Independent Front Suspension

Technical Training
Contents

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• Tuthill Models
• Features and Benefits
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• Special Tools
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Why Independent?

- **Solid-Axle I-Beam**
  - Left and right wheels connected
  - Impact on one wheel effects the other wheel
  - Impact on one wheel effects steering, “bump steer”
  - Camber not (easily) adjusted
  - Camber does not change during cornering, no assist

- **Independent Front Suspension**
  - Left and rights not connected
  - Impact on one wheel does not effect the other wheel
  - Impact on one wheel does not effect steering
  - Camber is adjustable
  - Camber changes during cornering to assist road holding
## Tuthill Models

<table>
<thead>
<tr>
<th>SUSPENSION MODEL</th>
<th>GVWR (LBS)</th>
<th>WHEEL MOUNT</th>
<th>WHEEL CUT</th>
<th>BRAKE</th>
<th>SWAY BAR</th>
<th>IN CURRENT PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFS1050-HP</td>
<td>10,500</td>
<td>Hub Pilot</td>
<td>50°</td>
<td>15x4 Drum</td>
<td>No</td>
<td>No</td>
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<tr>
<td>IFS1050S</td>
<td>10,500</td>
<td>Hub Pilot</td>
<td>55°</td>
<td>15x4 Drum</td>
<td>No</td>
<td>No</td>
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<tr>
<td>IFS1050S-SB</td>
<td>10,500</td>
<td>Hub Pilot</td>
<td>55°</td>
<td>15x4 Drum</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>IFS1200-HP</td>
<td>12,000</td>
<td>Hub Pilot</td>
<td>45°</td>
<td>15x4 Drum</td>
<td>No</td>
<td>No</td>
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<tr>
<td>IFS1200-SP</td>
<td>12,000</td>
<td>Stud Pilot</td>
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<td>No</td>
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<td>Hub Pilot</td>
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<tr>
<td>IFS1200S2</td>
<td>12,000</td>
<td>Hub Pilot</td>
<td>50°</td>
<td>15x4 Drum</td>
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<td>No</td>
</tr>
<tr>
<td>IFS1200S2-SB</td>
<td>12,000</td>
<td>Hub Pilot</td>
<td>50°</td>
<td>15x4 Drum</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>IFS1260S</td>
<td>12,600</td>
<td>Hub Pilot</td>
<td>57° *</td>
<td>15x4 Drum</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>IFS1260S-SB</td>
<td>12,600</td>
<td>Hub Pilot</td>
<td>57° *</td>
<td>15x4 Drum</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* 57° for Aluminum Rims only. Steel Rims limited to 55° Wheel Cut.
## Tuthill Models

<table>
<thead>
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<th>WHEEL CUT</th>
<th>BRAKE</th>
<th>SWAY BAR</th>
<th>IN CURRENT PRODUCTION</th>
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</thead>
<tbody>
<tr>
<td>IFS1320-HP</td>
<td>13,200</td>
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<td>16.5x5 Drum</td>
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<tr>
<td>IFS1320-SP</td>
<td>13,200</td>
<td>Stud Pilot</td>
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<tr>
<td>IFS1370-HP</td>
<td>13,700</td>
<td>Hub Pilot</td>
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<td>16.5x5 Drum</td>
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<tr>
<td>IFS1370-SP</td>
<td>13,700</td>
<td>Stud Pilot</td>
<td>45°</td>
<td>16.5x5 Drum</td>
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<td>No</td>
</tr>
<tr>
<td>IFS1370S-SB</td>
<td>13,700</td>
<td>Hub Pilot</td>
<td>45°</td>
<td>16.5x5 Drum</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>IFS1460-HP</td>
<td>14,600</td>
<td>Hub Pilot</td>
<td>52°</td>
<td>16.5x5 Drum</td>
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<td>No</td>
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<tr>
<td>IFS1460S</td>
<td>14,600</td>
<td>Hub Pilot</td>
<td>55°</td>
<td>16.5x5 Drum</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>IFS1460S-SB</td>
<td>14,600</td>
<td>Hub Pilot</td>
<td>55°</td>
<td>16.5x5 Drum</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>IFS1460S-DSB</td>
<td>14,600</td>
<td>Hub Pilot</td>
<td>55°</td>
<td>Air Disc</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>IFS1660S</td>
<td>16,600</td>
<td>Hub Pilot</td>
<td>55°</td>
<td>Air Disc</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>IFS1660S-SB</td>
<td>16,600</td>
<td>Hub Pilot</td>
<td>55°</td>
<td>Air Disc</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Features and Benefits

• Industry leading wheel cut (57° on IFS1260)
• Full range of products
• Bilstein shock absorbers for optimized ride and handling
• Both sway bar and non-sway bar models available
• Automotive style Short-Long-Arm suspension design
• Lubed for life ball joints
• Unitized construction
• Built in brake anti-dive
Family of Units

