



*Installation, Operation, and
Maintenance Manual*

Welker[®] Liquid Knockout System

The information in this manual has been carefully checked for accuracy and is intended to be used as a guide for the installation, operation, and maintenance of the Welker equipment described above. Correct operating and/or installation techniques, however, are the responsibility of the end user. Welker reserves the right to make changes to this and all products in order to improve performance and reliability.

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SPECIFICATIONS

1. GENERAL

1.1 Introduction

We appreciate your business and your choice of Welker products. The installation, operation, and maintenance liability for this product becomes that of the purchaser at the time of receipt. Reading the applicable *Installation, Operation, and Maintenance (IOM) Manual* prior to installation and operation of this equipment is required for a full understanding of its application and performance prior to use.*

If you have any questions, please call 1-800-776-7267 in the USA or 1-281-491-2331.

Notes, Warnings, and Cautions



NOTE

Notes emphasize information or set it off from the surrounding text.



CAUTION

Caution messages appear before procedures that, if not observed, could result in damage to equipment.



WARNING

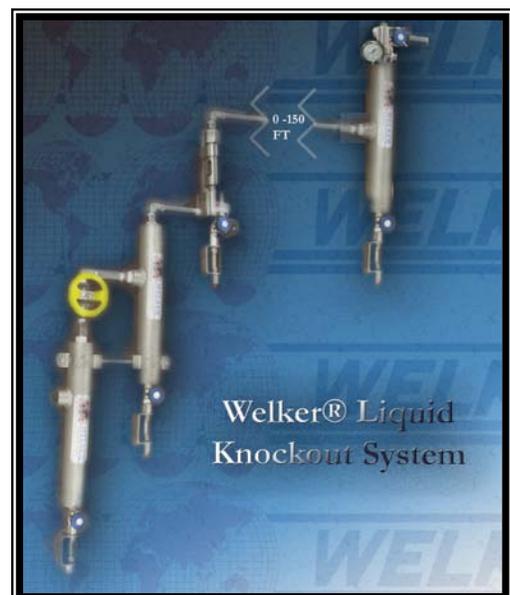
Warnings alert users to a specific procedure or practice that, if not followed correctly, could cause personal injury.

The following procedures have been written for use with standard Welker parts and equipment. Assemblies that have been modified may have additional requirements and specifications that are not listed in this manual.

1.2 Description of Product

The Liquid Knockout system is a four-stage liquid separation system that is designed to remove liquids from a gaseous flow in the pipeline. The result of this process is an output of gas with no free liquids, which allows for optimal analysis of the pipeline components.

See Section 1.5 Principle of Operation, for further details.



SPECIFICATIONS

1.3 Specifications

N NOTE

The specifications listed in this Section are generalized for this equipment. Welker can modify the equipment according to your company's needs. However, please note that **the specifications may vary depending on the customization of your product.**

