This Excel workbook includes 5 sheets.

Instructions & Calculator | Image of Firebox Tube Sheet | Image of Cab Arrangement Lima Locomotive Works Document | DRRY Eng. No. C&O 308

Excel Workbook Produced by Jeffrey G. Hook Revision of September 1, 2025

This Excel workbook is applicable only to a miniature locomotive boiler having a longitudinal level crown sheet or the slope of the crown sheet declining from the point of attachment at the top of the firebox tube sheet or combustion chamber tube sheet.

When ascertaining relative elevations by any means the locomotive shall be on level track, the suspension system in condition of normal working order and the weight of the locomotive near that when in normal working order.

When using a pipe and hose water level device to compare elevations extra care must be taken to insure its readings are accurate by seeing to it that the water in the pipe and hose flows freely and does not leak out from between the ends, and air bubbles, air pockets, kinks, dirt, oil, etc., etc. are not present in the pipe or hose.

It must be fully understood that errors in the application or use of the water level device will generally produce results where THE INDICATED ELEVATION IS LOWER THAN THE ELEVATION OF THE END OF THE PIPE IN CONTACT WITH THE FIRESIDE OF THE CROWN SHEET.

See also Excel workbook titled "Water-Gauge-Elevation-Calculator" See notice below drawing. Excel Calculator and Instructions for the Application of a Water Level Device to Ascertain Deerfield and Roundahout Railway the Elevation of the Highest Point of the Fireside of the Crown Sheet in Relation to ROUNDABOUT Lake Forest Live Steamers Railway Museum Other Elements of a 1:8 Scale Miniature Steam Locomotive Boiler Original J. G. Hook 1-17-2016 Revised J. G. Hook 5-30-2019 Based on Lima Locomotive Works, Inc. Standard Practice, Shop, No. 27-SP-1D of January 12, 1939, Sheet No. 3 of 4 Sheets. Abbreviations IT MUST BE KEPT UPPER MOST IN MIND AT ALL TIMES THAT THE WATER LEVEL DEVICE DOES NOT INDICATE THE ELEVATION OF THE HIGHEST PART OF THE CROWN SHEET. FCS = Highest point of fireside of crown sheet. HPCS = Highest part of crown sheet. LRWG = Lowest reading of water gauge. One type of device that may be used for gradually introducing water into the top of the water level device (WLD) WLD = Water level device. clear vinyl hose. The water must be introduced slowly and in a manner that avoids entrainment of air bubbles and a rapid flow of water out the end of the WLD pipe that may result in a false low water level indication. Tubular glass portion of typical water gauge. A crown sheet sloping as illustrated effectively increases the vertical distance between the HPCS and the end of the pipe of Highest part of crown sheet. the WLD. This may be accounted for including a compensation (HPCS) value in the calculation to the right of this drawing. Lowest reading of water gauge (LRWG) Waterside of crown sheet Calculated highest part of crown sheet (HPCS) Thickness of crown sheet plate. Fireside of crown sheet. Water level device (WLD) indicated Clearance between FCS highest point of fireside and end of pipe of WLD. 1/4 inch outside diameter of crown sheet (FCS) Typically taken as 0.032 inches stainless steel tube End of pipe of water level device (WLD) held in Slip over joint closest practicable proximity to highest point of between pipe fireside of crown sheet (FCS) with extra care and clear vinyl hose with clamp taken to avoid contact with weld fillet, boiler tube end, etc., etc. that may reduce its elevation. if required to prevent leaking Firebox tube sheet 1/4 inch inside diameter clear vinyl hose. Fixed horizontal surface of locomotive, such as cab deck, Typical Deerfield and Roundabout Railway practice uses either a magnetic base or clamping base arrangement, normally used to hold a that may be used as a reference dial indicator, to hold the water level device pipe in contact with the highest point of the fireside of the crown sheet (FCS). The foregoing surface for vertical measurements in the future. To be used instead is adjusted to grip the water level device pipe near the joint with the clear vinyl hose. A hand held mirror and battery power light are used to view through the boiler fire hole the end of the water level device pipe as it is positioned to make contact with the highest point of the of "prink punch" marks placed on boiler back head as described in fireside of the crown sheet (FCS). The crown sheet of a 1:8 scale miniature locomotive boiler is typically flat in its lateral dimension and if construction of the boiler results in it not being level than the water level device will be located at either its left or right edge. After the Lima Locomotive Works pipe of the water level device has been positioned and fixed in contact with the highest point of the fireside of the crown sheet, light air document. pressure is applied at the end of the clear vinyl hose to clear out any soot that may have entered the end of the pipe.

NOTICE: Any and all information, data, images or drawings published as part of this Excel workbook have been prepared solely for the non-commercial amateur engineering use of designers, builders, maintainers or operators of one-eighth scale miniature railway track, locomotives or rolling stock. It has been compiled from information sources believed by Lake Forest Live Steamers Railway Museum Incorporated and any author credited to be competent. However, recognizing that each component of any system must be designed and installed to meet the particular circumstances, Lake Forest Live Steamers Railway Museum Incorporated and any author credited assumes no responsibility or liability of any kind in connection with the information, data, images or drawings published as part of this document that are used in any way by any person or organization and makes no representations or warranties of any kind hereby.

