HITACHI SUBMERSIBLE MOTORS

F 1

Date: 03/22/16 Supersedes: 09/01/07

SAFETY PRECAUTIONS

For the best results with submersible motors, read this manual and all of the warning sign attached to the motor carefully before installing and operating it, or maintaining and testing it, and follow the instructions exactly.

In this manual, the rank of cautions is distinguished as **WARNING** and **CAUTION**.



Indicates a potentially hazardous situation may happen, which, if not avoided, can result in death or serious injury.



Indicates a potentially hazardous situation may happen, which, if not avoided, can result in injury or damage of product.

In some situations, serious results may be caused even by the reason of **CAUTION**. Please be sure to keep every instruction on this manual. After reading this manual, keep it at hand of endusers for quick reference.

HANDLING AND INSTALLATION



This motor is intended for installation by technically qualified personnel.

Verify motor is filled with clean water before installing. The warranty is void if this is not done. This motor and lead assembly are designed only for use submerged in water.

 Do not use lead wires to pull, lift or handle the motor. The lead wires should be protected during storage, handling, moving and installation of the motor.

Inspect the motor to determine that it is the correct HP, voltage

and size for the job and that there is no shipping damage.

The factory-installed water in the motor is supplied with Propylene Glycol capable of temperatures to -30°C(-22°F). Do not install, transport or store below these temperatures. If storage is necessary below these temperatures, drain the water from the motor.

4) After long periods of idleness and on all new installations, check the electrical resistance and megger the motor with lead wires connected: see table A. Prior to installation, the motor should have an insulation value of at least 50 megohms. After installation, motor and power cable should have a minimum insulation value of 1 megohm. If minimum values are not obtained, contact factory.

5) Check the tightness of drain plugs, mounting bolts and cable connections

6) Do not hammer the shaft, coupling or slinger since this may damage the thrust bearing. Check the rotation of the shaft by hand to insure that it turns freely.

7) Do not drop the bottom end of the motor in the dirt or mud since this may plug up the diaphragm opening.

8) If motor is to be installed in a horizontal position, make sure

that the lead wires are at the 12 o'clock position when facing the motor shaft (in horizontal position).

TROUBLE SHOOTING OF SUBMERSIBLE MOTORS

1) Motor does not start.

- No power supply.

 Check for loose or corroded connections and motor lead terminals.
- Defective connections. → Correct connections.
- 2) Fuses or relay blow when motor starts.
- Incorrect voltage. → Apply correct voltage (Nameplate).
- Incorrect fuses or relay. → Replace with proper fuses and relay.
- Defective capacitors. → Replace with proper capacitors.
- Wrong connections. → Correct wrong connections or short circuit.
- Locked rotor conditions. →Correct pump or well conditions.
- Insulation resistance down. →Check the line and correct.
- 3) Motor runs for a while and then blown fuses or relay.
- Low voltage or high voltage. → Apply rated voltage.
- Defective capacitors. → Replace with proper capacitors.
- Different control box for the motor. \rightarrow Replace with proper control box.
- Defective starting voltage relay. → Replace with proper relay.
- Pump is sand clogged. → Pull pump and clean well.
- Overheated protector. → Shield the control box from heat source.

The following conditions are stated to provide the owner with a list of criteria for maximum motor life and to assure motor warranty.

PRE-INSTALLATION

- 1) Maximum water temperature:
 - A) 35°C(95°F): 6" (5 \sim 40HP) motors.
 - B) 25°C(77°F): 6" (50, 60HP), 8", 10", 12" and 14" motors.
- 2) PH content of the water between: 6.5 -8
- 3) Maximum chlorine content: 500 PPM
 - Maximum Sulfuric acid iron content: 15 PPM
 - Maximum Fluorine content: 0.8 PPM
 - Maximum Electric conductivity: 118 µMHO/INCH
- 4) Maximum sand content: 50 PPM
- 5) Proper approved three-phase overload protection. See TABLE B.
- 6) Proper fusing for motor circuit protection. See TABLE C.
- 7) Proper line voltage variation during running conditions: 60Hz: 460V, $230V \pm 10\%$, 50Hz: $380V \pm 10\%$ at motor lead terminal.
 - (voltage drop of cable should be considered by user.)
 - Combination of voltage and frequency variation: ±10%
 - (sum of absolute values of voltage and frequency)
- Current unbalance between legs should not exceed 5% of the average.
- 8) Proper sizing of motor HP. (current, thrust, voltage, etc.)
- Motor must be set with minimum 10 feet clearance from the bottom of the well.