- IFS1050
- IFS1200/1320/1370
- IFS1260
- IFS1460/1660
IFS1200/IFS1200S2/IFS1320/IFS1370 Family

- Hub and Drum Assembly
- Upper Control Arm
- Cradle
- Knuckle
- Shock
- Air Spring
- Steering Stabilizer
- Relay Rod
- Serial Tag
- Bell Crank
- Tie Rod
- Brake
- Lower Control Arm
IFS1460/1660 Family

- Steering Arm
- Tie Rod
- Sway Bar
- Carrier
- Carrier Pin
- Knuckle
- Bell Crank
- Idler Arm
- Lower Shock Mount
IFS1460/1660 Family

- Cap
- Kingpin
- Bearing
- Shim
- Draw Key (Upper)
- Seal
- Draw Key (Lower)
Special Tools

- Service Manual(s)
- Dial Indicators
- C-Clamps
- Pry Bar
- Ruler or Tape Measure
- Torque Wrench and Sockets
- Voltmeter (AC Volts)
Special Tools

• Ball Joint Remover (Do not use "pickle forks")
  • Recommend Snap-On Bar-Type "CJ" Pullers
    • 4-3/8" Jaws
    • 3/4"-16x4-1/4" Pressure Screw
    • 3-1/2" to 6" Yoke

• Ball Joint Wrenches
  • 40mm Ball Joint Special Tool
  • 50mm Ball Joint Special Tool
  • 65mm Ball Joint Special Tool
Regular Maintenance

• Topics in Service Manuals:
  • Part Identification/Description
  • Maintenance Record
  • Maintenance Schedule
  • Lubrication Schedule
  • Inspection Procedures
  • Lubrication Procedures
  • Trouble Shooting and Repair
  • Adjustments
  • Torque Specifications
### Regular Maintenance

**Lubricant Specification and Intervals**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>SERVICE INTERVAL</th>
<th>CHANGE INTERVAL</th>
<th>LUBRICANT SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Studs on Ends of Tie Rods, Relay Rod, Drag Link</td>
<td>Which ever comes first: 50,000 miles (80,000 kilometers) or once a year.</td>
<td>N/A</td>
<td>Multi-Purpose Chassis Grease NLGI Grade 1 or 2 Lithium Base</td>
</tr>
<tr>
<td>Bell Crank and Idler Arm</td>
<td>Which ever comes first: 50,000 miles (80,000 kilometers) or once a year.</td>
<td>N/A</td>
<td>Multi-Purpose Chassis Grease NLGI Grade 1 or 2 Lithium Base</td>
</tr>
<tr>
<td>Brake S-Cam Tube and Automatic Slack Adjuster</td>
<td>Which ever comes first: Brakes relined, 50,000 miles (80,000 kilometers) or once a year.</td>
<td>N/A</td>
<td>Multi-Purpose Chassis Grease NLGI Grade 1 or 2 Lithium Base</td>
</tr>
<tr>
<td>Wheel End</td>
<td>1000 miles (1600 kilometers) Check fluid level.</td>
<td>Which ever comes first: Seals replaced, brakes relined, 100,000 miles (160,000 km), or once a year.</td>
<td>Gear Oil SAE 80W/90 or equivalent</td>
</tr>
</tbody>
</table>

1 Moly-disulfide type grease is not recommended since it may lower friction capabilities in the adjusting clutch parts of the automatic slack adjuster.
Troubleshooting and Repair

• Part Identification/Description
• Service Parts
• Troubleshooting Charts
• Inspection
• Adjustments and Alignment
• Repair
• Torque Specifications
## Troubleshooting and Repair

### Suspension System -- General

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>POSSIBLE CAUSES</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tires wear out quickly or have uneven tire tread wear.</td>
<td>1) Tires have incorrect pressure.</td>
<td>1) Put specified air pressure in tires.</td>
</tr>
<tr>
<td></td>
<td>2) Tires out of balance.</td>
<td>2) Balance or replace tires.</td>
</tr>
<tr>
<td></td>
<td>3) Incorrect toe-in setting.</td>
<td>3) Adjust toe-in to specified setting.</td>
</tr>
<tr>
<td></td>
<td>4) Incorrect ride height.</td>
<td>4) Adjust ride height to specified setting.</td>
</tr>
<tr>
<td></td>
<td>5) Incorrect rear axle alignment.</td>
<td>5) Align rear axle to specified thrust angle.</td>
</tr>
<tr>
<td></td>
<td>6) Incorrect steering arm geometry.</td>
<td>6) Adjust tie rod lengths as required.</td>
</tr>
<tr>
<td></td>
<td>7) Improper (mismatched) tires and wheels.</td>
<td>7) Install correct tire and wheel combination.</td>
</tr>
</tbody>
</table>
Troubleshooting and Repair

