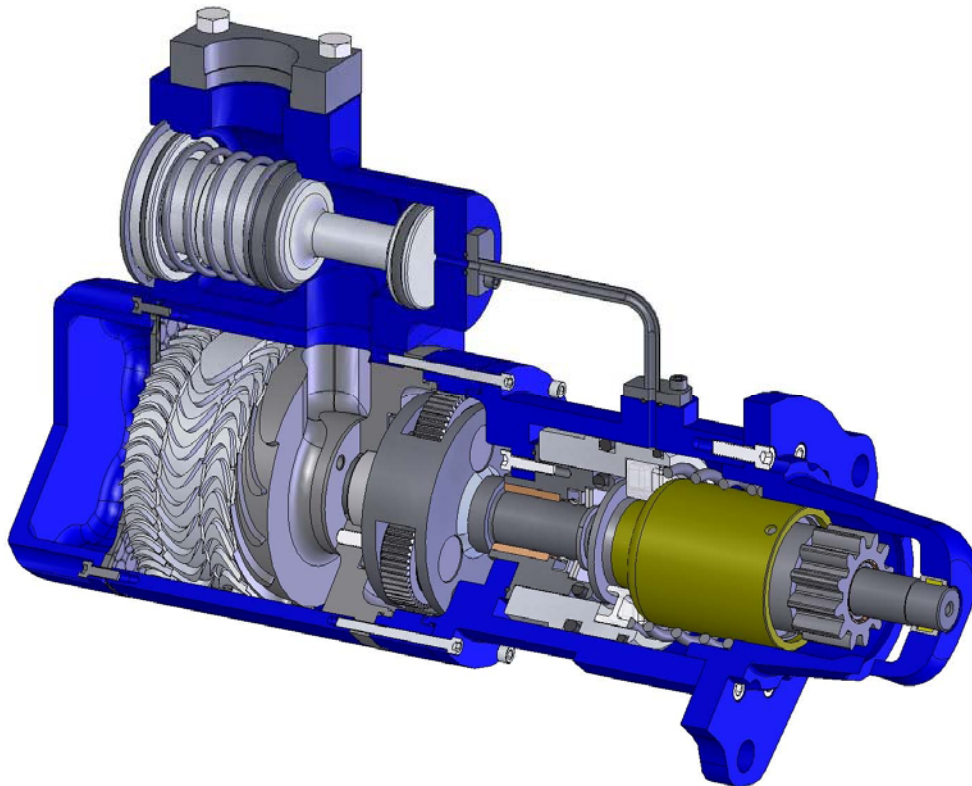

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INSTALLATION AND OPERATING MANUAL



MODEL: T25 **TURBO***TWIN* Engine Air Starter

Air Only

AN08-483

RJ Mann & Associates Inc.
Engine Controls & Panels/Compressor Parts
860 North 9th Avenue, Brighton, CO 80603
Ph: (303) 659-5139 Fax: (303) 659-5309
www.rjmann.com

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1.0 GENERAL INFORMATION

This manual provides instructions for the installation and operation of the TDI TurboTwin™ Model T25 engine air starter. If there are questions not answered by this manual, please contact your TDI TurboTwin™ distributor or dealer for assistance.

The Model T25 is a turbine driven air starter with a pre-engage starter drive. It is well suited for starting diesel engines up to 15 liters. The Model T25 is designed for installation on engines using a SAE 1, 2, or 3 mounting pad.

The T25 Series starters are suited to operate within a wide range of inlet air pressures and ambient temperatures. The engine size and parasitic loading will determine the exact minimum pressure that will insure reliable starting.

The T25 Series starters are designed for operation with compressed air only. Moderate amounts of foreign matter or liquid in the air stream will not adversely affect T25 Series starters. The T25 does not require lubrication in the supply air.

You need to review the rest of this manual before installing your TDI TurboTwin™ T25 Series starter.

1.1 WARNINGS, CAUTIONS, & NOTES

Throughout this manual, certain types of information will be highlighted for your attention:

WARNING - used where injury to personnel or damage to the equipment is possible.

