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AXLE APPLICATION GUIDELINES

HEAVY HAUL

TP-9441HH4

REVISED 4-98

TP-9441HH4

Heavy Haul Vocational Definition:

Vehicles (usually Tractor/Trailer combinations) used for the movement of heavy equipment and materials at legal maximums and special permit loadings. High horsepower engines and auxiliary gear boxes are typically used in this vocation.

Greater than 30 miles average between starting and stopping. Duty cycle is defined as loaded going and empty return on 0-12% maximum grades. Vehicles are considered 100% on-road.

Heavy Haul Vehicles Include:

- Lowboy
- Equipment Hauling
- Steel Hauling
- Flatbed Trailer Haul
- Michigan Special Steel Haul

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Heavy Haul Vocation — Axle Guidelines

Intended Use of This Guideline

This document addresses approvable GAW, Axle Torque and GVW/GCW Ratings for Meritor Axles used in the **Heavy Haul** vocation (U.S. and Canada only).

Conditions for Approval

Axles are approved for use in the vocation covered by this document, when the axles meet the guidelines for STRUCTURE (Pages 3-7), TORQUE (Pages 8-9), and GROSS VEHICLE or GROSS COMBINATION WEIGHT (Page 10), as described by this publication. IMPORTANT NOTES (Pages 11-12) are considered to be part of the axle approval.

For any questions concerning this document (interpretations and calculations) or for loadings, configurations or duty cycles outside the parameters of this guideline, contact Meritor Axle Engineering by telephone, by FAX or in writing to the address shown below, using the Meritor Axle Components Application form RA-4901-B-040.

MERITOR AUTOMOTIVE, INC.
AXLE ENGINEERING
2135 W. MAPLE RD. TROY, MI 48084
PHONE: 800-535-5560
FAX: 248-435-3545

Warranty

Meritor Axle Products which are included in this guideline and are operated within the vocational limitations set forth by this document are covered by Meritor's industry competitive warranty. For **complete details** (*and* ***specific coverage***) refer to Meritor's Warranty Publication (SP-95155).

Consult Meritor on questions concerning warranty coverages and application approvals for products used outside of these published guidelines.

NOTE: Axle applications for tire sizes, tracks, mounting centers, other front axle KPIs, other Meritor axle models, engine/transmission torques beyond those listed, or GVW/GCW other than as shown within this **AXLE GUIDELINE** may still be approvable. Contact Meritor Axle Engineering for possible approval.

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Heavy Haul Vocation — Axle Guidelines

What Is Heavy Haul

- Movement of heavy equipment and materials at legal maximums and special permit loadings.
- Operation on road surfaces made of concrete, asphalt, maintained gravel, crushed rock, hard packed dirt or other similar surfaces.
- High horsepower engines and auxiliary gear boxes are typically used in this vocation.
- Greater than 30 miles average between starting and stopping.
- Vehicle may use a single retarder (engine, exhaust, hydraulic transmission, or chassis mounted electromagnetic).

NOTES: Increases in grades and/or numbers of starts/stops will have a notable influence on the service life of the driving axle(s).

Vehicles using multiple retarders are not covered by this guideline.

Types of Vehicles

- 6x4 and 8x4 tractors with semi-trailers (Michigan Specials are included in Duty I of this axle guideline).

Duty Cycles

DUTY	HEAVY HAUL LOADING (Refer to Pages 10-11)	GRADES
I	100% Load Going/Empty Return	12% Max

Meritor Axle Models . . . **nominal** Gross Axle Weight Ratings

FRONT STEER		TANDEM REAR	
Model	lbs	Model	lbs
FG-941	14600	RT-46-160/P/A*	46000
FG-943	14600	RT-46-164/P/A	46000
FL-941	20000	RT-50-160/P/A	50000
FL-943	20000	RT-52-185/380	52000
		RT-58-185/380	58000
		RT-70-380	70000
OPTION: P = Pump (Forward Carrier) A = Aluminum Carrier			
Consult Meritor Publication TP-7824 for additional dimensional information.			

*RT-46-160 not approvable for use in Canada for this vocation. The RT-46-164 is required.

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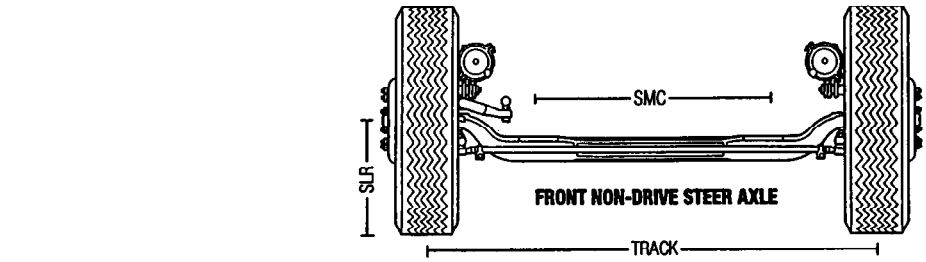
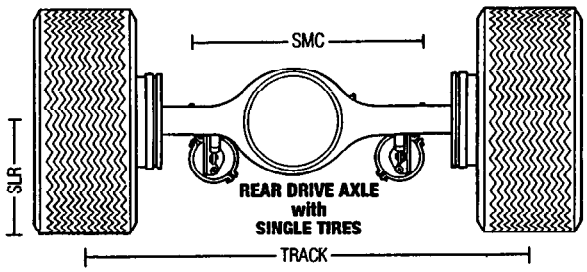
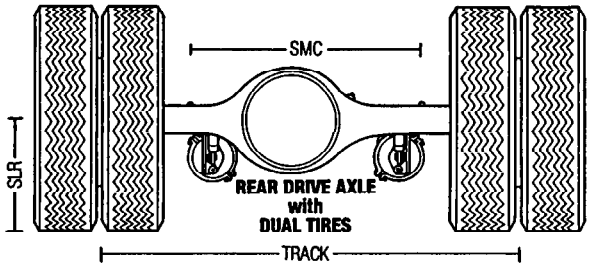
Heavy Haul Vocation — Axle Guidelines

