TL113037
INSTALLATION MANUAL FOR TELMA AF50-90
ON
NAVISTAR IC BUS CHASSIS WITH SPL100 U-JOINTS
and CUMMINS ENGINE SINGLE CANISTER EXHAUST
USING
ROTARY FOOT SWITCH FOR HYDRUALIC BRAKES
OR
OPTIONAL PRESSURE TRANSDUCER FOR AIR BRAKES
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SCOPE OF THIS MANUAL

This manual covers the installation of Telma into the NAVISTAR IC Bus chassis equipped with Spicer SPL100 driveline. This manual and the kit listed is not compatible with driveline u-joint sizes larger than SPL100 such as Spicer SPL140 or Spicer 1710. Contact Telma engineering support at engineering@telmacse.com for additional information or help with a Telma installation on a chassis equipped with these larger u-joint sizes.

Due to the nature of the Navistar IC Bus chassis which can have many different options which affect the driveline such as engine choice, transmission choice, air or hydraulic brakes, and air or spring suspension, if you do not find an installation drawing for your chassis configuration in the Installation drawing section it may be necessary to submit an installation drawing request using our Online Installation Drawing Request Form. TIL03019 Chassis Measurement Templates and TIL03020 Driveline Retarder Pre-Installation Measurement Guide can be used as worksheets to gather the necessary information. Contact Telma engineering support at engineering@telmacse.com if you have any questions.

SECTION 1  PREPARATION OF THE CHASSIS

1.1 DRIVELINE
Remove the complete drive-shaft assembly after measurements have been taken.

1.2 EXHAUST
Remove the exhaust just past the DPF sensors.
### SECTION 2  RETARDER INSTALLATION

#### 2.1 INSTALLATION KIT TIK11212

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY</th>
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<tbody>
<tr>
<td>LBA101158</td>
<td>AF50-90 12V 1480/1550/1610</td>
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<tr>
<td>JZ1007XX-45</td>
<td>Rubber mount kit</td>
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<tr>
<td>TIB01017</td>
<td>CONTROL/RELAY BOX BRACKET</td>
<td>2</td>
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<tr>
<td>TIB01039</td>
<td>Navistar rotary switch bracket</td>
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<tr>
<td>TIB03100</td>
<td>Control Module Bracket</td>
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<tr>
<td>TIB03104</td>
<td>UNIVERSAL CHASSIS BRACKET</td>
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<tr>
<td>TIB03107</td>
<td>TOP WASHER FOR AXIAL RETARDER BRACKET</td>
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<tr>
<td>TIB07010</td>
<td>AF5 retarder bracket - Zero Degrees</td>
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<td>TID15001</td>
<td>Complete wiring harness for AD5-6 retarders</td>
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<tr>
<td>TIF01064</td>
<td>hex head bolt 1/4 - 28 x 1.25 grade 8 yellow zinc for TRCM mounting</td>
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<td>nylon insert locknut 1/4-28UNF for TRCM mounting</td>
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<td>TIF01068</td>
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<td>TIF01070</td>
<td>7/16 - 14 serrated flange nut</td>
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<td>all metal lock nut 3/8-24UNF</td>
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<td>TIF05010</td>
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<tr>
<td>TIF05011</td>
<td>NUT 5/16</td>
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<tr>
<td>TIF05012</td>
<td>BOLT 5/16-18UNC x 1-3/4 HEX HEAD G5</td>
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<td>LOCK WASHER 1/2 MED SPLIT</td>
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<td>TIF05025</td>
<td>5/8-18 x 2 GRADE 8 HEX FLANGE CAP SCREW</td>
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<td>5/8-18 GRIP FLANGE LOCKNUT</td>
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<tr>
<td>TIF05031</td>
<td>1/2 - 20 X 1.75 flanged head bolt</td>
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</tr>
<tr>
<td>TIF05032</td>
<td>1/2 - 20 flanged nut</td>
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<tr>
<td>TIF07001</td>
<td>M12 x 1.75 x 35 Grade 10.9 DIN 933 Black Phosphate 200+ Salt</td>
<td>6</td>
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<tr>
<td>TIG11010</td>
<td>TELMA LIGHT BAR DISPLAY</td>
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**Note1:** SPL90 flange yokes 2 x Spicer part number 90-2-19 must be ordered separately.

