31 Materials

31.1 The material of a part, such as an enclosure, a frame, a guard, or the like, the breakage of which may result in risk of injury to persons, shall have such properties as to meet the demand under expected loading conditions.

31.2 The requirement in 31.1 applies to those portions of a part adjacent to parts involving a risk of electric shock or moving parts considered to involve a risk of injury to persons.

31.3 The impact resistance of a part as mentioned in 31.1 shall be investigated in accordance with 31.4. The results are acceptable if the pump withstands the impact described in 31.4 without:

a) Reduction of spacings below the minimum values;

b) Making live parts accessible to contact;

c) Breakage, cracking, rupture, or the like, such as to produce any adverse effect on the insulation; and

d) Producing any other condition that would result in a risk of electric shock or injury to persons.

31.4 The pump is to be subjected to an impact of 5 foot-pounds (6.8 J) on any surface that is exposed to a blow during use. This impact is to be produced by dropping a steel sphere, 2 inches (50.8 mm) in diameter and weighing 1.18 pounds (0.54 kg), from the height necessary to produce the specified impact. If the impact cannot be produced on the desired surface by means of a vertical drop, the sphere may be swung as a pendulum to produce a sidewall impact of 5 foot-pounds.

32 Stability

32.1 A fountain pump shall have means for mounting or shall be constructed so that it will be stable while resting on a surface that is tilted 15 degrees from the horizontal.

33 Polymeric Motor Supports

33.1 A polymeric part that supports a motor shall be subjected to the test described in 33.2 and 33.3. The results are acceptable if the motor remains securely mounted.

33.2 If a motor and its supporting polymeric parts are intended to be mounted in the field, they are to be mounted in accordance with the instructions that accompany the unit. All bolts or screws that are intended to be field-mounted are to be tightened to the torque value specified in the instructions. If the motor and polymeric supporting parts are factory-assembled, the unit is to be tested in the factory-assembled condition with the torque on the screws or bolts tightened to the upper manufacturing tolerance limit. The information on torque values is to be provided by the manufacturer for the testing of factory-assembled units.

33.3 The motor and parts are then to be placed for 300 hours in an air-circulating oven maintained at a temperature at least 10°C (18°F) higher than that measured on the polymeric part during the temperature test, but no less than 70°C (158°F). While in the oven, the motor is to be operated through cycles, repeated at 10 minute intervals, consisting of:

a) Starting the motor,

b) Letting it reach maximum speed, and

c) Stopping the motor.

The motor is then to be removed from the oven and examined visually to determine if the means of mounting provides the necessary support under operating conditions.

34 Parts Subject to Pressure

34.1 A pressure vessel having an inside diameter more than 6 inches (152 mm), subjected to a pressure more than 15 psig (102 kPa), and eligible to be covered by the National Board of Boiler and Pressure Vessel Inspectors shall be marked in accordance with the appropriate boiler and pressure vessel code symbol of the American Society of Mechanical Engineers (ASME) for a working pressure no less than the pressure determined in accordance with 34.3.

34.2 A pressure vessel, because of its application, not covered by the scope of the inspection procedure of the ASME code shall be constructed so that it will comply with the requirements in 34.3.

34.3 A part or assembly that is subject to air or vapor pressure, including the vapor pressure in a vessel containing only a superheated fluid, during normal or abnormal operation shall withstand a pressure equal to the highest of the following that is applicable:

a) Five times the pressure corresponding to the maximum setting of a pressure-reducing valve provided as part of the assembly, but no more than five times the marked maximum supply pressure from an external source and no more than five times the pressure setting of a pressure-relief device provided as part of the assembly.

b) Five times the marked maximum supply pressure from an external source, unless the pressure is limited by a pressure-relief device in accordance with (a).

c) Five times the pressure setting of a required pressure-relief device.

d) Five times the maximum pressure that can be developed by an air compressor that is part of the assembly unless the pressure is limited by a pressure-relief device in accordance with (a).

e) Five times the working pressure marked on the part.

Exception No. 1: This requirement does not apply to a section of a pressure system constructed of continuous tubing or of lengths of tubing connected by hard-soldered, brazed, or welded joints provided the wall thickness of tubing is no less than the value specified in Table 34.1.

