

Appendix B—Specifications for Vertical Single-Acting Models 91–691

Equipment Type and Options

Single-acting, vertical, reciprocating piston type vapor compressor
 Single packed rod
 NPT or Class 300 RF connections

Applications

Bulk transfer	Tank evacuation
Vapor recovery	Gas scavenging

Features and Benefits

Self-lubricating piston rings:	Non-lubricated operation to minimize oil in gas
NPT or Class 300 RF connections:	Versatility for your application
Multiple mounting configurations:	Versatility for your application
High efficiency valves:	Quiet, reliable operation
Reversible oil pump:	Allows operation in either direction
Simplified top down design:	Routine maintenance is minimally invasive

Operating Specifications

Model	91	291	491	691
Bore of cylinder inches (mm)	3.0 (76.2)	3.0 (76.2)	4.0 (101.6)	4.5 (114.3)
Stroke inches (mm)	2.5 (63.5)	2.5 (63.5)	3.0 (76.2)	4.0 (101.6)
Piston displacement cfm (m ³ /hr)				
minimum @ 400 RPM	4.1 (7.0)	8.2 (13.9)	17.5 (29.7)	29.5 (50.0)
maximum @ 825 RPM	8.4 (14.3)	16.9 (28.7)	36.0 (61.2)	60.7 (103.2)
Maximum working pressure psig (bar g) ¹	335 (23.1)			
Maximum brake horsepower (kW)	7.5 (5.6)	15 (11.2)	15 (11.2)	45 (33.6)
Maximum rod load lb (kg)	3,600 (1,632.9)	3,600 (1,632.9)	4,000 (1,814.4)	7,000 (3,175.1)
Maximum outlet temperature °F (°C)	350 (177)			
Maximum flow—propane gpm (m ³ /hr)	50 (11.4)	101 (22.9)	215 (48.8)	361 (82.0)

¹ These numbers specify pressure-containing abilities of the compressor cylinder and head. For many applications, factors other than the pressure rating will limit the maximum allowable discharge pressure to lower values. These factors include horsepower, temperature and rod load.

Appendix B—Specifications for Vertical Single-Acting Models 91–691

Material Specifications

Part	Model	Standard Material
Head, Cylinder	All	Ductile iron ASTM A536
Crosshead guide crankcase, flywheel, bearing carrier	All	Gray iron ASTM A48, Class 30
Flange	691	Ductile iron ASTM A536
Valve seat and bumper	91, 291	17-4 PH stainless steel
	491	Ductile iron ASTM A536
	691	17-4 PH stainless steel
Valve plate	91, 291	410 stainless steel
	491	17-7 PH stainless steel
	691	PEEK
Valve spring	91, 291, 691	17-7 PH stainless steel
	491	Inconel
Valve gaskets	None	Soft aluminum
Piston	All	Gray iron ASTM A48, Class 30
Piston rod	None	1045 steel Nitrotec ^{®1} coated
Crosshead	All	Gray iron ASTM A48, Class 30
Piston rings	91, 291, 491	PTFE, glass and moly filled
	691	Alloy 50
Ring expanders	All	302 stainless steel
Packing cartridge, connecting rod	All	Ductile iron ASTM A536
Packing V-rings	91, 291, 491	PTFE, glass and moly filled
	691	Alloy 50
Crankshaft	All	Ductile iron ASTM A536
Connecting rod bearing	All	Bimetal D-2 babbitt
Wrist pin	All	C1018 steel
Wrist pin busing	All	Bronze SAE J461
Main bearing	All	Tapered roller
Inspection plate	All	Aluminum
O-rings	All	Buna-N, Neoprene ^{®2} (optional)
Retainer rings	All	Steel
Misc. gaskets	All	Rubber compositions

¹ Registered trademark of TTI Group Ltd.

² Registered trademark of the DuPont company.

