VAPOR MANUAL

THIS MANUAL . . .

has been prepared for the information and guidance of all those having anything to do with the application, operation, maintenance and repair of passenger train heating equipment. In addition to the actual devices which convey steam through the train for heating purposes, various other types of equipment are mentioned in the pages of this manual.

Where more detailed information on a specific device is required, such information is available upon request. The equipment and devices made by the Vapor Heating Corporation have been fully protected by basic patents either issued or pending; and materials may be purchased from us with the absolute assurance that they will involve no infringement of patents not owned or controlled by us.

INSTRUCTIONS FOR FILING BULLETINS IN THIS MANUAL

For your convenience in using this Manual, and to enable you to properly place new sheets or reissues of present sheets which will be sent to you from time to time, a special system of Section and Page reference is shown in the upper right hand corner of each sheet.

This system of numbering permits a flexibility in cataloging bulletins on new devices so that the new sheets may be grouped with other like devices in the various sections. There are six general sections, as follows:

CAR HEATING	FOR ALL SHEETS WITH PREFIX "BULLETIN 61—"
TRAIN LINE	FOR ALL SHEETS WITH PREFIX "BULLETIN 62—"
LOCOMOTIVE	FOR ALL SHEETS WITH PREFIX "BULLETIN 63—"
CONTROLS	FOR ALL SHEETS WITH PREFIX "BULLETIN 64—"
STEAM GENERATORS	FOR ALL SHEETS WITH PREFIX "BULLETIN 65—"
YARD AND ROUNDHOUSE	FOR ALL SHEETS WITH PREFIX "BULLETIN 66—"

In the respective sections, sheets should be filed according to the consecutive numbers following the section number. The divisions of the sections are represented by the first number following the section number; further subdivisions of the sections are represented by the second number following the section number. Still further divisions and subdivisions of each section are indicated by the third and fourth number following the section number.

Both a Numerical Index and an Alphabetical Index are provided in the Index Section to aid in quickly finding the correct location of Bulletins in this Manual. New Indexes will be furnished from time to time to keep the Manual up to date on newly issued bulletins.

VAPOR HEATING CORPORATION

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San Francisco 5, Cal.

Room 1024—Investment Bldg.
Washington 5, D. C.

Room 1144—Suburban Station Bldg.
Broad Street
Philadelphia 3, Pa.

Room 609—Lynch Bldg.
11 East Forsythe Ave.
Jacksonville, Fla.

Room E—1523—First Nat. Bank Bldg.
St. Paul 1, Minn.

Room 1210—Citizens Bldg.
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Cleveland, Ohio

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Denver 2, Col.

VAPOR CAR HEATING CO. OF CANADA, Ltd.
Place D'Armes P. O. Box 3030 Montreal 1, Canada

PRINTED IN U. S. A

CAR HEATING EQUIPMENT

VAPOR SYSTEM

valves

Manual Cutout
Magnetic
Motorized
Shut-Off and Drain
Constant Pressure
Vacuum Check

vapor regulators

radiation

Vapor-Vulcan
Vertical Pipe
Cast Iron

fittings

Standard
Special
Pipe Stands, Hooks and Clamps
Extension Handles

condensation relief traps

radiation balancers

HOT WATER SYSTEMS

Heaters
Expansion Drums
Smoke Jacks
Special Fittings
Safety Valves

PRESSURE STEAM

Steam Traps
Valves
Floor Plates

HEATING STOVES

Emergency Heating
Caboose

WASH WATER HEATING

Water Heaters
Water Mixing Valves
Hot Water Regulators
Air Press. Reducing Valves
Anti-Freeze Fittings

VENTILATORS

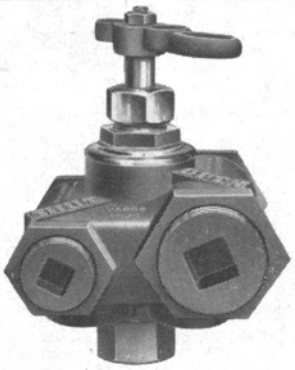
ZONE SYSTEM

Regulators
Flow Limit Valves
Solenoid Steam Admission Valves
Fittings
Remote Manual Controls

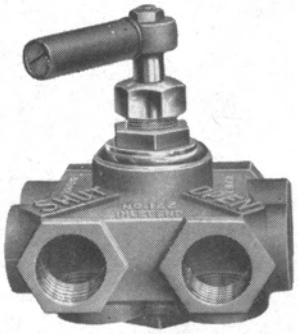
Printed in U.S.A

Nos. 120, 121, AND 122 VAPOR CUT-OUT VALVES

INLET: 1" OUTLET, 120: 1½"; 121 and 122: 1"



No. 120 Cut-Out Valve



No. 122 Cut-Out Valve

GENERAL DESCRIPTION

In the Vapor System of Railway Car Heating, the cut-out valve controls the admission of steam to the radiating pipes by directing the flow of atmospheric pressure steam. A wing provided in the valve guides the steam from the regulator either into the radiation if the valve is open and heat is required, or if no heat is needed and the valve is closed directs it across the valve and back into the regulator for discharge as condensate.

All three of these cut-out valves operate on the same principle, however a variation in the bodies of the three valves provides a valve for every application need.

The No. 120 Vapor Cut-Out Valve is equipped with a 1" inlet and a 1½" outlet. It is generally used in baggage cars where brass body valves and quick drainage of condensate are desirable.

The No. 122 Vapor Cut-Out Valve is furnished with a 1" inlet and a 1" outlet and in either of two types. Type No. 2 is equipped with a small drain port in the valve body between the inlet and "return to the regulator" outlet. To aid in the identification of either type, the No. 1 type is furnished with hexagonal bosses of the inlet and outlets while the No. 2 type is furnished with round bosses of the inlets and outlets.

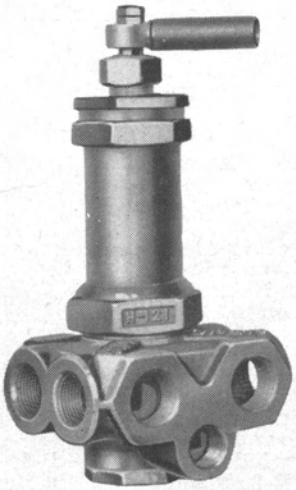
The No. 121 Vapor Cut-Out Valve is also furnished in two types and with a 1" inlet and a 1" outlet. This valve is designed for location underneath a car, but with facilities for operation from the inside of the car. For this purpose, it is equipped with a long sleeve (available in three different lengths to accommodate various conditions for piping and drainage.

When an arrangement is desired for operating the cut-off valve from a more convenient location for car men or for passengers in compartments, a No. 190 Passenger Operating Handle should be used with the valve. This handle is available with either levers or universal joints to meet the requirements of the location of the valve. An illustration and parts list for this operating handle is shown on page 2. It is important in operating the cut-out valves that they be turned completely "on" or "off." A part way position would place the wing in the valve in a half open position and steam may escape through the drain port, or be dissipated in both directions without performing any heating service.

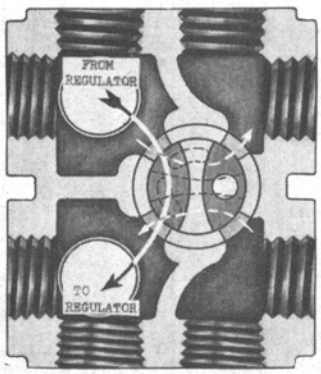
MAINTENANCE AND OVERHAUL

The Nos. 120, 121 and 122 Vapor Cut-Out Valves should be disassembled and overhauled every two years. At this time each part should be cleaned and inspected for wear. Worn or deteriorated parts should be replaced. Spring tension should be checked and damaged or worn packing should be renewed.

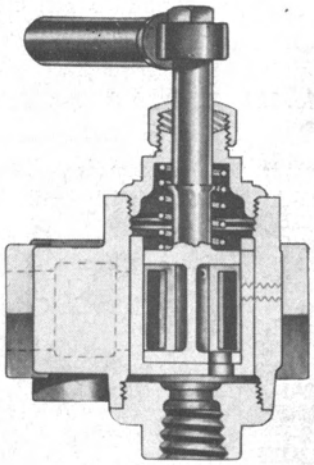
To disassemble any of the three cut-out valves, unscrew the handle nut (sym. K) and remove the lever handle (sym. F). Unscrew the stuffing box (sym. D), remove the packing ring (sym. P) and unscrew the bonnet (sym. C). Lift out the stem and valve (sym. B), (sym. B, B-1 and B-2 in No. 121 valve). Then unscrew the drain bushing (sym. T (120), J (122), or S (121). Clean, reassemble and test the valve on a steam line before placing it in service again.



No. 121 Cut-Out Valve

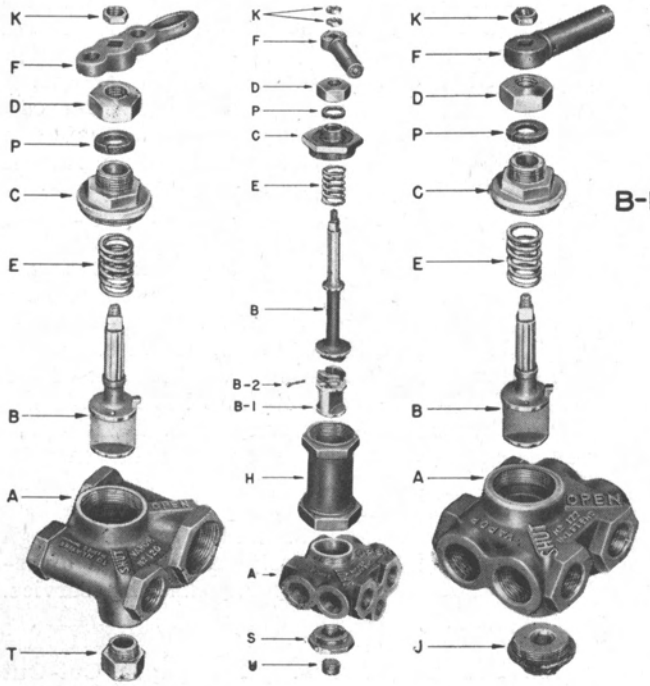


Horizontal Sectioned View of No. 122 Valve



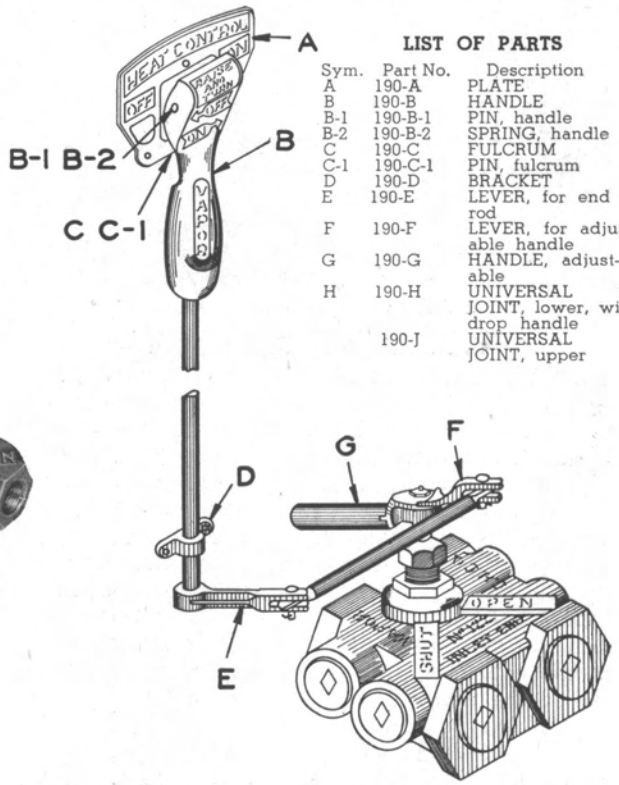
Vertical Sectioned View of No. 122 Valve

Nos. 120, 121 AND 122 VAPOR CUT-OUT VALVES (Cont.)



Exploded No. 120 Exploded No. 121 Exploded No. 122

No. 190 PASSENGER OPERATING HANDLE



LIST OF PARTS

Sym.	Part No.	Description
A	190-A	PLATE
B	190-B	HANDLE
B-1	190-B-1	PIN, handle
B-2	190-B-2	SPRING, handle
C	190-C	FULCRUM
C-1	190-C-1	PIN, fulcrum
D	190-D	BRACKET
E	190-E	LEVER, for end of rod
F	190-F	LEVER, for adjustable handle
G	190-G	HANDLE, adjustable
H	190-H	UNIVERSAL JOINT, lower, with drop handle
	190-J	UNIVERSAL JOINT, upper

LIST OF PARTS

No. 120 VAPOR CUT-OUT VALVE

Sym.	Part No.	Description	Amt.
A	120-A	Body (with Drain Bushing)	1
B	120-B	Stem and Valve	1
C	120-C	Bonnet	1
D	120-D	Stuffing Box	1
E	120-E	Spring	1
F	120-F	Lever Handle	1
K	120-K	Lever Handle Nut	1
P	120-P	Packing Ring	1
T	120-T	Drain Bushing	1
	120-BB	Stem and Valve with Handle (Includes syms. B, F and K)	
	120-CC	Bonnet and Stem Complete (Includes syms. B, C, D, E, F, K and P)	

No. 122 VAPOR CUT-OUT VALVE

Sym.	Part No.	Description	Amt.
A	122-A	Body (with Drain Bushing)	1
B	122-B	Stem and Valve	1
C	122-C	Bonnet	1
D	122-D	Stuffing Box	1
E	122-E	Spring	1
F	122-F	Lever Handle Complete	1
	122-F-1	Lever	
	122-F-2	Cover	
	122-F-3	Screw	
J	122-J	Drain Bushing	1
K	122-K	Lever Handle Nut	1
P	122-P	Packing Ring	1
	122-BB	Stem and Valve with Handle (Includes syms. B, F and K)	
	122-CC	Bonnet and Stem Complete (Includes syms. B, C, D, E, F, K and P)	

No. 121 VAPOR CUT-OUT VALVE

Sym.	Part No.	Description	Amt.
A	121-A	Body (with Drain Bushing and Body Bushing)	1
B	121-B	Stem (Standard)	1
	121-B-5	Stem (Long)	
	121-B-6	Stem (Short)	
B-1	121-B-1	Valve	1
B-2	121-B-2	Valve and Stem Cotter Pin (⅛"x1¼")	1
C	121-C	Bonnet	1
D	121-D	Stuffing Box	1
E	121-E	Spring	1
F	121-F	Handle Complete	1
	121-F-1	Handle	
	121-F-2	Fibre Cover	
	121-F-3	Screw	
	121-F-4	Fibre Cover (for Type 2 Valve)	
H	121-H	Body Extension Sleeve-(Standard)	1
	121H-1	Body Extension Sleeve (Long)	
	121-H-2	Body Extension Sleeve (Short)	
K	121-K	Lever Handle Nut	1
P	121-P	Packing Ring	1
S	121-S	Drain Bushing	1
	121-BB	Stem and Valve with Handle (Includes syms. B, B-1 B-2,, F and K)	
	121-BB-1	Stem and Valve (Includes syms. B, B-1 and B-2)	

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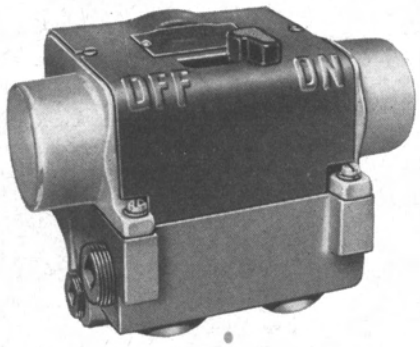
Nos. 1619-5, 1620-5, 1621-5, 1623-5 and 1624-5

MAGNETIC VALVES

WEIGHT 24 LBS.



VAPOR Magnetic Valve

DESCRIPTION

These are improved magnetic vapor cut-out valves of the Nos. 1620 to 1624 Type. The improvements consist in the use of a packless durochrome plated valve stem and of a durochrome plated valve wing.

The new valve stem and bonnet arrangement provides a metallic seal, eliminating the use of composition packings entirely, thereby cutting down the possibility of sticking difficulties caused by seizing and deterioration of valve packing. The new valve stem is durochrome treated to resist wear and provides freer operation.

Durochrome plating of the valve wing increases its diameter by 0.002", which cuts down the amount of steam leakage by the valve wing, speeding up the circulation of steam through the radiators and assuring positive feeding of the entire radiator. The use of the larger valve wing cuts down the previously experienced tendency for short-circuiting of the valve in the "ON" position of the valve, preventing starving of radiators on restricted circuits. Durochrome treating of the wing, further, provides dissimilar metals between the wing and body, lessening friction, preventing galling and making for less wear.

CONVERSION OF No. 1620 TO No. 1624 MAGNETIC VALVES INTO NEW "5" TYPE VALVES

The Nos. 1620, 1621, 1623 and 1624 Magnetic Valves can be converted into the new type and it is recommended that all such valves be thus converted.

For this conversion the No. 1620-BB-40 Metallic Seal Valve Stem Assembly Complete should be purchased with the return of the old No. 1620-C Bonnet for revision into the No. 1620-C-11.

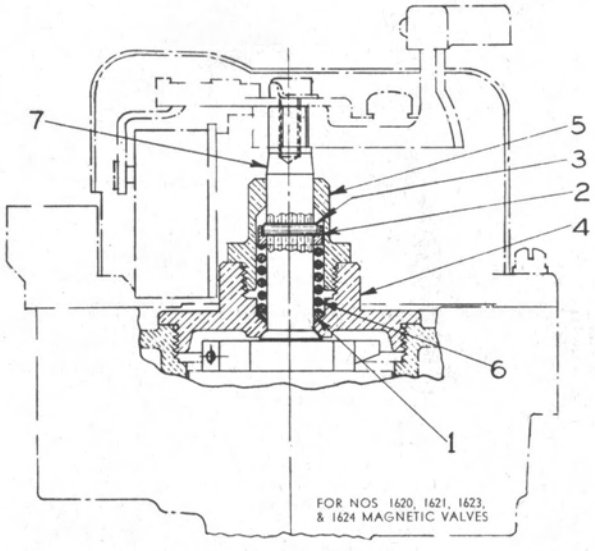
Also, the old valve wing should be sent to the Vapor Car Heating Co. for durochrome treating, which will be done at a reasonable charge.

Such a revision of the magnetic valves in service will result in materially improved operation and will considerably reduce maintenance requirements. When conversion is made, the body of the magnetic valve should be thoroughly cleaned to remove scale and boiler compound.

NOTE: The No. 1621-B or No. 1621-B-21 Valve Wings must not be used on the No. 1620 or No. 1620-5 Type Magnetic Valves. If the No. 1620 Valve is converted for single coil installations, the Nos. 1620-B and 1621-B Wing may be used, but not the new style No. 1621-B-21 Wing. The No. 1621-B Wing only can be used with No. 1621 Valve Bodies.

No. 1620-BB-40

METALLIC SEAL VALVE STEM ASSEMBLY



LIST OF PARTS

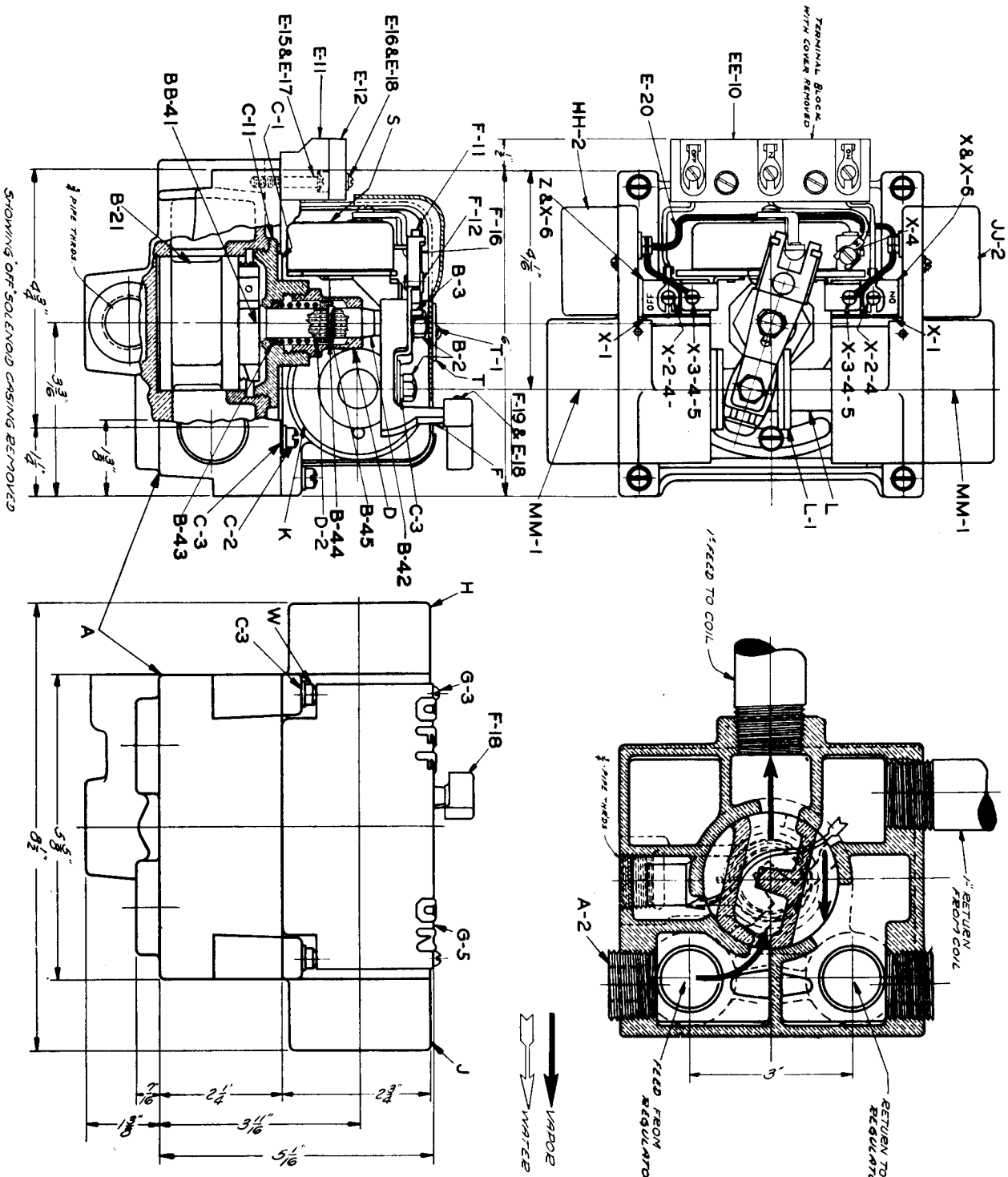
SYM.	PART NO.	DESCRIPTION	AM'T	MATERIAL
1	1620-B-43	Ring (Filler)	1	C.R.S. Cad. Pl't
2	1620-B-44	Washer (Spring)	1	C.R.S. Cad. Pl't
3	1620-B-45	Pin (Cupwasher)	1	Drill Rod Cad. Pl't
4	1620-C-11	Bonnet	1	Brass
5	1620-D	Stuffing Nut	1	Brass
6	1620-D-2	Packing Spring	1	Stainless Steel
7	1620-BB-41	Valve Stem with Equalizer	1	

Nos. 1619-5, 1620-5, 1621-5, 1623-5 and 1624-5 MAGNETIC VALVES

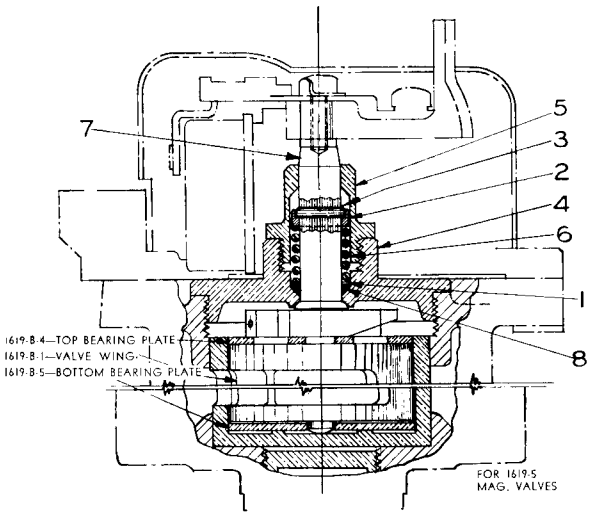
LIST OF PARTS

SYM.	DESCRIPTION	AM'T	1619-5 PART NO.	1620-5 PART NO.	1621-5 PART NO.	1623-5 PART NO.	1624-5 PART NO.
AA	VALVE PORTION COMPLETE	1	1619-AA	1620-AA	1621-AA	1620-AA	1621-AA
A	Valve Body	1	1619-A	1620-A	1621-A	1620-A	1621-A
A-1	Water Seal Plug	1	.....	1620-A-1	.....	1620-A-1	.....
A-20	Body Plug	2	.....	785 1"	785 1"	785 1"	785 1"
B-21	Valve Wing	1	1619-BB	1620-B	1621-B-21	1620-B	1621-B-21
B-2	Valve Stem Cap Screw	1	1/4"-20x1/2" Hex.	1/4"-20x1/2" Hex.	1/4"-20x1/2" Hex.	1/4"-20x1/2" Hex.	1/4"-20x1/2" Hex.
B-3	Valve Stem Lockwasher	1	1620-B-3	1620-B-3	1620-B-3	1620-B-3	1620-B-3
BB-40	BONNET AND STEM COMPLETE	1	1619-BB-40	1620-BB-40	1620-BB-40	1620-BB-40	1620-BB-40
BB-41	VALVE STEM COMPLETE	1	1620-BB-41	1620-BB-41	1620-BB-41	1620-BB-41	1620-BB-41
C-11	Bonnet	1	1619-C-48	1620-C-11	1620-C-11	1620-C-11	1620-C-11
D	Stuffing Nut	1	1620-D	1620-D	1620-D	1620-D	1620-D
B-43	Ring, Filler	1	.....	1620-B-43	1620-B-43	1620-B-43	1620-B-43
B-44	Washer, Spring	1	1620-B-44	1620-B-44	1620-B-44	1620-B-44	1620-B-44
B-45	Pin	1	1620-B-45	1620-B-45	1620-B-45	1620-B-45	1620-B-45
D-2	Packing Spring	1	1620-D-2	1620-D-2	1620-D-2	1620-D-2	1620-D-2
D-3	Washer, Packing	1	1619-D-3	.....	.....	.....	.....
	Packing, Candlewick		1619-D-8	.....	.....	.....	.....
C-1	Bonnet Lock	1	1620-C-1	1620-C-1	1620-C-1	1620-C-1	1620-C-1
C-2	Bonnet Locking Screw	1	14-20x1/2" Fil. Hd.	14-20x1/2" Fil. Hd.	14-20x1/2" Fil. Hd.	14-20x1/2" Fil. Hd.	14-20x1/2" Fil. Hd.
C-3	Bonnet Locking Washer	1	1214 Shakeproof	1214 Shakeproof	1214 Shakeproof	1214 Shakeproof	1214 Shakeproof
EE-10	TERMINAL BLOCK COMPLETE, NEW STYLE	1	1620-EE-10	1620-EE-10	1620-EE-10	1620-EE-10	1620-EE-10
E-11	Terminal Block	1	12531	12531	12531	12531	12531
E-12	Terminal Block Cover	1	12548	12548	12548	12548	12548
E-13	Terminal (On-Off-N)	6	1620-Z-7	1620-Z-7	1620-Z-7	1620-Z-7	1620-Z-7
E-14	Terminal Screw	3	8-32x5/16" B. H.	8-32x5/16" B. H.	8-32x5/16" B. H.	8-32x5/16" B. H.	8-32x5/16" B. H.
E-15	Block Mounting Screw	2	10-24x7/8" R. H.	10-24x7/8" R. H.	10-24x7/8" R. H.	10-24x7/8" R. H.	10-24x7/8" R. H.
E-16	Cover Screw	2	6-32x1/2" R. H.	6-32x1/2" R. H.	6-32x1/2" R. H.	6-32x1/2" R. H.	6-32x1/2" R. H.
E-20	Wire Leads	3	5" long	5" long	5" long	5" long	5" long
FF-1	VALVE HANDLE COMPLETE	1	1620-FF-1	1620-FF-1	1620-FF-1	1620-FF-1	1620-FF-1
F	Valve Handle	1	1620-F	1620-F	1620-F	1620-F	1620-F
	Clamping Screw	1	14-20x5/8" Fil. Hd.	14-20x5/8" Fil. Hd.	14-20x5/8" Fil. Hd.	14-20x5/8" Fil. Hd.	14-20x5/8" Fil. Hd.
	Clamping Screw Lockwasher	1	1/4"x5/64"x3/64"	1/4"x5/64"x3/64"	1/4"x5/64"x3/64"	1/4"x5/64"x3/64"	1/4"x5/64"x3/64"
F-18	INSULATOR	1	11146	11146	11146	11146	11146
FF-16	HANDLE COMPENSATOR	1	1620-FF-16	1620-FF-16	1620-FF-16	1620-FF-16	1620-FF-16
F-11	Insulator	1	1620-F-11	1620-F-11	1620-F-11	1620-F-11	1620-F-11
	Compensator Adjusting Screw	1	1/4"-20x3/8" Hex.	1/4"-20x3/8" Hex.	1/4"-20x3/8" Hex.	1/4"-20x3/8" Hex.	1/4"-20x3/8" Hex.
	Compensator Lockwasher	1	1414 Shakeproof	1414 Shakeproof	1414 Shakeproof	1414 Shakeproof	1414 Shakeproof
HH-1	L. H. SOLENOID CASING COMPLETE	1	1620-HH-1	1620-HH-1	1620-HH-1	1623-HH-1	1623-HH-1
H	L. H. Solenoid Casing Only	1	1620-H	1620-H	1620-H	1623-H	1623-H
HH-2	VALVE CONDENSER COMPLETE	1	.....	.....	.....	1623-HH-2	1623-HH-2
K	Solenoid Cap	1	1620-K	1620-K	1620-K	1620-K	1620-K
MM-1	Solenoid Coil (Specify Volt.)	1	1620-MM-1	1620-MM-1	1620-MM-1	1620-MM-1	1620-MM-1
ZZ	L. H. CONNECTOR BLOCK COMPLETE	1	1620-ZZ	1620-ZZ	1620-ZZ	1620-ZZ	1620-ZZ
Z	L. H. Connector Block Only	1	1620-Z	1620-Z	1620-Z	1620-Z	1620-Z
X-1	Block Protector	1	1620-X-1	1620-X-1	1620-X-1	1620-X-1	1620-X-1
X-2	Contact Connector—Short	1	1620-X-2	1620-X-2	1620-X-2	1620-X-2	1620-X-2
X-3	Contact Connector—Long	1	1620-X-3	1620-X-3	1620-X-3	1620-X-3	1620-X-3
X-4	Contact Connector Screw	2	8-32x5/16" B. H.	8-32x5/16" B. H.	8-32x5/16" B. H.	8-32x5/16" B. H.	8-32x5/16" B. H.
X-5	Contact Connector Washer	2	1208 Shakeproof	1208 Shakeproof	1208 Shakeproof	1208 Shakeproof	1208 Shakeproof
X-6	Block Anchor Screw	2	6-32x3/4" R. H.	6-32x3/4" R. H.	6-32x3/4" R. H.	6-32x3/4" R. H.	6-32x3/4" R. H.
Z-7	Terminal Stamped "OFF"	1	1620-Z-7	1620-Z-7	1620-Z-7	1620-Z-7	1620-Z-7
JJ-1	R. H. SOLENOID CASING COMPLETE	1	1620-JJ-1	1620-JJ-1	1620-JJ-1	1623-JJ-1	1623-JJ-1
J	R. H. Solenoid Casing Only	1	1620-J	1620-J	1620-J	1623-J	1623-J
JJ-2	VALVE CONDENSER COMPLETE	1	.....	.....	.....	1623-JJ-2	1623-JJ-2
K	Solenoid Cap	1	1620-K	1620-K	1620-K	1620-K	1620-K
MM-1	Solenoid Coil	1	1620-MM-1	1620-MM-1	1620-MM-1	1620-MM-1	1620-MM-1
XX	R. H. CONNECTOR BLOCK COMPLETE	1	1620-XX	1620-XX	1620-XX	1620-XX	1620-X-3
X	R. H. Connector Block Only	1	1620-X	1620-X	1620-X	1620-X	1620-X
X-1	Block Protector	1	1620-X-1	1620-X-1	1620-X-1	1620-X-1	1620-X-1
X-2	Contact Connector—Short	1	1620-X-2	1620-X-2	1620-X-2	1620-X-2	1620-X-2
X-3	Contact Connector—Long	1	1620-X-3	1620-X-3	1620-X-3	1620-X-3	1620-X-3
X-4	Contact Connector Screw	2	8-32x5/16" B. H.	8-32x5/16" B. H.	8-32x5/16" B. H.	8-32x5/16" B. H.	8-32x1/4" B. H.
X-5	Contact Connector Washer	2	1208 Shakeproof	1208 Shakeproof	1208 Shakeproof	1208 Shakeproof	1208 Shakeproof
X-6	Block Anchor Screw	2	6-32x3/4" R. H.	6-32x3/4" R. H.	6-32x3/4" R. H.	6-32x3/4" R. H.	6-32x3/4" R. H.
X-7	Terminal Stamped "ON"	1	1620-X-7	1620-X-7	1620-X-7	1620-X-7	1620-X-7
LL	SOLENOID PLUNGER COMPLETE	1	1620-LL	1620-LL	1620-LL	1620-LL	1620-LL
L-1	Plunger Shock Washer	2	1620-L-1	1620-L-1	1620-L-1	1620-L-1	1620-L-1
S	SNAP SWITCH	1	1619-S	1619-S	1619-S	1619-S	1619-S
G-5	VALVE COVER COMPLETE	1	1619-GG	1620-GG	1621-GG	1623-GG	1624-GG
	Name Plate	1	10911	10911	10911	10911	10911
W	Solenoid Anchor Screw	4	.....	14-20x3/4" Fil. Hd.	14-20x3/4" Fil. Hd.	14-20x3/4" Fil. Hd.	14-20x3/4" Fil. Hd.
	Solenoid Anchor Lockwasher	4	.....	1414 Shakeproof	1414 Shakeproof	1414 Shakeproof	1414 Shakeproof

Nos. 1619-5, 1620-5, 1621-5, 1623-5, and 1624-5 Magnetic Valves



CONVERSION OF No. 1619 THERMOSTATIC WATER BY-PASS VALVES INTO No. 1619-5 TYPE



The No. 1619 Valves are converted similarly to the Nos. 1620 and 1624 Valves.

The new No. 1619-BB-40 Stem and Bonnet Assemblies should be ordered. The older No. 1619-CC-4 Bonnets complete can be converted into the No. 1619-BB-40 if returned in reasonable quantities, or the bonnets only, No. 1619-C-4 can be returned for re-machining into the new No. 1619-C-48 type.

It is recommended, although not essential, that the No. 1619-BB Valve Wing be used with the new No. 1619-BB-40 Assembly. This new wing, which includes the No. B-1 and No. B-5 discs or bearing plates is entirely different from the old No. 1619-B Wing.

LIST OF PARTS

SYM.	PART NO.	DESCRIPTION	AM'T	MATERIAL
1	1619-D-3	Washer (Packing Retainer)	1	Hard Brass
2	1620-B-44	Washer (Spring)	1	C.R.S. Cad. Pl't
3	1620-B-45	Pin (Cupwasher)	1	Drill Rod Cad. Pl't
4	1619-C-48	Bonnet	1	Brass
5	1620-D	Stuffing Nut	1	Brass
6	1620-D-2	Packing Spring	1	Stainless Steel
7	1620-BB-41	Valve Stem with Equalizer	1	
8		Packing	1	Candlewick

INSTRUCTIONS FOR TRAINMEN

Should these magnetic valves jam in either open or closed position, proceed as follows:

1. Move the compensator handle manually several times from open to closed position. This should free any obstruction and permit automatic operation.

   Obstruction in one of the steam valves will be indicated by flashing of the indicator light near the temperature control panels. By lifting the toggle switches "F.H." and "O.H." and returning them to the automatic position, one at a time, it can be determined which thermostatic circuit is affected. Each circuit may include one or more magnetic valves. The indicator light will stop flashing when the toggle switch for the valve circuit in trouble is lifted to the "Manual" position.

   If valve circuit cannot be freed by manually moving the compensator handle several times from "On" to "Off" position, and light continues or resumes frequent flashing, leave toggle switch for that circuit in "Manual" position and operate the valve or valves by hand for the remainder of the trip. Report trouble upon arrival at terminal.

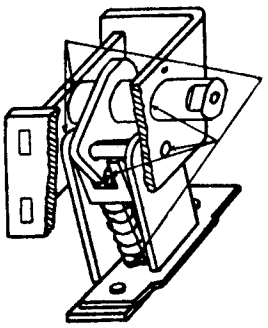
TERMINAL ATTENTION

If magnetic valve is reported as sticking, or is so found when tested, proceed as follows:

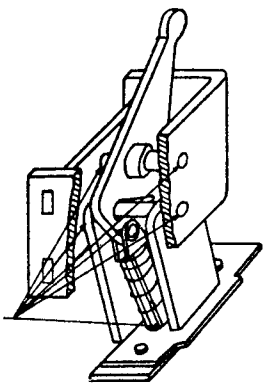
1. Remove cover and determine by manually moving the solenoid plunger, if the snap switch lever has been given sufficient movement by the compensator, so as to trip the snap switch contacts. If manually moving the solenoid plunger will not trip the contacts, loosen the compensator adjustment screw and readjust the compensator (striker arm), which has a small slot provided for the purpose of adjusting its movement. The compensator should be set to permit the snap switch to trip slightly before the end of the solenoid plunger travel in either direction. (Move the solenoid plunger by hand directly and not with compensator handle, when adjusting the compensator.)
2. Check the snap switch mechanism by operating it manually to determine if it trips the contacts. The contacts should be examined, if necessary, to see that they make proper contact. If switch stays on dead center it should be replaced and repaired.
3. Check for binding of valve stem which may be caused by packing adhering to the stem and stuffing nut, where packing is used.
4. Check for binding of the solenoid plunger, by moving the plunger to end of its travel in either direction. Solenoid plunger binding may be caused by improper alignment of the solenoids at time of valve installation.

MAINTENANCE

Magnetic valves should be overhauled before the beginning of each heating season. All the parts should be thoroughly cleaned to remove all dirt and scale. To clean valve wing and stem, place in undiluted boiler compound, such as Oakite No. 32. When effervescence stops, wash out in clear water. For the valve body, Oakite No. 32 should be poured into the wing chamber, about a pint of compound being used. Flush out, after effervescence stops, with about three pints of clear water. Inspect and properly adjust the snap switch, as indicated below:

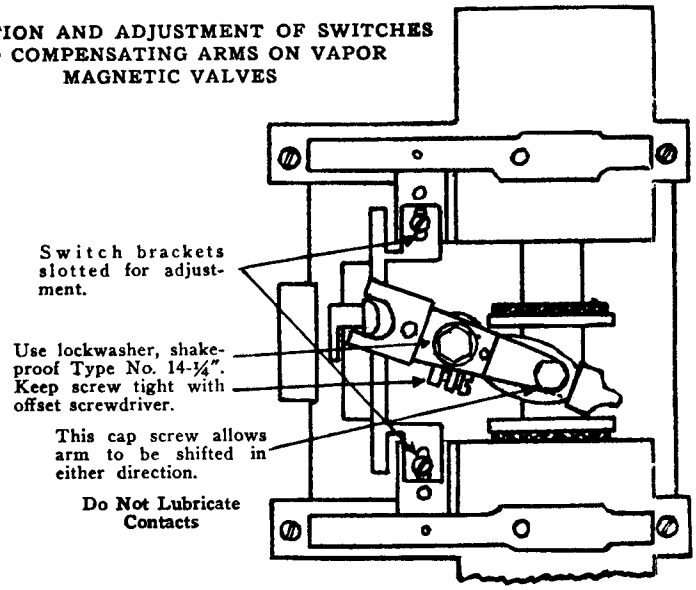


No. 1619-S Snap Switch Mechanism



No. 1620-S Snap Switch Mechanism

INSPECTION AND ADJUSTMENT OF SWITCHES AND COMPENSATING ARMS ON VAPOR MAGNETIC VALVES



Move solenoid plunger slowly by hand. Gauge distance plunger moves from each solenoid at time snap action of switch takes place. By shifting switch on slotted brackets and by shifting compensating arm adjust until switch trips with an equal amount of plunger travel in either direction.

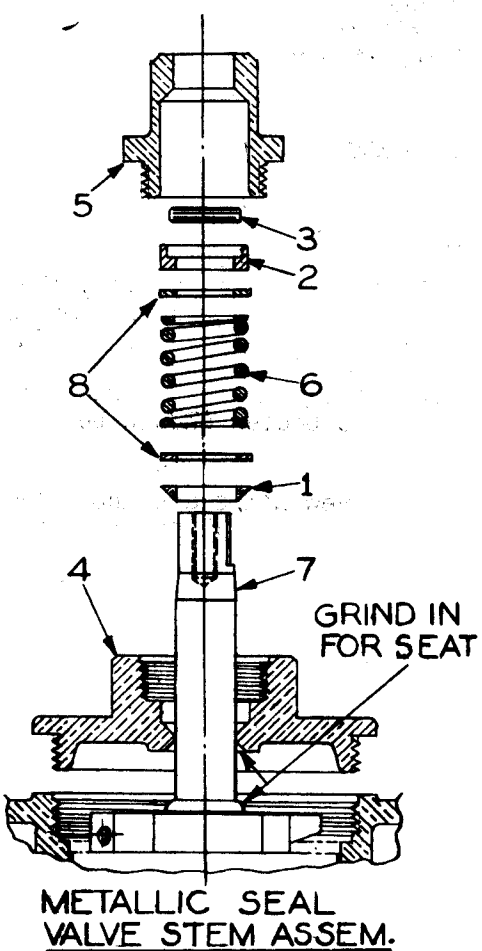
VAPOR CAR HEATING CO., INC.
RAILWAY EXCHANGE
CHICAGO

SEPTEMBER , 1941 BULLETIN NO. 61-112-1A

APPLICATION OF NO. 1620-BB-40 METALLIC SEAL VALVE STEM ASSEMBLY to NOS. 1620, 1621, 1623 and 1624 MAGNETIC VALVES.

(Note: This Bulletin Supersedes Information and Parts List Given on Metallic Seal Valve Stem Assembly in Bulletin 61-112-1.)

Improvement in operation and reduction in maintenance of Nos. 1620 to 1624 type Magnetic Vapor Cut-Out Valves may be obtained by application of the new packless type stem in combination with a re-machined bonnet, to provide a metallic seal and by durochrome plating of the valve wing. This eliminates repacking of stems, prevents valves from sticking, increases wear and overcomes possibility of steam short-circuiting when valve is in OPEN position.



METALLIC SEAL VALVE STEM ASSEM.

List of Parts

Sym.	Part No.	Description	Amt.
1	1620-B-43	Ring, Filler	1
2	1620-B-44	Washer, Cup	1
3	1620-B-45	Pin, Cupwasher	1
4	1620-C-11	Bonnet	1
5	1620-D	Stuffing Nut	1
6	1620-D-21	Packing Spring	1
7	1620-BB-41	Valve Stem with Equalizer	1
8	1619-D-3	Washer, Spring	1

When the complete assembly is purchased, all that is required is a substitution of the new assembly for the old one. The stem and bonnet are shipped ground in.

When the stems are ordered separately, i.e. the No. 1620-BB-41, the railroads must grind in the stem into the bonnet they machine and assemble.

INSTRUCTIONS FOR GRINDING

1. Mix cup grease with crocus powder to a thick paste.
2. Apply a small amount on ball face of stem.
3. Screw a stuffing nut into bonnet and apply stem without spring.
4. Fit stem into socket on electric grinding tool, which reverses automatically.
5. Start grinder and press bottom of stem against bonnet with fingers, lifting stem off of seat occasionally so grinding compound can work in.
6. Grind for about one minute, or enough to show a complete 45° angle ring on both bonnet and stem.
7. Wash with gasoline or suitable cleaner.
8. Apply a small amount of high temperature grease to both ends of spring and inside of cup washer.
9. Assemble and tighten stuffing nut.
10. Test with air or on steam for tightness.

Follow same procedure when grinding in by hand.

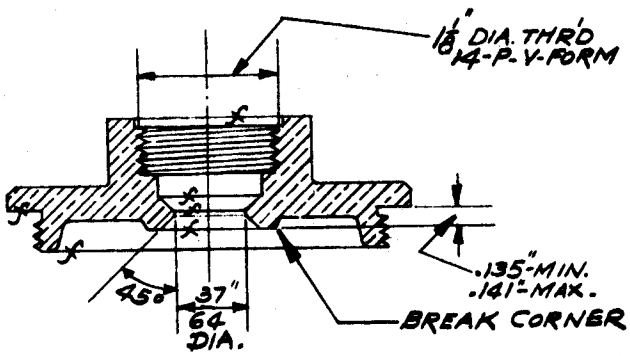
(Over)

LUBRICATION

Suprema ST-27 Valve Lubricant, obtainable from Vapor Car Heating Co., must be applied to all metallic valve stem assemblies, when application is made, also, periodically thereafter. This lubricant may be squirted around stem without disassembling any part. The lubricant will run down the stem and coat the washer and the spring, and thereby, should aid in keeping foreign matter from depositing, giving trouble-free operation.

REMACHINING BONNET

The old No. 1620-C Bonnets should be sent preferably to the Vapor Car Heating Co. for re-machining. Where railroad prefers to do its own machining, the drawing below should be followed.



NOTE: REMACHINED FROM NO 1620-C-BONNET.

VALVE WING

Where the new No. 1620-BB-40 Metallic Seal Valve Stem Assemblies are to be applied, the existing valve wings should be durochrome plated. This can be done at the Vapor Company's plant. When shipping wings to us for reconditioning and plating, they should be carefully packed to prevent damage in shipment. This plating process reduces friction in operation - contacting surfaces being of unlike metals; and the .002 in. diameter increase of wing prevents steam short-circuiting when in OPEN position. Valve bodies should be thoroughly cleaned before replacing plated wings.

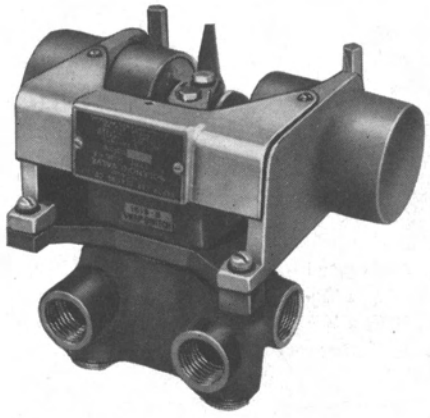
New durochrome wings can be supplied for magnetic valves. These new wings are known as No. 1620-B-21 for Nos. 1620 and 1623 valves; and for Nos. 1621 and 1624 valves the new plated wings are known as No. 1621-B-21.

Printed in U.S.A.

No. 1636 TYPE 5 and No. 1637 TYPE 5

MAGNETIC VAPOR CUT-OUT VALVES

¾" STANDARD I. P. S. FEMALE PIPE THREADS — WEIGHT 22 LBS.



GENERAL DESCRIPTION

The No. 1636 Type 5 and No. 1637 Type 5 Valves are magnetic vapor cut-out valves for use on thermostatically controlled vapor system installations for mounting above floor. These valves are vertically positioned and are of the rotable disc type.

The No. 1636 Magnetic Valve, with changes in piping, can replace the Nos. 1620 and 1621 Magnetic Valves, and is used on 32-volt D.C. installations only.

The No. 1637 Magnetic Valve is the same as the No. 1636 Magnetic Valve but with the addition of condensers for use on 64 volts D.C. and on 125 volts D.C. for suppressing the arc developed at these voltages at the snap switch contacts. The No. 1637 Valve can also be used on 32 volts D.C., where it is desired to use condensers at this voltage.

Both the Nos. 1636 and 1637 Valves, on account of being designed for above floor mounting, do not require any manual remote control operating mechanism. These valves are more compact and are designed primarily to prevent sticking in service due to excess pressures encountered in the feed cycle on the standard magnetic valves of Nos. 1620 and 1621 type. Free drainage is provided, at all times, from the radiating loop, with these valves.

OPERATION

These valves work as vapor cut-out valves in the conventional way. When in the closed or "off" position, the steam flows directly through the valve to the discharge pipe and thence back to the vapor regulator, which immediately acts to cut off the steam supply. When the cut-out valve is moved to the open or "on" position, the steam is shunted from the valve through a radiator or radiating loop and thence back to the valve, from which it passes through the discharge pipe, as before, together with the collected condensate, to the vapor regulator.

A manually operable lever is provided, the same as on Nos. 1620 to 1624 Magnetic Valves, to make possible manual operation, in the event of thermostatic failure.

The electrical valve operating mechanism is the same as on Nos. 1620 to 1624 Magnetic Valves, consisting of two opposing solenoids, which alternately swing the valve stem lever, and with it the valve disc, to "on" or "off" position, as the case may be, at the same time moving the snap switch lever to break the circuit established by the thermostat to the actuating solenoid and establish the snap switch contacts for the next energization of the opposing solenoid by the thermostat.

The steam is directed to the radiator or bypassed back to the vapor regulator by a rotable disc, which is held yieldably with its rear face in flat engagement with the valve seat, which constitutes the vertical rear wall of the valve body

(Continued on page 5)

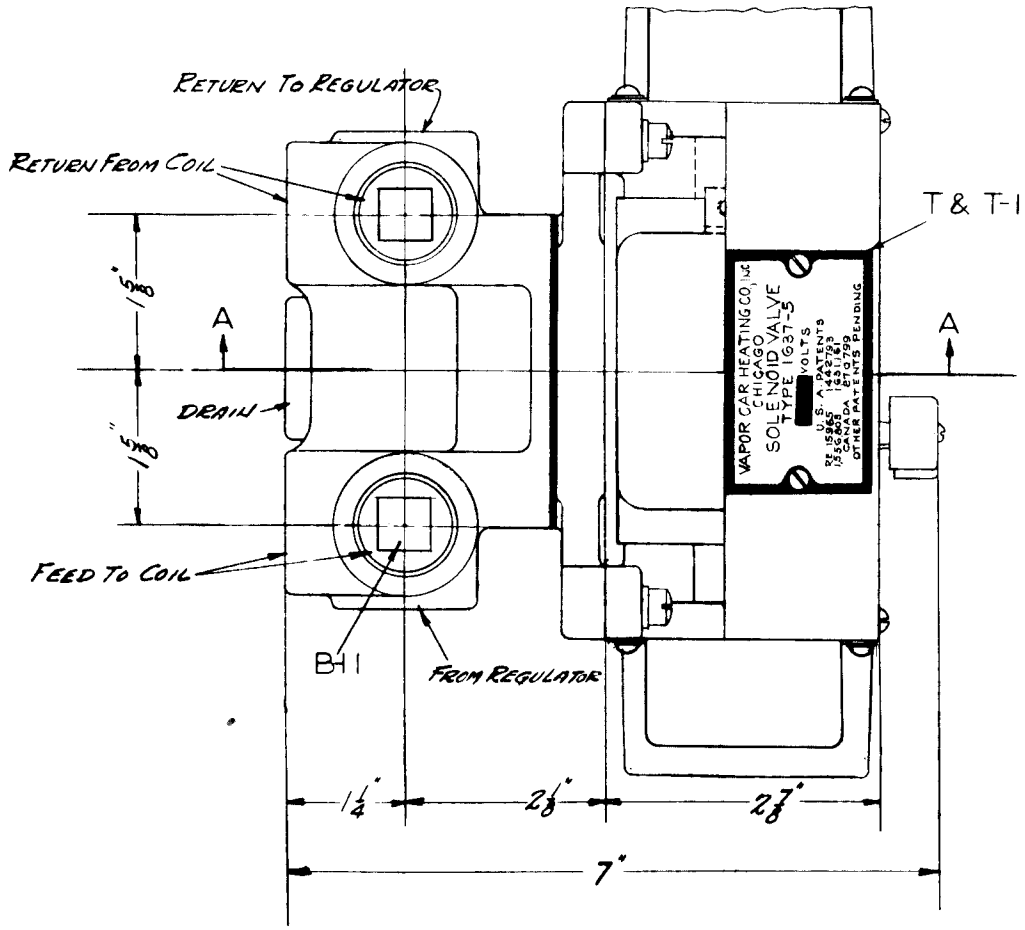
No. 1636 Type 5 and No. 1637 Type 5 MAGNETIC CUT-OUT VALVES

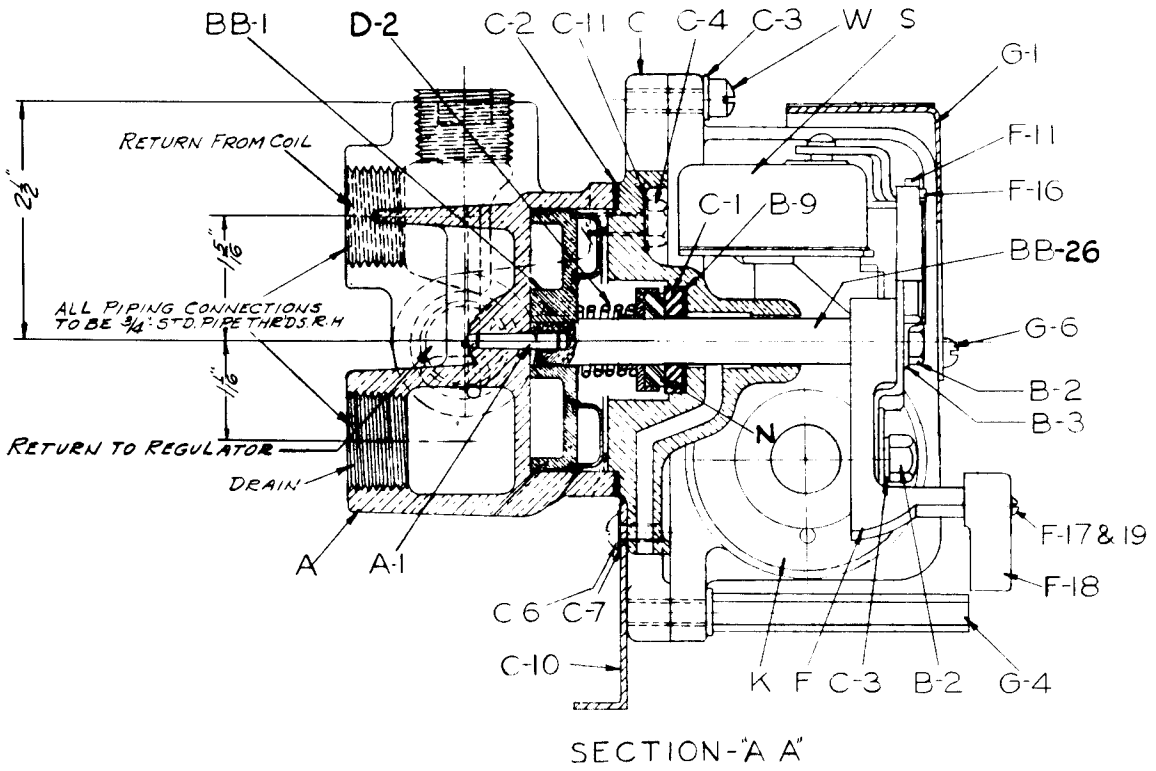
LIST OF PARTS

SYMBOL	1636 TYPE 5 PART NO.	1637 TYPE 5 PART NO.	DESCRIPTION	AM'T	MATERIAL
A	1638-A	1638-A	Body	1	Brass
A-1	1638-A-1	1638-A-1	Pilot (Stem)	1	Stainless Steel
BB-1	1638-BB-1	1638-BB-1	Disc, Complete	1	
BB-26	1638-BB-26	1638-BB-26	Stem, Complete	1	
B-1	1638-B-1	1638-B-1	Disc	1	Brass
B-2	¼"-20 x ⅜" lg.	¼"-20 x ⅜" lg.	Screw (Hex. Hd. Mach.)	2	St. C. P.
B-3	1620-B-3	1620-B-3	Lockwasher	1	St. C. P.
B-9	1638-B-9	1638-B-9	Gasket (Sealing Ring)	1	Neoprene
B-11	¾" Std.	¾" St'd.	Plug	2	Cast Iron
C	1638-C	1638-C	Cap	1	Brass
C-1	1638-C-1	1638-C-1	Ring (Sealing)	1	Stainless Steel
C-2	1638-C-2	1638-C-2	Gasket	1	Victor No. 4451
C-3	¼"-Shakeproof	¼"-Shakeproof	Lockwasher	5	Steel
C-4	5/16"-18 x ⅝" lg.	5/16"-18 x ⅝" lg.	Cap Screw (Hex. Hd.)	4	Everdur
C-6	No. 10-24 x ¼" lg.	No. 10-24 x ¼" lg.	Screw (Rd. Hd. Mach.)	2	St. C. P.
C-7	No. 10-Shakeproof	No. 10-Shakeproof	Lockwasher	2	St. C. P.
C-10	1636-C-10	1636-C-10	Support	1	H. R. Steel
C-11	5/16"-Shakeproof	5/16"-Shakeproof	Lockwasher	4	Steel
D-2	1620-D-2	1620-D-2	Spring	1	St. Steel
F-18	11146	11146	Insulator (Handle)	1	Bakelite
F	1638-F	1638-F	Handle	1	Bronze
F-11	1620-F-11	1620-F-11	Insulator (Compensator)	1	AA-Dilecto
F-16	1620-F-16	1620-F-16	Compensator	1	St. U. P.
F-17	No. 4-Shakeproof	No. 4-Shakeproof	Lockwasher	1	Steel
F-19	No. 4-36 x ⅜" lg.	No. 4-36 x ⅜" lg.	Screw (Rd. Hd. Mach.)	1	St. C. P.
G-1	1636-G-1	1636-G-1	Cover	1	St. U. P.
G-4	1638-G-4	1638-G-4	Stud (Solenoid Anchor)	2	St. C. P.
G-6	No. 8-32 x ¼" lg.	No. 8-32 x ¼" lg.	Screw (Binder Hd. Mach.)	2	St. C. P.
H	1620-H	1623-H	Casing (Solenoid Off)	1	C. I. C. P.
HH-2		1623-HH-2	Valve Condensor Complete	1	
J	1620-J	1623-J	Casing (Solenoid On)	1	C. I. C. P.
JJ-2		1623-JJ-2	Valve Condensor Complete	1	
K	1620-K	1620-K	Cap (Solenoid for H. & J.)	2	C. I. C. P.
L	1620-L	1620-L	Plunger (Solenoid)	1	C. I. C. P.
L-1	1620-L-1	1620-L-1	Shockwasher (Solenoid Plunger)	2	Asbestos
MM-1	1620-MM-1	1620-MM-1	Solenoid Coil, Complete	2	
N	124-N	124-N	Packing Ring	1	
S	1619-S	1619-S	Snap Switch	1	
T	1636-T	1637-T	Name Plate	1	Brass
T-1	No. 4-¼" Self-tapping	No. 4-¼" Self-tapping	Screw (Binder Hd.)	2	St. C. P.
W	No. ¼"-20 x 1⅛" lg.	No. ¼"-20 x 1⅛" lg.	Screw (Fil. Hd. Mach.)	2	St. C. P.
X	1620-X	1620-X	Connector Block, R. H., "ON"	1	Bakelite
X-1	1620-X-1	1620-X-1	Block Protector	2	Black Dilecto
X-2	1620-X-2	1620-X-2	Contact Connector, Short	2	Brass
X-3	1620-X-3	1620-X-3	Contact Connector, Long	2	Brass
X-4	No. 8-32 x 5/16" lg.	No. 8-32 x 5/16" lg.	Screw (Binder Hd. Mach.)	8	Br. C. P.
X-5	No. 8-Shakeproof	No. 8-Shakeproof	Lockwasher	2	Steel
X-6	No. 6-32 x ¾" lg.	No. 6-32 x ¾" lg.	Screw (Rd. Hd. Mach.)	4	St. C. P.
Z	1620-Z	1620-Z	Connector Block, L. H., "OFF"	1	Bakelite
Z-7	1620-Z-7	1620-Z-7	Terminal	3	Br. C. P.

NOTE: Specify voltage, when ordering Solenoid Coil or Complete Valve.

No. 1636 Type 5 and No. 1637 Type 5 MAGNETIC CUT-OUT VALVES





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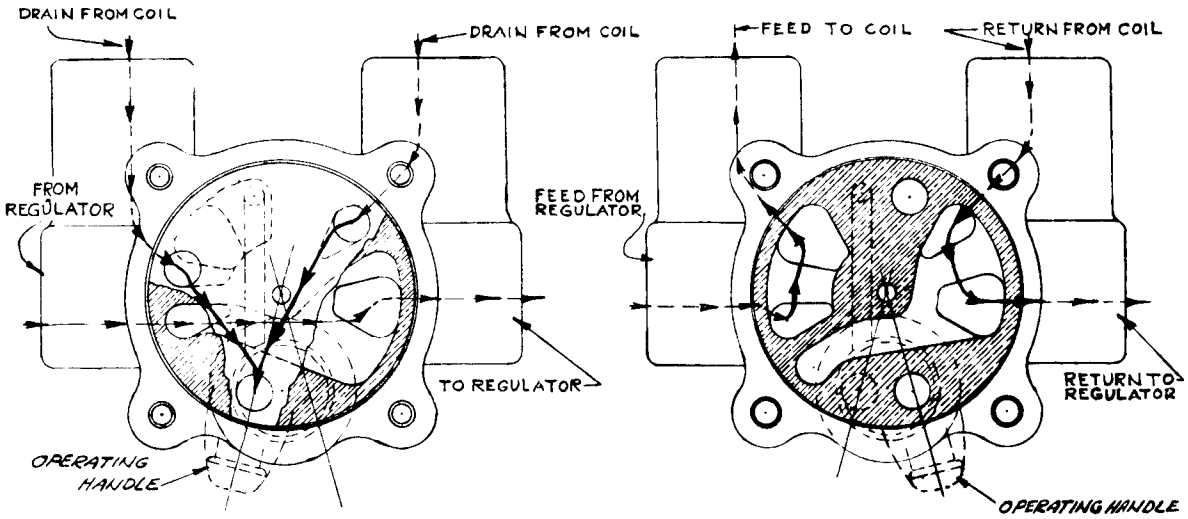
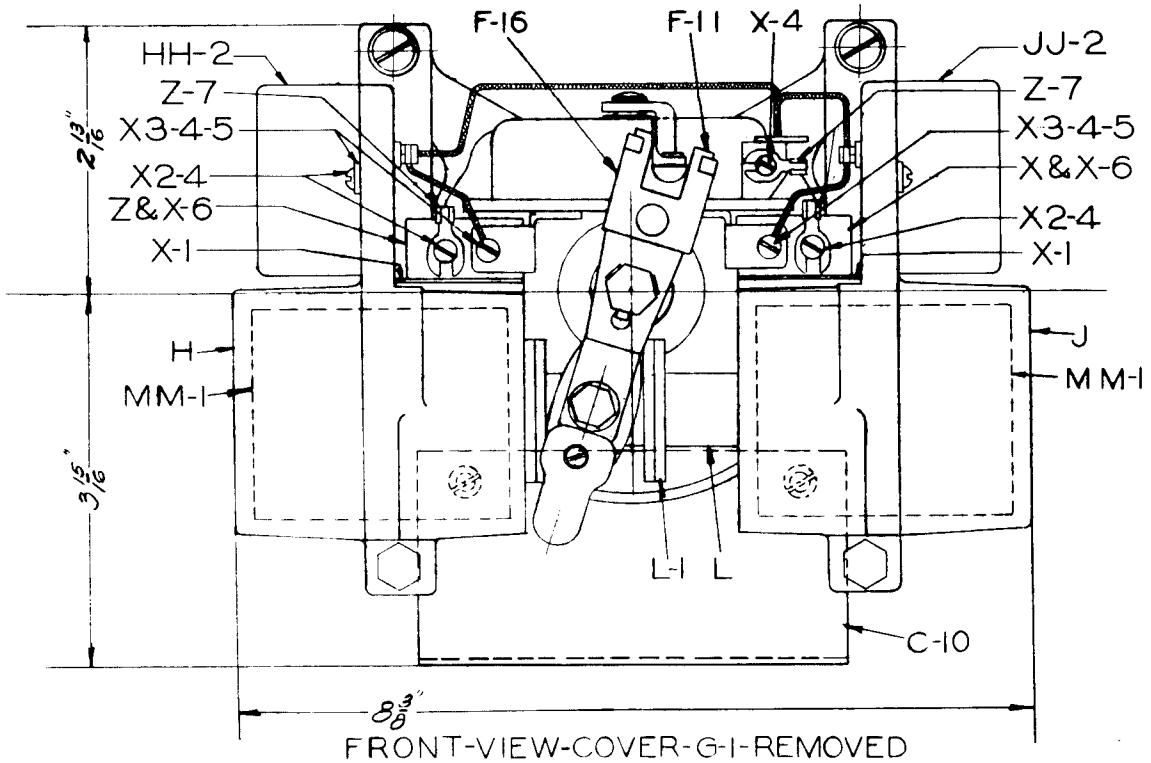


SHORT CIRCUIT POSITION

FEED POSITION



FRONT-VIEW-COVER-G-I-REMOVED

casing. Both the rotary valve disc and the valve seat have passages and recesses which cooperate collectively to conduct the steam to the proper ports in the "on" and "off" positions. In the "off" position, the radiator loop is shut off from the source of steam supply, but is connected with the drain outlet to drain the radiator from condensation.

The valve disc is oscillated through a small arc from the open or "on" position to the closed or "off" position or vice versa, by thermostatically actuated means engaging the outer portion of the shaft or valve stem. While the valve stem is made of brass, it is treated by the Duro-Chrome process to give it a hard, long wearing finish.

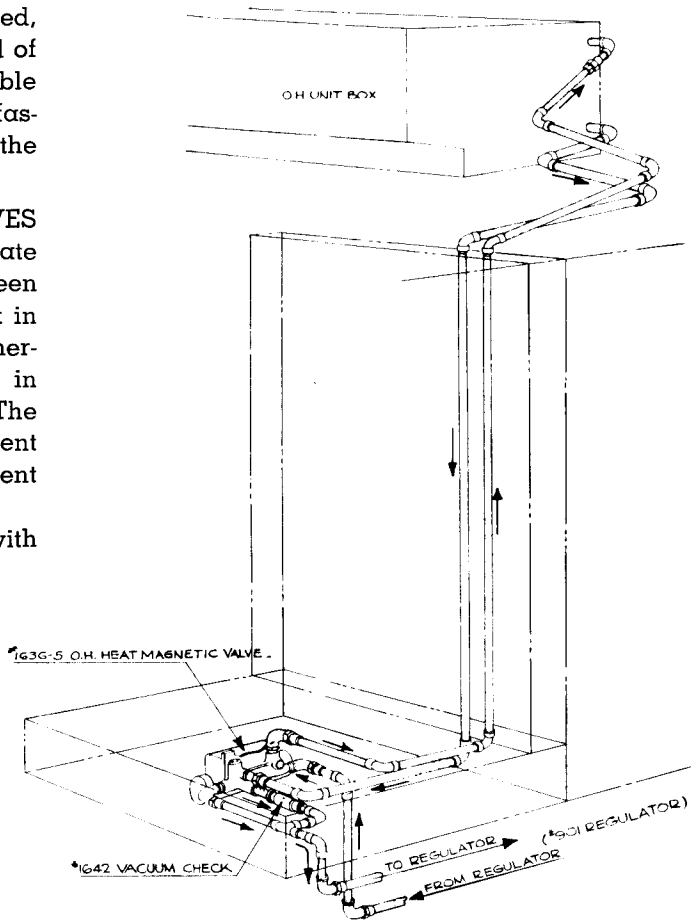
APPLICATION

These valves are mounted above floor or in floor box. It is important that these valves be mounted on their side, i.e., vertically, in order to get drainage through the body casing and disc.

When mounted in floor box, solenoids can be removed easily, as hexagon studs are used, which can be loosened with a wrench instead of a screw driver. Mounting screws are accessible with a short screw driver. The base plate fastened to the valve body casing is used as the back side of the valve box.

WHERE TWO OR MORE MAGNETIC VALVES ARE USED IN SERIES, the No. 906 Condensate Relief Valve is used in the piping between valves, in order to permit water to drain out in these portions of the system that might otherwise remain pocketed, when the car is not in service and the steam supply is cut off. The relief valve will remain tightly closed to prevent escape of any steam, as long as steam is present in the system.

For other application recommendations with regards to allowance for drainage pitch, allowances for expansion in piping, dust covers, trenching, valve boxes and valve wire, see Bulletin 61-112 on Nos. 1619 to 1624 Magnetic Valves.



INSTRUCTIONS FOR TRAINMEN

Should these valves jam or stick in either open or closed position, proceed, as follows:

1. Move the compensator lever handle manually several times from the open to closed position. This should free any obstruction and permit automatic operation.

Obstruction in one of the steam valves will be indicated by flashing of the Indicator Light near the Temperature Control Panels. By lifting the Toggle Switches "F.H." and "O.H." and returning them to the automatic position, one at a time, it can be determined which thermostatic circuit is affected. Each circuit

may include one or more magnetic valves. The Indicator Light will stop flashing, when the Toggle Switch for the valve circuit in trouble is lifted to the "Manual" position.

2. If valve circuit cannot be freed by manually moving the compensator handle several times from "ON" to "OFF" position, and light continues or resumes frequent flashing, leave Toggle Switch for that circuit in "Manual" position and operate the valve or valves by hand for the remainder of the trip. Report trouble upon arrival at terminal.

MAINTENANCE

All magnetic vapor cut-out valves should be overhauled once a year, before the beginning of the heating season.

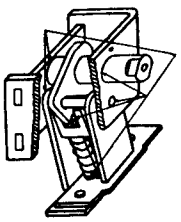
The chamber in the valve body casting constituting the valve seat and the valve disc should be carefully cleaned.

The rotary sealing arrangement should be checked for effectiveness and where the valve stem with bellows sealing arrangement is used, it should be replaced by the No. 1638-BB-26 Stem Complete and the No. 1620-D-2 Packing Spring. The new stem includes a packing ring. At the same time the No. 1620-F Valve Handle should be substituted by the No. 1638-F Valve Handle.

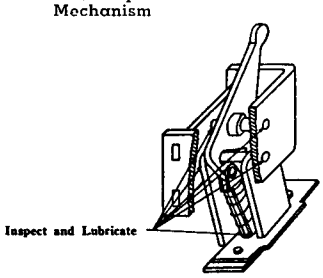
The stainless steel sealing ring in the bonnet should be checked to see that it is tightly cemented in bonnet. This ring must be re-cemented with Neoprene, if necessary.

When valves are reported or found stuck or jammed in either open or closed position, they should be given the following attention:

1. Remove cover and determine by manually moving the solenoid plunger, if the snap switch lever has been given sufficient movement by the compensator, so as to trip the snap switch contacts. If manually moving the solenoid plunger will not trip the contacts, loosen the compensator adjustment screw and readjust the compensator (striker arm), which has a small slot provided for the purpose of adjusting its movement. The compensator should be set to permit the snap switch to trip slightly before the end of the solenoid plunger travel in either direction. (Move the solenoid plunger by hand directly and not with compensator handle, when adjusting the compensator.)
2. Check the snap switch mechanism by operating it manually to determine if it trips the contacts. The contacts should be examined, if necessary, to see that they make proper contact. If switch stays on dead center, it should be replaced and repaired.
3. Check for binding of valve stem, which may be caused by faulty sealing arrangement. The sealing arrangement should be cleaned and replaced if necessary. If the stainless steel sealing ring is loose in bonnet it should be recemented with Neoprene. Valve stem packing ring may have to be replaced.
4. Check for binding of the solenoid plunger, by moving the plunger to end of its travel in either direction. Solenoid plunger binding may be caused by improper alignment of solenoids at time of valve installation.

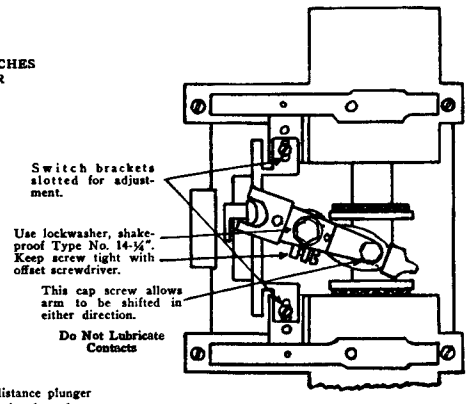


No. 1619-S Snap Switch Mechanism



No. 1620-S Snap Switch Mechanism

INSPECTION AND ADJUSTMENT OF SWITCHES AND COMPENSATING ARMS ON VAPOR MAGNETIC VALVES

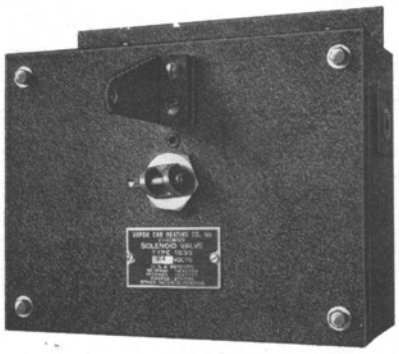


Move solenoid plunger slowly by hand. Gauge distance plunger moves from each solenoid at time snap action of switch takes place. By shifting switch on slotted brackets and by shifting compensating arm adjust until switch trips with an equal amount of plunger travel in either direction.

No. 1638 TYPE 5 AND No. 1639 TYPE 5

MAGNETIC VAPOR CUT-OUT VALVES

¾" STANDARD I.P.S. FEMALE PIPE THREADS — WEIGHT 30 LBS.



Nos. 1638 and 1639

Type 5 VAPOR Cut-Out Valves

GENERAL DESCRIPTION

The No. 1638 Type 5 and No. 1639 Type 5 Valves are Magnetic Vapor Cut-Out Valves designed primarily for use under the floor of a car. These valves are of the same type as the No. 1636 and No. 1637, respectively, except that they are completely enclosed and are used on thermostatically controlled Vapor System installations in conjunction with a Flexible Remote Control Mechanism for manual operation from inside the car, should manual operation be required due to thermostatic failure.

The valve mechanism consists of a rotary disc rotating against the bottom wall of the valve body casing which constitutes the seat.

These valves overcome sticking encountered in the feed cycle on standard magnetic valves of the 1620 and 1621 type and provide free drainage from the radiating loop at all times.

The No. 1638 Type 5 with no condensors is for use on 32-volt D.C. installations.

The No. 1639 Type 5 Magnetic Valve with Condensors is for use on 64 volts D.C. and on 125 volts D.C. for suppressing the arc developed at these voltages at the snap switch contacts. This valve can also be used on 32 volts D.C., where it is desired to use condensors at this voltage.

OPERATION

These valves work as Vapor Cut-Out Valves in the conventional way. When in the closed or "off" position, the steam flows directly through the valve to the discharge pipe and thence back to the Vapor Regulator, which immediately acts to cut off the steam supply. When the cut-out valve is moved to the open or "on" position, the steam is shunted from the valve through a radiator or radiating loop and thence back to the valve, from which it passes through the discharge pipe, as before, together with the collected condensate, to the Vapor Regulator.

The electrical valve operating mechanism is the same as on Nos. 1620 to 1624 Magnetic Valves, consisting of two opposing solenoids, which alternately swing the valve stem lever, and with it the valve disc, to "on" or "off" position, as the case may be, at the same time

No. 1638 TYPE 5 and No. 1639 TYPE 5
MAGNETIC VAPOR CUT-OUT VALVES

OPERATION (Cont.)

moving the snap switch lever to break the circuit established by the thermostat to the actuating solenoid and establish the snap switch contacts for the next energization of the opposing solenoid by the thermostat.

The steam is directed to the radiator or bypassed back to the Vapor Regulator by a rotable disc, which is held yieldably with its rear face in flat engagement with the valve seat, which constitutes the vertical rear wall of the valve body casing. Both the rotary valve disc and the valve seat have passages and recesses which cooperate collectively to conduct the steam to the proper ports in the "on" and "off" positions. In the "off" position, the radiator loop is shut off from the source of steam supply, but is connected with the drain outlet to drain the radiator from condensation.

The valve disc is oscillated through a small arc from the open or "on" position to the closed or "off" position, or vice-versa, by thermostatically actuated means engaging the outer portion of the shaft or valve stem. While both the valve disc and the valve stem are made of brass, they are treated by the Duro-Chrome process to give them a hard, long-wearing finish.

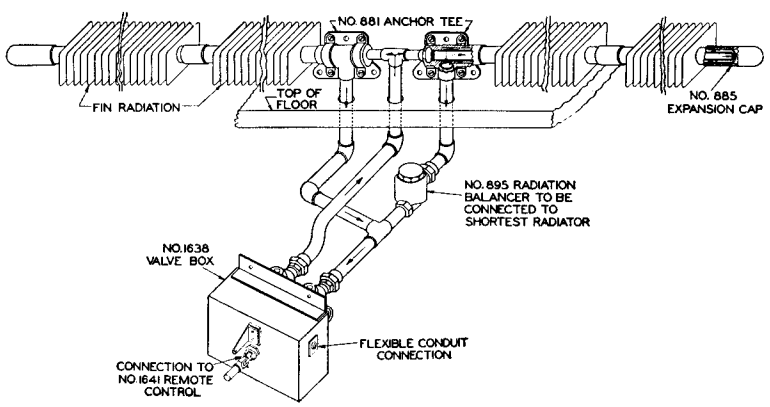
Inside the sealed valve box is a quadrant mechanism held centrally in the clear from the valve handle. This mechanism is attached by means of universal joints to a flexible cable, which goes up through the floor of the car and is operated manually, when necessary, by means of a handle or berth key arrangement on the floor of the car. Rotary motion of the flexible cable by turning the handle or berth key arrangement on floor of car moves the mechanism in the valve box to engage the valve operating handle, turning it "on" or "off". The quadrant mechanism operating arrangement in the valve box has a spring centering feature, so that when the valve has been manually moved to the "on" or "off" position, the levers inside the box are left in the clear for free magnetic operation. The handle on the floor will be returned to the neutral or central position.

APPLICATION

These valves, which come completely housed in boxes for application under floor of car, are so made that they constitute the support for both the valve and the piping. The box is so constructed that it can be readily removed for inspection and maintenance. The valve must be positioned vertically and not horizontally. Below is an example of an application on unit fin radiation installations:

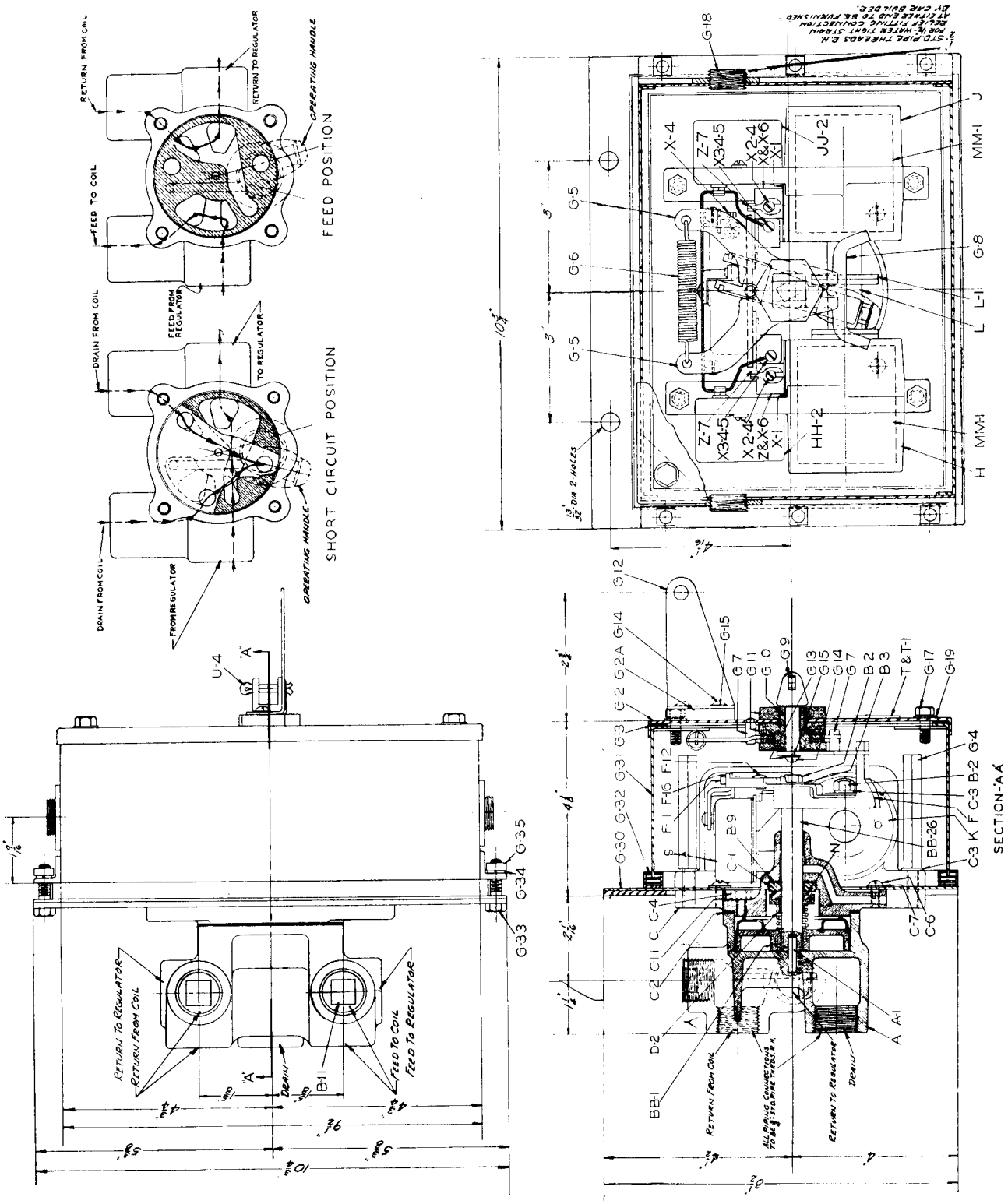
Where two or more of these magnetic valves are used in series, a No. 896, or preferably the No. 906 Condensate Relief Valve is used in the piping between valves, in order to permit water to drain out in these portions of the system that might otherwise remain pocketed, when the car is not in service and the steam supply is cut off. The relief valve will remain tightly closed to prevent escape of any steam, as long as steam is present in the system.

For other application recommendations with regards to allowance for drainage pitch, use of No. 1650 Strainer Tee, allowances for expansion in piping, and type of valve wire to use, see Bulletin 61-112 on Nos. 1619 to 1624 Magnetic Valves.



No. 1638 TYPE 5 and No. 1639 TYPE 5

MAGNETIC VAPOR CUT-OUT VALVES



LIST OF PARTS

SYMBOL	1638 TYPE 5 PART NO.	1639 TYPE 5 PART NO.	DESCRIPTION
A	1638-A	1638-A	Body
A-1	1638-A-1	1638-A-1	Pilot (Stem)
BB-1	1638-BB-1	1638-BB-1	Disc Complete
BB-26	1638-BB-26	1638-BB-26	Stem Complete
B-2	1/4"-20x3/8" lg.	1/4"-20x3/8" lg.	Screw (Hex. Hd. Mach.)
B-3	1620-B-3	1620-B-3	Lockwasher
B-9	1638-B-9	1638-B-9	Gasket (Sealing Ring)
B-11	3/4"—Std. Pipe	3/4"—Std. Pipe	Plug Countersunk (Valve Body)
C	1638-C	1638-C	Cap
C-1	1638-C-1	1638-C-1	Ring (Sealing)
C-2	1638-C-2	1638-C-2	Gasket
C-3	1/4"—Shakeproof	1/4"—Shakeproof	Lockwasher
C-4	5/16"-18x5/8" lg.	5/16"-18x5/8" lg.	Cap Screw (Hex. Hd.)
C-6	No. 10—24x1/4" lg.	No. 10—24x1/4" lg.	Screw (Rd. Hd. Mach.)
C-7	No. 10—Shakeproof	No. 10—Shakeproof	Lockwasher
C-11	5/16"—Shakeproof	5/16"—Shakeproof	Lockwasher
D-2	1620-D-2	1620-D-2	Spring
F	1638-F	1638-F	Handle
F-11	1620-F-11	1620-F-11	Insulator (Compensator)
F-12	3/16"x23/64" Hd. x 3/8" lg.	3/16"x23/64" Hd. x 3/8" lg.	Rivet
F-16	1620-F-16	1620-F-16	Compensator (Handle)
GG	1638-5-GG	1638-5-GG	Box Complete
G-2	1638-G-2	1638-G-2	Cover (Box)
G-2-A	1638-G-2-A	1638-G-2-A	Plate (Support Mounting)
G-3	1638-G-3	1638-G-3	Gasket (Box Cover)
G-4	1638-G-4	1638-G-4	Stud (Solenoid Anchor)
G-5	1638-G-5	1638-G-5	Lever
G-6	1638-G-6	1638-G-6	Spring (Lever)
G-7	1638-G-7	1638-G-7	Pin (Lever & Yoke Stop)
G-8	1638-G-8	1638-G-8	Yoke (Valve Handle)
G-9	1638-G-9	1638-G-9	Stem (Yoke)
G-10	1638-G-10	1638-G-10	Bushing (Yoke Stem)
G-11	1638-G-11	1638-G-11	Locknut (Yoke Stem Bushing)
G-12	1638-G-12	1638-G-12	Support (Flexible Shaft)
G-13	No. 10x7/16"-O.D.	No. 10x7/16"-O.D.	Plain Washer
G-14	No. 10-24x1/4" lg.	No. 10-24x1/4" lg.	Screw (Valve Handle Yoke)
G-15	No. 10—Shakeproof	No. 10—Shakeproof	Lockwasher (Valve Handle Yoke)
G-17	1/4"—20 x 1/2" lg.	1/4"—20 x 1/2" lg.	Screw (Cover) (Hex. Hd.)
G-18	1/2" Std. Pipe	1/2" Std. Pipe	Plug Countersunk (Box)
G-19	No. 14x9/16"-O.D.	No. 14x9/16"-O.D.	Plain Washer
G-30	1638-G-30	1638-G-30	Plate (Mounting)
G-31	1638-G-31	1638-G-31	Box (Valve)
G-32	1638-G-32	1638-G-32	Gasket
G-33	1/4"—20 x 1" lg.	1/4"—20 x 1" lg.	Cap Screw (Hex. Hd.)
G-34	1/4"—Split Type	1/4"—Split Type	Lockwasher
G-35	1/4"—20, Square	1/4"—20, Square	Nut
H	1620-H	1623-H	Casing Solenoid "Off"
J	1620-J	1623-J	Casing Solenoid "On"
K	1620-K	1620-K	Cap, Solenoid (for "H. & J.")
L	1620-L	1620-L	Plunger (Solenoid)
L-1	1620-L-1	1620-L-1	Shockwasher (Solenoid Plunger)
MM-1	1620-MM-1	1620-MM-1	Solenoid Coil Complete
N	124-N	124-N	Packing Ring
S	1619-S	1619-S	Snap Switch Complete
T	1638-T	1639-T	Name Plate
T-1	No. 4x1/4" B. H. Self-tapping	No. 4x1/4" B. H. Self-tapping	Screw (Name Plate) (Binder Hd.)
U-4	3/16" Dia. x 1 1/8" lg.	3/16" Dia. x 1 1/8" lg.	Cotter Pin
X	1620-X	1620-X	Connector Block ("ON")
X-1	1620-X-1	1620-X-1	Block Protector
X-2	1620-X-2	1620-X-2	Contact Connector, Short
X-3	1620-X-3	1620-X-3	Contact Connector, Long
X-4	No. 8—32 x 5/16" lg.	No. 8—32 x 5/16" lg.	Screw (Binder Hd. Mach.)
X-5	No. 8—Shakeproof	No. 8—Shakeproof	Lockwasher
X-6	No. 6—32x3/4" lg.	No. 6—32x3/4" lg.	Screw (Rd. Hd. Mach.)
Z	1620-Z	1620-Z	Connector Block ("OFF")
Z-7	1620-Z-7	1620-Z-7	Terminal
HH-2		1623-HH-2	Valve Condensor Complete
JJ-2		1623-JJ-2	Valve Condensor Complete

NOTE: Specify voltage when ordering Solenoid Coil or Complete Valve.

No. 1638 TYPE 5 and No. 1639 TYPE 5
MAGNETIC VAPOR CUT-OUT VALVES

INSTRUCTIONS FOR TRAINMEN

Should these valves jam or stick in either open or closed position, as indicated by flashing of the Indicator Light near the Temperature Control Panels, proceed as follows:

1. Lift the toggle switches "F.H." and "O.H." to the automatic position, and return them to the "automatic" position, one at a time, to determine which thermostatic circuit is affected. Each circuit may include one or more magnetic valves. The Indicator Light will stop flashing, when the toggle switch for the valve circuit in trouble is lifted to the "manual" position.
2. Move the remote control operating attachment handle or lever on floor of car from open to closed position, or vice-versa, several times. Use berth key on berth key slot, where lever or handle is not applied. Several such movements should free the obstruction and permit automatic operation.
3. If valve circuit cannot be freed by manually moving the handle or key on floor of the car several times from "on" to "off" position, and light continues or resumes frequent flashing, the toggle switch for the valve circuit in trouble should be placed in "manual" position and the valve or valves operated by hand for remainder of the trip by means of the remote control mechanism. Report trouble upon arrival at terminal.

OPERATION OF REMOTE MANUAL CONTROL

TO MANUALLY OPEN the Magnetic Cut-out Valve, move the remote control operating handle about a one-quarter (¼) turn to the RIGHT, as far as it will go and allow it to return to center. TO MANUALLY CLOSE the Magnetic Cut-out Valve, move the remote control operating handle about a one-quarter (¼) turn to the LEFT, as far as it will go, and allow it to return to center.

Where a berth key or a berth key type lever is used, move the lever or berth key about a one-quarter (¼) turn in the same direction as a globe valve to either open or close the magnetic valve manually.

NOTE: The handle or key arrangement of the remote control cable does not stay in either open or closed position, but returns to normally central position. Therefore, it is not possible to tell whether the magnetic valve is open or closed by the position of the remote control operating handle or key end.

MAINTENANCE

All magnetic vapor cut-out valves should be overhauled once a year, before the beginning of the heating season.

The chamber in the valve body casting constituting the valve seat and the valve disc should be thoroughly cleaned.

The rotary sealing arrangement should be checked for effectiveness. Where valve stem with bellows sealing arrangement is used, it should be replaced by the No. 1638-BB-26 Stem Complete and the No. 1620-D-2 Packing Spring. The new stem includes a packing ring. At the same time the No. 1620-F Valve Handle should be substituted by the No. 1638-F Valve Handle.

The stainless steel sealing ring in the bonnet should be checked to see that it is tightly cemented in the bonnet. This ring must be recemented with Neoprene, if necessary.

When valves are reported or found stuck or jammed in either open or closed position, they

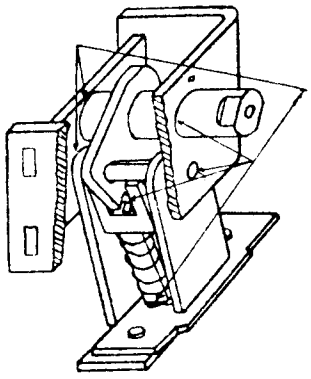
No. 1638 TYPE 5 and No. 1639 TYPE 5
MAGNETIC VAPOR CUT-OUT VALVES

MAINTENANCE (Cont.)

should be given the following attention:

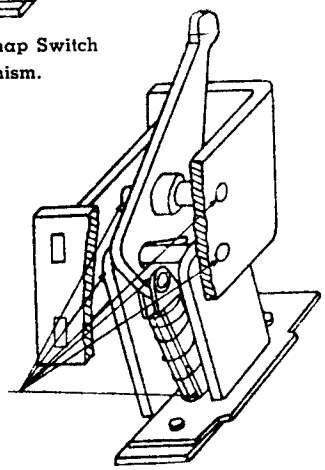
1. Remove cover and determine by manually moving the solenoid plunger, if the snap switch lever has been given sufficient movement by the compensator, so as to trip the snap switch contacts. If manually moving the solenoid plunger will not trip the contacts, loosen the compensator adjustment screw and readjust the compensator (striker arm), which has a small slot provided for the purpose of adjusting its movement. The compensator should be set to permit the snap switch to trip slightly before the end of the solenoid plunger travel in either direction. (Move the solenoid plunger by hand directly and not with compensator handle, when adjusting the compensator.)
2. Check the snap switch mechanism by operating it manually to determine if it trips the contacts. The contacts should be examined, if necessary, to see that they make proper contact. If switch stays on dead center, it should be replaced or repaired.
3. Check for binding of valve stem, which may be caused by faulty sealing arrangement. The sealing arrangement should be cleaned and replaced, if necessary. If the stainless steel sealing ring is loose in bonnet it should be recemented with Neoprene. Valve stem packing ring may have to be replaced.
4. Check for binding of the solenoid plunger, by moving the plunger to end of its travel in either direction. Solenoid plunger binding may be caused by improper alignment of solenoids at time of valve installation.

INSPECTION AND ADJUSTMENT OF SWITCHES AND COMPENSATING ARMS ON VAPOR MAGNETIC VALVES



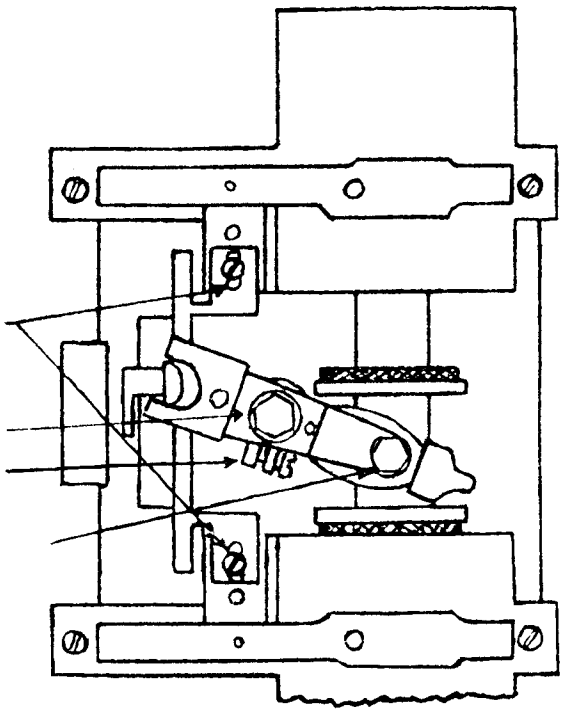
Lubricate these six points after inspecting same for excessive wear. Use a high temperature grease known as "Lubriplate."

No. 1619-S Snap Switch Mechanism.



Inspect and lubricate.

No. 1620-S Snap Switch Mechanism.



Switch brackets slotted for adjustment.

Use lockwasher, shakeproof type No. 14, ¼". Keep screw tight with an offset screwdriver.

This cap screw allows arm to be shifted in either direction.

Do Not Lubricate Contacts

Move solenoid plunger slowly by hand. Gauge distance plunger moves from each solenoid at time snap action of switch takes place. By shifting switch on slotted brackets and by shifting compensating arm adjust until switch trips with an equal amount of plunger travel in either direction.

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SHUT-OFF AND DRAIN VALVES
Nos. S-124, 132 and 143

1" INLET
1" OUTLET

MAXIMUM PRESSURE
300 LBS.

No. S-124 Shut-off and Drain Valve

No. 132 Shut-off and Drain Valve

No. 143 Shut-off and Drain Valve

GENERAL DESCRIPTION

Shut-off and Drain Valves are used between the trainline and Vapor Regulators to provide a positive shut-off of steam to the heating system during summer months, when no heat is desired inside the car but when steam is carried through the trainline for heating wash water, or for steam ejector cooling systems. They also provide a means of repairing a single regulator without shutting the steam off from the entire car.

Each of the three shut-off and drain valves has been designed for a particular purpose so that any kind of an installation may be made. The No. S-124 globe type valve is made for horizontal positions, as is the No. 132. However, the No. 132 angle type is used in a location where the piping forms a right angle. The No. 143 globe type valve is used in vertical positions.

Each of the shut-off and drain valves is equipped with a small drain port which must be situated so that it points to the ground. In this position, condensate from the regulator head and piping will drain back to the valve and be discharged to the ground when the valve is closed. This feature prevents freezing and the formation of rust in the regulator when the loop is not in use. Be sure that the valve is installed so that the steam flows through it in the direction indicated by the arrow cast in the metal of the valve body.

If it is desirable to operate the No. S-124 or 132 valves from inside the car, a No. 124-PP valve operating mechanism (see picture below) may be used to provide control of the valve from a remote point. This device consists of a coupling, a gear box and a floor plate; the connecting rods must be furnished by the railroad. A No. 143-YY universal joint is used with the No. 143 valve for this purpose.

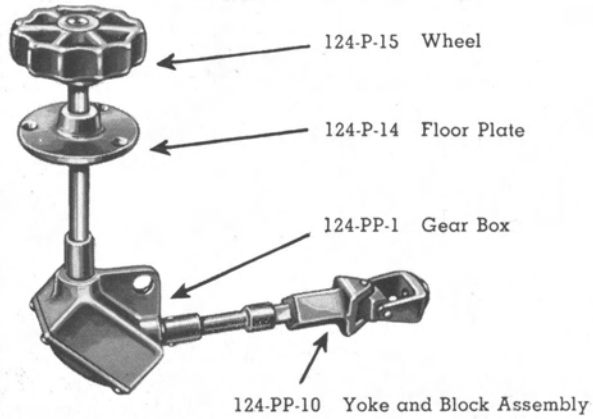
Also available, as shown, are various types of wheel handles with letters cast in the metal to indicate the use of a loop controlled by a particular valve. Wheels with the letters OH for overhead heat, HW for hot water, SL for steam loop or AF for anti-freeze are made for this purpose.

OVERHAUL

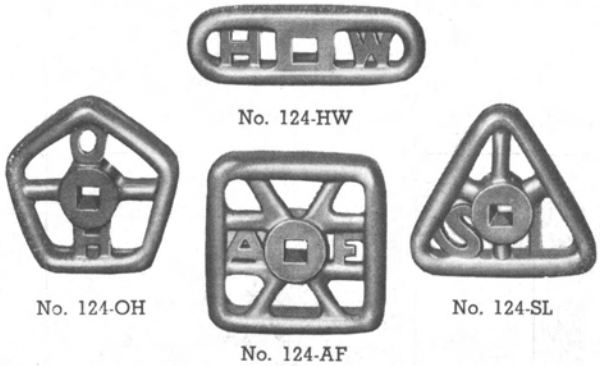
The shut-off and drain valves should be overhauled at least once every two years. Disassemble the valve by removing the wheel nut, the stuffing box and the bonnet ring and taking out the stem, the main disc and the blow-off disc.

Each part should be cleaned and inspected for wear. Replace any parts showing excessive wear or distortion. Check the discs and seats to be sure that they have not scored or become wire-drawn.

When the No. 143 valve is being inspected, be sure that the blow-off valve lever moves freely and that the blow-off valve spring has retained its proper tension. A spring which has lost its tension should be replaced.



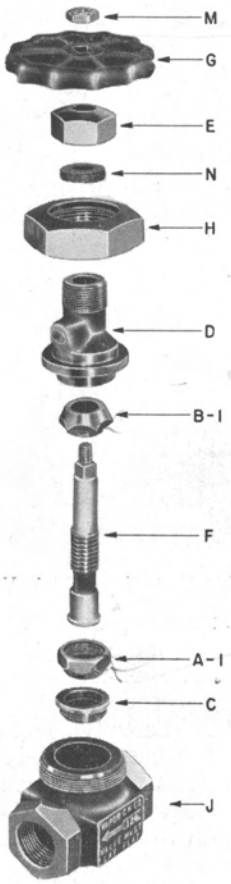
No. 124-PP Valve Operating Mechanism



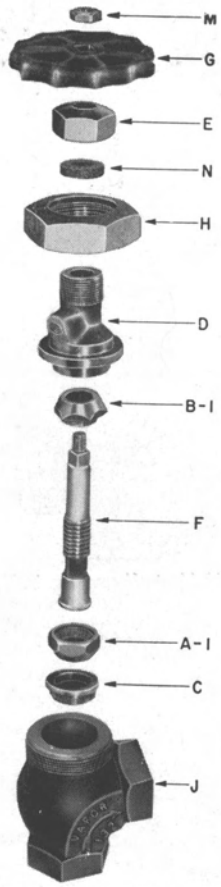
No. 124-HW
No. 124-OH
No. 124-AF
No. 124-SL

Wheels for No. S-124 Shut-off and Drain Valve Denoting Use.

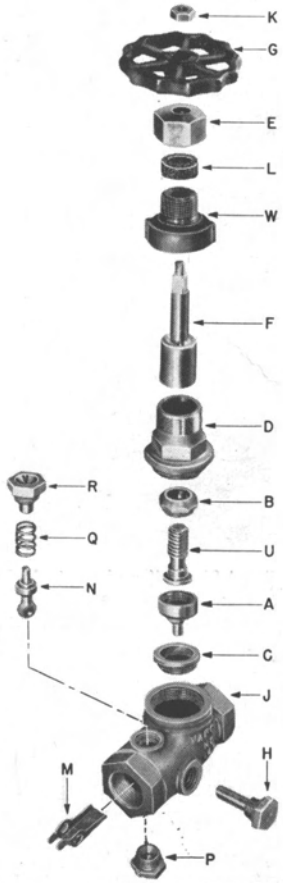
SHUT-OFF AND DRAIN VALVES Nos. S-124, 132 and 143 (cont.)



Exploded View—No. S-124 Shut-off and Drain Valve



Exploded View—No. 132 Shut-off and Drain Valve



Exploded View—No. 143 Shut-off and Drain Valve

LIST OF PARTS

NO. S-124 SHUT-OFF AND DRAIN VALVE

Sym.	Part No.	Description	Amt.
A-1	124-A-1	Disc	1
B-1	124-B-1	Blow-off Disc	1
C	124-C	Seat Ring	1
D	124-D	Bonnet	1
E	124-E	Stuffing Box	1
F	124-F	Stem	1
G	124-G	Wheel	1
H	124-H	Bonnet Ring	1
J	124-J	Body	1
M	120-K	Nut (Wheel)	1
N	124-N	Packing Ring	1

NO. 132 SHUT-OFF AND DRAIN VALVE

Sym.	Part No.	Description	Amt.
A-1	124-A-1	Main Disc	1
B-1	124-B-1	Blow-off Disc	1
C	124-C	Seat Ring	1
D	124-D	Bonnet	1
E	124-E	Stuffing Box	1
F	124-F	Valve Stem	1
G	124-G	Wheel	1
H	124-H	Bonnet Ring	1

No. 132 SHUT-OFF AND DRAIN VALVE (Cont.)

Sym.	Part No.	Description	Amt.
J	124-J	Body	1
M	120-K	Wheel Nut	1
N	124-N	Packing Ring	1

NO. 143 SHUT-OFF AND DRAIN VALVE

Sym.	Part No.	Description	Amt.
A	142-A	Disc	1
B	142-B	Disc Ring	1
C	124-C	Seat Ring	1
D	143-D	Bonnet	1
E	125-E	Stuffing Box	1
F	143-F	Upper Stem	1
G	117-V	Wheel	1
H	444-21	Lever Retaining Pin	1
J	143-J	Body	1
K	5/16-18	Wheel Nut (Jam type)	1
L	117-Z	Packing Ring	1
M	142-M	Blow-off Valve Lever	1
N	142-N	Blow-off Valve	1
P	142-P	Blow-off Valve Seat	1
Q	142-Q	Blow-off Valve Spring	1
R	142-R	Blow-off Valve Guide Cap	1
U	143-U	Lower Stem	1
W	143-W	Bonnet Nut	1

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Nos. 242, C-242, L-242 and CL-242 PRESSURE REGULATING VALVES

FEED INLET—1" I.P.S.
OUTLET—1" I.P.S.

WEIGHT—6¾ LBS.

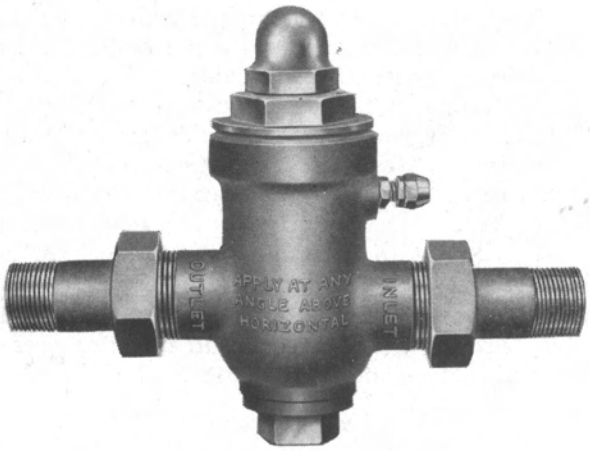


Fig. 1. No. 242 Pressure Regulating Valve

GENERAL DESCRIPTION

The No. 242 Series Pressure Regulating Valves are designed to reduce and maintain at a uniform pressure the steam admitted to various units in the underneath equipment of railway cars. These valves, which replace the No. 244 Constant Pressure Valve, are similar to the pressure reducing feature of the No. 955 series Vapor Safe-Control Regulators (see Bulletin 61-702).

The Nos. 242 and C-242 Pressure Regulating Valves are used in cases where steam pressures of approximately 50 pounds are required. The No. 242 valve is provided with 1" I.P.S. connections of both inlet and outlet. The No. C-242 is provided with a 1" I.P.S. inlet connection, but its outlet is designed for connection to a 1⅛" O.D. copper tube.

The Nos. L-242 and CL-242 Pressure Regulating Valves are used in cases where a 15-lb. or less pressure is required. These valves are similar to the Nos. 242 and C-242 valves but are equipped with lighter springs and smaller valves and seats. The No. L-242 valve is provided with 1" I.P.S. connections of both inlet and outlet. The No. CL-242 valve is provided with a 1" I.P.S. inlet connection, but its outlet is designed for connection to a 1⅛" O.D. copper tube.

Steam pressure is regulated in these Pressure Regulating Valves by a needle valve which opens and closes to pass steam through the unit in response to the action of a bellows diaphragm located in the discharge side of the valve. Steam pressure in excess of the setting of the valve collapses the bellows (due to the difference between steam pressure below and the spring pressure above the diaphragm) allowing the needle valve to be closed by the needle valve spring. With the valve in a closed position, built-up steam pressure is expended through the discharge outlet and the tension of the bellows adjusting spring forces the diaphragm to return to its expanded form, which reopens the needle valve and again allows steam to pass through the unit.

In actual practice, the reduction of steam pressure is not accomplished by the repeated opening and closing of the valve, but by the fact that the needle valve assumes a position of balance which allows a uniform flow of steam to be fed to the loop continuously.

MAINTENANCE AND OVERHAUL

These valves require no routine maintenance.

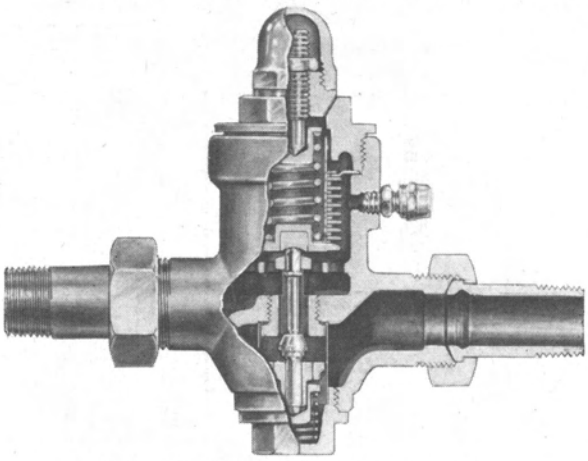


Fig. 2. Sectioned View of No. 242 Valve

No. 242 PRESSURE REGULATING VALVE (Cont.)

Steam blowing from the tell-tale hole in the valve bonnet (sym. 2) indicates a ruptured diaphragm. In this event it will be necessary to replace the diaphragm.

A valve should be overhauled at least once every two years to maintain its effectiveness. At this time it should be completely disassembled and thoroughly cleaned, each part being closely inspected for wear or defects.

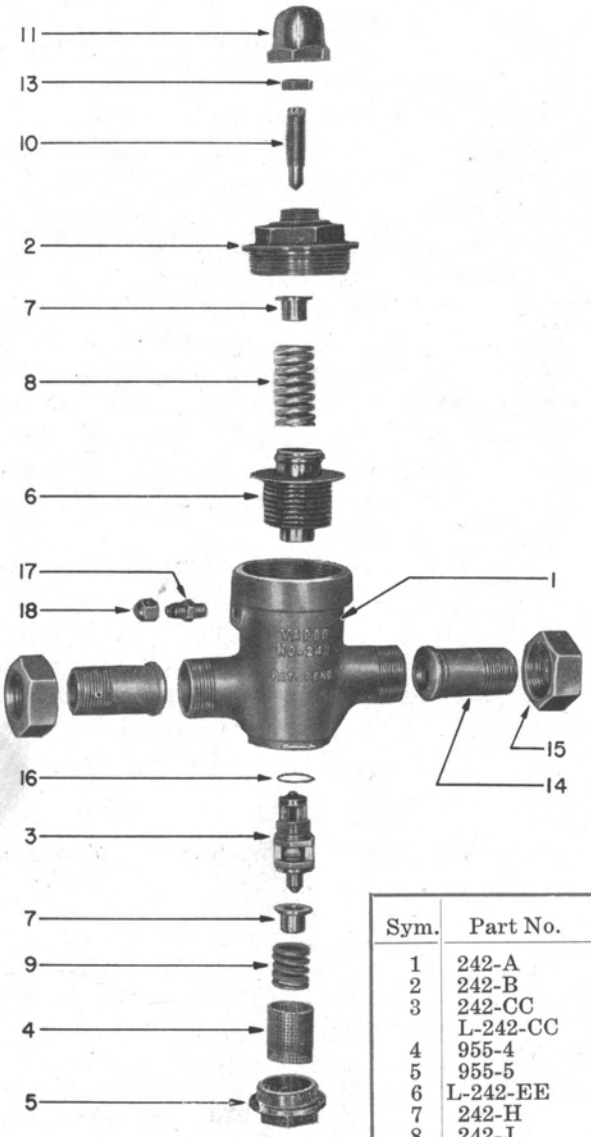


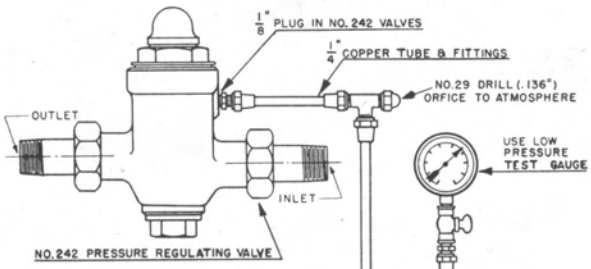
Fig. 3.—Exploded View of No. 242 Pressure Regulating Valve.

Distorted or leaking diaphragms should be replaced. The needle valve and seat (sym. 3) should be inspected to be sure that they are in good condition. Scored or wire drawn parts should be replaced.

The valve should be reassembled and the adjustment setting checked before it is put back into service.

To check the adjustment, place the valve on a test rack under steam with the outlet closed off, with a pressure gauge ahead of the valve and a test assembly connected to the half union test fitting (sym. 17) on the side of the body. (See Fig. 4.) Remove the cap (sym. 11), loosen the locknut (sym. 13) and turn the adjusting screw (sym. 10) to the right or left to adjust the gauge reading to 50 lbs. Tighten the locknut to secure the setting and replace the cap.

The Pressure Regulating Valves will control very close to their settings with trainline pressure varying from 75 to 225 lbs.



Note: Outlet must be dead-ended during test. Turn adjusting screw until gauge reads 50 lbs. If only one or two threads of the adjusting screw are above locknut—replace 242-J Springs and repeat test.

Fig. 4.—Showing test assembly used with the No. 242 Pressure Regulating Valve.

LIST OF PARTS

Sym.	Part No.	Description	Type of Valve	Amt.
1	242-A	Body	All	1
2	242-B	Bonnet	All	1
3	242-CC	Needle Valve Assembly	242, C-242	1
	L-242-CC	Needle Valve Assembly	L-242, CL-242	1
4	955-4	Strainer	All	1
5	955-5	Cap, Bottom	All	1
6	L-242-EE	Bellows Assembly	All	1
7	242-H	Retainer	All	2
8	242-J	Spring, Bellows Adjusting	242, C-242	1
	L-242-J	Spring, Bellows Adjusting	L-242, CL-242	1
9	242-K	Spring, Needle Valve	242, C-242	1
	L-242-K	Spring, Needle Valve	L-242, CL-242	1
10	242-M	Screw, Adjusting	All	1
11	242-N	Cap	All	1
13	244-17	Locknut	All	1
14	441-A	Nipple, Union	L-242, 242	2
	441-A	Nipple, Union	C-242, CL-242	1
	441-3-A	Union Body for 1⅛" O.D.C.T.	C-242, CL-242	1
15	441-B	Ring, Union	All	2
16	955-28	Washer	All	1
17	⅛" IPS x ¼" O.D.C.T.	Half Union	All	1
18	7/16"-20SAE	Cap	All	1
	14165	Plate, Identification	L-242, CL-242	1

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PRESSURE REGULATING VALVES
Nos. 244 and L-244

INLET—1" I.P.S.
OUTLET—1" I.P.S.

WEIGHT
6¾ LBS.

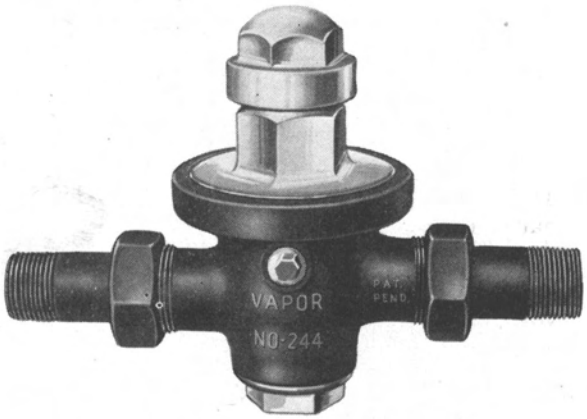

Fig. 1. No. 244 Pressure Regulating Valve

GENERAL DESCRIPTION

The No. 244 Pressure Regulating Valve is designed to automatically reduce and maintain a uniform pressure of steam admitted to Vapor Regulators, Traps, etc. It is located between the shut-off and drain valve and the regulator in cases where the regulator does not have a built-in pressure regulating feature.

The No. L-244 Pressure Regulating Valve is used where less than a 10-lb. output pressure is desired. This valve is like the No. 244 valve except that it has a smaller needle valve and seat.

When an entire pressure regulating valve is to be ordered, it is preferable to order the improved No. 242 or L-242 valve, as described in Bulletin No. 61-115-1, although the No. 244 and L-244 valves are available.

By the use of the Pressure Regulating Valves, a steady and uniform flow of steam is assured to the equipment regardless of variations in trainline pressures. Wasted steam due to improperly adjusted regulators is eliminated.

The uniform pressure of steam delivered by the valve is obtained through the action of a needle valve suspended between two springs and a diaphragm in the path of the steam. The tension of the springs keeps the valve in an open position, but a flow of steam in excess of the valve setting causes the diaphragm in the discharge side of the valve to contract, permitting the opposing spring tension to move the needle valve further into the orifice seat. This movement reduces the flow of steam through the valve. As the flow of steam is reduced, the pressure drops and the diaphragm expands to allow the needle valve to be moved by the greater spring tension to enlarge the opening in the orifice seat and a larger volume of steam is permitted to flow from the discharge side of the valve.

APPLICATION

The Nos. 244 and L-244 Pressure Regulating Valves are usually installed in a position so that the needle valve is vertical. They may be used, in case of necessity, in a position so that the needle valve seat is 45° from a vertical position but the valve should never be installed at a greater angle than this to insure drainage.

MAINTENANCE AND OVERHAUL

It is important that the Pressure Regulating Valves be checked to be sure that the pressure setting of the valve is correct.

The test assembly described in Bulletin 61-115-1 may be used to check the pressure setting of these valves. To adjust the setting: place the valve on a test rack, under steam, with a pressure gauge ahead of the valve and a test assembly connected to the half union test fitting (sym. 22) on the body. Remove the cap (sym. 9), loosen the locknut (sym. 17) and turn the adjusting screw (sym. 8) to the right or left to correct the setting. Tighten the locknut to secure the setting and replace the cap.

With a trainline pressure of 70 lbs. or more, set the valve for a 40-lb. delivery. For trainline pressures of less than 70 lbs. use the following settings:

Trainline pressure—60 lbs.—set valve at 36 lbs.
Trainline pressure—50 lbs.—set valve at 33 lbs.
Trainline pressure—40 lbs.—set valve at 29 lbs.

The Pressure Regulating Valves should be overhauled every two years, and all of the parts inspected for wear. Replace any part showing excesssive wear or any springs which have lost their tension.

To disassemble the valve, remove the cap

NOS. 244 AND L-244 PRESSURE REGULATING VALVES (Cont.)

(sym. 9), the bonnet (sym. 3) and the bottom cap (sym. 2) and take out the needle valve assembly (sym. 118 or 148), the diaphragm (sym. 4), the snubber (sym. 36), the button (sym. 35) and the button spring (sym. 6).

Check the needle valve assembly to be sure the stem is true and that the valve and seat have not scored.

When reassembling the housing to the valve body, keep in mind that the stem of the main valve must extend not less than 1/64", nor more than 1/32" below the face against which the diaphragm rests. After complete reassembly the valve setting should be adjusted before the valve is again put into service.

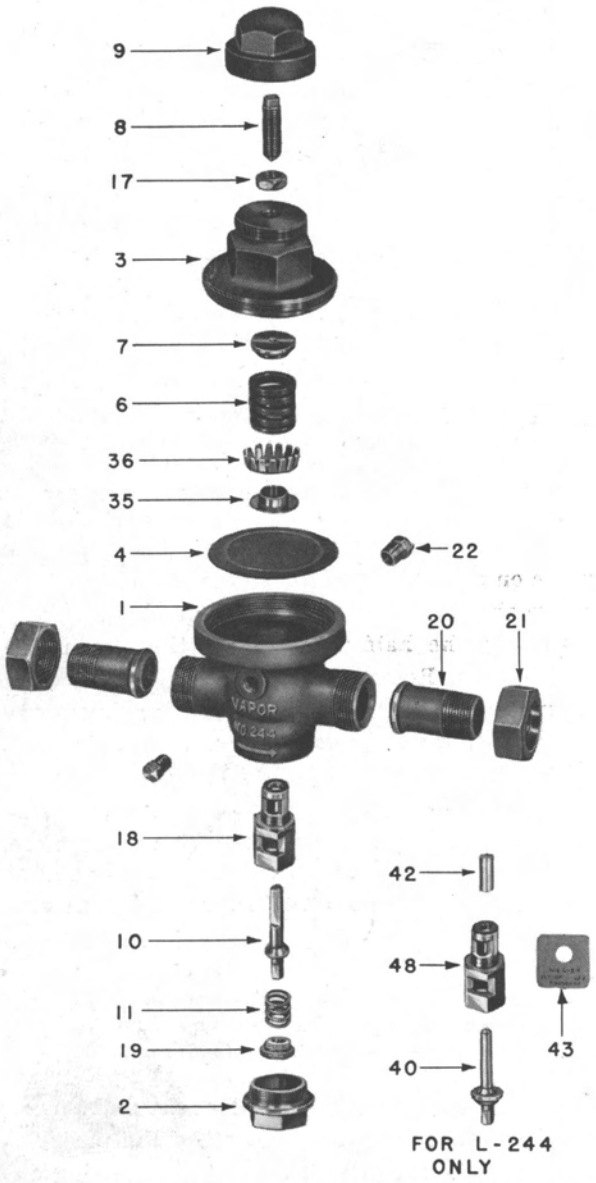

Fig. 2. Exploded View of No. 244 Pressure Regulating Valve

LIST OF PARTS

NO. 244 PRESSURE REGULATING VALVE

Sym.	Part No.	Description	Amt.
1	244-1	Body	1
2	244-2	Bottom Cap	1
3	244-3	Bonnet	1
4	244-4	Diaphragm	1
35	244-35	Button (Diaphram Spring)	1
6	244-6	Button Spring	1
7	244-7	Button Set Screw	1
8	244-8	Adjusting Screw	1
9	244-9	Adjusting Screw Cap	1
10	244-10	Main Valve	1
11	244-11	Main Valve Outer Spring	1
17	244-17	Adjusting Screw Locknut	1
18	244-18	Main Valve Housing	1
19	244-19	Main Valve Spring Nut	1
20	441-A	Inlet and Outlet Union Tail Piece	2
21	441-B	Inlet and Outlet Union Nut	2
22	244-22	Test Outlet Plug ¼" Std. Pipe Thrd.	2
36	244-36	Snubber (Vibration)	1
	244-118	Valve Housing Assembly (Includes Parts 10, 11, 18 and 19)	

LIST OF PARTS

NO. L-244 PRESSURE REGULATING VALVE

Sym.	Part No.	Description	Amt.
1	244-1	Body	1
2	244-2	Bottom Cap	1
3	244-3	Bonnet	1
4	244-4	Diaphragm	1
35	244-35	Button (Diaphragm Spring)	1
6	244-6	Spring	1
7	244-7	Button Set Screw	1
8	244-8	Adjusting Screw	1
9	244-9	Adjusting Screw Cap	1
40	L-244-40	Main Valve	1
11	244-11	Main Valve Outer Spring	1
17	244-17	Adjusting Screw Locknut	1
48	L-244-48	Main Valve Housing	1
19	244-19	Main Valve Spring Nut	1
20	441-A	Inlet and Outlet Union Tail Piece	2
21	441-B	Inlet and Outlet Union Nut	2
22	244-22	Test Outlet Plug ¼" Std. Pipe Thrd.	2
36	244-36	Snubber (Vibration)	1
42	L-244-42	Button Valve	1
43	14165	Identification Plate	1
	L-244-148	Valve Housing Assembly (Includes Parts 11, 19, 40, 42 and 48)	

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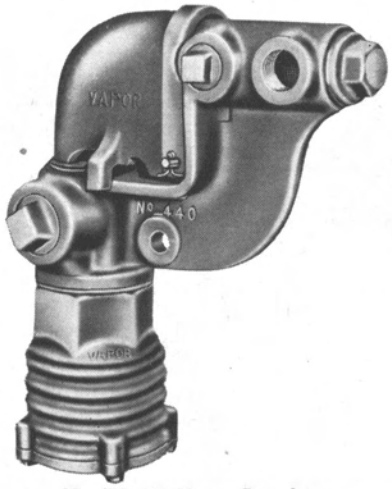
Nos. 425, 440, B-440 AND BA-440 VAPOR REGULATORS

WEIGHT: BA-440: 34 Lbs.



No. BA-440 Vapor Regulator

GENERAL DESCRIPTION

The Vapor Regulator is the "heart" of the Vapor system of railway car heating. It is designed to regulate the passage of steam from the train line into the car heating piping so that steam heats the coils when heat is needed, yet is not wasted when heat is not required.

Prior to 1940 the No. 440 regulator and the shorter No. 425 regulator (for special installations) were developed to regulate this steam. An improvement known as the Economy Diaphragm was introduced at this time and regulators equipped with this improvement were called first the No. B-440 regulator, and later the No. BA-440 regulator as further improvements were added. Any of the regulators of this series can be converted into BA-440 type units by replacing several parts (see Notes on page 3).

Steam at train line pressure (or at reduced pressure if a No. 244 Pressure Regulating Valve is used ahead of the regulator) enters the regulator high pressure chamber, passes through a vapor valve into the low pressure chamber and is then piped to the cut out valve (see illustration). If the vapor cut-out valve is open, steam passes into the heating coil inside the car and returns to the cut-out valve; or if steam is not required in the radiation and the cut-out valve is closed, steam is diverted across the valve. In either case steam and condensate is piped from the cut-out valve back to the regulator.

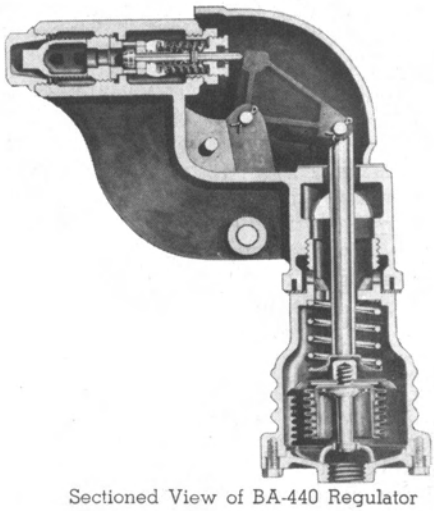
These Vapor Regulators depend for their operation on the action of a diaphragm located in the lower part of the units. The Nos. 425 and 440 are equipped with a liquid filled disc-type diaphragm, while the Nos. B-440 and BA-440 are equipped with the liquid filled bellows-type Economy Diaphragm. Condensate returning to the regulator is discharged to the ground through a drain port, but steam returning comes into contact with the diaphragm and causes it to expand.

The expanding diaphragm moves an operating rod and lever arrangement to close the vapor valve in the regulator and shut off or reduce the volume of steam from the high pressure chamber. After the supply of steam has been reduced the diaphragm cools and contracts. This allows a spring action to re-open the vapor valve and again allow steam to pass through the regulator. In normal operation the diaphragm maintains a position of balance of the vapor valve and only a volume of steam sufficient to keep the temperature of the diaphragm between 195° F. and 210° F. is allowed to pass.

A No. B-440-TT drain tube, which must be purchased separately, should be used with the B-440 or BA-440 regulators, ONLY where required to allow the condensate to be discharged to the ground at a lower level. Nos. 425 or 440 regulators do not require a drain tube.

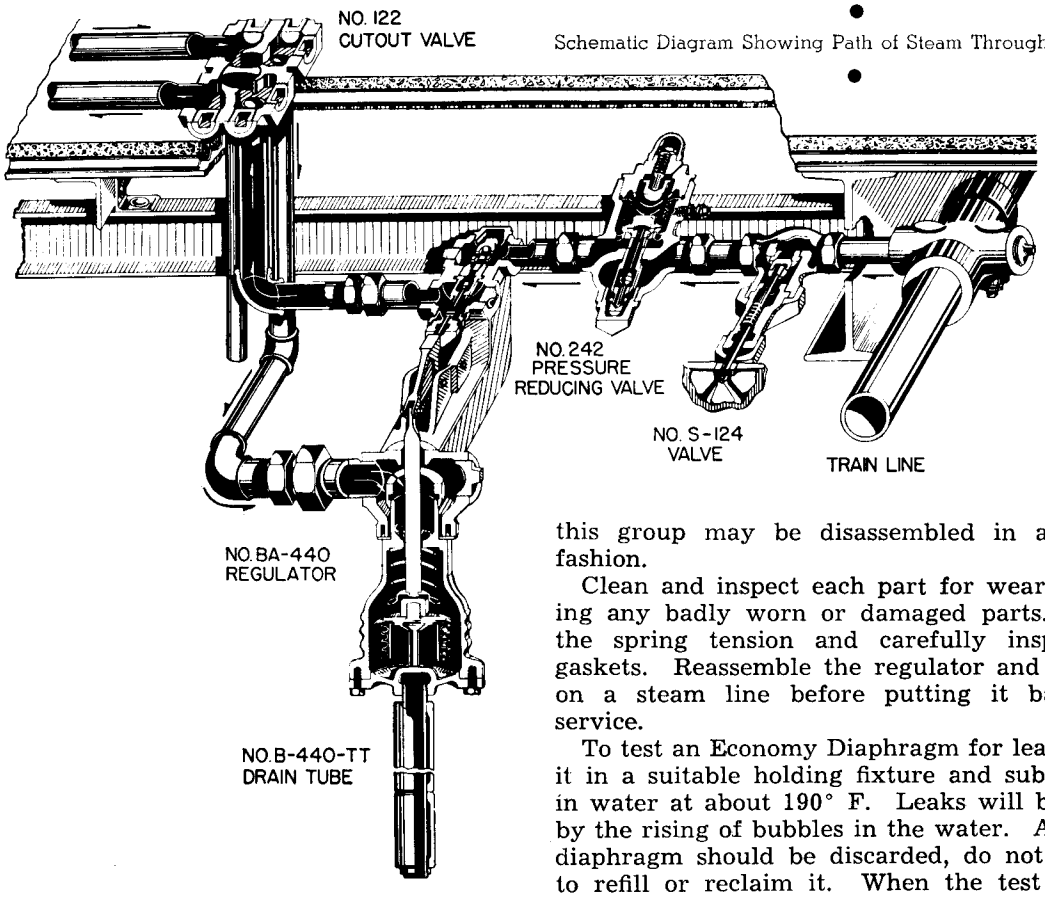
MAINTENANCE AND OVERHAUL

Little maintenance is required for the continued efficient operation of the Nos. 425, 440, B-440 or BA-440 Vapor Regulators. Visual observation for steam blows from these regulators is sufficient to insure proper functioning. Steam leaking through any of these regulators when the vapor valve is closed is an indication that the valve is not seating properly. This may be caused by a worn valve seat, or by dirt between the valve and seat. A worn seat should be reground or replaced and dirt may be blown out from between the valve and seat by closing the



Sectioned View of BA-440 Regulator

Nos. 425, 440, B-440 AND BA-440 REGULATORS (Cont'd)



Schematic Diagram Showing Path of Steam Through Regulator

shut-off valve ahead of the regulator for a few minutes and then opening it again. Steam blowing from the drain tube may mean a damaged bellows diaphragm, which should be replaced.

These regulators should be disassembled and overhauled every two years, at which time they should be tagged with a metal date tag. To disassemble the No. BA-440 regulator, remove the cotter from the pin (sym. 23) which holds the lever shield (sym. 17) in place. Lift off the shield and remove the cotters from the lever pin (sym. 19) and the fulcrum pin (sym. 22). Take out the pins to release the lever (sym. 28). Remove the four screws (sym. 9) from the diaphragm casing cover (sym. 7), allowing the cover assembly, the spring (sym. 5) and the operating rod (sym. 12) to be removed. Then unscrew the diaphragm casing (sym. 6) and remove the gasket (sym. 8). Separate the cover assembly by removing the shield retainer nut (sym. 10), the diaphragm shield (sym. 13) and the Economy Diaphragm (sym. 1). To remove the automatic valve assembly, unscrew the strainer nut (sym. 16), take out the strainer (sym. 18) and remove the disc holder (sym. 21) and the felt washer (sym. 30). Then remove the bellows retaining nut (sym. 27) and take out the bellows (sym. 25) and the bonnet (sym. 26). Remove the valve assembly (sym. 24) and the disc gasket (sym. 20). Other regulators of this group may be disassembled in a similar fashion.

Clean and inspect each part for wear, replacing any badly worn or damaged parts. Check the spring tension and carefully inspect the gaskets. Reassemble the regulator and check it on a steam line before putting it back into service.

To test an Economy Diaphragm for leaks, place it in a suitable holding fixture and submerge it in water at about 190° F. Leaks will be shown by the rising of bubbles in the water. A leaking diaphragm should be discarded, do not attempt to refill or reclaim it. When the test is completed, submerge the diaphragm in cold water to cause it to contract before removing it from the holding fixture. A suitable holding fixture is shown on our Drawing No. 22659, copies of which are available upon request.

CAUTION: Do not remove the Economy Diaphragm from the enclosure while hot, nor subject it to live steam when not enclosed as it will become over-expanded and will not return to its normal fully contracted form when cool.

LIST OF PARTS

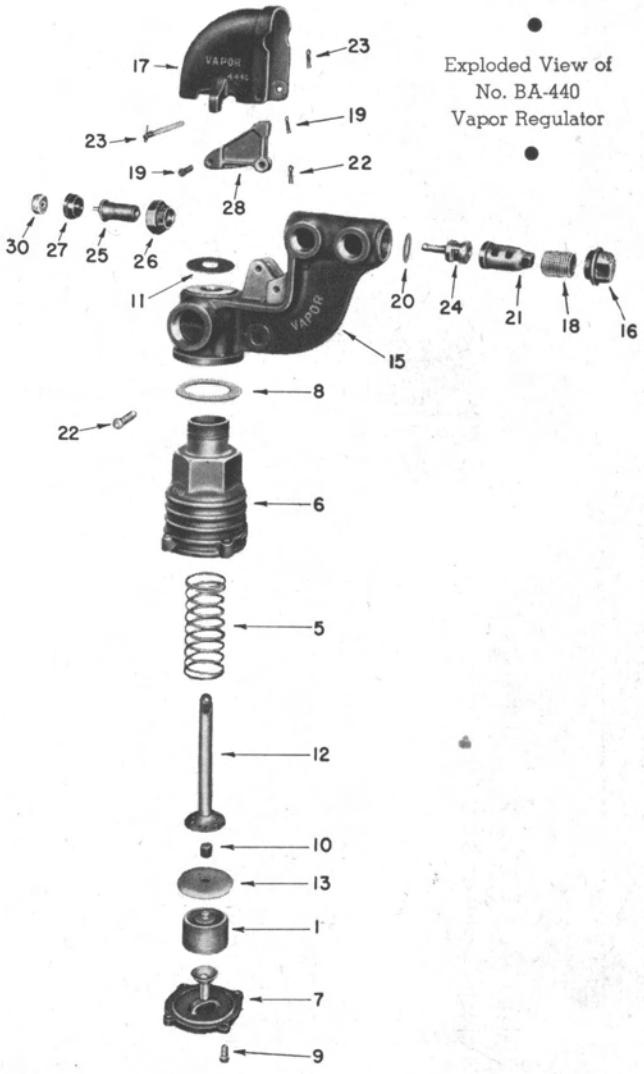
No. BA-440 REGULATOR

Sym.	Part No.	Description	Amt.
1	900-E	Economy Diaphragm	1
5	B-440-H	Spring	1
6	BA-440-J	Economy Diaphragm Casing	1
7	BA-440-K	Casing Cover Includes Post and Cap)	1
8	BA-440-36	Gasket	1
9	⅜"x16x ⅞" lg.	Cap Screw (Hex Head)	4
10	B-440-U	Nut (Shield Retainer)	1
11	B-440-G-5	Deflector Ring	1
12	B-440-G-1	Operating Rod (Includes spring retainer)	1
13	BA440-L	Econmy Diaphragm Shield	1

Nos. 425, 440, B-440 AND BA-440 REGULATORS (Cont'd)

15	440-A	Body	1
16	440-B	Cap	1
17	440-C	Lever Shield	1
18	440-D	Strainer	1
19	440-I	Lever Pin and Cotter	1
20	440-N-1	Disc Gasket	1
21	440-R	Disc Holder	1
22	440-X	Fulcrum Pin and Cotter	1
23	440-Y	Shield Bolt and Cotter	1
24	BA-440-S	Valve Assembly	1
	BA-440-S-10	Valve Housing Assembly	
	BA-440-S-5	Valve Spring	
	900-Q-5	Stem Washer	
	900-Q-6	Stem Pin	
25	900-G	Bellows	1
26	BA-440-Q	Bonnet	1
27	901-N	Nut	1
28	BA-440-W	Lever	1
30	1901-A-90	Felt Washer	1
	B-440-TT	Drain Tube Complete, Not Furnished with Regulator (Includes Jacket, Nipple and Clamp)	
	BA-440-JJK	Lower Casing Assembly (Economy Enclosure) (Includes syms. 1 to 13)	
	BA-440-SS	Vapor Valve Assembly (Includes syms. 24 to 27)	

For Other Parts Lists See Page 4



Exploded View of No. BA-440 Vapor Regulator

IMPORTANT NOTES CONCERNING THE Nos. 425, 440, B-440 AND BA-440 REGULATORS

All underneath piping should be extra heavy and should be pitched to drain not less than one inch in ten feet. Avoid forming pockets where water may be trapped and freeze in cold weather.

* * *

Be sure that all piping has been blown clean before re-applying the regulator to a car, and that good threads are cut on pipes and fittings to insure tight joints. Use only graphite and oil on pipe joints to form a steam-tight connection. Avoid the use of red or white lead for this purpose as steam is likely to carry some of it into the regulator where it will cause sticking of the moving parts.

* * *

The Nos. 425, 440 and B-440 regulators should be converted into No. BA-440 regulators by replacing several of the parts. The No. BA-440-JJK Economy Diaphragm Enclosure should replace the lower casing assemblies of the 425 and 440 regulators or the B-440-JJK enclosure of the B-440 regulator. A No. BA-440-W lever should replace the 440-W or the B-440-W levers and a No. B440-C-1 operating rod replaces the other types of operating rods. Also a No. BA-440-SS vapor valve assembly should replace the valve assemblies furnished in the 425, 440 or B-440 regulators. All of these parts must be ordered separately for converting these regulators into BA-440 regulators.

* * *

When converting the Nos. 425, 440 or BA-440 regulators to BA-440 regulators, it is not necessary to remove the regulator or disturb the piping to make the change. It requires only the removal of the lever shield to replace the vapor valve assembly and the diaphragm enclosure may be unscrewed and replaced with the Economy Diaphragm Enclosure. The new operating

Nos. 425, 440, B-440 AND BA-440 REGULATORS (Cont'd)

rod and lever may easily be put in place while the lever shield is off.

* * *

It has been found in some cases, where a regulator is located near the steam admission valve, that it is advisable to replace the No. B-440-H spring in the Economy Diaphragm Enclosure with a heavier No. B-440-H-40 spring to compensate for a tendency of the Economy Enclosure to be too thrifty with steam when heat is needed. This may be done ONLY when a pressure regulating valve (No. 244 or 242) is used ahead of the regulator. (See Bulletin 1130.)

LIST OF PARTS

No. 425 VAPOR REGULATOR

Part No.	Description
425-A	Body
425-B	Cap
425-C	Shield
425-D	Strainer
425-E	Diaphragm
425-F	Adjusting Screw
425-G	Operating Rod
425-G-5	Deflector Ring
425-H-1	Rider
425-H-2	Link and H-3 Thumb Nut
425-I	Lever Pin with Cotter
425-J	Lower Casing
425-K-5	Hinged Cover Only
425-L	Diaphragm Hook
425-M	Diaphragm Plate
425-N	Disc
425-O	Stuffing Box
425-P	Valve Stem
425-Q	Bonnet
425-R	Disc Holder
425-S-1	Valve
425-T	Inside Tube
425-T-1	Outside Tube
425-U	Lock Nut
425-V	Valve Retaining Ring
425-W	Lever
425-X	Fulcrum Pin and Cotter
425-Y	Shield Bolt and Cotter
425-Z	Dust Protector
425-Z-1	Packing Ring
425-I-1	Upper Lever Pin and Cotter
425-H-4	Cover Lock Cotter and Pin
425-K-1	Cover Bushing
425-K-2	Cover Bushing Pin
425-H	Cover Lock—Complete
425-K-3	Cover Pin and Cotter
425-P-1	Retaining Washer
425-N-1	Disc. Gasket

LIST OF PARTS

No. 440 VAPOR REGULATOR

Part No.	Description
440-A	Body
440-B	Cap
440-C	Shield
440-D	Strainer
440-E	Diaphragm
440-F	Adjusting Screw
440-G	Operating Rod
440-G-5	Deflector Ring
440-H	Cover Lock—Complete
440-I	Lever Pin—Cotter
440-J	Lower Casing Only
440-J-1	Clamp
440-K-5	Hinged Cover Only
440-L	Diaphragm Hook
440-M	Diaphragm Plate
440-N	Disc
440-O	Stuffing Box
440-P	Valve Stem Only
440-Q	Bonnet
440-R	Disc Holder
440-S-1	Valve
440-T	Inside Tube
440-T-1	Outside Tube
440-U	Lock Nut
440-V	Valve Retaining Ring
440-W	Lever
440-X	Fulcrum Pin—Cotter
440-Y	Shield Bolt—Cotter
440-Z	Dust Protector
440-Z-1	Packing Ring
440-I-1	Upper Lever Pin—Cotter
440-H-1	Rider
440-H2	Link and H-3 Thumb Nut
440-H-4	Cover Lock Cotter and Pin
440-K-1	Cover Bushing
440-K-2	Cover Bushing Pin
440-K-3	Cover Pin and Cotter
440-P-1	Retaining Washer
440-N-1	Disc. Gasket

LIST OF PARTS

No. B-440 REGULATOR

Part No.	Description
440-A	Body
440-B	Cap
440-C	Lever Shield
440-D	Strainer
900-E	Economy Diaphragm
B-440-G-1	Operating Rod (Includes Spring Retainer)
B-440-G-5	Deflector Ring
B-440-H	Spring
440-I	Lever Pin (Upper)
440-I-1	Lever Pin (Lower)
B-440-J	Casing (Includes Post and Cap)
B-440-K	Adapter
B-440-K-1	Adapter Gasket
5/16"-18x¾" Lg.	Slotted Cap Screw (Hex Head)
3/16" Dia. x 10" Lg.	Gasket
B-440-L	Economy Diaphragm Shield (Includes Shield Retainer)
440-N	Disc
440-N-1	Disc Gasket
440-O	Stuffing Box
440-P	Stem
440-P-1	Washer
440-Q	Bonnet
440-R	Disc Holder
440-S-1	Valve
B-440-U	Shield Retainer Nut
440-V	Valve Retaining Ring
440-W	Lever
440-X	Fulcrum Pin and Cotter
440-Y	Shield Bolt and Cotter
440-Z	Dust Protector
440-Z-1	Packing Ring
B-440-JJK	Lower Casing Assembly Complete (Includes Part Nos. 900-E, B-440-G-1, B-440-G-5, B-440-H, B-440-J, B-440-K, B-440-K-1, B-440-L, B-440-U, 5/16"x18x¾" Cap Screws and 3/16" Dia.x10" Lg. Gasket).

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Nos. 448, B-448 AND BA-448 VAPOR REGULATORS

WEIGHT: BA-448: 38¼ Lbs.

No. BA-448 Vapor Regulator

GENERAL DESCRIPTION

The Vapor Regulator is the "heart" of the Vapor System of Railway Car Heating. It is designed to regulate the passage of steam from the train into the car heating piping so that steam heats the coils when heat is needed, yet is not wasted when heat is not required.

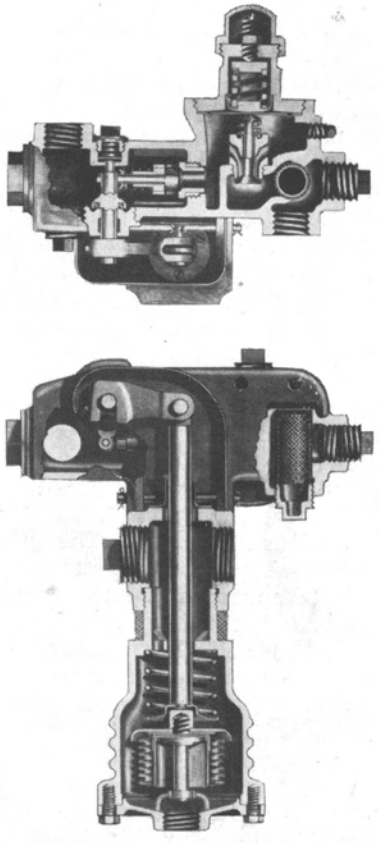
Prior to 1940, the No. 448 regulator, combining the functions of the Nos. 440 or 425 regulator and the No. 244 pressure regulating valve, was the latest development in the regulation of this steam. An improvement known as the Economy Diaphragm was introduced at this time and regulators equipped with this improvement were called first the No. B-448 regulator and later the No. BA-448 regulator as further improvements were added. Either of the Nos. 448 or B-448 regulators can be converted into BA-448 type units by replacing several parts (see Notes on page 3).

Steam at train line pressure enters the regulator high pressure chamber, passes through the pressure reducing feature, through a vapor valve and into a low pressure chamber where it is then piped to the cut-out valve (similar to illustration in Bulletin 61-121). If the cut-out valve is open, steam passes into the heating coil inside the car and returns to the cut-out valve; or if steam is not required in the radiation and the cut-out valve is closed, steam is diverted across the valve. In either case steam and condensate is piped from the cut-out valve back to the regulator for discharge.

These vapor regulators depend for their operation upon the action of a diaphragm located in the lower part of the unit. The No. 448 is equipped with a liquid filled disc-type diaphragm, while the Nos. B-448 and BA-448 are equipped with the liquid filled bellows-type Economy Diaphragm. Either of these two types of diaphragms is caused to expand by steam returning from the cut-out valve.

The expanding diaphragm moves an operating arm and lever arrangement to close the vapor valve to shut off or reduce the volume of steam released by the regulator. After the supply of steam from the regulator has been shut off or reduced by the vapor valve, the volume of steam returning to the regulator is lessened and diaphragm cools and contracts. This allows a spring action re-open the vapor valve and again permit steam to flow from the regulator. In normal operation, the diaphragm permits the vapor valve to assume a position of balance and only a volume of steam sufficient to keep the temperature of the diaphragm between 190° F. and 210° F. is allowed to pass through the regulator.

The pressure reducing feature embodied in this



Sectioned View of No. BA-448 Regulator

series of regulators is an improvement over previously used regulators because it assures a reduced pressure for the vapor valve to work against. So no changes or readjustments of the regulator are required regardless of varying train line pressures.

A No. B-440-TT drain tube, which must be purchased separately, should be used with the Nos. B-448 or BA-448 regulators ONLY where required to allow the condensate to be discharged to the ground from a lower level. The No. 448 regulator does not require a drain tube.

MAINTENANCE AND OVERHAUL

Little maintenance is required for the continued efficient operation of the Nos. 448, B-448 or BA-448 Vapor Regulators. Visual observation for steam blows from these regulators is sufficient to insure proper functioning. Steam leaking through any of these regulators when the vapor valve is closed is an indication that the valve is not seating properly. This may be caused by a worn seat, or by dirt between the valve and seat. A worn seat should be reground or replaced and dirt may be blown out from between the valve and seat by closing the shut-off valve ahead of the regulator for a few minutes and then opening it again. Steam blowing from the drain port or drain tube may mean a damaged diaphragm which should be replaced.