**Note2:** For air brake applications it is recommended to order pressure transducer TIG31065 and universal transducer harness TID11051 to use in place of rotary foot switch included in the kit.
2.2 INSTALLATION OF THE CHASSIS BRACKETS

- Remove any bolts such as battery box and/or exhaust hanger mounts that will interfere with the chassis bracket mounting.
- Mark the reference hole at dimension T1 from the outside top of the frame down to the reference hole and at dimension CC from the center of the transmission U-joint.
- Drill a 5/8” hole in the frame and bolt the chassis bracket (TIB03104) against the outside of the frame rail using the reference hole in the bracket.
- Rotate the bracket to the angle specified on the installation drawing and tighten the reference bolt and nut to 150 lb-ft (±10%) to hold the bracket in place at the correct angle.
  Note: Use an electronic angle meter with 0.1° accuracy (e.g. SPI Pro 360 digital protractor). Calibrate the angle meter using the frame rail to set an alternate reference so that all angles measured are with frame reference of 0°. In order to maintain calibration, do not rotate the angle meter in the horizontal plane after calibration.
- Drill four 1/2” holes in each chassis bracket and frame rail evenly distributed across the chassis bracket using existing holes when possible. Keep away from fuel and brake lines and secure with the 1/2”-20UNF x 1.75” flanged bolts (TIF05031) and 1/2”-20UNF flanged lock nuts (TIF05032) included in the kit. Tighten to 100 lb-ft (±10%).
- Drill through the chassis bracket any holes needed for battery box and/or exhaust hanger mounts and reinstall the original bolts that were previously removed.
2.3 RETARDER BRACKET INSTALLATION

- Attach the retarder brackets TIB07010 to the retarder as shown below according to the position indicated on the installation drawing.
- Use three of the M12x1.75x35mm bolts with nylon patch lock (TIB07001), and Trep washers (VF201400) provided with the kit to fasten each Telma bracket onto the side of the unit. Tighten bolts to 35 lb.-ft. (±5 lb-ft).
2.4 INSTALLATION OF THE TELMA IN THE CHASSIS

- Assemble the mounts to the Telma brackets as shown below with the male portion of the mounts on the bottom side of the brackets.
- Use fasteners included in the rubber mount kit JZ1007XX-45 to attach the Telma and bracket assembly to the chassis brackets which were installed previously.
- Install the Telma, equipped with the brackets and rubber mounts to the chassis brackets in the hanging position.
- As shown below, secure the Telma to the chassis bracket using the M16x2.0x110mm long bolts through the holes in the chassis brackets, mounts and retarder brackets. At each mount, install two M16x71mm (2.80") diameter flat washers (one on each end of the rubber mount, one M16 spring washer under the head of the bolt and another between the large diameter flat washer and the M16 all metal lock nut. Tighten to 150 lb.-ft. (±10%).
- Place ¼" square washer TIB03107 on top of chassis bracket at each mount and tack weld in place after retarder is in final position.
2.5 END and TOP VIEW - TELMA INSTALLED IN CHASSIS

- 5 x ø 1/2" BOLTS 100 lb-ft
- TRIM EXCESS ABOVE FRAME
- DRIVER SIDE 150 lb-ft

- 1/4" SQUARE WASHER TIB030107 ON TOP OF CHASSIS BRACKET AT EACH MOUNT
- WELD IN PLACE AFTER RETARDER IS IN FINAL POSITION
2.6 DRIVE SHAFT MODIFICATION AND INSTALLATION

- A slip assembly is required on each side of the Telma. The slip position should be at center of slip travel when the shaft is installed.
- Refer to chassis manufacturers guidelines for proper drive shaft manufacture, balance, straightness, and critical speed limits.
- Refer to the installation drawings in the appendix for approximate shaft lengths.
- Always verify proper shaft lengths before modification.
- Connect the flange yoke to the Telma coupling flange using 3/8-24UNF all metal locknuts TIF03001.