• “Vehicle pulls to one side without the brakes applied”
  • Spartan has an inspection list. This will include:
    • Check Rear Axle Thrust Angle
      • Adjust the rear axle alignment per Spartan or ReycoGranning® procedure.
  • Front Suspension Toe Settings
    • Adjust the toe-in per the alignment procedure
    • Overall Toe-In of 1/8” total recommended
  • Steering Gear is on Center
  • Ride Height of Front and Rear Suspensions
  • Tire Pressure

• If problem persists, Contact Spartan
Alignment

• Industry standard alignment equipment is recommended
  • Both Josam and Protrak alignment equipment have been used by ReycoGranning® and Spartan
  • Calibration of alignment equipment is Critical

• Toe is adjustable on all units
  • IFS1200/1320/1370: use relay rod
  • IFS1050/1260/1460/1660: use outer tie rods

• All units equipped with Eccentrics
  • IFS1200/1320/1370: Upper control arms only
  • IFS1460/1660: Lower control arms only
  • IFS1050/1260: Both upper and lower control arms
Alignment: Caster and Camber

- Adjust using the Eccentrics
  - The set screw is orientated opposite to the control arm pivot bolt
    - Set screw closest to frame, the control arm pivot bushing is furthest from the frame
    - Set screw furthest from the frame, the control arm pivot bushing is closest to the frame

- To Adjust Camber:
  - Move both bushing sets of eccentrics on the control arm the same direction

- To Adjust Caster:
  - Move one bushing set opposite of the other bushing set on the control arm
Alignment: Caster

- More Caster: UCA pivot move back -and/or- LCA pivot move forward
- Less Caster: UCA pivot move forward -and/or- LCA pivot move back

King Pin Angle (or through ball joint centers)
Alignment: Camber

Less Camber
(Red shows negative camber)

UCA in
LCA out

More Camber
UCA out
LCA in
## Alignment: Caster and Camber Spec’s

<table>
<thead>
<tr>
<th>Model</th>
<th>Left Caster</th>
<th>Right Caster</th>
<th>Left Camber</th>
<th>Right Camber</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFS1050</td>
<td>+1/4°</td>
<td>+1/4°</td>
<td>2-1/4°</td>
<td>2-1/4°</td>
</tr>
<tr>
<td></td>
<td>±1/4°</td>
<td>±1/4°</td>
<td>±1/2°</td>
<td>±1/2°</td>
</tr>
<tr>
<td>IFS1200/1200S2</td>
<td>+1/4°</td>
<td>+1/4°</td>
<td>3°</td>
<td>3-1/2°</td>
</tr>
<tr>
<td></td>
<td>±1/4°</td>
<td>±1/4°</td>
<td>±1/2°</td>
<td>±1/2°</td>
</tr>
<tr>
<td>IFS1320/1370</td>
<td>+1/4°</td>
<td>+1/4°</td>
<td>3°</td>
<td>3-1/2°</td>
</tr>
<tr>
<td></td>
<td>±1/4°</td>
<td>±1/4°</td>
<td>±1/2°</td>
<td>±1/2°</td>
</tr>
<tr>
<td>IFS1260</td>
<td>+1/4°</td>
<td>+1/4°</td>
<td>3°</td>
<td>3°</td>
</tr>
<tr>
<td></td>
<td>±1/4°</td>
<td>±1/4°</td>
<td>±1/2°</td>
<td>±1/2°</td>
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<td>3°</td>
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<td></td>
<td>±1/4°</td>
<td>±1/4°</td>
<td>±1/2°</td>
<td>±1/2°</td>
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</table>
Alignment: Toe (IFS1050)
Alignment: Toe (IFS1260)

Tie Rods
Alignment: Toe (IFS1050/1260)

- Center the gearbox
- Loosen all four tie rod clamps
- Adjust the length of each tie rod until the toe-in on each side is 1/16” ± 1/32” and the overall toe-in is 1/8” ± 1/16”.
- Measure the length of each tie rod and adjust until the tie rods measure within 1/16” of each other.
- Orient the tie rod clamps as shown and retighten.
Alignment: Toe (IFS1200/1320/1370)

- Relay Rod
- Outer Tie Rods
- Stabilizer Shock
- U-Bolts
Alignment: Toe
(IFS1200/1320/1370)

- Measure Outer Tie Rods:
  - Lengths should be within 1/8” of each other.
  - If not, adjust length to 20-3/4” (center of grease fitting to grease fitting).

- Loosen Stabilizer Shock U-Bolts

- Loosen Relay Rod End Nuts
  - Nuts with notches in points are left handed threads.