These regulators should be disassembled and overhauled every two years, at which time they should be tagged with a metal date tag. To disassemble the No. BA-448 regulator remove the cotter from the shield bolt (sym. 33) and lift off the shield (sym. 32). Remove the operating rod pin and cotter (sym. 13) and the operating rod lever binding screw (sym. 15) and take out the operating rod lever (sym. 14). Unscrew the vapor valve lever bonnet (sym. 24), take out the vapor valve lever disc (sym. 23) and remove the vapor valve lever assembly (sym. 22) which may be further disassembled. Unscrew the cap (sym. 29) and unscrew the vapor valve (sym. 90). Remove the vapor valve lever spring cap (sym. 51) and the vapor valve lever spring (sym. 25). Unscrew the pipe plug (sym. 65) and remove the strainer (sym. 2). The pressure reducing feature should be disassembled by unscrewing the diaphragm bonnet (sym. 3) and removing the diaphragm (sym. 4), the main valve spring (sym. 11) and the main valve housing (sym. 18). The adjusting screw (sym. 8) and the locknut (sym. 17) may be removed after the cap (sym. 9) has been removed. By unscrewing the cap screws (syms. 99) from the cover (sym. 97), the cover may then be removed allowing the operating rod (sym. 12) and the spring (sym. 95) to be released. Unscrew the shield nut (sym. 100) to release the diaphragm shield (sym. 113) and the bellows diaphragm (sym. 91). The Nos. 448 and B-448 regulators may be disassembled in a similar manner.

Clean and inspect each part for wear, replacing any badly worn or damaged parts. Check the spring tension and carefully inspect the threads of the parts. Reassemble the regulator and check it on a steam line before putting it back into service again.

To test an Economy Diaphragm for leaks, place it in a suitable holding fixture and submerge it in water at about 190° F. Leaks will be shown by the rising of bubbles in the water. A leaking diaphragm should be discarded, do not attempt to refill or reclaim it. When the test is completed submerge the diaphragm in cold water to cause it to contract before removing it from the holding fixture. A suitable holding device is shown on our Drawing No. 22659, copies of which are available upon request.

CAUTION: Do not remove the Economy Diaphragm from the enclosure while hot, nor subject it to live steam when not enclosed as it will become over-expanded and will not return to its normal fully contracted form when cool.

IMPORTANT NOTES CONCERNING THE Nos. 448, B-448 AND BA-448 VAPOR REGULATORS

All underneath piping should be extra heavy and should be pitched to drain not less than one inch in ten feet. Avoid forming pockets where water may be trapped and freeze in cold weather.

* * *

Be sure that all piping has been blown clean before re-applying the regulator to a car, and that good threads are cut on pipes and fittings to insure tight joints. Use only graphite and oil on pipe joints to form a steam-tight connection. Avoid the use of red or white lead for this purpose as steam is likely to carry some of it into the regulator where it will cause sticking of the moving parts.

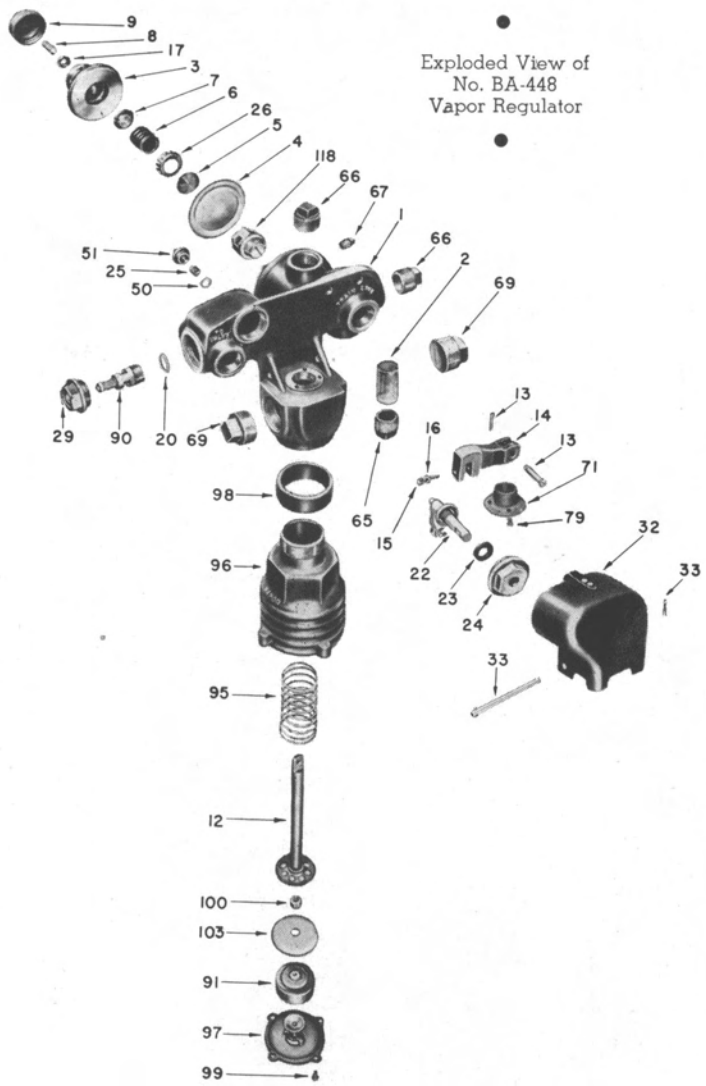
* * *

The Nos. 448 and B-448 regulators should be converted into No. BA-448 regulators by replacing several of the parts. The No. BA-448-176 Economy Diaphragm Enclosure should replace the lower assemblies of the Nos. 448 or B-448 regulators, a No. B-448-12 operating rod (which includes a spring retainer) replaces the formerly used operating rods, and a No. 448-90 vapor valve assembly should replace the vapor valve assemblies of the Nos. 448 or B-448 regulators.

* * *

When converting the Nos. 448 or B-448 regulators into a No. BA-448 regulator, it is not necessary to remove the regulator or disturb the piping to make the change. It requires only

Nos. 448, B-448 AND BA-448 VAPOR REGULATORS (Cont'd)



the removal of the cap and the vapor valve lever to replace the vapor valve assembly and the diaphragm enclosure may be unscrewed and replaced with the Economy Diaphragm enclosure. The operating rod may be changed on the No. 448 regulator by removing the lever shield and replacing the No. 448-12 operating rod with the No. B-448-12 operating rod. This is not necessary on the No. B-448 regulator, since it uses the B-448-12 operating rod.

* * *

It has been found in some cases, where a regulator is located near the steam admission valve that it is advisable to replace the No. B-440-H spring in the Economy Diaphragm Enclosure with a heavier No. B-440-H-40 spring to compensate for a tendency of the Economy Diaphragm to be too thrifty with steam when heat is needed. See Bulletin 1130 for further details of this change.

LIST OF PARTS

No. BA-448

Sym.	Part No.	Description	Amt.
1	448-1	Body	1
2	411-A	Strainer	1
3	244-3	Diaphragm Bonnet	1
4	244-4	Pressure Reducing Valve Diaphragm	1
5	244-35	Diaphragm Spring Button	1
6	244-6	Diaphragm Spring	1
7	244-7	Button Set Screw	1
8	244-8	Adjusting Screw	1
9	244-9	Adjusting Screw Cap	1
118	448-18	Main Valve Housing Assembly	1
	448-10	Main Valve	
	244-11	Main Valve Spring	
	448-18	Main Valve Housing	
	448-19	Main Valve Spring Nut	
12	B-448-12	Operating Rod (includes Spring Retainer)	1
13	440-1-1	Operating Rod Pin and Cotter	1
14	448-14	Operating Rod Lever	1
15	¼"x20x1" Lg.	Operating Rod Lever Binder Screw	1
16	¼" Shake-proof	Operating Rod Lock Washer	1
17	244-17	Adjusting Screw Lock Nut	1
20	448-20	Vapor Valve Seat Gasket	1
22	448-22	Vapor Valve Lever Complete (includes Lever, Roller and Rivet)	1
23	444-23	Vapor Valve Lever Disc	1
24	444-24	Vapor Valve Lever Bonnet	1
25	444-25	Vapor Valve Lever Spring	1
26	244-36	Vibration Snubber	1
29	444-29	Cap	1
32	448-32	Shield Complete (Includes Shield Clip and Rivet)	1
33	440-Y	Shield Bolt and Cotter	1
50	448-50	Vapor Valve Lever Spring Plate	1
51	448-51	Vapor Valve Lever Spring Cap	1
65	411-B	1" Std. Pipe Plug—Sq. Shank	1
66	786	1" Std. Pipe Plug—Sq. Shank	3
67	244-22	Test Outlet Plug—¼" Std. Pipe	1
69	786	1½" Std. Pipe Plug—Sq. Shank	1
71	448-71	Bellows Ferrule	1
79	#8-32x¼" Lg.	Deflector Ring Screw (R. H. M.)	3
90	448-90	Vapor Valve Assembly	1
91	900-E	Ecoomy Diaghragm	1
95	B-440-H	Spring	1
96	BA-440-J	Casing (Economy Diaphragm)	1
97	BA-440-K	Casing Cover (Includes Post and Cap)	1
98	B-448-36	Casing Ring	1
99	⅜" Dia. ⅞" Lg.	Cap Screw (Hex Head)	4
100	B-440- U	Shield Nut	1
103	BA-440-L	Shield (Economy Diaphragm)	1
	BA-448-176	Lower Casing Assembly (Includes syms. 91 to 100 and 12)	
	B-440TT	Drain Tube Complete (Not furnished with regulator)	

Nos. 448, B-448 AND BA-448 VAPOR REGULATORS

LIST OF PARTS

No. 448 VAPOR REGULATOR

Sym.	Part No.	Description
1	448-1	Body
2	411-A	Strainer
3	244-3	Diaphragm Bonnet
4	244-4	Pressure Reducing Valve Diaphragm
5	244-5	Diaphragm Spring Button
6	244-6	Diaphragm Spring
7	244-7	Spring Plate
8	244-8	Adjusting Screw
9	244-9	Adjusting Screw Cap
10	448-10	Main Valve
11	244-11	Main Valve Spring
12	448-12	Operating Rod (specify whether for A or F Type Regulator)
13	440-I-1	Operating Rod Pin and Cotter
14	448-14	Operating Rod Lever
15	¼"x20x1"	Operating Rod Lever Binder Screw
16	¼" Shake proof	Operating Rod Lockwasher
17	244-17	Adjusting Screw Locknut
18	448-18	Main Valve Housing
19	448-19	Main Valve Spring Nut
20	448-20	Vapor Valve Seat Gasket
21	448-21	Vapor Valve Stem
22	448-22	Vapor Valve Lever Complete (includes Lever, Roller and Rivet)
23	444-23	Vapor Valve Lever Disc
24	444-24	Vapor Valve Lever Bonnet
25	444-25	Vapor Valve Lever Spring
26	440-P-1	Vapor Valve Stem Retaining Washer
27	448-27	Vapor Valve
28	448-28	Vapor Valve Seat
29	444-29	Vapor Valve Guide Cap
30	440-V	Valve Retaining Ring
32	448-32	Shield Complete (includes Shield Clip and Rivet)
33	440-Y	Shield Bolt and Cotter
34	448-34	Tube (specify whether for A or F Type Regulators)
35	448-35	Operating Rod Spring
36	244-36	Vibration Snubber
38	440-E	Diaphragm
40	440-F-1	Adjusting Screw
41	440-U-1	Adjusting Screw Locknut
45	440-H-1	Rider
46	440-H-2 and H-3	Link and Thumb Screw
49	440-H-4	Link Pin and Cotter
50	448-50	Vapor Valve Lever Spring Plate
51	448-51	Vapor Valve Lever Spring Cap
55	446-55	Diaphragm Shield Plate
64	446-64	Clamp with Bolt and Nut
65	411-B	1" Std. Pipe Plug, Square Shank
66	786	1" Std. Pipe Plug, Square Shank
67	244-22	Test Outlet Plug ¼" Std. Pipe
69	786	1½" Std. Pipe Plug, Square Shank
71	448-71	Bellows Ferrule
76	448-76	Diaphragm Casing
77	448-77	Diaphragm Casing Cover (includes Bushing ad Pin)
79	8-32x¼"	Deflector Ring Screw (R.H.M.)
80	448-80	Guide Plate
	448-18	Valve Housing Assembly (includes Syms. 10, 11, 18 and 19)
	448-121	Vapor Valve Complete (includes Syms. 21, 26, 27 and 30)
		(After May 1, 1940, Regulators made with Vapor Valve No. 448-90, which superseded Syms. 21, 26, 27, 28 and 30 above.)
	448-176	Lower Casing Complete (includes Syms. 45 (2), 46 (2), 49 (2), 76 and 77)

LIST OF PARTS

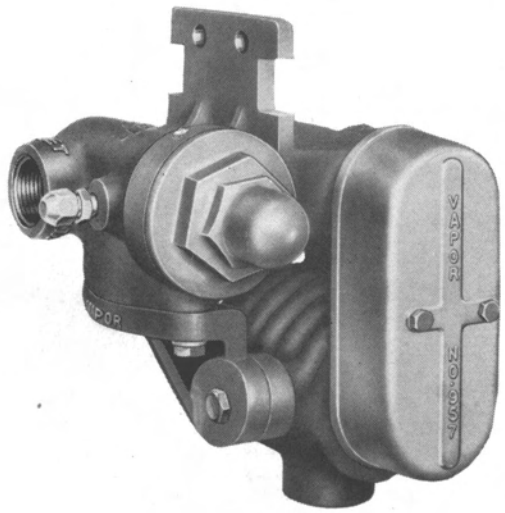
No. B-448 VAPOR REGULATOR

Sym.	Part No.	Description
1	448-1	Body
2	411-A	Strainer
3	244-3	Diaphragm Bonnet
4	244-4	Pressure Reducing Valve Diaphragm
5	244-35	Diaphragm Spring Button
6	244-6	Diaphragm Spring
7	244-7	Set Screw Button
8	244-8	Adjusting Screw
9	244-9	Adjusting Screw Cap
118	448-118	Valve Housing Assembly
	448-10	Main Valve
	244-11	Main Valve Spring
	448-18	Main Valve Housing
	448-19	Main Valve Spring Nut
12	B-448-12	Operating Rod (includes Spring Retainer)
13	440-I-1	Operating Rod Pin and Cotter
14	448-14	Operating Rod Lever
15	¼"x20x1" Lg.	Operating Rod Lever Binder Screw
16	¼" Shake-proof	Operating Rod Lockwasher
17	244-17	Adjusting Screw Locknut
20	448-20	Vapor Valve Seat Gasket
22	448-22	Vapor Valve Lever Complete (includes Lever, Roller and Rivet)
23	444-23	Vapor Valve Lever Disc
24	444-24	Vapor Valve Lever Bonnet
25	444-25	Vapor Valve Lever Spring
26	244-36	Vibration Snubber
29	444-29	Cap
32	448-32	Shield Complete (includes Shield Clip and Rivet)
33	440-Y	Shield Bolt and Cotter
36	B-448-36	Adapter Ring
50	448-50	Vapor Valve Lever Spring Plate
51	448-51	Vapor Valve Lever Spring Cap
65	411-B	1" Std. Pipe Plug, Square Shank
66	786	1" Std. Pipe Plug, Square Shank
67	244-22	Test Outlet Plug, ¼" Std. Pipe
69	786	1½" Std. Pipe Plug, Square Shank
71	448-71	Bellows Ferrule
79	8-32x¼" Lg.	Deflector Ring Screw (R.H.M.)
90	448-90	Vapor Valve Assembly
E	900-E	Economy Diaphragm
H	B-440-H	Spring
J	B-440-J	Casing (includes Post and Cap)
K	B-440-K	Adapter
K-1	B-440-K-1	Adapter Gasket
K-2	5/16"x18x¾" Lg.	Cap Screw (Hex Head) Slotted
L	B-440-L	Bellows Shield
M	B-440-M	Economy Diaphragm Retainer
U	B-440-U	Shield Retainer Nut
	B-448-176	Lower Casing Complete (includes Syms. 12, 36, E, J, K, K-1, K-2, L, M, and U)
	B-440-TT	Drain Tube Complete, not furnished with regulator (includes Jacket, Clamp and Nipple)

No. 957 VAPOR REGULATOR

No. 957-TT Drain Tube

1" I.P.S. CONNECTIONS WEIGHT 26 LBS.



GENERAL DESCRIPTION

The No. 957 Vapor Regulator is designed to control the volume of steam made available to the cut-out valves on radiation in railway cars using the vapor system of heating. In construction this regulator is similar to the regulators of the No. 955 series, except that it is not equipped with the safe-control feature. A pressure reducing feature is incorporated within the regulator itself, making unnecessary the use of a separate pressure reducing valve ahead of the regulator.

Installations of the No. 957 regulator which replace the Nos. 425, 440 or BA-440 regulators require the removal of the pressure reducing valve used ahead of the old regulator.

A No. 957-TT single drain tube, which must be ordered separately, should be installed on this regulator. The return piping from the cut-out valves is brought back to the drain tube and steam returning from the radiation rises in the drain tube, while condensate draining from the radiation to the drain tube is discharged to the ground simultaneously.

The steam which rises in the drain tube acts upon a bellows diaphragm (sym. 46, p. 2) in the regulator, causing it to expand. In expanding, the bellows diaphragm moves an operating arm (sym. 52) to close the vapor valve and stop any further flow of steam to the loop. When the bellows diaphragm cools and contracts, a spring action re-opens the vapor valve and steam is again made available to the heating equipment.

A No. 471 mounting bracket (illustrated in Bulletin 61-702) is used to attach the No. 957 regulator to the car. This bracket is not furnished with the regulator and must be ordered separately.

MAINTENANCE AND OVERHAUL

The care and maintenance of the No. 957 Vapor Regulator is similar to that described in Bulletin 61-702 for the regulators of the No. 955 series. Steam blowing from the regulator drain tube is an indication that dirt may have lodged between the vapor valve and its seat (sym. 56). Close the shut-off valve ahead of the regulator for a few minutes and then open it again. The blow of steam resulting from this procedure will clear out the dirt.

If the regulator continues to blow steam from the drain tube a defective bellows diaphragm may be the cause. Close the shut-off valve ahead of the regulator and allow about five minutes for the diaphragm to cool and contract. Remove the bellows diaphragm (sym. 46) from the regulator for inspection. If it has failed to return to a normal, fully contracted form when cooled, it is defective and should be replaced. A test for checking a bellows for leaks is described in Bulletin 61-702.

A blow of steam from the tell-tale hole in the pressure reducing valve spring bonnet indicates that the bellows seal (sym. 41) which encloses the pressure reducing spring has become ruptured and should be replaced.

The No. 957 Vapor Regulator should be disassembled and completely overhauled at least once every two years and a metal date tag attached to the regulator. Each part should be inspected for wear and cleaned or replaced. Check all valves and seats to be sure that they are not scored or wire-drawn. Rods and stems should be cleaned and inspected for freedom of movement. After being re-assembled, the regulator should be thoroughly tested before it is again placed in service. The test assembly shown in Fig. 6, p. 4 of Bulletin 61-702 may be used for this purpose.

No. 957 VAPOR REGULATOR (Cont.)

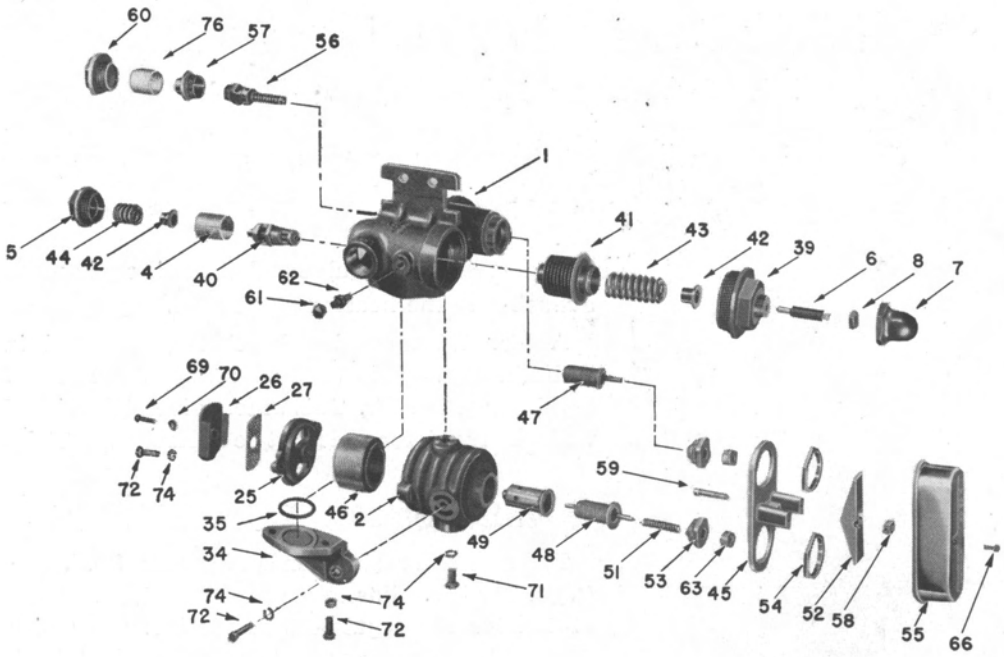


Fig. 2
Exploded View
of No. 957
Vapor Regulator

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	955-1	Body	1
2	955-2	Housing (Diaphragm)	1
4	955-4	Strainer	1
5	955-5	Cap (Bottom)	1
6	242-M	Screw	1
7	242-N	Cap	1
8	244-17	Locknut	1
25	955-25	Cap (Diaphragm Body)	1
26	955-26	Shield (Diaphragm Body)	1
27	955-27	Screen	1
34	957-34	Flange (Diaphragm Housing)	1
35	357-35	Gasket	1
39	242-B	Bonnet	1
40	242-CC	Needle Valve Assembly	1
41	242-EE	Bellows Assembly	1
42	242-H	Retainer (Spring)	2
43	242-J	Spring (Bellows)	1
44	242-K	Spring (Needle Valve)	1
45	901-C	Yoke	1
46	900-EE	Diaphragm (Economy)	1
47	900-G	Bellows Complete (Valve Packing)	1
48	900-H	Bellows Complete (Diaphragm Packing)	1
49	900-JJ	Shield With Bearing	1
51	900-L	Spring (Operating Rod)	1
52	901-M	Arm (Operating)	1
53	901-N	Nut (Bellows Retaining)	2
54	901-O	Nut (Yoke Retaining)	2
55	901-P	Cover	1
56	900-Q	Needle Valve Complete	1
57	901-Q-1	Adapter	1
58	900-R	Pivot (Operating Arm)	1
59	901-S	Screw (Adjusting)	1
60	901-T	Cap (Strainer)	1
61	7/16"-20-S.A.E.	Cap	2
62	1/8"-I.P.S.x1/4"	O.D.C.T. Half Union	2
63	1901-A-90	Washer	2
*	441-3	Union Complete	1
*	441-4	Union Complete	1
66	1/4"-20x1/2" Lg.	Cap Screw (Hex. Head)	2
69	5/16"-18x3/4" Lg.	Cap Screw (Hex. Head)	1

*Not furnished with regulator.

LIST OF PARTS (Cont.)

Sym.	Part No.	Description	Amt.
70	5/16" Split Type	Lockwasher (Std.)	1
71	3/8"-16x3/4" Lg.	Cap Screw (Hex. Head)	3
72	3/8"-16x7/8" Lg.	Cap Screw (Hex. Head)	3
74	3/8"-Split Type	Lockwasher (Std.)	6
76	955-76	Strainer	1

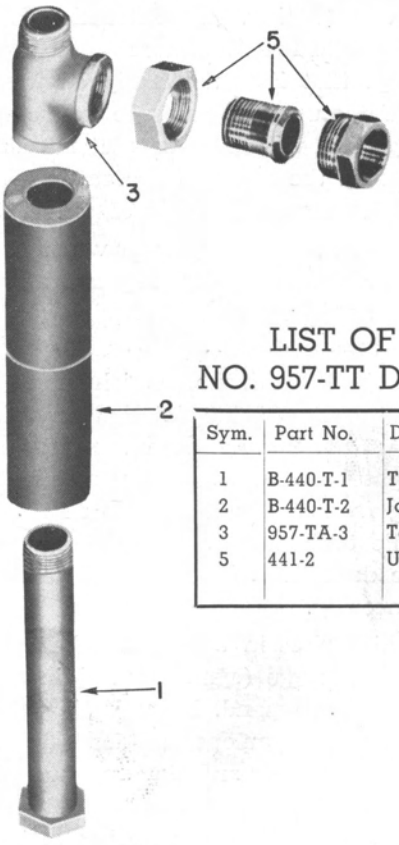


Fig. 3
Exploded
View of
No. 957-TT
Drain Tube

LIST OF PARTS NO. 957-TT DRAIN TUBE

Sym.	Part No.	Description	Amt.
1	B-440-T-1	Tube	1
2	B-440-T-2	Jacket	1
3	957-TA-3	Tee	1
5	441-2	Union Complete	1

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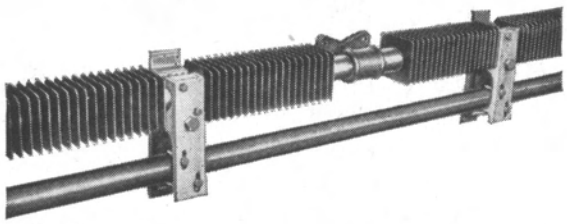
VULCAN FIN-TYPE RADIATION AND FITTINGS

SIZES AND WEIGHTS ON PAGE 4



Length of Vulcan Fin-Type Radiation

GENERAL DESCRIPTION

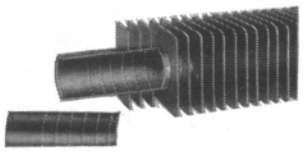
Vulcan fin-type radiation is designed for use with steam, hot water or special liquids for heating or cooling. It is considerably lighter in weight, requires less space and has a larger radiating surface than earlier types of car heating systems which required a pipe coil.

Fins of this radiation are furnished in aluminum, copper or steel and are attached at right angles to the tube. They are held securely in place by the mandrel-expanded tube, which is expanded after the fins have been positioned. The radiation is furnished with various spacing of the fins to deliver a required amount of heat and to allow a maximum of air circulation. The illustration below shows a length of fin radiation with part of the tube and several of the fins cut away to illustrate the firm bond between the fins and the tube.

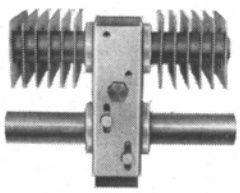
Steam or liquid, passing into the radiation from the steam admission valve travels the entire length of the tube to heat the entire radiation evenly. Condensate from the radiation may be discharged to the atmosphere from a steam trap or a retarder at the end of the radiation; or, if desired, a pipe (with or without fins) may be used to return the steam to the steam admission valve where condensate is discharged to the return section of the supply loop.

Fin-type radiation is available in a variety of lengths up to fourteen feet, equipped with either round, square or rectangular fins of a desired size. The lengths of radiation are furnished painted, and with plain ends for sweated fittings, or threaded for pipe fittings. A list of the sizes and shapes of fins which can be furnished is shown on page 4, along with a description of special clamps and fittings used to apply this type of fin radiation in a car.

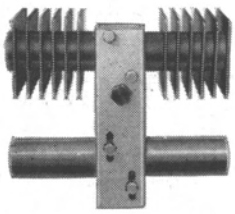
When applying the radiation in a car, it must be remembered to allow space for longitudinal expansion of the piping. This generally amounts to about ¾″ at each end of a 70′ car for steel tubing and about 1½″ at each end for copper tubing. Fins may be removed from the radiation for cutting to special lengths, threading or strapping by using a sharp cold chisel or a pair of tin snips.



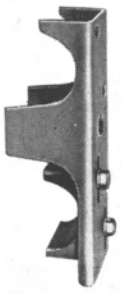
Sectioned View of Vulcan Fin-Type Radiation



Clamping arrangement with sleeves for copper tubing

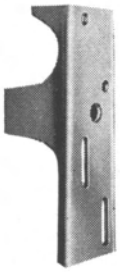


Clamping arrangement with sleeves for steel tubing

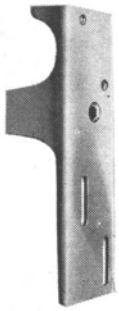


No. 497 Complete No. 496 Same but 1" shorter

No. 486 Complete No. 487 Same but 1" longer



No. 486-A Clamp



No. 487-A Clamp

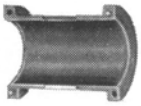
FITTINGS FOR VULCAN FIN TYPE RADIATION

VAPOR NO.	
6	1" Offset fitting, M.I.
15	1¼" x 1" Coupling, eccentric reducing, M.I.
16	2" x 1½" Coupling, eccentric reducing, M.I.
17	2" x 1" Coupling, eccentric reducing, M.I.
19	1½" x 1" Coupling, eccentric reducing, M.I.
27	1½" "Y" fitting, M.I. special design 2½" c. to c.
33	1" x 1" Loop fitting, M.I. 1⅞" c. to c.
37	1½" x 1½" x 1½" Loop fitting, M.I. 2½" c. to c.
39	1½" Return bend, swing type, R.H. or L.H. (40–A and 39–B)
40	1½" Manifold, swing type 3-pipe, R.H. or L.H. (consists of one 40-B and two 40-As)
41	2" Return bend, swing type, 3¼" c. to c.
42	2" Manifold, 3-pipe, M.I. extra heavy R.H. or L.H.
45	1¼" Return bend, swing type, 4" c. to c.
49	1¼" Return bend, swing type, 3" c. to c.
51	1½" Manifold, 3-pipe, expansion type (one A and two Bs)
53	1½" Return bend, expansion type (53-A and 51-BB)
57	1¼" Return bend, expansion type
171 to 195	Expansion Joints (See Bulletin 62-400)
381 to 382-11	Anti-Freeze Fittings (See Bulletin 61-550)
383	Anti-Freeze Drip Tee 1⅛" O.D. C.T. for 1" I.P.S. Drains
384	Anti-Freeze Drip Tee 1⅛" O.D. C.T. for 2" I.P.S. Drains
393	Anti-Freeze Drip Tee for 1" Pipe
394	Anti-Freeze Drip Tee for 2" Pipe
398 to 437-S	Strainer Tees and Crosses (See Bulletin 62-401)
414	Strainer tee for 2" train pipe special
433	Strainer tee, brass, 2⅜" O.D. C.T.
438	Strainer cross, brass, 2⅛" O.D. tubing x 1" I.P.S.
438–S	Strainer cross, cast steel, 2¼" O.D. tubing x 1" I.P.S.

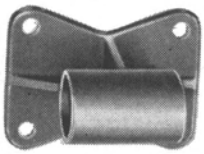
VAPOR NO.	
441	1" Special male and female union, for use with vapor regulator
441–2	Regulator union, special for 1⅛" O.D. tubing, 1" male pipe thread tailpiece
441–3	Regulator union, special for 1⅛" O.D. tubing, 1" male pipe thread body
441–4	Regulator union, special 1" male and female pipe threads (short nipple type)
441–5	Union assembly, 1" std. pipe thread
441–6	Half union for 1" I.P.S.
441–7	Half union for 1⅛" O.D. tubing
442	1½" Special male and female union for use with vapor regulator
442–2	Regulator union, special, for 1⅝" O.D. tubing, 1½" male pipe thread tailpiece
442–3	Union, 1⅜" O.D. tubing to 1½" I.P.S.
455	Pipe strap anchor for four 1" feed pipes
456–C	Center anchor coupling for 1¼" pipe
456–D	Center anchor coupling for 1¼" pipe, curved back
457–A	Center anchor coupling for 1¼" pipe
457–B	Center anchor coupling for 1½" pipe
476	Center anchor coupling for 1⅜" O.D. tubing
476–B	Center anchor coupling for 1⅜" O.D. tubing
481	Half sleeve for 1⅜" O.D. C.T.
484–B	Support
486	Clamp for Fin Radiation, 3"—4" Centers
486–A	Clamp 3"—4" Centers
487	Clamp for Fin Radiation, 4"—5" Centers
487–A	Clamp 4"—5" Centers
496	Clamp for Steel Fin Radiation, 3"—4" Centers
497	Clamp for Steel Fin Radiation, 4"—5" Centers
498–6	Supporting Stand with Bolt; 6¼" overall height, 5⅛" c. to c., 2⅜" top to slot
498–7	Supporting Stand with Bolt; 7¾" overall height, 6⅝" c. to c., 2⅜" top to slot

No. 481 Half Sleeve

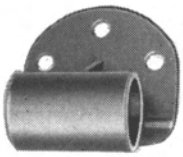
No. 484-B Support



No. 480 Half Sleeve



No. 476 Center Anchor Coupling for Copper Tubing
No. 456-C Similar design for 1¼" I.P.S. Steel Tubing



No. 476-B Center Anchor Coupling for Copper Tubing

FITTINGS FOR VULCAN FIN TYPE RADIATION

VAPOR NO.	
498–7–A	Supporting Stand with Bolt; 7¾" overall height, 6⅝" c. to c., 2 19/32" top to slot
498–7–B	Supporting Stand with Bolt; 7¾" overall height, 6⅝" c. to c., 2¾" top to slot
498–8	Supporting Stand with Bolt; 8" overall height, 6⅞" c. to c., 2" top to slot
498–10	Supporting Stand with Bolt; 9½" overall height, 8⅜" c. to c., 2⅜" top to slot
498–10–A	Supporting Stand with Bolt; 9½" overall height, 8⅜" c. to c., 3¾" top to slot
498–10–B	Supporting Stand with Bolt; 9½" overall height, 8⅜" c. to c., 5½" top to slot
498–G	Clamp Bolt
614	1" Ell R.H. or L.H.C.I.
616	1½" Ell R.H. or L.H. C.I.
652	1½" x 1" Ell R.H. or L.H. C.I.
712	½" Ell R.H. M.I.
714	1" Ell R.H. or L.H. M.I.
715	1¼" Ell R.H. or L.H. M.I.
716	1½" Ell R.H. or L.H. M.I.
734	1¼" x 1" Ell M.I.
781	1" R.R. Union M.I.
785	Countersunk Plugs—¾", 1", 1¼", 1½" and 2"
786	Square Shank Plugs—¾", 1", 1¼", 1½" and 2"—C.I.
796	Offset Fitting for Copper Tubing
799	½" R.R. Union M.I.
818	1" Return Bend, M.I.R.H., 2½" c. to c.
819	1¼" Return Bend, M.I.R.H., 2¼" c. to c.
820	1½" Return Bend, M.I.R.H., 2½" c. to c.
821	2" Return Bend, M.I.R.H. or R. & L., 3¼" c. to c.
825	1¼" Return Bend, M.I. R.H. or R. & L. only, 4" c. to c.
825–A	1¼" Return Bend, M.I. R. & L. only, 4" c. to c., tapped to spread 3" in 10 ft.
841	2" Return Bend, C.I. R.H. or R. & L., 3¼" c. to c., tapped to spread 3" in 10 ft.

VAPOR NO.	
855	1¼" Straight Shank Hose Nipple
864	Offset
865	Adapter
866	Retarder
868	Bracket Assembly (For Fin or Unit Fin)
870	1" Coupling, C.I. extra heavy, R.H. or R. and L.
871	1¼" Coupling, C.I. extra heavy, R. H. or R. and L.
873	2" Coupling, C.I. extra heavy, R. H. or R. and L.
876	1" Coupling R.H. or R. & L. Wrot. I.
877	1¼" Coupling R. H. Wrot. I.
878	1½" Coupling Ext. Heavy Reamed
879	2" Coupling R. H. or Wrot. I. (Ext. Heavy)
883	Bracket 9/16" Height
883–1	Bracket 1 1/16" Height
883–2	Bracket 1¼" Height
885–1	Cap
886	Cap
A–886	End Cap (For Fin or Unit Fin)
D–889	Double Bracket (complete)
S–889	Single Bracket (complete)
891	Clamp
892	Coupling for ¾" tube
893	Clamp
894	Clamp (complete)
899–6	Support Stand, Valve—overall height 6¼", 5⅛" c. to c.
899–8	Support Stand, Valve—overall height 8", 6⅞" c. to c.
899–10	Support Stand, Valve—overall height 9½", 6⅜" c. to c.
S–899–6	Support Stand, Fin Radiation — overall height 6¼", 5⅛" c. to c.
S–899–7	Support Stand, Fin Radiation — overall height 8", 6⅞" c. to c.
S–899–10	Support Stand, Fin Radiation — overall height 9½", 8⅜" c. to c.

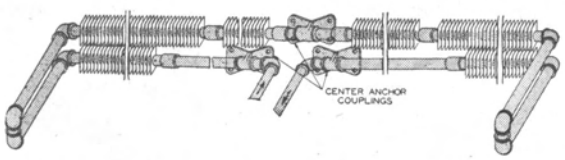


Diagram Showing Use of Vulcan Fin-Type Radiation

VAPOR "VULCAN" COPPER FIN DATA

TUBING		FINS		OUTPUT PER LINEAR FT.		WEIGHT	
Size	Wall Thick-ness	Size	No. Per Ft.	Sq. Ft. EDR	BTU Per Hr. (Steam)	Pounds Per Linear Ft.	
						Copper	Alum.
1⅛" O.D.	.055"	3¼" Sq.	40	4.50	1080	3.30	1.89
			32	4.15	995	2.79	1.67
			24	3.65	875	2.29	1.44
			16	3.00	720	1.79	1.22
			12	2.60	625	1.52	1.11
1⅛" O.D.	.055"	2¾" x 3¾"	40	4.50	1080	3.26	1.75
			32	4.15	995	2.76	1.55
			24	3.65	875	2.27	1.36
			16	3.00	720	1.77	1.16
			12	2.60	625	1.51	1.06
1⅛" O.D.	.055"	2¼" Round	40	1.85	445	1.60	1.17
			32	1.70	410	1.43	1.08
			24	1.50	360	1.26	1.01
			16	1.20	290	1.11	0.92
			12	1.05	250	1.02	0.88
1⅜" O.D.	.055"	3¼" Sq.	40	4.40	1060	3.44	2.08
			32	4.05	975	2.94	1.86
			24	3.55	850	2.44	1.63
			16	2.90	700	1.95	1.41
			12	2.50	605	1.70	1.30
1⅜" O.D.	.055"	2¾" x 3¾"	40	4.40	1060	3.40	1.94
			32	4.05	975	2.91	1.74
			24	3.55	850	2.42	1.55
			16	2.90	700	1.94	1.36
			12	2.50	605	1.69	1.26
1⅜" O.D.	.055"	2" x 3¾"	40	3.40	815	2.62	1.67
			32	3.15	750	2.29	1.53
			24	2.75	655	1.96	1.38
			16	2.25	540	1.62	1.25
			12	1.95	465	1.46	1.17
1⅜" O.D.	.055"	2" x 5"	40	4.20	1010	3.34	2.01
			32	3.90	930	2.86	1.80
			24	3.40	810	2.39	1.59
			16	2.80	670	1.91	1.38
			12	2.40	575	1.67	1.28

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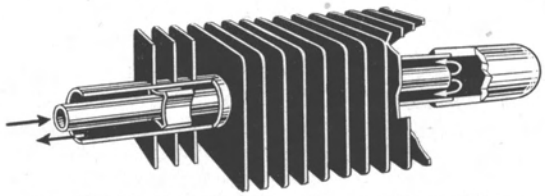
VAPOR-VULCAN UNIT FIN RADIATION

OUTER PIPE: 1⅜" O.D. INNER PIPE: ¾" O.D.



Length of Unit Fin Radiation, Showing Path of Steam.

GENERAL DESCRIPTION

Unit Fin Radiation is a complete radiating system in one pipe. Its advantages over previously used two pipe fin radiating systems are found in a relatively even surface temperature of the fins regardless of the amount of steam in the unit, as well as in an appreciable reduction of weight and size.

As shown in the illustration above, Unit Fin Radiation consists of an inner feed pipe and a finned outer return pipe. The vertical fins attached to the outer pipe can be furnished in aluminum, copper or steel as required. The radiation is available with any of several standard fin spacings according to the requirements of a particular car heating arrangement.

Steam flows through the entire length of the inner feed pipe to the far end of the radiation before it flows out into the finned outer pipe for return. Condensate, resulting from steam which has cooled inside of the radiation also returns through the finned outer pipe for discharge. This condensate in the pipe forms a river of water which acts as a medium of heat exchange between the heated inner pipe and the outer pipe to which the fins are attached. The heat exchange action and the passage of steam to the far end of the radiation are designed to provide all of the fins in the unit with a uniform surface temperature.

A steam admission valve at the feed end of the radiation controls the flow of steam from a supply loop into the unit. This steam admission valve may be of the manual control type, or of the automatic control type. In cars using the Rador-'Lectronic system of cycle modulation, a steam admission valve equipped with an electric solenoid is used to place the radiation under the control of the Rador thermostat.

A table of sizes, shapes, weights and materials of various fins which can be furnished in Unit Fin Radiation is shown below. These units are available in any length up to fourteen feet, painted and with plain ends for sweat fittings. Special clamps and fittings designed for use with Unit Fin Radiation are shown on page 2.

MAINTENANCE

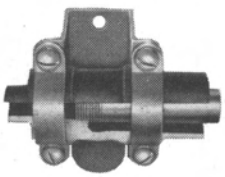
No special care is required for the continued efficient operation of Unit Fin Radiation beyond the cleaning of the fins. Dirt and dust collecting on the surface of the fins acts as a heat insulation and when present will prevent a proper and uniform delivery of heat from the unit.

TUBING		FINS		OUTPUT PER LINEAR FT.		WEIGHT	
						Pounds per linear ft.	
Size	Wall thickness	Size	No. per ft.	Sq. Ft. EDR	BTU per hr. (steam)	Copper	Alum.
1⅜"O.D.	.055	3¼" sq.	40	4.40	1060	3.70	2.34
			32	4.05	975	3.20	2.12
			24	3.55	850	2.70	1.89
			16	2.90	700	2.21	1.67
			12	2.50	605	1.96	1.56
1⅜"O.D.	.055	2¾"x3¾"	40	4.40	1060	3.66	2.20
			32	4.05	975	3.17	2.00
			24	3.55	850	2.68	1.81
			16	2.90	700	2.20	1.62
			12	2.50	605	1.95	1.52
1⅜"O.D.	.055	2"x3¾"	40	3.40	815	2.88	1.93
			32	3.15	750	2.55	1.79
			24	2.75	655	2.22	1.64
			16	2.25	540	1.88	1.51
			12	1.95	465	1.72	1.43
1⅜"O.D.	.055	2"x5"	40	4.20	1010	3.60	2.27
			32	3.90	930	3.12	2.06
			24	3.40	810	2.65	1.85
			16	2.80	670	2.17	1.64
			12	2.40	575	1.93	1.54
1⅜"O.D.	.055	2¾"x5"	40	5.50	1315	4.42	2.72
			32	5.05	1210	3.78	2.42
			24	4.40	1055	3.14	2.12
			16	3.65	870	2.50	1.82
			12	3.10	750	2.18	1.67

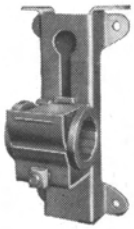
Unit Fin Radiation Data.

VAPOR-VULCAN UNIT FIN RADIATION (Continued)

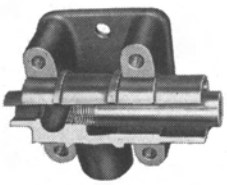
SPECIAL CLAMPS AND FITTINGS FOR UNIT FIN RADIATION



No. 882
ANCHOR TEE



No. 898
SUPPORTING
STAND

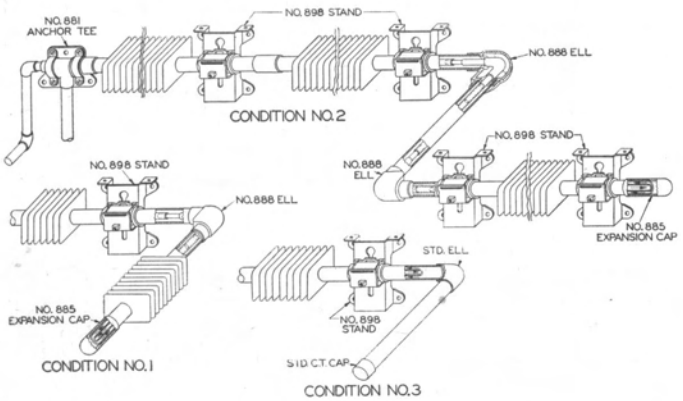


No. 881 CLAMP

No. 888 ELL

No. 885 CAP

DRAWING SHOWING USE OF SPECIAL UNIT FIN RADIATION FITTINGS



IMPORTANT NOTE: As the total length of the inner tube may vary after it is soldered in place it should be cut off to proper length just before last outer tube is soldered in place to leave space for expansion. NOTE: Supporting clamps to be spaced 5 to 6 ft. centers.

ANCHOR TEES — Nos. 881-2, 881-3, 882, 882-2 and 882-3 anchor tees serve a dual purpose. They provide a substantial support for the radiation and at the same time function as discharge points for condensate returning through the outer pipe of the radiation.

OFFSET FITTINGS — The No. 884 offset fitting is used in locations where piping difficulties are encountered. This fitting, like the Unit Fin Radiation, has a double pipe to carry separately the steam from each pipe of the radiation through a jog in direction.

UNIT FIN ELL — Nos. 887, 888-1 and 888-2 ells are used in the piping of Unit Fin Radiation when a change of direction in the radiation is desired. These fittings are elbow joints with a double pipe to carry the steam from each pipe of the radiation separately.

EXPANSION JOINT — The No. 908 expansion joint is connected into longer lengths of Unit Fin Radiation to permit expansion of the piping from heat. Steam from the two pipes of the radiation is also carried separately in this device.

EXPANSION CAPS — Nos. 885, 885-1, A-886 and 886 expansion caps are placed on the far end of a length of Unit Fin Radiation. They permit the expansion of the radiation inner pipe from heat and are designed to guide the flow of steam from the inner pipe back through the outer pipe.

SUPPORT STANDS — The No. 898 Series of support stands are placed at intervals of from 5′ to 6′ along a length of Unit Fin Radiation. They serve as braces for the piping and because of their adjustability permit the piping to be installed at the proper pitch.

BRACKETS — No. 868 Bracket Assemblies are used to hold Unit Fin radiation securely in position. A special spring type clip allows for vibration.

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Nos. 68-50 and 68-55 VENTURI-TYPE OVERHEAD FIN RADIATORS

INLET—1¼" I.P.S. OUTLET—1¼" I.P.S.

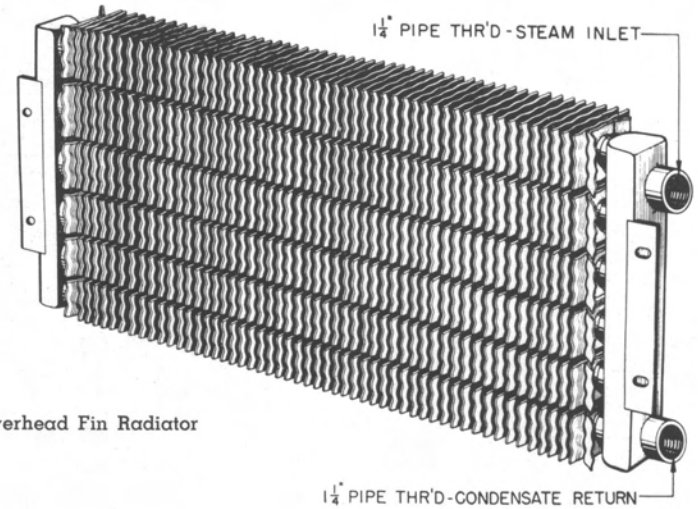


Figure 1. No. 68 Venturi Overhead Fin Radiator

Overhead fin radiators of the No. 68 series are located on the discharge side of the blower in the warm air distribution ducts of railway cars. These radiators are heated by steam from the train line and the temperature of the heated air is controlled by a thermostat in the car.

The outstanding feature of this series of radiators is the relatively even surface temperature of the fins. To bring about this condition, each horizontal tube is supplied with an equal amount of steam and the steam is evenly distributed throughout the tube. Figure 2 illustrates the way in which this is accomplished.

Steam flowing to the radiator from a steam admission valve, enters a vertical supply header provided with orifice openings on one side which lead into the horizontal double tubes of the radiator. Since these openings are all of the same size and a head of steam is built up within the vertical steam supply header, each horizontal tube receives the same amount of steam at the same pressure.

As steam flows into the inner tubes of the radiator from the orifice openings, it passes through a venturi, or constriction in the tube. The use of this venturi creates a suction between the orifice opening and the entrance of the inner tube in the path of the steam. The steam which flows from the discharge end of the inner tube and also that escaping from the ¼" holes drilled at irregular intervals in the inner tube is drawn back between the inner tube and the outer tube by this suction and recirculated through the inner tube. It is this recirculating process that distributes the heat evenly to the fins attached to the outer tube of the radiator.

Condensate from all of the radiator tubes passes into another vertical casting at the opposite end of the radiator where it drains back through the lower horizontal tube to the return section of the supply loop for discharge.

The No. 68-55 Venturi Overhead Radiator, having a height of 15" is designed for installation in standard cars and coaches, while the No. 68-50 Radiator, having a height of 18", is designed for installation in the overhead ducts of Pullman cars.

Both radiators are capable of heating 2,500 cubic feet of air per minute to deliver 80,000 BTUs of heat per hour, with air taken in at 55° F. and delivered at 85° F. The smaller sized radiator is equipped with a larger number of fins per foot in order to furnish this same delivery of heated air as the larger radiator.

NOS. 68-50 AND 68-55 VENTURI OVERHEAD RADIATOR (Continued)

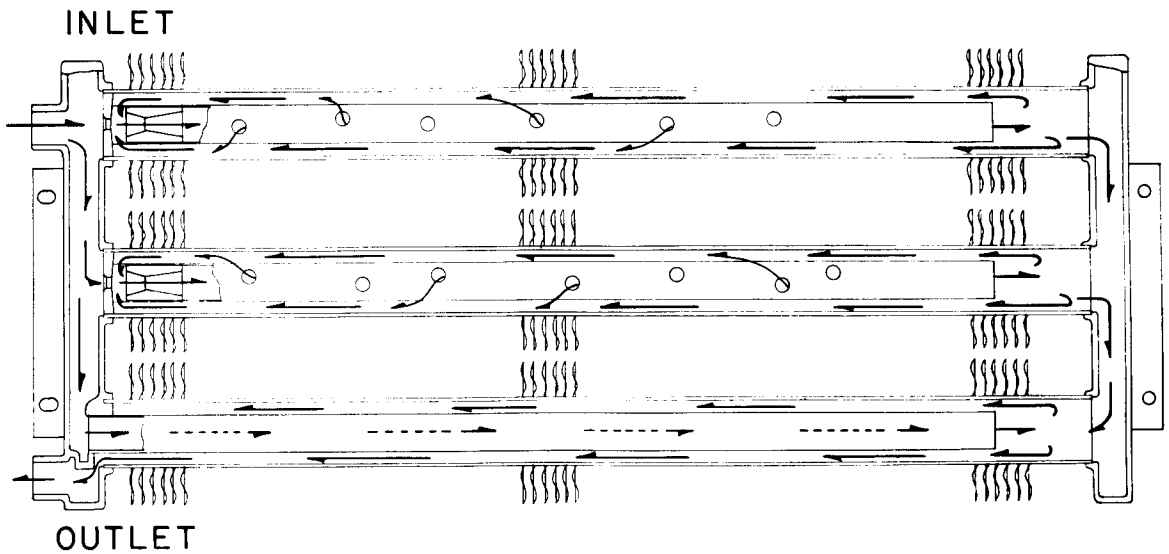


Figure 2. Sectioned view of three tubes of an Overhead Radiator with size of tubes exaggerated to show the flow of steam

For other radiators than the above our Engineering Department will recommend the proper sized radiator for a particular purpose, if they are supplied with the necessary specifications. These should include the height and and width of the space available for the radiator, the amount of air to be heated, the minimum temperature of incoming air and the maximum temperature of air heated.

No regular maintenance procedure is required for these overhead fin radiators. The surfaces of the fins should be cleared of dust and dirt at the same time that the duct work is cleaned out, to insure efficient and even heating, since dust and dirt tend to act as insulation.

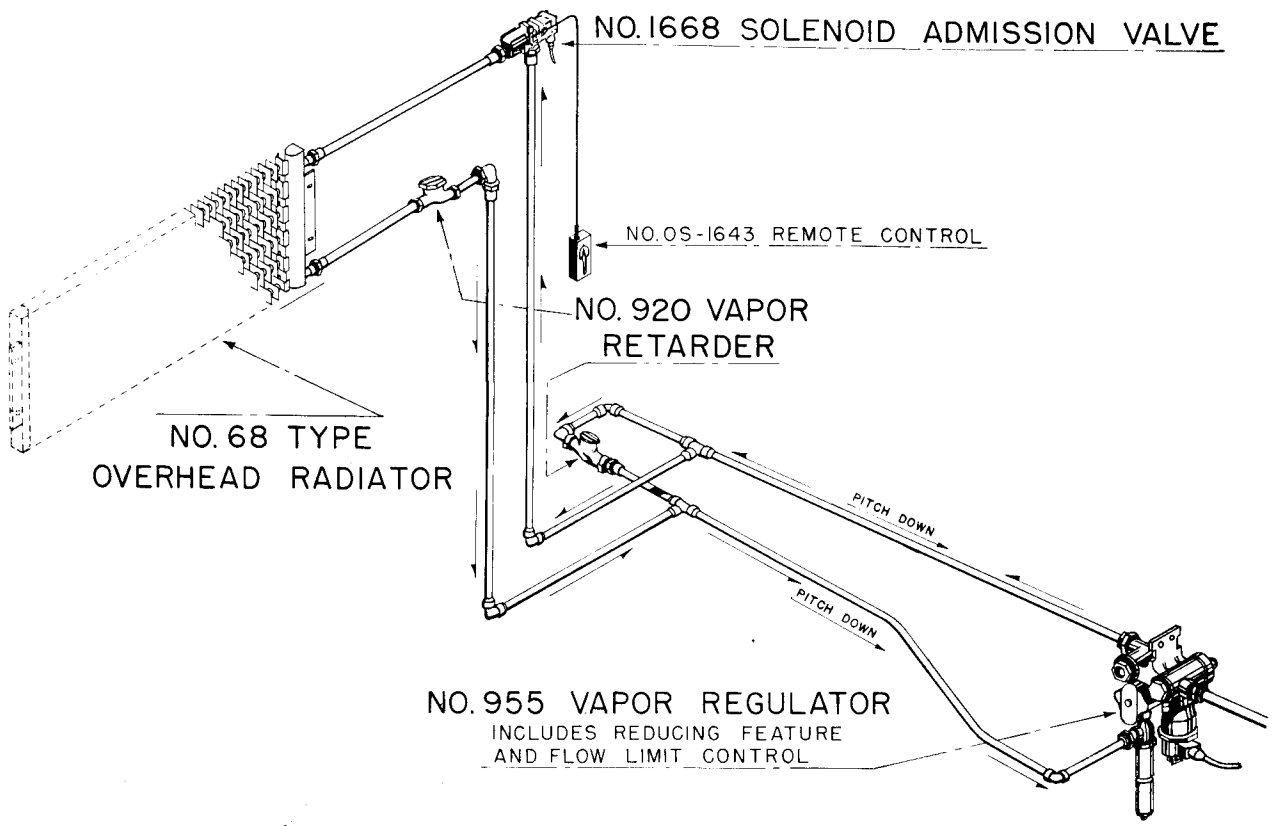
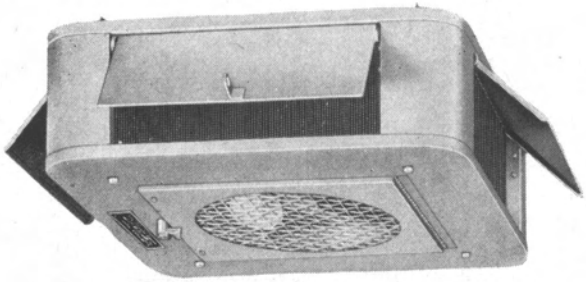


Figure 3. Diagram showing steam supply source and condensate discharge arrangement for the No. 68 Radiator

Nos. V-935 AND VA-935 OVERHEAD BAGGAGE CAR HEATER

CAPACITY: 50,000 BTU Per Hour | MOTOR: 32 Volts—4.5 Amps. 40 Volts—3.5 Amps. 64 Volts—2.2 Amps. 120 Volts—1.2 Amps. | WEIGHT: 140 Lbs.



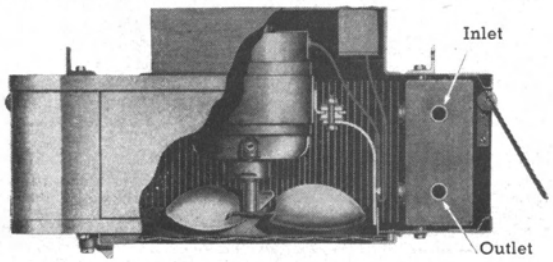
Overhead Baggage Car Heater

GENERAL DESCRIPTION

The Nos. V-935 and VA-935 Overhead Baggage Car Heaters are designed for use in baggage, or coach-baggage cars where loading arrangements may interfere with a normal circulation of heated air from floor radiation. They provide these cars with heat circulated from above the load, so that warm air is evenly distributed throughout the car. In certain cars, floor radiation is used for auxiliary heating during extremely cold weather and to protect water in the hopper from freezing during layover periods when fans are idle or in case of electrical failure. During summer months these heaters may also be used for ventilation when a No. 945 cut-out valve is installed in the steam piping at the floor to prevent steam from reaching the heater.

The parts of these heaters are identical except for the motor. A No. V-935 heater is provided with a shunt type motor and is recommended in cases where a single heater is required in a car. A No. VA-935 heater is provided with a series type motor so that when several heaters are to be installed in a single car, a single fan speed control may be used to regulate the motor speed of all the heaters simultaneously. In this case a No. 1901 type or a No. 1906 type control panel should be connected into the circuit.

Warm air is delivered by the heater from four openings equipped with adjustable louvers (one on each side), any of which may be partially or completely closed to concentrate the heat in other directions. A fan attached to the shaft of an electric motor draws air in through the bottom of the unit, moves it through the heated fins of the radiation and discharges it through the louver openings.

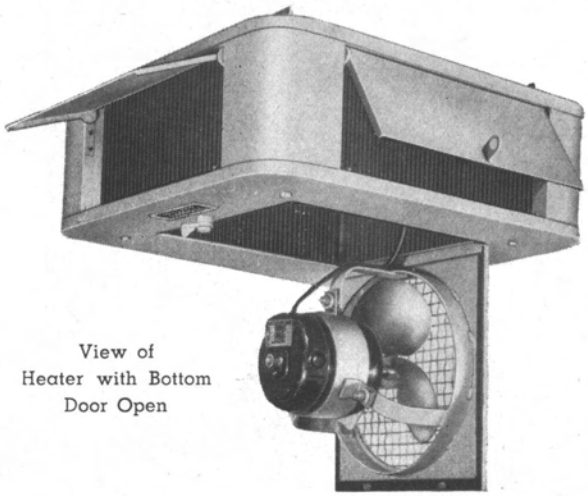


Sectioned View of Heater

Steam taken from the train line passes through a regulator and a supply loop, and then flows through the radiation piping of the heater. Condensate passes back from the heater through a drain pipe to the return portion of the supply loop for discharge by the regulator drain tube. A No. D-135 globe valve should be located ahead of the heater in the steam line as a means of throttling the volume of steam admitted to the heater, so that in milder weather less steam can be supplied to the unit.

SPECIFICATIONS

Both the Nos. V-935 and VA-935 Overhead Baggage Car Heaters are 25″ square, 8½″ high and weigh 140 pounds. Each is capable of delivering 50,000 BTU of heat per hour, using 1,000 CFM of air. The temperature of air passing through the heater is raised 50 degrees (under the above conditions), so that air entering the unit at a temperature of 60 degrees F. is discharged at a temperature of 110 degrees F. Either heater is available with a 32 volt motor (approx. 4.5 Amps.), a 40 volt motor (approx. 3.5 Amps.), a 64 volt motor (approx. 2.2 Amps.) or a 120 volt motor (approx. 1.2 Amps.). These motors are listed in the table on page 2 of this Bulletin.



View of Heater with Bottom Door Open

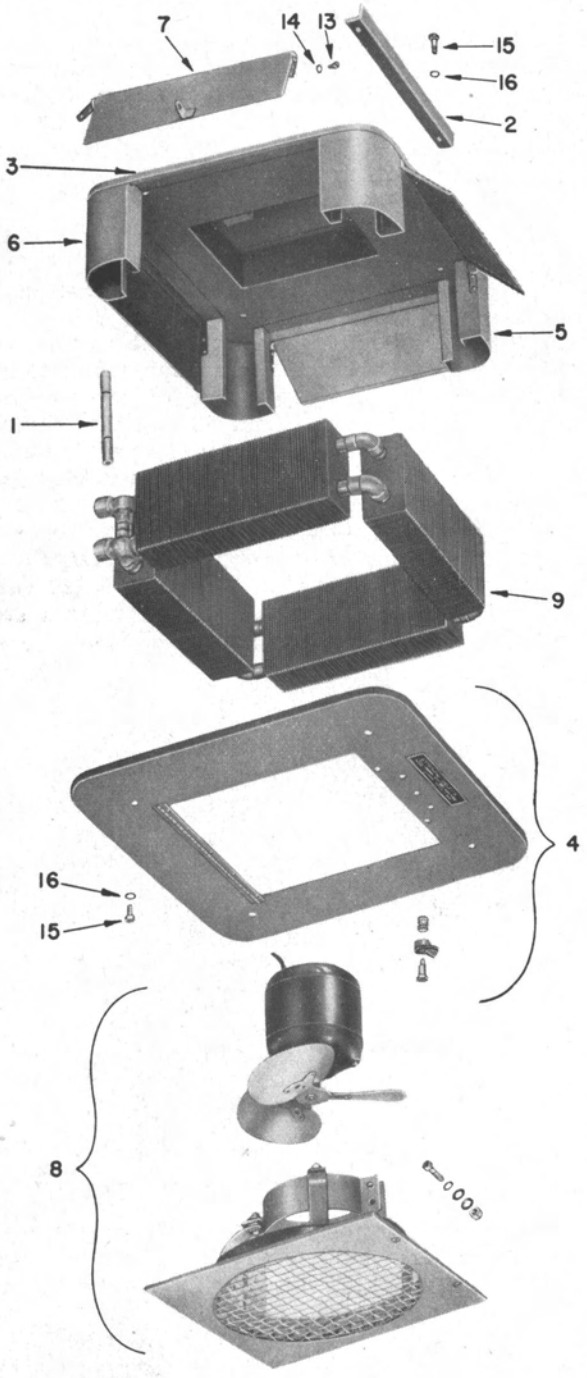
MAINTENANCE AND OVERHAUL

This heater requires very little operational maintenance beyond inspection of the fan and motor. The radiation fins must be kept clear of

NOS. V-935 AND VA-935 OVERHEAD BAGGAGE CAR HEATERS (Cont.)

dust and dirt as this accumulation tends to retard the radiation of heat from the fins. For this purpose, loosen the two round head screws on the door and turn the lock so that the door on which the motor and fan are mounted will swing down for easy access. With the door in this position, blow out the radiating fins with an air hose.

For the purpose of general overhaul, the following procedure should be followed. Remove the four cap screws (syms. 15) from the top sheet assembly (sym. 3) and the four cap screws (syms. 15) from the bottom sheet assembly (sym. 4). The motor and fan may be removed for inspection and overhaul by unscrewing the nut and capscrew from the motor band clamp.



Exploded View of Overhead Baggage Car Heater

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	V-935-1	Radiator Mounting Post	4
2	V-935-2	Mounting Angles	2
3	V-935-AA	Top Sheet Assembly	1
4	V-935-BB	Bottom Sheet Assembly	1
	V-935-B-1	Bottom Sheet (with Port Channel Assembly)	
	V-935-B-2	Reinforcing Plate	
	V-935-B-3	Lock Handle	
	V-935-B-4	Stud	
	V-935-B-5	Hinge	
	935-C-12	Spring	
	V-935-B-9	Spring	
	1/8"x1/4" Lg.	Rivet (Rd. Head)	
	3/16"x3/8" Lg.	Rivet	
	#8-32x5/16" Lg.	Screw (Fil. Head)	
	#10	Plain Washer	
	#8	Lockwasher	
	#8-32	Hex Nut	
5	V-935-CC	Corner Post Assembly	3
6	V-935-DD	Inlet Post Assembly	1
7	V-935-EE	Louver Assembly	4
	V-935-E-1	Louver	
	V-935-V-3	Louver Support (Right)	
	V-935-V-4	Louver Support (Left)	
	3/16"x5/16" Lg.	Rivet	
8	V-935-FF or VA-935-FF	Motor, Fan and Door Assembly	1
	V-935-F-1	Lower Motor Mount	
	V-935-F-2	Upper Motor Mount	
	V-935-F-3	Motor Mount Spacer	
	V-935-F-4	Retainer	
	V-935-F-5	Motor Band Clamp	
	V-935-F-6	Propeller Fan	
	V-935-FF-7	Door Assembly	
	V-935-F-8	Grille Door (with Hinge Spacer)	
	V-935-F-9	Grille	
	V-935-F-10	Side Gasket	
	V-935-F-11	Front Gasket	
	V-935-F-13	Hoop and Grill Frame Assem.	
	V-935-FF-7-7	Fastener	
	V-935-FF-7-8	Grommet	
	1/8"x7/16" Lg.	Rivets	
	#6	Plain Washer	
	V-935-FF-18	Motor Band Assembly	
	103,760-S-56	Clamp	
	See Table	Motor (Marathon Electric—Specify Voltage)	
	3/8"-16x1" Lg.	Cap Screw, Hex Head	
	3/8"	Std. Split Lockwasher	
	3/8"-16	Hex Nut	
	5/16"-24-1-3/8" Lg.	Hex Head Cap Screw	
	5/16"	Plain Washer	
	5/16"	Std. Split Lockwasher	
	5/16"-24	Hex Nut	
	#1/4-28-5/16" Lg.	Round Head Screw	
	1/4"	Std. Split Lockwasher	
9	V-935-GG	Radiator Assembly	1
	1/2"	Handy Box	1
		Handy Box Cover	1
	1/2"	Box Connector	1
	#10-32-3/8" Lg.	Rd. Head Machine Screw	2
	#10-32	Hex Nut	2
	#10	Std. Split-Type Lockwasher	2
13	#8-32-5/16" Lg.	Bd. Head Screw	21
14	#8	Shakeproof Lockwasher	21
15	3/8"-16-3/4" Lg.	Hex Head Cap Screw	8
16	3/8"	Std. Split-Type Lockwasher	8
	46-A-363	Name Plate	1
	#4-3/16" Lg.	Parker Talon B. H. Screw	4

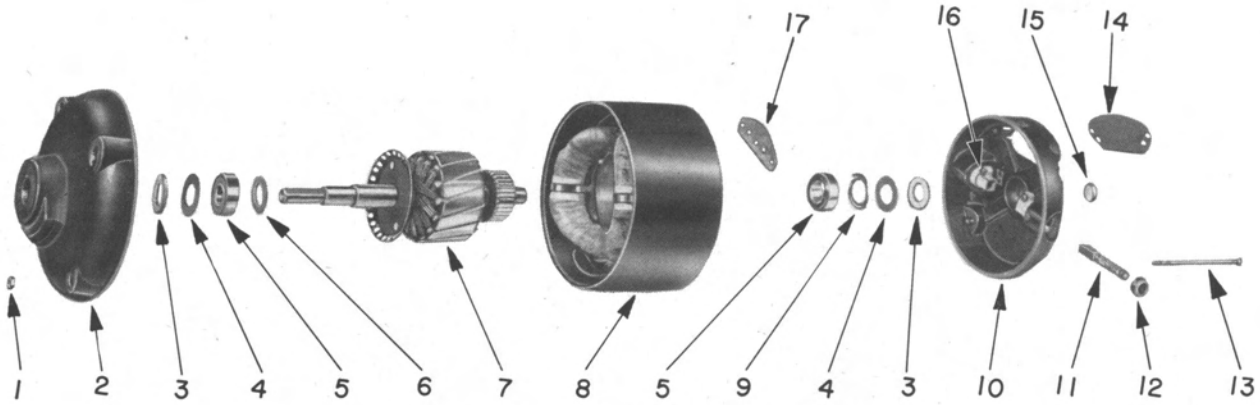
NOTES:
1. For Parts List of Motors see Bulletin 61-135-1.
2. The Nos. 1901 type and 1906 type control panels, which are used when several No. VA-935 Overhead Baggage Car Heaters are located in the same car and are to be connected in series for simultaneous speed control, are shown on Vapor Drawings 49-B-335, 49-B-389 and 50-B-61, copies of which are available upon request.

For	Motor	32 Volt	40 Volt	64 Volt	120 Volt
V-935	Shunt Type	3-107,071	4-107,071	6-107,071	12-107,071
VA-935	Series Type	3-107,091	4-107,091	6-107,091	12-107,091

PRINTED IN U.S.A.

REPLACEMENT PARTS FOR MOTORS FOR OVERHEAD BAGGAGE CAR HEATERS Nos. V-935 AND VA-935

32 VOLT MOTOR—4.5 AMPS.
40 VOLT MOTOR—3.5 AMPS.
64 VOLT MOTOR—2.1 AMPS.
120 VOLT MOTOR—1.2 AMPS.



Exploded View of Motor Showing Replaceable Parts

LISTS OF REPLACEABLE PARTS

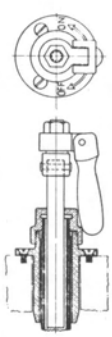
Sym.	Description	SHUNT TYPE MOTORS				SERIES TYPE MOTORS			
		32 Volt 3-107,071	40 Volt 4-107,071	64 Volt 6-107,071	120 Volt 12-107,071	32 Volt 3-107,091	40 Volt 4-107,091	64 Volt 6-107,091	120 Volt 12-107,091
1	Stud Nut	107,071-1	107,071-1	107,071-1	107,071-1	107,071-1	107,071-1	107,071-1	107,071-1
2	End Bracket Compl. (Shaft End)	107,071-2	107,071-2	107,071-2	107,071-2	107,071-2	107,071-2	107,071-2	107,071-2
3	Felt Washer	107,099-15	107,099-15	107,099-15	107,099-15	107,099-15	107,099-15	107,099-15	107,099-15
4	Steel Take-Up Washer	107,099-14	107,099-14	107,099-14	107,099-14	107,099-14	107,099-14	107,099-14	107,099-14
5	Ball Bearing	107,071-5	107,071-5	107,071-5	107,071-5	107,071-5	107,071-5	107,071-5	107,071-5
6	Pull Washer	107,099-16	107,071-6	107,099-16	107,099-16	107,099-16	107,099-16	107,071-6	107,071-6
7	Armature and Shaft Assemb.	3-107,071-7	4-107,071-7	6-107,071-7	12-107,071-7	3-107,091-7*	4-107,091-7	6-107,091-7	12-107,091-7
8	Frame and Stator Assemb.	3-107,071-8	6-107,091-8	6-107,071-8	12-107,071-8	3-107,091-8*	4-107,091-8	6-107,091-8	12-107,091-8
9	Loader Spring	107,099-13	107,099-13	107,099-13	107,099-13	107,099-13	107,099-13	107,099-13	107,099-13
10	End Bracket Compl. (Comm. End)	107,071-10	107,091-10	107,071-10	107,071-10	107,071-10	107,071-10	107,091-10	107,091-10
11	Brush	107,071-11	4-107,071-11	107,071-11	107,071-11	107,099-10	107,091-11	107,099-10	107,099-10
12	Brush Cap	107,071-12	107-071-12	107,071-12	107,071-12	107,071-12	107,071-12	107,071-12	107,071-12
13	Stud Bolt	107,071-13	107,091-13	107,071-13	107,071-13	107,091-13	107,091-13	107,091-13	107,091-13
14	Terminal Plate	107,071-14	107,091-14	107,071-14	107,071-14	107,071-14	107,091-14	107,091-14	107,091-14
15	Dust Cap	107,071-15	107,108-22	107,071-15	107,071-15	107,108-22	107,108-22	107,108-22	107,108-22
16	Brush Rigging Assemb.	107,099-9	107,099-9	107,099-9	107,099-9	107,099-9	107,099-9	107,099-9	107,099-9
17	Terminal Block	107,071-17	107,071-17	107,071-17	107,071-17	None	None	None	None

Note: *Part listed for standard Motor Model 52M13. To order part for early Motor Model 52A13, add suffix—52A13 to part number.

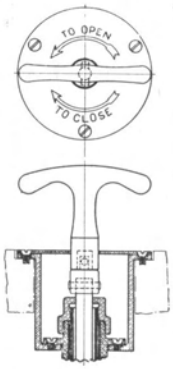
No. 1641 REMOTE CONTROL OPERATING ATTACHMENT

FOR MANUALLY OPERATING MAGNETIC VAPOR CUT-OUT VALVES MOUNTED UNDERNEATH FLOORS

WEIGHT 3 LBS.



Type "A"



Type "B"

GENERAL DESCRIPTION

The No. 1638 and No. 1639 Magnetic Vapor Cut-Out Valves, which are mounted underneath the floor of the car, are equipped with the No. 1641 Remote Control Operating Attachment of Type A or Type B, as partially illustrated at left for manual operation of the valves in the event of sticking or thermostat failure.

The Type A attachment has a drop handle. Type B has a recessed floor box for use with berth key. The Type C attachment, not illustrated on this page, but also available, is not recessed but also is designed for use of berth key.

The handle or berth key turns an operating rod or shaft attached to a flexible shaft or cable within a flexible casing, transmitting the motion to the valve box beneath the floor. To protect the flexible casing from rusting, etc., the casing is enshrouded in a braid moulded rubber casing jacket.

FOR APPLICATION, see illustrations on page 3.

OPERATION

TO OPEN the Magnetic Cut-Out Valve, move the Remote Control Operating handle about a quarter turn to the RIGHT, as far as it will go and allow it to return to center.

TO CLOSE the Magnetic Cut-out Valve, move the remote control operating handle about a quarter turn to the LEFT, as far as it will go and allow it to return to center.

Where a berth key or a berth key type lever is used, as on the "B" Type Remote Control, move the lever or berth key about ¼ turn in the same direction as a globe valve to either open or close the magnetic valve.

NOTE: The handle or key arrangement of the remote control cable does not stay in either open or closed position, but turns to normally central position. Therefore, it is not possible to tell whether the magnetic valve is open or closed by the position of the remote control operating handle or key end.

MAINTENANCE

CHECK THE OPERATING ATTACHMENT at the beginning of each heating season. When making repairs, disconnect the complete cable from the valve box and remove couplings to pull out the inner flexible shaft or cable. The inner cable should then be heavily greased with Dixon's graphite grease, which will not only provide lubrication, but also prevent rusting.

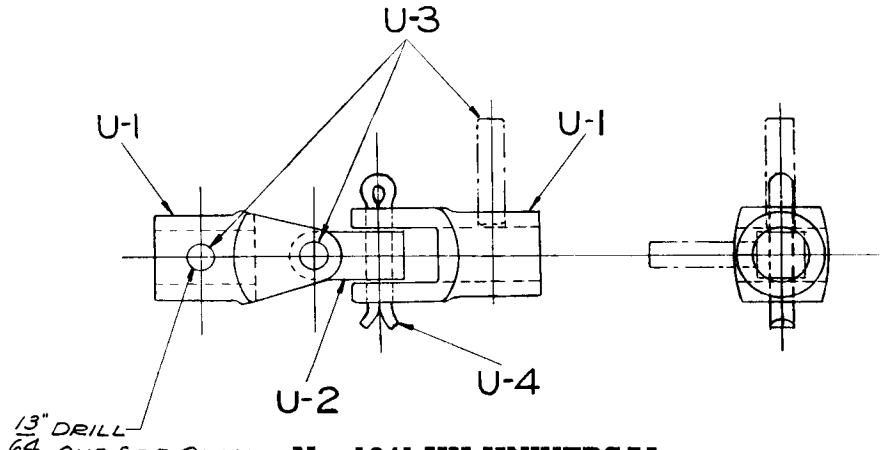
During the course of the heating season, the operating rod can be lubricated by introducing oil into the oil groove provided in the operating rod and housing nut.

No. 1641 REMOTE CONTROL OPERATING ATTACHMENT

LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T	MATERIAL
⊗ A	1641-A	Shaft	1	Steel
⊗ B	1641-B	Casing	1	Steel
⊗ C	1641-C	Nut (Casing)	1	Brass
⊗ D	1641-D	Coupling (Shaft)	2	Brass
⊗ E	1641-E	Yoke (Shaft)	1	Brass
⊗ F	1641-F	Sleeve	1	Brass
⊗ G	1641-G	Dust Ring	1	Felt
H	122-H	Handle (Complete)	1	M. I.
J	1641-J	Adapter (Handle)	1	Brass
⊗ K	1641-K	Housing	1	Brass
⊗ L	1641-L	Nut (Housing)	1	Brass
⊗ M	1641-M	Clamp (Flexible Shaft Support)	1	Steel
⊗ M-1	5/16"-18 x ¾"	Bolt and Nut	1	Steel
N	1641-N	Adapter (Berth Key)	1	Brass
P	1641-P	Plate	1	Brass
Q	1641-Q	Extension (Housing)	1	Brass
⊗ R	1641-R	Operating Rod (Specify length)	1	Brass
⊗ R-8	1641-R-8	Rod—8" long	1	Brass
⊗ R-14	1641-R-14	Rod—14" long	1	Brass
⊗ R-20	1641-R-20	Rod—20" long	1	Brass
⊗ R-26	1641-R-26	Rod—26" long	1	Brass
S	No. 10-24 x ⅜"	Screw (F. H. M.)	3	Brass
⊗ T	1641-T	Operating Rod Tube (Specify length)	1	½" Std. Conduit
⊗ T-6	1641-T-6	Tube—6" long	1	½" Std. Conduit
⊗ T-12	1641-T-12	Tube—12" long	1	½" Std. Conduit
⊗ T-18	1641-T-18	Tube—18" long	1	½" Std. Conduit
⊗ T-24	1641-T-24	Tube—24" long	1	½" Std. Conduit
* UU	1641-UU	Universal Complete	1	Brass
X	1641-X	Stop (Operating Rod)	1	Brass
⊗ U-2	1641-U-2	Block	1	Brass
⊗ U-3	1641-U-3	Pin	1	Brass
⊗ V	½" Std. Pipe	Coupling	1	M. I.
W	⅜"-16 x 5/16"	Nut	1	Brass
U-4	3/16" dia. x 1"	Cotter	1	
RR	1641-RR	Flexible Shaft and Rod Assembly Includes parts A, B, 2 Cs, 2 Ds, E, F, G & R	1	Sing. Braid
Y	1641-Y	Jacket (Casing) 12¼" lg. (½" I. D.)	1	Mould. Rubber

NOTE:
TYPE A—Consists of parts bearing ⊗ plus parts H, J & W. 1 of U-3.
TYPE B—Consists of parts bearing ⊗ plus parts N, P, Q & S. 2 of U-3.
TYPE C—Consists of parts bearing ⊗ plus part N and 2 of U-3.



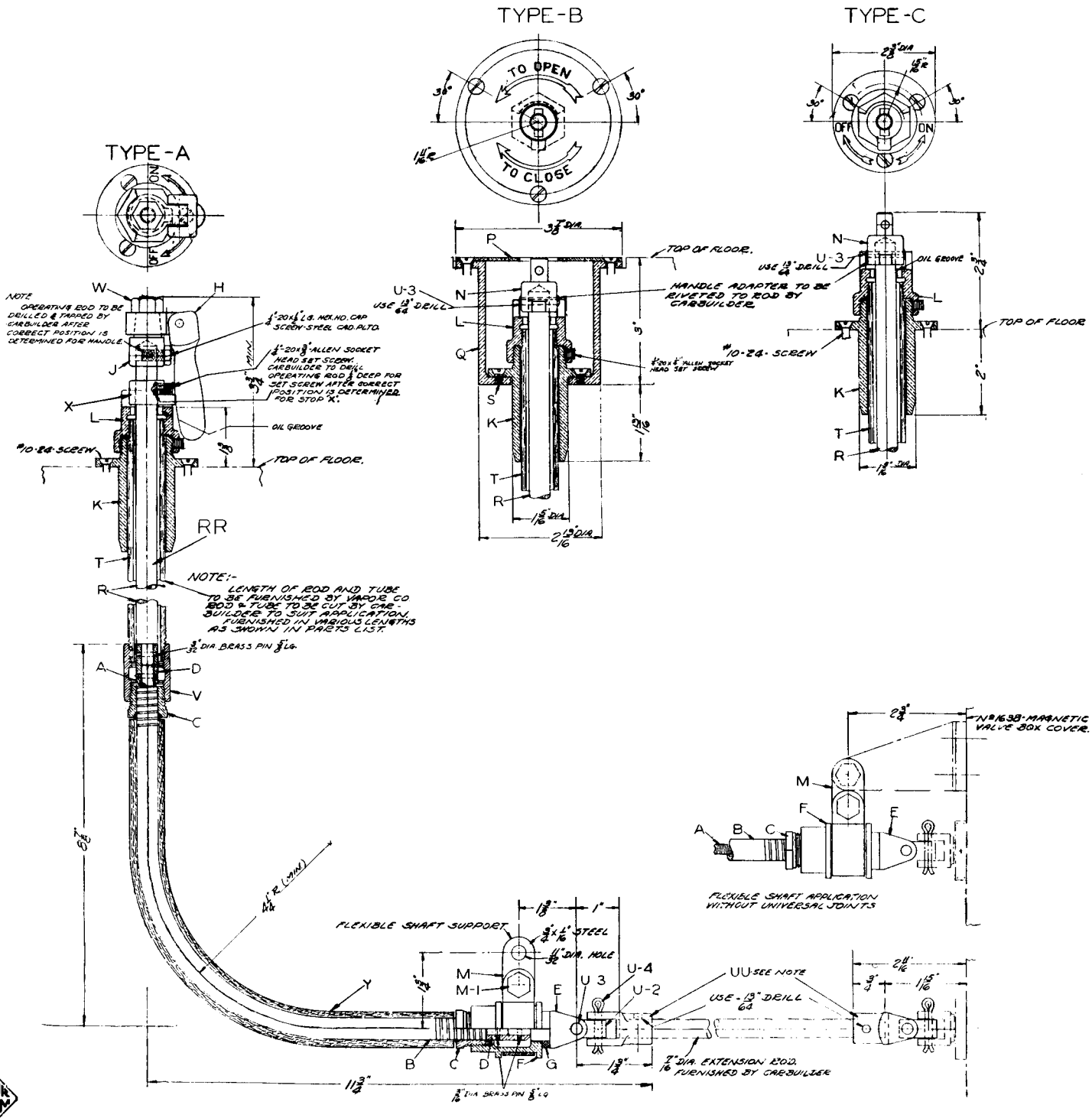
No. 1641-UU UNIVERSAL

LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T	MATERIAL
U-1	1641-U-1	Yoke (Incl. U-4)	2	Brass
U-2	1641-U-2	Block	1	Brass
U-3	1641-U-3	Pin	3	Brass
U-4	3/16" dia. x 1" long	Cotter	1	Brass
UU-1	1641-UU-1	Yoke with U-2 Block, U-3 Pins and U-4 Cotter		

* NOTE: Use 1 No. 1641-UU Universal Joint when application of 7/16" dia. extension rod is necessary.

No. 1641 REMOTE CONTROL OPERATING ATTACHMENT FOR MANUALLY OPERATING MAGNETIC VAPOR CUT-OUT VALVES MOUNTED UNDERNEATH FLOORS



No. 906 CONDENSATION RELIEF VALVE

1" MALE I. P. S. INLET — 1" FEMALE I. P. S. OUTLET — WEIGHT 1 LB. 14 OZS.

No. 906 VAPOR
Condensation Relief Valve

GENERAL DESCRIPTION

The No. 906 Condensation Relief Valve was designed and developed for use with Nos. 1636 to 1639 Disc Type Magnetic Vapor Cut-Out Valves to drain the pocket between valves when applied in series. This relief valve will open to relieve condensate from pocket on vapor pressure line between cut-out valves, but will close tightly against steam. Where the Nos. 1639 to 1639 Cut-Out Valves are applied singly, or are fed in parallel and not in series, no condensate relief valve is required.

A drain tube can be attached to the Condensate Relief Valve for depositing the relieved condensation at a lower level, where desired.

The No. 906 Condensation Relief Valve should not be used on pressure steam lines. The No. 141 Steam Trap should be used for draining low pressure steam lines (between 0 lbs. and 75 lbs.), while the Nos. 112, 113, 115, and 152 Steam Traps are available for draining high pressure steam lines (between 0 lbs. and 250 lbs.).

ADVANTAGES OF THE NO. 906 CONDENSATION RELIEF VALVE:

The discharge valve is of the ball type and is attached to a thermostatic element, which expands against steam temperature to seat the valve against a 3/8" seat orifice.

Both the ball valve and the valve seat are easily renewable.

The thermostatic element or bellows is helically corrugated, made of seamless bronze tubing of heavy wall.

OPERATION OF THERMOSTATIC ELEMENT:

When steam strikes the thermostatic element or bellows, a portion of the volatile liquid contained within it vaporizes, building up internal pressure to expand the bellows and close the valve. When air or condensate at about 150° F. reaches the bellows, it cools and contracts to open the valve.

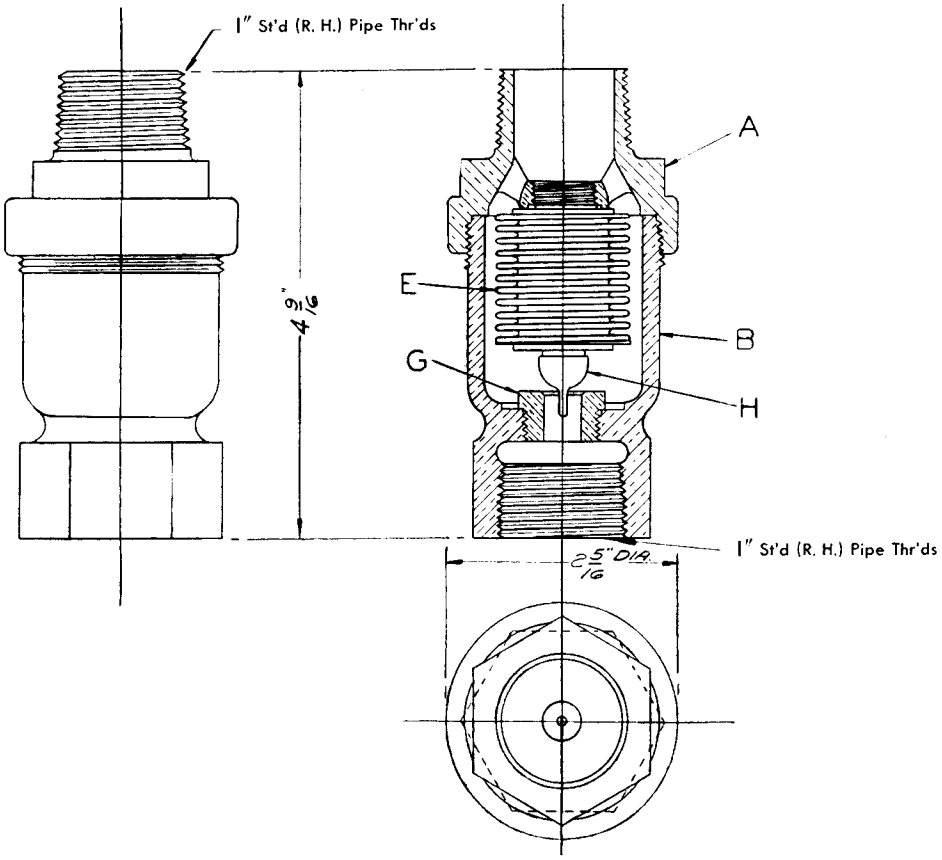
The bellows for the No. 906 Condensation Release Valve is marked "906" and it is important that only bellows so marked be used on this particular device. Bellows of like size and appearance that may possibly be used on other similar devices, have different temperature responsive characteristics and cannot be used in this valve to obtain proper operative results.

No. 906 CONDENSATION RELIEF VALVE (Cont.)

TESTING BELLOWS FOR LEAKS:

To test thermostatic bellows, place in a clamp and submerge in water at about 190° F. If the bellows has any leaks, this will be indicated by bubbling due to vaporized liquid or air escaping from the bellows. Such a bellows must be replaced. Do not attempt to refill or reclaim thermostatic bellows.

CAUTION: Do not remove bellows from device, when hot, nor subject the bellows to live steam when not in device, as otherwise bellows will become over-expanded and will not come back to its normal fully contracted form when cooled down. Also, when testing bellows in hot water, do not remove bellows, while still hot, from clamp.



LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION
A	906-A	Retainer, Bellows
B	906-B	Body
E	906-E	Bellows, Thermostatic (Incl. "H" Valve and "J" Nut)
G	895-G	Valve Seat
H	895-H	Valve
J	895-J	Nut, Valve Retaining

MAINTENANCE

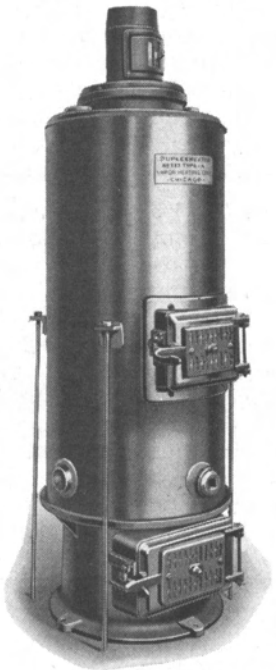
This device should be checked each year before the beginning of the heating season. The bellows should be removed and tested for leaks, as indicated above. In the event the valve and seat are badly scored and do not seat tight, they should be renewed. The valve seat can be lapped, if ever required.

Failure of the bellows or thermostatic element will be indicated in service by steam blowing at the drain outlet.

Printed in U. S. A.

No. 557 SIMPLEX AND DUPLEX HOT WATER HEATERS

CAPACITY: 400 Sq. Ft. WEIGHT SIMPLEX: 570 Lbs. WEIGHT DUPLEX: 600 Lbs.



No. 557 Hot Water Heater

GENERAL DESCRIPTION

The No. 557 Hot Water Heater is designed to meet the requirements of hot water heating systems on railway cars which use this method of heating. This unit is of welded steel construction and is made to withstand any pressures to which it may be subjected in service. It is furnished in both a Duplex model (with an auxiliary steam pipe coil for connection to a steam line when it is available), and a Simplex model which has no steam pipe coil.

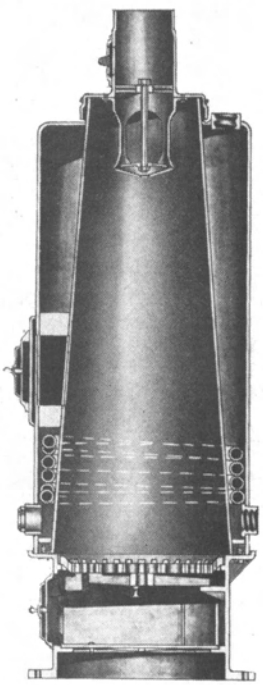
In cases where the welded shell heater is used in self-propelled railway cars, or cars powered by other means than steam, present regulations call for a control mechanism to limit the temperature of the water in the unit. Such a control mechanism is shown in the illustration on page 4 and may be ordered separately in the form of a kit for these installations. The control limits the temperature of the water to 250° F. by operating the check and draft dampers in accordance with the water temperature. Heaters equipped with this control are available on order, if desired.

The heaters are designed to burn hard coal or a good grade of range size soft coal. If soft coal is used, it should have a heat value of not less than 12,000 BTU per pound (dry). Water is heated between the inner shell which contains the fire and the outer shell of the heater. A number of inlets and outlets are provided so that the heater may be connected into any type of water piping.

When connecting the No. 557 Simplex Hot Water Heater into a car several pieces of additional equipment are required. This equipment includes a No. 515 Expansion Drum, a No. 516 Water Gauge, two No. 517 Inlet Cocks, a No. 520 Combination Filling Valve, a No. 513 (type 3) Safety Valve, a No. 508 Safety Valve, a No. 291 Pressure Gauge and a No. C-4050-ZZ Smoke Jack. The Duplex model of this heater requires also a No. 124 or 125 steam inlet valve, a No. S-155 steam trap, a No. 242 pressure regulating valve, a No. 291-B pressure gauge and a strainer tee for connection of the auxiliary pipe coils to the steam supply. A No. B-4071 circulating pump is recommended for rapid heating and even temperatures in the car.

MAINTENANCE AND OVERHAUL

No special attention is required for the efficient operation of the No. 557 Hot Water Heater beyond proper firing, the emptying of ashes and the correct control of the water heated. The drafts of the heater should be adjusted to suit the heating requirements of the car.



Sectioned View of No. 557 Duplex Heater

No. 557 SIMPLEX AND DUPLEX HOT WATER HEATERS (Continued)

Safety valves and water gauges should be checked about every ninety days for clogging from impurities in the water. The No. 513 Safety Valve on the expansion tank should be set for 45 lbs. of steam and the No. 508 Valve on the heater set at 50 lbs. of water.

The No. 520 Combination Filling Valve should be inspected and cleaned and the water gauges should be cleaned as follows:

1. Remove and clean glass A. This may be done with the system in operation by closing valves B and C. Then open valve C to make sure that the valve and fittings are free from sediment. Be careful not to scald face or hands during this operation. Replace the glass and open both valves to indicate water level.
2. Remove and clean glass A as in step 1. Remove plug E and "rod out" the piping to free it of sediment. Then replace the plug and the glass and open both valves.
3. Remove the glass A and the nipple F, clean all parts and remove sediment from elbow G. Replace the glass and the nipple and leave the valves open.
4. For a final test, or for a 30-day inspection, close valve C and drain the water from the glass by opening petcock D. Then open valve C and allow additional water to drain through. This procedure will indicate whether or not the connections are open. Close the petcock and fill the system to the proper level, making sure that the valves are left open.

The heater should be washed out every year. For this purpose, remove the washout plug and the pipe plug in the top of the heater which is not being used and apply a hose to wash out all dirt and sediment. Heater door locks should be oiled and inspected to be sure that they close and lock properly. Inspect the grates and replace them if they show signs of burning out. Also, check the ash pan for replacement if necessary. If a Duplex heater is used, inspect the pressure regulating valve, gauges, inlet valve and steam trap for wear and proper operation.

LIST OF PARTS

No. 557 SIMPLEX HOT WATER HEATER

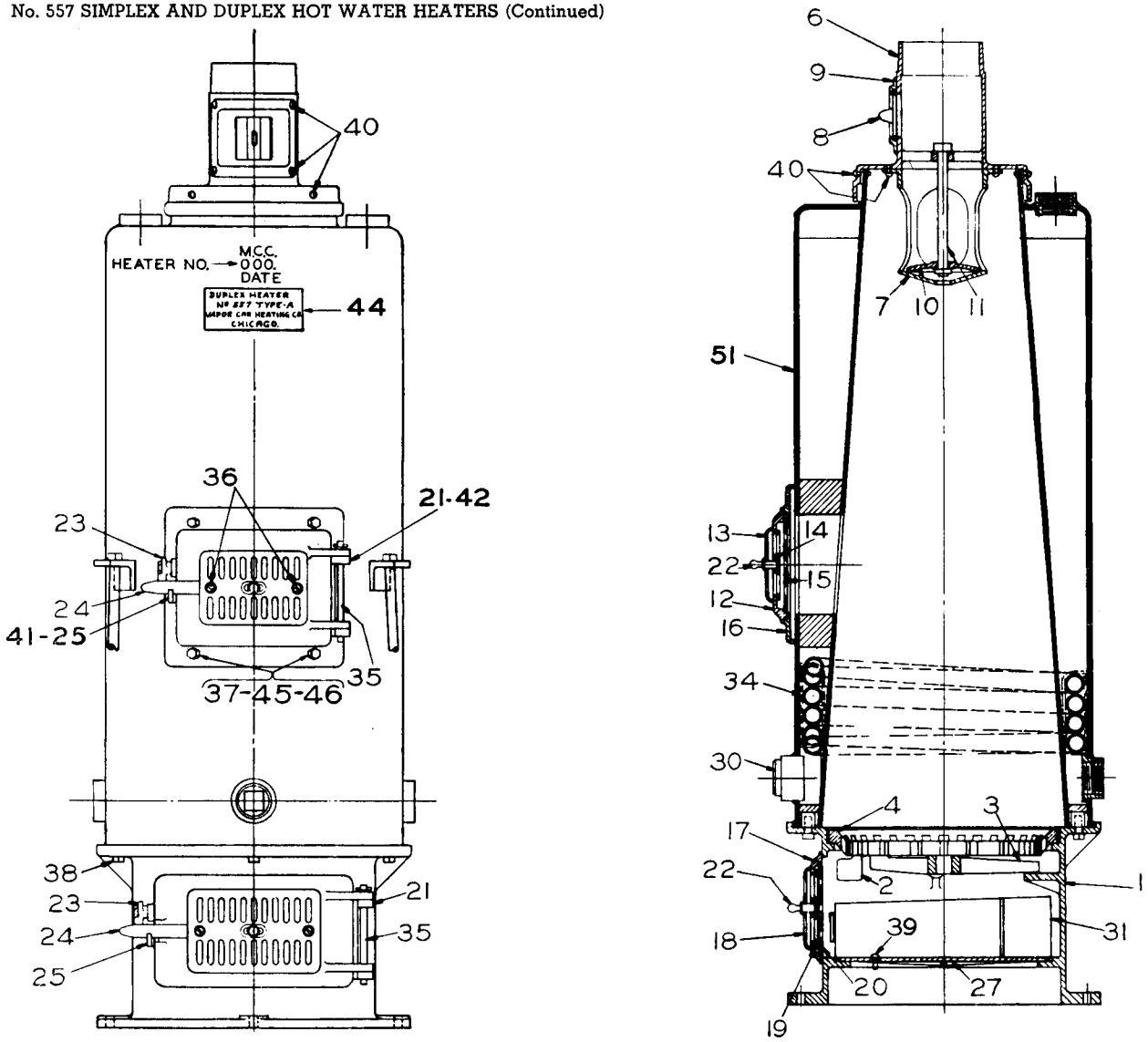
Sym.	Part No.	Description	Amt.
1	557-1	Base	1
2	557-2	Grate	1
3	557-3	Grate Bar	1
4	557-4	Grate Ring	1
5	557-5	Shaker	1
6	557-6	Heater Top	1
7	557-7	Magazine	1
8	557-8	Top Draft Slide	1
9	557-9	Top Draft Slide Frame	1
10	557-10	Deflector	1
11	557-11	Deflector Bolt	1
12	557-12	Upper Door	1
13	800-P	Upper Door Front	1
14	800-R	Upper Door Slide	1
15	557-15	Upper Door Warp Plate	1
16	557-16	Upper Door Casing	1
17	557-17	Lower Door	1
18	557-18	Lower Door Front	1
19	557-19	Lower Door Slide	1
20	557-20	Lower Door Warp Plate	1
21	557-21	Upper and Lower Door Hinge	2
22	800-S	Upper and Lower Door Knob	2
23	800-T	Upper and Lower Door Lock	2
24	557-24	Upper and Lower Door Latch	2
25	557-25	Upper and Lower Door Latch Plate	2
26	557-26	Heater Body	1
27	557-27	Base Bottom	1
30	557-30	Washout Plug	1
31	557-31	Ash Pan	1
35	557-35	Upper and Lower Door Hinge Pin	2
36		Door Front Bolt (¼"x1½" lg.)	4
37		Door Casing Sq. Hd. M. Bolt (⅜"-16x⅝" lg.)	4
38		Base Fastening Bolt (½"x1¼" lg.)	4
39		Base Bottom Fastening Bolt (¼"x1" lg.)	4
40		Heater Top, Draft Frame and Magazine Bolts (¼"x¾" lg.)	12
41		Latch Plate F. H. Stove Bolts (5/16"x1" lg.)	4
42		Hinge Bolts (5/16"x1" lg.)	4
43	557-43	Name Plate	1
45	557-45	Cap Nut (⅜" Std. Hex. Hd.)	4
46		Lockwasher (⅜" Dia. Std.)	4

LIST OF PARTS

No. 557 DUPLEX HOT WATER HEATER

Sym.	Part No.	Description	Amt
1	557-1	Base	1
2	557-2	Grate	1
3	557-3	Grate Bar	1
4	557-4	Grate Ring	1

No. 557 SIMPLEX AND DUPLEX HOT WATER HEATERS (Continued)



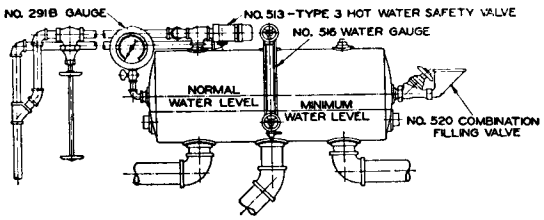
Drawing of the No. 557 Duplex Hot Water Heater Showing Part Numbers

Sym.	Part No.	Description	Amt.
5	557-5	Shaker	1
6	557-6	Heater Top	1
7	557-7	Magazine	1
8	557-8	Top Draft Slide	1
9	557-9	Top Draft Slide Frame	1
10	557-10	Deflector	1
11		Deflector Bolt	1
12	557-12	Upper Door	1
13	800-P	Upper Door Front	1
14	800-R	Upper Door Slide	1
15	557-15	Upper Door Warp Plate	1
16	557-16	Upper Door Casing	1
17	557-17	Lower Door	1
18	557-18	Lower Door Front	1
19	557-19	Lower Door Slide	1
20	557-20	Lower Door Warp Plate	1
21	557-21	Upper or Lower Door Hinge	2
22	800-S	Upper or Lower Door Knob	2
23	800-T	Upper or Lower Door Lock	2
24	557-24	Upper or Lower Door Latch	2

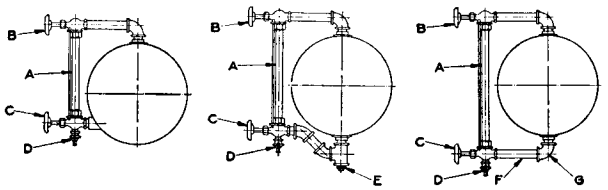
Sym.	Part No.	Description	Amt.
25	557-25	Upper or Lower Door Latch Plate	2
27	557-27	Base Bottom	1
30	557-30	Washout Plug	1
31	557-31	Ash Pan	1
34	562-34	Steam Coil (¼" OD. Tube)	1
35	557-35	Door Hinge Pin	2
36	¼"x1½"	Door Bolt	4
37		Door Casing Bolt (⅜"x ⅝" Sq. Hd. Mach.)	4
38		Base Fastening Bolt (½" Dia. x 1¼" lg.)	4
39	(¼"x1" lg.)	Base Bottom Bolt	4
40	¼"x¾"	Heater Top, Draft Frame and Magazine Bolts	12
41		Latch Plate F. H. Stove Bolts (5/16"x1" lg.)	4
42	5/16"x1"	Hinge Fastening Bolt (5/16"x1" lg.)	4
44	557-44	Name Plate	1
45	557-45	Cap Nut (⅜" Hex Hd.)	4
46		Lockwasher (⅜" Std.)	4
51	557-51	Heater Body	1

No. 557 SIMPLEX AND DUPLEX HOT WATER HEATERS (Continued)

Expansion Tank Application



Methods of Water Gauge Installation



No. 1 No. 2 No. 3

DIRECTIONS FOR FILLING A HOT WATER SYSTEM

To fill the hot water system, open the vents at the ends of the coils and at the top of the expansion tank. Fill the system slowly through the inlet cock at the low point of the system. Close the vents as the water reaches them and fill the system to a point 4″ or 5″ in depth in the expansion tank. Then fire the heater and circulate the system with the vent open in the expansion tank. When the circulation is completed and the water is thoroughly heated, remove the fire and allow the system to cool. After the pipes are cool, open all vents to allow air to escape to prevent the formation of air pockets. Then add more water through the combination valve on the expansion tank to fill the system to the proper level.

A special Instruction Card is issued with each heater. This card should be placed near the unit for the information of those who are concerned with the operation or maintenance of the heating equipment.

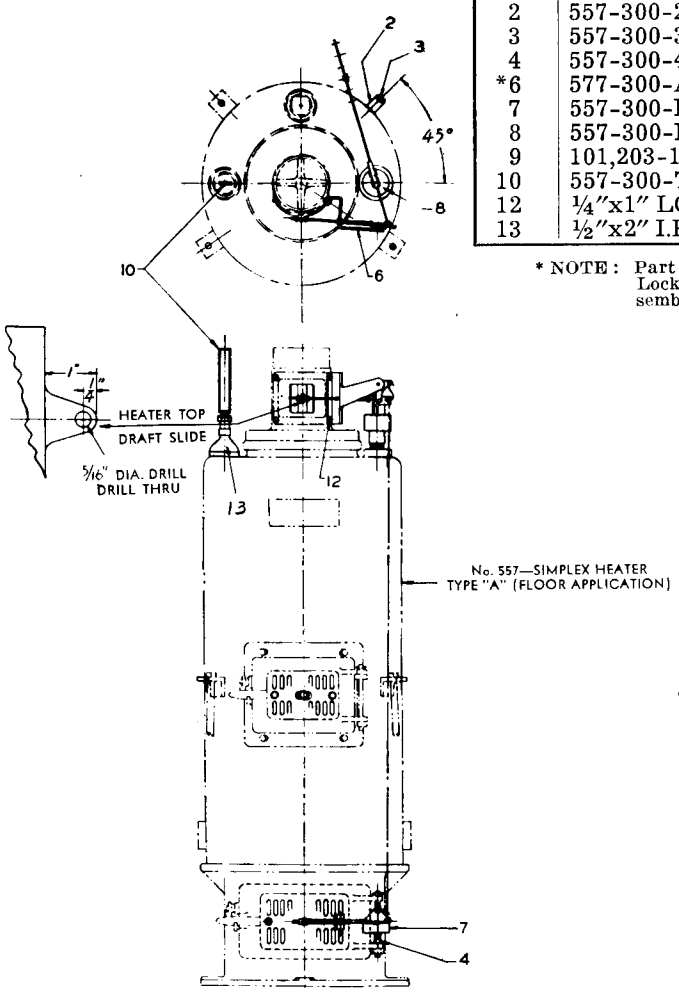
No. 557-300 DAMPER CONTROL KIT

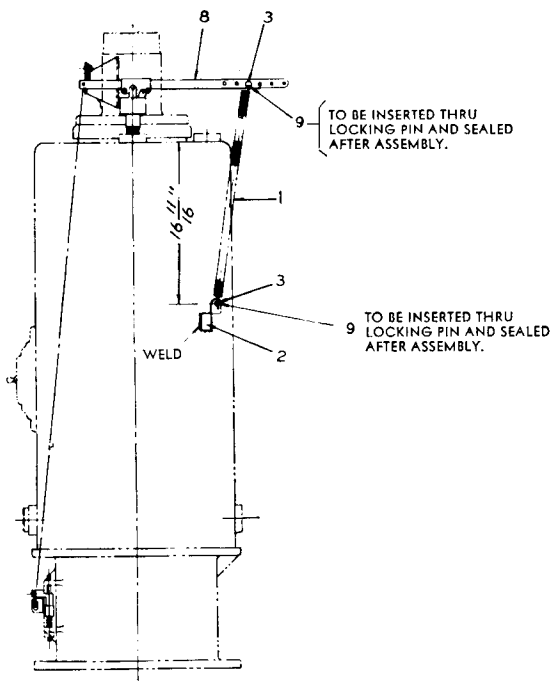
(For Application to No. 557 Simplex Heater)

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	557-300-1	Tension Spring	1
2	557-300-2	Mounting Bracket	1
3	557-300-3	Seal Pin (Tension Spring)	2
4	557-300-4	Spring (Lower Door Hinge)	1
*6	577-300-AA	Upper Damper Door Assembly	1
7	557-300-BB	Lower Damper Door Assembly	1
8	557-300-DD	Damper Regulator	1
9	101,203-13	Lead Seal	2
10	557-300-TT	50° to 400° F. Thermometer	1
12	¼″x1″ LG.	Stove Bolts	2
13	½″x2″ I.P.S.	Reducer	1

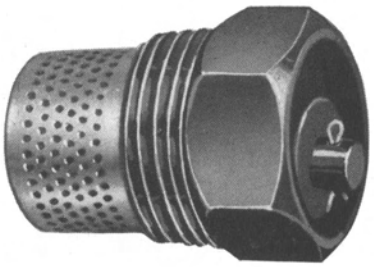
* NOTE: Part Nos. C-4050-BJ-39 Chain (6′ long) and 557-300-A-6 Locking Pin are included in Symbol 6 (Upper Door Assembly). They may also be ordered separately.





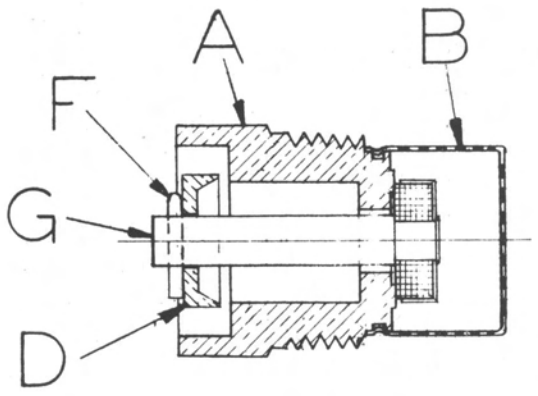
No. 114 TYPE-2 GRAVITY TRAP

1" STANDARD R. H. PIPE THREADS — WEIGHT 7 OZS.

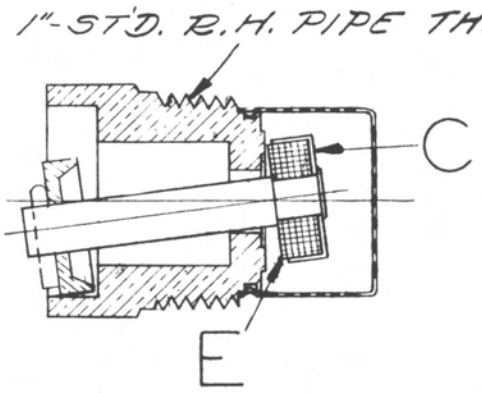


GENERAL DESCRIPTION

This trap is used in connection with steam coupler heads for draining condensation when pressure leaves trainline to prevent connections between cars from freezing in extremely cold territories.



POSITION UNDER PRESSURE.



NORMAL POSITION.

LIST OF PARTS

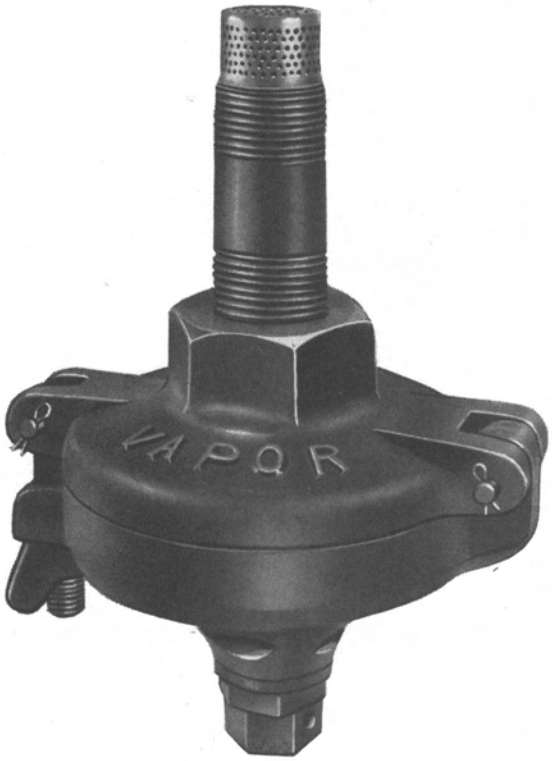
SYMBOL	PART NO.	DESCRIPTION
A	114-A	Body
B	112-D	Strainer
C	114-C	Disc Holder
D	114-D	Weight
E	114-E	Valve and Disc
F	114-F	Cotter Pin
G	114-G	Stem

No. 115 STEAM TRAP

1" STANDARD R. H. PIPE THREADS FOR INLET

WEIGHT 6¾ LBS.

MAXIMUM WORKING PRESSURE 200 LBS. AND 250 LBS.



No. 115 VAPOR Steam Trap

GENERAL DESCRIPTION

This is a vertical type high pressure steam trap with a vented cover and with no condensate return outlet provided.

This trap is now superseded on all new installations by either the No. 141 or the No. 152 trap, depending upon the installation.

The valve seat and disc are both of monel metal, assuring long service with lessened maintenance attention required.

MAINTENANCE

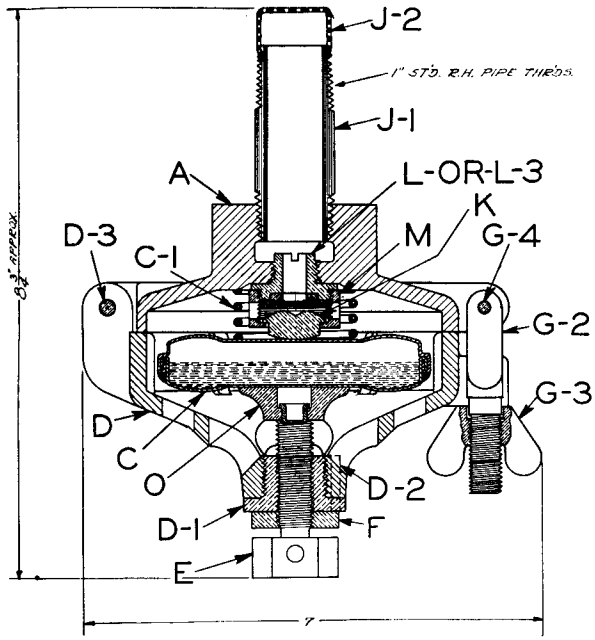
If excessive steam blows are noted, adjust with the adjusting screw. If this will not eliminate excessive steam blow, apply new diaphragm. If still not remedied, renew valve seat or disc.

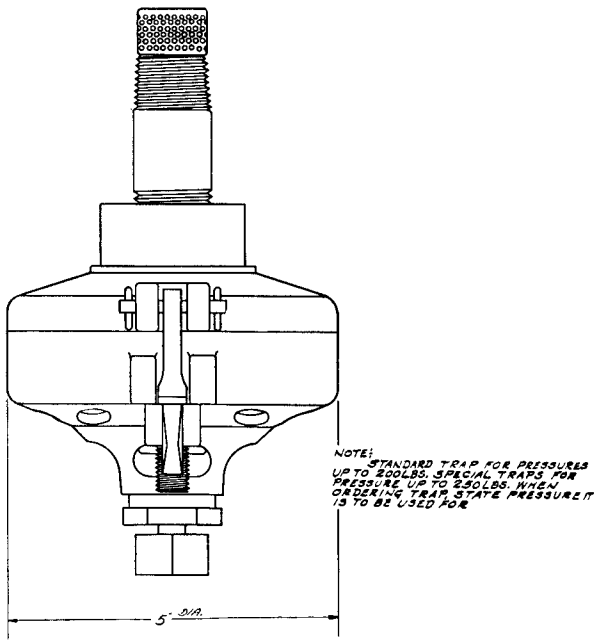
After adjusting trap, the adjusting screw should be secured by tightening the locknut.

OVERHAULING: Each year, before the beginning of the heating season, the steam traps and strainers should be removed for testing of the diaphragm, and examination of the spring, seat, disc and strainer. Any parts found defective should be repaired or replaced. See that adjusting screw, pins and cotters are in proper working order. Reassemble steam traps and test on standard steam rack under a steam pressure of about 55 lbs.

The diaphragm is to be tested for leaks and for proper expansion in hot water, in the same way as the diaphragms on the No. 440 Vapor Regulators.

No. 115 STEAM TRAP (Cont.)





LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION
A	115-A	Body
C	440-E	Diaphragm
C-1	115-C-1	Spring, Diaphragm
D	115-D	Cover
D-1	440-K-1	Bushing, Cover
D-2	440-K-2	Pin, Cover Bushing
D-3	440-K-3	Pin and Cotter, Cover
E	440-F	Adjusting Screw
F	440-U	Lock Nut
G-2	115-G-2	Link, Cover
G-3	440-H-3	Thumb Nut
G-4	440-H-4	Pin and Cotters, Cover Lock
J-1	113-J-1	Strainer Nipple
J-2	112-D	Strainer
K	115-K	Valve (Std. and for 250-lb. Trap)
L	115-L	Valve Seat, Standard (Incl. Monel Disc)
L-3	115-L-3	Valve Seat (For 250-lb. Trap, incl. Monel Disc)
M	115-M	Nut, Valve Seat Retaining
O	440-M	Plate, Diaphragm

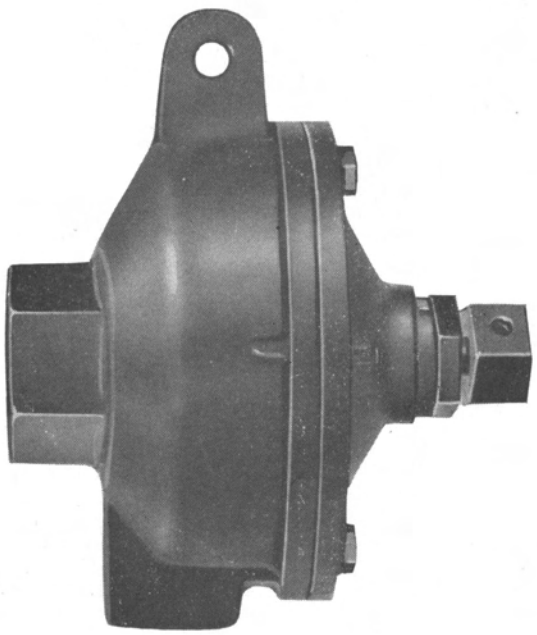
NOTE: Standard Trap for 200-lb. pressure furnished with 115-L Valve Seat. Special trap for pressures up to 250 lbs. furnished with 115-L-3 Valve Seat. When ordering trap, state pressure it is to be used for.

SYMBOL	PART NO.	DESCRIPTION
AA	115-AA	BODY COMPLETE (Incl. Parts Symbols A, K, L, M, G-2, G-3 & G-4)
DD	115-DD	HINGED COVER COMPLETE (Incl. Parts Symbols D, D-1, D-2, E, F & O)
DD-1	115-DD-1	COVER WITH BUSHING AND PIN (Incl. Symbols D, D-1 & D-2)
EE	440-FF	ADJUSTING SCREW COMPLETE (Incl. Symbols E, F & O)
JJ	113-JJ	STRAINER NIPPLE AND STRAINER (Incl. Symbols J-1 & J-2)

No. 141 STEAM TRAP

FOR LOW PRESSURE STEAM

1" PIPE INLET; ¾" PIPE OUTLET — WEIGHT 7 LBS. 13 OZS. — MAXIMUM PRESSURE 75 LBS.



No. 141 VAPOR Steam Trap

GENERAL DESCRIPTION

This Low Pressure trap is designed for use behind the No. 244 Constant Pressure Regulating Valve (or Nos. 440 to 448 Regulators) on anti-freeze lines and water protection lines. This trap is also used on steam coils underneath locomotive cab radiators and wherever low pressure steam is used, up to a maximum of 75 lbs. pressure.

The threaded outlet makes possible the return of condensate back to the tank.

The valve disc and the seat insert are both of Monel metal, assuring long service and lessening maintenance requirements.

MAINTENANCE

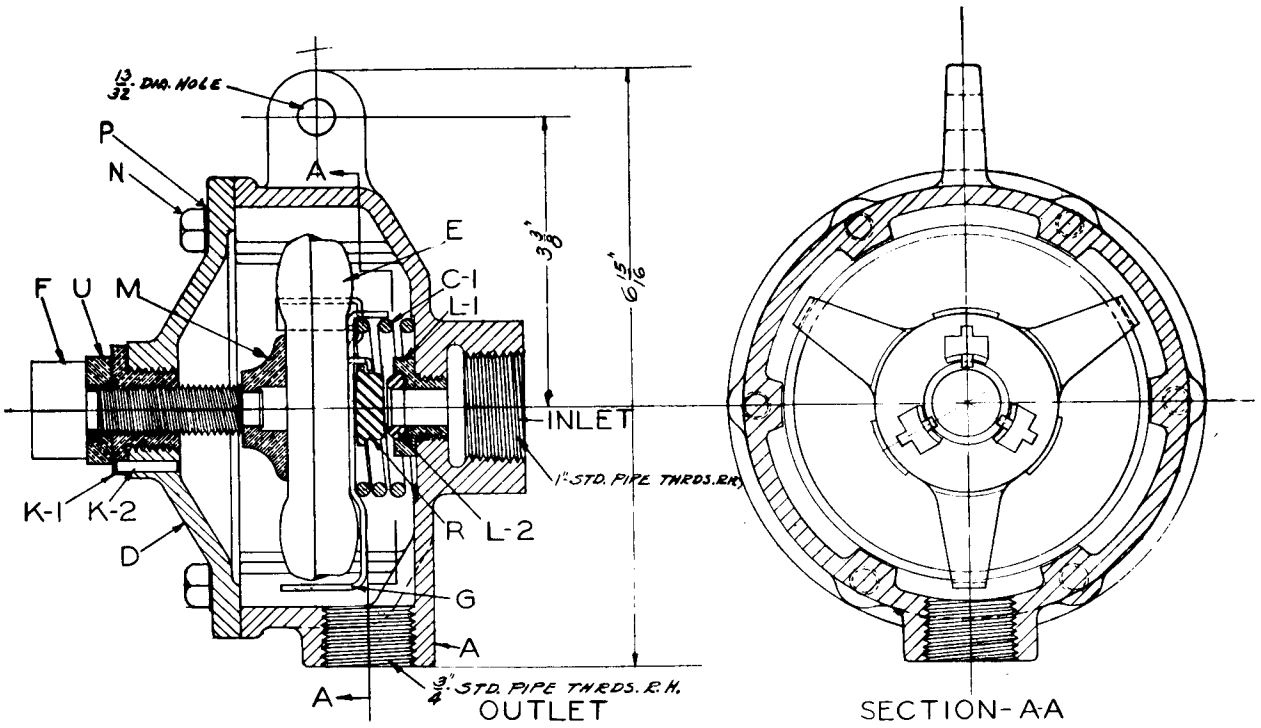
If excessive steam blows are noted, adjust set screw. If this will not eliminate excessive steam blow, apply new diaphragm. If still not remedied, renew valve seat or disc.

After adjusting trap, the adjusting screw should be secured by tightening the adjusting screw locknut.

OVERHAULING: Each year, before the beginning of the heating season, the steam traps and strainers should be removed for testing of the Diaphragm, and examination of the springs, seats, disc and strainers. If any of these parts are found to be defective or "wire - drawn," new or repaired parts should be applied. See that adjusting screws, pins and cotters are in proper working order. Reassemble steam traps and test on standard rack under a steam pressure of about 55 lbs.

The diaphragm can be tested for leaks and for proper expansion in hot water, in the same way as on No. 440 Vapor Regulators.

No. 141 STEAM TRAP (Cont.)



LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION
A	141-A	Body
C-1	115-C-1	Spring
D	141-D	Cover
E	440-E	Diaphragm
F	440-F	Screw, Adjusting
G	141-G	Guide Plate
K-1	440-K-1	Bushing
K-2	440-K-2	Pin
L	141-L	VALVE SEAT Compl. (Incl. L-1 & L-2)
L-1	141-L-1	Retainer (Not sold separately)
L-2	141-L-2	Seat (Not sold separately)
M	440-M	Plate
N	5/16"—18x3/4" long	Cap Screw
R	141-R	Disc
U	440-U	Locknut
P	5/16" Shakepr.	Lockwasher
AA	141-AA	BODY COMP. (Incl. Sym. A, L-1 & L-2)
DD	141-DD	COVER COMPL. (Incl. Parts Sym. D, F, K, K-1, M & U)
DD-1	141-DD-1	COVER WITH BUSHING & PIN (Incl. Parts Sym. D, K & K-1)
FF	440-FF	ADJUSTING SCREW COMPLETE (Incl. Sym. F, M & U)
GG	141-GG	GUIDE PLATE WITH DISC (Incl. Sym. G & R)

Printed in U. S. A.

No. 152 STEAM TRAP

FOR HIGH PRESSURE STEAM

1" PIPE INLET

WEIGHT—8 LBS. 4 OZS.
MAXIMUM WORKING PRESSURE—250 LBS.

No. 152 Steam Trap

GENERAL DESCRIPTION

This trap is designed for use on high pressure up to 250 lbs., especially for high speed service, where the No. 112 or No. 115 Steam Traps would become loaded up with dirt. The cover construction is such as to prevent dirt being driven into the trap in high speed service. Furthermore, this trap is lighter in weight than the No. 112 Trap.

The seat is of Monel metal, while the valve is of the Pilot type also of Monel. This construction keeps the valve and seat free from dirt, assuring more positive seating under difficult operating conditions, and lessens wire drawing.

This trap has no provision for returning the condensate, but has the ability to perform properly under varying train line pressures.

MAINTENANCE

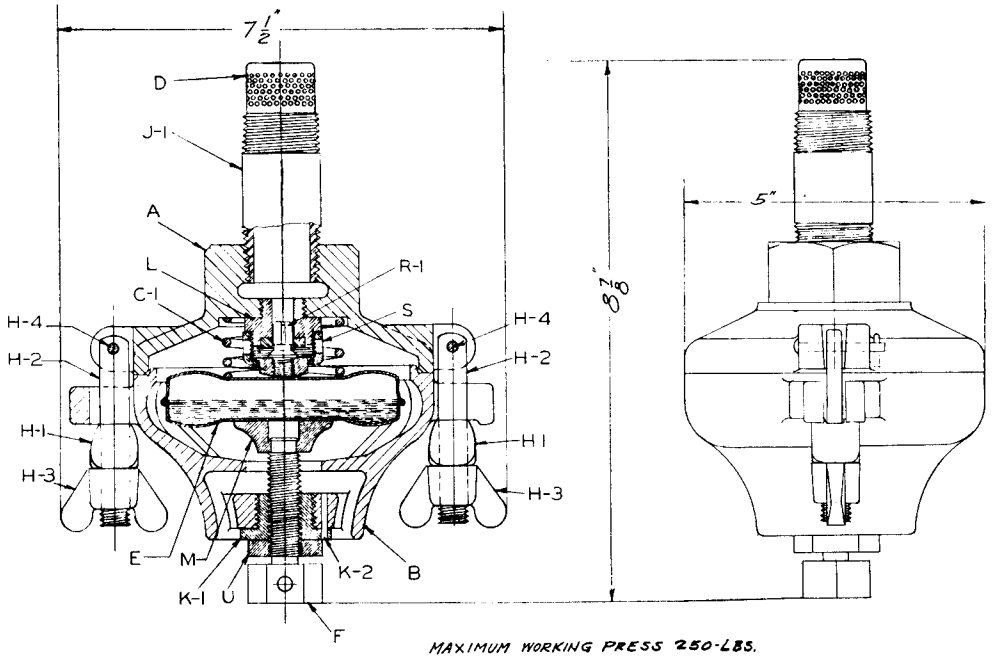
If excessive steam blows are noted, adjust with the adjusting screw. If this will not eliminate excessive steam blow, apply new diaphragm. If still not remedied, renew valve seat or disc.

After adjusting trap, the adjusting screw should be secured by tightening the locknut.

OVERHAULING: Each year, before the beginning of the heating season, the steam traps and strainers should be removed for testing of the diaphragm, and examination of the spring, seat, disc and strainer. Any parts found defective or wire-drawn should be repaired or replaced. See that adjusting screw, pins and cotters are in proper working order. Reassemble steam traps and test on standard steam rack under a steam pressure of about 55 lbs.

The diaphragm is to be tested for leaks and for proper expansion in hot water, in the same way as the diaphragms on the No. 440 Vapor Regulators.

No. 152 STEAM TRAP (Cont.)



MAXIMUM WORKING PRESS 250-LBS.

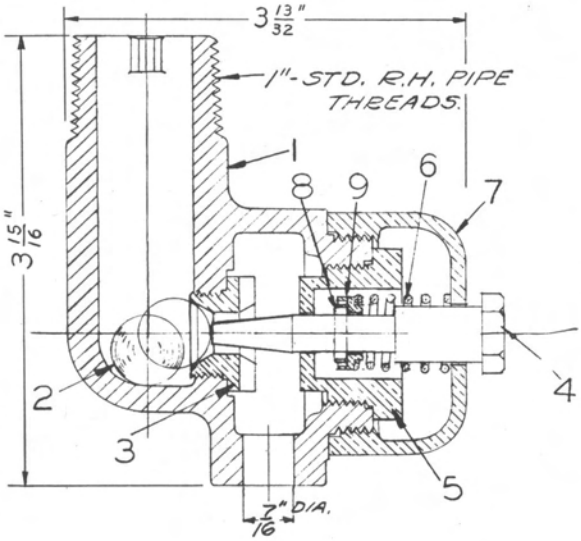
LIST OF PARTS

SYM.	PART NO.	DESCRIPTION	MATERIAL	AM'T.
A	152-A	Body	Mall. Iron	1
B	152-B	Cover	Mall. Iron	1
C-1	115-C-1	Spring	Phos. Bronze	1
D	112-D	Strainer	Brass	1
E	440-E	Diaphragm	Brass	1
F	440-F	Screw, Adjusting	Brass	1
H-1	440-H-1	Rider	Mall. Iron	2
H-2	440-H-2	Link	Brass	2
H-3	440-H-3	Thumb Nut	Brass	2
H-4	440-H-4	Pins and Cotters	Brass	2
J-1	113-J-1	Nipple, Strainer	Ex. Hy. W. I.	1
K-1	440-K-1	Bushing, Cover	Brass	1
K-2	440-K-2	Pin	Steel	1
LL	152-LL	Valve Seat Compl. (Includes Insert)	Brass	1
M	440-M	Plate, Diaphragm	Brass	1
R	152-R	Valve (Includes Parts R-1 and R-2)	Monel & Brass	1
S	115-M	Nut, Valve Retaining	Brass	1
U	440-U	Locknut	Brass	1
AA	152-AA	BODY ASSEMBLY (Includes Parts Sym. A, L and L-1)		
BB	152-BB	COVER COMPL. (Includes Parts Sym. B, F, K-1, K-2, M and U)		
BB-1	152-BB-1	COVER WITH BUSHING AND PIN (Includes, Sym. B, K-1 and K-2)		
FF	440-FF	ADJUSTING SCREW COMPL. (Incl. Sym. F, M and U)		
JJ	113-JJ	STRAINER NIPPLE COMPL. (Includes Parts Sym. J-1 and D)		

No. 145 CONDENSATION RELEASE TRAP

1" STANDARD R. H. PIPE THREADS — WEIGHT — 5 LBS.

No. 145 Condensation Release Trap



LIST OF PARTS

SYM.	PART No.	DESCRIPTION	MAT'L.	AMT.
1	145-1	Body	M. I.	1
2	145-2	Ball	Stainless Steel	1
3	145-3	Seat	Naval Brass	1
4	145-4	Stem	Brass	1
5	145-5	Guide	Brass	1
6	145-6	Spring	Stainless Steel	1
7	145-7	Cap	Brass	1
8	448-90-7	Valve Stem Pin	Stainless Steel	1
9	448-90-6	Valve Stem Washer	Brass	1

DESCRIPTION

This is a ball type, high pressure steam trap especially designed for draining steam train lines underneath the car. This trap has a stainless steel ball, which seats with pressure against a vertical seat. The trap will remain closed as long as there is 4 lbs. pressure or more in the train line. Such steam pressures will hold the ball against the seat in opposition to the spring loaded stem. When steam pressure in the train line drops below 4 lbs., the trap will be opened by the spring loaded stem forcing the ball of the seat, as well as by gravity.

Inasmuch as this trap does not work thermostatically, it is very desirable for use to drain pocketed pressure steam lines. This trap should be used on all train lines instead of Vapor Co.'s No. 152 Steam Trap, No. 1667 Thermal Drain and in place of any other traps recommended for steam train lines heretofore. With the No. 145 Trap there is no objectionable continuous fogging and no diaphragm to corrode, as with thermostatic steam traps.

The spring loaded stem protruding through body cap makes it possible to have this type of trap blown out very easily by merely pushing this stem or plunger rod when trap is under pressure. Any dirt lodging between ball and seat can in this manner be easily blown out.

APPLICATION

It is important that this trap be screwed directly into the bottom of strainer tee or cross of train line, so that heat conductivity from the train line will keep this trap warm and thus prevent freezing.

Use these traps on all pockets in trainline, always screwing into a strainer tee or a strainer cross.

MAINTENANCE

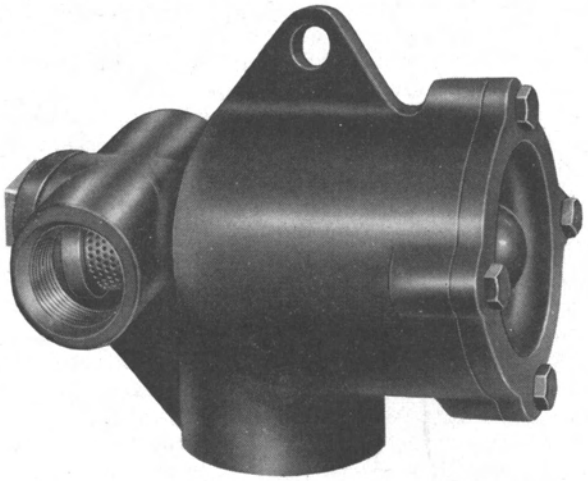
No adjustment or any special maintenance attention is required by this trap. The only recommendation is that this trap be removed at the beginning of each heating season for inspection of the ball valve and seat for wire drawing. The ball and seat can be replaced, if necessary. The spring loaded stem should be checked for freedom from binding. All parts should be thoroughly cleaned at time of such overhaul.

400 - 401 - 402 - 403

No. S-155 STEAM TRAP

1" I.P.S. INLET
1½" I.P.S. OUTLET

WEIGHT — 6¾ LBS.
MAXIMUM WORKING PRESSURE — 250 LBS.



No. S-155 Vapor Steam Trap

GENERAL DESCRIPTION

The No. S-155 Vapor Steam Trap is a thermostatically operated condensate drain, designed for fast and positive closing in the presence of steam. Through the use of this trap, steam is retained in the piping while condensate (which might otherwise freeze in pipes exposed to outside temperatures) is drained out.

Within this trap is a thermostatic bellows diaphragm (containing a volatile liquid) which is connected to a needle valve located in the path of the condensate. As long as condensate passes through the trap the bellows diaphragm remains contracted which allows the needle valve to remain in the open position. As soon as steam passes into the trap the bellows diaphragm expands and closes the needle valve against a spring to prevent steam from passing through the trap. Then, when the steam surrounding the bellows diaphragm cools and condenses, the diaphragm begins to contract again which permits the spring action to reopen the needle valve and drain off any additional condensate in the piping. This action is repeated every time steam enters the trap.

The No. S-155 Vapor Steam Trap supersedes the Nos. 115, 117, 141 and 152 Vapor Steam Traps. It may also be used instead of the No. 111 Vapor Steam Trap on interior pressure heating systems or on the inside of certain railway cars (connected directly to the radiator) provided that a drain pipe is applied to the outlet to carry the water of condensation to the return pipe of the system or to a waste outlet. The Economy Diaphragm used in the No. S-155 trap is the same as that used in the BA-440, BA-448 and 955 series Vapor Regulators and replacement diaphragms are generally carried in railroad stock.

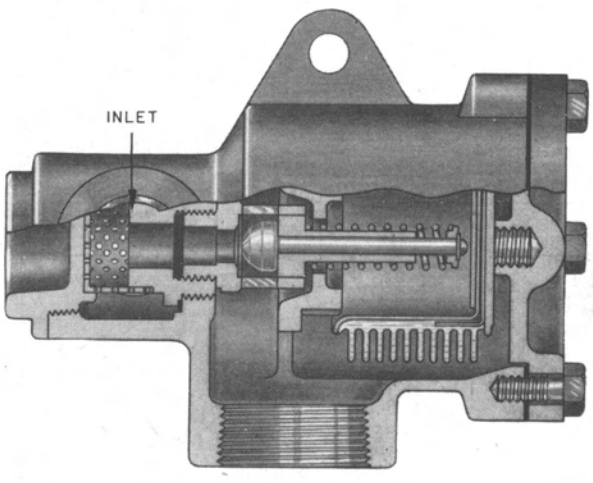
In addition to their use on railway car steam heating systems, the No. S-155 trap is recommended for use on anti-freeze steam lines around air pressure water tanks, on the end of anti-freeze steam lines protecting wash basins, refrigerators, etc., on the end of steam table coils in diners, on shop heating or any other pipe coils carrying straight steam. The condensate discharge can be run by gravity direct to the ground or to an outlet at a remote point or to a drain (collection) tank. This trap, however, is not designed to return condensate under high back pressure in the drain tank.

All pipes carrying condensate to the outside of the car should be pitched downward ¼" per foot of length and where a trap is used a one-foot length of pipe ahead of the trap must be pitched downward at least 2" for proper drainage. The trap must be mounted in a horizontal position with the drain outlet pointing downward.

MAINTENANCE AND OVERHAUL

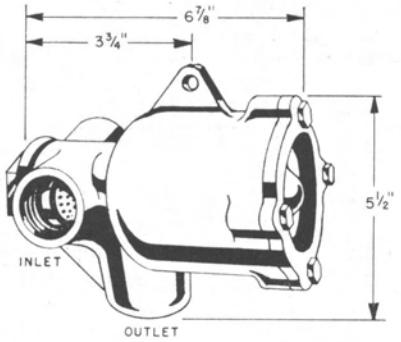
The No. S-155 Vapor Steam Trap should be disassembled for overhaul and inspection for wear at every shopping period or at least once every two years. The strainer may easily be removed for cleaning if required by removing the strainer cap (sym. 7) and taking out the strainer (sym. 8). For this procedure the trap need not be removed from the piping provided the steam has been shut off ahead of the trap.

Steam blowing from the drain outlet of the trap indicates a ruptured bellows diaphragm which must be replaced, dirt between the valve and seat, or a needle valve which is not seating properly.



Sectioned View of No. S-155 Trap

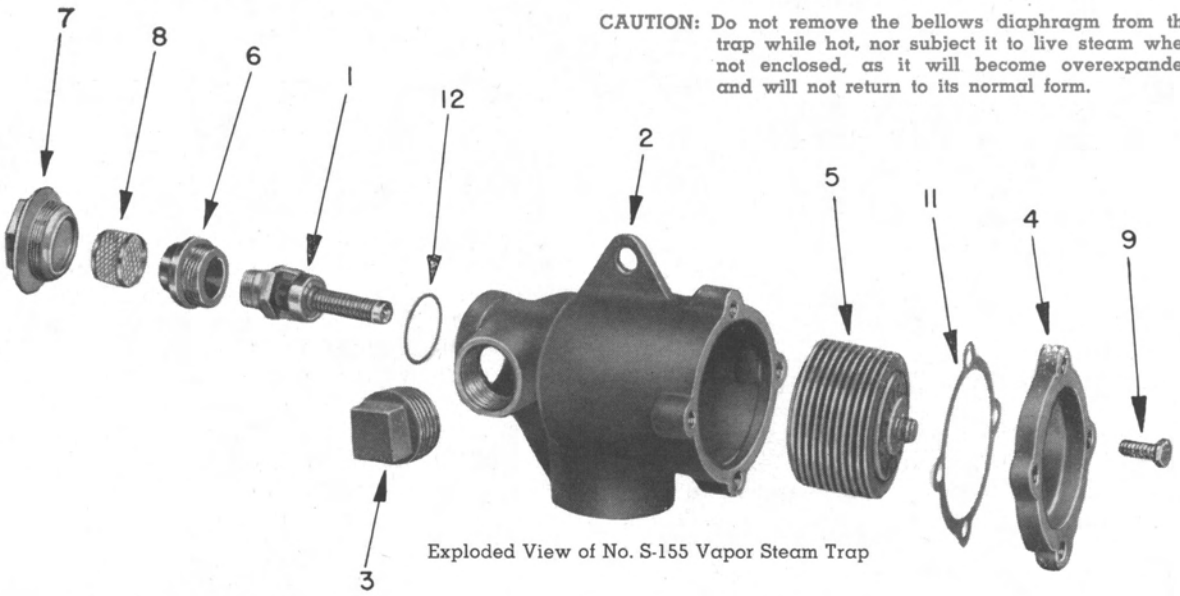
No. S-155 Steam Trap (Cont.)



To disassemble the trap for overhaul or inspection, remove the four hex-head bolts (sym. 9) and remove the diaphragm cover (sym. 4) and the diaphragm cover gasket (sym. 11). The bellows diaphragm (sym. 5) may then be detached from the diaphragm cover. From the opposite side of the trap remove the strainer cap (sym. 7) and take out the strainer (sym. 8). Then unscrew the needle valve assembly (sym. 1) and the gasket (sym. 12). Replace the diaphragm cover gasket if it is worn or damaged. Inspect the valve and seat for wear, scoring or wire drawing. Test the bellows diaphragm to be sure it has no leaks. Then clean each part thoroughly and re-assemble the trap, using new or repaired parts where required. Test the trap on a steam line before re-applying it in service. To inspect the diaphragm, shut off the steam ahead of the trap and allow about five minutes for the bellows diaphragm to cool and contract. Then remove the diaphragm from the trap. If the bellows has failed to return to its normal, fully contracted form when cooled, it is defective and should be replaced.

TESTING: To test a bellows diaphragm for leaks, place it in a suitable holding fixture and submerge it in water at about 190° F. Leaks will be shown by the rising of bubbles in the water. A leaky diaphragm should be discarded; do not attempt to refill and reclaim it. Before removing the diaphragm from the holding fixture, submerge it in cold water. A suitable holding device for conducting this test is shown in our drawing No. 22659, copies of which are available upon request.

CAUTION: Do not remove the bellows diaphragm from the trap while hot, nor subject it to live steam when not enclosed, as it will become overexpanded and will not return to its normal form.



Exploded View of No. S-155 Vapor Steam Trap

LIST OF PARTS

SYM.	PART NO.	DESCRIPTION	AMT.
1	155-A	VALVE COMPLETE	1
	900-Q-4	Spring, Valve	1
	900-Q-5	Washer, Valve Stem	1
	900-Q-6	Pin, Valve Stem	1
2	S-155-B	Body, Malleable Iron	1
3	786 1"	Plug, 1" Std. Pipe, Sq. Shank	1
4	900-D	Cover, Diaphragm	1
5	900-E	Diaphragm, Economy	1
6	901-Q-1	Adapter, Valve	1
7	901-T	Cap, Strainer	1
8	112-D	Strainer	1
9	5/16"x18 x¾" Lg.	Machine Bolt, Hex. Hd.	4
*11	*S-155-G	*Gasket, Cover	1
12	901-Q-2	Gasket	1

*NOTE: The No. S-155-G Gasket is not essential when trap is underneath a railroad car and the condensate spills to the ground. Therefore, on such installations, if and when the gasket wears out, it need not be replaced.

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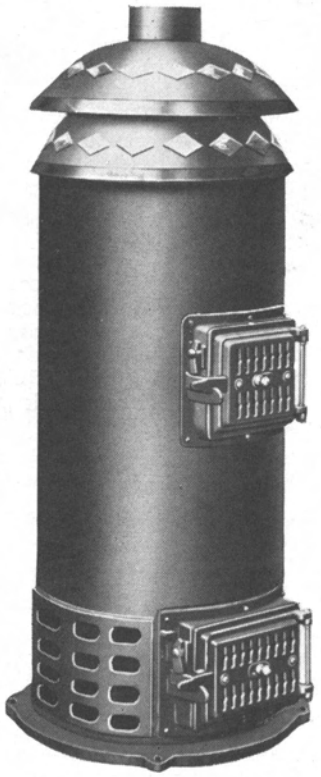
No. 800 EMERGENCY STOVE

HEIGHT 44½" WIDTH 17½" WEIGHT 412 LBS.



No. 800 Emergency Stove

GENERAL DESCRIPTION

The No. 800 Emergency Stove is designed for heating postal and baggage cars and coaches in mixed train service or for use in terminals where steam is not available. This stove will burn hard or soft coal or wood as desired. (A special grate is required when soft coal is burned.)

In order to prevent any possibility of fire, if the stove should be turned over in a wreck or accident, these heaters are equipped with a safety lock on the doors and on the deflector plate below the chimney. They are constructed with an inner and outer casing of sheet steel to prevent overheating of the outer casing. As a result the outer casing is never uncomfortably hot, even to the touch.

The necessary thorough circulation of warmed air in the car is created by a constant and rapidly moving supply of cold air taken in at the floor passing in between the burner and outer casing.

MAINTENANCE

The No. 800 Emergency Stove should be thoroughly cleaned and carefully inspected every year prior to the heating season. Check all cast iron parts to be sure that none have developed cracks and inspect all door hinges and locks to be sure that they function properly. Coal dust and soot should be removed in order to develop the highest heating efficiency from the stove. Air holes and grates must be cleared of all debris to insure a free draft of air, and ash pans should be clean and empty before a new fire is built.

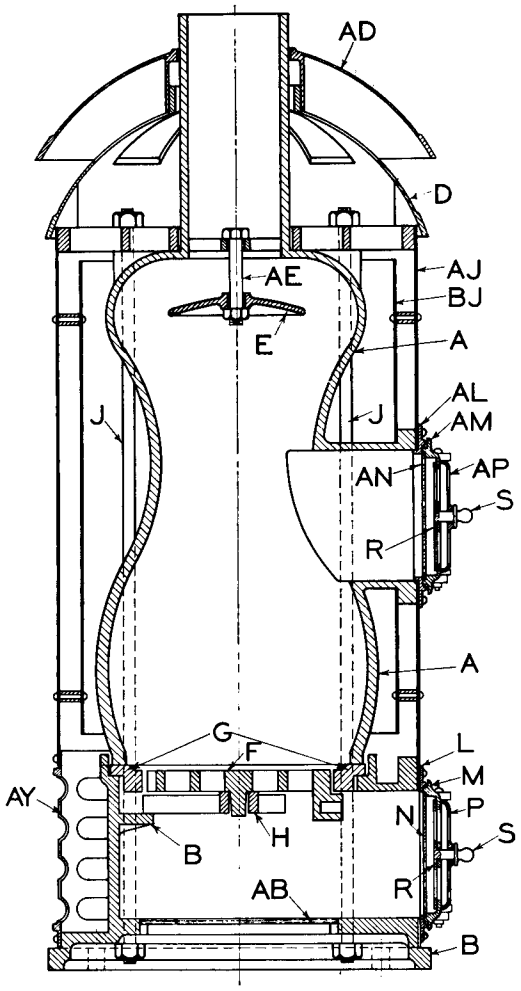
SPECIFICATIONS

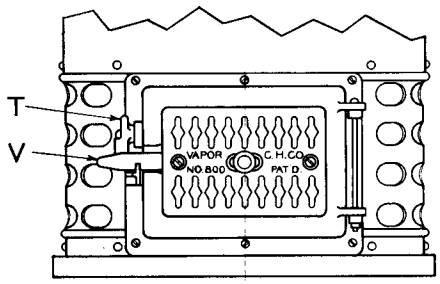
This stove weighs 412 lbs. and measures 44½" in height. The base is 17½" square and the top cover, provided to reflect the heat downward, is 18" in diameter. A 12" clearance is required to swing the upper and lower doors open when feeding the fire or removing the ashes. We suggest that a metal plate be placed underneath the stove as a protection to the flooring from burning sparks and hot coals. The plate should extend at least 12" beyond the outside edge of the stove.