Front Non-Drive Steer and Rear Drive Axle Structural Guides







The following items determine the structural requirements of the axle:

- The load capacities (Gross Axle Weight Rating) are compared against the TRACK using the following
  1. The maximum value of the Static Loaded Radius (SLR) of the tires.
  2. Suspension Mounting Centers (SMC).
  3. The standard front axle King Pin Intersection (KPI) dimensions.
- If single tires are used, the TRACK is measured (at the ground) from the center of one tire to the center of the opposite tire.
- If dual tires are used, the TRACK is measured from the center of the dual tires to the same point on the opposite side.
- The Gross Axle Weight Rating, as a function of SLR, and the axle SMC must meet the specifications of the graphs.

NOTE: Axle applications for tire sizes, tracks, mounting centers, other front axle KPIs and other Meritor axle models not shown within this **AXLE GUIDELINE** may still be approvable. Contact Meritor Axle Engineering for possible approval.

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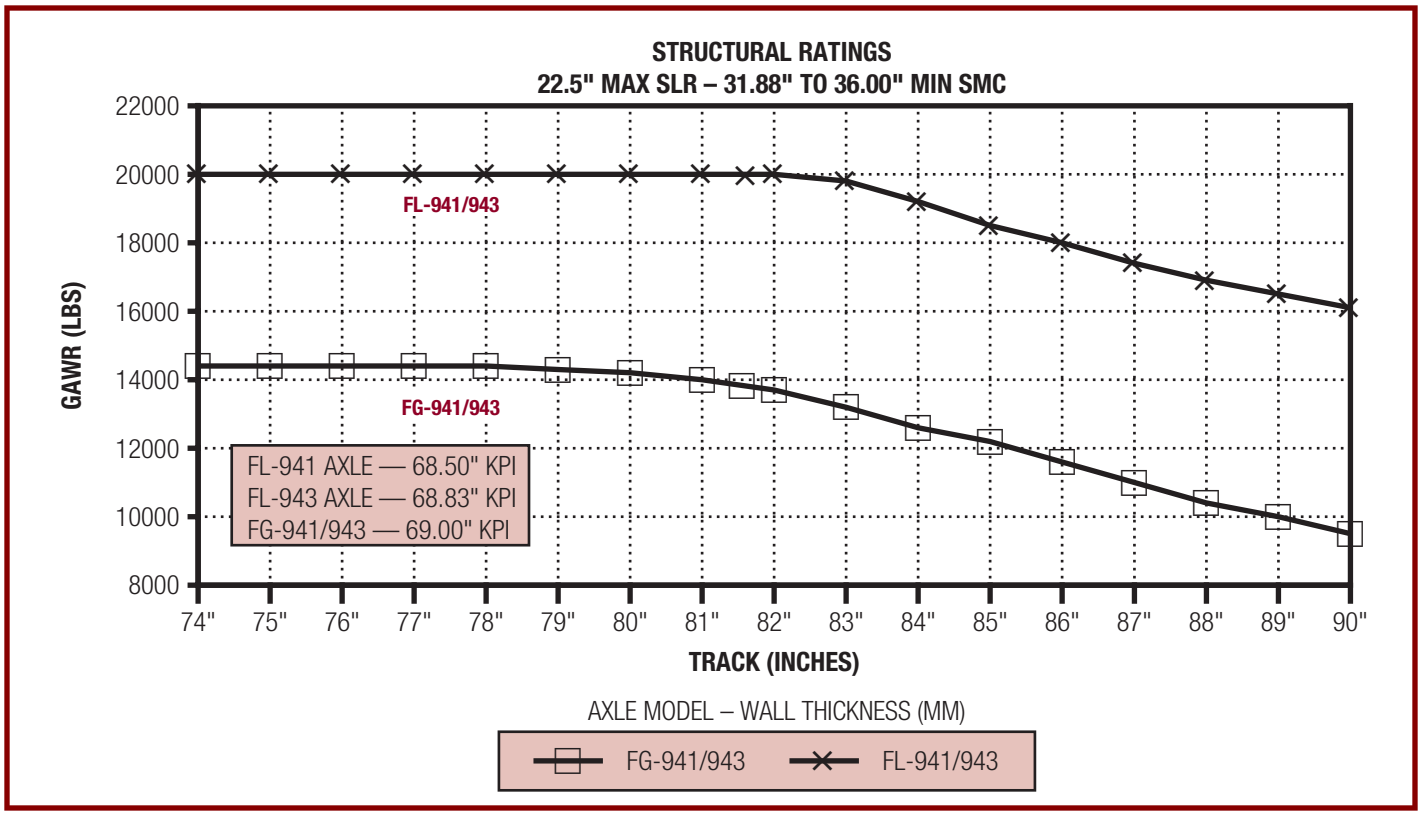
Heavy Haul Vocation — Axle Guidelines

