Spicer® Drive Axles

DANA SPICER® Drivetrain Products

Application Guidelines

DAAG-0080

February 2018

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Introduction

Important Information about These Guidelines

Purpose

The purpose of these Drive Application Guidelines is to provide original equipment manufacturer (OEM) builders of medium and heavy-duty trucks with information about which Spicer® drive axle products are approved by Dana Holding Corporation's Commercial Vehicle Products (Dana CVP) for use in common vocational applications in the USA and Canada.

Use of Guidelines

These Guidelines apply to on-, on-off, and off-highway axle applications and vocations in the USA and Canada. Vehicle applications that meet the specified vocation definitions and specified axle criteria are approved by Dana CVP for use within the applicable General Requirements and Recommendations without formal review by Dana CVP. Applications outside the specified vocations, duty cycles, ratings, and all off-road applications must be reviewed and approved on an individual basis by the Dana CVP Application Engineering Department.

This review requirement also applies to the approval of drive axles with available options.

Drive Warranties

Dana CVP's warranties for drive axles are printed in the Spicer® Warranty Guide (SWGR1). Applications and installations must either meet the requirements of these Guidelines or be approved by the Dana CVP Application Engineering Department. Failure to obtain applications approval of the use of Spicer® axles or their components in non-approved applications will void the Dana CVP warranty coverage. Modification of the vehicle or drive axle configuration, changes in the vocational use, or service outside the limits of these Guidelines will void the Dana CVP warranty coverage.

Questions

For answers to questions concerning the Guidelines or to request a Drive Axle Approval Request Form for a use not covered by the Guidelines, contact one of the following:

Dana Sales and Service Office
1-877-777-5360
24 hours a day in the USA or Canada

Dana Holding Corporation
Commercial Vehicle Products
3939 Technology Drive
Maumee, OH 43537

Phone: 1-877-342-3000

Changes to Guidelines

These Guidelines are subject to change at any time, without prior notice, at the discretion of Dana CVP. For the most current revision to these Guidelines, visit the Dana website at www.dana.com.

Effective Date: [February 2018]

Drive Axle Application Guidelines

General Notes:

1. Additional ratios may be available and would require individual application approval.

2. Maximum allowable torsional driveline acceleration is 300 rad./sec./sec. within the defined operating speed range of the engine manufacturer. When a manual transmission is used, a soft dampened clutch is recommended.

3. Double reduction models offer added durability and gross weight capability in severe service applications where higher numeric ratios are required.

4. Single vehicle retarders can be approved with all axle models, provided the product selected meets all the application requirements of the specified vocation.

5. The use of dual retarders (engine, exhaust, transmission and/or electromagnetic) is only approved with tandem drive axle models with gross weight ratings of 46,000 lbs. or higher and the maximum allowable retardation is limited to 100% of the max. rated engine torque. For line haul or heavy haul applications, the maximum allowable retardation can be limited to 110% of the max. rated engine torque.

6. All vehicles with electromagnetic retarders, such as Telma or Eaton's Hydraulic Launch Assist (HLA), require individual application approval by the Dana CVP Application Engineering Department.

7. For optimum axle shaft retention to the hub, .750 in. diameter studs or .625 in. diameter studs with tapered dowels are recommended for single axles with GAWR ratings of 23,000 lbs. and above or tandem and tridem drive axles with GAWR ratings of 46,000 lbs. and above. OEMs are responsible for axle shaft retention on all units not dressed by Dana. See page 75 for illustration.

8. Localized sources of heat, such as engine exhaust, that may cause high axle operating temperatures or reduced seal life are to be avoided. Maximum intermittent drive axle surface temperatures measured at the input seal are not to exceed 300° F for more than 30 minutes. Maximum continuous operating temperatures are not to exceed 250° F.

9. Dana CVP application approval is required for all vehicles with hybrid power systems.

10. The following optional components are approved by this Guideline. All options may not be available on every axle model.

a. Driver-Controlled Wheel Differential Lock
b. Oil Pump
c. Low Maintenance Wheel Ends (LMS®)

11. The use of NoSPIN® differentials in any drive axle will result in the exclusion of axle shafts from warranty consideration. Certain other carrier components may also be excluded from warranty consideration if their failure is deemed to be the result of NoSPIN® use. Depending on the axle loading, the NoSPIN® can cause all the torque to be directed to one axle shaft resulting in overload and potential failure. NoSPIN® is a registered trademark of Eaton Corporation.

12. Drive axle application approval and allowable gross axle weight are based on the vehicle suspension selected. Dana CVP is not responsible for the durability of any attachments to the axle housing(s) unless produced by Dana Holding Corporation. In addition, Dana CVP is responsible for the integrity of the bracket attachment only if the bracket is installed by Dana or if the bracket is installed by the vehicle manufacturer following procedures approved by Dana through prior agreement.

13. For certain suspension models, Dana may require the use of an increased housing wall thickness. Refer to the Housing Structural Rating Section of this Guideline or contact Dana CVP Application Engineering for specific requirements.

14. Drive axles configured with single tires and outset wheels that increase the track over the standard track width with dual tires require special considerations. Allowable gross axle weight ratings may have to be reduced from the nominal rating to compensate for the increase in housing stress created through the usage of single tires with outset wheels. Refer to the Housing Structural Rating Section of this Guideline for additional information regarding gross axle weight ratings based on increased track width due either to the usage of single tires and outset wheels or wide track housings. Outset wheels greater than 2.0 in. are not approved. All drive axles with single tires and outset wheels require a pre-set hub system (such as Dana's LMS® or LMSi™).

15. Oil pumps and/or Driver-Controlled Wheel Differential Lock(s) are recommended for operations where vehicles operate in areas of poor traction.

16. It is the responsibility of the vehicle manufacturer and/or the dealer to accurately convey all approved axle loading information to the body builder if the chassis is sold incomplete. It is also the responsibility of the final vehicle builder to insure the assigned tagged values for GAWR and GVW/GCW do not exceed those limits approved by this Guideline. Dana is not responsible for non-compliance to this request.

17. Suspension capacity shall not exceed nominal drive axle capacity by more than 3,000 lbs. per axle with the exception of the S20-045B, DS404, D40-145, D40-155, D40-156 and S20-140 drive axle models. For the above exceptions, only a suspension capacity of 1,000 lbs. per axle over the nominal drive axle capacity is approved.

18. For straight trucks, pusher and tag axles should be used to comply with the Federal Bridge Formula.

19. Vehicle testing of any nature voids the warranty on Dana Spicer® drive axles.

20. For specific warranty coverage, see Spicer® Warranty Guide (SWGR1).

21. For approval of Spicer® drive lines, Bendix brakes or other Spicer components contact Dana at 1-877-777-5360.

Formulas:

In vehicles equipped with driving steerable axles, the wheel speed mismatch between the front and rear axle(s) is a concern. This mismatch is affected by the front and rear axle ratios as well as the tire revolution per mile (TRPM) and tire static loaded radius (SLR). Dana CVP Application Engineering requires this mismatch value not to exceed ±1.5%. The % of mismatch is calculated below:

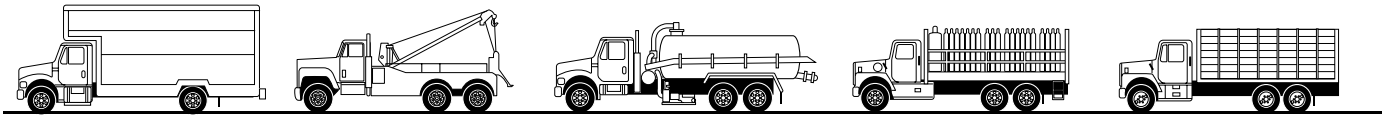
For high vehicle speed:

$$\% \text{ mismatch} = \frac{(\text{Rear drive axle ratio} \times \text{rear axle tire TRPM}) - (\text{front drive axle ratio} \times \text{front axle tire TRPM})}{\text{Rear drive axle ratio} \times \text{rear axle tire TRPM}}$$

For slow vehicle speed:

$$\% \text{ mismatch} = \frac{(\text{Rear drive axle ratio} \times \text{front axle tire SLR}) - (\text{front drive axle ratio} \times \text{rear axle tire SLR})}{\text{Rear drive axle ratio} \times \text{front axle tire SLR}}$$

City Delivery



Vocational Description

- Pickup and delivery service within cities and/or suburban areas
- 100% of operation on road surfaces of concrete, asphalt and maintained gravel
- Three (3) miles between starts/stops (typical)
- 100% load going / up to 40% load return (typical)

Typical Vehicle Types

- Armored Truck
- Ambulance
- Auto Transport Truck
- Beverage Truck
- Flatbed Truck
- General Freight Truck
- Livestock Hauler
- Moving Van
- Municipal Truck
- Newspaper Delivery
- Pickup and Delivery
- Postal Delivery
- Refrigerated Truck
- Regional Haul
- Roll Back Auto Transporter
- Side Truck
- Stake Truck
- Tanker Truck
- Utility Truck
- Wrecker

Service Definitions

(vocational description applies to all operations)

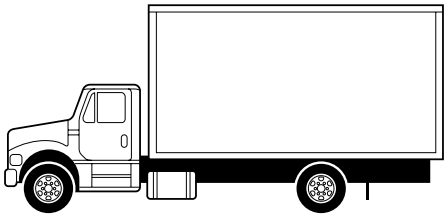
Operation 1 - Grades up to 8%

Operation 2 - Grades up to 12%

Operation 3 - Grades up to 20%

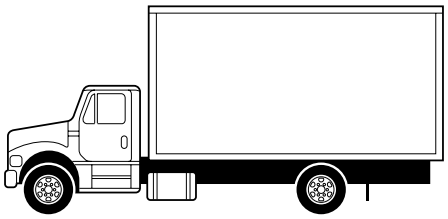
Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lb.) (GVW / GCW)			Gear Ratios	
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 8% Grade**	**Operation 2 12% Grade**	**Operation 3 20% Grade**	**Fastest**	**Slowest**
Single Axles									
S14-110	13,500	16.5	325	560	23,000	23,000	N/A	3.73	5.38
S14-130	13,500	15.7	300	660	25,000	25,000	N/A	3.73	5.38
S16-130	15,500	18.1	325	605	35,000	25,000	N/A	3.73	5.38
S17-140	17,000	19.7	300	860	46,000	40,000	N/A	3.58	5.57
17060S	17,000	19.7	300	860	60,000	50,000	45,000	3.08	5.57
S19-140	19,000	19.7	300	860	46,000	40,000	N/A	3.58	5.57
19060S	19,000	20.1	300	860	60,000	50,000	45,000	3.08	5.57
S20-140	20,000	19.7	300	860	46,000	40,000	N/A	3.58	5.57
S21-140	21,000	19.7	300	860	46,000	40,000	N/A	3.58	5.57
21060S	21,000	21.1	300	860	60,000	50,000	45,000	3.08	5.57
21065P	21,000	21.1	300	860	60,000	55,000	50,000	5.32	7.60
21065T	21,000	21.1	300	860	60,000	55,000	50,000	3.90/5.32	5.57/7.60
S21-170/170E	21,000	21.1	405	1450	80,000	65,000	55,000	3.07	5.57
S21-172/172E	21,000	21.1	405	1450	80,000	65,000	55,000	3.07	5.57
S21-190	21,000	22.0	500	1650	100,000	85,000	70,000	3.07	5.57
S21-190E	21,000	22.0	500	1650	100,000	85,000	70,000	3.42	5.57
22060S	22,000	21.1	300	860	60,000	50,000	45,000	3.08	5.57
22065P	22,000	21.1	300	860	60,000	55,000	50,000	5.32	7.60
22065T	22,000	21.1	300	860	60,000	55,000	50,000	3.90/5.32	5.57/7.60
23060SH	23,000	19.8	300	860	60,000	50,000	45,000	3.08	5.57
23082T	23,000	22.0	405	1450	80,000	65,000	55,000	3.70/5.04	5.43/7.39
S23-170/170E	23,000	22.0	405	1450	80,000	65,000	55,000	3.07	5.57
S23-172/172E	23,000	22.0	405	1450	80,000	65,000	55,000	3.07	5.57
S23-190	23,000	22.0	500	1650	100,000	85,000	70,000	3.07	5.57
S23-190	23,000	19.8	565	1850	80,000	70,000	60,000	3.07	4.30
S23-190E	23,000	22.0	500	1650	100,000	85,000	70,000	3.42	5.57
S25-170/170E	25,000	22.0	405	1450	80,000	65,000	55,000	3.42	5.57
S25-172/172E	25,000	22.0	405	1450	80,000	65,000	55,000	3.42	5.57
26082T	26,000	22.0	405	1450	80,000	65,000	55,000	3.70/5.04	5.43/7.39
S26-190/190E	26,000	22.0	500	1650	100,000	85,000	70,000	3.42	5.57

City Delivery (Continued)



			Engine		Max. Gross Weight (lb.) (GVW / GCW)			Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 8% Grade**	**Operation 2 12% Grade**	**Operation 3 20% Grade**	**Fastest**	**Slowest**	
EconoTrek 6x2										
S21-170 & S20-045B	40,000	21.1	405	1450	80,000	65,000	55,000	3.07	5.57	
S21-172 & S20-045B	40,000	21.1	405	1450	80,000	65,000	55,000	3.07	5.57	
S21-190 & S20-045B	40,000	22.0	500	1650	100,000	85,000	70,000	3.07	5.57	
Tandem Axles										**Note**
DS404/405	40,000	21.1	485	1650	90,000	90,000	80,000	3.08	5.57	**1,2**
DSP40/41	40,000	21.1	485	1650	90,000	90,000	80,000	3.08	5.57	**1,2**
DSP40/41	40,000	19.8	500	1650	105,000	N/A	N/A	3.91	4.11	**1,2**
D40-145	40,000	19.3	485	1650	80,000	80,000	60,000	3.36	5.57	**1,2**
D40-145	39,000	19.8	485	1650	80,000	70,000	50,000	3.36	5.57	**1**
D40-145	38,000	20.2	455	1550	80,000	N/A	N/A	3.36	5.57	**1,3**
D40-155	40,000	19.8	485	1650	80,000	80,000	80,000	2.26	2.93	**1,2**
D40-156	40,000	20.7	485	1650	90,000	85,000	80,000	3.08	3.91	**1,2**
D40-156	40,000	20.7	550	1850	80,000	80,000	80,000	3.08	3.91	**1**
DSH40	40,000	19.8	565	1850	105,500	90,000	80,000	3.36	3.90	**3**
DSH40	40,000	21.1	565	1850	90,000	90,000	80,000	3.08	4.88	
D40-170	40,000	21.1	605	2050	160,000	140,000	120,000	3.07	5.38	
D40-172	40,000	21.1	605	2050	160,000	140,000	120,000	3.07	5.38	
D46-170/170H	46,000	21.1	605	2050	160,000	140,000	120,000	3.07	5.38	
D46-172/172H	46,000	22	605	2050	160,000	140,000	120,000	3.07	5.38	

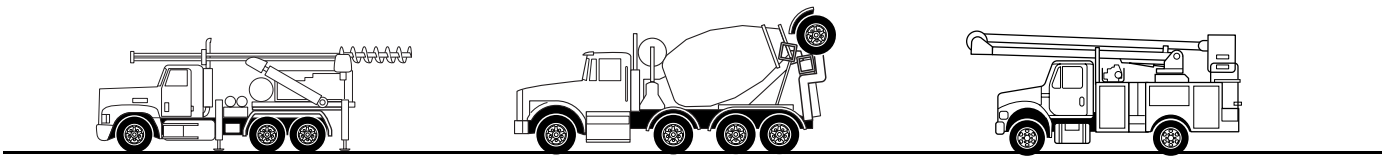
Note

1 Suspension restrictions may exist with the DS404, D40-145, D40-155 and D40-156. Please consult the Housing Structural Ratings Section for minimum housing box section requirements.

2 When multiple torque engines are specified, a maximum engine torque of 1750 Lb-Ft can be approved if the higher engine torque is limited to direct and/or overdrive transmission gears.

3 Operation 1 is limited to 6% Grade.

Construction/Agriculture



Vocational Description

- Movement of material to, from, or around a job site
- 90% of loaded operation on prepared road surfaces of concrete, asphalt, gravel, crushed rock or hard packed dirt and up to 10% of loaded operation into sandy or muddy work areas.
- Liftable tag and pusher axles are often used to increase legal load capacity on highway.
- Vehicles typically operate a high percentage of time off-highway making a high number of stops and starts.
- Straight trucks as well as trucks with equipment trailers are considered construction vehicles. Tractor/semi-trailers and straight trucks pulling material trailers or dump body pups will be considered mining applications and should be reviewed based on guidelines established for that vocation.

Typical Vehicle Types

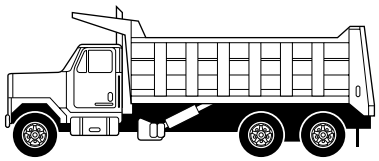
- Asphalt Truck
- Block/Brick Truck
- Bucket Truck
- Concrete Pumper
- Crane/Cherry Picker
- End/Side Dump Truck
- Feedlot Truck
- Flatbed Truck
- Grain Truck
- Landscape Truck
- Milk Tanker Truck
- Mixer Truck
- Roll-off Container Truck
- Silage Truck
- Stake Body Truck
- Snowplow/Snowblower
- Tanker Truck
- Transit Mixer
- Utility Truck

Service Definitions

Operation 1 - GVW/ GCW - straight trucks and straight trucks with equipment trailers. Grades up to 12%.

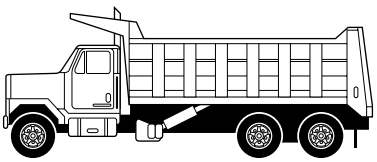
Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lb.) (GVW / GCW)	Gear Ratios	
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 12% Grade**	**Fastest**	**Slowest**
Single Axles							
S16-130	15,500	18.1	325	605	25,000	3.73	5.38
S17-140	17,000	19.7	300	860	29,000	3.58	5.57
17060S	17,000	19.7	300	860	29,000	3.58	5.57
S19-140	19,000	19.7	300	860	31,000	3.58	5.57
19060S	19,000	20.1	300	860	31,000	3.55	5.57
S20-140	20,000	19.7	300	860	31,000	3.58	5.57
S21-140	21,000	19.7	300	860	31,000	3.58	5.57
21060S	21,000	21.1	300	860	33,000	3.55	5.57
21065P	21,000	21.1	300	860	33,000	5.32	7.21
21065T	21,000	21.1	300	860	33,000	3.90/5.32	5.29/7.21
S21-170/170E	21,000	21.1	370	1350	50,000	3.07	5.57
S21-172/172E	21,000	21.1	405	1450	50,000	3.07	5.57
S21-190/190E	21,000	21.1	375	1450	60,000	3.07	5.57
22060S	22,000	21.1	300	860	34,000	3.55	5.57
22065P	22,000	21.1	300	860	34,000	5.32	7.21
22065T	22,000	21.1	300	860	34,000	3.90/5.32	5.29/7.21
23060SH	23,000	19.8	300	860	34,000	3.55	5.57
23082T	23,000	22.0	310	1150	50,000	3.70/5.04	5.43/7.39
S23-170/170E	23,000	22.0	370	1350	50,000	3.07	5.57
S23-172/172E	23,000	21.1	405	1450	50,000	3.07	5.57
S23-190	23,000	22.0	375	1450	60,000	3.07	5.57
S23-190E	23,000	22.0	375	1450	60,000	3.42	5.57
S23-590	23,000	22.0	375	1450	60,000	4.75	7.30
S25-170/170E	25,000	22.0	370	1350	50,000	3.07	5.57
S25-172/172E	25,000	21.1	405	1450	50,000	3.07	5.57
26082T	26,000	22.0	310	1150	50,000	3.70/5.04	5.43/7.39
S26-190/190E	26,000	22.0	375	1450	60,000	3.42	5.57
S26-590	26,000	22.0	375	1450	60,000	4.75	6.65
S30-190/190E	30,000	22.7	375	1450	60,000	3.42	5.57
S30-590	30,000	22.7	375	1450	60,000	4.75	6.65
S35-590	35,000	22.7	375	1450	60,000	4.75	6.65

Construction/Agriculture (Continued)



			Engine		Max. Gross Weight (lb.) (GVW / GCW)	Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 12% Grade**	**Fastest**	**Slowest**	
Tandem Axles								**Note**
DS405	40,000	21.1	375	1450	66,000	3.55	5.57	
DSP41	40,000	21.1	485	1650	68,000	3.55	5.57	
DSH40	40,000	21.1	485	1650	70,000	3.55	4.88	
DSH40	40,000	21.1	500	1850	70,000	3.55	4.33	**3,4**
D40-170	40,000	21.1	625	2050	100,000	3.42	5.38	
D40-172	40,000	21.1	625	2050	100,000	3.42	5.38	
DSH44	44,000	21.1	485	1650	72,000	3.55	5.29	
DT463-P	46,000	22.0	600	1850	100,000	3.70/5.04	4.88/6.64	
D46-170/170H	46,000	22.0	625	2050	100,000	3.42	5.38	**1**
D46-172/172H	46,000	22.0	625	2050	100,000	3.42	5.38	**1**
D46-590HP	46,000	22.0	625	2050	110,000	4.75	7.75	
D50-170	50,000	22.0	625	2050	100,000	3.42	4.56	
D50-172	50,000	22.0	625	2050	100,000	3.42	5.38	
D52-190P	52,000	22.0	625	2050	110,000	3.42	5.57	
D52-590P	52,000	22.0	625	2050	110,000	4.75	7.75	
D60-190P	60,000	22.7	625	2050	110,000	3.42	4.56	
D60-590P	60,000	22.7	625	2050	110,000	4.75	7.75	
D70-590P	70,000	22.7	625	2050	110,000	4.75	7.75	
Tridem Axles								**Note**
T60-174P	Note 2	19.7	485	1650	80,000	3.90	4.63	**2**
TDT583-P		20.1	600	1850	100,000	3.90/5.32	4.88/6.64	**2**
T69-170HP		20.8	625	2050	100,000	3.91	4.78	**2**
T69-172HP		20.8	625	2050	100,000	3.91	4.78	**2**
T78-190P		20.8	625	2050	110,000	3.91	4.78	**2**
T78-590P		20.8	625	2050	110,000	4.75	7.30	**2**

Note

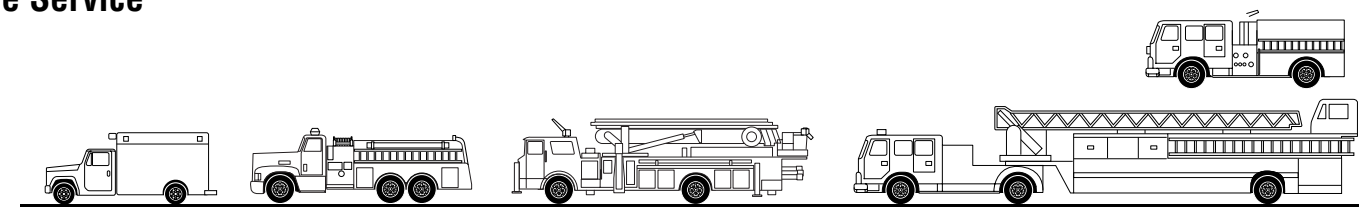
1 Suspension restrictions may exist with the D46-170 and D46-172. Please consult the Housing Structural Ratings Section for minimum housing box section requirements.

2 Allowable tridem gross axle weight rating (GAWR) varies with axle ratio. Refer to the Tridem Load Ratings Section for information regarding permissible gross axle weight ratings.

3 Operation 1 is limited to 6% Grade.

4 Suspension restriction exists: the Chalmers and/or Hendrickson walking beam suspensions are not approved.

Fire Service



Vocational Description

- Vehicles used to transport people and equipment for the purpose of extinguishing fires or ambulance service
- 90% of operation on prepared road surfaces of concrete, asphalt, gravel, crushed rock, or hard packed dirt and up to 10% of loaded operation into sandy or muddy areas.
- Mileage is typically under 15,000 miles per year
- Typical vehicle routes are three (3) miles between start and stop
- Vehicle retarders (engine, exhaust, transmission, or electromagnetic) are common
- High engine horsepower and automatic transmissions are typical.
- Loaded 100% of the time.

Typical Vehicle Types

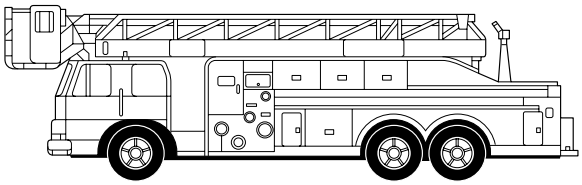
- Aerial Ladders
- Aerial Platforms
- Ambulances
- Emergency Vehicle non-pumper
- Fire Truck
- First Responder Truck
- Foam Tender Truck
- Hazardous Material
- Pumpers
- Tankers

Service Definitions

Operation 1 - GVW - Straight trucks. Grades up to 20%

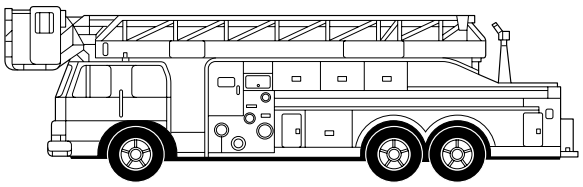
Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lb.) (GVW / GCW)	Gear Ratios	
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 20% Grade**	**Fastest**	**Slowest**
Single Axles							
S14-110	13,500	16.5	330	550	24,500	3.73	5.13
S14-130	13,500	15.7	300	660	26,500	3.73	5.13
S16-130	15,500	18.1	330	605	26,500	3.73	5.13
S17-140	17,000	19.7	300	860	27,000	3.58	5.57
17060S	17,000	19.7	330	950	27,000	3.25	5.57
S19-140	19,000	19.7	300	860	31,000	3.58	5.57
19060S	19,000	20.1	330	950	31,000	3.25	5.57
S20-140	20,000	19.7	300	860	31,000	3.58	5.57
21060S	22,000	21.1	330	950	34,000	3.25	5.57
S21-140	22,000	19.7	300	860	31,000	3.58	5.57
S21-170/170E	22,000	21.1	450	1450	45,000	3.07	5.57
S21-172/172E	22,000	21.1	450	1450	45,000	3.07	5.57
S21-190	22,000	21.1	525	1650	45,000	3.07	6.14
S21-190E	22,000	21.1	525	1650	45,000	3.42	6.14
22060S	22,000	21.1	330	950	34,000	3.25	5.57
23060SH	23,000	19.8	330	950	34,000	3.25	5.57
S23-170/170E	23,000	22.0	450	1450	45,000	3.07	5.57
S23-172/172E	23,000	22.0	450	1450	45,000	3.07	5.57
S23-190	24,000	22.0	525	1650	46,000	3.07	6.14
S23-190E	24,000	22.0	525	1650	46,000	3.42	6.14
S25-170/170E	26,000	22.0	450	1450	48,000	3.07	5.57
S25-172/172E	26,000	22.0	450	1450	48,000	3.07	5.57
S26-190/190E	27,000	22.0	525	1650	49,000	3.42	6.14
S30-190/190E	31,000	22.7	525	1650	53,000	3.42	6.14
S30-590	31,000	22.7	525	1650	53,000	4.75	6.65
S35-590	35,000	22.7	525	1650	58,000	4.75	6.65

Fire Service (Continued)

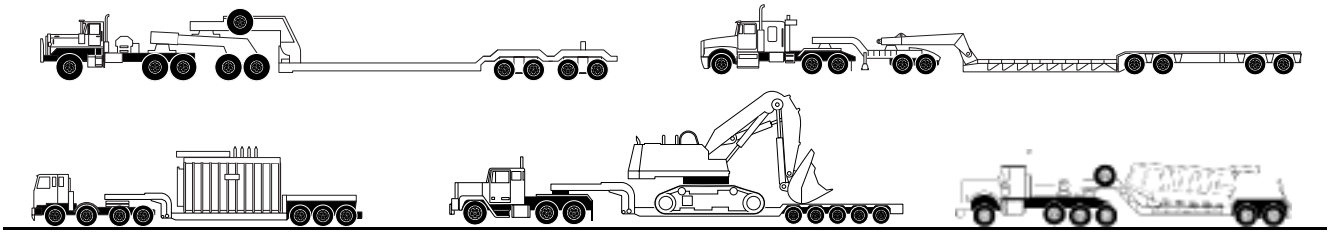


			Engine		Max. Gross Weight (lb.) (GVW / GCW)	Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 20% Grade**	**Fastest**	**Slowest**	
Tandem Axles								**Note**
DS404	40,000	21.1	500	1550	62,000	3.25	5.57	**1**
DS405	42,000	21.1	500	1550	64,000	3.25	5.57	
DSP40	40,000	21.1	500	1550	62,000	3.25	5.57	**1**
DSP41	42,000	21.1	500	1550	64,000	3.25	5.57	
DSH40	42,000	21.1	550	1850	64,000	3.25	4.88	
D40-170	42,000	21.1	625	2050	64,000	3.21	5.57	
D40-172	42,000	21.1	625	2050	64,000	3.21	5.57	
DSH44	45,000	21.1	550	1850	67,000	3.25	5.29	
D46-170	46,000	22.0	625	2050	68,000	3.21	5.57	**1**
D46-170H	50,000	22.0	625	2050	70,000	3.21	5.57	
D46-172	46,000	22.0	625	2050	68,000	3.21	5.57	**1**
D46-172H	50,000	22.0	625	2050	70,000	3.21	5.57	
D50-170	52,000	22.0	625	2050	72,000	3.21	5.57	
D50-172	52,000	22.0	625	2050	72,000	3.21	5.57	
D52-190P	54,000	22.0	625	2050	76,000	3.42	5.38	
D60-190P	60,000	22.7	625	2050	82,000	3.42	5.38	

Note

1 Suspension restrictions may exist with the DS404, DSP40, D46-170, and D46-172. Please consult the Housing Structural Ratings Section for minimum housing box section requirements.

Heavy Haul



Vocational Description

- Movement of heavy equipment or materials at legal maximums or special permit loadings
- Exclusive operation on prepared road surfaces of concrete, asphalt and maintained gravel
- High horsepower engines and auxiliary transmissions are typically used
- Loaded going and empty return
- Infrequent stops

Typical Vehicle Types

- Flatbed
- Heavy Equipment Transport
- Heavy Wrecker
- Lowboy
- Specialized Heavy Haul
- Steel Hauling

Service Definitions

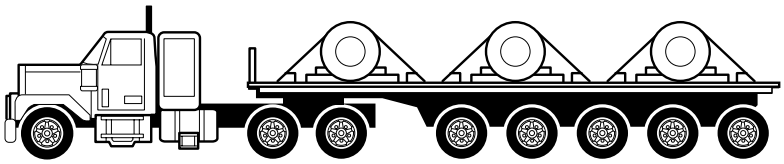
(Vocational descriptions applies to all operations)

Operation 1 - Grades up to 8%

Operation 2 - Grades up to 12%

Housing Structural Ratings

See the Housing Structural Ratings section.

