INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER® inFLOW™ ELECTRIC CRUDE OIL EXTRACTOR
FIXED INSERTION

MODEL
LSMEFI

DRAWING NUMBER
AD949AA

MANUAL NUMBER
IOM-261

REVISION
Rev. 0, 05/01/2025

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IMPORTANT SAFETY INFORMATION
READ ALL INSTRUCTIONS

Notes emphasize information and/or provide additional information to assist the user.

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

Warning messages appear before procedures that could result in personal injury if not observed.

This manual is intended to be used as a basic installation and operation guide for the Welker® inFlow™ Electric Crude Oil Extractor, LSMEFI. For comprehensive instructions, please refer to the IOM Manuals for each individual component. A list of relevant component IOM Manuals is provided in Appendix A of this manual.

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 in this manual. Correct installation and operation, however, are the responsibility of the end user. Welker® reserves the right to make changes to this manual and all products in order to improve performance and reliability.

BEFORE YOU BEGIN

Read these instructions completely and carefully.

IMPORTANT - Save these instructions for local inspector's use.

IMPORTANT - Observe all governing codes and ordinances.

Note to Installer - Leave these instructions with the end user.

Note to End User - Keep these instructions for future reference.

Installation of this inFlow™ Electric Crude Oil Extractor is of an electrical and mechanical nature.

Proper installation is the responsibility of the installer. Product failure due to improper installation is not covered under the warranty.

If you received a damaged inFlow™ Electric Crude Oil Extractor, please contact a Welker® representative immediately.

Phone: 281.491.2331
Address: 13839 West Bellfort Street
Sugar Land, TX 77498

SECTION 1: PRODUCT INFORMATION

1.1 Introduction

We appreciate your business and your choice of Welker® products. The installation, operation, and maintenance liability for this equipment becomes that of the purchaser at the time of receipt. Reading the applicable *Installation, Operation, and Maintenance* (IOM) *Manuals* 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 Welker® at 1.281.491.2331.

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

1.2 Product Description

The Welker® LSMEFI *Fixed Insertion inFlow™ Electric Crude Oil Extractor* is an isokinetic probe sampler designed to extract a representative sample of liquid product from the flowing stream and transfer the sample to a sample container.

The LSMEFI features a fixed insertion length to accommodate the specific size of the operator's pipe. Sampling is actuated electrically and is electronically controlled from a Programmable Logic Controller (PLC) or other signal control system. Sampling may be timed or proportional-to-flow.

The electronic motor rotates when receiving a power signal, causing the collection head—located in the center one-third (⅓) of the pipeline—to open and close in order to capture a sample from the flowing liquid stream. Then the probe's rotary piston will slowly move the liquid sample through the outlet relief valve into the sample container. The LSMEFI is designed such that all collected liquid and sediment slopes downward from the probe tip to the sample container, thus ensuring a representative sample is collected.

The LSMEFI is designed with the Welker® ESR-2 External Sand Relief Valve, which renders the sampler capable of sampling product containing sand or debris.

For this manual, the term "PLC," or Programmable Logic Controller, will be used to refer to the PLC, DCS, or other signal control system used by the customer to activate and operate the solenoid.

Welker® might custom design the LSMEFI to suit the particular application and specifications of each customer.

1.3 Specifications

The specifications listed in this section are generalized for this equipment. Welker® can modify the equipment according to your company's needs. **Please note that the specifications might vary depending on the customization of your equipment.**

Table 1: Welker® inFlow™ Electric Crude Oil Extractor—Fixed Insertion—Specifications	
Products Sampled	Condensate, Light to Heavy Crude Oil, Liquid Products Compatible With the Materials of Construction, Refined Hydrocarbons
Materials of Construction	316/316L Stainless Steel, FKM, NBR
Maximum Allowable Operating Pressure (With ESR-2 Balanced Relief Valve)	1480 psig @ -40 °F to 140 °F (*49.64 barg @ -40 °C to 60 °C*) – Ambient Temperature 1480 psig @ -40 °F to 150 °F (*49.64 barg @ -40 °C to 65.5 °C*) – Process Temperature
Maximum Allowable Insertion/Retraction Pressure	0 psig
Pipeline Connection	1"–2" Class 150, 300, or 600 RF 2" MNPT Others Available
Sample Outlet Connections	¼" FNPT
Power Connection	¾" FNPT
Insertion Length (Fixed)	4"–24" Others Available
Utility Requirements	DC 12 V DC 24 V AC 110/220 V
Actuation Method/Style	Electrical / SPDT (Single-Pole Double-Throw) Switch
Minimum Process Pressure and Viscosity	5 psig/5–500 cSt
Sample Volume	1.5 cc +/-5% 3.0 cc +/-5%
Sample Grab Rate	Up to 30 Samples/Minute (For 1.5 cc Only)
Mounting	Horizontal
Approximate Dimensions	18¼" x 6" x 7¼" (Length x Width x Height) (For an 18" Insertion Length)
Approximate Weight	20 lb (For an 18" Insertion Length)
Electrical Standard	Class I, Division 1, Groups C & D
Features	316/316L Stainless Steel Probe Electrically Powered ESR-2 Differential Pressure or Non-Differential Pressure Relief Valve NACE Compliance Single-Seal Collection Head
Options	ATEX Certification CSA Certification UL Certification

