

tesla

submersible motors



INSTALLATION and OPERATION MANUAL

2008

4GG & 4TW series/60Hz

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1 – Nomenclature - Submersible Motors

Sample : **4 GG 005 115 M TP**

Motor Size
4 = 4 inch

Number of Wire
GG = Three wire
TW = Two wire

Horse Power
005 = 1/2 Hp
075 = 3/4 Hp
100 = 1 Hp
150 = 1 1/2 Hp
200 = 2 Hp
300 = 3 Hp
500 = 5 Hp
750 = 7 1/2 Hp
1000 = 10 Hp

Voltage
115 = 115 V
230 = 230 V
460 = 460 V

Phase
M = 1 Ph (monophase)
T = 3 Ph (threephase)

Motor protection
TP = Thermally Protected

2 – Nomenclature – Control Box

Sample : **CB S 005 115**

General
CB = Control Box

Model Control Box
S = PSC – Permanent split Capacitor
B = CSCR – Capacitor Start / Capacitor Run

Horse Power
005 = 1/2 Hp
075 = 3/4 Hp
100 = 1 Hp
150 = 1 1/2 Hp
200 = 2 Hp
300 = 3 Hp
500 = 5 Hp

Voltage
115 = 115 V
230 = 230 V

3 – Overview

This manual gives important information concerning the installation, use and maintenance of the motors. The contents of this manual refer to the standard product, as presented in the sales documentation. Any special versions will be supplied with supplementary instruction sheets. Please refer to the sales contract for the features of variants and special versions. Always specify the exact type of motor and code when requesting our Sales and Service Department for technical information or spare parts. For any instructions, situations and events not covered in this manual or in the sales documentation, please contact the nearest Technical Assistance Centre.

4 - Applications

All the motors in the 4GG/4TW range can be used to drive submersible pumps in the conditions established in CSA Standard C22.2 No. 100-04 (Motors and Generators) / UL Standard 1004 (Electric Motors), and at the supply voltage / frequency specified on the rating plate.

The shaft extension and flange size of these motors comply with NEMA MG1:2006

The power of the pumps coupled to these motors must be less than or equal to that of the motors.

5 – Liquids in which the motor can operate

This motor can be used in cold water.

Do not use this motor with corrosive or explosive liquids, or particularly dirty or hard water (impurities may deposit on the outer casing).

6 – Compatible pumps

Make sure the motor is compatible with the pump. Incompatible combinations may cause problems.

In particular, before coupling the motor to the pump check that:

- the power of the pump to couple to the motor is less than or equal to that of the motor.
 - the supply voltage and frequency match those indicated on the rating plate of the motor
- the motor and pump shafts turn freely

7 – Motor powered by a frequency converter

Only specially ordered motors can be powered with a frequency converter.

If the motor is combined with a frequency converter, downgrade power by 10% and make sure you never exceed the rated input frequency of the motor.

To ensure the motor is properly cooled, the minimum water flowrate at the minimum frequency of use must equal the minimum flowrate indicated in the previous points.

8 – Installation

Before installing the motor, read this instructions manual and the one supplied with the pump or electric pump to which the motor will be coupled. Keep both manuals with care.

If the product shows clear signs of damage, do not proceed with installation, but contact the Technical Service Centre. Use suitable equipment and protective devices. Observe all accident prevention regulations.

Always refer to current local and/or national regulations, legislation and bylaws governing installation and water and power connections.

9 – Electrical connections to the electric pump

Electrical connections may only be performed by a qualified installer in compliance with current regulations. Make sure that the supply voltage and frequency are compatible with the electrical panel. The relative information is shown on the motor rating plate and in the documents supplied with the panel. Provide suitable short circuit protection on the supply line.

Before proceeding, make sure that all the connections (even if they are potential-free) are voltage-free.

Unless otherwise specified in local bylaws, the supply line must be fitted with:

- a short circuit protection device
- a high sensitivity residual current circuit breaker (30mA) for additional protection from electrocution in case of inefficient grounding.
- a general switch with a contact aperture of at least 3 millimetres.

Ground the system in compliance with current regulations

Single-phase version

Connect the electric pump to a supply line via a suitable electrical control panel containing the overload protection and the capacitor.

Refer to the wiring diagram on the outer casing of the motor and in figure 1 and the documentation supplied with the electrical panel.

Refer to the motor rating plate for the capacity of the capacitor.

Install the electrical panel in a sheltered area.

Three-phase version

Connect the electric pump to a supply line via a suitable electrical control panel .

Install the electrical panel in a sheltered area.

Refer to the documentation supplied with the electrical panel.

For connections to any external control devices (e.g.: pressure switch, float) follow the instructions supplied with these devices.

10 – Maintenance, Service, Spare Parts

Before proceeding, always make sure the motor is disconnected from the supply line.

Maintenance operations may only be performed by expert and qualified people. Use suitable equipment and protective devices. Observe all accident prevention regulations.

Do not attempt to disconnect the connector from the motor head cable.

This may only be done by authorised personnel.

Only use original spare parts to replace faulty components.

The motor does not require any scheduled routine maintenance.

Users wishing to prepare a maintenance schedule should bear in mind that maintenance frequencies depend on the conditions of use.

For any requirements, please contact our Sales and Service Department.

11 – Spare Parts

Always specify the exact type of motor and code when requesting our Sales and Assistance Service for technical information or spare parts.

Only use spare parts to replace faulty components. Unsuitable spare parts may cause the product to work incorrectly and cause hazards for people and property.

12 - Storage

Tesla S.r.l. submersible motors are a water-lubricated design. The fill solution consists of a mixture of de-ionized water and Propylene Glycol (a non-toxic antifreeze). The solution will prevent damage from freezing in temperatures to -23°F (-5°C); motors should be stored in areas that do not go below this temperature.

There may be an interchange of fill solution with well water during operation. Care must be taken with motors removed from wells during freezing conditions to prevent damage.

When the storage temperature does not exceed 104°F (40°C), storage time should be limited to two years. Where temperatures reach 100° to 130°F, storage time should be limited to one year.

Loss of a few drops of liquid will not damage the motor as an excess amount is provided, and the filter check valve will allow lost liquid to be replaced by filtered well water upon installation. If there is reason to believe there has been a considerable amount of leakage, consult the factory for checking procedures.

13 - Frequency of Starts

The average number of starts per day over a period of months or years influences the life of a submersible pumping system. Excessive cycling affects the life of control components such as pressure switches, starters, relays and capacitors. Rapid cycling can also cause motor spline damage, bearing damage, and motor overheating. All these conditions can lead to reduced motor life.

The pump size, tank size and other controls should be selected to keep the starts per day as low as practical for longest life. The maximum number of starts per hour is 20 for a minimum running of two minutes, in order to dissipate heat build up from starting current.

14 - Mounting Position

Tesla submersible motors are designed primarily for operation in the vertical, shaft-up position.

During acceleration, the pump thrust increases as its output head increases. In cases where the pump head stays below its normal operating range during startup and full speed condition, the pump may create upward thrust. This creates upward thrust on the motor upthrust bearing. This is an acceptable operation for short periods at each start, but running continuously with upthrust may cause excessive wear on the upthrust bearing.

With certain restrictions, motors are also suitable for operations in positions from shaft-up to shaft-horizontal. As the mounting position becomes further from vertical and closer to horizontal, the probability of shortened thrust bearing life increases. For normal thrust bearing life expectancy with motor positions other than shaft-up, follow these recommendations:

1. All the motors in the range can be installed horizontally as long as the axial thrust of the pump never falls below 100 N while it is working.
2. Do not use in systems which can run even for short periods at full speed without thrust toward the motor.

15 - Water Temperature and Flow

Tesla standard submersible motors are designed to operate up to maximum service factor horsepower in water up to 95°F (35°C). A flow of 0.65 ft/sec for 4" motors is required for proper cooling.

The table shows minimum flow rates, in GPM, for various well diameters and motor sizes.