NO. 800 EMERGENCY STOVE (Cont.)

LIST OF PARTS
NO. 800 EMERGENCY STOVE

Sym.	Part No.	Description
A	800-A	Body
AB	800-AB	Base Bottom
AD	800-AD	Stove Top Cover
AE	800-AE	Deflector Bolt
AJ	800-AJ	Outer Casing
AL	800-AL	Upper Door Casing
AM	800-AM	Upper Door
AN	800-AN	Upper Door Warp Plate
AP	800-AP	Upper Door Front
AY	800-AY	Air Intake Casting
B	800-B	Base
BJ	800-BJ	Inner Casing
C	800-C	Spider
D	800-D	Stove Top
E	800-E	Deflector
F	800-F	Grate
G	800-G	Grate Ring
H	800-H	Grate Bar
J	800-J	Tie Bolt and Nut
K	800-K	Shaker
L	800-L	Lower Door Casing
M	800-M	Lower Door
N	800-N	Lower Door Warp Plate
P	800-P	Lower Door Front
R	800-R	Upper and Lower Slides
S	800-S	Upper and Lower Knobs
T	800-T	Door Lock
V	800-V	Door Latch





Sectional View of No. 800 Emergency Stove

Nos. 588-2 and 588-6
WASH WATER HEATERS

No. 588-2—Capacity 65 gallons per hour **No. 588-6—Capacity 240 gallons per hour**

KLEEN TUBE TYPE

No. 588-2—¾" I.P.S. WATER CONNECTIONS No. 588-6— 1" I.P.S. WATER CONNECTIONS	1" I.P.S. STEAM CONNECTIONS	WEIGHT 8 LBS. WEIGHT 20 LBS.

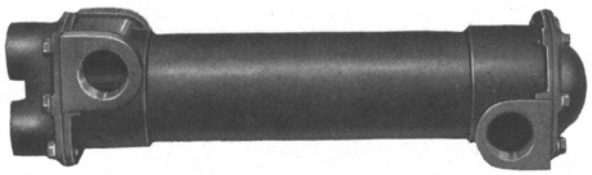


Fig. 1. No. 588 Wash Water Heater.

GENERAL DESCRIPTION

The Nos. 588-2 and 588-6 Wash Water Heaters are used to heat water for use in wash rooms, diners, etc. The heat exchange unit consists of a drawn seamless copper body, drawn seamless copper tubes and cast valve-bronze headers.

As shown in Figure 2, steam supplied through a Vapor Regulator from the trainline enters the body of the heater, flows inside the jacket and around the tubes, then leaves the heater and is piped to the drain tube of the Vapor Regulator where the condensate is discharged. Cold water fed through the lower connection of the front header is heated as it circulates through the tubes. Partitions in each of the headers direct the flow back and forth through the heater until, finally, hot water leaves the heater from the upper connection of the front header.

We recommend that our Water Mixing Valve be used with these heaters to control the temperature of the heated water and thus eliminate the possibility of scalding passengers.

These heaters are usually located beneath the wash basins or under the car inside the water box. In the former case they should be insulated, in the latter they should not.

The heaters should be installed horizontally with the steam inlet at the top and the steam outlet at the bottom. Union connections should be provided in both the steam and water lines so the heater can be removed easily for cleaning.

MAINTENANCE

Little if any maintenance is required on these heaters. They should be cleaned, however, every two years.

To clean the heater, unscrew the cap screws and remove the front and rear headers. With the water tubes thus exposed at each end, it is possible to "rod out" scale formation. Kleen Tube heaters are easily cleaned by this method because they have no coils or "U" shape bends.

In cases where the location of the heater makes it difficult to get at the tubes, the complete heater should be removed by breaking the steam and water connections.

While the headers are off, inspect the gaskets; replace them if they are worn or defective.

After the heater has been cleaned, make sure that all the cap screws are tightened and that the steam and water connections do not leak.

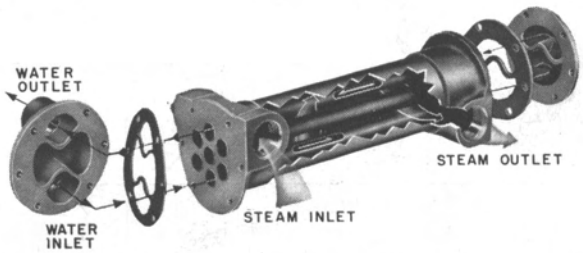


Fig. 2. Schematic Diagram Showing Flow of Steam and Water.

No. 588 WASH WATER HEATER (Continued)

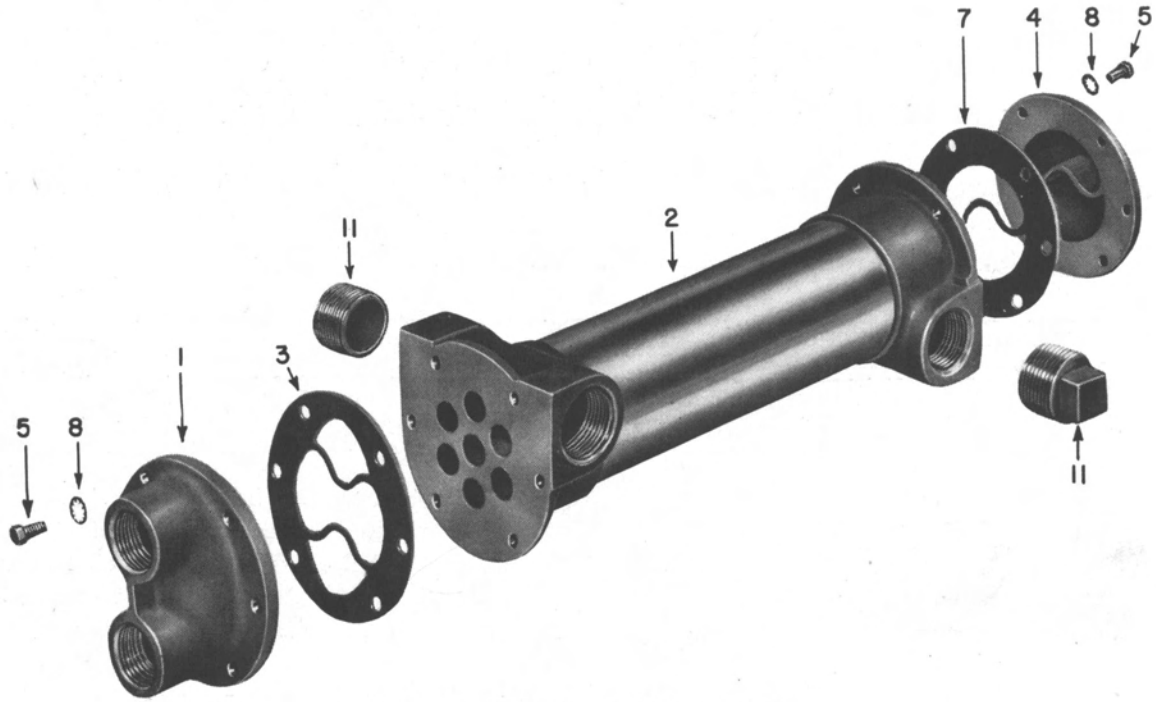


Fig. 3. Exploded View No. 588 Wash Water Heater.

LIST OF PARTS

SYM.	HEATER NO. 588-2 Part No.	HEATER NO. 588-6 Part No.	DESCRIPTION	AMT.
1	1-SC-8	1-SC-5	Front Header	1
2	588-2-BB	588-6-BB	Body complete with tubes	1
3	8-SC-8	8-SC-5	Front Header Gasket	1
4	4-SC-8	4-SC-5	Rear Header	1
5	¼"-20 x ½"	5/16"-18 x ¾"	Cap Screw, Hex. Hd.	12
7	9-SC-8	9-SC-5	Rear Header Gasket	1
8	¼" Shakeproof	5/16" Shakeproof	Lock Washer	12
11	1" Std.	1" Std.	Pipe Plug	2

NOTE: When ordering parts specify number and size of heater.

TABLE OF DIMENSIONS AND CAPACITIES

Heater Number	Body Width	C to C Water Opening	Overall Length	Steam Connection	Water Connection	Capacity Gal. per Hr. (See Note)	Shipping Wt.
588-2	4"	2"	14 $\frac{7}{16}$"	1"	¾"	65	8 lbs.
588-6	5¾"	2⅝"	20 $\frac{5}{16}$"	1"	1"	240	20 lbs.

NOTE: Capacity based on steam at 212° F with 70° F rise in water temperature.

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No. 525 HOT WATER MIXING VALVE

INLET: ¾" OUTLET: ¾" WEIGHT: 4¾ Lbs.

No 525 Water Mixing Valve

GENERAL DESCRIPTION

The No. 525 Hot Water Mixing Valve is designed to limit the temperature of wash water provided for passengers on railway trains. Through the proper proportioning of hot and cold water, the temperature of delivered water from the hot water faucets in the train is regulated at a maximum point.

The temperature of delivered water is controlled by means of a bellows diaphragm in the valve which is directly connected to a piston. The piston itself is suspended between the bellows diaphragm and a spring, and it moves up or down over the hot water inlet and the cold water inlet in response to the action of the diaphragm. The valve is constructed so that the piston is wide enough to completely block either the cold water inlet or the hot water inlet in accordance with the demand.

Hot water entering the valve at too high a temperature causes the bellows diaphragm to expand and move the piston away from the cold water inlet, allowing enough cold water to mix with the hot water to provide a delivered water of the correct temperature. In normal operation the piston assumes a position of balance so that hot and cold water are mixed to deliver water at the proper temperature according to the charge in the bellows diaphragm.

The No. 525 Hot Water Mixing Valve is furnished in four different types designated as A, B, C or D. The location of the valve and its use determines the type of valve which should be used. The chart on page 2 is provided as a guide for the selection of the proper valve to use under certain conditions.

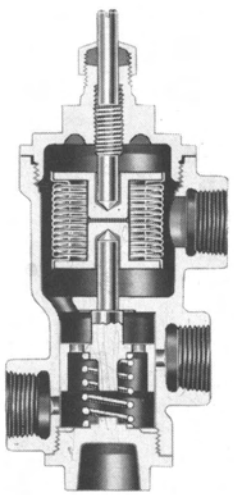
MAINTENANCE AND OVERHAUL

No maintenance procedure is required for the continued efficiency of the No. 525 water mixing valve. Visual inspection and a test of the temperature of the delivered water will be sufficient to assure correct operation of the valve. A distorted or leaking bellows is indicated when the temperature of the delivered water is higher than is called for by the valve. If this occurs it is necessary to replace the bellows assembly.

The No. 525 water mixing valve should be overhauled at least once every two years. Disassemble the valve, clean and inspect all of the parts for wear. All moving parts should be checked for freedom of movement and the bellows diaphragm tested for leaks. (For proper test of bellows diaphragm see Bulletin 61-702.) If the tension of the spring has become lessened, it should be replaced.

To disassemble the valve, remove the stuffing box (sym. 6), the bonnet (sym. 3) and the bottom cap (sym. 2). Lift the bellows assembly (sym. 104) out and take the piston (sym. 7) and the spring (sym. 11) out of the valve from the bottom.

After the overhaul has been completed, reassemble the valve and test the temperature of delivered water before re-installing the valve in the car.



Sectioned View of No. 525 Valve

No. 525 WATER MIXING VALVE (Con't.)

Exploded View of No. 525 Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	525-1	Valve Body	1
2	525-2	Bottom Cap	1
3	525-3	Bonnet	1
6	440-0	Stuffing Box	1
7	525-7	Piston	1
8	525-8	Adjusting Screw	1
9	440-Z-1	Packing Ring	1
11	See Table	Spring	1
104	See Table	Bellows Complete	1

TYPES AND LOCATIONS OF No. 525 WATER MIXING VALVES

Type	Bellows		Spring	Valve Is:	Water Tank Is:	Delivered Water Temp.
A	525-104-A	115°F.	525-11-A	Under Basin	Under Car at 18 Lbs. Pressure	About 118°F.
B	525-104	135°F.	525-11	In Water Tank Box	Under Car at 18 Lbs. Pressure	About 118°F.
C	525-104	135°F	525-11-A	Under Basin	Overhead Providing Gravity Feed	About 115°F.
D	525-104-B	160°F	525-11	In Water Tank Box	Under Car at 18 Lbs. Pressure for Dish Washing Purposes	About 160°F.

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No. 625 HOT WATER MIXING VALVE

INLETS: 2" I.P.S. | OUTLET: ¾" I.P.S. | WEIGHT: 5 Lbs.

No. 625 Water Mixing Valve

GENERAL DESCRIPTION

The No. 625 Hot Water Mixing Valve is designed to limit the temperature of wash water provided for passengers on railway trains. Through the proper proportioning of hot and cold water, the temperature of delivered water from the hot water faucets in the train is regulated at a maximum point.

The temperature of delivered water is controlled by means of a bellows diaphragm in the valve which is directly connected to a piston. The piston itself is suspended between the bellows diaphragm and a spring, and it moves up or down over the hot water inlet and the cold water inlet in response to the action of the diaphragm. The valve is constructed so that the piston is wide enough to completely block either the cold water inlet or the hot water inlet in accordance with the demand. This valve differs from the previously used No. 525 Hot Water Mixing Valve in that the mixed water outlet is differently located, and in that union joints are furnished in inlets and outlet.

Hot water entering the valve at too high a temperature causes the bellows diaphragm to expand and move the piston away from the cold water inlet, allowing enough cold water to mix with the hot water to provide a delivered water of the correct temperature. In normal operation the piston assumes a position of balance so that hot and cold water are mixed to deliver water at the proper temperature according to the charge in the bellows diaphragm.

The No. 625 Hot Water Mixing Valve is furnished in four different types designated as A, B, C or D. The location of the valve and its use determines the type of valve which should be used. The chart on page 2 is provided as a guide for the selection of the proper valve to use under certain conditions.

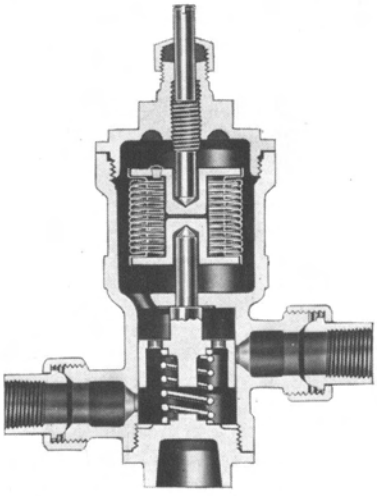
MAINTENANCE AND OVERHAUL

No maintenance procedure is required for the continued efficiency of the No. 625 water mixing valve. Visual inspection and a test of the temperature of the delivered water will be sufficient to assure correct operation of the valve. A distorted or leaking bellows is indicated when the temperature of the delivered water is higher than is called for by the valve. If this occurs it is necessary to replace the bellows assembly.

The No. 625 water mixing valve should be overhauled at least once every two years. Disassemble the valve, clean and inspect all of the parts for wear. All moving parts should be checked for freedom of movement and the bellows diaphragm tested for leaks. (For proper test of bellows diaphragm see Bulletin 61-702.) If the tension of the spring has become lessened, it should be replaced.

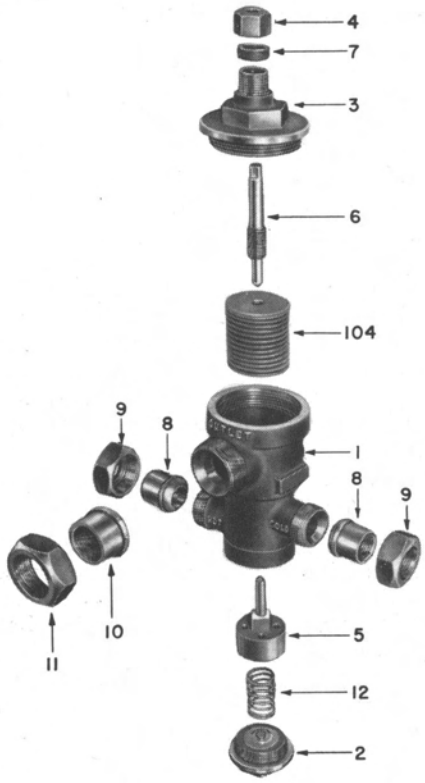
To disassemble the valve, remove the stuffing box (sym. 4), the bonnet (sym. 3) and the bottom cap (sym. 2). Lift the bellows assembly (sym. 104) out and take the piston (sym. 5) and the spring (sym. 12) out of the valve from the bottom.

After the overhaul has been completed, reassemble the valve and test the temperature of delivered water before re-installing the valve in the car.



Sectional View of No. 625 Valve

No. 625 WATER MIXING VALVE (Con't.)



Exploded View of No. 625 Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	625-1	Valve Body	1
2	525-2	Bottom Cap	1
3	525-3	Bonnet	1
4	440-0	Stuffing Box	1
5	525-7	Piston	1
6	525-8	Adjusting Screw	1
7	440-Z-1	Packing Ring	1
8	625-2	Union Tail Piece (½" I.P.S.)	2
9	625-3	Union Ring (½" I.P.S.)	2
10	625-4	Union Tail Piece (¾" I.P.S.)	1
11	625-5	Union Ring (¾" I.P.S.)	1
12	See Table	Spring	1
104	See Table	Bellows Complete	1

TYPES AND LOCATIONS OF No. 625 WATER MIXING VALVES

Type	Bellows	Spring	Valve Is:	Water Tank Is:	Temp. of Delivered Water from Faucets
A	525-04-A 115°F.	525-11-A	Under Basin	Under Car at 18 Lbs. Pressure	About 118°F.
B	525-104 135°F.	525-11	In Water Tank Box	Under Car at 18 Lbs. Pressure	About 118°F.
C	525-104 135°F.	525-11-A	Under Basin	Overhead Providing Gravity Feed	About 115°F.
D	525-104-B 160°F.	525-11	In Water Tank Box	Under Car at 18 Lbs. Pressure for Dish Washing Purposes	About 160°F.

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No. 948 1" CUT-OUT VALVE

INLET—1" I.P.S.
OUTLET—1" I.P.S.

WEIGHT
4¼ LBS.

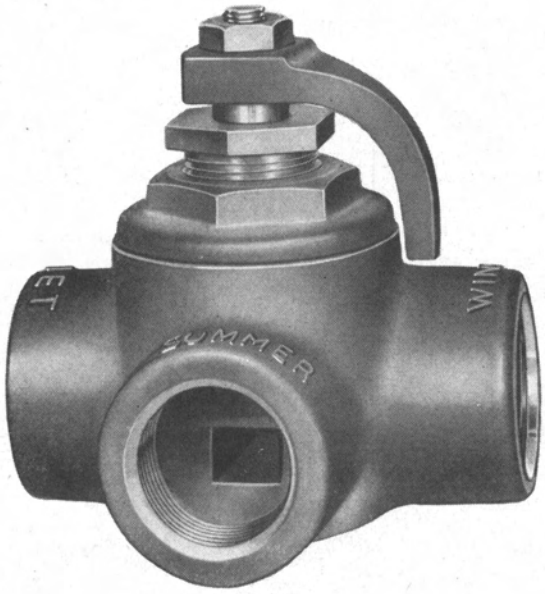


Fig. 1. No. 948 Cut-Out Valve

GENERAL DESCRIPTION

The No. 948 Cut-Out Valve is a tee shaped valve having one inlet and two outlets. A movable wing in the valve can be set to direct the steam from the inlet into either of the two outlets.

This valve is designed for installation in the wash water heating systems of railway cars which carry the water supply tank underneath the car and use a steam loop around the tank to protect it from freezing in cold weather.

The words "Winter" and "Summer" cast in the metal of the valve body mark the two settings of the valve and an indicator handle connected to the stem and wing can be adjusted to either setting. When the valve is set in the "Summer" position, the wing allows the steam to flow directly from the wash water heat exchanger to the return piping of the regulator. When it is set in the "Winter" position, the wing causes the steam to flow through the protective loop as well as the heat exchanger. Figure 2 shows the position of the wing in both summer and winter positions.

MAINTENANCE AND OVERHAUL

No regular inspection of the No. 948 Cut-Out Valve is required for efficient operation. Steam escaping from around the stem is an indication that the valve needs repacking. If the valve allows steam to heat the protective loop when it is set in the "Summer" position, this indicates that the wing is not seating properly on the valve body and should be replaced. If it does not heat the protective loop when set in the "Winter" position, this is also an indication that the wing is not seating properly.

The valve should be overhauled once every two years. To disassemble it, remove the nut (sym. 7) and the indicator handle (sym. 6), unscrew the gland (sym. 4) and the bonnet (sym. 3) and take out the stem (sym. 2), the spring (sym. 5) and the packing (sym. 8).

Clean and inspect each part for wear. Replace the stem if it is not true and renew the packing if it is worn. Check the spring and replace it if it has lost its tension. When reassembling the valve, be sure that the stem moves freely before putting the valve back into service again.

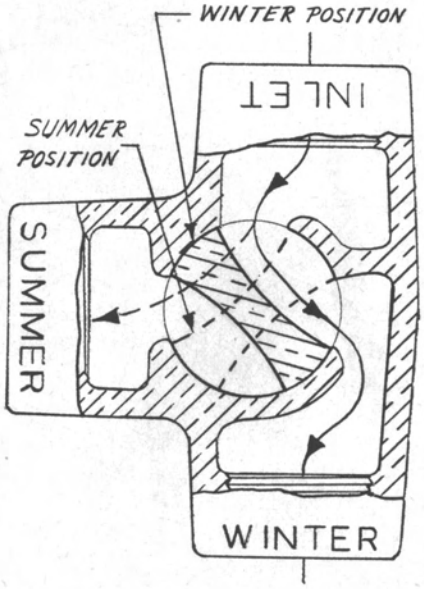
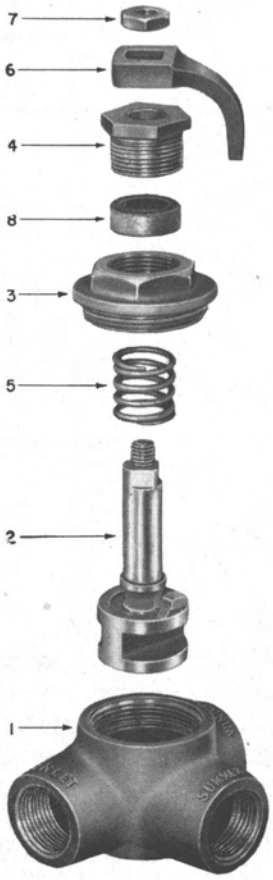


Fig. 2. Cross Section of No. 948 Cut-Out Valve

NO. 948 CUT-OUT VALVE (Cont.)



LIST OF PARTS

NO. 948 CUT-OUT VALVE

Sym.	Part No.	Description	Amt.
1	948-A	Body	1
2	948-B	Stem	1
3	948-C	Bonnet	1
4	948-D	Gland	1
5	948-E	Spring	1
6	948-F	Indicator Handle	1
7	120-K	Nut ⅜"-16 (Jam Type)	1
8	120-P	Packing	1

Fig. 3. Exploded View of No. 948 Cut-Out Valve

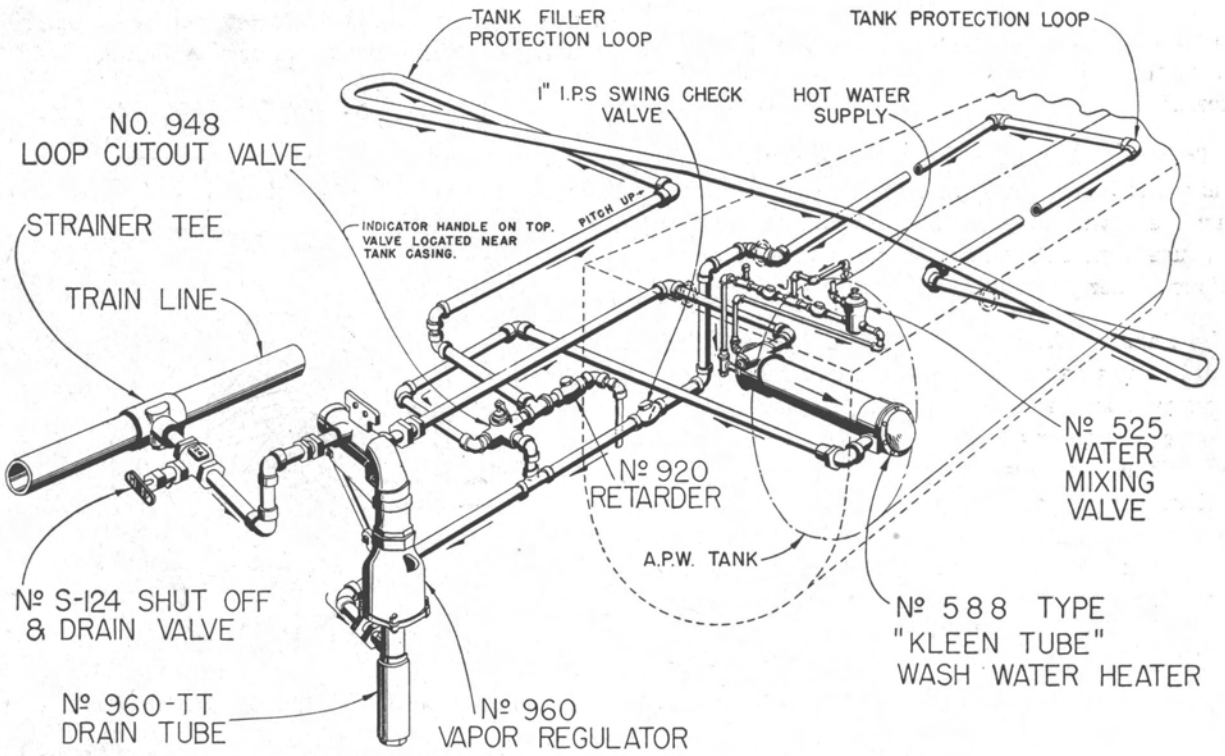


Fig. 4. Schematic Diagram Showing Use of No. 948 Cut-Out Valve in Summer and Winter

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Nos. 530, 530-1, B-530 AND BA-530 Hot Water Regulators

WEIGHT: BA-530 33 lbs.

No. BA-530 Hot Water Regulator

GENERAL DESCRIPTION

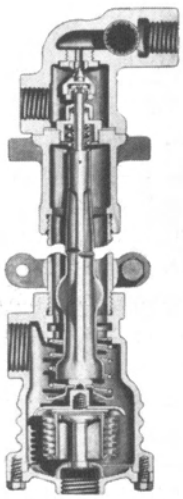
Hot Water Regulators are designed to regulate the passage of steam from the train line into the wash water heating pipe system of railway cars. Through the use of these regulators steam is made available to the piping when it is needed to heat the wash water, yet it is not wasted when the temperature of the wash water is hot enough.

Prior to 1940 the No. 530 hot water regulator and the No. 530-1 hot water regulator (which is used only with a No. 244 pressure regulating valve) were used to control the passage of this steam from the train line. An improvement known as the Economy Diaphragm was introduced at this time and regulators equipped with this improvement were called first the No. B-530 hot water regulators and later the No. BA-530 hot water regulators as further improvements were added. Any of the regulators of this series can be converted into BA-530 type units by replacing several of the parts. (See Notes on page 3.)

In operation, steam at train line pressure (or, at reduced pressure if a No. 244 pressure regulating valve is used ahead of the regulator) enters the high pressure chamber, passes through a vapor valve into a low pressure chamber and is then piped to the heat exchanger. In the heat exchanger heat from the steam is transferred to the wash water and condensate or steam is returned to the hot water regulator.

These hot water regulators depend for their operation upon the action of a diaphragm in the lower part of the unit. The Nos. 530 and 530-1 regulators are equipped with a liquid filled disc-type diaphragm, while the Nos. B-530 and BA-530 regulators are equipped with the liquid filled bellows-type Economy Diaphragm. Condensate returning to the hot water regulator from the heat exchanger is discharged to the ground from the regulator drain port, but steam returning with the condensate comes into contact with the diaphagm and causes it to expand.

The expanding diaphragm moves an operating rod, to which is attached a valve disc, to stop any further flow of steam from the regulator. After the supply of steam has been shut off by the valve and steam no longer returns to the regulator with the condensate from the heat exchanger, the diaphragm cools and contracts. This allows a spring to reopen the valve and again permit steam to pass through the regulator. In normal operation the diaphragm maintains a position of balance of the valve and only a volume of steam sufficient to keep the diaphragm between 195° F. and 210° F. is allowed to pass.



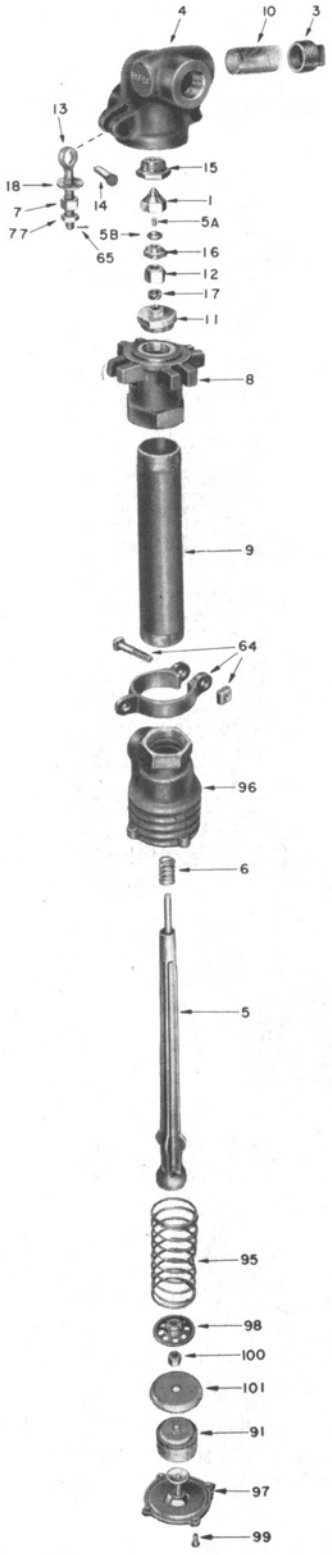
Sectioned View of No. BA-530 Regulator

The No. 530-1 hot water regulator is like the No. 530 unit except that it is furnished with a slotted head screw and locknut in the bottom cover. The slotted screw in the regulator is intended to provide an adjustment setting and is used as a means of discouraging needless and overfrequent adjustment of the regulator. Neither the B-530 nor the BA-530 hot water regulators are equipped with this slotted adjusting screw since the Economy Diaphragm furnished in these regulators has enough take up to compensate for wear and readjustment is unnecessary. No drain tube is used with any of these regulators.

MAINTENANCE AND OVERHAUL

Little maintenance is required for the continued efficient operation of the Nos. 530, 530-1, B-530 or BA-530 hot water regulators. Visual observation for steam blows from these regulators is sufficient to insure proper functioning. Steam leaking through the regulator when the valve is closed is an indication that the valve is not seating properly. This may be caused by a worn valve seat, or by dirt between the valve and seat. A worn valve seat should be reground or replaced and dirt may be blown out from between the valve and seat by closing the shut-off valve ahead of the regulator for a few minutes and then opening it again. Steam blowing from the drain port may mean a damaged bellows diaphragm which should be replaced.

These regulators should be disassembled and overhauled every two years, at which time they should be tagged with a metal date tag. To disassemble the No. BA-530 hot water regulator, unscrew the strainer plug (sym. 3) and remove the strainer (sym. 10). Remove the cotter pins and the nuts (syms. 7 and 77) from the eye-bolts (sym. 13). This will permit the removal of the head (sym. 4) of the regulator and the valve seat (sym. 15) may then be taken out. Unscrew the valve disc (sym. 1) and by removing the screw in the end of the operating rod (sym. 5) the valve disc ring (sym. 16) may then be removed. Then unscrew the stuffing box (sym. 12) and take out the packing ring (sym. 17). Unscrew the bonnet (sym. 11) and remove the spring (sym. 6). Remove the cap screws (sym. 99) from the casing cover (sym. 97) and remove the cover, which includes the post and cap. Unscrew the shield nut (sym. 100) and remove the diaphragm shield



Exploded View of No. BA-530 Regulator

Nos. 530, 530-1, B-530 AND BA-530 HOT WATER REGULATORS (Cont.)

LIST OF PARTS

NO. BA-530 HOT WATER REGULATOR

Sym.	Part No.	Description	Amt.
1	530-A-4	Valve Disc (includes Disc Insert)	1
3	411-B	Strainer Plug	1
4	530-C	Head	1
5	530-E	Operating Rod Complete	1
5-A	#8 32x3/8" Lg.	Screw	1
5-B	530-E-3	Valve Stem Washer	1
6	530-E-6	Spring	1
7	530-F	Std. Hex Nut for Eye-Bolt 1/2"-13th-1/2" thick	2
77	530-F-1	Half Std. Hex Nut for Eye-Bolt 1/2"-13th-1/4" thick	2
8	530-K	Center Casting	1
9	530-N	Tube	1
10	411-A	Strainer	1
11	530-Q	Bonnet	1
12	440-O	Stuffing Box	1
13	530-S	Eye-Bolt	2
14	3/8"x2"Rd.H.	Eye Bolt Pin	2
15	530-W-3	Valve Seat (includes Disc Insert)	1
16	530-Y	Valve Disc Ring	1
17	440-Z-1	Packing Ring	1
18	1/2" St.Plain	Eye Bolt Washer	2
64	446-64	Clamp with Bolt and Nut	1
65	1/8"x1"	Eye Bolt Cotter	2
91	900-E	Economy Diaphragm	1
95	B-440-H	Spring	1
96	BA-530-L	Casing (Economy Diaphragm)	1
97	BA-440-K	Casing Cover (includes Post and Cap)	1
98	B-530-G1	Spring Retainer and Plate	1
99	3/8"-16x7/8" Lg.	Cap Screw (Hex Head)	4
100	B-440-U	Shield Nut	1
101	BA-440-L	Shield (Economy Diaphragm)	1
	BA-530-LL	Lower Casing Assembly (includes syms. 91-101)	

LIST OF PARTS

NO. B-530 HOT WATER REGULATOR

Sym.	Part No.	Description
1	530-A-4	Disc (includes A-5 Disc Insert)
3	411-B	Strainer Plug
4	530-C	Head
5	530-E	Operating Rod Complete (includes)
6	530-E-6	Spring
7	530-F	Standard Hex Nut for Eye-Bolt 1/2"-12th) 1/2" thick x 7/8" across flats
77	530-F-1	Half Std. Hex Nut for Eye-Bolt (1/2"-12th) 1/4" thick x 7/8" across flats
8	530-K	Center Casting
9	530-N	Tube
10	411-A	Strainer
11	530-Q	Bonnet
12	440-O	Stuffing Box
13	530-S	Eye-Bolt
15	530-W-3	Valve Seat (includes W-2 Disc Insert)
16	530-Y	Valve Disc Ring
17	440-Z-1	Packing Ring
36	B-530-L	Adapter
64	446-64	Clamp with Bolt and Nut
91	900-E	Economy Diaphragm
94	B-530-G-1	Spring Retainer Plate
95	B-440-G-2	Spring Retainer
96	B-440-H	Spring
97	B-440-J	Casing (includes Post and Cap)
98	B-440-K-1	Adapter Gasket
99	5/16"x18x 3/4" Lg.	Slotted Cap Screw (Hex Head)
100	B-440-L	Economy Diaphragm Shield
101	B-440-M	Shield Retainer
102	B440-U	Shield Retainer Nut
	B-530-LL	Lower Casing Assembly Complete (includes 36, 91, 94, 95, 96, 97, 98, 99, 100, 101 and 102)

(sym. 101) and the bellows diaphragm (sym. 91). Take out the spring (sym. 95) and the operating rod (sym. 5) and separate the parts of the casing (syms. 8, 9 and 96). Other hot water regulators of this series may be disassembled in a similar manner.

Clean and inspect each part for wear, replacing any worn or damaged parts. Check the spring tension and carefully inspect the threads of the castings. Reassemble the regultor and test it on a steam line before placing it back in service again.

To test an Economy Diaphragm for leaks, place it in a suitable holding fixture and submerge it in water at about 190° F. Leaks will be shown by the rising of bubbles in the water. A leaking diaphragm should be discarded, do not attempt to refill or reclaim it. When the test is completed, submerge the diaphragm in cold water to cause it to contract before removing it from the holding fixture. A suitable holding device is shown on our Drawing No. 22659, copies of which are available upon request.

CAUTION: Do not remove the Economy Diaphragm from the enclosure while hot, nor subject it to live steam when not enclosed as it will become over-expanded and will not return to its normal fully contracted form when cooled.

LIST OF PARTS

NO. 530 HOT WATER REGULATOR

Sym.	Part No.	Description
A-4	530-A-4	Disc (includes A-5 Disc Insert)
B	411-B	Strainer Plug
C	530-C	Head
D	440-Z-1	Packing Ring
E	530-E	Operating Rod Complete (Includes)
E-6	530-E-6	Spring
F	530-F	Standard Hex Nut for Eye-Bolt (½"-13th) ½" thick x ⅞" across flats
F-1	530-F-1	Half Std. Hex Nut for Eye-Bolt (½"-13th) ¼" thick x ⅞" across flats
G	440-F	Set Screw
H	440-HH	Cover Lock Complete
	440-H-1	Rider
	440-H-2	Link
	440-H-3	Thumb Nut
	440-H-4	Pin and Cotter
K	530-K	Center Casting
L	530-L	Diaphragm Casing
M	440-K-5	Hinged Cover (includes Bushing and Pin and Cotter)
N	530-N	Tube
O	440-M	Diaphragm Plate
P	411-A	Strainer
Q	530-Q	Bonnet
R	440-O	Stuffing Box
S	530-S	Eye-Bolt
T	440-L	Diaphragm Hook
U	446-64	Clamp with Bolt and Nut
W-3	530-W-3	Valve Seat (includes W2 Disc Insert)
X	440-U	Locknut
Y	530-Y	Valve Disc Ring.
Z	530-Z	Diaphragm

NO. 530-1 HOT WATER REGULATOR USED ONLY WHERE A NO. 244 PRESSURE REGULATING VALVE IS USED AHEAD OF REGULATOR

	440-F-1	Slotted Head Adjusting Screw (Replaces 440-F)
	440-U-1	Recessed Locknut (replaces 440-U)

Other parts are the same as in No. 530 Regulator.

IMPORTANT NOTES CONCERNING THE NOS. 530, 530-1, B-530 AND BA-530 HOT WATER REGULATORS

All underneath piping should be extra heavy and should be pitched to drain not less than one inch in ten feet Avoid forming pockets where water may be trapped and freeze in cold weather.

* * *

Be sure that all piping has been blown clean before re-applying the regulator to a car, and that good threads are cut in pipes and fittings to insure tight joints. Use only graphite and oil on pipe joints to form steam-tight connections. Avoid the use of red or white lead for this purpose as steam is likely to carry it into the regulator where it will cause sticking of the moving parts.

* * *

The Nos. 530, 530-1 and B-530 hot water regulators should be converted into No. BA-530 hot water regulators by replacing several of their parts. The No. BA-530-LL Economy Diaphragm Enclosure should replace the lower casing assemblies of the Nos. 530 or 530-1 regulators or the No. B-530-LL enclosure of the B-530 unit. The valve disc and seat in the regulators being converted should be replaced with a No. 530-A-4 disc and 530-W-3 seat and a No. 530-E-6 operating rod spring must be applied to help pull the operating rod through the packing.

* * *

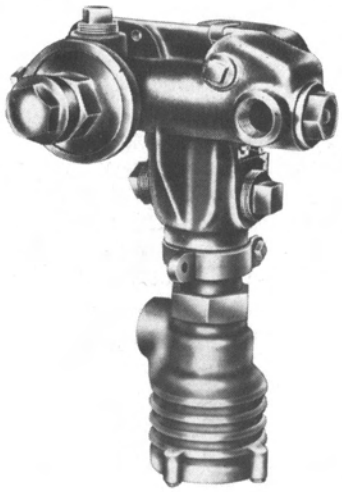
Then converting the Nos. 530, 530-1 or B-530 hot water regulators into BA-530 regulators, it is not necessary to remove the unit or disturb the piping to make the change. It requires only the loosening of the nuts on the eye-bolts to separate the head from the rest of the unit so that the valve disc and seat may be exchanged. The Economy Diaphragm Enclosure simply screws into the threads of the tube to replace the previously used enclosure.

* * *

It has been found in some cases where a regulator is located near the heat exchanger that it is advisable to replace the No. B-440-H spring in the Economy Diaphragm Enclosure with a heavier No. B-440-H-40 spring to compensate for a tendency of the diaphragm to be too thrifty with steam when it is needed to heat the water. This may be done ONLY when a No. 244 pressure regulator valve is used ahead of the regulator. All 530 regulators which have been equipped with the Economy Diaphragm Enclosure must be protected with a pressure regulating value ahead of the regulator.

Nos. 590, B-590 AND BA-590 HOT WATER REGULATORS

WEIGHT: BA-590 45 lbs.



No. BA-590 Hot Water Regulator

GENERAL DESCRIPTION

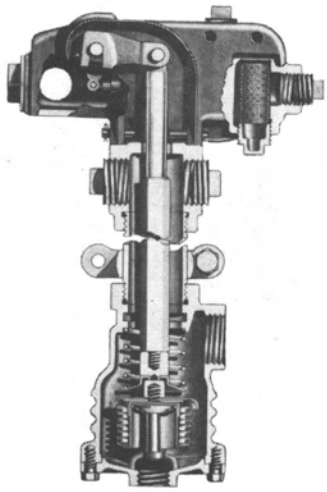
Hot water regulators are designed to regulate the passage of steam from the train line into wash water heating pipe systems of railway cars. Through the use of these regulators steam is made available to the piping when it is needed to heat the wash water, yet it is not wasted when the temperature of the water is hot enough.

Prior to 1940 the No. 590 hot water regulator was used to control this passage of steam. This unit performed the same important function as the well known No. 530 hot water regulator but incorporated within the regulator itself the pressure regulating feature of the No. 244 pressure regulating valve which was formerly used as a separate unit ahead of the No. 530 hot water regulator. An improvement known as the Economy Diaphragm Enclosure was introduced at this time and regulators equipped with this improvement were called first the No. B-590 hot water regulators and later the No. BA-590 hot water regulators as further improvements were added. Either the 590 regulator or the B-590 regulator can be converted into the BA-590 type units by replacing several of their parts. (See Notes on page 3.)

In operation, steam at train line pressure enters the regulator and passes through the pressure reducing feature which maintains a constant feed of steam to the vapor valve. Then the steam passes through the vapor valve in the regulator and into the low pressure chamber where it is then piped to the heat exchanger. In the heat exchanger, heat is transferred from the steam to the wash water and condensate is returned to the regulator for discharge.

These regulators depend for their operation upon the action of a diaphragm in the lower part of the unit. The No. 590 regulator is equipped with a liquid filled disc-type diaphragm, while the Nos. B-590 and BA-590 regulators are equipped with the liquid filled bellows-type Economy Diaphragm. Condensate returning to the hot water regulator from the heat exchanger is discharged to the ground from the regulator drain port, but steam returning with the condensate comes into contact with the diaphragm and causes it to expand.

The expanding diaphragm moves an operating rod and lever arrangement to close the vapor valve and shut off or reduce the flow of steam from the high pressure chamber. After the supply of steam has been reduced the diaphragm cools and contracts. This allows a spring to reopen the vapor valve and again permit steam to be passed through the regulator. In normal operation the diaphragm maintains a position of balance of the vapor valve and only a volume of steam sufficient to keep the temperature of the diaphragm between 190°F. and 210°F. is allowed to pass. No drain tube is used with these regulators.



Sectioned View of No. BA-590 Regulator

MAINTENANCE AND OVERHAUL

Little maintenance is required for the continued efficient operation of the Nos. 590, B-590 and BA-590 hot water regulators. Visual observation for steam blows is sufficient to insure proper functioning. Steam leaking through the regulator when the vapor valve is closed is an indication that the valve is not seating properly. This may be caused by a worn seat, or by dirt between the valve and seat. A worn seat should be reground or replaced and dirt may be blown out from between the valve and seat by closing the shut-off valve ahead of the regulator for a few minutes and then opening it again. Steam blowing from the drain port may mean a damaged bellows diaphragm which should be replaced.

These regulators should be disassembled and overhauled every two years, at which time they should be tagged with a metal date tag. To disassemble the No. BA-590 hot water regulator, remove the cotter from the shield bolt (sym. 33) and lift off the shield (sym. 32). Remove the operating rod pin and cotter (sym. 13) and the operating rod binding screw (sym. 15) and take out the operating rod lever (sym. 14). Unscrew the vapor valve lever bonnet (sym. 24) take out the vapor valve lever disc (sym. 23) and remove the vapor valve lever assembly (sym. 22) which may then be further disassembled. Unscrew the cap (sym. 29) and unscrew the vapor valve assembly (sym. 90). Remove the vapor valve lever spring cap (sym. 51) and the vapor valve lever spring (sym. 25). Unscrew the pipe plug (sym. 65) and remove the strainer (sym. 2). The pressure reducing feature should be disassembled by unscrewing the diaphragm bonnet (sym. 3) and removing the diaphragm (sym. 4), the main valve spring (sym. 11) and the main valve housing (sym. 18). The adjusting screw (sym. 8) and the locknut (sym. 17) may be removed after the cap (sym. 9) has been removed. By unscrewing the cap screws (syms. 99) from the cover (sym. 97), the cover may be removed, allowing the operating rod (sym. 12) and the spring (sym. 95) to be released. Unscrew the shield nut (sym. 100) to release the diaphragm shield (sym. 113) and the bellows diaphragm (sym. 91). Nos. 590 and B-590 regulators may be disassembled in a similar manner.

Clean and inspect each part for wear, replacing any worn or damaged parts. Check the spring tension and carefully inspect the threads of the castings. Reassemble the regulator and test it on a steam line before putting it back into service again.

To test an Economy Diaphragm for leaks, place it in a suitable holding fixture and submerge it in water at about 190°F. Leaks will be shown by the rising of bubbles in the water. A leaking diaphragm should be discarded, do not attempt to refill or reclaim it. When the test is completed, submerge the diaphragm in cold water to cause it to contract before removing it from the holding fixture. A suitable holding fixture is shown on our Drawing No. 22659, copies of which are available upon request.

CAUTION: Do not remove the Economy Diaphragm from the enclosure while hot, nor subject it to live steam when not enclosed as it will become over-expanded and will not return to its normal fully contracted form when cooled.

IMPORTANT NOTES CONCERNING THE NOS. 590, B-590 AND BA-590 HOT WATER REGULATORS

All underneath piping should be extra heavy and should be pitched to drain not less than one inch in ten feet. Avoid forming pockets where water may be trapped and freeze in cold weather.

* * *

Be sure that all piping has been blown clean before re-applying the regulator to a car, and that good threads are cut in pipes and fittings to insure tight joints. Use only graphite and oil on pipe joints to form steam-tight connections. Avoid the use of red or white lead for this purpose as steam is likely to carry it into the regulator where it will cause sticking of the moving parts.

* * *

The Nos. 590 and B-590 hot water regulators should be converted into BA-590 hot water regulators by changing several of their parts. The No. BA-590-136 Economy Diaphragm Enclosure should replace the lower casing assembly of the 590 regulator or the B-590-136 enclosure of the B-590 unit. The vapor valve and seat of the No. 590 regulator should be replaced with the complete vapor valve assembly No. 448-90.

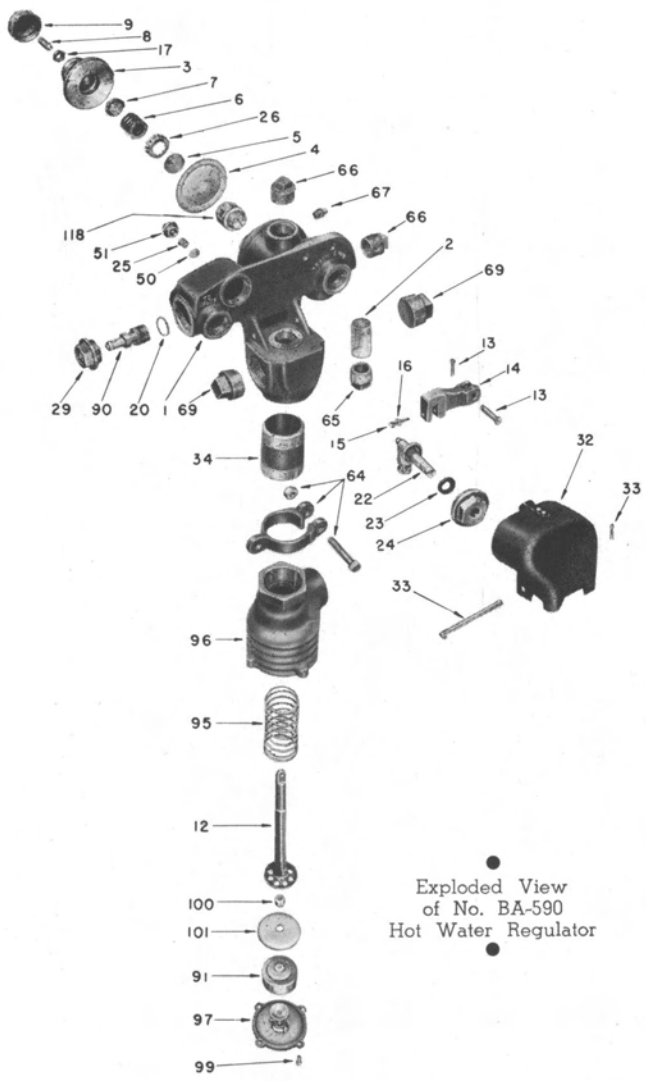
* * *

When converting the Nos. 590 or B-590 hot water regulators into BA-590 regulators, it is not necessary to remove the unit or disturb the piping to make the change. The old vapor valve and seat can be replaced by removing the vapor valve guide cap, the vapor valve lever spring cap and the vapor valve lever assembly so that the new assembly may be screwed into place. The Economy Diaphragm Enclosure may be screwed into place after removing the lower casing assembly of either the 590 or B-590 regulators.

* * *

It has been found in some cases where a regulator is located too near the heat exchanger that it is advisable to replace the No. B-440-H spring in the Economy Diaphragm Enclosure with a heavier No. B-440-H-40 spring to compensate for a tendency of the diaphragm to be too thrifty with steam when it is needed to heat the water.

NOS. 590, B-590 AND BA-590 HOT WATER REGULATORS (Con't.)



Exploded View of No. BA-590 Hot Water Regulator

LIST OF PARTS

No. BA-590 Hot Water Regulator

Sym.	Part No.	Description	Amt.
1	448-1	Body	1
2	411-A	Strainer	1
3	244-3	Diaphragm Bonnet	1
4	244-4	Pressure Reducing Valve Diaphragm	1
5	244-35	Diaphragm Spring Button	1
6	244-6	Diaphragm Spring	1
7	244-7	Button Set Screw	1
8	244-8	Adjusting Screw	1
9	244-9	Adjusting Screw Cap	1
10	448-10	Main Valve	1
11	244-11	Main Valve Spring	1
12	448-12	Operating Rod (includes Spring Retainer)	1
13	440-1-1	Operating Rod Pin and Cotter	1
14	448-14	Operating Rod Lever	1
15	½"x20x1" Lg.	Operating Rod Lever Binder Screw	1
16	½" Shake-proof	Operating Rod Lock Washer	1
17	244-17	Adjusting Screw Lock Nut	1
18	448-18	Main Valve Housing	1
19	448-19	Main Valve Spring Nut	1
20	448-20	Vapor Valve Seat Gasket	1
22	448-22	Vapor Valve Lever Complete (includes lever, roller and rivet)	1
23	444-23	Vapor Valve Lever Disc	1
24	444-24	Vapor Valve Lever Bonnet	1
25	444-25	Vapor Valve Lever Spring	1
26	244-36	Snubber (Vibration)	1
29	444-29	Cap	1
32	448-32	Shield Complete (includes Shield Clip and Rivet)	1
33	440-Y	Shield Bolt and Cotter	1
34	448-34	Tube (specify A or F Type)	1
50	448-50	Vapor Valve Lever Spring Plate	1
51	448-51	Vapor Valve Lever Spring Cap	1
64	446-64	Clamp with Bolt and Nut	1
65	411-B	1" Std. Pipe Plug—Sq. Shank	1
66	786	1" Std. Pipe Plug—Sq. Shank	3
67	244-22	Test Outlet Plug ¼" Std. Pipe	1
69	786	1½" Std. Pipe Plug—Sq. Shank	2
91	900-E	Economy Diaphragm	1
95	B-440-H	Spring	1
96	BA-530-L	Casing (Economy Diaphragm)	1
97	BA-440-K	Casing Cover (includes Post and Cap)	1
98	B-590-55	Nut (Operating Rod Adapter)	1
99	⅜"-16x ⅞" Lg.	Cap Screw (Hex Head)	4
100	B-440-U	Shield Nut	1
101	BA-440-L	Shield (Economy Diaphragm)	1
	BA-590-136	Lower Casing Assembly (includes Syms. 91 to 101)	
	448-118	Valve Housing Assembly (includes Syms. 10, 11, 18 and 19)	
	448-90	Vapor Valve Assembly includes	

Other Parts Lists on Page 4

NOS. 590, B-590 AND BA-590 HOT WATER REGULATORS (Con't.)

LIST OF PARTS

No. 590 HOT WATER REGULATOR

Sym.	Part No.	Description
1	448-1	Body
2	411-A	Strainer
3	244-3	Diaphragm Bonnet
4	244-4	Pressure Reducing Valve Diaphragm
5	244-35	Diaphragm Spring Button
6	244-6	Diaphragm Spring
7	244-7	Spring Plate
8	244-8	Adjusting Screw
9	244-9	Adjusting Screw Cap
118	448-118	Valve Housing Assembly
	448-10	Main Valve
	244-11	Main Valve Spring
	448-18	Main Valve Housing
	448-19	Main Valve Spring Nut
12	448-12	Operating Rod (specify whether for A or F type regulator)
13	440-I-1	Operating Rod Pin and Cotter
14	448-14	Operating Rod Lever
15	¼"x20x1"	Operating Rod Cap Screw
16	¼" Shake-proof	Operating Rod Lockwasher
17	244-17	Adjusting Screw Locknut
20	448-20	Vapor Valve Seat Gasket
21	448-21	Vapor Valve Stem
22	448-22	Vapor Valve Lever Complete (includes lever, roller and rivet)
23	444-23	Vapor Valve Lever Disc
24	444-24	Vapor Valve Lever Bonnet
25	444-25	Vapor Valve Lever Spring
26	440-P-1	Vapor Valve Stem Retaining Washer
27	448-27	Vapor Valve
28	448-28	Vapor Valve Seat
29	444-29	Vapor Valve Guide Cap
30	440-V	Valve Retaining Ring
32	448-32	Shield (includes shield clip and rivet)
33	440-Y	Shield Bolt and Cotter
34	448-34	Tube (specify whether for A or F type regulator)
35	448-35	Operating Rod Spring
36	590-36	Diaphragm Casing
38	530-Z	Diaphargm
39	244-36	Vibration Snubber
40	440-F-1	Adjusting Screw
41	440-U-1	Adjusting Screw Locknut
45	440-H-1	Rider
46	440-H-2	Link with 440-H-3 Thumb Nut
49	440-H-4	Link Pin and Cotter
50	448-50	Vapor Valve Lever Spring Plate
51	448-51	Vapor Valve Lever Spring Cap
55	465-55	Diaphragm Shield Plate
64	446-64	Clamp with Bolt and Nut
65	411-B	1" Std. Pipe Plug, Square Shank
66	786	1" Std. Pipe Plug, Square Shank
67	244-22	Test Outlet Plug, ¼"-Std. Pipe
69	786	1½" Std. Pipe Plug, Square Shank
77	448-77	Diaphragm Casing Cover (includes Bushing and Pin)
79	8-32x½"	Deflector Ring Screw (R.H.M.)
80	448-80	Guide Plate
81	448-31	Deflector Ring

LIST OF PARTS

No. B-590 HOT WATER REGULATOR

Sym.	Part No.	Description
1	448-1	Body
2	411-A	Strainer
3	244-3	Diaphragm Bonnet
4	244-4	Pressure Reducing Valve Diaphragm
5	244-35	Diaphragm Spring Button
6	244-6	Diaphragm Spring
7	244-7	Set Screw Button
8	244-8	Adjusting Screw
9	244-9	Adjusting Screw Cap
118	488-118	Valve Housing Assembly
	448-10	Main Valve
	448-11	Main Valve Spring
	448-18	Main Valve Housing
	448-19	Main Valve Spring Nut
12	448-12	Operating Rod (specify whether for A or F type regulator)
13	440-I-1	Operating Rod Pin and Cotter
14	448-14	Operating Rod Lever
15	¼"x20x1" Lg.	Operating Rod Lever Binder Screw
16	¼" Shake-proof	Operating Rod Lockwasher
17	244-17	Adjusting Screw Locknut
20	448-20	Vapor Valve Seat Gasket
22	448-22	Vapor Valve Lever Complete (includes lever, roller and rivet)
23	444-23	Vapor Valve Lever Disc
24	444-24	Vapor Valve Lever Bonnet
25	444-25	Vapor Valve Lever Spring
26	244-36	Vibration Snubber
29	444-29	Cap
32	448-32	Shield Complete (includes Shield Clip and Rivet)
33	440-Y	Shield Bolt and Cotter
34	448-34	Tube (specify whether for A or F type regulator)
36	B-530-L	Adapter
50	448-50	Vapor Valve Lever Spring Plate
51	448-51	Vapor Valve Lever Spring Cap
55	B-590-55	Spring Retainer Nut
64	446-64	Clamp with Bolt and Nut
65	411-B	1" Std. Pipe Plug, Square Shank
66	786	1" Std. Pipe Plug, Square Shank
67	244-22	Test Outlet Plug, ¼" Std. Pipe
69	786	1½" Std. Pipe Plug, Square Shank
90	448-90	Vapor Valve Assembly
91	900-E	Economy Diaphragm
95	B-440-G-2	Spring Retainer
96	B-440-H	Spring
97	B-440-J	Casing (includes Post and Cap)
98	B-440-K1	Adapter Gasket
99	5/16"x18x ¾" Lg.	Cap Screw (Hex Head)
100	B-440-L	Shield (Economy Diaphragm)
101	B-440-M	Shield Retainer
102	B-440-N	Shield Retainer Nut
	B-590-136	Lower Casing Assembly Complete (includes Syms. 36, 55, 91, 95, 96, 97, 98, 99, 100, 101 and 102)

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MAINTENANCE AND OVERHAUL

Little maintenance is required for the continued efficient operation of the Nos. 590, B-590 and BA-590 hot water regulators. Visual observation for steam blows is sufficient to insure proper functioning. Steam leaking through the regulator when the vapor valve is closed is an indication that the valve is not seating properly. This may be caused by a worn seat, or by dirt between the valve and seat. A worn seat should be reground or replaced and dirt may be blown out from between the valve and seat by closing the shut-off valve ahead of the regulator for a few minutes and then opening it again. Steam blowing from the drain port may mean a damaged bellows diaphragm which should be replaced.

These regulators should be disassembled and overhauled every two years, at which time they should be tagged with a metal date tag. To disassemble the No. BA-590 hot water regulator, remove the cotter from the shield bolt (sym. 33) and lift off the shield (sym. 32). Remove the operating rod pin and cotter (sym. 13) and the operating rod binding screw (sym. 15) and take out the operating rod lever (sym. 14). Unscrew the vapor valve lever bonnet (sym. 24) take out the vapor valve lever disc (sym. 23) and remove the vapor valve lever assembly (sym. 22) which may then be further disassembled. Unscrew the cap (sym. 29) and unscrew the vapor valve assembly (sym. 90). Remove the vapor valve lever spring cap (sym. 51) and the vapor valve lever spring (sym. 25). Unscrew the pipe plug (sym. 65) and remove the strainer (sym. 2). The pressure reducing feature should be disassembled by unscrewing the diaphragm bonnet (sym. 3) and removing the diaphragm (sym. 4), the main valve spring (sym. 11) and the main valve housing (sym. 18). The adjusting screw (sym. 8) and the locknut (sym. 17) may be removed after the cap (sym. 9) has been removed. By unscrewing the cap screws (syms. 99) from the cover (sym. 97), the cover may be removed, allowing the operating rod (sym. 12) and the spring (sym. 95) to be released. Unscrew the shield nut (sym. 100) to release the diaphragm shield (sym. 113) and the bellows diaphragm (sym. 91). Nos. 590 and B-590 regulators may be disassembled in a similar manner.

Clean and inspect each part for wear, replacing any worn or damaged parts. Check the spring tension and carefully inspect the threads of the castings. Reassemble the regulator and test it on a steam line before putting it back into service again.

To test an Economy Diaphragm for leaks, place it in a suitable holding fixture and submerge it in water at about 190°F. Leaks will be shown by the rising of bubbles in the water. A leaking diaphragm should be discarded, do not attempt to refill or reclaim it. When the test is completed, submerge the diaphragm in cold water to cause it to contract before removing it from the holding fixture. A suitable holding fixture is shown on our Drawing No. 22659, copies of which are available upon request.

CAUTION: Do not remove the Economy Diaphragm from the enclosure while hot, nor subject it to live steam when not enclosed as it will become over-expanded and will not return to its normal fully contracted form when cooled.

IMPORTANT NOTES CONCERNING THE NOS. 590, B-590 AND BA-590 HOT WATER REGULATORS

All underneath piping should be extra heavy and should be pitched to drain not less than one inch in ten feet. Avoid forming pockets where water may be trapped and freeze in cold weather.

* * *

Be sure that all piping has been blown clean before re-applying the regulator to a car, and that good threads are cut in pipes and fittings to insure tight joints. Use only graphite and oil on pipe joints to form steam-tight connections. Avoid the use of red or white lead for this purpose as steam is likely to carry it into the regulator where it will cause sticking of the moving parts.

* * *

The Nos. 590 and B-590 hot water regulators should be converted into BA-590 hot water regulators by changing several of their parts. The No. BA-590-136 Economy Diaphragm Enclosure should replace the lower casing assembly of the 590 regulator or the B-590-136 enclosure of the B-590 unit. The vapor valve and seat of the No. 590 regulator should be replaced with the complete vapor valve assembly No. 448-90.

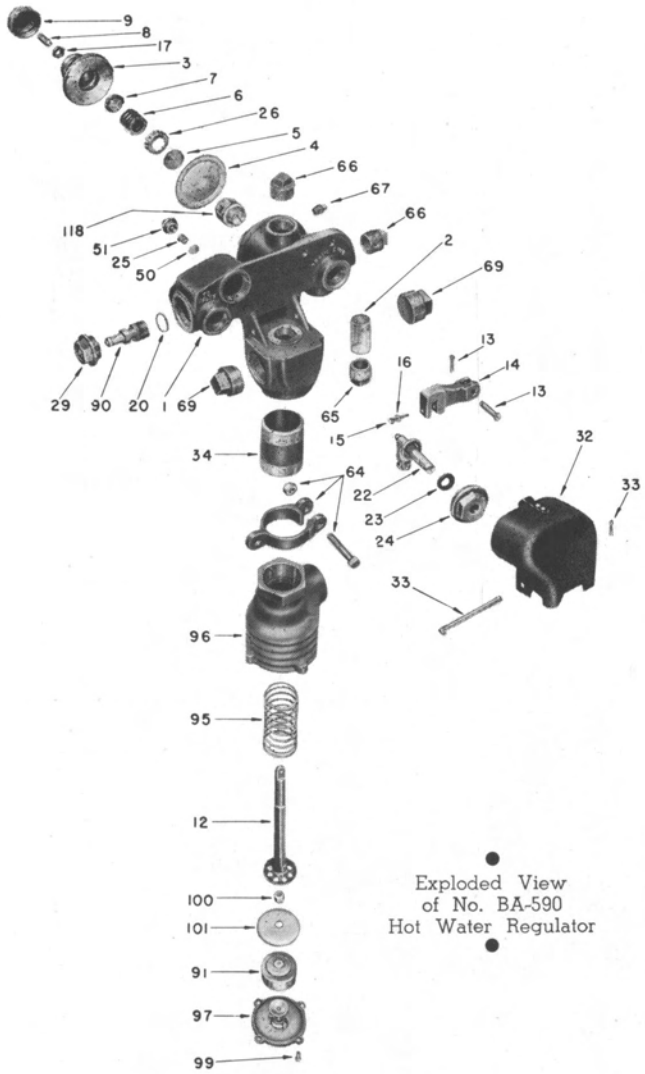
* * *

When converting the Nos. 590 or B-590 hot water regulators into BA-590 regulators, it is not necessary to remove the unit or disturb the piping to make the change. The old vapor valve and seat can be replaced by removing the vapor valve guide cap, the vapor valve lever spring cap and the vapor valve lever assembly so that the new assembly may be screwed into place. The Economy Diaphragm Enclosure may be screwed into place after removing the lower casing assembly of either the 590 or B-590 regulators.

* * *

It has been found in some cases where a regulator is located too near the heat exchanger that it is advisable to replace the No. B-440-H spring in the Economy Diaphragm Enclosure with a heavier No. B-440-H-40 spring to compensate for a tendency of the diaphragm to be too thrifty with steam when it is needed to heat the water.

NOS. 590, B-590 AND BA-590 HOT WATER REGULATORS (Con't.)



Exploded View of No. BA-590 Hot Water Regulator

LIST OF PARTS

No. BA-590 Hot Water Regulator

Sym.	Part No.	Description	Amt.
1	448-1	Body	1
2	411-A	Strainer	1
3	244-3	Diaphragm Bonnet	1
4	244-4	Pressure Reducing Valve Diaphragm	1
5	244-35	Diaphragm Spring Button	1
6	244-6	Diaphragm Spring	1
7	244-7	Button Set Screw	1
8	244-8	Adjusting Screw	1
9	244-9	Adjusting Screw Cap	1
10	448-10	Main Valve	1
11	244-11	Main Valve Spring	1
12	448-12	Operating Rod (includes Spring Retainer)	1
13	440-1-1	Operating Rod Pin and Cotter	1
14	448-14	Operating Rod Lever	1
15	½"x20x1" Lg.	Operating Rod Lever Binder Screw	1
16	½" Shake-proof	Operating Rod Lock Washer	1
17	244-17	Adjusting Screw Lock Nut	1
18	448-18	Main Valve Housing	1
19	448-19	Main Valve Spring Nut	1
20	448-20	Vapor Valve Seat Gasket	1
22	448-22	Vapor Valve Lever Complete (includes lever, roller and rivet)	1
23	444-23	Vapor Valve Lever Disc	1
24	444-24	Vapor Valve Lever Bonnet	1
25	444-25	Vapor Valve Lever Spring	1
26	244-36	Snubber (Vibration)	1
29	444-29	Cap	1
32	448-32	Shield Complete (includes Shield Clip and Rivet)	1
33	440-Y	Shield Bolt and Cotter	1
34	448-34	Tube (specify A or F Type)	1
50	448-50	Vapor Valve Lever Spring Plate	1
51	448-51	Vapor Valve Lever Spring Cap	1
64	446-64	Clamp with Bolt and Nut	1
65	411-B	1" Std. Pipe Plug—Sq. Shank	1
66	786	1" Std. Pipe Plug—Sq. Shank	3
67	244-22	Test Outlet Plug ¼" Std. Pipe	1
69	786	1½" Std. Pipe Plug—Sq. Shank	2
91	900-E	Economy Diaphragm	1
95	B-440-H	Spring	1
96	BA-530-L	Casing (Economy Diaphragm)	1
97	BA-440-K	Casing Cover (includes Post and Cap)	1
98	B-590-55	Nut (Operating Rod Adapter)	1
99	⅜"-16x ⅞" Lg.	Cap Screw (Hex Head)	4
100	B-440-U	Shield Nut	1
101	BA-440-L	Shield (Economy Diaphragm)	1
	BA-590-136	Lower Casing Assembly (includes Syms. 91 to 101)	
	448-118	Valve Housing Assembly (includes Syms. 10, 11, 18 and 19)	
	448-90	Vapor Valve Assembly includes	

Other Parts Lists on Page 4

NOS. 590, B-590 AND BA-590 HOT WATER REGULATORS (Con't.)

LIST OF PARTS

No. 590 HOT WATER REGULATOR

Sym.	Part No.	Description
1	448-1	Body
2	411-A	Strainer
3	244-3	Diaphragm Bonnet
4	244-4	Pressure Reducing Valve Diaphragm
5	244-35	Diaphragm Spring Button
6	244-6	Diaphragm Spring
7	244-7	Spring Plate
8	244-8	Adjusting Screw
9	244-9	Adjusting Screw Cap
118	448-118	Valve Housing Assembly
	448-10	Main Valve
	244-11	Main Valve Spring
	448-18	Main Valve Housing
	448-19	Main Valve Spring Nut
12	448-12	Operating Rod (specify whether for A or F type regulator)
13	440-I-1	Operating Rod Pin and Cotter
14	448-14	Operating Rod Lever
15	¼"x20x1"	Operating Rod Cap Screw
16	¼" Shake-proof	Operating Rod Lockwasher
17	244-17	Adjusting Screw Locknut
20	448-20	Vapor Valve Seat Gasket
21	448-21	Vapor Valve Stem
22	448-22	Vapor Valve Lever Complete (includes lever, roller and rivet)
23	444-23	Vapor Valve Lever Disc
24	444-24	Vapor Valve Lever Bonnet
25	444-25	Vapor Valve Lever Spring
26	440-P-1	Vapor Valve Stem Retaining Washer
27	448-27	Vapor Valve
28	448-28	Vapor Valve Seat
29	444-29	Vapor Valve Guide Cap
30	440-V	Valve Retaining Ring
32	448-32	Shield (includes shield clip and rivet)
33	440-Y	Shield Bolt and Cotter
34	448-34	Tube (specify whether for A or F type regulator)
35	448-35	Operating Rod Spring
36	590-36	Diaphragm Casing
38	530-Z	Diaphargm
39	244-36	Vibration Snubber
40	440-F-1	Adjusting Screw
41	440-U-1	Adjusting Screw Locknut
45	440-H-1	Rider
46	440-H-2	Link with 440-H-3 Thumb Nut
49	440-H-4	Link Pin and Cotter
50	448-50	Vapor Valve Lever Spring Plate
51	448-51	Vapor Valve Lever Spring Cap
55	465-55	Diaphragm Shield Plate
64	446-64	Clamp with Bolt and Nut
65	411-B	1" Std. Pipe Plug, Square Shank
66	786	1" Std. Pipe Plug, Square Shank
67	244-22	Test Outlet Plug, ¼"-Std. Pipe
69	786	1½" Std. Pipe Plug, Square Shank
77	448-77	Diaphragm Casing Cover (includes Bushing and Pin)
79	8-32x½"	Deflector Ring Screw (R.H.M.)
80	448-80	Guide Plate
81	448-31	Deflector Ring

LIST OF PARTS

No. B-590 HOT WATER REGULATOR

Sym.	Part No.	Description
1	448-1	Body
2	411-A	Strainer
3	244-3	Diaphragm Bonnet
4	244-4	Pressure Reducing Valve Diaphragm
5	244-35	Diaphragm Spring Button
6	244-6	Diaphragm Spring
7	244-7	Set Screw Button
8	244-8	Adjusting Screw
9	244-9	Adjusting Screw Cap
118	488-118	Valve Housing Assembly
	448-10	Main Valve
	448-11	Main Valve Spring
	448-18	Main Valve Housing
	448-19	Main Valve Spring Nut
12	448-12	Operating Rod (specify whether for A or F type regulator)
13	440-I-1	Operating Rod Pin and Cotter
14	448-14	Operating Rod Lever
15	¼"x20x1" Lg.	Operating Rod Lever Binder Screw
16	¼" Shake-proof	Operating Rod Lockwasher
17	244-17	Adjusting Screw Locknut
20	448-20	Vapor Valve Seat Gasket
22	448-22	Vapor Valve Lever Complete (includes lever, roller and rivet)
23	444-23	Vapor Valve Lever Disc
24	444-24	Vapor Valve Lever Bonnet
25	444-25	Vapor Valve Lever Spring
26	244-36	Vibration Snubber
29	444-29	Cap
32	448-32	Shield Complete (includes Shield Clip and Rivet)
33	440-Y	Shield Bolt and Cotter
34	448-34	Tube (specify whether for A or F type regulator)
36	B-530-L	Adapter
50	448-50	Vapor Valve Lever Spring Plate
51	448-51	Vapor Valve Lever Spring Cap
55	B-590-55	Spring Retainer Nut
64	446-64	Clamp with Bolt and Nut
65	411-B	1" Std. Pipe Plug, Square Shank
66	786	1" Std. Pipe Plug, Square Shank
67	244-22	Test Outlet Plug, ¼" Std. Pipe
69	786	1½" Std. Pipe Plug, Square Shank
90	448-90	Vapor Valve Assembly
91	900-E	Economy Diaphragm
95	B-440-G-2	Spring Retainer
96	B-440-H	Spring
97	B-440-J	Casing (includes Post and Cap)
98	B-440-K1	Adapter Gasket
99	5/16"x18x ¾" Lg.	Cap Screw (Hex Head)
100	B-440-L	Shield (Economy Diaphragm)
101	B-440-M	Shield Retainer
102	B-440-N	Shield Retainer Nut
	B-590-136	Lower Casing Assembly Complete (includes Syms. 36, 55, 91, 95, 96, 97, 98, 99, 100, 101 and 102)

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No. 960 HOT WATER REGULATOR

1" I.P.S. CONNECTIONS WEIGHT 25 LBS.

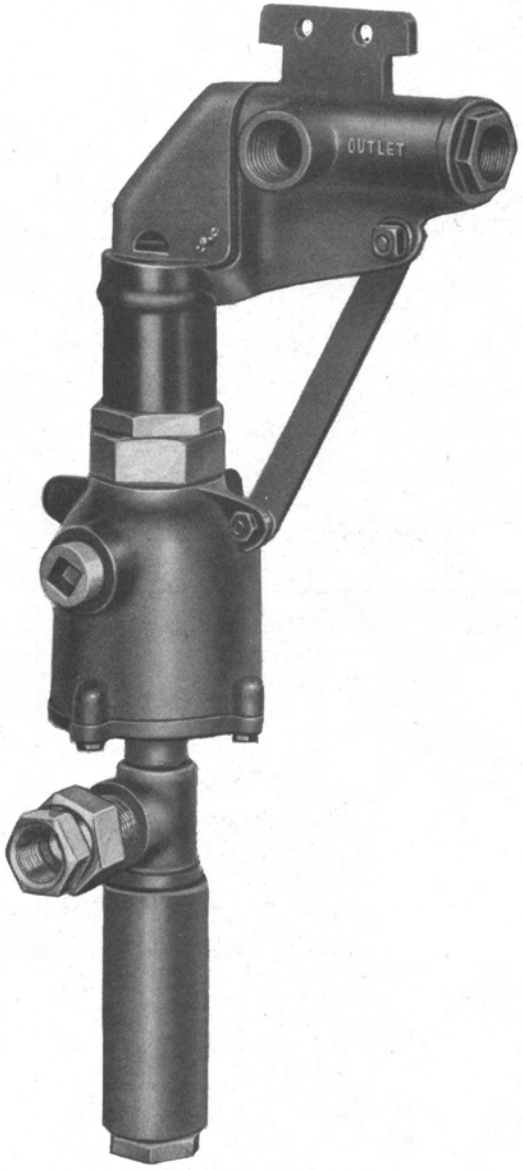

Fig. 1. No. 960 Hot Water Regulator

GENERAL DESCRIPTION

The No. 960 Hot Water Regulator controls the admission of steam to a supply loop and heat exchanger for heating wash water in railway cars. Its action is similar to that of the No. BA-530 and BA-590 hot water regulators which it supersedes. A pressure regulating valve is not used ahead of this regulator.

As in the case of other vapor regulators, the return of steam from the loop causes a thermostatic bellows in the lower part of the regulator to expand. The expansion of this bellows moves an operating rod and lever arrangement to close a needle valve and shut off the admission of steam to the loop.

The needle valve is re-opened to again feed steam to the loop when the thermostatic bellows contracts. Condensate is discharged to the ground through a No. 960-TT drain tube. (See Fig. 2.)

A No. 471 Mounting Bracket is used to attach the No. 960 Hot Water Regulator to the car. (See Bulletin 61-702 for illustration of this bracket.) It must be purchased separately as it is not furnished with the regulator.

MAINTENANCE AND OVERHAUL

There is very little operational maintenance required for the efficient operation of the No. 960 Hot Water Regulator. A blow of steam from the regulator indicates sticking of the needle valve or a ruptured thermostatic bellows.

A sticking needle valve can usually be cleared by closing the shut-off valve ahead of the regulator for a few minutes and then opening it again. This procedure will supply enough steam to blow out any dirt particles between the valve and seat.

To test a thermostatic bellows for leaks, close the shut-off valve ahead of the regulator and allow about five minutes for the bellows to cool and contract. Then remove the bellows from the regulator for inspection. Place it in a suitable holding device and submerge in water at about 190° F. Leaks will be shown by the rising of bubbles in the water. A leaky bellows should be discarded; do not attempt to refill and reclaim it. A suitable holding device is shown in our drawing No. 22659, copies of which are available upon request.

CAUTION: Do not remove thermostatic bellows from the regulator while hot nor subject it to live steam when not enclosed, as bellows will become overexpanded and will not return to its normal form.

The No. 960 Hot Water Regulator should be completely overhauled at least once every two years and a metal date tag attached at this time. The unit should be disassembled and thoroughly cleaned. The thermostatic bellows (sym. 5) should be tested for leaks and inspected for distortion.

The strainer (sym. 4) should be cleaned and the lever (sym. 25) and pins (sym. 26, 27 and 28) cleaned and lubricated. Check the operating rod (sym. 18) for freedom of movement. If the valve or seat has become scored or wire drawn, the needle valve assembly (sym. 19) should be replaced.

When the regulator has been reassembled, test it carefully before putting it back into service. Be sure there is 7/32" to 1/4" movement for opening and closing the valve when regulator is cold.

No. 960 HOT WATER REGULATOR (Cont.)

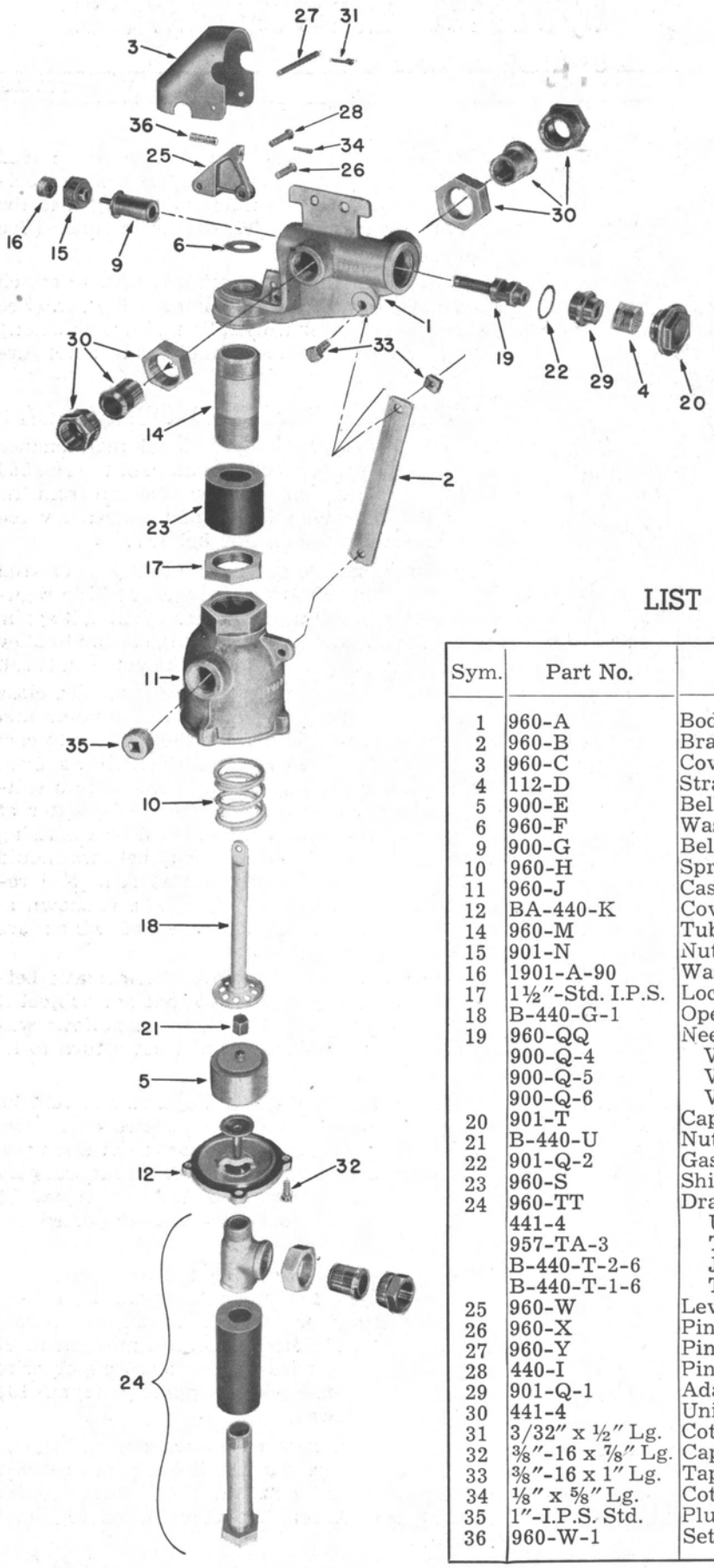

Fig. 2.—Exploded View of No. 960 Hot Water Regulator

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	960-A	Body	1
2	960-B	Brace	1
3	960-C	Cover	1
4	112-D	Strainer	1
5	900-E	Bellows Assembly	1
6	960-F	Washer	1
9	900-G	Bellows (Valve Packing)	1
10	960-H	Spring	1
11	960-J	Casing (Diaphram)	1
12	BA-440-K	Cover (Including Post and Cap)	1
14	960-M	Tube	1
15	901-N	Nut (Bellows Retaining)	1
16	1901-A-90	Washer	1
17	1½"-Std. I.P.S.	Locknut	1
18	B-440-G-1	Operating Rod	1
19	960-QQ	Needle Valve Assembly	1
	900-Q-4	Valve Spring	1
	900-Q-5	Valve Stem Washer	1
	900-Q-6	Valve Stem Pin	1
20	901-T	Cap (Strainer)	1
21	B-440-U	Nut	1
22	901-Q-2	Gasket	1
23	960-S	Shield (Tube)	1
24	960-TT	Drain Tube	1
	441-4	Union Complete	1
	957-TA-3	Tee	1
	B-440-T-2-6	Jacket	1
	B-440-T-1-6	Tube	1
25	960-W	Lever	1
26	960-X	Pin (Lever)	1
27	960-Y	Pin (Cover)	1
28	440-I	Pin (Operating Rod)	1
29	901-Q-1	Adapter	1
30	441-4	Union Complete	2
31	3/32" x ½" Lg.	Cotter Pin (Spring Type)	2
32	⅜"-16 x ⅞" Lg.	Cap Screw (Hex. Head)	4
33	⅜"-16 x 1" Lg.	Tap Bolt and Nut (Sq. Head)	2
34	⅛" x ⅝" Lg.	Cotter Pin (Spring Type)	2
35	1"-I.P.S. Std.	Plug Countersunk	1
36	960-W-1	Set Screw	1

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No. 245
AIR PRESSURE REDUCING VALVE

INLET ½" I.P.S. OUTLET ½" I.P.S.	WEIGHT 4¾ LBS.

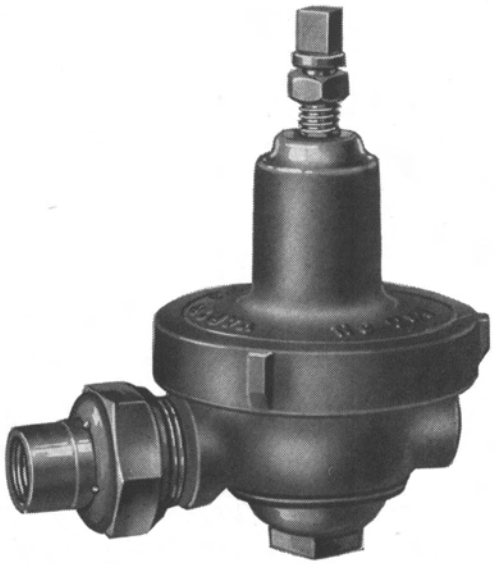


Fig. 1. No. 245 Air Pressure Reducing Valve.

GENERAL DESCRIPTION

The No. 245 Air Pressure Reducing Valve is designed to regulate the pressure of air used in certain pieces of railway equipment. An adjusting screw is provided in the valve to permit the regulation of pressure. To set the adjustment, loosen the locknut and turn the adjusting screw either to the right or left to increase or decrease the discharged air pressure to the desired point. Valves used to provide less than 40 lbs. pressure are equipped with a No. 245-F mainspring, while valves used to provide more than 40 lbs. pressure are equipped with a No. 245-F-1 mainspring of heavier material.

The sectional view of the valve (Fig. 2) shows how air pressure, above that desired, acts upon a diaphragm to close the valve by raising a movable seat to block the air supply. In operation the valve controls the air pressure by assuming a position of balance to maintain a uniform pressure.

MAINTENANCE AND OVERHAUL

The No. 245 Air Pressure Reducing Valve requires very little maintenance during operation. An escape of air from the relief port in the valve bonnet is an indication of a leaking diaphragm. Unsolder the damaged diaphragm and replace it, being sure to resolder the new one in place. Air leaking through the valve is an indication of a worn or damaged seat which must be replaced.

To disassemble the valve for overhaul, loosen the locknut (sym. D), remove the adjusting screw (sym. C), unscrew the bonnet (sym. B) and the bottom cap (sym. R); then remove the yoke screws (sym. P) so that the seat retaining ring (sym. N) will be released from the yoke (sym. K). Unscrew the strainer union nut (sym. T) and remove the strainer union tail piece (sym. T-4) and the strainer (sym. U).

Clean the strainer and replace it if it has become worn or damaged. Inspect the composition rubber seat and replace it if it has become worn. Particular attention should be given to the springs, which should be replaced if they show a lack of tension.

After all parts have been cleaned and inspected, reassemble the valve and be sure to test it carefully before putting it back into service again.

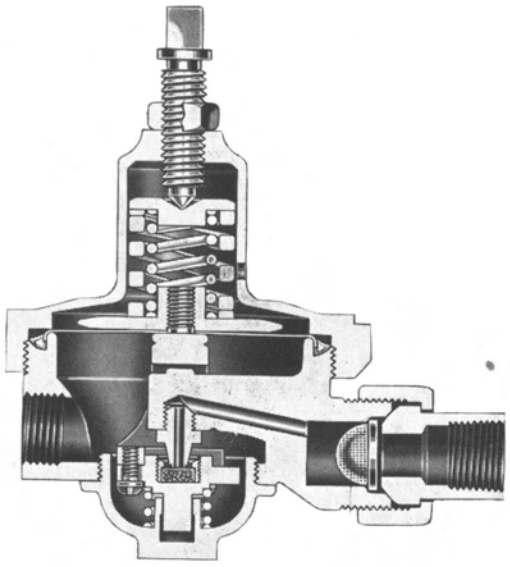
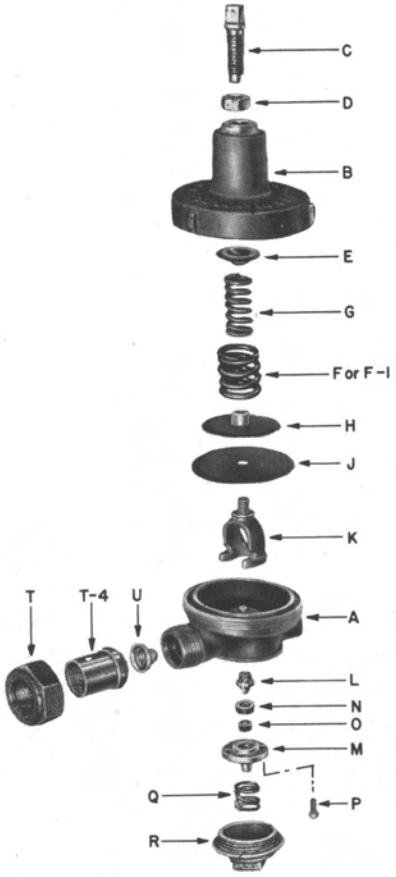


Fig. 2. Sectional View of No. 245 Valve.

No. 245 AIR PRESSURE REDUCING VALVE (Continued)



LIST OF PARTS

Sym.	Part No.	Description	Amt.
A	245-A	Body	1
B	245-B	Bonnet	1
C	245-C	Adjusting Screw	1
D	245-D	Locknut	1
E	245-E	Spring Plate	1
F	245-F	Mainspring (40 lbs. or under)	1
F-1	245-F-1	Mainspring (40 lbs. or over)	1
G	245-G	Auxiliary Spring	1
H	245-H	Diaphragm Plate	1
J	245-J	Diaphragm	1
K	245-K	Yoke	1
L	245-L	Nozzle	1
M	245-M	Seat Plate	1
N	245-N	Seat Retaining Ring	1
O	245-O	Seat	1
P	245-P	Yoke Set Screw	3
Q	245-Q	Seat Plate Spring	1
R	245-R	Bottom Cap	1
T	245-T	Strainer Union Nut	1
T-4	245-T-4	Strainer Union Tail Piece	1
U	245-U	Strainer	1

NOTE: Valve Furnished With Either Symbol F or F-1. Specify Which Is Desired.

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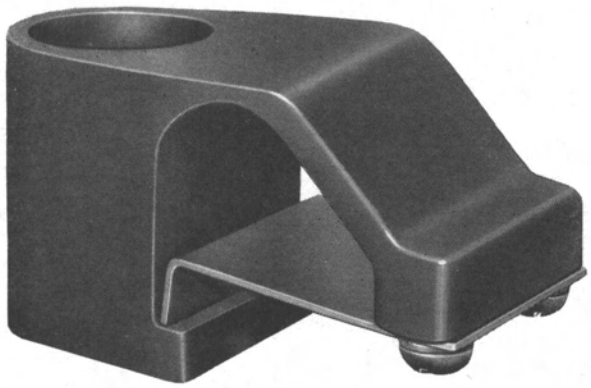
Nos. 381, 381-11, 382, A-382 AND 382-11 ANTI-FREEZE FITTINGS

Supersedes Nos. 383, 384, 393 and 394 Anti-Freeze Tees

SEE PAGE 2 FOR INLET AND OUTLET SIZES AND LISTS OF PARTS



Anti-Freeze Fitting

GENERAL DESCRIPTION

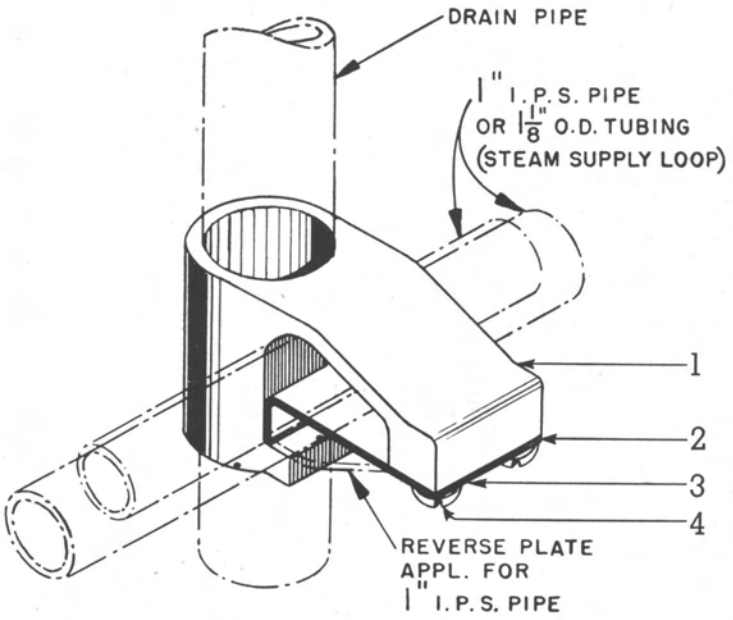
Anti-Freeze Fittings are used to prevent the freezing of water in drain pipes from wash stands, sinks, toilets, drinking fountains or other equipment on railway cars. By the application of heat from steam taken from the steam train line, these drain pipes are kept warm so that they cannot freeze in cold weather or northern climates.

The Nos. 381, 381-11, 382 and 382-11 Anti-Freeze Fittings supersede the Nos. 383, 384, 393 and 394 Anti-Freeze Tees which are still available for replacement purposes. A separate steam loop is taken off the train line and steam is channeled through the fitting which is located in this loop. While steam does not actually contact the drain pipe, heat is transferred by conduction through the brass body of the fitting (see illustration below). The No. A-382 Anti-Freeze Fitting is like a No. 382-fitting but includes a bushing for use on 1½" I.P.S. drains.

A reversible plate in the fitting forms a clamp to hold either 1⅛" O.D. copper tubing or 1" iron pipe, whichever is used for the special steam loop. Four different sizes of fittings are available, so that various sized drain pipes may be accommodated. A list of these dimensions, along with a list of parts of each fitting is shown on page 2 to aid in ordering parts or complete fittings.

MAINTENANCE

No maintenance is required for the Nos. 381, 381-11, 382 and 382-11 Anti-Freeze Fittings except that the screws which hold the reversible plate must be kept drawn up tightly to prevent the fitting from working loose as a result of vibration.



Anti-Freeze Fitting

Nos. 381, 381-11, 382, A-382 and 382-11 ANTI-FREEZE FITTINGS (Continued)

LIST OF PARTS

No. 381 Anti-Freeze Fitting—1¼" O.D. Drains

	Sym.	Part No.	Description	Amt.
No. 381	1	381-1	Anti Freeze Fitting Body	1
For 1¼"	2	381-2	Plate (Rev'ble)	1
O.D. Drain	3	¼"-20-⅜"	Rd. Hd. Machine Screw	2
	4	¼" Std.	Split Type Lockwasher	2

No. 381-11 Anti-Freeze Fitting—1⅜" O.D. Drains

	Sym.	Part No.	Description	Amt.
No. 381-11	1	381-11-A	Anti Freeze Fitting Body	1
For 1⅜"	2	381-2	Plate (Rev'ble)	1
O.D. Drain	3	¼"-20-⅜"	Rd. Hd. Machine Screw	2
	4	¼" Std.	Split Type Lockwasher	2

LIST OF PARTS

No. 382 Anti-Freeze Fitting—2⅛" O.D. Drains

	Sym.	Part No.	Description	Amt.
No. 382	1	382-1	Anti-Freeze Fitting Body	1
For 2⅛"	2	381-2	Plate (Rev'ble)	1
O.D. Drains	3	¼"-20-⅜"	Rd. Hd. Machine Screw	2
	4	¼" Std.	Split Type Lockwasher	2

No. A-382 Anti-Freeze Fitting—1½" I.P.S. Drains

	Sym.	Part No.	Description	Amt.
No. A-382	1	382-1	Anti-Freeze Fitting Body	1
For 1½"	2	381-2	Plate (Rev'ble)	1
I.P.S. Drains	3	¼"-20-⅜"	Rd. Hd. Machine Screw	2
	4	¼" Std.	Split Type Lockwasher	2
		A-382-6	Bushing	1

No. 382-11 Anti-Freeze Fitting—1⅝" O.D. Drains

	Sym.	Part No.	Description	Amt.
No. 382-11	1	382-1	Anti Freeze Fitting Body	1
For 1⅝"	2	381-2	Plate (Rev'ble)	1
O.D. Drains	3	382-6	Bushing	1
	4	¼"-20-⅜"	Rd. Hd. Machine Screw	2
	5	¼" Std.	Split Type Lockwasher	2

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VAPOR CAR HEATING CO., INC., CHICAGO — BULLETIN 61-700
REVISION "A"

VAPOR-ZONE SYSTEM OF PASSENGER TRAIN HEATING

BRIEF DESCRIPTION AND INSTRUCTIONS

SUPERSEDES BULLETIN No. 1002

MARCH, 1944

VAPOR-ZONE SYSTEM OF PASSENGER TRAIN HEATING

The Vapor-Zone System of Car Heating is an improved, thermostatically controlled, heating system, which divides the car into two or more areas or "zones" under the control of independent thermostats, gives immediate response to heat requirement in each area or "zone," provides for parallel individual feeding of radiators, ensures obtainance of uniform temperatures in each such "zone" or area and makes possible much more uniform temperatures thruout the car. In addition to increasing passenger comfort, due to the elimination of wide temperature differentials encountered with other thermostatically controlled heating systems, this system is much more economical than any other heating system from the standpoint of the construction of the devices used, the cost of installation and reduction in maintenance attention requirements.

Economy with the use of the Vapor-Zone System is further obtained for the following definite reasons:

Only steam actually needed for heating is admitted into the system.

Latest bellows type economy diaphragm arrangement in the new and compact Vapor Regulator, eliminates blowing of steam.

By use of Vapor Retarders steam is retained in the radiators until the condensate is no longer useful as a heating medium.

Construction details vary in different car plans; therefore, it is important that each contemplated installation of the Vapor-Zone System of Heating should be studied carefully from an engineering standpoint and proper lay-out plans for installation should be prepared by the Vapor Car Heating Company.

On the following pages a general arrangement of the heating system is shown, and the function of each device is described.

GENERAL DESCRIPTION

Essentially, this heating system consists of one or more steam supply loops underneath the car, each such loop being supplied with steam by a Vapor Regulator from a steam train line. The steam supply loop in turn furnishes steam to two or more radiators, which are of the extended surface unit-fin type.

Briefly this heating system does the following:

(a) Divides the radiation in the car into two or more zones under the control of separate thermostats.

(b) Provides for parallel feeding of radiators by separate individual risers to each radiator admission valve from a special steam supply-return loop underneath the car.

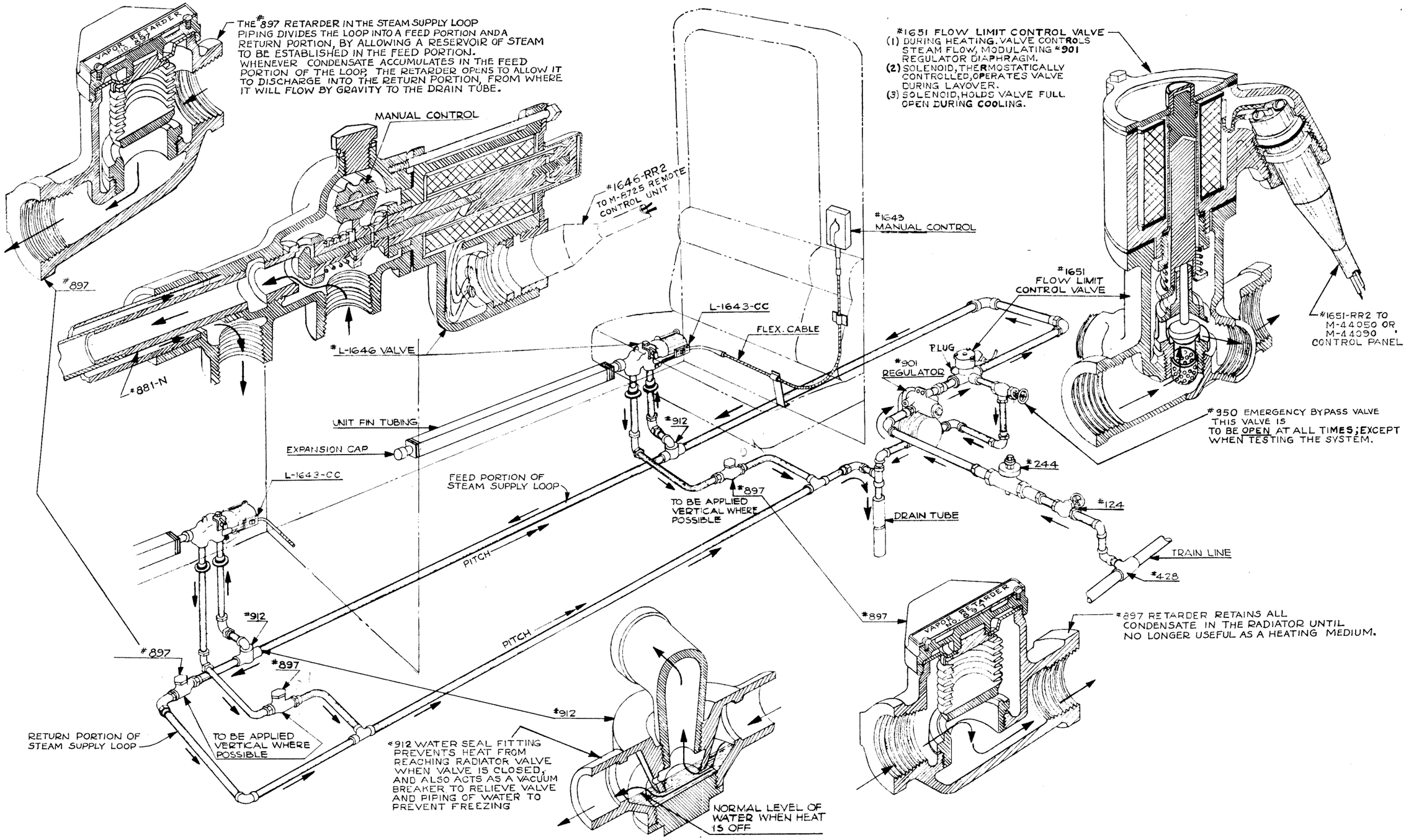
(c) Utilizes our Unit-Fin type Radiators, in which the steam is fed thru an inner tube to the farthest end of the radiator and is then returned to the radiator steam admission valve thru the outer finned pipe.

(d) Connects the radiator returns to a common return pipe constituting a section of the supply loop and provides a central drain for each such loop for draining the condensate from the radiators connected thereto.

Steam from the train line is conducted from the train line Strainer Tee (or Cross) to the No. 901 Vapor Regulator in the steam supply loop underneath the car. The steam pressure to the Vapor Regulator is reduced to about 40 lbs. by a No. 244 Constant Pressure Regulating Valve ahead of the Regulator. A No. 124 Shut-off and Drain Valve is placed ahead of the No. 244 Valve to permit shutting off the steam to the Vapor Regulator and the steam supply loop, if required.

The steam supply loop includes a Vapor Regulator, a No. 1651 or a No. 1653 Flow Limit Valve, an Emergency By-Pass Valve and a loop of piping with a No. 897 type Vapor Retarder in the loop.

There are usually two or more such steam supply loops under each car, each under the control of its own Vapor (Steam) Regulator, whose steam delivery to the loop is controlled in accordance with actual steam requirements by a Flow Limit Valve. Each steam supply loop is in actuality a combination supply and return loop as it is



VAPOR-ZONE SYSTEM

This diagram shows how a heating circuit is arranged to provide two or more radiators with steam.

VAPOR-ZONE SYSTEM OF PASSENGER TRAIN HEATING *(Continued)*

divided into a feed portion and a return portion by the No. 897 type Vapor Retarder, whose function is to create a reservoir of steam in the feed portion for assuring an immediate delivery of steam to the radiators whenever the radiator steam admission valves are open. The radiator condensate returns are piped to the return portion of the loop. Each supply loop has a central drain for all the radiators being fed with steam from the same loop. Each supply loop serves two or more radiators, depending upon the length and capacity of the radiators, as well as other factors, which have to be taken into consideration by our engineers when making up heating lay-out plans for different types of cars.

Condensate from the radiators is discharged by the No. 897 Vapor Retarders into the return section of the steam supply loop and the return or draining condensate is continually open to the atmosphere thru a return pipe drain tube adjacent to the Regulator. The return pipe (return section of the supply loop) as well as the drain tube is kept warm by the Regulator and the Vapor Retarders and all condensate drains quickly when steam is shut off at the radiator steam admission valves. There are no separate drips from the radiators, valves or traps that would cause ice accumulation under cars. There is no blowing and consequent waste of steam at the drain tube, due to the very sensitive nature of the bellows type diaphragms used in the Vapor Retarders and in the Vapor Regulator.

The radiation is planned out and installed to provide proper distribution of heat, as required in each area or zone. The radiators and steam admission Valves are located strategically to assure uniform distribution of heat thruout the car. The Unit Fin (inner pipe feed, outer pipe radiating return) type radiators assure radiation at the point needed most, at the coldest end of the car. The control of the radiator steam admission valves is under our compensating or cycle-modulation type of thermostatic control. The thermostats are of our adjustable double bulb mercury type and anticipate temperature over-runs and under-runs by automatic compensation thru the medium of cycling resistors on the control panel, to assure maintaining of more uniform temperatures in each area or "zone." Furthermore, the thermostats are so located in each area or "zone," so as to ensure obtaining more uniform temperatures thruout the car. Selective type of thermostatic control utilizing multiple tube thermostats may be used on some cars.

NOTE: The steam for this heating system is conveyed, in the conventional way, from the locomotive thru a train line or main supply pipe underneath each car. The steam train line is connected between cars by flexible metallic conduits with the usual steam couplers to permit separation of cars or changing their sequence in the train.

Strainer Tees are provided in the steam train line to allow for branching off to the "steam supply-return loops" for the car heating system.

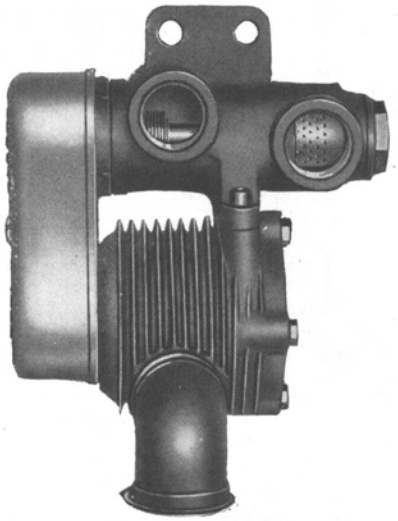
ADVANTAGES OF VAPOR-ZONE TYPE HEATING SYSTEM

Among the advantages of the Vapor-Zone type Heating System are the following:

1. Unlike the conventional straight Vapor System which comprises more than one radiating coil, the radiators of this system, being in parallel, are filled simultaneously from a steam supply loop. In the Vapor System, which is a "push around" system, the delivery of steam to the radiators is usually in series.
2. Since the various valves are of a generous size and resistance thru system is decreased due to parallel feeding, steam can flow thru easily and quickly with only a small flow differential provided between inlets and outlets of system.
3. Regulator is controlled entirely and directly by flow changes in supply pipe and is not influenced or disturbed in any way by permitting condensation returned from the radiators to come near the controlling thermostatic member (diaphragm) of the regulator.
4. Only sufficient steam will flow from source into supply pipe to replace steam that is withdrawn, at desired flow differential, to satisfy needs of radiators at any time.

DESCRIPTION OF DEVICES USED

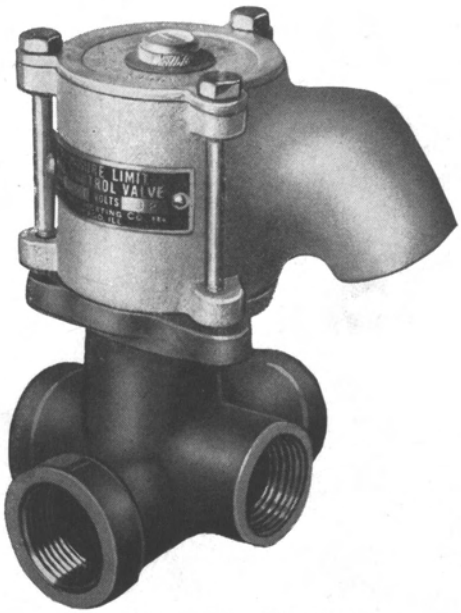
The Regulator supplies steam to the system. The No. 901 VAPOR REGULATOR used with the ZONE SYSTEM is very sensitive. Made with a positive and accurate shut-off valve, coupled with an economy thermostatic diaphragm, the regulator responds quickly to temperature changes due to the sensitivity of the diaphragm. Operation of this Regulator is controlled entirely by the Flow Limit Valve (described below), which modulates the diaphragm of the regulator, to allow the valve in the regulator to open wholly or partially in accordance with demand for steam. None of the returning condensate from the radiators comes into contact with the diaphragm of the regulator.



No. 901 REGULATOR
Less Drain Tube

The No. 1651 FLOW LIMIT VALVE, located between the feed and return chambers of the regulator, is so designed that should there develop an excessive supply of steam in the supply pipe this valve will open and divert steam to expand the regulator diaphragm and thereby throttle or shut off the delivery of steam by the regulator to control volume of steam supplied to the system in accordance with steam demand.

This valve is a spring loaded relief valve that is also magnetically operated to provide "lay-over control" when used in conjunction with thermostatic protection.

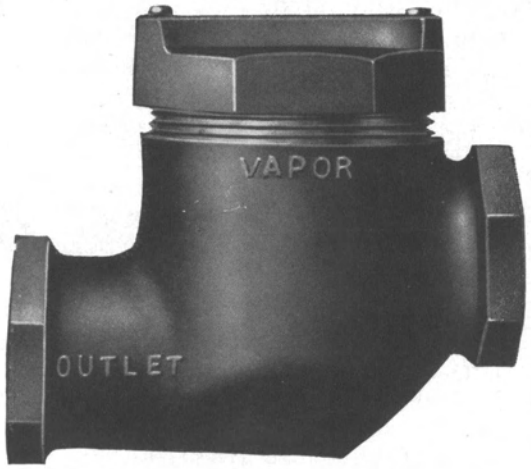


No. 1651 FLOW LIMIT VALVE

The No. 1653 FLOW LIMIT VALVE is a spring loaded relief valve used in place of the No. 1651 Flow Limit Valve where no lay-over thermostat is used. In this case cars are controlled in the usual manner through selection of low temperature through the air-conditioning panel and steam valves are intermittently energized. When the No. 1651 Flow Limit Valve is used all valves remain de-energized and the solenoid of the flow valve controls lay-over heat.

No. 1653 FLOW LIMIT VALVE

NO. 897 VAPOR RETARDER



NO. 897 VAPOR RETARDER

A differential between the feed and return portions of the supply loop is maintained by the No. 897 Vapor Retarder, which accumlates a reservoir of steam ahead of itself. This makes possible an immediate flow of steam into the radiators when the solenoid operated steam admission valves open. This Retarder is operated by a bellows type diaphragm which expands to close its seat in the presence of steam. In the presence of condensate the diaphragm opens the seat to allow for purging of the steam supply loop of condensate. When steam is cut off the car, the Retarder seat will open and facilitate rapid drainage of condensate from the system.

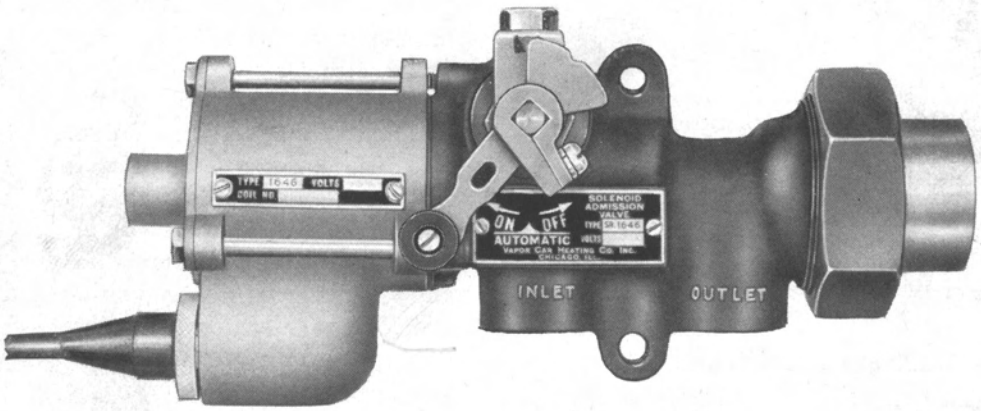
The No. 897 Vapor Retarders are also used as condensate release fittings in the return lines from the radiators and discharge the condensate, after it is no longer useful as a heating medium, into the return section of the steam supply loop. The Retarders also prevent steam vapors from rising in the return pipes and backing up thru the open return port of the solenoid steam admission valves to the radiators when the valves are closed.

(The No. 914 type Vapor Retarder, which has slots in the seat and was originally supplied for use in the steam supply loop, is no longer required and can be substituted by the No. 897 Vapor Retarder).

SOLENOID STEAM ADMISSION VALVES FOR FLOOR HEAT RADIATORS

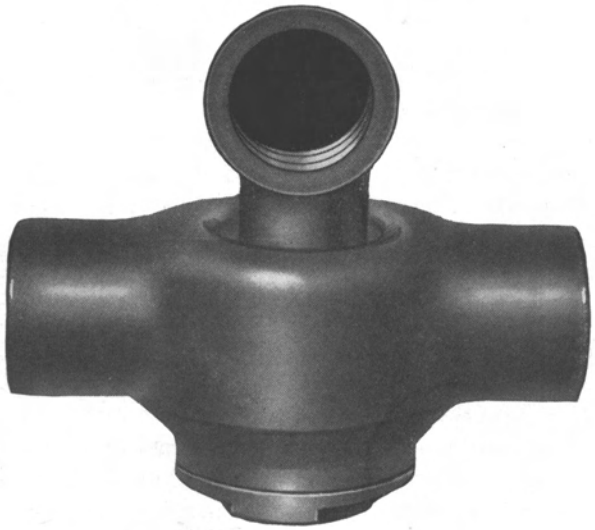
The admission of steam into the radiators is controlled automatically by Solenoid Steam Admission Valves of the 1646 type in accordance with the dictation of their respective thermostats. The valve now supplied for floor heat radiators is our No. S-1646, which has a cast iron body and which is provided with a union connection for either copper tubing or pipe as required.

These valves are without the conventional limit switches, thus eliminating usual maintenance attention. The valve rests normally in the open position and is closed electrically thru the energizing of the single solenoid on the valve by the thermostatic circuit. The valve is held closed electrically until the thermostat circuit is broken, when the valve will open mechanically to admit steam into the radiators. Only about 10 watts are required to hold the valve in the closed position.



NO. S-1646 SOLENOID STEAM ADMISSION VALVE

WATER SEAL FITTING



No. 912 WATER SEAL FITTING

In order to prevent the steam admission valves at the radiators from being heated, when the valves are shut off, a water seal fitting is provided for each valve. Each such fitting is located in the feed portion of the supply loop and connects with the steam admission valve in the car by means of a riser pipe. The fitting allows condensate from the steam in the valve chamber and in the riser pipe to build up a substantial water column in the riser pipe, sealing off the admission of steam to the valve. The water column is built up and maintained in the riser by means of a partial vacuum due to the condensation of steam in the riser.

When the car is out of service and there is no longer any steam supplied by the Regulator to the supply loop, the vent opening provided on the cast inward projection of the fitting acts as a vacuum breaker to permit the trapped condensate to drain out of the riser pipe, thus preventing freezing in the exposed portion of this piping.

There are two types of Water Seal Fittings used. The No. 912 fitting is of brass for use on copper tubing for soldered connections, while the No. 913 is of iron and has a threaded inlet and threaded outlets for use with pipe. The No. 913 fitting has no cap for cleanout purposes, as it is readily removable from the line.

UNIT FIN RADIATION

The radiators used with ZONE SYSTEM are known as UNIT FIN RADIATORS and consist of a pipe within a pipe — the steam being fed through the inside pipe to the extreme end and returning through the outer finned pipe. This type of radiator provides immediate dissipation of heat at the farthest end of the radiator, and a more uniform distribution throughout its entire length.

The important factor in the use of Unit Fin Radiation with the VAPOR-ZONE SYSTEM is the location of the radiator and the thermostat, in order to give immediate heat first in that area of each zone where it is first needed, and to maintain uniform temperatures in that zone.

OVERHEAD HEATING

For Overhead Heating, the No. 1657, 1658 or 1659 Solenoid Steam Admission Valve is used. It is similar in construction and operation to the No. 1646 Valve used with floor heat, except that the Overhead Valve operates in reverse sequence —it is energized to open, and when de-energized the valve will close.

When used with the new Venturi Type Overhead Radiator supplied by the Vapor Car Heating Company, a much more constant supply of steam is provided with a much faster circulation, eliminating stratification in delivery ducts. The Venturi Type Radiator for overhead heating is of special design, utilizing the Unit-Fin type principle. It permits quick heat response, eliminating cold spots of partially heated radiators. This radiator is available in sizes to meet any requirements for overheated heating.

REMOTE MANUAL CONTROL

Remote Control Operating Mechanisms, for partition mounting, have been designed for manual operation of No. 1646 Steam Admission Valves. The type required depends on the location of the No. 1646 Valve. No. 1643 Remote Control is a flexible cable operated and is used where valves are installed in rooms; No. 1644 Type, not shown, is used where valves are located under seat at end of coach sections and is universal joint operated.

No. 1643 REMOTE CONTROL

AUTOMATIC CONTROLS

Zone System Controls may be either of the cycle-modulation or selective type. The floor heat, overhead heat and cooling are all interlocked through one centralized control panel. Independent temperature selection switches and thermostats may be provided for rooms and compartments, as required. This permits passengers to select the desired heating temperatures in their own rooms or compartments.

Where independent room or compartment controls are provided, the relays for thermostat operation in such rooms are usually located near the steam admission valve to reduce the amount of car wiring.

APPLICATION

1. All steam regulators should be securely fastened to the under-framing or some suitable bracket underneath the car in such a way or place as to be readily accessible for repairs and maintenance. Bearing in mind ample clearance must be allowed for removal of diaphragm and valve assembly, the regulators must be hung low enough (but not lower than trainline) so that sufficient pitch can be obtained when piping the supply loop. A minimum pitch of 1" per 10 feet of piping is required. The regulator must drain back to the trainline. The regulator must be as far as possible from the rails and air brakes.
2. Both the feed and the return lines of the supply loop are to pitch for drain with the No. 897 Vapor Retarder in the steam supply loop at high point. The feed portion of the loop is to drain back to the head of the regulator, then to the trainline. The return portion of the loop drains to the ground through the drain at the regulator.
3. The No. 1651 and No. 1653 Valves must be installed in such a manner as to provide room for removal of solenoids and valve seats.
4. The No. 897 Vapor Retarders in the radiator return lines should be located near the return pipe, about 6" but not more than 18" away from the return line, applied in branch pipe from the return port of the solenoid steam admission valve.
5. The No. 912 Water Seal Fitting is located in the feed line leading to the feed port of the steam admission valve.
6. The No. 897 Vapor Retarders are to be applied preferably in a vertical position but may be placed horizontally, if necessary, to allow for removal of cap and diaphragm. Enough clearance should be left to allow the removal of the caps for inspection and replacement of the bellows diaphragms in the retarders.
7. A minimum space of 4" is required between the solenoid end of steam admission valves and the nearest obstruction.
8. When the solenoid steam admission valve is applied in a room, the No. 1643 Remote Control Operating Mechanism is used for either partition or side wall applications for manual operation of the valve.
9. When the solenoid steam admission valve is applied in center of coach section, access should be provided in grille for operating valve lever. When valve is located under seat at end of coach section, the No. 1644 Remote Control Operating Mechanism is used.
10. The unit fin radiators should be properly supported and anchored by the car builder, using recommended Vapor Car Heating Co.'s fittings and stands for the purpose. (See proper bulletins for various types available.)
11. All pipe joints should be made tight on the threads to prevent possibility of leaking from subsequent expansion and contraction. Also, a graphite compound or graphite and oil should be used instead of red or white lead in making up pipe joints; and the compound should be applied to the male threads only. The use of white or red lead, particularly when smeared on female threads, has a tendency to clog up piping and often works loose later on and gives trouble by lodging in and gumming up valves, preventing their proper operation.
12. The entire system should be blown out with steam to wash all parts free from graphite and dirt, and then a pressure test (see page 9) made to make sure that all joints are tight before cars leave the shops.

13. OVERHEAD HEAT: For application and location of overhead heat Solenoid Steam Admission Valve and other devices in connection with overhead heat, see Bulletins on Valves Nos. 1657, 1658 and 1659.

GENERAL OPERATING INSTRUCTIONS

The ZONE SYSTEM of heating is equipped with either compensated, cycle-modulation or selective type of thermostatic controls. The compensated and cycle-modulation type of controls utilize Vapor Car Heating Co.'s "Adjustable Tube Type Thermostats," while the selective controls utilize Vapor Car Heating Co.'s "Multiple Tube Thermostats."

The ZONE SYSTEM of floor heat is interlocked with the air conditioning controls.

The air conditioning control switch on the air conditioning panel must be in the HEATING sector to provide automatic temperature control of both overhead heating and floor heating.

When separate remote temperature selector switches are used in some of the rooms, the room switches should be set to desired heating temperature.

Overhead heat will not be available until the BLOWER SWITCH is turned "ON."

NOTE: When the air conditioning control switch is in the "COOLING" sector, all heating valves are automatically held in off or closed position. The No. 1651 Flow Limit Valves, where used instead of the No. 1653 Valves, will also be energized during cooling to prevent steam from entering the supply loops underneath the car.

When the air conditioning control switch is in the "HEATING" sector and the thermostats are calling for heat, the No. 1646 floor heat valves will be de-energized and will admit steam into the floor heat radiators. The Overhead Heat Solenoid Valve will become electrically energized and will open to admit steam into the overhead heat radiator.

LAY-OVER PROTECTION

At the end of trip the AIR CONDITIONING CONTROL SWITCH and the BLOWER STARTER SWITCH should be turned to the "OFF" position. This will permit floor heat to be controlled automatically at low position during lay-over, generally 60° F., and will protect the water system from freezing in freezing weather.

IMPORTANT!

See that all No. 1646 Solenoid Steam Admission Valves are in the center or "Automatic" position before leaving car at end of trip. Otherwise floor heat will not be thermostatically controlled at low temperature during lay-over.

With *compensated type of controls on coaches,* automatic lay-over low temperature control is obtained by having the blower switch in the OFF position and the air conditioning control switch in the OFF position to automatically set down the floor heat thermostats to operate at low position. Such floor heat thermostats in rooms and compartments that have independent floor heat control switches (remote temperature selectors) will control according to their setting. The No. 1653 Flow Limit Valve is used instead of the No. 1651.

On PULLMAN cars equipped with compensated controls, where each room is individually controled by its own remote temperature selector switch, which can be left in any setting during lay-over, a separate 60° lay-over thermostat is used, in conjunction with one or more No. 1651 Flow Limit Valves. With this arrangement the floor heat valves are all de-energized when the blower fan is turned off and are in the open position. However, no steam will be available until the lay-over thermostat tube drops to 60°. Below this temperature the No. 1651 Flow Limit Valve will be de-energized and cause steam to feed from the vapor regulator into the supply loop and into all of the room radiators. Thus the entire car will receive heat until temperature rises above 60°, at which time all the No. 1651 Flow Limit Valves will again become energized to allow the vapor regulators to become short-circuited and steam flow to the radiators will stop.

Should batteries fail or should they be removed from a car, all No. 1646 Valves will be open, provided the manual operating handles are set at "Automatic." As the No. 1651 Flow Limit Valve will then close, steam will immediately flow into all radiators and protect the car against freezing temperatures.

Nos. 1646, 1657, 1658 and 1659

SOLENOID STEAM ADMISSION VALVES

All Zone Type Steam Admission Valves have a handle and knob arrangement for manually setting these valves to ON or OFF position. This arrangement will allow valves to be operated manually if desired. Also, this arrangement will allow the occupant of a room to have heat admitted manually into the room during cooling, should he consider the room too cool for his personal comfort. However, where the No. 1651 Flow Limit Valve is used and where an emergency heat switch is provided on the air conditioning panel, the switch will have to be placed in emergency heating position.

To obtain automatic operation of floor heat and overhead heat valves, these valves must have the handle or knob arrangement at AUTOMATIC position.

TESTING

This system of heating, in both the mechanical and electrical devices, does not require any routine testing.

If the vapor regulators are found to operate satisfactorily by observation without a blow of steam, the heating system will function satisfactorily.

Before departure, in summer or winter, all solenoid steam admission valves should be checked to see that they are in "automatic" position.

The thermostats and valves can be checked in the conventional way for proper operation by alternately heating and cooling the respective thermostat tubes. A thorough test, however, should be made at the beginning of each heating season after each device has been properly checked and overhauled where necessary.

PROCEDURE FOR MAKING PRESSURE TEST TO DETERMINE IF THERE ARE ANY LEAKS IN THE PIPING AT TIME OF INSTALLATION

1. Blow out entire system with steam to wash all parts free from graphite and dirt.
2. Place all solenoid steam admission valves in the manually open position.
3. Close the ¾" manual emergency by-pass valves and disconnect the return line of the loops at the regulator drain outlet, applying a standard shutoff valve to these pipes, as otherwise the system would be open to the atmosphere.
4. Substitute test caps for the "caps with bellows" on the Vapor Retarders, as these bellows must not be allowed to remain in the system under high pressure.
5. Proceed with pressure test, not allowing, however, more than 100 pounds pressure to be built up. This pressure can be regulated by manipulation of the ¾" manual emergency valve until test is finished. If no emergency valve is used, pressure can be regulated by stop valve at the regulator. All joints must be tight, especially those leading from supply loop to the Solenoid Steam Admission Valves.
6. Remove test caps and replace bellows and caps on the Vapor Retarders after pressure test is completed.
7. Do not fail to open the ¾" manual emergency by-pass valve. Replace all piping connections.

MAINTENANCE

The various devices used on the ZONE SYSTEM of heating and controls, such as the Flow Limit Valve, the Vapor Retarders, Water Seal Fittings and Solenoid Steam Admission Valves, do not require any adjustment or special maintenance attention.

The No. 901 Vapor Regulators have a factory adjustment, which is soldered and which does not have to be disturbed.

NOTE: Once a year, before the beginning of the heating season, the whole heating system should be thoroughly checked. The diaphragms in the vapor regulators and retarders should be examined and replaced, if necessary.

For detailed information on the various devices see separate bulletins on each device in Vapor Manual.

TROUBLE SHOOTING

A. IF ANY RADIATOR FAILS TO HEAT

1. Check to see that the handle of the steam admission valve on the radiator is in the center or "automatic" position. If handle is found in automatic position, move it to the manual "on" position and check to see if radiator will heat up. If radiator will heat up, failure may be due to the thermostat or may be in the electrical circuit.

B. IF THERE IS A CONTINUOUS BLOW OF STEAM AT THE DRAIN TUBE:

NOTE: All radiators connected to the steam supply loop with the continuously blowing drain tube will fail to heat.

The continuous steam blow may be due to obstruction between valve and seat of Vapor Regulator, or to failure of bellows diaphragm in the Vapor Regulator.

1. Any obstruction between valve and seat of Vapor Regulator may be dislodged by closing the No. 124 Shut-off and Drain Valve ahead of the Regulator for a few minutes, in order to give the Regulator diaphragm time to cool, and then re-opening the No. 124 Valve. The re-opening of No. 124 Valve, after the diaphragm in the Regulator has become contracted, will allow a large flow of steam to blow out the obstruction between valve and seat of Vapor Regulator. This procedure should be gone thru, as outlined, before going ahead any further.
2. If the drain tube continues to blow steam continuously, this will then be due to failure of the bellows diaphragm in the Vapor Regulator. Do not attempt to remove and replace the Vapor Regulator diaphragm without first becoming familiar with the procedure for so doing given under heading: "How To Replace Diaphragms in Vapor Regulators and Vapor Retarders."

C. IF THERE IS A SPASMODIC BLOW OF STEAM AT THE DRAIN TUBE: (A blow every 2 to 3 minutes)

1. If all steam admission valves are open and all the radiators connected to the steam supply loop with the spasmodic (intermittent) blowing drain tube fail to heat properly, this is an indication that the failure is due to the Flow Limit Valve or to the Vapor Retarder in the steam supply loop piping.
2. If some of the radiators connected to the steam supply loop with the blowing drain tube do heat, this is an indication that the spasmodic steam blow is due to failure of one or more Vapor Retarders in the radiator return lines.
3. If indication is that spasmodic steam blow is due to failure of Flow Limit Valve or to Vapor Retarder in the steam supply loop, proceed, as follows:
   (a) Something may have lodged between valve and seat of Flow Limit Valve. Open and close the Emergency By-Pass Valve quickly several times. This will usually allow any obstruction between valve and seat to be blown thru. The valve may also be cleared by rapping it a few times. If this will not make the radiators heat again, check the Vapor Retarder in the steam supply loop piping.
   (b) There may be an obstruction between valve and seat of the Vapor Retarder in the steam supply loop piping, or the bellows diaphragm in this Retarder may be defective. Do not attempt to remove Vapor Retarder bellows diaphragm for examination or replacement, without first becoming familiar with the correct procedure for so doing, which is indicated under the heading "How to Replace Diaphragms in Vapor Regulators and Vapor Retarders."
4. If the indication is that spasmodic steam blow is due to faulty Vapor Retarder(s) in the radiator return lines, proceed as follows:
   (a) Place all Steam Admission Valves, which are connected to the steam supply loop under the car with the blowing drain tube, in the manual "off" position, check to see if there is spasmodic blow at the drain tube. If there is, replace the diaphragm in the Vapor Retarder in the steam supply loop. If spasmodic steam blow still continues, the Flow Limit Valve may have a broken spring or may be held open electrically, if it is of the No. 1651 type. Remove the Flow Limit Valve for an examination and repair.
   (b) If there is no spasmodic steam blow when all Steam Admission Valves to the radiators are closed manually, by placing them in the manual "off" position, open the valves, one at a time, and check the drain tube each time for reappearance of a spasmodic steam blow. If such a steam blow appears, this is an indication that the Vapor Retarder in the return line from the Steam Admission Valve opened is at fault. After having remedied the

TROUBLE SHOOTING—(Continued)

faulty Retarder, check the balance of the Vapor Retarders by opening the rest of the Solenoid Steam Admission Valves and checking the drain tube for blow each time, in the same fashion.

NOTE: Do not attempt to replace diaphragm in Vapor Retarder without first closing the No. 124 Shut-off and Drain Valve and allowing about 5 minutes time for the bellows diaphragm in the Retarder to cool. The No. 124 Valve will have to be reopened to allow for checking of the balance of the Vapor Retarders. Return all steam admission valves to the "automatic" position, after replacement of defective Retarder diaphragm or after making whatever other corrections that may be necessary. Vapor Retarders may cause the radiators to fail to heat for the following additional reasons: Obstruction between diaphragm and seat; scoring of seat and diaphragm valve face causing leakage.

D. IF THERE IS NO STEAM BLOW, THERMOSTAT AND THERMOSTAT CIRCUIT IS O. K., BUT RADIATOR STILL FAILS TO HEAT:

1. This may be due to water logging of the radiator, due to loosening and falling out of Vapor Retarder diaphragm, blanking the outlet where old type diaphragms not equipped with locking plates are used. Such diaphragms can be reapplied with litharge and glycerine to prevent loosening. When reapplying, place a split type lockwasher in the cap before screwing the diaphragm into the cap. Tighten diaphragm by hand as far as it will go. New type diaphragms are equipped with locking plates for clamping by the cover, and consequently do not require any lockwasher to prevent loosening and falling out because of vibration.

E. IF ANY RADIATORS OVERHEAT

Check the steam admission valves at such radiators. The valve handles must be in the "automatic" or center position for the thermostat to automatically control the flow of steam to the radiators. If a valve handle is found in "automatic" position, move the handle to the manual "off" position and check to see if radiator will cool off. If radiator will cool off, this will be an indication that failure is due to the thermostat or is in the electrical circuit.

If trouble is not found in the electrical circuit, the trouble may be due to sediment or dirt lodging between valve and seat to block open the seat within the solenoid steam admission valve, to make the valve feed steam to the radiator all the time. It is of utmost importance that only the standard No. 1646-B-21 Gasket of Vapor Car Heating Co. manufacture is used between solenoid and valve body on all solenoid steam admission valves.

INFORMATION FOR TRAINMEN

Should any radiators fail to heat, while enroute, and placing the solenoid steam admission valves in the manual "on" position will not restore heat to such radiators, this will probably be due to sticking of the Flow Limit Valve, underneath the car, in the open by-passing position, because of obstruction between its valve and seat. Where the No. 1651 Flow Limit Valve is used, it may be cleared of obstructing matter by turning the Blower Fan Switch to "on" and flipping the Air Conditioning Control Switch (both on the temperature Control Panel) a few times back and forth, from the heating to the cooling sector of the switch. This will energize and de-energize the solenoid on the Flow Limit Valve and may clear the valve by repeated lifting of the valve off the seat.

In the event the above procedure will not restore heat to the radiators, close and open the Emergency By-Pass Valve quickly several times, at the next stopping point. This may blow the dirt off the seat. If this will not restore heat to the radiators, as a last resort, allow the Emergency By-Pass Valve to remain closed for the balance of the trip and operate the Radiator Steam Admission Valves manually. The radiators will heat when the radiator solenoid steam admission valves are in the manual "on" position. Report condition to terminal point for proper repairs.

HOW TO REPLACE DIAPHRAGMS IN VAPOR REGULATORS AND VAPOR RETARDERS

Close the No. 124 Shut-off and Drain Valve between the train line and the No. 244 Constant Pressure Regulating Valve ahead of the Vapor Regulator. All drainage and leakage will then be taken care of by means of the drain port on the No. 124 Valve, while it is in the closed position. Allow sufficient time, *about five (5) minutes,* for the bellows diaphragms in the Vapor Regulator and in the Vapor Retarders to cool and contract before removing them for examination or replacement. If a diaphragm will not come back to its normal fully contracted form, when cooled down *at room temperature,* the diaphragm bellows is defective and must be replaced. If the diaphragm is fully contracted, the blowing of the Vapor Regulator may be due to faulty valve within the Regulator, accumulation of dust in cover on Regulator, dirt or sediment between diaphragm and seat preventing valve closure on Vapor Retarders, or to other causes.

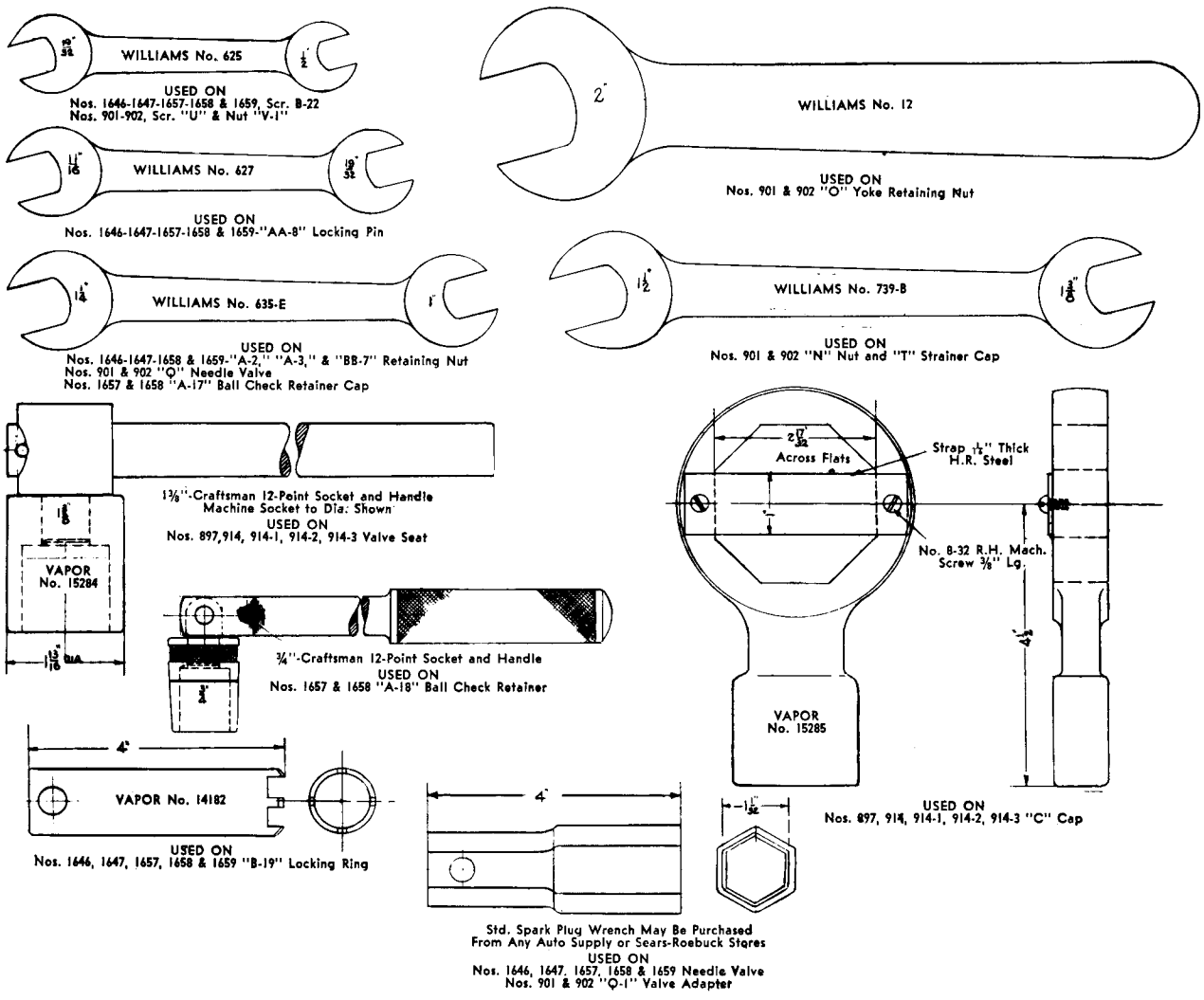
TROUBLE SHOOTING—(Continued)

CAUTION: *Do not remove the bellows diaphragm when hot,* nor subject it to live steam, when not in enclosure, or when not clamped, as otherwise the diaphragm will become overexpanded and will not come back to its normal fully contracted form when cooled down. Diaphragms can be checked for proper expansion by placing them in a holding fixture on the order of one shown on Drawing No. 22659 and submerging in cold and then hot water. Copies of this drawing will be furnished on request.

NOTE

The trouble shooting information given on the preceding two pages should not lead to the impression that this heating system is apt to give trouble. The bellows diaphragms and all the devices used are very reliable, strainers are provided at all important points and under ordinary circumstances, no difficulties will be experienced. The diaphragms will give a long life and by following recommended periodic testing and replacement, when required, failures in service will be prevented.

STANDARD AND SPECIAL WRENCHES FOR VAPOR-ZONE HEATING SYSTEM EQUIPMENT



THE VAPOR-ZONE SYSTEM OF PASSENGER CAR HEATING AS REVISED IN 1946

The modification of the Vapor-Zone system of passenger car heating, introduced in 1946, is based on the same engineering principles as was the original Vapor-Zone system. This system has been redesigned to reduce the number of devices used, to improve them wherever possible and to make them easier to maintain.

GENERAL DESCRIPTION

In the thermostatically controlled system, which is used on all air conditioned cars, the steam admission valves are of the solenoid type and are operated electrically by thermostats to admit steam to the radiation as required to maintain pre-determined temperatures in each room or zone.

In air conditioned cars, the Vapor-Zone system of heating makes use of both floor and overhead heat. The floor heat is furnished by fin radiation which extends along the base of the side walls of the car. This radiation causes a rising current of heated air to flow up the walls to offset the heat absorption by the side walls and windows. Thru Cycle-Modulation, which will be explained later, we are able to control the skin temperature of the radiation in accordance with the amount of heat actually required. This eliminates hot blasts of air during mild weather as the temperature of the radiation is kept at a minimum when the heat demand is low.

The floor heat radiation is usually divided into three or more zones, five being the recommended standard for a coach or an open body type of car. In each zone, the radiation is under the independent control of a separate thermostat and heat is supplied as needed in that particular area. Overhead heat is furnished by a steam radiator which is placed in the path of the air delivered by the overhead ducts.

Steam for heating each car is taken from the steam train line or main supply pipe underneath the car. Branch steam connections are made from this line to the steam supply loops, of which there may be two or more underneath each car depending on the type of car and the amount of radiation. Each loop is supplied with steam from the train line by a Vapor Regulator and in turn furnishes steam to two or more radiators in the car.

A loop is divided by a Vapor Retarder into a steam supply portion and a condensate return portion. Risers to the radiator steam admission valves are taken off the supply portion of the loop; condensate which forms in the radiation inside the car is piped back to the return portion of the loop and, as this part of the loop is connected to the drain tube of the regulator, flows out this tube to the ground.

The Vapor Regulator is the heart of the system. In addition to reducing the steam pressure, the

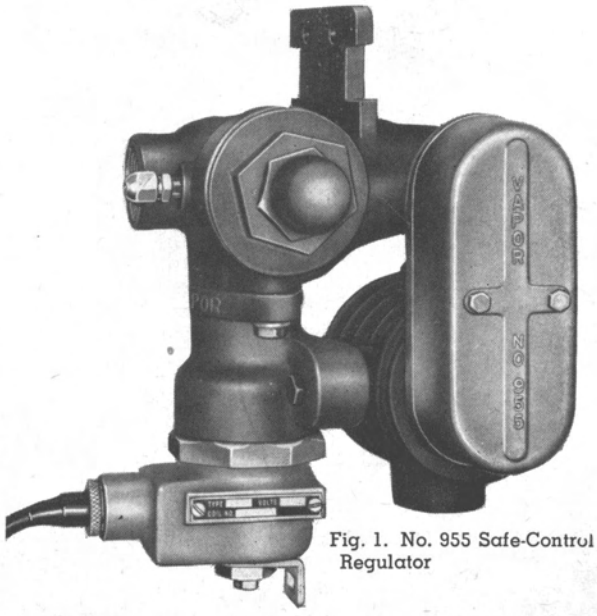


Fig. 1. No. 955 Safe-Control Regulator

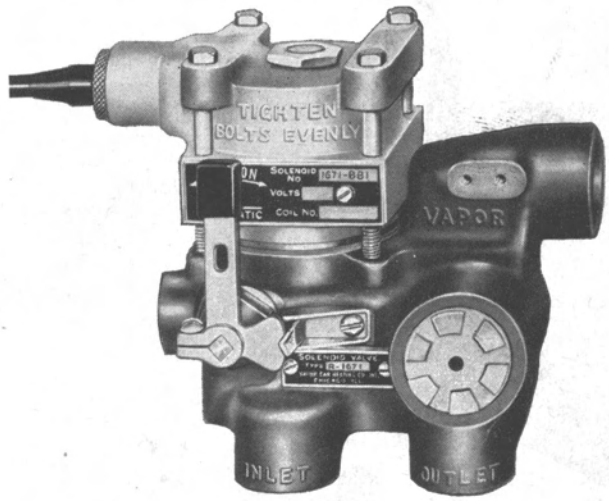


Fig. 2. No. R-1671 Solenoid Steam Admission Valve.

THE VAPOR-ZONE SYSTEM OF PASSENGER CAR HEATING (Cont.)

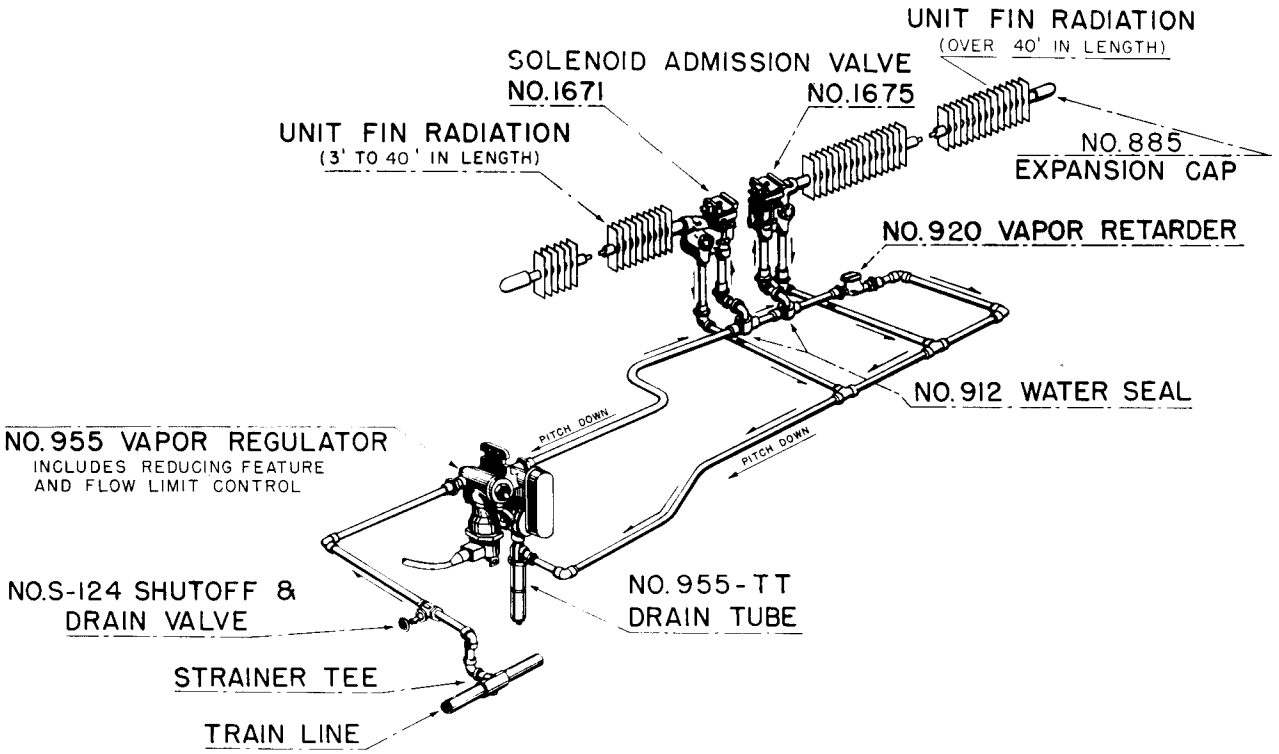


Fig. 3. No. 955 Vapor Regulator with No. 1671 or No. 1675 Solenoid Steam Admission Valve.

