RED JACKET® PETROLEUM EQUIPMENT

ENGINEERING REPORT

TEST PROCEDURES FOR
MECHANICAL LEAK DETECTORS

September 1992

TESTING MECHANICAL LEAK DETECTORS
OPTION B - FINITE TESTING

The following defined terms are used throughout Red Jacket literature and instructions to bring attention to the presence of hazards of various risk levels, or to important information concerning the life of the product.

DANGER	indicates presence of a hazard which *will* cause *severe* personal injury, death or substantial property damage if ignored.	**CAUTION**	indicates presence of a hazard which *will* or *can* cause *minor* personal injury or property damage if ignored.
WARNING	indicates presence of a hazard which *can* cause *severe* personal injury, death or substantial property damage if ignored.	**NOTICE**	indicates special instructions on installations, operation, or maintenance which are important but not related to personal injury hazards.

FTA DESCRIPTION

This report (RJ-20) provides the procedure for finite testing of Red Jacket mechanical leak detectors utilizing the field test apparatus (FTA). In addition to establishing that the unit is functioning, it provides for a demonstration of the leak detectable by subject leak detector in subject system under current conditions. The characteristics of the pumping system in which the line leak detector (LLD) is installed will affect its performance. This procedure provides some evaluation of the pumping system as well as the LLD. It can be utilized for further evaluation of the pumping system. **Please note that the performance of the procedures set forth in Sections V and VI is intended to satisfy functionality check requirements for annual inspection of leak detectors. Section IV of Option A (RJ-21) is also intended to satisfy the minimum requirement.** For information on this as well as reference information on the LLD and the pumping system in which it is installed, including symptoms, probable causes, suggested action, see Red Jacket Mechanical Leak Detector Manual, #5191, and/or Red Jacket Petroleum Products Service Manual, #5190.

Option A, utilizing the Apparatus to Verify Operation (AVO) will provide a more basic, less extensive approach to evaluating the Red Jacket LLD. See Form RJ-21 for proper procedure.

Under 40CFR280.44(a), EPA has

1. defined performance standards for automatic LLDs (out-of-the-box) prior to installation. Red Jacket mechanical leak detectors have been constructed to meet the EPA requirements as outlined in 40CFR280.44(a). A copy of our third-party certification is available upon request.
2. stated that an annual test of the operation of the leak detector must be conducted in accordance with the manufacturer's requirements.

The EPA requires "...that the LLDs be tested annually to insure that they are properly installed and maintained and have not been tampered with and are operating in accordance with the manufacturer's requirements". In addition, to assure maintenance of leak detector capability, Red Jacket requires that operation of the mechanical leak detector be verified upon start-up and that testing of the leak detector be performed routinely—at least annually. Section IV of Option A (RJ-21) or Sections V and VI of Option B (RJ-20) are intended to meet the minimum requirement for verifying the functionality of the LLD.

This report, as well as report RJ-21, provides the manufacturer's requirements for testing Red Jacket mechanical LLDs. The procedures covered in this form and report RJ-21, supersede previously issued procedures for testing Red Jacket LLDs.

WARNING **Competent mechanical leak detector evaluation requires A) that testing be performed by trained, qualified personnel and B) consistent, proper procedures involving good maintenance, quality control and calibration of equipment are utilized.**

Education on this and all technical aspects of Red Jacket petroleum submersible pumping and monitoring systems is available via our TECHS program.

It has been established that the obligation of compliance with the appropriate regulations covering USTs is the owners, with the following guidelines in place in reference to LLDs.

EPA regulations require that the LLD be installed and operating, capable of detecting a catastrophic leak and tested annually in accordance with the manufacturer's requirements. The manufacturer's requirements and procedures for annual testing of Red Jacket LLDs are covered in Option A, Form RJ-21 and Option B, Form RJ-20. While some regulatory bodies have, EPA has not issued guidelines as to when LLDs are to be replaced based on quantitative performance. They state that annual quantitative performance tests of LLDs installed in the field are not required by EPA standards. It is suggested to check with state and local authorities for any requirements that may differ from those of the U.S. EPA.

Based on the above and other pertinent factors, it is our opinion that the UST owner is the best equipped to assess their situations and therefore to make the decision as to when subject LLD is to be replaced. We do not consider it prudent as the manufacturer to make that determination.

We do urge that if, after evaluation in the pumping system, subject LLD is not demonstrating the capability of reacting to a leak at the rate of or equivalent to 5 GPH at 10 psi or greater, serious assessment be made of the entire pumping system and of replacement of the LLD versus continued use.

NOTICE **We have no control, influence or participation with reference to the design, operation or quality of any mechanical leak detectors other than those manufactured and marketed by The Marley Pump Company under the Red Jacket petroleum equipment identification. We, therefore, do not advise or condone use of the information, procedures or equipment covered in this or any other publication issued by The Marley Pump Company for any equipment other than Red Jacket petroleum equipment.**

For additional assistance with regard to the above or any Red Jacket petroleum equipment, call us at 1-913-831-5700 or our fax number is 913-831-5172.