Minimum GPM required for motor cooling in water up to 95°F (35°C)			
Casing or Sleeve I.D. Inches (mm)		4" Motor (1/2-10Hp) 0,65 ft/sec (0,2m/sec)	
		GPM	l/min
4"	102	5	19
5"	127	21	79
6"	152	40	150
7"	178	63	237
8"	203	94	353
10"	254	161	604
12"	305	247	927
14"	356	352	1320
16"	406	467	1752

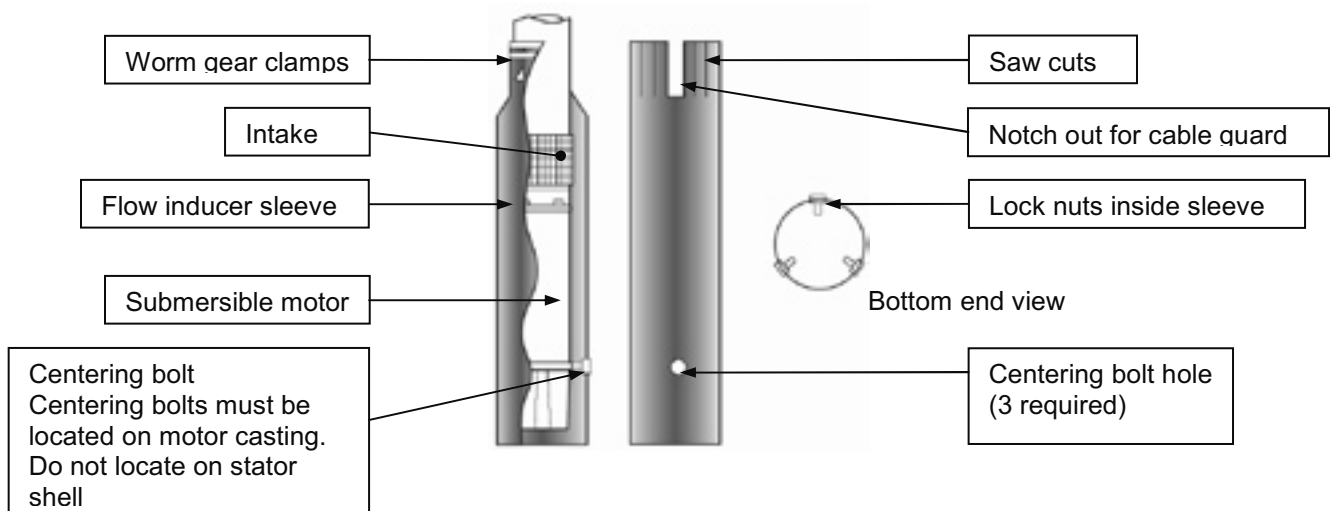
16 – Flow Inducer Sleeve

If the flow rate is less than specified or coming from above the pump, then a flow inducer sleeve must be used. A flow sleeve is always required in an open body of water. Figure shows a typical flow inducer sleeve construction.

Example : A four-inch motor and pump that delivers 60 GPM will be installed in a 8" well.

From up table, 122 GPM would be required to maintain proper cooling.

In this case adding an 6" or smaller flow sleeve provides the required cooling.



17 - Hot Water Application

When the pump-motor operates in water hotter than 95°F (35°C), a flow rate of at least 11.5 ft/sec is required. When selecting the motor to drive a pump in over 95°F (35°C) water, the motor horsepower must be de-rated per the following procedure.

Using next Table to determine pump GPM required for different well or sleeve diameters. If necessary, add a flow sleeve to obtain at least 11.5 ft/sec flow rate.

Minimum GPM required for motor cooling in water up to 95°F (35°C)			
Casing or Sleeve I.D. Inches (mm)		4" Motor (1/2-10Hp)	
		11,5 ft/sec (3,2m/sec)	
		GPM	l/min
4"	102	75	283
5"	127	330	1244
6"	152	650	2450

18 - 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 correct relay positioning for proper, trouble-free operation.

Control boxes should be shaded from direct sunlight in areas where temperatures exceed 95°F (35°C) as excessive heat may dry out capacitors and shorten their life. It is advisable to paint the enclosure white if outside in very hot, sunny climates.

19 - Two Wire – Single Phase - Motor Data

	Motor Model Suffix	Rating					Full Load		Maximum (S.F.Load)		Winding Res. In Ohms	Efficiency %		Power Factor %		Locked Rotor	KVA Code
		HP	kW	Volts	Hz	S.F.	Amps	Watts	Amps	Watts	M=Main Res. S=Start Res.	F.L.	S.F.	F.L.	S.F.	Amps	
Type 4TW 2 wire	005115MTP	1/2	0,37	115	60	1,6	8,6	800	10	1100	0,9-1,1	46	54	88	95	36	K
	005230MTP	1/2	0,37	230	60	1,6	3,9	800	5	1100	3,7-4,5	46	54	88	95	18	K
	075115M	3/4	0,55	115	60	1,5	9,8	1200	13	1400	0,6-0,73	47	59	82	88	54	J
	075230MTP	3/4	0,55	230	60	1,5	6,3	1200	6,9	1400	2,3-2,9	47	59	82	88	27	J
	100230MTP	1	0,75	230	60	1,4	7,7	1500	8,8	1850	1,7-2,1	50	56	84	91	37	K
	150230M	1 1/2	1,1	230	60	1,3	10,6	2100	12,1	2500	1,3-1,6	53	57	85	90	50	J

20 - Three Wire – Single Phase - Motor Data

	Motor Model Suffix	Rating					Full Load		Maximum (S.F.Load)		Winding Res. In Ohms		Efficiency %		Power Factor %		Locked Rotor	KVA Code
		HP	kW	Volts	Hz	S.F.	Amps	Watts	Amps	Watts	M=Main Res.	S=Start Res.	F.L.	S.F.	F.L.	S.F.	Amps	
Type 4GG (1Ph) 3 wire	005115MTP	1/2	0,37	115	60	1,6	Y-8,6 B-8,4 R-5,8	800	Y-10 B-8,3 R-5,6	1100	M 0,9-1,1 S 1,9-2,3		46	54	88	95	36	K
	005230MTP	1/2	0,37	230	60	1,6	Y-3,9 B-3,6 R-2,7	800	Y-5 B-4,2 R-2,6	1100	M 3,7-4,5 S 7,8-9,5		46	54	88	95	18	K
	075115M	3/4	0,55	115	60	1,5	Y-9,8 B-9,6 R-7,0	1200	Y-13 B-12,7 R-9,3	1400	M 0,6-0,7 S 1,1-1,4		47	59	82	88	54	J
	075230MTP	3/4	0,55	230	60	1,5	Y-6,3 B-6,2 R-3,4	1200	Y-6,9 B-6,5 R-3,3	1400	M 2,3-2,9 S 4,4-5,4		47	59	82	88	27	J
	100115M	1	0,75	115	60	1,4	Y-13,3 B-10,7 R-9,6	1500	Y-16,5 B-12,7 R-9,3	1850	M 0,5-0,6 S 1-1,2		50	56	84	91	74	K
	100230MTP	1	0,75	230	60	1,4	Y-7,7 B-7,6 R-5,2	1500	Y-8,8 B-8,0 R-5,1	1850	M 1,7-2,1 S 3,8-4,6		50	56	84	91	37	K
	150230M	1 1/2	1,1	230	60	1,3	Y-10,6 B-10,8 R-6,0	2100	Y-12,1 B-11,5 R-5,9	2500	M 1,3-1,6 S 3-3,7		53	57	85	90	50	J
	200230M	2	1,5	230	60	1,25	Y-11,1 B-9,2 R-6,7	2400	Y-13,1 B-10,6 R-6,6	2900	M 1,2-1,5 S 2,3-2,8		61	64	94	96	55	H
	300230M	3	2,2	230	60	1,15	Y-15,3 B-12,2 R-7,0	3350	Y-17,0 B-13,8 R-6,8	3750	M 1-1,2 S 2,4-3		66	67	95	96	60	D
	500230M	5	3,7	230	60	1,15	Y-25 B-21,2 R-10,8	5200	Y-28 B-23,5 R-10,6	5900	M 0,64-0,78 S 1,6-2		71	72	90	92	120	F