- 10) In the case of horizontal installation, the motor is to be rigidly aligned with the pump and firmly mounted to prevent any load on the shaft and bearings and to avoid any damaging vibrations to the motor.
- 11) The motor must always be immersed in water so that a flow velocity of cooling water at a rate of 0.5 feet per second flows past any and all parts of the motor. The motor will not operate in mud or sand.
- 12) Hitachi motor leads are sized for operation while submerged in water at the maximum rated ambient water temperature. The factory motor leads must be fully submerged at all times during operation to avoid damage or failure.
- 13) The power cables shall be sized large enough so that at rated current there will be less than a 5% voltage drop. See TABLE C. Cables must be waterproof submersible type.
- 14) For three-phase motors a balanced and properly sized transformer bank shall be provided. Improper electrical supply (for example, phase converter, V-connection transformer, etc.) or connections will void the warranty.
- 15) Single-phase protection is recommended for protection of the installation. Any failure due to single phasing of the incoming voltage causing the motor to fail will void the warranty.
- 16) Surge suppressors are recommended in the interest of protecting the control panel, as well as the insulation system of the motor. Any motor failure due to lightning or other natural disasters will void the warranty.
- 17) Provide waterproof insulation splices between all lead wires and well cables.
- 18) In the event that a reduced voltage starter is used to start the motor, the following should be verified:
- A. Correct quick trip, class 10 or better, ambient compensated overloads are incorporated.
- B. Proper short circuit protection is utilized.
- C. The torque required by the motor and pump package is attainable by this type starter.
- D. The lead arrangement of the motor is acceptable with the proposed starter load connections.
- E. Verify that if any time delay relays are used in switching contactors in and out, that the time settings do not exceed 2 seconds; this could damage the motor.
- F. If a manual auto-transformer starter is used, voltage should be minimum 60% of rated voltage, and switched to "Run" condition within 2 seconds. Double check TABLE B and C for correct protection.
- 19) Single-Phase Motors (5-15HP)
 - Proper connections and correct capacitors and relays are necessary for single-phase motor starting and running. Connection diagram: See Fig. 1.
 - Performance and recommendable capacitors: See TABLE D.
- 20) VFD (Inverter) Please contact Hitachi for VFD(inverter) usage on Hitachi

Submersible Motors

MAINTENANCE

There are no bearings that need oil or grease. The motor, being inaccessible, should be monitored through its electrical connections.

- 1) Measure and record operating current and voltage.
- 2) Measure and record the motor insulation resistance. Any resistance of less than 50 megohm for a new motor should be evaluated or checked further by a qualified service shop.
- 3) Lightning arrestors and/or surge capacitors will help prevent damage to the control box, cables, and motor.
- 4) Single-phase protection will help in preventing motor failure due to adverse incoming primary power.
- 5) Based on the values obtained in A and B above and the output flow rates and pressures of the pump, a complete picture of total performance can be obtained. This can be used to determine any pump and motor maintenance and overhauling which might be required.

6) If the motor is to be stored, protect the unit from freezing by storing in an area with a temperature higher that -30°C(-22°F).

OPERATION

- 1) After energizing the motor, check the flow and pressure of the pump to make sure that the motor is rotating in the correct direction. To correct a wrong rotation, switch any two of the three cable connections. (Three-phase motor only)
- 2) When starting the pump for the first time, inspect the water for sand. If sand appears, then continue to pump till the water clears up; otherwise, sand will accumulate in the pump stages and will bind or freeze the moving parts if water is allowed to flow back down the well.
- 3) During testing or checking rotation (such as "bumping" or "inching") the number of "starts" should be limited to 3, followed by a full 15 minutes cooling-off period before any additional "starts" are attempted. Depending on the depth of the well and/or method of checking, these rotational checks or "starts" may actually be fullfledged starts. If this is the case, then a full cooling-off period of 15minutes is required between this type of start.
- 4) For automatic (pilot device) operation, the motor should be allowed to cool for 15 minutes between starts.
- 5) Input voltage, current and insulation resistance values should be recorded throughout the life of the installation and should be used as a from of preventive maintenance.

