

MILROYAL D[®]

with Dynamic Stiffness Diaphragm Technology[®]



MILROYAL® D Dynamic Stiffness Diaphragm® Technology Liquid End

Advanced design for critical applications

Milton Roy® is proud to present one of the most significant and ground-breaking advances in metering pump technology in recent time. The heart of this pump design is the Dynamic Stiffness Diaphragm® (DSD) technology. Its rigid design prevents forward movement of the diaphragm, eliminates hydraulic cavitation, and provides a long service life.

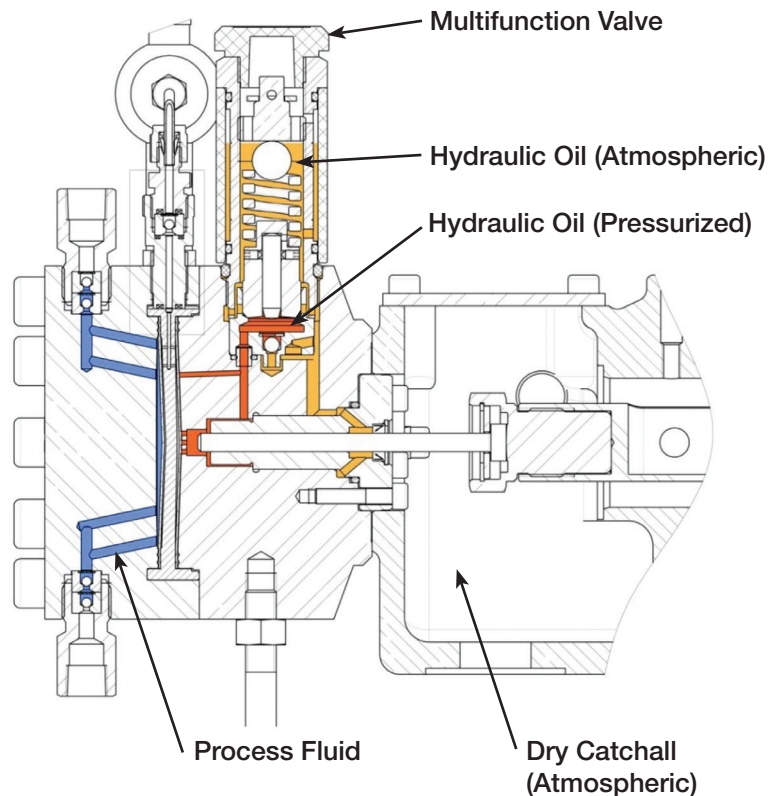
Technological advances include:

- Internal Relief Valve
- Refill Valve
- Air Bleed Valve
- Small Hydraulic Fluid Reservoir (1.35 oz / 40 mL)
- Visual Overpressure Indication
- Visual Oil Level Indication

MILROYAL® D series metering pumps are ideal metering technology where chemical injection is required for critical processes in oil and gas, chemical and hydrocarbon processing, water and wastewater treatment and most industries.

A history of reliability

With over 80 years of experience, Milton Roy combines vast industry experience, a proven track record, and a culture of continuous technological improvement to provide customized solutions for all pump applications. Milton Roy delivers the market's most reliable, comprehensive range of metering pumps. Every one of our pumps is engineered to exceed expectations and is backed by a global network of highly trained field engineers and after-sales support that is second-to-none.



Product Information

Applications

Metered injection of chemicals such as corrosion inhibitors, wax inhibitors, biocides, antifreeze, disinfectants, coagulants, oxygen scavengers, polymers, softening agents, acids and bases for pH control, process additives and many more for the following areas of chemical treatment.

