver for a 12-16mm cable collet range with a 16mm O.D. cable or blue to blue for a 16-20mm cable collet range with a 16mm O.D. cable. When the correct setting is achieved hold the adjusting screw and turn the locking clock wise to lock in position and prevent any movement during installation. (Refer to section 11 for details).



17. With the tractor drive unit in its upper position, guide the cable through the infeed guide assembly, tractor drive and feed approximately 6 ft (2 meters) into the sub-duct, by hand.



Close the infeed cable guide upper housing and secure with the swing bolt and thumb nut, ensure the cable is correctly located in the bore of the collet.



Note: Ensure that the compressor air supply is never allowed to enter the air chamber or sub-duct when the top tractor drive frame is in the upper position. (i.e. not clamping the cable) and / or the infeed guide bracket is open or not correctly secured.

Failure to do so could result in personal injury due to the cable being ejected from the cable blowing machine with high force and velocity.

Close the tractor drive, ensuring the cable is located correctly in the Vee of both upper and lower drive chains.

Set the clamping force

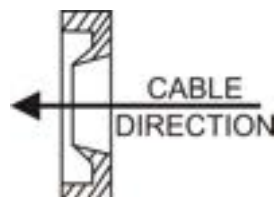
The correct cable clamping force is vital to the performance of the machine. It should be set as follows:



Tighten the handle with one hand while rotating the clamp washers with the other. The clamp washers will turn easily until the handle begins to clamp them. When the clamp washers become almost impossible to turn with one hand this is the start point for the clamp force setting. Continue to turn the handle a further 1 full turn. This will ensure the correct cable clamp force.

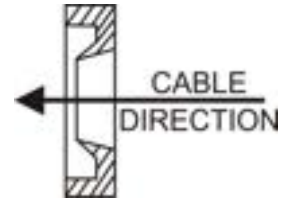


20. Apply a smear of silicone grease to each seal and install the first cable seal into the groove nearest the tractor drive. Ensure the split of the seal is in the lower half of the air chamber rotated slightly to one side of the vertical, ensure the groove is away from the tractor drive facing the sub-duct.

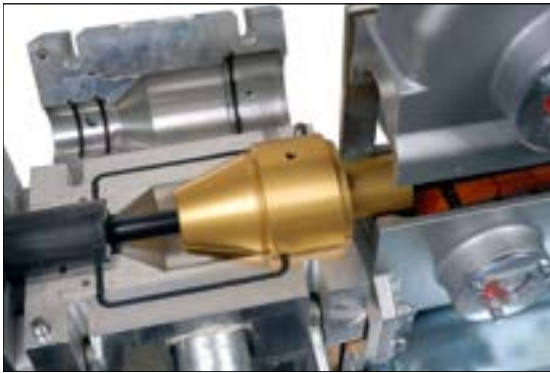




21. Install the second seal into the outer groove with the seal split in the lower half of the air chamber rotated slightly to the other side of the vertical (compared to the first cable seal). Ensure the groove seal lip is away from the tractor drive facing the sub-duct.



22. Fit the upper cable guide collet in position ensuring both seals are located correctly.



23. Re-fit the air chamber lid ensuring correct location on the dowels and tighten down the 4 retaining knobs.



ENSURE THAT:

24. The hydraulic control lever is in the "OFF" position.



25. The speed control knob is in the "MIN" position (fully rotated counter-clockwise).



26. The emergency stop button is set. (i.e. in upper position). If not set, twist counter-clockwise to reset.



27. Connect the two hydraulic hoses and the emergency stop cable from the power pack (or hydraulic power source). Never run the blowing machine without the emergency stop cable being connected. **NOTE: Only authorized, fully trained operators should be allowed to operate the hydraulic power pack (or hydraulic power source).**

28. Check the air valve is in the closed position and connect the air supply from the compressor (if not already connected).



NOTE: ENSURE THE AIR VALVE REMAINS IN THE CLOSED POSITION UNTIL REQUIRED.



29. NOTIFY INSTALLATION TEAM

Notify installation team that preparations are complete and cable blowing operations are ready to commence.

30. **Note: Only authorized, fully trained operators should be allowed to operate the air compressor and the power pack/hydraulic power source. Ensure that both services are available and running and have enough fuel for the duration of the blowing operation. Note: the air shut off valve is till in the closed position.**

31. Turn hydraulic valve to “ON” position.



32. Ensure the emergency stop button is in the reset position. (Twist counterclockwise to reset).



33. Press the on/off button.

Note: Do not press the RST Button while powering up the counter.



The display will indicate the speed and distance travelled by the cable. To toggle between speed and distance press the SEL (green) button. R displayed on the left side of the screen designates speed (rate). To reset the distance press RST (red) button.

Note: It is possible to reset the distance to zero while installing, even if speed is being displayed on the screen.

34. Turn the speed control valve clockwise (towards “MAX”) until the required speed is achieved.



35. Continue to install cable into sub-duct. The operator wearing work gloves should hand guide the cable into the blowing machine through a dry clean cloth to prevent any debris on the cable entering the blowing machine and to ensure the cable enters the machine inline with the tractor drive belt without and bending or deviation.

Note: Care must be taken to avoid injury by clothing or fingers being dragged into the machine. Failure to do so **will** result personal injury.

36. When approximately (650 ft.) 200 meters of cable have been installed into the sub-duct or the hydraulic pressure begins to rise, “open” the air valve **slowly** to allow the compressed air to enter the air chamber. This assists the installation of the cable through the duct.



37. When the cable has reached its destination, the worker stationed at the other end of the duct will notify the operator to stop the machine by turning the hydraulic valve to the off position.



38. Turn the speed control knob to the “MIN” (counter clockwise) and press the reset button.



39. Turn the air valve to the “closed” position. Allow the air pressure to exhaust. This may take several minutes as there may be a considerable amount of air in the sub-duct. Do not open the air chamber until the air pressure gauge reads **Zero**.



40. IF THE BLOWING MACHINE STOPS SUDDENLY

If the cable blowing machine stops suddenly during the blowing operation it is likely that the pressure switch has tripped stopping the power pack because:

- A) The cable has reached its destination and the cable exit retaining device has stopped the travel of the cable.
- B) The cable has become jammed, has hit an obstruction in the duct or the cable blowing operation has reached its maximum capability.
- C) The power pack has developed a problem or has run out of fuel

IN THE EVENT OF AN EMERGENCY

Push the emergency stop push button.



Turn the hydraulic valve to the "off" position.



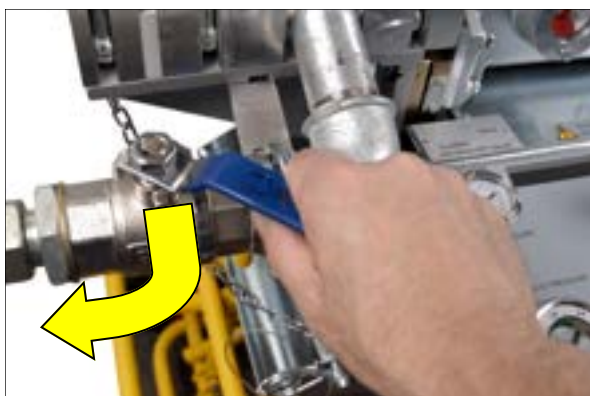
Turn the speed control knob to "MIN" position (fully counter clockwise)



Press the on/off button to turn the electric's off.



Turn off the air supply (if required).



Correct the problem that caused it to stop.

TO RESTART

1. Ensure the power pack is running



2. Turn the hydraulic valve to the “on” position.



3. Press the power on/off button



4. Turn the air valve to the open position (assuming the required amount of cable in in the duct)



5. Turn the speed control valve towards “MAX” until the required speed is achieved



7. MAINTENANCE

To ensure reliable service from your Cable Blowing Machine, we **recommend the unit be completely serviced every 6 months**

AIR CHAMBER

The air chamber **should** be inspected after each operation for seal damage or wear. Seal cord **should** be replaced if damaged or missing and secured in position with the adhesive provided.

The cable seals should be checked for damage or wear and replaced with new ones if required.

ALWAYS apply a smear of silicone grease to the seal bore and lip when installing the seal on to a cable.

ALWAYS clean out any debris in the air chamber.



Seal Cord Locations

TRACTOR DRIVE

Inspect the chain drive blocks for wear each week.