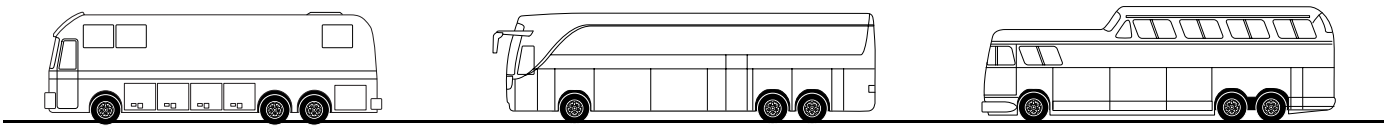


			Engine		Max. Gross Weight (lb.) (GVW / GCW)		Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 8% Grade**	**Operation 2 12% Grade**	**Fastest**	**Slowest**	
Tandem Axles									
DT463-P	46,000	22.0	625	2050	190,000	175,000	3.70/5.04	4.56/6.20	
D46-170H	46,000	22.0	625	2050	200,000	185,000	3.42	4.56	
D46-172H	46,000	22.0	625	2050	210,000	190,000	3.42	4.56	
D46-590HP	46,000	22.0	650	2250	240,000	225,000	4.75	7.30	
D50-170	50,000	22.0	625	2050	200,000	185,000	3.42	4.56	
D50-172	50,000	22.0	625	2050	210,000	190,000	3.42	4.56	
D52-190P	52,000	22.0	650	2250	240,000	225,000	3.58	4.78	
D52-590P	52,000	22.0	650	2250	240,000	225,000	4.75	7.30	
D60-190P	60,000	22.7	650	2250	240,000	225,000	3.58	4.78	
D60-590P	60,000	22.7	650	2250	240,000	225,000	4.75	7.30	
D70-590P	70,000	22.7	650	2250	240,000	225,000	4.75	7.30	
Tridem Axles									**Note**
T60-174P	Note 1	19.7	485	1650	180,000	160,000	3.90	4.63	**1**
TDT583-P		20.1	625	2050	190,000	175,000	3.90/5.32	4.56/6.21	**1**
T69-170HP		20.8	625	2050	200,000	185,000	3.91	4.78	**1**
T69-172HP		20.8	625	2050	200,000	185,000	3.91	4.78	**1**
T78-190P		20.8	650	2250	240,000	225,000	3.91	4.78	**1**
T78-590P		20.8	650	2250	240,000	225,000	4.75	7.30	**1**

Note

1 Allowable tridem gross axle weight rating (GAWR) varies with axle ratio. Refer to the Tridem Load Ratings Section for information regarding permissible gross axle weight ratings.

Intercity Coach



Vocational Description

- Transportation of people and, on occasion, light freight between cities or suburban areas
- Exclusive operation on well maintained paved surfaces
- High mileage operation
- Typical vehicle routes exceed 30 miles between start and stop
- No towed load allowed

Typical Vehicle Types

- Tour Coach
- Cross Country Coach

Vehicle Configuration

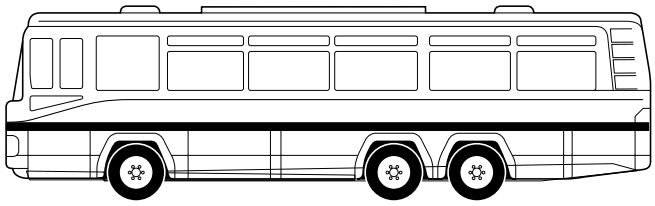
6 x 2 straight coach with fixed tag or pusher axle

Service Definitions

Operation 1 - Grades up to 8%

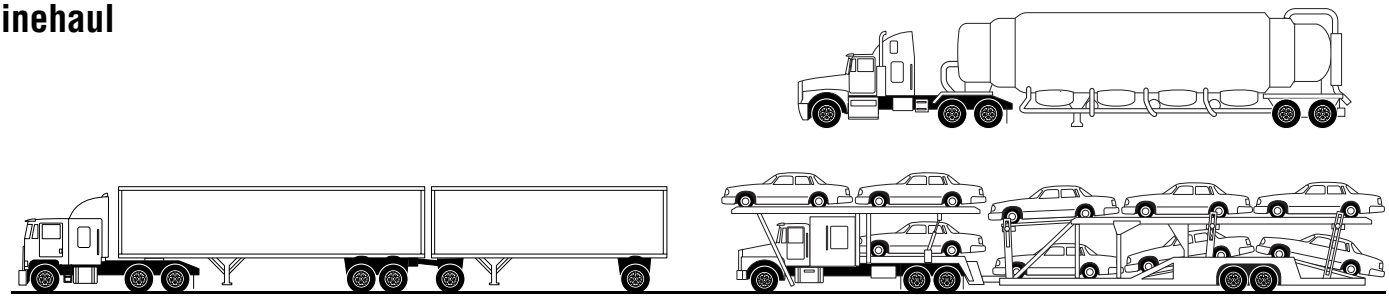
Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lb.) (GVW)	Gear Ratios	
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 8% Grade**	**Fastest**	**Slowest**
Single Axles							
S21-140	21,000	20.1	300	860	42,000	3.31	4.88
22060S	22,000	20.7	350	1050	45,000	3.36	4.78
23060SH	23,000	19.8	350	1050	45,000	3.36	4.78
S23-170	23,000	21.1	375	1450	55,000	3.42	4.78
S23-172	23,000	21.1	375	1450	55,000	3.42	4.78
S23-190	23,000	21.1	485	1650	55,000	3.42	4.78
S25-170	25,000	21.1	375	1450	55,000	3.42	4.78
S25-172	25,000	21.1	375	1450	55,000	3.42	4.78
S26-190	26,000	21.1	485	1650	55,000	3.42	4.78
EconoTrek 6x2							
S21-170/ S20-045B	40,000	21.1	375	1450	55,000	3.42	4.78
S21-172/ S20-045B	40,000	21.1	375	1450	55,000	3.42	4.78
S21-190/ S40-145B	40,000	21.1	485	1650	55,000	3.42	4.78

Linehaul



Vocational Description

- Long distance transport of various types of freight in high mileage operation (min 60,000 miles/year)
- Exclusive operation on road surfaces of good to excellent concrete or asphalt
- Vehicle routes are typically on limited access highways and exceed 30 miles between starts and stops
- Maximum infrequent grades of up to 8%
- Majority of vehicles are 4 x 2, 6 x 2 (fixed tag or pusher) and 6 x 4 tractor/trailer combinations and some straight trucks

Typical Vehicle Types

- Auto Hauler
- Bulk Hauler
- Double Trailers
- Flatbed Trailers
- General Freight
- Grain Haulers
- Hay Haulers
- Livestock Haulers
- Lumber Haulers
- Moving Van
- Pipe Hauler
- Refrigerated Freight
- Refuse/On-Highway Trailer
- Tanker Trailer
- Triple Trailers
- Van Trailer

Service Definitions

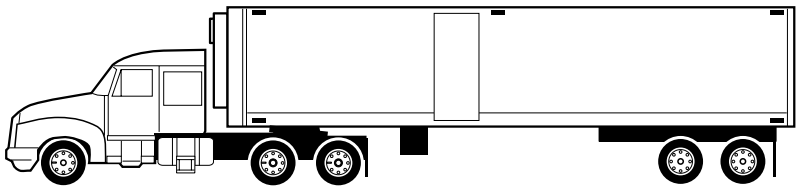
(interstate highways, turnpikes and limited access roadways)

Operation 1 - Grades up to 3%

Operation 2 - Infrequent grades up to 8%

Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lb.) (GVW / GCW)		Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 3% Grade**	**Operation 2 8% Grade**	**Fastest**	**Slowest**	
Single Axles									**Note**
S21-140	21,000	19.7	300	860	46,000	46,000	3.58	4.56	
21060S	21,000	21.1	300	860	60,000	60,000	3.08	4.63	
S21-170	21,000	21.1	425	1450	100,000	90,000	3.07	4.56	
S21-170	21,000	19.8	500	1650	90,000	80,000	3.07	4.10	1
S21-172	21,000	21.1	500	1650	100,000	90,000	3.07	4.56	2
S21-190	21,000	22.0	500	1650	140,000	110,000	2.56	4.56	
S21-190	21,000	20.1	565	1850	100,000	80,000	2.56	4.30	2
22060S	22,000	21.1	300	860	60,000	60,000	3.08	4.63	
23060SH	23,000	19.8	300	860	60,000	60,000	3.08	4.63	
S23-170	23,000	21.1	425	1450	100,000	90,000	3.07	4.56	
S23-170	23,000	19.3	500	1650	90,000	80,000	3.07	4.10	
S23-172	23,000	21.1	500	1650	100,000	90,000	3.07	4.56	2
S23-190	23,000	22.0	500	1650	140,000	110,000	2.56	4.56	1
S23-190	23,000	20.1	565	1850	100,000	80,000	2.56	4.30	2
EconoTrek 6x2									**Note**
S21-170/ S20-045B	40,000	21.1	425	1450	100,000	90,000	3.07	4.56	
S21-170/ S20-045B	40,000	19.8	500	1650	90,000	80,000	3.07	4.10	1
S21-172 / S20-045B	40,000	21.1	500	1650	100,000	90,000	3.07	4.56	2
S21-190/ S20-045B	40,000	22.0	500	1650	140,000	110,000	2.56	4.56	1
S21-190/ S20-045B	40,000	20.1	565	1850	100,000	80,000	2.93	4.30	
S23-170/ S20-045B	40,000	21.1	425	1450	100,000	90,000	3.07	4.56	
S23-170/ S20-045B	40,000	19.8	500	1650	90,000	80,000	3.07	4.10	1
S23-172 / S20-045B	40,000	21.1	500	1650	100,000	90,000	3.07	4.56	2
S23-190/ S20-045B	40,000	22.0	500	1650	140,000	110,000	2.56	4.56	1
S23-190/ S20-045B	40,000	20.1	565	1850	100,000	80,000	2.56	4.56	

Note

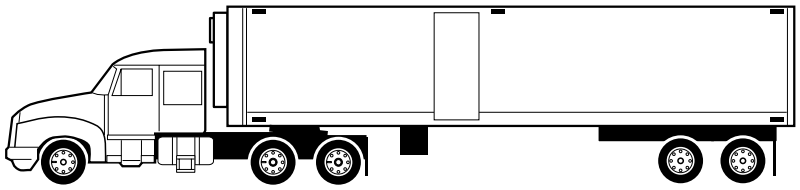
1 When engines with multiple torque outputs are specified, a maximum engine torque of 1750 lb-ft can be approved if limited to direct and overdrive transmission gears only.

2 When engines with multiple torque outputs are specified, a maximum engine torque of 1850 lf-ft can be approved if limited to direct and overdrive transmission gears only.

3 Suspension restrictions may exist with the DS404, DSP40, D40-145, D40-155.

4 Operation 2 is limited to 6% maximum Grade.

Linehaul (Continued)



			Engine		Max. Gross Weight (lb.) (GVW / GCW)		Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb. ft.)**	**Operation 1 3% Grade**	**Operation 2 8% Grade**	**Fastest**	**Slowest**	
Tandem Axles									**Note**
DS404/405	40,000	21.1	500	1650	143,000	110,000	3.08	4.11	**3**
DS404/405	40,000	21.1	565	1850	80,000	80,000	3.08	4.11	**3**
DS404/405	40,000	21.1	485	1550/1750	80,000	80,000	3.08	3.70	**1,3**
DSP40/41	40,000	21.1	500	1650	143,000	110,000	3.08	4.33	**3**
DSP40/41	40,000	21.1	565	1850	80,000	80,000	3.08	4.33	**3**
DSP40/41	40,000	21.1	485	1550/1750	80,000	80,000	3.08	3.70	**1,3**
D40-145	40,000	19.3	485	1650	110,000	80,000	3.36	3.91	**1,3**
D40-145	39,000	19.8	485	1650	100,000	80,000	3.36	3.91	**1,3**
D40-145	38,000	20.2	485	1650	90,000	80,000	3.36	3.91	**1,3,4**
D40-155	40,000	19.9	485	1650	145,000	110,000	2.26	2.93	**1,3**
D40-155	40,000	19.9	565	1850	80,000	80,000	2.26	2.93	**3**
D40-156	40,000	21.1	500	1650	145,000	110,000	3.08	3.91	**1,3**
D40-156	40,000	21.1	550	1850	80,000	80,000	3.08	3.91	**3**
DSH40	40,000	21.1	605	2050	143,000	110,000	3.08	4.88	
D40-170	40,000	21.1	625	2050	185,000	160,000	3.07	4.10	
D40-172	40,000	21.1	625	2050	185,000	160,000	3.07	4.56	
D46-170/170H	46,000	21.1	650	2250	185,000	160,000	3.07	4.10	
D46-172/172H	46,000	22.0	650	2250	185,000	160,000	3.07	4.56	

Note

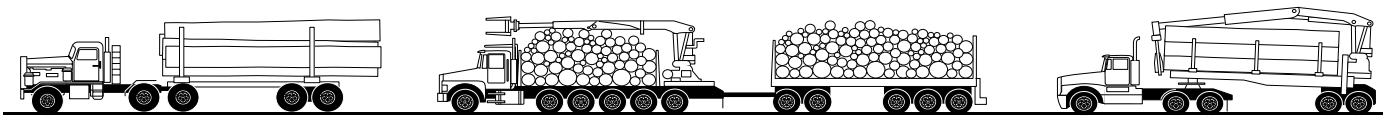
1 When engines with multiple torque outputs are specified, a maximum engine torque of 1750 lb-ft can be approved if limited to direct and overdrive transmission gears only.

2 When engines with multiple torque outputs are specified, a maximum engine torque of 1850 lf-ft can be approved if limited to direct and overdrive transmission gears only.

3 Suspension restrictions may exist with the DS404, DSP40, D40-145, D40-155.

4 Operation 2 is limited to 6% maximum Grade.

Logging



Vocational Description

- Movement of logs, chips and pulp between logging sites mills, or processing plants
- High horsepower engines and vehicle retarders are typically used in this vocation
- Vehicle routes are typically 3 to 30 miles between starts and stops
- Fully loaded going and empty return
- Majority of vehicles are 6 x 4 tractor/trailer combination or trucks with full trailers unique to this vocation

Typical Vehicles Types

- Chip Hauler
- Divorced Hauler
- Log Hauler
- Pole Truck & Trailer
- Straight Truck with Trailer
- Tractors with Pole Trailers

Service Definitions

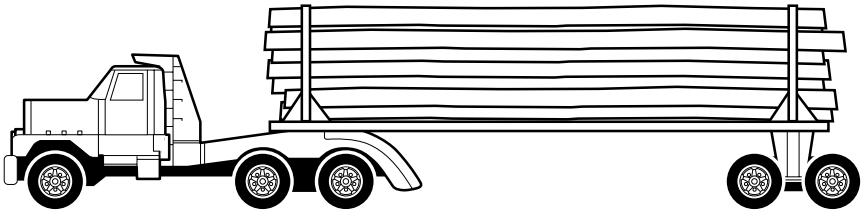
Operation 1 - Exclusive operation on road surfaces of concrete or asphalt. Grades not exceeding 8%.

Operation 2 - Infrequent grades up to 12%. 90% of loaded operation on prepared road surfaces of concrete, asphalt, gravel, crushed rock, or hard packed dirt with up to 10% of loaded operation into sandy or muddy job sites.

Operation 3 - Infrequent grades up to 20%. 90% of loaded operation on prepared road surfaces of concrete, asphalt, gravel, crushed rock, or hard packed dirt with up to 10% of loaded operation into sandy or muddy job sites.

Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lb.) (GVW / GCW)			Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 8% Grade**	**Operation 2 12% Grade**	**Operation 3 20% Grade**	**Fastest**	**Slowest**	
Tandem Axles										
DS405	40,000	21.1	485	1650	80,000	N/A	N/A	3.36	4.88	
DSH40	40,000	21.1	550	1850	100,000	N/A	N/A	3.36	4.33	
D40-170	40,000	21.1	625	2050	160,000	150,000	135,000	3.42	4.78	
D40-172	40,000	22.0	625	2050	160,000	150,000	135,000	3.42	4.78	
DT463-P	46,000	22.0	600	1850	150,000	140,000	130,000	3.70/5.04	4.88/6.64	
D46-170H	46,000	22.0	625	2050	160,000	150,000	135,000	3.42	4.78	
D46-172H	46,000	22.0	625	2050	160,000	150,000	135,000	3.42	4.78	
D46-590HP	46,000	22.0	625	2050	180,000	170,000	160,000	4.75	7.30	
D50-170	50,000	22.0	625	2050	160,000	150,000	135,000	3.42	4.78	
D50-172	50,000	22.0	625	2050	160,000	150,000	135,000	3.42	4.78	
D52-190P	52,000	22.0	625	2050	180,000	170,000	160,000	3.42	4.78	
D52-590P	52,000	22.0	625	2050	180,000	170,000	160,000	4.75	7.30	
D60-190P	60,000	22.7	625	2050	180,000	170,000	160,000	3.42	4.78	
D60-590P	60,000	22.7	625	2050	180,000	170,000	160,000	4.75	7.30	
D70-590P	70,000	22.7	625	2050	180,000	170,000	160,000	4.75	7.30	
Tridem Axles										**Note**
T60-174P	Note 1	19.7	485	1650	120,000	110,000	100,000	3.90	4.63	**1**
TDT583-P		20.1	600	1850	150,000	140,000	130,000	3.90/5.32	4.88/6.64	**1**
T69-170HP		20.8	625	2050	160,000	150,000	135,000	3.91	4.78	**1**
T69-172HP		20.8	625	2050	160,000	150,000	135,000	3.91	4.78	**1**
T78-190P		20.8	625	2050	180,000	170,000	160,000	3.91	4.78	**1**
T78-590P		20.8	625	2050	180,000	170,000	160,000	4.75	7.30	**1**

Note

1 Allowable tridem gross axle weight rating (GAWR) varies with axle ratio. Refer to the Tridem Load Ratings Section for information regarding permissible gross axle weight ratings.

Mining

Vocational Description

- Movement of rock, ore, gravel and minerals around mine sites and between mines and processing plants
- High horsepower engines are typically used in this vocation
- Vehicle routes are typically 3 to 30 miles between starts and stops
- 90% of operation on-road with up to 10% into sandy or muddy job sites
- Fully loaded going and empty return
- Tractor/trailer and straight truck/material trailer combinations are considered mining vehicles. Straight trucks without trailers or trucks with equipment trailers are considered construction applications and should be reviewed based on the guidelines established for that vocation.

Typical Vehicle Types

- Belly/Bottom Dump Trailer
- Hopper Trailer Combinations
- Michigan Special Gravel Trains
- Ore Hauling Trailer
- Side/Semi-End Dump Trailer
- Super/Transfer Dump

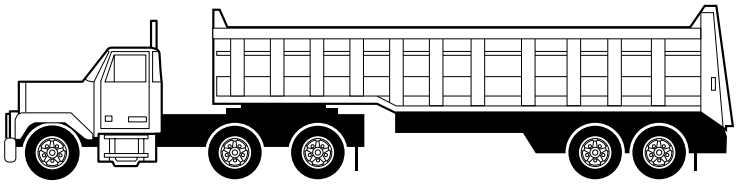
Service Definitions

Operation 1 - Exclusive tractor/semi-trailer or truck and material trailer operation on prepared road surfaces of concrete, asphalt, gravel, crushed stone, or hard packed dirt. Grades of up to 8%.

Operation 2 - Tractor/semi-trailer or truck and material trailer operation on prepared road surfaces of concrete, asphalt, gravel, crushed stone, or hard packed dirt with up to 10% of the total operation going into sandy or muddy mine sites. Grades of up to 20%.

Housing Structural Ratings

See the Housing Structural Ratings section.

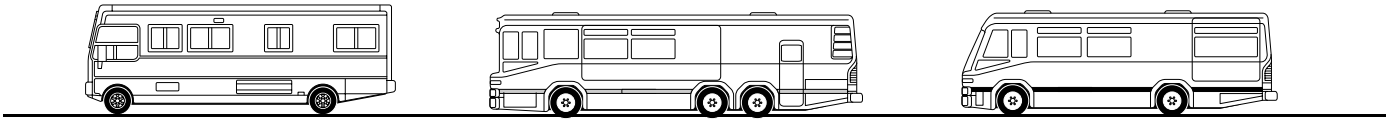


			Engine		Max. Gross Weight (lb.) (GVW / GCW)		Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 8% Grade**	**Operation 20% Grade**	**Fastest**	**Slowest**	
Single Axles									
S23-170	23,000	19.9	405	1450	65,000	N/A	3.90	4.56	
S23-172	23,000	19.9	405	1450	66,000	N/A	3.91	4.56	
S23-190	23,000	21.1	485	1650	80,000	N/A	3.73	4.56	
Tandem Axles									
DS405	40,000	21.1	485	1650	80,000	N/A	3.36	4.88	
DSH40	40,000	21.1	565	1850	80,000	N/A	3.36	4.88	
D40-170	40,000	21.1	625	2050	165,000	140,000	3.42	4.56	
D40-172	40,000	21.1	625	2050	165,000	140,000	3.42	4.56	
DT463-P	46,000	22.0	600	1850	165,000	130,000	3.70/5.04	4.88/6.64	
D46-170/170H	46,000	22.0	625	2050	165,000	140,000	3.42	4.56	
D46-172/172H	46,000	22.0	625	2050	165,000	140,000	3.42	4.56	
D46-590HP	46,000	22.0	625	2050	180,000	160,000	4.75	6.65	
D50-170	50,000	22.0	625	2050	165,000	140,000	3.42	4.56	
D50-172	50,000	22.0	625	2050	165,000	140,000	3.42	4.56	
D52-190P	52,000	22.0	625	2050	180,000	160,000	3.42	4.78	
D52-590P	52,000	22.0	625	2050	180,000	160,000	4.75	6.65	
D60-190P	60,000	22.7	625	2050	180,000	160,000	3.42	4.78	
D60-590P	60,000	22.7	625	2050	180,000	160,000	4.75	6.65	
D70-590P	70,000	22.7	625	2050	180,000	170,000	4.75	6.65	
Tridem Axles									**Note**
T60-174P	NOTE 1	19.7	485	1650	120,000	100,000	3.90	4.63	**1**
TDT583-P		20.1	600	1850	165,000	130,000	3.90/5.32	4.88/6.64	**1**
T69-170HP		20.8	625	2050	165,000	140,000	3.91	4.78	**1**
T69-172HP		20.8	625	2050	165,000	140,000	3.91	4.78	**1**
T78-190P		20.8	625	2050	180,000	160,000	3.91	4.78	**1**
78-590P		20.8	625	2050	180,000	160,000	4.75	7.30	**1**

Note

1 Allowable tridem gross axle weight rating (GAWR) varies with axle ratio. Refer to the Tridem Load Ratings Section for information regarding permissible gross axle weight ratings.

Motorhome



Vocational Description

- Vehicles generally used for non-commercial transportation and as traveling domiciles for families
- Loaded full time
- May pull small passenger car, boat, or pick-up truck
- Typically vehicle routes exceed 30 miles between starts and stops
- Annual mileage generally less than 30,000
- Typical operation is on paved roads and short distances within campgrounds and parks
- Equipped with Automatic transmissions

Typical Vehicle Types

- Integral Coach
- Recreational Vehicles

Vehicle Configurations

Straight coach type vehicles with towing ability:

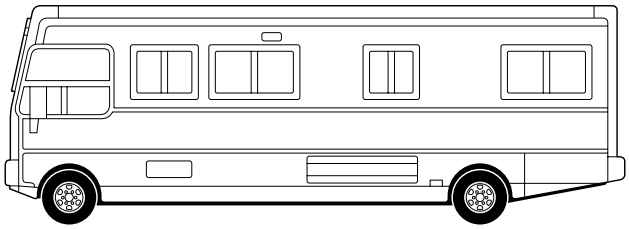
- 4 x 2 straight coach
- 6 x 2 (with fixed tag or pusher axles)

Service Definitions

Operation 1 - Loaded full time. Infrequent grades up to 8%

Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lb.) (GVW / GCW)	Gear Ratios	
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 8% Grade**	**Fastest**	**Slowest**
Single Axles							
S14-110	13,500	16.5	300	605	27,500	4.10	5.38
S16-130	15,500	18.1	300	660	30,000	4.10	5.38
S17-140	17,000	19.7	300	860	40,000	3.58	5.57
17060S	17,000	19.7	300	860	40,000	3.55	5.57
S19-140	19,000	19.7	300	860	42,000	3.58	5.57
19060S	19,000	19.7	300	860	42,000	3.55	5.57
S20-140	20,000	19.7	300	860	42,000	3.58	5.57
S21-140	21,000	19.7	300	860	42,000	3.58	5.57
21060S	21,000	20.1	330	1050	44,000	3.55	5.57
S21-170	21,000	20.1	430	1550	50,000	3.58	5.57
S21-172	21,000	20.1	430	1550	50,000	3.58	5.57
S21-190	21,000	20.1	485	1750	65,000	3.58	5.57
22060S	22,000	20.1	330	1050	45,000	3.55	5.57
23060SH	23,000	19.6	330	1050	45,000	3.55	5.57
S23-170	23,000	20.1	430	1550	50,000	3.58	5.57
S23-172	23,000	20.1	430	1550	50,000	3.58	5.57
S23-190	23,000	20.1	485	1750	65,000	3.58	5.57
EconoTrek 6x2							
S21-170/ S20-045B	40,000	20.1	430	1550	60,000	3.07	5.57
S21-172/ S20-045B	40,000	20.1	430	1550	60,000	3.07	5.57
S21-190/ S40-145B	40,000	20.1	485	1750	70,000	3.07	5.57

Oil Field

Vocational Description

- Movement of production related products, supplies and tools between job sites
- Movement of processing equipment and laboratories on job sites
- Low mileage operation on road surfaces made of concrete, asphalt, maintained gravel, crushed rock or hard packed dirt
- High horsepower engines common
- Vehicles are typically 6x4 or 6x6 straight trucks or tractors with permanently mounted equipment for well servicing or exploration

Typical Vehicle Types

- Cementing Vehicle
- Demolition
- Drill Rig
- Fracturing Truck
- Geophysical Exploration
- Rigging Truck
- Tanker
- Well Serving Truck
- Winch Truck

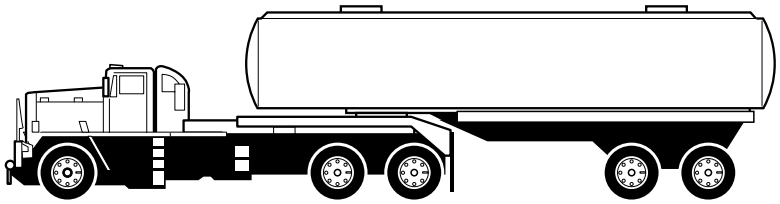
Service Definitions

Operation 1 - Up to 25% job site operation, minimum 3 miles between stops, exclusive operation on prepared road surfaces. Grades of up to 12%.

Operation 2 - Full time job site operation, frequent starts and stops, fully loaded going/empty return, low mileage. Grades of up to 12%.

Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lb.) (GVW / GCW)		Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 12% Grade**	**Operation 2 12% Grade**	**Fastest**	**Slowest**	
Tandem Axles									**Note**
DS405	40,000	21.1	375	1450	100,000	N/A	3.55	5.29	
DSH40	40,000	21.1	485	1650	100,000	N/A	3.55	4.88	
D40-170	40,000	21.1	625	2050	120,000	100,000	3.42	5.38	
D40-172	40,000	21.1	625	2050	120,000	100,000	3.42	5.38	
DSH44	44,000	21.1	485	1650	72,000	72,000	3.55	5.29	**3**
DT463-P	46,000	22.0	600	1850	120,000	100,000	3.70/5.04	4.88/6.64	
D46-170/170H	46,000	22.0	625	2050	120,000	100,000	3.42	5.38	**1**
D46-172/172H	46,000	22.0	625	2050	120,000	100,000	3.42	5.38	**1**
D46-590HP	46,000	22.0	625	2050	140,000	120,000	4.75	6.65	
D50-170	50,000	22.0	625	2050	120,000	100,000	3.42	5.38	
D50-172	50,000	22.0	625	2050	120,000	100,000	3.42	5.38	
D52-190P	52,000	22.0	625	2050	140,000	120,000	3.42	5.38	
D52-590P	52,000	22.0	625	2050	140,000	120,000	4.75	6.65	
D60-190P	60,000	22.7	625	2050	140,000	120,000	3.42	5.38	
D60-590P	60,000	22.7	625	2050	140,000	120,000	4.75	6.65	
D70-590P	70,000	22.7	625	2050	140,000	120,000	4.75	6.65	
Tridem Axles									**Note**
T60-174P	Note 2	19.7	450	1650	100,000	80,000	3.90	4.63	**2**
TDT583-P		20.1	600	1850	120,000	100,000	3.90/5.32	4.88/6.64	**2**
T69-170HP		20.8	625	2050	120,000	100,000	3.91	4.78	**2**
T69-172HP		20.8	625	2050	120,000	100,000	3.91	4.78	**2**
T78-190P		20.8	625	2050	140,000	120,000	3.91	4.78	**2**
T78-590P		20.8	625	2050	140,000	120,000	4.75	7.30	**2**

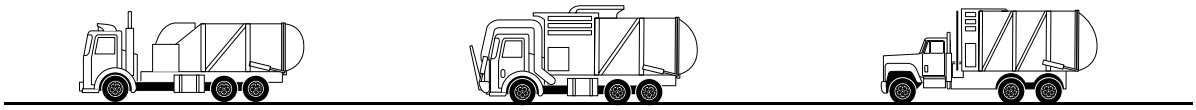
Note

1 Suspension restrictions may exist with the D46-170. Please consult the Housing Structural Ratings Section for minimum housing box section requirements.

2 Allowable tridem gross axle weight rating (GAWR) varies with axle ratio. Refer to the Tridem Load Ratings Section for information regarding permissible gross axle weight ratings.

3 Applies to straight truck only, no combination vehicles.

Refuse



Vocational Description

- 4x2 and 6x4 straight trucks, generally with automatic transmissions, used for residential refuse/recycle pickup
- Typically a high number of stops and starts per mile
- 6x4 straight trucks operating in commercial/industrial pickup with approximately 1 to 3 miles between stops
- 6x4 tractor/semi-trailers or 6x4 straight trucks with roll-off containers used for transfer/relocation of material. Stops are typically more than 10 miles apart.
- 90% of loaded operation on road surfaces of concrete, asphalt or maintained gravel and up to 10% of loaded operation into landfill, transfer or recycling sites

Typical Vehicle Types

- Front/Rear/Side Loader
- Liquid Waste Hauler
- Residential/Commercial Pickup
- Roll-Off Container Truck
- Scrap Truck
- Sewer/Septic/Vacuum
- Street Sweeper
- Transfer Vehicle

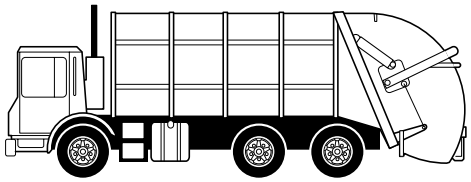
Service Definitions

Operation 1 GVW - Straight truck vehicles used for residential and commercial pick-up of refuse and recyclables. Grades up to 20%

Operation 2 GVW/GCW - Straight trucks with roll-off containers and tractor/semi-trailers used to transport material to transfer stations, recycling facilities, or landfill sites. Grades up to 8%.

Housing Structural Ratings

See the Housing Structural Ratings section.

