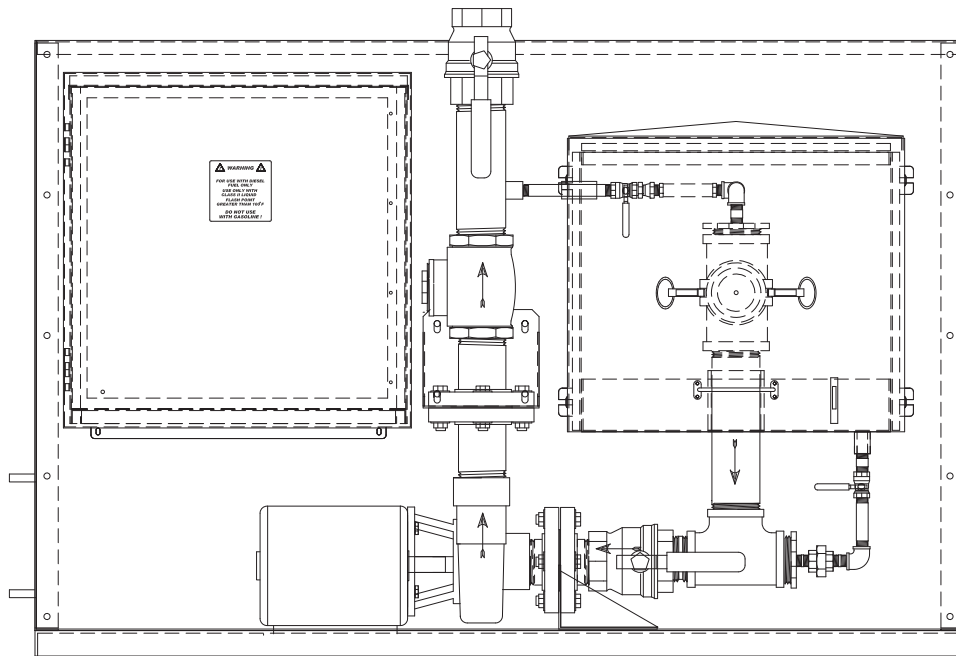


SIMPLEX[®]

SMARTPUMP MANUAL

with Touchscreen - January 2011



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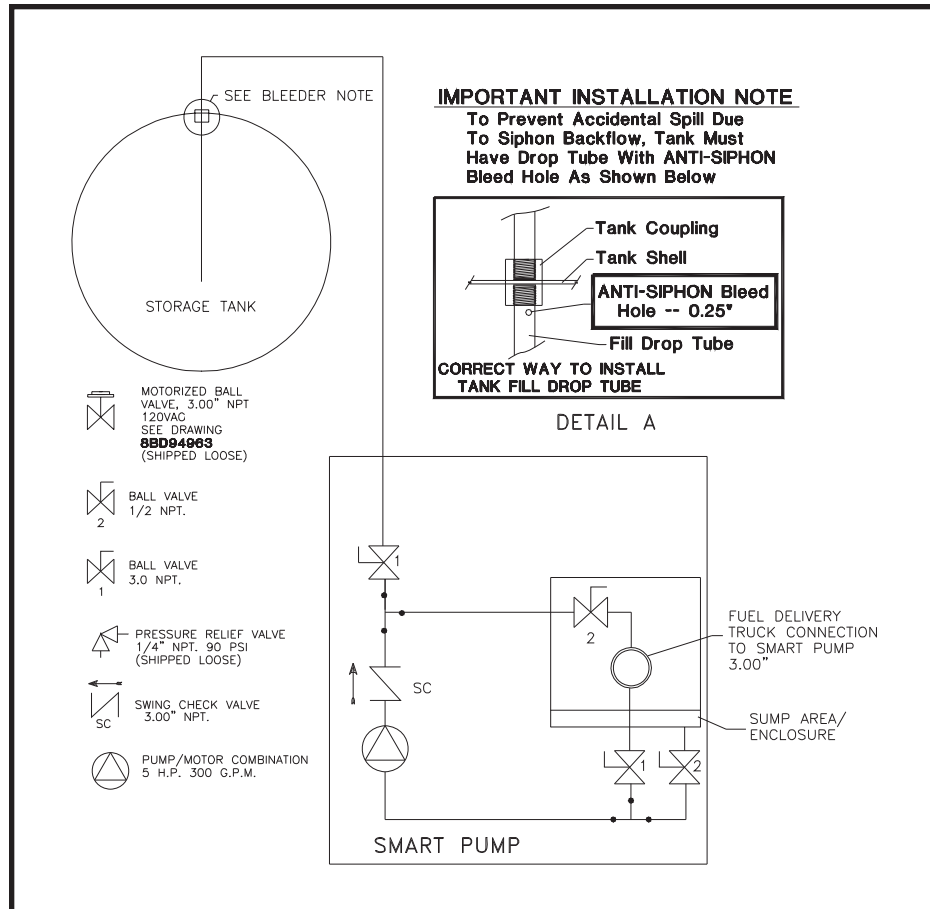
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DESCRIPTION

The Simplex Fuel Supply System provided on this work order consists of a Simplex Smart-Pump designed to transfer fuel from gravity trucks to an above ground fuel storage tank, control the filling operation to prevent overfilling of the tank, and allow for full draining of the truck delivery hose. A floatswitch assembly is shipped loose for installation on the above ground fuel storage tank.

INSTALLATION

1. Anchor the Smart-Pump to concrete pad using mounting holes provided in the base of the unit.
2. Connect to an earth ground using the threaded ground stud in the lower left-hand corner of left-hand side panel. Connect ground wires from SmartPump to the above ground storage tank.
3. See *Piping Drawing*:
 - a. Connect the outlet of SmartPump to the above ground storage tanks using 3 inch steel pipe or black iron pipe.
 - b. Install the SmartPump Transducer, Floatswitch assembly and optional Tank Leak Floatswitch, if provided, in the appropriate NPT fittings in the top of the fuel storage tank.