- Oil and gas production
- Chemical and petrochemical processing
- Industrial water and wastewater treatment
- Cooling towers and boilers
- Potable water treatment
- Power generation
- Agriculture

Features and benefits

- Hydraulically balanced, PEEK or PTFE diaphragm depending on process fluid compatibility designed for 25,000 hours service life.
- Patented DSD® liquid end technology incorporating a rigid diaphragm (PEEK), an integrated, internal safety valve, and an effective degassing design that is only available on Milton Roy® pumps.
- Internal six function valve comprised of a safety valve, hydraulic fluid intake valve, air bleed valve, hydraulic oil reservoir, visual overpressure indication and visual hydraulic oil indication.
- Small hydraulic reservoir (only 1.4 ounces / 40 mL) is filled and primed for use upon receipt of pump.
- The DSD® liquid end design with a rigid diaphragm eliminates hydraulic cavitation.
- Hermetically sealed, leak-resistant liquid end design prevents any contact between process fluid, atmosphere, and hydraulic fluid.
- High viscosity (up to 6200 cps / 6200 mPa) and suction lift (MASP 5%: 10.15 psia / 0.7 bar a) capabilities.
- Dosing accuracy of $\pm 1\%$ over the range of 10% to 100% of nominal flow rate.
- API 675 compliant.
- ATEX zone 1 and 2, T3 or T4 compliant dependent on model selection and area classification.
- Multiplex capability of 10 units (depending on configuration).
- Manual or electronic stroke adjustment while in operation or stopped.
- Metallic and non-metallic liquid end materials are available for corrosion resistance for any chemical application.
- Sealed, cast iron drive provides a robust enclosure for operation in the harshest plant and field environments.
- Service and maintenance plans are available.
- Environmentally friendly design with small oil and hydraulic fluid reservoirs.
- Long service life and leak-resistant design.

Specifications

MilRoyal® D DSD Technology is optimal for high pressure applications

Accuracy	±1% over a range of 10 to 100% of nominal flow rate — stainless steel micrometer stroke adjustment	
Thrust	247 lbf (110 daN)	
Hydraulic stroke length	1.0" (25.4 mm)	
Flow rate adjustment	While running or stopped: from 0 to 100% of nominal	
Liquid end materials	PVC PVDF 316L stainless steel	
Fluid temperature limits	VR-PVDF liquid end	XR/XV-Stainless Steel liquid ends
	+23° F (-5° C) to +122° F (+50° C)	+23° F (-5° C) to +212° F (+100° C) Single Diaphragm
	See performance charts for temperature pressure derates	+23° F (-5° C) to +176° F (+80° C) Double Diaphragm
Ambient Temperature limits	+14 F (-10° C) to +122° F (+50 C)	
API 675	Compliant	
ATEX	Conforms to ATEX zone 1 and 2, T3 or T4 compliant (Milton Roy Europe only)	
MASP (5%)*	10.15 psia (0.7 bar a)	
Minimum discharge pressure	58 psi (4 bar) with flooded suction for plastic liquid ends or 29 psi (2 bar) for SS — over-suction pressure	
Lubrication	Oil bath	
Housing	Cast iron	
Multiplex capability	up to 10 units (depending on configuration)	

* MASP = maximum allowable suction pressure for 5% of flow rate

Configuration Flexibility

Strokes per Minute	Motor Power	Plunger Diameter in (mm)	Liquid End Type	Operating Pressure	Multiplex Options
23-46-93-160 (50 Hz)	F — 1/3 HP (0.25 kW)	0.12 — 0.16 in (3 mm — 4 mm)	CR (PVC)	Internal Safety Relief valve set in accordance with this pressure psi / Bar	SX (Simplex)
31-61-124-187 (60 Hz)	G — 1/2 HP (0.37 kW)	0.24 — 0.32 in (6 mm — 8 mm)	VR (PVDF)		DX (Duplex)
	H — 3/4 HP (0.55 kW)	0.39 — 0.47 in (10 mm — 12 mm)	XR (T-316 SS)		TX (Triplex)
	S — without motor	0.55 — 0.63 in (14 — 16 mm)	XV (316 SS) High viscosity)		

Configuration

Modular design for high-pressure applications

MilRoyal® D Example MD23F3VR20DX

Strokes per Minute	Motor Power	Plunger Diameter in (mm)	Liquid End Type	Operating Pressure	Multiplex Options
23	F	3	VR	20	DX

