Parabolic Trough-Solar Tracking and Energy Extraction

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Operations Manual
Document

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1. DRIVE/PLC SETTINGS

1.1 Caster/Wheel Specs

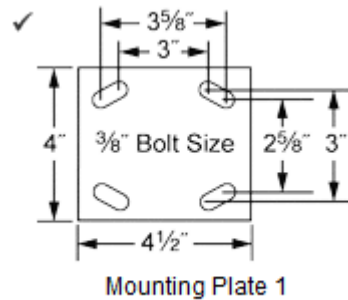| Wheel Diameter	Wheel Width	Tire Size	Mounting Height	Capacity
10"	4.1"	4.10/3.50-4	12"	350lbs

Figure 1 - Schematic of Caster Mount

1.2 Trim Specs

6063-T52 Aluminum
   Width(A) = 1.25"
   Legs(B) = 1.25"
   Web Thickness(C) = 0.125"
Curved edged cut into 2" sections
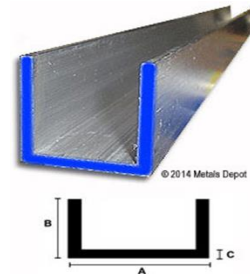
Figure 2 - Trim Dimensions

1.3 Motor Specs

Table 1- Motor Specification #1

Part#:	Part#: CDP3445
	Item#: 100846553
Manufacturer:	Baldor Motors & Drives
Weight:	43 lbs.
Product Name:	Permanent Magnet SCR Drive DC Motor

Table 2- Motor Specification #2

HP	1 hp	Base Speed	1800 rpm
Mounting	C-Face - With Base	Enclosure	TEFC
Motor Application	General Purpose	Armature Voltage	90
Frame	56C	Winding	Permanent Magnet
Enclosure Designation	TEFC - Totally Enclosed Fan Cooled	Field Voltage	PM
Field Weakened rpm	1750 rpm	Inch/Metric	
Service Factor	1	Washdown Duty	No
Ambient Temperature	40 °C	Armature Amps Full Load	10:00 AM
Blower No.	N/A	C Dimension	15.46 in
C-Face Size		Control Voltage AC Input	
Drive End Bearing	6203	Field Amps Full Load	PM
Insulation	F	Motor Shaft Length	1.88 in
Motor Shaft Size	5/8 in	Mounting Style	F-1
Open End Bearing	6203	Recommended Control	BC140
Recommended Tachometer Kit	TK3400	Remarks	SCR Drive Motor

Please read the GS2-11P0 drive manual before operating motor

2. Tracking System

2.1 Wire connections
Ensure power cord to drive is disconnected from power supply for at least 3 minutes before working on all wire connections.

2.1.1 **Motor to Drive connections**
1. Connect white wires from motor as a low voltage line as follows:
    T1 and T7; T2 and T8; T3 and T9; T4, T5 and T6
2. Connect T1 and T7 into T1 port on the bottom of the drive

3. Connect T2 and T8 into T2 port on the bottom of the drive
4. Connect T3 and T9 into T3 port on the bottom of the drive
5. T4. T5 and T6 do not connect to any ports on the drive
6. No other connections from the motor to the drive are required

2.1.2 Power cords
Figures 3 and 4 show the power supply cords are connect to the drive and PLC respectively.

Figure 3- Drive power supply

Figure 4-PLC power supply

Note: Chapter 4 in the drive manual displays all parameter numbers and meanings

2.2 Manual control:
Flip the switch on the PLC to STOP

    1. Parameter 3.00 to 00 (Tells the drive that controls will be made through the keypad)
    2. Parameter 4.00 to 00 (Tells the drive that output frequency will be controlled by potentiometer)

2.3 PLC control:
    2.3.1 Running the PLC
    Flip the switch on the PLC to **STOP**

1. Change parameter 3.00 to 03 (Drive functions will be controlled by RS-485 interface, keypad STOP is enabled)
2. Change parameter 4.00 to 05 (Frequency determined by RS232C/RS-485 communication interface)

For proper synchronization to computer, set the below values BEFORE connecting the PLC to the computer (these values do NOT need to be set back to 00 for manual use)

3. Parameter 9.00 to 02 (Communication address)
4. Parameter 9.01 to 02 (Transmission speed, 19200 baud)
5. Parameter 9.02 to 02 (Communication protocol, Modbus RTU mode, 8 data bits, odd parity, 1 stop bit)