1.4 Equipment Diagrams

Figure 1: Welker® LSME inFlow™ Electric Crude Oil Extractor – Fixed Insertion – Connections Diagram

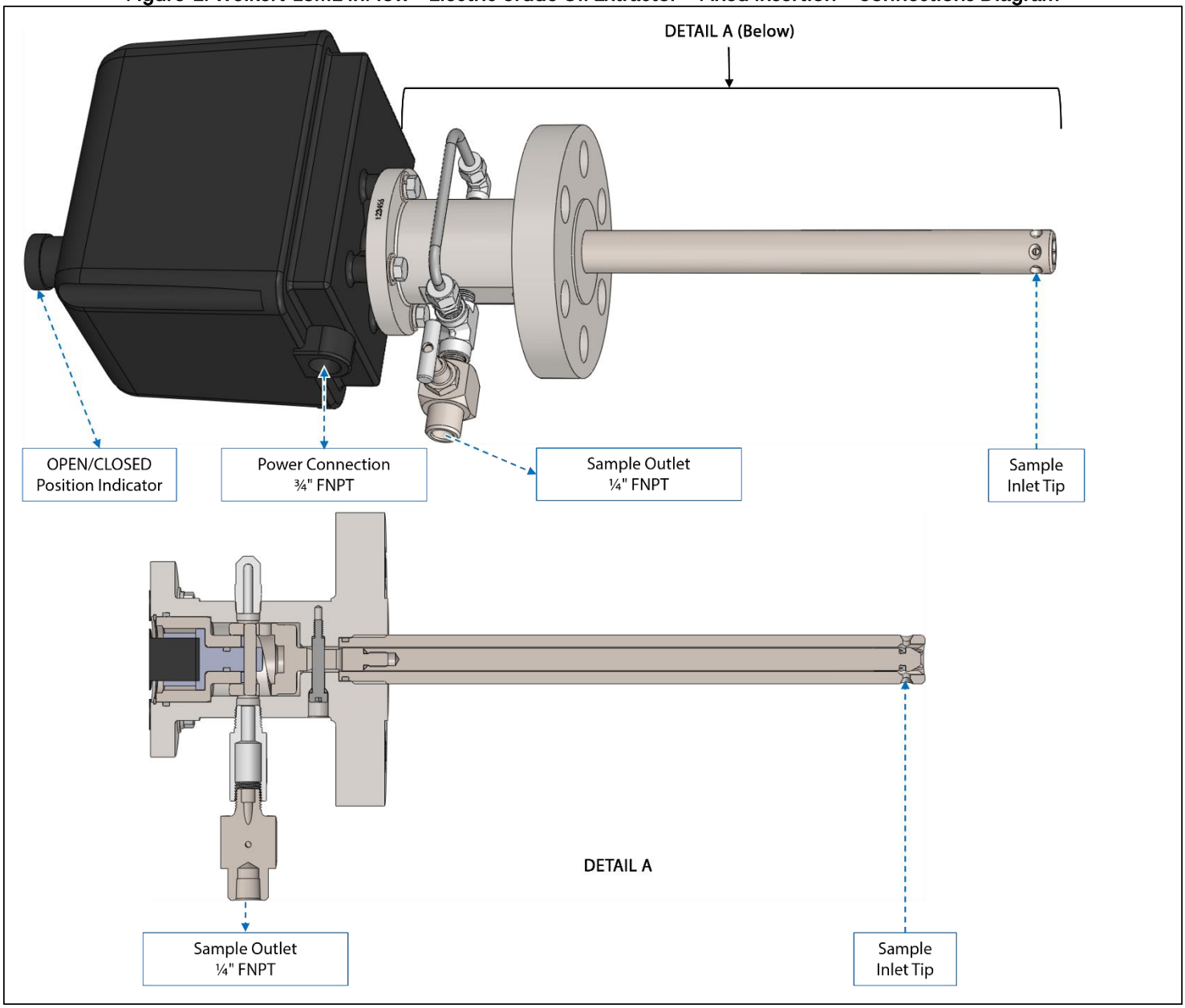
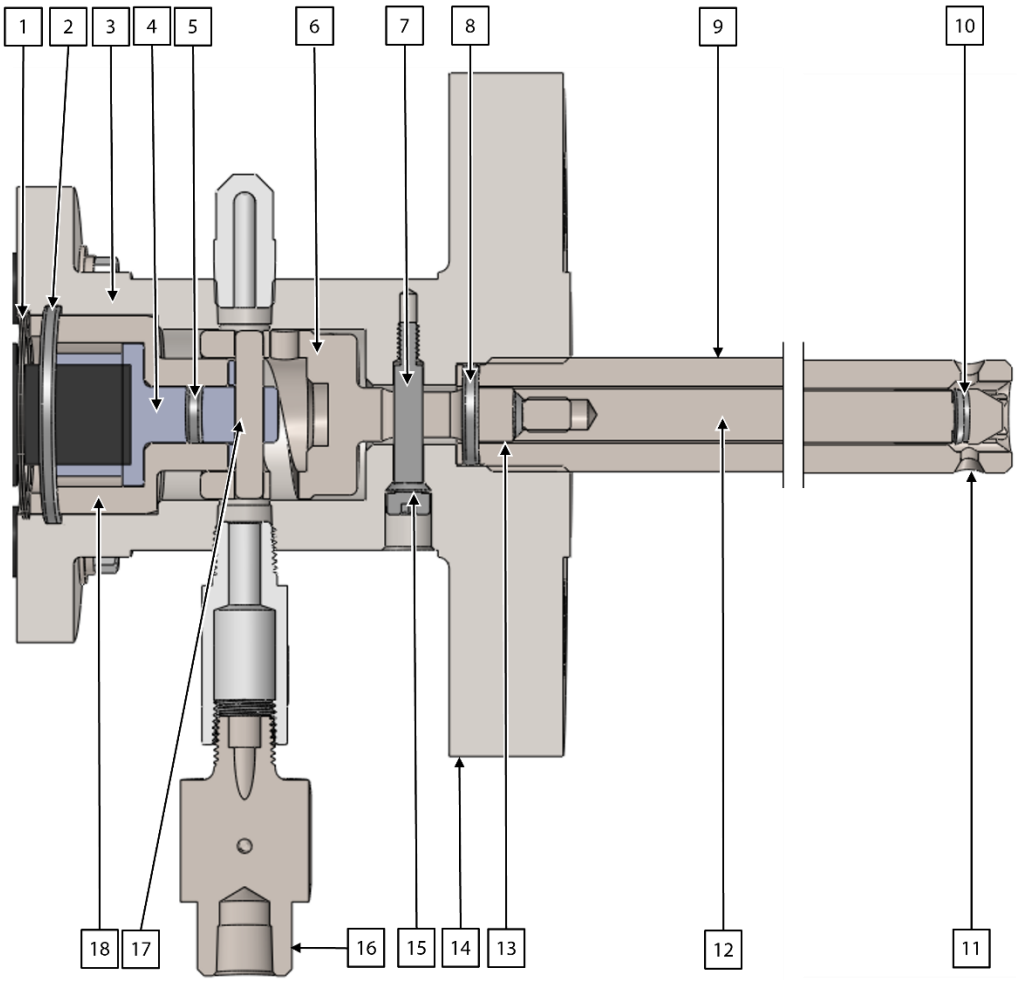


