

SD63UL
Rev 9
July 2006
Supersedes Rev 8

Model Series 63UL Differential Type Flow Controller

INTRODUCTION

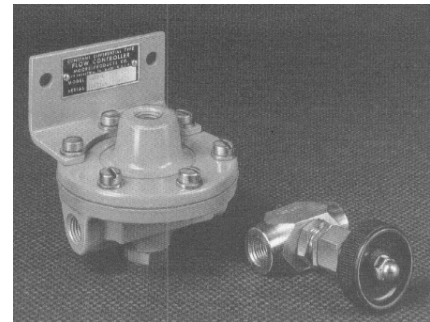
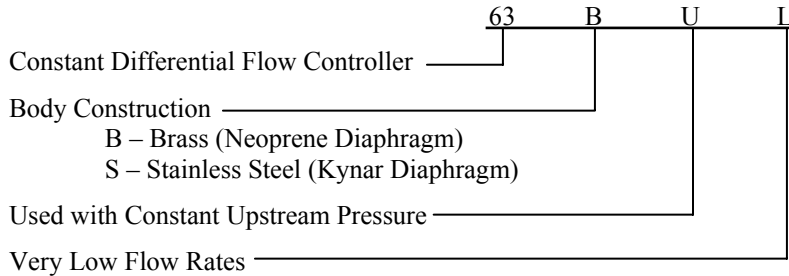
The 63UL Controller is used in conjunction with an external needle valve to provide constant volume flow rates for either liquids or gases over a continuously adjustable flow range.

In gas service, the 63U is used when the upstream pressure is constant to provide a constant mass flow rate (i.e. standard volume units per time unit; e.g. SCFM). In gas systems where the downstream pressure is constant, a 63D is used.

Constant upstream pressure is not needed for constant volume flow rates (i.e. volume units per time unit; e.g. CFM). With liquids, both mass and volumetric flow rates are held constant, regardless of up or downstream pressures.

This instruction has eight major sections: Introduction, Installation, Principle of Operation, Capacity, Operation, Maintenance, Warranty, and Parts List.

Model Designation



Note: Series 63DL shown, Series 63UL is similar

Specifications

Supply Pressure

- Minimum..... At least 5 psig greater than the maximum downstream pressure of the needle valve-controller combination
- Maximum See the table below

Model	Needle Valve	
	Open	Closed
63BU	250 psig	50 psig
63BU-L	250 psig	50 psig
63SU	500 psig	100 psig
63SU-L	500 psig	50 psig

Ambient Temperature Limits

- Models 63BU & 63BU-L -40° to +180°F (-40° to +82°C)
- Models 63SU & 63SU-L -40° to +250°F (-40° to +120°C)

INSTALLATION

Shipping and Storage

If the controller is to be stocked, stored, or shipped to another location prior to piping, make sure that the factory installed plastic plugs are in the ports to prevent entry of moisture, dirt, or other contaminants.

Mounting

Mounting dimensions and the locations and sizes of connections are shown on the installation drawing; see Figure 1. The controller may be mounted in any position. Install the needle valve and feedback connections as close to the controller as possible to minimize pressure drop between these points. The supply to the controller must be filtered to remove any solids.

CAUTION

When installing the constant upstream controller, be sure the external needle valve is open; see Figure 1. Failure to do this could result in applying a differential pressure across the diaphragm of the flow controller in excess of its rate limit, thus causing the diaphragm to rupture.

Blow out all piping before connections are made to prevent the possibility of dirt or chips entering the controller. Use pipe sealant sparingly, and then only on the male threads. A non-hardening sealant is strongly recommended. Connect the controller to a source of clean, dry, oil-free instrument air. See Instrument Air Requirements.

CAUTION

Exceeding the specified ambient temperature limits can adversely affect performance and may cause damage to the controller.

Supply pressure in excess of that stated in the Specifications section may cause damage to the controller.

Instrument Air Requirements

Connect the instrument to a source of clean, dry, oil-free instrument air. Failure to do so will increase the possibility of a malfunction or a deviation from specified performance.