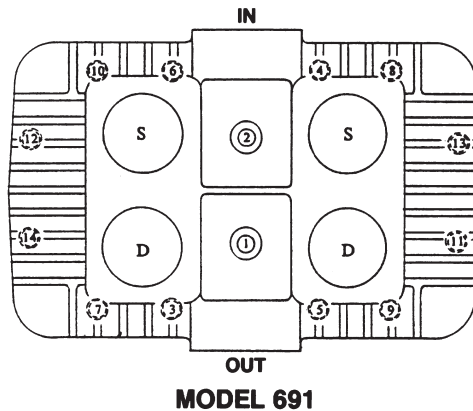
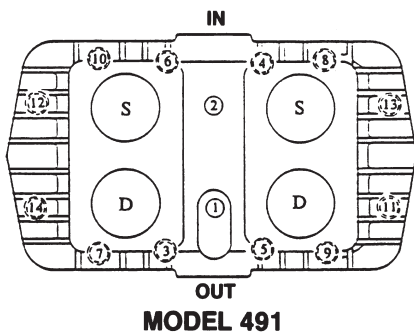
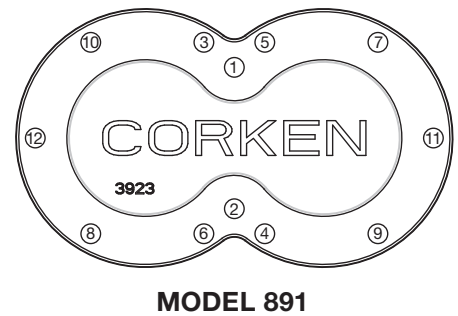
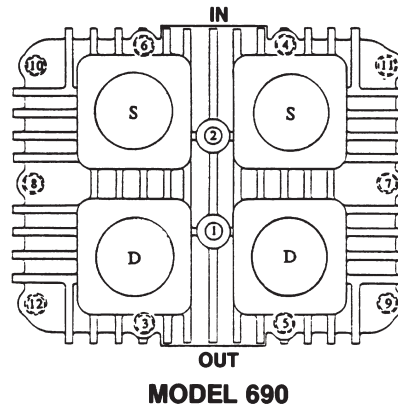
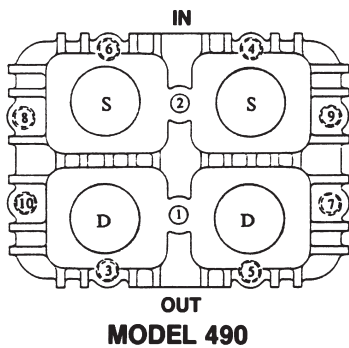
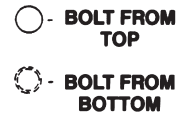
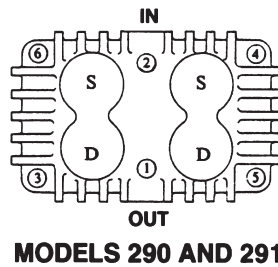
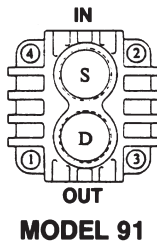
Appendix B—Specifications for Vertical Single-Acting Models 91–891

Bolt Torque Values (in ft•lb)

Model	91	291	491	691	891
Connecting rod bolt	28	28	30	40	40
Bearing carrier	38	30	26	40	40
Bearing cover	38	30	35	40	40
Crankcase inspection plate	15	13	8	9	9
Crosshead guide	30	25	33	40	65
Cylinder to head ^{1,2}	20	20	33	30	65
Valve cover plate bolt	—	—	35	37	37
Valve holddown screw ²	40	40	40	40	40
Piston locknut	45	45	45	60	150
Piston screw	50	50	100	100	8
Valve cap with gaskets	40	40	40	40	—
Valve cap with O-rings	25	25	25	25	25

¹ Preliminary tightening – snug all head bolts in the sequence shown. Final torquing – torque all head bolts in the sequence shown to the listed value.

² Retorque to the listed value after 1 hour running time.



Appendix B—Specifications for Vertical Single and Double-Acting Models 91–891

Clearances and Dimensions for Single-Acting Models

Model	91	291	490	491	691 (M crankcase)
“X” piston clearance figure 5.4A and 5.4B ¹	0.020 0.044	0.020 0.044	0.000 0.024	0.020 0.044	0.025 0.040
Clearance from connecting rod bearing to crankshaft journal	0.001 0.0025	0.001 0.0025	0.001 0.0025		0.0019 0.0035
Clearance from wrist pin to wrist pin bushing ²	0.0006 0.0011	0.0006 0.0011	0.0006 0.0011		0.0009 0.0015
Maximum cylinder bore diameter	3.009	3.009	4.011		4.515
Cylinder finish (RMS)	16–32	16–32	16–32		16–32
Minimum piston ring radial thickness	0.082	0.082	0.082		0.082
Maximum clearance from oil pump adapter shaft to bushing ²	N/A	0.0050	0.0050		0.0050
Crankshaft end play	0.000 0.002	0.000 0.002	0.000 0.002		0.002 0.003
Maximum flywheel runout at O.D.	0.020	0.020	0.020		0.020
Maximum clearance from crosshead to crosshead guide bore	0.011	0.011	0.012		0.013
Crosshead guide bore finish	32 RMS (limited number of small pits and scratches are acceptable)				