Available Options

Motor	As per Application and Area Classification				
Liquid end material	PVC	PVDF	Type 316L SS (see Liquid End chart for component materials)		
Multiplex capability	Up to 10 units (depending on configuration)				
Diaphragm structure	As per Area Classification				
	Manual	Electronic	Pneumatic		
Detection rupture	Pressure gauge	Pressure switch	Pressure transmitter		
Detection indication	As per Area Classification				
Custom check valves	Consult factory				
Connections	NPT	GAS	ANSI/DIN	Horizontal or vertical	
Available paint colors	Standard Yellow RAL1018	Food grade White RAL9010	Offshore — as per specification		
	Standard Gray RAL7035	Standard Gray RAL7035			
Low temperature	- 40°F (-40°C) to +120°F (+50°C)				

Performance Data 50Hz-1450 RPM

XR - Stainless steel liquid end

Ø Plunger mm Diaphragm Ø mm	Flow Rate		Pressure bar	Frequency spm	P max. Suction bar	Max. Viscosity at P max. mPA.s at NPSHa = 6 mWC Standard Check Valves	Connections (Valves) Seat Balls	Stroke Capacity Motor		
	L/h									
	10 Bar	P max								
3 DSD 51	0.22	0.09	130	23	98	58	¼" NPT f (Ø3.17 mm - D) 316L Hastelloy C	Swept volume 0.17 cm ³ Motor: 0.25 kW		
	0.44	0.17	130	46		40				
	0.88	0.35	130	93		22				
	1.11	0.44	130	117		10				
	1.33	0.53	130	140		10				
4 DSD 51	0.40	0.20	130	23	98	58		¼" NPT f (Ø3.17 mm - D) 316L Hastelloy C	Swept volume 0.31 cm ³ Motor: 0.25 kW	
	0.79	0.41	130	46		40				
	1.60	0.83	130	93		22				
	2.02	1.05	130	117		10				
	2.41	1.25	130	140		10				
6 DSD 71	0.93	0.65	130	23	98	58			¼" NPT f (Ø3.17 mm - D) 316L Hastelloy C	Swept volume 0.71 cm ³ Motor: 0.25 kW
	1.86	1.30	130	46		40				
	3.77	2.63	130	93		22				
	4.74	3.31	130	117		10				
	5.67	3.97	130	140		10				
8 DSD 71	1.66	1.16	130	23	59	58	¼" NPT f (Ø3.17 mm - D) 316L Hastelloy C			Swept volume 1.27 cm ³ Motor: 0.25 kW
	3.31	2.32	130	46		40				
	6.70	4.69	130	93		22				
	8.42	5.90	130	117		10				
	10.08	7.06	130	140		10				
10 DSD 91	2.58	1.87	120	23	37	58		½" NPT m (Ø6.35 mm - D) 17.4PH 316L		Swept volume 2.0 cm ³ Motor: 0.25 kW
	5.17	3.75	120	46		40				
	10.46	7.58	120	93		22				
	13.16	9.54	120	117		10				
	15.75	11.42	120	140		10				
12 DSD 91	3.72	3.20	80	23	25	58			½" NPT m (Ø6.35 mm - D) 17.4PH 316L	Swept volume 2.87 cm ³ Motor: 0.25 kW
	7.45	6.41	80	46		40				
	15.07	12.96	80	93		22				
	18.95	16.30	80	117		10				
	22.68	19.50	80	140		10				
14 DSD 91	5.07	4.61	55	23	19	58	½" NPT m (Ø6.35 mm - D) 17.4PH 316L			Swept volume 3.91 cm ³ Motor: 0.25 kW
	10.14	9.23	55	46		40				
	20.50	18.66	55	93		22				
	25.80	23.48	55	117		10				
	30.80	28.00	55	140		10				
16 DSD 91	6.62	6.23	40	23	14	58		½" NPT m (Ø6.35 mm - D) 17.4PH 316L		Swept volume 5.11 cm ³ Motor: 0.25 kW
	13.25	12.45	40	46		40				
	26.78	25.20	40	93		22				
	33.70	31.60	40	117		10				
	40.30	37.30	40	140		10				

