APPLICATION MANUAL

FARADYNE MOTORS

A higher standard in submersible motors.

FARADYNE
MOTORS

INDEX

MOTOR STORAGE

Water lubricated 4" motors are filled with a non-toxic Propylene Glycol and water solution to prevent damage from freezing temperatures. We recommend storing 4" motors where temperatures are above 0° F. If stored in colder temperatures (down to -40° F) the fill solution will become slushy. In this case, the motor should be allowed to sit in the well for several minutes before being operated. If stored in an area where temperatures range from freezing to over 100° F, some fill solution may be expelled from the motor. If the leakage appears significant, we suggest installing (submerging) the motor for 10 minutes before starting, allowing the check valve to replace the lost fluid.

When removing a used motor from a well, it must be protected from freezing, as it may have taken on well water and no longer have enough Propylene Glycol in solution to prevent freezing.

Coolant Leakage: during storage or shipment, it is common for some coolant/fluid to leak from the motors. This should not be a concern. The filtered check valve will refill the motor upon submergence in a well. If leakage appears extraordinary or you are concerned, please call the nearest factory customer service number found on the back cover of this manual for further instructions.

FREQUENCY OF STARTS

A one (1) minute minimum run cycle for pumps and motors up to 1.5 HP and two (2) minutes for 2 HP and larger motors is recommended. Motor, pressure switch, tank and pump life may be extended by limiting starts per hour and per day. Proper tank sizing is critical to control pump cycle times. Excessive or rapid cycling creates heat which can prematurely damage motors, switches and controls.

MOTOR INSTALLATION POSITION

Best service life is obtained when motors are installed in a vertical position. The shaft end should be at least 15° higher than the bottom of the motor. This places some weight on the thrust bearing, which helps to prevent thrust bearing coast down wear as the motor slows down. When installed in near horizontal installations, we recommend keeping starts to a minimum and maintaining back pressure (head) on the system. Even when installed vertically, operating pumps at open discharge with little or no head (to the far right of the pump curve) may create excessive upward thrust, which may damage the motor's upward thrust bearing and internal pump parts. In applications with high static water levels or little system head, a throttling valve should always be used in the discharge line to create back pressure (head) on the pump and bearing.

CONTROL BOX MOUNTING

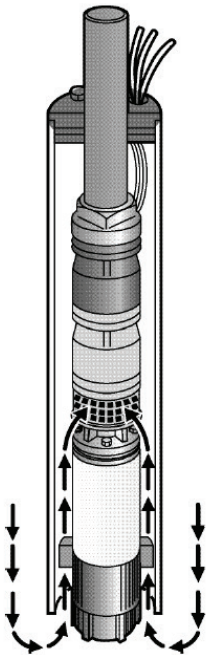
Single Phase submersible control boxes feature NEMA 3R enclosures for indoor or outdoor mounting. They should be mounted in a vertical position as relay manufacturers recommend for proper, trouble-free operation.

Control boxes should be shaded from direct sunlight in areas where temperatures exceed 90° F, as excessive heat may shorten capacitor life. It is advisable to paint the enclosure white if exposed to intense sun light.

MOTOR COOLING AND TEMPERATURE RATINGS

All 4" Faradyne Motors may be operated continuously in water up to 86° F. Optimum service life will be attained by maintaining a minimum water flow rate of 0.25 feet per second passing the motor. Use a Flow Sleeve if water flow rate is below 0.25 feet per second, the well is top feeding or when the pump is used in a large body of water or large tank.

MINIMUM FLOW RATES FOR PROPER MOTOR COOLING



Flow Sleeve

Well or Sleeve Diameter (Inches)	3.75" Diameter 4" Faradyne or FE Motor .25'/sec
	GPM Required
4	1.2
5	7
6	13
7	20
8	30
10	50
12	80
14	110
16	150

Multiply GPM by .2271 for m^3/Hr.
Multiply GPM by 3.785 for L/min.

2-WIRE PREMIUM MOTOR DATA

Single Phase, 2-Wire Premium PSC 4" Motors - Electrical Data 60 Hertz, 3450 RPM

Type	Motor Catalog No. Faradyne	HP	KW	Volts	SF	Full Load Amps	Full Load Watts	Service Factor Amps	Service Factor Watts	Locked Rotor Amps	Winding Resistance
2-Wire (PSC) Premium	FM4200511A-01	0.5	0.37	115	1.6	8.1	890	10.2	1110	28	1.4 - 2.0
	FM4200531A-01	0.5	0.37	230	1.6	4.3	845	4.8	1035	16	6.1 - 7.2
	FM4200731A-01	0.75	0.55	230	1.5	5	1100	6.4	1375	18	5.9 - 6.9
	FM4201031A-01	1	0.75	230	1.4	6.7	1450	8.2	1770	23.5	4.2 - 5.2
	FM4201531A-01	1.5	1.1	230	1.3	9.1	1950	10.5	2300	43	1.8 - 2.4

Single Phase, 2-Wire Premium PSC 4" Motors - Engineering Data

Type	Motor Catalog No. Faradyne	HP	Volts	Efficiency % F.L.	Efficiency % S.F.	Power Factor % F.L.	Power Factor % S.F.	Thrust Rating	KVA Code
2-Wire (PSC) Premium	FM4200511A-01	0.5	0.37	42	54	99	99	700	H
	FM4200531A-01	0.5	0.37	44	58	90	96.5	700	J
	FM4200731A-01	0.75	0.55	51	61	99	98.5	700	F
	FM4201031A-01	1	0.75	51.5	59	99	99	700	F
	FM4201531A-01	1.5	1.1	57.5	63	98	99	700	H

2-Wire - Premium Fuse and Circuit Breaker Amps

Type	Motor Order Number Faradyne	HP	Volts	Fuse or Circuit Breaker Amps: Standard Fuse	Dual Element Time Delay	Circuit Breaker
2-Wire (PSC) Premium	FM4200511A-01	0.5	115	25	15	20
	FM4200531A-01	0.5	230	15	10	10
	FM4200731A-01	0.75	230	15	10	15
	FM4201031A-01	1	230	20	15	20
	FM4201531A-01	1.5	230	30	20	25

2-WIRE STANDARD MOTOR DATA

Single Phase, 2-Wire Standard PSC 4" Motors - Electrical Data 60 Hertz, 3450 RPM

Type	Motor Catalog No. Faradyne	HP	KW	Volts	SF	Full Load Amps	Full Load Watts	Service Factor Amps	Service Factor Watts	Locked Rotor Amps	Winding Resistance
2-Wire (PSC) Standard	FM4200511-E	0.5	0.37	115	1.6	8.4	880	10	1090	25	2.0 - 2.5
	FM4200531-E	0.5	0.37	230	1.6	4.2	870	5.1	1050	14	7.2 - 8.8
	FM4200731-E	0.75	0.55	230	1.5	4.8	1040	6.1	1325	17	5.7 - 7.1
	FM4201031-E	1	0.75	230	1.4	7	1570	8	1820	22	4.7 - 5.8
	FM4201531-E	1.5	1.1	230	1.3	9	1980	10.6	2350	34	2.7 - 3.3

Single Phase, 2-Wire Standard PSC 4" Motors - Engineering Data

Type	Motor Catalog No. Faradyne	HP	Volts	Efficiency % F.L.	Efficiency % S.F.	Power Factor % F.L.	Power Factor % S.F.	Thrust Rating	KVA Code
2-Wire (PSC) Standard	FM4200511-E	0.5	0.37	42.5	55	98	99	700	G
	FM4200531-E	0.5	0.37	43	57	92	97	700	H
	FM4200731-E	0.75	0.55	54	63.5	99	99	700	F
	FM4201031-E	1	0.75	47.5	57.5	99	99	700	E
	FM4201531-E	1.5	1.1	56.5	62	99	99	700	F

2-Wire Standard - Fuse and Circuit Breaker Amps

Type	Motor Order Number Faradyne	HP	Volts	Fuse or Circuit Breaker Amps Standard Fuse	Dual Element Time Delay	Circuit Breaker
2-Wire (PSC) Standard	FM4200511-E	0.5	115	25	15	20
	FM4200531-E	0.5	230	15	10	10
	FM4200731-E	0.75	230	15	10	15
	FM4201031-E	1	230	20	15	20
	FM4201531-E	1.5	230	30	20	25

3-WIRE PREMIUM MOTOR DATA

Single Phase, 3-Wire Premium 4" Motors - Electrical Data 60 Hertz, 3450 RPM

Type	Motor Catalog No.	HP	KW	Volts	SF	Full Load		Service Factor		Locked Rotor Amps	Winding Resistance		Required Control Box
	Faradyne					Amps (B or Y/B/R)	Watts	Amps (B or Y/B/R)	Watts		Main (B-Y)	Start (R-Y)	
3-Wire Premium with CSIR Cap. Start Box	FM4300511A-01	0.5	0.37	115	1.6	9.8/9.8/0	670	11.6/11.6/0	980	44	1.0 - 1.4	2.5 - 3.1	FM005CB-IR1
	FM4300531A-01	0.5	0.37	230	1.6	5.7/5.7/0	735	6.3/6.3/0	1035	20.5	5.1 - 6.1	12.4 - 13.7	FM005CB-IR2
	FM4300731A-01	0.75	0.55	230	1.5	6.7/6.7/0	940	7.9/7.9/0	1335	32	2.6 - 3.3	10.4 - 11.7	FM007CB-IR2
	FM4301031A-01	1	0.75	230	1.4	8.5/8.5/0	1175	9.5/9.5/0	1590	41	2.0 - 2.6	9.3 - 10.4	FM010CB-IR2
3-Wire Premium with CSCR or Magnetic Contractor Deluxe Control Box	FM4300531A-01	0.5	0.37	230	1.6	4.4/4.3/1.9	715	5.0/4.5/1.9	950	21	5.1 - 6.1	12.4 - 13.7	FM005CB-CR2
	FM4300731A-01	0.75	0.55	230	1.5	4.6/4.6/2.6	920	6.1/5.1/2.6	1235	32	2.6 - 3.3	10.4 - 11.7	FM007CB-CR2
	FM4301031A-01	1.00	0.75	230	1.4	6.2/6.0/3.6	1165	7.4/6.3/3.3	1490	41	2.0 - 2.6	9.3 - 10.4	FM010CB-CR2
	FM4301531A-01	1.5	1.1	230	1.3	9.2/8.7/1.2	1660	11.0/9.9/1.2	2110	49	2.1 - 2.5	10.0 - 10.8	FM015CB-CR2
	FM4302031A	2	1.5	230	1.25	9.9/9.1/2.6	2170	12.2/11.7/2.6	2660	49	1.6 - 2.2	4.8 - 5.9	FM020CB-CR2
	FM4303031A	3	2.2	230	1.15	14.3/12.0/5.7	3170	16.5/13.9/5.6	3620	76	1.0 - 1.4	2.0 - 2.5	FM030CB-CR2
	FM4305031A	5	3.7	230	1.15	24/19.1/10.2	5300	27.0/22.0/10.0	6030	101	.6 - .8	1.3 - 1.7	FM050CB-CR2

Single Phase, 3-Wire Premium 4" Motors - Engineering Data

Type	Motor Catalog No.	HP	Volts	Efficiency %		Power Factor %		Thrust Rating	KVA Code
	Faradyne			F.L.	S.F.	F.L.	S.F.		
3-Wire Premium with CSIR Cap. Start Box	FM4300511A-01	0.5	115	55.5	61.0	63.0	77.0	700	M
	FM4300531A-01	0.5	230	51.0	58.0	60.0	75.0	700	L
	FM4300731A-01	0.75	230	60.0	63.0	64.0	78.0	700	L
	FM4301031A-01	1	230	63.5	66.0	63.0	76.0	700	L
3-Wire Premium with CSCR or Magnetic Contractor Deluxe Control Box	FM4300531A-01	0.5	230	52.0	63.0	75.0	86.0	700	L
	FM4300731A-01	0.75	230	61.0	68.0	86.0	93.0	700	L
	FM4301031A-01	1.00	230	64.0	70.0	85.0	91.0	700	L
	FM4301531A-01	1.5	230	68.0	69.0	82.0	87.0	700	J
	FM4302031A	2	230	68.0	69.0	96.0	95.0	900	G
	FM4303031A	3	230	72.0	72.0	96.0	97.0	900	G
	FM4305031A	5	230	70.5	71.0	97.0	97.5	1500	E