CAUTION



Use of process fluids other than instrument air is not recommended. No claim is made as to the suitability of this product for use with other process fluids, such as hazardous gases, except as listed on the appropriate certificate. Non-approved instruments are suitable for use with instrument air only. Optional features and modifications such as tapped exhaust do not imply suitability for use with hazardous gases except as listed on the approval certificate.

There are many types of synthetic compressor lubricants. Some may not be compatible with the materials used in construction of the instrument. Wetting of these materials by such an oil mist or vapor, etc., may cause them to deteriorate. This may ultimately result in failure of the positioner.

CAUTION



Synthetic compressor lubricants in the air stream at the instrument may cause it to fail.

The requirements for a quality instrument air supply can be found in the Instrument Society of America's "Quality Standard for Instrument Air" (ISA-S7.3). Basically, this standard calls for the following:

Particle Size — Maximum particle size in the air stream at the instrument should be no larger than 3 microns.

Dew Point — The dew point, at line pressure, should be at least 10°C (18°F) below the minimum temperature to which any part of the instrument air system is exposed at any season of the year. Under no circumstances should the dew point, at line pressure, exceed 2°C (35.6°F).

Oil Content — Maximum total oil or hydrocarbon content, exclusive of non-condensable, should not exceed 1 ppm under normal operating conditions.

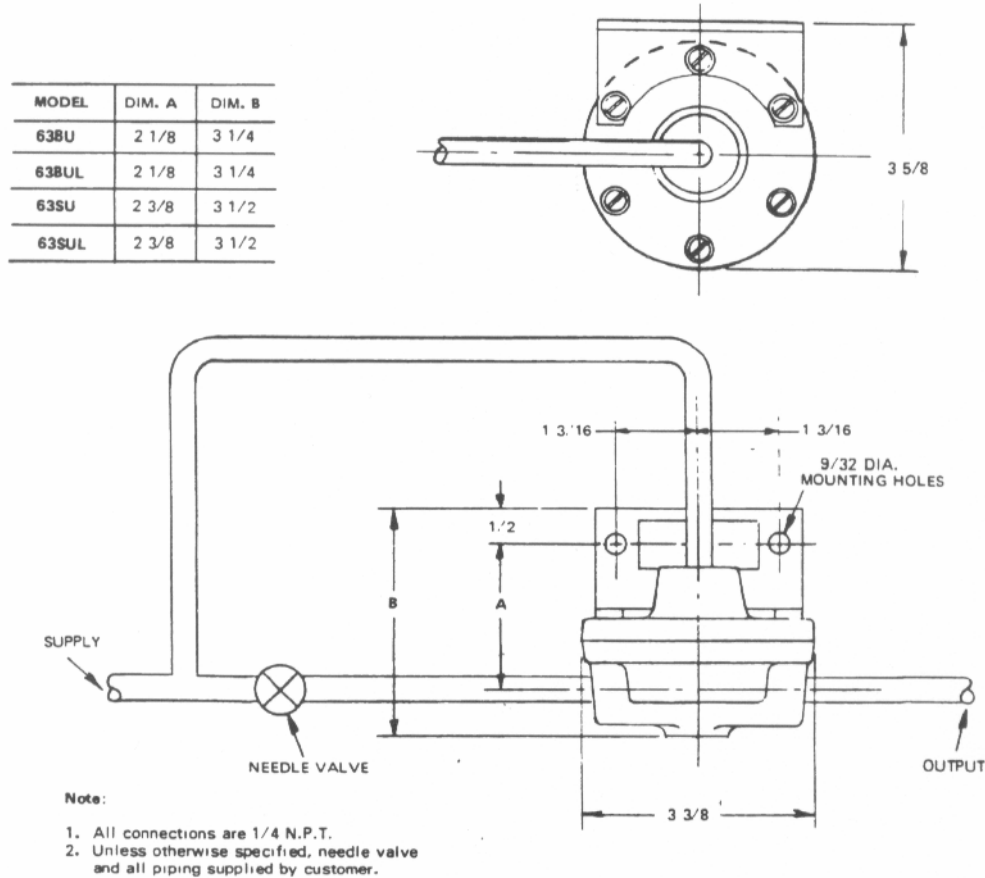


Figure 1 Installation Dimensions

PRINCIPLE OF OPERATION

If the pressure drop across a restriction is held constant, the volume flow through the restriction is constant; refer to Figure 2 on the next page. The needle valve (a variable restriction) can be set to an opening which will produce the desired flow rate. The pressure drop (ΔP) across the needle valve is held constant by the flow controller as follows:

