



The tools of a new generation™

USER NOTES AND SETUP GUIDE

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Read Thoroughly Before Use

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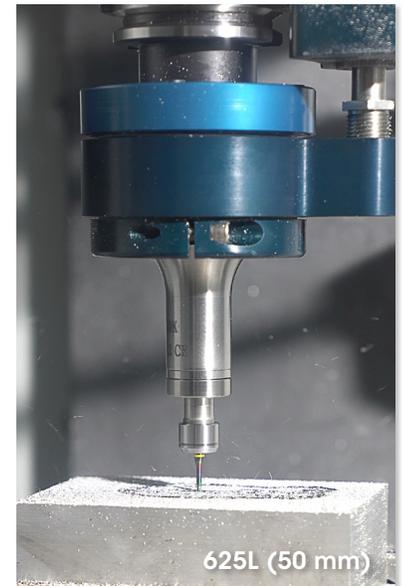


WARNING

Connection to air supply starts motor rotation.
Do not connect air to your tool until installation is complete.

Key Points for Successful Operation

1. Eliminate flow restrictions in your airline. Check if the minimum internal diameter of your hose and fittings meets the requirements for your Air Turbine Spindle® as specified on **Figure 4 on page 1**.
2. Ensure a 0.3 micron air filter/regulator is installed. Set the regulator between 90 psi (6.2 bar) to 100 psi (6.9 bar). Air pressure exceeding 100 psi (7 bar) must not be used.
3. Check for and repair any airleaks and obstructions.
4. Use the air flow meter to check the CFM (L/s) air flow volume to your Air Turbine Tool® at the air inlet port to ensure the air flow volume and pressure meets the specifications as stated in **figure 3 on page 3**.
5. If your Air Turbine Spindle® has underpower performance, check the psi (bar) pressure using the air filter/regulator gauge to see if the pressure drops below 90 psi (6.2 bar). If the gauge dial indicates that there is less than 90 psi (6.2 bar) pressure:
 - › Check internal diameters of all couplings/connectors/hoses for restrictions on air flow.
 - › Review compressor operation to turn up minimum psi (bar). If your default compressor settings allow psi/bar to drop down to ~80 or 85 psi (5.5 or 5.9 bar), then it is necessary to build up pressure before you turn the compressor on. An extra holding tank may be required.
6. Ensure the rear air inlet of your spindle is plugged if using the side air inlet. Do not use retention knobs with holes unless using the rear air inlet for air supply.



Always Operate in Compliance With the Following

1. **CAUTION:** Your Air Turbine Spindle® will rotate **immediately** when air is connected.
2. Safety code for portable air tools - ANSI 186.1, etc. Always use eye + face protection.
3. General industry safety & health regulations, part 1910 and 2206 OSHA, etc.
4. Federal, state and local regulations and laws in your country.
5. Cutting tool manufacturers operating instructions. Ensure your cutting tool is rated for the rotational speed you are using. Your tool must be balanced and truly concentric. Incorrect tool selection results in unbalanced rotation or overloading, which will result in stress on the bearings and premature failure. The stick-out extension length of the cutting tool from your collet should optimally be no more than 3 times the diameter of your cutting tool.



WARNING

Failure to comply with all safety regulations could result in serious injury.



For further assistance call our factory technicians for support at +1-561-994-0500 or email us at ask@airturbinetools.com.

Read all instructions thoroughly before installation and use.

Initial Installation

Install a new dedicated clean air line from a filter/regulator to your **Air Turbine Spindle®** as shown in **figure 1**. Filter/regulators are included with your spindle and are available for an additional purchase.

Ensure all air lines and fittings meet the minimum internal diameter specified for your model as specified in figure 2. Additionally, place a plug in any air inlet that is not being used.

Refer to **page 4** to review the three different mounting options for your **Air Turbine Spindle®**. If you are using the Tool Changer Mounting Assembly (TMA) for ATC, refer to the installation guide for the TMA on **page 5**.

Optional: If you have a manual shut-off valve, install it after the filter/regulator as shown in **figure 1**. Using a manual valve is recommended.

