TWO PLACE ASSEMBLY PROCEDURES

The following is a brief description of the assembly process. This text is designed to give you the order in which the aircraft should be assembled. It will also call out important notes and help clear up complicated areas of the instructional drawings. This text is designed to supplement the drawings.

First, place the fuselage in an upside down position. This is best accomplished by supporting the fuselage at the engine mounts and nose. The fuselage should be stable, as it will be drilled into during the assembly process.

Next, locate the belly skin instructions, drawing numbers B92-INS-0254 (use B05-INS-1435 for SS model), and B92-INS-0255. Caution: Make sure the aft edges of the aft belly skin extend 1 1/2" past the steel frame tubes. Later in the assembly process, the fiberglass aft panel will fit under the extended edges. At this time you will want to fit the skins to the fuselage and drill all the necessary mounting holes. Once the skins are completely fitted to the fuselage, you need to take a marker and go along the outside edge of the tubes to mark the final trim on the belly skins. The less skin material you try to roll over the better the fit. Keep in mind you need approximately 4” above the longeron tube on the left side only and 1/4" minimum edge distance for rivets. Remove the skins and deburr all the drilled holes. At this point the fuselage should be cleaned and degreased for painting. The fuselage must be degreased as a light coat of oil may have been applied to prevent rusting. Do not permanently install the skins until the entire fuselage interior has been built, as the skins will become an obstacle for later assemblies.

The next step is to install the nose fork and steering arm. Locate drawing number B92-INS-0176. An important point that may be highlighted on the drawing is drilling through the steering arm and nose fork at a 45-degree angle. Also, ensure that the nose fork and steering arm ride on the nylon bushings and do not ride on any other metal surface. This prevents excessive wear on the parts.

Install the brake shoe assembly to the spindle assembly. Drawing number B92-INS-0178 explains this. Drawing number B92-INS-0272 may provide a useful reference and will be used for installing the gear legs. There is a very important sentence buried within the notes section that states, “Insert the bolts from the brake shoe side”. This prevents the brake drum (installed later) from riding on the bolts.

Once the brake shoes are installed, the gear legs can be bolted onto the fuselage. The tolerance on the fiberglass gear legs is very loose. We have found that this style of leg works best with a snug fit. This may require some shimming. Aluminum tape and/or mylar have proven acceptable, since the gear leg must also remain removable. If applicable, the titanium main landing gear leg assemblies have been pre-fitted and pre-drilled at the factory. Slide the gear leg assemblies into the fuselage frame and attach them with the AN4-21A bolts, AN960-416 washers, and AN365-428 nuts. Ensure that there is exactly 10 inches between the spindle assembly and the main gear tube.

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A small difference between the gear legs will become large at the wingtips of the aircraft. Care must also be taken when sighting through the axles, as the gear legs must be aligned with each other. If you do not feel comfortable with the sighting method, the standard “Plumb Bob” method may be used. Also, note the crossing patterns of the bolts are not 90 degrees to one another. Finally, install the wheels to the gear legs and nose fork. Refer to drawing numbers B92-INS-0331 and B92-INS-0332 for this procedure.

If you have the Matco hydraulic brake option, make sure to assemble the wheels and brakes using the Matco instructions. Although Matco wheels come with an o-ring so they can be used with tubeless tires, we provide tubes and suggest they be used to increase reliability.

The fuselage should remain in its upside down position for the next few steps. This keeps assemblies at an easier level to work at. Note the drawings are in their right side up position.

Installation of the aft brake and rudder pedals is next. Refer to drawing number B92-INS-0273 for details. The rudder pedal and rudder pedal driver must be mounted in the vertical position. The rudder pedal stands upright and the rudder pedal driver hangs down when the fuselage is in its upright position. When sandwiching the brake pedal between two rivets, allow the pedal to swing freely but do not allow them to slide from side to side.

Locate drawing number B92-INS-0271, swing arm instructions. Lightly lubricate the swing arm guide rails and crank weldment threads with grease. Install the swing arm and check to make sure it can be adjusted through its operating range. Leave it in a position that is approximately centered before install the rudder pedals.