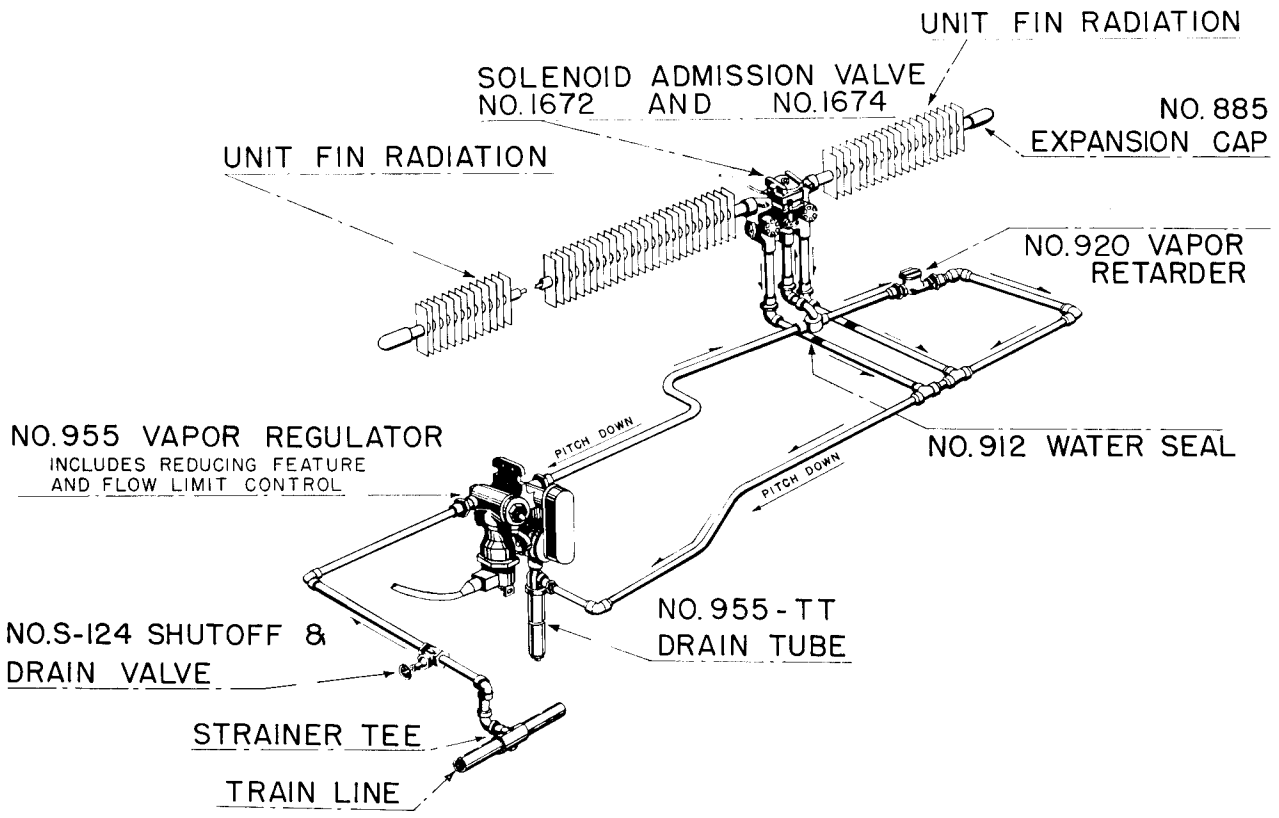


Fig. 4. No. 955 Vapor Regulator with No. 1672 or No. 1674 Solenoid Steam Admission Valve.

regulator modulates the steam input to the supply loop in accordance with demand to maintain a constant supply of steam in the loop.

The No. 955 Regulator (Fig. 1) performs the function of three devices used in the original Vapor-Zone system, the No. 900 type regulator, the No. 244 Constant Pressure Valve and the No. 1651 Flow Limit Valve. Floor heat solenoid steam admission valves (Fig. 2) are designed so that, when set for automatic operation, they will be open when their solenoids are de-energized. This protects the car against freezing in case of failure of the electric current. With any type of sleeping car, the floor heat valves are de-energized during layover periods and the temperature of the car is controlled at a lower figure by a thermostat which operates the solenoid on the flow limit feature of the No. 955 Regulator. This device is also used to keep steam out of the supply loop during cooling.

The No. 956 Regulator performs the same functions as the No. 955 except that it lacks the solenoid feature of the latter valve and so can not be used to keep steam from entering the loop. For this reason, it is seldom used on air conditioned cars.

THERMOSTATICALLY CONTROLLED FLOOR HEAT ARRANGEMENTS

On the type of floor heat circuit illustrated in Fig. 3, steam is conducted from a strainer tee or cross in the train line through a No. S-124 shut-off and drain valve to the No. 955 Vapor Regulator, which feeds steam to the supply loop in accordance with requirements. In passing through the regulator the steam is reduced from train line pressure. The supply loop is divided by a Vapor Retarder into a feed and a return portion. The Retarder causes a reservoir of steam to be established in the feed portion of the loop. Condensate discharges through the retarder into the return portion of the loop which is connected to the drain tube of the regulator.

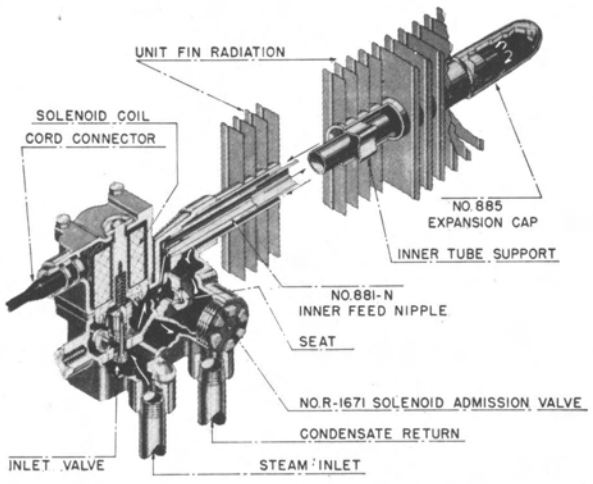


Fig. 5. No. R-1671 Solenoid Admission Valve with Unit Fin Radiation.

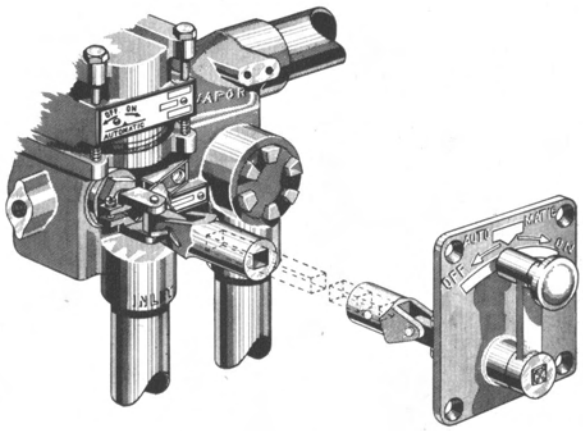


Fig. 6. No. 1684 Manual Remote Control.

Steam from the feed portion of the supply loop flows to a solenoid steam admission valve through the No. 912 Water Seal Fitting. This fitting serves to keep the steam admission valve from being heated while in the "off" position. The flow of steam through the valve and the manner in which the condensate returns through the valve is shown in Fig. 5. Unit Fin Radiators, as can be seen in Fig. 5, are of the pipe-within-a-pipe type. Steam feeds from the valve through the inner tube or pipe to the end of the radiator and returns through the outer finned tube. As condensate forms, it collects in the bottom of the outer tube and, as unit-fin radiation is always pitched slightly towards the valve, it flows back to the return chamber in the valve.

The orifice within the return chamber of the No. 1671 Valve and the bellows retarder in the No. 1675 Valve act to retain steam within the radiation but permit condensate to drain into the return portion of the loop.

When the lever on the valve is set at "automatic," steam admission to the radiator is under control of a thermostat. Manually "on" or "off" positions are also selectable. When the valve is located under a seat in the coach section, the No. 1684 Manual Remote Control is used (as shown in Fig. 6) to allow the valve to be operated from the aisle. Where the valve is located in a room, the No. 1643 Flexible Shaft Type Remote Control (Fig. 7) is mounted on a wall or bulkhead partition and allows the valve to be operated manually. If the valve is located behind a grille, as in passageways, the No. 18597 Indicator Plate is mounted

THE VAPOR-ZONE SYSTEM OF PASSENGER CAR HEATING (Cont.)

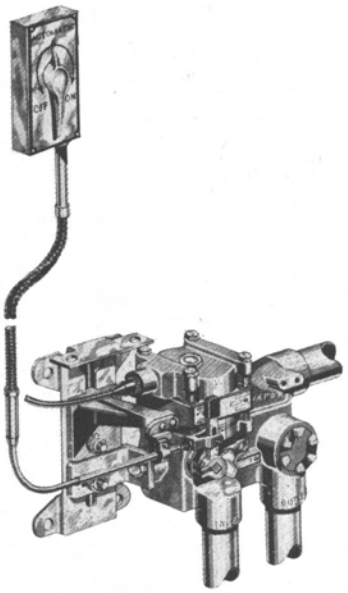


Fig. 7. No. 1643 Flexible Shaft Type Remote Control.

over an opening in the grille (shown in Fig. 8) to expose the lever for manual operation.

The No. 956 Vapor Regulator may be substituted for the No. 955 when cars are not air conditioned and when automatic control of layover temperature is not desired.

The floor heat circuit shown in Fig. 4 differs from the previous one only in having a double feed solenoid steam admission valve—No. 1672 or No. 1674—in place of two single valves. The double valves, which control the admission of steam to two unit fin radiators simultaneously, are used on certain classes of cars which are not zoned in accordance with our usual recommendations. In this type of installation, there are usually two valves in the car, one on each side, and an equal run of fin

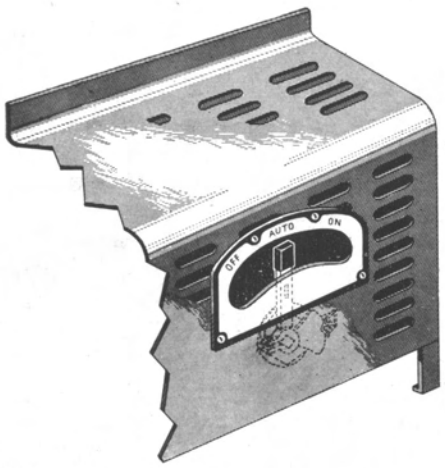


Fig. 8. No. 18597 Indicator Plate Used Over Cut-out in Grille.

radiation is connected to each side of the valve. The steam feeds from the center of the car toward the ends. Condensate from the two radiators return to two separate return chambers in the valve and from these to the return portion of the loop.

When the lever on the valve is set at "automatic," steam admission to the radiation is under the control of a thermostat. Manually "on" or "off" positions are also selectable. The comments on the use of manual remote controls and on the substitution of the No. 956 Regulator, made in the previous section, apply also to this circuit.

Figure 9 shows a floor heating arrangement which uses a No. 1673 Solenoid Steam Admission Valve to feed Vapor-Vulcan fin radiation (not unit-fin). Steam flows from the regulator to the supply loop and from the supply loop to the valve in the same manner as in the preceding arrangements. However, this valve incorporates neither an orifice fitting nor a bellows retarder and the condensate does not return to the valve. Instead a retarder is used in the return piping from the radiation.

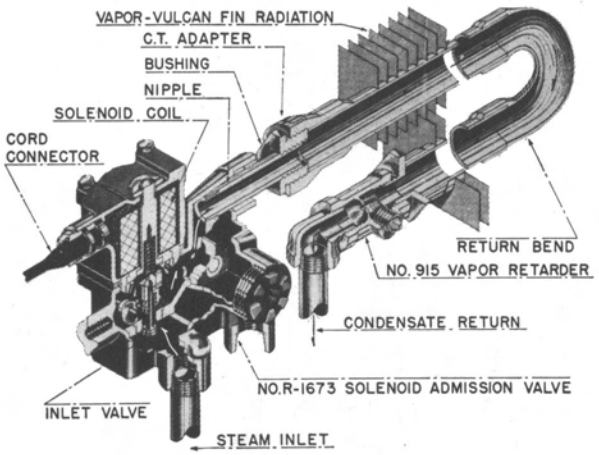


Fig. 9. No. 1673 Solenoid Steam Admission Valve.

In manual floor heat arrangements (Fig. 10), which are used on horse cars, baggage cars, etc., the No. 956 Vapor Regulator is usually used with valves of the No. 945 type and with Vapor-Vulcan fin radiation (not unit-fin).

The No. 945 Valve is a disc operated valve. In the open position, steam flows from the supply loop thru the valve to the radiator. As condensate forms, it drains thru the Vapor Retarder at the end of the radiation, thence to the return side of the loop and from there to the regulator drain tube. When the valve is in the closed position, the disc opens a drip port to drain condensate that otherwise might settle in the valve body.

THE VAPOR-ZONE SYSTEM OF PASSENGER CAR HEATING (Cont.)

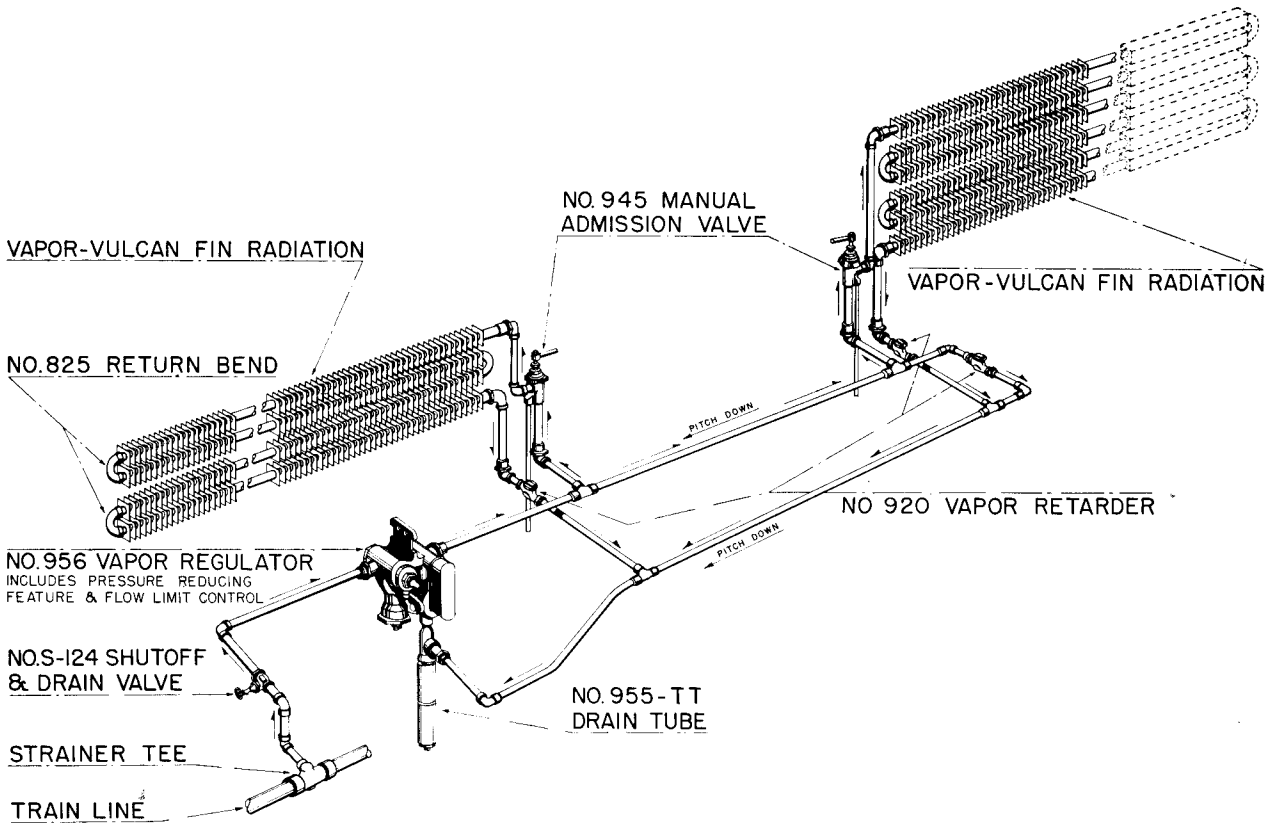


Fig. 10. Manual Floor Heat Arrangement with No. 956 Regulator and No. 945 Admission Valve.

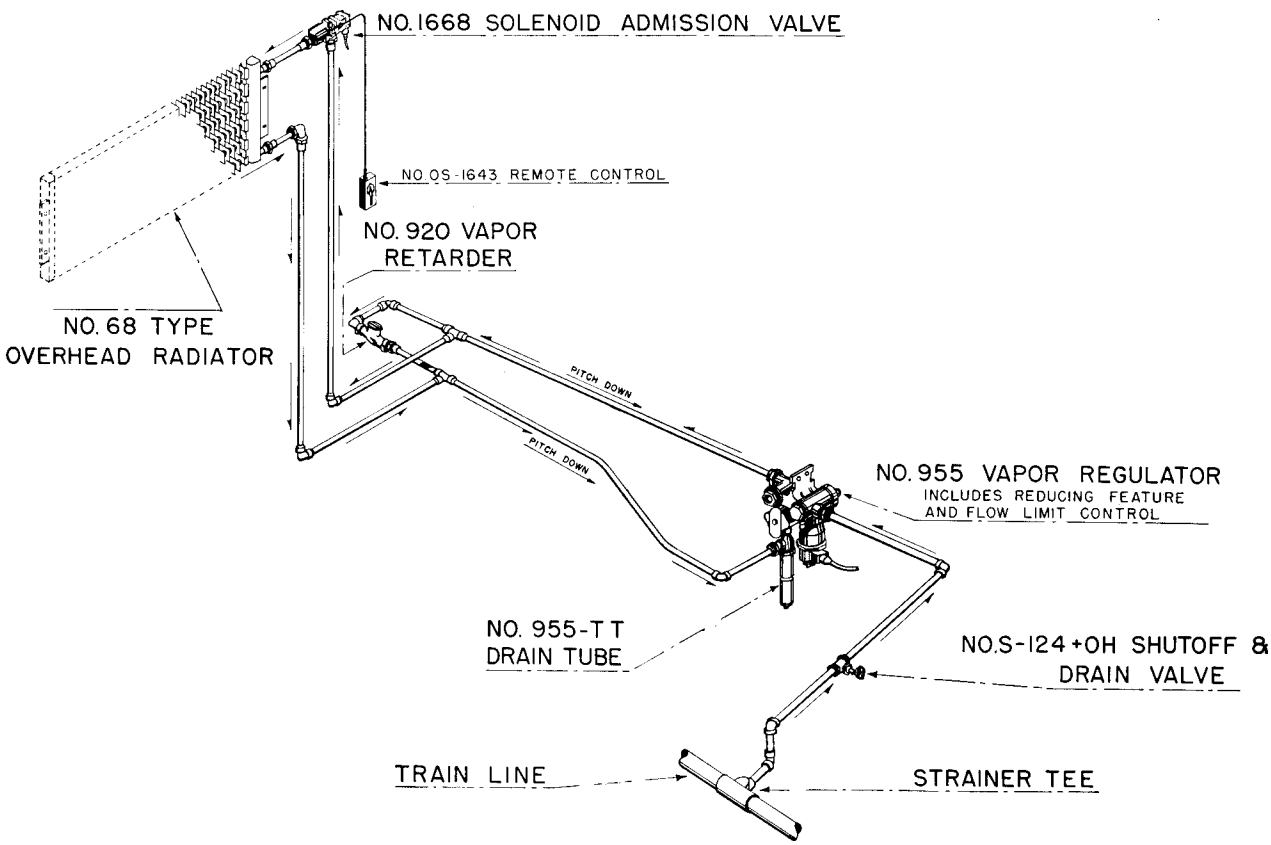


Fig. 11. Overhead Heat Arrangement with No. 955 Regulator and No. 1668 Solenoid Steam Admission Valve.

OVERHEAD HEAT ARRANGEMENT

The overhead heating system heats the fresh and recirculated air introduced into the car by the air circulating system. During mild weather only the overhead system is used to heat the car. As the demand for heat increases, the overhead and floor heat systems work together to provide an even temperature through each zone.

Steam for the overhead radiator is usually provided by a separate loop underneath the car; this is the arrangement shown in Fig. 11. The other equipment used in this system consists of a finned venturi type radiator which is located on the discharge side of the blower at the intake of the air distribution ducts, a No. 1668 Solenoid Steam Admission Valve at the inlet to the radiator, a thermostat located approximately six feet above the floor of the car and in the path of the moving air returning to the recirculated air intake grille, and a remote control of the 1643 type to permit the manual operation of the steam admission valve when necessary.

UNIT HEATER ARRANGEMENT FOR BAGGAGE AND MAIL CARS

Baggage-and-mail cars are heated by floor heat radiation under manual or thermostatic control along both sides of the car, similarly to the manual floor heat arrangement shown in Fig. 10 and the thermostatic arrangement shown in Fig. 3. However, in addition to such radiation, vertically built-up pipe-coil fin radiators are used along the side walls beside the doors. On some installations unit heaters are used instead of such built-up radiators. Steam is supplied to unit heaters by our No. 1668 Solenoid Steam Admission Valves, which are placed under thermostatic control. Supply loop connections are the same as with our overhead heat arrangements on passenger cars.

TEMPERATURE CONTROL SYSTEM

Temperature control for the Vapor-Zone heating system depends on the car lighting current for its operation. This is true whether the car is in service or laying over in yard or terminal. In air conditioned cars the temperature is controlled by a panel which is located in the electric locker in the car. On this panel are mounted the relays and switches necessary for operating both the heating and the air conditioning equipment.

Two types of temperature control panels are used, a selective type with cycle-modulation and an automatic type. Both panels incorporate the cycle-modulation feature. This calls for the use of double bulb thermostats with an electrical heat winding around one of the bulbs. By the intermittent application of heat to this bulb, we are able to supply steam to the radiation in frequent spurts. These spurts are very short in mild weather and result in low radiator temperature. This provides a constant supply of mild heat and eliminates the occasional blasts of hot air that would result from any continuous feeding of the radiation. As the need for heat increases, the "on" cycles of the valves increase in length with a resultant increase in radiator temperature. In extremely cold weather, if called for by the thermostats, the steam admission valves may be held open.

The selective type of panels have a master air conditioning switch which has an "off" position, a heating sector and a cooling sector. To permit the train crew to select the most desirable temperature, there are usually three settings provided in each sector. No selection switch is provided to control the floor heat temperature as that temperature is selected simultaneously with that of the overhead heat when the master switch is placed in the heating sector.

Some cars are equipped with what we term an "Automatic" panel. These panels change over from heating to ventilation to cooling and back again as required to maintain the proper temperature in the car. This type of panel has a single master switch, but there are two types of this switch. One is only an off and on switch; the other has "Day," "Night" and "Off" positions. When the master switch is turned to the "Off" position, the blower fan will be shut down and both the overhead heat and the cooling will be locked out.

When the selective type of panels are used, the floor heat, whether in the body of the car or in rooms, will be placed under layover temperature control, that is at 60° F., when the blower fan switch is set to the off position. In Pullman cars the floor heat is placed in layover temperature control when the light switch is pulled, regardless of the position of other switches.

The floor heat radiation in compartments, rooms or roomettes is usually under the control of individual switches to permit the occupant of the space to select whatever temperature he desires, even to the extent of obtaining heat during cooling should the occupant consider the temperature too low for his personal comfort.

RECOMMENDED INSPECTIONS AND TESTS

Before Each Departure

Before departure, both in summer and winter, check all solenoid steam admission valves to make sure that they are in the "automatic" position.

Monthly

1. Inspect Air Conditioning and Floor Heat Control Panel equipment. Remove panel fronts and inspect all relays, switches and other equipment on the panel. Clean the relay contacts. Lubricate the Temperature Selector Switch and the Blower Fan Switch with a small amount of Lubriplate. Inspect the switches carefully to see that the contacts are not burned and that the mechanism operates freely. Do not lubricate the main contacts of the snap switch on blower fan switches. Check the Temperature Switch by moving through all positions. The contact fingers must always have a definite spring pressure against the stationary contacts. The center shaft and bearing, the segments and the button contacts, and the contact arms must be lubricated with "Lubriplate." Terminal and mounting screws should be checked and tightened. See that all other screws and nuts are tight. Where 9116 type switches are used which have silver contacts, no lubrication of contacts is required.
2. Check operation of solenoid steam admission valves to determine if valve or its operating mechanism are sluggish due to scale or dirt. Move valve several times by hand.
3. Inspect all thermostats, both heating and cooling. Clean off accumulation of dirt. See that connections are tight.

Annually

Check the entire heating system at about the beginning of each heating season: Clean strainer tees and crosses; remove bellows diaphragms from Vapor Regulators, vapor retarders, solenoid steam admission valves and steam traps, for testing, and do whatever else is indicated under the individual device bulletins.

The operation of the thermostats and solenoid valves can be checked by alternately heating and cooling the respective thermostat tube. A thorough test should be made at the beginning of each heating season.

GENERAL MAINTENANCE DETAILS

1. **To Check Operation of Steam Admission Valves and Other Thermostatic Equipment:**

A rag immersed in hot water can be held against the bottom of the tube to cause it to "make" the thermostat circuits. A rag immersed in ice water can be used on the tube to break the thermostat circuit. The operation of the valve in "Automatic" position should be checked in this manner, in all positions of the switch controlling the thermostat circuit. If the valve does not respond correctly, the thermostat tube may be defective. Where a single-tube, double-bulb thermostat tube is used, and it fails to control the operation of the valve only on one of the positions of the control switch, this is an indication of a faulty or burnt-out resistor.

The resistors, both set-down and cycling type, can be checked by means of our No. 2535 Test Meter, in accordance with instructions given in Bulletin 64-190.

Before concluding that thermostat tube is at fault, check the relays involved in the circuit to see that the contacts are clean and operating correctly. Check relay coils by means of suitable instruments to see that they are not burned out. If any relay contacts show excessive burn, determine cause and replace where necessary. Also, see that all terminal connections are tight. If any resistor elements are cracked or show indications of overheating, replace with new elements. See that the fuses are tight in their mountings. Also, check car voltage.

2. **To Free Flow Limit Valve in Vapor Regulator:**

Insert screw driver through rectangular opening in bracket just below flow limit valve portion of the Vapor Regulator and, using the bracket as a fulcrum, push up the plunger. Hold the plunger in the up position for about one minute, then release quickly to allow any obstructing particles between valve and seat to blow out.

3. **To Blow Out Any Obstructing Particles Between Vapor Valve and Seat of Regulator:**

Close the No. 124 Shut-off Valve ahead of the Regulator for a few minutes, and then re-open the valve.

4. **To Determine Which Steam Admission Valve or Which Vapor Retarder Has a Faulty Bellows:**

If only Nos. 1671 or 1674 valves are used on the loop, the blowing of the outer drain tube of the regulator is due to the failure of the bellows in the loop retarder. If Nos. 1675, 1672 or 1673 valves are on the loop, close them one after the other. If the blowing stops after the closing of a No. 1675 or No. 1672 valve, that is an indication of a defective bellows in the valve. If the blowing stops after closing a No. 1673 valve, that is an indication

of a defective bellows in the retarder in the return piping from the valve to the loop.

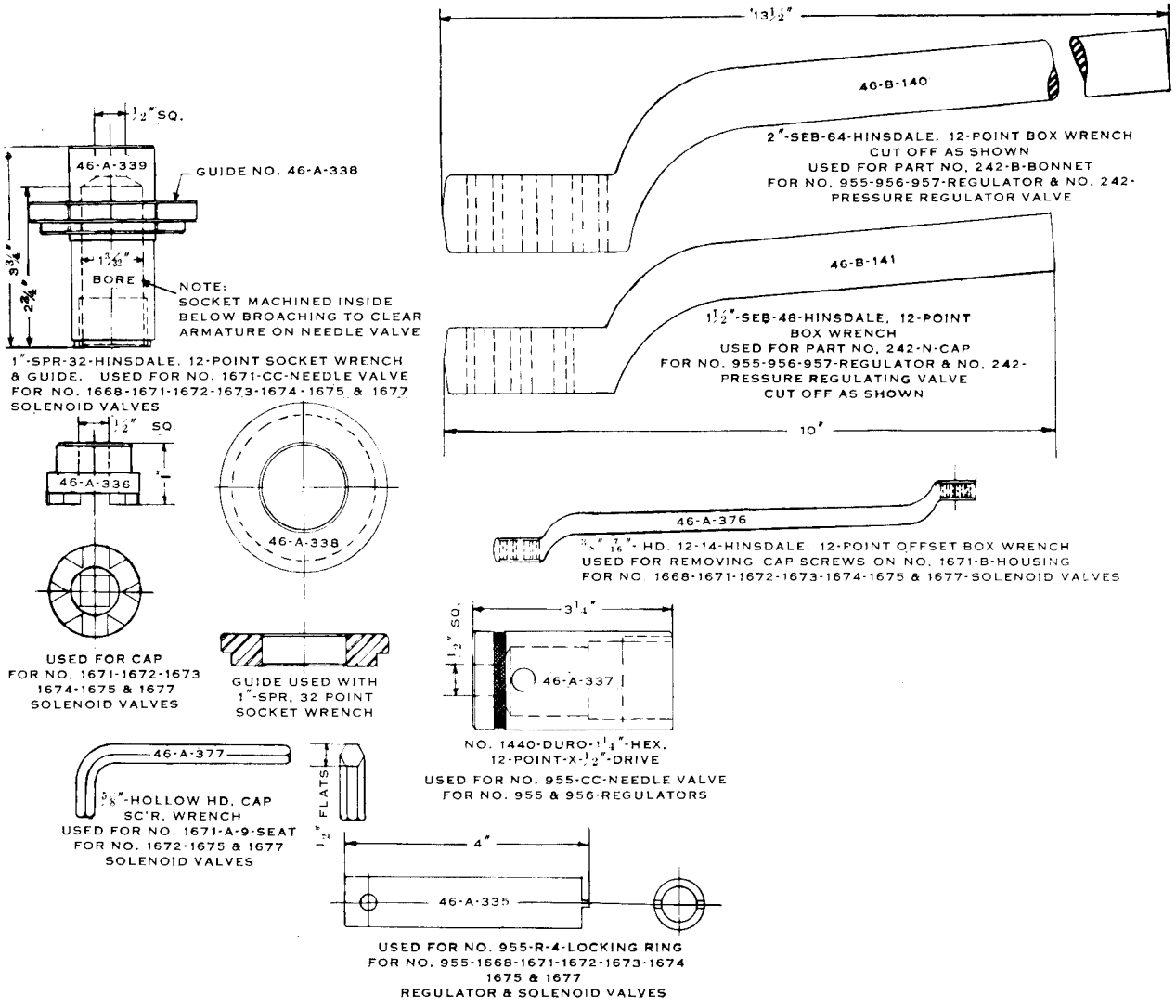
In the case of the No. 1668 valve used with overhead radiators, blowing from the outer drain tube of the regulator while the valve is energized would indicate a blower fan failure.

If the blow persists after all the valves have been closed, the bellows in the loop retarder is at fault.

5. **To Replace Thermostatic Bellows Diaphragms in Vapor Regulators, Solenoid Steam Admission Valves and Vapor Retarders:**

Close No. 124 Shut-off Valve and allow about five minutes for the thermostatic element to cool, before removing it for examination and testing. Failure to allow sufficient time for cooling before removal will overexpand a satisfactory bellows and render it useless.

STANDARD AND SPECIAL WRENCHES FOR VAPOR-ZONE HEATING SYSTEM EQUIPMENT



Nos. 900, 901 and 902 VAPOR REGULATORS

1" I. P. S. CONNECTIONS

WEIGHT OF 900 & 901—15 LBS.
WEIGHT OF 902—16 LBS.

No. 901 VAPOR Regulator

GENERAL DESCRIPTION

The Nos. 900, 901 and 902 Vapor Regulators are new type of steam regulators of very compact, light weight and efficient design for use on Vapor and Zone type of Heating Systems on Railway Trains. These regulators have a positive and accurate shut-off valve coupled to a thermostatic element bellows construction, which is very sensitive to changes in temperature and allows the valve in the regulator to open wholly or partially in accordance with steam demand. Blowing and waste of steam are entirely eliminated in these types of regulators, only a faint breathing being noticeable during operation. No readjustment is required to keep the regulator feeding properly in different kinds of weather without a blow of steam. The fixed adjustment provided on the rocker arm is factory made and sealed against tampering by soldering.

CONSTRUCTION

Essentially, the complete regulator includes a valve casing and a diaphragm casing anchored side by side and operated by a centrally pivoted rocker arm instead of the customary bell crank lever. Expansion of the thermostatic bellows in the Bellows Casing moves an operating rod against the arm of the rocker lever, making its opposite arm force the Needle Valve in the Valve Casing towards its seat. This is accomplished against the opposition of a Compression Spring on the Needle Valve Assembly, which consists of a Needle Valve guided within a cage structure constituting its seat. The operating rods project through bellows diaphragm sealing arrangements, effectively sealing against steam leakage and eliminating the necessity for using any packing rings. The needle valve is made of Silichrome, while the valve cage seat and all operating rods, as well as the compression spring, are made of stainless steel, to assure long and trouble-free life.

THERMOSTATIC ELEMENT EXTREMELY SENSITIVE. The Thermostatic Element has a flexible metallic corrugated bellows structure secured at the upper end to an annular collar and protected by a telescopic guide. The corrugated thermostatic bellows is contracted to shortest length when cold. When subjected to steam temperature, the bellows will expand to force the top plate upwardly, thereby elongating the bellows

and this will result in rocker arm being forced upwardly to close the needle valve in the valve casing. The bellows is vacuum filled with a volatile fluid, a portion of which vaporizes in the presence of steam to create internal pressure and expand the bellows. In the absence of steam and in the presence of condensate, the bellows will cool and contract to open the needle valve in the valve casing or steam chamber of the regulator. The rate of expansion per degree difference in temperature is very rapid, resulting in a wide range of movement. Quick response to temperature changes by the thermostatic element is further made possible by the finned construction of the casing, which has a plurality of extended ribs or fins for accelerating the heat dissipation through the casing. This thermostatic bellows will maintain an outlet temperature of 210° F. maximum and 195° F. minimum and will assure a constant feed of steam into the heating system to replace the steam condensed.

ECONOMY IN STEAM CONSUMPTION: There is a considerable economy in steam consumption brought about by the use of this type of regulator, primarily because of the fact that steam blows from the regulator are entirely eliminated. Waste of steam occasioned by high speed operation of trains, bringing about artificial cooling of the diaphragm, is also eliminated. Heating of longer trains is thus materially improved. Elimination of steam blows and cutting down of vapor or steam discharge further retards formation and accumulation of ice underneath car structure. Also, vapor pocketing under floor structure, when cars are parked, is practically eliminated, and consequently, rusting of parts underneath of cars is thus cut down.

SAVING IN WEIGHT: The new regulator weighs only 15 pounds as compared to 54 pounds for a No. 440 Vapor Regulator.

OPERATION

ON REGULAR VAPOR HEATING SYSTEM INSTALLATIONS, the thermostatic bellows of the regulator is activated, in the conventional way, by the steam and condensate returning from the radiating system.

ON ZONE TYPE OF HEATING INSTALLATIONS the return condensate does not flow back into the thermostatic bellows chamber, but is separately disposed of by returning directly to the drain tube at the regulator. The thermostatic bellows is controlled instead by the flow (pressure) changes in the steam supply pipe behind the regulator, through the by-passing of the No. 1651 or No. 1653 Flow Limit Valve to the thermostatic bellows casing or chamber. In case of failure or sticking of Vapor Retarder, returning steam or vapor will rise to the thermostatic bellows casing and the flow of steam to the system will be controlled by the returning vapor.

DIFFERENCES BETWEEN THE Nos. 900, 901 AND 902 VAPOR REGULATORS

The No. 900 Regulator is the first type of regulator put out in this new design.

The No. 901 Regulator is the same as the No. 900 except for some improvements, such as strengthening of parts, making the construction more rugged, and a change in the Needle Valve Assembly application, so as to make it possible to remove it completely from end of head of regulator without disturbing the leverage construction.

The No. 902 Regulator is the same as the No. 901 except for the incorporation of a vented diaphragm casing cover. The Vent Nipple on the new diaphragm casing cover makes the "Economy Diaphragm" respond still more sensitively and faster to temperature changes. This type of regulator is used particularly on overhead heat installations, so as to keep available a constant supply of steam to the overhead radiator. This regulator is also used for supplying steam to hot water jackets (heaters) for heating wash water, and when used on cars which have underneath equipment enclosed in "bellies" or shrouds.

APPLICATION

LOCATION AND FASTENING: Regulators should be securely fastened to the under-framing or to some suitable bracket underneath the car, in such a way or place, as to be readily accessible for repairs and maintenance. Ample clearance must be allowed for removal of diaphragm and valve assembly.

PITCH AND PIPING: Regulators must be hung low enough (but not lower than the trainline) so that sufficient pitch can be obtained when

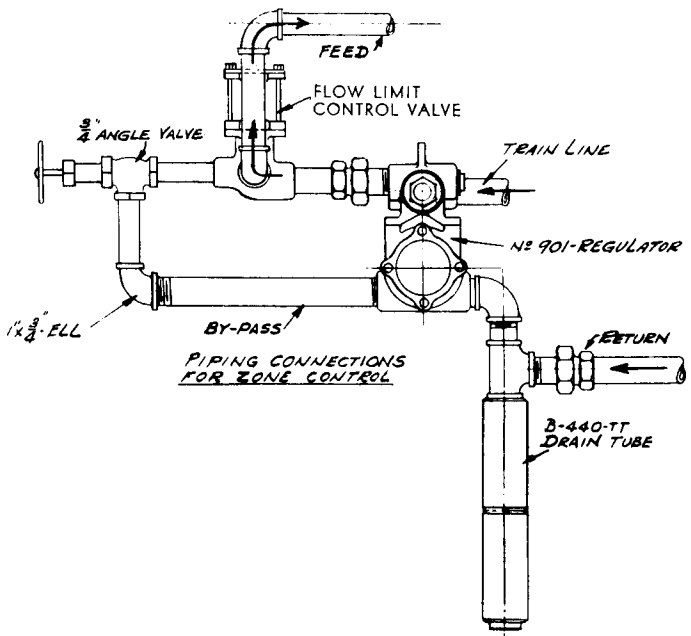
piping the supply loop. A minimum pitch of 1" per 10' of piping is required. The regulator must drain back to the trainline, and must be as far as possible from the rails and air brakes.

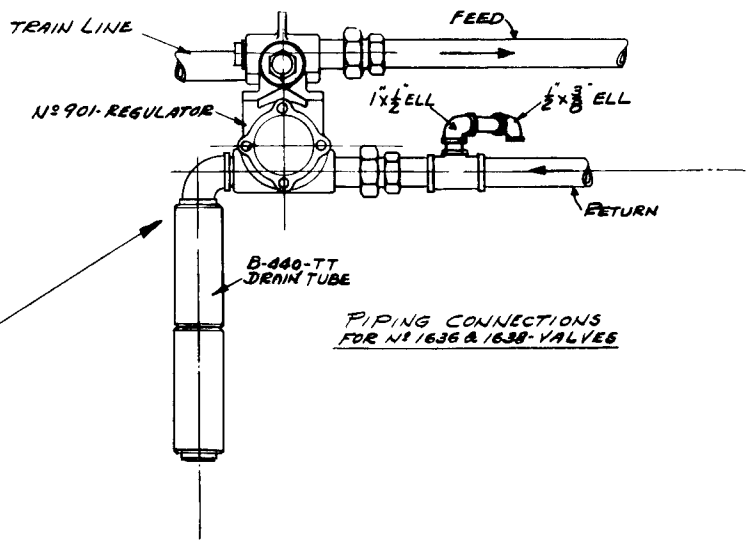
Pipe joints should be made tight on the threads to prevent possibility of leakage from subsequent expansion and contraction. Be sure that all piping has been blown clean before applying to cars and that good threads are cut on all pipes and fittings. Use graphite and oil only on pipe joints. Do not depend upon pipe joint cement or compounds for steam-tight joints. Avoid red or white lead, as they will cause gumming up of the internal parts of the regulator and the solenoid valves, making them likely to stick.

PROTECTED DRAIN OUTLET: These regulators are furnished with the No. B-440-TT Drain Tube Assembly to allow condensate to discharge at a lower level. This drain tube complete with clamp and nipple is available in three different lengths, viz.: 7½", 13" or 18½". Unless otherwise specified, the standard 13" length drain tube assembly will always be furnished.

IMPORTANT NOTE: The Economy Diaphragms on these Regulators must be protected against high pressures by the use of the No. 244 Constant Pressure Regulating Valve to reduce the pressure of the steam from trainline pressure to about 40 lbs.

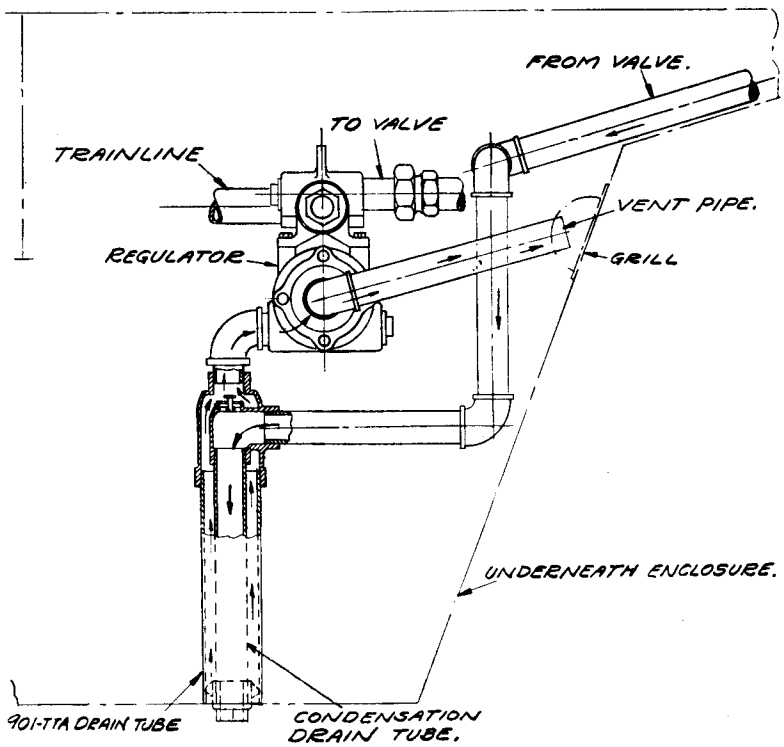
DIAGRAMS SHOWING PIPING CONNECTIONS AND APPLICATION OF NOS. 900, 901 AND 902 REGULATORS

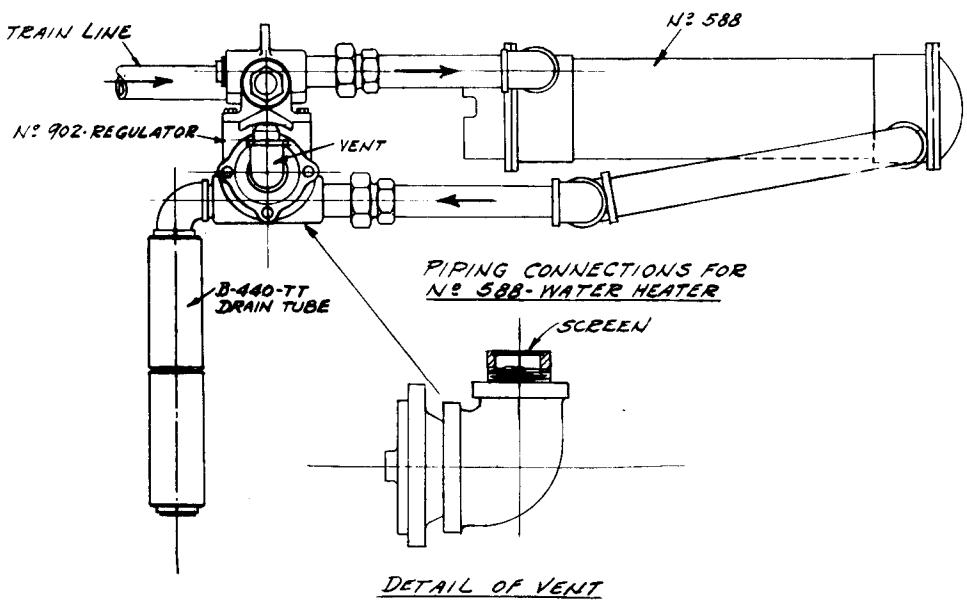




PIPING CONNECTIONS FOR Nº 901-REGULATOR WHEN CONNECTED TO - Nº 1&2-MANUAL VALVES A Nº 1621-VALVE AND 1636 & 1638 TYPE VALVES WHEN DISTANCE BETWEEN VALVES & REGULATOR IS LESS THAN 10-FEET.

Nos. 900, 901 and 902 VAPOR REGULATORS





DETAIL OF VENT

MAINTENANCE

ROUTINE ATTENTION AND TESTING

No routine attention or testing on these regulators is required during the heating season, beyond visual observation before each departure. If the regulators are found to operate satisfactorily, by observation, without a blow of steam, they will function satisfactorily.

If a regulator is found to be blowing, which may occur very rarely, this may be due to dirt lodging between valve and seat, or to faulty diaphragm. Any such obstruction on the seat may be dislodged by closing the No. 124 Shut-off and Drain Valve ahead of the regulator for a few minutes, in order to give the thermostatic bellows time to cool, and then reopening the No. 124 Shut-off Valve. Reopening of the shut-off valve after the diaphragm has become contracted will allow a large flow of steam to blow out the obstruction between valve and seat.

If the regulator continues to blow, the Economy Diaphragm may be defective. Shut off the No. 124 Shut-off and Drain Valve, as before, and after allowing sufficient time (about 5 minutes) for thermostatic bellows to cool and contract, remove bellows from regulator for examination. If the bellows will not come back to its normal fully contracted form, with its top and bottom plates touching, when cooled down, the bellows is defective and should be replaced. If the bellows is fully contracted, the blowing of the regulator may be due to faulty valve or other causes.

CAUTION: Do not remove the economy diaphragm from the regulator casing when hot, nor subject the diaphragm to live steam when not in enclosure or when not clamped, as otherwise the diaphragm will become over-expanded and will not come back to its normal fully contracted form, with its top and bottom plates touching, when cooled down.

TESTING THERMOSTATIC ELEMENT FOR LEAKS

The thermostatic element or bellows may be tested for leaks by clamping and submerging same in water at about 190° F. If the bellows has any leaks, this will be indicated by bubbling due to escapement of vaporized fluid or expanded air from the bellows. Such a bellows must be scrapped. Do not attempt to refill and reclaim thermostatic bellows.

ADJUSTMENT OF REGULATOR

No readjustment of the regulator is required during the heating season, as the diaphragm has sufficient take-up for wear. However, if at any time the soldered adjustment should become loosened, proceed as follows:

1. Place regulator on test rack under steam.
2. Remove cover over adjustment and unsolder the adjustment screw.
3. Turn down the adjustment screw until steam blows from the regulator drain tube.
4. Turn up the adjustment screw until steam blow ceases.
5. Tighten adjustment screw one complete turn and solder adjustment screw and nut, so that adjustment cannot change.

OVERHAULING

These regulators should be overhauled each year before the beginning of the heating season. After the regulators are overhauled, they should be tagged with a metal band and dated.

At time of overhaul, the regulators should be thoroughly checked and tested. The thermostatic bellows should be tested for proper expansion and freedom from leaks, as previously indicated. The Needle Valve should be observed for freedom of movement and freedom from scoring. In the event valve or seat are scored and do not seat tight, the complete Needle Valve Assembly should be replaced. There should be no binding of the operating rods or stems. Strainers, as well as all other parts, should be thoroughly cleaned. The bellows diaphragm sealing arrangement on the operating rods should be examined for any ruptures and, in the event there are steam leaks around these rods or stems, such bellows and stem assemblies should be replaced.

Should the fixed factory adjustment have become loosened, the regulator should be readjusted, as already described, and the adjustment should be soldered, in order to prevent tampering during the heating season.

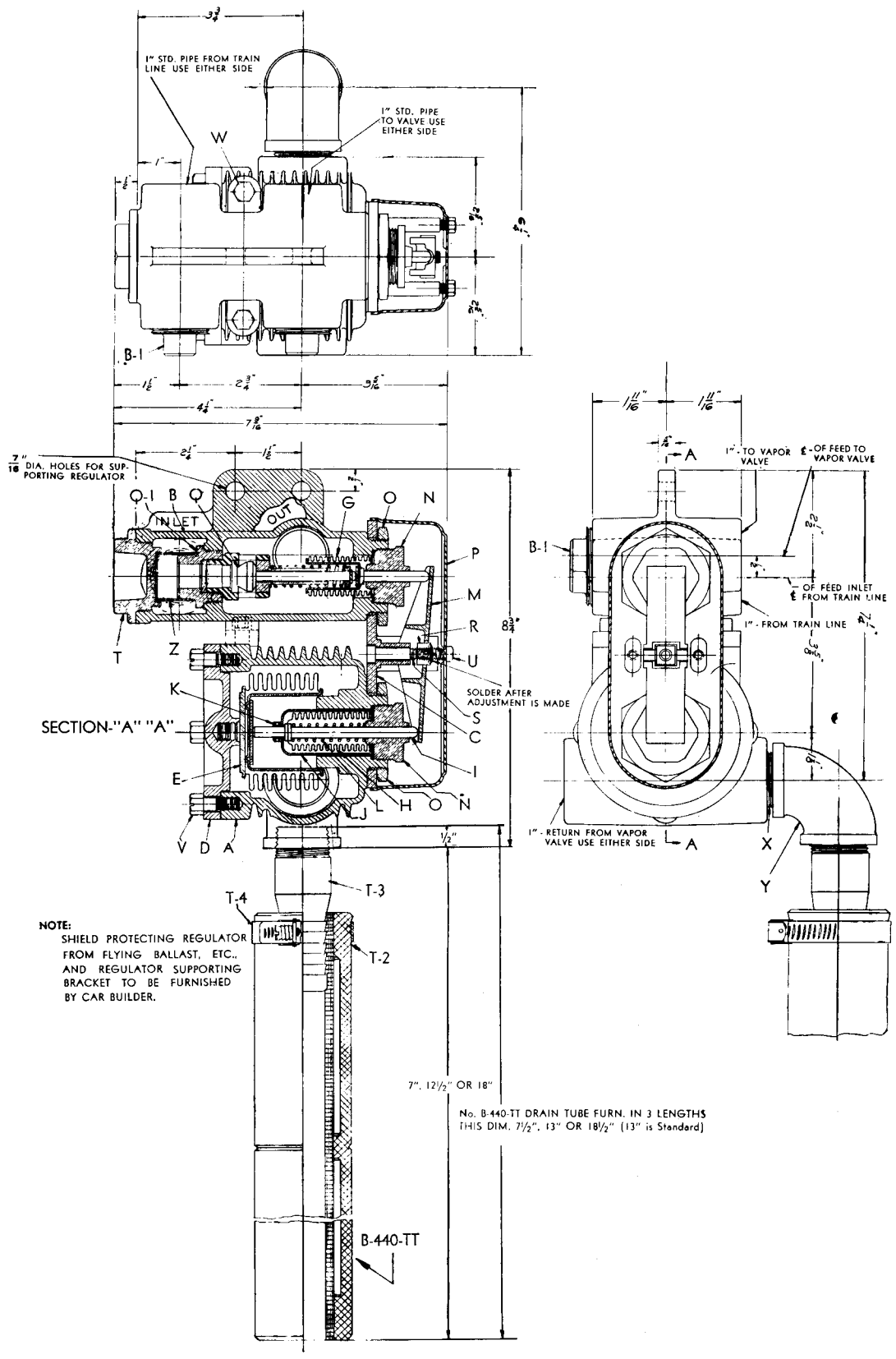
LIST OF PARTS

SYMBOL	900 PART NO.	901 PART NO.	902 PART NO.	DESCRIPTION	AM'T
A	900-A	901-A	901-A	Body, Thermostatic Bellows	1
B	900-B	901-B	901-B	Body, Valve	1
B-1	786—1"	786—1"	786—1"	Plug, Std. Sq. Shank	2
C	900-C	901-C	901-C	Yoke, Retaining	1
D	900-D	900-D	902-D	Cap	1
D-1	.....	.....	1½" x 1" Std.	Elbow, Reducing	1
D-2	.....	.....	902-D-2	Nipple, Vent	1
E	900-E	900-E	900-E	Bellows, Thermostatic	1
F	900-F	.....	.....	Bonnet	1
G	900-G	900-G	900-G	Diaphragm Assem., Bellows	1
H	900-H	900-H	900-H	Diaphragm Assem., Bellows	1
I	900-I	900-I	900-I	Rod, Diaphragm Operating	1
J	900-J	900-J	900-J	Shield, Bellows Diaphragm—Includes Sym. "K" Bearing	1
L	900-L	900-L	900-L	Spring, Operating Rod	1
M	900-M	901-M	901-M	Arm, Operating	1
N	900-N	901-N	901-N	Nut, Retaining	2
O	900-O	901-O	901-O	Nut, Yoke Retaining	2
P	900-P	901-P	901-P	Cover	1
Q	900-Q	900-Q	900-Q	NEEDLE VALVE COMPLETE	1
	900-Q-4	900-Q-4	900-Q-4	Spring, Valve	1
	900-Q-5	900-Q-5	900-Q-5	Washer, Valve Stem	1
	900-Q-6	900-Q-6	900-Q-6	Pin, Valve Stem	1
Q-1	.....	901-Q-1	901-Q-1	Adapter, Valve	1
R	900-R	900-R	900-R	Pivot, Operating Arm	1
S	900-S	901-S	901-S	Screw, Adjusting	1
T	900-T	901-T	901-T	Cap, Strainer	1
*TT	B-440-TT	B-440-TT	B-440-TT	DRAIN TUBE COMPLETE	1
**T-2	B-440-T-2	B-440-T-2	B-440-T-2	Jacket, Insulating	1
T-3	901-T-3	901-T-3	901-T-3	Nipple	1
T-4	901-T-2	901-T-2	901-T-2	Clamp (Griptite No. 2)	1
U	10-24 B. H. x ¼" lg.	¼"-20 x ½" lg.	¼"-20 x ½" lg.	Screw, Hex. Hd.	2
V	5/16"-18 x ¾" lg.	5/16"-18 x ¾" lg.	5/16"-16 x ¾" lg.	Screw, Slotted Hex. Hd.	4
W	5/16"-18 x ¾" lg.	5/16"-18 x ¾" lg.	5/16"-16 x ¾" lg.	Screw, Hex. Hd.	2
X	1" Std. Pipe	1" Std. Pipe	1" Std. Pipe	Nipple, Close	1
Y	1" Std.	1" Std.	1" Std.	Elbow (714)	1
Z	112-D	112-D	112-D	Strainer	1

*NOTE: The complete drain tube is available in three lengths, 7½", 13" and 18½". Unless otherwise specified, the 13" length will always be furnished.

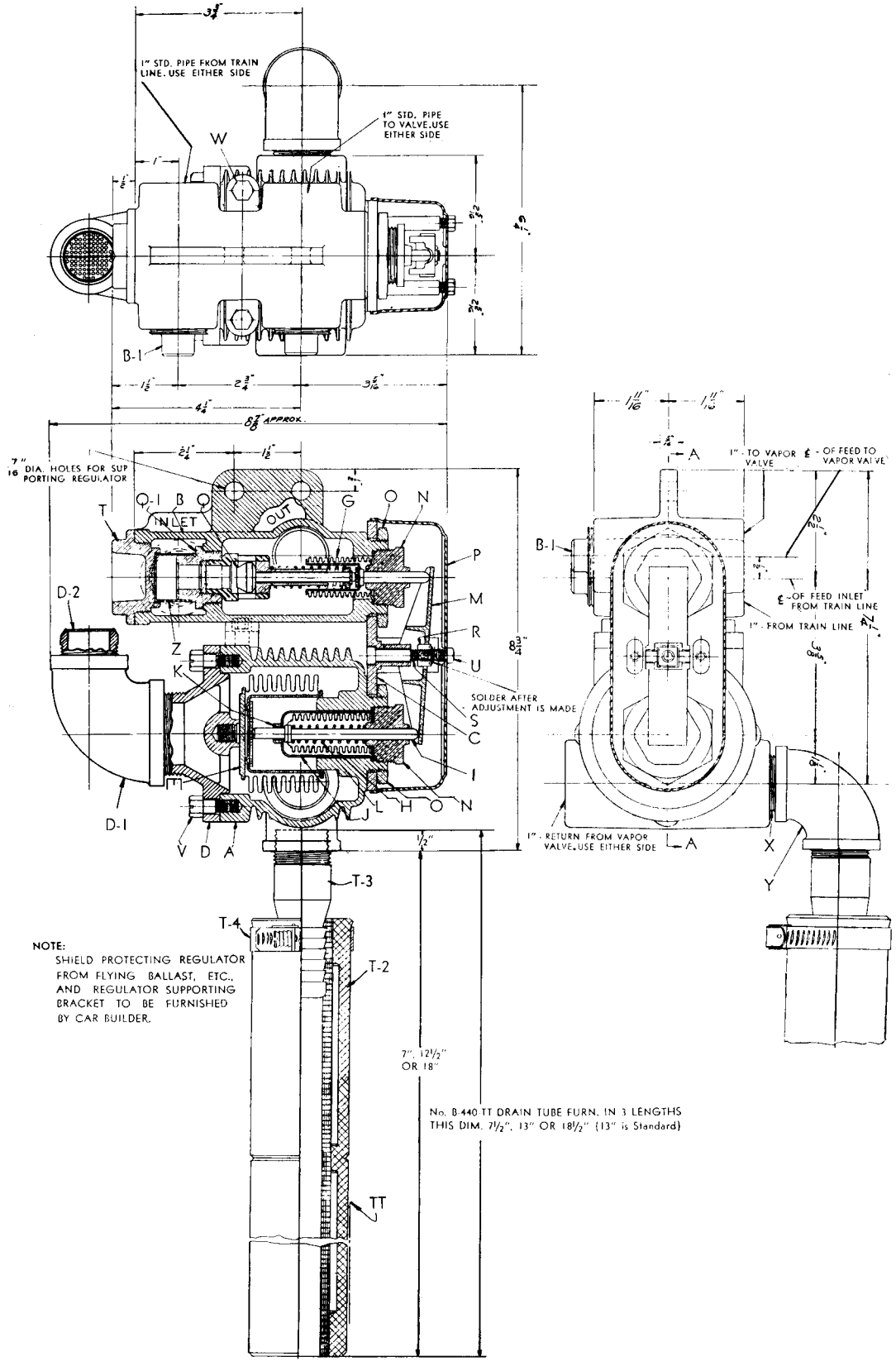
**NOTE: The No. B-440-T-2 Insulating Jacket is available in three lengths, 5½", 11" and 16½". Unless otherwise specified, the 11" Insulating Jacket will always be furnished on order.

No. 901 VAPOR REGULATOR



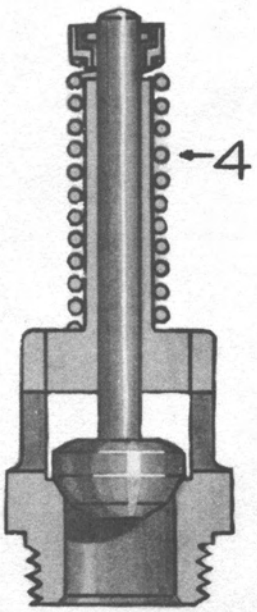
NOTE:
SHIELD PROTECTING REGULATOR FROM FLYING BALLAST, ETC., AND REGULATOR SUPPORTING BRACKET TO BE FURNISHED BY CAR BUILDER.

No. 902 VAPOR REGULATOR



NOTE:
SHIELD PROTECTING REGULATOR FROM FLYING BALLAST, ETC., AND REGULATOR SUPPORTING BRACKET TO BE FURNISHED BY CAR BUILDER.

NEEDLE VALVES FOR THE No. 900 SERIES AND THE No. 955 SERIES VAPOR REGULATORS NOW STANDARDIZED



To eliminate confusion and to reduce the number of spare parts carried in stock by railroads, the No. 955-QQ needle valve has been adopted as the standard needle valve for both the 900 series and the 955 series of vapor regulators. This valve will replace the No. 900-Q needle valve formerly used on some of these regulators.

To enable the railroads to stock a single spring for use in several needle valves, the No. 955-Q-4 spring has been adopted as a standard. This spring, which is used in the No. 955-QQ needle valves of all of the above regulators, also replaces the No. 155-Q-4 spring formerly used in the No. 155-A needle valve of the No. 155 steam trap.

DEVICE	VALVE FORMERLY USED	NOW USED	SPRING FORMERLY USED	NOW USED
Regulators				
900 901 902	900-Q	955-QQ	900-Q-4	955-Q-4
903 957 958				
959				
955 956 ...	955-QQ	955-QQ	955-Q-4	955-Q-4
Steam Trap				
155	155-A	155-A	155-Q-4	955-Q-4

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Nos. 953-955-956-958 and 959 VAPOR SAFE-CONTROL REGULATORS

No. 471 Mounting Bracket—Nos. 955-TT, 955-XX and B-440-TT Drain Tubes

FEED INLET—1" I.P.S.
RETURN OUTLET—1⅛" O.D.C.T.

WEIGHT—Nos. 953-955-958—26½ LBS.
WEIGHT—Nos. 956-959—26 LBS.

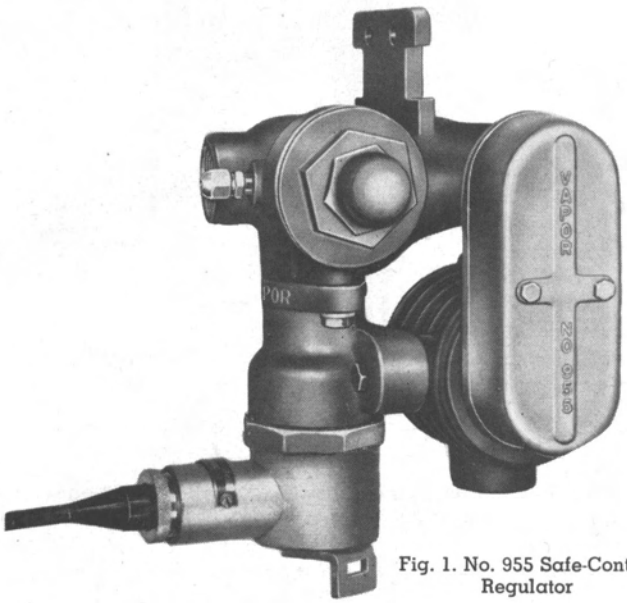


Fig. 1. No. 955 Safe-Control Regulator

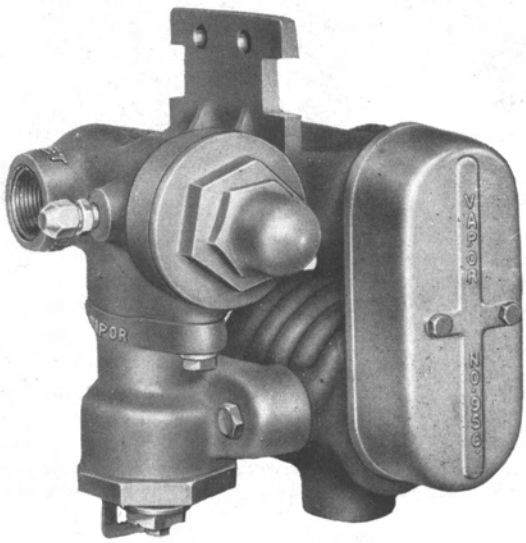


Fig. 2. No. 956 Safe-Control Regulator

GENERAL DESCRIPTION

The Vapor Safe-Control Regulator is placed between the steam train line and a steam supply loop on railway passenger cars. It is designed to reduce the pressure of the steam taken from the train line and to maintain a constant supply of steam in the loop. The Safe-Control feature insures that no more than the required steam pressure can develop in the loop at any time.

This regulator combines the functions of three devices previously used in the Vapor Zone system of railway car heating—the No. 900 series regulator, the pressure reducing valve and the flow limit valve. Maintenance of the equipment has been greatly simplified by incorporating these several devices in one unit. In case of operating difficulties the regulator may be readily removed and replaced with another unit which has been overhauled. This requires only the breaking of three union connections and the disengaging of a clamp.

The Nos. 955 and 956 regulators function to keep 12 lbs. of steam pressure in the supply loop; Nos. 958 and 959 regulators allow only an 8-lb. pressure and the No. 953 regulator allows only a 3-lb. pressure in the loop.

The Nos. 953, 955 and 958 regulators are equipped with a solenoid assembly on the safe-control feature to allow them to be used to keep steam out of the loop during cooling or, by the action of a layover thermostat, to control the temperature of the car during layover periods. When ordering complete regulators, specify voltage required (32, 64 or 125 V.D.C). The Nos. 956 and 959 regulators are not equipped with the solenoid assemblies.

A No. 955-TT or 955-XX drain tube assembly, which must be purchased separately, should be installed at the drain outlet of the Vapor Safe-Control Regulators in cases where the drains return to the regulator. A No. B-440-TT single drain tube is used in cases where the drains do not return to the regulator.

A No. 471 mounting bracket (see Fig. 8, p. 6) is used to mount these regulators on the cars. This bracket must be ordered separately as it is not furnished with the regulators.

The four features of the Safe-Control regulators are designed to govern the volume and pressure of steam in the supply loop. During operation, steam enters the regulator at train line pressure and is reduced to fifty pounds by

Nos. 953-955-956-958 and 959 VAPOR SAFE-CONTROL REGULATORS (Cont.)

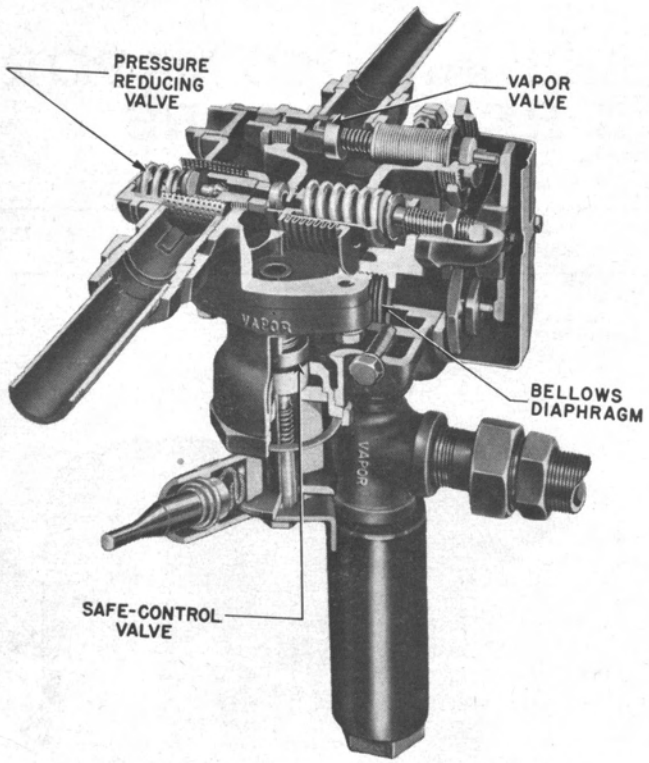


Fig. 3. Sectioned view showing the pressure reducing valve and the vapor valve in the No. 955 Regulator.

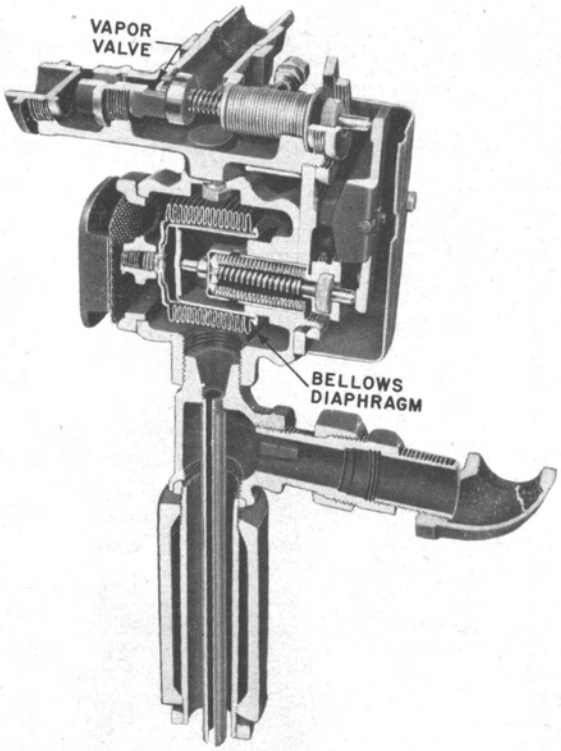


Fig. 4. Sectioned view showing the bellows diaphragm and the vapor valve in the No. 955 Regulator.

the pressure reducing valve (Fig. 3) which is set to close at that point.

The steam then flows through the vapor valve (Fig. 3) and on into the supply loop, where it is available to the admission valves of the car radiation. Steam in the loop never builds up to more than the required pressure because of the action of the Safe-Control valve (Fig. 3) which opens when pressure in the loop and in the feed portion of the regulator reach the limit point (12 lbs. in the Nos. 955 and 956, 8 lbs. in the Nos. 958 and 959 and 3 lbs. in the 953).

This steam passing through the Safe-Control valve is jetted onto a bellows diaphragm filled with a volatile liquid (Fig. 4), which is caused to expand by the heat of the steam. In expanding, the diaphragm moves a pivoted operating arm to close the vapor valve and stop any further flow of steam into the loop.

As steam in the loop is used, and no further steam comes into contact with the diaphragm, the bellows diaphragm cools and contracts. This allows a spring to reopen the vapor valve so that steam is again permitted to flow into the supply loop. In operation, the regulator maintains steam in the supply loop by short spurts of steam rather than by long periods of "off" and "on" functioning.

Nos. 955-BB-1 Solenoid Housing Assembly and 955-RR-2 Connector Complete, used on earlier regulators are now superseded by 955-BBA-1 (hermetically sealed) and 1651-RR-2 Assemblies respectively or by 955-BBA-1R Assembly which includes both 955-BBA-1 and 1651-RR-2. See parts lists on pages 3 and 6.

MAINTENANCE RECOMMENDATIONS

These regulators require no routine attention outside of visual inspection for steam blows before each departure.

A blow of steam from the inner drain tube indicates that the regulator is in need of attention. Dirt particles may have lodged between the vapor valve and the seat. This condition can usually be corrected by closing the shut-off valve ahead of the regulator for a few minutes and then opening it again. The blow of steam caused by this procedure will clear out the dirt.

If the regulator continues to blow steam from the inner drain tube, it generally indicates a defective bellows diaphragm. To inspect the diaphragm, close the shut-off valve ahead of the regulator and allow about five minutes for the bellows diaphragm to cool and contract. Then remove the diaphragm from the regulator. If the bellows has failed to return to its normal, fully contracted form when cooled, it is defective and should be replaced.

To test a bellows diaphragm for leaks, place it in a suitable holding fixture and submerge it in water at about 190° F. Leaks will be shown by the rising of bubbles in the water. A leaky diaphragm should be discarded; do not attempt to refill and reclaim it. Before removing the diaphragm from the holding fixture, submerge it in cold water. A suitable holding device for conducting this test is shown in our drawing No.

(Continued on page 5)

Nos. 953-955-956-958 and 959 VAPOR SAFE-CONTROL REGULATORS (Cont.)

Sym.	Description	Amt.	Part No. 953	955	956	958	959
1	Body	1	955-1	955-1	955-1	955-1	955-1
2	Housing (Diaphragm)	1	955-2	955-2	955-2	955-2	955-2
3	Body (Safe-Control Valve)	1	955-3	955-3	955-3	955-3	955-3
4	Strainer	1	955-4	955-4	955-4	955-4	955-4
5	Cap (Bottom)	1	955-5	955-5	955-5	955-5	955-5
9	Plunger	1	955-9	955-9	956-29	955-9	956-29
10	Spring (Plunger)	1	955-10	955-10	955-10	955-10	955-10
11	Bracket	1	955-BA-7	955-BA-7		955-BA-7	
13	Gasket	1	955-13	955-13		955-13	
14	Retainer (Plunger)	1	955-14	955-14	955-14	955-14	955-14
25	Cap (Diaphragm Body)	1	955-25	955-25	955-25	955-25	955-25
26	Shield (Diaphragm Cap)	1	955-26	955-26	955-26	955-26	955-26
27	Screen	1	955-27	955-27	955-27	955-27	955-27
28	Gasket	1	955-28	955-28	955-28	955-28	955-28
29	Safe-Control Valve Assembly (Inc. Syms. 28 and 81)	1	953-CC	955-CC	955-CC	958-CC	958-CC
30	Adapter Assembly	1	955-EE	955-EE		955-EE	
30	Cap	1			956-130		956-130
32	Screw	1	242-M	242-M	242-M	242-M	242-M
33	Cap		242-N	242-N	242-N	242-N	242-N
	Connector Comp. (Inc. Syms. 35, 36 and 38) (Replaces 955-RR-2)	1	1651-RR-2	1651-RR-2		1651-RR-2	
35	Receptacle (with 72" cord)	1	1651-R-2	1651-R-2		1651-R-2	
36	Washer	1	1646-R-3	1646-R3		1646-R-3	
38	Jam Nut	1	1646-B-20	1646-B-20		1646-B-20	
39	Bonnet	1	242-B	242-B	242-B	242-B	242-B
40	Needle Valve Assembly	1	242-CC	242-CC	242-CC	242-CC	242-CC
41	Bellows Assembly (Replaces 242-EE)	1	L-242-EE	L-242-EE	L-242-EE	L-242-EE	L-242-EE
42	Retainer (Spring)	2	242-H	242-H	242-H	242-H	242-H
43	Spring (Bellows)	1	242-J	242-J	242-J	242-J	242-J
44	Spring (Needle Valve)	1	242-K	242-K	242-K	242-K	242-K
45	Yoke	1	901-C	901-C	901-C	901-C	901-C
46	Diaphragm (Economy)	1	900-E	900-E	900-E	900-E	900-E
47	Bellows Cplt. (Valve Pack)	1	900-G	900-G	900-G	900-G	900-G
48	Bellows Complete (Diaphragm Pack.)	1	900-H	900-H	900-H	900-H	900-H
49	Shield (including Oper. Rod Bearing)	1	900-J	900-J	900-J	900-J	900-J
51	Spring (Oper. Rod)	1	900-L	900-L	900-L	900-L	900-L
52	Arm (Operating)	1	901-M	901-M	901-M	901-M	901-M
53	Nut (Bellows Retaining)	2	901-N	901-N	901-N	901-N	901-N
54	Nut (Yoke Retaining)	2	901-O	901-O	901-O	901-O	901-O
55	Cover (Specfy Regulator)	1	900-P	900-P	900-P	900-P	900-P
56	Needle Valve Comp.	1	955-QQ	955-QQ	955-QQ	955-QQ	955-QQ
	Valve Seat		900-Q-1	900-Q-1	900-Q-1	900-Q-1	900-Q-1
	Needle		900-QQ-2	900-QQ-2	900-QQ-2	900-QQ-2	900-QQ-2
	Valve Stem Guide		900-Q-3	900-Q-3	900-Q-3	900-Q-3	900-Q-3
	Valve Spring		955-Q-4	955-Q-4	955-Q-4	955-Q-4	955-Q-4
	Washer		900-Q-5	900-Q-5	900-Q-5	900-Q-5	900-Q-5
	Pin		900-Q-6	900-Q-6	900-Q-6	900-Q-6	900-Q-6
57	Adapter	1	901-Q-1	901-Q-1	901Q-1	901-Q-1	901-Q-1
58	Pivot (Opr. Arm)	1	900-R	900-R	900-R	900-R	900-R
59	Screw (Adjusting)	1	901-S	901-S	901-S	901-S	901-S
60	Cap (Strainer)	1	901-T	901-T	901-T	901-T	901-T
61	Cap	2	7/16" 20 SAE	7/16" 20 SAE	7/16" 20 SAE	7/16" 20 SAE	7/16" 20 SAE
62	Half Union	2	⅛" IPS x ¼" ODCT	⅛" IPS x ¼" ODCT	⅛" IPS x ¼" ODCT	⅛" IPS x ¼" ODCT	⅛" IPS x ¼" ODCT
63	Washer	2	1901-A-90	1901-A-90	1901-A-90	1901-A-90	1901-A-90
66	Cap Screw (Hex. Hd.)	2	¼" 20 x ½" LG	¼" 20 x ½" LG	¼" 20 x ½" LG	¼" 20 x ½" LG	¼" 20 x ½" LG
67	Locknut	1	244-17	244-17	244-17	244-17	244-17
69	Cap Screw (Hex. Hd.)	1	5/16" 18 x ¾" LG	5/16" 18 x ¾" LG	5/16" 18 x ¾" LG	5/16" 18 x ¾" LG	5/16" 18 x ¾" LG
70	Lockwasher (St'd)	1	5/16" Split Type	5/16" Split Type	5/16" Split Type	5/16" Split Type	5/16" Split Type
71	Cap Screw (Hex. Hd.)	3	⅜"-16 x ¾" LG	⅜"-16 x ¾" LG	⅜"-16 x ¾" LG	⅜"-16 x ¾" LG	⅜"-16 x ¾" LG
72	Cap Screw (Hex. Hd.)	2	⅜"-16 x 1" LG	⅜"-16 x 1" LG	⅜"-16 x 1" LG	⅜"-16 x 1" LG	⅜"-16 x 1" LG
73	Cap Screw (Hex. Hd.)	1	⅜"-16 x 1½" LG	⅜"-16 x 1½" LG	⅜"-16 x 1½" LG	⅜"-16 x 1½" LG	⅜"-16 x 1½" LG
74	Lockwasher (St'd)	6	⅜" Split Type	⅜" Split Type	⅜" Split Type	⅜" Split Type	⅜" Split Type
77	*Solenoid and Adapter Assembly, Inc. Sym. 9, -10, -11, -13, -14, -30, -78, -79 (Replaces 955-BB)	1	955-BBA	955-BBA		955-BBA	
78	*Solenoid Housing Assembly (Herm. Sealed) Replaces 955-BB-1, includes Syms. 11 & 79. See Note.		955-BBA-1	955-BBA-1		955-BBA-1	
79	Spring Washer	1	955-BA-6	955-BA-6		955-BA-6	
81	Strainer Replaces 955-36)	1	955-91	955-91	955-91	955-91	955-91
	Plate (Ident.) Used with Unstamped Cover	1	955-92	955-92	955-92	955-92	955-92
	Protector (S. R. Hsg. th.)		1671-10	1671-10		1671-10	
	Union Complete (Not Furnished with Reg.)	1	441-3	441-3	441-3	441-3	441-3
	Union Complete (Not Furnished with Reg.)	1	441-4	441-4	441-4	441-4	441-4

* Specify Voltage 32, 64 or 125 V.D.C.

NOTE: When ordered by No. 955-BBA-1R, connector complete 1651-RR-2 is included.

Nos. 953-955-956-958 and 959 VAPOR SAFE-CONTROL REGULATORS (Cont.)

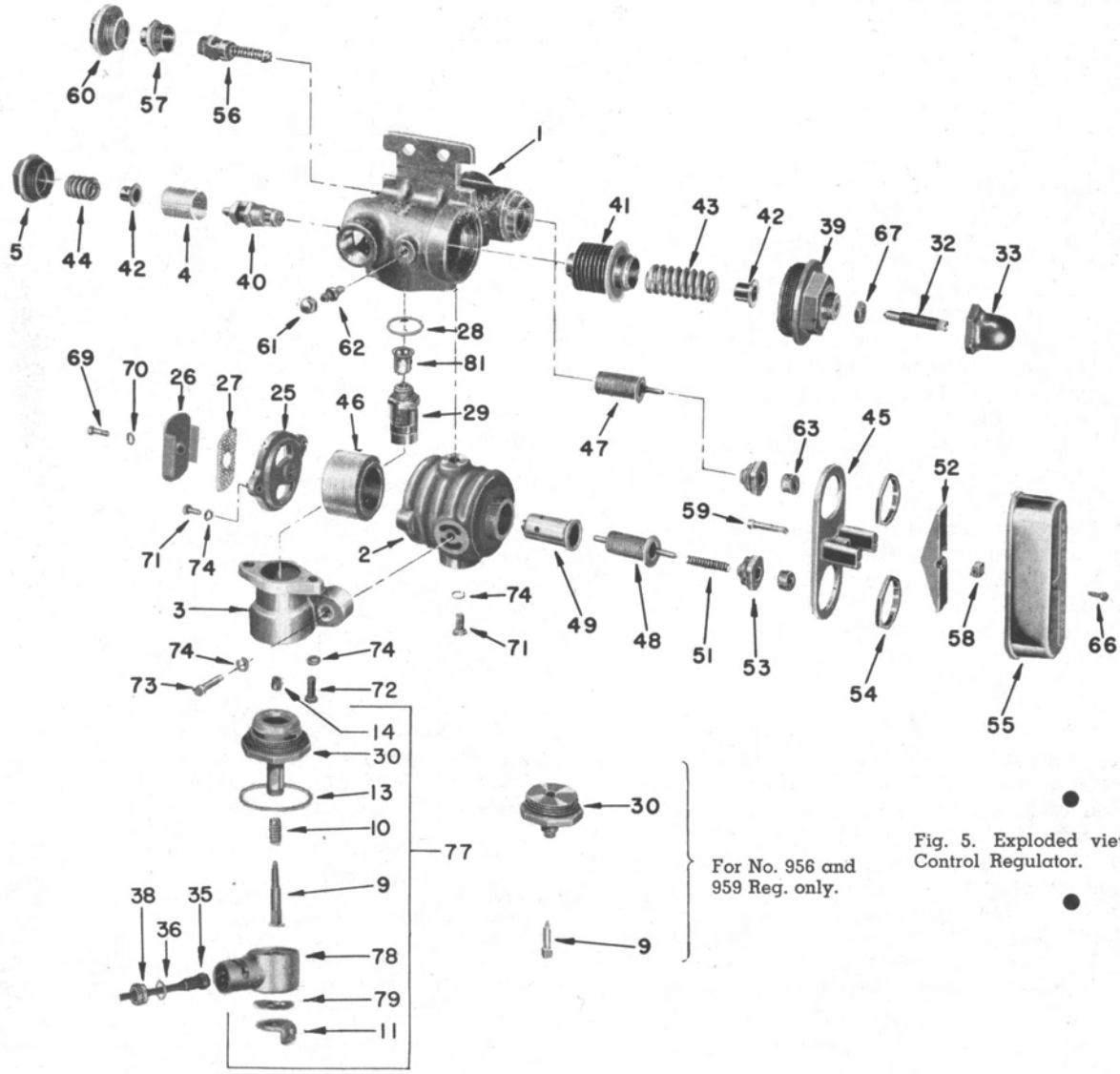


Fig. 5. Exploded view of Safe-Control Regulator.

NO. 955-TT DRAIN TUBE

Sym.	Part No.	Description	Amt.
1	B-440-T-1	Tube	1
2	B-440-T-2	Jacket	1
3	955-TA-3	Tee	1
5	955-TA-5	Inner Tube	1
7	441-2	Union Complete	1

LIST OF PARTS
NO. B-440-TT DRAIN TUBE

Sym.	Part No.	Description	Amt.
1	B-440-T-1	Tube	1
2	B-440-T-2	Jacket	1

NO. 955-XX DRAIN TUBE

(Not Illustrated)

955-X-1	Inner Tube	1
955-X-2	Outer Tube	1
955-TA-3	Tee	1
955-X-4	Inner Tube Nipple	1
955-X-5	Outer Tube Nipple	1
955-X-6	Clamp (Inner Tube)	1
955-X-7	Clamp (Outer Tube)	1
441-2	Union Complete	1

Note: Inner and Outer Tubes are of Composition Rubber.

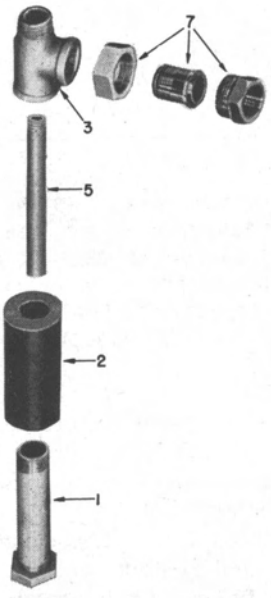


Fig. 6 Drain Tube Assembly.

Nos. 953-955-956-958 and 959 VAPOR SAFE-CONTROL REGULATORS (Cont.)

22659, copies of which are available upon request.

CAUTION: Do not remove the bellows diaphragm from the regulator while hot, nor subject it to live steam when not enclosed, as it will become overexpanded and will not return to its normal form.

Failure of the regulator to feed steam to the supply loop may indicate that the safe-control valve is not operating freely. To correct, insert a screwdriver through the rectangular opening in the bracket and push up the plunger. Hold it up for about one minute and then release it quickly to allow any particles of dirt between the valve and seat to be blown out.

Steam blowing from the outer drain tube of the regulator usually indicates a faulty vapor retarder in the steam supply loop or in one of the admission valves in the car. (See Bulletin 61-700-1 p. 7.)

An escape of steam through the tell-tale hole in the pressure reducing valve spring bonnet (sym. 39) indicates a rupture in the bellows seal which encloses the spring. It will be necessary to replace the seal in order to correct this condition.

OVERHAUL

These regulators should be overhauled at least once every two years. At that time the regulator should be thoroughly cleaned and tested and a metal date tag attached upon the completion of the overhaul. The diaphragm should be checked for proper expansion and freedom from leaks. The bellows seal should also be inspected. Check all valves to be sure that they move freely and are not scored. Defective valves and seats should be replaced. All rods and stems should be cleaned and inspected for freedom of movement.

Remove the solenoid and test it for insulation resistance. The resistance of the coil should also be tested and should be approximately as follows:

32 volt coil	62 ohms
64 volt coil	245 ohms
125 volt coil	725 ohms

The plug (sym. 34) and the receptacle (sym. 35) should be checked and replaced if the rubber has become hardened or vulcanized. Should the coil or the plug need to be replaced, it will be necessary to replace the entire solenoid housing casting (sym. 78) as this is a hermetically sealed unit. For replaceable parts of older type solenoid housing assembly 955-BB-1 still available, see page 6.

To readjust the tension on the reducing valve spring, if the pressure should vary 10% or more from the prescribed settings, place the regulator on a test rack under steam, as shown in Fig. 7, below. Remove the reducing valve screw cap (sym. 33) and adjust the reducing valve adjusting screw (sym. 32) to give the correct readings on the gauges.

To correct the lever arm adjustment, should it ever become loose, adjust the lever arm with the regulator cold so as to be as loose as possible without slipping off of the stems and solder the adjusting screw in place.

When ordering 900-P cover for replacement, please specify Part Number of regulator on which it will be used—so the cover can be stamped. Use 955-92 identification plate—properly stamped—on regulators using unstamped replacement 900-P covers. This aids in regulator identification.

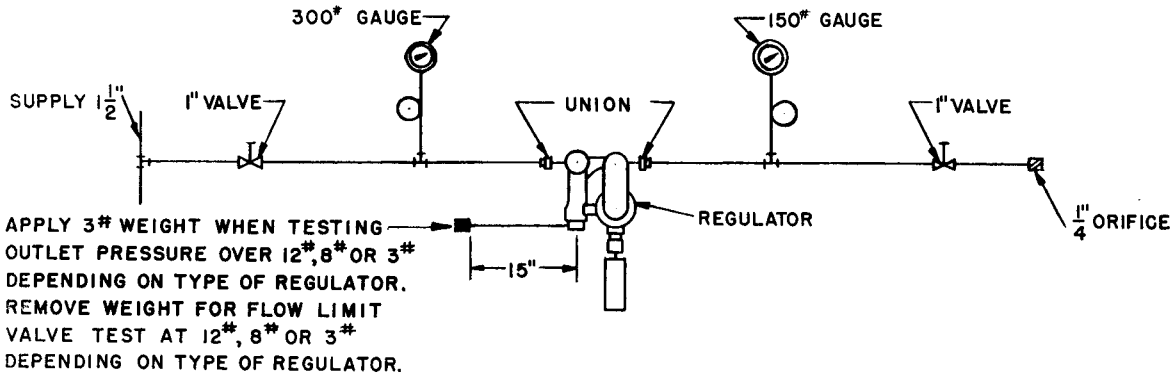


Fig. 7. Drawing of Test Assembly

With both 1″ valves open, pressure reading on 150 lb. gauge should be as shown in table with varying inlet pressures. Adjust reducing valve screw, if necessary.

To test safe-control valve, close 1″ valve at outlet orifice and remove weight. Safe-control valve should unload when pressure on 150 lb. gauge reaches 12 lbs. in Nos. 955 and 956 regulators; 8 lbs. in Nos. 958 and 959 regulators and 3 lbs. in 953 regulator.

REDUCING VALVE PRESSURE RANGE

Inlet	Outlet	Inlet	Outlet
75 lbs.	51 lbs.	150 lbs.	50 lbs.
100 lbs.	51 lbs.	175 lbs.	49 lbs.
125 lbs.	50 lbs.	200 lbs.	49 lbs.
		225 lbs.	48 lbs.

Nos. 953-955-956-958 and 959 VAPOR SAFE-CONTROL REGULATORS (Cont.)

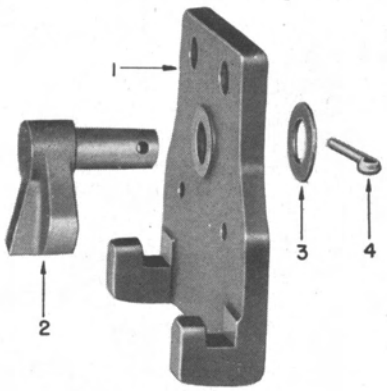


Fig. 8. No. 471 Mounting Bracket

LIST OF PARTS
NO. 471 MOUNTING BRACKET

Sym.	Part No.	Description	Amt.
1	471-1	Bracket	1
2	471-2	Cam	1
3	1104-Q	Washer	1
4	5/32" x 1"	Cotter Pin	1

Fig. 9 No. 955-162 Bleed Test Cock

No. 955-162 Bleed Test Cock, which must be ordered separately, may be used where No. 970 Water Seal Fitting is not used for visual steam flow inspection of regulator.

No. 970 Water Seal Fitting (See Bulletin 61-762) must be ordered separately. It is used for visual steam flow inspection and provides a water seal to prevent steam leakage into the loop when Safe-Control valve is energized.

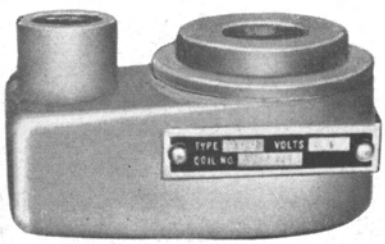


Fig. 10 Old Style.
No. 955-BB-1 Solenoid Housing Assembly.

The No. 955-BB-1 Solenoid Housing Assembly (superseded by the No. 955-BBA-1 Assembly) is still in use in certain regulators. Replaceable parts listed are available. No. 955-RR-2 Connector is used only with 955-BB-1. Early 955-BB-1 Assemblies were not filled with plastic and parts may be replaced. Plastic filled 955-BB-1 Assemblies must be replaced complete. Orders for 955-BB-1 will be filled with 955-BBA-1R Assemblies which include a 72" cord as part of the 1651-RR-2 cord and plug assembly furnished in addition to the 955-BBA-1 Assembly in this case.

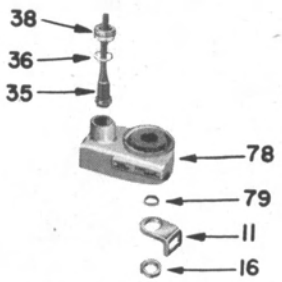


Fig. 11. Exploded View of 995-BB-1 and Parts Required For Its Use.

LIST OF PARTS—No. 955-BB-1.

Sym.	Part. No.	Description	Amt.
78	955-BB-1	Solenoid Hsing. Asbly.	1
	955-B-2	Coil (Specify Volt.)	1
	955-B-6	Housing	1
	955-R-1	Plug	1
	955-R-3	Washer	1
	955-R-4	Locking Ring	1
	5 x 40¼" Lg.	Screw, RHM	2
	No. 6	Shakeproof Washer	2
	1657-B-22	Ident. Plate	1
	No. 4 x 3/16" Lg.	P-K B.H. Self Tapping Screw	2
79	*955-79	"O" Ring	1
11	955-11	Bracket	1
16	955-16	Nut	1

No. 955-RR-2 CONNECTOR COMPLETE—USED WITH 955-BB-1.

35	955-R-2	Receptacle with 72" Cord	1
36	955-R-3	Washer	1
38	955-5	Jam Nut	1

PRINTED IN U. S. A.

No. EBR-968
VAPOR SAFE-CONTROL REGULATOR

USED IN UNIZONE AND MODUZONE CAR HEATING SYSTEMS

Inlet and Outlet:
1" IPS Connections

Weight:
38 Lbs.

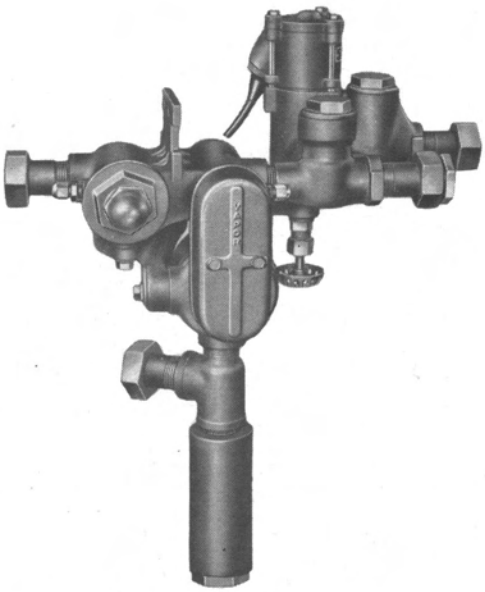


Fig. 1 No. EBR-968 UNIZONE Regulator

GENERAL DESCRIPTION

To save time, labor and cost in maintenance, Vapor's UNIZONE Safe-Control regulators of the No. 968 Series are designed with a new concept of coach yard servicing in mind. Instead of the usual on-the-car maintenance procedures, these regulators are so constructed that periodically the entire unit may be removed and replaced quickly—with the removed unit then being sent to the shop for complete overhaul. In this way worn or distorted parts are usually discovered before they can interfere with the operation of the unit, and coach yard maintenance is reduced to a minimum.

By including, within the unit, several devices formerly used separately under the car in previous heating systems—a major portion of the heating system is here compacted into one assembly. This assembly may be quickly removed for replacement by breaking four union joints and disengaging a clamp, as shown in Fig 2. Thus, an entire heating system—with the exception of the radiation — may be removed within a few moments when required.

In operation, the regulator is normally open to pass steam into the radiation. It is closed to withhold steam from the radiation by the action of the Safe-Control valve whenever a sufficient quantity of steam is in the radiation—or when no heat is required (either because of a satisfied thermostat or because cooling is supplied). In addition to the function of passing or withholding steam to the radiation, the regulator also performs two other functions: train line steam pressure reduction and, where desired, the supplying of steam for wash water heating.

To show how these functions are accomplished, the path of steam passing through the regulator is drawn schematically in Figure 3. Steam enters the regulator inlet (follow arrow in illustration) and passes through a pressure reducing valve. Then this steam (at reduced pressure) flows through the vapor valve (which passes steam to

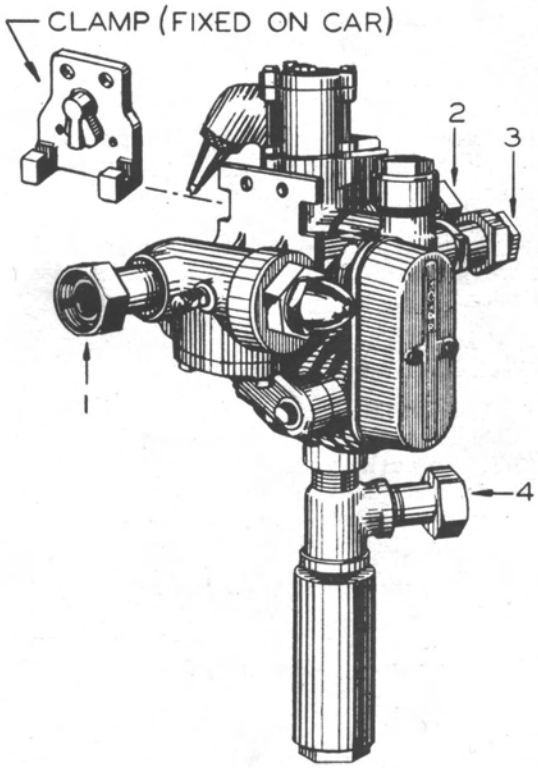


Fig. 2 Break Four Unions and Disengage Clamp

NO. EBR-968 VAPOR SAFE-CONTROL REGULATOR (Cont.)

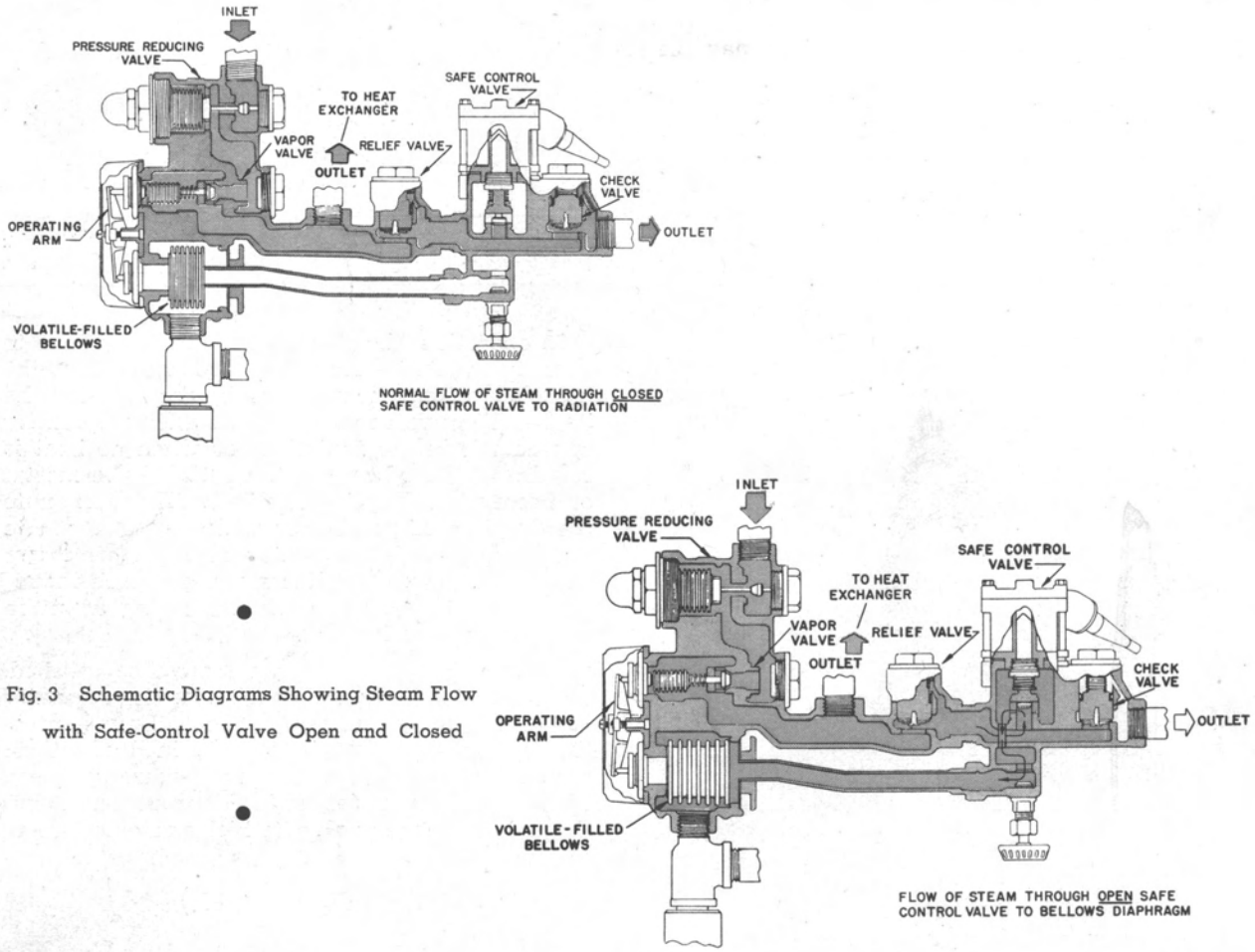


Fig. 3 Schematic Diagrams Showing Steam Flow with Safe-Control Valve Open and Closed

the radiation when open or, withholds steam from the radiation when closed). If this valve is open, steam flows through it and into the Safe-Control portion of the regulator. With the Safe-Control valve closed, steam passes on through and, lifting the weight of a check valve, flows on into the radiation.

The Safe-Control valve is opened as a result of either of two conditions:

(1) When the controlling thermostat is satisfied and no further heat is required or when cooling is supplied and no heat is desired, the Safe-Control valve is opened by its solenoid coil which is energized by the thermostatic circuit.

(2) When steam has filled the radiation, additional steam entering the regulator builds up a sufficient pressure to push open the Safe-Control valve.

In either case, the steam escaping through the opened Safe-Control valve is directed to another chamber of the regulator where a bellows diaphragm, filled with a volatile liquid, expands when the steam comes into contact with it. The expansion of the bellows causes a pivoted operating arm to close the vapor valve to withhold further steam from the radiation. When the steam surrounding the bellows has cooled and condensed, discharging to the ground through the regulator drain tube, the bellows cools and contracts so that the vapor valve is permitted to reopen by the pressure of a spring: again passing steam to the radiation. A normally open, manually operable by-pass valve is located below the Safe-Control valve in the unit. This valve is intended for emergency use **only** and when closed, sets up the heating system for manual regulation inside the car (see Bulletin 61-700-2 for details) should automatic temperature control system become inoperative.

Located in the path of the steam, between the vapor valve and the Safe-Control valve is a weighted check valve with a secondary outlet. The purpose of this valve is to permit steam to pass into the heat exchanger to heat the wash water regardless of whether steam is required for heat in the car or not. When the heat exchanger has become filled with steam, any additional steam overcomes the check and flows on to the Safe-Control valve. In this way—even though the Safe-Control valve may be open to prevent steam from reaching the radiation—steam for heating wash water is still supplied. If it is not desired to heat wash water with steam from

LIST OF PARTS
NO. EBR-968 REGULATOR

SYM.	PART NUMBER	DESCRIPTION	AMT.
	A-1753	Assembly, Safe-Control Valve and Check	
1	¼"-20 x 3½" Lg.	Screw, Hex Head Cap	3
2	A-1753-B3	Cover, Solenoid Housing	1
3	1753-B12	Gasket, Cover	1
4	1651-B2	Coil, Solenoid (Specify Voltage)	1
5	A-1753-B1	Housing, Solenoid Coil	1
6	No. 6-32 x 3/16" Lg.	Screw, Name Plate (R.H. Machine)	2
7	1651-B10	Plate, Identification Name (Spec. Voltage stamping)	1
8	R-1656-B7	Gasket	1
9	1651-BB5	Assembly, Guide Tube	1
10	A-1753-B4	Nut, Guide Tube Retaining	1
11	1651-C5	Spring, Safe-Control Valve	1
12	1651-CCA	Assembly, Safe-Control Valve	1
13	1646-B21	Gasket	1
14	A-1753-A	Body, Safe-Control Valve and Check	1
15	1646-R1	Plug, Connector	1
16	1646-R3	Washer	2
17	1646-B19	Ring, Locking	1
18	1646-B20	Nut, Jam	1
19	1651-R2	Receptacle, Connector (With Cord)	1
20	955-5	Cap	1
21	A-512-2	Spring, Piston	1
‡22	A-1753-A3	Spring, Contraction	1
‡23	A-1753-A2	Spring, Snubber Band	1
24	512-3	Needle, Piston	1
25	512-A1	Washer	1
27	1663-E4	Washer	1
28	A-1663-E3	Screw, Valve Disc	1
29	1753-D7	Stem	1
30	1753-D1	Bonnet	1
31	1753-D5	Packing	1
32	1753-D4	Gland	1
33	1753-D6	Nut	1
34	1753-D3	Handwheel, Emergency By-Pass	1
35	1753-D8	Washer	1
36	1753-D2	Locknut, Handwheel	1
37	625-2	Tail Piece, Union	1
38	625-3	Ring, Union	1
	1651-RR2	Connector, Receptacle (Complete—Includes Syms. 16, 18, & 19)	
	512-AA	Assembly, Piston Needle (Includes Syms. 22, 23, 24, 25, 27 & 28)	
	A-1753-BB1	Assembly, Solenoid Housing (Includes Syms. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 1 of 16 and 17)	
	A-512	Assembly, Relief Check Valve	
20	955-5	Cap	1
21	A-512-2	Spring, Piston	1
‡22	A-1753-A3	Spring, Contraction	1
‡23	A-1753-A2	Spring, Snubber Band	1
24	512-3	Needle, Piston	1
25	512-A1	Washer	1
27	1663-E4	Washer	1
28	A-1663-E3	Screw, Valve Disc	1
41	A-512-1	Body Relief Check Valve	1
	512-AA	Assembly, Piston Needle (Includes Syms. 22, 23, 24, 25, 27 & 28)	

SYM.	PART NUMBER	DESCRIPTION	AMT.
	BA-957	Assembly, Vapor Regulator	
42	7/16"-20-SAE	Cap	2
43	⅛" IPS x ¼" ODCT	Union, Half	2
44	955-1	Body, Vapor Regulator	1
45	955-QQ	Assembly, Needle Valve (Vapor Valve)	1
46	901-Q1	Adapter	1
47	901-T	Cap	1
20	955-5	Cap	1
48	242-K	Spring, Needle Valve	1
49	242-H	Retainer, Spring	2
50	955-4	Strainer	1
51	242-CC	Assembly, Needle Valve (Press. Red. Valve)	1
52	L-242-EE	Assembly, Bellows	1
53	242-J	Spring, Bellows	1
54	242-B	Bonnet	1
55	242-M	Screw, Adjusting (Pressure Reducing Valve)	1
56	244-17	Locknut	1
57	242-N	Cap	1
58	900-G	Bellows, Valve Packing	1
59	901-N	Nut, Bellows Retaining	2
60	1901-A90	Washer	2
61	901-C	Yoke	1
62	901-O	Nut, Yoke Retaining	2
63	901-M	Arm, Operating	1
64	900-R	Pivot, Operating Arm	1
65	901-P	Cover (Specify Stamping)	1
66	¼"-20 x ½" Lg.	Screw, Hex Head Cap	2
67	901-S	Screw, Adjusting	1
68	900-L	Spring, Operating Rod	1
69	900-H	Bellows, Diaphragm Packing	1
70	900-J	Shield, Bellows (Includes Bearing)	1
71	955-2	Housing, Diaphragm	1
72	900-E	Diaphragm, Bellows	1
73	957-35	Gasket	1
74	955-25	Cap, Diaphragm	1
75	BA-957-27	Screen	1
76	955-26	Shield	1
77	5/16"	Lockwasher, Split Type	1
78	5/16"-18 x ¾" Lg.	Screw, Hex Head Cap	1
79	⅜"-16 x ¾" Lg.	Screw, Hex Head Cap	3
80	⅜"	Lockwasher, Split Type	6
81	BA-957-84	Flange	1
82	⅜"-16 x ⅞" Lg.	Screw, Hex Head Cap	3
83	½" IPS x 1¾" Lg.	Nipple	1
84	½"	Elbow, Female (90°)	1
85	½" IPS x 2½" Lg.	Nipple	1
86	EB-968-2	Plug	1
87	955-92	Plate, Identification (Specify Stamping)	1
88	441-A	Nipple, Union	3
89	441-B	Nut, Union	3
*	EBR-968-TT	Drain Tube (Must Be Ordered Separately)	†
*	471	Mounting Bracket (Ordered Separately)	†
*	104-413-2	Protector, Thread	2
*	441-C	Body, Union (For 1" IPS —Order Separately)	†
*	441-2-C	Body, Union (For 1⅛" ODCT —Order Separately)	†

NOTE: * Indicates Not Illustrated.
† Indicates Not Included With Regulator, Must Be Ordered Separately.
‡ Gap in Contraction Spring Must Be on Opposite Side to Gap in Snubber Band Spring

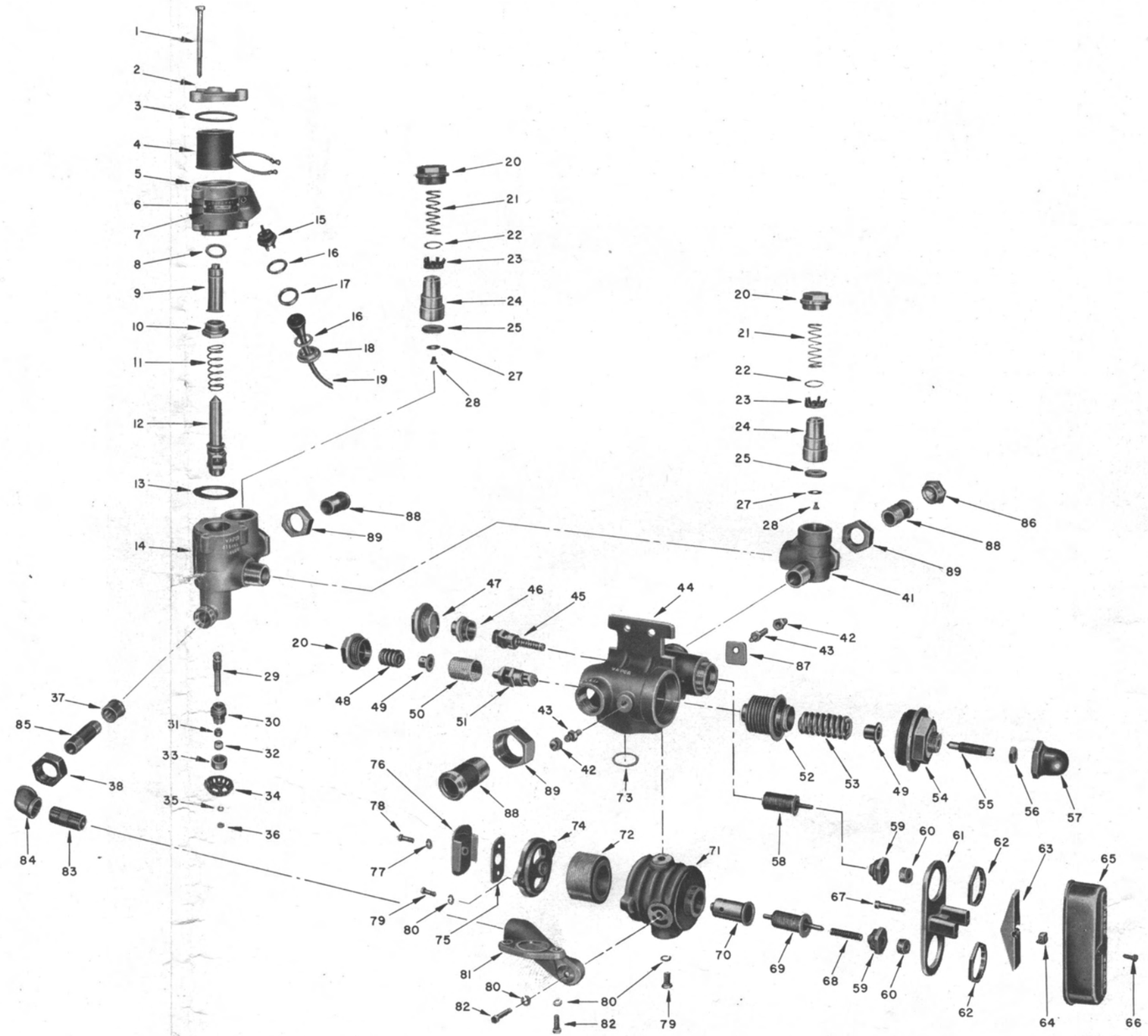


Fig. 4 Exploded View of No. EBR-968 Regulator

the regulator, the secondary outlet may be plugged.

TRAIN CREW OPERATING INSTRUCTIONS

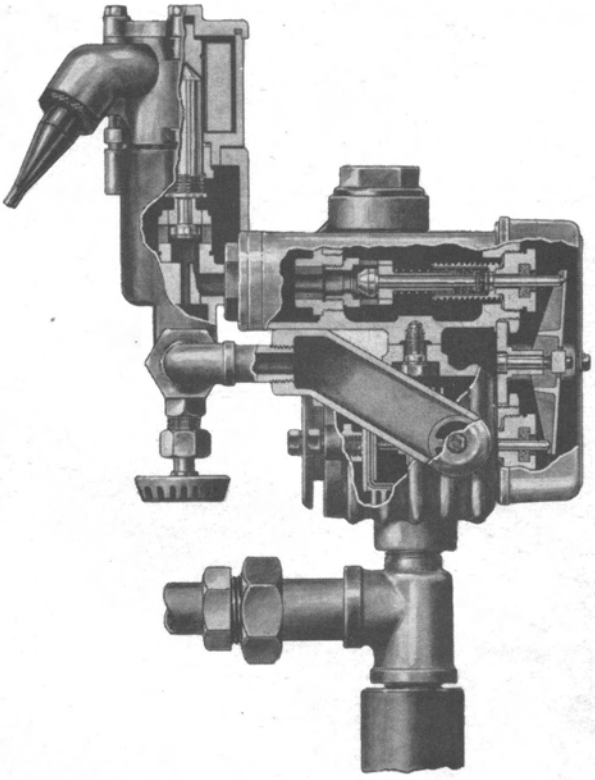
These regulators require no routine inspection beyond visual checking for steam blows before each departure. A blow of steam from the regulator drain tube indicates that the unit is in need of attention; such a steam blow usually results from dirt or other material lodging between the vapor valve and seat.

To clear out foreign matter between the vapor valve and seat, close the shut-off and drain valve ahead of the regulator for a few minutes and then open it again. This can be done in the station before departure or at station stops enroute.

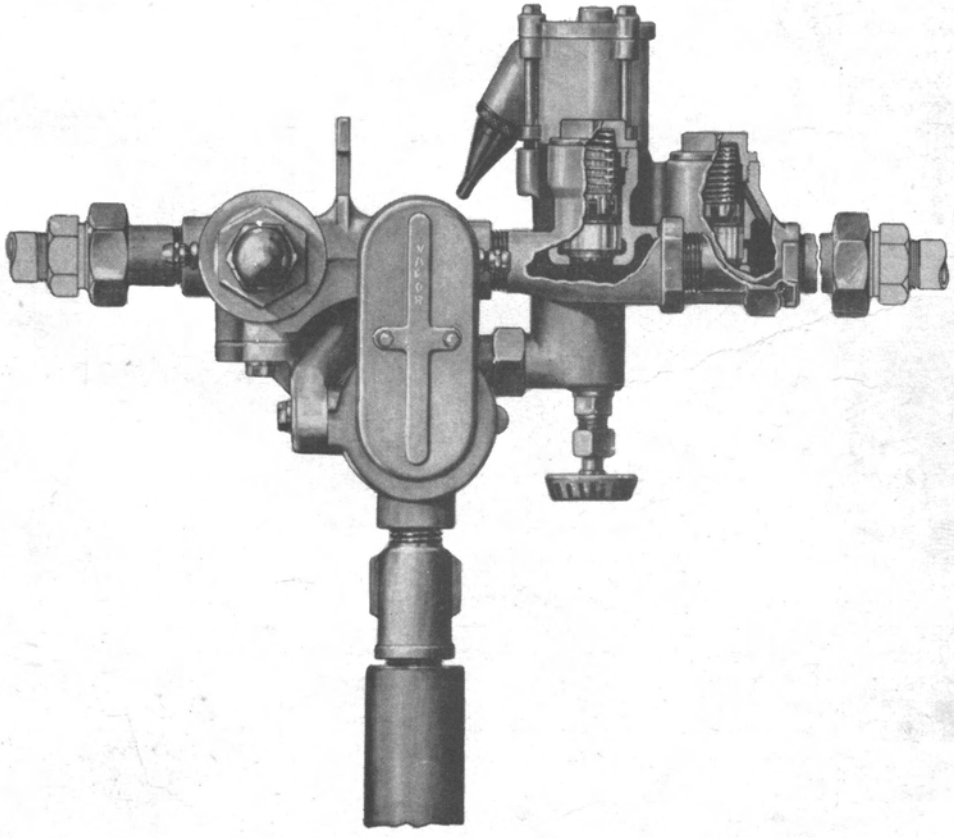
If this procedure does not stop the blow of steam from the drain tube the trouble is likely a leaking bellows diaphragm or a bad solenoid coil and the regulator should be replaced at the first opportunity. This type of failure will result in an overheated car unless the manual shutoff valves in the car are used to limit the steam flow into radiation.

When a car is not being heated it is likely that foreign matter has lodged between the valve and seat of the Safe-Control valve. Normally this foreign matter can be cleared out by holding the reset button in for about one minute. This action should be repeated five or six times.

If this procedure does not cause steam to flow into the car the regulator should be replaced at the first opportunity. Meanwhile, if no replacement regulator is available—emergency operation will maintain heat in the car. At the first



Right—Above, Fig. 5
Sectioned Side View
of UNIZONE Regulator



Right, Fig. 6
Sectioned Front View
of UNIZONE Regulator

stop the emergency by-pass valve below the Safe-Control valve should be closed.

This procedure places the regulator in a continuous steam feed adjustment and steam to the radiation must be throttled or shut off by the use of manually adjusted valves inside the car to prevent overheating.

An escape of steam from the tell-tale hole in the pressure reducing valve spring bonnet (Sym. 54) indicates a rupture in the bellows seal which encloses the spring. This is a procedure covered in shop overhaul so the regulator should be replaced and sent to the shop for reconditioning.

OVERHAUL PROCEDURES

Regulators of the No. 968 Series should be completely overhauled once every twelve to eighteen months (even though necessity is not apparent). After overhaul and re-assembly the regulator should be date-tagged for record purposes to determine when it will next be overhauled. Since servicing is eliminated on the car and maintenance is a shop procedure, it is assumed that proper tools and equipment for the work are available.

Overhaul of the regulator is most quickly accomplished by disassembling each section of the regulator in order. It is not necessary to separate the regulator components for this purpose.

SAFE-CONTROL VALVE AND CHECK ASSEMBLY

Check the Safe-Control valve assembly to be sure the valve seats tightly and the tension of the valve spring (Sym. 11) is correct. Also check the tension of the piston spring (Sym. 21) which should be 3″ (+ or — ⅛″) in free length and inspect the piston needle (Part No. 512-AA). If the rubber washer (Sym. 25) on the piston is worn or distorted, it should be replaced. Then check the solenoid coil (Sym. 4). Remove the solenoid and test it for insulation resistance. The resistance of the coil should also be tested and should be approximately as follows:

32 volt coil	62 ohms
64 volt coil	245 ohms
125 volt coil	725 ohms

Inspect the receptacle and connector and replace them if the rubber has become hardened or vulcanized. The packing and the valve and seat of the by-pass valve should be inspected to be sure they are in proper condition.

RELIEF VALVE ASSEMBLY

Inspect the rubber washer (Sym. 25) on the piston needle (512-AA) and replace if the rubber has become worn or distorted. Check the tension of the piston spring (Sym. 21), which should be 3″ (+ or —⅛″) in free length.

VAPOR STEAM REGULATOR ASSEMBLY

Check the bellows diaphragm for proper expansion and freedom from leaks. To inspect the diaphragm, close the shut-off valve ahead of the regulator and allow about five minutes for the bellows diaphragm to cool and contract. Then remove the diaphragm from the regulator. If the bellows has failed to return to its normal, fully contracted form when cooled, it is defective and should be replaced.

To test a bellows diaphragm for leaks, place it in a suitable holding fixture and submerge it in water at about 190° F. Leaks will be shown by the rising of bubbles in the water. A leaky diaphragm should be discarded; do not attempt to refill and reclaim it. Before removing the diaphragm from the holding fixture, submerge it in cold water. A suitable holding device for conducting this test is shown in our drawing No. 22659, copies of which are available upon request.

> **CAUTION:** Do not remove the bellows diaphragm from the regulator while hot, nor subject it to live steam when not enclosed, as it will become overexpanded and will not return to its normal form.

Inspect the diaphragm packing bellows and the valve packing bellows for freedom from leaks. Check all valves and seats to be sure that they move freely and are not scored, wire drawn or leaking. Rods and stems should be cleaned and inspected for freedom of movement and to be sure they have not become bent. Check the screen in the diaphragm chamber to be sure it is clean and the openings are clear.

To readjust the tension on the reducing valve spring, if the pressure should vary 10% or more from the prescribed settings, place the regulator on a test rack under steam. Remove the reducing valve screw cap (Sym. 57) and adjust the reducing valve adjusting screw (Sym. 55) to give the correct readings on the gauges.

REDUCING VALVE PRESSURE RANGE

Inlet	Outlet	Inlet	Outlet
75 lbs.	51 lbs.	150 lbs.	50 lbs.
100 lbs.	51 lbs.	175 lbs.	49 lbs.
125 lbs.	50 lbs.	200 lbs.	49 lbs.
		225 lbs.	48 lbs.

To correct the lever arm adjustment, should it ever become loose, adjust the lever arm with regulator on steam. Turn adjustment screw (Sym. 67) clockwise until steam blows from the drain tube. Then turn screw counter-clockwise until steam blow stops; then turn screw one-half turn more counter-clockwise.

When ordering 901-P cover replacement, please specify Part Number of regulator on which it will be used—so the cover can be properly stamped. Use Sym. 87 identification plate, properly stamped, on regulators using unstamped replacement 901-P covers. This aids in regulator identification.

When each part has been checked and overhauled the regulator may then be re-assembled by reversing the dis-assembly procedure. It should then be tested, under steam, on a test rack before being replaced in service.

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Nos. EBC-968 and EWC-968 VAPOR SAFE-CONTROL REGULATORS

Inlet and Outlet
1" IPS Connections

Weight:
Approx. 40 Lbs.

GENERAL DESCRIPTION

Nos. EBC-968 and EWC-968 Vapor Safe-Control Regulators are Nos. EB-968 and EW-968 regulators which have been converted, by the use of No. EBC-968-301 conversion kit or No. EWC-968-301 conversion kit, to function like No. EBR-968 UNIZONE regulator. Refer to Bulletin 61-703 for information and maintenance of these regulators.

LIST OF PARTS

(Refer to Fig. 4 in Bulletin 61-703)

Sym.	EWC-968 Part No.	EBC-968 Part No.	Description	Amt.
	—	—	Assembly, Safe-Control Valve & Check	
1	¼"-20X3½"	¼"-20X3½"	Screw, Hex Head Cap	3
2	A-1753-B3	A-1753-B3	Cover, Solenoid Housing	1
3	1753-B12	1753-B12	Gasket, Cover	1
4	1651-B2	1651-B2	Coil, Solenoid (Specify Volt)	1
5	A-1753-B1	A-1753-B1	Housing, Solenoid Coil	1
6	#6-32X3/16"	#6-32X3/16"	Screw, Name Plate (R. H. Mach.)	2
7	1651-B10	1651-B10	Plate, Identification	1
*	1753-301-B	1753-301-B	Adapter, Sol. Hsng.	1
8	R-1656-B7	R-1656-B7	Gasket	1
9	1651-BB5	1651-BB5	Assembly, Guide Tube	1
10	A-1753-B4	A-1753-B4	Nut, Guide Tube Retaining	1
11	1651-C5	1651-C5	Spring, Safe-Control Valve	1
12	1651-CCA	1651-CCA	Assembly, Safe-Control Valve	1
*	1753-301-A	1753-301-A	Adapter, Safe-Control Valve	1
13	—	1646-B21	Gasket	1
	—	—	Body, Safe-Control Valve & Check	1
15	1646-R1	1646-R1	Plug, Connector	1
16	1646-R3	1646-R3	Washer	2
17	1646-B19	1646-B19	Ring, Locking	1
18	1646-B20	1646-B20	Nut, Jam	1
19	1651-R2	1651-R2	Receptacle, Connector, (with Cord)	1
*	¼"-20X⅞"	—	Screw, Cap	3
20	509-7	955-5	Cap	1
*	1646-B21	—	Gasket	1
21	—	A-512-2	Spring, Piston	1
‡22	A-1753-A3	A-1753-A3	Spring, Contraction	1
‡23	A-1753-A2	A-1753-A2	Spring, Snubber Band	1
24	EWC-968-301-A1	512-3	Needle, Piston	1
25	512-A1	512-A1	Washer	1
27	1663-E4	1663-E4	Washer	1
28	A-1663-E3	A-1663-E3	Screw, Valve Disc	1
29	—	1753-D7	Stem	1
30	—	1753-D1	Bonnet	1
31	—	1753-D5	Packing	1
32	—	1753-D4	Gland	1
33	—	1753-D6	Nut	1
34	—	1753-D3	Handwheel, Emergency By-Pass	1
35	—	1753-D8	Washer	1
36	—	1753-D2	Locknut, Handwheel	1
37	—	625-2	Tailpiece, Union	1
38	—	625-3	Ring, Union	1
	1651-RR2	1651-RR2	Assembly, Connector Receptacle Complete (Includes Syms. 16, 18 and 19)	
	EWC-968-301-AA	512-AA	Assembly, Piston Needle (Includes Syms. 22, 23, 24, 25, 27 and 28)	
	A-1753-BB1	A-1753-BB1	Assembly, Solenoid Hsng. (Includes Syms. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, One of 16 and 17)	
	—	A-512	Assembly, Relief Check Valve	
*	¼"-20X⅞"	—	Screw, Cap	3
20	509-7	955-5	Cap	1
*	1646-B21	—	Gasket	1
21	—	A-512-2	Spring, Piston	1
‡22	A-1753-A3	A-1753-A3	Spring, Contraction	1
‡23	A-1753-A2	A-1753-A2	Spring, Snubber Band	1

(Continued on Page 2)

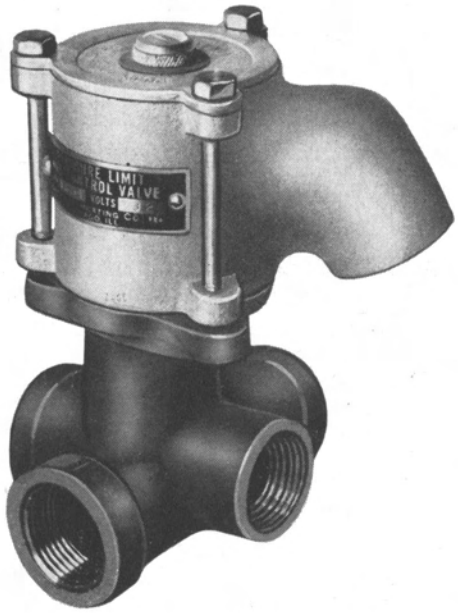
NOS. EBC-968 AND EWC-968 VAPOR SAFE-CONTROL REGULATORS (Cont.)

Sym.	EWC-968 Part No.	EBC-968 Part No.	Description	Amt.
24	A-1753-A1	512-3	Needle, Piston	1
25	512-A1	512-A1	Washer	1
27	1663-E4	1663-E4	Washer	1
28	A-1663-E3	A-1663-E3	Screw, Valve Disc	1
41	512-1	A-512-1	Body, Relief Check Valve	1
	A-1753-AA	512-AA	Assembly, Piston Needle (Includes Syms. 22, 23, 24, 25, 27 and 28)	1
	—	BA-957	Assembly, Vapor Regulator	
42	7/16"-20-SAE	7/16"-20-SAE	Cap	2
43	⅛"IPSX¼"ODCT	⅛"IPSX¼"ODCT	Union, Half	2
44	955-1	955-1	Body, Vapor Regulator	1
45	955-QQ	955-QQ	Assembly, Needle Valve (Vapor Valve)	1
46	901-Q1	901-Q1	Adapter	1
47	901-T	901-T	Cap	1
20	955-5	955-5	Cap	1
48	242-K	242-K	Spring, Needle Valve	1
49	242-H	242-H	Retainer, Spring	2
50	955-4	955-4	Strainer	1
51	242-CC	242-CC	Assembly, Needle Valve (Pr. Red. Valve)	1
52	L-242-EE	L-242-EE	Assembly, Bellows	1
53	242-J	242-J	Spring, Bellows	1
54	242-B	242-B	Bonnet	1
55	242-M	242-M	Screw, Adj. (Press. Red. Val.)	1
56	244-17	244-17	Locknut	1
57	242-N	242-N	Cap	1
58	900-G	900-G	Bellows, Val. Pack.	1
59	901-N	901-N	Nut, Bellows Retaining	2
60	1901-A90	1901-A90	Washer	2
61	901-C	901-C	Yoke	1
62	901-O	901-O	Nut, Yoke Retaining	2
63	901-M	901-M	Arm, Operating	1
64	900-R	900-R	Pivot, Operating Arm	1
65	901-P	901-P	Cover (Specify Stamping)	1
66	¼"-20X½"	¼"-20X½"	Screw, Hex Head Cap	2
67	901-S	901-S	Screw, Adjusting	1
68	900-L	900-L	Spring, Operating Rod	1
69	900-H	900-H	Bellows, Diaphragm Packing	1
70	900-J	900-J	Shield, Bellows (Incl. Bearing)	1
71	955-2	955-2	Housing, Diaphragm	1
72	900-E	900-E	Diaphragm, Bellows	1
73	957-35	957-35	Gasket	1
74	955-25	955-25	Cap, Diaphragm	1
75	BA-957-27	BA-957-27	Screen	1
76	955-26	955-26	Shield	1
77	5/16"	5/16"	Lockwasher, Split Type	1
78	5/16"-18X¾"	5/16"-18X¾"	Screw, Hex Head Cap	1
79	⅜"-16X¾"	⅜"-16X¾"	Screw, Hex Head Cap	3
80	⅜"	⅜"	Lockwasher, Split Type	6
81	957-84	BA-957-84	Flange	1
82	⅜"-16X⅞"	⅜"-16X⅞"	Screw, Hex Head Cap	3
83	½"X2½"	½"X2¼"	Nipple	1
84	443	EB-968-3	Elbow, Female (90°)	1
85	½"X3"	½"X3"	Nipple	1
86	EB-968-2	EB-968-2	Plug	1
87	955-92	955-92	Plate, Identification Date (Spec. Stamping)	1
88	441-A	441-A	Nipple, Union	3
89	441-B	441-B	Nut, Union	3
*	951	—	Assembly, Emergency By-Pass Valve	
*	951-1	—	Plate, Name	1
*	951-2	—	Nut, Wheel	1
*	951-3	—	Wheel	1
*	951-4	—	Gland	1
*	951-5	—	Packing	1
*	951-6	—	Nut, Packing	1
*	951-7	—	Stem	1
*	951-8	—	Bonnet	1
*	951-9	—	Union Ring, Bonnet	1
*	951-10	—	Retainer, Disc	1
*	951-11	—	Disc	1
*	951-12	—	Body	1
*	951-13	—	Nut, Disc Retainer	1
*	957-TT	957-TT	Drain Tube (Order Separately)	†
*	471	471	Mounting Bracket (Order Separately)	†
*	104-413-2	104-413-2	Thread Protector	2
*	—	441-C	Body, Drain Tube Union (For 1" IPS Order Separately)	†
*	—	441-2C	Body, Drain Tube Union (For 1⅛"ODCT Order Separately)	†

NOTES: 1. Symbol * indicates not illustrated part.
2. Symbol † indicates part must be ordered separately—is not furnished with regulator.
3. Symbol ‡ indicates gap in Sym. 22 Contraction Spring—must be opposite gap in Sym. 23 Snubber Band Spring.

No. 1651 FLOW LIMIT VALVE

WEIGHT 7 LBS. WITH CORD INCLUDED



No. 1651 VAPOR Flow Limit Valve

GENERAL DESCRIPTION

This is a spring loaded relief valve for use on Zone Type Heating System installations for limiting the flow of steam to the steam supply loop, by modulating the thermostatic diaphragm in the Steam (Vapor) Regulator.

IN REGULAR HEATING SERVICE, this valve discharges any excess flow of steam (above 8 lbs. pressure) to the thermostatic "Economy Diaphragm" chamber of the regulator to expand the diaphragm and thus control the volume of steam supplied to the heating system. This is accomplished, as the steam flow (pressure) rises, by lifting of the valve from its seat against the opposition of a spring. The spring is of such a type that the spring load will increase rapidly as the spring is compressed. Consequently, a slight lifting of the valve from its seat permits a restricted flow of steam to the regulator diaphragm, whose slight expansion will partially close the valve in the steam regulator and decrease the flow of steam. The parts quickly assume a balanced position, in which the valve in the regulator is only open to an extent sufficient to replace the volume of steam used by the heating radiators and to maintain the desired volume of steam in the supply loop.

DURING LAYOVER, this Flow Limit Valve, which is equipped with a Solenoid, is magnetically operated by a layover thermostat to control the car at low position (generally 60° F.) to prevent the car from freezing in cold weather. The Air Conditioning Control Switch and the Blower Starter Switch being in the "OFF" position for layover, all the No. 1646 type Solenoid Steam Admission Valves

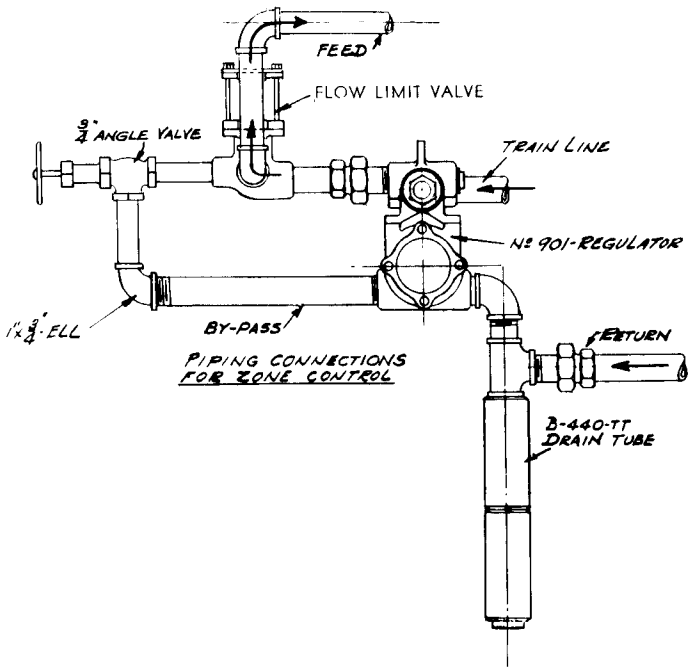
will be de-energized and, therefore, in the open position. Admission of steam into the car is then controlled thermostatically through the operation of the Solenoid on the No. 1651 Flow Limit Valve. The use of the No. 1651 Solenoid Operated Flow Limit Valve, on installations with many No. 1646 type Solenoid Steam Admission Valves, makes possible layover heat control protection without the use of current by the No. 1646 type Solenoid Steam Admission Valves, thereby preventing depletion of batteries.

IN COOLING, the Solenoid on this Flow Limit Valve is energized to hold the valve fully open. This keeps the steam out of the supply loop, any steam that might be passed by the regulator being short-circuited back to the thermostatic diaphragm to keep the regulator shut off.

CONSTRUCTION FEATURES: The Valve Assembly within the complete device has a silichrome valve within a cage structure of stainless steel, which constitutes the seat. This makes for a positive alignment of the valve and seat. A perforated strainer is pressed into the lower end of the seat to prevent passage of any solid particles that might cause sticking. The stainless steel seat and valve give freedom from rusting and wire drawing, consequently assuring a long life. This valve assembly includes the Solenoid

(Continued on page 4)

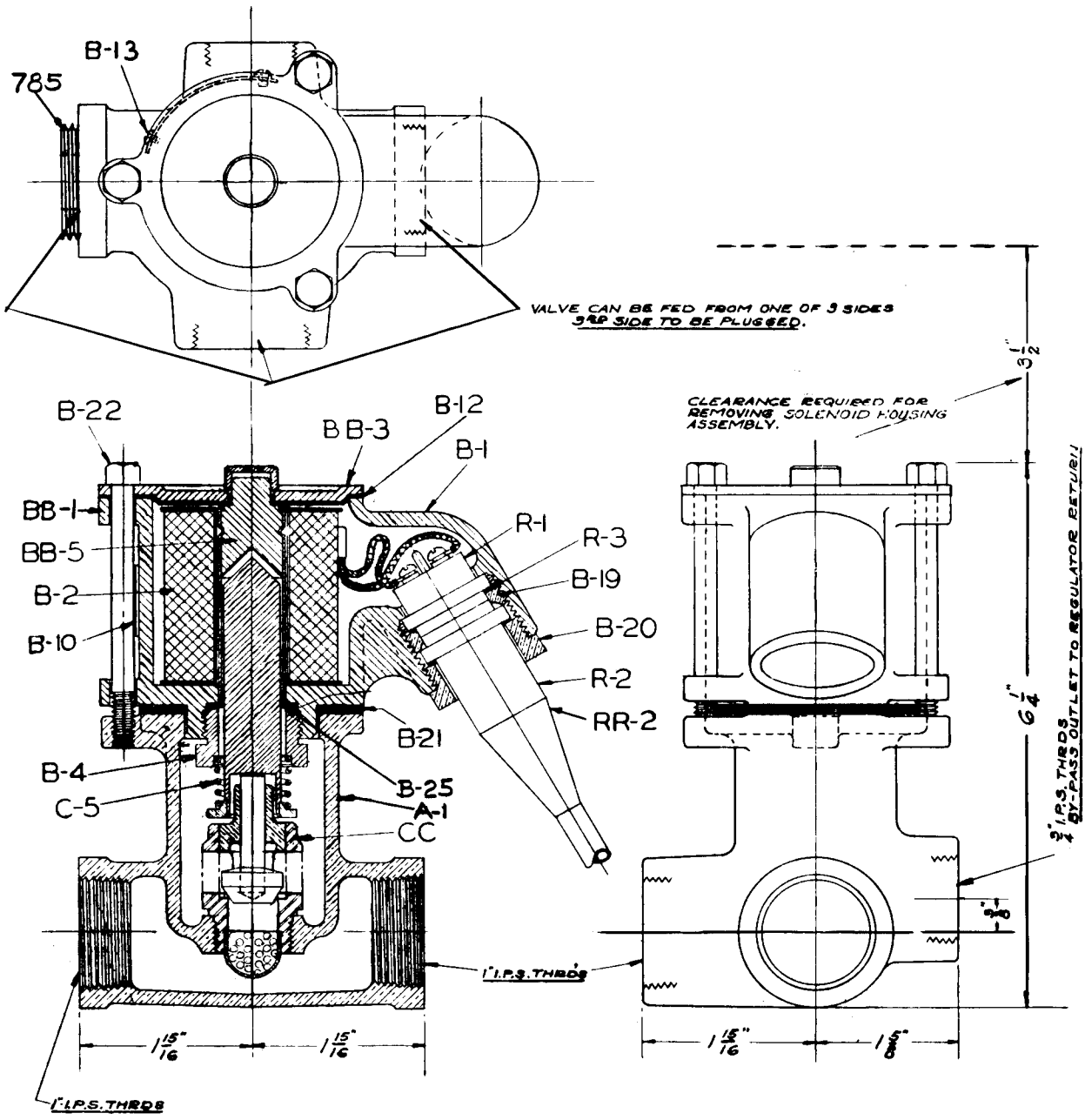
LOCATION AND APPLICATION



The Flow Limit Valve is located in the steam supply line just behind the regulator. The valve can be fed from any one of the three 1" I.P.S. ports, the third one being plugged.

The valve must be installed in such a manner as to provide room for removal of Solenoid and inner valve assembly.

A ¾" Angle Valve must be installed in the by-pass connection to allow for closing, when testing the system or when valve fails to provide steam for the system. Otherwise, this Emergency By-Pass Angle Valve is to be open at all times.



LIST OF PARTS

SYM.	PART NO.	DESCRIPTION	AM'T
A-1	S-1651-A-1	Body	1
BB-1	1651-BB-1	Solenoid Housing (Compl. less RR-2 Connector Receptacle)	1
B-1	1651-B-1	Housing, Solenoid	1
B-2	1651-B-2	Solenoid Coil	1
BB-3	1651-BB-3	Cover, Solenoid Housing	1
B-4	1651-B-4	Retaining Nut, Guide Tube	1
BB-5	1651-BB-5	Guide Tube Assembly	1
785	785	Plug—1" Std. Pipe Countersunk Type	1
B-10	1651-B-10	Name Plate	1
B-12	1651-B-12	Gasket	1
B-13	6x32x3/16" long	Screws—R. H. M.	2

SYM.	PART NO.	DESCRIPTION	AM'T
B-19	1646-B-19	Connector Locking Ring	1
B-20	1646-B-20	Connector Jam Nut	1
B-21	1646-B-21	Gasket	1
B-22	¼x20x3" long	Cap Screw—Hex. Hd.	3
B-25	1646-B-25	Gasket, Copper	1
CC	1651-CC	INLET VALVE & CORE ASSEMBLY	1
	1651-CC-1	Inlet Valve Assembly	
	1651-CC-7	Core Assembly	
C-5	1651-C-5	Spring	1
R-1	1646-R-1	Connector Plug	1
R-2	1651-R-2	Connector Receptacle	1
R-3	1646-R-3	Washers	2
RR-2	1651-RR-2	Connector Receptacle (Includes B-20, R-2 & R-3)	1

NOTE: Specify voltage when ordering Solenoid coil or complete valve.

For TESTING and MAINTENANCE see following page

plunger or core and other parts, which are not separately available for replacement, as it is not possible to renew these parts without special tools for taking the parts apart.

A connector plug with locking ring is incorporated into the Solenoid housing and a cord about four (4) feet long with a special receptacle fitting at one end, is provided, but is wrapped separately for shipment with each valve. The cord plugging arrangement includes a jam nut, which must be unscrewed to release the receptacle and cord.

TESTING

No routine testing of this device is required. However, in the event operation is not quite satisfactory, or at time of overhaul, an air test or steam test can be given this device to check the opening pressure of the valve, which should be between 7½ and 8½ pounds. Should the by-pass pressure not be between the proper limits, and the fault does not lie with the "Economy Diaphragm" in the Regulator, the free height of the valve spring should be checked. This free height should be 2⅝" for springs relieving at about 8 lbs. pressure.

MAINTENANCE

This device should be checked and overhauled each year, before the beginning of the heating season. The inner valve assembly should be removed and thoroughly cleaned, particularly the strainer. The stem must guide freely in the cage seat and the core or plunger must not bind. In the event the seat or valve are pitted or so worn that they do not seat tight, the valve and seat arrangement must be replaced. If the valve body is not steam tight, the hex head cap screws that connect the Solenoid housing to the valve body should be tightened; the gasket may have to be replaced. The valve should then be tested, as indicated under the caption "TESTING."

At time of overhaul old type inlet valve assemblies provided with ball valves should be replaced by latest type provided with needle type valves. Also, old type 5-lb. springs should be replaced by latest type 8-lb. springs.

No attention of any sort, inspection, testing or maintenance, should be required during the heating season.

Should the Flow Limit Valve fail to provide steam for the heating system, the ¾" Emergency Angle Valve in the by-pass connection should be closed to provide steam for the system, until repairs can be made.

❖ ❖ ❖ ❖ ❖

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No. 1653 FLOW LIMIT VALVE

WEIGHT 4 LBS.

GENERAL DESCRIPTION

This is a spring loaded relief valve for use on Zone Type Heating System installations for limiting the flow of steam to the steam supply loop, by modulating the thermostatic diaphragm in the Steam Regulator. This valve is the same as the No. 1651 in principle and operation, except for the fact that it is entirely non-electrical, that is, it does not have a solenoid for low heat control operation during layover. Layover heat control is accomplished in the conventionally known ways (use of No. 1851 Air Selector Switch, pulling light switch, etc.), on installations using the No. 1653 Flow Limit Valve. Further, inasmuch as this valve is not solenoid operated, steam is not kept out of the supply loop under the car during cooling.

This valve discharges any excess flow of steam (above 8 lbs. pressure) to the thermostatic "Economy Diaphragm" chamber of the Regulator to expand the diaphragm and thus control the volume of steam supplied to the heating system in the same way as the No. 1651 Flow Limit Valve.

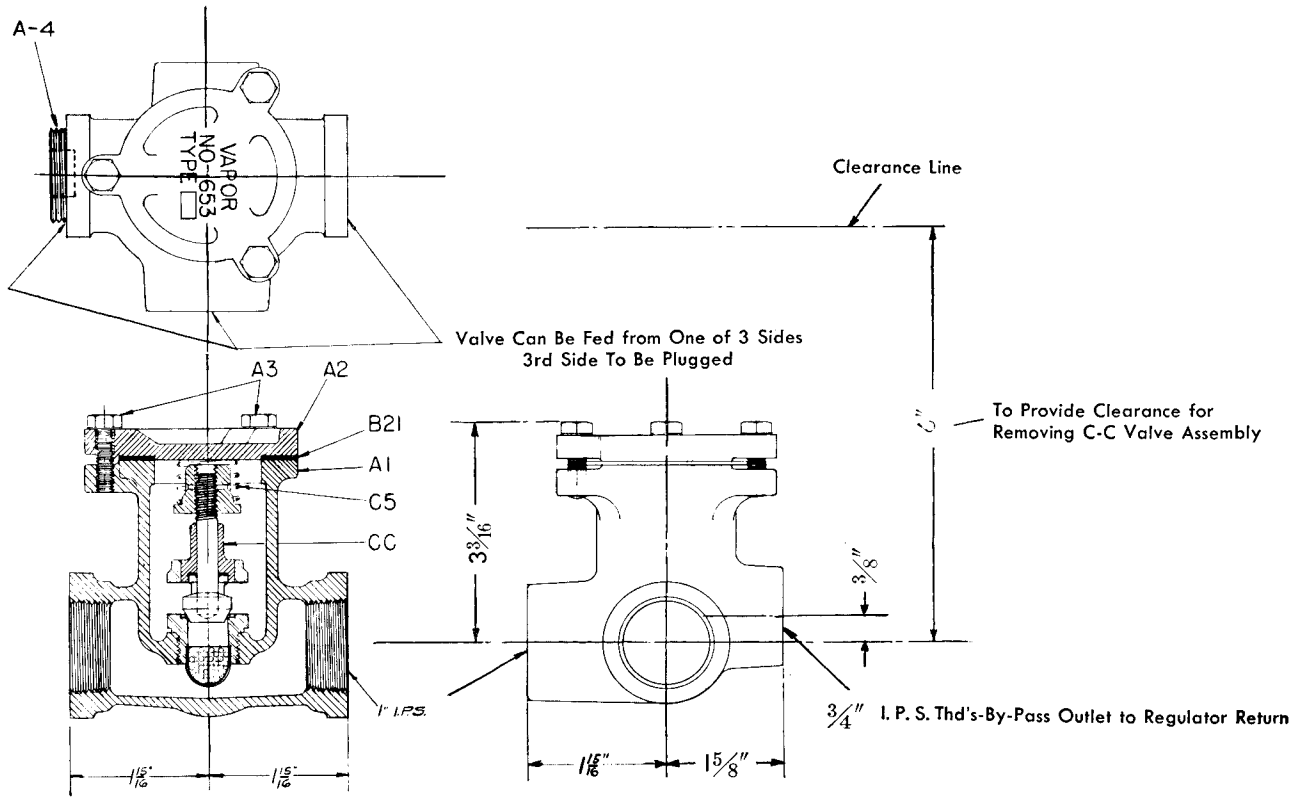
The Valve Assembly within the complete device is somewhat different than on the No. 1651 Flow Limit Valve, but incorporates the same spring loaded type relief valve in a cage type stainless steel valve seat. The several parts constituting the Valve Assembly are not separately available for replacement, as they are pressed together and it is not possible to renew any of the parts without special tools for taking them apart.