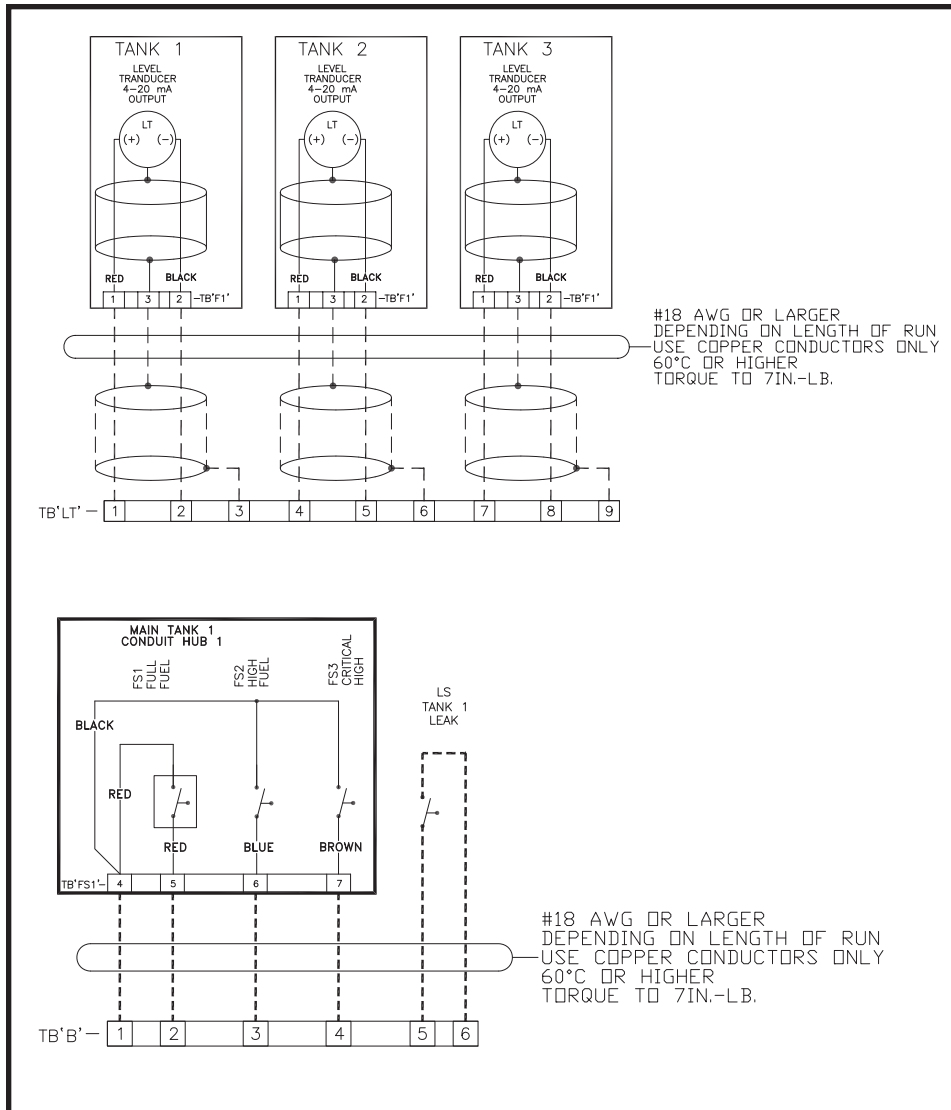


WARNING

ALL PIPING MUST RISE ABOVE THE SMARTPUMP. Low spots can cause air locks in the line and prevent proper pump operation.

WARNING

To prevent an accidental spill due to siphon backflow the tank must have drop tube with an anti-siphon bleed hole.



Typical Transmitter and PLC Analog Input Electrical Schematic and Typical Floatswitch Connections to TB'B'

4. See *Wiring Drawing*. Run all wiring in solid conduits.
 - a. Connect control power to terminal block as shown on the drawings shipped with the equipment.
 - b. Using #18 AWG or larger, connect the floatswitch assembly as shown.
 - c. If required, connect leak sensors and remote alarm contacts as shown. Contacts are rated.
 - d. Using #18 AWG or greater shielded wire, connect contacts on the Smartpump to the Level Transducer as shown.

INITIAL START-UP TEST PROCEDURES

1. The unit is operated with the control panel outer door open to reveal operator control panel. Do not access the interior of the control panel with the customer supplied control power circuit breaker On.

2. Flip the customer supplied control power circuit breaker to the On position.

a. The Power Available indicator will illuminate.

3. Check direction of rotation and operation of the pump and motor.

a. Place the customer supplied control power circuit breaker in the Off position.

b. Remove shaft coupler guard from the pump.

c. Place the customer supplied control power circuit breaker in the On position.

d. Press F4 on the digital display. The pump should start and run.

e. Observe shaft rotation. Rotation should be clockwise as viewed from above.

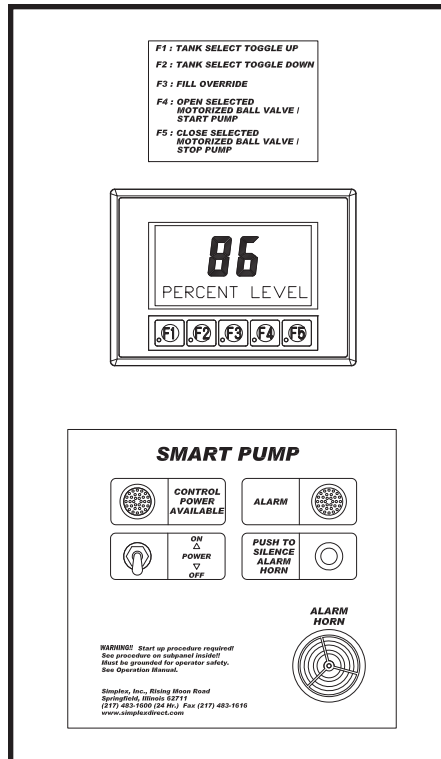
f. If rotation is incorrect:

1. Press the Pump Stop push-button.

2. Ensure the customer supplied control power circuit breaker is Off.

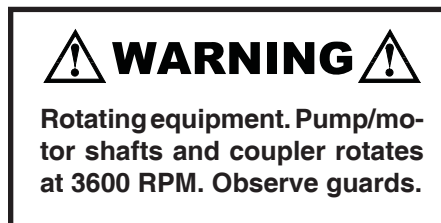
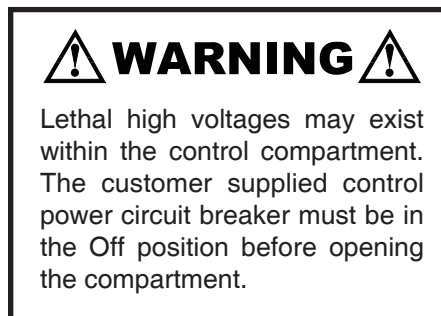
3. Open the Control Panel inner door to access the control compartment.

4. Locate the overload relay, labeled OLR. On either side of the relay, reverse the black and red wires: connect the red wire to line one and the black wire to line two.



5. Close the Control Panel inner door and repeat steps C through E.

g. Place the customer supplied control power circuit breaker to the Off position. Reinstall the shaft guard.



OPERATION

1. Connect a ground cable from the truck to the provided ground stud.
2. Unlock the fill box and connect a delivery hose to the hose coupling.
3. Turn the Control Power switch to the ON position.
4. Select the tank to fill using F1 or F2 on the digital display.
5. Press F4 on the digital display to open the fill valve for the selected tank. (Only one fill valve may be open at a time.)
6. The fill valve opens, and the pump starts.
7. Open the valve on the truck.
8. Start the delivery pump on the truck (if applicable).
9. Fuel is delivered to the tank.
10. Delivery may be stopped at any time by pressing F5 on the digital display to close the fill valve and stop the pump.
11. When the Tank Full level is reached, an alarm will be displayed and the tank fill valve will close. To reopen the valve for 30 seconds, press F3 to override the high fuel level and top off the tank or drain the hose.
12. When the Tank High level is reached, an alarm will be displayed; the fill valve will close and cannot be reopened until the fuel level falls below high level.
13. If any tank in the system reaches the Critical High level, an alarm will be displayed and no fill valves will be allowed to open.
14. During a filling operation, if any tank not selected for filling reaches Full, High or Leak, the selected tank's fill valve will close. At this point the operator can reopen the selected fill valve if desired.
15. Stop the delivery pump on the truck.
16. Close the valve on the truck.
17. Drain the delivery hose.
18. When the filling operation is complete, press F5 to close the fill valve and stop the pump.
19. Disconnect the delivery hose.
20. Turn the Control Power switch to the Off position.
21. Close and lock the fill box.
22. Fuel delivery is complete; disconnect the ground cable from the trucker's grounding stud.