Flip the switch on the PLC to **RUN**
Plug communication chord from the PLC into the computer

Once cable is plugged into computer, open CLICK Programming Software

On the "PLC" tab, select "Connect to PLC"
>Protocol: MODBUS
>Baud Rate: 38400
>Address: 1
>Parity Bit: Odd
>Stop Bit: 1

On the "Setup" tab, select "Com Port Setup"
Under "Port 2," select "Setup"
>Node Address: 2
>Baud Rate: 19200
>Parity Bit: Odd
>Stop Bit: 1

2.3.2 Run the Program:
1. Open CLICK Programming Software
2. Select "Connect to PLC"
3. Open Project written into PLC
4. In the "PLC" tab on the top of the window, select "Write Project Into PLC"
5. Click yes until writing is complete
   > **If any values are changed, or if a new program wants to be downloaded into the** PLC**, steps 4 and 5 must be done for each change**
6. On the left side of the window double-click "Data View 1"
7. Find C200 relay, double click "Off," and then double-click "On"

*If you wish to change the speeds, change the value of DS2
- This value sets the frequency of the drive to the motor
- A value of 200 is 20.0 Hz

2.3.3 Slave Address
For each Slave Address, there is a corresponding Master Address (DS1, DS2, etc.)
>402231 - Controls on/off of motor
>>0=Off
>>1=On
>402332 – Controls output frequency of the drive to the motor (speed)
>Values 0-600 (0 Hz – 60.0 Hz)
>402333 – Controls direction of motor
>>0=Forward
>>1=Reverse

- Timer T4 controls how long the motor will run in each interval
- Counter CT1 controls how many times motor will stop/start until reverting back to original position
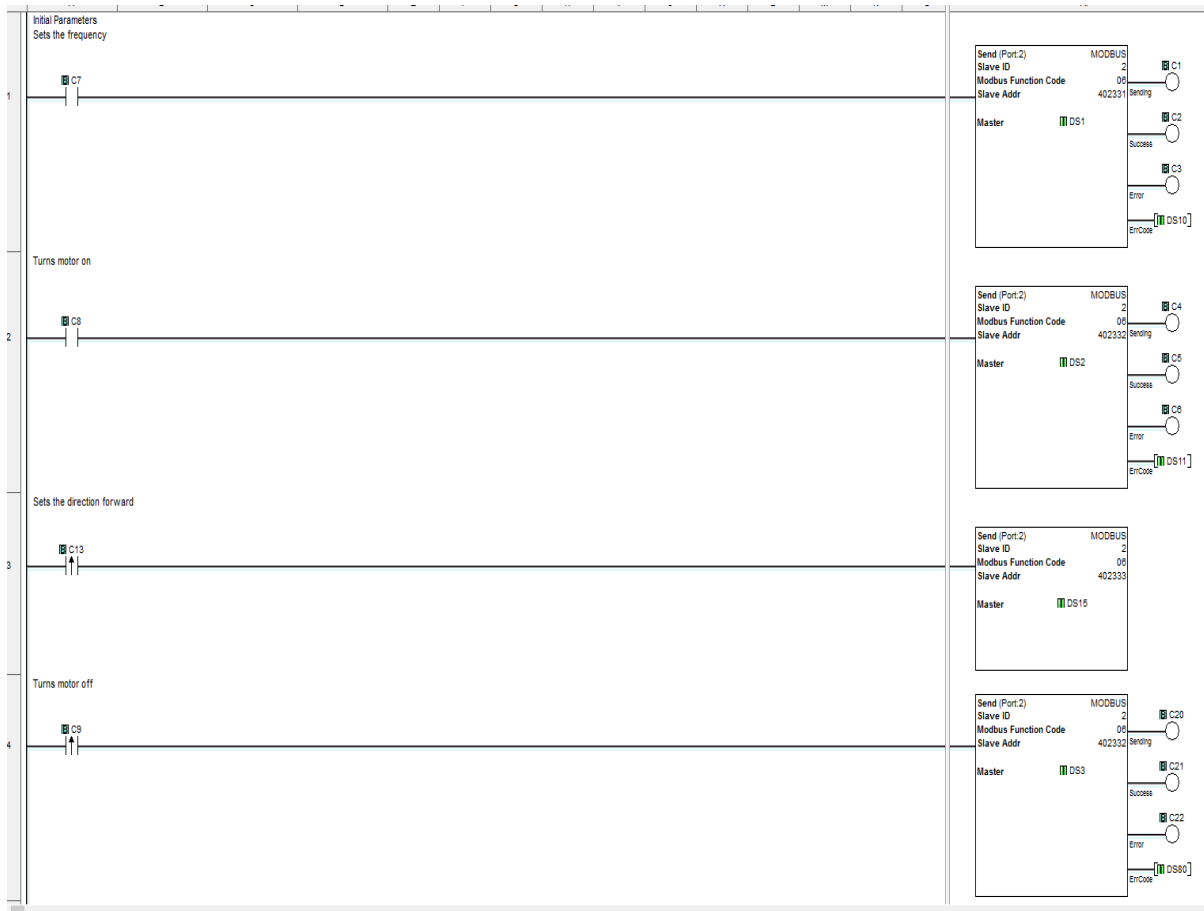
Figure 5 shows an example of what each parameter does