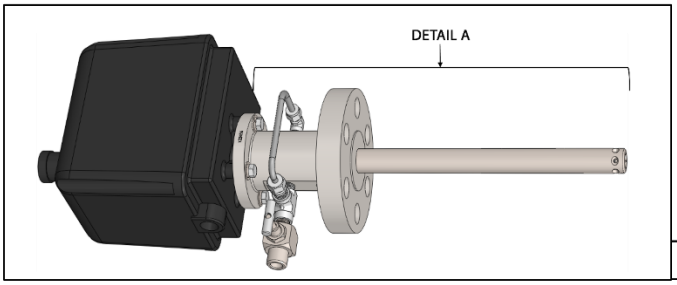
Figure 2: Welker® LSME inFlow™ Electric Crude Oil Extractor – Fixed Insertion – Diagram – Detail A



No.	Description
1	Spirolox
2	O-Ring
3	Base Nipple
4	Rotary Cap
5	O-Ring
6	Guided Rotary Piston
7	Shoulder Screw

No.	Description
8	O-Ring
9	Outer Shaft Extension
10	U-Cup Seal
11	Probe Sample Inlet (Qty = 6)
12	Inner Shaft Extension
13	O-Ring

No.	Description
14	Pipeline Connection Flange
15	O-Ring
16	Emergency Shutoff Valve
17	Rotary Piston Pin
18	Rotary Piston Adapter



DETAIL A – EXTERNAL VIEW

SECTION 2: INSTALLATION & OPERATION

2.1 Before You Begin

After unpacking the unit, check the equipment for compliance and any damage that might have occurred during shipment. Immediately contact a Welker® representative if you received damaged equipment.

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

Take care not to close the pipeline isolation valve on the insertion shaft while the shaft is inserted in the pipeline. This is the most common cause of damage to Welker® probes.