3-WIRE STANDARD MOTOR DATA

Single Phase, 3-Wire Standard 4" Motors - Electrical Data 60 Hertz, 3450 RPM

Type	Motor Catalog No.	HP	KW	Volts	SF	Full Load		Service Factor		Locked Rotor Amps	Winding Resistance		Required Control Box
	Faradyne					Amps (B or Y/B/R)	Watts	Amps (B or Y/B/R)	Watts		Main (B-Y)	Start (R-Y)	
3-Wire (CSIR) Standard	FM4300511-E	0.5	0.37	115	1.6	9.0/9.0/0	690	11.0/11.0/0	1020	41	1.5 - 1.9	3.1 - 3.9	FM005CB-IR1
	FM4300531-E	0.5	0.37	230	1.6	4.8/4.8/0	720	5.6/5.6/0	1055	18	6.2 - 7.7	13.0 - 16.0	FM005CB-IR2
	FM4300731-E	0.75	0.55	230	1.5	6.2/6.2/0	980	7.4/7.4/0	1390	29	4.0 - 4.9	9.5 - 11.6	FM007CB-IR2
	FM4301031-E	1.0	0.75	230	1.4	7.4/7.4/0	1235	9.0/9.0/0	1670	39	3.3 - 4.1	11.9 - 14.6	FM010CB-IR2
3-Wire (CSCR) Standard	FM4300531-E	0.5	0.37	230	1.6	3.7/3.6/1.7	690	4.6/4.4/1.6	950	18	6.2 - 7.7	13.0 - 16.0	FM005CB-CR2
	FM4300731-E	0.75	0.55	230	1.5	4.9/4.8/2.8	1000	6.1/5.5/2.6	1300	29	4.0 - 4.9	9.5 - 11.6	FM007CB-CR2
	FM4301031-E	1.0	0.75	230	1.4	5.7/5.2/3.0	1185	7.1/5.9/2.9	1495	39	3.3 - 4.1	11.9 - 14.6	FM010CB-CR2
	FM4301531-E	1.50	1.1	230	1.3	8.9/8.5/1.3	1685	10.7/10.4/1.2	2170	43	2.6 - 3.3	8.0 - 9.8	FM015CB-CR2

Single Phase, 3-Wire Standard 4" Motors - Engineering Data

Type	Motor Catalog No.	HP	Volts	Efficiency %		Power Factor %		Thrust Rating	KVA Code
	Faradyne			F.L.	S.F.	F.L.	S.F.		
3-Wire (CSIR) Standard	FM4300511-E	0.5	115	54.0	58.5	68.0	82.0	700	L
	FM4300531-E	0.5	230	52.0	56.5	66.0	81.0	700	K
	FM4300731-E	0.75	230	57.0	60.5	69.0	81.0	700	K
	FM4301031-E	1.0	230	60.5	62.5	74.0	82.0	700	K
3-Wire (CSCR) Standard	FM4300531-E	0.5	230	54.0	63.0	85.0	94.0	700	K
	FM4300731-E	0.75	230	56.0	64.5	91.0	96.0	700	K
	FM4301031-E	1.0	230	63.0	70.0	92.0	95.0	700	K
	FM4301531-E	1.50	230	66.5	67.0	84.0	89.0	700	H

3-WIRE MOTOR DATA

3-Wire Premium - Fuse and Circuit Breaker Amps

Type	Motor Order Number	HP	Volts	Fuse or Circuit Breaker Amps		
	Faradyne			Standard Fuse	Time Delay	Circuit Breaker
3-Wire Premium with CSIR Cap. Start Box	FM4300511A-01	0.5	115	30	20	30
	FM4300531A-01	0.5	230	20	10	15
	FM4300731A-01	0.75	230	20	15	20
	FM4301031A-01	1.0	230	25	15	25
3-Wire Premium with CSCR or Magnetic Contractor Deluxe Control Box	FM4300531A-01	0.5	230	15	10	10
	FM4300731A-01	0.75	230	15	10	15
	FM4301031A-01	1.0	230	20	15	15
	FM4301531A-01	1.5	230	30	20	25
	FM4302031A	2.0	230	30	20	25
	FM4303031A	3.0	230	45	25	40
	FM4305031A	5.0	230	80	45	60

3-Wire Standard - Fuse and Circuit Breaker Amps

Type	Motor Order Number	HP	Volts	Fuse or Circuit Breaker Amps		
	Faradyne			Standard Fuse	Dual Element Time Delay	Circuit Breaker
3-Wire Standard with CSIR Cap. Start Box	FM4300511-E	0.5	115	30	20	30
	FM4300531-E	0.5	230	20	10	15
	FM4300731-E	0.75	230	20	15	20
	FM4301031-E	1.0	230	25	15	25
3-Wire Standard with CSCR or Magnetic Contractor Deluxe Control Box	FM4300531-E	0.5	230	15	10	10
	FM4300731-E	0.75	230	15	10	15
	FM4301031-E	1.0	230	20	15	15
	FM4301531-E	1.50	230	30	20	25

SINGLE PHASE SEVERE DUTY MOTOR DATA

Single Phase, 3-Wire Severe Duty 4" Motors - Electrical Data 60 Hertz, 3450 RPM

Type	Motor Catalog No. Faradyne	HP	KW	Volts	SF	Full Load Amps (B or Y/B/R)	Full Load Watts	Service Factor Amps (B or Y/B/R)	Service Factor Watts	Locked Rotor Amps	Winding Resistance Main (B-Y)	Winding Resistance Start (R-Y)	Required Control Box
3-WIRE (CSCR) SEVERE DUTY	XD4302031A	2.0	1.5	230	1.25	9.9/9.1/2.6	2170	12.2/11.7/2.6	2660	49	1.6 - 2.2	4.8 - 5.9	FM020CB-CR2
	XD4303031A	3.0	2.2	230	1.15	14.3/12.0/5.7	3170	16.5/13.9/5.6	3620	76	1.0 - 1.4	2.0 - 2.5	FM030CB-CR2
	XD4305031A	5.0	3.7	230	1.15	24/19.1/10.2	5300	27.0/22.0/10.0	6030	101	.6 - .8	1.3 - 1.7	FM050CB-CR2

Single Phase, 3-Wire Severe Duty 4" Motors - Engineering Data

Type	Motor Catalog No. Faradyne	HP	KW	Efficiency % F.L.	Efficiency % S.F.	Power Factor % F.L.	Power Factor % S.F.	Thrust Rating	KVA Code
3-WIRE (CSCR) SEVERE DUTY	XD4302031A	2.0	1.5	68.0	69.0	96.0	95.0	1500	G
	XD4303031A	3.0	2.2	72.0	72.0	96.0	97.0	1500	G
	XD4305031A	5.0	3.7	70.5	71.0	97.0	97.5	1500	E

3-Wire Severe Duty- Fuse and Circuit Breaker Amps

Type	Motor Order Number Faradyne	HP	Volts	Fuse or Circuit Breaker Amps Standard Fuse	Fuse or Circuit Breaker Amps Dual Element Time Delay	Fuse or Circuit Breaker Amps Circuit Breaker
3-WIRE (CSCR) SEVERE DUTY	XD4302031A	2.0	230	30	20	25
	XD4303031A	3.0	230	45	25	40
	XD4305031A	5.0	230	80	45	60

PREMIUM MOTOR WIRE SIZING CHARTS

Premium 2-Wire Single Phase Motor Wire Sizing Chart

	Motor Lead Lengths - Faradyne 2 Wire Motors - Based on Service Factor Amps, 30C Ambient, & 5% Voltage Drop																	
	Motor Rating					60º C and 75º C Insulation - AWG Copper Wire Size												
Type	Volts	HP	KW	FLA	SFA	14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0
2-WIRE (PSC) Premium	115	1/2	0.37	8.1	10.2	107	171	273	432	672	1071	1346	1700	2142	2703	3411	4305	5424
	230	1/2	0.37	4.3	4.8	457	726	1158	1835	2855	4551	5721	7225	9102	11489			
	230	3/4	0.55	5.0	6.4	342	545	869	1376	2141	3413	4291	5419	6826	8617	10871		
	230	1	0.75	6.7	8.2	267	425	678	1074	1671	2664	3349	4229	5328	6725	8485	10711	
	230	1 1/2	1.1	9.1	10.5	209	332	530	839	1305	2080	2615	3303	4161	5252	6626	8365	

Premium 3-Wire Single Phase Motor Wire Sizing Chart

	Motor Lead Lengths - Faradyne 3 Wire Motors - Based on Service Factor Amps, 30C Ambient, & 5% Voltage Drop																	
	Motor Rating					60º C and 75º C Insulation - AWG Copper Wire Size												
Type	Volts	HP	KW	FLA	SFA	14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0
3-Wire Premium CSIR CONTROL BOXES	115	1/2	0.37	9.8	11.6	94	150	240	380	591	942	1184	1495	1883	2377	2999	3786	4770
	230	1/2	0.37	5.7	6.3	348	553	883	1398	2175	3467	4359	5505	6935	8753			
	230	3/4	0.55	6.7	7.9	277	441	704	1115	1734	2765	3476	4390	5530	6981	8807		
	230	1	0.75	8.5	9.5	231	367	585	927	1442	2299	2891	3651	4599	5805	7324		
3-Wire Premium CSCR CONTROL BOXES	230	1/2	0.37	4.4	5	438	697	1112	1761	2740	4369	5492	6936	8738	11029			
	230	3/4	0.55	4.6	6.1	359	571	912	1444	2246	3581	4502	5685	7162	9040	11406		
	230	1	0.75	6.2	7.4	296	471	751	1190	1852	2952	3711	4686	5904	7452	9402		
	230	1 1/2	1.1	9.2	11	199	317	505	801	1246	1986	2496	3153	3972	5013	6325		
	230	2	1.5	9.9	12.2	180	286	456	722	1123	1790	2251	2843	3581	4520	5703		
	230	3	2.2	14.3	16.5	133	211	337	534	830	1324	1664	2102	2648	3342	4217	5323	
	230	5	3.7	24	27			206	326	507	809	1017	1284	1618	2042	2577	3253	

Table based on values from NEC, Tables 310.16 and 310.17 and NEC, Chapter 9, Table 8 Conductor Properties.

NOTE: Motors and control boxes are designed to operate on 230V systems. Systems with low line voltage, between 200 - 207 volts require the next larger cable size than shown in the 230V charts. If using a 3-Wire motor with control box on a low voltage application switch to a 208V start relay. The 208V start relay order numbers are found on control box repair part charts in this manual.

Another option is to use a boost transformer to increase voltage.

The 2-Wire sizing chart above is only for the use with PSC type, two-wire motors.

Temperature Conversions: 20˚ C = 68˚ F, 30˚ C = 86˚ F, 60˚ C = 140˚ F, 75˚ C = 167˚ F, 90˚ C = 194˚ F

3-Wire Severe Duty Single Phase Motor Wire Sizing Chart

	Motor Lead Lengths - Faradyne 3 Wire Severe Duty Motors - Based on Service Factor Amps, 30C Ambient, & 5% Voltage Drop																	
	Motor Rating					60º C and 75º C Insulation - AWG Copper Wire Size												
Type	Volts	HP	KW	FLA	SFA	14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0
3-Wire SEVERE DUTY MOTORS CSIR CONTROL BOXES	230	2	1.5	9.9	12.2	180	286	456	722	1123	1790	2251	2843	3581	4520	5703		
	230	3	2.2	14.3	16.5	133	211	337	534	830	1324	1664	2102	2648	3342	4217	5323	
	230	5	3.7	24	27			206	326	507	809	1017	1284	1618	2042	2577	3253	

STANDARD MOTOR WIRE SIZING CHARTS

Standard 2-Wire Single Phase Motor Wire Sizing Chart

	Motor Lead Lengths - Faradyne 2 Wire Motors - Based on Service Factor Amps, 30C Ambient, & 5% Voltage Drop																	
	Motor Rating					60º C and 75º C Insulation - AWG Copper Wire Size												
Type	Volts	HP	KW	FLA	SFA	14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0
2-WIRE (PSC) Standard	115	1/2	0.37	8.4	10	110	174	278	440	685	1092	1373	1734	2184	2757	3479	4392	5533
	230	1/2	0.37	4.2	5.1	430	684	1090	1727	2687	4283	5384	6800	8566	10813			
	230	3/4	0.55	4.8	6.1	359	571	912	1444	2246	3581	4502	5685	7162	9040	11406		
	230	1	0.75	7	8	274	436	695	1101	1713	2730	3433	4335	5461	6893	8697	10979	
	230	1 1/2	1.1	9	10.6	207	329	525	831	1293	2061	2591	3272	4121	5203	6564	8286	

Standard 3-Wire Single Phase Motor Wire Sizing Chart

	Motor Lead Lengths - Faradyne 3 Wire Motors - Based on Service Factor Amps, 30C Ambient, & 5% Voltage Drop																	
	Motor Rating					60º C and 75º C Insulation - AWG Copper Wire Size												
Type	Volts	HP	KW	FLA	SFA	14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0
3-Wire (CSIR) Standard	115	1/2	0.37	9	11	100	158	253	400	623	993	1248	1576	1986	2507	3162	3992	5030
	230	1/2	0.37	4.8	5.6	391	622	993	1573	2447	3901	4904	6193	7801	9848			
	230	3/4	0.55	6.2	7.4	296	471	751	1190	1852	2952	3711	4686	5904	7452	9402		
	230	1	0.75	7.4	9	243	387	618	978	1522	2427	3051	3853	4854	6127	7731		
3-Wire (CSCR) Standard	230	1/2	0.37	3.7	4.6	476	758	1209	1914	2979	4749	5970	7539	9497	11988			
	230	3/4	0.55	4.9	6.1	359	571	912	1444	2246	3581	4502	5685	7162	9040	11406		
	230	1	0.75	5.7	7.1	309	491	783	1240	1930	3077	3868	4884	6153	7767	9799		
	230	1 1/2	1.1	8.9	10.7	205	326	520	823	1281	2041	2566	3241	4083	5154	6502		

Table based on values from NEC, Tables 310.16 and 310.17 and NEC, Chapter 9, Table 8 Conductor Properties.