TABLE A. RESISTANCE DATA Single Phase 2 Pole 230V/60Hz

250

300

12", W

0_0776

0.0386

MOTOR	HP	RESISTANCE (Ω)										
SIZE & TYPE	nr	R - Y	B-Y	R — B								
6", C	5	2.143	0,482	2,597								
11	7.5	1,372	0.371	1,715								
11	10	1,022	0.286	1.280								
"	15	0.648	0.200	0.821								

Three Phase 2 Pole

Three Phase 4 Pole

MOTOR IZE & TYPE	HP	VOLT	RESISTANCE (Ω)	MOTOR SIZE & TYPE	HP	VOLT	RESISTANCE (Ω)
6", C	5	230	0.776	8", W	7.5	230	0.564
(2)	5	460	3_021		7.5	460	2 178
(66)	7.5	230	0 621	1960	10	230	0 564
177.1	7.5	460	2_400	.**	10	460	2.178
	10	230	0.418	-44	15	230	0,399
(80)	10	460	1,590	79%	15	460	1.519
	15	230	0 282	**	20	230	0.399
(+):	15	460	1.044	960	20	460	1 519
(#)	20	230	0.229	1990	25	230	0.242
796.5	20	460	0.832	244	25	460	0.888
180	25	230	0.180	3#1	30	230	0 242
140	25	460	0,636	744	30	460	0.888
(9)	30	230	0,147	10 ¹⁰ , W	40	460	0 408
	30	460	0,530	10	50		0.408
39	40	460	0,358	1040	60	3900	0.288
77	50	77.	0.308	VME I	75	111	0.257
19	60	H	0,308	5445	100	1401	0.171
8" , C	40	M	0,278	7,460	125	180	0.171
	50	12	0 202	12", W	150	14.	0.138
399	60	36	0 202	**	175	160	0.119
8", W	40	77	0.372	7,8%	200	(7)	0.0826
94	50	**	0 331	14", W	250	394	0,0552
22	60	#1	0.278	(*)	300	::::	0.0517
164	75	11	0.218	Values are for norma	d temp.	58°F (20°C) and
39	100	997	0 164	LEAD WIRE COLO		ince.	
	125		0.132	R Red , Y. Yellow MOTOR TYPE	, B: Bla	ck , G: Gi	cen (6°C. 8°C)
36	150	**)	0.115	C : CANNED , W	: WATE	RTIGHT	
10", W	175	70.	0.121				
	200	66	0.0000				