1. The input pressure (P_1) is applied to the needle valve and to the top of the controller's diaphragm and forces the diaphragm and plunger down.
2. The differential spring and downstream pressure (P_2) force the diaphragm and plunger up. The differential spring produces an upward force equal to that produced by a constant pressure (K).

3. The controller is in balance when the force due to P_1 equals the forces due to P_2 and K (i.e. $P_1 = P_2 + K$; $P_2 = P_1 - K$; and $K = P_1 - P_2$). Since the pressure drop (ΔP) across the needle valve equals $P_1 - P_2$ and since $P_1 - P_2$ equals K , then the pressure drop (ΔP) must equal K ; therefore flow is constant.

Examples:

$P_1 = P_2 + K$	$P_2 = P_1 - K$	$K = P_1 - P_2$
= 15 + 3	= 18 - 3	= 18 - 15
= 18 psig	= 15 psig	= 3 psig

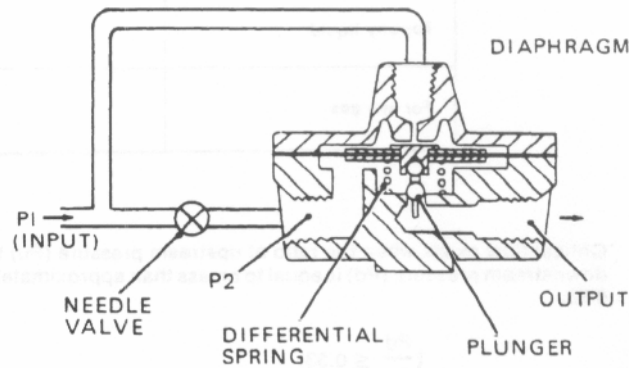


Figure 2 Schematic

CAPACITY

The formulas for the calculation of maximum and minimum flow rated can be found in Table 1.

The minimum controllable flow will depend on the leakage past the valve plunger in the controller. It is, therefore, a function of the cleanliness of the valve and pressure drop across it as well as any inherent leakage. In general, for a standard flow controller, the maximum controllable flow will be approximately 1/100 of the maximum flow.

OPERATION

With the supply turned on, adjust the needle valve to obtain the desired flow rate, within the capacity of the controller.

MAINTENANCE

The only maintenance normally required is to keep the valve plunger and external needle valve clean. Any change in the rate of flow for a given needle valve setting will probably be caused by partial clogging of the needle valve.

CAUTION



Before disassembling the instrument, turn off supply air pressure to the instrument.

Failure to obtain minimum flows will probably be caused by solids on the controller valve plunger. It will be necessary to disassemble the 63_U model controller to remove the plunger valve. Refer to the Parts List for the model at hand for component location.

Table 1 Flow Capacity Formulas

	Higher Range Models 63BD and 63SD; 63BU and 63SU	Low Flow Models 63BD-L and 63SD-L; 63BU-L and 63SU-L
GAS FLOW-CAPACITY		
Maximum at less than critical flow*	$SCCM = 4000 \sqrt{\frac{\Delta P \times Pd \times 530}{SG \times T}}$	$SCCM = 400 \sqrt{\frac{\Delta P \times Pd \times 530}{SG \times T}}$
Maximum at critical flow*	$SCCM = 2000 P_u \sqrt{\frac{1 \times 530}{SG \times T}}$	$SCCM = 200 P_u \sqrt{\frac{1 \times 530}{SG \times T}}$
Minimum controllable flow	Approximately 1/200 of maximum	$SCCM = 8 \frac{\Delta P (P_u + Pd)}{R_v T}$
LIQUID FLOW-CAPACITY		
Maximum	$CCM = 470 \sqrt{\frac{\Delta P}{SG}}$	$CCM = 47 \sqrt{\frac{\Delta P}{SG}}$
Minimum	Approximately 1/200 of maximum	$CCM = .06 \frac{\Delta P}{R_v}$
NEEDLE VALVE SIZING (With 3 psi drop across valve)		
For any liquid	$K_n = \frac{CCM}{6550 \sqrt{\frac{1}{SG}}}$	
For any gas	$K_n = \frac{SCCM}{49000 \sqrt{\frac{1 \times P_n \times 530}{SG \times T}}}$	