Performance Data 50Hz-1450 RPM

XV - High viscosity stainless steel liquid end

Ø Plunger	Flow Rate		Pressure	Frequency	P max. Suction	Max. Viscosity at P max.		Connections	Stroke Capacity
mm Diaphragm Ø mm	L/h		bar	spm	bar	mPAs		(Valves) Seat Balls	Motor
	10 Bar	P max				At NPSHa = 6 mWC Standard Check Valves	At NPSHa = 6 mWC Option VS1		
3 DSD 51	0.22 ⁽¹⁾	0.06 ⁽¹⁾	130	23	98	1385	NA	Standard: ¼" NPT f (Ø4 mm - VS) VS1: ½" NPT m (Ø6.35 mm - VS) 316L Hastelloy C	Swept volume 0.17 cm ³ Motor: 0.25 kW
4 DSD 51	0.4 ⁽¹⁾	0.2 ⁽¹⁾	130	23		750	NA		Swept volume 0.31 cm ³ Motor: 0.25 kW
	0.79 ⁽¹⁾	0.41 ⁽¹⁾	130	46		600	NA		Swept volume 0.71 cm ³ Motor: 0.25 kW
6 DSD 71	0.93 ⁽¹⁾	0.48 ⁽¹⁾	130	23	59	560	4900	Swept volume 1.27 cm ³ Motor: 0.25 kW	
	1.86 ⁽¹⁾	0.97 ⁽¹⁾	130	46		280	2500		
8 DSD 71	1.66 ⁽¹⁾	0.86 ⁽¹⁾	130	23	37	300	2500	Swept volume 2.0 cm ³ Motor: 0.25 kW	
	3.31 ⁽¹⁾	1.72 ⁽¹⁾	130	46		100	1400		
10 DSD 91	2.48 ⁽¹⁾	1.79 ⁽¹⁾	120	23	25	1200	6200	Swept volume 2.87 cm ³ Motor: 0.25 kW	
	4.95 ⁽¹⁾	3.59 ⁽¹⁾	120	46		580	3100		
12 DSD 91	3.57 ⁽¹⁾	3.07 ⁽¹⁾	80	23	19	700	3600	Swept volume 3.91 cm ³ Motor: 0.25 kW	
	7.13 ⁽¹⁾	6.13 ⁽¹⁾	80	46		340	1800		
14 DSD 91	4.85 ⁽¹⁾	4.42 ⁽¹⁾	55	23		480	2500	Swept volume 5.11 cm ³ Motor: 0.25 kW	
	9.71 ⁽¹⁾	8.84 ⁽¹⁾	55	46		240	1200		
16 DSD 91	6.34 ⁽¹⁾	5.96 ⁽¹⁾	40	23		340	920		
	12.68 ⁽¹⁾	11.92 ⁽¹⁾	40	46		180	920		
	25.64 ⁽¹⁾	24.10 ⁽¹⁾	40	93		80	460		
	32.26 ⁽¹⁾	30.30 ⁽¹⁾	40	117		60	360		

Performance Data 50Hz-1450 RPM

VR - PVDF liquid end

Ø Plunger	Flow Rate		Pressure	Frequency	P max. Suction	Max. Viscosity at P max.	Connections	Stroke Capacity
mm Diaphragm Ø mm	L/h		bar	spm	bar	mPA.s At NPSHa = 6 mWC Standard Check Valves	(Valves) Seat Balls	Motor
	10 Bar	P max						
3 DSD 51	0.18	0.15	20	23	12	58	¼" Gaz f (Ø3.17 mm - ND) Hastelloy C	Swept volume 0.17 cm ³ Motor: 0.25 kW
	0.36	0.23	20	46		40		
	0.73	0.46	20	93		22		
	0.92	0.58	20	117		10		
	1.10	0.69	20	140		10		
4 DSD 51	0.33	0.30	20	23		58		Swept volume 0.31 cm ³ Motor: 0.25 kW
	0.67	0.60	20	46		40		
	1.35	1.02	20	93		22		
	1.70	1.28	20	117		10		
	2.10	1.53	20	140		10		
6 DSD 71	0.93	0.79	20	23		58		Swept volume 0.71 cm ³ Motor: 0.25 kW
	1.86	1.58	20	46		40		
	3.77	3.20	20	93		22		
	4.74	4.03	20	117		10		
	5.67	4.82	20	140		10		
8 DSD 71	1.66	1.41	20	23	58	Swept volume 1.27 cm ³ Motor: 0.25 kW		
	3.31	2.82	20	46	40			
	6.70	5.69	20	93	22			
	8.42	7.16	20	117	10			
	10.08	8.57	20	140	10			

