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Residential Water Systems

Goulds Pumps

BALANCED FLOW™

BF20, BF30 and BF50

Constant Pressure Controllers for
1/2-2, 3 and 5 HP Submersible Pumps



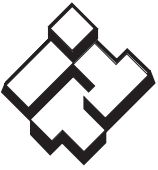
Goulds Pumps is a brand of ITT Residential and Commercial Water.

www.goulds.com

Engineered for life

FEATURES

- **Enclosure Rating:** NEMA 3R, IP22 rainproof, indoor/outdoor enclosure. Allows mounting the controller outdoors.
- **Current Limit Selector Switch:** Rotary switch to set current limit to match motor Service Factor Amps (SFA).
- The controller may be used on smaller pump/motor combinations as long as the motor SFA is within the current limit range of the controller.
- **Communications Port:** RS-232 serial port to facilitate software updates and future expansion.
- Three sizes available for 1/2 - 5 HP pumps.
- **Constant Pressure:** The system provides consistent pressure even as system flow requirements vary.
- Controller acts as a pump protection device and troubleshooting device.
- Flashing LED lights indicate system faults by number of flashes.
- Controller will operate between 190 and 260 volts.
- Standard pressure sensor cable is 25' long, optional lengths of 10', 50' and 100' are available.
- Integrated output motor filter protects the motor from voltage spikes and limits electrical interference with devices such as portable telephones, radios, televisions and garage door openers.
- **Cooling fan:** Allows operation in ambient temperatures up to 122°F.



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BF20 SPECIFICATIONS

- Controller will operate a 3-phase, 230V submersible motor up to:
 - Max. HP: 2
 - Min. HP: ½
 - Max. SFA: 8.1 amps.
 - 30 – 60 Hz speed.
 - 30 – 80 Hz optional. (see table 1 for details.)
- Controller Ambient Temperature Range:
 - Min.: 0°F (-18°C)
 - Max.: 122°F (50°C)
- Input Voltage: single-phase, 230 volt, two (2) wire grounded system.
- Output Voltage: Variable frequency, 230 volt, three-phase power to the motor.
- Pressure set point adjustable between 20 – 70 PSI when used with included PRT0100SAIP sensor.**
- BF20 Dimensions and Weight:
 - Height: 18.57"
 - Width: 9.88"
 - Depth: 5.29"
 - Weight: 18.3 lbs.
- Packaged Dimensions and Weight:*
 - Height: 23"
 - Width: 14.5"
 - Depth: 10.5"
 - Weight: 22.9 lbs.

* Includes carton plus sensor and sensor cable.

** Sensor with higher pressure ranges are available.

Goolds Pumps is ISO 9001 Registered.

BF30 SPECIFICATIONS

- Controller will operate a 3-phase, 230V submersible motor up to:
 - Max. HP: 3
 - Min. HP: ¾
 - Max. SFA: 10.9 amps.
 - 30 – 60 Hz speed.
 - 30 – 80 Hz optional. (see table 1 for details.)
- Controller Ambient Temperature Range:
 - Min.: 0°F (-18°C)
 - Max.: 122°F (50°C)
- Input Voltage: single-phase, 230 volt, two (2) wire grounded system.
- Output Voltage: Variable frequency, 230 volt, three-phase power to the motor.
- Pressure set point adjustable between 20 – 70 PSI when used with included PRT0100SAIP sensor.**
- BF30 Dimensions and Weight:
 - Height: 18.57"
 - Width: 9.88"
 - Depth: 5.29"
 - Weight: 19.6 lbs.
- Packaged Dimensions and Weight:*
 - Height: 23"
 - Width: 14.5"
 - Depth: 10.5"
 - Weight: 23.2 lbs.

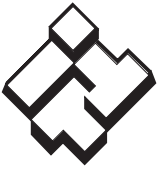
AGENCY LISTINGS



Tested to UL 778, 508C and
CSA 22.2 108-M89, 14-95
Standards By Canadian
Standards Association
File #LR38549

BF50 SPECIFICATIONS

- Controller will operate a 3-phase, 230V submersible motor up to:
 - Max. HP: 5
 - Min. HP: 3
 - Max. SFA: 17.8 amps.
 - 30 – 60 Hz speed.
 - 30 – 80 Hz optional. (see table 1 for details.)
- Controller Ambient Temperature Range:
 - Min.: 0°F (-18°C)
 - Max.: 122°F (50°C)
- Input Voltage: single-phase, 230 volt, two (2) wire grounded system.
- Output Voltage: Variable frequency, 230 volt, three-phase power to the motor.
- Pressure set point adjustable between 10 – 100 PSI when used with included PRT0200SAIP sensor.**
- BF50 Dimensions and Weight:
 - Height: 18.57"
 - Width: 9.88"
 - Depth: 5.29"
 - Weight: 24.4 lbs.
- Packaged Dimensions and Weight:*
 - Height: 23"
 - Width: 14.5"
 - Depth: 10.5"
 - Weight: 28 lbs.