Locate drawing number B92-INS-0274 (use B01-INS-1242 for S and SS models), rudder pedal assembly instructions. First mount the rudder pedals to the pedal axle and the swing arm. The pedals and pedal swing arm may need to be reamed to 1/2 inch. Next, install the steering arm push/pull rods and threaded rudder cable tangs. If the steering arm push/pull rods are installed properly, the steering arm should be in a straight, forward position and the rudder pedals should be vertical. Finally, install the rudder pedal driver push/pull rods. The rudder pedals and rudder pedal drivers should be vertical if the push/pull rods are installed correctly.

If you have the Matco hydraulic brake option, locate drawing number B01-INS-1244. Install the toe brake pedals as depicted. Use one steel rivet, SD42BS, to attach each outer brake pedal retainer sleeve.

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Install the aft pedals using drawing B92-INS-0273. The aft rudder pedals may be set slightly forward or slightly aft of vertical to accommodate larger or smaller pilots. This will be done when the rudder cables are installed later in the assembly process.

Next, install the control stick assembly using drawing number B95-INS-0503 (use B01-INS-1240 for S and SS models). The torque tube should ride on the nylon bushings only and not any metal surfaces. Both control stick mounts should be flush with the ends of the torque tube. A very important step that is sometimes missed is the sandwiching of the center control guide and the main torque tube bushing between the torque tube retainer sleeve and the aft control stick mount. The sandwiched parts need to be loose enough to allow the torque tube to turn, but tight enough so the torque tube will not move forward or aft. If the torque tube is allowed to more forward and aft, pitch control will be inadequate. All rivets that penetrate the torque tube need to be placed in the sides as depicted. If rivets are installed in the top or bottom of the torque tube, the push/pull tube will bind. Lightly grease the bushings prior to final assembly.

Slide the master aileron driver (TC92-150) in place but do not rivet. If you have an S or SS model, install the aileron side shaft weldment and linkage as depicted on drawing number B01-INS-1256. Lightly grease the plastic bushings.

The next two steps are rather simple—installing the nylon main control guide to the fuselage frame and installing the rudder cable guides to the crank-bushing bracket (welded to the fuselage frame). Refer to drawing numbers B92-INS-0236 and B92-INS-0271 for details.

Refer to drawing number B92-INS-0182. For bonding purposes, sand the inside surface of the forward and aft sockets. This is completed while the fuselage is upside down to provide easy access to the sockets. Do not permanently install the tail boom at this point.

Next, place fuselage in its upright position for the installation of the tail boom, vertical and strake assemblies. Locate drawing numbers B92-INS-0182 and B92-INS-0183 for details. Slide the tail boom into place. It may be temporarily held in place with a large hose clamp. Install the vertical assembly to the tail boom, and then set the vertical assembly 90 degrees from level. A plumb bob or electronic can be used. During this process make sure the fuselage remains level. All lubricants must be removed from the tail boom and both sockets before bonding. Install the strake after the tail boom is permanently installed. Note on drawing number B92-INS-0183 the SS strake dimension is different than the other Tornado models.

The next step is to route the rudder cables through the fuselage. Drawing number B92-INS-0236 will be used for actual cable routing and B92-INS-0191 (use B92-INS-1241 for S and SS models) will be used for mounting the rudder cable to the rudder control arm.

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At this point, do not mount the rudder control arm to the rudder or the opposite end of the rudder cables to the rudder pedals. If you have the Matco hydraulic brake option, look at the hydraulic system brake cable routing depicted on drawing numbers B01-INS-1244 and B01-INS-1255. The brake master cylinders should also be mounted at this time. Drawing number B01-INS-1159 shows an exploded view of the assembly.

Construction of the stabilator is the next step. You will need drawing numbers B92-INS-0184 for the 7' stabilator or B01-INS-1238 and B01-INS-1313 for the 8' stabilator. Even though the stabilator leading edge had been factory assembled, the rivet line that runs down the spar centerline must be installed. Follow the dimensions so that the rivets will clear the spar lightening holes. After completion of the stabilator, the anti-servo tab should be temporarily installed using drawing numbers B92-INS-0188 for the 7' stabilator or B01-INS-1239 for the 8' stabilator and B98-INS-0970.