Pressure limited to 20 BAR < 20° C. Derate pressure 3 BAR for every 5° C over 20° C to maximum temperature of 50° C

Performance Data 60Hz-1725 RPM

XR - Stainless steel liquid end

Ø Plunger mm	Flow Rate		Pressure	Frequency	P max. Suction	Max. Viscosity at P max.	Connections	Stroke Capacity
Diaphragm Ø mm	GPH		PSI	SPM	PSI	CPS at NPSHa 32 FT WC Standard Check Valves	(Valves) Balls Seat	Motor 1/3 HP
	145 psi	P max						
3 DSD 51	0.07	0.03	1885	28	1421	58	¼" NPT f 316L Hastelloy C	Swept volume 0.010 in ³
	0.14	0.05	1885	56		40		
	0.28	0.11	1885	112		22		
	0.35	0.14	1885	140		10		
4 DSD 51	0.13	0.06	1885	28		58		Swept volume 0.019 in ³
	0.25	0.13	1885	56		40		
	0.51	0.256	1885	112		22		
	0.66	0.33	1885	140		10		
6 DSD 71	0.29	0.21	1885	28		58		Swept volume 0.043 in ³
	0.59	0.41	1885	56		40		
	1.20	0.84	1885	112		22		
	1.50	1.05	1885	140		10		
8 DSD 71	0.53	0.37	1885	28	856	58	Swept volume 0.078 in ³	
	1.05	0.76	1885	56		40		
	2.12	1.49	1885	112		22		
	2.67	1.87	1885	140		10		
10 DSD 91	0.82	0.57	1885	28	537	58	Swept volume 0.122 in ³	
	1.66	1.15	1885	56		40		
	3.32	2.32	1885	112		22		
	4.17	2.92	1885	140		10		
12 DSD 91	1.18	0.99	1305	28	363	58	Swept volume 0.175 in ³	
	2.24	1.98	1305	56		40		
	4.78	4.01	1305	112		22		
	6.01	5.05	1305	140		10		
14 DSD 91	1.61	1.46	913	28	276	58	Swept volume 0.239 in ³	
	3.24	2.87	913	56		40		
	6.50	5.84	913	112		22		
	7.18	7.34	913	140		10		
16 DSD 91	2.10	1.95	681	28	203	58	Swept volume 0.312 in ³	
	4.20	3.89	681	56		40		
	8.49	7.87	681	112		22		
	10.70	9.90	681	140		10		