Where the No. 1651 Flow Limit Valve is used, all floor heat solenoid steam admission valves remain de-energized (in the "off" position) during layover and the solenoid of the No. 1651 Flow Limit Valve controls layover heat, by being energized intermittently by a special layover thermostat used.

Where the No. 1653 Flow Limit Valve is used, all the solenoid steam admission valves are directly and intermittently energized during layover to maintain required low heat control temperature.

For information on location, application and testing, see Bulletin No. 61-711 on the No. 1651 Flow Limit Valve.

No. 1653 FLOW LIMIT VALVE (Cont.)



LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T
A-1	S-1651-A-1	Body	1
A-2	1653-A-2	Cap	1
A-3	¼"—20 Hex. Hd., ⅞" long	Screw, Cap	3
A-4	785	Plug—1" Std. Pipe—Countersunk Type	1
B-21	1646-B-21	Gasket	1
C-5	1651-C5-B	Valve Spring	1
CC	1653-CC	Inlet Valve Assembly	1

MAINTENANCE

This device should be checked and overhauled each year, before the beginning of the heating season. The Inlet Valve Assembly should be removed and thoroughly cleaned, particularly the strainer. The stem must guide freely in the cage seat. Should the seat or valve be pitted or so worn that they do not seat tight, the valve and seat cage arrangement should be replaced. Where inlet valve assembly has a ball valve, it should be replaced by a needle type valve assembly, which is obtainable under the same No. 1653-CC as the former ball valve assembly. If the valve body is not steam tight, the hex. head cap screws that connect the cap to the valve body should be made tight; the gasket may have to be replaced. The valve should then be tested to determine if the opening pressure is between 7½ and 8½ pounds. Old 5-lb. pressure springs should be replaced at time of overhaul with latest 8-lb. springs. Should the by-pass pressure not be between indicated limits and the fault does not lie with the "Economy Diaphragm" in the Regulator, the free height of the valve spring should be checked to see if it still is $\frac{43}{64}$".

No attention of any sort, inspection, testing or maintenance, should be required during the heating season.

Should the Flow Limit Valve fail to provide steam for the heating system, the ¾" Angle Valve applied in the by-pass connection should be closed and the system so operated, until repairs can be made.

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Nos. 918 and 920
VAPOR RETARDERS

NO. 918—¾" I.P.S. CONNECTIONS — WEIGHT 2½ LBS.
NO. 920—1" I.P.S. CONNECTIONS — WEIGHT 3¼ LBS.

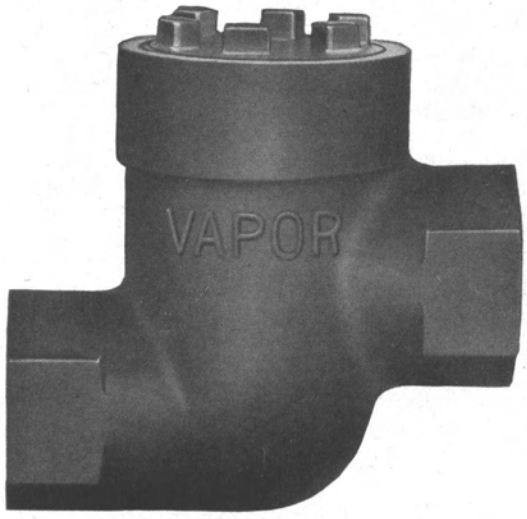

Fig. 1—No. 918 Vapor Retarder.

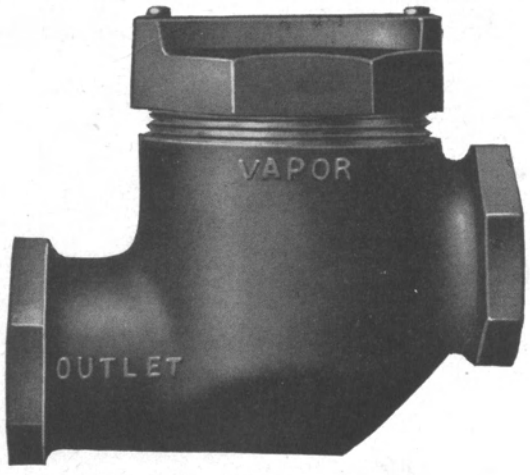

Fig. 2—No. 920 Vapor Retarder.

GENERAL DESCRIPTION

The No. 918 Vapor Retarder is a condensate release fitting designed to retain steam in the radiation of railway cars as long as it is useful as a heating medium.

This retarder is used above the floor of the car in the return line from a piece of radiation. It is furnished for ¾" pipe connections.

In the presence of steam the thermostatic bellows in this device expands to seat a needle valve located on the bottom of the bellows, which stops the flow of steam. When the steam in the radiation cools and forms condensate, the bellows cools and contracts, opening the needle valve to again allow the condensate to pass into the return section of the supply loop for discharge.

The No. 920 Vapor Retarder is also a condensate release fitting, but of sturdier construction for use in the underneath supply loops of cars. It differs from the No. 918 retarder in size, having 1" pipe connections and a larger thermostatic bellows but its principle of operation is the same.

It is designed to retain steam in the feed section of the supply loop so that it is available to the heating equipment at all times. It is also used in the return line from overhead radiators.

The No. N-920 Vapor Retarder is a condensate release fitting, generally used in the return line from overhead radiators when condensate is to be discharged directly to the ground instead of being returned to the regulator drain tube. This retarder is like the No. 920 retarder except that the seat is notched to provide a tiny steam bleed when the retarder is closed to prevent condensate from freezing in the piping.

MAINTENANCE AND OVERHAUL

The tiny wisp of steam escaping from the drain pipe of the No. N-920 Retarder is proper; only a heavy steam blow at this point indicates a need for attention.

A steam blow from the outer drain tube of a

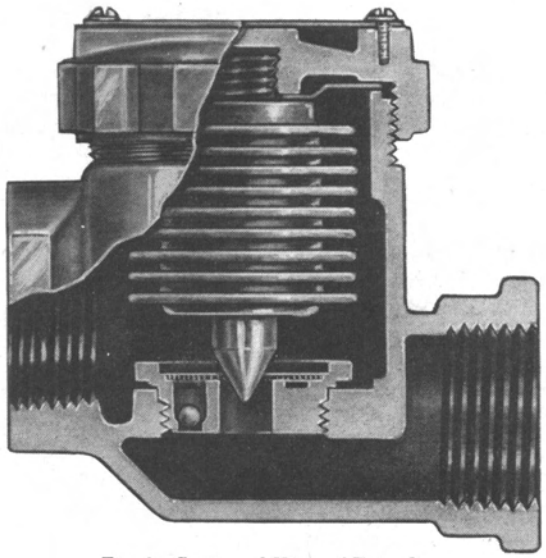

Fig. 3—Sectioned View of Retarder.

regulator usually indicates that a retarder is in need of attention. For details on this condition see Bulletin 61-700-1, p. 7.

Retarders should be dis-assembled, cleaned and inspected at least once every two years. To disassemble the unit, unscrew the cap (sym. 3), remove the bellows assembly (sym. 4) and the seat (sym. 2). Clean each part carefully before reassembling. Do not disassemble the vacuum breaker seat to clean it.

To test a thermostatic bellows for leaks, place it in a suitable holding fixture and submerge it in boiling water. Leaks will be shown by bubbles rising in the water. Distorted or leaking bellows should be discarded; those in good condition should be submerged in cold water to cool and contract before they are removed from the holding fixture. A suitable holding fixture is shown in our drawing No. 22659, copies of which are available upon request. CAUTION: Do not remove thermostatic bellows from retarder while hot, nor subject it to live steam when not enclosed, as it will become over-expanded and will not return to its fully contracted form.

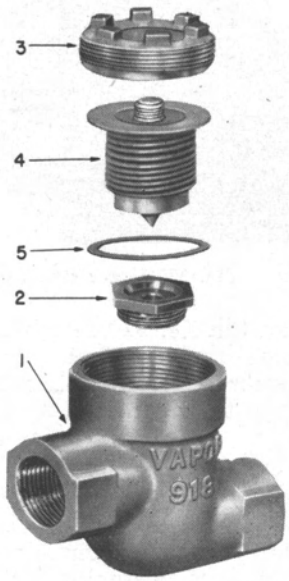

Fig. 3. Exploded View of No. 918 Vapor Retarder.

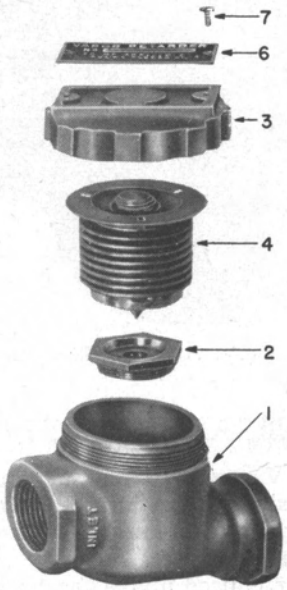

Fig. 4. Exploded View of No. 920 Vapor Retarder.

LIST OF PARTS
No. 918 VAPOR RETARDER

Sym.	Part No.	Description	Amt.
1	918-1	Body	1
2	1677-AA-9	Seat, Vacuum Breaker (Replaces 1671-A-9 Seat)	1
3	1671-A-10	Cap (Bellows Retaining)	1
4	1671-EE	Bellows Assembly	1
5	1671-A-17	Gasket	1

LIST OF PARTS
No. 920 VAPOR RETARDER

Sym.	Part No.	Description	Amt.
1	914-B	Body	1
2	920-GG	Seat, Vacuum Breaker (Replaces 920-G Seat)	1
3	914-C	Cap	1
4	920-EE	Bellows	1
6	13755	Nameplate	1
7	4″ x 3/16″ Lg.	Screw (Bd. Hd. Self Tapping)	2

LIST OF PARTS
No. N-920 VAPOR RETARDER

Sym.	Part No.	Description	Amt.
†	920-N	Seat (Notched)	1

Note: † Not shown.
Other parts of No. N-920 Retarder are the same as for No. 920 Retarder.

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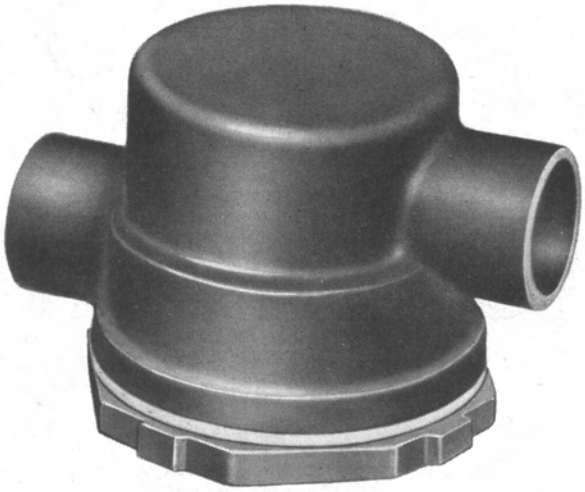
No. 926 SERIES VAPOR RETARDERS

BELLOWS AND SEAT REMOVABLE FROM RETARDER BOTTOM

INLET: 1⅛" O.D.C.T. WEIGHT: APPROX. 4½ LBS. OUTLET: 1⅛" O.D.C.T.



No. 926 Vapor Retarder

GENERAL DESCRIPTION

The No. 926 Series Vapor Retarders are condensate release fittings, similar in function and operation to the No. 920 retarder. They are designed so that the bellows and seat may be removed from the bottom of the retarder body for inspection and maintenance and are applied where car piping prevents easy access to a standard retarder for inspection or maintenance. These retarders are provided with plain ends for sweat fitting to 1⅛" O.D.C.T. and when connection to threaded pipe is required, they must be equipped with adapter fittings in the inlet and outlet.

In the presence of steam the thermostatic bellows expands to seat its valve (located on the bottom of the bellows) and stop the flow of steam. Condensate, formed when the steam in the retarder body cools and condenses, is permitted to pass through the retarder when the bellows cools and contracts to unseat its valve.

No. 926 This retarder is provided with a needle type valve and a tapered seat. It has been used in under-car piping where a retarder is required over truck areas and standard type retarders present difficulties in removal of the bellows and seat for maintenance and inspection.

No. A-926 This retarder is provided with a flat type valve and a flat seat to permit immediate discharge of condensate when the valve is clear of its seat. It is used in under-car piping in truck areas and also as a drain at the end of radiation piping where there is no return to the regulator.

No. N-926 This retarder is provided with a similar valve and seat to that used in the No. 926 Vapor Retarder, except that the seat is notched in two places to permit condensate to drain even when the valve is closed. It is used in the return piping from overhead radiators when specifically requested.

No. NA-926 This retarder is provided with a notched flat type seat to serve two functions. It permits immediate discharge of condensate when opened and also provides a bleed feature when closed to prevent freezing in the line. It is used in the return from the overhead radiator when condensate is discharged directly to the ground instead of being returned to the regulator drain tube.

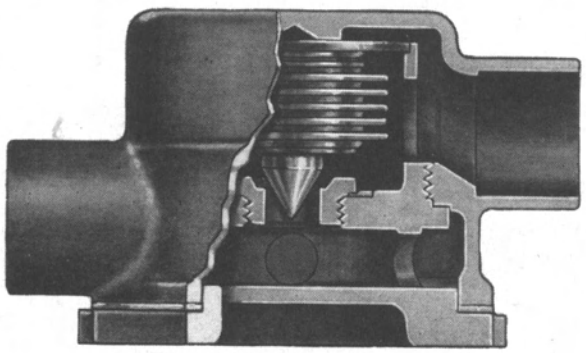
MAINTENANCE AND OVERHAUL

The tiny wisp of steam escaping from the drain pipe of the Nos. N-926 and NA-926 Retarders is proper; only a heavy steam blow at this point indicates a need for attention.

A steam blow from the outer drain tube of a regulator generally indicates that the loop retarder of that loop is in need of attention. For details concerning this condition, see Bulletin 61-700-1, page 7.

Retarders should be disassembled, cleaned and inspected for wear at every shopping period, or at least once every two years. Never remove the bellows while hot; always allow five minutes after steam is shut off for the bellows to cool. To disassemble the No. 926 Retarder, unscrew the bellows retainer (sym. 2) remove the gasket (sym. 5) and the thermostatic bellows (sym. 3); then unscrew the seat (sym. 4). Clean each part carefully and inspect for indications of wear before reassembling. If the seat is too badly worn or wire drawn it should be replaced. Test the thermostatic bellows and replace if overexpanded.

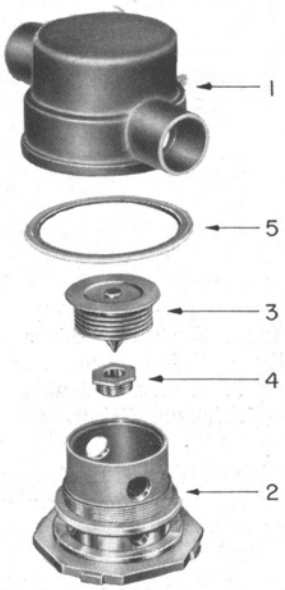
To test a thermostatic bellows for leaks, place it in a suitable holding fixture and submerge in water at about 190 degrees F. Leaks will be shown



Sectioned View of No. 926 Retarder

No. 926 SERIES RETARDERS (Continued)

by the rising of bubbles in the water. Distorted or leaking bellows should be discarded; those in good condition should submerged in cold water to cool and contract the bellows before removing it from the holding fixture. A suitable holding fixture is shown in our Drawing 22659, copies of which are available upon request. CAUTION: Do not remove the bellows from the retarder while hot, nor subject it to live steam when not enclosed as it will become over-expanded and will not return to its normal fully contracted form when cooled.



LIST OF PARTS

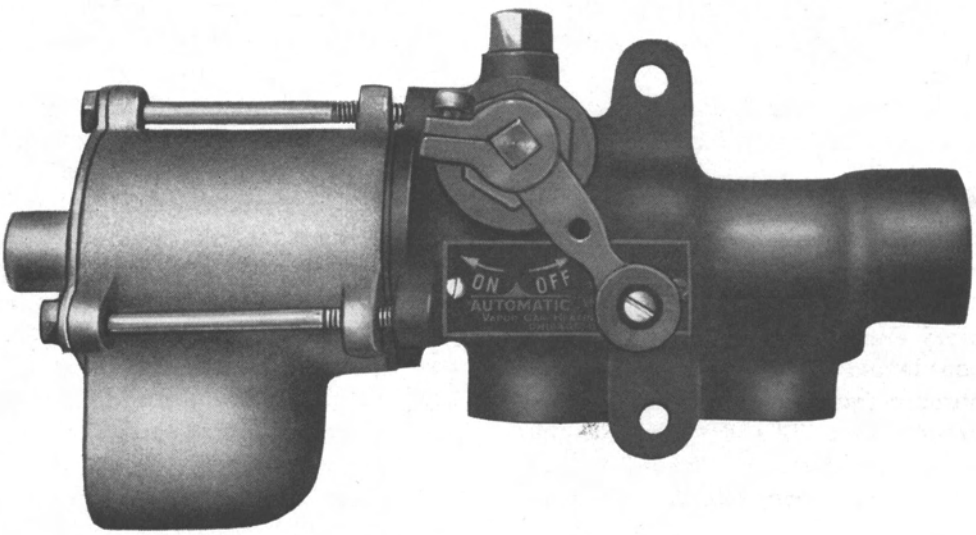
Sym.	Part No.	Description	Amt.
1	926-B	Body	1
2	926-C	Retainer, Bellows	1
3	926-EE	Bellows Assembly (For Nos. 926 and N-926 Retarders)	1
	A-926-EE	Bellows Assembly (For No. A-926 and NA-916 Retarders)	1
4	926-G	Seat (For No. 926 Retarder)	1
	A-926-G	Seat (For No. A-926 Retarder)	1
	926-N	Seat (For No. N-926 Retarder)	1
	NA-926-G	Seat (For No. NA-926 Retarder)	1
5	926-J	Gasket	1

No. 1646 SOLENOID STEAM ADMISSION VALVES

No. R-1646—R. H. Type **No. L-1646—L. H. Type**

FOR DIRECT CURRENT ONLY

FEED INLET — ¾" I. P. S.
RETURN OUTLET — ¾" I. P. S.
POWER CONSUMPTION — 10 WATTS at 32 V., D. C.
WEIGHT — 8¼ LBS. MAX. PRESSURE — 15 LBS.



GENERAL DESCRIPTION

This is an improved Solenoid Steam Admission Valve for controlling the flow of steam into a radiator, the valve being adapted for operation either thermostatically by suitable electrically actuated mechanism, or manually, with means for locking the valve yieldably in either open or closed position.

While this valve can be used to control the flow of steam into substantially any type of radiator, it is especially designed for use on Vapor Company's Zone Type Floor Heating System with a radiator of the "Inner-Feed" type (Unit Fin Radiation), comprising a pair of concentric pipes, one within the other, the outer pipe being finned.

The valve rests normally in the open position, and is closed electrically through the energizing of the single solenoid by the thermostat circuit. When the thermostat circuit is broken, the solenoid is de-energized and the valve will open mechanically to admit steam into the radiator. It takes continuous current to hold these valves in the closed position. However, the power consumption is only 10 watts at 32 volts D. C. While these valves will be energized during the cooling season, in order to hold them in the closed position, this is not objectionable, because of the low wattage consumption. Current is only consumed when the solenoid is energized, that is, whenever the valve is in the magnetically closed position.

These valves are available with the steam portion either on the right hand side or left hand side of the valve. The right hand side valve is known as R-1646; the left hand side valve is known as L-1646.

CONSTRUCTION AND ADVANTAGES

No packings are used in the construction of these valves. The conventional limit switches are also not used. Thus, the usual maintenance attention required on solenoid or magnetic type valves is eliminated.

Only one solenoid is used, whose movable core provides the electrically actuated means, when the solenoid is energized, for moving the valve to the closed position, against the opposition of a spring.

Whenever the solenoid coil is de-energized, the compression spring confined between the collar on the valve stem and the member bearing against the solenoid core extension rod will expand to move the valve stem outwards and so open the valve.

Whenever electric power is cut off or fails, valve will open automatically for admission of steam to the system.

The Inlet Valve Assembly comprises a Silichrome Needle Valve slidably guided within a cage structure of stainless steel, which constitutes the seat.

The Solenoid Assembly comprises a casing enclosing the solenoid coil, the movable solenoid core and the core retaining nut assembly. The retaining nut has pressed fitted into itself a guide tube for the core extension rod. The guide tube, which also serves as a core stop, fits within the solenoid casing.

A series of longitudinally extending drainage slots are formed in the outer surface of the guide tube or core stop for the purpose of draining the solenoid of condensate. When the solenoid is de-energized, the spring will expand to open valve and clamp the head of the collar on the valve stem against head of retaining nut, so as to effectively close the drain slots, as well as the central bearing passage in which the core rod is mounted. When the valve is in the closed position, the drain slots will open, so as to permit condensed steam to drain out of the solenoid assembly, that is from space within solenoid guide tube.

An integral casing extension projects from one side of the solenoid housing through which the circuit wires extend from the ends of the solenoid winding and connect with terminals at inner end of a connector plug held in place by locking ring screwed into threaded passage in the housing extension. A cord about 18 inches long with a special receptacle fitting at one end is provided, but is wrapped separately for shipment with each valve. The receptacle is held in place by a jam nut, screwed into the outer end of threaded passage of this housing extension. To remove the cord, simply screw out the jam nut and then pull out the receptacle and cord. The inner plug does not have to be disturbed.

The core bearing rods are made of stainless steel and all exposed iron parts are treated or plated to resist corrosion.

THERMOSTATIC OPERATION

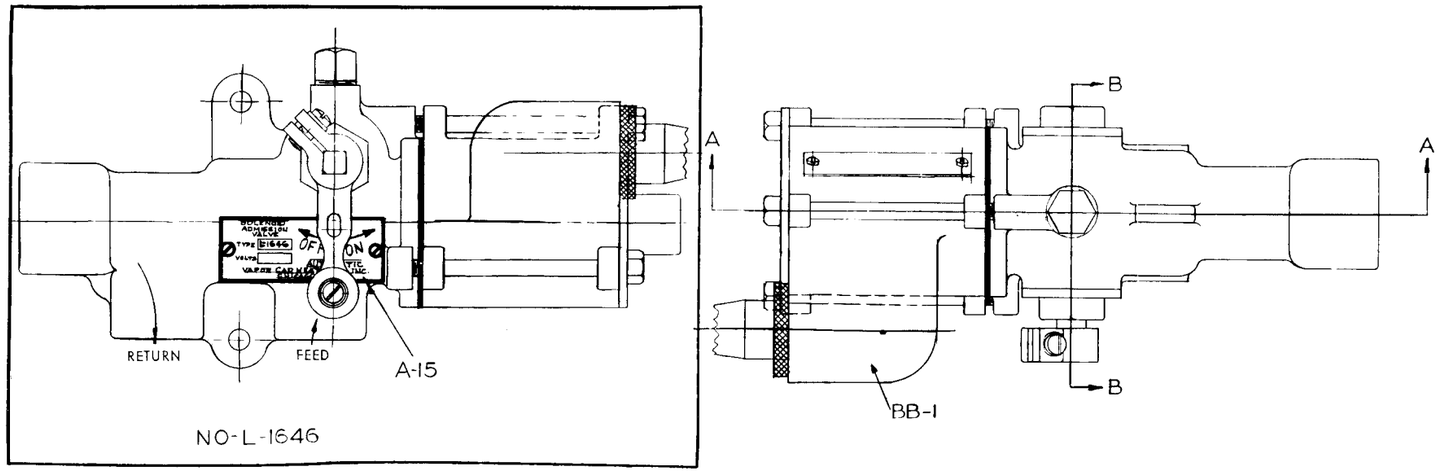
For thermostatic operation, the manually operable mechanism must be at "Automatic," that is the crank or operating rod handle must be in vertically central position. In this position, the valve is freely movable by the solenoid.

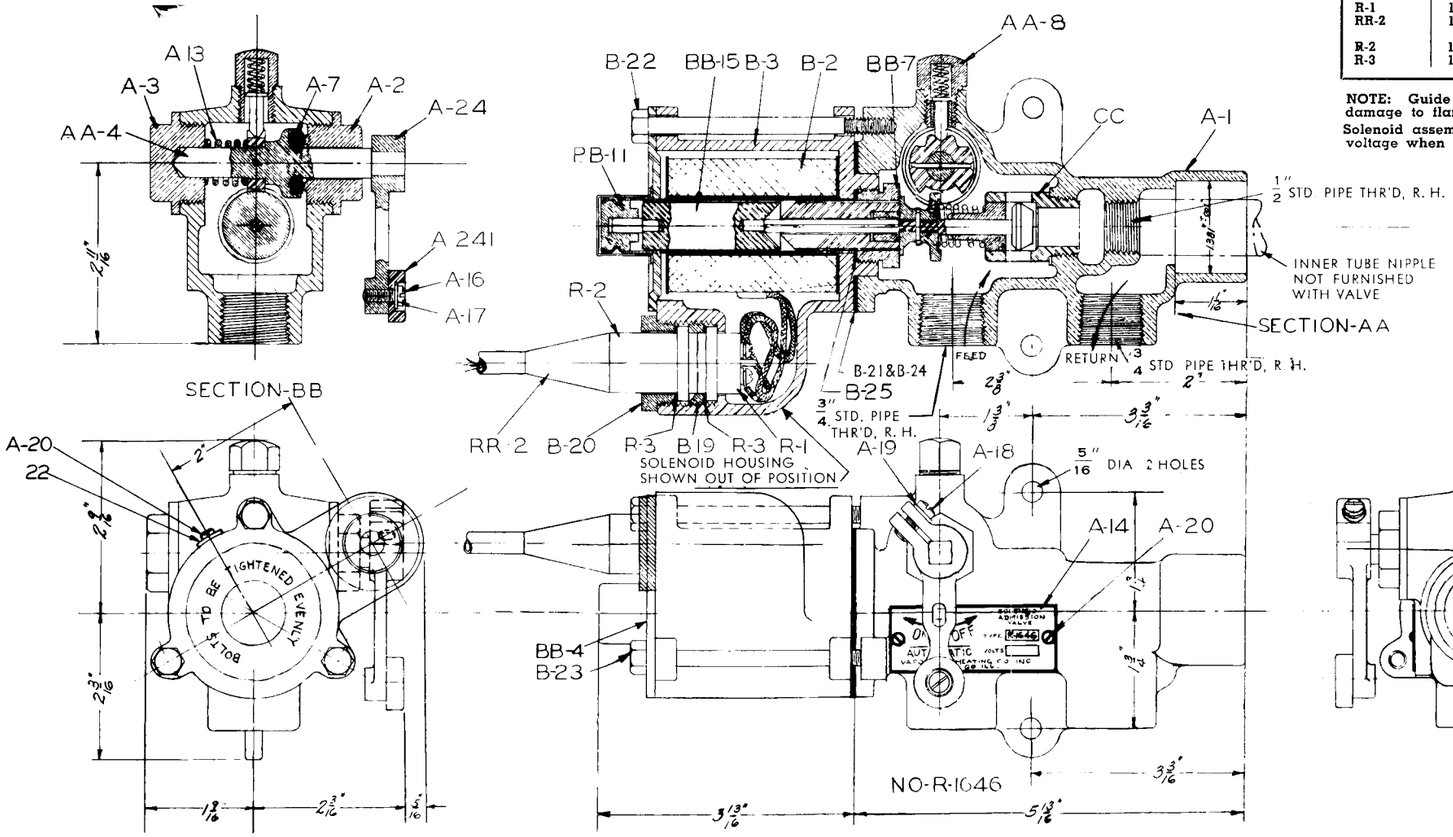
When heat is required, the mercury column in the thermostat will not be in contact with the upper thermostat contact, and therefore, the relay coil will be energized. The core of the thermostatic relay will be lifted so as to keep the relay contacts open and no current will flow to the solenoid of the steam admission valve. As the solenoid will not be energized, at this time, the spring on the valve stem will move the valve to the open position, and radiator will receive steam.

When desired temperature is reached, the mercury column within the thermostat will engage the upper thermostat contact and de-energize the relay. The contacts on the relay will then automatically close, thus completing the circuit to energize the solenoid on the steam admission valve. The solenoid will then draw in the core and force the inlet valve to the closed position against resistance of spring. This will cut off further flow of steam to the radiator. Obviously, as soon as the temperature has again fallen, so as to break contact between the mercury column and thermostat contact, relay will again be effective to open contacts and de-energize the solenoid, whereupon spring will again open the valve.

The functioning temperature of the thermostat is generally controlled by a remote temperature selector or rheostat, which may be set to temperature desired.

Nos. R-1646 and L-1646 SOLENOID STEAM ADMISSION VALVES





LIST OF PARTS

SYM.	PART NO.	DESCRIPTION	AM'T	MATERIAL
A-1	1646-A-1	Body	1	Brass
A-2	1646-A-2	Seal Retaining Nut	1	Brass
A-3	1646-A-3	Retaining Nut	1	Brass
AA-4	1646-AA-4	Operating Rod Assembly, Incl. A-7 Disc	1	
A-7	1646-A-7	Disc	1	Comp.
AA-8	1646-AA-8	Locking Pin Assembly	1	
A-13	1646-A-13	Operating Rod Spring	1	Steel
A-14	1646-A-14	Name Plate, R. H.—R-1646	1	Enduro
A-15	1646-A-15	Name Plate, L. H.—L-1646	1	Enduro
A-16	No. 10-24 x 1/2" lg.	Screw (Fil. Hd. Mach.)	1	St. C. P.
A-17	No. 10, Split Type	Lockwasher	1	Steel
A-18	1/4"-20 x 1/2" lg.	Screw (Fil. Hd. Mach.)	1	St. C. P.
A-19	1/4"-Split Type	Lockwasher	1	Steel
A-20	No. 4- x 3/16" Parker Kalon	Screw	4	St. C. P.
AA-24	1646-AA-24	Handle, Complete with Knob	1	
A-24	1646-A-24	Handle, Operating Rod	1	Brass
A-241	1646-A-241	Knob	1	Black Fibre
BB-1	1646-BB-1	Solenoid Housing Assembly—Less RR-2 Connector Receptacle	1	
B-2	1646-B-2	Solenoid Coil	1	
B-3	1646-B-3	Solenoid Housing	1	C. I. C. P.
BB-4	1646-BB-4	Solenoid Housing Cover Assembly	1	
BB-7	1646-BB-7	Guide Tube Retaining Nut Assembly	1	
BB-11	1646-BB-11	Guide Tube Assembly	1	
BB-15	1646-BB-15	Core Assembly	1	
B-19	1646-B-19	Connector Locking Ring	1	Brass
B-20	1646-B-20	Connector Jam Nut	1	Brass
B-21 & B-24	1646-B-21 & B-24	Gaskets	1 ea.	Comp. & Brass
B-22	1/4"-20 x 3 1/2" lg.	Cap Screw (Hex. Hd.)	1	St. C. P.
B-23	1/4"-20 x 3 3/4" lg.	Cap Screw (Hex. Hd.)	2	St. C. P.
B-25	1646-B-25	Gasket	1	Dead Soft / Anneal. Copper
22	1657-B-22	Coil Identification Plate	1	Enduro
CC	1646-CC	Inlet Valve Assembly	1	
R-1	1646-R-1	Connector Plug	1	
RR-2	1646-RR-2	Connector Receptacle—Includes B-20, R-2, & R-3	1	
R-2	1646-R-2	Connector Receptacle	1	
R-3	1646-R-3	Washers	2	Brass

NOTE: Guide tube, if stocked separately, must be handled carefully to avoid damage to flange.

Solenoid assembly carries name plate indicating voltage and coil number. Specify voltage when ordering complete solenoid or coil.

NOTE:
WHEN ORDERING, SPECIFY VOLTAGE REQUIRED, THUS:
32 V., D.C.
64 V., D.C.
110 V., D.C.

MANUAL OPERATION

A handle and knob arrangement is provided for manually setting these valves to "ON" or "OFF" position. This arrangement will allow valves to be operated manually in case of thermostatic control failure. Also, this arrangement will allow the occupant of a room to have heat admitted manually into the room during cooling, should he consider the room too cool for his personal comfort. However, where the No. 1651 Flow Limit Valve is used, the emergency heat switch provided on the air conditioning panel must be set to the heating position.

The manually operable handle or lever will normally be in vertical position in which position a free control of valve by solenoid and spring is permitted. If this lever is swung to position indicated on dial as "OFF", the collar on the valve stem will be engaged by a cam and the valve will be moved to the closed position. On the other hand, if lever is swung in the opposite direction to the "ON" position, the collar on the valve stem will be engaged from the opposite side by the cam disc and the valve will be moved to and held in the open position. On left hand type valves, the operating handle or lever is swung in the clockwise direction to the "OFF" position; on right hand type valves, the lever is swung counter-clockwise to the "OFF" position.

INSTRUCTIONS FOR TRAINMEN

The Air Conditioning Control Switch must be in the HEATING sector to provide automatic temperature control of both overhead heating and floor heating.

To obtain automatic operation of floor heat valves, they must have the handle or knob arrangement at "Automatic" position.

IMPORTANT: At end of trip, before leaving car, see that all No. 1646 Solenoid Steam Admission Valves are in the center or "Automatic" position. If these valves are not placed in Automatic position, floor heat will not be thermostatically controlled at low temperature during layover and there may be a possibility of freezing. The air conditioning control switch and the blower starter switch on the air conditioning panel must be at "OFF" positions.

APPLICATION AND LOCATION

A minimum space of 4" is required between the solenoid end of steam admission valve and the nearest obstruction.

On unit fin radiator installations, the inner feed radiator pipe is threaded into the inner threaded ½" port provided inside the valve. The outer pipe or tube is brazed into the larger outer port. Where plain fin radiators are used, the ¾" return outlet is plugged, the return pipe being connected directly to the return portion of the steam supply loop, the No. 897 Retarder being used in the return line connection, as before.

For general schematic application diagram, see separate Bulletin on Zone Control System of Train Heating.

For remote manual operation of valves, the No. 1643 Remote Control Operating Mechanism is used for partition applications, while the No. S-1643 Remote Control Operating Mechanism is used for side wall applications. The No. 1644 Remote Control is used on valve applications in open body cars, when valve is located under seat at end of coach section.

The Remote Manual Control Operating Mechanisms are used when valves are located in not very accessible places for manual operation. These mechanisms are flexible shaft attachments for connecting to the outer end of manual lever in lieu of knob for operating the valve manually from a distance for the convenience of the passengers.

These valves can be reversed from R. H. to L. H. operation by removing the plugs and reversing the entire manually operable assembly, shifting end for end, so as to place the operating handle on either side of valve casing, as may be most convenient in any particular installation.

MAINTENANCE

Solenoid Steam Admission Valves should be overhauled once a year, before the beginning of the heating season. At time of overhaul, the valve and seat should be checked for tight seating. In the event these are scored and do not seat tight, the inlet valve assembly should be replaced. The Inlet Valve Assembly can be removed with a standard spark plug wrench. The solenoid housing and complete valve should be thoroughly cleaned and thermostatic operation should be checked for valve and core binding, mis-alignment or seizing. The manually operable mechanism should be likewise checked for freedom from binding and seizing, and corrections should be made, if necessary. Should seat disc on manual operating rod be loose, it should be recemented in place.

Should this solenoid valve fail in service because of power or thermostat failure, it will do so in the "ON" position. The valve should then be operated manually to prevent overheating of car. Failure should be reported upon arrival at terminal.

The yard forces are to examine the thermostat, etc., on arrival. In the event thermostat and relay function satisfactorily, and the floor cycling resistors as well as rheostat or adjustment resistors are O. K., the valve should be examined for grounding due to moisture in the solenoid housing. However, ordinarily grounding should not occur, as the seal provided against steam leakage into the electrical portion is as perfect as possible.

The Inlet Valve Assembly can be removed with a standard 1" spark plug wrench (long type).

The Connector Locking Ring (Symbol B-19) can be removed with Vapor Company's No. 14182 Wrench, which can be purchased from the Vapor Car Heating Co.

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INSTRUCTIONS FOR REVISING OF Nos. 1646, 1647, 1657, 1658 and 1659 SOLENOID STEAM ADMISSION VALVES

A decided improvement in operation and a reduction in maintenance attention requirements will be obtained by revising the above named solenoid steam admission valves to provide a packing arrangement on the operating rod and an external means of locking the operating handle in either "off", "Automatic" or "on" position.

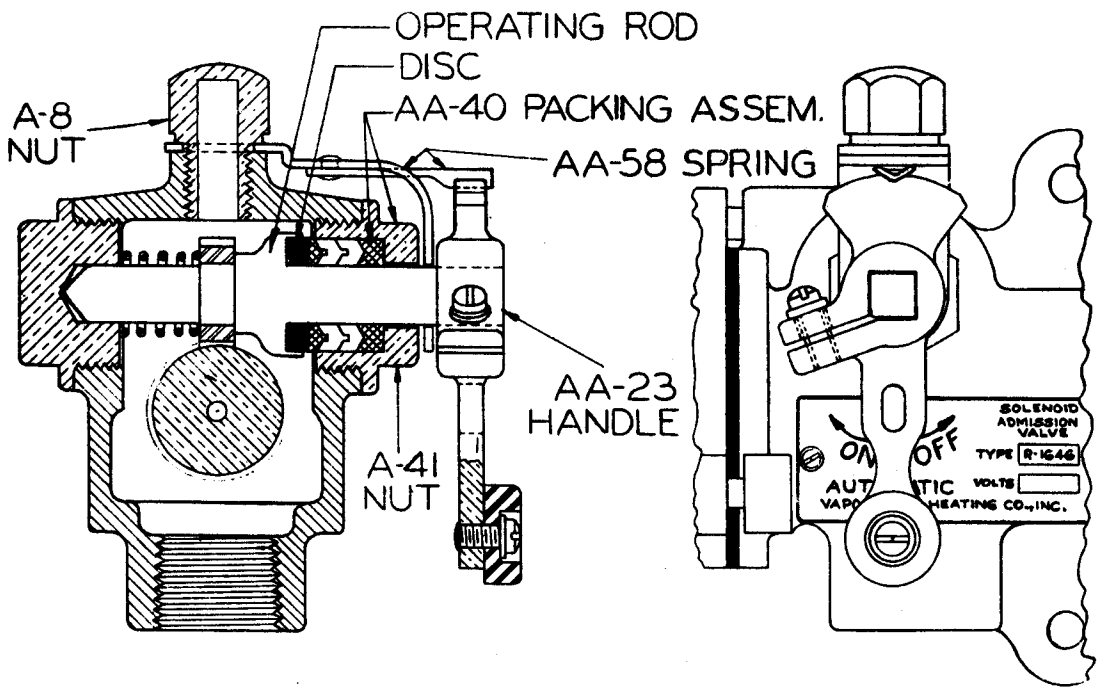
The application of the Packing Arrangement will positively eliminate leakage encountered around the Operating Rod past the Retaining Nut.

The replacement of the present internal method of locking the operating rod by an external arrangement of spring locking the Operating Handle will prevent interference with free movement of the handle due to sticking of the old locking pin because of corrosion and other difficulties.

To revise these valves the following revision material should be purchased per valve:

1 No. 1646-AA-40 Packing Assembly
1 No. 1646-AA-23 Operating Handle Assembly
1 No. 1646-AA-58 Spring

The present No. 1646-AA-8 (sym. A-8) Locking Pin Assembly should be taken out, its spring and pin removed, and the remaining Hex. Nut No. 1646-A-8 reapplied in all cases. Where no Remote Control Operating Attachment is used for the valve, this Hex. Nut (sym. A-8) is used to hold the new No. 1646-AA-58 External Spring in place. Where Operating Attachments are used, the External Spring (sym. AA-58) need not be applied, as friction in attachment will hold the valve in position.



The new No. 1646-AA-23 Operating Handle Assembly is then substituted for the old Operating Handle Assembly and anchored in place. The new handle may be applied either right hand or left hand to suit the Operating Attachment when used.

It is important that the spring and locking pin in the Hex. Nut (sym. A-8) are removed, as these parts would cause binding of the Operating Rod due to rust and corrosion, and cause interference with the free movement of the Operating Handle.

NOTE: On latest type valves equipped with Chevron Packings on the Operating Rod at the factory, the Disc is not used and is not required. The valves of present manufacture have a redesigned type Retaining Nut for the No. 1646-AA-58 Spring.

Nos. SR-1646 AND SL-1646 SOLENOID STEAM ADMISSION VALVES

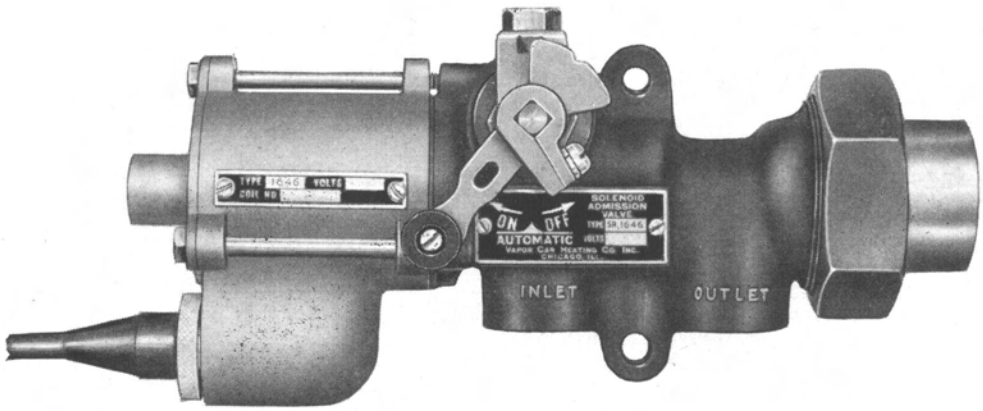
(Iron Body Type)

No. SR-1646—R. H. Type **No. SL-1646—L. H. Type**

FOR DIRECT CURRENT ONLY

FEED INLET—¾" I. P. S.
RETURN OUTLET—¾" I. P. S.

POWER CONSUMPTION—10 WATTS AT 32 VOLTS D. C.
WEIGHT—10¼ LBS. MAX. PRESSURE—15 LBS.



GENERAL DESCRIPTION

These valves are the same as the Nos. R-1646 and L-1646, except for the fact that steam portion body is of cast iron instead of brass, and that the body incorporates a union connection to the radiator, making possible either a soldered or a screwed connection to the radiator thru the use of proper tail piece.

When ordering specify whether for 1⅜" O. D. Copper Tubing or for 1¼" Pipe. Also, specify voltage.

OPERATION

For information on Manual and Thermostatic operation, as well as for Instructions for Trainmen, see Bulletin 61-741 covering R-1646 and L-1646 Valves.

APPLICATION AND LOCATION

Application and location recommendations are the same as for R-1646 and L-1646 Valves.

MAINTENANCE

See Bulletin 61-741 for recommendations on maintenance.

Nos. SR-1646 and SL-1646 Solenoid Steam Admission Valves

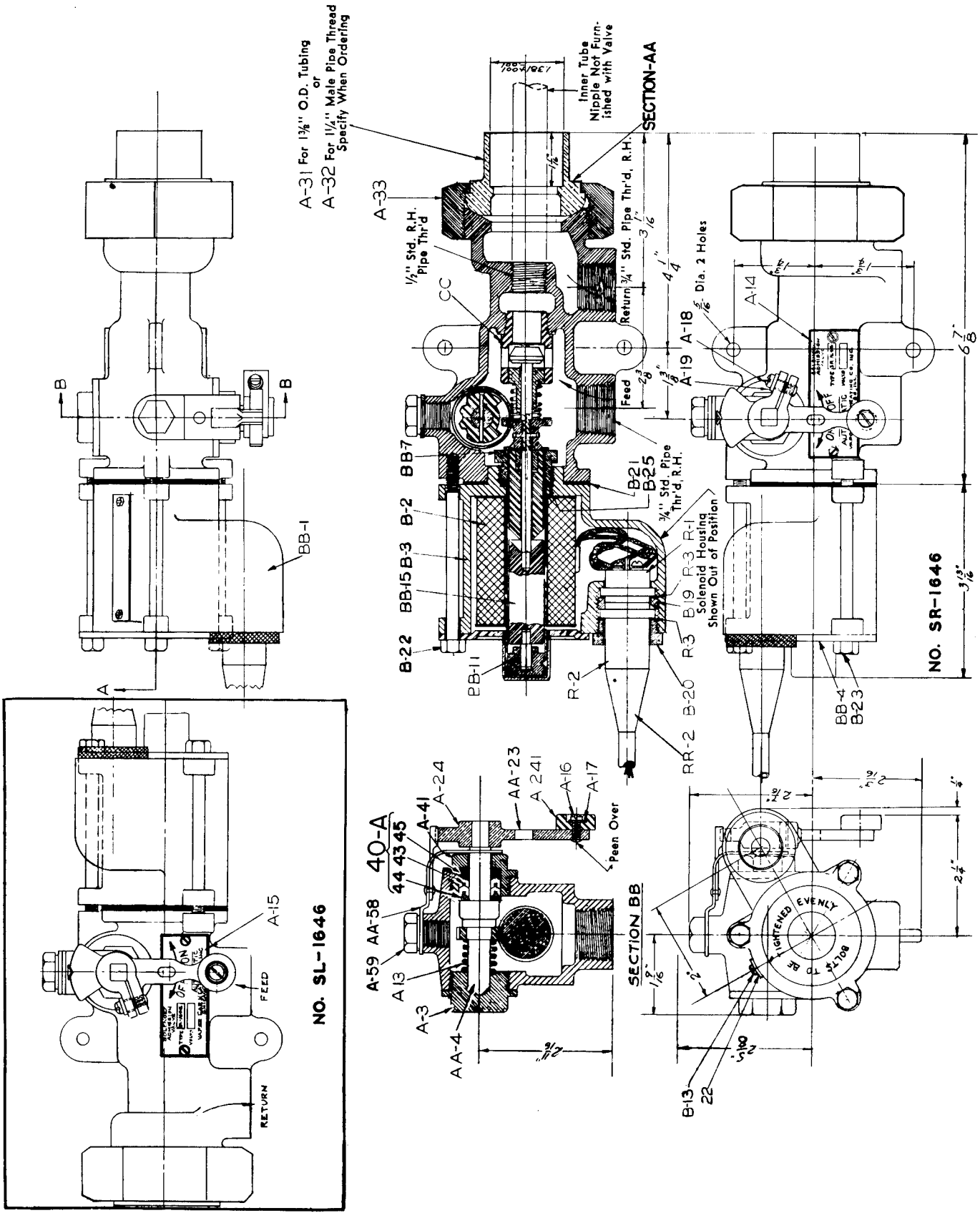
LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T
A-1	S-1646-A-1	Body	1
A-2	1646-A-41	Nut, Packing Retaining	1
A-3	1646-A-3	Nut, Retaining	1
AA-4	1646-AA-4	Operating Rod Assembly	1
A-13	1646-A-13	Spring, Operating Rod	1
A-14	1646-A-14	Name Plate, R. H. Valve	1
A-15	1646-A-15	Name Plate, L. H. Valve	1
A-20	#4-$\frac{3}{16}$" long	Screw, Parker-Kalon	2
A-31	1646-A-31	Tail Piece—for 1⅜" O. D. Tubing	1
A-32	1646-A-32	Tail Piece—for 1¼" Pipe	1
A-33	442-B	Nut, Tail Piece	1
AA-58	1646-AA-58	Bracket Spring	1
A-59	1646-A-59	Retaining Nut	1
AA-23	1646-AA-23	OPERATING HANDLE ASSEMBLY	1
A-16	#10-24 x ⅜" long	Screw, Fil. Hd. Mach.	1
A-17	#10 Split type	Lockwasher	1
A-18	¼"-20 x ½" long	Screw, Fil. Hd. Mach.	1
A-19	¼" Split type	Lockwasher	1
A-24	1646-A-24	Handle only	1
A-241	1646-A-241	Knob	1
40-A	1646-40-A	*CHEVRON PACKING ASSEMBLY	1
43	1646-A-43	Packing Ring, Chevron	2
44	1646-A-44	Packing Ring, Bottom Adapter Chevron	1
45	1646-A-45	Packing Ring, Top Adapter Chevron	1
BB-1	*1646-BB-1	*SOLENOID HOUSING ASSEMBLY	1
B-2	*1646-B-2	*Coil, Solenoid	1
B-3	1646-B-3	Housing, Solenoid	1
BB-4	1646-BB-4	Cover, Assembly, Solenoid Housing	1
BB-7	1646-BB-7	Retaining Nut Assembly	1
BB-11	**1646-BB-11	**Guide Tube Assembly	1
B-13	#6-32 x $\frac{3}{16}$" long	Screw, R. H. M.	2
BB-15	1646-BB-15	Core Assembly	1
B-19	1646-B-19	Ring, Connector Locking	1
B-21	1646-B-21	Gasket	1
B-22	¼"-20 x 3½" long	Cap Screw, Hed. Hd.	1
B-23	¼"-20 x 3¾" long	Cap Screw, Hex. Hd.	2
22	1646-B-22	Plate, Coil Identification	1
B-25	1646-B-25	Gasket	1
R-1	1646-R-1	Plug, Connector	1
R-3	1646-R-3	Washer	1
B-20	1646-B-20	Jam Nut, Connector	1
CC	1646-CC	INLET VALVE ASSEMBLY	1
R-2	1646-R-2	Connector Receptacle and Cord	1

NOTES:

1. *Specify voltage when ordering complete Solenoid Valve, Solenoid Housing Assembly, or Solenoid Coil.
2. **The Guide Tube Assembly, if stocked separately, must be handled carefully to avoid damage to flange.
3. Where Solenoid Valve is mounted behind a grille, the No. 1646-A-246 Operating Knob must be used instead of the No. 1646-AA-23 Operating Handle for mounting on outside of grille. Also, on the face of the grille use No. 14157 Indicator Plate for left hand Valves, and No. 14156 Indicator Plate for right hand Valves. These items must be purchased separately.
4. Where Solenoid Valves are used on Baggage Cars, the No. 1646-GG Guard should be purchased for mounting on the face of the valve.
5. Connector Receptacle complete can be ordered under No. 1646-RR-2 and includes symbol B-20, R-2 and R-3.

Nos. SR-1646 and SL-1646 Solenoid Steam Admission Valves



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Nos. A-1671 AND A-1679 SOLENOID STEAM ADMISSION VALVE

(FORMERLY NOS. 1671 AND 1679)

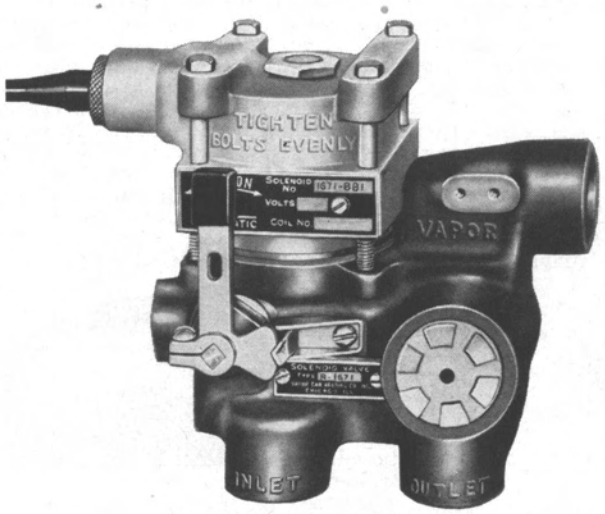
No. RA-1671—Right Hand Type
No. RA-1679—Right Hand Type

No. LA-1671—Left Hand Type
No. LA-1679—Left Hand Type

FEED INLET—¾" I.P.S.
RETURN OUTLET—¾" I.P.S.

WEIGHT 10 LBS.

POWER CONSUMPTION—17 WATTS at 32 volts D.C.
17 WATTS at 64 volts D.C.
30 WATTS at 125 volts D.C.



No. RA-1671 Solenoid Steam Admission Valve

GENERAL DESCRIPTION

The Nos. A-1671 and A-1679 Solenoid Steam Admission Valves are electrically operated steam admission valves for use on unit fin floor radiation, and which supersede the Nos. 1671 and 1679 valves respectively. Because of the difference in the size of the steam outlets in their respective needle valves, the No. A-1679 valve should be applied on radiation units of less than 20 ft. in length while the No. A-1671 valve should be applied on radiation units of more than 20 ft.

These valves differ from those which they supersede in that the needle valve has been redesigned. The new type needle valve is constructed to provide a positive shut-off of steam when the valve is closed. The CCB type needle valve is provided with a stainless steel needle valve and seat. The seat is formed by a stainless steel sleeve which is press fitted into the valve body in such a way that it fits tightly at the top, but at the seat end leaves a small space between the sleeve and the valve body. In this way distortion of the seat during installation is prevented by the space which permits a slight distortion of the body without disturbing the seat.

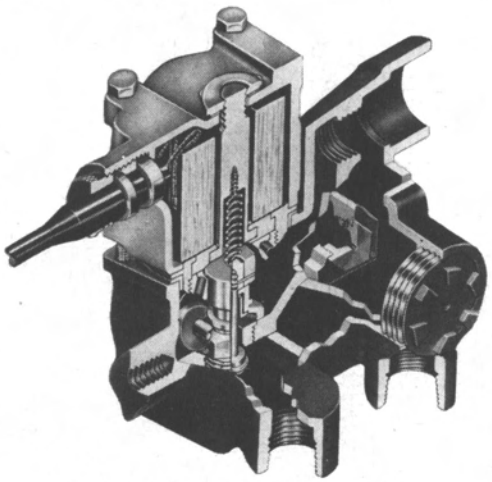
An orifice seat is located in the return chamber of the valve to act as a condensate relief trap to retain steam in the radiation as long as it is useful as a heating medium. This eliminates the need for a separate retarder in the return piping between the valve and the loop. Valves equipped with orifice seats may be identified by their caps, which have 3/16" holes drilled in them.

Each valve is provided with three operating settings: manually "OFF", "AUTOMATIC" which places the valve under thermostatic control, and manually "ON" for emergency operation. When set for automatic operation, the valve is normally open. It closes only when its solenoid coil is energized.

Valves with the outlet on the right side of the operating lever are designed as Nos. RA-1671 and RA-1679 valves. Those with the outlet on the left side of the lever are designated as Nos. LA-1671 and LA-1679 valves.

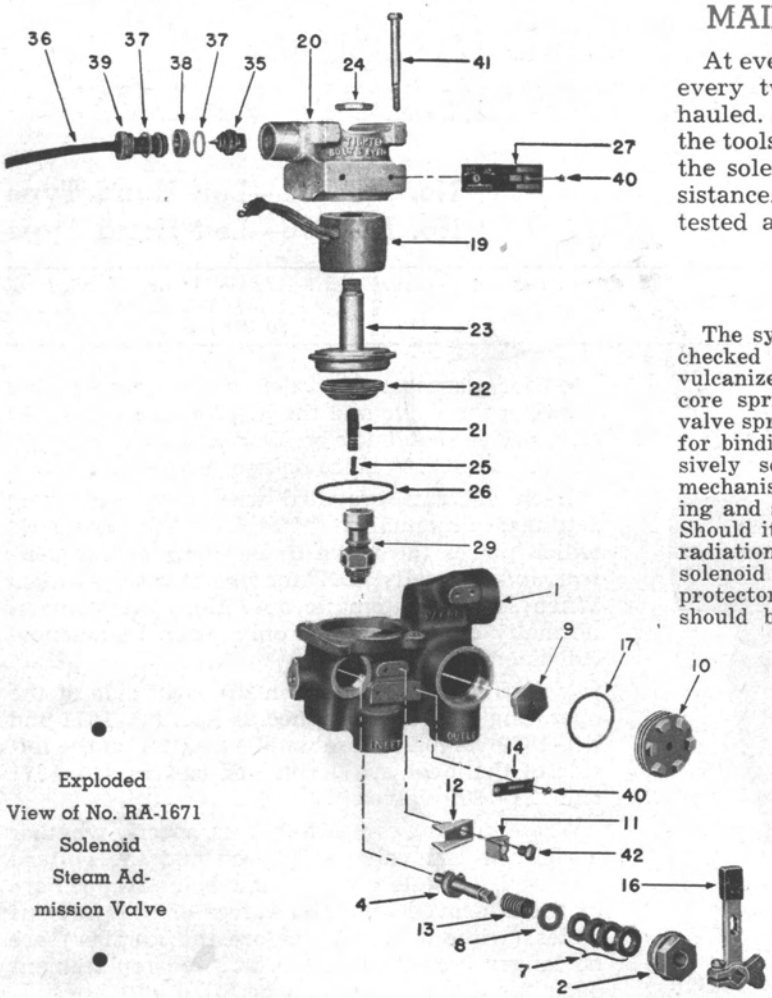
When ordering complete valves, specify whether a right or left valve is desired and the voltage required. Complete valves now being shipped are of the improved type and valves of the previous series (without an "A" before the number) are no longer furnished and orders for replacement parts for these valves will be filled with the improved parts.

To convert a No. 1671 solenoid steam admission valve to a No. A-1671 solenoid steam admission valve, replace the needle valve with a No. 1671-CCB needle valve. To convert a No. 1679 valve to a No. A-1679 valve, replace the needle valve with a No. 1675-CCB needle valve.



Sectioned View of No. RA-1671 Valve

Nos. A-1671 AND A-1679 SOLENOID STEAM ADMISSION VALVES (Cont.)



Exploded View of No. RA-1671 Solenoid Steam Admission Valve

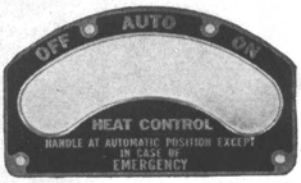
MAINTENANCE AND OVERHAUL

At every shopping period, but not less than once every two years, these valves should be overhauled. The valve should be disassembled, using the tools illustrated in Bulletin 61-700-1. Remove the solenoid assembly and test its insulation resistance. The resistance of the coil should also be tested and should be approximately as follows:

32 volt coil	62 ohms
64 volt coil	240 ohms
125 volt coil	500 ohms

The sym. 35 plug and sym. 36 receptacle should be checked and replaced if the rubber has hardened or vulcanized. Thread out the flux ring and clean the core spring cavity, the flux ring openings and the valve spring armature. Check the inlet valve assembly for binding and tight seating; replace valve if excessively scored and leaking. The manual operating mechanism should be checked for freedom from binding and seizing, as well as for leakage past the stem. Should it be necessary to unsweat the valve from the radiation, the sym. 35 plug should be taken out of the solenoid housing and be replaced with the 1671-R-10 protector. The orifice seat in the return chamber should be examined and, if constricted by deposit, rodded out to 3/32".

Where a grille covers the valve, the No. 18597 Indicating Plate is used over a cutout in the grille to allow the control lever to be operated through the opening in the plate. This plate is not supplied with the valve and must be purchased separately.



No. 18597 Indicating Plate

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	R-1671-A-1	Body (RA-1671 and RA-1679)	1
	L-1671-A-1	Body (LA-1671 and LA-1679)	1
2	1671-A-2	Nut (Seal Retaining)	
4	1671-AA-4	Operating Rod Assem.	1
7	1671-AA-7	Packing Assem.	1
8	1671-A-8	Washer (Packing)	1
9	1675-A-9	Seat	1
10	1675-A-10	Cap	1
11	1671-A-11	Spring	1
12	1671-A-12	Bracket	1
13	1671-A-13	Spring (Packing)	1
14	1671-A-14	Name Plate	1
16	1671-AA-23	Control Arm Assem.	1
17	1671-A-17	Gasket	1
	*1671-BB-1	Solenoid Assem. Includes Syms. 19, 20, 27, 35 and 2 of 40	1
19	*1671-B-2	Coil	1
20	1671-B-3	Housing (Solenoid)	1
21	1671-B-12	Spring	1
22	1671-B-13	Flux Ring	1
23	1671-BB-15	Core Assem.	1
24	1671-B-18	Locknut (Core Retaining)	1
25	1671-B-19	Screw (Spring Retaining)	1
26	1671-B-21	Gasket	1
27	1671-B-22	Plate (Identification)	1
29	1675-CCB	Needle Valve Assembly—For A-1675 Valve (Replaces 1675-CCA—See Note 5)	1
	1671-CCB	Needle Valve Assembly—For A-1677 Valve (Replaces 1671-CCA—See Note 5)	1
	1675-CCA	Needle Valve Assembly (Replaced by 1675-CCB —See Note 5)	
	1671-CCA	Needle Valve Assembly (Replaced by 1671-CCB —See Note 5)	
	955-RR-2	Connector Comp. (incl. R-2, R-3 and R-5)	1
35	955-R-1	Plug	1
36	955-R-2	Receptacle	1
37	955-R-3	Washer	2
38	955-R-4	Locking Ring	1
39	955-R-5	Jam Nut	1
40	No. 4x3/16	Parker Kalon Screw (Bd. Hd.)	4
41	¼" 20x3" lg.	Cap Screw (Hex. Hd.)	4
42	No. 10 24x5/16" lg.	Screw (Rd. Hd. Mach.)	1
	1671-R-10	Protector (Solenoid Housing Thrd.)	1
	No. 6	Shake Proof Washer	2

NOTES:

1. *Specify voltage when ordering complete Solenoid Valve, Solenoid Assembly, or Solenoid Coil.
2. For parts list on universal type remote control, see Bulletin No. 61-773.
3. For parts list on flexible cable type remote control, see Bulletin No. 61-771.
4. The No. 18597 Indicator Plate (see illustration) is used over cutout in grille when grille is in front of control arm (operating lever).
5. 1671-CA-1 "O" ring available for replacement on 1675-CCA and 1671-CCA needle valves of the type that use "O" rings.

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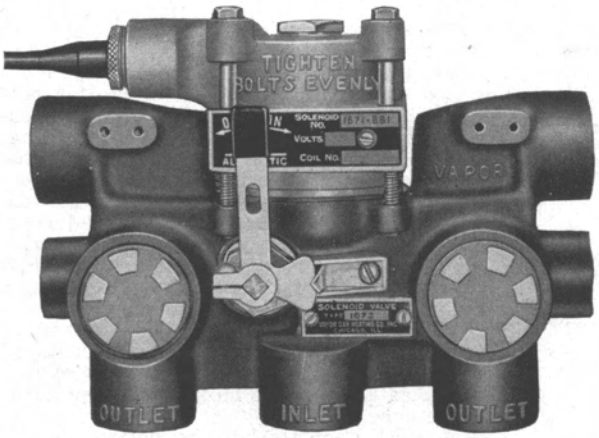
Nos. A-1672 and A-1674 SOLENOID STEAM ADMISSION VALVES

(FORMERLY NOS. 1672 AND 1674)

FEED INLET—¾" I.P.S.
RETURN OUTLETS—¾" I.P.S.
WEIGHT NO. 1672—13¾ LBS.
WEIGHT NO. 1674—13 LBS.
POWER CONSUMPTION—17 WATTS at 32 volts D.C.
17 WATTS at 64 volts D.C.
30 WATTS at 125 volts D.C.



No. A-1672 Solenoid Steam Admission Valve

GENERAL DESCRIPTION

The Nos. A-1672 and A-1674 Solenoid Steam Admission Valves are electrically operated steam admission valves for use on unit fin floor radiation, and which supersede the Nos. 1672 and 1674 valves respectively. They are similar respectively to the Nos. A-1677 and A-1671 single outlet valves but differ in that they have two steam outlets and each feed two pieces of radiation simultaneously. Bellows retarders are installed in the return chambers of the No. A-1672 valve and act as condensate relief traps to retain steam in the radiation as long as it is useful as a heating medium. Orifice seats in the return chambers of the No. A-1674 valve perform a similar function. Both serve to eliminate the need for separate retarders in the return piping between the valve and the loop.

These valves differ from those which they supersede in that their needle valves have been redesigned and the retarder seat used in the No. A-1672 valve has also been redesigned.

The new type needle valve is constructed to provide a positive shut-off of steam when the valve is closed. The CCB type needle valve is provided with a stainless steel needle valve and seat. The seat is formed by a stainless steel sleeve which is press fitted into the valve body in such a way that it fits tightly at the top, but at the seat end leaves a small space between the sleeve and the valve body. In this way distortion of the seat during installation is prevented by the space which permits a slight distortion of the body without disturbing the seat.

The new type retarder seats used in the No. A-1672 valve are designed to prevent the formation of a vacuum in the radiation due to the condensing of steam left in the radiation after the valve has been tightly closed. Such a vacuum sometimes results in cold radiation, even though the thermostats may call for heat, because in some cases this vacuum is sufficient to prevent the needle valve from returning to its normally open position.

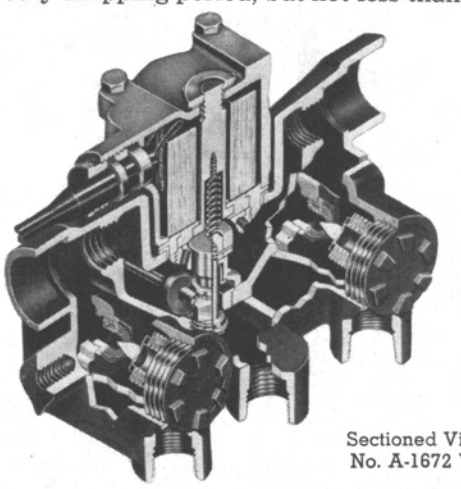
The No. A-1672 solenoid steam admission valve may be identified as having bellows retarders by its caps which have no holes drilled in them. The No. A-1674 valve may be identified as having orifice seats by the fact that there are 3/16" holes drilled in its caps. Each valve is provided with three operating settings: manually "OFF", "AUTOMATIC" which places the valve under thermostatic control and manually "ON" for emergency use. When set for automatic operation the valves are normally open and close only when their solenoid coils are energized.

When ordering complete valves, it is important to specify the voltage required. Complete valves now being shipped are of the improved type and valves of the previous series (without an "A" before the number) are no longer furnished. Orders for replacement parts for these valves will be filled with the improved parts and it is strongly recommended when converting these earlier valves to the improved type that both changes be made at the same time.

To convert a No. 1672 solenoid steam admission valve to a No. A-1672 solenoid steam admission valve, replace the needle valve with a No. 1671-CCB needle valve and the bellows retarder seats with No. 1677-AA-9 vacuum-breaker seats. To convert a No. 1674 valve to a No. A-1674 valve, replace the needle valve with a No. 1671-CCB needle valve.

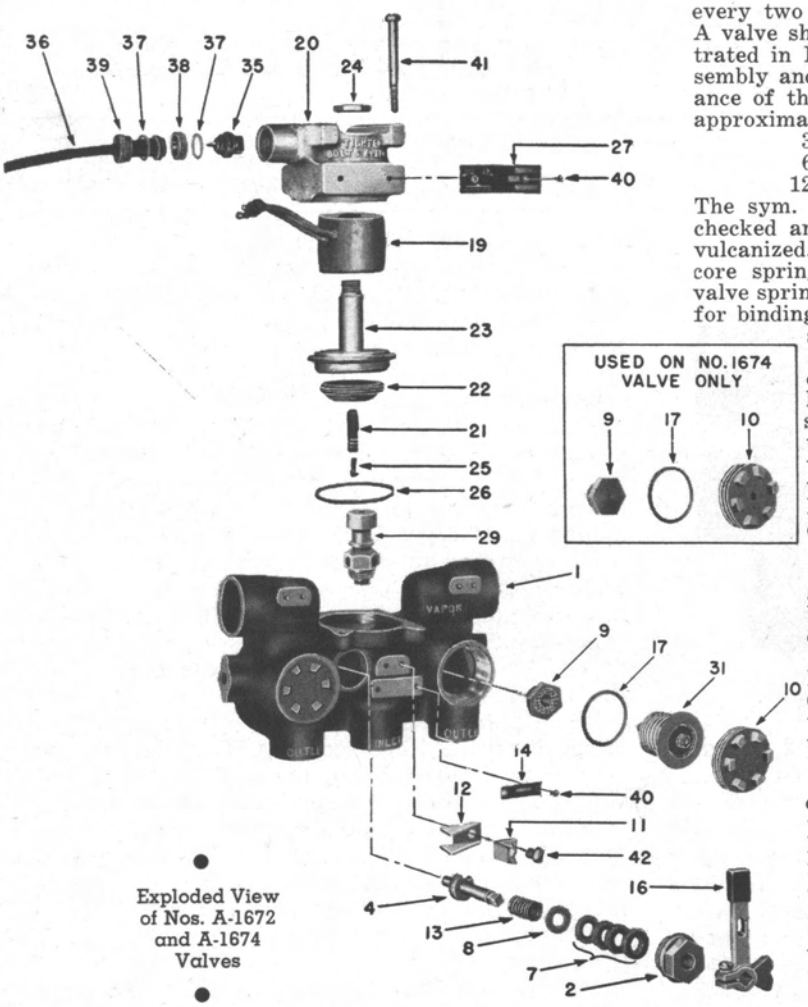
MAINTENANCE AND OVERHAUL

At every shopping period, but not less than once



Sectioned View of No. A-1672 Valve

NOS. A-1672 AND A-1674 SOLENOID STEAM ADMISSION VALVES (Cont.)



Exploded View of Nos. A-1672 and A-1674 Valves

every two years, these valves should be overhauled. A valve should be disassembled, using the tools illustrated in Bulletin 61-700-1. Remove the solenoid assembly and test its insulation resistance. The resistance of the coil should also be tested and should be approximately as follows:

32 volt coil	62 ohms
64 volt coil	240 ohms
125 volt coil	500 ohms

The sym. 35 plug and sym. 36 receptacle should be checked and replaced if the rubber has hardened or vulcanized. Thread out the flux ring and clean the core spring cavity, the flux ring openings and the valve spring armature. Check the inlet valve assembly for binding and tight seating; replace valve if excessively scored and leaking. The manual operating mechanism should be checked for freedom from binding and seizing, as well as for leakage past the stem. Should it be necessary to unsweat the valve from the radiation, the sym. 35 plug should be removed from the solenoid housing and be replaced with the 1671-R-10 protector. The retarder bellows should also be removed from the return chambers of the No. 1672 valve.

A retarder bellows in the No. 1672 valve (sym. 31) will not seat if it has developed a leak. Failure of the bellows to seat will be indicated by steam blows at the regulator drain tube.

A method of testing the bellows in the No. A-1672 valve is described in Bulletin 61-746, Revision "B". The orifice seats in the No. A-1674 valve should be rodded out to 3/32" if constricted by deposit.

Where a grille covers the valve, the No. 18597 Indicating Plate is used over a cutout in the grille to allow the control lever to be operated through the opening in the plate. This plate is not supplied with the valve and must be purchased separately.

No. 18597 Indicating Plate

LIST OF PARTS

Sym.	Part. No.	Description	Amt.	Sym.	Part. No.	Description	Amt.
1	1672-A-1	Body	1	25	1671-B-19	Screw (Spring Retaining)	1
2	1671-A-2	Nut (Seal Retaining)	1	26	1671-B-21	Gasket	1
4	1671-AA-4	Operating Rod Assem.	1	27	1671-B-22	Plate (Identification)	1
7	1671-AA-7	Packing Assem.	1		No. 6	Shake proof Washer	2
8	1671-A-8	Washer (Packing)	1	29	1671-CCB	Needle Valve Assembly (Replaces 1671-CCA—See Note 5)	1
9	1677-AA-9	Seat with Vacuum Breaker	2		1671-CCA	Needle Valve Assembly (Replaced by 1671-CCB—See Note 5)	
	1675-A-9	Seat (Orifice) (For No. A-1674 only)	2				
10	1671-A-10	Cap (Bellows Retaining)	2				
	1675-A-10	Cap (For No. A-1674 only)	2				
11	1671-A-11	Spring	1	31	1671-EE	Bellows Assem. (A-1672 Valve Only)	2
12	1671-A-12	Bracket	1		955-RR-2	Connector Comp. Incl. R-2, R-3 and R-5	1
13	1671-A-13	Spring (Packing)	1				
14	1671-A-14	Name Plate	1	35			
16	1671-AA-23	Control Arm Assem.	1	36	955-R-1	Plug	1
17	1671-A-17	Gasket	2	37	955-R-2	Receptacle	1
	*1671-BB-1	Solenoid Assem. Includes Syms. 19, 20, 27, 35 and 2 of 40	1	38	955-R-3	Washer	2
				39	955-R-4	Locking Ring	1
				40	955-R-5	Jam Nut	1
19	*1671-B-2	Coil	1		No. 4x3/16"	Parker Kalon Screw (Bd. Hd.)	4
20	1671-B-3	Housing (Solenoid)	1	41			
21	1671-B-12	Spring	1	42	¼" 20x3" lg.	Cap Screw (Hex. Hd.)	4
22	1671-B-13	Flux Ring	1		No. 10 24x5/16" lg.	Screw (Rd. Hd. Mach.)	1
23	1671-BB-15	Core Assem.	1		1671-R-10	Protector (Solenoid Housing)	1
24	1671-BB-18	Locknut (Core Retaining)	1				

NOTES:

1. *Specify voltage when ordering complete Solenoid Valve, Solenoid Assembly, or Solenoid Coil.
2. For parts list on universal type remote control, see Bulletin No. 61-773.
3. For parts list on flexible cable type remote control, see Bulletin No. 61-771.
4. The No. 18597 Indicator Plate (see illustration) is used over cutout in grille when grille is in front of control arm (operating lever).
5. No. 1671-CA-1 "O" ring available for replacement on 1671-CCA needle valves of the type that uses "O" rings.

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No. A - 1673
SOLENOID STEAM ADMISSION VALVE

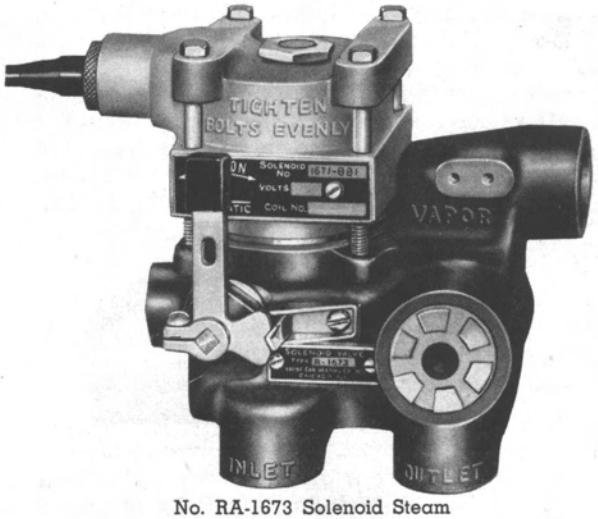
(FORMERLY NO. 1673)

No. RA-1673—Right Hand Type **No. LA-1673—Left Hand Type**

FEED INLET—¾" I.P.S.
OUTLET—¾" I.P.S.

WEIGHT 10 LBS.

POWER CONSUMPTION—17 WATTS at 32 volts D.C.
17 WATTS at 64 volts D.C.
30 WATTS at 125 volts D.C.



No. RA-1673 Solenoid Steam Admission Valve

GENERAL DESCRIPTION

The No. A-1673 Solenoid Steam Admission Valve is an electrically operated steam admission valve for use on floor heat radiation, and which supersedes the No. 1673 valve previously used for the same purpose. It differs from the Nos. A-1671, A-1675, A-1677 and A-1679 valves in that it contains neither a bellows retarder nor an orifice seat in the return chamber and is used with Vulcan-fin type radiation, requiring a retarder at the end of the radiation. Valves of this type may be identified by their caps which have ½" holes drilled in them.

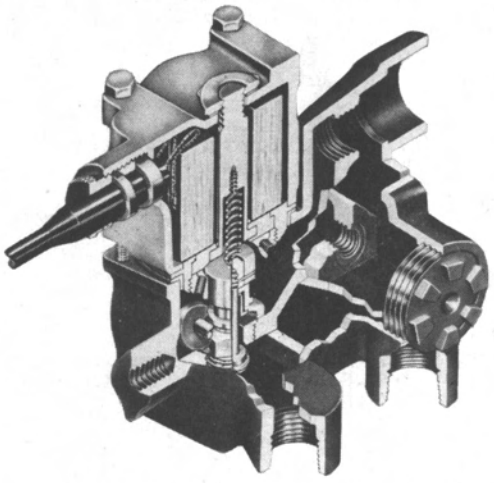
This No. A-1673 valve is of an improved design and differs from the valve which it supersedes in that its needle valve has been redesigned. The new type needle valve is constructed to provide a positive shut-off of steam when the valve is closed. The CCB type needle valve is provided with a stainless steel needle valve and seat. The seat is formed by a stainless steel sleeve which is press fitted into the valve body in such a way that it fits tightly at the top, but at the seat end leaves a small space between the sleeve and the valve body. In this way distortion of the seat during installation is prevented by the space which permits a slight distortion of the body without disturbing the seat.

The valve is provided with three operating settings: manually "OFF", "AUTOMATIC" which places the valve under thermostatic control, and manually "ON" for emergency operation. When set for automatic operation the valve is normally open. It closes only when its solenoid coil is energized. Valves with the steam outlet on the right side of the operating lever are designated as No. RA-1673 and those with the outlet on the left side of the lever are designated as No. LA-1673.

When ordering complete valves it is important to specify whether a right or left valve is desired and the voltage required. Complete valves now being shipped are of the improved type and valves of the previous series (without an "A" before the number) are no longer furnished. Orders for replacement parts for these valves will be filled with the improved parts. To convert a No. 1673 valve to a No. A-1673 valve, replace the needle valve with a No. 1671-CCB needle valve. If a No. 918 retarder or a No. 866 retarder is used replace the retarder seat with the improved No. 1677-AA-9 seat or if a No. 920 retarder is used slightly flatten one side of the retarder needle to allow a breaking of vacuum in the radiation when the valve is closed.

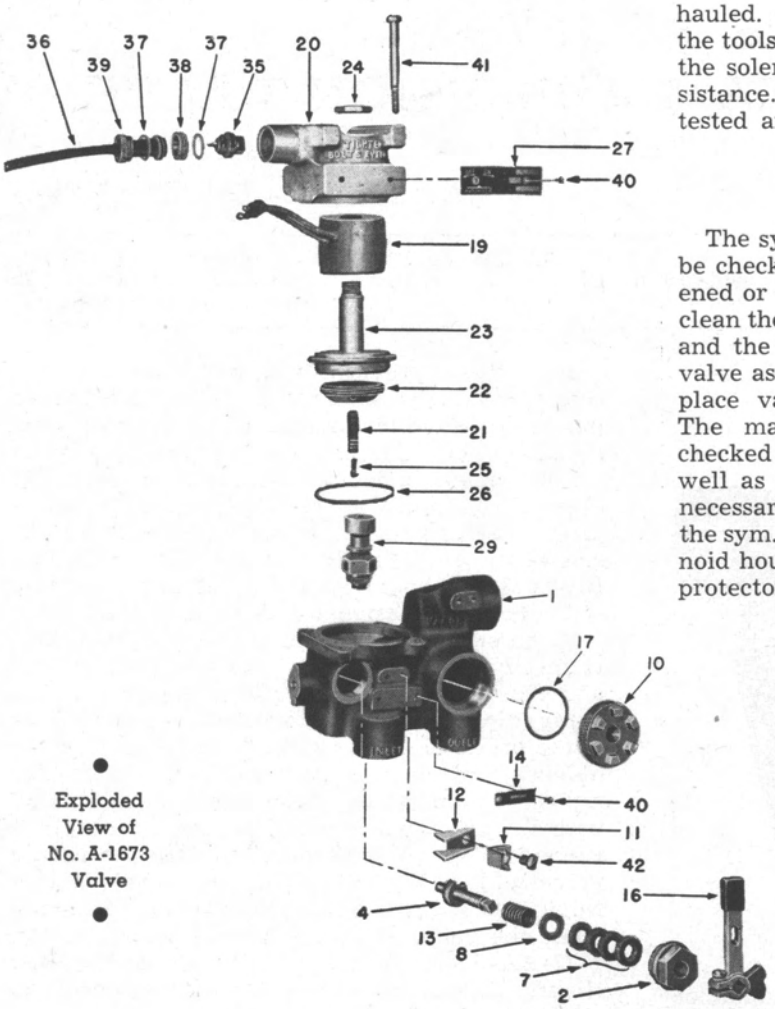
MAINTENANCE AND OVERHAUL

At every shopping period, but not less than once every two years, these valves should be over-



Sectioned View of No. RA-1673 Valve

No. 1673 SOLENOID STEAM ADMISSION VALVE (Cont.)

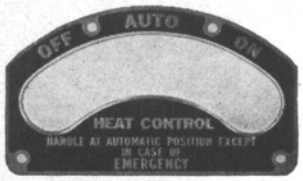


Exploded View of No. A-1673 Valve

hauled. The valve should be disassembled, using the tools illustrated in Bulletin 61-700-1. Remove the solenoid assembly and test its insulation resistance. The resistance of the coil should also be tested and should be approximately as follows:

32 volt coil	62 ohms
64 volt coil	240 ohms
125 volt coil	500 ohms

The sym. 35 plug and sym. 36 receptacle should be checked and replaced if the rubber has hardened or vulcanized. Thread out the flux ring and clean the core spring cavity, the flux ring openings and the valve spring armature. Check the inlet valve assembly for binding and tight seating; replace valve if excessively scored and leaking. The manual operating mechanism should be checked for freedom from binding and seizing, as well as for leakage past the stem. Should it be necessary to unsweat the valve from the radiation, the sym. 35 plug should be removed from the solenoid housing and be replaced with the 1671-R-10 protector.



No. 18597 Indicating Plate

Where a grille covers the valve, the No. 18597 Indicating Plate is used over a cutout in the grille to allow the control lever to be operated thru the opening in the plate. This plate is not supplied with the valve and must be purchased separately.

LIST OF PARTS

Sym.	Part No.	Description	Amt.	Sym.	Part No.	Description	Amt.
1	R-1671-A-1	Body (No. RA-1673)	1	27	1671-B-22	Plate (Identification)	1
	L-1671-A-1	Body (No. LA-1673)	1		No. 6	Shakeproof Washer	2
2	1671-A-2	Nut (Seal Retaining)	1				
4	1671-AA-4	Operating Rod Assem.	1	29	1671-CCB	Needle Valve Assembly (Replaces 1671-CCA—See Note 5)	1
7	1671-AA-7	Packing Assem.	1				
8	1671-A-8	Washer (Packing)	1		1671-CCA	Needle Valve Assembly (Replaced by 1671-CCB —See Note 5)	
10	1673-A-10	Cap	1				
11	1671-A-11	Spring	1				
12	1671-A-12	Bracket	1				
13	1671-A-13	Spring (Packing)	1		955-RR-2	Connector Comp. (incl. R-2, R-3 & R-5	1
14	1671-A-14	Name Plate	1				
16	1671-AA-23	Control Arm Assem.	1	35	955-R-1	Plug	1
17	1671-A-17	Gasket	1	36	955-R-2	Receptacle	1
	*1671-BB-1	Solenoid Assem. Includes Syms. 19, 20, 27, 35 and 2 of 40	1	37	955-R-3	Washer	2
				38	955-R-4	Locking Ring	1
				39	955-R-5	Jam Nut	1
19	*1671-B-2	Coil	1	40	No. 4x3/16	Parker-Kalon Screw (Bd. Hd.)	4
20	1671-B-3	Housing (Solenoid)	1				
21	1671-B-12	Spring	1	41	1/4"-20x3"-LG	Cap Screw (Hex. Hd.)	4
22	1671-B-13	Flux Ring	1				
23	1671-BB-15	Core Assem.	1	42	10-24x5/16" LG.	Screw (Rd. Hd. Mach.)	1
24	1671-B-18	Locknut (Core Retaining)	1				
25	1671-B-19	Screw (Spring Retaining)	1		1671-R-10	Protector (Solenoid Housing)	1
26	1671-B-21	Gasket	1				

NOTES:

1. * Specify voltage when ordering complete Solenoid Valve, Solenoid Assembly, or Solenoid Coil.
2. For parts list on universal type remote control, see Bulletin No. 61-773.
3. For parts list on flexible cable type remote control, see Bulletin No. 61-771.
4. The No. 18597 Indicator Plate (see illustration) is used over cutout in grille when grille is in front of control arm (operating lever).
5. No. 1671-CA-1 "O" ring available for replacement on 1671-CCA needle valves of the type that uses "O" rings.

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Nos. A-1675 AND A-1677 SOLENOID STEAM ADMISSION VALVES

(FORMERLY NOS. 1675 AND 1677)

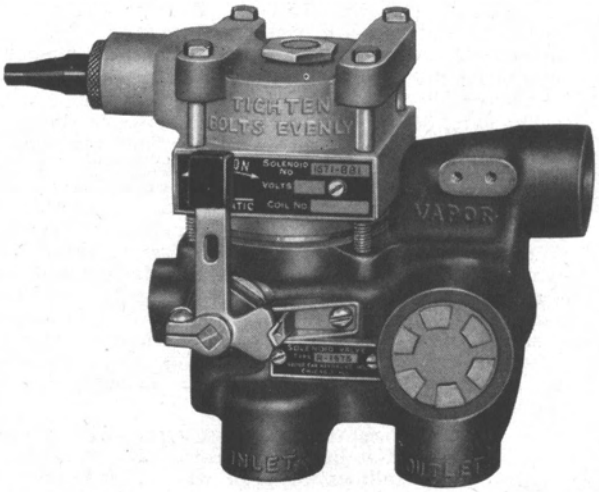
No. RA-1675—Right Hand Type
No. RA-1677—Right Hand Type

No. LA-1675—Left Hand Type
No. LA-1677—Left Hand Type

FEED INLET—¾" I.P.S.
RETURN OUTLET—¾" I.P.S.

WEIGHT 10½ LBS.

POWER CONSUMPTION—17 WATTS at 32 volts D.C.
17 WATTS at 64 volts D.C.
30 WATTS at 125 volts D.C.



No. RA-1675 Solenoid Steam Admission Valve

GENERAL DESCRIPTION

The Nos. A-1675 and A-1677 Solenoid Steam Admission Valves are electrically operated steam admission valves for use on unit fin floor radiation, and which supersede the Nos. 1675 and 1677 valves respectively. Because of the difference in the size of the steam outlets in their respective needle valves, the No. A-1675 valve should be applied on radiation units of less than 20 ft. in length while the No. A-1677 valve should be applied on radiation units of more than 20 ft.

These valves differ from those which they supersede in that both the needle valve and the retarder seat have been redesigned. The new type needle valve is constructed to provide a positive shut-off of steam when the valve is closed. The CCB type needle valve is provided with a stainless steel needle valve and seat. The seat is formed by stainless steel sleeve which is press fitted into the valve body in such a way that it fits tightly at the top, but at the seat end leaves a small space between the sleeve and the valve body. In this way distortion of the seat during installation is prevented by the space which permits a slight distortion of the body without disturbing the seat.

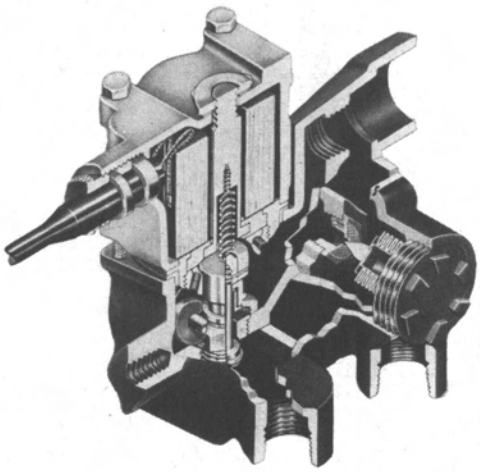
The new type retarder seat (called a vacuum-breaker seat) is designed to prevent the formation of a vacuum in the radiation due to the condensing of steam left in the radiation after the valve has been tightly closed. Such a vacuum sometimes results in cold radiation, even though the thermostats may call for heat, because in some cases this vacuum is sufficient to prevent the needle valve from returning to its normally open position.

The bellows retarder is located in the return chamber of the valve and acts as a condensate relief trap to retain steam in the radiation as long as it is useful as a heating medium. This eliminates the need for a separate retarder in the return piping between the valve and the loop. Valves equipped with bellows retarders may be identified by their caps which have no holes drilled in them.

Each valve is provided with three operating settings: manually "OFF", "AUTOMATIC" which places the valve under thermostatic control, and manually "ON" for emergency operation. When set for automatic operation, the valve is normally open. It closes only when its solenoid coil is energized.

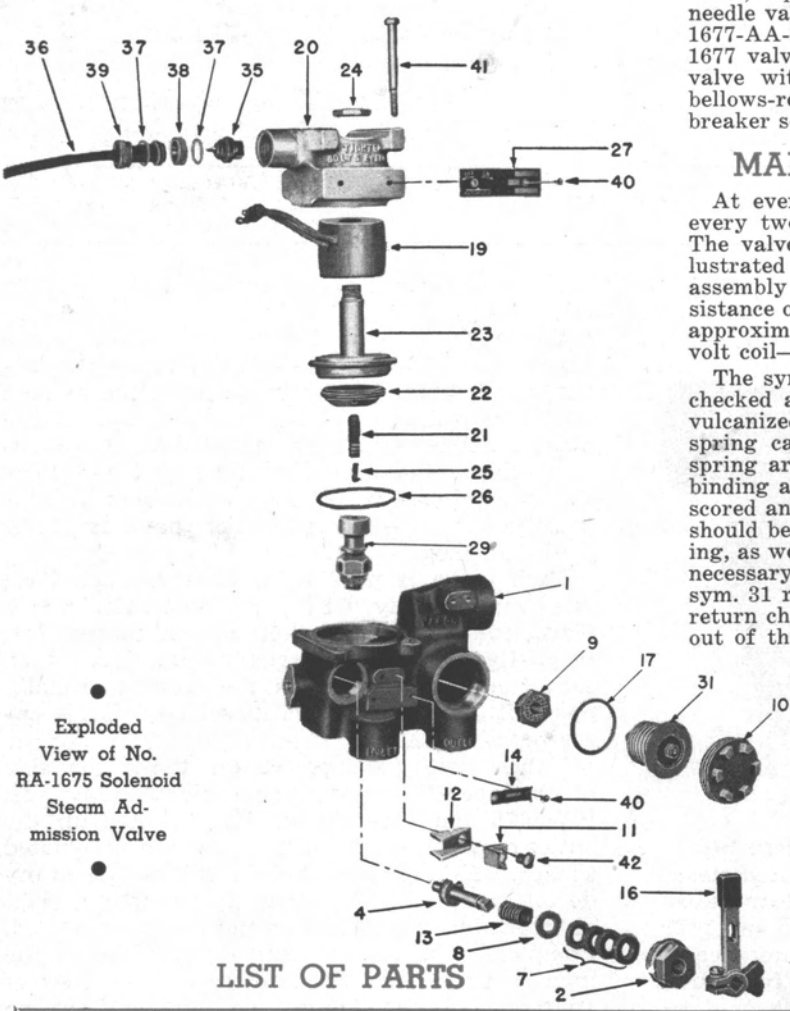
Valves with the outlet on the right side of the operating lever are designated as Nos. RA-1675 and RA-1677 valves. Those with the outlet on the left side of the lever are designated as Nos. LA-1675 and LA-1677 valves. When ordering complete valves, specify whether a right or left valve is desired and the voltage required. Complete valves now being shipped are of the improved type and valves of the previous series (without an "A" before the number) are no longer furnished. Orders for replacement parts for these valves will be filled with the improved parts and it is strongly recommended when converting these earlier valves to the improved type that both changes be made at the same time.

To convert a No. 1675 solenoid steam admis-



Sectioned View of No. RA-1675 Valve

Nos. A-1675 AND A-1677 SOLENOID STEAM ADMISSION VALVES (Cont.)



Exploded View of No. RA-1675 Solenoid Steam Admission Valve

sion valve to a No. A-1675 solenoid steam admission valve, replace the needle valve with a No. 1675-CCB needle valve and the bellows-retarder seat with a No. 1677-AA-9 vacuum-breaker seat. To convert a No. 1677 valve to a No. A-1677 valve, replace the needle valve with a No. 1671-CCB needle valve and the bellows-retarder seat with a No. 1677-AA-9 vacuum-breaker seat.

MAINTENANCE AND OVERHAUL

At every shopping period, but not less than once every two years, these valves should be overhauled. The valve should be disassembled using the tools illustrated in Bulletin 61-700-1. Remove the solenoid assembly and test its insulation resistance. The resistance of the coil should also be tested and should be approximately as follows: 32 volt coil—62 ohms; 64 volt coil—240 ohms; 125 volt coil—500 ohms.

The sym. 35 plug and sym. 36 receptacle should be checked and replaced if the rubber has hardened or vulcanized. Thread out the flux ring and clean the core spring cavity, the flux ring openings and the valve spring armature. Check the inlet valve assembly for binding and tight seating; replace valve if excessively scored and leaking. The manual operating mechanism should be checked for freedom from binding and seizing, as well as for leakage past the stem. Should it be necessary to unsweat the valve from the radiation, the sym. 31 retarder bellows should be removed from the return chamber and the sym. 35 plug should be taken out of the solenoid housing and be replaced with the 1671-R-10 protector.

The retarder bellows (sym. 31) will not seat if it has developed a leak. Failure of the bellows to seat will be indicated by steam blows at the regulator drain tube.

To test the bellows for leaks, place it in a testing device and submerge in boiling water. A leak will be indicated by bubbles escaping from the bellows or by failure of the bellows to expand. Such bellows should be discarded. No attempt should be made to refill and reclaim them. Submerge testing device in *cold* water before removing bellows. A suitable testing fixture is shown on our Drawing 22659, copies of which are available on request.

CAUTION: Do not remove the bellows from valve while hot and do not subject it to live steam after removal as this will overexpand the bellows and it will not again return to its contracted form.

LIST OF PARTS

Sym.	Part No.	Description	Amt.	Sym.	Part No.	Description	Amt.
1	R-1671-A-1	Body (Nos. RA-1675 and RA-1677)	1	29	1675-CCB	Needle Valve Assembly—For A-1675 Valve (Replaces 1675-CCA—See Note 5)	
	L-1671-A-1	Body (Nos. LA-1675 and LA-1677)	1				
2	1671-A-2	Nut (Seal Retaining)	1		1671-CCB	Needle Valve Assembly—For A-1677 Valve (Replaces 1671-CCA—See Note 5)	1
4	1671-AA-4	Operating Rod Assem.	1				
7	1671-AA-7	Packing Assem.	1				1
8	1671-A-8	Washer (Packing)	1		1675-CCA	Needle Valve Assembly (Replaced by 1675-CCB—See Note 5)	
9	1677-AA-9	Seat with Vacuum Breaker	1				
10	1671-A-10	Cap (Bellows Retaining)	1				
11	1671-A-11	Spring	1				
12	1671-A-12	Bracket	1		1671-CCA	Needle Valve Assembly (Replaced by 1671-CCB—See Note 5)	
13	1671-A-13	Spring (Packing)	1				
14	1671-A-14	Name Plate	1				
16	1671-AA-23	Control Arm Assem.	1	31	1671-EE	Bellows Assem.	1
17	1671-A-17	Gasket	1		955-RR-2	Connector Comp. Incl. R-2, R-3 and R-5	1
	*1671-BB-1	Solenoid Assem. Includes Syms. 19, 20, 27, 35 and 2 of 40	1	35	955-R-1	Plug	1
				36	955-R-2	Receptacle	1
19	*1671-B-2	Coil	1	37	955-R-3	Washer	2
20	1671-B-3	Housing (Solenoid)	1	38	955-R-4	Locking Ring	1
21	1671-B-12	Spring	1	39	955-R-5	Jam Nut	1
22	1671-B-13	Flux Ring	1	40	No. 4x3/16	Parker-Kalon Screw (Bd. Hd.)	4
23	1671-BB-15	Core Assem.	1				
24	1671-B-18	Locknut (Core Retaining)	1	41	¼" 20x3" lg.	Cap Screw (Hex. Hd.)	4
25	1671-B-19	Screw (Spring Retaining)	1	42	No. 10 24x5/16" lg.	Screw (Rd. Hd. Mach.)	1
26	1671-B-21	Gasket	1		1671-R-10	Protector (Solenoid Housing)	1
27	1671-B-22	Plate (identification)	1				
	No. 6	Shakeproof Washer	2				

NOTES:

1. *Specify voltage when ordering complete Solenoid Valve, Solenoid Assembly, or Solenoid Coil.
2. For parts list on universal type remote control see Bulletin No. 61-773.
3. For parts list on flexible cable type remote control, see Bulletin No. 61-771.
4. The No. 18597 Indicator Plate (see illustration in Bulletin 61-743) is used over cutout in grille when grille is in front of control arm (operating lever).
5. No. 1671-CA-1 "O" ring available for replacement on 1675-CCA and 1671-CCA needle valves of the type that use "O" rings.

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No. A - 1676
SOLENOID STEAM ADMISSION VALVE

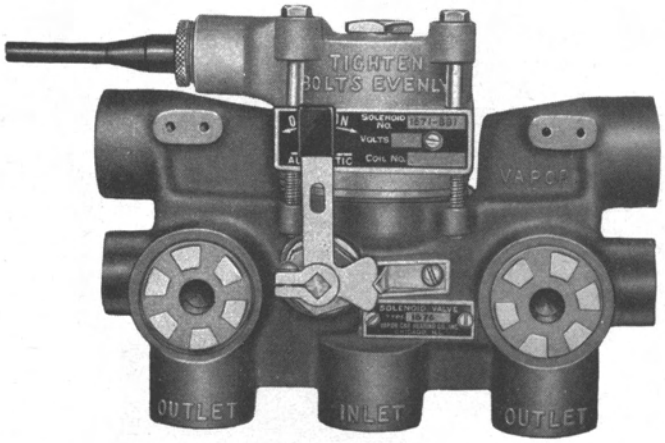
(FORMERLY NO. 1676)

INLET—¾" I.P.S.

OUTLETS—¾" I.P.S.

WEIGHT 12¾ LBS.

POWER CONSUMPTION—17 WATTS at 32 volts D.C.
17 WATTS at 64 volts D.C.
30 WATTS at 125 volts D.C.



No. A-1676 Solenoid Steam Admission Valve

GENERAL DESCRIPTION

The No. A-1676 Solenoid Steam Admission Valve is an electrically operated steam admission valve for use on floor heat radiation, and which supersedes the No. 1676 valve previously used for the same purpose. It differs from the Nos. A-1672 and A-1674 valves in that it contains neither a bellows retarder nor an orifice seat in the return chamber but is similar in that it feeds two pieces of radiation simultaneously. It is used with Vulcan-fin type radiation, requiring a retarder at the end of each piece of radiation. Valves of this type may be identified by their caps which have ½" holes drilled in them.

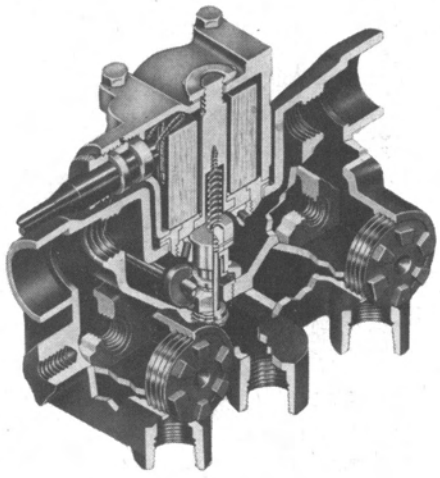
This No. A-1676 valve is of an improved design and differs from the valve which it supersedes in that its needle valve has been redesigned. The new type needle valve is constructed to provide a positive shut-off of steam when the valve is closed. The CCB type needle valve is provided with a stainless steel needle valve and seat. The seat is formed by a stainless steel sleeve which is press fitted into the valve body in such a way that it fits tightly at the top, but at the seat end leaves a small space between the sleeve and the valve body. In this way distortion of the seat during installation is prevented by the space which permits a slight distortion of the body without disturbing the seat.

The valve is provided with three operating settings: manually "OFF", "AUTOMATIC" which places the valve under thermostatic control, and manually "ON" for emergency operation. When set for automatic operation the valve is normally open. It closes only when its solenoid coil is energized.

When ordering complete valves it is important to specify the voltage required. Complete valves now being shipped are of the improved type and valves of the previous series (without an "A" before the number) are no longer furnished. Orders for replacement parts for these valves will be filled with the improved parts. To convert a No. 1676 valve to a No. A-1676 valve, replace the needle valve with a No. 1671-CCB needle valve. If No. 918 retarders or No. 866 retarders are used replace the retarder seats with the improved No. 1677-AA-9 seat or if No. 920 retarders are used on the end of the radiation—slightly flatten one side of the retarder needles to allow a breaking of vacuum in the radiation when the valve is closed.

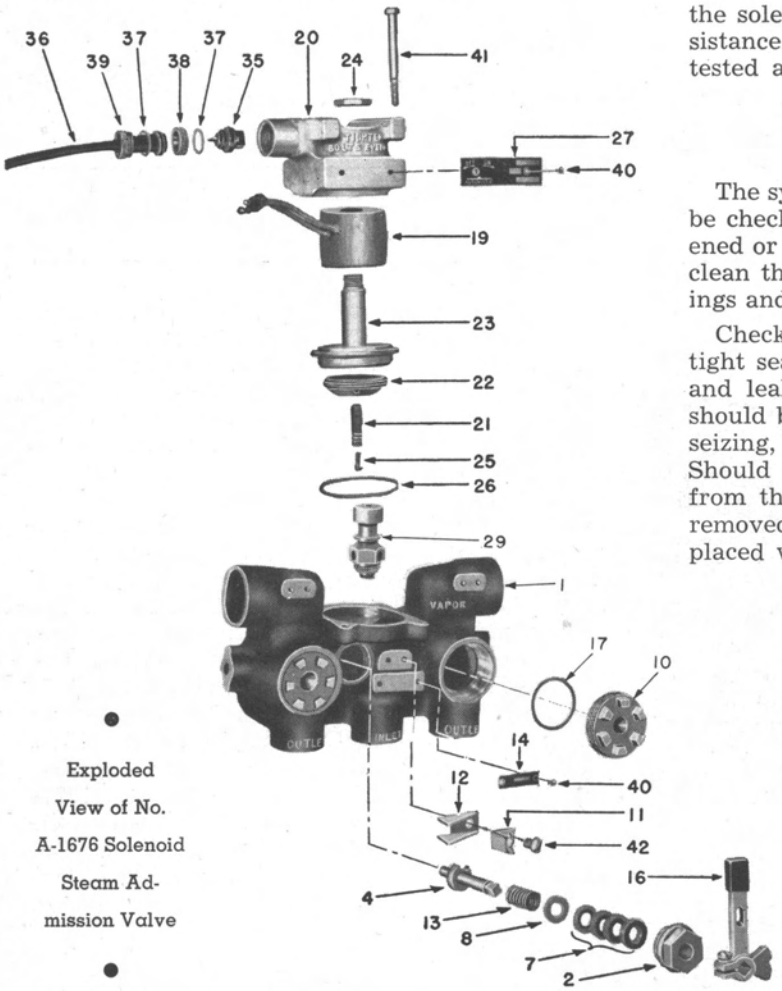
MAINTENANCE AND OVERHAUL

At every shopping period, but not less than once every two years, these valves should be overhauled. The valve should be disassembled, using the tools illustrated in Bulletin 61-700-1. Remove



Sectioned View of No. A-1676 Valve

No. A-1676 SOLENOID STEAM ADMISSION VALVE (Cont.)



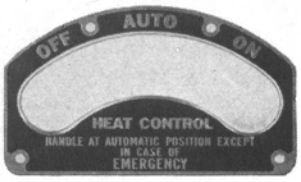
Exploded View of No. A-1676 Solenoid Steam Admission Valve

the solenoid assembly and test its insulation resistance. The resistance of the coil should also be tested and should be approximately as follows:

32 volt coil	62 ohms
64 volt coil	240 ohms
125 volt coil	500 ohms

The sym. 35 plug and sym. 36 receptacle should be checked and replaced if the rubber has hardened or vulcanized. Thread out the flux ring and clean the core spring cavity, the flux ring openings and the valve spring armature.

Check the inlet valve assembly for binding and tight seating; replace valve if excessively scored and leaking. The manual operating mechanism should be checked for freedom from binding and seizing, as well as for leakage past the stem. Should it be necessary to unsweat the valve from the radiation, the sym. 35 plug should be removed from the solenoid housing and be replaced with the 1671-R-10 protector.



No. 18597 Indicating Plate

Where a grille covers the valve, the No. 18597 Indicating Plate is used over a cutout in the grille to allow the control lever to be operated thru the opening in the plate. This plate is not supplied with the valve and must be purchased separately.

LIST OF PARTS

Sym.	Part No.	Description	Amt.	Sym.	Part No.	Description	Amt.
1	1672-A-1	Body	1	27	1671-B-22	Plate (Identification)	1
2	1671-A-2	Nut (Seal Retaining)	1		No. 6	Shakeproof Washer	2
4	1671-AA-4	Operating Rod Assem.	1	29	1671-CCB	Needle Valve Assembly (Replaces 1671-CCA—See Note 5)	1
7	1671-AA-7	Packing Assem.	1				
8	1671-A-8	Washer (Packing)	1		1671-CCA	Needle Valve Assembly (Replaced by 1671-CCB —See Note 5)	
10	1673-A-10	Cap	2				
11	1671-A-11	Spring	1				
12	1671-A-12	Bracket	1				
13	1671-A-13	Spring (Packing)	1		955-RR-2	Connector Comp. Incl. R-2, R-3 and R-5	1
14	1671-A-14	Name Plate	1				
16	1671-AA-23	Control Arm Assem.	1	35	955-R-1	Plug	1
17	1671-A-17	Gasket	2	36	955-R-2	Receptacle	1
	*1671-BB-1	Solenoid Assem. Includes Syms. 19, 20, 27, 35 and 2 of 40	1	37	955-R-3	Washer	2
				38	955-R-4	Locking Ring	1
				39	955-R-5	Jam Nut	1
19	*1671-B-2	Coil	1	40	No. 4x3/16"	Parker-Kalon Screw (Bd. Hd.)	4
20	1671-B-3	Housing (Solenoid)	1				
21	1671-B-12	Spring	1	41	¼"20x3" Lg.	Cap Screw (Hex. Hd.)	4
22	1671-B-13	Flux Ring	1	42	No. 10 24x3/16" Lg.	Screw (Rd. Hd. Mach.)	1
23	1671-BB-15	Core Assem.	1		1671-R-10	Protector (Solenoid Housing)	1
24	1671-B-18	Locknut (Core Retaining)	1				
25	1671-B-19	Screw (Spring Retaining)	1				
26	1671-B-21	Gasket	1				

NOTES:

1. * Specify voltage when ordering complete Solenoid Valve, Solenoid Assembly, or Solenoid Coil.
2. For parts list on universal type remote control, see Bulletin No. 61-773.
3. For parts list on flexible cable type remote control, see Bulletin No. 61-771.
4. The No. 18597 Indicator Plate (see illustration) is used over cutout in grille when grille is in front of control arm (operating lever).
5. No. 1671-CA-1 "O" ring available for replacement on 1671-CCA needle valves of the type that uses "O" rings.

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No. 945 1"
MANUAL STEAM ADMISSION VALVE

INLET—1" I.P.S.
OUTLET—1" I.P.S.

DRAIN PORT—½" I.P.S.
WEIGHT—4½ LBS.

Fig. 1. No. 945 Manual Steam Admission Valve

GENERAL DESCRIPTION

The No. 945 1" Manual Steam Admission Valve is designed for hand control of the radiation in baggage, crew or dormitory cars and sections of other cars where it is unnecessary to provide a uniform temperature at all times.

This valve is equipped with 1" connections and is normally used with Vapor-Vulcan radiation, although it may be used with Unit Fin radiation if provided with a special fitting. It may be connected to overhead, wall or floor heat radiation.

In order to prevent the freezing of pipes when the radiation is not in use, the No. 945 Manual Steam Admission Valve is equipped with a small drain port which is open to the atmosphere when the valve is closed. This drain port releases condensate between the valve and the radiation and also permits air to enter the radiation, to break any vacuum that may be present, which permits condensate in the radiator to drain rapidly and prevent freezing. Figure 2 shows the way in which a disc on the valve stem performs this function.

MAINTENANCE AND OVERHAUL

The No. 945 Manual Steam Admission Valve requires no special care during operating periods. Steam escaping from around the valve stem is an indication that the valve should be repacked.

A leak of steam from the drain port while the valve is open is an indication that the disc is not seating properly. This may be caused by wearing of the disc or seat, or by distortion of the disc. To correct this condition, the disc and its seat should be lapped, using a fine grinding powder.

For continued efficient operation the valve should be disassembled and overhauled every two years. At this time each part should be inspected for wear and the spring tension checked. To dismantle the valve, remove the nut (sym. 8) and lift off the handle (sym. 7). Unscrew the bonnet (sym. 5) and the stuffing box (sym. 4) and lift out the stem assembly (sym. 2). Remove the retaining ring (sym. 11) at the bottom of the stem and take off the retainer washer (sym. 10) and the disc (sym. 3). The packing (sym. 9) and the spring (sym. 6) will become loose as the valve is disassembled.

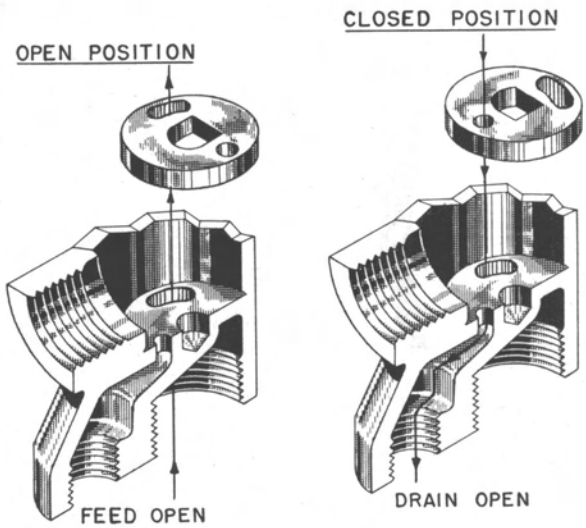

Fig. 2. View Showing the Position of the Disc when the Drain is Open or Closed

NO. 945—MANUAL STEAM ADMISSION VALVE (Cont.)

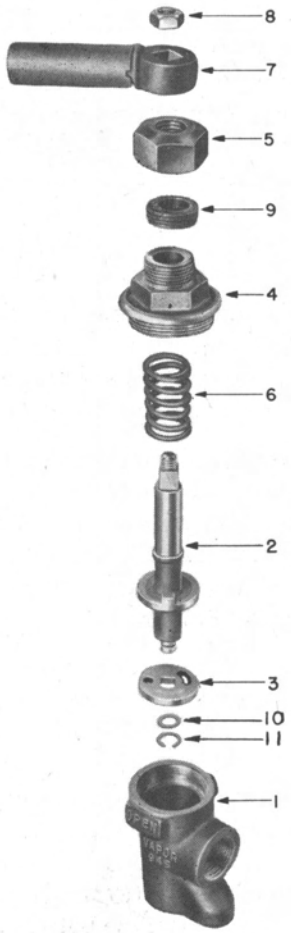

Fig. 3. Exploded View of No. 945 Valve

LIST OF PARTS

NO. 945 MANUAL STEAM ADMISSION VALVE

Sym.	Part No.	Description	Amt.
1	945-A	Body	1
2	945-B	Stem	1
3	945-B-1	Disc	1
4	120-C	Bonnet	1
5	120-D	Stuffing Box	1
6	120-E	Spring	1
7	122-FF	Handle, Complete	1
8	120-K	Nut 3/18″-16 x ¼″ thick—hex.	1
9	120-P	Packing	1
10	945-W	Washer (Retainer)	1
11	945-T	Retaining Ring	1

Nos. 947, B-947, BT-947, C-947 AND CT-947 METERING STEAM ADMISSION VALVES

For Floor Heat Unit Fin Radiation Lengths of Less Than Twelve Feet

B-947 HANDWHEEL OPERATED
C-947 REMOTE CONTROL OPERATED
BT-947 WITH ADAPTER-HANDWHEEL OPERATED
CT-947 WITH ADAPTER-REMOTE CONTROL OPERATED

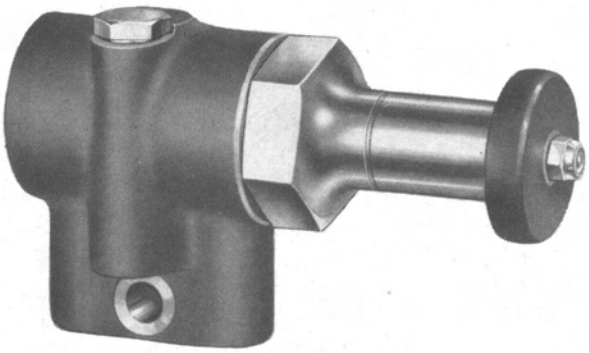

Fig. 1. No. B-947 Metering Steam Admission Valve

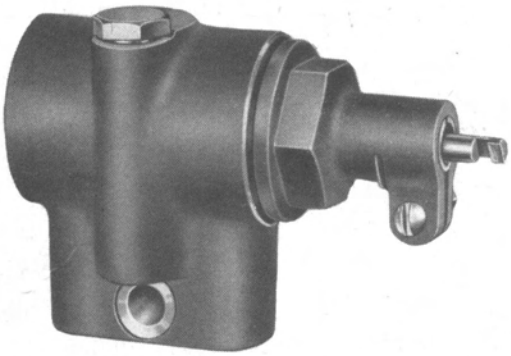

Fig. 2. No. C-947 Metering Steam Admission Valve

GENERAL DESCRIPTION

Metering steam admission valves of the No. 947 series are designed to control the volume of steam passed into the floor radiation units of less than twelve feet in railway cars of the room type. They may be adjusted to supply the radiation which they control with a selected proportion of total car steam for heating. Nos. 947, B-947 and C-947 valves are constructed for mounting in horizontal piping, while Nos. BT-947 and CT-947 valves are equipped with an adapter for mounting in vertical piping.

The operating principle of these valves is quite simple. The distance the needle is moved from its seat (which regulates the amount of steam passed into the radiation) is adjusted by manual operation by the passenger. This regulation is achieved in the Nos. 947, C-947 and CT-947 valves by a flexible cable, remote control lever located on the wall. In the Nos. B-947 and BT-947 this regulation is achieved by a button type handwheel located on the valve itself. As the remote control lever or handwheel is rotated, the needle is moved closer to or further away from its seat to control the amount of steam passed into the radiation.

The No. 947 (which is the earliest model of this type valve) contains a rack and pinion gear mechanism for transmitting the movement of the flexible cable to the needle. This valve is no longer furnished, but replacement parts are available for ordering and are listed on page 2.

MAINTENANCE AND OVERHAUL

Valves of the No. 947 series should be overhauled at every shopping period or at least once every two years. The valve should be disassembled, cleaned and inspected for wear. Worn or distorted parts should be replaced. Reassembled valves should be thoroughly tested before being replaced in service.

To disassemble the Nos. B-947 and BT-947 valves, unscrew the valve bonnet (sym. 12) and

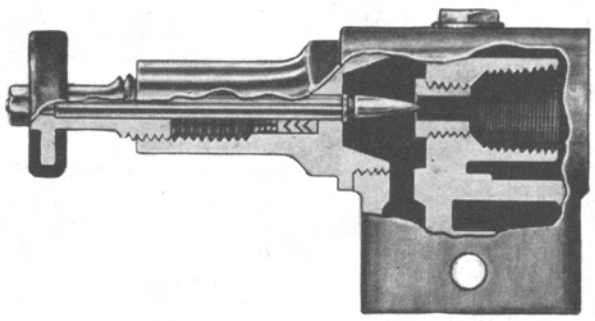

Fig. 3. Sectioned View of No. B-947 Valve

Nos. 947, B-947, BT-947, C-947, CT-947, METERING STEAM ADMISSION VALVES (Cont.)

remove it with the attached parts intact. Then unscrew the orifice plug (sym. 1) from the valve body (sym. 3) and remove the strainer (sym. 2). Clean the strainer. Unscrew the stop nut (sym. 19) and remove the button handwheel (sym. 18). From the bonnet (sym. 12) remove the spring retaining washer (sym. 10) to permit the removal of the spring (sym. 16), the female adapter (sym. 15), the packing rings (sym. 14) and the male adapter (sym. 13). Check the tension of the spring and inspect the packing for wear. Also inspect the needle and its seat to be sure of a tight fit and to be sure the needle and seat are not scored or wire drawn.

The same method of disassembly is used for the Nos. C-947 and CT-947 as above, except that the outer end of the bonnet (sym. 9) is not threaded but is equipped with a bushing (sym. 17) and is tightened by a nut (sym. 11) and bolt (sym. 8) to permit connection to the remote control cable. By loosening the nut and bolt, the needle (sym. 7) may be withdrawn far enough to disconnect the remote control cable (inset). Overhaul for these valves is like that previously described for the handwheel operated valves.

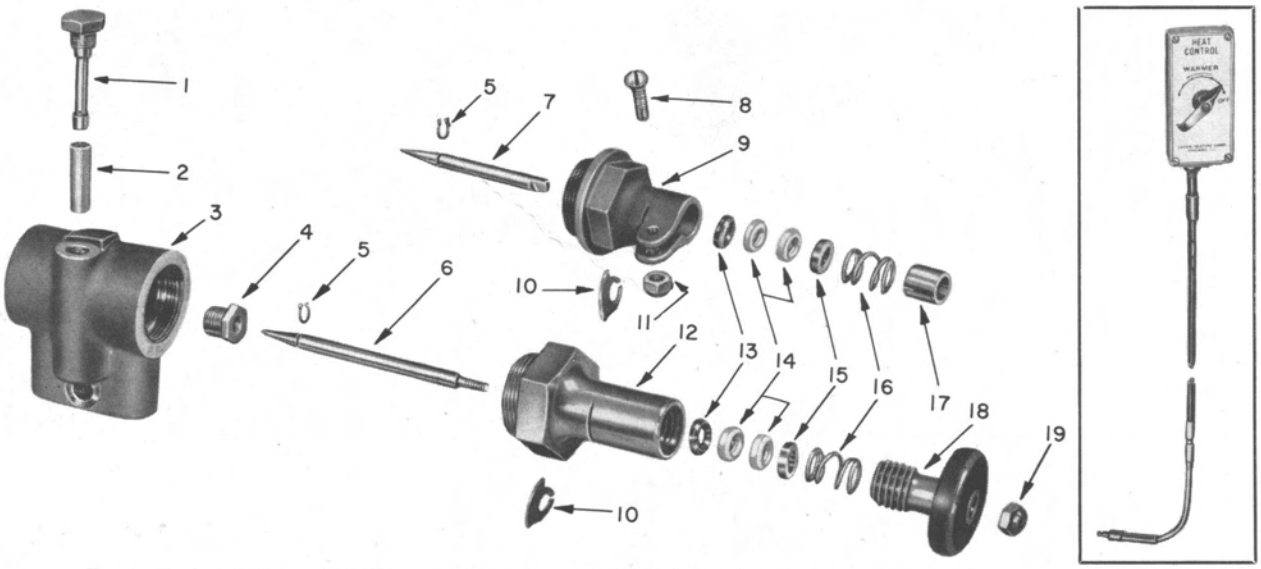

Fig. 4. Exploded View of 947 Type Valves and View of Remote Control Mechanism

LIST OF PARTS

Sym.	Description	Part Number					Amt.
		B-947	BT-947	C-947	CT-947	947	
1	Orifice Plug	947-10	947-10	947-10	947-10	947-10	1
2	Strainer	947-11	947-11	947-11	947-11	947-11	1
3	Valve Body	C-947-1	BT-947-1	C-947-1	BT-947-1	947-1	1
4	Seat	947-4	947-4	947-4	947-4	947-4	1
5	Retaining Ring	B-947-6	B-947-6	B-947-6	B-947-6	. . . . .	1
6	Needle (Handwheel)	B-947-4	B-947-4	. . . . .	. . . . .	. . . . .	1
7	Needle (Remote C.)	. . . . .	. . . . .	C-947-2	C-947-2	947-BB	1
8	Screw (R.H.M.)	. . . . .	. . . . .	No. 10-32x ¾″ Lg.	No. 10-32x ¾″ Lg.	No. 10-32x ¾″ Lg.	1
9	Bonnet (Remote C.)	. . . . .	. . . . .	C-938-2	C-938-2	947-3	1
10	Washer (Sp. Ret.)	C-938-5	C-938-5	C-938-5	C-938-5	. . . . .	1
11	Nut (ESNA)	. . . . .	. . . . .	No. 10-32	No. 10-32	No. 10-32	1
12	Bonnet (Handwheel)	B-947-2	B-947-2	. . . . .	. . . . .	. . . . .	1
13	Adapter (Male)	947-17	947-17	947-17	947-17	947-17	1
14	Packing Ring	947-19	947-19	947-19	947-19	947-19	2
15	Adapter (Female)	947-18	947-18	947-18	947-18	947-18	1
16	Spring	947-16	947-16	947-16	947-16	947-16	1
17	Bushing	. . . . .	. . . . .	C-938-4	C-938-4	947-23	1
18	Button Assembly	B-947-DD	B-947-DD	. . . . .	. . . . .	. . . . .	1
19	Nut (Elastic Stop)	No. 8-32	No. 8-32	. . . . .	. . . . .	. . . . .	1
*	Adapter Body	. . . . .	BT-947-2	. . . . .	BT-947-2	. . . . .	1
*	Bolt (Anchor)	. . . . .	BT-947-3	. . . . .	BT-947-3	. . . . .	2
*	Gasket	. . . . .	BT-947-4	. . . . .	BT-947-4	. . . . .	1
*	Gasket	. . . . .	BT-947-5	. . . . .	BT-947-5	. . . . .	2
*	Operating Guide	. . . . .	. . . . .	. . . . .	. . . . .	947-2	1
*	Washer (Split Type)	. . . . .	. . . . .	. . . . .	. . . . .	¼″ ID, ⅜″ OD	2
*	Spur Gear	. . . . .	. . . . .	. . . . .	. . . . .	947-12	1
*	Rack	. . . . .	. . . . .	. . . . .	. . . . .	947-13	1
*	Set Screw	. . . . .	. . . . .	. . . . .	. . . . .	947-21	2
*	Washer, Friction	. . . . .	. . . . .	. . . . .	. . . . .	947-22	1
*	Packing Gland	. . . . .	. . . . .	. . . . .	. . . . .	947-24	1

NOTE: *Not Illustrated.

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Nos. BV-949 AND CV-949 METERING STEAM ADMISSION VALVES

For Floor Heat Unit Fin Radiation Lengths of More Than Twelve Feet

BV-949 HANDWHEEL OPERATED

CV-949 REMOTELY OPERATED

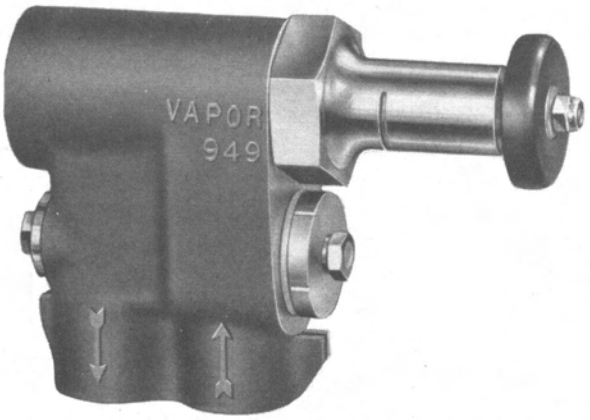

Fig. 1. No. BV-949 Metering Steam Admission Valve

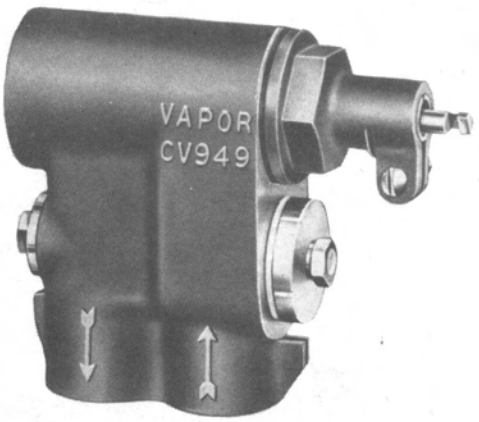

Fig. 2. No. CV-949 Metering Steam Admission Valve

GENERAL DESCRIPTION

Metering steam admission valves of the No. 949 series are designed to control the volume of steam passed into the floor radiation units in coaches, other open-body type railway cars or in long runs of radiation in room cars. They may be set to supply the radiation units which they control with a selectable proportion of the total car steam from full "ON," through several stages of restriction to full "OFF."

The operating principle of these valves is quite simple. The space between the needle valve and its seat (which determines the volume of steam passed) is adjusted in the No. BV-949 valve by a manually operated button on the valve. The same operation is accomplished in the No. CV-949 valve by a manually operated remote control mechanism with a flexible cable. The button, or handwheel, on the BV-949 valve is rotated so that its threaded portion moves the needle closer to or further from the seat; the flexible cable on the CV-949 valve exerts a push or pull on the needle to move it closer to or further from the seat. Each valve includes an orifice plug in the riser side which is adjusted to limit the maximum amount of steam to be passed. This adjustment is made when the car is first placed in service (and should not be further readjusted) to balance the system in accord with the heating requirements.

MAINTENANCE AND OVERHAUL

Valves of the No. 949 series should be overhauled at every shopping period, or at least once every two years. The valves should be disassembled, cleaned and inspected for wear (replacing worn or distorted parts) and reassembled, after which they should be thoroughly tested before being replaced in service.

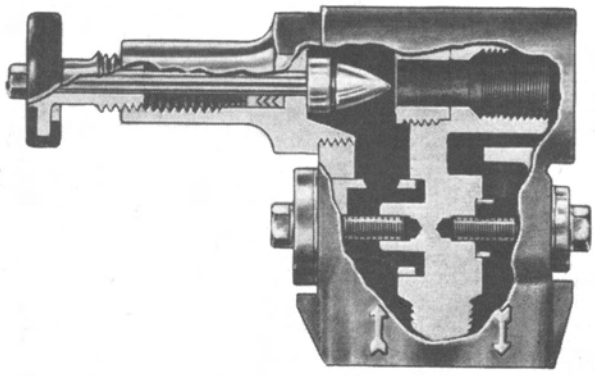

Fig. 3. Sectioned View of No. BV-949 Valve

Nos. BV-949 and CV-949, METERING STEAM ADMISSION VALVES (Cont.)

To disassemble the No. BV-949 valve, unscrew the valve bonnet (sym. 15) and remove it from the valve body with the other parts intact. Then unscrew the nut (sym. 22) from the operating button (sym. 21). Unscrew the button and remove the spring retaining washer (sym. 11), thus allowing the spring (sym. 19), the female adapter (sym. 18), the packing rings (sym. 17) and the male adapter (sym. 16) to be removed. Do not remove the needle valve seat (sym. 6) from the valve body (sym. 5). Check the tension of the spring and inspect the packing for wear. Also check the needle valve (sym. 9) and its seat to be sure it is not scored, wire drawn or binding. Remove the orifice plugs (syms. 3 and 8) and inspect them to be sure the holes are open.

The same method of disassembly applies to the No. CV-949 valve as that for the No. BV-949 except that the outside end of the bonnet (sym. 13) is not threaded, but is provided with a bushing (sym. 20) and a clamp arrangement with a nut (sym. 14) and bolt (sym. 12) to permit connection to a remote control mechanism and flexible cable. By loosening the clamp bolt and nut, the needle valve may be withdrawn far enough to disconnect the flexible cable (inset). Maintenance for this valve is similar to that of the No. B-949 valve.

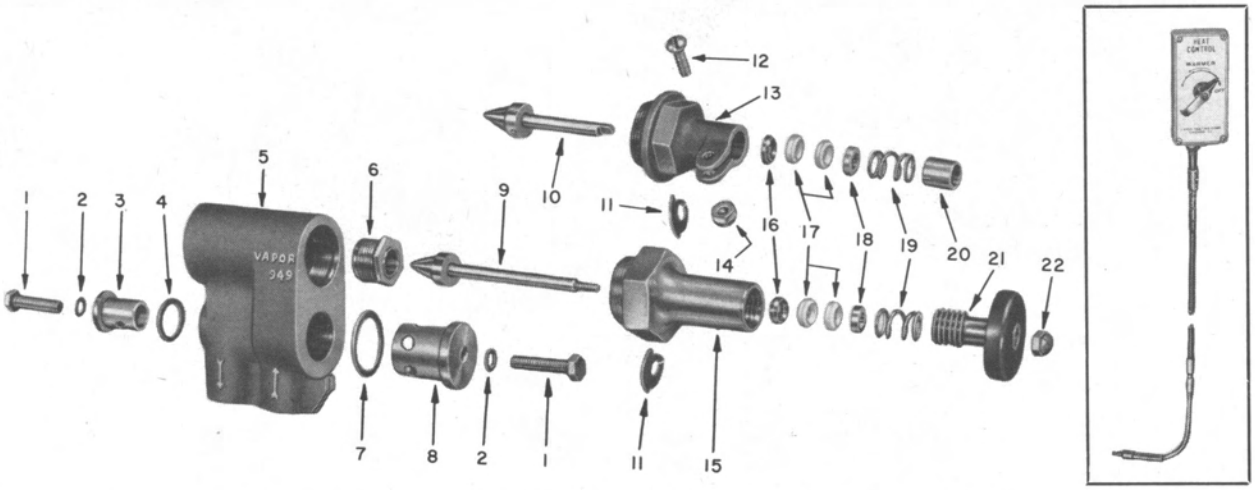

Fig. 4. Exploded View of 949 Type Valve, and View of Remote Control Mechanism

LIST OF PARTS

Sym.	Description	No. BV-949 Part No.	No. CV-949 Part No.	Amt.
1	Cap Screw	¼"-20-1-¼"	¼"-20-1-¼"	2
2	Gasket (Cap Screw)	CV-949-15	CV-949-15	2
3	Orifice Return Plug	CV-949-3	CV-949-3	1
4	Gasket (Return Plug)	CV-949-13	CV-949-13	1
5	Valve Body	CV-949-1	CV-949-1	1
6	Seat	C-938-3	C-938-3	1
7	Gasket (Feed Plug)	CV-949-14	CV-949-14	1
8	Orifice Feed Plug	CV-949-4	CV-949-4	1
9	Needle (Handwheel)	B-949-AA	. . . . .	1
10	Needle (Remote C.)	. . . . .	C-938-AA	1
11	Washer (Sp. Ret.)	C-938-5	C-938-5	1
12	Screw (R. H. M.)	. . . . .	No. 10-32x¾" Lg.	1
13	Bonnet (Remote C.)	. . . . .	C-938-2	1
14	Nut (ESNA)	. . . . .	No. 10-32	1
15	Bonnet (Handwheel)	B-947-2	. . . . .	1
16	Adapter (Male)	947-17	947-17	1
17	Packing Ring	947-19	947-19	2
18	Adapter (Female)	947-18	947-18	1
19	Spring	947-16	947-16	1
20	Bushing	. . . . .	C-938-4	1
21	Button Assembly	B-947-DD	. . . . .	1
22	Nut (Elastic Stop)	No. 8-32	. . . . .	1

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Nos. B-938 AND C-938 METERING STEAM ADMISSION VALVES

For Overhead Heat Radiators

B-938 HANDWHEEL OPERATED

C-938 REMOTELY OPERATED

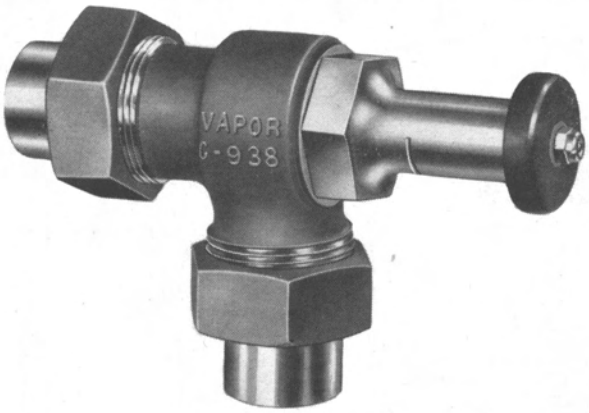

Fig. 1. No. B-938 Metering Steam Admission Valve

Fig. 2. No. C-938 Metering Steam Admission Valve

GENERAL DESCRIPTION

Metering steam admission valves of the No. 938 series are designed to control the volume of steam passed into the overhead radiators of railway cars. They are normally adjusted to supply the radiation units which they control with full steam for heating, being positioned "OFF" only in emergency.

The operating principle of the valves is quite simple. The distance the needle valve is moved from its seat (which determines the volume of steam passed) is adjusted by manual operation. Any adjustment other than fully "ON" is used to balance the system. The B-938 valve is generally located in the riser pipe leading to the radiation and is equipped with a handle. As the handle is rotated in its threads the needle valve is moved toward, or away from, its seat. The C-938 valve is located near the radiator and is equipped with a flexible cable and remote control mechanism. As the remote control lever is rotated, the flexible cable exerts a push or pull on the needle valve to move it toward or away from its seat.

MAINTENANCE AND OVERHAUL

Valves of the No. 938 series should be overhauled at every shopping period, or at least once every two years. The valves should be disassembled, cleaned and inspected for wear (replacing worn or distorted parts) and reassembled, after which they should be thoroughly tested before being replaced in service.

To disassemble the No. B-938 valve, unscrew the valve bonnet (sym. 9) and remove it from the valve body with the other parts intact. Then unscrew the nut (sym. 17) from the operating button (sym. 16). Unscrew the button and remove the spring retaining washer (sym. 6), thus allowing the spring (sym. 14), the female adapter (sym. 13), the packing rings (sym. 12) and the male adapter (sym. 11) to be removed. Do not remove the needle valve seat (sym. 5) from the

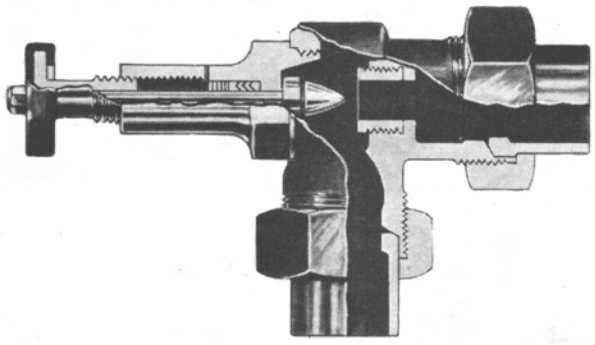

Fig. 3. Sectioned View of No. B-938 Valve

Nos. B-938 and C-938, METERING STEAM ADMISSION VALVES (Cont.)

valve body (sym. 3). Check the tension of the spring and inspect the packing for wear. Also check the needle and its seat to be sure of a tight fit and to be sure the needle and seat are not scored or wire drawn.

The same method of disassembly applies to the No. C-938 valve as that for the No. B-938 except that the outside end of the bonnet (sym. 10) is not threaded, but is provided with a bushing (sym. 15) and a clamp with a nut (sym. 18) and bolt (sym. 8) to permit connection to a remote control mechanism and flexible cable. By loosening the clamp bolt and nut, the needle valve may be withdrawn far enough to disconnect the flexible cable (inset). Maintenance for this valve is similar to that of the No. B-938 valve.

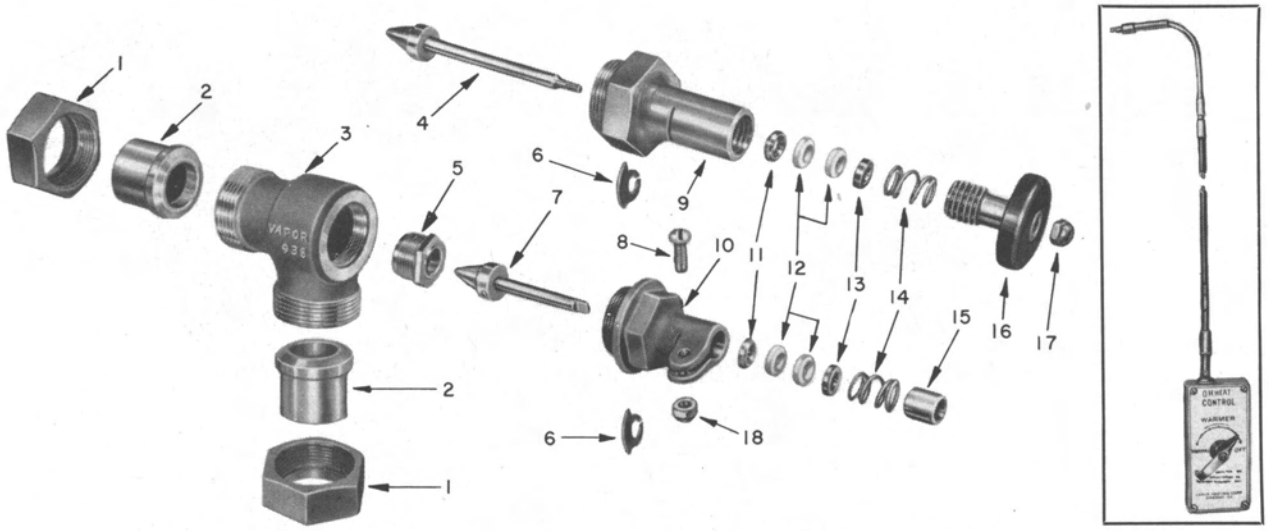

Fig. 4. Exploded View of No. 938 Type Valves and View of Remote Control Mechanism

LIST OF PARTS

Sym.	Description	No. B-938 Part Number	No. C-938 Part Number	Amt.
1	Nut, Union	441-B	441-B	2
2	Body, Union	441-3A	441-3A	2
3	Valve Body	C-938-1	C-938-1	1
4	Needle (Handwheel)	B-949-AA	. . . . .	1
5	Seat	C-938-3	C-938-3	1
6	Washer, Sp. Retain	C-938-5	C-938-5	1
7	Needle (Remote C.)	. . . . .	C-938-AA	1
8	Screw (R.H.M.)	. . . . .	No. 10-32x¾" Lg.	1
9	Bonnet (Handwheel)	B-947-2	. . . . .	1
10	Bonnet (Remote C.)	. . . . .	C-938-2	1
11	Adapter, Male	947-17	947-17	1
12	Packing Ring	947-19	947-19	2
13	Adapter, Female	947-18	947-18	1
14	Spring	947-16	947-16	1
15	Bushing	. . . . .	C-938-4	1
16	Button (Handwheel Assembly)	B-947-DD	. . . . .	1
17	Nut (Elastic Stop)	No. 8-32	. . . . .	1
18	Nut (ESNA)	. . . . .	No. 10-32	1

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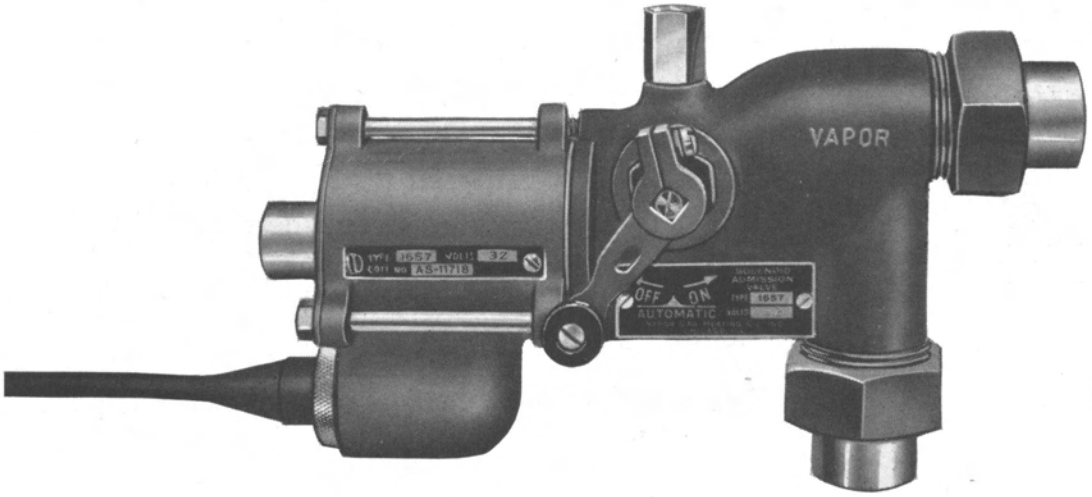
No. 1657 SOLENOID STEAM ADMISSION VALVE

FOR DIRECT CURRENT ONLY

UNION INLET AND OUTLET FOR SOLDERING TO 1⅛" O. D. COPPER TUBING OR FOR 1" I. P. S.

POWER CONSUMPTION — 10 WATTS AT 32 VOLTS D. C.
WEIGHT — 10¾ LBS. MAXIMUM PRESSURE — 15 LBS.



DESCRIPTION

This is a horizontal type Solenoid Steam Admission Valve for controlling the flow of steam into an overhead radiator on overhead heat installations made in conjunction with the Zone Type of Heating System. This valve is similar in construction to the No. 1646 Solenoid Steam Admission Valve. However, where the No. 1646 Valve is closed electrically and consumes current in the closed position, the No. 1657 Valve is opened electrically and consumes current in the open position.

The No. 1657 solenoid valve rests normally in the closed position with the solenoid de-energized. This is accomplished mechanically by tension of the spring confined between the collar on the valve stem and the member bearing against the solenoid core guide tube retaining nut. The valve is opened magnetically by the energization of the solenoid, which pulls in the core to open the valve against the opposition of the spring. Current is consumed only whenever the solenoid is energized, that is

DESCRIPTION (Continued)

whenever the valve is in the magnetically open position to feed steam into the overhead radiator.

Condensate from the overhead radiator will drain back into the valve body outlet chamber, from where it will overflow through the ball check valve (trap) arrangement into the inlet chamber, by lifting the ball off its seat, whenever the condensate back pressure is greater than the inlet steam pressure. From the inlet chamber the condensate will drain back to the drain tube at the Regulator (generally No. 902).

These valves are available only in the left hand type, that is with the solenoid on the left hand side of the assembly, when facing the valve. The manually operable mechanism cannot be reversed to the under side of the valve, as steam would then be fed through the ball check into the radiator in the "OFF" or closed position of the valve.

The No. 1657 Solenoid Valves may also be used to control the admission of steam to radiators on other than overhead heat installations, where it is considered preferable to have no current consumed in the closed or "OFF" position of the valve.

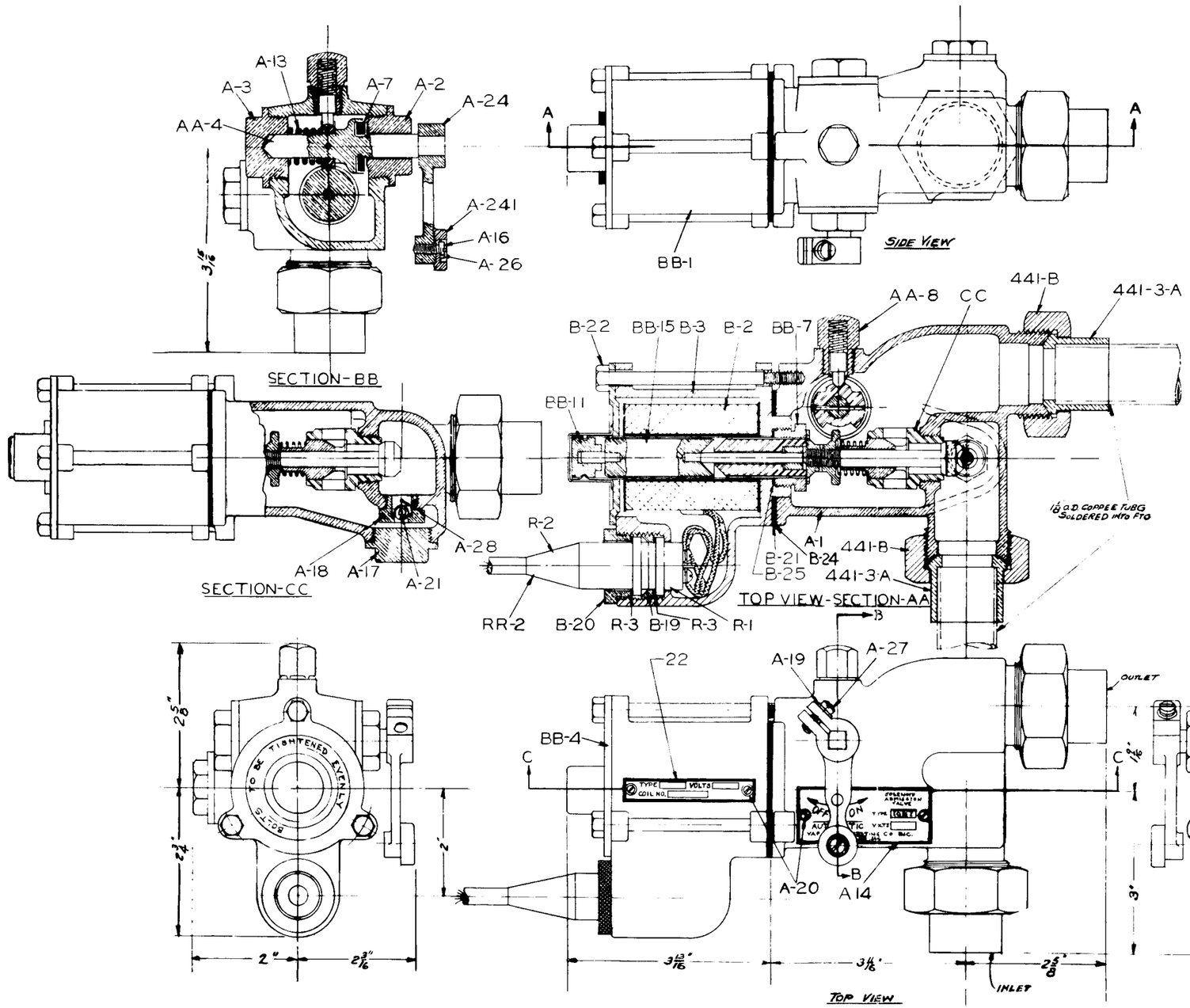
THERMOSTATIC OPERATION

For thermostatic operation, the manually operable mechanism must be at "Automatic," that is the crank or operating rod handle must be in central position. In this position, the valve is freely movable by the solenoid.