OPTION B

FINITE TESTING

Red Jacket Mechanical Line Leak Detectors with the Field Test Apparatus (FTA) Testing Procedure

FIELD TEST APPARATUS

The Field Test apparatus (FTA) will be required for this procedure. It can be constructed from readily available parts. See material list and assembly instruction, page 8. See pages 9 and 10 for an explanation of the 3-Step Leak Detector Test.

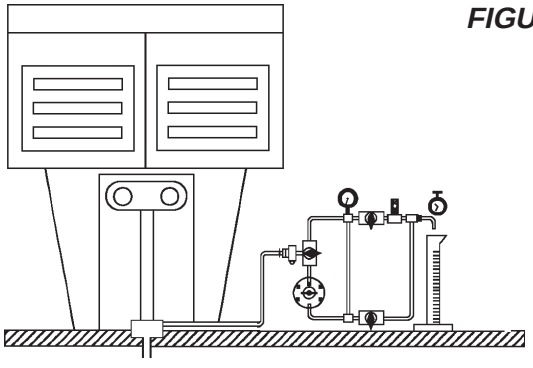
I. INSTALLATION OF THE FTA

WARNING **Disable power to submersible pump before attempting to connect FTA to impact valve. Failure to do so may cause an accidental discharge of pressurized gasoline that may result in personal injury, fire or explosion. Tag or lock out submersible pump breaker to avoid pump being accidentally turned on.**

1. **Carefully bleed** any residual pressure present in the system, catching the fluid discharged in a suitable container. If the test plug in the shear valve is used for this purpose, see the following **NOTICE** in step 2 first.

WARNING **Use a suitable container to receive product throughout this procedure. Plastic containers may store static electricity which could discharge, causing severe personal injury, fire and/or explosion. Use only approved metal type containers. Use adequate absorbants to catch any spillage and avoid ground contamination.**

FIGURE 1



2. Install the FTA in the dispenser shear valve as shown in Figure 1.

NOTICE

A 3/8" to 1/4" reducer may be necessary depending on the size of the test port in the impact valve. This reducer is not called out in the parts list.

Loss of product as well as introduction of air into the system can be minimized by closing the emergency valve previous to removing plug from the test port. Reopen valve after installing the FTA.

To insure a tight, accurate test and to avoid accidental spillage, check for any leakage of product around any of the fittings on the FTA and on dispenser impact valve.

The simulated leak must be created at a height between the solenoid valve and the impact valve.

DO NOT attempt to perform a leak test above the solenoid valve. Properly installed leak detectors may not react to leaks above solenoid valves that are normally inside dispensers—sometimes several feet above island level. See Figure 2.

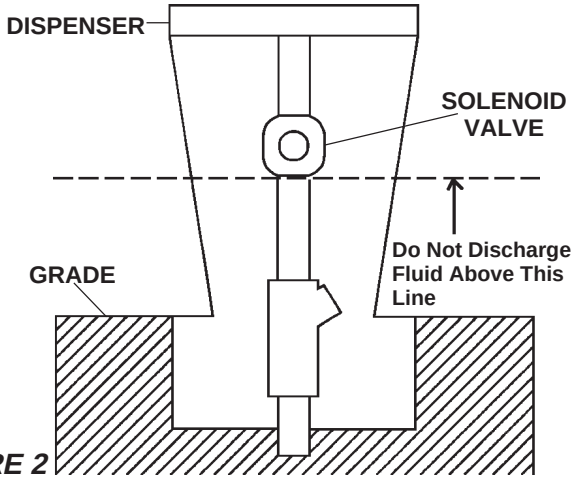


FIGURE 2

By raising the discharge point of the simulated leak from the FTA above the test area, additional static head is placed on the leak detector. Static head is defined as the pressure exerted on the leak detector by the vertical column of fluid contained within the piping, from the leak detector upward to the point of discharge of the leak. By placing the point of discharge high enough above the island, sufficient static head pressure could be placed upon the leak detector to keep it from entering the leak sensing position. It is assumed that piping from the leak detector to the point of discharge is a continual, gradual, upward or positive run and does not have a negative (declining) run.

For more information on static head effects, please see Red Jacket Service Bulletin 23-5 and 23-18 or the application section of the mechanical leak detector manual covering the effects of static head on mechanical leak detectors.

NOTICE

If the leak detector or pumping system operation differs significantly from that described in the following during the evaluation, see leak detector manual #5191 and/or Petroleum Products Service Manual #5190, for possible causes and solutions.