CHECK the chain tension weekly and adjust if necessary with the two external adjustment screws. (Do not over tension) the chain should slightly lift off the chain guides, when pulled at the center by finger.



THE CHAIN SHOULD BE LUBRICATED EACH TIME USED by application of Metaflux spray grease 70-88. This is achieved by running the cable blowing machine at about 150 ft/min (45m/min) without any cable or applied air and carefully inserting the spray tube from the canister into the red painted holes on the operator side of the aluminum drive castings (2). The spray tube should be carefully inserted until the chain can just be felt and then withdrawn about 7/8 to 1 inch (20 - 25mm) and spraying for approximately 1 second.

Do not over lubricate, as this may lead to the drive belts being contaminated with lubricant. If contamination does result, wipe the belts clean thoroughly before attempting any blowing operation. Do not use harsh solvents. (This is based on normal use where the chains are not exposed to excessive contamination).



GENERAL

The machine **should** be stored under cover when not in use. The machine should be wiped clean after each time used.

ALWAYS ensure that there are sufficient cable seals, cord seal, cord adhesive and silicone grease available in the toolbox to cover the next installation.

ALWAYS ensure that the battery is fully charged, before the cable blowing machine is to be used. **Note:** The battery is not charged by the power pack. The machine uses a conventional gel cell battery and is charged through the Battery Charger Connection (see below).

Charging the 12 volt battery before use:

Plug in the supplied battery charger in the charging jack found on the right of the control panel. Initially charge the battery for 8 hours before use (to approximately 13 volts). Continuous charging of the battery with your charger will reduce the life of the battery. Remove the charger when charging is complete. When voltage dips to 12 volts, recharge the battery. Optimize battery life by turning off the display when not in use.



CHECK the tire pressures and condition weekly. Oil the frame pivot points monthly and lubricate the Oilite bearings with light machine oil every month. Apply grease to the jacking screw thread each month. Clean out any dirt/debris from the cable-measuring wheel, measuring disc and speed pick up probe.

Oil air chamber adjusting screw and cable infeed guide adjusting screw monthly.

Grease axles every month. Check function of electrical panel each time.

SERVICE CONNECTIONS

CHECK the condition of the hydraulic hoses each time they're used and replace if worn or damaged.

CHECK the condition of the emergency stop cable each time it's used and replace if worn or damaged.

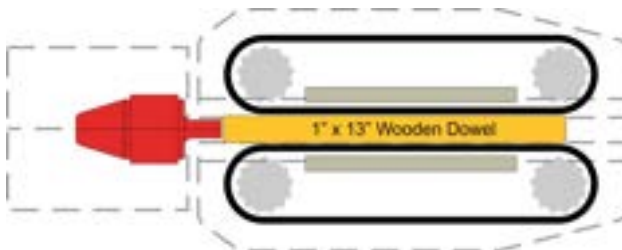
CHECK the condition of the compressed air hose each time and replace if worn or damaged.

PROCEDURE FOR SETTING THE RELIEF VALVE AND PRESSURE SWITCH FOR CABLE SIZES .24-.47 inch (6-12mm) OD

When installing small diameter cables with “soft/flexible” characteristics, it will be necessary to reduce the pressure relief valve and pressure switch settings to help prevent the cable from buckling or being jammed in the air chamber mounted collet. The pressure relief valve should be set to **1015 psi (70 bar)**. The pressure switch should be set to **870 psi (60 bar)**. For “softer/more flexible” cables the above values may have to be reduced proportionally to enable successful installation.

TO SET PRESSURE RELIEF VALVE FOR SMALL DIAMETER, .47 INCH OD (12MM) OR UNDER OR FLEXIBLE CABLE

Clamp a piece of 1” O.D. dowel/round bar x 13” long in the drive belts so it butts up to the air chamber mounted collets (in effect placing the motors in stall mode). **Note:** The below procedure will put the unit in a hydraulic bypass condition and will rapidly heat the oil. Try to keep the time in bypass to a minimum as the heated oil could change your readings.



1. Connect the hydraulic hoses and start the power pack. With the electric control panel switched “off”, turn hydraulic on/off valve to the “on” position.
2. Rotate the speed control knob fully clockwise to “MAX” and observe pressure gauge reading of approximately 1600 psi (110 bar).
3. Loosen the 1/2” lock nut and adjust pressure relief valve (see fig. 1) using a 5/32” Hex wrench until the pressure gauge pointer drops to **1015 psi (70 bar)**.
4. Rotate the speed control knob counter-clockwise (towards “MIN”) until the pressure gauge reads 0 psi (0 bar).
5. Rotate the speed control knob again, fully clockwise to “MAX” and re-check pressure gauge reading of approximately 1015 psi (70 bar).
6. Re-adjust the relief valve slightly if needed until 1015 psi (70 bar) is indicated on the gauge. Finally tighten the lock nut while preventing the relief valve adjustment from turning.
7. Rotate the speed control knob again, fully clockwise to “MAX” and re-check the pressure reading of approximately 1015 psi (70 bar) after lock nut is tightened. If different, readjust.

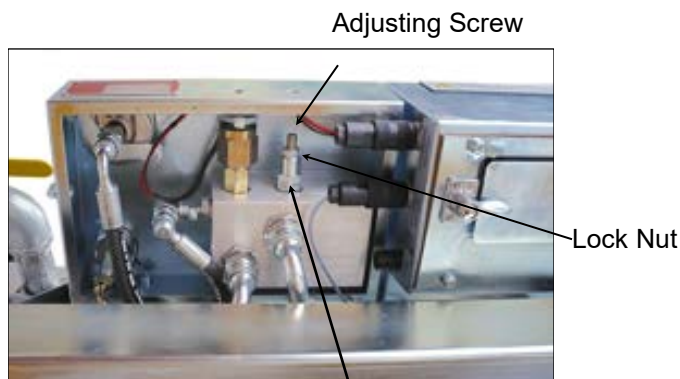


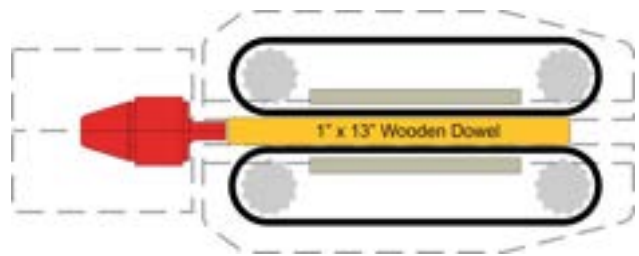
Fig1



Pressure Relief Valve

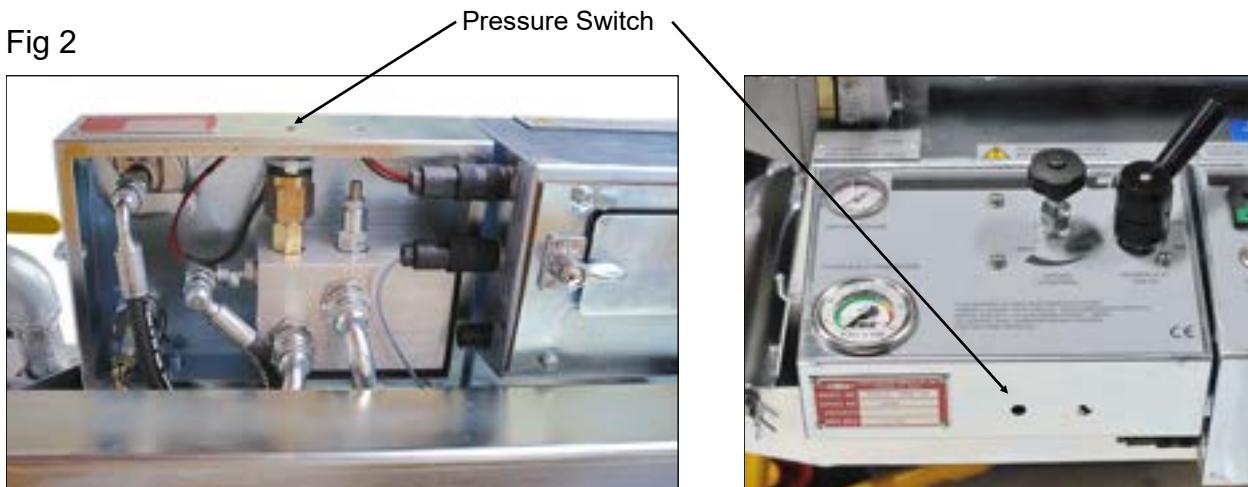
TO SET PRESSURE SWITCH FOR SMALL DIAMETER .47 INCH OD (12MM) OR UNDER OR FLEXIBLE CABLE