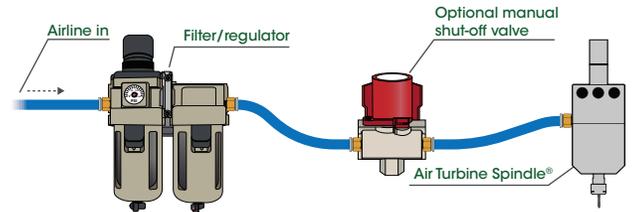


Figure 1: A clean airline from a filter/regulator to a manual shut-off valve to an Air Turbine Spindle®.



WARNING

Connection to air supply starts spindle rotation. Do not connect air to your tool until installation is complete.

Model	Hose/Connector Minimum Required Internal Diameter	
	Metric	Imperial
› 600X › 601 › 602	4 mm	5/32"
› 625	6 mm	15/64"
› 625X › 650 › 660	8 mm	5/16"
› 650X	10 mm	2/5"

Figure 2: Air Turbine Spindles® hose/fitting/connector internal diameter specifications.

Air Hoses and Fittings Requirements

Avoid fittings, couplings and hoses with a smaller internal diameter than the minimum required for your model. Any connections smaller than the minimum will restrict air flow and reduce power to your **Air Turbine Spindle®**. You can find the minimum required internal diameter (ID) for fittings and hoses for your tool on the table shown in **figure 2**.

Air flow restrictions (such as air leaks and obstructions) will cause underpower performance and drag your tool through the material, damaging the bearings. **Some fittings with nominal internal dimensions may have an ID passage that is smaller than stated and restrict air flow and power.** It only takes one fitting with an internal diameter that is too small to reduce air flow and power of your **Air Turbine Spindle®**.

General Air Fitting Dimensions

- › **1/4" male > ID** - Usually 0.210" but some variations occur.
- › **1/4" male (high flow, harbor) ID** - 0.277" with 1/4" NPT male thread.
- › **3/8" male hole** - 0.283" to 0.285" with thread of 3/8" - NPT (internal ID of female mating OD appears even smaller ID).
- › **1/2" male hole** - 0.375" (0.655" OD).

General Hoses

Actual internal diameter on brass fittings (i.e. swedged on ends) of standard Goodyear, etc. brands of 1/2" & 3/8" hose have various internal dimensions. As an example, Goodyear 1/2" Red hose with 3/8" / 9.5 mm NPT fitting has an internal diameter hole of 0.282", which is sufficient for models that require a minimum ID of 6 mm, but not for models that require a minimum ID of 8 mm. Goodyear black 3/8" / 9.5 mm hose has internal diameter hole on swedged fittings of ~0.265" and is suitable for models requiring a 6 mm ID or smaller.



WARNING

Your Air Turbine Spindle® must be run at least 10 minutes every 30 days from manufacture date to maintain optimal performance. Run at least 10 minutes before initial use.



600X

Air Requirements

Do not oil or lubricate. Use dry, clean, oil free 90 psi (6.2 bar) air supply only.

Ensure there is sufficient volume of clean compressed air flow at **90 psi/6.2 bar** with the specified air flow volume CFM (L/s) for your model as shown in the table in **figure 3** to maintain working air consumption. Depending on application, consider peak or stall capacity consumption. Our governor increases air flow volume on demand to keep rotation at the high speed when your tool starts to cut. **Air pressure and flow volume must therefore be available on demand and remain constant with no drop over time or when cutting.**

Avoid pressure below 90 psi (6.2 bar), which causes the tool to be dragged through the material, causing rapid bearing wear and underpowered performance. Do not use more than 100 psi (6.9 bar) pressure which will burst the turbine power producer.

Air pressure and flow must remain constant with no drops under cutting load. Insufficient flow will cause the rotation of your tool to slow or stop suddenly, damaging the bearings. If a drop in psi (bar) occurs below 90 psi (6.2 bar), your compressor may not have enough CFM (L/s) to power the **Air Turbine Spindle®** or there is a flow restriction in the air line.



WARNING
Never turn on the main spindle while the Air Turbine Spindle® is loaded.