Exception No. 2: A pressure vessel bearing the ASME code inspection symbol – other than the UM symbol – need not comply provided the vessel is marked with a value of working pressure no less than that to which it is subjected during normal or abnormal operation.

Table 34.1
Wall thickness for copper and steel tubing

Outside diameter,		Minimum wall thickness,		Maximum pressure to which tubing is subjected					
				Seamless copper,		Butt-welded steel,		Seamless steel,	
inch	(mm)	inch	(mm)	Psig	(MPa)	Psig	(MPa)	Psig	(MPa)
3/8 or smaller	(9.5)	0.016	(0.41)	500	(3.45)	600	(4.14)	1000	(6.90)
1/2	(12.7)	0.016	(0.41)	400	(2.76)	480	(3.31)	800	(5.52)
5/8	(15.9)	0.016	(0.41)	320	(2.21)	384	(2.65)	640	(4.42)

Table 34.1 Continued on Next Page

Table 34.1 Continued

Outside diameter,		Minimum wall thickness,		Maximum pressure to which tubing is subjected					
				Seamless copper,		Butt-welded steel,		Seamless steel,	
inch	(mm)	inch	(mm)	Psig	(MPa)	Psig	(MPa)	Psig	(MPa)
5/8	(15.9)	0.021	(0.53)	420	(2.90)	504	(3.48)	840	(5.80)
3/4	(19.0)	0.021	(0.53)	360	(2.48)	432	(2.98)	720	(4.97)
3/4	(19.0)	0.025	(0.64)	420	(2.90)	504	(3.48)	840	(5.80)
1	(25.4)	0.021	(0.53)	260	(1.79)	312	(2.15)	520	(3.59)
1	(25.4)	0.025	(0.64)	320	(2.21)	384	(2.65)	640	(4.42)

34.4 If a test is required to determine whether a part complies with requirements in 34.3, two samples of the part are to be subjected to a hydrostatic pressure test. Each sample is to be filled with water so as to exclude air, and is to be connected to a hydraulic pump. With the pressure-relief device bypassed or otherwise prevented from operating, the pressure is to be raised gradually to the specified test value, and is to be held at that value for 1 minute. The results are not acceptable if either sample bursts or leaks.

Exception: Leakage or rupture of a nonmetallic fluid-transfer line and its connections, or at a gasket is acceptable if repeated tests conducted with the media they are intended to contain show no evidence of presenting a risk of electric shock or injury to persons.

34.5 A part supported or actuated hydraulically that could result in a risk of injury to persons due to pressure loss shall comply with the requirement in 34.4 when tested at a pressure equal to five times the maximum pressure capable of being developed in the system.

35 Pressure-Relief Devices

35.1 A means for safely relieving pressure generated by an external source of heat shall be provided for a part that is subject to pressure as described in Parts Subject to Pressure, Section 34.

35.2 A pressure-relief device, fusible plug, a soldered joint, nonmetallic tubing, or other equivalent pressure-relief means may be used to comply with the requirements in 35.1.

35.3 A pressure-relief device is considered to be a pressure-actuated value or rupture member constructed to relieve excessive pressures automatically.

35.4 There shall be no shut-off valve between the pressure-relief means and the parts that it is intended to protect.

35.5 A vessel having an inside diameter of more than 3 inches (76 mm) and subject to air or steam pressure generated or stored within the pump shall be protected by a pressure-relief device.

35.6 The start-to-discharge pressure setting of a pressure-relief device shall be no higher than the working pressure marked on the vessel. The discharge rate of the device shall be adequate to relieve the pressure.

35.7 A pressure-relief device shall:

a) Be connected as close as possible to the pressure vessel or part of the system that it is intended to protect;

b) Be installed so that it is readily accessible for inspection and repair, and cannot be readily rendered inoperative so that it will not perform its intended function; and

c) Have its discharge opening located and directed so that:

1) Operation of the device will not deposit moisture on bare live parts or on insulation or components detrimentally affected by moisture and

2) The likelihood of scalding persons is reduced.