TO DRAIN WITH MOTOR-PUMP

1. Start the pump by pressing F4 on the digital display. If the high fuel alarm is activated, press F3 on the digital display. Override is activated for 30 seconds and can be reactivated until the critical high fuel level is reached.
2. The pump will start. Operate the hand pump to prime the pump.
3. Open the hand pump bypass valve.
4. The pump will empty the spill basin. Note: Full basin will be emptied in about 20 seconds.
5. Stop the pump when the basin is empty by pressing F5 on the digital display.

TANK LEAK ALARM

1. The Tank Leak alarm is activated by a sensor (optional) located within the interstitial space of the double wall above ground tank. Activation of this alarm indicates a leak within the tank that has been captured within the secondary containment of the tank. Relay contacts to annunciate this alarm are provided.

PURGING THE PUMP

Failure to Pump May Be Due to Air in the System

It is necessary to purge the pump of air on initial start-up or whenever air has entered the pump system. Open the SmartPump inlet and outlet valves to flood the system. Open the air purge valve located at the pump discharge then close the valve. The pump should now be purged of air and able to deliver oil.

**WARNING**

Lethal high voltages may exist within the control compartment. The customer supplied control power circuit breaker must be in the Off position before opening the compartment.

**WARNING**

Rotating equipment. Pump/motor shafts and coupler rotates at 3600 RPM. Observe guards.

SPECIFICATIONS**Power**

120VAC or 24VDC (specify),
<100mA

Accuracy

2%

Display

3.1 inch Micro-Graphic
Panel

Resolution

Percent display: 1/10 percent
Gallons/liters display: 1 unit

Temperature range*

Display:
32 - 122°F
0 - 50°C

Transmitter:
-50 - 125°F
-46 - 52°C

*Caution: Do not exceed flash
point of tank contents

TC-25 TANK COMMANDER

The TC-25 Tank Commander is an economical instrument for accurate liquid level indication scaled in percent level for cylindrical and square tanks or in gallons/liters for square tanks only. The TC-25 can be in an open construction suitable for flush panel mounting or in an enclosure for wall mounting.

The TC-25 is for use with Class-II liquids (fuel oils, lubricating oils) only. **Do not use with gasoline or other Class I liquids.**

The TC-25 is a fully electronic device using a submersible level transmitter. The Receiver/Indicator displays tank level on a 1-inch LCD display. Level indication can be scaled in percent level or gallons for square/rectangular tanks.

The Transmitter is installed in a 2-inch NPT or larger pipe fitting in the tank top. The length of the Transmitter is equal to the inside height of the tank and is available for any tank height. Stock transmitters are available for a range of 0-253 in.

Convenient user adjustment potentiometers allow field calibration for specific tank constructions.

The TC-25 is powered from either 120V AC or 24V DC (voltage must be specified when ordering). Refer to electrical drawing.

The TC-25 has a 4-20 mA output linear with fuel level.

INSTALLATION

TRANSMITTER

The Transmitter is mounted on the tank top and must span entire inside height of tank for an accurate measurement (See *Standard Transmitter Drawing*).

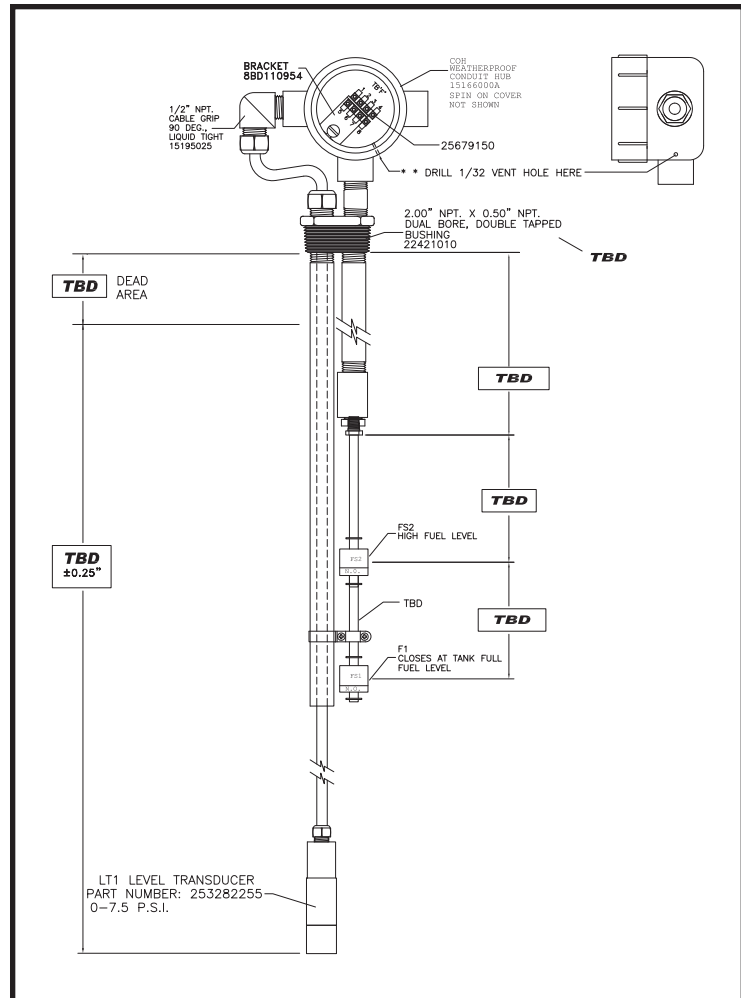
A weatherproof conduit hub with 0.50NPT conduit fittings is provided for electrical connections.

Connection

Using a 3 conductor shielded cable, #20 AWG, connect TC-25 Level Transmitter to terminal block as shown on the electrical drawings.

LEVEL TRANSMITTER OPERATIONAL VERIFICATION

1. Check drawings for changes in specifications (e.g. size of tank, percentage or gallons).
2. If there are no changes in the specifications the unit is ready for a system check.



Standard Transmitter



WARNING

Care must be taken when installing the system. Incorrect wiring will damage the Receiver/Indicator. Follow drawing provided with system for proper installation.

INCHES OF FUEL TO OUTPUT CURRENT CONVERSION CHART

Inches	Feet	mA
0.0	0.00	4.000
0.5	0.04	4.032
1.0	0.08	4.063
1.5	0.13	4.095
2.0	0.17	4.126
2.5	0.21	4.158
3.0	0.25	4.189
3.5	0.29	4.221
4.0	0.33	4.252
4.5	0.38	4.284
5.0	0.42	4.316
5.5	0.46	4.347
6.0	0.50	4.379
6.5	0.54	4.410
7.0	0.58	4.442
7.5	0.63	4.473
8.0	0.67	4.505
8.5	0.71	4.536
9.0	0.75	4.568
9.5	0.79	4.599
10.0	0.83	4.631
10.5	0.88	4.663
11.0	0.92	4.694
11.5	0.96	4.726
12.0	1.00	4.757
12.5	1.04	4.789
13.0	1.08	4.820
13.5	1.13	4.852
14.0	1.17	4.883
14.5	1.21	4.915

Inches	Feet	mA
15.0	1.25	4.947
15.5	1.29	4.978
16.0	1.33	5.010
16.5	1.38	5.041
17.0	1.42	5.073
17.5	1.46	5.104
18.0	1.50	5.136
18.5	1.54	5.167
19.0	1.58	5.199
19.5	1.63	5.230
20.0	1.67	5.262
20.5	1.71	5.294
21.0	1.75	5.325
21.5	1.79	5.357
22.0	1.83	5.388
22.5	1.88	5.420
23.0	1.92	5.451
23.5	1.96	5.483
24.0	2.00	5.514
24.5	2.04	5.546
25.0	2.08	5.578
25.5	2.13	5.609
26.0	2.17	5.641
26.5	2.21	5.672
27.0	2.25	5.704
27.5	2.29	5.735
28.0	2.33	5.767
28.5	2.38	5.798
29.0	2.42	5.830
29.5	2.46	5.861