Idle CFM/L/s Rating vs. Working Air Consumption Ratings

Air Turbine Spindles® consume more air as the cutting load or the amount of material removed increases. This is normal operation of our patented governor which maintains high speed on your tool path and makes **Air Turbine Spindles®** efficient in air consumption.



Air Turbine Spindles® Idle CFM (L/s) and Working Air Consumption Ratings			
Model	Speed RPM	Air Consumption Idle CFM (L/s)	Air Consumption Working Flow (L/s)
600X	65,000	3.5 (1.65)	5 (2.36)
	80,000		
601, 602	40,000	4.5 (2.1)	5 (2.36) - 6 (2.83)
	50,000		
	65,000		
	90,000	5 (2.36)	
625	30,000	12 (5.66)	11 (5.19) - 20 (9.44)
	40,000	14 (6.61)	
	50,000	16 (7.55)	
	65,000	16 (7.55)	
625X	30,000	16 (7.55)	22 (10.38) - 30 (14.16)
	40,000	20 (9.44)	
	50,000	20 (9.44)	
625XVS	30,000 - 50,000	12 (5.66) - 20 (9.44)	11 (5.19) - 30 (14.16)
650	25,000	13 (6.14)	14 (6.61) - 35 (16.52)
	30,000	18 (8.49)	
	40,000	18 (8.49)	
650X	25,000	14 (6.61)	19 (8.97) - 40 (18.89)
	30,000	20 (9.44)	
	40,000	23 (10.85)	
650XVS	25,000 - 40,000	13 (6.14) - 23 (10.85)	14 (6.61) - 40 (18.89)
660	50,000	20 (9.44)	20 (9.44) - 35 (16.52)

Figure 3: Idle CFM (L/s) and working air consumption ratings for Air Turbine Spindles®

Retrofitting Air Turbine Spindles® in your CNC

You have 3 options for mounting your **Air Turbine Spindle®** to your CNC machine. Side air inlet, thru-toolholder air supply and with the Tool Changer Mounting Assembly. If necessary, use magnets for temporary mounting during set up. Your spindle has 2 air inlets (rear + side) as shown in the images below. Ensure the inlet not in use is closed. If you hear a loud noise or have under rated power performance check if the plug is in the second inlet.

1. Side or Rear Air Inlet

The 600X, 601, 602, 625 and 625X series of **Air Turbine Spindles®** have selectable rear or side inlet options. JS units combine with ER32 or other toolholders for infinite compatibility. 650JS and 650XJS models only use the side inlet for air supply.

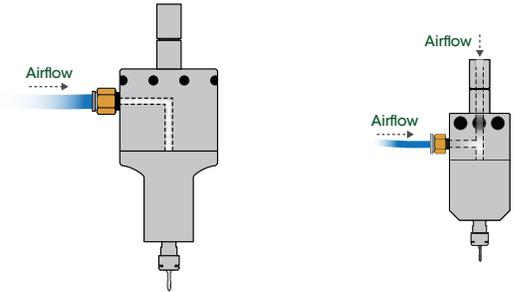


Figure 4: A 625JS with side or rear air inlet Air Turbine Spindle® mounting and a 650JS with side air inlet mounting.

2. Thru-Toolholder Air Supply

To supply Thru-Spindle-Air (TSA) to power to **Air Turbine Spindles®**, verify the maximum CFM (L/s) flow possible through the air channel and determine the maximum drawbar/pull stud/internal hose Internal Diameter in the system, including any solenoid used to actuate the air.

Some retention knobs can be drilled to enlarge opening and permit the proper flow as specified in **figure 3 on page 3**. The channel must be clean with no part smaller than the minimum internal diameter as specified for your model in the table in **figure 2 on page 2** so that air volume is unrestricted. Purge the line before use.

All HSK spindles may be used with the center air feed if the airline and all connectors meet the minimum internal diameter requirements stated for your model in **figure 2 on page 2**.