NOTE: Motors and control boxes are designed to operate on 230V systems. Systems with low line voltage, between 200 - 207 volts require the next larger cable size than shown in the 230V charts. If using a 3-Wire motor with control box on a low voltage application switch to a 208V start relay. The 208V start relay order numbers are found on control box repair part charts in this manual.

Another option is to use a boost transformer to increase voltage.

The 2-Wire sizing chart above is only for the use with PSC type, two-wire motors.

Temperature Conversions: 20˚ C = 68˚ F, 30˚ C = 86˚ F, 60˚ C = 140˚ F, 75˚ C = 167˚ F, 90˚ C = 194˚ F

USING TWO DIFFERENT CABLE SIZES

Customers sometimes desire to use two or more wire sizes on a pump installation. This is acceptable as long as the maximum cable length ratings are not exceeded. The data below describes how to safely accomplish the task. The cable lengths in the wire sizing charts represent 100% of the allowable length for each wire size. Never use more than 100% of any length shown in the table.

The 3-Wire, Single Phase Motor Wire Chart will be used in this example. See page 7.

INSTALLATION DATA

- 2 HP, 230V, Single Phase, 3-Wire Motor
- 150 feet of #12 wire buried between the home (service entrance) and the well
- Pump is set at 340 feet
- Total wire length is 490 feet

Refer to 3-Wire Motor Lead Length Chart
- Select row for 2 HP, 230V, 1Ph Motor
- Maximum wire lengths are:
  - #12 – 286'
  - #10 – 456'
  - # 8 – 722'
- Allowable drop cannot exceed 100% of any length or combination of lengths

The existing 150 feet of #12 underground wire uses 150'/286' = 52.4% of the allowable length. 100% - 52.4% = 47.6% is left to be used by a different wire size. We need to choose a wire size that does not exceed 47.6% of its maximum length as the following calculation demonstrates:

340'/456' = 74.5% of #10 – 74.5% + 52.4% = 126.9% - over 100% is not allowable.
340'/722' = 47.1% of # 8 – 47.1% + 52.4% = 99.5% which is allowable.

On this application we can use 150' of #12 with 340' of #8.
The formula:

$$\frac{\text{Actual Length 1}}{\text{Maximum Allowed}} + \frac{\text{Actual Length 2}}{\text{Maximum Allowed}} \leq 1 \text{ or } \leq 100\%$$

By using this formula, it is possible to choose more than one wire size in motor installation.

THREE PHASE PREMIUM 4" MOTOR DATA

Three Phase 3-Wire 4" Motors - Electrical Data 60 Hertz, 3450 RPM

Motor Catalog No.					Full Load		Service Factor		Locked Rotor Amps	Line - Line Resistance
Faradyne	HP	KW	Volts	SF	Amps	Watts	Amps	Watts		
FM4300523A	0.5	0.37	200	1.6	2.9	600	3.5	860	22	4.1 - 5.2
FM4300723A	0.75	0.55	200	1.5	3.9	820	4.7	1150	30	2.8 - 3.7
FM4301023A	1.0	0.75	200	1.4	4.8	1120	5.7	1470	34	2.2 - 3.1
FM4301523A	1.5	1.10	200	1.3	6.6	1650	7.6	1950	40	1.9 - 2.5
FM4302023A	2.0	1.5	200	1.25	8.0	1960	9.3	2455	51	1.4 - 2.0
FM4303023A	3.0	2.20	200	1.15	10.9	2890	12.0	3290	71	1.2 - 1.5
FM4305023A	5.0	3.70	200	1.15	18.3	4850	20.2	5515	113	.7 - .9
FM4307523A	7.5	5.50	200	1.15	27.0	7600	30.0	8800	165	.4 - .6
FM4300533A	0.5	0.37	230	1.6	2.4	575	3.0	860	18	5.7 - 7.2
FM4300733A	0.75	0.55	230	1.5	3.3	805	4.0	1160	27	3.3 - 4.3
FM4301033A	1.0	0.75	230	1.4	4.1	1070	4.9	1440	26	3.2 - 4.2
FM4301533A	1.5	1.10	230	1.3	5.8	1550	6.6	1950	36	2.5 - 3.1
FM4302033A	2.0	1.5	230	1.25	6.7	1965	8.0	2465	44	2.2 - 2.8
FM4303033A	3.0	2.2	230	1.15	9.2	2880	10.1	3280	59	1.6 - 2.0
FM4305033A	5.0	3.7	230	1.15	15.7	4925	17.5	5650	93	.9 - 1.3
FM4307533A	7.5	5.5	230	1.15	24.0	7480	26.4	8570	140	.5 - .9
FM4300553A	0.5	0.37	460	1.6	1.3	620	1.5	865	9	23.6 - 26.1
FM4300753A	0.75	0.55	460	1.5	1.7	825	2.0	1140	14	14.4 - 16.2
FM4301053A	1.0	0.75	460	1.4	2.2	1140	2.5	1460	15	16.8 - 18.6
FM4301553A	1.5	1.10	460	1.3	3.0	1540	3.4	1960	16	9.5 - 10.5
FM4302053A	2.0	1.5	460	1.25	3.6	1960	4.1	2440	23	7.5 - 9.3
FM4303053A	3.0	2.20	460	1.15	4.8	2920	5.3	3320	30	6.3 - 7.7
FM4305053A	5.0	3.70	460	1.15	7.6	4810	8.5	5530	48	3.9 - 4.9
FM4307553A	7.5	5.50	460	1.15	12.2	7400	13.5	8560	87	2.1 - 2.7
FM4310053A	10.0	7.50	460	1.15	15.6	9600	17.2	11000	110	1.8 - 2.2
FM4301563A	1.5	1.10	575	1.3	2.3	1540	2.6	1970	15	15.6 - 17.3
FM4302063A	2.0	1.50	575	1.25	2.7	1610	3.3	2400	21	10.2 - 12.5
FM4303063A	3.0	2.20	575	1.15	3.7	2850	4.1	3240	21	10.2 - 12.5
FM4305063A	5.0	3.7	575	1.15	7.0	5080	7.6	5750	55	3.6 - 4.2
FM4307563A	7.5	5.5	575	1.15	9.1	7260	10.0	8310	55	3.6 - 4.2

THREE PHASE PREMIUM 4" MOTOR DATA

Three Phase 3-Wire Premium 4" Motors - Engineering Data

Motor Catalog No. Faradyne	HP	KW	Volts	Efficiency %		Power Factor %		Thrust Rating	KVA Code
				F.L.	S.F.	F.L.	S.F.		
FM4300523A	0.5	0.37	200	64.0	69.5	60.0	75.0	700	R
FM4300723A	0.75	0.55	200	68.0	73.0	65.0	75.0	700	R
FM4301023A	1.0	0.75	200	69.0	73.0	71.0	79.0	700	N
FM4301523A	1.5	1.1	200	73.0	74.5	71.0	79.0	700	L
FM4302023A	2.0	1.5	200	76.0	76.0	74.0	79.5	900	K
FM4303023A	3.0	2.20	200	77.0	77.0	77.0	80.0	900	K
FM4305023A	5.0	3.70	200	76.0	76.0	78.0	80.0	1500	J
FM4307523A	7.5	5.50	200	74.0	74.0	81.0	85.0	1500	J
FM4300533A	0.5	0.37	230	65.0	69.5	64.5	77.0	700	R
FM4300733A	0.75	0.55	230	69.5	72.5	66.0	77.5	700	R
FM4301033A	1.0	0.75	230	70.0	72.5	69.0	78.0	700	M
FM4301533A	1.5	1.1	230	72.0	74.5	71.5	79.0	700	L
FM4302033A	2.0	1.5	230	76.0	75.5	78.0	82.5	900	K
FM4303033A	3.0	2.2	230	77.0	77.0	78.0	81.0	900	J
FM4305033A	5.0	3.7	230	76.0	76.0	80.0	83.0	1500	J
FM4307533A	7.5	5.5	230	75.0	75.0	79.0	83.0	1500	J
FM4300553A	0.5	0.37	460	60.5	69.0	64.0	75.5	700	R
FM4300753A	0.75	0.55	460	68.0	73.5	68.5	80.0	700	R
FM4301053A	1.0	0.75	460	65.5	71.5	70.0	76.0	700	N
FM4301553A	1.5	1.1	460	73.0	74.0	70.0	78.0	700	L
FM4302053A	2.0	1.5	460	76.0	76.5	73.5	79.0	900	L
FM4303053A	3.0	2.20	460	77.0	77.0	78.0	81.0	900	J
FM4305053A	5.0	3.70	460	77.0	77.0	80.0	82.0	1500	J
FM4307553A	7.5	5.50	460	76.0	76.0	77.0	80.0	1500	L
FM4310053A	10.0	7.50	460	79.0	80.0	78.0	82.0	1500	K
FM4301563A	1.5	1.1	575	73.0	74.0	73.0	82.5	700	K
FM4302063A	2.0	1.50	575	78.0	78.0	61.0	74.0	900	M
FM4303063A	3.0	2.20	575	78.0	78.0	79.0	81.0	900	J
FM4305063A	5.0	3.7	575	74.0	75.0	73.0	77.0	1500	M
FM4307563A	7.5	5.5	575	77.0	77.0	82.0	85.0	1500	J

THREE PHASE PREMIUM 4" MOTOR DATA

Three Phase Fuse and Circuit BreakerAmps

Motor Order Number	HP	Volts	Fuse or Circuit Breaker Amps		
Faradyne			Standard Fuse	Dual Element Time Delay	Circuit Breaker
FM4300523A	0.5	200	10	6	10
FM4300723A	0.75	200	15	10	10
FM4301023A	1.0	200	15	10	10
FM4301523A	1.5	200	20	10	15
FM4302023A	2.0	200	25	15	20
FM4303023A	3.0	200	35	20	30
FM4305023A	5.0	200	60	35	50
FM4307523A	7.5	200	80	50	70
FM4300533A	0.5	230	6	6	6
FM4300733A	0.75	230	6	6	6
FM4301033A	1.0	230	10	6	10
FM4301533A	1.5	230	15	10	15
FM4302033A	2.0	230	15	15	20
FM4303033A	3.0	230	25	15	25
FM4305033A	5.0	230	45	30	40
FM4307533A	7.5	230	70	45	60
FM4300553A	0.5	460	3	3	3
FM4300753A	0.75	460	3	6	3
FM4301053A	1.0	460	6	3	6
FM4301553A	1.5	460	10	6	6
FM4302053A	2.0	460	15	6	10
FM4303053A	3.0	460	15	10	15
FM4305053A	5.0	460	25	15	15
FM4307553A	7.5	460	40	25	30
FM4310053A	10.0	460	45	25	35
FM4301563A	1.5	575	6	3	6
FM4302063A	2.0	575	10	6	10
FM4303063A	3.0	575	10	10	10
FM4305063A	5.0	575	20	15	20
FM4307563A	7.5	575	25	20	25