Inches	Feet	mA
30.0	2.50	5.893
30.5	2.54	5.925
31.0	2.58	5.956
31.5	2.63	5.988
32.0	2.67	6.019
32.5	2.71	6.051
33.0	2.75	6.082
33.5	2.79	6.114
34.0	2.83	6.145
34.5	2.88	6.177
35.0	2.92	6.209
35.5	2.96	6.240
36.0	3.00	6.272
36.5	3.04	6.303
37.0	3.08	6.335
37.5	3.13	6.366
38.0	3.17	6.398
38.5	3.21	6.429
39.0	3.25	6.461
39.5	3.29	6.492
40.0	3.33	6.524
40.5	3.38	6.556
41.0	3.42	6.587
41.5	3.46	6.619
42.0	3.50	6.650
42.5	3.54	6.682
43.0	3.58	6.713
43.5	3.63	6.745
44.0	3.67	6.776
44.5	3.71	6.808

INCHES OF FUEL TO OUTPUT CURRENT CONVERSION CHART CONT'D

Inches	Feet	mA
45.0	3.75	6.840
45.5	3.79	6.871
46.0	3.83	6.903
46.5	3.88	6.934
47.0	3.92	6.966
47.5	3.96	6.997
48.0	4.00	7.029
48.5	4.04	7.060
49.0	4.08	7.092
49.5	4.13	7.123
50.0	4.17	7.155
50.5	4.21	7.187
51.0	4.25	7.218
51.5	4.29	7.250
52.0	4.33	7.281
52.5	4.38	7.313
53.0	4.42	7.344
53.5	4.46	7.376
54.0	4.50	7.407
54.5	4.54	7.439
55.0	4.58	7.471
55.5	4.63	7.502
56.0	4.67	7.534
56.5	4.71	7.565
57.0	4.75	7.597
57.5	4.79	7.628
58.0	4.83	7.660
58.5	4.88	7.691
59.0	4.92	7.723
59.5	4.96	7.754

Inches	Feet	mA
60.0	5.00	7.786
60.5	5.04	7.818
61.0	5.08	7.849
61.5	5.13	7.881
62.0	5.17	7.912
62.5	5.21	7.944
63.0	5.25	7.975
63.5	5.29	8.007
64.0	5.33	8.038
64.5	5.38	8.070
65.0	5.42	8.102
65.5	5.46	8.133
66.0	5.50	8.165
66.5	5.54	8.196
67.0	5.58	8.228
67.5	5.63	8.259
68.0	5.67	8.291
68.5	5.71	8.322
69.0	5.75	8.354
69.5	5.79	8.385
70.0	5.83	8.417
70.5	5.88	8.449
71.0	5.92	8.480
71.5	5.96	8.512
72.0	6.00	8.543
72.5	6.04	8.575
73.0	6.08	8.606
73.5	6.13	8.638
74.0	6.17	8.669
74.5	6.21	8.701

Inches	Feet	mA
75.0	6.25	8.733
75.5	6.29	8.764
76.0	6.33	8.796
76.5	6.38	8.827
77.0	6.42	8.859
77.5	6.46	8.890
78.0	6.50	8.922
78.5	6.54	8.953
79.0	6.58	8.985
79.5	6.63	9.016
80.0	6.67	9.048
80.5	6.71	9.080
81.0	6.75	9.111
81.5	6.79	9.143
82.0	6.83	9.174
82.5	6.88	9.206
83.0	6.92	9.237
83.5	6.96	9.269
84.0	7.00	9.300
84.5	7.04	9.332
85.0	7.08	9.364
85.5	7.13	9.395
86.0	7.17	9.427
86.5	7.21	9.458
87.0	7.25	9.490
87.5	7.29	9.521
88.0	7.33	9.553
88.5	7.38	9.584
89.0	7.42	9.616
89.5	7.46	9.647

INCHES OF FUEL TO OUTPUT CURRENT CONVERSION CHART CONT'D

Inches	Feet	mA
90.0	7.50	9.679
90.5	7.54	9.711
91.0	7.58	9.742
91.5	7.63	9.774
92.0	7.67	9.805
92.5	7.71	9.837
93.0	7.75	9.868
93.5	7.79	9.900
94.0	7.83	9.931
94.5	7.88	9.963
95.0	7.92	9.995
95.5	7.96	10.026
96.0	8.00	10.058
96.5	8.04	10.089
97.0	8.08	10.121
97.5	8.13	10.152
98.0	8.17	10.184
98.5	8.21	10.215
99.0	8.25	10.247
99.5	8.29	10.278
100.0	8.33	10.310
100.5	8.38	10.342
101.0	8.42	10.373
101.5	8.46	10.405
102.0	8.50	10.436
102.5	8.54	10.468
103.0	8.58	10.499
103.5	8.63	10.531
104.0	8.67	10.562
104.5	8.71	10.594

Inches	Feet	mA
105.0	8.75	10.626
105.5	8.79	10.657
106.0	8.83	10.689
106.5	8.88	10.720
107.0	8.92	10.752
107.5	8.96	10.783
108.0	9.00	10.815
108.5	9.04	10.846
109.0	9.08	10.878
109.5	9.13	10.909
110.0	9.17	10.941
110.5	9.21	10.973
111.0	9.25	11.004
111.5	9.29	11.036
112.0	9.33	11.067
112.5	9.38	11.099
113.0	9.42	11.130
113.5	9.46	11.162
114.0	9.50	11.193
114.5	9.54	11.225
115.0	9.58	11.257
115.5	9.63	11.288
116.0	9.67	11.320
116.5	9.71	11.351
117.0	9.75	11.383
117.5	9.79	11.414
118.0	9.83	11.446
118.5	9.88	11.477
119.0	9.92	11.509
119.5	9.96	11.540

Inches	Feet	mA
120.0	10.00	11.572
120.5	10.04	11.604
121.0	10.08	11.635
121.5	10.13	11.667
122.0	10.17	11.698
122.5	10.21	11.730
123.0	10.25	11.761
123.5	10.29	11.793
124.0	10.33	11.824
124.5	10.38	11.856
125.0	10.42	11.888
125.5	10.46	11.919
126.0	10.50	11.951
126.5	10.54	11.982
127.0	10.58	12.014
127.5	10.63	12.045
128.0	10.67	12.077
128.5	10.71	12.108
129.0	10.75	12.140
129.5	10.79	12.171
130.0	10.83	12.203
130.5	10.88	12.235
131.0	10.92	12.266
131.5	10.96	12.298
132.0	11.00	12.329
132.5	11.04	12.361
133.0	11.08	12.392
133.5	11.13	12.424
134.0	11.17	12.455
134.5	11.21	12.487

INCHES OF FUEL TO OUTPUT CURRENT CONVERSION CHART CONT'D

Inches	Feet	mA
135.0	11.25	12.519
135.5	11.29	12.550
136.0	11.33	12.582
136.5	11.38	12.613
137.0	11.42	12.645
137.5	11.46	12.676
138.0	11.50	12.708
138.5	11.54	12.739
139.0	11.58	12.771
139.5	11.63	12.802
140.0	11.67	12.834
140.5	11.71	12.866
141.0	11.75	12.897
141.5	11.79	12.929
142.0	11.83	12.960
142.5	11.88	12.992
143.0	11.92	13.023
143.5	11.96	13.055
144.0	12.00	13.086
144.5	12.04	13.118
145.0	12.08	13.150
145.5	12.13	13.181
146.0	12.17	13.213
146.5	12.21	13.244
147.0	12.25	13.276
147.5	12.29	13.307
148.0	12.33	13.339
148.5	12.38	13.370
149.0	12.42	13.402
149.5	12.46	13.433