Figure 5-PLC Program

3. Energy Extraction System

To use the system, use Section 2.1 or 2.2 for desired control of the trough.

Because the pump has no on/off switch, it will begin to run as soon as it is plugged in.

Insert pump into water tank and plug it in. The pump does not need to be fully submerged in water to operate.

By adjusting the gate valve on the end of the black solar pipe on the trough opposite of the control box, the Gallons per Hour (GPH) can be changed (750GPH to 0 GPH).

To measure the temperature, the installed thermocouple can be used, or an external temperature measuring device can be used.
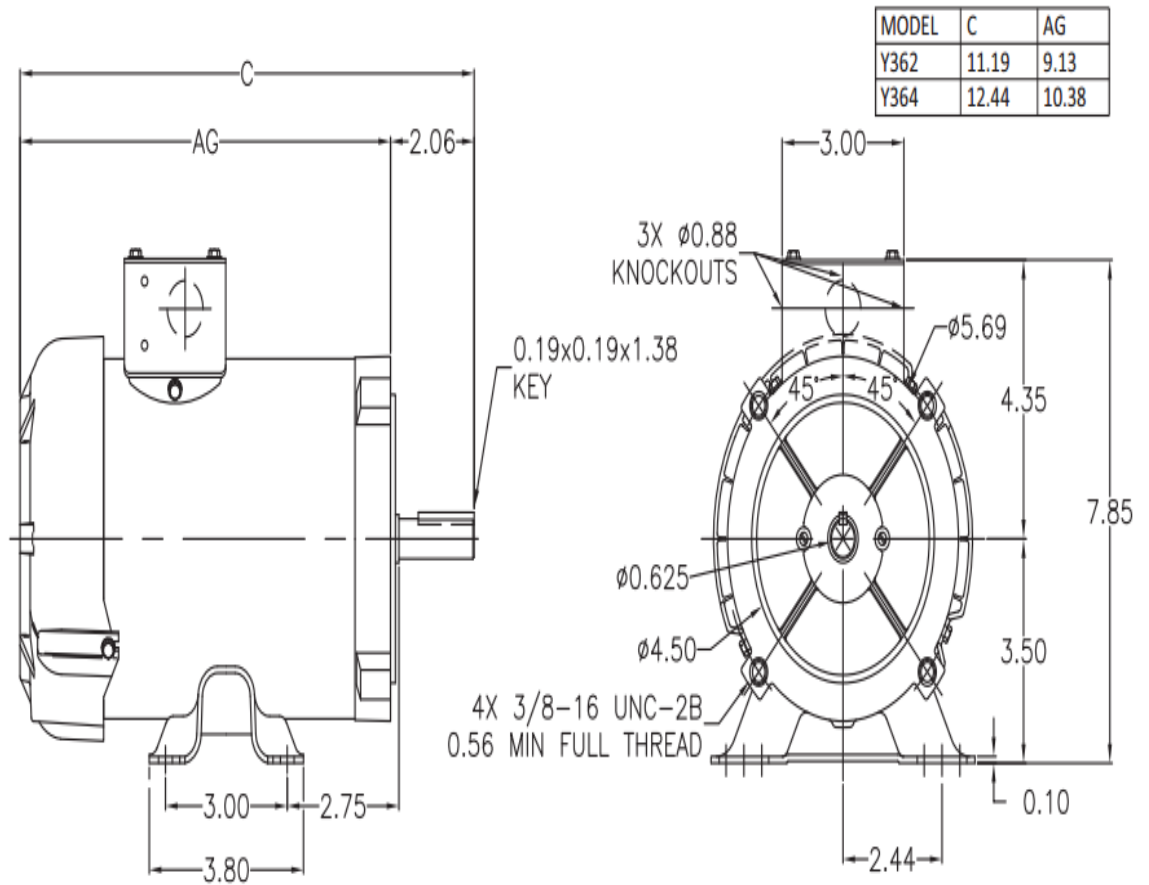
4. Technical Drawings