35.8 A pressure-relief device having an adjustable setting shall be judged on the basis of the maximum setting unless the adjusting means is reliably sealed at a lower setting.

35.9 A control that limits the pressure in a vessel required to have a pressure-relief device shall perform under rated load for 100,000 cycles of operation, and shall operate so that the pressure does not exceed 90 percent of the relief-device setting under any condition of normal operation.

35A Button or Coin Cell Batteries of Lithium Technologies

35A.1 The battery compartment of an appliance or any accessory, such as a wireless control, incorporating one or more coin cell batteries of lithium technologies shall comply with the Standard for Products Incorporating Button or Coin Cell Batteries of Lithium Technologies, UL 4200A, if the appliance or any accessory:

a) Is intended for use with one or more single cell batteries having a diameter of 32 mm (1.25 in) maximum with a diameter greater than its height; and

b) The appliance is intended for household use.

Exception No. 1: UL 4200A is not applicable in pumps and accessories that meet the following:

a) The battery is not intended to be replaced.

b) The battery is not referenced in the instructions or markings.

c) A battery access door or cover is not provided.

d) The appliance or accessory is not intended to be handheld during normal operation.

Exception No. 2: UL 4200A is not applicable if the enclosure or other means of making the battery inaccessible complies with the requirements of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

PERFORMANCE

36 Leakage Current Test

36.1 A cord-connected pump shall comply with leakage current requirements in the Standard for Leakage Current for Appliances, UL 101, and in 36.2.

36.2 A submersible pump is to be tested for leakage current while submersed in a tank filled with water. The top of the pump is to be at least 12 inches (305 mm) below the surface of the water during the test. The test tank shall be isolated from ground and the meter is to be connected between the grounding conductor and the grounded supply conductor of the flexible supply cord.

37 Leakage Current Test Following Humidity Conditioning

37.1 A pump as described in 36.1 shall comply with the requirements for leakage current in 36.1 following exposure for 48 hours to air having a relative humidity of 88 ±2 percent at a temperature of 32 ±2°C (90 ±4°F).

37.2 To determine whether a pump complies with the requirement in 37.1, a sample of the pump is to be heated to a temperature just above 34°C (93°F) to reduce the risk of condensation of moisture during conditioning. The heated sample is to be placed in the humidity chamber and conditioned for 48 hours under the conditions specified in 37.1. Following the conditioning and while still in the chamber, the sample is to be tested unenergized as described in the Test Procedure specified in the Standard for Leakage Current for Appliances, UL 101. Either while the sample is still in the humidity chamber or immediately after it has been removed from the chamber, the sample is to be energized and tested as described in the Test Procedure specified in the Standard for Leakage Current for Appliances, UL 101. The test is to be discontinued when the leakage current stabilizes or decreases.

38 Starting Current Test

38.1 A pump shall be capable of starting and operating normally on a circuit protected by an ordinary (not time-delay) fuse having a current rating corresponding to that of the branch circuit to which the pump is intended to be connected.

Exception: A pump that meets all three of the following conditions:

a) The construction of the pump or the nature of its use is such that the pump is likely to be used continually on the same branch circuit after installation;

b) The pump will start and operate normally on a circuit protected by a time-delay fuse; and

c) The pump is marked in accordance with 58.10.

38.2 To determine compliance with the requirement in 38.1, the pump is to be started three times from a standstill without opening the fuse. The pump is to be at room temperature at the beginning of the test. The test is to be conducted at rated frequency and at the voltage specified in 39.1. Each start is to be made under conditions representing the beginning of normal operation – the beginning of the normal operating cycle in the case of an automatic pump – and the motor is to be allowed to come to rest between successive starts. Tripping of an overload protector provided as part of the pump, or opening of the fuse is not acceptable. Load conditions are to be in accordance with the requirements in 40.2.1.