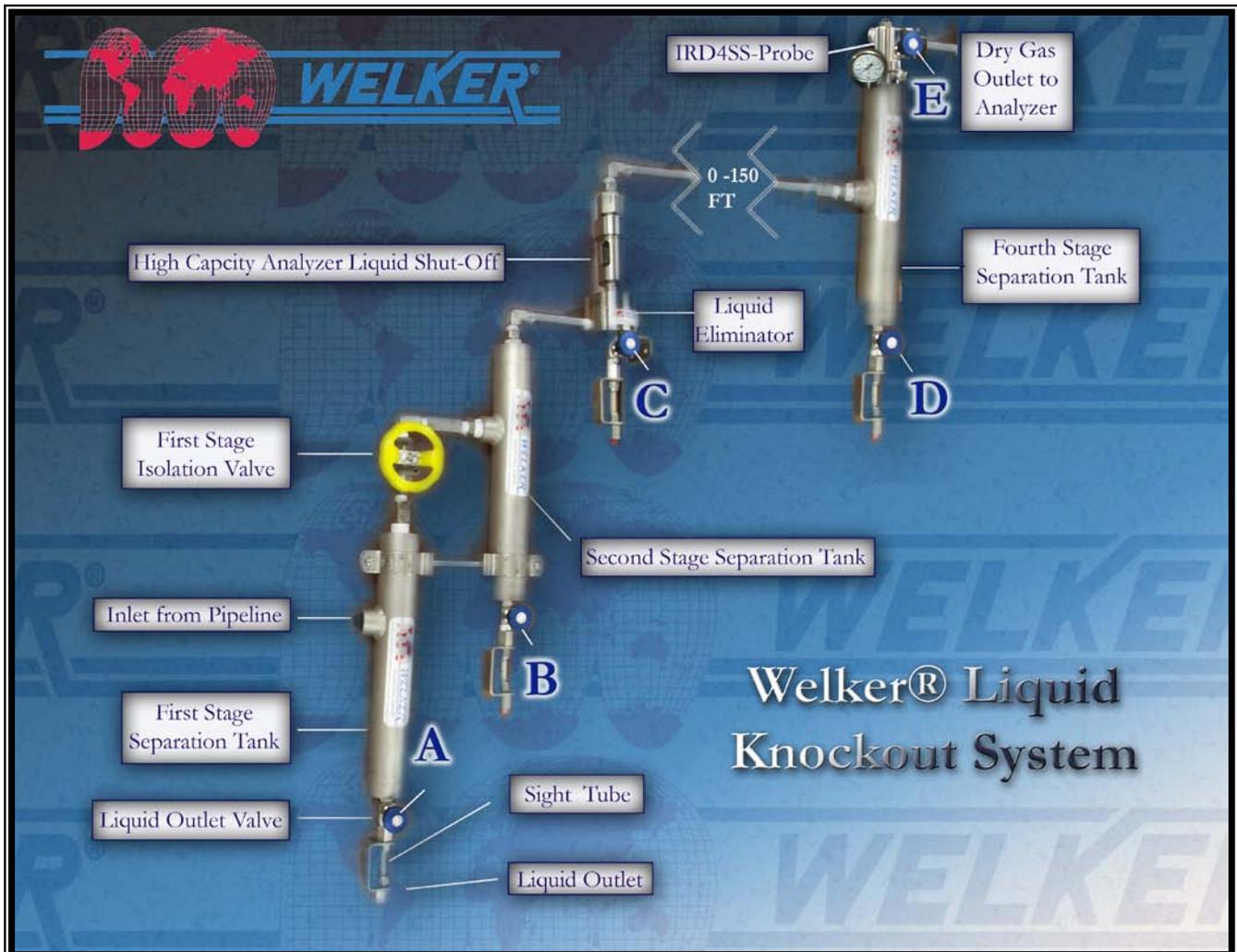
Table 1

Specifications	
Materials of Construction:	PTFE, 316 Stainless Steel, Viton®, and Lexan®, and clear tubing.
Maximum Allowable Operating Pressure:	1,000 PSIG
Maximum Allowable Temperature:	-20°F to 100°F
Inlet Port:	1/4" NPT
Outlet Ports:	1/4" NPT
Products Separated:	Free Liquids

SPECIFICATIONS

1.4 System Components Liquid Knockout

- Stage One Separation Tank - Drip Pot (DP15A)
-Equipped with Sample Probe (SP-3) installed inside, not shown on diagram below
- Stage Two Separation Tank - Drip Pot with Baffle (DP15ABD)
-Equipped with Sample Probe (SP-1) installed inside, not shown on diagram below
- Liquid Eliminator (LE2SS)
- High Capacity Analyzer Liquid Shut-off (ALS1HC)
- Four PFA Sight Tubes (ST1)
- Stage Four Separation Tank - Drip Pot (DP15A)
-Equipped with IRD-4SS Probe Regulator with 1031 KO tip
- Needle valves and associated piping, fittings, etc.



