



# Small service cart | MP Series III Operating Manual (original version)

Type-no.: B143R11 | Comm-no.: 155797 |

Year of construction: 2013



**DILO.** Sustainably tight.



## Table of contents

General Safety Notes <ul style="list-style-type: none"><li>▪ Obligation to exercise due care</li><li>▪ Specific safety notes and standard symbols</li><li>▪ Basic safety measures during normal operation</li><li>▪ Installation of device</li><li>▪ Personal protective equipment for operating personnel</li><li>▪ Basic safety measures during maintenance</li><li>▪ Work on electrical equipment</li><li>▪ Work on SF<sub>6</sub> gas filled equipment</li><li>▪ Observe environmental standards</li></ul>	1
B143R11 Overview <ul style="list-style-type: none"><li>▪ Primary functions of the B143R11 gas-reclaiming unit</li><li>▪ Additional functions</li><li>▪ Key components and functions</li></ul>	7
Familiarize Yourself with the B143R11	8
General Operating Procedure <ul style="list-style-type: none"><li>▪ Recovery of SF<sub>6</sub></li><li>▪ Evacuation of air</li><li>▪ Filling breaker with SF<sub>6</sub></li></ul>	9
Operating Panel	11
Functional Diagram & Part List	12
Recovery & Storage of SF <sub>6</sub>	14
Evacuating Ambient Air & Moisture	15
Filling of SF <sub>6</sub>	16
Cylinder Consolidation	17
Self-Evacuation <ul style="list-style-type: none"><li>▪ Checking for pressure</li><li>▪ Depressurizing</li><li>▪ Self-Evacuation procedure</li></ul>	18
Troubleshooting	20
Maintenance <ul style="list-style-type: none"><li>▪ SF<sub>6</sub> Filter</li><li>▪ Compressors</li><li>▪ Vacuum compressor</li><li>▪ Vacuum pump</li></ul>	21
Limited Warranty	23
Integrated Cylinder Weight Scale	24
Wiring Schematics	32
Notes	37
Attachments: Vacuum Pump Operating Instructions	39

*This document is copyrighted by DILO Company, Inc.  
Any use, duplication in whole or in part without written permission of DILO is strictly prohibited*

**DILO** Company, Inc.  
11642 Pyramid Drive, Odessa, FL 33556  
727-376-5593 Office  
727-372-0277 Fax  
sales@dilo.com



## General safety notes

### Obligation to exercise due care

The device has been designed and constructed bearing in mind the standards to be observed as well as additional technical specifications.

Safe use of the machine can only be achieved if all the necessary measures are followed.

The operator has to ensure that:

- The device is only used for the purposes for which it is intended (see chapter 2 product description).
- The device is only operated in accordance with the instructions and in good condition and that the safety devices are regularly checked.
- Maintenance and repair personnel are issued with all the required safety and protective clothing, which shall always be used.
- Complete and legible operating instructions are available on site.
- Only qualified personnel operate or repair the device.
- Personnel are regularly instructed in safety procedures and environmental protection, and that these personnel are fully aware of the complete operating instructions, with an emphasis on the safety notes.
- The safety and warning notes on the device are legible and not removed.
- All obligatory registrations and tests prescribed by law are carried out on the devices in accordance with the local regulations (e. g. pressure vessel tests, test for electrical safety, etc.)
- The material safety data sheet (MSDS) on SF<sub>6</sub> (which can be obtained from the SF<sub>6</sub> supplier) is available for the operating personnel. The instructions mentioned in the data sheet and safety precautions must be known, *and* observed.

## General safety notes

### Specific safety notes and standard symbols

In the following operating instructions, specific safety warnings are given in order to draw your attention to residual risks, which cannot be avoided during the operation of the device.

These residual risks contain dangers for:

- Persons
- Product and machine
- The environment

The symbols used in the operating instructions should draw your attention specifically to the safety notes:



**This symbol refers to risks for persons (danger to life, danger of injury)**



**This symbol refers to risks for machines, material and the environment.**



**This symbol refers to electric shock**

The most important aim of the safety notes is to prevent personal injuries.

- If the warning sign "**Danger**" appears, danger from machines, materials, and the environment are not excluded.
- If the warning sign "**Warning**" appears, there is no danger for persons.

The corresponding symbol which is used cannot replace the text of the safety note. Therefore, the complete text must always be read.

## General safety notes

### Basic safety measures during normal operation

Throughout the EU SF<sub>6</sub> recovery equipment may only be operated by trained and qualified persons who have been certified in accordance with EC 305/2008 regulations.

For customers within North, South, and Central America, no certification is required, but training from qualified DILO personnel is highly recommended. These trainings ensure that all users are familiar with important operating and safety procedures pertaining to the service cart. Frequency of these courses can be scheduled as needed by the customer and their DILO area manager.

Only trained and authorized persons who are fully aware of the operating instructions should operate the device and should do so in accordance with the operating instructions.

Before operating the device ensure that:

- only authorized persons are present.
- nobody can be hurt by the operation of the device.

Whenever the service cart is used, check for visible damage (damaged hoses, tubing, defective electric cables, or visible leaks) beforehand and ensure that it is operated in the correct conditions. Eliminate any damage immediately or inform your supervisor.

Prior to each start, check and make sure that the safety features are properly set.



**For concentrations of SF<sub>6</sub> decomposition products of >100 ppm<sub>v</sub> we recommend using a pre-filter unit to protect the device.  
In case of contamination, rinse the device (for at least 10 minutes) with pure SF<sub>6</sub> gas (e.g. by circulation).**



**All gas compartments and vessels connected to the device, via gas connecting hose, must be equipped with their own safety equipment to protect against overpressure and vacuum. The safety equipment integrated in the device only serves for the self-protection of the device itself without consideration of the load-bearing capacity of the connected gas compartment. In case of non-observance, there is the danger of implosion or explosion of the gas compartment if the device is not operated correctly.**



## General safety notes

### Installation of the device

- Position the service cart on a level surface and hard subgrade **only**. The locking devices on the wheels are **not designed** to hold the cart on a grade.
- Only operate the cart in sufficiently large and ventilated compartments (room volumes >100m<sup>3</sup>), so that the admissible SF<sub>6</sub> concentration in the ambient air (OSHA states 1000PPMv, or less) is not exceeded in case of sudden leakages.
- For operation in smaller compartments, SF<sub>6</sub> warning devices must be available as well as readily available exits.
- In the event of a fire, the service cart and applicable storage cylinders must be removed from the heat source to prevent damage and a possible overpressure situation.

### Personal protective equipment for operating personnel

- Safety gloves allowing protection from the electrical operating elements.
- Ear protection is recommended for all devices with a sound power level of >80 dB(A)..
- Safety shoes
- Wearing safety goggles is necessary in case hoses and tubes which are under pressure are opened (e.g. cylinder threads on SF<sub>6</sub>-gas bottles), as gas or fluid jet could escape.

### Basic safety measures during maintenance

- Follow inspection and maintenance periods described in the operating instructions.
- Follow maintenance and repair instructions for individual components in these operating instructions.
- Prior to carrying out maintenance and/or repair, ensure that the main power breaker is turned off.
- When removing or installing heavy machine parts, use suitable lifting devices that are in good working order.
- Heavy components are to be secured against drops by proper methods.
- Prior to carrying out maintenance and/or repair work, ensure that parts which may need to be handled have cooled down to room temperature.
- Dispose of grease, coolant, and cleaning material in accordance with local and federal environmental regulations.
- If a device has been contaminated with SF<sub>6</sub> decomposition products, additional safety measures are to be taken. Protective clothing and a dust mask (equipped with a HEPA/Acid Vapor cartridge) should be worn, depending upon the degree of contamination.
- The working protection set is available under the order number: 3-442-R001.

## General safety notes

### Work on electrical equipment

Only properly trained electricians should carry out repairs on electrical equipment.



Regularly check the electrical equipment.

Re-tighten loose connections.

Replace damaged lines/cable immediately.

Always keep the control cabinet closed. Only authorized persons with key/tools should work on the device.

Never clean control cabinets and other electrical equipment housings using a water hose.

### Work on SF<sub>6</sub> gas filled equipment

Only specially trained personnel should perform maintenance and on gas filled equipment. Prior to maintenance, depressurize the gas filled sections of the device.

After having carried out any maintenance/repair work and prior to putting back into service:

- Check that any loosened screws are properly reinstalled.
- Ensure that the tank caps, sieves, or filters that have been removed have been reinstalled and leak tested.

After any maintenance/repair work and before functional tests are performed, ensure that:

- All materials, tools, and other equipment, which were necessary for the maintenance or repair work, have been removed from the working area of the device.
- Liquids that may have come out have been removed (wiped down)
- All safety devices for the unit are properly set and in working order.

## General safety notes

### Observe environmental standards

Whenever working on or with the service cart, please observe local and federal legal requirements for waste handling and disposal.

The following substances can be present during installation, repair, and maintenance:

- lubricating greases and oil
- hydraulic oils
- cooling agents
- cleaning solvents

These substances must not contaminate the soil or flow into drains. They should be stored in suitable vessels and disposed of in accordance with the regulations set out by the aforementioned agencies.



**Danger**

**This service cart processes the greenhouse gas, sulfur hexafluoride (SF<sub>6</sub>). This gas is cited in the Kyoto Protocol, USEPA guideline, and Cigre handbook to have a global warming potential (GWP) of approximately 23,000. Due to its high GWP, SF<sub>6</sub> needs to be contained so that it is not allowed to be released into the atmosphere. When using and handling SF<sub>6</sub>, please observe IEC 62271-303 “High-voltage switchgear and control gear – Part 303 Use and handling of Sulfur Hexafluoride (SF<sub>6</sub>)”.**



## B143R11 Overview

### Primary functions of the B143R11 gas-reclaiming unit:

- Recovery and liquid storage of SF<sub>6</sub> from GIE.
- Cleansing/filtering of SF<sub>6</sub> during the recovery and filling processes.
- Refilling of SF<sub>6</sub> gas into enclosed GIE.
- Ambient air and moisture evacuation from GIE, service cart, and applicable hoses.

### Additional Functions:

- Service cart evacuation and internal gas cleanup.
- Transferring SF<sub>6</sub> from one storage vessel to another.
- Top-off enclosed equipment containing SF<sub>6</sub>.

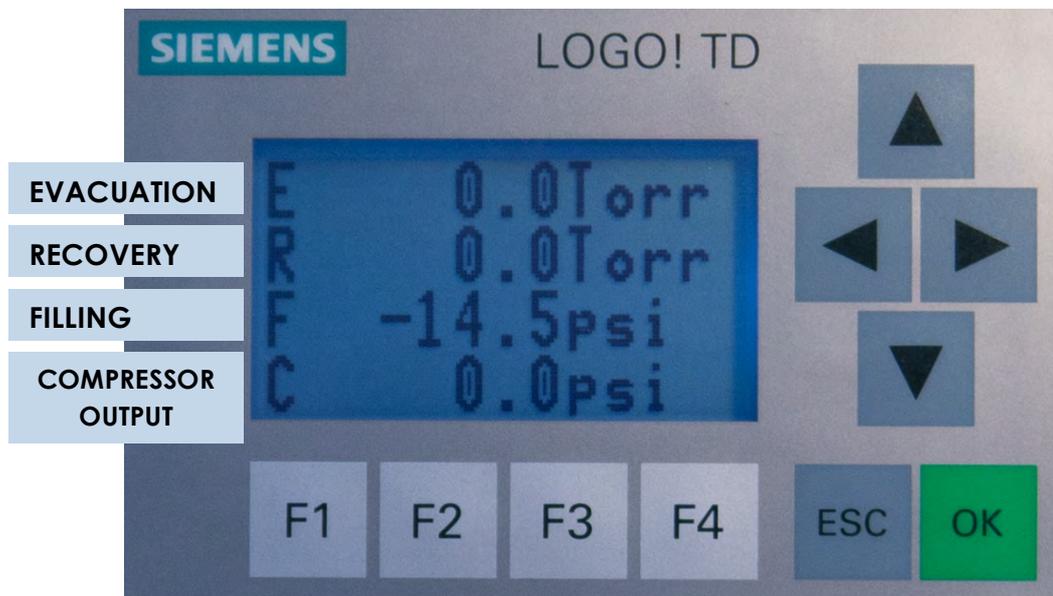
### Key components and functions:

Component	Functions involved
Oil-less compressor(s)	Pumps and compresses (into liquid) the SF <sub>6</sub> gas from GIE and storage devices
Vacuum compressor	Recovers SF <sub>6</sub> at pressures < 0 PSIG
Filter/dryer cartridges	Removes dust particulates, moisture, and gaseous decomposition byproducts from SF <sub>6</sub>
DILO self-sealing ports	Couples hoses to unit without gas loss
Pressure regulator	Safely backfills SF <sub>6</sub> into GIE and SF <sub>6</sub> storage devices
Solenoid valves	Electronically controls the direction of gas flow
Valves	Establishes gas paths to for certain functions
Digital pressure display	Monitors operating conditions, i.e. breaker pressure, tank pressure, backfill pressure, etc.
Two-stage vacuum pump	Removes ambient air and moisture
Digital Display	Displays Pressure Readings, Warning Messages and Operating Hours.