Inches	Feet	mA
150.0	12.50	13.465
150.5	12.54	13.497
151.0	12.58	13.528
151.5	12.63	13.560
152.0	12.67	13.591
152.5	12.71	13.623
153.0	12.75	13.654
153.5	12.79	13.686
154.0	12.83	13.717
154.5	12.88	13.749
155.0	12.92	13.781
155.5	12.96	13.812
156.0	13.00	13.844
156.5	13.04	13.875
157.0	13.08	13.907
157.5	13.13	13.938
158.0	13.17	13.970
158.5	13.21	14.001
159.0	13.25	14.033
159.5	13.29	14.064
160.0	13.33	14.096
160.5	13.38	14.128
161.0	13.42	14.159
161.5	13.46	14.191
162.0	13.50	14.222
162.5	13.54	14.254
163.0	13.58	14.285
163.5	13.63	14.317
164.0	13.67	14.348
164.5	13.71	14.380

Inches	Feet	mA
165.0	13.75	14.412
165.5	13.79	14.443
166.0	13.83	14.475
166.5	13.88	14.506
167.0	13.92	14.538
167.5	13.96	14.569
168.0	14.00	14.601
168.5	14.04	14.632
169.0	14.08	14.664
169.5	14.13	14.695
170.0	14.17	14.727
170.5	14.21	14.759
171.0	14.25	14.790
171.5	14.29	14.822
172.0	14.33	14.853
172.5	14.38	14.885
173.0	14.42	14.916
173.5	14.46	14.948
174.0	14.50	14.979
174.5	14.54	15.011
175.0	14.58	15.043
175.5	14.63	15.074
176.0	14.67	15.106
176.5	14.71	15.137
177.0	14.75	15.169
177.5	14.79	15.200
178.0	14.83	15.232
178.5	14.88	15.263
179.0	14.92	15.295
179.5	14.96	15.326

INCHES OF FUEL TO OUTPUT CURRENT CONVERSION CHART CONT'D

Inches	Feet	mA
180.0	15.00	15.358
180.5	15.04	15.390
181.0	15.08	15.421
181.5	15.13	15.453
182.0	15.17	15.484
182.5	15.21	15.516
183.0	15.25	15.547
183.5	15.29	15.579
184.0	15.33	15.610
184.5	15.38	15.642
185.0	15.42	15.674
185.5	15.46	15.705
186.0	15.50	15.737
186.5	15.54	15.768
187.0	15.58	15.800
187.5	15.63	15.831
188.0	15.67	15.863
188.5	15.71	15.894
189.0	15.75	15.926
189.5	15.79	15.957
190.0	15.83	15.989
190.5	15.88	16.021
191.0	15.92	16.052
191.5	15.96	16.084
192.0	16.00	16.115
192.5	16.04	16.147
193.0	16.08	16.178
193.5	16.13	16.210
194.0	16.17	16.241
194.5	16.21	16.273

Inches	Feet	mA
195.0	16.25	16.305
195.5	16.29	16.336
196.0	16.33	16.368
196.5	16.38	16.399
197.0	16.42	16.431
197.5	16.46	16.462
198.0	16.50	16.494
198.5	16.54	16.525
199.0	16.58	16.557
199.5	16.63	16.588
200.0	16.67	16.620
200.5	16.71	16.652
201.0	16.75	16.683
201.5	16.79	16.715
202.0	16.83	16.746
202.5	16.88	16.778
203.0	16.92	16.809
203.5	16.96	16.841
204.0	17.00	16.872
204.5	17.04	16.904
205.0	17.08	16.936
205.5	17.13	16.967
206.0	17.17	16.999
206.5	17.21	17.030
207.0	17.25	17.062
207.5	17.29	17.093
208.0	17.33	17.125
208.5	17.38	17.156
209.0	17.42	17.188
209.5	17.46	17.219

Inches	Feet	mA
210.0	17.50	17.251
210.5	17.54	17.283
211.0	17.58	17.314
211.5	17.63	17.346
212.0	17.67	17.377
212.5	17.71	17.409
213.0	17.75	17.440
213.5	17.79	17.472
214.0	17.83	17.503
214.5	17.88	17.535
215.0	17.92	17.567
215.5	17.96	17.598
216.0	18.00	17.630
216.5	18.04	17.661
217.0	18.08	17.693
217.5	18.13	17.724
218.0	18.17	17.756
218.5	18.21	17.787
219.0	18.25	17.819
219.5	18.29	17.850
220.0	18.33	17.882
220.5	18.38	17.914
221.0	18.42	17.945
221.5	18.46	17.977
222.0	18.50	18.008
222.5	18.54	18.040
223.0	18.58	18.071
223.5	18.63	18.103
224.0	18.67	18.134
224.5	18.71	18.166

INCHES OF FUEL TO OUTPUT CURRENT CONVERSION CHART CONT'D

Inches	Feet	mA
225.0	18.75	18.198
225.5	18.79	18.229
226.0	18.83	18.261
226.5	18.88	18.292
227.0	18.92	18.324
227.5	18.96	18.355
228.0	19.00	18.387
228.5	19.04	18.418
229.0	19.08	18.450
229.5	19.13	18.481
230.0	19.17	18.513
230.5	19.21	18.545
231.0	19.25	18.576
231.5	19.29	18.608
232.0	19.33	18.639
232.5	19.38	18.671
233.0	19.42	18.702
233.5	19.46	18.734
234.0	19.50	18.765
234.5	19.54	18.797
235.0	19.58	18.829
235.5	19.63	18.860
236.0	19.67	18.892
236.5	19.71	18.923
237.0	19.75	18.955
237.5	19.79	18.986
238.0	19.83	19.018
238.5	19.88	19.049
239.0	19.92	19.081
239.5	19.96	19.112

Inches	Feet	mA
240.0	20.00	19.144
240.5	20.04	19.176
241.0	20.08	19.207
241.5	20.13	19.239
242.0	20.17	19.270
242.5	20.21	19.302
243.0	20.25	19.333
243.5	20.29	19.365
244.0	20.33	19.396
244.5	20.38	19.428
245.0	20.42	19.460
245.5	20.46	19.491
246.0	20.50	19.523
246.5	20.54	19.554
247.0	20.58	19.586
247.5	20.63	19.617
248.0	20.67	19.649
248.5	20.71	19.680
249.0	20.75	19.712
249.5	20.79	19.743
250.0	20.83	19.775
250.5	20.88	19.807
251.0	20.92	19.838
251.5	20.96	19.870
252.0	21.00	19.901
252.5	21.04	19.933
253.0	21.08	19.964
253.5	21.13	19.996
254.0	21.17	20.027

SMARTPUMP TOUCHSCREEN OPERATION

1. Main Screen

- F1 / F2 Select tank
 - F3 High level fill override
 - F4 Open valve to selected tank
 - F5 Close valve to selected tank
- To access system setup, press and hold F1+F2+F3

```
TANK1  3000 gal
                    75.0 %
```

