BRAKES

ALL MODELS

Air Brake Modifications

Certification Procedures For DOT FMVSS-121

The Federal Department of Transportation’s Motor Vehicle Safety Standard 121 required that virtually all trucks equipped with air brakes and manufactured on or after March 1, 1975 must comply with a comprehensive set of design and performance parameters concerning the air brakes and related systems.

Of the many requirements of FMVSS 121, two are of primary concern between the truck manufacturer and the body and allied equipment manufacturer. The first concern is the center of gravity location on a truck used for compliance testing and the second involves the tubing and air flow design of the brake system.

Cautions - FMVSS-121 Air Brake System Modifications

**CAUTION:** If wheelbase alterations are made to International vehicles with FMVSS-121 brakes:
- **DO NOT** make alterations to air lines with hose, piping or fittings of sizes other than those currently in use on the truck.
- **DO NOT** allow sharp bends or other constrictions in hosing.
- **DO NOT** exceed the minimum or maximum wheelbase available from the factory for that model after lengthening or shortening the wheelbase. For wheelbases longer or shorter than those available from the factory, International will provide verbal opinion (through contacting your local International dealer). International will be available to provide certification testing and documentation of compliance or non-compliance with FMVSS-121 for the specific situation at an additional cost.

**CAUTION:** Air reservoirs may be relocated providing these guidelines are followed:
- **DO NOT** make alterations to air lines with hose, piping or fittings of sizes other than those currently in use on the truck.
- **DO NOT** allow sharp bends or other constrictions in hosing.
- **DO NOT** alter brake line to port location.

CAUTION: Air-operated auxiliary attachments may be added to International FMVSS-121 vehicles if you:
- **DO NOT** use air tap locations other than those shown on these drawings for these models.
- **Pressure protection valves are required where shown and should be mounted with the vent port downward. All new parts are available from International truck dealers.** Since the FVMSS-121 has very specific criteria for the time allowed for air to reach and release the brakes, it is obvious that the tubing design is very critical and that the allowable sources for air tap must necessarily be restricted. Consult FMVSS-121 for criteria for time allowed for apply and release of brakes.
**Safety Measures**

Should it be necessary to modify the braking system, for example in connection with a wheelbase alteration, the following must always be observed:

- Make sure that the brake circuits are not altered. Before any part of the braking system is dismantled, mark the brake pipes and connections concerned, or make a sketch showing the original routing.
- Avoid joints, preferably change the entire brake pipe.
- Preferably, use bent brake pipes instead of elbow unions so as not to affect the brake application/release times.
- Install the brake pipes in positions where they are protected against damage and heat.
- Install the air tanks so that the drain valves still function well and are easy to reach.

**CAUTION:** When a brake pipe is replaced or jointed, use only genuine International parts of the correct type.

**NOTE:** On trucks with ABS brakes, the sensor cable must not be jointed. If necessary, it must be completely replaced.
Full Power Hydraulic Brake System Schematic
(with Truck Brake System Code 04085)
Antilock Air Brake System Schematic
(with Truck Brake System Code 04091)

Key:
- Secondary Circuit
- Primary Circuit
- Parking Brake Circuit
- Electrical Circuits

- Air Pressure Gauge
- Low Pressure Switch
- Secondary Stop Light Switch
- Primary Stop Light Switch
- Foot Valve
- Spring Brake Chamber
- Service Brake Chamber
- ABS Modulator Valve
- ABS Wheel Speed Sensor (4)
- Air Dryer
- Compressor
- Governor
- Safety Valve
- Drain Valve
- Primary Tank
- Secondary Tank
- Air Accessory Solenoid Module
- Air supply for various air controlled accessories.
- Extra port for non-solenoid air accessories such as air suspensions, transmissions, etc.
**All Models**

**Routing Guidelines**

If modifications are made to International vehicles with the addition or re-routing of tubing the following guidelines found in the Federal Motor Carrier Safety Regulations Pocketbook, section 393.45, should be followed:

- Be designed and constructed in a manner that insures proper, adequate, and continued functioning of the tubing or hose.
- Be installed in a manner that insures proper continued functioning of the tubing or hose.
- Be long and flexible enough to accommodate without damage all normal motions of the part to which it is attached.
- Be suitably secured against chafing, kinking, or other mechanical damage.
- Be installed in a manner that prevents it from contacting the vehicle’s exhaust system or any other source of high temperatures.
Air-Operated Auxiliary Attachments