INSTALLATION & OPERATIONS

2. INSTALLATION & OPERATION INSTRUCTIONS

2.1 Principle of Operation

1. Gaseous fluids from the pipeline will flow through the inlet valve, located on the Stage One Separation Tank, which will begin the process of separating the free liquids from the gases (see Figure 1):

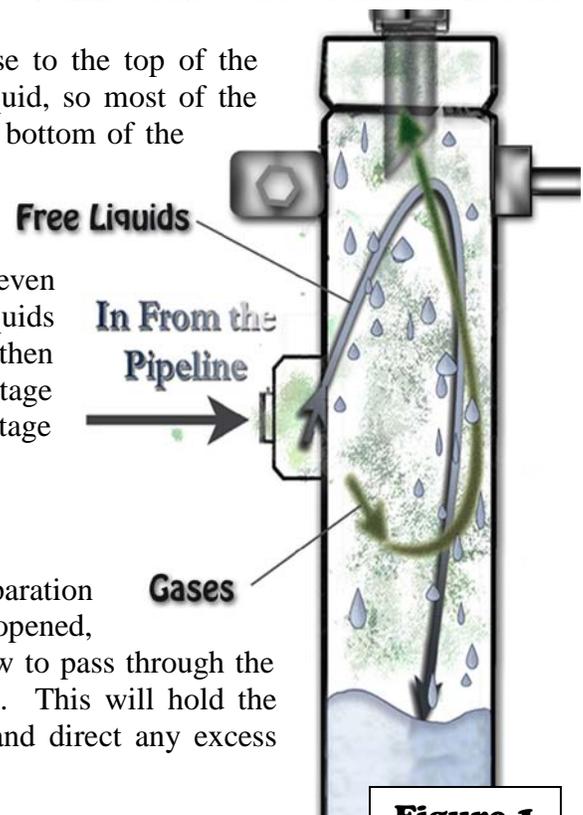
A. Flow to top of tank:

As the gases fill the chamber, they rise to the top of the cylinder. Gas is much lighter than liquid, so most of the free liquid in the flow will drop to the bottom of the chamber. Once the chamber is filled, the gases will pass through the shielded sample probe (SP3), to slow the velocity and separate the flow even more by causing heavy aerosols/free liquids to fall to the bottom. The gases will then pass through the upper outlet of the Stage One Separation Tank and into the Stage Two Separation Tank.

B. Flow to bottom of tank:

The lower valve on the Stage One Separation Tank, valve "A", should be slightly opened, and adjusted for a small amount of flow to pass through the sight tube, and into a recovery system. This will hold the liquids separated through Stage One, and direct any excess gas caught in them to flare.

Stage One Separation Tank



2. Gases and any residual liquids flow in from Stage One Separation Tank. Upon entering the Stage Two Separation Tank, the flow will repeat the same process; however, an additional method for liquid separation will be used in stage two. The Stage Two Separation Tank is equipped with a diagonal sloped baffle, which blocks the liquids from rising (see diagram on page 7); most liquid droplets fall to the bottom of the tank, and the miniscule amount of liquid that does travel upward is directed to the bottom by the baffle.

A. Flow to top of tank:

Gases are lighter and can also travel around corners, thus the baffle does not prevent them from floating all the way to the top of the tank, through the sample probe (SP1), and out of the outlet.