					E OF OVERLOAD PROTECTION Overload					TABLE C. FUSE AND COPPER CONDUCTION CO																
Phase	MOTOR Size & Type Pole	LID	77.10		AMPS		Protection		F	JSE				, C		ductor				ox to N	1010	K (FEI		COND	TEM	P:80
nase		HP	Volts	Hz	Rated AMPS	S.F=1.15 AMPS	STARTER Size	HEATER CODE (Furnas AMB COMP.)	STD Size	Dual- Element Size		10	8	6	4	2	0	00	000	0000	250	300	350	400	500	6
		-5	230 460	60	7.5	8.5	0	K58 K43	45 25	30	960	380 1520	610 2420	970	1500	2380			-							Ŧ
			380	50	9	-	0.	K49	30	17.5	670	1060	1670													t
		7.5	230 460	60	22	13		K64 K54	70 35	20	160	260 1050	410 1670	650 2660	1010	1610	2430									Ţ
			380	50	13	13	-i-	K55	40	25	450	710	1130		2790				-	_		_	_	-		t
		10	230 460	60	29 14.5	33	1-3/4	K68 K58	90	60	400	200	320	500	780	1240	1880									1
			380	50	17	16.5	1	K58	45 60	30	340	780 540	1250 850	1990	2110									-		ł
		15	230	60	42	46	2	K74	150	80			210	340	530	840	1270	1590	2020							1
			460 380	60 50	21 25	23	1-3/4	K63 K64	70 80	40	3.40	540 360	860 580	920	2120 1430	2260						_	_			1
	6", C	20	230	60	54	60	2-1/2	K77	175	100		853	JA 8.5.	260	400	640	970	1220	1550	1940						t
	2Pole		460 380	50	27 32	30	2 2	K67 K69	100	50	-	410 280	650 440	710	1620	2570 1740	2620									Į
		25	230	60	68	76	3	K83	225	125		200	440	710	330	520	780	980	1240	1560	1800					+
			460 380	60 50	34	38	2	K72	110	60			530	840	1300	2060										1
		30	230	60	41 82	94	3	K73 K86	125 250	150			350	550	860	1370 430	2060 650	810	1030	1300	1490	1790				+
			460	60	41	47	2-1/2	K74	125	80			430	690	1070	1700	2570			79.00	1,7,00					t
		40	380 460	50 60	48 53	60	2-1/2	K75 K76	150	100			300	480 520	740 810	1170	1940	2220		_						Ţ
		-10	380	50	62	-	3	K76	200	125	_	_		360	560	890		1700	2150	_			-	-		
		50	460	60	70	79	3	K83	225	125					650		1560	distribution (see	1224	2000						
		60	380 460	50 60	83	94	3-1/2	K85 K86	250	150					440	690 850	1040	1310		2090				-	_	+
	8", C 2Pole	40	460	60	54	6,1	3	K76	175	100.				520	810	1280	1930									t
		50	380 460	50 60	64	75	3	K77 K78	200	125	_			360	550 670	870 1060	1320	1660 2010	2100			_	_	_		ļ
		30	380	50	78	-10	3	K85	250	150					450	710	1070	1350	1710	2150		-		-		+
		60	460 380	60	79 94	89	3-1/2	K86	250	150						860	1310	1640	2080	1 200000						İ
		40	460	50 60	56	63	3-1/2	K87	300 175	175	-	-	_	520	810	590 1280	1930	1110	1410	1770	2040		-	_		+
			380	50	65	-	3	K77	200	125				360	550	870	1320		2100							1
		50	460 380	50	65 78	7.3	3	K78 K85	200 250	125			_	_	670	710	1600	2010 1350	1710	2150						1
	ı	60	460	60	80	90	3-1/2	K86	250	150					4.112	860	1310	1640	2080	2150			-			t
тее	8", W 2Pole	75	380	50. 60	95 96	- 100	3-1/2	K87	300	175						590	880	1110	1410		2040					1
iase		1.0	460 380	50	115	109	3-1/4	K88 K89	300 350	175				-		710 480	730	1360 910	1720	2160 1460	1680	2010		_		+
		100	460	60	127	145	4	K92	400	225							810	1020	1300	1630	1880					t
		125	380 460	60	152	180	4-1/2	K26 K28	500	300			_			-	550	690 820	870 1040	1100	1270	1510	1760			H
			380	50	192	-	4-1/2	K28	600	350			-					020	700	880	1020	1220	1420	1620	2030	+
		150	460 380	60 50	197 235	220	4-1/2	K31	600 700	350										1090	1250	1500	1750			
Ī	_	175	460	60	205	230	5	K32 K31	700	450 400		_								740 950	850 1090	1010	1180	1350	1690	1 2
		77.	380	50	261		6	K23	800	500								- 7		289588	700	840	970	1110	1390	1
	10", W 2Pole	200	460 380	50	23.5	270	5	K33 K24	900	450 600	_	_		-		-	-					1130	1320 870	1510	1889	
- 1		250	460	60	295	340	6	K27	900	600				Ϊī									620	1210		
- 1	1011 771	300	380 460	50 60	370 350	396	6	K28 K29	1200	650 650															990	1
	12", W 2Pole	300	380	50	420	- 390	6	K31	1300	750							-	-							1270	1
Ī		7.5	230	60	26	29	1-3/4	K68	80	50		270			1050	1660	2510									Ť
	-	10	460 230	60	13 32	36	1-3/4	K56 K70	40 100	25 60	670	1060 200	310	2700 500	770	1230	1850	_		_						-
			460	60	16	18		K60	50	30	490	780	1250	1990			- 0				-					+
	8". W	15	230 460	60	46 23	52 26	2-1/2	K75 K64	150 70	90 45	330	530	840	340 1340	520 2080	830	1250	1570	1990							1
	4Pole	20	230	60	58	66	2-1/2	K77	175	110	33U	2311	040	250	390	610	930	1160	1480	1860						1
		50	460	60	29	33	2	K69	90	60		390	620	1000	1540	2450	= // /				Tim-					1
		25	230 460	60	76 38	86	3 2	K85 K73	250 125	150 70			520	830	320 1280	510 2040	770	970	1230	1540	1780	-				f
		30	230	60	88	100	3	K87	300	175						420		800	1010	1270	1470	1760				1
-		40	460	60	62	71	2-1/2	K75 K77	150	80			430	680		1680 1310		2,100	- 12							I
	+	50	460	60	73	83	3	K83	225	150							1590									+
	10", W	60	460	60	91	104	3-1/2	K87	300	175							1350	1690		27.00						İ
	4Pole	75 100	460 460	60	106 145	121	3-1/2 4-1/2	K89 K26	350 450	200 300							1090		1740 1300		1880	2250				1
		125	460	60	175	200	4-1/2	K29	600	350								7,000	1030	1300	1490	1790				+
	12", W	175	460 460	60	190 220	218	4-1/2 5	K29 K32	600 700	350 400										1100			1760		2100	I
	4Pole	200	460	60	255	293	6	K24	800	450				-	-						1100		1530 1330			
	14", W	250	460	60	305	350	6	K27	1000	600														1230		
-	4Pole	300	460 230	60	370 24	425 27.5	.6	K29	1200	650 45		190	300	470	730	1170										H
gle	6", C	7.5	230	60	36	41			110	70		. 7.0	190	300	470	750										+
ise	2Pole	10	230 230	60	50 72	58 85			175 225	90 150				220	340 240		830 570		020							T
		1.0	E-70	.vu	1.6	0.7			+63	1,00	لــــــــــــــــــــــــــــــــــــــ	\perp	\perp	للسبا	659	369	279	1.69	249							L