3. Verify that line pressure is at zero psi by observing that the FTA pressure gauge has a zero reading under the following conditions:

   V_1 VERTICAL (Pointing up toward pressure gauge)
   V_2 CLOSED
   V_3 OPEN
   M_1 OPEN FULLY

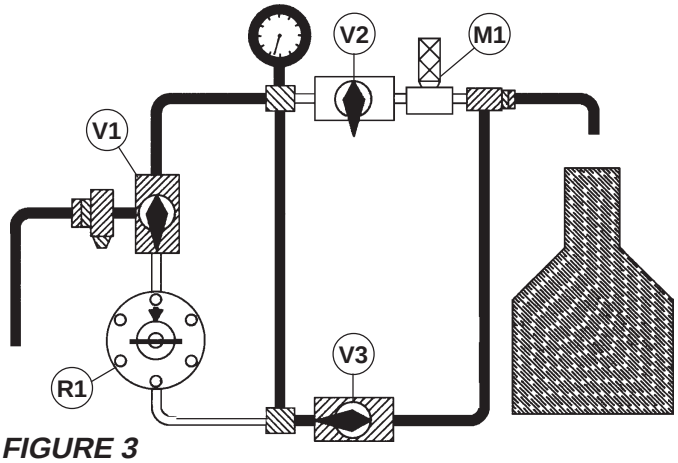


FIGURE 3

CAUTION

To avoid product spillage, assure that the discharge of the FTA is directed into a suitable container and that the product flow into the container has stopped.

4. Close V_3 and restore power to submersible pump.

5. Start the submersible pump.

NOTICE

Do not attempt to dispense product at this time.

6. Observe the pressure on the FTA until normal operating pressure is reached.

NOTICE **Normal operating pressure can be verified by observing any running pressure above 22 psi. If air has been introduced while installing the FTA, pressure on the gauge will increase slowly as the leak detector pressurizes the system.**

7. Through the nozzle, dispense adequate product into a suitable container to remove any air that may have entered during the installation of the FTA. (Usually two to five gallons is sufficient.)

8. Remove air from the FTA by opening V_3 bypass valve first and dispensing about 400 milliliters of product through the FTA to remove trapped air.

9. Rotate valve V_1 to the downward position so that arrow on V_1 is pointing toward the regulator, R_1. With V_2 open and V_3 closed, adjust regulator R_1 so 10 psi is observed on the FTA gauge.

NOTICE **Maintain 10 psi throughout the testing procedure to provide the consistency necessary for appropriate evaluation.**

NOTICE **M_1 is still open and no product is being dispensed from the nozzle.**

10. Close V_2. Turn off the submersible pump.

11. Open V_3 and reduce line pressure to zero.

Care should be taken to observe that all product has stopped flowing from the FTA into the suitable container. It may be necessary to wait at least two minutes to ensure that the leak detector has fully moved into the leak-sensing position. Experience has shown that if the discharge hose is still dripping after one minute, usually within the next 60 seconds a small stream of fluid will quickly spurt out. This is an indication that the leak detector has dropped into the leak-sensing position.

12. Close V_3 and start the submersible pump. Allow pump to run 5 seconds.

II. RESILIENCY TEST

13. Shut off the submersible pump. Open V_3 and drain product into an empty graduated cylinder.

14. Measure the volume of fluid discharged (in ml) into the graduated cylinder. As the pressure drops to zero, record on the leak detector test chart the total volume collected between the holding pressure and zero.

NOTICE **Values for a typical station should be about 60 to 110 ml or less if a diaphragm leak detector is used; 350 to 410 ml or less if a piston leak detector is used. If larger amounts of product are measured, it is possible air is still present in the system which will prolong the operating time of the leak detector. If air is present, repeat Steps 3 through 21 before proceeding to Sect. V.**

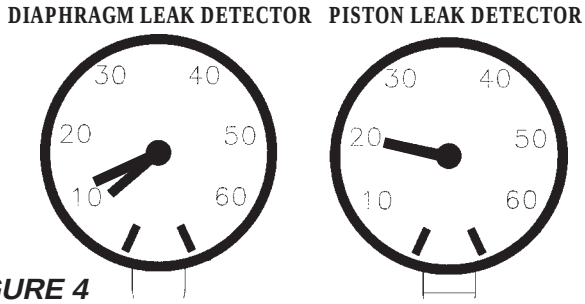


FIGURE 4

III. OBSERVATION OF LEAK DETECTOR OPENING TIME

15. Close V_3 and rotate V_1 back to upward position.

NOTICE **V_2 should be closed at this time.**

16. Operate the submersible pump. Observe that line pressure will rise to a constant level and pause there momentarily. At this point, a slight drop on the pressure gauge may be observed followed by an immediate sharp increase to full line pressure. For piston leak detectors, the constant level (metering pressure) will be approximately 17 to 22 psi. For diaphragm leak detectors, the constant level (metering pressure) will be approximately 8 to 12 psi. Full line pressure of approximately 25 to 30 psi will also be observed, determined by the size of the submersible pump and the product it is pumping. See Fig. 4.

17. Using a stop watch, observe the approximate opening time in seconds from the metering pressure, 18 to 22 psi, to full pump pressure, 26 to 30 psi, as being approximately 2.0 to 3.5 seconds for the piston style leak detector. If a diaphragm leak detector is in use, approximately 2.0 to 3.0 seconds should be observed for the time it takes to go from the metering pressure, 8 to 12 psi, to full pump pressure, 26 to 30 psi. Longer opening times may be indicative of air in the system, system resiliency or a small leak. See Red Jacket publications RJ-33, 5268 and the mechanical leak detector manual.