Performance Data 60Hz-1725 RPM

XV - High viscosity stainless steel liquid end

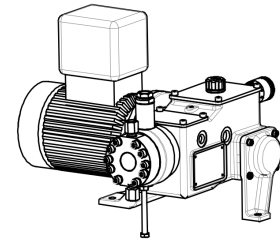
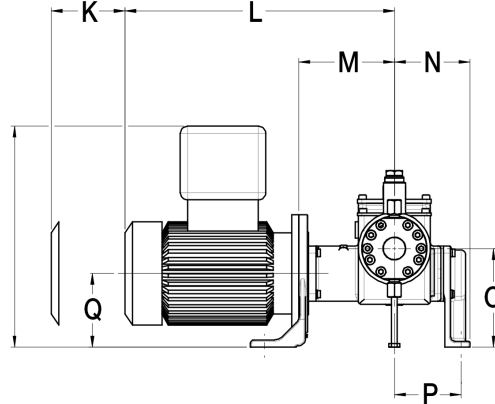
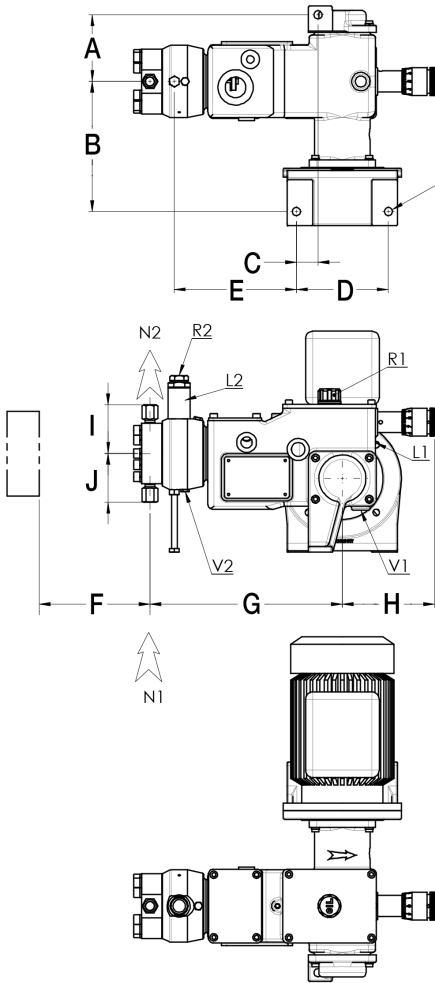
Ø Plunger mm	Flow Rate		Pressure	Frequency	P max. Suction	Max. Viscosity at P max.		Connections	Stroke Capacity
Diaphragm Ø mm	GPH		PSI	SPM	PSI	CPS		(Valves) Seat Balls	Motor 1/3 HP
	145 PSI	P max				At NPSHa = 32 FT-WC Standard Check Valves	At NPSHa = 32 FT-WC Option VS1		
3 DSD 51	0.07 ⁽¹⁾	0.02 ⁽¹⁾	1885	23	1421	1385	NA	Standard: ¼" NPT f (Ø4 mm - VS) VS1: ½" NPT m (Ø6.35 mm - VS) 316L Hastelloy C	Swept volume 0.01 in ³ Motor: 0.25 kW
	0.12 ⁽¹⁾	0.06 ⁽¹⁾		28		750	NA		Swept volume 0.019 in ³ Motor: 0.25 kW
4 DSD 51	0.25 ⁽¹⁾	0.13 ⁽¹⁾	1885	56	600	NA	Swept volume 0.043 in ³ Motor: 0.25 kW		
	0.29 ⁽¹⁾	0.15 ⁽¹⁾	1885	28	560	4900	Swept volume 0.078 in ³ Motor: 0.25 kW		
6 DSD 71	0.59 ⁽¹⁾	0.30 ⁽¹⁾	1885	56	280	2500	Swept volume 0.122 in ³ Motor: 0.25 kW		
	0.52 ⁽¹⁾	0.27 ⁽¹⁾	1885	28	300	2500	Swept volume 0.175 in ³ Motor: 0.25 kW		
8 DSD 71	1.05 ⁽¹⁾	0.55 ⁽¹⁾	1885	56	100	1400	Swept volume 0.239 in ³ Motor: 0.25 kW		
	0.76 ⁽¹⁾	0.55 ⁽¹⁾	1885	28	1200	6200	Swept volume 0.312 in ³ Motor: 0.25 kW		
10 DSD 91	1.57 ⁽¹⁾	1.10 ⁽¹⁾	1885	56	580	3100	½" NPT m (Ø6.35 mm - D) 17.4PH 316L		
	1.13 ⁽¹⁾	0.95 ⁽¹⁾	1305	28	700	3600			
12 DSD 91	2.26 ⁽¹⁾	1.90 ⁽¹⁾	1305	56	340	1800			
	1.54 ⁽¹⁾	1.38 ⁽¹⁾	913	28	480	2500			
14 DSD 91	3.08 ⁽¹⁾	2.75 ⁽¹⁾	913	56	240	1200			
	2.01 ⁽¹⁾	1.86 ⁽¹⁾	681	28	340	920			
16 DSD 91	4.02 ⁽¹⁾	3.72 ⁽¹⁾	681	56	180	920			
	8.13 ⁽¹⁾	7.53 ⁽¹⁾	681	112	80	460			
	10.2 ⁽¹⁾	9.48 ⁽¹⁾	681	140	60	360			