Clamp a piece of 1" O.D. dowel/round bar x 13" long between top and bottom housings so it butts up to the air chamber mounted collets (in effect placing the motors in stall mode). **Note:** The below procedure will put the unit in a hydraulic bypass condition and will rapidly heat the oil. Try to keep the time in bypass to a minimum as the heated oil could change the readings



1. Connect the electric lead to the power pack and blowing machine.
2. Rotate the speed control knob fully counter-clockwise to "MIN".
3. Press the on/off button (to turn the electric's on).
4. Turn the pressure switch adjusting screw fully in (clockwise) using a 1/8 inch Hex key through the hole in the front of the panel (see fig. 2).
5. Start the power pack.
6. Turn the hydraulic on/off valve to "on" position.
7. Turn the speed control knob towards "max" (clockwise) until the pressure gauge reads **870 psi (60 bar)**.
8. Turn the pressure switch adjusting screw slowly out (counter-clockwise) until the power pack stops.
9. Turn the speed control knob to minimum (turned fully counter-clockwise).
10. After 5 seconds has elapsed restart the power pack and turn the speed control knob slowly towards "MAX" and note what pressure the power pack stops, repeat the procedure and fine adjust the pressure switch adjusting screw until **870 psi (60 bar)** is achieved.

Fig 2



Note: When installation of cables of diameters .47inch (12mm) O.D. and above are required again, reset the pressure relief valve and pressure switch to:

Pressure relief valve	1600 psi (110 bar)
Pressure switch	1450 psi (100 bar)

7.1. MAINTENANCE SCHEDULE

PROCEDURE	DAILY	WEEKLY	MONTHLY
Clean all assemblies and components thoroughly			
Inspect hydraulic hoses for leaks and cracks			
Inspect fasteners, screws and retaining pins / wire			
Check / adjust chain tension			
Check tractor drive pads for wear / damage			
Clean air chamber			
Check / replace cord seals			
Check / replace cable seals			
Tire pressure / condition			
Check condition of emergency stop lead			
Clean rod infeed guide bracket and collets			
Clean measuring wheel measuring disc and speed pick up probe			
Function of electronic panel			
Oil the frame pivot points			
Grease jacking screw thread			
Oil air chamber adjusting screw			
Oil Oilite bearings with light machine oil			
Grease mounting frame axles			
Clean and lubricate chain*			
Clean and lubricate the chain support slide bars			
Check the condition of service and spare 12V DC battery			
Check condition of the compressed air hose			

* Should be more often if subjected to abnormal use and / or excessive contamination.

7.2. TYPICAL PROBLEMS EXPERIENCED WHEN CABLE BLOWING:

PROBLEM	SOLUTION
Tractor feed does not pull the cable off the drum	Assist the drum by turning it or pulling the cable off the drum by hand.
The Cable Blowing Machine stops. Hydraulic pressure gauge reads zero.	Machine has tripped out on pressure switch, cable has hit an obstruction or become jammed. Turn hydraulic valve to off position. Turn speed control knob to "MIN". If cable is jammed try restarting the Cable Blowing Machine. If this fails it may be necessary to pull the cable out a short distance and start again. Investigate obstruction in duct. If all else fails it may be necessary to remove the sub-duct and remake the bad connection.
It is difficult to keep the cable moving near the end of a duct run	Assist the Cable Blowing Machine by manually pushing the cable into the tractor drive. DO NOT BEND OR CRIMP THE CABLE.
The cable is hard to re-start having stopped	Put air to the system with the cable clamped between the upper and lower drive chains. The tractor feed can be restarted after the air pressure has increased and stabilized. If the cable cannot be restarted, this may be due to the weight of cable in the sub-duct, it will be necessary to pull the cable out and restart the installation with the full air pressure applied.

Tornado Tool Kit

(complete kit P/N 34647)

PART No.	DESCRIPTION	Location
36292	5/32" T-Handle Hex Wrench	1
32604	Battery Tester	2
34444	1/8" T-Handle Hex Wrench	3
89142	3mm Hex Key	4
89143	4mm Hex Key	5
89144	5mm Hex Key	6
89145	6mm Hex Key	7
89147	3mm dia O-Ring Cord 10 ft.	8
89148	Silicone Grease Dow Corning 7 100gr Tube	9
89588	Sealing Cord Glue	10
89153	Chain Lubrication Spray	11
89150	Pliers 6"	12
87096	Screwdriver 6" (slot)	13
89146	17mm Combination Wrench	14
37481	1 1/4 x 12 Wooden Dowel	15
32617	1/2" Combination Wrench	16
32485	Charging Transformer	17
32486	Power Cord	18
37437	External DC Power Cord	19
32905	13mm Combination Wrench	20



8. PROCEDURE FOR REPLACEMENT OF CHAIN DRIVES

Tools required: 6mm Hex Key

13mm Wrench

Ensure the hydraulic hoses to the power pack are disconnected from the blowing machine before carrying out this procedure.



1. Remove the hydraulic motor from the top frame using 6mm Hex Key. Do not disconnect hydraulic hoses connected to the motor.

2. Remove the stop washer on the bottom of the main jacking screw using a 6 mm Hex key.



3. Unscrew the main clamping screw and separate the top and the bottom of the pusher unit. Place in a safe location.

4. On the lower unit, slacken the 2 chain adjusters using a 13mm wrench.



5. Remove the swing bolt from the side of unit using a 13mm wrench.

6. Pull the tensioner pin out from the sprocket assembly. Remove spacer from other side.



7. Remove the tension sprocket assembly



8. Remove the chain-connecting link.



9. Remove the chain.



10. Check the chain support slide bars for wear. Clean and relubricate.



11. Pass the pre-lubricated new chain around the drive sprocket. Feed the chain along the unit and reconnect the chain-connecting link. Remember to install the 2 center connecting link plates.



12. Align the tension sprocket with the chain and locate into position. Insert the tension pin through the tension sprocket. Place the tension pin spacer on the tension pin through the opposite hole. Refit swing bolts using a 13mm wrench. Adjust the chain evenly via the swing bolts, checking free rotation of the chain. Do not over tighten the chain.

Replace the chain in the top housing using the same steps that are used above for the bottom housing.

Reassembling the top and the bottom parts of the pusher unit.▪

- Refit the main clamping screw.
- Replace the stop washer on the bottom of the main jacking screw using a 6mm Hex key.
- Replace the hydraulic motor using the 6mm Hex key. Adjust top chain, **do not over tighten chain.**

9. PROCEDURE FOR REPLACEMENT OF CABLE COLLETS

Ensure the air supply is disconnected from the blowing machine before carrying out this procedure.

Tools Required 4mm Hex Key



Step 1 Collet Removal

- Ensure that the air valve is closed and the air pressure is at zero.
- Open the air chamber to expose the collets.
- Remove the socket head cap screw (2) using a 4mm Hex key and remove the collet (2)

Step 2 Collet Refitting

- Select the replacement collets (refer to appendix 5 for collet information)
- Clean the air chamber with a dry cloth.
- Fit the appropriate collets and secure with a socket head cap screw using a 4mm Hex key. The collet with horizontal O-ring grooves is fitted into air chamber base.
- Re-new any worn or damaged radial cord seals and always renew both air chamber split cord seals. Ensure there is sufficient cord to butt up to the sub-duct and the cable seal.

Note: Correct fitting of the cord seals is a major factor in air leakage from the air chamber.

- Close the air chamber.

NOTE: The main seals in the air chamber consist of a 3mm cord seal, which is cut to the correct length and permanently fixed with adhesive.

10. PROCEDURE FOR REPLACEMENT OF SUB-DUCT COLLETS

Ensure the air supply is disconnected from the blowing machine before carrying out this procedure.

Always check and verify the correct size collets are fitted before operating the blowing machine.

SUB-DUCT CLAMP COLLETS

Tools Required 4mm Hex Key



Step 1 Collet Removal

- Open the sub-duct clamp.
- Remove the socket head cap screws (2) using a 4mm Hex key and remove the collet (2).

4mm Hex

Step 2 Collet Refitting

- Select the replacement collets (refer to Appendix 6 for collet information)
- Clean the sub-duct clamp with a dry cloth.
- Fit the required collets and secure with a socket head cap screws using a 4mm Hex key.
- Close the sub-duct clamp.