## Familiarize yourself with the B143R11

This B143R11 service cart is engineered to be a self-contained unit. It contains all equipment and features needed for safe, easy, and successful SF<sub>6</sub> recycling. Like all machinery, it is essential for the operator to be familiar with the various components and their functions.

- The B143R11 utilizes a single two-position, four-way valve. The four way valve is used to route the gas flow between the “SF<sub>6</sub> Filling Position” and “SF<sub>6</sub> Recovery Position”.
- All other valves are solenoid valves and do not require any manual operation.
- All four connections on the control panel (3 in front and one on the left side) are DILO self-sealing VK/BG-03/8 connectors. The cylinder connector(s) is a standard CGA-590.
- Each of the four ports have separate and distinct functions (filling, recovery, air evacuation, and external storage).
- The “SF<sub>6</sub> Recovery” port is not equipped with a pressure regulator. This limits the maximum pressure that can be applied to the service cart to **10bar** (145psig).
- There is a breaker panel on the front of the control cabinet; one breaker controls the main power of the unit, and the others protect major components.
- The compressor unit(s), vacuum compressor, and vacuum pump also employ individual protective relays, which trip if the associated component cannot start. This relay will automatically reset after approximately 10 minutes.
- An adjustable pressure regulator is used to fill SF<sub>6</sub> into GIE or storage cylinders to a set pressure. The fill pressure can be monitored by the “SF<sub>6</sub> Filling (F)” pressure display on the digital gauge.
- The vacuum pump is used for evacuation of ambient air and moisture. It is equipped with a solenoid valve that interrupts gas flow if the pump is turned off. This eliminates siphoning of vacuum pump oil back into the service cart. The vacuum level is displayed via the “Evacuation (E)” readout on the digital gauge.

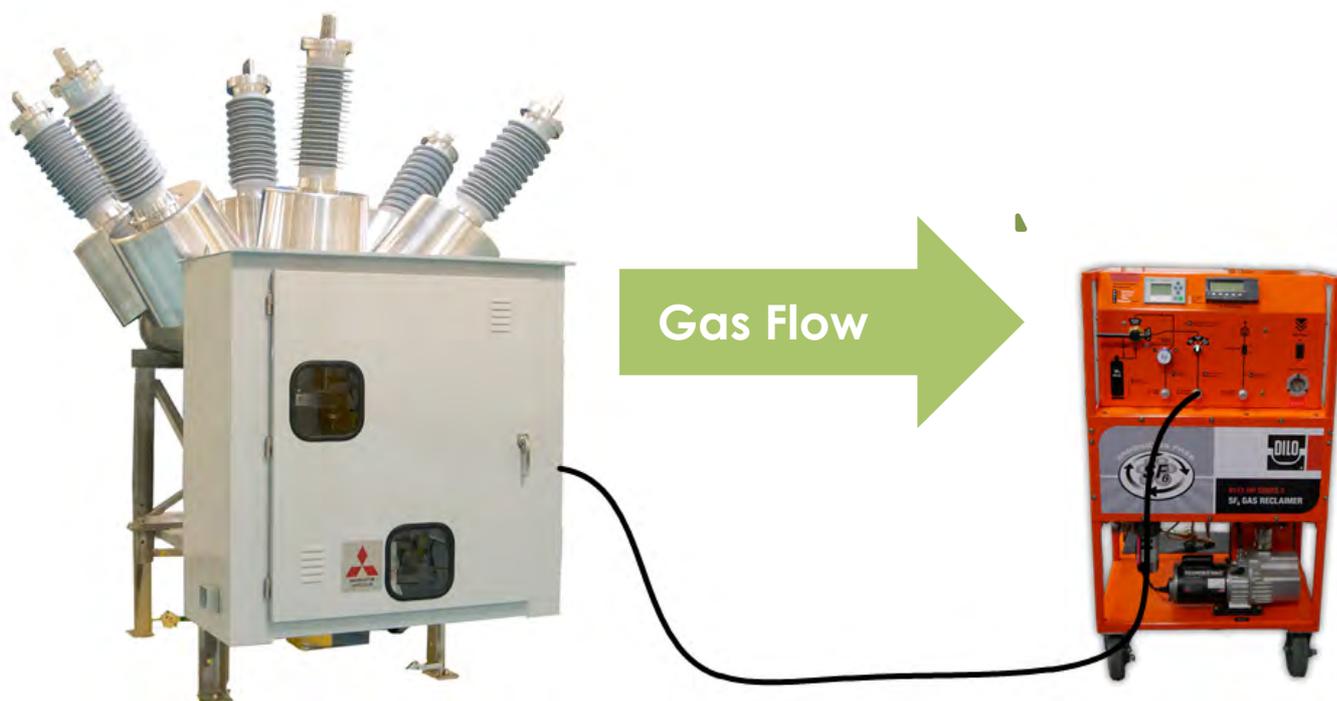


## General operating procedure

The B143R11 is designed to safely perform all functions associated with SF<sub>6</sub> reclamation from GIE. The processor is connected to the SF<sub>6</sub> equipment using a flexible hose with DILO self-sealing fittings on either end. SF<sub>6</sub> gas cylinders provide the storage medium.

### Recovery of SF<sub>6</sub>

The SF<sub>6</sub> gas from the equipment is pumped into the storage vessel via the processing unit's oil-less compressors (as shown on the example below).



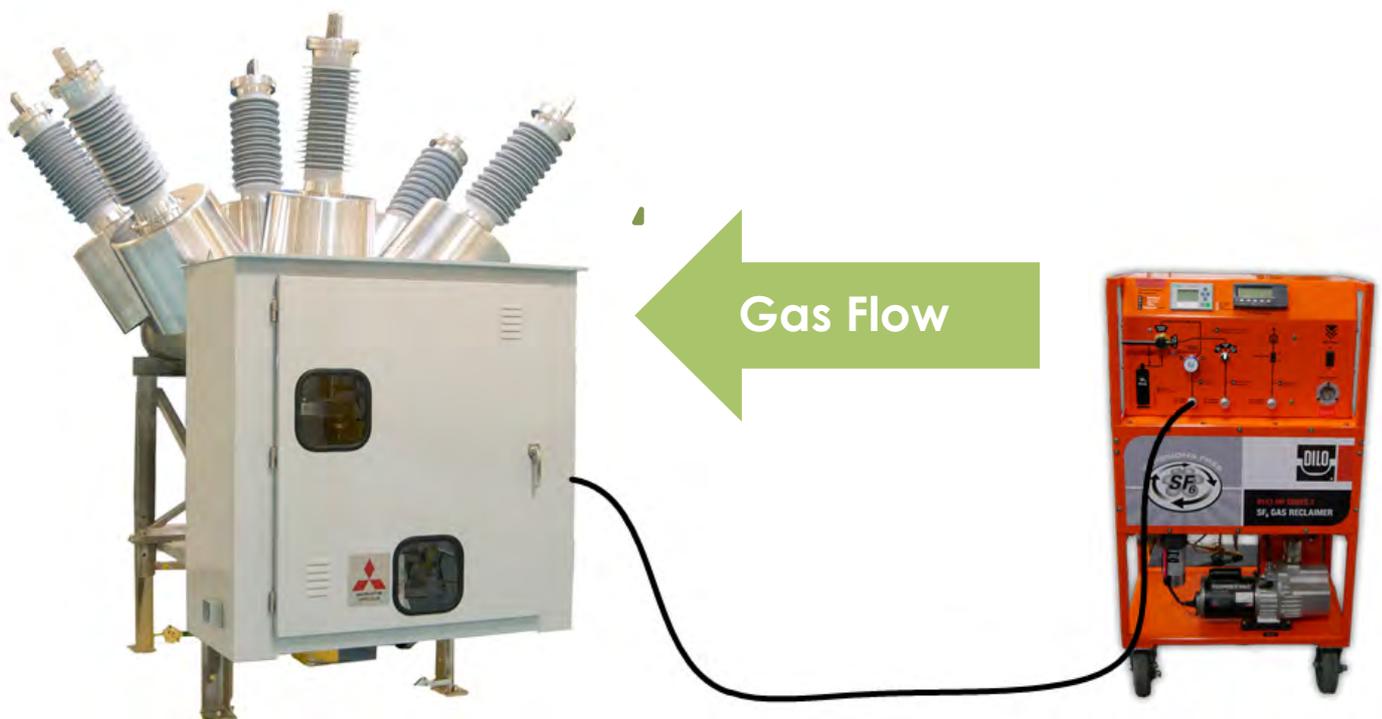
During this recovery process, the SF<sub>6</sub> gas passes through two filters to remove foreign particles, moisture, and decomposition by-products. The temperature of the SF<sub>6</sub> gas is reduced by an air-cooled radiator before entering the storage tank(s); this allows maximum use of the storage capacity. The main compressor can achieve a pressure differential of 50:1 when recovering in positive pressure and 10,000:1 when under vacuum, with the aid of the vacuum compressor. The compressor(s) can generate a maximum pressure of 725 PSIG. When running on its own, the main compressor can only pull the breaker down to approximately 0 psig, while maintaining a 725 PSIG output pressure. To overcome this limitation, the vacuum compressor bypass is automatically switched off when the recovery pressure reaches 0 psig. The vacuum compressor then suctions the gas out of the GIE, which allows the main compressor to focus on pushing the SF<sub>6</sub> gas into the storage cylinder(s), without losing its ability to maintain a 725 PSIG outlet pressure.

## Evacuation of Air

Using the on-board vacuum pump, the B143R11 can remove air and moisture from GIE prior to refilling with SF<sub>6</sub>. Before any refilling operation, the operator must confirm that a sufficient vacuum has been obtained and held. Without this step, considerable air contamination or SF<sub>6</sub> emissions may result.

## Filling Breaker with SF<sub>6</sub>

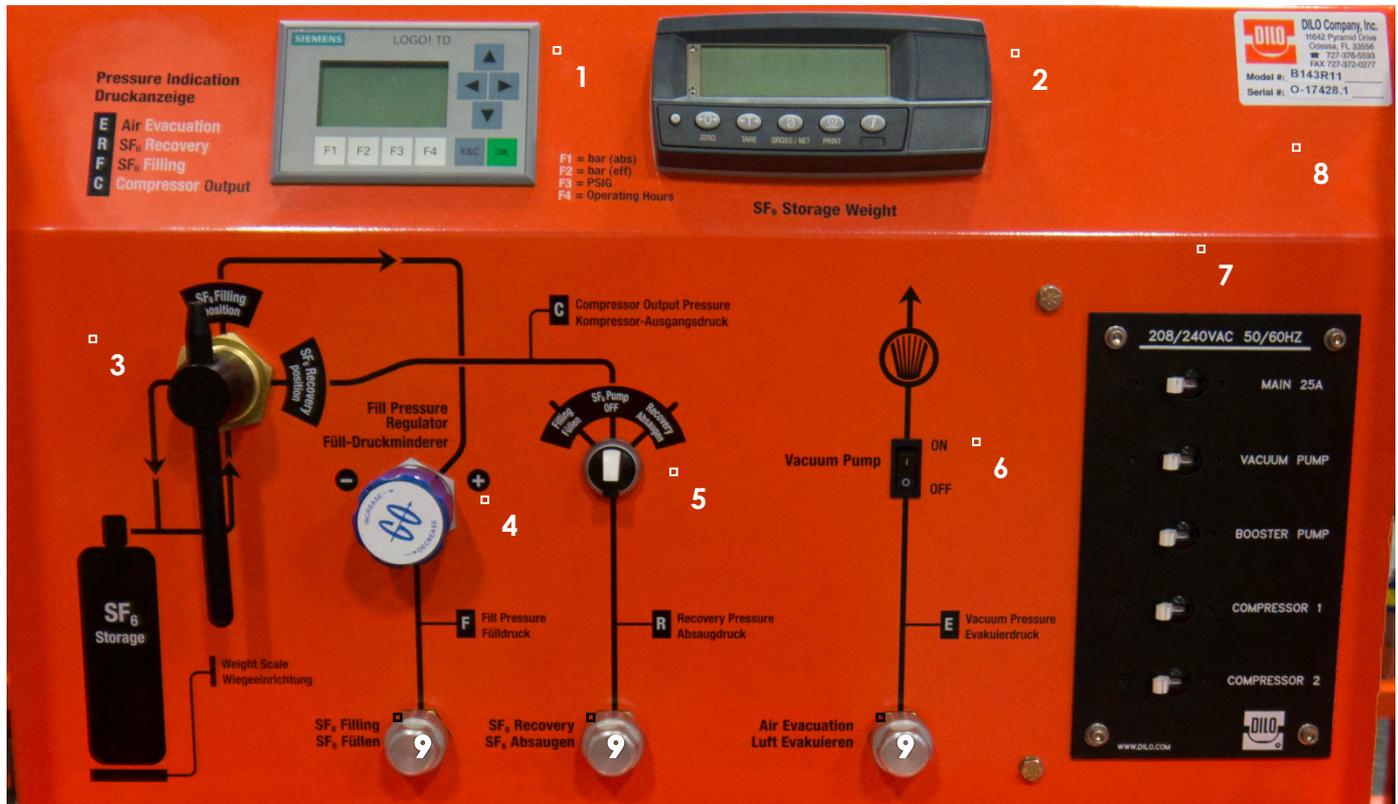
The B143R11 can also fill from a storage vessel into GIE or other SF<sub>6</sub> cylinders. This function allows SF<sub>6</sub> gas from the storage medium to be filled through a self-contained pressure regulator into any gas-tight equipment. If the breaker is not under vacuum before filling, it is essential to evacuate ambient air and moisture using the installed vacuum pump (see “Evacuating Ambient Air & Moisture” on page 15).



