NMRA Recommended Practice	
Locomotive and Tender Drawbars	
Jul 17, 2025	RP-37 Draft

[Optional] Authors of this revision; include prior authors if minor revisions

1 General

1.1 Introduction and Intended Use (Informative)

This Recommended Practice explains the specifications and relationships that are recommended for implementing a drawbar between a locomotive and a tender. Both the drawbar and attachment methods, often referred to as pins or screws, are discussed. Drawbar electrical issues related to both DC and DCC operation are also explained.

In this current version of the document dimensions for HO and TT scales are presented with an accuracy of 0.001" and 0.025 mm, unless otherwise noted. The tolerance for all dimensions, unless otherwise noted is +/- 0.005" or +/- 0.125 mm. Other scales are not addressed in the current version of this RP.

1.2 References

This standard should be interpreted in the context of the following NMRA Standards, Technical Notes, and Technical Information.

1.2.1 Normative

- S-9.1 DCC Electrical Standard
- S-9.2 DCC Communication Standard

1.2.2 Informative

- None

1.3 Terminology

Term	Definition
CC	Drawbar Hole Center-to-Center Dimension
DC	Direct Current
DCC	Digital Command and Control
DD	Drawbar Hole Diameter
DH	Drawbar Height Above Rail
DP-4	Drawbar Projection (Distance between rear of locomotive and tender mount) for 4 wheel tender
DP-6	Drawbar Projection (Distance between rear of locomotive and tender mount)) for 6 wheel tender

Commented [BK1]: Th original RPs used imperial fractions including some really fine ones like 23/64" (0.359375"). This version is converted to decimal, except for one fraction hex wrench dimension.

Commented [Ma2R1]: I agree. It should be decimal. Older docs used fractional inches. Manufacturing and Inspections are now with digital calipers in decimal inches.

Commented [Ma3]: Brian, I suggest adding any new or unique terms about drawbars.

DP-Cent	Drawbar Projection (Distance between rear of locomotive and tender mount)) for centipede tender
DT	Drawbar Thickness
DW	Drawbar Width
FH	Height of Tender Floor Underside Above Rail
PC	Metal Tender Pin Clearance Above Rail
PD	Metal Tender Pin Diameter
PF	Metal Tender Pin Flange Diameter
PL	Metal Tender Pin Length
PM	Metal Tender Pin Mounting Length
PT	Metal Tender Pin Length of Taper
RP	Recommended Practice
TS-4	Tender setback (distance between front of tender and mount point) For 4-Wheel Tender
TS-6	Tender setback (distance between front of tender and mount point) For 6-Wheel Tender
TS-Cent	Tender setback (distance between front of tender and mount point) For Centipede Tender
WD	Drawbar Spring Wire Diameter

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2 Drawbars

For model railroad locomotive configurations that include a tender, a drawbar is the device that provides the necessary pivoting mechanical interconnection between the locomotive and tender. When a metal drawbar is used, it may also provide electrical connectivity for some configurations.

Traditionally, the drawbar has been considered a permanent component of the locomotive and its attachment method to the locomotive is not specified in this RP. In addition, historically, drawbars were in almost all cases made of metal. This however is no longer the case as plastic drawbars are now very popular.

When metal drawbars are employed with metal frame locomotives, the conventional locomotive attachment method is to use a spring-loaded screw or bolt, insulated from the locomotive frame. The spring permits rotation while maintaining electrical conductivity with the screw or bolt. An electrical lug is wired to the screw or bolt for conductivity within the locomotive. The drawbar must always be free to rotate on its locomotive attachment through a limited arc that allows the tender to pivot with the locomotive on curved track.

Since each locomotive differs in its drawbar attachment details, this RP specifies only the height of the drawbar above railhead, its general size, and its projection beyond the floor of the locomotive cab. This projection will vary, dependent upon the type of tender truck and location under the tender of the mating pivot drawbar attachment point.

Changing tender trucks from one type to another, e.g., from four wheel to six wheel, with no change in bolster location, requires no change in drawbar or tender attachment location, but if the change entails relocating the bolster, both the drawbar projection and the tender attachment location should change accordingly in order to maintain constant spacing between locomotive and tender.

A locomotive backing against its tender thru the mechanical interconnection of the drawbar introduces a skewing action that throws the engine and its tender out of line with each other. The load of a train behind the tender accentuates this action. The longer the drawbar, with pivot centers at, or near, the rear driver and the front tender truck bolster, the less this action will be. It is seldom feasible in most models to adjust this geometry enough to remove all of the skew that may occur.

Buffers are used in the prototype to reduce the skewing tendency, but are also seldom seen in model locomotives. An aesthetic simulation of these buffers has been the use of dark foam plastic between the end sills of the locomotive cab and the tender, but these can be counted on to serve only a small part of the prototype buffer action.