SUB-DUCT SEAL COLLETS

Tools Required 4mm Hex Key



Step 1 Collet Removal

- Ensure that the air valve is closed and the air pressure gauge is at zero.
- Open the air chamber to expose the collets.
- Remove the socket head cap screw (2) using a 4mm Hex key.

Step 2 Collet Refitting

- Select the collets (refer to Appendix 6 for collet information).
- Clean air chamber with a dry cloth.
- Fit the replacement collets and secure with a socket head cap screw using a 4mm Hex key.
- Re-new any worn or damaged radial cord seals always renew both air chamber split cord seals.

Note: Correct fitting of the cord seals is a major factor in air leakage from the air chamber.

- Close the air chamber.

Note: The main seals in the air chamber consist of a 3mm cord seal, which is cut to the correct length and permanently fixed with adhesive.

11. PROCEDURE FOR REPLACEMENT OF CABLE SEALS

Ensure the air supply is disconnected from the blowing machine before carrying out this procedure.

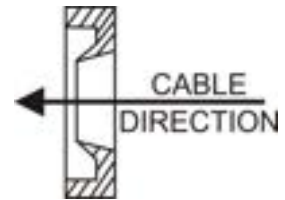
Always check and verify the correct size collets are fitted before operating the blowing machine.



Tools Required No tools are required.

Step 1 Seal Removal / Refitting

- Ensure that the air valve is closed and that the air pressure gauge is at zero.
- Open the air chamber to expose the cable seals.
- Remove the seals.
- Refit the required seals. Apply silicone grease to the seal bore and groove, ensure the seal groove is fitted away from the pusher unit (i.e. towards the sub-duct). Ensure split in innermost seal faces downwards and offset to one side and the split in the outermost seal faces downwards and offset to the opposite side to the innermost seal. Always fit both new seals (refer to Appendix 6 for cable seal information).
- Close the air chamber.



12. PROCEDURE FOR THE AIR CHAMBER AND COLLET TYPE CABLE INFEEED CABLE GUIDE ASSEMBLY HEIGHT

Step 1

When changing collets and seals to accept smaller / larger sizes of cable it is necessary to adjust the height of the air chamber and the collet type infeed guide assembly.

This setting must be carried out accurately, as failure to do so will seriously impair the function of the machine.

AIR CHAMBER:

- To adjust the air chamber bracket in either direction, release the adjusting knob locking ring and turn the knob placed directly under the air chamber. Down for smaller OD cables, and up for larger OD cables.
- Select the adjustment required using the increment gauge on the side of the unit.
- Tighten the locking ring to prevent any movement during installation.



CABLE INFEEED GUIDE ASSEMBLY:

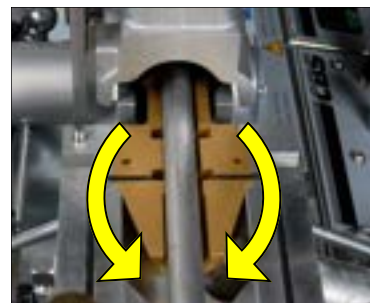
- To adjust the collet type cable infeed guide assembly bracket in either direction, release the adjusting knob locking ring and turn the knob placed directly under the infeed guide bracket, down for smaller OD cables, and up for larger OD cables.
- Select the adjustment required using the increment gauges on the side of the infeed cable guide bracket. Align the cable collet size arrow indicator for the range of cable collet being used, to the outside diameter (OD) cable size to be installed in the same color band for each marker plate i.e. silver to silver for a 12-16mm cable collet range with a 16mm OD cable. Or blue to blue for a 16-20mm cable collet range with a 16mm OD cable.
- Tighten the locking ring to prevent any movement during installation.



13. ALIGNMENT OF AIR CHAMBER TO THE CABLE PUSHER UNIT

1. Insert a round parallel bar between the top and bottom cable pusher housings and clamp down. Ensure the rod doesn't interfere with metering wheel and that it passes through the air chamber. (See picture).
2. Refer to Section 11.0 Procedure for adjusting the air chamber and infeed guide assembly height and the height of the air chamber. Adjust the air chamber such that the top face of the lower housing is inline with the centre line of the rod.
3. The lateral alignment of the air chamber needs to be checked and adjusted. The objective is to position the air chamber such that the center line of the rod is parallel with the center line of the air chamber, adjustment is made by slackening the four socket cap screws that secure the air chamber to the support bracket (see picture).

When the alignment is correct re-tighten the four socket cap screws.



14. MONTHLY SERVICE – CHECK LIST

1. Remove the drive chains from the pusher unit. Check both of the chains for excessive wear. Replace, if required and lubricate with the spray grease provided.
2. Remove any debris from the housings.
3. Check the chain supports slide bars for excessive wear and lubricate with the spray grease provided. Replace, if required.
4. Check all other moving parts e.g. bearings, shafts, sprockets etc. . and lubricate.
5. Check main jacking screw . and lubricate.
6. Check all hydraulic fittings and check for leaks.
7. Check the hydraulic hoses for external damage.
8. Check the electrical lead for external damage.
9. Check the electrical plug and sockets.
10. Check the function of the electronic control module.
11. Check the operation of the emergency stop button.
12. Check condition of cable seals and cord seals in the air chamber.
13. Check the operation of the cable measuring device.
14. Check the wheel tire pressures and free rotation. Inflate and lubricate, as necessary.
15. Clean the infeed cable guide bracket.
16. Complete service history record.

15. SERVICE HISTORY RECORD

Service no	Date	Carried out by	Record of service/repair

16. TROUBLESHOOTING GUIDE

Initial starting hydraulic pressure at the point of starting a cable installation the hydraulic pressure must be between 290 - 580 psi (20-40 bar). If not, do not continue. See the below sections “**Will Not Achieve Max Pressure**” and “**Runs At Higher Than Expected Pressure**” to rectify the problem before commencing cable installation.

WILL NOT ACHIEVE MAX PRESSURE

- Hydraulic control valve not open fully
- Speed control not positioned fully
- Faulty power pack (check performance)
- Jacking screw not tight enough (producing belt slip)
- Worn pads due to cable slip
- Excessive lubrication of chains (on to pads causing belt slip)

RUNS AT HIGHER THEN EXPECTED PRESSURE

- Chains too tight / excessive clamping force.
- Poor lubrication
- Seized chain links
- Over tightening of jacking screw
- Misalignment of air chamber slider
- Cable drum not rotating freely
- Misalignment of entry guide
- Poor duct, installation / friction
- Insufficient out-put from compressor
- Incorrect seal/collet fitted
- Dirt / debris in pusher housings

CABLE BLOWING MACHINE STOPS SUDDENLY DURING CABLE INSTALLATION

- Max pressure achieved
- Obstacle in duct installation
- Power Pack out of fuel
- Emergency button pressed
- Damaged lead between Power Pack and blowing machine

ENGINE DOES NOT STOP AT MAX PRESSURE

- Emergency lead not connected
- Electrical control panel not switched on
- Battery low on power
- Pressure switch unplugged
- Fuse blown in control panel

EXCESSIVE AIR LEAKAGE FROM AIR CHAMBER

- Damaged cord seal
- Cable seals worn, incorrect size, wrong way round, misalignment of air chamber bracket in relation to cable diameter
- Incorrect collets