**NOTE:** There are two main voltage issues that can potentially cause the B143R11 to not function properly:

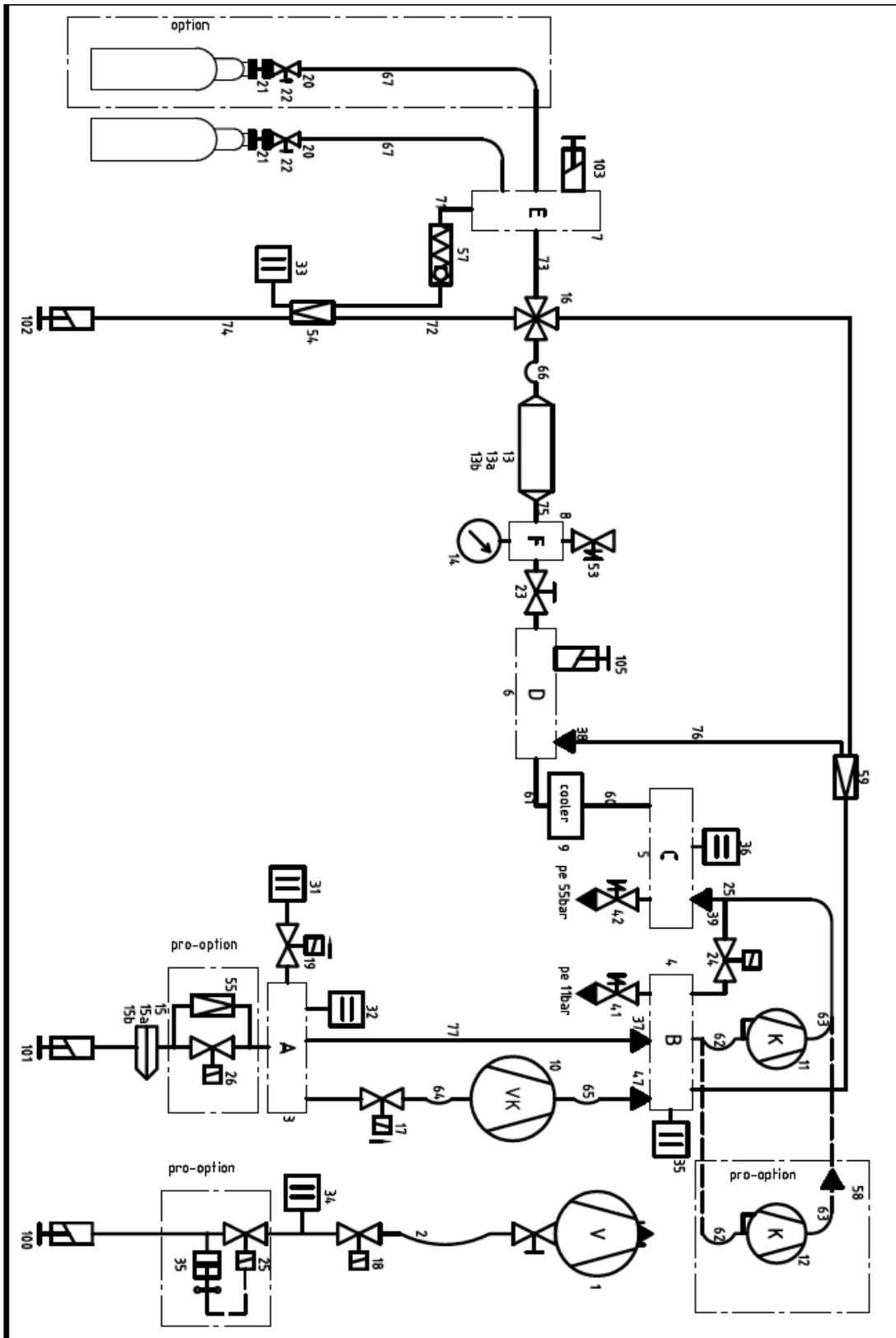
- *Improper input voltage. The voltage must remain between 208V-240V while under load.*
- *The use of extension cords can cause low voltage. If an extension cord must be used, keep the length as short and use as heavy gauge as possible*

# Operating Panel – B143R11



1	Digital Pressure/Vacuum Display
2	Integrated Cylinder Weight Scale
3	4-Way 2 Position Valve
4	SF6 Filling Regulator
5	Rotary Switch
6	Vacuum Pump Power Switch
7	B143R11 Circuit Breaker Panel
8	DILO Information Sticker
9	Service Connections (DN8)

# Functional Diagram & Parts List



## B143R11 Parts List

Pos.	Qty	Description	Part #
01	01	08 CFM vacuum pump 220V/50-60Hz	P-0001-R001
01a	01	Oil mist filter for vacuum pump	P-0002-R001
02	01	25" R3 vacuum pump hose with fittings	25" 3/8"R3 1/2"FJIC 1/2FJIC90
03	01	SF <sub>6</sub> recovery inlet manifold block	K133R03
04	01	Compressor manifold block	K133R01
05	01	Compressor bypass manifold block	K133R02
06	01	Compressor output manifold block	K133R04
07	01	Storage manifold block	K133R05
08	01	Filter manifold block	K133R06
09	01	Condenser with fan shroud	N/A
09a	02	220V radial fan	P-0003-R001
09b	01	Condenser housing 220V	N/A
10	01	Vacuum compressor 50/60Hz	05-1647-R003U
11	01	1.5 m3/h compressor 220V 50/60Hz	B100R30
12	01	1.5 m3/h compressor 220V 50/60Hz (Pro Option only)	B100R30
13	01	Lower filter housing	P-0005-R001
13a	01	Activated alumina filter cartridge	6-1077-R003
13b	01	Filter housing o-ring	05-0057-R112
14	01	Compressor output pressure gauge 0-1000PSI	P-0007-R001
15	01	Upper filter housing	P-0005-R001
15a	01	Activated alumina filter cartridge	6-1077-R003
15b	01	Filter housing o-ring	05-0057-R112
16	01	4-way valve	P-0010-R001
17	01	Vacuum compressor solenoid valve	P-0011-R001
18	01	Vacuum pump solenoid valve	P-0011-R001
19	01	Vacuum compressor sensor solenoid valve	P-0011-R001
20	01	DN8 adapter	3-593-R009 P
21a	01	Adapter CGA590 to DN8 female for DOT cylinders	3-334-R001 P
21b	01	Adapter TUV cylinder connection to DN 08 female	3-316-R001 P
22	01	DN8 ball valve (storage)	3-365-R008 P
23	01	DN8 ball valve (filter)	3-365-R001 P
24	01	Bypass solenoid valve	P-0012-R001
31	01	SF <sub>6</sub> recovery inlet vacuum sensor 0-100mbar	05-0495-R322U
32	01	Pressure transmitter 0-10bar abs.	05-1563-R022
33	01	Pressure transmitter 0-10bar abs.	05-1563-R022
34	01	Vacuum pump sensor 0-100mbar	05-0495-R322U
35	01	Pressure transmitter 0-10bar abs.	05-1563-R022
36	01	Pressure transmitter 0-63bar rel.	05-1563-R020
37	01	DN8 check valve	VR/A-03/8 PU
38	01	DN8 check valve	VR/A-03/8 PU
39	01	DN8 check valve	VR/A-03/8 PU
41	01	B block safety valve 11bar	05-1200-R053
42	01	C block safety valve 55bar	05-1200-R052
47	01	DN8 check valve	VR/A-03/8 PU
53	01	F block safety valve 55bar	05-0110-R500
54	01	GO regulator brass 0-160PSIG	P-0013-R001
57	01	Overflow check valve	P-0014-R001
58	01	DN8 Check Valve	VR/A-03/8 PU
59	01	Pressure regulator brass 0-160PSIG	P-0004-R001
60-61	01	copper tubing 1/4"	CT-4
62	01	Polyester tubing 1/4"	234 0842
63	01	Stellbraided Teflonhose	13" 3/16 TF 1/4" Stub
64	01	Polyester tubing 3/8"	234 1472
65	01	Polyester tubing 1/4"	234 0842
66	01	Polyester tubing 1/4"	CT-4
67	01	Coonecting hose SF6 cylinder	44" 1/4"NY3/8"FJIC1/4"FJIC90deg
71-76	01	1/4" copper tubing	CT-4
100-102	01	DN8 port connection	VK/BG-03/8 PU



## Evacuating Ambient Air & Moisture

This procedure allows the operator to evacuate the contents of the GIE, associated cart hoses, and all volumes attached to the "Air Evacuation" port. The evacuation is performed via the integrated vacuum pump.

**Note:** all of the evacuated material is discharged to atmosphere at the vacuum pump exhaust. It is important to verify that no SF<sub>6</sub> gas is still present in order to avoid unnecessary gas emissions.

### This procedure is necessary for:

- Removal of ambient air and moisture from GIE, prior to re-filling SF<sub>6</sub>.
- Removal of ambient air/moisture and foreign gases from any hoses that are to be used for SF<sub>6</sub> gas servicing.

### Follow these steps:

- A. Confirm that pressures within the gas insulated equipment are 3 PSIG or less via the "SF<sub>6</sub> Recovery" port connection.



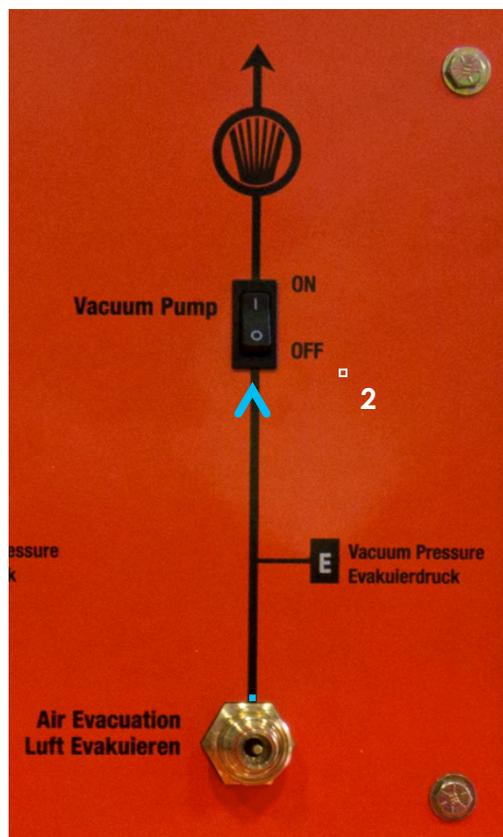
**Warning**

The vacuum pump and vacuum sensor are very sensitive to overpressure. Extreme caution must be used when connecting to the evacuation port of the B143R11. Any positive pressure must be reduced prior to connecting a hose to the "Air Evacuation" port

- B. Connect the verified hose to the "Air Evacuation" (1) port  
 C. Turn on vacuum pump (2).

**Note:** If the vacuum pump fails to start immediately or is slow to start, open the ballast valve on the vacuum pump and then try to turn on the pump. Close the ballast valve once the pump is running.

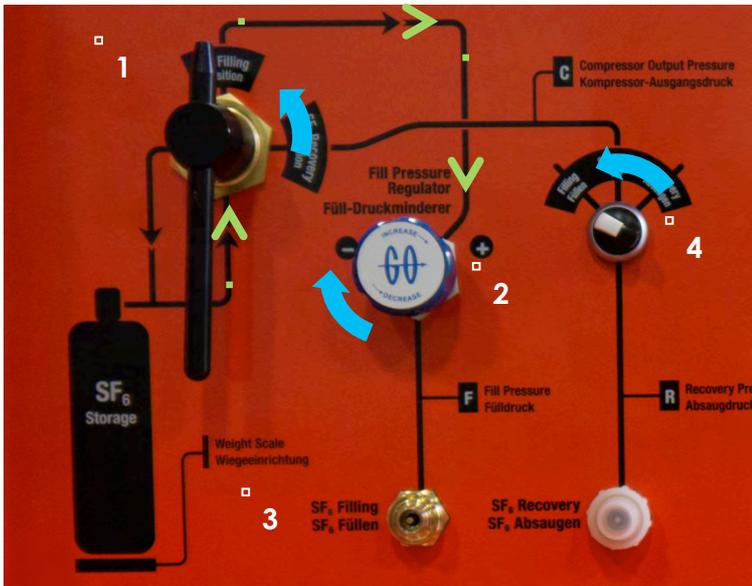
- D. **SLOWLY** open the isolation valve on the vacuum pump (shown on example 1 in blue).  
 E. The vacuum pump is now actively pulling vacuum on the connected gas compartment. Wait until the digital Vacuum Gauge indicates sufficient vacuum. (< 1mbar, 0.75 mmHg)  
 F. Once substantial vacuum has been achieved, close the isolation valve (shown on example 2 in blue).  
 G. Turn off pump (2).  
 H. Remove the hose from the "Air Evacuation" port.