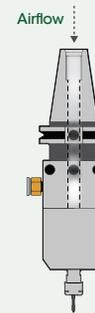


Figure 5: A 625XHSK-A63 with Thru-Toolholder Air Supply (TSA) Air Turbine Spindle® mounting. All HSK spindles can be used with center air feed if the air supply line has sufficient ID.

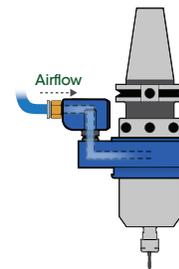
3. Tool Changer Mounting Assembly (ATC)

Our patented wrap-around Tool Changer Mounting Assembly (TMA) option allows CNC tool-changers to automatically load/unload our family of high-speed precision spindles using a proprietary collar system and mounting block or a ring around the CNC spindle, the TMA collar orientates integrating to the right side of the CNC spindle in minutes.

Mounting blocks or rings compatible with Haas, Hurco, Doosan, Robodrill, Hardinge, DMG, Brother, Okuma, and all other CNC's are available. Review **figure 6** for the different types of Tool Changer Mounting Assemblies. We are accustomed to developing custom solutions for any CNC. A universal block can be provided for drilling your CNC screw positions. Installation kits are available. The TMA block remains on the CNC spindle for normal tool changes, even if not using the **Air Turbine Spindles®** as it will not interfere when using the main spindle. **See page 5 for setup instructions for the Tool Changer Mounting Assembly.**

TMA Assembly Includes

1. Mounting block or ring assembly.
2. Spindle manifold collar with adjustable height connector to block.



Screw in Mounting Block



Two Piece Ring and Block



Drill Tap

Figure 6: With different block or ring combinations available the TMA Air Turbine Spindle® mounting option allows for automatic tool change on any CNC.

Tool Changer Mounting Assembly

Installation

Install the supplied spindle mount block by connecting the dedicated clean air line from the included filter/regulator to your spindle as shown in the diagram below. We offer many pre-drilled spindle mount blocks for different CNC machine models, and a universal block.

**Install action requires SHCS 10-32 x 0.75" on Haas CNC machines.*

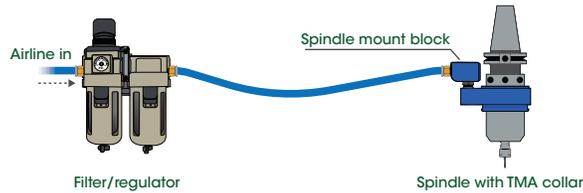


Figure 7: A clean airline from a filter/regulator to an Air Turbine Spindle® with the Tool Changer Mounting Assembly.

Prepare the CNC spindle by performing M19 or spindle orientation. **Ensure the TMA nozzle will clear all portions for CNC tool changer guard or machine columns** by consulting your CNC manufacturer drawings or verifying all clearances with a mock-up tool. For some gantry machines, the nozzle or O.D. of the TMA collar will not clear the column corner (i.e., All GR type machines require special tool rack on machine table or hand loading).

Note: Once the **Air Turbine Spindle®** is loaded into your CNC spindle, you should adjust the height of the nozzle screw more to engage the ball valve seal as shown in **figure 8**. The air flow will turn on the spindle upon coupling.

Some trial and error may be needed when adjusting the height of your nozzle screws. Do not allow the main spindle drawbar (tool release button) to start unless the connector nozzle goes up into the block inlet hole (Approximately 1/4" (6 mm) up into the inlet hole.).

If the nozzle arm is misaligned from the inlet, remove the **Air Turbine Spindle®** from CNC spindle taper area and adjust the clocking of the TMA nozzle to properly align it with the inlet hole and re-try loading procedure. Once successfully loaded into the CNC main spindle, turn on air hose shut-off valve. If the spindle turns on and no air is escaping, then the connector nozzle can be presumed to be set at the correct height. If you hear air escaping, then further adjustment is required.

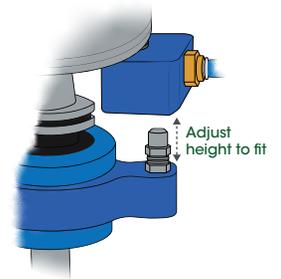


Figure 8: Adjusting the height of the nozzle screw.