COUNTER NOT READING OR GIVING INCORRECT READINGS

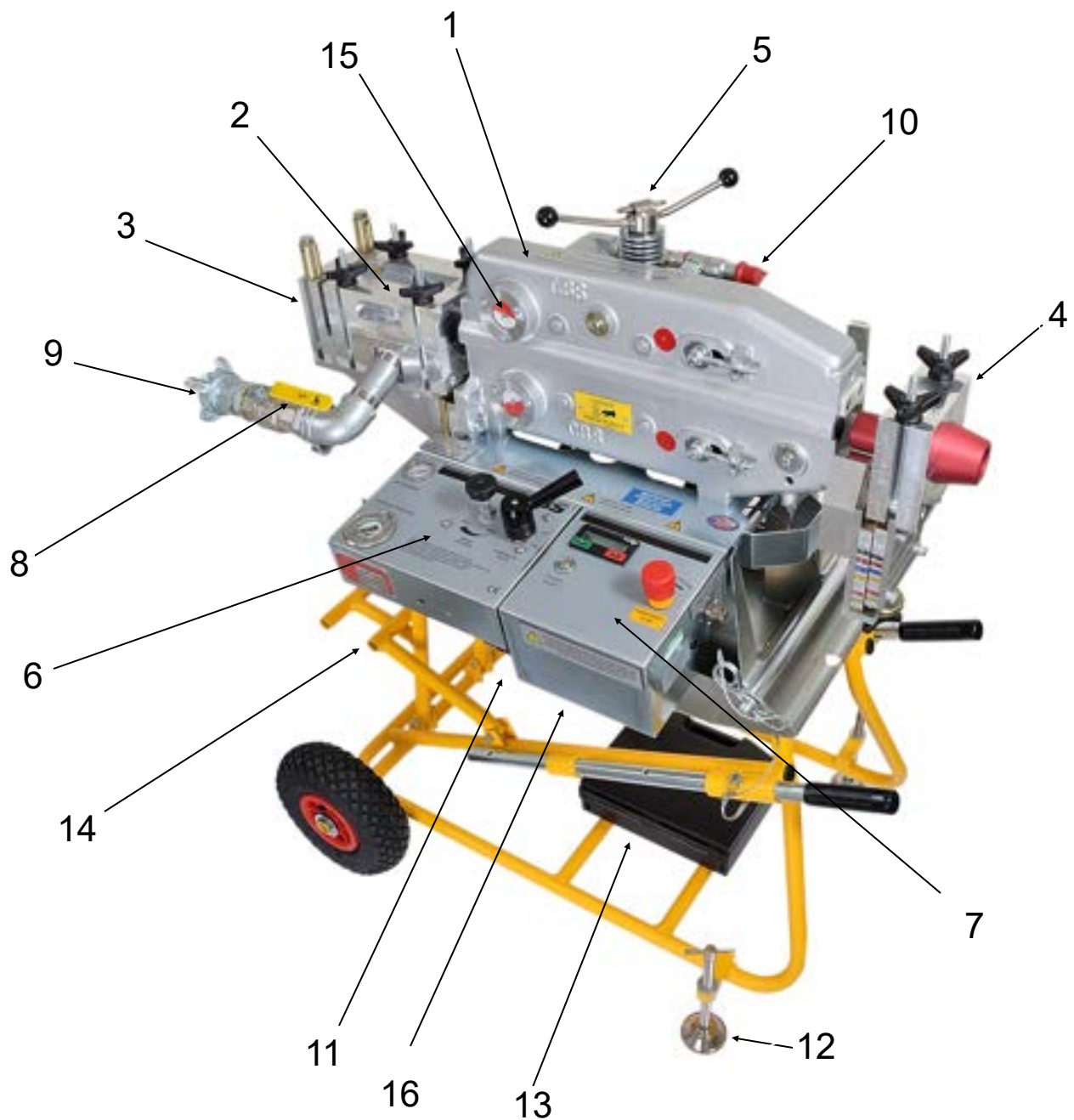
- Battery low on power
- Counter program has been changed - clear program and re-program as described on page 60

17. RECOMMENDED SPARE PARTS

Part No	Description	Qty Required
89140	Tornado Belt Orange	2
32294	Motor Hydraulic 32 cc	2
89147	Seal Cord (cut to length as required)	10 ft.
89148	Silicon Grease	1 tube
89588	Silicon Cord Glue	1 tube
89156	Wheel Blower Pneumatic	2
89151	Wheel Blower Solid	2
34471	Wheel Blower w/Metal Hub	2
89153	Lubricant Chain Spray	1 can
31727	Chain Support Slide Bar	1
30328	Battery 12 V DC	1
32216	Bearing Belt Drive	4
32217	Circlip - External 20mm	4
89401	Bolt Swing F/Clamp Housing	2
28883	Thumb Nut Cap	2
28882	Thumb Nut	2
32307	Seloc Pin M6X24	2

Appendix 1

LAYOUT OF CABLE BLOWING MACHINE



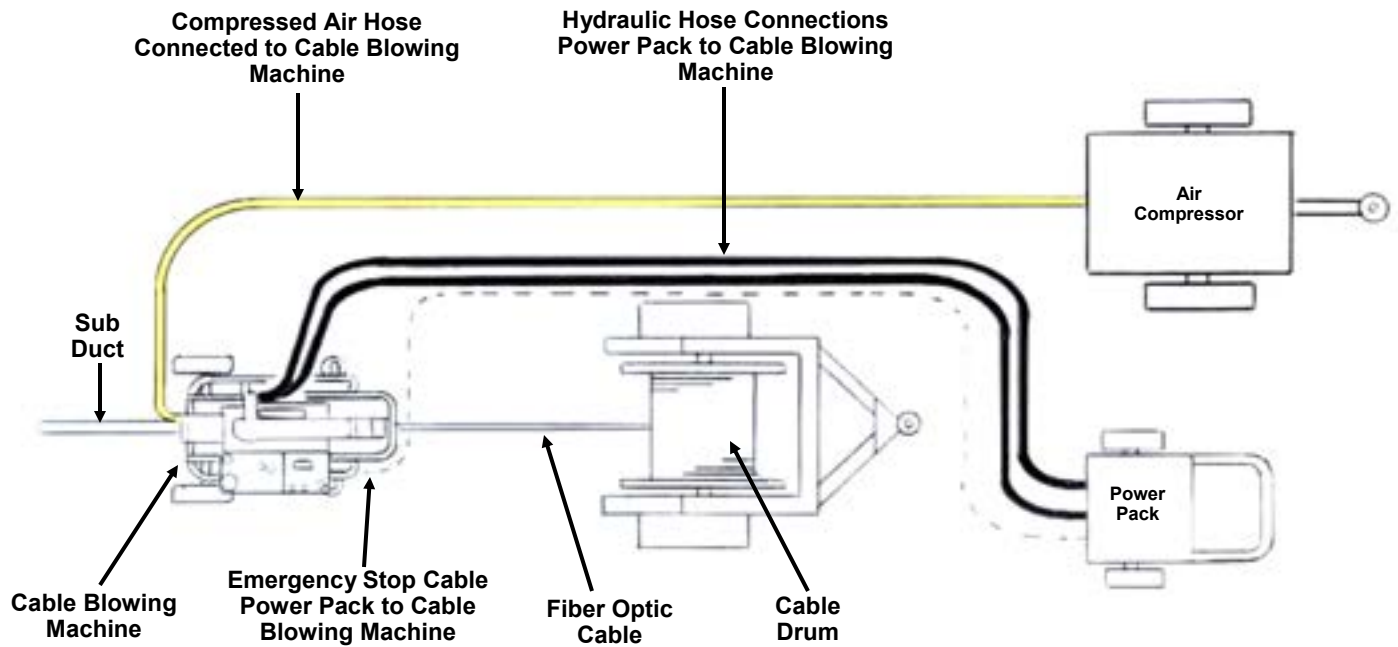
- 1 Cable Pusher
- 2 Air Chamber
- 3 Sub-Duct Clamp
- 4 Cable infeed bracket assembly
- 5 Unit Lifting Point
- 6 Hydraulic Control Panel
- 7 Electronic Control Panel
- 8 Air "Open / Close" Valve

- 9 Air Hose Connection
- 10 Hydraulic Hose Connection (at rear of unit)
- 11 Emergency stop socket (on side of unit)
- 12 Frame Leveling Foot
- 13 Tool Box
- 14 Mounting Frame
- 15 Tractor Drive Movement Indicator
- 16 12 Volt Battery Access door (under unit)