## Filling of SF<sub>6</sub>

This procedure is used to fill GIE or external storage medium with SF<sub>6</sub> from either the on-board storage cylinders, or an external cylinder. SF<sub>6</sub> is passed through an adjustable regulator (2) which gives the operator control over the final pressure to fill to.

### Follow these steps:



- A. Confirm that **NO** hoses are attached to the three fittings on the front of the B143R11. You will need to have a cylinder(s) connected to any of the storage connections on the left side of the unit. Additionally, verify that the regulator (2) is fully closed by turning the knob counterclockwise.
- B. Open the storage cylinder valves (if closed).
- C. Switch the 4-way valve (1) on the control panel to "SF<sub>6</sub> Filling".
- D. Check the available gas pressure in the storage vessel by reading "Compressor Output" (C) on the display.
- E. Adjust the fill pressure via the regulator (2) by turning the knob clockwise until the "Fill Pressure (F)" on the digital gauge reads the desired pressure.

F. If the desired pressure was exceeded by turning the regulator too far, you can switch the 4-way valve to "SF<sub>6</sub> Recovery" position and turn the rotary switch to "Recovery" until the pressure display "Fill Pressure" (F) is below the desired fill pressure again. Then set the rotary switch back to "OFF" and the 4-way valve back to "SF<sub>6</sub> Filling". Repeat step F.

G. Connect the service hose to the "SF<sub>6</sub> Filling" port (3).

**Note:** During the filling process it is likely that the temperature in the storage cylinder(s) will drop significantly. To prevent excessive loss of heat and therefore, loss of pressure, it is recommended that external heating be added to the storage cylinder(s); this can be accomplished using a cylinder heating blanket (HB-120 or HB-220). Please contact DILO Company, Inc. for more information regarding the heating blankets.

H. Open the valve on the GIE or on the external storage medium (if applicable).

I. In the event that the storage cylinder and connected equipment equalize prior to the set fill pressure being reached, turn the rotary switch to the "Filling" position (4) to allow the compressor(s) to aide in the functions completion. When the pressure in the breaker reaches the correct fill pressure, the regulator will stop the flow of gas to the equipment, at which point the B143R11 can be turned off. The compressor will continue to run, even though gas is no longer being transferred. A safety bypass valve is installed within the service cart to prevent the compressor(s) from over pressurizing, but it is still recommended to monitor the function in order to minimize excess run time for compressor.

J. Disconnect the hose or close the valve on the equipment being filled (if applicable).

K. If used, turn the rotary switch to the "OFF" position to stop the compressor(s).

L. Close the storage cylinder(s) valves.

M. Disconnect the hose and reset the regulator by turning it counterclockwise to the fully closed position.

## Cylinder Consolidation

This procedure is used to transfer gas from one cylinder to another and can be used to consolidate partial cylinders into one cylinder.

### **Follow these steps:**

- A. Place the 4-way valve in the "SF<sub>6</sub> Recovery position".
- B. If there is neither SF<sub>6</sub> nor a vacuum in the hose to be connected to the source cylinder, connect the hose to the "Air Evacuation" port and evacuate the hose (page 15).
- C. Connect the integrated storage hose(s) or external storage hose assembly to the destination cylinder.

**NOTE:** refer to the "**General Safety Notes**" section for cylinder filling recommendations.

- D. Before connecting the source hose, attach a regulator to the source cylinder and set the secondary pressure to below 145PSIG (10 bar).



*It is important to remember that the "SF<sub>6</sub> Recovery" port does not have pressure protection and a regulator **MUST** be used when attaching anything with more than 145PSIG (10bar) of pressure. Damage may occur if high pressure is allowed into the service cart.*

- E. Open the valve on the Destination Cylinder and the valves on the integrated storage connection or the external storage assembly, if applicable.

**Note:** Make sure the cylinder you are filling into does not have a check-valve.

- F. Connect the hose from step B to the regulator on the source cylinder and the "SF<sub>6</sub> Recovery" port.
- G. Turn the rotary switch to the "Recovery" position to start the compressor(s).
- H. When the "SF<sub>6</sub> Recovery (R)" display shows 5 Torr or less, the source cylinder is considered empty.
- I. Disconnect the hose from the source cylinder.
- J. Turn the rotary dial to "OFF" to stop the compressors.
- K. If there are no more cylinders to consolidate, remove the hoses from the B143R11 and the external destination cylinder, if applicable.

## Self-Evacuation Under normal circumstances self-evacuation is NOT required.

**Note:** Self-evacuation is only required when the cart has been exposed to air (i.e. changing filter, part replacement, or internal plumbing modification).

### Checking for Pressure:

This procedure explains how to properly check for positive pressure in the SF<sub>6</sub> gas recovery path prior to self-evacuating the service cart. Testing for positive pressure is necessary to prevent damage and/or an explosive condition to the vacuum pump.

### Follow these steps:

- A. Turn the 4-way valve to the "SF<sub>6</sub> Recovery" position.
- B. Check all gauges on the unit for pressure.
  - If you find pressure, please proceed to **Depressurizing** section of the manual below.
  - If no pressure is found, please proceed to the next step.
- C. Turn the 4-way valve to the "SF<sub>6</sub> Filling" position.
- D. Fully open the regulator by turning the knob clockwise.
- E. Check the "SF<sub>6</sub> Filling (F)" readout for pressure.
  - If you find pressure, please proceed to **Depressurizing** section of the manual below.
  - If no pressure is found, please proceed to the **Self Evacuation Procedure** section on page 20.

### Depressurizing:

**Note:** Unless a second recovery system is used, only about 80% of the internal gas will be salvaged. **ONLY PROCEED IF ABSOLUTELY NECESSARY**

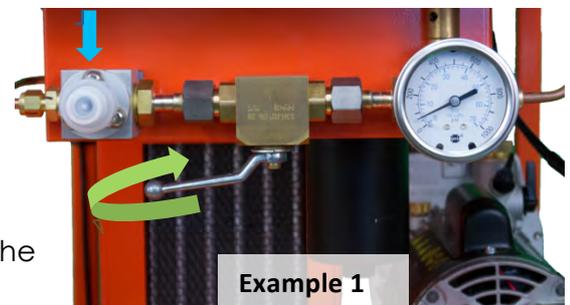
This procedure allows the operator to evacuate positive pressure in processing unit, all attached hoses, and equipment prior to self-evacuating the unit.

Depressurizing the B143R11 should be done:

- Prior to doing a self-evacuation.
- Prior to performing maintenance.

### Follow these steps:

- A. Turn the 4-way valve to the "SF<sub>6</sub> Filling" position.
- B. Connect an empty external cylinder to the DN8 fitting (blue arrow) on the lower left side of the recovery cart.
- C. Close the ¼ turn ball valve on the filter housing. (green arrow)
- D. Open the valve on the cylinder.
- E. Connect the supplied DN8 service hose as a jumper to the "SF<sub>6</sub> Recovery" port and the "SF<sub>6</sub> Filling" port.
- F. Fully open the regulator by turning the knob clockwise.
- G. Turn the rotary switch to the "Filling" position to start to main compressor(s).
- H. Let the compressor(s) run until the pressure on the "SF<sub>6</sub> Filling (F)" gauge reaches 0 psig or less.
- I. Turn the rotary switch to the "Pump OFF" position.
- J. Close the cylinder valve(s).





## **Self-Evacuation Procedure:**

**Under normal circumstances self-evacuation is NOT required.**

This procedure allows the operator to evacuate the contents of the processing unit, all applicable hoses, and equipment.

**Note:** *all of the evacuated gas/air is discharged to atmosphere at the vacuum pump. If there is more than 3 psig in the system, return to Depressurizing section on the previous page.*

### **Follow these steps:**

**Note:** *Unless a second recovery system is used, approximately 80% of the internal gas will be salvaged. Only proceed if absolutely necessary.*

- A. Using the supplied DILO DN8 hose, connect the "External Storage Connection Port" to the "AIR EVACUATION" port.
- B. Turn the four-way valve to the "SF<sub>6</sub> Recovery" position.
- C. Turn on the vacuum pump.

**Note:** *If the vacuum pump fails to start immediately or is slow to start, open the ballast valve located on the vacuum pump, then try to turn on the pump. Close the ballast valve once the pump is running.*

- D. **Slowly** open the isolation valve located on the vacuum pump.
- E. Wait until the "Air Evacuation (E)" readout displays a sufficient vacuum.

**Note:** *the vacuum sensor is located within close proximity to the vacuum pump. Readings will be better than the actual vacuum, unless the pump is either turned off (after closing the isolation valve) or the isolation valve is closed during operation.*



## Troubleshooting

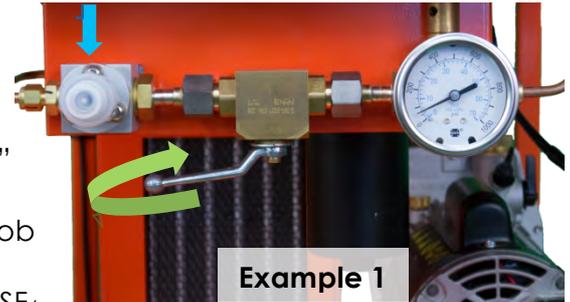
Symptom	Cause	Solution
The compressor(s) does not start	Motor start relay tripped	Turn off breaker switch to affected compressor. Wait until the relay resets (may take up to 10 minutes).
	High pressure cut-off	Pressure switches within the cart have detected discharge (storage pressure) in excess of 725 PSIG. Relieve the pressure by adding additional storage.
	The compressor motor(s) draws relatively high current upon starting.	Avoid use of extension cords. If needed, use at least 12 gauge (1,5 mm <sup>2</sup> ) cable.
	No Power	Provide an appropriate power supply, 220V 50/60 Hz, 16 amp service. Check the label on the front panel for your voltage requirements. Check the condition of cables, extension cords (at least 12 gauge), and all breakers.
	The set point on the integrated weight scale has been exceeded	Switch to a new cylinder or adjust the set point to the correct cut-off weight.
High pressure indication (>725PSIG) on the "Compressor Output (C)" readout	Storage cylinder(s) is full	Switch to new cylinder.
	Check-valve in cylinder(s)	Switch to new non-check valve cylinder.
	Excessive air in the gas	Contact DILO Company, Inc.
	Regulator is closed (or has reached its set point) during filling process	Check the "SF <sub>6</sub> Filling (F)" readout for proper fill setting without a hose connected to the "SF <sub>6</sub> Filling" port.
	Storage cylinder/manifold valves closed	Open respective valves.
Vacuum pump cannot reach a low vacuum	If there is no considerable volume to be evacuated (i.e. nothing is connected to the evacuation port) the vanes in the pump head may not seal completely	Attach a volume to the inlet port.
	The isolation valve on the pump is closed.	Open the isolation valve.
	A leak may be present.	Close the isolation valve on the pump and observe the "Air Evacuation (E)" readout. If the vacuum steadily rises to 0PSIG, a leak is present. Contact DILO Company, Inc. for further assistance.
	Dirty or contaminated vacuum pump oil.	Change the vacuum pump oil.

## Service Cart Maintenance

### SF<sub>6</sub> Filter:

The filter cores (PN: GCC-4909-A) should be exchanged when the quality of the gas is no longer being improved. This can happen if a contaminated batch of gas has been run through the system, or if the service cart has been in use for a minimum of one year since its delivery, or last filter change.

- A. Isolate (close cylinder valves) any gas cylinders connected to the storage connection port(s). If this is not done, any gas in these cylinders will be removed in the following steps. Position the four-way valve to the "SF<sub>6</sub> Recovery" position.
- B. Connect a service hose from the "SF<sub>6</sub> Recovery" port to the "SF<sub>6</sub> Filling" port.
- C. Close the ball valve to isolate the filter housing (shown on example 1 in **green**).
- D. Turn the electric rotary switch to the "SF<sub>6</sub> Recovery" position to start the compressor(s).
- E. Open the fill regulator completely by turning the knob clockwise
- F. Let the compressor(s) run until the pressure on the "SF<sub>6</sub> Recovery (R)" gauge reaches 5 Torr.
- G. Turn the rotary switch to "SF<sub>6</sub> Pump OFF" position.
- H. Close all applicable valves on the external cylinder.

