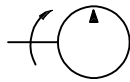


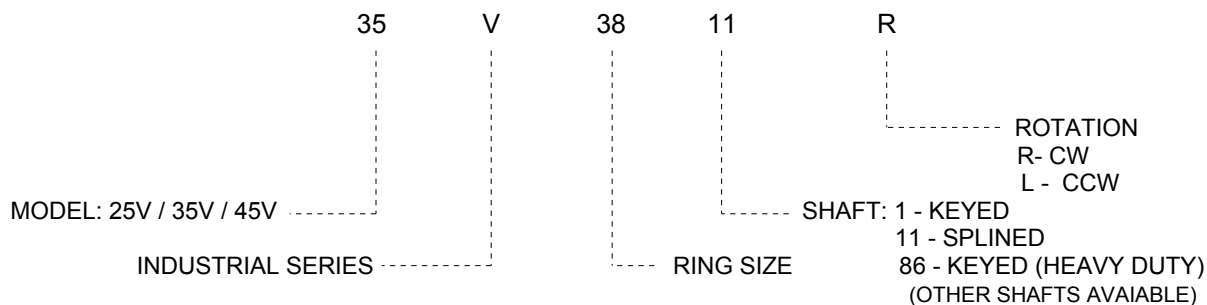
# HIGH PERFORMANCE INDUSTRIAL SINGLE INTRA-VANE PUMPS



- \* High Volumetric Efficiency
- \* Maximum 3000 PSI operating pressure
- \* Twelve Vane Design for quiet operation
- \* Hydraulic Balanced for external life
- \* Versatile
- \* Compact



## ◆ Single Pump Ordering Specifications



Values based on using anti-wear type petroleum oil 150 SUS at 100 F and 0 PSI inlet pressure

Model Series	Flow in GPM @ 1200 RPM & 100 PSI	Displacement in3/rev	Maximum Speed (RPM)	Maximum Pressure (PSI)	Typical Delivery GPM @ max. speed & pressure	Typical Input Power (HP) @ max. speed & pressure	Weight (lbs)
20V	5	1.10	1800	3000	7.5	15.00	26
	8	1.67	1800	3000	12	22.78	
	11	2.22	1800	3000	15	30.28	
	12	2.47	1800	3000	16.4	33.69	
25V	14	2.78	1800	3000	18.4	37.91	32
	12	2.47	1800	2500	16.4	30.75	
	14	2.78	1800	2500	18.4	34.50	
	17	3.39	1800	2500	22.8	40.00	
35V	21	4.13	1800	2500	28	45.60	50
	35	6.83	1800	2500	48	82.40	
	30	5.91	1800	2500	40.8	73.00	
	25	4.94	1800	2500	33	61.00	
45V	38	7.37	1800	2500	51.2	88.30	75
	60	11.75	1800	2500	82	139.00	
	50	9.85	1800	2500	67	117.00	
50V	42	8.41	1800	2500	55	101.00	138
	109	20.99	1800	1700	153	150.00	
	100	19.25	1800	1700	142	140.00	
	85	16.40	1800	1700	128	126.00	

RIO offers a complete line of high performance (12 vane ) single intra-vane pumps for industrial applications. Units are available with large selection of SAE mounts and shafts. The high pressure capacity and multiple displacements, combined with the low flow pulsation and quiet operating characteristics of this 12 - vane design, makes them ideal for industrial applications. Factory tested cartridge kits are readily available, providing efficient field serviceability, avoiding costly down time and increased productivity. These units can operate on a wide variety of fluids.

Contact the local representative with your requirements.