21 - Three Wire – Three Phase - Motor Data

	Motor Model Suffix	Rating					Full Load		Maximum (S.F.Load)		Winding Res. In Ohms M=Main Res. S=Start Res.	Efficiency %		Power Factor %		Locked Rotor Amps	KVA Code
		HP	kW	Volts	Hz	S.F.	Amps	Watts	Amps	Watts		F.L.	S.F.	F.L.	S.F.		
Type 4GG (3Ph) 3 wire	005230T	1/2	0,37	230	60	1,6	3,6	560	3,7	780	5,2-6,4	66	75	40	53	16	P
	075230T	3/4	0,55	230	60	1,5	4,6	870	4,9	1160	3,85-4	63	71	47	59	24	P
	075460T	3/4	0,55	460	60	1,5	2,2	870	2,4	1160	16,4-18,1	63	71	47	59	12	P
	100230T	1	0,75	230	60	1,4	4,7	1100	5,2	1450	3,5-4,2	66	71	59	70	30	N
	100460T	1	0,75	460	60	1,4	2,6	1100	2,8	1450	12-13,2	66	71	59	70	15	N
	150230T	1 1/2	1,1	230	60	1,3	8,1	1720	8,5	2100	2-2,5	64	68	53	62	48	N
	150460T	1 1/2	1,1	460	60	1,3	3,6	1720	3,9	2100	8,5-9,3	64	68	53	62	24	N
	200230T	2	1,5	230	60	1,25	10,2	2310	10,8	2750	1,35-1,66	64	67	57	64	62	N
	200460T	2	1,5	460	60	1,25	4,6	2310	4,9	2750	5,4-6	64	67	57	64	31	N
	300230T	3	2,2	230	60	1,15	10,7	2960	11,6	3450	1,2-1,5	75	74	69	75	80	L
	300460T	3	2,2	460	60	1,15	5,6	2960	6,0	3450	4,8-5,3	75	74	69	75	40	L
	500230T	5	3,7	230	60	1,15	20,4	5700	21,6	6400	0,74-0,9	71	73	70	75	132	L
	500460T	5	3,7	460	60	1,15	8,9	5700	9,6	6400	3,1-3,5	71	73	70	75	66	L
	750230T	7,5	5,5	230	60	1,15	25,7	7300	27,5	8300	0,53-0,65	76	76	71	76	180	L
	750460T	7,5	5,5	460	60	1,15	12,0	7300	13,0	8300	2,2-2,5	76	76	71	76	90	L
	1000460T	10	7,5	460	60	1,15	15,4	9550	16,9	11000	1,8-2,2	77	77	78	82	110	K

22 – Two/Three Wire Single Phase – Cable Lengths

Maximum Lengths in Feet

Motor Rating				Single Phase - 60/75° C Insulation - AWG Copper Wire Size												
Volts	Phase	HP	kW	14	12	10	8	6	4	3	2	1	0	00	000	0000
115	1	1/2	0,37	100	160	250	390	620	960	1190	1460	1780	2160	2630	3140	3770
		3/4	0,55	65	110	160	275	425	660	820	1010	1230	1500	1830	2190	2630
		1	0,75	50	85	125	215	335	520	650	800	975	1190	1450	1735	2085
230	1	1/2	0,37	400	650	1020	1610	2510	3880	4810	5880	7170	8720			
		3/4	0,55	300	480	760	1200	1870	2890	3580	4370	5330	6470	7870	9380	
		1	0,75	250	400	630	990	1540	2380	2960	3610	4410	5360	6520	7780	9350
		1 1/2	1,1	190	310	480	770	1200	1870	2320	2850	3500	4280	5240	6300	7620
		2	1,5	150	250	390	620	970	1530	1910	2360	2930	3620	4480	5470	6700
		3	2,2	120	190	300	470	750	1190	1490	1850	2320	2890	3610	4470	5550
		5	3,7	0	110	180	280	450	710	890	1110	1390	1740	2170	2680	3330

Lengths in bold type – only for 75°C Insulation

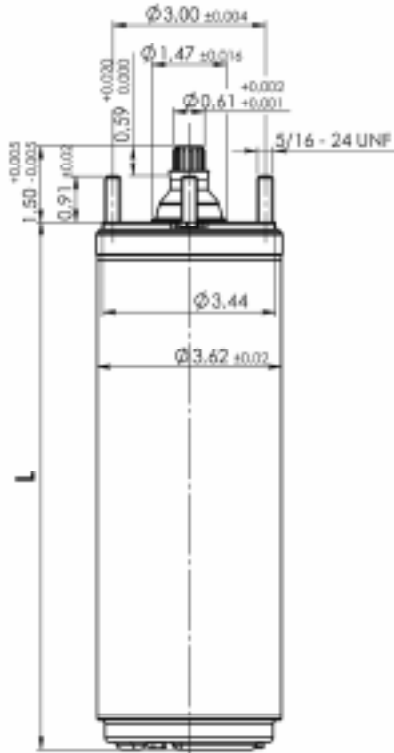
23 – Three Wire Three Phase – Cable Lengths

Maximum Lengths in Feet

Motor Rating				Three Phase - 60/75° C Insulation - AWG Copper Wire Size												
Volts	Phase	HP	kW	14	12	10	8	6	4	3	2	1	0	00	000	0000
230	3	1/2	0,37	930	1490	2350	3700	5760	8910							
		3/4	0,55	670	1080	1700	2580	4190	6490	8060	9860					
		1	0,75	560	910	1430	2260	3520	5460	6780	8290					
		1 1/2	1,1	420	670	1060	1670	2610	4050	5030	6160	7530	9170			
		2	1,5	320	510	810	1280	2010	3130	3890	4770	5860	7170	8780		
		3	2,2	240	390	620	990	1540	2400	2980	3660	4480	5470	6690	8020	9680
		5	3,7	140	230	370	590	920	1430	1790	2190	2690	3290	4030	4850	5870
		7 1/2	5,5	0	160	260	420	650	1020	1270	1560	1920	2340	2870	3440	3440
460	3	3/4	0,55	2730	4350	6850										
		1	0,75	2300	3670	5770	9070									
		1 1/2	1,1	1700	2710	4270	6730									
		2	1,5	1300	2070	3270	5150	8050								
		3	2,2	1000	1600	2520	3970	6200								
		5	3,7	590	950	1500	2360	3700	5750							
		7 1/2	5,5	420	680	1070	1690	2640	4100	5100	6260	7680				
		10	7,5	310	500	790	1250	1960	3050	3800	4680	5750	7050			

24 – Dimensions and weights

4GG Dimensions



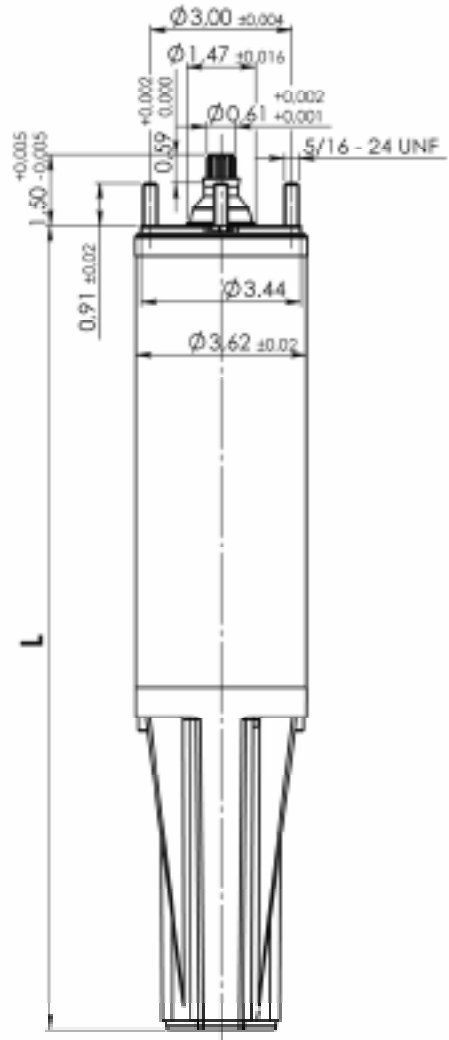
Single Phase

Rated Hp	Rated KW	Phase	Axial thrust		L		Weight	
			N	lbs	mm	inch	Kg	lbs
1/2	0,37	1	2000	450	266	10,47	8,0	17,62
3/4	0,55	1	2000	450	286	11,26	9,0	19,82
1	0,75	1	2000	450	331	13,03	11,0	24,23
1 1/2	1,1	1	3000	675	391	15,39	13,0	28,63
2	1,5	1	3000	675	411	16,18	14,0	30,84
3	2,2	1	3000	675	451	17,76	15,7	34,58
5	3,7	1	6000	1350	684	26,93	26,5	58,37