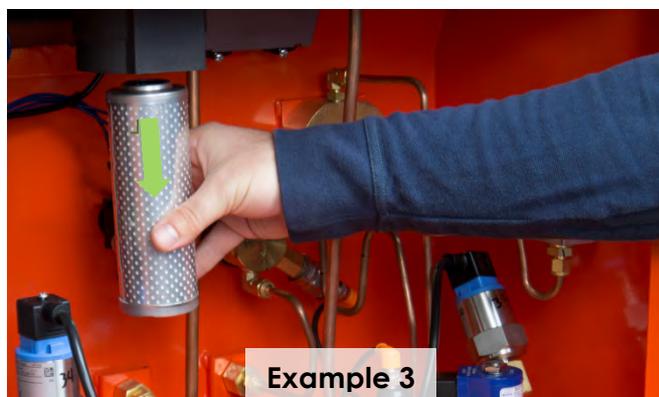
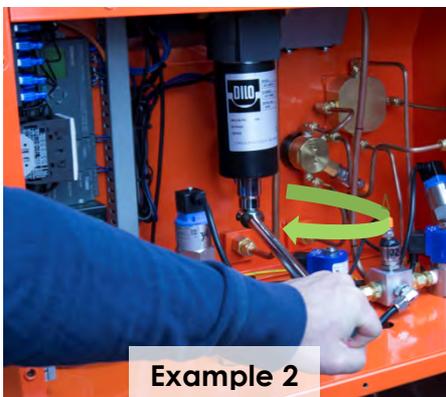


**Danger**

The filter housing must never be opened when a positive pressure exists. This can be verified via the "SF<sub>6</sub> Recovery (R)" or "SF<sub>6</sub> Filling (F)" display.

**NOTE:** The B143R11 has two identical filter housings: one in the upper control cabinet and one by the vacuum pump. The following instructions are for the upper filter housing that is within the control cabinet.

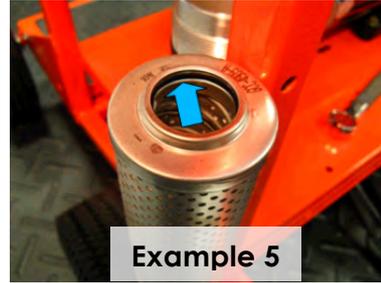
- I. Remove the seven bolts from the upper control cabinet to expose the filter housing.
- J. Unscrew and remove the filter bowl from the filter housing with a 7/8" wrench/socket (shown on example 2 in **green**).
- K. Remove and dispose of the old cartridge (shown on example 3 in **green**).
- L. Clean filter housing and filter bowl.



M. Install the new Lubricate the O-ring in the filter housing and new core (shown on examples 4 & 5 in **blue**).



Example 4

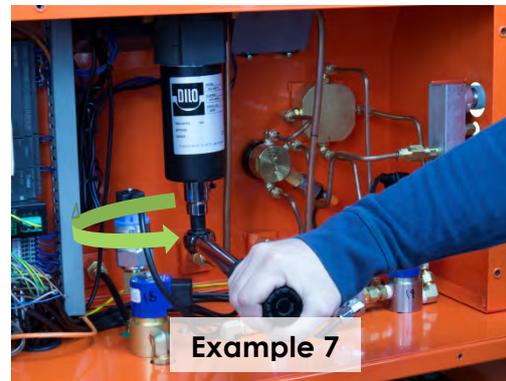


Example 5

N. Install the new filter core and the filter bowl hand tight. Torque the filter bowl to 40ft-lb (shown on examples 6 & 7 in **green**).



Example 6



Example 7

- O. Repeat steps 12 thru 16 for the lower filter housing.
- P. When both filter cores have been replaced, the supplied DN8 hose between the “Air Evacuation” and the “SF<sub>6</sub> Filling” ports.
- Q. Start the vacuum pump via the “Vacuum Pump” switch and then **slowly** open the isolation valve on the pump.
- R. After reaching a sufficient vacuum, close the isolation valve, turn the “Vacuum Pump” switch to the off position, disconnect the service hose between the two ports, and fully close the regulator by turning the knob counterclockwise.

**NOTE:** It is important to ensure that the regulator is fully closed before moving on to the next step. Failure to do so will result in pressure buildup at the “SF<sub>6</sub> Filling” port when the filter service ball valve is opened, resulting in a potential overpressure situation upon the next filling function.

- S. Confirm that the valve is closed on the external cylinder and open the ball valve on the filter housing.
- T. Once pressure has been equalized, the service hose between the cylinder and filter port can be removed.
- U. Check the filter housing for leaks.



### **Compressors:**

The B143R11 has been designed for minimal maintenance. The compressors should be evaluated for wear after 250 hours of use. Call DILO for an explanation of the evaluation procedure. For a minimal cost, you can trade your used compressors for remanufactured units, which are covered by the same warranty as new compressors. Remanufactured compressors are tested to new compressor specifications before shipment to our customers.

### **Vacuum Compressor:**

Vacuum compressors do not require any maintenance for a long time. The ball bearings are closed and permanently lubricated. If the vacuum compressor is operated between 1bar/750torr and 10mbar(a)/7.5torr, the diaphragms should be replaced every 1500 working hours, or after 3 years, at the latest. Should the delivery rate of the vacuum compressor decrease or even completely fail, it could be necessary to exchange the diaphragms and valves.

### **Vacuum Pump:**

The oil in the vacuum pump should initially be changed after the first 100 hours of use and 500 hours every time after. Operating instructions and repair manual for the vacuum pump is attached to this manual.

## **Limited Warranty**

The B143R11 is warranted to be free from defects in workmanship, materials, and components for a period of one year from date of purchase. All parts and labor required to repair defective products covered under warranty will be at no charge. The following restrictions apply:

- The warranty applies to the original purchaser only.
- The warranty applies to the product in the situations described in the manual only. The product must also be serviced and maintained as specified.
- If the product fails, it will be repaired or replaced at the discretion of DILO Company, Inc.
- Warranty service claims are subject to factory inspection. The factory personnel are the sole determiners of warranty coverage.
- DILO Company, Inc. shall not be liable for any additional costs associated with a product failure, including, but not limited to, loss of work time, loss of SF<sub>6</sub>, and any shipping or unauthorized labor charges.
- All warranty service claims must be made within the specified warranty period. Proof-of-purchase date must be supplied.
- Use of this product with unauthorized gases/liquids will void this warranty. SF<sub>6</sub> is the only gas authorized for use in the B143R11.

### **This Limited Warranty does not apply if:**

- The product, or part, is broken by accident.
- The product is misused, tampered with, or modified.
- The product is used for recovering any substance other than SF<sub>6</sub>.

Please see other warranty terms and conditions supplied with the original invoice for further warranty details.

## Integrated Cylinder Weight Scale



The front panel has various main display sections for the visual output of weight information. Each display section feature is described below:

### Weight Display

The weight display indicates the weight readings, setup information, errors and warnings.

### Units Display

The units display shows the units of weight reading as either grams (g), kilograms (kg), pounds (lb), tons (t) or none ( ). If the instrument is set up for counting the units display will show pieces (p).

### Status Annunciators

For status annunciators description see table below:

### Annunciators

SYMBOL	NAME	DESCRIPTION
→ 0 ←	ZERO	Visible when the gross reading is within $\pm \frac{1}{4}$ of a division of true zero.
NET	NET	Visible when the displayed reading represents Net weight.
~	MOTION	Visible when the displayed reading is not stable.
▲	OVER	Visible when the set-point weight is over the set-point target.

## Operation Keys

KEY	DESCRIPTION
	<b>POWER:</b> The <POWER> key is used to turn the instrument on and off. <ul style="list-style-type: none"> <li>• <b>Automatic Operation:</b> The &lt;POWER&gt; key has a memory function associated with it. This means that the state of the power setting is remembered even if external power is interrupted..</li> </ul>
 <b>ZERO</b>	<b>ZERO:</b> The <ZERO> key is used to perform a Zero adjustment on the scale display when an empty scale has drifted away from a true zero reading. This button is disabled in normal operating mode.
 <b>TARE</b>	<b>TARE:</b> The <TARE> key is used to temporarily set the scale to zero even if there is a weight on the scale This button is <b>disabled</b> in normal set up.
 <b>GROSS/ NET</b>	<b>GROSS/NET:</b> The <GROSS/NET> key toggles the weight display between the Gross weight and the Net weight (provided that a Tare has previously been acquired using the <TARE> key).
 <b>PRINT</b>	<b>PRINT:</b> The <PRINT> key is disabled.
 	<b>FUNCTION:</b> The <FUNCTION> key is pre-programmed to adjust the setpoint 1 of the reclaimer. It is also used to enter the programming mode.

### Stability Considerations

Once a <ZERO>, <TARE> or <PRINT> key is pressed, the unit waits for a stable valid reading before performing the associated operation. If the weight readings remain unstable or invalid due to some diagnostic error for longer than 10 seconds, the operation is cancelled and the **STABLE ERROR** message is displayed.

### Calibrating the Weight Scale

The scale is calibrated by DILO before shipment. The weighing system usually requires calibration only once. However, should calibration be required (for example when installing a storage cylinder with different weight), follow these steps:

Calibration requires two steps, "zero" calibration and "load" calibration.

(NOTE: **BLACK** wording are things you must do, **RED** wording is what you should see.)

- Remove the storage cylinder from the weighing platform. Nothing should be touching or resting on the platform (except for the strap).
- To access Calibration Settings first ensure that scale indicator is powered on by pressing the power button for 2 seconds.

#### ZERO Calibration Procedure:

- Press and hold the power button and function "f" key at the same time for 3 seconds.  
(The LED display will flash "**FULL SETUP**" and several bits of information, and will then display the word "**BUILD**")
- Press the "**Zero**" button twice until the LED display shows "**CAL**".



- C. Press the "**Gross/Net**" button and then the "**f**".  
(The display will flash "**2Er0**").
- D. Press the "**f**" button once.  
(The display will flash a numeric value).
- E. Press the "**Gross/Net**" button.  
(The LED display will flash "**2.in P**" for a few moments, beep three times, and the display will flash "**0.0 lbs**").
- F. Press the "**Zero**" button and the LED display will show "**CAL**".
- G. Press and hold the power button and function key at the same time for 3 seconds.  
(The display will flash "**SAVING**" and then display the regular weight mode of the unit).
- H. Power the unit off by pressing the power button for 3 seconds.  
(The unit will count down till "**power off**" is complete).

You have now completed the "**Zero**" calibration portion of the process.

## LOAD Calibration Procedure:

- A. Turn the unit back on by pressing the power button for 2 seconds.  
(You are now ready to begin the **“Load”** Calibration process.)
- B. Press and hold the power button and function key at the same time for 3 seconds.  
(The LED display will flash **“FULL SETUP”** and several bits of information, and will display the word **“BUILD”**)
- C. Press the **“Zero”** button twice until the LED display shows **“CAL”**.
- D. Press the **“Tare”** button twice.  
(The word **“SPAN”** will be displayed in the LED screen.)
- E. Press the **“f”** button once.  
(The LED screen will display a flashing numeric number.)
- F. Load the predetermined weight onto the scale. (ex: 110 lbs., 50kg)
- G. Press the **“f”** button once.
- H. Use the **“Gross/Net”** to button move the flashing cursor from left to right to the desired number value you wish to change. Use the **“Print”** button to change the number to the desired number you want displayed.  
(Example: if you loaded 110 lbs. of weight onto the scale then you would want to change the display numbers to read: **“00110.0”**)
- I. Once you have set the display numbers to reflect the numeric values you desire press the **“f”** button once.  
(The LED display will flash **“5.n.P”** for a few moments, beep three times, and then display the regular weight mode of the unit.)
- J. Press and hold the power button and function key **“f”** at the same time for 3 seconds.  
(The LED display will flash **“SAVING”** and then display the regular weight mode of the unit.)
- K. Power the unit off by pressing the power button for 3 seconds.  
(The unit will count down till **“power off”** is complete. You have now completed the **“LOAD”** calibration portion of the process.)

The device is now calibrated. Recalibration should not be required but periodic checks of the scale accuracy are suggested, this is best done with NIST certified weight.

## Unlock TARE button function and adjustment of tare weight:

This becomes necessary when a different size storage cylinder should be installed. The TARE weight must be set to 0 and the max. permissible storage weight (set point 1) must be adjusted accordingly.

- A. Press buttons (i) and (f) for 5 seconds simultaneously.  
„buiLd“ appears at the display.
- B. Press button (Zero) 3 times. Display will show SPEC .
- C. Press button (TARE) 3 times until the display shows „key.Loc“.
- D. Press ( GROSS / NET) button once until P1-345 is displayed



- E. Press ( GROSS / NET) button to move the cursor from left to until it is under the ( - ) display. Press (PRINT) button to display 2.
- F. Place the new storage cylinder onto the weight scale and press the ( TARE ) button. The scale is now set to 0.
- G. Lock TARE button by repeating steps A-E. This time set the 2 in the display back to (-).

### Adjust set point:

- A. Press "f" button for 2 seconds.  
"setpt1," will be displayed followed by the current set point value.  
for example: 00047.0 lbs. or 21.3 kg. (This value was preprogrammed by the factory to match the initially installed storage cylinder.)
- B. Change set point 1:
  - a. Press "Gross/Net" button to move the cursor from left to right.
  - b. Press "print" button to toggle the active digit from 0 through 9

#### Example:

factory setting for a  
**20 Liter** cylinder



new setting for a  
**40 Liter** cylinder



- C. The new value is now the fill weight that will activate set point 1 and shut down the SF6 recovery function.
- D. Press "f" button. Display shows "setpt2," then "00000.0" (set point 2 is not used)
- E. Press "f." button.