Clearances and Dimensions for Double-Acting Models

Model	891
“X” piston clearance figure 5.4A and 5.4B ¹	0.010/0.020 (bottom) 0.084/0.104 (top)
Clearance from connecting rod bearing to crankshaft journal	0.0019 0.0035
Clearance from wrist pin to wrist pin bushing ²	0.0009 0.0015
Maximum cylinder bore diameter	4.515
Cylinder finish (RMS)	16–32
Minimum piston ring radial thickness	0.082
Maximum clearance from oil pump adapter shaft to bushing ²	0.0050
Crankshaft end play	0.002 0.003
Maximum flywheel runout at O.D.	0.020
Maximum clearance from crosshead to crosshead guide bore	0.008
Crosshead guide bore finish	32 RMS (limited number of small pits and scratches are acceptable)

¹ Clearances should be set with machine cold.

² Dimensions for honing are included with new bushings (which must be installed, then honed).

Appendix B—Specifications for Vertical Double-Acting Model D891/FD891

Equipment Type and Options

Double-acting, vertical, reciprocating piston type vapor compressor
 Double packed rod
 Slip-on weld connections or Class 300 RF flanges

Applications

Bulk transfer	LTVR and scavenger applications
Truck, tank, railcar, barge unloading	Emergency evacuation

Features and Benefits

Self-lubricating piston rings:	Non-lubricated operation to minimize oil in gas
Multiple materials and configurations:	Versatility for your application
Multiple mounting configurations:	Versatility for your application
High efficiency valves:	Quiet, reliable operation
Reversible oil pump:	Allows operation in either direction
Simplified top down design:	Routine maintenance is minimally invasive

Operating Specifications

Model	D891/FD891
Bore of cylinder inches (mm)	4.5 (114)
Stroke inches (mm)	4.0 (101.6)
Piston displacement cfm (m ³ /hr)	
minimum @ 400 RPM	56.6 (96.2)
maximum @ 825 RPM	116.8 (198.4)
Maximum working pressure psig (bar g)	450 (31.0)
Maximum brake horsepower (kW)	45 (34)
Maximum rod load lb (kg)	7,000 (3,175.2)
Maximum outlet temperature °F (°C)	350 (177)
Maximum flow—propane gpm (m ³ /hr)	694 (157.6)

¹ These numbers specify pressure-containing abilities of the compressor cylinder and head. For many applications, factors other than the pressure rating will limit the maximum allowable discharge pressure to lower values. These factors include horsepower, temperature and rod load.

Appendix B—Specifications for Vertical Double-Acting Model D891/FD891

Material Specifications

Part	Standard Material
Head, cylinder, and cylinder cap	Ductile iron ASTM A536
Crosshead guide	Gray iron ASTM A48, Class 30
Crankcase, flywheel	Gray iron ASTM A48, Class 30
Bearing carrier	Gray iron ASTM A48, Class 30
Flange	ASTM A36 carbon steel (D891 only)
Valve seat, bumper	17-7 PH stainless steel
Valve plate	PEEK
Valve spring	17-7 PH stainless steel
Valve gaskets	Soft aluminum
Piston	Ductile iron ASTM A536
Piston rod	1045 steel, Nitrotec
Crosshead	Ductile iron ASTM A536
Piston rings	PTFE, glass and moly filled
Piston ring expanders	302 stainless steel
Packing cartridge and barrel	Ductile iron ASTM A536
Connecting rod	Ductile iron ASTM A536
Segmented packing	Carbon filled PTFE
V-ring packing	Alloy 50
Crankshaft	Ductile iron ASTM A536
Connecting rod bearing	Bimetal D-2 SAE 12
Wrist pin	C1018 steel or equivalent
Wrist pin bushing	Bronze SAE J461
Main bearing	Tapered roller
Inspection plate	Aluminum
O-rings	Buna-N or Neoprene ^{®1} (optional)
Retainer rings	Steel
Miscellaneous gaskets	Rubber compositions

¹ Registered trademark of the DuPont company.