THREE PHASE SEVERE DUTY 4" MOTOR DATA

Three Phase Severe Duty 4" Motors - Electrical Data 60 Hertz, 3450 RPM

Motor Catalog No.					Full Load		Service Factor		Locked Rotor Amps	Line - Line Resistance
Faradyne #	HP	KW	Volts	SF	Amps	Watts	Amps	Watts		
XD4303033A	3.0	2.2	230	1.15	9.2	2880	10.1	3280	59	1.6 - 2.0
XD4305033A	5.0	3.7	230	1.15	15.7	4925	17.5	5650	93	.9 - 1.3
XD4307533A	7.5	5.5	230	1.15	24	7480	26.4	8570	140	.5 - .9
XD4303053A	3	2.2	460	1.15	4.8	2920	5.3	3320	30	6.3 - 7.7
XD4305053A	5.0	3.7	460	1.15	7.6	4810	8.5	5530	48	3.9 - 4.9
XD4307553A	7.5	5.5	460	1.15	12.2	7400	13.5	8560	87	2.1 - 2.7
XD4310053A	10	7.5	460	1.15	15.6	9600	17.2	11000	110	1.8 - 2.2

Three Phase Severe Duty - Engineering Data

				Efficiency %		Power Factor %		Thrust Rating	KVA Code
Motor Catalog No. Faradyne	HP	KW	Volts	F.L.	S.F.	F.L.	S.F.		
XD4303033A	3	2.2	230	77	77	78	81	900	J
XD4305033A	5	3.7	230	76	76	80	83	1500	J
XD4307533A	7.5	5.5	230	75	75	79	83	1500	J
XD4303053A	3	2.2	460	77	77	78	81	900	J
XD4305053A	5	3.7	460	77	77	80	82	1500	J
XD4307553A	7.5	5.5	460	76	76	77	80	1500	L
XD4310053A	10	7.5	460	79	80	78	82	1500	K

Three Phase Severe Duty Fuse and Circuit BreakerAmps

Motor Order Number	HP	Volts	Fuse or Circuit Breaker Amps		
Faradyne			Standard Fuse	Dual Element Time Delay	Circuit Breaker
XD4303033A	3.0	230	25	15	25
XD4305033A	5.0	230	45	30	40
XD4307533A	7.5	230	70	45	60
XD4303053A	3	460	15	10	15
XD4305053A	5.0	460	25	15	15
XD4307553A	7.5	460	40	25	30
XD4310053A	10	460	45	25	35

PREMIUM THREE PHASE WIRE CHART

Three Phase, 3-Wire 4" Motors - Electrical Data 60 Hertz, 3450 RPM

	Motor Lead Lengths - Faradyne 2 Wire Motors - Based on Service Factor Amps, 30C Ambient, & 5% Voltage Drop																	
	Motor Rating					60° C and 75° C Insulation - AWG Copper Wire Size												
Type	Volts	HP	KW	FLA	SFA	14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0
PREMIUM MOTORS	200	0.5	0.37	2.9	3.5	629	1000	1595	2526	3931								
	200	3/4	0.55	3.9	4.7	468	745	1188	1881	2927								
	200	1	0.75	4.8	5.7	386	614	979	1551	2414	3848	4837						
	200	1.5	1.1	6.6	7.6	290	461	735	1163	1810	2886	3628						
	200	2	1.5	8	9.3	237	376	600	951	1479	2358	2965	3744	4717	5954			
	200	3	2.2	10.9	12	183	292	465	737	1147	1828	2298	2902	3656	4614			
	200	5	3.7	18.3	20.2	109	173	276	438	681	1086	1365	1724	2172	2741	3458	4366	5500
	200	7.5	5.5	27	30	73	117	186	295	459	731	919	1161	1462	1846	2329	2940	3704
	230	0.5	0.37	2.4	3	844	1342	2140	3389	5274	8408	10570						
	230	0.75	0.55	3.3	4	633	1006	1605	2542	3956	6306	7927	10011					
	230	1	0.75	4.1	4.9	516	821	1310	2075	3229	5148	6471	8172					
	230	1.5	1.1	5.8	6.6	383	610	973	1541	2397	3822	4804	6067	7643	9648			
	230	2	1.5	6.7	8	316	503	803	1271	1978	3153	3964	5006	6306	7960	10042		
	230	3	2.2	9.2	10.1	251	399	636	1007	1567	2497	3140	3965	4995	6305	7954	10042	12651
	230	5	3.7	15.7	17.5			367	581	904	1441	1812	2288	2883	3639	4591	5795	7301
	230	7.5	5.5	24	26.4				385	599	955	1201	1517	1911	2412	3043	3842	4840
	460	0.5	0.37	1.3	1.5	3374	5367	8561										
	460	0.75	0.55	1.7	2	2531	4025	6420	10168									
	460	1	0.75	2.2	2.5	2024	3220	5136	8135									
	460	1.5	1.1	3	3.4	1489	2368	3777	5981									
	460	2	1.5	3.6	4.1	1234	1964	3132	4960	7718								
	460	3	2.2	4.8	5.3	955	1519	2423	3837	5971								
	460	5	3.7	7.6	8.5	595	947	1511	2393	3723	5935							
	460	7.5	5.5	12.2	13.5	375	596	951	1506	2344	3737	4698	5933	7474				
	460	10	7.5	15.6	17.2	294	468	747	1182	1840	2933	3687	4656	5866				
	575	1.5	1.1	2.3	2.6	2433	3870	6173										
	575	2	1.5	2.7	3.3	1917	3049	4864	7703									
	575	3	2.2	3.7	4.1	1543	2454	3915	6200									
	575	5	3.7	7	7.6	832	1324	2112	3345	5205								
	575	7.5	5.5	9.1	10	633	1006	1605	2542	3956								

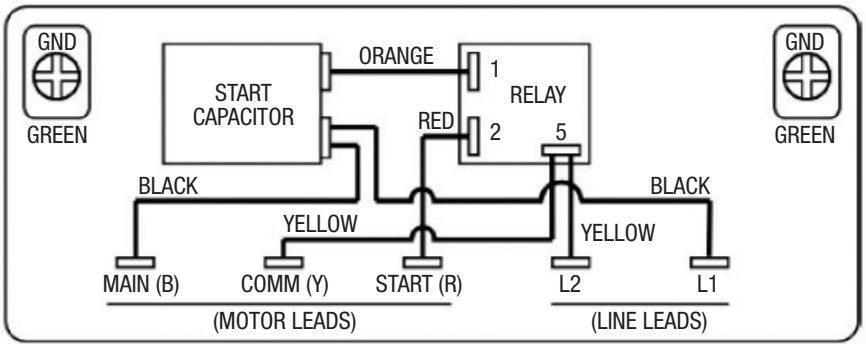
SEVERE DUTY THREE PHASE WIRE CHART

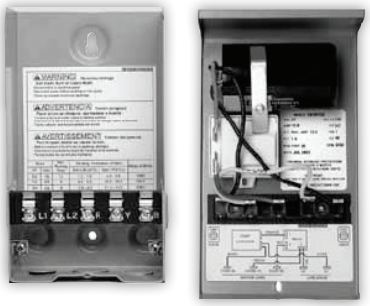
Three Phase 4" Severe Duty - Wire Sizing Chart

Motor Lead Lengths - Faradyne 2 Wire Motors - Based on Service Factor Amps, 30C Ambient, & 5% Voltage Drop																	
Motor Rating					60° C and 75° C Insulation - AWG Copper Wire Size												
Volts	HP	KW	FLA	SFA	14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0
230	3	2.2	9.2	10.1	251	399	636	1007	1567	2497	3140	3965	4995	6305	7954	10042	12651
230	5	3.7	15.7	17.5			367	581	904	1441	1812	2288	2883	3639	4591	5795	7301
230	7.5	5.5	24	26.4				385	599	955	1201	1517	1911	2412	3043	3842	4840
460	3	2.2	4.8	5.3	955	1519	2423	3837	5971								
460	5	3.7	7.6	8.5	595	947	1511	2393	3723	5935							
460	7.5	5.5	12.2	13.5	375	596	951	1506	2344	3737	4698	5933	7474				
460	10	7.5	15.6	17.2	294	468	747	1182	1840	2933	3687	4656	5866				

SINGLE PHASE CSIR CONTROL BOXES
CAPACITOR START – INDUCTION RUN

Capacitor Start – Induction Run ½ - 1 HP Wiring Diagram





CSIR Control Boxes - Capacitor Start - Induction Run
For use with Three Wire, Premium and Standard Motors

Control Box Catalog Number	Motor			Standard Circuit Breaker	Standard Fuse	Dual Element Time Delay Fuse	Enclosure Dimensions W X D X H (Inches)	Shipping Weight (Lbs.)
	HP	KW	Volts					
FM005CB-IR1	0.5	0.37	115	30	30	20	W 4.9 D 2.8 H 8.5	5
FM005CB-IR2	0.5	0.37	230	15	20	10		
FM007CB-IR2	0.75	0.55	230	20	20	15		
FM010CB-IR2	1.0	0.75	230	25	25	15		

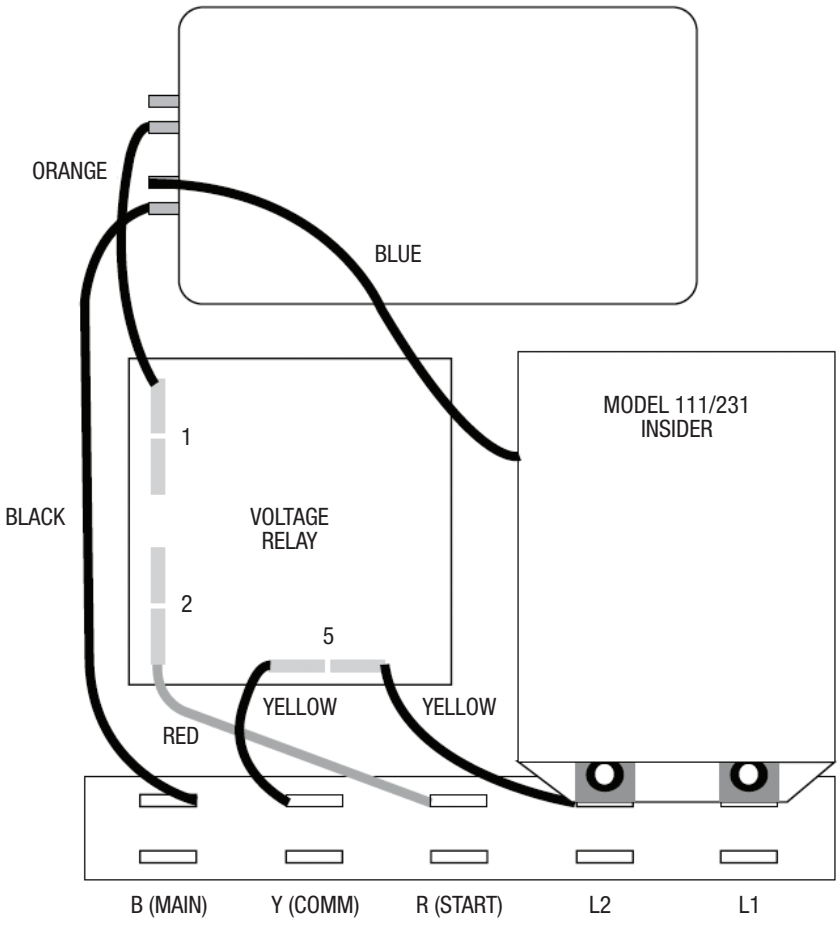
Repair Parts for CSIR Style Control Boxes

Order Number	HP	Volts	Capacitor Order Number	Start Capacitor Mfd	Capacitor Voltage	Capacitor Quantity	Start Relay Order Number
CB05411	0.5	115	SC300	250 - 300	125	1	SR115
CB05412	0.5	230	SC71	59 - 71	220	1	SR230
CB07412	0.75	230	SC103	86 - 103	220	1	
CB10412	1.0	230	SC126	105 - 126	220	1	
Special 208 V Relay for 0.5 - 1.0 HP operating on 200 or 208 volt power supplies Order Number SR208.							