Front Non-Drive Steer Axles — Structural Ratings

The approvable area is located on or below each structural curve as follows:



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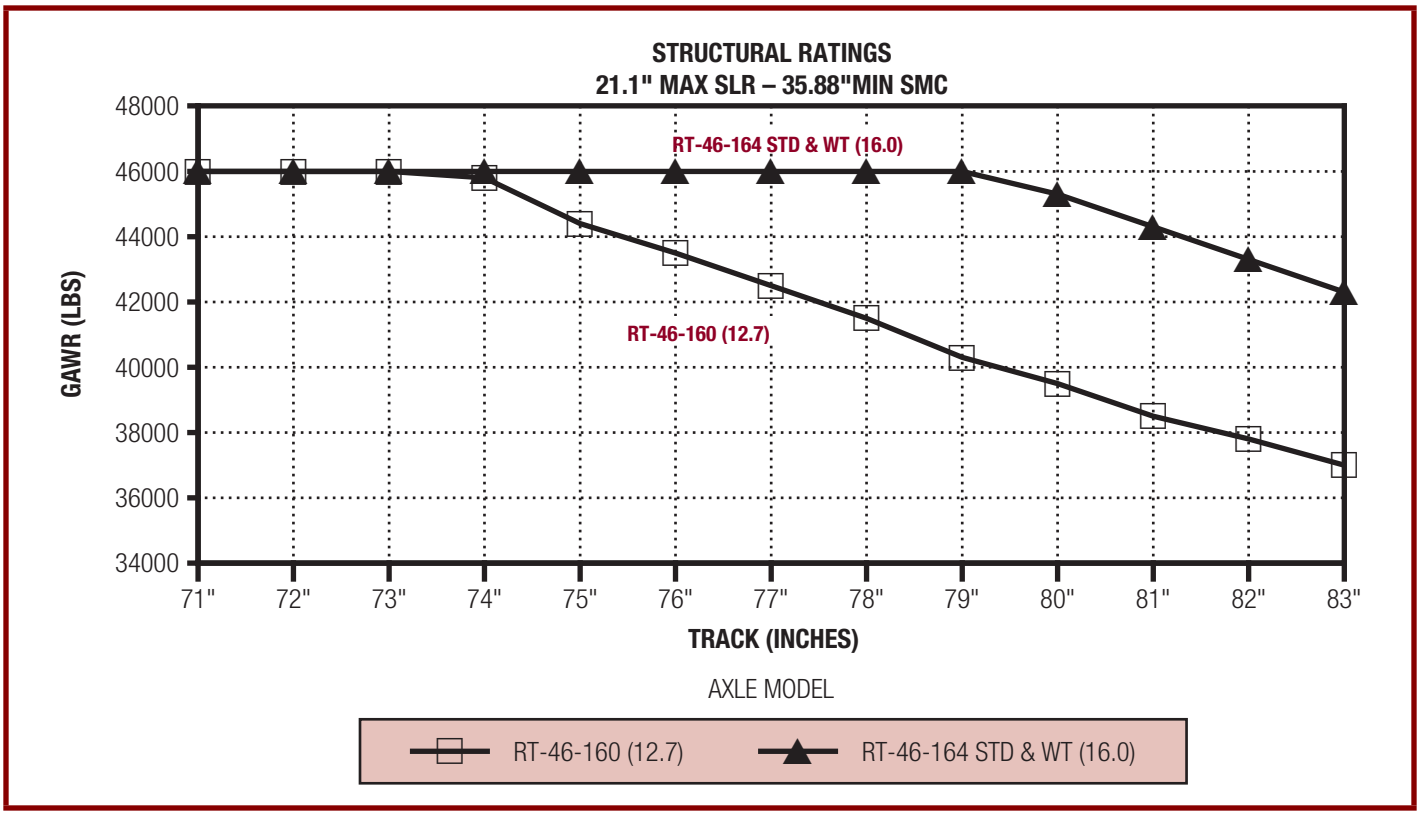
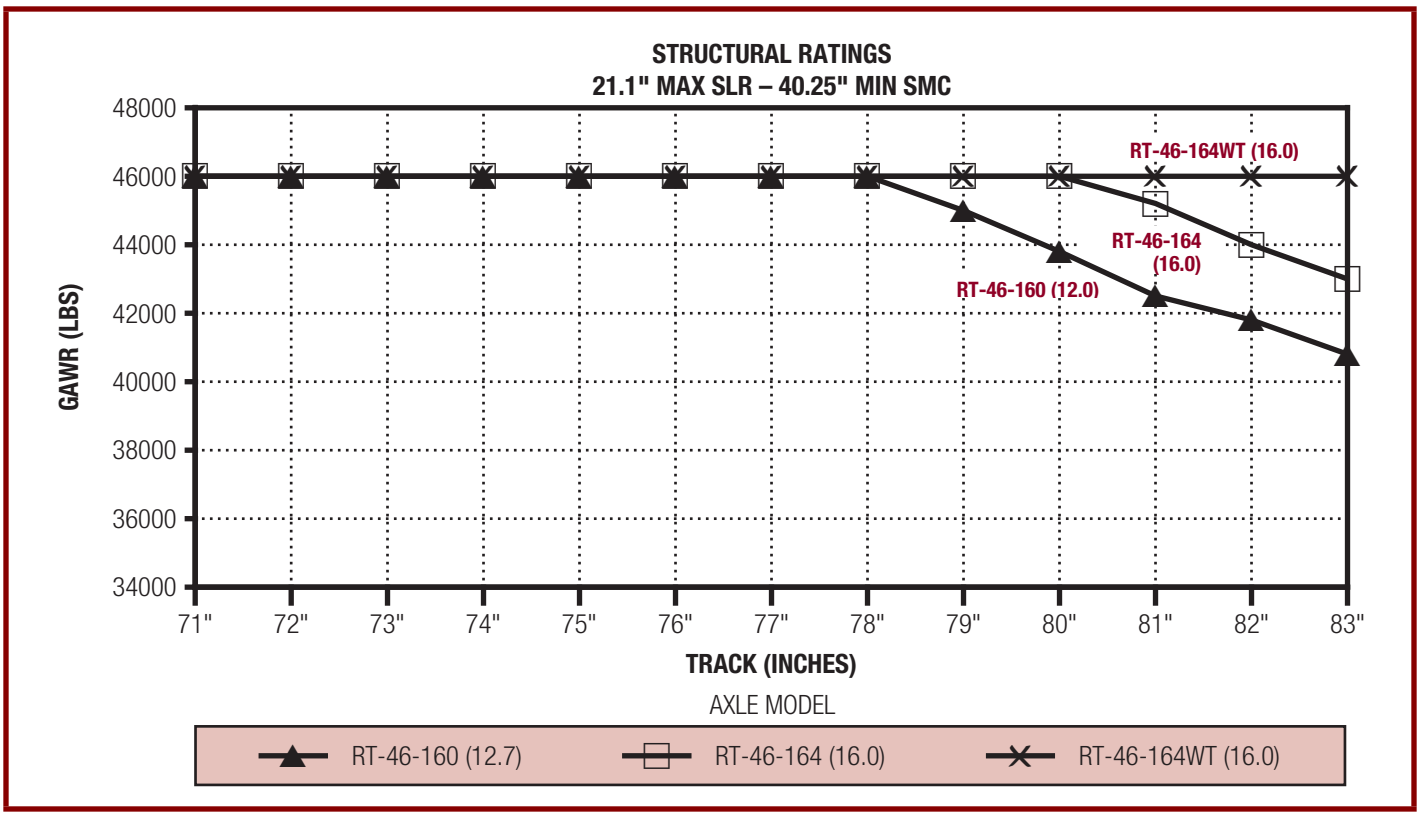
Heavy Haul Vocation — Axle Guidelines