# HIGH PERFORMANCE INDUSTRIAL SINGLE INTRA-VANE PUMPS



## Performance Data - Typical Flows at 120° F, 10 W oil (128SUS), 0 PSI inlet

### Flow in Gallons Per Minute (GPM).

Pump Model	Displacement (in <sup>3</sup> /rev.)	R.P.M.	100 P.S.I. (INPUT H.P.)	1500 P.S.I. (INPUT H.P.)	2500 P.S.I. (INPUT H.P.)	
20 V	5 (1.10)	1200	5.0 (0.4)	4.5 (5.0)	4.2 (6.0)	
		1500	6.9 (1.0)	6.4 (7.0)	6.0 (8.0)	
		1800	8.5 (1.5)	7.7 (8.5)	7.5 (12.0)	
	8 (1.67)	1200	8.0 (1.0)	7.4 (8.0)	7.1 (14.0)	
		1500	10.5 (1.2)	9.5 (10.5)	9.1 (17.0)	
		1800	13.7 (1.7)	11.9 (12.0)	11.2 (20.5)	
	11 (2.22)	1200	11.0 (1.2)	10.2 (11.0)	9.9 (16.0)	
		1500	14.2 (1.5)	13.5 (14.5)	12.5 (23.0)	
		1800	17.1 (2.8)	16.5 (18.0)	15.5 (28.5)	
	12 (2.47)	1200	12.0 (1.3)	11.6 (12.5)	11.2 (19.0)	} MAX. PSI 2300
		1500	15.0 (1.5)	14.8 (15.5)	14.0 (25.0)	
		1800	18.6 (3.0)	17.8 (19.0)	16.4 (30.0)	
	14 (2.78)	1200	14.0 (1.5)	12.2 (13.5)	11.2 (23.0)	} MAX. PSI 2000
		1500	17.5 (3.0)	16.1 (17.0)	14.5 (29.0)	
		1800	21.0 (3.5)	18.4 (20.0)	18.0 (34.0)	
25 V	12 (2.47)	1200	12.0 (1.0)	10.8 (12.0)	10.2(21.0)	
		1500	15.0 (1.5)	13.8 (14.5)	13.5 (25.0)	
		1800	18.0 (2.5)	16.4 (17.0)	16.4(30.0)	
	14 (2.78)	1200	14.0 (2.0)	12.4 (13.5)	11.5 (23.0)	
		1500	17.5 (2.0)	16.8 (17.0)	14.8 (29.0)	
		1800	21.0 (3.0)	18.6 (20.0)	18.4 (34.5)	
	17 (3.39)	1200	17.0 (2.0)	15.5 (16.5)	15.0 (28.0)	
		1500	21.0 (2.0)	20.0 (20.0)	18.3 (34.0)	
		1800	25.5 (3.0)	23.2 (24.0)	22.8 (40.0)	
	21 (4.13)	1200	21.0 (2.0)	19.5 (20.0)	18.5 (33.0)	
		1500	26.0 (3.6)	24.0 (24.5)	23.5 (42.0)	
		1800	31.5 (3.8)	29.2 (29.0)	28.0 (46.0)	
35 V	21 (4.13)	1200	21.0 (2.0)	19.5 (20.0)	18.5 (31.0)	
		1500	26.0 (3.6)	24.0 (24.5)	23.5 (41.0)	
		1800	31.5 (3.8)	29.2 (29.0)	28.0 (45.0)	
	25 (4.94)	1200	25.0 (2.5)	22.5 (23.0)	21.0 (41.0)	
		1500	31.0 (3.0)	29.0 (30.0)	27.0 (50.0)	
		1800	37.8 (4.0)	35.5 (36.0)	33.0 (61.0)	
	30 (5.91)	1200	30.0 (4.0)	28.0 (28.5)	25.5 (49.0)	
		1500	37.0 (5.0)	35.0 (35.5)	33.0 (61.0)	
		1800	44.8 (6.0)	42.0 (43.0)	40.5 (73.0)	
	35 (6.83)	1200	35.0 (4.0)	32.0 (33.0)	30.5 (54.0)	
		1500	43.0 (5.0)	41.0 (42.5)	39.0 (68.0)	
		1800	52.0 (6.5)	50.0 (51.5)	47.5 (82.0)	
	38 (7.37)	1200	38.0 (4.5)	35.0 (35.5)	32.0 (58.0)	
		1500	46.5(6.0)	43.0 (44.0)	41.5 (73.0)	
		1800	56.5 (7.0)	53.5 (55.0)	51.0 (88.0)	
45 V	42 (8.41)	1200	42.0 (4.0)	36.0 (38.0)	33.0 (68.0)	
		1500	53.0 (6.0)	48.0 (49.0)	44.0 (79.0)	
		1800	64.0 (7.0)	59.0 (60.0)	55.0 (101.0)	
	50 (9.85)	1200	50.0 (4.0)	45.0 (46.0)	42.5 (75.0)	
		1500	62.0 (8.0)	57.5 (59.0)	55.0 (97.0)	
		1800	74.0 (8.0)	69.0 (71.0)	67.0 (117.0)	
	60 (11.75)	1200	60.0 (6.0)	55.0 (57.0)	52.0 (93.0)	
		1500	75.0 (7.0)	69.0 (72.0)	66.0 (116.0)	
		1800	91.0 (9.0)	86.0 (88.0)	82.0 (139.0)	

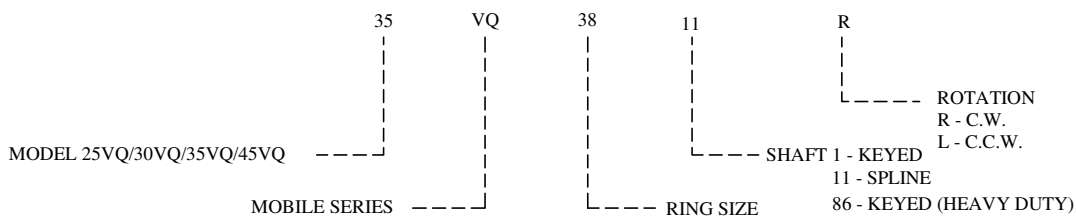
# HIGH PERFORMANCE MOBILE SINGLE INTRA-VANE PUMPS



- \* 3000 PSI Maximum Operating Pressure
- \* High Operating Speeds
- \* Pressure Balanced Brass Flex Plates
- \* Versatile
- \* Compact
- \* Contaminant Tolerant



### ◆ Single Pump Ordering Specifications



Values based on using anti-wear type petroleum oil 150 SUS at 100°F and 0 PSI inlet pressure.

MODEL SERIES	FLOW IN GPM @ 1200 RPM & 100 PSI	DISPL. in <sup>3</sup> r	MAXIMUM SPEED (RPM)	MAXIMUM PRESSURE (PSI)	TYPICAL DELIVERY GPM @ max. speed & pressure	TYPICAL INPUT POWER (HP) @ max. speed & pressure	WEIGHT (lbs.)
20VQ	5	1.10	2700	3000	11.0	24.0	26
	8	1.67	2700	3000	17.0	35.0	
	11	2.22	2700	3000	23.0	47.5	
	12	2.41	2700	2300	22.5	38.0	
	14	2.80	2700	2000	30.0	39.0	
25VQ	12	2.45	2700	3000	23.0	55.0	32
	14	2.77	2700	3000	27.0	62.5	
	17	3.37	2500	3000	31.0	69.5	
	19	3.72	2500	3000	35.0	76.0	
	21	4.12	2500	3000	38.0	83.0	
30VQ	24	4.70	2700	3000	23.0	55.0	36
	28	5.50	2500	3000	31.0	69.5	
35VQ	21	4.12	2500	3000	38.0	83.0	50
	25	4.98	2500	3000	45.0	101.0	
	30	5.96	2500	3000	55.0	117.5	
	35	6.88	2400	3000	60.0	132.0	
	38	7.42	2400	3000	65.0	140.0	
45VQ	42	8.46	2200	2500	66.5	122.5	75
	47	9.54	2200	2500	71.0	131.00	
	50	9.90	2200	2500	79.0	141.00	
	57	11.20	2200	2500	92.0	160.00	
	60	11.80	2200	2500	96.0	170.00	

RIO offers a complete line of high performance single intra-vane pumps for mobile equipment. A large number of SAE mounts, shafts, and displacements, along with their high pressure and speed capabilities, provide the combination best suited for mobile applications. The cartridge assemblies are designed with two flex plates in hydrostatic balance which seal against the rotor to provide optimum running clearances for minimum internal leakage and friction. The bronze face of the flex plates provides excellent wear for cold-start conditions. The availability of our factory tested cartridges offers fast and efficient field serviceability, and the replacement pump cartridge reduces down time to increase productivity. These units can operate on a wide variety of fluids.

Contact the local representative with your requirements.

# HIGH PERFORMANCE MOBILE SINGLE INTRA-VANE PUMPS

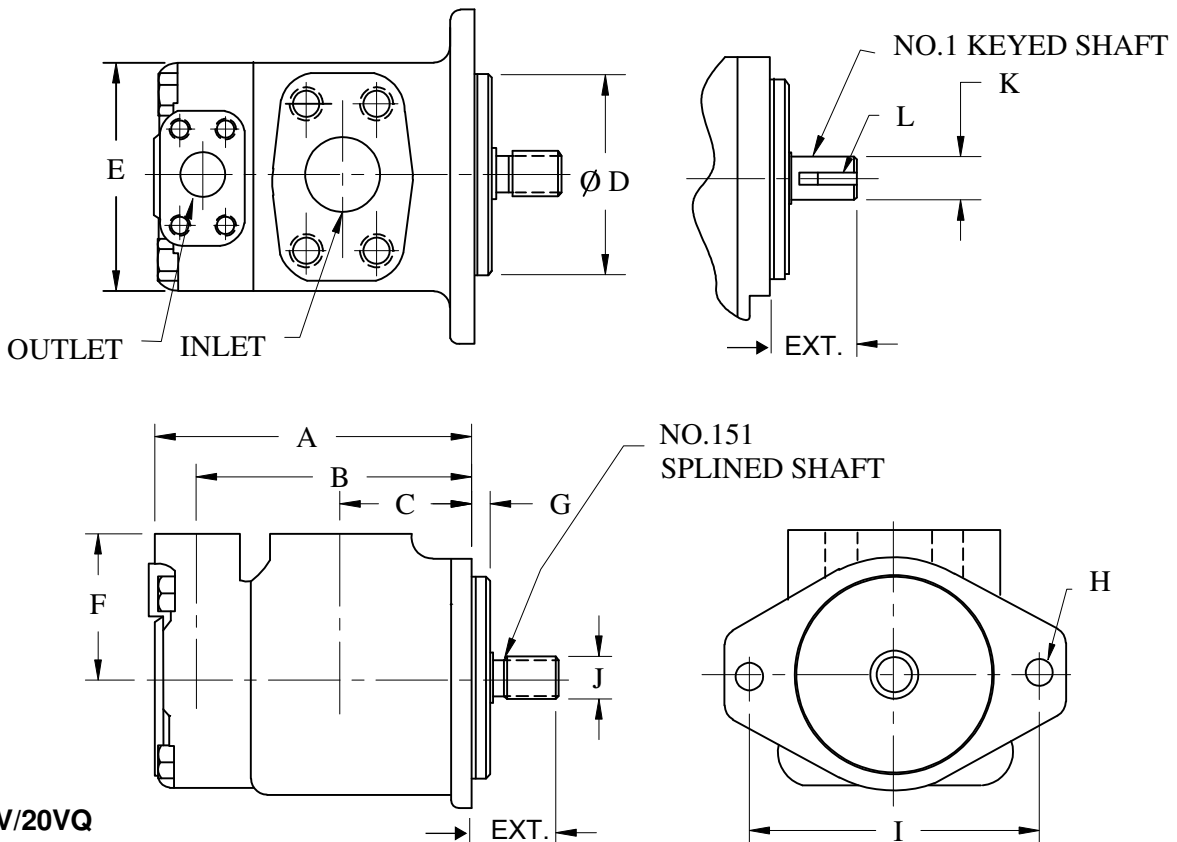
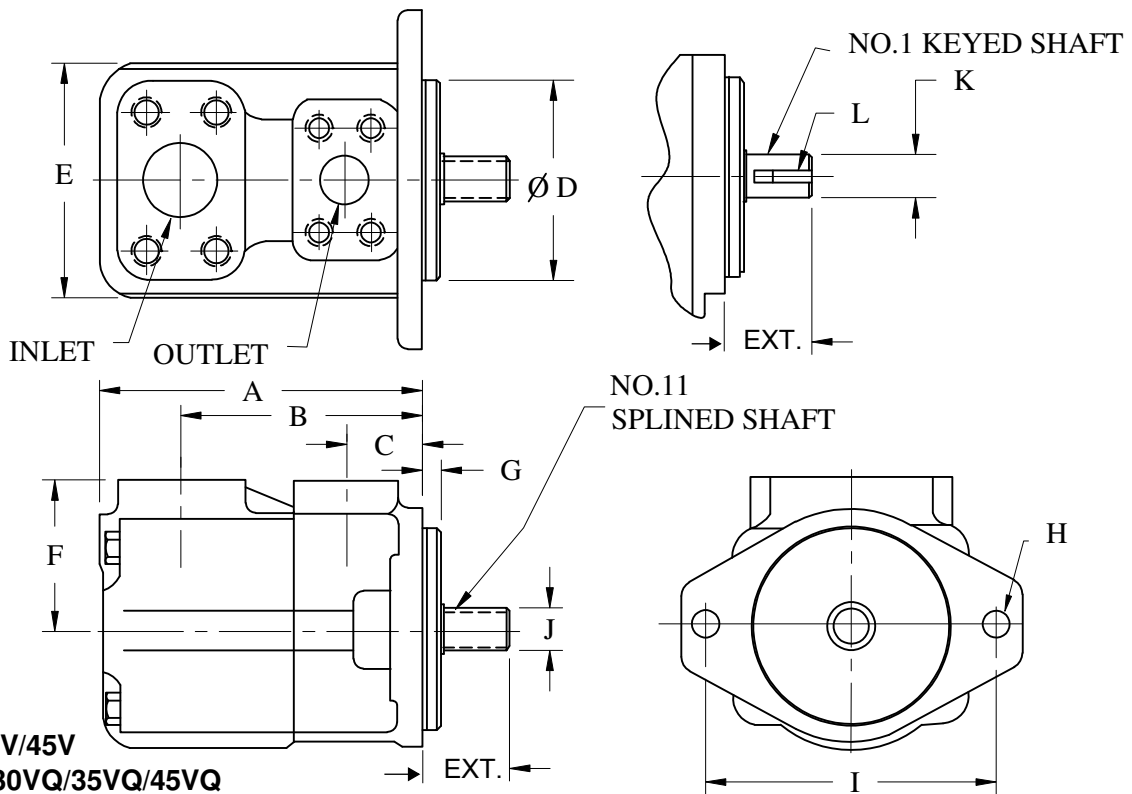


## Performance Data - Typical Flows at 120° F, 10 W oil (128SUS), 0 PSI inlet

Flow in Gallons Per Minute (GPM).

Pump Model	Displacement (in <sup>3</sup> /rev.)	R.P.M.	100 P.S.I. (INPUT H.P.)	1500 P.S.I. (INPUT H.P.)	3000 P.S.I. (INPUT H.P.)	
20 VQ	5 (1.10)	1200	5.0 (0.4)	4.3 (5.0)	4.0 (10.0)	} MAX. PSI 2300
		1800	7.5 (1.5)	7.0 (8.5)	7.0 (16.5)	
		2400	10.0 (2.0)	10.2 (12.0)	9.5 (22.0)	
	8 (1.67)	1200	8.0 (1.0)	7.0 (8.0)	6.5 (16.5)	
		1800	12.0 (1.7)	11.5 (12.0)	10.5 (23.0)	
		2400	16.0 (2.8)	16.0 (17.0)	14.9 (32.0)	
	11 (2.22)	1200	11.0 (1.2)	9.8 (11.0)	8.5 (21.5)	
		1800	16.5 (2.8)	15.4 (18.0)	14.2 (31.0)	
		2400	22.0 (3.0)	21.0 (22.0)	20.0 (42.0)	
	12 (2.41)	1200	12.0 (1.5)	11.0 (12.5)	9.8 (22.0)	
		1800	18.0 (3.0)	17.2 (19.0)	16.0 (34.0)	
		2400	24.0 (3.0)	23.4 (23.5)	22.2 (45.0)	
14 (2.80)	1200	14.0 (2.0)	12.9 (13.5)	12.0 (27.5)		
	1800	21.0 (3.0)	18.5 (20.0)	19.0 (39.5)		
	2400	28.0 (3.5)	27.0 (27.0)	26.4 (52.5)		
25 VQ	12 (2.47)	1200	12.0 (1.0)	9.5 (12.0)	7.5 (24.0)	} MAX. PSI 2200
		1800	18.0 (2.5)	16.0 (17.0)	13.5 (35.0)	
		2400	24.0 (3.0)	22.5 (24.0)	20.0 (46.0)	
	14 (2.77)	1200	14.0 (2.0)	11.5 (13.5)	9.5 (26.5)	
		1800	21.0 (3.0)	18.0 (20.0)	16.0 (39.0)	
		2400	28.0 (3.5)	25.0 (25.0)	23.0 (52.0)	
	17 (3.37)	1200	17.0 (2.0)	14.0 (16.5)	12.0 (32.0)	
		1800	25.5 (3.0)	22.0 (24.0)	20.0 (47.0)	
		2400	34.0 (3.5)	31.0 (32.0)	29.0 (62.0)	
	19 (3.72)	1200	19.0 (3.0)	17.0 (20.0)	15.0 (39.0)	
		1800	28.5 (3.5)	25.5 (28.0)	24.0 (58.0)	
		2400	38.0 (4.5)	35.0 (36.0)	32.0 (70.0)	
21 (4.12)	1200	21.0 (2.0)	17.5 (20.0)	15.5 (39.0)		
	1800	31.5 (3.8)	28.0 (29.0)	25.5 (59.0)		
	2400	42.0 (4.5)	39.0 (39.0)	36.5 (76.0)		
30 VQ	24 (4.70)	1200	24.0 (2.2)	21.0 (22.0)	19.0 (46.0)	
		1800	36.0 (3.3)	33.0 (33.0)	31.5 (71.0)	
		2400	48.0 (4.4)	45.0 (47.0)	42.5 (95.0)	
	28 (5.50)	1200	28.0 (2.6)	26.0 (22.0)	23.5 (58.0)	
		1800	42.0 (5.0)	39.0 (33.0)	37.5 (77.0)	
		2400	56.0 (6.5)	52.5 (47.0)	49.5 (98.0)	
35 VQ	21 (4.12)	1200	21.0 (2.0)	17.5 (20.0)	15.5 (39.0)	
		1800	31.5 (3.8)	28.0 (29.0)	25.5 (59.0)	
		2400	42.0 (4.5)	39.0 (39.0)	36.5 (76.0)	
	25 (4.98)	1200	25.0 (2.5)	20.5 (23.0)	17.5 (46.0)	
		1800	37.0 (4.0)	33.5 (36.0)	30.0 (69.0)	
		2400	50.0 (4.5)	42.0 (46.5)	42.5 (92.0)	
	30 (5.96)	1200	30.0 (4.0)	25.0 (28.5)	25.5 (56.0)	
		1800	45.0 (5.0)	40.0 (43.0)	37.0 (82.0)	
		2400	60.0 (6.0)	55.0 (56.0)	52.5 (110.0)	
	35 (6.88)	1200	35.0 (4.0)	29.0 (33.0)	25.0 (67.0)	
		1800	52.5 (5.0)	46.0 (51.0)	42.0 (95.0)	
		2400	70.0 (5.5)	62.5 (64.0)	60.0 (125.0)	
38 (7.42)	1200	38.0 (4.5)	32.0 (35.5)	29.0 (69.0)		
	1800	57.0 (5.5)	50.5 (52.0)	47.0 (102.0)		
	2400	76.5 (6.0)	68.0 (69.0)	65.0 (136.0)		
45 VQ	42 (8.46)	1200	42.0 (4.0)	34.5 (39.5)	30.0 (68.0)	} MAX. PSI 2500
		1800	63.0 (60.0)	56.5 (58.0)	52.0 (104.0)	
		2400	77.0 (7.0)	70.5 (72.0)	66.5 (123.0)	
	47 (9.54)	1200	47.0 (4.0)	39.0 (22.0)	34.0 (46.0)	
		1800	70.0 (5.0)	64.0 (33.0)	60.5 (71.0)	
		2400	94.0 (9.0)	86.0 (47.0)	80.5 (95.0)	
	50 (9.90)	1200	50.0 (4.0)	42.0 (48.0)	38.5 (78.0)	
		1800	75.0 (6.0)	65.5 (70.0)	62.0 (116.0)	
		2400	91.5 (8.0)	81.5 (86.0)	79.0 (141.0)	
	57 (11.20)	1200	57.0 (5.0)	49.0 (22.0)	45.5 (92.0)	
		1800	85.5 (7.5)	76.5 (33.0)	71.5 (125.0)	
		2400	104.5 (8.0)	94.5 (47.0)	89.5 (160.0)	
60 (11.80)	1200	60.0 (5.5)	51.0 (55.0)	47.0 (94.0)		
	1800	90.0 (7.0)	80.0 (82.0)	75.5 (138.0)		
	2400	110.0 (8.5)	99.0 (101.0)	96.0 (170.0)		

# MOBILE & INDUSTRIAL SINGLE PUMP INSTALLATION DIMENSIONS



# MOBILE & INDUSTRIAL SINGLE PUMP INSTALLATION DIMENSIONS



## DIMENSION CHART

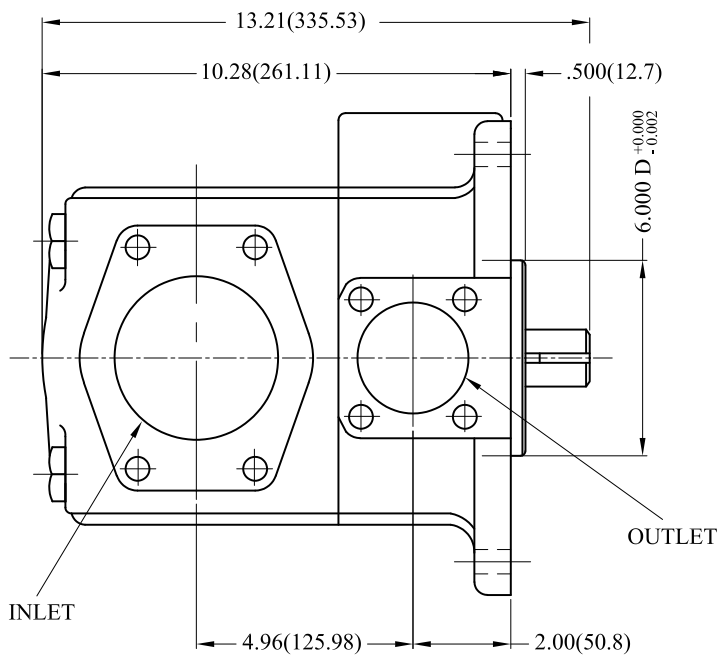
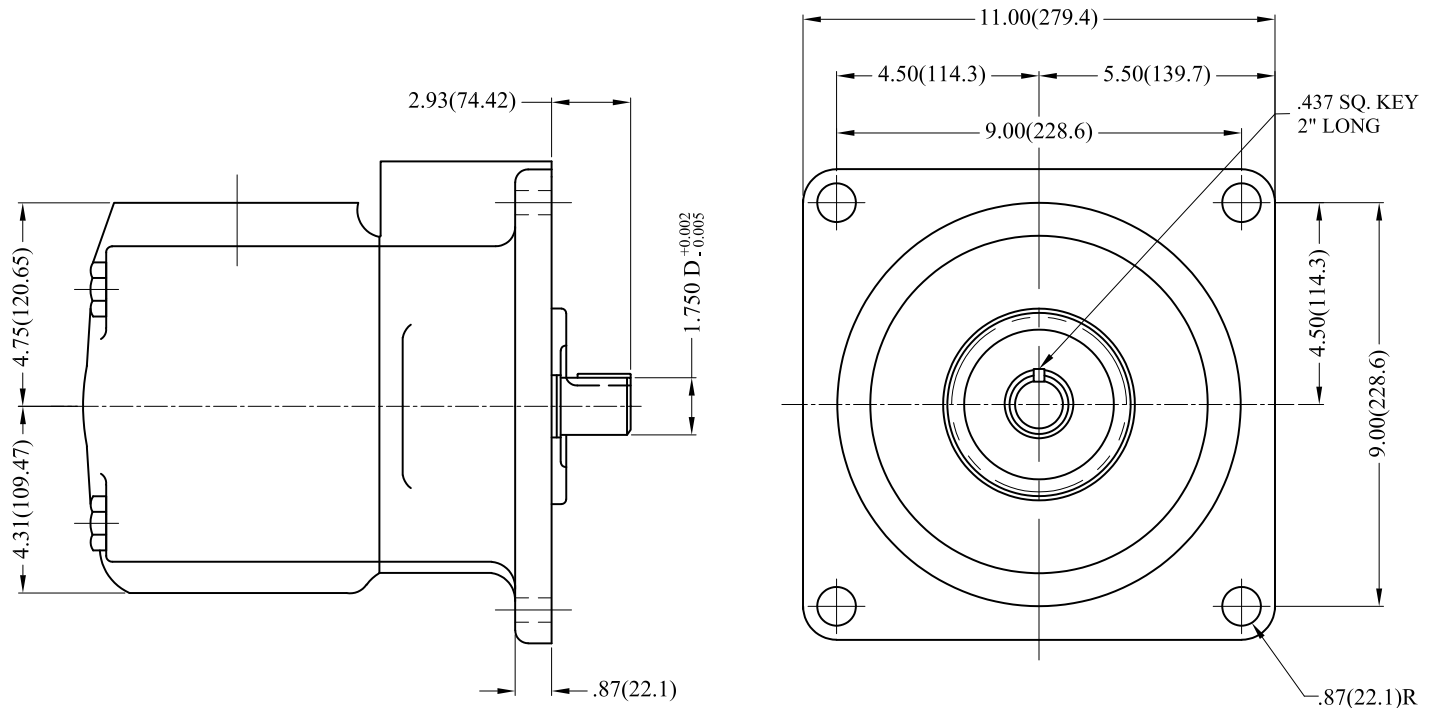
	20 SERIES	25SERIES	30 SERIES	35 SERIES	45 SERIES
A	6.12	6.38	6.96	7.28	8.5
B	5.22	4.75	4.85	4.94	6.02
C	2.5	1.5	1.5	1.5	1.69
D	4"Ø SAE 'B'	4"Ø SAE 'B'	4"Ø SAE 'B'	5"Ø SAE 'C'	5"Ø SAE 'C'
E	4"	4.62	4.62	5.51	6.36
F	3	3	3	3.25	3.69
G	.375	.375	.375	.375	.500
H	.56	.56	.56	.688	.688
I	5.75	5.75	5.75	7.125	7.125
J	.875Ø 13 TH. 1.75 EXT.	.875Ø 13 TH. 1.75 EXT.	.875Ø 13 TH. 1.75 EXT.	1.25Ø 14 TH. 2.31 EXT.	1.25Ø 14 TH. 2.44 EXT.
K	.875Ø EXT. 2.13	.875Ø EXT. 2.31	.875Ø EXT. 2.31	1.25Ø EXT. 2.88	1.25Ø EXT. 2.44
L	KEY .187	KEY .187	KEY .187	KEY .3125	KEY .3125
Inlet	1-1/2" FL.	1-1/2" FL.	1-1/2" FL.	2" FL.	3" FL.
Outlet	3/4" FL.	1" FL.	1-1/4" FL.	1-1/4" FL.	1-1/2" FL.
Foot Bracket	IFB - B	IFB - B	IFB - B	IFB - C	IFB - C
Weight	32 lbs.	32 lbs.	36 lbs.	50 lbs.	75 lbs.

## SHAFTS DESCRIPTIONS & CODES

Pump Style	Code	Description	Major Dia.	Ext.
20V/VQ	1	3/16 Square Keyed	0.875	2.310
	151	13T 16/32 Splined	0.875	1.620
25V/VQ	1	13/16 Square Keyed	0.875	2.312
30V/VQ	3	#15 Woodruff Key	0.875	2.440
	11	13T 16/32 Splined	0.875	1.750
	25	14T 12/24 Splined	1.250	1.750
	127	14T 12/24 Splined	1.250	2.310
35V/VQ	1	5/16 Square Keyed	1.250	2.880
	11	14T 12/24 Splined	1.250	2.310
	19	14T 12/24 X-Long Splined	1.250	3.050
	86	5/16 Heavy-Duty Square Keyed	1.375	3.380
45V/VQ	1	15/16 Square Keyed	1.250	2.440
	11	14T 12/24 Splined	1.248	2.440
	19	14T 12/24 X-Long Splined	1.248	3.060
	86	3/8 Heavy-Duty Square Keyed	1.500	3.440

- Other shafts available on request -

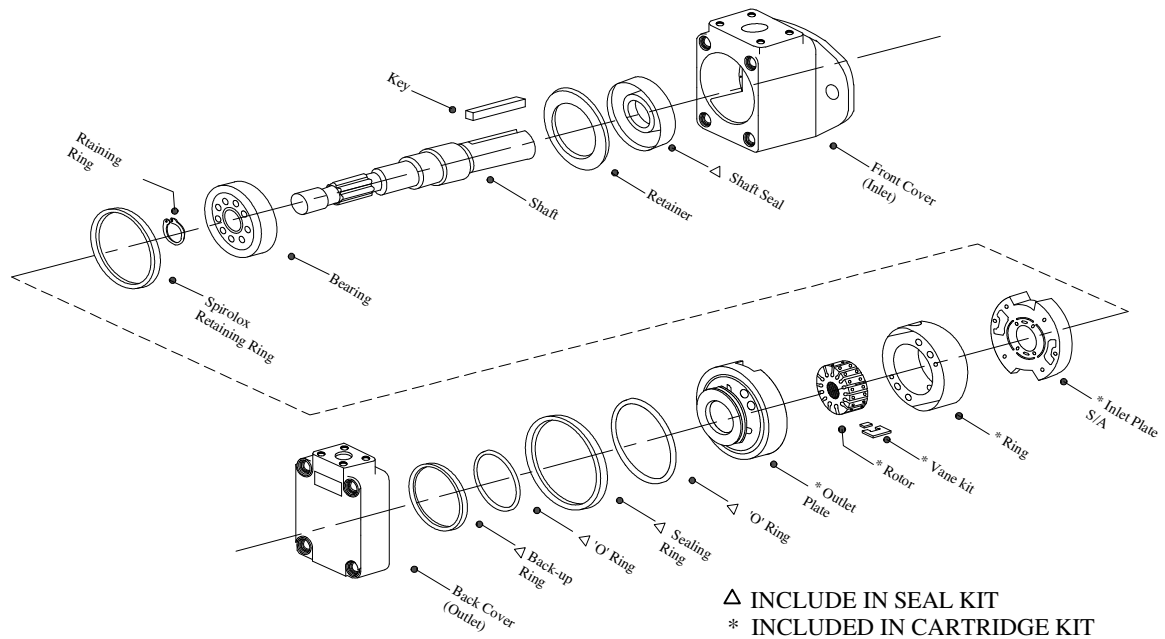
# 50 V INDUSTRIAL SINGLE PUMP INSTALLATION DIMENSIONS



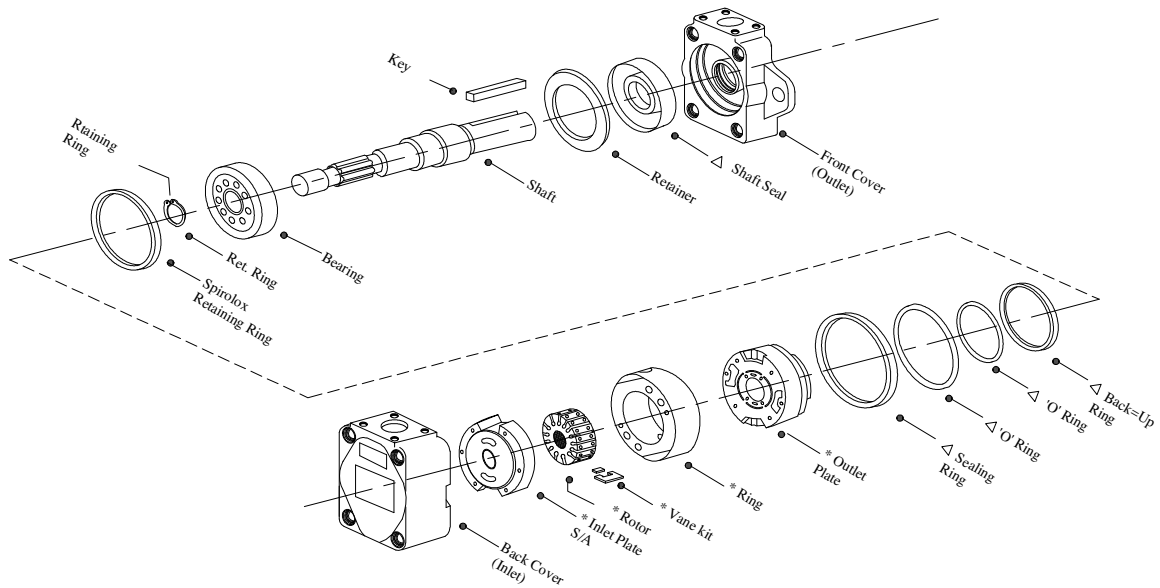
Weight - 138 lbs  
 Inlet - 4" Flange Connection  
 Outlet - 2" Flange Connection