CAUTION - used where there is the possibility of damage to the equipment.

NOTE - used to point out special interest information.

1.2 INSTALLATION and SERVICE

The TDI TurboTwin™ T25 Series starters provide distinct advantages of size and efficiency compared to electric motor, vane-type, or other turbine-type air starters. It is important to properly install the starter to receive full benefit of these advantages. Repair technicians or service organizations without turbine

starter experience should not attempt to repair this starter until they receive factory approved training from TDI, or its representatives. Proper operation and repair of your TDI TurboTwin™ T25 Series starter will assure continued reliable and superior performance for many years.

WARNING

The TDI TurboTwin™ T25 Series starter must be installed and operated in accordance with the instructions given in this manual. Failure to properly install the starter or failure to operate it according to these instructions may result in damage to the starter or the engine, or cause personal injury.

NOTE

THIS STARTER IS TO BE SERVICED ONLY BY AUTHORIZED TDI TURBOTWIN™ DISTRIBUTORS, DEALERS, AND REPAIR STATIONS. DO NOT OPERATE THIS STARTER UNLESS IT IS PROPERLY ATTACHED TO AN ENGINE.

1.3 PRODUCT IDENTIFICATION

The identification nameplate attached to starter housing should indicate the following information:

- Model Designation - T25
- Part Number identifies number of nozzles, orientation, and pinion configuration.
- Serial Number (date manufactured code)
- Maximum Operating (Inlet) Supply Pressure
- Direction of Rotation

NOTE

Direction of Rotation - either left hand LH (CCW) or right hand RH (CW) is designated from pinion end of the starter.

NOTE

Maximum Operating Pressure as indicated on the nameplate can be verified at the pressure check port below starter inlet port, and set dynamically.

NOTE

The Proof Pressure shown on the nameplate indicates the maximum static pressure rating at which starter turbine housing will not burst in operation.

2.0 ORIENTATION OF THE STARTER

If the factory orientation of the starter's pinion housing, gearbox assembly, or optional exhaust port does not fit your engine installation, these components can be re-oriented.

2.1 MODEL T25 ORIENTATION

- Determine the required orientation of the mounting flange relative to the desired position of starter inlet. The optional exhaust adapter can also orient to the desired position.
- Note that the drive housing can be rotated to twelve different positions relative to the gearbox housing. Additionally, the optional exhaust port can be rotated to seven positions relative to the inlet port.

CAUTION

All screw threads are treated at the factory with a fastener retention compound. Every screw and tapped hole must be clean and have Loctite 242 applied to the threads before being reinstalled.

2.1.1 Drive Housing Re-Orientation

Remove the 12 drive housing to gearbox housing screws and rotate drive housing to desired position.

Reinstall the twelve socket head cap screws and torque to 150 in-lbs.

2.1.2 Exhaust Housing Orientation

If this unit has an optional exhaust deflector, remove the eight screws connecting the exhaust to the turbine assembly. Rotate the exhaust housing to the desired position relative to the inlet port.

Apply Loctite 242 to the screw threads and reinstall the 8 screws. Torque to 59 in-lbs.

2.2 SUPPLY & EXHAUST INSTALLATION

WARNING

Be sure to either bleed the pressurized air reservoir and/or safety the system such as closing all air/gas supply valves prior to installing starter or a new supply line.

The T25 supply line consists of the line from the air/gas supply source (via a pressure regulator when necessary) through filters, manual and/or automatic relay valves to the starter inlet.

The exhaust line consists of the line from the starter exhaust to a "safe" location. Turbine exhaust (gas) is typically plumbed away from the engine area.

Hard piping may be used on supply/exhaust lines. A section of flexible tubing (gas approved where required) is recommended, between starter inlet/exhaust outlets, to the hard piping. This can prevent leaks due to piping weight & vibration and ease of field maintenance/replacement of the starter.

3.0 INSTALLING THE STARTER

The components may vary in shape, but there must be at least a start switch and air tank to correctly operate a T25 starter. A regulator should be installed in the starting system if the air pressure exceeds the maximum pressure rating of the starter. The regulator should be installed within 10 feet (3 meters) of the starter.