2. System Setup

- F1 Access tank setup
- F2 Calibrate transducer (factory set)
- F3 Select PLC Modbus node
- F4 Set PLC analog card type (factory set)
- F5 Enable/disable pump

```
F1 NEXT SCREEN
F2 TRANSDUCER CAL
    139.0 IN@20mA
F3 NODE 1 MODBUS
F4 4-POINT ANALOG
F5 SMARTPUMP NOT USED
```

3. Tank Setup

- F1 Select next tank
- F2 Set tank capacity (0 for tank not used)
- F3 Set tank inside height (0 for tank not used)
- F5 Toggle square tank / round tank / tank not used

```
F1 NEXT SCREEN TANK1
F2 CAPACITY
    4000 GAL
F3 INSIDE HEIGHT
    100 INCHES
F5 SQUARE TANK
```

4. Status Indications

- Critical High Fuel (>95% by float) – Fill Disabled
- High Fuel (>90% by float) – Fill disabled, but may be overridden with F3
- Refill (<55% by transducer)
- Low Fuel (<10% by transducer)

```
TANK1  3800 gal
                    95.0 %
TANK 1 CRIT HIGH
```

```
TANK1  3600 gal
                    90.0 %
TANK 1 HIGH
```

```
TANK1  2200 gal
                    55.0 %
REFILL TANK 1
```

```
TANK1  400 gal
                    10.0 %
TANK 1 LOW
```

APPENDIX A - ABBREVIATIONS USED IN THIS MANUAL

Listed below are abbreviations of terms found on Fuel Supply Systems. When following a drawing utilize this guide to define abbreviated system and component names. As this is a master list, drawings and text pertaining to your equipment may not contain all these terms.

AC -Alternating Current	MOT -Motor
AHR -Alarm Horn Relay	N.C. -Normally Closed
AR -Alarm Horn	NEC -National Electric Code
BPRV -Back Pressure Regulating Valve	NEMA -National Electric Manufacturers Association
BRK -Motor/Pump Bracket	NFPA -National Fire Protection Association
BV -Ball Valve	N.O. -Normally Open
C -Contactor	NP -Nameplate
CB -Circuit Breaker	NPT -National Pipe Thread
CSR -Check Strainer Relay	O.D. -Outside Diameter
CV -Check Valve	OLR -Over Load Relay
DC -Direct Current	OPT -Option
DPDT -Double Pole Double Throw	PCB -Printed Circuit Board
F -Fuse	PCRX -Pump Control Relays
FLS -Flowswitch	PG -Pressure Gauge
FS -Floatswitch	PLR -Pipe Leak Relay
FSR -Simplex Fuel Strainer	PRV -Pressure Relief Valve
GA -Gauge	PS -Pressure Switch
GAL -Gallons	PSI -Pounds Per Square Inch
GPM -Gallons Per Minute	PSR -Pressure Switch Relay
HFL -High Fuel Level Relay	PRR -Pump Running Relay
HG -Mercury	SC -Swing Check Valve
HP -Horsepower	SOL -Solenoid
HZ -Hertz	SST -Simplex Super Tank
I.D. -Inside Diameter	TB -Terminal Block
JB -Junction Box	T -Control Transformer
Hz -Hertz	TDR -Time Delay Relay
INHG -Inches of Mercury	TEFC -Totally Enclosed, Fan Cooled
L -Lamp	THR -Tank Heater Control Relay
L.E.D. -Light Emitting Diode	TS -Transducer Pressure Switch
LAFD -Los Angeles Fire Department	V -Voltage
LFF -Loss of Flow Relay	VAC -Voltage, Alternating Current
LFL -Low Fuel Level Relay	VDC -Voltage, Direct Current
LPR -Low Pressure Relay	VG -Vacuum Gauge
MDB -Main Distribution Block	
MDS -Main Disconnect Switch	

APPENDIX B - TECHNICAL DATA

Thermal expansion of oil is approximately 1 cubic inch per 1 gallon per 10°F rise in temperature.

Hydraulic Formulas

$$\text{Horsepower} = \frac{\text{GPM} \times \text{PSI}}{1714}$$

$$\text{Torque (lb. in.)} = \frac{\text{CU IN./REV.} \times \text{PSI}}{2}$$

$$\text{Torque (lb. in.)} = \frac{\text{HP} \times 63025}{\text{RPM}}$$

$$\text{Flow (gpm)} = \frac{\text{CU IN./REV} \times \text{RPM}}{231}$$

Head and Pressure Equivalents

When converting pressure from feet of water to P.S.I., the specific gravity of the liquid must be considered.

Here are some typical conversion figures:

1 P.S.I.=2.30 feet of water
(specific gravity 1.0)

1 P.S.I.=2.88 feet of oil
(specific gravity 0.8)

Conversion Factors

1HP = 33,000 ft. lbs. per minute
1HP = 42.4 btu per minute
1HP = 0.746 kw/hr (kilowatt hours)

1 U.S. gallon= 231 cubic inches

Pipe Volume varies as the square of the diameter; volume in gallons = 0.0034 D² L where:
D=inside diameter of pipe in inches;
L=length in inches

Velocity in feet per sec.= $\frac{0.408 \times \text{flow (gpm)}}{D^2}$

where:
D=inside diameter of pipe in inches

Atmospheric pressure at sea level = 14.7PSI
Atmospheric pressure decreases approximately 0.41PSI for each one thousand feet of elevation up to 23,000 feet.

Pressure (PSI) = feet head x 0.433 x specific gravity

Specific gravity of oil is approximately 0.85.

PRESSURE AND CONVERSION TABLE		
Feet Water	PSI Oil	PSI Water
1	.35	.43
2	.70	.87
3	1.05	1.3
4	1.4	1.73
5	1.75	2.17
10	3.5	4.33
15	5.2	6.5
20	7.0	8.66
25	8.7	10.8
30	10.5	13.0
35	12.2	15.2
40	14.0	17.3
45	15.7	19.5
50	17.5	21.7
55	19.2	23.9
60	21.0	26.0
65	22.7	28.1
70	24.5	30.5
75	26.2	32.5
80	28.0	34.6
85	29.7	36.8
90	31.5	39.0

SUPER X-L PUMP

PUMP MODEL	DISPLACEMENT IN ³ (CC/REV.)	RPM	Flow, GPM (LPM)				
			100 PSI (6.9 Bar)	1000 PSI (69 Bar)	1500 PSI (103 Bar)	2000 PSI (138 Bar)	2500 PSI (172 Bar)
SUPER XL-11	.262 (4.29)	1800	1.99 (7.54)	1.86 (7.05)	1.79 (6.78)	1.73 (6.56)	1.66 (6.29)
SUPER XL-39	.942 (15.44)	1800	7.08 (26.83)	6.87 (26.04)	6.77 (25.66)	6.66 (25.24)	6.56 (24.86)
SUPER XL-62	1.47 (24.14)	1800	11.10 (42.07)	10.81 (40.97)	10.70 (40.55)	10.60 (40.17)	10.40 (39.42)
SUPER XL-90	2.23 (36.5)	1800	16.70 (63.29)	16.50 (62.54)	16.30 (61.78)		
SUPER XL-114	3.35 (54.9)	1800	25.30 (95.89)	24.90 (94.37)	24.60 (93.23)	24.40 (92.48)	

PUMP PERFORMANCE DATA 40 SSU • 200 SSU • 500SSU (SERIES 420)

		40SSU						200SSU											
		0 PSI		50 PSI		100 PSI		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI	
MODEL	RPM	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
420	1200	1.9	¼	1.7	¼	1.5	⅓	1.9	⅛	1.9	⅛	1.7	¼	1.5	⅓	1.4	½	1.2	¾
	1800	2.9	¼	2.7	½	2.5	½	2.9	⅛	2.8	¼	2.7	⅓	2.5	½	2.3	¾	2.1	1½
422	1200	3.7	⅓	3.4	½	3.1	¾	3.7	⅛	3.4	¼	3.1	¼	2.8	½	3.0	1	2.8	1½
	1800	5.4	½	4.9	¾	4.8	1	5.5	¼	4.9	⅓	4.9	½	4.6	¾	4.3	1½	3.8	2
424	1200	9.0	¼	7.6	¾	6.0	1	9.0	⅓	8.6	½	8.2	1	7.7	2	7.1	3	-	-
	1800	11.5	⅓	11.1	1	10.7	1½	13.7	½	13.3	1	12.9	1½	10.9	3	10.2	5	-	-
426	1200	10.0	¾	8.2	1	6.3	1½	12.0	¾	11.0	1	10.5	1½	-	-	-	-	-	-
	1800	15.0	1	12.2	1½	9.5	3	18.0	1	17.0	1½	16.0	3	-	-	-	-	-	-
428	1200	20.9	¾	17.4	1½	14.0	3	24.5	¾	23.8	1½	23.0	3	-	-	-	-	-	-
	1800	31.2	1½	26.1	3	21.0	5	37.0	1½	36.0	3	35.0	5	-	-	-	-	-	-
429	1200	34.0	1½	29.0	3	22.0	5	41.0	1½	40.0	3	38.5	5	-	-	-	-	-	-
	1800	53.0	3	45.0	5	36.0	7½	61.7	3	61.0	5	60.0	7½	-	-	-	-	-	-

		500SSU											
		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI	
MODEL	RPM	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
420	1200	1.8	⅛	1.8	⅛	1.7	¼	1.6	⅓	1.4	½	1.1	1
	1800	2.7	¼	2.7	¼	2.6	⅓	2.5	½	2.4	1	2.2	1½
422	1200	3.6	⅛	3.5	¼	3.3	⅓	2.8	½	2.7	¾	2.0	1½
	1800	5.3	¼	5.2	⅓	4.9	½	4.4	1	4.0	1½	3.0	2
424	1200	8.7	½	8.6	¾	8.5	1½	8.2	2	7.8	3	-	-
	1800	2.9	1	12.8	1½	12.7	2	12.5	3	12.0	5	-	-
426	1200	12.0	1	11.5	1½	11.0	2	-	-	-	-	-	-
	1800	18.1	1½	18.0	2	16.3	3	-	-	-	-	-	-
428	1200	24.5	1½	24.0	2	23.7	3	-	-	-	-	-	-
	1800	37.0	3	36.5	5	36.0	5	-	-	-	-	-	-
429	1200	41.0	2	40.0	5	39.5	5	-	-	-	-	-	-
	1800	61.7	5	61.0	5	60.0	7½	-	-	-	-	-	-

PUMP PERFORMANCE DATA 1000 SSU • 5000 SSU • 10000SSU (SERIES 420)

		1000SSU											
		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI	
MODEL	RPM	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
420	1200	1.9	1/8	1.9	1/8	1.8	1/4	1.7	1/3	1.6	1/2	1.4	3/4
	1800	2.8	1/4	2.7	1/4	2.7	1/4	2.6	1/2	2.5	3/4	2.2	1 1/2
422	1200	3.5	1/4	3.4	1/4	3.3	1/3	3.0	3/4	2.6	3/4	1.8	1 1/2
	1800	5.0	1/3	4.9	1/2	4.9	3/4	4.7	1	4.2	1 1/2	3.4	2
424	1200	8.8	3/4	8.7	1	8.5	1 1/2	8.2	2	7.8	3	-	-
	1800	13.0	1 1/2	12.7	2	12.5	2	10.2	3	9.9	5	-	-
426	1200	12.5	1 1/2	12.0	1 1/2	11.8	2	-	-	-	-	-	-
	1800	18.7	2	18.5	2	17.0	3	-	-	-	-	-	-
428	1200	24.9	2	24.5	3	24.0	5	-	-	-	-	-	-
	1800	37.4	5	37.2	5	36.5	5	-	-	-	-	-	-
429	1200	41.7	3	41.7	5	41.0	5	-	-	-	-	-	-
	1800	61.7	5	61.7	7 1/2	61.0	7 1/2	-	-	-	-	-	-

		5000SSU									10000SSU						
		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		0 PSI		50 PSI		100 PSI	
MODEL	RPM	PM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
420	1200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
422	1200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
424	1200	8.2	1	8.0	1 1/2	7.8	2	7.6	3	7.4	3	-	-	-	-	-	-
	1800	11.2	2	11.0	3	10.7	3	10.2	5	9.9	5	-	-	-	-	-	-
426	1200	12.5	2	12.4	2	11.6	3	-	-	-	-	-	-	-	-	-	-
	1800	18.7	3	18.5	3	17.5	5	-	-	-	-	-	-	-	-	-	-
428	1200	24.9	5	24.9	5	24.5	5	-	-	-	-	23.3	5	23.0	5	22.8	5
	1800	37.4	7 1/2	37.4	7 1/2	37.0	7 1/2	-	-	-	-	-	-	-	-	-	-
429	1200	41.7	5	41.0	5	40.0	7 1/2	-	-	-	-	-	-	-	-	-	-
	1800	61.7	7 1/2	61.7	7 1/2	61.0	10	-	-	-	-	-	-	-	-	-	-

MOTORS FOR PUMP DRIVE *CONTINUOUS DUTY, 40°C, UL RECOGNIZED***Single Phase Motors**

Split Phase Start, Drip Proof, Rigid Base, Class B
Insulation, Moderate Starting Torque, Sleeve Bearing

HP	RPM	Voltage	NEMA Frame	Bearing	Thermal Prot.	Service Factor	Approx. F.L. Amps
1/3	1800	115	48	Sleeve	Auto	1.0	6.6
1/2	1800	115	56	Sleeve	None	1.0	9.2

Capacitor Start, Drip Proof, Rigid Base, Class B Insulation,
High Starting Torque, Ball Bearing

HP	RPM	Voltage	NEMA Frame	Bearing	Thermal Prot.	Service Factor	Approx. F.L. Amps
1/3	1800	115/230	48	Sleeve	Auto	1.0	7.0/3.5
1/2	1800	115/230	56	Sleeve	Auto	1.0	9.2/4.6
3/4	1800	115/230	56	Sleeve	Auto	1.0	10.4/5.2

Capacitor Start, Drip Proof, Rigid Base, Class B Insulation,
Moderate Starting Torque, Sleeve Bearing

HP	RPM	Voltage	NEMA Frame	Thermal Prot.	Service Factor	Approx. F.L. Amps
1	1800	115/208-230	56	Auto	1.15	13.4/6.8-6.7
1 1/2	1800	115/208-230	56H	Auto	1.15	18.0/9.3-9.0
2	1800	115/208-230	145T	None	1.15	21.0/11.3-10.5
3	1800	115/208-230	184T	None	1.15	33.0/16.5
5	1800	208-230	184T	None	1.15	23.0-21.0
7 1/2	1800	208-230	215T	None	1.15	35.2

Capacitor Start, Totally Enclosed, Fan-Cooled, Rigid
Base, Class B Insulation, NEMA-L (>1.0 HP) High Starting
Torque, Ball Bearing