Now install the stabilator mount ring. Refer to drawing number B92-INS-1297. Once again, ensure the fuselage remains level for this procedure. Also, double-check the stabilator is level and aligned before drilling. At this time, permanently install the stabilator mount ring, but not the stabilator, as it will be removed later to gain access to the tail boom interior.

The anti-servo control system is installed next. Drawing numbers B92-INS-0181, B92-INS-0226, B92-INS-0227, and B92-INS-0228 will be needed. Most of the parts that mount in the tail boom are factory assembled to the trim torque tube. Slide the trim torque tube into the rear of the tail boom and out the front through the main control guide and into the fuselage. Position the components in the tail boom as shown in drawing number B92-INS-0181. Next, mount the trimwheel to the seat frame as detailed in drawing numbers B92-INS-0226, B92-INS-0227, and B92-INS-0228. Once everything is in proper position, it may then be permanently installed. The trim torque tube should run under the rudder control arm.

The tail wheel should be mounted next. This is a simple procedure. Refer to drawing number B92-INS-0195.

Locate drawing numbers B92-INS-0236 and B93-INS-0334. Mount the brake pedals to the rudder pedals, making sure they will clear all obstacles such as the rudder pedals and fuselage frame. When "sandwiching" the brake pedals between two rivets, ensure the pedals swing easily, but do not slide side to side. Next, route the brake cable sheathing as illustrated in drawing number B92-INS-0236. Insert the brake cable through the sheathing and mount the cable as described in drawing number B93-INS-0334. Before permanently installing main brake cables, slide the nicos for the aft brake cables onto the main brake cables. Nico the aft brake cables after the main brake cables have been installed and adjusted.

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The rudder cables should be completed using drawing number B92-INS-0236. First, temporarily install the rudder. The rudder cables should already be routed through the tail boom. Make sure they did not tangle with the trim torque tube. Route the cables through the fuselage, installing the turnbuckles and finally mounting the cables to the rudder pedal via the rudder pedal tang. Note that the rudder pedals and rudder should be in neutral position during the assembly process. When complete, shine a light into the tail boom and make sure the cables are not wound around each other or around the trim torque tube. Install safety wire so the turnbuckles will not loosen or become disconnected.

Note: For 1994 models and earlier
Route stabilator control cables next, referring to drawing numbers B92-INS-0236 and B92-INS-260. Route cables through tail boom so that they do not ride on any other metal surfaces (other cables, rudder control arm, etc…). Next, attach the aft end of the stabilator control cables to the stabilator control horn. Temporarily mount the stabilator to the stabilator mount ring, install the turnbuckles, and mount the cables to the elevator driver. Ensure the cables are set to the neutral position as described in the drawing and check for full stabilator deflection. If full deflection is not achieved, adjust cables while continuing to keep them in the neutral position, until full deflection is reached. All slack must be adjusted out of the cables.

Note: For 1995 models and later
Refer to drawing numbers B92-INS-0236, B95-INS-0516, and B96-INS-0758 (use B05-INS-1434 for SS model) to install the forward push/pull tube (TC95-250) in the main push/pull tube assembly (TC95-243). Align the 3/16” drill holes in each tube and then drill the rest of the way through both tubes with a 3/16” drill. Remove the forward push/pull tube, sand, acetone, and epoxy it to ensure the adhesive insulates the aluminum from the steel. The rear push/pull tube weldment is installed with this same method. The support plug (TC95-233) is used to restrict the amount of deflection, while the system is in compression or down stick. The support plug will also help guide the main push/pull assembly for clearance around the rudder bushing. Install the support plug so that it is positioned as depicted on drawing number B95-INS-0516. This view is from the rear of the aircraft.

Next, route the main elevator push/pull tube assembly through the tail boom so that it goes through the support plug’s 1 1/4" hole and under the landing gear truss but over the main control guide (TC95-259) that is shown on drawing number B92-INS-0236. Temporarily mount the rear push/pull weldment to the stabilator control horn and the forward push/pull tube weldment to the elevator driver. Ensure that stabilator is level to the left rear longeron tube. Set control to the neutral position, then check for full deflection as described on drawing number B96-INS-0758 (use B05-INS-1434 for SS model). If full deflection is not achieved, adjust until it is reached.