FARADYNE MOTORS CSIR CONTROL BOX WITH PUMPSAVER® INSIDER

CONNECTIONS

1. Remove the cover from the front of the 3-Wire Faradyne Motors control box.
2. Remove the yellow wire from the terminal strip at L2.
3. Remove the black wire connecting L1 and the capacitor completely from the box.
4. Press the PumpSaver® onto the L1 and L2 terminals.
5. Reconnect the yellow wire to L2 on the PumpSaver®.
6. Connect the blue wire attached to the PumpSaver® to the dual-lug terminal (with the black wire) of the capacitor.



Faradyne Motors Control Box with Insider Installed

THREE PHASE MOTOR OPERATION ON VFDs

Variable Frequency Drives (VFD) can be used with the Three Phase Faradyne motors, provided the application meets the following criteria:

1. Maintain frequencies from 30Hz - 60Hz. Do not operate below 30Hz for more than 1 second. Up to 80Hz operation can be used as long as max amps not exceeded;
2. Ensure VFD is a PWM, IGBT, Volts per Hz scalar type and its voltage rise time dV/dT does not exceed 500 volts/micro seconds;
3. Use a load reactor (load filter) of 3% impedance or more on motor lead lengths of 50 feet or more.
4. Follow all NEC, state, local and provincial electrical codes for Power Conversion Equipment wiring and installation;
5. Provide appropriate dedicated short circuit protection, properly sized fuses or breaker disconnects;
6. Size wire according to NEC, state, local and provincial codes OR refer to manufacturer's recommendations for wiring sizing;
7. Ensure minimum flow rate recommended by manufacturer is satisfied; and
8. Maintain proper grounding of the motor back to drive and service entrance. Common ground should be maintained throughout the system.

CSCR SINGLE PHASE CONTROL BOXES CAPACITOR START - CAPACITOR RUN

For use with 3-Wire, Single Phase, 4" Faradyne Motors; Premium, Standard and Severe Duty

Control Box Order Number	HP	KW	Volts	Standard Circuit Breaker	Standard Fuse	Dual Element Time Delay Fuse	Enclosure Dimension W x D x H (inches)	Shipping Weight (lbs.)
FM005CB-CR2	0.5	0.37	230	10	15	10	4.9 x 2.8 x 8.5	5
FM007CB-CR2	0.75	0.55		15	15	10		
FM010CB-CR2	1.0	0.75		15	20	15		
FM015CB-CR2	1.5	1.1		25	30	20	7.9 x 5.7 x 10.7	7
FM020CB-CR2	2.0	1.5		25	30	20		
FM030CB-CR2	3.0	2.2		40	45	25		
FM050CB-CR2	5.0	3.7		60	80	45		

Repair Parts

Control Box Order Number	HP	Volts	Capacitor Repair Part Number	Capacitor Mfd.	Capacitor Type	Capacitor Voltage	Capacitor Quantity	Overload Order Number[1]	Start Relay Order Number[2]
FM005CB-CR2	0.5	230	SC53	43 - 53	Start	220	1	N/A	SR230
			RC15	15	Run	370			
FM007CB-CR2	0.75		SC71	59 - 71	Start	220	1	N/A	SR230
			RC23	23	Run	370			
FM010CB-CR2	1.0		SC103	86 - 103	Start	220	1	N/A	SR230
			RC23	23	Run	370			
FM015CB-CR2	1.5		SC126	105 - 126	Start	220	1	T0L015CR2	SR230
			RC10	10	Run	370			
FM020CB-CR2	2.0		SC126	105 - 126	Start	220	1	T0L020CR2	SR230
			RC20	20	Run	370			
FM030CB-CR2	3.0		SC250	208 - 250	Start	220	1	T0L030CR2	SR230HD
			RC45	45	Run	370			
FM050CB-CR2	5.0		SC324	270 - 324	Start	330	1	T0L050CR2	SR230HD
			RC40	40	Run	370	2		

[1]Overloads for 2, 3 and 5 HP CSCR boxes are sold prewired and soldered as an assembly. No field soldering or wiring required.

[2]Order Number SR208 for 200 / 208 Volt Start Relay.

MAGNETIC CONTRACTOR (DELUXE) CONTROL BOXES

For use with 3-Wire, Single Phase, 4" Faradyne Motors; Premium, Standard and Severe Duty

Control Box Order Number	HP	KW	Volts	Standard Circuit Breaker	Standard Fuse	Dual Element Time Delay Fuse	Enclosure Dimension W x D x H (inches)	Shipping Weight (lbs.)
FM020CB-CR2-D	2.0	1.5	230	25	30	20	7.9 x 5.7 x 10.7	7
FM030CB-CR2-D	3.0	2.2		40	45	25		8
FM050CB-CR2-D	5.0	3.7		60	80	45	7.9 x 5.7 x 17.0	12

Repair Parts

Control Box Order Number	HP	KW	Volts	Capacitor Repair Part Number	Capacitor Type	Capacitor Mfd.	Capacitor Voltage	Capacitor Quantity	Contactor Order Number	Overload Order Number	Start Relay Order Number
FM020CB-CR2-D	2.0	1.5	230	SC126	Start	105 - 126	220	1	CON-020-030	T0L020CR2-D-S	SR230
				RC20	Run	20	370			T0L020CR2-D-R	
FM030CB-CR2-D	3.0	2.2		SC250	Start	208 - 250	220	1		T0L030CR2-D-S	SR230HD
				RC45	Run	45	370			T0L030CR2-D-R	
FM050CB-CR2-D	5.0	3.7		SC324	Start	270 - 324	330	1	CON-050	T0L050CR2-D-S	SR230HD
				RC40	Run	40	370	2		T0L050CR2-D-R	

Order Number SR208 for 200 / 208 Volt Start Relay.

CSCR AND DELUXE MAGNETIC CONTACTOR CONTROL BOX CHECK OUT

CHECKING PROCEDURE:

Be sure power is turned off.

A. Overload (Push reset buttons to make sure contacts are closed.)
    1. Ohmmeter Setting: (R x 1)
    2. Terminal Connections: Ohmmeter leads to overload terminals.
    3. Ohmmeter Reading: Should not be over 0.5 Ohms.

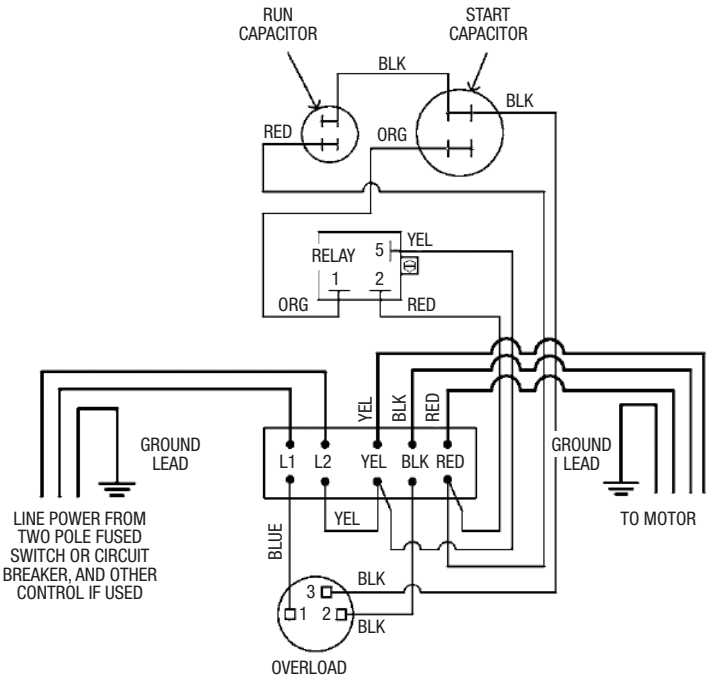
B. Capacitor (Disconnect one lead from each capacitor prior to checking.)
    1. Ohmmeter Setting: (R x 1000)
    2. Terminal Connections: Individual Capacitor Terminals.
    3. Ohmmeter Reading: Pointer should swing toward zero then drift back toward infinity.

C. Relay Coil (Disconnect Lead from Terminal 5)
    1. Ohmmeter Setting: (R x 1000)
    2. Terminal Connections: "5" and "2" on Relay.
    3. Ohmmeter Reading: 4500 - 7000 Ohms.

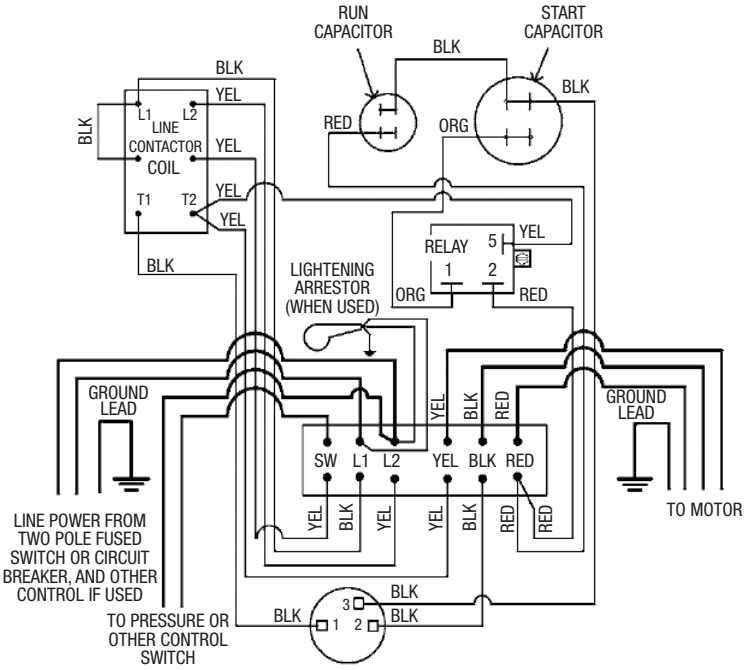
D. Relay Contact (Disconnect lead from Terminal 1)
    1. Ohmmeter Setting: (R x 1)
    2. Terminal Connections: "1" and "2" on Relay.
    3. Ohmmeter Reading: Should be zero.

E. Magnetic Contractor Only (Disconnect 1 Coil Lead)
    1. Ohmmeter Setting: (R x 100)
    2. Check Coil Resistance: 180 - 1400 Ohms.
    3. Remove contact cover and inspect contacts.

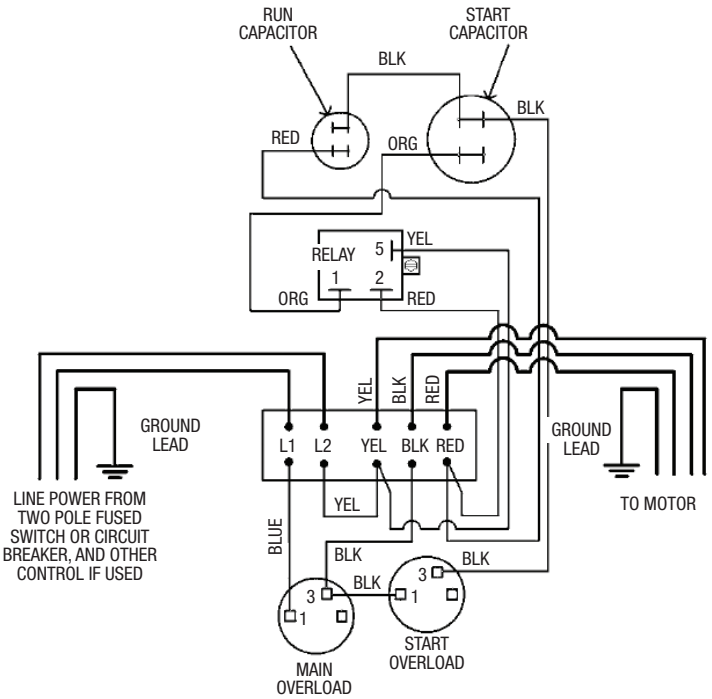
SINGLE PHASE CONTROL BOX WIRING DIAGRAMS