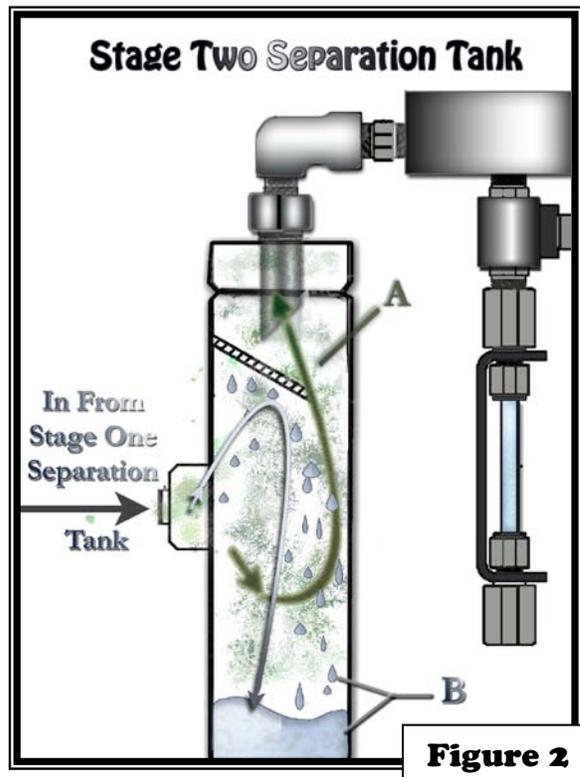
INSTALLATION & OPERATIONS

2.1 Principle of Operation (Continued)

B. Flow to the bottom of the tank:

As in stage one, the lower valve on the Stage Two Separation Tank, valve "B", should be slightly opened, and adjusted for a small amount of flow to pass through the sight tube, and into a recovery system.

3. The Liquid Eliminator is designed to remove any remaining liquid. It was designed so that on the rare occasions that there may be any liquid remaining in the gaseous flow, the chances of any such liquid passing farther through the system are extremely rare, because the eliminator is equipped with an internal filter made of porous copolymer. Any liquid that enters from the Stage Two Separation Tank will be funneled through to the final outlet valve "C", through the sight glass and into the sump.



4. In cases in which there is a consistent flow of liquid passing through the pipeline, the liquid knockout system is also equipped with a high capacity Analyzer Liquid Shut-off (ALS). Should any liquids pass through with the gas that flows beyond the filter in the Liquid Eliminator and into the ALS, a ball will float upward and seal off the dry gas outlet to the ALS completely. Thus, when there is a heavy amount of liquid flowing through the pipeline, the flow from the "A", "B", and "C" valves will be almost constant, and there will be no flow of gas to the ALS.

N NOTE

A high-capacity ALS is not as sensitive as a normal ALS, so it is possible a miniscule amount of microscopic droplets of liquid will not shut off flow to the Automatic Liquid Shut-off. Therefore in this system, there is a fourth and final stage separation tank, which is equipped with an IRD-4SS Probe Regulator with a 1031 tip. This will prevent any possible aerosols from entering the gas chromatograph Automatic Liquid Shut-off.

5. Additionally, in cases in which the pipeline flow is expected to contain heavy liquid amounts, the stage one isolation valve can be closed in order to isolate liquid from the flow, and direct it to the sump without damaging the remaining components of the system.

INSTALLATION & OPERATIONS

2.2 General

After unpacking the unit, check it for compliance and for any damages that may have occurred during shipment.

N NOTE

Claims for damages caused during shipping must be initiated by the receiver and directed to the shipping carrier. Welker is not responsible for any damages caused from mishandling by the shipping company.

N NOTE

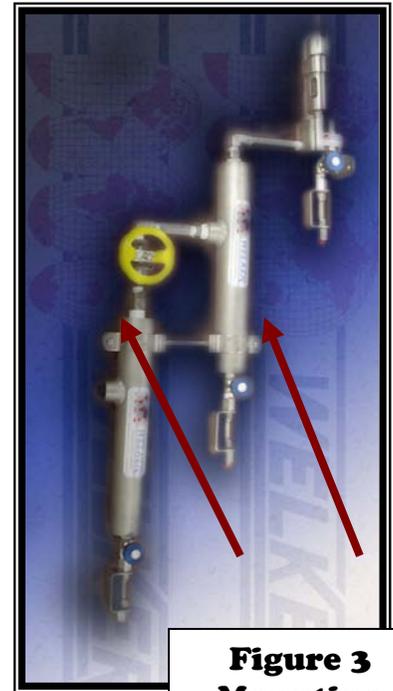
When sealing fittings with PTFE tape, refer to the proper sealing instructions for the tape used.

2.3 Installation Instructions *(Refer to Diagram on page 5)*

N NOTE

The above equipment will ship from the manufacturer, "hard tube" connected and ready for mounting.