When the Air Conditioning Control Switch is in the "HEATING" sector, the BLOWER SWITCH has been turned "ON" (both on the Air Conditioning Control Panel), and overhead heat is required, the overhead heat thermostat setting not having been reached, the No. 1657 Overhead Heat Solenoid Steam Admission Valve will become energized and will open electrically to admit steam into the overhead heat radiator. The solenoid on the steam admission valve will be energized by the overhead heat relay, which will be energized to close its contacts when the overhead heat thermostat is not in contact.

When the desired set overhead heat temperature has been reached, the mercury in the overhead heat thermostat will be in contact with the upper thermostat contact. This will de-energize the overhead heat relay, opening the relay contacts to de-energize the solenoid on the No. 1657 Steam Admission Valve. The valve will then close mechanically by spring tension, cutting off the flow of steam to the overhead heat radiator.

No. 1657 SOLENOID STEAM ADMISSION VALVE



LIST OF PARTS

SYM.	PART NO.	DESCRIPTION	MATERIAL	AM'T
A-1	1657-A-1	Body	Brass	1
A-2	1646-A-2	Seal Retaining Nut	Brass	1
A-3	1646-A-3	Retaining Nut	Brass	1
AA-4	1646-AA-4	Operating Rod Assembly		1
A-7	1646-A-7	Disc	Comp.	1
AA-8	1646-AA-8	Locking Pin Assembly		1
A-13	1646-A-13	Operating Rod Spring	Steel	1
A-14	1657-A-14	Name Plate	Enduro	1
A-16	No. 10-24x½" lg	Screw (Fil. Hd. Mach.)	St. C. P.	1
A-17	1657-A-17	Cap	Brass	1
A-18	1657-A-18	Ball Check Retainer	Brass	1
A-19	¼" Split Type	Lockwasher	Steel	1
A-20	No. 4 x 1/8" Parker Kalon	Screw	St. C. P.	4
A-21	¼" Dia.	Ball Bearing	Steel	1
AA-24	1646-AA-24	Handle Complete with Knob, Incl: A-16, A-24, A-26, A-241		
A-24	1646-A-24	Handle (Operating Rod)	Brass	1
A-26	No. 10 Split Type	Lockwasher	Steel	1
A-27	¼"-20x½" lg.	Screw (Fil. Hd. Mach.)	St. C. P.	1
A-28	1/8"x1/16" lg.	Retaining Wire (Ball Bearing)	Brass	1
A-241	1646-A-241	Knob	Black Fibre	1
BB-1	1646-BB-1	Solenoid Housing Assembly		1
B-2	1657-B-2	Solenoid Coil		1
B-3	1646-B-3	Solenoid Housing	C. I. C. P.	1
BB-4	1646-BB-4	Solenoid Housing Cover Assembly		1
BB-7	1646-BB-7	Guide Tube Retaining Nut Assembly		1
BB-11	1646-BB-11	Guide Tube Assembly		1
BB-15	1646-BB-15	Core Assembly		1
B-19	1646-B-19	Connecting Locking Ring	Brass	1
B-20	1646-B-20	Connector Jam Nut	Brass	1
B-21	1646-B-21	Gasket	No. 7228 Garlock	1
B-22	¼"-20x3½" lg.	Cap Screw, Hex. Hd.	St. C. P.	3
B-24	1646-B-24	Gasket	Soft Brass	1
B-25	1646-B-25	Gasket	Dead Soft Ann'l'd Copper	1
CC	1657-CC	Inlet Valve Assembly		1
R-1	1646-R-1	Connector Plug		1
R-2	1651-R-2	Connector Receptacle		1
R-3	1646-R-3	Washer	Brass	2
RR-2	1651-RR-2	Connector Receptacle, inc. B-20, R-2, R-3		
441-3-A	441-3-A	Tail Piece or Nipple	Brass	2
441-B	441-B	Nut, Union	Mall. Iron	2
22	1657-B-22	Coil Identification Plate	Enduro	1

NOTE: Guide tube, if stocked separately, must be handled carefully to avoid damage to flange.

Solenoid assembly carries name plate indicating voltage and coil number. Specify voltage when ordering complete solenoid or coil.

NOTE: Where specified, valve can be furnished with No. 441-A Male Union Nipples for 1" I. P. S. connection.

NOTE:
WHEN ORDERING, SPECIFY VOLTAGE REQUIRED, THUS:
32 V., D.C.
64 V., D.C.
110 V., D.C.
ALSO SPECIFY WHETHER FOR COPPER TUBING OR 1" I. P. S.

No. 1657 SOLENOID STEAM ADMISSION VALVE

MANUAL OPERATION

These valves are operated manually in the same way as the No. 1646 Steam Admission Valves, in case of thermostatic control failure, whether due to thermostat failure, power failure, or valve sticking.

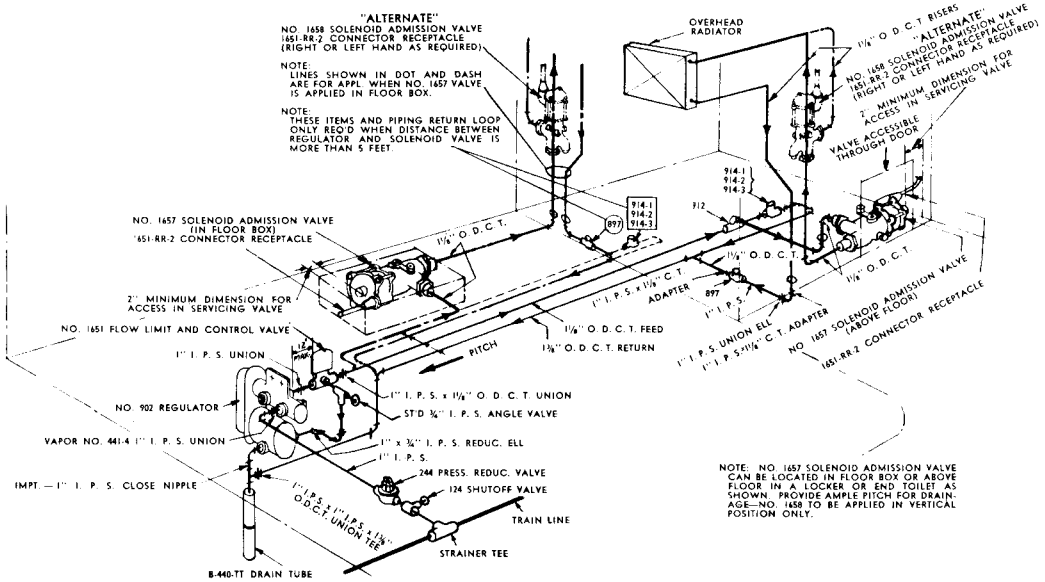
The manually operable handle or lever should normally be in the neutral or "AUTOMATIC" position. The handle or lever is swung clockwise to "ON" position for keeping the valve in the manually open position; the lever is swung counter-clockwise to "OFF" for keeping the valve in the manually closed position.

INSTRUCTIONS FOR TRAINMEN

Overhead heat will not be available unless the Air Conditioning Control Switch on the Air Conditioning Panel is in the "HEATING" sector. Also, the BLOWER SWITCH on the Air Conditioning Control Panel must be turned "ON".

When the Air Conditioning Control Switch is in "COOLING", the overhead heat solenoid steam admission valve will be de-energized and thereby will be in the closed position. Should the solenoid steam admission valve be in manually "ON" position, no overhead heating will still be available during cooling, as the No. 1651 Type Flow Limit Valve will be energized to short circuit the steam back to the thermostatic diaphragm in the Regulator, thereby keeping the Regulator shut-off.

APPLICATION AND LOCATION



The No. 1657 Solenoid Steam Admission Valve must be applied in horizontal position and must be so located, as to be easily accessible. The valve can be mounted on the floor in an upright position, or with the manually operable mechanism face up.

A minimum space of about 4" is required between the solenoid end and the nearest obstruction.

When the solenoid valve is more than five (5) feet away from the Regulator, the Nos. 897 and 914 Vapor Retarders

APPLICATION AND LOCATION (Continued)

must be used between the feed and return portions of the steam supply loop.

The No. 912 Water Seal Fitting is used in conjunction with these solenoid valves, where it is necessary that the valves be kept cool in the closed or "OFF" position.

For remote manual operation of valves, the No. 1643 Remote Control Operating Mechanism is used for partition applications, while the No. S-1643 Remote Control Operating Mechanism is used for side wall applications. The No. 1644 Remote Control is used on valve applications in open body cars, when valve is located under seat at end of coach section and on other type applications.

The Remote Manual Control Operating Mechanisms are used when valves are located in not very accessible places for manual operation. These mechanisms are flexible shaft attachments for connecting to the outer end of manual lever in lieu of knob for operating the valve manually from a distance for the convenience of the passengers.

MAINTENANCE

Solenoid Steam Admission Valves should be overhauled once a year, before the beginning of the heating season. At time of overhaul, the valve and seat should be checked for tight seating. In the event these are scored and do not seat tight, the inlet valve assembly should be replaced. The Inlet Valve Assembly can be removed with a standard 1" spark plug wrench (long type). The solenoid housing and complete valve should be thoroughly cleaned and thermostatic operation should be checked for valve and core binding, mis-alignment or seizing. The manually operable mechanism should be likewise checked for freedom from binding and seizing, and corrections should be made, if necessary. Should seat disc on manual operating rod be loose, it should be recemented in place.

Should this solenoid valve fail in service because of power or thermostat failure, it will do so in the "OFF" position. The valve should then be operated manually to prevent overheating of car. Failure should be reported upon arrival at terminal.

The yard forces are to examine the thermostat, etc., on arrival. In the event thermostat and relay function satisfactorily, and the cycling resistors as well as rheostat or adjustment resistors are O. K., the valve should be examined for grounding due to moisture in the solenoid housing. However, ordinarily grounding should not occur, as the seal provided against steam leakage into the electrical portion is as perfect as possible.

To remove the cord, simply screw out the jam nut (Symbol B-20) and pull out the receptacle and cord (Symbol RR-2). The inner connector plug does not have to be disturbed.

To remove the inner connector plug (Symbol R-1), screw out the Connector Locking Ring (Symbol B-19).

The Connector Locking Ring can be removed with Vapor Company's No. 14182 Wrench, which can be purchased from the Vapor Car Heating Co.

Printed in U.S.A.

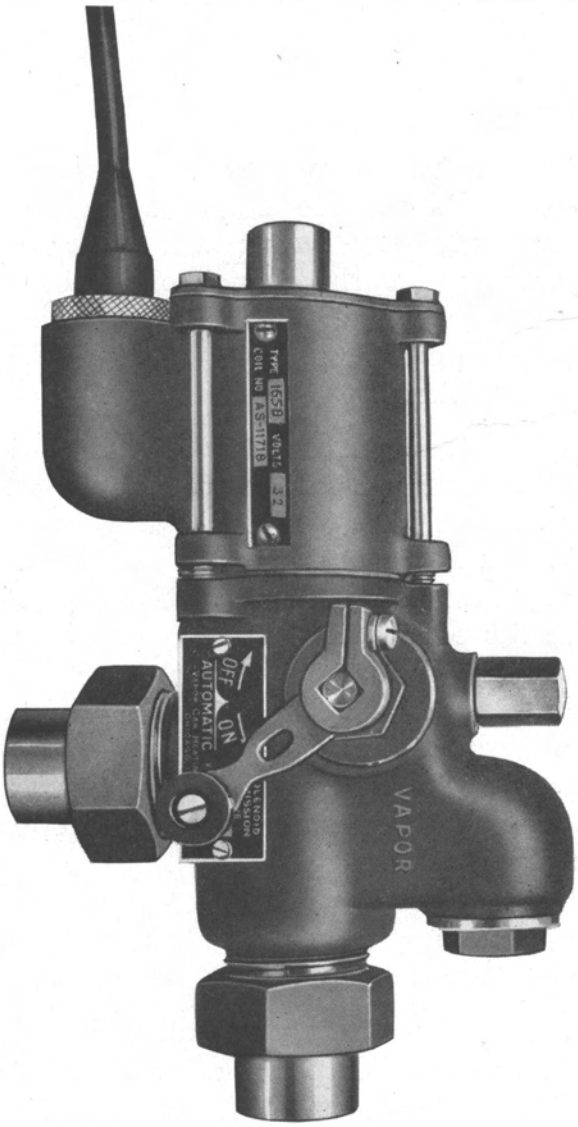
No. 1658 SOLENOID STEAM ADMISSION VALVE

No. R-1658—R. H. Type **No. L-1658—L. H. Type**

FOR DIRECT CURRENT ONLY

UNION INLET AND OUTLET FOR SOLDERING TO 1⅛" O. D. COPPER TUBING OR FOR 1" I. P. S.

POWER CONSUMPTION — 50 WATTS AT 32 VOLTS D. C.
WEIGHT — 10¾ LBS. MAXIMUM PRESSURE — 15 LBS.



DESCRIPTION

This is a vertical type Solenoid Steam Admission Valve for controlling the flow of steam into an overhead radiator on overhead heat installations made in conjunction with the Zone Type of Heating System. This valve is similar in construction and operation to the No. 1657 Solenoid Steam Admission Valve, except that the No. 1658 Valve is vertically instead of horizontally positioned.

The solenoid valve rests normally in the closed position with the solenoid de-energized. This is accomplished mechanically by tension of the spring confined between the collar on the valve stem and the member bearing against the solenoid core guide tube retaining nut. The valve is opened magnetically by the energization of the solenoid, which pulls in the core to open the valve against the opposition of the spring. Current is consumed only whenever the solenoid is energized, that is whenever the valve is in the magnetically open position to feed steam into the overhead radiator.

Condensate from the overhead radiator will drain back into the valve body outlet chamber and from there it will drain through the ball trap (check valve) arrangement into the inlet chamber, whenever the condensate back

DESCRIPTION (Continued)

pressure is greater than the inlet steam pressure. From the inlet chamber the condensate will drain back to the drain tube at the Regulator (generally No. 902).

This valve supersedes the No. 1647 Solenoid Steam Admission Valve, which is the first vertical type valve of this design put out. The No. 1647 valve is closed by the weight of its movable parts instead of by a spring. Prints from Vapor Car Heating Co.'s drawing, showing all replacement parts for this valve, will be furnished upon request.

These valves are available with the steam portion either on the right hand side or left hand side of the valve. The right hand side valve is known as R-1658; the left hand side valve is known as L-1658.

THERMOSTATIC OPERATION

This type of valve operates thermostatically in the same way as the No. 1657 Solenoid Steam Admission Valve. For thermostatic operation, the manually operable mechanism must be at "Automatic", that is the operating rod handle must be in central position, in which position the valve is freely movable by the solenoid.

When the Air Conditioning Control Switch is in the "HEATING" sector, the BLOWER SWITCH has been turned "ON" (both on the Air Conditioning Control Panel), and overhead heat is required, the overhead heat thermostat setting not having been reached, the No. 1658 Overhead Heat Solenoid Steam Admission Valve will become energized and will open electrically to admit steam into the overhead heat radiator. The solenoid on the steam admission valve will be energized by the overhead heat relay, which will be energized to close its contacts when the overhead heat thermostat is not in contact.

When the desired set overhead heat temperature has been reached, the mercury in the overhead heat thermostat will be in contact with the upper thermostat contact. This will de-energize the overhead heat relay, opening the relay contacts to de-energize the solenoid on the No. 1658 Steam Admission Valve. The valve will then close mechanically by spring tension, cutting off the flow of steam to the overhead heat radiator.

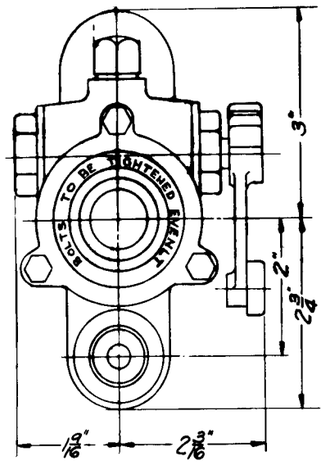
MANUAL OPERATION

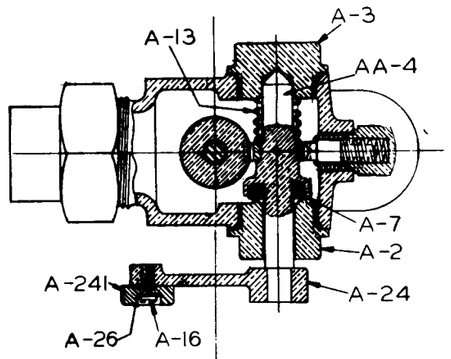
These valves are operated manually in the same way as the Nos. 1646 and 1657 Steam Admission Valves, in case of thermostatic control failure, whether due to thermostat failure, power failure, or valve sticking.

The manually operable handle or lever should normally be in the neutral or "AUTOMATIC" position. The handle or lever is swung to "ON" position for keeping the valve in the manually open position; the lever is swung to "OFF" for keeping the valve in the manually closed position.

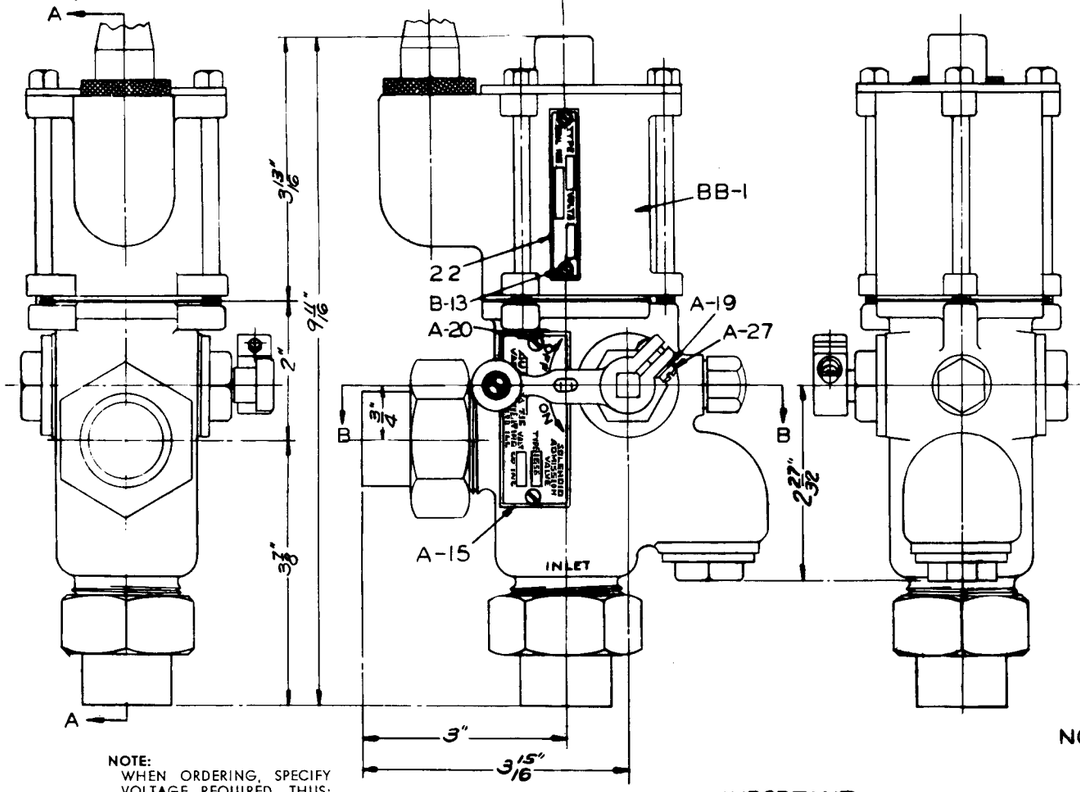
No. 1658 SOLENOID STEAM ADMISSION VALVE

Nos. R-1658 and L-1658 SOLENOID STEAM ADMISSION VALVES





SECTION-BB



NOTE:
WHEN ORDERING, SPECIFY VOLTAGE REQUIRED, THUS:
32 V., D.C.
64 V., D.C.
110 V., D.C.
ALSO SPECIFY WHETHER FOR COPPER TUBING OR 1" I.P.S.

IMPORTANT-
VALVE MUST BE APPLIED IN VERTICAL POSITION.

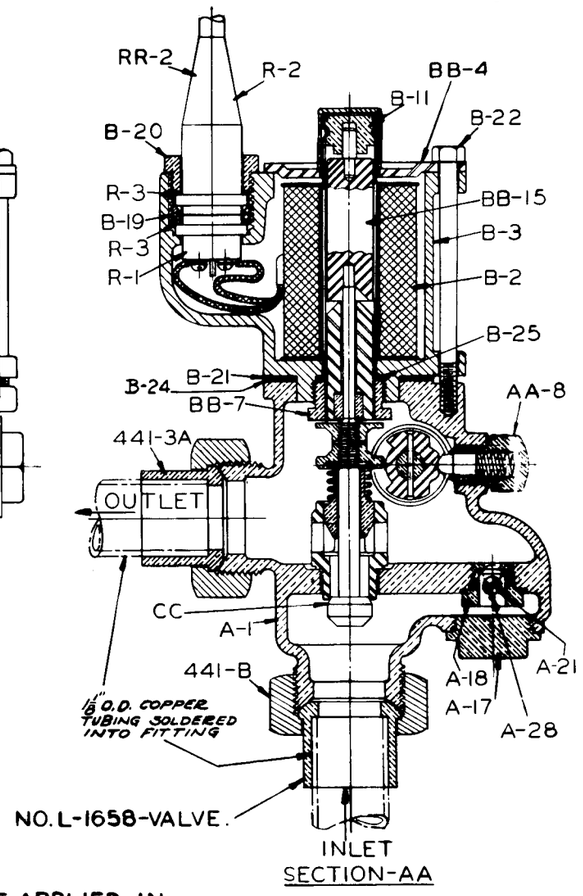
LIST OF PARTS

SYM.	PART NO.	DESCRIPTION	MATERIAL	AM'T
A-1	1658-A	Body	Brass	1
A-2	1646-A-2	Nut (Seal)	Brass	1
A-3	1646-A-3	Nut (Retaining)	Brass	1
AA-4	1646-AA-4	Rod Assembly		1
A-7	1646-A-7	Disc	Comp.	1
AA-8	1646-AA-8	Pin (Assembly)		1
A-13	1646-A-13	Spring (Operating Rod)	Steel	1
A-14	1658-A-14	Plate (Name), R. H. Valve	Enduro	1
A-15	1658-A-15	Plate (Name), L. H. Valve	Enduro	1
A-16	No. 10-24x½"	Screw (Fil. Hd. Mach.) Knob	St. C. P.	1
A-17	1657-A-17	Cap	Brass	1
A-18	1658-A-18	Retainer (Ball Check)	Brass	1
A-19	¼" Split Type	Lockwasher (Handle)	Steel	1
A-20	No. 4 x 1/16" Parker Kalon	Screw (Name Plate)	St. C. P.	2
A-21	¼" Dia.	Ball Bearing	Steel	1
AA-24	1646-AA-24	Handle Compl. with Knob, Incl: A-16, A-24, A-26, A-241		
A-24	1646-A-24	Handle (Operating Rod)	Brass	1
A-26	No. 10 Split Type	Lockwasher (Handle)	Steel	1
A-27	¼"-20x½" lg.	Screw (Handle), Fil. Hd. Mach.	St. C. P.	1
A-28	1/16"x1¼" lg.	Wire (Ball Bearing Retaining)	Brass	1
A-241	1646-A-241	Knob (Handle)	Black Fibre	1
BB-1	1657-BB-1	Housing Assembly		1
B-2	1657-B-2	Coil (Solenoid)		1
B-3	1646-B-3	Housing (Solenoid)	C. I. C. P.	1
BB-4	1646-BB-4	Cover Assembly		1
BB-7	1646-BB-7	Nut (Guide Tube) Assembly		1
BB-11	1646-BB-11	Tube Assembly		1
B-13	No. 6-32x1/8" lg.	Screw, R. H. M.	St. C. P.	2
BB-15	1646-BB-15	Core Assembly		1
B-19	1646-B-19	Ring (Connector Locking)	Brass	1
B-20	1646-B-20	Nut (Connector Jam)	Brass	1
B-21	1646-B-21	Gasket	No. 7228 Garlock	1
B-22	¼"-20x3½" lg.	Cap Screw, Hex. Hd.	St. C. P.	3
B-24	1646-B-24	Gasket	Soft Brass	1
B-25	1646-B-25	Gasket	Dead Soft Ann'l'd Copper	1
CC	1657-CC	Valve Assembly		1
R-1	1646-R-1	Plug (Connector)		1
R-2	1651-R-2	Receptacle (Connector)		1
R-3	1646-R-3	Washer (Connector)	Brass	2
RR-2	1651-RR-2	Connector Receptacle—B-20, R-2, R-3		
441-3A	441-3-A	Tail Piece or Nipple	Brass	2
441-B	441-B	Nut, Union	Mall. Iron	2
22	1657-B-22	Plate (Coil Identification)	Enduro	1

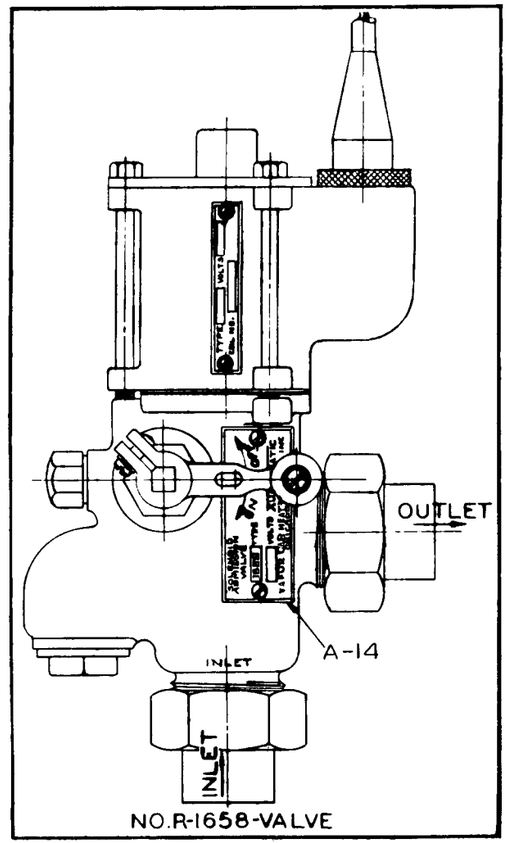
NOTE: Where specified, valve can be furnished with No. 441-A Male Union Nipples for 1" I. P. S. connection.

NOTE: Guide tube, if stocked separately, must be handled carefully to avoid damage to flange.

Solenoid assembly carries name plate indicating voltage and coil number. Specify voltage when ordering complete solenoid or coil.



SECTION-AA



NO. R-1658-VALVE

INSTRUCTIONS FOR TRAINMEN

Overhead heat will not be available unless the Air Conditioning Control Switch on the Air Conditioning Panel is in the "HEATING" sector. Also, the blower switch on the Air Conditioning Control Panel must be turned "ON".

When the Air Conditioning Control Switch is in "COOLING," the overhead heat solenoid steam admission valve will be de-energized and thereby will be in the closed position. Should the solenoid steam admission valve be in manually "ON" position, no overhead heating will still be available during cooling, as the No. 1651 Type Flow Limit Valve will be energized to short circuit the steam back to the thermostatic diaphragm in the Regulator, thereby keeping the Regulator shut off.

APPLICATION AND LOCATION

The No. 1658 Solenoid Steam Admission Valve must be applied in vertical position and must be so located, as to be easily accessible.

A minimum space of about 4" is required between the solenoid end and the nearest obstruction.

When the solenoid valve is more than five (5) feet away from the Regulator, the No. 914 Vapor Retarder must be used between the feed and return portions of the steam supply loop.

The No. 912 Water Seal Fitting is used in conjunction with these solenoid valves, where it is necessary that the valves be kept cool in the closed or "OFF" position.

For application diagram, see Bulletin No. 61-751 on the No. 1657 Solenoid Steam Admission Valve.

For remote manual operation of valves, the No. 1643 Remote Control Operating Mechanism is used for partition applications, while the No. S-1643 Remote Control Operating Mechanism is used for side wall applications. The No. 1644 Remote Control is used on valve applications in open body cars, when valve is located under seat at end of coach section and on other type applications.

The Remote Manual Control Operating Mechanisms are used when valves are located in not very accessible places for manual operation. These mechanisms are flexible shaft attachments for connecting to the outer end of manual lever in lieu of knob for operating the valve manually from a distance for the convenience of the passengers.

These valves can be reversed from R. H. to L. H. operation by removing the plugs and reversing the entire manually operable assembly, shifting end for end, so as to place the operating handle on either side of valve casing, as may be most convenient in any particular installation. Proper new indicating plates should then be obtained and applied, as manually "ON" and "OFF" positions will then be reversed.

MAINTENANCE

Solenoid Steam Admission Valves should be overhauled once a year, before the beginning of the heating season. At time of overhaul, the valve and seat should be checked for tight seating. In the event these are scored and do not seat tight, the inlet valve assembly should be replaced. The Inlet Valve Assembly can be removed with a standard 1" spark plug wrench (long type). The solenoid housing and complete valve should be thoroughly cleaned and thermostatic operation should be checked for valve and core binding, mis-alignment or seizing. The manually operable mechanism should be likewise checked for freedom from binding and seizing, and corrections should be made, if necessary. Should seat disc on manual operating rod be loose, it should be recemented in place.

Should this solenoid valve fail in service because of power or thermostat failure, it will do so in the "OFF" position. The valve should then be operated manually to prevent overheating of car. Failure should be reported upon arrival at terminal.

The yard forces are to examine the thermostat, etc., on arrival. In the event thermostat and relay function satisfactorily, and the cycling resistors as well as rheostat or adjustment resistors are O. K., the valve should be examined for grounding due to moisture in the solenoid housing. However, ordinarily grounding should not occur, as the seal provided against steam leakage into the electrical portion is as perfect as possible.

To remove the cord, simply screw out the jam nut (Symbol B-20) and pull out the receptacle and cord (Symbol RR-2). The inner connector plug does not have to be disturbed.

To remove the inner connector plug (Symbol R-1), screw out the connector locking ring (Symbol B-19).

The Connector Locking Ring (Symbol B-19) can be removed with Vapor Company's No. 14182 Wrench, which can be purchased from the Vapor Car Heating Co.

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Printed in U.S.A.

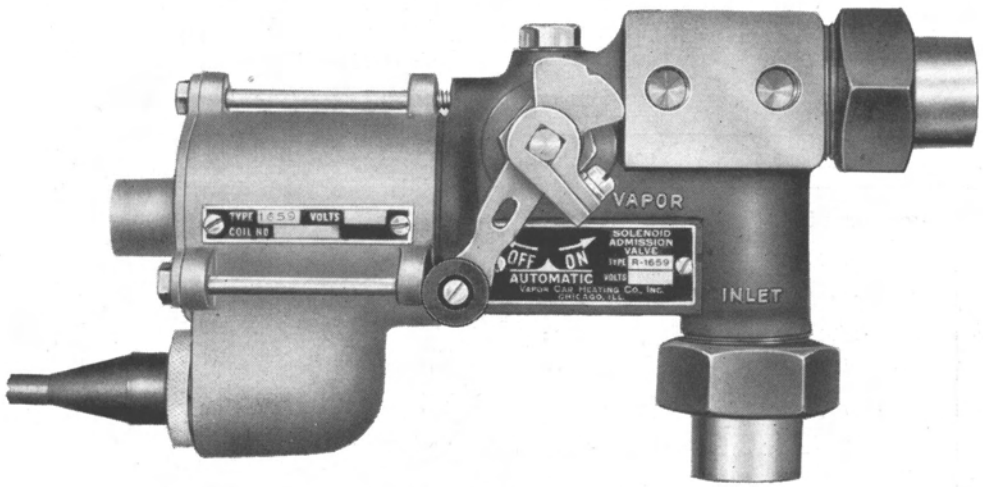
No. 1659 SOLENOID STEAM ADMISSION VALVE

No. R-1659—R. H. Type **No. L-1659—L. H. Type**

FOR DIRECT CURRENT ONLY

UNION INLET AND OUTLET FOR SOLDERING TO 1⅛" O. D. COPPER TUBING OR FOR 1" I. P. S.

POWER CONSUMPTION—50 WATTS AT 32 VOLTS D. C.
WEIGHT—11 LBS. MAX. PRESSURE—15 LBS.



GENERAL DESCRIPTION

This is a horizontal type Solenoid Steam Admission Valve for controlling the flow of steam to an overhead heat radiator on installations made in conjunction with the Zone type of Heating System. This valve is similar in construction and operation to the No. 1658 Valve, but is designed for horizontal application, with a boss on either side of the body to permit supporting it from a bracket from either side. Inasmuch as this valve is designed for application at the top of the radiator, there is no trap incorporated into the construction of this valve, as there is no condensate to be drained from a riser pipe to the radiator as with the No. 1658 Valve.

The No. 1659 Valve is available in two types. The No. R-1659 Valve has the solenoid on the right hand side of the valve; the No. L-1659 Valve has the solenoid on the left hand side of the valve.

When ordering specify whether for 1⅛" O. D. Copper Tubing or for 1" pipe. Also, specify voltage.

The No. 1643 Manual Flexible Remote Control is used in conjunction with these Valves to allow the setting of them to "Automatic," to manually "on", or to manually "off" position, as required from a convenient location on wall.

OPERATION

This valve is operated thermostatically and manually in the same manner as the No. 1658 Valve covered by Bulletin 61-752. The solenoid valve rests normally in the closed position with the solenoid de-energized. The valve is held in the open position magnetically by the energization of the solenoid.

APPLICATION AND LOCATION

This valve must be applied in a horizontal position at the top of the overhead heat radiator. A minimum space of about 4" is required between the feed and return portions of the steam tion.

A Vapor Retarder must be used between the feed and return portions of the steam supply loop under the car and another Vapor Retarder must be used in the radiator return line to the loop, as indicated on our car heating layouts.

The No. 1643 Remote Control flexible cable for remote setting of these valves from a convenient location on wall or partition can be strapped to either the solenoid end or the steam feed end of the valve. When the cable is strapped to the steam feed end of the valve, the No. 1643-BB-19

No. 1659 Solenoid Steam Admission Valve

Flexible Control Support must also be used in addition to the No. 1643 Remote Control. Both the No. 1643 Remote Control and the No. 1643-BB-19 Support must be separately ordered. The cable support is not required when the flexible cable of the Remote Control is strapped to the solenoid end of the valve.

These valves can be reversed from right hand to left hand operation and vice-versa, by removing and reversing the entire manually operable assembly, shifting end for end, so as to place the operating handle on the opposite side of the valve casing (body), if required for a more convenient installation. Inasmuch as the manually "on" and "off" positions will then be reversed, new indicating plates with proper "on" and "off" designations will have to be applied to the valve, on the same side as the operating handle.

MAINTENANCE

The same maintenance recommendations apply to this valve, as on the 1658 Solenoid Steam Admission Valve covered by Bulletin 61-752.

The packing on the operating handle may be replaced at time of overhaul, if they are found to have become too worn and cause leakage.

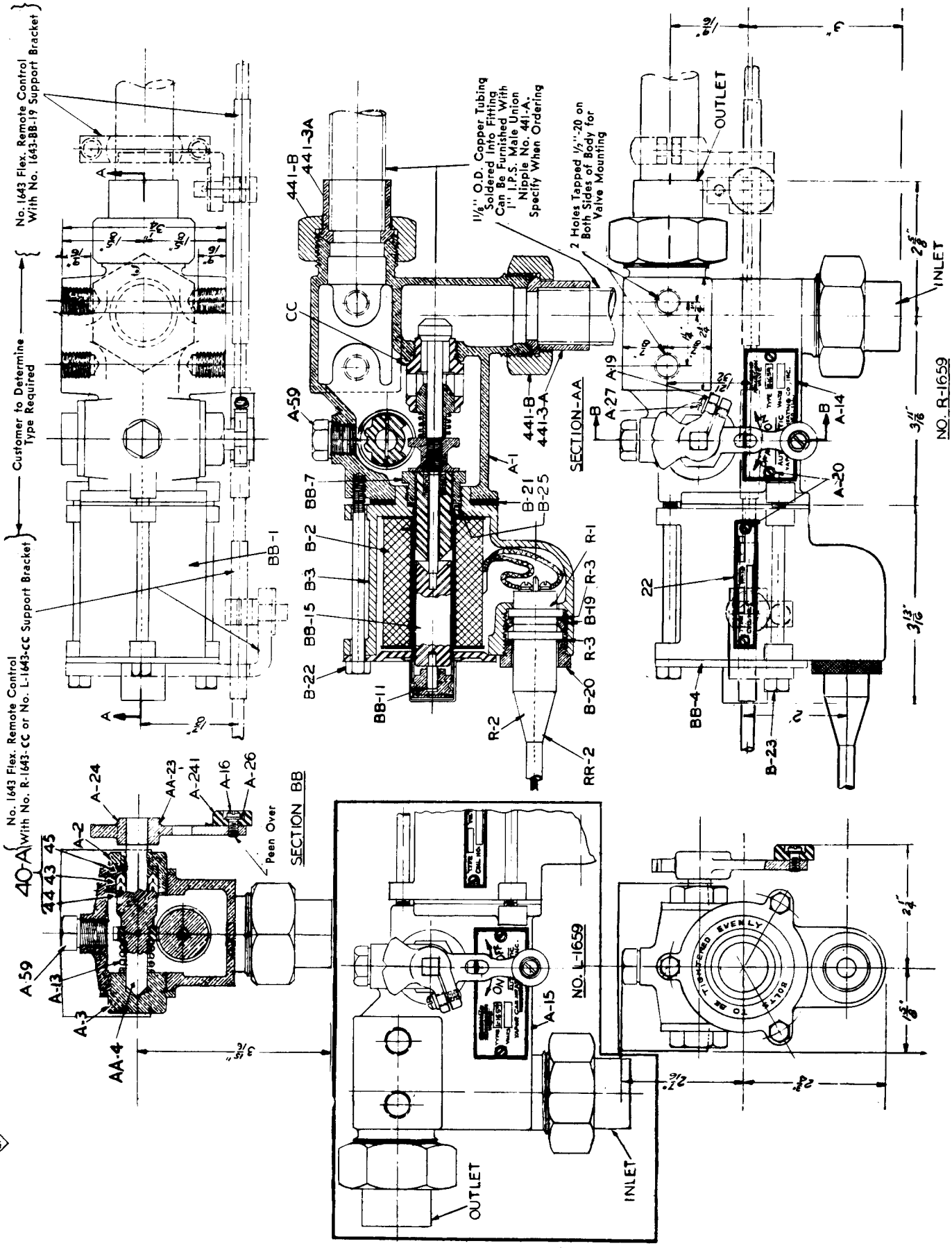
LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T
A-1	1659-A-1	Body	1
A-2	1646-A-41	Nut, Packing Retaining	1
A-3	1646-A-3	Nut, Retaining	1
AA-4	1646-AA-4	Operating Rod Assembly	1
A-13	1646-A-13	Spring, Operating Rod	1
A-14	1659-A-14	Name Plate, R. H.	1
A-15	1659-A-15	Name Plate, L. H.	1
A-20	#4-$\frac{3}{16}$" long	Screw, Parker-Kalon	2
A-59	1646-A-59	Retaining Nut	1
AA-23	1646-AA-23	OPERATING HANDLE ASSEMBLY	1
A-16	#10-24 x 3/8" long	Screw, Fil. Hd. Mach.	1
A-19	1/4" Split type	Lockwasher	1
A-24	1646-A-24	Handle only	1
A-241	1646-A-241	Knob	1
A-26	#10 Split type	Lockwasher	1
A-27	1/4"-20 x 1/2" long	Screw, Fil. Hd. Mach.	1
40-A	*1646-40-A	*CHEVRON PACKING ASSEMBLY	1
43	*1646-A-43	*Packing Ring, Chevron	2
44	*1646-A-44	*Packing Ring, Bottom Adapter Chevron	1
45	*1646-A-45	*Packing Ring, Top Adapter Chevron	1
BB-1	**1657-BB-1	**SOLENOID HOUSING ASSEMBLY	1
B-2	**1657-B-2	**Coil, Solenoid	1
B-3	1646-B-3	Housing, Solenoid	1
BB-4	1646-BB-4	Cover, Assembly, Solenoid Housing	1
BB-7	1646-BB-7	Retaining Nut Assembly	1
BB-11	***1646-BB-11	***Guide Tube Assembly	1
B-13	#6-32 x $\frac{11}{16}$" long	Screw, R. H. M.	2
BB-15	1646-BB-15	Core Assembly	1
B-19	1646-B-19	Ring, Connector Locking	1
B-21	1646-B-21	Gasket	1
B-22	1/4"-20 x 3 1/2" long	Cap Screw, Hex. Hd.	1
B-23	1/4"-20 x 3 3/4" long	Cap Screw, Hex. Hd.	2
22	1657-B-22	Plate, Coil Identification	1
B-25	1646-B-25	Gasket	1
R-1	1646-R-1	Plug, Connector	1
R-3	1646-R-3	Washer	1
B-20	1646-B-20	Nut, Connector Jam	1
CC	1657-CC-1	INLET VALVE ASSEMBLY	1
R-2	1651-R-2	Connector Receptacle	1
441-A	441-A	Body, Union—(Tail Piece)—for 1" I. P. S. Pipe	1
441-3-A	441-3A	Body, Union—(Tail Piece)—for 1 1/8" O. D. Tubing	1
441-B	441-B	Ring, Union—(Tail Piece Nut)	1

NOTES:

1. * On old type installations equipped with a Composition Sealing Disc on the Operating Rod, the use of Chevron Packings will require substitution of the No. 1646-A-2 Seal Retaining Nut by the No. 1646-A-41 Packing Retaining Nut. This can be best taken care of by purchasing the No. 1646-AA-40 PACKING ASSEMBLY, which includes the Chevron Packings and the No. 1646-A-41 Retaining Nut. This assembly can then be applied to the stem against the old disc; the Operating Rod does not have to be taken out. The old No. 1646-A-2 Retaining Nut can then be returned for credit for remachining into the No. 1646-A-41. On latest type valves equipped with Chevron Packings on the Operating Rod at the factory, the Disc is not used and is not required.
2. ** Specify voltage when ordering complete Solenoid Valve, Solenoid Housing Assembly, or Solenoid Coil.
3. *** The Guide Tube Assembly, if stocked separately, must be handled carefully to avoid damage to flange.
4. Connector Receptacle Assembly can be ordered under No. 1651-RR-2 and includes sym. B-20, R-2 and R-3.

No. 1659 Solenoid Steam Admission Valve



No. 1668 SOLENOID STEAM ADMISSION VALVE

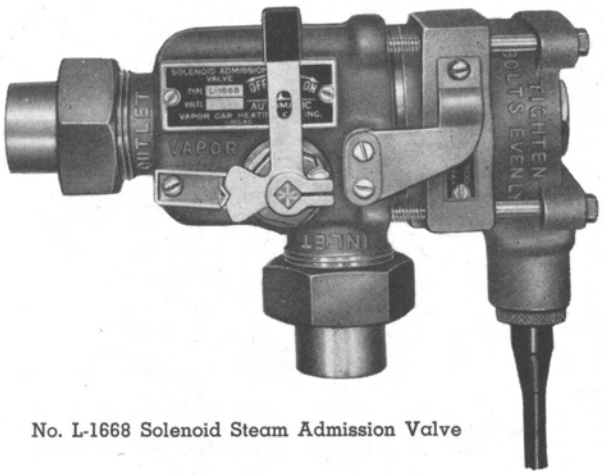
Right Hand Type—No. R-1668 **Left Hand Type—No. L-1668**

FOR DIRECT CURRENT ONLY

FEED INLET—1⅛" O.D. Copper Tubing
RETURN OUTLET—1⅛" O. D. Copper Tubing

WEIGHT 10¼ IBS.

POWER CONSUMPTION—40 WATTS at 32 volts D.C.
47 WATTS at 64 volts D.C.
61 WATTS at 125 volts D.C.



No. L-1668 Solenoid Steam Admission Valve

GENERAL DESCRIPTION

The No. 1668 Solenoid Steam Admission Valve is an electrically operated steam admission valve designed for use with overhead radiators in railway heating systems. It is a horizontal mounting type of valve and is available for either right hand or left hand installations. The right hand type valve is made with the steam outlet on the right of the control lever. In the left hand type, the steam outlet is located on the left of the control lever.

The No. 1668 Solenoid Steam Admission Valve has three operating settings; manually "Off," "Automatic," which places it under thermostatic control, and manually "On." When set for automatic operation the valve is normally closed. It opens when the solenoid is energized and re-closes by the mechanical action of a spring when the solenoid is de-energized. The operation of the No. 1668 Solenoid Steam Admission Valve is similar to that of the No. 1659 valve which it replaces.

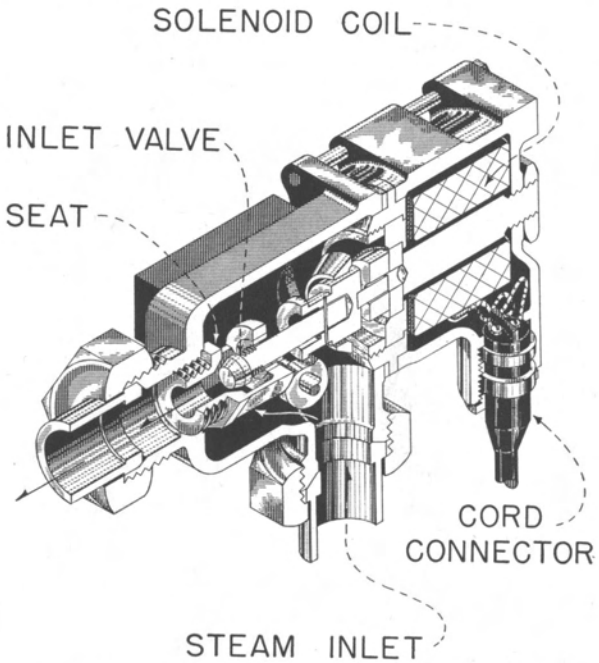
This valve may be controlled from a convenient location by the use of the No. OS-1643 Remote Control unit (see 61-771 Bulletins) which enables the operator to set the valve to any of the three desired settings from a position some distance from the valve.

When ordering complete valve, be sure to specify whether for 1⅛" O.D. copper tubing or for 1" pipe, the voltage and also indicate by the proper prefix letter whether a right or left hand type of valve is required.

MAINTENANCE AND OVERHAUL

Beyond visual inspection of the remote control unit to see that the valve is in the "Automatic" position, no routine maintenance is required for the No. 1668 Solenoid Steam Admission Valve.

These valves should be overhauled at least once every two years to insure their continued efficient operation. At this time the valve should be taken completely apart and thoroughly cleaned. The solenoid assembly should be removed and its insulation resistance tested. The resistance of the



Sectional View of No. L-1668 Steam Admission Valve

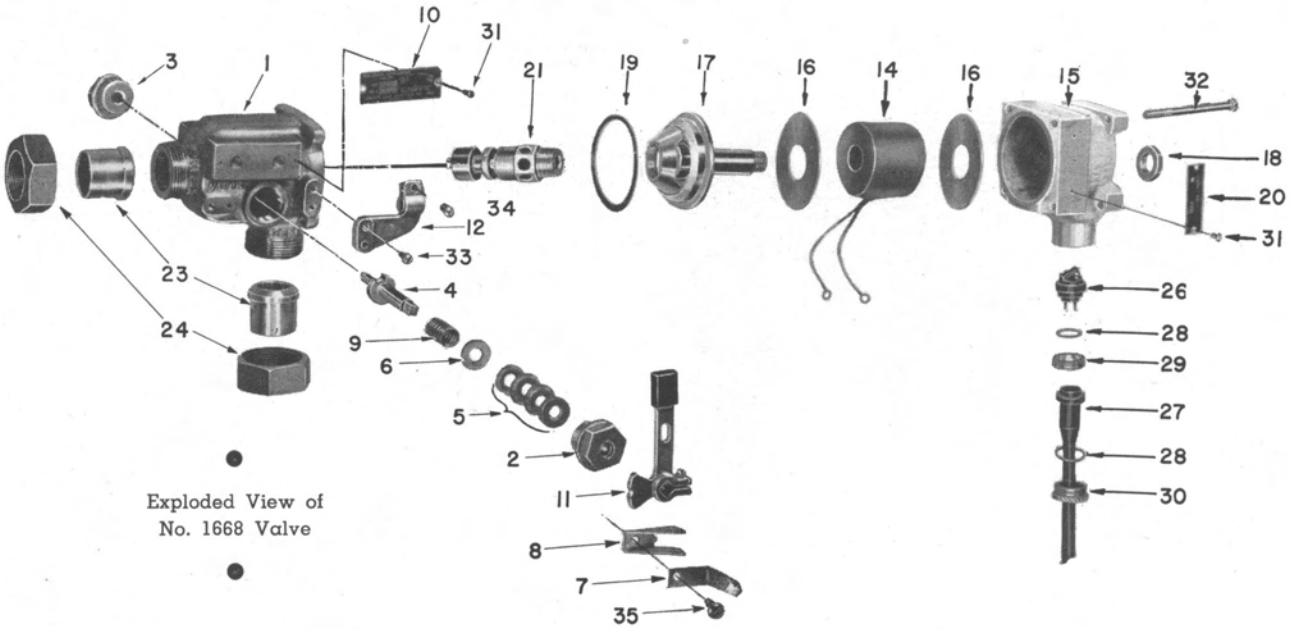
NO. 1668 SOLENOID STEAM ADMISSION VALVE (Cont.)

coil should also be tested and should be approximately:

32 volt coil..... 26 ohms
64 volt coil..... 85 ohms
125 volt coil.....257 ohms

The plug (sym. 26) and the receptacle (sym. 27) should be checked and replaced if the rubber has become hardened or vulcanized. The needle valve should be inspected for binding or seizing and should be replaced if found to be scored or leaking. All parts of the operating rod assembly should be inspected to be sure that there is no binding in this mechanism.

After being overhauled, the valve should be thoroughly tested before being put back into operation again.



Exploded View of No. 1668 Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.	Sym.	Part No.	Description	Amt.
1	1668-A-1	Body	1	23	441-3-A	Body (1⅛" O.D.C.T.)	2
2	1671-A-2	Nut (Seal Retaining)	1	24	441-B	Ring	2
3	1668-A-3	Retaining Nut	1		955-RR-2	Connector Comp. (Incl. sym. 27, 28,30)	1
4	1671-AA-4	Operating Arm Assembly	1	26	955-R-1	Plug (Incl. 2 Washers and 2 Screws)	1
5	1671-AA-7	Packing Assembly	1	27	955-R-2	Receptacle	1
6	1671-A-8	Washer (Packing)	1	28	955-R-3	Washer	2
7	1671-A-11	Spring	1	29	955-R-4	Locking Ring	1
8	1671-A-12	Bracket	1	30	955-R-5	Jam Nut	1
9	1671-A-13	Spring (Packing)	1	31	4"x3/16"	Parker Kalon Screw (Binder Head)	4
10	1668-A-15	Plate (Identification) L.H.	1	32	4"x3/16"	Cap Screw (Hex. Head)	4
10	1668-A-14	Plate (Identification) R.H.	1	33	#10—24x½"	Screw (Round Head)	2
11	1671-AA-23	Control Arm Assembly		34	#10—24x⅜"lg.	Screw (Round Head)	1
12	1668-A-31	Manual Control Bracket L.H.	1	35	#10—24x5/16"	Screw (Round Head)	1
12	1668-A-30	Manual Control Bracket R.H.	1		1668-BB	SOLENOID HOUSING ASSEMBLY (Incl. sym. 14, 15, 18, 19, 20, 26, 29, one of 28 and two of 16 and 31)	
14	1668-B-2	Coil (Specify Voltage)	1				
15	1671-B-3	Housing	1				
16	1671-B-23	Coil End Washer	2				
17	1668-BB-15	Core Assembly	1				
18	1671-B-18	Locknut (Core Retaining)	1		1668-BB-1	SOLENOID ASSEMBLY (Incl. syms. 14, 15, 20, 26, 29, 30, two of 16 and two of 31)	
19	1671-B-21	Gasket	1				
20	1668-B-22	Coil Housing Nameplate	1				
21	1668-CCD	Needle Valve Assembly	1				

Note 1 When ordering, specify voltage and whether Right or Left Hand Valve is desired.

Note 2 Valve can be furnished with 1" I.P.S. Male Union Nipple (441-A). Specify when ordering.

Note 3 For Parts List of No. OS-1643 Remote Control, see 61-771 Bulletins.

No. 1152 SERIES
RADIATION MANIFOLD FITTINGS

FOR IRON PIPE: PREFIX P	FOR ANGLE MOUNTING: PREFIX B	FOR COPPER TUBING: PREFIX C

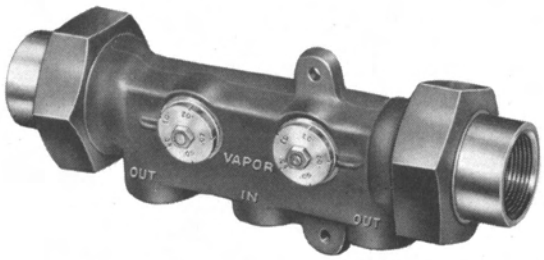


Fig. 1 No. P-1152 Radiation Manifold

GENERAL DESCRIPTION

Radiation Manifold Fittings of the No. 1152 series are designed to feed two lengths of radiation simultaneously from the same supply. These fittings are so constructed that an orifice plug (with several settings) is located in the path of the steam entering each length of radiation. By properly adjusting the setting of the orifice to coincide with the length of the radiation—the entire heating system may be balanced so that steam fills the longer radiation units in the same length of time that it fills the shorter lengths. Once this adjustment has been made, no future setting is required, and the adjustment must in no way be confused with that of a steam admission valve which turns on or off the steam supply.

These fittings have been utilized in the UNIZONE and MODUZONE systems of car heating, their usefulness in these cases being in balancing the radiation units for equalized heating.

Steam enters through a single inlet in the lower part of the fitting, passes into the radiation inner tube. Condensate, returning from the outer tube of the radiation is passed through drain outlets into the piping of the system for discharge.

ORIFICE PLUGS. The orifice plugs which are located in the fitting are available in either of two types, as shown below, and should be specified in ordering the fitting or reordering parts for it.

Standard Orifice Plug

Markings:	.02	.03	.04	.05	.07
Openings:	5/32″	3/16″	7/32″	1/4″	5/16″

"A" Type Orifice Plug (indicated by prefix "A" in fitting part number)

Markings:	.05	.06	.07	.11	.15
Openings:	1/4″	9/32″	5/16″	3/8″	7/16″

Explanation: No. P-1152, C-1152 and B-1152 would have standard orifices.

Nos. PA-1152, CA-1152 and BA-1152 would have "A" type orifices.

MOUNTING. Nos. P-1152, C-1152, PA-1152 and CA-1152 fittings are constructed for wall mounting, with mounting holes located above and below the fitting. Nos. B-1152 and BA-1152 fittings are designed for mounting with a bracket so that the fitting may be employed in cars where curved floor-wall construction is used.

MAINTENANCE AND OVERHAUL

Since there are no moving parts in the No. 1152 series Radiation Manifold Fittings, there is no mechanical maintenance required for their continued efficient operation. However, the orifice plugs should be removed and cleaned out every 18 months to two years in order to prevent accumulated dirt, etc. from restricting the passage of steam through the fitting.

CAUTION: When reapplying the orifice plugs, be sure that the settings are the same as they were before disassembly so that the heating system does not require re-balancing.

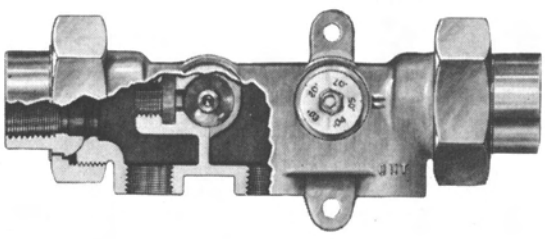


Fig. 2 Sectioned View of Fitting

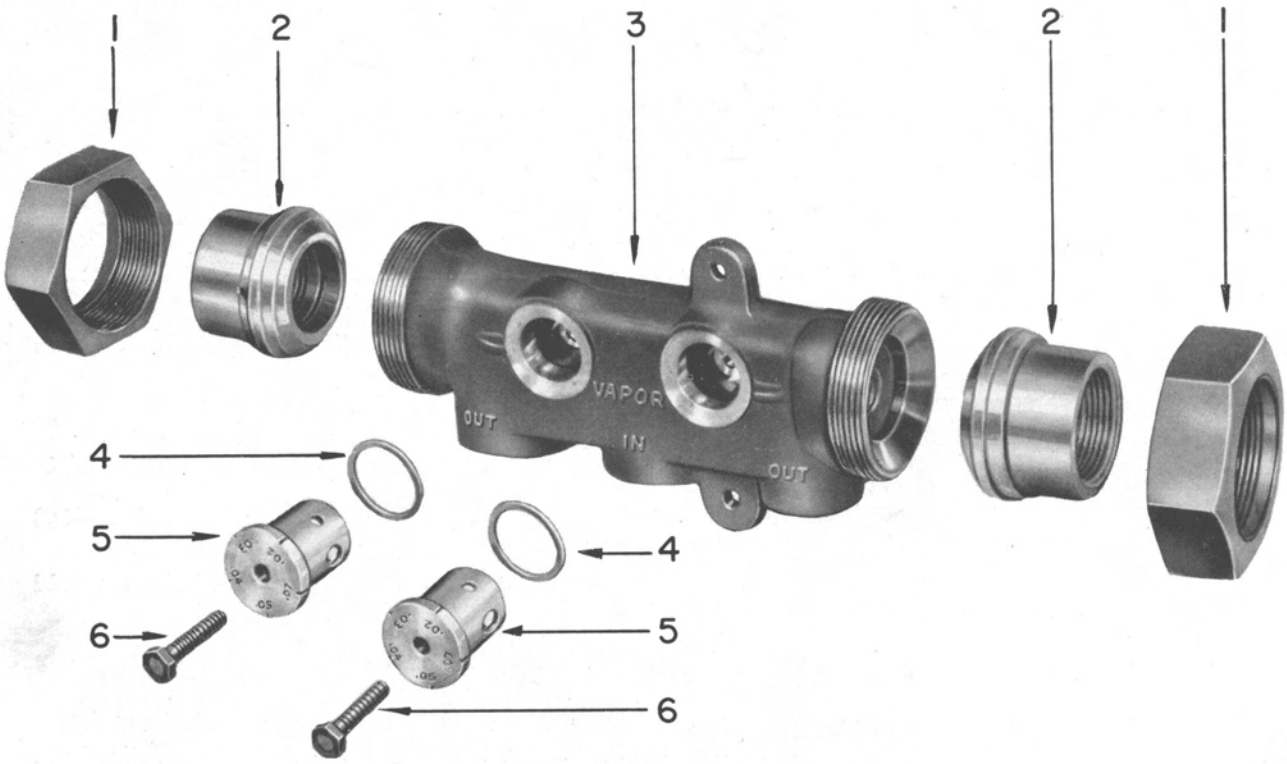


Fig. 3 Exploded View of No. P-1152 Manifold Fitting

LISTS OF PARTS

Nos. P-1152, C-1152, B-1152, PA-1152, CA-1152 and BA-1152

No. P-1152

Sym.	Part No.	Description	Amt.
1	442-B	Union Ring	2
2	1646-A-32	Tailpiece (1¼" Std. Pipe)	2
3	1152-1	Body	1
4	CV-949-14	Gasket, Orifice Plug	2
5	CV-949-4	Orifice Plug (Std. Type)	2
6	¼"-20-1¼"	Cap Screw	2

No. PA-1152

Sym.	Part No.	Description	Amt.
1	442-B	Union Ring	2
2	1646-A-32	Tailpiece (1¼" Std. Pipe)	2
3	1152-1	Body	1
4	CV-949-14	Gasket, Orifice Plug	2
5	CVA-949-4	Orifice Plug ("A" Type)	2
6	¼"-20-1¼"	Cap Screw	2

No. C-1152

Sym.	Part No.	Description	Amt.
1	442-B	Union Ring	2
2	1646-A-31	Tailpiece (1⅜" ODCT)	2
3	1152-1	Body	1
4	CV-949-14	Gasket, Orifice Plug	2
5	CV-949-4	Orifice Plug (Std. Type)	2
6	¼"-20-1¼"	Cap Screw	2

No. CA-1152

Sym.	Part No.	Description	Amt.
1	442-B	Union Ring	2
2	1646-A-31	Tailpiece (1⅜" ODCT)	2
3	1152-1	Body	1
4	CV-949-14	Gasket, Orifice Plug	2
5	CVA-949-4	Orifice Plug ("A" Type)	2
6	¼"-20-1¼"	Cap Screw	2

No. B-1152

Sym.	Part No.	Description	Amt.
3	B-1152-1	Body	1
4	CV-949-14	Gasket, Orifice Plug	2
5	CV-949-4	Orifice Plug (Std. Type)	2
6	¼"-20-1¼"	Cap Screw	2

No. BA-1152

Sym.	Part No.	Description	Amt.
3	B-1152-1	Body	1
4	CV-949-14	Gasket, Orifice Plug	2
5	CVA-949-4	Orifice Plug ("A" Type)	2
6	¼"-20-1¼"	Cap Screw	2

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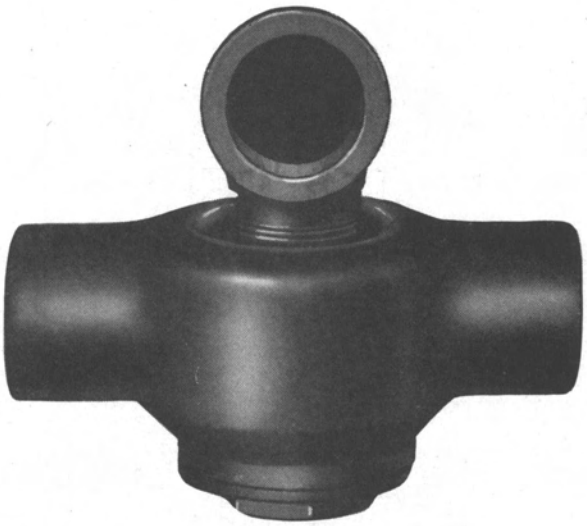
Nos. 912 AND 913 WATER SEAL FITTINGS

WEIGHT OF No. 912 — 2½ LBS. WEIGHT OF No. 913 — 2¾ LBS.



No. 912

No. 913

GENERAL DESCRIPTION

The No. 912 and No. 913 Water Seal Fittings are used in conjunction with the No. 1646 Type Solenoid Steam Admission Valves on Zone Type Heating System installations. The No. 912 fitting is of brass for use on copper tubing throughout for soldered connections, while the No. 913 is of iron and has a threaded inlet and threaded outlets for use with pipe. The No. 913 fitting has no cap for cleanout purposes, as it is readily removable from the line.

This fitting is located in the feed portion of the steam supply loop and connects the steam supply in the loop with the steam admission valve in the car by means of a riser pipe. This fitting should be located a minimum of 18 inches from the solenoid valve. The function of this water seal fitting is to prevent undesired heating and retention of steam in the riser pipe, when the steam admission valve is closed for any considerable length of time, for example, when the heating system is not in operation.

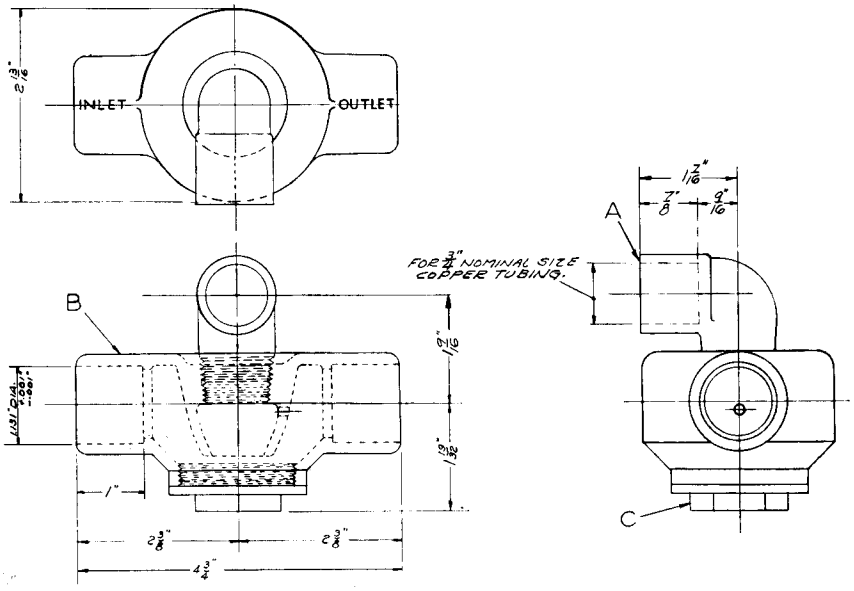
This fitting has a depressed central portion in its casing which holds an accumulation of condensate. When the steam admission valve is closed, the steam in the riser pipe and valve chamber will condense, thus forming a partial vacuum, which will draw up the condensate thus formed, as well as the water in the water seal (depressed central portion of fitting). In this way a substantial water column will be formed which will prevent the flow of steam to the upper portion of the riser or branch supply pipe. The steam admission valve will thus not be heated by steam when in the closed position.

When the car is out of service and there is no longer any steam supplied by the Regulator to the steam supply loop, the vent opening provided in the body of the fitting will act as a vacuum breaker to permit the trapped condensate to flow out of the riser pipe, thus preventing freezing in the exposed portion of this piping.

NOTE: As there are no moving parts, no maintenance will be required beyond possible replacement, in due time, because of weathering. An annual cleanout is recommended.

Nos. 912 and 913 WATER SEAL FITTINGS (Cont.)

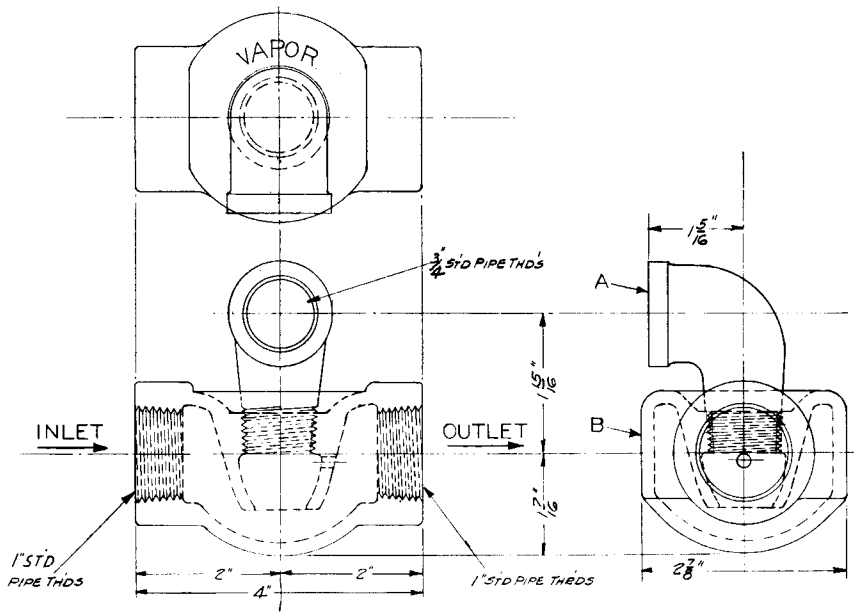
No. 912 WATER SEAL FITTING



LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T
A	Chase Brass C-409-3896	90° Ell (¾" Copper to ¾ SP.S. Male)	1
B	912-B	Body	1
C	912-C	Cap	1

No. 913 WATER SEAL FITTING



LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T
A	¾" Standard	Ell (Street)	1
B	S-913-B	Body	1

No. 970 WATER SEAL FITTING

INLET AND OUTLET: UNION CONNECTIONS FOR 1" I.P.S. OR 1⅛" O.D.C.T.

No. 970 Water Seal Fitting

GENERAL DESCRIPTION

The No. 970 Water Seal Fitting is located on the outlet side of a Safe-Control Regulator between the regulator and the steam supply loop. This fitting supersedes both the No. 912 Water Seal Fitting and the No. 955-162 Test Fitting which was formerly supplied for the No. 955 Series of Vapor Safe-Control Regulators.

It is designed to serve a three-fold purpose. It provides an effective water seal to prevent steam leakage into the loop when the regulator safe-control valve is energized, provides an easily accessible test fitting for checking the pressure and volume of steam passing into the loop and also provides a strainer to catch the back-wash from the radiation and the loop piping.

Steam flows from the regulator into the Water Seal Fitting and is channeled into a lower chamber where it passes through a strainer and up into an upper chamber. It is then permitted to flow on into the steam supply loop. This strainer prevents dirt particles and bits of solder from pipe connections from lodging in the safe-control valve of the regulator as steam or condensate returns from the supply loop.

A ¼" key cock in the lower chamber of the fitting provides a test for pressure and volume of steam being delivered by the regulator. By turning the key handle of this petcock a blow of steam may be observed (care should be taken by the operator to stand so that the steam will not scald him) and the pressure and volume of this steam can be estimated quickly.

During cooling periods, or at other times when no heat is desired in the car radiation, the No. 970 Water Seal Fitting permits a pocket of condensate to form in the lower chamber as a means of preventing the leakage of steam into the supply loop.

MAINTENANCE AND OVERHAUL

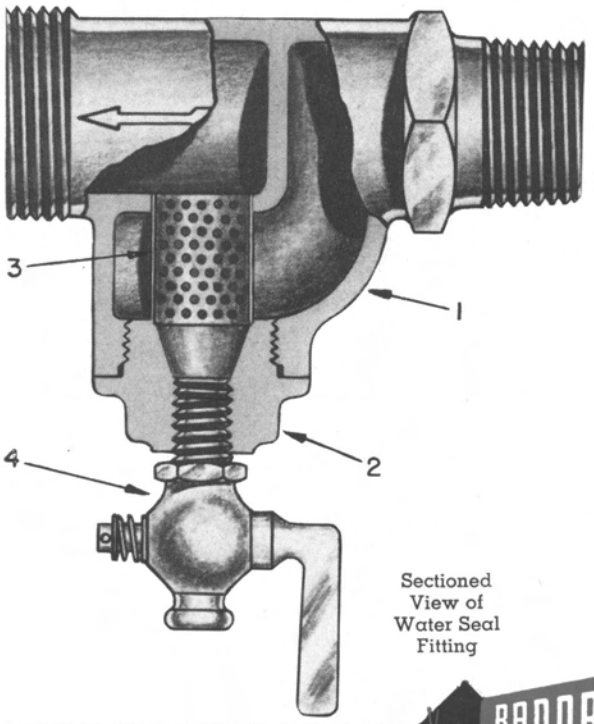
Very little maintenance is required for the efficient operation of the No. 970 Water Seal Fitting. By unscrewing the Strainer Plug (Sym. 2) from the body (Sym. 1), the strainer (Sym. 3) can be removed for cleaning. The inside of the body casting can then be cleaned out at the same time. Then check the petcock to be sure that it is not clogged with dirt.

The No. 970 Water Seal Fitting can be furnished with a No. 441-6 half union for 1⅛" O.D.C.T. or with a No. 441-7 half union for 1" I.P.S. thread connections as required. In either case the half union and the union ring must be ordered separately.

LIST OF PARTS

NO. 970 WATER SEAL FITTING

Sym.	Part No.	Description	Amt.
1	970-1	Body	1
2	970-2	Strainer Plug	1
3	970-3	Strainer	1
4	¼"	Key Cock	1
■	441-6	Half Union 1⅛" O.D.C.T. (not furnished with fitting)	
■	441-7	Half Union 1" I.P.S. (not furnished with fitting)	



Sectioned View of Water Seal Fitting

PRINTED IN U.S.A.

No. 1643 and No. S-1643

MANUAL FLEXIBLE REMOTE CONTROL

WEIGHT 2 LBS.

VAPOR
Manual Flexible Remote Control

DESCRIPTION

This is a manually operated flexible remote control arrangement for manually operating a solenoid valve of the No. 1646 type from a location considerably away from the valve. This manual remote control arrangement includes a lever operated mechanism, for mounting on a side wall or partition, attached to a flexible push and pull cable connecting to the manual operating handle on the solenoid valve. The cable has an inner longitudinally movable power element.

Movement of the lever on the remote control mechanism to either ON, AUTOMATIC or OFF positions transmits a push or pull movement, as the case may be, to the power element within the cable, to place the solenoid valve in the manually on, automatic or manually off positions.

The No. 1643 Manual Remote Control is used for partition mounting, where solenoid valves are installed in rooms. The No. S-1643 Manual Remote Control is used for sidewall application and is somewhat differently arranged, as indicated on illustrations on page 2.

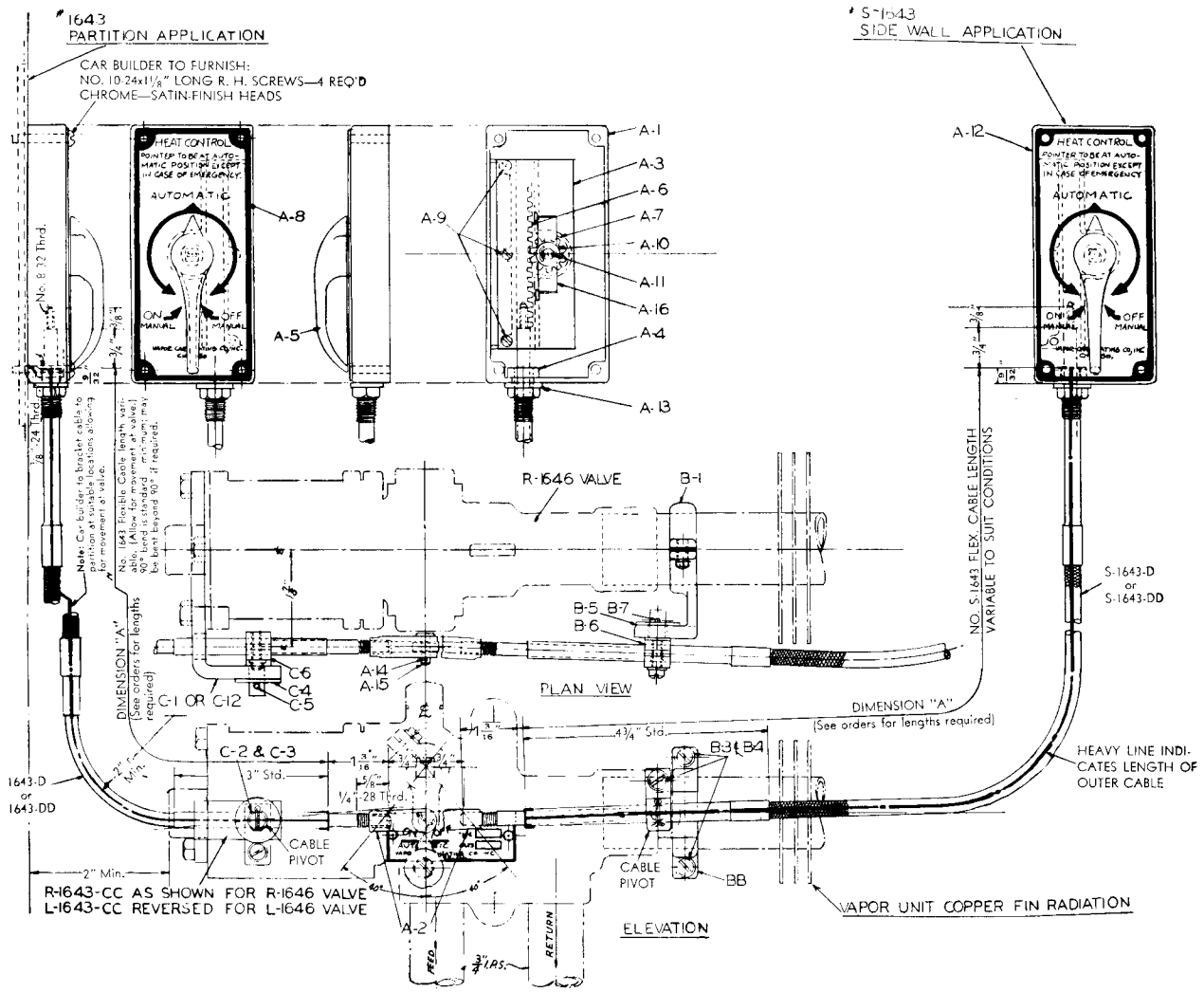
APPLICATION

For application, see illustration on Page 2. The cable must be strapped to partition, as indicated, allowing for movement at valve.

MAINTENANCE

At the beginning of each heating season check the operating mechanism and cable for ease of operation and make replacement of parts, if and where necessary. The gear rack and spur gear mechanism, as well as the power element within the flexible cable should be lubricated with light oil.

No. 1643 AND No. S-1643 MANUAL FLEXIBLE REMOTE CONTROL (Cont.)



LIST OF PARTS

Symbol	Part No.	Description
AA	1643-AA	Operating Case Assem.
AA	S-1643-AA	Operating Case Assem.
A-1	1643-A-1	Case—Operating
*A-2	1643-A-2	Clevis
*A-3	1643-A-3	Cover Plate—Gear Rack
*A-4	1643-A-4	Bushing
*A-5	1643-A-5	Lever—Operating
*A-6	1643-A-6	Rack—Gear
*A-7	1643-A-7	Spur Gear
*A-8	1643-A-8	Indicating Plate
*A-9	No. 6-32—3/16" lg.	Screw—Binder Head
*A-10	No. 10	Washer (7/16" O. D.)
*A-11	1/16" dia. x 1/2" lg.	Cotter Pin
A-12	S-1643-A-12	Case—Operating
*A-13	3/8" Hole	Washer (11/16" O. D. x 3/32")
*A-14	1/16" dia. x 1/2" lg.	Cotter Pin
*A-15	3/16" dia. x 17/32" lg.	Clevis Pin (AN-393-17)
*A-16	1643-A-16	Spring
	1643-D	Flex. Cable (Specify Dim. "A")
	S-1643-D	Flex. Cable (Specify Dim. "A")
BB	1643-BB	Flexible Control Support Assem. For 1 3/8" O.D.C.T.
B-1	1643-B-1	Bracket—Flex. Control Support
B-3	No. 10-24—1/2" lg.	Fil. Hd. Mach. Screw
B-4	No. 10 Split type	Lockwasher for No. 10-24 Screw
B-5	11/32" Hole	Washer (7/8" O. D. x 1/16")
B-6	1643-B-6	Pivot—Flex. Control Support
B-7	3/32" dia. x 3/4" lg.	Cotter Pin
**	1643-B-20	Bracket—Flex. Control Support
**	1643-BB-19	Bracket Assem.
CC	R-1643-CC	(As shown) Flexible Control Support Assem.
	L-1643-CC	(Reversed) Flex. Control Support Assem.
C-1	R-1643-C-1	(As shown) Bracket, Flex. Control Support
C-12	L-1643-C-12	(Reversed) Bracket, Flex. Control Support
C-2	No. 10-24—1/2" lg.	Fil. Hd. Mach. Screw
C-3	No. 10 Split type	Lockwasher for No. 10-24 Screw
C-4	11/32" Hole	Washer (7/8" O. D. x 1/16")
C-5	3/32" dia. x 3/4" lg.	Cotter Pin
C-6	1643-C-6	Pivot—Flex. Control Support
	1643-DD	Flex. Cable Assem. includes Parts 1643-D, A-2, A-4 & A-13
	S-1643-DD	Flex. Cable Assem. includes Parts S-1643-D, A-2, A-4 & A-13

NOTE 1: No. 1643 consists of parts bearing asterisk (*) plus parts symbols A-1 and 1643-D.

NOTE 2: No. S-1643 consists of parts bearing asterisk (*) plus parts symbols A-12 and S-1643-D.

NOTE 3: No. 1643-D Flexible Cable is cable with inner power element less A-2 Clevis, A-4 Bushing and A-13 Washer.

NOTE 4: Order Complete Manual Flexible Remote Control thus:
No. 1643 with Dimension "A" as required.
No. S-1643 with Dimension "A" as required.
Car Builder or Railroad is to check type and length required.

NOTE 5: Bracket Assembly, identified by double asterisk (**) is for 1 1/8" O.D.C. tubing and is furnished as part of No. S-1643 Mechanism only when so specified.

Printed in U.S.A.

No. SA-1643 AND No. SB-1643

MANUAL FLEXIBLE REMOTE CONTROL

WEIGHT 2 LBS.

DESCRIPTION: This is a manually operated flexible remote control arrangement for manually operating a solenoid valve of the No. 1659 type, when used alongside the overhead radiator, for remotely operating the valve.

The operating case of this remote control is the same as the No. 1643 and No. S-1643, but with the flexible cable connected to the top instead of to the bottom of the case.

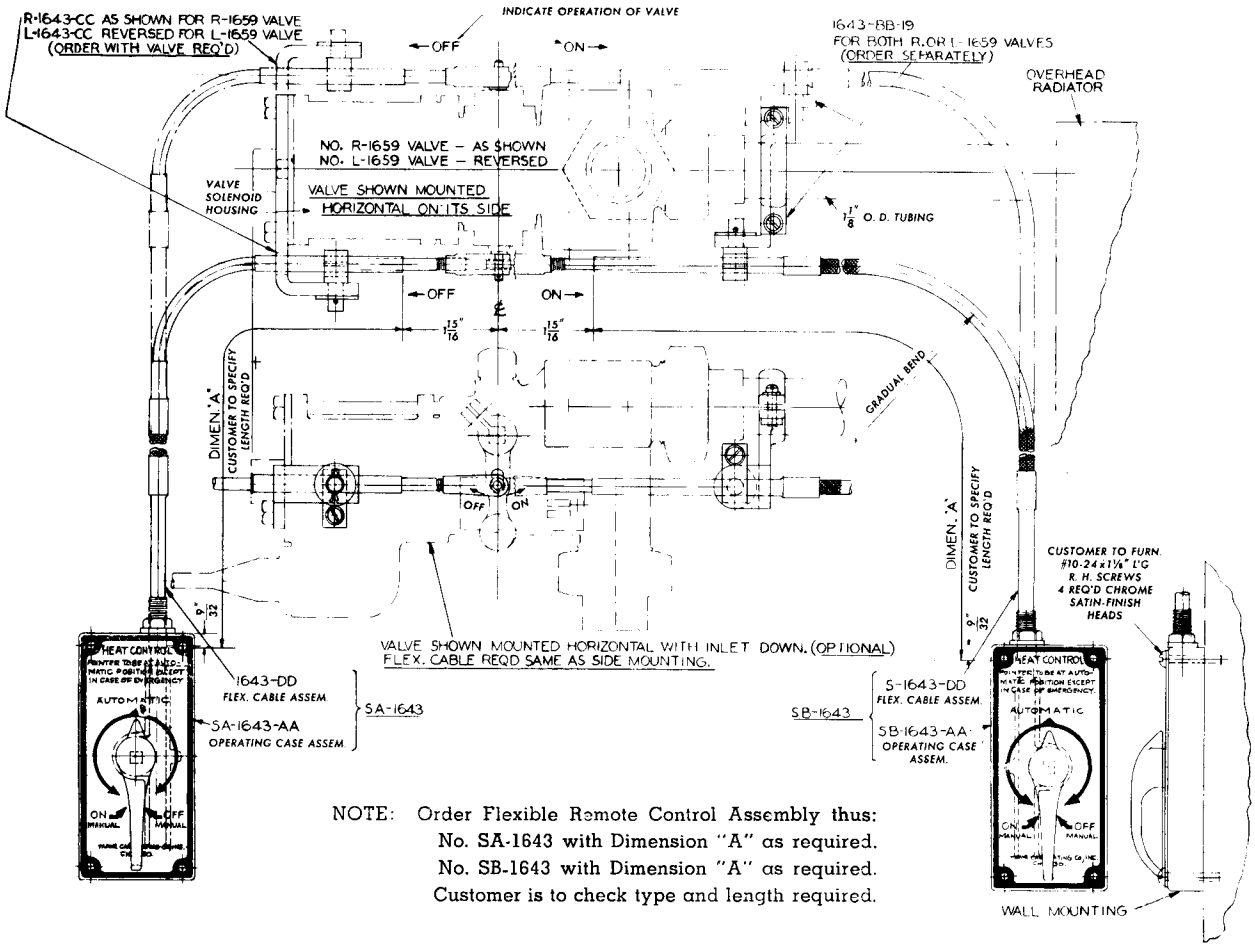
The No. SA-1643 Remote Control is used where the cable is applied on the solenoid end of the valve.

The No. SB-1643 Remote Control is used where the cable is applied on the steam feed tubing of the overhead radiator.

Operation of these controls is the same as on the No. 1643 and No. S-1643 Manual Flexible Remote Controls.

APPLICATION: The cable must be strapped as indicated on illustration below, allowing for movement at valve.

MAINTENANCE: For maintenance see Bulletin 67-771 covering Nos. 1643 and S-1643 Manual Flexible Remote Controls.



NOTE: Order Flexible Remote Control Assembly thus:
No. SA-1643 with Dimension "A" as required.
No. SB-1643 with Dimension "A" as required.
Customer is to check type and length required.

LIST OF PARTS

No. SA-1643 Flexible Remote Control consists of No. SA-1643-AA Operating Case Assembly and No. 1643-DD Flexible Cable Assembly.

No. SB-1643 Flexible Remote Control consists of No. SB-1643-AA Operating Case Assembly and No. 1643-DD Flexible Cable Assembly.

For list of replacement parts on Operating Case, Cable and Brackets, see Bulletin 61-771, as replacement parts are the same on the Nos. SA-1643 and SB-1643 Controls as on Nos. 1643 and S-1643.

No. 1644 MANUAL REMOTE CONTROL OPERATING MECHANISM

WEIGHT 1 LB. 1 OZ.

No. 1644 VAPOR
Manual Remote Control

GENERAL DESCRIPTION

This is a universal joint operated remote control mechanism for manually operating Solenoid Steam Admission Valves of the No. 1646 type.

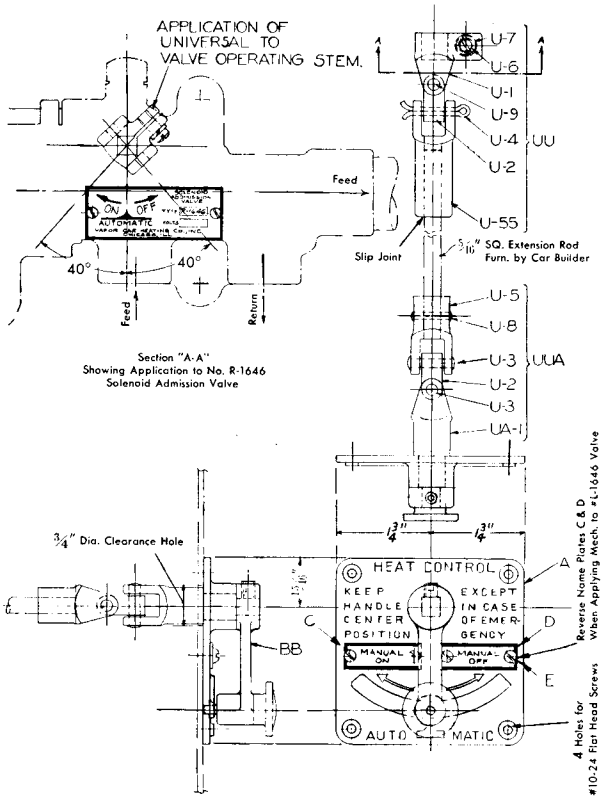
This type of remote control mechanism is used when the Solenoid Steam Admission Valve is applied under seat in coach section. With this type of mechanism an operating rod is run from the valve underneath the seat to the aisle side of seat, making it possible to operate the valve from the aisle side of the seat. Use of this mechanism will obviate the necessity of asking passengers to get up from their seats, should it be necessary to operate the valve manually.

MAINTENANCE

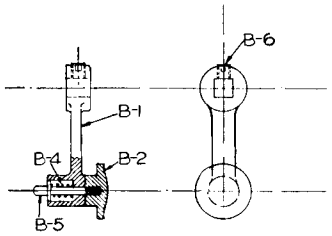
Check all parts of this mechanism and of the universal joints at the beginning of each heating season. The Cotter Pins should be replaced, if too worn. All moving parts should be lubricated with light oil.

No. 1644 MANUAL REMOTE CONTROL
OPERATING MECHANISM (Cont.)

APPLICATION OF NO. 1644 MANUAL REMOTE CONTROL OPERATING MECHANISM TO NOS. R-1646 AND L-1646 SOLENOID STEAM ADMISSION VALVES



NO. 1644-BB OPERATING HANDLE ASSEMBLY



NOTE: Make sure there is no end thrust against operating rod stem to keep the disc on the operating rod off the sealing ring.

LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T
A	1644-A	Plate, Indicator	1
BB	1644-BB	HANDLE ASSEMBLY, OPERATING	1
B-1	1644-B-1	Handle, Operating	1
B-2	1644-B-2	Knob	1
B-4	1644-B-4	Spring	1
B-5	1644-B-5	Plunger	1
B-6	1/4"—20x1/4" Lg.	Screw, Allen Hollow Head	1
C	1644-C	Name Plate—"Manual On"	1
D	1644-D	Name Plate—"Manual Off"	1
E	No. 4—3/32" Lg. Self-tapping, Binder Head	Screw	4
UU	1644-UU	VALVE STEM UNIVERSAL ASSEMBLY	1
U-1	1644-U-1	Yoke, Valve Stem	1
U-2	1644-U-2	Block	1
U-4	3/16" Dia. x 1" Lg.	Cotter Pin	1
U-6	1/4"—20x1/2" Lg.	Screw, Fil. Hd. Mach.	1
U-7	1/4" Split Type	Lockwasher	1
U-9	1644-U-9	Pin—3/16"x1 1/8" Lg.	1
U-55	1644-U-55	Yoke, Slip Joint	1
UUA	1644-UUA	INDICATOR PLATE UNIVERSAL ASSEMBLY	1
UA-1	1644-UA-1	Yoke, Indicator Plate	1
U-2	1641-U-2	Block	1
U-3	1641-U-3	Pin	2
U-5	1644-U-5	Yoke	1
U-8	1/8" Dia. x 7/8" Lg.	Pin	1

STEAM TRAIN LINE EQUIPMENT

STEAM HOSE COUPLERS

STEAM CONDUITS AND HOSE

END TRAIN PIPE VALVES

EXTENSION HANDLES & OPERATING ATTACHMENTS

TRAIN PIPE FITTINGS

Printed in U. S. A

No. V-S-4 1½" STEAM COUPLER AND RUBBER HOSE CLAMPS AND NIPPLES

INLET 1½"
OUTLET 1½"

WEIGHT
5½" LBS.

Fig. 1. Two No. V-S-4 Couplers Joined.

GENERAL DESCRIPTION

The No. V-S-4 Steam Coupler is used to connect the steam lines of railway cars equipped with rubber hose steam conduits. The locking arrangement of this coupler consists of a single "U" shaped link, one leg of which is passed through a lug on the coupler head, leaving the other leg free. When two No. V-S-4 couplers are joined, the free leg of each coupler is thrown over the corresponding lug on the opposing coupler. This lock should not be put in place until the couplers have been properly joined.

The gasket in this coupler is made of composition rubber, and is equipped with a brass ring around it to protect the material from wear. It is held in place by a gasket retaining spring which will allow the gasket to assume the proper position on the seat, and at the same time to present a flat seat against the gasket in the opposing coupler.

MAINTENANCE

Remove the rust and dirt from the cam and the gasket seat with emery cloth to allow the couplers to join tightly. Do not remachine the cam or the gasket seat as this will change relationship between them and the couplers will not lock properly.

Couplers heads should be inspected and checked for wear at the time and place of overhauling of the rubber hose conduits, as follows:

Check the coupler cam with the Vapor Car Heating Co.'s No. 312-X cam gauge, which is made to conform to the contour of a new cam, and determine whether more than an acceptable tolerance exists.

Raised surfaces in the gasket cavity should be removed, care being used not to go below the surface of the original contour. The dimensions and specifications of a new coupler body are shown on our drawing No. 30041 which is available upon request.

Gaskets in the No. V-S-4 Steam Coupler may be removed easily with the No. 314 Gasket Tool which is shown in the photograph below. These gaskets should be renewed when they are loose, steam cut, scored, badly marred or otherwise damaged and leaking. A new gasket may be applied by pressing it into place. The gasket retaining spring will enter and expand behind a shoulder provided for this purpose inside the coupler gasket cavity.

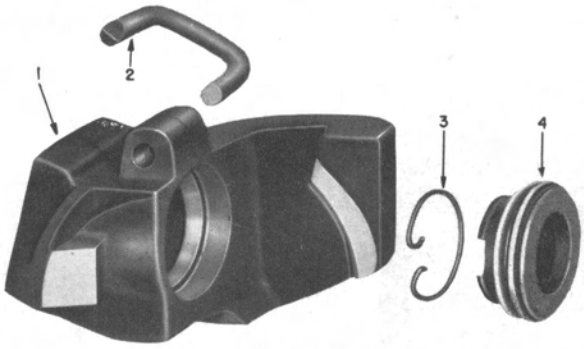


Fig. 3. Exploded View of No. V-S-4 Coupler.

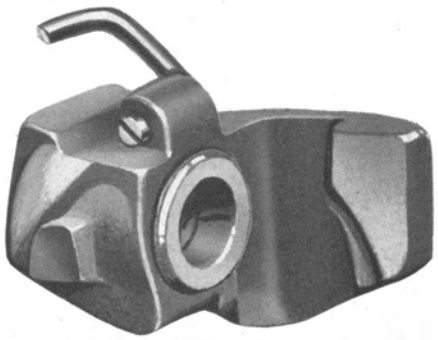


Fig. 2. Single No. V-S-4 Coupler.

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	V-S-4-Body	Body	1
2	S-4-L	Locking Link	1
3	V-S-4-S	Gasket Spring	1
4	V-S-4-G	Gasket	1

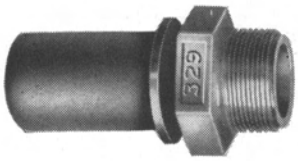
HOSE CLAMPS AND NIPPLES

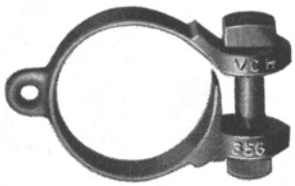
No. 342 Two-piece Hose Clamp for use with No. 329 or No. 332 Nipple

For 1⅝" Hose at the Ends—5 and 6 Ply

No. 342-A—Half Clamp with Eye for Chain.
No. 342-B—Half Clamp without Eye for Chain.
No. 343-A and B—Two-piece Clamp for 7 and 8-ply Hose.

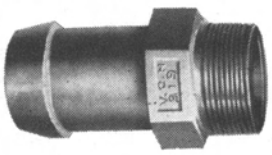
No. 329 Nipple for 1⅝" Hose at the Ends—used only with 1½" Couplers





No. 356 Hose Clamp
(For use with No. 317 Nipple)
No. 357 Clamp for No. 319 Nipple
No. 358 Clamp for No. 320 Nipple

No. 319 Hose Nipple
(For hose 1½" inside diameter at end)
No. 317 Nipple for 1¼" Hose.
No. 318 Nipple for 1⅜" Hose.
No. 320 Nipple for 1⅝" Hose.

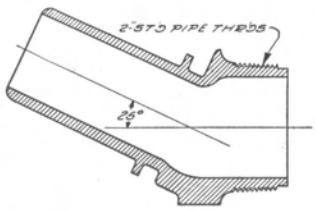


No. 360 Two-Piece Hose Clamp, Complete

This Clamp is assembled with two half clamps—the No. 360-A half clamp has lug to engage the hook on the No. 360-B half clamp.

The No. 360 two-piece Hose Clamp is designed for use with standard No. 329 Nipple (or No. 332 Nipple) and is made with a hinged connection at one side, thus eliminating one bolt and nut and providing a more even and uniform compression on the hose over nipple.

No. 373 Steam Hose Supporting Chain



No. 332 Angle Hose Nipple for No. 312 Coupler

For use with No. 342 or No. 360 Clamps in mounting steam hose.

No. 312 STEAM COUPLER

INLET 2"
OUTLET 2"

WEIGHT
8½ LBS.

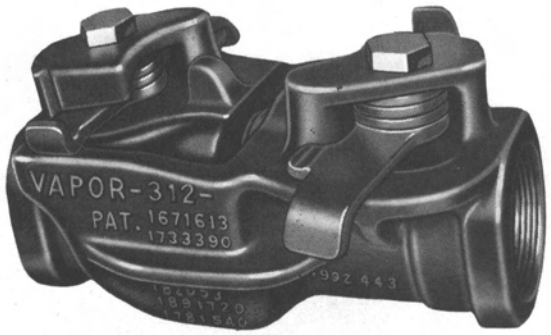


Fig. 1. Two No. 312 Steam Couplers Joined.

GENERAL DESCRIPTION

The No. 312 Coupler is a straight-port coupler which has a full 2-inch area throughout and which conforms to A.A.R. recommended dimensions. It is designed to function with another coupler to form a joint between the flexible metallic conduits of two railway cars; or between the conduits of a railway car and a locomotive. This coupler which is similar to and supersedes the No. 310 steam coupler will lock with other couplers of the same size; or with standard 2½" or 1½" couplers. In the latter case a No. 312-K Adapter Gasket should be used.

A heavy spring steel lever is made to swing in an arc over the arm of the opposing coupler and force it straight down to lock it in the coupled position. The resilience of the coil spring above the lever forms a lock which will compensate for road shock when the train is in motion, and increase the life of the gaskets by preventing friction between the couplers.

The gaskets used in the No. 312 Couplers are made of a durable bakelite and are held in place by a gasket spring. This spring is designed to allow the gaskets to assume the proper position on the seat, and at the same time to present a flat seat against the gasket of the opposing coupler.

MAINTENANCE

The height of the coupler arms is important in providing the proper locking tension and it should be checked periodically with Vapor Heating Corporation's No. 312-G Master Coupler Gauge. This gauge consists of a dummy coupler fitted with a gasket and a sliding bar for gauging the height of the coupler arm. The sliding bar is marked for proper height of the coupler arm and serves as an indicator for arms which are worn below a minimum permissible height.

Remove the rust and dirt from the cam and the gasket seat in order to allow the couplers to join tightly. Do not attempt to remachine either the cam or the gasket seat as this will change the relationship between them and the coupler will not lock properly.

Coupler heads should be inspected and gauged at the time and place of the overhauling of the metallic conduits, as follows:

Check the coupler head cam with Vapor Heating Corporation's No. 312-X Coupler Cam Gauge, which is made to conform to the contour of a new cam. If an acceptable tolerance does not exist, the coupler head must be scrapped.

Raised surfaces in the gasket cavity should be removed, care being taken not to go below the surface of the original contour. If the arm of the coupler is battered or distorted too badly, the coupler head should be scrapped. Check the coupler arm with the No. 312-G Master Coupler Gauge. If the arm is worn below the minimum permissible height, it should be built up by brazing or by electric welding with a hard welding rod, and then milled to a height of 1 21/32" above the center line. This is the proper height as indicated by the gauge.

Disassemble the coupler and check the locking lever with a straight edge. If it is distorted more than ⅛", it should be replaced. Examine the locking lever pin for wear. Coil springs which measure less than 11/16" in height should be scrapped. If the ramp on which the locking lever rides is badly battered it should be built up in the same manner as the coupler arm and milled to protrude ⅛" above the finished arm height.

Gaskets are easily removed with the Vapor Heating Corporation's No. 314 Gasket Tool. Renew the gaskets when they are loose, steam cut, scored,

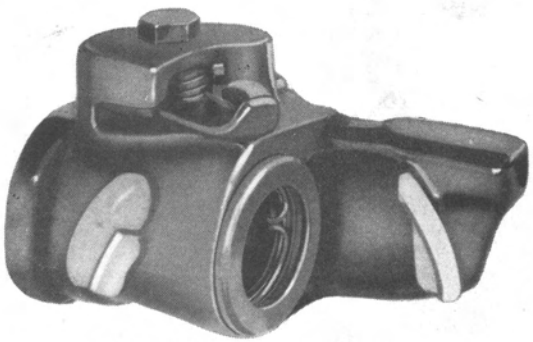


Fig. 2. No. 312 Steam Coupler.

No. 312 STEAM COUPLER (Continued)

badly marred or otherwise damaged and leaking. New gaskets may be applied by pressing them into place, holding the gasket so that the prongs or springs will enter horizontally and seat in the grooves provided for them on either side of the inside coupler body.

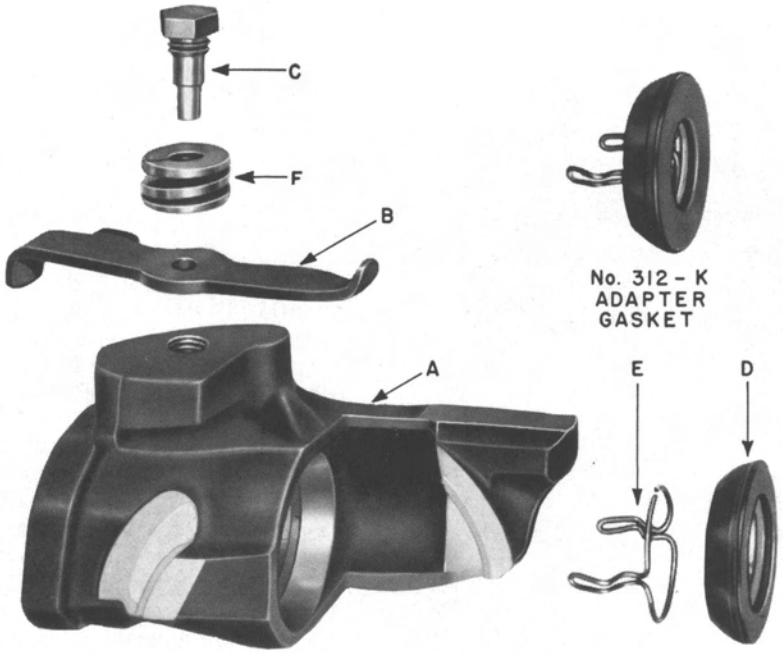


Fig. 3. Exploded View of No. 312 Coupler.

PARTS LIST FOR NO. 312 STEAM COUPLER

Sym.	Part No.	Description	Amt.
A	312-A	Coupler Body	1
B	312-B	Locking Lever	1
C	312-C	Locking Lever Pin	1
D	312-D	Gasket 2″ (Oscillating) (with E Spring)	1
E	312-E	Gasket Retaining Spring	1
F	312-F	Lever Coil Spring	1

Sym.	Part No.	Description	Amt.
K	312-K	Adapter Gasket 1½″ (Oscillating) (with E Spring)	1

NO. 350 2½" STEAM COUPLER

INLET 2½"	WEIGHT
OUTLET 2½"	10½ Lbs.

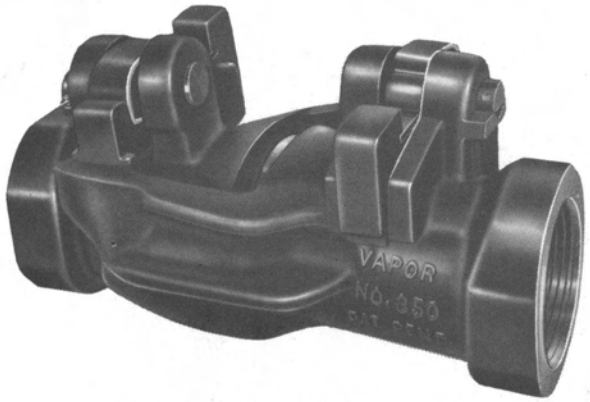


Fig. 1. Two No. 350 Couplers Joined.

GENERAL DESCRIPTION

The No. 350 Steam Coupler is a straight port coupler which has a full two and one-half inch area throughout and which conforms to A.A.R. recommended dimensions. This coupler will lock with other couplers of the same size; or with couplers of the 2″ size if desired. While the No. 350 coupler may be joined with a 2″ coupler without using a special gasket, it is preferable to use a No. 350-S adapter gasket in place of the standard No. 350-K gasket in cases where a more or less permanent connection is to be made.

The locking arrangement on this coupler consists of a wedge equipped with a spring to hold the couplers in a locked position regardless of train motion or road shock. The possibility of an accidental release of the locking system is avoided by the fact that a light hammer blow is required to set or release the locking wedge. A hook provided in the wedge spring is designed to grasp the retaining pin when the wedge is free and to hold it in the open position during the coupling or uncoupling procedure.

Before two couplers can be locked together, they must first be joined properly. Only then can the locking wedge, which exerts a downward pressure on the opposing coupler arm, be driven home to complete the locking action. This feature prevents the twisting and distorting of coupler arms and cams during the locking procedure. Another feature which is designed to prevent excessive wear of coupler arms is the insertion of a hardened steel plug in the coupler arm to serve as a riding place for the locking wedge.

The gasket used in the No. 350 coupler is made of a specially treated bakelite. It is held in place by a gasket retaining spring which will allow the gasket to assume the proper position on the seat, and the same time to present a flat seat against the gasket in the opposing coupler.

MAINTENANCE AND OVERHAUL

The height of the coupler arm is important in providing the proper locking tension and it should be checked periodically with Vapor Car Heating Co.'s No. 312-G master coupler gauge. This gauge consists of a dummy coupler fitted with a gasket and a sliding bar for checking the height of the coupler arm. The sliding bar is marked for the proper height and serves as an indicator for arms which are worn below a minimum permissable height.

Remove the rust and dirt from the cam and the gasket seat in order to allow the coupler to join tightly. Do not attempt to remachine the cam or gasket seat as this will change the relationship between them and the couplers will not lock properly.

Gaskets are easily removed with our No. 314 gasket tool. Renew the gaskets when they are loose, steam cut, scored, badly marred or otherwise damaged or leaking. New gaskets may be applied by pressing them into place, holding the gasket so that the gasket springs will enter horizontally and seat in the grooves provided for them on either side of the inside coupler body.

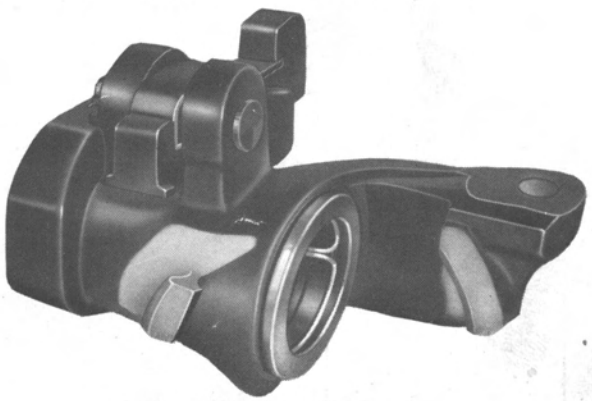


Fig. 2. Single No. 350 Coupler.

NO. 350 COUPLER (Cont.)

Coupler heads should be inspected and gauged at the time and place of the overhauling of the metallic conduits, as follows:

Check the coupler head cam with our No. 312-X coupler cam gauge, which is made to conform to the contour of a new cam. If more than an acceptable tolerance exists the coupler head must be scrapped.

Raised surfaces in the gasket cavity should be removed, care being taken not to go below the surface of the original contour. If the arm of the coupler is battered or distored too badly, the coupler head should be scrapped. Check the coupler arm with the No. 312 master coupler gauge. If the arm is worn below the minimum permissible height, it should be built up by brazing or by welding with a hard welding rod and then ground to a height of 1-21/32" above the center line, which is the proper height as indicated by the gauge.

Inspect the locking wedge, retaining pin and wedge spring. If the wedge is broken or distorted it should be renewed and a wedge spring that has rusted should also be renewed. If the spring under the wedge is broken it can be replaced by breaking out the heel plate and rebrazing with a new spring underneath. This spring is not a necessity, but it aids in lifting the wedge to start over the opposing arm.

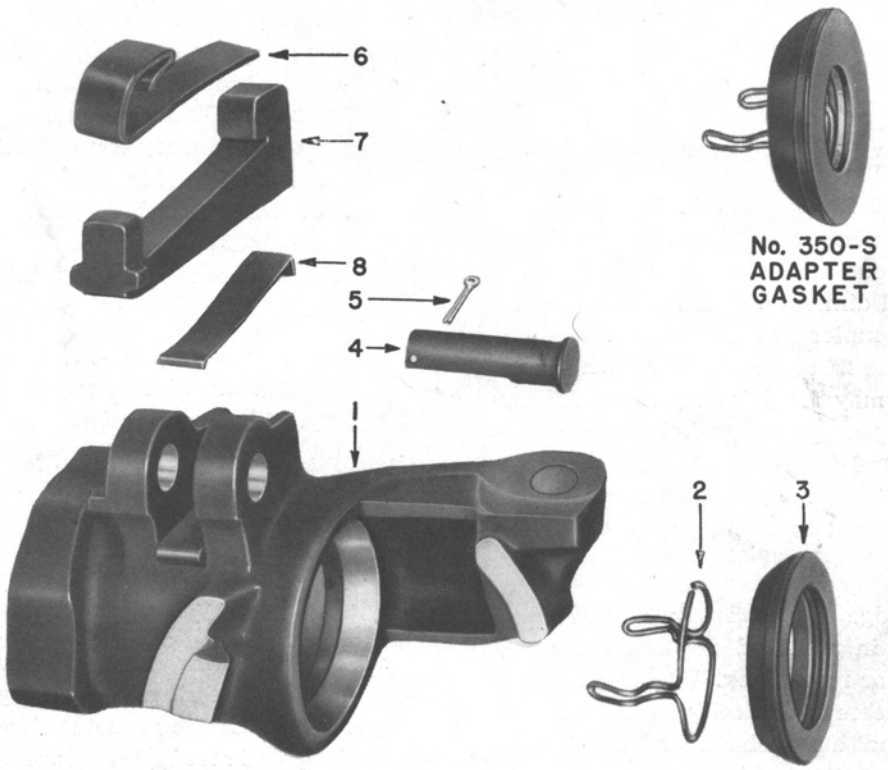


Fig. 3. Exploded View of No. 350 Coupler.

PARTS LIST

Sym.	Part No.	Description	Amt.
1	350-1	Body	1
2	350-E	Spring (Gasket Retaining)	1
3	350-K	Gasket	1
4	350-7	Pin	1
5	⅛"x1"lg.	Cotter Pin (Spring Type)	1
6	351-6	Wedge Spring	1

Sym.	Part No.	Description	Amt.
7	350-16	Wedge	1
8	350-30	Spring	1
	350-S	Adapter Gasket (Not furnished with coupler)	

No. 322 2″ STEAM COUPLER

INLET 2″
OUTLET 2″

WEIGHT
10½ LBS.

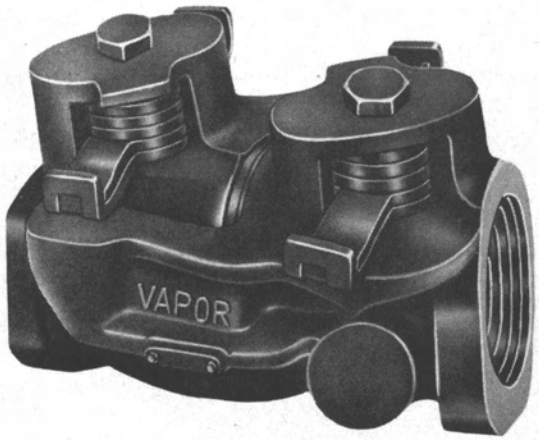


Fig. 1. Two No. 322 Steam Couplers Joined.

GENERAL DESCRIPTION

The No. 322 Steam Coupler is a straight port coupler which has a 2″ area throughout and which conforms to A.A.R. recommended dimensions. It is designed to function with another coupler to form a joint between the flexible metallic conduits of two railway cars, or between the conduits of a railway car and a locomotive. This coupler will lock with other couplers of the same size or with standard 2½″ couplers. In the latter case, when a more or less permanent connection is to be made, it is preferable to use a No. 350-S adapter gasket in place of the No. 350-K gasket in the larger coupler.

The locking arrangement of this coupler is of an improved design and provides a greater follow-up in wear between the coupler cam and the arm of the opposing coupler. This is an advantage over the lock of the No. 312 coupler which sometimes required the use of wooden wedges under the locking lever to maintain a tight joint. The lock of the No. 322 coupler is equipped with double locking levers and a coil spring, all of which exert a downward pressure on the arm of the opposing coupler to maintain a tight joint. This lessens the wear on coupler gaskets and cams by eliminating vibration and road shock at the joint when the car is in motion.

This coupler is of a heavier construction than were previously used 2″ couplers and for that reason has a longer life in service. Another advantage of this coupler over previous 2″ couplers is the insertion of a steel plug in the arm of the coupler to serve as a riding place for the wedge type lock of the No. 350 2½″ couplers when they are joined, and an additional flat surface on the coupler arm to provide a face for hammering to lock or unlock a pair of couplers. To separate a pair of couplers, after the lock has been disengaged, strike several sharp hammer blows on the bottom surface of the coupler arm, being careful not to damage the coupler cam.

The gasket used in the No. 322 coupler is made of a specially treated, durable bakelite and is held in place by a gasket spring. This spring is designed to allow the gasket to assume the proper position on the seat and at the same time to present a flat surface against the gasket of the opposing coupler.

MAINTENANCE

The height of the coupler arm is important in providing the proper locking tension and it should be checked periodically with Vapor Heating Corporation's No. 312-G Master Coupler Gauge. This gauge consists of a dummy coupler fitted with a gasket and a sliding bar for gauging the height of the coupler arm. The sliding bar is marked for proper height of the coupler arm and serves as an indicator for arms which are worn below a minimum permissible height.

Remove the rust and dirt from the cam and the gasket seat in order to allow the couplers to join tightly. Do not attempt to remachine either the cam or the gasket seat as this will change the relationship between them and the coupler will not lock properly.

Coupler heads should be inspected and gauged at the time and place of the overhauling of the metallic conduits, as follows:

Check the coupler cam with Vapor Heating Corporation's No. 312-X Coupler Cam Gauge, which is made to conform to the contour of a new cam. If an acceptable tolerance does not exist, the coupler head must be scrapped.

Raised surfaces in the gasket cavity should be

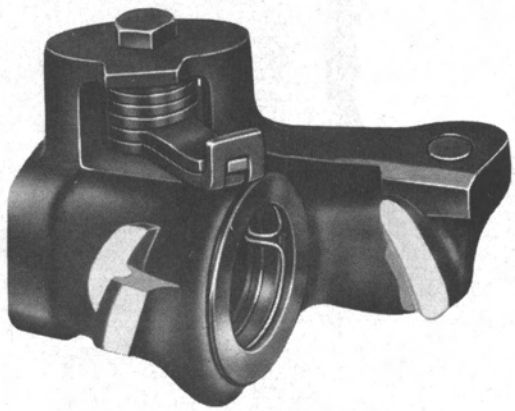


Fig. 2. No. 322 Steam Coupler.

No. 322 2" STEAM COUPLER (Continued)

removed, care being taken not to go below the surface of the original contour. If the arm of the coupler is battered or distorted too badly, the coupler head should be scrapped.

Check the coupler arm with the No. 312-G Master Coupler Gauge. If the arm is worn below the minimum permissible height, it should be built up by brazing or by electric welding with a hard welding rod, and then milled to a height of 1-21/32" above the center line, and in accordance with the taper of the slide bar on the gauge. This is the proper height as indicated by the gauge.

Disassemble the coupler and check the top locking lever with a straight edge. If it is distorted more than ⅛", it should be replaced. Examine the locking lever pin for wear. Coil springs, which measure less than 31/32" in height should be scrapped. If the ramp on which the locking lever rides is badly battered it should be built up in the same manner as the coupler arm and milled to protrude ⅛" above the finished arm height.

Gaskets are easily removed with the Vapor Heating Corporation's No. 314 Gasket Tool.

Renew the gaskets when they are loose, steam cut, scored, badly marred or otherwise damaged and leaking. New gaskets may be applied by pressing them into place, holding the gasket so that the prongs or springs will enter horizontally and seat in the grooves provided for them on either side of the inside coupler body.

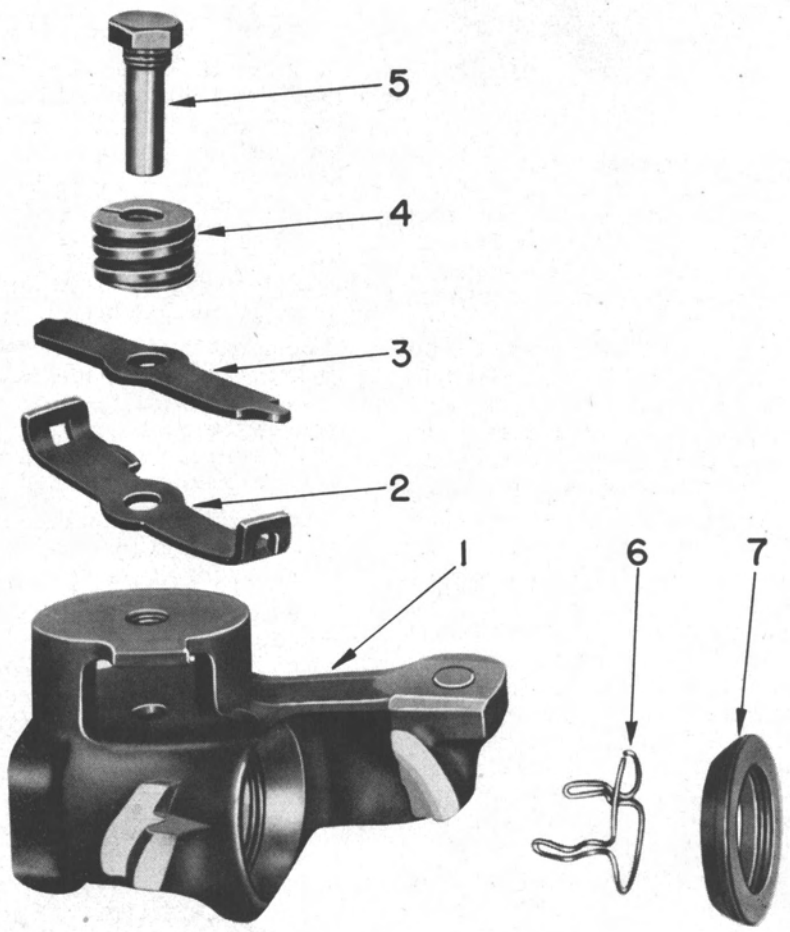


Fig. 3. Exploded View of No. 322 Coupler.

LIST OF PARTS FOR No. 322 2" STEAM COUPLER

Sym.	Part No.	Description	Amt.
1	322-1	Coupler Body	1
2	364-2	Lever (Bottom Locking)	1
3	364-3	Lever (Top Locking)	1
4	364-4	Spring	1
5	364-5	Pin	1
6	312-E	Gasket Spring	1

Sym.	Part No.	Description	Amt.
7	312-D	Gasket	1
	No. 6 x ¼" Lg.	Screw (Drive)	2
		Plate (Identification)	1

No. 364 2½" STEAM COUPLER

INLET 2½"
OUTLET 2½"

NO. 362 2½" outlet 2" inlet

WEIGHT
12 LBS.

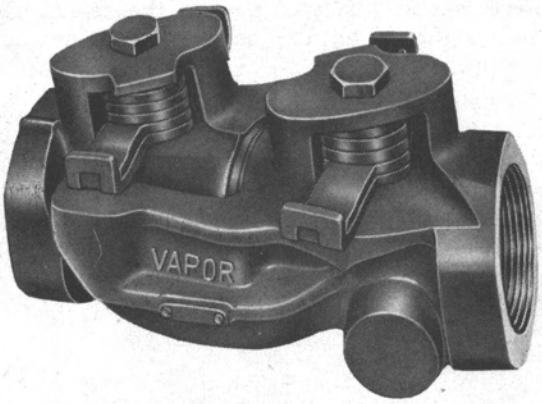


Fig. 1. Two No. 364 Steam Couplers Joined.

GENERAL DESCRIPTION

The No. 364 2½" Steam Coupler is a straight port coupler which has a full two and one-half inch area throughout and which conforms to A.A.R. recommended dimensions. This coupler will lock with other couplers of the same size or with couplers of the 2" size if desired. While the No. 364 coupler may be joined with 2" couplers without using a special gasket, it is preferable to use a No. 350-S adapter gasket in place of the standard No. 350-K gasket in cases where a more or less permanent connection is to be made.

The locking arrangement of this coupler, like that of the No. 322 2" coupler, is of an improved design and provides a greater follow-up for wear between the coupler cam and the arm of the opposing coupler. This is an advantage over the wedge type lock used on previous 2½" couplers which sometimes presented difficulty from driving the wedge in too far, or else not in far enough to lock the couplers. In the newer coupler the locking lever is driven as far as it will go in one direction to lock the couplers or as far as it will go in the other direction to unlock them. The lock on this coupler is equipped with double locking levers and a coil spring all of which exert a downward pressure on the arm of the opposing coupler to maintain a tight joint. This feature, as in the No. 322 coupler, lessens the wear on the coupler gaskets and cams by eliminating vibration and road shock at the joint when the train is in motion. Before the pair of couplers to be connected can be locked, they must first be properly joined. Only then can the locking levers be driven home to complete the locking action. This feature prevents the twisting and distorting of the coupler arms and cams during the locking procedure.

This No. 364 coupler is of a heavier construction than previously used 2½" couplers and for that reason has a longer life in service. An additional flat surface on the coupler arm provides a surface for hammering to lock or unlock a pair of couplers. To separate a pair of couplers, after the lock has been disengaged, strike several sharp hammer blows on the bottom surface of the coupler arm, being careful not to damage the coupler cam.

The gasket used in the No. 364 coupler is made of a durable, specially treated bakelite. It is held in place by a gasket retaining spring which will allow the gasket to assume the proper position on the seat and to present a flat seat against the gasket of the opposing coupler. This is the same gasket as was previously used in the No. 350 2½" couplers which utilized the wedge type lock.

MAINTENANCE

The height of the coupler arm is important in providing the proper locking tension and it should be checked periodically with Vapor Heating Corporation's No. 350-G Master Coupler Gauge. This gauge consists of a dummy coupler fitted with a gasket and a sliding bar for checking the height of the coupler arm. The sliding bar is marked for the proper height and serves as an indicator for arms which are worn below a minimum permissible height.

Disassemble the coupler and check the top locking lever with a straight edge. If distorted more than ⅛" it should be replaced. Examine the locking lever pin for wear. Coil springs which measure less than 31/32" in height should be scrapped. If the ramp on which the locking lever rides is badly battered it should be built up in the same manner as the coupler arm and milled to protrude ⅛" above the finished arm height.

Coupler heads should be inspected and gauged

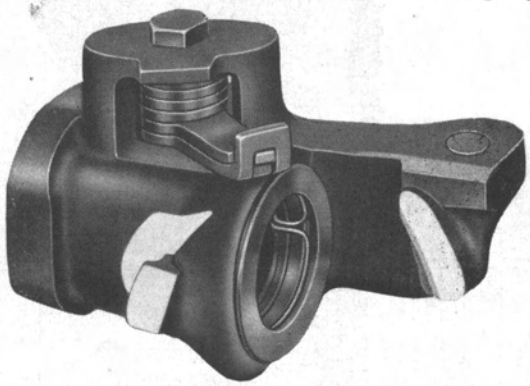


Fig. 2. No. 364 Steam Coupler.

No. 364 STEAM COUPLER (Continued)

at the time and place of the overhauling of the metallic conduits, as follows:

Check the coupler head cam with our No. 312-X coupler cam gauge, which is made to conform to the contour of a new cam. If more than an acceptable tolerance exists the coupler head must be scrapped.

Raised surfaces in the gasket cavity should be removed, care being taken not to go below the surface of the original contour. If the arm of the coupler is battered or distorted too badly, the coupler head should be scrapped. Check the coupler arm with the No. 350-G master coupler gauge. If the arm is worn below the minimum permissible height, it should be built up by brazing or by welding with a hard welding rod and then ground to a height of 1-21/32" above the center line and in accordance with the taper of the slide bar which is the proper height as indicated by the gauge.

Remove the rust and dirt from the cam and the gasket seat in order to allow the coupler to join tightly. Do not attempt to remachine the cam or gasket seat as this will change the relationship between them and the couplers will not lock properly.

Gaskets are easily removed with our No. 314 gasket tool. Renew the gaskets when they are loose, steam cut, scored, badly marred or otherwise damaged or leaking. New gaskets may be applied by pressing them into place, holding the gasket so that the gasket springs will enter horizontally and seat in the grooves provided for them on either side of the inside coupler body.

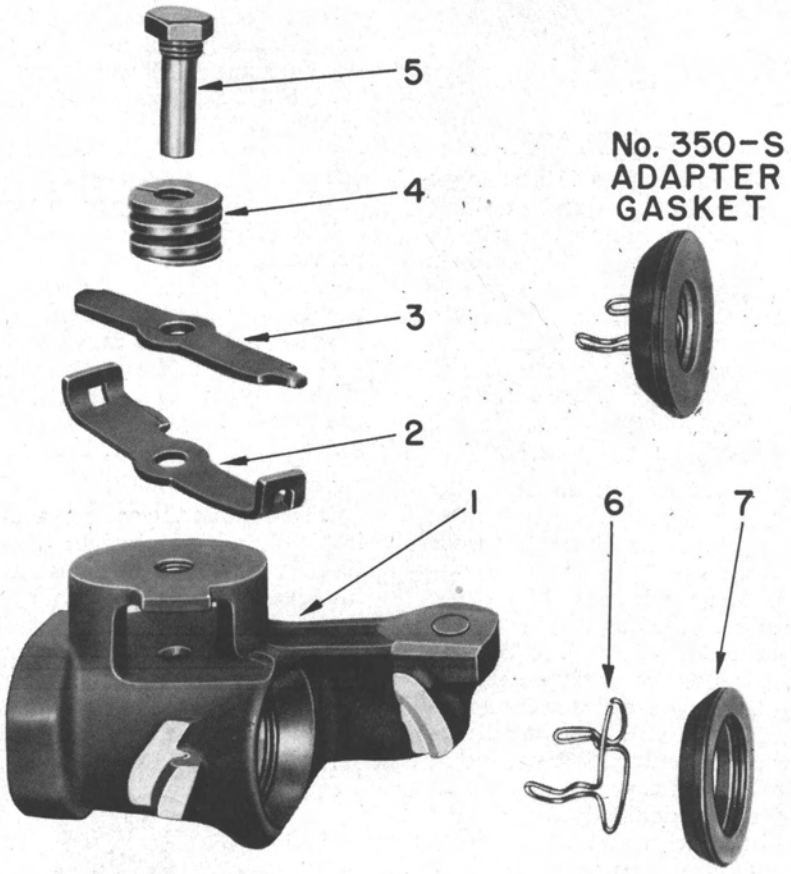


Fig. 3. Exploded View of No. 364 Coupler.

LIST OF PARTS FOR No. 364 2½" STEAM COUPLER

Sym.	Part No.	Description	Amt.
1	364-1	Coupler Body	1
2	364-2	Lever (Bottom Locking)	1
3	364-3	Lever (Top Locking)	1
4	364-4	Spring	1
5	364-5	Pin	1
6	350-E	Gasket Spring	1
7	350-K	Gasket	1

Sym.	Part No.	Description	Amt.
	No. 6 x ¼" Lg.	Screw (Drive)	2
		Plate (Identification)	1

PRINTED IN U. S. A.

No. 1136 FLEXIBLE METALLIC CONDUIT

2" I.P.S. CONNECTIONS — WEIGHT 45 LBS.

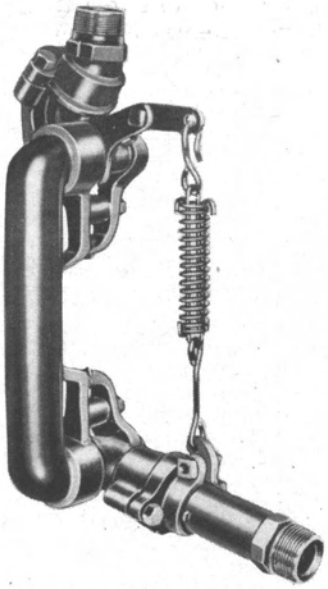


Fig. 1. No. 1136 Flexible Metallic Conduit

GENERAL DESCRIPTION

The No. 1136 Flexible Metallic Conduit is designed to replace the rubber hose connectors formerly used to pass steam from one car to another for heating purposes in railroad trains. This metal connector will withstand full boiler steam pressure in any position and because of its sleeve-type construction will flex freely in any direction.

Regardless of the sway of the cars in rounding curves in the track, a 2" opening is provided through the length of the conduit for a passage of steam. Each joint of the connector is equipped with a gasket as an insurance against a leakage of steam and the gaskets are provided with a spring to follow up gasket wear and to maintain a tight joint.

If desired, asbestos insulation and covers, as shown in Figure 3, may be applied to the conduit. This will prevent a heat loss from the connector due to outdoor temperatures or to wind when the train is in motion.

MAINTENANCE

Considerable savings for railroads have resulted from the installation of a regular program in their shops for the maintenance of flexible metallic conduits. Our bulletin 1106, which is available upon request, describes in detail how this type of program may easily be established and lists the numbers of our drawings of tools, bench jigs and gauges used in this work. The drawings are available upon request and the devices may be made up by men in the shop. If proper tools are not available, conduits requiring reconditioning should be sent in to Vapor Heating Corporation for this work, otherwise we strongly recommend the establishment of a maintenance program in the railroad's own shops.

Minor repairs, such as the replacing of worn gaskets, can be made in the yards between runs. This type of maintenance does not require the complete dismantling of the conduit, and is only necessary when a leakage of steam indicates that attention is needed by the conduit.

If the noses on the "B" and "L" castings should be refaced, due to wear and corrosion, care should be taken, when refacing, that no more metal than necessary is removed, in order to leave a smooth finish. If the face of the nose is very bad, metal should be removed from both faces, so as to maintain a $\frac{13}{32}$" dimension. If this is done, it will be necessary to apply No. 1136-M $\frac{1}{32}$" thick steel washers behind the "N" bearing in the clamps to compensate for the metal removed. It is important that approximately $\frac{1}{32}$" space between movable castings be maintained for free movement.

APPLICATION OF GASKETS: When it is necessary to replace a gasket in the conduit, it should not be lubricated as gaskets are pre-treated with silicone oil. Place the heavy spring (O-2) in the ferrule and apply the complete gasket assembly in the recess of the conduit casting, inserting the spring end of the gasket first, so that the wide face of the gasket will bear against the nose of the opposing male member.

Figure 2 shows an exploded view of the conduit castings and explains how the unit may be dismantled for inspection and maintenance. First remove the two "H" clamps, which will separate the conduit into three parts. By removing the "C" clamp, one of these parts may be further dismantled and by removing the two cap screws which hold the "L" and "Y" castings together, another of the assemblies may be further disassembled.

In reassembling the unit, either bushings which have passed the gauging test or new ones may be used. New gaskets should be used throughout and gasket springs which measure less than 1⅛" in free height must be replaced.

CAUTION: When putting the flexible metallic conduit back into service be sure that it is installed with sufficient clearance from the rails.

No. 1136 FLEXIBLE METALLIC CONDUIT (Continued)

Also be sure that the mark on the conduit "A" casting matches the mark on the end train valve. If these two marks correspond, the conduit is in the proper position. Attach a safety chain from the car frame to the hole provided for it in the "A" casting.

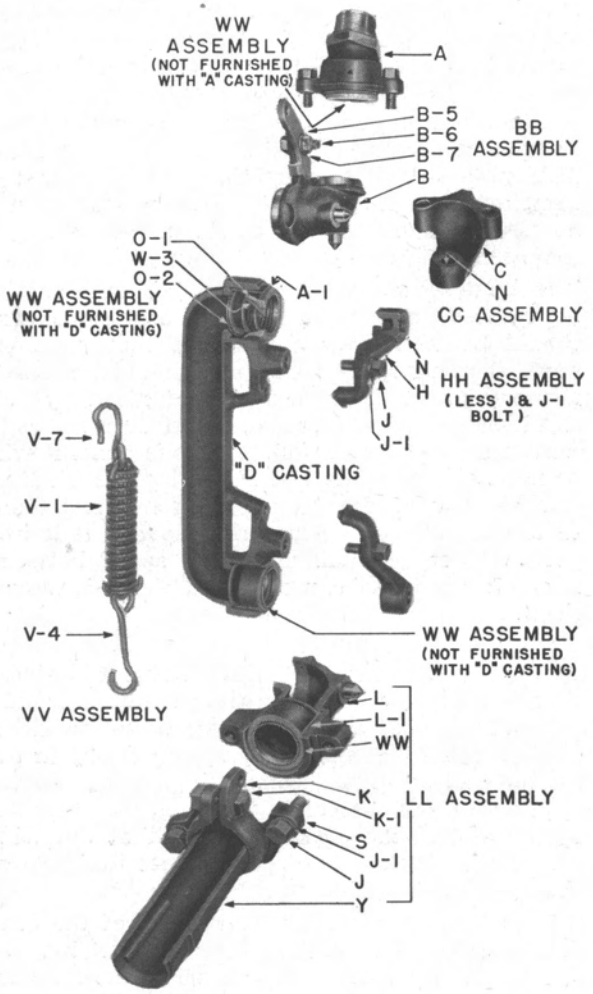


Fig. 2. Exploded View of No. 1136 Flexible Metallic Conduit Castings

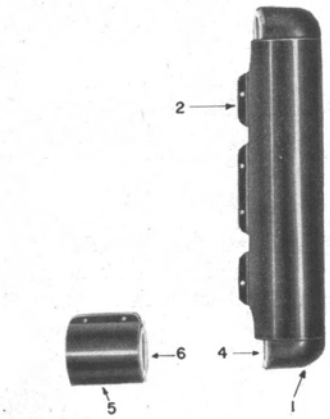


Fig. 3. Insulation for No. 1136 Conduit

LIST OF PARTS

No. 1136 FLEXIBLE METALLIC CONDUIT

Sym.	Part No.	Description	Amt.
A	1136-A	Conduit End Valve Connector (Includes one of A-1)	1
A-1	1136-A-1	Steel Bushing	3
B	1136-B	Upper Joint Body	1
B-5	1136-B-5	Spring Support Extension Arm	1
B-6	1136-B-6	Bolt and Nut (½" Dia. U. S. Std. 1¼" Lg.)	1
B-7	1136-B-7	Lock Washer (½" x $\frac{5}{16}$" x $\frac{1}{16}$")	1
D	1136-D	Intermediate Body Casting (Includes two of A-1)	1
J	1164-J	Cap Screw (⅝" Dia. U. S. Std. 1¾" Lg.)	6
J-1	1136-J-1	Lock Washer (⅝" x $\frac{3}{16}$" x $\frac{1}{16}$")	6
K	1136-K	Spring Support Clamp	1
K-1	1136-K-1	Bolt and Nut (½" Dia. U. S. Std. 2" Lg.)	1
L	1136-L	Lower Joint Body Casting	1
L-1	1136-L-1	Steel Bushing	1
N	1136-N	Renewable Thrust Bearing	3
O-1	1164-O-1	Gasket	4
O-2	1164-O-2	Spring	4
S	1136-S	Coupler Adapter Retaining Ring	1
V-1	1136-V-1	Spring Complete (Consists of Syms. V-2 and V-3)	1
V-2	1136-V-2	Spring	1
V-3	1136-V-3	Spring Support	1
V-4	1136-V-4	Lower Hook	1
V-7	1136-V-7	Upper Hook	1
W-3	1136-W-3	Ferrule	4
Y	1136-Y	Conduit Coupler Adapter	1
BB	1136-BB	Upper Joint Body Complete (Consists of Syms. B, B-5, B-6 and B-7)	1
CC	1136-CC	Upper Joint Body Clamp Complete (Consists of Syms. C and N)	1
HH	1136-HH	Intermediate Body Clamp Complete (Consists of Syms. H and N)	2
LL	1136-LL	Lower Joint Body Complete (Consists of Syms. K, K-1, L, L-1, Y, WW, J, J-1 and S)	
VV	1136-VV	Flexible Support Complete (Consists of Syms. V-1, V-4 and V-7)	1
WW	1136-WW	Gasket Assembly Complete (Consists of Syms. O-1, O-2 and W-3)	3

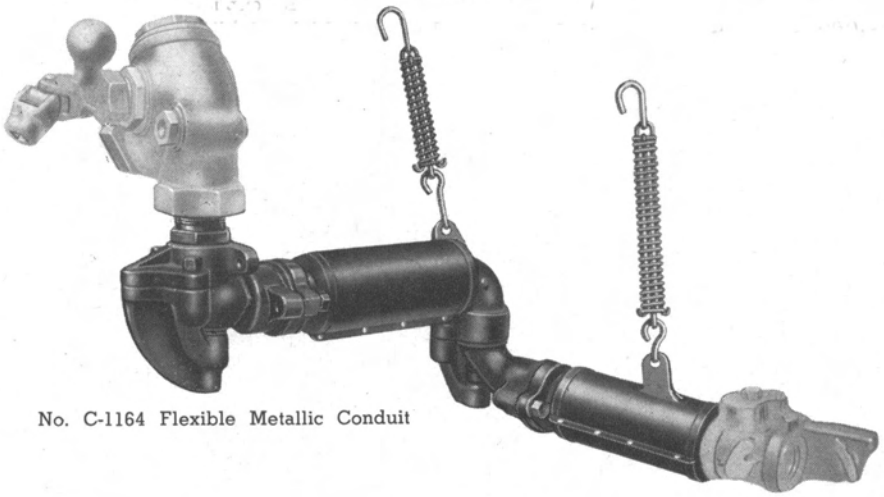
NOTE—1136-M Shim Washers not furnished with conduit must be ordered separately.

Nos. 1141 AND 1141-1 INSULATION

Sym.	Part No.	Description	Amt.
1	1141-A	Casing (Vertical)	1
2	1141-B	Clamp	1
	1141-C	Rivet	6
4	1141-D	Asbestos Liner	1
5	1141-1-A	Casing (Horizontal)	1
6	1141-1-B	Asbestos Liner	1

No. C-1164 FLEXIBLE METALLIC CONDUIT

No. B-1164 2½" Connector | No. C-1164 2" Connector | No. F-1164 2½" Flanged Connector



No. C-1164 Flexible Metallic Conduit

GENERAL DESCRIPTION

The No. C-1164 Flexible Metallic Conduit is designed for use on cars equipped with "tight lock" drawbar construction, where the couplers and hangers do not permit the standard location of end valves. These metal connectors will withstand full boiler steam pressure in any position and because of their type of joint construction, will flex freely in any direction.

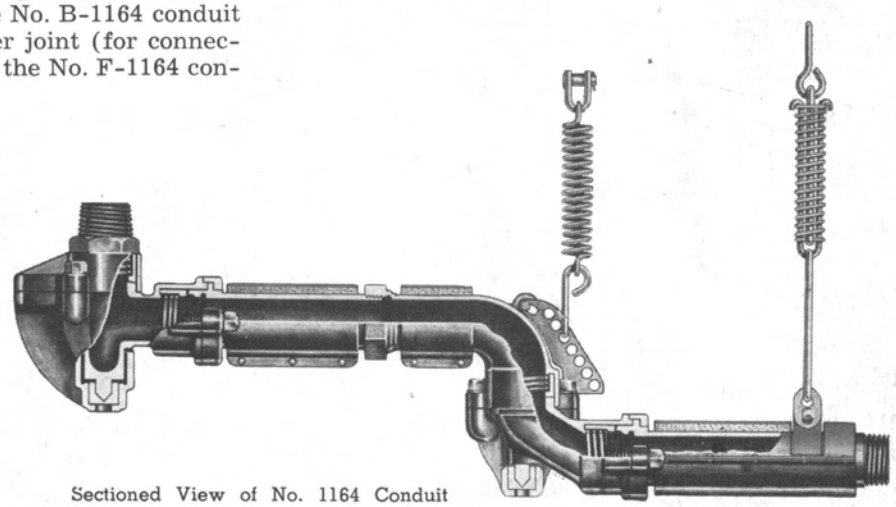
Each joint of these flexible metallic conduits is equipped with a gasket as a protection against steam leakage and each gasket is provided with a spring to follow up the gasket wear and to maintain a tight joint. Regardless of the movement of the cars in rounding a curve in the track, the conduits provide a full 2" opening throughout for the passage of steam. The No. B-1164 conduit is furnished with a 2½" upper joint (for connection to a 2½" end valve), and the No. F-1164 conduit is furnished with a flange for connection to a No. F-1117 2½" flanged end valve.

Asbestos insulation, with metal casings is furnished with the conduit to prevent a heat loss between cars caused by wind wipe and cold weather. The No. 1164 Flexible Metallic Conduit is available in a number of different types, each with a variation of dimensions of the connectors to accommodate various locations of end valves.

Considerable savings for railroads have resulted from the installation of a regular program in their shops for the maintenance of flexible metallic conduits. Our Bulletin 1106 describes in detail how this type of a program may easily be established, and lists the numbers of our drawings of tools, bench jigs and gauges used in this work. The drawings are available upon request and the devices may be made up by the men in the shops. If proper tools are not available, conduits requiring reconditioning should be sent in to the Vapor Heating Corporation for this work, otherwise we strongly recommend the establishment of a maintenance program in the railroad's own shops as a great time saving element.

Minor repairs, such as the replacing of worn gaskets can be made in the yards between runs. This type of maintenance does not require the complete dismantling of the conduit, and is only necessary when a leakage of steam indicates that attention is needed by the conduit.

The various types of No. 1164 Flexible Metallic Conduits should be disassembled every year for cleaning, inspection and replacing or rebuilding of worn parts. To disassemble any of these conduits, remove the eight cap screws and unscrew the lower joint body from the "Y" body, and the



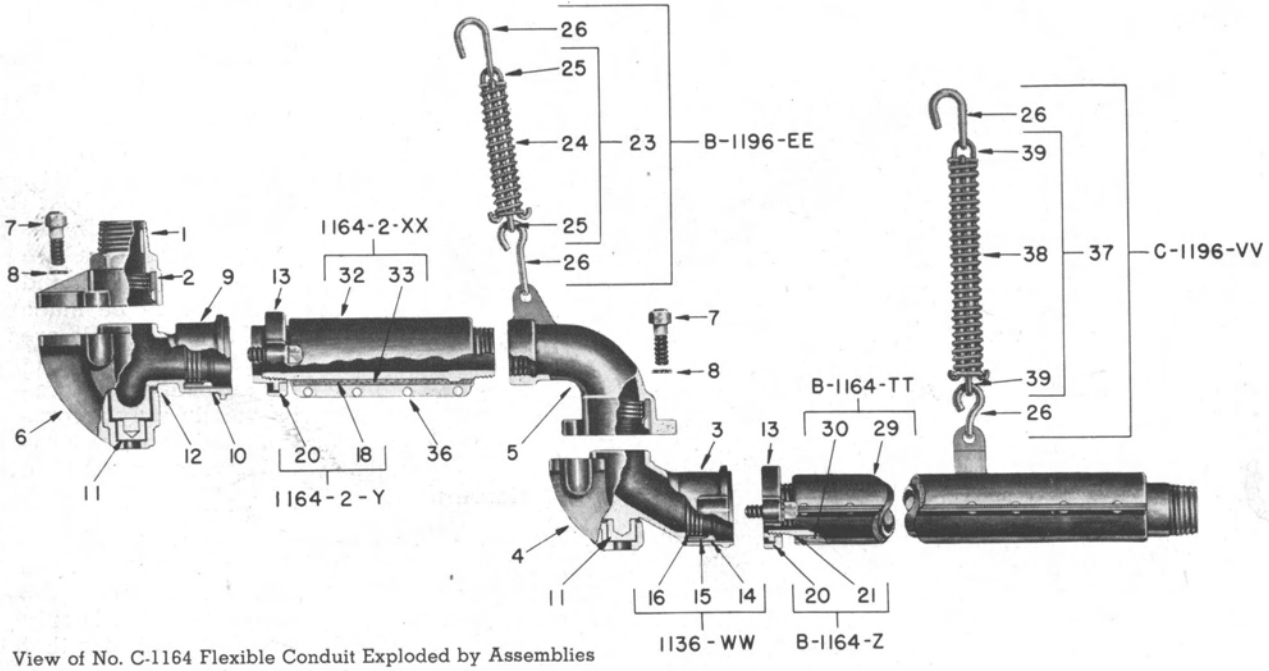
Sectioned View of No. 1164 Conduit

No. 1164 FLEXIBLE METALLIC CONDUIT (Cont.)

coupler from the "Y" or "Z" tube as the case may be.

With the conduits disassembled check the castings for wear, using the special gauges mentioned in Bulletin 1106 and either replace or build up worn parts. Then inspect the gaskets and bushings for wear, replacing them where necessary. Gasket springs should be tested for tension and should measure 1⅜" in free height. Considerable care must be taken in an inspection of the couplers, with proper measurements being assured by the use of gauges. This procedure is described in detail in Bulletin 1106.

Lubricate the gaskets with a solution of cylinder oil and graphite before re-inserting them. When the conduit has been reassembled check it for leaks on a steam line before placing it in service again. Also be sure that when the conduit is re-applied to a car, that it is installed with the proper clearance from the rails. A minimum of 5½" is required between the lowest part of the conduit and the top of the rail.