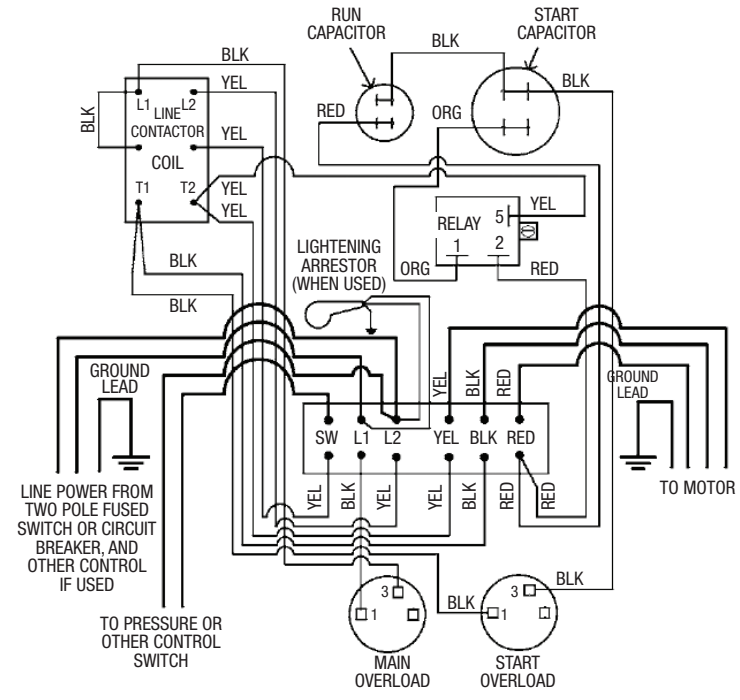
½ Thru 1½ HP Standard



1½ HP with Magnetic Contactor

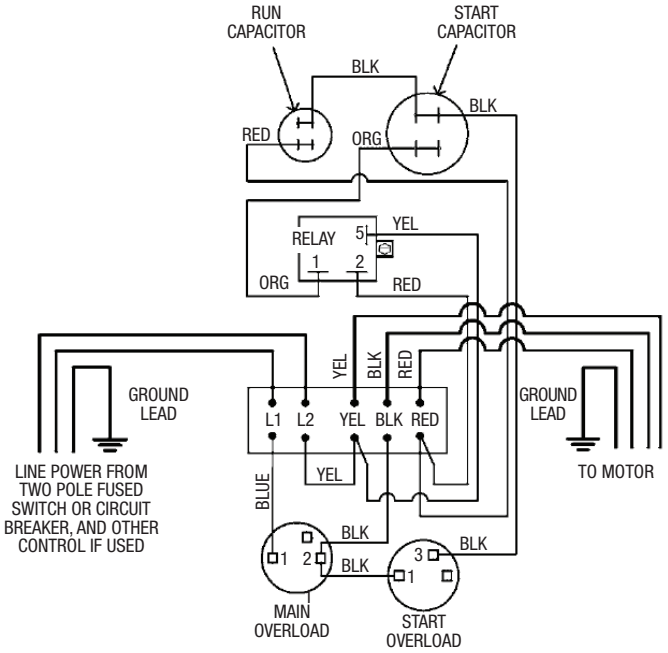


2 HP Standard

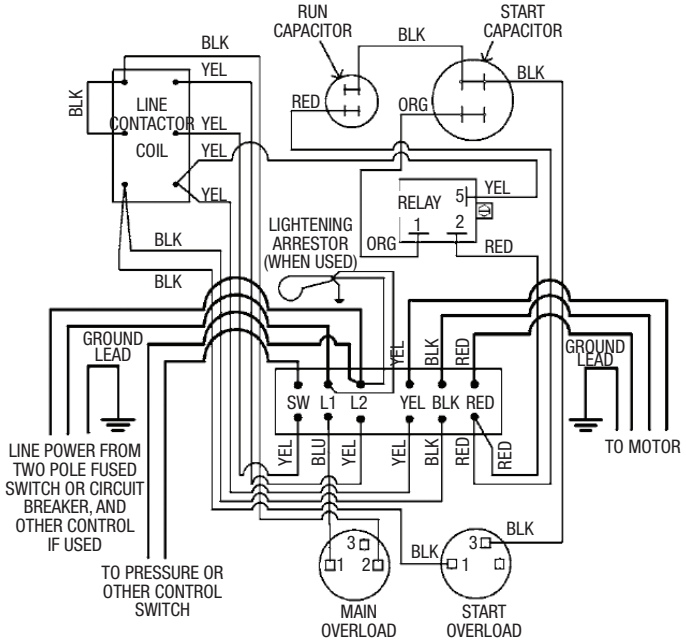


2 HP with Magnetic Contactor

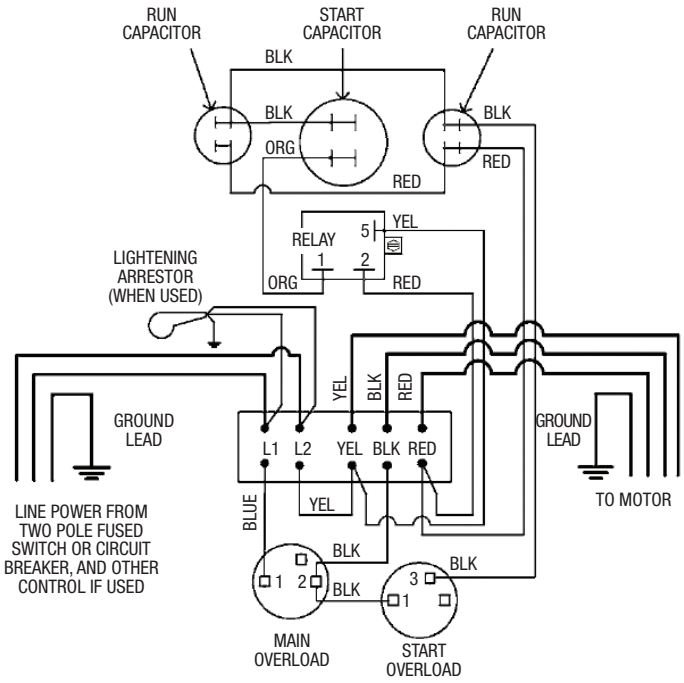
SINGLE PHASE CONTROL BOX WIRING DIAGRAMS



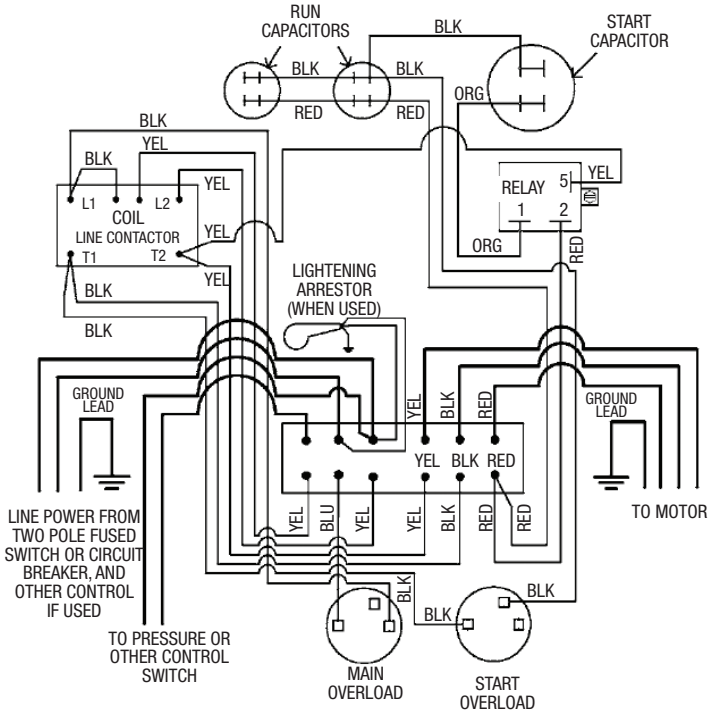
3 HP Standard



3 HP with Magnetic Contactor



5 HP Standard



5 HP with Magnetic Contactor

PUMP AND MOTOR TROUBLESHOOTING

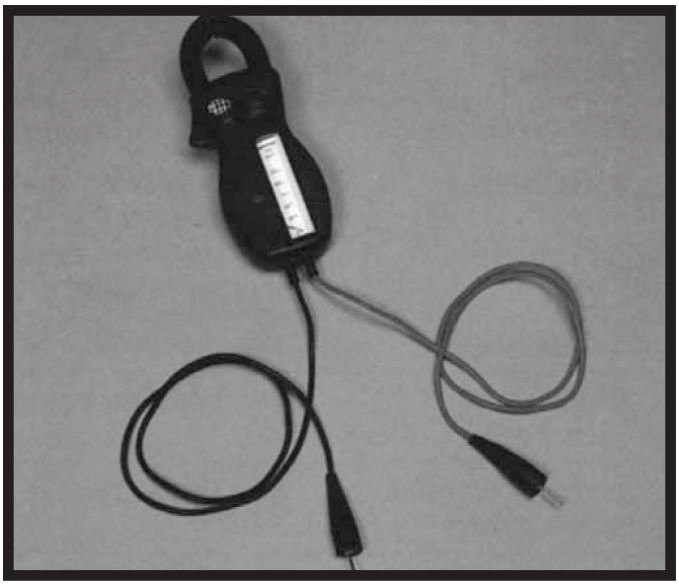
WARNING

Hazardous voltage can shock, burn or cause death.

Disconnect and lockout electrical power before attempting any service. Failure to do so can cause shock, burns or death.

Symptom	Probable Cause	Recommended Action
Pump / Motor Not Running	1. Motor thermal protector tripped a. Incorrect control box b. Incorrect or faulty electrical connections c. Faulty thermal protector d. Low voltage e. Ambient temperature of control box / starter too high f. Pump bound by foreign matter g. Inadequate submergence	1. Allow motor to cool, thermal protector will automatically reset a - e. Have a qualified electrician inspect and repair, as required f. Pull pump, clean, adjust set depth as required g. Confirm adequate unit submergence in pumpage
	2. Open circuit break or blow fuse	2. Have a qualified electrician inspect and repair, as required
	3. Power source inadequate for load	3. Check supply or generator capacity
	4. Power cable insulation damage 5. Faulty power cable splice	4 - 5. Have a qualified electrician inspect and repair, as required
Little or no liquid delivered by pump	1. Faulty or incorrectly installed check value	1. Inspect check valve, repair as required
	2. Pump air bound	2. Successively start and stop pump until flow is delivered
	3. Lift too high for pump	3. Review unit performance, check with dealer
	4. Pump bound by foreign matter	4. Pull pump, clean, adjust set depth, as required
	5. Pump not fully submerged	5. Check well recovery, lower pump if possible
	6. Well contains excessive amounts of air or gas	6. If successive starts and stops do not remedy, well contains excessive air or gases
	7. Excessive pump wear	7. Pull pump and repair, as required
	8. Incorrect motor rotation – Three Phase only	8. Reverse any two motor electrical leads

AMPROBE INSTRUCTIONS



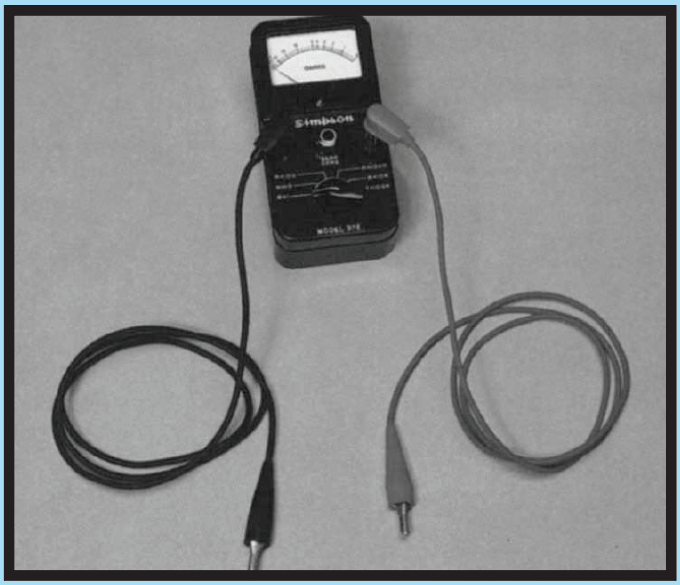
The Amprobe is a multi-range, combination ammeter and voltmeter.

Voltmeter Scales:	150 Volts	600 Volts
Ammeter Scales:	5 Amps	40 Amps
	15 Amps	100 Amps

1. When used as an Ammeter, the tongs are placed around the wire being measured with the rotary scale on the 100 amp range. Then rotate the scale back to the smaller ranges until an exact reading is indicated.

2. When used as a Voltmeter, the two leads are clipped into the bottom of the instrument with the rotary scale on the 600 volt range. If the reading is less than 150 volts, rotate the scale to the 150 volt range to get a more exact reading.

OHMMETER INSTRUCTIONS



The Ohmmeter is used for measuring the electrical resistance of a wire circuit. The unit of measurement is called an ohm.