**FRONT DRIVE SHAFT 1-1 OR 1-2 CONFIGURATION**

**REAR DRIVE SHAFT 1-1 CONFIGURATION**

**REAR DRIVE SHAFT 1-2 CONFIGURATION**

**FOLLOW DANA-SPICER GUIDELINES PERTAINING TO MANUFACTURE, STRAIGHTNESS, DYNAMIC BALANCING AND CRITICAL SPEED. ALWAYS VERIFY SHAFT LENGTHS BEFORE MODIFICATION**
2.7 EXHAUST MODIFICATION

- Loosen the clamp and rotate pipe with the bends after the exhaust sensors.
- Rotate the exhaust pipe outboard to clear Telma.
- After the Telma bring the exhaust back to the original position in accordance with Navistar document G-2481 (Exhaust Modifications Allowed) estimated to require (2) 45 degree bends.
- Reuse existing exhaust hangers and positions as much as possible.
SECTION 3 CONTROL SYSTEM COMPONENTS INSTALLATION

3.1 RELAY BOX MOUNTING

- Mount the relay box brackets 2 x TIB01017 to the relay box using the 5/16” bolts, nuts, and lock washers supplied in the kit.
- Mark and drill two ½” holes in the frame using the relay box and bracket assembly as a guide. Install the relay box and bracket assembly to the inside of the left frame rail using the ½” bolts and lock washers supplied in the kit.
- Tighten the four 5/16” bolts to 17 lb-ft (±10%) and the two ½” bolts to 75 lb-ft (±10%).

NOTE: Brackets TIB01017 are not needed if the relay box is to be mounted to the outside of the frame rail.

3.2 LIGHT BAR INSTALLATION

- The Light Bar should be mounted so that it is easily visible to the driver.
- Make a rectangular hole, 7/8” wide x 1 ¾” tall in the lower dash to the right of the steering column or install the Light Bar in an existing console receptacle.
- Feed the harness through the hole and connect to the Light Bar.
- Plug the light bar into the hole.

![Diagram of relay box and light bar installation](image-url)
3.3 TRCM INSTALLATION

Mount the TRCM to the left side of the steering column using an existing hole and bracket TIB03100 high enough and with wiring oriented to be away from driver interference.

Green diagnostics connector indicates 500k baud rate setting is needed
3.4 ROTARY FOOT SWITCH INSTALLATION FOR HYDRAULIC BRAKE APPLICATIONS

Step 1
Install rotary switch (TIG31066) to bracket (TIB01039) using TIF01067 M4x0.7x20mm hex head bolt and TIF01068 wave washer as shown below. Tighten to 12 lb-in ±10%.

Step 2
Locate existing OEM hole and pedal stop.

Step 3
Using the OEM hole, align the hole in the bracket and secure it with the 7/16-14UNCx1” bolt (TIF01069) and 7/16 nut (TIF07003) provided in the kit. Be sure the cut out in the bracket rests against the pedal stop when tightening the bolt.
3.5 PRESSURE TRANSDUCER INSTALLATION FOR AIR BRAKE APPLICATIONS

For air brake applications it is recommended to use the pressure transducer instead of the rotary switch. The transducer should be installed in the primary delivery line of the brake pedal valve.