View of No. C-1164 Flexible Conduit Exploded by Assemblies

LIST OF PARTS

No. C-1164 FLEXIBLE METALLIC CONDUIT

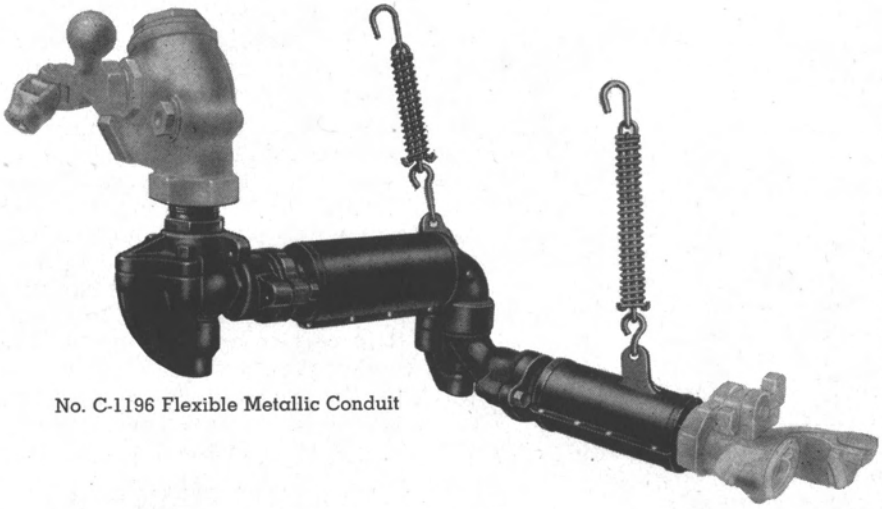
Sym.	Part No.	Description	Amt.
1	1163-A	Upper Joint "A" Connector (includes one of sym. 2)	1
2	1136-A-1	Bushing for "A" and "D" Bodies	2
3	1162-B	Lower Joint "B" Body (includes one of sym. 10)	1
4	1136-C	Lower Joint Body Clamp (includes one of sym. 11)	1
5	B-1164-D	Lower Joint "D" Body (includes one of sym. 2)	1
6	1163-H	Upper Joint Body Clamp (includes one of sym. 11)	1
7	1164-J	Cap Screw	8
8	1136-J-1	Lockwasher	8
9	1163-L	Upper Joint "L" Body (includes one of sym. 10)	1
10	1136-L-1	Bushing for "B" and "L" Bodies	2
11	1163-N	Renewable Thrust Bearing	2
12	1163-R	Dust Ring	1
13	1136-S	Retaining Ring	2
14	1164-O-1	Gasket	4
15	1136-W-3	Gasket Ferrule	4
16	1164-O-2	Gasket Spring	4
18	1164-2-Y-2	Tube (Y Body)	1
20	1164-Z-1	Piece	2
21	B-1164-Z-2	Tube (Z Body)	1

Sym.	Part No.	Description	Amt.
23	1136-V-1	Spring Complete (includes syms. 24 and 25)	1
24	1136-V-2	Spring	1
25	1136-V-3	Support	2
26	B-1196-V-5	Hook	4
29	B-1164-T-21	Insulation Casing for "Z" Body	1
30	B-1164-T-22	Insulation Liner for "Z" Body	1
32	1164-2-X-21	Insulation Casing for "Y" Body	1
33	1164 T-32-A	Insulation Liner for "Y" Body	1
36	3/16"x¼"	Tubular Rivet	11
37	C-1196-V-11	Spring Complete (includes syms. 38 and 39)	1
38	C-1196-V-12	Spring (only)	1
39	C-1196-V-13	Support	2
	1164-2-Y	"Y" Connector Assembly (includes syms. 18 and 20)	
	B-1164-Z	"Z" Connector Assembly (includes syms. 20 and 21)	
	B-1164-TT	"Z" Body Insulation Complete (incl. syms. 29 and 30)	
	1164-2-XX	"Y" Body Insulation Complete (incl. syms. 32 and 33)	
	B-1196-EE	Spring (Support) Comp. (incl. syms. 23 and two of 26)	
	C-1196-VV	Spring (Safety) Comp. (incl. syms. 37 and two of 26)	

Nos. 1195, 1196 and 1197 SERIES 2½" FLEXIBLE METALLIC CONDUITS

(Supersede the Nos. 1165, 1165-1, 1166, 1166-1, 1166-2 and 1167 Metallic Conduits, Respectively)

WEIGHT WITH COUPLER AND INSULATION:—ABOUT 90 LBS.



No. C-1196 Flexible Metallic Conduit

GENERAL DESCRIPTION

These conduits are designed for use on cars and locomotives equipped with 2½" train-lines and are arranged with different connector lengths to suit different installation requirements, where "Tightlock" drawbars are used, and when the couplers and hangers do not permit the standard end train pipe location.

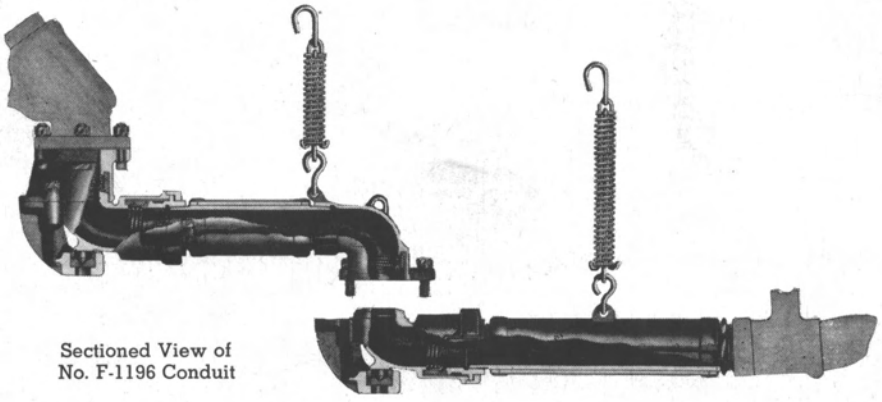
These metal connectors will withstand full boiler steam pressure in any position and because of their type of joint construction will flex freely in any direction, regardless of the movement of the cars in rounding a curve in the track. The conduits provide a full opening throughout for the passage of steam. Asbestos insulation, with metal coverings is furnished with the conduits to prevent a heat loss between the cars caused by wind wipe. Certain conduits of this series are furnished with a flanged connector for connection to a 2½" flanged end valve and are designated by the letter "F" prefixing the conduit number.

MAINTENANCE AND OVERHAUL

Considerable savings for railroads has resulted from the installation of a regular program in their shops for the maintenance of flexible metallic conduits. On page 6 is a list of the numbers of our drawings of tools, bench jigs and gauges which may be used in this work. The drawings are available upon request and the devices may be made up by the men in the shops. If proper tools are not available, conduits requiring reconditioning should be sent to the Vapor Heating Corporation for this work.

Minor repairs, such as the replacing of a worn gasket, can be made in the yards between runs. This type of maintenance does not require the complete dismantling of the conduit and is only necessary when a leakage of steam indicates that the conduit needs attention.

Flexible Metallic Conduits of the 1195, 1196 and 1197 series should be disassembled every year for inspection, cleaning and replacing or re-machining of worn parts. The conduits may be disassembled by removing the eight cap screws which hold the joints in place.



Sectioned View of No. F-1196 Conduit

Nos. 1195, 1196 AND 1197 SERIES CONDUITS (Cont.)

When removing or applying the Y-1 connector pieces it will be necessary to use a bar or special round plug wrench with slots on each side to fit against the two lugs on the inside of the connector piece, in order to allow it to be held in place while the tubes are screwed in or out with a Stillson wrench. Considerable power will be needed to pull the pieces tight. A Stillson wrench should not be used on the outside of the connector pieces, as this would mar them.

With the conduit disassembled, check each of the castings for wear. Clean and polish all bearing surfaces and gasket cavities with fine emery cloth or a wire buffer. Clean out all bearing cavities in the clamps and be sure that they are of the proper dimensions. This may be determined by a gauge.

Inspect the gaskets, ferrules, gasket springs and bushings for wear, replacing them where necessary. Gaskets which have become hard, cracked or worn or which have been through a heating season should be replaced. The old gasket ferrules, if straightened, may be used with new gaskets. Gasket springs found with a free height of less than 1 9/16" should be scrapped.

If the bushings in the gasket cavities are scored, apply new bushings. The old bushings can be removed with the aid of an acetylene torch by passing the flame up and along the casting to heat a strip about 1" in width. The bushing can then be easily knocked out by the use of a blunt nose cape chisel with which one portion of the bushing may be crushed to decrease its diameter and permit removal. It is also possible to remove the bushing by heating it to a cherry red with a torch, placing a stopper in the cavity and then pouring water in the bushing. The bushing remover (Vapor Drawing No. 46-D-41) will then remove the bushing easily.

The noses of the upper and lower joint castings and the nose of the "Y-1" connector pieces should be refaced if required on account of wear or corrosion. Check these castings carefully with the gauge and when refacing be sure that no more metal than is necessary is removed to leave a smooth finish. If the diameter of the nose is worn so that the condemning gauge will pass over it, the casting should be scrapped.

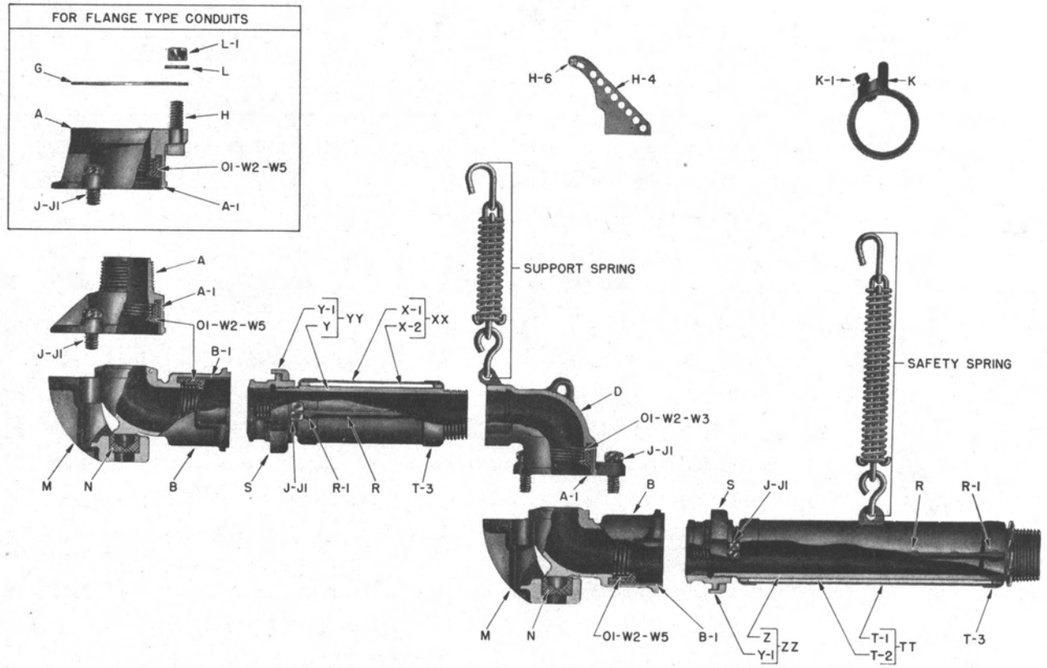
If the flexible support springs have weakened, they should be renewed or readjusted to prevent sagging and insure the proper height of the conduit above the rail. Also replace old insulation which is badly worn or deteriorated.

When re-assembling the conduit, be sure that lockwashers are placed under the heads of all the cap screws and that all threads and thrust bearings are lubricated with a solution of cylinder oil and graphite. The cap screws should be well cleaned to be sure that they will pull down tight to insure a tight joint. After the conduit has been re-assembled, check on a steam line for leaks before placing it in service again. Also be sure that when the conduit is re-applied to a car, that it is installed with the proper clearance from the rails. A minimum of 5½" is required between the lowest part of the conduit and the top of the rail.

APPLICATION OF GASKETS

Vapor gaskets are pre-treated with silicone oil and require no further lubrication. Place the heavy spring (W-2) in the ferrule and apply the complete gasket assembly in the recess of the casting, inserting the spring end of the gasket first, so that the wide face of the gasket will bear on the nose of the opposing male member.

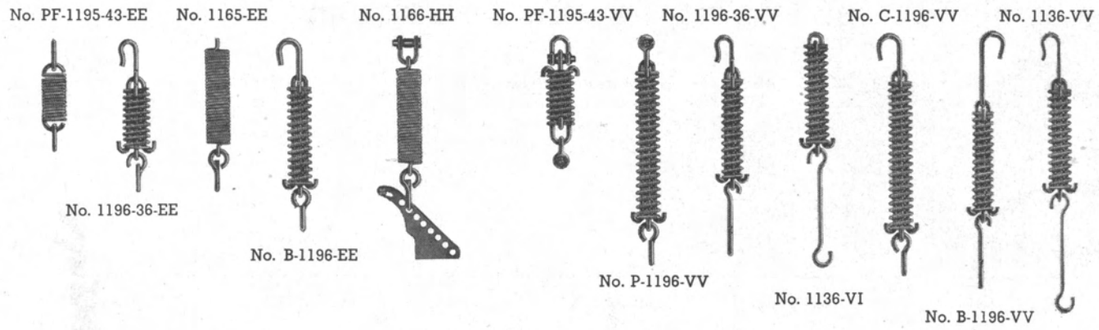
Conduit	"A" Upper Joint Connector	Amount	"A-1" Bushing	Amount	"B" Upper and Lower Joint Body	Amount	"B-1" Bushing	Amount	"D" Lower Joint El Body	Amount	"J" Cap Screw	Amount	"J-1" Lock-washer	Amount	"K" Clamp	Amount	"K-1" Set-Screw	Amount	"M" Clamp	Amount	"N" Thrust Bear-ing	Amount	"S" Re-tain-ing Ring	Amount	"O-1" Gasket	Amount	"W-2" Gasket Spring	Amount
1195	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	⅜x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1195-1	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1195-2	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1195-4	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1195-14	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1195-22	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
P-1195	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
PF-1195	PF-1196-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
PF-1195-23	PF-1196-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
PF-1195-24	PF-1196-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
PF-1195-31	PF-1196-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
PF-1195-43	PF-1196-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-1	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-2	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-3	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-4	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-5	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-6	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-16	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-17	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-26	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1196-36	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
B-1196	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
C-1196	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	2	1165-W-2	4
C-1196-22	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
F-1196	PF-1196-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
F-1196-5	PF-1196-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
PF-1196	PF-1196-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
PF-1196-1	PF-1196-A	1	1165-A-1	2	1195-B PF-1196-1-B	1 1	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
1197	1165-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	1165-K	1	½x13x⅞	1	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4
PF-1197	PF-1196-A	1	1165-A-1	2	1195-B	2	1165-B-1	2	1165-D	1	1165-J	8	¾x1¼x⅛	8	.....	...	.....	...	1165-M	2	1165-N	2	1195-S	2	1195-O-1	4	1165-W-2	4



View of No. C-1196 Flexible Conduit Exploded by Assemblies

LIST OF PARTS

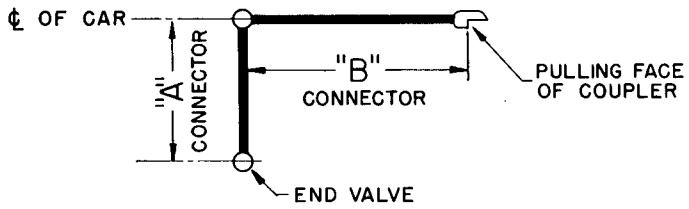
"W-5" Gasket Ferrule	Amount	"YY" Upper Joint Connector	Amount	Tailpiece	Amount	Tube	Amount	"ZZ" Lower Joint Connector	Amount	Tube	Amount	"R-1" Rivet	Amount	"R" Rivet	Amount	"T-3" Insulation End Cap	Amount	"TT" Lower Joint Insulation Complete	Amount	Casing	Amount	Liner	Amount	Liner	Amount	"XX" Upper Joint Insulation	Amount	Casing	Amount	Liner	Amount	Support Spring	Amount	"H-6" Pin and "H-4" Plate	Amount	Safety Spring	Amount	"G" Gasket	Amount	"H" Tee-Head Bolt	Amount	"L" Lock-Washer	Amount	"L-1" Hex-Head Nut	Amount	Steam Coupler Furnished With Conduit	Amount
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1195-2-Z	1	1195-2-Z-2	1	5/8x3/8	4	5/8x1/4	8	B-1196-T-3	8	1195-TT	1	1195-T-21	1	1165-T-22-A	1	1165-T-22-B	1	1195-XX	1	B-1196-X-1	1	1165-X-22	1	1166-HH	1			1163-VV	1										
1165-W-5	4	1195-Z	1	1195-Y-1	2	1165-Z-2	1	1195-1-Z	1	1195-1-Z-2	1	5/8x3/8	4	5/8x1/4	8	B-1196-T-3	8	1195-1-TT	1	1195-1-T-21	1	1165-T-22-A	1	1167-T-22-B	1	1195-1-XX	1	1195-1-X-21	1	1166-T-22-B	1	1166-HH	1			1163-VV	1										
1165-W-5	4	1195-Z	1	1195-Y-1	2	1165-Z-2	1	1195-2-Z	1	1195-2-Z-2	1	5/8x3/8	4	5/8x1/4	9	B-1196-T-3	8	1195-2-TT	1	1195-2-T-21	1			1164-T-22-B	1	1195-1-XX	1	1195-1-X-21	1	1166-T-22-B	1	1165-EE	1	1166-HH-4	1									No. 350	1		
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1195-2-Z	1	1195-2-Z-2	1	5/8x3/8	4	5/8x1/4	9	B-1196-T-3	8	1195-2-TT	1	1195-2-T-21	1			1164-T-22-B	1	1195-XX	1	B-1196-X-1	1	1165-X-22	1	1165-EE	1	1166-HH-4	1									No. 350	1		
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1195-2-Z	1	1195-2-Z-2	1	5/8x3/8	4	5/8x1/4	9	B-1196-T-3	8	1195-2-TT	1	1195-2-T-21	1			1164-T-22-B	1	1195-XX	1	B-1196-X-1	1	1165-X-22	1	1165-EE	1	1166-HH-4	1									No. 351	1		
1165-W-5	4	1195-Z	1	1195-Y-1	2	1165-Z-2	1	1195-2-Z	1	1195-2-Z-2	1	5/8x3/8	4	5/8x1/4	9	B-1196-T-3	8	1195-2-TT	1	1195-2-T-21	1			1164-T-22-B	1	1195-1-XX	1	1195-1-X-21	1	1166-T-22-B	1	1165-EE	1	1166-HH-4	1									No. 351	1		
1165-W-5	4	B-1196-YY	1	1195-Y-1	2	B-1196-Y	1	PF-1195-ZZ	1	PF-1195-Z	1	5/8x3/8	4	5/8x1/4	8	B-1196-T-3	8	PF-1195-TT	1	PF-1195-T-1	1	PF-1195-T-2	1			B-1196-XX	1	B-1196-X-1	1	B-1196-X-2	1	B-1196-EE	1			C-1196-VV	1			5/8x13/16x3/32	4	5/8 x No. 11	4				
1165-W-5	4	B-1196-YY	1	1195-Y-1	2	B-1196-Y	1	PF-1195-ZZ	1	PF-1195-Z	1	5/8x3/8	4	5/8x1/4	8	B-1196-T-3	4	PF-1195-TT	1	PF-1195-T-1	1	PF-1195-T-2	1			B-1196-XX	1	B-1196-X-1	1	B-1196-X-2	1	B-1196-EE	1			P-1196-VV	1	PF-1196-G	1	PF-1196-H	4	5/8x13/16x3/32	4	5/8 x No. 11	4		
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1195-2-ZZ	1	PF-1195-Z	1	5/8x3/8	4	5/8x1/4	8	B-1196-T-3	4	PF-1195-TT	1	PF-1195-T-1	1	PF-1195-T-2	1			B-1196-XX	1	B-1196-X-1	1	B-1196-X-2	1	B-1196-EE	1			P-1196-VV	1									No. 351	1
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1195-2-ZZ	1	PF-1195-Z	1	5/8x3/8	4	5/8x1/4	8	B-1196-T-3	4	PF-1195-TT	1	PF-1195-T-1	1	PF-1195-T-2	1			B-1196-XX	1	B-1196-X-1	1	B-1196-X-2	1	B-1196-EE	1			P-1196-VV	1									No. 351	1
1165-W-5	4	PF-1195-31-YY	1	1195-Y-1	2	PF-1195-31-Y	1	PF-1195-ZZ	1	PF-1195-Z	1	5/8x3/8	4	5/8x1/4	12	B-1196-T-3	4	PF-1195-TT	1	PF-1195-T-1	1	PF-1195-T-2	1			FF-1195-31-XX	1	PF-1195-31-X-1	1	PF-1195-31-X-2	1	B-1196-EE	1			C-1196-VV	1	PF-1196-G	1	PF-1196-H	4	5/8x13/16x3/32	4	5/8 x No. 11	4		
1165-W-5	4	B-1196-YY	1	1195-Y-1	2	B-1196-Y	1	PF-1195-43-ZZ	1	PF-1195-43-Z	1	5/8x3/8	4	5/8x1/4	16	B-1196-T-3	4	PF-1195-43-TT	1	PF-1195-43-T-1	1	PF-1195-43-T-2	1			B-1196-XX	1	B-1196-X-1	1	B-1196-X-2	1	PF-1195-43-EE	1			PF-1195-43-VV	1	PF-1196-G	1	PF-1196-H	4	5/8x13/16x3/32	4	5/8 x No. 11	4		
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1196-3-Z	1	1196-3-Z-2	1	5/8x3/8	4	5/8x1/4	12	B-1196-T-3	8	1196-TT	1	1196-T-21	1	1196-T-22-A	1	1166-T-22-B	1	1195-XX	1	B-1196-X-1	1	1165-X-22	1	1166-HH	1			1163-VV	1										
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1196-36-ZZ	1	1196-16-Z-2	1	5/8x3/8	4	5/8x1/4	4	B-1196-T-3	8									1195-XX	1	B-1196-X-1	1	1165-X-22	1	1166-HH	1			1163-VV	1										
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1196-2-Z	1	1166-2-Z-2	1	5/8x3/8	4	5/8x1/4	13	B-1196-T-3	8	1196-2-TT	1	1196-2-T-21	1	1165-T-22-A	1	1196-2-T-22-B	1	1195-XX	1	B-1196-X-1	1	1165-X-22	1	1166-HH	1			1163-VV	1										
1165-W-5	4	1196-Z	1	1195-Y-1	2	1166-Z-2	1	1196-3-Z	1	1196-3-Z-2	1	5/8x3/8	4	5/8x1/4	11	B-1196-T-3	8	1196-TT	1	1196-T-21	1	1165-T-22-A	1	1166-T-22-B	1	1196-3-XX	1	1196-3-X-21	1	1167-X-22	1	1166-HH	1			1163-VV	1										
1165-W-5	4	1196-4-Y	1	1195-Y-1	2	1196-4-Y-2	1	1196-1-Z	1	1166-1-Z-2	1																					Special	1																
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1196-5-Z	1	1196-5-Z-2	1	5/8x3/8	4	5/8x1/4	9	B-1196-T-3	8	1196-5-TT	1	1196-5-T-21	1	1165-T-22-A	1	1196-5-T-22-B	1	1195-XX	1	B-1196-X-1	1	1165-X-22	1	1166-HH	1			1163-VV	1										
1165-W-5	4	1195-Z	1	1195-Y-1	2	1165-Z-2	1	1196-3-Z	1	1196-3-Z-2	1	5/8x3/8	4	5/8x1/4	10	B-1196-T-3	8	1196-TT	1	1196-T-21	1	1165-T-22-A	1	1166-T-22-B	1	1195-1-XX	1	1195-1-X-21	1	1166-T-22-B	1	1166-HH	1			1163-VV	1										
1165-W-5	4	1196-Z	1	1195-Y-1	2	1166-Z-2	1	1196-16-Z	1	1196-16-Z-2	1	5/8x3/8	2	5/8x1/4	6	B-1196-T-3	4									1196-3-XX	1	1196-3-X-21	1	1167-X-22	1	1165-EE	1	1166 HH-4	1									No. 350	1		
1165-W-5	4	1196-17-YY	1	1195-Y-1	2	1196-17-Y	1	1196-17-Z	1	1196-5-Z-2	1	5/8x3/8	2	5/8x1/4	5	B-1196-T-3	4	1196-17-TT	1	1196-17-T-1	1	1196-17-T-2	1									1165-EE	1	1166-HH-4	1									No. 350	1		
1165-W-5	4	1196-Z	1	1195-Y-1	2	1166-Z-2	1	1196-16-Z	1	1196-16-Z-2	1	5/8x3/8	2	5/8x1/4	6	B-1196-T-3	4									1196-3-XX	1	1196-3-X-21	1	1167-X-22	1	1165-EE	1	1166-HH-4	1									No. 351	1		
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1196-36-ZZ	1	1196-16-Z-2	1	5/8x3/8	4	5/8x1/4	4	B-1196-T-3	4									1195-XX	1	B-1196-X-1	1	1165-X-22	1	1196-36-EE	1	1166-HH-4	1	1196-36-VV	1										
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1196-ZZ-1	1																							B-1196-EE	1			B-1196-VV	1										
1165-W-5	4	B-1196-YY	1	1195-Y-1	2	B-1196-Y	1	B-1196-ZZ	1	B-1196-Z	1	5/8x3/8	4	5/8x1/4	10	B-1196-T-3	8	B-1196-TT	1	B-1196-T-1	1	B-1196-T-2	1			B-1196-XX	1	B-1196-X-1	1	B-1196-X-2	1	B-1196-EE	1			C-1196-VV	1										
1165-W-5	4	1196-Z	1	1195-Y-1	2	1166-Z-2	1	PF-1195-ZZ	1	PF-1195-Z	1	5/8x3/8	4	5/8x1/4	10	B-1196-T-3	4	PF-1195-TT	1	PF-1195-T-1	1	PF-1195-T-2	1			1196-3-XX	1	1196-3-X-21	1	1167-X-22	1	1165-EE	1			C-1196-VV	1										
1165-W-5	4	B-1196-YY	1	1195-Y-1	2	B-1196-Y	1	B-1196-ZZ	1	B-1196-Z	1	5/8x3/8	4	5/8x1/4	10	B-1196-T-3	4	B-1196-TT	1	B-1196-T-1	1	B-1196-T-2	1			B-1196-XX	1	B-1196-X-1	1	B-1196-X-2	1	B-1196-EE	1			C-1196-VV	1	PF-1196-G	1	PF-1196-H	4	5/8x13/16x3/32	4	5/8 x No. 11	4		
1165-W-5	4	1195-Y	1	1195-Y-1	2	1165-Y-2	1	1196-5-Z	1	1196-5-Z-2	1	5/8x3/8	4	5/8x1/4	9	B-1196-T-3	8	1196-5-TT	1	1196-5-T-21	1	1165-T-22-A	1	1196-5-T-22-B	1	1195-XX	1	B-1196-X-1	1	1165-X-22	1	1166-HH	1			P-1196-VV	1	PF-1196-G	1	PF-1196-H	4	5/8x13/16x3/32	4	5/8 x No. 11	4		
1165-W-5	4	B-1196-YY	1	1195-Y-1	2	B-1196-Y	1	B-1196-ZZ	1	B-1196-Z	1	5/8x3/8	4	5/8x1/4	10	B-1196-T-3	4	B-1196-TT	1	B-1196-T-1	1	B-1196-T-2	1			B-1196-XX	1	B-1196-X-1	1	B-1196-X-2	1	B-1196-EE	1			P-1196-VV	1	PF-1196-G	1	PF-1196-H	4	5/8x13/16x3/32	4	5/8 x No. 11	4		
1165-W-5	4	B-1196-YY	1	1195-Y-1	2	B-1196-Y	1	PF-1196-1-ZZ	1	PF-1196-1-Z	1	5/8x3/8	4	5/8x1/4	2	B-1196-T-3	2									B-1196-XX	1	B-1196-X-1	1	B-1196-X-2	1	B-1196-EE	1			C-1196-VV	1	PF-1196-G	1	PF-1196-H	4	5/8x13/16x3/32	4	5/8 x No. 11	4		
1165-W-5	4	1196-Z	1	1195-Y-1	2	1166-Z-2	1	1195-1-Z	1	1195-1-Z-2	1	5/8x3/8	4	5/8x1/4	9	B-1196-T-3	8	1195-1-TT	1	1195-1-T-21	1	1165-T-22-A	1	1167-T-22-B	1	1196-3-XX	1	1196-3-X-21	1	1167-X-22	1	1166-HH	1			1163-VV	1										
1165-W-5	4	PF-1197-YY	1	1195-Y-1	2	PF-1197-Y	1	PF-1197-ZZ	1	PF-1197-Z	1	5/8x3/8	4	5/8x1/4	10	B-1196-T-3	4	PF-1197-TT	1	PF-1197-T-1	1	PF-1197-T-2	1			1196-3-XX	1	1196-3-X-21	1	PF-1197-X-2	1	B-1196-EE	1			C-1196-VV	1	PF-1196-G	1	PF-1196-H	4	5/8x13/16x3/32	4	5/8 x No. 11	4		



LIST OF PARTS

	Upper Hook	Lower Hook	Plate	Spring Complete	Spring Part	Spring Part
Support Spring						
PF-1195-43-EE	PF-1195-43-E-2	PF-1195-43-E-2		PF-1195-43-E-1		
1196-36-EE	1136-V-17	1136-V-17		1164-VV-5	1164-V-2	1164-V-4 (2)
1165-EE		1136-V-17		1165-E		
B-1196-EE	B-1196-V-5	B-1196-5		1136-V-1	1136-V-2	1136-V-3 (2)
1166-HH	1166-HH-1	1136-V-17	1166-HH-4	1165-E		
Special (For 1196-4)		1163-V-4		1136-V-1	1136-V-2	1136-V-3 (2)
Safety Spring						
PF-1195-43-VV	1166-HH-1	1166-HH-1		1164-VV5	1164-V-2	1164-V-4 (2)
P-1196-VV	1166-HH-1	B-1196-V-5		C-1196-V-11	C-1196-V-12	C-1196-V-13 (2)
1196-36-VV	1136-V-17	B-1196-V-7		1136-V-1	1136-V-2	1136-V-3 (2)
1163-VV	1136-V-7	1163-V-4		1136-V-1	1136-V-2	1136-V-3 (2)
C-1196-VV	B-1196-V-5	B-1196-V-5		C-1196-V-11	C-1196-V-12	C-1196-V-13 (2)
B-1196-VV	B-1196-V-7	B-1196-V-7		1136-V-1	1136-V-2	1136-V-3 (2)

2½" FLEXIBLE METALLIC CONDUIT DATA



Part No.	Drawing No.	"A" Dim.	"B" Dim.	"A" Tube	"B" Tube
1195	50825	18⅝"	22"	10¼"	12½"
1195-1	50966	21"	19¾"	12½"	10¾"
1195-2	50972	21"	22"	12½"	12½"
1195-4	51002	18⅝"	22"	10¼"	12½"
1195-14	46-E-35	18⅝"	22"	10¼"	12½"
1195-22	46-E-33	21"	22"	12½"	12½"
P-1195	47-E-79	18⅝"	22"	10¼"	12½"
PF-1195	46-E-73	18⅝"	22"	10¼"	12½"
PF-1195-23	48-E-89	18⅝"	22"	10¼"	12½"
PF-1195-24	48-E-91	18⅝"	22"	10¼"	12½"
PF-1195-31	48-E-59	18⅝"	22"	22⅜"	12½"
PF-1195-43	48-E-47	18⅝"	43"	10¼"	33¼"
1196	50943	18⅝"	27½"	10¼"	17¾"
1196-1	50967	18⅝"	16"	10¼"	6½"
1196-2	50968	18⅝"	34"	10¼"	24½"
1196-3	51003	26¼"	27½"	17¾"	17¾"
1196-4	50960	15"	13⅜"	6½"	3½"
1196-5	50990	18⅝"	23¼"	10¼"	13½"
1196-6	51012	20⅝"	27½"	12½"	17¾"
1196-16	51004	26¼"	16"	17¾"	6½"
1196-17	48-E-79	13"	23¼"	3⅞"	13¾"
1196-26	46-E-34	26¼"	16"	17¾"	6½"
1196-36	47-E-41	18⅝"	16"	10¼"	6½"
B-1196	50970	18⅝"	27½"	10¼"	17¾"
C-1196	46-E-74	18⅝"	27½"	10¼"	17¾"
C-1196-22	47-E-34	26¼"	22"	17¾"	12½"
F-1196	47-E-58	18⅝"	27½"	10¼"	17¾"
F-1196-5	48-E-73	18⅝"	23¼"	10¼"	13½"
PF-1196	46-E-37	18⅝"	27½"	10¼"	17¾"
PF-1196-1	46-E-43	18⅝"	16"	10¼"	6½"
1197	50944	26¼"	19¾"	17¾"	10¼"
PF-1197	47-E-69	26¼"	19¾"	17¾"	10¼"

GAUGES, TOOLS AND FIXTURES FOR REPAIRING 2½" STEAM CONDUITS TYPES 1195 - 1196 - 1197

Part Number	Description	Drawing Number
1195-73	Condemning Gauge for No. 1195-B, PF-1196-1-B and 1195-Y-1 Bodies	48-A-770
1195-75	Condemning Plug Gauge for No. 1165-N Bearing	48-A-772
1195-81	Arbor (For Pressing Bushings into 2½" A, B, and D Bodies)	48-A-877
1195-71	Condemning Gauge for No. 1195-B and PF-1196-1-B Bodies	48-A-768
1195-72	Condemning Gauge for No. 1195-Y-1 Tail Piece. (Min. Height)	48-A-769
1195-83	"Go"-Gauge—For 1195-B and PF-1196-1-B Nose	48-A-885
1195-74	Condemning Gauge (For 1195-B and PF-1196-1-B Bearing Tip)	48-A-771
1195-82	"Go"-Gauge for Tip of 1195-B and PF-1196-1-B Bodies	48-A-884
1195-77	Facing Tool (For Nose of 2½" B and Y Bodies)	48-B-391
1195-76	Face Polisher (For Nose of 2½" B and Y Bodies)	48-B-389
1195-85	Facing Tool for Tip of 1195-B and PF-1196-1-B Bodies	48-B-415
1195-80	Holding Fixture—For Facing and Polishing Nose of No. 1195-B and PF-1196-1-B Bodies	48-C-334
1195-78	Holding Fixture (For Pressing Bushings in 2½" A, B, and D Bodies)	48-D-197
1136-55	2" and 2½" Metallic Steam Conduit Bushing Remover	46-D-41
1195-79	Holding Fixture—for Machining Face of 1195-Y-1 Tail Piece and Bearing Tip of 1195-B and PF-1196-1-B Bodies	48-E-81
1195-86	Stopper for 2½" A, B and D Bodies	48-A-1053

No. 98 END TRAIN PIPE VALVE

INLET—2″
OUTLET—2″

WEIGHT:
17 lbs.

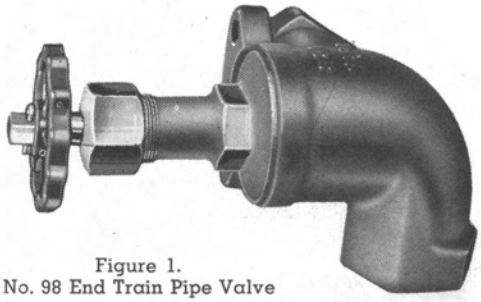


Figure 1.
No. 98 End Train Pipe Valve

GENERAL DESCRIPTION

End train pipe valves are used between the railway car steam line and the flexible metallic conduit to provide a solid support for the conduits, and to provide an accessible point at which to shut off the supply of steam to the rear of the train.

The No. 98 End Train Pipe Valve is a screw-type valve and offers a full 2″ steam passage throughout. It is furnished with inlet and outlet having 2″ standard pipe threads. In cases where a temporary connection to a 1½″ hose nipple is desired, the outlet may be bushed with a No. 98-R adapter fitting. This fitting is shown in Figure 2.

If it is desired to operate this valve from the side of the car, a No. 407 extension handle should be used. This handle must be ordered separately; see page 2 for illustration of this attachment. The extension handle should be well supported at each end in order to open or close the valve quickly and smoothly.

An exploded view of the No. 98 End Train Pipe Valve is shown in Figure 3 on page 2. By referring to this photo, identification of the valve parts may easily be made.

MAINTENANCE AND OVERHAUL

No regular maintenance is required for the efficient operation of the No. 98 end valve. Steam leaking through the valve when it is closed is an indication that the valve is not seating properly. This condition may be caused by a worn seat (which may be corrected by grinding the seat to fit) or by the presence of dirt between the valve and seat. In the latter case the dirt may be blown out by turning the valve off and then on again to allow a blow of steam. Steam leaking from around the valve handle is an indication that the valve needs repacking.

To disassemble the valve for a thorough cleaning and for an inspection of the parts, remove the cotter pin (sym. 9) from the valve stem (sym. 5), take off the hand wheel (sym. 8) and unscrew the stuffing box (sym. 3) and the bonnet (sym. 2). Remove the gland (sym. 4) and the packing ring (sym. 7) and lift out the valve stem. The seat ring (sym. 6) may then be unscrewed.

Clean and inspect each part for wear. Check the packing ring and the seat ring to be sure that they are both in good condition. Replace any parts which show excessive wear or distortion. Then reassemble the valve and test it for leakage on a steam line before placing it in service again.

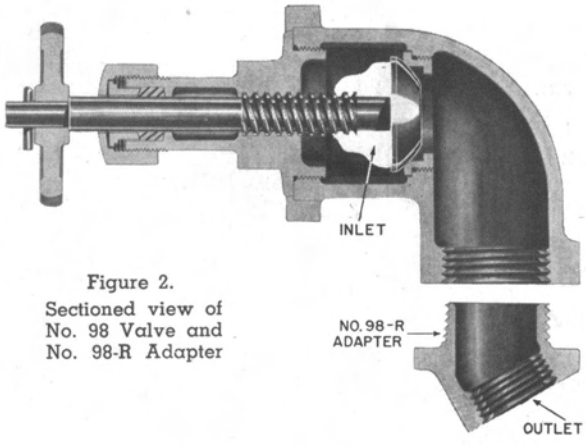


Figure 2.
Sectioned view of No. 98 Valve and No. 98-R Adapter

NO. 98 END TRAIN PIPE VALVE (Continued)

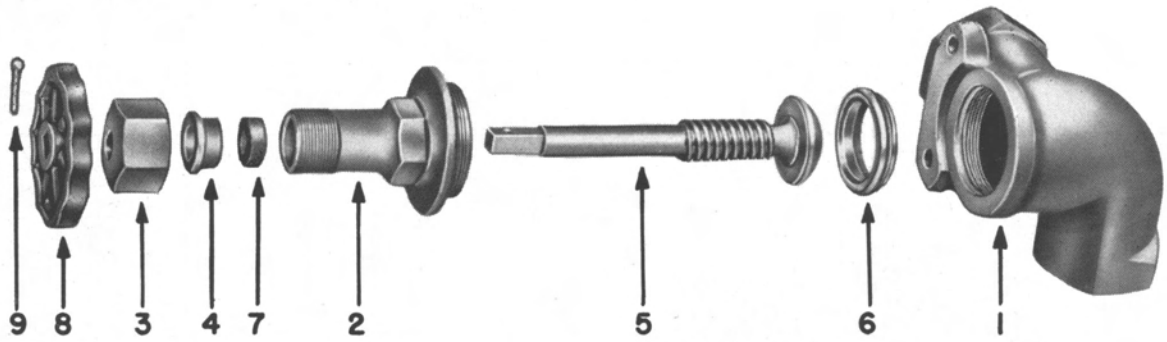


Figure 3. Exploded View of No. 98 End Train Pipe Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.	Sym.	Part No.	Description	Amt.
1	98-A	Body	1	8	98-W	Hand Wheel	1
2	98-B	Bonnet	1	9		Cotter Pin	1
3	98-C	Stuffing Box	1		98-AA	Body Assembly (Consists of Syms. 1 and 6	
4	106-D	Gland	1				
5	98-E	Valve and Stem	1		98-BB	Bonnet Assembly (Consists of Syms. 2, 3, 4 and 7	
6	98-F	Valve Seat Ring	1				
7	106-K	Packing Ring	2				

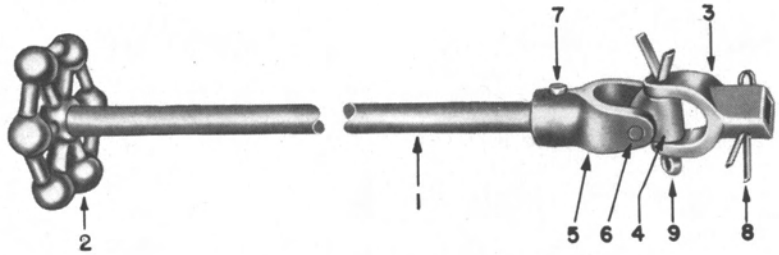


Figure 4. No. 407 Extension Handle, Used with No. 98 End Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.	Sym.	Part No.	Description	Amt.
1	407-A	Rod	1	4	407-C-2	Block (Universal)	1
2	407-B	Wheel	1	5	407-C-3	Yoke (Rod)	1
	407-C	Universal Complete, (Includes syms. 3 to 9)		6	407-C-4	Pin (Block)	1
				7	407-C-5	Pin (Yoke)	1
				8	$\frac{3}{16}$" x ½" lg.	Cotter	1
3	407-C-1	Yoke (Valve Stem)	1	9	¼" x 2" lg.	Cotter	1

No. 105 END TRAIN PIPE VALVE

INLET—2" I.P.S.
OUTLET—1½" I.P.S.

WEIGHT:
16½ lbs.

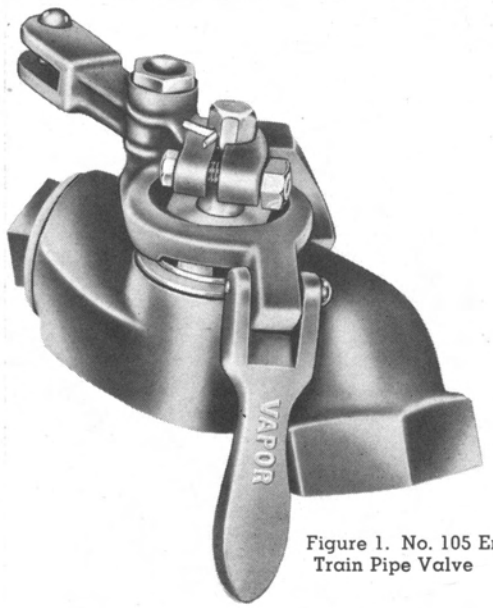


Figure 1. No. 105 End Train Pipe Valve

GENERAL DESCRIPTION

End train pipe valves are used between the railway car steam line and flexible metallic conduits to provide a support for the conduit and to provide an accessible point at which to shut off the supply of steam to the rear of the train.

The No. 105 End Train Pipe Valve is designed for use on railway cars having a 2" steam train line and 1½" steam hose conduits. It is a quick-opening, throw-type valve with the inlet threaded to fit 2" standard pipe and the outlet threaded for connection to a 1½" hose nipple. A spring loaded friction pin in the valve handle assembly, has been provided to hold the valve in the open or bleed position, and steam in the valve body exerts a pressure against the main valve to hold it in the closed position. These features make a positive action necessary to move the handle, and prevent an accidental change in the valve setting from vibration or road shock.

If it is desired to operate this end valve from the side of the car, or from the car platform, a No. 405 Extension Handle should be used. The rods of this attachment must be furnished by the railroad. The other parts are illustrated on page 2 and must be ordered separately. The extension handle should be attached with a support at each end to permit freedom of movement in opening and closing the valve quickly and smoothly.

MAINTENANCE AND OVERHAUL

The No. 105 End Train Pipe Valve should be overhauled at least once every two years. Steam leaking from around the stem is an indication that the valve needs repacking. Steam leaking through the valve, when it is in a completely closed position, is an indication that either the main valve or the bleeder valve is not seating properly. This may be caused by the presence of dirt between the valve and seat, or by a worn seat in either valve. If dirt is present between the valve and seat, it can usually be blown out by the steam blow resulting from opening the valve and then closing it again several times. A worn valve seat should be reground to fit.

To disassemble the No. 105 valve, unscrew the cap (sym. 12), remove the cotter pin (sym. 20) from the main valve fastening pin (sym. 18) and unscrew the main valve fastening pin itself. This will release the bleeder valve (sym. 19) which should next be removed. Take out the main stem cotter pin (sym. 21) and lift off the valve handle yoke assembly after removing the yoke nut and bolt (syms. 2 and 3). Then unscrew the stuffing box (sym. 15), remove the packing ring (sym. 22), unscrew the bonnet (sym. 14) and lift out the main valve stem (sym. 16). Check the seat ring (sym. 13) and replace it if it has become scored or wire drawn. The valve handle yoke assembly may be further disassembled to check the tension of the locking spring by unscrewing the locking plug (sym. 10) and removing the locking spring (sym. 8) and the locking pin (sym. 9).

Clean and inspect each part for wear or distortion before reassembling the valve, and test it on a steam line before putting it back into service.

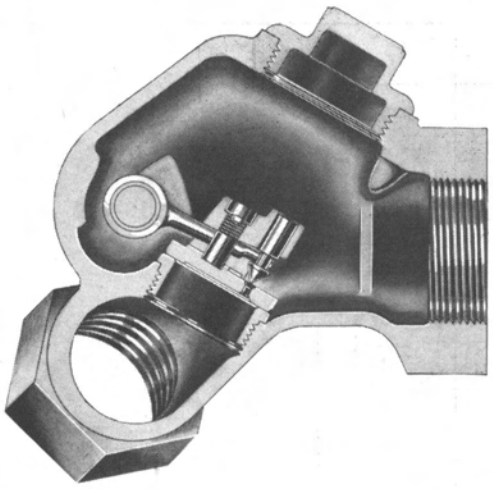


Figure 2. Sectioned View No. 105 End Valve

NO. 105 END TRAIN PIPE VALVE (Continued)

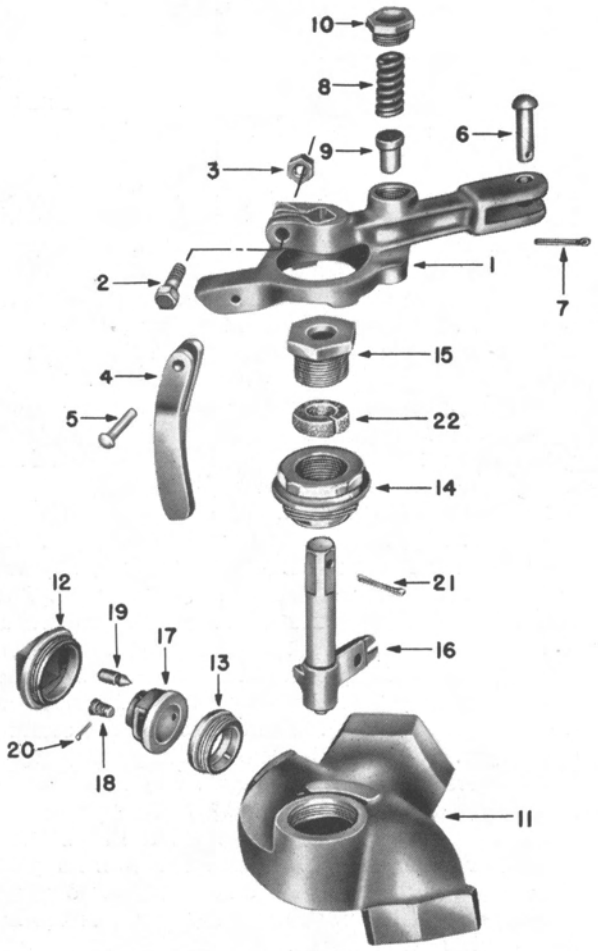


Figure 3. Exploded View of No. 105 Valve

LIST OF PARTS

NO. 105 END TRAIN PIPE VALVE

Sym.	Part No.	Description	Amt.
1	105-A	Valve Handle Yoke	1
2	105-A-1	Bolt	1
3	105-A-2	Nut	1
4	105-B	Drop Handle	1
5	105-B-1	Drop Handle Rivet	1
6	105-C	Link Pin	1
7	105-D	Link Pin Cotter Pin	1
8	105-F	Locking Spring	1
9	105-G	Locking Pin	1
10	105-H	Locking Plug	1
11	105-J	Valve Body	1
12	105-K	Cap	1
13	105-L	Valve Seat	1
14	105-M	Bonnet	1
15	105-N	Stuffing Box	1
16	105-P	Valve Stem	1
17	105-Q	Main Valve	1
18	105-R	Main Valve Fastening Pin	1
19	105-S	Bleeder Valve	1
20	105-T	Main Valve Cotter Pin	1
21	105-U	Valve Stem Cotter Pin	1
22	105-Z-1	Packing Ring	2

LIST OF PARTS

NO. 405 EXTENSION HANDLE

Sym.	Part No.	Description
1	405-A-B	Drop Handle and Fulcrum Assembly
	405-A-1	Fulcrum
	410-H	Clip
	410-H-1	Screw—No. 10—25 RHM
	410-H-2	Lockwasher
	405-B	Handle
2	405-C	Indicator Pointer
3	405-D	Indicator Plate
	405-D-1	Indicator Plate
4	405-F	Bracket
5	405-G	Yoke
6	405-H	Horizontal Link—Single
7	405-J	Horizontal Link—Double

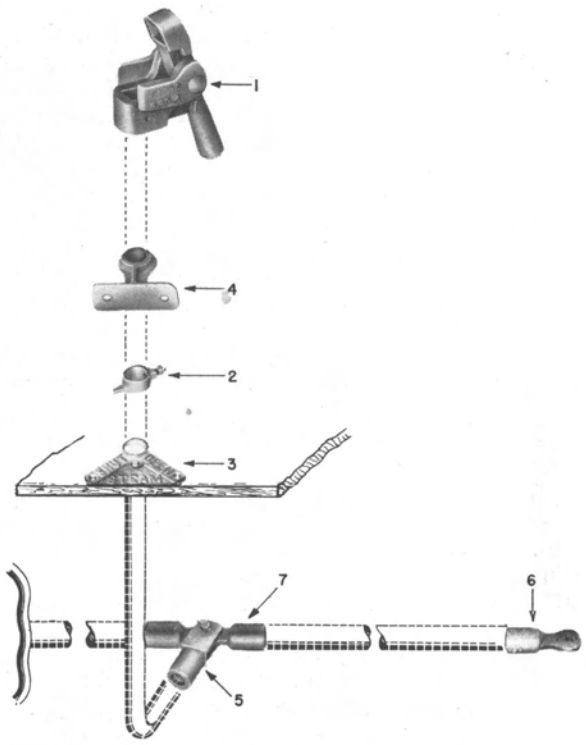
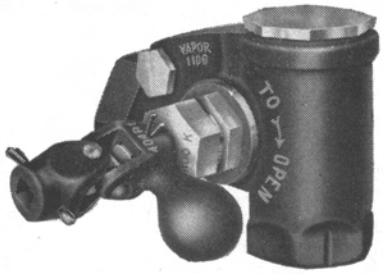


Figure 4. No. 405 Extension Handle

Nos. 1104, 1106, 1107 AND 1108 END TRAIN PIPE VALVES

INLETS—2" OUTLETS—2" WEIGHTS: 28 lbs.-30 lbs.



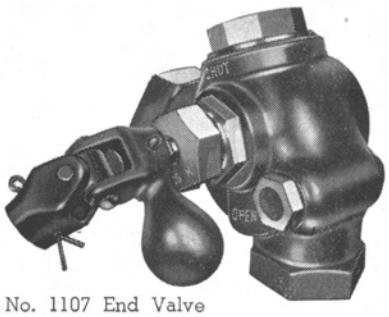
No. 1104 End Valve

GENERAL DESCRIPTION

End train pipe valves are used between the railway car steam line and flexible metallic conduits to provide a connection to the conduit and to provide an accessible point at which to shut off the supply of steam to the rear of the train. The Nos. 1104 and 1106 2" end valves have been superseded by the Nos. 1107 and 1108 2" end valves. However, there are still some of these earlier valves in service and parts for all four valves are shown on page 2.

These end valves all operate similarly in that a disc is seated to stop the flow of steam when the valve is closed. The disc is raised by a handle and linkage arrangement to open the valve. A bleed port is provided in each valve as a means of draining condensate from the train line when the valve is used on the rear of the last car in the train. The bleed port is opened by moving the handle slightly to allow the weight of the linkage arrangement to raise the bleeder valve. All four valves lock in the "open" position and neither steam pressure nor vibration can accidentally close them.

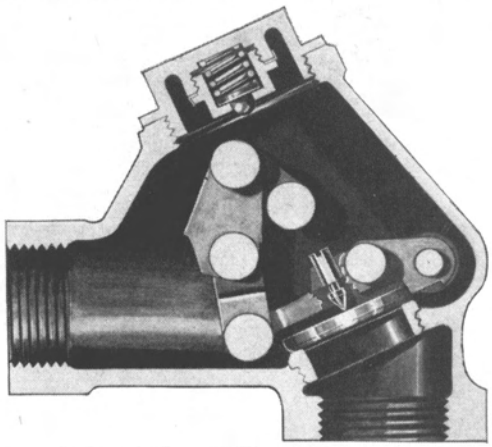
End valves must be applied with the body in a vertical position and with the outlet pointing straight down. All four of these valves are furnished with 2" inlets and 2" outlets. However the Nos. 1106 and 1108 valves differ from the other two in that they are constructed with the nose 1" lower in relation to the center of the train line, since they are used on cars having a train line which moves with the draw bar and coupler. Cars with this type of a train line should be equipped with a No. 404 operating attachment if it is desired to operate the valve from the side of the car or the car platform. The Nos. 1104 and 1107 valves are designed for use on cars having a stationary train line and a No. 403 opearting attachment should be used on these cars to operate the valve from the side of the car or the car platform.



No. 1107 End Valve

MAINTENANCE AND OVERHAUL

No regular maintenance is required for the efficient operation of the Nos. 1104, 1106, 1107 and 1108 end valves. Steam leaking through the valves when they are closed is an indication that the valve is not seating properly. This may be caused by a worn seat (which should be replaced or reground to fit) or by the presence of dirt between the valve and seat. This condition can usually be corrected by opening the valve long enough to blow out the dirt.

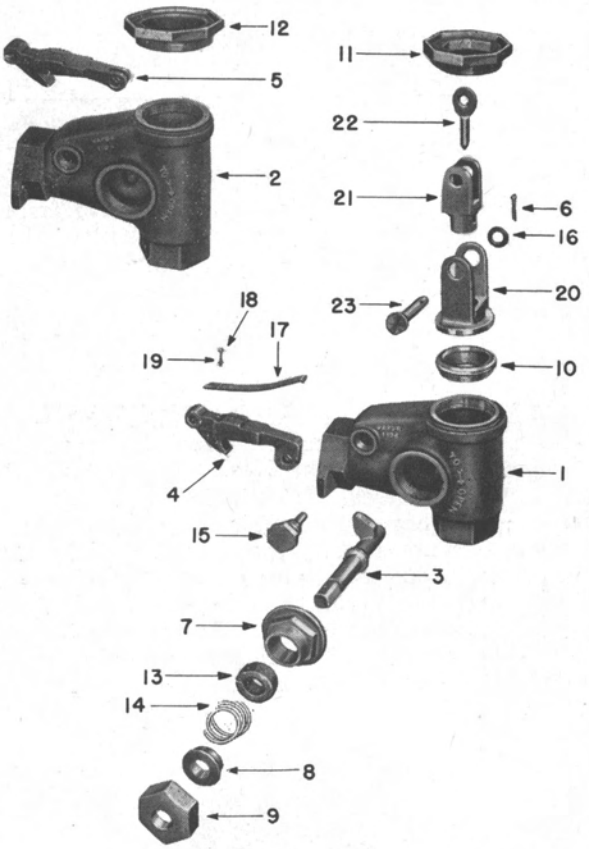


Sectioned View of No. 1107 End Valve

These valves should be disassembled for overhaul and inspection every two years. At that time they should be thoroughly cleaned and checked for wear. The operating mechanism should be inspected for freedom of movement and the tension of the spring should be tested.

To disassemble the valve, remove the cotter pin from the valve stem and lift off the valve handle assembly, which may be further disassembled. Then unscrew the stuffing box and remove the gland and the packing rings. Unscrew the bonnet and remove the valve stem. Unscrew the cap and the yoke pin, take out the linkage, the main valve and the bleeder valve. This assembly can be further disassembled for cleaning and inspection by removing the pins and the cotter pins and unscrewing the bleeder valve. After the valve has been inspected and reassembled, test it on a steam line before placing it back in service.

NOS. 1104, 1106, 1107 AND 1108 END TRAIN PIPE VALVES (Continued)



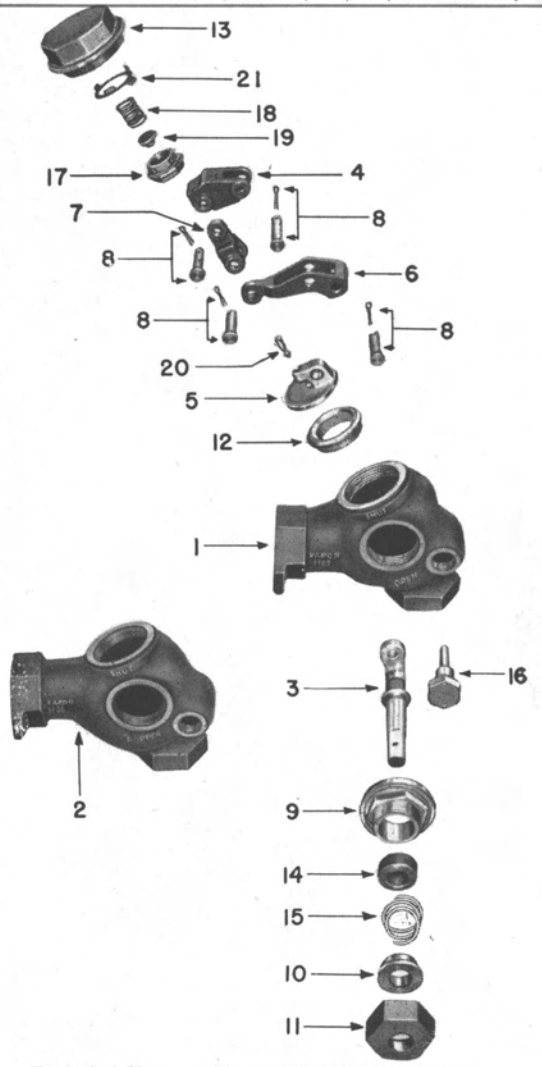
Exploded View of Nos. 1104 and 1106 Valves

1104 AND 1106 END VALVES

Sym.	Part No.	Description	Amt.
1	1104-A	Body (For 1404 only)	1
2	1106-A	Body (For 1106 only)	1
3	1104-B	Valve Stem	1
4	1104-D	Valve Lifting Lever (1104)	1
5	1106-D	Valve Lifting Lever (1106)	1
6	1104-G	Valve Lifting Pin cotter	1
7	1104-H	Bonnet	1
8	1100-J	Gland (1104)	1
	1104-J	Gland (1106)	1
9	1100-K	Stuffing Box (1104 only)	1
	1104-K	Stuffing Box (1106 only)	1
10	1100-L	Valve Seat (1104 only)	1
	1104-L	Valve Seat (1106 only)	1
11	1104-M	Cap (For 1104 only)	1
12	1106-M	Cap (For 1106 only)	1
13	1117-N	Packing	1
14	1117-U	Spring	1
15	1104-P	Valve Lifting Lever Retaining Pin	1
16	1104-Q	Valve Lifting Pin Washer	1
17	1104-R	Lever Tension Spring	1
18	1104-S	Lever Tension Spring Screw	1
19	1104-S-1	Lever Tension Spring Lockwasher	1
20	1104-T	Main Valve	1
21	1104-U	Auxiliary Valve	1
22	1104-V	Bleeder Valve	1
23	1104-W	Valve Lifting Pin	1
	1104-DD	Assembly (Valve Lifting Lever) Complete (consists of syms. 4, 17, 18 and 19)	
	1106-DD	Assembly (Valve Lifting Lever) Complete (consists of syms. 5, 17, 18 and 19)	
	1104-TT	Assembly (Internal Valve) Complete (consists of syms. 6, 16, 20, 21, 22 and 23)	

1107 AND 1108 END VALVES

Sym.	Part No.	Description	Amt.
1	1107-A	Body (1107 only)	1
2	1108-A	Body (1108 only)	1
3	1108-B	Valve Stem	1
4	1108-C	Valve Stem Link	1
5	1108-D	Main Valve	1
6	1108-E	Main Valve Yoke	1
7	1108-F	Yoke Link	1
8	1108-G	Retaining Pins and Cotters	1
9	1104-H	Bonnet	1
10	1104-J	Gland	1
11	1104-K	Stuffing Box	1
12	1104-L	Seat Ring	1
13	1108-M	Cap	1
14	1117-N	Packing	1
15	1117-U	Spring	1
16	1108-P	Yoke Retaining Pin	1
17	1108-Q1	Locking Pin Cap	1
18	1108-R	Locking Spring	1
19	1108-S	Locking Spring Pin	1
20	1108-V	Bleeder Valve	1
21	1108-Q-2	Locking Pin Cap Lock Washer	1
	1108-BB	Valve Stem and Bonnet Complete (consists of syms. 3, 9, 10, 11, 14 and 15)	
	1108-DD	Valve and Link Assembly (consists of syms. 4, 5, 6, 7, 20 and 4 of sym. 8.	
	1108-MM	Cap Complete (consists of syms. 13, 17, 18, 19 and 21)	

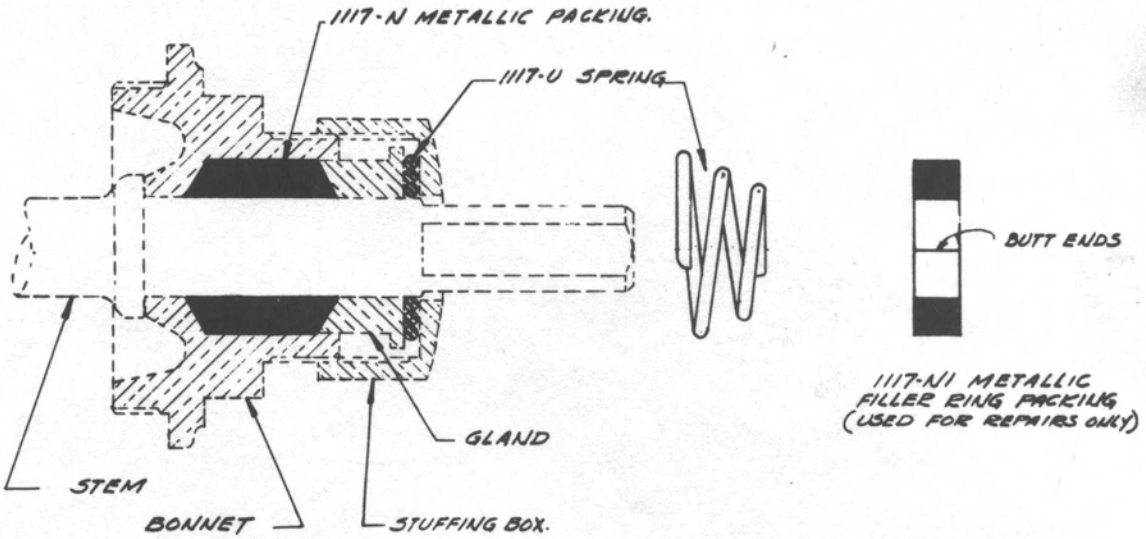


Exploded View of Nos. 1107 and 1108 Valves

Note: No. 1117-N-1 metallic filler ring not furnished with valve. Must be ordered separately.

IMPROVED PACKING FOR END TRAIN PIPE VALVES

To Be Used In Valves Nos. 1104, 1106, 1107, 1108, 1117, F-1117 And 1118



In order to insure a more satisfactory performance of the Nos. 1104, 1106, 1107, 1108, 1117 and 1118 end train pipe valves, the new No. 1117-N Metallic Packing has now been adopted as standard. This packing is more sturdy than the previously used composition rubber packings and will give considerably longer wear.

In applying this new packing, a No. 1117-U coil spring must be used to maintain a steady pressure on the packing. This spring tension will prevent the stuffing box from vibrating loose and will also provide a follow-up for packing wear, at the same time holding the packing firmly in place.

INSTRUCTIONS FOR APPLICATION

1. Remove all old packing.
2. Insert one No. 1117-N Metallic Packing.
3. Apply gland and stuffing box, then pull up tight to form metallic packing.
4. Remove the stuffing box and apply the spring.
5. Tighten the stuffing box until the stem tightens and then back off one-half turn.

If gland leaks after the stuffing box has been pulled up as far as it will go on the threads, add a No. 1117-N-1 metallic filler ring. This filler ring is not furnished with the valves and it must be ordered separately.

NOS. 1110 AND 1111 END TRAIN PIPE VALVES

INLET: 1110 2"x2½" BUSHING
1111 2"

OUTLET: 2"

Fig. 1. No. 1110 End Train Pipe Valve

GENERAL DESCRIPTION

End train pipe valves are used between the railway car steam line and flexible metallic conduits to provide a connection for the conduits and to provide an accessable point at which to shut off the supply of steam to the rear of the train.

The Nos. 1110 and 1111 End Train Pipe Valves are straight port, gate type valves, designed for use on refrigeration, express or other railway cars where construction is not suitable for the use of other end valves. They may also be used on the rear of tenders. The No. 1110 valve is equipped with a 2" x 2½" bushing in the inlet for connection to a 2" train line; this bushing is removable to connect the valve to a 2½" train line. A 2" outlet is furnished in this valve. The No. 1111 valve is equipped with a 2½" inlet and a 2½" outlet.

Both Valves operate similarly in that each is equipped with a movable disc which seats to close the valve. The disc is lifted clear of the path of the steam, by a handle, to open either valve. Both the No. 1110 valve and the No. 1111 valve are equipped with a bleed port, which is opened by raising the disc slightly to discharge condensate from the train line when the valve is used on the rear of the last car in a train.

If it is desired to operate either of these valves from the side of the car an operating rod, which must be furnished by the railroad or carbuilder, should be applied as shown in Figure 4. This rod should have two notches cut in it to engage a bracket fastened on the car. One notch should hold the valve in the open position, and the other notch should be cut wide enough to either completely close the valve or to open the bleeder port.

MAINTENANCE AND OVERHAUL

The Nos. 1110 and 1111 end valves require little maintenance outside of an occasional visual inspection for steam leaks. They should be overhauled at least once every two years for cleaning and for inspection of the parts. Worn, scored or wire drawn seats should be replaced or reground to fit. All moving parts should be inspected for freedom of movement and the packing checked to be sure it is in good condition.

To disassemble the valves for overhaul, remove the valve stem cotter pin (sym. 5) and the operating lever (sym. 7). Unscrew the stuffing box (sym. 13), remove the packing (sym. 14), unscrew the bonnet (sym. 12), and take out the valve stem (sym. 4). Then unscrew the cap (sym. 10) and lift out the assembly consisting of the valve disc (sym. 2), the guide disc (sym. 3) and the valve lever (sym. 6) which may then be further disassembled for inspection. Be sure to check the valve seat (sym. 11) for wear.

After careful inspection and a thorough cleaning, reassemble the valve, being sure that the operating mechanism moves freely, and then test the valve on a steam line before placing it in the service again.

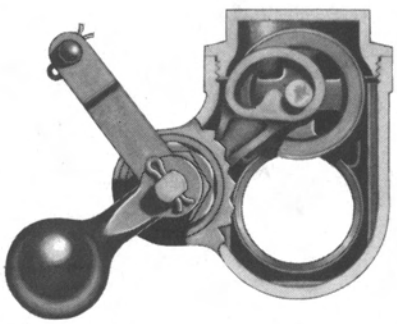
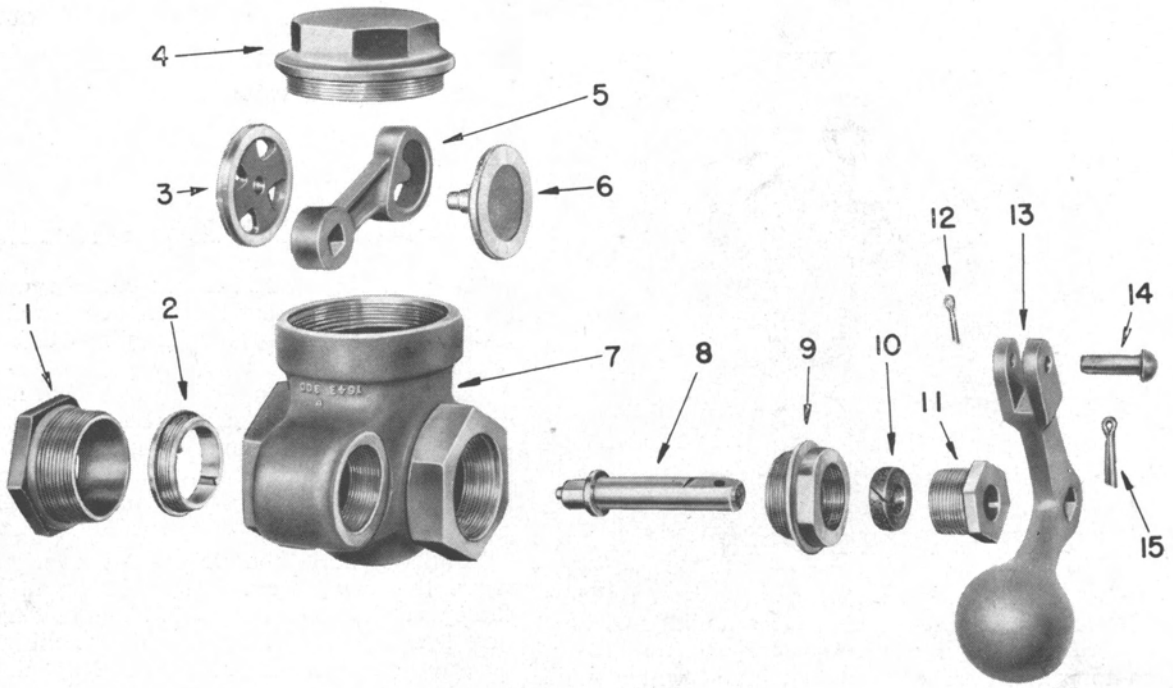


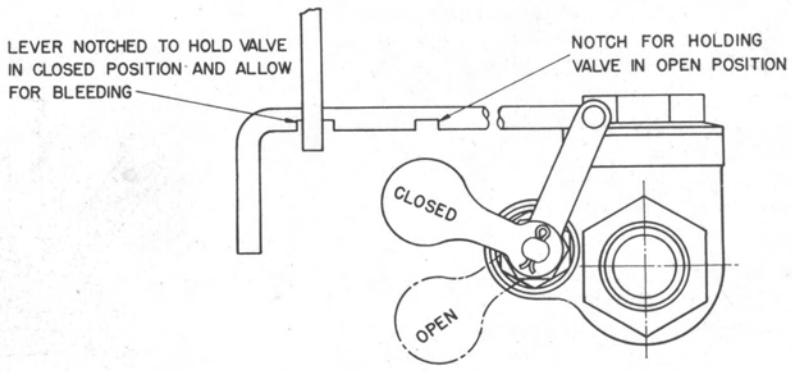
Fig. 2. Sectioned View of No. 1110 Valve

Nos. 1110 AND 1111 END TRAIN PIPE VALVES (Cont'd)



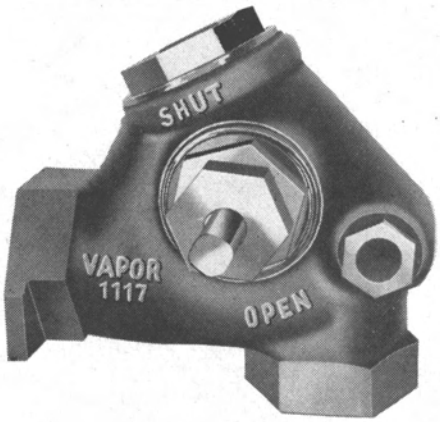
LIST OF PARTS

Sym.	Part No.	Description	Amt.	Sym.	Part No.	Description	Amt.
7	1110-A	Body	1	14	105-C	Link Pin	1
6	1110-B	Valve Disc	1	12	105-D	Link Pin Cotter Pin	1
3	1110-B-1	Guide Disc	1	4	1110-K	Cap	1
8	1110-D	Valve Stem	1	2	1104-L	Valve Seat	1
15	1110-E	Valve Stem Cotter Pin	1	9	105-M	Bonnet	1
5	1110-F	Valve Lever	1	11	105-N	Stuffing Box	1
13	1110-G	Operating Lever	1	10	105-Z-1	Packing Ring	2
				1		Bushing (2″x2½″)	1



Nos. 1117, F-1117 AND 1118 END TRAIN PIPE VALVES

INLETS—2½" OUTLETS—2½" WEIGHTS: 22½ lbs.



No. 1117 End Train Pipe Valve

GENERAL DESCRIPTION

End train pipe valves are used between the railway car steam line and flexible metallic conduits to provide a connection for the conduit and to provide an accessible point at which to shut off the supply of steam to the rear of the train. The Nos. 1117, F-1117 and 1118 2½" end valves are designed to meet the requirements of greater steam supply for heating, and in some cases cooling, of modern railway passenger cars.

These end valves all operate similarly in that a disc is seated to stop the flow of the steam when the valve is closed. The disc is raised by a handle and linkage arrangement to open the valve. A bleed port is provided in each valve as a means of draining condensate from the train line when the valve is used on the rear of the last car in a train. The bleed port is opened by moving the handle slightly to allow the weight of the linkage arrangement to raise the bleeder valve. All three valves lock in the "open" position and neither steam pressure nor vibration can accidentally close them.

End valves must be applied with the body in a vertical position with the outlet pointing straight down. All three of these valves are furnished with 2½" inlets and 2½" outlets. The No. 1117 valve may be equipped with a 2½" x 2" bushing in the outlet for connection to a 2" conduit. This bushing must be purchased separately. The No. F-1117 valve is furnished with a flanged outlet for connection to a 2½" flanged conduit and the No. 1118 valve differs from the other two in that the nose is 1" lower in relation to the center of the train line. This valve is used on cars having a train line which moves with the draw bar and coupler.

To operate these valves from the side of the car or from the car platform a No. 404 operating attachment should be used on cars having a movable train line, while a No. 423 operating attachment should be used on cars having a stationary train line.

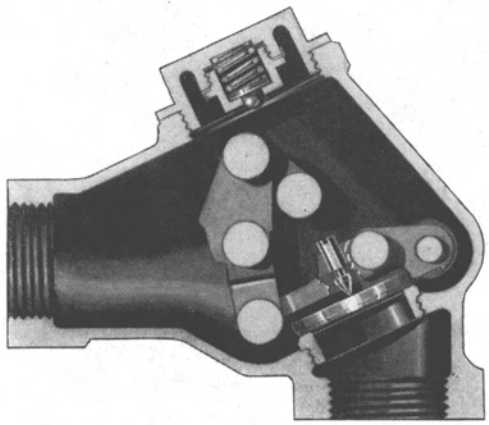
MAINTENANCE AND OVERHAUL

No regular maintenance is required for the efficient operation of the Nos. 1117, F-1117 and 1118 end valves. Steam leaking through the valves when they are closed is an indication that the valve is not seating properly. This may be caused by a worn seat (which should be replaced or reground to fit) or by the presence of dirt between the valve and seat. This condition can usually be corrected by opening the valve long enough to blow out the dirt.

These valves should be disassembled for overhaul and inspection every two years. At that time they should be thorougly cleaned and checked for wear. The operating mechanism should be inspected for freedom of movement and the tension of the spring should be tested.

To disassemble the valve, remove the cotter pin from the valve stem and lift off the valve handle assembly, which may be further disassembled. Then unscrew the stuffing box and remove the gland and the packing rings. Unscrew the bonnet and remove the valve stem. Unscrew the cap and the yoke pin, take out the linkage, the main valve and the bleeder valve. This assembly can be further disassembled for cleaning and inspection by removing the pins and cotter pins and unscrewing the bleeder valve. After the valve has been inspected and reassembled, test it on a steam line before placing it back in service.

(Cont. on page 2)

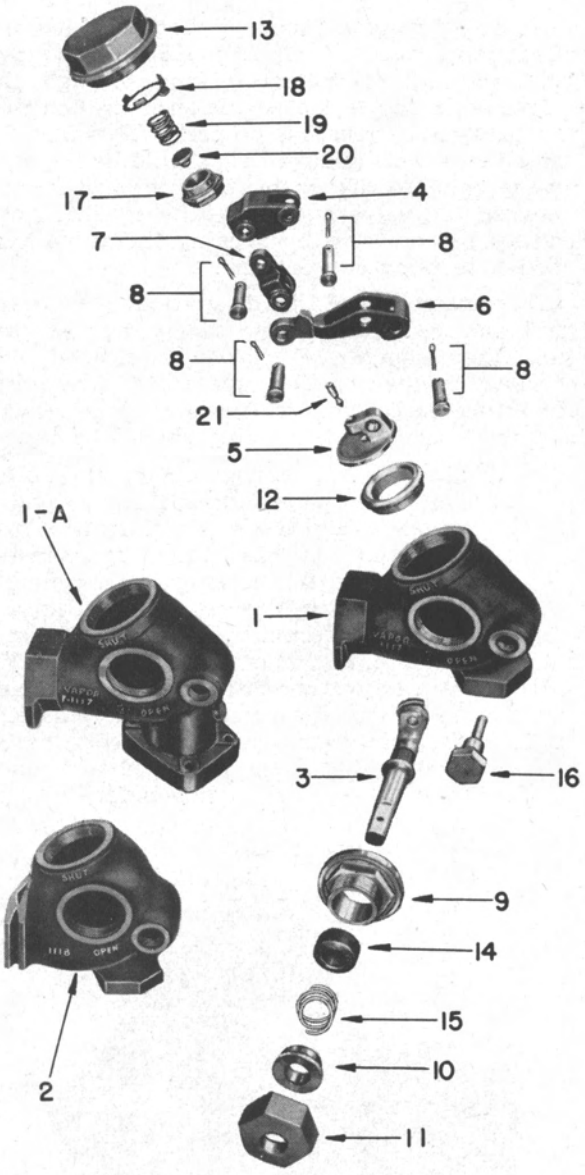


Sectioned View of No. 1117 End Valve

NOS. 1117, F-1117 AND 1118 END TRAIN PIPE VALVES (Continued)

If the valve leaks steam around the stem, it is an indication that new packing is needed. To form new packing, apply the packing, packing gland and stuffing box and pull up tight. Remove the stuffing box and apply the spring. Then replace the stuffing box.

If the stem continues to leak steam after the stuffing box has been pulled up as far as it will go, add a No. 1117-N-1 Metallic Filler Ring (not furnished with valve) to the packing.



Exploded View of Nos. 1117, F-1117 and 1118 End Valves

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	1117-A	Body (1117)	1
1-A	F-1117-A	Body (F-1117)	
2	1118-A	Body (1118)	
3	1108-B	Stem	1
4	1117-C	Link (Valve Stem)	1
5	1117-D	Main Valve (1117, F-1117)	1
	1118-D	Main Valve (1118 only)	1
6	1117-E	Yoke (Main Valve)	1
7	1108-F	Link (Yoke)	4
8	1108-G	Pins and Cotters	1
9	1117-H	Bonnet	1
10	1104-J	Gland	1
11	1104-K	Stuffing Box	1
12	1117-L	Seat	1
13	1117-M	Cap	1
14	1117-N	Packing (Main Ring)	1
15	1117-U	Spring	1
16	1108-P	Pin (Yoke Retaining)	1
17	1108-Q-1	Cap (Locking Pin)	1
18	1108-Q-2	Lockwasher (Pin Cap)	1
19	1108-R	Spring (Locking)	1
20	1108-S	Pin (Locking Spring)	1
21	1108-V	Bleeder Valve (1117, F-1117)	1
	1118-V	Bleeder Valve (1118 only)	1
	1118-DD	Valve and Yoke Assem. Includes 1117-C, 1118-D, 1117-E, 1108-F and four of 1108-G.	

Note: No. 1117-N-1 Metallic Filler Ring, for Repair Purposes Only, Not Furnished with Regulator.

PRINTED IN U.S.A.

No. 1119 END VALVE

INLETS—2½" WEIGHT: 37 lbs. OUTLETS—2½"

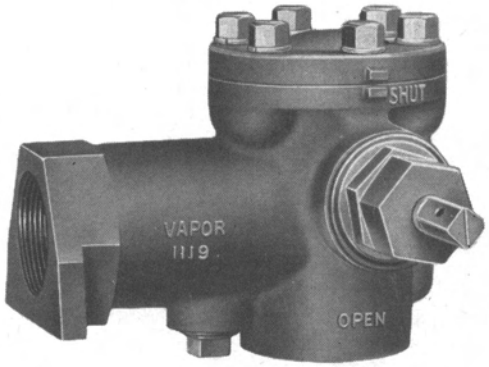


Fig. 1. No. 1119 End Valve

GENERAL DESCRIPTION

The No. 1119 End Valve is of an improved type and is designed for rapid action, positive positioning and ease of operation. This valve may be opened, closed or set in the "Bleed" position with a minimum of effort regardless of the pressure of steam in the train line.

For use on passenger cars at the ends of the steam train line, the newly designed No. 1119 End Valve is interchangeable with (having the same body dimensions and I.P.S. inlet and outlet center lines) the No. 1117 End Valve.

This valve is designed with a balanced piston principle to increase ease of operation. The operating stem includes a cam portion having two steel rollers at its outer extremities. As the stem is turned, one roller rotates across a stainless steel insert to raise or lower the piston and open or close the main valve. The other roller rotates across a spring-loaded stainless steel actuating button to open the bleeder valve. Like preceding Vapor End Valves, this unit seats the main valve in the path of the steam to close, unseats the main valve to open and seats the main valve but opens a bleeder valve to drain condensate from the train line.

A No. 404-Y Operating Lever, which is not furnished with the valve, may be purchased separately for operation of the valve from outside. To operate the valve from inside the car, a No. 404 Operating Attachment may be purchased separately.

MAINTENANCE AND OVERHAUL

The No. 1119 End Valve requires very little maintenance beyond occasional inspection for steam leaks. However it is recommended that this valve be disassembled completely and overhauled at every shopping period or at least once every two years. At this time it should be thoroughly cleaned and checked for wear. After the overhaul is completed and the valve has been reassembled a metal date tag should be attached for record purposes.

To disassemble the valve, unscrew the bonnet (sym. 10) and remove the operating stem assembly with the bonnet. Then unscrew the six cap screws (sym. 1) and remove the lockwashers (sym. 2), valve cap (sym. 3) and cap gasket (sym. 4). This will permit the removal of the sleeve (sym. 5) and the main valve assembly (sym. 6) from the valve body (sym. 8). Slide the piston end of the main valve into the sleeve (sym. 5) to be sure it fits snugly; if side play is evident, the rings are worn and should be replaced. To replace the Teflon packing rings (sym. 6-E) in the main valve assembly (sym. 6) if worn, remove the locking wire (sym. 6-B), the two screws (syms. 6-A and 6-C) and remove the packing top (sym. 6-D). When applying new rings be sure the packing spring and the adapter are placed in proper position first. Then use the packing top plate to push the packing rings down until they stop against the top of the adapter.

Check the bleeder valve assembly for steam leaks by placing it inside a bushing (made to fit the threads of the bleeder valve body) and placing bushing and valve on a steam line with a shut-off valve and steam gauge ahead of the bleed valve. With the shut-off valve open, the bleeder valve should not leak steam under 150 lbs. pressure. Otherwise it should be lapped. When lapping the bleeder valve, remove the retaining ring (sym. 6-P), spring retainer (sym. 6-O) and spring (sym. 6-N)—then replace the spring retainer to keep the needle (sym. 6-M) in align-

(Continued)

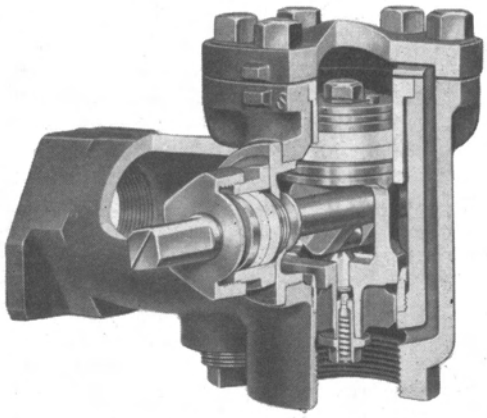


Fig. 2. Sectioned View of No. 1119 End Valve

NO. 1119 END VALVE (Continued)

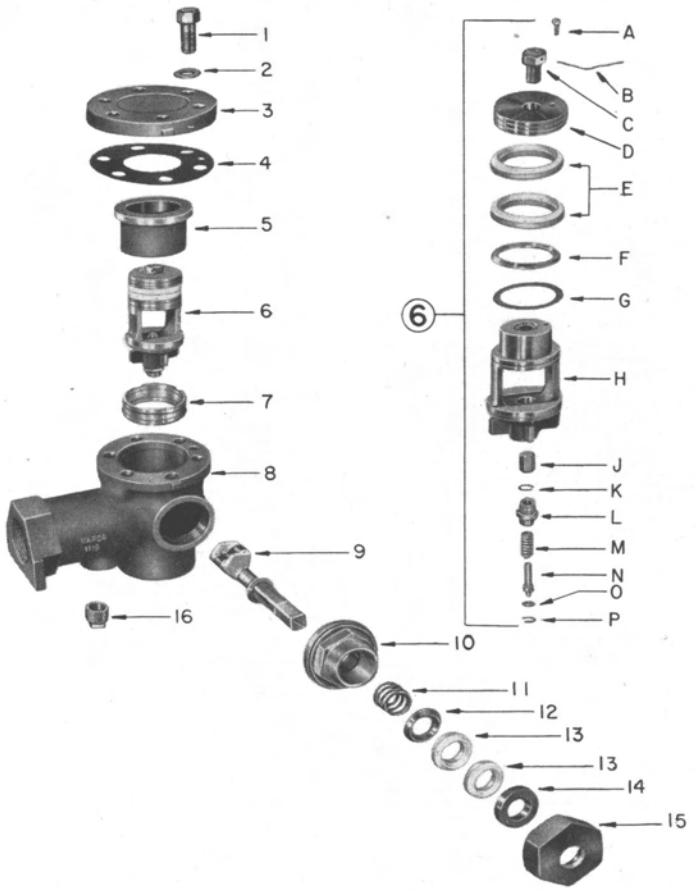


Fig. 3 Exploded View of No. 1119 End Valve

(Continued from Page 1)

ment, while lapping. Time Saver Yellow Label No. 80 Fine Compound or equivalent is recommended for lapping. Remove all traces of the lapping compound with carbon tetrachloride and compressed air. Check the bleeder valve again and replace if lapping has not stopped the leaking.

Inspect the actuating button (sym. 6-J) and replace if excessive wear is shown on the corners of the hexagon bearing points. Inspect the seat ring (sym. 7) and replace if worn, scratched or wire drawn. (We recommend the return of the entire valve body to the Vapor Heating Corporation to replace this seat ring because it must be machined properly after installation in the valve body.) Before sending the valve body in to have the seat ring replaced, the main valve and the seat should be lapped, which will, in most cases, correct the leakage. Examine the cam lobes on the operating stem for wear. Check the bonnet (sym. 10), the packing (sym. 13), the adapters (syms 12 and 14) and the spring (sym. 11) for wear or distortion. Replace the packing if it has become deteriorated.

Reassemble the valve and test on steam line under steam pressure around 150 lbs.

LIST OF PARTS

Sym.	Part. No.	Description	Amt.
1	⅝"-11NC x 1½" Lg.	Screw, Hex Head Cap	6
2	⅝"x⅛"x 13/69"	Lockwasher (Split Type)	6
3	1119-M	Cap	1
4	1119-G	Gasket	1
5	1119-E	Sleeve	1
6	1119-DD	Main Valve Assembly	1
A	1119-D-9	Screw, F. H.	1
B	#18(.040)	Lock Wire	1
C	1119-D-8	Screw, Hex. Head	1
D	1119-D-7	Plate, Packing Top	1
E	1119-D-6	Teflon "V" Pack. Ring	2
F	1119-D-5	Adapter, Male	1
G	1119-D-4	Spring, Packing	1
H	1119-D-1	Needle, Main Valve	1
J	1119-D-2	Button, Actuating	1
K	940-13	Retaining Ring, Button	1
L	1119-C-1	Body, Bleeder Valve	1
M	1119-C-2	Needle Bleeder Valve	1
N	1119-C-3	Spring, Bleeder Valve	1
O	1119-C-4	Retainer, B. V. Spring	1
P	1119-C-5	Ring, Retainer	1
7	1119-L	Seat Ring	1
8	1119-A	Body	1
9	1119-BB	Operating Stem Assemb.	1
10	1104-H	Bonnet	1
11	A-1120-H5	Spring	1
12	A-1120-H3	Adapter, Male	1
13	A-1120-H4	Teflon Packing Ring	2
14	A-1120-H2	Adapter, Female	1
15	A-1120-H1	Stuffing Box	1
16	1" I.P.S.	Pipe Plug	1
	1119-CC	Bleeder Valve Assembly Complete (Includes Syms. 6L to 6P)	1

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No. A-1120 END VALVE

INLETS—2½" WEIGHT: 37 lbs. OUTLETS—2½"

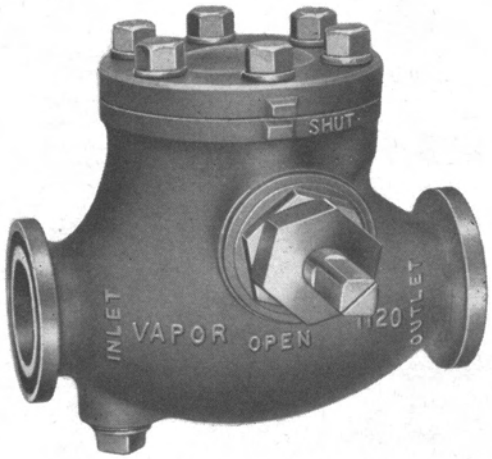

Fig. 1. No. A-1120 End Valve

GENERAL DESCRIPTION

The No. 1120 End Valve is of an improved type and is designed for rapid action, positive positioning and ease of operation. This valve may be opened, closed or set in the "Bleed" position with a minimum of effort regardless of the pressure of steam in the train line.

For use on locomotives and in certain railway cars, the No. 1120 End Valve, offers these improvements in a 2½" valve of the globe type. This valve is designed for quick disconnection and easy replacement. A clamp (adjusted by two nuts and bolts) is used at the train line connection to attach the valve to the car, while another similar clamp is used at the valve outlet.

This valve is designed with a balanced piston principle to increase ease of operation. The operating stem includes a cam portion having two steel rollers at its outer extremities. As the stem is turned, one roller rotates across a stainless steel insert to raise or lower the piston and open or close the main valve. The other roller rotates across a spring-loaded stainless steel actuating button to open the bleeder valve. Like preceding Vapor End Valves, this unit seats the main valve in the path of the steam to close, unseats the main valve to open and seats the main valve but opens a bleeder valve to drain condensate from the train line.

A No. 404-A Operating lever, which is not furnished with the valve, may be purchased separately for operation of the valve from outside. To operate the valve from inside the car, a No. 404 operating attachment may be purchased separately.

MAINTENANCE AND OVERHAUL

The 1120 End Valve requires very little maintenance beyond occasional inspection for steam leaks. However it is recommended that this valve be disassembled completely and over-hauled at every shopping period or at least once every two years. At this time, it should be thoroughly cleaned and checked for wear. After the overhaul is completed and the valve has been reassembled a metal date tag should be attached for record purposes.

To disassemble the valve, unscrew the bonnet (sym. 10) and remove the operating stem assembly with the bonnet. Then unscrew the six cap screws (sym. 1) and remove the lockwashers (sym. 2), valve cap (sym. 3) and cap gasket (sym. 4). This will permit the removal of the sleeve (sym. 5) and the main valve assembly (sym. 6). Do not take out the valve seat (sym. 7) from the valve body (sym. 8). Slide the piston end of the main valve into the sleeve (sym. 5) to be sure it fits snugly; if side play is evident, the rings are worn and should be replaced. To replace the Teflon packing rings (sym. 6-E) in the main valve assembly (sym. 6) if worn, remove the locking wire (sym. 6-B), the two screws (syms. 6-A and 6-C) and remove the packing top (sym. 6-D. When applying new rings be sure the packing spring and the adapter are placed in proper position first. Then use the packing top plate to push the packing rings downward until they stop against the top of the adapter.

Check the bleeder valve assembly for steam leaks by placing it inside a bushing (made to fit the threads of the bleeder valve body) and placing bushing and valve on a steam line with a shut-off valve and steam gauge ahead of the bleed valve. With the shut-off valve open, the bleeder valve should not leak steam under 150 lbs. pressure. Otherwise it should be lapped. When lapping the bleeder valve, remove the retaining ring

(Continued)

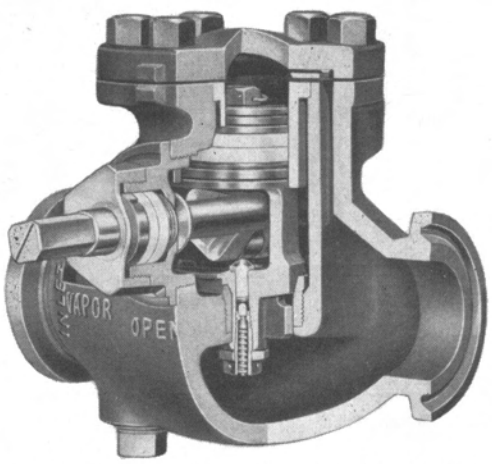

Fig. 2. Sectioned View of No. A-1120 End Valve

NO. A-1120 END VALVE (Continued)

(Continued from Page 1)

(sym. 6-P), spring retainer (sym. 6-O) and spring (sym. 6-N)—then replace the spring retainer to keep the needle (sym. 6-M) in alignment, while lapping. Time Saver Yellow Label No. 80 Fine Compound or equivalent is recommended for lapping. Remove all traces of the lapping compound with carbon tetrachloride and compressed air. Check the bleeder valve again and replace if lapping has not stopped the leaking.

Inspect the actuating button (sym. 6-J) and replace if excessive wear is shown on the corners of the hexagon bearing points. Inspect the seat ring (sym. 7) and replace if worn, scratched or wire drawn. (We recommend the return of the entire valve body to the Vapor Heating Corporation to replace this seat ring because it must be machined properly after installation in the valve body.) Before sending the valve body in to have the seat ring replaced, the main valve and the seat should be lapped, which will, in most cases, correct the leakage. Examine the cam lobes on the operating stem for wear. Check the bonnet (sym. 10), the packing (sym. 13), the adapters (syms. 12 and 14) and the spring (sym. 11) for wear or distortion. Replace the packing if it has become deteriorated.

Reassemble the valve and test on steam line under pressure around 150 lbs.

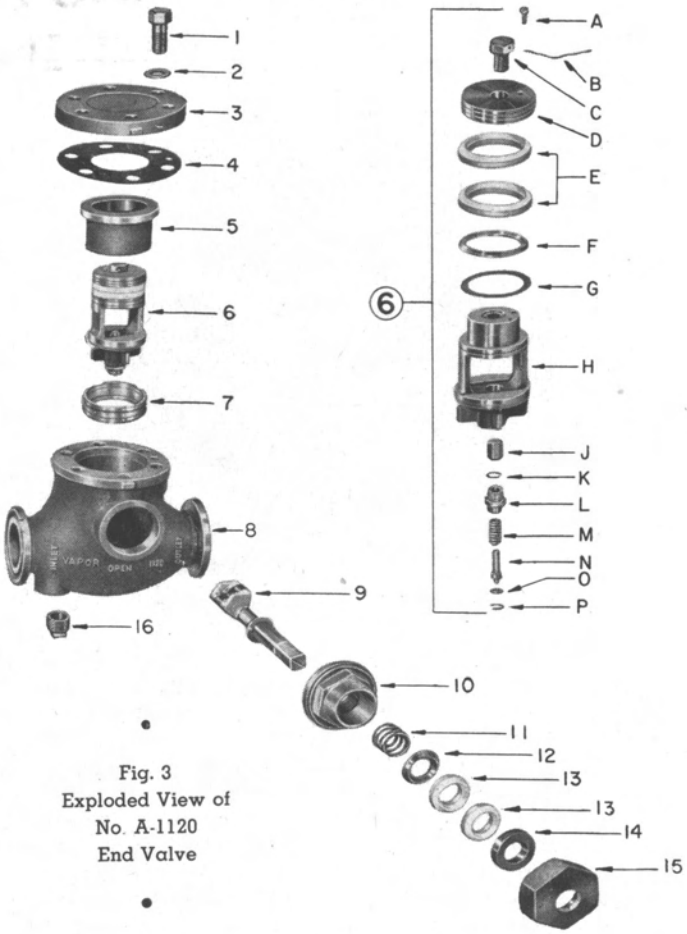

Fig. 3
Exploded View of
No. A-1120
End Valve

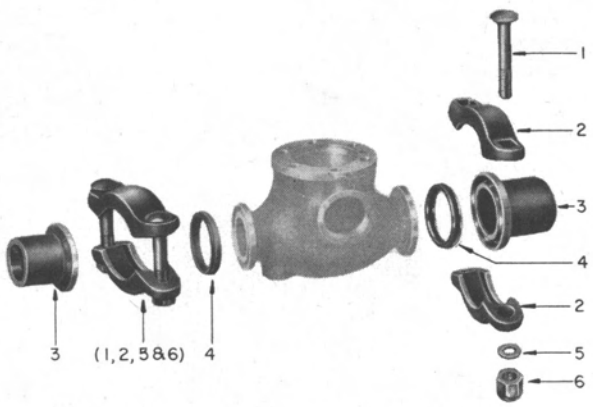

Fig. 4. No. 1120 FF Clamp Ring Union Assembly

LIST OF PARTS

No. 1120-FF

Sym.	Part No.	Description	Amt.
1	⅝"x4½"	Lg. Bolt, Carriage	2
2	1120-F1	Clamp (Half)	2
3	1120-F3	Nipple	1
4	1120-F2	Gasket	1
5	⅝" Std.	Washer (S.A.E.)	2
6	⅝" Std.	Elastic Stop Nut	2

Sym.	Part. No.	Description	Amt.
1		⅝"-11NCx1½" Lg. Screw, Hex Head Cap	6
2		⅝"x⅛"x13/69" Lockwasher (Split Type)	6
3	1119-M	Cap	1
4	1119-G	Gasket	1
5	1119-E	Sleeve	1
6	1119-DD	Main Valve Assembly	1
A	1119-D-9	Screw, F. H.	1
B	#18(.040)	Lock Wire	1
C	1119-D-8	Screw, Hex. Head	1
D	1119-D-7	Plate, Packing Top	1
E	1119-D-6	Teflon "V" Pack. Ring	2
F	1119-D-5	Adapter, Male	1
G	1119-D-4	Spring, Packing	1
H	1119-D-1	Needle, Main Valve	1
J	1119-D-2	Button, Actuating	1
K	940-13	Retaining Ring, Button	1
L	1119-C-1	Body, Bleeder Valve	1
M	1119-C-2	Needle Bleeder Valve	1
N	1119-C-3	Spring, Bleeder Valve	1
O	1119-C-4	Retainer, B. V. Spring	1
P	1119-C-5	Ring, Retaining	1
7	1119-L	Seat Ring	1
8	1120-A	Body	1
9	1119-BB	Operating Stem Assemb.	1
10	1104-H	Bonnet	1
11	A-1120-H5	Spring	1
12	A-1120-H3	Adapter, Male	1
13	A-1120-H4	Teflon Packing Ring	2
14	A-1120-H2	Adapter, Female	1
15	A-1120-H1	Stuffing Box	1
16		1" I.P.S. Pipe Plug	1
	1119-CC	Bleeder Valve Assembly Complete (Incl. Syms. 6L to 6P)	1

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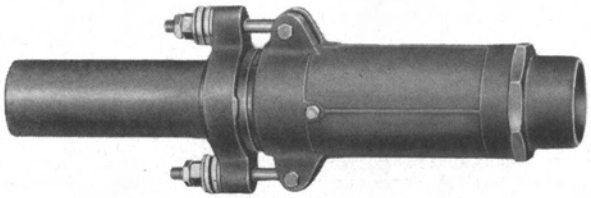
Nos. 171 to 195 EXPANSION JOINTS

AND NO. 908 EXPANSION JOINT

FOR STANDARD PIPE SIZES OR TUBING



No. 187 Expansion Joint

GENERAL DESCRIPTION

Vapor Expansion Joints are special steam line fittings constructed with a movable sleeve inside a body. They are connected in a steam line so that any longitudinal expansion or contraction of the piping will occur within the fitting rather than at either end where it might cause damage. Both iron pipe and copper tubing require a provision for expansion or contraction, although the copper tubing has a greater co-efficient of expansion than does the iron pipe.

These expansion joints are furnished with various sized inlets and outlets and with either plain ends for sweat fittings or with threaded ends for connection to threaded piping.

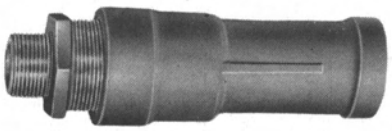
Each expansion joint is equipped with a number of packing rings to prevent a leakage of steam as the sleeve of the joint moves in response to the shortening or lengthening of the piping. Certain of the expansion joints are also equipped with an eye-bolt and spring adjustment which automatically follows up packing wear in order to maintain a tight joint. This feature is included on expansion joints intended for use in high pressure steam lines such as steam train lines underneath railway cars.

Other lighter weight, smaller sized joints are used inside of the car, in radiation piping or where piping of smaller diameters is used.

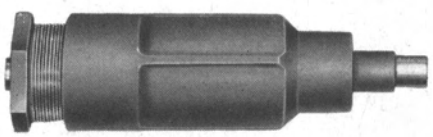
MAINTENANCE

No routine maintenance is required for the continued efficient operation of the Nos. 171 to 195 Expansion Joints. The packing should be renewed whenever it becomes worn. Those joints having take-up adjustments should be kept closely drawn up to prevent steam from leaking past the packing.

When applying or re-applying any of these expansion joints in a car, they should be located near the center of the piping and the piping provided with proper supports within two feet of the joint. The piping must be correctly aligned to prevent binding or wear on the sleeve of the joint. In order to be sure that sufficient room is left for movement of the sleeve, the expansion joint should be fitted when it is cold. Our engineering drawings of these expansion joints, which are available upon request, show the proper distance to allow when fitting the joints cold.



No. 176 Expansion Joint



No. 177 Expansion Joint

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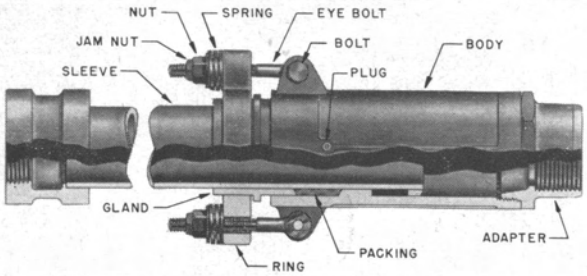
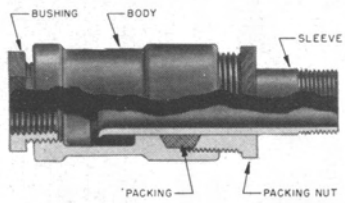
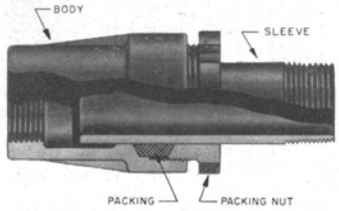


Sectioned View of No. 187 Joint



Sectioned View of No. 176 Joint



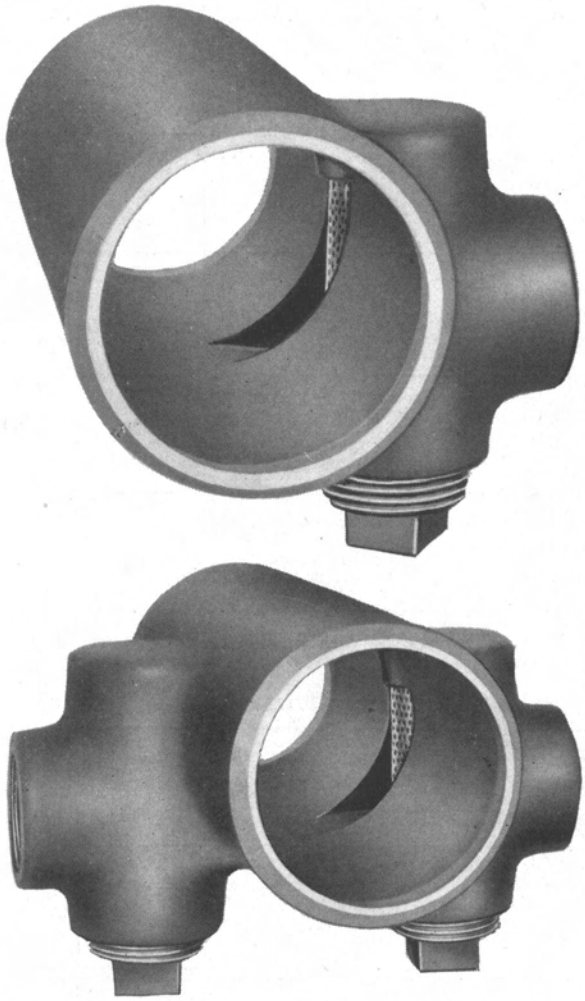
Sectioned View of No. 177 Joint

LIST OF PARTS

EXPANSION JOINT	BODY	GLAND or PACKING NUT	RING	SLEEVE	BUSHING	ADAPTER	ADJUSTING RING	BOLT	HEX NUT	HEX LOCKNUT	ADJUSTING BOLT	NUT	JAM NUT	SPRING	WASHER	
No. 171 (1⅛" ODT)	171-A	171-B	171-C													
No. 172 (1⅜" ODT)	172-A	172-B	172-C													
No. 173 (1⅝" ODT)	173-A	173-B	173-C													
No. 175 (2⅛" ODT)	175-A	175-B	175-C													
No. 176 (1" Pipe)	176-A	176-C	176-D	176-B	176-A-1											
No. 177 (1¼" Pipe)	177-A	177-C	177-D	177-B												
No. 178 (1½" Pipe)	178-A	51-C	51-D	178-B	178-A-1											
No. 179 (2⅜" ODT)	179-A	179-B	179-C													
No. 183 (2⅛" ODT) (2" Pipe)	183-A	183-D	183-C	183-B		183-F	183-J	⅜"x16x2½"	⅜"x16	⅜"x16	186-S	530-F	530-F-1	312-F	½" Std.	
No. 186 (2⅞" ODT)	186-A	186-D	186-C	186-B		186-F	186-J	⅜"x16x2½"	⅜"x16	⅜"x16	186-S	530-F	530-F-1	312-F	½" Std.	
No. 186-1 (2½" Pipe)	186-A	186-D	186-C	186-B		186-F-1	186-J	⅜"x16x2½"	⅜"x16	⅜"x16	186-S	530-F	530-F-1	312-F	½" Std.	
No. 187 (2⅞" ODT)	186-A	186-D	187-C	187-B		187-F	186-J	⅜"x16x2½"	⅜"x16	⅜"x16	186-S	530-F	530-F-1	312-F	½" Std.	
No. 187-1 (2½" Pipe)	186-A	186-D	187-C	187-B		187-F-1	186-J	⅜"x16x2½"	⅜"x16	⅜"x16	186-S	530-F	530-F-1	312-F	½" Std.	
No. 195 (1" Pipe)	195-A	195-C	195-D	195-B												195-D-1 Repair Packing
No. 908 (1⅜" ODT)	908-A	172-B	172-C													908-D Nipple 908-E Nipple

Nos. 398 to 437
STRAINER TEES AND STRAINER CROSSES

SEE PAGE 2 FOR INLET AND OUTLET SIZES AND LISTS OF PARTS



Top: No. 428 Strainer Tee, Bottom: No. 429 Strainer Cross

GENERAL DESCRIPTION

Strainer tee and strainer cross fittings are installed in steam pipe lines wherever single or double take-offs are required. These fittings are similar to standard tees and crosses except that they are constructed with brass strainers in the outlets.

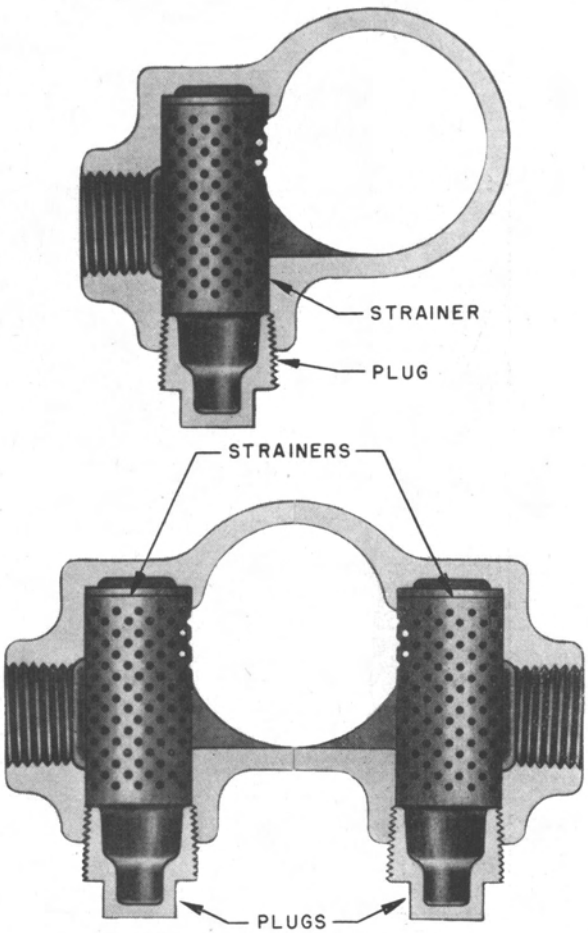
The brass strainers used in these fittings protect devices in the branch steam lines from particles of dirt and bits of metal which sometimes find their way into the main steam line. Another important feature of the brass strainers is that of self-cleaning. Because of the location of the strainer in the outlet opening, a part of the strainer is exposed to steam passing on through the main steam line. This steam wipes the surface of the strainer with a cleaning action so that any dirt adhering to the strainer is carried on through the main steam line.

Both strainer tees and strainer crosses are available in a number of sizes and with either threaded connections or beveled connections for welding. As an aid in ordering parts or complete fittings, a parts list and inlet and outlet sizes of each fitting is shown on page 2.

MAINTENANCE

Strainer fittings should be cleaned out at every shopping period, but not less than every two years. To clean the fitting, unscrew the plug and remove the strainer. Clean the strainer very thoroughly before replacing it.

New cars often have an excessive quantity of metal shavings, drops of solder and other dirt particles in the piping. Until these particles have been flushed out, new equipment requires frequent inspection and cleaning of the strainer fittings.



Top: Cross Section View of No. 428 Tee
Bottom: Cross Section View of No. 429 Cross

STRAINER TEES AND STRAINER CROSSES (Cont.)

LIST OF PARTS

Fitting	Part No.	Description	Amt.
No. 398 Strainer Tee (2⅝" O.D.C.T. x 1" I.P.S.)	411-A	Strainer	1
	411-B	Plug	1
	398-C	Body (Brass)	1
No. 409 Strainer Tee (2" I.P.S. x 1" I.P.S.)	411-A	Strainer	1
	411-B	Plug	1
	409-C	Body (Iron)	1
No. 426 Strainer Tee (2½" I.P.S. x 1" I.P.S.)	411-A	Strainer	1
	411-B	Plug	1
	426-C	Body (Iron)	1
No. 428 Strainer Tee (2⅞" O.D.S.T. x 1" I.P.S.)	411-A	Strainer	1
	411-B	Plug	1
	428-C	Body (Steel)	1
No. 431 Strainer Tee (2⅞" O.D.C.T. x 1" I.P.S.)	411-A	Strainer	1
	411-B	Plug	1
	431-C	Body (Brass)	1
No. 436 Strainer Tee (1⅝" O.D.C.T. x 1" I.P.S.)	436-A	Strainer	1
	411-B	Plug	1
	436-C	Body (Brass)	1
No. 437 Strainer Tee (2⅛" O.D.C.T. x 1" I.P.S.)	411-A	Strainer	1
	411-B	Plug	1
	437-C	Body (Brass)	1
No. 437-S Strainer Tee (2¼" O.D.S.T. x 1" I.P.S.)	411-A	Strainer	1
	411-B	Plug	1
	437-C-S	Body (Steel)	1
No. 399 Strainer Cross (2⅝" O.D.C.T. x 1" I.P.S.)	411-A	Strainer	2
	411-B	Plug	2
	399-C	Body (Brass)	1
No. 411 Strainer Cross (2" I.P.S. x 1" I.P.S.)	411-A	Strainer	2
	411-B	Plug	2
	411-C	Body (Iron)	1
No. 427 Strainer Cross (2½" I.P.S. x 1" I.P.S.)	411-A	Strainer	2
	411-B	Plug	2
	427-C	Body (Iron)	1
No. 429 Strainer Cross (2⅞" O.D.S.T. x 1" I.P.S.)	411-A	Strainer	2
	411-B	Plug	2
	429-C	Body (Steel)	1
No. 432 Strainer Cross (2⅞" O.D.C.T. x 1" I.P.S.)	411-A	Strainer	2
	411-B	Plug	2
	432-C	Body (Brass)	1

LOCOMOTIVE EQUIPMENT

PRESSURE REDUCING VALVES

STOP VALVES

STEAM GAUGES

CAB HEATING

SPECIAL FITTINGS

CONDUITS (Between Locomotive & Tender)

Printed in U. S. A.

No. 235 STEAM PRESSURE REDUCING VALVE

INLET—1½" OUTLET—2" WEIGHT: 22½ lbs.

No. 235 Steam Pressure Reducing Valve

GENERAL DESCRIPTION

Pressure reducing valves are used on locomotives as a means of reducing the pressure of steam passing into the steam train line, so that it has sufficient pressure to heat the train, yet not enough pressure to waste steam. The No. 235 Pressure Reducing Valve permits the passage of enough steam to heat trains of limited length. It is furnished with a 1½" inlet and a 2" outlet, and with various combinations of union tail pieces as required. Bulletins 63-104 and 63-105 describe other pressure reducing valves which should be placed on locomotives capable of hauling longer trains.

The valve is equipped with an auxiliary valve which operates with a spring and diaphragm to maintain the pressure of delivered steam at the adjustment of the valve setting. This auxiliary valve permits the passage of a small amount of steam behind the piston to give force to the piston and the main valve against the high pressure steam so that a steam flow is permitted.

The No. 235 valve is a "packless" type, being operated through a phospher bronze diaphragm which completely seals the steam from the bonnet. A renewable cylinder is provided in the valve so that the valve need not be removed, nor the piping disturbed to replace a worn cylinder or piston. It is important that the pressure reducing valve be installed in the proper position, with the piston cap on top. The piston should be in a vertical position or, if absolutely necessary, it may be moved either way from vertical to horizontal; but it must never be used below a horizontal position. This is to prevent water from becoming trapped behind the piston and causing the valve to become inoperative. The use of graphite and oil is recommended for sealing all steam heat piping joints.

Steam pressure into the train line may be decreased by turning the valve handle counter-clockwise, but the valve should never be used to turn off the steam; a shut-off valve should be provided for this purpose. The presence of foreign matter in the steam which causes deposits to form on the working parts of the valve may necessitate an occasional inspection. Should the valve stick, a light hammer blow on the piston cap or on the bottom of the valve will often dislodge this foreign matter.

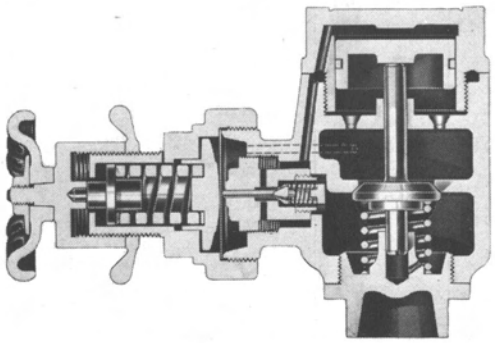
MAINTENANCE AND OVERHAUL

The No. 235 Pressure Reducing Valve should be disassembled and overhauled every two years. At this time it should be thoroughly cleaned, inspected for wear, adjusted and tested on a steam line before being put back into service.

Do not oil or grease the working parts of the valve as lubrication is unnecessary. If the main valve or the auxiliary valve do not seat properly, they should be ground to fit. Avoid the use of coarse grinding compounds which may cause deep grooving. Also be sure to inspect the small ports in the valve body to be sure that they are not clogged.

No. 235 Pressure Reducing Valves manufactured after December, 1943 are furnished with an improved piston ring and an improved auxiliary valve assembly. On all orders for parts of the old valves, new complete DDA valve assemblies will be furnished. Valves equipped with the old parts may be converted by replacing these parts.

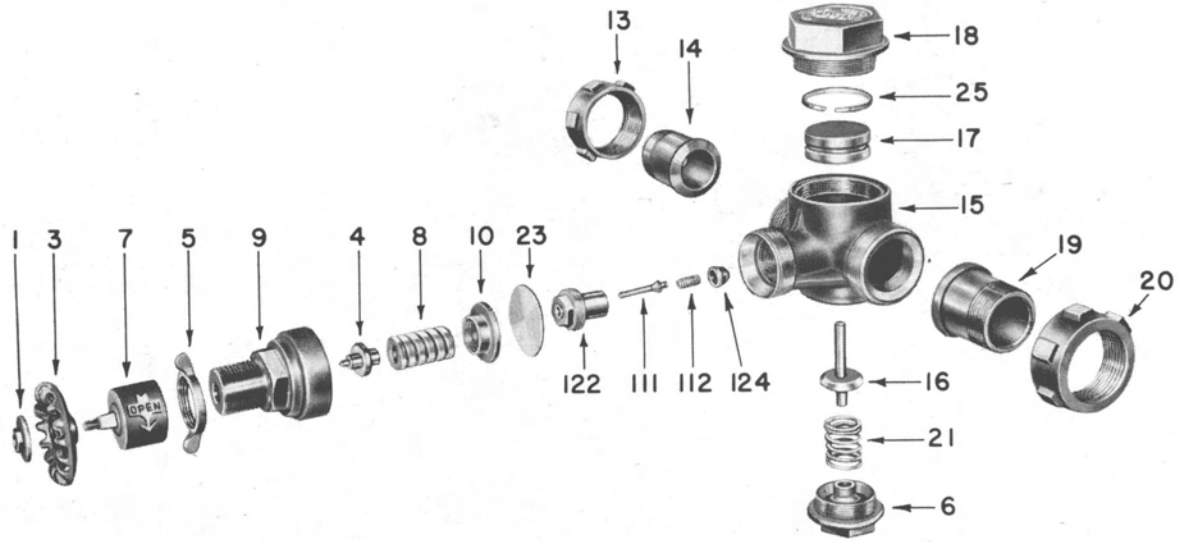
To disassemble the valve, unscrew the plate wheel nut (sym. 1), remove the handwheel (sym. 3), unscrew the spring case cap (sym. 7) and the locknut (sym. 5). Unscrew the spring case (sym. 9) and lift out the diaphragm spring guide (sym. 4), the spring (sym. 8), the diaphragm button (sym. 10) and the diaphragm (sym. 23). The auxiliary valve assembly (syms. 111, 112,



Sectioned View of No. 235 Valve

No. 235 STEAM PRESSURE REDUCING VALVE (Cont'd.)

122 and 124) may then be unscrewed and removed. This assembly should be further disassembled by unscrewing the auxiliary valve spring retainer (sym. 124) and releasing the auxiliary valve spring (sym. 112). Remove the bottom cap (sym. 6), the main valve spring (sym. 21) and the main valve (sym. 16). Unscrew the piston cap (sym. 18) and remove the piston (sym. 17) and the piston ring (sym. 25). By unscrewing the union nuts (syms. 13 and 20) the union tail pieces (syms. 14 and 19) may be removed.



Exploded View of No. 235 Steam Pressure Reducing Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	235-1	Wheel Nut & Plate	1
3	235-3	Hand Wheel	1
4	235-4	Diaphragm Spring Guide	1
5	234-5	Locknut	1
6	235-6	Bottom Cap	1
7	235-7	Spring Case Cap	1
8	235-8	Diaphragm Spring	1
9	235-9	Spring Case	1
10	235-10	Diaphragm Button	1
111	235-111	Auxiliary Valve	1
112	235-112	Auxiliary Valve Spring	1
13	235-13	Inlet Union Nut (Specify for "G", "M", or "S" type)	1
14	235-14	Inlet Tail Piece (Specify for "G", "M", or "S" type)	1
15	235-15	Body (Specify for "G", "M", or "S" type)	1
16	235-16	Main Valve	1
17	235-17	Piston	1
18	235-18	Piston Cap	1
19	235-19	Outlet Tail Piece (Specify for "G", "M", or "S" type)	1
20	235-20	Outlet Union Nut (Specify for "G", "M", or "S" type)	1
21	235-21	Main Valve Spring	1

Sym.	Part No.	Description	Amt.
122	235-122	Auxiliary Valve Seat	1
23	235-23	Diaphragm	1
124	235-124	Auxiliary Valve Spring Retainer	1
25	235-25	Piston Ring	1
AA	235-AA	Spring Case Complete (Includes parts No. 1, 3, 5, 7 & 9)	
BB	235-BB	Piston With Ring (Includes parts No. 17 & 25)	
CC	235-CC	Piston Cap Complete (Includes parts No. 17, 18, & 25)	
DDA	235-DDA	Auxiliary Valve Assembly (Includes parts No. 111, 112, 122, & 124)	

Note: No. 235-DD Assembly No Longer Furnished. Orders for No. 235-DD Assembly or Any of Its Parts Now Filled with a Complete No. 235-DDA Assembly.

SIZES OF INLET AND OUTLET THREADS ON BODY CASTING

					Dim. "A"
G	Inlet-V-Thrds.	2.2786"	Pitch Dia	10-P	5 3/4"
	Outlet- "	2.9054"	" "	8-P	
S	Inlet- "	2.4898"	" "	14-P	5 1/2"
	Outlet- "	2.8368"	" "	14-P	
M	Inlet- "	2.4748"	" "	14-P	5 3/4"
	Outlet- "	3.2756"	" "	10-P	

No. 238 STEAM PRESSURE REDUCING VALVE

INLET—2″ OUTLET—2″ WEIGHT: 30 lbs.

No. 238 Steam Pressure Reducing Valve

GENERAL DESCRIPTION

Pressure reducing valves are used on locomotives as a means of reducing the pressure of steam passing into the steam train line, so that it has sufficient pressure to heat the train, yet not enough pressure to waste steam. The No. 238 Pressure Reducing Valve permits the passage of enough steam to heat trains of moderate length. It is furnished with a 2″ inlet and a 2″ outlet, and with various combinations of union tail pieces as required. Bulletins 63-102 and 63-105 describe other pressure reducing valves which should be placed on locomotives capable of hauling trains of other lengths.

This valve is equipped with an auxiliary valve which operates with a spring and diaphragm to maintain the pressure of delivered steam at the adjustment of the valve setting. This auxiliary valve permits the passage of a small amount of steam behind the piston to give force to the piston and to an auxiliary main valve against the high pressure steam so that a smaller steam flow is permitted when less than the full capacity of the valve is required. This steam also causes the piston to open the main valve when required.

The No. 238 valve is a "packless" type, being operated through a phospher bronze diaphragm which completely seals the steam from the bonnet. A renewable cylinder is provided in the valve so that the valve need not be removed, nor the piping disturbed to replace a worn cylinder or piston. It is important that the pressure reducing valve be installed in the proper position, with the piston cap on top. The piston should be in a vertical position or, if absolutely necessary, it may be moved either way from vertical to horizontal, but it must never be used below a horizontal position. This is to prevent water from becoming trapped behind the piston and causing the valve to become inoperative. The use of graphite and oil is recommended for sealing all steam heat piping joints.

Steam pressure into the train line may be decreased by turning the valve handle counterclockwise, but the valve should never be used to turn off the steam; a shut-off valve should be provided for this purpose. The presence of foreign matter in the steam which causes deposits to form on the working parts of the valve may necessitate an occasional inspection. Should the valve stick, a light hammer blow on the piston cap or on the bottom of the valve will often dislodge the foreign matter.

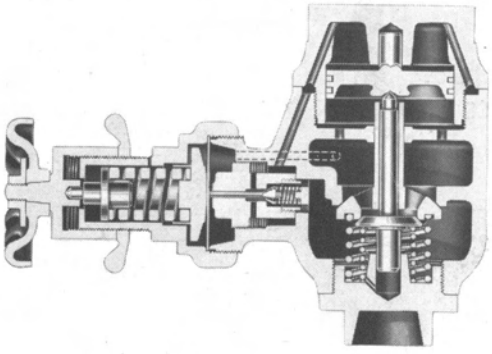
MAINTENANCE AND OVERHAUL

The No. 238 Pressure Reducing Valve should be disassembled and overhauled every two years. At this time it should be thoroughly cleaned, inspected for wear, adjusted and tested on a steam line before being put back into service.

Do not oil or grease the working parts of the valve as lubrication is unnecessary. If the main valve or the auxiliary valve do not seat properly, they should be ground to fit. Avoid the use of coarse grinding compounds which may cause deep grooving. Also be sure to inspect the small ports in the valve body to be sure that they are not clogged.

No. 238 Pressure Reducing Valves manufactured after December, 1943, are furnished with an improved piston ring, an improved auxiliary valve assembly, and an improved main valve. On all orders for parts of the old auxiliary valves, new complete DDA auxiliary valve assemblies will be furnished. Valves equipped with the old parts may be converted by replacing these parts.

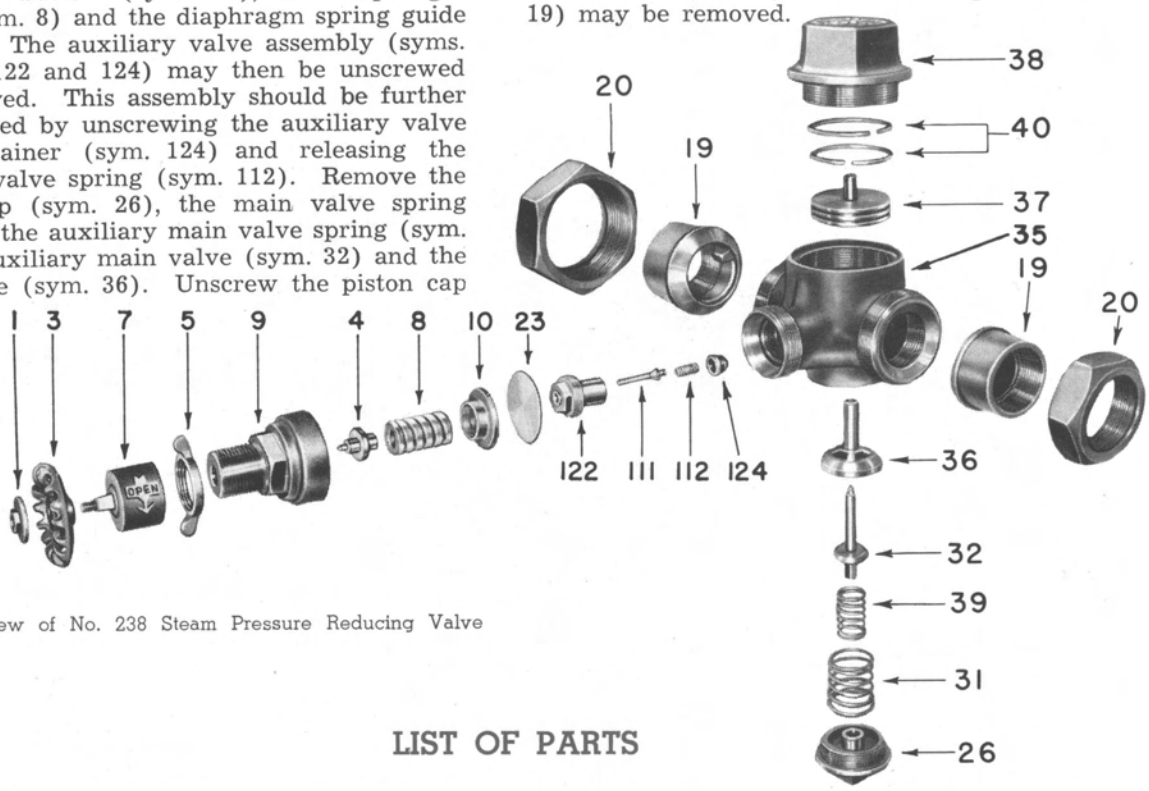
To disassemble the valve, unscrew the plate wheel nut (sym. 1), remove the handwheel (sym. 3), unscrew the spring case cap (sym. 7) and the



Sectioned View of No. 238 Valve

NO. 238 STEAM PRESSURE VALVE (Cont'd)

locknut (sym. 5). Unscrew the spring case (sym. 9) and lift out the diaphragm (sym. 23), the diaphragm button (sym. 10), the diaphragm spring (sym. 8) and the diaphragm spring guide (sym. 4). The auxiliary valve assembly (syms. 111, 112, 122 and 124) may then be unscrewed and removed. This assembly should be further disassembled by unscrewing the auxiliary valve spring retainer (sym. 124) and releasing the auxiliary valve spring (sym. 112). Remove the bottom cap (sym. 26), the main valve spring (sym. 31) the auxiliary main valve spring (sym. 39), the auxiliary main valve (sym. 32) and the main valve (sym. 36). Unscrew the piston cap (sym. 38) and remove the piston (sym. 37) and the piston rings (sym. 40). By unscrewing the union nuts (sym. 20) the union tail pieces (sym. 19) may be removed.



Exploded View of No. 238 Steam Pressure Reducing Valve

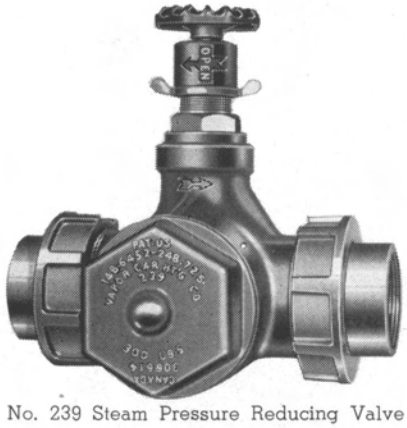
LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	235-1	Wheel Nut Plate	1
3	235-3	Hand Wheel	1
4	235-4	Diaphragm Spring Guide	1
5	235-5	Lock Nut	1
7	235-7	Spring Case Cap	1
8	235-8	Diaphragm Spring	1
9	235-9	Spring Case	1
10	235-10	Diaphragm Button	1
111	235-111	Auxiliary Valve	1
112	235-112	Auxiliary Valve Spring	1
19	235-19-M	Inlet & Outlet Tail PC "M" Type	2
	235-19-G	Inlet & Outlet Tail PC "G" Type	
20	235-20-M	Inlet & Outlet Union Nut "M" Type	2
	235-20-G	Inlet & Outlet Union Nut "G" Type	
122	235-122	Auxiliary Valve Seat	1
23	235-23	Diaphragm	1
124	235-124	Auxiliary Valve-Spring Retainer	1
26	238-26	Bottom Plug	1
31	238-31	Main Valve Spring	1
32	238-32	Auxiliary Main Valve	1
35	238-35	Body	1
36	238-36	Main Valve	1
37	238-37	Piston	1
38	238-38	Piston Cap	1
39	238-39	Auxiliary Main Valve Spring	1
40	238-40	Piston Ring	2
	235-AA	Spring Case Complete (includes parts No. 1, 3, 5, 7 & 9)	
	238-BB	Piston with Ring (includes parts No. 37 & 40)	
	238-CC	Piston Cap Complete (includes parts No. 37, 38 & 40)	
	235-DDA	Auxiliary Valve Assembly (includes parts Nos. 111, 112, 122 and 124)	

Note: No. 235-DD Assembly No Longer Furnished. Orders for No. 235-DD Assembly or Any of Its Parts Now Filled with a Complete No. 235-DDA Assembly.

No. 239 STEAM PRESSURE REDUCING VALVE

INLET—2½" OUTLET—2½" WEIGHT: 48 lbs.



No. 239 Steam Pressure Reducing Valve

GENERAL DESCRIPTION

Pressure reducing valves are used on locomotives as a means of reducing the pressure of steam passing into the steam train line, so that it has sufficient pressure to heat the train, yet not enough pressure to waste steam. The No. 239 Pressure Reducing Valve permits the passage of enough steam to heat trains of the longest length. It is furnished with a 2½" inlet and a 2½" outlet, and with various combinations of union tail pieces as required. Bulletins 63-102 and 63-104 describe other pressure reducing valves which should be placed on locomotives capable of hauling trains of other lengths.

The valve is equipped with an auxiliary valve which operates with a spring and diaphragm to maintain the pressure of delivered steam at the adjustment of the valve setting. This auxiliary valve permits the passage of a small amount of steam behind the piston to give force to the piston and to an auxiliary main valve against the high pressure steam so that a smaller steam flow is permitted when less than the full capacity of the valve is required. This steam also causes the piston to open the main valve when required.

The No. 239 valve is a "packless" type, being operated through a phosphor bronze diaphragm which completely seals the steam from the bonnet. A renewable cylinder is provided in the valve so that the valve need not be removed, nor the piping disturbed to replace a worn cylinder or piston. It is important that the pressure reducing valve be installed in the proper position, with the piston cap on top. The piston should be in a vertical position or, if absolutely necessary, it may be moved either way from vertical to horizontal, but it must never be used below a horizontal position. This is to prevent water from becoming trapped behind the piston and causing the valve to become inoperative. The use of graphite and oil is recommended for sealing all steam heat piping joints.

Steam pressure into the train line may be decreased by turning the valve handle counterclockwise, but the valve should never be used to turn off the steam; a shut-off valve should be provided for this purpose. The presence of foreign matter in the steam which causes deposits to form on the working parts of the valve may necessitate an occasional inspection. Should the valve stick, a light hammer blow on the piston cap or on the bottom of the valve will often dislodge the foreign matter.

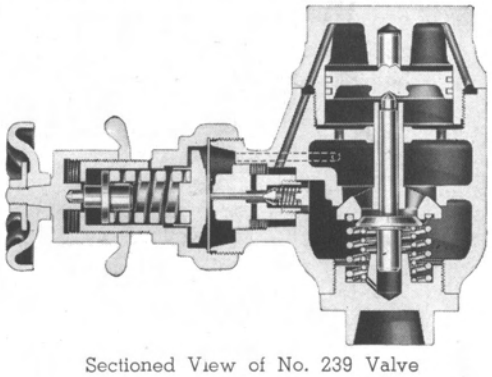
MAINTENANCE AND OVERHAUL

The No. 239 Pressure Reducing Valve should be disassembled and overhauled every two years. At this time it should be thoroughly cleaned, inspected for wear, adjusted and tested on a steam line before being put back into service.

Do not oil or grease the working parts of the valve as lubrication is unnecessary. If the main valve or the auxiliary valve do not seat properly, they should be ground to fit. Avoid the use of coarse grinding compounds which may cause deep grooving. Also be sure to inspect the small parts in the valve body to be sure that they are not clogged.

No. 239 Pressure Reducing Valves manufactured after December, 1943, are furnished with an improved piston ring, an improved auxiliary valve assembly, and an improved main valve. On all orders for parts of the old auxiliary valves, new complete DDA auxiliary valve assemblies will be furnished. Valves equipped with the old parts may be converted by replacing these parts.

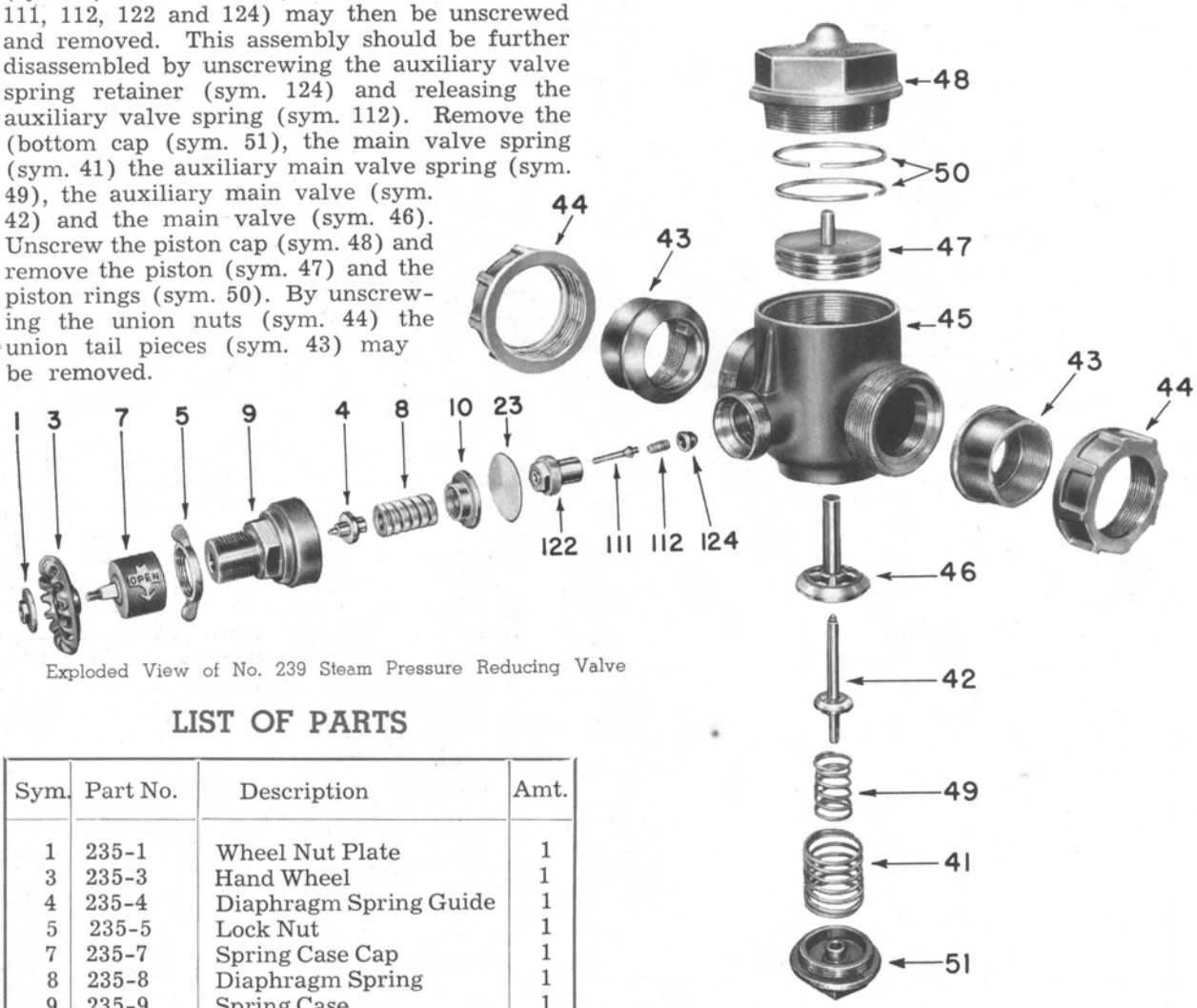
To disassemble the valve, unscrew the plate wheel nut (sym. 1), remove the handwheel (sym. 3), unscrew the spring case cap (sym. 7) and the locknut (sym. 5). Unscrew the spring case (sym. 9) and lift out the diaphragm (sym. 23), the diaphragm button (sym. 10) the diaphragm spring (sym. 8) and the diaphragm spring guide



Sectioned View of No. 239 Valve

NO. 239 STEAM PRESSURE REDUCING VALVE (Continued)

(sym. 4). The auxiliary valve assembly (syms. 111, 112, 122 and 124) may then be unscrewed and removed. This assembly should be further disassembled by unscrewing the auxiliary valve spring retainer (sym. 124) and releasing the auxiliary valve spring (sym. 112). Remove the (bottom cap (sym. 51), the main valve spring (sym. 41) the auxiliary main valve spring (sym. 49), the auxiliary main valve (sym. 42) and the main valve (sym. 46). Unscrew the piston cap (sym. 48) and remove the piston (sym. 47) and the piston rings (sym. 50). By unscrewing the union nuts (sym. 44) the union tail pieces (sym. 43) may be removed.



Exploded View of No. 239 Steam Pressure Reducing Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	235-1	Wheel Nut Plate	1
3	235-3	Hand Wheel	1
4	235-4	Diaphragm Spring Guide	1
5	235-5	Lock Nut	1
7	235-7	Spring Case Cap	1
8	235-8	Diaphragm Spring	1
9	235-9	Spring Case	1
10	235-10	Diaphragm Button	1
111	235-111	Auxiliary Valve	1
112	235-112	Auxiliary Valve Spring	1
122	235-122	Auxiliary Valve Seat	1
23	235-23	Diaphragm	1
124	235-124	Auxiliary Valve Nut	1
41	239-41	Main Valve Spring	1
42	239-42	Auxiliary Main Valve	1
43	239-43	Inlet & Outlet Tail Piece	2
44	239-44	Inlet & Outlet Union Nut	2
45	239-45	Body	1
46	239-46	Main Valve	1
47	239-47	Piston	1
48	239-48	Piston Cap	1
49	239-49	Auxiliary Main Valve Spring	1
50	239-50	Piston Ring	2
51	239-51	Bottom Cap	1
	235-AA	Spring Case Complete (includes parts 1, 3, 5, 7 & 9),	

Part No.	Description
239-BB	Piston with Ring (includes parts 47 & 50)
239-CC	Piston Cap Complete (includes parts 47, 48 & 50)
235-DDA	Aux. Valve Assembly (includes parts, 111, 112, 122 & 124)
239-43	Tail Piece for 2½" Std. Pipe Thrds.
239-43-A	Tail Piece for 2" Std. Pipe Thrds.
239-43-B	Tail Piece for 2⅝" O.D. C.T.
239-43-C	Tail Piece for 2¼" O.D. C.T.
239-43-D	Tail Piece for 2½" Std. Pipe Thrd. Male
239-43-E	Tail Piece for 2½" I.D. CT.
239-43-H	Tail Piece for 2¾" O.D. CT.
239-43-U	Tail Piece for 2½" Std. Pipe Thrds. (Female)

Note: No. 235-DD Assembly No Longer Furnished. Orders for No. 235-DD Assembly or Any of Its Parts Now Filled with a Complete No. 235-DDA Assembly.

Nos. 202 and 206 STOP VALVES

INLET: No. 202—1½"
No. 206—2"

UNION TAIL PIECE: No. 202—1½"
No. 206—1½"

No. 202 Stop Valve

GENERAL DESCRIPTION

Stop Valves of the No. 200 series are designed to provide positive shut-off in the flow of high pressure steam. Primarily these valves are intended for use on steam locomotives and steam generators, but they may also be used on any other high pressure steam line.

Both the No. 202 Stop Valve and the No. 206 Stop Valve are built to withstand steam pressures up to 300 lbs. and both are used on railway equipment having a 1½" steamline. Although the complete valves are no longer carried in our stock, we can still supply replacement parts for either valve. For convenience in ordering parts for replacement, an exploded view of each valve is shown on page 2.

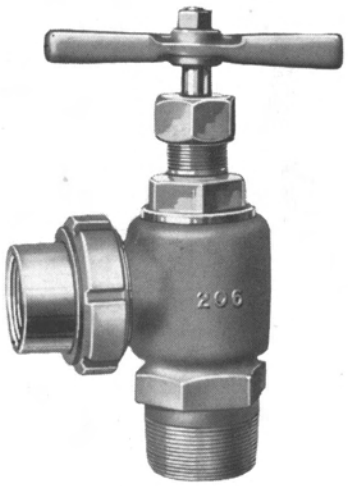
These valves are substantially made and particular attention has been given to the valve stems which are extra heavy to prevent bending and are double threaded to permit quick opening or closing of the valves. Both of these valves are equipped with a 1½" outlet; the No. 202 Stop Valve also has a 1½" inlet, while the No. 206 Stop Valve has a 2" inlet.

MAINTENANCE AND OVERHAUL

The Nos. 202 and 206 Stop Valves require very little operating maintenance. Steam leaking through the valve when it is closed is an indication that the valve is not seating properly. This condition may be caused from a worn valve seat or from the presence of a piece of dirt between the valve and its seat (which may be blown out by turning the valve off and then on again.) Steam leaking from around the stem when the valve is open is an indication that the valve needs repacking.

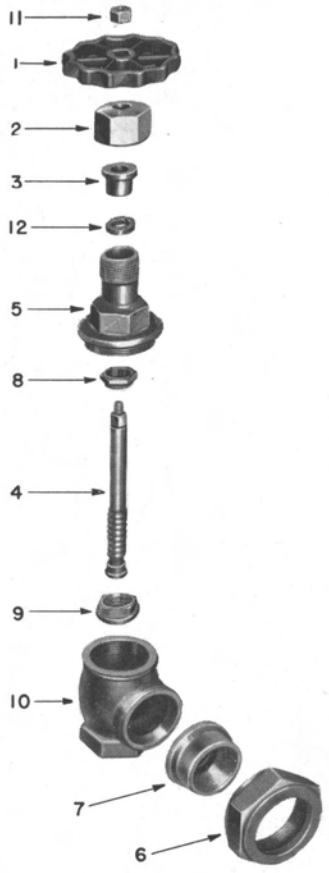
To disassemble either valve for overhaul, unscrew the handle nut, the packing nut, the bonnet and the union nut. Remove the stem and further disassemble the valve by unscrewing the stem nut from the valve.

Clean and inspect each part for wear. If the valve seat is badly worn or has become wire drawn it should be re-ground or replaced and packing which has become deteriorated should be renewed. Reassemble the valve and test it on a steam line for leakage before putting it back into service again.

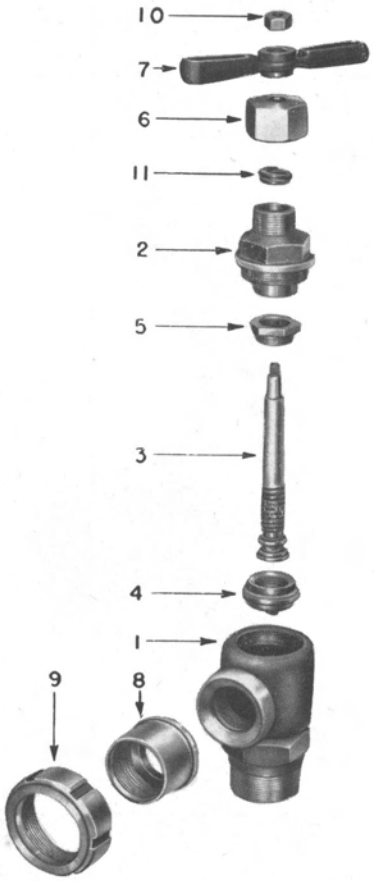


No. 206 Stop Valve

Nos. 202 and 206 STOP VALES (Continued)



Exploded View of No. 202 Valve



Exploded View of No. 206 Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	202-A	Wheel	1
2	202-B	Stuffing Nut	1
3	202-C	Gland	1
4	202-D	Stem	1
5	202-E	Bonnet	1
6	202-F	Union Ring	1
7	202-G	Union Tail Piece	1
8	202-H	Disc Ring	1
9	202-J	Disc	1
10	202-K	Body	1
11	202-L	Wheel Nut ⅜"- 16 Std. Jam Type	1
12	202-M	Packing Ring	2

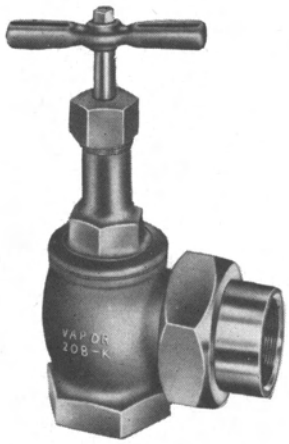
LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	206-A	Body	1
2	206-C	Bonnet	1
3	206-D	Stem	1
4	206-E	Valve	1
5	206-F	Stem Nut	1
6	206-G	Packing Nut	1
7	206-H	Handle	1
8	206-I	Nipple	1
9	206-J	Spanner Nut	1
10	206-K	Handle Nut (⅜" Hex.)	1
11	206-L	Packing Ring	1

PRINTED IN U S. A.