Three Phase

Rated Hp	Rated KW	Phase	Axial thrust		L		Weight	
			N	lbs	mm	inch	Kg	lbs
1/2	0,37	3	2000	450	236	9,29	6,7	14,76
3/4	0,56	3	2000	450	266	10,47	8,0	17,62
1	0,75	3	2000	450	286	11,26	9,0	19,82
1 1/2	1,1	3	3000	675	346	13,62	11,0	24,23
2	1,5	3	3000	675	391	15,39	13,0	28,63
3	2,2	3	3000	675	411	16,18	14,0	30,84
5	4	3	6000	1350	614	24,17	23,0	50,66
7 1/2	5,5	3	6000	1350	684	26,93	26,6	58,59
10	7,5	3	6000	1350	764	30,08	30,6	67,40

4TW Dimensions



Rated Hp	Rated KW	Phase	Axial thrust		L		Weight	
			N	lbs	mm	inch	Kg	lbs
1/2	0,37	1	2000	450	435	17,13	8,0	17,62
3/4	0,56	1	2000	450	455	17,91	9,1	20,04
1	0,75	1	2000	450	500	19,69	11,5	25,33
1 1/2	1,12	1	3000	675	560	22,05	13,3	29,30

25 – Tightening Motor Lead Connector Screws

4" Motors:

1,2 to 1,6 ft-lb. (1,7 to 2,1 N-m)

Screws tightening torques recommended for field assembly are shown. Rubber compression set within the first few hours after assembly may reduce the screws torque. This is a normal condition which does not indicate reduced seal effectiveness. Retightening is not required, but is permissible and recommended if original torque was questionable.

A motor lead assembly should not be reused. A new lead assembly should be used whenever one is removed from the motor, because rubber set and possible damage from removal may prevent proper resealing of the old lead.

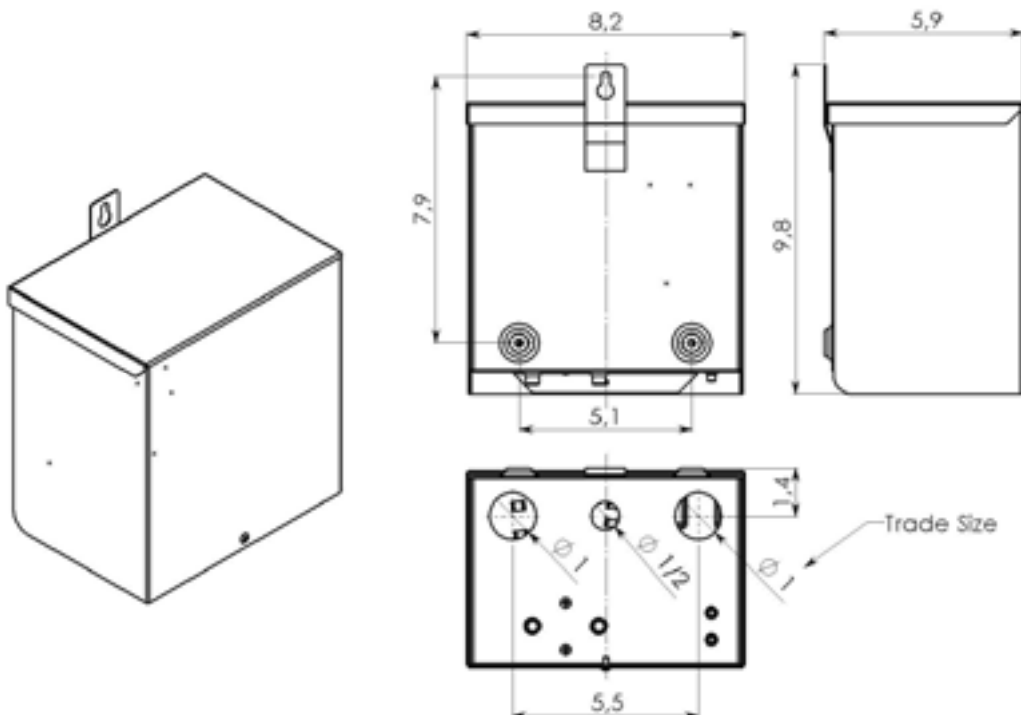
All motors returned for warranty consideration must have the lead returned with the motor.

26 – Shaft Height Free End Play

Motor	Normal Shaft Height		Dimension Shaft Height		Free End Play	
					Min.	Max.
4"	1 1/2"	38,1mm	1,508"	38,30 mm	0,010"	0,045"
			1,498"	38,05 mm	0,25 mm	1,14 mm

If the height, measured from the pump-mounting surface of the motor, is low and/or end play exceeds the limit, the motor thrust bearing is possibly damaged, and should be replaced.

27 – Control Box Knockouts Dimensions



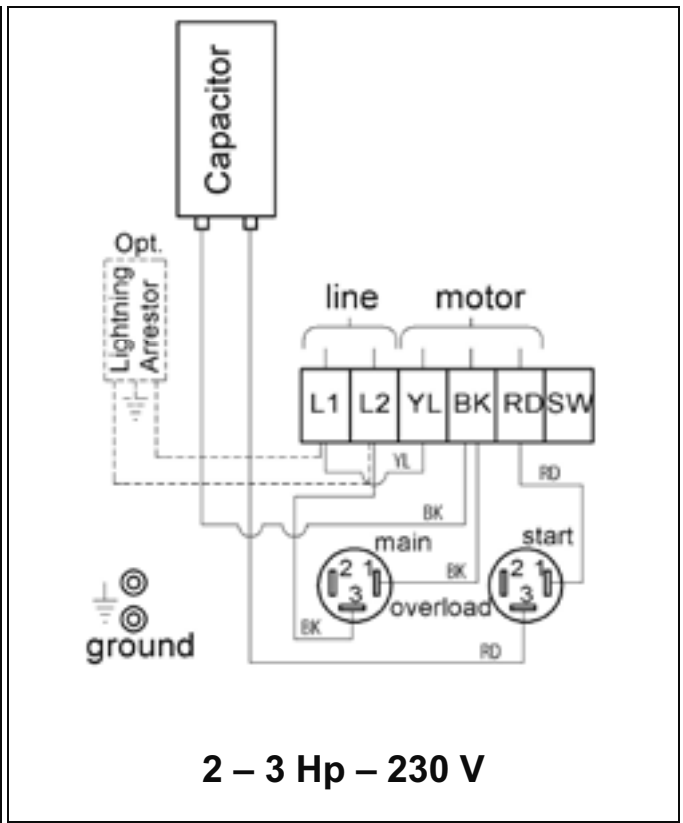
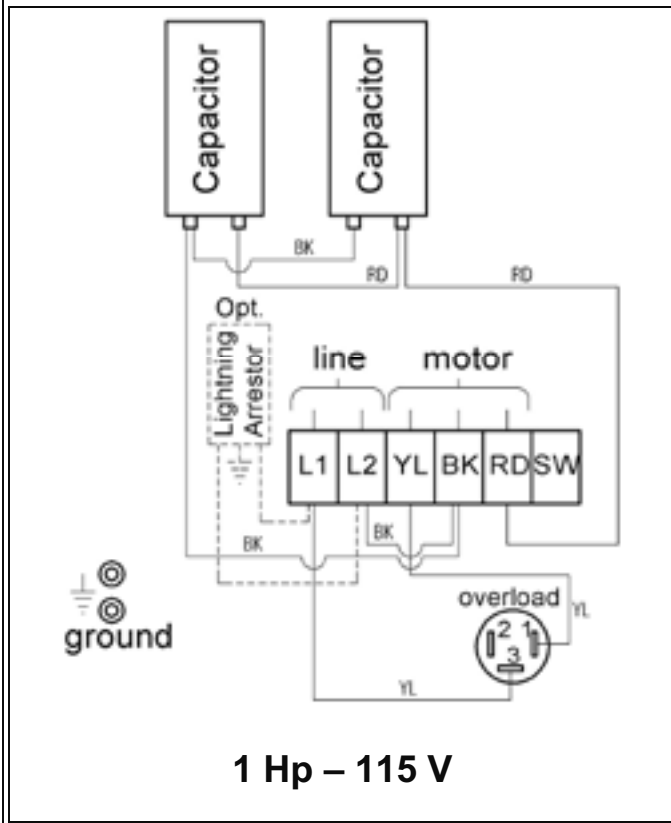
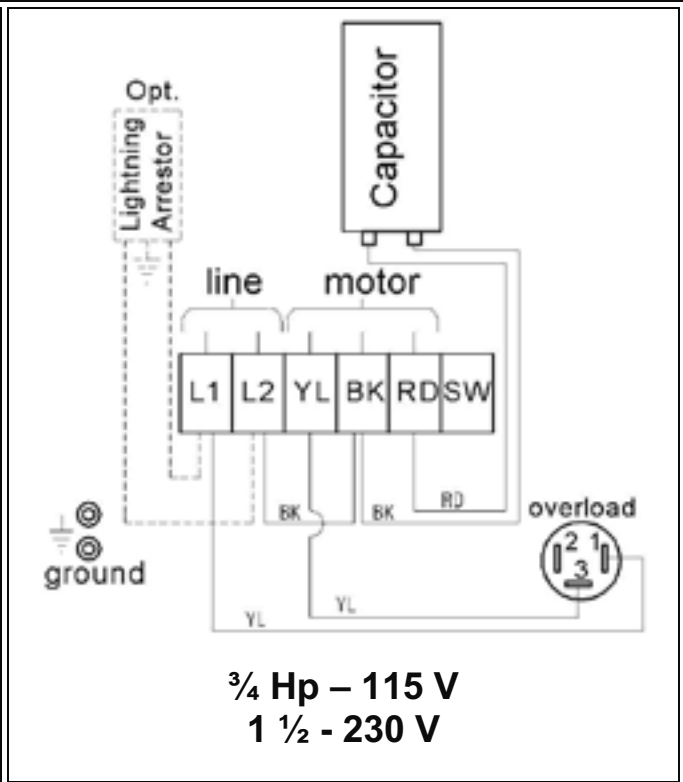
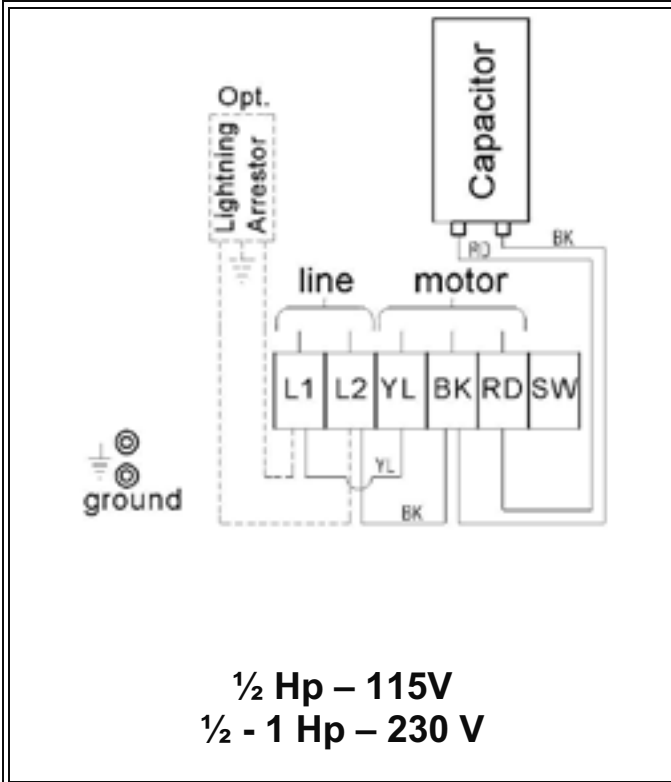
28 – Single Phase Motors and Controls – PSC series