Order pressure transducer TIG31065 and universal transducer harness TID11051 in addition to main installation kit TIK11212. Connect using wiring diagram TL134057.
SECTION 4  WIRING HARNESS INSTALLATION

4.1 HARNESS ASSEMBLY TID15001

- Light Bar TJD1010
- TRCM
- Cab Harness
- Power Harness
- Cut off 0002 pass through
  - Connect red/wht to 10N+
  - Connect blk to ground
  - Connect red to J1939 CAN Lo
  - Connect pink to J1939 CAN Hi
- Relay box ground cable
4.2 POWER HARNESS INSTALLATION

- From the relay box, route the Telma power connection and ground harness along the inside of the frame rail and up over the top along the middle of the Telma.
- Connect the 8G orange, blue, yellow, and brown wires to the connecting block at the top right corner.
- Connect the 8G relay box ground cable and the 2G Telma main ground cable to the insulated ground terminal at the Telma top left corner. Coat the terminals with anti-corrosion paint or body undercoat after the connections are made.
- Secure the harness to the center of the Telma brackets with rubber coated cable clamps. The harness should be secured along the centerline of the Telma and as far away as possible from either rotor to avoid heat damage to the harness. No cables should cross the heat outlets in the periphery of the rotors.
- Connect the black 2G ground cable and to negative terminal of the battery pack or frame mounted battery pack ground point. Secure the cable with rubber coated cable clamps.
- Connect the red 2G power positive cable to the positive terminal of the battery pack or battery disconnect switch. Secure the cable with rubber coated cable clamps.
4.3 CAB HARNESS MODIFICATION AND INSTALLATION

- Cut off the OBD2 pass through part of the cab harness.
- Connect the red/wht wire in the cab harness to ign+.
- Connect the blk wire to ground.
- Connect the red wire to J1939 CAN LO (refer to the wiring diagram for details)
- Connect the pnk wire to J1939 CAN HI (refer to the wiring diagram for details)

- Route the control harness into the cab through a hole with rubber grommet in the fire wall.
- Separate the four wires (org, blu, yel, brn) found in the relay box control harness and install into the white AMP mating connector marked “TO RELAY BOX”.
- Separate the five wires (org/wht, blu/wht, yel/grn, brn/wht, blk) found in the relay box control harness route to the Light Bar mounting position and into the Light Bar mating connector positions 1-5 respectively.
- Feed the harness equipped with the light bar mating connector through the light bar hole and plug in the Light Bar.
- Plug the light bar into the hole.
4.4 WIRING DIAGRAM WITH ROTARY SWITCH

TL134064
WIRING DIAGRAM
TRCM
AND J1939 with rotary switch for hydraulic brake systems
16aug16h

NAVISTAR IC BUS with Cummins engine and SPL90 U-JOINTS, TELMA AF50-90, and TRCM

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7jun17jh
4.5 WIRING DIAGRAM WITH PRESSURE TRANSDUCER FOR VEHICLES WITH AIR BRAKES
4.6 TRCM CONFIGURATION

- After final installation of the wiring, connect the PC to configure the Telma Control Module (TRCM) and check proper function.
- Use the Telma Desktop Client Software to change transducer set points. If you have never taken advantage of using the Telma Desktop Client Software for configuration and diagnosis of the Telma system, you will need to download this free software from our website.
  - If you do not have a 9 pin serial port on your computer you will need to order a usb-to-serial port adapter TIG01027.
  - If your computer has a 9 pin serial port you will need a straight through DB9 Male to DB9 Female serial extension cable (e.g. Belkin F2N209).
- The voltage set points recommended in the installation manual may need to be adjusted.
- Observe the transducer voltage in the diagnostics page when the brake pedal is not being applied. 1st stage voltage setting should be above this voltage.
- Observe the transducer voltage in the diagnostics page with the engine running and the brake pedal pushed with your hand until you begin to feel resistance from the brake pedal. The last Telma stage voltage setting should be below this voltage.
- Check that desired configuration changes show up on the “Current Values” side of the configuration screen indicating that the TRCM was updated. Occasionally it may be necessary to push the “Send All Config” or power cycle the TRCM by turning the ignition switch off and then back on for the current values to update. The picture below shows the typical set points when using the rotary switch. For air brake vehicles if the pressure transducer is used as recommended the set points should be set to stage1=1.3, stage=1.5, stage3=1.7, and stage4=1.9.
- Road test the vehicle to verify proper and desired function of the Telma system with the new rotary foot switch.
SECTION 5  RECOMMENDED TOOLS