G-Codes and Spindle Orientation

Ensure the installation was successful by performing a tool change with the over-ride set to the lowest speed several times to observe the loading and unloading of the **Air Turbine Spindle®** to ensure it engages and operates correctly. Each CNC control has different codes to ensure the CNC main spindle does not turn on while the **Air Turbine Spindle®** is loaded. **It is critical for safety to ensure setup personnel, machine operators, programmers, etc. are all properly notified that the main spindle must remain stationary, except while the CNC machine is doing a tool change.** During a tool change, after loading the **Air Turbine Spindle®** a CNC spindle normally does a spindle orientation or rotation to ensure the drive dogs are aligned prior to loading into the tool changer drum or side mount magazine mechanism. The Tool Changer Mounting Assembly allows a spindle orientation due to its patented collar system.

Troubleshooting your TMA Installation

Air Turbine Spindle® Does Not Turn On

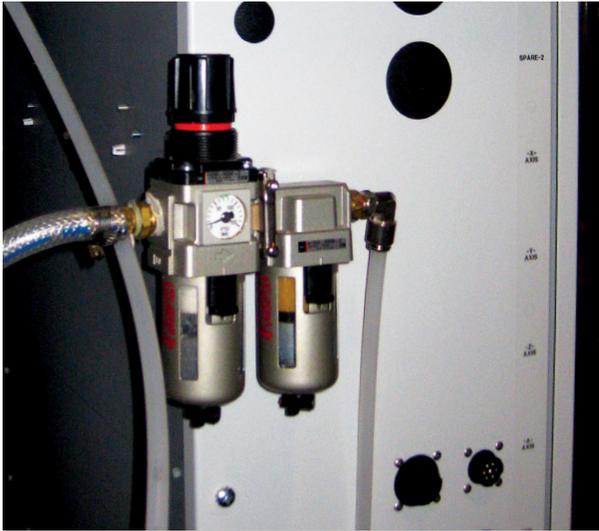
Take a wrench on the connector nozzle screw and turn it counterclockwise to raise the height. **Use caution with hands and any clothing that may be near the spindle as your spindle will turn on and rotate at the rated RPM when air is supplied.** Once the **Air Turbine Spindle®** turns on, raise the nozzle screw another small amount and then lock the hex locknut to secure the nozzle in place.

Nozzle is Too High

You will see the blue spindle collar tilt if the nozzle is too high. This may loosen the bottom lock in the spindle collar or allow excessive air to be released from the collar O-rings, which seal the TMA collar to the main flange portion of the TMA collar system. If the nozzle is too high, reverse the procedure to lower the nozzle and re-tighten the locknut so the connector is an accurate fit.

TMA Collar Rotation

A factory set level of resistance (i.e., collar with plunger section to spindle body section) keeps the plunger in place during a tool change, while still allowing the free rotation (i.e., spindle orient). Over time friction may change the stiffness in rotation due to coolant, dust, etc. Ensure there is not too much friction or too little, either will cause the spindle to misload. The tightness of the collar may be adjusted using hex keys. If the spindle collar does not rotate, loosen the collar by adjusting the hex nuts in the spindle collar to allow free rotation at a light pressure without being loose. Your spindle must remain free to rotate while being securely in place.



Maintenance

Your Air Turbine Spindle® must be run at least 10 minutes every 30 days from manufacture date to maintain optimal performance.

Run at least 10 minutes before initial use.

The airline must be impeccably clean with no coupling or hose smaller than the minimum internal diameter required for your model as described in **figure 2 on page 2** so that air flow volume is unrestricted.

Purge the airline of contamination before each use.

A 0.3 micron filter extractor regulator combination is a necessary accessory for Air Turbine Spindles® to eliminate impurities in your air supply. Contamination will damage your turbine components and require repair. **Filter elements need to be changed periodically and extractor drained in regular maintenance cycles.** Filters are included with all Air Turbine Spindles®. Replacement elements and a repair service are available on our website.

Operation

Purge the line of contamination and run at least 10 minutes before initial use to ensure the bearing lubrication does not solidify.