- The primary air reservoir has a dedicated port for a two-port pressure protection valve (PPV). If no air-operated features are ordered on the vehicle, then this port is plugged from the factory. A PPV can be ordered from an International dealer if a PPV is needed.
- The PPV will come installed from the factory if an air suspension or other air-operated device is ordered (i.e., fifth wheel slide, air suspension dump, etc.). Depending on vehicle ordered features; one port may be open. If this is the case, then unplug that port and use the port.
- If all of the ports on the PPV are utilized, then a Quality Connect tee should be installed into the one of the used ports. The recommended tee - 3/8-inch x 3/8-inch x 3/8-inch stem (International part number 2024458C1) – can be ordered from an International dealer.
**ALL MODELS**

**Tube Fitting Installation Instructions**

The majority of tube fitting connections in the air braked chassis utilize a Quality Connect fitting (fitting integral to an air brake component or plastic fitting) or an PTC fitting (fitting threaded into an air brake component). Both of these fitting types are comprised of a collet which bites into the tube to hold it firmly in place and a fitting O-ring which seals the tube to the valve, manifold or tee body to prevent leakage. To aid in service, a kit is available with tools for each port and tube size used by International.

To assure standardization of tubing used on International vehicles, the following table illustrates tubing color, abbreviations and where that color is used.

<table>
<thead>
<tr>
<th>Color</th>
<th>Abbreviation</th>
<th>Where Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>BK</td>
<td>MV-3, PPDC Exhaust&lt;br&gt;Air Seat&lt;br&gt;Air Horn&lt;br&gt;Air Dryer to Wet Tank&lt;br&gt;Wet tank to Governor</td>
</tr>
<tr>
<td>Blue</td>
<td>BL</td>
<td>Trailer Service, 1st Pusher Delivery</td>
</tr>
<tr>
<td>Brown</td>
<td>BN</td>
<td>Air Suspension system, 2nd Pusher Delivery</td>
</tr>
<tr>
<td>Green</td>
<td>GN</td>
<td>Primary Brake system</td>
</tr>
<tr>
<td>Orange</td>
<td>OR</td>
<td>Secondary Brake system</td>
</tr>
<tr>
<td>Purple</td>
<td>PL</td>
<td>1st Tag Delivery</td>
</tr>
<tr>
<td>Red</td>
<td>RD</td>
<td>Trailer emergency</td>
</tr>
<tr>
<td>Silver</td>
<td>SIL</td>
<td>PDL control, 2nd Pusher Supply&lt;br&gt;Governor to Dryer</td>
</tr>
<tr>
<td>Tan</td>
<td>TN</td>
<td>Locking differential, 1st Pusher Supply&lt;br&gt;Traction differential&lt;br&gt;Two-speed axle</td>
</tr>
<tr>
<td>White</td>
<td>WH</td>
<td>Solenoid Pack Supply Load Sensing Gauge, 1st Tag Supply</td>
</tr>
<tr>
<td>Yellow</td>
<td>YL</td>
<td>Spring Brake System, Cab Air Suspension</td>
</tr>
</tbody>
</table>
**DuraStar® SERIES**

**All Models**

Removal and Insertion Procedures for Tubing in QC or PTC Fittings

---

**WARNING:** Do not attempt to disassemble tubing from fittings with air pressure in the system. Failure to drain system of air pressure before removing components may cause personal injury or death.

---

**Removal of Tube from Fitting**

- Use the tube release tool (see graphic 1 below) to remove the tube.
- Push down on the release tool, then pull on the tube. Pushing the tool depresses the fitting collet, allowing it to release the tube. Sometimes the brass tube support will be pulled out of the fitting when the tube is removed. Be sure to reinstall a tube support when installing the tube.

**Preparation of Tube for Installation**

- Inspect the tube end for external scratches, burrs, or cracks. If it is damaged, trim the damaged portion off at an insertion depth mark (see graphic 2 below) or replace the tube. **DO NOT** reuse a damaged end.

**Installing Tube Into The Fitting**

- Lubricate the tube end and install it to the correct insertion depth (see graphic 3 below). Install the tube by pushing it straight into the fitting. The insertion depth mark should be flush with the face of the fitting (see graphic 3 below). Gently tug on the tube to make sure it is secured in the fitting.
- Test to make sure the assembly is free from leaks using a soap solution and clean, dry air at system pressure. When performing a bubble test, leakage should not exceed a soap bubble of 1/2-inch (12 mm) in 3 seconds with system air pressure of 100 to 130 psi. If a leak exceeding the above specification is still present, remove and replace the valve, manifold or tee.