*Critical flow exists when the ratio of upstream pressure (P_u) to downstream pressure (P_d) is equal to or less than approximately 0.53:

$$\left(\frac{P_d}{P_u} \leq 0.53\right)$$

The actual ratio value for air is 0.528; it should be noted that it varies slightly for other gases.

SCCM = Cubic centimeters per minute of gas at standard conditions (70° F, 14.7 psia). Note: 1 SCF = 28,317 SCC.

ΔP = psi pressure drop across the controller valve = total drop minus 3 psi.

P_u = psia pressure at inlet of controller (allow 3 psi for drop across the needle valve, if it is installed upstream).

P_d = psia pressure at outlet of controller (allow 3 psi for drop across the needle valve, if it is installed downstream).

P_n = psia pressure at outlet of needle valve.

SG = Specific gravity of the gas referred to air, or specific gravity of the liquid referred to water at 4° C.

T = Absolute temperature of the gas = degrees F + 460.

R_v = Ratio of viscosities of gas referred to air; or Ratio of viscosities of liquid at operating temperature to water at 4° C.

K_n = Flow constant of needle valve.

Rangeability and minimum controllable flow of each size depend upon the needle valve used, the specific gravity of the fluid, the operating pressures, and other factors.

The formulas permit calculation of maximum flows for both the low-flow and higher-range models. Because minimum flows occur in a laminar pattern with the low-flow models, a separate formula is furnished. Rangeability is considerably higher on gases than on liquids.

FLOW-RANGE EXAMPLES

Conditions:

15 psig (29.7 psia) at inlet of controller

10 psi drop across controller (not including 3 psi needle-valve drop)

70° F process temperature

	Max. Flow	Min. Flow
Higher-range units (Series 63)		
On air	56,000 scc/min	280 scc/min
On water	1,500 cc/min	7.5 cc/min
Low-range units (Series 63L)		
On air	5,600 scc/min	7 scc/min
On water	149 cc/min	0.6 cc/min

Product Support

This section provides the Internet site addresses, e-mail addresses, telephone numbers, and related information for customers to access Siemens product support.

When contacting Siemens for support:

- Please have complete product information at hand:
 - For hardware, this information is provided on the product nameplate (part number or model number, serial number, and/or version).
 - For most software, this information is given in the Help > About screen.
- If there is a problem with product operation:
 - Is the problem intermittent or repeatable? What symptoms have been observed?
 - What steps, configuration changes, loop modifications, etc. were performed before the problem occurred?
 - What status messages, error messages, or LED indications are displayed?
 - What troubleshooting steps have been performed?
 - Is the installation environment (e.g. temperature, humidity) within the product's specified operating parameters? For software, does the PC meet or exceed the minimum requirements (e.g. processor, memory, operating system)?
- A copy of the product Service Instruction, User's Manual or other technical literature should be at hand. The Siemens public Internet site (see the table) has current revisions of technical literature, in Portable Document Format, for downloading.
- To send an instrument to Siemens for repair, call Repair Service and request a Return Material Authorization (RMA).



IMPORTANT

An instrument must be thoroughly cleaned (decontaminated) to remove any process materials, hazardous materials, or blood born pathogens prior to return for repair. Read and complete the Siemens RMA form(s).

For Product Support in the U.S.A.