Always monitor the air pressure gauge during operation of your Air Turbine Spindle®. The key to successful high-speed machining and optimized tool performance is to program light passes at very high feed rates. Start with a light pass observing surface finish quality and gradually step down or increase your rate of advance for optimal cutting conditions. Do not try to cut too aggressively. You will overload your turbine causing your cutting tool to stall or drag in the material. Dragging your tool on the work or a sudden stop will cause stress to the bearings and force the grease out, causing premature failure.

Programming your Air Turbine Spindle®

Apart from a few instances, Air Turbine Spindles® will run your normal CAM programs. All you need to do is remove the spindle RPM command (S3000) and the rotation direction command (M3 or M4). At high speed a small concentric speed rated cutting tool should be used with a fast advance using shallow depths of cut. This layering programming technique produces clean cutting action and optimizes tool performance and life.

Spindle Commands

Gradually increase depth of cut to establish optimal cutting conditions. Use M05 on Fanuc type controls to ensure main spindle is turned off. **Always ensure main spindle is programmed not to rotate (S0/M05).**

Canned Cycles

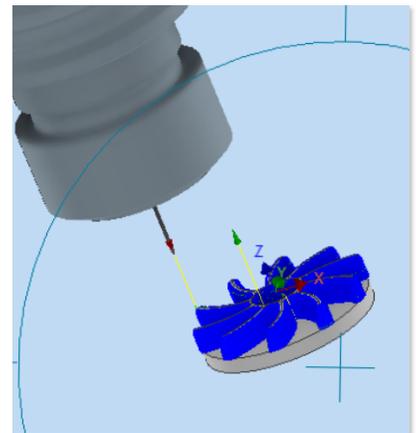
Beware that on CNC controls the G81, G82, G83 (peck drilling) commands will turn on the machine spindle, even with M05 (spindle stop). In most drilling applications you will not need to peck thanks to the high-speed of your Air Turbine Spindle®. There are several alternative solutions: Some CAM programs will allow you to program to drill without a canned cycle or you could program the path long hand, or you can use macros.

Dry Run, Graphic Run

Always run the CNC machine program in graphics and/or in a slow dry run to verify that the CNC spindle does not turn on and that you have no obstruction.

Disable CNC Main Spindle RPM

Program your CNC machine control to allow for normal operation without spindle rotation.



WARNING
Never turn on the main spindle while the Air Turbine Spindle® is loaded.

Installation or Removal of Collet and Cutting Tool

Ensure your cutting tool is rated for the rotational speed you are using. **Your tool must be balanced and truly concentric to operate at the high speed of Air Turbine Spindles®.** Incorrect tool selection results in unbalanced rotation or overloading, which will result in stress on the bearings and premature failure. **The stick-out extension length of the cutting tool from your collet should optimally be no more than 3 times the diameter of your cutting tool.** Do not impact the collet when opening your collet.

1. Take the wrench included with your Air Turbine Tool® and insert it to the wrench flat of your Air Turbine Tools® shaft.
2. Take the ER8 or ER11 collet wrench included with your Air Turbine Spindle®, and apply it on the collet slot as shown in **figure 9**. Turn the wrench counterclockwise to release the current cutting tool.
3. After the cutting tool is free, continue to turn the collet nut counterclockwise with the ER8 or ER11 collet wrench to fully remove the collet nut and release the existing collet. Remove the wrench from the shaft.
4. Remove the existing collet from the shaft and replace it with the new collet. Re-apply the collet nut by turning it clockwise on the shaft, use **figure 10** to determine the torque (ft-lbs) needed for your collet.
5. Insert the new cutting tool by sliding it into the shaft of your Air Turbine Tool®. Ensure that the new cutting tool goes completely through the collet as shown in **figure 11**.
6. Re-insert the wrench onto the wrench flat of your Air Turbine Tools® shaft, and turn the collet nut clockwise until it's firmly held. **Do not over tighten the collet nut**, refer to **figure 10** for the torque needed for your collet.
7. Insert the collet wrench into the collet nut and turn it clockwise as shown in **figure 9** to ensure the new collet and cutting tool is firmly held.