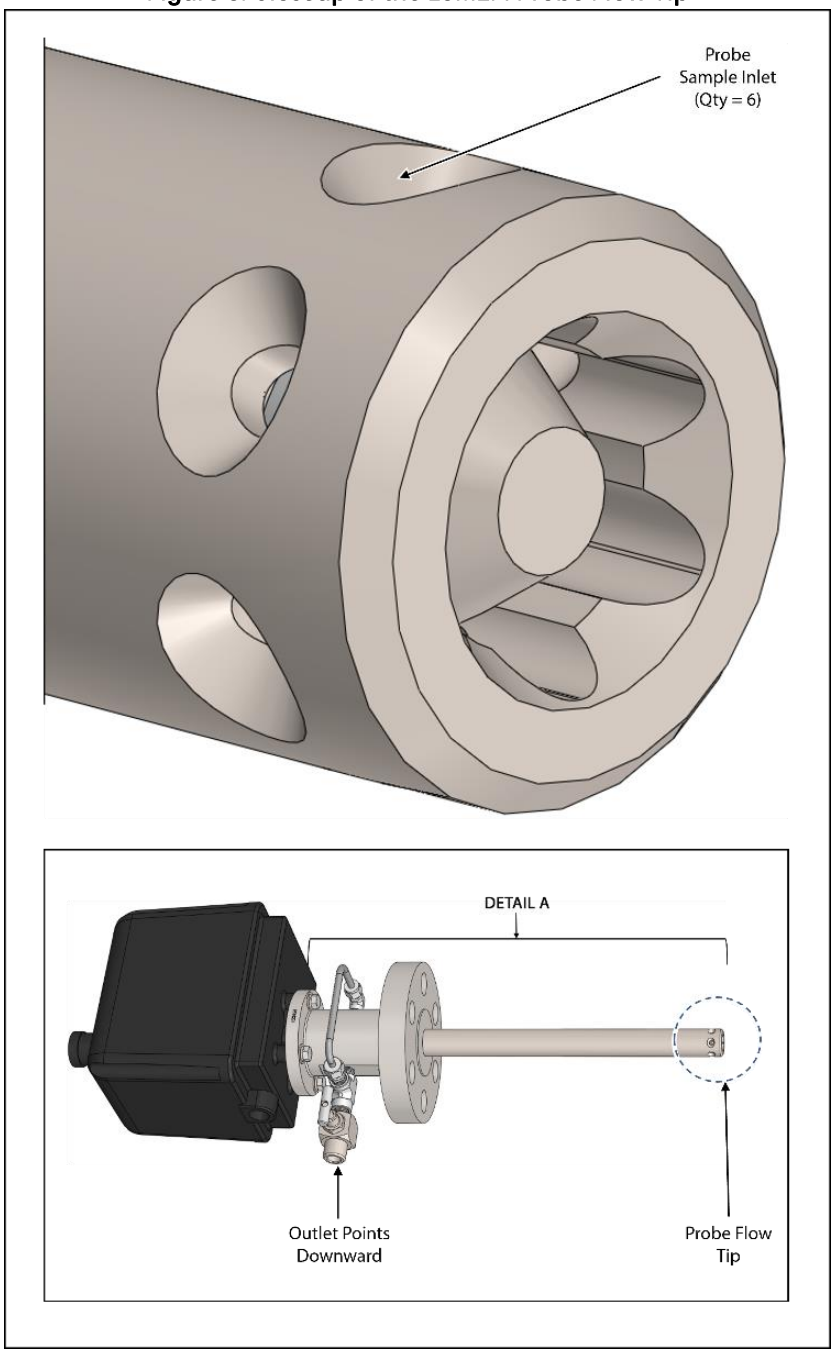
1. The unit MUST be installed horizontally—that is, to the side of the pipe—and inserted into the center one-third (⅓) of the pipeline in a location where the product is well-mixed and will yield an accurate and representative sample.
2. Locate the unit at least two to four pipe diameters downstream of an inline static mixer or other flow conditioning system.
3. Handle the unit with care. Avoid bending the insertion shaft.
4. To avoid damaging the unit, operate the unit slowly and smoothly while inserting and retracting.

2.2 Preparing the Unit for Installation

1. The LSMEFI inFlow™ Electric Crude Oil Extractor features an isokinetic probe tip that can be oriented in any direction in relation to product flow within the pipeline (*Figure 3*).
2. However, it is necessary to ensure that the LSMEFI inFlow™ Electric Crude Oil Extractor is oriented such that the sample outlet port (i.e., emergency shutoff valve) faces downward (*Figure 1* and *Figure 3*). This is to make certain that product slopes in a downward direction from the collection head at the probe tip to the sample outlet port to the sampling container.

The LSMEFI sample volume is not adjustable. It is either 1.5 cc +/-5% or 3.0 cc +/-5%