A turbine driven starter does not require lubrication in the supply air. Therefore, if a vane-type starter motor is replaced, TDI recommends all lubrication devices and lines are removed to minimize flow restrictions.

WARNING

If a fuel (pulse) lubricator has previously been installed in the system, disconnect and plug the line to eliminate spraying diesel fuel on the engine.

Liberal grease the starter's pinion teeth with chassis lube and then install the T25 Series starter on the engine. Tighten all mounting hardware as appropriate.

After securing the starter to the engine, attach the supply air line to the "IN" port of the integral relay valve. Connect the wires from the start switch to the solenoid on the relay valve.

Because turbine starters are sensitive to flow restrictions, care must be taken to use uniform hose or tubing and fittings for supply air line connection. Tees, elbows, and line length must be kept to a minimum. TDI recommends hose or flex couplings

are installed to eliminate possible leakage caused by strain on the supply air line or engine vibration.

Normally a filter is not required in the supply line. However, in dirty environments, use of a #40 mesh Y-strainer P/N: 52-93550-100 is recommended.

Only type approved metallic hose assemblies are approved in permanently pressurized compressed air lines of starters. Non-metallic hose assemblies are allowed only in case the piping system will be emptied after the starting procedure.

Pipe unions must be type approved by GL. Downstream of the pressure regulator a pressure relief valve is to be provided.

WARNING

Recheck all connections for tight fit to eliminate air leakage.



T25 installed on MAN D2842 engine

4.0 STARTER OPERATION

The maximum operating pressure limit is that pressure measured at the starter inlet pressure check port during the crank cycle. In order to check the starter inlet pressure, a 1/8" NPT pipe tap connection is provided in the inlet housing for attaching a pressure gauge.

CAUTION

IN NO CASE SHOULD INLET OPERATING PRESSURE EXCEED 10.3 BAR (150 PSIG).

WARNING

Do not operate the T25 Series air starter with air pressure greater than the pressure rating on the nameplate. This pressure should be measured at the starter inlet while the starter is operating.

The static supply pressure will always be higher than the operating pressure. As a guideline, the maximum pressure limit (proof pressure) the T25 Series starter may be subjected to is 600 psig (42 bar). System pressure that exceeds the maximum operating limit must use a pressure regulator to insure operating pressure limit to the T25 Series starter is maintained.

System pressure that exceeds the 600 PSIG (42 bar) limit must, in addition to a pressure reducer device, incorporate a pressure relief valve, set below 600 PSIG (42 bar), in the supply air line. The relief valve can be set 10 - 15% above the starter's maximum pressure rating.

WARNING

All appropriate local pressure codes and pressure limitations on other system components must be adhered to and supersedes guidelines given in this manual.

Follow all the engine manufacturer's instructions for starting the engine.

WARNING

Do not engage the starter while the engine is running.

If the starter fails to function properly when first operated, or its performance deteriorates with use, refer to the Operator's Trouble Shooting Guide, Section 6.0. If you cannot solve the problem, or repair is necessary, contact your local TDI TurboTwin™ distributor or dealer.

Turbine starters share a common characteristic known as "coast-down". Once unloaded, turbines coast to a stop from their unloaded or *free-speed*. Turbines behave differently in this respect, compared to positive displacement devices, because the friction (drag) of rubbing, sealing surfaces (piston rings or vanes) quickly stops an

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unloaded machine. Less encumbered by drag, and typically decelerating from much higher operating speeds, turbines can take considerably longer to come to rest.

When pre-engaged starters are used, a procedure specifying a 30-second delay between engine crank attempts is sufficient to insure correct operation. This is common practice by many users and delays are typically programmed into fully automated starter control systems.

This "**30 Second Rule**" should also be strictly followed when using the starter in a "manual mode" or to perform routine maintenance tasks such as engine timing, inspections, valve adjustments, etc.

WARNING

Re-engaging pre-engaged turbine starters during coast-down can damage the starter pinion and the engine ring gear. Turbine air starters must **NEVER** be re-engaged during coast-down or before the starter comes to a complete stop.