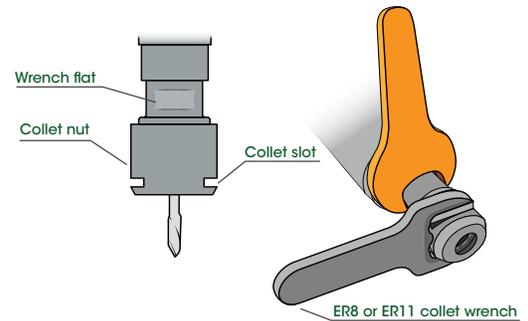


Figure 9: Correct insertion of both the wrench and the ER8 or ER11 collet wrench to remove or secure the collet nut.

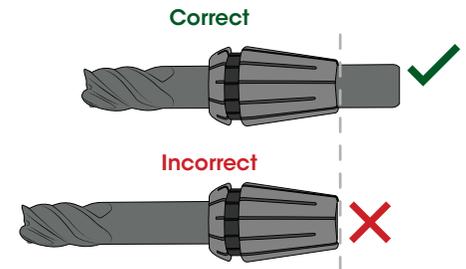


Figure 11: A comparison showing the correct and incorrect way to insert the cutting tool into the collet. **Ensure that the cutting tool goes completely through the collet** and that the stick-out extension length of the cutting tool from your collet is no more than 3 times the diameter of your cutting tool.

Collet Type	Collet Size	ft-lbs	Torco-Fix
ER8	Ø 0.039" (1.0 mm) - 0.196" (5.0 mm)	4	Micro
ER11	Ø 0.039" (1.0 mm) - 0.098" (2.9 mm)	7	Micro, S
	Ø 0.118" (3.0 mm) - 0.256" (7.0 mm)	7	Micro, S

Figure 10: Rego-Fix recommended torque (ft-lbs) for ER8 and ER11 collet nuts.

Switching Between Speed and Power Ratings with The Variable Speed Series

Switching between the two different speed and power ratings with the Variable Speed series of **Air Turbine Spindles®** is simple. Take a hex key and insert it in the back of your 625XVS or 650XVS, then rotate the nut within your spindle clockwise or counterclockwise to switch between single turbine and twin turbine mode as shown in **figure 13**. Refer to the table below in **figure 12** to review the speed and power ratings of the 625XVS and 650XVS while in both modes.

Model	Mode	Speed	Power
625XVS	Single Turbine Mode	30,000 RPM	0.4 HP (0.3 kW)
	Twin Turbine Mode	50,000 RPM	0.7 HP (0.57 kW)
650XVS	Single Turbine Mode	25,000 RPM	0.8 HP (0.6 kW)
	Twin Turbine Mode	40,000 RPM	1.4 HP (1.04 kW)

Figure 12: Speed and power ratings for the 625 and 650 Variable Speed Air Turbine Spindles® in both single turbine and twin turbine modes.

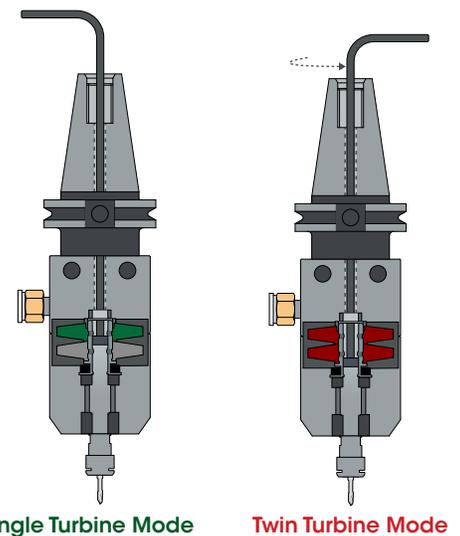


Figure 13: The turning a hex key that was inserted in the back of a 625XVS to switch from single turbine mode to twin turbine mode.

