Spicer® Commercial Vehicle
Driveline Application Guidelines
Driveline Sizing
   Specifying a Spicer Driveline ........................2
   Application Definitions ..............................2
   Calculating Maximum Driveshaft Torque
   Domestic Applications .............................3
   Export Applications ...............................5
   Application Guidelines ..............................6
   10-Series Graph .....................................6
   SPL Graph ............................................7
   SPL Interaxle Graph ................................8

Critical Speed
   Critical Speed .........................................9
   Standard Equation ....................................9
   Simplified Equations ................................9
   Adjusted Critical Speed ..........................10
   Maximum Driveshaft Length ......................11
   Spicer Standard Tube Sizes .....................12

Center Bearing Mounting
   Center Bearing Mounting ..........................13

Driveline Analysis
   Driveline Analysis ..................................14
   Design Criteria ....................................14
   Torsional and Inertial Excitation ..............14
   Center Bearing Loading ............................18
   Joint Life vs. Joint Angles .....................20

Appendix
   Application Form ..................................21
   End Yoke Dimensions ..............................23
   Attaching Hardware and Torque Specs ........28
Specifying a Spicer Driveline

Application Definitions

• Domestic applications - restricted to the continental United States, Canada, Australia and New Zealand.
  
  - On-highway - operation on well-maintained, concrete and asphalt roadways including turnpikes, interstates, and state routes with not more than 10% off-highway operation.
  
  - Off-highway - operation on unimproved dirt or gravel roads, as well as, poorly maintained paved roads, more than 10% of the time.
  
  - Line haul - operation on well maintained concrete and asphalt roadways including turnpikes, interstates, and state routes 100% of the time with a maximum 80,000 lb. GCW.

• Export applications - outside of the continental United States, Canada, Australia and New Zealand.

  Driveline sizing for export applications is based on Maximum Driveshaft Torque only. (see "Calculating Maximum Driveshaft Torque (Export Applications)" on page 5)
Calculating Maximum Low Gear Torque

Step 1 - Low Gear Torque Calculation
\[ \text{LGT} = T \times \text{TLGR} \times \text{TE} \times \text{SR} \times \text{TCR} \times \text{C} \]

- \( \text{LGT} = \) Maximum Driveshaft Low Gear Torque
- \( T = \) Net Engine Torque or 95\% of the Gross Engine Torque
- \( \text{TLGR} = \) Transmission Low Gear Ratio (forward)*
- \( \text{TE} = \) Transmission Efficiency (automatic = 0.8; manual = 0.85)
- \( \text{SR} = \) Torque Converter Stall Ratio (if applicable)
- \( \text{TCR} = \) Transfer Case or Auxiliary Transmission Ratio (if applicable)
- \( \text{C} = \) Transfer Case Efficiency (if applicable, 0.95)

* Some applications require deep reduction transmissions for speed-controlled operations such as paving and pouring. In these applications it may be more appropriate to use the second lowest forward transmission ratio to calculate the Maximum Low Gear Torque. To use the second lowest forward gear ratio to calculate LGT, all three of the following conditions must be met:
  1. Lowest forward gear ratio numerically greater than 16:1.
  2. Split between the lowest forward gear ratio and the second lowest forward gear ratio is greater than 50\%.
  3. Startability Index must be greater than 25 (see below calculation).

Startability Index Calculation
\[ \text{SI} = \frac{(T \times \text{TR} \times \text{AR} \times \text{TCR} \times 942.4)}{(\text{RR} \times \text{GCW})} \]

- \( \text{SI} = \) Startability Index
- \( T = \) Engine Clutch Engagement Torque at 800 RPM
- \( \text{TR} = \) Transmission Second Lowest Forward Gear Ratio
- \( \text{AR} = \) Axle Ratio
- \( \text{TCR} = \) Transfer Case or Auxiliary Transmission Ratio (if applicable)
- \( \text{RR} = \) Tire Rolling Radius (in)
- \( \text{GCW} = \) Maximum Gross Combination Weight (lbs)

Step 2 - Wheel Slip Calculation
\[ \text{WST} = \frac{(.71 \times \text{W} \times \text{RR})}{(11.4 \times \text{AR})} \]

- \( \text{WST} = \) Wheel Slip Torque Applied to the Driveshaft
- \( \text{W} = \) Axle Capacity (lbs)
- \( \text{RR} = \) Tire Rolling Radius (in)
- \( \text{AR} = \) Axle Ratio
Step 3 - Gradeability Calculation
Calculate the torque required for 25% gradeability.

Note: For Linehaul applications with 3.10 axle ratio or numerically larger only.

\[ GT = \left(0.265 \times RR \times GVW\right) / \left(11.4 \times AR\right) \]

- GT = Net Driveline Torque at 25% Gradeability
- RR = Tire Rolling Radius (in)
- GVW = Gross Vehicle Weight (lbs)
- AR = Axle Ratio

Step 4 - Overall Low Gear Ratio Calculation
\[ OLGR = TLGR \times SR \times TCR \]

- OLGR = Overall Low Gear Ratio
- TLGR = Transmission Low Gear Ratio
- SR = Torque Converter Stall Ratio (if applicable)
- TCR = Transfer Case or Auxiliary Transmission Ratio (if applicable)

Step 5 - Driveline Series Selection
To select a driveline series:

1. Plot the torque values determined from Steps 1, 2, and 3 with the overall low gear ratio (OLGR) from Step 4 on the appropriate graph for Ten Series or SPL Series in the Applications Guidelines section on pages 6 & 7.

2. To determine the appropriate driveline series for SPL or 10 Series using the Application Guidelines graphs on pages 6 & 7, use the smallest series for the main driveline as determined from Steps 1, 2, and 3.

Note: The selected driveline series can not be more than one series smaller than the series selected from Step 1 (LGT).

Step 6 - Specifying the Interaxle Driveline (if applicable)
To specify the interaxle driveline, use:

1. 60% of the Driveline Series Selection torque from Step 5 and the OLGR from Step 4.

2. Find the appropriate interaxle driveline series for SPL using the Driveline Sizing graph under "Application Guidelines" on page 8, and for Ten Series using the Driveline Sizing graph under "Application Guidelines" on page 6.