2.1 Metal Drawbars

The materials used for metal drawbars should have electrical conductivity. Brass (nickel plated to reduce oxidation when feasible) and nickel-silver are acceptable for their conductivity. The dimensions for metal drawbars are shown in Figure 1 and presented in Table 1 for specific scales. The dimensions for drawbars used in other scales has not yet been specified.

Metal drawbars often include an attached spring wire that serves two purposes: enhance electrical conductivity, and enhance drawbar captivity, as discussed below. The spring wire is often attached by soldering near the locomotive end of the drawbar. The spring wire material is therefore usually plated steel wire or brass. The spring wire is shown in Figure 1 and dimensions for the spring wire are given in Table 1.

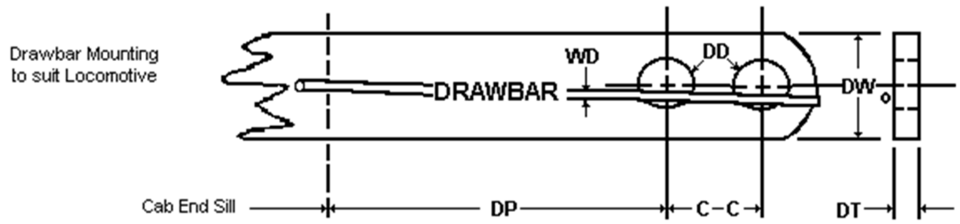

Figure 1. Metal drawbar layout.

Commented [BK4]: All the drawings are cut and pasted from the 1997 RP. Once I get feedback on what needs to change, I will redraw them in Google Drawings.

2.2 Plastic Drawbars

Plastic drawbars are an acceptable means of providing the pivoting mechanical interconnection between the locomotive and the tender. The design of the drawbar must provide enough tensile and compression strength to withstand the repeated pull and push forces associated with interconnecting operating model locomotives and tenders in the desired scale. The annular dimensions at the ends of the drawbar, where holes are typically present to allow for attachments, are particularly sensitive to tensile forces. At this time, no dimensions are specified in this RP for plastic drawbars.

2.3 Drawbar Captivity

Drawbars must remain attached to both the locomotive and the tender during all operational phases regardless of whether tensile forces, compression forces, or no forces at all are present in the drawbar. To the extent that drawbars are considered permanently attached to the locomotive this issue may be addressed for the locomotive end of the drawbar. However, at the tender end, the issue of captivity must be addressed. Traditionally, metal drawbars have attached to tenders using simple metal pins that protrude downward from the front-underside of the tender, as shown in Figure 2.

When tenders employ a simple downward protruding pin for attachment, any drawbar that uses an attached spring wires may provide the necessary captivity. The wire typically applies force against the tender drawbar pin and this force may create enough friction to keep the weight of the drawbar from falling off the pin. The spring wire is common on metal drawbars, but can also be implemented on plastic drawbars for both mechanical and electrical purposes. If a drawbar spring wire is not employed when a simple tender pin is used, then another method must be used for captivity. One alternative method is to limit vertical motion of the drawbar at the locomotive attachment point. This restriction prevents the drawbar from falling off the tender pin or sliding down it when the locomotive backs down on the tender.

Other attachment methods that can enhance captivity, as discussed below, include metal or plastic screws that attach to the tender floor but permit drawbar rotation and also capped plastic pins that friction fit in the tender floor but also permit rotation.

Where ever possible, an attachment method at the tender that remains captive when the locomotive and tender are removed from the layout is preferred. Although it is recognized some storage methods require separating the locomotive and tender, during normal operations in and around a model railroad, relocating a locomotive and tender is usually expedited by having the drawbar remain captive at both ends.

Drawbar captivity is often of particular concern with DCC equipped locomotives. The multi-conductor connections that are often employed between the locomotive and tender can be damaged if the drawbar detaches. Many DCC multi-conductor connections on smaller scales are permanent and are particularly vulnerable to detached drawbars.

Table 1. Metal drawbar dimensions in inches and (millimeters).

Scale	**Height** **DH**	**Width** **DW**	**Thickness** **DT**	**Hole Diameter** **DD**	**Hole Centers** **CC**	**Wire Diameter** **WD**
O/On3	Not Specified					
S/Sn3	Not Specified					
HO	0.312 (7.925)	0.172 (4.375)	0.040 (1.025)	0.082 (2.075) #45 drill	0.156 (3.975)	0.022 (0.550)
HOn3	Not Specified					
HOn30	Not Specified					
TT	0.266 (6.750)	0.125 (3.175)	0.032 (0.825)	0.067 (1.700) #51 drill	0.125 (3.175)	0.022 (0.550)
TTn3	.219 (5.550)	0.125 (3.175)	0.032 (0.825)	0.067 (1.700) #51 drill	0.125 (3.175)	0.022 (0.550)
N	Not Specified					
Z	Not Specified					

2.4 Drawbar Locomotive Weighting

Using the drawbar to transfer tender weight to the locomotive is not recommended. While it may be possible to transfer weight to the rear locomotive drivers by creating a downward force on the drawbar at the locomotive end, the forces involved can compromise the drawbar's ability to rotate properly and may exacerbate the skewing phenomenon discussed above. In addition, tender truck tracking may also be compromised if tender weight is transferred from the front truck to the drawbar.