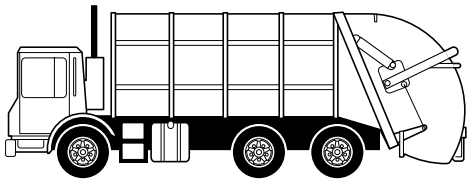


			Engine		Max. Gross Weight (lb.) (GVW)	Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 20% Grade**	**Fastest**	**Slowest**	
Single Axles								**Note**
S21-140	21,000	19.7	300	860	31,000	3.58	5.57	**1**
21060S	21,000	21.1	275	860	33,000	3.55	5.57	**1**
21065P	21,000	21.1	275	860	33,000	5.32	7.60	**1**
21065T	21,000	21.1	275	860	33,000	3.90/5.32	5.29/7.21	**1**
S21-170/170E	21,000	21.1	330	1150	45,000	3.42	5.57	
S21-172/172E	21,000	21.1	330	1150	45,000	3.42	5.57	
S21-190	21,000	22.0	375	1450	55,000	3.42	5.57	
22060S	22,000	21.1	275	860	33,000	3.55	5.57	**1**
22065P	22,000	21.1	275	860	33,000	5.32	7.60	**1**
22065T	22,000	21.1	275	860	33,000	3.90/5.32	5.29/7.21	**1**
23060SH	23,000	20.2	275	860	33,000	3.55	5.57	
23082T	23,000	22.0	330	1150	45,000	3.70/5.04	4.88/6.64	
S23-170/170E	23,000	22.0	330	1150	45,000	3.42	5.57	
S23-172/172E	23,000	22.0	330	1150	45,000	3.42	5.57	
S23-190	23,000	22.0	375	1450	55,000	3.42	5.57	
S23-190E	23,000	22.0	375	1450	55,000	3.42	5.57	
S23-590	23,000	22.0	375	1450	55,000	4.75	6.65	
S25-170/170E	25,000	22.0	330	1150	45,000	3.42	5.57	
S25-172/172E	25,000	22.0	330	1150	45,000	3.42	5.57	
26082T	26,000	22.0	330	1150	46,000	3.70/5.04	4.88/6.64	
S26-190	26,000	22.0	375	1450	58,000	3.42	5.57	
S26-190E	26,000	22.0	375	1450	58,000	3.42	5.57	
S26-590	26,000	22.0	375	1450	58,000	4.75	6.65	
S30-190	30,000	22.7	375	1450	58,000	3.42	5.57	
S30-190E	30,000	22.7	375	1450	58,000	3.42	5.57	
S30-590	30,000	22.7	375	1450	58,000	4.75	6.65	
S35-590	35,000	22.7	375	1450	58,000	4.75	6.65	

Note

1 The 21060S, 21065P, 21065T, 22060S, 22065P and 22065T are not approved in vehicles equipped with retarders.

Refuse (Continued)



			Engine		Max. Gross Weight (lb.) (GVW / GCW)		Gear Ratios		
Axle Model	**Max. GAWR (lb.)**	**Max SLR (.in)**	**HP**	**Torque (lb.ft.)**	**Operation 1 (GVW) 20% Grade**	**Operation 2 (GVW / GCW) 8% Grade**	**Fastest**	**Slowest**	
Tandem Axles									**Note**
DS405	40,000	21.1	375	1450	N/A	110,000	3.36	5.57	**2**
DSH40	40,000	21.1	485	1650	N/A	110,000	3.36	4.88	**2**
D40-170	40,000	21.1	625	2050	60,000	165,000	3.42	5.57	
D40-172	40,000	21.1	625	2050	60,000	165,000	3.42	5.57	
DSH44	44,000	21.1	485	1650	64,000	N/A	3.36	5.29	
DT463-P	46,000	22.0	600	1850	66,000	155,000	3.70/5.04	4.88/6.64	
D46-170/170H	46,000	22.0	625	2050	66,000	165,000	3.42	5.57	**3**
D46-172/172H	46,000	22.0	625	2050	66,000	165,000	3.42	5.57	**3**
D46-590HP	46,000	22.0	625	2050	66,000	175,000	4.75	6.65	
D50-170	50,000	22.0	625	2050	70,000	165,000	3.42	5.57	
D50-172	50,000	22.0	625	2050	70,000	165,000	3.42	5.57	
D52-190P	52,000	22.0	625	2050	72,000	175,000	3.42	5.25	
D52-590P	52,000	22.0	625	2050	72,000	175,000	4.75	6.65	
D60-190P	60,000	22.7	625	2050	80,000	175,000	3.42	5.25	
D60-590HP	60,000	22.7	625	2050	80,000	175,000	4.75	6.65	

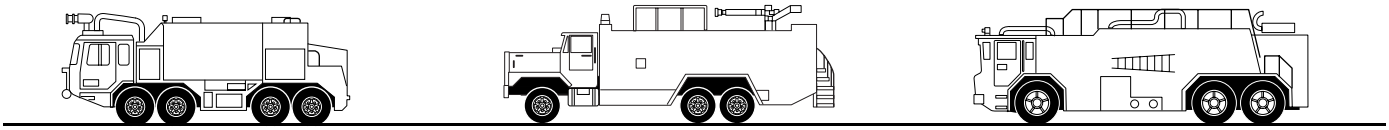
Note

1 The 21060S, 21065P, 21065T, 22060S, 22065P and 22065T are not approved in vehicles equipped with retarders.

2 The DS405 and DSH40 are not approved for house to house pick-up, residential Refuse applications.

3 Suspension restrictions may exist with the D46-170 and D46-172. Please consult the Housing Structural Ratings Section for minimum housing box section requirements.

Rescue



Vocational Description

- Specialized all wheel drive vehicles designed for rapid acceleration to airport crash sites
- Operation on road surfaces made of concrete, asphalt, maintained gravel, crushed rock, hard packed dirt, or other similar surfaces for 90% of the total miles and sandy or muddy crash sites for the remaining 10%
- Extremely low mileage operation
- High horsepower engines and automatic transmissions are typical
- Vehicle retarders are common (engine, exhaust, transmission, electro-magnetic)

Typical Vehicle Types

- Airport Rescue Fire (ARF)
- Crash Fire Rescue (CFR)
- Rapid Intervention Vehicle (RIV)
- Emergency Service

Vehicle Configuration

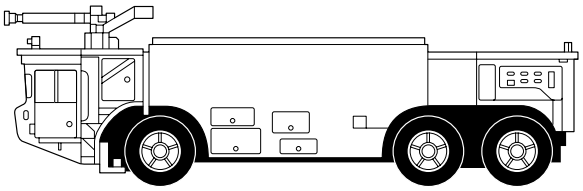
4 x 4 or 6 x 6 specialized straight trucks

Service Definitions

Operation 1 - 100% loaded full time. Grades of up to 20%.

Housing Structural Ratings

See the Housing Structural Ratings section.

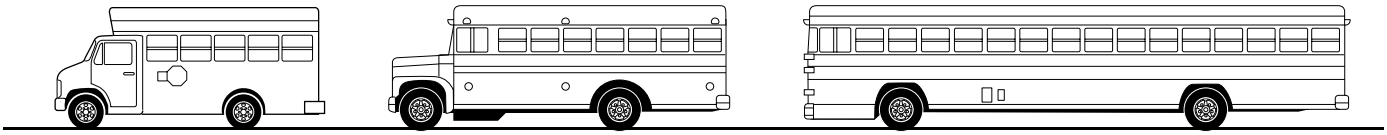


Axle Model	Max. GAWR (lbs.)	Max SLR (.in)	Engine HP	Engine Torque (lbs.ft.)	Max. Gross Weight (lbs.) (GVW) Operation 1 20% Grade	Gear Ratios Fastest	Gear Ratios Slowest	Note
Single Axles								
S23-170/170E	23,000	24.5	450	1450	45,000	3.07	5.57	
S23-172/172E	23,000	24.5	450	1450	45,000	3.07	5.57	
S23-190	24,000	24.5	525	1650	47,000	3.07	5.57	
S23-190E	24,000	24.5	525	1650	47,000	3.42	5.57	
S23-590	24,000	24.5	525	1650	47,000	4.75	6.65	
S25-170/170E	26,000	24.5	450	1450	50,000	3.07	5.57	
S25-172/172E	26,000	24.5	450	1450	50,000	3.07	5.57	
S26-190	27,000	24.5	525	1650	50,000	3.42	5.57	
S26-190E	27,000	24.5	525	1650	50,000	3.42	5.57	
S26-590	27,000	24.5	525	1650	50,000	4.75	6.65	
S30-190	31,000	24.5	525	1650	54,000	3.42	5.57	
S30-190E	31,000	24.5	525	1650	54,000	3.42	5.57	
S30-590	31,000	24.5	525	1650	54,000	4.75	6.65	
Tandem Axles								**Note**
D46-170	46,000	24.5	700	2450	68,000	3.21	4.78	**1**
D46-170H	50,000	24.5	700	2450	70,000	3.21	4.78	
D46-172	46,000	24.5	700	2450	68,000	3.21	4.78	**1**
D46-172H	50,000	24.5	700	2450	70,000	3.21	4.78	
D50-170	52,000	24.5	700	2450	72,000	3.21	4.78	
D50-172	52,000	24.5	700	2450	72,000	3.21	4.78	
D52-190P	54,000	24.5	700	2450	76,000	3.42	4.78	
D52-590P	54,000	24.5	700	2450	76,000	4.75	6.65	
D60-190P	60,000	24.5	700	2450	82,000	3.42	4.78	
D60-590P	60,000	24.5	700	2450	82,000	4.75	6.65	

Note

1 Suspension restrictions may exist with the D46-170 and D46-172. Please consult the Housing Structural Ratings Section for minimum housing box section requirements.

School Bus



Vocational Description

- Transporting students to and from school and/ or school sponsored events
- Operation on prepared road surfaces of concrete, asphalt, maintained gravel, crushed rock, or hard packed dirt
- 2 stops per mile are considered typical
- Automatic transmissions are typical
- 100% load going / empty return (typical)

Typical Vehicle Types

- Front Engine Commercial Chassis
- Front Engine Integral Coach
- Rear Engine Commercial Chassis
- Rear Engine Integral Coach
- Shuttle Bus

Vehicle Configuration

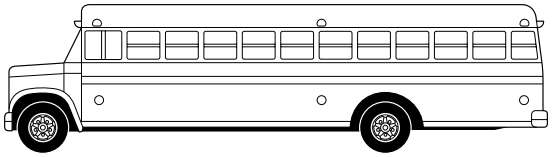
4 x 2 straight bus

Service Definitions

Operation 1 - Grades up to 20%

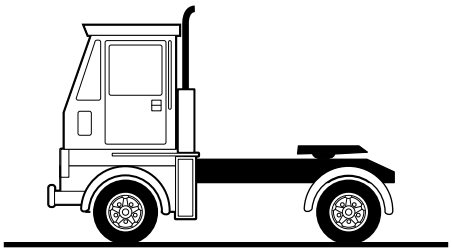
Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lbs.) (GVW)	Gear Ratios	
Axle Model	**Max. GAWR (lbs.)**	**Max SLR (.in)**	**HP**	**Torque (lbs.ft.)**	**Operation 1 20% Grade**	**Fastest**	**Slowest**
Single Axles							
S14-110	13,500	16.5	225	520	23,000	4.10	5.38
S16-130	15,500	16.5	275	605	25,000	4.10	5.38
S17-140	17,000	19.7	300	860	29,000	3.91	5.57
17060S	17,000	19.7	300	860	29,000	3.90	5.57
S19-140	19,800	19.7	300	860	31,000	3.91	5.57
19060S	19,800	20.1	300	860	31,000	3.90	5.57
S20-140	20,000	19.8	300	860	31,000	3.58	5.57
S21-140	21,000	19.8	300	860	31,000	3.58	5.57
21060S	21,000	20.1	300	860	33,000	3.90	5.57
S21-170	21,000	20.1	310	900	38,000	3.91	6.14
S21-172	21,000	20.1	310	900	38,000	3.91	6.14
22060S	22,000	20.1	300	860	34,000	3.90	5.57
23060SH	23,000	19.3	300	860	34,000	3.90	5.57
S23-170	23,000	20.1	310	900	38,000	3.91	6.14
S23-172	23,000	20.1	310	900	38,000	3.91	6.14

Yard Tractor



Vocational Description

- Transporting trailers on/off vessels, into/out of storage areas, around loading docks
- Operation on prepared road surfaces of concrete, asphalt or maintained gravel
- 6 stops per mile are considered typical
- Annual Mileage: very low
- Restricted Speed (< 25 mph)

Typical Vehicle Types

- Port Tractor
- Rail Yard Spotter
- Trailer Spotter
- Yard Jockey

Vehicle Configuration

4x2 tractor 6x4 tractor

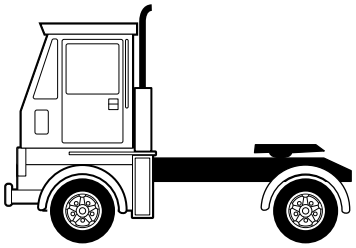
Service Definitions

(vocational description applies to all operations)

Operation 1 - Grades up to 3%

Housing Structural Ratings

See the Housing Structural Ratings section.



			Engine		Max. Gross Weight (lbs.) (GCW)	Gear Ratios		
Axle Model	**Max. GAWR (lbs.)**	**Max SLR (.in)**	**HP**	**Torque (lbs.ft.)**	**Operation 1 3% Grade**	**Fastest**	**Slowest**	
Single Axles								**Note**
S23-170	30,000	19.6	300	660	81,000	6.14	7.17	**1**
S23-172	30,000	19.6	300	660	81,000	6.14	7.17	**1**
S23-190	30,000	19.6	325	660	100,000	6.14	7.17	
S30-190	42,000	19.6	325	660	100,000	6.14	7.17	
S30-590	42,000	19.6	325	660	100,000	7.30	9.97	
Tandem Axles								
DSH40	40,000	19.6	400	1550	125,000	5.57	6.50	
D40-170	40,000	19.6	500	1650	160,000	6.14	7.17	
D40-172	40,000	19.6	500	1650	160,000	6.14	7.17	
DT463-P	46,000	19.6	500	1650	160,000	5.43/7.39	6.17/8.40	
D46-170H	46,000	19.6	500	1650	160,000	6.14	7.17	
D46-172H	46,000	19.6	500	1650	160,000	6.14	7.17	
D50-170	50,000	19.6	500	1650	160,000	6.14	7.17	
D50-172	50,000	19.6	500	1650	160,000	6.14	7.17	
D52-190P	52,000	19.6	500	1650	160,000	6.14	7.17	
D60-190P	60,000	19.6	500	1650	160,000	6.14	7.17	

Note

1 0.5” housing wall thickness and 2.24” diameter axle shafts are required.

Housing Structural Ratings

13,500 lbs. Housing Structural Ratings

Housing Dimensions (Standard Track Width)

Drive Axle Model - Note 1 (Nominal GAWR - 13,500 lbs.)	Housing Box Section (in.) (H x W x T)	Inner Bearing Shoulder to Inner Bearing Shoulder (in.)	Appoximate Track Width (in.)	Spindle Diameters (Inner/Outer)	Note
S14-110, S14-130	4.25 x 4.25 x .31	64.5-65.0	70	Note 4	7
		66.5-67.3	72		
		68.8-69.3	74		
		71.2	76		

Gross Axle Ratings Based on the Use of Narrow or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	70 in. Maximum Track Width	74 in. Maximum Track Width	76 in. Maximum Track Width	Note
4.25 x 4.25 x .31	13,500	12,500	11,000	5,6

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	70 in. Maximum Track Width	72 in. Maximum Track Width	74 in. Maximum Track Width	76 in. Maximum Track Width	Note
4.25 x 4.25 x .31	Not Approved	Not Approved	Not Approved	Not Approved	2,5,6

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	70 in. Maximum Track Width	72 in. Maximum Track Width	74 in. Maximum Track Width	76 in. Maximum Track Width	Note
4.25 x 4.25 x .31	Not Approved	Not Approved	Not Approved	Not Approved	2,5,6

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 72 in.

2 The S14-110 and S14-130 are not approved with single outset wheels.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Spindle dimensions vary with customer.

5 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in.

6 Track widths are nominal and may vary with wheel equipment.

7 The S14-110 and S14-130 are not approved with suspension capacity ratings above 16,000 lbs.

15,500 lbs. Housing Structural Ratings

Housing Dimensions (Standard Track Width)

Drive Axle Model - Note 1 (Nominal GAWR - 15,500 lbs.)	Housing Box Section (in.) (H x W x T)	Inner Bearing Shoulder to Inner Bearing Shoulder (in.)	Appoximate Track Width (in.)	Spindle Diameters (Inner/Outer)	Note
S16-130	4.25 x 4.25 x .39	64.2-64.88	70	Note 4	7
		65.0-66.5	72		
		68.8-69.2	74		

Gross Axle Ratings Based on the Use of Narrow or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	70 in. Maximum Track Width	74 in. Maximum Track Width	Note
4.25 x 4.25 x .39	15,500	14,500	5, 6

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	70 in. Maximum Track Width	71 in. Maximum Track Width	72 in. Maximum Track Width	74 in. Maximum Track Width	Note
4.25 x 4.25 x .39	Not Approved	Not Approved	Not Approved	Not Approved	2,5,6

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	70 in. Maximum Track Width	72 in. Maximum Track Width	74 in. Maximum Track Width	76 in. Maximum Track Width	Note
4.25 x 4.25 x .39	Not Approved	Not Approved	Not Approved	Not Approved	2,5,6

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 72 in.

2 The S16-130 is not approved with single outset wheels.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Spindle dimensions vary with customer.

5 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in.

6 Track widths are nominal and may vary with wheel equipment.

7 The S16-130 is not approved with suspension capacity ratings above 17,000 lbs.

17,000 lbs. Housing Structural Ratings

Housing Dimensions (Standard Track Width)

Drive Axle Model - Note 1 (Nominal GAWR - 17,000 lbs.)	Housing Box Section (in.) (H x W x T)	Spindle Diameters (Inner/Outer)	Spindle Type	Note
17060S, S17-140	5.24 x 4.61 x .38	3.250/2.625	L	5

Gross Axle Ratings Based on the Use of Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	78 in. Maximum Track Width
5.24 x 4.61 x .38	Not Available

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	75 in. Maximum Track Width	Note
5.24 x 4.61 x .38	Not Approved	2

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	72 in. Track (Standard Housing)	78 in. Track (Wide Track Housing)	75 in. Track (Outset Wheels)
5.24 x 4.61 x .38	Not Approved	Not Approved	Not Approved

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 72 in.

2 The 17060S and S17-140 are not approved with single outset wheels.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Track widths are nominal and may vary with wheel equipment.

5 The 17060S and S17-140 are not approved with suspension capacity ratings above 21,000 lbs.

19,000 lbs. Housing Structural Ratings

Housing Dimensions (Standard Track Width)

Drive Axle Model - Note 1 (Nominal GAWR - 19,000 lbs.)	Housing Box Section (in.) (H x W x T)	Spindle Diameters (Inner/Outer)	Spindle Type	Note
19060S, S19-140	5.24 x 4.61 x .38	3.250/2.625	L	**4,5**

Gross Axle Ratings Based on the Use of Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	78 in. Maximum Track Width
5.24 x 4.61 x .38	Not Available

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	75 in. Maximum Track Width	Note
5.24 x 4.61 x .38	Not Approved	**2**

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	72 in. Track (Standard Housing)	78 in. Track (Wide Track Housing)	75 in. Track (Outset Wheels)
5.24 x 4.61 x .38	Not Approved	Not Approved	Not Approved

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 72 in.

2 The 19060S and S19-140 are not approved with single outset wheels.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Track widths are nominal and may vary with wheel equipment.

5 The 19060S and S19-140 are not approved with suspension capacity ratings above 21,000 lbs.

20,000 lbs. Housing Structural Ratings

Housing Dimensions (Standard Track Width)

Drive Axle Model - Note 1 (Nominal GAWR - 20,000 lbs.)	Housing Box Section (in.) (H x W x T)		Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	SelecTTrac™			
S20-045B, S20-140	5.24 x 4.61 x .38	5.24 x 4.61 x .38	3.250/2.625	R	6

Gross Axle Ratings Based on the Use of SelecTTrac™ Housings (lbs.)

Housing Box Section (in.) (H x W x T)	75 in. Maximum Track Width SelecTTrac™	Note
5.24 x 4.61 x .38	20,000	2,5

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	75 in. Maximum Track Width (Standard Track Housing)	78 in. Maximum Track Width (SelecTTrac™ Housing)	Note
5.24 x 4.61 x .38	17,000	17,000	2,3,5,7

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	73 in. Maximum Track Width	75 in. Track (SelecTTrac™ Housing)	75in. Maximum Track Width	78 in. Maximum Track Width	Note
5.24 x 4.61 x .38	Not Approved	Not Approved	Not Approved	Not Approved	2,3,5

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 The S20-140 are not approved with single tires and outset wheels.

4 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

5 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. and a maximum track width of 75 in. for the S20-045B and 8 in. for the S20-045BS axle models.

6 The S20-045B and S20-140 are not approved with suspension capacity ratings above 21,000 lbs.

7 Single tires with outset wheels beyond 2.0 in. are not approved.

21,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 21,000 lbs.)	Housing Box Section (in.) (H x W x T)			Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	SelecTTrac™	Wide Track			
21060S, S21-060B, S21-140	5.24 x 4.61 x .43	5.24 x 4.61 x .43	5.24 x 4.61 x .50	3.750/3.250	R	7,8,9
21065P, 21065T	5.24 x 4.61 x .38	Not Available	5.24 x 4.61 x .56			
S21-170, S21-172, S21-190	5.24 x 4.61 x .43	5.24 x 4.61 x .50	5.24 x 4.61 x .63			7,8

Gross Axle Ratings Based on the Use of SelecTTrac™ or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track Width SelecTTrac™	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .43	20,000	Not Available	2,7,8
5.24 x 4.61 x .50	21,000	19,000	2,9
5.24 x 4.61 x .56	Not Available	21,000	2
5.24 x 4.61 x .63	Not Available	21,000	2

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	79 in. Maximum Track (SelecTTrac™ Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .38	Not Approved	Not Available	Not Available	2,3
5.24 x 4.61 x .43	19,500	18,000	Not Available	2,5,6,7,8
5.24 x 4.61 x .50	Not Available	Not Available	17,000	2,5,9
5.24 x 4.61 x .56	Not Available	Not Available	19,000	2,5
5.24 x 4.61 x .63	Not Available	Not Available	21,000	2,5

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 The 21065P and 21065T are not approved with single tires and outset wheels.

4 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

5 Single tires with outset wheels beyond 2.0 in. are not approved.

6 Single tires with outset wheels are approved for the S21-060B tag axle in a 6x2 configuration only.

7 SelecTTrac™ is only available in S21-140, S21-170 and S21-190.

8 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. for SelecTTrac™.

9 S21-140 is not available with wide track housings.

10 All 21,000-pound-rated, drive axle models are not approved with suspension capacity ratings above 23,000 lbs.

21,000 lbs. Housing Structural Ratings (Continued)

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 4

Housing Box Section (in.) (H x W x T)	73 in. Maximum Track (Standard Track Housing)	76 in. Track (SelecTTrac™ Housing)	78.5 in. Track (Wide Track Housing)	Note
5.24 x 4.61 x .38	26,000	Not Available	Not Available	**2,4**
5.24 x 4.61 x .43	29,000	26,000	Not Available	**2,4,7,8**
5.24 x 4.61 x .50	Not Available	Not Available	26,000	**2,4,7,9**
5.24 x 4.61 x .56	Not Available	Not Available	29,000	**2,4**
5.24 x 4.61 x .63	Not Available	Not Available	31,000	**2,4**

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	79 in. Track (Select w/Outset)	82 in. Track (Wide w/Outset)	Note
5.24 x 4.61 x .38	Not Approved	Not Available	Not Available	**3**
5.24 x 4.61 x .43	29,000	23,000	Not Available	**2,4,5,7,8**
5.24 x 4.61 x .50	Not Available	Not Available	23,000	**2,4,5,9**
5.24 x 4.61 x .56	Not Available	Not Available	24,000	**2,4**
5.24 x 4.61 x .63	Not Available	Not Available	26,000	**2,4**

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 The 21065P and 21065T are not approved with single tires and outset wheels.

4 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

5 Single tires with outset wheels beyond 2.0 in. are not approved.

6 Single tires with outset wheels are approved for the S21-060B tag axle in a 6x2 configuration only.

7 SelecTTrac™ is only available in S21-140, S21-170, S21-172 and S21-190.

8 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. for SelecTTrac™.

9 S21-140 is not available with wide track housings.

10 All 21,000-pound-rated drive axle models are not approved with suspension capacity ratings above 23,000 lbs.

22,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 22,000 lbs.)	Housing Box Section (in.) (H x W x T)		Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	Wide Track			
22060S	5.24 x 4.61 x .43	5.24 x 4.61 x .50	3.750/3.250	R	2
22065P, 22065T	5.24 x 4.61 x .38	5.24 x 4.61 x .56			

Gross Axle Ratings Based on the Use of Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track Width SelecTTrac™	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .50	Not Available	19,000	2
5.24 x 4.61 x .56	Not Available	19,800	

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	79 in. Maximum Track (SelecTTrac™ Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .38	Not Approved	Not Available	Not Available	3
5.24 x 4.61 x .43	Not Approved	Not Available	Not Available	
5.24 x 4.61 x .50	Not Available	Not Available	Not Approved	
5.24 x 4.61 x .56	Not Available	Not Available	Not Approved	

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 4

Housing Box Section (in.) (H x W x T)	73 in. Track (Standard Housing)	76 in. Maximum Track (SelecTTrac™ Housing)	78.5 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .38	26,000	Not Available	Not Available	2,4
5.24 x 4.61 x .43	29,000	Not Available	Not Available	
5.24 x 4.61 x .50	Not Available	Not Available	23,000	
5.24 x 4.61 x .56	Not Available	Not Available	23,000	

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 The 22060S, 22065P and 22065T are not approved with single outset wheels.

4 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

5 All 22,000 pound-rated drive axle models are not approved with suspension capacity ratings above 23,000 lbs.

23,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 23,000 lbs.)	Housing Box Section (in.) (H x W x T)			Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	SelecTTrac™	Wide Track			
S23-170, S23-172	5.24 x 4.61 x .43	5.24 x 4.61 x .50	5.24 x 4.61 x .63	3.750/3.250	R	2,5
23082T	5.24 x 4.61 x .56	Not Available	5.24 x 4.61 x .56			2
23060SH, S23-190, S23-590, S23-070B	5.24 x 4.61 x .50	5.24 x 4.61 x .50	5.24 x 4.61 x .63			2,5,7
S23-170H, S23-190H	5.24 x 4.61 x .63	Not Available	5.24 x 4.61 x .63			2

Gross Axle Ratings Based on the Use of SelecTTrac™ or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track Width SelecTTrac™	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .43	Not Available	Not Available	2,5
5.24 x 4.61 x .50	22,000	Not Available	2,5,7
5.24 x 4.61 x .56	Not Available	22,000	2,4
5.24 x 4.61 x .63	Not Available	23,000	2,4

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	79 in. Maximum Track (SelecTTrac™ Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .43	20,000	18,000	Not Available	2,4,5
5.24 x 4.61 x .50	22,000	20,000	Not Available	2,4,5,7
5.24 x 4.61 x .56	23,000	Not Available	19,000	2,4
5.24 x 4.61 x .63	23,000	Not Available	21,000	2,4

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. for SelecTTrac™.

6 The .43 in. wall thickness housings are not approved with suspension capacity ratings above 24,000 lbs.
The .50 in. wall thickness housings are not approved with suspension capacities rated above 26,000 lbs.
The .63 in. wall thickness housings are not approved with suspension capacities above 29,000 lbs.

7 The 23060SH is not available in SelecTTrac™ or wide track housings.

23,000 lbs. Housing Structural Ratings (Continued)

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	73 in. Track (Standard Track Housing)	76 in. Track (SelecTTrac™ Housing)	78.5 in. Track (Wide Track Housing)	Note
5.24 x 4.61 x .43	29,000	26,000	Not Available	**2,3,5**
5.24 x 4.61 x .50	30,000	29,000	Not Available	**2,3,5,7**
5.24 x 4.61 x .56	32,000	Not Available	29,000	**2,3**
5.24 x 4.61 x .63	32,500	Not Available	31,000	**2,3**

Housing Box Section (in.) (H x W x T)	76 in. Track (Standard w/Outset)	79 in. Track (Select w/Outset)	82 in. Track (Wide w/Outset)	Note
5.24 x 4.61 x .43	26,000	23,000	Not Available	**2,3,4,5**
5.24 x 4.61 x .50	28,000	26,000	Not Available	**2,3,4,5,7**
5.24 x 4.61 x .56	30,000	Not Available	24,000	**2,3,4**
5.24 x 4.61 x .63	31,000	Not Available	26,000	**2,3,4**

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. for SelecTTrac™.

6 The .43 in. wall thickness housings are not approved with suspension capacity ratings above 24,000 lbs.
The .50 in. wall thickness housings are not approved with suspension capacities rated above 26,000 lbs.
The .63 in. wall thickness housings are not approved with suspension capacities above 29,000 lbs.

7 The 23060SH is not available in SelecTTrac™ or wide track housings.

25,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 25,000 lbs.)	Housing Box Section (in.) (H x W x T)			Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	SelecTTrac™	Wide Track			
S25-170, S25-172	5.24 x 4.61 x .50	5.24 x 4.61 x .50	5.24 x 4.61 x .63	3.750/3.250	R	2,5

Gross Axle Ratings Based on the Use of SelecTTrac™ or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track Width SelecTTrac™	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .50	22,000	Not Available	2, 5
5.24 x 4.61 x .63	Not Available	24,000	2

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	79 in. Maximum Track (SelecTTrac™ Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .50	22,000	20,000	Not Available	2,4,5
5.24 x 4.61 x .63	Not Available	Not Available	21,000	2,4

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	73 in. Maximum Track (Standard Track Housing)	76 in. Maximum Track (SelecTTrac™ Housing)	78.5 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .50	30,000	29,000	Not Available	2,3,5
5.24 x 4.61 x .63	Not Available	Not Available	31,000	2,3

Housing Box Section (in.) (H x W x T)	76 in. Track (Standard w/Outset)	79 in. Track (Select w/Outset)	82 in. Track (Wide w/Outset)	Note
5.24 x 4.61 x .50	28,000	26,000	Not Available	2,3,4,5
5.24 x 4.61 x .63	Not Available	Not Available	26,000	2,3,4

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. for SelecTTrac™.

6 The .50 in. wall thickness housings are not approved with suspension capacities rated above 26,000 lbs.
The .63 in. wall thickness housings are not approved with suspension capacities above 29,000 lbs.

26,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 26,000 lbs.)	Housing Box Section (in.) (H x W x T)		Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	Wide Track			
26082T	5.24 x 4.61 x .56	5.24 x 4.61 x .56	3.750/3.250	R	2
S26-190, S26-590	5.24 x 4.61 x .63	5.24 x 4.61 x .63			

Gross Axle Ratings Based on the Use of Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track Width SelecTTrac™	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .56	Not Available	22,000	2,5
5.24 x 4.61 x .63	Not Available	24,000	

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	79 in. Maximum Track (SelecTTrac™ Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .56	24,000	Not Available	19,000	2,4
5.24 x 4.61 x .63	26,000	Not Available	21,000	2,4,5

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 4

Housing Box Section (in.) (H x W x T)	73 in. Track (Standard Housing)	76 in. Track (Standard w/Outset)	76 in. Track (SelecTTrac™ Housing)	78.5 in. Track (Wide Track Housing)	82 in. Track (Wide w/Outset)	Note
5.24 x 4.61 x .50	32,000	30,000	Not Available	29,000	25,000	2,3,4,5
5.24 x 4.61 x .63	32,000	31,000	Not Available	31,000	27,000	

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 The .56 in. wall thickness housings are not approved with suspension capacities rated above 29,000 lbs.
The .63 in. wall thickness housings are not approved with suspension capacities above 29,000 lbs.

30,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 30,000 lbs.)	Housing Box Section (in.) (H x W x T) Narrow/Standard/Wide Track	Spindle Diameters (Inner/Outer)	Spindle Type	Note
S30-190, S30-590	5.91 x 5.31 x .63	4.125 / 3.500	W	2

Gross Axle Ratings Based on the Use of Narrow or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	72.5 in. Maximum Track Width Narrow Track	76 in. Maximum Track Width Wide Track	Note
5.91 x 5.31 x .63	30,000	29,000	2

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Narrow Track Housing)	78 in. Maximum Track (Standard Track Housing)	80 in. Maximum Track (Wide Track Housing)	Note
5.91 x 5.31 x .63	28,000	26,000	24,000	2,4

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	72 in. Track (Narrow Housing)	74 in. Track (Standard Housing)	76 in. Track (Wide Track Housing)	Note
5.91 x 5.31 x .63	36,000	35,000	34,000	2,3

Housing Box Section (in.) (H x W x T)	76 in. Track (Narrow w/Outset)	78 in. Track (Standard w/Outset)	80 in. Track (Wide w/Outset)	Note
5.91 x 5.31 x .63	34,000	32,000	31,000	2,3,4

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 74 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

35,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 35,000 lbs.)	Housing Box Section (in.) (H x W x T)		Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	Wide Track			
S35-590	6.75 x 5.63 x .88	6.75 x 5.63 x .88	4.125/3.500	W	2

Gross Axle Ratings Based on the Use of Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	75 in. Maximum Track Width Intermediate Track	80 in. Maximum Track Width Wide Track	85 in. Maximum Track Width Wide-Wide Track	Note
6.75 x 5.63 x .88	35,000	35,000	35,000	2

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	79 in. Maximum Track (Intermediate Housing)	84 in. Maximum Track (Wide Track Housing)	89 in. Maximum Track (Wide-Wide Housing)	Note
6.75 x 5.63 x .88	Not Approved	Not Approved	Not Approved	Not Approved	2,4

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	72 in. Track (Standard Track)	75 in. Track (Intermediate Track)	80 in. Track (Wide Track)	85 in. Track (Wide-Wide Track)	Note
6.75 x 5.63 x .88	40,000	40,000	40,000	40,000	2,3

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard w/Outset)	79 in. Maximum Track (Intermediate w/Outset)	84 in. Maximum Track (Wide w/Outset)	89 in. Maximum Track (Wide-Wide w/Outset)	Note
6.75 x 5.63 x .88	Not Approved	Not Approved	Not Approved	Not Approved	2,3,4

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 72 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 S35-590 is not approved with single outset wheels.