39 Input Test

39.1 The ampere input to a pump shall not exceed 110 percent of the rated value when the pump is operated under the conditions of maximum normal load as described in 40.2.1 while connected to a branch circuit of maximum rated voltage and rated frequency. Maximum rated voltages are determined as follows:

a) For a pump with a single DC voltage rating or a single AC rating not within the ranges of 110 – 120, 200– 208, 220 – 240, 440 – 480, or 550 – 600 volts, rated voltage is that single voltage.

b) For a pump with a single AC voltage rating that falls within one of the ranges given in (a), the rated voltage is considered to be the highest voltage in the range.

c) For a pump marked with a range of voltages, the highest voltage in the marked range is to be considered as if it were a single voltage rating in (a) or (b).

39.2 A pump having a single frequency rating is to be tested at that frequency. A pump rated AC-DC, DC-60 hertz, or DC-25-60 hertz, is to be tested either on direct current or at 60 hertz, whichever results in the higher temperatures. A pump rated 25 – 60 hertz or 50 – 60 hertz is to be tested at 60 hertz.

40 Temperature Test

40.1 General

40.1.1 While loaded as described in 40.2.1, a pump shall not attain a temperature at any point sufficiently high to constitute a risk of fire, to damage any materials or parts used in the pump, or to exceed the temperatures specified in Table 40.1.

40.1.2 All temperature values in Table 40.1 are based on an assumed room ambient temperature of 25°C (77°F). The temperature test is to be conducted at any room temperature within the range of 10 – 40°C (50 – 104°F). If a test is conducted at an ambient temperature other than 25°C (77°F), an observed temperature shall be corrected as described in 40.1.3. A corrected temperature shall not exceed the maximum value specified in Table 40.1.

Exception No. 1: For a submersible pump intended for use with unheated water, the ambient temperature shall be considered to be that of the water. The tank shall have enough capacity or be otherwise arranged so that the heat from the pump has a negligible effect on overall ambient water temperature.

Exception No. 2: A submersible sump or deep-well pump is to be tested with water maintained at a temperature in the range of 15 – 25°C (59 – 77°F).

Exception No. 3: A submersible pump intended for use with heated water or assigned a maximum water temperature by the manufacturer is to be tested at the maximum water temperature. The observed temperatures are not to exceed the temperature limits specified in Table 40.1.

Table 40.1
Temperature limits

Materials and components	°C	(°F)
A. MOTORS		
1. Class 105 (A) insulation system on coil windings of an AC motor having a frame diameter 7 inches (178 mm) or less, not including a universal motor, and on a vibrator coil[a,b]:		
a. In an open motor and on a vibrator coil:		
Thermocouple method or resistance method	100	(212)
b. In a totally enclosed motor:		
Thermocouple method or resistance method	105	(221)
2. Class 105 (A) insulation systems on coil windings of an AC motor having a frame diameter of more than 7 inches, of a DC motor, and of a universal motor[a,b]:		
a. In an open motor:		
Thermocouple method	90	(194)
Resistance method	100	(212)
b. In a totally enclosed motor:		
Thermocouple method	95	(203)

Table 40.1 Continued on Next Page

Table 40.1 Continued

Materials and components	°C	(°F)
Resistance method	105	(221)
3. Class 130 (B) insulation systems on coil windings of an AC motor having a frame diameter of 7 inches or less not including a universal motor[a,b]:		
a. In an open motor:		
Thermocouple or resistance method	120	(248)
b. In a totally enclosed motor:		
Thermocouple method or resistance method	125	(257)
4. Class 130 (B) insulation systems on coil windings of an AC motor having a frame diameter of more than 7 inches (178 mm), of a DC motor, and of a universal motor[a,b]:		
a. In an open motor:		
Thermocouple method	110	(230)
Resistance method	120	(248)
b. In a totally enclosed motor:		
Thermocouple method	115	(239)
Resistance method	125	(257)
5. Class 155 (F) insulation systems on coil windings of an AC motor having a frame diameter of 7 inches or less, not including a universal motor[b]:		
a. In an open motor:		
Thermocouple or resistance method	145	(293)
b. In a totally enclosed motor:		
Thermocouple or resistance method	150	(302)
6. Class 155 (F) insulation systems on coil windings of AC motors having a frame diameter of more than 7 inches (178 mm), and of a DC motor, and a universal motor[b]:		
a. In open motors		
Thermocouple method	135	(275)
Resistance method	145	(293)
b. In totally enclosed motors		
Thermocouple method	140	(284)
Resistance method	150	(302)
7. Class 180 (H) insulation systems on coil windings of AC motors having a frame diameter of 7 inches (178 mm) or less-not including a universal motor[b]:		
a. In open motors		
Thermocouple or resistance method	160	(320)
b. In totally enclosed motors		
Thermocouple or resistance method	165	(239)
8. Class 180 (H) insulation systems on coil windings of AC motors having a frame diameter of more than 7 inches (178 mm), of a DC motor, and a universal motor[b]:		
a. In open motors		
Thermocouple method	150	(302)
Resistance method	160	(320)
b. In totally enclosed motors		