Nos. 208 and 211 STOP VALVES

INLET:	WEIGHT:	OUTLET:
No. 208—2″	No. 208—16 lbs.	No. 208—2″
No. 211—2″	No. 211—18¾ lbs.	No. 211—2″



No. 208 Stop Valve

GENERAL DESCRIPTION

Stop Valves of the No. 200 series are designed to provide a positive shut-off in the flow of high pressure steam. Primarily, these valves are intended for use on steam locomotives and steam generators, but they may also be used on any other high pressure steam line.

Both the No. 208 Stop Valve and the No. 211 Stop and Check Valve are built to withstand steam pressures up to 300 lbs. and both are used on railway equipment having a 2″ steam line. These valves are substantially made and particular attention has been given to the valve stems, which are extra heavy to prevent bending and are double threaded to permit quick opening or closing of the valves.

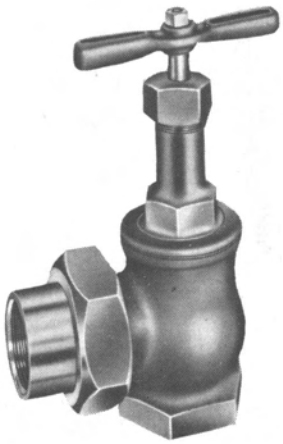
Each of these valves is designed for a particular purpose. The No. 208 Stop Valve is a high lift valve which permits a full flow of steam when it is open. It is furnished with either a 2″ female or a 2½″ male inlet and a 2″ outlet union tail piece for iron pipe, copper tube or I.P.S. copper tube. The No. 211 Stop and Check Valve has a built-in check feature which prevents a back flow of steam when the valve is open. It is furnished with a 2″ female inlet and a 2″ male outlet union tail piece of iron pipe. An exploded view of each valve is shown on page 2 for convenience in ordering replacement parts.

MAINTENANCE AND OVERHAUL

The Nos. 208 and 211 Stop Valves require very little maintenance. Steam leaking through the valve when it is closed is an indication that the valve is not seating properly. This condition may be caused by a worn seat or by the presence of dirt between the valve and seat (which may be blown out by turning the valve off and then on again). Steam leaking from around the stem is an indication that the valve needs repacking.

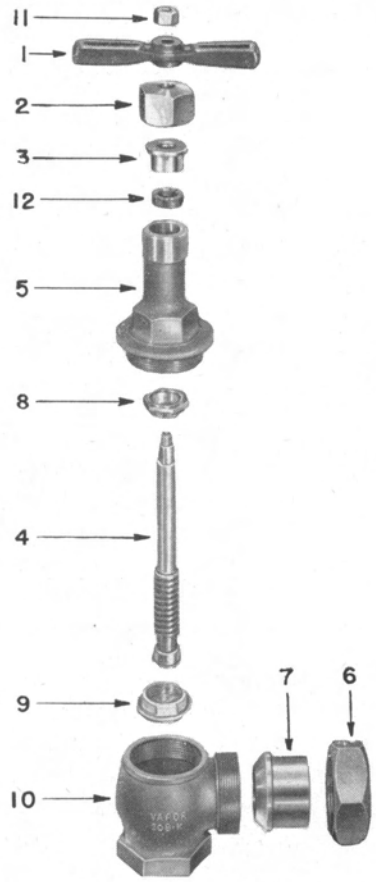
To disassemble either valve for overhaul, unscrew the handle nut, the packing nut, the bonnet and the union nut. Remove the stem and further disassemble the valve by unscrewing the stem nut from the valve.

Clean and inspect each part for wear. If the valve seat is badly worn or has become wire drawn it should be reground or replaced and packing which has become deteriorated should be renewed. Reassemble the valve and test it on a steam line for leakage before putting it back into service again.

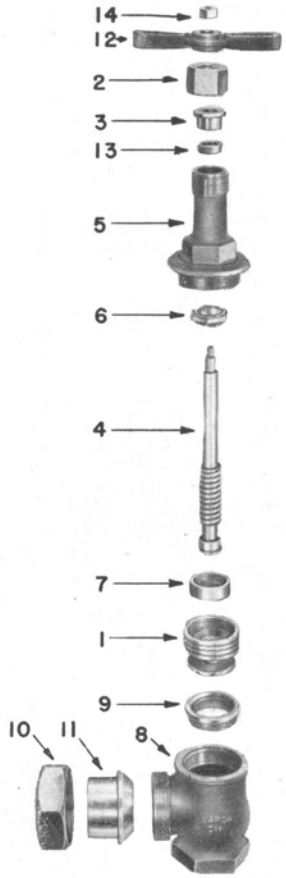


No. 211 Stop and Check Valve

NOS. 208 AND 211 STOP VALVES (Continued)



Exploded View of No. 208 Valve



Exploded View of No. 211 Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	206-H	Handle	1
2	208-B	Stuffing Box	1
3	208-C	Gland	1
4	208-D	Stem	1
5	208-E	Bonnet	1
6	235-20-M	Union Ring	1
7	235-19-M	Union Tail Piece (2″ Male Std. Pipe Thd.)	1
	208-G-1	Union Tail Piece (2″ O.D.C.T.)	
	208-G-2	Union Tail Piece (2″ I.P.S. Copper Tube)	
8	208-H	Disc Ring	1
9	208-J	Disc	1
10	208-K	Body (2″ Female Pipe Threads)	1
	208-K-1	Body (2½″ Male Pipe Threads)	
11	206-K	Handle Nut	1
12	S-211-5	Packing Ring	1

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	211-A	Disc	1
2	208-B	Stuffing Box	1
3	208-C	Gland	1
4	208-D	Stem	1
5	208-E	Bonnet	1
6	208-H	Disc Ring	1
7	211-J	Disc Stop	1
8	211-K	Body	1
9	211-L	Valve Seat	1
10	235-20-M	Union Ring	1
11	235-19-M	Union Tail Piece (2″ Male Std. Pipe Thd.)	1
12	206-H	Handle	1
13	208-M	Packing	1
14	206-K	Handle Nut	1

No. 210 STOP VALVE

INLET 2½" OR 3" AS SPECIFIED
UNION TAIL PIECE 2" TO 3" AS SPECIFIED

WEIGHT
35 LBS.

No. 210 Stop Valve

GENERAL DESCRIPTION

Stop Valves of the No. 200 series are designed to provide a positive shut-off in the flow of high pressure steam. Primarily, these valves are intended for use on steam locomotives and steam generators, but they may also be used on any high pressure steam line.

The No. 210 Stop Valve is built to withstand steam pressures up to 300 lbs. and is used on railway equipment having a 2½" steam line. This valve is substantially made and particular attention has been given to the valve stem, which is extra heavy to prevent bending and is double threaded to permit quick opening or closing of the valve.

This valve can be furnished with any one of three different bodies, providing for a 2½" male, a 2½" female or a 3" male inlet. The outlet union tail piece may be specified from any of eight available sizes. These union tail pieces are made for 2" or 2½" standard pipe and for 2¼", 2½", 2⅝", 2¾" or 2⅞" O.D. copper tubing. See parts list on page 2 for identification of these parts.

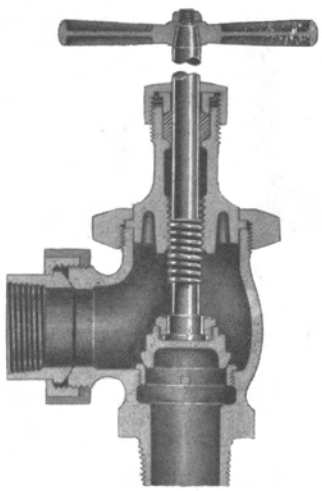
In design, the No. 210 Stop Valve is a high lift type of valve which permits a full flow of steam when it is open. An exploded view of the valve is shown on page 2 for convenience in ordering replacement parts.

MAINTENANCE AND OVERHAUL

The No. 210 Stop Valve requires very little maintenance. Steam leaking through the valve when it is closed is an indication that the valve is not seating properly. This condition may be caused by a worn seat or by the presence of dirt between the valve and seat (which may be blown out by turning the valve off and then on again). Steam leaking from around the stem is an indication that the valve needs repacking.

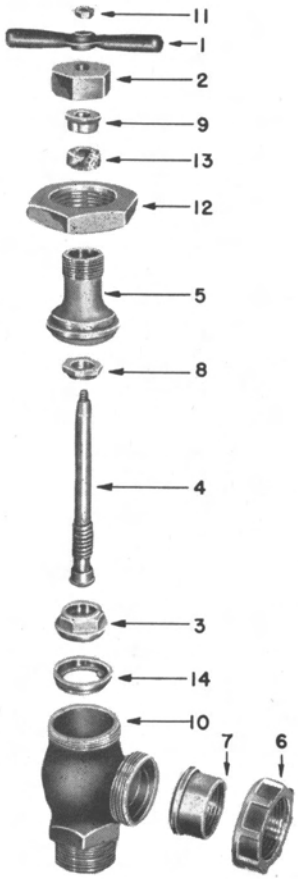
To disassemble the valve for overhaul, unscrew the handle nut, the packing nut, the bonnet and the union nut. Remove the stem and further disassemble the valve by unscrewing the stem nut from the valve.

Clean and inspect each part for wear. If the valve seat is badly worn or has become wire drawn it should be reground or replaced and packing which has become deteriorated should be renewed. Reassemble the valve and test it on a steam line for leakage before putting it back into service again.



Sectional View of No. 210 Valve

No. 210 STOP VALVE (Continued)



Exploded View of No. 210 Stop Valve

LIST OF PARTS

Sym.	Part No.	Description	Amt.
1	210-A	Handle	1
2	209-B	Stuffing Box	1
3	209-C	Disc	1
4	209-D	Stem	1
5	210-E	Bonnet	1
6	239-44	Union Ring	1
7	239-43	Union Tail Piece (2½" Female Std. P. Thd.)	1
	239-43-A	Union Tail Piece (2" Female Std. P. Thd.)	
	239-43-J	Union Tail Piece (2⅞" O.D.C.T.)	
	239-43-H	Union Tail Piece (2¾" O.D.C.T.)	
	239-43-B	Union Tail Piece (2⅝" O.D.C.T.)	
	239-43-E	Union Tail Piece (2½" O.D.C.T.)	
	239-43-C	Union Tail Piece (2¼" O.D.C.T.)	
	239-43-D	Union Tail Piece (2½" Male Std. P. Thds.)	
8	209-H	Disc Ring	1
9	1104-J	Gland	1
10	210-K	Body (Inlet 2½" Std. Male Pipe Thds.)	1
	210-K-1	Body (Inlet 2½" Female Pipe Thds.)	
	210-K-2	Body (Inlet 3" Std. Male Pipe Thds.)	
11	209-L	Handle Nut	1
12	210-M	Bonnet Ring	1
13	1104-N	Packing	1
14	210-P	Seat Ring	1

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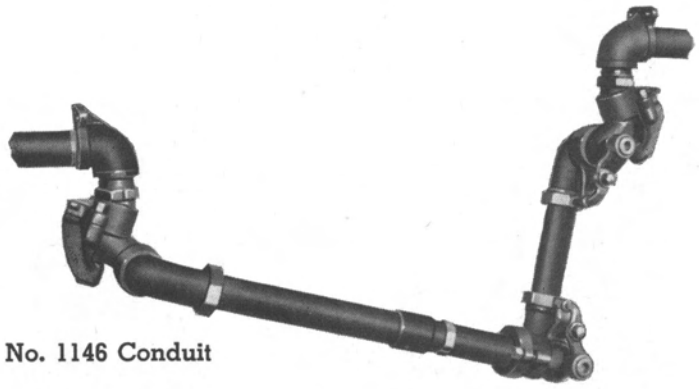
No. 1146 and No. 1146 STYLE 5

2" VAPOR SMOOTH BORE FLEXIBLE METALLIC CONDUITS

WEIGHT OF No. 1146 — 60 LBS. LESS PIPE

WEIGHT OF No. 1146 Style 5 — LBS.



No. 1146 Conduit

GENERAL DESCRIPTION

The No. 1146, two-inch Flexible Metallic Conduit is designed for use as a steam connection between locomotive and tender and uses the same flexible joints as the No. 1136 Conduit. The two-inch extra heavy wrought iron lap welded pipe between the joint units is not supplied by the Vapor Car Heating Co. The joints are furnished, however, with proper two-inch female threads, so that correct lengths of pipe may be made up for this connection to suit the requirements on each locomotive.

The No. 1146 Conduit can also be used as an oil conduit by substitution of special No. 1146-W-5 Gasket designed for use in oil line only.

The No. 1146 Style 5 Conduit is somewhat differently arranged and includes the indicated definite lengths of the two-inch extra heavy wrought iron lap welded pipe between the joint units. This conduit also includes insulation for the lengths of pipe indicated and comes equipped with safety chains. This conduit has been designed for use as a steam connection between units of diesel-electric locomotives.

APPLICATION

Before applying metallic conduits, the location of the end train pipe valves or elbows should be checked for proper distance from draw bars and also for rail clearance.

After having checked the location of end train valves and elbows, conduit should be screwed tightly into valve or elbow, and safety chain applied, where used, with not less than half inch slack.

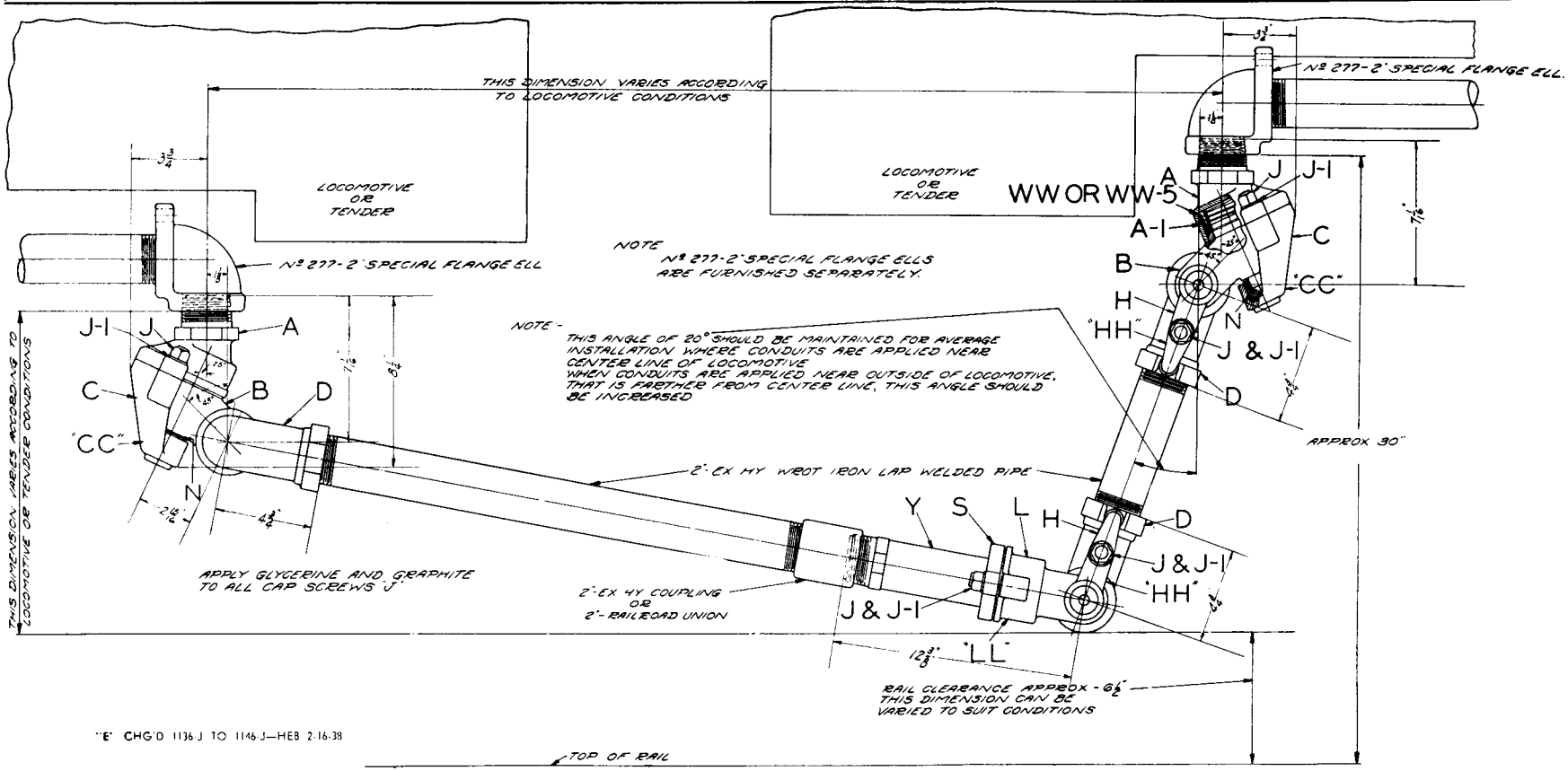
All cap screws have holes drilled through their hexagon head, so that they can be laced in place with wire to prevent the cap screws and studs from working loose and backing out, thus eliminating possibility of conduit separation on the road. This wire lacing should be particularly done when conduits are used on oil lines. On steam conduits, the lock washers provided under each cap screw should be sufficient to keep the screws from working loose.

No. 1146 FLEXIBLE METALLIC CONDUIT

LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T	MATERIAL
A	1136-A	Conduit End Valve Connector	2	M. I.
A-1	1136-A-1	Steel Bushing	5	Case Hard. Steel
B	1136-B	Upper Joint Body (Less Lug)	2	M. I.
C	1136-C	Upper Joint Body Clamp	2	M. I.
D	1146-D	Clamp Ell Casting	3	M. I.
H	1136-H	Clamp	3	M. I.
J	1146-J	Cap Screw, 5/8" U. S., 1 3/4" long	9	J. T. Ryerson Steel No. 2
J-1	1136-J-1	Lockwasher, 5/8" x 1/16" x 1/16"	9	Steel
L	1136-L	Lower Joint Body	1	M. I.
L-1	1136-L-1	Steel Bushing	1	Case Hard. Steel
N	1136-N	Renewable Thrust Bearing	5	Lubricat. Comp.
S	1136-S	Adapter Retaining Ring	1	M. I.
Y	1136-Y	Adapter	1	M. I.

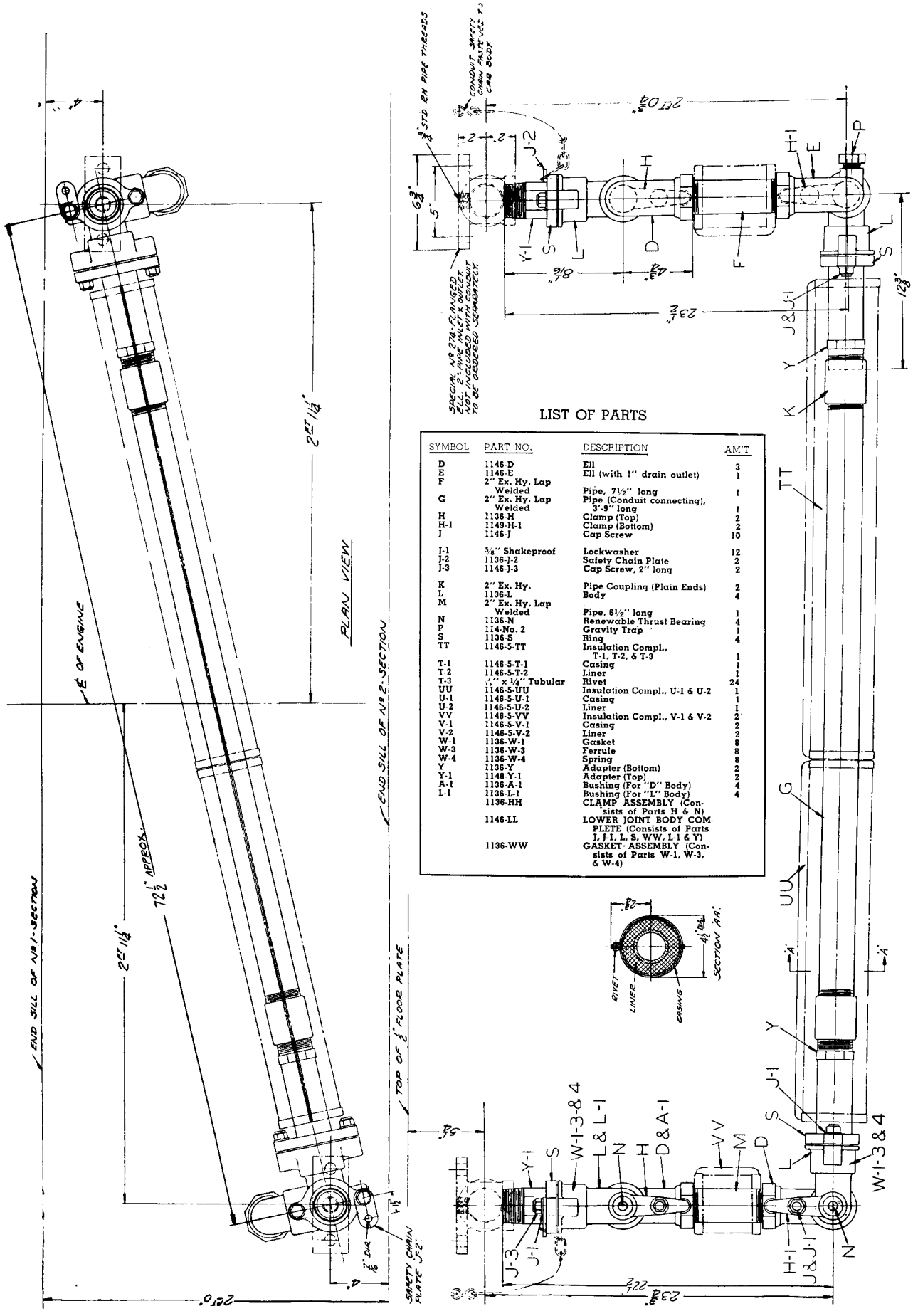
SYMBOL	PART NO.	DESCRIPTION	AM'T	MATERIAL
W-1	1136-W-1	Gasket for use in Steam Line Only	6	Moulded Comp.
W-3	1136-W-3	Gasket Ferrule	6	Steel
W-4	1136-W-4	Gasket Spring	6	Steel
CC	1136-CC	Upper Joint Body Clamp—Consists of Parts "C" and "N"		
HH	1136-HH	Clamp—Consists of Parts "H" and "N"		
LL	1146-LL	Lower Joint Body Complete—Consists of Parts "J," "J-1," "L," "L-1," "S" "WW" and "Y"		
WW	1136-WW	Gasket Assembly Complete—Consists of Parts "W-1," "W-3" and "W-4"		
W-5	1146-W-5	Special Gasket for use in Oil Line Only	6	Moulded Comp.
WW-5	1146-WW-5	Gasket Assembly Complete—Consists of Parts "W-5," "W-4," "W-3"		



"E" CHG'D 1136-J TO 1146-J—HEB 2-16-38

No. 1146 and No. 1146 Style 5 CONDUITS

No. 1146 STYLE No. 5 FLEXIBLE METALLIC CONDUIT



LIST OF PARTS

SYMBOL	PART NO.	DESCRIPTION	AM'T
D	1146-D	Ell	3
E	1146-E	Ell (with 1" drain outlet)	1
F	2" Ex. Hy. Lap Welded	Pipe, 7½" long	1
G	2" Ex. Hy. Lap Welded	Pipe (Conduit connecting), 3'-9" long	1
H	1136-H	Clamp (Top)	2
H-1	1149-H-1	Clamp (Bottom)	2
J	1146-J	Cap Screw	10
J-1	⅝" Shakeproof	Lockwasher	12
J-2	1136-J-2	Safety Chain Plate	2
J-3	1146-J-3	Cap Screw, 2" long	2
K	2" Ex. Hy.	Pipe Coupling (Plain Ends)	2
L	1136-L	Body	4
M	2" Ex. Hy. Lap Welded	Pipe, 6½" long	1
N	1136-N	Renewable Thrust Bearing	4
P	114-No. 2	Gravity Trap	1
S	1136-S	Ring	4
TT	1146-5-TT	Insulation Compl., T-1, T-2, & T-3	1
T-1	1146-5-T-1	Casing	1
T-2	1146-5-T-2	Liner	1
T-3	⅛" x ¼" Tubular	Rivet	24
UU	1146-5-UU	Insulation Compl., U-1 & U-2	1
U-1	1146-5-U-1	Casing	1
U-2	1146-5-U-2	Liner	1
VV	1146-5-VV	Insulation Compl., V-1 & V-2	2
V-1	1146-5-V-1	Casing	2
V-2	1146-5-V-2	Liner	2
W-1	1136-W-1	Gasket	8
W-3	1136-W-3	Ferrule	8
W-4	1136-W-4	Spring	8
Y	1136-Y	Adapter (Bottom)	2
Y-1	1148-Y-1	Adapter (Top)	2
A-1	1136-A-1	Bushing (For "D" Body)	4
L-1	1136-L-1	Bushing (For "L" Body)	4
	1136-HH	CLAMP ASSEMBLY (Consists of Parts H & N)	
	1146-LL	LOWER JOINT BODY COMPLETE (Consists of Parts J, J-1, L, S, WW, L-1 & Y)	
	1136-WW	GASKET ASSEMBLY (Consists of Parts W-1, W-3, & W-4)	

MAINTENANCE

When cars are in shops and at the beginning of the heating season, all metallic conduits should be inspected and tested and necessary repairs made, to put them in proper condition for service throughout the heating season.

ROUTINE INSPECTION RECOMMENDED: We recommend a routine inspection so that no part be overlooked which may cause train delays or expensive repairs later on.

Conduits should be completely dismantled by removing cap screws "J" on each clamp. Remove gaskets, ferrules, springs and thrust bearings.

Bearing surfaces and gasket cavities should be cleaned and polished with fine emery cloth.

Bearing cavities on all clamps should be cleaned out to proper diameter by reaming, and checked with gauges. Renew bearings if necessary and apply grease.

TO REMOVE BUSHINGS: Check gasket cavities with gauge. Any scored or damaged bushings should be replaced. The old bushings can be removed by passing the flame of an acetylene torch along the bushing. The bushing can then be knocked out. If a flame is not used, bushings can also be removed by use of a cape chisel, cutting down one side until bushing becomes loose enough to be removed.

The noses on the B and L castings should be refaced if required. Care should be taken when refacing, that no more metal is removed than necessary to smooth the surface. If the face of the nose is badly worn or damaged, so that considerable metal must be taken off, the shoulder should also be machined back to maintain the $1\frac{3}{32}$" dimension. If this is done it will be necessary to apply No. 1136-M Discs behind the N bearings in the clamps to compensate for the metal removed. It is important that $\frac{1}{32}$" space between the movable castings be maintained for free movement. A flat gauge with a throw-out dimension of $\frac{3}{8}$" can be used for checking the height of the nose on these castings. When the nose height becomes less than $\frac{3}{8}$" the castings should be scrapped.

The nose on the Y casting should be held within $\frac{1}{32}$" of its original height as there is no take-up feature on this casting. The diameter of the nose should be checked, and if less than 2.710" the casting should be scrapped.

Badly bent clamps or distorted body castings should be replaced. Slightly bent clamps can be straightened with fixture shown on Vapor Car Heating Co.'s drawing 31110.

Gaskets which have become hard, cracked or worn should be replaced. Gaskets which have given service through one heating season should be replaced. Old gasket ferrules may be used with new gaskets if they are not out of round and are in good condition otherwise. They may be straightened by use of a mandrel suitable for this work.

Gasket springs with a free height of less than $1\frac{3}{8}$" should be scrapped.

WHEN RE-ASSEMBLING be sure to apply lock washers "J-1" under heads of all cap screws "J." Cap screws should be cleaned so they will pull down tight. Use graphite and oil on threads.

If old insulation is in bad condition, new insulation should be applied and securely riveted.

After being assembled and tested, the conduits should be given one coat of body color and reapplied.

SPECIAL INSTRUCTIONS FOR APPLICATION OF GASKETS

Gaskets should be lubricated inside and outside before ferrule "W-3" is inserted. Then place spring "W-4" in ferrule and apply complete assembly in gasket cavity inserting spring end first so that wide face of gasket will bear against nose of opposing casting.

Lubricant should be "Superla 2-X," "No-Oxide-E" or equivalent. This lubricant should not be applied to gaskets until they are ready to be placed in conduit.

NOTE: If proper tools are not available for remachining castings, replacement of bushings, straightening clamps, etc., conduits requiring re-conditioning should be returned to the Vapor Car Heating Co. factory for this work.

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CONTROLS

THERMOSTATS
- Multiple Tube Types
- Single Tube Adjustable Types

CONTROL PANELS

REMOTE CONTROL SWITCHES

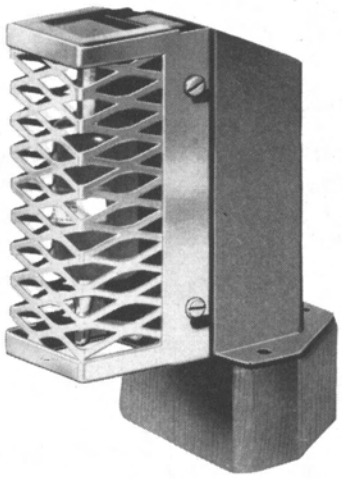
DAMPER MOTORS

AIR SELECTOR SWITCHES

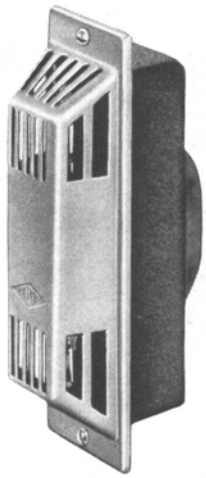
Printed in U. S. A.

2501 SERIES RADOR THERMOSTATS

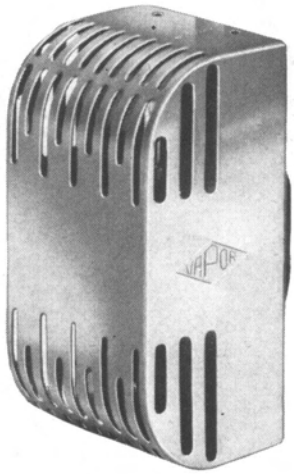
WEIGHT:	FSN-2501 THERMOSTAT 24 oz.	RN-2501 THERMOSTAT 13 oz.	WN2-2501 THERMOSTAT 24 oz.
	DN-2501 THERMOSTAT 12 oz.	WN-2501 THERMOSTAT 10 oz.	RWN-2501 THERMOSTAT 24 oz.



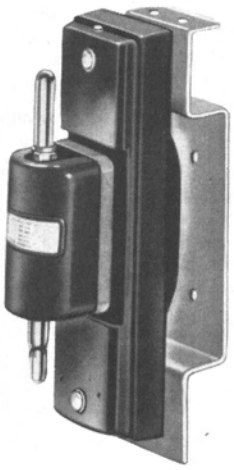
NO. FSN-2501 THERMOSTAT*
(For Floor Mounting)



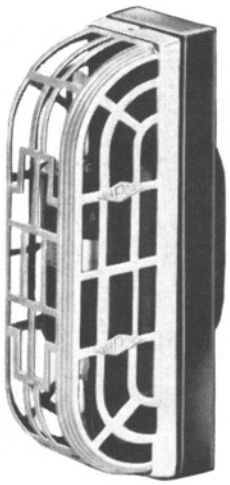
NO. RN-2501 THERMOSTAT*
(Recessed Type)



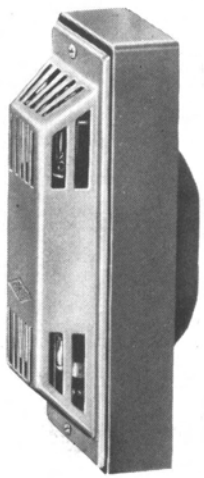
NO. WN2-2501 THERMOSTAT*
(For Wall Mounting)



NO. DN-2501 THERMOSTAT*
(For Duct Mounting)



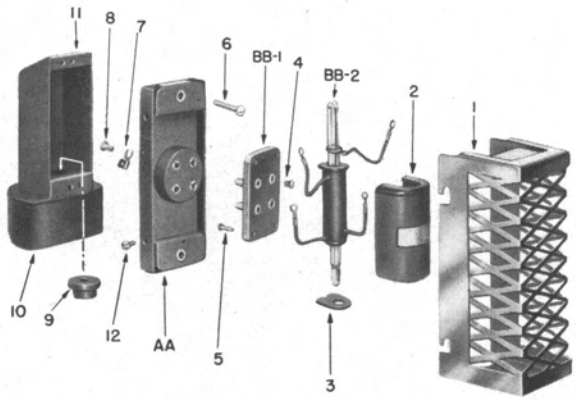
NO. WN-2501 THERMOSTAT*
(For Wall Mounting)



NO. RWN-2501 THERMOSTAT*
(For Wall Mounting)

*Specify desired setting when ordering replacement.

No. 2501 SERIES RADOR THERMOSTATS (Continued)



NO. FSN-2501 THERMOSTAT
(For Floor Mounting)

LIST OF PARTS

NO. FSN-2501 THERMOSTAT*
(For Floor Mounting)

Sym.	Part No.	Description	Amt.
1	FC-2501-E	Cover	1
--	N-2501-BB*	Tube Panel Assem. Complete	1
2	30611	Mounting Shield	1
BB-2	2501-BB-2*	Tube Complete (includes 1 of Sym. 3)	1
3	11218	Tube Support Washer	1
4	#4-36 R.H.x⅛"	Terminal Screw	4
BB-1	N-2501-BB-1	Tube Panel Assem.	1
5	#4-36 R.H.x5/16"	Mtg. Shield Anchor Screw	4
AA	FCN-2501-AA	Instrument Base Assem. Complete (includes 4 of Sym. 7 and 4 of Sym. 8)	1
6	#8-32-R.H.x¾"	Instrument Base Assem. Screw	2
7	1901-A-64	Terminal	4
8	#8-32-B.H.x¼"	Terminal Screw	4
9	1626-Y-2	Insulator	1
10	12617	Base	1
11	32292	Floor Thermostat Support	1
12	#6-32 B.H.x3/16"	Cover Screw	4

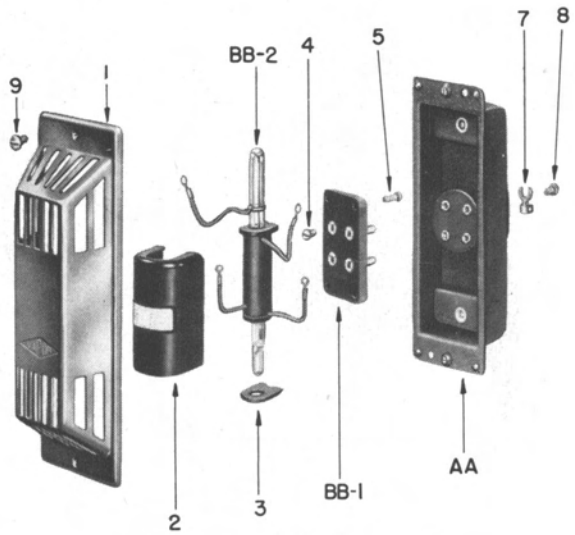
*Specify desired setting when ordering replacement.

LIST OF PARTS

NO. RN-2501 THERMOSTAT*
(Recessed Type)

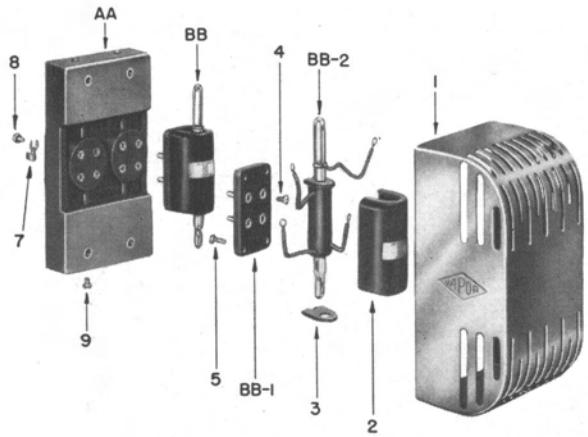
Sym.	Part No.	Description	Amt.
1	R-2501-C	Cover	1
--	N-2501-BB*	Tube Panel Assem. Comp.	1
2	30611	Mounting Shield	1
BB-2	2501-BB-2*	Tube Complete (includes 1 of Sym. 3)	1
3	11218	Tube Support Washer	1
4	#4-36 R.H.x⅛"	Terminal Screw	4
BB-1	N-2501-BB-1	Tube Panel Assem.	1
5	#4-36 R.H.x5/16"	Mtg. Shield Anchor Screw	4
AA	RN-2501-AA	Mounting Case Assem. (includes 4 of Sym. 7 and 4 of Sym. 8)	1
7	1901-A-64	Terminal	4
8	#8-32-B.H.x¼"	Terminal Screw	4
9	#6-32-B.H.x⅛"	Cover Screw	2

*Specify desired setting when ordering replacement.



NO. RN-2501 THERMOSTAT
(Recessed Type)

2501 SERIES RADOR THERMOSTATS (Cont'd)



WN2-2501 THERMOSTAT
(For Wall Mounting)

LIST OF PARTS

NO. WN2-2501 THERMOSTAT*
(For Wall Mounting)

Sym.	Part No.	Description	Amt.
1	31898	Cover	1
BB	N-2501-BB*	Tube Panel Assem. Complete	2
2	30611	Mounting Shield	2
BB-2	2501-BB-2*	Tube Complete (includes 1 of Sym. 3)	2
3	11218	Tube Support Washer	2
4	#4-36 R.H.x1/8"	Terminal Screw	8
BB-1	N-2501-BB-1	Tube Panel Assem.	2
5	#4-36 R.H.x5/16"	Mtg. Shield Anchor Screw	8
AA	WN2-2501-AA	Instrument Base Assembly (includes 8 of sym. 7 and 8 of sym. 8)	1
7	1901-A-64	Terminal	8
8	#8-32-B.H.x1/4"	Terminal Screw	8
9	#4-36-B.H.x3/16"	Cover Screw	2

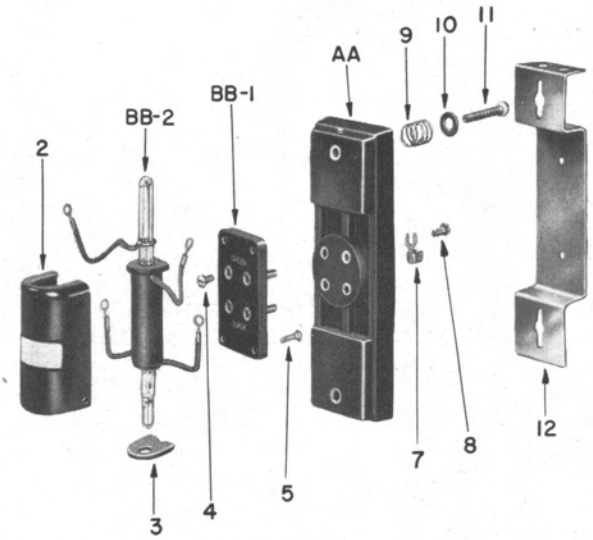
*Specify desired setting when ordering replacement.

LIST OF PARTS

NO. DN-2501 THERMOSTAT*
(For Duct Mounting)

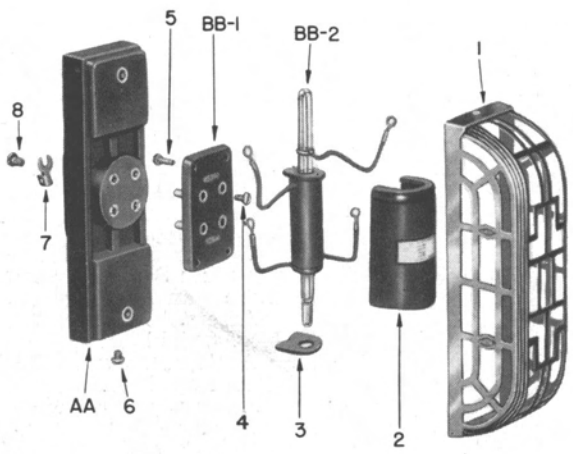
Sym.	Part No.	Description	Amt.
--	N-2501-BB*	Tube Panel Assem. Comp.	1
2	30611	Mounting Shield	1
BB-2	2501-BB-2*	Tube Complete (includes 1 of Sym. 3)	1
3	11218	Tube Support Washer	1
4	#4-36 R.H.x1/8"	Terminal Screw	4
BB-1	N-2501-BB-1	Tube Panel Assem.	1
5	#4-36 R.H.x5/16"	Mtg. Shield Anchor Screw	4
AA	DN-2501-AA	Instrument Base Assem. Complete (includes 4 of Sym. 7 and 4 of Sym. 8)	1
7	1901-A-64	Terminal	4
8	#8-32-B.H.x1/4"	Terminal Screw	4
9	13828	Mounting Bracket Spring	2
10	#14-9/16" O. D.	Mounting Bracket Washer	2
11	13841	Mounting Bracket Rivet	2
12	D-2501-DD	Mounting Bracket	1

*Specify desired setting when ordering replacement.



NO. DN-2501 THERMOSTAT
(For Duct Mounting)

2501 SERIES RADOR THERMOSTATS (Cont.)



NO. WN-2501 THERMOSTAT
(For Wall Mounting)

LIST OF PARTS

NO. WN-2501 THERMOSTAT*
(For Wall Mounting)

Sym.	Part No.	Description	Amt.
1	2500-N	Cover	1
--	N-2501-BB*	Tube Panel Assem. Complete	1
2	30611	Mounting Shield	1
BB-2	2501-BB-2*	Tube complete includes 1 of Sym. 3)	1
3	11218	Tube Support Washer	1
4	#4-36 R.H.x1/8"	Terminal Screw	4
BB-1	N-2501-BB-1	Tube Panel Assem.	1
5	#4-36 R. H.x5/16"	Mtg. Shield Anchor Screw	4
6	#4-36-B.H.x3/16"	Cover Screw	1
AA	N-2501-AA	Instrument Base Assem. Complete (includes 4 of Sym. 7 and 4 of Sym. 8)	1
7	1901-A-64	Terminal	4
8	#8-32-B.H.x1/4"	Terminal Screw	4

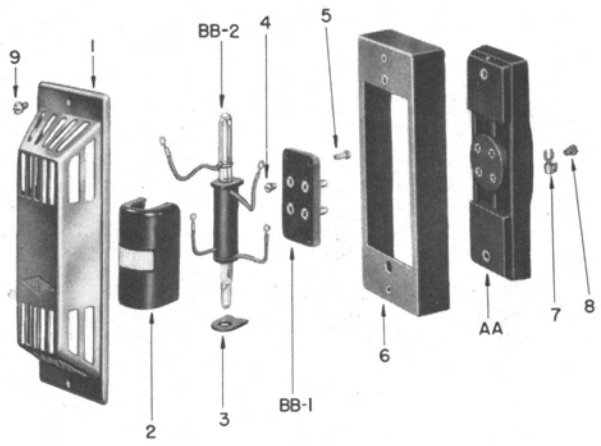
*Specify desired setting when ordering replacement.

LIST OF PARTS

NO. RWN-2501 THERMOSTAT*
(For Wall Mounting)

Sym.	Part No.	Description	Amt.
1	R-2501-C	Cover	1
--	N-2501-BB*	Tube Panel Assem. Complete	1
2	30611	Mounting Shield	1
BB-2	2501-BB-2*	Tube Complete (includes 1 of Sym. 3)	1
3	11218	Tube Support Washer	1
4	#4-36 R.H.x1/8"	Terminal Screw	4
BB-1	N-2501-BB-1	Tube Panel Assem.	1
5	#4-36 R.H.x5/16"	Mtg. Shield Anchor Screw	4
6	RW-2501-D	Adapter Mtg. Case Assem.	1
AA	N-2501-AA	Instrument Base Assem. (includes 4 of Sym. 7 and 4 of Sym. 8)	1
7	1901-A-64	Terminal	4
8	#8-32-B.H.x1/4"	Terminal Screw	4

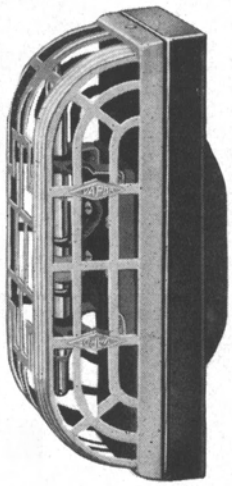
*Specify desired setting when ordering replacement.



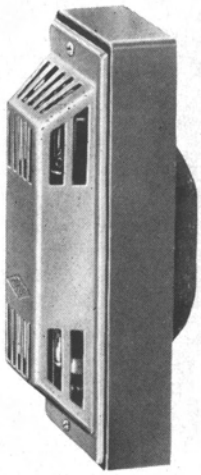
NO. RWN-2501 THERMOSTAT
(For Wall Mounting)

2522 SERIES THERMOSTATS

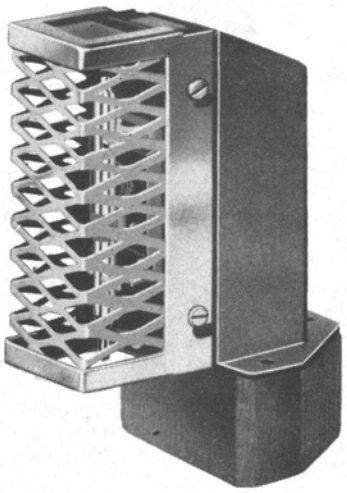
WEIGHT:	WN-2522-1 THERMOSTAT 10 oz. RN-2522-1 THERMOSTAT 13 oz.	RWN-2522-1 THERMOSTAT 24 oz. WN2-2501-22-1 THERMOSTAT 24 oz.	FSN-2522-1 THERMOSTAT 24 oz. DN-2522-1 THERMOSTAT 12 oz.



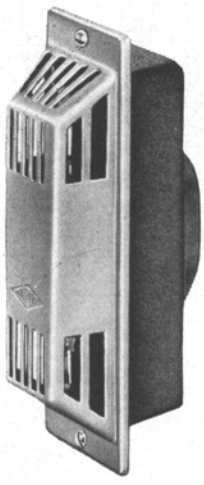
NO. WN-2522-1 THERMOSTAT*
(For Wall Mounting)



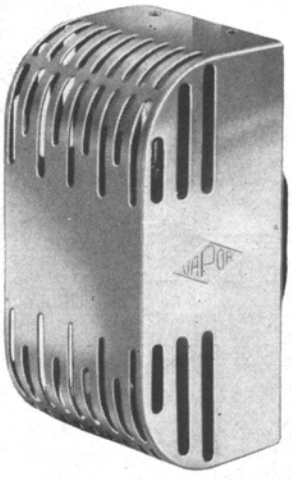
NO. RWN-2522-1 THERMOSTAT*
(For Wall Mounting)



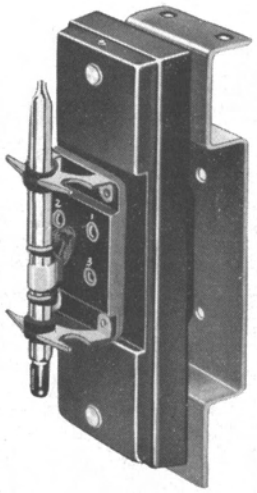
NO. FSN-2522-1 THERMOSTAT*
(For Floor Mounting)



NO. RN-2522-1 THERMOSTAT*
(Recessed Type)



NO. WN2-2501-22-1 THERMOSTAT*
(For Wall Mounting)



NO. DN-2522-1 THERMOSTAT*
(For Duct Mounting)

*Specify desired settings and number of tubes when ordering replacement.

Vapor RADOR ELECTRONIC
MODULATES
TEMPERATURES ALWAYS AT THE CONTROL POINT

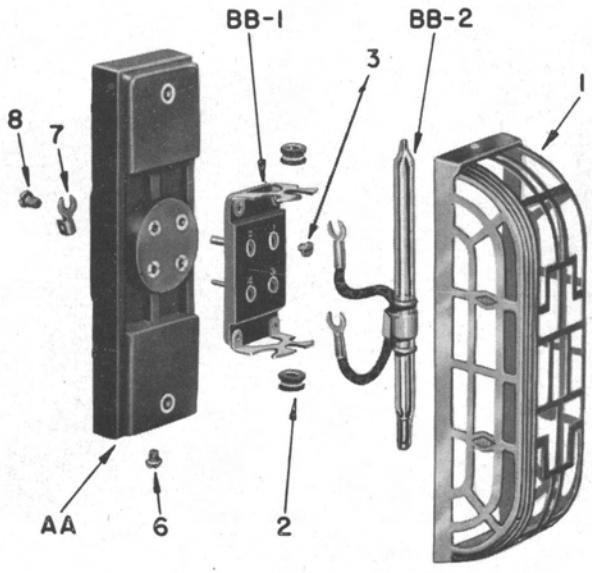
No. 2522 SERIES THERMOSTATS (Continued)

LIST OF PARTS

NO. WN-2522-1 THERMOSTAT*
(For Wall Mounting)

Sym.	Part No.	Description	Amt.
1	2500-N	Cover	1
—	N-2522-1-BB*	Tube Panel Assem. Complete	1
BB-2	2522-BB-2*	Tube	1
2	11220	Tube Spool	2
3	#4-36-R.H. x ⅛"	Terminal Screw	2
BB-1	N-2522-BB-1	Tube Panel Assem.	1
6	#4-36-B.H. x 3/16"	Cover Screw	1
AA	N-2501-AA	Instrument Base Assem. Complete (includes 4 of Sym. 7 and 4 of Sym. 8)	1
7	1901-A-64	Terminal	4
8	#8-32-B.H. x ¼"	Terminal Screw	4

*Specify desired setting when ordering replacement.



NO. WN-2522-1 THERMOSTAT
(For Wall Mounting)

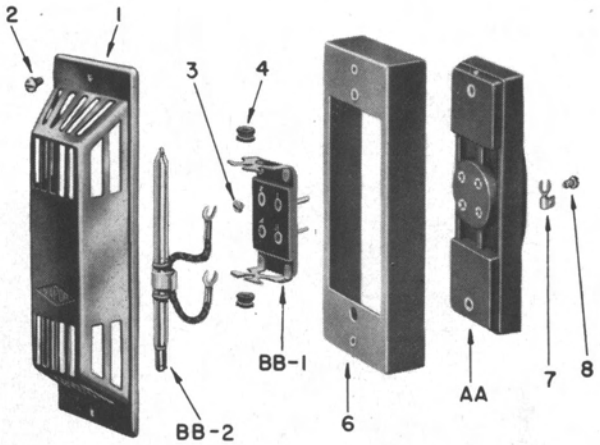
NO. WN-2522-2 includes two tubes
NO. WN-2522-1-1 includes two tubes
NO. WN-2522-3 includes three tubes

LIST OF PARTS

NO. RWN-2522-1 THERMOSTAT*
(For Wall Mounting)

Sym.	Part No.	Description	Amt.
1	R-2501-C	Cover	1
—	N-2522-1-BB*	Tube Panel Assem. Complete	1
BB-2	2522-BB-2*	Tube	1
3	#4-36-R.H. x ⅛"	Terminal Screw	2
4	11220	Tube Spool	2
BB-1	N-2522-BB-1	Tube Panel Assem.	1
2	#6-32-B.H. x ⅛"	Cover Screw	2
6	RW-2501-D	Adapter Mounting Case Assem.	1
AA	N-2501-AA	Instrument Base Assem. Complete (includes 4 of Sym. 7 and 4 of Sym. 8)	1
7	1901-A-64	Terminal	4
8	#8-32-B.H. x ¼"	Terminal Screw	4

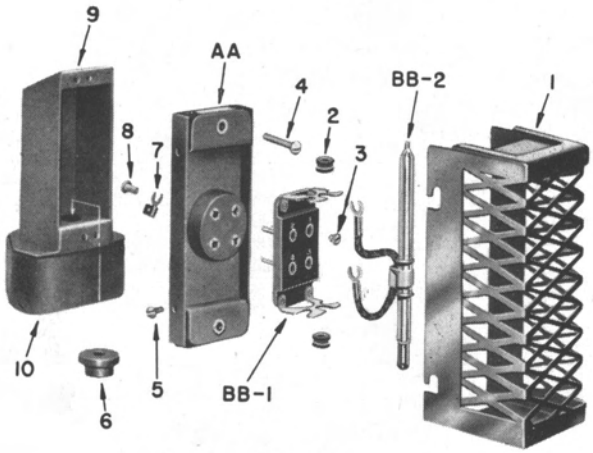
*Specify desired setting when ordering replacement.



NO. RWN-2522-1 THERMOSTAT
(For Wall Mounting)

NO. RWN-2522-2 includes two tubes
NO. RWN-2522-1-1 includes two tubes
NO. RWN-2522-3 includes three tubes

No. 2522 SERIES THERMOSTATS (Continued)



NO. FSN-2522-1 THERMOSTAT
(For Floor Mounting)

NO. FSN-2522-2 includes two tubes
NO. FSN-2522-1-1 includes two tubes
NO. FSN-2522-3 includes three tubes

LIST OF PARTS

NO. FSN-2522-1 THERMOSTAT*
(For Floor Mounting)

Sym.	Part No.	Description	Amt.
1	FC-2501-E	Cover	1
—	N-2522-1-BB*	Tube Panel Assem. Complete	1
BB-2	2522-BB-2*	Tube	1
2	11220	Tube Spool	2
3	#4-36 R.H. x ⅛"	Terminal Screw	2
BB-1	N-2522-BB-1	Tube Panel Assem.	1
4	#8-32 R.H. x ¾"	Instrument Base Assem. Screw	2
AA	FCN-2501-AA	Instrument Base Assem. Complete (includes 4 of Sym. 7 and 4 of Sym. 8)	1
7	1901-A-64	Terminal	4
8	#8-32-B.H. x ¼"	Terminal Screw	4
5	#6-32-B.H. x 3/16"	Cover Screw	4
6	1626-Y-2	Insulator	1
9	32292	Floor Thermostat Support	1
10	12617	Base	1

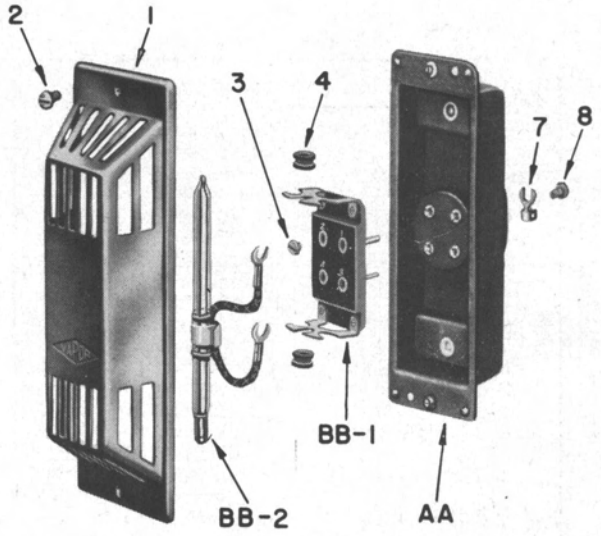
*Specify desired setting when ordering replacement.

LIST OF PARTS

NO. RN-2522-1 THERMOSTAT*
(Recessed Type)

Sym.	Part No.	Description	Amt.
1	R-2501-C	Cover	1
—	N-2522-1BB*	Tube Panel Assem. Complete	1
BB-2	2522-BB-2*	Tube	1
3	#4-36 R.H. x ⅛"	Terminal Screw	2
4	11220	Tube Spool	2
BB-1	N-2522-BB-1	Tube Panel Assem.	1
2	#6-32-B.H. x ⅛"	Cover Screw	2
AA	RN-2501-AA	Instrument Base Assem. Complete (includes 4 of Sym. 7 and 4 of Sym. 8)	1
7	1901-A-64	Terminal	4
8	#8-32-B.H. x ¼"	Terminal Screw	4

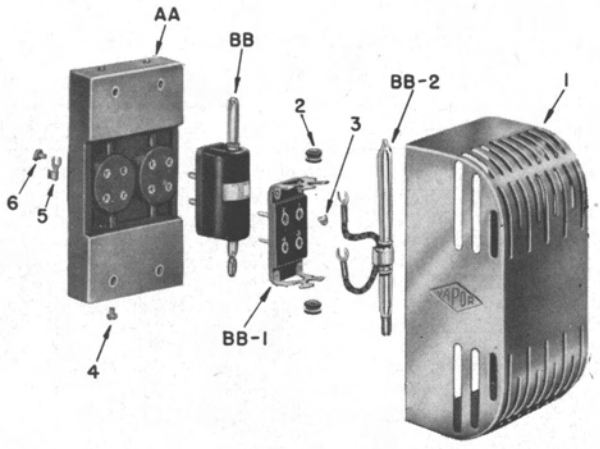
*Specify desired setting when ordering replacement.



NO. RN-2522-1 THERMOSTAT
(Recessed Type)

NO. RN-2522-2 includes two tubes
NO. RN-2522-1-1 includes two tubes
NO. RN-2522-3 includes three tubes

No. 2522 SERIES THERMOSTATS (Continued)



NO. WN2-2501-22-1 THERMOSTAT
(For Wall Mounting)

NO. WN2-2501-22-2 includes one No. N-2501-BB Assembly and one No. N-2522-2-BB Assembly

NO. WN2-2501-22-1-1 includes one No. N-2501-BB Assembly and one No. N-2522-1-1-BB Assembly

NO. WN2-2501-22-3 includes one No. N-2501-BB Assembly and one No. N-2522-3-BB Assembly.

LIST OF PARTS

NO. WN2-2501-22-1 THERMOSTAT*
(For Wall Mounting)

Sym.	Part No.	Description	Amt.
1	31898	Cover	1
BB	N-2501-BB*†	Tube Panel Assem. Complete	1
—	N-2522-1-BB*	Tube Panel Assem. Complete	1
BB-2	2522-BB-2*	Tube	1
3	#4-36-R.H. x ⅛"	Terminal Screw	2
2	11220	Tube Spool	2
BB-1	N-2522-BB-1	Tube Panel Assem.	1
4	#4-36-B.H. x 3/16"	Cover Screw	2
AA	WN2-2501-AA	Instrument Base Assem. (includes 8 of Sym. 7 and 8 of Sym. 8)	1
5	1901-A-64	Terminal	8
6	#8-32-B.H. x ¼"	Terminal Screw	8

*Specify desired setting when ordering replacement.

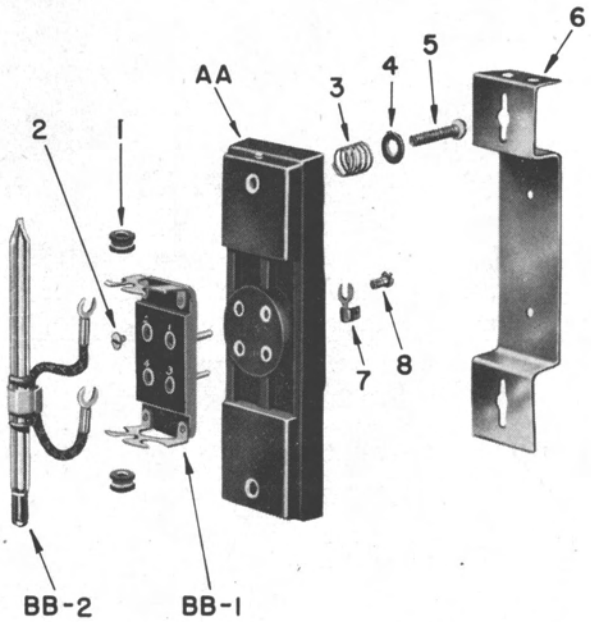
†See Bulletin 64-103 for parts of assembly.

LIST OF PARTS

NO. DN-2522-1 THERMOSTAT*
(For Duct Mounting)

Sym.	Part No.	Description	Amt.
—	N-2522-1-BB*	Tube Panel Assem. Complete	1
BB-2	2522-BB-2*	Tube	1
1	11220	Tube Spool	2
2	#4-36-R.H. x ⅛"	Terminal Screw	2
BB-1	N-2522-BB-1	Tube Panel Assem.	1
AA	DN-2501-AA	Instrument Base Assem. Complete (includes 4 of Sym. 7 and 4 of Sym. 8)	1
7	1901-A-64	Terminal	4
8	#8-32-B.H. x ¼"	Terminal Screw	4
3	13828	Mounting Bracket Spring	2
4	14-9/16" O.D.	Mounting Bracket Washer	2
5	13841	Mounting Bracket Rivet	2
6	D-2501-DD	Mounting Bracket	1

*Specify desired setting when ordering replacement.



NO. DN-2522-1 THERMOSTAT
(For Duct Mounting)

NO. DN-2522-2 includes two tubes
NO. DN-2522-1-1 includes two tubes
NO. DN-2522-3 includes three tubes

Nos. 9600, 9603 AND 9620 SERIES RADOR PLUG-IN THERMOSTATS

TYPE A—2 VANES
TYPE B—3 VANES
TYPE C—CLOSED
TYPE AA—2 VANE—EXTRA BRACKET

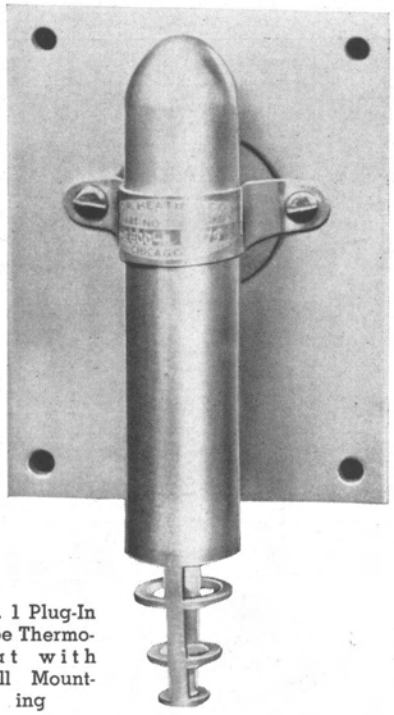


Fig. 1 Plug-In Type Thermostat with Wall Mounting

GENERAL DESCRIPTION

No. 9600 THERMOSTAT utilizes a double bulb, single contact tube assembly with a heat winding around the upper bulb. This is the unit most generally used for temperature control in railway cars.

No. 9603 THERMOSTAT utilizes a single bulb, single contact tube assembly with a heat winding around the bulb. This unit is used as a wattage regulator to maintain a constant wattage in car heating temperature control systems regardless of voltage variations in the current supply.

No. 9620 THERMOSTAT utilizes a single bulb, single contact tube assembly with no heat winding. This unit is used as a thermal switch—to energize or deenergize a flow of current only at a given temperature level. It is sometimes used to influence the action of a control thermostat.

These improved RADOR thermostats are a plug-in type and are designed for simple and rapid removal from a temperature control system for inspection and maintenance. Each thermostat is constructed with a four pronged plug which fits into a receptacle mounted on wall, floor or outdoor box. To prevent a loosened connection resulting from jar or vibration, the thermostat is also attached to the mounting by a bracket and two screws.

Like preceding RADOR thermostats, these units function essentially as thermally operated electrical switches, closing or opening the circuits which they control according to the height of the mercury column in the tube—which fluctuates with the rise and fall of the controlled temperature. The mercury column is one part of the circuit—the electrical contact in the tube at a fixed temperature level is the other. When the mercury column rises to meet the contact, the circuit is completed; when the mercury column recedes below this level, the circuit is broken.

RADOR thermostats are constructed so that their operating temperature may be adjusted to a lower point when required. A secondary bulb of mercury is located in the mercury column. It is wrapped with a winding of heat element wire and insulated from ambient temperature. When the operating temperature is to be lowered, electrical current applied to this winding produces heat to raise the mercury column above its ambient temperature level. Thus, because the top of the mercury column has, in this way, been raised to a position closer to the contact than it would normally be, a lesser rise in controlled temperature is required to cause the column to meet contact; the effect is that of lowering the operating temperature of the thermostat. This is important for proper adjustment of the temperature control system, in cases where settings for day and night

(Continued on Page 3)

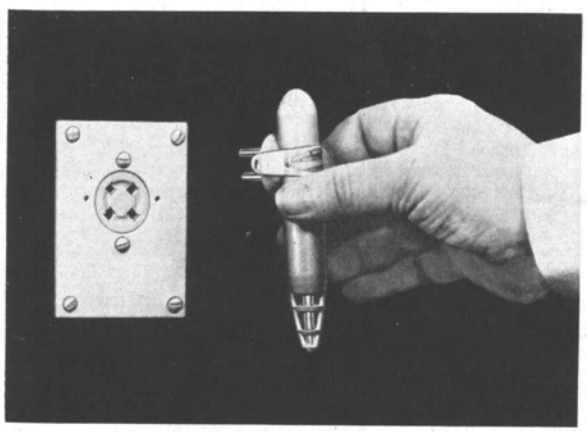


Fig. 2 Thermostat Easily Removable for Inspection and Maintenance

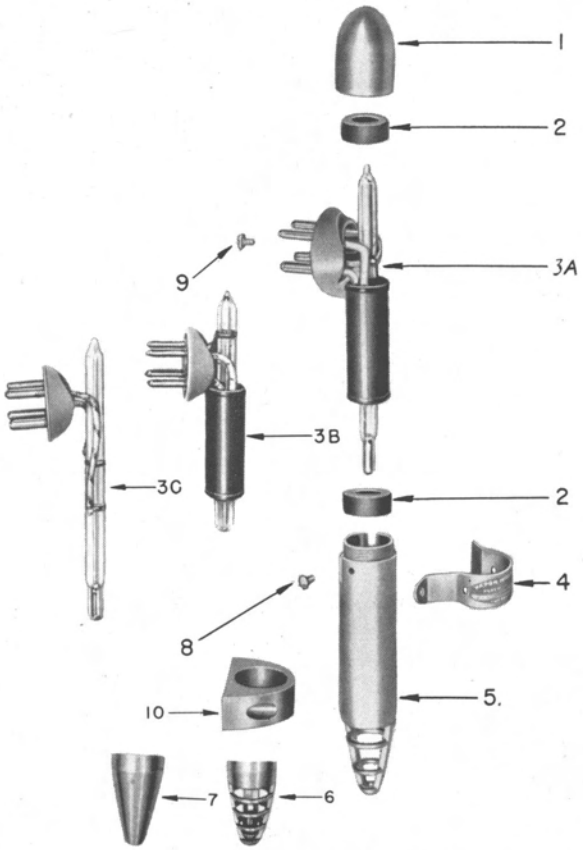


Fig. 3 Exploded View of Plug-In Thermostat

ORDERING INFORMATION

When reordering either a complete thermostat or a thermostat tube assembly, be sure to give the necessary specifications in order to assure shipment of the proper unit. The following information is needed:

(1) Prefix A, B, C or AA—
To indicate, when a complete thermostat is needed, whether a two vane (Sym. 5), three vane (Sym. 6) or closed (Sym. 7) case is desired or if an extra bracket (Sym. 10) is needed.

(2) Part Number—
(9600, 9603 or 9620)
To indicate whether the thermostat tube assembly of the required thermostat (see Syms. 3A, 3B and 3C) is for temperature control, wattage regulator or thermal switch use. (See explanation on page 1).

(3) Resistance of Winding—
(B) or (H) for 9600
(J) or (K) for 9603
No winding for 9620
To indicate required Ohmage of the heat winding (see Parts List—tube assemblies listed under Syms. 3A, 3B and 3C).

(4) Temperature Setting
(Location of fixed electrical contact)
To indicate the desired operating temperature of the thermostat. This data is given in degrees F.

EXAMPLE: A-9600-B (76°)—
indicates an order for a complete thermostat having a two vane casing, a control type element, a 600 Ohm resistance of the heat winding and a fixed setting (or control point) at 76°F.

9600-B-BB (76°)—
indicates a thermostat tube assembly for the same unit—no prefix required here. (See Parts List, Syms. 3A, 3B or 3C tube assemblies.)

LIST OF PARTS

9600 Series

Sym.	Part No.	Description	Amt. 2 Vane Lower Case Type A	3 Vane Lower Case Type B	Closed Lower Case Type C	Lower Case with Extra Bracket Type AA
1	46A304	Upper Case	1	1	1	1
2	49A561	Grommet	2	2	2	2
3A	9600(B)BB	Tube Assembly(*), 600 Ohm Winding	1	1	1	1
	9600(H)BB	Tube Assembly(*), 250 Ohm Winding	1	1	1	1
4	49A542	Bracket	1	1	1	1
5	46A303	Lower Case (2 Vanes)	1	—	—	1
6	49A318	Lower Case (3 Vanes)	—	1	—	—
7	49A317	Lower Case (Closed)	—	—	1	—
8	R3234x3/32"	Rivet (Bracket)	2	2	2	2
9	6-32x¼"	Screw, F.H.	1	1	1	1
10	49A299	Bracket (Extra)	—	—	—	1
†	6-32x⅛"	Screw (for Sym. 10)	—	—	—	2

9603 Series

1	46A304	Upper Case	1	1	1	1
2	49A561	Grommet	2	2	2	2
3B	9603(J)BB	Tube Assembly(*), 345 Ohm Winding	1	1	1	—
	9603(K)BB	Tube Assembly(*), 400 Ohm Winding	1	1	1	—
4	49A542	Bracket	1	1	1	1
5	46A303	Lower Case (2 Vanes)	1	—	—	1
6	49A318	Lower Case (3 Vanes)	—	1	—	—
7	49A317	Lower Case (Closed)	—	—	1	—
8	R3234x3/32"	Rivet (Bracket)	2	2	2	2
9	6-32x¼"	Screw, F.H.	1	1	1	1
10	49A299	Bracket (Extra)	—	—	—	1
†	6-32x⅛"	Screw (for Sym. 10)	—	—	—	2

9620 Series

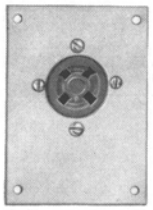
1	46A304	Upper Case	1	1	1	1
2	49A561	Grommet	2	2	2	2
3C	9620BB	Tube Assembly(*), No Winding	1	1	1	1
4	49A542	Bracket	1	1	1	1
5	46A303	Lower Case (2 Vanes)	1	—	—	1
6	49A318	Lower Case (3 Vanes)	—	1	—	—
7	49A317	Lower Case (Closed)	—	—	1	—
8	R3234x3/32"	Rivet (Bracket)	2	2	2	2
9	6-32x¼"	Screw, F.H.	1	1	1	1
10	49A299	Bracket (Extra)	—	—	—	1
†	6-32x⅛"	Screw (for Sym. 10)	—	—	—	2

NOTES:

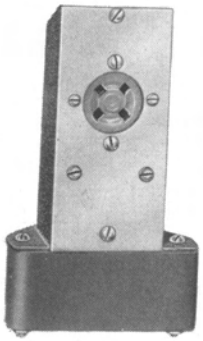
(1)* Specify required temperature settings of thermostat tube.

(2)† Not shown in illustration.

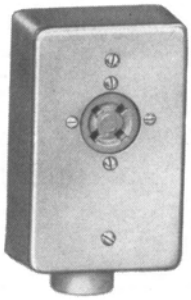
THERMOSTAT MOUNTINGS



No. 9500-1 (Wall)



No. 9506 (Floor)



No. 9505 (Outdoor)

MOUNTINGS equipped with receptacles are not supplied with the thermostats and must be ordered separately. For wall mounting the No. 9500 mounting plate is used (with suffix-1, -2, -3 or -4 indicating one, two, three or four receptacles on a single plate). For certain cases where added sturdiness in wall mounting is required a No. 9500-1A plate is used which contains additional holes punched to receive the screws for the extra bracket on the AA type thermostat. For floor mounting a No. 9506 floor mounting assembly is used. This mounting contains a cover plate in which the holes for the bracket of the AA type thermostat are punched, so that this type thermostat may be used if desired. For outdoor mounting the No. 9505 weatherproof outside box is available. These mountings are illustrated on page 4. Note that because of their size and shape the cover plate assemblies of the floor and outdoor mountings are not interchangeable with the wall mountings. These parts are shown in the illustrations and parts lists on page 4 of this bulletin.

(Continued from Page 1)

must differ. In addition, the intermittent application of this heat produces a cycling of the thermostat to stabilize the controlled temperature at a definite level, with practically no fluctuation.

Because of the wide variety of uses to which they may be put, these plug-in type thermostats are available with several specifiable features. The casing which houses the thermostat tube (see parts list) is available with two vanes, three vanes or closed. Any of these can be furnished with an added bracket for extra security in mounting. The tube assembly (see parts list) may be selected from any of three types. The resistance of the heat winding may be specified in accordance with the requirements of the application. And the operating temperature of the thermostat (location of the fixed electrical contact in the tube) must be determined according to the intended application and so specified. For complete information concerning these four selectable modifications, refer to parts list, illustrations and data on page 2 of this bulletin.

MAINTENANCE AND OVERHAUL

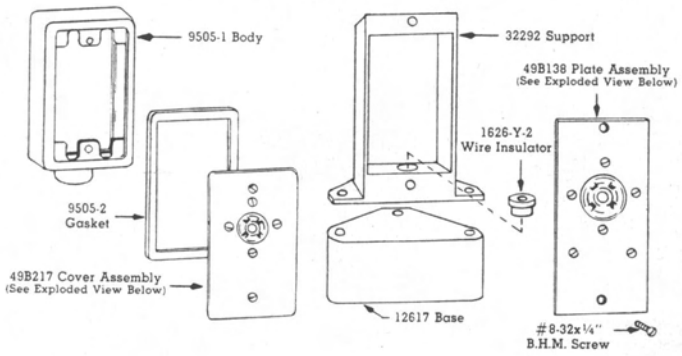
These thermostats seldom require servicing; there are, however, cases in which the wiring or contacts become loose or burned after long service. Should the thermostat become inoperative, it should be disassembled and the tube assembly tested. Replace the tube assembly if it cannot be repaired.

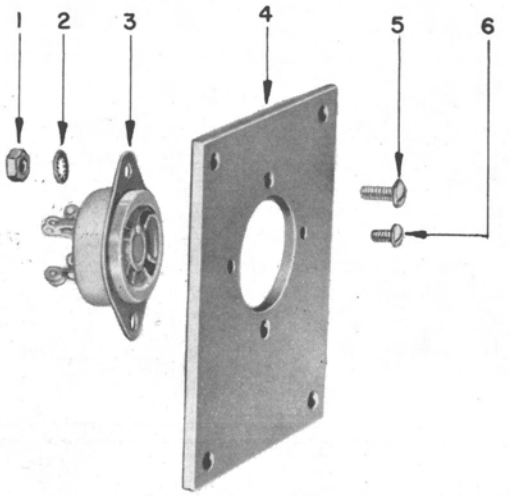
To take out the tube assembly, for testing, unscrew the top of the case (Sym. 1) and remove the upper grommet (Sym. 2). To remove the tube assembly (Sym. 3A, 3B or 3C) grasp the glass tube (not the connector plug) and pull straight out. Do not attempt to loosen the tube assembly by working it back and forth as this procedure might break the glass tube.

After the tube assembly has been tested and repaired or replaced the unit may be reassembled. If the grommets have become hardened they should be replaced.

If the lower grommet is removed, it can be replaced with a special tool which can be made up—having a diameter slightly less than that of thermostat case, with a small projection on one end which is slightly less in diameter than that of the hole in the grommet. Using this tool, the grommet should be seated on the projection and pushed into the case so that the grommet assumes a flat position at the lower end of the case; the tool may then be easily withdrawn.

To facilitate reassembly, place one drop of glycerine on the inner diameter of the upper grommet. For the lower grommet, the glycerine may be applied to the tube itself (**only** between the two bulbs), care being taken not to permit any of the glycerine to remain on bulb since it would collect dust and form a film over the bulb to prevent accurate operation of the thermostat.





Sym.	Part No.	Description	Amt. 9500—1	9500—2	9500—3	9500—4	9500—1A	9505	9506
1	#6-32	Hex Nut	2	4	6	8	2	2	2
2	#1206	Lockwasher (S.P.)	2	4	6	8	2	2	2
3	46A292-1	Connector Socket	1	2	3	4	1	1	1
4	49A266	Mounting Plate (Wall)	1	—	—	—	—	—	—
	49A267	Mounting Plate (Wall)	—	1	—	—	—	—	—
	48A1068	Mounting Plate (Wall)	—	—	1	—	—	—	—
	49A268	Mounting Plate (Wall)	—	—	—	1	—	—	—
	49A266-1	Mounting Plate (Wall)	—	—	—	—	1	—	—
	49A321	Cover Mtg. Plate (Outdoor)	—	—	—	—	—	1	—
	49A328	Cover Mtg. Plate (Floor)	—	—	—	—	—	—	1
†	49A322	Gasket (For Outdoor Mtg.)	—	—	—	—	—	1	—
†	#6-32x⅜"	Screw, R.H.M. (For Mounting Extra Bracket)	—	—	—	—	2	—	2
5	#6-32x⅜"	Screw, R.H.M.	2	4	6	8	2	2	2
6	#4-40x¼"	Screw, B.H.	2	4	6	8	2	2	2
	49B217	Cover Plate Assembly Comp., Outdoor Mtg.	—	—	—	—	—	1	—
	49B138	Cover Plate Assembly Comp., Floor Mtg.	—	—	—	—	—	—	1

NOTE: † Not Shown in Illustration

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Nos. 2535 AND C-2535 THERMOSTAT TEST METERS

No. 2535 WEIGHT: Approx. 1½ Lb. No. C-2535 WEIGHT: Approx. 1 Lb.

No. C-2535 TEST METER

GENERAL DESCRIPTION

The Vapor Heating Corporation has developed a small, compact meter for testing the setting and operation of single or double bulb Vapor Thermostats used in railway car temperature control systems. The No. C-2535 Test Meter (which supersedes the earlier No. 2535 Test Meter) is of a streamlined design and is very easily operated. The case is fabricated from sheet aluminum, which provides strength, durability and the utmost in lightness of weight.

The use of this test meter offers a great saving in time and trouble in railway yards, carbuilder's shops and other shops where car temperature control systems are installed or serviced. The meter is similar to a very high resistance volt meter, but is equipped with a specially calibrated scale so that the amount of adjustment of the thermostat may be read directly in degrees Fahrenheit. Thus, there is no possibility of error in calculation as might be the case if a volt meter were used (requiring conversion of a reading in millivolts). To compensate for voltage variations and to provide for adjustment to any voltage conditions (when the operator is not sure of exact voltage in a circuit) the test meter is equipped with a manually variable compensating resistance in its circuit.

After the resistance in the circuit under test has been shorted out, the knob on the meter should be adjusted until the pointer rests on a pre-determined check point. Then the short circuited resistance is again placed in the circuit and the reading of the meter is observed. This degree value, subtracted from the degree value etched upon the thermostat tube, will give the operating temperature of that thermostat under a given selector switch setting. Keep in mind that when testing double bulb thermostats, it is also necessary to check their adjustment resistors and the circuit as well. Complete instructions for testing are shown on page 2 of this bulletin.

No. 2535 THERMOSTAT TEST METER

Nos. 2535 AND C-2535 TEST METERS (Cont.)

INSTRUCTIONS FOR USING TEST METER

All types of Vapor Thermostat Test Meters operate in the same manner. However, the type of control panel under test will determine the proper method of adjusting the meter to the check point.

READ CAREFULLY

PROCEDURE FOR ADJUSTING TEST METER FOR TESTING POST-WAR CONTROL PANELS HAVING "MT" TERMINALS

When the control panel under test is of the post-war type, equipped with MT (Meter Test) terminals, place the test meter across the MT terminals. Then adjust the meter to the 32, 64 or 110 volt check point depending upon the nominal battery voltage of the car under test. The test meter is adjusted to test any circuit on that particular car and the leads of the meter may be moved from point to point to test any other circuit in that car without further adjustment of the meter. Place the test meter leads across the winding of any car thermostat which is to be tested and check the reading. Follow the same procedure with other thermostats to be tested.

TO CHECK RESISTOR IN OVERHEAD HEAT CIRCUITS ON COMPENSATED CONTROL

1. Remove OC cycling resistor for circuit to be tested.
2. Connect meter leads to OTA and OTA on panel, observing the polarity and reverse, if necessary.
3. Set air conditioning control switch to low position and with a small piece of wire short out OL resistor, as indicated on left side of meter and then turn the small knob at bottom of meter until pointer goes to proper check point for the voltage being used. Note: *Do not change this setting while checking all the remaining circuits in this car.* If the meter pointer stays at zero, it indicates reversed polarity or open circuit in resistor or wiring. If the pointer swings over to the exteme right hand side, it indicates an open circuit in the adjustor winding on the thermostat tube.
4. Remove the jumper wire on OL resistor as indicated in note on right side of knob and meter will then indicate the number of degrees the resistor has lowered the operating temperature of the thermostat for low position on air conditioning control switch. If thermostat tube is 76° (indicated by etching near top of tube) and is supposed to operate at 71° in low position of switch, the meter should indicate a temperature set down of 5° for the resistor.
5. Turn air conditioning control switch to each of its other positions and observe the temperature reduction for each circuit comparing with requirements.
6. Replace cycling resistor and note its effect on any one of the various positions by pulling in and out the overhead valve relay. It will vary the temperature indication above and below the actual resistor setting, as it cycles. If pointer on meter scale does not vary the degree indication during the time that the overhead heat valve relay is pulled in and out, the overhead heat cycling resistor may be open or may be burned out.

TO CHECK RESISTOR ON FLOOR HEAT CIRCUITS ON COMPENSATED CONTROL

7. Follow same procedure as outlined for overhead heat, removing all FC cycling resistors for these circuits and connecting meter leads to 1TA and 1TA or 2TA and 2TA, etc.

FOR CHECKING CORRELATIVE CONTROL CIRCUITS

1. Connect meter leads to the terminals supplying the heater windings of the various circuits as outlined in compensating control instructions.
2. Remove cycling resistor for that particular circuit.
3. Check overhead heat and floor heat thermostats with the heat cycling relay in the de-energized position.
4. Replace all cyling resistors, after check of these circuits. Then check floor heat cycling resistors similarly to overhead heat cycling resistors.
5. Check the master heat thermostat with the heat cycling relay in the de-energized position.
6. Check Cooling Master Thermostat and cooling control thermostat with the cooling cycling relay in energized position.

Be sure that all resistors are mounted securely in their proper positions.

NOTE: If mercury in thermostat tube is split, tube will not operate at proper temperature, although the adjustment resistors may be indicated as O. K. by the test meter.

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RESISTOR TABLES

THERMOSTAT ADJUSTMENT RESISTORS FOR VAPOR AUTOMATIC CONTROLS

Temp. Reduction Below Thermq Tube Marking	PART NUMBERS OF RESISTORS USED WITH ONE DOUBLE BULB THERMOSTAT HAVING A 600 OHM WINDING								
	24 Volts Without Ballast	28 Volts Without Ballast	32 Volts Without Ballast	48 Volts Without Ballast	56 Volts Without Ballast	64 Volts Without Ballast	96 Volts Without Ballast	110 Volts Without Ballast	125 Volts Without Ballast
1°	2550-AL	2550-AJ	2550-AJ	2550-AF	2550-AE	2550-AE	2550-AD	2550-AD	2550-AC
2°	2550-AP	2550-AN	2550-AM	2550-AH	2550-AG	2550-AF	2550-AE	2550-AD1	2550-AD
3°	2550-AR	2550-AP	2550-AO	2550-AK	2550-AH	2550-AG	2550-AE2	2550-AE	2550-AD2
4°	2550-AT	2550-AR	2550-AQ	2550-AL	2550-AK	2550-AH	2550-AF	2550-AE1	2550-AE
5°	2550-AU	2550-AS	2550-AR	2550-AM	2550-AL	2550-AJ	2550- AG	2550-AF	2550-AE1
6°	2550-AW	2550-AT	2550-AS	2550-AN	2550-AM	2550-AK	2550-AG2	2550-AF1	2550- AF
7°	2550-AX	2550-AV	2550-AT	2550-AO	2550-AN	2550-AL	2550-AG4	2550-AF3	2550-AF1
8°	2550-AY	2550-AW	2550-AU	2550-AP	2550-AN1	2550-AM	2550-AH	2550-AG2	2550-AF2
9°	2550-AZ	2550-AW1	2550-AV	2550-AP1	2550-AO	2550-AM1	2550-AH2	2550-AG3	2550- AG
10°	2550-BA	2550-AX	2550-AW	2550-AQ	2550-AO1	2550-AN	2550-AJ	2550-AG4	2550-AG1
11°	2550-BB	2550-AY	2550-AW1	2550-AR	2550-AP	2550-AN2	2550-AJ1	2550-AH1	2550-AG2
12°	2550-BC	2550-AZ	2550-AX	2550-AR1	2550-AP1	2550-AN3	2550-AJ3	2550-AH2	2550-AG3
13°	2550-BD	2550-AZ1	2550-AY	2550-AR2	2550-AQ	2550-AO	2550-AK	2550-AJ	2550-AG4
14°	2550-BD1	2550-BA	2550-AY1	2550-AS	2550-AQ1	2550-AO2	2550-AK1	2550-AJ1	2550-AH
15°	2550-BE	2550-BA2	2550-AZ	2550-AS1	2550-AR	2550-AP	2550-AL	2550-AJ2	2550-AH2
16°	2550-BG	2550-BB	2550-AZ1	2550-AT	2550-AR1	2550-AP1	2550-AL1	2550-AJ3	
17°	2550-BF	2550-BC	2550-BA	2550-AT1	2550-AR2	2550-AQ		2550-AK	2550-AJ
18°	2550-BF1	2550-BD	2550-BA1	2550-AU	2550-AS	2550-AQ1	2550-AL2	2550-AK1	
19°	2550-BG2	2550-BD1	2550-BA2	2550-AU1		2550-AQ2	2550-AM		2550-AJ1
20°	2550-BH	2550-BE	2550-BB	2550-AV	2550-AS1	2550-AR	2550-A N	2550-AL	2550-AJ2
21°	2550-BH1					2550-AR1		2550-AL1	2550-AJ3
22°	2550-BH2	2550-BE1	2550-BB1	2550-AV1	2550-AT	2550-AR2	2550-AN1		2550-AK
23°	2550-BJ	2550-BF	2550-BC1					2550-AL2	
24°	2550-BK	2550-BF1	2550-BD	2550-AW	2550-AT1	2550-AS	2550-AN2		2550-AK1
25°	2550-BL	2550-BG	2550-BE	2550-AW	2550-AU	2550-AS1	2550-AN3	2550-AM	2550-AL
30°	2550-BN1	2550-BJ	2550-BF	2550-AX1	2550-AV1	2550-AT1	2550-AO	2550-AN1	2550-AL2
35°	2550-CA1	2550-BL	2550-BH	2550-AZ	2550-AW1	2550-AU1	2550-AP1	2550-AN3	2550-AM1
40°	2550-CD	2550-BN1	2550-BJ	2550-BA	2550-AX1	2550-AV1	2550-AQ1	2550-AO1	2550-AN1

RESISTOR TABLES (Continued)

Temp. Reduction Below Thermo Tube Marking	PART NUMBERS OF RESISTORS USED WITH TWO DOUBLE BULB THERMOSTATS HAVING 600 OHM WINDINGS CONNECTED IN PARALLEL								
	24 Volts Without Ballast	28 Volts Without Ballast	32 Volts Without Ballast	48 Volts Without Ballast	56 Volts Without Ballast	64 Volts Without Ballast	96 Volts Without Ballast	110 Volts Without Ballast	125 Volts Without Ballast
1°	2550-AR2	2550-AQ	2550-AO1	2550-AK1	2550-AJ	2550-AH	2550-AF	2550-AE1	2550-AE
2°	2550-AV1	2550-AT1	2550-AS	2550-AN3	2550-AM	2550-AL	2550-AG4	2550-AG	2550-AF1
3°	2550-AY	2550-AW	2550-AU1	2550-AQ	2550-AO	2550-AL2	2550-AJ1	2550-AH	2550-AG2
4°	2550-BA	2550-AY	2550-AW1	2550-AR2	2550-AQ	2550-AO1	2550-AK1	2550-AJ1	2550-AH1
5°	2550-BB1	2550-AZ1	2550-AX1	2550-AT	2550-AR1	2550-AP1	2550-AL2	2550-AK	2550-AJ1
6°	2550-BD1	2550-BA2	2550-AZ	2550-AT1	2550-AS	2550-AQ2	2550-AN	2550-AL1	2550-AJ3
7°	2550-BE1	2550-BC	2550-BA	2550-AV	2550-AT	2550-AR1	2550-AN1	2550-AL2	2550-AK1
8°	2550-BF1	2550-BD	2550-BA2	2550-AV1		2550-AS	2550-AN3	2550-AN	2550-AL1
9°	2550-BG1	2550-BE	2550-BB1	2550-AW1	2550-AU	2550-AT	2550-AO1	2550-AN1	2550-AM
10°	2550-BH1	2550-BF	2550-BD	2550-AX	2550-AV	2550-AT1	2550-AP	2550-AN2	2550-AM1
11°	2550-BH2	2550-BF1	2550-BE	2550-AX1	2550-AV1	2550-AU	2550-AP1	2550-AO	2550-AN
12°	2550-BJ1	2550-BG1	2550-BE1	2550-AY	2550-AW	2550-AU1	2550-AQ	2550-AO1	2550-AN1
13°	2550-BK	2550-BH	2550-BF	2550-AY1	2550-AW1	2550-AV	2550-AQ1	2550-AP	2550-AN2
14°	2550-BL	2550-BH1	2550-BF1	2550-AZ	2550-AX	2550-AV1	2550-AR	2550-AP1	2550-AO
15°	2550-BM	2550-BH2	2550-BG	2550-BA	2550-AY	2550-AW	2550-AR1	2550-AQ	2550-AO1

Temp. Reduction Below Thermo Tube Marking	PART NUMBERS OF RESISTORS USED WITH THREE DOUBLE BULB THERMOSTATS HAVING 600 OHM WINDINGS CONNECTED IN SERIES								
	24 Volts Without Ballast	28 Volts Without Ballast	32 Volts Without Ballast	48 Volts Without Ballast	56 Volts Without Ballast	64 Volts Without Ballast	96 Volts Without Ballast	110 Volts Without Ballast	125 Volts Without Ballast
1°	2550-AO	2550-AM	2550-AK	2550-AF3	2550-AF	2550-AE1	2550-AD1	2550-AD	2550-AD
2°	2550-AU	2550-AR1	2550-AP	2550-AJ2	2550-AH	2550-AG1	2550-AE	2550-AD2	2550-AD1
3°	2550-AZ1	2550-AV1	2550-AS1	2550-AM	2550-AK	2550-AH2	2550-AF	2550-AE1	2550-AD2
4°	2550-BE1	2550-AZ	2550-AV1	2550-AO	2550-AM	2550-AK	2550-AF3	2550-AF	2550-AE1
5°	2550-BL	2550-BD	2550-AY1	2550-AQ	2550-AN2	2550-AL2	2550-AG3	2550-AF2	2550-AF
6°	2550-CD	2550-BG2	2550-BB	2550-AR2	2550-AO2	2550-AN	2550-AH2	2550-AG1	2550-AF1
7°	2550-CV	2550-BM	2550-BE	2550-AT	2550-AQ1	2550-AN3	2550-AJ	2550-AG3	2550-AF3
8°		2550-CC	2550-BH	2550-AU	2550-AR1	2550-AP	2550-AJ2	2550-AH2	2550-AG2
9°		2550-CR	2550-BL	2550-AV1	2550-AS1	2550-AQ	2550-AK	2550-AJ	2550-AG4
10°			2550-CA	2550-AW1	2550-AT1	2550-AR	2550-AL	2550-AJ1	2550-AH
11°			2550-CK	2550-AY	2550-AU	2550-AR2	2550-AL2	2550-AJ3	2550-AH2
12°			2550-CV	2550-AZ	2550-AV1	2550-AS1	2550-AM	2550-AK1	2550-AJ
13°				2550-BA1	2550-AW1	2550-AT	2550-AN	2550-AL	2550-AJ1
14°				2550-BB1	2550-AX	2550-AU	2550-AN1	2550-AL1	2550-AJ3
15°				2550-BD1	2550-AY1	2550-AV	2550-AN2	2550-AM	2550-AK

RESISTOR TABLES (Continued)

Temp. Reduction Below Thermo Tube Marking	PART NUMBERS OF RESISTORS USED WITH					
	One Double Bulb Thermostat With 250 Ohm Winding		Two Double Bulb Thermostats With 250 Ohm Winding Connected In Parallel		Three Double Bulb Thermostats With 250 Ohm Winding Connected In Series	
	12 Volts Without Ballast	16 Volts Without Ballast	12 Volts Without Ballast	16 Volts Without Ballast	12 Volts Without Ballast	16 Volts Without Ballast
1°	2550-AV	2550-AT	2550-BC1	2550-BA	2550-AZ	2550-AW
2°	2550-AZ1	2550-AX	2550-BH1	2550-BE1	2550-BH	2550-BC1
3°	2550-BD	2550-BA	2550-BK	2550-BH	2550-BP	2550-BH1
4°	2550-BE1	2550-BB1	2550-BN	2550-BJ1	2550-CJ	2550-BN1
5°	2550-BG	2550-BD1	2550-BO	2550-BL	2550-CV	2550-CC
6°	2550-BH1	2550-BE1	2550-CA	2550-BN		2550-CM
7°	2550-BJ1	2550-BF1	2550-CB	2550-BO		2550-CV
8°	2550-BL	2550-BG2	2550-CC	2550-BO1		
9°	2550-BM	2550-BH1	2550-CD	2550-CA		
10°	2550-BN	2550-BJ1	2550-CE	2550-CA1		
11°	2550-BN1	2550-BK	2550-CF	2550-CB		
12°	2550-BO1	2550-BL	2550-CH	2550-CC		
13°	2550-BP	2550-BM	2550-CJ	2550-CD		
14°	2550-CA1	2550-BN	2550-CK			
15°	2550-CB	2550-BN1	2550-CL	2550-CE		
16°	2550-CC	2550-BO	2550-CM	2550-CF		
17°	2550-CC1	2550-BO1	2550-CN	2550-CH		
18°	2550-CD	2550-BP	2550-CO			
19°	2550-CE	2550-CA	2550-CP	2550-CJ		
20°	2550-CF	2550-CA1	2550-CQ	2550-CK		
21°	2550-CH	2550-CB	2550-CR	2550-CL		
22°	2550-CJ		2550-CS			
23°	2550-CK	2550-CC	2550-CT	2550-CM		
24°	2550-CL	2550-CC1	2550-CU	2550-CN		
25°	2550-CM	2550-CD	2550-CV	2550-CN1		
30°	2550-CR	2550-CK		2550-CU		

RESISTOR TABLES (Continued)

OHMIC VALUES FOR NO. 2550 SERIES RESISTORS

*2550-AB	55,000	2550-AO	3,000	2550-BA	920	2550-CA	225
*2550-AC	30,000	2550-AO1	2,900	2550-BA1	890	2550-CA1	210
2550-AD	20,000	2550-AO2	2,800	2550-BA2	840	2550-CB	200
2550-AD1	17,000	2550-AP	2,700	2550-BB	800	2550-CC	179
2550-AD2	13,000	2550-AP1	2,600	2550-BB1	775	2550-CC1	165
2550-AE	12,000	2550-AQ	2,500	2550-BC	750	2550-CD	160
2550-AE1	11,000	2550-AQ1	2,400	2550-BC1	725	2550-CE	147
2550-AE2	10,000	2550-AQ2	2,300	2550-BD	700	2550-CF	135
2550-AF	9,000	2550-AR	2,250	2550-BD1	675	2550-CH	125
2550-AF1	8,500	2550-AR1	2,200	2550-BE	650	2550-CJ	115
2550-AF2	8,000	2550-AR2	2,100	2550-BE1	600	2550-CK	105
2550-AF3	7,700	2550-AS	2,000	2550-BF	560	2550-CL	98
2550-AG	7,500	2550-AS1	1,900	2550-BF1	540	2550-CM	90
2550-AG1	7,300	2550-AT	1,800	2550-BG	520	2550-CN	83
2550-AG2	7,000	2550-AT1	1,700	2550-BG1	500	2550-CN1	80
2550-AG3	6,800	2550-AU	1,600	*2550-BG2	500	2550-CO	77
2550-AG4	6,400	2550-AU1	1,550	2550-BH	470	2550-CP	72
2550-AH	6,100	2550-AV	1,500	2550-BH1	450	2550-CQ	67
2550-AH1	6,000	2550-AV1	1,425	2550-BH2	425	2550-CR	62
2550-AH2	5,800	2550-AW	1,350	2550-BJ	410	2550-CS	58
2550-AJ	5,400	2550-AW1	1,275	2550-BJ1	400	2550-CT	54
2550-AJ1	5,200	2550-AX	1,200	2550-BK	380	2550-CU	50
2550-AJ2	5,000	2550-AX1	1,150	2550-BL	350	2550-CV	47
2550-AJ3	4,900	2550-AY	1,100	2550-BM	320		
2550-AK	4,700	2550-AY1	1,050	2550-BN	300		
2550-AK1	4,500	2550-AZ	1,000	2550-BN1	280		
2550-AL	4,300	2550-AZ1	960	2550-BO	260		
2550-AL1	4,100			2550-BO1	250		
2550-AL2	3,950			2550-BP	230		
2550-AM	3,800						
2550-AM1	3,650						
2550-AN	3,500						
2550-AN1	3,350						
2550-AN2	3,200						
2550-AN3	3,100						

2570 Resistor is Superceded by 2550-BO1
2571 Resistor is Superceded by 2550-BE1
2572 Resistor is Superceded by 2550-AO
2573 Resistor is Eliminated
2574 Resistor is Eliminated
2575 Resistor is Superceded by 2550-CD
2576 Resistor is Superceded by 2550-CC
2577 Resistor is Superceded by 2550-BN
2578 Resistor is Superceded by 2550-CN1
2579 Resistor is Superceded by 2550-AH1
2581 Resistor is Superceded by 2550-AE
2582 Resistor is Eliminated
2583 Resistor is Superceded by 2550-BG1
2584 Resistor is Superceded by 2550-AZ
2585 Resistor is Superceded by 2550-AV
2586 Resistor is Superceded by 2550-AS
*2587 Resistor is Superceded by 2550-BG2

*Resistor is 1-3/4" long

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RESISTOR TABLES

THERMOSTAT ADJUSTMENT RESISTORS FOR VAPOR AUTOMATIC CONTROLS

Temp. Reduction Below Thermo Tube Marking	PART NUMBERS OF RESISTORS USED WITH TWO DOUBLE BULB THERMOSTATS HAVING 600 OHM WINDINGS CONNECTED IN SERIES								
	24 Volts Without Ballast	28 Volts Without Ballast	32 Volts Without Ballast	48 Volts Without Ballast	56 Volts Without Ballast	64 Volts Without Ballast	96 Volts Without Ballast	110 Volts Without Ballast	125 Volts Without Ballast
1°	2550-AM1	2550-AL	2550-AJ1	2550-AF1	2550-AE2	2550-AE1	2550-AD1	2550-AD	2550-AC
2°	2550-AR1	2550-AP	2550-AN1	2550-AJ	2550-AG3	2550-AF2	2550-AD2	2550-AD1	2550-AD
3°	2550-AU	2550-AS	2550-AQ	2550-AL	2550-AJ1	2550-AH	2550-AF	2550-AE1	2550-AE
4°	2550-AX	2550-AU	2550-AR2	2550-AM1	2550-AL	2550-AJ1	2550-AF1	2550-AE2	250-AE1
5°	2550-AZ1	2550-AW1	2550-AU	2550-AO	2550-AL2	2550-AK1	2550-AG1	2550-AF1	2550-AE2
6°	2550-BC	2550-AY	2550-AW	2550-AP	2550-AN1	2550-AL1	2550-AG4	2550-AF2	2550-AF
7°	2550-BJ1	2550-BA	2550-AX	2550-AQ1	2550-AO	2550-AM	2550-AH2	2550-AG2	2550-AF1
8°		2550-BC	2550-AY	2550-AQ2	2550-AP	2550-AN1	2550-AJ	2550-AG4	2550-AG
9°		2550-BD1	2550-AZ1	2550-AS	2550-AQ	2550-AO	2550-AJ1	2550-AH	2550-AG2
10°			2550-BA2	2550-AS1	2550-AQ2	2550-AO1	2550-AJ3	2550-AH2	2550-AG3
11°			2550-BC	2550-AT1	2550-AR1	2550-AP1	2550-AK	2550 AJ	2550-AG4
12°			2550-BD1	2550-AU	2550-AS	2550-AQ	2550-AL	2550AJ1	2550-AH
13°				2550-AV	2550-AS1	2550-AS1	2550-AL1	2550-AK	2550-AH2
14°				2550-AW	2550-AT	2550-AT	2550-AL2	2550-AK1	2550-AJ
15°				2550-AW1	2550-AT1	2550-AU	2550-AM1	2550-AL	2550-AJ1

THERMOSTAT ADJUSTMENT RESISTORS, BALLAST RESISTORS AND CYCLING RESISTORS FOR VAPOR COMPENSATING AND CORRELATIVE CONTROLS

Temperature Reduction Below Thermostat Tube Marking	PART NUMBERS OF RESISTORS USED ON:			
	24 volts with Ballast	**32** volts with Ballast	**64** volts with Ballast	**125** volts with Ballast
1°	**2550**-AL	**2550**-AJ	**2550**-AE	**2550**-AD
2°	**2550**-AR	**2550**-AN	**2550**-AG	**2550**-AE
3°	**2550**-AT	**2550**-AP	**2550**-AJ	**2550**-AF
4°	**2550**-AV	**2550**-AR	**2550**-AL	**2550**-AG
5°	**2550**-AX	**2550**-AS	**2550**-AM	**2550**-AH
6°	**2550**-AY	**2550**-AT	**2550**-AO	**2550**-AJ
7°	**2550**-BA	**2550**-AV	**2550**-AP	**2550**-AK
8°	**2550**-BC	**2550**-AW	**2550**-AQ	**2550**-AL
9°	**2550**-BD	**2550**-AX	**2550**-AR	**2550**-AM
10°	**2550**-BE	**2550**-AY	**2550**-AS	**2550**-AN
11°	**2550**-BG	**2550**-AZ	**2550**-AT	**2550**-AO
12°	**2550**-BH	**2550**-BA	**2550**-AU	**2550**-AP
13°	**2550**-BJ		**2550**-AV	**2550**-AQ
14°	**2550**-BK	**2550**-BB	**2550**-AW	**2550**-AR
15°	**2550**-BM	**2550**-BC	**2550**-AX	**2550**-AS
16°	**2550**-BN	**2550**-BD	**2550**-AY	
17°	**2550**-BO	**2550**-BE	**2550**-AZ	**2550**-AT
18°	**2550**-BP		**2550**-BA	**2550**-AU
19°	**2550**-CC	**2550**-BF		**2550**-AV
20°	**2550**-CD	**2550**-BG	**2550**-BC	**2550**-AW
21°	**2550**-CF		**2550**-BD	**2550**-AX
22°	**2550**-CJ	**2550**-BH	**2550**-BE	**2550**-AY
23°	**2550**-CL		**2550**-BF	**2550**-AZ
24°	**2550**-CO	**2550**-BJ	**2550**-BG	**2550**-BA
25°	**2550**-CR	**2550**-BK	**2550**-BH	**2550**-BB
26°		**2550**-BL	**2550**-BJ	**2550**-BD
27°		**2550**-BN	**2550**-BL	**2550**-BE
28°			**2550**-BM	**2550**-BF
29°		**2550**-BO	**2550**-BN	
30°			**2550**-BP	**2550**-BJ
31°				**2550**-BL
32°				**2550**-BN
33°				**2550**-BP
35°				
40°				
"B" Ballast Resistor	**2550**-BN	**2550**-BN	**2550**-AV	**2550**-AO
"OC" Overhead Heat Cycling Resistor.		**2550**-AJ	**2550**-AE	**2550**-AD
"FC" Floor Heat Cycling Resistor.....		**2550**-AC	**2550**-AB	**2550**-AA*

NOTE: *On 125 volts use two No. 2550-AB Resistors in series to get equivalent of No. 2550-AA for floor heat cycling.

Order Resistors by Part Numbers, in accordance with the number of degrees of temperature reduction desired from thermostat tube marking, and in accordance with the voltage of the temperature control panel.

For example: (1) Where a Ballast resistor is used, to adjust a 76° thermostat tube to control at 71° on 32 volts, use Resistor No. 2550-AS.

(2) With a Ballast resistor used, to adjust a 76° thermostat tube to control at 71° on 64 volts, use Resistor No. 2550-AM.

Circuits should be checked with Vapor Test Meter No. C-2535 or equivalent.

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RESISTOR TABLES

THERMOSTAT ADJUSTMENT RESISTORS FOR VAPOR AUTOMATIC CONTROLS

Temperature Reduction Below Thermostat Tube Marking	PART NUMBERS OF RESISTORS USED ON:								
	12 to **14** volts without Ballast	**24** volts without Ballast	**28** volts without Ballast	**32** volts without Ballast	**48** volts without Ballast	**56** volts without Ballast	**64** volts without Ballast	**96** volts without Ballast	**125** volts without Ballast
1°	**2550**-BC	**2550**-AL	**2550**-AJ	**2550**-AJ	**2550**-AF	**2550**-AE	**2550**-AE	**2550**-AD	**2550**-AC
2°	**2550**-BH	**2550**-AP	**2550**-AN	**2550**-AM	**2550**-AH	**2550**-AG	**2550**-AF	**2550**-AE	**2550**-AD
3°	**2550**-BL	**2550**-AR	**2550**-AP	**2550**-AO	**2550**-AK	**2550**-AH	**2550**-AG		
4°	**2550**-BN	**2550**-AT	**2550**-AR	**2550**-AQ	**2550**-AL	**2550**-AK	**2550**-AH	**2550**-AF	**2550**-AE
5°	**2550**-BO	**2550**-AU	**2550**-AS	**2550**-AR	**2550**-AM	**2550**-AL	**2550**-AJ	**2550**-AG	
6°	**2550**-CA	**2550**-AW	**2550**-AT	**2550**-AS	**2550**-AN	**2550**-AM	**2550**-AK		**2550**-AF
7°	**2550**-CB	**2550**-AX	**2550**-AV	**2550**-AT	**2550**-AO	**2550**-AN	**2550**-AL		
8°	**2550**-CC	**2550**-AY	**2550**-AW	**2550**-AU	**2550**-AP		**2550**-AM	**2550**-AH	
9°	**2550**-CD	**2550**-AZ		**2550**-AV		**2550**-AO			**2550**-AG
10°	**2550**-CE	**2550**-BA	**2550**-AX	**2550**-AW	**2550**-AQ		**2550**-AN	**2550**-AJ	
11°	**2550**-CF	**2550**-BB	**2550**-AY		**2550**-AR	**2550**-AP			
12°	**2550**-CH	**2550**-BC	**2550**-AZ	**2550**-AX					
13°	**2550**-CJ	**2550**-BD		**2550**-AY		**2550**-AQ	**2550**-AO	**2550**-AK	
14°	**2550**-CK		**2550**-BA		**2550**-AS				**2550**-AH
15°	**2550**-CL	**2550**-BE		**2550**-AZ		**2550**-AR	**2550**-AP	**2550**-AL	
16°	**2550**-CM		**2550**-BB		**2550**-AT				
17°	**2550**-CN	**2550**-BF	**2550**-BC	**2550**-BA			**2550**-AQ		**2550**-AJ
18°	**2550**-CO	**2550**-BG	**2550**-BD		**2550**-AU	**2550**-AS			
19°	**2550**-CP							**2550**-AM	
20°	**2550**-CQ	**2550**-BH	**2550**-BE	**2550**-BB	**2550**-AV		**2550**-AR	**2550**-AN	
21°	**2550**-CR								
22°	**2550**-CS					**2550**-AT			**2550**-AK
23°	**2550**-CT	**2550**-BJ	**2550**-BF						
24°	**2550**-CU	**2550**-BK					**2550**-AS		
25°	**2550**-CV	**2550**-BL	**2550**-BG	**2550**-BE	**2550**-AW				**2550**-AL
26°						**2550**-AU			
27°		**2550**-BM	**2550**-BH						
28°						**2550**-AV			
29°		**2550**-BN					**2550**-AT		
30°			**2550**-BJ		**2550**-AX			**2550**-AO	**2550**-AM
31°									
32°									
33°									
35°				**2550**-BH					
40°				**2550**-BJ					

NOTE: Circuits should be checked with Vapor Test Meter No. **2535** or equivalent. See Reverse side of this sheet for ohmic values of all these resistors.

OHMIC VALUES FOR No. 2550 SERIES RESISTORS

2550-AA.....110,000 ohms	**2550**-BA.....920 ohms	**2550**-CA.....225 ohms
2550-AB..... 55,000 ohms	**2550**-BB.....800 ohms	**2550**-CB.....200 ohms
2550-AC..... 30,000 ohms	**2550**-BC.....750 ohms	**2550**-CC.....179 ohms
2550-AD..... 20,000 ohms	**2550**-BD.....700 ohms	**2550**-CD.....160 ohms
2550-AE..... 12,000 ohms	**2550**-BE.....650 ohms	**2550**-CE.....147 ohms
2550-AF..... 9,000 ohms	**2550**-BF.....560 ohms	**2550**-CF.....135 ohms
2550-AG..... 7,500 ohms	**2550**-BG.....520 ohms	**2550**-CH.....125 ohms
2550-AH..... 6,100 ohms	**2550**-BH.....470 ohms	**2550**-CJ.....115 ohms
2550-AJ..... 5,400 ohms	**2550**-BJ.....410 ohms	**2550**-CK.....105 ohms
2550-AK..... 4,700 ohms	**2550**-BK.....380 ohms	**2550**-CL..... 98 ohms
2550-AL..... 4,300 ohms	**2550**-BL.....350 ohms	**2550**-CM..... 90 ohms
2550-AM..... 3,800 ohms	**2550**-BM.....320 ohms	**2550**-CN..... 83 ohms
2550-AN..... 3,500 ohms	**2550**-BN.....300 ohms	**2550**-CO..... 77 ohms
2550-AO..... 3,000 ohms	**2550**-BO.....260 ohms	**2550**-CP..... 72 ohms
2550-AP..... 2,700 ohms	**2550**-BP.....230 ohms	**2550**-CQ..... 67 ohms
2550-AQ..... 2,500 ohms		**2550**-CR..... 62 ohms
2550-AR..... 2,250 ohms		**2550**-CS..... 58 ohms
2550-AS..... 2,000 ohms		**2550**-CT..... 54 ohms
2550-AT..... 1,800 ohms		**2550**-CU..... 50 ohms
2550-AU..... 1,600 ohms		**2550**-CV..... 47 ohms
2550-AV..... 1,500 ohms		
2550-AW..... 1,350 ohms		
2550-AX..... 1,200 ohms		
2550-AY..... 1,100 ohms		
2550-AZ..... 1,000 ohms		

OHMIC VALUES OF THERMOSTATIC OR MISCL. RESISTORS

Part No.		Identification Color Characteristics
2570	250 ohms	Red
2571	600 ohms	Blue
2572	3000 ohms	Orange
2573	75 ohms	Lavender
2574	150 ohms	Brown Body, Green End
***2575**	160 ohms	Brown
****2576**	179 ohms	Brown Body, Grey End
*****2577**	300 ohms	Orange Body, Brown End
2578	80 ohms	White
2579	6000 ohms	Blue Body, Black Ends
******2581**	12000 ohms	Brown Body, Red End
2582	15000 ohms	Carbon Resistor
2583	500 ohms	Green
2584	1000 ohms	Brown Body, Black End
2585	1500 ohms	Brown Body, Blue End
2586	2000 ohms	Red Body, Orange End
2587	500 ohms	Green, 1¾" long

*No. **2575** Resistor is Superseded by No. **2550**-CD Resistor
No. **2576 Resistor is Superseded by No. **2550**-CC Resistor
***No. **2577** Resistor is Superseded by No. **2550**-BN Resistor
****No. **2581** Resistor is Superseded by No. **2550**-AE Resistor

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SECTION FIVE

Bulletins "65—"

STEAM GENERATING UNITS

VAPOR - CLARKSON STEAM GENERATORS

Printed in U. S. A.

YARD AND ROUNDHOUSE

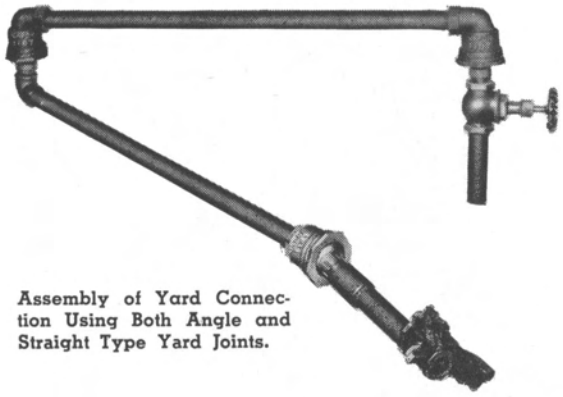
BALL JOINTS

Printed in U. S. A.

FLEXIBLE METALLIC YARD JOINTS

FOR STEAM, AIR OR OIL

¾" TO 2"



Assembly of Yard Connection Using Both Angle and Straight Type Yard Joints.

GENERAL DESCRIPTION

The Vapor Heating Corporation handles a complete line of Yard Joints for Passenger Terminal Yards, Stations, Round Houses, Blower-Line Connections, etc.

These Joints are available in sizes from ¾-inch to 2-inch, and in either angle or straight type to meet any application requirements.

In this Joint, the more desirable features of advantage in our former Yard and Round House Joint have been retained—such as keeping the gasket automatically tight above and against the ball without adjustment, which prolongs gasket life. Gaskets are easily and quickly replaced when necessary.

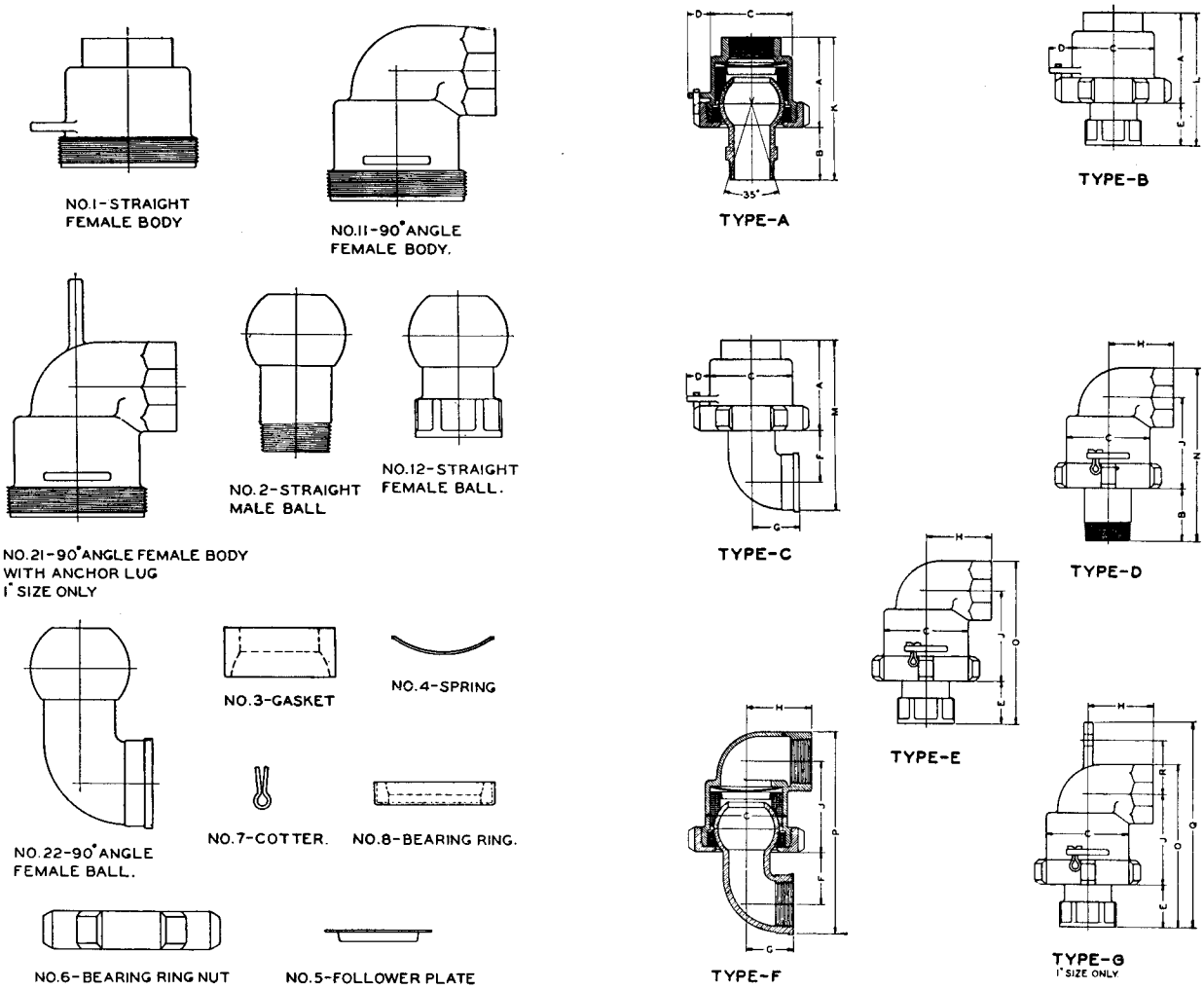
Vapor Yard Joints have a maximum angle movement of 35°. The Joint bodies and bearing ring nuts are of malleable iron, and the balls are of bronze.

As will be noted from the illustrations, the Joint balls are made with either straight or angle ends, and with either male or female threads, to facilitate their use in any present Joint assembly. Vapor Yard Joints are interchangeable with the same size and type of other Joints.

These Joints are sturdy in construction, and the automatic follow-up feature of the gasket arrangement will greatly minimize the cost of maintenance.

For quick reference, the following is a list of size, catalogue number, type, description and overall length of Vapor Ball Joint units complete.

	No.	Type	Description	Over-all Length
¾" Size	1183-A	Joint with straight female body and	straight male ball	4 11/16"
	1183-B	Joint with straight female body and	straight female ball	4 5/16"
	1183-C	Joint with straight female body and	angle female ball	5 1/4"
	1183-D	Joint with angle female body and	straight male ball	5 5/16"
	1183-E	Joint with angle female body and	straight female ball	4 15/16"
	1183-F	Joint with angle female body and	angle female ball	5 7/8"
1" Size	1184-A	Joint with straight female body and	straight male ball	5 5/16"
	1184-B	Joint with straight female body and	straight female ball	4 13/16"
	1184-C	Joint with straight female body and	angle female ball	6 1/8"
	1184-D	Joint with angle female body and	straight male ball	6 1/8"
	1184-E	Joint with angle female body and	straight female ball	5 5/8"
	1184-F	Joint with angle female body and	angle female ball	6 15/16"
	1184-G	Joint with angle female body and	straight female ball	7 3/8"
1¼" Size	1185-A	Joint with straight female body and	straight male ball	5 7/8"
	1185-B	Joint with straight female body and	straight female ball	5 7/16"
	1185-C	Joint with straight female body and	angle female ball	6 3/4"
	1185-D	Joint with angle female body and	straight male ball	6 13/16"
	1185-E	Joint with angle female body and	straight female ball	6 3/8"
	1185-F	Joint with angle female body and	angle female ball	7 11/16"
1½" Size	1186-A	Joint with straight female body and	straight male ball	6 1/16"
	1186-B	Joint with straight female body and	straight female ball	5 5/8"
	1186-C	Joint with straight female body and	angle female ball	7 3/16"
	1186-D	Joint with angle female body and	straight male ball	7 5/16"
	1186-E	Joint with angle female body and	straight female ball	6 7/8"
	1186-F	Joint with angle female body and	angle female ball	8 7/16"
2" Size	1187-A	Joint with straight female body and	straight male ball	7 1/16"
	1187-B	Joint with straight female body and	straight female ball	7 7/16"
	1187-C	Joint with straight female body and	angle female ball	8 1/2"
	1187-D	Joint with angle female body and	straight male ball	8 13/16"
	1187-E	Joint with angle female body and	straight female ball	8 3/16"
	1187-F	Joint with angle female body and	angle female ball	10 1/4"



Vapor Yard Joints are Made in Seven Different Types or Assemblies Indicated by Illustrations, as Type A, Type B, Type C, Etc.

Each Type is supplied in any desired size from ¾" to 2"—the various sizes being identified by numbers, as follows: No. 1183—¾" size, No. 1184—1" size, No. 1185—1¼" size, No. 1186—1½" size, and No. 1187—2" size.

For ordering purposes—for the ¾" size Joint with straight female body and straight male nipple, specify No. 1183-A; for 1¼" Joint with angle female body and straight male nipple, specify No. 1185-D; for 2" Joint with angle female body and angle female nipple, specify No. 1187-F, etc.

The Table below shows actual dimensions indicated by letter references on cuts, for each size and type of Joint.

No.	Size	TABLE OF DIMENSIONS																
		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
1183	¾"	3"	1 11/16"	2 7/16"	1"	1 5/16"	1½"	1 3/8"	1 3/8"	2 7/8"	4 11/16"	4 5/16"	5¼"	5 5/16"	4 15/16"	5 7/8"		
1184	1"	3 5/16"	2"	2 13/16"	1"	1½"	1 13/16"	1¾"	1 5/8"	3¼"	5 5/16"	4 13/16"	6 1/8"	6 1/8"	5 5/8"	6 15/16"	7 3/8"	1 7/8"
1185	1¼"	3 9/16"	2 5/16"	3 3/16"	1"	1 7/8"	2 1/16"	1 7/8"	2 5/8"	3 3/8"	5 7/8"	5 7/16"	6¾"	6 13/16"	6 3/8"	7 11/16"		
1186	1½"	3 13/16"	2¼"	3 7/16"	1"	1 13/16"	2 3/16"	2"	2¾"	3 13/16"	6 1/16"	5 5/8"	7 3/16"	7 5/16"	6 7/8"	8 7/16"		
1187	2"	4 5/16"	2¾"	4 7/16"	1"	2 1/8"	2 11/16"	2 3/8"	3 3/16"	4 9/16"	7 1/16"	6 7/16"	8½"	8 13/16"	8 3/16"	10¼"		

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SECTION SEVEN

Bulletins "67—"

RULES FOR TRAIN CREWS

Printed in U. S. A.

GENERAL INFORMATION

Many railroads issue special instructions to their employees covering the operation and maintenance of passenger train heating equipment. Such instructions should be carefully followed by all employees handling heating equipment.

For the information of those not already familiar with the principles of steam heating of passenger trains, the following brief explanation should be made:

1. If the source of steam supply is the steam locomotive, a pressure reducing valve regulates the pressure and amount of steam for train heating—depending upon weather conditions and the length of the train. On Diesel powered locomotives equipped with steam generators, the steam pressures are automatically regulated by the pressure switch or the water by-pass regulator.

2. A steam train line, consisting of a pipe under each car and steam connections between cars, extends from the source of steam supply to the rear of the train.

3. From the main steam pipe under each car, steam is taken for the separate and independent heating of each zone in each car. It is the usual practice to place in each car a set of printed instructions for operating the heating system in that car.

INSTRUCTIONS FOR OPERATION

LOCOMOTIVES

Be sure that all valves operate properly and that gaskets in the coupler and conduit in the rear of the tender are in good condition.

After coupling up to a train and receiving the signal that steam couplers are connected and ready for steam, stop valve should be opened wide. In steam locomotives, the reducing valve should be adjusted to pressure and volume requirements for steam heating. In Diesel locomotives, pressure and volume requirements are adjusted by the water by-pass regulator on some steam generators or the pressure switch on others.

Steam must not be shut off or pressure reduced between terminals, except upon request of the trainmen. Reducing pressure or shutting off steam while the train is running may cause freezing of condensation and result in serious train delays.

In steam locomotives, always turn the steam off or on by using the stop valve—do not turn steam off by manipulating the reducing valve. This valve is exclusively for regulating the pressure of steam supplied to the steam train line and is in no sense a stop or shut-off valve. In Diesel locomotives, the remote control switch in the locomotive cab is used to electrically close the shut-off valve on the generator and stop the flow of steam to the train line.

At all times when the engine is disconnected from the train in cold weather, the stop valve should be "cracked" just enough to allow a little steam to escape from the coupler at the rear of the engine tender to prevent freezing of the line.

An engineer should not cut his engine from the train until he knows positively that he will be relieved by another engine having steam heat equipment.

Do not shut off steam at the engine until the train line has been blown out at the rear. Wait for the signal that this has been done.

CARS

Heating equipment on every car should be known to function properly before the car is placed in service.

Steam couplers between cars should be properly connected and locked (see Bulletins 62-101 to 62-104). Make sure that end valves throughout the train are in wide open position.

When steam is first applied to the train, the rear end valve should be fully open until steam at full pressure blows through the rear. Then close the rear end valve and adjust it to permit only sufficient steam to escape continuously through the rear steam coupler to prevent the accumulation of condensation and freezing.

At any time when the engine is to be detached, the rear end valve should be opened wide for about two minutes before the engineer shuts off the steam supply. This will blow out condensation and when steam is turned off, all steam pressure in the train line will quickly dissipate.

REGULATION OF CAR TEMPERATURES

In cars equipped with manually controlled Vapor Systems, the hand-operated cut-out valves may be opened or closed as required for proper temperature regulation.

In cars with thermostatically controlled Vapor System, adjustments may be made on thermostats or by remote control units for changing temperature regulation.

Cars equipped with the system using Rador thermostats and 'Lectronic control panels require no adjustment outside of an initial setting of the control switch. The 'Letronic panel automatically furnishes heating, cooling or ventilating in response to the demand of the Rador thermostats located in the various zones of the car. By setting the master switches on the control panel to the desired "Day" or "Night" position, temperatures in the various zones of the car are regulated to maintain this temperature regardless of other existing conditions affecting the temperature of different zones, which may vary in each zone.

In cars equipped with air selector switches, the thermostat will automatically be set to maintain low temperatures while the car is laying over in

the yards at terminals, and will automatically resume a higher setting for proper temperatures when the car goes back into train service. In certain cars, the opening of the switch controlling the car lighting will automatically place the low thermostat setting in control in the same manner as the air electric selector switch.

WATER SUPPLY SYSTEMS

To protect water supply systems on sleeping cars, or other cars which are equipped with the Vapor System and with no other means of warming the car, steam must always be obtained during layover periods from either a locomotive or a stationary steam plant. Where steam is not available, all water should be drained from the water system and toilet water pipes to prevent freezing and, if possible, the water system should be blown out with air.

INSTRUCTIONS FOR MAINTENANCE

Every two years all steam heat specialties should be carefully overhauled, the operating features inspected and cleaned, and worn parts replaced where required. This procedure will reduce maintenance costs and prevent possible delays from steam heat failures in train service.

LOCOMOTIVES

Steam heat pressure reducing valves on steam locomotives should be taken apart, thoroughly cleaned and put in proper working order before the beginning of the heating season. The stop valve should be checked for wire drawn seats and ground in where necessary. Gauges should be tested frequently during the heating season.

PASSENGER CARS

All steam heating equipment on cars passing through the shops for repairs should be carefully checked and put in proper condition the same way as air brakes and other equipment are handled

End valves, conduits and couplers between cars should be thoroughly checked each heating season to prevent possible waste of steam through leakage and to avoid possible train delays due to steam heat failures.

All regulators should be carefully inspected and adjusted. Renewal of diaphragms, discs and valve seats should be made where necessary. (Instructions for testing diaphragms may be found in the bulletins under Vapor Regulators.) Steam admission valves should be checked and stem packing replaced where it is necessary.

Passenger car yard men should also occasionally check the pipe coverings on steam pipes underneath the car. If pipe coverings are not in good condition a heat loss is caused and much steam is wasted.

Inspectors and terminal men should always have on hand a supply of couplers and gaskets for both couplers and conduits, as well as extra diaphragms and other items of maintenance parts. If this procedure is followed it will avoid delays of trains for maintenance.

GENERAL RULES FOR APPLICATION OF VAPOR SPECIALTIES

1. Be sure that the ends of steam train lines are the proper height from the rails.
2. Train pipes must be pitched to drain at least one inch in ten feet. On some cars, where the train line is low in the center of the car, it should be drained automatically by a steam trap.
3. Regulators should be located high enough to permit the condensate to drain back to the train line. The regulator must be properly strapped or braced and should be located to avoid dripping condensate on rails, air brake rigging, generators or other equipment.
4. Pipe connections from the regulator to the steam admission valves must drain back to the regulator. All underneath steam pipes should be properly protected with pipe covering.
5. Radiation inside of a car must be properly supported to permit movement from expansion, but strapped to prevent damage to valve connections from this movement. Radiation must be installed to drain all condensate back to the steam admission valves.
6. All pipe joints used in making valve connections and radiation connections must be tight to prevent leakage from contraction and expansion. Graphite compound is recommended for sealing pipe joints and should be applied to male threads only.
   When copper tubing and radiation is used, all tubing subject to low pressure steam must be soldered with 95-5 solder (95% tin—5% antimony) or silver solder. On all high pressure lines silver solder MUST be used.
7. In new cars, or on older cars where the piping has been removed or any work done on pipe connections, the entire system should be thoroughly blown out with air or steam pressure. All steam admission valves and regulators should be opened wide and retarder bellows removed before blow-out pressure is turned on.

CAUTION

Never leave a car at any time without steam required to protect against freezing of the water system. If no steam is available, drain all of the water.

Be sure that steam is coming out of steam connection at the rear of the train before leaving the terminal. Always keep a "feather of steam" escaping through the rear steam connection.

In cars equipped with thermostatic or Rador and 'Lectronic controls, do not "experiment" with the thermostats or try to make any adjustments enroute. Report any difficulties at terminals for correction.

Note the Instruction Card in each car, which explains the heating system of that car. Observe the information contained on this card for proper operation and maintenance of the equipment on that car.

PRINTED IN U.S.A.

SECTION EIGHT

Bulletins "68—"

ENGINEERING DATA

Printed in U. S. A.

STEAM

There are three states of matter: solid, liquid and gas. Under normal atmospheric conditions substances exist in any one of these three states and when the outside conditions are varied they change from one state to another.

Water under average conditions exists in the form of a liquid. When a body of water is heated by means of some external medium, the temperature of the water rises and soon small bubbles are noted on the surface which break and form continuously. This phenomenon is described as "boiling."

The amount of heat necessary to cause the temperature of the water to rise is expressed in British Thermal Units (B.T.U.). One B.T.U. is the quantity of heat required to raise the temperature of 1 lb. of water from 60 to 61° F. or, as is generally stated, 1/180 part of the heat necessary to raise the temperature of 1 lb. of water from 32° F. (freezing point) to 212° F. (boiling point).

After the temperature of 212° F. is reached each pound of water contains 180 B.T.U. (above 32° F.). This quantity of heat is called "heat of the liquid" or "sensible heat." In order to change the liquid into a vapor at atmospheric pressure (14.7 pounds per sq. in. absolute), 970.2 B.T.U. must be added to each pound of water after the temperature of 212° F. is reached. During this transition period the temperature remains constant. The added quantity of heat is called the "latent heat of evaporation." Consequently, the "total heat" in the vapor formed when water boils at atmospheric pressure is the sum of the two quantities 180 B.T.U. and 970.2 B.T.U. or 1150.2 B.T.U. per pound.

If water is heated in a closed vessel not completey filled, the pressure will rise after steam or water vapor begins to form accompanied by an increase in temperature.

Steam may exist in two states: saturated or superheated.

Saturated Steam is steam in contact with the liquid water from which it was generated, at a temperature which is the boiling point of the water and the condensing point of the steam. It may be either "DRY" or "WET," depending upon the generating conditions. "DRY" saturated steam is steam free from mechanically mixed water particles. "WET" saturated steam on the other hand contains water particles in suspension. Saturated steam at any pressure has a definite temperature.

Superheated Steam is steam at any given pressure which is heated to a temperature higher than the temperature of saturated steam at that pressure. Water cannot exist in the presence of superheated steam.

BOILER HORSE POWER

The accepted rule for figuring boiler horse power is as follows: One Horse Power equals the evaporation of 30 lbs. of water per hour from an initial temperature of 100 deg. Fahr. into steam at 70 lbs. gauge pressure, or its equivalent; 34½ lbs. of water evaporated per hour from a temperature of 212 deg. Fahr. into steam at 212 deg.

PRESSURE-TEMPERATURE RELATION FOR SATURATED STEAM

Gauge Press. lbs. sq." Vac.	Temperature Deg. F.	Deg. C.	Gauge Press. lbs. sq."	Temperature Deg. F.	Deg. C.
29.9	32.0	0.0	90	331.2	166.1
25	132.6	56.0	100	337.9	169.8
20	161.1	71.9	125	352.9	178.1
15	178.8	81.5	150	365.9	185.3
10	192.2	89.0	175	377.4	191.5
5	202.9	95.0	200	387.9	197.6
Press. 0	212	100	250	405.1	207.7
5	227.2	108.4	300	421.9	216.6
10	239.4	115.2	350	435.8	224.3
15	249.7	120.9	400	448.3	231.4
20	258.8	125.9	450	459.7	237.8
25	266.9	130.4	500	470.3	243.6
30	274.1	134.4	550	480.1	249.1
40	286.7	141.4	600	490.0	254.4
50	297.7	147.9	700	506.4	263.6
60	307.3	152.8	800	521.7	272.0
70	316.0	157.7	900	535.7	279.8
80	323.9	162.1	1000	548.7	287.0

TEMPERATURE CONVERSION TABLE

Locate known temperature in bold type; Centigrade Equivalent left, Fahrenheit right

C. ← F.		C. → F.	C. ← F.		C. → F.	C. ← F.		C. → F.	C. ← F.		C. → F.
−17.8	**0**	32	10.0	**50**	122.0	38	**100**	212	316	**600**	1112
−17.2	**1**	33.8	10.6	**51**	123.8	43	**110**	230	321	**610**	1130
−16.7	**2**	35.6	11.1	**52**	125.6	49	**120**	248	327	**620**	1148
−16.1	**3**	37.4	11.7	**53**	127.4	54	**130**	266	332	**630**	1166
−15.6	**4**	39.2	12.2	**54**	129.2	60	**140**	284	338	**640**	1184
−15.0	**5**	41.0	12.8	**55**	131.0	66	**150**	302	343	**650**	1202
−14.4	**6**	42.8	13.3	**56**	132.8	71	**160**	320	349	**660**	1220
−13.9	**7**	44.6	13.9	**57**	134.6	77	**170**	338	354	**670**	1238
−13.3	**8**	46.4	14.4	**58**	136.4	82	**180**	356	360	**680**	1256
−12.8	**9**	48.2	15.0	**59**	138.2	88	**190**	374	366	**690**	1274
−12.2	**10**	50.0	15.6	**60**	140.0	93	**200**	392	371	**700**	1292
−11.7	**11**	51.8	16.1	**61**	141.8	99	**210**	410	377	**710**	1310
−11.1	**12**	53.6	16.7	**62**	143.6	104	**220**	428	382	**720**	1328
−10.6	**13**	55.4	17.2	**63**	145.4	110	**230**	446	388	**730**	1346
−10.0	**14**	57.2	17.8	**64**	147.2	116	**240**	464	393	**740**	1364
−9.44	**15**	59.0	18.3	**65**	149.0	121	**250**	482	399	**750**	1382
−8.89	**16**	60.8	18.9	**66**	150.8	127	**260**	500	404	**760**	1400
−8.33	**17**	62.6	19.4	**67**	152.6	132	**270**	518	410	**770**	1418
−7.78	**18**	64.4	20.0	**68**	154.4	138	**280**	536	416	**780**	1436
−7.22	**19**	66.2	20.6	**69**	156.2	143	**290**	554	421	**790**	1454
−6.67	**20**	68.0	21.1	**70**	158.0	149	**300**	572	427	**800**	1472
−6.11	**21**	69.8	21.7	**71**	159.8	154	**310**	590	432	**810**	1490
−5.56	**22**	71.6	22.2	**72**	161.6	160	**320**	608	438	**820**	1508
−5.00	**23**	73.4	22.8	**73**	163.4	166	**330**	626	443	**830**	1526
−4.44	**24**	75.2	23.3	**74**	165.2	171	**340**	644	449	**840**	1544
−3.89	**25**	77.0	23.9	**75**	167.0	177	**350**	662	454	**850**	1562
−3.33	**26**	78.8	24.4	**76**	168.8	182	**360**	680	460	**860**	1580
−2.78	**27**	80.6	25.0	**77**	170.6	188	**370**	698	466	**870**	1598
−2.22	**28**	82.4	25.6	**78**	172.4	193	**380**	716	471	**880**	1616
−1.67	**29**	84.2	26.1	**79**	174.2	199	**390**	734	477	**890**	1634
−1.11	**30**	86.0	26.7	**80**	176.0	204	**400**	752	482	**900**	1652
−0.56	**31**	87.8	27.2	**81**	177.8	210	**410**	770	488	**910**	1670
0	**32**	89.6	27.8	**82**	179.6	216	**420**	788	493	**920**	1688
0.56	**33**	91.4	28.3	**83**	181.4	221	**430**	806	499	**930**	1706
1.11	**34**	93.2	28.9	**84**	183.2	227	**440**	824	504	**940**	1724
1.67	**35**	95.0	29.4	**85**	185.0	232	**450**	842	510	**950**	1742
2.22	**36**	96.8	30.0	**86**	186.8	238	**460**	860	516	**960**	1760
2.78	**37**	98.6	30.6	**87**	188.6	243	**470**	878	521	**970**	1778
3.33	**38**	100.4	31.1	**88**	190.4	249	**480**	896	527	**980**	1796
3.89	**39**	102.2	31.7	**89**	192.2	254	**490**	914	532	**990**	1814
4.44	**40**	104.0	32.2	**90**	194.0	260	**500**	932	538	**1000**	1832
5.00	**41**	105.8	32.8	**91**	195.8	266	**510**	950	543	**1010**	1850
5.56	**42**	107.6	33.3	**92**	197.6	271	**520**	968	549	**1020**	1868
6.11	**43**	109.4	33.9	**93**	199.4	277	**530**	986	554	**1030**	1886
6.67	**44**	111.2	34.4	**94**	201.2	282	**540**	1004	560	**1040**	1904
7.22	**45**	113.0	35.0	**95**	203.0	288	**550**	1022	566	**1050**	1922
7.78	**46**	114.8	35.6	**96**	204.8	293	**560**	1040	571	**1060**	1940
8.33	**47**	116.6	36.1	**97**	206.6	299	**570**	1058	577	**1070**	1958
8.89	**48**	118.4	36.7	**98**	208.4	304	**580**	1076	582	**1080**	1976
9.44	**49**	120.2	37.2	**99**	210.2	310	**590**	1094	588	**1090**	1994

INTERPOLATION FACTORS

0.56	**1**	1	1.67	**3**	5.4	3.33	**6**	10.8	5.00	**9**	16.2
1.11	**2**	3.6	2.22	**4**	7.2	3.89	**7**	12.6	5.56	**10**	18.0
			2.78	**5**	9.0	4.44	**8**	14.4			

PIPE DATA

Pipe Size	External Diam. Inches	Internal Diam. Inches Standard	Internal Diam. Inches Extra Strong	Weight Lbs. Per Foot Standard	Weight Lbs. Per Foot Extra Strong	Sq. Ft. Surface Per Lineal Foot	Internal Area, Sq. In.	Per Lin. Ft. Capacity Gal. Standard Wt.
¾"	1.050	.824	.742	1.130	1.473	.275	.532	.0276
1"	1.315	1.049	.957	1.678	2.171	.346	.865	.0449
1¼"	1.660	1.380	1.278	2.272	2.996	.434	1.49	.0774
1½"	1.900	1.610	1.500	2.717	3.631	.494	2.04	.106
2"	2.375	2.067	1.939	3.652	5.022	.622	3.35	.174
2½"	2.875	2.469	2.323	5.793	7.661	.753	4.78	.248
3"	3.50	3.068	2.90	7.575	10.252	.916	7.37	.383

EXPANSION OF PIPE

Increase in Length Inches per 100 ft.

Temp. Deg. F.	Steel	Wrought Iron	Brass or Copper	Temp. Deg. F.	Steel	Wrought Iron	Brass or Copper
20	.15	.15	.25	240	2.00	2.05	2.90
40	.30	.30	.45	260	2.15	2.20	3.15
60	.45	.45	.65	280	2.35	2.40	3.45
80	.60	.60	.90	300	2.50	2.60	3.75
100	.75	.80	1.15	320	2.70	2.80	4.05
120	.90	.95	1.40	340	2.90	3.05	4.35
140	1.10	1.15	1.65	360	3.05	3.25	4.65
160	1.25	1.30	1.90	380	3.25	3.45	4.95
180	1.45	1.50	2.15	400	3.45	3.65	5.25
200	1.60	1.65	2.40	420	3.70	3.90	5.60
220	1.80	1.85	2.65				

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REFRIGERANTS

Temp.—Press. Relation for Sat. Ammonia		Temp.—Press. Relation for Carbon Dioxide		Temp.—Press. Relation for Sulphur Dioxide		Temp.—Press. Relation for Freon	
Deg. F.	Gauge Press.	Deg. F.	Gauge Press.	Deg. F.	Gauge Press.	Deg. F.	Gauge Press.
	Vac.				Vac.		Vac.
—40	8.2	—110	0.0	—40	23.6	—40	10.92
—35	4.9	—100	8.4	—35	22.8	—35	8.33
—30	1.2	—90	20.6	—30	21.6	—30	5.45
	Lbs.	—80	38.5	—25	19.5	—25	2.18
—25	1.5	—70	59.5	—20	18.0		Lbs.
—20	3.8	—60	79.4	—15	15.9	—20	0.58
—15	6.3	—50	103.0	—10	13.8	—15	2.46
—10	9.1	—40	131.2	—5	11.6	—10	4.50
—5	11.2	—30	163.2	0	9.0	—5	6.75
0	15.7	—20	200.6	5	6.2	0	9.17
5	19.5	—10	242.5	10	2.9	5	11.81
10	23.9	0	291.0		Lbs.	10	14.65
15	28.2	5	317.5	15	0.3	15	17.74
20	33.3	10	345.5	20	2.3	20	21.05
25	38.7	15	374.9	25	4.4	25	24.63
30	44.7	20	407.0	30	6.7	30	28.46
35	51.2	25	441.0	35	9.3	35	30.89
40	58.3	30	476.5	40	12.0	40	36.98
45	66.0	35	514.7	45	15.1	45	41.68
50	74.3	40	553.0	50	18.5	50	46.69
55	83.2	45	594.0	55	22.0	55	52.04
60	92.9	50	638.0	60	25.9	60	57.71
65	103.3	55	685.0	65	30.2	65	63.74
70	114.5	60	713.8	70	34.5	70	70.12
75	126.6	65	783.5	75	39.5	75	76.90
80	139.4	70	838.0	80	44.7	80	84.06
85	153.2	75	896.5	85	50.3	85	91.65
90	168.1	80	955.5	90	56.3	90	99.60
95	183.7	85	1019	93	60.0	95	108.1
100	200.4	90	1125	95	62.6	100	116.9
110	237.3	95	1200	100	69.6	105	126.2
120	278.8	100	1273	110	84.8	110	136.0
130	325.7	105	1349	120	101.8	115	146.8
140	377.5	110	1428	130	121.3	120	157.1
150	435.8	115	1508	140	143.0	125	168.4
160	499.7	125	1735	150	166.0	130	180.2
165	534.3					140	205.5

TABLE OF STANDARD WIRE GAGES

This table shows the standard wire gages and the names of major commodities for which each is used. To determine the gage used for any commodity, notice the number in parenthesis opposite the commodity named and find the gage column below bearing the same number in parenthesis.

Aluminum (2) [Except Tubing, (1)]
Bands (1)
Brass Tubing (⅜" O.D. and larger) (1)
Brass Tubing (Smaller than ⅜" O.D.) (2)
Brass Sheets (2)
Brass Strips (2)
Brass Wire (2)
Copper Sheets (2)
Copper Wire (2)
Chromaloid (6)
Flat Wire (1)
Hoops (1)
Iron Wire (4)
Monel Metal Sheets (3)
Music Wire (5)
Nickel Sheets (3)
Nickel Silver Sheets (2)
Nickel Silver Wire (2)
Nickeloid (6)
Phosphor Bronze Strip (2)
Spring Steel (1)
Steel Plates (3)
Steel Sheets (3)
Steel Tubing, Seamless and Welded (1)
Steel Wire (4) [Exceptions: Music Wire (5), Armature Binding Wire (2), Flat Wire (1)]
Strip Steel (1)
Zinc (6)

Ga. No.	(1) Birmingham or Stubs'	Lbs. per ft. C. R. Strip St. 1" wide Bir., Ga.	(2) American or Brown & Sharp	(3) U. S. Standard	(4) A. S. & W. Co. (W. & M)	Ft. per lb. R'nd Steel Wire W. & M. Ga.	(5) Music Wire Std.)	(6) Zinc Ga..	Fractions of an inch with Decimal Equivalent
6-0	.....	.....	.5800	.4687	.4615	1.760	.004	.....	1/64-.016
5-0	.....	.....	.5165	.4375	.4305	2.023	.005	.....	1/32-.031
4-0	.454	1.5418	.4600	.4062	.3938	2.418	.006	.....	3/64-.047
3-0	.425	1.4433	.4096	.3750	.3625	2.853	.007	.....	1/16-.062
2-0	.380	1.2905	.3648	.3437	.3310	3.422	.008	.....	5/64-.078
1-0	.340	1.1546	.3249	.3125	.3065	3.991	.009	.....	3/32-.094
1	.300	1.0200	.2893	.2812	28.30	4.681	.010	.....	7/64-.109
2	.284	.9656	.2576	.2656	.2625	5.441	.011	.....	1/8-.125
3	.259	.8806	.2294	.2500	.2437	6.313	.012	.006	9/64-.140
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