

BARTON®

# Differential Pressure Units

## *Models 199 & 199N*

Barton® Differential Pressure Units (DPUs) serve as actuating units for a wide variety of instruments. All models feature Barton's® rupture-proof bellows.

### Description

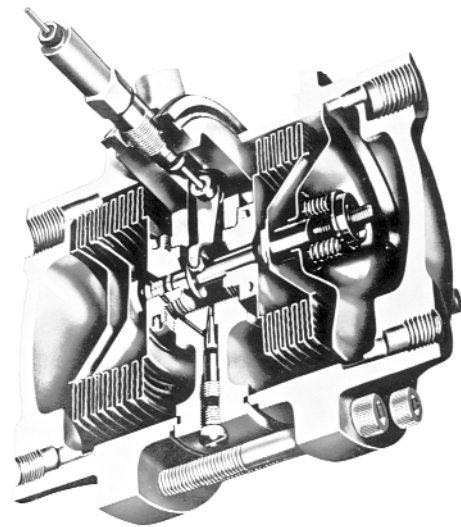
Each DPU consists of a Bellows Unit Assembly (BUA) and removable pressure housings. Within the BUA, flexible bellows are secured to a centerplate. In dual-bellows models, the movable bellows are rigidly connected by a dual valve stem that passes through the centerplate. Valve seats, in the centerplate passage, form a seal with the valves. Contacting the valve stem in the centerplate is a drive arm pivoted on the end of a sealed torque tube. The bellows is filled with a clean, noncorrosive, low-freezing point liquid. A range spring assembly provides tension against applied pressures.

In operation, pressure is applied to both sides of the bellows. Any difference in pressure causes the bellows to move until the spring effect (range springs) balances out the force. The linear motion of the bellows (proportional to the DP) is transmitted as a rotary motion through the torque tube.

In dual-bellows units, if the bellows are subjected to a DP greater than the unit's DP rating, a valve closes and "traps" the fill liquid in the bellows — fully supporting the bellows and preventing rupture. Since opposing valves are used, full protection is provided in either direction.

### Common Components

- **Bellows Construction:** Individual diaphragms, stamped and formed from selected materials (see individual DPU specifications), are assembled using highly specialized techniques, the results — exacting linearity characteristics, a long cycle life, and freedom from effects of work hardening commonly encountered with the hydraulically formed or mechanically rolled types.



- **Torque tube:** Eliminates the possibility of leakage and need for lubrication. The needle bearing (inboard end) and ball bearing (on follower drive arm) operate with a minimum of friction — resulting in high sensitivity over the life of the unit.
- The torque tube assembly consists of a tube, shaft, and supporting members. The outboard end of the torque tube is attached to the centerplate. The shaft passes through the center of the tube and is welded to the inboard end. Since its outer end is attached to the centerplate, the tube must twist when subjected to torque. The shaft, freely supported at its outer end and attached to the tube and drive arm at its inner end, rotates through the same angle as the drive arm — the mechanical output of the DPU.
- **Range springs:** Determine the DP range of the unit, based upon their number and strength. They have extremely low hysteresis and exceptional temperature stability. The M199 has an external range spring assembly that is field replaceable.

## Model 199

### Dual Bellows

The 199 is designed to measure differential pressures under the most severe operating conditions. The unit incorporates Barton's® rupture-proof bellows. Ease of installation, stable calibration, and minimal maintenance are inherent qualities of the M199 DPU.

The 199 is composed of a Bellows Unit Assembly (BUA) and a pair of pressure housings that enclose opposite sides of the BUA. The BUA consists of a pair of bellows, centerplate, overrange valves, temperature compensator, torque tube assembly, dampener valve, and range spring assembly.

- Temperature Compensator: An auxiliary free-floating bellows, attached to HP bellows, automatically protects unit from zero/calibration drift caused by ambient temperature changes.
- Pulsation Dampener: Internal dampening is accomplished by restricting the flow of liquid through its normal channel (the annular passage in the centerplate) and causing it to follow an alternate route controlled by an adjustable needle valve. Response time for the unit depends upon the range and fill liquid, but is typically adjustable between a few seconds and several minutes for full scale travel of the bellows.
- Mounting: The M199 is supplied with a 2-in. pipe-mount bracket. The bracket is provided with four 1/2-20 U.N.C.-2B holes for use in attaching the DPU to the instrument being actuated. The unit can also be wall mounted.

## Model 199N

### Dual Bellows NACE Unit

The 199N is a 199 DPU specifically designed to meet NACE requirements for HzS service. It can measure DP up to 2,000 PSI (138 bar) without damage to the unit due to overpressure.

For DP up to 15 PSI (1 bar), a 3-3/4-in. diameter bellows is used; above 15 PSI (1 bar), a 2 1/8-in. diameter bellows is used.

All other features and functions are the same as the standard M199 DPU.