THE MINIATURE 1:8 SCALE 7.5 INCH GAGE OF TRACK DEERFIELD AND ROUNDABOUT RAILWAY USES BALDWIN LOCOMOTIVE WORKS STANDARD PRACTICE SHEET 12-1C SKETCH NO. 4 PRINCIPLES TO ESTABLISH THE MINIMUM VERTICAL DISTANCE BETWEEN THE LOWEST READING OF A WATER GAUGE AND THE HIGHEST PART OF THE CROWN SHEET AND IN NO CASE SHALL THE DISTANCE BE LESS THAN 0.500 INCHES.

CARL A, PURINTON WRITING IN 1951. SUGGESTED THAT THE MINIMUM VERTICAL.
DISTANCE BETWEEN THE LOWEST READING OF A WATER GAUGE AND THE HIGHEST
PART OF THE CROWN SHEET SHOULD BE NOT LESS THAN 0.250 INCHES. GIVEN THE
TIME PERIOD OF C. A. PURINTON'S WRITINGS IT MAY REASONABLY BE ASSUMED
THAT THE AUTHOR WAS REFERRING TO MINIATURE STEAM LOCOMOTIVES
CONSTRUCTED TO REPRESENT FULL SCALE PRACTICE STANDARD GAUGE EXAMPLES
AND NO LARGER THAN THAT WHICH WOULD RESULT FROM EMPLOYING A
MINIATURE TO FULL SCALE PRACTICE REDUCTION RATIO OF THREE-QUARTER
INCHES EQUALS ONE FOOT OR POSSIBLY ONE INCH EQUALS ONE FOOT.

1		
ı		Enter data in gray boxes.
1	0.063	Compensation for affect of slope of crown sheet.
-	0.250	Compensation for thickness of crown sheet plate.
l	0.032	Compensation for clearance between end of water level device pipe and fireside of crown sheet.
-	0.345	Calculated vertical distance between highest part of crown sheet (HPCS) and water level device indicated highest point of fireside of crown sheet (FCS).
	0.000	Minimum required vertical distance between the lowest reading of the water gauge (LRWG) and the highest part of the crown sheet (HPCS). As specified in other documents and rules related thereto.
-		Minimum required vertical distance between the lowest reading of the water gauge (LRWG) and the water level device indicated highest point of fireside of crown sheet (FCS).
-	0.000	Vertical distance measured between water level device indicated highest point of fireside of crown sheet (FCS) and fixed horizontal reference surface of locomotive.
	0.345	Calculated vertical distance between highest part of crown sheet (HPCS) and water level device indicated highest point of fireside of crown sheet (FCS).
-[Calculated vertical distance between highest part of crown sheet (HPCS) and fixed horizontal reference surface of locomotive.

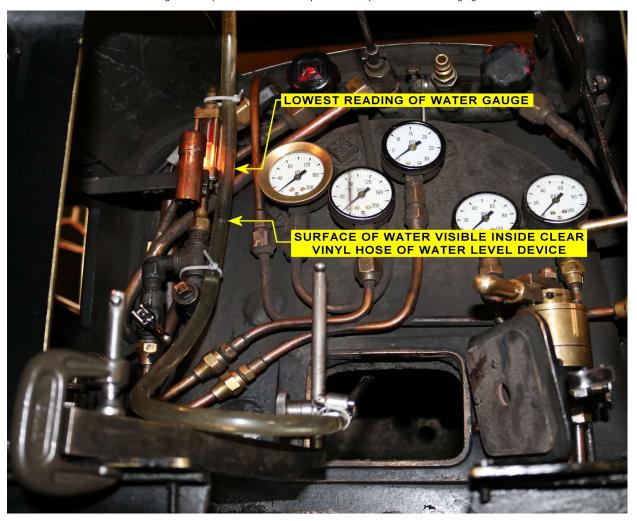
Description of identity of locomotive and fixed horizontal reference surface employed on the same.

Type in here additional pertinent data. Engine No., Date of use of water level device, etc., etc.

Image of typical 1:8 scale miniature locomotive boiler firebox tube sheet illustrating placement of end of water level device pipe near to the highest point of fireside of crown sheet.



Image of typical 1:8 scale miniature locomotive boiler back head illustrating mounting of water level device pipe by means of clamping arrangement and placement of the clear vinyl hose vertically and near to the water gauge.



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STANDARD PRACTICE

SHOP

FOUR SHEETS SHEET NO. 3

NO 27-5P-1D

SUPERSEDING 27-5P-1C

LIMA LOCOMOTIVE WORKS STANDARD PRACTICE No. 27-SP-1D EXCERPT PRODUCED BY JGH 3-10-2019

Y W.H.S. CHECKED BY EPP METHOD OF LOCATING WATER COLUMNS, WATER

FITTING PRICK PUNCH LIGHTLY THICKNESS PLUG OF CROWN SHEET WATER LEVEL THICKNESS OF PRICK PUNCH LIGHTLY HIGHEST POINT CROWN SHEETS AT WATER LEVEL of Crown Sheet WATER LEVEL. Place Glass Against Crown Sheet and Tilt WATER GLASS mark water Level on Back Head. Move Glass Slightly Away From GLASS UNTIL WATER JUST RUNS OUT OF GLASS. CROWN. RUBBER HOSE CROWN AND RECHECK LEVEL.

MOTE:
FILL HOSE WITH WATER AND OBTAIN LEVELS
AS INDICATED. BLOW OUT HOSE BEFORE
STARTING AND SEE THAT THE WATER IS KEPT
FREE OF DIRT AND GREASE OR OIL: THAT
GLASSES ARE CLEAN WITH WATER CLEARLY
VISIBLE IN GLASS: THAT HOSE IS FREE

FROM KINKS AND AIR POCKETS AND THAT WATER FLOWS FREELY IN HOSE.

1939