Table 40.1 Continued on Next Page

Table 40.1 Continued

Materials and components	°C	(°F)
Thermocouple method	155	(311)
Resistance method	165	(329)
B. COMPONENTS		
1. Capacitors:		
a. Electrolytic[c]	65	(149)
b. Other types[d]	90	(194)
2. Fuses:		
a. Class G, J, L, T, and CC:		
Tube	125	(257)
Ferrule or blade	110	(230)
b. Others[e]	90	(194)
3. Relay, solenoid, and coils (except motor coil windings and transformers) with:		
a. Class 105 (A) insulated systems:		
Thermocouple method	90	(194)
Resistance method	110	(230)
b. Class 130 (B) insulation systems:		
Thermocouple method	110	(230)
Resistance method	120	(248)
4. Coils of a Class 2 transformer:		
a. Class 105 (A) insulation systems:		
Thermocouple method	90	(194)
Resistance method	110	(230)
b. Class 130 (B) insulation systems:		
Thermocouple method	110	(230)
Resistance method	120	(248)
C. CONDUCTORS		
1. Rubber- or thermoplastic-insulated wires and cords[e,f]	60	(140)
2. Copper		
a. Tinned or bare strands having:		
i) A diameter less than 0.015 inch (0.38 mm)	150	(302)
ii) A diameter of 0.015 inch or more	200	(392)
b. Plated with nickel, gold, silver, or a combination of these	250	(485)
D. ELECTRICAL INSULATION – GENERAL		
1. Fiber used as electrical insulation	90	(194)
2. Phenolic composition used as electrical insulation or as a part the deterioration of which is capable of resulting in a risk of fire or electric shock[e]:		
a. Laminated	125	(257)
b. Molded	150	(302)
3. Varnished-cloth insulation	85	(185)
E. SURFACES		

Table 40.1 Continued on Next Page

Table 40.1 Continued

Materials and components	°C	(°F)
1. A surface of flammable material upon which a pump is capable of being placed or mounted in service, and a surface that may be adjacent to the pump when it is so placed or mounted	90	(194)
2. Any point within a terminal box or wiring compartment of a permanently connected pump in which power-supply conductors are to be connected, including such conductors themselves, unless the pump is marked in accordance with 58.15	60	(140)
3. Wood or other flammable material, including the inside surface of the test enclosure and the surface supporting the pump	90	(194)

[a] At a point on the surface of a coil where the temperature is affected by an external source of heat, the temperature measured by means of a thermocouple that is greater than the maximum temperature specified in this table complies with the intent of this requirement as long as the temperature, as measured by the resistance method, is not more than that specified. The temperature measured by means of a thermocouple is not prohibited from being greater than the specified value by:

1. 5°C (9°F) for Class 105 (A) insulation on coil windings of an AC motor having a diameter of 7 inches or less, open type;
2. 10°C (18°F) for Class 130 (B) insulation on coil windings of an AC motor having a diameter of 7 inches or less, open type;
3. 15°C (27°F) for Class 105 (A) insulation on coil windings of an AC motor having a diameter of more than 7 inches, open type;
4. 20°C (36°F) for Class 130 (B) insulation on coil windings of an AC motor having a diameter of more than 7 inches, open type.

[b] This is the diameter measured in the plane of the laminations of the circle circumscribing the stator frame, excluding lugs, fins, boxes, and similar parts, used solely for motor mounting, cooling, assembly, or connection.