- Transmission Jack
- Heavy duty drill motor
- Standard assortment of mechanics hand tools
- Vehicle hoist, pit, or floor jack with stands
- Electrical terminal crimping pliers for use with non-insulated terminals
- Electronic angle meter with 0.1° accuracy (e.g. SPI Pro 360 digital protractor)
## INSTALLATION FOLLOWUP CHECKLIST

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<th>CHASSIS #:</th>
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<tbody>
<tr>
<td>CHASSIS MAKE/MODEL:</td>
</tr>
<tr>
<td>Telma part number:</td>
</tr>
<tr>
<td>Telma Serial number:</td>
</tr>
<tr>
<td>End Customer:</td>
</tr>
<tr>
<td>INSTALLER:</td>
</tr>
<tr>
<td>INSPECTION DATE:</td>
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<tr>
<td>INSPECTED BY:</td>
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Retain a copy of this checklist in the chassis VIN record
Record Telma serial number in electronic VIN record

### ELECTRICAL

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<th>Comments</th>
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<tr>
<td>Harness properly routed along center of Telma away from rotors and secured with cable clamps to retarder bracket X</td>
</tr>
<tr>
<td>Minimum 1/4” clearance between chassis bracket and retarder bracket</td>
</tr>
<tr>
<td>Harnesses routed on inside of frame rail away from heat sources, sharp edges, etc. and secured with rubber coated metal cable clamps</td>
</tr>
<tr>
<td>Correct cable eyelet size at battery / disconnect switch</td>
</tr>
<tr>
<td>Relay box mounted vertical with wiring exiting from the bottom and can be easily accessed</td>
</tr>
<tr>
<td>Telma battery power cable connected to battery switch or to battery “+” terminal and is protected with corrosion inhibitor</td>
</tr>
<tr>
<td>Telma battery ground cable connected to frame rail bare metal surface where battery pack is grounded or directly to battery ground post and protected with corrosion inhibitor</td>
</tr>
<tr>
<td>Relay box ground connected to retarder ground post</td>
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<tr>
<td>Electrical connections (weatherproof connectors, no quick splice, avoid butt connectors)</td>
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<tr>
<td>Light Bar Display installed correctly, visible to driver, and operates properly</td>
</tr>
<tr>
<td>Telma Control Module accessible and secured with screws</td>
</tr>
<tr>
<td>Telma foot control shuts off automatically at 1mph</td>
</tr>
<tr>
<td>Telma activates when moving and brakes are applied</td>
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<tr>
<td>Connect PC to TRCM to check proper configuration and function</td>
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### MECHANICAL

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<td>All fasteners are paint marked after tightening to proper torque</td>
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<tr>
<td>Cables, hoses and air lines are at least 4” from rotors or heat shield installed</td>
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<tr>
<td>Drive shaft weld quality, slip installed on each side of Telma at center of travel, balance, u-joints same quality as OEM</td>
</tr>
<tr>
<td>Transmission angle measurement</td>
</tr>
<tr>
<td>Telma angle measurement</td>
</tr>
<tr>
<td>First shaft angle and installed length measurement</td>
</tr>
<tr>
<td>Second shaft angle and installed length measurement</td>
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<tr>
<td>Third shaft angle and installed length measurement</td>
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<td>Fourth shaft angle and installed length measurement</td>
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<td>Axle angle measurement</td>
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<tr>
<td>Drive shaft lengths/angles, transmission, Telma, and axle angle conform to drawing</td>
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<tr>
<td>Flange yokes are in same plane</td>
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SECTION 7
INSTALLATION DRAWINGS

(SUBMIT INSTALLATION DRAWING REQUEST ON OUR WEBSITE FOR DRAWINGS NOT INCLUDED)
**NAVISTAR IC BUS with Cummins engine and SPL90 U-JOINTS, TELMA AF50-90, and TRCM**

### VEHICLE TECHNICAL DATA

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<thead>
<tr>
<th>CHASSIS MAKE / MODEL</th>
<th>NAVISTAR HC</th>
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<td>VOCATION SHUTTLE</td>
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**Note:** If any of the above mentioned factors vary with your application, please call our TECHNICAL DEPARTMENT.