4.1 Y364 Motor Drawing

MODEL	C	AG
Y362	11.19	9.13
Y364	12.44	10.38

Figure 6- Motor Dimensions
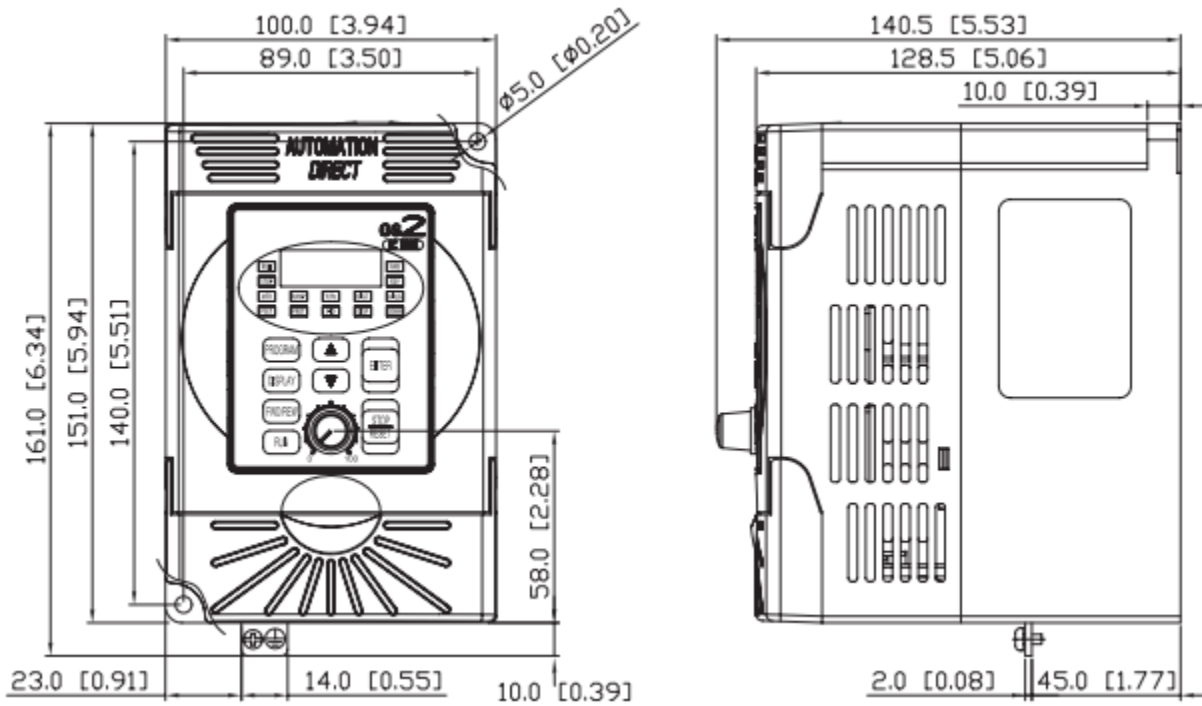
4.2 AC Micro Drive Drawing