3 Drawbar Attachments

Specifications are provided below for metal attachment pins intended for use with metal drawbars, but only for specific scales. It is recognized that other attachment methods are available and they are discussed below. However, no additional specifications have been developed for these alternative attachment methods at this time.

3.1 Metal Attachments

The traditional attachment method for metal drawbars attaching to metal tenders has been the simple protruding metal pin shown in Figure 2. The materials used for metal pins should have electrical conductivity. Brass (nickel plated to reduce oxidation when feasible) and nickel-silver are acceptable for their conductivity. The dimensions for metal pins are shown in Figure 2 and presented in Table 2 for specific scales. The dimensions for metal pins used in other scales has not yet been specified. The recommended pin includes a hex nut flange that can be used to tighten the pin when a threaded installation is employed. The metal pin should be mounted to the tender floor so as to clear the railhead by the amount specified in Table 2 and setback from the tender end sill by the amount specified below in Section 4. Mounting of the metal pin may be threaded or soldered in place, to be in conductive connection to the tender frame if needed. If the tender floor height varies from that shown in Section 4, Pin length should be modified to suit.

An alternative metal attachment method that can be considered is to attach a drawbar to the tender with a metal screw or bolt. Machine or sheet-metal style screw or bolt options are acceptable. To reduce the chance of the drawbar binding with the threads of the screw or bolt, a protective, and conductive, thin-wall metal tube may be necessary. Regardless of the solution, drawbar rotation must be maintained and conductivity requirements may need to be considered. There are no recommended dimensions for this alternative metal attachment method at this time.

With tender drive or tender equipped motors that use the drawbar for conductivity, the attachment method may include electrical insultation from the tender frame. See Section 5 below.

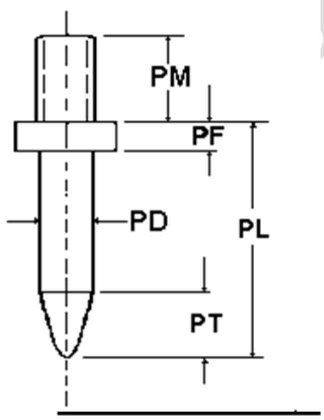

Figure 2. Metal attachment pin layout.

Table 2. Metal attachment pin dimensions in inches and (millimeters).

Scale	Clearance PC	Diameter PD	Length PL	Taper PT	Flange PF	Mounting PM
O/On3	Not Specified					
S/Sn3	Not Specified					
HO	0.094 (2.375)	0.078 (1.975)	0.344 (8.725)	0.094 (2.375)	5/32 hex nut, 0.047	2-56 thread, 0.047

Commented [BK5]: This dimension is 3/64” (0.046875”) in the 1997 RP. This seems awful short to me. It is less than the 1/16 length for TT below.

					(1.200) thick	(1.200) long
HOn3	Not Specified					
HOn30	Not Specified					
TT	0.078 (1.975)	0.062 (1.575)	0.281 (7.150)	0.062 (1.575)	7/64 hex nut, 0.047 (1.200) thick	1-72 thread, 0.062 (1.575) long
TTn3	0.078 (1.975)	0.062 (1.575)	0.203 (5.150)	0.062 (1.575)	7/64 hex nut, 0.047 (1.200) thick	1-72 thread, 0.062 (1.575) long
N	Not Specified					
Z	Not Specified					

3.2 Plastic Attachments

Plastic attachment methods are an acceptable means of connecting the drawbar to the tender. Plastic pins, screws, or bolts may be used. The design of the attachment must provide enough shear strength to withstand the repeated pull and push forces associated with interconnecting operating model locomotives and tenders in the desired scale. At this time, no dimensions are specified in this RP for plastic attachment methods.

4 Drawbar and Attachment Relationship

The overall drawbar and attachment relationship when a metal drawbar and metal pin are used is shown in Figure 3 with dimensions given in Table 3. At this time, no dimensions are specified in this RP for the relationships involving plastic drawbars or other attachment methods.