### Changing units between lbs. and kg.

- A. Simultaneously press and hold "power" & "f" for approximately 3 seconds. (Display will show "bUild.")
- B. Press "f." (Display will show "dP.")
- C. Press "tare" 3 times. (Display will show "UnitS.")
- D. Press "f." Display will show 00000.0 (weighing unit, ex: lbs)
- E. Press "print" until desired unit shows.
- F. Press "f." (Display will show "UnitS")
- G. Simultaneously press and hold "power" & "f" for approximately 3 seconds to save. (Display will reset and return to normal operation showing weight.)



## Using the Device

### Normal Weighing

- Ensure instrument is on and **Zero** annunciator is lit.
- Place your item on the weigh platform.
- Read the weight display.

### Using Tare

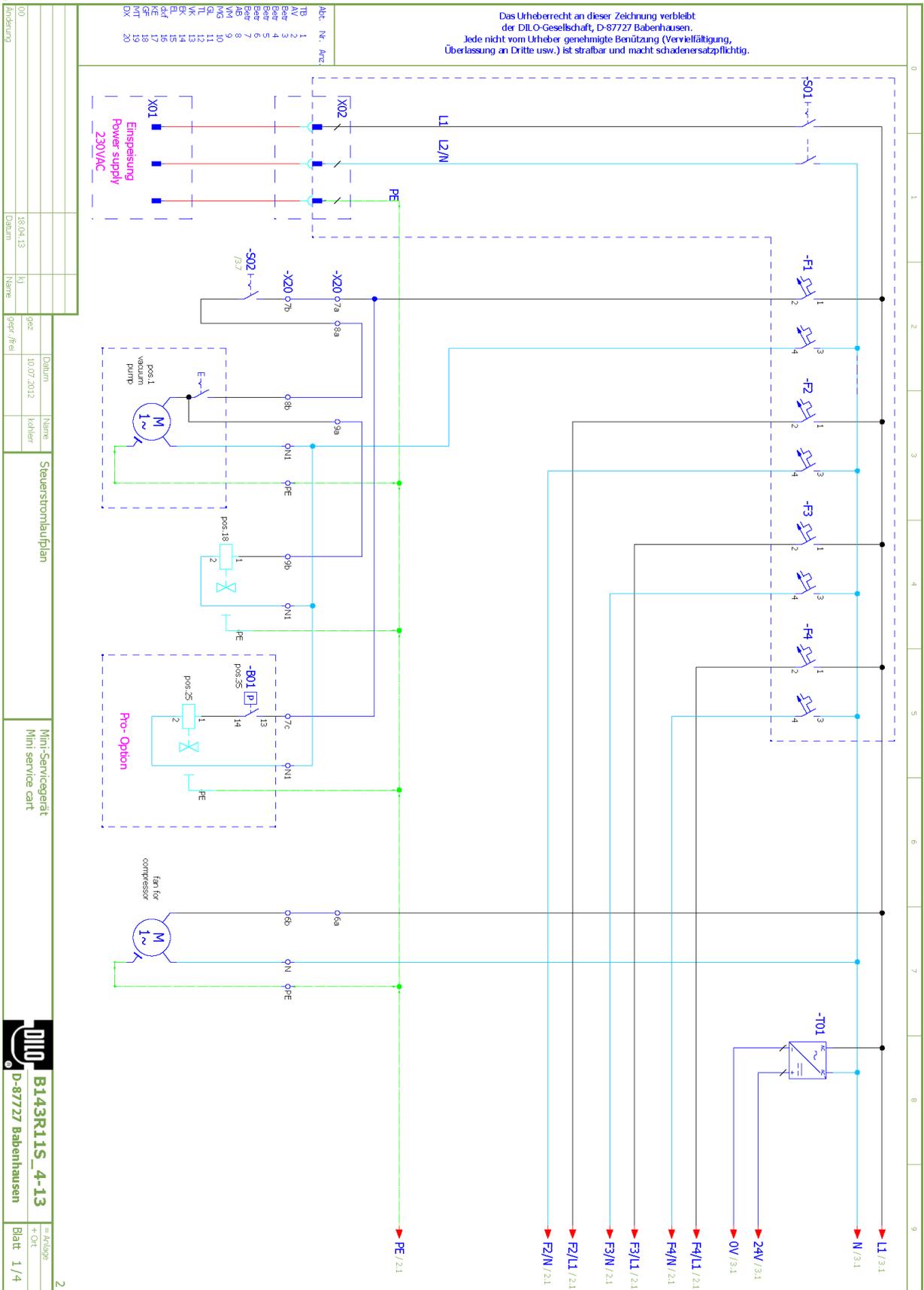
- The indicator displays zero with **Zero** annunciator lit.
- Place the container on the weigh platform.
- Press the **<TARE>** key. 
- The indicator will show the displayed zero weight and the **Net** annunciator will be lit.
- Fill the container to the required weight.
- Press the **<GROSS/NET>** key to toggle between the Net weight and the Gross (total) weight. 

## ERROR MESSAGES

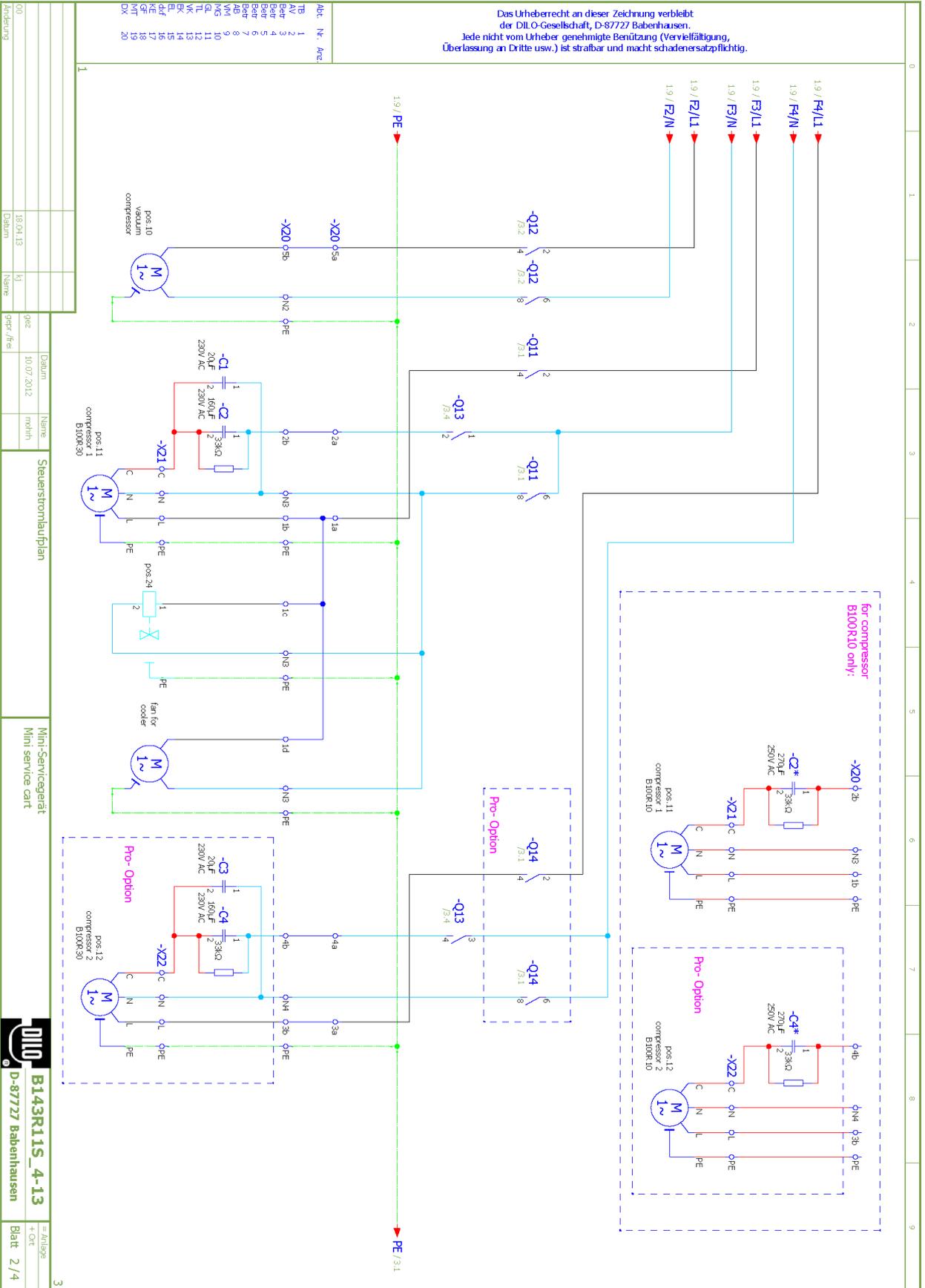
### Weighing Errors

Error	Description	Resolution
(U - - - - -)	The weight is below the minimum allowable weight reading.	Increase the weight or decrease the minimum allowable weight reading.
(O - - - - -)	The weight is above the maximum allowable weight reading. <b>Warning</b> – overloading may damage mechanical scale elements.	Check the condition of load cell connections. Check for damaged load cell.
(ZERO) (ERROR)	The weight reading is beyond the limit set for Zero operation. The operation of the <b>&lt;ZERO&gt;</b> key is limited in the setup during installation. The indicator cannot be zeroed at this weight.	Increase the Zero Range (OPTION: Z.RANGE) or use the <b>&lt;TARE&gt;</b> key instead.
(STABLE) (ERROR)	Scale motion has prevented a <b>&lt;ZERO&gt;</b> , <b>&lt;TARE&gt;</b> or <b>&lt;PRINT&gt;</b> operation from occurring on command.	Try the operation again once the scale is stable.

# Wiring Schematics:



# Wiring Schematics (cont'd):

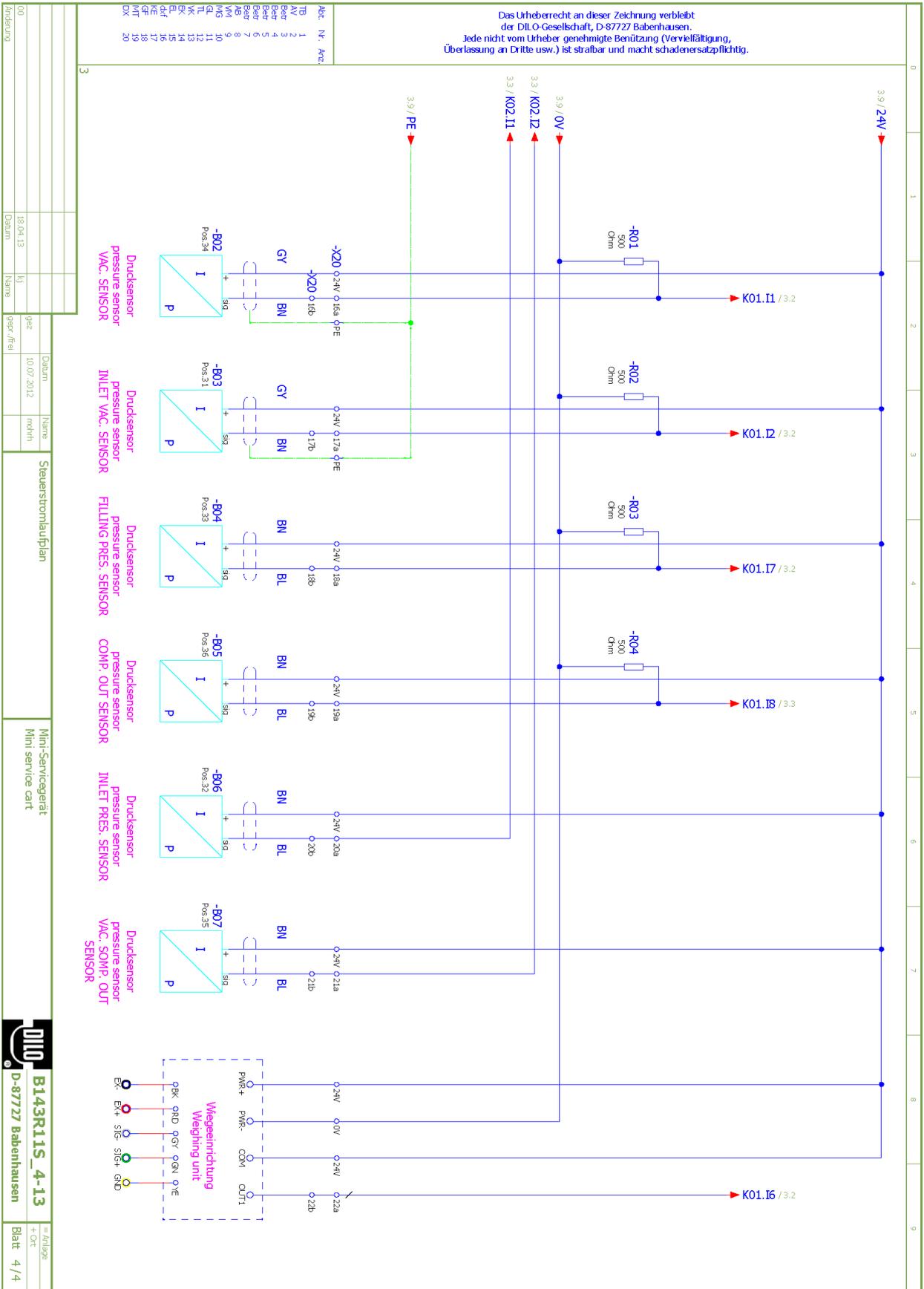


00	Änderung	18.04.13	KJ	ges	10.07.2012	modh	Steuerstromlaufplan	Mini-Servicegerät	B143R11S_4-13	Blatt 2/4
----	----------	----------	----	-----	------------	------	---------------------	-------------------	---------------	-----------