[c] For an electrolytic capacitor that is physically integral with or attached to a motor, the maximum temperature rise on insulating material integral with the capacitor enclosure shall not be more than 90°C (194°F).

[d] A capacitor that operates at a temperature of more than 90°C complies with the intent of this requirement when evaluated on the basis of its marked temperature limit.

[e] These limitations do not apply to compounds and components that have been investigated and rated for use at higher temperatures.

[f] A rubber-insulated conductor with a motor, a rubber-insulated motor lead, and a rubber-insulated conductor of a flexible cord entering a motor that is subjected to a higher temperature complies with the intent of this requirement when the conductor is provided with sleeving or a braid that has been investigated and rated for use at the higher temperature. This does not apply to thermoplastic-insulated wires or cords.

40.1.3 Other than for a submersible pump intended for use with heated water and assigned a maximum temperature by the manufacturer, an observed temperature is to be corrected by addition [if the ambient temperature is lower than 25°C (77°F)] or subtraction (if the ambient temperature is higher than 25°C) of the difference between 25°C and the ambient temperature.

40.1.4 If a corrected temperature exceeds the required value specified in Table 40.1, at the request of the manufacturer, the test may be repeated at an ambient temperature closer to 25°C (77°F).

40.1.5 A pump marked for use with heated water in accordance with 58.7 shall be tested while pumping water as close to the marked temperature as practicable. Heated water is considered as being water maintained at a temperature above 30°C (86°F).

40.1.6 For the temperature test, the voltage and frequency of the test circuit are to be as specified for the input test described in the Input Test, Section 39. A pump rated for use at more than one voltage or for a range of voltages and containing a tapped transformer or other means of adaption to different supply voltages is to be tested under the most severe combination of supply voltage and internal adjustment. The pump may be tested by connecting it in accordance with the manufacturer's instructions if:

a) It is marked in accordance with 58.13 and 58.14 and

b) The means provided for adjusting for different supply voltages complies with the requirements for wiring terminals in Supply Connections, Section 16.

40.1.7 A thermocouple is to be used for determining the temperature of a coil or winding if it can be mounted without removal of encapsulating compound or the like:

a) On the integrally applied insulation of a coil without a wrap or

b) On the outer surface of a wrap that is no more than 1/32 inch (0.8 mm) thick and consists of cotton, paper, rayon, or the like.

The change-of-resistance method is to be used if the thermocouple measurement cannot be conducted in accordance with the foregoing. For a thermocouple-measured temperature of a motor coil as indicated in (A)(1) and (A)(3) of Table 40.1, the thermocouple is to be mounted on the integrally applied insulation of the conductor.

40.1.8 Thermocouples are to consist of wires no larger than 24 AWG (0.21 mm^2) and no smaller than 30 AWG (0.05 mm^2). Whenever referee temperature measurements by thermocouples are necessary, thermocouples consisting of 30 AWG iron and constantan wire and a potentiometer-type instrument are to be used.

40.1.9 The water around a submersible pump shall be still and not filled with entrained air, whirls, and the like, from recirculated discharge. The top of the pump shall be at least 12 inches (305 mm) below the surface of the water.

40.1.10 If a pump incorporates a cord reel for the power-supply cord, one-third of the length of the cord is to be unreeled for the temperature test.

40.1.11 A short length of rubber- or thermoplastic-insulated flexible cord exposed to a temperature higher than 60°C (140°F), such as at a terminal, may be used if supplementary heat-resistant insulation that is of dielectric strength and has temperature properties that have been determined to be acceptable is used on the individual conductors of the cord to reduce deterioration of the conductor insulation within the appliance.

40.1.12 Unless investigated and determined to be acceptable for the application, rubber and other material subject to abrasion and deterioration shall be removed from feet and other supports of a pump if absence of the material could result in the pump attaining higher temperatures.

40.1.13 The temperature test is to be conducted using the maximum normal load, and is to be continued until thermal equilibrium is attained.

40.1.14 With reference to those tests that are to be continued until constant temperatures are attained, thermal equilibrium is considered to exist when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but no less than 5-minute intervals, indicate no change.