Pre-Installation

1. Ensure the air supply is turned off before installing the Tool Breakage Alarm™ monitor.
2. Mount monitor and filter on to your CNC.
3. Connect the airline to the filter supplied with the spindle to the airline from your compressor. From the filter connect the air line into the Tool Breakage Alarm™ monitor inlet port as shown in **figure 14**.
4. From the system monitor, connect the airline to your **Air Turbine Spindle®**.
5. **OPTIONAL:** Connect the alarm output port to your control and program for the Tool Breakage Alarm™ monitor to stop your program.

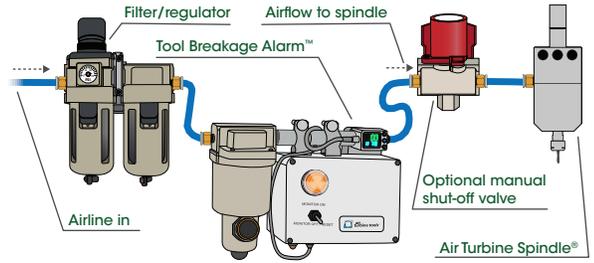


Figure 14: System monitor airline diagram showing the connection from a filter/regulator to the Tool Breakage Alarm™ and then to the Air Turbine Spindle®.

WARNING
Connection to air supply starts spindle rotation.

Initial Airline Setup

1. Ensure your air supply is adequate and set regulator at 90 psi/6.2 bar at the CFM, L/s specified flow rate for your **Air Turbine Spindle®** as shown in the table in **figure 3 on page 3**.
2. Ensure all hoses, couplings and connections have the minimum internal diameter specified for your spindle. Refer to **figure 2 on page 2** for the specific minimum size ID required for your model.
3. Set your machine spindle control for zero spindle rotation and close the machine door securely.
4. Connect the system monitor power cord to a 120 volt outlet, confirm that the air supply on/off switch is in the 'off' position.

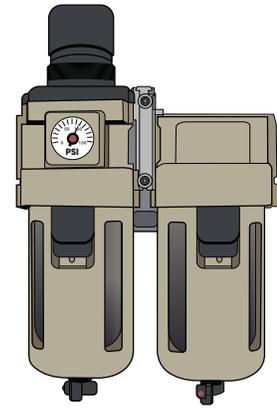


Figure 15: Ensure the filter/regulator properly set to 90 psi/6.2 bar.

Record Baseline Air Consumption and Start your Monitor

1. Turn on the air. Record the baseline cubic feet per minute/liters per second air consumption running while your spindle in idle for 5 minutes with no cutting load or until the CFM/L/s flow is stable.
2. On the flowswitch control, press the center blue button to begin measurement mode to record air flow rate while there is no load.
3. Press the up and down buttons on the flowswitch control to change the top value to match the baseline number displayed on the flowswitch control.
4. Press the blue button for the second time to confirm and fix your baseline.
5. Start your program on your CNC control and start cutting.
6. Flip the switch on the front of the system monitor to the 'on' position.

If your tool breaks or your compressor malfunctions the system will activate the light and klaxon. If connected to your CNC control and properly programmed, the system monitor will stop your machine.

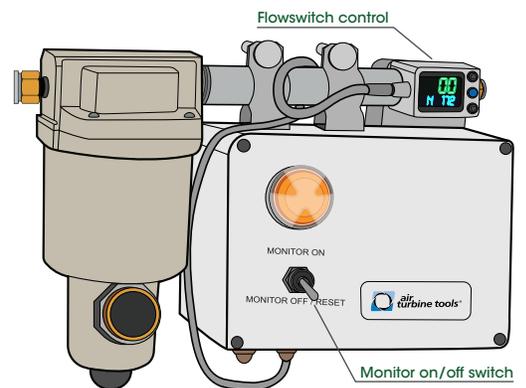
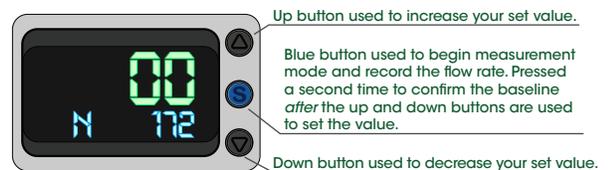


Figure 16: Diagram of the flowswitch control and system monitor.