18. RECORD opening time in test chart. See sample test chart on Page 30.

19. Turn off the submersible pump.

IV. FUNCTIONAL ELEMENT OPERATION TEST

20. Observe holding pressure of functional element. If standard functional element is used, a holding pressure of between 8 to 20 psi is normally observed. If a precision functional element is used, a holding pressure of about 11 to 15 psi should be observed.

21. Record the holding pressure on the leak detector test chart under functional element psi test column.

V. 10 PSI CALIBRATION

The procedure in this section establishes a leak at a given pressure that may be used as a consistent comparison point. This will aid in managing and maintaining leak detector populations. Future replacements may be anticipated from these consistent test results.

22. Close V_3. Assure V_2 also is closed and M_1 is fully open.

23. Close M_1 (approximately 5 turns).

24. Start the submersible pump to obtain full line pressure. Rotate V_1 to the downward position (arrow toward regulator).

25. Open V_2. See Fig. 5.

26. With the submersible pump on, verify the volume of fluid dispensed into the graduated cylinder in one minute. Also, observe that 10 psi is maintained on R_1. Use a stopwatch to make this determination. (See Notes A and B below.)

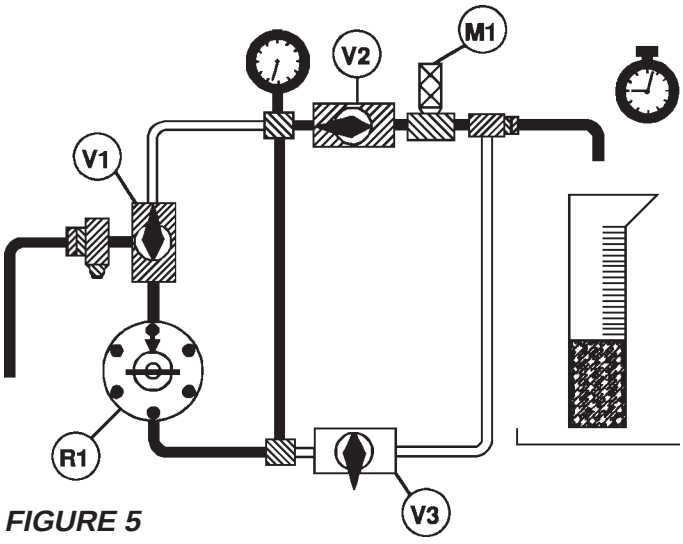


FIGURE 5

A. Adjust R_1, if needed, to obtain a 10 psi reading.

B. Adjust M_1 as necessary to obtain the desired simulated leak rate.

NOTICE **Flow rates through valve M1 will vary with the type of fuel passing through it (i.e., diesel vs gasoline). It is necessary to check the flow rate through M1 when products are changed.**

To identify the simulated leak rate experienced, utilize the conversion chart below to convert ml/minute to gal/hour. The formula to convert gal/hour to ml/minute is:

Gal/hour x (63.1) = ML/minute

CONVERSION CHART

GPH AT 1O PSI	ML/MIN FLOW
.5	32
1.0	63
1.5	95
2.0	126
2.5	158
3.0	189
3.5	221
4.0	252
5.0	316
6.0	379
7.0	442
8.0	505
9.0	568
10.0	631

M_1 CALIBRATION CHART (Approximate Only)*

# Turns Out	ML/Minute
1	34
2	85
3	106
4	192
5	224
6	292
7	352
8	412
9	463

* The above are actual measurements taken on a typical M_1 valve through regulator R_1 at 10 psi using gasoline. They are for reference only and may vary from valve to valve.

VI. SIMULATED LEAK TEST

27. Shut off the submersible pump.

28. Rotate V_1 to the vertical position to remove pressure regulator from the fluid circuit and to place the simulated leak on the product line. This allows the line pressure to drop to zero. Leave V_2 open and observe zero psi on the FTA pressure gauge. This should cause the leak detector to move into the leak sensing position. See Fig. 6.

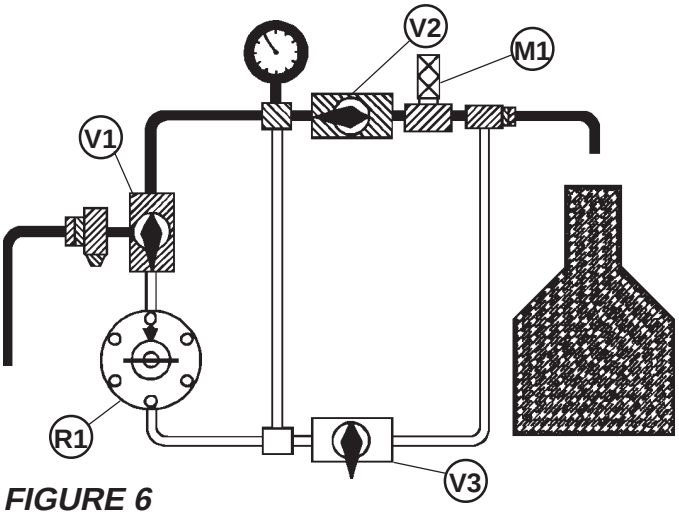


FIGURE 6

NOTICE **Care must be taken as in Step 11 to assure the leak detector is in the leak-sensing position.**

NOTICE **V_3 may be opened to quickly drop line pressure to zero but V_3 MUST BE CLOSED BEFORE CONTINUING TESTING PROCEDURE.**

29. Place discharge hose into suitable test container.

30. Restart the submersible pump and observe pressure gauge. If pressure remains at or below 22 psi for piston leak detector or 13 psi for the diaphragm leak detector, the leak detector has sensed the leak and will remain in the metering position.