Appendix 2

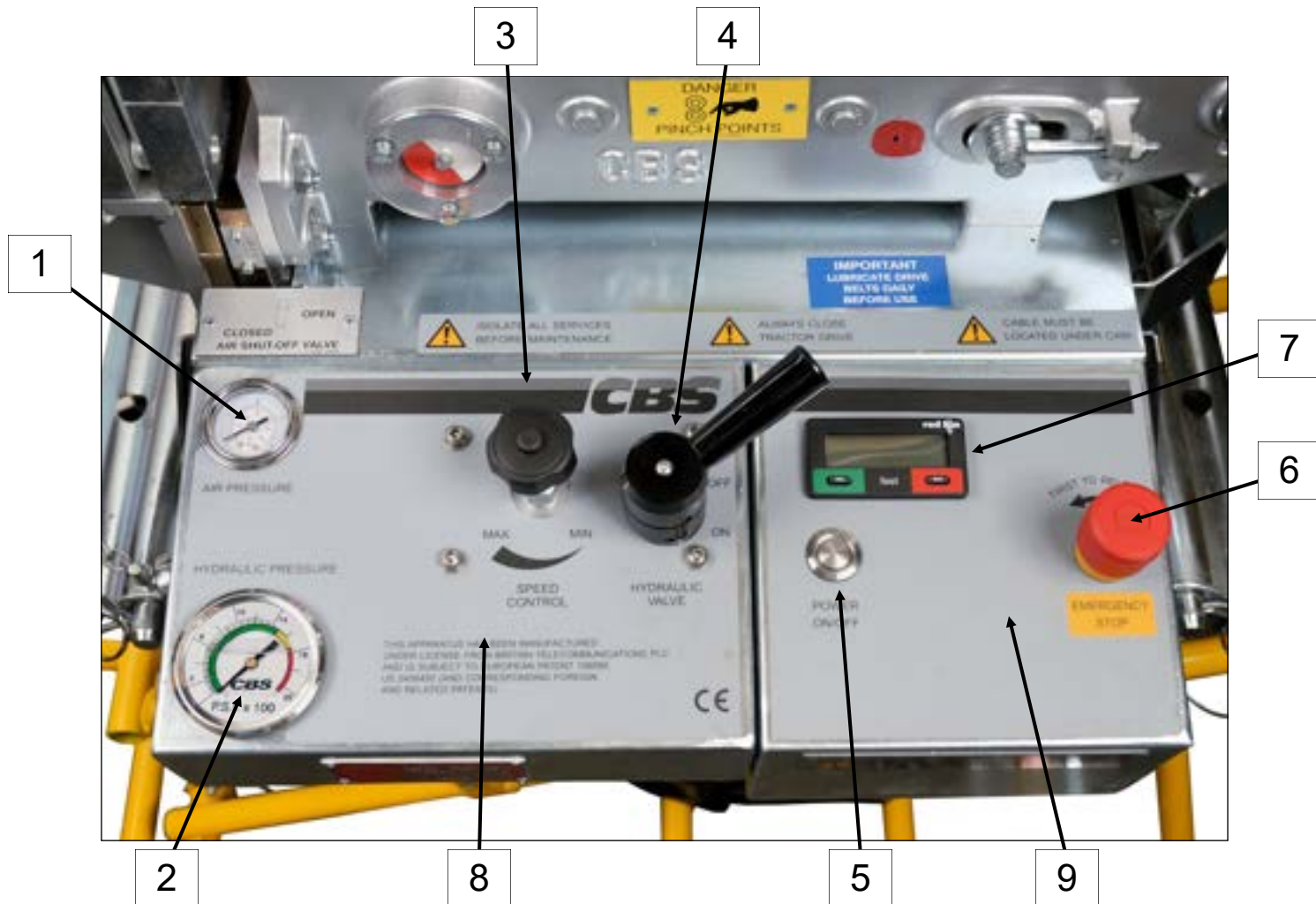
Appendix 3

CABLE BLOWING MACHINE SERVICE CONNECTIONS



Appendix 4

HYDRAULIC AND ELECTRONIC CONTROL PANEL LAYOUT



- 1 Air Pressure Gauge
- 2 Hydraulic Pressure Gauge
- 3 Speed Control Knob
- 4 Hydraulic "On / Off" Lever
- 5 Power "On / Off" Button
- 6 Emergency Stop Button
- 7 Length / Speed Digital Display
- 8 Hydraulic Control Panel
- 9 Electronic Control Panel

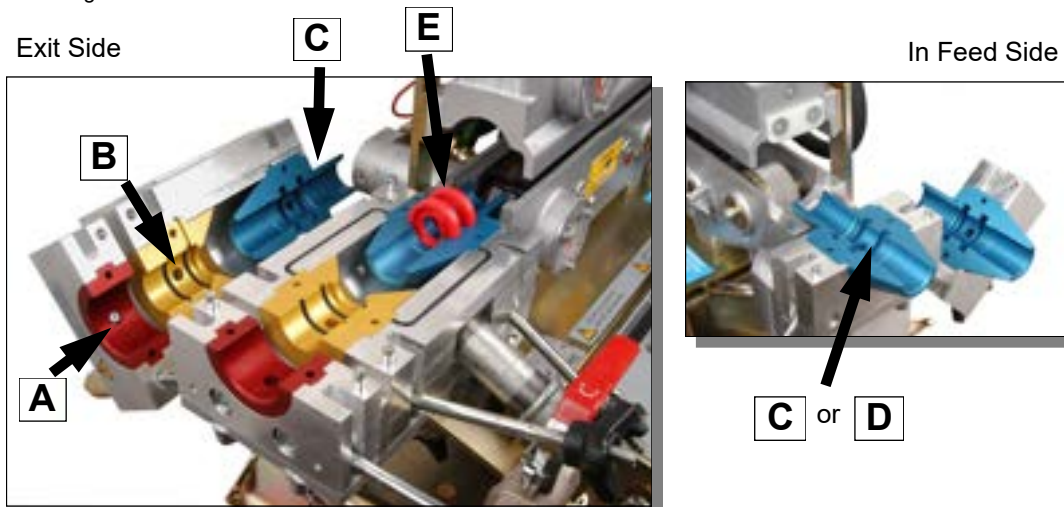
Appendix 5

Tornado Configuration Guide

Let our "Cable Blowing Experts" tailor your configuration. Call our Hotline at **1-800-345-6009** for any questions.

Locator	Description	Qty needed
(A)	Duct Clamp	1 (2 halves)
(B)	Duct Seal	1 (2 halves)
(C)	Cable Collet	1 or 2 (2 halves) <i>see note 3</i>
(D)	Cable Guide	0 or 1 (2 halves) <i>see note 3</i>
(E)	Cable Seals	1 (pkg of 10)
(F)	Cable Seal Plug	1 unit

In order to configure your Tornado to work with your specific cable requirements you must select items below that match your duct and cable size at additional charge



How to specify the collets and seals to match your cable and duct size .

1. Select one (1) Duct Clamp (locator A) that represents the **size** of the duct that you're using.
2. Select one (1) Duct Seal (locator B) that represents the **size** of the duct that you're using.
3. Select the Cable Collet (locator C). Always use a Cable Collet on the cable exit side.
If you use either 6-9 mm or 9-12 mm cable, use a Cable Guide (locator D) on the cable in feed side, for anything larger than these sizes, use a Cable Collet on the in feed side.
4. Select the Cable Seals (locator E) that match your cable size.
5. Select one (1) Cable Seal Plug (locator F) that match your cable size.

(Loc A) DUCT CLAMPS (O.D. Controlled)

89033	DUCT CLAMP 3/4"
89021	DUCT CLAMP 1"
89041	DUCT CLAMP 1.25"
89061	DUCT CLAMP 1.50"
89071	DUCT CLAMP 2"



(Loc B) DUCT SEALS (O.D. Controlled)

89034	DUCT SEAL 3/4"
89022	DUCT SEAL 1"
89042	DUCT SEAL 1.25"
89062	DUCT SEAL 1.50"
89072	DUCT SEAL 2"



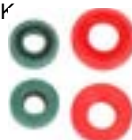
(Loc C & D) CABLE COLLETS (6-28 MM) & GUIDES (6-12 MM)

89081	6-9 MM (.23 - .35") (1 Collet REQ) (exit side)	Collet & guide used together for this size cable
89082	6-9 MM (.23 - .35") (1 Guide REQ) (in feed side)	
89083	9-12 MM (.35 - .47") (1 Collet REQ) (exit side)	Collet & guide used together for this size cable
89084	9-12 MM (.35 - .47") (1 Guide REQ) (in feed side)	
89091	12-16 MM (.47 - .63") (2 Collets REQ)	Same collet used on both in feed and exit side
89092	16-20 MM (.63 - .79") (2 Collets REQ)	
89101	20-24 MM (.79 - .95") (2 Collets REQ)	
89102	24-28 MM (.95 - 1.10") (2 Collets REQ)	



(Loc E) CABLE SEALS (6-34 MM)