1. Bolt the system vertically so that the liquid outlets are facing downward (See Figure 3).
2. Make sure all valves are closed.
3. Remove red safety plugs from liquid outlets under valves "A", "B", "C", and "D", and then hard tube connect the liquid outlets to a safe recovery system. This recovery system should have a top outlet in which the gas may be sent through a 10 PSI check valve and then to a flare.
4. Tube the pipeline flow outlet to the inlet from pipeline.
5. Tube the dry gas outlet to the desired analyzing equipment.
6. Allow flow from pipeline to begin.
7. Slightly open valves "A", "B", "C" and "D" and "E" to the desired amount.
8. Slowly open Stage One Isolation Valve.
9. Check for leaks. The system is now in operation.



**Figure 3
Mounting
Holes**

MAINTENANCE

3. MAINTENANCE

3.1 General

Prior to maintenance or disassembly of the unit, it is advisable to have a repair kit handy for the system in case of unexpected wear or faulty seals. All maintenance and cleaning of the unit should be done on a smooth, clean surface.

N NOTE

We recommend that the unit have maintenance according to the list below, however this list was created with the assumption the equipment will be used during normal operating conditions. In the case of severe service, dirty conditions, excessive cycling usage, or other unique applications that may subject the equipment to unpredictable circumstances, a more frequent maintenance schedule may be appropriate. If the equipment is not functioning properly, please see troubleshooting guide on page 14 to determine if maintenance is necessary to correct the system operation problems.

3.2 Maintenance Preparation

Recommended Maintenance Schedule per System Component:

Stage One Separation Tank - Drip Pot (DP15A) - Equipped with Sample Probe (SP-3)	No Maintenance
Stage Two Separation Tank - Drip Pot with Baffle (DP15ABD) - Equipped with Sample Probe (SP-1)	No Maintenance
Liquid Eliminator (LE2SS)	Change the LE2 Liquid Copolymer Membrane Filter every 3 months or as needed.
High Capacity Automatic Liquid Shut-off Liquid Shut-off (ALS1HC)	Service every 3 to 6 months
Three PFA Sight Tubes (ST1)	Replace as needed.
Stage Four Separation Tank - Drip Pot (DP15A) - Equipped with IRD-4SS Probe Regulator with 1031 KO tip	Service every 3 to 6 months
Needle valves and associated piping, fittings, etc.	No Maintenance

MAINTENANCE

3.2 Maintenance Preparation

Recommended Tools:

It would be advisable to have the following tools available for maintenance of the unit; however, tools used will vary depending on product modifications.

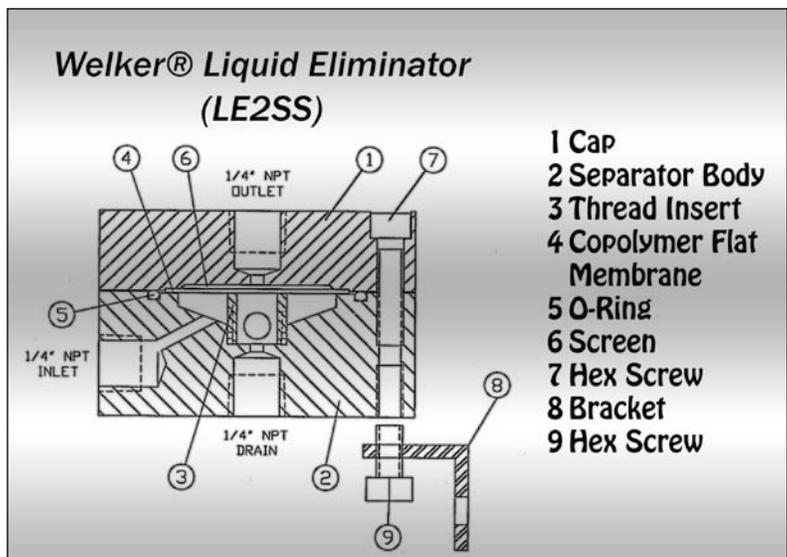
- a. Small hex key set
- b. 6" adjustable wrench
- c. 1/4" allen key wrench

N NOTE

Prior to performing any maintenance procedures on this system, terminate flow from the pipeline, and depressurize and purge all gas and free liquids from the system.