Tandem Rear Drive Axles — Structural Ratings

The approvable area is located on or below each structural curve as follows:





See IMPORTANT NOTE 11 for additional information (Page 12).

WT designates Widetrack Axle Housing Option.

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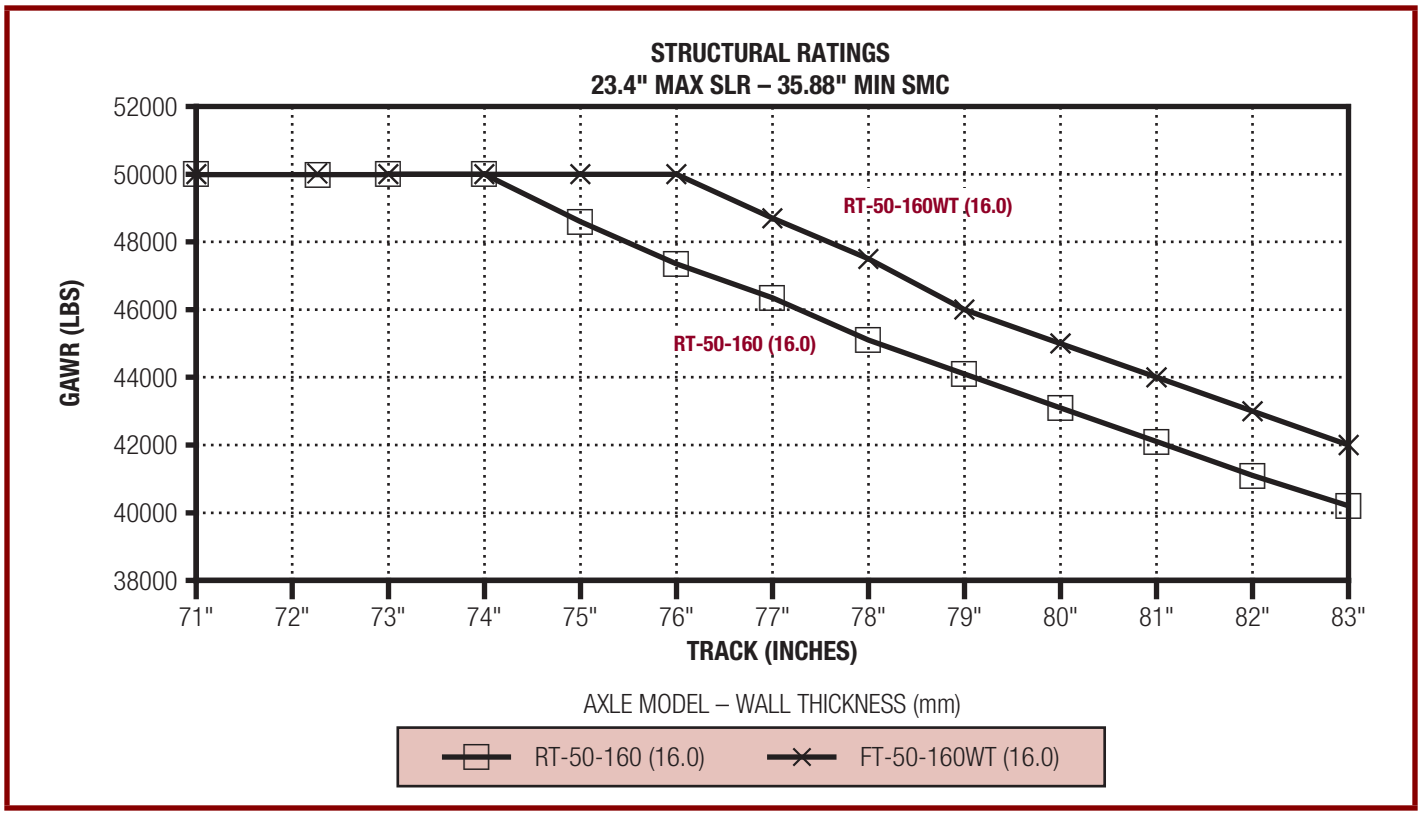
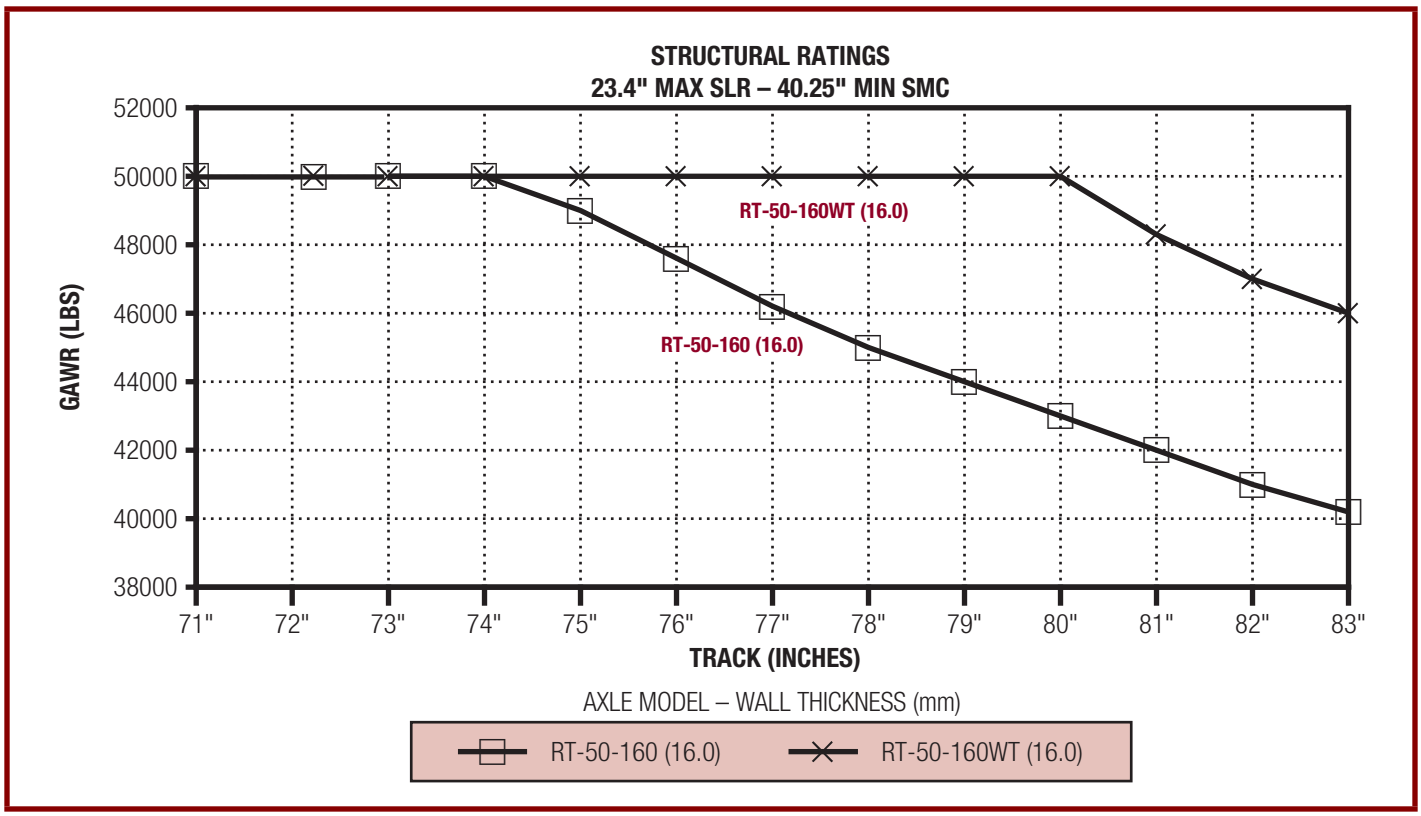
Heavy Haul Vocation — Axle Guidelines