89085	6-7.5 MM (.23 - .29") 10/PK
89086	7.5-9 MM (.29 - .35") 10/PK
89087	9-10.5 MM (.35 - .41") 10/PK
89088	10.5-12 MM (.41 - .47") 10/PK
89093	12-14 MM (.47 - .55") 10/PK
89094	14-16 MM (.55 - .63") 10/PK
89095	16-18 MM (.63 - .71") 10/PK
89096	18-20 MM (.71 - .79") 10/PK
89103	20-22 MM (.79 - .87") 10/PK
89104	22-24 MM (.87 - .95") 10/PK
89105	24-26 MM (.95 - 1.02") 10/PK
89106	26-28 MM (1.02 - 1.10") 10/PK
89110	28-30 MM (1.10 - 1.18") 10 PK
89111	30-32 MM (1.18 - 1.26") 10 PK
89112	32-34 MM (1.26" - 1.34") 10 PK



ID COLOR CODES

GREEN 1 LINE
GREEN 2 LINES
PURPLE 1 LINE
PURPLE 2 LINES
SILVER 1 LINE
SILVER 2 LINES
GOLD 1 LINE
GOLD 2 LINES
BLUE 1 LINE
BLUE 2 LINES
RED 1 LINE
RED 2 LINES
BLACK 1 LINE
BLACK 2 LINES
BLACK 3 LINES

(Loc F) CABLE SEAL PLUGS (6-34 MM)

89125	6-7.5 MM (.23 - .29")
89126	7.5-9 MM (.29 - .35")
89127	9-10.5 MM (.35 - .41")
89128	10.5-12 MM (.41 - .47")
89129	12-14 MM (.47 - .55")
89130	14-16 MM (.55 - .63")
89131	16-18 MM (.63 - .71")
89132	18-20 MM (.71 - .79")
89133	20-22 MM (.79 - .87")
89134	22-24 MM (.87 - .94")
89135	24-26 MM (.94 - 1.02")
89136	26-28 MM (1.02 - 1.10")
89162	28-30 MM (1.10 - 1.18")
89164	30-32 MM (1.18 - 1.26")
89122	32-34 MM (1.26 - 1.34")



[illegible]

Appendix 6

Programming Parameters for CUB5R Counter/rate Meter Serial Numbers 0315 Onwards

The device must be wired and installed into the machine prior to programming.

Tornado is fitted with C-M-DEV-CUB5R, reflective version

The DIP switch positions are as follows:

1 OFF
2 OFF
3 OFF
4 OFF



Please see the attached CUB5 Programming Overview attached to this document.

- Press and hold SEL for 2 seconds to enter programming mode
- Enter the Pro-Code **222** by pressing RST to change numbers and SEL to skip to the next number.
- Once correct Press and Hold SEL for 2 seconds
- Pro-no should now be flashing, press RST
- Press RST to move through the various sections 1-input, 2-rate 3-display, sections 4 and 5 will be unavailable, see the next page of instructions for the parameters required.
- Press SEL to enter that section
- To change the value of a parameter press RST
- Press SEL to move to the next parameter (You will have to hold for 2 seconds on certain parameters).
- When all the parameters in the section have been scrolled through you will return to the Pro-no display, press RST to scroll to another section else press SEL to exit programming mode.

First reset the current settings to Factory Settings on the counter:

Scroll to 3-DSPLAY

Skip through the parameters until FACT SET is displayed.

Change this to YES by pressing RST

PRO NO should be displayed, Press SEL.

Continue to re-program the Counter by pressing and holding SEL to re-enter programming mode. Pro-no will be displayed, press RST to move through the relevant sections. The following parameters are required for the Tornado counter:

Press RST Once:

Counter Parameters (1-INPUT)

INPA-B = Cnt ud - if correct press SEL.

CNT A DP = 0 - if correct press SEL.

CNT A SCF = 0.01 (Metric, m) or 0.0328 (Imperial, ft) - once
correct press & Hold SEL.

CNT A RST = TO ZERO - if correct press SEL.

CNT A DIR = NOR - if correct press SEL.

CNT B LD = 0 - once correct press & Hold SEL.

CNT B BAT = NO - if correct press SEL.

RST P-UP = NO - if correct press SEL.

USER INP = NO - if correct press SEL.

Press RST Twice:

Rate Parameters (2-RATE)

RATE ENB = YES - if correct press SEL.

RATE DP = 0 - if correct press SEL.

RATE DSP = 60 - once correct press & Hold SEL.

RATE INP = 100 (Metric, m/min) or 30.5 (Imperial, ft/min)-
once correct press & Hold SEL.

LO-UDT = 1.0 - if correct press SEL.

HI-UDT = 2.0 - if correct press SEL.

Press RST Three times:

DISPLAY (3-DSPLAY)

SEL ENB = YES - if correct press SEL.

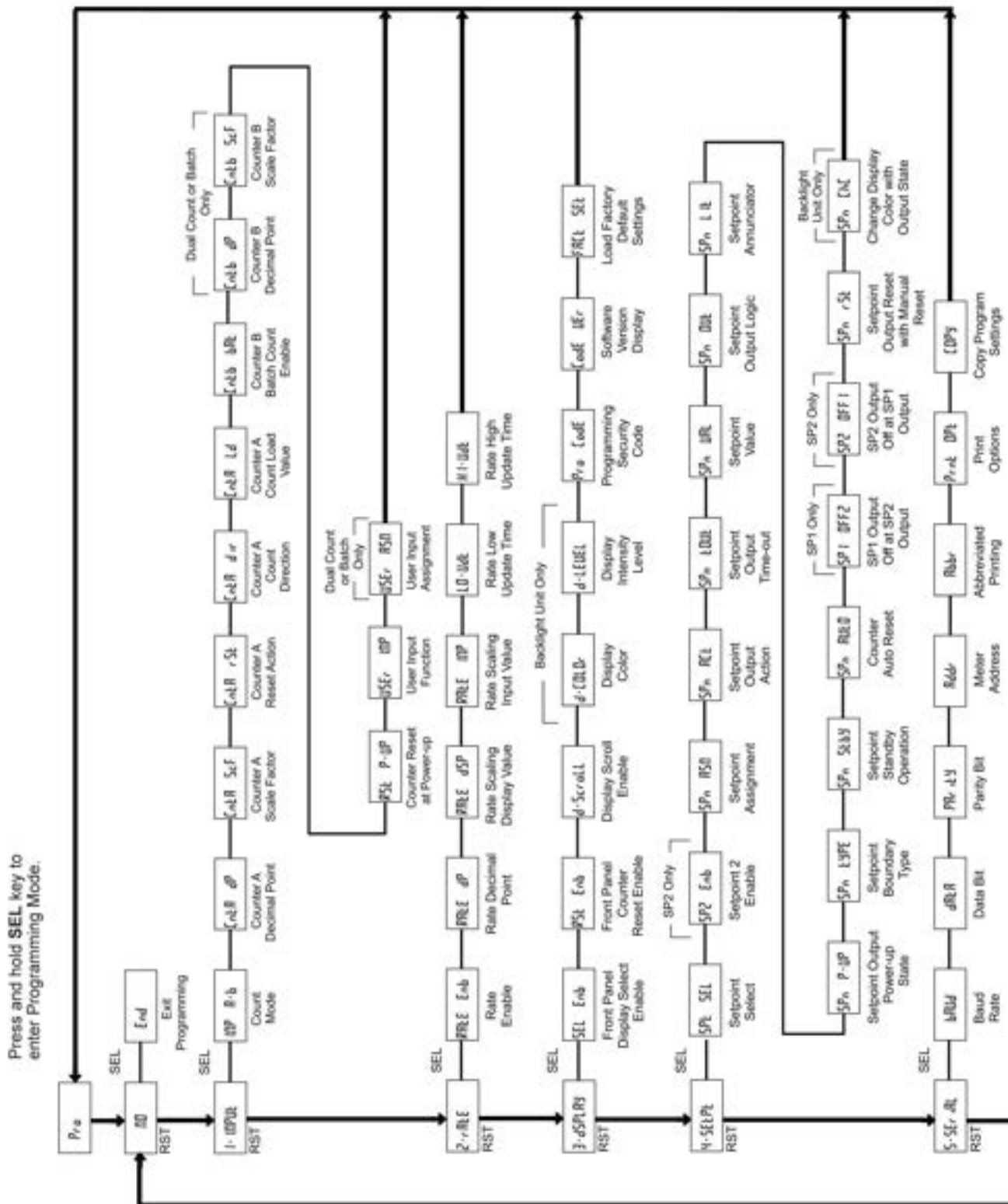
RST ENB = YES - if correct press SEL.

D-SCROLL = NO - if correct press SEL.