3.3 LE2SS & ALS1HC Maintenance

1. Disconnect tubing from Second Stage Separation Tank and tubing from Stage Four Separation Tank.
2. Remove Liquid Eliminator and Analyzer Liquid Shut-off;
3. Unscrew the Liquid Separator from the Analyzer Liquid Shut-off.
4. Set the ALS aside.
5. Unscrew the hex head bolts (Part 7 & 9) from the separator body.
6. Replace the Copolymer Flat Membrane (Part 4), and the O-ring (Part 5) in the body.
7. Clean and replace, if necessary, the screen (Part 6).
8. Put the separator body back together with the cap, making sure the copolymer flat membrane is on top of the O-ring on the body side of the separator, and the screen is laying flat at its original position in the cap of the separator.



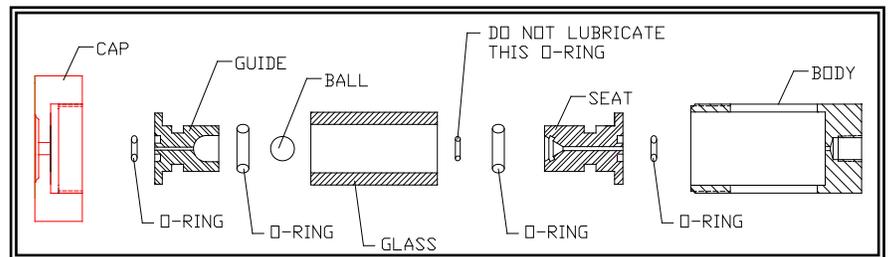
MAINTENANCE

3.3 LE2SS & ALS1HC Maintenance (Continued)

9. If it is necessary to perform maintenance on the Analyzer Liquid Shut-off, place the Liquid Eliminator to the side and go on. If not, skip to step 14.
10. Remove the ALS Glass Assembly from its body.
11. Replace all five seals and O-rings in the assembly (*See Figure below*).

IMPORTANT: Do not lubricate the seal that is located inside the glass assembly with the shut-off ball.

ALS Glass Assembly



12. Make sure that the ball has no dings or scratches. Replace if necessary.
13. Reinstall the glass assembly inside the liquid shut-off body.
14. Hand-tighten the separator body to the ALS body, and reinstall the components to the liquid knockout system.

MAINTENANCE

3.4 IRD4SS Regulator Maintenance (See Figure 3)

1. **Close the appropriate pipeline valves to depressurize the pipeline.** Disconnect the instrumentation from the regulator's outlet port. Remove the probe from the pipeline.
2. Loosen the adjusting nut (Part 2) on the adjusting screw (Part 1).
3. Loosen the adjusting screw to relieve tension on the spring (Part 6).
4. **Disassemble Diaphragm Assembly:**
 - a) Unscrew the spring housing (Part 4) and remove.
 - b) Remove the top spring guide (Part 5) and the spring (Part 6).
 - c) Remove the bottom spring guide (Part 7).
 - d) Remove the diaphragm assembly (Part 8). Inspect for wear, and replace if necessary.
 - e) Set the diaphragm back into place.
 - f) Set the bottom spring guide back into place on top of the diaphragm.
5. Set the spring (Part 6) back into place.
6. Set the top spring guide (Part 5) back into place on top of the spring.
7. Reattach the spring housing (Part 4) securely. Hand-tighten the housing.
8. Proceed to Section 3.5 for probe maintenance.