Note: High angle (45°) interaxle drivshafts are available in SPL170, SPL250 and 1710 Series only.
Calculating Maximum Driveshaft Torque for Export Applications

**Step 1 - Low Gear Torque Calculation**

\[ \text{LGT} = T \times \text{TLGR} \times \text{TE} \times \text{SR} \times \text{TCR} \times \text{C} \]

- LGT = Maximum Driveshaft Low Gear Torque
- \( T \) = Net Engine Torque or 95% of the Gross Engine Torque
- \( \text{TLGR} \) = Transmission Low Gear Ratio (forward)
- \( \text{TE} \) = Transmission Efficiency (automatic = 0.8; manual = 0.85)
- \( \text{SR} \) = Torque Converter Stall Ratio (if applicable)
- \( \text{TCR} \) = Transfer Case or Auxiliary Transmission Ratio (if applicable)
- \( \text{C} \) = Transfer Case Efficiency (if applicable, 0.95)

**Step 2 - Overall Low Gear Ratio Calculation**

\[ \text{OLGR} = \text{TLGR} \times \text{SR} \times \text{TCR} \]

- \( \text{OLGR} \) = Overall Low Gear Ratio
- \( \text{TLGR} \) = Transmission Low Gear Ratio
- \( \text{SR} \) = Torque Converter Stall Ratio (if applicable)
- \( \text{TCR} \) = Transfer Case or Auxiliary Transmission Ratio (if applicable)

**Step 3 - Driveline Series Selection**

To select a driveline series:

1. Plot the torque value determined from Step 1 with the overall low gear ratio (OLGR) from Step 2 on the appropriate graph for 10 Series or SPL Series in the "Applications Guidelines" section on pages 6 & 7.

**Step 4 - Specifying the Interaxle Driveline (if applicable)**

To specify the interaxle driveline, use:

1. 60% of the Driveline Series Selection torque from Step 1 and the OLGR from Step 2.
2. Find the appropriate interaxle driveline series for SPL using the Driveline Sizing graph, under "Application Guidelines" on page 8, and for 10 Series using the Driveline Sizing graph, under "Application Guidelines" on page 6.

**Note:** High angle (45°) interaxle driveshafts are available in SPL170, SPL250 and 1710 Series only.
Application Graphs

10 Series Graph
SPL Series Graph
SPL Interaxle Series Graph

SPL SERIES
INTERAXLE APPLICATION GUIDELINES

MAX. NET DRIVESHAFT TORQUE

LOW GEAR RATIO

SPL250

SPL170

N\text{m}
Lb.\text{ft.}

21,000
15,490

15,000
11,064

10,000
7,375

2,000
1,475

4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Critical Speed

Critical speed is defined as: The speed at which the rotational speed of the driveshaft coincides with the natural frequency of the shaft.

Standard Equation

\[ CS = 30 \pi \sqrt{\frac{E \times 386.4 \left( O^2 + I^2 \right)}{P \times L^4 \times 16}} \]

- \( CS \) = Critical Speed
- \( E \) = Modulus of tubing material (psi)
- \( O^* \) = Outside Diameter of Tubing (in)
- \( I^* \) = Inside Diameter of Tubing (in)
- \( P \) = Density of Tubing Material (lbs/in³)
- \( L \) = Distance Between Journal Cross Centers (in)

* Refer to "Spicer Standard Tube Sizes" on page 11 for tube dimensions.

Material Properties

<table>
<thead>
<tr>
<th>Material</th>
<th>Modulus</th>
<th>Density</th>
<th>E/P x 386.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>30.00 x 10⁶</td>
<td>0.2830</td>
<td>41.0 x 10⁹</td>
</tr>
<tr>
<td>Aluminum</td>
<td>10.30 x 10⁶</td>
<td>0.0980</td>
<td>39.4 x 10⁹</td>
</tr>
</tbody>
</table>

Simplified Equations

Steel:

\[ CS = \frac{4.769 \times 10^6}{L^2} \sqrt{O^2 + I^2} \]

Aluminum:

\[ CS = \frac{4.748 \times 10^6}{L^2} \sqrt{O^2 + I^2} \]

- \( CS \) = Critical Speed
- \( L \) = Distance Between Journal Cross Centers (in)
- \( O \) = Outside Diameter of Tubing (in)
- \( I \) = Inside Diameter of Tubing (in)
Adjusted Critical Speed (Maximum Safe Operating Speed)

**ACS = TC x CF x SF**

- ACS = Adjusted Critical Speed
- TC = Theoretical Critical
- CF = Correction Factor
- SF = Safety Factor

Suggested factors for Adjusted Critical Speed:

- Safety Factor = 0.75
- Correction Factor
  - Outboard Slip = 0.92
  - Inboard Slip = 0.75

**Note:** The value for ACS (Maximum Safe Operating Speed) must be greater than the maximum driveshaft speed of the vehicle.
Maximum Driveshaft Length

Refer to the chart at the bottom of this page for maximum driveshaft length vs. RPM guidelines. This information can also be found in TMC Recommended Practice RP610A Chart 3.

The general length limitations are as follows:

<table>
<thead>
<tr>
<th>Tube O.D. (mm)</th>
<th>Maximum Length * (inches, mm)</th>
<th>Driveline Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0 in. (76.2 mm)</td>
<td>60 in. (1524 mm)</td>
<td>SPL32, SPL36</td>
</tr>
<tr>
<td>3.5 in. (88.9 mm)</td>
<td>65 in. (1651 mm)</td>
<td>SPL55, SPL70</td>
</tr>
<tr>
<td>4.0 in. (101.6 mm)</td>
<td>70 in. (1778 mm)</td>
<td>1710, 1760, SPL100</td>
</tr>
<tr>
<td>4.21 in. (107.0 mm)</td>
<td>72 in. (1829 mm)</td>
<td>SPL140</td>
</tr>
<tr>
<td>4.33 in. (110.0 mm)</td>
<td>73 in. (1854 mm)</td>
<td>SPL140HD</td>
</tr>
<tr>
<td>4.5 in. (114.3 mm)</td>
<td>75 in. (1905 mm)</td>
<td>1710, 1810</td>
</tr>
<tr>
<td>4.66 in. (118.4 mm)</td>
<td>80 in. (2032 mm)</td>
<td>SPL250 Lite HT</td>
</tr>
<tr>
<td>4.72 in. (120.0 mm)</td>
<td>80 in. (2032 mm)</td>
<td>SPL350 Lite HT</td>
</tr>
<tr>
<td>5.0 in. (127.0 mm)</td>
<td>80 in. (2032 mm)</td>
<td>SPL170, SPL250</td>
</tr>
<tr>
<td>5.5 in. (140 mm)</td>
<td>83 in.</td>
<td>SPL350, SPL350HD</td>
</tr>
</tbody>
</table>

* Installed length u-joint center to u-joint center.
## Spicer Standard Tube Sizes