Technical Support	
Telephone	+1 800 569 2132, option 2 for Siemens and Moore Products Co. brand instruments
Fax	+1 215 646 3547
E-mail	PITechSupp@sea.siemens.com
Hours of Operation	8 a.m. to 4:45 p.m. eastern time, Monday through Friday (except holidays)
Technical Publications in PDF	http://www.sea.siemens.com/ia ; under Customer Support Process Instrumentation, click on Documentation & Support Links
Public Internet Site	http://www.sea.siemens.com/ia
Repair Service	+1 215 646 7400 extension 3187

For Product Support Outside of the U.S.A.

Visit the Siemens public Internet site (see the above table for the URL), locate "Customer Support Process Instrumentation," and click on the Contact Tech Support link to access the Global Support link.

WARRANTY

(a) Seller warrants that on the date of shipment the goods are of the kind and quality described herein and are free of non-conformities in workmanship and material. This warranty does not apply to goods delivered by Seller but manufactured by others.

(b) Buyer's exclusive remedy for a nonconformity in any item of the goods shall be the repair or the replacement (at Seller's option) of the item and any affected part of the goods. Seller's obligation to repair or replace shall be in effect for a period of one (1) year from initial operation of the goods but not more than eighteen (18) months from Seller's shipment of the goods, provided Buyer has sent written notice within that period of time to Seller that the goods do not conform to the above warranty. Repaired and replacement parts shall be warranted for the remainder of the original period of notification set forth above, but in no event less than 12 months from repair or replacement. At its expense, Buyer shall remove and ship to Seller any such nonconforming items and shall reinstall the repaired or replaced parts. Buyer shall grant Seller access to the goods at all reasonable times in order for Seller to determine any nonconformity in the goods. Seller shall have the right of disposal of items replaced by it. If Seller is unable or unwilling to repair or replace, or if repair or replacement does not remedy the nonconformity, Seller and Buyer shall negotiate an equitable adjustment in the contract price, which may include a full refund of the contract price for the nonconforming goods.

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(d) Buyer and successors of Buyer are limited to the remedies specified in this article and shall have no others for a nonconformity in the goods. Buyer agrees that these remedies provide Buyer and its successors with a minimum adequate remedy and are their exclusive remedies, whether Buyer's or its successors' remedies are based on contract, warranty, tort (including negligence), strict liability, indemnity, or any other legal theory, and whether arising out of warranties, representations, instructions, installations, or non-conformities from any cause.

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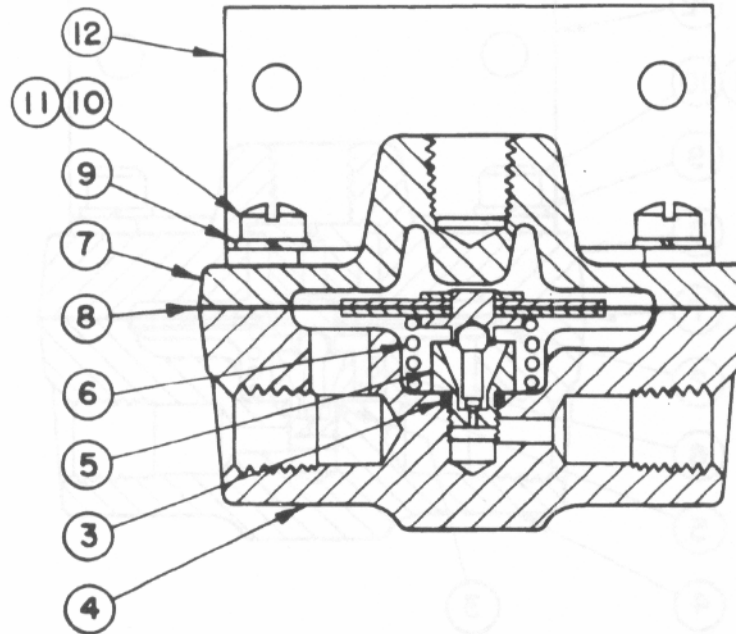
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PARTS LIST**Siemens Constant Differential Flow Controller for Small Flows, Model 63BU-L**