VR - PVDF liquid end

Ø Plunger mm	Flow Rate		Pressure	Frequency	P max. Suction	Max. Viscosity at P max.	Connections	Stroke Capacity
Diaphragm Ø mm	GPH		PSI	spm	PSI	CPS At NPSHa = 32 FT-WC Standard Check Valves	(Valves) Seat Balls	Motor 1/3 HP
	145 PSI	P max						
3 DSD 51	0.06	0.05	290	28	174	58	¼" NPT f Hastelloy C	Swept volume 0.010 in ³
	0.11	0.10	290	56		40		
	0.23	0.20	290	112		22		
	0.28	0.25	290	140		10		
4 DSD 51	0.10	0.10	290	28		58		Swept volume 0.019 in ³
	0.21	0.19	290	56		40		
	0.43	0.39	290	112		22		
	0.54	0.49	290	140		10		
6 DSD 71	0.29	0.28	290	28		58	Swept volume 0.043 in ³	
	0.59	0.55	290	56		40		
	1.20	1.12	290	112		22		
	1.50	1.44	290	140		10		
8 DSD 71	0.53	0.49	290	28		58	Swept volume 0.078 in ³	
	1.05	0.99	290	56		40		
	2.12	1.99	290	112		22		
	2.70	2.54	290	140		10		

Physical Data

DSD 51 - DSD 71 - DSD 91



DSD 51 - DSD 71 -DSD 91	
V2	Drain hydraulic oil
L2	Hydraulic oil level
R2	Hydraulic oil filling
V1	Drain mechanic oil
L1	Mechanic oil level
R1	Mechanic oil filling

	Description	DSD 51	DSD 71	DSD 91
N1	Suction connection	1/4" NPT - F	1/4" NPT - F	1/2" NPT - M
N2	Discharge connection	1/4" NPT - F	1/4" NPT - F	1/2" NPT - M

	Dimensions (mm)			Dimensions (inch)		
	DSD 51	DSD 71	DSD 91	DSD 51	DSD 71	DSD 91
A	91	91	91	3.58	3.58	3.58
B	177	177	177	3.94	3.94	3.94
C	29.5	29.5	29.5	1.16	1.16	1.16
D	125	125	125	4.92	4.92	4.92
E	166	159	231	6.54	6.25	9.09
F	150	150	150	5.91	5.91	5.91
G	261	267	285	10.28	10.51	11.22
H	125	125	125	4.92	4.92	4.92
I	66	82	114	2.61	3.23	4.49
J	66	82	114	2.61	3.23	4.49
K	100	100	100	3.94	3.94	3.94
L	366	404	420	14.41	15.90	16.53
M	130	130	130	5.12	5.12	5.12
N	103	103	103	4.06	4.06	4.06
O	134	134	134	5.28	5.28	5.28
P	90.5	91	91	3.56	3.58	3.58
Q	100	100	100	3.94	3.94	3.94

	Weight (Kg)			Weight (lb)		
	DSD 51	DSD 71	DSD 91	DSD 51	DSD 71	DSD 91
Motor weight	15	15	26	33.1	33.1	57.3
Weight without motor	25	30	61	55.1	66.1	134.5

Contact Information

Milton Roy® is a brand of Ingersoll Rand (NYSE:IR). For more information, visit www.ingersollrand.com.



To learn more about the MILROYAL D® with DSD® Technology pumps, contact your local representative or visit our website.

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