To ensure correct starter operation, users may choose to incorporate an electronic P/N: 2-28582 or pneumatic control device to prevent accidental re-engagement during coast-down. In addition, operators and technicians should be educated about the effects of coast-down.

CAUTION

The grease used in the planetary system has a shelf life of 2 years. Therefore, if the starter is NOT installed and operated on the engine for 2 years after the starter is manufactured, the grease should be replaced prior to starter operation. The manufactured date is reflected in the starter serial number. (Ex: S/N: 0802-0567 has a manufactured date of February 2008).

5.0 WARRANTY

Tech Development (TDI) warrants to the original user of the TDI *TURBOTWIN™* air starters to be free from defects in material and workmanship for a period of one year (6 month for remanufactured units) from the date of installation. The warranty period shall not extend beyond two years (12 months for factory remanufactured units) from the date the unit was manufactured. (i.e.: a unit with a manufactured date of July 1999 (SN: 9907-101) will not be covered under warranty after July 2001). The conditions of this warranty are: **a)** TDI is notified within this period by return of such product to TDI or its authorized distributor/dealer, transportation prepaid by user; **b)** the starter has been installed according to TDI's specifications; **c)** the starter has not been misused, abused, or improperly maintained by user; **d)** the defect is not the result of normal wear and tear; **e)** the starter has been repaired with parts manufactured or authorized by TDI; and **f)** TDI installation and repair procedures as outlined in the appropriate manual were properly followed.

Tech Development will repair, or at its option, replace the unit during the warranty period at no charge to the customer, provided it is returned to TDI with the proper return procedure.

Tech Development makes no other warranty, and implied warranties including any warranty or merchantability or fitness for a particular purpose are hereby disclaimed.

This warranty constitutes the entire obligation of Tech Development relating to the sale and use of such product and TDI's maximum liability is limited to the purchase price of such product at the date of purchase. In no event shall TDI be liable for incidental, indirect, consequential, or special damages of any nature arising from the sale or use of such engine starter product.

6.0 OPERATOR'S TROUBLESHOOTING GUIDE

| TROUBLE | PROBABLE CAUSE | SOLUTION |
|--|--|--|
| 1. Air always flow through exhaust | A. Relay valve improperly installed. | A. Check typical installation diagram and correct |
| | B. Relay valve not sealing properly. | B. Check for damaged sealing ring, replace relay valve or damaged parts. |
| | C. Solenoid is not sealing, pressure remains in APP port of relay valve. | C. Check solenoid potential at the lead to ground should be 0. If not, fix ignition switch problem. |
| 2. Starter engages but does not run. | A. Bad relay valve | A. Replace relay valve. |
| 3. Starter does not run, small air flow from turbine exhaust or drive housing. | A. Nozzle blockage. | A. Remove blockage or obstruction from nozzles. |
| 4. Starter does not run. Normal air flow from exhaust. | A. Excessive bends in the supply line. | A. Shorten length or straighten supply air line. |
| 5. Pinion does not engage | A. Air pressure is too low | A. Increase air pressure to 40 -150 psig. |
| | B. Control lines to starter ports reversed. | B. Check installation diagram and correct. |
| | C. Solenoid valve not operating or plugged. | C. Check wiring and solenoid operation. Check for correct voltage. Correct wiring, remove blockage, or replace solenoid valve as needed. |
| | D. Damaged pinion teeth. | D. Replace pinion or starter drive as necessary. |
| 6. Starter runs but engine cranks slowly or not at all. | A. Air pressure too low | A. Increase air pressure to 40 -150 psig. |
| | B. Excessive back pressure. | B. Check Exhaust Adapter |
| | C. Worn or broken starter drive. | C. Replace starter drive. |
| | D. Nozzle blocked or damaged. | D. Remove blockage or replace damaged parts. |
| 7. Starter continues to operate after start button is released. | A. Solenoid valve is not sealing correctly. | A. See 1C above |
| | B. Relay valve is not sealing correctly. | B. See 1B above |
| 8. Air tank pressure decays after extended shut down. | A. Air connections are not tight. | A. Tighten loose fittings. Repair or replace damaged fittings. |
| | B. Damaged air lines: crushed, frayed, and kinked. | B. Replace damaged lines. |
| | C. Relay valve is not sealing correctly. | C. See 1B above |
| | D. Solenoid valve is stuck open. | D. See 1C above |