Control box PSC series – Permanent Split Capacitor							
Volts	Hp Motor	kW Motor	CB Model	Start cap. Part.n°-	MFD	Volts	Overload Part.n°-
115	1/2	0,37	S005115	3002869	80	450	/
	3/4	0,55	S075115	3002873	100	250	3012000
	1	0,75	S100115	3002851-2pcs	70+70	450	3012005
	1/2	0,37	S005230	3002764	20	450	/
	3/4	0,55	S075230	3002771	25	450	/
230	1	0,75	S100230	3002799	35	450	/
	1 1/2	1,1	S150230	3002801	40	450	3012010
	2	1,5	S200230	3002828	50	450	S 3012015 M 3012020
	3	2,2	S300230	3002828	50	450	S 3012025 M 3012030

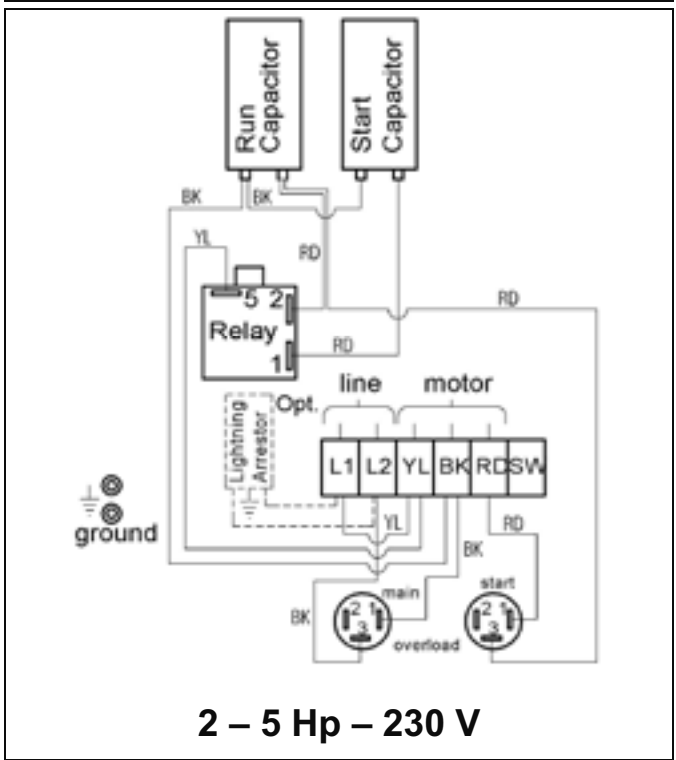
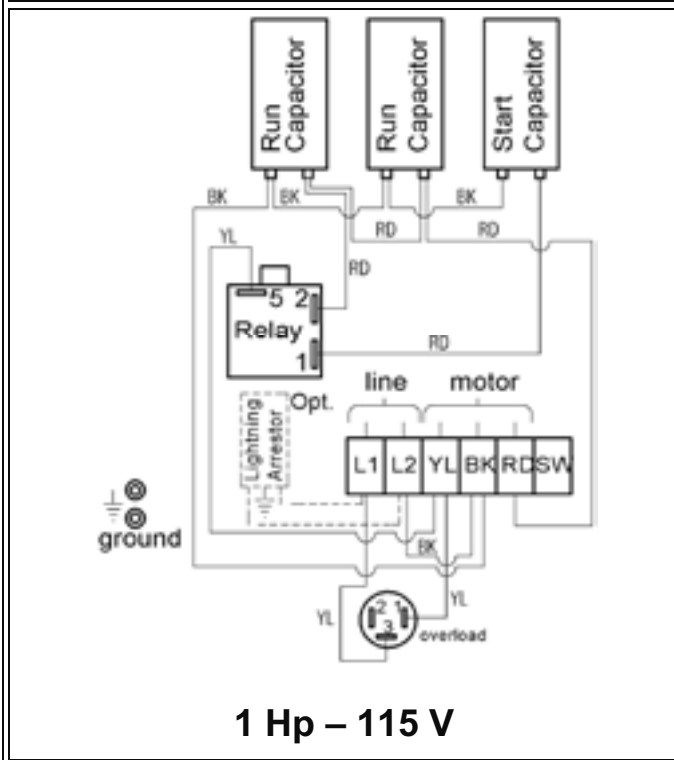
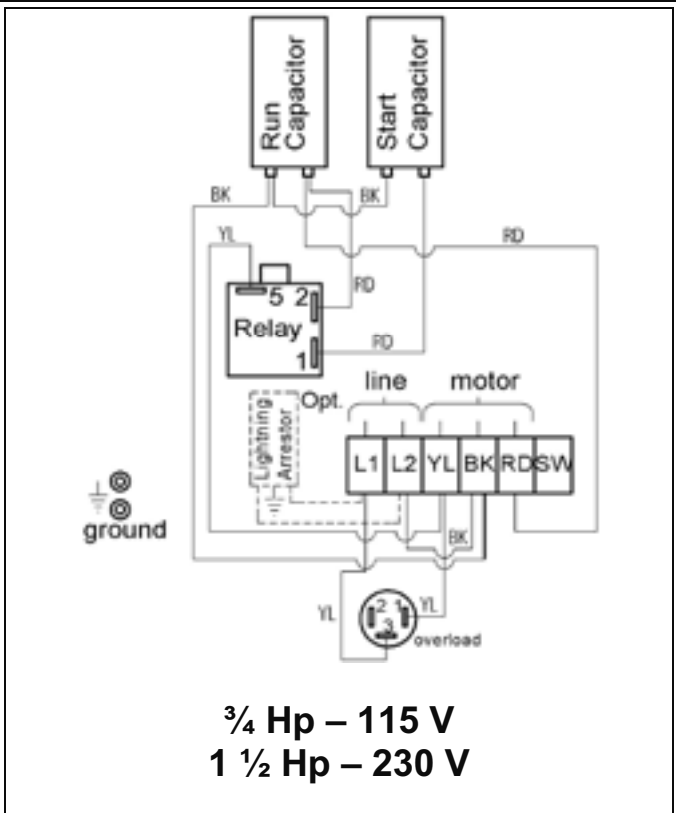
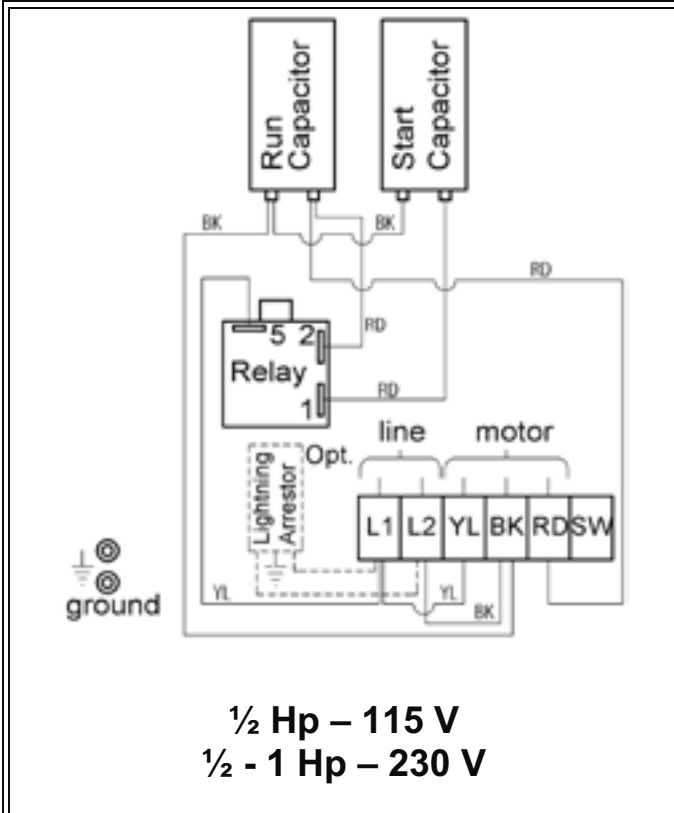
29 – Single Phase Motors and Controls – CSCR series