<table>
<thead>
<tr>
<th>Series</th>
<th>Tube Size (in)</th>
<th>Dana Part Number</th>
<th>Torque Rating (lbs. ft.)</th>
<th>Tube JAEL (lbs. ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1610</td>
<td>4.00 x .134</td>
<td>32-30-52</td>
<td>5,700</td>
<td>8,600</td>
</tr>
<tr>
<td>1710</td>
<td>4.00 x .134</td>
<td>32-30-52</td>
<td>7,700</td>
<td>8,600</td>
</tr>
<tr>
<td>1710 HD</td>
<td>4.09 x .180</td>
<td>32-30-72</td>
<td>10,200</td>
<td>13,925</td>
</tr>
<tr>
<td>1760</td>
<td>4.00 x .134</td>
<td>32-30-92</td>
<td>10,200</td>
<td>10,435</td>
</tr>
<tr>
<td>1760 HD</td>
<td>4.09 x .180</td>
<td>32-30-72</td>
<td>12,200</td>
<td>13,925</td>
</tr>
<tr>
<td>1810</td>
<td>4.50 x .134</td>
<td>36-30-62</td>
<td>12,200</td>
<td>13,065</td>
</tr>
<tr>
<td>1810 HD</td>
<td>4.59 x .180</td>
<td>36-30-102</td>
<td>16,500</td>
<td>17,935</td>
</tr>
<tr>
<td>SPL 90</td>
<td>4.00 x .095</td>
<td>32-30-12</td>
<td>4,900</td>
<td>6,300</td>
</tr>
<tr>
<td>SPL 100</td>
<td>4.00 x .095</td>
<td>32-30-12</td>
<td>5,700</td>
<td>6,300</td>
</tr>
<tr>
<td>SPL 140</td>
<td>4.21 x .138</td>
<td>100-30-3</td>
<td>7,744</td>
<td>11,010</td>
</tr>
<tr>
<td>SPL 140 HD</td>
<td>4.33 x .197</td>
<td>100-30-5</td>
<td>11,063</td>
<td>16,519</td>
</tr>
<tr>
<td>SPL 170</td>
<td>4.96 x .118</td>
<td>120-30-3</td>
<td>12,539</td>
<td>13,185</td>
</tr>
<tr>
<td>SPL 170 HD</td>
<td>5.06 x .167</td>
<td>120-30-4</td>
<td>14,751</td>
<td>19,617</td>
</tr>
<tr>
<td>SPL 170 I/A</td>
<td>4.59 x .180</td>
<td>36-30-102</td>
<td>11,063</td>
<td>17,935</td>
</tr>
<tr>
<td>SPL 250 I/A</td>
<td>5.06 x .167</td>
<td>120-30-4</td>
<td>15,489</td>
<td>19,617</td>
</tr>
<tr>
<td>SPL250 Lite HT</td>
<td>4.66 x .205</td>
<td>108-30-5</td>
<td>18,439</td>
<td>20,652</td>
</tr>
<tr>
<td>SPL 250</td>
<td>5.06 x .167</td>
<td>120-30-4</td>
<td>16,595</td>
<td>19,617</td>
</tr>
<tr>
<td>SPL250 HD</td>
<td>5.12 x .197</td>
<td>120-30-5</td>
<td>18,439</td>
<td>23,555</td>
</tr>
<tr>
<td>SPL350 Lite HT</td>
<td>4.72 x .236</td>
<td>108-30-6</td>
<td>22,127</td>
<td>24,041</td>
</tr>
<tr>
<td>SPL350</td>
<td>5.45 x .167</td>
<td>130-30-21720</td>
<td>22,127</td>
<td>24,180</td>
</tr>
<tr>
<td>SPL350 HD</td>
<td>5.51 x .197</td>
<td>130-30-21718</td>
<td>25,815</td>
<td>28,731</td>
</tr>
</tbody>
</table>
Center Bearing Mounting

Spicer heavy duty center bearings must be mounted within 3° of perpendicular to the coupling shaft centerline as shown in Figure 1 below and the center bearing assembly must not operate with a linear offset greater than 1/8 inch as shown in Figure 2.

Note: The Spicer "Dura-Tune" self aligning center bearing may be mounted up to +/- 10° of perpendicular to the coupling shaft centerline as shown in the side view of Figure 1. The rubber isolator must remain perpendicular to the coupling shaft centerline within 3° as shown in Figure 1.

Figure 1

Figure 2
Driveline Analysis

Design Criteria

- Torsional Vibration
- Inertial Vibration
- Center Bearing Loading

Torsional and Inertial Excitation

Driveline Layout

Calculate Joint Angles

To find the true joint angle of each joint, first find the top-view and side-view angles of each joint. The top-view angle of Joint A is equal to 0.67 - 0.00 = 0.67 and the side-view joint angle of Joint A is equal to (-4.0) - (-1.3) = -2.70. By putting the top-view angle (0.67) to the X-axis and the side-view angle (-2.70) to the Y-axis, the true joint angle of Joint A is equal to 2.78° 284.1 degrees.

Note: The true joint angle is a vector: the 2.78 degrees is the magnitude and the 284.1 degree is the argument. The true joint angles of joints A, B, and C are shown in the following chart.
Calculate Torsional and Inertia Excitation

Calculate the torsional effect:

\[ \Theta_{\text{exc}} = \sqrt{((\Theta_1 - \phi_1)^2 + (\Theta_2 - (90^\circ - \delta_2))^2 + (\Theta_3 - (90^\circ - \delta_3))^2)} \]

(1) When \( \theta_1 = 0 \) deg, \( \theta_2 = 0 \) deg.

\[
\begin{align*}
\Theta_{\text{exc}} &= \sqrt{(2.78 \cdot 284.1^\circ)^2 + (1.26 \cdot (276.01 - 90)^\circ)^2 + (2.58 \cdot 108.29^\circ)^2} \\
&= \sqrt{(7.7284 \cdot -151.8^\circ) + (1.5876 \cdot 12.02^\circ) + (6.6564 \cdot -143.42^\circ)} \\
&= \sqrt{(12.8667 \cdot -145.4^\circ)} \\
&= 3.5870^\circ \cdot -72.75^\circ \\
3.3405 \times 10^6 (2368 \text{rpm})^2 (3.5870^\circ)^2 &= 241.0154 \frac{\text{rad}}{\text{sec}^2}
\end{align*}
\]

(2) When \( \theta_1 = 0 \) deg, \( \theta_2 = 90 \) deg.

\[
\begin{align*}
\Theta_{\text{exc}} &= \sqrt{(2.78 \cdot 284.1^\circ)^2 + (1.26 \cdot (276.01 - 90)^\circ)^2 + (2.58 \cdot (108.29 - 90)^\circ)^2} \\
&= \sqrt{(7.7284 \cdot -151.8^\circ) + (1.5876 \cdot 12.02^\circ) + (6.6564 \cdot 36.58^\circ)} \\
&= \sqrt{(0.65124 \cdot 82.32^\circ)} \\
&= 0.80699^\circ \cdot 41.162^\circ \\
3.3405 \times 10^6 (2368 \text{rpm})^2 (0.80699^\circ)^2 &= 12.1988 \frac{\text{rad}}{\text{sec}^2}
\end{align*}
\]

(3) When \( \theta_1 = 90 \) deg, \( \theta_2 = 90 \) deg.