5 Dowel pins are not available on this housing.

40,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 40,000 lbs.)	Housing Box Section (in.) (H x W x T)			Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	SelecTTrac™	Wide Track			
D40-145, D40-155, D40-156	5.24 x 4.61 x .38	5.24 x 4.61 x .38	Not Available	3.750/3.250	R	2,4
DS404, DSP40	5.24 x 4.61 x .38	Not Available	5.24 x 4.61 x .50			2,6
D40-145H, D40-155H, D40-156H	5.24 x 4.61 x .43	5.24 x 4.61 x .43	Not Available			2,4
DS405, DSP41, DSH40	5.24 x 4.61 x .43	Not Available	5.24 x 4.61 x .50			2,6
D40-170, D40-172	5.24 x 4.61 x .43	5.24 x 4.61 x .50	5.24 x 4.61 x .63			2,4
EconoTrek™ S21-170 & S21-172/S20-045B	5.24 x 4.61 x .43/.38	5.24 x 4.61 x .50/.38	Not Available			2,4
EconoTrek™ S21-190/S20-045B	5.24 x 4.61 x .43/38	5.24 x 4.61 x .50/.38	Not Available			2,4

Gross Axle Ratings Based on the Use of SelecTTrac™ or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track Width SelecTTrac™	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .38	40,000	Not Available	2,4
5.24 x 4.61 x .43	40,000	Not Available	2,4
5.24 x 4.61 x .50	Not Available	39,000	2,6
5.24 x 4.61 x .63	Not Available	40,000	2
5.24 x 4.61 x .43/.38	40,000	Not Available	2,4

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	75 in. Maximum Track (Standard Track Housing)	78 in. Maximum Track (SelecTTrac™ Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .38	34,000	34,000	Not Available	2,4,5,8
5.24 x 4.61 x .43	40,000	37,500	Not Available	2,4,5,8
5.24 x 4.61 x .50	Not Available	Not Available	35,000	2,5,6,8
5.24 x 4.61 x .63	Not Available	Not Available	40,000	2,5,8
5.24 x 4.61 x .43/.38	34,000	34,000	Not Available	2,4,5,8

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. for SelecTTrac™ housings.

5 Single tires with outset wheels beyond 2.0 in. are not approved.

6 The only wider track version of the DST40/41 is 78.5 in. The forward-rear housing has a .50 in. wall thickness while the rear-rear housing is .56 in. thick.

7 A minimum wall thickness of .433 in. (11 mm) is required when a suspension rated at 46,000 lbs. is used.

8 For detailed track versus allowable gross axle weight rating information when outset wheels are used, see 40,000 lb. Tandem Rating Chart.

9 The .38 in. wall thickness housings are not approved with suspension capacity ratings above 42,000 lbs. The .43 in. wall thickness housings are not approved with suspension capacity ratings above 46,000 lbs.

40,000 lbs. Housing Structural Ratings (Continued)

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	73 in. Track (Standard Housing)	76 in. Track (SelecTTrac™ Housing)	78.5 in. Track (Wide Track Housing)	Note
5.24 x 4.61 x .38	54,000	54,000	Not Available	2,3,4
5.24 x 4.61 x .43	58,000	58,000	Not Available	
5.24 x 4.61 x .50	Not Available	Not Available	53,000	2,3,6
5.24 x 4.61 x .63	Not Available	Not Available	62,000	2,3
5.24 x 4.61 x .43/.38	54,000	54,000	Not Available	2,3,4

Housing Box Section (in.) (H x W x T)	75 in. Track (Standard w/Outset)	78 in. Track (Select w/Outset)	82 in. Track (Wide w/Outset)	Note
5.24 x 4.61 x .38	40,000	40,000	Not Available	2,3,4,5
5.24 x 4.61 x .43	48,000	44,000	Not Available	
5.24 x 4.61 x .50	Not Available	Not Available	43,000	2,3,5,6
5.24 x 4.61 x .63	Not Available	Not Available	52,000	2,3,5
5.24 x 4.61 x .43/.38	40,000	40,000	Not Available	2,3,4,5

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. for SelecTTrac™ housings.

5 Single tires with outset wheels beyond 2.0 in. are not approved.

6 The only wider track version of the DST40/41 is 78.5 in. The forward-rear housing has a .50 in. wall thickness while the rear-rear housing is .56 in. thick.

7 A minimum wall thickness of .433 in. (11 mm) is required when a suspension rated at 46,000 lbs. is used.

8 For detailed track versus allowable gross axle weight rating information when outset wheels are used, see 40,000 lb. Tandem Rating Chart.

9 The .38 in. wall thickness housings are not approved with suspension capacity ratings above 42,000 lbs. The .43 in. wall thickness housings are not approved with suspension capacity ratings above 46,000 lbs.

40,000 lb. Housing Structural Ratings (Continued)

Housing Wall Thickness Requirements for Various Non-Proprietary Suspensions - Note 7

Suspension				Minimum Box Section Requirements (in.) (H x W x T)	
Manufacturer	Model	Type	Application	USA	Canada
Chalmers	800-40	Rubber Spring walking beam	Vocational	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Hendrickson	HAS 40LH	Trailing Arm Air Ride	Linehaul	5.24 x 4.61 x .38	5.24 x 4.61 x .38
Hendrickson	HAS 400	Trailing Arm Air Ride	On-off highway	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Hendrickson	HAS 402	Trailing Arm Air Ride	On-off highway	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Hendrickson	HMX 400	Rubber Spring walking beam	Vocational	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Hendrickson	HN 402	Rubber Spring walking beam	Vocational	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Hendrickson	HTB LT	Air Ride	On-highway	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Hendrickson	Primaax	Trailing Arm Air Ride	On-off highway	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Hendrickson	RS 403	Rubber Spring walking beam	Vocational	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Hendrickson	R 403	Solid walking beam	Vocational	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Hendrickson	RT(E) 403	Steel Spring walking beam	Vocational	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Neway	ARDAB-240-5	Air Beam	On-highway	5.24 x 4.61 x .38	5.24 x 4.61 x .38
Reyco	240AR	Trailing Arm Air Ride	On-highway	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Reyco	102AR	Trailing Arm Air Ride	On-highway	5.24 x 4.61 x .43	5.24 x 4.61 x .43
Reyco	102W	4 spring	On-highway	5.24 x 4.61 x .38	5.24 x 4.61 x .38

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. for SelecTTrac™ housings.

5 Single tires with outset wheels beyond 2.0 in. are not approved.

6 The only wider track version of the DST40/41 is 78.5 in. The forward-rear housing has a .50 in. wall thickness while the rear-rear housing is .56 in. thick.

7 A minimum wall thickness of .433 in. (11 mm) is required when a suspension rated at 46,000 lbs. is used.

8 For detailed track versus allowable gross axle weight rating information when outset wheels are used, see 40,000 lb. Tandem Rating Chart.

9 The .38 in. wall thickness housings are not approved with suspension capacity ratings above 42,000 lbs.
The .43 in. wall thickness housings are not approved with suspension capacity ratings above 46,000 lbs.

44,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 44,000 lbs.)	Housing Box Section (in.) (H x W x T)			Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	Intermediate Track	Wide Track			
DSH44	5.24 x 4.61 x .50	5.24 x 4.61 x .50	5.24 x 4.61 x .50	3.750/3.250	R	2

Gross Axle Ratings Based on the Use of Intermediate or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track Width Intermediate Track	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .50	43,000	39,000	2

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	79 in. Maximum Track (Inter Track Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .50	43,000	38,000	35,000	2,4,5

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) (See Note 3)

Housing Box Section (in.) (H x W x T)	73 in. Track (Standard Housing)	76 in. Track (Intermediate Track Housing)	78.5 in. Track Wide Track Housing	Note
5.24 x 4.61 x .50	62,000	58,000	53,000	2,3

Housing Box Section (in.) (H x W x T)	76 in. Track (Standard w/Outset)	79 in. Track (Intermediate w/Outset)	82 in. Track Wide w/Outset	Note
5.24 x 4.61 x .50	56,000	48,000	45,000	2,3,4

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 For detailed track versus allowable gross axle weight rating information when outset wheels are used, see 44,000 lb. Tandem Rating Chart.

6 The .50 in. wall thickness housings are not approved with suspension capacities rated above 50,000 lbs.

46,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 40,000 lbs.)	Housing Box Section (in.) (H x W x T)			Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	SelecTTrac™	Wide Track			
D46-170, D46-172	5.24 x 4.61 x .50	5.24 x 4.61 x .50	5.24 x 4.61 x .63	3.750/3.250	R	2
D463-P	5.24 x 4.61 x .56	Not Available	5.24 x 4.61 x .56			
D46-170H, D46-172H, D46-590HP	5.24 x 4.61 x .63	Not Available	5.24 x 4.61 x .63			

Gross Axle Ratings Based on the Use of SelecTTrac™ or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track Width SelecTTrac™	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .50	44,000	Not Available	2,7
5.24 x 4.61 x .56	Not Available	44,000	2
5.24 x 4.61 x .63	Not Available	46,000	

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	79 in. Maximum Track (SelecTTrac™ Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .50	44,000	40,000	Not Available	2,4,5,7
5.24 x 4.61 x .56	46,000	Not Available	38,000	2,4,5
5.24 x 4.61 x .63	46,000	Not Available	42,000	

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	73 in. Track (Standard Housing)	76 in. Track (SelecTTrac™ Housing)	78.5 in. Track (Wide Track Housing)	Note
5.24 x 4.61 x .50	62,000	58,000	Not Available	2,3,7
5.24 x 4.61 x .56	64,000	Not Available	58,000	2,3
5.24 x 4.61 x .63	65,000	Not Available	62,000	

Housing Box Section (in.) (H x W x T)	76 in. Track (Standard w/Outset)	79 in. Track (Select w/Outset)	82 in. Track (Wide w/Outset)	Note
5.24 x 4.61 x .50	58,000	52,000	Not Available	2,3,4,7
5.24 x 4.61 x .56	60,000	Not Available	48,000	2,3,4
5.24 x 4.61 x .63	62,000	Not Available	52,000	

46,000 lbs. Housing Structural Ratings (Continued)

Housing Wall Thickness Requirements for Various Non-Proprietary Suspensions - Note 7

		Suspension		
Manufacturer	**Model**	**Type**	**Application**	**Minimum Box Section Requirements (in.) (H x W x T)**
Chalmers	800-46	Rubber Spring walking beam	Vocational	5.24 x 4.61 x .56
Hendrickson	HAS 460	Trailing Arm Air Ride	On-off highway	5.24 x 4.61 x .50
Hendrickson	HMX 460	Rubber Spring walking beam	On-off highway	5.24 x 4.61 x .50
Hendrickson	HN 462	Rubber Spring walking beam	Vocational	5.24 x 4.61 x .50
Hendrickson	RT(E) 463	Steel Spring walking beam	Vocational	5.24 x 4.61 x .50
Hendrickson	RS 463	Rubber Spring walking beam	Vocational	5.24 x 4.61 x .50
Hendrickson	Primaax 460	Trailing Arm Air Ride	On-off highway	5.24 x 4.61 x .50
Hendrickson	R 463	Solid walking beam	Vocational	5.24 x 4.61 x .50
Neway	AD-246	Trailing Arm Air Ride	Vocational	5.24 x 4.61 x .50
Neway	ADZ-246	Trailing Arm Air Ride	Vocational	5.24 x 4.61 x .50
Raydan	Air Link	Air Bag walking beam	On-off highway	5.24 x 4.61 x .56
Reyco	102AR	Trailing Arm Air Ride	On-highway	5.24 x 4.61 x .50
Reyco	102W	4 spring	On-highway	5.24 x 4.61 x .50
Ridewell	RD202S	Rubber Spring Torque Beam	Vocational	5.24 x 4.61 x .56
Ridewell	RAD-227C	8 Air Bag Beam	Vocational	5.24 x 4.61 x .50
Ridewell	RAD-241-OS	Trailing Arm Air Ride	Vocational	5.24 x 4.61 x .50

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 35.88 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 For detailed track versus allowable gross axle weight rating information when outset wheels are used, see 46,000 lb. Tandem Rating Chart.

6 The .50 in. wall thickness housings are not approved with suspension capacity ratings above 50,000 lbs.
The .56 in. wall thickness housings are not approved with suspension capacities rated above 52,000 lbs.
The .63 in. wall thickness housings are not approved with suspension capacities above 52,000 lbs.

7 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 40 in. for SelecTTrac™ housings.

50,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 50,000 lbs.)	Housing Box Section (H x W x T)		Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	Wide Track			
D50-170, D50-172	5.24 x 4.61 x .63	5.24 x 4.61 x .63	3.750/3.250	R	2

Gross Axle Ratings Based on the Use of Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .63	47,500	2,5

Gross Axle Ratings Based on the Use of Outset Single Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .50	50,000	42,000	2,4

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	73 in. Track (Standard Housing)	78.5 in. Track (Wide Track Housing)	Note
5.24 x 4.61 x .63	65,000	62,000	2,3

Housing Box Section (in.) (H x W x T)	76 in. Track (Standard w/Outset)	82 in. Track (Wide w/Outset)	Note
5.24 x 4.61 x .63	62,000	52,000	2,3,4,5

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 35.88 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 The .63 in. wall thickness housings are not approved with suspension capacities above 52,000 lbs.

52,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model (Nominal GAWR - 52,000 lbs.)	Housing Box Section (H x W x T)		Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	Wide Track			
D52-190P, D52-590P, DT521P	5.91 x 5.31 x .63	5.91 x 5.31 x .63	3.750/3.250	R	2

Gross Axle Ratings Based on the Use of Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	78.5 in. Maximum Track Width Wide Track	81.0 in. Maximum Track Width Wide-Wide Track	Note
5.91 x 5.31 x .63	52,000	48,000	2

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	82 in. Maximum Track (Wide Track Housing)	85 in. Maximum Track (Wide-Wide Track Housing)	Note
5.91 x 5.31 x .63	50,000	46,500	42,000	2,4

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	73 in. Track (Standard Housing)	78.5 in. Track (Wide Track Housing)	81.0 in. Track (Wide-Wide Track Housing)	Note
5.91 x 5.31 x .63	66,000	63,000	56,000	2,3

Housing Box Section (in.) (H x W x T)	76 in. Track (Standard w/Outset)	82 in. Track (Wide w/Outset)	85 in. Track (Wide-Wide w/Outset)	Note
5.91 x 5.31 x .63	63,000	53,000	46,000	2,3,4

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 35.88 in. and a maximum track width of 73 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 The .63 in. wall thickness housings are not approved with suspension capacities above 52,000 lbs.

60,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 60,000 lbs.)	Housing Box Section (H x W x T)		Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Narrow/Stnd Track	Wide Track			
D60-190P, D60-590P	5.91 x 5.31 x .63	5.91 x 5.31 x .63	4.125/3.500	W	2

Gross Axle Ratings Based on the Use of Narrow or Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	72.5 in. Maximum Track Width Narrow Track	76 in. Maximum Track Width Wide Track	Note
5.91 x 5.31 x .63	60,000	58,000	2

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Narrow Track Housing)	78 in. Maximum Track (Standard Track Housing)	80 in. Maximum Track (Wide Track Housing)	Note
5.91 x 5.31 x .63	57,500	53,000	49,500	2,4

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	72.5 in. Track (Narrow Track Housing)	74 in. Track (Standard Track Housing)	76 in. Track (Wide Track Housing)	Note
5.91 x 5.31 x .63	70,000	68,000	66,000	2,3

Housing Box Section (in.) (H x W x T)	76 in. Trac (Narrow w/Outset)	78 in. Track (Standard w/Outset)	80 in. Track (Wide w/Outset)	Note
5.91 x 5.31 x .63	66,000	64,000	62,000	2,3,4

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 35.88 in. and a maximum track width of 74 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 The .63 in. wall thickness housings are not approved with suspension capacities above 65,000 lbs.

70,000 lbs. Housing Structural Ratings

Housing Dimensions

Drive Axle Model - Note 1 (Nominal GAWR - 70,000 lbs.)	Housing Box Section (H x W x T)		Spindle Diameters (Inner/Outer)	Spindle Type
	Standard Track	Wide Track		
D70-590P	6.75 x 5.63 x .88	6.75 x 5.63 x .88	4.125/3.500	W

Gross Axle Ratings Based on the Use of Intermediate, Wide or Wide-Wide Track Housings (lbs.)

Housing Box Section (H x W x T)	75 in. Maximum Track Width Intermediate Track	80 in. Maximum Track Width Wide Track	85 in. Maximum Track Width Wide-Wide Track	Note
6.75 x 5.63 x .88	70,000	70,000	70,000	2

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Housing)	79 in. Maximum Track (Intermediate Housing)	84 in. Maximum Track (Wide Track Housing)	89 in. Maximum Track (Wide-Wide Housing)	Note
6.75 x 5.63 x .88	Not Approved	Not Approved	Not Approved	Not Approved	2,4

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	72 in. Track (Standard Track)	75 in. Track (Intermediate Track)	80 in. Track (Wide Track)	85 in. Track (Wide-Wide Track)	Note
6.75 x 5.63 x .88	77,000	77,000	77,000	77,000	2,3

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard w/Outset)	79 in. Maximum Track (Inter w/Outset)	84 in. Maximum Track (Wide w/Outset)	89 in. Maximum Track (Wide-Wide w/ Outset)	Note
6.75 x 5.63 x .88	Not Approved	Not Approved	Not Approved	Not Approved	2,3,4

Note

1 Nominal gross axle weight rating (GAWR) is based on minimum axle mounting centers of 38 in. and a maximum track width of 72 in.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 The D70-590P is not approved with single outset wheels.

5 Dowel pins are not available on this housing.

Tridem Load Ratings

Load Ratings

Housing Dimensions

Drive Axle Model - Note 1	Housing Box Section (in.) (H x W x T)		Spindle Diameters (Inner/Outer)	Spindle Type	Note
	Standard Track	Wide Track			
T60-174	5.24 x 4.61 x .50	5.24 x 4.61 x .50	3.750/3.250	R	1,5
TD583-P	5.24 x 4.61 x .56	5.24 x 4.61 x .56			1
T69-170HP, T69-172HP	5.24 x 4.61 x .63	5.24 x 4.61 x .63			1
T78-190P, T78-590P	5.91 x 5.31 x .63	5.91 x 5.31 x .63			1

Gross Axle Ratings Based on the Use of Wide Track Housings (lbs.)

Housing Box Section (in.) (H x W x T)	78.5 in. Maximum Track Width Wide Track	Note
5.24 x 4.61 x .50	Note 1	1,2,5
5.24 x 4.61 x .56		1
5.24 x 4.61 x .63		1
5.91 x 5.31 x .63		1

Gross Axle Ratings Based on the Use of Single Outset Wheels (lbs.)

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard Track Housing)	82 in. Maximum Track (Wide Track Housing)	Note
5.24 x 4.61 x .50	Note 1		1,2,4,5
5.24 x 4.61 x .56			1,2,4
5.24 x 4.61 x .63			1,2,4
5.91 x 5.31 x .63			1,2,4

Tridem Load Ratings (Continued)

Gross Axle Ratings Based on Site Travel Conditions Only (lbs.) - Note 3

Housing Box Section (in.) (H x W x T)	73 in. Track |(Standard Housing)	78.5 in. Track (Wide Track Housing)	Note
5.24 x 4.61 x .50	68,000	60,000	2,3,5
5.24 x 4.61 x .56	70,000	64,000	2,3
5.24 x 4.61 x .63	72,000	69,000	2,3
5.91 x 5.31 x .63	78,000	78,000	2,3

Housing Box Section (in.) (H x W x T)	76 in. Maximum Track (Standard w/Outset)	82 in. Maximum Track (Wide w/Outset)	Note
5.24 x 4.61 x .50	54,000	50,000	2,3,4,5
5.24 x 4.61 x .56	59,000	57,000	2,3,4
5.24 x 4.61 x .63	69,000	63,000	2,3,4
5.91 x 5.31 x .63	75,000	69,000	2,3,4

Note

1 Maximum allowable gross axle weight ratings (GAWR) vary with ratio and track width. See charts on next page for values.

2 Track widths are nominal and may vary with wheel equipment.

3 Site travel: 5 miles per hour maximum speed with liftable axles raised. This condition shall not exceed 5% of the total operating miles of the vehicle.

4 Single tires with outset wheels beyond 2.0 in. are not approved.

5 The forward rear, wide track housing has a .63 in. wall thickness while the two rear most wide track housings are .50 in. thick.

6 The .50 in. wall thickness housings are not approved with suspension capacities above 63,000 lbs.

Tridem Load Ratings (Continued)

Dana T60-174 Tire SLR ≤ 19.7 in.	Ratio	GAWR Rating	78.5 in. Wide Track	76 in. Track	82 in. Track
		Standard Housing	Wide Track Housing	Single Tires Standard Housing	Single Tires Wide Track Housing
	3.36	44,000	44,000	44,000	44,000
	3.55	46,000	46,000	46,000	46,000
	3.70	48,000	48,000	48,000	48,000
	3.90	51,000	51,000	51,000	50,000
	4.11	53,000	53,000	53,000	50,000
	4.33	56,000	56,000	54,000	50,000
	4.63	60,000	60,000	54,000	50,000
	5.29	60,000	60,000	54,000	50,000
	5.57	59,000	59,000	54,000	50,000
	6.17	59,000	59,000	54,000	50,000
	7.17	53,000	53,000	53,000	50,000

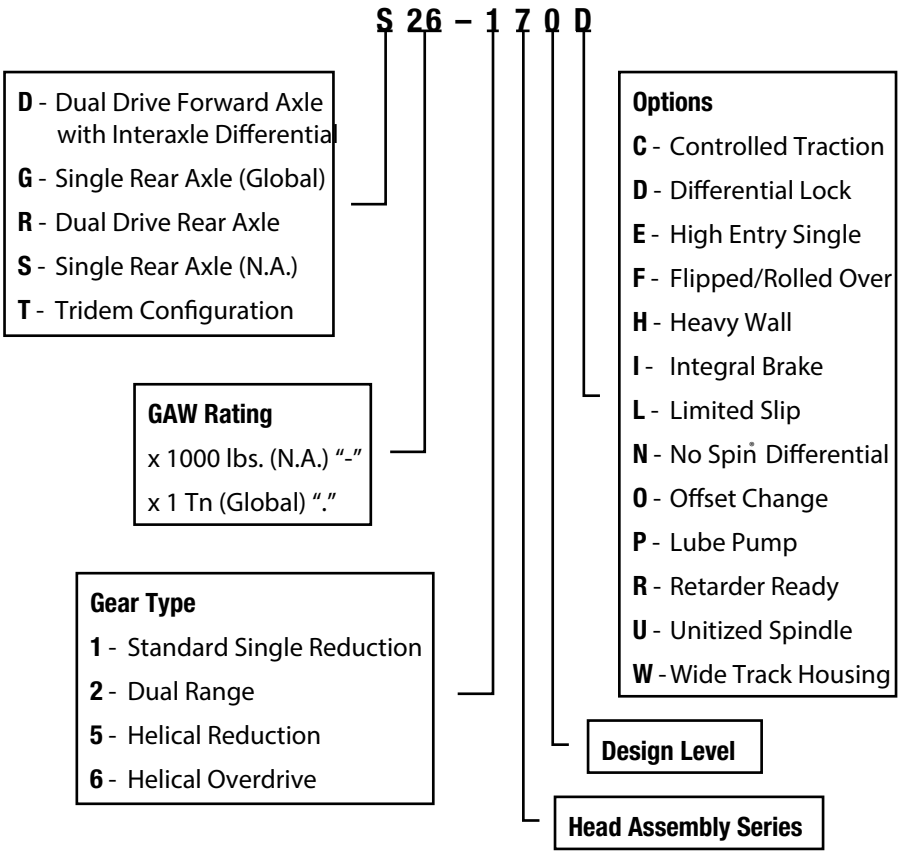
Dana T78-190P, T78-590P Tire SLR ≤ 20.8 in.	Ratio		GAWR Rating	78.5 in. Wide Track	76 in. Track	82 in. Track
	190P	590P	Standard Housing	Wide Track Housing	Single Tires Standard Housing	Single Tires Wide Track Housing
	3.42	4.75	60,000	60,000	60,000	60,000
	3.58	4.99	60,000	60,000	60,000	60,000
	3.73	5.19	60,000	60,000	60,000	60,000
	3.91	5.44	60,000	60,000	60,000	60,000
	4.10	5.70	61,000	61,000	61,000	61,000
	4.30	5.98	64,000	64,000	64,000	64,000
	4.56	6.34	68,000	68,000	68,000	68,000
	4.78	6.65	71,000	71,000	71,000	69,000
	5.25	7.30	78,000	78,000	75,000	69,000
	5.38	7.48	78,000	78,000	75,000	69,000
	5.57	7.75	78,000	78,000	75,000	69,000
	6.14	8.55	78,000	78,000	75,000	69,000
	6.83	9.51	77,000	77,000	75,000	69,000
	7.17	9.97	71,000	71,000	71,000	69,000

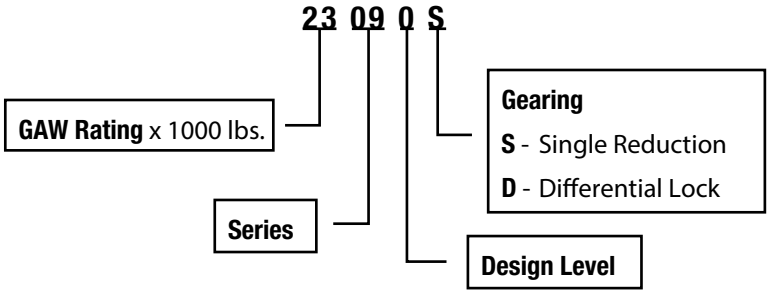
Dana T69-170/172HP Tire SLR ≤ 20.8 in.	Ratio	GAWR Rating	78.5 in. Wide Track	76 in. Track	82 in. Track
		Standard Housing	Wide Track Housing	Single Tires Standard Housing	Single Tires Wide Track Housing
	3.42	51,000	51,000	51,000	51,000
	3.58	53,000	53,000	53,000	53,000
	3.73	55,000	55,000	55,000	55,000
	3.91	58,000	58,000	58,000	58,000
	4.10	61,000	61,000	61,000	61,000
	4.30	64,000	64,000	64,000	63,000
	4.56	68,000	68,000	68,000	63,000
	4.78	69,000	69,000	69,000	63,000
	5.25	69,000	69,000	69,000	63,000
	5.38	69,000	69,000	69,000	63,000
	5.57	69,000	69,000	69,000	63,000
	6.14	69,000	69,000	69,000	63,000
	6.83	69,000	69,000	69,000	63,000
	7.17	69,000	69,000	69,000	63,000

Dana TDT583-P Tire SLR ≤ 20.1 in.	Ratio		GAWR Rating	78.5 in. Wide Track	76 in. Track	82 in. Track
	Hi	Low	Standard Housing	Wide Track Housing	Single Tires Standard Housing	Single Tires Wide Track Housing
	3.70	5.04	54,000	54,000	54,000	54,000
	3.90	5.32	58,000	58,000	58,000	57,000
	4.11	5.60	59,000	59,000	59,000	57,000
	4.33	5.90	55,000	55,000	55,000	55,000
	4.56	6.21	52,000	52,000	52,000	52,000
	4.88	6.64	52,000	52,000	52,000	52,000
	5.43	7.39	49,000	49,000	49,000	49,000
	6.17	8.40	44,000	44,000	44,000	44,000

Spicer® Drive Axle Model Identification

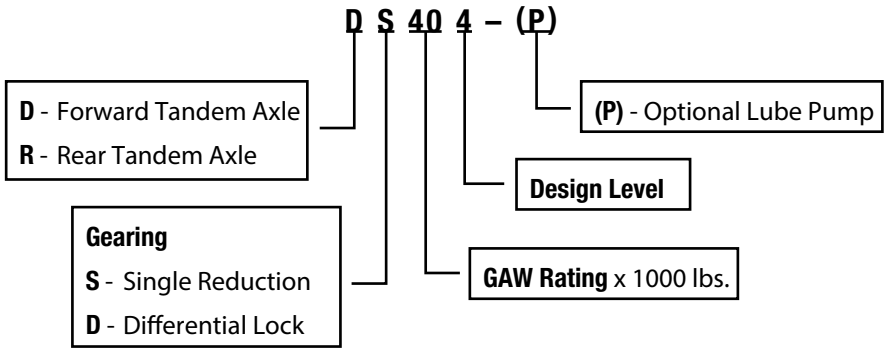
Note: All options are not available for each model.

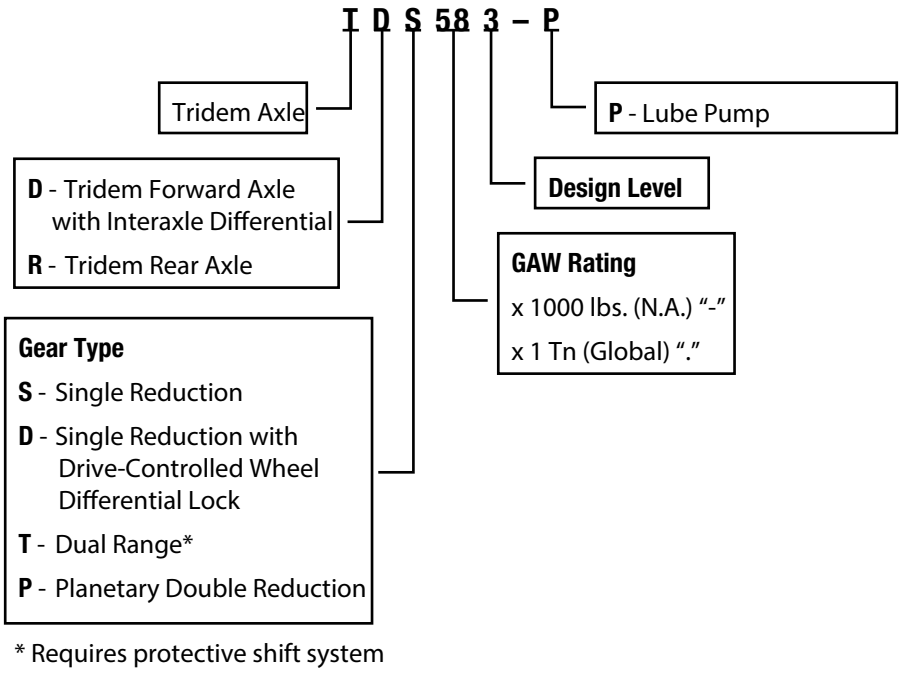




Spicer® Drive Axle Model Identification (Continued)

Note: All options are not available for each model.