# Wiring Schematics (cont'd):



0.0	Änderung		
18.04.13	Datum	ky	Name

10.07.2012	Datum	rohhh	Name
10.07.2012	gepr./frei		

Steuerstromlaufplan	Mini-Servicegerät
	Mini service cart

	<b>B143R11S_4-13</b>	Blatt	4 / 4
	D-87727 Babenhausen		

Pos.	Qty.	Description	Part #
A01	1	Text panel	05-1520-R021
C1	1	Capacitor 20yF	05-1781-R010U
C2	1	Capacitor 160yF	05-1781-R001U
C3	1	Capacitor 20yF	05-1781-R010U
C4	1	Capacitor 160yF	05-1781-R001U
F01	1	Breaker 7.5 A	206-444
F02	1	Breaker 7.5A	206-444
F03	1	Breaker 10A	206-162
F04	1	Breaker 10A	206-162
K01	1	Display main module	05-1520-R010
K02	1	Display extension module 2 AE	05-1520-R009
K03	1	Display extension module 4 DE 4 RA	05-1520-R007
Q11	1	Relay	CF30A002240
Q12	1	Relay	CF30A002240
Q13	1	Contacteur	05-0722-R001U
Q14	1	Relay	CF30A002240
S01	1	Main Breaker 25A	206-166
S02	1	Switch for Vacuum pump	C1250APBB-085W
S03	1	Switch "Filling-Recovery"	M22-WRK3
T01	1	24 V Power supply	05-1461-R001U





# **SUPEREVAC™**

**Vacuum Pump**



## **Operation and Maintenance Manual**

**Models 93511 - 93516  
93540 - 93598**

## Table of Contents

Page

Features of your new pump.....	3
The purpose of the SuperEvac™ design.....	4
The 7 important steps of initial start-up.....	5
Vacuum tips for best performance.....	5, 6
Basic troubleshooting.....	7
• Four most common problems	
• Oil leakage	
• The steps to solving 95% of all problems	
Diagnostic chart.....	8, 9
Replacement parts.....	10, 11
Warranty and Service.....	12

---

## Important Notices to Purchaser

Check for damage immediately.

Prior to shipment, all YELLOW JACKET® SuperEvac™ vacuum pumps are completely tested and inspected to assure compliance with Ritchie Engineering factory specifications.

If the pump carton is damaged, check contents immediately. Note damage on shipper's Bill of Lading and have shipper sign your statement. Notify the carrier immediately of the damage to arrange inspection of the pump and packaging.

The CARRIER ALONE is responsible for handling and settling your claim. Ritchie Engineering will cooperate in assessing damage if the pump is returned to the factory prepaid.

Carton contents include:

- SuperEvac pump
- Bottle of YELLOW JACKET SuperEvac Pump Oil
- Owner's manual
- Warranty registration card

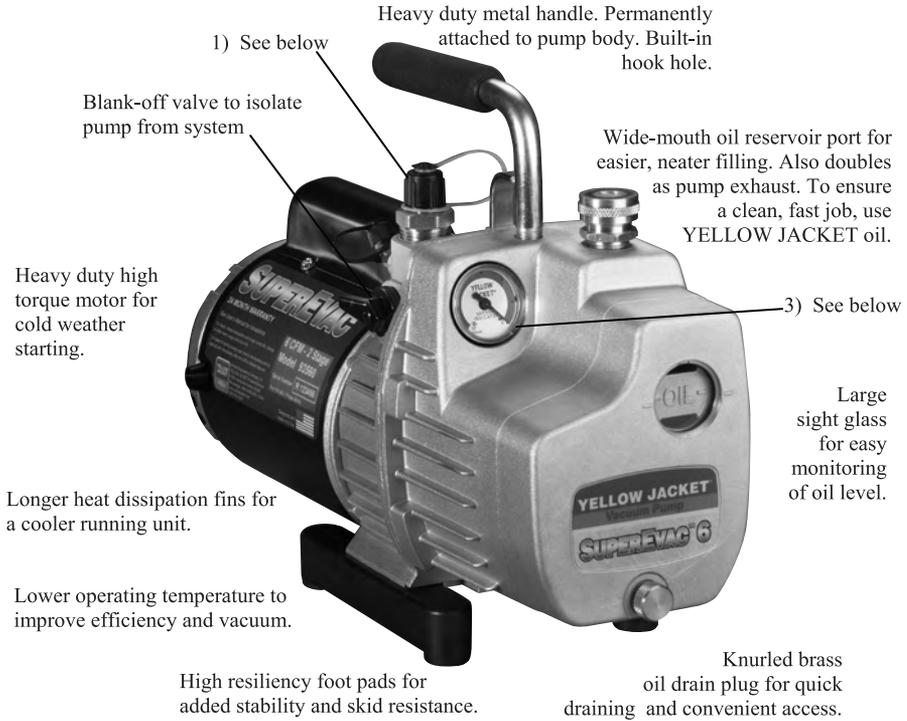
To validate warranty, mail registration card within 10 days.

---

## Warning:

- This unit generates a deep vacuum that can be harmful to human tissue. Do not expose any part of the human body to the vacuum.
- Do not operate this unit with the exhaust blocked or restricted. Remove red shipping cap prior to use.
- Keep unit a minimum of 4" (10 cm) from objects to provide adequate cooling of motor.
- Continuous sound pressure level of this unit can exceed 70dB (A).
- Wear goggles and protective clothing when using this product.

# Features of your New Pump



- 1) Male flare pump intake. Tethered cap stays with unit. Large diameter hose suggested for maximum pull down.
- 2) Additional 1/4" male flare port.
- 3) Vacuum gauge shows evacuation progress down to 30" range, so you'll know when to turn on electronic gauge for more precise reading.
- 4) Gas ballast valve (not shown) helps remove moisture and other condensable vapors that have been drawn into the pump as a result of evacuation.

- Opening the ballast allows fresh air to enter the cartridge and keep vapors from combining with the oil. Vapors escape harmlessly through the exhaust valve. If combined with oil, vapors can turn the oil milky white and lower pump performance below specifications.
- 5) To operate ballast, turn the valve counter-clockwise one full turn after evacuation starts. As the vacuum reading reaches 1000-2000 microns, close the ballast to achieve a higher vacuum range.

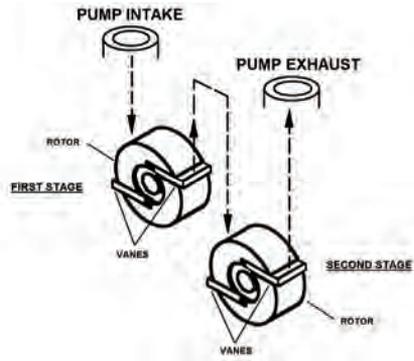
# The Purpose of the SuperEvac™ Design

The SuperEvac™ Pump is a 2-stage rotary vane design (at right) that increases efficiency and speeds pump down to 15 microns.

The pump lowers the internal pressure of a refrigeration system until moisture boils into a vapor. As the moisture is vaporized, it is evacuated by the pump, helping dehydrate the system. Most technicians try to achieve between 250 and 1000 microns.

A manometer or electronic vacuum gauge are the only ways to monitor evacuation progress. Manometer readings are approximate in inches of mercury. Only an electronic vacuum gauge (see page 8) is accurate enough to show when you reach the desired micron range.

As the chart shows, only an electronic gauge reads fine differences to provide assurance that the vacuum is low enough to boil the greatest possible amount of moisture.



*First stage exhausts into the intake of the second stage similar to two single stage pumps connected together.*

If air – a non-condensable – remains in the system, it collects on the high side reducing system efficiency. This causes a rise in head pressure. The discharge valve gets hotter than normal and organic solids form causing compressor failure.

Moisture in the system can form ice which closes off openings in expansion valves and cap tubes, and prevent adequate cooling.

Ultimately moisture and air can produce acids and sludge which could cause in-warranty failures.

During service and parts replacement, the same contaminants get in again, and you could be called back for repairs by a dissatisfied customer.

Moisture and air can even enter through system leaks. And as the moisture in the air increases, so does the amount of contamination. The higher the humidity, the bigger your problem.

A vacuum pump "pulls" air and moisture out of the system before the system is damaged. The higher and more complete the vacuum, the more moisture is removed. That's why your SuperEvac pump is specifically engineered for high vacuums of 15 microns and better.

Boiling temp of water	Inches mercury	Microns
212°F (100°C)	0	760,000
151°F (66°C)	22.05	200,000
101°F (38°C)	27.95	50,000
78°F (26°C)	28.95	25,000
35°F (2°C)	29.72	5,000
1°F (17°C)	29.882	1,000
- 50°F (-46°C)	29.919	50

## How one small drop dampens your profits.

A small drop of moisture can hurt your profits and reputation.

During new system set-up, protective caps are removed admitting moisture and air into system components.

## The 7 Important Steps of Initial Start-Up

- 1) Make sure motor is off and name plate voltage on motor bottom matches outlet voltage.
- 2) Remove oil fill cap on pump cover. Fill with YELLOW JACKET® SuperEvac™ Pump Oil until oil level is even with oil level line.
- 3) Make sure blank-off valve is in the open position (vertical). **Stay clear of the oil fill/exhaust port!** Remove intake cap to open intake to the atmosphere and then switch on the motor. When pump reaches running speed, replace cap. The vacuum indicator gauge should read 30 inches.
- 4) To check the pump's performance, attach a micron gauge to the 1/4" male flare fitting, making sure that the intake fitting is capped and the gas ballast valve is closed. Turn on the pump. The micron gauge will

display the ultimate vacuum reached.

- 5) Improve cold weather starting by opening intake and running your pump for 10-15 seconds.
- 6) When turning pump off, open intake fitting until vacuum indicator gauge reads zero to break vacuum just prior to shut-off.
- 7) Disconnect pump and put cap on intake to keep out contaminants.
- 8) If an extension cord is needed, refer to the below chart for proper sizing:

**RECOMMENDED EXTENSION  
CORD SIZES**

Total Extension Cord Length (Feet)		
25'	50'	100'
16 Ga.	14 Ga.	12 Ga.
Wire Gauge (AWG)		

## Vacuum Tips for Best Performance

### Quick tips:

- 1) For the fastest vacuum, connect your pump **directly** to the system. Going through a manifold slows the job.
- 2) Use as **large** a hose as possible, even though the system has 1/4" fittings. A 1/2" or 3/8" hose allows a much faster and more complete vacuum.
- 3) Use as **short** a hose as practical to get maximum evacuation speed. Short hoses make evacuation faster than longer hoses. Long hoses slow the process.
- 4) **Metal hoses** are the most impervious so will be most effective in evacuation.
- 5) Evacuate through **both high and low**

sides at the same time to speed evacuation.

- 6) Use the **4-in-1 Vacuum/Charge Valve & Core Tool (Part #18975)** to remove the Schrader valves from the system and evacuate through unrestricted lines for a faster and higher vacuum. Removing Schraders saves over 30% in time.
- 7) Use **two pumps** on very large systems to reduce vacuum time. Put one of the pumps on the low side of the system.



8) Use a **SuperEvac™ System I, II or III** to decrease vacuum time by over 50%.

These systems include a 2-valve vacuum manifold and two 3/8" vacuum hoses which can evacuate three times faster than a 1/4" hose.



9) Use a heat gun on the condenser and evaporator to speed the evacuation process.

### Built-in vacuum gauge:

The unique built-in indicator gauge in your pump monitors evacuation progress down to the 29-30" range. If the reading stays in the mid range, there is either high contamination or a large leak in the system.



Gross Leak

If you think there is excessive moisture, blow out the AC&R system with dry nitrogen wherever possible. This reduces the amount of contaminants that must be "pulled" into the pump and increases evacuation speed.

Use a nitrogen regulator valve with pressure limited to 150 psi, and a frangible disc device set at 175 PSIG.

When the indicator reaches the 29-30" range, turn on the electronic micron gauge for more precise readings.



Turn on electronic gauge

### Oil changes

**CHANGE OIL AFTER EACH USAGE** to protect pump components from contaminants pulled into pump during service. Place used oil in a sealable container and dispose properly in accordance with local regulations.

**YELLOW JACKET®** vacuum pump oil is specially refined and formulated for extremely low vapor pressure and high pump efficiency at all temperature conditions. This means it can help you get a **continued return on your pump investment**.

In fact, with **proper maintenance**, your pump can keep making money for you up to ten years and more.

Proper maintenance includes -

- 1) Change the oil immediately after every use while the oil is still warm. This insures that contaminants are still in suspension and are removed with the oil.