Drawing 10746PL

Rev 3/78



B/M - 10746S6

Item No.	Part No.	Description	Req'd
3	2938-1	"O" Ring	1
4	10746-10	Bottom Forging	1
* 5	10917-24	Valve Seat	1
* 6	1518-5	Differential Spring	1
7	2881-9	Top Forging	1
* 8	10746-2	Diaphragm and Valve Assembly	1
9		1/4" Lockwasher	6
10	Screw	1/4-20 x 3/4" Lg. Fil. Hd.	3
11	Screw	1/4-20 x 5/8" Lg. Fil. Hd.	3
12	1145-19	Mounting Bracket	1

IMPORTANT

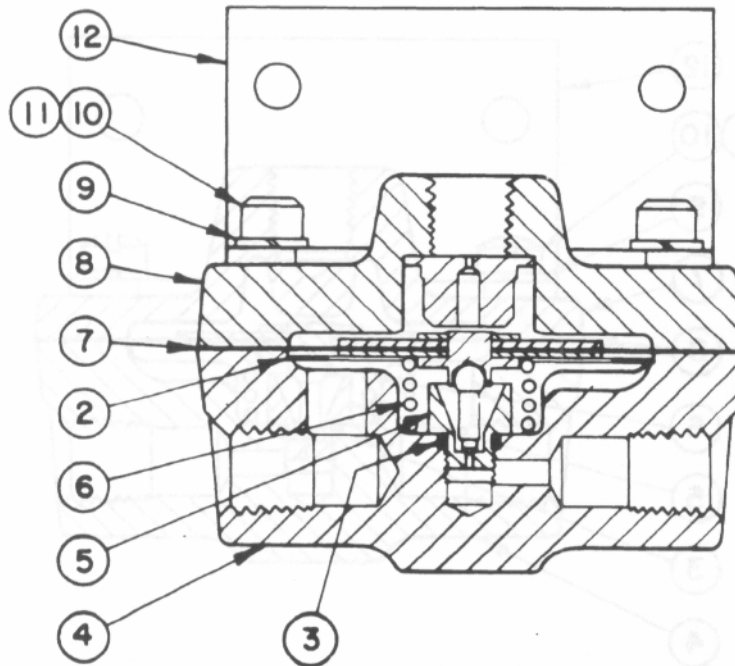
Service Parts Kits are available for servicing the instrument. Contact Siemens for available kits; refer to the Product Support section of this instruction. Some parts in this Parts List may not be available for separate purchase.

* Recommended on-hand spare parts. Always specify range, serial number, or other nameplate information when ordering spare parts.

PARTS LIST**Siemens Constant Differential Flow Controller for Small Flows, Model 63SU-L**

Drawing 12046PL

Rev 3/78



B/M – 12046S11

Item No.	Part No.	Description	Req'd
2	12041-23	Protecting Ring	1
3	2938-120	"O" Ring	1
4	12046-16	Bottom Forging	1
* 5	12046-8	Valve Seat	1
* 6	3131-22	Differential Spring	1
* 7	12046-9	Diaphragm and Valve Assembly	1
8	12041-42	Top Housing Assembly	1
9		1/4" Lockwasher	6
10	Screw	1/4-20 x 1-1/4" Lg. Soc. Hd.	3
11	Screw	1/4-20 x 1" Lg. Soc. Hd.	3
12	1145-19	Mounting Bracket	1