\[
\begin{align*}
\Theta_{\text{exc}} &= \sqrt{(2.78 \cdot 284.1^\circ)^2 + (1.26 \cdot (276.01 - 90 - 90)^\circ)^2 + (2.58 \cdot (108.29 - 90 - 90)^\circ)^2} \\
&= \sqrt{(7.7284 \cdot -151.8^\circ) + (1.5876 \cdot -167.98^\circ) + (6.6564 \cdot -143.42^\circ)} \\
&= \sqrt{(15.847236 \cdot 149.89^\circ)} \\
&= 3.98085^\circ \cdot 74.94^\circ \\
3.3405 \times 10^6 (2368 \text{rpm})^2 (3.98085^\circ)^2 &= 296.84 \frac{\text{rad}}{\text{sec}^2}
\end{align*}
\]
(4) When $d_1 = 90$ deg, $d_2 = 0$ deg.

\[
\begin{align*}
\Theta_d &= \sqrt{2(2.78 \cdot 284.1^2) + (1.26 \cdot (276.01 - 90)^2) + (2.58 \cdot (108.29 - 90)^2)} \\
&= \sqrt{7.7284 \cdot 151.8^2 + 1.5876 \cdot 167.98^2 + 6.6564 \cdot 36.58} \\
&= \sqrt{3.018639 \cdot 179.69^2} \\
&= 1.737423 \cdot 36.58 \\
3.3405 \times 10^{-2} (2368 \text{rpm})^2 (1.737423)^2 &= 56.54 \text{ rad}^2 \\
&\text{sec}^{-2}
\end{align*}
\]

Calculate the inertia drive effects:

\[
\Theta_d = \sqrt{2(\Theta_1 \cdot (\phi_1)^2) + (\Theta_2 \cdot (\phi_2 + 90^\circ - \delta))^2}
\]

(1) When $d_1 = 0$ deg, $d_2 = 0$ deg or $d_1 = 0$ deg, $d_2 = 90$ deg.

\[
\begin{align*}
\Theta_d &= \sqrt{2(2.78 \cdot 284.1^2) + (1.26 \cdot (276.01 - 90)^2) + (2.58 \cdot (108.29 - 90)^2)} \\
&= \sqrt{15.4568 \cdot 151.8^2 + 1.5876 \cdot 12.02^2} \\
&= \sqrt{16.987278 \cdot 153.29^2} \\
&= 4.12156 \cdot 76.64 \\
3.3405 \times 10^{-2} (2368 \text{rpm})^2 (4.12156)^2 &= 318.19 \text{ rad}^2 \\
&\text{sec}^{-2}
\end{align*}
\]

(2) When $d_1 = 90$ deg, $d_2 = 90$ deg or $d_1 = 90$ deg, $d_2 = 0$ deg.

\[
\begin{align*}
\Theta_d &= \sqrt{2(2.78 \cdot 284.1^2) + (1.26 \cdot (276.01 - 90)^2) + (2.58 \cdot (108.29 - 90)^2)} \\
&= \sqrt{15.4568 \cdot 151.8^2 + 1.5876 \cdot 167.98^2} \\
&= \sqrt{16.987278 \cdot 140.24^2} \\
&= 3.44777 \cdot 70.11 \\
3.3405 \times 10^{-2} (2368 \text{rpm})^2 (3.44777)^2 &= 222.66 \text{ rad}^2 \\
&\text{sec}^{-2}
\end{align*}
\]

Calculate the inertia coast effects:

\[
\Theta_c = \sqrt{2(\Theta_1 \cdot (\phi_1)^2) + (\Theta_2 \cdot (\phi_2 + 90^\circ + \delta))^2}
\]

(1) When $d_1 = 0$ deg, $d_2 = 0$ deg or $d_1 = 90$ deg, $d_2 = 0$ deg.

\[
\begin{align*}
\Theta_c &= \sqrt{2(2.58 \cdot 108.29^2) + (1.26 \cdot (276.01 + 90)^2) + (2.58 \cdot (108.29 + 90)^2)} \\
&= \sqrt{13.3128 \cdot 143.42^2 + 1.5876 \cdot 12.02^2} \\
&= \sqrt{11.887165 \cdot 140.24^2} \\
&= 3.44777 \cdot 70.11 \\
3.3405 \times 10^{-2} (2368 \text{rpm})^2 (3.44777)^2 &= 222.66 \text{ rad}^2 \\
&\text{sec}^{-2}
\end{align*}
\]
(2) When \( d_1 = 0 \) deg, \( d_2 = 90 \) deg or \( d_1 = 90 \) deg, \( d_2 = 90 \) deg.

\[
\begin{align*}
&= \sqrt{\left(2.58 \times 108.29^0\right)^2 + (1.26 \times (276.01 + 90 + 90))^2} \\
&= \sqrt{(13.3128 \times 143.42^0) + (1.5876 \times 167.98^0)} \\
&= \sqrt{(14.77151 \times -145.98^0)} \\
&= 3.84337 \times -72.99^0 \\
&= 3.3405 \times 10^{-6} \text{ (2368rpm)} \left(3.84337^0\right)^2 = 276.69 \text{ rad/sec}^2
\end{align*}
\]

**Note:** The recommended torsional excitation level is 300 rad/sec^2 or less. The recommended inertia excitation level is 1000 rad/sec^2 or less.

Calculate the torque fluctuations:

The mass moment of inertia of the following items are approximately equal to:

<table>
<thead>
<tr>
<th></th>
<th>lbf-in-sec^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission</td>
<td>2.33</td>
</tr>
<tr>
<td>Axle</td>
<td>2.53</td>
</tr>
<tr>
<td>1760 Driveshaft</td>
<td>1.3</td>
</tr>
</tbody>
</table>

(1) The torque fluctuation at the axle end is:

\[
T_{\text{axle}} = T_{\text{torsional, axle}} + T_{\text{inertia, drive}} = J_{\text{axle torsional}} + J_{\text{driveshaft drive}} = (2.53)(241.01) + (1.3)(261.10) = 949.18 \text{ in-lb} = 79.1 \text{ ft-lb}
\]

(2) The torque fluctuation at the transmission end is:

\[
T_{\text{transmission}} = T_{\text{torsional, transmission}} + T_{\text{inertia, coast}} = J_{\text{transmission torsional}} + J_{\text{driveshaft coast}} = (2.33)(241.01) + (1.3)(222.66) = 851.01 \text{ in-lb} = 70.92 \text{ ft-lb}
\]
Center Bearing Loading

Calculate Static / Dynamic Center Bearing Load

**Static**

\[ \frac{1}{2} \frac{T}{AB - DB} \left( \sin \alpha \angle (\phi_1 + 90) + \left( \tan \beta \frac{AB}{BC} \sin \beta \right) \angle (\phi_2 + 90) \right) + \frac{AB}{BC} \tan \gamma \angle (\phi_3 - 90) \right) \]

\[ = \frac{1}{2} \frac{12214 \times 12}{40 \times 6.2} \left( \sin 2.78 \angle (284.1 + 90) \right) \]

\[+ \left( \tan 1.26 \frac{40}{44.34} \sin 1.26 \angle (276.01 + 90) \right) \]

\[+ \frac{40}{44.34} \tan 2.58 \angle (108.29 - 90) \right) \]

\[= 2168.1657 \left\{ \left( 0.0485 \angle 74.1 \right) + \left( 0.0022 \angle 366.01 \right) + \left( 0.0406 \angle 18.29 \right) \right\} \]

\[= 2168.1657 \left( 0.0912 \angle 15.77 \right) \]

\[= 197.7738 \text{ lbs} \angle 15.77^\circ \]