31. Record the psi observed on the gauge while the leak detector was in metering position.

32. Verify Step 30 by attempting to dispense product from nozzle into a suitable container. Slow flow from the nozzle should be observed.

33. Record results on leak detector test chart on Page 11.

34. Mark "yes" column if restricted flow through the nozzle is observed when the simulated leak is present

    or

    Mark "no" column if restricted flow is not experienced through nozzle when the simulated leak is present.

NOTICE **If the leak detector does not function, record the date code and replace subject leak detector immediately. Test the new replacement leak detector for proper operation after installation.**

Prior to reaching the conclusion that the leak detector is not a functioning unit, evaluate its operation removed from the pumping system. Equipment exists to allow this evaluation and may be utilized provided specifications covered in our recommended evaluation procedures are met.

WARNING **Follow proper procedure in removing leak detector and/or FTA.**

Pressure may be decreased to the point that adequate testing of subject areas would not occur.

35. To remove the FTA, shut off the submersible pump. Bleed the pressure to zero by discharging the remaining pressurized product into a suitable container by opening valve V_3.

WARNING **Disable power to submersible pump before attempting to disconnect the FTA. Failure to do so may cause an accidental discharge of pressurized gasoline that may result in personal injury, fire or explosion. Tag or lock out submersible pump breaker to avoid pump being accidentally turned on. Remove the FTA, replace and tighten the impact valve plug.**

36. Enable and operate the submersible pump and dispense two to five gallons of product into the suitable container to remove any air that may have been introduced by removing the equipment. Check for leakage with the pump running before closing the dispenser housing.

WARNING **While checking for leakage around impact valve plug and dispenser housing, DO NOT dispense product through nozzle.**

FTA ACCURACY

The accuracy of the FTA depends a great deal on the operator. Care must be taken by the operator when operating M_1 not to overtighten M_1. Careful measuring of the flow out of M_1 into a graduated cylinder intended for the fuel being tested and using a stopwatch to time out the flow rate per minute is important. Be sure that when the desired simulated leak rate is occurring, the regulator holds a steady pressure on the gauge. With M_1 fully open, the regulator should not show more than a 1/4 psi fall-off in reading on the pressure gauge. Each complete revolution of M_1 at 10 psi approximates 1/2 gph flow rate change, either increase or decrease. Always verify the change in flow.

Use of the optional flow gauge as listed on the parts list can greatly increase the flexibility of the FTA and cut down testing time. If flow readings become difficult, accuracy verifications can be made by using the graduated cylinder. It is important to calibrate the flow meter for various fluids used and verify them in the field. Before switching to a new fluid with the tester, the calibration for the FTA must be checked since specific gravities and viscosities may vary. Pressure gauges must be calibrated periodically to verify they are reading true pressures and that flow rates are being set properly.

FTA OVERVIEW AND USES

The FTA unit can help in evaluating the operation of the mechanical leak detector in the field. It also can be used to monitor line pressure either at the dispenser or at the line test port of most submersibles by attaching it at the line test port. The functional element seating pressure may also be verified as well as noting if packer-manifold discharge seal and check valve are holding properly. The opening pressure of the leak detector may also be tested by observing beginning pressure at zero then operating submersible pump. See Step 15 of test procedure. Under normal conditions, the piston leak detector should open from metering pressure, (17 to 22 psi), to full line pressure in about 2.0 to 3.5 seconds and the diaphragm leak detector should open from metering pressure, (10 to 13 psi), to full line pressure in about 2.0 to 3.0 seconds.

FTA PARTS LIST

Parts List: Majority of parts to be purchased from Swagelok-Whitey-Nupro-Snotrik Dealers or equivalent.

Qty.	Cat. #	Description	Reference
1	B4CS	4 way cross 1/4" fnpt	1
5	B4HN	hex nipple 1/4" mnpt	2
2	B43F4	ball valve 2-way 1/4" fnpt (V2 & V3)	3
1	B4MG2	needle valve 1/4" fnpt (M1) (Nu-Pro)	4
2	B4T	tee 1/4" fnpt	5
4	B4SE	street el 90 1/4"	6
1	B43XF4	3-way ball valve 1/4" fnpt (V1)	7
4	B40024	90-el 1/4" Swagelok x 1/4" mnpt	8
	Quick Connects for Inlet Side		
1	BQC4B4PM	Quick Connect 1/4" mnpt x 1/4 " FE OC	N/S
1	BQC4B400	Quick Connect 1/4" FE QC x 1/4" FE QC	N/S
	Quick Connects for Discharge Side		
1	BQC4S4PM	Quick Connect 1/4" MNPT x 1/4" M QC	N/S
1	BZC4S400	Quick Connect 1/4" FE Swagelok X 1/4" M QC	N/S
1	215	Watts Regulator (Regulator must be 3/8" or larger and compatible with fuels and alcohols)	9
1	23K	Marshall 0-60psi, 2-1/2" DIAL, 1/4" MNPT BIM or Equivalent	10
	Hose		
1	S7R4TA4PM4-48	1/4" M Swagelok x 1/4" MNPT— INLET HOSE	11
1	S7R4TA4TA4-36	" " " " " M Swagelok-DIS	12
1	S7R4TA4TA4-12	" " " " " " " "	13
1	S7R4TA4TA4-14	" " " " " " " "	14
1	500ML	Graduated Cylinder	15
1	B4TF2-440	1/4 NPTM Filter Swagelok	16