Note: Pump inlet Pressure may not exceed 20 PSI

# INDUSTRIAL SINGLE VANE PUMP SERVICE PARTS INFORMATION



**20V**



**25V/35V/45V**



# INDUSTRIAL SINGLE VANE PUMP SERVICE PARTS INFORMATION



## CARTRIDGE CHART

PUMP SE	CARTRIDGE KITS		ROTOR	VANE KIT	RING	INLET PLATE	OUTLET PLATE	SHAFTS	
20V	5	02-102518	402690	02-136720	333624	584383	585382	1 151	497109 497113
	8	02-102519			333625				
	11	02-102520	403539	02-136721	333626	584384			
	12	02-102521			353901				
	14	02-102522			353902				
25V	12	02-102532	584618	941214	326984	591016	588690	1	238755
	14	02-102533			326985			11	238929
	17	02-102534			326986			86	419882
	21	02-102535			326988				
35V	21	02-102551	575478	941019	394961	576265	575479	1	233624
	25	02-102552			319396			11	242287
	30	02-102553			319397			86	392669
	35	02-102554			319398				
	28	02-102555			319399				
45V	42	02-102572	578900	941049	297510	578903	580921	1	233369
	50	02-102574			297502			11	242885
	60	02-102575			297503			86	361760

- All Cartridge assemblies are factory tested before shipping -

PUMP SE	BUNA SEAL KIT	VITON SEAL KIT	BUNA SHAFT SEAL	VITON SHAFT SEAL	SECONDARY SHAFT SEAL	BEARING	FRONT COVER	BACK COVER
20V	497125	981322	394976	429286	429283	1704	02-102335	250824
25V	922850	919656	394976	429286	429283	1705	942353	224309
35V	922851	919262	394973	429284	429281	38441	942355	234248
45V	919850	919632	394974	429285	429282	131812	942356	229633