Figure 3: Closeup of the LSMEFI Probe Flow Tip

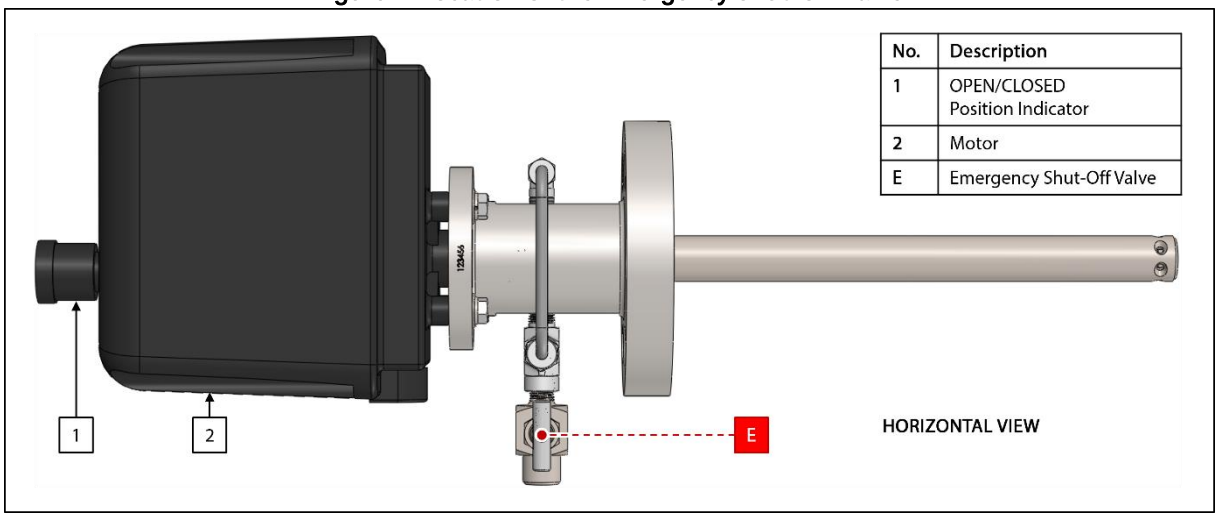


2.3 Installing the Unit

The pipeline MUST BE depressurized prior to installation or removal of the unit. Failing to depressurize the pipeline will likely result in damage to the equipment and injury to the operator.

1. Depressurize the pipeline.
2. Ensure the OPEN/CLOSED position indicator is in the OPEN position.
3. Close emergency shut-off valve E on the LSMEFI (*Figure 4*).

Figure 4: Location of the Emergency Shut-Off Valve



4. Install the LSMEFI to the pipeline such that the sample outlet port (also known as the emergency shut-ff valve) faces downward (*Figure 1* and *Figure 4*).
5. Secure the LSMEFI to the pipeline.
6. Using ¼" tubing, connect from the sample outlet port (*Figure 1*) to an appropriate customer-supplied sample container, such as a Welker® TCC Transportable Crude Oil Container.

Customer-supplied ¼" tubing MUST slope downward from the sample outlet port to the sample container.

7. Install the Welker® ESR-2 External Sand Relief Valve to the front of the customer-supplied sample container.
8. If you desire to have a means of verifying sample volume, install an optional customer-supplied spot-sample 3-way ball valve after the ESR-2.
9. Slowly open the customer's pipeline isolation valve. Check for leaks and repair or replace as necessary.
10. Use appropriately sized cable to connect from the customer-supplied PLC to the ¾" FNPT power connection on the LSMEFI motor housing (*Figure 1*).
11. The customer must install an SPDT (Single-Pole Double-Throw) switch to power the LSMEFI.
12. Open emergency shut-off valve E (*Figure 4*).
13. As necessary, adjust the ESR-2 External Sand Relief valve. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the relief for instructions on adjusting and setting the relief.

For operating pressures above 200 psig, the differential ESR-2 External Sand Relief is required. For pressures below 200 psig, the non-differential ESR-2 External Sand Relief is required.

The ESR-2 External Sand Relief valve should be set to approximately 50 psig above maximum pipeline operating pressure.

If requested at the time of the order, the ESR-2 External Sand Relief valve comes factory-set by the manufacturer.

14. As necessary, adjust the ESR-2 External Sand Relief. With emergency shut-off valve E open, loosen the jam nut and tighten the adjusting screw on the ESR-2 until no product emerges from the outlet. Then tighten the jam nut to lock the ESR-2 External Sand Relief.

After the ESR-2 has been set, emergency shut-off valve E MUST REMAIN open during sampling. For further information about emergency shut-off valve E, see *Section 2.5, Emergency Shut-Off*.

2.4 Preparing the Unit for Operation

1. Turn ON the power supply.
2. Set the customer-supplied PLC's timer or controller to energize at the desired sampling actuation frequency based on the sampling equations provided (*Figure 5*).

Figure 5: Proportional-to-Flow and Timed Liquid Sampling Frequency Equations

Liquid Sampling, Proportional-to-Flow Collection

Equation 1: Number of Samples Needed

$$\text{Number of Samples Needed to Fill to 80\%} = \frac{\text{Container Size (cc)} * 0.8}{\text{Bite Size (cc)}}$$

Equation 2: Proportional-to-Flow

$$\text{Volume of Flow Between Sample Grabs} = \frac{\text{Batch Size (Total Volume to Be Sampled)}}{\text{Number of Samples Needed (Eq. 1)}}$$

Use Equation 1 to determine the number of actuations needed.
Use Equation 2 to determine how often (after what volume of flow) to take each sample.

Liquid Sampling, Timed Collection

Equation 1: Number of Samples Needed

$$\text{Number of Samples Needed to Fill to 80\%} = \frac{(\text{Container Size (cc)} * 0.8)}{\text{Bite Size (cc)}}$$

Equation 2: Timed Sampling

$$\text{Time Between Sample Grabs} = \frac{\text{Total Time in Sample Period}}{\text{Number of Samples Needed (Eq. 1)}}$$

Use Equation 1 to determine the number of actuations needed.
Use Equation 2 to determine how often (after what amount of time) to take each sample.

NEVER fill the sample container above 80% of its capacity. Allow AT LEAST 20% room for product expansion should the container be exposed to increased temperatures.

Note that the 0.8 in Equation 1 of the Sampling Equations represents the 80% volume limit for liquid sampling.

3. Ensure that emergency shut-off valve E is open (*Figure 4*).
4. Turn on the customer-provided PLC at the set sampling frequency.

At start-up, several actuations might be required to displace trapped air and fill the insertion shaft with product before sample appears at the sample outlet.

5. Collect a sample from the sample outlet to ensure that the sample volume collected is the same as the desired sample volume. Because the collection cup is only one size, this should be straightforward.
6. The unit is now ready for operation.