Optional Accessories - Figure 2

0-500 ml/min Flow Gauge, Viscosity Corrected; Must be calibrated for Various Specific Gravities.

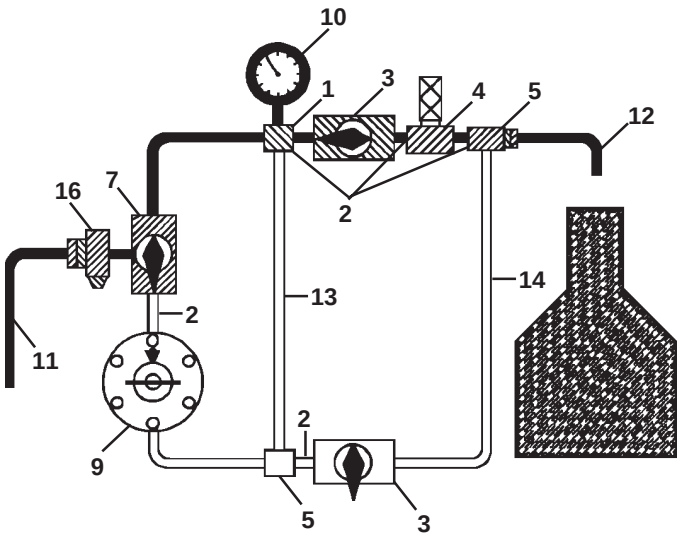


FIGURE 7

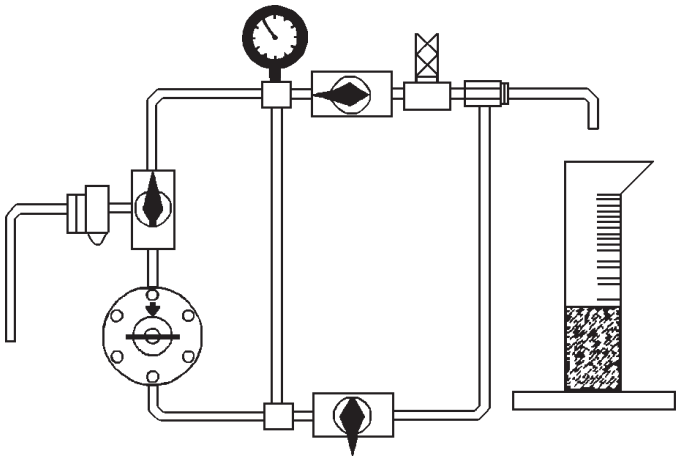


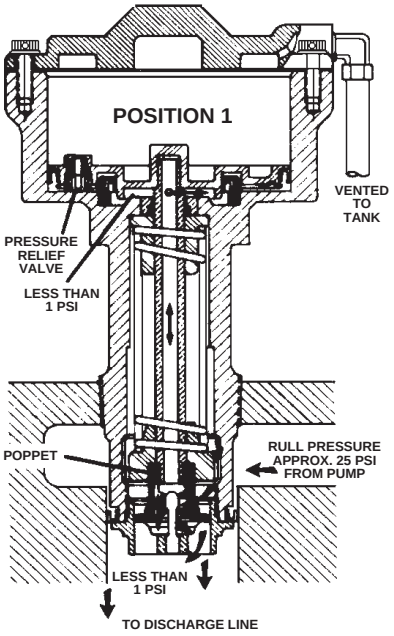
FIGURE 8

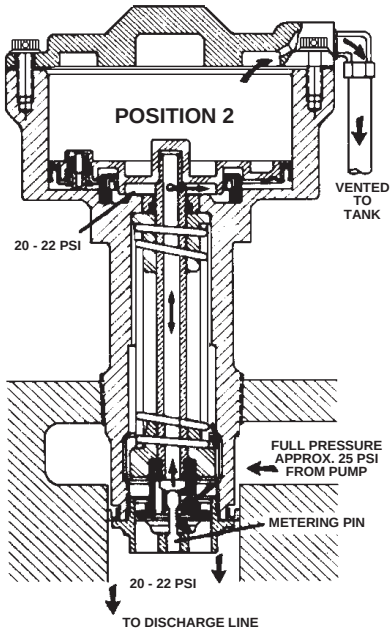
The Piston-type Leak Detector...3 STEP LEAK TEST