Tandem Rear Drive Axles — Structural Ratings

The approvable area is located on or below each structural curve as follows:





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Heavy Haul Vocation — Axle Guidelines

Tandem Rear Drive Axles — Structural Ratings

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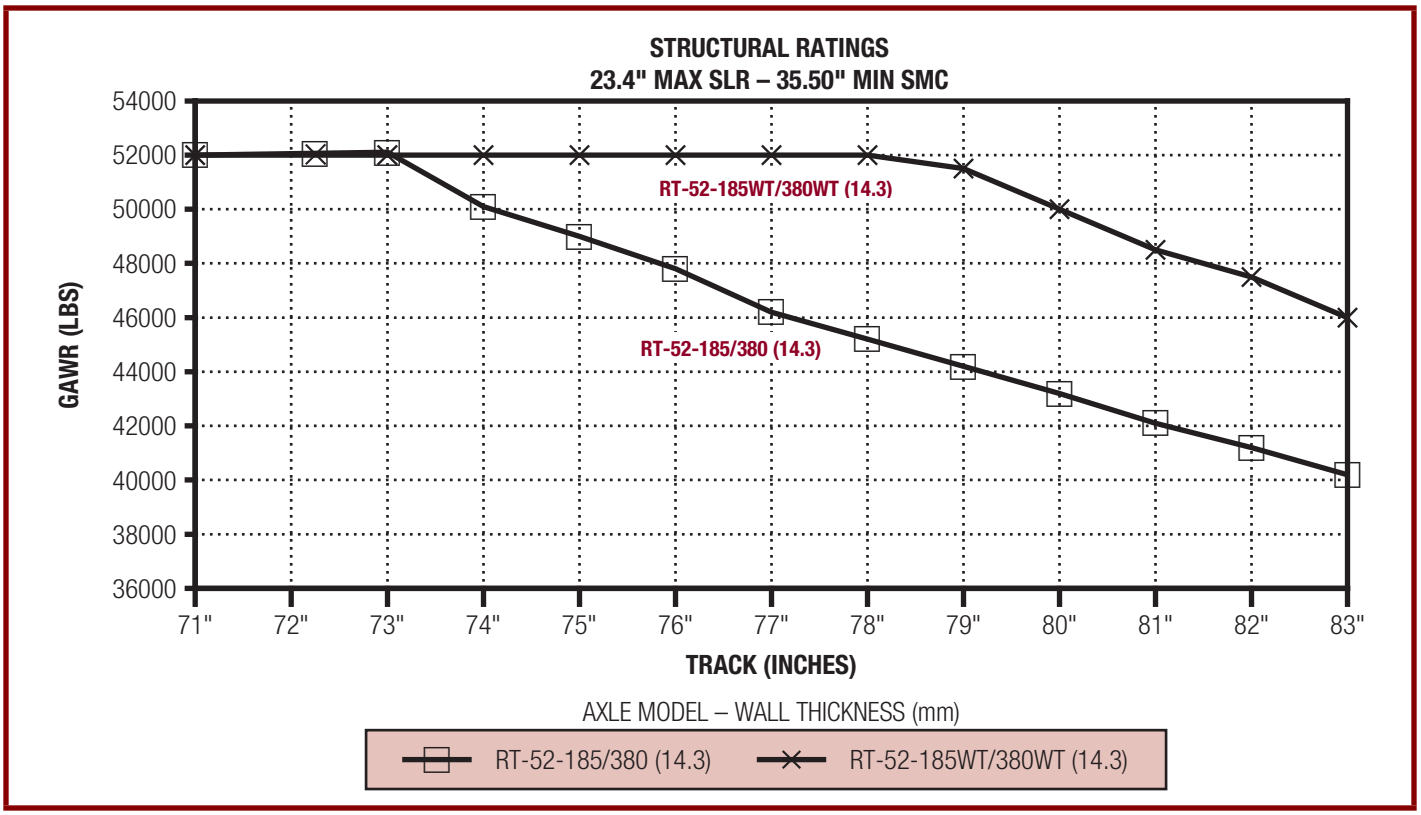