PRO CODE = 222 - CODE REQUIRED TO RE-PROGRAM -
once correct press & Hold SEL.

FACT SET = NO - Press SEL Twice

CUB5 PROGRAMMING QUICK OVERVIEW



Appendix 7 TORNADO W/MANIFOLD LESS POWER PACK

GMP P/N 89007

The modified Tornado Cable Blowing Machine is designed to be used with an alternative hydraulic power source in lieu of the standard Tornado Power Pack.

The unit is equipped with an external flow and pressure control manifold, which effectively regulates the hydraulic power source as high as 12 gpm (45 l/m) and 3000 psi (207 bar) to the required 4 gpm (15 l/m) at 1700 psi (117 bar) .

The manifold is fitted with 3/8" hydraulic quick release couplings. The power source must be connected to manifold's inlet and outlet with two detachable hoses via the quick release coupling. **(Fig1)**

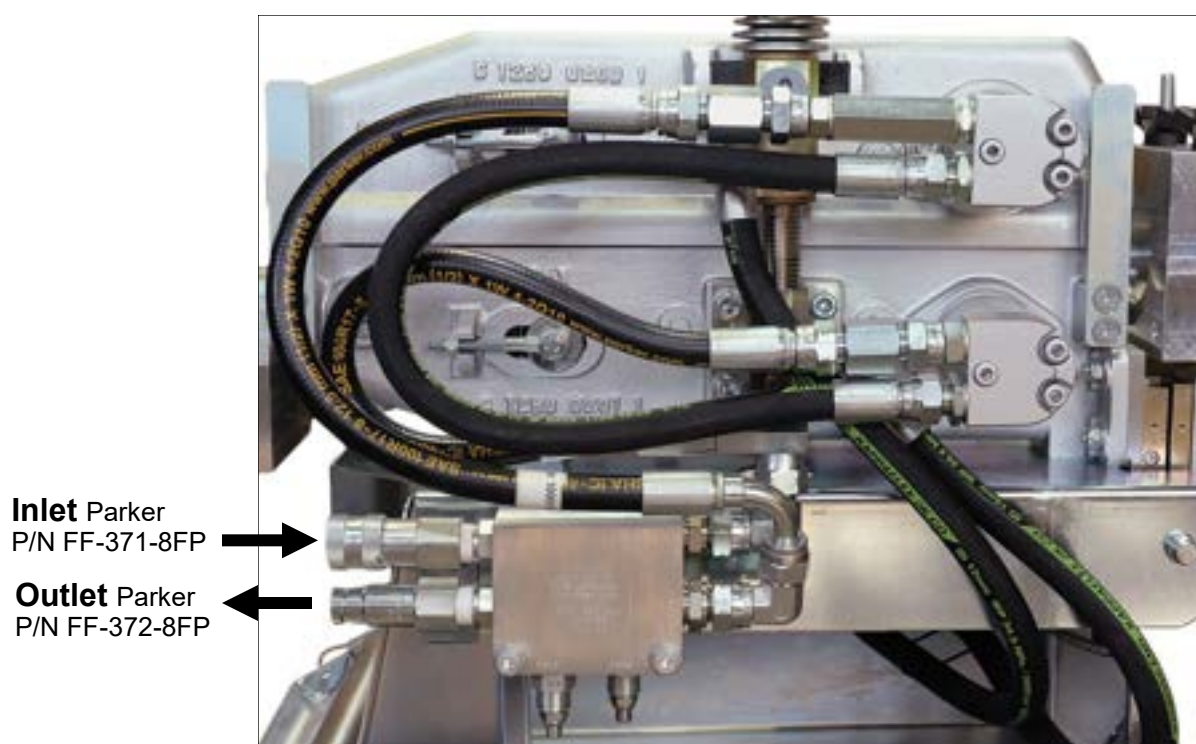


Fig 1



Important: The Tornado Emergency Stop Accessory Kit (GMP P/N 29003), is required with an alternative power source in order to be connected with Tornado's emergency stop circuit.

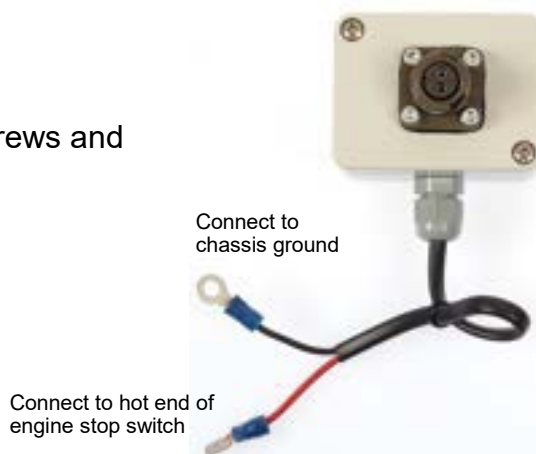
Note: The cartridges are factory set. Do not tamper nor adjust.

Emergency Stop Kit P/N 29003

The kit is designed to connect the gasoline engine of an alternative hydraulic power source with the emergency stop circuit of the GMP P/N 89007 Tornado with manifold less power pack.

The kit consists of:

- Emergency Stop Terminal Box includes M4 screws and lock washers
- Armored Cable 26 ft. (8m) with connectors
- ScotchLok® inline splice connector
- Wire (brown) 5 ft. (1.5m) with spade connector

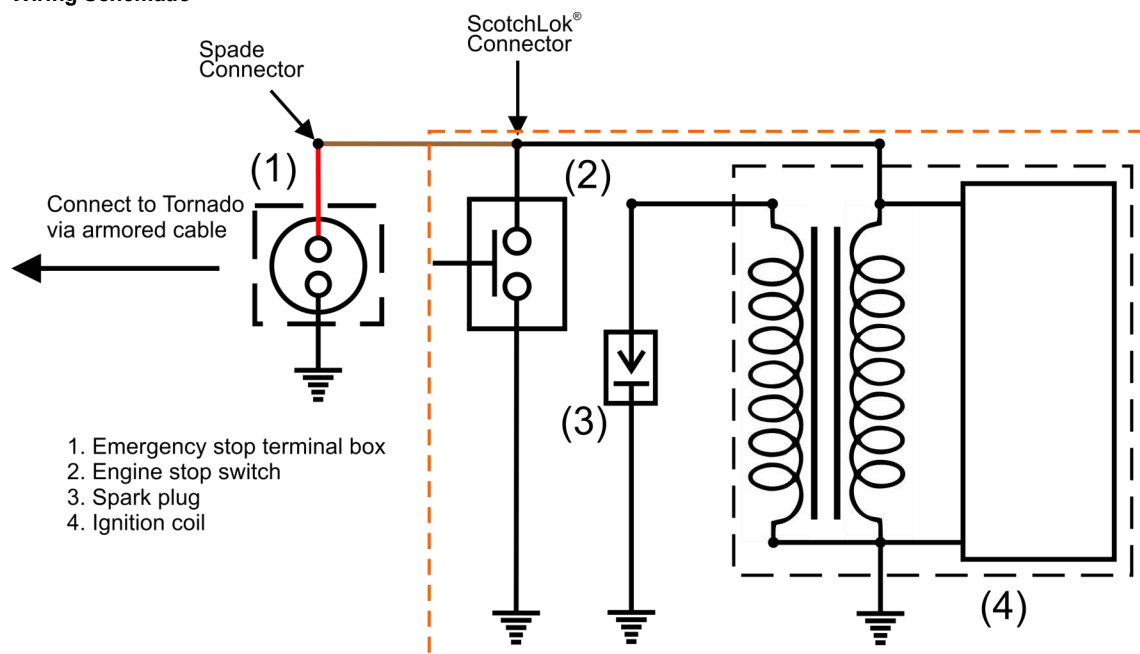


Emergency Stop Terminal Box

Installation procedure:

- Mount the emergency stop terminal box to the hydraulic unit in an accessible location.
- Connect the terminal box's black wire (with ring terminal) to the hydraulic unit frame for grounding. Remove powder coating or paint if required.
- Connect engine's stop switch wire with the brown wire via the ScotchLok® connector.
- Connect terminal box's red wire (with spade male connector) to the female spade connector of the brown wire.
- Connect engine's stop circuit to the emergency stop terminal box via the armored cable.
- Verify that the circuit is wired properly. Ensure that when the emergency stop button is depressed on the Tornado's control panel that the engine stops.

Wiring Schematic





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