2.5 Emergency Shut-Off

1. If sample begins to free flow from the sample outlet, close emergency shut-off valve E (*Figure 4*).
2. Turn OFF the electrical power.

> Free flow from the sample outlet indicates that the ESR-2 either has not been set correctly or that the ESR-2 External Sand Relief valve has failed.

3. If leaking becomes evident elsewhere on the LSMEFI, energize the LSMEFI so that the OPEN/CLOSED position indicator (*Figure 1*) shows it is in the CLOSED position. This will help seal the pressure at the tip.
4. If the leaking continues, depressurize the pipeline and check for leak locations. Repair or replace as necessary.

2.6 Removing the Unit

1. Depressurize the pipeline.

> The pipeline MUST BE depressurized prior to installation or removal of the unit. Failing to depressurize the pipeline will likely result in damage to the equipment and injury to the operator.

2. Close emergency shut-off valve E (*Figure 4*).
3. Disconnect the sample container tubing from the sample outlet (*Figure 1*).
4. Drain the unit by opening the sample outlet valve (also known as the emergency shut-off valve) (*Figure 1* and *Figure 4*).
5. The unit is now ready to be removed from the pipeline for maintenance or to be relocated.

SECTION 3: MAINTENANCE

3.1 Before You Begin

1. **Welker® recommends that the unit have quarterly maintenance under normal operating conditions.** In cases of severe service, dirty conditions, excessive usage, or other unique applications that might lead to excess wear on the unit, a more frequent maintenance schedule might be appropriate.
2. Prior to maintenance or disassembly of the unit, it is advisable to have a repair kit available for repairs of the system in case of unexpected wear or faulty seals.

New seals supplied in spare parts kits should be lightly lubricated before being installed to ease the installation of the seals and reduce the risk of damage when positioning them on parts. Wipe excess lubricant from the seals, because it might adversely affect analytical instrument results.

For sample-exposed seals, Welker® recommends non-hydrocarbon-based lubricants, such as Krytox®.
For non-sample-exposed seals, Welker® recommends either non-hydrocarbon-based lubricants or silicone-based lubricants, such as Molykote® 111.

After the seals are installed, the outer diameter of shafts and inner diameter of cylinders may be lubricated to allow smooth transition of parts.

3. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
4. Welker® recommends having the following tools available for maintenance. Please note that the exact tools required might vary by model.
    a. Adjustable Wrench (Qty = 2)
    b. Hex Key Set
    c. High-Pressure Grease Gun
    d. Reversible Snap Ring Pliers
    e. Seal Pick
    f. Tongue-and-Groove Pliers

3.2 Maintenance

1. Prior to performing maintenance, the unit must be removed from the pipeline. See *Section 2.6, Removing the Unit,* for instructions on removing the unit from the pipeline.
2. Relieve any trapped pressure by slowly releasing the spring tension on the ESR-2 External Sand Relief valve.
3. Lay the LSMEFI on a flat, smooth, clean surface.

U-Cup Seal

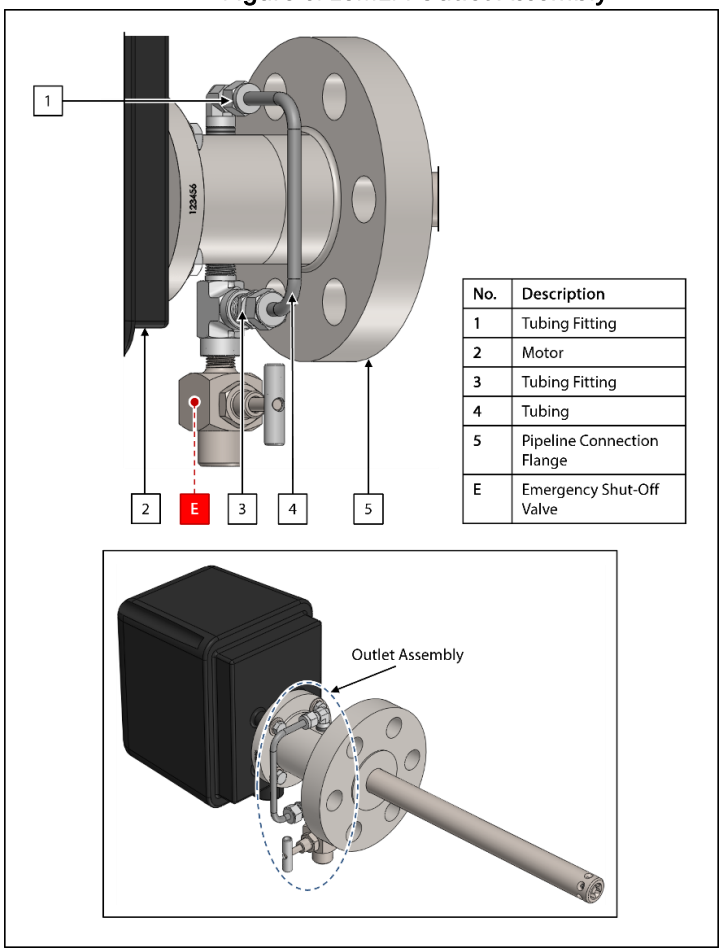
4. Unscrew and remove the outer shaft extension (*Figure 7*).
5. Note the way the U-cup seal is placed in the shaft (*Figure 7*).
6. Using a seal pick, carefully remove the U-cup seal.
7. Discard the U-cup seal and replace it with a new one. Be careful to insert the new cup seal facing the same direction as the old one.