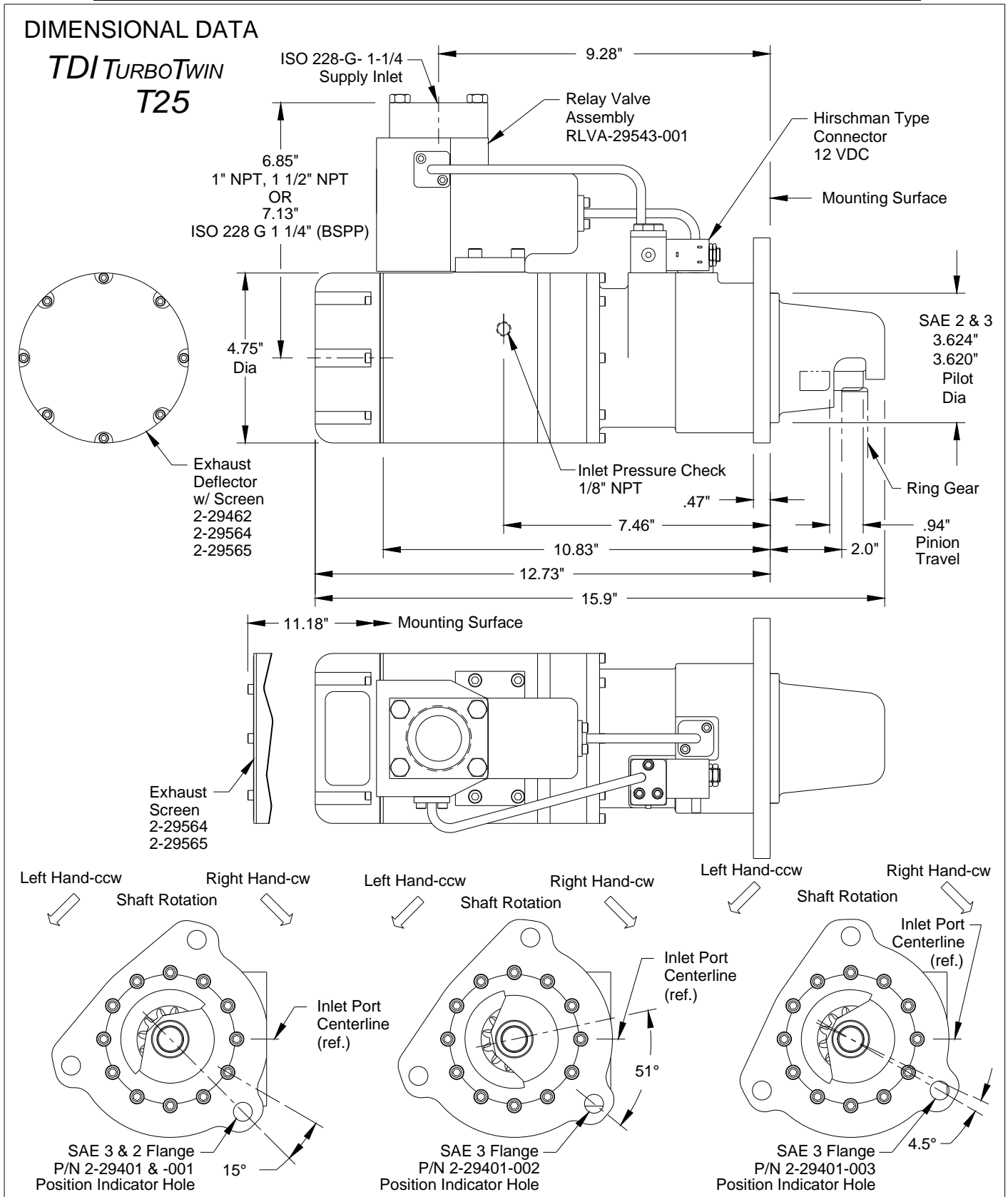


Figure 1. T25 Envelope Drawing