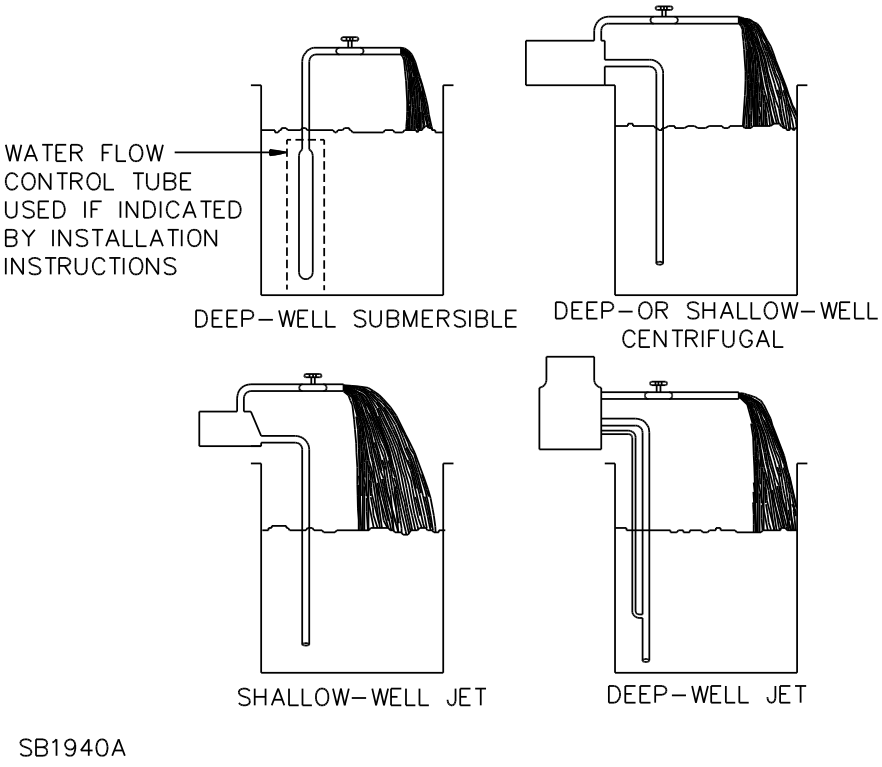
40.2 Maximum normal load

40.2.1 In tests on a pump, maximum normal load is considered to be that load that approximates as closely as possible the most severe conditions of normal use. It is not a deliberate overload except as the conditions of actual use are likely to be somewhat more severe than the maximum load conditions recommended by the manufacturer of the pump. Test loads that have been found to be close approximations of the most severe conditions of normal use are described in 40.2.2 and 40.2.3 for some common types of pumps. Pumps having features not covered by these requirements are to be tested as

necessary to meet the intent of the requirements. Sump, sewage, and effluent pumps are to be tested while pumping water. Test setups for various types of pumps are illustrated in Figure 40.1.

Figure 40.1

Maximum normal load test set-ups



40.2.2 A pump is to be mounted as intended, considering any limitations of its use in the installation instructions provided in accordance with 61.1(c). The test tank or sump is to be large enough to permit compliance with Exception No. 1 to 40.1.2 and 40.1.9. The pump is to be operated in the intended manner with the valve located in the water outlet pipe adjusted so that the maximum current is drawn by the pump.

Exception No. 1: For a centrifugal pump other than a sump pump, the water static discharge head distance is to be as short as possible unless the pump is marked for some other discharge head distance, in which case the marked distance is to be used.

Exception No. 2: For a sump pump, the water lift distance is to be 4 – 10 feet (1.2 – 3 m), and is to be adjusted to produce the highest electrical input.

40.2.3 A pump that is intended to circulate heated water – see 58.7 – is to be tested installed in a pipe loop attached to a heating unit adjusted to maintain the maximum water temperature recommended by the manufacturer.

41 Dielectric Voltage-Withstand Test

41.1 General

41.1.1 A pump shall withstand for 1 minute without electrical breakdown the application of a DC potential or an AC potential at a frequency within the range of 40 to 70 Hz: