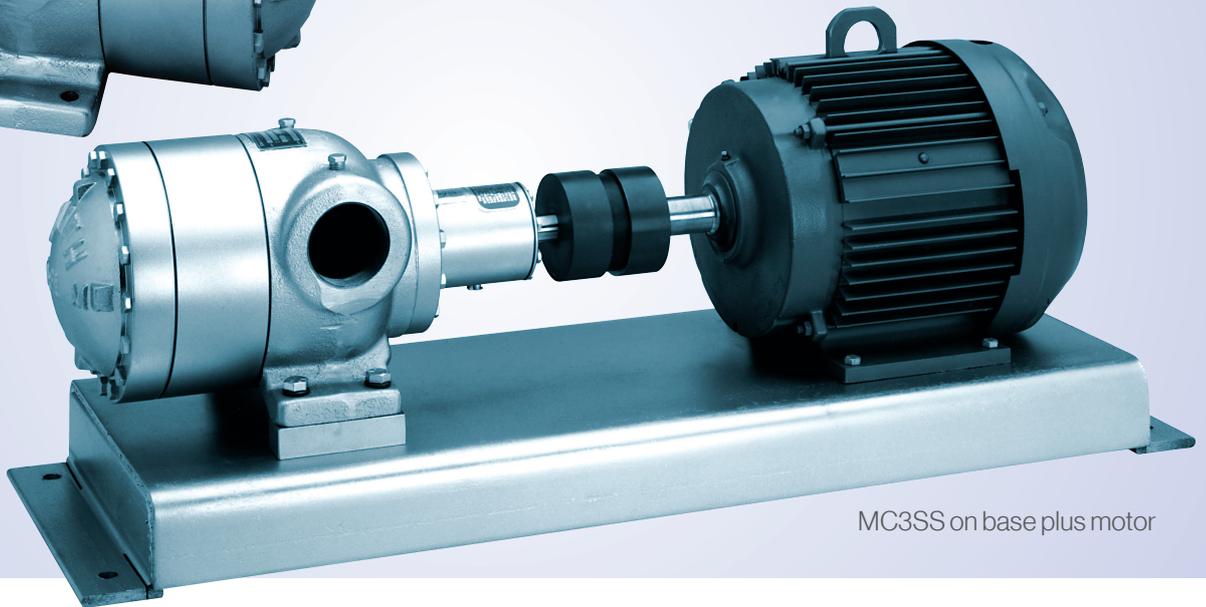


Low Pressure Transfer Pumps for CO₂



MC3SS bare shaft



MC3SS on base plus motor

The liquid CO₂ transfer pumps manufactured by Smith Precision Products of California are designed for moving large quantities of bulk carbon dioxide between two low pressure vessels, where the differential pressure does not exceed 4.8 bar, typically between a road tanker and a CO₂ bulk storage tank. The complete range includes pumps with CO₂ transfer capacities between 0.5 te/h and 35 te/h.

The Smith pumps use precision-cut, interlocking gears to propel the liquid carbon dioxide. The gears are lubricated by the liquid CO₂ and hence run oil free. The shaft seal assembly which turns the drive gears is connected directly by means of a coupling to the electric motor and can be run at speeds of up to 1800 rev/min, although a slower running speed is recommended to prolong pump life.

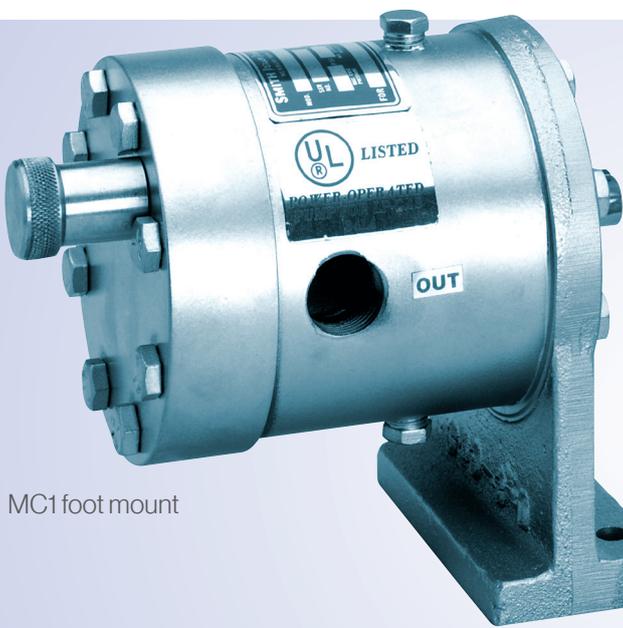
The recommended shaft seal assembly contains a 'Superseal' sealing ring, which minimises seal wear. This 'Superseal' option on the pump is denoted by the addition of the letters 'SS' after the pump model number, e.g. Smith pump MC2SS.

Many of the Smith pump models are reversible, avoiding the need for cumbersome loading and discharge pipework arrangements. The inlet and outlet ports on the standard pumps have NPT female threads, although bodies with flange connections can also be supplied.

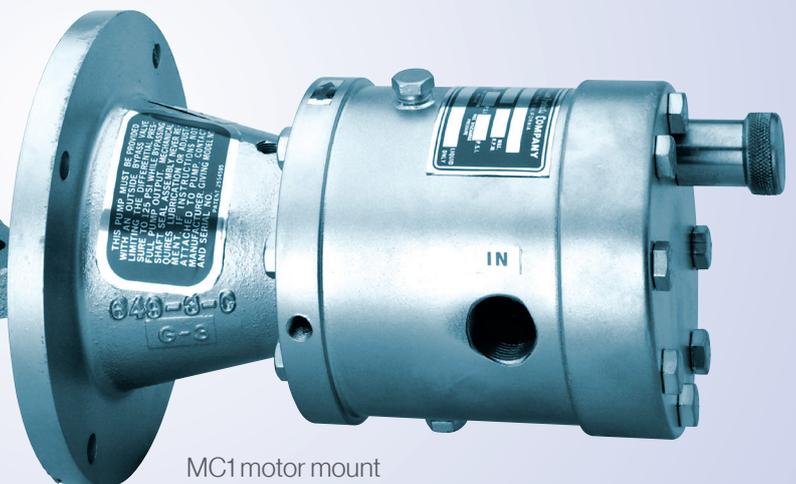
Pumps can be supplied with or without motor, baseframe, coupling and separate by-pass valve, if required.

Smith CO₂ Transfer Pump Model Specifications

Model	Differential Pressure (bar)	Recommended Motor Size (kW)	Recommended Coupling Size	Port Size Threads NPT Female (inch)	Reversible	Net Weight Pump Only (kg)	Recommended By-pass Valve	By-pass Valve Threads NPT Female (inch)
MC1SS	0 1.4 3.5	0.55 0.55 0.55	VC-20	¾	No	9	WW120	½
MC1044SS	0 1.4 3.5	1.1 1.1 1.5	VC-35	1½	Yes	23	WW100	1
MC1044HSS	0 1.4 3.5	1.1 1.1 2.2	VC-35	1½	Yes	23	WW100	1
MC2SS	0 1.4 3.5	2.2 2.2 4.0	VC-35 VC-35 VC-40	2½	Yes	34	WW114	1¼
MC3SS	0 1.4 3.5	4.0 4.0 5.5	VC-40	2½	Yes	45	WW112	1½
MC4SS	0 1.4 3.5	5.5 5.5 7.5	VC-40 VC-40 VC-50	Inlet 4 Outlet 2½	No	61	WW 200	2
MC5SS	0 1.4 3.5	7.5 7.5 11.0	VC-50	Inlet 4 Outlet 2½	No	77	WW 212	2½



MC1 foot mount



MC1 motor mount

Smith Pump Transfer Capacities

Pump Type	Actual Shaft Speed (rpm)	Differential Pressure (bar)	Actual Capacity (kg/h)
MC1SS	700	0	449
	900	0	577
	1400	0	898
	700	1.4	384
	900	1.4	513
	1400	1.4	834
	700	3.5	287
	900	3.5	416
	1400	3.5	737

MC1044SS	700	0	1796
	900	0	2310
	1400	0	3593
	700	1.4	1538
	900	1.4	2051
	1400	1.4	3334
	700	3.5	1150
	900	3.5	1663
	1400	3.5	2946

MC1044HSS	700	0	3144
	900	0	4042
	1400	0	6287
	700	1.4	2691
	900	1.4	3589
	1400	1.4	5835
	700	3.5	2012
	900	3.5	2910
	1400	3.5	5156

MC2SS	700	0	4491
	900	0	5774
	1400	0	8982
	700	1.4	3844
	900	1.4	5127
	1400	1.4	8335
	700	3.5	2874
	900	3.5	4157
	1400	3.5	7365

MC2HSS	700	0	5389
	900	0	6929
	1400	0	10778
	700	1.4	4742
	900	1.4	6282
	1400	1.4	10131
	700	3.5	3772
	900	3.5	5312
	1400	3.5	9161

MC3SS	700	0	8982
	900	0	11548
	1400	0	17964
	700	1.4	7688
	900	1.4	10255
	1400	1.4	16670
	700	3.5	5748
	900	3.5	8315
	1400	3.5	14730

Pump Type	Actual Shaft Speed (rpm)	Differential Pressure (bar)	Actual Capacity (kg/h)
MC3HSS	700	0	10778
	900	0	13858
	1400	0	21556
	700	1.4	9485
	900	1.4	12564
	1400	1.4	20263
	700	3.5	7545
	900	3.5	10624
	1400	3.5	18323

MC4SS	700	0	13473
	900	0	17322
	1400	0	26945
	700	1.4	11533
	900	1.4	15382
	1400	1.4	25005
	700	3.5	8623
	900	3.5	12472
	1400	3.5	22095

MC4HSS	700	0	16167
	900	0	20786
	1400	0	32334
	700	1.4	14227
	900	1.4	18846
	1400	1.4	30394
	700	3.5	11317
	900	3.5	15936
	1400	3.5	27484

MC5SS	700	0	17964
	900	0	23096
	1400	0	35927
	700	1.4	15377
	900	1.4	20509
	1400	1.4	33340
	700	3.5	11497
	900	3.5	16629
	1400	3.5	29460

MC5HSS	700	0	21556
	900	0	27715
	1400	0	43113
	700	1.4	18970
	900	1.4	25129
	1400	1.4	40526
	700	3.5	15089
	900	3.5	21248
	1400	3.5	36646

Capacities listed assume inlet conditions are as recommended and will vary with liquid CO₂ temperature.

Smith CO₂ Pump Options

High Capacity

Pump life can be considerably extended by the use of the high capacity ('H') range of pumps operated at a reduced speed. Utilising a larger gear set the pump can achieve required transfer rates at lower speeds. In addition to a reduction in noise levels, operating the pump at half the recommended speed can extend the life of the pump by up to three times.

Continuous Duty

Standard Smith CO₂ pumps are designed for intermittent duty and generally should not be operated for more than two hours at any one time.