### Reference Hole

- **CC1**
- **T1**

### Transmission and Chassis Bracket Angles

- **Transmission:** 4.5°
- **Chassis Bracket:** 2.5°
- **Retarder:** 2.5°
- **Rear Axle Loaded:** 6.6°
- **Rear Axle Unloaded:** 6.6°
- **L1:** 3.3°
- **L2:** 6.6°

### Dimensions

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**CAUTION:**

- NOTE 1: L1 and L2 are measured from center of U-joint and are installed lengths.
- NOTE 2: All drive shafts must be dynamically balanced after modification.
- NOTE 3: When not specified, the front & the rear drive shafts, on each retarder side, must have at least the same slip as the original driveshaft.
- NOTE 4: When not specified, the flange yoke on each retarder side must have the maximum working angle capacity available in the driveline series concerned.
- NOTE 5: **USE MOUNTING BRACKETS TIB03104, TIB07010**
- NOTE 6: **USE RETARDER BRACKET POSITION 2 (AF)**
- NOTE 9: adjust retarder to angle indicated by rotating bracket
- NOTE 10: bottom of frame to bottom of air bag air bag should be 15.25" for 2.5 deg axle angle. Check and adjust if necessary.
- NOTE 11: Check and adjust air bag height if necessary. Dimension from bottom of frame to bottom of air bag should be 15.25".
VEHICLE TECHNICAL DATA

CHASSIS MAKE / MODEL: NAV HC  
ENGINE MAKE / MODEL: CUMMINS B 6.7  
TRANSMISSION MAKE / MODEL: ALLISON 2200PTS  
AXLE MAKE / MODEL: MERITOR RS17145  
DRIVE TYPE: 4x2  
RETARDER MODEL: AF50-90  
ENGINE Vin: VEHICLE NUMBER:  
CHASSIS VIN:  
VEHICLE NUMBER:  
WHEELBASE: 217.0"  
CONTROL MODULE: TRCM  
TIRESIZE: 245/70R-19.5  
AXLE RATIO: 4.33  
GVW / GCW: 23500 lbs  
HOURS AT TIME OF INSTALL:  
DRIVE TYPE: 4x2  
VOCATION: SHUTTLE  
DRIVE TYPE: 4x2  
VOCATION: SHUTTLE  
SUSPENSION TYPE: AIR  
AIR  
RETARDER MODEL: AF50-90  
ABS: WABCO  
AXLE RATIO: 4.33  
DRIVE LINE SERIES: SPL100  
FLANGE YOKE: 90-2-19  
NOTE: If any of the above mentioned factors vary with your application, please call our TECHNICAL DEPARTMENT.

CAUTION:
NOTE 1: L1, L2 and L3 are measured from center of U-joint and are installed lengths.  
NOTE 2: All drive shafts must be dynamically balanced after modification.  
NOTE 3: When not specified, the front & the rear drive shafts, on each retarder side, must have at least the same slip as the original drive shaft  
NOTE 4: When not specified, the flange yoke on each retarder side must have the maximum working angle capacity available in the driveline series concerned.  
NOTE 5: After installation is completed, measure drive shaft angles and compare to the angles on the installation drawing. Contact TELMA Customer Support Engineering if the angles measured do not conform to the drawing  
NOTE 6: USE MOUNTING BRACKETS TIB03104, TIB07010  
NOTE 7: USE BRACKET POSITION 2 (AF)  
NOTE 8: ADJUST CARRIER BEARING SO THAT SECOND SHAFT SHAFT (L2) IS 3.0°  
NOTE 9: ADJUST CARRIER BEARING SO THAT OFFSET MATCHES TELMA OFFSET  
NOTE 10: CHANGE L3 ORIGINAL SHAFT LENGTH  
NOTE 11: Check and adjust air bag height if necessary. Dimension from bottom of frame to bottom of air bag should be 15.25".