If contaminants cool, solidify and stay in the pump, they lower vacuum efficiency. In extreme cases, the oil stops lubricating and the pump seizes.

Oil may look clean, but still be contaminated. "Looking clean" is not enough. One job is more than enough to contaminate oil. The only way to determine oil condition is to test vacuum pulled with an electronic vacuum gauge.

- 2) When finished with the pump, replace the tethered cap on the intake fittings (check for o-rings in caps). This keeps out moisture and contaminants.

SuperEvac vacuum levels can be reached only when the correct amount of **YELLOW JACKET** oil is used.

**Use of other oils voids your pump warranty.** Refrigerant oil, brake fluid and any other oil such as motor oil cannot be used.



# Basic Troubleshooting

## 4 most common comments on pump return paperwork

- 1) **"Will not pump"** This usually means the pump will not pull a high enough vacuum. This can be caused by valve being left open, missing "O"-rings under caps or contaminated oil.

SUGGESTION: Change valve and "O"-rings change oil twice and recheck vacuum.

- 2) **"Will not pull below 1000 microns."**

SUGGESTION: Check for "O"-rings. Test pump to determine actual pull down. Remove all hoses and connect vacuum sensor directly to pump.

- 3) **"Noisy."** Pumps are noisy when they have not achieved a high vacuum. In intermediate vacuum, there will be oil, vane and exhaust noises.

SUGGESTION: Listen to the pump at high vacuum. If relatively quiet, the pump is running properly. If still noisy, there may be a system leak.

- 4) **"Repair and return."** This is the most difficult return comment to handle, since we are unsure of what needs to be done to keep the customer satisfied.

SUGGESTION: Be specific about the problem with your pump if returning it.

## Starting problems

- Be sure pump is plugged into live receptacle with line voltage plus or minus 10% of voltage on motor name-plate. Long extension cords can greatly reduce voltage and cause problems.
- Pump/oil temp. must be 30°F (-1°C) or higher. Open intake to atmosphere and switch on pump; run up to speed before connecting to system.

- Your SuperEvac™ pump features a heavy-duty high torque motor for cold weather starting, but dirty oil makes starting more difficult, causing unnecessary wear on your unit.
- Dropping your pump can damage it. In a locked pump condition, motor will not run and the thermal overload will kick out.
- Disconnect power cord and set pump with front cover face down on table. Reach into coupling area and try to rotate the coupling. Do not use pliers. If the pump does not rotate, it is "locked up."

## Oil leakage

- If leak develops between front and rear half of oil case, tighten all seven screws. Replace gasket if necessary.
- If shaft seal leaks, replace it.
- Wipe pump dry and watch for source of leak. Tighten screws and repair.

## The steps to solving 95% of all problems

- 1) **Check oil level when pump is running.** It should be 1/2 to 5/8 up in the sight glass, the level necessary for proper operation.
- 2) **Check vacuum pump.** Connect micron gauge directly to the 1/4" port and cap intake port. Turn on pump, open the valve and check vacuum reading. If reading is good, check the system for leaks. OR, if testing a system, isolate pump with blank-off valve and get vacuum reading from the pump alone. If the pump does not pull and stay at a good vacuum level, run until hot and change oil.
- 3) **Check all flare connections.** Make sure they are tight.

## SuperEvac™ LCD Digital Vacuum Gauge



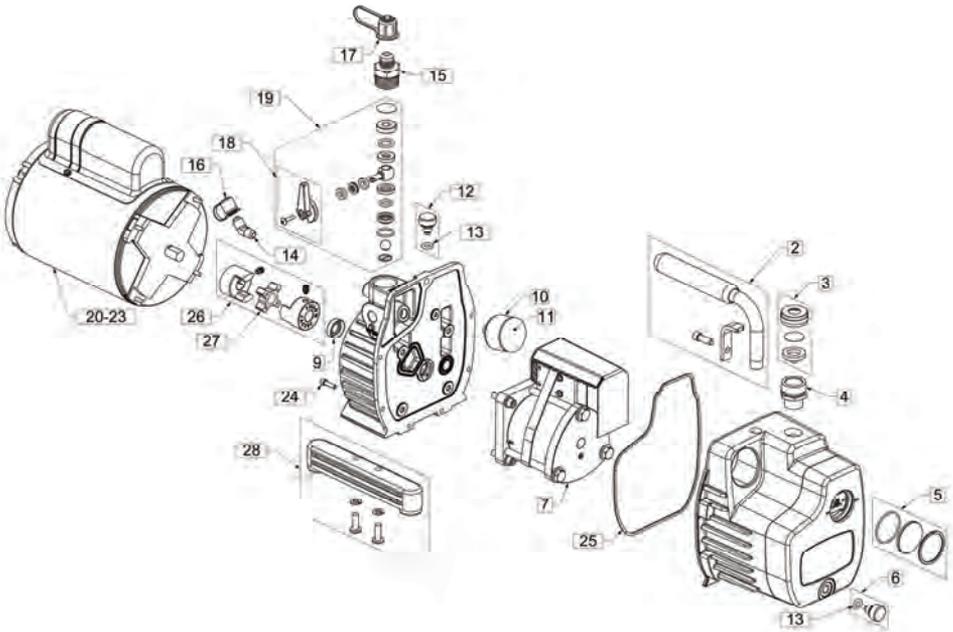
This portable, lightweight, solid state instrument indicates the vacuum pressure in the system using thermocouple technology. This is important because you need to know the vacuum to confirm moisture removal. The battery powered gauge measures atmospheric pressures of 760,000 to 1 micron in easy to read 1/2" high numbers (**Part #69075**).

### Diagnostics Chart

Condition	Pump Area	Possible Problem	Solution
Poor vacuum	Quiet pump	Dirty oil Drive coupling or set screw loose Bent or broken exhaust valve Pump not oiling Vaness not functioning	Flush 1 to 3 times  Repair or replace Repair or replace Call factory Call factory
	Ultimate of pump - does not need mfg. spec (read with thermocouple)	Pump dropped Micron gauge malfunction Poor motor performance Dirty oil Air leaks System leaks Fitting sealant compound	Call factory Verify with second gauge Repair or replace Flush 1 to 3 times Repair or replace Isolate/repair Repair or replace
Oil Leaks	Exhaust	Oil level high System vented pressure through pump Pump tipped over	Adjust oil level Check oil level, add or replace oil Check oil level, add or replace oil
	Seal	Worn or damaged seal Motor loose	Replace Adjust/tighten, check seal
	Case	Gasket bolts loose Oil drain fitting Gasket damaged	Tighten Repair or replace Replace

Condition	Pump Area	Possible Problem	Solution
Pump won't start	Motor stalled hot/cold	Damaged motor Damaged pump Closed intake/gas ballast on pumps	Repair or replace Replace/call factory Open intake fitting and gas ballast.
	Thermal	Low voltage Cold weather cut-out  Dirty oil	Shorter extension cord Open intake fitting for 10-15 sec. to warm up while starting. Flush 1 to 3 times
Unusually noisy	Motor areas	Worn motor Loose motor bolts Drive coupling	Replace motor Tighten bolts Adjust/replace coupling
	Pump cartridge	Dirt, low, improper oil Air leaks: 1) caps/connection 2) Gaskets/"O"-rings 3) Fittings 4) System leak	Flush and replace oil  Tighten Replace/put on oil Replace/reseal Isolate pump with blank-off valve and repair system leak
High temp	Motor	Low voltage	Short extension cord
	Pump	Dirty oil Low oil Lint/foreign material Parts friction Too small for system Air leaks	Flush and replace Add/replace Open gas ballast Replace oil/call factory Size pump for system Replace/repair
Poor vacuum	Noisy pump	System leaks Low oil level Dirty oil Worn pump Air leaks and fittings or gasket seals	Repair leaks Add/replace Flush 1 to 3 times Replace module, call factory Replace/repair

# Replacement Parts



	Pump # 93514 93516 93594 9354x	Pump # 93515 93596 9356x	Pump # 93511 9358x	Pump # 93590 93592 93593 93595 93598
	4 CFM	6 CFM	8 CFM	11 CFM
	(95 L/M)	(142 L/M)	(190 L/M)	(260 L/M)
<b>Pump oil cover</b>				
1. Complete cover (individual parts listed below)	93501	93502	93503	93504
2. Handle with screw	93370	93370	93370	93370
3. Oil fill cap and seal	93390	93390	93390	93390
4. Oil fill fitting	93391	93391	93391	93391
5. Oil sight glass	93365	93365	93365	93365
6. Oil drain	93368	93368	93368	93368
<b>Vacuum cartridge</b>				
7. Complete cartridge with oil cover gasket	93541	93561	93581	93591

	<b>Pump # 93514 93516 93594 9354x</b>	<b>Pump # 93515 93596 9356x</b>	<b>Pump # 93511 9358x</b>	<b>Pump # 93590 93592 93593 93595 93598</b>
	<b>4 CFM</b>	<b>6 CFM</b>	<b>8 CFM</b>	<b>11 CFM</b>
	<b>(95 L/M)</b>	<b>(95 L/M)</b>	<b>(95 L/M)</b>	<b>(260 L/M)</b>
<b>Mounting body</b>				
8. Complete body (individual parts below)	93500	93500	93500	93500
9. Shaft seal	93031	93031	93031	93031
10. 30" vacuum gauge	93011	93011	93011	93011
11. Vacuum gauge crystal	93012	93012	93012	93012
12. Gas ballast with "O"-ring	93368	93368	93368	93368
13. "O"-ring for gas ballast/drain plug	93398	93398	93398	93398
14. 1/4" elbow fitting	93028	93028	93028	93028
15. Intake fittings	93377 (3/8") 40265 (Acme)	93377 (3/8") 40265 (Acme)	93393 (1/2") 40265 (Acme)	93393 (1/2") 40265 (Acme)
16. Intake cap (1/4")	93394	93394	93394	93394
17. Flare caps	93399 (3/8") 40284 (Acme)	93399 (3/8") 40284 (Acme)	93395 (1/2") 40284 (Acme)	93395 (1/2") 40284 (Acme)
18. Blank-off valve with handle	93366	93366	93366	93366
19. Complete parts for blank-off handle	93367	93367	93367	93367
<b>Motor</b>				
20a. 1/2 hp - 115V / 60 Hz (includes items 21, 22, 23a below)	93505	93505	93505	93505
20b. Export models: 1/2 hp - dual voltage 115V / 60 Hz, 230V / 50 Hz (includes items 21 and 22)	93513	93513	93513	93513
21. 8/32 x 7-1/4" motor bolts (4)	93099	93099	93099	93099
22. Rocker style switch	93117	93117	93117	93117
23a. 8' long US cord	93115	93115	93115	93115
23b. 8' long EU cord (detachable IEC-320)	95431	95431	95431	95431
23c. 8' long UK cord (detachable IEC-320)	95432	95432	95432	95432
<b>Final assembly parts</b>				
24. 8/32 x 5/8" socket head screws	93506	93506	93506	93506
25. Oil cover gasket	93507	93507	93507	93507
26. Drive coupling	93047	93047	93047	93047
27. Coupling spider	93050	93050	93050	93050
28. Right or left leg assembly with screws	93034	93034	93034	93034

Damaged supply cords must be replaced by special assemblies available from the manufacturer or its distributors.

<b>9354x</b>	<b>9356x</b>	<b>9358x</b>	<b>9359x</b>
28.3 lbs. (12.8 kg)	29.0 lbs. (13.1 kg)	30.3 lbs. (13.7 kg)	31.5 lbs. (14.3 kg)

# WARRANTY INFORMATION

Ritchie Engineering guarantees YELLOW JACKET<sup>®</sup> products to be free of defective material and workmanship which could affect the life of the product when used for the purpose for which it was designed. This warranty does not cover items that have been altered, abused (including failure to use the correct type of vacuum pump oil) or returned solely in need of field service maintenance.

If found defective, we will either replace or repair at our option products within warranty period. Returns must be pre-paid.

Warranty does not cover use of lithium bromide, ammonia or leak stop type products.

See [www.yellowjacket.com](http://www.yellowjacket.com) or contact customer service for full warranty details.

## How to Obtain Service

Most returned pumps are merely in need of normal field service maintenance, such as changing oil or making minor adjustments. In many instances, the troubleshooting information in this manual can save you the time and effort of returning your pump. When the information contained in this manual, however, does not solve the problem, please call for service.

Call the Ritchie Engineering Customer Service Department:

Phone: (952) 943-1333 or  
(800) 769-8370

Fax: (952) 943-1605 or  
(833) 322-8684

E-mail: [custserv@yellowjacket.com](mailto:custserv@yellowjacket.com)

You will receive personal help in determining if the problem can be solved without sending your pump to the factory and taking it out of service.



Ritchie Engineering Co., Inc.  
YELLOW JACKET Products Division  
10950 Hampshire Ave., S.  
Bloomington, MN 55438-2623 USA  
e-mail: [custserv@yellowjacket.com](mailto:custserv@yellowjacket.com)  
Web Site: [www.yellowjacket.com](http://www.yellowjacket.com)

Phone: 800-769-8370  
Int'l Phone: 952-943-1333  
Fax: 800-322-8684  
Int'l Fax: 952-943-1605