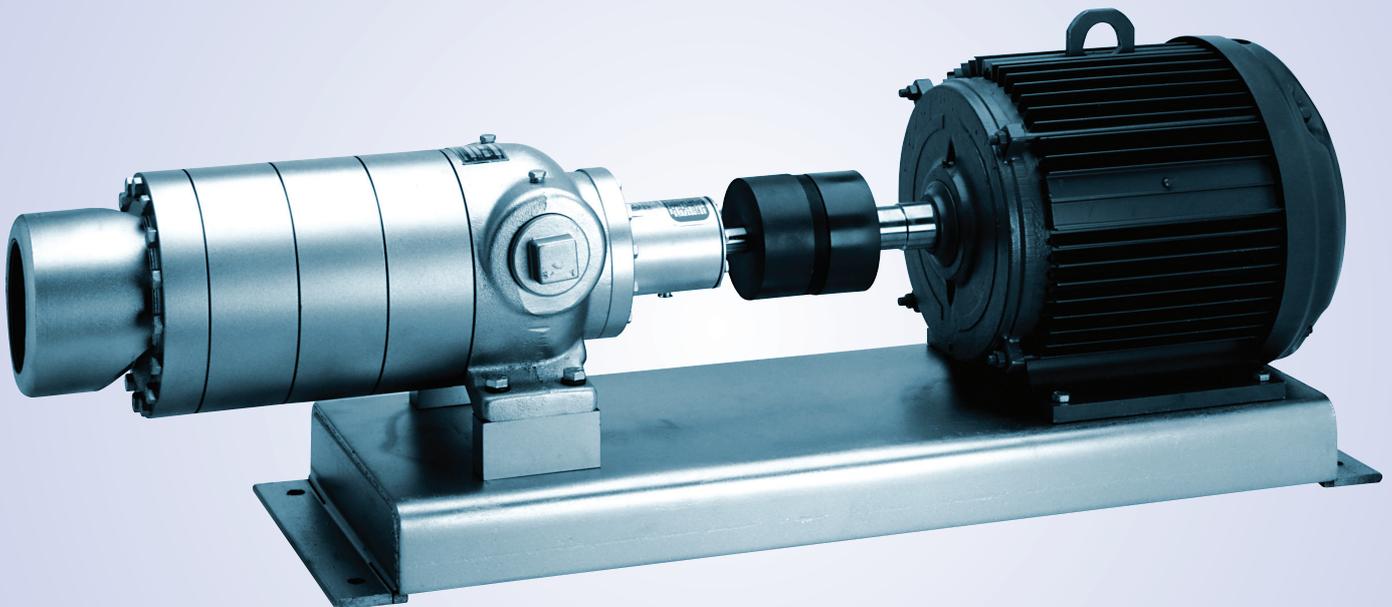
Special pumps (NSSA Option) are available for use in installations requiring extended operating periods (for example in continuous re-circulation) or where higher than normal differential pressures are encountered. In these cases a larger pump running at a lower speed would be recommended to maximise pump life.

The NSSA option features gear sets made from aircraft quality steel (Nitalloy 135MOD) hardened with a special nitriding process to provide a very hard wearing surface. Special Tungsten Carbide idler gear shafts are fitted to provide rigidity under high load conditions.

Pump Connections

Standard Smith CO₂ pumps feature an ANSI standard female NPT thread connection. Installation must be made with a compatible sealant to produce a pressure tight joint.

An option is available to provide either screwed or butt weld companion connection which may improve access for maintenance.



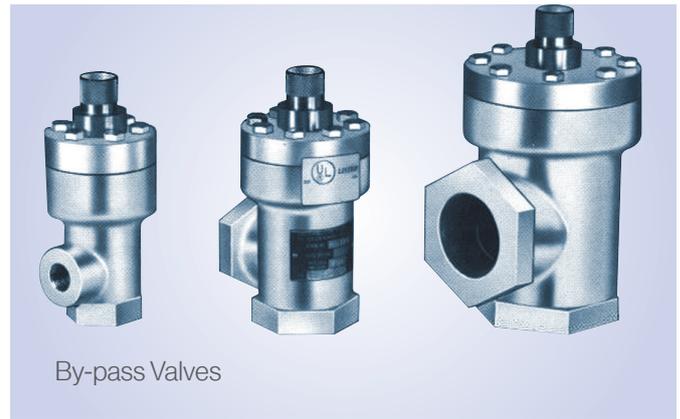
MC5SS on base plus motor

Smith CO₂ Pump Ancillaries

By-pass Valves

The Smith by-pass valves can safely control and limit excessive differential pressure without cavitating the pump. A by-pass valve properly installed provides a safe automatic product return through a separate circuit which allows generated heat and vaporisation to dissipate before the liquid CO₂ passes once again to the pump inlet.

All Smith by-pass valves incorporate a unique flow plate to evenly dissipate flow when the valve opens. This eliminates chatter and minimises overpressure even at higher flow rates. The valve is designed for continuous flow applications and can be used to meter flow if desired. Each valve is adjustable for a differential pressure of between 1.7 bar and 8.6 bar. Unless otherwise specified valves are factory set at 2.75 bar.