- Rotate Relay Rod
  - Toe each side: 1/16” ± 1/32”
  - Overall Toe: 1/8” ± 1/16”
Alignment: Toe
(IFS1460/1660)

Tie Rods (note clamp orientation)
Alignment: Toe (IFS1460/1660)

- Loosen all four tie rod clamps
- Adjust the length of each tie rod until the toe-in on each side is \(1/16\)” \(\pm\) \(1/32\)” and the overall toe-in is \(1/8\)” \(\pm\) \(1/16\)”.
- Measure the length of each tie rod and adjust until the tie rods measure within \(1/16\)” of each other.
- Orient the tie rod clamps as shown and retighten.
Troubleshooting and Repair

• “Clunking noise during turns”
  • Loose components.
    • Check torque on all fasteners, especially bell crank and idler arm mounts, upper and lower control arm mounts, and steering gear box mounts.
    • Check torque on all steering tie rod components.
  • Excessive axial end play in bell crank and/or idler arm (IFS1200/1370 only)
    • Granning® kit 9898 provides shims and instructions.
Troubleshooting and Repair

Checking for Bell Crank/Idler Arm end play, per p/n 9898.

100122-P1 Torque to 475 ft-lbs. During reassembly

102354-P1 Washer Retaining Ring

8611 Shims Bearing Inner Race

89430596 Bolt

Inner Race Retaining Ring

Inner Sleeve

Check Shim Height Here
Troubleshooting and Repair

• “Vehicle ride is too soft”
  • This is subjective.
  • Motor home manufacturers and Spartan Motors have selected the current valving of the shock absorber.
  • IFS1200 units can use IFS1320 shock absorbers. This is not an warrantable item.

• “Vehicle pulls to one side with the brakes applied”
  • Uneven brake adjustment side to side.
    • Adjust slacks per Haldex guidelines.
  • Brake drum out of round.
    • Re-machine brake drums as required.
    • Brake drums can not be relined.
  • See “Vehicle pulls to one side without the brakes applied”.
Troubleshooting and Repair

• **Steering Adjustments**
  - For readjusting the Steering Gear Box Poppet valves refer to TRW’s TAS Steering Gear Service Manual.
  - Do not adjust the turn angle greater than maximum noted earlier
  - Unequal toe-in side to side or out-of-center steering gear can result in unequal turn angles.
    - Recommended to set Toe-In through the use of the Relay Rod
    - Check that the outer Tie-Rods are of equal length.
    - Check that the steering gear is centered with equal toe-in side to side.
    - Do not adjust the length of the Drag Link or Tie Rods to center the steering wheel.
Troubleshooting and Repair

• “Vehicle front end will not remain aired up overnight”
  • Air leaks.
  • Height Control Valves.
  • Contact Spartan for possible resolutions.
Troubleshooting and Repair

• “Broken shock absorber mounts” (IFS1200/1370)
  • Earlier units used “stud” style mounts.
  • Kit 9902 converts to “bolt” style mounts
Available Kits

• Eccentric Adapter Kit: 9890 (IFS1200/1370) (For one side)
• Bell Crank/Idler Arm Shim Kit:
  • 9898 (IFS1200/1320/1370)
  • K703991 (IFS1460/1660)
• Shock Absorber Mount Retrofit Kit: 9902 (IFS1200/1370)
• Brake Shoe and Lining Kits (ES420)
  • K702986 (IFS1200/1050/1260) Dana ES 15x4
  • K702988 (IFS1200 older) Dana XL15x4
  • K703828 (IFS1320/1370) Dana ES 16.5x5
  • K703829 (IFS1460) Dana ES 16.6x5
• IFS1200/1320/1370 Idler Arm Kit: K700382
• IFS1200/1320/1370 Bell Crank Kit: K700382 (not for IFS1200S2)
• Cradle Gusset Kits:
  • K700524 (IFS1320/1370)
  • K701017 (IFS1200)
• Carrier Bolt Kit (IFS1460): K704627
Contacting Tuthill

• For all Parts Inquiries, Warranty, or Technical Assistance:
• Call: 1-800-255-7824 (Customer Service)
• Fax: 1-219-279-2390 (Customer Service)
• Website: www.reycogranning.com
• Mail: Tuthill Transport Technologies
  P.O. Box 600
  Brookston, IN 47923
Contacting Spartan

• For all Parts Inquiries, Warranty, or Technical Assistance:
• Call:
  • 1-800-543-4277 (Motorhome Support)
  • 1-800-722-3025 (Parts)
• Email: RVCustservice@spartanmotors.com
• Website: www.spartanchassis.com
• Mail: Spartan Chassis
  1165 Reynolds Rd.
  Charlotte, MI 48813-0440