Figure 7- Control box Dimensions

4.3 PLC Drawing
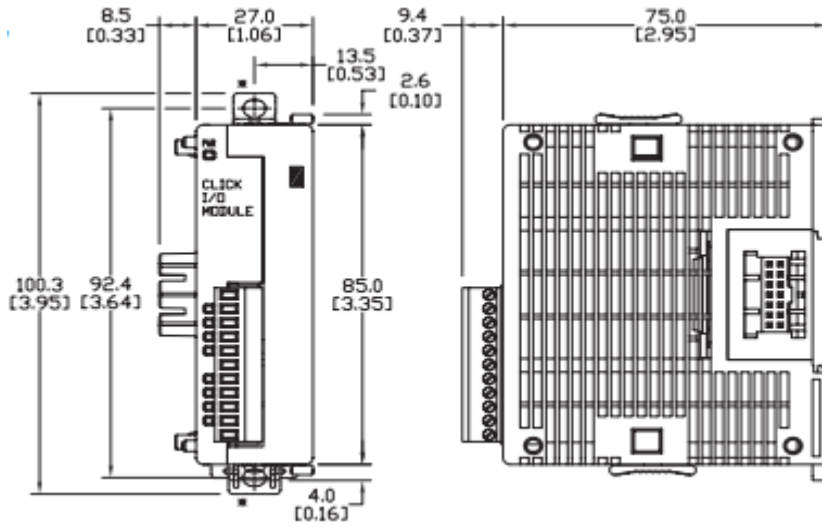

Figure 8- PLC Dimensions
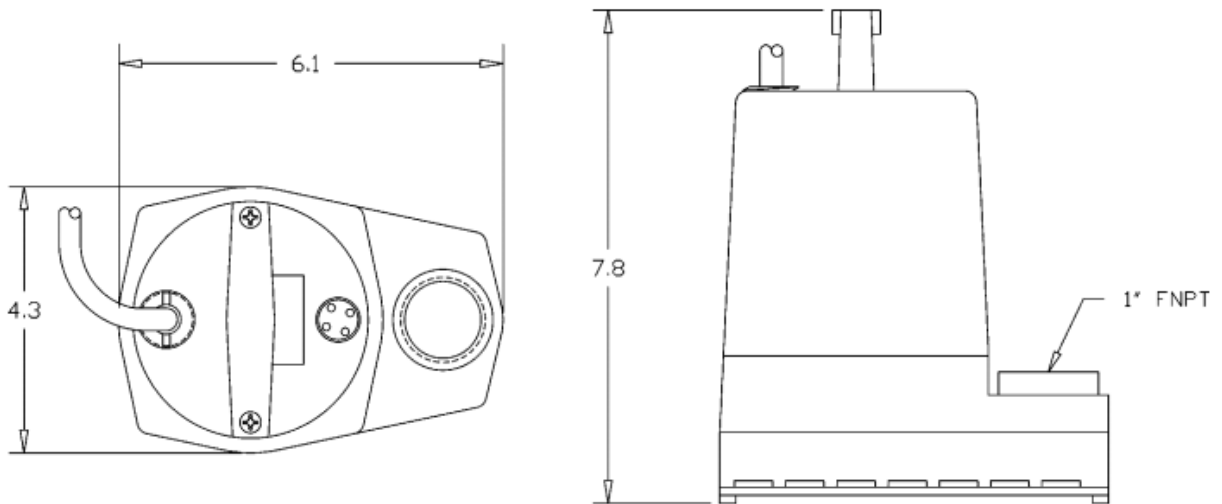
4.4 Little Giant Utility Pump Drawing