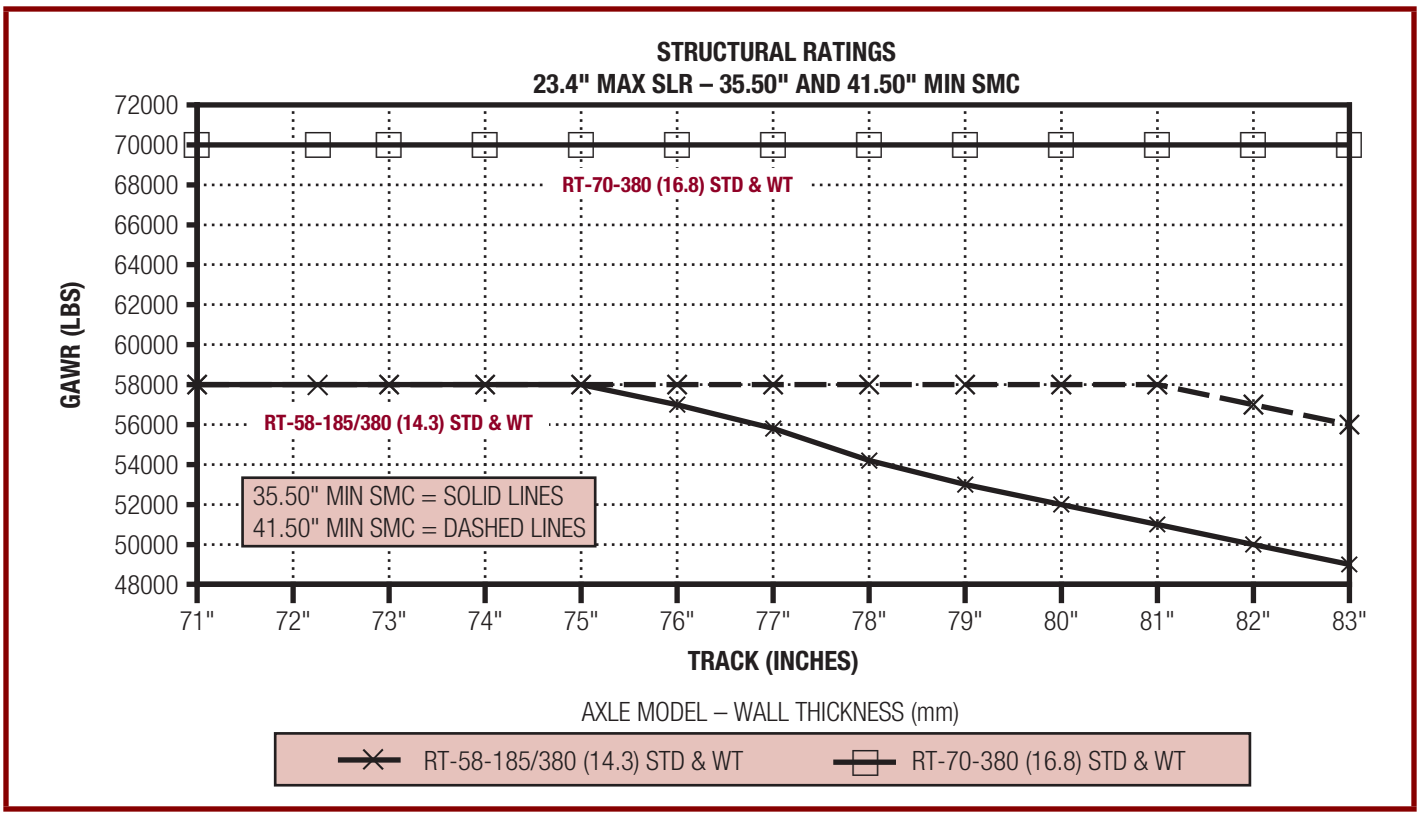

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Heavy Haul Vocation — Axle Guidelines

Axle Torque Ratings

- The following formula is to be used to determine **CALCULATED INPUT TORQUE TO AXLE**.

CALCULATED INPUT TORQUE TO AXLE = T x N1 x N2

where	T	=	Maximum Gross Engine Torque (LB-FT)
	N1	=	Lowest Transmission Forward Gear Ratio
	N2	=	Torque Converter Stall Ratio
		=	2.5 or specific value for **Automatic Transmission**
		=	1.0 for **Manual Transmission**

- Maximum engine torques greater than 2050 LB-FT are not approved by this Axle Guideline. Contact Meritor Axle Engineering for possible approval.
- Calculated values of input torque to axle which are outside the limits of the Axle Torque Ratings shown within this Axle Guideline may be approvable (i.e., **Torque Limiting Devices**). Contact Meritor Axle Engineering for possible approval.
- The chart on Page 9 is to be used to determine axle torque limits approved for the identified Meritor axle models by available ratio.

See IMPORTANT NOTE 11 for additional information (Page 12).

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Heavy Haul Vocation — Axle Guidelines

Axle Torque Ratings For Heavy Haul

Axle	MAXIMUM ALLOWABLE INPUT TORQUE TO AXLE (LB-FT)		
	RT-16X	RT-185	RT-380
Ratio			
3.07	30,000	x	x
3.21	30,000	x	x
3.42	30,000	x	x
3.58	30,000	x	x
3.73	30,000	30,000	x
3.91	30,000	x	x
4.10	30,000	30,000	x
4.30	30,000	30,000	x
4.56	30,000	30,000	x
4.89	30,000	30,000	x
5.38	26,200	30,000	x
5.52	x	x	30,000
5.63	23,000	x	x
6.07	x	x	30,000
6.14	20,400	24,000	x
6.37	x	x	27,200
6.43	17,800	x	x
6.75	x	x	26,200
6.83	17,800	20,400	x
7.17	16,000	18,400	x
7.24	x	x	21,200
7.83	x	x	20,400
9.14	x	x	16,000
10.12	x	x	13,400
10.62	x	x	12,200

NOTES:
1) Axle torque ratings charted above are to be used only with guidelines for Heavy Haul Vocation.
2) Calculated Input Torque to Axle (per formula) must be less than Maximum Allowable Input Torque to Axle (per chart).
3) Maximum engine torques greater than 2050 lb-ft are not approved by this guideline. Contact Meritor Axle Engineering for possible approval.
4) x = Ratio not available.