HP	RPM	Voltage	NEMA Frame	Thermal Prot.	Service Factor	Approx. F.L. Amps
1/3	1800	115/208-230	56	Auto	1.15	6.6/3.1-3.3
1/2	1800	115/208-230	56	Auto	1.15	8.8/4.2-4.4
3/4	1800	115/208-230	56	Auto	1.15	11.0/5.4-5.5
1	1800	115/208-230	56	Auto	1.15	13.4/6.8-6.7
1 1/2	1800	115/208-230	56H	Auto	1.15	15.2/8.2-7.6
2	1800	115/208-230	145T	None	1.15	18.8/9.4
3	1800	115/208-230	184T	None	1.0	34.0/17.0
5	1800	208-230	213T	None	1.0	27.5-26.0
7 1/2	1800	208-230	215T	None	1.0	36.5-33.0

MOTORS FOR PUMP DRIVE *CONTINUOUS DUTY, 40°C, UL RECOGNIZED*

Three Phase Motors

Drip Proof, Rigid Base, Class B Insulation, NEMA B, High Starting Torque, Ball Bearing

HP	RPM	Voltage	NEMA Frame	Thermal Prot.	Service Factor	Approx. F.L. Amps
1/3	1800	208-230/460	56	Auto	1.35	1.5-1.6/0.8
1/2	1800	208-230/460	56	Auto	1.35	2.3-2.4/1.2
3/4	1800	208-230/460	56	Auto	1.25	2.9-3.0/1.5
1	1800	208-230/460	56	Auto	1.15	3.5-3.6/1.8
1 1/2	1800	208-230/460	145T	Auto	1.15	4.8-4.8/2.4
2	1800	208-230/460	145T	Auto	1.15	6.2-6.2/3.1
3	1800	208-230/460	145T	Auto	1.15	9.2-8.6/4.3
5	1800	230/460	184T	Auto	1.15	13.2/6.6
7 1/2	1800	230/460	213T	Auto	1.15	20.0/10.0
10	1800	230/460	215T	Auto	1.15	26.6/13.3

Totally Enclosed-Fan-Cooled, Rigid Base, Class B Insulation, Class F (182T -254T), NEMA B, High Starting Torque

HP	RPM	Voltage	NEMA Frame	Approx. F.L. Amps
1/3	1800	208-230/460	56	1.5-1.6/0.8
1/2	1800	208-230/460	56	2.3-2.4/1.2
3/4	1800	208-230/460	56	2.9-3.0/1.5
1	1800	208-230/460	56	3.5-3.6/1.8
1 1/2	1800	208-230/460	145T	4.8-4.8/2.4
2	1800	208-230/460	145T	6.0-5.8/2.9
3	1800	208-230/460	145T	8.6/4.3
5	1800	230/460	184T	14.0-13.2/6.6
7 1/2	1800	230/460	213T	21.0-20.0/10.0
10	1800	230/460	215T	28.0-27.0/13.5

DC Motors - Ampere Ratings and Fuse Sizes

Motors HP	Ratings of DC Motors Full-Load Amperes		Amp. Cap. of Fuses for Recommended Values	
	120 Volts	240 Volts	120 Volts	240 Volts
1/8	1.4	.7	3	3
1/6	1.8	.9	3	3
1/4	2.9	1.5	5	3
1/3	3.6	1.8	5	3
1/2	5.2	2.6	7	3
3/4	7.4	3.7	10	5
1	9.4	4.7	15	7
1 1/2	13.2	6.6	20	10
2	17	8.5	25	12
3	25	12.2	30	15
5	40	20	50	25
7 1/2	58	29	80	40
10	76	38	100	50

Pipe Friction- Fuel Oil 2

Pressure Drop in PSI per 100 feet of Pipe and Tube

NOMINAL SIZES - INSIDE DIAMETERS								
Pipe Size, In.	2.0 GPM	7.0 GPM	10.0 GPM	17.0 GPM	23.0 GPM	30. GPM	40.0 GPM	50.0 GPM
.50	2.337	24.65	56.10	148.75	233.75	408.00		
.75		3.61	7.31	21.25	39.53	64.6	93.5	182.75
1.00	.306	2.00	4.16	11.70	19.55	31.87	54.40	80.75
1.25	.10	.51	1.00	2.55	5.10	8.50	14.88	22.10
1.5		.23	.425	1.10	2.04	3.27	5.70	8.33
2.00			.13	.34	.60	.96	3.10	2.38
2.50			.10	1.62	.30	.51	.94	1.275
3.00					.10	1.74	3.06	4.93

NOTE: Pipe sizes shown apply to standard weight schedule 40 pipe.
Tube is standard copper tubing

FLAMMABLE LIQUIDS FLASH POINTS

Excerpts from NFPA 325, "Fire Hazards properties of Flammable Liquids..."

	Flash Points °F(°C)
Diesel Fuel Oil No. 1-D	100 Min. (38) or Legal
Diesel Fuel Oil No. 2-D	125 Min. (52) or Legal
Diesel Fuel Oil No. 4-D	130 Min. (54) or Legal
Fuel Oil No. 1 (Kerosene) (Range Oil) (Coal Oil)	100-162 (43-72)
Fuel Oil No.2	126-204 (52-96)
Fuel Oil No. 4	142-240 (61-116)
Fuel Oil No. 5 Light Fuel Oil No. 5 Heavy	156-336 (69-169) 160-250 (71-121)
Fuel Oil No. 6	150-270 (66-132)
Jet Fuels Jet A and A-1	110-150 (43-66)
Jet Fuels Jet B	-10 to +30 (-23 to -1)
Jet Fuels JP-4	-10 to +30 (-23 to -1)
Jet Fuels JP-5	95-145 (35-63)

Specific Gravity and Viscosity of Oils

Oils	*Specify Gravity At 60°F	Viscosities In SSU at Various Temperatures							
		30°F	60°F	80°F	100°F	130°F	170°F	210°F	250°F
Auto Lubricating S.A.E.-									
10 Max.	.880 to .935	4,400	1,090	430	240	120	66		
20 Max.	.880 to .935	6,900	1,650	750	400	185	90	57	
30 Max.	.880 to .935	13,000	2,700	1,200	580	255	120	66	49
40	.880 to .935	25,000	4,850	2,000	950	380	150	80	55
50	.880 to .935	58,000	10,000	3,700	1,600	600	220	105	67
60	.880 to .935	100,000	15,000	5,300	2,300	800	285	128	76
70	.880 to .935		22,000	7,500	3,100	1,050	342	150	86
10W	.880 to .935								
20W	.880 to .935								
Fuel Oil-									
Diesel No. 2D	.82 to .95	138	70	53.6	45.5	39			
Diesel No. 3D	.82 to .95	390	145	92	65	48	39		
Diesel No. 4D	.82 to .95	4,400	700	280	140	70	44.2		
Diesel No. 5D	.82 to .95	16,500	3,500	1,500	750	320	136	76.5	54
No. 1	.82 to .95				35				
No. 2	.82 to .95	104	56	45.5	40				
No. 3	.82 to .95	126	68	53	45	39			
No. 5A	.82 to .95	1,480	420	215	125	72	48		
No. 5B	.82 to .95	850	600	490	400	315	235	178	141
No. 6	.82 to .95		72,000	21,500	7,800	2,150	590	225	110
Navy Spec.	.989 Max.	3,300	1,100	600	360	190	100	66	50.2
Navy II	1.0 Max.		24,000	8,600	3,500	1,150	370	160	89
Turbine-									
Heavy	.91 Avg.	4,800	1,280	625	350	170	86	57	
Light	.91 Avg.	770	330	208	138	87	58.8		