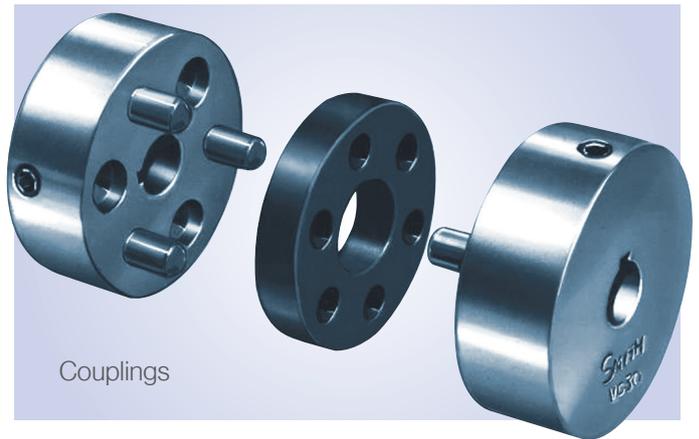
Valve Selection Table

By-pass Valve	Port Size NPT/API Female (in)	Weight (kg)	Rated Capacity (kg/h)	Pump
WW120	½ x ½	4	2300	MC1SS
WW100	1 x 1	5.35	8000	MC1044SS
WW114	1¼ x 1¼	5.35	11500	MC2SS
WW112	1½ x 1½	11.40	23000	MC3SS
WW200	2 x 2	11.40	34600	MC4SS
WW212	2½ x 2½	10.70	57000	MC5SS

Smith CO₂ Pump Ancillaries

Couplings

Flexible drive couplings are used for Smith CO₂ pumps whether mounted on steel baseframes with motors or engines or for pumps mounted directly onto electric motors. Recommended couplings consist of two metal flanges and one flexible rubber vibration damping insert disc. Custom sized bores for metric and unusual motor shaft sizes can be supplied on request.



Couplings Fitted to Standard Installations

Part Number	Coupling	Insert Number	Pump	Motor Size (1500 rpm)		
				Standard Bore Diameters (in)	(hp)	(kW)
	VC-20	FD20	MC1SS	5/8, 3/4	0.5	0.55
2226.1360	VC-35	FD35	MC1044SS	7/8, 1, 1 1/8	2	1.5
2226.1360	VC-35	FD35	MC2SS	7/8, 1, 1 1/8	3	2.2
2226.1361	VC-40	FD40	MC2SS	1, 1 1/8, 1 1/4, 1 3/8	5	4
2226.1361	VC-40	FD40	MC3SS	1, 1 1/8, 1 1/4, 1 3/8	7.5	5.5
	VC-50	FD50	MC4SS	1, 1 3/8, 1 5/8	10	7.5
	VC-50	FD50	MC5SS	1, 1 3/8, 1 5/8	15	11

NOTE: There is an additional charge for couplings with non-standard or metric-sized bores.

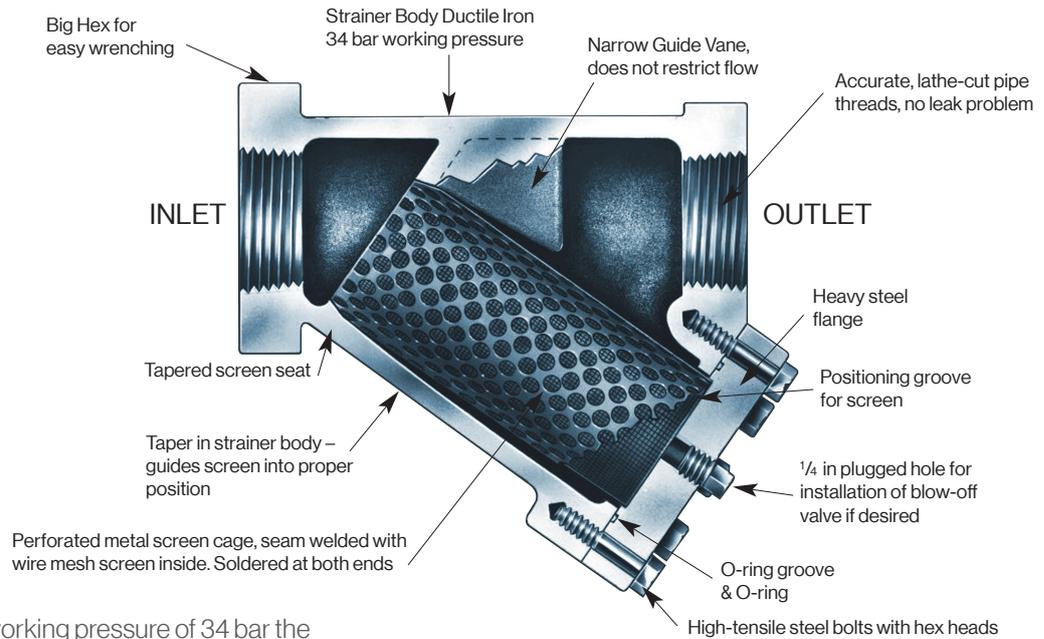
Table to Select Correct Coupling related to hp and rpm