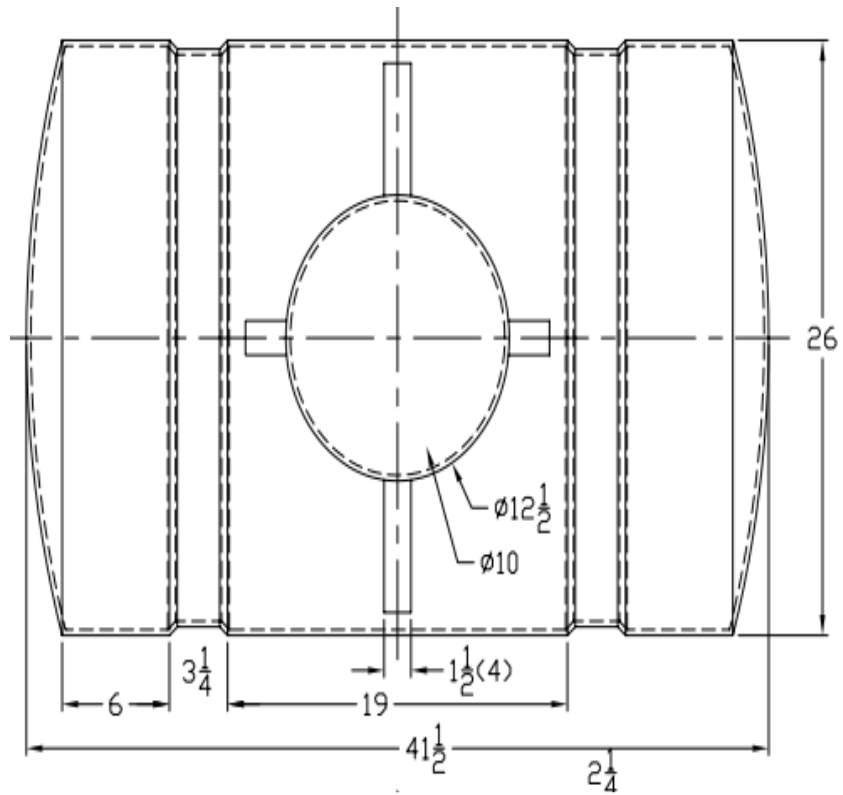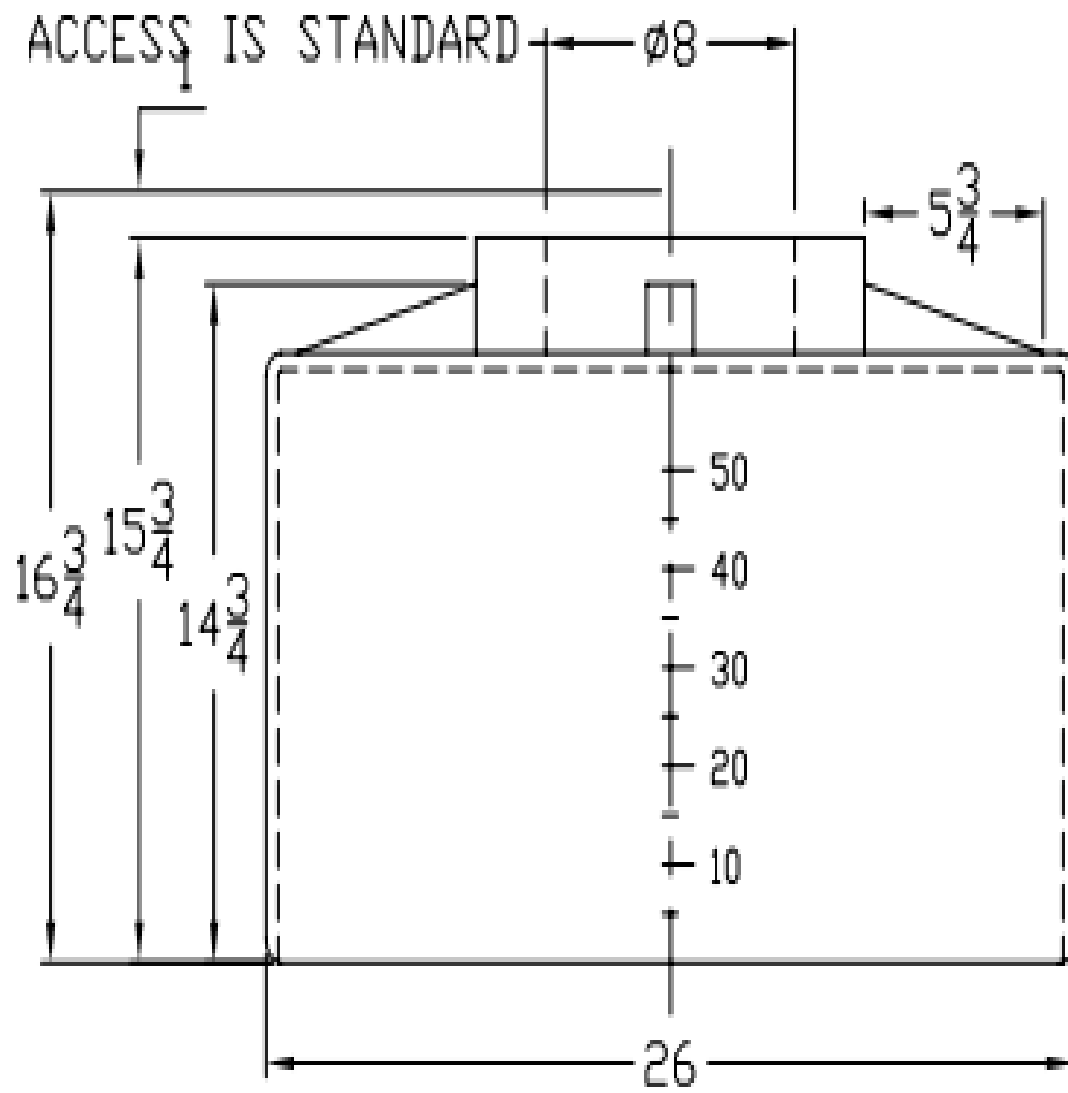**Figure 9-** Pump Dimensions

4.5 Gallon Water Tank

Figure 10- Tank Dimensions #1

Figure 10- Tank Dimensions #1