1. The knob at the bottom of the Ohmmeter is adjustable through six ranges:
   - RX_{1} = R x 1
   - RX_{10} = R x 10
   - RX_{100} = R x 100
   - RX_{1000} = R x 1,000
   - RX_{10K} = R x 10,000
   - RX_{100K} = R x 100,000

2. The round center knob is for the purpose of adjusting the instrument to zero (0) after clipping the two Ohmmeter leads together. This must be done every time the range selection is changed.

⚠ CAUTION **Use Ohmmeter only with POWER OFF.**

If your Ohmmeter is digital readout type, refer to the instructions that came with it.

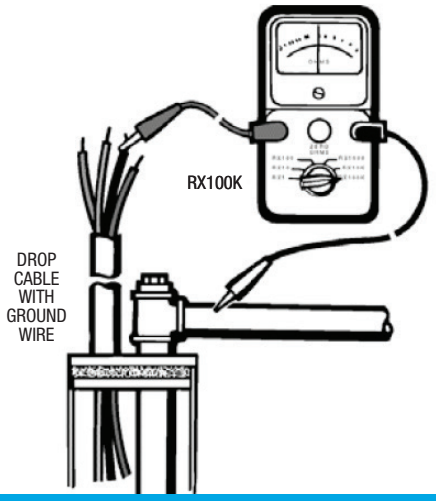
MEASURING INSULATION RESISTANCE

1. Set the scale lever to R x 100K (R x 100,000) and set the ohmmeter on zero.

Open (turn off) master breaker or disconnect all leads from starter or control box to avoid damage to meter or electric shock hazard.

⚠ WARNING

2. Connect an ohmmeter lead to any one of the motor leads and another lead to the metal drop pipe. If the drop pipe is plastic, connect the ohmmeter lead to the metal well casing or ground wire.



MEGGER...

WHAT IT MEANS

1. If the ohm value is normal, the motor windings are not grounded and the cable insulation is not damaged.
2. If the ohm value is below normal, either the windings are grounded or the cable insulation is damaged. Check the cable at the well seal as the insulation is sometimes damaged by being pinched.

TABLE 1 - Normal Ohm and MegOhm Values (Insulation Resistance) Between All Leads and Ground

Insulation resistance does not vary with rating. All motors of all HP, voltage and phase rating have similar values of insulation resistance.

Condition of Motor and Leads	Ohm Value	MegOhm Value
A new motor (without drop cable).	20,000,000 (or more)	20.0
A used motor which can be reinstalled in the well.	10,000,000 (or more)	10.0
Motor in well. Ohm readings are for drop cable plus motor. A new motor in well.	2,000,000 (or more)	2.0
A motor in the well in reasonably good condition.	500,000 - 2,000,000	0.5 - 2.0
A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason.	20,000 - 500,000	0.02 - 0.5
A motor which definitely has been damaged or with damaged cable. The pump should be pulled and repairs made to the cable or the motor replaced. The motor will not fail for this reason alone, but it will probably not operate for long.	10,000 - 20,000	0.01 - 0.02
A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced.	Less than 10,000	0 - 0.01

MOTOR WINDING RESISTANCE CHECKOUT

Measuring Winding Resistance

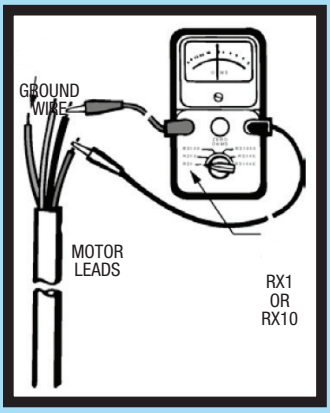
1. Set the scale lever to R x 1 for values under 10 ohms. For values over 10 ohms, set the scale lever to R x 10. Zero balance the ohmmeter as described earlier on page 23.

CAUTION **Open master breaker and disconnect all leads from control box to pressure switch (Q-D type control, remove lid) to avoid damage to meter or electric shock hazard.**

2. Connect the ohmmeter leads as shown below.

TABLE 2 - Cable Resistance Copper

Cable Size	DC Resistance of Cable per 100 Foot Length Ohms per Pair of Leads
14	0.544
12	0.338
10	0.214
8	0.135
6	0.082
4	0.052
2	0.032



If aluminum cable is used the reading will be higher. Divide the ohm readings on this chart by 0.61 to determine the actual resistance of the aluminum cable.

See motor data pages for motor resistance ratings.

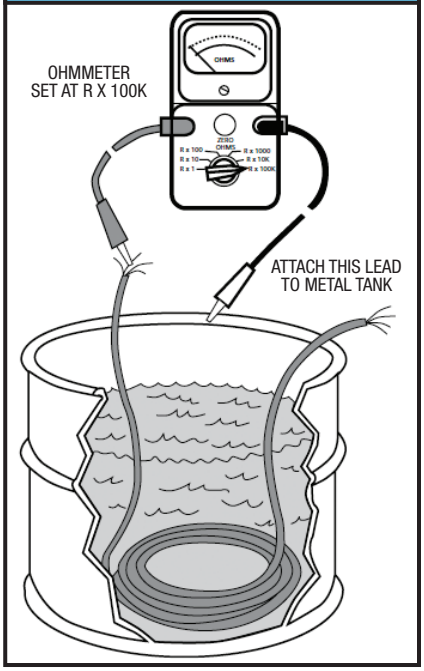
Add resistance of drop cable when checking pump in well. See Table 2 above.

CABLE CHECKOUT

Checking Cable and Splice

1. Submerge cable and splice in steel barrel of water with both ends out of water.
2. Set ohmmeter selector on RX100K and adjust needle to zero (0) by clipping ohmmeter leads together.
3. After adjusting ohmmeter, clip one ohmmeter lead to barrel and the other to each cable lead individually, as shown.
4. If the needle deflects to zero (0) on any of the cable leads, pull the splice up out of the water. If the needle falls back to (∞) (no reading) the leak is in the splice.
5. If the leak is not in the splice, pull the cable out of the water slowly until needle falls back to (∞) (no reading). When the needle falls back, the leak is at that point.
6. If the cable or splice is bad, it should be repaired or replaced.

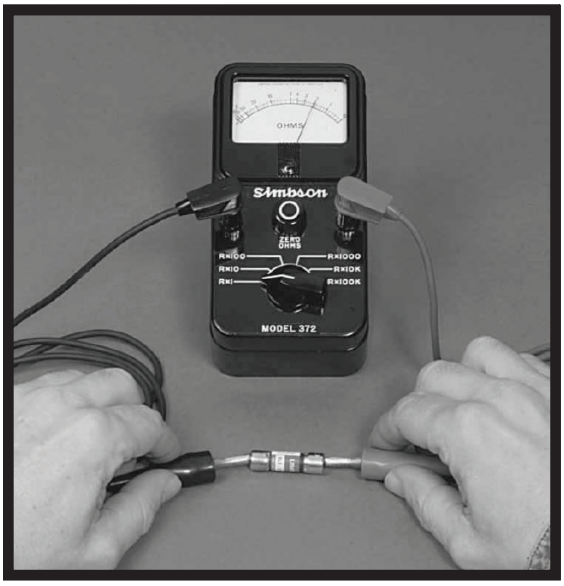
Checking Cable and Splice Test



What It Means

1. If all ohm values are normal, the motor windings are neither shorted nor open, and the cable colors are correct.
2. If any one ohm value is less than normal, the motor is shorted.
3. If any one ohm value is greater than normal, the winding or the cable is open, or there is a poor cable joint or connection.
4. If some ohm values are greater than normal and some less, the leads are mixed.

FUSE CHECKOUT

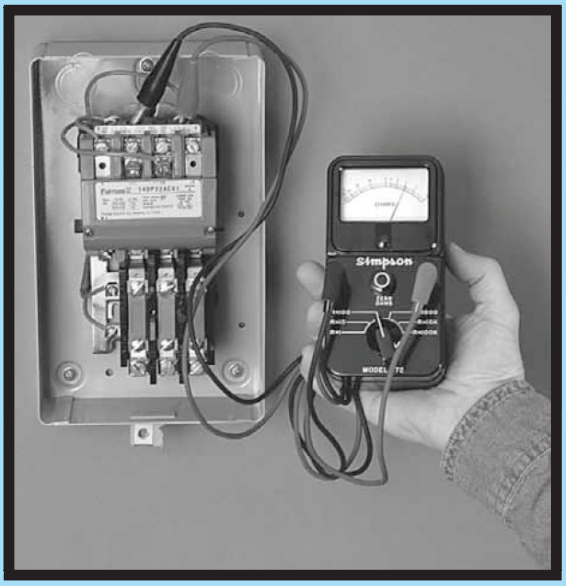


1. Set R x 1.
2. Connect leads as shown.
3. Reading: Should register zero.

WHAT IT MEANS

Zero reading indicates fuse is OK.
Infinity (∞) reading indicates bad fuse.

THREE PHASE STARTER COIL CHECKOUT



Open master breaker and disconnect all leads from starter to avoid damage to meter or electric shock hazard. Connect the ohmmeter leads as shown above.

COIL WITH OHMMETER

1. Set R x 100.
2. Connect leads as shown.
3. Reading: Should register some value. Approximately 200 - 1000 Ohms.

WHAT IT MEANS

Infinity (∞) reading indicates coil is open. Zero reading indicates coil is shorted. In either case, the coil should be replaced.

A reading of 200 - 1000 Ohms indicates coil is OK.

3 PHASE STARTER VOLTAGE CHECKOUT

Checking Voltage at Fused Disconnect and Magnetic Starter

WARNING **POWER IS ON during voltage checking.**

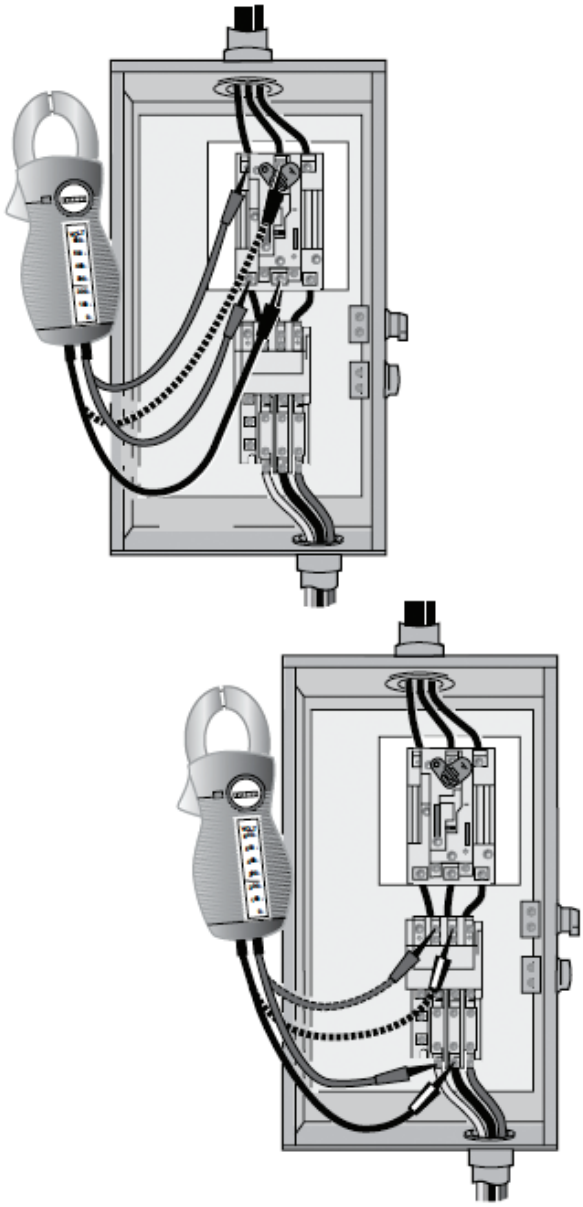
1. To check voltage: Use voltmeter on L1, L2 and L3 in sequence. Check should be made at four locations.
   Step 1: Checking incoming power supply.
   Step 2: Checking fuses.
   Step 3: Checking contact points.
   Step 4: Checking heaters.

2. When checking voltage, all other major electrical appliances (that could be in use at the same time) should be running.

3. If incoming power supply readings are not within the limits (see chart), call your power supplier.

Voltage Limits		
Name Plate	Measured Volts	
	Minimum	Maximum
208V 3Ø	198	218
230V 3Ø	219	242
460V 3Ø	437	483
575V 3Ø	546	604

NOTE: Phase to phase - full line voltage.
Phase to neutral - ½ full line voltage.
(Depending on transformer connection)



Incoming power should be within 5% of power supply voltage. Motors are rated ± 10% of name-plate. The other 5% is used for cable voltage drop.