---

**IMPORTANT:**

Use the tube cutter (supplied in the tool kit) to ensure that the cut is square within 15° to help prevent leakage. Do not use a dull or heavy cutting tool such as side cutters, pocket knife or hack saw which could collapse (flatten) the tube or create O-ring damaging burrs. Do not use the tube cutter to cut anything other than nylon air line tubing. Replace the blade or cutter if the cutting edge becomes dull.

---

![1 – Remove Tube](04_007)

![2 – Prepare for Installation](04_008)

![3 – Install Tube into the Fitting](04_009)
**ALL MODELS**

Air Brake Tubing – Front Section

- 1/2" ORANGE SUPPLY TO MODULATOR VALVE
- 1/2" ORANGE SUPPLY FROM FOOT VALVE TO FITTING
- 1/2" ORANGE SUPPLY TO ANCHOR FITTING
- 3/8" ORANGE TO SPRING BRAKE MODULATOR VALVE
**DuraStar® Series**

*All Models*

Air Brake Tubing – Rear Section – Tractor Brakes

- **5/8” Green** Delivery from Relay Valve to Modulator Valve
- **3/8” Yellow**
- **5/8” Green** (4x2); **3/4” Green** (6x4) Supply from Primary Air Tank to Relay Valve
- **3/8” Green** Signal Line from Foot Valve to Relay Valve

*Note*: The diagram illustrates the tubing connections and flow directions for the air brake system in the rear section of the tractor.
**All Models**

Air Brake Tubing – Rear Section – Truck Brakes

- **5/8” Green** Delivery from Relay Valve to Modulator Valve
- **3/8” Green** Delivery from Inversion Valve to QRV
- **5/8” Green** Delivery from Inversion Valve to Bottom Port of Relay Valve
- **3/8” Green** Delivery from Spring Brake Control Valve
- **3/8” Green** Delivery from X Fitting to Inversion Valve
- **3/8” Yellow** Delivery from Foot Valve to Relay Valve
- **3/8” Green** Signal Line from Inversion Valve to Relay Valve
- **3/8” Orange** Signal Line from X Fitting to Inversion Valve
- **5/8” Green (4x2); 3/4” Green (6x4)** Supply from Primary Air Tank to Relay Valve
For connections not shown, please refer to the appropriate schematic in the CT-400 General Information book.

- **3/8" Black**
  - Exhaust from Spring Brake Control Valve

- **3/8" Orange**
  - Supply to Spring Brake Control Valve

- **5/8" Orange**
  - Supply from Secondary Air Tank to Foot Valve

- **3/8" Green**
  - Supply to Spring Brake Control Valve

- **3/8" Yellow**
  - Delivery from Spring Brake Control Valve

- **5/8" Green**
  - Supply from Primary Air Tank to Foot Valve

- **Dash Panel**
All Models

Hydraulic Control Unit Plumbing

- 1/4" tube to left front brake
- 5/8" tube to master cylinder reservoir
- 1/4" tube to right front brake
- 1/4" tube to master cylinder (primary)
- 1/4" tube to master cylinder (secondary)
- 1/4" tube to left rear brake
- 1/4" tube to right rear brake
- High pressure brake accumulators (see ISIS Service Manual prior to service)
- Back of cab crossmember

04_0014
With hydraulic brakes, the park brake assembly is attached to the rear axle. It is mechanically actuated through the use of a three-section cable. Due to the construction of the cables, it is not possible to alter the length.
ALL MODELS
Air ABS ECU (Electrical Control Unit)
**DuraStar® SERIES**

**ALL MODELS (except 4x4)**

**Air Tank Location**

With Hydraulic Brakes and Air Effects Right (504030) and Left (504616) Side Mounted

[Diagram showing Air Tank Location with dimensions and labels for CREW CAB, EXT. CAB, REG. CAB, and DIA.]
**ALL MODELS**

**Air Tank Location**

With Air Brakes Left (508003) Side Mounted Under Battery Box, Back of Cab

---

**Key**

<table>
<thead>
<tr>
<th></th>
<th>8.5&quot; Tank</th>
<th>11&quot; Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>4.1 (103.8)</td>
<td>1.6 (41.7)</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>21.8 (553.7)</td>
<td>24.2 (614.7)</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>3.8 (96.7)</td>
<td>23.9 (606.6)</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>12.5 (318.3)</td>
<td>14.9 (379.2)</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>5.6 (142.3)</td>
<td>5.4 (137.4)</td>
</tr>
<tr>
<td><strong>F</strong></td>
<td>40.5 (1029.3)</td>
<td>41.3 (1048.3)</td>
</tr>
</tbody>
</table>
**ALL MODELS**