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Heavy Haul Vocation — Axle Guidelines

GVW/GCW Ratings

This chart lists maximum GVW/GCW for Meritor axle models (by ratio) for the duty cycle outlined in this **AXLE GUIDELINE.**

MAX GVW/GCWS (LBS) BY AXLE BY RATIO

DUTY I (12% Max Grades) **100% Load Going/Empty Return**			
Axle Model	**RT-16X**	**RT-185**	**RT-380**
Hypoid Ratios			
3.07	190,000	x	x
3.21	190,000	x	x
3.42	190,000	x	x
3.58	190,000	x	x
3.73	190,000	225,000	x
3.91	190,000	x	x
4.10	190,000	225,000	x
4.30	180,000	225,000	x
4.56	180,000	225,000	x
4.89	170,000	225,000	x
5.38	160,000	210,000	x
5.52	x	x	250,000
5.63	160,000	x	x
6.07	x	x	250,000
6.14	120,000	170,000	x
6.37	x	x	250,000
6.43	110,000	x	x
6.75	x	x	250,000
6.83	100,000	140,000	x
7.17	100,000	130,000	x
7.24	x	x	240,000
7.83	x	x	210,000
9.14	x	x	170,000
10.12	x	x	140,000
10.62	x	x	130,000

NOTES:
1) x = Ratio not available.
2) GVW/GCW limits beyond those shown within this **AXLE GUIDELINE** may be approvable. Contact Meritor Axle Engineering for possible approval.

See IMPORTANT NOTE 9 for additional information (Page 11).

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Heavy Haul Vocation — Axle Guidelines

Important Notes

1. The following optional components are approved by this **AXLE GUIDELINE**. All options may not be available on all axle models:
   a. **Driver-Controlled Differential Lock (DCDL)**
   b. **ABS**
   c. **Oil Pump**
   d. **Advanced Lube**
2. The use of **NoSPIN** "differentials" in any single or tandem rear drive axle will result in the exclusion of axle shafts from warranty considerations. Certain other carrier components will also be excluded from warranty considerations if their failure is deemed the result of a NoSPIN failure or malfunction. Depending on axle loading, the NoSPIN can cause all differential torque to be directed to one axle shaft causing overload (and potential failure). NoSPIN is a product of Tractech, a Titan Wheel International Company.
3. For approval of Meritor **Transmission, Clutch, Driveline, Brake, Retarder, Wheel End, Trailer Axle** and all other components contact the appropriate Meritor engineering function: 800-535-5560.
4. For certain **Suspension** models, Meritor requires the use of an increased housing wall thickness. See Meritor Product Information Letter No. 134 or contact Meritor Axle Engineering for clarification.
5. For details on Meritor's **Advanced Lubrication Program** consult Meritor Technical Publication TP-9303 or Maintenance Manual MM No. 1.
6. Vehicles equipped with multiple **Retarders** of any type (engine brake, exhaust brake, hydraulic transmission, chassis mounted or axle mounted electromagnetic) must be approved by Meritor as well as the manufacturers of the selected retarders. Contact Meritor Axle Engineering for possible approval. Vehicles with single retardation devices are approvable.
7. Vehicles using **Liftable (Tag or Pusher)** axles within this vocation may be approvable. Contact Meritor Axle Engineering for possible approval.
8. Meritor Automotive's Axle Application Approval, with respect to the **Suspension** selected, is limited to the location of the suspension attaching positions relative to those parameters (track, tire, mounting centers, etc.) specified. Attachment to the axle housing assembly and durability of the axle housing assembly as a result of suspension loadings on the housing, is the responsibility of the OEM. Meritor assumes responsibility of the bracket integrity and attachment only if:
   a. The brackets are attached by Meritor or,
   b. Meritor has established a prior agreement with the OEM.
9. It is the responsibility of the OEM and/or the dealer to accurately convey all approved axle loading information to the **Body Builder** if the chassis is sold as 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 approvable by this vocational guideline.

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Heavy Haul Vocation — Axle Guidelines

Important Notes (Cont'd.)

10. The **OEM has the responsibility** to determine Steering Axle Specifics (Maximum Turn Angle, Tie Rod Arm Selection, Steering Arm Selection, Geometry Limits, etc.). Meritor Axle Engineering can assist the OEM with these parameters.
11. Drive axles configured with **single tires** may require special consideration. Aggressive High Mobility single tires of on/off-road and agricultural tread designs are capable of transmitting higher than normal wheel torque into the ground surface. This can result in axle components being stressed beyond allowable limits. If single tires are utilized with other than strict On-Highway tread designs, Meritor Axle Engineering should be consulted for special consideration of the application.
12. The **Driver-Controlled Differential Lock** option, when available, is highly recommended for all Heavy Haul operations where maximum drive bogie tractive effort is required.
13. Vehicle testing of any nature voids the warranty on Meritor axles. Meritor does not approve of automatic transmission **stall testing** and does not warrant components against these procedures.

For more information, dial our toll-free number: **800-535-5560**

The entire family of Meritor axles is an integral member of **Drivetrain Plus™** by Meritor, the industry's most complete drivetrain.

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