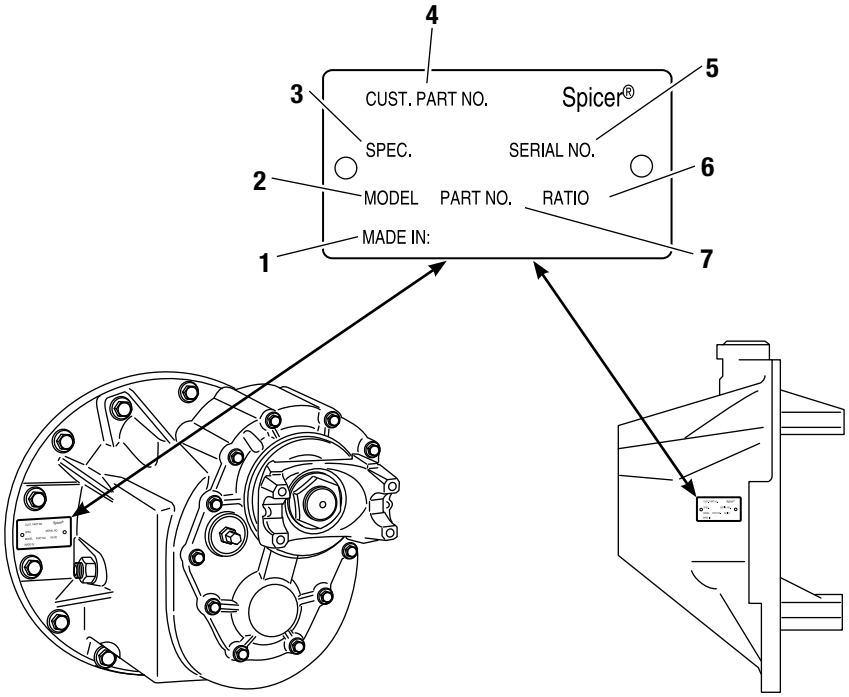




* Requires protective shift system

Spicer® Drive Axle Identification

Drive Axle Head Assembly



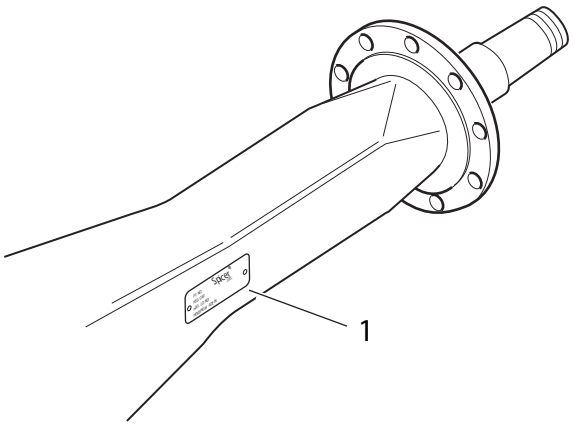
Forward Axle

Rear Axle (Top View)

1 — Country of origin
2 — Axle model identification
3 — Specification number assigned to the axle built by Dana. Identifies all component parts of the axle including special OEM requirements such as yokes or flanges.

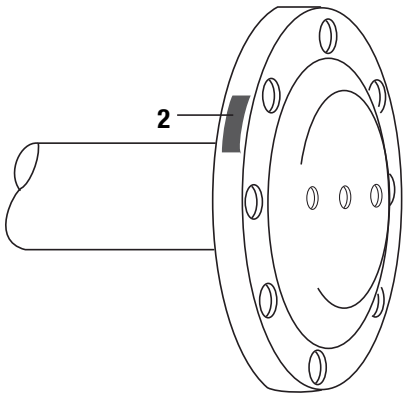
4 — OEM part number assigned to the axle build
5 — Carrier assembly serial number assigned by the manufacturing plant
6 — Axle gear ratio
7 — Carrier assembly production or service part number

Axle Housing



1 — ID tag

Axle Shaft



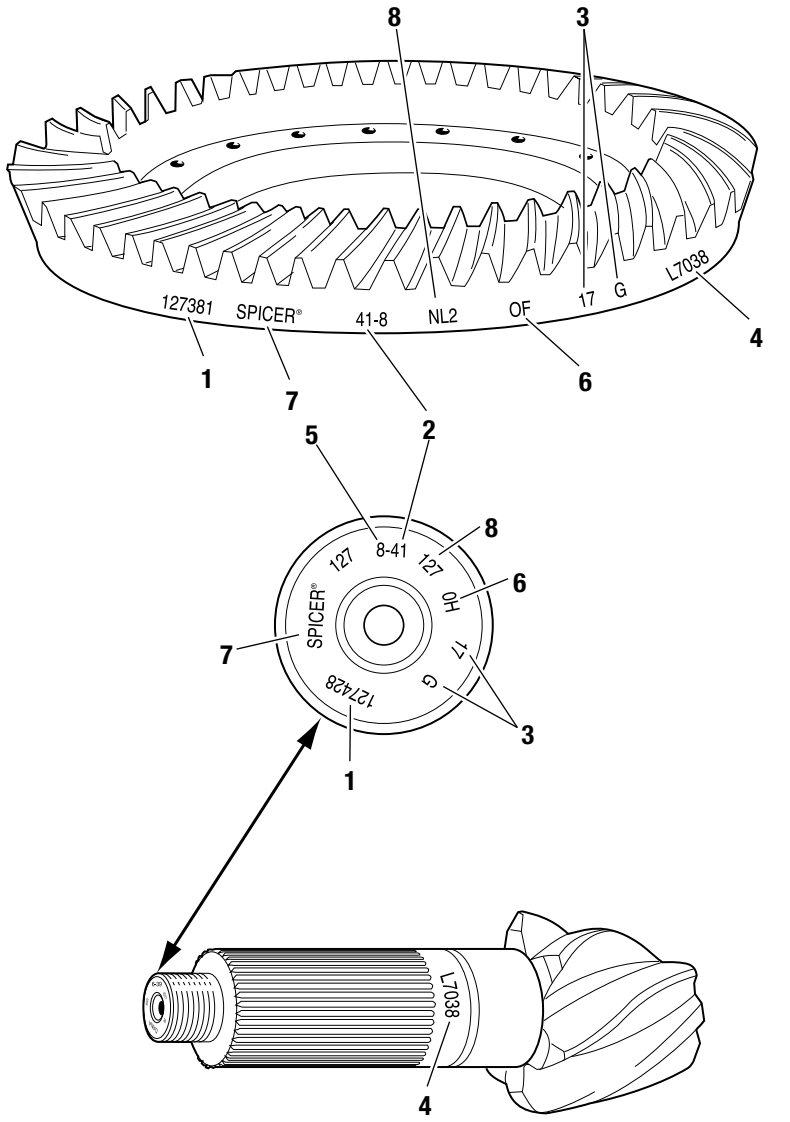
2 — Axle shaft part number

Spicer® Drive Axle Identification (Continued)

Parts Identification

Ring Gear and Pinion

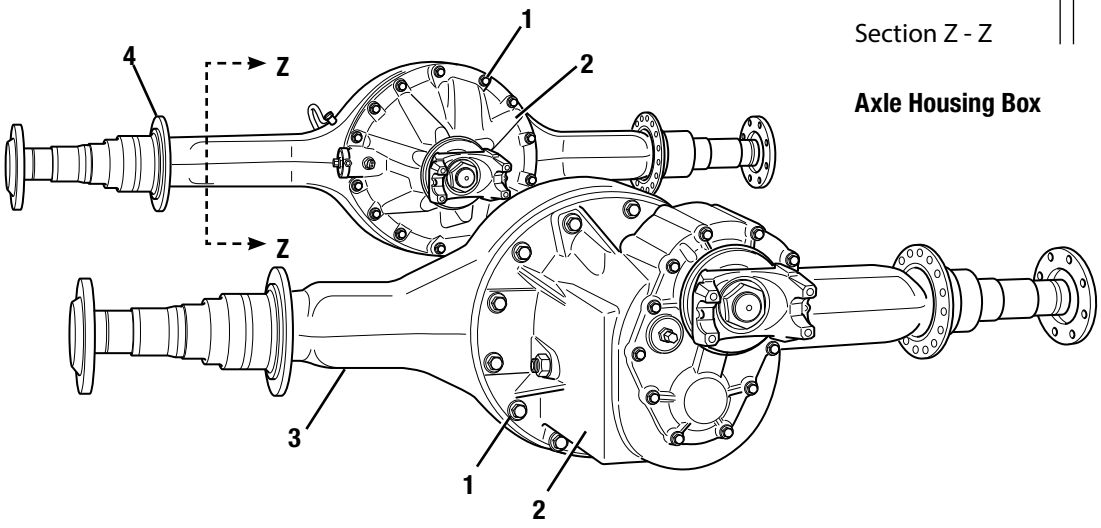
Note: Ring gear and drive pinion are matched parts and must be replaced in sets.

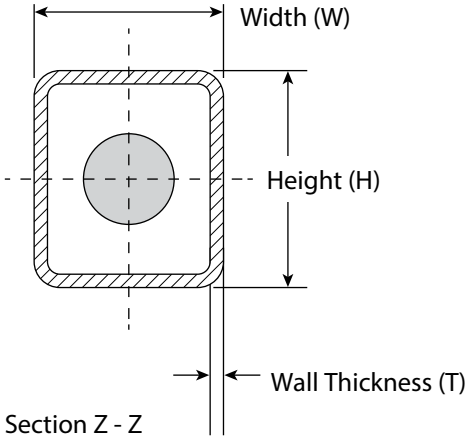


1 — Part number
2 — Number of ring gear teeth
3 — Manufacturing numbers
4 — Matching gear set numbers
5 — Number of pinion teeth
6 — Date code
7 — Indicates genuine Spicer® parts
8 — Heat code

Nomenclature

Tandem Axle Assembly

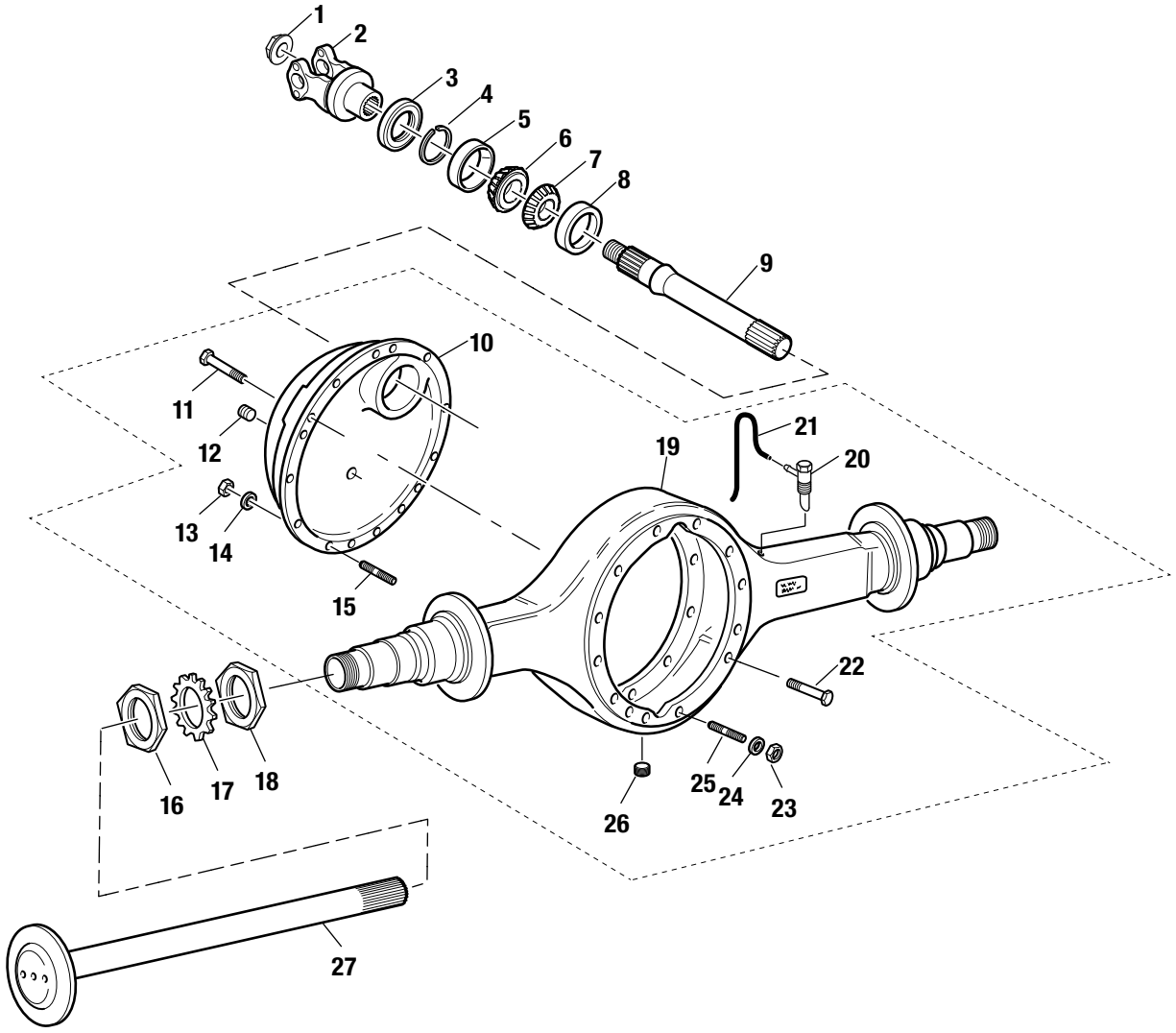




Axle Housing Box

1 — Carrier fasteners
2 — Carrier assembly
3 — Forward axle assembly
4 — Rear axle assembly

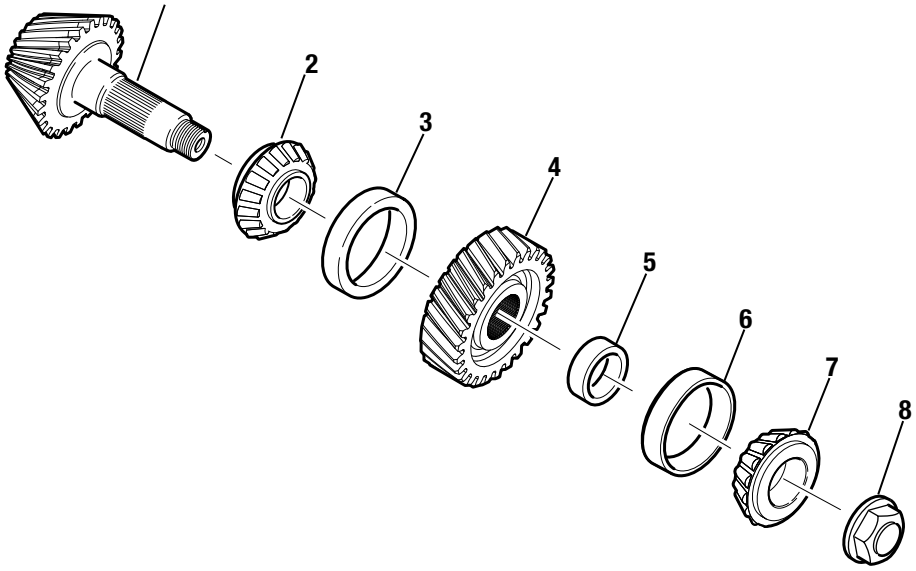
Housing and Output Shaft Assembly



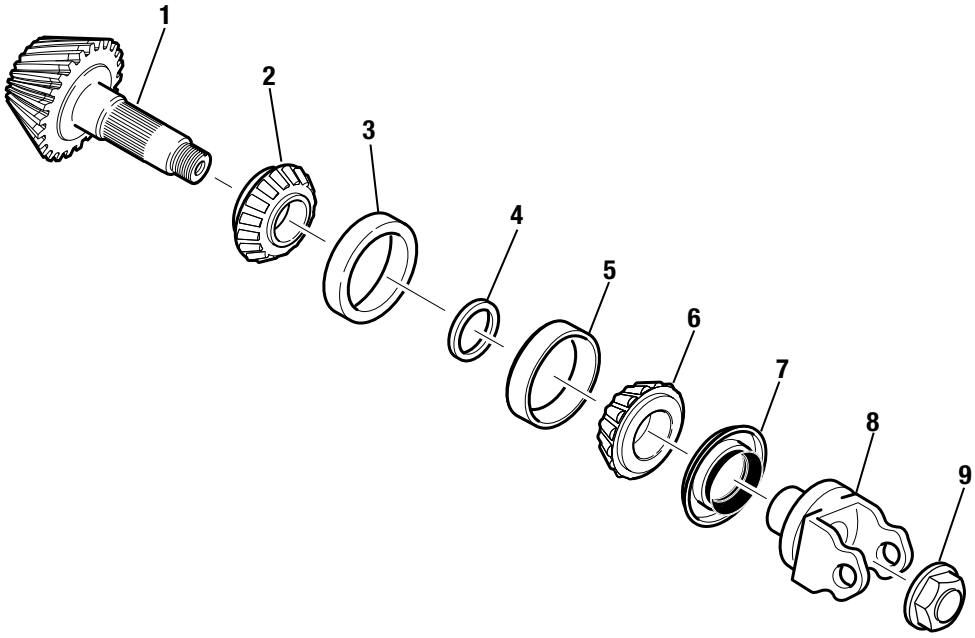
1 — Output shaft nut
2 — Output yoke
3 — Output seal
4 — Output shaft bearing snap ring
5 — Outer bearing cup
6 — Outer bearing cone
7 — Inner bearing cone
8 — Inner bearing cup
9 — Output shaft
10 — Rear cover
11 — Rear cover capscrew
12 — Fill plug
13 — Rear cover nut
14 — Washer
15 — Stud
16 — Spindle nut - outer*
17 — Locking ring*
18 — Spindle nut - inner*
19 — Axle housing
20 — Breather
21 — Breather hose
22 — Carrier capscrew
23 — Nut
24 — Washer
25 — Stud
26 — Drain plug
27 — Axle shaft

*Varies - See page 74.

Forward Axle Pinion Assembly (Tandem Axle)

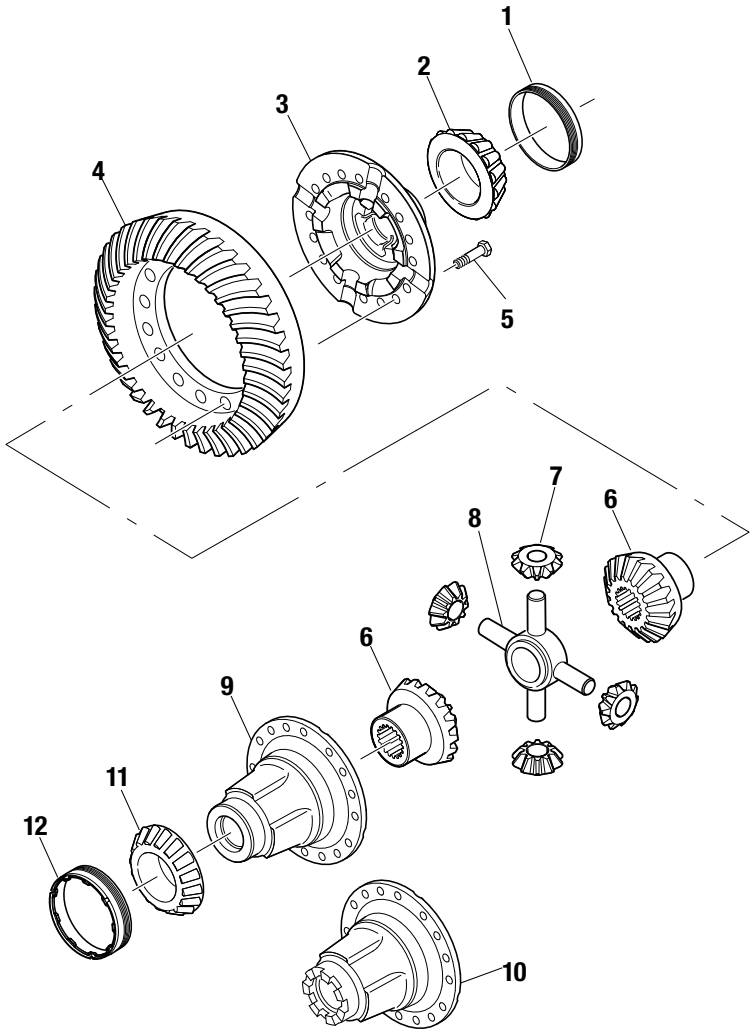


1 — Pinion
2 — Pinion bearing cone - inner
3 — Pinion bearing cup - inner
4 — Pinion helical gear
5 — Pinion bearing spacer
6 — Pinion bearing cup - outer
7 — Pinion bearing cone - outer
8 — Pinion nut



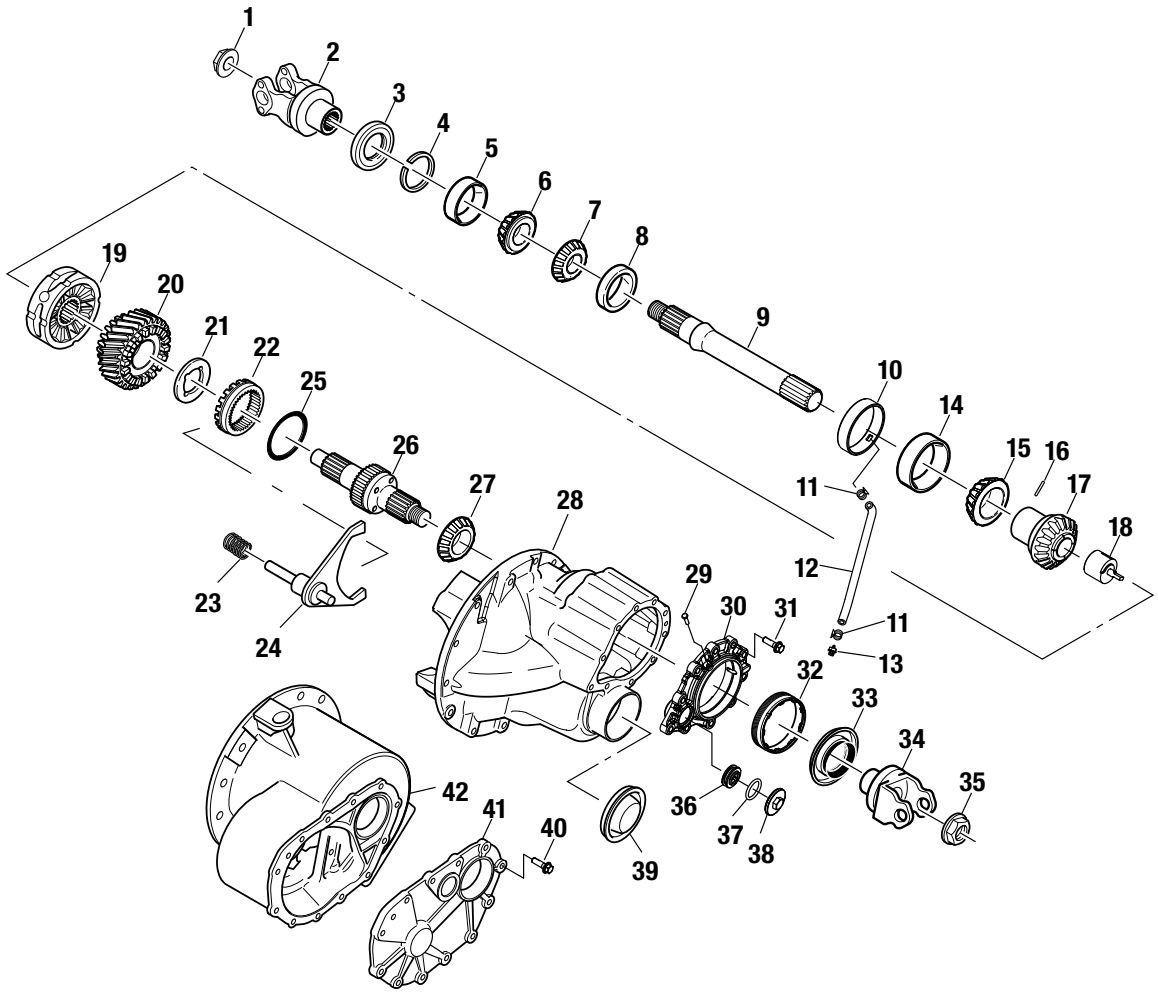
1 — Pinion
2 — Pinion bearing cone - inner
3 — Pinion bearing cup - inner
4 — Pinion bearing spacer
5 — Pinion bearing cup - outer
6 — Pinion bearing cone - outer
7 — Oil seal
8 — Yoke
9 — Pinion nut

Wheel Differential



1 — Threaded bearing adjuster (flange half)
2 — Bearing cone (flange half)
3 — Differential case (flange half)
4 — Ring gear
5 — Ring gear bolt
6 — Side gear
7 — Side pinion
8 — Differential spider
9 — Differential case (plain half)
10 — Differential case (plain half) wheel differential lock
11 — Bearing cone (plain half)
12 — Threaded bearing adjuster (plain half)

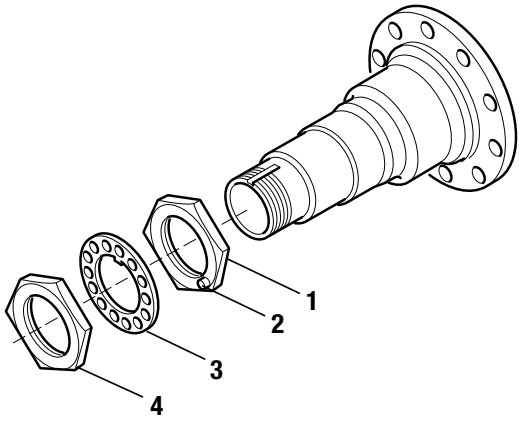
Power Divider



1 — Output shaft nut
2 — Output yoke
3 — Output seal
4 — Output shaft bearing snap ring
5 — Outer bearing cup
6 — Outer bearing cone
7 — Inner bearing cone
8 — Inner bearing cup
9 — Output shaft
10 — Seal manifold
11 — Clamp
12 — Seal manifold feed tube
13 — Sump screen
14 — Output side gear bearing cup
15 — Output side gear bearing cone
16 — Pin
17 — Output side gear
18 — Pump
19 — Interaxle differential
20 — Helical side gear
21 — Thrust washer
22 — Lockout sliding clutch
23 — Shift fork spring
24 — Shift fork assembly
25 — V-ring
26 — Input shaft
27 — Input shaft bearing cone
28 — Carrier housing
29 — Locking capscrew
30 — Input cover
31 — Input cover capscrew
32 — Bearing cup and cage
33 — Input seal
34 — Input yoke
35 — Input nut
36 — Piston
37 — O-ring
38 — Piston cover
39 — Pinion cover
40 — Input cover capscrew
41 — Input cover
42 — Carrier housing

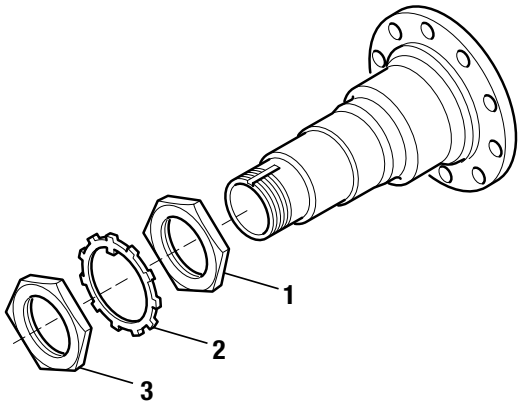
Spindle Nut Systems

Three-piece Dowel-type Lock Washer System



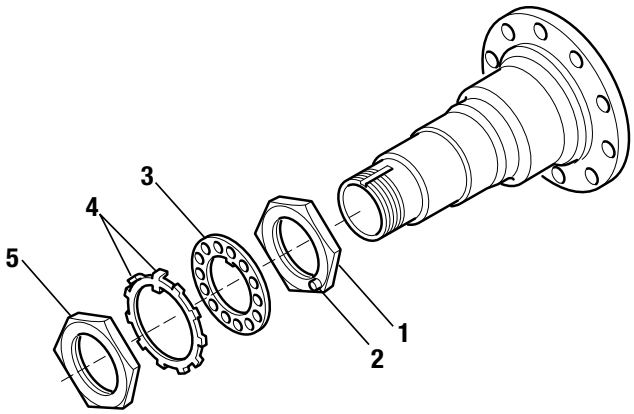
1 — Inner nut
2 — Dowel pin
3 — Dowel-type lock washer
4 — Outer nut

Three-piece Tang-type Lock Washer System



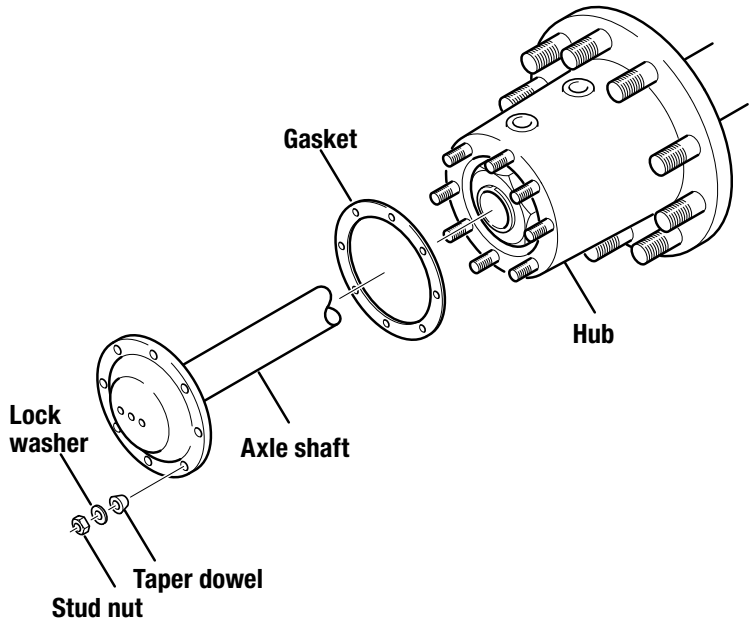
1 — Inner nut
2 — Tang-type lock washer
3 — Outer nut

Four-piece Tang/Dowel-type Lock Washer System

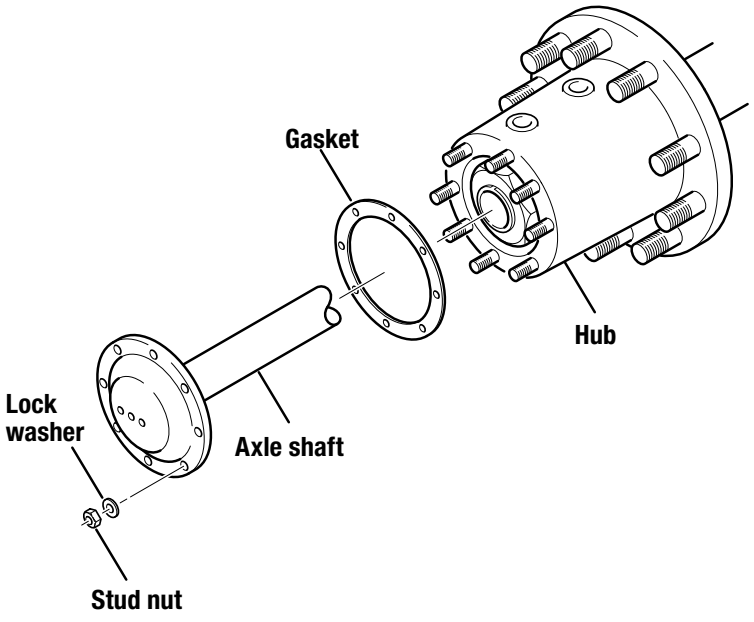


1 — Inner nut
2 — Dowel pin
3 — Dowel-type lock washer
4 — Tang-type lock washer
5 — Outer nut

Axle Shaft Flange to Hub



With tapered holes in axle shaft flange



With straight holes in axle shaft flange

Power Divider Operation

Power Flow and Torque Distribution

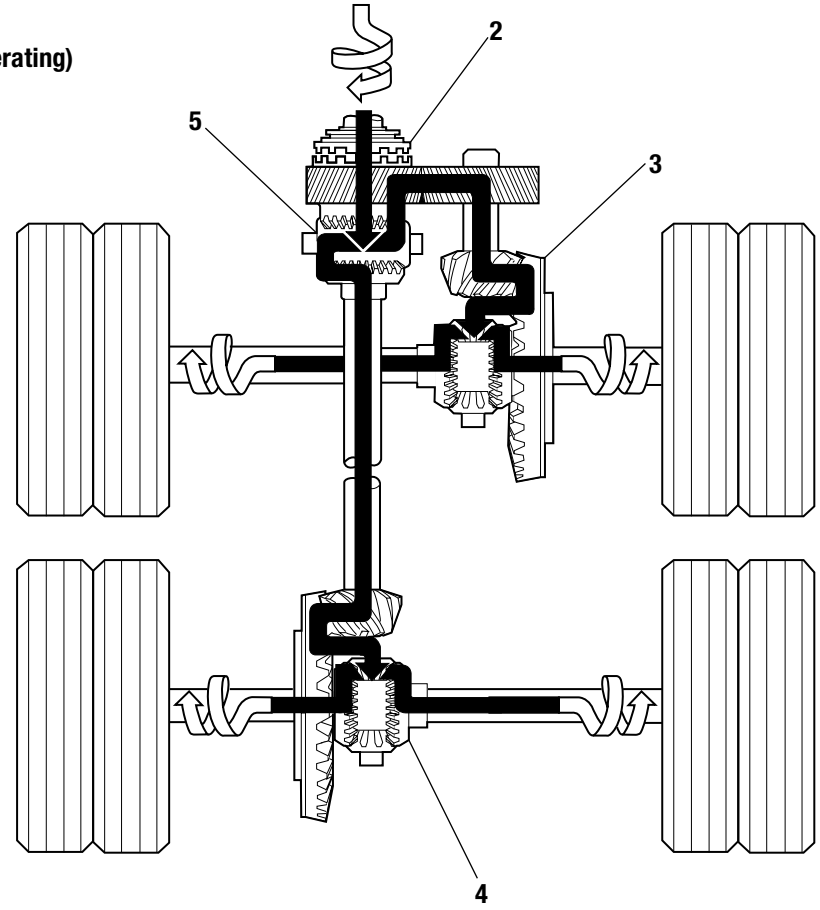
In operation, the power divider accepts torque from the vehicle driveline and distributes it equally to the two axles.