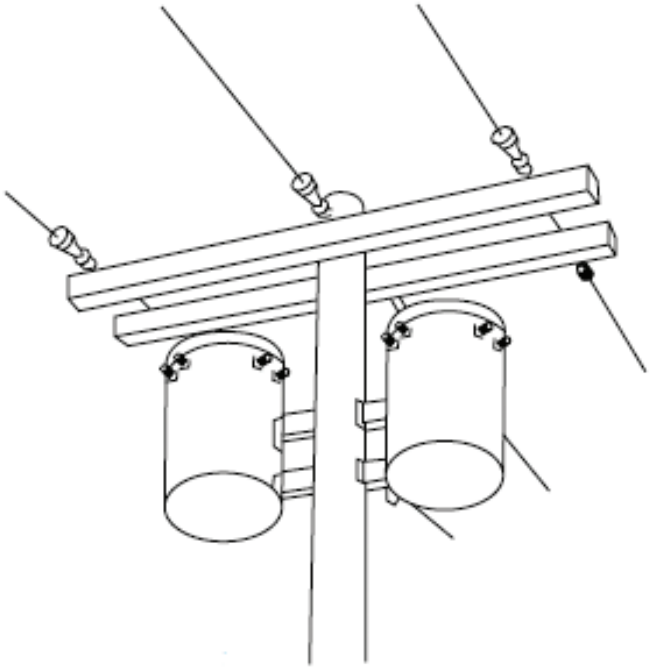
TRANSFORMER SIZES

A full Three Phase supply is recommended for all Three Phase motors, consisting of three individual transformers or one three phase transformer. "Open" delta or wye connections using only two transformers can be used, but are more likely to cause problems from current unbalance.

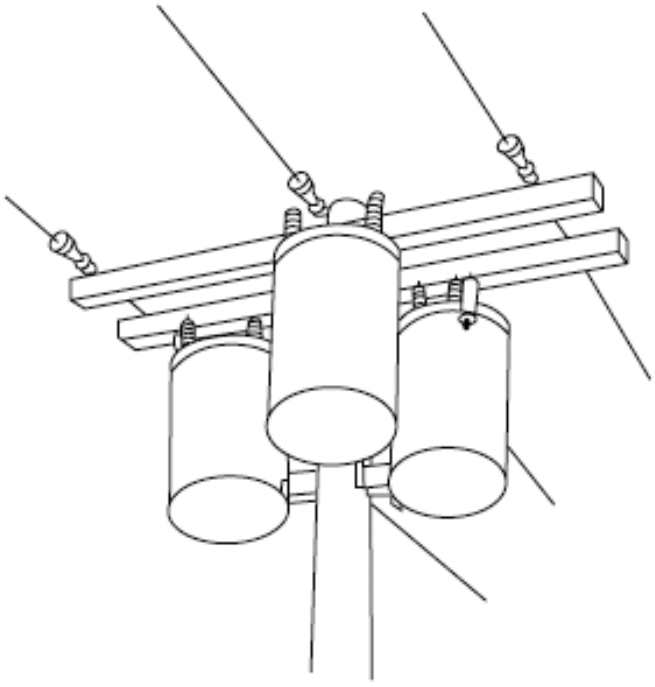
Transformer KVA ratings should be no smaller than listed in the table below.

Transformer Capacity Required for Submersible Motors

Submersible 3Ø Motor HP Rating	Total Effective KVA Required	Smallest KVA Rating – Each Transformer	
		Open WYE Delta 2 Transformers	WYE or Delta 3 Transformers
1½	3	2	1
2	4	2	1½
3	5	3	2
5	7½	5	3
7½	10	7½	5
10	15	10	5
15	20	15	7½
20	25	15	10
25	30	20	10
30	40	25	15
40	50	30	20
50	60	35	20
60	75	40	25
75	90	50	30
100	120	65	40



Open Delta or Wye



Full Three Phase

THREE PHASE POWER UNBALANCE

A full three phase supply is recommended for all three phase motors, consisting of three individual transformers or one three phase transformer. So-called "open" delta or wye connections using only two transformers can be used, but are more likely to cause problems, such as poor performance overload tripping or early motor failure due to current unbalance.

Transformer ratings should be no smaller than listed on Transformer Size Chart on the previous page.

Checking and correcting rotation and current unbalance:

1. Establish correct motor rotation by running in both directions. Change rotation by exchanging any two of the three motor leads. The rotation that gives the most water flow is always the correct rotation.
2. After correct rotation has been established, check the current in each of the three motor leads and calculate the current unbalance as explained in 3 below.

If the current unbalance is 2% or less, leave the leads as connected.

If the current unbalance is more than 2%, current readings should be checked on each leg using each of the three possible hook-ups. Roll the motor leads across the starter in the same direction to prevent motor reversal.

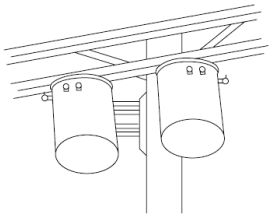
3. To calculate percent of current unbalance:
   A. Add the three line amp values together;
   B. Divide the sum by three, yielding average current;
   C. Pick the amp value which is furthest from the average current (either high or low);
   D. Determine the difference between this amp value (furthest from average) and the average; and
   E. Divide the difference by the average. Multiply the result by 100 to determine percent of unbalance.
4. Current unbalance should not exceed 5% at service factor load or 10% at rated input load. If the unbalance cannot be corrected by rolling leads, the source of the unbalance must be located and corrected. If, on the three possible hook-ups, the leg farthest from the average stays on the same power lead, most of the unbalance is coming from the power source. However, if the reading farthest from average moves with the same motor lead, the primary source of unbalance is on the "motor side" of the starter. In this instance, consider a damaged cable, leaking splice, poor connection, or faulty motor winding.

Phase designation of leads for CCW rotation viewing shaft end. To reverse rotation, interchange any two leads.

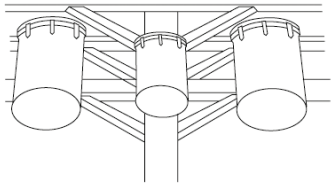
Phase 1 or "A" – Black Motor Lead or T1
Phase 2 or "B" – Yellow Motor Lead or T2
Phase 3 or "C" – Red Motor Lead or T3

Notice: Phase 1, 2 and 3 may not be L1, L2 and L3

	Hookup 1			Hookup 2			Hookup 3		
Starter Terminals	L1	L2	L3	L1	L2	L3	L1	L2	L3
	T1	T2	T3	T1	T2	T3	T1	T2	T3
Motor Leads	R	B	Y	Y	R	B	B	Y	R
	T3	T1	T2	T2	T3	T1	T1	T2	T3
Example:	T3 - R = 51 amps			T2 - Y = 50 amps			T1 - B = 50 amps		
	T1 - B = 46 amps			T3 - R = 48 amps			T2 - Y = 49 amps		
	T2 - Y = 53 amps			T1 - B = 52 amps			T3 - R = 51 amps		
	Total = 150 amps			Total = 150 amps			Total = 150 amps		
	÷ 3 = 50 amps			÷ 3 = 50 amps			÷ 3 = 50 amps		
	- 46 = 4 amps			- 48 = 2 amps			- 49 = 1 amps		
	4 ÷ 50 = .08 or 8%			2 ÷ 50 = .04 or 4%			1 ÷ 50 = .02 or 2%		



Open Delta or Wye



Full Three Phase

GENERATOR SIZES

Note: Always consult the generator manufacturer whenever questions arise.

These sizing charts are recommendations based on motor service factor loading for typical continuous duty generators. If you need to call the generator manufacturer, be prepared to tell them the motor KVA code, the service factor amperage, locked rotor amperage, phase, hertz, motor type, etc. This information can all be found in this manual.

Please note that the 2-Wire chart is only for PSC (permanent split capacitor) type, 2-Wire motors.

You must know which type of generator you have before using the charts, as the required generator size varies by type. Internally regulated generators are also called self-excited. Externally regulated generators are the most common. In addition to the KW / KVA rating, the generator frequency (Hertz, typically 60 Hz in USA) is very important when operating pumping equipment because frequency variations affect pump output in direct relation to the pump Affinity Laws. Operating under 60 Hertz will reduce flow and head while operating over 60 Hertz will increase flow, head, HP and amp draw and could overload the motor.

The generator should always be started before the pump/motor is started, and the pump/motor should always be stopped before the generator is shut down. Operating generators at higher elevations or using natural gas as fuel can affect performance. The generator's manufacturer should be consulted for its recommendations in these instances.

Motor	HP	Externally Regulated		Internally Regulated	
		KW	KVA	KW	KVA
		Minimum Generator Rating			
PSC Type 2-Wire Single Phase	0.5	2.5	3.1	1.75	2.2
	0.75	3.5	4.4	2.5	3.1
	1.0	5	6.3	3.2	4
	1.5	6	7.5	4	5
3-Wire Single Phase and Three Phase Motors	0.5	2	2.5	1.5	1.9
	0.75	3	3.8	2	2.5
	1.0	4	5	2.5	3.2
	1.5	5	6.3	3	3.8
	2.0	7.5	9.4	4	5
	3.0	10	12.5	5	6.3
	5.0	15	18.8	7.5	9.4
	7.5	20	25	10	12.5
	10.0	30	37.5	15	18.8
	15.0	40	50	20	25
	20.0	60	75	25	31
	25.0	75	94	30	37.5
	30.0	100	125	40	50
	40.0	100	125	50	62.5
	50.0	150	188	60	75
	60.0	175	220	75	94
	75.0	250	313	100	125
	100.0	300	375	150	188
	125.0	375	469	175	219
	150.0	450	563	200	250
	175.0	525	656	250	313
	200.0	600	750	275	344

UL AND CSA AGENCY LISTING(S)

Our control boxes, motors, complete pump assemblies and electrical accessories are tested by independent product safety and testing organizations to ensure compliance with the US National Electric Code (NEC) and/or Canadian Standards Association (CSA) standards. Underwriters Laboratories Inc. and CSA are the agencies with whom we contract. They have agreed to eliminate overlapping efforts through an agreement which allows either to test to the other's standards. This is good for manufacturers and consumers, as overlapping independent testing is very expensive. This agreement does not appear to have been effectively communicated at this time.

Unfortunately, there is a great deal of misunderstanding associated with the Agency Listings and their marks or logos. By meeting specific safety requirements, products can be either UL Listed or UL Recognized. The UL mark in a circle signifies that a product is UL Listed (approved) for its intended use by Underwriters Laboratories Inc. Radios, televisions, CD players, fans and small appliances are a good example of UL Listed products.

The lesser known and most misinterpreted UL mark is the backwards, signifying a UL Recognized Component. This is used on products that are combined to create a complete assembly, such as submersible motors, which do work only when combined with a matching pump to form a complete assembly. Due to their length and weight, only .5 - 1.5 HP submersible pumps are assembled to motors by manufacturers. These sizes meet shipping company weight and length guidelines and will survive transit. Larger pumps and motors are shipped in separate containers to avoid shipping damage and employee injuries. Since motors are sold as separate components and field assembled to pump ends, they can only be tested and sold as Recognized Components. It is for this reason that all water ends are tagged with warning labels stating they must be mated to a motor of equal or greater HP to avoid overloading the motor. Think of the UL Recognized Component marking as a caution to installers to verify they have correctly matched motors and water ends.

Testing by the Canadian Standards Association is denoted by the CSA logo.

Per their recent agreement UL can test products sold in the USA and / or Canada, conversely, CSA can test products sold in Canada and / or the USA.

Logos and their meanings to follow:

- UL Listed for USA
- UL Listed for Canada (tested by UL to CSA Standards)
- UL Listed for USA and Canada (tested by UL and CSA Standards)
- UL Recognized Component for USA
- UL Recognized Component for Canada (tested by UL to CSA Standards)
- UL Recognized Component for USA and Canada (tested by UL to UL and CSA Standards)
- CSA Approved for Canada
- CSA Approved for USA (tested by CSA to UL Standards)
- CSA Approved for USA and Canada (tested by CSA to CSA and UL Standards)

Per the reciprocity agreement between the two agencies, electrical inspectors in both countries should now be honoring either the UL or CSA mark on products approved for their respective country.

FARADYNE
MOTORS

FARADYNE MOTORS

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