IMPORTANT

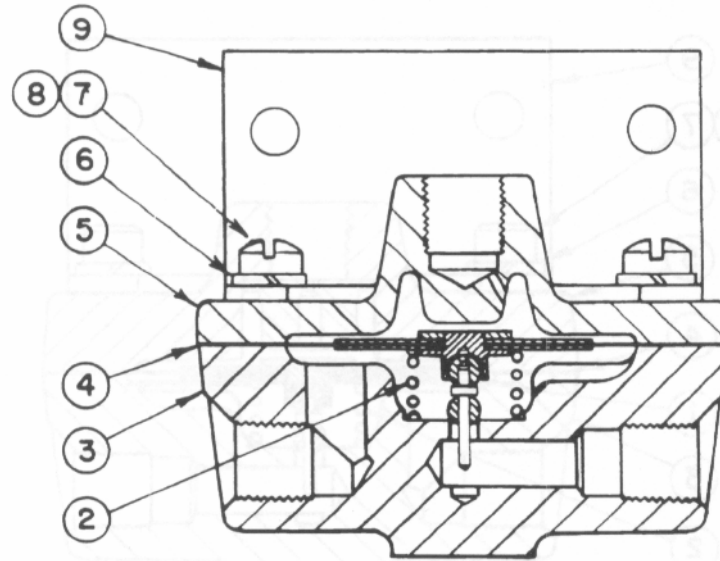
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* Recommended on-hand spare parts. Always specify range, serial number, or other nameplate information when ordering spare parts.

PARTS LIST**Siemens Constant Differential Flow Controller, Model 63BU**

Drawing 2882PL

Rev 3/78



B/M – 2882S9

Item No.	Part No.	Description	Req'd
*2	1518-5	Differential Spring	1
3	2882-18	Bottom Forging	1
*4	2882-8	Valve and Diaphragm Assy.	1
5	2881-9	Top Forging	1
6	Lockwasher	1/4" Neverslip, Steel, W.N.P.	6
7	Screw	1/4-20 x 3/4 Lg. Fil. Hd. Steel, W.N.P.	3
8	Screw	1/4-20 x 5/8 Lg. Fil. Hd. Steel, W.N.P.	3
9	1145-19	Mounting Bracket	1

IMPORTANT

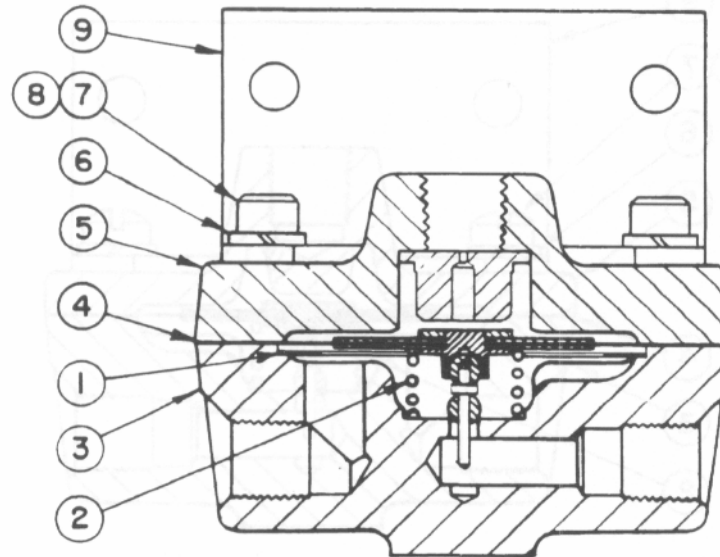
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* Recommended on-hand spare parts. Always specify range, serial number, or other nameplate information when ordering spare parts.

PARTS LIST**Siemens Constant Differential Flow Controller, Model 63SU**

Drawing 12041PL

Rev 3/78



B/M - 12041S10

Item No.	Part No.	Description	Req'd
1	12041-23	Diaphragm Protecting Ring	1
*2	3131-22	Differential Spring	1
3	12041-41	Bottom Forging	1
*4	12041-33	Valve and Diaphragm Assy.	1
5	12041-42	Top Housing Assy.	1
6	Lockwasher	1/4", Steel, W.N.P.	6
7	Screw	1/4-20 x 1-1/4 Lg. Socket Hd., Steel, W.N.P.	3
8	Screw	1/4-20 x 1 Lg. Socket Hd., Steel, W.N.P.	3
9	1145-19	Mounting Bracket	1

IMPORTANT

Service Parts Kits are available for servicing the instrument. Contact Siemens for available kits; refer to the Product Support section of this instruction. Some parts in this Parts List may not be available for separate purchase.

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