## BOLT TORQUES

PUMP SE	COVER BOLT ( FT. LB. )	CARTRIDGE KIT ( IN. LB. )
20V	50	30
25V	50	40
35V	100	90
45V	100	100

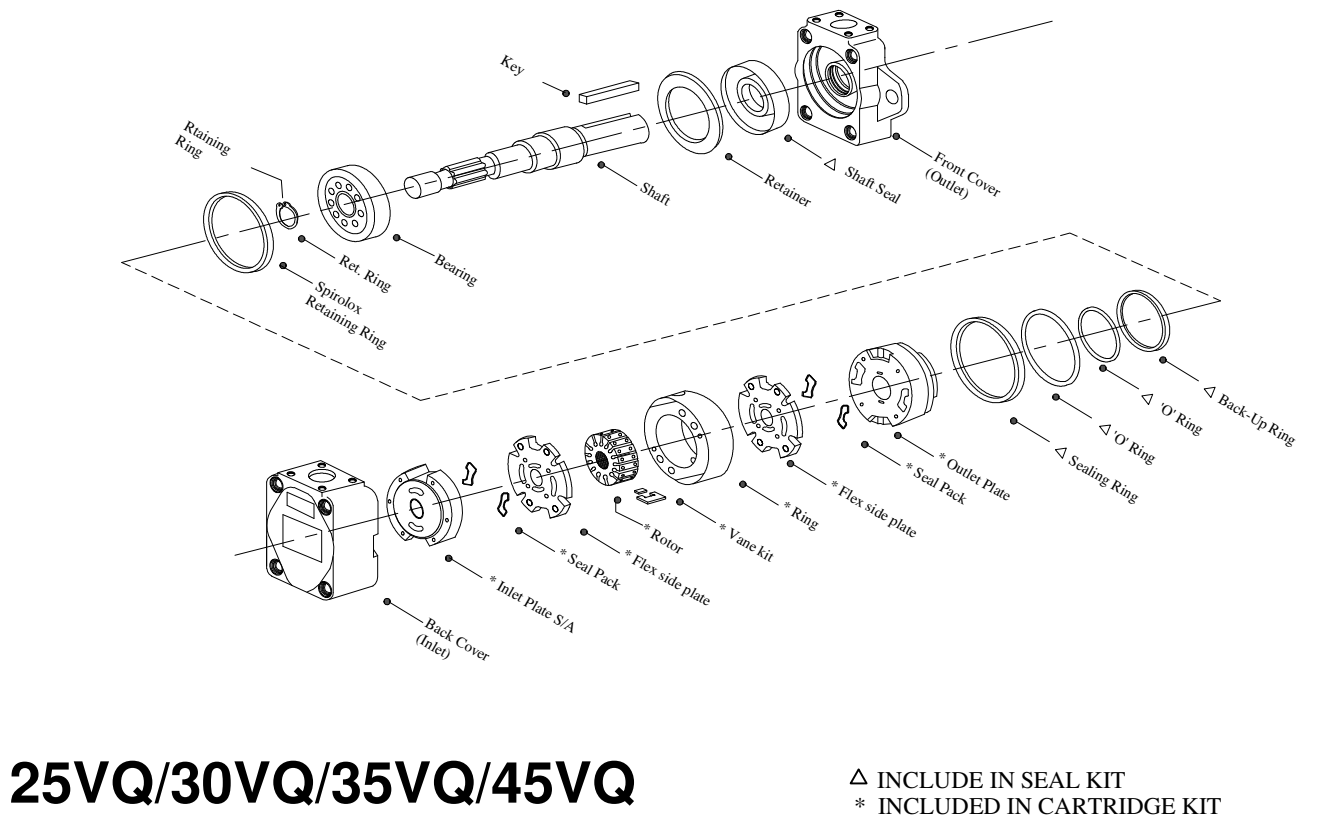
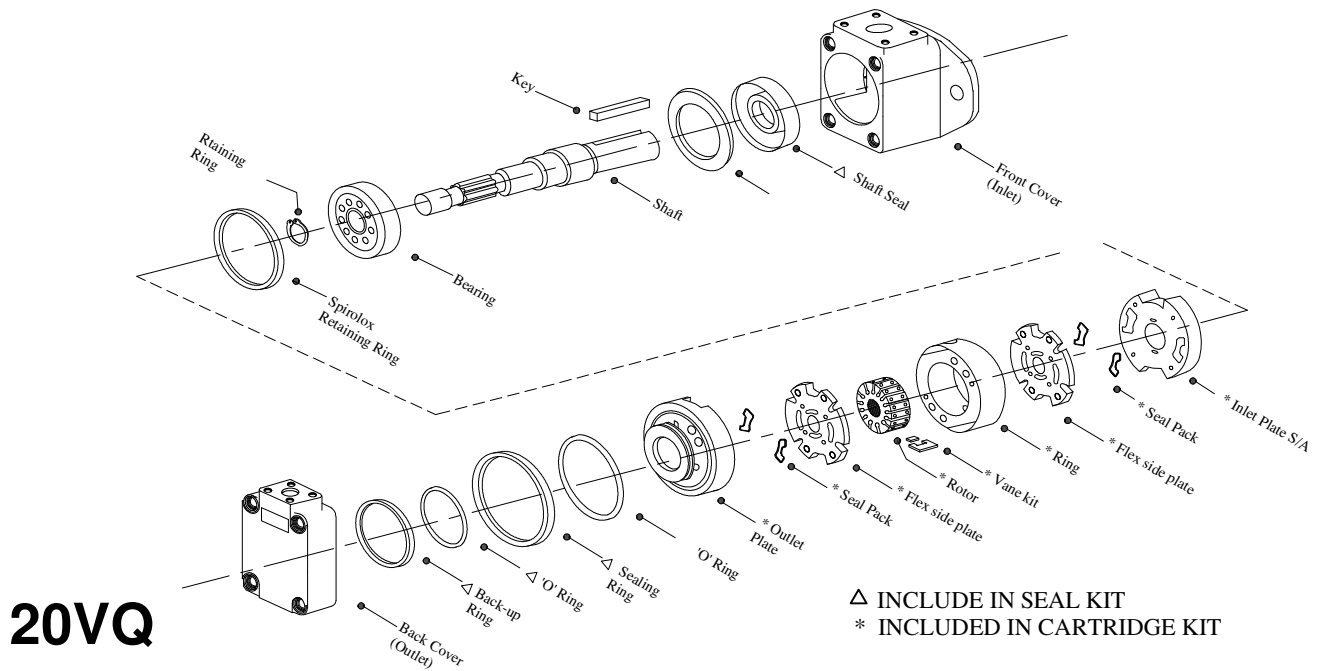
### Cartridge Kit Rotation

To change Cartridge Kit rotation, reverse the location of the inlet and the outlet support plates. Hand tighten the cartridge screws and use pump cover to align all the parts. Remove the cover and tighten the cartridge screws to the designated value. Sharp edge of vanes must lead in direction of rotation.

### Filtration

For satisfactory service life, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or better.

# MOBILE SINGLE VANE PUMP SERVICE PARTS INFORMATION



# MOBILE SINGLE VANE PUMP SERVICE PARTS INFORMATION



## CARTRIDGE CHART

PUMP SE	CARTRIDGE KITS	ROTOR	VANE	RING	FLEX PLATE	INLET PLATE	OUTLET PLATE	SHAFTS
20VQ	5 497115	402690	922741	333624	923955	419502	497134	1 497109 151 497113
	8 497118			333625				
	11 497120	403539	922743	333626		419501		
	12 497121			353901				
	14 497122			353902				
25VQ	12 416439	270597	922710	326984	923956	430805	419079	1 238755 3 242747 11 238929 25 270187 127 424457
	14 416440			326985				
	17 416441			326986				
	19 421232			326987				
	21 416442			326988				
30VQ	24 417052	262152	922642	234470	923956	430805	419079	SAME AS 25VQ
	28 416452			224525				
35VQ	21 413420	262154	922700	394961	923953	430806	412003	1 233624 11 242287 19 275270
	25 413421			319396				
	30 413422			319397				
	35 413418			319398				
	38 413419			319399				
45VQ	42 416435	283271	922701	297510	923954	430807	415382	1 233369 11 242885 19 265575
	47 421234			297718				
	50 416436			297502				
	57 421233			306772				
	60 416437			297503				

**- All Cartridge assemblies are factory tested before shipping -**

PUMP SE	BUNA SEAL KIT	VITON SEAL KIT	BUNA SHAFT SEAL	VITON SHAFT SEAL	SECONDARY SHAFT SEAL	BEARING	FRONT COVER	BACK COVER
20VQ	497123	451471	394976	429286	429283	001704	02-102335	250824
25VQ	920021	920023N	394976	429286	429283	1705	942353	224309
30VQ	920021	920023	394976	429286	429283	1705	942354	224526
35VQ	920015	920029	394973	429284	429281	38441	942355	234248
45VQ	920025	920027	394974	429282	429285	131812	942356	229633

## BOLT TORQUES

PUMP SE	COVER BOLT ( FT. LB. )	CARTRIDGE KIT ( IN. LB. )
20VQ	50	30
25VQ	50	45
30VQ	50	45
35VQ	100	100
45VQ	100	105

## Cartridge Kit Rotation

To change Cartridge Kit rotation, reverse the location of the inlet and the outlet support plates. Hand tighten the cartridge screws and use pump cover to align all the parts. Remove the cover and tighten the cartridge screws to the designated value. Sharp edge of vanes must lead in direction of rotation.

## Filtration

For satisfactory service life, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or better.