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While the stabilator is mounted to the tail ring, install the anti-servo push/pull rod. Refer to drawing numbers B92-INS-0187 and B98-INS-0970. The push/pull rod should run inline with the tail boom. Position the anti-servo control horn accordingly. The forward most rivet hole of the control horn receives a larger rivet than the other three. Cut slots in the stabilator aft skin so the push/pull rod can pass through.

The flap detent strip may be installed at this time. Refer to drawing number B92-INS-0237. This is a very simple procedure. This step is not necessary with the electric flap option.

If equipped with a 10-gallon fuel tank, refer to drawing number B92-INS-0252 for installation. The fuel tank should not extend beyond the indicated fuselage tube, as it would interfere with the rear seat or back panel. Refer to drawing number B96-INS-0786 for fuel line routing.

If equipped with a 15-gallon fuel tank, refer to drawing number B03-INS-1391 for installation. Refer to drawing numbers B02-INS-1379, B02-INS-1380, and B97-INS-0842 for fuel system connection to the tank.

Installation of the instrument panel and hood is next. Refer to drawing number B92-INS-0266 for installation instructions. When laying out the instruments onto the instrument panel, use extra care to prevent the instruments from colliding with any of the fuselage tubes. The instrument panel may be as tall as needed, but ensure the pilot's legs will comfortably fit under the panel. Do not permanently install the instrument panel at this time; access to the rear of the panel is need for wiring purposes.

For wiring, temporarily mount the engine to the fuselage referencing drawing number B92-INS-0266. The exhaust does not need to be installed at this time. Using drawing numbers B92-INS-0231 and B92-INS-0233, install the throttle handle and throttle cable. Note, the throttle cable is sheathed from the cable stop to the engine. Also, note that the engine will have to be removed later for painting purposes. The drawing numbers listed above are for the two stroke engines. The 912 engine installation and wiring diagrams are also included in the back of the manual. Use only the appropriate drawings for your engine. Note that other engines may use a different throttle handle and choke system.

Even though there are wiring diagrams included in the manual, due to the wide variety of instrumentation, lighting, and avionics options, it is recommended that these items be wired using reference materials supplied by their manufacturer.

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Drawing number B92-DT-0251 is a diagram of the mag switches pinout and switch condition of each key position. All of the wiring diagrams and information contained on the diagrams may not apply to each aircraft, as it depends on which options have been ordered. Install the electrical connectors provided in the kit, near the engine and outside the aircraft. This makes engine removal much easier. Studs have been welded into the fuselage for grounding purposes.

The belly skins may now be permanently installed. Once again, use drawing numbers B92-INS-0254 (use B05-INS-1435 for SS model), and B92-INS-0255. Only the pre-drilled mounting holes should be riveted. The forward skin should overlap the aft skin.

Next, install the nose cone and pitot tube, refer to drawing numbers B92-INS-0269 and B97-INS-0936. When cutting out the slot on the bottom of the nose cone, ensure that it is along the inner edge of the fuselage tubes. To protect the pitot tube from inadvertent damage, do not allow it to extend beyond the front edge of the nose cone. The nose cone may be permanently installed at this time. The nose cone should overlap the forward belly skin.

Installation of the left window is the next step. Use drawing number B92-INS-0313 for this procedure. The notes on the drawing are the steps for installing the window. Please read and follow them carefully. The better the window is clamped to the fuselage, the closer to actual shape it will be. This will make the assembly process much easier. Do not drill near the wing fittings. This may degrade the structural integrity of the aircraft and eventually cause failure. The Lexan strip that runs down the forward down tube serves as a spacer for the front door. Aircraft with .090” windows will have a .060” strip provided. Do not permanently install the window at this time.

Next, install the upper right window and moldings. Refer to drawing number B92-INS-0314 for details. This window and molding installation should be much easier than the left window. Once again, take time to install them correctly and follow the steps in the drawing. Do no permanently mount the windows at this time.