Air Tank Location

With Air Brakes Left (504602) Side Mounted Under Battery Box, Under Cab

<table>
<thead>
<tr>
<th>Key</th>
<th>8.5&quot; Tank</th>
<th>11&quot; Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.1 (103.8)</td>
<td>1.6 (41.7)</td>
</tr>
<tr>
<td>B</td>
<td>21.8 (553.7)</td>
<td>24.2 (614.7)</td>
</tr>
<tr>
<td>C</td>
<td>4.0 (102.4)</td>
<td>3.8 (96.7)</td>
</tr>
<tr>
<td>D</td>
<td>12.5 (318.3)</td>
<td>14.9 (379.2)</td>
</tr>
<tr>
<td>E</td>
<td>3.5 (89.9)</td>
<td>2.3 (59.0)</td>
</tr>
</tbody>
</table>
MODELS LP, 4x2

Air Tank Location

With Air Brakes Left (504615) Side Mounted, Back of Cab, With 19.5" Dia. Wheels

Diagram showing air tank location with dimensions and labels for REG. CAB, EXT. CAB, CREW CAB, and DIA. Dimensions are given in inches (e.g., 25.33, 5.96, 33.83) and millimeters (e.g., 643, 151, 859).

---

DuraStar® Series — Medium Conventional Body Builder Diagrams (CT-471)

October, 2010

DuraStar® SERIES

INTERNATIONAL®
ALL MODELS (except 4x4)

Air Tank Location
With Air Brakes Right (504603) Side Mounted Under Battery Box, Under Cab

<table>
<thead>
<tr>
<th>Key</th>
<th>8.5&quot; Tank</th>
<th>11&quot; Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.1 (103.8)</td>
<td>1.6 (41.7)</td>
</tr>
<tr>
<td>B</td>
<td>21.8 (553.7)</td>
<td>24.2 (616.7)</td>
</tr>
<tr>
<td>C</td>
<td>4.0 (102.4)</td>
<td>3.8 (96.7)</td>
</tr>
<tr>
<td>D</td>
<td>12.5 (318.3)</td>
<td>14.9 (379.2)</td>
</tr>
<tr>
<td>E</td>
<td>3.5 (89.9)</td>
<td>2.3 (59.0)</td>
</tr>
</tbody>
</table>
All Models

Air Dryer Location
Codes 04EBD, 04EBS, and 04EBT

Location Codes

504393
04VBC

Battery Box Mounted

504395
504396

Frame Mounted

12.74 (324)
12.65 (321)
12.50 (318)

12.00 (305)
12.11 (308)
8.46 (215)

9.58 (243)
11.79 (299)

8.40 (213)
8.40 (213)
13.50 (343)

11.79 (299)
(308)
(321)

13.19 (335)
14.21 (361)
11.79 (299)

04EBT
04EBS
04EBT
04EBD

BATTERY BOX MOUNTED
FRAME MOUNTED
ALL MODELS
Air Dryer Location
Air Dryer 04EBD with Location Code 504396 – Mounted Left Side Inside Rail, Back of Reg Cab

BACK OF STD CAB 26.00 (660.40"
BACK OF STD CAB 18.00 (457.20"
BACK OF STD CAB 14.5 (368.5"

FWD

04EBD 504396

4.4 (111.5)
ALL MODELS

Air Dryer Location

Air Dryer 04EBS with Location Code 504395 – Mounted Right Side Inside Rail, Back of Standard Cab

REG. CAB

25.98 (660) (REF)

EXT. CAB

17.91 (455) (REF)

CREW CAB

2.31 (59)

04EBS 504395

4.72 (120)
**ALL MODELS (except 4x4)**

**Air Dryer Location**

Air Dryer 04EBS with Location Code 504396 – Mounted Left Side Inside Rail, Back of Standard Cab
**All Models**

**Air Dryer Location**

Air Dryer 04EBT with Location Codes 04VBC or 504393 — Mounted Left Side, Back of Battery Box, Under Cab

[Diagram showing the location of the air dryer with dimensions and labels for REG., CAB, EXT. CAB, CREW CAB, and FWD.]

- 25.98 (660) (REF)
- 17.91 (455) (REF)
- 8.48 (215)
- 04EBT
- 504393
- 04VBC
- 4.30 (109)