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Table 1: Controller, Breaker, Generator Sizing

3 Phase Motor			Controller Model ②			Circuit Breaker ③	Generator ④ (VA)
HP	Voltage ①	SFA	BF20	BF30	BF50		
1/2	230	2.9				15	2200
	200	3.4					
3/4	230	3.8					2900
	200	4.4					
1	230	4.7					3500
	200	5.4					
1 1/2	230	5.9				4400	
	200	6.8					
2	230	8.1				6100	
	200	9.3					
3	230	10.				8100	
	200	12.5					
5	230	17.8				13300	
	200	20.5					

NOTES:

- ① Motor Nameplate must be the same as supply voltage.
- ② Shaded areas indicate which controller models can be used with which motors. Lighter shading indicates combinations where controller will limit peak performance to 85% of catalog value for pump/motor.
- ③ Circuit Breaker or Dual Element Time Delay Fuse Size (Amps) protecting branch circuit supplying controller.
- ④ Minimum size of single phase 240 V generator required.

TANK SIZING RECOMMENDATIONS

- The diaphragm style pressure tank pre-set should be 20 psi below the system operating pressure. Ex. For a 50 psi system the tank pressure should be set at 30 psi.
- Total Tank Volume, not drawdown volume, is used to select the proper tank size. The total tank volume should be 20% of the pump maximum flow.
Example: A 100 gpm pump requires a 20 gallon tank or a V60. A 50 gpm pump requires a minimum 10 gallon tank. A V25 at 8.2 gallons is too small; next size is required, V45 at 13.9 gallons. These sizing recommendations will prevent objectionable pressure drops on start-up and provide smooth operation for your BF system.

Maximum Pump GPM	Recommended Tanks		
	Total Volume	Order No.	or Order No.
10	2	V6P	TP6P
23	4.5	V15P	TP15P
41	8.2	V25P	TP25P
70	13.9	V45	TP45
100	19.9	V60	TP60
130	25.9	V80	TP80
160	31.8	V100	TP100
225	45.2	V140	TP140
325	65.1	V200	TP200
418	83.5	V250	TP250
425	84.9	V260	TP260
580	115.9	V350	TP350



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Table 2: Wire Sizing

Maximum Cable Lengths in Feet to Limit Voltage Drop to 5% for 230 V Systems^⑤

Service Entrance to Controller

Controller Input	Motor HP	Copper Wire Size 75°C Insulation Exposed to a Maximum of 50°C (122°F) Ambient Temperature ^⑥																	
		14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0	250	300	350	400	500
230V 1 PH	1/2	366	583	925	1336	2107	3345	4175	5267	6637	8364								
	3/4	279	445	706	1020	1608	2552	3186	4019	5065	6383	8055							
	1	226	360	571	824	1300	2064	2576	3250	4095	5161	6513	8201						
	1 1/2	*	286	455	657	1036	1644	2052	2589	3262	4111	5188	6533	8236	9710				
	2	*	*	331	478	754	1197	1495	1886	2376	2995	3779	4759	5999	7073	8455	9852		
	3	*	*	246	355	561	890	1111	1401	1766	2225	2808	3536	4458	5256	6283	7321	8343	
	5	*	*	*	218	343	545	680	858	1081	1363	1720	2165	2730	3219	3847	4483	5109	6348

Controller to Motor

Controller Output	Motor HP	Copper Wire Size 75°C Insulation Exposed to a Maximum of 50°C (122°F) Ambient Temperature ^⑥																	
		14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0	250	300	350	400	500
230V 3 PH	1/2	905	1442	2290	3306	5213	8276												
	3/4	690	1100	1748	2523	3978	6316	7884	9945										
	1	558	890	1413	2040	3216	5106	6375	8041										
	1 1/2	445	709	1126	1625	2562	4068	5078	6406	8072									
	2	324	516	820	1184	1866	2963	3699	4666	5879	7410	9351							
	3	241	384	609	880	1387	2202	2749	3467	4369	5506	6949	8750						
	5	*	235	373	539	849	1348	1683	2123	2675	3372	4255	5358	6755	7964	9520			

^⑤ Reduce lengths by 13% for 200 V systems.

^⑥ Lengths in bold require 90°C wire. Shading indicates 40°C max. ambient.

* Wire does not meet the N.E.C. ampacity requirement.

The lengths in each of the Wire Sizing tables represent 100% of the allowable voltage drop when motor is running at full load. When sizing wire, the voltage drop of each wire segment must be included. The total must not exceed 100% of the allowable drop. Take for example a 1.5 HP motor with a distance from Service Entrance to Controller of 100' and 500' between the Controller and Motor.