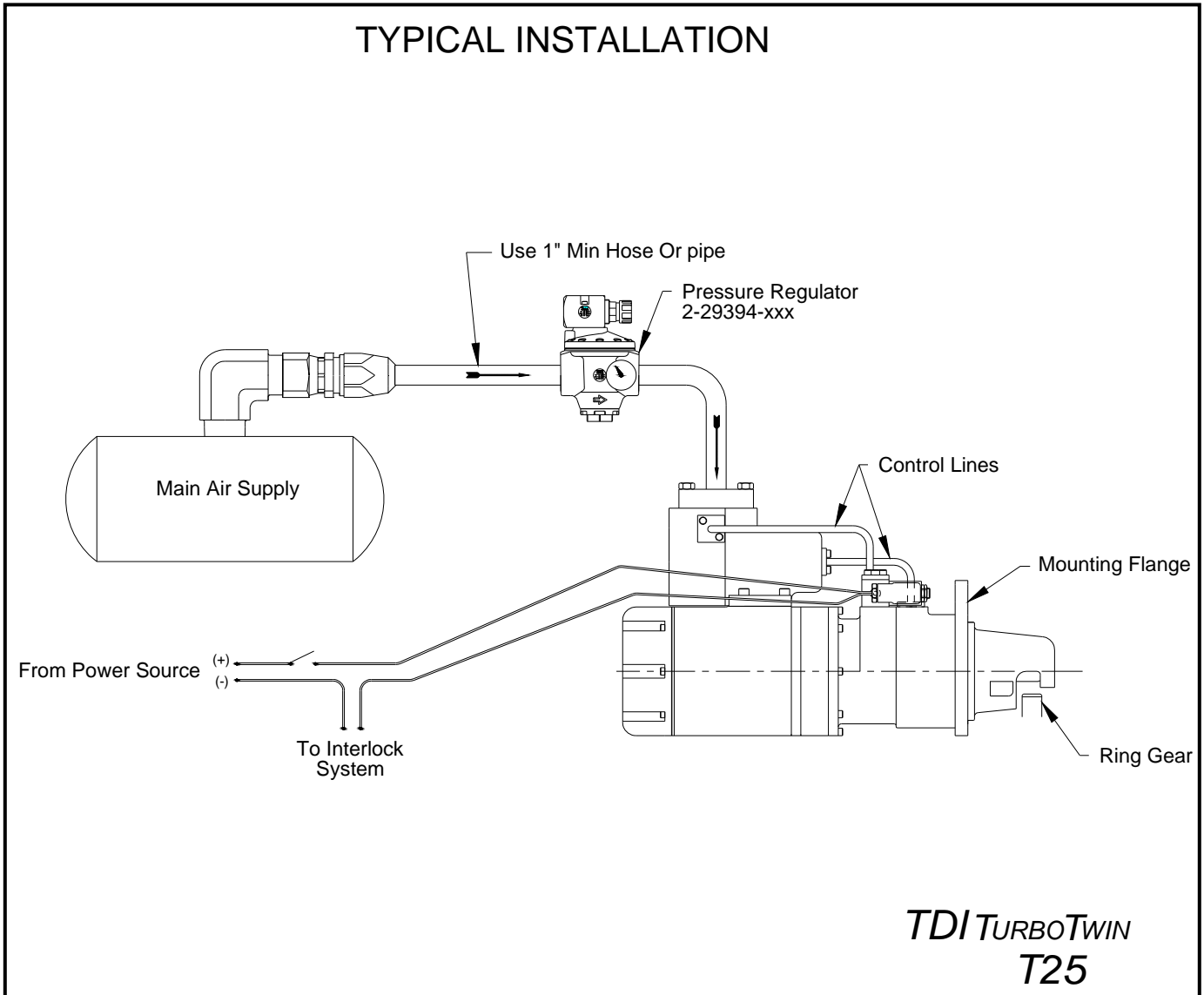


Figure 2. T25 Installation Diagram