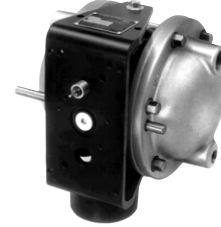
### Specifications

- Materials
  - Housing/Centerplate: Forged Steel AISI C1018
  - Bolts: AISI 4140, per ASTM A.320 L7M
  - Housing O-rings: Viton
  - Bellows: 316L SST
  - Range Springs: Inconel or Elgiloy
  - Torque Tube Material: Monel
- Performance
  - Safe Working Pressure: 2,000 PSI (138 bar) Maximum

All other specifications are the same as the M199 DPU.

### Available 199N NACE Instruments

- Indicators: M200N
- Switches: M289N, M291N
- Recorders: M202N
- Pneumatic Controllers: M335N, M338N
- Pneumatic Transmitters: M274N, M285N



**Model 199**  
Dual Bellows



**Model 199**  
Dual Bellows  
NACE Unit

## Model 199 DPU Specifications

Model 199 SWP - psi (bar)	Body Housing Material	Available Differential Pressure Ranges			
		Stainless Steel Bellows		Inconel Bellows	
		2-1/8-in. (55 mm) O.D.	3-3/4-in. (95 mm) O.D.	2-1/8-in. (55 mm) O.D.	3-3/4-in. (95 mm) O.D.
1,000 (69)	Cast Aluminum 356T6 Forged Stainless Steel 316				
2,500 (172)	Forged Steel A.I.S.I. C1018				
3,000 (207)	Forged Stainless Steel 316	0-15 psi (0-1 bar) to 0-100 psi (0-6.9 bar)	0-10-in. w.c. (0-25 mbar) to 0-400-in. w.c. (0-993 mbar)	0-15 psi (0-1 bar) to 0-100 psi (0-6.9 bar)	0-10-in. w.c. (0-25 mbar) to 0-400-in. w.c. (0-993 mbar)
4,500 (310)	Forged Alloy Steel 4142				
6,000 (414)	Forged Alloy Steel 4142 Forged Stainless Steel 17-4 PH				
Net Volume (cu. in.)	L.P. Head	35-in. (575 cc)	30-in. (490 cc)	35-in. (575 cc)	30-in. (490 cc)
	H.P. Head	31-in. (510 cc)	26-in. (425 cc)	31-in. (510 cc)	26-in. (425 cc)
Displacement in cu. in. for full-scale travel		0.5-in. (8.2 cc)	1.5-in. (25 cc)	0.5-in. (8.2 cc)	1.5-in. (25 cc)

## Performance Specifications

Torque Tube Rotation (full scale D.P.)	8° +/- 10%
Torque Tube Material	Beryllium Copper (BeCu) or K-Monel
Temperature Limits	-40°F/°C to +180°F (+82°C)
Maximum Non-Linearity	
0-10-in. w.c. to 0-400-in. w.c. (0-25 mbar to 0-993 mbar)	+/- 0.5% of full scale w/appropriate linkage
0-401-in. w.c. to 0-100 psi (0-996 mbar to 0-6.9 bar)	+/- 0.75% of full scale w/appropriate linkage
Repeatability	0.20% of full scale D.P.

Notes: Zero center or split ranges available on special order [e.g., a 0-50-in. w.c. (0-124 mbar) range may be ordered 25-0-25-in. w.c. (62-0-62 mbar) or 10-0-40-in. w.c. (25-0-99 mbar)]. Intermediate differential pressure ranges available from 0-20-in. w.c. to 0-100 psi (0-50 mbar to 0-6.9 bar). Other sizes and types of connection (welding stubs, MS, A.N.D., etc.) available upon request. Standard pressure connections are 1/2-in. (top) and 1/4-in. (bottom) NPT. Range springs are not interchangeable between the different size bellows, the Inconel bellows, or the 10-in. w.c. (25 mbar) range. Can be specified to meet NACE MR0175-2002. Metric conversions are approximate. Outline dimension drawings available upon request.

### External Sensors

External Sensors: For applications requiring external sealed sensors, such as: corrosive, high temp., and dangerous fluids.

- Bellows Fill Fluids
  - Mineral Oil (Standard M-Fill)
  - Ethylene Glycol/Water
  - Distilled Water

- Silicone
- Fluorolube for O<sub>2</sub> Service
- Others available (Contact NuFlo™)

### Ordering Information

When ordering, please specify the following items:

- Quantity
- Model Number

- Housing Pressure Rating (SWP)
- Housing and Bellows Materials
- Process Material Contacting Bellows
- Differential Pressure Range
- Mounting (pipe, wall, flush panel)

### Weights

DPU Model	Approximate Gross Weight (lbs/kg)						
	Material/Safe Working Pressure (PSI)						
	Aluminum	Forged Steel			Forged SST		
	1000	2500	4500	6000	1000	3000	6000
199	23 (10)	39 (17.7)	40 (18.1)	45 (20.4)	30 (13.6)	40 (18.1)	45 (20.4)

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