**Dynamic**

\[ \frac{1}{2} \frac{T}{AB - DB} \left( \sin \alpha \angle (90 - \phi_1) + \left( \tan \beta \frac{AB}{BC} \sin \beta \right) \angle (90 - \phi_2 + 2 \delta) \right) \]

\[+ \frac{AB}{BC} \tan \gamma \angle (90 - \phi_3 + 2 \delta) \right) \]

(1) When \( d_1 = 0 \) deg, \( d_2 = 0 \) deg.

\[ = \frac{1}{2} \frac{12214 \times 12}{40 \times 6.2} \left( \sin 2.78 \angle (90 - 284.1) \right) \]

\[+ \left( \tan 1.26 \frac{40}{44.34} \sin 1.26 \angle (90 - 276.01) \right) \]

\[+ \frac{40}{44.34} \tan 2.58 \angle (90 - 108.29) \right) \]

\[= 2168.1657 \left\{ \left( 0.0485 \angle -194.1 \right) + \left( 0.0418 \angle 186.01 \right) + \left( 0.0406 \angle -18.29 \right) \right\} \]

\[= 2168.1657 \left( 0.0502 \angle 176.0 \right) \]

\[= 108.7635 \text{ lbs} \angle 176.0^\circ \]
(2) When \(d_1=0\) deg, \(d_2=90\) deg.

\[
\begin{align*}
&= \frac{1}{2} \frac{12214}{(40 - 6.2)} \left\{ \sin 2.78^\circ \left( 90 - 284.1^\circ \right) \\
&+ (\tan 1.26^\circ + \frac{40}{44.34} \sin 1.26^\circ) \left( 90 - 276.01^\circ \right) \\
&+ \frac{40}{44.34} \tan 2.58^\circ \left( 90 - 108.29 + 2 \times 90^\circ \right) \right\} \\
&= 2168.1657 \left\{ (0.0485 \times 194.1^\circ) + (0.0418 \times 186.01^\circ) + (0.0406 \times 161.71^\circ) \right\} \\
&= 2168.1657 (0.0485 \times 194.1^\circ) \\
&= 282.9240 \text{ lbs} \times 167.18^\circ
\end{align*}
\]

(3) When \(d_1=90\) deg, \(d_2=90\) deg.

\[
\begin{align*}
&= \frac{1}{2} \frac{12214}{(40 - 6.2)} \left\{ \sin 2.78^\circ \left( 90 - 284.1^\circ \right) \\
&+ (\tan 1.26^\circ + \frac{40}{44.34} \sin 1.26^\circ) \left( 90 - 276.01 + 2 \times 90^\circ \right) \\
&+ \frac{40}{44.34} \tan 2.58^\circ \left( 90 - 108.29^\circ \right) \right\} \\
&= 2168.1657 \left\{ (0.0485 \times 194.1^\circ) + (0.0418 \times 186.01^\circ) + (0.0406 \times 18.29^\circ) \right\} \\
&= 2168.1657 (0.0485 \times 194.1^\circ) \\
&= 72.8115 \text{ lbs} \times 9.11^\circ
\end{align*}
\]

(4) When \(d_1=90\) deg, \(d_2=0\) deg.

\[
\begin{align*}
&= \frac{1}{2} \frac{12214}{(40 - 6.2)} \left\{ \sin 2.78^\circ \left( 90 - 284.1^\circ \right) \\
&+ (\tan 1.26^\circ + \frac{40}{44.34} \sin 1.26^\circ) \left( 90 - 276.01 + 2 \times 90^\circ \right) \\
&+ \frac{40}{44.34} \tan 2.58^\circ \left( 90 - 108.29^\circ \right) \right\} \\
&= 2168.1657 \left\{ (0.0485 \times 194.1^\circ) + (0.0418 \times 6.01^\circ) + (0.0406 \times 18.29^\circ) \right\} \\
&= 2168.1657 (0.0485 \times 194.1^\circ) \\
&= 105.03326 \text{ lbs} \times 155.36^\circ
\end{align*}
\]

**Maximum Center Bearing Loads**

<table>
<thead>
<tr>
<th>Design</th>
<th>Static Load</th>
<th>Dynamic Load</th>
<th>Applicable Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD Solid Rubber</td>
<td>500 lbs.</td>
<td>500 lbs.</td>
<td>1710HD, 1760, 1810, SPL170, SPL250</td>
</tr>
<tr>
<td>HD Slotted Rubber</td>
<td>250 lbs.</td>
<td>250 lbs.</td>
<td>1710HD, 1760, 1810, SPL140, 170, 250</td>
</tr>
<tr>
<td>MD Slotted Rubber</td>
<td>100 lbs.</td>
<td>100 lbs.</td>
<td>SPL100, SPL140, 1710</td>
</tr>
</tbody>
</table>
Joint Life vs. Joint Angle

% of Expected Joint Life

Angle (degrees)
Application Form

Heavy / Medium-Duty Applications

Company: ___________________________ Contact: ___________________________

Email: ___________________________ Date: ___________________________

Phone: ___________________________ Fax: ___________________________

Vocation: ________________ Vehicle Make: ________________ Vehicle Model: ________________

Weight - Empty: ________________ GVW Total: ________________

  GVW (Front): ___________  GVW (Rear): ___________  GCW: ________________

Tires - Size: ________________ Make: ________________ Rolling Radius: ________________

Engine - Make: ________________ Model: ________________ Displacement: ________________

  Net Torque: ___________ At Speed: ___________  Net H.P.: ___________ At Speed: ___________

  Gross Torque: ___________ At Speed: ___________  Gross H.P.: ___________ At Speed: ___________

Maximum Operating Speed (including engine over speed): ___________________________

Trans - Make: ________________ Model: ________________

  Ratios - Forward (including overdrive): ________________ Reverse: ________________

  Torque Converter - Make: ________________ Model: ________________ Stall Ratio: ________________

  Auxiliary - Make: ________________ Model: ________________ Ratios: ________________

  Transfer Case - Make: ________________ Model: ________________ Ratios: ________________

  Torque Split Ratio - Front: ________________ Rear: ________________

  Axle Make - Front: ________________ Model: ________________ Ratios: ________________

  Make - Front: ________________ Model: ________________ Ratios: ________________

B₁₀ Life Expectancy: ___________________________

Vehicle Duty Cycle: ___________________________

Description of Vehicle Function: ___________________________

_____________________________________________________________________________________

_____________________________________________________________________________________

Signed: ___________________________

Title: ___________________________

Spicer Engineer: ___________________________ Phone: ___________________________

Email: ___________________________ Fax: ___________________________
### APPLICATION PROPOSAL

<table>
<thead>
<tr>
<th>Vehicle Position</th>
<th>Series</th>
<th>Dana Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission to Rear Axle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission to Auxiliary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary to Rear Axle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission to Mid Bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid Bearing to Rear Axle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaxle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheel Drive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Vehicle Application Sketch

<table>
<thead>
<tr>
<th>Plan View</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Side View</th>
</tr>
</thead>
</table>

Proposed By: ________________________________
Signed: ________________________________
Title: ________________________________
Yoke Dimensions

Snap Ring Cross Holes

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>A (mm / in)</th>
<th>B (mm / in)</th>
<th>C* (mm / in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snap Ring</td>
<td>1210</td>
<td>65.0 / 2.56</td>
<td>26.9 / 1.06</td>
<td>79.2 / 3.12</td>
</tr>
<tr>
<td>Construction</td>
<td>1280 / 1310</td>
<td>84.8 / 3.34</td>
<td>26.9 / 1.06</td>
<td>96.8 / 3.81</td>
</tr>
<tr>
<td></td>
<td>1330</td>
<td>95.0 / 3.74</td>
<td>26.9 / 1.06</td>
<td>106.4 / 4.19</td>
</tr>
<tr>
<td></td>
<td>1350</td>
<td>95.0 / 3.74</td>
<td>30.2 / 1.19</td>
<td>108.0 / 4.25</td>
</tr>
<tr>
<td></td>
<td>1410</td>
<td>109.2 / 4.30</td>
<td>30.2 / 1.19</td>
<td>124.0 / 4.88</td>
</tr>
<tr>
<td></td>
<td>1480 / SPL 55</td>
<td>109.2 / 4.30</td>
<td>34.8 / 1.37</td>
<td>124.0 / 4.88</td>
</tr>
<tr>
<td></td>
<td>1550 / SPL 70</td>
<td>129.0 / 5.08</td>
<td>34.8 / 1.37</td>
<td>144.5 / 5.69</td>
</tr>
<tr>
<td></td>
<td>SPL 90 / SPL 100</td>
<td>130.6 / 5.14</td>
<td>41.1 / 1.62</td>
<td>149.4 / 5.88</td>
</tr>
<tr>
<td></td>
<td>1650</td>
<td>146.8 / 5.78</td>
<td>41.1 / 1.62</td>
<td>165.1 / 6.50</td>
</tr>
<tr>
<td></td>
<td>SPL350</td>
<td>177.0 / 6.97</td>
<td>65.0 / 2.56</td>
<td>206.0 / 8.11</td>
</tr>
</tbody>
</table>

* Swing diameter clears yoke by 1.5 mm / 0.06 in.
## 10 Series Half Round Cross Holes

### Type | Series | A (mm / in) | B (mm / in) | C (mm / in) | D (mm / in) | E (mm / in) | F* (mm / in) | G (mm / in) | H
---|---|---|---|---|---|---|---|---|---
**U-bolt**
1210 | 62.0 / 2.44 | 26.9 / 1.06 | 56.4 / 2.22 | 35.8 / 1.41 | 0.8 / 0.03 | 87.4 / 3.44 | 8.4 / 0.33 | -
1280/1310 | 81.8 / 3.22 | 26.9 / 1.06 | 73.9 / 2.91 | 35.8 / 1.41 | 0.8 / 0.03 | 101.6 / 4.00 | 8.4 / 0.33 | -
1330 | 91.9 / 3.62 | 26.9 / 1.06 | 84.1 / 3.31 | 35.8 / 1.41 | 0.8 / 0.03 | 115.8 / 4.56 | 8.4 / 0.33 | -
1350 | 91.9 / 3.62 | 30.2 / 1.19 | 81.0 / 3.19 | 42.2 / 1.66 | 0.8 / 0.03 | 115.8 / 4.56 | 9.9 / 0.39 | -
1410 | 106.4 / 4.19 | 30.2 / 1.19 | 95.2 / 3.75 | 42.2 / 1.66 | 0.8 / 0.03 | 125.5 / 4.94 | 9.9 / 0.39 | -
1480 | 106.4 / 4.19 | 35.1 / 1.38 | 93.7 / 3.69 | 48.5 / 1.91 | 0.8 / 0.03 | 134.9 / 5.31 | 11.7 / 0.46 | -
1550 | 126.2 / 4.97 | 35.1 / 1.38 | 113.5 / 4.47 | 48.5 / 1.91 | 0.8 / 0.03 | 152.4 / 6.00 | 11.7 / 0.46 | -
**Bearing**
1210 | 62.0 / 2.44 | 26.9 / 1.06 | 53.8 / 2.12 | 40.1 / 1.58 | 0.8 / 0.03 | 87.4 / 3.44 | - | 0.25 - 28
1280/1310 | 81.8 / 3.22 | 26.9 / 1.06 | 73.9 / 2.91 | 40.1 / 1.58 | 0.8 / 0.03 | 101.6 / 4.00 | - | 0.25 - 28
1330 | 91.9 / 3.62 | 26.9 / 1.06 | 84.1 / 3.31 | 40.1 / 1.58 | 0.8 / 0.03 | 115.8 / 4.56 | - | 0.25 - 28
1350 | 91.9 / 3.62 | 30.2 / 1.19 | 81.0 / 3.19 | 45.7 / 1.80 | 0.8 / 0.03 | 115.8 / 4.56 | - | 0.312 - 24
1410 | 106.4 / 4.19 | 30.2 / 1.19 | 95.2 / 3.75 | 45.7 / 1.80 | 0.8 / 0.03 | 125.5 / 4.94 | - | 0.312 - 24
1480 | 106.4 / 4.19 | 35.1 / 1.38 | 93.7 / 3.69 | 53.8 / 2.12 | 0.8 / 0.03 | 134.9 / 5.31 | - | 0.375 - 24
1550 | 126.2 / 4.97 | 35.1 / 1.38 | 113.5 / 4.47 | 53.8 / 2.12 | 0.8 / 0.03 | 152.4 / 6.00 | - | 0.375 - 24
1610 | 134.9 / 5.31 | 47.8 / 1.88 | 122.2 / 4.81 | 63.5 / 2.50 | 9.7 / 0.38 | 171.4 / 6.75 | - | 0.375 - 24
1710 | 157.2 / 6.19 | 49.3 / 1.94 | 142.0 / 5.59 | 71.4 / 2.81 | 7.9 / 0.31 | 190.5 / 7.50 | - | 0.50 - 20
1760 | 180.1 / 7.09 | 49.3 / 1.94 | 165.1 / 6.50 | 71.4 / 2.81 | 7.9 / 0.31 | 212.9 / 8.38 | - | 0.50 - 20
1810 | 194.1 / 7.64 | 49.3 / 1.94 | 179.1 / 7.05 | 71.4 / 2.81 | 7.9 / 0.31 | 228.6 / 8.90 | - | 0.50 - 20
**Strap**
1410 | 106.4 / 4.19 | 30.2 / 1.19 | 95.2 / 3.75 | 45.7 / 1.80 | 0.8 / 0.03 | 125.5 / 4.94 | 8.4 / 0.33 | -
1480 | 106.4 / 4.19 | 35.1 / 1.38 | 93.7 / 3.69 | 53.8 / 2.12 | 0.8 / 0.03 | 134.9 / 5.31 | 9.9 / 0.39 | -
**Thru-Hole**
1550 | 126.2 / 4.97 | 35.1 / 1.38 | 113.5 / 4.47 | 53.8 / 2.12 | 0.8 / 0.03 | 152.4 / 6.00 | 9.9 / 0.39 | -

* Swing diameter clears yoke by 1.5 mm / 0.06 in.
SPL Full Round Cross Holes

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D * (mm)</th>
<th>E (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPL</td>
<td>SPL 140</td>
<td>128</td>
<td>49</td>
<td>32</td>
<td>160</td>
<td>M8 x 1.00</td>
</tr>
<tr>
<td>Full</td>
<td>SPL 170</td>
<td>153</td>
<td>55</td>
<td>32</td>
<td>185</td>
<td>M8 x 1.00</td>
</tr>
<tr>
<td>Round</td>
<td>SPL 250</td>
<td>152</td>
<td>60</td>
<td>32</td>
<td>184</td>
<td>M8 x 1.00</td>
</tr>
</tbody>
</table>

* Swing diameter clears yoke by 1.5 mm.
## SPL Half Round Cross Holes

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>F * (mm)</th>
<th>G (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing</td>
<td>SPL 55</td>
<td>106.4</td>
<td>35.1</td>
<td>93.7</td>
<td>53.8</td>
<td>0.8</td>
<td>134.9</td>
<td>0.375 x 24 UNF</td>
</tr>
<tr>
<td></td>
<td>SPL 70</td>
<td>126.2</td>
<td>35.1</td>
<td>113.5</td>
<td>53.8</td>
<td>0.8</td>
<td>152.4</td>
<td>0.375 x 24 UNF</td>
</tr>
<tr>
<td></td>
<td>SPL 100</td>
<td>126</td>
<td>41</td>
<td>115</td>
<td>59</td>
<td>6</td>
<td>154</td>
<td>0.375 x 24 UNF</td>
</tr>
<tr>
<td>Tapped</td>
<td>SPL 140</td>
<td>139</td>
<td>49</td>
<td>113</td>
<td>76</td>
<td>8</td>
<td>174</td>
<td>12 x 1.25</td>
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<tr>
<td></td>
<td>SPL 170</td>
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<td>55</td>
<td>140</td>
<td>82</td>
<td>8</td>
<td>193</td>
<td>12 x 1.25</td>
</tr>
<tr>
<td></td>
<td>SPL 250</td>
<td>163</td>
<td>60</td>
<td>135</td>
<td>88</td>
<td>10</td>
<td>193</td>
<td>12 x 1.25</td>
</tr>
<tr>
<td></td>
<td>SPL 350</td>
<td>171.8</td>
<td>65</td>
<td>142</td>
<td>100</td>
<td>0</td>
<td>219</td>
<td>14 x 1.25</td>
</tr>
</tbody>
</table>
# BP Cross Holes

*Swing Diameter Clears Yoke by 1.5/0.06 mm/in.*

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D* (mm)</th>
<th>E (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing</td>
<td>1610</td>
<td>134.9/5.31</td>
<td>47.8/1.88</td>
<td>58.7/2.31</td>
<td>180.8/7.12</td>
<td>0.312-24</td>
</tr>
<tr>
<td>Plate</td>
<td>1710</td>
<td>1.54.7/6.09</td>
<td>49.3/1.94</td>
<td>62.0/2.44</td>
<td>200.2/7.88</td>
<td>0.375-24</td>
</tr>
<tr>
<td>Full</td>
<td>1760</td>
<td>177.8/7.00</td>
<td>49.3/1.94</td>
<td>62.0/2.44</td>
<td>220.5/8.68</td>
<td>0.375-24</td>
</tr>
<tr>
<td>Round</td>
<td>1810</td>
<td>191.8/7.55</td>
<td>49.3/1.94</td>
<td>62.0/2.44</td>
<td>235.0/9.25</td>
<td>0.375-24</td>
</tr>
<tr>
<td></td>
<td>1880</td>
<td>205.5/8.09</td>
<td>55.6/2.19</td>
<td>71.4/2.81</td>
<td>250.9/9.88</td>
<td>0.438-20</td>
</tr>
</tbody>
</table>
Joint Kit Attaching Hardware and Torque Specifications

U-bolts

<table>
<thead>
<tr>
<th>Series</th>
<th>Spicer U-Joint Kit No</th>
<th>U-Bolt Kit</th>
<th>Recommended Nut Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1210</td>
<td>5-443X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1310, SPL22</td>
<td>5-1310X, 5-1310-1X</td>
<td>2-94-28X</td>
<td>14-17 lbs. ft.</td>
</tr>
<tr>
<td>1330, SPL25</td>
<td>5-1330X, 5-1330-1X</td>
<td>2-94-28X</td>
<td>14-17 lbs. ft.</td>
</tr>
<tr>
<td>1350, SPL30</td>
<td>5-1350X, 1350-1X</td>
<td>3-94-18X</td>
<td>20-24 lbs. ft.</td>
</tr>
<tr>
<td>1410, SPL36</td>
<td>5-1410X, 5-1410-1X</td>
<td>3-94-18X</td>
<td>20-24 lbs. ft.</td>
</tr>
<tr>
<td>1480, SPL55</td>
<td>SPL55X, SPL55-1X</td>
<td>3-94-28X</td>
<td>32-37 lbs. ft.</td>
</tr>
<tr>
<td>1550, SPL70</td>
<td>SPL70X, SPL70-1X</td>
<td>3-94-28X</td>
<td>32-37 lbs. ft.</td>
</tr>
<tr>
<td>3R</td>
<td>5-3147X, 5-795X</td>
<td>2-94-58X</td>
<td>17-24 lbs. ft.</td>
</tr>
</tbody>
</table>