- Service Entrance to Controller = 100' of 10 AWG (100/455) = 22 % (455' is from the S.E. to Controller chart)

- Controller to Motor = 500' of 12 AWG (500/709) = 71 % (709' is from the Controller to Motor chart)

Total Drop (must be ≤ 100%) 93 %

If the distance from the Controller to Motor was 600' (600/709) = 85% + 22% = 107%, we would need to use #10 wire for that segment, ex. 600/1126 = 53% + 22% (for 100' of #10) = 75% which is acceptable. It is also acceptable to use different wire sizes for the Buried and Well sections of wire.



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HOW TO PRODUCE A 30-60 HZ RANGE CURVE

- Use the Intellitronic II Pump Sizing Program – it will produce a variable speed curve for any of our submersibles.
- Performance multipliers – use these multipliers with points from a 60 Hz, 3450 RPM standard curve, to create a minimum performance 30 Hz curve. The controller will never let the pump operate outside of the selected speed range and will prevent motor overloading, therefore a range curve for these systems is not necessary.

Variable Speed Performance Multipliers				
RPM	Hz	Flow	TDH	HP
3450	60	1	1	1
2875	50	0.83	0.69	0.57
2300	40	0.667	0.444	0.296
1725	30	0.5	0.25	0.125

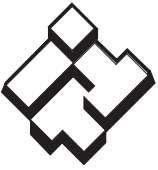
- Use 4 or more points from a 3450 curve and apply the multipliers to produce a 30 Hz curve. Example: Using 5 points from a 3450 RPM, 60 Hz 25GS30 curve determine the 30 Hz operation points.

	GPM	30 Hz Mult.	=	30 Hz GPM	TDH	30 Hz Mult.	=	30 Hz TDH
Point 1	0	.5	=	0	Point 1	462	.25	= 116
Point 2	10	.5	=	5	Point 2	440	.25	= 110
Point 3	20	.5	=	10	Point 3	370	.25	= 93
Point 4	30	.5	=	15	Point 4	232	.25	= 58
Point 5	33	.5	=	16.5	Point 5	162	.25	= 41

- On the 60 Hz curve, plot the new points: 0 at 116', 5 GPM at 110', 10 GPM at 93', 15 GPM at 58' and 16.5 GPM at 41'. Connecting the dots will create a 30 Hz or lower range curve. The controller will always operate the pump somewhere between the upper and lower curves depending on water depth and required flow.

CONTROLLER CURRENT LIMIT SETTINGS

BF20	BF30	BF50
2.9	4.4	9.3
3.4	4.7	9.5
3.8	5.4	10.9
4.4	5.9	12.5
4.7	6.8	15.0
5.4	8.1	15.9
5.9	9.3	16.6
6.8	10.0	17.0
7.7	10.6	17.5
8.1	10.9	17.8



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Choosing Maximum Speed: 60 or 80 Hz

You have an option of operating the Balanced Flow System at either 30-60 or 30-80 hertz speeds.

For 30 – 60 Hz operation (60/80 Hz switch in 60 Hz position) the HP of the water end should match the HP of the motor.

This table shows examples of suitable configurations for the 30-60 Hz operation:

Controller	Water End	Motor	WE Example	Max. Curve – 60 HZ Catalog
BF20	1	1	10GS10	10GS10
BF20	1½	1½	18GS15	18GS15
BF20	2	2	18GS20	18GS20
BF30	1½	1½	10GS15	10GS15
BF30	2	2	18GS20	18GS20
BF30	3	3	25GS30	25GS30
BF50	5	5	25GS50	25GS50

For 30 – 80 Hz operation (60/80 Hz switch in 80 Hz position) the HP of the water end should be ½ the HP of the motor.

This table shows examples of suitable configurations for the 30-80 Hz operation:

Controller	Water End	Motor	WE Example	Max. Curve – 60 HZ Catalog
BF20	½	1	10GS05	10GS10
BF20	¾	1½	10GS07	10GS15
BF20	1	2	18GS10	18GS20
BF30	¾	1½	10GS07	10GS15
BF30	1	2	18GS10	18GS20
BF30	1½	3	25GS15	25GS30
BF50	3	5	25GS30	25GS50

When using the 80 hertz switch with mismatched water ends and motors, use the larger pump curve as the top curve. The bottom, or 30 hertz, curve would be calculated using the smaller water end curve and data from the 30-60 curve section.

Setting up a pump system is entirely in the hands of the installer, you choose whether to operate at 30-60 or 30-80 hertz. We recommend using matched pumps and motors operating at 30 – 60 Hz speeds for optimum pump, motor and system life.



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