Control box CSCR series – Capacitor Start / Capacitor Run											
Volts	Hp Motor	kW Motor	CB Model	Run cap. Part.n°-	MFD	Volts	Start cap. Part.n°-	MFD	Volts	Overload Part.n°-	Relay Part.n°-
115	1/2	0,37	B005115	3002869	80	450	30028801	189-227	250	/	7156075
	3/4	0,55	B075115	3002873	100	250	30028801	189-227	250	3012000	7156075
	1	0,75	B100115	3002851-2pcs	70+70	450	30028801	189-227	250	3012005	7156075
	1/2	0,37	B005230	3002764	20	450	30028451	53-64	250	/	7156020
	3/4	0,55	B075230	3002771	25	450	30028741	108-130	250	/	7156020
230	1	0,75	B100230	3002799	35	450	30028741	108-130	250	/	7156020
	1 1/2	1,1	B150230	3002801	40	450	30028801	189-227	250	3012010	7156020
	2	1,5	B200230	3002828	50	450	30028801	189-227	250	S 3012015 M 3012020	7156020
	3	2,2	B300230	3002828	50	450	30028801	189-227	250	S 3012025 M 3012030	7156055
	5	3	B500230	3002851	70	450	30028823	324-389	250	S 3012035 M 3012040	7156055

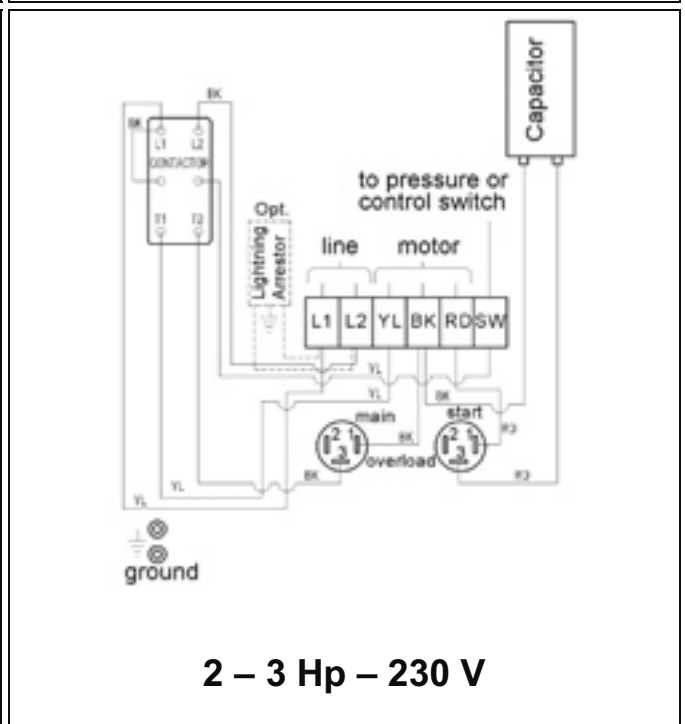
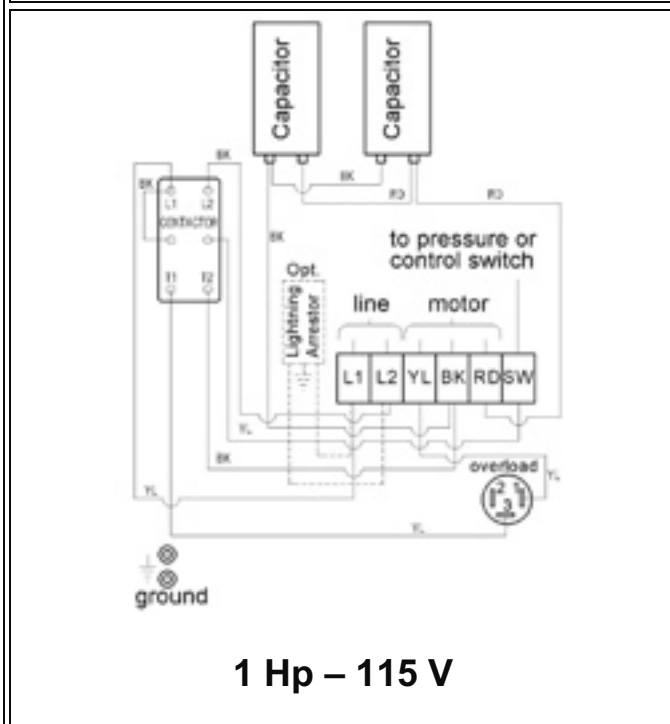
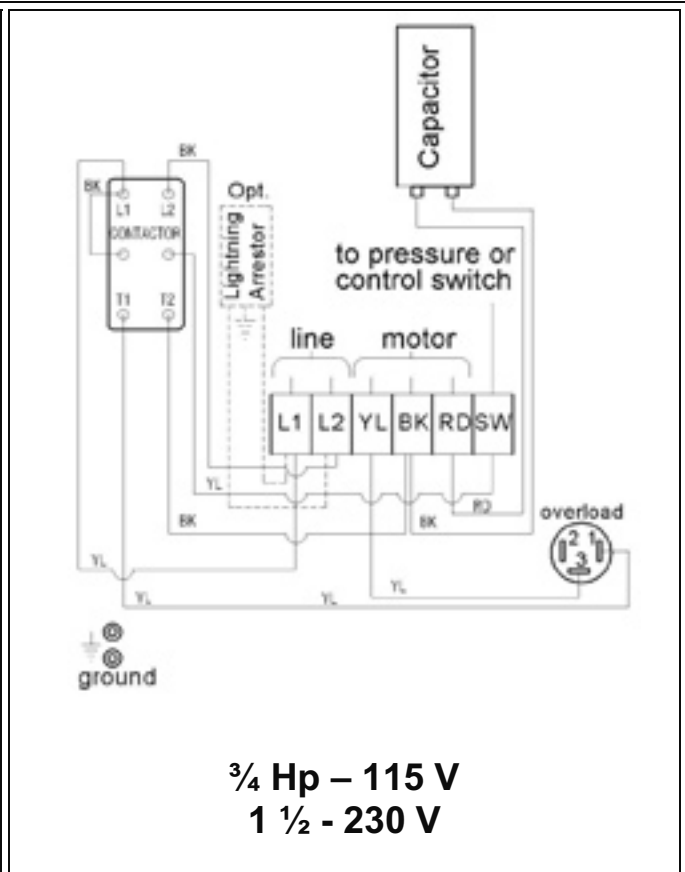
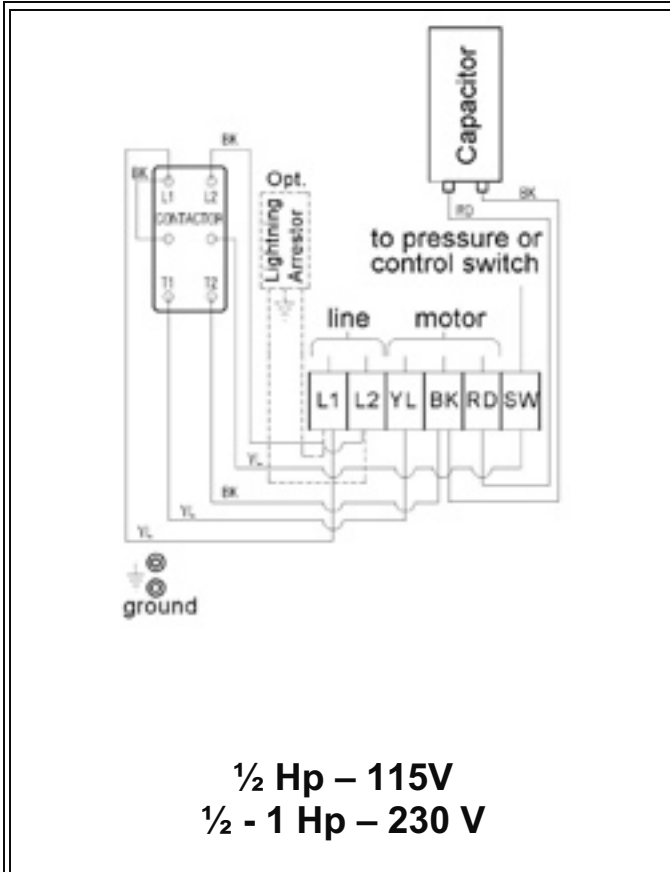
30 - Control Box - Wiring Diagrams – PSC series