hp of Motor	rpm of Motor	Coupling
1 1/2	1500	VC-30
	1000	VC-35
	750	VC-35
2	1500	VC-35
	1000	VC-35
	750	VC-40
3	1500	VC-35
	1000	VC-40
	750	VC-40
5	1500	VC-40
	1000	VC-40
	750	VC-50

hp of Motor	rpm of Motor	Coupling
7 1/2	1500	VC-40
	1000	VC-50
	750	VC-50
10	1500	VC-50
	1000	VC-50
	750	VC-50
15	1500	VC-50
	1000	VC-50
20	1500	VC-50

Smith CO₂ Pump Ancillaries

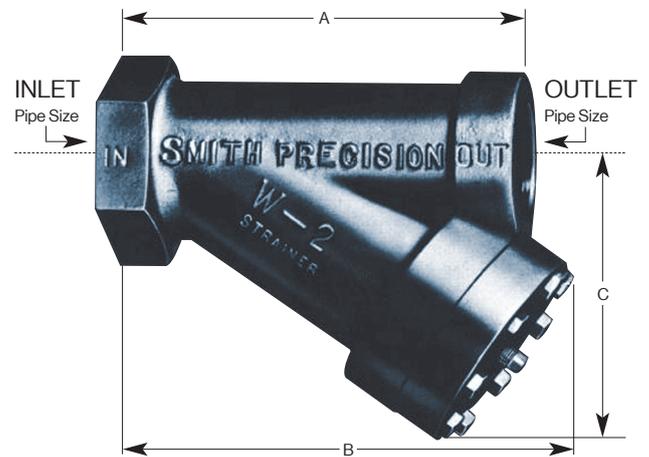
Strainers



With a maximum allowable working pressure of 34 bar the Smith strainer is perfectly suited to remove particulate matter in the inlet of Smith CO₂ pumps.

Improved safety and reduced costs can be achieved by the use of strainers with reducing sizes eliminating extra fittings or bushings.

The screen is very easy to replace due to the exclusive narrow guide vane and a taper in the strainer body. The screen glides easily into position preventing breakage or buckling which otherwise could allow foreign matter to pass through. The reinforced mesh screen provides superior efficiency compared with inferior perforated metal screens. Screens are available in either brass 40 mesh or 300 series stainless steel 80 mesh.



Specification

Strainer Type Number	Pipe Sizes (NPT/API)		A (mm)	B (mm)	C (mm)
	Inlet (in)	Outlet (in)			
W-1	1	¾	162	178	114
W-1B-100	1	1	162	178	114
W-1	1¼	¾	162	178	114
W-1	1¼	1	162	178	114
W-1	1¼	1¼	162	178	114
W-1B-112	1½	1½	162	178	114
W-2	2	1½	208	228	168
W-2B-200	2	2	208	228	168
W-3	2½	2½	260	286	191
W-3	3	2½	260	286	191
W-3	3	3	260	286	191

Air Liquide CO₂ Equipment: Freeze, Pump, Vaporise, Protect



FM12962

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