This assembly is of the two-gear design consisting of an input shaft, interaxle differential, output shaft, and two constant-mesh helical gears.

The interaxle differential compensates for minor variations in speed between the two axles, the same way the wheel differential works between the two wheels of a single drive axle. This unit also acts as a central point in distribution of torque to the two axles.

The power divider also includes a driver-controlled, air-operated lockout. When lockout is engaged, it mechanically prevents interaxle differentiation for better performance under poor traction conditions.

With Lockout Disengaged
(Interaxle Differential Is Operating)



1 — Input torque
2 — Lockout disengaged
3 — Forward axle torque is transmitted from the helical side gear through the pinion helical gear, drive pinion, ring gear, wheel differential, and axle shafts.
4 — Rear axle torque is transmitted from the output shaft side gear through the output shaft, interaxle driveline, drive pinion, ring gear, wheel differential, and axle shafts.
5 — Input torque (power flow) from the vehicle driveline is transmitted to the input shaft and the interaxle differential spider. The differential distributes torque equally to both axles.

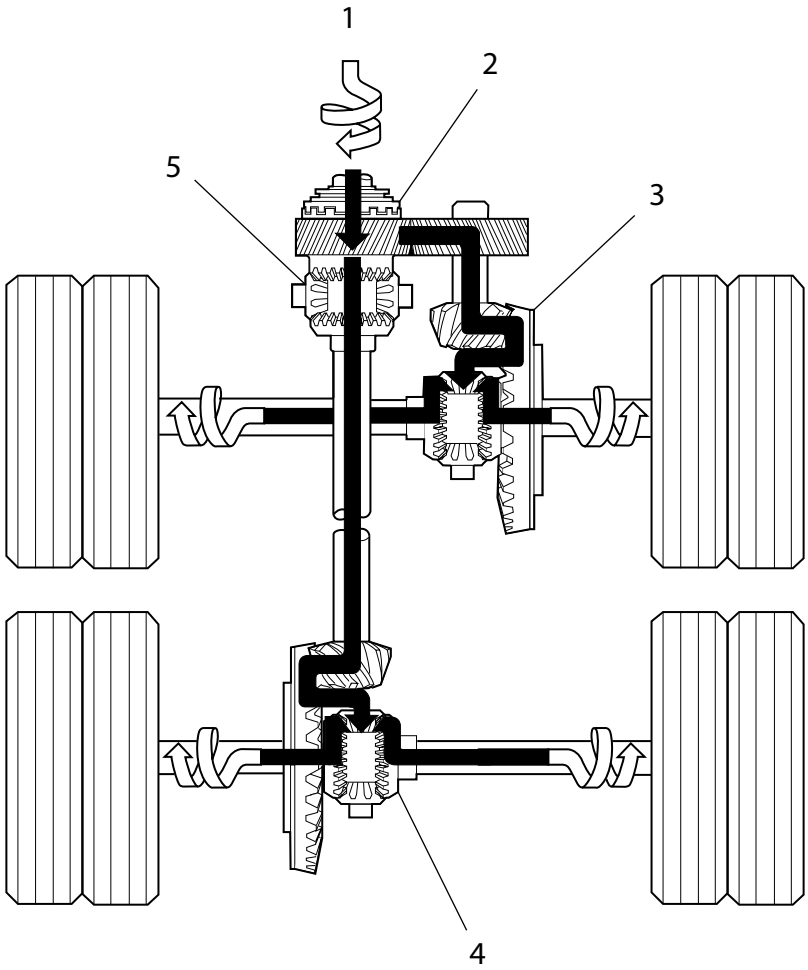
Power Flow and Torque Distribution

With Lockout Engaged (Interaxle Differential Is Not Operating)

Lockout should only be engaged when both axles are rotating at the same speed. Operation should be limited to low-traction situations and should be disengaged when normal traction returns. Failure to do so will result in poor handling and damage to the axle components.

Note: Varied road surface conditions can result in unequal torque distribution between the two axle assemblies.

⚠ **CAUTION:** Prolonged operation with the lockout engaged can damage axle and driveline components.



1 — Input torque
2 — Lockout engaged
3 — Forward axle torque is transmitted from the helical side gear through the pinion helical gear, drive pinion, ring gear, wheel differential, and axle shafts.
4 — Rear axle torque is transmitted from the output shaft side gear through the output shaft, interaxle driveline, drive pinion, ring gear, wheel differential, and axle shafts.
5 — Input torque (power flow) from the vehicle driveline is transmitted directly to the helical side gear and the output shaft. A positive drive is provided to both axles for maximum traction under adverse road conditions.

Wheel Differential Lock

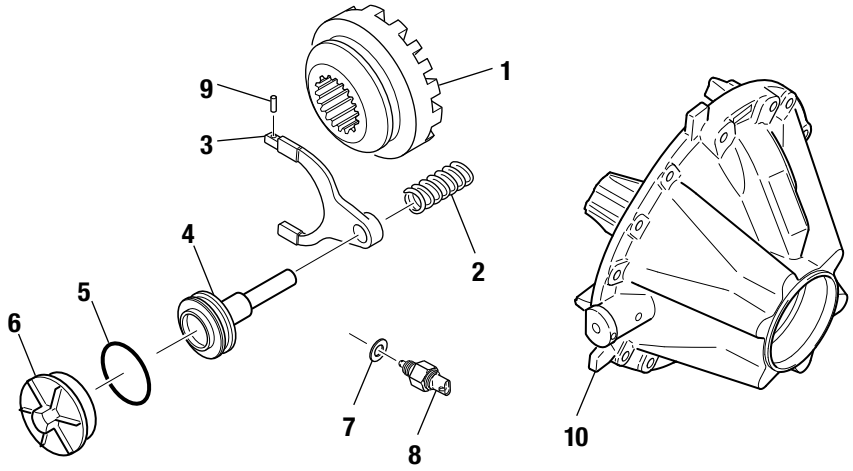
The Spicer® wheel differential lock is an optional feature for Spicer axles. In operation, it positively locks the wheel differential to provide improved traction under adverse road conditions.

The differential lock is driver-controlled through an electric switch or air valve mounted in the cab. The locking mechanism is air-operated to engage a mechanical clutch and lock the wheel differential. It is spring-operated to disengage the lock and permit the wheel differential to function normally.

The wheel differential lock consists of three major assemblies.

- **Shift Cylinder Assembly:** Operates a shift fork and push rod assembly.
- **Shift Fork and Push Rod Assembly:** Engages and disengages the differential lock curvic clutch assembly.
- **Curvic Clutch Assembly:** Consists of a sliding clutch splined to an axle shaft and a fixed clutch which is splined to the differential case hub.

The differential lock also includes a selector switch (electric) which senses clutch engagement and sends an electrical signal to a cab-mounted indicator light (or an audible signal device).

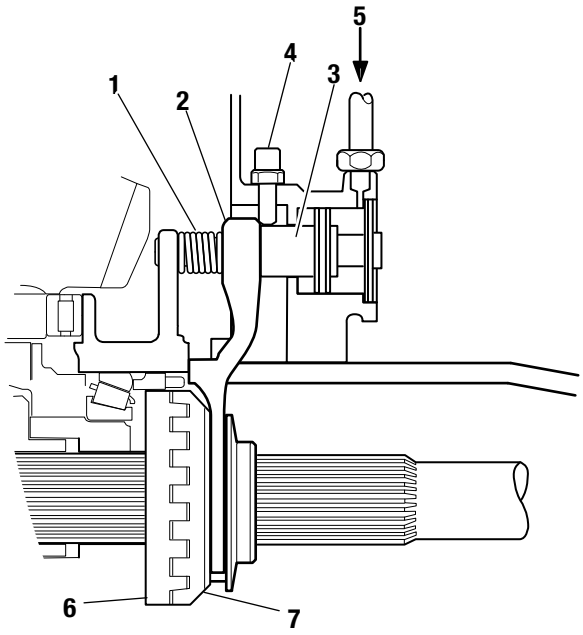


1 — Sliding clutch
2 — Spring
3 — Clutch fork
4 — Piston and rod
5 — O-ring
6 — Piston cover
7 — Washer
8 — Switch
9 — Pin
10 — Carrier

Differential Lock Engaged

Air pressure applied to the shift cylinder moves the piston, push rod, and shift fork, and the sliding curvic clutch engages the fixed curvic clutch.

The sliding clutch is splined to the axle shaft. The fixed clutch is splined to the differential case hub. Engaging the two clutches locks the wheel differential, preventing wheel differential action.



Differential Lock Engaged

1 — Spring is compressed
2 — Shift fork
3 — Piston and rod
4 — Selector switch
5 — Air pressure applied engages clutches
6 — Fixed clutch splined to differential case
7 — Sliding clutch splined to axle shaft and engaged with fixed clutch

Differential Lock Engagement Indicator

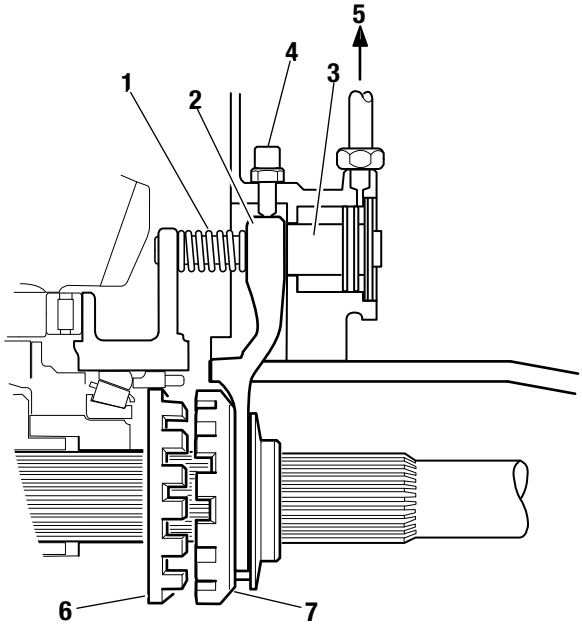
Differential lock engagement is detected by a switch (electric) mounted on the differential carrier. An actuator, mounted in the piston cover, operates the switch.

When the shift fork moves to engage the differential lock, the push rod actuator moves away from the switch, allows the switch to close, and sends an electrical signal to turn on a cab-mounted indicator light (or an audible signal).

When the shift fork moves to disengage the differential lock, the compression spring also moves the push rod actuator to contact the switch. The switch is opened and turns off the cab-mounted indicator light (or the audible signal).

Differential Lock Disengaged

When air pressure at the shift cylinder is released, a compression spring (mounted on the push rod) moves the push rod, shift fork, and sliding clutch as an assembly. The sliding clutch moves out of engagement with the fixed clutch. The wheel differential is unlocked and operates normally.



Differential Lock Disengaged

1 — Spring is decompressed
2 — Shift fork
3 — Piston and rod
4 — Selector switch
5 — Air pressure released disengages clutches
6 — Fixed clutch splined to differential case
7 — Sliding clutch splined to axle shaft

Dual Range Tandem Axle Drives

Description and Operation

Two-speed, single or tandem, are dual range shiftable axles. They provide low and high range gearing and are designed for heavy-duty service in on-off highway operations. Low range for deep gear reduction and slow speed hauling off-highway. High range for cruising speeds on-highway.

The complete tandem axle assembly includes two axle units, each with double gear reduction capability coupled by a two-gear power divider.

Gearing and Torque Distribution - Dual Range Gearing

The gearing for each axle is a combination of a spiral bevel ring gear and pinion and a planetary unit. First reduction (High Range) is provided by the spiral bevel gearing. Second reduction (Low Range) is through the planetary gearing. Four planetary idler pinions are confined within the ring gear internal teeth. The planetary gears rotate around a sliding clutch gear.

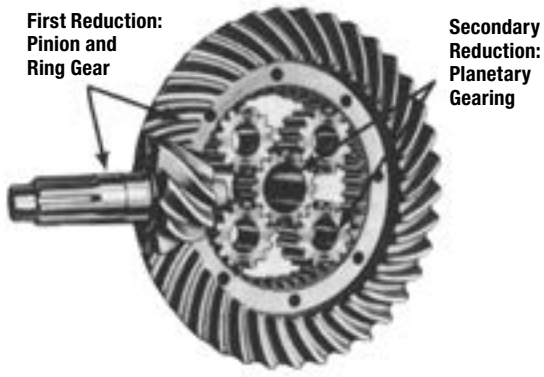
Each axle is equipped with a shift unit, which operates the sliding clutch gear to provide a means for selecting the axle range. Range selection is accomplished through the movement of the sliding clutch gear in and out of engagement with low- and high-speed clutch plates.

Planetary Double Reduction Axles

Description and Operation

The planetary double reduction axles share their basic design concepts and many components with the dual range tandem.

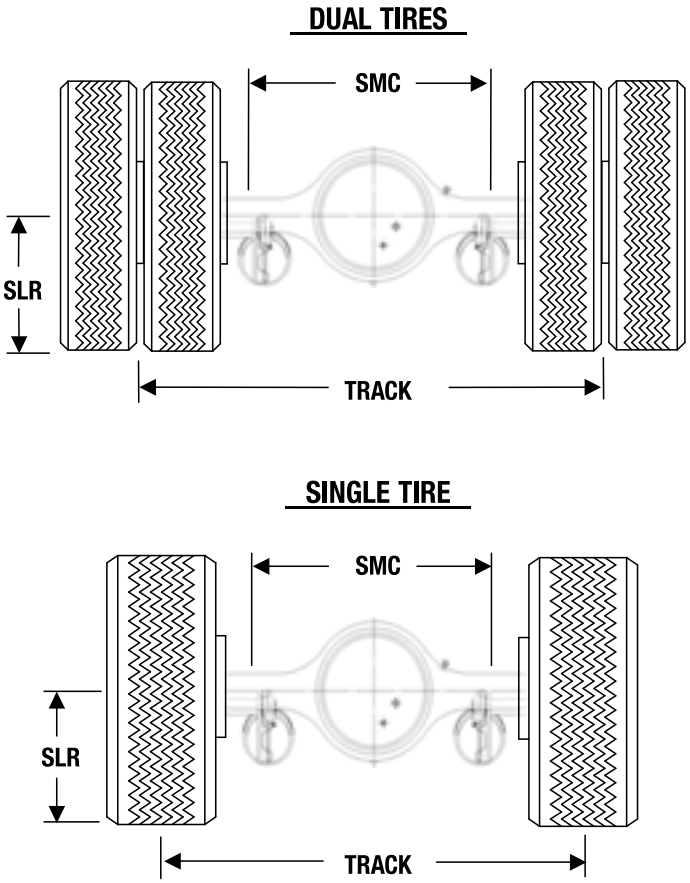
The principle variation is the permanent engagement of the double reduction feature. A stationary sun gear, fixed in engagement with the low-speed clutch plate, replaces the sliding clutch gear and provides continuous double reduction operation in the same manner as the dual range axle when in Low Range.



Planetary Double Reduction Gearing

Track, SLR, SMC

Dual/Single Tire



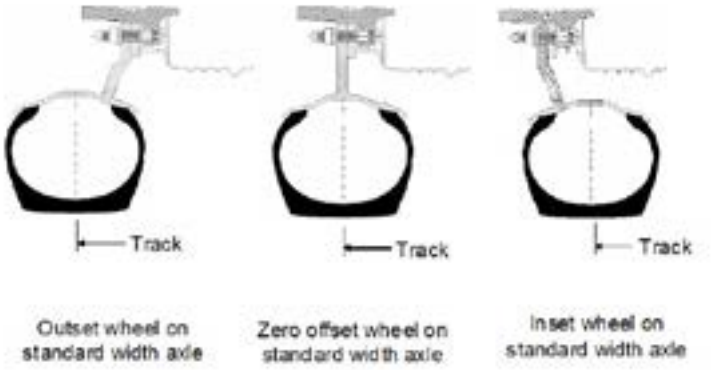
TRACK – The distance between the dual tire centerlines or the distance between the tire centerlines on a single tire.

SLR (Static Loaded Radius) – The distance from the centerline of the axle to the ground, underrated tire capacity, with the tire at rest.

SMC (Suspension Mounting Centers) – The distance between suspension mounting points on an axle.

Super Single Tires / Offset Wheels

Offset Wheels

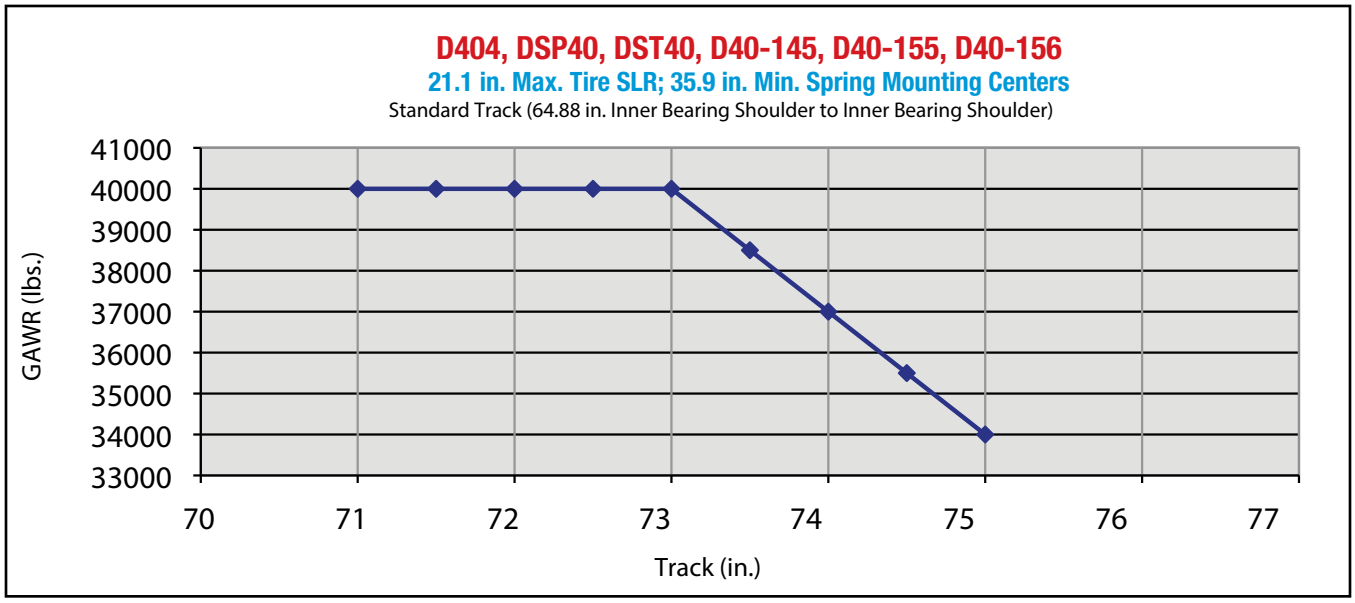


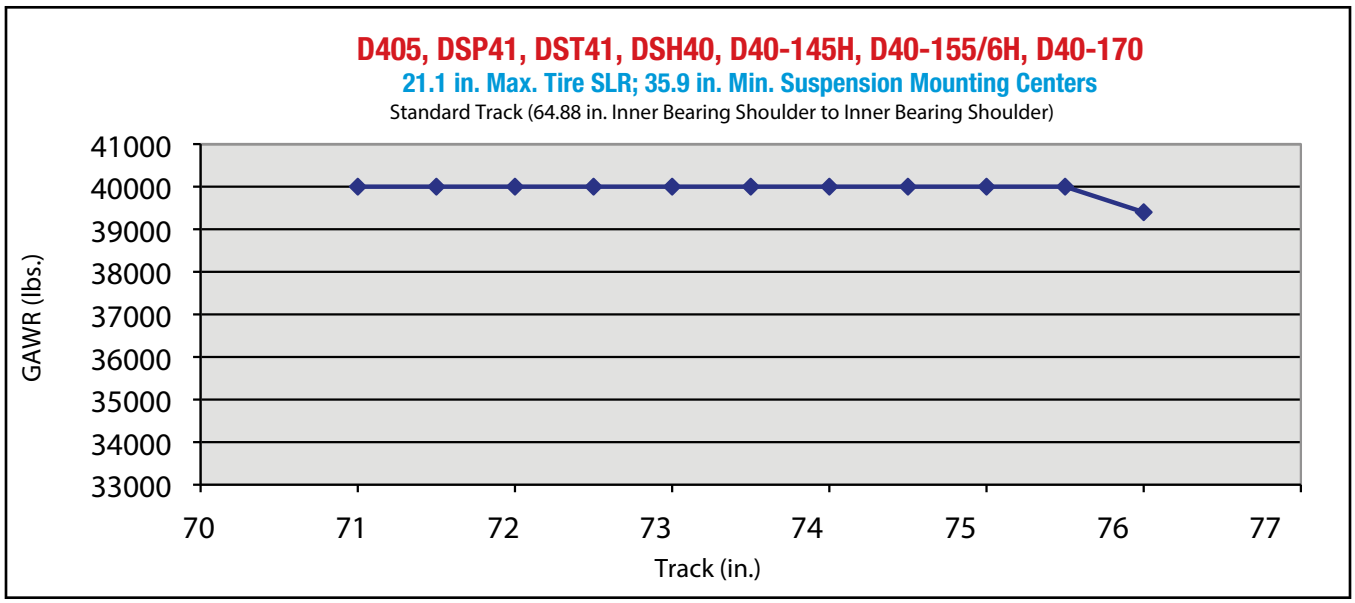
- **Outset (positive) –** The tire centerline is positioned outboard of the wheel mounting face.
- **Inset (negative) –** The tire centerline is positioned inboard of the wheel mounting face.

Super Singles or Wide-Based Tires – Term associated with single tire drive axle arrangements typically used with outset or zero offset wheels (in place of dual tire arrangements).

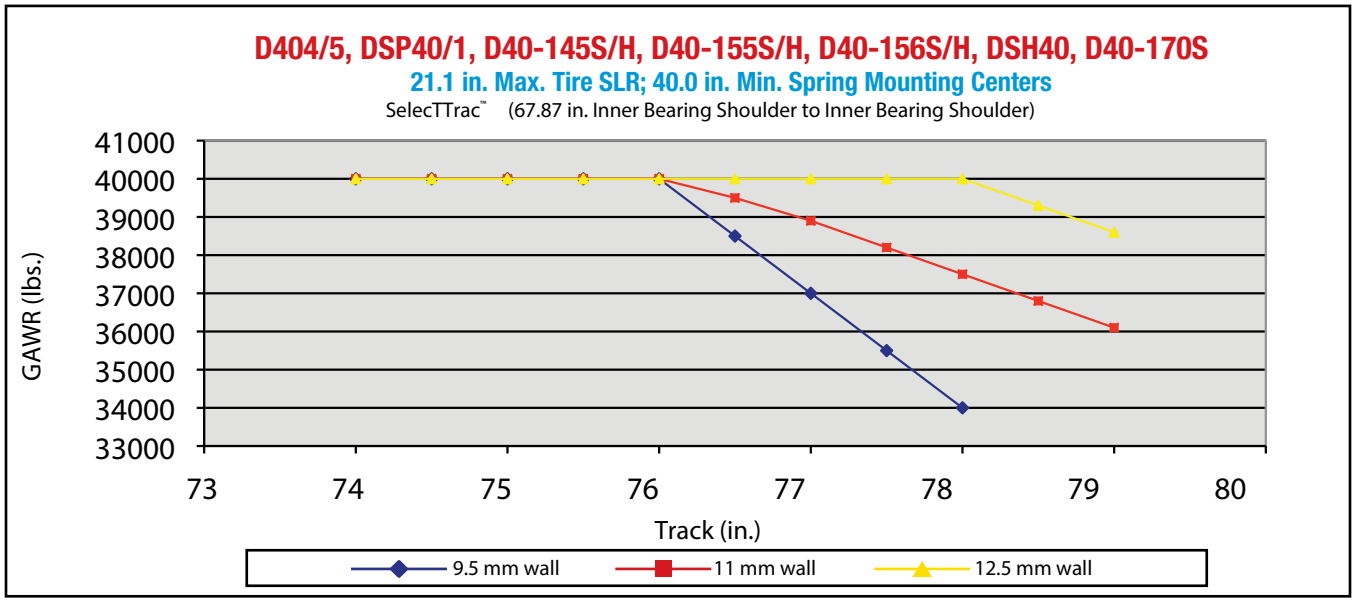
Ratings Charts

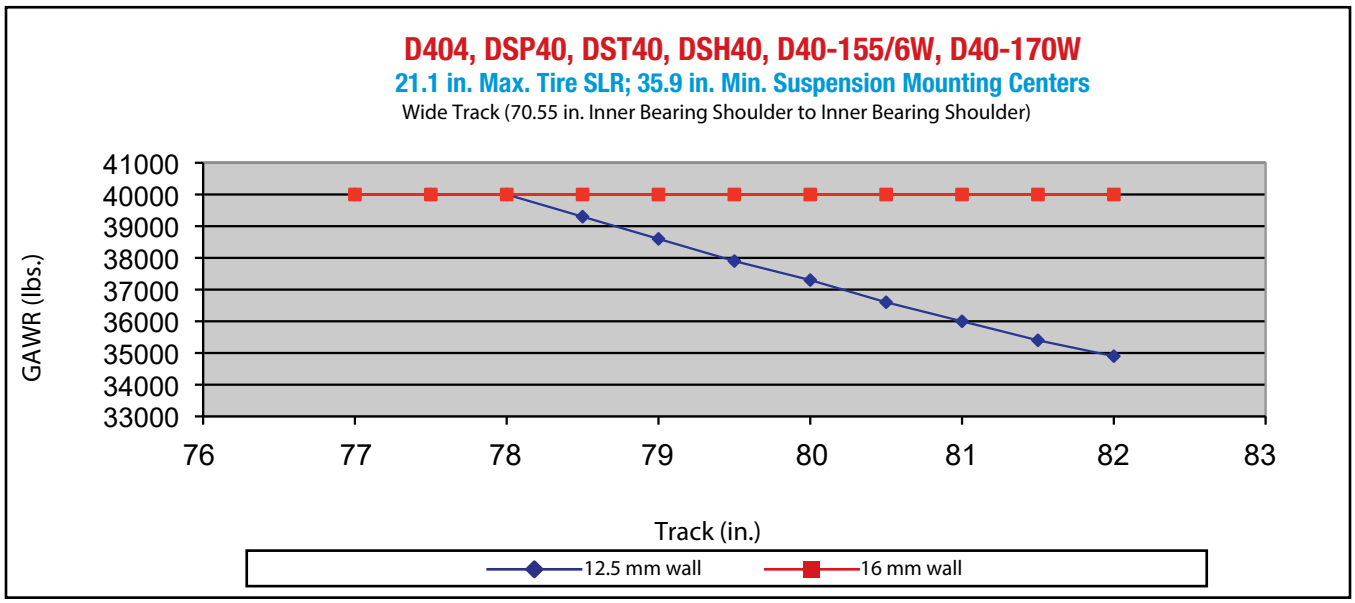
40,000 lb. Ratings



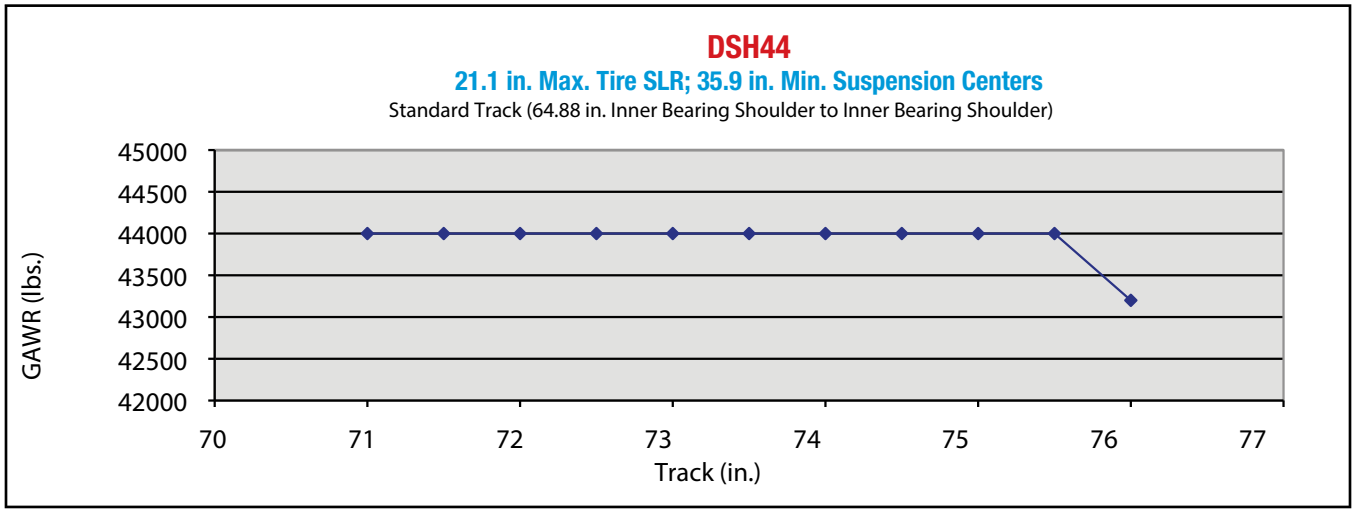


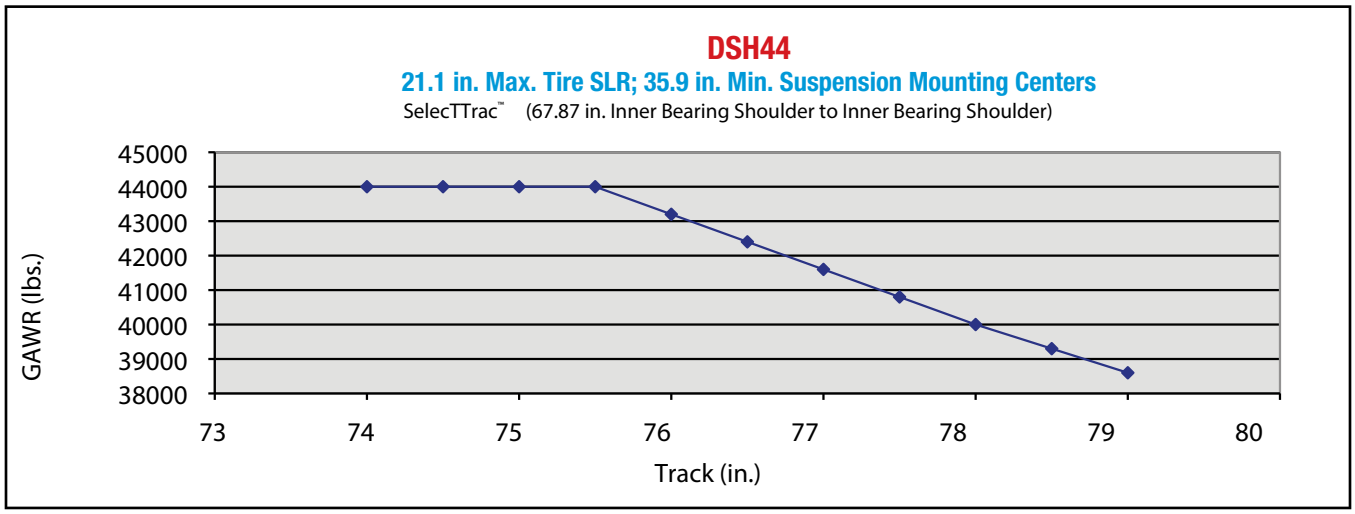
40,000 lb. Ratings (Continued)