Shaft Maintenance

8. Remove and replace the O-ring (*#9* in *Figure 7*) on the outer shaft extension.
9. Screw the outer shaft extension back into the pipeline connection flange.
10. Tighten the outer shaft extension.

Outlet Assembly

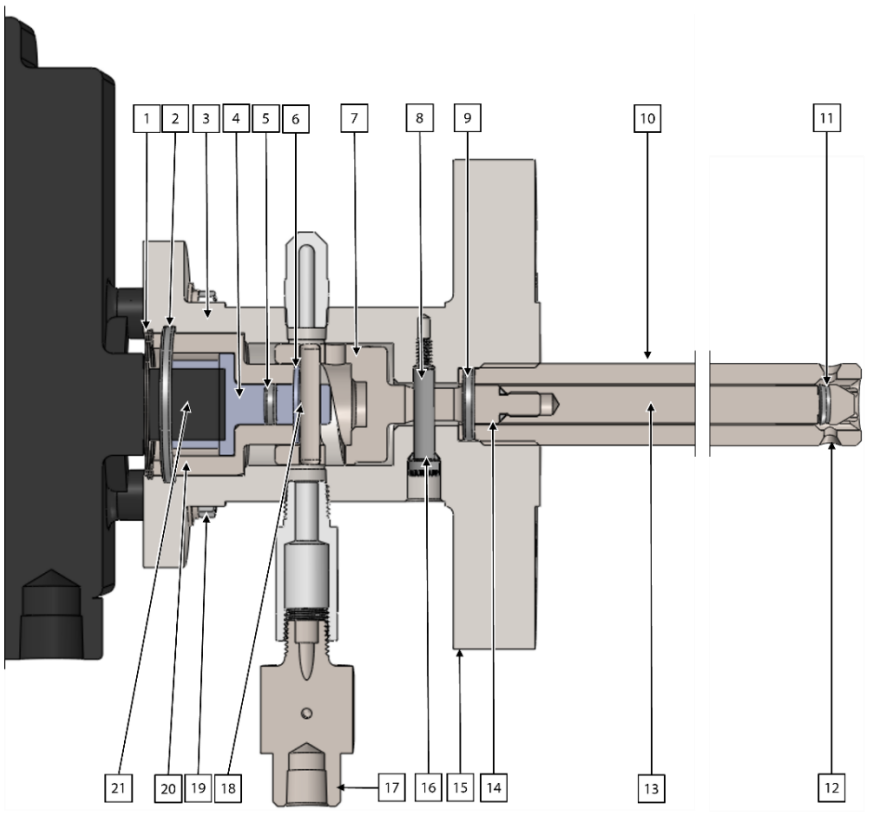
Figure 6: LSMEFI Outlet Assembly



No.	Description
1	Tubing Fitting
2	Motor
3	Tubing Fitting
4	Tubing
5	Pipeline Connection Flange
E	Emergency Shut-Off Valve

11. Disconnect the tubing. Clean the tubing as necessary.
12. Unscrew the emergency shut-off valve E (also known as the sample outlet). Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the shut-off valve for maintenance instructions.

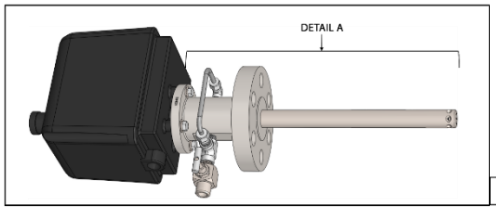
Figure 7: Detail A: Maintenance Diagram



No.	Description
1	Spirolox
2	O-Ring
3	Base Nipple
4	Rotary Cap
5	O-Ring
6	Washer
7	Guided Rotary Piston
8	Shoulder Screw

No.	Description
9	O-Ring
10	Outer Shaft Extension
11	U-Cup Seal
12	Probe Sample Inlet (Qty = 6)
13	Inner Shaft Extension
14	O-Ring
15	Pipeline Connection Flange

No.	Description
16	O-Ring
17	Emergency Shutoff Valve
18	Rotary Piston Pin
19	Motor Bolt (Qty = 4)
20	Rotary Piston Adapter
21	Motor Slot With Motor



DETAIL A – EXTERNAL VIEW

Rotary Assembly

13. Ensure that the OPEN/CLOSED position indicator (*Figure 4*) is in the completely CLOSED position.
14. Unscrew the four (4) motor bolts (*Figure 7*) and set them aside in a safe place.
15. Remove the motor and set it aside in a safe place.
16. Remove the spirolox (#1 in *Figure 7*)
17. Unscrew the shoulder screw (#8 in *Figure 7*). Replace the O-ring (#9 in *Figure 7*) on the shoulder screw.
18. Pull the rotary assembly out of the pipeline connection flange and set aside the flange/shaft assembly in a safe place.
19. Remove the rotary piston pin (#18 in *Figure 7*) and set it aside in a safe place.
20. Remove the rotary cap (#4 in *Figure 7*) and set it aside in a safe place.
21. Remove and replace the O-ring (#5 in *Figure 7*).
22. Remove and replace the rotary piston adapter (#20 in *Figure 7*).
23. Remove and replace the O-ring (#2 in *Figure 7*).