Bearing Strap

**WARNING:** Bearing strap retaining bolts should not be reused.
<table>
<thead>
<tr>
<th>Series</th>
<th>Spicer U-Joint Kit No</th>
<th>Strap and Bolt Kit</th>
<th>Recommended Bolt Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPL90</td>
<td>SPL90X</td>
<td>90-70-28X</td>
<td>45-60 lb. ft.</td>
</tr>
<tr>
<td>SPL100</td>
<td>SPL100X</td>
<td>90-70-28X</td>
<td>45-60 lb. ft.</td>
</tr>
<tr>
<td>1210</td>
<td>5-443X</td>
<td>2-70-18X</td>
<td>13-18 lb. ft.</td>
</tr>
<tr>
<td>1310, SPL22</td>
<td>5-1310X, 5-1310-1X</td>
<td>2-70-18X</td>
<td>13-18 lb. ft.</td>
</tr>
<tr>
<td>1330, SPL25</td>
<td>5-1330X, 5-1330-1X</td>
<td>2-70-18X</td>
<td>13-18 lb. ft.</td>
</tr>
<tr>
<td>1350, SPL30</td>
<td>5-1350X, 5-1350-1X</td>
<td>3-70-28X</td>
<td>30-35 lb. ft.</td>
</tr>
<tr>
<td>1410, SPL36</td>
<td>5-1410X, 5-1410-1X</td>
<td>3-70-28X</td>
<td>30-35 lb. ft.</td>
</tr>
<tr>
<td>1480, SPL55</td>
<td>SPL55X, SPL55-1X</td>
<td>3-70-38X</td>
<td>45-60 lb. ft.</td>
</tr>
<tr>
<td>1550, SPL70</td>
<td>SPL70X, SPL70-1X</td>
<td>3-70-38X</td>
<td>45-60 lb. ft.</td>
</tr>
<tr>
<td>1610</td>
<td>5-674X</td>
<td>5-70-28X</td>
<td>45-60 lb. ft.</td>
</tr>
<tr>
<td>1710</td>
<td>5-675X</td>
<td>6.5-70-18X</td>
<td>115-135 lb. ft.</td>
</tr>
<tr>
<td>1760</td>
<td>5-677X</td>
<td>6.5-70-18X</td>
<td>115-135 lb. ft.</td>
</tr>
<tr>
<td>1810</td>
<td>5-676X</td>
<td>6.5-70-18X</td>
<td>115-135 lb. ft.</td>
</tr>
<tr>
<td>3R</td>
<td>5-3147X, 5-795X</td>
<td>2-70-48X</td>
<td>30-35 lb. ft.</td>
</tr>
<tr>
<td>7260</td>
<td>5-1306X, 5-789X</td>
<td>2-70-38X</td>
<td>13-18 lb. ft.</td>
</tr>
</tbody>
</table>
### Cap and Bolts

(*) Discontinued

<table>
<thead>
<tr>
<th>Series</th>
<th>Spicer Kit No</th>
<th>Cap and Bolt Kit</th>
<th>Recommended Bolt Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1650</td>
<td>5-165X</td>
<td>5-70-18X</td>
<td>77-103 lb. ft.</td>
</tr>
<tr>
<td>1850</td>
<td>5-185X</td>
<td>8-70-18X</td>
<td>110-147 lb. ft.</td>
</tr>
<tr>
<td>2050</td>
<td>5-340X</td>
<td>9-70-28X</td>
<td>744-844 lb. ft.</td>
</tr>
</tbody>
</table>

#### Bearing Plate

**WARNING:** Self locking bolts should not be reused.

**Serrated Bolts with Lock Patch / No Lock Strap (Models after Spring 1994)**

<table>
<thead>
<tr>
<th>Series</th>
<th>Bolt Part No</th>
<th>Thread Size</th>
<th>Recommended Bolt Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1610</td>
<td>5-73-709</td>
<td>.312-24</td>
<td>26-35 lb. ft.</td>
</tr>
<tr>
<td>1760</td>
<td>6-73-209</td>
<td>.375-24</td>
<td>38-48 lb. ft.</td>
</tr>
<tr>
<td>1880</td>
<td>7-73-315</td>
<td>.438-20</td>
<td>60-70 lb. ft.</td>
</tr>
</tbody>
</table>

**Bolt with Lock Strap (Pre-Spring 1994 Models)**

<table>
<thead>
<tr>
<th>Series</th>
<th>Bolt Part No</th>
<th>Thread Size</th>
<th>Recommended Bolt Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1880</td>
<td>7-73-115</td>
<td>.438-20</td>
<td>60-70 lb. ft.</td>
</tr>
</tbody>
</table>

**Quick Disconnect (Half Round)**

<table>
<thead>
<tr>
<th>Series</th>
<th>Bolt Part No</th>
<th>Thread Size</th>
<th>Recommended Bolt Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPL90</td>
<td>6-73-412</td>
<td>.375-24</td>
<td>45-60 lb. ft.</td>
</tr>
<tr>
<td>1610</td>
<td>6-73-412</td>
<td>.375-24</td>
<td>45-60 lb. ft.</td>
</tr>
<tr>
<td>1710</td>
<td>8-73-316</td>
<td>.500-20</td>
<td>115-135 lb. ft.</td>
</tr>
<tr>
<td>1760</td>
<td>8-73-316</td>
<td>.500-20</td>
<td>115-135 lb. ft.</td>
</tr>
<tr>
<td>1810</td>
<td>8-73-316</td>
<td>.500-20</td>
<td>115-135 lb. ft.</td>
</tr>
</tbody>
</table>
## Bearing Retainer

<table>
<thead>
<tr>
<th>Series</th>
<th>U-Joint Kit No</th>
<th>Retainer Kit No</th>
<th>Bolt Part No</th>
<th>Recommended Bolt Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPL140</td>
<td>SPL140X</td>
<td>140-70-18X</td>
<td>5007417</td>
<td>115-125 lb. ft.</td>
</tr>
<tr>
<td>SPL170</td>
<td>SPL170-4X</td>
<td>170-70-18X</td>
<td>5007417</td>
<td>115-125 lb. ft.</td>
</tr>
<tr>
<td>SPL250</td>
<td>SPL250-3X</td>
<td>250-70-18X</td>
<td>5007417</td>
<td>115-125 lb. ft.</td>
</tr>
<tr>
<td>SPL350</td>
<td>SPL350X</td>
<td>350-70-18X</td>
<td>5019836</td>
<td>177-199 lb. ft.</td>
</tr>
</tbody>
</table>

## Spring Tab

<table>
<thead>
<tr>
<th>Series</th>
<th>U-Joint Kit No</th>
<th>Spring Tab Kit No</th>
<th>Bolt Part No</th>
<th>Recommended Bolt Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPL140</td>
<td>SPL140X</td>
<td>211941X</td>
<td>8-73-114M</td>
<td>25-30 lb. ft.</td>
</tr>
<tr>
<td>SPL170</td>
<td>SPL170X</td>
<td>211941X</td>
<td>8-73-114M</td>
<td>25-30 lb. ft.</td>
</tr>
<tr>
<td>SPL250</td>
<td>SPL250X</td>
<td>211941X</td>
<td>8-73-114M</td>
<td>25-30 lb. ft.</td>
</tr>
</tbody>
</table>