Locate drawing number B92-INS-0316 for the installation of the front door. Follow the steps outlined in the drawing. For the best appearance, ensure the door skin is aligned with the belly skin on the opposite side of the aircraft. The 3/8” to 1/2" gap between the doorframe and fuselage frame is to prevent the door from catching on the fuselage during use. Removing the left window at the time of the door window installation allows clamping of the door window to the fuselage down tube. The hinge should overlap the door window. Do not permanently install the door skin or window at this time.

The rear door should be installed next using drawing number B92-INS-0318. As with the front door, there must be a 1/4" gap between the two frames. Again, follow the steps in the drawing. Also, notice the hinge mounting detail in the lower left corner of the drawing. Do not permanently install the door at this time.

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Next, prepare the aircraft for painting. First remove the windows, doors, stabilator, rudder and engine. At this time apply the stits material to the rudder, stabilator, and the aft portion of the fuselage, if applicable. Use drawing number B92-INS-0312 for the layout of the covering fabric. Refer to stits manual provided for the covering procedure. After the fabric has been installed, these items may be painted. Do not get any acetone, paint or paint thinner on any plastic, foam, or other synthetic parts as it will destroy those materials.

After the aircraft has been painted, the rudder, stabilator, engine, windows and doors may be permanently installed. Refer back to the appropriate drawings for details. The windows may be sealed with silicone to prevent any water leakage. Also, upon final assembly of the windows, the wing gap seal must be installed. Refer to drawing number B92-INS-0320 for details.

After the doors have been permanently installed, the door latches may then be installed. Refer to drawing number B92-INS-0241 for the front door latch and drawing number B92-INS-0243 for the rear door latch. The heads of the rivets that mount on the fuselage exterior (for the rear door latch) may be painted before installation or touched up after installation.

If applicable, install the pulley and guides for the pull start rope. Refer to drawing number B92-INS-0243 for details. Be sure not to mount the nylon bushing where they will interfere with the wing.

The wing may now be mounted to the fuselage. If the wing has not been assembled, please turn to that section of the manual. See drawing number B92-INS-0321 for wing mounting details. It is normal to have some play between the two pairs of forward wing fittings. Do not over tighten the nuts and bolts causing the wing fittings to bend. Refer to drawing number B92-INS-0321 to mount the rear wing fittings to the wing. Now that the wing has been mounted, the leading edge gap seal can be installed.
Ailerons and control stick must be kept in a neutral position for the next procedures. You can lock your ailerons in position with the aileron center stand on drawing number B96-INS-0759. First, pre-drill one end of the main aileron push/pull tube. Then, measure in 1/2" from the end of the main aileron push/pull tube, drill a 5/16” hole through one side of the tube and insert one aileron push/pull tube end (TC91-4) to act as a guide and drill through the other side. Bolt the aileron push/pull tube end to the main aileron push/pull tube. Then thread a 1/4" ball joint with a jam nut halfway into the aileron push/pull tube end. Attach the main aileron push/pull tube to the center aileron drivers with the aileron torque tube stand to lock the ailerons in the neutral position. Insert the other aileron torque tube end into the other end of the main aileron push/pull tube; do not drill at this end. Attach the main aileron push/pull tube to the master aileron driver (TC92-150). Slide the master aileron driver forward until you have 1 1/2" of clearance between the main aileron push/pull tube and the front seat support tube.

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This will give you the proper clearance needed for the main aileron push/pull tube. It will also determine the distance from the center control guide and the bushing to the center of the master aileron driver or dimension “A” on drawing number B95-INS-0503. Now, set the height of the master aileron driver. This is measured from the fuselage floor tubes to the center of the threaded end of the master aileron driver’s bolt or dimension “B” on drawing number B95-INS-0503. Dimension “B” is determined by achieving a 90 degree angle between the master aileron driver and the main aileron push/pull tube.

If you have an S or SS model, refer to drawing numbers B02-INS-1376 and B02-INS-1377 to install the main aileron push/pull tube (TC04-396). Make sure the ailerons are locked in the neutral position and the control stick is in the neutral position before installing and adjusting the main aileron push/pull tube. The ailerons may be locked using the aileron center stand depicted on drawing number B01-INS-1247. Remember to remove the aileron center stand when finished.