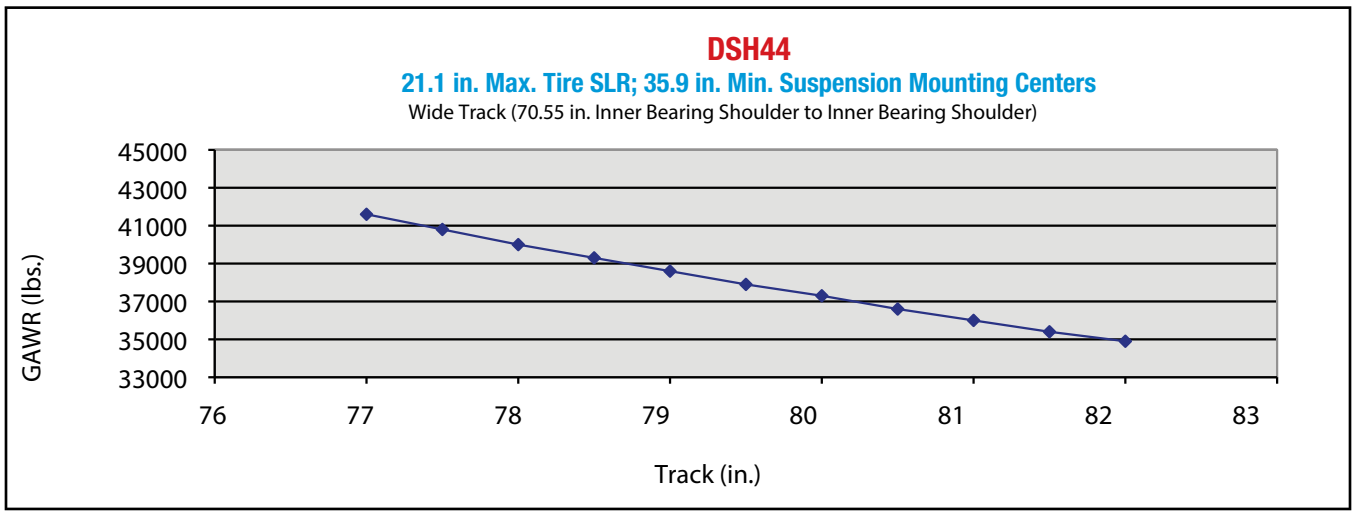




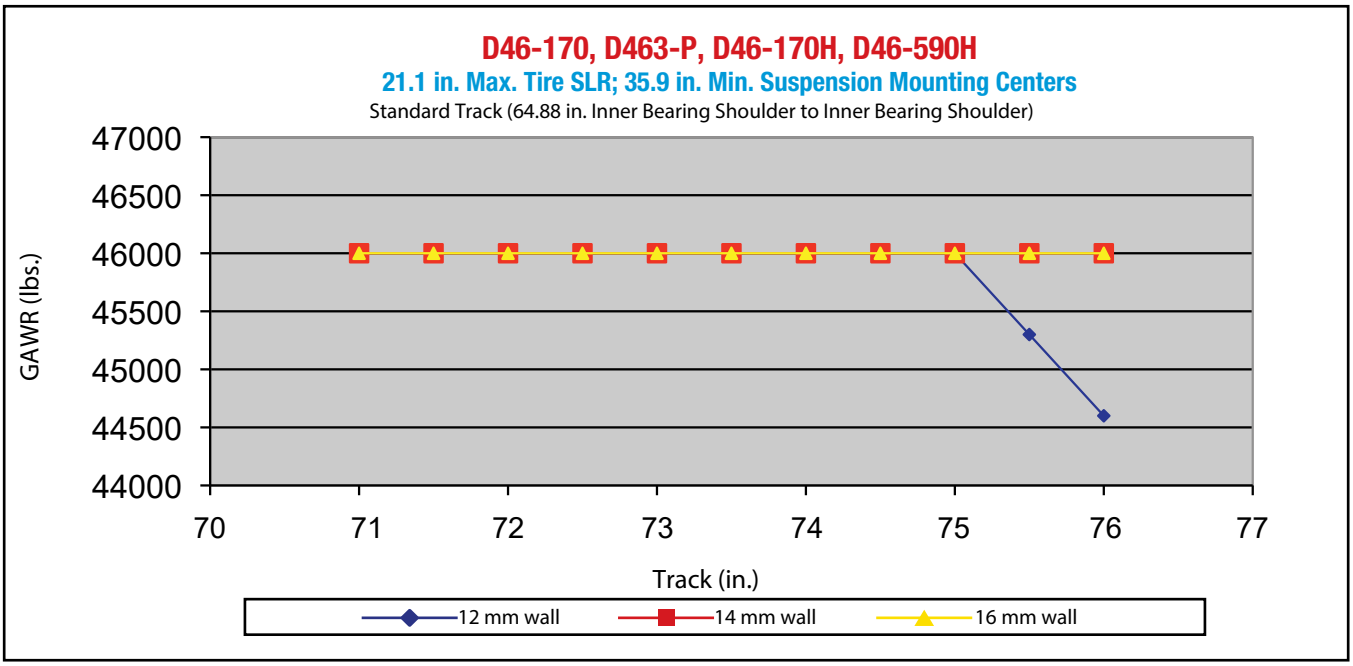
44,000 lb. Ratings

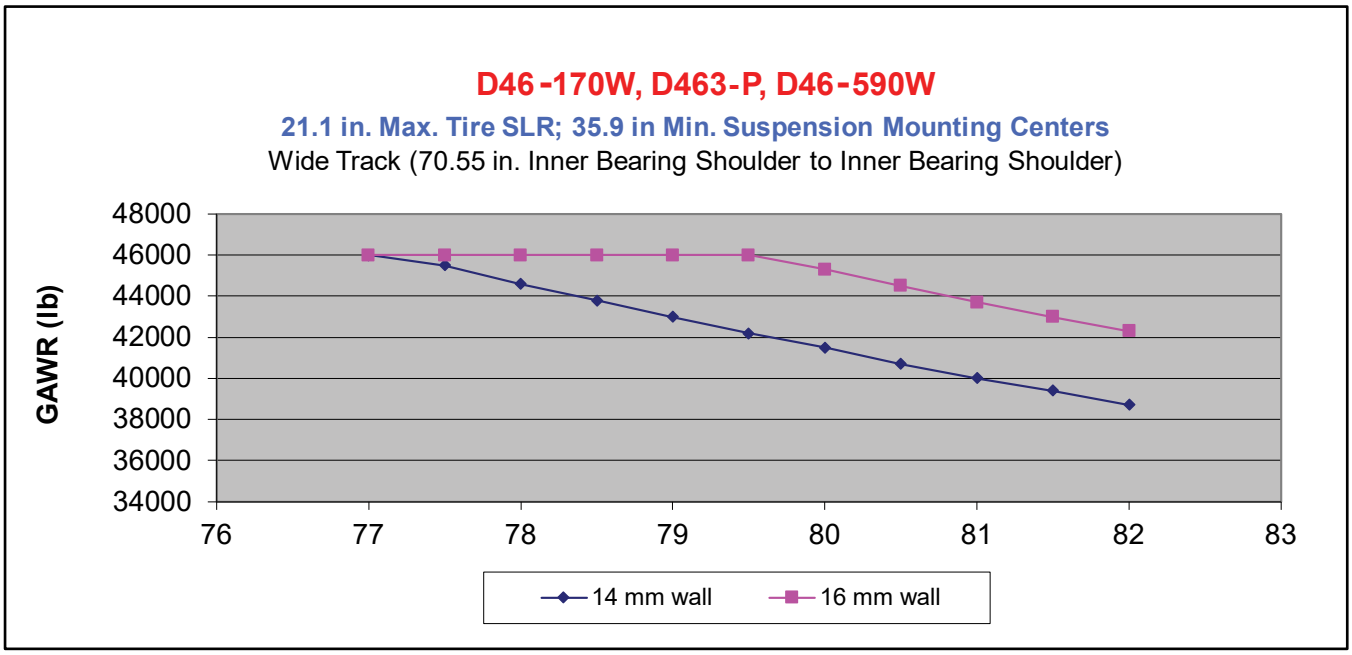






46,000 lb. Ratings





Glossary

Terms

ABA (Automatic Brake Adjuster) - Also called an Automatic Slack Adjuster (ASA), this is a lever connecting the brake chamber push rod with the foundation brake camshaft. It provides torque to rotate the brake camshaft when the brake treadle is depressed. It also provides a means of automatically adjusting clearance between brake shoes and the drum to compensate for lining wear. Some brake adjusters require manual adjustment.

ABS (Anti-lock Brake System) - Electronically monitors wheel speed and prevents wheel lockup by rapidly cycling the brakes during panic stops and when stopping on low-friction surfaces.

ABS Control Valves - Control valves that are actuated by the ABS Electronic Control Unit (ECU) to ensure wheels are optimally braked. On a tractor, they are called ABS modulator valves. On a trailer, they're called ABS relay valves.

A/C Centers - The distance from the centerline of one brake chamber to the other.

Ackermann Geometry - The relative angular movements of the front wheels while traveling along a curved path. (A double pivoting steering system, where the outer tie rod arms are bent slightly inward so that when a vehicle is making a turn the wheels toe out and the inside wheel will turn more sharply than the outer wheel.) This is done to compensate for the greater distance the outside wheel must travel. These angular movements relate to the length of wheelbase and the width of track. True Ackermann geometry includes the Jeantaud modification to Rudolph Ackermann's original principle.

Active Suspension - While conventional suspension uses springs and shock absorbers to isolate the vehicle from the bouncing movement of the wheels when it contacts rough roads, active suspension uses power actuators that are controlled by a computer. These actuators place the wheels of the vehicle in the best position to accommodate rough roads as well as compensate for different load levels.

Actuate - To initiate mechanical motion of a brake system component.

Actuator - A device that physically initiates mechanical motion of a brake system component.

ADB - See "Air Disc Brakes."

ADR 35 (Australian Design Rule 35) - Specifies braking requirements under normal and emergency conditions.

Aftercooler - Optional device that condenses and eliminates water from air pressurized by the compressor.

Air Build-Up - Process of compressor building pressure to a predetermined maximum level, usually 100-120 psi, within the brake system air tanks.

Air Compressor - Engine-driven via a belt or direct gear, the compressor pressurizes the air tank.

Air Compressor Cut-Out - Predetermined point at which the air governor halts compression of air by the compressor.

Air Disc Brakes - Air-actuated brakes, which upon application, employ a caliper to clamp two brake pads against a rotor. Air discs, compared with drum-type brakes, have superior ability to resist fade.

Air Dryer - A filter, typically containing a desiccant, which is installed between the compressor and service reservoir to remove water and vapor plus oil blow-by from the compressor.

Air Gauge - Dash-mounted gauge indicating air pressure in terms of pounds per square inch (psi).

Air Governor - Controls the compressor unloader mechanism and also maintains system air pressure between predetermined minimum and maximum levels, usually between 90-120 psi.

Air Over/Under - In relation to suspensions.

Overslung - Suspension arm goes above or over the axle air bag.

Underslung - Suspension arm goes below or under the axle air bag.

Air System Balance - Can be separated into two different aspects: pressure level balance and timing balance. Air system balance deals primarily with the vehicle air system components that directly control the actuation of the service brakes during normal stops, foot control valve, check valves, relay valves and their arrangement or system design. Their purpose is to balance the time it takes air pressure to build uniformly at all wheel ends.

Air Tank - A reservoir for compressed air. Typically, a combination vehicle has several tanks: three in the tractor and one per trailer. The tractor's supply air tank (formerly "wet tank") receives air from the compressor and delivers it to the primary and secondary air tanks in the tractor. A check valve on each tank prevents total air loss in the event of a leak.

Alcohol Evaporator - Optional device, installed in compressor discharge line between the compressor and supply air tank, which injects alcohol mist into the air flow to reduce the risk of freeze up. It's not normally used in a vehicle with an air dryer.

AL Factor - A mathematical expression of the brake adjuster and brake chamber combination. "A" equals the effective area, in square inches, of the brake chamber (e.g., Type 30 chamber has effective area of 30 sq. in.). "L" equals the effective length, in inches, of the slack adjuster. For example, 30 x 6 in. = 180.

Alignment - Method of maintaining proper relationship between all components of the steering system.

Amboid Gear - Modified Spiral Bevel Gear that allows the pinion to be positioned above the ring centerline.

Analog Processing - A method of processing information used in older ABS control units. Today's Electronic Control Units (ECUs) use digital processing, which is many times faster and more reliable.

Anchor Pin - A pin or pins used to retain brake shoes within the brake assembly.

Anti-Compounding - A system that prevents application of service brakes from compounding the force exerted by parking brakes. This guards against damage to brake components due to excessive loads.

Anti-lock Brake System - See "ABS."

Application Time - Time elapsed between depression of the brake treadle and engagement of the linings with the drums (or, per FMVSS 121, the point at which all service chambers reach 60 psi).

Application Valve - Air valve, such as foot valve or trailer control valve, which controls the pressure delivered to the brake chambers.

ASR (Anti-Spin Regulation) - See "ATC."

ATC (Automatic Traction Control) - Also called ASR, it's an optional system that is available on 4- and 6-channel ABS systems. Automatic traction control minimizes wheel slipping during acceleration by controlling both the engine throttle and brake pressures.

Automatic Brake Adjuster - See "ABA."

Automatic Traction Control - See "ATC."

Auxiliary Lift Axle - An extra axle often kept in a lifted position and only dropped to the pavement when its extra load-carrying capacity is needed.

Auxiliary Retarder - See "Retarder."

Auxiliary Transmission - Additional gear box increasing the gear ratio combinations when used with main transmission or multi-speed axles.

Axle Carrier Assembly - Portion of the axle assembly that contains the drive gears and differential. To complete the axle assembly, the carrier assembly is combined with the housing.

Axle, Live - Driven Axle.

Axle Mounting Centers - Also referred to as the "Suspension Mounting Centers." This is the distance between centerlines of where the suspension clamps to the axle.

Axle Shaft - Transmits torque from the wheel differential to the wheel equipment.

Axle Shaft Floating - Shaft carries no vehicle loads, but transmits torque.

Axle Shaft Semi-Floating - Shaft carries vehicle loads as well as torque.

Axle Shift System - The actual control mechanism that is employed to control movement of a shift fork or sliding clutch to vary the axle ratio. Three general types are employed for this purpose:

1. Air shift system

2. Electric over air shift system

3. Electric shift system

Axle Spindle - Used on a full floating housing design, supports the wheel end system.

BCCC Dimension - Distance from the Brake Shoe centerline to the Brake Chamber centerline.

Beam Drop - Distance from the kingpin to spindle intersection to the spring-mounting pad surface.

Bearing Shoulder to Bearing Shoulder Dimension - Distance from the machined inner bearing contact point on one side of the axle to the machined inner bearing contact point on the other side.

Belleville Washer - Also known as coned-disc springs or Belleville disc springs. They provide very high loads at small deflection and also maintain a constant force regardless of dimensional variations due to wear, temperature changes or tolerances.

Bell-Mouthed Drum - Drum with variation of inner diameter (i.e., greater at open end), preventing full contact with brake lining.

Blue Drum - Brake drum with friction surface turned blue from high temperature. High temperature may result from dragging of brakes caused by weak return springs. Blue drum also may result from lack of brake balance (i.e., excessive brake torque at wheel with blue drum and lack of brake torque and other wheel ends).

Bogie - Combination of two axles usually pivoting about a common trunnion.

Brake Adjuster - See "Slack Adjuster."

Brake Balance - Balance is achieved when all brakes on all axles do their fair share of the work. The four types of brake balance are: pneumatic, thermal, timing, and torque.

Brake Block - Friction material, also known as brake lining, attached to a brake shoe. Disc brakes use pads with friction material.

Brake Chamber - Device inside which a diaphragm converts air pressure to mechanical force, via a push rod, for brake actuation. Consists of service chamber or service chamber/spring chamber.

For example: A 30/36 chamber consists of a Type 30 service chamber and a Type 36 spring chamber. See "Service Brake" and "Spring Brake."

Brake Chamber Diaphragm - Compression molded device within a brake chamber that converts air pressure to mechanical force via a push rod. The size of the brake chamber correlates with the effective area of the diaphragm. A Type 30 chamber diaphragm has an effective area of 30 sq. in.

Brake Drag - Failure of one or more brakes to release immediately and/or completely after a driver removes his foot from the brake treadle. Constant drag, unrelated to a brake application, also can exist. See "Quick-Release Valve."

Brake Drum - Attached to the hub. Converts kinetic energy from the shoe and lining assembly to heat and transfers that heat away from the brake surface to dissipate into the atmosphere over time. The majority of drums are entirely of cast iron.

Generally these are divided into three service-rating codes based on application. There is standard duty, heavy duty, and extra heavy duty. In addition, there are inboard mounted drums (with spoke wheels) and outboard mounted drums (with hubs). The other brake drum is the steel jacketed type. This consists of a steel mounting face with a cast iron braking surface insert.

Brake, Engine - See "Engine Brake."

Brake, Exhaust - See "Exhaust Brake."

Brake Fade - There are many types and causes of braking fade. Fade may result, for example, from a reduction in friction between linings and drums caused by exposure to water. Most typically, however, fade involves a reduction in braking force experienced when dragging brakes on a long grade. If brakes are maladjusted, an overheated drum may expand to the degree that push rod travel is insufficient to fully actuate the brakes.

This is one example of mechanical fade, which also may result from various mechanical defects (e.g., scored drums) within the foundation brake system. In contrast, heat fade occurs when linings overheat and become less aggressive. Gradual and predictable fade is desirable as a warning.

Brake Proportioning - Optional safety-oriented system, often called "bobtail proportioning," for limiting drive axle brakes while a tractor is operated without a trailer. Also, system that varies individual axle braking effort in response to weight or other variable.

Brake Treadle - Functionally, the brake pedal - a mechanical lever attached to the foot brake valve.

Breakaway Valve - Upon accidental separation of trailer(s), a tractor protection system that prevents air loss from the power unit. See "Tractor Protection Valve."

Breather - A vent in the drive axle housing for relieving internal pressure due to heating and cooling within the housing.

Bridge Formula - See "Federal Bridge Formula."

Broached Bushing - Bushing that is finished by a round cutting tool that has multiple teeth each removing a small portion of the bushing material to achieve desired finished size.

B/S-B/S - See "Bearing Shoulder to Bearing Shoulder Dimension."

Burnish - The conditioning or "seasoning" of a brake lining by wear and temperature via a test procedure or in-service operation.

Caliper - In an air disc brake system, the clamping device containing friction material mounted to pads. When actuated, the caliper applies braking force to both sides of the rotor.

Camber - The tilt of the wheel side-to-side while looking from the front - places the road contact points closer to the king pin axis, thereby reducing road inputs to the steering system and contributes to steering stability.

Camber, Negative - Top of the wheel tilts inward.

Camber, Positive - Top of the wheel tilts outward.

Cam Roll-Over - Jargon denoting that an S-cam has traveled beyond its designed stopping position during brake application. The wheel end must be removed to repair cam roll over. It is caused by a combination of excessively worn lining and drum.

Cam Same/Opposite Drum Rotation - As can be seen in this force vector comparison, the direction of the application force is different between cam same and cam opposite. In the cam same, the cam rotation is in the same direction as drum rotation. In the cam opposite, the primary shoe roller is pushed out and up, which tends to allow the cam end of the shoe to be pushed against the drum instead of the center of the shoe. This allows the shoe to energize itself and increases torque output (slightly) over a cam same brake. Also in some cases with certain combinations of hardware and lining materials, cam opposite brakes are noisy. Of course the question comes to mind "why have a cam opposite brake if it is a disadvantage?" The answer is that some suspension systems do not have enough clearance to allow chamber brackets to be mounted in the proper location to allow cam same brakes.

Cam UH Length - On DAP trailer axles, the length as measured from under the brake cam head to the end of the drum.

Cardan Universal Joint - A non-constant universal joint consisting of two yokes joined by a cross.

Carrier - Portion of the axle assembly that contains the drive gears and differential.

Caster - Tilt of the kingpin centerline looking from the side - offers directional stability and assists in returning wheels to a straightahead position through self-centering action.

Caster, Negative - Kingpin centerline projected behind the road contact point.

Caster, Positive - Kingpin centerline projected ahead of the road contact point.

Central Tire Inflation System - See "CTIS."

Channel, ABS - The number of channels in an ABS system refers to the number of valves its Electronic Control Unit (ECU) is capable of independently controlling.

1-Channel ABS - A system design that uses two-wheel speed sensors and one control valve (2S/1M). This is the most popular system for most trailers. It is called tandem control.

2-Channel ABS - A system design that uses two- or four-wheel speed sensors and two control valves (2S/2M or 4S/2M). The ABS monitors wheel speed and avoids wheel lockup on one axle while braking on low-friction surfaces or in emergency situations by rapidly cycling the brakes on the wheel ends of two axles. Commonly used on trailers.

4-Channel ABS - A system design that uses four-wheel speed sensors and four ABS control valves (4S/4M) on a two-axle truck or tractor. A 4-channel system can also be used on a three-axle vehicle, controlling the left and right side drive axle wheels in pairs. This popular system, which offers an optimum blend of performance and economy, is the most common system on trucks, tractors and buses.

6-Channel ABS - A system design that features six-wheel speed sensors and six ABS control valves (6S/6M) to individually monitor and control all six wheels of a three-axle truck or tractor. This type of system provides the highest available level of ABS control. It's commonly used on vehicles with lift or tag axles.

Check Valve - A one-way check valve is used, for example, to prevent air from bleeding back out of a reservoir. A two-way check valve activates selectively, for instance, by drawing air for brake application from the most highly pressurized reservoir (primary or secondary).

Clearance Sensing Brake Adjuster - Senses force when brake lining contacts the drum to adjust lining to drum clearance.

Clevis Pin - Pin connecting the arm of a slack adjuster to a brake chamber push rod yoke.

CMVSS 121 (Canadian Motor Vehicle Safety Standard 121) - Standard for air brake vehicles.

Combination - Truck coupled to one or more trailers.

Combination Lining Block - Two different lining materials on the same brake shoe. The higher friction material is on the cam end of the brake shoe with the lower friction material on the anchor end.

Companion Flange - Drive shaft side of the joint that connects the drive shaft to the drive axle.

Compressible Inserts - Foam inserts installed in the top and bottom of the kingpin under the cap that reduce the pressure / vacuum that is found in the bushing area during typical service.

Connectors, ABS - Sealed, corrosion-resistant plugs that link the ABS wiring system to the Electronic Control Unit (ECU), wheel speed sensors and modulator or relay valves using a shielded wiring harness.

Control Algorithm - The computer commands programmed into the Electronic Control Unit (ECU) to control brake actuation under impending wheel lockup.

Controlled Traction Differential - A differential assembly that incorporates a friction plate assembly whose purpose is to transfer torque from the slipping wheel to the one with traction. This assembly consists of a multiple-disc clutch that is designed to slip when a predetermined torque value is reached.

Cracked Drum - Brake drum cracked all the way through by excessive heat build-up (perhaps signifying inadequate drum weight, and/or driver abuse and/or resurfacing of a drum beyond the manufacturer's limit). It could also be caused by poor brake balance. (See "Brake Balance.")

Crack Pressure - Minimum air pressure, expressed in pounds per square inch (psi), required to open an air valve.

Cramp Angle - Maximum turn of steering wheel in either direction.

Creep Rating - Extremely slow operation (<1.0 mi/hr) typically applying to crane service.

Cross Link - Composed of the adjustable cross tube and threaded tie rod ends with ball sockets that connect the LH knuckle tie rod arm to the RH knuckle tie rod arm.

Cross Tube - Center tube portion of a cross link assembly that is threaded with opposite threads on each end, thereby allowing adjustment by turning the tube with one hand.

CTIS (Central Tire Inflation System) - A means of easily adjusting the vehicle tire pressure, both inflate and deflate, for the conditions encountered whereby improving vehicle mobility performance. CTIS is synonymous with military off-road applications.

DAP (Double Anchor Pin) - Brake system using two pivot pins as opposed to just one for anchoring the brake shoes.

Diagnostics, ABS - A component-by-component selfcheck performed each time the truck's ignition is turned on. An independent microprocessor also checks the system continuously during vehicle operation.

Diagonal System, ABS - A brake system design that divides the ABS into two circuits (front wheel on one side with rear on the other side, and vice versa) to allow partial system function should one diagonal malfunction.

Differential - Rear axle gear assembly permitting one axle shaft and wheel to turn more slowly or faster than the other when negotiating a turn.

Differential Lock - A mechanism that eliminates the action of the differential so that both wheels can be driven to improve tractive efforts on slippery surfaces. See "Driver-Controlled Wheel Differential Lock."

Digital Processing, ABS - The latest processing technology that is many times faster and more reliable than analog processing.

Disc Brake - A foundation brake system consisting of a flat disc or rotor on either side, which are friction pads. Equal and opposite forces are applied to these pads to press their working surfaces into contact with the braking path of the rotor.

Dolly - Two-wheel trailer equipped with drawbar and the lower portion of a fifth wheel and other components necessary to permit a semi-trailer and dolly combination to operate a full trailer; sometimes called a "pup."

Double Anchor Pin - See "DAP."

Double Diaphragm Air Chamber - Generates force output by utilizing two separate diaphragms, one in the service chamber and the other inside the spring chamber. Double diaphragm brake chambers are the most common in North America for general truck/tractor and trailer applications. (See "Spring Brake.")

Double Drop - Beam having a drop in the center between the spring mounting pads, as well as the drop from the KPI to the spring mounting pads.

Double Reduction - Dual gear reduction generally used in rear axles.

Draglink - Connection between the pitman arm and the steer ball on the steer arm. Acts as a pull-and-push rod to convey steering movements from the chassis-mounted steering box to the spring-mounted axle.

Drain Valve - Used to drain oil and water from air reservoirs. Valve may be manual or automatic in operation. Automatic versions, which may be heated electrically to prevent the valve from freezing open, often are referred to as spitter valves.

Draw Key - Fastener in the steer axle that works like a wedge and provides a mechanism to lock the beam to the kingpin while allowing rotation of the knuckle on the kingpin.

Driver-Controlled Wheel Differential Lock - Driver-controlled traction device that can be operated from the vehicle cab by a switch. During periods of good traction, the differential lock should not be engaged. When locked, power transfer will be through the locked differential casing, gearing, and axle halfshafts together. This provides maximum traction to both sides, prevents "spinout," and protects against gearing damage.

Driving Axles, Steerable - Heavy-duty on- and off-road vehicles of 4x4 or 6x6 wheel configuration often require traction and maneuverability that can only be obtained with a steerable front drive axle.

Drop-In Unit - Generally refers to rear axle gear assembly located in axle housing by drop-in.

Drop Socket - Socket with the ball center not coincident with the threaded end.

Drum Brake - A brake system in which two brake shoes with friction material expand into a rotating drum.

Dry Park Maneuver - Turning steering wheel/tires without any forward or reverse movement.

Dual Drive Axle - See "Tandem Drive Axle."

Dual Brake System - A redundant air system (primary and secondary) designed to retain braking ability in the event one system fails.

Dual Draw Key - Arrangement of two draw keys used to balance load on kingpin to maintain alignment of kingpin to knuckle beam bore. (See "Draw Key.")

Dual Range - Two-speed, shiftable drive axles that provide two gearing ratios: a low range for slow speed hauling off-highway and a high range for cruising speeds on-highway.

Dump Body - A large truck's metal body that is generally hinged at the rear and dumped by hydraulic means. The size is generally given in cubic yard water level capacity.

Duplex Gauge - Essentially, a diagnostic device incorporating two separate air gauges with a common housing and utilizing indicator needles of different colors. Device is used to diagnose brake system imbalance within a combination vehicle via simultaneous connection to two points (such as the tractor glad-hand and a trailer brake chamber). It's also used as a dash gauge for dual reservoirs.

Dust Shield - Plate made of metal or polyethylene that is mounted behind a brake drum to minimize entry of dirt and road splash.

Duty Cycle - Measurement of the amount of time a component is fully utilized, expressed as a percentage of the complete usage of the component.

Duty Cycle "Class Definitions"

AA Turnpike or Interstate - Operation on limited access, well-maintained, multi-lane highways of excellent concrete or asphalt with maximum adverse grades not in excess of 3 percent.

A On-Highway - Exclusive of operation on well-maintained major highways of excellent concrete or asphalt construction. Terrain may be level to rolling with occasional maximum adverse grades to 8 percent. Operations are subject to legal weight and dimensional limitations.

B On-/Off-Highway or Mountainous Highway - Secondary roads of good concrete or asphalt where intermittent grades of up to 12 percent adverse may be encountered or where up to 20 percent of the total operating time is spent on well maintained, off-highway roadways of crushed rock or similar material. Grades in this class are more frequent and severe than in Class A operation. Operation is subject to legal weight and dimensional limitations.

C Off-Highway - Operation exceeding 20 percent of the time on roads of gravel or maintained crushed rock surface where the maximum grade is 12 percent and frequent grades of 8 percent can be encountered. This operation is not generally subject to legal weight or dimensional limitations.

D Off-Road - Exclusively off-highway on private roadways with partial operation off-road in areas with no maintained hard surface. Grades and surface conditions may be variable. Operation is not subject to legal weight or dimensional limitations.

EBS - The abbreviation for Electronic Braking System, or brake-by-wire. A system in which the control signal is sent electronically, rather than pneumatically, although the actual service application is still made by air pressure.

ECE 13 - Uniform provisions concerning the approval of vehicles with regard to braking in Europe.

ECU, ABS - The abbreviation for Electric Control Unit, is a microprocessor that evaluates how fast a wheel is rotating. The electrical signals generated by the inductive sensors pick up impulses from toothed rings that spin with the wheel. It is part of an Anti-lock Brake System.

Edge Codes - Developed by Friction Materials Standards Institute, a double letter code (e.g., EE, FF, GG, FG) printed on the edge of a brake block to designate its range of friction in cold and hot test conditions.

EEC - On the approximation of the laws of the member states relating to the braking devices of certain categories of motor vehicles and their trailers. Published in the official journal of European Economic Communities.

Emergency Brake System - Not a separate system, emergency braking (in the event of air loss) involves various portions of the parking and service brake systems. See “Spring Brake.”

End Play - Looseness in bearing clearance in an axial direction.

End Yoke - Connects the drive shaft to other driveline components.