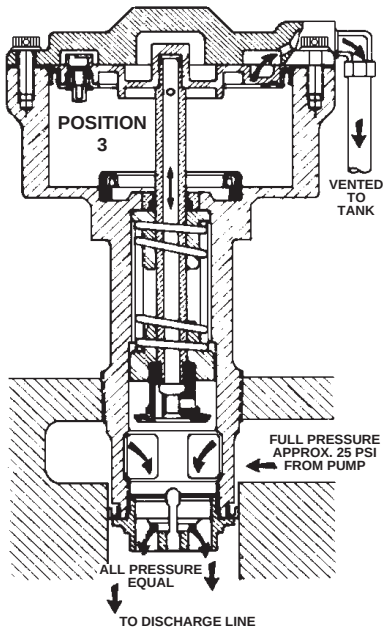
The Red Jacket piston leak detector is a pressure-sensing, piston-operated valve designed to indicate a leak in the piping between the leak detector and the dispenser.

When the line pressure is at approximately less than 1 psi and the submerged pump is turned on, a controlled amount of product (three gallons per hour) is metered through the **LLD** into the piping system. If a leak is present that equals or exceeds this amount, as much product escapes from the system as is metered in through the **LLD**. Under this condition pressure cannot build up in the piping system. When a nozzle is opened, a poppet in the **LLD** moves to a position that restricts the flow to approximately 1-1/2 to 3 GPM. This is the indication to the operator that a leak is present.*

If there are no leaks, pressure rapidly builds in the system forcing the **LLD** to open to the full-flow position. In a system with no leaks, it takes approximately two seconds for a complete test. No further line testing takes place until the line pressure drops below 1 psi.







1. **The Trip or Relaxed Position.** Under normal operating conditions, it is assumed that the lines are filled with gasoline. When the system pressure is less than 1 psi, the piston and poppet are in their "down" or "tripped" position. The position of the valve poppet is such as to allow approximately 1-1/2 to 3 GPM flow into the delivery line through a bypass opening in the **LLD** valve poppet when the submersible pump starts. Since the system is full, pressure builds rapidly and the poppet moves to the leak sensing position assuming there is no leak present. The pressure relief valve prevents any build up of pressure under piston when in trip position by allowing relief of trapped product.
2. **Leak Sensing Position.** As the pressure builds to approximately 20 to 22 psi (rapidly) the piston has moved the poppet to such a position as to almost stop the flow into the piping through the **LLD** valve poppet. In this position, all the flow must then travel around the metering pin which limits it to approximately 3 GPH rate. If a simultaneous loss from the system equals or exceeds this amount, the line pressure will not build beyond this point and the valve will remain in the leak sensing position with the main flow blocked. If there is an attempt to dispense while the valve is in this position, the line pressure will drop, the piston will respond, and the poppet will return to Position 1 where the 1-1/2 to 3 GPM will flow to the dispensers.* If there is no leakage in the system, the small flow around the metering pin increases the line pressure to 22 psi in approximately two seconds at which point the piston will snap the poppet to Position 3, allowing full flow. Any product relieved through pressure relief valve during trip position will be vented through vent tube to tank. This allows piston to move freely with no back pressure to hamper its movement.
3. **Non-Leak Position.** This position allows full flow. The poppet will remain in this position as long as the system pressure remains above 1 psi. At less than 1 psi, the poppet will return to Position 1 and the next time the pump is activated, the **LLD** will perform a line test.

*If the dispensing system (the solenoid valve and the nozzle) is opened previous to the completion of the line test, the **LLD** will detect this opening as a leak and restricted flow will result. Closing of the nozzle(s) for a period of time, adequate to allow completion of the line test, will allow the **LLD** to open. This, in turn, will allow full flow providing there is no additional escape for fuel in the system.

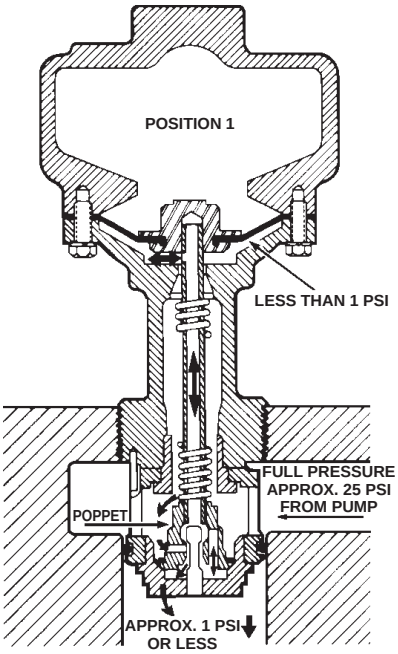
NOTICE **Per the above process, this product is designed and sold to detect leaks of 3 GPH or greater only. For leaks of less than 3 GPH, please consult with your Marley Pump Company representative.**