Reassembly

24. Reassemble the rotary assembly.
25. Slide the rotary piston pin to lock.
26. Slide the rotary assembly into the pipeline connection flange.
27. Align the guided rotary piston (#7 in *Figure 7*) so the shoulder screw (#8 in *Figure 7*) can be inserted and tightened.
28. Replace the spirolox and secure the rotary assembly.
29. Using a flathead screwdriver, rotate the rotary cap counterclockwise until it is tight.
30. Line up the motor with the motor slot (#21), as indicated in *Figure 7*.
31. Using a wrench, screw in the motor bolts following a cross-bolting sequence (*Figure 7*). Torque the bolts to 12 ft/lb.
32. Screw in the emergency shut-off valve, being careful not to over-torque.
33. Reconnect the outlet assembly tubing.
34. The unit is now ready for reinstallation and operation.

3.3 Troubleshooting Guidelines

Table 2: Welker® LSMEFI inFlow™ Electric Crude Oil Extractor Troubleshooting Guidelines		
Issues	**Possible Causes**	**Solutions**
The sample container is not filling.	The inlet valve on the sample container might be closed.	Ensure that the sample inlet valve on the sample container is open during sampling.
	The outlet on the sample container might be open.	Ensure that the sample outlet valve on the sample container is closed during sampling.
	The LSMEFI is not collecting the correct sample volume.	This is because the seal in the sample inlet tip is leaking. Check the seal and replace as necessary. In addition, if desired, to be certain the correct sample volume is collected, Welker® recommends the Welker® Checkpoint™ Sample Bite Verification Panel for verifying the sample volume of the LSMEFI.
	The LSMEFI's customer-supplied PLC might be set at a slower sampling frequency than desired.	Adjust the customer-supplied PLC to ensure the LSMEFI will sample at the desired rate. Make certain that the calculations used to determine the sample frequency are correct (*Figure 6*).
	The ESR-2 relief valve might be set too high.	Check the setting on the ESR-2 relief and adjust as necessary. See *Section 2.3* of this manual, starting at step 13. If necessary, refer to the *Installation, Operation, & Maintenance* (IOM) *Manual* for the ESR-2.
	There is air trapped in the sampler.	Especially at start-up but also at any point when air becomes trapped in the sampler, several actuations might be required to displace the trapped air and fill the insertion shaft with product before sample appears at the sample outlet.
	The electric actuator is not operating properly.	Ensure there is adequate power energizing the actuator. Also, ensure the position indicator (*Figure 4*) can rotate from open to closed and back again. If the position indicator is not rotating because it is stuck, please call a Welker® Service Representative at 281.491.2331.

Table 2: Welker® LSMEFI inFlow™ Electric Crude Oil Extractor Troubleshooting Guidelines *(Continued)*		
Issues	**Possible Causes**	**Solutions**
	The LSMEFI might be set at a faster sampling frequency than desired.	Adjust the customer-supplied PLC to ensure that the LSMEFI will sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (*Figure 6*).
The sample container is filling too quickly.	The ESR-2 relief valve might be set too low.	Check the setting on the ESR-2 relief and adjust as necessary. See *Section 2.3* of this manual, starting at step 13. If necessary, refer to the *Installation, Operation, & Maintenance* (IOM) *Manual* for the ESR-2.

APPENDIX: REFERENCED OR ATTACHED DOCUMENTS

Welker® *Installation, Operation, and Maintenance* (IOM) *Manuals* suggested for reference or for use with this unit:

- IOM-105: Welker® NV-1 and NV-2 Instrument Valves
- IOM-112: Welker® Electrohydraulic Unit (EHUC)
- IOM-117: Welker® TCC-1 Transportable Crude Oil Container
- IOM-165: Welker® PNP Plug & Purge Panel
- IOM-186: Welker® TCC Optimum™ Transportable Crude Oil Container
- IOM-197: Welker® TCC-5 Transportable Crude Oil Container
- IOM-206: Welker® TCC-2 Transportable Crude Oil Container
- IOM-207: Welker® TCC-3 Transportable Crude Oil Container
- IOM-208: Welker® TCC-10 Transportable Crude Oil Container
- IOM-251: Welker® ESR-1 and ESR-2 External Sand Relief Valves

Other *Installation, Operation, and Maintenance* (IOM) *Manuals* suggested for reference or for use with this unit:

- ENERPAC® Model P-392 – Instructions for Using an Optional Hydraulic Hand Pump (Welker® IOM-V522)
- Kepner Products Company Kepsel® Cartridge Insert Valves (Welker® IOM-V078)
- Parker Hannifin Corporation Fluoropolymer Hose (Welker® IOM-V174)
- Swagelok Company Proportional Relief Valves R Series (Welker® IOM-V086)

Welker® drawings and schematics suggested for reference or for use with this unit:

- Assembly Drawing: AD949AA (Welker® inFlow™ Electric Crude Oil Extractor – Fixed Insertion)

NOTES

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