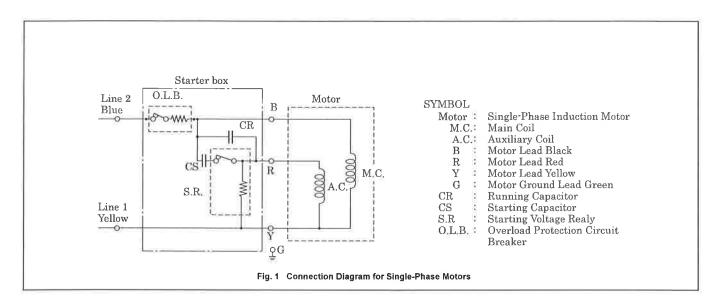


TABLE D. PERFORMANCE DATA OF SINGLE-PHASE SUBMERSIBLE MOTOR

								2P F	OR 6" I	DEEP V	/ELL												
Output (HP)			5					7.5							10		15						
Voltage-Frequency No Load Current (A)			230V			60Hz		230V 60Hz			z	230V 60Hz			z	230V			60Hz				
		(A)	8,8					8.3							12.0			16.1					
No Load Loss		(W)			1184					1428					1544					2050			
	Load	(%)	25	50	75	100	125	25	50	75	100	125	25	50	75	100	125	25	50	75	100	125	
Load Characteristics	Current	(A)	11.5	14.6	18.9	23,8	30,2	13.6	19.5	26.7	35,2	45,6	18.0	25.5	35,5	48,0	59.0	25.5	38.1	52.7	70 8	968	
cteris	Efficiency	(%)	47.8	66.2	72 2	74,8	72.8	51.1	67.6	72 5	72,9	70.8	54 0	67.8	73_1	73,6	71.5	57.5	70 8	74.7	73 7	69 2	
oad hara	Power Factor	(%)	73.5	84.0	89 0	91,2	92.3	87.8	92.5	94.5	94.9	94.2	81_8	88.9	91_8	93.2	93_7	82.9	90.2	92.7	93.2	90.8	
70	Slip	(%)	0.8	1.5	2.2	3.0	4.2	0.8	1.8	2.9	4.2	5.8	0.7	1.7	2.8	4.1	5.6	1.0	2.1	3.3	49	7.3	
Full Load Torque		(fi•lbs)	7.53					11,42					15.23					23					
Break	Down Torque	(ft•lbs)	15.5					22 0					27.4					45					
Locke	d Rotor Torque	(ft•lbs)	12.5					18,3							21.3		34						
Locke	d Rotor Current	(A)	124						167						202		275						
Locke	d Rotor Code		G							F					Е		D						
Rated	Input	(W)		4987						7675					10135	15180							
Currer	nt of SF 1:15	(A)			27_5			41							58			85					
Input	of SF 1,15	(W)			5735			8950							11830			18050					
Spec	of Running Capac	itor			40VAC					I40VAC		-			440VAC			440VAC					
opec.	or remaining cupito				30μFD					40µFD					50µFD			70μFD					
Spec	of Starting Capaci	tor			130VAC 200µFD					30VAC 250µFD					370VAC 350µFD					370VAC 450μFD			