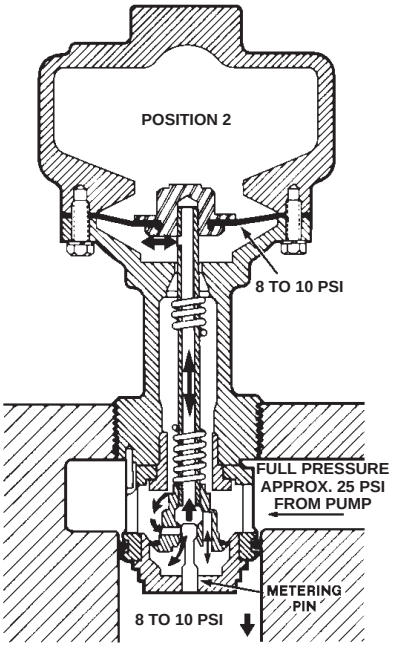
The Diaphragm-type Leak Detector...3 STEP LEAK TEST

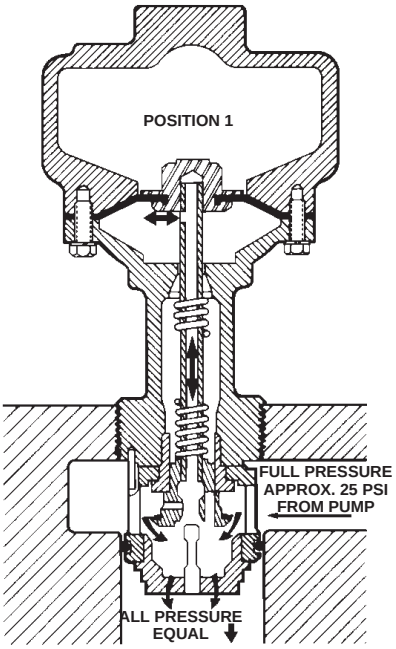
The Red Jacket diaphragm leak detector is a pressure-sensing, diaphragm-operated valve designed to indicate a leak in the piping between the leak detector and the dispenser.

When the submerged pump is turned on, a controlled amount of product (three gallons per hour) is metered through the **LLD** into the piping system. If a leak is present which equals or exceeds this amount, as much product escapes from the system as is metered in through the **LLD**. Under this condition pressure cannot build up in the piping system. When a nozzle is opened, a poppet in the **LLD** moves to a position that restricts the flow to approximately 1-1/2 to 3 GPM. This is the indication to the operator that the leak is present.

If there are no leaks, pressure rapidly builds in the system forcing the **LLD** to open to the full-flow position. In a system with no leaks, it takes approximately two seconds for the complete test. No further line testing takes place until the line pressure drops below 1 psi.







1. **The Trip or Relaxed Position.** Under normal operating conditions, it is assumed that the lines are filled with gasoline. When the system pressure is less than 1 psi, the diaphragm and poppet are in their "down" or "tripped" position. The position of the valve "poppet" is such as to allow approximately 1-1/2 to 3 GPM flow into the delivery line through a bypass opening in the **LLD** valve poppet when the submersible pump starts. Since the system is full, pressure builds rapidly and the poppet moves to the leak sensing position assuming there is no leak present.
2. **Leak Sensing Position.** As the pressure builds to approximately 8 to 10 psi (rapidly) the diaphragm has moved the poppet to such a position as to almost stop the flow into the piping through the **LLD** valve poppet. In this position, all the flow must then travel around the metering pin which limits it to approximately 3 GPH rate. If a simultaneous loss from the system equals or exceeds this amount, the line pressure will not build beyond this point and the valve will remain in the leak sensing position with the main flow blocked. If there is an attempt to dispense while the valve is in this position, the line pressure will drop, the diaphragm will respond, and the poppet will return to Position 1 where the 1-1/2 to 3 GPM will flow to the dispensers. Leaks smaller than 3 GPM will be indicated by the **LLD** taking longer than approximately two seconds to open completely. If there is no leakage in the system, the small flow around the metering pin increases the line pressure to 10 psi in approximately two seconds at which point the diaphragm will snap the poppet to Position 3. This all takes place in less time than it takes to reset the dispenser, walk to the car, remove the gas tank cap, insert and open the nozzle.
3. **Non-Leak Position.** This position allows full flow. The poppet will remain in this position as long as the sytem pressure remains above 1 psi. At less than 1 psi, the poppet will return to Position 1 and the next time the pump is activated, the **LLD** will perform a line test.

NOTICE **Per the above process, this product is designed and sold to detect leaks of 3 GPH or greater only. For leaks of less than 3 GPH, please consult with your Marley Pump Company representative.**

SAMPLE FTA TEST CHART

Location	Service Company	Date

Technician Performing Test _____

TECH # _____

Type of Leak Detectors tested (check one)

☐ XLD P/N 116036-5 ☐ XLP P/N 116035-5 ☐ BFLD (XL Model) P/N 116039-5
☐ DLD P/N 116017-5 ☐ PLD P/N 116030-5 ☐ BFLD P/N 116012-5
☐ OTHER _____

TEST INFORMATION

	Serial Number	Resiliency	Opening Time	Test Leak Rate ML/Min	Functional Element Holding PSI	Metering PSI	Yes or No
1							
2							
3							
4							
5							
6							
7							
8							

Marley Pump
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