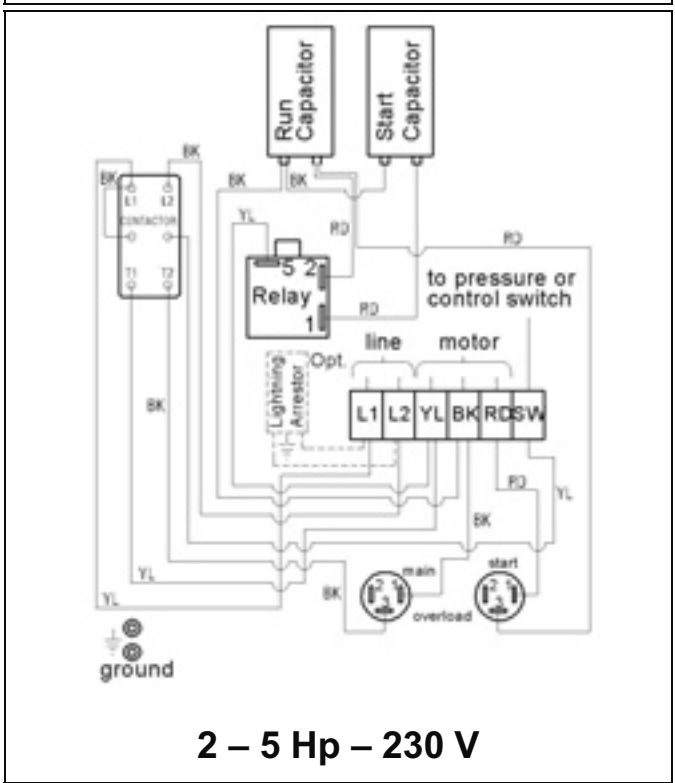
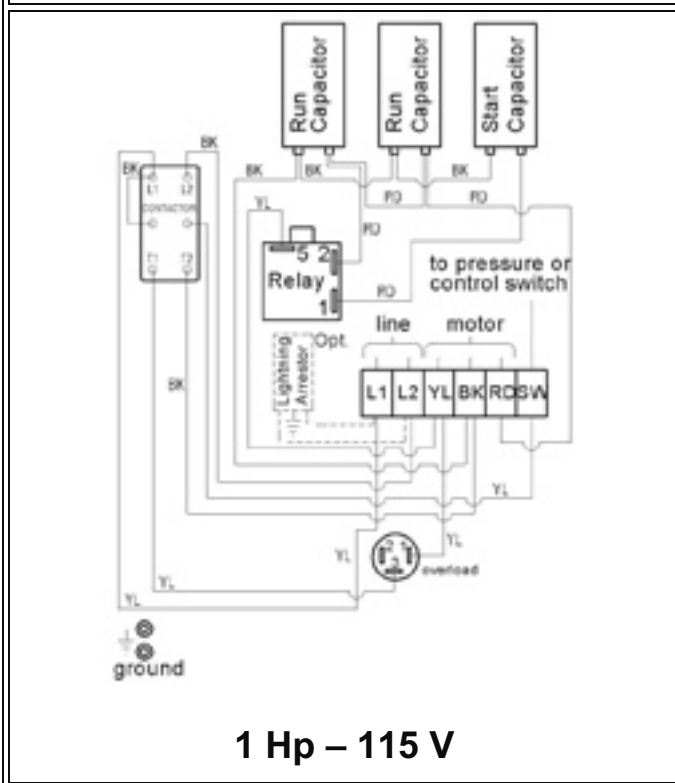
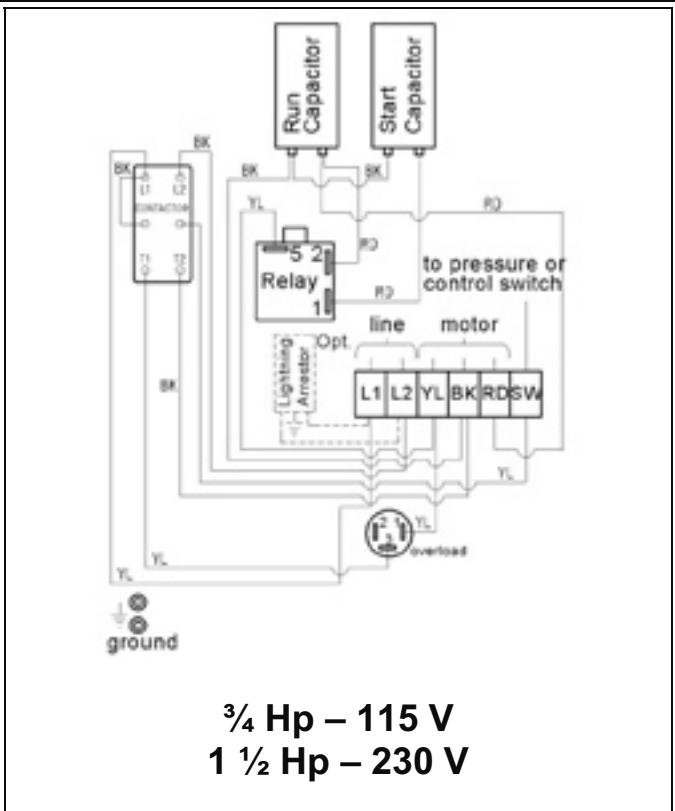
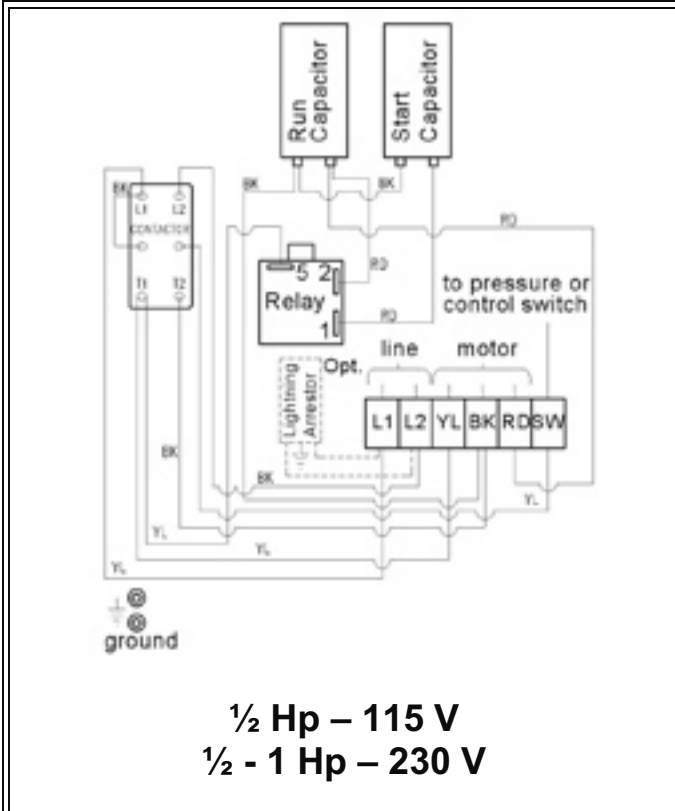
31 - Control Box - Wiring Diagrams – CSCR series