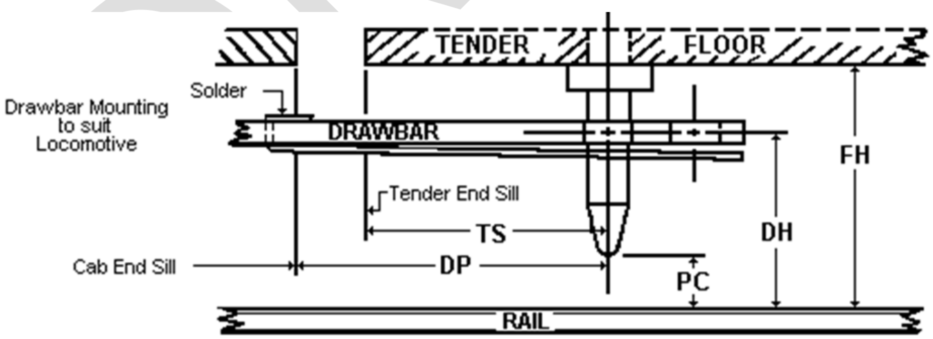

Figure 3. Drawbar and attachment relationships.

Table 3. Drawbar and attachment relationship dimensions in inches and (millimeters)

		Tender Attachment Setback	Drawbar Projection

Scale	Floor Height FH	4-wheel TS-4	6-wheel TS-6	Centipede TS-Cent	4-wheel DP-4	6-wheel DP-6	Centipede DP-Cent
O/On3	Not Specified						
S/Sn3	Not Specified						
HO	0.437 (11.125)	0.250 (6.350)	0.375 (9.525)	0.500 (12.700)	0.375 (9.525)	0.500 (12.700)	0.625 (15.875)
HOn3	Not Specified						
HOn30	Not Specified						
TT	0.359 (9.125)	0.187 (4.775)	0.281 (7.150)	0.375 (9.525)	0.281 (7.150)	0.375 (9.525)	0.469 (11.900)
TTn3	0.281 (7.150)	0.187 (4.775)	0.281 (7.150)	0.375 (9.525)	0.281 (7.150)	0.375 (9.525)	0.469 (11.900)
N	Not Specified						
Z	Not Specified						

5 Electrical Considerations

The drawbar can be used to conduct electricity between the locomotive and the tender. Traditionally, in locomotive equipped motors, when metal drawbars are used to conduct electricity, metal drawbars are electrically connected to the tender frame and insulated from the locomotive frame. In this configuration the tender trucks, with one side insulated, provide conductivity to one rail, through the tender frame, to the drawbar. The locomotive drivers, also with one side insulated, provide conductivity to the other rail and thus to the locomotive frame.

Commented [Ma6]: Do we need to consider changing this to best practices where all wheel pickup is used and wheels are insulated from the frame both on the locomotive and tender?

With tender drive or tender equipped motors, when a metal drawbar conducts electricity the drawbar insulation is usually at the tender end.

Especially when retrofitting DCC or re-motoring a DC locomotive, the electrical conductivity of a metal drawbar must be given careful consideration before its conductivity is decommissioned or repurposed.

5.1 DC Operation

In DC operations, as just presented, a metal drawbar can provide electrical conductivity between one rail and the motor. If the motor is in the locomotive, the drawbar brings electricity from one rail, usually through the tender frame, then through an insulated locomotive connection, to one terminal of the motor. If the motor is in the tender, the drawbar brings electricity from the locomotive, often the locomotive frame, and then through an insulated tender connection, to one terminal of the motor.

Metal drawbars do not always carry electricity. If they do not, care must be taken to ensure the metal drawbar does not cause a short circuit between the frames of the tender and the locomotive since one or both frames may be electrically conductive in powering the motor.

If plastic drawbars are used, there are no electrical considerations for the drawbar itself.

5.2 DCC Operation

Especially when retrofitting Digital Command Control (DCC) in a locomotive, but also in new designs, the conductivity of a metal drawbar must be given careful consideration. It is necessary to electrically insulate the terminals of a DCC motor from the track circuits. This means the mounting method of an existing motor that has one terminal electrically connected to the frame (locomotive or tender) must be modified to insulate the terminal. This change may mean the electrical conductivity of the drawbar must be reconsidered. In addition, DCC installations often include multi-conductor connections between the locomotive and tender that carry all necessary circuits. If the electrical conductivity of a metal drawbar is not needed its electrical configuration, e.g., which end if any is insulated, may need to be reconsidered.

Commented [Ma7]: Do we need to propose a standard on this similar to S-9.1.1 or since the tender and locomotive e are manufactured by one company, leave it to them how many pins and configuration?

If plastic drawbars are used, there are no electrical considerations for the drawbar itself.

6 Document History

Date	Description
March 1997	RP-37 and RP-37.1 last published.
17-July 2025	RP-37 and RP-37.1 combined and expanded to include plastic drawbars and DCC considerations. Converted all imperial fractional dimensions to new accuracy and tolerance ranges in both imperial and metric decimal units.

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