Engine Brake - A system that allows for slowing of a vehicle that is independent of the conventional braking systems. A driver would normally downshift to slow his descent on a hill, using engine compression. The engine brake increases the effectiveness of this retarding force.

Exhaust Brake - Brake device using engine compression pressure as a retarding medium.

Fail-Safe, ABS - If the antilock brake system should fail during vehicle operation, a dash light warns the driver that ABS is disengaged. Meanwhile, the tractor’s pneumatic system returns to normal relay valve functions and maintains standard air brake performance.

Fault Codes, ABS - A series of codes displayed by the self-diagnostic portion of the ABS unit, isolating the section of the system that is now or has malfunctioned.

FC - Fast Change style brake shoes, with standard thickness lining.

FC XLII - Fast Change style brake shoes, with extra thick lining.

Federal Bridge Formula - Formula that limits the weight on groups of axles in order to reduce the risk of damage to highway bridges. Allowable weight depends on the number of axles a vehicle has and the distance between those axles. However, the single or tandem axle weight limits supersede the Bridge Formula limits for all axles not more than 96 in. apart.

FMSI - An industry standard number assigned to a brake shoe lining. All shoe linings that have the same FMSI number should dimensionally be the same regardless of brand.

FMVSS 121 (Federal Motor Vehicle Safety Standard 121) - Performance Standard for air-braked vehicles.

Foam Insert - Foam piece also known as the compressible insert.

Foot Valve - A foot-operated valve controlling air pressure delivered to the brake chambers.

Force Balance - Optimum stopping capability requires tire-to road retarding forces in proportion to the loads on all wheels.

Foundation Brake Balance - Foundation brake balance deals with the brake itself (not including the air system), brake lining, tire size, air chamber, slack length, etc. Can be separated into two different aspects, torque balance and thermal balance, between different axles.

Foundation Brake System - Term inclusive of mechanical components involved in providing braking force (i.e., brake chambers, slack adjusters, brake drums, rotors, and brake linings) on a vehicle.

Four Bag Suspension - A single axle air ride suspension with four air springs, usually located at each corner of the suspension structure. The suspension moves up and down as a parallelogram design.

Frame (Disc Brake) - Structural element which supports caliper and mounts brake assembly to torque plate.

Friction Couple - Refers to the lining and drum combination used to convert kinetic energy to heat energy.

Front Axle Limiting Valve - See “Ratio Limiting Valve.”

FT - A fabricated brake shoe comprised of a stamped shoe table and webs welded together.

Full-Floating Axle - Axle shaft transmits torque and the axle housing supports the vehicle ground load.

GAW (Gross Axle Weight) - Total weight on a specific axle position.

GAWR (Gross Axle Weight Rating) - The total weight capacity of an axle (single, tandem, or tridem).

GCW (Gross Combination Weight) - The weight of a truck and trailer combination and its entire contents.

GCWR (Gross Combination Weight Rating) - The total weight capacity of a truck and trailer combination and its entire contents as determined by axle ratings.

Gear Ratio, Axle - Ratio of the speed of the propeller shaft to the speed of the rear axle shaft.

Glad-Hand - A separable mechanical connector used to join air line hoses when combination vehicles are coupled together.

Grade - The degree of inclination of a road. Typically specified in percent (rise/100 ft run).

Gradeability - Percent grade that a vehicle will negotiate.

Grease-Stained Drum - A brake drum with discoloration of friction surface caused by, for example, improper greasing of brake camshaft or wheel seal leakage.

Gusset - A reinforcement welded to the camshaft bracket to provide additional support for severe service applications.

GVW (Gross Vehicle Weight) - The total weight capacity of a single vehicle.

GVWR (Gross Vehicle Weight Rating) - The total weight capacity of a single vehicle as determined by axle ratings.

Hand Valve - See "Trailer Control Valve."

Heat-Checked Drum - Brake drum with hairline cracks on friction surface caused by thermal cycling. Mild checking normally does not require drum replacement.

Heat-Spotted Drum - Brake drum with a pattern of hard, slightly raised dark spots of martinsite on its friction surface. Caused by localized overheating and sudden cooling, those spots should be ground off to prevent drum cracking, uneven lining wear, and loss of braking efficiency. If spots cannot be removed, the drum should be discarded. Heat spotting is promoted by light and steady braking on downgrades.

Helper Spring - Additional spring device permitting greater load on axle.

High Articulation Suspension - Type of suspension for off-road activity. Greater articulation or suspension travel is required to keep tires in contact with the ground.

High Entry Single - Front tandem axle used as a single axle.

Highway - A major road used for any form of motor transport, typically outside of any city limits and with road surfaces of good to excellent concrete or asphalt.

Hold-Off Spring - A spring within a relay valve or quick release valve that is designed to retard valve operation until a predetermined amount of air pressure is exerted. See "Crack Pressure."

Horsepower - English unit used to denote the amount of work done in a given period of time, equal to 33,000 foot-pounds per minute.

Housing - A casing or container for mechanical components.

Housing Box - Cross-section of square-armed or rectangular-armed axle housing.

Hub Mount Wheel - Wheels that are designed to center on the hub at the bore of the wheel. These wheels generally have straight-through bolt holes, since the bolt holes only supply clearance for the stud. Hub mount wheels are used with two-piece flange nuts.

Hypoid Gear - Modified Spiral Bevel Gear that allows the pinion to be positioned below the ring centerline.

Hysteresis - Difference between the amount of pressure needed to open a valve and the pressure drop needed to close it.

I-Beam - Forged steel structural beam constructed in the shape of an "I."

Inertia Excitation - Excitation produced by the oscillating torque loads resulting from the driveshaft inertia being accelerated through non-uniform motion.

Inset Wheels (or Negative Offset) - The wheel centerline is positioned inboard of the wheel mounting surface.

Installation Angle - Angle that the drive shaft enters the differential relative to horizontal.

Integral Coach - Designed to carry passengers, the cab and body of this style coach are built as one, most often with rear engine design.

Integral Knuckle - One-piece steel knuckle forging made with both steer and tie rod arms forged into one piece.

Interaxle Differential - Gear device dividing power equally between axles and compensating for unequal tire diameters.

Interstate - One of a system of limited access highways extending between the major cities of the 48 contiguous United States.

Inversion Valve - Valve used on trucks to release air from the parking brake chambers and apply the rear brakes if the rear air reservoir fails, modulated by the brake pedal.

Jackknife - Uncontrollable articulation of a tractor-trailer typically resulting from lockup or spinning of tractor drive axle(s). The risk of jackknife is greatest on a slippery road with an empty or lightly laden trailer in tow.

Jake Brake - Trademark of engine brakes by the Vehicle Equipment Division of The Jacobs Manufacturing Co. See "Engine Brake."

Jam Nut - Second nut on a screw or bolt that locks against the first nut (i.e., jams against it) so that the nut won't come loose.

Kingpin - Front axle pin allowing wheels to steer vehicle. Also called knuckle pin.

Kingpin Angle - Angle of the kingpin in relation to a vertical line at the point of intersection on the ground at tire contact as viewed from the front or back.

Kingpin Cap - Bolt-on or threaded-in cap used to seal the outer sides of the upper and lower portion of the steer knuckle. This cap is used to prevent contamination from getting into the kingpin joint area.

Knuckle - Integral with the spindle, the inner portion of which is affixed to, and pivots on, the kingpin.

Knuckle Cap - See "Kingpin Cap."

Knuckle Pin - See "Kingpin."

Knuckle Seal - Seal built into inner side of the upper and lower portion of the steer knuckle. This seal is used to prevent contamination from entering the areas between the kingpin, the knuckle, and the beam.

KPI (Kingpin Intersection) - The distance between the intersection points of LH and RH steer knuckles pivot, or the points where the spindle axis crosses the kingpin axis.

Leak-Down Test - A common method of checking for air leaks. With the engine off, vehicle stationary, the air system at maximum governed pressure and all service brakes fully applied, there should be no more than a 3 psi/min. air loss noted on the dash-mounted pressure gauge for straight trucks; 4 psi/min. for combination vehicles.

Liftable Axle - Axle that is capable of lifting off the ground and reducing load during parking maneuvers and lowering to the ground and reducing the load from bridge laws. See "Pusher Axle" and "Tag Axle."

Limited Access - Roads where access is controlled and limited to entrance and exit in designated areas such as highway ramps. See "Turnpike."

Limited-Slip Differential - Mechanical action that resists the free working of an ordinary differential, thus distributing a greater torque to the slower-turning wheel or axle.

Linehaul - Trucking involving moving different types of freight in high mileage operation (over 60,000 miles/year).

Lining Swell - Temporary swell of brake lining that occurs with heat, but returns to original when cooled.

Lining Growth - Permanent swelling of brake lining resulting from heat exposure. Occurs in new lining only.

LMS® (Low Maintenance System) - Optional packages are either lube for life or annual lube.

Locator Dowel Hole - Drilled hole located centrally on the spring pad drilling that is used to locate the caster block used to attach the springs to the steer axle.

Lockout Assembly - A shift unit that controls the operation of the interaxle differential in tandem drive axles. The operation of this unit is controlled from the vehicle cab by the driver and is activated by either air pressure from the vehicle's air reservoir (brakes) or by electrical means.

Long-Stroke Chamber - A brake chamber designed to have longer-than-normal push rod travel, adding safety factor to chamber stroke. For example, a regular, clamp-type, Type 30 chamber has a readjustment limit of 2 in. and a maximum stroke of 2.5 in. A Long has a readjustment limit of 2.5 in. and a maximum stroke of 3 in.

Low Maintenance System - See "LMS®."

Low Pressure Warning Device - Pressure-sensitive electrical switch that actuates an in-cab buzzer and warning light when air pressure falls below a predetermined level (typically, 60 psi).

Marion Support - A "tear-drop" shaped support that fits over the camshaft barrel located between the chamber bracket and the automatic brake adjuster (ABA). The Marion Support is welded to the axle housing after the brake assembly is mounted to the axle. This is an optional means of support where the BCCC dimension is 13.5 in. or longer.

Mechanical Suspension - A suspension that is not an air ride suspension.

Michigan Special Gravel Trains - An 11-axle combination permitted in Michigan with gross weights as high as 164,000 lbs.

Multiplexing - A means of sending discreet electrical signals to multiple devices along a common pair of wires.

Neutral Engagement Valve - A component of the pneumatic system that permits the service brake to be applied when the transmission is in neutral and the driver is out of the cab. Typically found on refuse trucks.

NoSPIN®- Speed-sensitive automatic locking differential. It powers both drive wheels while automatically permitting differential action to compensate for wheel speed differences from turning or driving on uneven surfaces.

OAW (Overall Width) - Width across the widest portion of the vehicle/axle/etc.

OEM (Original Equipment Manufacturer) - Company that first created the product.

Off-Highway - Refers to trucking usually performed on private logging roads, construction sites, mining locations, etc. Offhighway trucks are always constructed much more ruggedly as they are subjected to severe stresses.

On-Highway - Refers to trucking performed on turnpike quality roads, freeways or expressways.

On-/Off-Highway - Refers to trucking operations that involve traveling both on highways and on roads of lesser standards; typical of this is timber haulage wherein logs are hauled on forest tracks or roads, and then on the highway to a mill or rail sliding. Also livestock haulage when the loading point is some distance along a rough road, and the load is then moved to abattoirs or elsewhere on a highway or similar road.

Original Equipment Manufacturer - See "OEM."

Out-of-Round Drum - Brake drum with variations in its inner diameter, causing reduced braking efficiency. An out-of-round drum often can be machined, within manufacturer's limits, to restore concentricity.

Outset Wheel - Wheel with a centerline of the tire outboard of the wheel mounting surface.

Overall Width - See "OAW."

Overhang - The distance from the center of the leaf spring or air suspension bracket to the centerline of the tire/tires.

Oversized Drum - Refers to a brake drum having an inner diameter greater than the discard diameter marked on the drum by its manufacturer.

Parallelogram Suspension - A suspension with four trailing arms that allow the axle to travel in a linear motion without caster change.

Parking Brake - See "Spring Brake."

Parking Brake Priority - A type of trailer brake control valve that prioritizes delivery of air for quick release of a trailer's parking brakes after being hooked to a tractor. Charging a trailer's service reservoirs, to provide braking ability, is a secondary concern.

Pawl - A mechanical device allowing rotation in only one direction. One type consists of a hinged tongue, the tip of which engages the notches of a cogwheel, preventing backward motion.

Payload - Actual weight of useful cargo carried by the vehicle.

Piston Type Chamber - Incorporates a piston in place of the diaphragm inside the spring chamber. This chamber will provide approximately 30% to 40% higher pushrod output for parking. The service chamber, however, still utilizes a diaphragm. Piston type chambers are more common in Europe and also for transit buses in North America.

Pitman Arm - Arm attached between the steering gear sector shaft and the draglink that transmits the steering force from the cross shaft to the steering linkage system. This is how the rotary motion of the steering wheel is turned into lateral movement of the arm.

Planetary Double Reduction Axle - The double reduction axle provides greater overall gear reduction and is ideal for peak torque development and transmission. This feature makes the axle desirable for starting heavy loads in adverse terrain. The first reduction is through the primary gearing. The second reduction is with adjacent planetary gearing.

Planetary Gears - A gearing unit consisting of a ring gear with internal teeth, a sun or central pinion gear with external teeth, and a series of planet gears that mesh with both the ring and the sun gear. Frequently used in overdrives and automatic transmission. Also called epicyclic gearbox.

PLC (Power Line Carrier) - A form of multiplexing wherein a discreet electrical signal is sent along a wire already carrying power for another purpose. PLC technology is used in tractor/trailer communications, allowing more utility than the standard, J-560, 7-pin connector could otherwise afford.

Pneumatic Balance - Achieved when individual air chambers receive the air pressure required for each brake in the system to do its fair share of the work. Lack of pneumatic balance is most likely at low brake application pressures, rarely during panic stops.

Pneumatic Timing Balance - Achieved when individual air chambers sequentially receive air within a timeframe that ensures each brake in the system will do its fair share of the work. In a combination vehicle, lack of proper timing is likely to occur because tractor brakes receive air faster than trailer brakes. See "Trailer Push."

Pole Trailer - Trailer used to transport utility poles.

Polished Drums - A brake drum with a friction surface polished to a mirror-like finish by unsuitable brake linings. Remove gloss from drum with 80-grit emery cloth.

Pop-Off Valve - Jargon for a pressure-relief valve, installed in the service reservoir or wet tanks as insurance against over-pressurization.

Power Divider - See "Interaxle Differential."

Power Line Carrier - See "PLC."

Pressure Differential - Difference between the inlet and outlet air pressure of an open brake valve. Also, difference in air pressure between any two points within a brake system.

Pressure Level Balance - Obtained when all of the vehicles' brake chambers are receiving the required level of air pressure (once pressures have stabilized). This does not necessarily mean the same pressure. Different design brakes on the same vehicle may require different levels of air pressure. Pressures may be varied on different axles to compensate for different size brakes or different amount of underbody cooling received by the brakes.

Propeller Shaft - Driveshaft used to transmit torque from engine or transmission to rear axle.

Pumping the Brakes - Phrase denoting a rapid series of brake application (a.k.a. fanning) used to avoid locking brakes on axles during sudden stops. Phrase also may apply to a slower series of heavy brake application (a.k.a. snubbing) used in an attempt to prevent brake overheating and resultant fade on long downgrades.

Pup - See "Dolly."

Pusher Axle - A "dead axle" (no driving capability) used to give vehicle more weight carrying capacity. A pusher axle is ahead of the drive axle. A tag axle is behind the drive axle. This type of axle may have the capability of being raised or lowered and some are made to be steerable.

Push Rod - A rod, protruding from a brake chamber, that is connected to the arm of a slack adjuster via a clevis pin.

Quick-Release Valve - Designed to reduce the chance of brake drag, a valve that speeds the process of exhausting air from brake chambers when driver releases the brake treadle.

Radio Frequency Interference - See "RFI."

Ratio Limiting Valve - Prevents locking of front brakes by automatically limiting application pressure to steer axle during normal braking. Progressively harder braking, however, will progressively increase steer axle braking until maximum air pressure is applied.

Regional Haul - On-highway usage within a region, typically a one-day round trip.

Relay Valve - Valve located near a reservoir that is activated by a control signal from another valve that usually is farther away. It is used to speed the application of brakes on drive and trailer axles.

Release Time - Time between release of brake treadle and total disengagement of brake linings and brake drums. Or, per FMVSS-121, the time required to reduce pressure to 5 psi from 95 psi within all service chambers.

Relief Pressure - Maximum pressure where the steering gear is protected from providing too much load into the steering system.

Retarder - Auxiliary speed-reducing device.

Return Springs - Springs that retract brake shoes upon release of the brake treadle.

Reverse Cam Rotation - When the axle is installed into the vehicle in such a way that the brake cam rotates opposite to the forward normal turning direction of the tire.

RFI (Radio Frequency Interference) - External interference or false signals from such sources as radar, citizens-band radio, other types of radio transmissions and television signals. While the effects of this interference on ABS were a concern during the 1970's, today's technology has virtually eliminated the problem.

Ring Gear - The large bevel, circular gear that is attached to the flange or carrier of the differential case. It meshes with the drive pinion on the end of the propeller shaft.

Rolled Over - Axle used when engine is located behind axle; typically the pinion will be above the centerline.

Rolling Resistance - Sum of the forces at area of contact between a vehicle's tires and road surface acting against the direction of movement.

Roll-Off Containers - Detachable open containers generally used for hauling refuse, scrap, and construction debris that are hoisted or winched over the rear of the truck chassis for transport.

Rotor - Braking surface for disc brake system. On heavy trucks the rotor is generally cast iron and has vented design. The rotor can be either separate or integral to the hub. Rotors are also referred to as discs.

SAE (Society of Automotive Engineers) - An international organization of automotive/truck/bus engineers who develop test procedures and requirements for all ground transportation vehicles and their components.

SAP - Single anchor pin-type brakes.

S-cam Brake - Type of brake where mechanically induced rotation of an S-shaped cam forces brake linings against the brake drum.

Scored Drum - Brake drum with a grooved friction surface, resulting in excessive lining wear. Severe scoring requires that a drum be machined, within manufacturer's limits, before replacing the linings.

Secondary - Roads that are typically well-maintained gravel or crushed rock; surface conditions are not as favorable as on primary roads.

Semi-Active Suspension - A suspension that changes its ride quality in response to hitting a bump or alteration in the road. This change must occur in milliseconds to be effective.

Semi-Trailer - Trailer used in connection with truck tractor.

Sensor Sleeve - Rigid steel sleeve mounted in the knuckle to provide a pilot for the ABS sensor to be mounted in close proximity to the tone ring on the hub.

Service Brake Priority - A type of trailer brake control valve that prioritizes delivery of air to a trailer's service reservoirs, to provide braking ability, after being hooked to a tractor. Releasing a trailer's parking brakes is a secondary concern.

Service Brake - As opposed to spring or parking brakes, that portion of the brake system used for normal brake application while driving.

Shift Inhibitor - Pneumatic-mechanical system that delays the shifting process until the engine has returned to idle speed. This prevents drivetrain damage due to high RPM shifting.

Shims - Spacers used to fill in the space between knuckle and top of beam after thrust washer is installed on the bottom side of the beam.

Single-Reduction Axle - Any axle assembly with only one gear reduction through its differential ring gear and drive pinion.

Site Travel - Slow speed operation up to 5 mph at a job site not to exceed 5% of total operating miles of the vehicle.

Slack Adjuster - Also called a brake adjuster, this is a lever connecting the brake chamber push rod with the foundation brake camshaft. It provides torque to rotate the brake camshaft when the brake treadle is depressed. It also provides a means of adjusting clearance between brake shoes and the drum to compensate for lining wear. Some models are automatic while others require manual adjustment. See "ABA."

Slip Torque - Engine torque required to slip wheels on the driving surface.

SLR (Static Loaded Radius) - The distance from the centerline of the axle to the ground, underrated tire capacity, with the tire at rest.

SMC (Suspension Mounting Centers) - The distance between centerlines of where the suspension clamps to the axle.

Soft Dampened Clutch - Special type of clutch that features a torsional mechanism that avoids impact loads being transmitted through the driveline.

Speed Sensor, ABS - An electromagnetic device that, in conjunction with a rotating toothed wheel, generates an electrical signal proportional to the wheel speed and transmits the information to the ABS Electronic Control Unit (ECU).

Spider - Spider-like casting or forging containing axle differential or the foundation brake structural member.

Spindle - A shaft-like projection from the steering knuckle or the drive axle housing to which the wheel is mounted.

Spinout - When the maximum drive slip resistance has been exceeded by its tractive effort and a sudden increase in drive wheel speed occurs.

Spiral Bevel Gear - The teeth of both the ring and the pinion are tapered and are cut on a spiral so that they are at an angle to the centerline of the pinion shaft.

Spitter Valve - Slang for automatic drain valve.

Spline - Series of parallel keys cut along the driveshaft that mate with corresponding slots in hub or fitting. Also found on brake camshaft interface to slack adjuster.

Split-Coefficient Surface - Also called split-Mu, a road condition where one side of a lane has low friction and the other has high friction (for example, the left side of the lane is ice covered, the right side is dry). A 2-, 4-, or 6-channel ABS system (anti-lock brake system) with individual wheel control will provide optimum stability and stopping-distance performance under these conditions.

Spring Brake - Generally refers to a tandem-chamber brake actuator that incorporates an air-applied service brake chamber and an air-release/spring-applied parking or emergency brake chamber. Spring brakes apply upon sudden air loss (emergency mode) or activation of a dash-mounted parking brake control. Spring brakes remain applied until that chamber is recharged with air or the spring is manually compressed or caged. The spring portion is often referred to as the "piggyback." Spring brakes generally come in two types: double diaphragm or piston.

WARNING: Disassembly of a spring brake is dangerous. Only trained mechanics should attempt the procedure.

Spring Mounting Centers - See "SMC."

Spring Pad - Flat locator surface on the beam that is drilled for the specific mounting pattern for the U-bolt connection to the leaf spring.

Static Loaded Radius - See "SLR."

Steerable Drive Axles - See "Driving Axles, Steerable."

Steer Arm - Rigid connection between the steering mechanism and the steer knuckle.

Steer Arm Ball Stud - Tapered round ball mounted in the steer arm providing a means of articulation when the draglink transmits steering motion from the steering gear, that is mounted on the frame to the steer axle which is mounted as part of the suspension.

Steer Arm Swing Radius - Radius created when the steer knuckle rotates from stop to stop; establishes clearance window.

Steering Gear - The mechanism that translates the steering wheel rotation into movement at the steer knuckle through the draglink.

Steering Knuckle - The inner portion of the spindle that is connected to, and pivots on, the kingpin allowing the wheels to turn while under load.

Stopping Distance - The distance traveled by a vehicle on a road between the initial brake pedal movement and a full stop.

Stopping Time - The time elapsed between the initial brake pedal movement and a full stop.

Stop Screw - A combination screw and lock nut arrangement that limits the angular travel of the steer knuckle in a steer axle.

Straight Truck - A non-articulated vehicle that carries cargo in a body mounted to its chassis, rather than on a trailer towed by the vehicle.

Stroke - Refers to a total distance traveled by a brake chamber push rod or slack adjuster arm during brake application.

Stroke Sensing ABA - Excessive stroke caused by lining wear raises the actuator rod during brake apply. The spiral serrated activator will jump over serrations on the spring-loaded pawl if adjustment is required. Actual brake adjustment is made on the return stroke.

Stud Mount Wheels - Wheels that are designed to center on the studs of a hub. These wheels have chamfers at the bolt holes into which a ball seat or conical nut is installed to center the wheel. The center bore of the wheel is only for clearance of the axle end.

Super Single Tire - Specially designed tire used in lieu of dual tires in certain linehaul rigs and local gasoline tankers. Super singles can reduce maintenance and/or save hundreds of pounds of tire weight when compared to duals. Also known as "Wide Base Tire."

Supply Air Tank - The air reservoir immediately downstream of the air compressor. See "Wet Tank."

Suspension - Attaching parts including springs for securing axle or axles to chassis frame.

Suspension Mounting Centers - See "SMC."

Swept Area - The total surface area of the drum or rotor of a brake that comes in contact with the friction material during one revolution of the wheel. In general, the more swept area a brake has, the cooler it will operate.

Tag Axle - A non-driven (dead) axle installed behind the drive axle(s) to increase the permissible gross weight and consequently, the payload. Also termed "Trailing Axle."

Tandem Drive Axle - Two-axle drive combination or dual drive axles.

Taper - Cone-shaped object or form.

Thermal Balance - Achieved when all brakes are operating at the same temperature. If the proper thermal balance is achieved, both the tractor and trailer brakes see the same temperature throughout any given braking cycle. On some vehicles, steer axle brake temperatures should be somewhat below drive brakes to avoid aggressiveness and pull.

Threaded Drum - Brake drum improperly resurfaced on a lathe, resulting in a friction surface akin to that of a scored drum.

Thrust Bearing - These bearings are designed to carry only thrust loads.

Tie Rod Arm - The arm that is rigidly connected to the steer knuckle that ties the LH knuckle to the RH knuckle and also sets up the steering/Ackermann geometry.

Tie Rod Arm Angle - The angle formed in the horizontal plane between the vertical plane formed by the kingpin intersection/ pivot point and the tie rod arm mounting hole where the tie rod end attaches.

Tie Rod End - Threaded part with a ball socket for articulation that attaches in the cross tube for adjustment. Each end is threaded the opposite of the other.

Tie Rod Offset - The distance from the kingpin intersection/ pivot point to the tie rod arm mounting hole where the tie rod end attaches in the lateral direction.

Timing Balance - Achieved when all brake chambers are receiving the required air pressure within an appropriate time from application. Due to the nature of long vehicle air systems, air cannot be expected to arrive at all axles at the exact same time.

Tire Pressure Controls - See “CTIS.”

Tire Rolling Radius - See “SLR.”

TMC (The Maintenance Council) - An organization consisting of fleet operators, independent truckers, truck manufacturers, component manufacturers, government agencies, media, and academia whose primary goal is to communicate the latest and best vehicle maintenance procedures to the end-users. These maintenance procedures are communicated to the trucking industry in the form of Recommended Practices (RP).

TMS (Tire Maintenance System) - Keeps tires properly inflated.

Toe - The difference between the tire centerline-to-centerline distances in the front versus the rear of steer axle tires.

Toe-In (Positive toe) - Tires are pointing in as seen from the front; provides straight-line directional stability.

Toe-Out (Negative Toe) - Tires are pointing out as seen from the front; will result in “road wander.”

Top Mount Suspension - A trailing arm suspension in which the trailing arm is mounted to the top of the axle.

Torque Balance - Achieved when individual brakes exert the degree of braking force required for each brake in the system to do its fair share of the work.

Torque Converter - A hydraulic drive that transmits power with ability to change torque.

Torque Plate - A plate used to mount the disc brake caliper to the axle brake flange or steer knuckle.

Torsional Driveline Acceleration - Each universal joint in a driveshaft rotates non-uniformly. This non-uniformity is minimized or eliminated by the proper relative positioning (phasing) of the universal joint yokes at either end of the driveshaft.

Torsional Excitation - Excitation produced by the non-uniform velocity obtained when a Cardan joint operates at an angle.

TPCS (Tire Pressure Control System) - A means of easily adjusting the vehicle tire pressure, both inflate and deflate, for the conditions encountered whereby improving vehicle mobility performance. TPCS is used primarily in the commercial vocation market, on-/off-highway.

Track Width - The distance between the dual tire centerlines on a dual tire arrangement or the distance between the tire centerlines on a single tire arrangement.

Tractor - Truck portion of combination or train.

Tractor Protection Valve - Isolates tractor air system in event of a trailer breakaway or dangerous decrease in the tractor’s reserve air; typically applied (via dash-mounted control) before disconnecting a trailer.

Trailer Control Valve - Hand-operated valve, located on (or adjacent to) the steering column, which permits independent control of the trailer brakes; also known as the trolley valve or hand valve.

Trailer Push - Caused by the tractor braking prior to the trailer and/or with greater torque. Even with “perfect” brake balance, the trailer pushes the tractor to some extent since the tractor brakes absorb part of the trailer’s load.

Trailer Swing - Articulation of the trailer caused by locking the trailer brakes.

Trailing Arm Suspension - A suspension with a total of two trailing arms. This suspension forces the axle to travel in an arc, which results in a caster change and also torques the axle as the suspension goes into roll.

Trailing Axle - See “Tag Axle.”

Transfer Case - Split power gear box transmitting drive to front and rear axles.

Transmission (Main) - Selective gearbox providing various combinations of gear ratios.

Transmission (Auxiliary) - Additional gearbox increasing the gear ratio combinations when used with main transmission or multi-speed axles.

Treadle Valve - Foot-operated brake actuation valve.

Tridem Axle - A combination of three axles having a common suspension.

Tri-Drive - See "Tridem Axle."

Trolley Valve - See "Trailer Control Valve."

Trunnion - Journals allowing pivoting or turning.

Tubular Beam - Beam constructed of a seamless/hollow tube with forged steel beam ends welded on the ends to create the foundation of a steer axle.

Turned Drum - A brake drum that has been resurfaced on a lathe to remove scoring or other defects. The diameter must stay within manufacturer's limits.

Turnpike - Expressway or freeway.

Two-Speed Axle - A rear-axle assembly that has two different output ratios from the differential carrier assembly. Used primarily for export and most popular with 5-speed transmissions to provide a fast ratio for top speed and a slower ratio for greater pulling power. These ratios are controlled by the vehicle driver from the cab at the driver's discretion. This axle is sometimes called a dual range unit.

Two-Spring Suspension - A standard leaf-spring suspension.

Underslung Suspension - A trailing arm suspension in which the trailing arm is mounted to the bottom of the axle.

Unitized Hub System - Hub system that is factory-filled with synthetic grease and sealed to avoid lubrication intervals, bearing adjustment, and seal replacement, thereby eliminating hours of typical maintenance.

Vocation - Specific usage of a vehicle in a defined industry.

Vocational - Dedicated to one specific type of service (i.e., mining, oil field, logging etc.).

Walking Beam Suspension - A mechanical suspension that attaches two axles together with the use of a leaf spring or structural beam that pivots about a trunnion tube.

Warning Light, ABS - An indicator light on the truck or tractor instrument panel that illuminates to indicate the status of the ABS system. On trailer ABS, the indicator light may be located on the trailer body where the driver or maintenance personnel can easily see it.

Wedge Brakes - As opposed to a brake applied by an S-cam, this type of brake is applied by a single or double wedge-type mechanism. This type of brake is self-adjusting and, as such, does not utilize an external brake adjuster.

Wet Tank - Also known as the supply air tank, the reservoir nearest to the air compressor where water and oil are most likely to accumulate (assuming the lack of a functional air dryer).

Wheelbase - Distance between centerlines of front steer and rear drive axles or to centerline of tandem axles.

Wheel Bearing - Typically a set of two opposing tapered roller bearings that provide radial and thrust load capability while at the same time providing rolling motion.

Wheel Inset, Negative - The rim centerline is positioned inboard of the wheel mounting face.

Wheel Offset - See "Wheel Inset" or "Wheel Outset."

Wheel Outset, Positive - The rim centerline is positioned outboard of the wheel mounting face.

Wide Base Tire - See "Super Single Tire."

Wide Brake Package - An optional package consisting of 16.5 x 5 (12K steer) and 16.5 x 8-5/8; (20K/23K drive axle). The greater width will reduce brake-operating temperatures thus increasing brake life.

Wide Track - Axle that is wider than standard maximum 96 in. overall width.

Wide Track Housing - Extended-length housing used to meet increased track and stability requirements.

Woodruff Key - A half-moon shaped piece of metal used to secure something to a shaft that has a notch cut in the shaft to accommodate the key.

Worm Gear - Component of brake adjuster. The worm and worm gear provide for adjusting lining-to-drum clearance.

Zerk Grease Fittings - Lubrication fitting used for pressurized grease application.

Glossary term sources:

- Dana Engineering
- www.100megsfree4.com/dictionary/car-dicm.htm
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