32 - Control Box - Wiring Diagrams with Magnetic Contactor – PSC series



33 - Control Box - Wiring Diagrams with Magnetic Contactor – CSCR series



34 - PSC Control Box Check Out

CHECKING PROCEDURE: BE SURE POWER IS TURNED OFF

A - OVERLOAD (Push reset button to make sure contacts are closed).

- 1-Ohmmeter setting: (Rx1).
- 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: (Rx1000).
- 2-Terminal connections: individual capacitor terminals.
- 3-Ohmmeter reading: pointer should swing toward zero then drift back toward infinity.

C – MAGNETIC CONTACTOR ONLY (Disconnect 1 coil lead)

- 1-Ohmmeter setting: (Rx100).
- 2-Check coil resistance: 180-1400 Ohms
- 3-Remove contact cover and inspect contacts.

35 - CSCR Control Box Check Out

CHECKING PROCEDURE: BE SURE POWER IS TURNED OFF

A - OVERLOAD (Push reset button to make sure contacts are closed).

- 1-Ohmmeter setting: (Rx1).
- 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: (Rx1000).
- 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: (Rx1000).
- 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: (Rx1).
- 2-Terminal connections: "1" and "2" on relay.
- 3-Ohmmeter reading: should be zero.

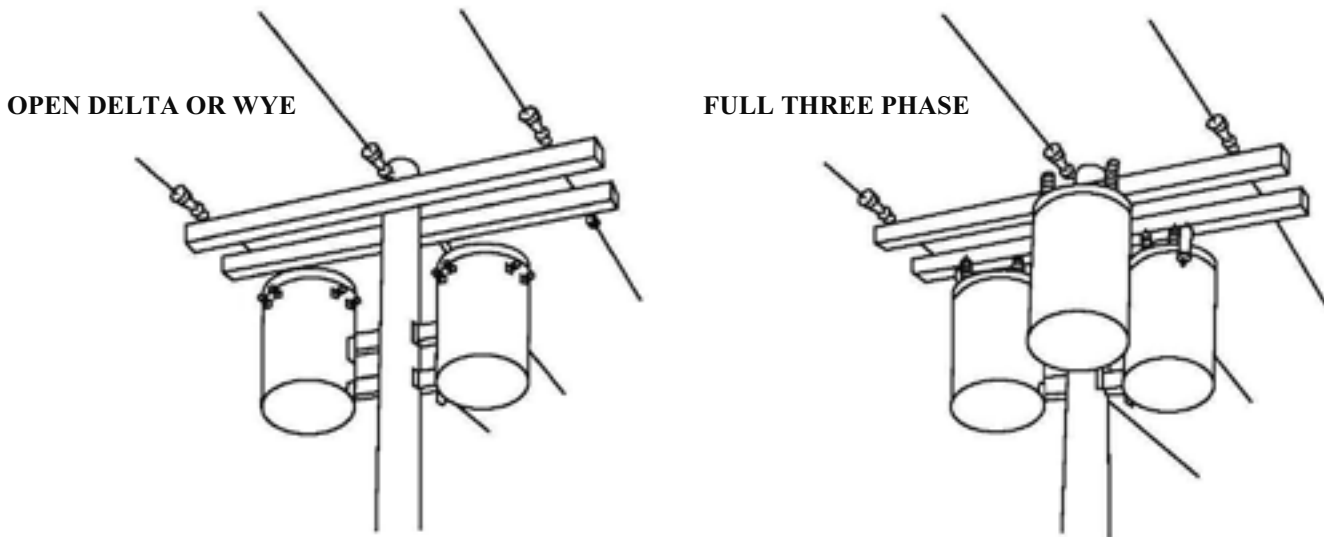
E – MAGNETIC CONTACTOR ONLY (Disconnect 1 coil lead)

- 1-Ohmmeter setting: (Rx100).
- 2-Check coil resistance: 180-1400 Ohms
- 3-Remove contact cover and inspect contacts.

36 - 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 previous page.



Checking and correcting rotation and current unbalance.

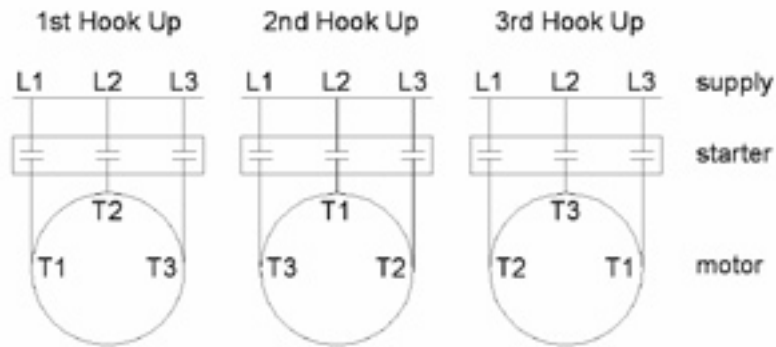
1. Establish correct motor rotation by running in both directions. Change rotation by exchanging any two of the three motor leads. The rotation that gives the most water flow is always the correct rotation.
2. After correct rotation has been established, check the current in each of the three motor leads 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. by three, yielding average current.
 - B. Pick the amp value which is furthest from the average current (either high or low).
 - C. Determine the difference between this amp value (furthest from average) and the average.
 - D. Divide the difference by the average. Multiply the result by 100 to determine percent of unbalance.
 - E. Add the three line amp values together.
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 hookups, 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.



Example:

T1 = 51 amps + T2 = 46 amps + T3 = 53 amps =	T1 = 50 amps + T2 = 49 amps + T3 = 51 amps =	T1 = 50 amps + T2 = 48 amps + T3 = 52 amps =
Total = 150 amps	Total = 150 amps	Total = 150 amps
150/3 = 50 amps	150/3 = 50 amps	150/3 = 50 amps
50-46 = 4 amps	50-49 = 1 amps	50-48 = 2 amps
4/50 = 0.08 or 8%	1/50 = 0.02 or 2%	2/50 = 0.04 or 4%

37 - Transformer Sizes

A full three phase supply is recommended for all three phase motors, consisting of three phase 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 ratings should be no smaller than listed in the table for supply power to the motor alone.

HP	kW	Required KVA	KVA Rating (smallest) For Each Transformer	
			Open WYE or D 2 Transformers	Closed WYE or D 3 Transformers
1 1/2	1,1	3,0	2,0	1,0
2	1,5	4,0	2,0	1,5
3	2,2	5,0	3,0	2,0
5	3,7	7,5	5,0	3,0
7,5	5,5	10,0	7,5	5,0
10	7,5	15,0	10,0	5,0

NOTES