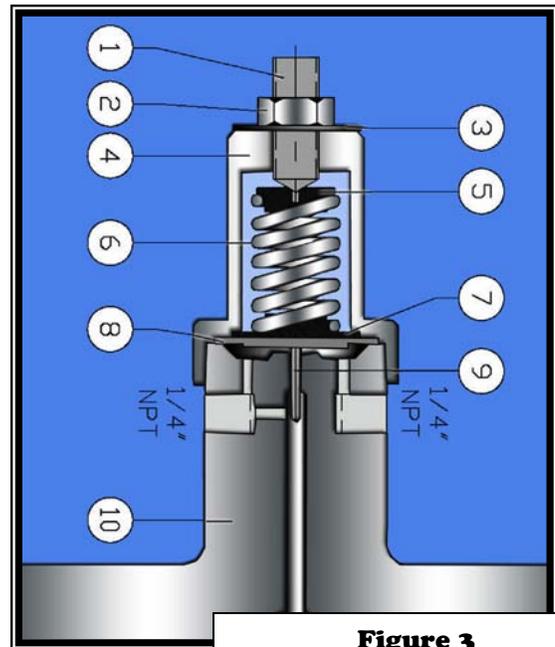


Figure 3
Instrument Regulator

MAINTENANCE

3.5 IRD4SS Probe Maintenance

(See Figure 3)

1. Use a pair of channel lock pliers as a backup to hold the thermal fins (Part 16) while using another pair to remove the seat retainer (Part 20).

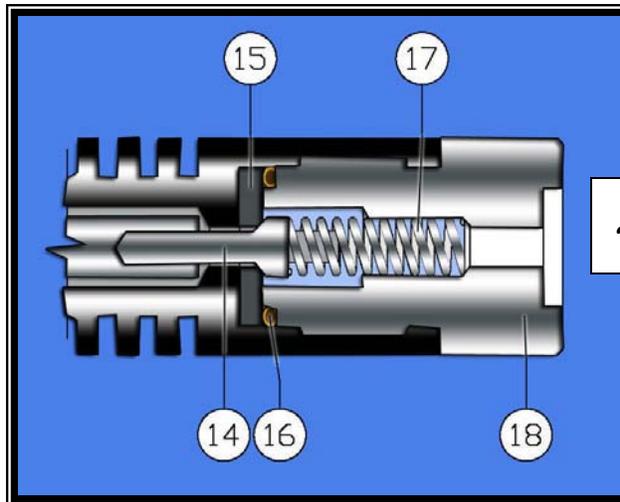


Figure 5
Thermal Fins & Retainer

2. Remove the poppet spring (Part 17) and the poppet (Part 14).
3. Use a pointed instrument to carefully pick the seat (Part 15) out of the body of the thermal fin.
4. Examine the poppet and the seat for scratches. If scratches are present, the part will need to be replaced.

! CAUTION

Debris or scratches on either the poppet or the seat will prevent positive shut-off of the regulator.

5. Guide the poppet into the seat.
6. Replace the spring and seat retainer.
7. Tighten the seat retainer firmly.
8. Replace the O-ring (Part 16) on the shaft.
9. If there is a shaft extension, remove the extension from the thermal fins.
10. Reattach the thermal fins to the shaft. Tighten firmly.

! CAUTION

When reattaching the base to the body, make sure that the contact rod and push rod are carefully installed and lined up correctly. The push rod should fit easily over the poppet and should not stack on top of it. If the rod is stacked on top of the poppet, the device will not be able to be reassembled properly.

11. Follow instructions in Section 2.3 to reinstall the probe assembly.

TROUBLESHOOTING

4. Troubleshooting Guide

The following is a troubleshooting table of issues most commonly associated with the Welker Liquid Knockout System models. If you are having a problem that is not listed, or if the solution provided does not repair the problem, please call Welker for service options.

PROBLEM	POSSIBLE CAUSE	SOLUTION
There is no output from drain valves.	There is no pressure coming from the pipeline, or valve is clogged.	Depressurize the system, and remove and clean the valve.
No output from the ALS	Liquid has passed through the Liquid Eliminator, and the ALS has shut off the dry gas outlet to the Automatic Liquid Shut-off.	Follow maintenance procedures to replace filter and clean and dry the system.
Stage 1, 2, & 3 Separation Tanks are sweating or show excess condensation.	Too much bleed rate causes Joule-Thomson effect	Adjust drain valves to sump to a minimal flow of liquid - No Gas.
Sight tubes turn black.	Oil or carbon deposits in liquids.	Replace tubing regularly.



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